HEAVY RARE EARTHS LIMITED
ABN 35 648 991 039
ACN 648 991 039

PROSPECTUS

This Prospectus is for an offer of 30,000,000 Shares at an issue price of $0.20 (20 cents) per Share to raise $6 million before costs, referred to herein as the **Equity Offer**.

This Prospectus also contains:

- An offer of 1,000,000 Shares as part consideration for the acquisition of the Cowalinya Project (**Vendor Offer**); and
- An offer of an aggregate of 7,000,000 Class A Options and 2,500,000 Class B Options to former and existing Directors (or their nominee(s)) (**Founder Option Offer**); and
- An offer of an aggregate of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)) (**Advisor Option Offer**).

LEAD MANAGER TO THE EQUITY OFFER:

Taylor Collison Limited

ABN 53 008 172 450 AFSL 247083

TAYLOR COLLISON

THE EQUITY OFFER IS NOT UNDERWRITTEN

IMPORTANT INFORMATION

This is an important document that should be read in its entirety. If you do not understand it you should consult your professional advisors without delay. **THE SECURITIES OFFERED UNDER THIS PROSPECTUS SHOULD BE CONSIDERED HIGHLY SPECULATIVE.**

COMPLETION OF THE OFFERS IS CONDITIONAL upon the satisfaction of certain conditions. Further details of the conditions of the Offers are set out on page 7 and in Section 7.3.

IMPORTANT NOTICES

General

This Prospectus **(Prospectus)** is dated 5 July 2022 and was lodged with ASIC on that date. ASIC and its officers take no responsibility for the contents of this Prospectus or the merits of the investment to which this Prospectus relates.

In addition, ASX and its officers take no responsibility for the contents of this Prospectus or the merits of the investment to which this Prospectus relates.

No person is authorised to give information or make any representation in connection with the Offers that is not contained in this Prospectus. Any information or representation not so contained may not be relied on as having been authorised by Heavy Rare Earths Limited (**HRE** or the **Company**) in connection with this Prospectus.

It is important you read this Prospectus in its entirety and seek professional advice where necessary. The securities the subject of this Prospectus should be considered highly speculative.

Investment Advice

This Prospectus does not provide investment advice and has been prepared without taking account of your financial objectives, financial situation or particular needs (including financial or taxation issues). You should seek professional investment advice before subscribing for Shares under this Prospectus.

Exposure Period

This prospectus will be circulated during the Exposure Period. The purpose of the Exposure Period is to enable this Prospectus to be examined by market participants prior to the raising of funds. You should be aware that this examination may result in the identification of deficiencies in this Prospectus. In such circumstances, any Application that has been received may need to be dealt with in accordance with section 724 of the Corporations Act. Applications under this Prospectus will not be processed by the Company until after the Exposure Period. No preference will be conferred upon Applications received during the Exposure Period.

Expiry Date

No securities may be issued on the basis of this Prospectus later than 13 months after the date of this Prospectus.

Documents incorporated by reference

The Constitution and the audited financial report of the Company for the period from incorporation to 31 December 2021 have been lodged with ASIC and is taken to be included in this Prospectus by operation of section 712 of the Corporations Act. Any person may request a copy of these materials during the application period of this Prospectus. A copy of these materials can also be downloaded at the website of the Company at:
https://hreltd.com.au/about-us/corporate-governance

Company Website

Other than the Constitution and the audited financial report of the Company for the period from incorporation to 31 December 2021 which are incorporated by reference as set out above, any other reference to documents included on the Company's website at https://hreltd.com.au/about-us/corporate-governance/ are for convenience only. No documents or information available on the Company's website are incorporated by reference into this Prospectus.

Target market determination

The Company has adopted a target market determination (**TMD**) for the offer of Class A Options and Class B Options. The TMD is available on the website of the Company, https://hreltd.com.au/prospectus/.
By making an application under the Founder Option Offer and/or the Advisor Option Offer, an investor warrants that they have read and understood the TMD and that they fall within the target market set out in the TMD.

Forward-looking statements

This Prospectus contains forward-looking statements which are identified by words such as 'may', 'could', 'believes', 'estimates', 'targets', 'expects', or 'intends' and other similar words that involve risks and uncertainties.

These statements are based on an assessment of past and present economic and operating conditions, and on a number of assumptions regarding future events and actions that, as at the date of this Prospectus, are expected to take place.

Such forward-looking statements are not guarantees of future performance and involve known and unknown risks, uncertainties, assumptions and other important factors, many of which are beyond the control of the Company, its Directors and management.

Although the Company believes that the expectations reflected in the forward looking statements included in this Prospectus are reasonable, none of the Company, its Directors or officers, or any person named in this Prospectus, can give, or gives, any assurance that the results, performance or achievements expressed or implied by the forward-looking statements contained in this Prospectus will actually occur or that the assumptions on which those statements are based will prove to be correct or exhaustive beyond the date of its making. Investors are cautioned not to place undue reliance on these forward-looking statements. Except to the extent required by law, the Company has no intention to update or revise forward-looking statements, or to publish prospective financial information in the future, regardless of whether new information, future events or any other factors affect the information contained in this Prospectus.

The forward-looking statements contained in this Prospectus are subject to various risk factors that could cause actual results to differ materially from the results expressed or anticipated in these statements. The key risk factors of investing in the Company are set out in Section 3.

Privacy statement

By completing and returning an application or acceptance form, you will be providing personal information directly or indirectly to the Company, the Share Registry, the Lead Manager and other brokers involved in the Offers and related bodies corporate, agents, contractors and third-party service providers of the foregoing (**Collecting Parties**). The Collecting Parties collect, hold and will use that information to assess your application, service your needs as a Shareholder and to facilitate distribution payments and corporate communications to you as a Shareholder.

By submitting an application form, you authorise the Company to disclose any personal information contained in your application (**Personal Information**) to the Collecting Parties where necessary, for any purpose in connection with the Offers (or any of them), including processing your acceptance of the Offers (or any of them) and complying with applicable law, the ASX Listing Rules, the ASX Settlement Operating Rules and any requirements imposed by any public authority.

If you do not provide the information required in respect of your application, the Company may not be able to accept or process your acceptance of the Offers (or any of them). If the Offers (or any of them) are successfully completed, your Personal Information may also be used from time to time and disclosed to persons inspecting the register of Shareholders, including bidders for your Shares in the context of takeovers, public authorities, authorised securities brokers, print service providers, mail houses and the Share Registry.

Any disclosure of Personal Information made for the above purposes will be on a confidential basis and in accordance with the Privacy Act 1988 (Cth) and all other legal requirements. If obliged to do so by law or any public authority, Personal Information collected from you will be passed on to third parties strictly in accordance with legal requirements. Once your Personal Information is no longer required, it will be destroyed or de-identified.

Subject to certain exemptions under law, you may have access to Personal Information that the Collecting Parties hold about you and seek correction of such information. Access and correction requests, and any other queries regarding this privacy statement, must be made in writing to the Share Registry at the address set out in the Corporate Directory at the end of this Prospectus. A fee may be charged for access.

Currency

All financial amounts contained in this Prospectus are expressed as Australian currency unless otherwise stated. All references to "$" or "A$" are references to Australian dollars.

Web Site – Electronic Prospectus

A copy of this Prospectus can be downloaded from the Company's website at https://hreltd.com.au/prospectus/.

The Corporations Act prohibits any person passing onto another person an application or acceptance form unless it is attached to a hard copy of this Prospectus or it accompanies a complete and unaltered version of this Prospectus. You may obtain a hard copy of this Prospectus free of charge by contacting the Company.

The Company reserves the right not to accept an application or acceptance from a person if it has reason to believe that when that person was given access to the application or acceptance form, it was not provided together with the Prospectus and any relevant supplementary or replacement Prospectus or any of those documents were incomplete or altered.

Foreign offer restrictions

Except as set out elsewhere in this Prospectus (notably in Section 8.10), this Prospectus may not be distributed outside Australia and the securities under the Prospectus may not be offered outside Australia. If you are outside Australia it is your responsibility to obtain any necessary approvals for the Company to allot and issue Shares to you pursuant to this Prospectus.

Defined terms

Unless the contrary intention appears or the context otherwise requires, words and phrases contained in this Prospectus have the same meaning and interpretation as given in the Corporations Act and capitalised terms have the meaning given in the Glossary in Section 10.

Time

All references to time in this Prospectus are references to the time in Melbourne, Victoria, Australia.

Trademarks

All trademarks are the property of their respective owners and should not be interpreted to mean that any owner or user of a trademark endorses the Prospectus or its content or that a commercial or other relationship between an owner or user of a trademark exists.

Photographs and Diagrams

Photographs used in this Prospectus which do not have descriptions are for illustration only and should not be interpreted to mean that any person shown in them endorses the Prospectus or its contents or that the assets shown in them are owned by the Company. Diagrams used in this Prospectus are illustrative only and may not be drawn to scale.

Maps

Maps and geological diagrams included in Section 1 of this Prospectus are extracted for the convenience of potential investors from the independent Geologist's Report set out in Annexure A. The maps are a combination of extracts of publicly available information and annotations and overlays made by the competent person/s responsible for preparation of the Independent Geologist's Report set out in Annexure A.

Geological information

The geological information included in Section 1 of this Prospectus are extracted for the convenience of potential investors from the Independent Geologist's Report (including the Mineral Resource Estimate Report that forms Appendix 7 to the Independent Geologist's Report) set out in Annexure A, which contains detail on sources of information set out to and referred to in Section 1 of this Prospectus. The Independent Geologist's Report (including the Mineral Resource Estimate Report that forms Appendix 7 to the Independent Geologist's Report) also contains an analysis of exploration results and other information prepared in accordance with the JORC Code. The geological information contained in this Prospectus fairly represents information and supporting documentation prepared and compiled by the competent persons named in the Independent Geologist's Report (including the Mineral Resource Estimate Report that forms Appendix 7 to the Independent Geologist's Report) but must be read in conjunction with the report set out in Annexure A.

Enquiries

If you are in any doubt as to how to deal with any of the matters raised in this Prospectus, you should consult your broker or legal, financial or other professional advisor without delay.

Should you have any questions about any of the Offers or how to accept any of the Offers, please call the Company on (03) 8630 3321.

CONTENTS

HEAVY RARE EARTHS LIMITED
Level 21, 459 Collins Street
Melbourne, VIC 3000

info@hreltd.com.au
+61 (03) 8630 3321

LETTER FROM THE CHAIR

Dear Investors,

On behalf of the Board of Heavy Rare Earths Limited (HRE), I am pleased to present this Prospectus and to invite you to become a Shareholder in HRE.

HRE is an Australian rare earths exploration company pursuing projects in both Western Australia and the Northern Territory that is seeking to list on the ASX.

The rapid expansion in the development and growth of transport electrification across the globe, coupled with the supply chain issues brought on by the COVID-19 pandemic, have highlighted the strategic importance of critical minerals, including rare earths, in recent years.

Rare earths are essential to the world's efforts to decarbonise, and are central in many future facing growth applications, including hybrid and electric vehicles, wind energy, robotics, healthcare and mobile phones.

China mines and refines a majority of the global supply of rare earths. Most of the production of heavy rare earths is derived from China's clay deposits and the environmental and social issues associated with their development are becoming more and more challenging.

HRE has identified clay-hosted rare earths mineralisation at our main project, Cowalinya in Western Australia, one of the world's premier mining jurisdictions, and located close to infrastructure including Esperance, a deep-water shipping port. HRE holds an option to acquire the exploration licence (E63/1972) forming Cowalinya, which HRE will exercise immediately prior to listing.

In a relatively short space of time, a JORC inferred mineral resource of 28 million tonnes @ 625ppm TREO has been declared at the Cowalinya project, with a desirable rare earths composition where 25% are valuable magnet rare earths. Further details are set out in the Mineral Resource Estimate Report which forms an appendix to the Independent Geologist's Report contained in Annexure A. Despite their modest grade, low-cost shallow mining and simple inexpensive metallurgy can make clay-hosted rare earth deposits potentially profitable to exploit. HRE is seeking to determine the potential suitability and viability of the Cowalinya project through conduct of its planned exploration activities.

The exploration and evaluation process associated with the declaration of the JORC inferred mineral resource has enabled us to build a solid team of professionals capable of advancing not only Cowalinya but other opportunities too, including the applications for two exploration licences in the Northern Territory which form HRE's Duke project.

Over the next two years, the majority of HRE's planned expenditure will be applied to exploring, expanding and upgrading clay-hosted rare earth resources at Cowalinya.

There are risks associated with an investment in HRE as detailed in Section 2 of this Prospectus, including risks relating to the HRE's business as a minerals exploration company operating in the mining industry in Australia and risks relating to an investment in a company with a small market capitalisation. Potential investors should consider that an investment in HRE is speculative and should consult their professional advisers before deciding whether to apply for securities offered under this Prospectus.

This Prospectus contains detailed information about the Offers and the current and proposed operations of HRE. Prospective investors should read this Prospectus in full and consult their professional advisors before deciding whether to apply for securities under this Prospectus.

HEAVY RARE EARTHS LIMITED
Level 21, 459 Collins Street
Melbourne, VIC 3000

info@hreltd.com.au
+61 (03) 8630 3321

I invite you to join us in building a company that will explore for rare earths on Australian soil and help us become a leading company that develops rare earth opportunities.

Sincerely,

John Byrne,
Non-Executive Chairman

KEY OFFER INFORMATION

Indicative timetable

Lodgement of Prospectus with ASIC	5 July 2022
Offer period opens	13 July 2022
Offer period closes	2 August 2022
Issue of Shares	9 August 2022
Dispatch of holding statements	12 August 2022
Quotation of Shares on ASX	17 August 2022

The above dates are indicative only and may change without notice. The Company , in consultation with the Lead Manager, reserves the right to extend or shorten the offer period or close the Offers in its absolute discretion and without prior notice. The Company also reserves the right to not to proceed with all or part of the Offers prior to the issue of Shares under the Equity Offer.

The Offers

The Offers contained in this Prospectus are:

- The Equity Offer, being an invitation to apply for 30,000,000 Shares at an issue price of $0.20 (20 cents) to raise $6 million before costs.
- The Vendor Offer, being an offer of 1,000,000 Shares to the Cowalinya Vendors (or their nominee(s)) as part consideration for acquisition by the Company of the Cowalinya Project.
- The Founder Option Offer, being an offer of an aggregate of 7,000,000 Class A Options and 2,500,000 Class B Options to former and existing Directors (or their nominee(s)).
- The Advisor Option Offer, being an offer of an aggregate of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)).

The Equity Offer, Vendor Offer, Founder Option Offer and Advisor Option Offer are collectively referred to in this Prospectus as the **Offers**. Details regarding the Offers including the application process are set out in Section 8.

The Offers are conditional upon:

- The Company completing the acquisition of the Cowalinya Project. Further details of the terms under which the Company proposes acquiring the Cowalinya Project are set out in Section 9.2(a).
- The Company receiving applications and application monies for $6 million (being 30,000,000 Shares) under the Equity Offer; and
- ASX giving its conditional approval for the admission of the Company to the Official List and quotation of the Shares issued to successful applicants.

If the conditions above are not met, the Offers will not proceed, no securities will be issued pursuant to this Prospectus and application monies will be refunded to applicants in full (without interest) in accordance with the Corporations Act.

Key statistics of the Offers

SHARES

Existing Shares	37,275,150
Offer Price per Share under the Equity Offer	$0.20 (20 cents)
Total Shares offered under Equity Offer	30,000,000
Cash proceeds to be received under Equity Offer (before costs)	$6,000,000
Total Shares offered under the Vendor Offer	1,000,000
Total Shares at Listing	68,275,150
Market capitalisation at the Offer Price ($0.20)	$13,655,030
Ownership of investors in the Equity Offer at Listing	43.94%
Ownership of the Cowalinya Vendors at Listing	1.46%
Ownership of existing Shareholders at Listing	54.60%
% of Shares at listing anticipated to be subject to mandatory ASX escrow [2]	45.44%

Notes to table:

1. *The above table assumes no convertible securities convert to Shares prior to Listing.*
2. *The percentage of Shares that are anticipated to be subject to mandatory ASX escrow is an estimate by the Company based on guidance from ASX that is publicly available and the actual number of Shares subject to mandatory ASX escrow may differ. The Company will release details of the mandatory ASX escrow applied to its securities as part of its pre-quotation disclosures to ASX.*
3. *All percentages are subject to rounding.*

Shares in the Company may not trade at the Equity Offer Price upon, or after, the Company becomes Listed.

OPTIONS

The Company anticipates having the following options on issue at Listing:

Class	Number	Exercise Price	Expiry Date
Class A Options	9,850,000	$0.30 (30 cents)	3 years from Listing
Class B Options	4,350,000	$0.40 (40 cents)	3 years from Listing
Total	**14,200,000**	-	-

Other than the options set out in the table above, the Company will not have any other convertible securities on issue at Listing.

INVESTMENT OVERVIEW

This Section is a summary only and is not intended to provide full information for investors intending to apply for securities offered pursuant to the Offers. This Prospectus should be read and considered in its entirety.

Item	Summary	Further information
A. Heavy Rare Earths Limited		
Who is the issuer of this Prospectus?	Heavy Rare Earths Limited [ABN 35 648 991 039] (**HRE** or **the Company**).	Sections 1 and 9.1
Who is the Company?	The Company is an Australian public company that operates in the mineral exploration industry with a focus on exploration for rare earths.	Sections 1 and 9.1, Annexure A
B. Business overview		
What is the business of the Company?	The Company is an exploration company that holds an option to acquire the tenement forming the Cowalinya Project (E63/1972) located in Western Australia. An Inferred Mineral Resource of 28 Mt @ 625 ppm TREO (Total Rare Earth Oxides) has been declared at the Cowalinya Project. The Company has also applied for two exploration licences (EL 33101 and EL 33194) in the Northern Territory which form the Duke Project. Further details regarding the projects of HRE are set out in Annexure A and details of the declared resource are set out in Appendix 7 of Annexure A.	Section 1, Annexure A
What are the aims and objectives of the Company?	The majority of HRE's planned expenditure over the next two years will be applied to exploring, expanding and upgrading clay-hosted rare earth resource at Cowalinya. Further details are set out in Section 1 and Annexure A.	Section 1, Annexure A
C. Risks		
What are the key risks of investment in the Company?	Any securities offered under this Prospectus are considered highly speculative. An investment in the Company carries risk. Those risks include, but are not limited to: **Limited history:** The Company has limited operating and financial history on which to evaluate its business and prospects. Given the high level of risk and uncertainty in the mineral exploration sector, no assurance can be given that the Company will identify a commercially viable mineral deposit and, even if such a deposit is identified, that the Company will be able to develop commercially viable mineral production operations. **Regulatory risk:** The operations of the Company at the Cowalinya Project will be subject to the maintenance (including renewal) of the relevant tenement (E63/1972) which the Company will acquire at Listing. The Company may also be required to obtain other approvals and authorisations to conduct its operations. The Company has also filed applications for exploration licences in the Northern Territory (EL 33101 and EL 33194) and cannot guarantee such applications (or either of them) will be granted. In addition, any future changes to legislation and regulation may impose restrictions on the Company which cannot be predicted. **Operating & development risks:** The operations of the Company may be adversely affected by various factors, both inside and outside of the control of the Company. Exploration activities may not result in the development of the interests held by the Company into one or more commercially viable project. **Exploration risk:** Mineral exploration is uncertain by its nature. There can be no assurance given that the exploration activities conducted by the Company will result in the discovery of mineral deposits of sufficient size and/or scale to warrant	Section 2

<table>
<tr><th>Item</th><th>Summary</th><th>Further information</th></tr>
<tr><td></td><td>
product or that, should the Company locate such a deposit, it will be in a position to commence production activities in a reasonable period of time, if at all.
Environmental risk: The proposed activities of the Company will be subject to various laws and regulations concerning the environment. Mining operations have inherent risks and liabilities associated with safety and damage to the environment and the disposal of waste product occurring as a result of mining exploration and production.
Access risk: The Company may be required to obtain access and other approvals or authorisations, including under applicable Native Title legislation. No guarantee can be given that the Company will obtain such access, approvals or authorisations on particular terms, or at all. Any changes to legislation may also adversely impact upon the Company.
Future requirements for capital: The Company may in future require additional capital in excess of the funds raised under the Equity Offer for its activities, including future exploration of its exploration interests.
Third party risks: The Company has contracted with, or may in future need to contract with, various third parties to carry out mineral exploration or mining operations. There is a risk that third parties may fail to perform their obligations under agreements, which may lead to delays, increased costs or disputes that could negatively affect the operations of the Company.
Offers conditional: The Offers under this Prospectus are subject to and conditional upon certain matters, including ASX granting conditional approval for the admission of the Company to the Official List. There is no assurance of the conditional approval being granted or, if granted, that the Company will be able to satisfy the conditions of admission imposed by ASX, which may have a material adverse effect on the financial position and operations of the Company.
Further details of the risks associated with an investment in the Company are set out in Section 2.
</td><td></td></tr>
<tr><td colspan="3">D. Key People, Interests and Benefits</td></tr>
<tr><td>Who is the management team of the Company?</td><td>
The management team of the Company comprises:

John Joseph Byrne as Non-Executive Chairman.
Richard Francis Brescianini as an Executive Technical Director.
Ryan Matthew Skeen as a Non-Executive Director.
Justin Mouchacca as Chief Financial Officer and Company Secretary.

</td><td>Section 5</td></tr>
<tr><td>What are the equity interests of management?</td><td>
The direct and indirect equity interests of the Directors are set out in the table below:
<table>
<tr><th>Name</th><th>Number</th><th>Current %</th><th>% following Equity Offer</th></tr>
<tr><td>John Byrne</td><td>150,000</td><td>0.40%</td><td>0.22%</td></tr>
<tr><td>Richard Brescianini</td><td>120,000</td><td>0.32%</td><td>0.18%</td></tr>
<tr><td>Ryan Skeen</td><td>90,000</td><td>0.24%</td><td>0.13%</td></tr>
<tr><td>Total</td><td>360,000</td><td>0.96%</td><td>0.53%</td></tr>
</table>
Notes to table:
</td><td>Section 5.3</td></tr>
</table>

Item	Summary	Further information
	• *All percentages are subject to rounding.* • *The above table does not include Shares that may be received by Directors as a result of participation in the Equity Offer.* • *The above table does not include the impact of conversion of convertible securities.* • *The following Directors (either personally or via a nominee) are proposed to receive Class A Options under the Founder Option Offer as follows: John Bryne – 2,000,000 Class A Options; Richard Brescianini – 2,000,000 Class A Options.*	
E. Key Financial Information		
What is the key financial information?	The pro-forma statement of financial position of the Company (based on the 31 December 2021 accounts of the Company which are incorporated by reference into this Prospectus) is set out in Section 3 and has been reviewed by William Buck Audit (Vic) Pty Ltd as part of the Investigating Accountant's Report set out in Section 4. Other detailed financial information is also set out in Section 3.	Sections 3 and 4
What is the financial outlook of the Company following completion of the Offers?	Given the current status of the Company, its operations and the speculative nature of mineral exploration, the Directors do not consider it appropriate to forecast future earnings. Any forecast or projection information would contain such a broad range of potential outcomes and possibilities that it is not possible to prepare a reliable estimate forecast or projection on a reasonable basis. The Directors have provided an indication on how the Company intends to deploys funds raised under the Equity Offer in Section 7.6.	Sections 3, 4 and 7.6
What is the Company's dividend policy?	The Company is an early stage speculative exploration company and as such does not envisage being in a position to pay dividends in the short to medium term. A dividend policy is proposed to be established in the event the Company is able to establish economically viable mining operations. Any future payment of dividends will be at the discretion of the Board.	
How has the Company historically performed?	The Company was only recently incorporated and has no operating history and limited historical financial performance. As a result, the Company is not in a position to disclose any key financial ratios. Given the limited operating history of the Company, the Board does not consider that the financial history of the Company is a relevant guide to the future performance post Listing.	Sections 3 and 4
F. Key Offer Information		
What are the Offers?	*Equity Offer* The Company is inviting applications for 30,000,000 Shares at an issue price of $0.20 per Share to raise $6 million before costs. *Vendor Offer* An offer of 1,000,000 Shares to the Cowalinya Vendors (or their nominee(s)) as part consideration for the acquisition of the Cowalinya Project. *Founder Option Offer* An offer of an aggregate of 7,000,000 Class A Options and 2,500,000 Class B Options to former and existing Directors (or their nominee(s)). *Advisor Option Offer* An offer of an aggregate of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)).	Section 8

<table>
<tr><th>Item</th><th>Summary</th><th>Further information</th></tr>
<tr><td>What are the terms of Shares?</td><td>Shares offered under the Equity Offer and Vendor Offer will rank equally with existing ordinary shares of the Company.</td><td>Section 9.4(a)</td></tr>
<tr><td>What are the terms of Class A Options?</td><td>Class A Options have an exercise price of $0.30, expire 3 years from Listing and, upon exercise, entitle the holder to one Share.

The full terms of Class A Options are set out in Section 9.4(b).</td><td></td></tr>
<tr><td>What are the terms of Class B Options?</td><td>Class B Options have an exercise price of $0.40, expire 3 years from Listing and, upon exercise, entitle the holder to one Share.

The full terms of Class B Options are set out in section 9.4(b).</td><td></td></tr>
<tr><td>Are the Offers conditional?</td><td>The Offers are conditional upon:
The Company completing the acquisition of the Cowalinya Project. Further details are set out in Section 9.2(b); and
The Company receiving applications and application monies for the $6 million (being 30,000,000 Shares) raising under the Equity Offer; and
ASX giving its conditional approval for the admission of the Company to the Official List and quotation of the Shares.</td><td>Section 7.3</td></tr>
<tr><td>Will I be guaranteed a minimum allocation under the Equity Offer?</td><td>There is no guarantee that applicants will be allocated Shares that they apply for under the Equity Offer, in part or in full. The basis of allocation of Shares will be determined by the Company at its discretion.</td><td>Section 8.1</td></tr>
<tr><td>Is the Equity Offer underwritten?</td><td>No, the Equity Offer is not underwritten.</td><td>Section 8.6</td></tr>
<tr><td>How will the proceeds from the Equity Offer be used?</td><td>The Company intends to use the proceeds from the Equity Offer as set out below:
<table>
<tr><th>Activity</th><th></th></tr>
<tr><td>Drilling* – exploration & resource upgrade</td><td>$2,340,000</td></tr>
<tr><td>Assaying</td><td>$440,000</td></tr>
<tr><td>Metallurgical process development</td><td>$325,000</td></tr>
<tr><td>Project studies**</td><td>$400,000</td></tr>
<tr><td>Duke project exploration (Northern Territory)***</td><td>$100,000</td></tr>
<tr><td>Payment to Cowalinya Vendors – exercise option to acquire</td><td>$300,000</td></tr>
<tr><td>Administration & working capital</td><td>$1,455,000</td></tr>
<tr><td>Costs of the Offers</td><td>$640,000</td></tr>
<tr><td>Total</td><td>$6,000,000</td></tr>
</table>
* Including contractors, wire-line logging, field support, heritage surveys & site rehabilitation
** Including Resource & Reserve estimation
*** Proposed to encompass the following activities at NT EL 33101 and EL 33194 (assuming grant): field reconnaissance, orientation soil and rock chip sampling, collation of existing geophysical surveys, review of previous exploration, field mapping, grid soil/rock sampling and assay, drill target planning and mine management plan submission.

The above use of funds is indicative only. The Directors believe that, following completion of the Equity Offer, the Company will have enough working capital to carry out its stated objectives.</td><td>Section 7.6</td></tr>
</table>

<table>
<tr><th>Item</th><th>Summary</th><th>Further information</th></tr>
<tr><td>What will the Company's capital structure look like following completion of the Offers?</td><td>
Immediately following completion of the Offers, the capital structure of the Company will be as set out below:

SHARES
<table>
<tr><th></th><th>Number</th></tr>
<tr><td>Existing Shares</td><td>37,275,150</td></tr>
<tr><td>Shares under the Equity Offer</td><td>30,000,000</td></tr>
<tr><td>Shares under the Vendor Offer</td><td>1,000,000</td></tr>
<tr><td>Total Shares</td><td>68,275,150</td></tr>
</table>
Notes to table: All percentages are subject to rounding.

OPTIONS
<table>
<tr><th>Class</th><th>Number</th><th>Exercise Price</th><th>Expiry Date</th></tr>
<tr><td>Class A Options</td><td>9,850,000</td><td>$0.30 (30 cents)</td><td>3 years from Listing</td></tr>
<tr><td>Class B Options</td><td>4,350,000</td><td>$0.40 (40 cents)</td><td>3 years from Listing</td></tr>
<tr><td>Total</td><td>14,200,000</td><td>-</td><td>-</td></tr>
</table>
</td><td>Section 7.7</td></tr>
<tr><td>Will and securities of the Company be subject to escrow?</td><td>
The Company anticipates the following escrow treatment of its securities in accordance with publicly available guidance from ASX. Escrow of securities is subject to the discretion of ASX and the below is provided for indicative purposes only:

Shares under the Equity Offer are not anticipated to be subject to escrow.
Shares under the Vendor Offer are anticipated to be subject to mandatory escrow for 12 months from issue.
All Class A Options and Class B Options are anticipated to be subject to mandatory escrow for 24 months from Listing.
A portion of existing Shares are anticipated to be subject to mandatory escrow for between 12 months from issue and 24 months from Listing.

</td><td>Section 8.4</td></tr>
<tr><td>Will securities under the Offers be quoted (listed)?</td><td>
Application for quotation of Shares will be made to ASX no later than 7 days from the date of this Prospectus.

However, applicants should be aware that ASX will not commence Official Quotation of any Shares until the Company has complied with Chapters 1 and 2 of the ASX Listing Rules. As such, Shares may not be able to be traded for some time after the close of the Offers.

Other securities the subject of the Offers under this Prospectus will not be quoted (listed). Official quotation of the other securities is not being applied for and is not a condition of the Offers. It is expressly not stated or implied that permission will
</td><td>Section 8.3</td></tr>
</table>

Item	Summary	Further information
	be sought for the official quotation of other securities under the Offers or that official quotation of such other securities will be granted within three months or any other period after the date of this Prospectus.	
G. Additional information		
Is there any brokerage, commission or stamp duty payable by applicants under the Offers?	No brokerage, commission or stamp duty is payable by applicants on acquisition of securities under the Offers.	Section 8.7
Where can I find more information?	Additional information can be obtained through the following methods: • speaking to your broker, solicitor, accountant or other independent professional advisor; • by contacting Justin Mouchacca, the Chief Financial Officer and Company Secretary, on (03) 8630 3321; or • by contacting the Share Registry on 1300 737 760 (within Australia) or 02 9290 9600 (outside Australia).	

1. PROJECT OVERVIEW

Cowalinya Rare Earth Project, Western Australia

The Cowalinya rare earth project ("Cowalinya", "the Cowalinya Project" or "the Project") is located 70 km south-east of Norseman, Western Australia. It comprises a single 230 km² exploration licence E63/1972 on unallocated crown land hosting dominantly granitic type rocks in the Central Biranup Zone of the Albany Fraser Orogen. Below are maps of the Project area, locations and cross sections of drill holes, and a summary of preliminary metallurgical test-work.

The mineralisation being targeted is shallow, flat lying, supergene concentrations of rare earths present in the weathering profile overlying granitic basement. This mineralisation is similar in style to southern Chinese ionic rare earth clay deposits, the world's main source of heavy rare earths. Although this type of rare earth deposit is low grade, low-cost open pit mining and simple inexpensive metallurgy make them profitable to exploit.

The Cowalinya area was primarily chosen on the basis of historical drilling which indicated the presence of anomalous rare earth values in fresh bedrock and higher-grade supergene concentrations of rare earths in the overlying in-situ weathered saprolite profile.

In June 2021 HRE Corporation Limited, subsequently renamed Heavy Rare Earths Limited ("HRE" or "the Company"), acquired all rights to an option over 100% of E63/1972. The acquired option had been granted to Cobold Metals Limited [ACN 623 245 205] by the holders of that tenement, Mr David and Mrs Christine Ross (who are not related parties or promoters of the Company) in October 2020. The option expires in May 2024. The Company is seeking to raise funds under the Equity Offer to exercise the option and thereby acquire the Cowalinya Project as part of listing. HRE proposes exercising the option upon receiving conditional listing approval. Exercise of the option and acquisition of the Cowalinya Project is a condition of the Equity Offer.

Under the option, HRE has the right to manage and conduct all activities at the Project. In 2021, drilling of 109 aircore holes at Cowalinya by HRE discovered significant supergene concentrations of rare earths in two areas, Cowalinya South and North. The rare earths mineralisation, occurring as flat lying sheets within the in-situ clay-rich weathered saprolite, is contained within an average 8-9 m thick layer which starts ~17-18 m below surface.

A resource consultant was subsequently engaged to prepare and report a maiden Mineral Resource estimate for the Project in accordance with the 2012 JORC Code. This work resulted in the declaration of an Inferred Mineral Resource of 28 Mt @ 625 ppm TREO (Total Rare Earth Oxides) using a 300 ppm TREO-Cerium Oxide cut-off grade. Importantly, the resource has a desirable rare earths composition where 25% are the valuable magnet rare earths and 23% the strategic heavy rare earths.

The resource at Cowalinya remains open in all lateral directions and currently covers only a small proportion (<1.5%) of the Project tenement.

Preliminary metallurgical test-work on 40 samples from the 2021 drilling program shows the rare earths are successfully brought into solution using a weak hydrochloric acid leach. Recoveries of >90% for some of the rare earths have been achieved.

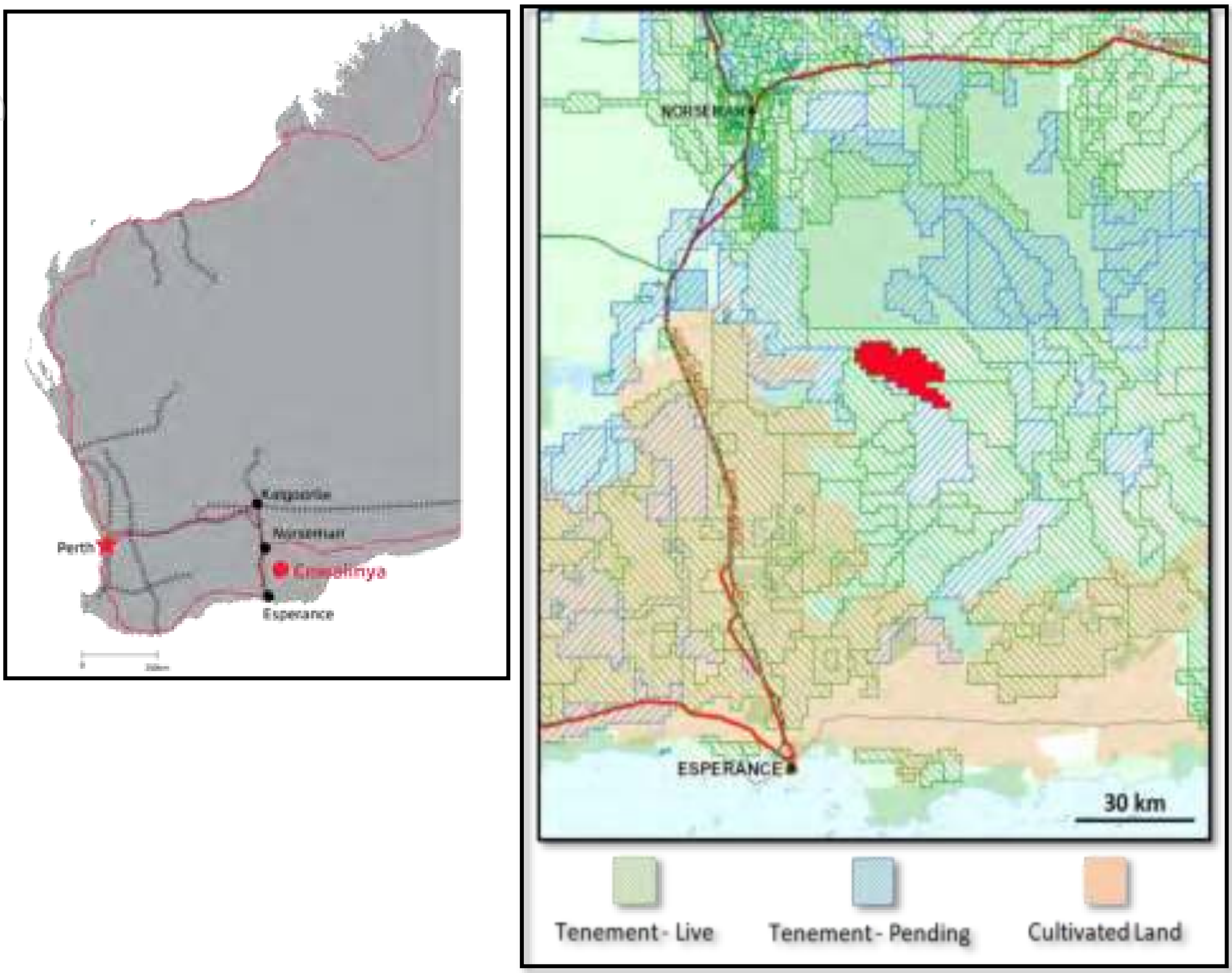
Project Development Program

The majority of HRE's planned expenditure over the next two years will be applied to exploring, expanding and upgrading clay-hosted rare earth resources at Cowalinya.

HRE plans to commence up to 10,000 m of aircore drilling (330 holes) in the third quarter 2022. The purpose of the program is to explore for rare earth resources primarily to the west and south-east of the Cowalinya South resource, initially on a 400 m x 200 m spacing, with results guiding the extent of closer spaced drilling to increase resource confidence. Cultural heritage surveys and drill line clearing have been completed in preparation for the drilling program.

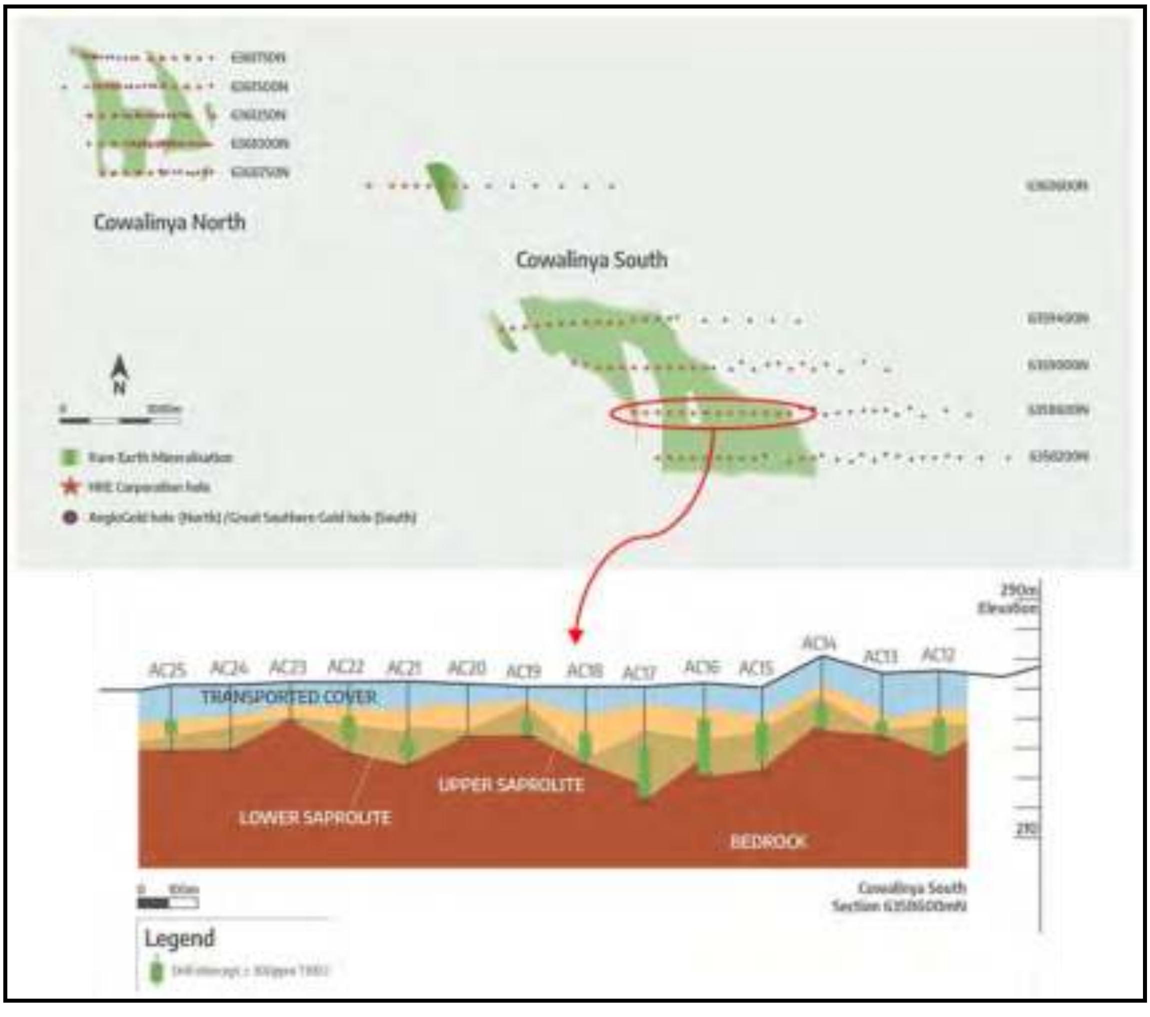
Extensive downhole wireline logging and targeted shallow diamond drilling will also be undertaken to obtain in-situ density measurements and further samples for geotechnical and metallurgical test-work.

The development of a metallurgical process flow sheet aimed at commercially recovering rare earths from Cowalinya will also be a key focus for HRE over the coming months. HRE will be engaging an independent metallurgical consulting company to design and complete this work.



Location of HRE's Cowalinya tenement E63/1972.

Extent of Inferred Mineral Resources on Cowalinya E63/1972.



Plan view of rare earth mineralisation (≥300 ppm TREO) and representative geological cross section at Cowalinya.

Area	Classification	Tonnes (Mt)	TREO (ppm)	TREO-CeO_2 (ppm)	Sc_2O_3	Magnet REOs/TREO (%)
Cowalinya North	Inferred	7	635	450	26	25
Cowalinya South	Inferred	22	620	430	32	25
Total	**Inferred**	**28**	**625**	**435**	**31**	**25**

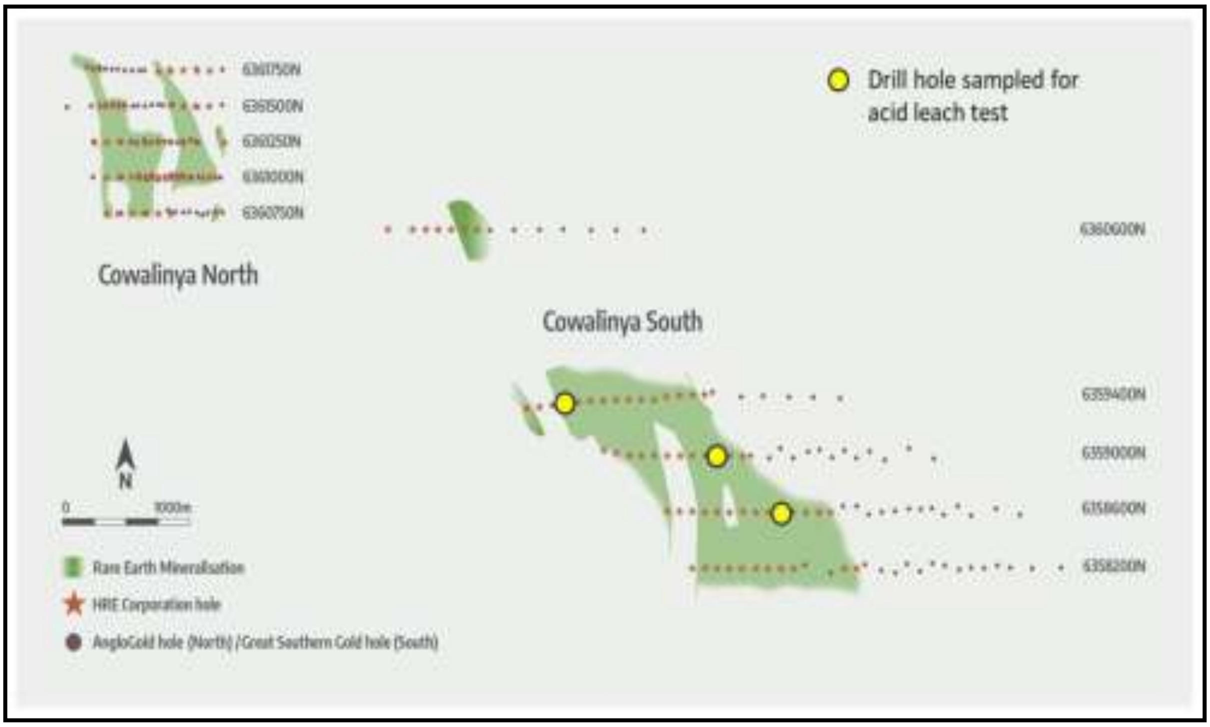
Mr John Tyrrell of JMCT Consulting is the Competent Person for the Cowalinya Mineral Resource estimate (in accordance 2012 JORC Code)
TREO = $La_2O_3+CeO_2+Pr_6O_{11}+Nd_2O_3+Sm_2O_3+Eu_2O_3+Gd_2O_3+Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3$
Magnet REOs = $Pr_6O_{11}+Nd_2O_3+Tb_4O_7+Dy_2O_3$. Totals may not add due to rounding ; Reported above a TREO-CeO_2 cut-off grade of 300 ppm

2021 Cowalinya Mineral Resource estimate.

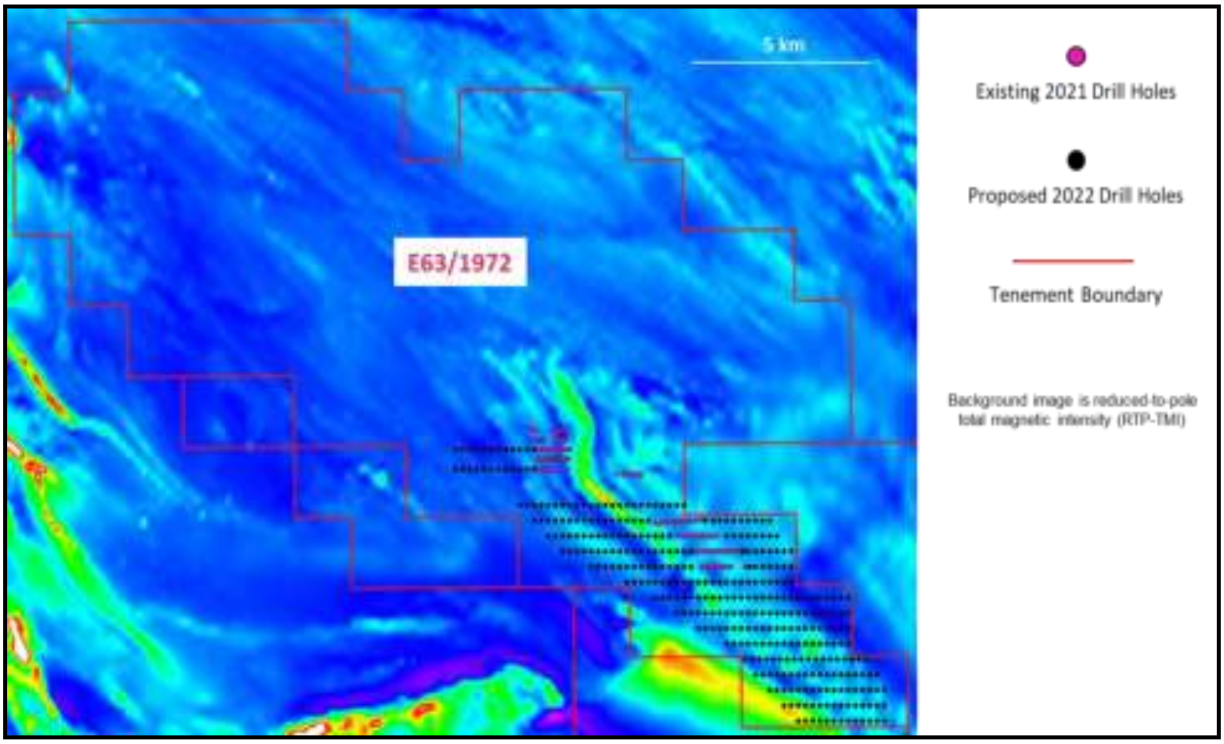
COWALINYA SOUTH - RARE EARTH RECOVERY SUMMARY
AVERAGE OF 40 SAMPLES FROM 3 DRILL HOLES
DIGESTS DONE OVER 24 HOURS

HYDROCHLORIC ACID CONCENTRATION	TEMPERATURE °C	TOTAL RARE EARTH RECOVERY
10%	50	91.0%
5%	50	89.2%
2%	50	81.9%
5%	30	91.0%
2%	30	71.1%
20%	20	90.6%
10%	20	26.9%

Summary of rare earth recovery results in acid leach test work on mineralised drill samples from Cowalinya.



Plan view of rare earth mineralisation (≥300 ppm TREO) at Cowalinya showing locations of drill holes sampled for acid leach test work.



Location of existing (2021) and planned drilling at Cowalinya E63/1972.

Duke Rare Earth Project, Northern Territory

The Company has applied for a 255 km^2 land package 50 kilometres north-west of Tennant Creek in the Northern Territory comprising two exploration tenements EL 33101 and EL 33194. These tenements are under application and accordingly the exploration plans are early stage.

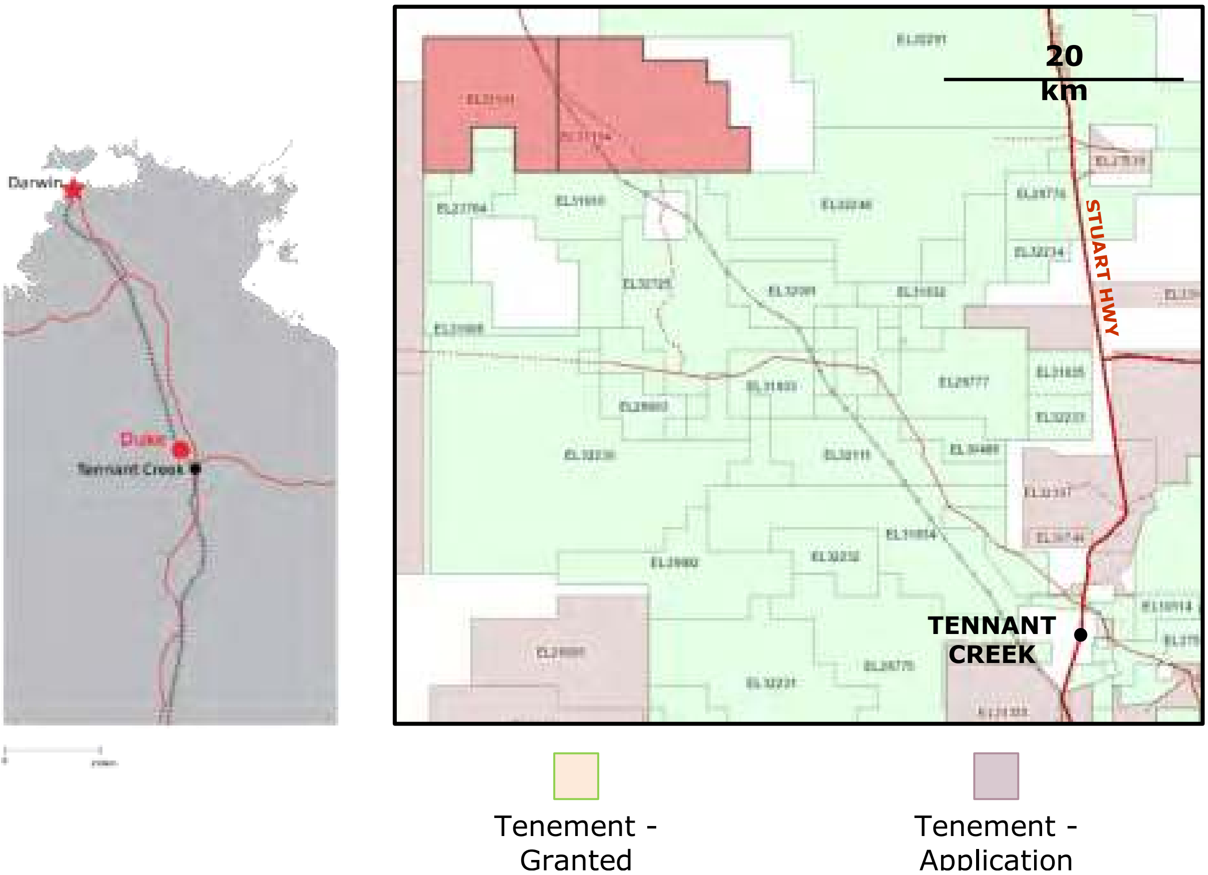
Previous exploration in the area of the application has been undertaken for Tennant Creek-style ironstone hosted Cu-Au-Bi and Olympic Dam-type Cu-U-Au deposits. This is the first time the area has been subject to systematic exploration for rare earths.

The exploration model being adopted by HRE is a Browns Range-style breccia-hosted hydrothermal mineralized system potentially related to a regional magmatic event. Exploration will target the unconformity between the

Tomkinson (Tomkinson Creek Group) and the Warramunga (Ooradidgee Group) provinces which is present in the application area.

Subject to successful application of the exploration model, rare earths are expected to be hosted in xenotime, a yttrium phosphate mineral that is enriched in strategically important heavy rare earths such as terbium and dysprosium.

A program of prospecting and surface geochemistry is planned for H1 CY2023 to initially verify the exploration model.



Location of HRE's Duke tenement applications EL 33101 and EL 33194.

Other opportunities

The Company's focus will primarily be on the exploration and development of the Cowalinya and Duke projects as described in this Section 1 and the Independent Geologist's Report in Annexure A. The Company may, if considered appropriate by the Board, choose to examine additional opportunities with a view of acquiring suitable exploration or mining licences, or other commercial enterprises, to complement its portfolio. The practice of identifying suitable, complementary acquisition opportunities is common for entities engaged in exploration activities similar to the Company. No such opportunities have been identified by the Company as at the date of this Prospectus.

2. RISK FACTORS

2.1 Introduction

The securities offered under this Prospectus are considered highly speculative. An investment in the Company carries risk.

This Section identifies circumstances that the Directors regard as the major risks associated with an investment in the Company and which may, either alone or in combination, have a material adverse impact on the financial performance of the Company and the market price of the securities of the Company, should they arise.

The Directors strongly recommend potential investors consider the risk factors described below, together with information contained elsewhere in this Prospectus, and consult their professional advisors if they have any queries before deciding whether to apply for Shares or any other securities offered under this Prospectus.

The business, assets and operations of the Company are subject to certain commercial, operational and financial risk factors that, alone or in combination with other factors, have the potential to influence the operating and financial performance of the Company in the future (refer Section 2.2).

In addition, there are other general investment risks, many of which are largely beyond the control of the Company and difficult to predict or anticipate (Section 2.3).

The Board aims to manage these risks by carefully planning the Company's activities and implementing risk control measures. However, as noted above, some of the risks identified below are highly unpredictable and the Company is limited to the extent to which it can effectively manage them.

The following risk factors are not intended to be an exhaustive list of the risk factors to which the Company is exposed. Before applying for Shares, you should be satisfied that you have sufficient understanding of the risks identified in this Section and their potential impact on the value of your investment in the Company, so that you can fully consider whether or not an investment in the Company is suitable for you. In addition, you should note that this Section has been prepared without taking into account an applicant's individual financial objectives, financial situation and particular needs. Applicants should seek professional investment advice if they have any queries in relation to making an investment in the Company.

2.2 Specific Risks

Limited history

The Company was incorporated on 25 March 2021 and has limited operating and financial history on which to evaluate its business and prospects. The Company also proposes operating in the mineral exploration sector, which has a high level of inherent risk and uncertainty. The Company has sought to mitigate this risk by engaging personnel who have significant experience in the mineral resources and exploration sectors as members of its Board (refer to the biographies for the members of the Board in Section 5.1 for further information).

Notwithstanding the Company seeking to mitigate the risk of its limited history, no assurance can be given that the Company will identify a commercially viable mineral deposit and, even if such a deposit is identified, that the Company will subsequently be able to develop commercially viable mineral production operations.

Until the Company is able to realise value from its interests, it is likely to only incur operating losses.

Regulatory risk

The mining and exploration activities of the Company are dependent upon the maintenance (including renewal) of the tenements in which the Company has or proposes acquiring an interest. Maintenance of these tenements is dependent on, amongst other matters, the ability of the Company to meet conditions imposed by relevant authorities. Although the Company has no reason to think that the tenement forming the Cowalinya Project (E63/1972) will not be renewed, there is no guarantee that such a renewal will be given as a matter of course and there is no assurance that new conditions will not be imposed or whether the Company will be able to meet the conditions of renewal on commercially viable terms, or at all. The Company has also filed applications for exploration licences in the Northern Territory (EL 33101 and EL 33194) and cannot guarantee such applications (or either of them) will be granted.

The Company may also be required to obtain access and other approval or authorisations from regulatory and/ or other entities, including under applicable native title legislation. Such approvals or authorisations may be complex and require the input of third parties. In addition, any future changes to legislation and regulation may impose obligations or restrictions on the Company which cannot be predicted.

The Company cannot guarantee that any or all requisite approvals and authorisations will be obtained. A failure to obtain any required regulatory approval or authorisation may mean that the Company may be restricted, either in part or absolutely, from exploration, development and mining activities.

Operating and development risks

The operations of the Company may be affected by various factors including logistics, occupational health and safety, environmental management and compliance and failures in internal controls and financial fraud. To the extent that such matters may be in the control of the Company, the Company will seek to mitigate these risks through management and supervision controls.

In addition, the operations of the Company may be affected by various factors which are beyond the control of the Company, including adverse weather conditions, industrial and environmental accidents, industrial disputes and unexpected shortages or increases in the costs of consumables, plant and equipment, fire, explosions and other incidents beyond the control of the Company.

The operations of the Company may also be affected by natural disasters, epidemics, terrorist attacks and other disasters which may materially and adversely affect the economy in Australia and the Company's business.

Exploration activities may not result in the development of the interests of the Company into a commercially viable project. For a wide variety of reasons, not all discoveries are commercially viable and even if an apparently viable deposit is identified, there is no guarantee that it can be economically developed and exploited. If a discovery is not commercially viable, the financial position and prospects of the Company could be adversely affected and could potentially result in the Company scaling back activities.

The development of the exploration interests of the Company may require further capital to be raised in excess of the funds under the Equity Offer. The Company does not intend to proceed with further development beyond the planned activities until it has obtained and extensively analysed the results of its exploration activities, and the ongoing activities of the Company are dependent in large part on the results of its planned exploration activities. Details of the use of funds under the Equity Offer are set out in Section 7.6.

Exploration risk

Potential investors should understand that mineral exploration is a high-risk undertaking. Whilst a mineral resource has been declared at the Cowalinya Project (refer Annexure A for further information), there can be no assurance that exploration activities will result in the discovery of an economically viable mineral deposit. The future exploration activities of the Company may be affected by a range of factors including geological conditions, limitations on activities due to seasonal weather patterns, unanticipated operational and technical difficulties, industrial and environmental accidents, local title processes, changing government regulations and many other factors beyond the control of the Company.

The tenements held by the Company (including, if granted, NT EL 33101 and EL 33194) may include various restrictions excluding, limiting or imposing conditions upon the ability of the Company to conduct exploration activities. Further details of these potential restrictions are set out under “Regulatory Risk” below. While the Company will formulate its exploration plans to accommodate and work within such access restrictions, there is no guarantee that the Company will be able to satisfy such conditions on commercially viable terms, or at all.

Environmental risk

The proposed activities of the Company will be subject to various laws and regulations concerning the environment. Mining operations have inherent risks and liabilities associated with safety and damage to the environment and disposal of waste products occurring as a result of mining exploration and production. The occurrence of any such safety or environmental incident could delay production or increase production cost or result in a substantial liability being accrued against the Company.

Proceeding with a mining operation would be expected to create significantly enhanced environmental risks, particularly with respect to environmental damage through construction activities, disposal of waste products and/or water contamination. Such occurrences could delay production or increase costs of operations.

Access risk

Exploration licences may include various restrictions excluding, limiting or imposing conditions upon the ability of the Company to conduct exploration activities, including but not limited to in respect of exclusions from pursuing exploration on certain areas of Commonwealth land, requirements arising from Native Title legislation and claims and/or state legislation relating to Aboriginal heritage, culture and objects, environmental based conditions and restrictions and access procedures in relation to privately held land.

While the Company will formulate its exploration plans to accommodate and work within any such access restrictions, there is no guarantee the Company will be able to satisfy such conditions on commercially viable terms, if at all. In addition, such restrictions may be complex and/or require approvals, consents or negotiations involving governmental entities or third parties. As such, there is a risk that access issues may prevent the Company from implementing its intended exploration plans, which may adversely impact upon the financial position, operations and prospects of the Company.

Any future changes in legislation and regulations may impose significant obligations or restrictions on the Company which cannot be predicted.

The COVID-19 pandemic may also give rise to issues, delays or restrictions in relation to land access, the extent of the effect of COVID-19 on land access is hard to predict at the current time given the situation remains uncertain and is evolving rapidly.

Future requirements for capital

Whilst the Company will at Listing have enough working capital to carry out its stated objections (refer Sections 1 and 7.6 regarding the stated objectives of the Company and its use of funds raised under the Equity Offer), further development activities may be required for the Company to identify and commence commercially viable mining operations. Accordingly, the Company will in future require additional capital in excess of the funds to be raised under the Equity Offer for its activities, including for the future development activities.

There can be no guarantee that further financing will be available on commercially acceptable terms, or at all. Any additional financing through equity issues would be dependent upon the ability of the Company to raise funds in the securities market, which in turn is dependent on there being sufficient identifiable appetite from investors for equity in the Company. If successfully conducted, such issues would also be dilutive to the current equity holders in the Company. Furthermore, debt financing may not be available to support the scope and extent of the proposed activities of the Company.

Change in strategy

The medium to long term plans and strategies of the Company may evolve over time due to review, analysis and assessment of results from planned exploration activities. This is consistent with other entities conducting mineral exploration similar to the Company. Accordingly, the plans and strategies of the Company as at the date of this Prospectus may not reflect the plans and strategies following review, analysis and assessment of results. Any such changes have the potential to expose the Company to heightened or additional risks.

In addition, any development of exploration interests of the Company to and including commercial operations will expose the Company to further risks associated with such activities. Nothing in this Prospectus is to be taken to indicate that the Company will commence development at a specific time, if at all.

In addition, as with most exploration entities, the Company may assess and pursue other new business opportunities in the resource sector over time which complement its business (which may take the form of joint ventures, farm-ins, acquisitions and other forms of opportunities). In such cases the Company may, by pursuing such new opportunities, become subject to additional or heightened risks.

Reliance on key management personnel

The responsibility of overseeing the day-to-day operations and strategic management of the Company depends substantially on the Directors and senior management of the Company. As noted above, the Company has sought to mitigate the risk of its limited history by engaging personnel who have significant experience in the mineral resources and exploration sectors as members of its Board. The Company relies, and will in future rely, on the skills and experience of these personnel in its operations.

Noting the above, there can be no assurance given that there will be no detrimental impact on the performance of the Company and its growth potential if one or more of its Directors and/or senior management cease to be engaged by the Company and the Company gives no guarantee that, if one or more of its Directors and/or senior management cease to be engaged by the Company, that a suitable replacement would be identified and engaged in a timely manner, if at all.

Third party

The Company has contracted with, or will in the future need to contract with, various parties to enable the implementation of its exploration plans. Such counterparties include service contractors, consultants, suppliers, landowners and native title holders. There is a risk that counterparties may fail to perform their obligations under existing or future agreements. This could lead to delays, increase in costs, disputes and even litigation. All these factors could negatively affect the Company's operations and there can be no assurance the Company would be successful in seeking remedies or enforcement of its rights through legal actions.

Offers conditions

The Offers under this Prospectus are subject to and conditional upon certain matters, including ASX granting conditional approval for the admission of the Company to the Official List. If this condition is not satisfied then the Offers will not proceed and failure to complete the Offers may have a material adverse effect on the financial position and operations of the Company. In addition, the conditions imposed for the admission of the Company to the Official List is at the discretion of ASX and no guarantee can be given that the Company will be able to satisfy the conditions of admission imposed by ASX in a certain time period, or at all.

Climate change

As an entity engaged in exploration activities, the Company anticipates it will be subject to climate risks and in particular:

- the emergence of new or expanded regulations associated with transitioning to a lower carbon economy including market changes associated with climate change mitigation. The Company may be impacted by local and international compliance regulations, or specific taxes or penalties associated with carbon emissions or environmental damage. Given the uncertainty with respect to the future regulatory framework regarding climate change mitigation, the Company may be subject to further restrictions, conditions and risks. While the Company will seek to manage such risks as and when they arise, there can be no guarantee that the Company will be able to do so in a cost effective manner, if at all; and

- climate change may cause physical and environmental risks that cannot be predicted, including extreme weather patterns and events that may directly or indirectly impact the operations of the Company and may significantly disrupt the industry in which the Company operates.

2.3 General Investment Risks

General economic climate

The performance of the Company is likely to be affected by changes in economic conditions. The success of the Company may be affected by some of the matters listed below:

- general financial issues which may affect policies, exchange rates, inflation and interest rates;
- deterioration in economic conditions, possibly leading to reductions in business spending and other potential revenues which could be expected to have a corresponding adverse impact on operations and financial performance of the Company;
- the strength of the equity and share markets in Australia and throughout the world;
- financial failure or default by any entity with which the Company is or may become involved in a contractual relationship;
- the impact that geo-political factors have on the world and/or Australia, on the financial markets and/or on investments generally or specifically;
- terrorism or other hostilities;
- global health and safety; and
- industrial disputes in Australia and other relevant markets.

Changes in legislation & government regulation

Changes in government, financial policy, taxation and other laws in any local and/or international markets or regions cannot be predicted and may affect the Company's ability to carry on its proposed activities, restrict the Company in achieving its objectives or may result in increased compliance costs or complexities in managing the Company's proposed operations and activities.

The Company is also subject to various regulatory requirements, including mining and accounting requirements. Changes to standards, policies, guidelines, interpretations or principles may affect the Company's ability to carry out its activities and/or achieve its objectives. The Company cannot control or predict changes to regulatory requirements, which may adversely affect the Company.

Commodity price volatility and exchange rate risk

If the Company achieves success leading to mineral production, the revenue it may derive through the sale of commodities exposes the potential income of the Company to commodity price and exchange rate risks. Commodity prices fluctuate and are affected by many factors beyond the control of the Company. Such factors include supply and demand fluctuations for precious and base metals, technological advancements, forward selling activities and other macro-economic factors.

Furthermore, international prices of various commodities are denominated in United States dollars, whereas the income and expenditure of the Company are and will be taken into account in Australian currency, exposing the Company to the fluctuations and volatility of the rate of exchange between the United States dollar and the Australian dollar as determined in international markets.

Market conditions

The Company's operating results, economic and financial prospects and other factors will affect the trading price of Shares. In addition, the price of Shares is subject to varied and often unpredictable influences on the market for equities, including but not limited to, general economic conditions including the performance of the Australian dollar, the Euro and US dollars on world markets, inflation rates, foreign exchange rates and interest rates, variations in the general market for listed stocks in general, short-selling, changes to government policy, legislation or regulation, industrial disputes, general operational and business risks, and hedging or arbitrage trading activity that may develop involving the Shares.

The Share prices for many companies have been and may in the future be highly volatile which in many cases may reflect a diverse range of non-company specific influences such as global hostilities and tensions relating to certain unstable regions of the world, acts of terrorism and the general state of the global economy. No assurances can be made that the Company's market performance will not be adversely affected by any such market fluctuations or factors.

Lack of liquidity may affect the value of securities. The trading price of securities offered under this Prospectus carry no guarantee with respect to payment of dividends, return of capital or their market value or price.

Pandemic

The Company's operations may be adversely affected in the short to medium term by the economic uncertainty caused by a pandemic, including as a result of the COVID-19 pandemic which remains ongoing. Although the impacts of COVID-19 appear to have stabilised in most countries including Australia, no guarantee can be given that governmental or industry measures taken in response to COVID-19, or any potential future pandemic (if any), will not adversely impact the operations of the Company and are likely to be beyond the control of the Company.

Litigation

The Company is exposed to possible litigation risks including contractual disputes, occupational health and safety claims and employee claims. Further, the Company may be involved in disputes with other parties in the future which may result in litigation. Any such claim or dispute if proven, may impact adversely on the Company's operations, financial performance and financial position.

Insurance

The Company intends to insure its activities in accordance with industry practice, however there is a risk that the insurance cover held by the Company will not be of a nature or level adequate for a particular circumstance, which could have a material adverse effect on the business, financial condition and results of the Company. Insurance against all risks associated with exploration activities and, if applicable, production is not always commercially viable.

Taxation

There may be tax implications from applying for and receiving Shares or other securities under this Prospectus and/or the disposal of Shares or other securities (including on conversion of such other securities into Shares) in future. You should consult your professional advisor before deciding to apply for securities under this Prospectus.

Unforeseen risk

There may be other risks which the Directors and/or management are unaware of at the time of issuing this Prospectus which may impact upon the Company, its operations and/or the value and performance of the securities offered under this Prospectus.

2.4 Speculative Nature of Investment

The above list of risk factors ought not to be taken as exhaustive of the risks faced by the Company or by investors in the Company. The above risk factors, and other not specifically referred to above, may materially affect the future financial performance of the Company and the value of the securities offered under this Prospectus.

There may be other risks which the Directors are unaware of at the time of issuing this Prospectus which may impact the Company, its operations and/or valuation and performance of the Company's securities.

The Shares issue pursuant to this Prospectus therefore carry no guarantee with respect to the payment of dividends, returns of capital or market value. The Company does not expect to declare any dividends during the first two years following listing.

Potential investors should consider that investment in the Company is highly speculative and should consult their professional advisors before deciding whether to apply for securities under this Prospectus.

3. FINANCIAL INFORMATION

3.1 - INTRODUCTION

Heavy Rare Earths Limited (formerly HRE Corporation Limited) was incorporated on 25 March 2021. Prior to this Prospectus the Company has 37,275,150 fully paid ordinary shares on issue following a consolidation of share capital on a 1-for-5 basis on 17 March 2022. Unless otherwise stated, details regarding the issued capital of the Company are on a post-consolidation basis.

This Prospectus has been issued to provide information on the Company's initial public offer of 30,00,000 Shares at a price of $0.20 per Share to raise $6,000,000 (before costs) pursuant to the Equity Offer. The Shares to be issued through the Equity Offer will represent 43.94% of the total issued Shares at Listing.

A copy of the audited financial report for the Company for the period from incorporation to 31 December 2021 has been lodged with ASIC and is taken to be included in this Prospectus by operation of section 712 of the Corporations Act. Any person may request a copy of the financial report during the application period for this Prospectus and the Company will provide a copy free of charge. A copy of the financial report can also be downloaded from the website of the Company at https://hreltd.com.au/about-us/corporate-governance/.

This Section contains a summary of the relevant historical financial information and pro forma historical financial information of the Company, which has been prepared by the Directors of the Company.

The Statutory Historical Financial Information comprises the following:

- The historical Statement of Profit or Loss and Other Comprehensive Income for the period from incorporation to 31 December 2021 (“Historical Statement of Profit or Loss and Other Comprehensive Income”);

- The historical Statement of Cash Flows for the period from incorporation to 31 December 2021 (“Historical Statement of Cash Flows”); and

- The Company’s historical Statement of Financial Position as at 31 December 2021 (“Historical Statement of Financial Position”).

Collectively referred to as the “Statutory Historical Financial Information” see section 3.2

The pro forma historical information comprises the Pro forma historical Statement of Financial Position as at 31 December 2021, referred to as the “Historical Pro Forma Financial Information” - see section 3.3.

The Historical Pro forma Financial Information has been prepared to reflect the Statutory Historical Financial Information adjusted to give effect to the issue of the Shares.

The Statutory Historical Financial Information and Pro Forma Historical Financial Information is together referred to as the “Financial Information”. The basis of preparation and presentation of the Financial Information is set out in see Section 3.4. Accounting policies have been consistently applied throughout the periods presented unless otherwise stated.

The Statutory Financial Information has been derived from the audited general purpose financial report of Heavy Rare Earth Resources Limited for the period from incorporation to 31 December 2021. This financial report has been audited by William Buck who has issued an unqualified audit opinion.

The Pro Forma Historical Financial Information has been derived from the Statutory Financial Information and adjusted as set out below in section 3.3.

The information in this Section 3 should be read in conjunction with the risk factors set out in Section 4 and other information contained in this Prospectus.

All amounts disclosed in the tables are presented in Australian dollars unless otherwise noted. Past performance is not a guide to future performance. Pro forma financial information is not a forecast.

Forecast Financial Information

There are significant uncertainties associated with forecasting future revenues and expenses of the Company. In light of uncertainty as to timing and outcome of the Company's growth strategies and the general nature of the industry in which the Company will operate, as well as uncertain macro market and economic conditions in the Company's markets, the Company's performance in any future period cannot be reliably estimated. On these bases and after considering ASIC Regulatory Guide 170, the Directors do not believe they have a reasonable basis to reliably forecast future earnings and accordingly forecast financials are not included in this Prospectus.

3.2 – HISTORICAL FINANCIAL INFORMATION

3.2.1 – Historical Statement of Profit or loss and other comprehensive income

Set out below is the Statement of profit or loss and other comprehensive income for the Company for the period from 25 March 2021 to 31 December 2021, referred hereafter to as the financial period ended 31 December 2021.

	Audited financial period ended 31 December 2021
	$
Expenses	
Corporate and administration expenses	(118,568)
Loss before income tax expense	(118,568)
Income tax expense	-
Loss after income tax expense for the period attributable to the owners of the Company	(118,568)
Other comprehensive income	-
Total comprehensive income for the period	(118,568)

The historical Statement of profit or loss and other comprehensive income about should be read in conjunction with the Notes to this financial section.

During the financial period ended 31 December 2021, expenditures consisted of applying for the Company's exploration projects, review of historical exploration data and preparation for future exploration programs, in addition to activities associated with the preparation for an initial public offering and listing on the Australian Securities Exchange (ASX).

3.2.2 Historical Statement of financial position

Set out below is the historical statement of financial position for the Company as at the financial period ended 31 December 2021.

	Audited 31 December 2021 $
Current Assets	
Cash and cash equivalents	740,820
Trade and other receivables	8,453
Total Current Assets	**749,273**
Non-Current Assets	
Exploration and evaluation expenditure	407,593
Total Non-Current Assets	**407,593**
Total Assets	**1,156,866**
Current Liabilities	
Trade and other payables	56,579
Total Current Liabilities	**56,579**
Total Non-Current Liabilities	**-**
Total Liabilities	**56,579**
Net Assets	**1,100,287**
Equity	
Issued capital	1,218,855
Accumulated losses	(118,568)
Net Equity	**1,100,287**

The historical Statement of financial position should be read in conjunction with the Notes to this financial section.

During the financial period ended 31 December 2021, the Company issued shares to raise capital of $1,258,912 before costs and incurred exploration expenditure of $407,593 and corporate and administration costs of $118,568.

3.2.3 Historical Statement of cashflows

Set out below is the statement of cashflows for period from 25 March 2021 to 31 December 2021, referred hereafter to as the financial period ended 31 December 2021.

	Audited Financial period ended 31 December 2021 $
Cash flows from operating activities	
Payments to suppliers (inclusive of GST)	(70,442)
Net cash used in operating activities	**(70,442)**
Cash flows from investing activities	

Payments for exploration and evaluation	(407,593)
Net cash used in investing activities	**(407,593)**
Cash flows from financing activities	
Proceeds from issue of shares	1,288,912
Payments for capital raising costs	(70,057)
Net cash used in financing activities	**1,218,855**
Net increase in cash and cash equivalents	740,820
Cash and cash equivalents at the beginning of the financial period	-
Cash and cash equivalents at the end of the financial period	**740,820**

The historical Statement of cashflows should be read in conjunction with the Notes to this financial section.

3.3 – PRO FORMA FINANCIAL INFORMATION

3.3.1 Pro forma Statement of Financial Position

Set out below is the pro forma statement of financial position as at 31 December 2021 based on the pro forma assumptions set out below:

	Note	Audited 31 December 2021 $	Pro forma 31 December 2021 $
Current Assets			
Cash and cash equivalents		740,820	5,750,820
Trade and other receivables		8,453	8,453
Total Current Assets		**749,273**	**5,759,273**
Non-Current Assets			
Exploration and evaluation expenditure		407,593	907,593
Total Non-Current Assets		**407,593**	**907,593**
Total Assets		**1,156,866**	**6,666,866**
Current Liabilities			
Trade and other payables		56,579	56,579
Total Current Liabilities		**56,579**	**56,579**
Total Non-Current Liabilities		-	-
Total Liabilities		**56,579**	**56,579**
Net Assets/(Liabilities)		**1,100,287**	**6,610,287**
Equity			
Issued capital		1,218,855	6,550,196
Reserves		-	944,368
Retained Earnings/Accumulated losses		(118,568)	(884,277)
Net Equity/(Deficiency)		**1,100,287**	**6,610,287**

The pro forma statement of financial position for Heavy Rare Earths as at 31 December 2021 has been prepared as if the following transactions have taken place at that date:

Subsequent events transactions

- The inclusion of $50,000 for general administration of the Company and accounting fees, deducted from cash and recognised in accumulated losses; and

- The inclusion of an issue of 70,000 shares to a Director, valued at a total of $2,000 as consideration for pre-IPO consulting services in addition to and separate from the role as a Director, recorded in issued capital and trade payables.

Transactions of the IPO

- The inclusion of a capital raising of $6,000,000 under the Equity Offer raising amounts, net of capital raising costs paid from cash of $640,000;

- The inclusion of a share based payment expense for the grant of two tranches of 1,850,000 unlisted options to the lead manager as outlined at section 3.4.2, allocated to capital raising costs and share based payment reserve, with a total valuation of $235,659;

- The inclusion of a share-based payment expense relating to the grant of 4,000,000 unlisted options to Directors of the Company as outlined at section 3.4.2, allocated to retained earnings and share based payment reserve, with a total valuation of $283,819;

- The inclusion of a share-based payment expense relating to the grant of 5,500,000 unlisted options to former Directors of the Company as outlined at section 3.4.2, allocated to retained earnings and share based payment reserve, with a total valuation of $353,936;

- The inclusion of a share-based payment expense relating to the grant of 1,000,000 unlisted options to Company advisors as outlined at section 3.4.2, allocated to retained earnings and share based payment reserve, with a total valuation of $70,954;

- The inclusion of a share-based payment expense relating to the grant of shares to the vendor of the Company's projects as outlined at section 3.4.2, allocated to exploration asset and share based payment reserve, with a total valuation of $200,000; and

- The inclusion of a cash payment to the vendors of the Company's Cowalinya project of $300,000.

3.4 NOTES TO FINANCIAL STATEMENTS

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The financial information presented herein has been prepared in accordance with the measurement and recognition (but not all disclosure) requirements of applicable Australian Accounting Standards. The financial information is presented in abbreviated form insofar as it does not comply with all disclosure requirements set out in the Australian Accounting Standards and Interpretations and the *Corporations Act 2001*. Australian Accounting Standards include Australian Equivalents to International Financial Reporting Standards ("AIFRS").

The financial information has been prepared on the basis of historical cost and on a going concern basis. Cost is based on the fair values of the consideration given in exchange for assets. All amounts are presented in Australian dollars, unless otherwise stated. In the view of the Directors of Heavy Rare Earths Limited, the omitted disclosures provide limited relevant information to potential investors.

The following significant accounting policies have been adopted in the preparation and presentation of the historical and pro forma financial information (collectively referred to as the "financial statements"):

(a) Basis and Method of Preparation

The Financial Information has been prepared and presented in accordance with the recognition and measurement principles of Australian equivalents of International Financial Reporting Standards and the adopted accounting policies of the Company.

The Financial Information is presented in the Prospectus in an abbreviated form, insofar as it does not include all of the presentation and disclosures required by Australian Accounting Standards and other mandatory professional reporting requirements applicable to general purpose financial reports prepared in accordance with Australian Accounting Standards.

(b) Going Concern

The historical financial information has been prepared on a going concern basis, which contemplates the continuity of normal business activity and the realisation of assets and the settlement of liabilities in the normal course of business. The ability of the Company to continue as a going concern is dependent on securing additional funding through new or existing investors to fund its operational and marketing activities. These conditions indicate a material uncertainty that may cast a significant doubt about the entity's ability to continue as a going concern and, therefore, that it may be unable to realise its assets and discharge its liabilities in the normal course of business. The Directors believe that the Company will continue as a going concern. As a result, the financial information has been prepared on a going concern basis. However should the fundraising under the Prospectus be unsuccessful, the entity may not be able to continue as a going concern. No adjustments have been made relating to the recoverability and classification of liabilities that might be necessary should the Company not continue as a going concern.

(c) Current and non-current classification

Assets and liabilities are presented in the statement of financial position based on current and non-current classification.

An asset is classified as current when: it is either expected to be realised or intended to be sold or consumed in the company's normal operating cycle; it is held primarily for the purpose of trading; it is expected to be realised within 12 months after the reporting period; or the asset is cash or cash equivalent unless restricted from being exchanged or used to settle a liability for at least 12 months after the reporting period. All other assets are classified as non-current.

A liability is classified as current when: it is either expected to be settled in the company's normal operating cycle; it is held primarily for the purpose of trading; it is due to be settled within 12 months after the reporting period; or there is no unconditional right to defer the settlement of the liability for at least 12 months after the reporting period. All other liabilities are classified as non-current.

Deferred tax assets and liabilities are always classified as non-current.

(d) Cash and cash equivalents

Cash and cash equivalents includes cash on hand, deposits held at call with financial institutions, other short-term, highly liquid investments with original maturities of three months or less that are readily convertible to known amounts of cash and which are subject to an insignificant risk of changes in value.

(e) Exploration and evaluation assets

Exploration and evaluation expenditure in relation to separate areas of interest for which rights of tenure are current is carried forward as an asset in the statement of financial position where it is expected that the expenditure will be recovered through the successful development and exploitation of an area of interest, or by its sale; or exploration activities are continuing in an area and activities have not reached a stage which permits a reasonable estimate of the existence or otherwise of economically recoverable reserves. Where a project or an area of interest has been abandoned, the expenditure incurred thereon is written off in the year in which the decision is made.

(f) Impairment of non-financial assets

Non-financial assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognised for the amount by which the asset's carrying amount exceeds its recoverable amount.

Recoverable amount is the higher of an asset's fair value less costs of disposal and value-in-use. The value-in-use is the present value of the estimated future cash flows relating to the asset using a pre-tax discount rate specific to the asset or cash-generating unit to which the asset belongs. Assets that do not have independent cash flows are grouped together to form a cash-generating unit.

(g) Trade and other payables

These amounts represent liabilities for goods and services provided to the company prior to the end of the financial period and which are unpaid. Due to their short-term nature they are measured at amortised cost and are not discounted. The amounts are unsecured and are usually paid within 30 days of recognition.

(h) Share Based Payments

Equity-settled and cash-settled share-based compensation benefits are provided to employees and suppliers.

Equity-settled transactions are awards of shares, or options over shares, that are provided to employees and suppliers in exchange for the rendering of services. Cash-settled transactions are awards of cash for the exchange of services, where the amount of cash is determined by reference to the share price.

The cost of equity-settled transactions are measured at fair value on grant date. Fair value is independently determined using either the Binomial or Black-Scholes option pricing model that takes into account the exercise price, the term of the option, the impact of dilution, the share price at grant date and expected price volatility of the underlying share, the expected dividend yield and the risk free interest rate for the term of the option, together with non-vesting conditions that do not determine whether the company receives the services that entitle the employees to receive payment. No account is taken of any other vesting conditions.

The cost of equity-settled transactions are recognised as an expense with a corresponding increase in equity over the vesting period. The cumulative charge to profit or loss is calculated based on the grant date fair value of the award, the best estimate of the number of awards that are likely to vest and the expired portion of the vesting period. The amount recognised in profit or loss for the period is the cumulative amount calculated at each reporting date less amounts already recognised in previous periods.

The cost of cash-settled transactions is initially, and at each reporting date until vested, determined by applying either the Binomial or Black-Scholes option pricing model, taking into consideration the terms and conditions on which the award was granted. The cumulative charge to profit or loss until settlement of the liability is calculated as follows:

- during the vesting period, the liability at each reporting date is the fair value of the award at that date multiplied by the expired portion of the vesting period.

- from the end of the vesting period until settlement of the award, the liability is the full fair value of the liability at the reporting date.

All changes in the liability are recognised in profit or loss. The ultimate cost of cash-settled transactions is the cash paid to settle the liability.

Market conditions are taken into consideration in determining fair value. Therefore any awards subject to market conditions are considered to vest irrespective of whether or not that market condition has been met, provided all other conditions are satisfied.

If equity-settled awards are modified, as a minimum an expense is recognised as if the modification has not been made. An additional expense is recognised, over the remaining vesting period, for any modification that increases the total fair value of the share-based compensation benefit as at the date of modification.

If the non-vesting condition is within the control of the company or employee, the failure to satisfy the condition is treated as a cancellation. If the condition is not within the control of the company or employee and is not satisfied during the vesting period, any remaining expense for the award is recognised over the remaining vesting period, unless the award is forfeited.

If equity-settled awards are cancelled, it is treated as if it has vested on the date of cancellation, and any remaining expense is recognised immediately. If a new replacement award is substituted for the cancelled award, the cancelled and new award is treated as if they were a modification.

(i) Issued capital

Ordinary shares are classified as equity.

Incremental costs directly attributable to the issue of new shares or options are shown in equity as a deduction, net of tax, from the proceeds.

(j) Goods and services Tax ('GST') and other similar taxes

Revenues, expenses and assets are recognised net of the amount of associated GST, unless the GST incurred is not recoverable from the tax authority. In this case it is recognised as part of the cost of the acquisition of the asset or as part of the expense.

Receivables and payables are stated inclusive of the amount of GST receivable or payable. The net amount of GST recoverable from, or payable to, the tax authority is included in other receivables or other payables in the statement of financial position.

Cash flows are presented on a gross basis. The GST components of cash flows arising from investing or financing activities which are recoverable from, or payable to the tax authority, are presented as operating cash flows.

Commitments and contingencies are disclosed net of the amount of GST recoverable from, or payable to, the tax authority.

2. Critical Estimates and Judgements

The Directors evaluate estimates and judgements incorporated into the financial report of the Company based on historical knowledge and best available current information. Estimates assume a reasonable expectation of future events and are based on current trends and economic data obtained both externally and within the business.

Recovery of deferred tax assets
Deferred tax assets are recognised for deductible temporary differences or carry-forward losses only if the company considers it is probable that future taxable amounts will be available to utilise those temporary differences and losses.

Exploration and evaluation costs
Exploration and evaluation costs have been capitalised on the basis that the company will commence commercial production in the future, from which time the costs will be amortised in proportion to the depletion of the mineral resources. Key judgements are applied in considering costs to be capitalised which includes determining expenditures directly related to these activities and allocating overheads between those that are expensed and capitalised. In addition, costs are only capitalised that are expected to be recovered either through successful development or sale of the relevant mining interest.

Factors that could impact the future commercial production at the mine include the level of reserves and resources, future technology changes, which could impact the cost of mining, future legal changes and changes in commodity prices. To the extent that capitalised costs are determined not to be recoverable in the future, they will be written off in the period in which this determination is made.

Share based payments
The Company has recognised a pro forma share based payment expense related to the proposed grant of:

- 4,000,000 unlisted options over shares (comprising Class A options) and 70,000 fully paid ordinary shares to Directors;
- 5,500,000 unlisted options over shares (comprising 3,000,000 Tranche A and 2,500,000 Tranche B) to former Directors;
- 3,700,000 (comprising 1,850,000 Class A and 1,850,000 Class B) unlisted options over shares to the Lead Manager;
- 1,000,000 (Class A) unlisted options over Shares to advisors of the Company; and
- 1,000,000 Shares to the project vendors of the Company.

upon the Company being listed on ASX as detailed below.

Security	***Number***	***Valuation per security***	***Share based payment expense***
Fully paid ordinary shares	70,000	\$0.10 (1)	\$7,000
Fully paid ordinary shares	1,000,000	\$0.20 (2)	\$200,000
Unlisted options over shares			
• Class A - exercisable at \$0.30 each expiring three years from issue date	9,850,000	\$0.0710 (3)	\$698,903
• Class B - exercisable at \$0.40 each expiring three years from issue date	4,350,000	\$0.0564 (3)	\$245,465

Notes

(1) The fully paid ordinary shares are valued at the pre-IPO issue price of \$0.10 each.

(2) The fully paid ordinary shares are valued at the proposed issue price of new fully paid ordinary shares offered through this Prospectus of \$0.20 each.

(3) These valuations have been derived from the Blacks-Scholes option pricing model using a share price volatility input of 70% and a risk free interest rate of 1.00%.

	Audited 31 December 2021 \$	Pro forma 31 December 2021 \$
3. CASH AND CASH EQUIVALENTS		
Cash at bank and on hand	740,820	5,750,820

Adjustments arising in preparation of the pro forma statement of financial position are summarised as follows:

Company cash and cash equivalents as at 31 December 2021	740,820

Subsequent events

Subsequent administration costs recorded	(50,000)
Transactions of the IPO	
Proceeds received from Equity Offer share issue (gross)	6,000,000
Costs of capital raising	(640,000)
Vendor consideration payment	(300,000)
Pro-forma cash and cash equivalents	**5,750,820**

	Audited 31 December 2021 $	Pro forma 31 December 2021 $
4. ISSUED CAPITAL		
Issued Capital	1,218,855	6,550,196

Pro forma issued and fully paid up capital	**Shares**	**Issue price**	**$**
Shares on issue – 31 December 2021	37,205,150		1,218,855
Issue of shares to Director	70,000	$0.10	7,000
Equity Offer Shares at 20 cents	30,000,000	$0.20	6,000,000
Capital raising costs	-	-	(640,000)
Cost of granting options to lead manager	-	-	(235,659)
Issue of shares to project vendor	1,000,000	$0.20	200,000
Pro Forma issued and fully paid up capital	**68,275,150**		**6,550,196**

5. RESERVES	**Audited 31 December 2021 $**	**Pro forma Minimum 31 December 2021 $**
Share based payment reserve	-	944,368

Adjustments arising in the preparation of the pro-forma statement of financial position are summarised as follows:

Value of options to be granted to lead manager – 3,700,000 options	235,659
Value of advisor unlisted options – 1,000,000 options	70,954
Value of former Directors' unlisted options – 5,500,000 options	353,936
Value of Director unlisted options - 4,000,000 options	283,819
Pro-forma share based payment reserve	944,368

6. COMMITMENTS AND CONTINGENCIES

On 9 June 2021, the Company entered into an Assignment of Option to acquire the rights under an Option Deed in relation to the assignment of the proposed acquisition of an option to acquire 100% of Western Australia Exploration Licence 63/1972 (E 63/1972). The Assignment of Option was entered into with Cobold Metals Limited (Cobold) and David Ross and Christine Ross (Vendors) and is summarised in section 9.2(a) of this Prospectus.

The consideration payable to the Vendors under the Option Deed (as assigned under the Assignment of Option) is $300,000 cash and 1,000,000 fully paid ordinary shares in lieu of payment of $200,000, upon and subject to exercise of the Option the subject of the Option Deed.

Further, the Company is (and its predecessor Cobold was) obliged to comply with minimum expenditure obligations. Vendors have confirmed expenditure obligations of predecessor under the Deed of Option have been fulfilled or waived.

In accordance with the Option Deed the Company grants a royalty Agreement whereby the Vendors will receive rights to a royalty of $A0.25 per tonne for any type of ore processed from the tenements or any successor tenement payable on sale of the relevant mineral product provided that such royalty rate is not more than what would be deemed fair and reasonable and/or having regard to prevailing industry evidence of commercial arm's length royalty rates for such commodities. The total amount payable under the royalty is capped at $250,000 per annum.

7. PLANNED EXPLORATION EXPENDITURE

Planned exploration expenditure at the reporting date but not recognised as liabilities, payable:	**$**
Within one year	80,000
One to five years	480,000
More than five years	800,000
	1,360,000

The above expenditure is planned to take place under the Company's portfolio of tenements. In the event that this expenditure does not take place, the government authority that granted the tenement has the right to rescind the exploration rights under the tenement.

1 July 2022

The Directors
Heavy Rare Earths Limited
c/o Quinert Rodda and Associates
Level 6, 400 Collins Street
Melbourne VIC 3000

Dear Sirs

Investigating Accountant's Report on Heavy Rare Earths Limited historical and pro forma historical financial information

We have been engaged by *Heavy Rare Earths Limited* ("the Company") to report on the historical financial information and pro forma historical financial information of the Company for inclusion in a Prospectus document dated on or around 1 J*uly 2022* and relating to the issue of 30,000,000 shares in the Company ("the document").

Expressions and terms defined in the document have the same meaning in this report.

Scope

Historical Financial Information

You have requested William Buck to review the following historical information of the Company (the responsible party) included in the public document:

- the Statement of Financial Performance for the period from the Company's incorporation through to 31 December 2021;
- the Statement of Financial Position as at 31 December 2021;
- the Statement of Changes in Equity for the period from the Company's incorporation through to 31 December 2021; and
- the Statement of Cash Flows for the for the period from the Company's incorporation through to 31 December 2021.

The historical financial information has been prepared in accordance with the stated basis of preparation, being the recognition and measurement principles contained in Australian Accounting Standards and the Company's adopted accounting policies, which are disclosed in the financial information section of the Prospectus document. The historical financial information has been extracted from the general purpose financial report of the Company for the period from the Company's incorporation through to 31 December 2021, which were audited by William Buck Audit (Vic) Pty Ltd ("William Buck") in accordance with the Australian Auditing Standards.

ACCOUNTANTS & ADVISORS
Level 20, 181 William Street
Melbourne VIC 3000
Telephone: +61 3 9824 8555
williambuck.com

William Buck issued an unmodified audit opinion on the financial report. The historical financial information is presented in the public document in an abbreviated form, insofar as it does not include all of the presentation and disclosures required by Australian Accounting Standards and other mandatory professional reporting requirements applicable to general purpose financial reports prepared in accordance with the Corporations Act 2001.

Pro Forma historical financial information

You have requested William Buck to review the pro forma historical Statement of Financial Position as at 31 December 2021 referred to as "the pro forma historical financial information".

The pro forma historical financial information has been derived from the historical financial information of the Company, after adjusting for the effects of pro forma adjustments described in the financial information section of the Prospectus document. The stated basis of preparation is the recognition and measurement principles contained in Australian Accounting Standards applied to the historical financial information and the events and transactions to which the pro forma adjustments relate, as described in the financial information section of the Prospectus document, as if those events or transactions had occurred as at the date of the historical financial information. Due to its nature, the pro forma historical information does not represent the Company's actual or prospective financial position or financial performance.

Directors' responsibility

The directors of the Company are responsible for the preparation of the historical financial information and pro forma historical financial information, including the selection and determination of pro forma adjustments made to the historical financial information and include in the pro forma historical information. This includes responsibility for such internal controls as the directors determine are necessary to enable the preparation of historical financial information and pro forma historical financial information that are free from material misstatement, whether due to fraud or error.

Our responsibility

Our responsibility is to express a limited assurance conclusion on the financial information based on the procedures performed and the evidence we obtained. We have conducted our engagement in accordance with the Standard on Assurance Engagement ASAE 3450 *Assurance Engagements involving Corporate Fundraisings and/or Prospective Financial Information*.

A review consists of making enquiries, primarily of persons responsible for financial and accounting matters, and applying analytical and other review procedures. A review is substantially less in scope than an audit conducted in accordance with Australian Accounting Standards and consequently does not enable us to obtain reasonable assurance that we would become aware of all significant matters that might be identified in an audit. Accordingly, we do not express an audit opinion.

Our engagement did not involve updating or re-issuing any previously issued audit or review report on any financial information used as a source of the financial information.

Conclusions

Historical financial information

Based on our review, which is not an audit, nothing has come to our attention that causes us to believe that the historical financial information, as described in the financial information section of the Prospectus document, and comprising:

- the Statement of Financial Performance for the period from the Company's incorporation through to 31 December 2021;
- the Statement of Financial Position as at 31 December 2021;
- the Statement of Changes of Equity for the period from the Company's incorporation through to 31 December 2021; and
- the Statement of Cash Flows for the period from the Company's incorporation through to 31 December 2021;

…is not presented fairly, in all material aspects, in accordance with the stated basis of preparation, as described in the financial information section of the Prospectus document.

Pro Forma historical financial information

Based on our review, which is not an audit, nothing has come to our attention that causes us to believe that the pro forma historical financial information being the Statement of Financial Position as at 31 December 2021 is not presented fairly in all material aspects, in accordance with the stated basis of preparation as described in the financial information section of the Prospectus document.

Restriction on Use

Without modifying our conclusions, we draw attention to the financial information section of the Prospectus document which describes the purpose of the financial information, being for inclusion in the public document. As a result, the financial information may not be suitable for use for another purpose.

William Buck has consented to the inclusion of this assurance report in the public document in the form and context in which it is included.

Liability

Responsibility

Consent to the inclusion of this Investigating Accountant's Report in the Prospectus in the form and context in which it appears has been given but should not be taken as an endorsement of the Company or a recommendation by William Buck of any participation in the share issue by any intending investors. At the date of this report our consent has not been withdrawn.

General Advice Limitation

This Report has been prepared and included in the Prospectus to provide investors with general information only and does not take into account the objectives, financial situation or needs of any specific investor. It is not intended to take the place of professional advice and investors should not make specific investment decisions in reliance on this information contained in this Report. Before acting or relying on information, an investor should consider whether it is appropriate for their circumstances having regard to their objectives, financial situation or needs.

Declaration of Interest

William Buck does not have any interest in the outcome of the issue of shares other than in the preparation of this Investigating Accountant's Report for which normal professional fees will be received.

Yours faithfully

William Buck Audit (Vic) Pty Ltd
ABN 59 116 151 136

J.C. Luckins
Director

Dated in Melbourne, Australia this 1st day of July 2022

5. KEY PEOPLE, INTERESTS AND BENEFITS

5.1 Board of Directors

The Board comprises:

- John Joseph Byrne as Non-Executive Chairman.
- Richard Francis Brescianini as an Executive Technical Director.
- Ryan Matthew Skeen as a Non-Executive Director.

A biography for each of the Directors is set out below:

John Joseph Byrne – Non-Executive Chairman – Independent

Mr Byrne has 40 years' experience in the natural resource industry as a financial analyst, investor and mine developer. John formed and mentored Cambrian Mining Plc in 2002, which started with net assets of GBP£1.4 million and before being acquired in 2008 had net assets of GBP£149 million. John has been Chairman and CEO of numerous successful resource companies, including Western Coal Corp which was capitalised at less than C$1 million when he joined, and was sold for C$3.3billion in 2010.

Currently Mr Byrne is the Chairman of Lions Bay Capital Limited (LBI:TSXV) and Fidelity Minerals Limited (FMN:TSXV), both listed on the Toronto Ventures Exchange. Mr Bryne was previously Chairman of ASX listed Kalina Power Limited (ASX:KPO) and Jervois Global Limited (then Jervois Mining Limited) (ASX:JRV).

Mr Bryne is an independent Director.

Richard Francis Brescianini – Executive Technical Director – Not Independent

Mr Brescianini is a qualified geoscientist with an Honours degree from the University of Tasmania and is a member of the Australian Institute of Geoscientists and Australian Society of Exploration Geophysicists. Richard commenced his career in mineral exploration with BHP Minerals in 1987 working in teams focused on the discovery of base and precious metal deposits across Australia and North America. Richard's experience includes working as the Director of the Northern Territory Government's Geological Survey and working for rare earths developer Arafura Resources for 14 years in its executive management team.

Mr Brescianini is an Executive and is therefore not an independent Director.

Ryan Matthew Skeen – Non-Executive Director – Independent

Mr Skeen has a deep understanding of financial and economic markets while providing investment and strategic advice in complex situations. He is well versed in various capital raisings including IPO's, placements and rights issues and is focused on business development and growth. Mr Skeen is the Chief Executive Officer of First Au Limited (ASX:FAU). He holds a Master of Applied Finance (Distinction) and a Bachelor of Business (Financial Risk Management).

Mr Skeen is considered to be an independent Director.

5.2 Key Personnel

Justin Mouchacca – Chief Financial Officer and Company Secretary

Mr Mouchacca is a qualified Chartered Accountant with over 15 years' experience in public company responsibilities including statutory, corporate governance and financial reporting requirements. He graduated from RMIT University in 2008 with a Bachelor of Business majoring in Accounting. Mr Mouchacca completed the Chartered Accountants Program in 2011 and has been appointed Company Secretary and Financial Officer for a number of entities listed on the ASX and unlisted public companies. He specialises in the preparation of listing companies on stock exchanges, Corporations Act legislation, corporate governance policies, statutory report writing requirements, shareholder meeting requirements and assistance in the preparation of prospectuses, information memorandums and other disclosure documents.

5.3 Interests and remuneration of Directors

5.3.1 Interests of Directors

Following successful completion of the Offers and Listing, the Directors will have direct and indirect interests in the securities of the Company as set out in the table below:

Name	Number	Current %	% following Equity Offer
John Byrne	150,000	0.40%	0.22%
Richard Brescianini	120,000	0.32%	0.18%
Ryan Skeen	90,000	0.24%	0.13%
Total	**360,000**	**0.96%**	**0.53%**

Notes to table:

- *All percentages are subject to rounding.*
- *The above table does not include Shares that may be received by Directors as a result of participation in the Equity Offer.*
- *The above table does not include the impact of conversion of convertible securities.*
- *The following Directors (either personally or via a nominee) are proposed to receive Class A Options under the Founder Option Offer as follows: John Bryne – 2,000,000 Class A Options; Richard Brescianini – 2,000,000 Class A Options.*

5.3.2 Remuneration of Directors

The Directors are not receiving remuneration for Director services until the Company achieves Listing. The remuneration of the Directors on and from Listing (excluding statutory superannuation of 10% per annum) is set out in the table below:

DIRECTOR NAME	DIRECTORS FEES (PER ANNUM)
John Bryne	$60,000
Richard Brescianini	$200,000
Ryan Skeen	$48,000

Since incorporation, an aggregate of 70,000 Shares have been issued to Richard Brescianini (or his nominee) in lieu of cash for geological consulting services provided by Richard Brescianini to HRE. An amount of $68,950 is to be paid to Richard Brescianini following and subject to Listing, representing accrued fees for geological consulting services provided by Richard Brescianini to HRE.

Except as set out above, no fees or other amounts have been paid to the existing Directors.

5.4 Interests of advisors

The Company has engaged the following advisors in relation to the Offers:

- Taylor Collison Limited acted as Lead Manager of the Equity Offer. The Company has agreed to pay Taylor Collison Limited the fees summarised in Section 9.2(b) for acting as Lead Manager. During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not otherwise paid or agreed to pay any other fees or amounts to Taylor Collison Limited.

- William Buck Audit (Vic) Pty Ltd acted as Investigating Accountant. The Company has paid or agreed to pay William Buck Audit (Vic) Pty Ltd $10,000 (plus GST) for preparation of the Investigating Accountant's Report contained in Section 4.

  William Buck Audit (Vic) Pty Ltd also acted as auditor of the Company. The Company had paid or agreed to pay William Buck Audit (Vic) Pty Ltd $10,000 (plus GST) for acting as auditor and in respect of the audit of the accounts of the Company which form part of the pro-forma statement of financial position in Section 3. Further amounts may be paid (or agreed to be paid) to William Buck Audit (Vic) Pty Ltd for the performance of its role as auditor, in accordance with normal charge out rates.

  Except as set out above, during the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not paid or agreed to pay any other fees to William Buck Audit (Vic) Pty Ltd.

- Robin Rankin trading as GeoRes prepared the Independent Geologist's Report (excluding Appendix 7 to the Independent Geologist's Report) which is included in Annexure A. The Company has paid or agreed to pay Robin Rankin trading as GeoRes $44,000 (plus GST) for preparation of the Independent Geologist's Report (excluding Appendix 7 to the Independent Geologist's Report). During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not otherwise paid or agreed to pay any other fees or amounts to Robin Rankin trading as GeoRes.

- John Tyrrell trading as JMCT Consulting prepared the Mineral Resource Estimate Report which is included as Appendix 7 to the Independent Geologist's Report. The Company has paid or agreed to pay John Tyrrell trading as JMCT Consulting $33,000 (plus GST) for preparation of the Mineral Resource Estimate Report which is included as Appendix 7 to the Independent Geologist's Report. During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not otherwise paid or agreed to pay any other fees or amounts to John Tyrrell trading as JMCT Consulting.

- House Legal Pty Ltd prepared the Solicitor's Report which is included in Annexure B (excluding those sections of the Solicitor's Report attributed to Ward Keller Pty Ltd). The Company has paid or agreed to pay House Legal Pty Ltd $7,500 (plus GST) for preparation of the Solicitor's Report (excluding those sections of the Solicitor's Report attributed to Ward Keller Pty Ltd). During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not otherwise paid or agreed to pay any other fees or amounts to House Legal Pty Ltd.

- Ward Keller Pty Ltd prepared the sections of the Solicitor's Report attributed to Ward Keller Pty Ltd. The Company has paid or agreed to pay Ward Keller Pty Ltd $4,000 (plus GST) for preparation of the sections of the Solicitor's Report attributed to it. During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has not otherwise paid or agreed to pay any other fees or amounts to Ward Keller Pty Ltd.

- QR Lawyers Pty Ltd has acted as legal advisor to the Company. The Company has paid or agreed to pay QR Lawyers Pty Ltd $129,000 (plus GST) for legal services provided in connection with the Offers. During the 24 months preceding lodgement of this Prospectus with ASIC, the Company has paid QR Lawyers Pty Ltd approximately $20,000 for other services provided as solicitors for the Company, including the documentation for the acquisition of the Cowalinya Project. Subsequently, fees will be charged in accordance with normal charge out rates.

These amounts, and other expenses of the Offers, to the extent not paid by the Company prior to completion of the Offer will be paid out of funds raised under the Equity Offer or available cash. Further information on the use of proceeds and costs of the Offers is set out in Sections 7.6 and 9.8.

6. CORPORATE GOVERNANCE

6.1 ASX Corporate Governance Council Principles and Recommendations

The Company has adopted systems of control and accountability as the basis for the administration of its corporate governance. The Board is committed to administering the policies and procedures with openness and integrity commensurate with the Company's needs and as required to comply with legal and regulatory requirements (including the ASX Listing Rules and the Corporations Act).

The Board seeks, where appropriate, to provide accountability levels that meet or exceed *The Corporate Governance Principles and Recommendations (4th Edition)* as published by ASX Corporate Governance Council in February 2019 (**Recommendations**). A table setting out where the Company has not complied with the Recommendations and providing reasons for such non-compliance is set out below.

The departures from the Recommendations set out below includes information regarding how the Company seeks to address its non-compliance where appropriate.

The Company's corporate governance policies and procedures will be reviewed and where necessary updated and amended to address the Recommendations as amended from time to time.

Copies of the Company's corporate governance policies and procedures are available in full on the Company website at https://hreltd.com.au/about-us/corporate-governance/.

6.2 General Meetings

The Company is committed to upholding shareholder rights and facilitating shareholder participation in general meetings. Shareholders will be invited to attend and ask questions at each general meeting of the shareholders of the Company. In addition, the auditor of the Company is to be invited to attend and answer questions from shareholders at each annual general meeting of the Company.

If a resolution is proposed to be put at a general meeting for the election or re-election of Director(s) of the Company, the notice of meeting convening such general meeting will contain all material information for shareholders to determine whether to elect or re-election the Director(s).

All substantive resolutions at a general meeting of the Company will be determined by way of poll in accordance with the corporate governance policies and procedures of the Company.

6.3 Board of Directors

The Board is responsible for the overall management and corporate governance of the Company.

The responsibilities of the Board include but are not limited to:

- the development, implementation and alteration of the strategic direction of the Company, including future expansion of the Company's business activities;
- risk management, assessment and monitoring. The risk management framework is reviewed at least once during each Reporting Period and the Company will in future disclose that such review has taken place in accordance with the Recommendations;
- ensuring appropriate external reporting to shareholders, the ASX, ASIC and other stakeholders;
- encouraging ethical behaviour, including compliance with the Company's governing laws and procedures and compliance with corporate governance standards;
- establishing targets and goals for Senior Management (if any) to achieve and monitoring the performance of Senior Management (if any);

- review and oversight of compliance with applicable law including the ASX Listing Rules (whilst the Company is listed on the ASX), financing reporting obligations, including periodic and continuous disclosure, legal compliance and related corporate governance matters;

- monitoring and reviewing the operational performance of the Company including the viability of current and prospective operations and opportunities;

- the appointment of new Directors to fill a casual vacancy or as additional Directors, including the conduct of appropriate checks prior to appointment of such Directors, and the provision of all material information to shareholders in determining whether to elect or re-elect such Director(s);

- the appointment and, where appropriate, the removal of senior executives (Managing Director/CEO, CFO, Executive Directors, Company Secretary, and ratifying the appointment or removal of Senior Management) of the Company, including the conduct of appropriate background checks prior to the appointment of such senior executives;

- reviewing the code of conduct, communication and disclosure policy, securities trading policy, diversity policy, risk management policy and remuneration policy to ensure the policies meet the standard of corporate governance required by the Board and are being complied with;

- approving and monitoring major Company financing matters including approval and monitoring of major capital expenditure, capital management, acquisitions and divestitures, materials contracts and incurring material debt obligations; and

- periodic review of the performance of the Board, individual directors and senior executives by special purpose committees established by the Board.

The Company is committed to the circulation of relevant materials to Directors in a timely manner to facilitate Directors' participation in the Board discussions on a fully informed basis.

6.4 Composition of the Board

Election of Board members is substantially the province of the shareholders in a general meeting. Although the Board may appoint Directors to fill casual vacancies or as additions to the Board, the ongoing appointment of Directors is subject to receipt of requisite shareholder approval(s).

The Directors (other than the Managing Director) are subject to retirement by rotation and re-election requirements under the constitution that are consistent with the ASX Listing Rules.

It is the objective of the Company to establish and maintain a Board with a broad representation of skills, experience and expertise. The Board has adopted a skills matrix against which the skills and experience of the Board are measured and reported upon.

6.5 Board Charter and Policies

The Board has adopted a Board Charter and Code of Conduct which formally recognises its responsibilities, functions, power, authority, and composition. The Board Charter and Code of Conduct set out matters that are important for the effective corporate governance of the Company, including:

- a definition of "independence" consistent with the Recommendations;

- a framework for the identification of candidates for appointment to the Board and their selection (including undertaking appropriate background checks);

- a framework for individual performance evaluation;

- proper training to be made available to Directors both at the time of their appointment and on an ongoing basis for professional development purposes;

- basic procedures for meetings of the Board and its committees (if any) including frequency, agenda, minutes and discussions of management issues among non-executive directors;

- ethical standards and values (in a detailed code of corporate conduct which is to be reviewed periodically). The Directors are to be informed of any and all breaches of the code of conduct;

- dealings in securities (in a detailed code for securities transactions designed to ensure fair and transparent trading by Directors, senior management and their associates); and

- communication and disclosure to shareholders and the market.

Any breach of the Board Charter and/or the Code of Conduct is communicated to the Company Secretary who must immediately notify the Board of the particulars of any breach.

6.6 Independent professional advice

Under the Board Charter, subject to approval from the Chair, each Director has the right to seek independent legal or other professional advice at the Company's expense on all matters necessary for that Director to make fully informed and independent decisions to discharge his or her responsibilities.

6.7 Remuneration arrangements

The total maximum remuneration of non-executive Directors is determined by ordinary resolution of shareholders in a general meeting in accordance with the Constitution, the Corporations Act and the ASX Listing Rules (as applicable). The determination of non-executive Directors' remuneration within that maximum will be made by the Board having regard to the input and value to the Company of the respective contributions of each non-executive Director. The aggregate remuneration for non-executive Directors is currently set at $350,000.

6.8 Trading policy

The Board has adopted a securities trading policy that sets out the guidelines on the sale and purchase of securities in the Company by its key management personnel. The policy generally provides that written approval must be obtained from the Chair to trade in the securities of the Company or, if the Chair is the person seeking such approval to trade, the other Director(s) of the Company.

The policy also includes various "closed periods" where trading in the securities of the Company is restricted. The Board may determine additional closed periods at its discretion. The trading policy is available on the website of the Company at https://hreltd.com.au/about-us/corporate-governance/.

6.9 External audit

The Shareholders in annual general meetings are responsible for the ongoing appointment of the external auditors of the Company, and the Board will from time to time review the scope, performance and fees of those external auditors. Any auditor appointed by the Board to fill a casual vacancy in the office of auditor will only hold office until the next annual general meeting of the Company at which point the election of the auditor will be put to shareholders for approval.

6.10 Audit and Risk Committee

Having regard to its current and proposed business structure, financial capacity and objectives, the Company does not currently have, and does not propose appointing, an Audit and Risk Committee.

Until such time as the Audit and Risk Committee is established, the Board will undertake the functions of the Audit and Risk Committee in accordance with the terms of the Audit and Risk Committee Charter with adaptions as necessary and appropriate.

Where possible, the Audit and Risk Committee will consist of at least three non-executive Directors, a majority of whom are independent Directors and such other members so that the overall Audit and Risk Committee comprises:

- at least one member who understands the industry in which the Company operates; and
- members who can read and understand financial statements and are otherwise financially literate.

The Board may appoint one member of senior executive management to be a member of the Audit and Risk Committee if it is deemed their expertise is crucial in adding value to the Audit and Risk Committee.

The responsibilities of the Audit and Risk Committee (or, in their absence, the Board) include, amongst other matters:

- to review the audited annual, half year and periodic financial statements and any reports which accompany published financial statements to ensure compliance with applicable standards;
- to review the evaluation by management of factors related to the independence of the Company's public accountant and to assist them in the preservation of such independence;
- to oversee management's appointment of the company's public accountant;
- advising the Board in relation to risk oversight and management policies;
- advising and providing recommendations to the Board regarding establishment, implementation and review of risk management systems, Company policies and the Company risk profile to ensure the risk management framework of the Company continues to be sound and that the Company is operating with due regard to the risk appetite set by the Board;
- ensuring Senior Management have in place effective systems which identify, assess, monitor and manage risk in the Company in all areas and assessing the effectiveness of such systems;
- reviewing the performance and effectiveness of external auditors and, of any, internal auditors;
- monitoring and reviewing the propriety of related party transactions;
- recommending to the Board the appointment and removal where necessary of external auditors and approving their remuneration and terms of engagement; and
- ensuring the integrity and quality of the financial information of the Company, including the financial information provided to ASIC, ASX and shareholders.

Meetings will be held as often as required to enable to Audit and Risk Committee to undertake its role effectively. The Audit and Risk Committee may conduct investigations where appropriate to fulfil its functions and if considered necessary, including engaging independent experts or advisors.

Before the Company approves financial statements for a financial period (being a period within which the Company must report on its financial performance in accordance with its disclosure obligations), the Managing Director/CEO and CFO (or, if none, the person(s) fulfilling those functions) must provide a declaration that, in their opinion, the financial records of the Company have been properly maintained and that the financial statements comply with appropriate accounting standards and give a true and fair view of the financial position and performance of the Company and that the opinion of the Managing Director/CEO and the CFO (or, if none, the person(s) fulfilling those functions) has been formed on the basis of a sound system of governance, risk management and internal controls (the formulation of which are provided for in this Charter) which is operating effectively.

Periodic financial or other reports released in or for a particular financial period which are not audited or reviewed by the external auditor are to be peer-reviewed internally and signed off on by the CFO and the Board prior to release (including release as an announcement to ASX, as applicable).

6.11 Remuneration and Nomination Committee

Having regard to its current and proposed business structure, financial capacity and objectives, the Company does not currently have a Remuneration and Nomination Committee.

Until such time as the Remuneration and Nomination Committee is established, the Board will undertake the functions of the Remuneration and Nomination Committee in accordance with the terms of the Remuneration and Nomination Committee Charter with adaptions as necessary and appropriate.

Where possible, the Remuneration and Nomination Committee will be composed of not less than three members with a majority of independent Directors. Directors shall be appointed for a term of three years or such shorter period as they remain in office as a Director of the Company (excluding retirement by rotation in accordance with the Constitution and/or ASX Listing Rules).

The purpose of the Remuneration and Nomination Committee is to review and report on remuneration and related policies and practices and make recommendations to the Board about the appointment of new Directors and senior management of the Company.

The responsibilities of the Remuneration and Nomination Committee (or, in their absence, the Board) include, amongst other matters:

- reviewing and evaluation of market practices and trends on remuneration matters and apply them to the circumstances of the Company;
- making recommendations about the Company's remuneration policies and procedures including in respect of the remuneration of senior management and the non-executive Director fee pool;
- reviewing and making recommendations to the Board with respect to the equity based and financial incentive schemes of the Company;
- oversight of the performance of individual senior management and non-executive Directors, committees of the Board and the Board generally;
- identifying and recommending new appointees to the Board based on their skills, competencies and experience and assessing how candidates for the Board may contribute to the strategic direction of the Company;
- developing and implementing appropriate training and development programs;
- developing and reviewing a policy on Board structure including criteria for Board membership;
- identifying and screening specific candidates for nomination, including implementation of a procedure for undertaking appropriate background checks and ensuring that there is an appropriate Board succession plan in place (where applicable);

- reviewing the policy of the Company with respect to tenure, remuneration and retirement of Directors, including overseeing management succession planning; and
- reviewing the Company's reporting and disclosure practices in relation to the remuneration of Directors and senior executives.

6.12 Diversity Policy

The Board has adopted a diversity policy which provides a framework for the Company to achieve, amongst other things, a diverse and skilled workforce, a workplace culture characterised by inclusive practices and behaviours for the benefit of all staff, improved employment and career development opportunities for women and a work environment that values and utilises contributions of employees with diverse backgrounds, experiences and perspectives.

The Board will endeavour where practicable to set measurable objectives for achieving gender diversity and will report on the progress of the Company in achieving such objectives within each reporting period. The Board, having regard to the size and scale of the operations of the Company, has decided not to set measurable objectives for achieving gender diversity in the current reporting period.

The Company will disclose if it has not set measurable objectives in a particular reporting period in accordance with its continuous disclosure obligations under the ASX Listing Rules.

6.13 Whistleblower policy

The Company has a Whistleblower Policy which encourages employees and others involved with the Company to report suspected or known instances of eligible or unethical conduct. The Whistleblower Policy establishes the mechanisms and procedures for the reporting of illegal or unethical conduct in a manner which protects the whistleblower and identifies the necessary information to investigate such reports and act appropriately to investigate such reports in accordance with whistleblower regulations.

6.14 Anti-bribery and corruption policy

The Company has an Anti-Bribery and Corruption Policy for Directors, employees and contractors of the Company. It provides a summary of the law on bribery and corruption, outlines the circumstances in which it is unacceptable to receive and give gifts, entertainment and hospitality and provides a reporting mechanism for allegations of bribery and corruption.

The policy prohibits facilitation payments, secret commissions, money laundering. The policy also prohibits political and charitable donations without the authorisation of the Board.

6.15 Departures from Recommendations

As noted above, the Company seeks to adopt the Recommendations with respect to its corporate governance. Where the Company does not comply with a Recommendation it must identify the extent of the non-compliance and provide an explanation for the departure from the Recommendation.

The Company's departures from the Recommendations as at the date of this Prospectus are detailed in the table below:

Recommendation	**Explanation**
A listed entity should: (a) have and disclose a diversity policy; (b) through its board or a committee of the board set measurable objectives for achieving gender diversity in the	The Company partially complies with this Recommendation. (a) The Company has adopted a Diversity Policy which promotes the engagement of well qualified, diverse and motivated people and outlines the Company's policy of recruiting fairly and equitably regardless of

composition of its board, senior executives and workforce generally; and (a) disclose in relation to each reporting period: (i) the measurable objectives set for that period to achieve gender diversity; (ii) the entity's progress towards achieving those objectives; and (iii) either: (A) the respective proportions of men and women on the Board, in senior executive positions and across the whole workforce (including how the entity has defined "senior executive" for these purposes); or (B) if the entity is a "relevant employer" under the Workplace Gender Equality Act, the entity's most recent "Gender Equality Indicators", as defined in the Workplace Gender Equality Act.	age, gender, race, religion, cultural background, marital or family status, sexual orientation, disability or national origin. The Diversity Policy is available, as part of the Corporate Governance Pack, on the Company's website. (b) Given the size of the Company and status of the Company's projects, the directors believe that it is not appropriate at this stage to set measurable objectives for achieving gender diversity. Notwithstanding this, it is the Board's policy that gender discrimination has no position in the workplace and that men and women must be treated equally and without any discrimination. It is the Board's belief that employment should be on a merit-based system only.

A corporate governance statement will be released by the Company in accordance with its continuous disclosure obligations under the ASX Listing Rules.

7. DETAILS OF THE OFFERS

7.1 The Equity Offer

This Prospectus invites investors to apply for 30,000,000 Shares at an issue price of $0.20 (20 cents) per Share to raise $6 million before costs.

The Equity Offer is a general offer to all eligible investors. If the Company receives valid applications for Shares in excess of $6 million it will scale back applications at its discretion.

Details of how to apply for Shares under the Equity Offer are set out in Section 8.1.

7.2 Other Offers

Vendor Offer

This Prospectus contains an offer of 1,000,000 Shares to the Cowalinya Vendors (or their nominee(s)) as part consideration for the acquisition of the Cowalinya Project. Details of the agreement under which the Company proposes acquiring the Cowalinya Project are set out in Section 9.2(a).

Founder Option Offer

This Prospectus contains an offer of an aggregate of 7,000,000 Class A Options and 2,500,000 Class B Options to existing and former Directors (or their nominee(s)). Details of the number of Class A Options and Class B Options to be issued to the existing Directors are set out in Section 8.2. In addition, 2,500,000 Class A Options and 2,500,000 Class B Options are to be issued to Ryan Batros (or his nominee(s)) and 2,000,000 Class A Options are to be issued to Bryan Frost (or his nominee(s)), each of whom is a former Director of HRE. The Class A Options and Class B Options under the Founder Option Ofer are being issued in recognition of the role those former and existing Directors have performed in the formation and development of the activities of HRE.

Advisor Option Offer

This Prospectus contains an offer of an aggregate of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)). 1,850,000 Class A Options and 1,850,000 Class B Options are to be issued to the Lead Manager (or their nominee(s)). A summary of the terms of the mandate between the Company and the Lead Manager is set out in Section 9.2(b). The remaining 1,000,000 Class A Options are to be issued to unrelated third party advisors who facilitated the introduction of the Company to the Cowalinya Project.

7.3 Conditions of the Offers

The Offers are conditional upon:

- The Company completing the acquisition of the Cowalinya Project. Further details of the acquisition are set out in Section 9.2(a); and

- The Company receiving applications and application monies for $6 million (being 30,000,000 Shares) under the Equity Offer; and

- ASX giving its conditional approval for the admission of the Company to the Official List and quotation of the Shares.

If the conditions above are not met, the Offers will not proceed, no securities will be issued pursuant to this Prospectus and application monies will be refunded to applicants in full (without interest) in accordance with the Corporations Act.

7.4 Terms of Securities Offered

Shares

All Shares issued pursuant to the Equity Offer and the Vendor Offer will be issued as fully paid ordinary shares and will rank equally in all respects with the Company's ordinary shares already on issue.

The rights attaching to the shares are contained in the Constitution.

Class A Options

Class A Options have an exercise price of $0.30, expire 3 years from Listing and, upon exercise, entitle the holder to one Share.

The full terms of Class A Options are set out in section 9.4(b).

Class B Options

Class A Options have an exercise price of $0.40, expire 3 years from Listing and, upon exercise, entitle the holder to one Share.

The full terms of Class B Options are set out in section 9.4(b).

7.5 Purpose of this Prospectus and the Offers

The purposes of this Prospectus and the Offers are to facilitate the Company achieving Listing on the ASX.

The purpose of the Equity Offer is to raise funds to be applied as set out in Section 7.6. The Equity Offer has the ancillary purpose of raising funds such that the Company can meet the net tangible asset test under the ASX Listing Rules as part of seeking to meet the admission requirements and achieve Listing.

The purpose of the Vendor Offer is to facilitate the issue of Shares to the Cowalinya Vendors as part consideration for the acquisition by the Company of the Cowalinya Project. Further details of the arrangements under which the Company proposes acquiring the Cowalinya Project are set out in Section 9.2(b).

The purpose of the Founder Option Offer is to facilitation the issue of an aggregate of 7,000,000 Class A Options and 2,500,000 Class B Options to former and existing Directors (or their nominee(s)) in recognition of the role those former and existing Directors have performed in the formation and development of the activities of HRE.

The purpose of the Advisor Option Offer is to facilitate the issue of an aggregate of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)) in connection with services rendered by those third party advisors to the Company.

7.6 Use of Proceeds

The Company's intended use of funds raised under the Equity Offer on its business objectives as set out in the table below:

Activity	
Drilling[3] – exploration & resource upgrade	$2,340,000
Assaying	$440,000
Metallurgical process development	$325,000
Project studies[4]	$400,000
Duke project exploration (Northern Territory)[5]	$100,000
Payment to Cowalinya Vendors – exercise option to acquire	$300,000

Administration & working capital	$1,455,000
Costs of the Offers [6]	$640,000
Total	**$6,000,000**

Notes to table:

1. *The above intended use of funds is indicative only and is subject to change.*
2. *Exploration expenditure reflects the existing plans of the Company. As is common for entities engaged in mineral exploration, depending on the results of its exploration activities the Company may choose to allocate funds other than as set out above, including to accelerate development.*
3. *Including contractors, wire-line logging, field support, heritage surveys & site rehabilitation*
4. *Including Resource & Reserve estimation*
5. *Proposed to encompass the following activities at NT EL 33101 and EL 33194 (assuming grant): field reconnaissance, orientation soil and rock chip sampling, collation of existing geophysical surveys, review of previous exploration, field mapping, grid soil/rock sampling and assay, drill target planning and mine management plan submission.*
6. *Costs of the Offers represent the estimated costs which are unpaid at the date of this Prospectus. Details of the full costs of the Offers are set out in Section 9.9.*

Estimated future expenditure included in the table above is based on the budget of the Company. As at the date of this Prospectus HRE has cash at bank of approximately $150,000.

The Directors believe that, following completion of the Equity Offer, the Company will have enough working capital to carry out its stated objectives.

The future capital requirements of the Company depend on numerous factors and the Company may require further financing in addition to amounts raised under the Equity Offer. Any additional equity financing will dilute shareholdings. Debt financing, if available, may involve restrictions on financing and operating activities. If the Company is unable to obtain additional financing as needed, it may be required to reduce the scope of its operations.

7.7 Capital Structure

The capital structure of the Company following completion of the Offers is summarised below:

Shares

The anticipated share capital of the Company following completion of the Offers is set out below:

	Number (%)
Existing Shares	37,275,150 (54.60%)
Shares under the Equity Offer	30,000,000 (43.94%)
Shares under the Vendor Offer	1,000,000 (1.46%)
Total Shares	**68,275,150**

At Listing, the Company's free float will be not less than 20%. The Company confirms that the issue price for all securities for which it seeks quotation is at least $0.20 (20 cents) in cash.

Options

The proposed options of the Company following completion of the Offers are set out below:

Class	Number	Exercise Price	Expiry Date
Class A Options	9,850,000	$0.30 (30 cents)	3 years from Listing
Class B Options	4,350,000	$0.40 (40 cents)	3 years from Listing
Total	**14,200,000**	**-**	**-**

The Company confirms that the exercise price of all options for each underlying security is at least $0.20 (20 cents) in cash. Other than the options set out in the table above, the Company will not have any other convertible securities on issue at Listing.

7.8 Subscription amount

The Offer is seeking to raise $6 million before costs. No securities will be issued pursuant to the Offers unless applications for $6 million are received under the Equity Offer and the Shares are admitted to Official Quotation (Listed) by ASX. If the $6 million raising under the Equity Offer is not reached before the expiration of four months after the date of this Prospectus, or if the Shares are not admitted to Official Quotation before the expiration of three months after the date of issue of this Prospectus (or, in each case, any longer period as ASIC and ASX may permit), the Company will not issue any securities under the Offers and will repay all application monies for the Shares within the time prescribed by the Corporations Act, without interest.

8 HOW TO APPLY FOR SECURITIES

8.1 Applying under the Equity Offer

Applications for Shares under the Equity Offer must be made by returning an application form attached to or accompanying this Prospectus to the Share Registry, together with payment of the application amount, prior to the Closing Date.

Further details in respect of each method of applying for Shares under the Equity Offer are set out below.

Applications for Shares under the Equity Offer must be for a minimum of 10,000 Shares ($2,000) and thereafter in multiples of 2,500 Shares ($500). Payment for Shares under the Equity Offer must be made in full at the issue price of $0.20 (20 cents) per Share.

The allocation of Shares under the Equity Offer will be determined by the Company at its discretion.

Applications under the Equity Offer may be made, and will only be accepted, in one of the following forms:

- on the Equity Offer application form attached to or accompanying this Prospectus; or
- on a paper copy of the relevant electronic application form which accompanied an electronic version of this Prospectus, which can be found at and downloaded from the Company website (https://hreltd.com.au/prospectus/).

Instructions for completion and lodging the application form and paying the application amount are set out in the Equity Offer application form. Unless you have made arrangements with your broker, the completed application form and payment should be sent to:

Boardroom Pty Limited
GPO Box 3933
Sydney NSW 2001

For hand-delivered applications (please do not use this address for mailing purposes), deliver to:

Boardroom Pty Limited
Level 12, 225 George Street
Sydney NSW 2000

Payments are to be made in Australian currency by a cheque drawn on an Australian branch of an Australian bank. Do not send cash. Applications under the Equity Offer can only be made by BPAY in accordance with the instructions in the Equity Offer application form. Allow time for transfers or payments to be processed.

Acceptance of the Equity Offer generally

It is your responsibility to ensure that application and acceptance forms and payments are mailed in time to allow for delivery before the closing date. It is also your responsibility to ensure sufficient funds are available upon presentation of cheques. If returning your acceptance or application to your broker please allow sufficient time for your broker to receive and process your acceptance, application or bid.

The Company and the Share Registry take no responsibility for lost or delayed mail, or misprocessed acceptances and payments, or errors or delays by brokers. The Company may, but is not obliged to, accept late applications and acceptances.

To the extent permitted by law, an acceptance or application under the Equity Offer is irrevocable. If the amount received as application monies is less than the amount payable for the Shares accepted or applied for under the Equity Offer, the Company may (but is not obliged to) treat the acceptance or application as being for the number of Shares represented by the amount received and issue fewer Shares than were applied for under the Equity

Offer. The Company may correct or fill in an application or acceptance form and/or treat as valid and give effect to an application or acceptance form notwithstanding any error or that an information is incomplete.

The Company may reject or not accept an application in part or in whole or to allocate a fewer number of Shares than applied for. If acceptances in excess of $6 million are received, the Board reserves the right not to accept (in whole or in part) or to scale back applications at its discretion. If an application is rejected or not accepted in whole or in part or is scaled back, the relevant amount will be refunded to the applicant as soon as practicable after completion of the Equity Offer without interest.

There is no guarantee that applicants will receive any number of Shares applied for under the Equity Offer. Where the number of Shares allotted is fewer than the number applied for, surplus application monies will be refunded to the applicant without interest.

There is no maximum number of Shares that may be applied for under the Equity Offer, provided an applicant alone or with its associates (as that term is defined in the Corporations Act) must not acquire an interest in 20% or more of the issued voting shares of the Company unless permitted by the Corporations Act without further action by the Company.

By making an application, you declare that you were given access to a copy of this Prospectus together with the applicable application form. The Corporations Act prohibits any person from passing an application form to another person unless it is attached to, or accompanied by, a hard copy of this Prospectus or the complete and unaltered electronic version of this Prospectus.

8.2 Applying under other Offers

Vendor Offer

The Vendor Offer is only made to and capable of acceptance by the Cowalinya Vendors (or their nominee(s)). The Company will provide the Cowalinya Vendors with a personalised application form which will accompany a copy of this Prospectus under which the Cowalinya Vendors will be able to apply for Shares under the Vendor Offer.

Founder Option Offer

The Founder Option Offer is only made to and capable of acceptance by former and existing Directors (or their nominee(s)). Proposed recipients of Class A Options and/or Class B Options under the Founder Option Offer are:

- John Byrne: 2,000,000 Class A Options.
- Richard Brescianini: 2,000,000 Class A Options.
- Ryan Batros (being a former Director): 2,500,000 Class A Options and 2,500,000 Class B Options.
- Bryan Frost (being a former Director): 500,000 Class A Options.

Securities under the Founder Option Offer may also be issued to nominee(s) of the above proposed recipients.

The Company will provide the proposed recipients under the Founder Option Offer with a personalised application form which will accompany a copy of this Prospectus under which the proposed recipients (or their nominee(s)) will be able to apply for Class A Options and/or Class B Options under the Founder Option Offer.

Advisor Option Offer

The Advisor Option Offer is only made to and capable of acceptance by third party advisors (or their nominee(s)). The proposed recipients of Class A Options and/or Class B Options under the Advisor Option Offer are:

- Taylor Collison Limited, to be issued in connection with role as Lead Manager: 1,850,000 Class A Options and 1,850,000 Class B Options.

- An aggregate of 1,000,000 Class A Options (500,000 each) to Patrick Harford and Paul Dickson, to be issued in recognition of project introduction and advisory services previously provided to HRE.

Securities under the Advisor Option Offer may also be issued to nominee(s) of the above proposed recipients. The Company will provide the proposed recipients under the Advisor Options Offer with a personalised application form which will accompany a copy of this Prospectus under which the proposed recipients (or their nominee(s)) will be able to apply for Class A Options and/or Class B Options under the Advisor Option Offer.

8.3 ASX Listing

An application will be made to ASX not later than seven days after the date of this Prospectus for the Company to be admitted to the Official List of ASX and for official quotation of Shares. Acceptance of the application by ASX is not a representation by ASX about the merits of the Company or the Shares.

Neither ASIC or ASX nor any of their respective officers, taken any responsibility for the content of this Prospectus or the merits of the investment to which this Prospectus relates.

Official quotation of Shares, if granted, commences as soon as practicable after the issue of the initial holding statements to successful applicants.

It is expected that trading of the Shares on ASX will commence on or about 17 August 2022.

If the Shares are not admitted to Official Quotation by ASX before the expiration of three months after the date of issue of this Prospectus, or such period as varied by ASIC, the Company will not issue any securities under this Prospectus and will repay all application monies for the Shares under the Equity Offer within the time prescribed under the Corporations Act, without interest.

Except as set out above, other securities the subject of the Company will not be quoted (listed). Official quotation of the other securities is not being applied for and is not a condition of the Offers. It is expressly not stated or implied that permission will be sought for the official quotation of other securities of the Company or that official quotation of such other securities will be granted within three months or any other period after the date of this Prospectus.

8.4 Anticipated Escrow Treatment

The Company anticipates the following escrow treatment for securities on issue at Listing, in accordance with publicly available guidance from ASX. The imposition of disposal restrictions (escrow) on the securities of the Company as part of Listing is subject to the absolute and unfettered discretion of ASX and the below is therefore provided for indicative purposes only:

- Shares under the Equity Offer are not anticipated to be subject to disposal restrictions (escrow).

- Shares under the Vendor Offer are anticipated to be subject to disposal restrictions (escrow) for a period of 12 months from issue.

- All Class A Options and Class B Options are anticipated to be subject to disposal restrictions (escrow) for a period of 24 months from Listing.

- A portion of existing Shares are anticipated to be subject to disposal restrictions (escrow) for periods of 12 months from issue and 24 months from Listing.

Details of disposal restrictions (escrow) applied to the securities of the Company will be announced be ASX as part of the pre-Listing disclosure.

8.5 Issuance of securities

Subject to the conditions of the Offers being satisfied and the Equity Offer not being withdrawn, allotment of the securities offered under this Prospectus will take place as soon as practicable after the Closing Date. The

Company reserves the right not to proceed with all or part of the Offers at any time before the issue of Shares to applicants under the Equity Offer. If the Equity Offer does not proceed, all application amounts will be refunded to the applicants without interest.

8.6 Equity Offer Not Underwritten

The Equity Offer is not underwritten.

8.7 Commissions Payable

No brokerage, commission or stamp duty is payable by applicants on acquisition of securities under this Prospectus. The Company will pay the Lead Manager the fees set out in Section 9.2(b) for acting as the lead manager to the Equity Offer.

8.8 CHESS

The Company will agree to participate in the Clearing House Electronic Sub-Register System (**CHESS**). ASX Settlement, a wholly owned subsidiary of ASX, operates CHESS. Investors who do not wish to participate through CHESS will be issuer sponsored by the Company.

Electronic sub-registers mean that the Company will not be issuing certificates to investors. Instead, investors will be provided with holding statements (similar to a bank account statement) that set out the number of Shares issued to them under this Prospectus. The holding statements will also advise holders of their Holder Identification Number (if the holder is broker sponsored) or Security Holder Reference Number (if the holder is issuer sponsored) and explain, for future reference, the sale and purchase procedures under CHESS and issuer sponsorship.

Electronic sub-registers also mean ownership of shares or options can be transferred without having to rely upon paper documentation. Further, monthly statements will be provided to holders if there have been any changes in their security holding in the Company during the preceding month. Security holders may request a holding statement at any other time however a charge may be made for such additional statements.

8.9 Taxation Considerations

The taxation consequences of an investment in the Company depends upon an investor's particular circumstances. Investors should make their own enquiries about the taxation consequences of investment in the Company. If you are in doubt as to the course you should follow you should consult your accountant, stockbroker, lawyer or other professional advisor.

8.10 Selling restrictions and overseas applicants

This document does not constitute an offer of Shares in any jurisdiction in which it would be unlawful. In particular, this document may not be distributed to any person, and the Shares may not be offered or sold, in any country outside Australia except to the extent permitted below.

<u>Australia</u>

This Prospectus does not, and is not intended to, constitute an offer in any place or jurisdiction, or to any person to whom, it would not be lawful to make such an offer or to issue this Prospectus. The distribution of this Prospectus in jurisdictions outside Australia may be restricted by law and persons who come into possession of this Prospectus should seek advice on and observe any of these restrictions. Any failure to comply with such restrictions may constitute a violation of applicable securities law.

Except as set out below, no action has been taken to register or qualify the Shares or otherwise permit a public offering of the Shares the subject of this Prospectus in any jurisdiction outside Australia. Applicants who are resident in countries other than Australia should consult their professional advisors as to whether any governmental or other consents are required or whether any other formalities need to be considered and followed.

If you are outside Australia it is your responsibility to obtain all necessary approvals for the Company to allot and issue the Shares to you pursuant to this Prospectus. The return of a completed application or acceptance form will be taken by the Company to constitute a representation and warranty by you that you are a person whom the Company's securities can be offered and issued lawfully, that all relevant laws have been complied with and that all relevant approvals have been obtained.

Canada (British Columbia, Ontario and Quebec provinces)

This document constitutes an offering of Shares only in the Provinces of British Columbia, Ontario and Quebec (the "Provinces"), only to persons to whom Shares may be lawfully distributed in the Provinces, and only by persons permitted to sell such securities. This document is not a prospectus, an advertisement or a public offering of securities in the Provinces. This document may only be distributed in the Provinces to persons who are "accredited investors" within the meaning of National Instrument 45-106 – *Prospectus Exemptions*, of the Canadian Securities Administrators.

No securities commission or authority in the Provinces has reviewed or in any way passed upon this document, the merits of the Shares or the offering of the Shares and any representation to the contrary is an offence.

No prospectus has been, or will be, filed in the Provinces with respect to the offering of Shares or the resale of such securities. Any person in the Provinces lawfully participating in the offer will not receive the information, legal rights or protections that would be afforded had a prospectus been filed and receipted by the securities regulator in the applicable Province. Furthermore, any resale of the Shares in the Provinces must be made in accordance with applicable Canadian securities laws. While such resale restrictions generally do not apply to a first trade in a security of a foreign, non-Canadian reporting issuer that is made through an exchange or market outside Canada, Canadian purchasers should seek legal advice prior to any resale of the Shares.

The Company as well as its directors and officers may be located outside Canada and, as a result, it may not be possible for purchasers to effect service of process within Canada upon the Company or its directors or officers. All or a substantial portion of the assets of the Company and such persons may be located outside Canada and, as a result, it may not be possible to satisfy a judgment against the Company or such persons in Canada or to enforce a judgment obtained in Canadian courts against the Company or such persons outside Canada.

Any financial information contained in this document has been prepared in accordance with Australian Accounting Standards and also comply with International Financial Reporting Standards and interpretations issued by the International Accounting Standards Board. Unless stated otherwise, all dollar amounts contained in this document are in Australian dollars.

Statutory rights of action for damages and rescission. Securities legislation in certain Provinces may provide a purchaser with remedies for rescission or damages if an offering memorandum contains a misrepresentation, provided the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's Province. A purchaser may refer to any applicable provision of the securities legislation of the purchaser's Province for particulars of these rights or consult with a legal adviser.

Certain Canadian income tax considerations. Prospective purchasers of the Shares should consult their own tax adviser with respect to any taxes payable in connection with the acquisition, holding or disposition of the Shares as there are Canadian tax implications for investors in the Provinces.

Language of documents in Canada. Upon receipt of this document, each investor in Canada hereby confirms that it has expressly requested that all documents evidencing or relating in any way to the sale of the Shares (including for greater certainty any purchase confirmation or any notice) be drawn up in the English language only. *Par la réception de ce document, chaque investisseur canadien confirme par les présentes qu'il a expressément exigé que tous les documents faisant foi ou se rapportant de quelque manière que ce soit à la vente des valeurs mobilières décrites aux présentes (incluant, pour plus de certitude, toute confirmation d'achat ou tout avis) soient rédigés en anglais seulement.*

Hong Kong

WARNING: This document has not been, and will not be, registered as a prospectus under the Companies (Winding Up and Miscellaneous Provisions) Ordinance (Cap. 32) of Hong Kong, nor has it been authorised by the Securities and Futures Commission in Hong Kong pursuant to the Securities and Futures Ordinance (Cap. 571) of the Laws of Hong Kong (the "SFO"). Accordingly, this document may not be distributed, and the Shares may not be offered or sold, in Hong Kong other than to "professional investors" (as defined in the SFO and any rules made under that ordinance).

No advertisement, invitation or document relating to the Shares has been or will be issued, or has been or will be in the possession of any person for the purpose of issue, in Hong Kong or elsewhere that is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong) other than with respect to Shares that are or are intended to be disposed of only to persons outside Hong Kong or only to professional investors. No person allotted Shares may sell, or offer to sell, such securities in circumstances that amount to an offer to the public in Hong Kong within six months following the date of issue of such securities.

The contents of this document have not been reviewed by any Hong Kong regulatory authority. You are advised to exercise caution in relation to the offer. If you are in doubt about any contents of this document, you should obtain independent professional advice.

9 ADDITIONAL INFORMATION

9.1 Company registration and registered office

The Company was registered in Victoria on 25 March 2021 as an Australian public company named HRE Corporation Limited. It changed its name to Heavy Rare Earths Limited on 16 March 2022. Its registered office is located at c/o JM Corporate Services, Level 21, 459 Collins Street, Melbourne VIC 3000.

9.2 Material Contracts

Summaries of the material contracts entered into by the Company are set out below. Terms defined below as part of the material contract summary are defined for the purposes of that material contract summary only and are not definitions that apply elsewhere in this Prospectus:

(a) Deed of Option and Deed of Assignment – Cowalinya Project

On 27 October 2020, Cobold Metals Limited (**Cobold**) and David Ross and Christine Ross (**Vendors**) entered into a Deed of Option (**Option**) under which the Vendors granted Cobold an Option to acquire exploration licence E63/1972 (**Tenement**), the Tenement forming the **Cowalinya Project**. On 9 June 2021, Cobold, the Vendors and the Company entered into an Assignment of Option to Acquire Exploration Licence (**Assignment**) under which the rights and obligations of Cobold under the Option were assigned to the Company.

The Assignment varied the terms of the Option. The Assignment included, amongst other matters:

- Cobold and the Vendors jointly and severally providing warranties, representations and promises to the Company, including but not limited to the good standing of the Tenement, the fulfilment or waiver of each of the conditions for exercise of the Option and that all things require to be done (or not done) prior to the transfer had been completed.

- The conditions to be satisfied prior to the exercise of the Option were agreed to have been deemed fulfilled or waived with effect on and from 1 June 2021.

- The Company accepting the obligations of Cobold under the Option with effect on and from the transfer under the Assignment, including the continued development, funding and implementation of the work program to meet the minimum expenditure requirements for the Tenement.

- Cobold transferring all materials and information concerning or connected with the Tenement and the Option to the Company.

- Provisions typical for arrangements of this kind, including confidentiality provisions with specific carve outs for permitted disclosures and the parties providing mutual warranties.

A summary of the terms of the Option as varied by the Assignment is set out below:

- The Company is granted an option to acquire the Tenement. The Option may be exercised on or before 1 June 2024 by the Company delivering a sale and purchase agreement to the Vendors.

- The consideration payable for the exercise of the Option comprises:

  - $300,000 in cash, which is to be paid from funds raised under the Equity Offer; and

  - 1,000,000 Shares (with a deemed issue price of $0.20 (20 cents) per Share, being the Shares the subject of the Vendor Offer.

- From the Company completing the acquisition of the Tenement, the Company grants the Vendors (and/or their nominee(s)) a right to a royalty of $0.25 per tonne of any type of ore processed from the Tenement or any successor tenement payable on sale of the relevant mineral product provided that such royalty rate is not more than what would be deemed fair and reasonable by HRE having regard to prevailing industry evidence of commercial arm's length royalty rates for such commodities. Failing the royalty being established as not more than what is fair and reasonable, the parties will negotiate in good faith to agree on a lower royalty rate and associated terms which are consistent with prevailing reasonable commercial industry standards and failing agreement being reached within 14 days of the commencement of those negotiations the royalty shall remain at $0.25 per tonne but the amount payable thereunder shall be capped at a maximum amount of $250,000 per annum.

- If regulatory approvals or consents are required to transfer the Tenement, the transfer will be conditional on that consent or approval and the parties will negotiate in good faith to agree to provisions which enable the progression of exploration pending that approval or consent which may include the Vendors holding the Tenement on trust for the Company.

- The Vendors providing representations and warranties for the benefit of the Company, including but not limited to the status of the Tenement, compliance with applicable laws and the Vendors having disclosed all information material to a decision to enter into the Option.

- The Option otherwise contains terms typical for arrangements of this kind, including confidentiality provisions with specific carve outs for permitted disclosures and provisions with respect to assignment or transfer of the Option (which were utilised under the Assignment). The Company proposes exercising the Option and completing the acquisition of the Cowalinya Project prior to Listing.

(b) Broker mandate

Taylor Collison Limited [AFSL 247083] (**Taylor Collison**) has been engaged to act as the Lead Manager of the Equity Offer pursuant to the terms of a mandate letter (**Mandate**).

As Lead Manager, Taylor Collison has agreed, amongst other matters, to assist in the management of the Equity Offer (including using reasonable endeavours to identify investors to participate in the Equity Offer), provide advice as to the appropriate timing, pricing and structure of the Equity Offer, assist in the preparation of investor presentation materials and marketing of the Equity Offer, provide strategic market advice and other services typical for arrangements similar to the Mandate.

Taylor Collison will receive (subject to and conditional upon successful completion of the IPO) the following consideration for acting as Lead Manager:

- 2% of the total amount raised under the Equity Offer as a management fee; and

- 4% of the total amount raised under the Equity Offer as a selling fee; and

- 1.85 million Class A Options and 1.85 million Class B Options under the Advisor Option Offer, to be issued to Taylor Collison and/or its nominee(s) for nil cash for services provided in connection with the services provided under the Mandate. The value of the Class A Options and Class B Options proposed to be issued to Taylor Collison and/or its nominee(s) based on a Black-Scholes valuation at a 70% volatility rate, 1% risk free rate and 0% dividend yield are set out below:

  - Class A Options have a value of $0.0710 each (aggregate value of $131,350); and

  - Class B Options have a value of $0.0564 each (aggregate value of $104,340).

  If only the Class A Options or the Class B Options proposed to be issued to Taylor Collison and/or its nominee(s) were exercised into Shares (1,850,000 options exercised) at Listing, the Shares issued on exercise would represent 2.64% of the then issued Shares of the Company.

  If the Class A Options and Class B Options proposed to be issued to Taylor Collison and/or its nominee(s) were all exercised into Shares (3,700,000 options exercised) at Listing, the Shares issued on exercise would represent 5.14% of the then issued Shares of the Company.

The Company anticipates that ASX will impose mandatory escrow on the Broker Options for 24 months from Listing. Any escrow imposed on the Broker Options will apply to shares issued on exercise of Broker Options (if any).

Taylor Collison and its associates currently have a relevant interest in 1,486,667 existing Shares. These existing Shares include 86,667 free Shares as part of the free Share issue to Cobold shareholders, 1,000,000 Shares that were subscribed for at $0.05 (5 cents) per Share ($50,000 in aggregate) in a pre-IPO seed capital raising and 400,000 Shares that were acquired from a former holder.

Taylor Collison acknowledges that the fees payable by the Company may be subject to requirements from ASX and Taylor Collison agrees to act reasonably in connection with requests made by ASX regarding fees payable by the Company to Taylor Collison.

Taylor Collison is also entitled to be reimbursed for reasonable out-of-pocket and travel expenses incurred in connection with the Equity Offer and the performance of Taylor Collison of its role under the Mandate. Taylor Collison is required to seek prior approval for any one-off out of pocket or travel expense that exceeds $1,000, such approval not to be unreasonably withheld.

If the Company desists from actively pursuing the IPO, Taylor Collison notifies the Company of its concern and the Company does not provide positive confirmation that it is continuing the IPO within 5 business days of receipt of Taylor Collison's notice (a **Withdrawal Event**), the Company will pay Taylor Collison within 7 days after a Withdrawal Event a withdrawal fee of 25% of the fee that would have been payable had the Equity Offer been completed.

In addition, if the Company terminates the Mandate and, within 12 months of such termination an equity capital raising is completed that includes the participation of a party who Taylor Collison introduced during the engagement period (defined as any correspondence sent to a client of Taylor Collison marketing the Offer), the management fee and selling fee will be payable for any and all funds raised from those parties.

Subject to completion of the IPO and Listing, Taylor Collison will during the 12 months from the date of allotment of the Shares under the Equity Offer have a right to act as lead manager to any subsequent equity capital raisings, with the capital raisings for such issues to be the same management fee and selling fee as set out in the Mandate. The Company must actively offer the role of lead manager to Taylor Collison and give Taylor Collison a reasonable time to accept the role.

The Mandate may be terminated by a party providing 7 days written notice to the other party. Unless otherwise earlier terminated the Mandate will terminate on 30 September 2022 (unless otherwise extended by agreement by both the Company and Taylor Collison in writing).

The Mandate otherwise contains terms consistent with similar arrangements, including but not limited to the provision of warranties for the benefit of Taylor Collison, the provision of information to Taylor Collison, an indemnity being given in favour of Taylor Collison and provisions with respect to confidentiality.

(c) Executive Services Agreement – Richard Brescianini

The Company entered into an Executive Services Agreement with Richard Brescianini, a Director of the Company, under which Richard Brescianini will be engaged by the Company with effect on and from Listing as an Executive Technical Director to provide operational and technical geological services that promote the fulfilment of the Company's business objective including exploration and development of its project portfolio.

The Company will pay Richard Brescianini $200,000 per annum (plus superannuation, less the deduction of applicable taxation) for acting as an Executive Director, with effect on and from Listing. The Company shall reimburse Richard Brescianini for approved expenses reasonable incurred in the proper performance of duties under the Executive Services Agreement, subject to the prior consent when required by the Board.

Richard Brescianini may also participate in, and receive securities under, the Plan summarised in section 9.3. As at the date of this Prospectus, the Company has agreed to grant Richard Brescianini (or his nominee) 2,000,000 Class A Options under the Plan. These Class A Options form part of the Founders Option Offer.

The Company may immediately terminate the Executive Services Agreement if:

- in the reasonable opinion of the Company, Richard Brescianini commit an act of wilful dishonesty, fraud, wilful disobedience, gross misconduct or make a false representation to the Company, and which acts or representations have a material detrimental effect on the Company and/or any of its subsidiaries;
- Richard Brescianini resigns as a Director (except if eligible for re-election and is re-elected at the next meeting of the Company's shareholders after retiring in accordance with the Constitution, Corporations Act and/or the Listing Rules);
- Richard Brescianini is prohibited by law from acting as a Director of the Company;
- Richard Brescianini is convicted of any criminal offence involving fraud or dishonestly;
- Richard Brescianini becomes bankrupt or makes any arrangement or composition with their creditors;
- in the reasonable opinion of the Company, Richard Brescianini becomes unable to perform their duties or becomes of unsound mind or comes under the control of any committee or officer under any law relating to mental health; or
- in the reasonable opinion of the Company, Richard Brescianini wilfully refuses or neglects to comply with any lawful and reasonable direction or order given to them by the Board which Richard Brescianini, after receipt of prior notice, has failed to rectify within fourteen (14) days.

The Company may terminate the Agreement by giving not less than three (3) months written notice to the Officer if, in the reasonable opinion of the Company, Richard Brescianini becomes permanently incapacitated by illness, injury, accident or any other circumstance beyond his control. The Company may also terminate the Agreement without clause by written notice and the payment of three (3) months of remuneration (or such maximum amount permissible under applicable laws and rules).

The Executive Services Agreement may be terminated by Richard Brescianini giving three (3) months written notice to the Company.

Unless otherwise agreed by the Company in writing, Richard Brescianini will resign as a Director of the Company with immediate effect upon termination of the Executive Services Agreement.

Richard Brescianini is bound by restrictions prohibiting them from, without the written consent of the Board, being employed, engaged, concerned or interested in any other company or business in competition with the Company or its related body corporates. Richard Brescianini may hold external directorships may provide consultancy services to other entities provided such positions are not with competitors of the Company or inhibit or unduly interrupt Richard Brescianini from undertaking the role of Executive Technical Director.

The Executive Services Agreement otherwise contains terms typical for agreements of this nature, including provisions relating to confidentiality and an acknowledgement and agreement by Richard Brescianini to familiarise themselves with and be bound by the policies and procedures of the Company (including the corporate governance policies of the Company described in Section 6).

(d) Non-Executive Director Agreements

Each of John Byrne (Non-Executive Chairman) and Ryan Skeen (Non-Executive Director) have entered into appointment letters for their respective engagements as Non-Executive Directors of the Company.

The respective remuneration of each of the Non-Executive Directors is set out in Section 5.3.2.

Non-Executive Directors are entitled to be reimbursed for reasonable out of pocket expenses incurred in connection with their role, provided prior written approval is obtained.

Each of the Non-Executive Directors are engaged on terms typical for arrangements of this kind, including but not limited to provisions relating to confidentiality, requirements regarding disclosure of interests and independence, recognition and agreement to act in accordance with the corporate governance policies and procedures of the Company and an acknowledgement of the duties owed to the Company.

(e) Deeds of access, indemnity and insurance

The Company has entered a Deed of Access, Indemnity and Insurance (**Deed**) with each of its current Directors and Company Secretary (**Officers**). Each Deed has effect from its execution and ceases upon the later of 7 years after the Officer ceases to act or the date on which any claims to which the indemnity relates are either settled, resolved by final and binding decision or are barred by statute.

Under the terms of the Deed, the Company will indemnify an Officer to the extent permitted by law against any liability arising as a result of the Officer acting as an officer of the Company other than a liability is owed to the Company or its related body corporate, a pecuniary penalty order under section 1317G of the Corporations Act or a compensation order under section 1317H or 1317HA of the Corporations Act or a liability that is owed to something (other than the Company or its related body corporates) and did not arise out of conduct in good faith.

Where the Company indemnifies an Officer, the Company or its insurer will be entitled to conduct the defence of any claim under its sole management and control and at its sole cost. Where the Company conducts a defence, the Officer must render all reasonable assistance and cooperate with the Company.

In the event a Court determined the Officer is not entitled to an indemnity, the Officer receives a payment under a contract of insurance maintained by the Company or the Company pays an amount in excess of the amount payable under the indemnity, the Officer must repay such amount in excess of the indemnity payable. The Officer may request a loan, on commercial terms to be agreed between the Company and the Officer, to fund costs of defending a claim where an indemnity does not apply.

The Deeds otherwise contains provisions typical for arrangements of this kind, including the Officer's entitlement to obtain Board papers, the Company taking out Directors and Officers insurance, confidentiality of information and the Deed applying to the extent permitted by law.

9.3 Incentive Scheme

The shareholders of the Company approved the adoption of the Employee Security Ownership Plan (**Plan**).

The Plan provides for shares, options or other securities or interests (including performance rights) to be issued to eligible persons. The purpose of the Plan is to:

(a) provide eligible persons with an additional incentive to work to improve the performance of the Company;

(b) attract and retain eligible persons essential for the continued growth and development of the Company;

(c) to promote and foster loyalty and support amongst eligible persons for the benefit of the Company; and

to enhance the relationship between the Company and eligible persons for the long-term mutual benefit of all parties.

Eligible persons are directors, officers and employees of, or consultants to, the Company or an associated body corporate and, in the case of consultants, may include bodies corporate. Participants in the Plan, the number, type and terms of any securities offered or issue, and the terms of any invitation, offer or issue are determined by the Board with the advice of the remuneration committee, if any.

Directors and related parties are currently entitled to participate in the Plan. The Class A Options to be issued to Richard Brescianini and John Byrne as set out in Section 8.2 (2,000,000 each, aggregate of 4,000,000) are proposed to be issued under the Plan. If the Company is admitted to the Official List of ASX, Directors and related parties of the Company may only participate in the Plan if prior shareholder approval is obtained in accordance with the ASX Listing Rules.

Shares issued on exercise of an option or exercise or conversion of an interest issued under the Plan, and options or other interests which have been converted or cancelled or which have lapsed are not counted in determining the number of securities issued under the Plan.

The number of securities which may be issued under the Plan is 7.5% of the number of fully paid ordinary shares on issue in the Company at the time of listing on ASX.

Shares issued on exercise of an option or exercise or conversion of an interest issued under the Plan, and options or other interests which have been converted or cancelled or which have lapsed are not counted in determining the number of securities issued under the Plan.

The Board may offer loans to eligible persons to assist acquiring or for the purpose of acquiring securities under the Plan, subject to compliance with the Corporations Act and (if the Company is listed) ASX Listing Rules. The Company may permit cashless exercise of options, at the discretion of the Board.

The Board is to administer the terms of the Plan, including but not limited to determining the terms of securities issued, adoption of rules subordinate to the Plan for the administration of the Plan and the suspension or termination of the Plan.

The Plan is to be interpreted and applied in accordance with and subject to the ASX Listing Rules if the Company is listed.

9.4 Rights and liabilities attaching to securities offered under this Prospectus

(a) Shares

The Shares offered under this Prospectus will be fully paid ordinary shares in the issued capital of the Company and will, upon issue, rank equally with all other Shares then on issue.

The rights and liabilities attaching to Shares are regulated by the Constitution, the Corporations Act, the ASX Listing Rules, the ASX Settlement Rules and common law. The Constitution has been lodged with ASIC. The Constitution contains provisions of the kind common for companies in Australia and is taken to be included in this Prospectus by operation of section 712 of the Corporations Act. Any person may request a copy of the Constitution during the application period of this Prospectus, which the Company will provide free of charge.

(b) Class A Options and Class B Options

Reference in this Section 9.4(b) to "Option" is to each of a Class A Option and Class B Option. Reference below to "Exercise Price":

- In the context of Class A Options means $0.30 (30 cents).
- In the context of Class B Options means $0.40 (40 cents).

The Class A Options and Class B Options ("Options") have common terms as set out below.

(a) Entitlement

Each Option (**Option**) entitles the holder to subscribe for one ordinary share in the capital of the Company (**Share**) upon exercise of the Option.

(b) Exercise Period

The Options are exercisable prior to their expiry, being 3 years from Listing (**Expiry Date**).

(c) *Notice of Exercise*

The Options may be exercised by notice in writing to the Company (**Notice of Exercise**) and payment of the Exercise Price for each Option being exercised. Any Notice of Exercise of an Option received by the Company will be deemed to be a notice of the exercise of that Option as at the date of receipt.

(d) *Shares issued on exercise*

Shares issued on exercise of the Options will rank equally with all existing Shares on issue.

(e) *Quotation of Shares on exercise*

Application will be made by the Company to ASX for quotation of the Shares issued upon the exercise of the Options.

(f) *Timing of issue of Shares*

After an Option is validly exercised, the Company must, within, 20 Business Days of the notice of exercise and receipt of cleared funds equal to the sum payable on the exercise of the Option:

(a) issue the Share; and

(b) do all such acts, matters and things to obtain the grant of official quotation of the Share on ASX no later than 5 Business Days after issuing the Shares.

(g) *Participation in new issues*

There are no participation rights or entitlements inherent in the Options and holders will not be entitled to participate in new issues of capital offered to shareholders during the currency of the Options. However, the Company will give holders of the Options notice of the proposed issue prior to the date for determining entitlements to participate in any such issue.

(h) *Adjustment for bonus issues of Shares*

If the Company makes a bonus issue of Shares or other securities to existing shareholders of the Company (other than an issue in lieu or in satisfaction of dividends or by way of dividend reinvestment):

(a) the number of Shares which must be issued on the exercise of an Option will be increased by the number of Shares which the Optionholder would have received if the Optionholder had exercised the Option before the record date for the bonus issue; and

(b) no change will be made to the Exercise Price.

(i) *Adjustment for entitlement issue*

In the case of a pro rata issue other than a bonus issue, the Exercise Price of each Option will be reduced in accordance with the ASX Listing Rules (in particular Listing Rule 6.22.2, or any successor provision).

(j) *Adjustments for reorganisation*

If there is any reconstruction of the issued share capital of the Company, the rights of the Option holders may be varied to comply with the ASX Listing Rules which apply to the reconstruction at the time of the reconstruction.

(k) *Options not quoted*

The Company will not apply to ASX for quotation of the Options.

(l) *Options transferable*

The Options are not transferable.

(m) *Amendment to Terms*

If ASX requires amendments to these Option terms, the Company and the Optionholder must consult in good faith to agree the amendments to the extent necessary in order to comply with the ASX Listing Rule (and in the manner which achieves the most favourable treatment for the Optionholder).

(n) *Lodgement Instructions*

Cheques shall be in Australian currency made payable to the Company and crossed "Not Negotiable". The application for shares on exercise of the Options with the appropriate remittance should be lodged at the Company's share registry.

(o) *Plan*

If the Options are issued under the Plan, these terms of Options are otherwise subject to the terms of the Plan.

9.5 Litigation

As at the date of this Prospectus the Company is not engaged in any litigation. Furthermore, the Directors are not aware of any legal proceedings pending or threatened against the Company.

9.6 Top 20 Shareholders

The existing top 20 Shareholders and the percentage of the Shares they hold at the date of this Prospectus and at Listing (assuming the shareholders listed do not apply for and receive Shares under the Equity Offer and/or the Vendor Offer) are set out in the table below:

Holder name	Shares held	Current %	% after Equity Offer
J P Morgan Nominees Australia Pty Limited	4,333,334	11.63%	6.35%
Slipline Pty Limited	2,000,000	5.37%	2.93%
Mr David Hannon	1,500,000	4.02%	2.20%
Ms Chunyan Niu	1,500,000	4.02%	2.20%
Dinwoodie Investments Pty Ltd	1,486,667	3.99%	2.18%
Peter Vial & Amanda Vial	1,400,000	3.76%	2.05%
Merrill Lynch Australia	1,333,334	3.58%	1.95%
Mullens Family Super Fund Pty Ltd	1,266,667	3.40%	1.86%
Benprop Pty Ltd	1,248,890	3.35%	1.83%
Mr Nicholas Dermott Mc Donald	1,086,667	2.92%	1.59%
Porpette Pty Ltd	1,046,667	2.81%	1.53%
Holland International Pty Ltd	1,000,000	2.68%	1.46%
Terranora Limited	812,667	2.18%	1.19%
N & J Mitchell Holdings Pty Ltd	800,000	2.15%	1.17%
Ricketts Point Investments Pty	800,000	2.15%	1.17%
Halo Adapt Pty Ltd	680,853	1.83%	1.00%

Sanlam Private Wealth Pty Ltd	666,667	1.79%	0.98%
Mr Ryan Anthony Batros	612,667	1.64%	0.90%
Asenna Wealth Solutions Pty Ltd	600,000	1.61%	0.88%
Cobold Metals Limited	600,000	1.61%	0.88%
Total	**24,775,080**	**66.49%**	**36.30%**

9.7 Consents

Each of the parties listed below (each a **Consenting Party**) has given its written consent and has not, before lodgement of this Prospectus with ASIC, withdrawn its consent to being named in this Prospectus in the form and context in which it is named and, where applicable, to the inclusion in this Prospectus of its report specified below and/or statements by it (and to references to or statements based on its report and/or statements) in the form and context in which its report or statements and references to or statements based on its report and/or statements appear:

- Taylor Collison Limited as Lead Manager of the Equity Offer.
- William Buck Audit (Vic) Pty Ltd (**William Buck**) has given and not withdrawn its written consent to being named as Investigating Accountant and Auditor for Heavy Rare Earths Limited in the Prospectus in the form and context in which it is named and the issue of the Prospectus with its Investigating Accountant's Report dated 1 July 2022 in the form and context in which it is included and to all references to that report in the Prospectus in the form and context in which those references are included. William Buck has only participated in the preparation of the Prospectus to the extent of preparing its Investigating Accountant's Report on the Financial Information (see section 4). William Buck was not involved in the preparation of any other part of the Prospectus and did not authorise or cause the issue of any other part of the Prospectus. Except as provided above William Buck does not make, or purport to make, any statement in this Prospectus and is not aware of any statement in this Prospectus which purports to be based on a statement made by it and makes no representation, expressed or implied, regarding and takes no responsibility for any statement in or omissions from this Prospectus.
- Robin Rankin trading as GeoRes as the author of the Independent Geologist's Report (excluding Appendix 7 to the Independent Geologist's Report) and to the inclusion of its Independent Geologist's Report (excluding Appendix 7 to the Independent Geologist's Report) in this Prospectus.
- John Tyrrell trading as JMCT Consulting as author of the Mineral Resource Estimate Report which forms Appendix 7 to the Independent Geologist's Report and to the inclusion of the Mineral Resource Estimate Report (which is included as Appendix 7 to the Independent Geologist's Report) in this Prospectus.
- David Ross to being named and identified as a competent person and as the author of statements attributed to him in this Prospectus, including as set out in the Independent Geologist's Report (and the Mineral Resource Estimate Report which forms Appendix 7 to the Independent Geologist's Report).
- House Legal Pty Ltd as the author of the Solicitor's Report (excluding those sections of the Solicitor's Report attributed to Ward Keller Pty Ltd) and to inclusion of its Solicitor's Report in this Prospectus.
- Ward Keller Pty Ltd as the author of those sections of the Solicitor's Report attributed to Ward Keller Pty Ltd and to inclusion of its Solicitor's Report in this Prospectus.
- QR Lawyers Pty Ltd as legal advisor to the Company.
- Boardroom Pty Limited as the Share Registry.

9.8 Costs of the Offers

The total expenses of the Offer (excluding GST) are set out in the table below:

	$
Lead Manager fee	$360,000
Listing and lodgement fees	$95,000
Printing, typesetting, postage and miscellaneous	$10,000
Advisor fees	$175,000
Total costs of the Offers	**$640,000**

9.9 Continuous disclosure obligations

Upon Listing, the Company will be a "disclosing entity" (as defined in Section 111AC of the Corporations Act) and, as such, is subject to regular reporting and disclosure obligations. Specifically, like all listed companies, the Company will be required to continuously disclose any information it has to the market which a reasonable person would expect to have a material effect on the price or the value of the Shares.

Price sensitive information will be publicly released through ASX before it is disclosed to shareholders and market participants. Distribution of other information to shareholders and market participants will also be managed through disclosure to the ASX.

In addition, the Company will post this information on its website after the ASX confirms an announcement has been made, with the aim of making the information readily accessible to the widest audience.

9.10 Governing law

The Offers and the contracts formed on return of an application or acceptance form are governed by the laws applicable in Victoria, Australia. Each person who applies for securities pursuant to this Prospectus submits to the non-exclusive jurisdiction of the courts of Victoria, Australia, and the relevant appellate courts.

9.11 Directors' Authorisation

This Prospectus is issued by the Company and its issue has been authorised by a resolution of the Directors.

In accordance with section 720 of the Corporations Act, each Director has consented, and as at the date of this Prospectus has not withdrawn his consent, to the lodgement of this Prospectus with ASIC.

John Byrne
Non-Executive Chairman

10 GLOSSARY

In this Prospectus, the following terms and abbreviations have the following meanings, unless the context otherwise requires:

$	Australian dollar.
Advisor Option Offer	The offer of 2,850,000 Class A Options and 1,850,000 Class B Options to third party advisors (including the Lead Manager) (or their nominee(s)).
Applicant	Person who submits a valid Application Form pursuant to this Prospectus.
Application Form	The application form attached to or accompanying this Prospectus.
Application Monies	Money submitted by applicants under the Equity Offer in respect of their application for Shares.
ASIC	The Australian Securities and Investments Commission.
ASX Settlement	ASX Settlement Pty Limited (ABN 49 008 504 532).
ASX Settlement Operating Rules	The settlement rules of the settlement facility provided by ASX Settlement.
ASX	ASX Limited (ABN 98 008 624 691) or the securities market it operates, as the context requires.
Board	The board of Directors of the Company.
Chairman	The chairman of the Board, John Byrne.
CHESS	The Clearing House Electronic Sub-Register System of share transfers operated by ASX Settlement.
Class A Option	An option with an exercise price of $0.30, expiring three years from Listing and which, upon exercise, entitle the holder to a Share. Full terms of the Class A Options are set out in Section 9.4(b).
Class B Option	An option with an exercise price of $0.40, expiring three years from Listing and which, upon exercise, entitle the holder to a Share. Full terms of the Class B Options are set out in Section 9.4(b).
Closing Date	The date the Offers close.
Company	Heavy Rare Earths Limited [ABN 35 648 991 039]. **HRE** shall have a corresponding meaning.
Consenting Party	As defined in section 9.7.
Constitution	The constitution of the Company.
Corporations Act	The Corporations Act 2001 (Cth).
Directors	Directors of the Company as at the date of this Prospectus.
Equity Offer	Means the offer of 30,000,000 Shares at the Equity Offer Price to investors under this Prospectus.
Equity Offer Price	$0.20 per Share.
Exposure Period	The seven day period after the date of lodgement of this Prospectus with ASIC. This period may be extended by ASIC for a further period of up to seven days.
Founder Option Offer	The offer of 7,000,000 Class A Options and 2,500,000 Class B Options to former and existing Directors (or their nominee(s)).

GST Goods and services tax, being a tax charged on the sale of most goods and services in Australia.

Independent Geologist's Report Means the Independent Geologist's Report in Annexure A.

IPO The Company's initial public offering of Shares.

JORC Code The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (2012 Edition).

Lead Manager Taylor Collison Limited [ABN 53 008 172 450] [AFSL 247083].

Listing Rules The official Listing Rules of the ASX as amended from time to time.

Mineral Resource Estimate Report Means the Mineral Resource Estimate Report that forms Appendix 7 to the Independent Geologist's Report

Non-Executive Director A Director appointed as a non-executive director of the Company.

Offer Period The period during which investors may apply for securities under the Offers.

Offers Means collectively the Equity Offer, Founder Option Offer and Advisor Option Offer.

Personal Information As defined in the Important Notices.

Plan Means the Employee Security Ownership Plan of the Company.

Prospectus This prospectus dated 5 July 2022.

Recommendations The ASX Corporate Governance Principles and Recommendations (4th Edition) as published by the ASX Corporate Governance Council.

Related Body Corporate Has the meaning ascribed to that term in the Corporations Act.

Shareholder A holder of Shares.

Share Fully paid ordinary share in the capital of the Company.

Share Registry Boardroom Pty Limited.

TMD As defined in the Important Notices.

Vendor Offer The offer of 1,000,000 Shares as part consideration for the acquisition of the Cowalinya Project.

HRE Rare Earth Element Projects

Independent Geologist's Report

June 2022

Effective Date: 26th April 2022
Publication Date: 27th June 2022

For: Heavy Rare Earths Limited (HRE)

By: Robin Rankin
MAusIMM CP(Geo)

GeoRes *Project:* GR2206

Mail PO Box 2332 Bowral NSW 2576 Australia **Ph** +61 (0)2 4861 3568 **Mob** +61 (0)408 724 811
E-mail robin.rankin@geores.com.au

Cover photo: HRE 2021 air-core drill-hole AC104 location at Cowalinya (Area 2 / North). Showing typical flat topography, and bushy vegetation and cleared sandy drill-line track. Drill-hole collar peg is in the foreground in the centre of the track; location stake is on the right just off the track; and sample bags (30) are on the left in the middle distance. The hole was drilled to 39 m, and was sampled at 1 m intervals.

The HRE Directors

Heavy Rare Earths Limited
Level 21
459 Collins Street
Melbourne VIC 3000

GeoRes
PO Box 2332
Bowral NSW 2576
Australia

27th June 2022

Dear Directors

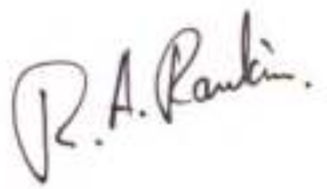
HRE REE Projects
Independent Geologist's Report – June 2022

This Document is Robin Rankin's "Independent Geologist's Report" (IGR or Report) for Heavy Rare Earths Limited (HRE) on their Rare Earth Element (REE) Projects at Cowalinya in Western Australia (WA) and Duke in the Northern Territory (NT). Its Publication Date is June 2022 but its Effective Date is 26th April 2022 (the date of the last substantive supply of data).

The February 2022 Cowalinya Resource Estimate Report is attached by HRE at Appendix 7.

The Report is issued through Robin's independent geological consultancy GeoRes. Readers of the Report should note the governing and qualifying Consultant's Statements in Appendix 1.

Yours sincerely



Robin A Rankin
MSc DIC MAusIMM CP(Geo)[1]

Principal Consulting Geologist – **Geo**Res

[1] Accredited by The Australasian Institute of Mining & Metallurgy (The AusIMM) since 2000 as a Chartered Professional (CP) in the Geology discipline.

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TABLES

FIGURES

NB: Tenement boundaries: Tenement outlines are NOT located completely accurately in Figures not extracted directly through the WA or NT geological and tenement on-line services. The boundaries are positioned as correctly as possible, but often are put onto Figures extracted from company reports which themselves have varying degrees of accuracy. Therefore tenement boundaries should be taken as approximate. In most cases the locations will be ±2-500 m.

REE ABBREVIATIONS & ELEMENTS

Rare Earths acronyms:

REE	Rare Earth Element (lanthanides, atomic numbers 57-71)
LREE	Light REE
HREE	Heavy REE (sometimes includes yttrium)
MREE	Medium REE (equivalent to SEG)
REC	Rare Earth Carbonate (term used for Browns Range production)
REO*	Rare Earth Oxide*
REY	REE + Y (rare earth elements plus yttrium)
SEG	Samarium+europium+godolinium
TREE	Total of REEs and yttrium
TREO	Total of REOs and yttrium oxide (also referred to as REO+Y)
TREO – CeO_2	TREO minus cerium oxide

* Rare Earth Oxide (REO) is the typical "form" used in REE commercialisation (REE products, manufacture, sale, prices etc). However assaying of REEs typically reports as a weight % (usually in ppm). A conversion factor (given below) is applied to convert from the element to the oxide. The factor is essentially derived from the oxide formula. Most of the individual lanthanide REE factors are ~1.15, but the range is 1.137 to 1.228. Yttrium's factor is slightly higher at 1.270 and scandium's is higher again at 1.534.

Rare Earth Elements: (in atomic number order)

Symbol	*Name (atomic number)*	*REE class*	*REO factor[2] (formula)*
Sc	Scandium (21)		1.5338 (Sc_2O_3)
Y	Yttrium (39)	(HREE)	1.2699 (Y_2O_3)
	Lanthanides (57-71)		
La	Lanthanum (57)	LREE	1.1728 (La_2O_3)
Ce	Cerium (58)	LREE	1.2284 (CeO_2)
Pr	Praseodymium (59)	LREE	1.2082 (Pr_6O_{11})
Nd	Neodymium (60)	LREE	1.1664 (Nd_2O_3)
Pm	Promethium (61)	-	
Sm	Samarium (62)	LREE / SEG	1.1586 (Sm_2O_3)
Eu	Europium (63)	LREE / HREE / SEG	1.1579 (Eu_2O_3)
Gd	Gadolinium (64)	LREE / HREE / SEG	1.1526 (Gd_2O_3)
Tb	Terbium (65)	HREE	1.1762 (Tb_4O_7)
Dy	Dysprosium (66)	HREE	1.1477 (Dy_2O_3)
Ho	Holmium (67)	HREE	1.1455 (Ho_2O_3)
Er	Erbium (68)	HREE	1.1435 (Er_2O_3)
Tm	Thulium (69)	HREE	1.1421 (Tm_2O_3)
Yb	Ytterbium (70)	HREE	1.1387 (Yb_2O_3)
Lu	Lutetium (71)	HREE	1.1371 (Lu_2O_3)

Other elements commonly associated with REEs:

Zr	Zirconium (40)
Nb	Niobium (41)
Hf	Hafnium (72)
Ta	Tantalum (73)
Th	Thorium (90) as a contaminant
U	Uranium (92) as a contaminant

[2] JCU Australia, Jan 2022. *Element-to-stoichiometric oxide conversion factors*. Online from Advanced Analytical Centre.

ABBREVIATIONS

AC	Air-core (drilling method)
ACCCGE	Australia China Corporation of Coal Geology Engineering Pty Ltd
AFO	Albany-Frazer Orogen
AGS	Arizona Geological Survey
AIG	Australian Institute of Geoscientists
Amdel	Amdel Laboratories Ltd
AMETS	Australian Mining & Exploration Title Services
AngloGold	AngloGold Ashanti Australia Ltd
AP / A to P	Authority to Prospect (early lease in the Northern Territory)
Aquitane	Aquitane Australia Minerals Pty Ltd
ATIC	Australian Trade and Investment Commission (also Austrade)
AusIMM	The Australasian Institute of Mining & Metallurgy
Austrade	Australian Trade and Investment Commission (also ATIC)
Azure	Azure Minerals Ltd
BHP / BHPM	BHP Minerals Exploration Pty Ltd
Bligh	Bligh Resources Ltd
BMR	Australian Bureau of Mineral Resources
BRD	Brown Range Dome (granitic pluton on WA/NT border)
BRM	Browns Range Metamorphics (immediately west of the BRD, hosting the Browns Range REEs)
BV	Bureau Veritas Laboratory, Perth, WA
Castile	Castile Resources Pty Ltd
CEGB / CEGBEA	Central Electricity Generating Board Exploration (Australia) Pty Ltd
CGS	China Geological Survey
COG	Cut-off grade (lower)
CP	Competent Person (as defined in the JORC Code)
CP(Geo)	Chartered Professional in the Geology discipline (accreditation through the AusIMM)
CRAE	CRA Exploration Pty Ltd
Delta Gold	Delta Gold Exploration Pty Ltd
DITT	Northern Territory Government – Department of Industry, Tourism and Trade
DME	Northern Territory – Department of Mines and Energy
DMIRS	Government of Western Australia – Department of Mines, Industry Regulation and Safety
DMP	Government of Western Australia – Department of Mines and Petroleum (prior to DMIRS)
E	East
EIS	Exploration Incentive Scheme (administered by DMIRS)
EL	Exploration Licence (mainly referring to Project's WA tenement E63/1972 and NT ELA33101)
eMetals	eMetals Limited
EOH	End-of-hole
EW	East-west
Focus	Focus Minerals Limited (owner of Focus Minerals (Laverton) Limited, formerly Crescent Gold Limited)
Fugro	Fugro Airborne Surveys (geophysical data contractors)
g	Gram
GA	Geoscience Australia
GDA94	Geocentric Datum of Australia 1994 (a geographic coordinate reference system)
Genalysis	Genalysis Intertek Laboratory Services, Perth, WA
Geopeko	Geopeko Limited
Geotechnics	Geotechnics (Aust) Pty Ltd
GeoVIEW	Online interactive geological map app for WA provided by DMIRS https://geoview.dmp.wa.gov.au/geoview/?Viewer=GeoView
Giants Reef	Giants Reef Mining Limited / Giants Reef Exploration Pty Ltd
Great Southern	Great Southern Gold Pty Ltd
GSA	The Geological Society of America
GSWA	Geological Survey of Western Australia
HCl	Hydrochloric acid
HRE	**Heavy Rare Earths Limited**
IAC	Ion-adsorption clay – type of REE deposit (same as IAD)
IAD	Ion-adsorption deposit / ionic adsorption deposit – type of REE deposit (same as IAC)
IGR	Independent Geologist's Report

Image	Image Resources
InterCopper	Inter-Copper NL
IOA	Iron oxide-apatite – type of REE deposit
IOCG	Iron oxide copper gold – type of ore deposit. Now more frequently known as IOCGU
IOCGU	Iron oxide copper gold uranium – type of ore deposit
IonicRE	Ionic Rare Earths Ltd
IPO	Initial Public Offering
JCU	James Cook University, Australia
JMCTC	JMCT Consulting (Resource geologist John Tyrrell's consulting business)
JORC	The Australasian Joint Ore Reserves Committee (the JORC Committee)
JORC Code	The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (as produced by the JORC Committee)
JV	Joint venture
km	Kilometre
km^2	Square kilometre
LabWest	LabWest Minerals Analysis Pty Ltd, Perth WA
m	Metre
m^3	Cubic metre
µm	Micro metre (or micron). 0.001 mm
Ma	Millions of years
mag	Magnetic (slang term for type of geophysical survey – as in "aero-mag")
Manto	Manto Mining Pty Ltd
Marathon	Marathon Petroleum Australia Limited
MAT	M.A.T. Exploration Pty Ltd
MAusIMM	Member of The Australasian Institute of Mining & Metallurgy
Meteoric	Meteoric Resources NL
MGA	Map Grid of Australia (a projected coordinate system, applied to GDA94)
MRM	Mount Ridley Mines Limited
N	North
NAHREY	North Australian HREE+Y mineral field
NE/NNE	North-east / north-north-east
NEGE	North Eastern Gold Exploration
Nobelex	Nobelex N.L.
Normandy	Normandy Gold Pty Limited (formerly PosGold)
Northern Minerals	Northern Minerals Limited
NS	North-south
NSW	New South Wales (State of Australia)
NT	Northern Territory (State of Australia)
NTGS	Northern Territory Geological Survey
NW	North-west
OK	Ordinary Kriging (a grade estimation method)
PosGold	Poseidon Gold Limited (formerly Golden Plateau NL)
ppb	Parts per billion
ppm	Parts per million (equivalent to g/t). 10,000 ppm = 1%
RAB	Rotary aur blast (a drilling technique)
Ravensgate	Ravensgate Pty Ltd (geological consultants)
RC	Reverse circulation (a drilling technique)
Red Metal	Red Metal Limited
RL	Reduced Level (effectively an elevation)
Rum Jungle	Rum Jungle Uranium Ltd / Rum Jungle Resources Ltd
Rwenzori	Rwenzori Rare Metals Ltd
S	South
Salazar	Salazar Gold Pty Ltd
Salmon Gums	Salmon Gums Minerals Pty Ltd
Santexco	Santexco Pty Ltd (formerly Normandy Tennant Creek Pty Ltd)
SE/SSE	South-east / south-south-east
SEGI	Society of Economic Geologists Inc.
Sipa	Sipa Exploration NL
SOC	SOC Resources Pty Ltd
Southern Geoscience	Southern Geoscience Pty Ltd
Spitfire	Spitfire Oil Pty Ltd
Strzelecki	Strzelecki Metals Ltd

STRIKE	Spatial territory resource information kit for exploration – online interactive geological map app for NT provided by DITT https://nt.gov.au/industry/mining-and-petroleum/geoscience-data-maps/online-geoscience-information-systems
SW	South-west
t	Tonne
t/m^3	Tonnes per cubic metre (unit of density)
Taylor Collison	Taylor Collison Limited
TMI	Total magnetic intensity (geophysical property)
USA	United States of America
USI	Universal Splendour Investments
Uranerz	Uranerz Australia Pty Ltd
Uranium West	Uranium West Pty Ltd
USGS	United States Geological Survey
VTEM™	"Versatile Time Domain Electromagnetic". A geophysical system operated by Geothech.
W	West
WA	Western Australia (State of Australia)
Westgold	Westgold Resources Limited (owner of Castile Resources Pty Ltd)
WMC	Western Mining Corporation Limited

1 SUMMARY

This Report summarises for **Heavy Rare Earths Limited** (**HRE**) the geological details and interpretations of their Rare Earth Element (REE) exploration projects in Australia. These include the partially-explored **Cowalinya REE Project** in Western Australia (WA) and the green-field **Duke HREE Project** in the Northern Territory (NT).

The Report is in the form of an **Independent Geologist's Report** (**IGR**, or the Report) by Consultant geologist **Robin Rankin** MAusIMM[3] CP(Geo)[4] through his independent geological consultancy **GeoRes**. The Consultant takes responsibility for the IGR's contents (***excluding the Cowalinya Resource Estimate Report*** fully appended as Appendix 7) as the Competent Person (CP)[5] according to the JORC Code[6]. The IGR's Effective Date was 26 April 2022, the date of the most recent relevant data supply to the Consultant. The Publication Date appears on the Report's title page.

The IGR's purpose is in support of an Initial Public Offering (IPO) of shares in HRE – aiming to raise $6.0M through selling 30M shares. Taylor Collison Limited (Taylor Collison) will be the Lead Manager for the Offer.

Cowalinya Project: The Cowalinya REE Project concerns near-surface mineral exploration for lateritic REEs in the southern WA goldfields, ~70 km south-east (SE) of Norseman. HRE currently hold a three year option to purchase 100% of the Cowalinya Project tenement E63/1972. The partially-explored Project targets a shallow secondary lateritic REE-enrichment deposit type which exists in supergene in-situ saprolitic clays weathered from immediately underlying basement granites and granitic gneisses (the original primary source of the REEs). This style of REE mineralisation is seen as an "ion-adsorption clay" (**IAC**) deposit – and is similar to extensive southern Chinese deposits which are dominant REE producers. IAC deposits there are often enriched in the more valuable "***heavy***" REEs (HREEs). As IAC deposits exist in shallow soft weathered rocks they are inexpensive to mine. REE extraction from those ores through acid-leaching is a similarly inexpensive and effective process.

Duke Project: The Northern Territory HREE Project concerns green-field mineral exploration for HREEs in the centre of the NT near Tennant Creek. HRE have recently applied for immediately adjacent tenements ~50 km NW of Tennant Creek, 38 block tenement EL33101 and 45 block tenement EL33194. Regionally the Tennant Creek area was known for substantial gold mining and recent exploration has focussed on Cu-Au type deposits (IOCGU) similar to Olympic Dam. HRE's intended exploration model is a Browns Range-style "vein-style" breccia-hosted hydrothermal xenotime HREE mineralised system. Browns Range in WA on the NT border (now in pre-production) has steep fault-controlled vein-like REE-bearing breccias intruded into meta-sediment hosts in association with an unconformity within the sediments. HRE's tenement is geologically highly analogous to Browns Range and contains similar sedimentary hosts, faulting and an unconformity. Manganese deposits in the area show some strong mineralisation processes akin to REE mineralisation.

> ***Consultant's overall opinion**: **Cowalinya Project**: In virtually all regards the Consultant's views confirm HRE's existing concepts of Cowalinya as a significant shallow lateritic HREE IAC deposit in the style of the world's biggest HREE producers in southern China. Overall the Consultant considers that the green-field Project has a clearly demonstrated and significant **Inferred** REE Mineral Resource of **28 Mt @ 625 ppm total REE oxide** (TREO) using a 300 ppm "TREO minus cerium oxide" lower cut-off. This maiden February 2022 Resource was estimated by HRE's Resource Consultant Mr John Tyrrell, who is the CP for the Mineral Resource estimate, and the Mineral Resource Estimate report is appended in full to this IGR. The Resource remains open in all lateral directions. Currently the drilled area covers only a very small proportion (~3.7 km², or ~1.6%) of the Project tenement area (230 km²). REE mineralisation is contained within a (mostly) single coherent contiguous ~8-9 m thick REE-mineralised layer within the in-situ clayey saprolite weathered from the granitic basement. Exploration through drilling utilised the very appropriate (to the weathered material) air-core drilling method. The weathered REE-enriched clayey material should be easily mined with open-cut methods. Overburden above the mineralised layer is not excessively thick (~17-18 m) and a third of it consists of relatively loose sandy alluvium. Several metallurgical test-work programs have shown that the REEs should be successfully (>90% recovery) and relatively cheaply extracted on-site into weak hydrochloric acid solution, potentially via heap leach methods.*

> ***Consultant's overall opinion**: **Duke HREE Project**: In the Consultant's opinion tenements EL33101 and EL33194 near Tennant Creek have the ideal prospective geological setting to fulfill HRE's hopes that the*

[3] Member #110551 of The Australasian Institute of Mining & Metallurgy (The AusIMM).
[4] Accredited by The AusIMM since 2000 as a Chartered Professional (CP) in the Geology discipline (CP(Geo)).
[5] CP Statement supplied in Appendix 1 – Consultant Statements.
[6] The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012 Edition. Abbreviated as the JORC Code, JORC or the Code. Prepared in 2012 by the Joint Ore Reserves Committee (JORC) of the Australasian Institute of Mining and Metallurgy (AusIMM), Australian Institute of Geoscientists (AIG) and Minerals Council of Australia (MCA).

area contains a HREE deposit similar the Browns Range xenotime HREE-rich vein-style deposits in WA. Sedimentary rocks in the area are highly analogous, as is the presence of an unconformity and faulting. Other REE-mineralising processes are also present in the area.

The Consultant and his dealings with the Project: The Consultant's qualifications to author this IGR would stem from his long geological and geological consulting career dealing with many mineral commodities from many and varied geological environments and settings – including the Rare Earths. The Consultant had no prior knowledge of the Project or of HRE prior to his engagement for the IGR in November 2021, and he is completely independent of HRE. The Consultant did not visit the Projects (because of the Covid Pandemic). He secured an independent WA-based professional to perform a Cowalinya Project verification visit in his place; the green-field nature of the Duke Project did not necessitate a site visit.

All actual Project data was supplied by HRE or by Other Consultants engaged by HRE. The Other Consultants for Cowalinya are the CP's for the Project's exploration data (Mr David Ross) and for the Mineral Resource Estimate (Mr John Tyrrell). Those CPs consent to being named in the IGR. Mr John Tyrrell (of JMCT Consulting) compiled the Resource Estimate as HRE's Resource Consultant at the same time as this IGR, and the Resource Estimate report[7] is fully appended to this IGR. Relevant details of that work are included within the IGR. All general background data was sourced by the Consultant.

What are REEs?: *Elements*: REEs are not "rare" in terms of average crustal abundance, but concentrated and economic deposits of them are very unusual geologically and relatively uncommon. REEs would now be classified as strategic minerals. The REEs are a series of elements (transitional metals adjacent to each other in the periodic table) with similar chemistries and unusual critically unique properties. Those properties are increasingly crucial to modern and emerging "high-tech" applications and this is creating increased demand and rising prices. REEs are typically the 15 elements from lanthanum (La, atomic number 57) to lutetium (Lu, atomic number 71) – collectively called the "lanthanides", as well as the element yttrium (Y, atomic number 39, in the row directly above lanthanum) and sometimes scandium (Sc, atomic number 21).

Light and heavy: REEs are traditionally divided into two groups on atomic weight – the Light Rare Earth Elements (LREE, atomic numbers 57 to 64 – lanthanum to gadolinium) and the Heavy Rare Earth Elements (HREE, atomic numbers 65 to 71 – terbium to lutetium, and 39 – yttrium). HREEs are increasingly important technologically, and being typically less abundant and harder to find they for the most part command higher prices than LREEs.

Geological deposit types: Concentrations of REEs, sufficient to represent economic "deposits", are geologically interesting because they occur in multiple and very varied settings, each hosting a different "type" of deposit. At least 10 deposit types are commonly recognised. Probably the most important types (in terms of current REE production) are carbonatites (a primary magmatic source, rich in LREEs) and ion-adsorption clays (IAC, a surface lateritic enrichment above granites, rich in HREEs). *Cowalinya is a IAC deposit, rich in HREE*. As HREEs become commercially more important the mix of important source deposit types is likely to change. *The Duke Project is potentially prospective for a vein-type deposit, usually HREE-rich*.

Sources: Historically REEs were produced mainly from the mineral monazite as by-products from the mineral sands industry (geologically a secondary concentration process). More recently an important source of the world's REE production became bastnaesite, principally from the Mountain Pass Mine carbonatite (a primary hard-rock REE source) in California, USA. The mine closed in the early-2000s and has largely remained closed since. In the mid-1980s China started significant production of REEs and have been the dominant world producer since 1990. The hard-rock Bayan Obo carbonatite deposit in Mongolia is the main world producer of LREE. However since the early 1970s, near-surface (generally 8-10 m thick) lateritic IAC deposits (secondarily lateritised and REE-enriched weathered granitic bedrock, generally converted to clay) in southern China became the major producers of HREE in a geological setting of easy recovery. These deposits have become known by various terms revolving around "ionic clays" and are now commonly referred to as "ion-adsorption clay" (IAC) REE deposits. The REEs are derived from bedrock and become loosely bound, via adsorption, to the in-situ weathered bedrock clay (known as saprolite). Although low grade (~0.05-0.20% TREO) IAC deposits are shallow and have low extraction and processing costs.

Since becoming reliant on China for REEs the west has seen renewed demand with increasing prices and this has reinvigorated exploration and production efforts. The significant past US producer Mountain Pass Mine re-opened in ~2018 and the West Australian Mt Weld Mine commenced first production in ~2018. Australia has now become a major producer. IAC deposits form a significant current exploration focus worldwide.

Uses: Unique physical and chemical properties give REEs diverse uses in defence, energy, industrial, and military technology applications . Many of their applications are crucial to modern and emerging technologies, particularly

[7] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Report issued to HRE by JMCT Consulting.

"high-tech" ones. Given their similar chemical nature, many different REEs have related or complementary uses - thus it is more convenient to describe their uses by application rather than by individual element. And in general the LREEs are cheaper, produced in greater quantities and are more extensively used than the HREEs. The least common and most expensive HREEs are typically used in the most highly specialized, high-technology applications. Early REE use was in mischmetal (lighter flints), an alloy of multiple REEs. Now key uses of REEs are in glass, catalysts, permanent magnets, batteries, metal alloys, phosphors, ceramics, and in the military.

Resources: Worldwide REE Resources are difficult to collate accurately – because sources are relatively numerous; geologically the sources are varied with very different concentrations; varying levels of understanding of the sector has caused unrealistically low cut-off grades to be used in reporting; and because of national secrecy surrounding strategic minerals.

Supply and demand: Like their Resources world REE supply and demand figures are not transparent. This is due to great differences in regional production as well as industrial secrecy going hand-in-hand with their use in strategic high-tech applications. Since WWII this situation has also been political, split between "East" and "West", with the East having become the dominant supplier whilst also being a significant consumer. REEs are usually sold as rare-earth oxides (REO). The Consultant finds that prices of most REOs have risen sharply in the last several years. Conversion factors are applied to individual REEs to convert to REO and also to determine an REE metal content. China has been the leading producer of REEs for the last three decades (~72% as of 2018), and is also likely to have been the biggest consumer. To meet demand global production increased by ~70% between 2006 and 2018.

Cowalinya REE Project (WA)

Location & topography: The Cowalinya REE Project is located in the far south of Western Australia, located ~70 km SE of Norseman and a similar distance north-east (NE) of the port of Esperance. The Project is situated on vacant Crown Land, characterised as thick native bush land with very low relief (rising very gently to the NE). Low-lying areas locally are occasionally-wet salt flats, often adjacent to ancient sand dune fields. Access is on dirt roads from the N/S oriented Coolgardie / Esperance Highway ~50 km to the west. Local bush tracks are sandy.

Cowalinya tenement E63/1972: HRE's tenement E63/1972 is large enough (~230 km^2) to easily host an IAC deposit of mineable size. And the tenement has enough time before expiry (2025) to allow it to be fully explored. Adjacent tenements to the south and west are held by other explorers also apparently looking for REEs in IACs.

Deposit type / geology: HRE's REE deposit at Cowalinya is interpreted as a shallow flat-lying supergene lateritic enrichment of REEs in saprolitic clays immediately overlying and weathered from granites and granitic gneisses (the original source of the REEs). This style of REE mineralisation is seen as an "ion-adsorption clay" (IAC) deposit developed above granite, very much analogous to the southern Chinese deposits. All indications are that the local nearly flat-lying ancient geomorphology and temperate climate promoted and preserved the lateritisation process. The local ancient granites were probably highly differentiated (given the re-working of the Biranup Orogen) and therefore likely to increase the source HREE content. Clays at Cowalinya are overlain by an ~6-10 m thick surface sandy alluvium layer.

Previous exploration: Evidence from previous recent (since 2009) explorers looking for gold (who luckily assayed partially for REEs as well) supports the Cowalinya REE deposit – both within the eastern parts of the tenement (AngloGold Ashanti Australia Ltd (AngloGold) and Great Southern Gold Pty Ltd (Great Southern)), nearby to the south (eMetals Limited (eMetals)), further to the SE (Salazar Gold Pty Ltd (Salazar) and Mt Ridley Mines Limited (MRM)), and to the west (Salmon Gums Minerals Pty Ltd (Salmon Gums)). Most exploration comprised initial surface soil/calcrete sampling (<2 m deep) followed by shallow (<60 m deep) "air-core" (AC) drilling of the weathered zone, both mostly on E/W lines. Salazar's metallurgical test-work proved that local REEs could be successfully acid-leached. The area possesses reasonable regional airborne geophysical data with magnetics being of principal interest. AngloGold collected detailed ground magnetics over part of the tenement.

Within the south-eastern part of the tenement Great Southern's AC drilling roughly defined the Night Watch REE prospect and ~2 km to the north-west (NW) of AngloGold's similarly defined the Double Tank REE prospect. Although initially targeted from their shallow surface calcrete sampling it is very likely that the surface REE samples were not linked to REE samples from the B Zone of the weathered saprolite above the fresh granite bedrock.

HRE's Cowalinya exploration model: Given Cowalinya's lateritic REE deposit type the exploration model to follow should entail shallow AC drilling and sampling of the weathered REE-enriched saprolite (lateritic B zone) above granite. The aim would be to collect data to allow computerised modelling of the upper and lower surfaces (layers) of the saprolite and particularly of the enriched REE layer within it. Sampling down-hole should be fine enough to characterise these surfaces accurately (the Consultant suggests 1 m). Drill hole spacing should be close enough to characterise distinct areas of particular REE enrichment (the Consultant suggests 50*50 m (X*Y), pending results of geostatistical variography).

HRE exploration drilling in 2021: HRE completed a comprehensive 109 hole AC drilling program (3,089 m) in 2021, with a hole depth average ~29 m. HRE's drilling built on the two previously delineated prospects, calling them Areas 1 (Night Watch) and 2 (Double Tank). The Areas are separated from each other in a roughly NW/SE orientation (Area 1 to the SE and Area 2 to the NW) and exist within a 6*4 km enclosing area (24 km^2). The Resource Estimate work refers to Area 1 as the South Area and Area 2 as the North Area.

AC drilling employed on the Project would be a method very applicable (because of its efficient recovery) to the difficult material characteristics (loose sand alluvium, soft clays) of the local geology. It is therefore an effective way of sampling the deposit. Sampling was well performed, was continuous down-hole, with the 1 m individual primary samples variously composited to 4 m for assaying. 827 samples (2,481 m) were assayed for REEs, 60% being 4 m composites. Samples were assayed for all REEs using a 4 acid digestion process.

The existing drill-hole spacing (~100*250/400 m) appeared suitable for first-pass exploration as mineralisation correlation and layer interpretation was possible between multiple adjacent drill-holes in the drill-line E/W direction. To confirm this the Consultant would need to see results of horizontal variography in the plane of the layers.

Interpreted REE-enriched composite layer intervals: REE-enriched layers were interpreted within the clay from contiguous down-hole REE-mineralised composite intervals of individual samples with >300 ppm TREO. A single dominant composite interval was interpreted in virtually all drill-holes (91%), some contained an upper and a lower interval. Mineralised layers averaged ~8-9 m in thickness. Overburden thickness above the mineralised layers averaged ~17-18 m, a third of which was surface alluvium. In plan view the REE-enriched layers were concentrated (thickness and grade) into a semi-banded shape with NW/SE trending bands.

REE-enriched composite layer grades: Layer intercepts averaged 624 ppm TREO (over ~9 m). Excluding marginal intervals reduced the layer thicknesses slightly (to ~8 m) whilst raising grades noticeably (to ~701 ppm TREO). Within layers higher grade concentrations existed in localised patches. 17% of composites had grades >1,000 ppm TREO and averaged 6.6 m @ 1,453 ppm (0.15%) TREO. Highest composite grade in Area 1 was 4 m @ 2,249 ppm (0.22%); and in Area 2 was 4 m @ 3,428 ppm (0.34%).

Deposit dimensions: As currently defined by drilling the Cowalinya REE deposit exists within a bounding ~23.4 km^2 area (~6.25 km E/W * ~3.75 km N/S) and averages ~8-9 m in vertical thickness. The deposit is overlain by ~17-18 m of overburden. At present the deposit is sub-divided into drilling Areas 1 (south) and 2 (north). Area 1 is within a skewed area ~2.70*1.40 km in extent (actual drilled area ~2.2 km^2); Area 2 is within a roughly square area ~1.25*1.20 km in extent (actual drilled area ~1.5 km^2). The Consultant presumes these areas are part of the same deposit and will join up when drilling is completed.

Consultant's rough deposit quantities: As a simple reality-check the Consultant roughly quantified (by combining past and recent drilling results) HRE's Cowalinya Project as potentially containing ~20 Mm^3 of enriched REE @ ~700 ppm TREO. That volume was determined from a 5 km^2 area, an 8 m thickness, and a conservative 50% layer coverage over the area. That ~20 Mm^3 volume would be equivalent to ~32 Mt using the Resource Consultant's density of 1.63 t/m^3. The Consultant notes that this rough 32 Mt over the full drilling area was very close to the Resource Consultant's 28 Mt estimate (see below) over the two smaller constituent drilling areas.

Computerised geological model*: Geological logging was used by HRE's Resource Consultant to create computerised geological models of the stratified rock lithologies. The primary focus was the REE-enriched saprolitic layer, which was subdivided into Upper and Lower zones. Modelling showed that the soil/clay/sand layers above the upper saprolite averaged ~10 m thickness, the upper saprolite ~12 m thickness, and the lower saprolite ~7m thickness (with the combined thickness range 2-32 m, average ~17 m). The Consultant's REE-enriched ~8-9 m thick composites would straddle the upper/lower saprolite boundary and might represent the classic Laterite B Zone.

Cowalinya 2021 Mineral Resource Estimate*: Block grades were estimated by the Resource Consultant for each individual REE within the computerised geological layer saprolite layer models using Ordinary Kriging. Sample scan distances were interpreted from variographic range interpretations for the different saprolite layers in each area and were very long (~450-865 m) and generally omni-directional. *The Consultant considers these very long ranges to be unlikely and although their use would not materially alter the overall estimated Resources they would conservatively diminish the influence of anomalously high grades*. Input sample lengths were composited to 4 m, and all REEs were top-cut to a degree.

Total dry **Inferred** Mineral Resources of **28 Mt @ 625 ppm TREO** were reported above a 300 ppm "TREO-CeO_2" (Total Rare Earth Oxides minus cerium oxide) grade cut-off using a default dry density of 1.63 t/m^3. The South Area contained 75% of the Resources, and the Lower Saprolite a slightly greater proportion.

The Resource Consultant qualified the Resource estimation by noting generally minor limitations introduced by wide drill-hole spacing, the long 4 m assay sample lengths, and insufficient density and moisture determinations. He also flagged that an alternative assaying method returned assays 12% higher.

** The Resource Estimate was undertaken independently by HRE's Resource Consultant (Mr John Tyrrell of JMCT Consulting) and was reported to HRE in February 2022. The Report of that Estimate is fully appended to this IGR and relevant details from it are included in the IGR.* ***Mr Tyrrell was the CP for Resources****.*

Future deposit extensions: Similar REE mineralisation found by eMetals ~6 km to the SSW (in similar geology, layering, thickness and depth) would strongly indicate continuations of HRE's mineralisation southwards generally. HRE identifies improving grades and thicknesses towards the SE (of its Area 1), with a further 6 km to go to the tenement boundary. And the previous calcrete sampling by AngloGold on the tenement and adjacent to it would indicate similar extension potential to the NE.

Contaminants: HRE observe that concentrations of common REE contaminant elements uranium and thorium are beneficially low. This may be crucial as permission would presumably be required to extract material with potentially high radioactivity.

Overburden: Thickness of overburden above the REE-bearing layers averages ~17-18 m, of which a third is estimated to be unconsolidated or semi-consolidated alluvium.

Metallurgical acid-leach extraction: Salazar's acid-leach metallurgical test-work in 2013 showed that REEs could be successfully extracted from nearby (Splinter Project, ~55 km away to the south-east) REE-enriched lateritic clays similar to Cowalinya's. Extraction proportions using warm hydrochloric acid were high (~90% of TREEs, ~97% of LREEs and ~58% of HREEs), leach times were moderate (~1 day), and acid consumption was low. These results were comparable to Chinese extraction.

HRE's metallurgical tests on selected samples from its drilling in 2021 were very similar to Salazar's – with >90% recovery to solution of TREE being possible under multiple combinations. The LREE/HREE extraction was also similar to Salazar's, with HRE also showing that for a "valuable" suite of REEs the recovery was generally >80%.

The closeness of HRE's metallurgical results (for each individual REE) to Salazar's was remarkable and would tend to strongly confirm the extraction technique's applicability to laterites at least locally if not regionally.

Comparable deposits: Cowalinya is directly comparable geologically to many (possibly all) of the Chinese lateritic ion-adsorption clay (IAC) REE deposits in production. Typical thicknesses (~5-10 m) and grades (~500-2,000 ppm REO) are similar, and the potential extraction method envisaged for Cowalinya would match many.

At the present there are no producing ion-adsorption clay REE deposits in Australia. However there is an increasing awareness of the deposit type and increasing numbers of similar deposits being recognised and explored for.

HRE considers the IonicRE's Makuutu deposit in Uganda as directly comparable to Cowalinya because of the geological, mineralogical and dimensional similarities and because of the involvement of an Australian explorer. Like Cowalinya, Makuutu is an ion-adsorption clay REE type deposit. The Makuutu REEs are enriched in a lateritic clay layer, in a basin structure, with the REEs derived from granites. In both deposits REEs would be extracted through chemical leaching into solution. In both cases the valuable HREEs are proportionally well represented.

HRE promotes the advantages Cowalinya has (like IonicRE with Makuutu) being an IAC REE deposit (as opposed to a hard rock deposit) as thus being essentially based on shallow/easy/cheap mining and potentially simple/cheap/effective heap leach extraction.

Duke HREE Project (NT)

HRE's NT exploration model: HRE's intended exploration model in the NT is a Browns Range-style vein breccia-hosted hydrothermal xenotime HREE mineralised system. Browns Range in WA on the NT border (now in pre-production) has steep fault-controlled vein-like REE-bearing breccias intruded into meta-sediment hosts in association with an unconformity within the sediments. HRE's Duke tenement is geologically highly analogous to Browns Range and contains similar sedimentary hosts, faulting and an unconformity. The initial target would be the unconformity between the Tomkinson (Tomkinson Creek Group) and Warramunga (Ooradidgee Group) Provinces which is present in the application area.

Location & topography: The Duke Project is located virtually in the centre of the NT, ~50 km NW of the regional centre of Tennant Creek. The sealed Stuart Highway connects the town to the port of Darwin to the north, as does the parallel Alice Springs to Darwin railway. Road access is good thanks to past exploration and mining. Elevation range in the Project area is minimal, existing between ~310 m RL and 362 m RL, indicating the area is generally flattish. Climate is warm, vegetation is relatively sparse, and pastoral activities centre on cattle production.

Tennant Creek mining history: Mining of gold is historically well established in the Tennant Creek area, sufficient for it to be known as the Tennant Creek Goldfield. Mining commence ~90 years ago and was considerable up until the 1980's after which it became sporadic. Principal production was of mineralogically deposit associated gold, copper and bismuth. Latterly manganese production has emerged.

Deposit types in the area: Gold and copper mining has historically been from "Tennant Creek-style ironstone gold-copper-bismuth" deposits in the region's older meta-sediments. Other deposit types interpreted in the area include "structurally emplaced" (including vein-style), "unconformity-related", "granite-hosted/contact", "porphyr-related", and "IOCGU" (iron oxide copper gold uranium". It is possible the ubiquitous Tennant Creek-style is a high-grade version of IOCGU deposits. The manganese is likely a "hydrothermal/supergene enrichment" deposit type.

NT tenement application EL33101 & EL33194: HRE's Duke Project is located within immediately adjacent Exploration Licences 33101 and 33194 (EL33101 & EL33194). The ELs are currently under "application", awaiting granting, and their term will be 6 years. EL33101 is roughly square in shape, contains 38 blocks, and has an area of ~109 km^2. EL33194 (immediately east of EL33101) is trapezoidal in shape (with the eastern side running ~NW/SE), contains 45 blocks, and has an area of ~146 km^2.

Geology: The EL largely covers meta-sedimentary rocks of the Tomkinson and Warramunga Provinces which dip to the NW and are separated by an unconformity. The SE corner of the EL covers the intrusive Warrego Granite. Various intrusives and volcanics exist nearby to the SE. Numerous faults are present, mostly oriented NNE or NW. Outcrop exposure is good in the northern parts of the EL, the rest is largely sand covered.

Previous exploration: HRE has not previously explored the tenement. Given the region's considerable gold mining history considerable exploration has also occurred regionally and locally – principally for gold and copper in Tennant Creek-style ironstone-hosted Cu-Au-Bi deposits in the Warramunga rocks. That has been concentrated around the mines to the SE of the Project – leaving the NW extremity of the Warramunga (where HRE's Project is located) relatively less explored. Latterly the sedimentary unconformity setting encouraged the search for uranium. The tenement has **not** previously been explored for REEs.

This Report lists ~20 exploration programs in the general area since the late 1960's, of which ~6 involved actual exploration over HRE's tenement. Most exploration was to the south of the tenements. Exploration usually commenced with airborne geophysical surveys (magnetic and radiometric), often followed by targeted ground surveys. Geochemical soil sampling often followed over geophysical anomalies – and scattered surveys were undertaken to the south and SE of the tenement, but none actually on it. Very limited drilling also occurred, similarly largely south of the tenement, with a smattering of scattered, mostly shallow, holes within the tenement. Shallow holes were typically auger or vacuum, deeper holes were virtually all RAB or RC type, with a very limited number of diamond holes. Although numerous geophysical and geochemical anomalies were defined in the area gold and copper results were very skinny and most were ascribed to ironstones or dolerite sills in the open-folded stratigraphic sequences. A weak uranium-in-water deposit was found in the early 1980's on the eastern boundary of the tenement. No gold-copper anomalies were followed up to any significant degree with drilling, particularly to the depths (>200m) indicated by the geophysics.

Geological potential to host a REE deposit: The Consultant considers that a strong case exists for HRE's tenement area being geologically similar to the Browns Range HREE deposit style in WA (the exploration model). The Project area has similar meta-sedimentary host rocks, the presence of unconformities, and the presence of conjugate fault systems. It is yet to be determined if the host sediments are phosphorus rich (to cater for xenotime formation) although the nearby granite could provide an alternative mineral source. Similarly it is yet to be determined if the area contains any fault-controlled pegmatites (although they are reported in the adjacent Warrego Granite), but the indication of numerous faults is encouraging (particularly from recent aero-mag data interpretation).

The Consultant also considers that the Project region has other mineralisation styles which may also concentrate REEs (vein/structurally-emplaced-IOCGU). Exploration for REEs has not been reported in the Tennant Creek Goldfield, something which may stem from past disinterest in REEs as a commodity. And finally the Consultant would point to the nearby Bootu Creek and Mucketty manganese deposits where mineralisation processes (hydrothermal and supergene enrichment) are akin to some for REE mineralisation.

2 INTRODUCTION

Consultant Robin Rankin, (MAusIMM CP(Geo)) was engaged in November 2021 by Heavy Rare Earths Limited (HRE, the Client) to produce an Independent Geologist's Report (IGR, the Report) on its "Rare Earth" mineral exploration projects in Australia. The IGR's purpose would be in support of an Initial Public Offering (IPO) of shares in HRE through the ASX.

The IGR is introduced in terms of:

- HRE's exploration projects.
- IGR authorship.
- IPO details.

2.1 HRE'S EXPLORATION PROJECTS

HRE's mineral exploration projects currently are:

- **Cowalinya REE Project** – the Cowalinya Rare Earth Element Project in the Cowalinya region of Western Australia (WA), ~70 km SE of Norseman.
- **Duke HREE Project** – the "Heavy" Rare Earth Element Project in the Northern Territory (NT), ~ 50 km NW of Tennant Creek.

HRE holds a three year option to purchase 100% of the Cowalinya Project's tenement E63/1972. HRE has applications lodged for the Duke Project's tenements EL33101 and EL33194.

Cowalinya REE Project: The Cowalinya REE Project (some ~70 km SE of Norseman in the WA goldfields) concerns near-surface mineral exploration for REEs (Rare Earth Elements). Previous exploration within the Project's tenement pointed to the potential for an extensive REE deposit. HRE's recent re-evaluation of existing data lead to the deposit being interpreted as a shallow flat-lying supergene in-situ lateritic secondary enrichment of REEs in saprolitic clays immediately overlying and weathered from granites and granitic gneisses (the original primary source of the REEs). HRE's own exploration in 2021 has confirmed that interpretation.

This style of REE mineralisation is seen as an "ion-adsorption clay" (IAC) deposit, similar to extensive southern Chinese deposits which are dominant REE producers. IAC deposits there are often enriched in the more valuable "heavy" REEs (HREEs). As IAC deposits exist in shallow soft weathered rocks they are inexpensive to mine using open-cut methods. And REE extraction from the ore through acid-leaching is a similarly inexpensive and effective process.

Duke HREE Project: The Northern Territory HREE Project concerns green-field mineral exploration for HREEs in the centre of the NT, ~50 km NW of Tennant Creek. HRE have recently applied for 38 block tenement EL33101 and 45 block tenement EL33194. HRE's intended exploration model is a Browns Range-style vein breccia-hosted hydrothermal xenotime HREE mineralised system. Browns Range in WA (now in pre-production) has steep fault-controlled vein-like REE-bearing breccias intruded into meta-sediment hosts in association with an unconformity within the sediments. HRE's tenement is geologically highly analogous to Browns Range and contains similar sedimentary hosts, faulting and an unconformity.

2.2 IGR AUTHORSHIP

The Consultant authored this IGR and takes responsibility for its contents (**excluding** the Cowalinya Resource Estimate Report appended in Appendix 7) as the Competent Person (CP) in terms of the JORC Code. It is issued through the Consultant's independent geological consultancy GeoRes. The terms Consultant and GeoRes are used interchangeably throughout the Report.

Details on the Consultant's interaction with the Projects (including engagement, communications, objectives, scope of work, and sources of data) are given in Section 3. The Consultant provides separate details in Appendix 1 to provide background to his consulting and in particular to provide his CP Statement.

The Effective Date of this IGR was 26 April 2022, the most recent date of relevant data supply to the Consultant.

2.3 IPO DETAILS

This IGR has been prepared for inclusion in the prospectus prepared by HRE in connection with an Initial Public Offering (IPO) of shares in HRE. Funds raised would be used primarily for further REE mineral exploration.

HRE: HRE's registered address is ATT: JM Corporate Services; Level 21, 459 Collins Street Melbourne VIC 3000. Mr Justin Mouchacca is Chief Financial Officer and Company Secretary. HRE's board is Mr John Byrne (Non-Executive Chair); Mr Richard Brescianini (Executive Director); and Mr Ryan Skeen (Non-executive Director).

IPO: The IPO (the Equity Offer) aims to raise $6.0M through the offer of between 30M shares at $0.20 per share in connection with seeking to list on the ASX. Taylor Collison Limited (Taylor Collison) is the Lead Manager for the Equity Offer. QR Lawyers is the legal advisor of HRE for the IPO. The share register will be through Boardroom Registry.

Proposed expenditure: The indicative use of the funds raised in the first two years following completion of the Equity Offer is given in Table 1. Expenditure is primarily on mineral exploration and project development.

Table 1 Indicative use of funds (2 years)

Activity	Funds
Drilling*	$2,340,000
Assaying	$440,000
Metallurgical process development	$325,000
Project studies**	$400,000
Payment to Cowalinya Project vendors***	$300,000
Duke Project (NT) – first pass exploration	$100,000
Administration & working capital	$1,455,000
Costs of the offer	$640,000
	$6,000,000

* Including contractors, wire-line logging, field support & site rehabilitation
** Including Resource & Reserve estimation
*** Exercise option to acquire 100% of Cowalinya

Future exploration objectives: HRE have described the broad objectives of future exploration as follows:

The main focus of exploration over two years is to increase both the quantity and confidence in rare earth resources present on the Cowalinya Project.

*Initially wide spaced air-core drilling (400*200 m) will be used to identify additional mineralised areas on the tenement, with subsequent infill drilling (200/100*100 m) used to increase resource confidence. Shallow diamond drilling will also be undertaken to obtain core samples for both metallurgical and geotechnical test-work. This will be supplemented with downhole wire-line logging for in-situ bulk density measurements.*

The use of aerial EM and magnetics will also be investigated to determine whether they can be used to better target areas of rare earth mineralisation.

Following the initial metallurgical test-work which indicated that good recovery rates were achievable, further process development work will be undertaken by consultants to optimise rare earth recoveries.

Further resource and/or reserve estimations will be completed based on the new information obtained.

Expenditure on the Duke Project in the Northern Territory will involve a review of previous exploration, geological reconnaissance, rock and soil sampling.

Consultant's opinions on projected expenditure: In terms of the technical items listed in Table 1 the Consultant considers that the list fairly (and without skimping) covers typical mineral exploration and project development requirements (tasks). He also considers the quantum of the expenditure over 2 years to be realistic and sufficient to achieve positive exploration outcomes.

Cowalinya Project: The Consultant believes that the great bulk of the expenditure (probably >95%) is aimed at the Cowalinya Project (see Section 2.1) – as he would expect given that the Project now has a declared Inferred Resource (see Section 11.8).

The quantum of expenditure for Cowalinya is substantial and realistic in developing what is now a second generation Project. Following the delineation of a reasonable Resource Cowalinya is now at the point of extending its Resources (through further drilling and assaying, lines 1 and 2 in Table 1) and moving into project development (addressed by the Metallurgy and Project studies, lines 3 and 4 in Table 1). Those activities almost by definition would require a substantial expenditure, which appears well catered for.

Duke Project: Early expenditure on a green-fields project (prior to finding and producing a Resource) would be expected to be subdued. The Duke Project is in that position as any REE mineralisation remains to be discovered. In such an early exploration state a low but steady burn of expenditure would be required to iteratively follow-up leads over (possibly) a longish period of exploration (estimated to at least be in the order of 2 to 5 years). Hence the single dedicated Duke Project exploration expenditure (line 6 in Table 1) in the first 2 years is moderate. However the Consultant expects that to be sufficient to cover the initial background research, field mapping, rock chip sampling and general deployment required to start exploration. And if necessary the Duke Project would not detract noticeably from the Cowalinya Project expenditure as HRE confirms it will not divert expenditure from committed expenditure on Cowalinya.

3 BACKGROUND

Background to writing this Report is given in terms of:

- Consultant Statements (Appendix 1)
- Engagement of GeoRes
- Personnel & communications
- Competent Persons (CPs)
- Objectives
- Scope of work
- Key dates
- Site inspections
- Sources of information
- Warranties by the Client
- Reliance on other experts
- Verification of information

3.1 CONSULTANT'S QUALIFYING STATEMENTS

Separate Consultant Statements are made (in Appendix 1) to provide context to the Consultant's relationship to this Report and to detail the declarations, conditions and qualifications governing it and the consulting undertaken to produce it. Primarily those Statements concern:

- The Consultant's qualifications, professional standing and independence from the Client.
- The Consultant's Competent Person (CP) Statement governing this Report.
- Consulting based on fees linked to an agreed Scope of Works, with results not tied to payments.
- No prior knowledge of the Project.
- Assumptions concerning completeness of supplied information and its legal standing.
- Limitations of geological consulting and disclamations relevant to data inaccuracies or omissions.

3.2 ENGAGEMENT OF GEORES

After the initial introduction to HRE (by Mr Mark Gordon for Taylor Collison Ltd, both of whom GeoRes is independent of) and at HRE's request, GeoRes submitted a Consulting Proposal (the Proposal) on 1 November 2021 by email to HRE to supply an Independent Geologist's Report (IGR) on the Project. The Proposal was accepted on 8 November 2021 by email. The Proposal was submitted after viewing HRE's brief Project summary document and inspecting their data room on-line.

GeoRes is an independent geological consultancy and had no prior knowledge of the Cowalinya REE Project or of the Duke HREE Project (the Projects) or of Heavy Rare Earths Limited (the Client). GeoRes is independent of HRE and GeoRes's consulting to HRE is provided on a paid fee basis of which results are not contingent.

3.3 PERSONNEL & COMMUNICATIONS

Initial GeoRes contact with HRE, and all subsequent formal communications, have been through email. Other in-direct communications with HRE, principally concerning Project details and data, have been via emails and telephone calls through Other Consultants to HRE. GeoRes is not specifically aware of the terms of engagement or relationships of those Other Consultants with HRE. Those Other Consultants (with consents to be named following immediately below) to HRE were:

- **Mr David Ross** (Geologist, MAusIMM & MAIG). Direct email communications. Mr Ross is a joint holder with his wife of the Cowalinya Project's tenement – on which HRE has a 3 year purchase option.
- **Mr Richard Brescianini** (Total Rare Earth Solutions, MAIG, now a Director of HRE). Direct email and telephone communications.
- **Mr John Tyrrell** (the Resource Consultant on the Cowalinya Project, JMCT Consulting, MAusIMM). In-direct email forwarding communications.

3.4 COMPETENT PERSONS (CPS)

A Competent Person (CP) – for the purpose of taking responsibility for information (say provided in a report) involving Mineral Resources – is defined under the JORC Code as that person with sufficient background education and specific experience with the minerals in question. CPs for various aspects of this Report are listed below, with their consents to be named.

IGR: The CP for this IGR (**excluding the Cowalinya Resource Estimate Report appended in Appendix 7 and the Mineral Resources reported in it**) is GeoRes's Principal Consultant **Mr Robin Rankin**. His CP Statement (in the prescribed JORC format) is supplied in Appendix 1 together with terms for his consent for the IGR to be issued.

Exploration data: The CP for the Cowalinya Project's exploration, exploration data and geology information is geologist **Mr David Ross** (Other Consultant to HRE). It is understood that Mr Ross designed and supervised the HRE 2021 exploration drilling described below, amongst other things. His CP Statement appears separately in Mr John Tyrrell's Resource Estimate Report appended in Appendix 7 (mentioned immediately below).

HRE advises[8] that:

- Mr David Ross is a joint holder of the Cowalinya project tenement and will be a vendor of the tenement under the option granted to HRE.
- Mr David Ross has consented to being named as a Competent Person in this Report.

Cowalinya Mineral Resources: The CP for the Cowalinya Project's recent Mineral Resource estimation is **Mr John Tyrrell** of JMCT Consulting. The February 2022 Resource Estimate Report[9] is fully appended to this IGR in Appendix 7. That Report contains John's CP Statement and a JORC Table 1. Relevant summary details of that work are included within the IGR.

HRE advises[10] that:

- Mr John Tyrrell has consented to being named as a Competent Person in this Report.

3.5 OBJECTIVES

GeoRes proposed to research existing information on the Cowalinya and Duke Projects and produce an Independent Geologist's Report (IGR). The Project information would comprise geological, mineral exploration and related Project development data and reports, and would be supplied by the Client from an electronic data room.

Scale of IGR: In scale the IGR was envisaged as a "broad brush" analysis of the Projects (taking into account the requirement for an early (late 2021/early 2022) production of an IGR; the Consultant's inability to visit the Cowalinya site; and in the absence of specific instructions from HRE to the contrary). With this approach GeoRes would take data at "face value". GeoRes would not personally verify Project information (such as the secure flow of data from drilling, sampling and assaying) to any great degree or to the detail which might be undertaken for a due diligence study. Where such independent data verification already existed that would be included in the Report together with all specific assurances gained for the Report from personnel able to visit the site.

3.6 SCOPE OF WORK

GeoRes's roughly envisaged "broad brush" Scope of Work in producing the IGR included:

- Research of the current REE state of play and details of "REE ionic clay deposits".
- Cowalinya Project:
  - Study of the Project's setting, past exploration and data.
  - Comparison of the Project's data with other ionic clay deposits.
  - Evaluation of the Project's exploration standing.
- Duke Project: Study of the Project's setting, objectives and past exploration.
- Collation of findings and opinions into an IGR report.

3.7 KEY DATES

IGR commencement and estimated delivery: The Consultant commenced work on the IGR on ~8 November 2021. Supply of the IGR was envisaged to take 4-6 weeks elapsed time and so be in late December 2021 or January 2022. Later inclusion of Duke Project details pushed back a delivery date to May/June 2022.

Effective Date: The "Effective Date" of the most recent supply to the Consultant of relevant data used in the IGR was **26 April 2022** (the Effective Date). The bulk of Project-specific data was supplied in November 2021 by HRE from their data room. The IGR was prepared as at the Effective Date.

Publication Date: The "Publication Date" of this IGR is the date given in the Report's title page (the Publication Date). The Publication Date post-dates the Effective Date.

[8] HRE, 7 June 2022. Email to Consultant.
[9] Tyrrell, J., 11 February 2022. *Report – Cowalinya Mineral Resource Estimate*. Report issued to HRE by JMCT Consulting.
[10] HRE, 7 June 2022. Email to Consultant.

3.8 SITE INSPECTIONS

Cowalinya Project, WA: The Consultant did **not** inspect the site of the Cowalinya Project in WA. This was due to the continuing Covid 19 pandemic in late 2021 and the WA travel restrictions current then. As those restrictions were not envisaged to end within months the IGR proceeded without a visit by the Consultant. Instead a WA based professional was engaged for a verification visit by HRE at the Consultant's behest (see below).

Cowalinya independent inspection: As an alternative to a visit to the Cowalinya Project site by the Consultant GeoRes suggested that one be carried out by an independent WA resident geologist. The purpose would be to verify the Project location and any visible exploration activity. HRE consequently specifically engaged WA based **Mr Richard Brescianini** (MAIG) of Total Rare Earth Solutions to visit the Site. Mr Brescianini subsequently became a director of HRE (on 2nd February 2022). He was not a director at the time of the November 2021 Cowalinya site visit. Documents relating to Richard and the visit appear in Appendix 3 – Cowalinya site data verification – Richard Brescianini. Mr Brescianini visited Cowalinya on 10th November 2021. He confirmed that he observed many drilling sites there (identified and located in HRE's data and maps) and specifically visited and photographed 10 drilling sites. In terms of his qualifications and competence to perform a visit Mr Brescianini stated that "*I am a professional geoscientist of 34 years' standing in the private and public sector, which includes a four-year term as Director of the Northern Territory Geological Survey. I am a Member of the Australian Institute of Geoscientists*".

Duke Project, NT: The Consultant did **not** inspect the Duke Project site in the NT. The Project's green-field nature obviated the necessity of a site visit.

3.9 SOURCES & DETAILS OF INFORMATION

Cowalinya Project: All specific Project technical information (the Information) was supplied to the Consultant by HRE, either directly by email, or by providing access to a digital data room. Details on the information was either supplied directly by HRE or through Other Consultants (see Reliance on Other Experts Section below) to HRE. The bulk of the data room information was accessed or downloaded in late November 2021. Details of the Resource Consultant's Resource estimation work were accessed in December 2021 and January 2022, the final Report in February 2022, and that Report is appended in full to this IGR at Appendix 7. A listing of the Information is given in Appendix 2 – Project Information listing. Specific Project Information comprised:

- Declarations.
- Reports.
- Photographs.
- Drill hole data.

Duke Project: Project details supplied by HRE to the Consultant only covered the tenements EL33101 and EL33194 application documentation. A listing is given in Appendix 2 – Project Information listing. Specific Project Information comprised:

- Tenement application reports and plans.

Details and reports on previous exploration in and around the tenement were accessed by the Consultant directly from the NT Government's on-line STRIKE webpage. Those reports are listed in the Section on References.

Both Projects: Other relevant details on REEs was sourced by the Consultant from external technical papers accessed via the web or from personal papers. Those papers are listed in the Section on References. The principal sources of external References were:

- US Geological Survey (USGS).
- WA Government's Department of Mines, Industry Regulation and Safety (DMIRS).
- NT Government's Department of Industry, Tourism and Trade (DITT).

3.10 WARRANTIES

HRE has warranted to GeoRes (see here below) the completeness of Project data and the location of some of that data. GeoRes makes **no** other warranties regarding the Project data, its completeness or its accuracy (see also verification Section 3.12 below). GeoRes would point to its Statements governing the production of this Report (in Appendix 1), particularly those on assumptions of full data supply and legal access, limitations and disclaimers.

Data: Regarding the Cowalinya Project HRE confirmed on 16 November 2021 that as of that date the HRE data room contained all currently available information regarding the Cowalinya Project. HRE also stated that analytical work was continuing and that results would be supplied when available. That later supply was taken by the

Consultant to principally reference the February 2022 Cowalinya Mineral Resource estimate report for which Mr David Ross took responsibility as CP for Exploration Results and Mr John Tyrrell took responsibility as CP for Mineral Resources.

Locations: After his visit to Cowalinya (see Section 3.8 above) Mr Richard Brescianini (then independent) made various statements on 16 November 2021 confirming the Cowalinya Project location and various drill hole locations. He stated "*I can confirm evidence of a systematic shallow drilling program at the Heavy Rare Earths Limited exploration site I visited …*". And in particular he stated "*I observed tens of drilling sites which were identified as shown in the photos at one of the sites (drill hole AC47: a location stake, bagged air core drilling samples and a dumpy peg indicating the location of the drill hole). I personally visited and photographed 10 of the drilling sites, all of which have been uploaded to Heavy Rare Earths Limited's Teams data room*".

3.11 RELIANCE ON OTHER EXPERTS

The Consultant was solely responsible for the compilation of this Report and for various opinions presented in it.

The Consultant is completely independent of all Other Experts mentioned in the Report.

The Consultant's only direct reliance on Other Experts was for the site visit to Cowalinya (see Section 3.8) by the Other Expert to confirm the location of the Cowalinya Project and some of its data.

The Consultant was partly reliant on Other Experts (detailed in the Personnel & Communications Section above) for background information on the Project and Project data. That information was principally supplied by Mr Richard Brescianini of Total Rare Earth Solutions.

Details of the Resource estimation work by HRE's Resource Consultant Mr John Tyrrell of JMCT Consulting (an Other Expert) were provided in December 2021 and January 2022, and the final Report in February 2022. That Report is appended in full to this IGR at Appendix 7. Relevant aspects were reviewed and summarised into this IGR, with the inclusion of a number of Figures. The Consultant took the Report's details at face value.

3.12 VERIFICATION OF INFORMATION

GeoRes took all Project information at face value and based this Report and opinions on that information using a considered experienced geological approach. The Consultant verified the information (to the limited extent that he could) simply against his considerable experience of similar information – finding it all to be believable and well within the bounds of credibility.

Limitations here on the extent of information verification largely revolve around the preclusion of actual physical data verification (say by geological observation, location verification and check sample assaying) and duplication (say by additional drilling). That preclusion, addressed by the limited Scope of work, derived from limited time, opportunity and funding.

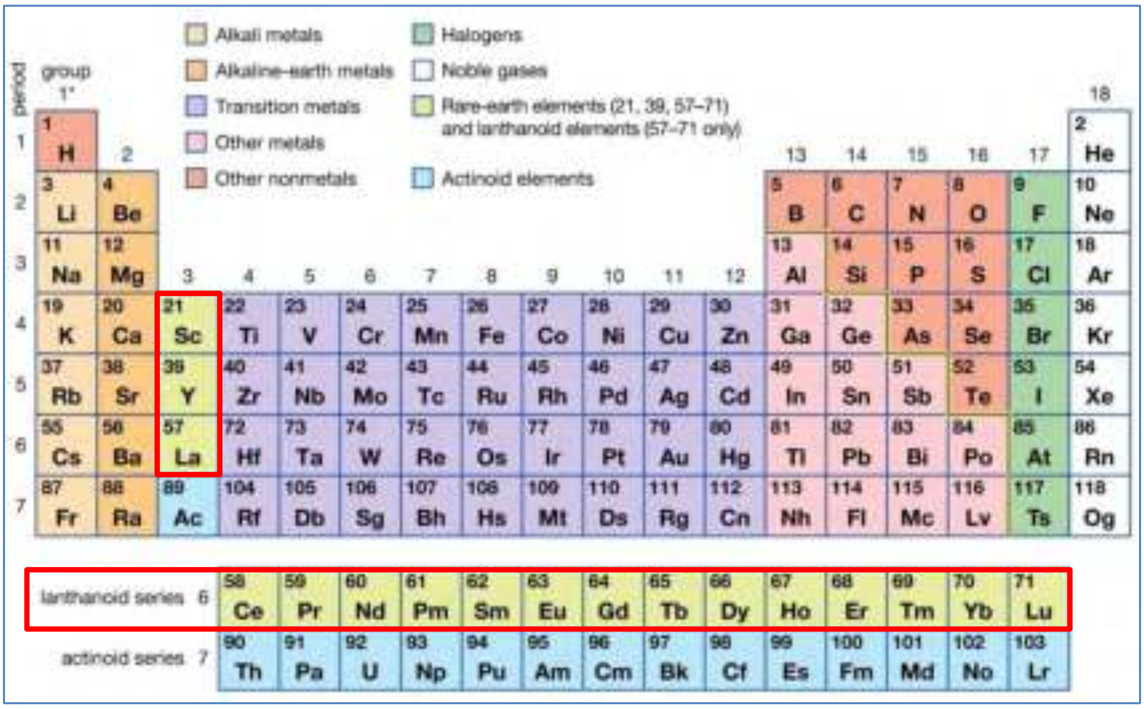
4 RARE EARTH ELEMENTS (REEs)

The Cowalinya and Duke Projects concerns exploration for **Rare Earth Element** (**REE**) minerals – which are currently highly topical because of their increasing use in electric vehicles (EVs) and other modern "high tech" devices. However as REEs and their sources are also poorly understood a summary of them is provided here. The majority of the information here was sourced from recent US Geological Survey (USGS) papers[11].

4.1 REE DEFINITION

The REEs are a series of elements with ***similar chemistries and unusual critically unique properties*** which are most easily visualised (in relation to other elements) by their adjacent positions in the Periodic Table (the olive shaded blocks in Table 2 outlined in red). The REEs are usually identified as the 15 elements from lanthanum (La, atomic number 57) to lutetium (Lu, atomic number 71) – collectively called the "lanthanides" or "lanthanoids", as well as the element yttrium (Y, atomic number 39, in the row directly above lanthanum). Sometimes scandium (Sc, atomic number 21, in the row directly above yttrium) is included as it is chemically similar but does not commonly occur in deposits with the lanthanides or yttrium. Promethium (Pm, atomic number 61) is excluded as it is not naturally occurring. Individual lanthanides are named in the Abbreviations Section above and in Table 7.

Table 2 Periodic Table of elements[12]



REEs are also traditionally divided into two groups on atomic weight – the **Light** Rare Earth Elements (LREE) and the **Heavy** Rare Earth Elements (HREE). The LREEs range from lanthanum (57) through to gadolinium (64); the HREEs from terbium (65) through to lutetium (71) and yttrium (39). However some authorities include europium (63) and gadolinium (64) with the HREEs. Although light atomically **yttrium** is included with the HREEs because its chemical and physical properties match the HREEs. The grouping of samarium + europium + gadolinium may be referred to as SEG or Medium REE (MREE). Uranium (U) and thorium (Th) are radioactive elements (and thus contaminants) often associated with REE mineralogy.

HREEs are becoming increasingly important economically because of their emerging technological uses. As they are typically less abundant and harder to find they now command a higher price than the LREEs.

REEs are not as rare as their name suggests. The term "earth" was originally defined for materials that could not be changed further by heat. The "rare-earths" were relatively more rare than other typical "earths" such as lime or magnesia[13]. However REEs are not "rare" in terms of average crustal abundance, but concentrated economic deposits of them are unusual geologically and uncommon. REEs would now be classified as strategic minerals.

[11] USGS. Various papers from 2017 and 2019.
[12] From Encyclopaedia Britannica Inc., November 2021.
[13] USGS. 2017. Rare earth elements (chapter 0). Pp3, 1st paragraph.

4.2 REE PRODUCTION SOURCES & HISTORY IN BRIEF[14]

Historically the REEs (along with thorium) were produced mainly from the mineral monazite [(Ce-La-Y, Th) PO_4] as by-products from the mineral sands industry (geologically a secondary concentration process). More recently (post 1950s) an important source of the world's REE production became bastnaesite [(Ce-La)CO_3F], principally from the Mountain Pass magmatic carbonatite (a primary hard-rock REE source) in California, USA. Between 1965 and 1995 that mine satisfied most of the world's REE consumption, and particularly the west's. In 2002 Mountain Pass closed due to environmental issues (thorium and radon) and low REE prices (but has recently re-opened).

In the mid-1980s China started significant production of REEs and they have become the dominant world producer since 1990 (and have been in the position to control the market and prices). The hard-rock Bayan Obo deposit in Mongolia is the main world producer of LREE which are dominantly hosted in bastnaesite and monazite, and lesser fluoro-carbonates. Niobium (Nb) is a valuable by-product.

However since the early 1970s, near-surface (generally 8-10 m thick) lateritic deposits in southern China became recognised as being enriched in HREE in a geological setting (weathered bedrock, generally converted to clay) of easy recovery. These lateritically (secondarily) REE-enriched deposits have become known by various terms, including "ionic clays", "elution-deposited" ore and "ion-adsorbed", and are now commonly known as "ion-adsorption clay" (IAC) deposits. The REE are derived from secondary processes and are loosely bound via adsorption processes within clay minerals. Although low grade (~0.05-0.20% REO) IAC deposits are shallow and have low extraction and processing costs. The Chinese IAC deposits are the dominant source of the world's HREEs.

Since becoming reliant on China for REEs (which are recently increasingly important technological minerals) the West has reinvigorated efforts to re-commence production. Mountain Pass has opened and closed twice since 2002 and re-opened again in ~2018. The significant Mt Weld Mine (primary carbonatite with a lateritic cap) in Australia commenced production in ~2018, and Australia may now be considered a major producer with production coming from three mines. A series of other countries are small producers.

Future production from laterites may increase and these form a significant current exploration focus worldwide.

4.3 REE USES

Unique physical and chemical properties give REEs diverse uses in defence, energy, industrial, and military technology applications[15]. ***Many of their applications are crucial to modern and emerging technologies, particularly "high-tech" ones, and this has caused recent increased demand***. Given similar chemical nature, many different REEs have related or complementary uses[16]; thus it is more convenient to describe their uses by application (as below) rather than by individual element. In general, the LREEs and yttrium are cheaper, are produced in greater quantities, and are more extensively used than the HREEs. The least common and most expensive HREEs (holmium to lutetium) are limited to a very few, highly specialized, high-technology applications.

Early use: Mischmetal is one of the earliest REE products and refers to an alloy of various REEs such as Ce, La, Nd and Pr. It was produced as the residue of monazite-bearing beach sands once the thorium had been extracted (for use in the first gas mantles). Use for the remaining lanthanides was found in lighter flints (after it was hardened up with the addition of iron oxide and pelletised).

Glass: The glass industry is the leading consumer of REE raw materials where they are used for glass polishing and as additives that provide colour and special optical properties. Cerium oxide is widely used in the production of glass types that require a precision polish, such as flat panel display screens. Cerium is also used to decolorize glass. Lanthanum and lutetium greatly increase the refractive index of optical glass. Lanthanum is widely used in camera lenses. A range of them are used as special colorants and to provide filtering and glare-reduction qualities for glass. Europium is a common dopant (doping agent) for optical fibres.

Catalysts: Catalysts are another major use for REEs. Lanthanum-based catalysts are used in petroleum refining, and cerium-based catalysts are used in automotive catalytic converters. Catalysts enriched in REEs are essential to cracking (breaking down) heavy hydrocarbon molecules into smaller molecules, which enables petroleum refineries to obtain significantly more product per barrel of oil processed. Small amounts are used as catalysts in catalytic converters to reduce automotive carbon monoxide emissions.

[14] Summarised and augmented from Hellman & Duncan, February 2018. *Evaluating Rare Earth Element Deposits*. Geology and production, pp2.
[15] USGS. 2017. Rare earth elements (chapter 0). Abstract, 2nd paragraph.
[16] USGS. 2017. Rare earth elements (chapter 0). Pp3.

Permanent magnets: Use of REEs in strong and light permanent magnets is a rapidly increasing application. Neodymium-iron-boron magnets, which are the strongest known type of magnets, are used when space and weight are restrictions. Significant uses include hard disk drives, cell phones, electric motors for hybrid vehicles and windmills, and actuators in aircraft. Lesser amounts of dysprosium, gadolinium, and praseodymium are also used in these magnets. Dysprosium is of particular importance because substituting it for a small portion of neodymium improves high-temperature performance and resistance to demagnetization.

Batteries: REEs now find use in rechargeable batteries. Nickel-metal hydride batteries use anodes made of a lanthanum-based alloys. These battery alloys are also a significant application of cerium, neodymium, praseodymium, and samarium. Demand for REEs in battery applications is however expected to decrease as lithium ion batteries displace nickel-metal hydride batteries. However as an indication of quantity nickel-metal hydride batteries in hybrid electric require as much as 10 to 15 kg of lanthanum per vehicle.

Metal alloys: Cerium, lanthanum, neodymium, and praseodymium, commonly in the form of a mixed oxide known as mischmetal, are used in steelmaking to remove impurities and in the production of special steel alloys. These REEs, along with yttrium, individually or in combination, are also used in various special alloys of chromium, magnesium, molybdenum, tungsten, vanadium, and zirconium.

Phosphors: Many REEs, especially yttrium, cerium, lanthanum, europium, and terbium, are used individually or in combination to make phosphors for many types of cathode ray tube and flat panel display screens, and in some incandescent, fluorescent, and light-emitting diode lighting. Gadolinium phosphors are used in X-ray imaging and various medical applications, such as magnetic resonance imaging (MRI).

Ceramics: Yttrium, lanthanum, cerium, neodymium, and praseodymium are used as pigments for ceramics.

Other uses: REEs are also used in synthetic gems, crystals for lasers, microwave equipment, superconductors, sensors, nuclear control rods, and cryo-coolers. Neodymium is the active constituent in a popular fertilizer in China.

Military: At an industry level REEs may be particularly important. REEs are used in many defence applications, such as in components of jet engines, missile guidance systems, antimissile defence systems, satellites, and communication systems[17].

4.4 REE RESOURCES

Globally: Resources of REEs worldwide are difficult to collate accurately – because sources are relatively numerous; because geologically they may be sourced from radically different geological settings (which have widely varying concentrations which require different extractive techniques); because varying levels of understanding of the sector has caused unrealistically low cut-off grades to be used in reporting many individual deposits; and because of national secrecy surrounding strategic minerals.

Geoscience Australia estimated Global economic Resources of REOs, at December 2018, to be **120 Mt** (Table 3[18]). The Resources tabulated refer to combined rare earth oxides and excludes yttrium oxide.

Because of the difficulty (mentioned above) in collating world Resources the individual Resources are therefore difficult to compare realistically.

According to Table 3 China dominates global Resources, with ~38%. As would be supported by their 72% of global production (Table 6 below) the Chinese Resource proportion would seem reasonable. However the next four biggest Resource countries (Brazil, Vietnam, Russia and India), accounting for ~54% of global Resources, are cumulatively only responsible for a mere ~2% of global production – which brings their Resources into question. And the second and third biggest producers (Australia and the USA) surprisingly only rank 6th and 7th respectively in the global Resource rankings.

Table 3 Global REO Resources

Rank	Country[a]	Economic Resources[b] (kt REO)	Percentage of world total[c]
1	China	44 000	38%
2	Brazil	22 000	19%
3	Vietnam	22 000	19%
4	Russia	12 000	10%
5	India	6900	6%
6	**Australia**	**3660**	**3%**
7	USA	1400	1%
8	Malaysia	30	<1%
	Others	4400	4%
	Total	**120 000**	

Individual deposits: As the Resources Table 3 is simply ranked on tonnage it gives little emphasis to REE grade and therefore to many very significant individual deposits scattered globally. Individual deposits are too numerous

[17] USGS. 2019. Rare earth element mineral deposits in the US. Abstract, 1st paragraph.

[18] Geoscience Australia. 2019. Australian Resource Reviews: Rare Earth Elements. Table 4, pp5. Source combines USGS (2019) and Geoscience Australia compilations.

to list here. However the Consultant would note a number of the larger deposits in Table 4. NB 1: The Southern China ion-adsorption clay type deposits are completely unrepresented because of the scarcity of data. NB 2: The lower grade cut-off used for these Resources is unclear, the Consultant assumes 300 ppm TREO, although that might be more associated with the Ion-adsorption Clay deposits.

Table 4 Selected individual deposit REE Resources[19]

Deposit	Country	Resources+	Deposit type
Araxá	Brazil	6.3 Mt @ 5.0% TREO	Carbonatite
Bayan Obo	China	48-800 Mt @ 6% TREO+Y	
Bear Lodge	Wyoming, USA	16.3 Mt @ 3.1% TREO	
Mt Weld	WA, Australia	23.9 Mt @ 7.9% TREO+Y	
Mountain Pass	California, USA	16.7 Mt @ 8.0% TREO+Y	
Mrima Hill	Kenya	48.7 Mt @ 4.4% TREO	
Ngualla	Tanzania	175 Mt @ ~2.2% TREO	
Nolans Bore	NT, Australia	24.4 Mt @ ~2.7% TREO	
Zandkopsdrift	South Africa	45.7 Mt @ ~1.9% TREO	
Brockman	WA, Australia	41.4 Mt @ 0.2% TREO (Ind)[1]	Peralkaline
Dubbo Zirconia	NSW, Australia	35.7 Mt @ 0.8% TREO	
Ilimaussaq, Knenfjeld	Greenland	437 Mt @ 1.1% TREO (Ind)	
Ilimaussaq, Sorensen	Greenland	242 Mt @ 1.1% TREO	
Nechalacho (Thor Lake)	NWT, Canada	95 Mt @ ~1.5% TREO (M+Ind+Inf)[2]	
Strange Lake	Canada	278 Mt @ 0.9% TREO	
Eco Ridge	Ontario, Canada	22.7 Mt @ 0.2% TREO	Polymetallic
Milo	Queensland, Australia	187 Mt @ 0.06% TREO (Ind)	
Browns Range	WA, Australia	9.3 Mt @ 0.7% TREO (Ind+Inf)[3]	Vein
Maoniuping	Sichuan, China	50.2 Mt @ 2.9% REE+Y	
All ?	Southern China	10? Mt @ 0.05-0.20% TREO	Ion-adsorption Clay
Makuutu	Uganda	79 Mt @ 0.084% TREO (Ind+Inf)[4]	

+ Resources reported from Measured + Indicated classes unless otherwise noted.
1 Hastings Technology Metals Ltd, webpage, February 2022.
2 Vital Metals, webpage, February 2022.
3 Northern Minerals, webpage, February 2022. Lower cut-off 0.15% TREO.
4 Ionic Rare Earths, webpage, February 2022.

4.5 REE SUPPLY & DEMAND

NB: The following REE Resource and production figures should be treated with caution as different sources vary widely. And the terms Resources and Reserves appear to be interchangeable in some cases.

World supply and demand figures for REEs are not particularly transparent. This is due to great differences in regional production as well as the industrial secrecy which typically goes hand-in-hand with their use in strategic high-tech applications. And since WWII this situation has also been political and split between "East" and "West" – the East having become the predominant supplier of REEs (which have come to be regarded as strategic minerals in the West) as well as a significant consumer.

REEs are usually sold as **rare-earth oxides** (**REO**). Terminology may be further refined by reporting them as rare-earth oxides plus yttrium oxide (REO+Y). Conversion factors (see REE Abbreviations) are applied to individual REEs to convert them to REOs and to determine an REE metal content.

4.5.1 SUPPLY

China has been the leading producer of REEs for the last three decades (blue region in Figure 1[20]) and since the late 1990s it has accounted for more than ~90% of global production (although in 2020 it might have dropped to ~60%). Before the mid-1980s the USA (mauve region in Figure 1) was the single biggest producer (Mountain Pass Mine), but virtually ceased by the mid-2000s. Production by other countries (grey region in Figure 1) has remained fairly constant and negligible in comparison to China. However whilst China is the biggest REE producer it is also very likely to be the biggest consumer. Table 5[21] gives recent (2011-17) annual global and Chinese production figures. Production remained fairly stable at ~130,000 t global and ~105,000 t China over the years 2014-2017 – indicating China's continuing massive proportion of production (~80%, but probably ~60% by 2020). This does

19 Collated from USGS. 2017. *Rare earth elements* (chapter 0 of Critical mineral resources of the United States). Table 4 & 5; Hellman & Duncan, 2017; and various others.
20 USGS. 2017. Rare earth elements (chapter 0). Fig 01, pp4. Data from USBM (1991-1996) and USGS (1997-2016).
21 Wang DH., et al, 2018. In *China Geology*, CGS, September 2018, Volume 1, Issue 3, Table 1, pp420.

ignore recent sharp increases in global production. However China's exports have risen continuously, reaching ~50% of their production in 201/7, being ~40% of world production. The Chinese figures may be well wide of actual production and exports as illegal production of REEs in China is accepted as being considerable. China also began restricting the supply of REEs in 2010 (through the imposition of quotas, licenses, and taxes) citing limited resources for domestic requirements and environmental concerns[22]. This

Figure 1 Cumulative global REO production 1960 to 2012

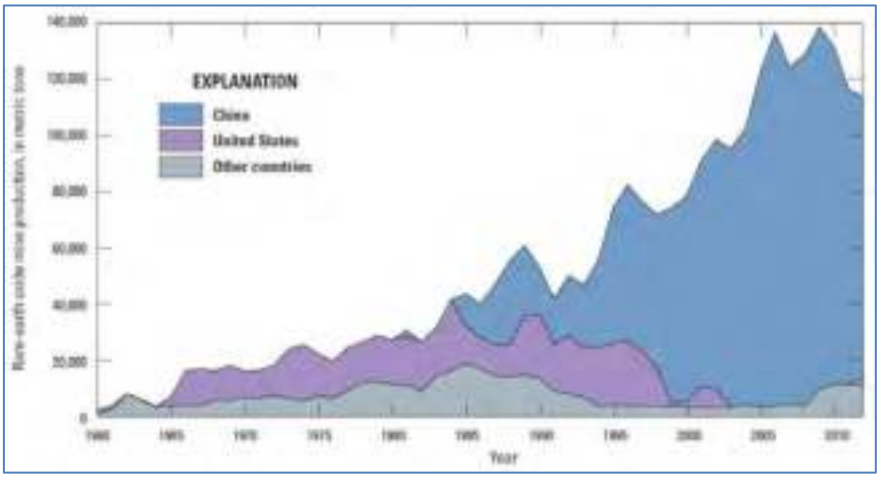


Table 5 Global and Chinese REE production Vs Chinese export

	2011	2012	2013	2014	2015	2016	2017
World total production/t[1]	111000	110000	110000	123000	130000	129000	130000
China production/t[1]	105000	100000	100000	105000	105000	105000	105000
China export/t[2]	16900	17343	22493	27769	34832	46749	51199

Note: [1]Data from U. S. Geological Survey; [2]Data from China Customs information network.

changed the world rare-earth industry in several ways – including by fostering increased stockpiling of REEs; increased exploration and development of deposits outside of China; and new efforts to conserve, recycle (still small), and find substitutes for and among the REEs.

Table 6 Global REO production

Rank	Country	Production* (kt REO)	Percentage of world total*
1	China	120	72%
2	Australia	19	11%
3	USA	15	9%
4	Myanmar	5	3%
5	Russia	2.6	2%
6	India	1.8	1%
7	Brazil	1	<1%
8	Burundi	1	<1%
9	Thailand	1	<1%
10	Vietnam	0.4	<1%
11	Malaysia	0.2	<1%
	Total	170	

The increased exploration and development outside China is illustrated by a re-ordering of global REO production by country (Table 6[23]). This includes the very recent re-invigoration of US production (re-opening Mountain Pass Mine), increased production in Australia (opening Mount Weld Mine), and by additional exploration and development projects in many other countries. Information on production from Myanmar is sketchy, but may be considerable and my feed into Chinese production.

In 2018 global REO production (Table 6) was 170,000 t (up from ~110,000 t in 2015). The production refers to combined rare-earth oxides and excludes Y_2O_3.

China[24]: China produced 72% of the global total of Reo in 2018 (Table 6). REE production in China is unusual in that it comes from both significant geological sources (see Section 4.8) – primary hard igneous rocks and secondary lateritic REE-bearing "ion-adsorption clays" (whereas production from outside China is predominantly from primary hard-rock sources only).

Chinese mine production takes place in many places in the south eastern provinces (Fujian, Guangdong, Hunan, Jiangxi, Shandong, Sichuan, Guangxi, and Yunnan (ion-adsorption type deposits)) and in the northern Autonomous Region of Nei Mongol (carbonatite deposits). This wide distribution is shown in Figure 2[25] (provinces shaded khaki, REE deposits shaded brown).

The largest mining operation is Baotou Rare Earth's **Bayan Obo Mine** (in the north), which produces iron ore as well as primary rare-earth minerals bastnaesite and monazite (mainly producing LREEs).

The SE area's production is from REE-bearing ion-adsorption clays, valued for their REE and HREE content.

Figure 3[26] shows the break-down of China's production by deposit type over time. The big fairly continuous

[22] USGS. 2017. Rare earth elements (chapter 0). Pp4, 1st paragraph.
[23] Geoscience Australia. 2019. Australian Resource Reviews: Rare Earth Elements. Table 5, pp5
[24] USGS. 2017. Rare earth elements (chapter 0). Pp4, 3rd paragraph.
[25] Wubbeke, J., 2013. *Rare earth elements in China: policies and narratives of reinventing an industry*. In ScienceDirect.
[26] Wang DH., et al, 2018. In *China Geology*, CGS, September 2018, Volume 1, Issue 3, Fig 5, pp420.

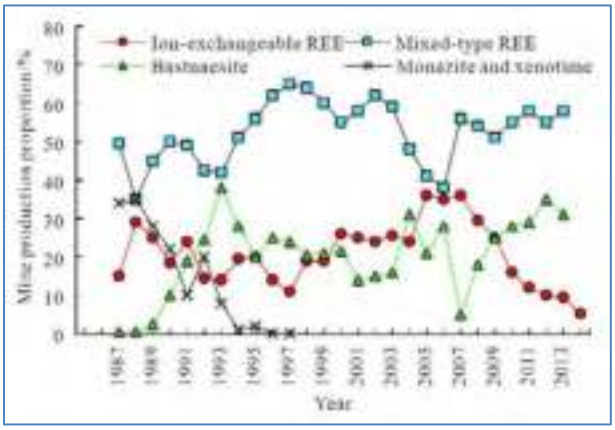
production source (upper line with blue squares) is Bayan Obo in Inner Mongolia which produces mixed REEs (bastnäsite and monazite). The other historically significant production source are the ion-adsorption type deposits in SE China (line with red dots), and they are clearly seen declining since ~2006. An emerging source is the bastnäsite from Sichuan and Shandong (line with green triangles).

Figure 2 Chinese REE deposit distribution

Reserves of REEs in China (2018) are estimated to be 44 Mt of contained REO (down from 55 Mt in 2015).

Australia[27]: Australia was the second biggest global REO producer in 2018, accounting for 11% (Table 6). Shallow sedimentary heavy-mineral sands produced in Australia contain significant quantities of REEs, mostly in the minerals monazite and xenotime. However (to 2015) monazite has not been produced from heavy-mineral sands operations since the 1990s to avoid the concentration of naturally occurring radioactive minerals (primarily thorium in monazite). Lynas Corporation Ltd. of Australia began production of rare-earth mineral concentrates at its **Mount Weld** carbonatite (including a supergene lateritic cap) complex in Western Australia (WA) in 2011. Concentrates are shipped to and refined in their facility in Malaysia, and commenced sometime after 2013. Mount Weld is Australia's predominant producer or REEs, with capacity of 22,000 tpa contained REO. Mount Weld's production in 2018 was 19,000 t of REO concentrates[28] (effectively all of the country's production).

Figure 3 Chinese REE sources over time



Australia also has a number of other advanced REE deposits. BHP Ltd's Olympic Dam Mine in South Australia has considerable Resources of REEs but is not currently known to be producing them as part of their predominantly copper operation. Other significant REE deposits include Browns Range (Kimberley region of WA, seven deposits, has produced minor pilot-plant quantities since 2018), Nolans Bore (NT), and Dubbo Zirconia (NSW). Australia's Economic Demonstrated Resources (EDR) of REEs (Geoscience Australia, Dec 2018[29]) are estimated at 4.1 Mt of REO plus Y_2O_3. Sub-economic Resources are estimated at 34.0 Mt.

USA[30]: The USA had been a leading REE supplier (and world number one until the early-1900s) up until the mid-2000s – from Molycorp, Inc.'s (Molycorp) **Mountain Pass Mine** in San Bernardino County, California. Mine production at Mountain Pass began in 1952 but was discontinued for a decade from 2002 to 2011 because of low rare-earth prices and environmental permitting issues. In 2012, Molycorp commissioned new mine and processing operations and produced again until 2015. Their never fully realized production capacity then was of 19,000 tpa. Operations were again idled in 2015 (due to substantial decreases in REE prices). Mountain Pass once again re-opened in ~2018, now owned by MP Materials Corporation. Like Australia the US has numbers of other deposits in development. Domestic reserves of REOs were estimated to be 1.4 Mt in 2018.

Myanmar: Details on Myanmar's reported 3% of world REE production are unknown to the Author. It is rumoured that production from Myanmar may partly report with China's production.

[27] USGS. 2017. Rare earth elements (chapter 0). Pp4, 2rd paragraph.
[28] Geoscience Australia. 2019. Australian Resource Reviews: Rare-earth Elements 2019. Pp2. Includes unspecified minor production from Browns Range.
[29] Geoscience Australia. 2019. Australian Resource Reviews: Rare-earth Elements 2019. Pp3.
[30] USGS. 2017. Rare earth elements (chapter 0). Pp5. 5th paragraph.

Russia[31]: In Russia, loparite mineral concentrates are produced at the Lovozero mining operation on the Kola Peninsula, Murmanskaya Oblast. Its concentrates are shipped to the Solikamsk magnesium plant in Permskiy Kray and rare-earth-bearing residues from the plant are exported for recovery of REEs. The Lovozero operation had the capacity to produce ~3,700 tpa REOs contained in mineral concentrates. Russia reportedly has considerable REE Resources (12 Mt or 10% of global total in 2018).

India[32]: In India, REEs are produced from monazite contained in heavy-mineral sands (India has a very significant mineral sand industry). The two Government-owned producers are the Rare Earth Division of Indian Rare Earths Ltd. (IREL) and Kerala Minerals and Metals Ltd. (KMML). Operations producing Monazite concentrate[33] include IREL's Manavalakurichi operation in the State of Tamil (6,000 tpa capacity) and KMML's Chavara operation in Kerala State (240 tpa capacity). IREL's capacity to produce rare-earth compounds from monazite is limited but is reported increasing. India's reserves of REEs are estimated to be 6.9 Mt (2018).

Other countries: Other countries with REE production (<1% of world production each) include Brazil, Thailand, Vietnam and Malaysia. Brazil's production is thought to come from hard-rock sources. Malaysia's production is a by-product of its tin mining. Canada began production in 2021 from the Nechalacho Project (Thor Lake).

Re-cycling & substitution: REEs are minerals with high prices and uncertainty of supply – which encourages their re-cycling and efforts to find substitutes. The leading consumers (Japan, USA and France) are all active in these areas. Re-cycling REEs from batteries and magnets is being investigated and is operational in places.

4.5.2 DEMAND

Details on REE demand and prices are sketchy. However their increasing use in high-tech applications has led to generally rising demand and increases in prices, particularly lately. To meet demand global production increased by ~70% between 2006 and 2018[34]. Leading markets for China (a leading consumer as well as the predominant supplier) are Japan, USA and France. Growing strategic importance of REEs and scandium was reflected in their inclusion in the US Government's 2018 list of 35 critical minerals (to the economy and military)[35].

Links between REO supply, demand and prices are not direct. China's near supply monopoly has allowed it to influence prices through its periodic use of production and export quotas[36]. Their 40% drop in production in 2010 (to ~20,300 t for the year) caused world prices to increase sharply and they peaked in 2011. China's annual quotas for 2011 to 2013 were ~31,000 tpa. The 2014 quota was ~30,600 t, split between 27,000 t for LREEs and 3,600 t for HREEs. China ended quotas after 2014. An interesting aspect of Chinese REE production is a large proportion of illegal production, estimated at 40,000 t in 2013 (which would have been greater than their legal production).

4.6 REE PRICES

Recent June 2022 REE prices of individual REOs are given in Table 7. Prices were derived on-line through Asian Metal[37] (listing provided by HRE and confirmed by the Consultant). Prices quoted are for high purity oxides in USD/kg, are EXW China, and are inclusive of 13% VAT. The June 2022 prices are compared in the Table with February 2020 prices (provided by HRE) – illustrating recent steeply rising trends in most REE prices.

Table 7 Recent REE prices – June 2022

Rare Earth Oxide (REO)	February 2020 (US$/kg)	27 June 2022 (US$/kg)	Change (%)
Light REEs (LREE):			
Lanthanum Oxide - La_2O_3	$1.67	$1.17	-43%
Cerium Oxide - CeO_2	$1.64	$1.25	-31%
Praseodymium Oxide - Pr_6O_{11}	$45.52	$145.55	69%
Neodymium Oxide - Nd_2O_3	$41.61	$145.55	71%
Samarium Oxide - Sm_2O_3	$1.78	$3.33	47%
Europium Oxide - Eu_2O_3	$29.87	$28.75	-4%
Gadolinium Oxide - Gd_2O_3	$23.83	$80.25	70%
Heavy REEs (HREE):			
Terbium Oxide - Tb_4O_7	$558.32	$2,132.00	74%
Dysprosium Oxide - Dy_2O_3	$258.18	$373.50	31%

[31] USGS. 2017. Rare earth elements (chapter 0). Pp5, 4th paragraph.
[32] USGS. 2017. Rare earth elements (chapter 0). Pp5, 2nd paragraph.
[33] Indian Bureau of Mines, 2015.
[34] Geoscience Australia. 2019. Australian Resource Reviews: Rare-earth Elements 2019. Extracted from Table 3, pp4.
[35] Geoscience Australia. 2019. Australian Resource Reviews: Rare-earth Elements 2019. Pp2, 2nd paragraph.
[36] USGS. 2017. Rare earth elements (chapter 0). Pp5, 1st paragraph.
[37] Asian Metal web page, 27 January 2022. https://www.asianmetal.com/

Rare Earth Oxide (REO)	February 2020 (US$/kg)	27 June 2022 (US$/kg)	Change (%)
Holmium Oxide - Ho2O3	$46.59	$198.50	77%
Erbium Oxide - Er2O3	$22.40	$53.50	58%
Thulium Oxide - Tm2O3	$140.00	$120.81	-16%
Ytterbium Oxide - Yb2O3	$20.29	$16.80	-21%
Lutetium Oxide - Lu2O3	$565.80	$777.50	27%
Yttrium Oxide - Y2O3	$2.84	$12.49	77%
Scandium Oxide - Sc2O3		$815.00	

4.7 REE GEOCHEMISTRY

REEs commonly occur together in the earth's crust because they have sequential atomic numbers and very similar ionic radii. REE analyses provide a useful tool for studying igneous rock (REE primary source) processes and the degree of magma differentiation[38]. With a couple of exceptions (cerium and europium) REEs (the lanthanides) have the same valence state of +3. They also have very similar chemical properties and geochemical behaviour due to their molecular electronic configuration.

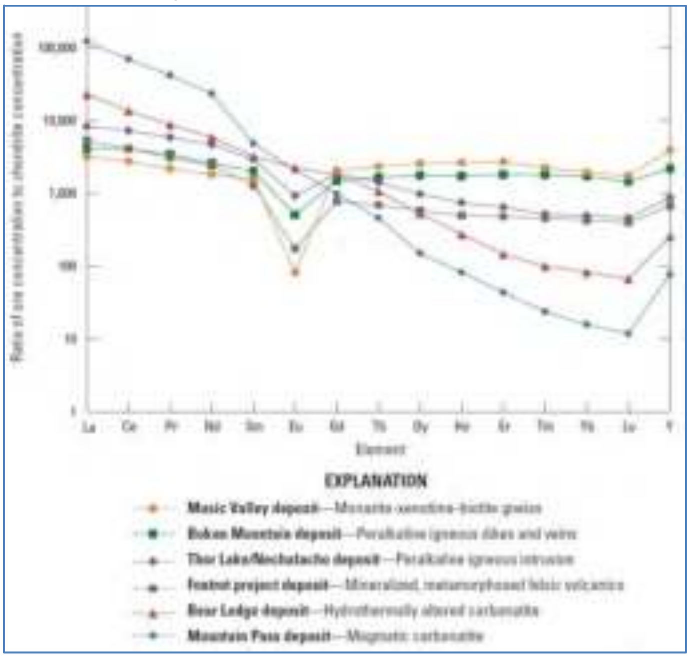
However REEs differ from each other in one particular respect – their ionic radii decrease slowly with increasing atomic number – a phenomenon known as the "lanthanide contraction". This contraction, together with their similar valence, means their ionic potential (and thus compatibility) increases from La to Lu. LREEs are relatively incompatible and the HREEs become increasingly more compatible. The systematic decrease in ionic radii across the lanthanides has two significant consequences – it affects the fractionation of the REEs to a high degree (which allows for their individual separation in geologic environments and in ore processing) – and it lends the REEs unusual and useful chemical and physical properties (such as unique magnetic and (or) optical properties).

In magmatic systems, the high +3 charge of REE ions impedes the ability of these elements to achieve charge balance and fit into the structure of the common rock-forming minerals (which have coordination sites best suited for valence states of +2 or +1)[39]. As a result, when common silicate minerals (such as amphiboles, feldspars, and olivine) crystallize, most of the REEs tend to remain in the coexisting melt. In contrast, europium is often depleted in magmas (anomaly seen in Figure 4) because it is incorporated into feldspars owing to its Eu2+ valence state. Successive generations of this process, referred to as crystal fractionation, increases the concentrations of REEs in the remaining melt until individual REE-mineral-rich phases crystallize.

Figure 4[40] shows "chondrodite-normalised" lanthanide concentrations for a series of REE deposits in the US. Chondrodite-normalised means compared to the average chemical composition of the solar system. Apart from the unusually high values (many >1,000) of the fractionated REEs in the Figure (in comparison to more average rocks which would plot well below (<100) these) it can be seen that the most fractionated rocks (say Mountain Pass) have a steep downward slope showing greater concentrations of the LREEs on the left than the HREEs to the right.

Elements, such as the REEs, that do not tend to participate in the early mineral-formation processes are referred to as incompatible elements. Other incompatible elements in magmatic systems include hafnium, niobium, phosphorus, tantalum, thorium, titanium, scandium, uranium, and zirconium – mostly transitional metals which are located just to the right of the lanthanides in the Periodic Table (purple in Table 2).

Figure 4 Chondrodite-normalised REE distribution in six different types of US REE deposits



This differing geochemical behaviour means that the LREEs would be enriched in highly differentiated rocks (such as pegmatites, leuco-granites or carbonatites, which are common sources of REEs) where HREEs would be depleted (Figure 4). In itself this characteristic is used to measure the degree of magma differentiation during

[38] Alexandre, P., 2021. Practical Geochemistry. Section 3.4.5, pp47-48.
[39] USGS. 2017. Rare earth elements (Chapter 0). Pp6, 3rd paragraph.
[40] USGS. 2017. Rare earth elements (Chapter 0). Fig 5, pp11.

fractional crystallisation (and the reverse process partial melting) thus providing a tool for primary igneous rock REE exploration.

4.8 REE MINERALOGY[41]

REE-bearing minerals are often grouped according to the common specific types of geological deposits they are found in. Those mineral associations are mentioned with the deposit type descriptions in Section 5.

Mineralogy is a key variable in determining the ease or difficulty, and therefore the cost, of processing and extraction of REE. Primary, hard rock deposits with the most abundant REE minerals (those containing bastnäsite, monazite, xenotime, loparite, parasite, and perhaps apatite) are more likely to be economical compared with those deposits with eudialyte, allanite, or zircon. The latter group is more refractory and economic processing of REE from these minerals is not currently possible. Another processing problem is that many development companies anticipate production of REE in concentrates while end users require finished products in the form of oxides and/or metals. Separation of HREE is more difficult than that of LREE, and few REE separation facilities exist outside China.

Minerals that contain REEs are numerous (245), diverse, and often complex in composition. A list (Jones et al, 1996) of 245 individual REE-bearing minerals includes silicates (85); oxides (59); carbonates, fluoro-carbonates, and hydroxyl-carbonates (42); phosphates (26); arsenates, sulfates, and vanadates (19); halides (6); uranyl-carbonates and uranyl-silicates (5); and borates (3). The principal REE-bearing minerals are listed below.

Bastnaesite (also spelled bastnäsite) may be considered the most important REE mineral because it is the primary ore mineral of the world's two largest REE deposits (predominantly LREE) – the carbonatite deposit at Mountain Pass in the USA and the iron-carbonatite deposits of Bayan Obo in China (both hard-rock deposits). Bastnäesite contains up to 75 weight-percent REE oxides and is highly enriched in the LREEs.

Monazite is a REE-phosphate mineral and was the primary REE ore mineral prior to the discovery of bastnäesite-rich deposits. Monazite is the most common REE mineral and occurs in a range of geologic environments and is typically enriched in the LREEs. Historically monazite was extracted from placer deposits. The weight percent of REEs within monazite is quite variable depending on what other elements are present. Monazite typically contains small amounts of thorium, making it radioactive (which may limit production).

Xenotime is an yttrium (Y) phosphate (YPO_4) mineral and has been a source of REEs as a by-product commodity in river placer mines (such as the Malaysian tin mines). Occurring as a minor accessory mineral, xenotime is found in pegmatites and other igneous rocks, as well as gneisses rich in mica and quartz. Because yttrium has a similar charge and ionic radius to other HREEs, xenotime generally contains substantial amounts of the (rarer) HREEs. The lanthanide content is typical of "yttrium earth" minerals and runs about two-thirds yttrium, with the remainder being mostly the HREEs. Dysprosium is usually the most abundant of the even-numbered heavies. Xenotime's crystal structure can accommodate significant quantities of uranium and thorium, which can contribute to environmental and handling issues when this mineral is separated and stockpiled (similar to the radioactivity issues associated with monazite).

Apatite is a calcium-phosphate mineral and is an important source of phosphate. It may also contain significant quantities of REEs. Apatite occurs in a range of rock types and can be LREE- or HREE-enriched, although they are most commonly LREE. Apatite may be an important source of REEs in some carbonatites and iron-oxide apatite deposits.

[41] Mostly USGS. 2017. Rare earth elements (Chapter 0 of Critical mineral resources of the United States). Mineralogy, pp7-10. Also USGS, 2019. Rare earth element mineral deposits in the United States (Ver 1.1). Pp5-7.

5 REE DEPOSIT TYPES[42]

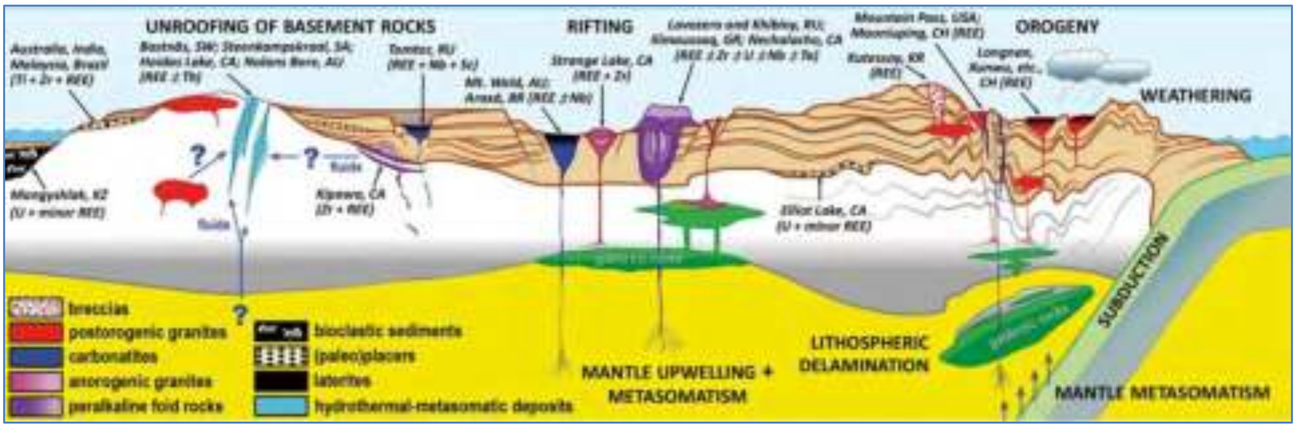
Deposits (concentrations) of REEs occur in diverse geologic settings and so are actually not "rare" in the geological sense. Although REEs are quite common they are not often found in economic concentrations (i.e. economic deposits). Economic or potentially economic REE deposits occur primarily in the following (generally un-common) geologic settings (not in order of importance):

- Carbonatite igneous deposits
- Peralkaline igneous systems
- Magmatic magnetite-hematite bodies (or iron oxide-apatite deposits)
- Iron oxide-copper-gold (IOCG) deposits
- Xenotime-monazite accumulations in mafic gneiss
- Ion-absorption clay (IAC) deposits (lateritic REE in granite-derived regolith) – ***Cowalinya Project relevant***
- Monazite-xenotime-bearing placer* deposits (heavy-mineral breach sands)
- Sedimentary phosphate deposits
- Vein deposits – ***Duke Project relevant***
- Lateritic supergene concentration (which may operate in various settings above)

Most information on these REE deposit types was referenced from the USGS 2017 or 2019 and AGS 2012 documents (referenced with the title above). However increasingly new types are found and described by other authors. And classification of individual deposits is not uncommonly disputed and evolve with time.

Figure 5[43] is a cartoon of most (at October 2012) REE deposit types, portrayed in a tectonic context to illustrate their wide distribution. Rock types are given in the legend (bottom left), but continental sediments of all sorts (brown layers) is missing. Major geological processes are shown in capital letters. Deposits are named in italics. The Authors noted that the Bayan Obo carbonatite deposit (see Section 5.1.6), despite being the world's largest REE deposit, is also one of the least understood (at least outside China), and hence is missing from the Figure.

Figure 5 REE deposit types in a tectonic context



5.1 CARBONATITE REE DEPOSITS[44]

5.1.1 CARBONATITE INTRODUCTION

Carbonatites are intrusive magmatic bodies, often in the form of pipes, which have >50% carbonate minerals and <20% quartz (SiO_2). They have been the world's main source for the **LREEs** since the 1960s. In 2016 REEs were being produced from large carbonatite bodies mined in China (Bayan Obo (world's single largest REE deposit), Maoniuping, Daluxiang, and Weishan deposits); Australia (Mount Weld in WA); the USA (Mountain Pass in California); and Brazil (Araxá, Minas Gerais).

Carbonatites are relatively rare igneous rocks – but contain the highest concentrations of REEs of any igneous

[42] Mostly USGS. 2017. *Rare earth elements* (chapter 0 of Critical mineral resources of the United States). Deposit Types, pp10 onwards. Also USGS. 2019. *Rare earth element mineral deposits in the United States* (Ver 1.1). Pp9 onwards. Also AGS, 2012. *Lateritic, supergene rare earth element (REE) deposits* (special paper #9, chapter 4 in proceedings of 48th annual forum, 2012).
[43] Chakhmouradian, A.R., and Wall, F., October 2012. In *Elements*, 2012, Vol 8, Fig 5, pp337.
[44] Along with the overall USGS and AGS references for the 'REE deposit types' the carbonatite references also came from Wang et al, 2020. *Carbonatite-related REE Deposits: An overview.* In *Minerals 2020*, published by MDPI.

rocks. Worldwide at least 500 carbonatites have been found – only a small fraction are REE-enriched. In addition to REEs, carbonatite-related deposits are the primary source of Nb (Araxá). Other commodities produced from carbonatite-related deposits include phosphates (Phalaborwa, South Africa), iron, fluorite, copper, vanadium, titanium, uranium, and calcite.

Globally carbonatite-related REE deposits mostly occur in continental marginal depression belts and rift belts along craton margins controlled by large-scale deep lithosphere faults (e.g., Mountain Pass REE deposit in the USA). Subordinately REE mineralization also occurs at stable geological structural units (such as the Araxá Nb-P-REE deposit in Brazil and the Sarfartoq REE deposit in Greenland). The distribution of carbonatite-related REE deposits in China is rather restricted to continental margin rifts or orogenic belts at the margin of cratons.

Carbonatite intrusions occur in a variety of forms and carbonate compositions. Forms include stocks (pipes), tabular bodies, dykes, irregular-shaped masses, and veins. Carbonatites vary in composition within three sub-divisions – from (1) calcic or calcio-carbonatites (calcite-dominant; originally called soviet), to (2) dolomitic / magnesio-carbonatites (dolomite dominant; called beforsite), to (3) iron-carbonate/ferro-carbonatites (rich in ankerite $[Ca(Mg,Fe^{2+}Mn)(CO_3)_2]$ or siderite $[Fe^{2+} CO_3]$). Calcite and dolomite can also occur in roughly equal proportions. Two other unique local sub-divisions are (4) silico-carbonatites (>20% SiO_2) – at Afrikander on the Kola Peninsula, Russia; and (5) natro-carbonatites (Na-K-Ca carbonates) – at Ol Doinyo Lengai volcano in Tanzania. Recent interpretation of the carbonatite in the Bayan Obo REE-Nb-Fe reveals that the evolutionary sequence of carbonatitic magma is from ferroan through magnesian to calcic, accompanied with an increase in LREE enrichment.

Carbonatites usually coexist with alkaline silicate igneous rocks to form carbonatite–alkaline (ring) complexes, but some appear in the form of isolated batholiths, dykes, intrusions, lava flows and pyroclastic overburdens.

Carbonate composition can vary complexly across an individual carbonatite intrusion, such as is displayed in the Sulphide Queen carbonatite at Mountain Pass. Cross-cutting relationships, mineralogy, and geochemistry have shown that carbonatite masses and dikes of different mineralogy and chemistry in a single district can represent multiple, discrete episodes of carbonate magma intrusion. Most carbonatites display a multiphase petrogenetic evolution, including hydrothermal overprinting of primary phases – thus mineralogical and textural characteristics are frequently varied and complex.

5.1.2 CARBONATITE MINERALOGY

Principal REE minerals in carbonatites are fluoro-carbonates (bastnaesite, parisite, and synchysite), hydrated carbonates (ancylite), and phosphates (monazite and xenotime). Bastnäsite typically is coarse grained and contains ~75% REO by weight. Less abundant REE minerals include REE-bearing allanite, britholite, burbankite, and fluor-apatite. Bastnaesite is typically the most significant source of REEs in carbonatite-related deposits. Mariano (1989) notes that strong enrichments in the LREEs occur in carbonatite deposits in which the dominant ore mineral is bastnaesite. Primary gangue (non-ore) minerals are carbonate minerals (calcite, dolomite, ankerite, siderite), which may be accompanied by aegerine-augite, barite, fluorite, fluorapatite, hematite, magnetite, phlogopite, quartz, and (or) strontianite. Accessory minerals – monazite, perovskite, pyrochlore, and thorite – are the most common uranium- and thorium-rich phases.

5.1.3 CARBONATITE TYPES

In carbonatites, REE mineral assemblages can be categorized by mineral-forming process into three groups:

1. Primary *magmatic* REE mineralization in carbonatites (e.g. Mountain Pass, USA).
2. *Hydrothermal-metasomatic* REE mineralization (e.g. Bayan Obo, China).
3. *Supergene (lateritic**) REE mineralization (e.g. Mount Weld, Australia; and Araxá in Minas Gerais, Brazil).

The first two types are collectively called carbonatite-related endogenetic REE deposits and are primarily formed from carbonatite magma and its derived hydrothermal fluids.

1. Primary magmatic mineralisation type: The mineralization of primary magmatic type REE deposits mainly occur by crystallisation in the magmatic stage. REE minerals such as bastnäsite, monazite, allanite, xenotime, parasite occur in carbonatite or magmatic phosphorite, and the entire rock body is mineralized. The REE mineralisation is usually skewed towards the LREEs. The largest REE deposit in the US is the Sulphide Queen carbonatite in Mountain Pass, California (see REE distribution in Figure 4). This is the only known (?) carbonatite where the REE ore minerals (bastnaesite and parasite are interpreted to have crystallized directly from the magma. Prior to 2002 the primary US producer had been the Mountain Pass carbonatite, and that mine has closed and re-opened twice since (the most recent re-opening in ~2019).

2. Hydrothermal mineralisation type: REE minerals of hydrothermal type deposits are formed from or with primary magmatic carbonatites by late-stage hydrothermal fluids that are evolved from magmas, and are usually associated with calcite, barite, fluorite, quartz and other minerals. REE mineralisation in hydrothermal type carbonatites is usually in veins. The mineralized veins frequently interpenetrate in the contact zone and surrounding rock of carbonatite complexes. The hydrothermal REE minerals can also occur as crack fillings superimposed on the minerals that are formed during the magmatic stage. This type of deposit is usually large in scale, and the REE minerals are relatively simple, mainly bastnäsite. This type of carbonatite forms the world's largest REE deposit (and leading producer of LREEs) at Bayan Obo in the Nei Mongol Autonomous Region of China. It is classified as an iron-carbonatite – a complex irregular mass of mixed iron deposits and carbonatite.

3. Supergene lateritic mineralisation type: Another type of REE enrichment in carbonatite systems is caused by secondary supergene processes – involving deep weathering and fluid leaching of a primary carbonatite in tropical hot and humid environments where. This lateritization creates a secondary REE-enriched laterite crust over the primary carbonatite (hence this type is also known as "weathering-crust type"). These deposits also require conditions where the laterite is preserved (ie not eroded away). Lateritic weathering may commonly extend to depths of 30-60 m below a topographic surface. REEs are mobilized from the breakdown of primary REE-bearing minerals and redeposited in the enriched zone deeper in the weathering horizon as secondary minerals, as colloids, or adsorbed on other secondary clay minerals (such as kaolinite) in the form of ions. Enrichment of REE may range from 3-10 times that of the source lithology; in some instances, enrichment may range up to 100 times. This type of REE deposit is usually HREE-enriched due to the higher mobility of LREE during weathering.

5.1.4 CARBONATITE DEPOSITS OF NOTE

Carbonatites of note (>1 Mt Reserves/Resources) include: Bayan Obo (Baotou, Nei Mongol, China [~48 Mt @ 6% TREO]); Daluxiang (Sichuan, China); Maoniuping (Sichuan, China); Weishan (Shandong, China); Mountain Pass (California, USA [2012: Proven+Probable Reserves 16.7 Mt @ 7.98% TREO at 5% cut-off]); Mount Weld (~34 Mt @ 9.0% REO, WA, Australia); Araxá (~28 Mt @ ~4.2% TREO, Minas Gerais, Brazil); Bear Lodge (Wyoming, USA); Elk Creek (Nebraska, USA); Ashram (Quebec, Canada); Cummins Range (WA, Australia); Glenover (South Africa); Lavergne-Springer (Ontario, Canada); Montveil (Quebec, Canada); Mrima Hill (Kenya); Ngualla (170 Mt @ 2.2% REO, laterite type,Tanzania); Nolan's Bore (NT, Australia); Sarfartoq (Greenland); Songwe Hill (Malawi); Wigu Hill (Tanzania); Zandkopsdrift (South Africa); Gakara (Burundi).

5.1.5 PRIMARY MAGMATIC CARBONATITE EXAMPLES

Mountain Pass[45]: The Sulphide Queen carbonatite deposit at Mountain Pass, USA, is illustrated in Figure 6[46]. The deposit is a tabular intrusion, thought to be the largest REE deposit in the US.

The mineralized local rocks include shoshonite, syenite, granite, and the Sulphide Queen carbonatite. However, only the carbonatite orebody is economically viable. The orebody intrudes into the Precambrian metamorphic basement in plate or lenticular form. It is mainly composed of calcite, dolomite, barite, and bastnäsite, and bastnäsite as the main ore mineral. Cerium (Ce) is (apparently) the main REE in the primary bastnäsite.

Figure 6 Mountain Pass Mine, Sulphide Queen carbonatite

The Sulphide Queen carbonatite is distinct from other carbonatites. Carbonatites are usually spatially and genetically associated with a set of sodic alkaline rocks in a ring-shaped and concentric circle, and are rich in LREE, Nb, Ta, Zr, and P. However, the formation of the Sulphide Queen carbonatite is associated with a suite of ultrapotassic intrusive rocks in plate-like form, and is rich in LREE and Ba and depleted in Nb and P. Studies suggest that the abnormal nature of the Sulphide Queen carbonatite is due to the fact that the carbonatite magma and associated ultrapotassic magma have a common source. Alternatively, the carbonatite magma evolved from the ultrapotassic magma.

[45] Wang et al, 2020. In *Minerals 2020*. 3.5, pp11.
[46] Reuters, 20 October 2021. *U.S. needs more mines to boost rare earth supply chain Pentagon says*. Photo 30 January 2020.

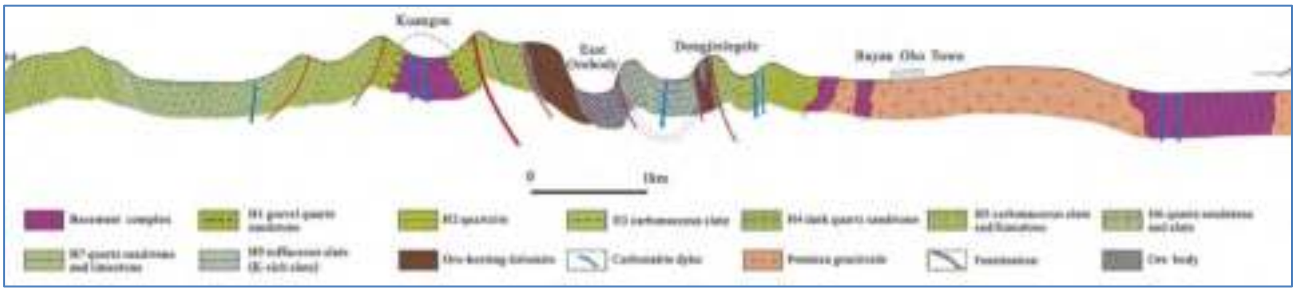
5.1.6 HYDROTHERMAL CARBONATITE EXAMPLES

Bayan Obo[47]: The largest REE mine in the world (and second largest niobium resource) is Bayan Obo in China. It is also an iron ore mine. Mineralization at Bayan Obo could be described as REE-Nb-Fe. Ore is rich in the LREEs, mostly are Ce, La and Nd. The principal REE minerals are bastnaesite (Ce) and monazite (Ce), accompanied by various kind of REE and Nb minerals such as huanghoite, aeschynite (Ce), felgusonite, and columbite. Iron minerals are magnetite and haematite. Main gangue minerals include fluorite, barite, alkali amphibole, apatite, quartz and aegirine.

Due to complicated element/mineral compositions and involving several geological events, the REE-enrichment mechanism and genesis of this giant deposit still remains intensely debated (see Figure 8), but metasomatism is strongly involved. Bayan Obo appears as a product of mantle-derived carbonatitic magmatism in multiple episodes allowing considerable fractionation (an evolutionary trend from ferroan through magnesian to calcic composition) and producing the primary progressive LREE mineralisation. Some remobilization of REE occurred later due to plate subduction, with weak vein-like dyke mineralization forming with more REEs introduced. A late metamorphic event caused recrystallisation.

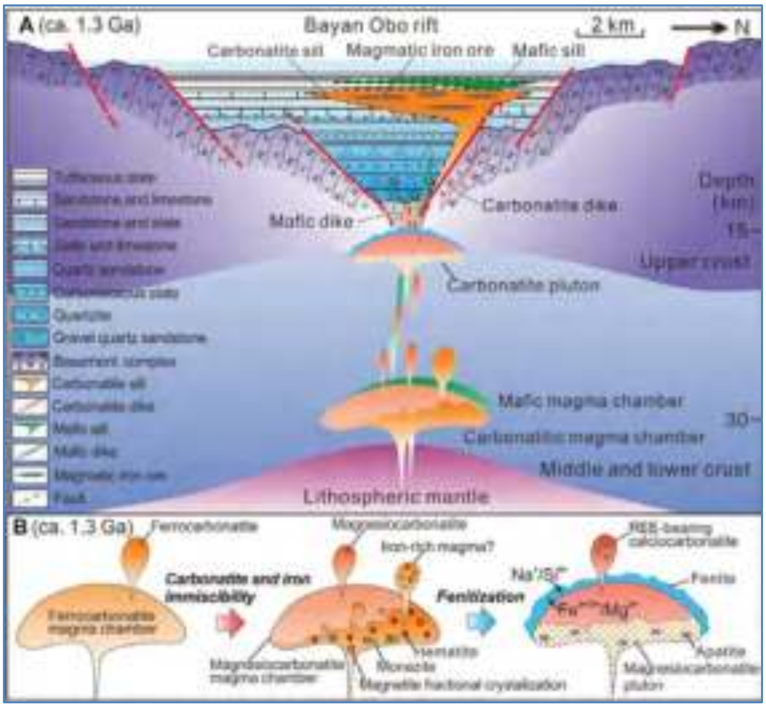
Regionally the geology is gently folded low grade meta-sediments and the Bayan Obo deposit is situated in a syncline core (N/S cross-section Figure 7[48], north on left). Basement rocks are granites.

Figure 7 Bayan Obo N/S geological cross-section



The deposit is hosted in massive dolomite (divided into coarse-grained and fine-grained), and nearly one hundred carbonatite dykes occur in the vicinity of the deposit. The dykes also intrude the basement rocks (and so the granites don't appear to be directly related to the REEs). The carbonatite dykes can be divided into three types from early to late – dolomite; co-existing dolomite-calcite; and calcite type – each corresponding to different evolutionary stages of carbonatite magmatism based on the REE and trace element data. The last calcite type dykes always have a higher REE content. The dyke widths are 0.5-2.0 m and their NE or NW strike lengths 10-200 m. The major constituent minerals in the dykes are dolomite and calcite, which are associated with subordinate apatite, monazite, barite, bastnaesite, and magnetite. REE contents in the different carbonatite dykes vary from ~0.02 to 20% by weight.

Figure 8 Bayan Obo – proposed genesis model



Coarse-grained dolomite occurs locally to the north of the Main and East orebodies and to the south of the West orebodies, commonly with layered and interbedded features. It mainly contains coarse-grained (300–1000 µm) dolomite with subordinate apatite, magnetite, and pyrochlore. Fine-grained dolomite is much more widespread than the coarse-grained dolomite, and contains obviously smaller dolomite crystals (50–150 µm) with subordinate magnetite, hematite, apatite, and monazite.

[47] Mostly Fan et al, 2016. In *Geoscience Frontiers*, 2016, Vol 7, Issue 3, pp335-344.
[48] Fan, et al, 2016. In *Geoscience Frontiers*, 2016, Vol 7, Issue 3, Fig 2, pp337.

The origin of the ore-hosting dolomite at Bayan Obo could be explained by various models, ranging from normal sedimentary carbonate rocks, to a volcano-sedimentary sequence, and a large carbonatitic intrusion. Figure 8[49] (N/S cross-section, N on the right (opposite to Figure 7)) shows one of the most recent models. The upper part of the Figure (A) shows the carbonatite developed in the sediments in the Bayan Obo rift. The lower part (B) shows the carbonatite differentiation – ferroan to magnesian (due to immiscibility of carbonatite and iron magma) and magnesian to calcic (resulting from fenitisation between magnesio-carbonatite pluton and wall rocks).

Most geochemical evidences show that the coarse-grained dolomite represents a carbonatite pluton and the fine-grained dolomite resulted from extensive remobilisation and modification of the coarse-grained variety with addition of further REEs.

The ore bodies, distributed along an E/W striking belt, occur as large lenses and underwent intense fluoridisation and fenitisation (metasomatic alteration particularly associated with carbonatite intrusions). The first mineralization episode is characterized by disseminated mineralization in the dolomite. The second (or Main) episode is characterised by banded and/or massive mineralization. These are both cut by the third episode consisting of aegirine rich veins. Dating data suggests that the mineralization was variable with two peaks at w~1,400 and 440 Ma. The early mineralization peak is closest in time to the intrusion of the carbonatite dykes. A significant thermal event at ~440 Ma resulted in the formation of late-stage veins with coarse crystals of REE minerals.

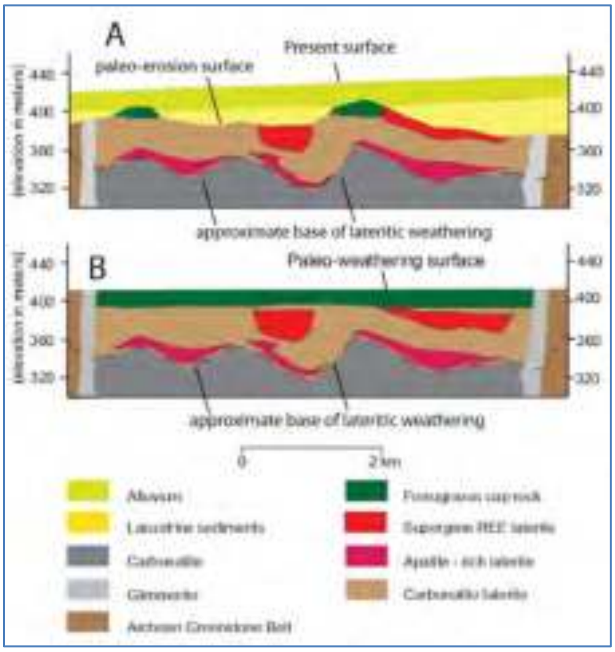
Figure 9 Bayan Obo Mine – Main ore body

The presence of REE-carbonates as an abundant solid in the ores shows that the original ore-forming fluids were very rich in REE.

Bayan Obo has at least four open pits spread over the three ore bodies (East, Main and West). A N/S geological cross-section through the East Pit is shown in Figure 7. The mining complex stretches over 18 km E/W and occupies 48 km^2. Production is currently from the Main and East ore bodies. The Main open-pit is shown in Figure 9[50].

5.1.7 LATERITIC CARBONATITE EXAMPLES

Figure 10 Cross-sections though Mt Weld lateritic REE deposit (A present day, B the past)



Examples of thick laterites above carbonatites with economic accumulations of residual REE minerals are the Araxá deposit in Brazil (that overlies the Barreiro carbonatite complex); the Catalão I carbonatite complex in Brazil; the Mount Weld carbonatite in Australia (which is the highest grade REE deposit); the Ngulla deposit in Tanzania (one of the highest tonnage REE deposits); Mrima Hill (Kenya); Zandkopsdrift (South Africa). See also the comments in Section 5.10 on "Lateritic deposits".

Mt Weld: The Mount Weld laterite is illustrated in brown, red and purple in cross-section in Figure 10[51]. The upper section A is at the present day with a thick sequence of most recent sediments and alluvium above an older surface eroded into the laterite capping the primary carbonatite. Lower section B shows the interpreted laterite (former weathering profile) before the more recent erosion and subsequent sedimentation. The Mt Weld laterite is up to about 120 m thick and is capped by an iron oxide zone. REE are enriched in a supergene zone near the top of the laterite and below the ferruginous cap rock. The REE-enriched zone may be up to 90 m thick.

Concentrations of secondary apatite occur above an irregular boundary between the laterite and fresh carbonatite.

[49] Yang, et al, 2019. In *Geology*, GSA, 2019, Vol 47, Fig 4, pp1201.
[50] EJAtlas, August 2020.
[51] AGS, 4 May 2012. *Lateritic, supergene rare earth element (REE) deposits.* Arizona Geological Survey. Fig 2, pp5.

Above the presently irregular top of the laterite and ferruginous cap rock are up to 40 m of lacustrine sediments; these are overlain by ~25 m of alluvium. The ferruginous cap rock and the top of the laterite appear to have been dissected and eroded to form the buried top of the deposit. The alluvium and sediments are the brown and red layers around the upper rim of the open-pit in Figure 11[52], with the dark brown laterite seen in the base of the pit.

Figure 11 Mt Weld Mine

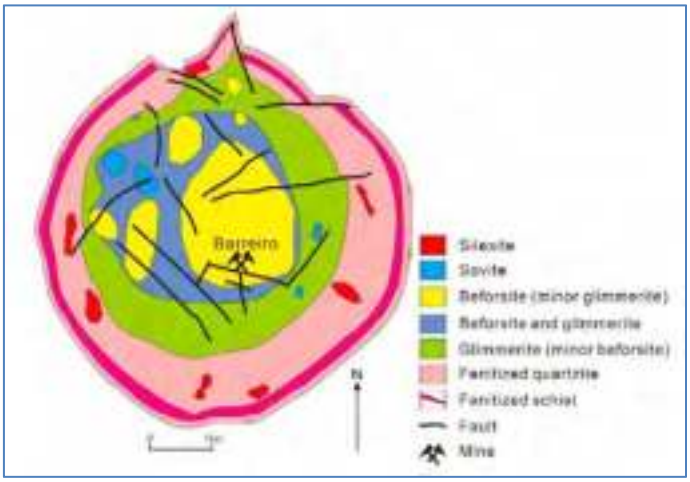
At Mt Weld most of the REE and yttrium (Y) are found in secondary monazite, churchite (a hydrous yttrium phosphate), and plumbogummite-group minerals (hydrated alumino-phosphates with a varied composition). The monazite, containing most of the LREE, occurs as microcrystalline aggregates on and replacing apatite. During the original lateritic weathering the REE were mobilized; complexed by carbonate, fluoride, or chloride ions; transported down through the laterite; and began to precipitate where pH conditions increased towards the less weathered carbonatite. The LREE elements were deposited in upper parts of the supergene zone, HREE at greater depths.

Published total REE grades in the unweathered Mt Weld carbonatite are 0.1–0.3%. Grades in the laterite are 23.9 Mt @ 7.9% REO and 9.7 Mt @ 11.7% REO. This represents REE enrichment in the laterite of up to 110 times that in the bedrock.

5.1.8 MIXED TYPE CARBONATITE EXAMPLES

Araxá[53]: Brazil has the second largest REE Resources in the world (22 Mt) although it is a relatively small producer. One of the main sources is the Araxá carbonatite Nb-P-REE deposit and mine located near Araxá City, Minas Gerais State in the SE of Brazil. It is the largest niobium deposit in the world, supplying >80% of the world's niobium, and also produces a significant amount of phosphorus, titanium and REE.

Figure 12 Araxá carbonatite geology plan



Araxá is a REE-enriched carbonatite example of mixed type – it is primary, hydrothermal, and has a surficial lateritic cap. The primary orebody appears as a concentric ring complex intruding into quartzite and schist strata country rocks (Figure 12).

Peripheral doming of the metamorphic country rocks provides evidence that the carbonatite did not breach the contemporary land surface during emplacement. Extensional fractures produced within the domed metamorphic rocks during igneous intrusion enhanced subsequent erosion and exposure of the buried carbonatite. The strongly domed peripheral metasedimentary rocks were subjected to intense silicification during the intrusive episode. Consequently, they crop out as resistant ridges surrounding a topographically depressed, lateritically weathered carbonatite plug ~4 km in diameter with deep internal drainage. The plug is effectively represented by the central yellow and blue areas in Figure 12.

The core of the complex (where the current mine is located, Figure 13[54]) is composed of fine-grained dolomite carbonatite (magnesio-carbonatite), which gradually transits to mica schists. The main constitutional minerals are dolomite, calcite and ankerite, and the accessory minerals are mica, apatite, alkaline amphibole, magnetite, monazite, pyrochlore, perovskite and zircon. The main REE minerals are monazite (over 70%) and plumbogummite group minerals. In contrast, bastnäsite and cerianite only take up about 1% of the REE minerals. Pyrochlore is the main niobium-bearing mineral.

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[52] Reuters, August 2019. Unknown date of the photograph, but interpreted as within months prior to August 2019.
[53] Wang et al, 2020. In *Minerals 2020*. 3.6, pp12. And Verplanck et al, 2016. Ch 1 of *Rare earth and critical elements in ore deposits*. SEGI.
[54] Captured February 2022 online from Google Earth.

The periphery of the complex underwent intense fenitization (hence hydrothermal type also), which is manifested in abundant alkaline feldspar, arfvedsonite and aegirine in the surrounding quartzite.

Supergene enrichment (hence lateritic cap) formed high-grade ores of Nb, P and REE and is well developed in the mining area. The open-pit laterite mining area is large with dimensions of ~2.5*2.0 km. The entire plug is weathered to laterite (pervasive brown material in Figure 13) in the near surface, with an average depth of laterization of 150 m. A major fault has allowed laterization to locally form to a depth of 350 m in the south-eastern part of the intrusion.

Figure 13 Araxá Mine

5.1.9 NIOBIUM

Some carbonatite intrusions are important sources of niobium (e.g. Bayan Obo), which is hosted primarily in the mineral pyrochlore [$(Na,Ca)_2Nb_2O_6(OH,F)$]. More than 90% of the world's supply of niobium comes from laterite deposits that are several hundred meters in thickness and that overlie the Barreiro carbonatite complex near Araxá in Brazil. The niobium-rich laterites at Araxá are now being evaluated for the recovery of REEs as a niobium by-product. The largest identified niobium resource in the US is the buried Elk Creek carbonatite in Nebraska. In Australia the Brockman deposit in WA has a considerable niobium resource (41.4 Mt @ 0.4% Nb_2O_5) associated with HREEs in a volcaniclastic tuff (classified with the peralkaline system deposits).

5.2 PERALKALINE IGNEOUS SYSTEM REE DEPOSITS

Peralkaline igneous systems are inherently enriched in REEs and in some instances host high-grade deposits. Alkaline igneous rocks make up a large grouping of rock types that are generally deficient in silicon dioxide (SiO_2) relative to Na_2O, K_2O, and calcium oxide (CaO). Peralkaline igneous rocks are a subclass of alkaline rocks, defined as those in which the molecular proportion of $Al_2O_3 < Na_2O + K_2O$. Peralkaline igneous rock types in REE-bearing systems can vary considerably from deposit to deposit; thus, it is difficult to generalize which peralkaline lithologies are consistently associated with REE deposits.

Many advanced exploration projects and a newly producing mine (Nechalacho/Thor Lake in Canada) indicate significant REE mineralization of 0.3 to 2.6% total REO in alkali granites, nepheline syenite, syenite, and trachyte. Peralkaline igneous rocks are typically more enriched in REEs, especially HREEs, than their silica-rich igneous counterparts. Resource grade in the Brockman deposit in WA is 0.2% TREO (2,100 ppm) of which 85% is HREE[55].

Still the processes of REE transport and enrichment in peralkaline systems remain poorly understood. And the mineralogies encountered in REE ores in peralkaline igneous systems present challenges in ore processing.

Peralkaline igneous systems enriched in REEs come in a variety of forms such as:

- Complexes exhibiting vertical and lateral zonation: Kipawa complex, Quebec, Canada; Strange Lake complex, Quebec and Labrador, Canada; Nechalacho/Thor Lake (geochemistry in Figure 4), Northwest Territories, Canada (began production in June 2021); Kutessay II project and Chuy Oblusu, Kyrgyzstan; and Tantalus Rare Earths (TRE) project, northern Madagascar.
- Complexes exhibiting layering: Lovozero complex, Murmanskaya Oblast', Russia; and Ilimaussaq complex (includes the Kvenfjeld, Sørensen, and Zone 3 deposits), Kommune Kujalleq, Greenland.
- Dikes and veins associated with peralkaline igneous complexes: Bokan Mountain (Figure 4), Alaska; Brockman Project, Western Australia, Australia; and Hoidas Lake deposit, Saskatchewan, Canada.
- Plutons, stocks, plugs, and other peralkaline intrusions: Norra Kärr deposit, Jönköpings län, Sweden; Dubbo Zirconia project, New South Wales, Australia; Two Tom deposit, Labrador, Canada; at Ghurayyah in Tabuk Province, Saudi Arabia; and at Khaldzan-Buregtey in Hovd Aymag, Mongolia.

Other deposits of note (>1 Mt Resources) include: Clay-Howells (Ontario, Canada); Foxtrot (Newfoundland and Labrador, Canada); Norra Karr (Sweden); Round Top (Texas, USA); Strange Lake (Quebec, Canada).

55 Hastings Technology Metals Ltd, website, February 2022.

5.3 MAGMATIC MAGNETITE-HEMATITE BODY REE DEPOSITS

Magmatic magnetite-hematite (iron ore) bodies can contain REE-bearing minerals and so give potential to recover REEs as a by-product during iron mining. These bodies are also called "iron oxide-apatite deposits", or IOA. Examples are deposits in the Pea Ridge iron district in Missouri and the Mineville iron district in upstate New York.

The Pea Ridge magnetite-rich orebody is interpreted as a high-temperature, magmatic-hydrothermal deposit in ash-flow tuffs and lavas, which may have formed in the root of a volcanic caldera. Four REE-bearing breccia pipes steeply crosscut the magnetite-hematite orebody and the altered rhyolite host rock. Identified REE-bearing minerals (up to 20% REO (by weight) in grab samples) in the breccia pipes are monazite, xenotime, and minor amounts of bastnaesite and britholite. Mine tailings contain additional lanthanide resources, primarily in fine-grained REE-bearing minerals, chiefly monazite and xenotime, which form inclusions within apatite.

Thorium and REEs reside within apatite in iron bodies once mined in the Mineville iron district. The orebodies are magnetite deposits that are intricately folded and faulted within a complex suite of Precambrian metamorphic and igneous rocks. The iron deposits are mainly magnetite, martite, and apatite. Iron deposits in the Mineville Port Henry area contain apatite and are likewise rich in phosphorous, REEs, and thorium because these elements are concentrated within the apatite grains. In addition, the magnetite (the primary iron ore mineral) is intergrown with 1-3 mm long rice-shaped grains of apatite. Massive tailings plus unmined parts of magnetite bodies in the Mineville district contain REE-bearing apatite-rich rock.

IOCG deposits (described below) are closely related to magmatic iron deposits and it could be argued that the Pea Ridge and Mineville iron deposits represent variations within the IOCG deposit group.

5.4 IRON OXIDE-COPPER-GOLD (IOCG) REE DEPOSITS

Iron oxide copper gold (IOCG) deposits are defined as magmatic-hydrothermal iron deposits that host economic concentrations of copper and gold. They are considered to be metasomatic expressions of large crustal-scale alteration events driven by intrusive activity. This group of deposits was first described and defined after the 1975 discovery of the giant Olympic Dam copper-uranium-gold-silver deposit (IOCGU deposit) in South Australia, Australia (now one of the largest ore deposits in the world). These recently appreciated deposits are now being widely explored for – and are significant here as them may contain significant REE concentrations.

IOCG deposits can be very large and surrounded by alteration zones that can extend for kilometres in width. As at Olympic Dam, IOCG deposits can host REE mineralization, occurring both in iron oxides and in small carbonatites within the intrusive complex. Although an REE resource of substantial size has been identified at Olympic Dam, the mine operator has not yet recovered REEs.

5.5 XENOTIME-MONAZITE ACCUMULATIONS IN MAFIC GNEISS REE DEPOSITS

Xenotime-monazite accumulations in mafic gneiss have not been historically important sources of REEs. However because deposits of this type tend to be preferentially enriched in the HREEs they may be more economic in the future. Example deposits occur in the Music Valley (see REE distribution in Figure 4) area of the northern part of Joshua Tree National Park in southern California, USA. Pod-like xenotime deposits of the Music Valley area lie within the Pinto Gneiss of probable Precambrian age. The Pinto Gneiss consists of roughly equal amounts of quartz and plagioclase feldspar, and it averages approximately 35% biotite. Accessory minerals present in trace amounts in the gneiss include, in general order of abundance, sericite, apatite, magnetite, zircon, and sphene, and locally monazite, actinolite, orthoclase, microcline, perthite and muscovite. Biotite-rich zones in the gneiss can contain abundant amounts of orange xenotime grains; xenotime commonly forms 10-15% of the biotite zones and locally as much as 35%. Owing to the REE-bearing xenotime and accompanying monazite, the biotite-rich zones can contain more than 8% yttrium and elevated percentages of HREEs.

5.6 ION-ADSORPTION CLAY (IAC) REE DEPOSITS[56]

This type of REE deposit has particular relevance to the **Cowalinya Project** because of HRE's observation of REE concentrations in the same geology hosting these deposits – namely elevated REEs in the in-situ weathered saprolitic clay layer above its fresh parent granite.

[56] Mostly Sanematsu, K., et al, 2016. *Characteristics & Genesis of ion adsorption-type rare earth element deposits*. Chapter 3 of *Rare earth and critical elements in ore deposits*, in *Reviews of Economic Geology*, SEGI, 2016, vol 18, pp55-79.

5.6.1 IAC REE DEPOSIT INTRODUCTION

Ion-adsorption clay (IAC) deposits in southern China are the world's primary sources of the **HREEs**. This deposit type is often informally referred to as "south China clays" and are almost exclusively (but maybe increasingly less) confined to areas underlain by granitic rocks. They are also described as "REE deposits in granite-derived regolith". They are assumed as near surface deposits and are a specific sub-set of more generalised **laterite** deposits. Despite their economic importance, relatively little detailed geologic research has been published. See also comments below in the Section on "Lateritic deposits".

These deposits are termed "ion adsorption-type" because the weathered granites below contain more than ~50% ion-exchangeable REY (REE + Y) relative to whole-rock REY. The parent granites are generally biotite and muscovite granites characterised by metaluminous to weakly peraluminous (ASI <~1.1) compositions and low P_2O_5 contents (<~0.08%). The HREE-rich deposits are confined to highly differentiated (SiO_2 >~75%) muscovite granites. The most favourable REE source minerals for formation of ion adsorption ores are REE fluoro-carbonates such as synchysite and bastnäsite.

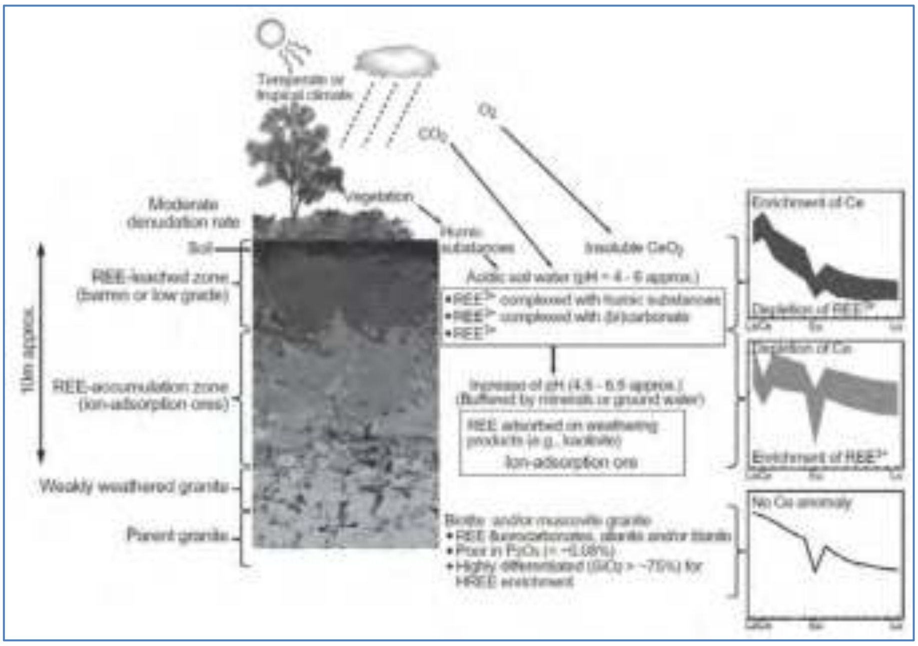
5.6.2 FORMATION OF IAC REE DEPOSITS

Formation process: Rare-earth-element-bearing ion-adsorption clay deposits form in temperate or tropical regions with moderate to high rainfall through the following general weathering processes:

- The REEs are leached by groundwater from bedrock granites* (*see also "source rocks" below).
- Thick zones of laterite soils develop above the granites; this intensely weathered zone contains an abundance of clays.
- The mobilized REEs become weakly fixed (through ion-adsorption) onto clays in the soils.

A schematic cross-section through an IAC deposit is given in Figure 14[57].

Figure 14 Schematic cross-section through an ion-adsorption deposit



Chemical weathering (leaching) is preferentially promoted by temperate and tropical climatic conditions because the chemical weathering rate increases with the increase in annual precipitation and temperature. A comparison between southern China (temperate) and Southeast Asia (mostly tropical) suggests that a temperate climate appears more favourable for preservation of ion adsorption-type REE deposits than a tropical climate. And low amounts of mechanical erosion (requiring low relief topography) is required to preserve ion adsorption orebodies.

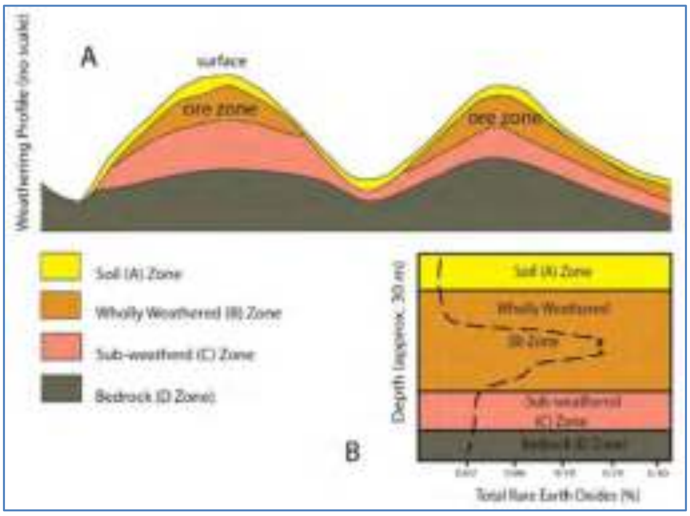
The ionic process: The REE-bearing minerals are decomposed by acidic soil water at shallow levels in the weathering profile, and the REE^{3+} ions move downward in the profile. The REEs are complexed with humic substances, with carbonate and bicarbonate ions, or are carried as REE^{3+} ions in soil and ground water at a near-neutral pH of 5-9. The REE^{3+} ions are removed from solution by adsorption onto or incorporated into secondary minerals. The removal from the aqueous phase is due to a pH increase, which results from either water-rock interaction or mixing with a higher pH ground water. The REEs commonly adsorb on the surfaces of kaolinite and halloysite, to form the ion adsorption ores, due to their abundances and points of zero charge. In addition, some REEs are immobilised in secondary minerals consisting mainly of REE-bearing phosphates (rhabdophane and florencite). In contrast to the other REEs that move downward in the weathering profile, Ce is less mobile and is incorporated into the Mn oxides and cerianite (CeO_2) as Ce^{4+} under near-surface, oxidizing conditions.

[57] Sanematsu, K. and Watenabe, Y., 2016. In *Reviews of Economic Geology*, SEGI, 2016, Vol 18, Fig 7, pp69.

Weathering profile: The weathering profile of the deposits (Figure 14) can be divided into a REE-leached zone in the upper part of the profile with a positive Ce anomaly, and a REE accumulation zone with the ion adsorption ores in the lower part of the profile that is characterized by a negative Ce anomaly.

In regolith soil terminology the highest REE concentrations usually occur in the B horizon (the subsoil) of the near-surface weathered zone (Figure 15[58]). This B horizon also contains the highest clay content. The overlying A horizon (the uppermost zone) is richest in organic matter, and also contains much clay. The underlying C horizon consists of clays and pieces of the weathered granite.

Figure 15 Idealised weathering profile through an ion adsorption deposit (Guangdong area, China)

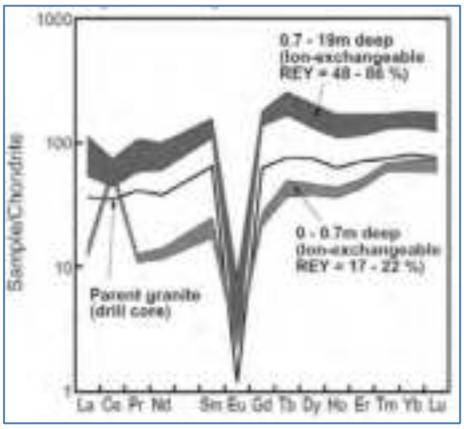


Thickness of weathering profiles are generally in the range 0.3-10 m but can be as much as 30 m and rarely up to 60 m. In the Longnan area (Jiangxi Province, China) laterites vary in thickness between several and 30 meters. In adjacent Hunan Province laterite exposures are discontinuous, as they are separated by mountains.

Chinese laterite deposits are thickest on hill crests and thin dramatically on hillsides as the valley floor is reached (illustrated with the idealised profile in Figure 15). Estimates of the extent of exploited ground (as seen from satellite images) suggest deposits with lengths up to 4.5 km and widths up to 2 km.

HREE concentration: From geochemical and sequential leaching experiments of ion-adsorption clays from deposits in Laos it was concluded that "the enrichment of REE[s] is attributed to the occurrence of ion-exchangeable clay minerals and REE phosphates in the weathered crusts and that HREE[s] are [more] selectively adsorbed on the clay minerals than are LREE[s] by weathering" (Sanematsu et al, 2009). However HREE/LREE ratios may change – laterite clay deposits of the Longnan district in Jiangxi Province in southern China produce HREE-rich material, whereas clay ores from the Xunwu district, also in Jiangxi Province, produce material that is rich in LREEs.

Figure 16 REE distribution in Zudong granite (below Lognan)



After the discovery of the Longnan deposits (Jiangxi province, China) in 1969, more than 200 HREE- and LREE-rich ion adsorption-type deposits were discovered and mined in southern China. Figure 16[59] shows the chondrodite-normalised REE distribution for the Zudong muscovite granite beneath the significant Lognan deposits. In contrast to distributions for more fractionated rocks where LREEs predominate (Figure 4) it is seen that the slopes in Figure 16 trend upwards (higher) for the HREEs on the right. Note the Ce depletion in the main thick REE accumulation zone. Other granites there show the opposite slope accentuating the LREEs.

Underlying source rocks: Most recent research indicates that lateritic weathering deposits are also found above rocks other than granites – such as felsic volcanic rocks, epi-metamorphic rocks and basic magmatic rocks[60].

Figure 17[61] illustrates cross-sections through three ion-adsorption REE deposits in South Jiangxi Province, China – where the underlying source rock types differ.

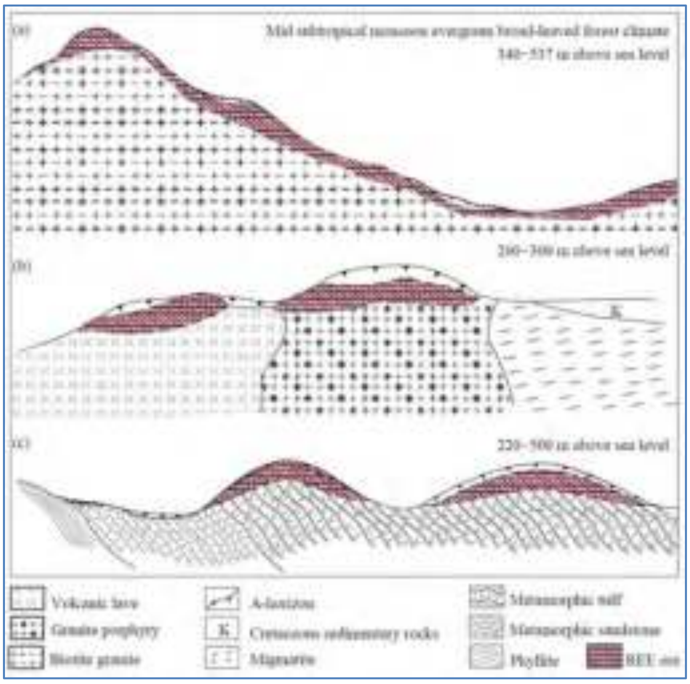
[58] AGS, , 4 May 2012. *Lateritic, supergene rare earth element (REE) deposits*. Arizona Geological Survey. Fig 4, pp58.
[59] SEG, 2016. Ion-adsorption paper. Fig 5 A, pp62.
[60] Wang DH., et al, 2018. In *China Geology*, CGS, September 2018, Volume 1, Issue 3, Abstract, pp415.
[61] Wang DH., et al, 2018. In *China Geology*, CGS, September 2018, Volume 1, Issue 3, Fig 4, pp420.

In (a) at Muzishan the bedrock is a typical source, biotite granite.

In (b) at Keshutang the bedrock is another typical source, a granite porphyry, as well as volcanic lavas.

In (c) at Getengzui the bedrock is metamorphosed volcanic tuff and meta-sediments.

Figure 17 IAC deposits above different source rocks



5.6.3 GRADES & EXTRACTION OF IAC REE DEPOSITS

Ore grades are in the range 140-6,500 ppm REY (0.01-0.65%) and are typically ~800 ppm (0.08%). Some deposits are remarkably enriched in HREEs (Eu, Dy and Tb). Whilst grades are relatively low their extraction is relatively easy. The presence of easily weathered HREE minerals in the underlying granites appears to be the primary control of the HREE-rich deposits. Although monazite, zircon, and xenotime are also present in the granites their greater resistance to chemical weathering presumably means they are not typically a source of the REEs in the clays. Ion adsorption ores generally contain lower amounts of radioactive elements (Th and U) than other residual REE ores (such as beach sands), and the Th and U concentrations in the leachate are low.

The southern China deposit REE concentrations are a modest 0.03-0.2% REE and appear to vary with the parent rocks. These modest REE concentrations are economic for the south China deposits because the REEs can be easily extracted from the clays with weak acids; the deposits are often enriched in the high-value HREEs; the area has low labour costs; and there has been a localized lack of environmental protection to discourage mining.

Processing and extraction of REE from lateritic deposits has proven to be relatively simple and economic particularly where the REE are in ion-exchangeable sites. The adsorbed REE are leached by ion exchange with inorganic salts in dilute electrolyte solutions. In the early period of REE processing, leaching was with sodium chloride (NaCl) and later with ammonium sulphate ($(NH_4)_2SO_4$) or a weak acid. At the Tantalus ion-adsorption type deposit in Madagascar, metallurgical test recovery rates for leaching with a sodium chloride solution were 37–42% TREE, and with an ammonium sulphate $(NH_4)_2SO_4$ solution, recovery rates were generally 59–76% TREE.

In China mining/recovery methods are by three methods – simple mechanical excavation followed by REE leaching in pools ("pool-leaching") or in heaps ("heap-leaching"); or by REE leaching **in-situ** (although it is unclear if this in-situ method is still allowed as sub-surface contamination results). With the in-situ method the leachate is introduced into the ground at the upper parts of the deposit (ponds on the crests of hills, or shallow leach wells dug into hillsides) and recovered downhill. Approximately 25–30 days are required for the leaching process to be complete. REE are precipitated from the leachate as carbonates or oxalates by addition of ammonium bicarbonate or oxalic acid. REE as colloids have been recovered using a weak acid such as hydrochloric acid.

5.6.4 CHINESE PRODUCTION FROM IAC REE DEPOSITS

IAC REE deposits were discovered in China in 1969 and their REE products have been exported to Japan, Europe and the USA since 1983. Mine production expanded rapidly between 1986 and 1995. China classified these deposits as national specific mining-protection minerals in 1991. They were exploited at large scale from 1996 to 2009 due to high demand. Production from ion-adsorption deposits since ~2007 has steadily declined (Figure 3).

After three decades of over-exploitation and disordered mining the resources were becoming quickly consumed and the environment seriously damaged. Figure 18[62] shows an old small IAC REE mine in China. Slopes have been stripped of ore and processing is occurring in the vats in the foreground. Chinese ion-adsorption deposits are facing economic and environmental problems and their long-term viability may not be assured. Those problems include declining grades; increasing extraction reagents costs (because of the declining grades); large stripping ratios; large volumes of leach residues; environmental rehabilitation costs; contamination of local ground water.

Figure 18 Chinese IAC REE mine

5.6.5 CHINESE EXPLORATION FOR IAC REE DEPOSITS

Chinese exploration for ion-adsorption type REE deposits has been widespread (accounting for the great number of deposits and large production) but relatively "low-tech". Once prospects are identified exploration has been by shallow shafts (<20 m) and drilling (<50 m), depth restrictions implying many deposits were only partially explored. Both methods are slow and are being replaced with faster and cheaper "Gannan" or probe drilling.

Exploration stepped-up in 2011 to address reducing supply and to address environmental issues. The exploration advances came with (1) appreciating that the deposits also occur over rocks other than granites; (2) improved exploration methods; 3) using big data sets to study the relationships between REEs and weathering profiles; and (4) establishing high resolution remote sensing technology as a method for quick, accurate and dynamic investigation of deposits.

Improved analytical methods have allowed discrimination of the actual material from which REEs can be extracted – the ion-exchangeable phase (~40-95% of total REE) – rather than the total REE (which also includes those soluble in water, colloidal sediment and minerals). It has also allowed analysis of the individual elements, enabling the low-content but high-value REEs (the HREEs) to be found and delineated.

5.6.6 IAC REE DEPOSITS OF NOTE

Significant Chinese ion adsorption-type deposits that have been mined (in decreasing Resource size) include deposits of Jiangxi (Lognan, Heling, Dingnan, Dajishan); Guangdong (Wujingfu and Wufang, Laishi, Zhaibeiding, Renju, Xaiche); Fujian; Guangxi, Zhuang Autonomous Region (Huashan, Qinghu, Majigang); Hunan, and Yunnan Provinces. Jiangxi province has the largest ore reserves and greatest production of ion adsorption ores, with the majority of deposits located near Ganzhou City.

Laterite clay deposits (generally similar to the southern China deposits) are under development in northern Vietnam at the Dong Pao Mine in Lai Chau Province. In Madagascar laterite clays formed by tropical weathering above REE-enriched dikes and sills are being explored at the Tantalus RE project. An announced pilot project in Jamaica is intended to test the recovery of REEs from tailings of red mud produced from bauxite mining. The red mud reportedly contains 0.23-0.38% REEs (by weight) and has higher HREE concentrations than representative Chinese clay examples.

Other deposit areas include: Malawi (Chambe); Brazil (Serra Verde); and elsewhere in SE Asia.

5.7 MONAZITE-XENOTIME-BEARING PLACER REE DEPOSITS

Monazite-xenotime-bearing placer deposits (heavy mineral beach sands) were important sources of REEs up to the mid-1960s, but they decreased in prominence owing to the discovery of the Mountain Pass deposit in California. However placer deposits may again be significant sources of REEs in the near future. NB: See also comments below in the Section on "Lateritic deposits".

[62] Kevnmh, 22 May 2016. Image available online through Wikimedia Commons.

Two broad settings for monazite-bearing placer deposits are:

- Deposits of streams and rivers (fluvial deposits).
- Coastal and nearshore deposits of sand and silt (beach sands).

Fluvial deposits: In both deposit types, heavy dense minerals (including REE-bearing monazite and xenotime) are physically sorted and deposited together by the combined actions of water movement and gravity. The resulting deposits of sediments, which are composed of sand and silt with thin layers of heavy minerals, are often referred to as "heavy-mineral sands." "Heavy minerals" are commonly defined as dense minerals with a specific gravity greater than ~2.9. These minerals are generally resistant to chemical weathering and physical degradation and thus survive well in fluvial environments. Heavy minerals are originally eroded from bedrock sources, carried by streams or rivers until they are deposited in the stream channel system or into a coastal plain setting. In the stream, the heavy minerals are carried within a slurry mixture of sand and silt. Because of their high density heavy minerals can be well sorted by fluvial processes and preferentially deposited into layers through the combined effects of gravity and decreases in stream energy. The Charley Creek deposits in Northern Territory, Australia are an example of REE-bearing alluvial placer deposits.

Beach sands: Carrying heavy minerals, sediments are brought to coastal areas by streams and rivers. These sediments are reworked in nearshore (coastal) areas by the actions of waves and tides, which sort the heavy minerals into discreet layers. In these deposits, dark layers of heavy minerals are often referred to as "black sands." A notable example of such deposits is the detrital monazite deposits in the coastal regions of southern India, which are found in piedmont lakes, shallow seas, sand bars across the mouths of rivers, deltas, beaches, and sand dunes behind the beaches. In addition to modern coastal regions, heavy-mineral deposits (which may carry monazite) occur in ancient coastal plain environments. Heavy-mineral deposits were formed by Pliocene transgressive-regressive events in the Upper Coastal Plain region of eastern North Carolina and eastern Virginia, USA.

The occurrence of REEs in fluvial placer or nearshore placer deposits depends on the presence of monazite and (or) xenotime in the bedrock sources upstream.

In the south-eastern US stream sediments associated with metamorphic rocks in the Piedmont and Blue Ridge terranes contain exceptionally high REE. Rocks in the Piedmont have been subject to intensive lateritic weathering, and the areal extent of the anomalous REE would make large areas permissive for lateritic REE deposits.

Heavy minerals in the fluvial and coastal deposit types may include, in order of general abundance, ilmenite, leucoxene, rutile, magnetite, zircon, staurolite, kyanite, sillimanite, tourmaline, garnet, epidote, hornblende, spinel, iron oxides, sulfides, monazite, and xenotime. The typical minerals of value are ilmenite, leucoxene, and rutile (for their titanium and titanium dioxide); zircon (for its refractory uses (such as specialty ceramics)); and in some cases, monazite (for its REEs and thorium). The heavy minerals as a suite typically make up no more than 15% of a deposit (and usually much less); quartz and clay minerals form the bulk of the sediment. As an example, in the coastal plain deposits of North Carolina and Virginia, the average heavy-mineral suite consists of ~9% of the sediments and monazite occurs in trace amounts (0.0-0.9% (by weight) of the heavy minerals).

Presently, monazite is extracted from coastal sands at the Buena Norte mining district on the east coast of Brazil; along the south-western coast of India in the State of Kerala; and along the coastline in the State of Odisha in north-eastern India. The monazite is recovered as a by-product during the extraction of ilmenite ($FeTiO_3$), leucoxene (altered ilmenite), and rutile (TiO_2) from beach sands. The ilmenite, leucoxene, and rutile (principal products of value) are chemically processed to remove titanium dioxide, which is used primarily as a pigment in paints. The heavy-mineral sands in the coastal plain of Virginia, USA, are currently worked by Iluka Resources Ltd as they have the ancient nearshore heavy-mineral deposits in Australia since the 1950s. Iluka's heavy-mineral sands operations target the titanium minerals (ilmenite, leucoxene, rutile) and zircon; they do not currently recover the monazite.

By-product monazite deposits of note include or are found in: Australia; Brazil; China; India; Indonesia; Korea; Malaysia; New Zealand; Sri Lanka; Thailand; Canakli (Turkey); Zaire; USA.

5.8 SEDIMENTARY PHOSPHATE REE DEPOSITS

USGS research discovered that francolite (a carbonate-rich apatite mineral), common to some sedimentary phosphate-rich rocks (phosphorite), is highly enriched in HREEs. A continent-scale assessment has identified several unmined HREE-bearing phosphorites in the United States that are exposed over large areas.

This research also demonstrated that REEs vary in a secular fashion because of oceanic redox state transitions during specific time periods in Earth's history. The consistency of REE abundances within individual time horizons has identified time periods (Late Mississippian, Devonian, and Ordovician) as particularly favourable for the formation of phosphorites with high-REE abundances. An Upper Ordovician horizon may rank as one of the largest concentrations of HREEs in the world. This nearly horizontal horizon occurs at, or just below the surface, over an area of 2,000 km^2 in northern Arkansas, USA. Samples from more than 100 km^2 of this 1.5 m thick horizon have remarkably homogenous REE abundances The horizon is estimated to comprise 235 Mt of phosphate rock with 1.3 Mt of extractable total REE, of which 0.37 Mt are HREE (which is nearly twice the HREE content of the south China clays deposits). This ore horizon extends in the shallow subsurface throughout Missouri and Indiana.

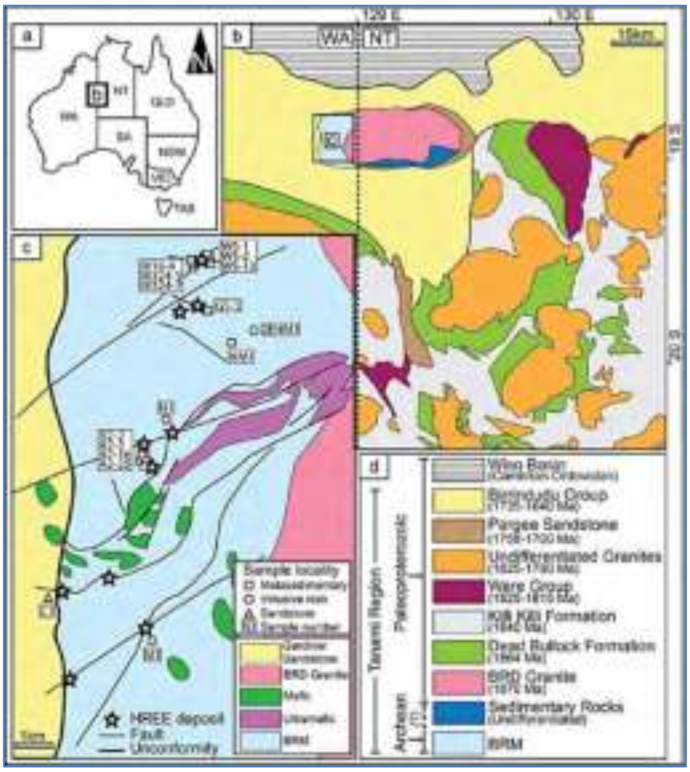
The REEs in sedimentary phosphorites are nearly 100% extractable, using technologies currently used in the phosphate fertilizer industry in the United States (Emsbo and others, 2015). The scale of the domestic fertilizer industry, which produces 30 Mtpa, suggests that by-product REE production from phosphate mines could meet much of the USA's HREE demand. Furthermore, the ease of beneficiation and chemical dissolution of sedimentary francolite suggests that higher-grade phosphorite deposits might constitute stand-alone REE deposits.

5.9 VEIN REE DEPOSITS

Mineral districts with multiple REE-rich veins of equivocal origin exist in parts of the world. Most of these vein deposits are interpreted to be related to alkaline igneous rocks (and should not to be confused with REE-rich veins associated with carbonatites). Relatively little has been published on this type of REE deposit – and it may well be a significant emerging type for its association with HREEs.

Although only one deposit (Browns Range) is described here it appears representative of the "Vein REE Deposit" type* – and is analogous to HRE's NT **Duke Project** (see Section 13). The brown-field Browns Range Project is being developed by Northern Minerals Limited[63] (Northern Minerals). Browns Range is relevant for very recently having gone into REE pre-production (2018), it is a producer of HREEs, it is outside China (whose production is very opaque), and it appears well documented. *Browns Range may also belong to a new type of REE deposit – an "Unconformity-Related REE Deposit"[64] (see "REE deposit type" below).

Figure 19 Browns Range geology



Browns Range: *Location*: The Browns Range Project is located in the south eastern Kimberley region of Western Australia, immediately adjacent to the NT border and thus also within the north wester Tanami region (Figure 19[65] (a)). It consists of (at least) seven individual REE deposits located around the western periphery of the Browns Range Dome (BRD) which straddles the border.

Geology[66]: Figure 19 also shows the Project regional geology ((b) top right) and local geology ((c) bottom left). The core of the BRD (pink) is a granite, is oval in shape with the long ~60 km axis E/W, and covers ~1,500 km^2. The BRD has been cut by numerous mainly E-W trending faults.

Enveloping the BRD granite, and occupying the outer margins of the dome, are Paleoproterozoic sedimentary rocks of the Pargee Sandstone (brown) and the Birrindudu Group (yellow) to the east and north; a package of undifferentiated sedimentary rocks of unknown age to the south; and metasedimentary rocks of the Browns Range Metamorphics (BRM) to the west (pale blue).

The metasedimentary BRM rocks (that host the economically significant HREE deposits) that occupy the WA segment of the BRD outcrop over an area of ~100 km^2 and consist mainly of metasedimentary rocks (medium to coarse-grained arkosic metasandstones) that experienced regional metamorphism, mostly of greenschist facies, but locally up to amphibolite grade. The BRM have been cut by numerous granitic, syenitic and **pegmatitic** intrusions (measuring tens to hundreds of metres in

[63] Northern Minerals, February 2022 – web site. Link https://northernminerals.com.au/browns-range
[64] Nazari-Dehkordi, T., et al, November 2018. Pp VII.
[65] Nazari-Dehkordi, T., et al, 2017. Fig 1, pp2.
[66] Nazari-Dehkordi, T., et al, 2017. Most geology summarised from this paper (pp2-3) and from Nazari-Dehkordi, T., et al, 2018.

dimension) and mafic (green) and ultramafic (purple) intrusions.

The BRM are unconformably overlain by a thick sequence of low-grade Paleoproterozoic marine sedimentary rocks with rare volcanic units (yellow area west of the BRM in (c) of Figure 19). This unconformity is now a focus of exploration as REE deposits are being been found close to it.

The REE deposits are characterised as breccia-hosted hydrothermal systems. Locally[67] (at Wolverine, see Figure 21) the host rocks are a sequence of meta quartz-lithic arkosic arenites and conglomerates with minor interbedded schists. The host rocks in the mineralised zone are silicified and brecciated along structures trending between east-west and 290°, and dipping steeply to the north. Hematite and sericite alteration is associated with mineralisation.

REE mineralisation academically: Giving a clue to the mineralisation the general area is also known as the North Australian HREE+Y mineral field[68] (NAHREY).

The REE deposits in the BRM contain **xenotime** (a REE phosphate with the major component being yttrium (HREE) orthophosphate (YPO_4)) and minor florencite (a samarium REE phosphate where the LREE samarium may be substituted by the HREE dysprosium) mineralisation in hydrothermal lodes within massive arkosic metasedimentary rocks. Xenotime is commonly associated with pegmatites. Cook et al. (2013) report that xenotime hosted by the BRM is more enriched by 3–7% total REE than other occurrences in the world.

Steeply dipping mineralisation is associated with silicification at major fault junctions (shown by the black stars on the black fault lines in Figure 19) and occurs mostly as: (1) high-grade, low-tonnage lodes with large (>10 m long and 1 m wide) veins and chaotic breccias of massive xenotime (±quartz, ±hematite, ±sericite); and (2) low-grade, probably higher tonnage disseminated mm-scale xenotime–quartz veins and crackle breccias in which xenotime grains occur in a number of morphological types. The veining and brecciation varies from 1-2 mm crackle vein selvages to matrix infill in 5 m wide zones of chaotic breccia. There are open spaced textures, vughs and minor cross-cutting quartz, pyrite or barite veins that are interpreted to post-date mineralisation.

The ore minerals (xenotime and minor florencite) occur mainly near the regional unconformity between the Archean metasedimentary rocks of the BRM and the overlying Paleoproterozoic Birrindudu Group sandstones. Ore petrography indicates multiple stages of xenotime and florencite crystallisation and recrystallisation. Both xenotime and florencite incorporated quantities of trace elements via a number of substitution mechanisms. Samples of the BRM are variably depleted in HREE compared to sedimentary protoliths, and also have un-radiogenic Nd isotope compositions that are comparable to the orebodies, but quite distinct from the igneous rocks or other sedimentary rocks (Birrindudu Group) from across the North Australian Craton. These observations demonstrated that the ore metals were derived directly from the BRM.

Combining whole-rock, fluid inclusion and isotopic data, an ore genesis model was developed[69] that suggests mixing of at least two hydrothermal fluids, one of which leached HREE+Y from the BRM and moved upward along fault structures in the vicinity of the regional unconformity and there mixed with another down-flowing P-bearing fluid originated from the Birrindudu Group sandstones. Leaching of ore metals was greatly enhanced by halogen (Cl, F) complexes. Introduction of P during fluid mixing/dilution and an increase in pH resulted in HREE deposition.

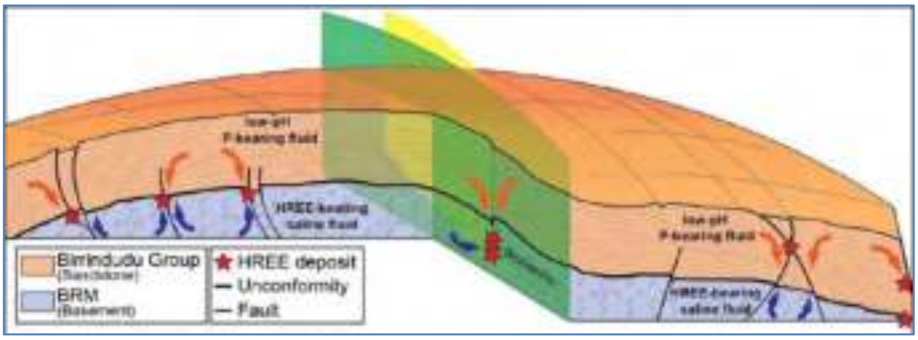
REE deposit type: Globally, the closest analogue to the NAHREY ore deposits is the Maw Zone[70], which formed in a very similar geological setting in the Athabasca Basin, Canada[71]. Collectively, this structurally controlled style of REE mineralisation is apparently unlike any other known REE ore style (according to Nazari-Dehkordi), who labels them an "Unconformity-Related REE deposit". This ore style is composed only of ore phosphate minerals, is completely hydrothermal in origin, and shows no demonstrable link to magmatic rocks. Ore-forming hydrothermal fluids, driven by far field stresses during large scale tectonic events (e.g., orogeny's), leached the REE and phosphorous from metasedimentary or sedimentary rocks. Hydrothermal transportation of the REE was enhanced particularly by Cl- and F-bearing complexes. Ore deposition occurred along near-unconformity structures and major faults, following mixing of ore-forming hydrothermal fluids, one carrying REE and another one carrying P from contrasting sources. These unconformity-related REE deposits should be found in intercontinental basins in close proximity to regional unconformities between Archean basement rocks and overlying Proterozoic sedimentary sequences containing P-rich units (containing apatite).

Figure 20[72] is a 3D cartoon of the BRD to illustrate the genesis of HREE ore formation through fluids (red and blue

[67] Scogings, A., October 2014.
[68] Nazari-Dehkordi, T., et al, November 2018. Pp V.
[69] Nazari-Dehkordi, T., et al, November 2018. Pp VII.
[70] Nazari-Dehkordi, T., et al, November 2018. Pp VII and pp212.
[71] Rabiei, M., et al, 2015.
[72] Nazari-Dehkordi, T., et al, November 2018. Fig 4-8, pp123.

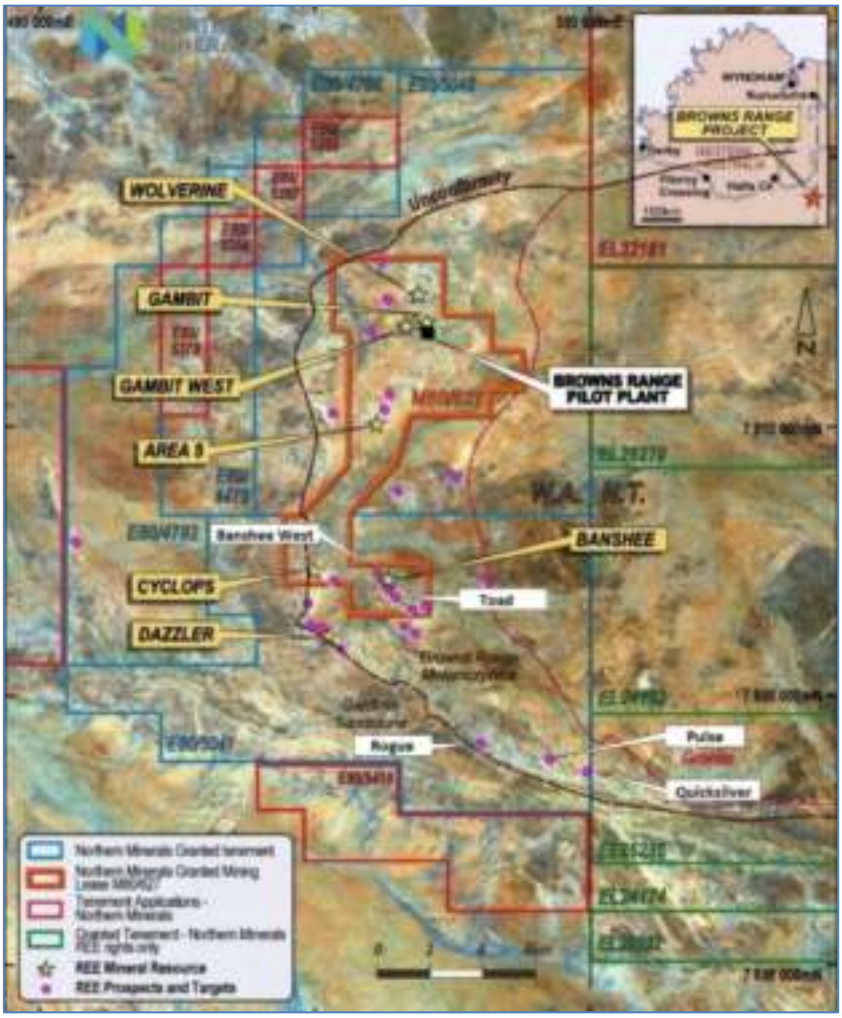
arrows) mixing along fault zones (black lines) in the vicinity of the regional unconformity (thick black line) between the BRM (light blue) and the overlying sandstones (light orange). The largest known REE deposit (Wolverine, see below) developed at the intersection of two steeply dipping faults (green and yellow planes).

Figure 20 Browns Range ore genesis model



REE mineralisation according to current exploration by Northern Minerals: Approximately seven economically mineralised REE deposits are currently named by Northern Minerals (yellow call-outs, Figure 21[73]), the largest of which is Wolverine.

Figure 21 Browns Range REE deposits



The REE deposits can mostly be characterised as breccia or quartz-vein hosted hydrothermal systems with the dominant mineralisation being the rare earth phosphate mineral xenotime (a rich source of dysprosium and other high value HREEs). Mineralisation at Browns Range has a high proportion of HREE, being 87% for the total Resource and ranging from 69% at Area 5 up to 96% at Gambit.

Although the whole of the BRD is a target Northern Mineral's exploration is now focussing along the unconformity (dashed brown line) south east of the Dazzler deposit. Because of the abundance of targets their model is to seek shallow (<200 m deep) open-pittable deposits with >0.5% TREO mineralisation.

Resources & Reserves[74]: Current JORC Mineral Resources reported by Northern Minerals from all seven deposits (plus the pilot plant stockpiles) stand at 9.24 Mt @ 0.67% TREO (Indicated (52%) and Inferred (48%)). That contains ~62 kt of TREO. The HREO proportion is 87%. A Resource of 4.85 Mt @ 0.86% TREO is from the Wolverine Deposit alone (~50% of the total), where HREO is 89%. Northern Mineral's lower cut-off grade is 0.15% TREO (low by world standard). Northern Minerals also report total open-pit (34% at Wolverine and Area 5) and underground (66% at Wolverine) Ore Reserves of ~3.3 Mt containing 22.4 t of TREO including 1.95 t of dysprosium.

Mining: Northern Minerals has mined several Browns Range deposits in the past for ore to stockpile and process in their pilot plant. Although it is not completely clear when or where mining has occurred they report Ore Reserves (see above) from open-pits at Wolverine and Area 5 and from underground at Wolverine. Figure 22[75] shows the Wolverine open-pit in the recent past, probably ~2012.

[73] Northern Minerals, February 2022 – web site. Projects > Browns Range.
[74] Northern Minerals, February 2022 – web site. Projects > Browns Range > Resources and exploration.
[75] Northern Minerals, ~September 2021. *2020 Annual Report*. Pp14.

REE production since 2018: A pilot plant (to run for 3 years) was constructed at the Project in 2018 for the purpose of testing REE beneficiation to produce a 30% TREO (xenotime) concentrate product. Product radioactive thorium and uranium levels are reportedly low.

By 2021 the plant had produced[76] a total of ~211.1 t of Rare Earth Carbonate (REC) concentrate (Figure 23[77]) containing ~103.7 t of REO. That REO contained 9,751 kg dysprosium oxide and 1,245 kg terbium oxide (both HREEs, critical elements in permanent magnet manufacture). At January 2022 prices (Table 7) that dysprosium and terbium oxide was worth US$7.3M and US$4.6M respectively. In the 2021 financial year 3,456 t of ore was processed to produce 40.4 t of REC.

Figure 23 Browns Range REC product

Figure 22 Wolverine open pit (~2012)

5.10 LATERITIC REE DEPOSITS

"Lateritic deposits" should be another fundamental REE deposit geological setting (as is done here as a postscript). It is not independently highlighted because most of the literature has not treated it as such. This type of REE deposit is detailed by Croker, M.D. (USGS) in his 2014 paper published by the Arizona Geological Survey (AGS) as Special Paper #9 in Proceedings of their 48th annual forum on the geology of industrial minerals, April-May 2012.

REEs are frequently concentrated by lateritic process operating at surface in response to sub-tropical conditions. This REE mineralisation may occur over carbonatites (a particularly good source of REE-bearing minerals, as at Mount Weld), as well as granites (creating IAC deposits), rhyolites, and various metamorphic rocks. It also operates on REE minerals in transported sediments such as placers. Therefore it is a process operating on several of the other REE deposit types discussed above (particularly carbonatites and ion-adsorption clays).

Lateritic soils form during intense weathering of bedrock under tropical or sub-tropical (i.e., hot and humid) conditions and may be important sources of viable economic mineral deposits. Lateritic weathering results in the breakdown of primary rocks and minerals, and concentration of metals such as aluminium (creating bauxites), iron, manganese, nickel, gold, phosphorous, and niobium. Many occurrences of rocks containing these elements have minerals that are otherwise difficult or costly to mine or process to obtain these elements (e.g. nickel in olivine and aluminium in mica, clay, and feldspar). Laterization changes the mineralogy and hence how these elements are situated in relation to the bonding of these minerals. Metallurgical methods, mostly developed during the last 50 years, allow economic recovery of these elements from lateritic minerals. Lateritic weathering increases concentration of these elements above background or sub economic levels to values that are considered to be economic (e.g. aluminous micas or clays are altered to bauxites, olivine may be altered to garnierite, nickel-rich smectite, or nickel-bearing goethite).

The REE element mineralogy of lateritic deposits is relatively simple compared with primary, hard-rock deposits. Weathering and breakdown of primary REE-bearing minerals releases the REE as ions in solution. The REE may be adsorbed as hydration cations or hydroxyl hydration cations or they may form secondary phases. Commonly, 30-90% of the REE in laterite deposits are as (1) cations in exchangeable sites on clay minerals such as halloysite, kaolinite and on iron and manganese oxides, or as (2) colloids; (3) in secondary phosphate minerals, most commonly monazite and apatite (or florenceite); (4) as secondary oxides, such as cerianite (CeO_2) containing REE; and (5) as residual REE-bearing minerals, including monazite and xenotime. Other REE-bearing phosphates such as gorceixite, rhadophane, and crandallite are reported in some deposits.

Processing and extraction of REE from lateritic deposits has proven to be relatively simple and economic particularly where the REE are in ion-exchangeable sites. The adsorbed REE are leached by ion exchange with

[76] Northern Minerals, ~September 2021. *2021 Annual Report*. Pp14.
[77] Northern Minerals, ~September 2021. *2021 Annual Report*. Pp11.

inorganic salts in dilute electrolyte solutions. See the Section on "ion adsorption clays" for processing details.

Depending on the mineralogy, other lateritic deposits may employ an acid leach. Mt. Weld (the only other lateritic deposit other than the Chinese ion adsorption clays in production) is now processing secondary rare earth phosphate minerals by mixing with sulphuric acid and cracking in a rotary kiln to form rare earth sulphates. Solvent extraction separates the REE into groups and elements which are then precipitated as carbonates, hydroxides or oxalates (Lynas). Whilst the solvents are not identified by Lynas the precipitates may be the same as for the ion-adsorption deposits. Metallurgical tests of lateritic ore from the Ngulla carbonatite in Tanzania point toward use of a sulphuric acid leach, which has a REO recovery rate of 87%. No rotary kiln processing is involved in the processing the bastnäsite iron oxide-rich ore.

Although reported grades and tonnages for lateritic REE deposits have similar ranges to those of primary hard-rock deposits, lateritic deposits have some important advantages over those of primary deposits. Those advantages include:

- Ease and cost of mining are low with near surface ore (<100 m).
- Soft ore that is easy and cheap to mine in open-pits.
- Ease and low cost of REE extraction and processing.
- Large areal extent of the deposits define larger exploration targets and increased options for development.
- Lateritic REE enrichment greatly expands the REE resource potential by including source lithologies that would be normally be considered to be sub economic.

COWALINYA REE PROJECT (WA)

6 COWALINYA REE PROJECT – BACKGROUND

Summary: The Cowalinya REE Project concerns near-surface mineral exploration for lateritic REEs in the southern West Australian (WA) goldfields. HRE currently hold a three year option to purchase 100% of the Cowalinya Project tenement E63/1972. The Project targets a shallow secondary lateritic REE-enrichment deposit type which exists in supergene in-situ saprolitic clays weathered from immediately underlying basement granites and granitic gneisses (the original primary source of the REEs). This style of REE mineralisation is seen as an "ion-adsorption clay" (IAC) deposit – and is similar to extensive southern Chinese deposits which are dominant REE producers. IAC deposits there are often enriched in the more valuable "heavy" REEs (HREEs). As IAC deposits exist in shallow soft weathered rocks they are inexpensive to mine. And REE extraction from the ore through acid-leaching is a similarly inexpensive and effective process

6.1 COWALINYA PROJECT – GEOGRAPHY

6.1.1 LOCATION

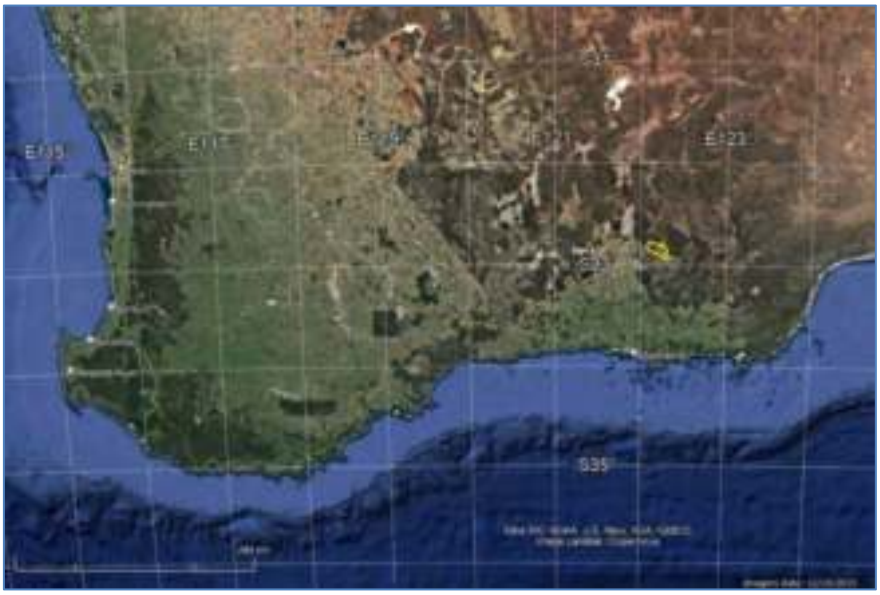
The Cowalinya REE Project (yellow polygon in Figure 24) is located in the far south of Western Australia, ~70 km SE of Norseman. Norseman is the nearest town and mining centre, located at the junction of the strategic N/S Coolgardie / Esperance Highway and the E/W Eyre Highway leading to Australia's eastern States. Norseman also lies on the N/S rail line to the port of Esperance. This location is in the southern part of the WA Goldfields mining region.

The Project's tenement (Section 0) location is shown by the yellow polygon in Figure 24[78]. Green areas are nature reserves. Regionally the Project is ~100 km NE of Esperance on the State's south coast; ~250 km south of Kalgoorlie (the nearest large regional centre and mining hub of the Goldfields); and ~700 km east of the State's capital Perth on the west coast.

Figure 25[79] shows the same area – but with satellite imagery. White grid lines mark 1° eastings and northings. The State's Goldfields regions roughly corresponds to the brown areas in the east; the State's Wheatbelt corresponds to the lighter green areas in the west and south.

Figure 24 Cowalinya Project regional location in south of WA

Figure 25 Cowalinya Project regional location satellite imagery



[78] Captured December 2021 from online mapping system *GeoVIEW.WA* provided by the Government of Western Australia – Department of Mines, Industry Regulation and Safety (DMIRS).
[79] Captured December 2021 online from Google Earth.

6.1.2 REGIONAL CADASTRE

Figure 26[80] shows the Project's yellow tenement boundary plotted above the area's regional cadastre (property boundaries and underlying land use).

White areas are cleared farm land (where surrounded by rectangular boundaries) or native grass lands; light green areas represent uncleared farms or native bush; olive green areas are nature reserves; light blues areas (apart from the sea to the south) are occasionally wet flat salt flats, here often adjacent to ancient sand dune fields.

The Project is situated on vacant Crown Land. Immediately to the north is the Dundas Nature Reserve (olive area in Figure 26).

Figure 26 Cowalinya regional cadastre

6.1.3 REGIONAL TOPOGRAPHY

Figure 27[81] shows the Project's yellow tenement boundary plotted above the local surface topography satellite image. This Landsat / Copernicus imagery (Google Earth December 2021) shows land use, vegetation and geomorphological features.

Closest village to the Project, Salmon Gums, is seen on the straight section of the yellow road to the west.

Figure 27 Cowalinya regional topography satellite image

The Project is situated in thick native bush land with very low relief. The land rises very gently towards the NE – the "Fraser Range". Jagged brown areas cut out of the dark green/brown native bush are bush-fire scars. Recently burnt areas now cover virtually all of the Project tenement and much of the Dundas Nature Reserve to the north. By comparison 2020's image showed ~70% burnt in the tenement and very little in the Reserve.

The many small light brown salt pans are scattered over much of the area. Their shape (very small and roundish or larger and elongate E/W) illustrates the flat nature of much of the land. Their shape also illustrates the prevailing

[80] Captured December 2021 online from *GeoVIEW.WA*. DMIRS. Cadastre.
[81] Captured December 2021 online from Google Earth.

wind directions which created (in ancient even drier times than now) low linear E/W dune fields between which the salt pans exist. The larger Lake Dundas (NW of the Project) is a typically summer-dry salt lake and represents a slightly deeper depression and coagulation of smaller pans. The lake is part of a much larger system of lakes stretching ~170 km north-south representing an ancient broad drainage channel.

6.1.4 ACCESS

Road access to the Project is from the tarred Coolgardie / Esperance Highway ~50 km to the west of the tenement (thick red line on the left of Figure 28). Eldred Road leads eastwards off the Highway ~8 km south of the town of Salmon Gums (kink on the Highway). After ~60 km Eldred Road joins the dirt Fraser Range Road which leads north-north-east towards the Project and fully traverses the tenement (yellow polygon in the top right of Figure 28).

Figure 28 Cowalinya Project access

Tracks on the tenement are limited in coverage and are sandy. Most were created for drilling access.

Figure 29[82] shows an E/W drill line being cleared for exploration by a front-end-loader, the track base is completely represented by soft sand.

Thick bush makes access off the Fraser Range Road difficult.

Figure 29 Track clearing

[82] Brescianini, R., January 2022. Photographs during 2021 air-core drilling program.

6.1.5 LOCAL TOPOGRAPHY

Figure 30[83] shows the yellow Project tenement above 1:250,000 State topographic mapping.

The map shows the roughly central Fraser Range track traversing the area in a NNE direction and rising gently. The Project is effectively at the SW end of the Fraser Range itself.

The map also shows that the Project area elevations range between ~250 m RL and ~300 m RL. This represents a smooth and very gentle slope down towards the SSW (50 m vertically over ~8 km at the least).

This smooth gentle slope in illustrated in Figure 31[84] which plots the NW shading of NASA's SRTM3 (Shuttle Radar Topography Mission) topography data. A very low ridge line trends ESE across the northern edge of the Project's tenement. The ground south of it slopes gently down to the salt pans to the west and south.

NB: The smooth slope and absence of surface erosion channels would be positive for the preservation of a lateritic profile.

Figure 30 Cowalinya local area topography map 1:250,000

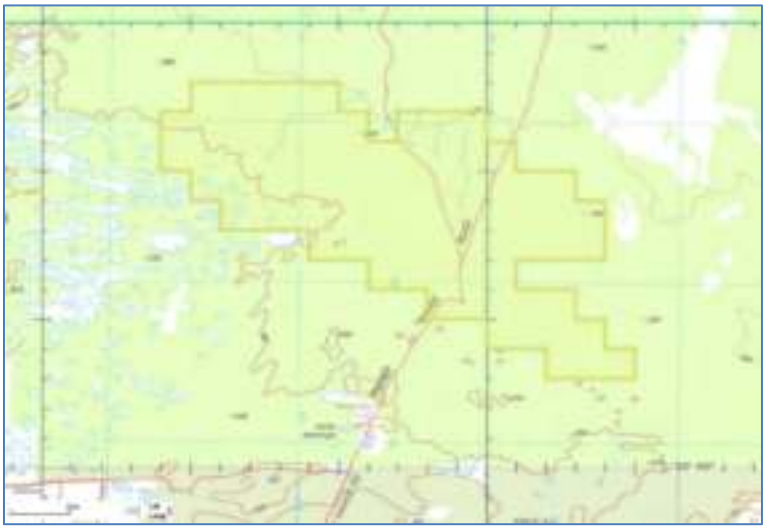


Figure 31 Cowalinya STRM3 slope topography

[83] Captured December 2021 online from *GeoVIEW.WA*. DMIRS. 1:250,000 topographic mosaic.
[84] Captured December 2021 online from *GeoVIEW.WA*. DMIRS. SRTM3 NW shading.

6.2 COWALINYA PROJECT – MINERAL TENURE

6.2.1 HRE WA TENEMENT E63/1972

HRE's Cowalinya Project is located within WA Exploration Licence (EL) 63/1972. The EL would typically be identified as E 63/1972 or simply **E63/1972**. The EL is "live" and active. It is held jointly by David and Christine Ross with whom HRE has a three year option to purchase 100% of the tenement.

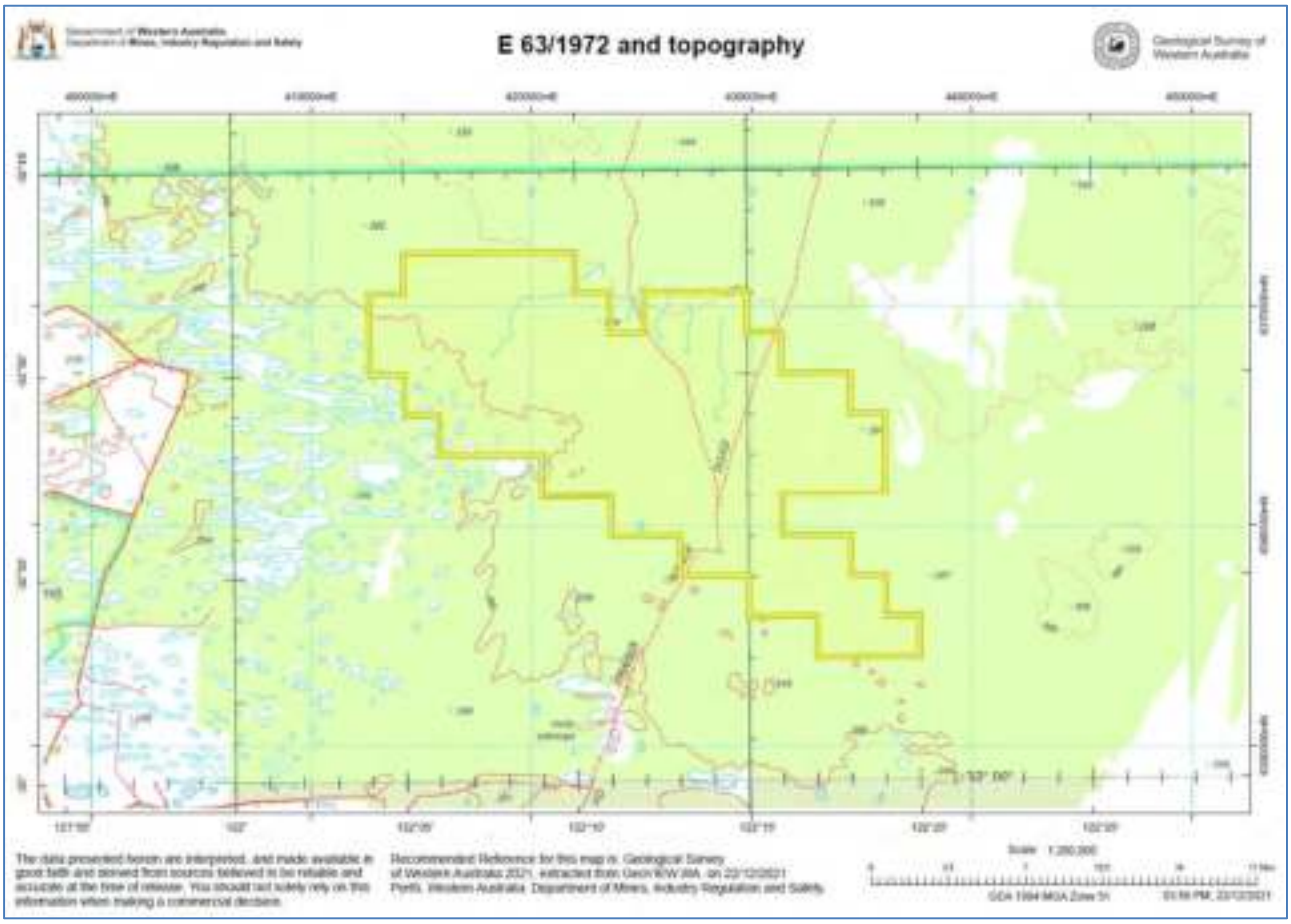
A search of the WA Tenement Register was provided to Mr David Ross (for the Client) by the WA DMIRS on 15 November 2021 and is included in Appendix 4 – Tenement report on WA EL 63/1972.

The following details on the EL are summarised from that search:

Tenement:	Exploration Licence 63/1972 (E63/1972)
Term:	5 years
Status:	Live
Commenced:	9 January 2020
Expires:	8 January 2025
Holders:	David Ian Ross and Christine Ann Ross, Bull Creek, WA 6149.
District:	Dundas M.F.
Shire:	Esperance
Area:	80 Blocks (~230 km^2)
Map sheet:	Esperance 1:1,000,000
Centroid:	32° 51' 14" S; 122° 12' 8" E

Figure 32 presents a formal print of the EL 63.1972 map obtained though the DMIRS's *GeoView* online service on 22 December 2021. This print gives the EL's coordinates in GDA 1994 (MGA Zone 51) and latitude and longitude degrees. The EL boundary yellow line is plotted above the State 1:250,000 topography.

Figure 32 HRE Cowalinya Project tenement E63/1972



6.2.2 ADJACENT TENEMENTS TO E63/1972

HRE's tenement E63/1972 is completely surrounded by current live or pending tenements. Those tenements are shown in Figure 33[85], as at 10 January 2022, as green (live granted tenements) and blue (pending tenements) polygonal cross-hatched areas surrounding the yellow polygon boundary marking HRE's tenement E63/1972.

Figure 33 Adjacent tenements to E63/1972 at 10/1/2022

Current immediately adjacent or very close by tenements to E63/1972 are tabulated in Table 8, in clock-wise order from the north, with an approximate direction from the tenement.

Table 8 Current adjacent tenements to E63/1972

Tenement	Blocks	Direction	Holder	Grant date	Expiry date
E63/1980	126	N & NE	Rio Tinto Exploration Pty Ltd	2 April 2020	1 April 2025
E63/1979	97	SE	Rio Tinto Exploration Pty Ltd	2 April 2020	1 April 2025
E63/2114	126	SSE	Mount Ridley Mines Ltd	Pending	
E63/2070	94	SW & W	ERL (Australia) Pty Ltd	23 July 2021	22 July 2026
E63/2049	26	S	SOC Resources Pty Ltd	21 Sept 2020	20 Sept 2025
E63/2144	5	SW	Future Metals Group Pty Ltd	Pending	
E63/2145	2	SW	Future Metals Group Pty Ltd	Pending	
E63/2127	122	W	Salmon Gums Minerals Pty Ltd	Pending	

SOC Resources is associated with eMetals Limited, and exploration on E63/2049 is described in Section 7.5.

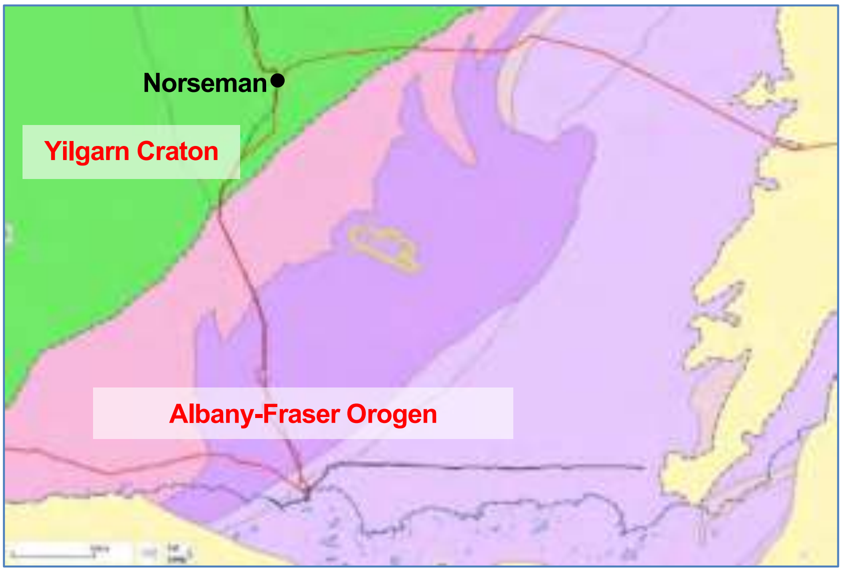
[85] Captured 10 January 2022 online from *GeoVIEW.WA*. DMIRS. Live/pending tenements on 1:250,000 topographic mosaic

6.3 COWALINYA PROJECT GEOLOGY[86]

6.3.1 REGIONAL BEDROCK GEOLOGY[87]

Major areas: The Project is located on the south-eastern margin of the mainly ~2,600-2,700 Ma Eastern Goldfields Super-terrane (EGS) of the Yilgarn Craton (green area in Figure 34[88], NW of Project), adjacent to the ~1,700–1,200 Ma Albany–Fraser Orogen (AFO, pink, purple and mauve areas in Figure 34). The Yilgarn Craton is the major western part of the WA Craton occupying most of Western Australia.

Figure 34 WA regional tectonic geology

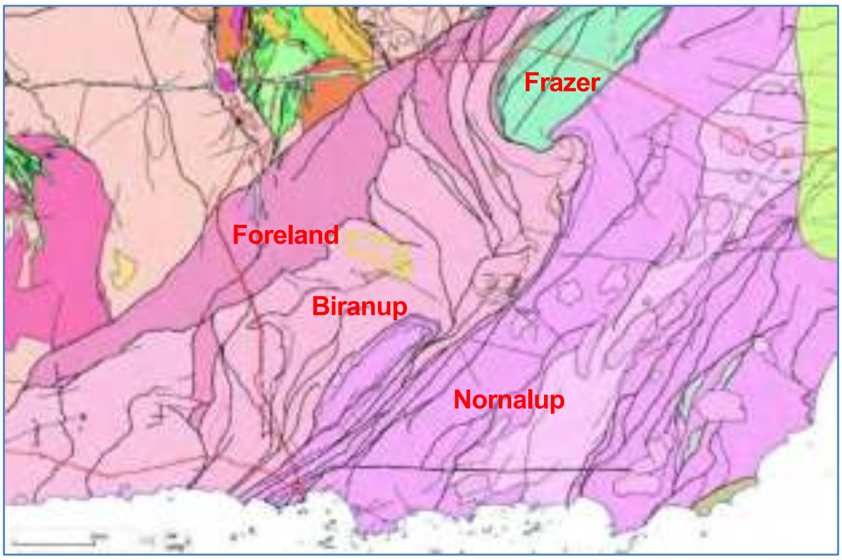


Yilgarn Craton rocks are granites and greenstones; Albany-Fraser Orogen rocks are variably igneous and high-grade metamorphic (the Orogen is essentially meta-granitic). The Cowalinya Project lies within the AFO. To the east of the AFO rocks are the younger sediments of the Eucla basin (pale yellow in Figure 34). Geological mapping of the region at 1:100,000 scale has been completed by GSWA, including the Norseman and adjacent Esperance sheets.

Albany-Fraser Orogen (AFO): This area is an arcuate orogenic belt that lies on the south and SE margins of the Archean Yilgarn Craton. Rocks along or close to the margin were extensively re-worked. The orogeny is thought to have been active during the Mesoproterozoic, with the rotation of the Mawson Craton onto the West Australian Craton, resulting in an initial Stage I of continental collision (c. 1,345–1,360 Ma), followed by intra-cratonic Stage II reactivation (c. 1,215–1,140 Ma). In other words, it is a collisional suture zone between two cratons.

AFO rocks are characterised by high-grade gneisses and granitic rocks (orthogneiss, paragneiss, migmatite and granitoid), but also contains large sheets of meta-gabbro, remnants of mafic dykes, and widespread low to medium-grade metasedimentary rocks.

Figure 35 Regional bedrock geology



The AFO is split into several components going towards the SE (Figure 35):

- Foreland component.
- Basement component:
  - Biranup Zone
  - Fraser Zone
  - Nornalup Zone.

These components are shown by the pink and mauve north-easterly trending regions in the more detailed 1:500,000 scale regional geology map of interpreted bedrock and lineations in Figure 35[89]. This north-easterly Zone trending is ascribed to north-westerly low-angle thrusting (continent collision) which developed the south-easterly dipping thrust sheets.

[86] Most Figures are presented from the DMIRS's *GeoView* online service.
[87] Text mostly Hardwick, B., February 2013. *Tenement Surrender Report E63/1271 & E63/1272.* AngloGold. 4, pp5-6; and Sharp, J., 5 April 2017. *Final surrender report E63/1409 & E63/1410.* Great Southern. 5.1, pp7.
[88] GeoView. DMIRS. 1:10,000,000 Tectonic units
[89] GeoView. DMIRS. 1:500,000 Bedrock geology and lineations

Foreland: Immediately SE of (abuts) the Yilgarn Craton is the most northern part of the Albany-Fraser Orogen – the NE trending Northern Foreland meta-granitic unit (pink in Figure 34; dark pink Figure 35, west of the project tenement). This may be a portion of the Yilgarn Craton (to the north) that was reworked during the later Albany-Fraser Orogeny.

The Foreland largely comprises thermally and structurally reworked late Archaean (3,000-2,600 Ma) granitoids of the south-eastern Yilgarn Craton. It comprises greenschist and amphibolite to granulite facies Archean gneisses and granites, remnant greenstones and younger dolerite dykes.

Deformation increases in intensity from north to south, with magmatic textures and intrusive relationships preserved in the north, whereas dykes are metamorphosed and rotated parallel to the regional trend. The Northern Foreland includes the predominantly granitic rocks of the Munglinup Gneiss, which is Yilgarn Craton reworked during the Stage II event. The Munglinup Gneiss is preserved in thrust sheets in the central part of the Northern Foreland.

Basement: The Kepa Kurl Booya Province (or Basement component of the Albany-Fraser Orogen) is defined as being the crystalline basement of the Orogeny, and was amalgamated during the Stage I tectonic event. The Province is comprised of three fault bounded zones: the Biranup Zone, the Fraser Zone, and the Nornalup Zone.

Immediately SE of the Northern Foreland are the basement rocks, the oldest component of which is the Biranup Zone which underlies the Project (purple area in Figure 34; pink area Figure 35) in a 60 km wide SW/NE belt. These rocks are meta-granitic and granulite facies gneissic dominant, locally with mafic amphibolite lenses; and may include remnants of Archean rocks. The zone is isoclinally folded and tectonically interleaved by thrusting with layered mafic intrusions of the Fraser Zone. The rocks date from c. 1800 to 1625 Ma. The rocks are strongly deformed. The Biranup Zone may also have formed by modification of the Yilgarn Craton.

East of the Biranup Zone is the Fraser Zone, which is dominated by younger high-grade meta-gabbroic rocks. It contains the Fraser Range Metamorphics (1305-1290 Ma, green area in Figure 35 NE of the pink Biranup rocks but east of Biranup rocks out of the Figure to the north) which are dominated by sheets of meta-gabbroic rocks interlaced with sheets of granitic material and layers of pelitic, sempelitic, and calcic meta-sedimentary rocks of the Arid Basin. The meta-sedimentary rocks were deposited shortly before the intrusion of magmatic rocks, with all then metamorphosed to granulite facies. The Fraser Zone is bounded by the Fraser Fault Zone along its north-western edge and the Newman Shear Zone and Boonderoo Fault along its south-eastern edge. The majority of the north-eastern portion of the Fraser Zone is concealed by the Eucla Basin (to the east), but the strong geophysical and gravity signature of the Zone shows that it is a north-easterly trending, fault bounded unit approximately 425 km long and up to 50km wide.

The Nornalup Zone is the south-eastern-most unit of the Albany-Fraser Orogeny and is composed of meta-granitic/gneiss interlayered with meta-gabbro (wide mauve and light mauve area, SE of the Project, Figure 35). The Nornalup Zone is dominated by the voluminous granitic intrusion of the Recherche Supersuite (1330-1280 Ma, mauve, Figure 35), and the Esperance Supersuite (1200-1140 Ma, light mauve Figure 35). The Recherche Supersuite represents a magmatic event that coincided with Stage I and is generally metamorphosed to amphibolite or granulite facies. The Esperance Supersuite represents a magmatic event coinciding with Stage II and is metamorphosed to greenschist or amphibolite facies. These Supersuites conceal much of the original basement of the Nornalup Zone, some components of which have recently been identified as migmatitic, monzogranitic gneiss containing angular mafic inclusions (1809 ±8 Ma), and a granitic gneiss (1763 ±11 Ma). The Nornalup Zone is separated from the Fraser and Biranup Zones by the Newman Shear Zone and the Boonderoo Fault.

6.3.2 Regional Surface Geology

Bedrock outcrops are rare (and are mostly granitic) and regionally the weathered bedrock is covered by a thin veneer of predominantly Quaternary aeolian sand cover. Local development of deeper Tertiary palaeo-channels is common, containing sand, silt and clayey sediments, overlying carbonaceous clays and lignite in deeper channels. Quaternary and Tertiary sediments are generally less than 10 m thick, but extend to over 60 m in palaeo-channels.

6.3.3 Local Geology

Local geology within the tenement is relatively poorly known with limited fine scale mapping available. Figure 36[90] shows the GSWA 1:250,000 paper mapping, with a legend given in Figure 37.

[90] GeoView. DMIRS. 1:250,000 GSWA geological mosaic image / map

Figure 36 Cowalinya Project local geology mapping

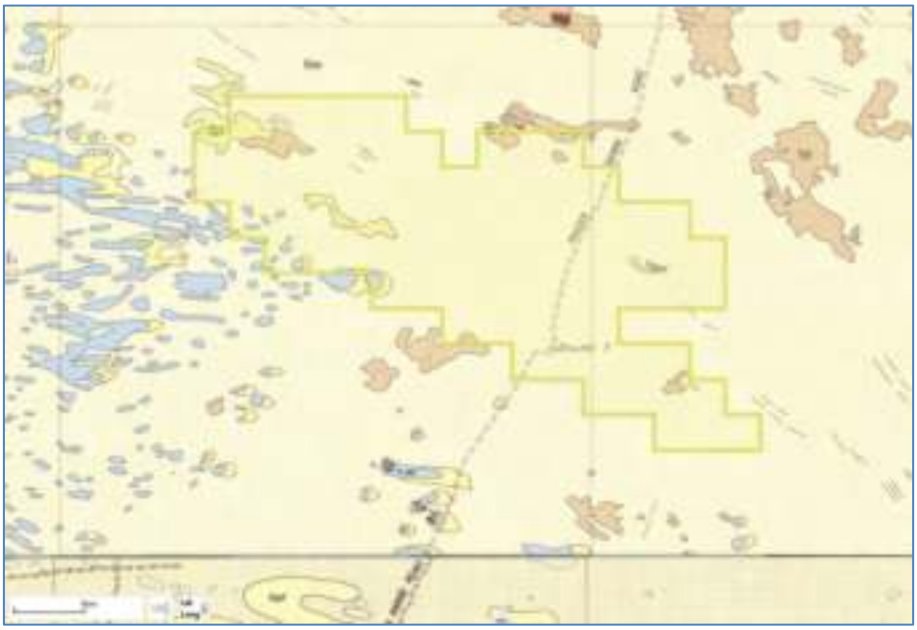
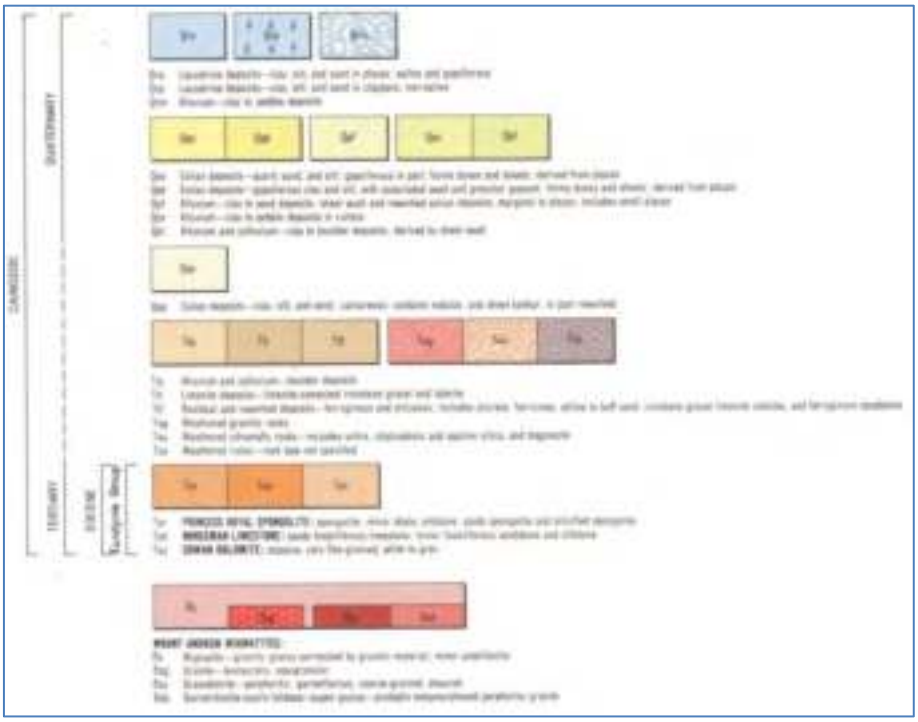


Figure 37 Geology map legend



The Precambrian bedrock geology of the Project is mainly (or even fully) concealed by recent cover sediments (including paleo-channels that can be up to ~100 m thick). These are mapped as eolian deposits (Qqs), created by wind action. At surface this colluvium/alluvium material is partly unconsolidated or loose (see photograph Figure 29).

Very limited solid outcrops through the sand are ferruginous and siliceous cemented residual and reworked rocks (Ttf). These would either represent concretions of the eolian deposits or residual highly weathered caps of the granitic basement just below. A very small outcrop of granite is mapped on the northern boundary of the Project. It is likely that detailed mapping within the tenement could reveal more outcrop.

Existing drilling on the tenement has shown bedrock to consist mainly of medium to coarse grained granitic gneisses, including monzonites and tonalites, along with subordinate amphibolites after dolerite.

Mapped outcrop in the Project area includes:

- Lacustrine deposits (Quaternary, Qra – light blue) – clay, silt, and sand in playas; saline and gypsiferous.
- Eolian deposits (Quaternary, Qps – predominant light yellow stippled areas) – quartz sand and silt; gypsiferous in part, forms dunes and sheets; derived from playas.
- Alluvium (Quaternary, Qpf – small irregular light yellow stippled areas) – clay to sand deposits; sheet wash and reworked eolian deposits, marginal to playas, includes small playas.
- Alluvium (Quaternary, Qpv – very small irregular light greenish yellow areas) – clay to pebble deposits in valleys.
- Alluvium and colluvium (Quaternary, Qpl – light greenish yellow fine horizontal lines) – clay to boulder deposits; derived by sheet wash.
- Eolian deposits (early Quaternary, Qqs – light yellow stippled areas) – clay, silt and sand; calcareous; contains nodular and sheet kankar; in part re-worked.
- Residual and reworked deposits (early Quaternary, Ttf – small irregular light brown areas, fine horizontal lines) – ferruginous and siliceous; includes silcrete, ferricrete, yellow to buff sand, ironstone gravel limonite nodules, and ferruginous sandstone.
- Granite (Proterozoic, Pag – red with white crosses) – leucocratic, equigranular. Part of Mount Andrew migmatites.

6.3.4 LOCAL GEOPHYSICS

With the dearth of outcrop in the Project area an obvious exploration tool would be geophysical data. Adjacent Figures plot the results of airborne geophysical surveys in relation to the Project's tenement. Figures are presented from the geophysics imagery in the DMIRS's *GeoView* online service.

Figure 40 Magnetics

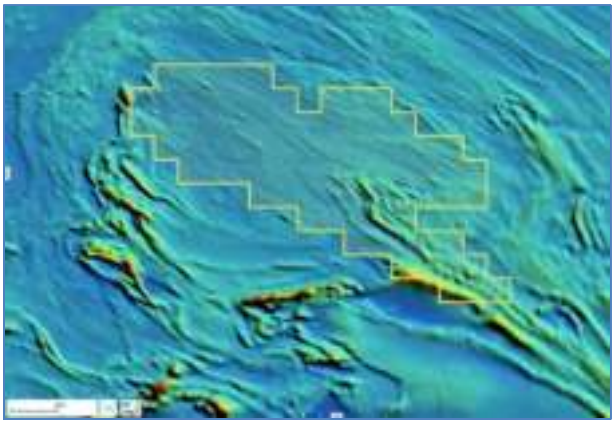


Figure 38 Gravity

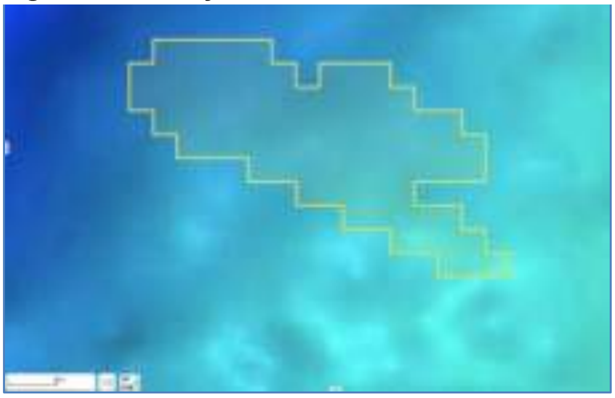
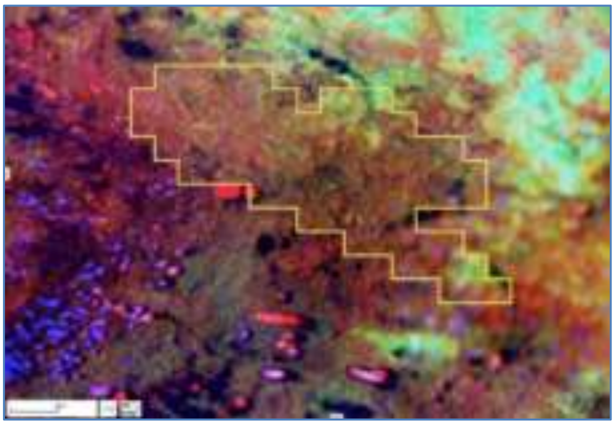


Figure 39 Radiometrics



6.3.5 GEOLOGICAL POTENTIAL FOR A HREE DEPOSIT

On the face of it the geology and geography of the Project area would indicate a **high potential** for the creation of a "ion-adsorption clay" (IAC) REE deposit (or lateritic REE deposit), similar to the Chinese exemplar deposits – and particularly for an HREE deposit as IAC deposits are enriched in the HREEs.

The area is underlain by granite, possibly highly differentiated given the re-working in the Orogen.

A thick in-situ residual clayey lateritic zone exists above the fresh granite – a "granite-derived regolith". The location in a wet sub-tropical climate allowed lateritisation to occur.

And the ancient low-relief topography would suggest both sufficient time to create significant lateritisation (and concentration of REEs) and the prevention of subsequent erosion (which might have removed the laterite).

7 COWALINYA PROJECT – PREVIOUS EXPLORATION

7.1 PREVIOUS EXPLORATION INTRODUCTION

Past relevant mineral exploration within, overlapping or nearby the Project EL is described in detail from ~2009 onwards. Comment is also made on a nearby project which undertook successful REE extraction metallurgy test-work on similar rocks. *This exploration was mostly brought to the Consultant's attention by HRE*.

Previous exploration is described for:

- Regional exploration prior to 2009 (a brief summary) – various companies and minerals.
- AngloGold Ashanti Australia Ltd (AngloGold) – 2009-2013 on the EL – for gold.
- Great Southern Gold Pty Ltd (Great Southern) – 2011-2017 on the EL – for gold.
- eMetals Limited (eMetals) – 2020-2021 south of EL – for REE.
- Salazar Gold Pty Ltd (Salazar) – 2011-2013 55 km ESE of EL – for gold, REE and iron ore.

Recent exploration objectives & sample recovery methods: The objective of most recent historic explorers at Cowalinya itself was finding **gold** (although they fortuitously assayed for other elements as well). Sampling used surface (<2 m deep) geochemical sampling (soil or auger sampling, also referred to as calcrete sampling) as a path-finder for more targeted (follow-up) shallow (~60 m maximum) air-core (AC) drill hole sampling of the soft alluvium and weathered basement on identified prospects. As all previous explorers failed to find sufficient gold mineralisation in the weathered zone to justify drilling deeper into the fresh basement (which would have required other and more costly drilling methods).

Highly applicable air-core drilling: Drilling at Cowalinya used the air-core method because of its speed, good recovery, relatively little sample contamination, and economy. The method is highly applicable to the Project's soft and clayey weathered material hosting the REE mineralisation.

Air-core is a drilling method somewhere between RC drilling and diamond-core drilling – which both produce relatively uncontaminated samples. RC (reverse circulation) drilling produces broken-rock samples by employing dual-walled rods to separate the air blown down the hole (to operate the hammer typically working with a button bit to break up the rock) between the outer tube and the inner tube from the mixed air and rock cuttings blown back up the hole inside the inner tube. Rock cuttings are recovered up the inner tube to shield them from contamination from the hole walls. Diamond core drilling recovers a nearly completely uncontaminated in-situ tube (core) of rock by typically employing a triple-tube wire-line system where the rock core is contained within an inner barrel fractionally smaller in diameter than the hollow diamond-embedded bit.

Air-core employs dual-walled rods (like RC) with a hollow blade bit (similar to diamond core). The blade bit can slice through clayey soft rocks (hence the method is fast). The specific bit design and tube arrangement causes the high-pressure air to recover the samples of soft rocks cored by the hollow bit (often in short tubes or cores) up the inner tube (hence samples are un-contaminated and recovery is high). The method works extremely with alluvium and soft rocks – such as with the weathered clayey zone above hard-rock basement at the Project. However the method could not drill the fresh hard basement rocks at the Project.

7.2 COWALINYA PROJECT – REGIONAL EXPLORATION PRIOR TO 2009

The Consultant is only slightly aware of exploration prior to 2009, and did not research it in depth. Previous explorers made reference to old exploration within surface paleo-channels seeking uranium and/or lignite and within underlying greenstone belts for gold. Exploration summarised here was contained in Great Southern's Report[91].

7.2.1 MOKEY / WESTERN COLLIERIES JV (~1982)

A JV between Mokey and Western Collieries undertook exploration for lignite coal in ~1982. Tertiary sediments were found to form a thin cover over the area. Thin and low quality lignite was found to be relatively common, however no economic deposits were discovered.

7.2.2 BHP MINERALS (2001)

BHP Minerals Pty Ltd (BHP) explored their Grass Patch Project / Albany-Fraser Project in ~2001. Exploration was

[91] Sharp, J., 5 April 2017. *Final surrender report E63/1409 & E63/1410*. Great Southern. 6, pp9.

for Broken Hill Type Zn-Pb-Ag mineralisation in the Proterozoic Fraser Mobile Zone. 95 drillholes were completed for 3,288 m. Weak Zn-Pb anomalism was detected. Several traverses were drilled. Depth to basement was found to vary significantly over short distances from 10-80 m. Basement lithologies included medium grained quartzo-feldspathic gneisses with high temperature low pressure metamorphism. Graphite was described as a common accessory mineral within the transition zone.

7.2.3 Strzelecki Metals (2009)

Strzelecki Metals Ltd (Strzelecki) explored their Beete Project within tenement E63/827 (or E63/1058-9), issuing a final surrender report in 2009. Their interest was in gold and nickel. Exploration was directed on historic workings in the Beete area (due west of this Project, near Salmon Gums). Bedrock geology was interpreted to be a sequence of Archean mafic, ultramafic, BIF and sedimentary units. 26 air-core drillholes were completed in 2004/05 for a total of 637 m. No significant anomalism was discovered. Strzelecki dropped the Project when Central Norseman Gold withdrew from their farm-in agreement.

7.2.4 Spitfire Oil (2009)

Spitfire Oil Pty Ltd (Spitfire) issued a final report on their Salmon Gums Lignite Project tenement E63/959 in 2009. Lignite was found to occur in an Eocene palaeo-channel which cuts through Archean basement. Spitfire completed 8 air-core drillholes for a total of 314 m. Six holes intersected lignite, however it was thought that an economic resource did not exist on the tenement.

7.3 Cowalinya Project – AngloGold Exploration (2009-2013)

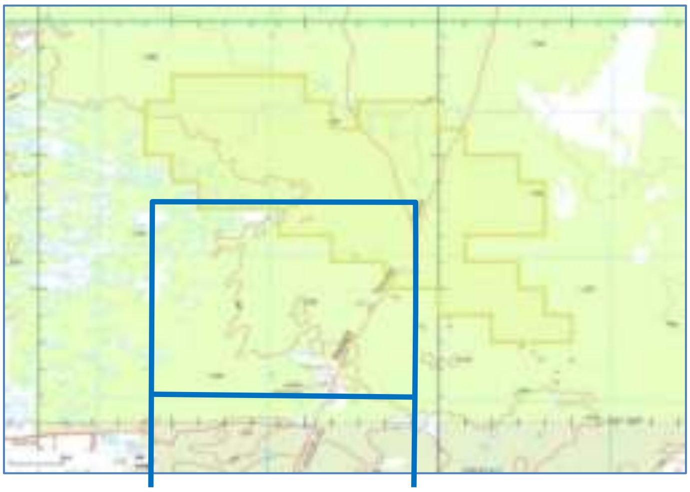
AngloGold Ashanti Australia Ltd's (AngloGold) conducted green-field gold[92] exploration over the SW part of HRE's tenement between 2009 and 2013. This local exploration was on the southern part of their much greater Viking 3 project, most of which was to the north of HRE's tenement. Part of AngloGold's exploration also concerns another local explorer's exploration mentioned here (eMetals, Section 7.5).

7.3.1 AngloGold Exploration Area

AngloGold's directly related exploration was within ELs E63/1271 and E63/1272 (directly north of 1271).

Figure 41 shows AngloGold's northern E63/1272 (upper blue rectangle) in relation to this Project's EL (yellow polygon). Only the NE corner of AngloGold's E63/1272 is seen to overlap the middle of the SW boundary of the Project EL, and extending about half-way in.

Figure 41 AngloGold's E63/1272



7.3.2 AngloGold Exploration Methods

AngloGold's exploration comprised:

- Historical data compilation.
- Geophysical data acquisition and interpretation.
- Shallow auger drill sampling (effectively near-surface geochemical sampling).
- Relatively shallow air-core (AC) drilling and sampling (to test the weathered bedrock saprolite (<50 m)).

[92] Hardwick, B., February 2013. *Tenement Surrender Report E63/1271 & E63/1272.* By AngloGold to WA DMP.

7.3.3 ANGLOGOLD GEOPHYSICS

Aero-magnetic/radiometric data was acquired from several sources. Surveys included:

- Airborne magnetic-radiometric DEM survey.
  - A large survey over the greater Viking Project was carried out by UTS Aeroquest in 2009.
  - The Total magnetic Intensity (TMI) over both ELs is shown in Figure 42.
  - Features in the NE corner of E63/1272 are within this Project area.
- Sub-audio magnetics survey.
  - A ground-based sub-audio magnetics survey was conducted over the Double Tank prospect (within E63/1272, see Figure 44) by Gap Geophysics Australia Pty Ltd in November 2011. The survey was similar to but in far finer detail than the airborne survey.
  - This was a ground based survey with the magnetometer sensor elevation at ~2 m. Traverse lines were E/W and spaced ~50 m apart N/S.
  - Results are shown in Figure 43 (which is at the same scale as Figure 42).
  - This survey was completely within HRE's Project E63/1972 area.

Figure 42 AngloGold TMI

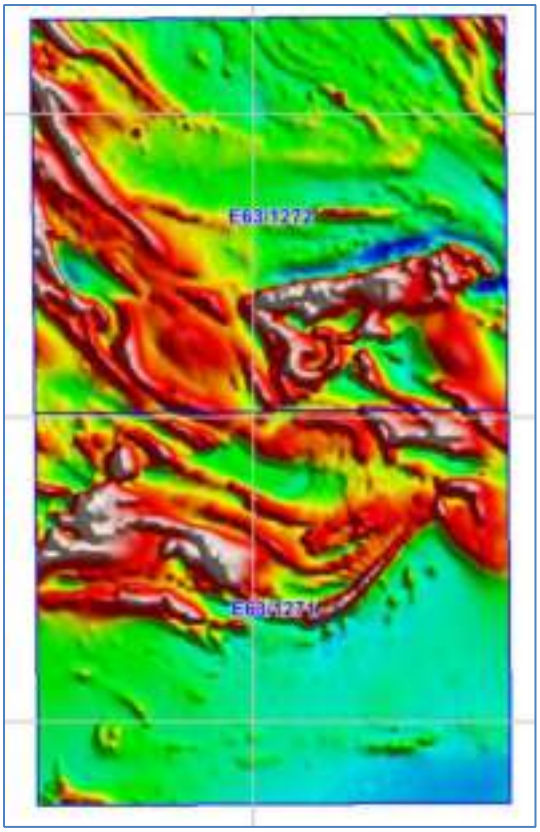
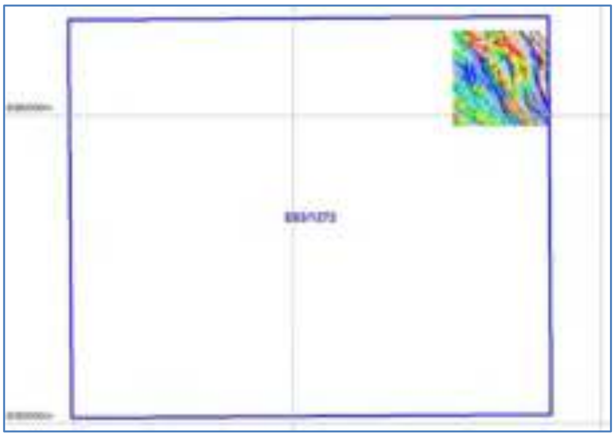


Figure 43 AngloGold sub-audio mag



7.3.4 ANGLOGOLD AUGER DRILL SAMPLING (GEOCHEM)

Auger drilling program: AngloGold's shallow auger drilling and sampling (effectively near-surface geochem) was conducted in 2011 and 2012 by Prodrill Pty Ltd. A total of 2,166 samples were taken. The drilling was initially done on a 200*1,000 m grid pattern (EW lines spaced 1,000 m apart N/S) over both ELs. An in-fill pattern of 50*250 m was selectively drilled in the NE corner of the northern E63/1272 (Double Tank Prospect). Holes were drilled to a 2.5 m maximum depth.

Auger sample locations are shown in Figure 44 by the grey dots. They are plotted above the 1:250,000 topography. The gold anomaly identified from the sampling (Double Tank) is labelled in the Figure. NB: Dots in the Figure represent all surface geochemical samples (grey) and drill holes (green) in the current DMIRS database. However within AngloGold's blue EL boundaries virtually all holes on the E/W lines are theirs.

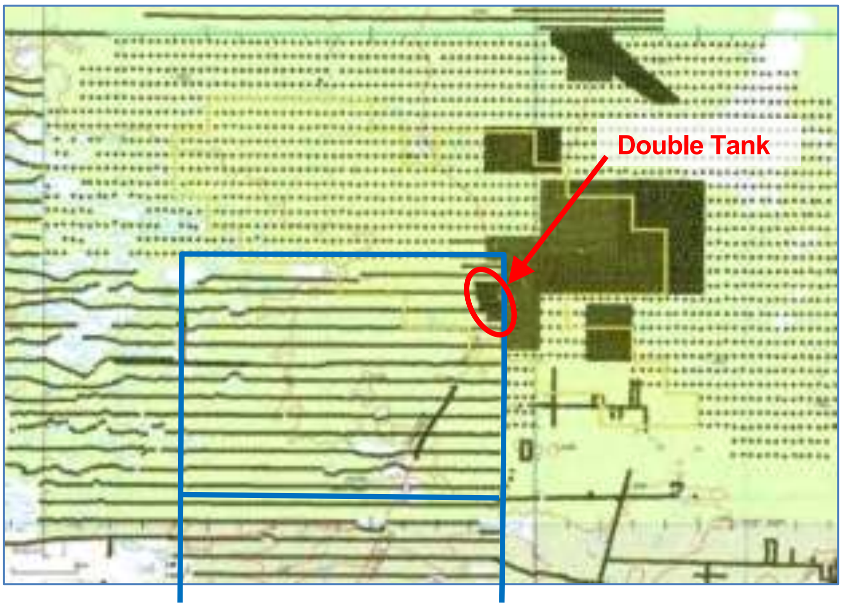
Auger sampling & analysis: In each hole a single sample was taken from the zone of greatest carbonate reactivity by testing with weak hydrochloric acid. Un-sieved samples weighed ~0.3-0.5 kg. Holes locations were recorded by hand-held Trimble Nomad GPS units. Standard and blank samples were routinely submitted approximately every 50 samples as part of quality control.

Samples were sent for preparation and analysis to Genalysis Intertek Laboratory Services (Genalysis) in Perth, WA. Preparation involved drying (in an oven at 100°) and then pulverising to a nominal size of -75 microns. The milled pulps were weighed out at 25 g and underwent stepwise aqua regia digestion in a temperature-controlled laboratory. The analyte was then presented to a graphite-furnace and AAS for gold analysis (method code B25/EETA or B/ETA, gold lower detection limits 0.1 ppb or 1 ppb respectively). They were then further analysed by

ICP mass spectrometry (B25/MS) and optical-emission spectrometry (method code B25/OES) to obtain multi-element (52) analyses (which included REEs). Maximum gold value encountered was 49 ppb.

Auger results: A discrete linear gold in surface calcrete anomaly (the **Double Tank** prospect), ~1*2 km in dimensions [Consultant unclear about orientation], was identified in the NE corner of E63/1272 (within this Project's E63/1972 tenement, approximately within the red oval in Figure 44). The anomaly was interpreted as coincident with an apparent sinistral [Consultant would interpret the movement as dextral] jog in the airborne magnetic imagery. No further surface anomalies were defined within the tenement.

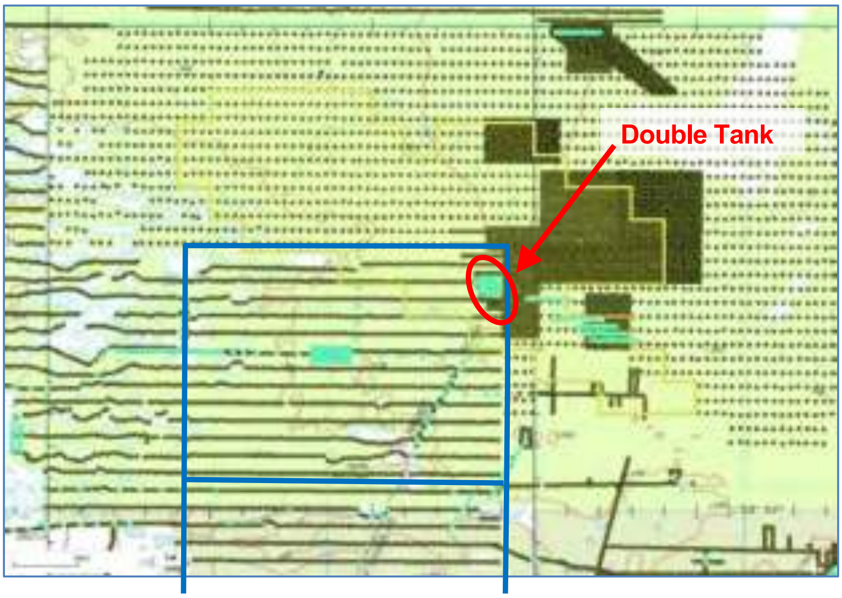
Figure 44 AngloGold auger drilling locations – grey dots



7.3.5 ANGLOGOLD AIR-CORE DRILLING

Air-core drilling program: AngloGold's relatively shallow vertical AC drilling and sampling program was to test the weathered saprolite zone of the bedrock. This implied depths <50 m where the weathered material was soft enough to drill. The program combined a few regional traverses along existing tracks (where holes were spaced ~1 km apart) with prospect scale (!50*250 m) pattern drilling at Gimpy Foot and Double Tank. AC hole locations are shown in Figure 45 by the green dots (which overly the grey Geochem sample points).

Figure 45 AngloGold air-core drilling locations – green dots



Drilling was undertaken by Bostech Drilling using a compact air-core rig (Bostech Drillboss 200) mounted on a light truck. A total of 155 vertical drill holes were completed for 6,522 m. According to Ross[93] 65 of those holes were inside the Project's tenement E663/1972.

Hole depths were determined by blade refusal – where the AC blade bit would become ineffective where it encountered fresher harder bedrock.

Air-core sampling and analysis:
Samples were collected in 1 m intervals down-hole – and laid out in rows on the ground for geological logging. 4 m long composite samples for analysis were collected by scoop from the individual 1 m sample heaps, each weighing ~3 kg. Standards and blanks were added into the sample sequence as part of the QA/QC process. Blanks, normally a quartz sand or un-mineralised granite / dolerite gravel, were inserted at the start of each hole. Standards were then inserted at a ratio of approximately 1-in-35 samples after the blank.

AC samples were sent for preparation and analysis to Genalysis in Perth, with sample prep similar to that for the auger samples. Drying was at a higher 120°. All samples were analysed for gold using AAS. These 4 m composite samples were assayed for at least some REEs (the A and B text drill hole assay files (for submittal to the Department) appear to have been poorly exported). The last (lowest) sample (EOH) in each hole was then further analysed by ICP and optical-emission spectrometry to obtain multi-element analyses (which included all REEs).

[93] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Pp5.

Where anomalous results were encountered in the 4 m composites 1 m re-samples were taken and submitted for a low-level aqua regia (method B25/ETA) or fire-assay (method FA25/SAAS using a 50 g charge) analysis.

7.3.6 AngloGold results & conclusion

Air-core results: AngloGold's regional air-core hole identified low level gold anomalism in two adjoining air-core holes (Gimpy Foot prospect) at the interface between carbonaceous sediments and reduced saprolite material. Follow-up drilling produced similar results with a peak of 4 m @ 0.28 g/t golds in hole SGA213. The gold anomalism was interpreted to represent low-level transported gold migrating down into the saprolite.

Prospect scale air-core drilling at the Double Tank prospect (within this Project's tenement, and within the red oval in Figure 45), following-up the 1*2 km surface calcrete anomalism, was competed in two iterations but failed to identify any significant gold anomalism in the weathered basement saprolite below the calcrete.

Conclusion: The poor gold results caused AngloGold to surrender both ELs in 2013. It does not appear that AngloGold studied the REEs in the area.

7.3.7 AngloGold data

All of the data files listed in Appendix 1 of the AngloGold Surrender Report[94] were collated and available in the Client's data room. The file listing is given in Appendix 2 – Project Information listing.

NB: The Consultant very briefly perused the data files and gained the impression that 1) they were comprehensive and 2) they represented the mapped data. However the Project scope did not extend to a detailed look at the data, such as databasing it to facilitate studying the distribution of the REE assays.

7.4 Cowalinya Project – Great Southern exploration (2011-2017)

Great Southern Gold Pty Ltd (Great Southern) conducted green-field exploration for gold[95] on the eastern parts of HRE's tenement between 2011 and 2017.

Rationale: Great Southern noted that there existed significant potential for the discovery of economic metal deposits as the region as a whole was relatively unexplored. Their exploration rationale in the area was that basement mineralisation should be visible in surface samples, depending on the thickness of cover. Exploration was focussed on the gold mineralisation potential of the Proterozoic/Archean basement rocks.

Known geology: Geology within the tenements was poorly known with limited mapping available. Outcrop shown on the GSWA 250 k maps within the tenements included Quaternary alluvium, colluvium and lacustrine deposits; Tertiary residual and reworked deposits; and Proterozoic granite and granitic gneiss.

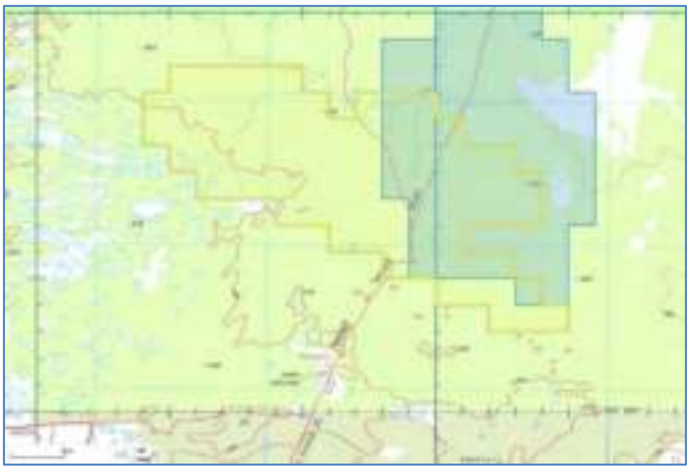
7.4.1 Great Southern exploration area

At surrender in 2017 Great Southern's exploration was within ELs E63/1409 (~42 km^2) and E63/1410 (~157 km^2).

Figure 46 shows Great Southern's two ultimate tenements (outlined and shaded in blue) in relation to this Project's E63/1972 (yellow polygon). E63/1409 is the tall thin western tenement, E63/1410 the larger eastern one.

In 2017 Great Southern's tenements were coincident with roughly the eastern half of E63/1972. Earlier on Great Southern held ground over a wider area, particularly to the west and nearly completely covering E63/1972.

Figure 46 Great Southern's E63/1409-1410



[94] Hardwick, B., February 2013. *Tenement Surrender Report.* AngloGold. Appendix 1, pp27.

[95] Sharp, J., 5 April 2017. *Final surrender report E63/1409 & E63/1410.* By Great Southern Gold to WA DMP.

7.4.2 GREAT SOUTHERN EXPLORATION METHODS

Great Southern's exploration comprised:

- Historical data compilation.
- Regional shallow geochemical (soil/calcrete) sampling.
- Follow-up relatively shallow air-core drilling and sampling.

7.4.3 GREAT SOUTHERN GEOCHEMICAL SAMPLING

Great Southern's shallow geochemical (Geochem) sampling was also termed "soil" and/or "calcrete" sampling. Assay files exist for both, with differing elements assayed. The soil file does not contain REE assays; the calcrete (and calcrete and soil) files do contain REE assays. It is not clear to the Consultant exactly how the geochemical sampling was undertaken, whether by hand from small pits or whether by auger drill as done by Anglo Gold. The Consultant presumes it was done by auger.

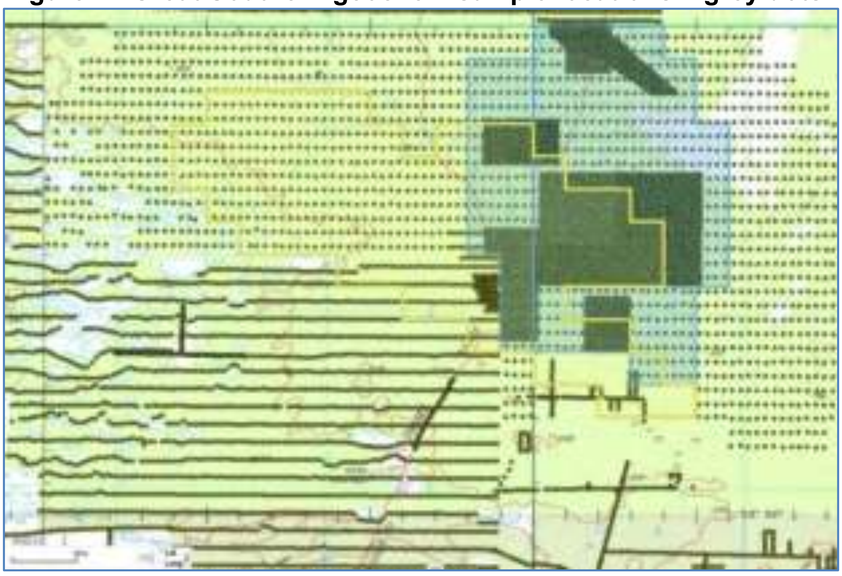
2011-2012: A first pass reconnaissance geochem sampling program was based on a grid sampling pattern of 400*800 m (E/W*N/S). During the 2011-2012 period 647 samples were collected on within the tenements. The widest spaced grey dots in Figure 47 show Great Southern's 400*800 m sample points – they nearly cover the whole of this Project's E63/1972 (only leaving out the very southern blocks). Samples were mostly collected on the grid pattern with the intention of in-filling any anomalies detected with later work programs. All samples collected were sent for gold and multi-element analysis (using an Aqua Regia digest) to Genalysis Laboratories in Perth.

Raw gold values ranged from 0-26 ppb gold. Values over 10 ppb were designated anomalous and three anomalies were found to be significant enough to warrant follow up work. Gold anomalism did not show a clear connection to structural elements evident in the available magnetic data. A roughly east-west magnetic feature, attenuated at its western end, was near the location of gold anomalism. The magnetic pattern was seen to become disrupted, with inflected magnetic highs, adjacent to the anomalies. However nothing was particularly evident as being associated to the gold anomalism detected. Given that the sampled area had Tertiary cover and a known layer of lignite the low level gold anomalism found was deemed worthy of further investigation.

2012-2013: Geochem sampling in 2012-2013 of calcrete in E63/1409 was unsuccessful and a portion of the tenement (presumed the western parts) was surrendered in 2012. In-fill sampling was undertaken on both ELs on a 200*200 m grid. Those closer spaced sample areas are seen in Figure 47 where the individual grey dots become indistinguishable at small scale. A total of 2,031 samples were collected. Those samples were analysed as before by Genalysis Laboratories.

Two in-fill areas were located in E63/1409 and three in E63/1410; however, both E63/1409 in-fill sets crossed over into E63/1410. Those 5 areas are seen in Figure 47 as the rectangular areas of the dense sampling subsequently done in them. Gold results across E63/1409 and E63/1410 were 0-30 ppb gold. Multiple anomalous areas were identified. The majority of the anomalies are within the Biranup Complex, with one gold and copper anomaly within the Yilgarn Craton. The anomalies trended with the regional magnetics, generally trending with the lineations.

Figure 47 Great Southern geochem sample locations – grey dots



2013-2014: In-fill geochemical sampling programs were designed over a number of grid patterns: 200*200 m, 100*200 m and 100*400 m (directions uncertain). The first round of 2013-2014 sampling was undertaken by North Eastern Gold Exploration (NEGE) in Nov-Dec 2013, with a calcrete and soil sample collected from each sample point. A total of 2,660 samples were collected, 1,330 calcrete and 1,330 soil. Calcrete samples were sent to Genalysis Laboratory for analysis via Aqua Regia Digest; the soil samples were retained for future analysis.

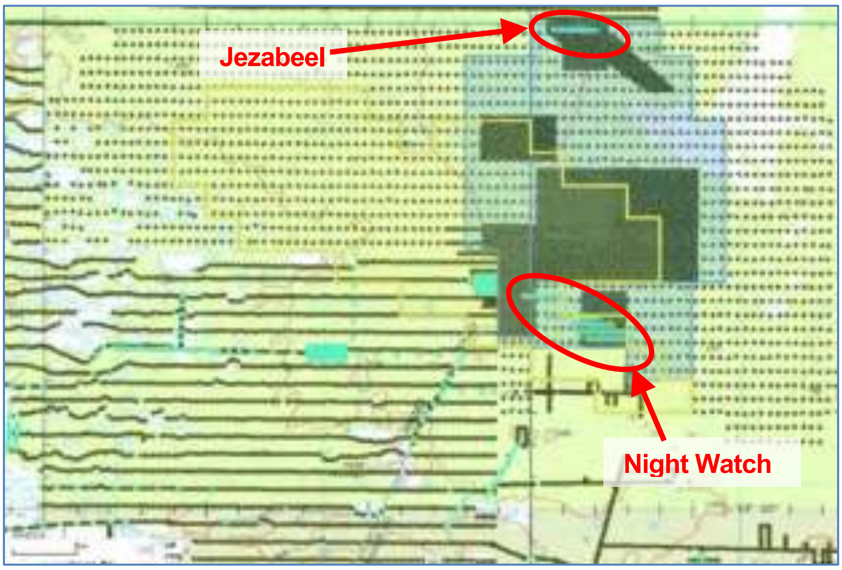
2014-2015: The 2014 in-fill geochemical surface sampling in E63/1410 was completed in the 2015. A total of 501 calcrete, and 501 soil samples were collected. Calcrete samples were sent to Genalysis Laboratory for analysis.

The soil samples previously collected were now analysed in-house with a portable XRF. Two areas of gold ± Ni and/or Cu were identified on E63/1410. An air-core drilling program was designed to test these two areas.

7.4.4 GREAT SOUTHERN AIR-CORE DRILLING

2015-2016: Follow-up air-core drilling commenced in 2015 and consisted of 99 planned holes across two prospects – 80 holes at **Night Watch** (SE of AngloGold's Double Tank prospect) and 19 holes at **Jezabeel** (to the north). These prospects are labelled in Figure 48, and the drill hole locations are shown by the green dots superimposed on the grey geochem sample points.

Figure 48 Great Southern air-core drilling locations - green dots



The 2015 drilling program was undertaken by Drillpower (Parlin Pty Ltd) for a total of 1,562 m over 56 holes. The holes were drilled to refusal, with a final hole depth (end-of-hole or EOH) range of 12-48 m and an average depth of 28 m. Air core samples were collected continuously down-hole on a 3 m composite basis, while EOH chips were sampled separately. The EOH chips were collected in chip trays and sent to for petrological study. Both the EOH and composite samples were sent to Genalysis for assaying.

2016-2017: The 2015 air-core drilling program at the two prospects was completed in 2016, adding 1,061 m. Holes were sampled as before and analysed at Genalysis.

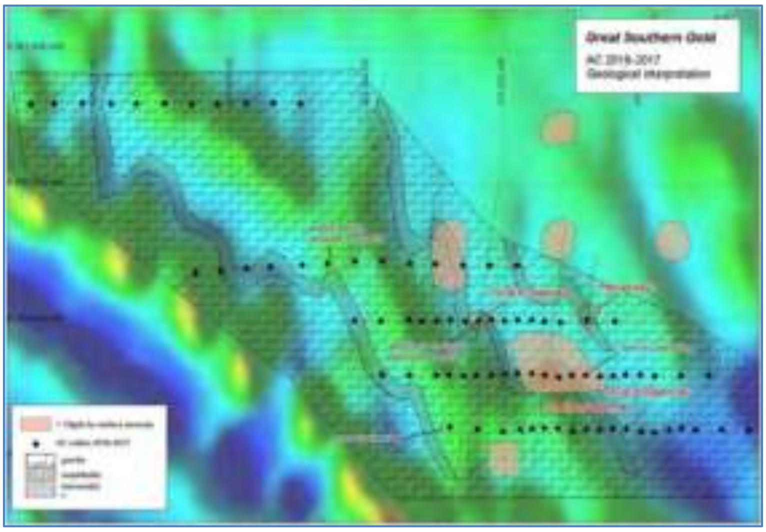
AC samples & assays: In 2015 there were 531 composite samples taken, 55 EOH samples taken, and 37 samples inserted for QA/QC. In 2016 there were 369 composite samples taken, 44 EOH samples taken, and 28 samples inserted for QA/QC.

Both the composite and EOH samples were sent to Genalysis for four acid digestion with ICP finish. The continuous down-hole composites were assayed for a 30 element suite – which included the LREEs lanthanum and cerium. The EOH were assayed for a 60 element suite – which included all REEs and associated elements). Additional Au, Pt and Pd analysis by fire assay was requested for EOH samples

7.4.5 GREAT SOUTHERN RESULTS

Air-core results – Night Watch: Dominant rock types encountered at Night Watch were medium to coarse grained granitic gneisses, including tonalites and aplites (fine grained granites). Fine grained meta-dolerites (amphibolites) with variable magnetic susceptibility occur regularly throughout the prospect.

Figure 49 Great Southern's Night Watch geol interpretation



The high magnetic features were generally not related to mafic units, but more likely represent magnetite bands within the felsic formations. Magnetic susceptibility measurements performed on the EOH sample piles largely confirmed this. Nonetheless the highest magnetic susceptibility value was taken (in NWAC028) in a late meta-doleritic dyke.

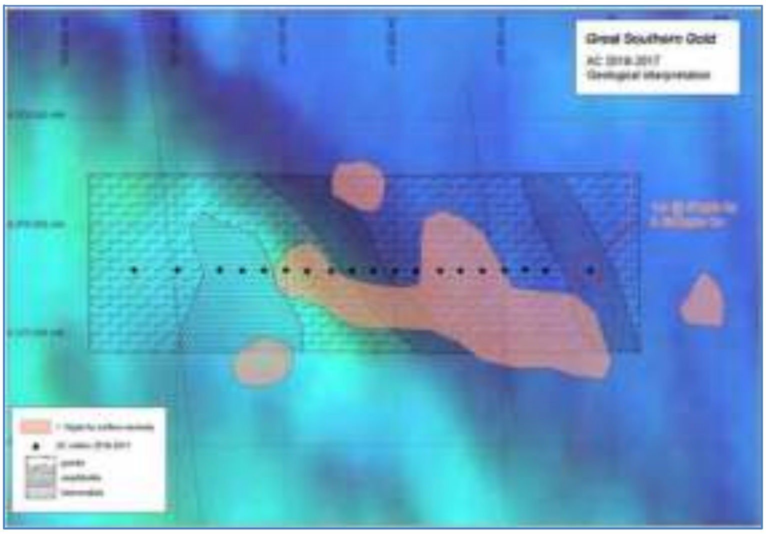
Results from the downhole composites and EOH assays confirmed the presence of some minor mineralization in holes 011 and

049 at the saprock/fresh rock interface, hosted in mafic to intermediate sills within the granite gneisses. And while the presence of gold seem to be dependent of the host rock, the precise location of the gold mineralization within the mafic band appeared to be controlled by the NNE/SSW trending structures identified on the magnetic image.

Figure 49[96] shows Great Southern's geological interpretation for the Night Watch prospect. The highest gold occurrences happen where the NNE/SSW structures intersect the mafic bands. Because the thickness of the mafic bands is probably very limited (~50-100m) the gold expression at surface for this setting (i.e. cross-cutting structures intersecting thin mafic bands) would result in small patchy Au anomalies (as observed throughout most of the tenement area).

Air-core results – Jezabeel: At Jezabeel (Figure 50), though the magnetic image suggested a more uniform geology, the same lithologies were found as those at Night Watch, namely amphibolites and a felsic gneiss. In addition medium grained hornblende bearing intermediate ortho-gneisses were also identified. As at Night Watch a magnetic high ridge seemed to correspond to magnetic bands contained in the felsic gneisses. At Jezabeel only the EOH sample of JBAC018 returned a gold anomaly (50 ppb). Sulphides were clearly identified at JBAC018 with significant alteration.

Figure 50 Great Southern's Jezabeel geol interpretation



7.4.6 GREAT SOUTHERN CONCLUSION

Conclusion: The poor gold results using geochemical surface sampling and AC drilling failed to identify any areas of coherent gold anomalism worthy of further exploration. This caused Great Southern to surrender both ELs in 2017. It does not appear that Great Southern studied the REEs in the area (although they assayed for them).

7.4.7 GREAT SOUTHERN DATA

All of the data files listed in the List of Attachments of the Great Southern Final Surrender Report were collated and available in the Client's data room. The file listing is given in Appendix 2 – Project Information listing.

NB: The Consultant very briefly perused the data files and gained the impression that 1) they were comprehensive and 2) they represented the mapped data. However the Project scope did not extend to a detailed look at the data, such as databasing it to facilitate studying the distribution of the REE assays.

7.5 COWALINYA PROJECT – EMETALS EXPLORATION (2020-2021)

eMetals Limited (eMetals) greenfield exploration for REEs on two tenements just to the south of this Project (E63/2049 & 2066) commenced with eMetal's 100% acquisition of SOC Resources Pty Ltd (SOC) on ~4 February 2021[97]. The tenements are held by SOC, and the project acquired was known as the "Cowalinya Ionic Rare Earth Project" (Cowalinya Project). *HRE confirms that it is not associated with eMetals and that the Project name similarity is simply a coincidence*.

The Consultant notes that eMetals subsequently intended to acquire another REE project in the local area in November 2021 – with the intended 100% acquisition of Salmon Gums Minerals Pty Ltd (Salmon Gums)[98]. Salmon Gums hold tenement E63/2127 ~3 km to the west of this Project and E63/2126 ~10 km to the east of this Project. Details on Salmon Gums's Project are sketchy and it is not summarised here.

eMetals mention, with regard to their acquisition of Salmon Gums, the relatively close proximity of their project to Mount Ridley Mines Limited (MRM) to the south. MRM hold a large package of tenements around Mt Ridley itself (red cross in Figure 51), which is ~50 km south of this Project MRM had recently discovered REE mineralisation

[96] Sharp, J., 5 April 2017. *Final surrender report E63/1409 & E63/1410*. Great Southern Gold. Fig 3, pp14.
[97] eMetals Limited, 4 February 2021. *Acquisition of Cowalinya Ionic Rare Earth Project*. Press release.
[98] eMetals Limited, 19 November 2021. *Acquisition of Salmon Gums REE Project & Capital Raising*. Press release.

(0.1% TREO and higher) in a belt extending NE in lateritic clay above granitoid rocks[99].

7.5.1 EMETALS EXPLORATION AREA (SOUTH OF HRE'S)

eMetals holds two adjacent tenements (E63/2049 & 2066) which are slightly south of HRE's tenement. Figure 51 shows the tenements shaded in blue, E63/2049 to the north and E63/2066 immediately to the south).

HRE's tenement E63/1972 (shown with the yellow polygonal boundary) is ~6 km NE of the northern boundary of E63/2049, directly along the Fraser Range Road.

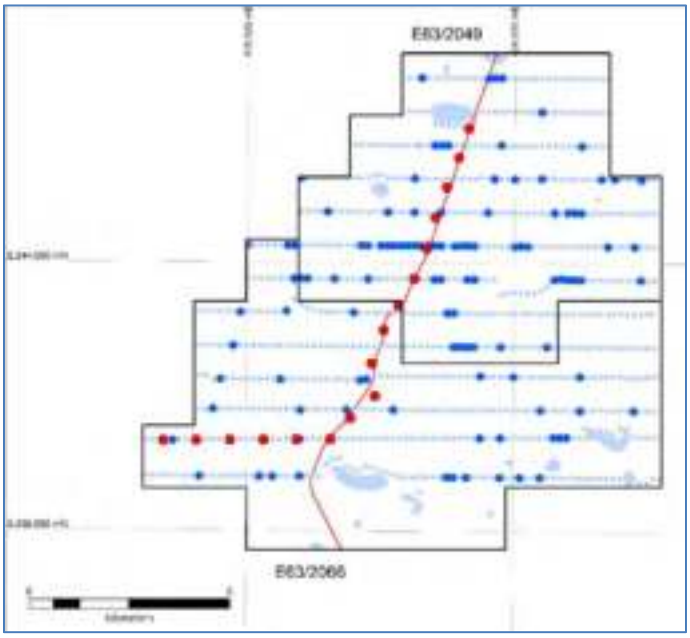
Figure 51 eMetals E63/2049 & 2066

7.5.2 EMETALS PREVIOUS EXPLORATION

The bulk of exploration on eMetals's tenements is historic and was performed by AngloGold for their Splinter Project. That exploration is of the same era and intent as that described about AngloGold in Section 7.3. That exploration was sampling through surface auger of calcrete and air-core drilling of weathered bedrock and so is seen at the bottom of AngloGold's exploration Figure 44 and Figure 45.

Auger calcrete: Figure 52[100] shows AngloGold auger sample points (blue dots) within eMetals's tenements. Light blue areas mark salt lakes. Red dots mark the air-core drilling (see below). Auger calcrete sampling was carried out on E/W lines. Details of the auger drilling and sampling are presumably the same as described for AngloGold in Section 7.3.4. An important detail is that this sampling was shallow (<2.5 m).

Figure 52 AngloGold auger holes in eMetals ELs



Samples were assayed for a 52 element suite (included (some) REEs) and separately for gold. eMetals reported that AngloGold assays up to 1,114 ppm TREO+Y with a large number of assays >180 ppm[101]. In Figure 52 the small light blue dots mark auger sites with <180 ppm TREO+Y, the larger blue dots mark sites of 180 to 1,110 ppm TREO+Y.

Subsequent interpretation of this REE mineralisation by eMetals (following their own air-core drilling, see below) was that it probably relates to younger marine sediments and not to basement granites.

Air-core: Figure 53[102] shows AngloGold's air-core drilling locations and EOH assays. A total of 17 air-core holes were drilled within the eMetals's tenements (although GeoView shows more).

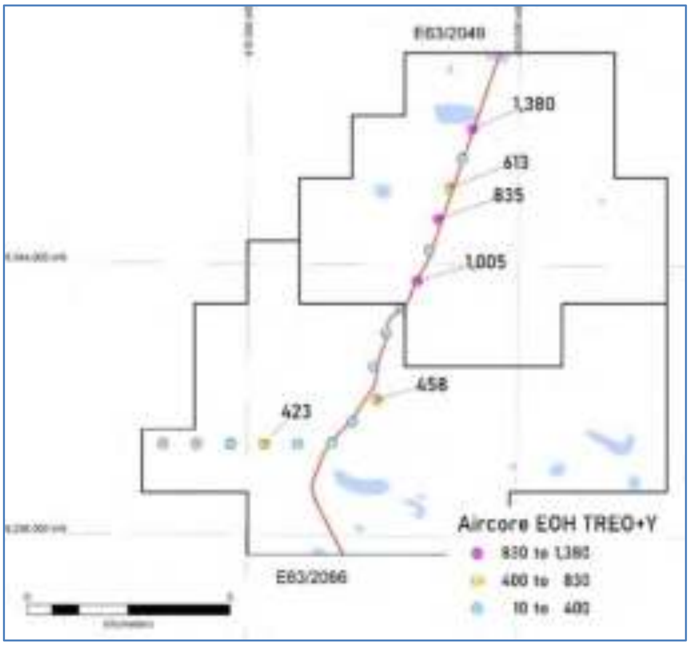
The air-core drilling was carried out along existing tracks or roads through the area. In Figure 53 the dots mark air-core drilling sites, and the red line is the Fraser Range Road. Hole spacing appears to be ~1 km.

[99] Mount Ridley Mines, mid-January, 2022. Web page https://mtridleymines.com.au/mt-ridley-project
[100] eMetals Limited, 4 February 2021. *Acquisition of Cowalinya Ionic Rare Earth Project*. Press release. Fig 2, pp3.
[101] eMetals Limited, 4 February 2021. *Acquisition of Cowalinya Ionic Rare Earth Project*. Press Release. Pp2, last para.
[102] eMetals Limited, 4 February 2021. *Acquisition of Cowalinya Ionic Rare Earth Project*. Press release. Fig 3, pp4.

Air core drilling was undertaken to geochemically survey the region for gold enrichments and to characterise bedrock lithology. Drill holes were sampled for gold from surface to end of hole with 4 m composites. Holes were not comprehensively sampled for REE's. Only the end of hole (EOH) sample was submitted for full characterisation of a 52 element suite, which included (some) REE's.

Within the tenements 6 EOH samples returned results of >400ppm TREO+Y with the maximum result being 1,380 ppm (0.13%) TREO. Higher EOH results are annotated in Figure 53. The dots are colour-coded on grade according to the legend at the bottom right of the Figure.

Figure 53 AngloGold air-core holes in eMetals ELs



7.5.3 eMetals Air-core Exploration

Air-core drilling: In order to test for ionic clay REE mineralisation, eMetals completed 29 vertical air-core drill holes[103] in May 2021 utilising a slimline RC rig with a hammer bit. The northernmost 10 holes were spaced ~200 m apart, the central 15 holes were spaced ~400 m apart, and the southern 5 holes were spaced ~800 m apart[104]. Drilling was completed to the base of oxidation (weathering).

Hole locations within the eMetals tenements are shown in Figure 54[105], and all were along the Fraser Range Road. The Figure's background is aerial photography, which highlights bush-fire scars.

Figure 54 eMetals air-core hole locations

Geology: Drilling encountered a variable veneer of transported cover including aeolian and marine sand, lacustrine clays and lignite, lateritised and silcretised sands and gravels, and older residual materials. The cover thicknesses ranged from 3 to 65 m (but was mostly 17-45 m). The transported cover overlay a 20-70 m thick zone of lower saprolite. The lower saprolite was partially to mostly weathered Archaean gneisses which were dominated by schistose, micaceous biotite monzogranite. eMetals found that the regolith geology was more complicated and thicker than expected from historical logging. In particular the saprolite profile was incomplete, with the upper saprolite likely stripped off during the Plantagenet Group marine transgression. *The Consultant would venture that eMetals might have included a portion of "upper" saprolite within their "cover" layer.*

The near ubiquitous marine and estuarine sedimentary young cover demonstrated to eMetals that AngloGold's original anomalous surface auger REE results over their tenement were sourced from the marine cover sequence and very little from bedrock or emanations from bedrock. This interpretation could cause them to re-assess their interpretation of air-core analysis in future.

[103] eMetals Limited, 15 June 2021. *Exploration update*. Press release. Pp5, last para.
[104] eMetals Limited, 15 June 2021. *Exploration update*. Press release. Table 2, pp11.
[105] eMetals Limited, 15 June 2021. *Exploration update*. Press release. Fig 5, pp6.

Sampling and assaying: Holes were sampled on a 2 m composite basis via scoop, with the end of hole sample submitted for a comprehensive multi-element assay. Samples were despatched to Intertek Genalysis for preparation and assaying. eMetals REE assaying schema was based on replicating Salazar Minerals's REE extraction metallurgical work (reported in Section 7.6.7). Composite samples were dried, split and pulverised (to -70 µm) and assayed via two methods:

- a 4 acid digest for analysis of 48 (58?) elements plus REE's, and
- a partial leach via a dilute hydrochloric acid method (Intertek TL7) for analysis of 53 (58?) elements including REE.

The aim of this assay method was to provide a near total digestion of REE's via the 4-acid digest with the partial digest intended to dissolve only soluble or loosely bound REE's. eMetals expected that an IAC deposit would show a marked difference between the two methods, with the partial leach expected to recover 0-60% of the REE of the 4 acid digest. A non-negligible partial leach result would provide sufficient evidence of soluble REE mineralogy and provide the basis to undertake further drilling and proceed to further metallurgical and mineralogical studies.

The REE gadolinium (Gd) was not reported in the TREO results as it was not reported in the TL7 partial leach and therefore could not be compared between the two methods. All TREO+Y (TREO plus yttrium oxide) values were therefore calculated as Ce, La, Nd, Pr, Er, Eu, Dy, Sm, Tb, Tl, Tm, Yb and Y with elemental ppm converted to oxides. TREO+Y were reported for both 4-acid digest and TL7 partial digest methods.

Figure 55 eMetals air-core drilling – significant TREO intersections

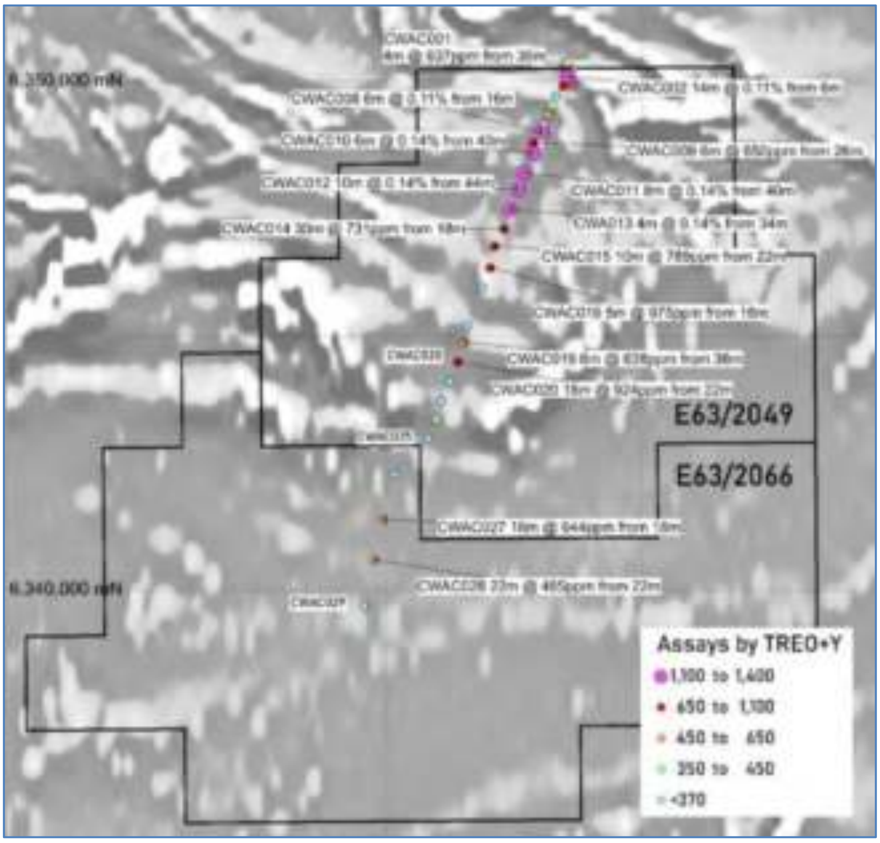


Figure 55[106] displays annotated significant TREO+Y composite intersections[107] based on the 4 acid digest. They are plotted above 1VD magnetics.

Intersections were calculated from samples >300 ppm (excluding Gd) and with a minimum thickness of 4 m and maximum 2 m of internal dilution (from samples <300 ppm).

The dots are also colour-coded on grade according to the legend at the bottom right of the Figure.

LREEs dominated. Cerium comprised 25-35% of TREO+Y on average, La 10-15% and Nd-Pr a relatively constant 21-23%. Yttrium oxide comprised approximately 18-25% on average with some outliers to 65%.

HREE therefore comprised ~2-15%, dominated by Dysprosium (max 95 ppm), Erbium (max 63 ppm), Samarium (max 104 ppm), Terbium (max 14 ppm) and Ytterbium (max 6 ppm).

The Consultant would assess that results would appear to have been very good. Of the 29 holes there were 25 with composites >300 ppm TREO+Y. There was also 15 (~50%) holes with composites >600 ppm, and 6 (~20%) with composites >1,000 ppm (0.1%). The highest two grade composites were 0.14%. >300 ppm composite thicknesses were in the range 4-30 m with an average ~10 m. >1,000 ppm composites thickness average was 8 m.

Most of the better composite intersections were in the northernmost holes (also the northernmost part of the tenements) – and there the surface alluvium was also thickest (~30 m and more). That areas corresponds to a topographic low, possibly the course of an old paleochannel.

[106] eMetals Limited, 29 July 2021. *Quuarterly activities report to 30 June 2021*. Press release. Fig 6, pp7.
[107] eMetals Limited, 29 July 2021. *Quuarterly activities report to 30 June 2021*. Press release. Table 1, pp8.

7.5.4 EMETALS CONCLUSIONS

On early AngloGold data: eMetals considered that the AngloGold auger drilling identified an anomalous concentration of REEs within the surface material (open in all directions). eMetals nevertheless also identified that AngloGold's auger and air-core datasets do not adequately test the full regolith profile for ionic clay type REE mineralisation and that the full regolith profile must be assayed to determine if REE's have accumulated in the saprolite clays. They planned to test this with air-core drilling.

The Consultant would hazard that the distribution of the blue dots in Figure 52 follows the NW/SE trends identified by HRE as following bedrock magnetics. eMetals also characterised the auger calcrete assays as "defining the laterite". The Consultant would dispute this as "calcrete geochem" sampling was very shallow and the "laterite" is deeper than auger can reach in most places. Auger therefore characterises the alluvium and surface calcrete. There appears to be little (or no clear) link (here and elsewhere) between REE in calcrete and REE in laterite.

After inclusion of eMetals drilling data: eMetals now considers that REEs are present in several associations:

1. Anomalous concentrations in discontinuous, relatively thin, layers within the cover sequence – enriched in excess of the underlying basement saprock. This layer has very low HCl extractability (4-6%) and is inferred to be composed of detrital heavy minerals such as ilmenite, rutile, allanite, monazite etc.
2. Broad but isolated zones of anomalous REE's in lower saprolite biotite-muscovite gneiss (200-600 ppm) with low to moderate HCl extractability (25-50%).
3. Discrete zones of highly anomalous REE's in saprock to fresh rock (0.10-0.14%) with moderate to high HCl extractability (40-60%) likely to be carbonates, fluorocarbonates or soluble REE phosphates.

They appreciate that the nature of the REE mineralogy is unknown and that further work would be required to characterise the deportment of REE's.

eMetals consider that the assay schema developed was successful at demonstrating a difference between total and partial leach digestions that relate to soluble mineralogy in the bedrock saprolite. This schema was highly effective at screening samples for soluble mineralogy and could be used more widely to detect IAC's or soluble carbonate-type REE's. They noted that the TL7 digest is a partial digest and does not represent metallurgical recoveries of rare earth elements, instead it simulates this. The extractability is therefore likely to be a minimum that could be achieved by a dedicated metallurgical investigation.

eMetals consider that the depth of cover in the tenement area was greater than expected and provides a significant hurdle to delineation of a significant economic opportunity given the narrow, discontinuous and varied REE mineralisation present.

7.6 COWALINYA PROJECT – SALAZAR EXPLORATION (2011-2013 – 55 KM S OF HRE)

Salazar Gold Pty Ltd (Salazar) principally explored for gold, REEs and iron ore as part of their Esperance Splinter Project on tenements ~55 km ESE of Cowalinya between 2011 and ~2013 (it is not clear when or if this Project ended).

Salazar's exploration rationale was based on the area's geological similarities with the Tropicana gold belt to the north-east; possible presence of REE enriched granitoids that could host supergene ionic-adsorption clay REE deposits like the Chinese deposits; and hope for iron deposits in granite-orthogneiss-paragneiss complexes like those of eastern Canada and the USA. They were also mindful of the proximity to the coastal setting Eucla Basin and so the possibility of heavy mineral sands, lignite and secondary uranium in paleo-channels.

Salazar's work therefore has direct relevance here in that 1) they were exploring for REEs in a similar geological environment (granitic basement, overlying clayey REE-bearing saprolite) and 2) they carried out metallurgical test-work on the saprolite which showed REEs could be extracted simply, effectively (90% TREE recovery to solution using 10% HCl) and economically. Details of the metallurgical test-work are summarised in Section 8 below.

7.6.1 SALAZAR EXPLORATION AREA

Salazar's initial exploration was in tenement E63/1415 (blue polygon on right in Figure 56). This is ~55 km ESE of HRE's E63/1972 (yellow polygon at top centre in Figure 56). Subsequently Salazar acquired further adjacent tenements to the south and east.

Figure 56 Salazar's E63/1415

7.6.2 SALAZAR GEOLOGY

At surface the Cowalinya and Salazar Projects are both covered almost exclusively by alluvium or residual weathering.

Cowalinya and Salazar bedrock is also similar in being granitic in origin.

However the projects exist in different bedrock Zones of the Albany-Frazer Orogen.

In contrast to Cowalinya's location in the centre of the older Biranup Zone of meta-granitic and gneissic rocks (pink area in Figure 57) the Salazar EL lies just inside the younger Nornalup Zone meta-granitic meta-gabbro interlayered rocks to the SE (mauve area in Figure 57).

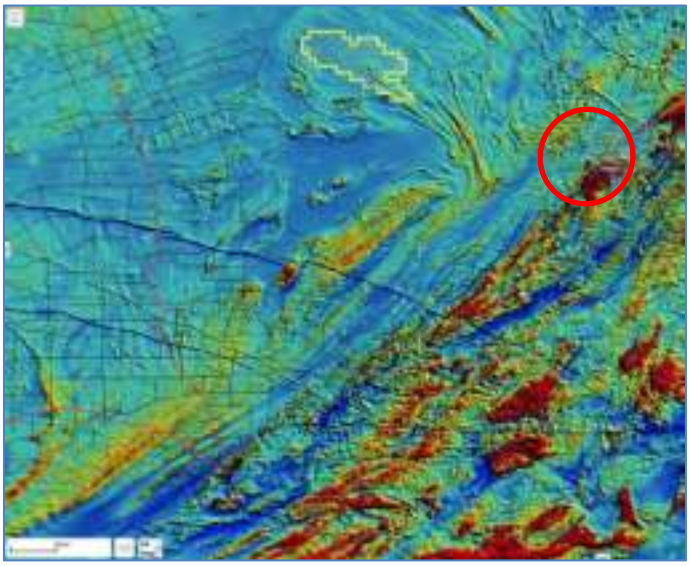
Locally Salazar encountered granitic gneisses and schists intruded by relatively undeformed magnetic granites and quartz diorites.

The differing bedrock geology between Cowalinya and the Salazar area is illustrated by the regional geophysical magnetics, shown in Figure 58.

Magnetics at Cowalinya (yellow polygon) in the older Biranup Zone are fairly smooth and low intensity shaded light blue. Salazar's Project (blue polygon within red oval) are by contrast in a high intensity red shading. Figure 58 is of exactly the same area as Figure 57.

Figure 57 Salazar regional bedrock geology

Figure 58 Salazar regional magnetics



7.6.3 SALAZAR EXPLORATION METHODS

Salazar's exploration in 2011-2012 comprised:

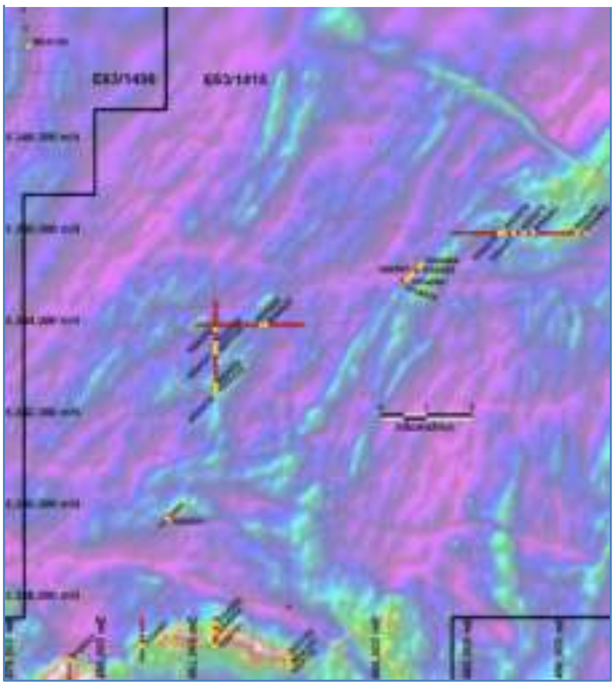
- Historic data compilation and research.
- Reconnaissance rock-chip sampling and re-sampling of Azure's air-core drill cuttings.
- Air-core drilling following-up on Azure's drilling.
- Metallurgical test-work for REEs.

7.6.4 SALAZAR RE-SAMPLING OF AZURE'S AIR-CORE DRILLING

Salazar report[108] bedrock granitic gneiss rock-chip assays of 300-500 ppm TREO, biotite-muscovite schist assays up to 3,000,ppm TREO, and intrusive magnetic granites commonly assaying 1,000 ppm TREO.

Salazar re-sampled the cuttings from parts of an historical air-core drilling program carried out by Azure Minerals Ltd (Azure). Figure 59[109] marks the Azure drill holes (hole name prefix NSA) in yellow that were re-sampled by Salazar. Azure was previously Nickel Australia Ltd and operated the Splinter Project from 2004 to 2008, initially looking for gold in calcrete and IOCGU deposits. Salazar references Kelly reports from 2005 to 2008 report[110].

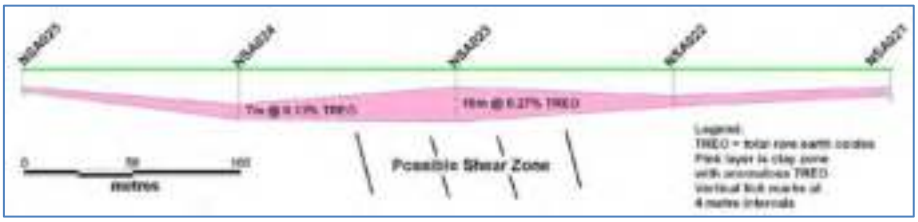
Figure 59 Azure holes re-sampled by Salazar



Azure's drilling was into the near surface regolith above basement. End-of-hole (EOH) rocks were predominantly logged as granitic rock types. The ~105 air-core drill hole orientation program (of various scattered N/S and E/W lines of holes at 100 m spacing) was sampled by Azure for (amongst other elements) gold and REE lanthanum in 4 m composites. Azure assays had shown anomalous lanthanum (up to ~600 ppm) in the saprolitic zone over a considerable area (and also anomalous 5m @ 0.44 % TREO in one hole (106) where they had assayed the full suit).

Salazar's re-sampling for REE was from remaining cuttings left at the drill collars. Azure's drill spoil had been laid out in rows but some areas had been disturbed by later track upgrades. In general Salazar found a reasonable depth and grade correlation between the new results and the original La assay undertaken by Azure.

Figure 60 E/W cross-section showing enriched REE layer



Salazar's re-sampling of the sandy clay regolith (over a sheared granitic basement) in holes NSA23 and 24 returned TREO values of ~1,000-5,500 ppm*. Hole NSA23 averaged 16 m @ 0.27% (2,700 ppm) TREO from 7 m and NSA24 7 m @ 0.13% TREO from 16m[111]. Figure 60[112] shows those holes in a vertical E/W cross-section, looking north (middle of Figure 59), with the REE-enriched clay regolith layer shaded pink.

**NB: Some Salazar TREO figures may have been extrapolated from previous single REE lanthanum assays by Azure. In hole NSA23 the lanthanum assay was 16 m @ 540 ppm. Salazar considered lanthanum to be a good proxy for TREE.*

[108] Rogers, KA., 16 March 2012. *Esperance Splinter Project – 2012 Annual Report*. Salazar Gold Pty Ltd. Pp33.
[109] Rogers, KA., 5 July 2013. *Esperance Project – 2013 Combined Annual Report*. Salazar Gold Pty Ltd. Fig 45, pp67.
[110] Kelly, M. 2007. *Splinter Project – 2007 Annual Report*. Azure Minerals Ltd.
[111] Rogers, KA., 16 March 2012. *Esperance Splinter Project – 2012 Annual Report*. Salazar Gold Pty Ltd. Pp35 & pp39.
[112] Rogers, KA., 16 March 2012. *Esperance Splinter Project – 2012 Annual Report*. Salazar Gold Pty Ltd. Fig 21, pp35.

7.6.5 SALAZAR AIR-CORE DRILLING FOLLOW-UP

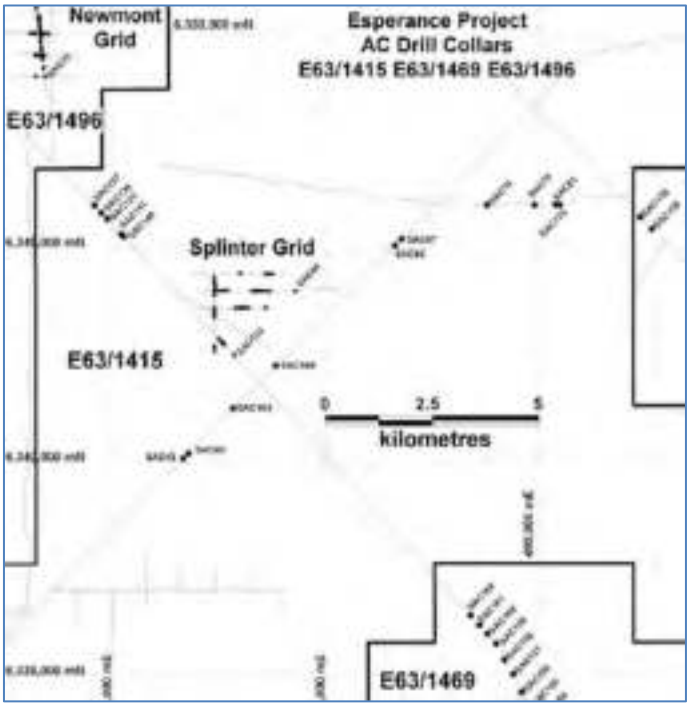
Salazar followed-up the earlier Azure drilling by completing a 101 hole air-core programme for 2,703 m in November and December 2012. Salazar's hole names were prefixed SAC.

The Salazar programme was designed largely to test Azure holes that reported high lanthanum values in tenement E63/1415 and a hole (NSA106) that reported 5 m at 0.44% TREO in tenement E63/1496 immediately west of E63/1415. Salazar's drill hole locations are shown in Figure 61[113] (roughly similar area to Figure 59).

The Azure AC holes had been assayed only for the REE lanthanum (not for the complete REE suite) but had nevertheless given some suggestion of a REE mineralised system, especially on the Splinter grid on E63/1415 and within the axial zone of a folded sequence on E63/1496. Several other Salazar holes were also drilled as reconnaissance on E63/1469, E69/2784 and E69/2783 based on geophysical interpretation of favourable basement geology and possible preserved of thick saprolite or sediment cover.

Salazar's EOH samples were assayed for precious and base metals, rare earth elements and oxides. In addition, 1,660 saprolite samples were assayed for rare earths elements; a selection of 36 samples of grey/black saprock/saprolite clays for precious and base metals; and 47 black sand samples in the overlying sandy sediments for a heavy mineral suite of Fe, Ti, Zr, and other trace elements.

Figure 61 Salazar drill hole locations



Salazar's drilling intersected regolith units, including transported sediments (aeolian and fluvial sands and clays), slightly sandy clay saprolite, saprock, and relatively fresh bedrock at EOH. Air-core blade refusal (at EOH) varied from 5-64 m.

The down-hole geological logging sequence was typically:

- surficial cover consisting of soil and sand;
- sticky brown mud;
- a fining upward sand sequence;
- white then brown saprolite clay;
- grey clayey saprock with some partly weathered basement rock chips.

Basement (at EOH) lithologies included permutations of granite, granitic gneiss, gneiss, leucogranite, tonalite, amphibolite and quartzite.

7.6.6 SALAZAR REE EXPLORATION MODEL DEVELOPED

Salazar recognised the style of mineralisation at Splinter as ion-adsorption clay REE enrichment over weathered granite. They were also aware that potassic granites might produce REE deposits with higher proportions of the more valuable HREEs. Additionally they were also aware that the basic mineralogy of the granite determined whether REE enrichment could occur in the regolith, and that presence of REE carbonates would be beneficial.

At Splinter in a magnetic granite they encountered REE minerals and REE-bearing minerals. The REE minerals included allanite, bastnaesite, synchysite, apatite, cerite, cerianite; other REE bearing minerals included titanite and a colloform leucoxene like mineral.

In terms of ultimate leach extraction efficiency from clays weathered from the granite Salazar appreciated various aspects as important:

- the original REE minerals in the granite and their quantities;
- the degree of weathering (completely weathered best);
- the type of clay (halloysite and kaolinite); and
- the form of the REEs in the clay (whether aqueous, colloidal, mineral phase (monazite, xenotime and secondary minerals), or ionic ($RE3^+$ ions attached to kaolinite and halloysite).

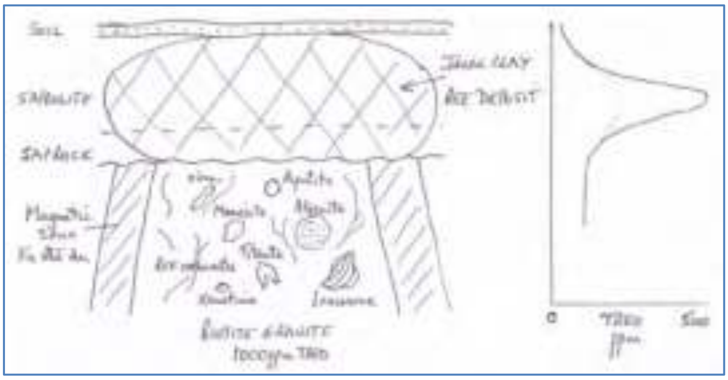
[113] Rogers, KA., 5 July 2013. *Esperance Project – 2013 Combined Annual Report*. Salazar Gold Pty Ltd. Fig 46, pp69.

The ionic clay REE model developed (represented in their Figure 62[114] cartoon) was that of a basement magnetic granite containing several REE-bearing minerals in sufficient primary concentrations to allow enough (ore grade) secondary concentration. They should include REE minerals that would weather readily (such as REE carbonates and also apatite and allanite if they are rimmed with REE enrichment) or already hydrothermally altered by REE carbonates.

Although left unsaid the model would rely on the existence of conditions for a long period of lateritisation (humid temperate climate).

The model was also dependent upon subsequent geomorphology – with limited erosion allowing the preservation of the weathering profile.

Figure 62 Salazar IAC REE deposit model cartoon



Salazar noted that drilling by previous explorers in the area has shown that the regolith profile commonly consisted of transported sediments overlying weathered saprolite, and that the regolith profile thickness varied from 2-60 m and was commonly 25-35 m thick.

7.6.7 SALAZAR METALLURGICAL TEST-WORK

Salazar engaged Amdel Laboratories Ltd (Amdel) to perform initial metallurgical test-work on saprolitic clays sampled from Azure's air-core hole cuttings from holes NSA23 and 24[115]. The tests were mostly to determine if REEs could be leached – drawing on details from the equivalent Chinese deposits. The results of Salazar's metallurgical test-work was reviewed by Ross in 2020 for HRE[116]. That review is summarised in Section 8 here.

Various leaching reagents were tried, at differing temperatures and for differing durations. **Outstanding** extraction of 90% TREE into solution was achieved using 10% hydrochloric acid at 50°C for 24 hours. Reportedly the consumption of acid was "very low".

7.6.8 SALAZAR CONCLUSIONS

As their exploration applied to REEs Salazar concluded that they had discovered ionic REE in the regolith saprolite over REE enriched granitic basement. That style of REE mineralisation was similar to the Chinese ionic clay deposits on granites hosting most of the world's HREE.

Saprolitic clay samples from two of Azure's earlier drill holes showing lanthanum enrichment (NSA23 and NSA24) were shown by Salazar to contain anomalous TREE grades (1,000 to 5,500 ppm TREO). Salazar also found similar grades (up to 10,000 ppm TREO) in other follow-up drill holes over a wide area. The REE-associated mineral scandium was also found in anomalous quantities in places.

Initial metallurgical tests suggested that the REE in the sandy clay can be leached into solution by hydrochloric acid with 90% recovery. WHIMS tests reported that very little (5%) of the TREO are in the magnetic fraction (dominated by monazite and xenotime), which further supports an ionic source for the REE enrichment in the clay zone.

[114] Rogers, KA., 5 July 2013. *Esperance Project – 2013 Combined Annual Report*. Salazar Gold Pty Ltd. Fig 21, pp31.
[115] Rogers, KA., 16 March 2012. *Esperance Splinter Project – 2012 Annual Report*. Salazar Gold Pty Ltd. Pp43-46.
[116] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Metallurgy, pp11-14.

8 COWALINYA PROJECT – PREVIOUS REE EXTRACTION METALLURGY (SALAZAR)

To demonstrate that the Cowalinya Project's clay-bound REEs might be extractable HRE (Ross) points to previous REE metallurgical test-work performed by Salazar Gold Pty Ltd (Salazar) in 2011 to 2013 on their Esperance Splinter Project[117]. Salazar sampled a lateritic zone (REE-enriched clay saprolitic material above granites) reportedly similar to that at Cowalinya. Sampling was within tenement E63/1415, ~55 km east-south-east of Cowalinya. Samples were taken from older air-core drilling performed by Azure (see Section 7.6.4). Salazar commissioned Amdel Laboratories Ltd (Amdel) to carry out the metallurgical test-work. **Please note the Consultant's comments on representivity at the end of the Section.*

Test-work comprised:

- Chemical leaching tests.
- Magnetic separation tests.

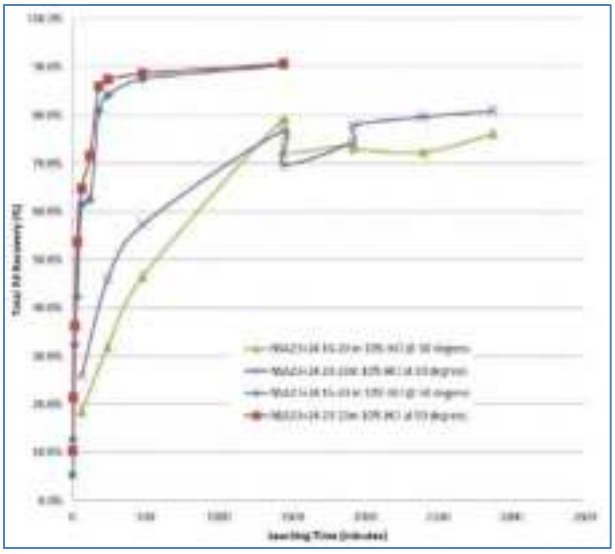
Test samples: Samples were tested from two air-core holes (NSA24 and NSA24) and from two composites taken between 16-23 m down-hole (16-20 m and 20-23 m). That 16-23 m intersection depth apparently corresponded to the highest REE values in the weathered zone.

8.1 CHEMICAL LEACHING

Amdel tested a variety of leaching reagents on pulverised samples including ammonium sulphate, sodium chloride, 10% sulphuric acid and 10% hydrochloric acid (HCl). Hydrochloric acid (HCl) produced the best REE recoveries to solution. HCl consumption was apparently low (average 4-6 kg/t). Sulphuric acid gave modest extractions (12-21%) and no extractions were obtained with ammonium sulphate or sodium chloride during a 2 hour test.

REE recovery: Reported and plotted tests used 10% HCl at 30°C and 50°C with residence times of up to 2 days. TREE recoveries are plotted over time for both temperatures and both depth in Figure 63[118]. Ross's reports were only given for the 16-20 m down-hole composites.

Figure 63 TREE recovery % over time



The best recovery of 90.3% TREE into solution was achieved using the 10% HCl at 50°C over 1 day (1,440 min, red and blue lines in Figure 63). Most recovery was achieved very quickly though as up to 84.1% TREE was achieved after only 4 hours (240 min). Using 10% HCl at the lower 30°C temperature achieved a slightly lower maximum recovery of 75-80% after 2 days (~3,000 min, purple and green line in Figure 63).

Individual REEs exhibited a range of recoveries, from ~95% for lanthanum, cerium and neodymium (LREEs) to the lowest at ~40% for thulium and ytterbium (HREEs).

Figure 64 Individual REE recovery

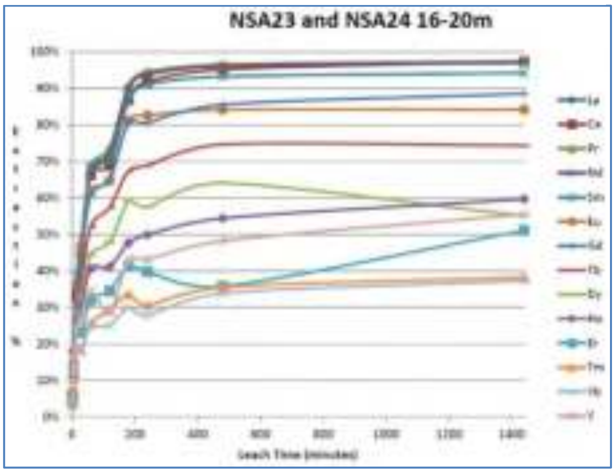


Figure 64 illustrates the recovery of individual REEs, for the upper composite interval 16-20 m, using 10% HCl at 50°C. The plot for the lower 20-23 m interval was very similar. The LREEs plot close together towards the top of the Figure, the HREEs are more spread out and plot lower down.

At 50°C the recovery of the LREEs was markedly higher and closer (average 97.2%) than that for the HREEs (average 58.5%, range ~40-85%). At 30°C the LREE recovery proportion declined (to ~84%) whilst the HREE remained approximately the same (~57%).

[117] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Metallurgy, pp11-14.
[118] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 15, pp12.

It was noted that the Salazar samples were associated with phosphorus (probably as a secondary iron phosphate (phosphosiderite) formed in the laterite). Phosphosiderite readily dissolves in HCl and the phosphorus and iron extraction paralleled that of the REEs.

Results of leaching test-work: REE leaching recoveries to solution were considered to be very good and comparable to Chinese deposits. The consumption of HCl leachate was reportedly low.

8.2 MAGNETIC SEPARATION

Magnetic separation testing (WHIMS) was undertaken on composite samples from holes NSA23 and 24. Details of the sampling or sample treatment have not been determined.

Results of magnetic-separation test-work: The Consultant interprets the brief reporting by Salazar to be inconclusive. Only a very small fraction was recovered, most of it was quartz, and assaying showed it to contain a very small fraction of the REEs.

* *This Section on metallurgical test-work is largely a precis of Ross's summary for HRE (referenced above) of Salazar's metallurgical test-work. The Consultant is aware that available Salazar's background reporting **is** comprehensive and detailed – and he has reviewed it to some degree and incorporated details into various Sections (such as regional and local geology, REE mineralisation, and this metallurgical test-work).*

*However, whilst the Consultant has no reason to doubt past reporting, the Consultant would nevertheless stress that he is **not** aware of:*

- *how accurate Ross's summary of Salazar's test-work is,*
- *how representative Salazar's sampling was (in terms of spread across their prospect and of the full laterite layer, basically the number and distribution of sample points),*
- *if Salazar's sampling of older Azure drill cuttings was representative and free from contamination, and*
- *most importantly, how actually representative of Cowalinya the Salazar area is.*

9 COWALINYA PROJECT – HRE EXPLORATION MODEL

9.1 MODEL BASIS

Recent historic explorers at Cowalinya (AngloGold and Great Southern) focussed on gold – but fortuitously also assayed variously for REEs. This REE assaying allowed HRE to assess the REE potential and then to develop an exploration model for REEs in the area based on determining an "REE deposit type" from the previous surface and weathered zone sampling.

At surface: HRE observed elevated REE values in the surface sampling in the Project area[119]. These existed in contiguous areas above known granitic basement.

At moderate depth in weathered rock: HRE also identified elevated REE values in the shallow drilling samples[120]. These existed in the well weathered saprolite derived from and above the granite and in the granite itself (in the upper-most slightly weathered part).

9.2 HISTORIC REE DATA

Surface sampling: AngloGold and Great Southern's REE surface sampling (referred to as variously as auger, soil and calcrete sampling) covered the whole Project area. This allowed HRE to fundamentally study REEs in the Project area generally.

Surface sample points are shown by khaki dots in Figure 65[121]. Regional airborne magnetics imagery forms the background.

Sample spacing in the EL's west is 400*800 m. Over the eastern parts the spacing steps down in various increments to the finest at 100*200 m (with some E/W spacing at 50 m).

Air-core drill sampling: REE analyses in samples from AngloGold's and Great Southern's combined shallow air-core drilling programs allowed HRE to study the near-bedrock REE concentrations and REE vertical distributions within weathered material above bedrock within a part of the Project area.

The air-core defined prospects are labelled in Figure 66[122] (AngloGold – Double Tank; Great Southern – Night Watch) with their blue drill hole locations shown above regional airborne magnetics imagery.

Figure 65 Surface sampling locations above magnetics

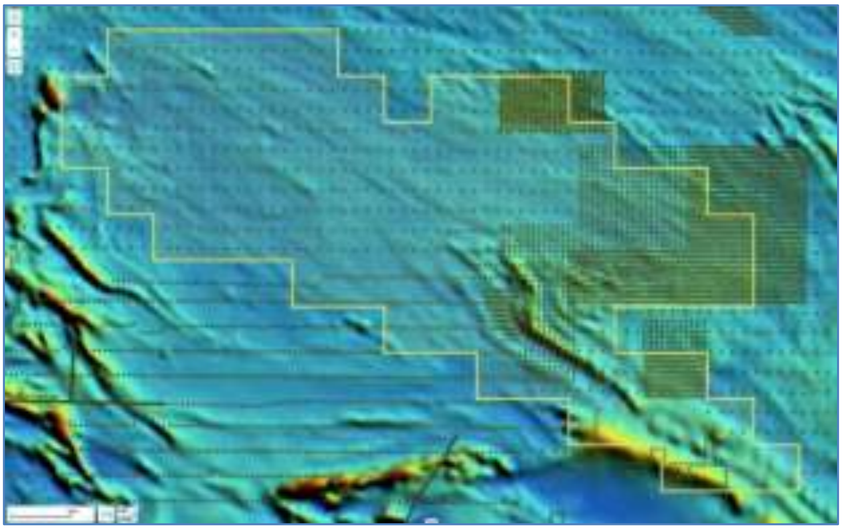
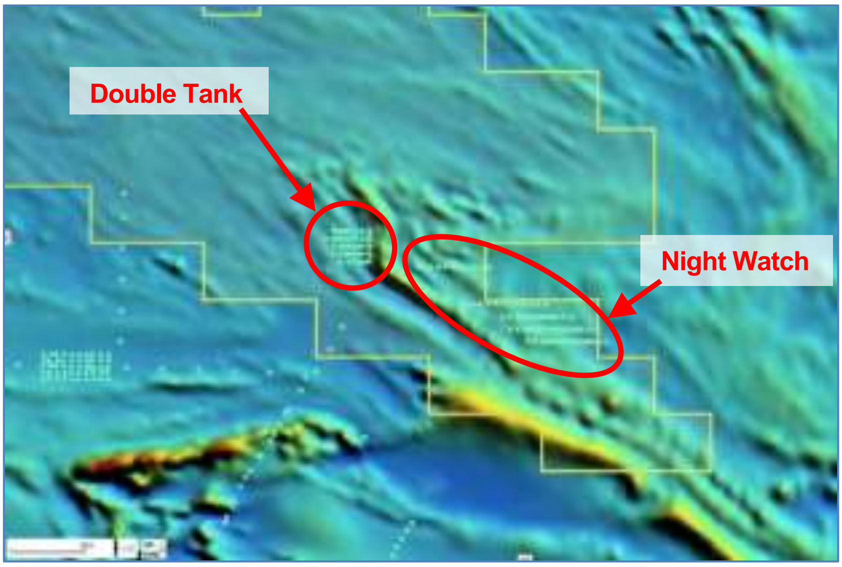


Figure 66 Air-core drilling locations above magnetics



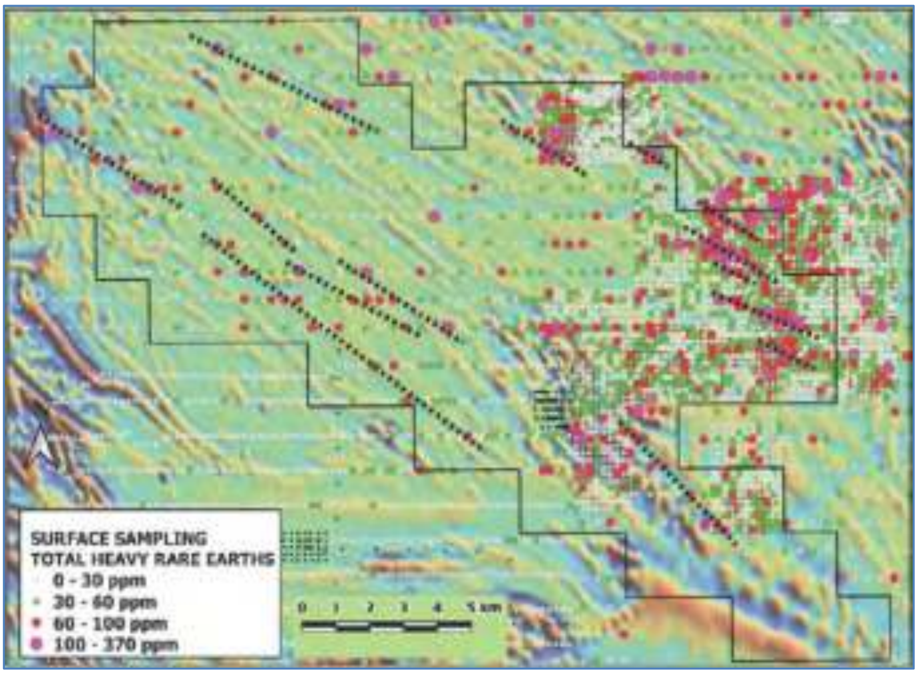
[119] Ross, D., August 2020. *Cowalinya Prospect Superge Heavy Rare Earths.* Auger pp10.
[120] Ross, D., August 2020. *Cowalinya Prospect Superge Heavy Rare Earths.* Air-core pp4-9.
[121] GeoView. DMIRS. Geophysics imagery magnetics anomaly & open file company surface sample geochemistry
[122] GeoView. DMIRS. Geophysics imagery magnetics anomaly & open file company exploration drill holes

9.3 ANALYSIS OF SURFACE REEs

Surface calcrete geochem samples by AngloGold and Great Southern were all assayed for REEs – thus facilitating the initial simple analysis of the area's REE potential.

Ross studied the (combined) total HREEs, and they are plotted in Figure 67[123] superimposed on regional magnetics (1st vertical derivative). Figure 77 below gives the same plot without magnetics. No equivalent plot is available for the LREEs or for the combined TREEs.

Figure 67 Surface calcrete geochem – HREE assays



Anomalous HREE values were wide-spread – thus fundamentally supporting the area's REE potential. Elevated HREEs were also contiguous in many areas.

Ross pointed out the HREE alignment with the regional magnetics lineaments.

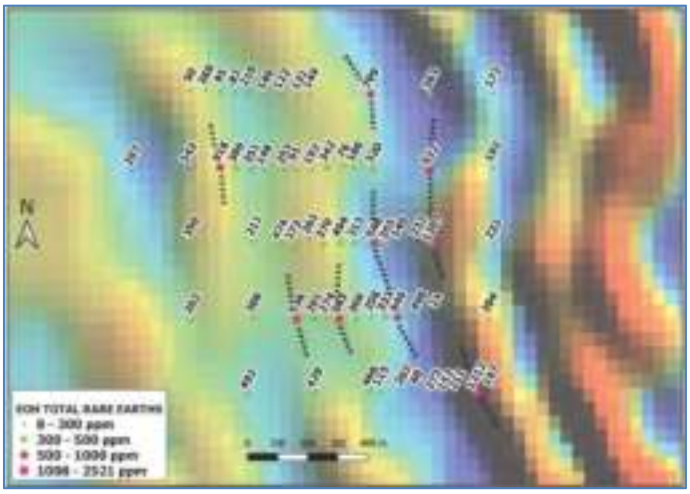
Rather than an association with magnetic lineations the Consultant would interpret the continuity of the HREEs in various areas (particularly the upper eastern area) more as 1) simply a reflection of "better" basement source rocks below or 2) actual sampling of weathered lateritic material at surface rather than overlying alluvium. This latter possibility would appear to be supported by the local geological outcrop mapping and the slightly increased topography slope.

9.4 ANALYSIS OF ANGLOGOLD'S BEDROCK REEs

According to Ross 65 of AngloGold's air-core drill holes were inside this Project's tenement E63/1972. These were at their Double Tank Prospect (Figure 45), at a tight ~50*250 m spacing in an area of ~1 km^2.

The last EOH samples (just above fresh rock) were assayed for REEs. Two thirds of the holes (44 out of the 65 holes) had EOH TREE assays >200 ppm (the lower cut-off for the Chinese deposits). The average EOH grade for the 44 holes was 411 ppm TREE, the maximum was 1,212 ppm. Those EOH TREE assays are annotated at each air-core hole location in Figure 68[124]. They are plotted above the regional magnetics (in this case the 1st vertical derivative).

Figure 68 AngloGold Double Tank prospect air-core drilling – EOH sample TREE assays



He stated that these concentrations were "comparable with or better than fresh rock values found beneath the Chinese ion clay deposits".

Ross observed that the TREE grades align with the magnetic lineation trends (dotted black lines in Figure 68), with the highest grades associated with the more magnetic bedrocks.

Ross also observed that in higher grade samples trending with the magnetics proportions of HREEs were >40%

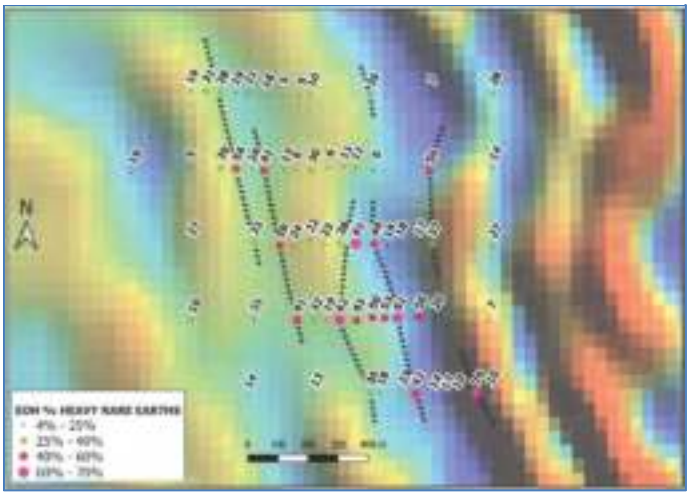
[123] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 14, pp10.
[124] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 5, pp5.

(and ranged up to 70%). HREE percentage proportions are shown in Figure 69[125]. The actual maximum HREE value was 843 ppm.

NB: The Consultant is not convinced by an HREE association with the magnetics, noting that the HREEs could also simply be interpreted to be concentrated more by area (as in the southern part of Figure 69). He would need to know more about bedrock geology.

Ross postulated that "Assuming a 3-5-fold supergene enrichment, potential grades between 1,300 to 2,300 ppm TREEs containing 600-1,000 ppm HREEs could be present in the weathering profile" (in the weathered saprolite above the granite). Depth of transported cover in this area was ~4-17 m (averaging 10 m); and depth to fresh bedrock is 18-54 m.

Figure 69 AngloGold Double Tank prospect air-core drilling – EOH sample HREE proportions



9.5 ANALYSIS OF GREAT SOUTHERN'S BEDROCK REEs

According to Ross 80 of Great Southern's air-core drill holes were inside this Project's tenement E63/1972. These were at their Night Watch Prospect (Figure 48), at a 100*400 m spacing and in an area of ~4 km^2. The Night Watch Prospect is ~5 km SE of Double Tank. The Samples were variably assayed for REEs, partially over their length depth on a 3 m basis, fully for the last EOH sample.

The Great Southern EOH TREE values and trends at Night Watch were similar to the AngloGold's at Double Tank although their general tenor was slightly lower.

The Night Watch EOH assays (just above fresh rock) showed elevated TREEs. Figure 70[126] shows the EOH TREE assays over magnetics at Night Watch, with the highest grade being 1,273 ppm. The higher grades again aligned with the more magnetic bedrocks (dotted black lines).

The two air-core holes labelled in the Figure are used below to illustrate REE vertical grade distributions.

Similarly the Night Watch HREE proportions were increased with the TREEs aligned with the more magnetic bedrocks. HREE percentage proportions are shown in Figure 71[127] and ranged up to 65%. The actual maximum HREE was 388 ppm.

Figure 70 Great Southern Night Watch prospect air-core drilling – EOH sample TREE assays

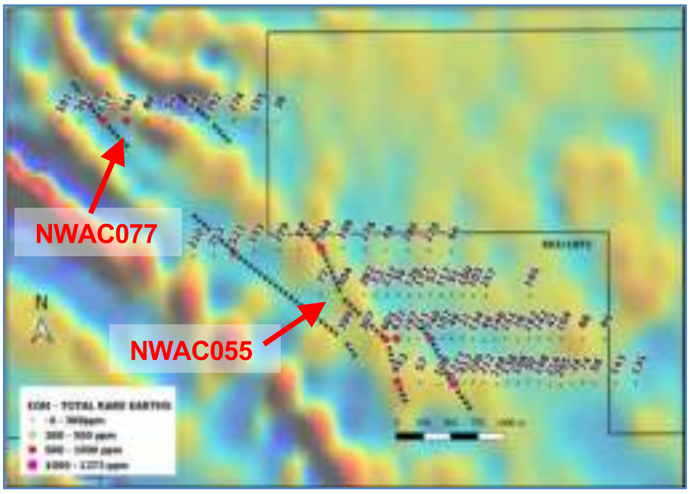
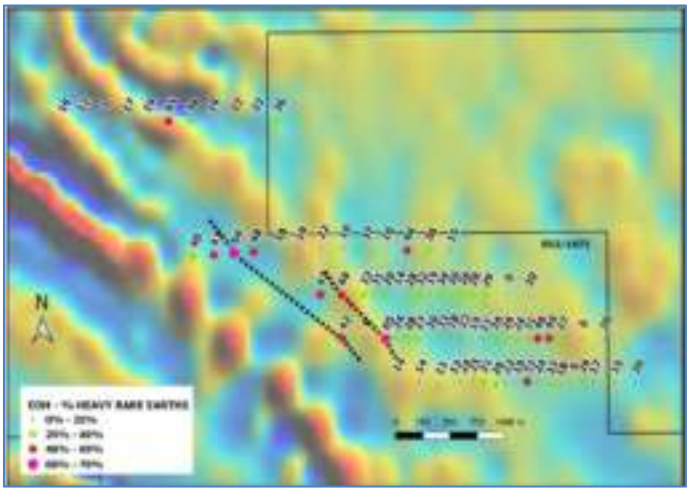


Figure 71 Great Southern Night Watch prospect air-core drilling – EOH sample HREE proportions



[125] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 7, pp6.
[126] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 8, pp7.
[127] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 10, pp8.

9.6 ANALYSIS OF REE ENRICHMENT IN THE WEATHERED ZONE ABOVE BEDROCK

Ross also analysed REE distribution vertically in the weathered zone above the granite bedrock. This zone was fully sampled for the LREEs Lanthanum and Cerium in Great Southern's air-core holes.

Ross illustrated lanthanum grade variations with depth in two air-core holes (NWAC055 and NWAC077, locations shown in Figure 70) situated on one of the higher grade lineations. Figure 72[128] for hole NWAC055 shows REE variations in a weathered zone developed above a granite; Figure 73[129] for hole NWAC077 shows variations above a mixed gabbro/granite. However note that the vertical depth scales in the Figures are the same but the horizontal lanthanum scales are different.

In both holes the LREE lanthanum is markedly enriched (with respect to bedrock values) within the in-situ clayey fully weathered (saprolite, lateritic Zone B) part of the bedrock. This supergene lateritic enrichment is very similar to the classic ion-adsorption clay REE deposits in China (as illustrated in Figure 14 and Figure 15 in Section 5.6).

In NWAC055 the enrichment over a 12 m section was >10 times the bedrock value (335 ppm vs 25 ppm). In NWAC077 the enrichment over a 6 m section was >4 times the bedrock value (240 ppm vs 57 ppm).

Figure 72 Lanthanum in NWAC055

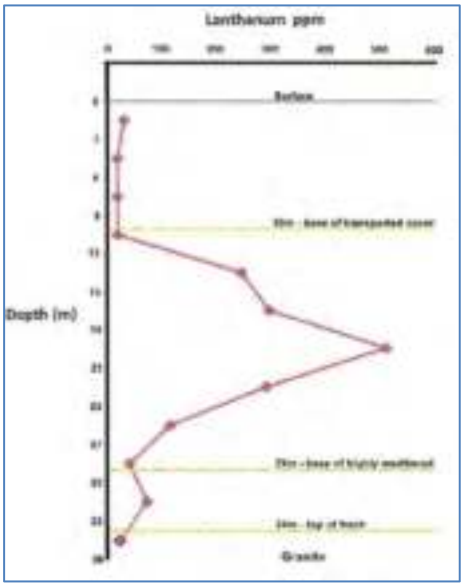
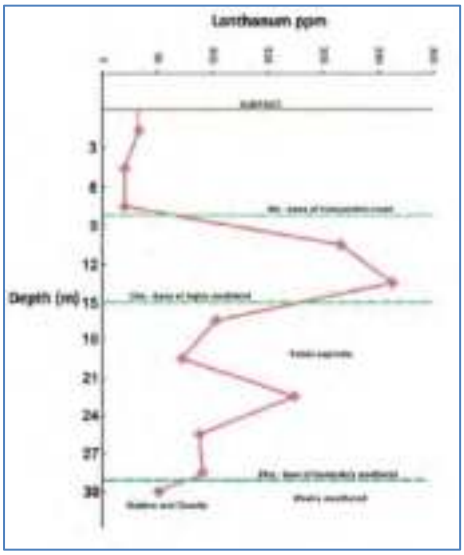


Figure 73 Lanthanum in NWAC077



NB: The Consultant is not aware how selective and/or representative Ross's choice of holes was. A brief perusal of the raw data showed similar enrichment in some holes and not in others. As the hole locations with respect to each other was not known it was not possible to evaluate the enrichment effect in a plan view distribution.

9.7 RESULTS OF HISTORIC REE DATA ANALYSIS – REE MINERALISATION

Analysis of the historic surface sampling REE data showed:

- Elevated and anomalous concentrations of REEs exist in surface material over the Project area.
- Concentration of the anomalous values is in contiguous areas (particularly on the eastern side) – probably in weathered lateritic material close to surface (not covered by as much or any surface transported alluvium).

Analysis of the historic shallow air-core drilling REE data showed:

- Elevated concentrations of REEs exist in the area's bedrock granites – at values similar to or above comparable Chinese REE deposit bedrocks.
- Higher REE bedrock grades align with regional bedrock geophysical magnetic highs and lineaments.
- REEs are enriched in the clayey highly weathered lateritic B zone above the bedrock granites – at many multiples of the bedrock grades – and at grades and thicknesses comparable to Chinese clay REE deposits.

[128] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 11, pp9.
[129] Ross, D., August 2020. *Cowalinya Prospect Supergene Heavy Rare Earths*. Fig 12, pp9.

9.8 COWALINYA REE DEPOSIT TYPE

Both the surface and slightly deeper REE values allowed HRE to interpret Cowaliya as a shallow flat-lying supergene lateritic enrichment of REEs in clays overlying suitable source granites – an "ionic clay deposit" or "ion-adsorption clay REE deposit" (IAC), or simply an "ion-adsorption REE deposit".

The Consultant strongly agrees (albeit at this point with the rider that he hasn't visited the Project) with HRE's classification of Cowalinya as an ion-adsorption REE deposit. Interpretation of Cowalinya's geology (Section 6.3) and past exploration (Section 7) shows the deposit to have many geological features in common with the Chinese ion-adsorption REE deposits (Section 5.6). Those Chinese ion-adsorption deposits are generally the world's largest suppliers of the HREEs. The lateritic REE weathering profile commonly consists of a depleted zone, an enriched zone (>200 ppm TREE), and a partially weathered zone which overlie the protolith (typically a granite). Lateritic weathering occurs in tropical to subtropical humid climates and may commonly extend to depths of 30-60 m. Laterites are preserved where geomorphological conditions allow. REEs are mobilized from the breakdown of primary REE-bearing minerals and redeposited in the enriched zone as secondary minerals, as colloids, or adsorbed on other secondary clay minerals. Enrichment of REE may range from 3-10 times that of the source lithology; in some instances, enrichment may range up to 100 times. Enriched zone thicknesses are typically in the range of 0.3-10 m but may reach 30 m or rarely more.

9.9 SUGGESTED REE EXPLORATION MODEL

Based on the identified "ion-adsorption clay" (IAC) REE deposit type HRE's exploration model could be characterised as "laterite exploration".

This would entail continuation of shallow air-core drilling and sampling of the weathered REE-enriched saprolite (lateritic B Zone) above granite. Air-core drilling is a highly appropriate sampling method for the Project's clayey weathered rocks.

The aim of the drilling would be to collect data to allow computerised modelling of the upper and lower surfaces (layers) of the saprolite and particularly of the enriched REE layer within it. Sampling down-hole should be fine enough to characterise these surfaces accurately. Drill hole spacing should be close enough to characterise distinct areas of particular REE enrichment.

*The Consultant's knowledge of laterites and computer modelling would lead him to suggest down-hole sampling on a 1 m basis and hole spacing probably down to 50*50 m (pending analysis of variographic data oriented in the layers).*

10 COWALINYA PROJECT – HRE EXPLORATION (2021)

10.1 HRE EXPLORATION INTRODUCTION

HRE's own exploration at Cowalinya is very recent, has operated for the last two years (since ~January 2020), and the company's internal reporting has not yet progressed to cover the bulk of the work in 2021 (particularly the exploration drilling, geological interpretation and deposit modelling).

Introductory details on HRE's early exploration in 2020 were largely gained from Ross's 2020 Annual Report[130] to the DMIRS. That Report was for the year from 9 January 2020 to 8 January 2021. In that period HRE established the potential for a lateritic ion-adsorption clay REE deposit and decisions were made to undertake a drilling program. However that Report gave no details of the intended drilling program.

Details on HRE's exploration in 2021 were initially gained from HRE's October 2021 Project overview document[131] and from the actual data in their on-line HRE data room[132]. Subsequently those 2021 exploration details were supplemented with information contained in extracts from the Resource Estimate Report[133] (Appendix 7).

10.2 HRE EXPLORATION METHODS

HRE's exploration on the Project has included:

- Initial project literature and data review and data collation.
- Geological field reconnaissance.
- Negotiations with relevant Ngadju Native Title Aboriginal Corporation – leading to the signing of a new Heritage Protection Agreement.
- Application to DMIRS for co-funded drilling through WA's Exploration Incentive Scheme (EIS).
- Air-core drilling and sampling program in two areas in 2021 to in-fill and extend the past Great Southern (HRE's Area 1) and AngloGold (HRE's Area 2) drilling programs.
- Metallurgical REE test-work.

10.3 HRE DATA REVIEW

A data review and compilation was conducted by HRE on most the most recent past exploration on and around E63/1972. That data was described in the Section 7 on Past exploration – and was focussed on lateritic exploration on parts of the tenement by AngloGold Ashanti Australia and Great Southern Gold. That review identified the potential for HREE mineralisation on the tenement and REEs became the exploration target. The past surface calcrete sampling (Figure 67) highlighted the spread of HREEs over a wide area (>40 km). The REE focus was intensified by reviewing Salazar Gold's successful REE metallurgical test-work on similar lateritic material from a tenement ~55 km to the ESE. By combining the past exploration and the metallurgical results HRE developed an REE exploration model, described in Section 9.

10.4 HRE GEOLOGICAL RECONNAISSANCE

Geological reconnaissance was undertaken to confirm previous geological mapping, sample any drill samples remaining from historical drilling and determine overall access within the tenement. The reconnaissance confirmed the previous geological mapping. Figure 74[134] shows the areas inspected (red polygon) within the tenement (black polygon). Access was limited to existing through tracks (the Fraser Range Road and the north-western fork off it) and the east-west drill tracks (Double Tank and Night Watch Prospects, green dots) due to thick bush. Historical drill samples had either been washed away or destroyed during rehabilitation.

Figure 74 HRE reconnaissance area

[130] Ross, D., February 2021. *Cowalinya Heavy Rare Earth Prospect E63/1972 2020 Annual Report*. Annual report for period 9/1/2020 to 8/1/2021 to WA DMIRS on exploration within tenement E63/1972.
[131] Heavy Rare Earths Limited, October 2021. *Cowalinya Rare Earths Project*. Introductory presentation of the Project.
[132] Listing given in Appendix 2 – Project Information listing.
[133] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*.
[134] Ross, D., February 2021. *Cowalinya Heavy Rare Earth Prospect E63/1972 2020 Annual Report*. Fig 5, pp14.

10.5 HRE HERITAGE PROTECTION AGREEMENT

The Ngadju Native Title Aboriginal Corporation, who hold granted Native Title over the area, requested a new Heritage Protection Agreement be signed before any work on the tenement be undertaken. After negotiations a new agreement was signed.

10.6 HRE APPLICATION FOR EXPLORATION INCENTIVE SCHEME CO-FUNDED DRILLING

Application was successfully made for a grant through the Co-funded Exploration Drilling Program part of the DMIRS's Exploration Incentive Scheme (EIS). The application in Round 21 was to help fund the drilling of 1,500 m in 43 air-core holes. The aim of the holes was to repeat and in-fill the historical AngloGold Ashanti drilling.

10.7 HRE AIR-CORE DRILLING (2021)

10.7.1 HRE DRILLING PROGRAM

Drill holes: A 109 hole (for 3,089 m) air-core drilling program commenced in on 15 July 2021 and was completed on 28 July 2021. Drilling was undertaken by Gyro Drilling Pty Ltd using an Edson drilling rig. The program was supervised by HRE's consultant geologist Mr David Ross.

Holes were numbered AC1 to AC109. Holes were vertical and drilled on east-west lines. Depth ranges were 12-44 m, averaging 28 m.

A number of HRE's holes were twinned with previous Great Southern air-core holes. Details are given in Section 10.7.2.

Figure 75[135] shows the air-core drilling rig starting one of the 2021 HRE holes. The hole collar is in the centre of the track, below the rig mast. Drill rods are in the rack on the right. Samples are delivered via the black rubber hose curving out above the rod rotation drive unit. The hose is connected to a red air cyclone one the left of the rig. Air is expelled from the cyclone out of the pipe at the top; drill sample cuttings fall out of the base of the cyclone into the green bag fixed there. Samples bags would be lined up in depth order on the side of the track on the left.

Figure 75 Air-core drilling rig

Figure 76 Hole AC47 location

A typical drill hole collar (hole AC104, Area 2 (see below)) is shown in the cover photograph on the Title page of the Report.

Figure 76[136] (see also Appendix 3 – Cowalinya site data verification – Richard Brescianini) shows another typical hole location, this one of hole AC47 (Area 1, see below). The re-habilitated hole collar is marked by the peg in the middle of the track in the foreground, green sample bags are on the side of the track in the background, and the hole details (hole number and E/N coordinates) are marked on the peg at the side of the track adjacent to the collar.

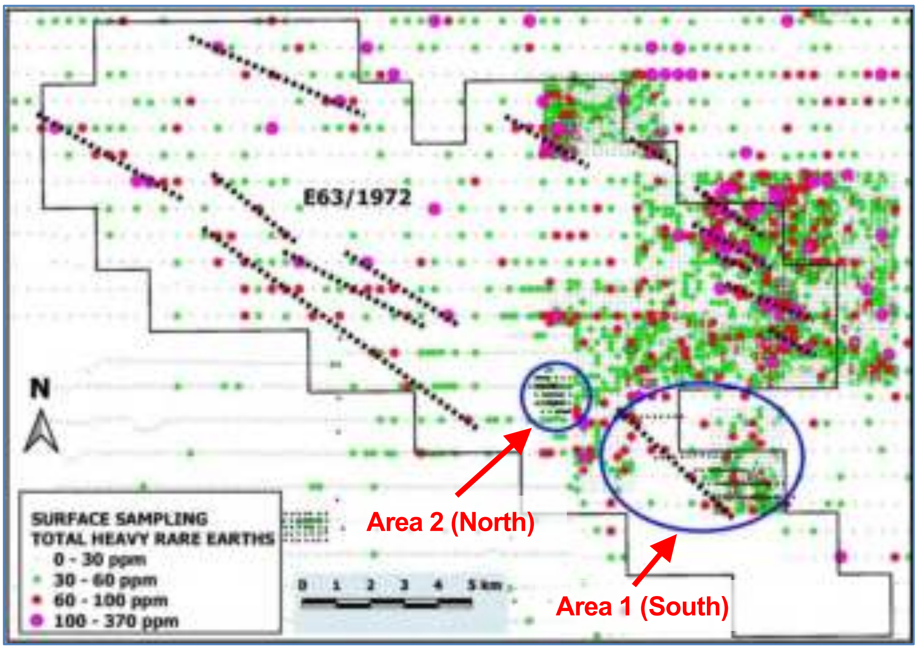
[135] Brescianini, R., January 2022. Photographs during 2021 air-core drilling program.
[136] Brescianini, R., 10 November 2021. Recent photograph within the Project tenement at drill hole site AC47.

Drilling areas: HRE holes were drilled in two areas (blue ovals in Figure 77[137]) to in-fill and extend the past air-core drilling (Section 7) by Great Southern at their Night Watch Prospect and AngloGold at their Double Tank Prospect (labelled in Figure 66).

HRE now refers to these areas as Area 1 (Great Southern's Night Watch) and Area 2 (AngloGold's Double Tank) respectively. NB: HRE's Resource Consultant refers to the areas as North and South respectively (as labelled in Figure 77).

The Areas exist within a ~6*4 km area (24 km^2). Area 1 is ~2.7*1.7 km in extent, Area 2 ~1.2*1.5 km.

Figure 77 HRE drilling areas – 2021



59 holes were drilled in Area 1 (AC1 to AC59) and 50 holes were drilled in Area 2 (AC60 to AC109). Hole locations are shown below in Figure 79 as well as in Appendix 5 – HRE Cowalinya drill hole location plans.

Hole E/W spacing was typically ~100 m with some at ~50 m in Area 2. Drill lines were 400 m apart N/S in Area 1 and 250 m apart in Area 2. Depth ranges in Area 1 were 12-39 m and in Area 2 were 13-44 m. Average depths were almost identical in both areas, being 28 m in Area 1 and 29 m in Area 2.

Geological logging: All drill holes were geologically logged. Logging appears to have been on a primary lithology basis with depths recorded at changes. The weathered zone (in-situ weathered bedrock – saprolite) was divided into "upper" and "lower" (although the basis is unknown). Sample recovery and moisture were logged. The recovery was a rough gauge of the material collected from the cyclone, and was recorded as good, moderate or poor. No significant recovery issues were encountered.

Sampling: Cuttings from all drill holes were fully and continuously sampled in the weathered bedrock (saprolite) zone – from below the surface alluvium to EOH at nearly fresh bedrock. Drill cuttings were bagged on a 1 m basis. Many of those samples were then composited into 4 m long intervals (except for the last sample which was typically less). A total of **2,481 m** of drilling was sampled for assaying. Approximately 60% of the samples for analysis were 4 m composites, 40% were raw 1 m intervals (with that proportion also applying to sampling of the saprolite zone). Compositing was performed by collecting spear samples from the bags. Sampling started at depths a little below surface (usually 8 m) and at a multiple of 4 m (i.e. 4 m, 8 etc). The Consultant presumes this may have been dependent on the drilling rig's 4 m long drilling rods (as it differs from Great Southern's 3 m composite length). The first sample start was a few metres above the top of the Upper Saprolite layer. Standard and blank samples appear to have been inserted every 40th sample and duplicates every 80th sample. *The Consultant is not clear about the basis for the 1 or 4 m sampling.*

Sample security: Sample security between drill hole and assay lab was assured through the supervising geologist personally logging, collecting and delivering samples.

Moisture & density: Samples from the Upper and Lower Saprolite layers were analysed for moisture and density. Moisture was determined from a total of 8 samples from 4 drill holes – giving a range 9-25% with an average of 17%. Density was determined from a total of 48 samples from 13 drill holes – giving an average dry density of 1.63 t/m^3. Using the most conservative higher moisture content (25%) the saprolite was characterised as 65% solids, 25% moisture and 10% air (porosity/voids).

Assaying: 827 samples (including duplicates, blanks and standards) were assayed by LabWest Minerals Analysis Pty Ltd in Perth, WA. The samples were from 2,481 m of drilling. ~60% of the samples were 4 m composites, the

[137] Ross, D., February 2021. *Cowalinya Heavy Rare Earth Prospect E63/1972 2020 Annual Report*. Fig 9, pp18, edited slightly.

remainder 1 m intervals. Reporting shows all of the 15 lanthanide REEs were individually assayed, plus scandium, yttrium, thorium and uranium. A selection of more "normal" elements were also analysed, but the Consultant has not studied the suite or the results. LabWest's MMA-04 technique was used which consisted of a microwave-assisted hydrofluoric acid based multi-acid (4) digest with ICP-MS/OES finish. This was considered a near total digest. The resulting solution was analysed for all required elements using ICP-MS and ICP-OES. Tyrrell states that "*The laboratory procedures all appear to be in line with industry standards and appropriate for rare earth deposits, and LabWest is industry recognized and certified*".

Assay QA/QC: Tyrrell has documented assay QA/QC work in detail – for duplicates, blanks and standards. Although the Consultant has not studied the results a brief inspection indicates that assay quality was reasonable. The fact that results were not better was ascribed by Tyrrell partly to the analytical methods used for REEs (which may have some degree of inherent unreliability, particularly with scandium), partly to the low numbers for comparisons, and partly to the primary sampling method (spear in bag). In terms of field duplicate repeatability Tyrrell states from the HARD (half absolute relative difference) plots that "*all [*elements, excepting scandium*] show good repeatability, with generally over 55% of the data pairs with differences of 10% or less*". He states further that typical expectations would be for >70% to have differences <10%. Repeatability improved considerably for the coarse duplicates (where >80% had differences <10%) – indicating the benefit of sample homogenisation through crushing. *The Consultant considers that the assaying accuracy was adequate; that the numbers of standard samples incorporated was adequate (~10%); but that the number of field and coarse (after initial lab crushing) duplicates was far too low (~1% and ~3% respectively).*

Alternative assay methods: Tyrrell's notes indicate to a degree that LabWest's assay repeatability with the 4 acid digestion method was slightly less than could be expected. He then compared them with "check" assaying (to evaluate different assay methods) of a small number of samples (46, including 13 standards) with two different methods at Bureau Veritas Laboratory (BV) in Perth. The BV laser ablation method apparently performed very well in repeatability, including for scandium. For actual values the BV laser ablation assays resulted in an average ~12% higher TREO (~8% median increase) than the original LabWest assays.

Tyrell summarised that "*it would appear that laser ablation is reporting most of the REEs within each sample... Sc seems to be more precisely measured using the laser ablation technique based on the standard plot results... JMCTC recommends using the laser ablation assay method for future programmes if possible, as Sc is one of the most valuable components of the mineralisation at Cowalinya...*"

10.7.2 HRE TWIN HOLES

A limited program of twinning HRE holes with historical Great Southern holes was undertaken to compare and validate available geological logging and REE assays. Although collars of Great Southern holes had been fully rehabilitated (and were therefore hidden) they were drilled on still-visible tracks and HRE considered that accuracy of collar pick-ups of the old holes with hand-held GPS was within 3-4 m.

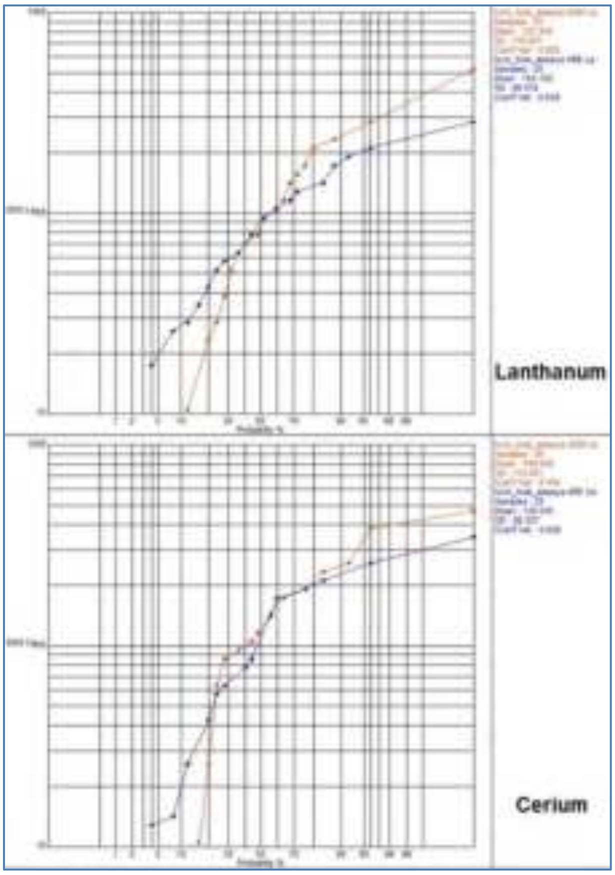
Twin holes: Three HRE holes in Area 1 (AC004/16/28) were drilled within 10-15 m of Great Southern holes (NWAC018/40/55 respectively).

Geological logs: Reporting does not detail how similar the geological logging was between adjacent holes – but Tyrrell states "*logged geology in each pair of drill holes was also very similar*".

Assays: Lanthanum and cerium assays could be compared (horizontally) as Great Southern had fully assayed for these elements down-hole. Assay methods were very similar (4 acid digests) but were from different laboratories. Sample length comparisons were approximated by compositing the 1 m HRE samples into the same 3 m lengths used by Great Southern.

Grade averages between holes/programs were within

Figure 78 Twin hole sample log probability



15%. Log probability plots (Figure 78[138]) showed populations for both elements to be similar (nearly parallel curves) from both programs. The HRE curves in the plots are blue; the Great Southern curves are red. The plots are for all samples (25) from the 3 holes.

Both elements contain a low grade population (steep part of curve on the left) and a high grade population (less steep part of curve on the right). The Great Southern curve was slightly steeper than HRE's for lanthanum, both were nearly identical for cerium.

On the face of it (and with the qualification that the comparison sample numbers were low and the aerial distribution of the holes has not been analysed) the Consultant would consider the twin hole program very successful in showing that results from historical drill holes are consistent with the latest HRE drill hole results.

10.7.3 HRE ASSAY DATA PROCESSING

HRE processed the raw assays to calculate the REO[139] for each individual REE (by factorising them, see Abbreviation Section) and then calculating totals for the LREO, HREO and TREO. These were simple additions of the individual REO values in each division. HRE also processed the individual assay intervals into composites to highlight higher grades – their interpretation of REE mineralisation.

10.7.4 HRE INTERPRETED REE MINERALISED COMPOSITE INTERVALS

HRE interpreted REE "mineralisation" to be drill-hole intervals with **TREO >300 ppm** in saprolitic material (where TREO referred to the 15 lanthanides). The 300 ppm figure is derived from analogous Chinese REE deposits where the figure is effectively considered a lower cut-off grade.

Individual assay intervals were interpreted into single length weighted REE mineralisation composite intervals in each hole from contiguous individual intervals where TREO >300 ppm. ~90% of holes contained a composite interval of multiple individual intervals. Composites excluded bedrock samples at the EOH and all alluvium. Most holes possessed a single composite interval >300 ppm; a number possessed two intervals. TREO >300 ppm composites are listed for Area 1 in Table 9 and Area 2 in Table 10.

[138] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 3-4, pp15.
[139] Hellman & Duncan, February 2018. *Evaluating Rare Earth Element Deposits*. Pp2, 1st para.

Table 9 HRE composite intervals >300 ppm TREO – Area 1

Hole ID	EOH (m)	From (m)	To (m)	Thickness (m)	TREO (ppm)	Comments
Area 1						
AC1	39	20	36	16	539	
AC2	34	8	32	24	892	
	includes	16	32	16	1,155	
AC3	33	32	33	1	759	still in saprolite
AC4	36	17	35	18	719	
	includes	31	34	3	1,067	
AC5	36	24	36	12	699	still in saprolite
	includes	32	36	4	1,154	
AC6	32	16	32	16	527	still in saprolite
AC7	32	28	32	4	551	still in saprolite
AC8	29	16	28	12	827	
	includes	24	28	4	1,360	
AC9	30	24	28	4	431	
AC10	27	16	24	8	542	
AC11	19				(<300)	
AC12	29	16	28	12	782	
	includes	20	24	4	1,165	
AC13	21	16	20	4	476	
AC14	25	16	24	8	450	
AC15	28	12	24	12	530	
AC16	32	12	31	19	839	
	includes	24	29	5	1,335	
AC17	39	20	36	16	761	
	includes	28	36	8	1,102	
AC18	26	16	24	8	718	
AC19	17	12	16	4	563	
AC20					(<300)	
AC21	28	20	24	4	554	
AC22	24	12	20	8	439	
AC23					(<300)	
AC24					(<300)	
AC25	22	12	16	4	356	
AC26	33	20	32	12	399	
AC27	39	20	36	16	670	
AC28	39	12	39	27	951	still in saprolite
	includes	15	25	10	1,511	
AC29	39	20	39	19	1,445	still in saprolite
AC30	39	20	36	16	453	
AC31	32				(<300)	
AC32	35				(<300)	
AC33	32	16	20	4	2,249	
		24	28	4	635	
AC34	30	24	28	4	434	
AC35	33	16	20	4	1,035	
		24	33	9	853	still in saprolite
AC36	31	16	28	12	631	
AC37	21	8	20	12	733	
	includes	12	16	4	1,149	
AC38	22	16	20	4	846	
AC39	15				(<300)	
AC40	16				(<300)	
AC41	30	11	29	18	669	
	includes	11	16	5	1,186	
AC42	22	12	16	4	985	
AC43	32	24	28	4	317	
AC44	26	12	24	12	346	
AC45	21	11	14	3	366	
AC46	32	28	32	4	367	still in saprolite
AC47	28	16	24	8	339	
AC48	23	16	20	4	340	
AC49	15	8	12	4	387	
AC50	35	16	32	16	541	
AC51	26	20	24	4	587	
AC52	20				(<300)	
AC53	28				(<300)	
AC54	19				(<300)	
AC55	27				(<300)	
AC56	24				(<300)	
AC57	21	14	18	4	591	
AC58	30	20	30	10	1,005	still in saprolite
AC59	21				(<300)	

Table 10 HRE composite intervals >300 ppm TREO – Area 2

Hole ID	EOH (m)	From (m)	To (m)	Thickness (m)	TREO (ppm)	Comments
Area 2						
AC60	27	12	24	12	512	
AC61	21	8	12	4	339	
AC62	20	-	-	-	(<300)	
AC63	34	16	32	16	419	
AC64	27	20	27	7	475	still in saprolite
AC65	30	-	-	-	(<300)	
AC66	35	16	32	16	501	
AC67	21	16	20	4	480	
AC68	21	16	20	4	346	
AC69	22	12	20	8	436	
AC70	28	16	24	8	517	
AC71	35	29	34	5	858	
	includes	31	32	1	1,286	
AC72	35	24	28	4	314	
AC73	29	-	-	-	(<300)	
AC74	32	24	28	4	454	
AC75	36	-	-	-	(<300)	
AC76	30	24	28	4	501	
AC77	34	24	32	8	506	
AC78	35	24	32	8	494	
AC79	39	24	39	15	488	still in saprolite
AC80	33	20	32	12	435	
AC81	36	24	36	12	1,580	still in saprolite
	includes	24	28	4	3,428	
AC82	22	12	20	8	458	
AC83	20	-	-	-	(<300)	
AC84	24	12	20	8	502	
AC85	31	16	28	12	352	
AC86	21	-	-	-	(<300)	
AC87	30	20	28	8	397	
AC88	36	28	36	8	536	still in saprolite
AC89	44	16	20	4	324	
		26	43	17	1,205	
AC90	36	32	36	4	1,864	still in saprolite
AC91	32	24	28	4	686	
AC92	27	-	-	-	(<300)	
AC93	19	-	-	-	(<300)	
AC94	24	-	-	-	(<300)	
AC95	30	24	28	4	366	
AC96	31	20	28	8	389	
AC97	31	20	28	8	415	
AC98	37	24	36	12	639	
AC99	39	20	32	12	582	
AC100	27	20	26	6	732	
AC101	25	20	24	4	827	
AC102	39	20	39	19	417	still in saprolite
AC103	35	20	28	8	524	
AC104	39	20	32	12	744	
		36	39	3	525	still in saprolite
AC105	30	8	12	4	383	
AC106	23	-	-	-	(<300)	
AC107	19	-	-	-	(<300)	
AC108	20	-	-	-	(<300)	
AC109	13	-	-	-	(<300)	

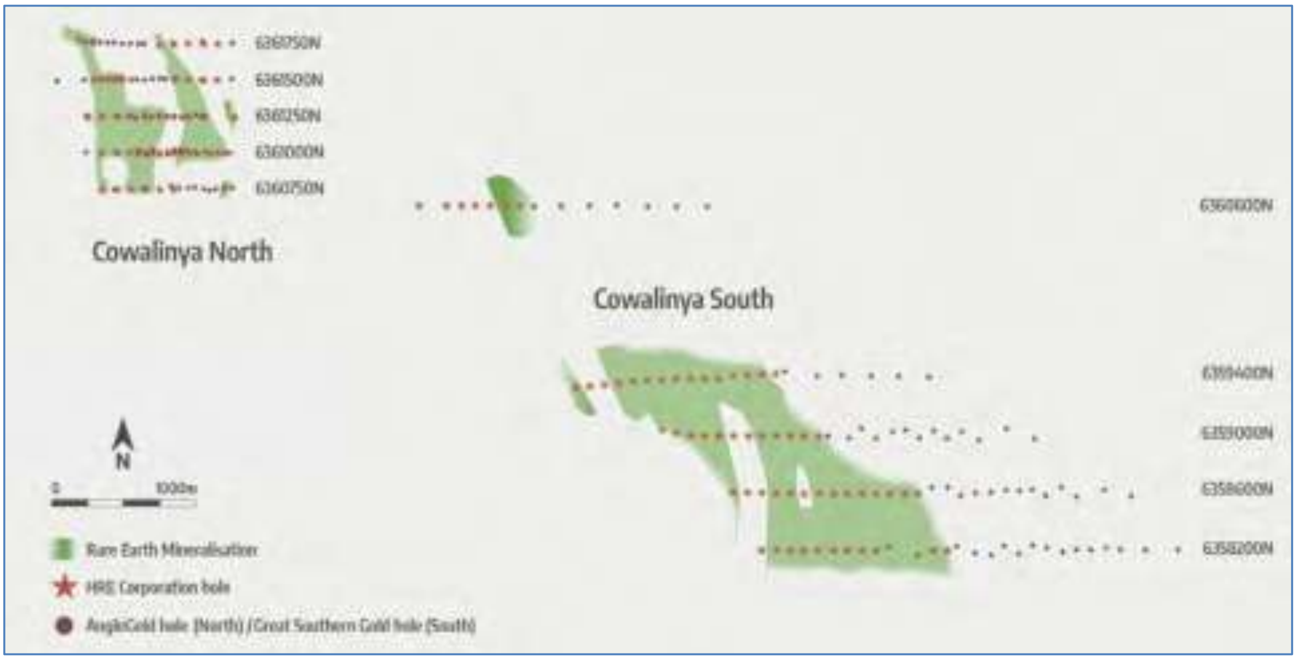
On the basis of maximising thickness of samples >300 ppm TREO there were 99 composite intervals with an average thickness of ~9 m and average grade of 624 ppm TREO. A bias towards higher grades reduced thickness to ~8 m and increased grade to ~701 ppm TREO. There were 17 composites with grades >1,000 ppm TREO (average thickness 6.6 m, average grade 1,453 ppm TREO). The highest composite value in Area 1 was 4 m @ 2,249 ppm (0.22%) in AC33. The highest composite value in Area 2 was 4 m @ 3,428 ppm (0.34%) in AC81. Total overburden thickness above the REE-mineralised layer averaged ~18m (~6 m alluvium, ~12 m clay).

10.7.5 HRE INTERPRETED REE MINERALISATION AREAS

Figure 79[140] illustrates (in plan view) the areas of REE mineralisation (shaded green) interpreted by HRE in their air-core drill holes (where TREO >300 ppm). The Figure shows HRE's drillings Area 1 (bottom right) and Area 2 (top left), referred to as South and North respectively by HRE's Resource Consultant (see Section 11)). HRE's holes span an area ~5 km E/W and ~3.5 km N/S. HRE's 2021 drill holes are marked by red stars (*), the previous AngloGold and Great Southern holes by block dots (.). This Figure was consolidated by HRE from their original raw separate plans of each Area, given in Appendix 5 – HRE Cowalinya drill hole location plans.

[140] HRE data room. Updated version February 2022.

Figure 79 REE mineralisation areas



10.7.6 HRE INTERPRETED REE MINERALISED LAYERS

The following Figures show HRE's interpreted REE mineralisation on their vertical E/W drilling cross-sections for each Area (looking north, west on left, east on right).

HRE's REE-mineralised layer(s) are solid shaded green and exist within the saprolitic zone. Bounding surfaces of the saprolite are shown as interpreted and modelled by the Resource Consultant for the Resource Estimate (see Section 11.1). The interpreted upper surface of the saprolite (the base of the overlying transported cover material) is marked by a dashed blue line – the lower surface of the saprolite (top of bedrock) is marked by a dashed red line. The Resource Consultant's interpreted surface division of Upper Saprolite from Lower Saprolite is marked by a dashed yellow line.

Sections are sequentially down the page going southwards in the order labelled in Figure 79. They are at approximately the same scale, and in each Area they line up approximately N/S (dashed black lines are constant easting coordinates). All cross-sections in Area 1 / South are to the east of those in Area 2 / North. The sections do not (unfortunately) show the previous drill holes.

In Figure 80[141] of Area 2 / North the spacing between adjacent holes on section is either 50 or 100 m E/W. Individual sections are 250 m apart N/S. Cross-sections in Area 2 are drawn with a 4:1 vertical exaggeration.

In Figure 81[142] of Area 2 / South the spacing between adjacent holes on section is 100 m E/W (NB: The horizontal scale of these Area 1 sections is slightly smaller than the Area 2 sections). Individual sections are 400 m apart N/S (except for the most northern two cross-sections which are 1,200 m apart). The most northern cross-section in Area 1 is 150 m south of the most southern cross-section in Area 2. Cross-sections in Area 1 are drawn with a 5:1 vertical exaggeration.

[141] HRE data room. Updated version February 2022.
[142] HRE data room. Updated version February 2022.

Figure 80 REE mineralisation on HRE drilling cross-sections – Area 2 / North

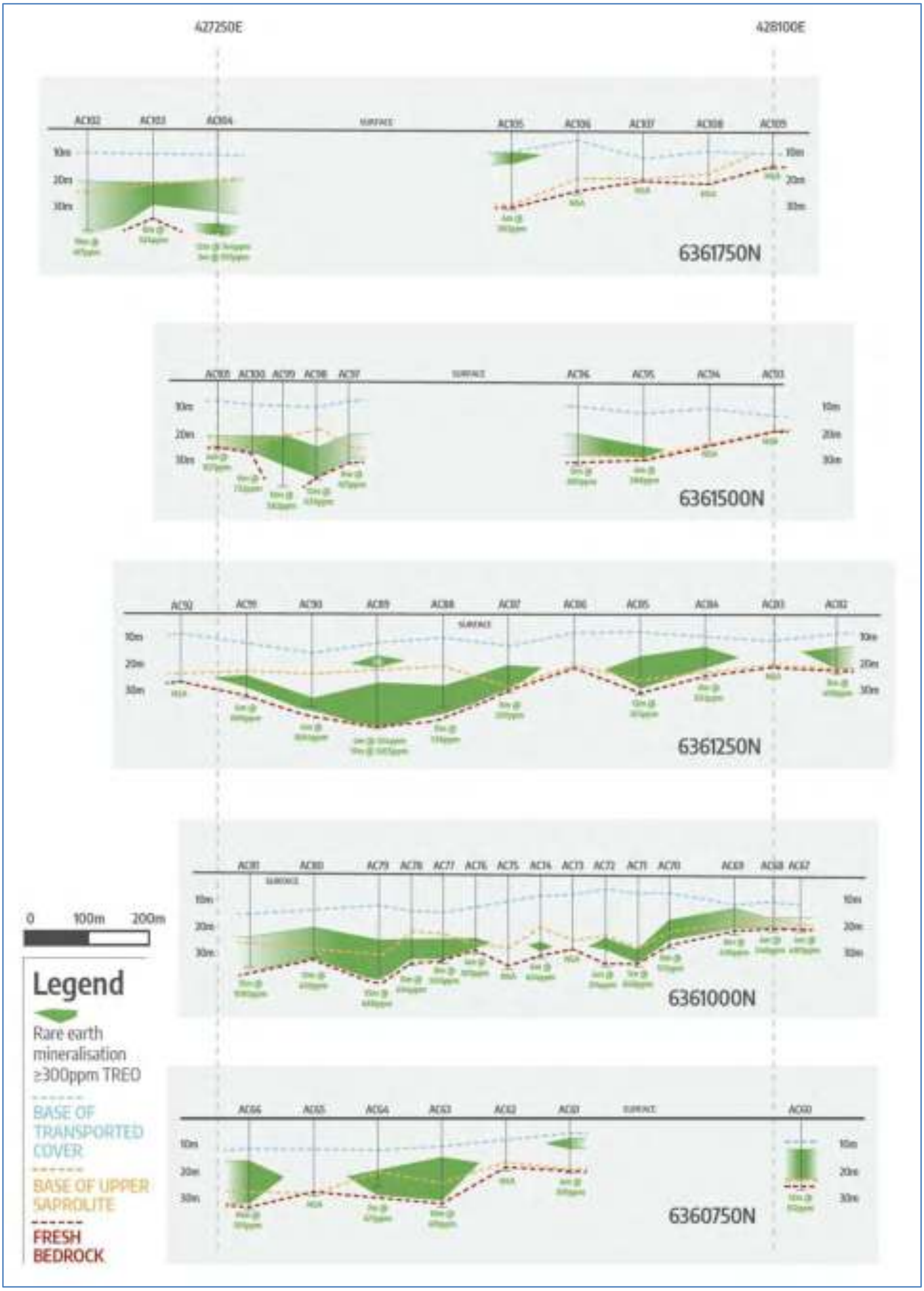


Figure 81 REE mineralisation on HRE drilling cross-sections – Area 1 / South

10.8 HRE METALLURGICAL REE TEST-WORK

HRE conducted a series of metallurgical REE test-works[143], using acid leaching to extract REEs into solution in an apparently similar fashion to the earlier Salazar work (Section 8). HRE used LabWest Mineral Analysis (LabWest). Salazar had used Ambel Laboratories. No specific reporting on the metallurgical test-work was supplied to the Consultant and hence these notes were derived by inspecting data files.

Tests were conducted on 40 REE-bearing highly weathered clay saprolite samples from 3 holes drilled into Area 1 / South. Testing was done using different acid concentrations, temperatures and residence times. Testing may have tried different acids but like Salazar the hydrochloric acid appears to have been the most effective. Summary results from Area 1 are presented in Table 11.

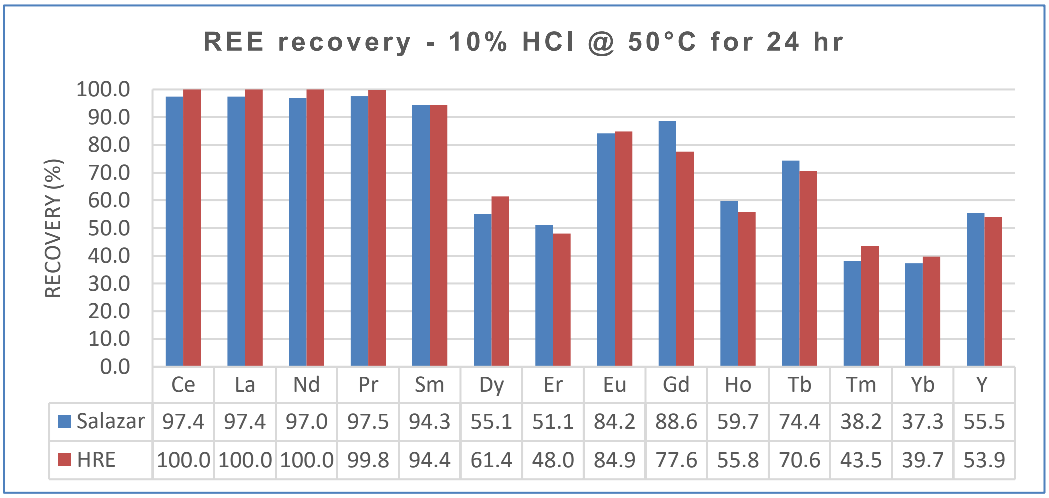
Table 11 HRE Metallurgical REE recovery – Area 1 / South

HCl	Temp	Recovery (acid digests over 24 hours)			
		TREE	LREE	HREE	Valuable REE
			Ce La Nd Pr Sm	Dy Er Eu Gd Ho Lu Tb Tm Yb Y	Nd Pr Dy Er Eu Gd Ho Lu Tb Tm Yb
(%)	(°C)	(%)	(%)	(%)	(%)
10%	50	91.0%	95.0%	59.3%	83.6%
5%	50	89.2%	93.3%	58.1%	81.6%
2%	50	81.9%	88.2%	51.2%	70.1%
5%	30	91.0%	95.2%	56.9%	81.2%
2%	30	71.1%	79.0%	44.6%	60.5%
20%	20	90.6%	95.0%	60.6%	87.8%
10%	20	26.9%	31.3%	17.0%	27.6%

Results appear to have been **very satisfactory**, with >90% recovery to solution of TREE being possible under multiple combinations. This result was in line with (and slightly better than) Salazar's results. At high enough temperatures (>30°C) the HCl concentration only needed to be 5% or greater to achieve ~90% recovery. LREE recovery (~95%) was significantly higher than for HREE (~55%), mimicking Salazar's results. Of a suite or REEs determined by HRE to be "valuable" the recovery was generally >80%.

Figure 82 compares individual REE recoveries achieved by Salazar at Splinter and by HRE in Area 1. The test results are considered to be **very close**, thus proving the robustness of the extraction method. The results are also surprisingly similar given that the projects are ~55 km apart and would be expected to have had at least slightly differing granitic basement compositions (primary source of the REEs).

Figure 82 HRE vs Salazar REE recoveries



10.9 HRE RESULTS & CONCLUSIONS

Initial decision: HRE's data review of previous exploration convinced them of the potential at Cowalinya for REE mineralisation (and particularly HREE mineralisation) over a wide area in the shallow lateritic clays above the basement granite. They noted Salazar's very successful recovery of >90% of TREE from similar nearby deposits using simple acid digestion, thus suggesting the possibility of low cost effective extraction at Cowalinya.

143 All data and tables on HRE's metallurgical testing was sourced from files in the HRE data room.

Consequently HRE commenced air-core drilling over the two previously drilled (by Great Southern and AngloGold) prospects (Night Shade and Double Tank) to in-fill and extend them.

Drilling results: HRE's recent drilling proves Cowalinya's ore-grade REEs in an ion-adsorption clay REE deposit.

HRE's 109 hole air-core drilling program (3,089 m) in two Areas (1 and 2) over the old prospects successfully confirmed the REE mineralisation spanning at least an area at least 5 km long (in an ESE direction) by 1 km wide (in the normal SSW direction). Those dimensions give mineralisation over 5 km^2. Hole depths averaged ~29 m. By excluding ~1 m at the EOH of bedrock that gave a thickness of ~28 m of the in-situ weathered and lateritised clay layer above bedrock plus a thin alluvial surface layer.

All holes contained anomalous TREEs in the bedrock granite and ~90% contained considerably enriched TREEs in sections within the saprolitic clay. Contiguous mineralised composites of the 4 m long individual samples >300 ppm TREO were interpreted in virtually all holes (91%). The majority of holes contained a single composite, a number contained two.

REE-mineralised layer interpretation: On cross-section and from hole-to-hole the composites were seen to represent a REE-enriched layer (or layers) within the clay zone. The mineralised layers were ~9 m thick and averaged 615 ppm TREO. If composites were interpreted to emphasise higher grades then the layers were marginally thinner (~8 m) and the grade noticeably higher (~700 ppm). There were 17 composites with grades >1,000 ppm TREO – average 6.6 m @ 1,445 ppm (0.15%) TREO. The highest composite value in Area 1 was 4 m @ 2,197 ppm (0.22%); in Area 2 was 4 m @ 3,417 ppm (0.34%).

In plan view the REE-enriched layers are concentrated (thickness and grade) into a semi-banded shape with the NW/SE trending bands possibly oriented parallel to magnetic lineations in the bedrock.

Drilling validation: HRE's drill hole twinning program (albeit small with 3 holes twinned with 3 Great Southern holes) was successful in showing consistency of their logging and assaying with previous drilling.

Assay method: And QA/QC analysis of their sample 4 acid digestion assaying showed that accuracy was acceptable but that more duplicates should be submitted to check repeatability. Interestingly a small program to evaluate other assay methods shows that a laser ablation method may produce noticeably higher and more accurate grades, particularly for scandium.

Metallurgy: HRE's metallurgical test-work to investigate REO acid leaching into solution was very successful with >90% recovery of TREE being possible under multiple combinations (of HCl acid strength, temperature and leach time). This work confirmed the previous Salazar test-work on their Splinter Project ~55 km to the ESE. Recovery of LREEs was ~95%; of HREEs was ~55%; and of the "valuable" REEs was generally >80%.

Mining: From a mining perspective the overburden thickness above the REE-mineralised layer is modest and averages ~17-18 m, a third of which is sandy alluvium. HRE asserts that concentrations of potential contaminants uranium and thorium are low.

Potential quantities: HRE's October 2021 in-house rough quantity[144] estimation for a deposit 2*1 km^2 in area and 10 m thick were closely borne out by the February 2022 Resources reported by their Resource Consultant (Section 11). So far the deposit remains laterally **open in all directions**.

10.10 HRE FUTURE EXPLORATION (2022)

Based on the 2021 drilling results HRE intend to undertake a 330 hole (10,000 m) air-core drilling program[145]. That program is based on the 2021 Areas 1 and 2 – aiming to extend Area 1 to the SE and Area 2 to the west. Total program cost (with line clearing and sample assaying) is estimated at $1.2M. That cost is a sub-set of the all-up "Drilling" expenditure in Table 1 in the IPO Details Section 2.3.

300 holes (9,000 m) would be drilled in Area 1, on lines 400 m apart N/S (same as before), and spaced 200 m apart E/W (100 m apart in 2021). 30 holes (1,000 m) would be drilled in Area 2, on 3 lines 500 m apart N/S (250 m in 2021), and spaced 200 m apart E/W (50 m apart in 2021).

[144] HRE, October 2021. *Cowalinya Rare Earths Project*. Introductory presentation. Slide 6, 3rd dot point.
[145] HRE, October 2021. *Cowalinya Rare Earths Project*. Introductory presentation. Slide 7.

11 COWALINYA PROJECT – RESOURCE ESTIMATION (2021)

A late-2021 Mineral Resource estimate for Cowalinya was being undertaken by independent Resource Consultant **Mr John Tyrrell** (of JMCT Consulting (JMCTC)) slightly in advance of this IGR. Details of the estimation work were provided to the Consultant in December 2021 and January 2022 and the final Report in February 2022[146]. That Report is appended in full to this IGR at Appendix 7. The estimation work was reviewed by the Consultant and relevant aspects are summarised here with the inclusion of a number of Figures from the Report.

11.1 GEOLOGICAL LAYER MODELLING

Computerised modelling of the geological layers at Cowalinya formed the initial part of the Resource estimation work. The layer cross-sections (Figure 80 and Figure 81) in Section 10.7.6 represent pre-modelling versions of the interpreted layers. A sequence of the weathered layers (REE-enriched) at Cowalinya were interpreted both from the historical AngloGold And Great Southern drill logs and the logs from HRE's 2021 drilling.

From that data the Resource Consultant simplified the geology into "*a series of layered sands and clays, with the occasional duricrust or silcrete zone. These are relatively thin above the primary mineralisation domains (the upper and lower saprolite units) averaging approximately 2 m in thickness, apart from the puggy clay which averages just over 5 m. The combined saprolite units* [below] *range in thickness from 2-32 m, averaging just over 17 m. … The focus for the geological interpretation was on the upper and lower saprolite units, as these hosted the interpreted mineralisation. Boundaries were defined by the logged geology, utilising the historical drilling where appropriate*."

Stratigraphy interpreted by the Resource Consultant is listed in Table 12[147]. The North Area (left column) is equivalent to HRE's Area 2 and the South Area is HRE's Area 1 (Figure 79).

Table 12 Cowalinya stratigraphy

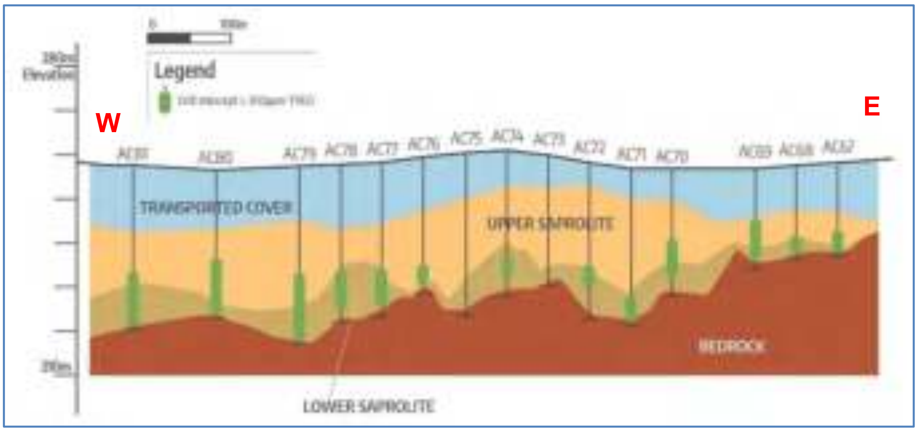
Geological Unit	
North Area (DOMAIN 1000)	*South Area (DOMAIN 2000)*
Calcrete/Soil	Calcrete/Soil
Upper Clay	Upper Clay
Upper Sand	n/a
Puggy Clay	Puggy Clay
Middle Sand	Middle Sand
Silcrete	Silcrete
Silcrete-Sand (Lower sand)	n/a
Upper Saprolite	Upper Saprolite
Lower Saprolite	Lower Saprolite
Bedrock (Fresh Rock)	Bedrock (Fresh Rock)

Layers were modelled with wire-frames from the geological logging intercepts. Layers were only modelled at the peripheries to half a hole spacing beyond the edge holes. Thus the layer extends were determined by available drilling (layers remain open laterally in all directions).

Typical vertical E/W cross-sections[148] are shown through the layer models in each Area in Figure 83 and Figure 84 (looking north, west on left, east on right). Green straws on the drill hole traces mark mineralisation TREO ≥300 ppm.

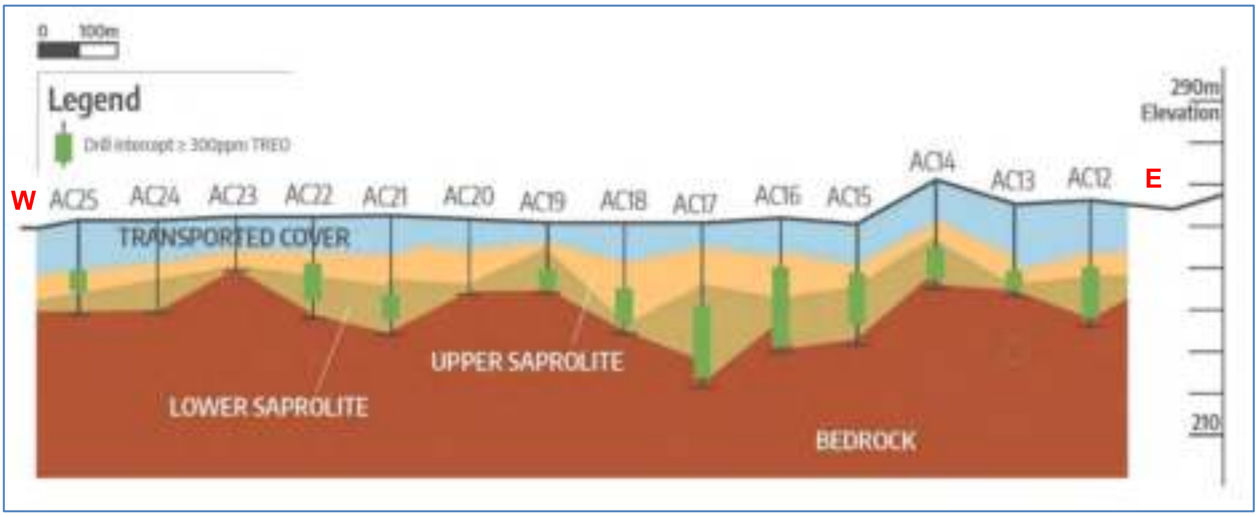
The Figures are vertically exaggerated 5x, horizontal scales are approximately equal. In Figure 83 the holes are 50 or 100 m apart; in Figure 84 the holes are 100 m apart.

Figure 83 Layer cross-section 6,361,000 N – Area 2 / North



[146] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Report issued to HRE by JMCT Consulting.
[147] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Partially extracted from Table 4.1, pp37.
[148] HRE, February 2022. Simplified from Tyrrell, 11 February 2022, Figs 4.2 & 4.3, pp38-39.

Figure 84 Layer cross-section 6,358,600 N – Area 1/ South

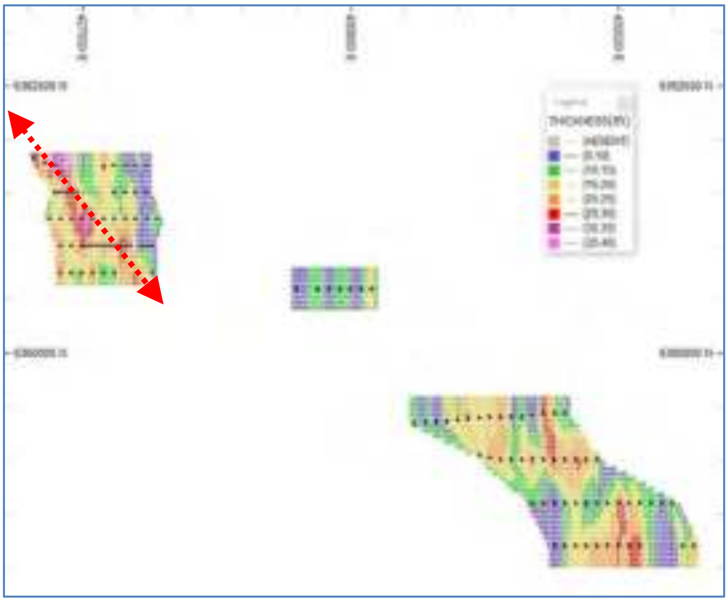


The upper transported soil/clay/sand layers (shaded light blue) averaged ~10 m thickness, the Upper Saprolite (shaded orange) layer averaged ~12 m thickness, and the Lower Saprolite layer (shaded khaki) averaged ~7m thickness. The combined Upper and Lower Saprolite thickness range was 2-32 m and averaged ~17 m. Bedrock (shaded brown) is shown directly below the Lower Saprolite.

Figure 83 and Figure 84 also shows the REE mineralisation >300 ppm TREO (marked by the green boxes on the black drill hole traces) being within both the Upper and Lower Saprolite layers. The mineralisation generally occupies the base of the Upper Saprolite and extends down into the Lower Saprolite where it represents most of the thickness.

The Consultant is unaware of the particular motivation for differentiating Upper from Lower Saprolite – other than that the Upper Saprolite was understood to be highly oxidised (weathered) and the Lower Saprolite represented a less oxidised transitional zone. The Consultant observes that the boundary between them straddles the zone of highest REE-mineralisation (the green boxes in Figure 83 and Figure 84 and identified by the composites described in Section 10.7.4). The saprolite layer distinction would seem superfluous to the modelling of REE mineralisation itself. It would however be important for modelling the base of oxidation if that has a material effect on metallurgical REE extraction from the clays.

Figure 85 Saprolite layer thickness (m)



Saprolite: Figure 85[149] illustrates a colour-coded plan view (north at top) of total saprolite (Upper + Lower) layer thickness. Drill holes are black dots. Coloured blocks appear to be 25*50 m (X*Y) in size.

Thickness colours would agree with Tyrrell's stated average thickness of ~17 m (light yellow 15-20 m being approximately the mid-range in the Figure). However the maxim coloured range (35-40 m) would appear to go slightly higher than Tyrrell's 32 m – probably as reasonable surface extrapolation into areas not drilled (such as the northern-most line in the top left).

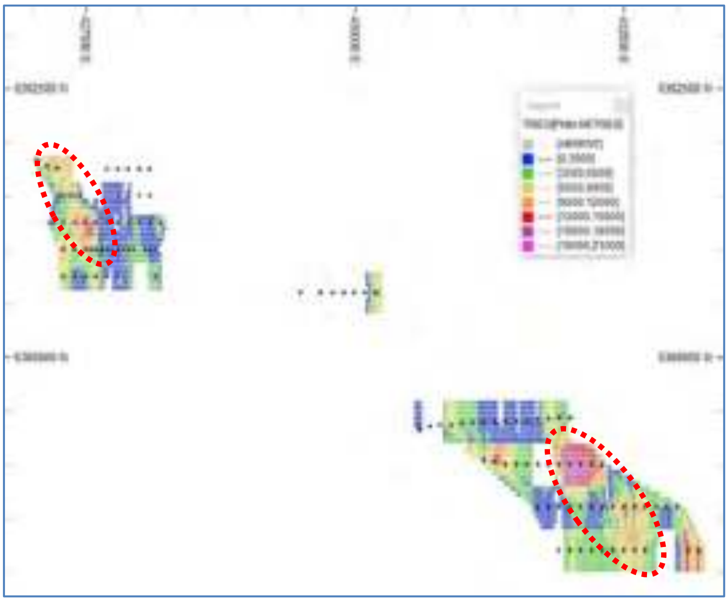
Because of the asymmetric hole geometry (close E/W and wide N/S hole spacing) the thickness trends have a distinct local N/S alignment ("line effects"). However the overall thickness trends could be interpreted as ~NW/SE (red dotted line), sub-parallel to the regional airborne geophysical magnetics trends (see Figure 66). It is not known if local topographic or groundwater drainage effects would influence weathering depths and thus the saprolite thickness (although that would seem unlikely as the slope in the area is gently to the SW, normal to the NW/SE thickness alignment). Therefore variations in the basement geology

[149] HRE, February 2022. Simplified from Tyrrell, 11 February 2022, Fig 4.1, pp36.

would seem to be the factor to control saprolite thickness, perhaps reflected by the magnetics trends.

Figure 86[150] illustrates a similar plan view – but colour-coded on total saprolite average TREO grade >300 ppm * total layer thickness. In other words, a grade-thickness plot. The lower 300 ppm cut-off was used as the effective lower cut-off in IAC deposits. TREO is not coloured where <300 ppm, hence the holes and the patchy appearance. NB: the grade is composited over the full saprolite depth.

Figure 86 Saprolite TREO >300 * thickness (ppm m)



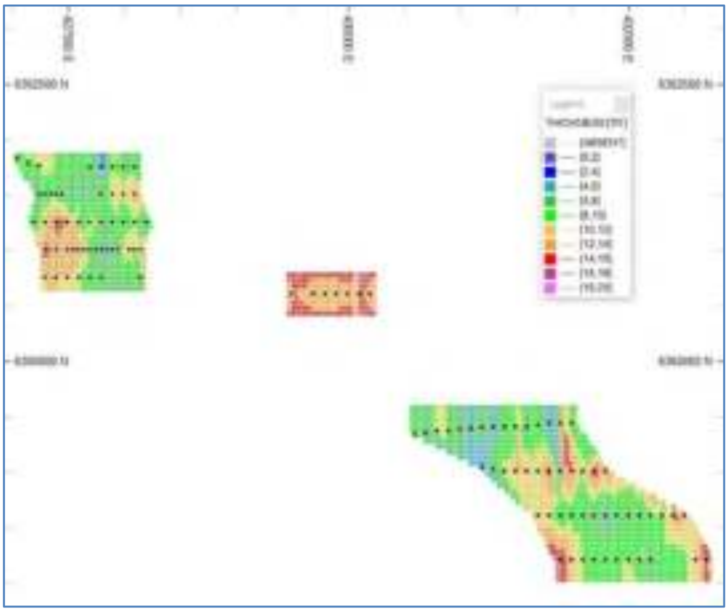
In many respects this grade/thickness plot resembles the thickness plot. However in several locations (one in each drilling area) higher grades are also found with thick saprolite, marking areas with better REE mineralisation in greater volumes. With NW/SE trending applied to the layer modelling it would seem probable that at least the ~300 m wide round high grade/thickness patch in the southern area (on the eastern end of the 6,359,000 N line) could actually form an ~800 m long SE trending oval (dotted red line) patch (linking to the 6,358,200 N line). A smaller high grade/thickness oval could also be interpreted in the northern area.

These high grade/thickness areas (red/purple) have values ~12-20,000 ppm-metres. If divided by their average thickness of 20 m they would have grades of ~600-1,000 ppm TREO. And given the TREO grade is over the full saprolite thickness, and not the more mineralised section, the mineralised areas would have much higher average grades.

The Consultant observes that the top of the simple ~8-9 m thick high-grade REE-enriched "composite layer" (Section 10.7.4) averaged ~18 m below surface – meaning it straddled the Upper/Lower Saprolite boundary (with 4 m above and 4 m below). A considerable upper section of the Upper Saprolite carried far lower REE-enrichment than the section at the base. Conversely the upper section of the Lower Saprolite was more REE-enriched than its base. The Consultant suggests that the high-grade REE-enriched composite layer simply represents the concentration zone within the classic Laterite B Zone (as illustrated in Figure 14 and Figure 15).

Overburden: Figure 87[151] illustrates a colour-coded plan view of the total overburden thickness above the Upper Saprolite (to the top of the Upper Saprolite). Drill holes are marked by black dots.

Figure 87 Overburden thickness to saprolite top (m)



Transported sediment overburden above the saprolite is ~10 m thick and in the range ~3-16 m.

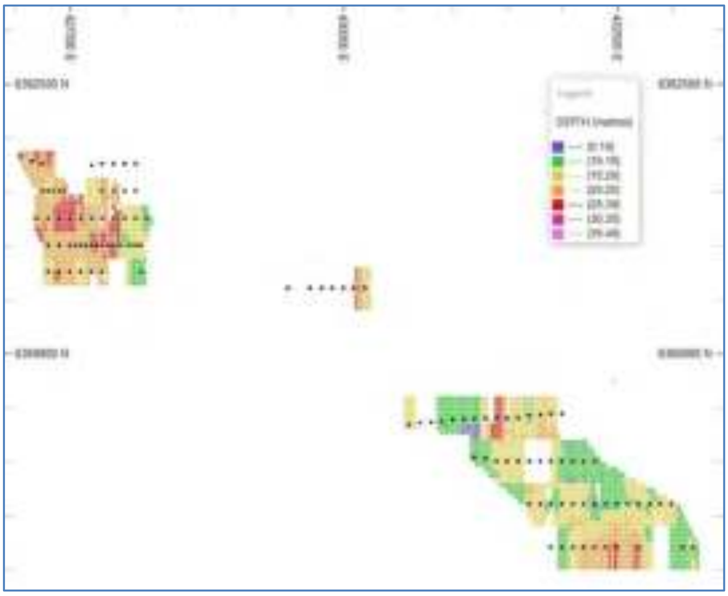
[150] HRE, February 2022.
[151] HRE, February 2022. Simplified from Tyrrell, 11 February 2022, Fig 4.5, pp42.

Figure 88[152] illustrates a similar overburden thickness plan view – but colour-coded on "true" overburden thickness above the >300 ppm mineralised saprolite (to the top of the REE-mineralised layer).

This overburden consists of transported sediments plus the un-mineralised saprolite and averages ~22+ m in the north and ~15 m in the south.

The thickness is not coloured where the TREO was <300 ppm, hence the patchy appearance.

Figure 88 Overburden thickness to TREO >300 ppm (m)



11.2 DATA POPULATION SEGREGATION & SAMPLE LENGTH COMPOSITING

Drill-hole sample assays were analysed (through statistical and geo-statistical analysis) in the lead-up to block grade estimation to determine their nature and continuity. This required data to be selectable by population. It also required sample intervals to be standardised by compositing.

Population domains/codes: In order to select different populations of data (segregate them) populations were flagged numbers. This was done initially by area domain – North 1000 and South 2000. Geology was done by code – Overburden 100 to 700, Upper Saprolite 800, Lower Saprolite 900, Bedrock 1000.

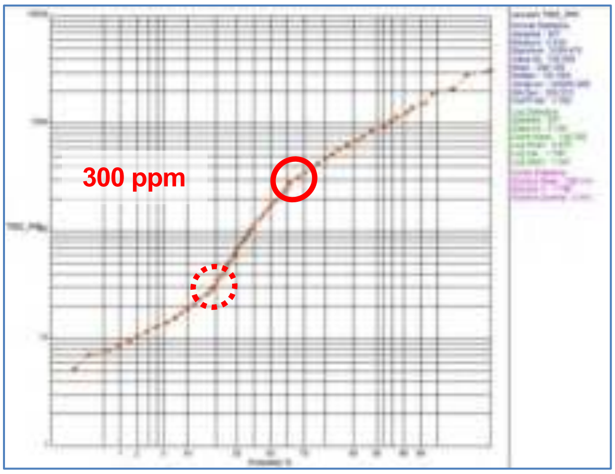
Compositing of sample intervals: Raw sample down-hole interval lengths were a mixture of 1 m (40% of intervals) and 4 m (60% of intervals). To give them the same weighting for analysis and grade estimation all sample intervals were composited to 4 m. Compositing was not done across geological boundaries – which resulted in a limited numbers of intervals being less than 4 m. In a very few places compositing did transgress geology.

11.3 STATISTICAL ANALYSIS

Drill-hole samples were studied statistically by Tyrrell to determine data populations and look at anomalous values.

Probability plot analysis: The "raw data" log probability plot for all REE assays added together (TREE) in all layers (827 samples) in Figure 89[153] clearly shows 3 data populations.

Figure 89 TREE log probability – all samples



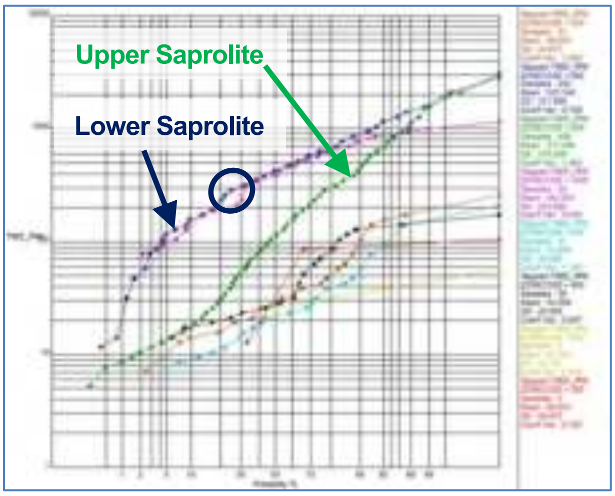
Inflection points on the curve separate the populations and exist at ~30 ppm (dashed red circle lower left) and ~300 ppm (solid red circle upper right and value labelled).

The higher grade samples >300 ppm effectively represent the REE-mineralised material (300 ppm could be considered a lower cut-off for Resources).

Figure 90[154] shows the TREE log probability plots broken down by individual geological layers. Of importance is the REE-mineralised Upper Saprolite (green, domain 800) and the Lower Saprolite (dark blue, domain 900). Together these account for 658 (80%) of the total 827 samples.

[152] HRE, February 2022.
[153] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.9, pp47.
[154] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.10, pp48.

Figure 90 TREE log probability – by layer



The thicker Upper Saprolite (green) contained most samples (406). Ignoring the very low grade samples (<20 ppm) it effectively appears to represent almost a single population (straight line) with only a slight indication of a very high grade population (>1,100 ppm).

However the Lower Saprolite (dark blue) with fewer samples (252) clearly represents two populations with the inflection again at ~300 ppm (blue circle).

Simple statistics analysis: Mean TREE grade in the overburden layers above the saprolite were very low (~45 ppm). In both the north and south areas the mean TREE grade was high, and more than twice as high for the Lower Saprolite was (~475 ppm) as for the Upper Saprolite (~200 ppm). The mean grade in the saprolite was also higher in the south than the north. Mean TREE grade in the basement rock was high (~460 ppm) but irrelevant to the Project as it would be uneconomic to extract from hard rock.

Within the saprolite the individual LREE elements correlated well together as did the HREE elements – but there was little correlation of the LREEs with the HREEs (except for terbium). Highly anomalous individual grades were sparse, leading to very light top-cutting (<5 samples from any element, being in the upper one or two percentiles) during the block grade estimation. And variances for the individual elements were low and generally <1.

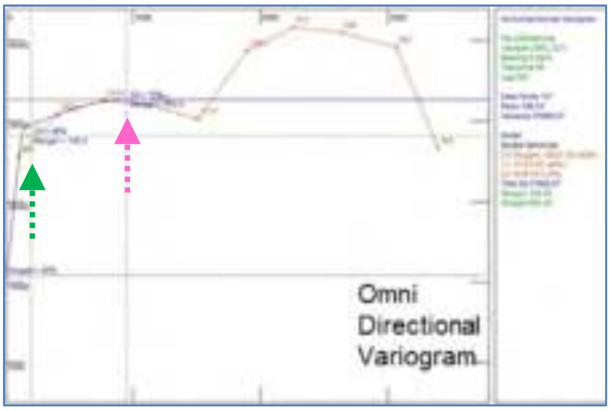
11.4 VARIOGRAPHIC ANALYSIS

Individual sample REE assays in the Upper and Lower Saprolite layers, in the north and the south areas, were analysed variographically for groupings of the LREEs (La, Ce, Pr, Nd, Sm); the HREEs (Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb,Lu and Y); and for associated elements (Sc, Th, U). Variography was done down-hole and in 3D. Modelling was done with two-structure (giving two ranges) spherical variograms. 3D variograms for the LREEs are presented below for the saprolite layers in both areas.

Upper Saprolite LREE: Figure 92[155] and Figure 91[156] present plan view (XY plane) 3D variograms for the LREEs in the Upper Saprolite in the north and south areas respectively.

Figure 92 Variogram - Upper Saprolite - North

Figure 91 Variogram - Upper Saprolite - South



Lower Saprolite LREE: Figure 94[157] and Figure 93[158] present plan view (XY plane) 3D variograms for the LREEs in the Lower Saprolite in the north and south areas respectively.

[155] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.21, pp62.
[156] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.23, pp63.
[157] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.22, pp63.
[158] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.24, pp63.

Figure 94 Variogram - Lower Saprolite - North

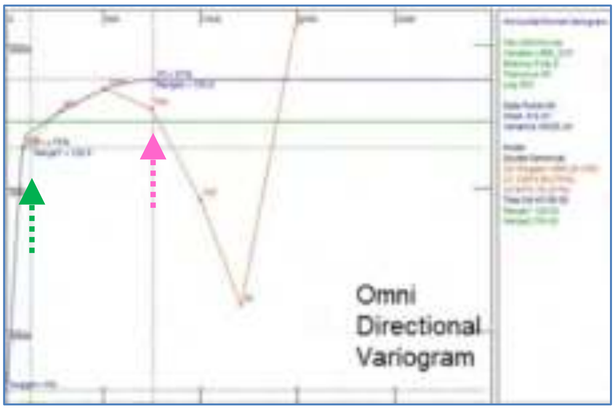
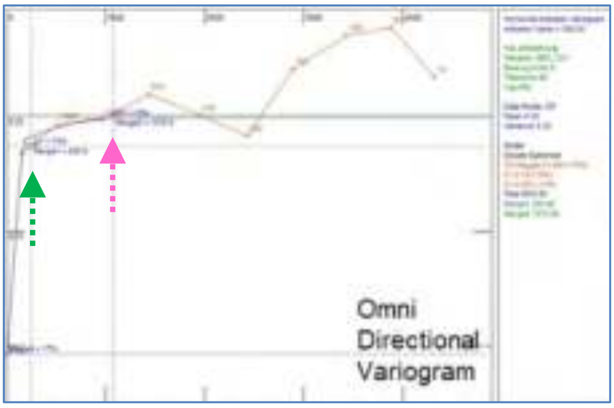


Figure 93 Variogram - Lower Saprolite - South



Anisotropy interpretations: Tyrrell flagged the pronounced impact on the variogram modelling of the drill-hole XY spacing asymmetry (100*400 m in the south; 100/50*250 m in the north). As the plan anisotropy was modest the variograms presented were mostly "omni-directional". In nearly all instances Tyrrell interpreted only a modest anisotropy to exist in plan view (XY plane), with the major axis direction being N/S (0°) or within 5-10° either side - the semi-major axis then being E/W (90°). The interpreted major axis azimuth directions for saprolite are given in Table 13 below.

Range interpretations: Ranges are distances up to which (pairs of) samples are related to some extent with a calculated variance. Samples are un-related beyond the range distance – implying that samples that far apart should not theoretically be used in block grade estimation. The two structure range distances interpreted from the variograms (Range 1 and 2) are given in Table 13[159] for saprolite. Range 1 is the shorter structure (and marked with the green arrows in the variogram figures) and Range 2 is the longer structure (marked with the pink arrows).

The interpreted plan view (XY) major direction short structure ranges (Range 1) were ~120-390 m, a "good" distance spanning ~2-5 holes E/W and ~1-3 holes N/S. The interpreted plan view major direction long structure ranges (Range 2) were very long at ~750-1,300 m and would span ~7-10+ holes E/W and ~3-5 holes N/W (see Consultant's comments below). The minor direction (Z) down-hole ranges of ~5-15+ m were very similar (maybe simply coincidentally) to the REE-mineralised layer thickness.

Table 13 Variogram interpreted anisotropy & ranges

Layer/Area	Elements	Azimuth	Range 1			Range 2		
		Major axis (°)	Major axis (m)	Semi-Major axis (m)	Minor axis (m)	Major axis (m)	Semi-Major axis (m)	Minor axis (m)
Upper Saprolite								
North	LREE	5	390	130	5	990	675	13
	HREE	10	370	130	5	1,300	415	11
South	LREE	0	195	195	7	950	950	15
	HREE	10	240	240	7	1,080	1,080	13
Lower Saprolite								
North	LREE	0	122	122	4	755	755	9
	HREE	155	395	140	5	870	730	11
South	LREE	0	245	245	11	1,075	1,075	22
	HREE	10	245	245	8	960	960	16

The Consultant would consider the variograms (examples above) to be poor with little detail given for the shorter ranges. Causes could be the lack of stratigraphic layering control employed (which would promote the layering continuity interpreted to exist) combined with excessively long lag distances used (which appear to have been 250-300 m or 3 the E/W drill spacing). Consequently the interpreted very long Range 2 distances (755-1,300 m) appear to be poorly supported and unlikely (they span 7-10+ drill holes E/W). The shorter Range 1 distances (122-390 m) would be more likely as the furthest ranges – and only span ~2-5 drill holes E/W.*

159 Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Partial extraction from Table 4.11, pp64.

11.5 BULK DENSITIES

Dry bulk densities (for use in the tonnage reporting) were determined for each of the principal individual geological units, mostly from published information or (for the saprolite) from actual measurements done on drilling samples.

Densities used by Tyrrell are given in Table 14[160].

Transported overburden (above the REE-mineralised saprolite) density would average ~2.0 t/m³ and saprolite density was ~1.6 t/m³.

Table 14 Dry density

Geological Unit	Density t/m^{-3}
Calcrete/Soil	1.35
Upper Clay	2.2
Upper Sand	1.6
Puggy Clay	2.2
Middle Sand	1.6
Silcrete	2.3
Silcrete-Sand (Lower sand)	1.6
Upper Saprolite	1.63
Lower Saprolite	1.63
Bedrock (Fresh Rock)	2.5

11.6 BLOCK MODELLING

A 3D block model was built within the vertically stacked wire-framed geological layers. The primary block size was 100*400*4 m (XYZ). Within this model a smaller block size of 100*250*4 m was used during grade estimation for the northern Area 1. The block model overall dimensions were 7.4 km E/W, 6.0 km N/S and 140 m vertically.

Figure 95 Block model and drill hole plan

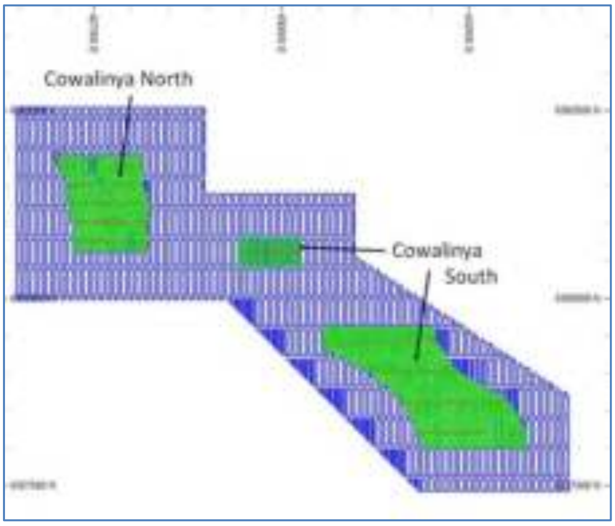


Figure 95[161] in plan view shows block outlines in blue, drill holes as red dots, and the wire-framed layer models in green. In the south the 400 m northing (Y) block dimensions matched the northing drill line spacing with block centroids roughly aligned with the E/W drill lines (so drill holes were roughly centred in the N/S direction). So in the south the red holes are seen in the middle of blocks. The closer drill lines in the northern area required the intermediate 250 m northing block dimensions.

Blocks were domained on a layer basis. Blocks were further sub-blocked down to 25*25 m in plan view (XY) on the layer boundary surfaces. Block volumes matched layer volumes closely (within 0.5%).

11.7 BLOCK GRADE ESTIMATION

Domain segregation: Block grades were estimated on a domain basis – meaning that confining layer surfaces (particularly important between the Upper and Lower Saprolite) were "hard" surfaces preventing estimation contamination into a particular layer from samples in other layers. Block grades were estimated separately for the north and south areas and for the Upper and Lower Saprolite. The particular software used (Datamine) meant that grades in sub-cells (sub-blocks) carried the same grades as their parent cells.

Input drill-hole data: Block grades were only estimated from assays in the 109 HRE holes drilled in 2021. Drill hole grades used were all composited to 4 m as described above and did not cross layer boundaries. High grade top-cuts were individually applied to many of the REEs (generally to extreme data outliers (top 1-2 percentiles) and different cuts were used in Areas 1 and 2.

Estimation method & parameters: Block grades were estimated for all REEs (plus Sc, Th and U) independently using Ordinary Kriging (OK). Subsequently the block REE grades were converted to oxide REO grades by applying constant factors (given in the Abbreviations). Various block estimation details were stored along with the grades, such as numbers of samples used to compute each block, variances and average sample distances.

Estimation search distance parameters were based on the variogram results and the directions and scan distances for saprolite are given in Table 15[162]. Maximum sample scan distances were set at ~⅔ of the maximum (Range 2) major axis range and then scaled for the other directions. Between 3 and 7 samples were required to estimate a block grade.

[160] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Extracted from Table 4.10, pp61.
[161] HRE, February 2022.
[162] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Extracted from Table 4.15, pp69.

Table 15 Grade estimation search parameters

Layer/Area	Elements	Azimuth	Scan dist			Range 2		
		Major axis (°)	Major axis (m)	Semi-Major axis (m)	Minor axis (m)	Major axis (m)	Semi-Major axis (m)	Minor axis (m)
Upper Saprolite								
North	LREE	0	450	660	9	990	675	13
	HREE	10	? 275	? 865	7	1,300	415	11
South	LREE	0	635	635	10	950	950	15
	HREE	10	720	720	9	1,080	1,080	13
Lower Saprolite								
North	LREE	0	500	500	6	755	755	9
	HREE	155	485	580	7	870	730	11
South	LREE	0	715	715	15	1,075	1,075	22
	HREE	0	640	640	11	960	960	16

Estimation validation: Estimated block grades were partly validated by visual inspection of colour-coded blocks plotted on cross-section. Typical E/W cross-sections through grade blocks coloured on TREO in the saprolite are shown for each area in Figure 96[163] and Figure 97[164] (which are equivalent to the layer sections Figure 83 and Figure 84). The Figures are vertically exaggerated 5x (in the north section the vertical tick mark spacing is 10 m, in the south area it is 25 m). Horizontal scales are approximately equal.

High REE grade (>300 ppm) blocks are coloured yellow through to red and purple and are confined to the lower parts of the saprolite. Highest grades are within the Lower Saprolite. Lower grades are coloured green to blue and exist above the higher grade blocks.

Figure 96 TREO block cross-section 6,361,000 N (North Area)

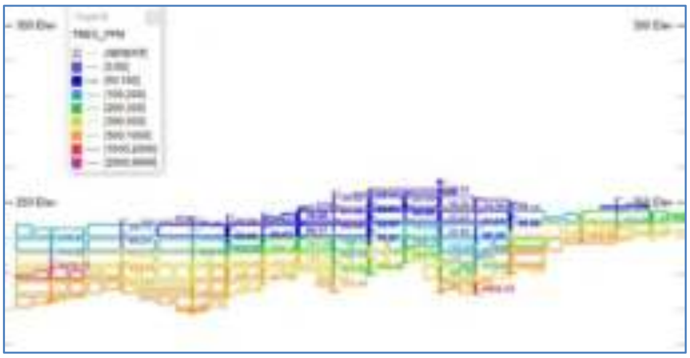


Figure 97 TREO block cross-section 6,358,600 N (South Area)

The Resource Consultant further validated block grades by comparing estimated block grades with cut drill hole grades, and the comparisons were close. Blocks were reported as slightly overestimated in the northern area (mean differences ~8%) and slightly underestimated in the southern area (mean differences ~3%). Further validation through TREO percentile plots showed good correlations for most of the grade range except for higher grades which were distinctly under-estimated where >600 ppm TREO.

The Consultant is not clear how well the estimation parameters prevented 1) undue smoothing or 2) undue dilution (given that Tyrrell stated that higher grades were under-estimated). Smoothing would be probable through the use of long scan distances (which the Consultant considered poorly supported by the Variography). Dilution would be from the lower REE grades above and below the central high REE grade layer (given the Consultant's view that the Upper/Lower Saprolite boundary appears to split the higher REE-mineralisation approximately in half).

[163] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.27, pp73.
[164] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Fig 4.28, pp74.

11.8 MINERAL RESOURCES

Reporting parameters: Mineral Resources were only reported by Tyrrell from the saprolitic layers. The lateral extent of the saprolitic layers to report from was limited to within 50 m of the perimeter drill-holes. Tonnage reporting was done on a dry basis using a default density of 1.63 t/m^3. Grades were reported above a lower 300 ppm TREO minus CeO_2 cut-off grade. This cut-off value was considered justified by the Resource Consultant giving consideration to the IAC deposit type (and cut-offs used in similar types of deposits) as well as mining and metallurgical assumptions. The Resource Consultant considered that REE-mineralised material above that cut-off would have a "*reasonable prospect for eventual economic extraction*".

JORC classification: Resource classification by the Resource Consultant was done according to the JORC Code, 2012 Edition. All Resources were classified as **Inferred**. Further notes on the JORC classification are given in Section 11.9.

The Inferred classification took into account the following factors:

- Relative confidence in the tonnage and grade estimations.
- Reliability of the input data.
- Confidence in the continuity of the geology and grade values.
- Quality, quantity and distribution of the drill-hole and supporting input data.

The Consultant believes that the Resource Consultant was relatively confident in each factor.

Cowalinya Mineral Resources: Summarised maiden Mineral Resources estimated for Cowalinya in 2021, by area, appear in Table 16[165]. They are reported above a TREO minus CeO_2 cut-off of 300 ppm and with a default dry density of 1.63 t/m^3. *NB: These Resources were extracted from Mr John Tyrrells Report (appended in full in Appendix 7) and* ***Mr Tyrrell is the CP for the Mineral Resources***.

Table 16 Cowalinya 2021 Mineral Resources

Area	Class	Tons (Mt)	TREO (ppm)	TREO - CeO_2 (ppm)	Sc_2O_3 (ppm)	Magnet REOs / TREO (%)	Magnet REOs / (TREO-CeO_2) (%)	Bulk Density (t/m^3)
North (Area 2)	Inferred	7	635	450	26	25	36	1.63
South (Area 1)	Inferred	22	620	430	32	25	37	1.63
Total	**Inferred**	**28**	**625**	**435**	**31**	**25**	**36**	**1.63**

Notes:
** TREO = La_2O_3+CeO_2+Pr_6O_{11}+Nd_2O_3+Sm_2O_3+Eu_2O_3+Gd_2O_3+Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3*
** Magnet REOs = Pr_6O_{11}+Nd_2O_3+Tb_4O_7+Dy_2O_3*
** Totals may not add due to rounding*

Further reporting broke the block model down into the individual Upper and Lower Saprolite layers and for each individual REE. Table 17[166] reports the saprolite in the block model above the chosen cut-off by layer area and by layer.

Table 17 Cowalinya 2021 Block model reported by area and by saprolite layer

Area	Layer	Tonnes (Mt)	TREO (ppm)
North (Area 2)	Upper Saprolite	0.1	485
	Lower Saprolite	6	640
	All	**7**	**635**
South (Area 1)	Upper Saprolite	6	495
	Lower Saprolite	16	665
	All	**22**	**620**
Total	**Total**	**28**	**625**

It can be seen that the mineralised part of the Lower Saprolite contained markedly greater contained mineralisation in both areas (tonnes and grades were both higher). It is also evident from Table 16 that by tonnes the Southern area had **75%** of the Resources.

[165] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Table 5.1, pp84.
[166] Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Extracted from Table 5.2, pp85.

Potentially deleterious radioactive element values were low (thorium oxide 15 ppm, uranium oxide 5 ppm).

11.9 QUALIFYING NOTES ON THE RESOURCE ESTIMATE

The Resource Consultant reported qualifications and areas of technical risk to the Resource Estimate in various parts of his Report. Those are collated and summarised below by the Consultant.

JORC classification[167]: The Resource Consultant added various qualifications to the Inferred classification, with reasons:

- Variography: Although variography of the primary mineralised units (the saprolite) showed very little variance in most of the estimated variables, and interpreted primary ranges were in the order of several hundred of metres, the input samples were 4 m composites partly created from raw 1 m samples (and transgressed geological boundaries in a few places). This input data compositing artificially reduced the natural variance of the data. He believes that to classify Resources any higher than Inferred the original 1 m samples should be assayed to match the geological logging (particularly to better assess data variability).
- Raw samples: Some of the QA/QC analysis implied assay repeatability problems with some samples.
- Density & moisture: Relatively very few density and moisture determinations were available. He noted that the air-core drilling technique did not lend itself to gathering suitable samples for testing the clayey saprolite.
- Drill-hole spacing: The relatively regular drilling pattern added confidence.
- Material: The classification was limited to the saprolitic material – with limited lateral extrapolation (50m).

Risks to the Resource Estimate[168]: The Resource Consultant considered technical risks to the Resource Estimate to be in the following areas (with the risk ascribed in brackets):

- Geological layer interpretation inaccurate (risk low): Due to the general wide spacing of drill-holes the actual layers may not be as continuous or as consistently thick as currently interpreted.
- Assay method accuracy (risk moderate). Alternative assay methods have produced other values. The very limited use of the BV laser ablation method gave 12% higher TREO values than the 4 acid digestion method currently used for the Project.
- Assay standard sample representivity (risk low): Current assay standard samples appear to only address very high or very low grades.
- Sample length 4 m compositing reducing definition (risk moderate): Compositing many 1 m samples to 4 m composites for assaying may have unnecessarily compromised geological and grade definition.
- Density & moisture determination accuracy (risk low to moderate): Essentially the current determination rests on very few tests and on partly inappropriate samples (due to the drilling method). Additionally the testing method (pycnometer) does not account for sample porosity – and as the Resource Consultant considers that as the weathered rock contains a degree of porosity it should be accounted for. Furthermore the density readings have been slightly factored according to very limited moisture determinations. All of these factors lend a degree of uncertainty around the accuracy of the density used for the saprolite – and therefore to the reported **tonnages**.

11.10 RECOMMENDATIONS FOR FURTHER WORK

The Resource Consultant also provided a list of recommendations for further work on the Project[169]. They are summarised below by the Consultant.

- For an uplift in classification level (increase in confidence) the Resource Consultant would require in-fill drilling at both North and South areas. He suggested a more consistent 100*100 m spacing
- New information to confirm the existing geology (top of mineralisation) and assaying. This would require sampling on 1 m intervals down-hole.
- Sampling to geological boundaries,
- Increased rigour in QA/QC processes in general, including the use of more assay standards, blanks, and a higher ratio (1:20) of check samples.
- Additional density determinations.

167 Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Section 4.6.1.3, pp80.
168 Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Section 7, pp89.
169 Tyrrell, J., 11 February 2022. *Report - Cowalinya Mineral Resource Estimate*. Section 8, pp90.

12 COWALINYA PROJECT – COMPARABLE DEPOSITS

Comparable REE deposits to Cowalinya could be found where shallow lateritisation and suitable geomorphology occurs above granites. A few likely regions are mentioned here, followed by a deposit currently under exploration.

12.1 CHINA

Cowalinya is directly comparable geologically to many (possibly all) of the Chinese lateritic ion-adsorption clay (IAC) REE deposits in production. Typical thicknesses (~5-10 m) and grades (~500-2,000 ppm REO) are similar, and the potential extraction method envisaged for Cowalinya would match many.

12.2 BRAZIL

Brazil has environmental conditions favourable to the formation of lateritic IAC deposits. The massive deposit at Araxá (although developed over a primary REE source carbonatite and not strictly an IAC deposit) is an example of how powerful the lateritisation process can be in forming REE deposits in suitable conditions.

12.3 AUSTRALIA

At the present there are no producing ion-adsorption clay REE deposits in Australia. However environmental conditions would appear favourable and there is an increasing awareness of the deposit type and increasing numbers of similar deposits being recognised and explored for (including in the immediate vicinity of Cowalinya (mentioned variously above, including Mt Ridley and eMetals)). And in similarity with Araxá in Brazil the Mt Weld deposit illustrates the favourable Australian conditions for lateritisation.

12.4 MAKUUTU DEPOSIT, UGANDA

In it's Cowalina Project presentation HRE[170] considers the Makuutu deposit in Uganda directly comparable to Cowalinya because of the geological, mineralogical and dimensional similarities and because of the involvement of an Australian explorer. Like Cowalinya, Makuutu is an ion-adsorption clay REE type deposit. The REEs enriched in a lateritic clay layer in a basin structure were derived from granites (like Cowalinya) – although at Makuutu the granites were adjacent to the deposit and their eroded material was sedimentarily deposited in the basin before lateritisation commenced (whilst Cowalinya more typically for an IAC simply lies directly above granites). In both deposits REEs would be extracted through chemical leaching into solution. In both cases the valuable HREEs are proportionally well represented.

The Makuutu Project[171] is held by Rwenzori Rare Metals Ltd (Rwenzori) with Australia-based Ionic Rare Earths Ltd (IonicRE) earning into the Project through development expenditure (currently at 51%, with the option to earn up to 60%). The Project is located ~30 km east of Jinja (close to the northern shore of Lake Victoria), on 243 km^2 of contiguous tenements in an E/W strip. According to IonicRE "*A key characteristic of Makuutu is the geology, which is similar to the southern China ionic clay-type deposits, which are the cheapest and most readily accessible source of heavy Rare Earth Oxides (HREO) and are extracted through rudimentary mining and processing methods*". Significantly IonicRE announced in April 2021[172], in relation to the development of Makuutu, the signing of a non-binding Memorandum of Understanding (MOU) with China Rare Metals and Rare Earth (Jiangsu) Co., Ltd (CREJ), a subsidiary of Chinalco, a global REE giant. Chinalco is the world's largest market capitalised REE miner and separator, and heavily involved with IAC REE deposits.

Geologically Makuutu[173] is recognised as a shallow, near surface orebody, with an REE-enriched clay saprolite layer averaging 9 m thick (and up to 28.5 m) below ~3 m of cover. The deposit is within a sedimentary basin ~37 km long E/W and ~2.5 km wide N/S. A series of Resource areas exist along the basin over ~20 km.

Figure 99[174] shows a plan view of the Makuutu Resource deposit areas (shaded polygons) within the sedimentary basin margins (as at February 2021). The background shows radiometrics, with the sedimentary basin being low (cyan) and the adjacent granites to the north and south being highs (red).

[170] HRE, October 2021. *Cowalinya Rare Earths Project*. Introductory presentation. Slide 8.
[171] IonicRE, mid-January 2022 – web site. Makuutu Project link https://ionicre.com/makutu-uganda.
[172] IonicRE, 30 June 2021. *Annual Report 2021*. Pp22.
[173] IonicRE, 6 January 2022. *Thickest intervals to date at Makutu* ... ASX press release. Pp11.
[174] IonicRE, 29 April 2021. *Scoping study* ... Fig 14, p22.

Figure 99 Makuutu deposit plan

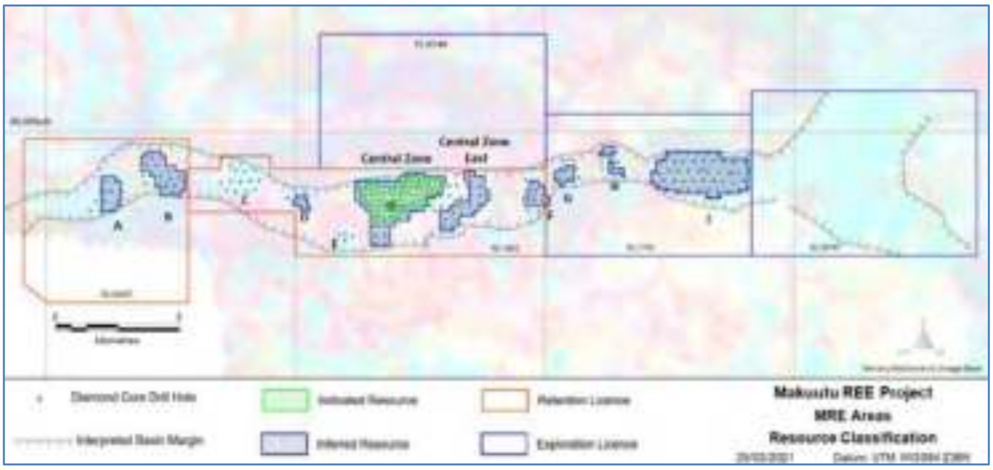


Figure 98 Makuutu W/E long-section (10* vertical exaggeration)

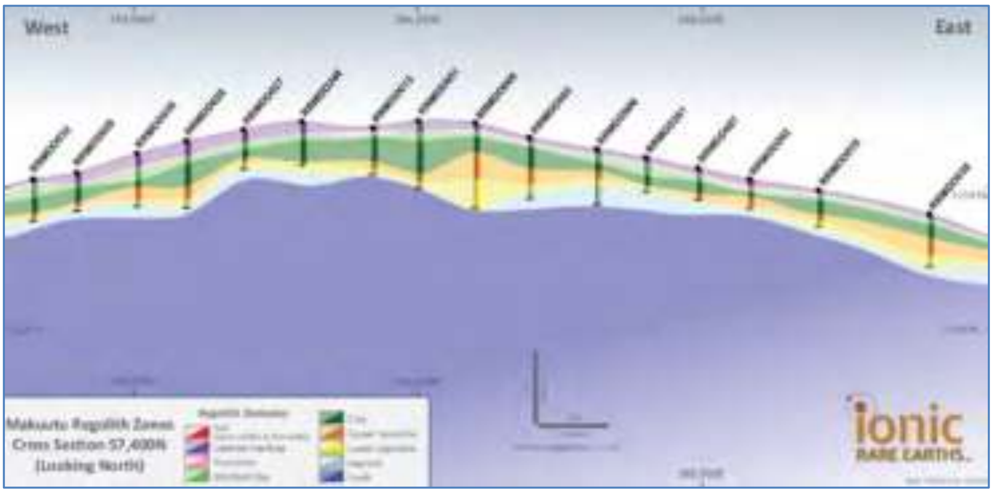


Figure 98[175] shows the regolith zonation in a long-section along the basin (at 10* vertical exaggeration). REE mineralisation[176] is contained within the tropical lateritic weathering profile of a basin filled with sedimentary rocks including shales, mudstones and sandstones potentially derived from the surrounding granitic rocks. These granitic rocks are considered the original source of the REEs which were then accumulated in the sediments of the basin as the granites degraded. These sediments then form the protolith that was subjected to prolonged tropical weathering. The weathering developed a lateritic regolith with a surface indurated hardcap, followed downward by clay rich zones that grade down through saprolite and saprock to unweathered sediments. The thickness of the regolith is 10-20 m from surface.

REE mineralisation is concentrated in the weathered profile where it has dissolved from its primary mineral form, such as monazite and xenotime, then adsorbed on to fine particles of aluminosilicate clays (e.g. kaolinite, illite, smectite). This adsorbed REE is the target for extraction and production of REO. The deposit is also enriched in scandium, which may become a co-product.

Exploration has recently been through drilling HQ diameter diamond core holes of which the great majority have been mineralised to >200 ppm TREO – cerium oxide. Older holes were drilled using RAB. In the "Central Zone" (containing the deposit's Indicated Resources) the drilling was at 200*200 m spacing. Other drilling was at 400*400 m spacing. Samples were analysed by ALS in Perth, WA, Australia.

At February 2022 the IonicRE web-page listed Indicated + Inferred Mineral Resources at Makuutu stood at 78.6 Mt @ 840 ppm TREO (or 610 ppm TREO-Ce), using a 300 ppm TREO lower cut-off. The Indicated portion stood at 9.5 Mt @ 750 ppm TREO (or 520 ppm TREO-Ce). However IonicRE's 2021 Annual Report[177] (which may represent the difference in reporting at a 300 ppm cut-off instead of at 200 ppm; or supersede a potentially out-of-date web site) reports Indicated + Inferred Mineral Resources of 315 Mt @ 650 ppm TREO (or 440 ppm TREO-Ce), using a 200 ppm TREO lower cut-off. The Indicated portion (for the Central Zone) stood at 66 Mt @ 820 ppm TREO (or 570 ppm TREO-Ce). Resource estimation was performed by Cube Consulting Pty Ltd (Cube). Metallurgical recoveries are up to 75% TREE (minus cerium). Extraction would be through stacking the ore and heap leaching it using an acidified salt solution (ammonium sulphate).

HRE promotes Cowalinya's advantage (like Makuutu) being an IAC deposit (as opposed to hard rock) and thus based on shallow/easy/cheap mining and potentially simple/cheap/effective heap leach extraction.

[175] IonicRE, 30 June 2021. *Annual Report 2021*. Fig 8, pp15.
[176] IonicRE, 6 January 2022. *Thickest intervals to date at Makutu* ... ASX press release. JORC Table 1, Geology, pp63-64.
[177] IonicRE, 30 June 2021. *Annual Report 2021*. Table 2, pp13.

DUKE HREE PROJECT (NT)

13 DUKE HREE PROJECT – BACKGROUND

Summary: The Northern Territory (NT) HREE Project concerns green-field mineral exploration for HREEs (heavy REEs) in the centre of the NT, ~50 km NW of Tennant Creek. HRE have recently applied for 38 block tenement EL33101 and 45 block tenement EL33194 immediately to the east. Regionally the Tennant Creek area was known for substantial gold and copper mining and recent exploration has focussed on Iron Oxide Copper Gold Uranium type deposits (IOCGU) similar to Olympic Dam. HRE's intended exploration model is a Browns Range-style vein breccia-hosted hydrothermal xenotime HREE mineralised system. Browns Range in WA (now in pre-production) has steep fault-controlled vein-like REE-bearing breccias intruded into meta-sediment hosts in association with an unconformity within the sediments. HRE's tenement is geologically highly analogous to Browns Range and contains similar sedimentary hosts, faulting and an unconformity. It is thought that HRE's exploration will be the first systematic exploration for REEs in the Tennant Creek area.

13.1 TENNANT CREEK MINING & EXISTING DEPOSIT STYLES

Mining history: The Tennant Creek area has a considerable mining history, with the first major gold deposit found in 1932. The Goldfield became a considerable gold and copper producer, with past combined production from many mines (possibly up to 130) being +5.5 Moz gold and 500,000 t copper. Other significant minerals produced in smaller quantities were bismuth, silver, tin and tungsten. Average life-of-mine grades in some mines were ~15-20 g/t gold and ~2-4% copper. Figure 100[178] shows mines and mineral occurrences in the area in relation to HRE's Duke Project tenements (blue polygons, see Section 13.4).

Figure 100 Tennant Creek area mines & minerals

Tennant Creek is near the bottom of the Figure at the junction of the Stuart Highway (thick red line) and the Warrego Road leading NW towards the Project ~50 km away. Gold mines (orange and green squares) and precious metal occurrences (yellow dots) are concentrated in the Goldfield around Tennant Creek Goldfield, within the Warramunga Province sediments (brown area, see Section 13.5). A line of gold mines traverses E/W along the Warrego Road some 30 km south of HRE's tenements and others exist to the east of the tenement along the Stuart highway. Up until WWII 113 mines were operating in the Goldfield. All but 2 closed during the war but by 1947 25 were again operating although by 1952 that had again dropped to 8 because of prices. Most mines had closed by

[178] Captured May 2022 online from STRIKE, NT DITT. Mineral titles; mines & minerals; 1:2.5M geological regions.

the 1980s. In recent decades airborne geophysics has played a part in rejuvenating mining and exploration in the area. Production figures given below are approximate as mining has stopped and started over recent decades.

The 3 most prolific gold mines in the Goldfield were Warrego (41.3 t), Nobles Nob (34.6 t) and Juno (26.1 t) and accounted for ~65% of production[179]. Other significant producers were White Devil, Peko and Gecko. The Warrego mine (~25 km SSE of the Project) produced ~1.2 Moz gold at a grade of 11.5 g/t (from ~7 Mt of ore @ 2.5% copper and 6.6 g/t gold).

Manganese (such as at Bootu Creek in the north of the area, see Figure 166) became a more recent addition to minerals mined in the region. This deposit is interesting in HRE's context as mineralisation starts with hydrothermal mineralisation processes (akin to the vein REE deposit-style at Browns Range) followed by surface supergene enrichment processes (akin to those operating in IAC REE deposits).

Minerals & deposit styles[180]: In the late 1980's[181] possible mineralisation styles and commodities considered to exist in the Tennant Creek area were:

- "Tennant Creek-style" ironstone-associated gold-copper-bismuth deposits[182].
    - Gold and copper mineralisation in the "Tennant Creek Field" is found in association with ironstone bodies hosted in Warramunga Formation sediments.
    - Gold found with the more massive ironstones; copper-gold-bismuth associated with quartz-haematite and quartz-magnetite lodes.
    - The ironstones are formed by intrusion or by replacement of brecciated mudstones.
    - The primary (fresh) ore bodies are composed of magnetite, quartz and often pyrite and chalcopyrite occurring disseminated though, in-filling fractures in, or forming lenses in the ironstone. These primary ironstones create magnetic anomalies.
    - The oxidised parts of the ore bodies have the magnetite altered to haematite (except for a fine-grained massive form which may persist unaltered to the surface). Sulphides here are oxidised, and intense leaching has occurred which results in the removal of the copper. Oxidation may occur to depths of ~100 m.
    - In addition to the copper-gold bearing magnetites other magnetites are gold-bismuth bearing. These appear restricted to bodies emplaced at the intersection of crush/shear zones with brecciated mudstones.
- Structurally emplaced mineralisation (also vein-type) – multicommodity.
    - Delta Gold Exploration Pty Ltd (Delta Gold) referred to this as "structurally controlled stockwork-type mineralisation"[183], such as found at Pine Creek.
    - Delta Gold also referred to "shear zone hosted mineralisation", such as in the Tanami region.
    - Meteoric Resources NL (Meteoric) believed evidence showed that the Tennant Creek mineral deposits were structurally controlled and occur within more ferruginous horizons of the Warramunga Formation, that he ironstones and mineralisation are discordant to the folded Warramunga rocks and that they tended to be located in structural flexures near fold axis hinge zones[184].
    - According to the NTGS uranium is found in a number of vein-type occurrences in the area. These deposits are hosted by a variety of rock types and are all associated with narrow, steeply dipping, brittle fault or fracture zones.
- Unconformity-related gold-copper-uranium mineralisation.
    - A significant source of uranium.
    - Found in deposits in the Alligator River and Rum Jungle areas.
    - Mines include Nabarlek, Ranger, Jabiluka, Koongarra and Rum Jungle.
- Granite-hosted/contact mineralisation – multicommodity.
- Porphyry-related – copper-gold-base metal deposits.
    - Found in close proximity to the ironstone mineralised bodies throughout the Field.

Other significant deposit types were added in the 2000's, such as:

- IOCGU-type mineralisation – iron oxide-copper-gold-uranium.
    - Because of the huge deposit at Roxby Downs / Olympic Dam in South Australia.
    - Initially seen as copper-gold-uranium (CGU) deposits, and then iron oxide-copper-gold (ICGU) deposits.

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[179] Ahmad and Munson, 2013. Geology and mineral resources of the NT. NTGS. 9:35.
[180] Ahmad and Munson, 2013. Geology and mineral resources of the NY. NTGS. Chapter 3 – Commodity reviews.
[181] Pos Gold, ~1990.
[182] MAT, 1971. Report on exploration. 4.2, pp4-5. And Marathon, 1981.
[183] Delta Gold, June 1994. 1st annual report EL8104. 1., pp1.
[184] Meteoric, January 2014. Annual report on EL23764. Para 5, pp3.

- Later appreciated as "iron oxide-copper-gold-uranium" (IOCGU) deposits.
- Possibly Tennant Creek-style ironstone deposits actually represent a "high-grade" variant of IOCGU deposits[185].

- Hydrothermal/supergene enrichment deposits – manganese.
    - As at the Bootu Creek Mine and Mucketty, ~100 km north of Tennant Creek.

IOCGU deposits (and maybe some of the others) may also contain REEs. HRE's exploration adds a new focus to the area:

- Browns Range-type vein REE deposits (see Section 5.9).

13.2 DUKE PROJECT – HRE EXPLORATION MODEL

HRE's overall corporate exploration objective is primarily focussed on finding high-value HREEs. HRE's Cowalinya Project already addresses HREEs in a "IAC REE Deposit" – a type possessing reasonable proportions of HREEs in very low concentrations near surface over wide areas – but theoretically economic because of very simple and cheap mining and processing.

At the other end of the scale the Browns Range REE deposit in WA (on the border with the NT, and in pre-production) is a "Vein REE Deposit" – a breccia-hosted hydrothermal mineralised type possessing very high proportions of HREEs in potentially high concentrations in the mineral xenotime (a REE phosphate). To the east of Browns Range the central NT area possesses very similar rocks in similar settings – and HRE's green-field exploration model is to discover an analogous deposit. The initial target would be the unconformity between the Tomkinson (Tomkinson Creek Group) and Warramunga (Ooradidgee Group) Provinces which is present in the application area.

Green-field exploration would initially focus on surface outcrop to i) determine if the local sediments are phosphorus-rich (from which xenotime could be derived hydrothermally) and ii) map geology and faults to find pegmatite intrusions. This would require combinations green-field exploration methods such as local data collation, geological mapping, surface rock chip sampling, geophysical surveying, stream sediment sampling and soil sampling. In turn that would lead to shallow and then deeper drilling.

13.3 DUKE PROJECT – GEOGRAPHY & HISTORY

13.3.1 LOCATION

The Duke Project is located virtually in the centre of the NT, ~50 km north west of the regional centre of Tennant Creek. Figure 101 shows most of the Northern Territory, with the blue dot pointed at by red arrow marking the Project's tenements near Tennant Creek.

Tennant Creek lies on the sealed N/S Stuart Highway, just south of the junction with the Barkly Highway leading to the east (red lines). Tennant Creek is also on the N/S Alice Springs to Darwin railway line (black line) which runs through the boundary between the tenements.

Tennant Creek is ~990 km by road south of the port of Darwin on the Timor Sea (top of Figure) and ~510 km by road north of the central Australian city of Alice Springs (base of Figure).

Figure 101 Duke Project location

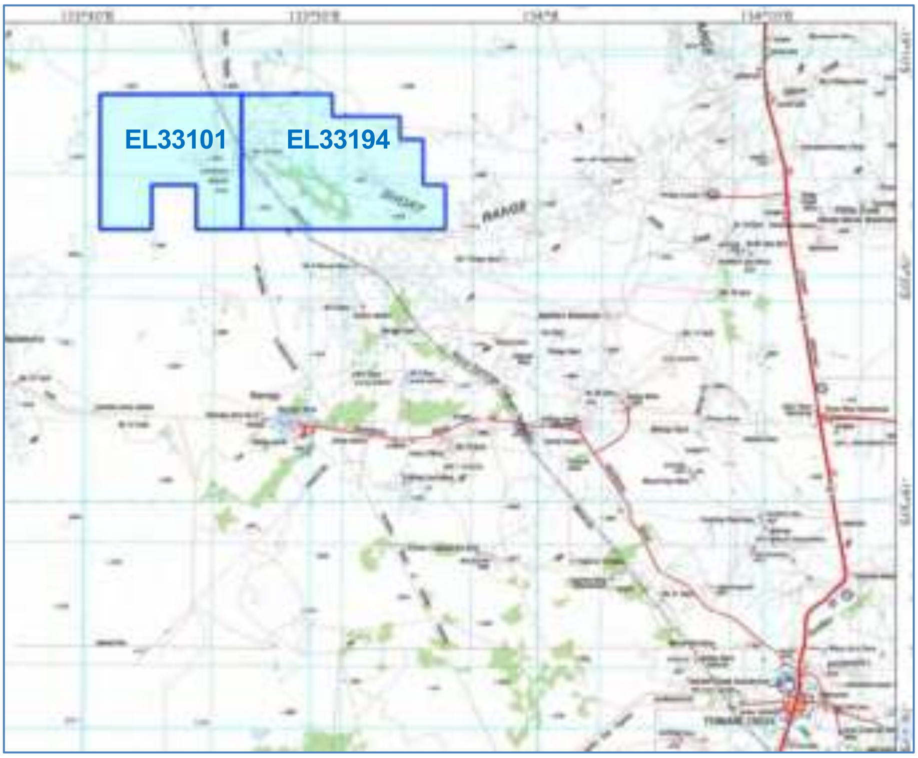
13.3.2 REGIONAL TOPOGRAPHY & ACCESS

Figure 102[186] shows the Duke Project's tenements EL33101 (left) and EL33194 (right) shaded in blue above the regional 1:250,000 topography map. The area's GDA94 coordinates (MGA zone 53) are labelled along the top and right of Figure 102. The centre of the tenements is at ~19°15' S : 133°48' E (374,800 E : 7,870,700 S).

[185] Meteoric, January 2014. Annual report on EL23764. Para 4, pp3.
[186] Captured May 2022 online from STRIKE, NT DITT. 1:250,000 topography.

Features: Tennant Creek is in the bottom right corner of the Figure, with most major roads (red) radiating away from it. The black hatched line is the Darwin to Alice Springs railway which traverses the N/S boundary between the tenements. Also traversing the same boundary is the Amadeus Basin to Darwin gas pipeline.

Figure 102 Duke Project regional topography map (1:250,000)



Running in a sinuous shape E/W across both tenements is the Short Range, which peters out to the west.

Access: In terms of access the red lines are sealed roads, brown dashed lines are secondary dirt roads. The Stuart Highway is the thick red line running N/S down the right side. Tenement access is ~50 km NW from Tennant Creek via the sealed Warrego Road to close to the Warrego Mine (due south of the tenements) and then northwards via unsealed roads and tracks.

Satellite image: Figure 103[187] shows the composite regional satellite imagery, with Project tenements marked by the blue boundaries. The coverage is approximately the same as in Figure 102.

Figure 103 Duke Project regional satellite imagery

The image indicates the general paucity of vegetation typical of the "warm desert climate" in the region.

The form of the Short Range hills running ~E/W through the tenements are clearly seen, with the ridges (dark brown) very sharply following the sinuous layered geology.

[187] Captured May 2022 online from STRIKE, NT DITT. Aerial photography.

Cadastre: Figure 104[188] shows the Project's regional cadastre. The Project's tenements are within the blue polygons.

Green areas are pastoral leases, yellow areas are freehold land. The Duke Project lies within Phillip Creek Station which raises cattle and horses.

Tennant Creek township is the grey area in the bottom right.

Figure 104 Duke Project cadastre

13.3.3 LOCAL TOPOGRAPHY

Figure 105[189] shows the Duke Project's tenements (blue) above local topography mapping (1:250,000).

Elevation range in the Project area is minimal, existing between ~310 m RL and 362 m RL, indicating the area is generally flattish.

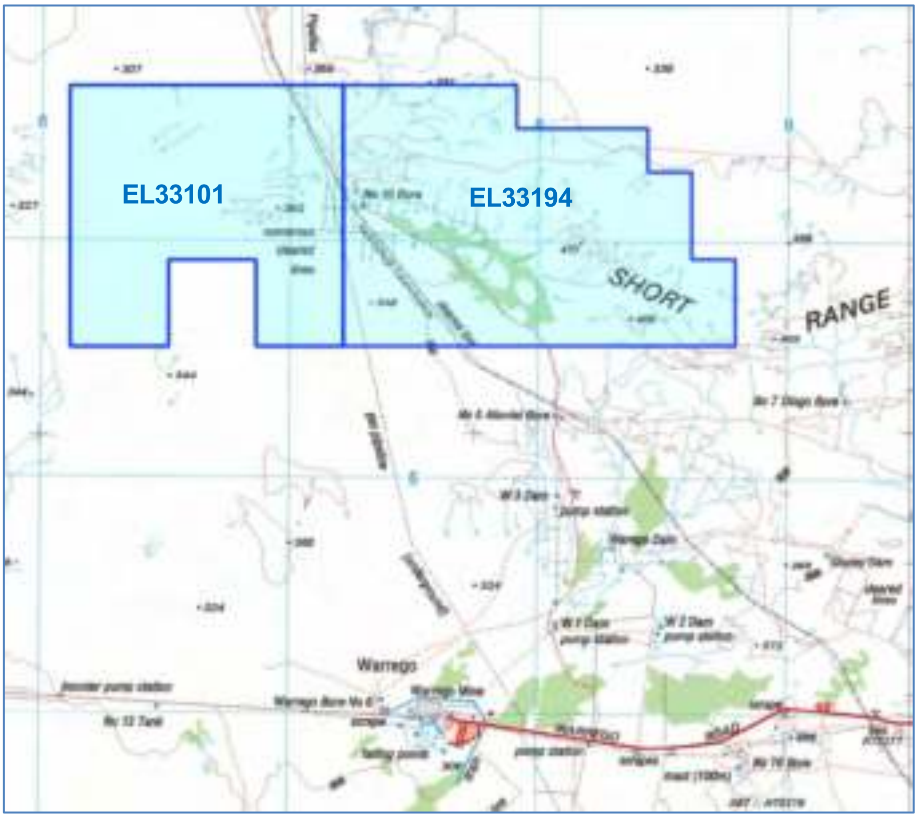
The E/W ridge of the Short Range runs through EL33194 and part of the way into EL33101.

The Short Range consists of low rocky hills.

Light blue coordinate lines are ~10 km apart – showing the tenement area to be ~25 km E/W and ~10 km N/S.

The area of EL33101 is ~109 km² and EL33194 is ~146 km².

Figure 105 Duke Project local topography



[188] Captured May 2022 online from STRIKE, NT DITT. Cadastre above 1:250,000 topography.
[189] Captured May 2022 online from STRIKE, NT DITT. 1:250,000 topography.

13.4 DUKE PROJECT – MINERAL TENURE

13.4.1 HRE NT TENEMENTS EL33101 & EL33194

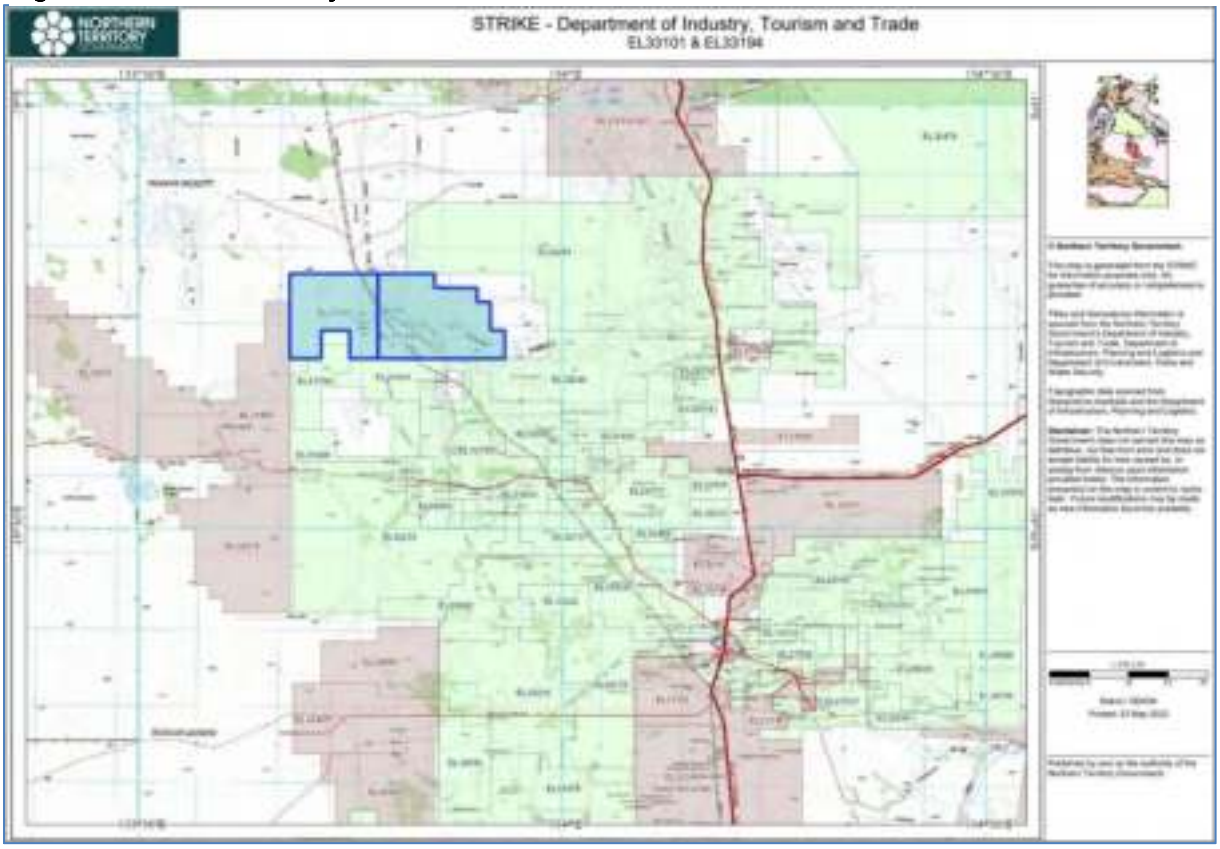
HRE's Duke Project is located within NT Exploration Licences 33101 and 33194. The ELs would typically be identified as **EL33101** and **EL33194**. The ELs are currently under "application". The 100% holder will be Heavy Rare Earths Limited. Searches of the NT STRIKE Tenement Register for tenement details were made by HRE for EL33101 on 22 December 2021 and on 27 April 2022 and they are included in Appendix 6 – Tenement summary reports on NT EL33101 & EL33194. The Consultant's searches through STRIKE found all details to be accurate. Details on the ELs are summarised from those searches in Table 18.

Table 18 HRE Duke Project NT tenement details

Tenement	**EL33101**	**EL33194**
Term	Exploration Licence 33101	Exploration License 33194
Status	Application	Application
Applied	21 December 2021	26 April 2022
Period	6 years	6 years
Holders	HRE Corporation Limited (now Heavy Rare Earths Limited) (100%) AMETS	Heavy Rare Earths Limited (100%) AMETS
District	Tennant Creek	Tennant Creek
Area/Blocks	38 blocks	45 blocks
Area (km^2)	108.8 km^2	145.9 km^2
Map sheet	Short Range 1:100,000 Tennant Creek 1:250,000	Short Range 1:100,000 Tennant Creek 1:250,000
Centroid	~ 19°15' S : 133°43' E 366,700 E : 7,871,600 S	~ 19°15' S : 133°51' E 379,400 E : 7,871,600 S

Figure 106[190] presents a formal print of the tenement map obtained though the NT's DITT online service (22 May 2022). The print gives the EL's latitude and longitude coordinates in GDA 1994 (MGA Zone 53). Tenements EL33101 and EL33194 are highlighted by the thick blue boundary. Other granted tenements are shown shaded green and those still under application are shaded brown.

Figure 106 HRE Duke Project tenements EL33101 & EL33194



[190] Printed by the Consultant 22 May 2022 online from STRIKE, NT DITT. Mineral titles and 1:250,000 topography.

13.4.2 ADJACENT NT TENEMENTS

HRE's NT tenements have adjacent tenements on all sides (shown in Figure 106), mostly granted (shaded green). Current (as at 22 may 2022) immediately adjacent or very close by tenements are tabulated in Table 19, in clock-wise order from the north, with an approximate direction from the tenements.

Table 19 HRE Duke Project adjacent tenements

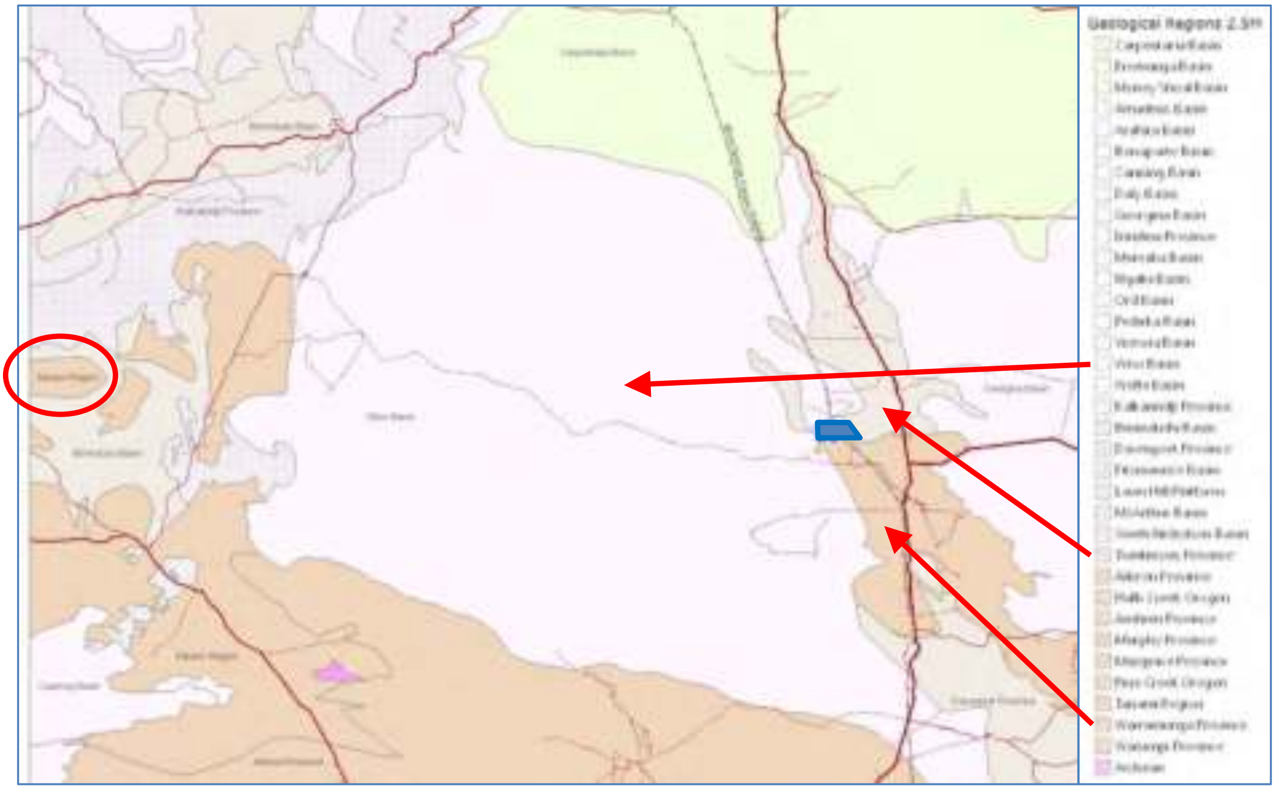
Tenement	Blocks	Direction	Holder	Grant date	Expiry date
EL32291	250	NE (194)	Barkly Operations Pty Ltd	22/4/2021	21/4/2027
EL32246	67	SE (194)	Rio Tinto Exploration Pty Ltd	30/4/2021	29/4/2027
EL32725	45	S (194)	Payne Gully Gold Pty Ltd	11/1/2022	10/1/2028
EL31610	25	S (101/194)	CGM (WA) Pty Ltd	22/5/2018	21/5/2024
EL23764	23	S (101)	Meteoric Resources NL	26/11/2003	25/11/2023
EL31608	22	SW (101)	CGM (WA) Pty Ltd	22/5/2018	21/5/2024
EL31609 (A)	69	W (101)	CGM (WA) Pty Ltd	4/1/2018	-

13.5 DUKE PROJECT – GEOLOGY

13.5.1 REGIONAL BEDROCK GEOLOGY[191]

Figure 107[192] illustrates regionally the major bedrock geological regions surrounding the Duke Project (tenement boundary in blue) – reproduced from the 1:2.5M state mapping.

Figure 107 NT regional bedrock geological regions (1:2.5M)



Geological regions in Figure 107, immediately surrounding the Project, are briefly described, from youngest to oldest, in terms of rough age; rock type; description and relationship:

- Wiso Basin (pink): Devonian (360-540 Ma). Sedimentary (dolostone, limestone, shale, sandstone, siltstone). Un-metamorphosed. A widespread intra-cratonic sedimentary basin (correlated with the Georgina basin to the east). Faulted against (locally overlying) the Aileron Province to the south. Unconformably overlies the Tanami Region and Birrindudu Basin to the west, and the Tennant Creek Region to the east. Overlain by younger Carpentaria Basin rocks to the north.

191 Mostly from STRIKE, NT DITT.

192 Captured February 2022 online from STRIKE, NT DITT. Geological regions, 2.5M.

- Tomkinson Province [Tennant Region] (light brown): Proterozoic (1,400-1,780 Ma). Sedimentary and minor volcanic (sandstone, dolostone, shale, basalt). Un-metamorphosed. Forms part of the Tennant Region. Un-metamorphosed and weakly deformed, predominantly shallow marine sedimentary rocks. Overlies the Warramunga Province to the south, is overlain by the Georgina, Wiso and Carpentaria Basins.
- Warramunga Province [Tennant Region] (brown): Proterozoic (1,840-1,870 Ma). Mixed sediments, meta-sediments, volcanics and igneous rocks (greywacke, shale, siltstone, haematitic shale, granite, felsic volcanics, dolerite, basalt, sandstone, dolostone). Un-metamorphosed to greenschist facies. Forms part of the Tennant Region. A basement inlier comprising volcaniclastic rocks, volcanics and flysch sediments. Intruded by granites and deformed by the Tennant Orogeny ~1,850 Ma. Overlain by the Davenport Province to the south, the Tomkinson Province to the north. Unconformably overlain by the Wiso Basin to the west and the Georgina Basin to the east.

The older sedimentary Tomkinson and Warramunga Provinces are analogous to similar age and type rocks in the Tanami Region to the west (red oval in the Figure) which host the Browns Range HREE deposits (see Section 5.9).

13.5.2 LOCAL GEOLOGY

Figure 108 Duke Project local regional geology (1:2.5M)

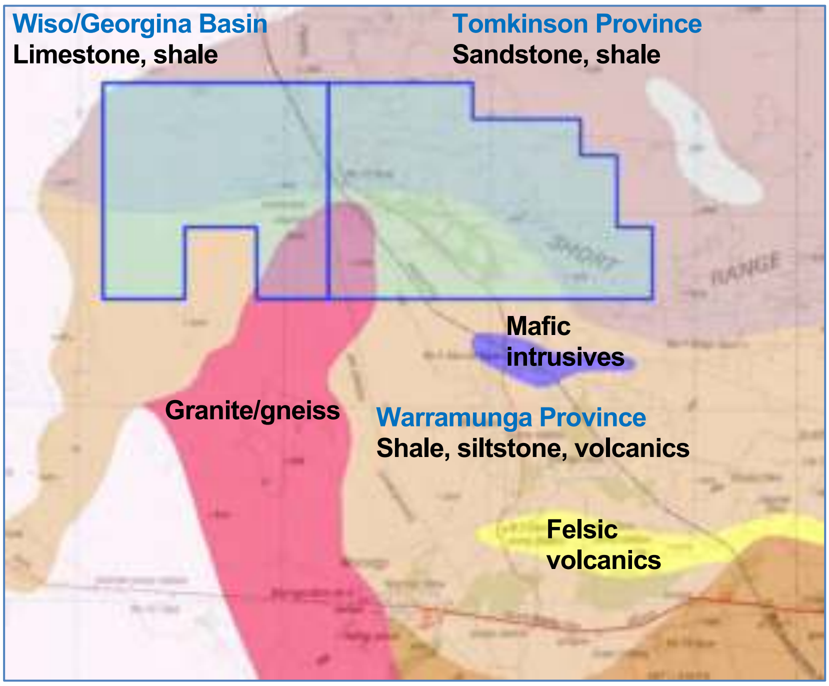


Figure 108[193] shows the 2.5M regional geology in the local Duke Project area. HRE's tenement EL33101 is the blue polygon. Blue labels on the Figure give the regional geological regions described above. These are basically getting younger to the north. Black labels give the rock types.

Most rocks in the local Project area (**unconformably** separated Tomkinson (brown) and Warramunga (light brown) Provinces) are sediments or meta-sediments (sandstones, shales and limestones).

Above the unconformity the (north) Tomkinson's lower Flynn Group consists of relatively undeformed and un-metamorphosed sedimentary rocks and volcanics.

Below the unconformity (south) the Warramunga Formation contains lithic tuffaceous, volcaniclastic and lithic sandstone, siltstone and haematitic siltstone, mudstone, slate and volcanic arenite (meta-greywacke). The unconformity is close to numerous dolerite/diorite intrusions, mostly sills.

At the unconformity the base of the Tomkinson rocks could be described as shallow water deposited quartz arenites and quartzites. Below the unconformity the Warramunga rocks could be described as deeper water deposited greywackes and siltstones. The exact position of the unconformity is not clear over much of the area. Based on regional magnetics its position would put the dolerite/diorite intrusions in the lower part of the Tomkinson (but see other comments below also).

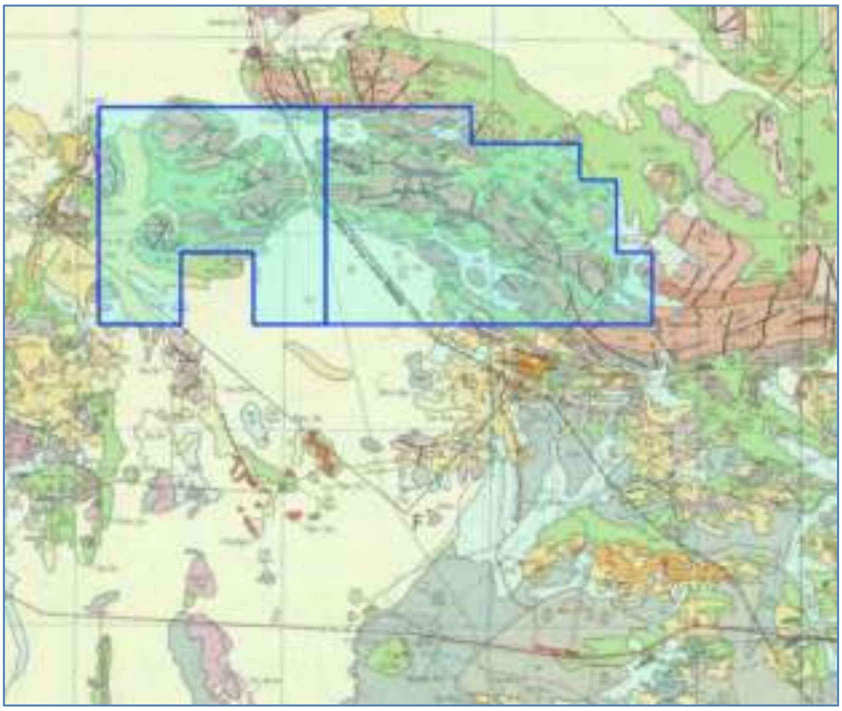
The Warramunga Province was deformed during the Barramundi/Tennent Orogeny – considered the mineralising event. The Warramunga Province was endowed with some +5.5 Moz of gold as FeOx-Cu-Au (IOCG) deposits associated with hydrothermal accumulations of ironstone – these deposits comprise the Tennant Goldfield.

The Warramunga Province in the area's southern parts also contains igneous granite/gneiss (red), mafic intrusives (purple) and felsic volcanics (yellow). The local granite is known as the Warrego Granite. Quartz veins cut the granite striking N/S. Minor dykes intrude the sediments adjacent to the granite. Western Mining Corporation Limited[194] (WMC) mentioned (interestingly for HRE) that the granite is "marked by a series of bucky quartz blows and some pegmatitic phases".

[193] Captured May 2022 online from STRIKE, NT DITT. Geology, 2.5M.
[194] Western Mining, February 1995. Final report on EL7153. 3., pp2.

Figure 109[195] shows the 250K geological mapping in the local Duke Project area (from the 1:250,000 NT State geological mapping, Tennant Creek sheet SE 53-14, NTGS, 2nd edition, 1998). This map shows surface geology – and the Project area contains a reasonable proportion (~50%) of bedrock (green and various shades of brown) outcropping through the surface alluvium (the light yellow and yellow areas).

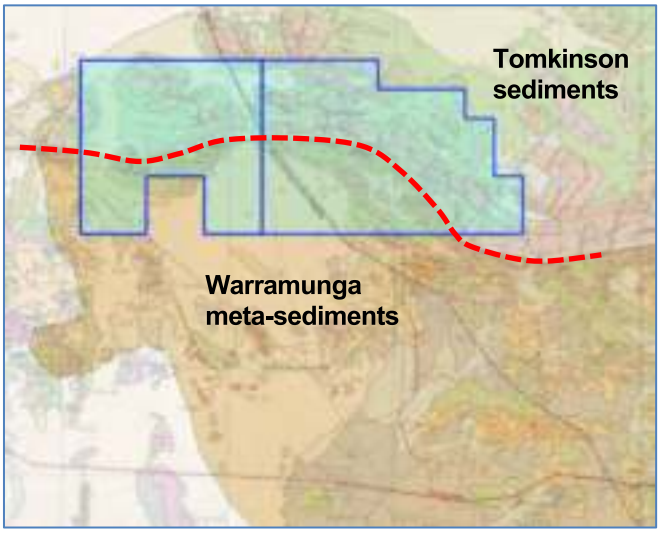
Figure 109 Duke Project local geological mapping (1:250K)



Details on individual rock type units are not given in depth here – but within the Project tenement all of the exposed rocks are sedimentary (and predominantly Tomkinson as the Warramunga are mostly covered by alluvium). Contacts between units run ~NE/SW and dips are to the NW at ~30-50°.

Figure 110[196] shows the regional divisions over the local geology – to illustrate the Tomkinson Formation (light brown) occupying the northern half of the tenement and the copper-gold mineralised Warramunga Formation (mid brown) occupying the southern half. The sinuous E/W **unconformity** (dashed red line) separating the Formations thus approximately crosses the centre of the tenement.

Figure 110 Duke Project local geology



Diorite and (rare) dolerite sills[197] and dykes intrude the lower Tomkinson and the upper parts of the Warramunga. These post-date the major folding and faulting (and intrusives) – and their weathering produces most of the valleys in the Short Range (crossing the northern part of the tenement). These sills also produce the crescent shaped magnetic anomalies due to their magnetite content. The diorite/dolerite bodies are known in shear zones, while dolerite dykes intrude the granites. Small lamprophyre dykes and sills also intrude the Warramunga sediments and the granites. Their intrusion is controlled by local faults and shears, and may be controlled by the granites and pegmatites compositionally and spatially.

The Figure 109 geological map contains a schematic NW/SE cross-section cutting across the SW corner of the tenement. The section EF is given in Figure 111[198], and its trace is marked by the oblique straight black line on Figure 109 from the top left corner to the large letter F nearer the bottom right.

Figure 111 Schematic NW/SE cross-section EF (1:250k)

On the right of the section (near the F) is a granite/gneiss intrusion (red). Then the sedimentary sequence of NW-

[195] Captured May 2022 online from STRIKE, NT DITT. Geological mosaic, 1:250K (2nd edition, 1999)
[196] Captured May 2022 online from STRIKE, NT DITT. Geology, 2.5M.
[197] CRAE, 7/1980. 1st annual report. Pp6-7.
[198] Tennant Creek 1:250,000 Geological map (sheet SE 53-14). NTGS. 2nd edition, 1998.

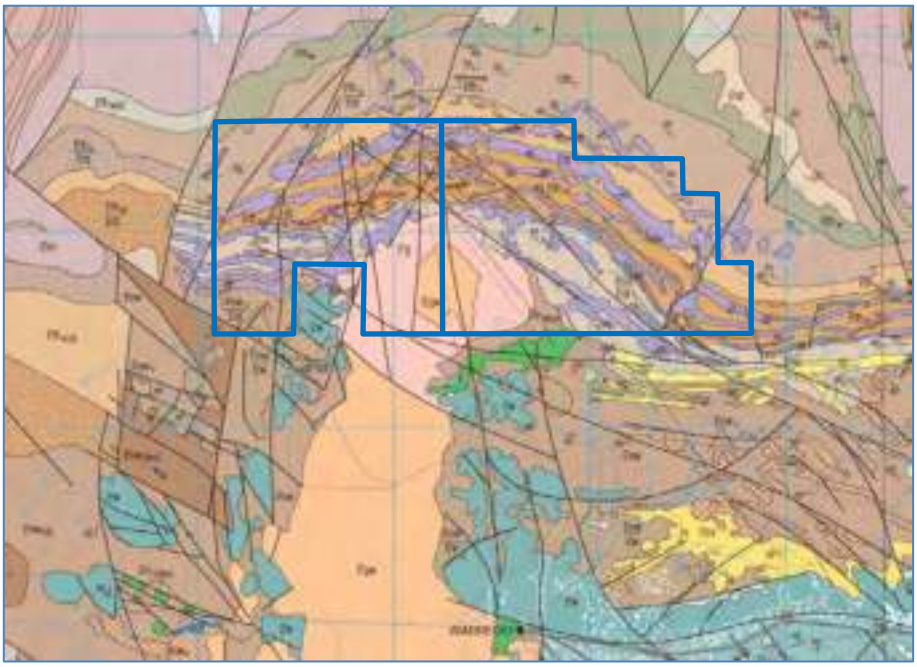
dipping (~30-50°) sediments (shades of brown) to the left of the granite, separated by unconformities (thick black curved lines), again illustrates the area's analogy with the Browns Range HREE deposits.

Regionally the outcrop is generally poor, being covered by sandy alluvium (yellow areas in Figure 109). The sandy alluvium is wind-blown with scattered laterite and silcrete covered caps. However locally in HRE's tenement area the Tomkinson Creek quartzites form prominent rocky ridges. Cleaner sandstone members within the Warramunga Formation outcrop as low rounded strike ridges with low relief. Dolerite and diorite sills generally represent narrow strike valleys in the Short Range but sometimes outcrop as laterite capped buttes and mesas. The margins of the Warrego Granite (within the Project area) are entirely obscured by sand.

13.5.3 LOCAL GEOLOGICAL STRUCTURE

Figure 112[199] shows the integrated geological interpretation of mapped geology and geophysics in the local Duke Project area. This is from the 1:250,000 NT State interpretation, Tennant Creek sheet SE 53-14, NTGS, 1st edition, 2003). It is shown for the same area as the geological mapping in Figure 109.

Figure 112 Duke Project local geological interpretation (1:250K)



The map shows multiple faults (black lines) in and around the Project area. Faults are mostly oriented NNE or NW.

The Figure also illustrates the broad open anticlinal fold structure of the Warramunga and Tomkinson rocks,

Marathon Petroleum Australia Ltd (Marathon), reporting on exploration in the early 1980's, documented their understandings of regional geological structures[200] – which implicitly would have relevance to HRE's "vein REE deposit" model in the area.

Those understandings were:

- Folding – the Warramunga (oldest) rocks were tightly isoclinally folded (deformation D_1) and then subsequently broadly folded into the open anticline (D_2) by strong N/S compression; the Tomkinson (younger) rocks were only folded by the D_2 event.
- Intrusion/metamorphism – the (oldest) Warramunga rocks were contact metamorphosed by the (younger) intruding Tennant Creek granites; the Tomkinson rocks rest unconformably on the granites, are not contact metamorphosed, indicating the Tomkinson rocks are younger than the granites.

The sequence of events would have been:

1. Warramunga intruded by the granites, then tighly isoclinally folded (D_1). Metamorphism accompanying this was low greenschist facies.
2. Uplift and erosion.
3. Tomkinson deposited unconformably over the Warramunga and Tennant Creek granites.
4. Second deformation event (D_2) folds Warramunga and Tomkinson rocks into broad open anticlinal and synclinal structures.
5. Third weak deformation event (D_3) causes flexing of pre-existing folds.

[199] Tennant Creek 1:250,000 Integrated interpretation of geophysics & mapped geology (sheet SE 53-14). NTGS. 1st edition, 2003.
[200] Marathon, January 1981(?). 3rd annual report. 2.2 and 2.3, pp13-15.

14 DUKE PROJECT – PREVIOUS EXPLORATION

HRE has **not** previously explored in the area. The Consultant researched past local and regional exploration through the NT's STRIKE online system – revealing geological mapping, geophysical surveys, geochemical soil sampling, biogeochemical sampling and drilling.

Previous historical and recent exploration in the general area has been undertaken principally for Tennant Creek-style ironstone-hosted Cu-Au-Bi (hosted in the Warramunga sediments) and Olympic Dam-type Cu-U-Au deposits. According to Giants Reef[201] the initial exploration in the area was for uranium deposits at the inferred margin of the Warrego Granite which intrudes the Warramunga; subsequently the exploration focus shifted to the Tennant Creek Style Au-Cu-Bi mineralisation together with unconformably related and structurally emplaced mineralisation.

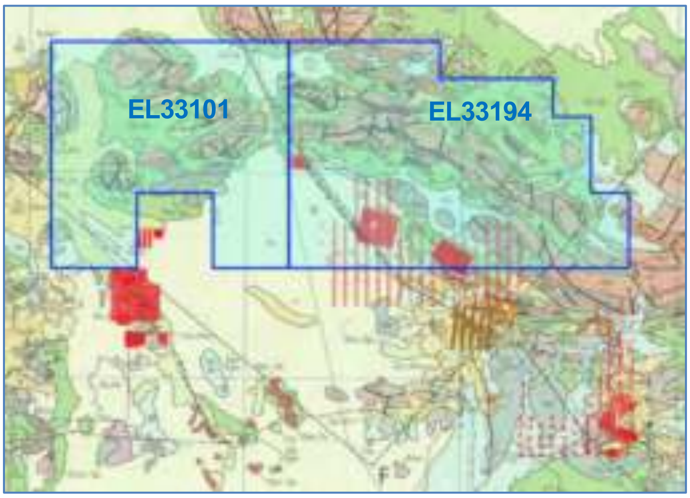
Past exploration programs: Exploration programs over the last 50 years in the general area, and some over HRE's current tenement, listed in approximate date order, included:

- Bureau of Mineral Resources (BMR) – 1960s-1970s.
- Geopeko Limited (Geopeko) – 1969.
- M.A.T. Exploration Pty Ltd (MAT) – 1970 to 1972 – AP2090.
- Inter-Copper NL (InterCopper) – 1970 to 1972 – EL59.
- Nobelex N.L. (Nobelex) – 1972 to 1974 – EL375/6.
- Aquitane Australia Minerals Pty Ltd (Aquitane) – 1972 to 19734 – EL87.
- Uranerz Australia Pty Ltd (Uranerz) / Marathon Petroleum Australia Limited (Marathon) – 1977 to 1981 – EL1668.
- CRA Exploration Pty Ltd (CRAE) – 1979 to 1983 – EL1877 (Short Range).
- CRAE – 1980 to 1981 – EL2353.
- CRAE – 1980 to 1982 – EL2662 (Last Hope).
- Geopeko – 1983 to 1985 – ELs 3573 and 4179.
- Central Electricity Generating Board Exploration (Australia) Pty Ltd (CEGBEA) / Poseidon Gold Ltd (PosGold) – 1986 to 1992 – EL4895 (Short Range).
- Western Mining Corporation Limited (WMC) – 1990 to 1974 – EL7153.
- PosGold / Normandy Gold Pty Ltd (Normandy, formerly PosGold) / Santexco Pty Ltd (Santexco, formerly Normandy Tennant Creek Pty Ltd) – 1992 to 2002 – EL7896/SEL8814.
- Delta Gold Exploration Pty Ltd (Delta Gold) / BHP Minerals Exploration Pty Ltd (BHP/BHPM) / Giants Reef Mining Limited for Giants Reef Exploration Pty Ltd (Giants Reef) – 1993 to 2001 – EL8104+.
- Giants Reef – 2001 to 2002 – ELs 9995, 9996, 22713.
- Red Metal Limited (Red Metal) – 2004 to 2007 – EL24012.
- Meteoric Resources NL (Meteoric) / Sipa Exploration NL (Sipa) – 2005 to 2013 – mostly ELs 24364 and 24138.
- Uranium West Pty Ltd (Uranium West) / Rum Jungle Uranium Ltd (Rum Jungle) – 2006 to 2012 – mostly ELs 24835, 2557.
- Castile Resources Pty Ltd (Castile) – 2008 to 2013 – EL26034.
- Universal Splendour Investments (USI) / Bligh Resources Ltd (Bligh) – 2010 to 2015 – ELs 27651, 27654.
- Manto Mining Pty Ltd (Manto) – 2012 to 2022 – EL28904.

Local geochemical sampling: Figure 113[202] illustrates past geochemical sampling (recorded by the NT STRIKE on-line service) locations of soil samples (red), rock chips (green) and whole rock (brown). They are plotted with HRE's tenement (blue line polygon) and the 1:250K geological map. *NB: Research shows that not all geochemical sampling has been databased in STRIKE.*

Samples were taken patchily to the south of the tenements, apparently none within EL33101, and patchily within the southern third of EL33194.

Figure 113 Duke Project past geochem sampling



[201] Giants Reef, January 2003. 1st and final annual report. 5.2, pp2.
[202] Captured May 2022 online from STRIKE, NT DITT. Geochemistry soils.

The small patch of soil samples (red) just east of the EL33101EL/33194 dividing boundary were taken by CRA Exploration in the early 1980's (see 14.8 and Figure 125). Most (or all) of the rest of the soil sampling within EL33194, and to the south of it, was done by Delta Gold[203] in the mid-1990's (see 14.15 and Figure 145). The small survey in the southern embayment into EL33101, and those to the immediate south, was soil sampling by Meteoric Resources in 2008/9[204] (see 14.18 and Figure 152). The small square patch of whole rock samples (brown) south of EL33194 was done by Poseidon Gold in 1994.

Local drilling: Figure 114[205] regionally illustrates most past drilling locations as blue dots. As with the geochemical sampling STRIKE does not appear to database all holes.

Figure 114 Duke Project past drilling regionally

Drilling was mostly off the tenements to the south (by PosGold, see 14.14 and Figure 142), with a limited number drilled within the tenements, principally in EL33101 (see Figure 115). Not all targets are known, but they included gold, copper and uranium.

Holes within tenement EL33101 were focussed within small scattered separate areas. This brief search indicates them to be very predominantly shallow (<20 m) RAB type drill holes with a handful of diamond holes.

Past exploration drilling programs in the general area included:

- Geopeko – 1960s to early 1980s.
- Inter-Copper – EL59 – 1970 to 1972.
- CRAE – EL1877 – 1979 to 1983.
- CEGBEA / PosGold – EL4895 – 1986 to 1992.
- PosGold / Normandy / Santexco – EL7896/SEL8144 – 1992 to 2002.
- Delta Gold – EL8104 – mid 1990's.
- Red Metal – EL24012 – 2004 to 2007.
- Meteoric / Sipa – many ELs – 2003 to 2013.
- Uranium West / Rum Jungle – mostly EL24835/EL25575 – 2006 to 2012.

Figure 115 Duke Project past drilling locally

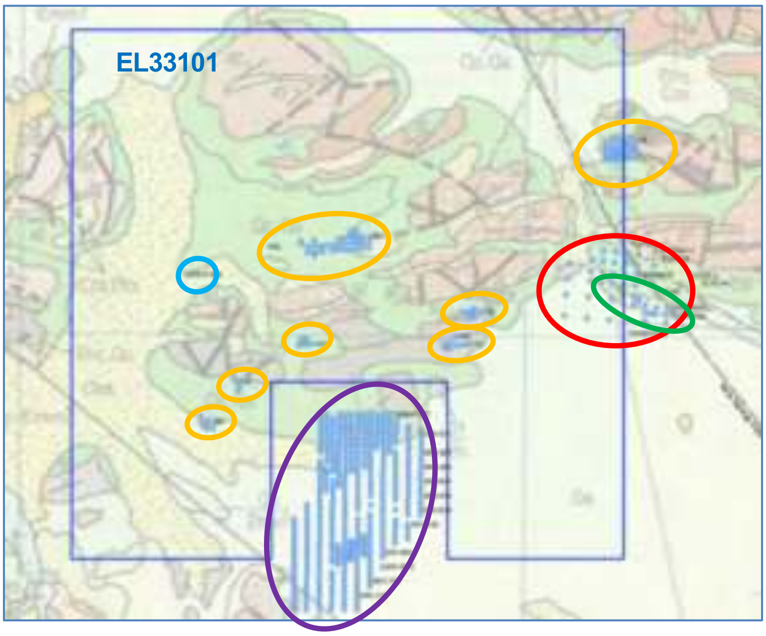


Figure 115 illustrates the local drill-hole locations in relation to HRE's western tenement EL33101 and the 1:250k geology. Percussion holes are blue, diamond holes are yellow.

The various drilling program areas are marked by coloured ovals and described below.

- InterCopper – orange.
- CRAE – red.
- CEGB – green.
- Red Metal – blue.
- PosGold – purple.

[203] Delta Gold, June 1994. 1st annual report on EL8104 (Short Range). Plans 1 & 2.
[204] Meteoric, December 2009. Annual report on EL23764. Fig 6.
[205] Captured May 2022 online from STRIKE, NT DITT. Drillholes

14.1 BMR (1960s-1970s)

In 1936 the "Aerial Geological and Geophysical Survey of Northern Australia" (precursor of the Bureau of Mineral Resources (BMR)) produced the first papers on magnetic prospecting in the area. The BMR then carried out a number of geophysical and geochemical studies in the 1960's and 1970's. They included a 1:100K scale geological map of the Warrego – Short Range area. The first 1:250K Tennant Creek geological sheet was published in 1978. The BMR geophysical data is referenced by many of the 70's and 80's explorers.

14.2 Geopeko (1969)

Geopeko Limited (Geopeko) explored fairly extensively in the region from the 1960s to the early 1980s. Details are sketchy and those given here were largely collated from the various subsequent explorers[206] described below. Peko Mines NL (later Peko Wallsend) was the initial significant local gold and copper miner in the region, and it and its exploration subsidiary Geopeko dominated the field through the 1960s and 70s. As much of the exploration work was carried out on mineral leases or as "open range" exploration few of Geopeko's reports are on open file through the Mines Department.

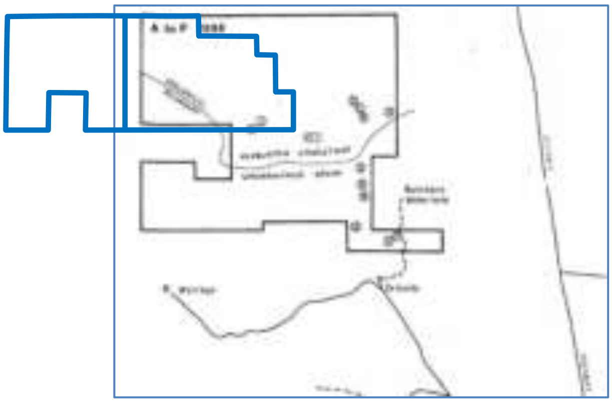
Geopeko's exploration in the local area in the 1970s and early 1980s utilised aero-magnetic data flown by the BMR. That produced ironstone targets to follow-up with ground-magnetics and Geochem sampling. Pos Gold report that the best of those were then followed-up by drilling, apparently with disappointing results, although not all ironstones were drilled. Their exploration model was "Tennant Creek-style ironstone hosted gold.

CRAE reported that Geopeko investigated AP1846 (southern part of CRAE's EL1877, see 14.8) during 1969, following aeromagnetic responses. They defined a series of targets ("Explorer" prospects 27, 35, 36, 59, 60 and 61). Meteoric report that Geopeko drilled diamond holes into targets 27, 36 and 59. At Explorer 27 a 183 m diamond drill-hole (hole #1) was drilled beneath a surface gossan with anomalous copper (1,500 ppm) and molybdenum (800 ppm). Dispersed chalcopyrite was intersected from 124 to 183 m (but no assays available). Another diamond hole at Explorer 36 intersected alternating diorite and feldspar porphyry containing disseminated magnetite and copper-iron sulphides with best intersections of 1.2 m at 0.4 g/t Au from 173 m and 1.2m at 0.22% Cu from 270 m. A hole at Explorer 59 intersected fresh weakly magnetic diorite.

14.3 M.A.T. Exploration (1970-1972) – AP2090

Background: M.A.T. Exploration Pty Ltd (MAT) had a JV in the early 1970's with Westmoreland Minerals Limited (Westmoreland) and Paringa Mining & Exploration Company Limited (Paringa) to explore three Authorities to Prospect (AP2090, 2092 and 2093) near Tennant Creek. Figure 116[207] shows AP2090 (black polygon), the NW part of which is virtually completely encompasses HRE's EL33194 and is immediately east of EL33101 (blue polygon, approximate position).

Figure 116 MAT AP2090



Objectives: MAT's objective was to discover copper mineralisation associated with magnetic ironstone bodies.

Exploration: A detailed aero-mag survey was initially carried out, from which 24 (out of 32) individual anomalies were interpreted and examined on the ground and geologically mapped. The identified anomalies in AP2090 are shown by labelled circles in Figure 116.

For interpreting anomalies the importance of cross-cutting and intersecting faults was appreciated. The aero-mag over the NW corner of the AP2090 (adjacent to HRE's tenement) is shown in Figure 117[208], with interpreted faults highly evident. The Tomkinson / Warramunga contact is marked by the arcuate contours, and Anomaly M is marked by the circle close to the contact and at the juncture of two faults.

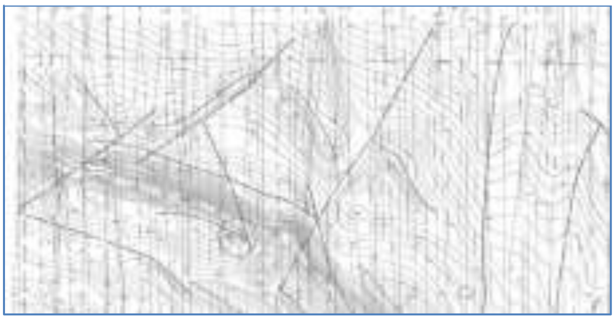
The mag anomalies were considered to be low intensity compared to those over local producing mines. It quickly became apparent that anomalies in the northern Ashburton sandstones (Tomkinson) had very low potential for Tennant Creek-type mineralisation and focus shifted south to those in Warramunga sediments. The boundary

[206] CRAE and Meteoric.
[207] MAT, February 1971. Report on 1970 exploration. Plate 1.
[208] MAT, February 1971. Report on 1970 exploration. AP2090 air-mag contour map, Sheet 1.

between them is shown in Figure 116.

In 1970 2 of the mag anomalies (O and S, resembling the local Orlando Mine anomaly) were soil geochemically surveyed and percussion drilled (12 holes for ~1,150 m). Significant mineralisation was not found and the anomalies were ascribed to low mineralisation potential magnetite-bearing dolerite intrusives (rather than the sought after ironstones).

Figure 117 MAT aero-mag in NW of AP2090

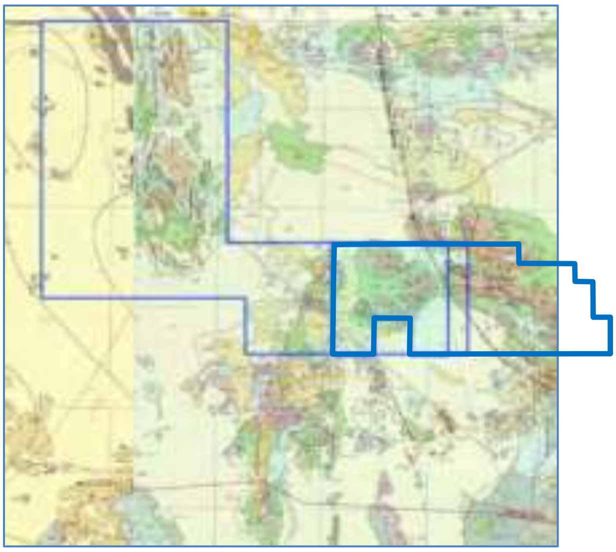


In 1971 2 more anomalies (U and V, in the SW of the tenement) were geophysically surveyed and shallow auger drilled. The anomalies were again interpreted as deep-seated dolerite dykes which the auger holes could not reach. Deeper drilling was not warranted. Another 2 anomalies (G and R, in the SE of the tenement) were auger drilled, and again revealed the presence of dolerite dykes. No further exploration was considered and EL39 application was relinquished.

14.4 INTER-COPPER (1970-1972) – EL59

Background: According to CRAE (see 14.8) Inter-Copper NL (Inter-Copper) held EL59 (initially PA (prospect authority) 2892). Figure 118[209] illustrates EL59 (thin blue polygon) above 1:250K geology – completely surrounding HRE's EL33101 (thick blue polygons) and occupying a thin strip down the west side of EL33194, and also extending well to the NW. Open-file reports of the exploration were by Geotechnics (Aust) Pty Ltd – and the holder of the tenement is not mentioned. Geotechnics addressed the last of their reports to Inter-Copper.

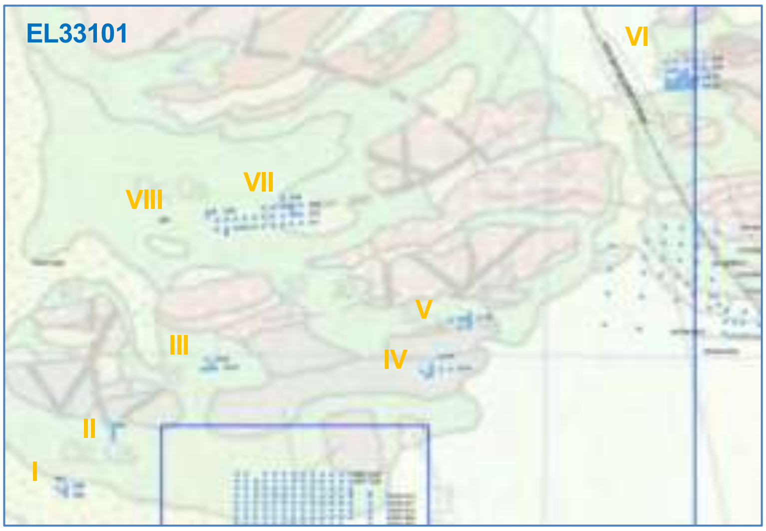
Figure 118 Inter-Copper EL59



Objective: Inter-Copper were (presumably) searching for copper.

Exploration: Inter-Copper carried our airborne magnetic and radiometric surveys in 1970, soil geochemical sampling, and detailed geological mapping. Shallow percussion drilling was then undertaken on 8 separate aeromagnetic anomalies, with bedrock samples assayed for copper (Cu) and bismuth (Bi).

Figure 119 Inter-Copper drill holes



Their initial interpretation[210] was that the copper anomalies found in association with the magnetic anomalies were probably caused by ironstone-associated copper mineralisation of the Tennant Creek type (or possibly basic horizons within the sandstone sequence). Subsequently Geotechnics reinterpreted[211] the geophysical surveys. This suggested that the magnetic anomalies were probably due to basic sills or intrusions within the base of the Tomkinson Creek Beds rather than ironstone bodies within the Warramunga Group. This would agree with CRAE's later exploration (14.8).

A program of drilling each of the 8 anomalies was undertaken, with 125 shallow (~9 m deep) vertical percussion holes drilled for 3,497 ft (1,157 m). Figure 119 shows the groups of holes drilled in the various areas (annotated in orange), plotted above 1:250 k geology. The areas were scattered in a E/W strip across the central part of HRE's

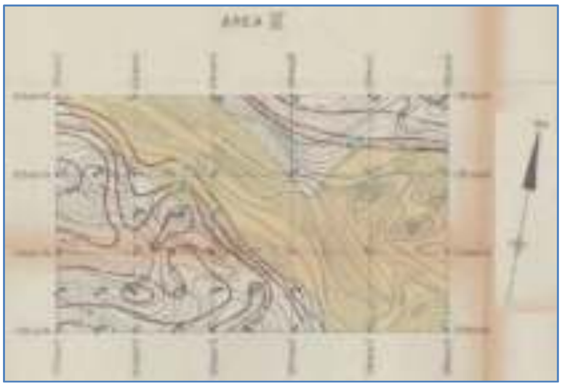
[209] Captured March 2022 online from STRIKE, NT DITT. Titles and 1:250K geology.
[210] Geotechnics, June 1972. Report on drilling etc.
[211] Geotechnics, September 1972. Report on reinterpretation etc.

EL33101 and just into EL33194 on the east. A sample from the base of each holes was assayed for Cu and Bi. No anomalous Bi values were encountered but a number of Cu ones were. Holes were drilled through surface colluvium (often lateritic), weathered material and then fresh hard shales or mudstones.

Drill holes in each area were:

- Area I – 9 holes for 235 ft (72 m). No anomalies.
- Area II – 10 holes for 190 ft (58 m). 1 anomalous Cu value (104 ppm).
- Area III – 8 holes for 200 ft (61 m). 3 anomalous Cu values (100 – 170 ppm).
- Area IV – 9 holes for 190 ft (58 m). No anomalies.
- Area V – 9 holes for 185 ft (56 m). 1 anomalous Cu value (88 ppm).
- Area VI – 41 (~10 m deep) holes for 1,245 ft (379 m). Anomalous Cu ranged up to 640 ppm with 8 above 200 ppm. Cu results paralleled the WNW trending magnetics anomaly. This trend was also parallel to the sandstone outcrop and possibly to the buried contact with the Warramunga rocks.
- Area VII – 38 (~10 m deep) holes for 1,242 ft (379 m). Anomalous Cu ranged up to 1,000 ppm. These increased southwards but did not correlate with magnetics.
- Area VIII – drilling abandoned.

Figure 120 Inter-Copper Area VI



Plots[212] of the vertical magnetics (thin black contours) and copper geochem (red contours) results are given for Areas VI (Figure 120) and VII (Figure 121). The beige shaded areas are the Ashburton Sandstone outcrop. Drill holes are marked by the black dots (mostly on the 400 ft spaced coordinate lines (whose grid is rotated anti-clockwise slightly).

Figure 121 Inter-Copper Area VII

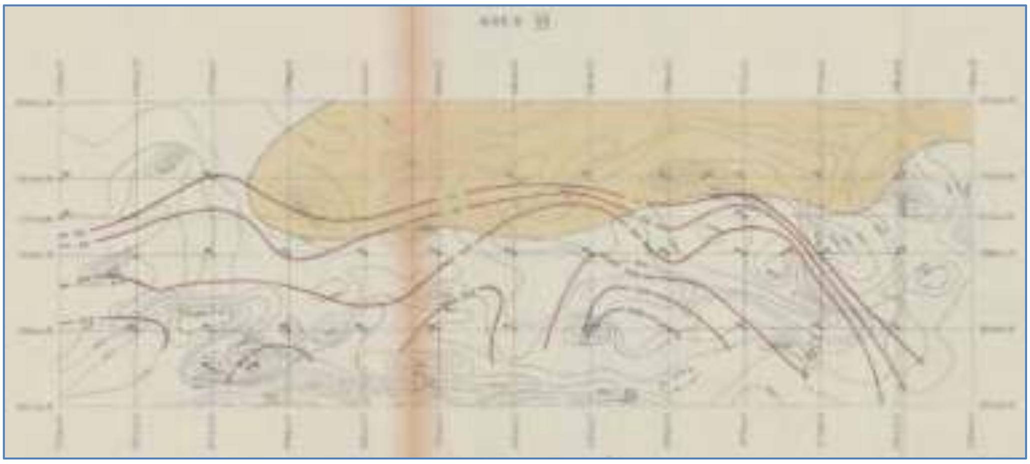


Figure 122[213] presents Inter-Copper's overall interpretation of geology from the aeromag data in Area VII.

Figure 122 Inter-Copper aero-mag interpretation of geology in Area VII

[212] Geotechnics, June 1972. Report on drilling etc. PDF pp15.

[213] Geotechnics, September 1972. Report on interpretation etc. PDF pp11.

14.5 NOBELEX (1972-1974) – EL375/6

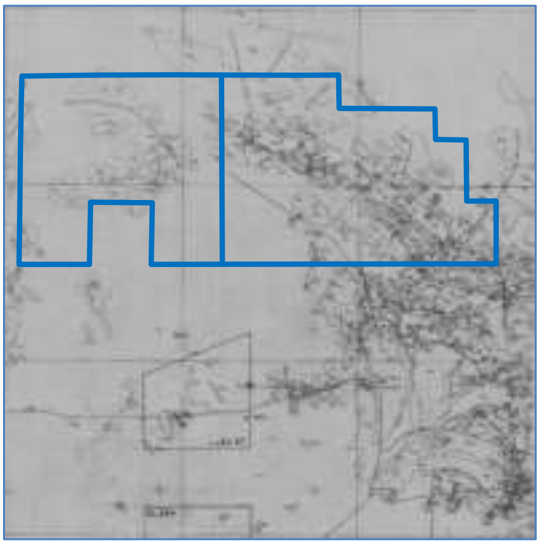
Background: Nobelex N.L. explored tenements EL375 (called Short Range II) and EL376 (called Short Range III) between 1972 and 1974, the tenements being to the east and south east of HRE's tenement. Nobelex's managing agent was Australian Development Limited who were responsible for reporting to the Mines Department. Reporting on the exploration was sparse.

Exploration: Initially work in 1972-3 used airborne magnetic mapping from a prior explorer. That proved to be too poor quality to use and the company decided to obtain its own. The survey was flown in 1974. The high quality data showed them that no anomalies existed which could be considered Tennant Creek-type ironstones. Responses that were evident were ascribed to dolerite dykes and sills (possibly proven by DAB and diamond drilling later mentioned by Delta Gold[214]). No further exploration was considered.

14.6 AQUITANE (1972-1974)[215] – EL87

Aquitane Australia Minerals Pty Ltd (Aquitane) explored tenement EL87 (granted in 1972) during 1973. Figure 123[216] shows Aquitane's EL87 (black trapezoidal polygon) due south of HRE's blue tenements. The base of the Figure is BMR geological mapping. Because of poor access and absence of mapping they utilised low level helicopter reconnaissance initially. It would seem that they relied extensively (at least at the start) on the existing BMG geological mapping and geophysics.

Figure 123 Aquitane EL87



A potentially interesting geological observation (it is not clear if it was theirs or the BMR's) was that the granite is cut by a complimentary NNW and NNE system of quartz veins. The NNW striking ones are up to 3 m wide and form elevated spines. *For HRE this could indicate the presence of pegmatites*.

An airborne mag survey conducted in 1969 was referenced in Aquitane's work. A small mag anomaly (WN 1) was delineated, situated above the granite-sediment contact. This anomaly was followed-up by ground magnetics.

Aquitane's conclusions were that 90% of the EL was underlain by granitic rocks; outcrop was poor and therefore geology was difficult to appreciate; airborne magnetics defined the contact between sediments and the granite; a low intensity mag anomaly was similar to the Warrego Mine anomaly; anomaly WN1 indicated a shallow magnetic force but would be regarded as having negligible economic potential; and the area had been thoroughly explored and EL87 had negligible economic potential.

14.7 URANERZ / MARATHON (1977-1981) – EL1668

Background: Open-file reports on Uranerz's exploration are slightly confusing and possibly in-complete – hence this summary may be inaccurate to a degree. However according to CEGBEA[217] (see 14.11) the first documented direct exploration for uranium in the general area was by Uranerz Australia Pty Ltd (Uranerz). CEGBEA's summary was that their exploration over the Warramunga / Tomkinson contact only found moderate radioactivity associated with shears around old gold workings.

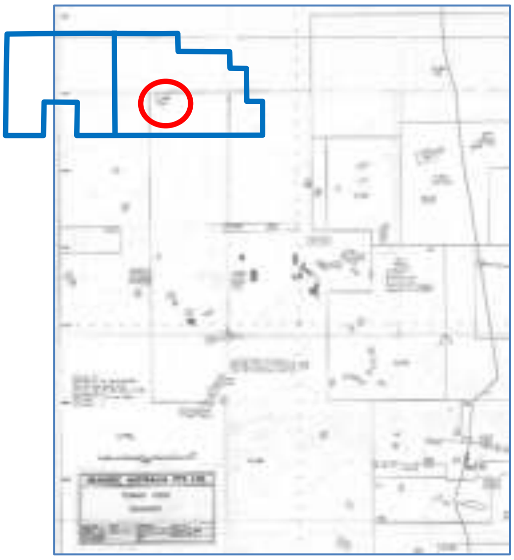
Uranerz was granted EL1668 (1,099 km^2) NW of Tennant Creek in 1977. In Figure 124[218] EL1668 is the tall thin tenement labelled in its top left corner in the red oval. HRE's tenements approximate location is shown to the NW by the blue polygon. EL1668 was explored in conjunction with EL1669 (immediately NE in Figure 124 and straddling the Stuart Highway), EL1745 (to the SE and E of the Highway), and EL1284 (S of EL1669). Small polygons are Mineral Claims. By 1980 relinquishments had reduced EL1668 to 535 km^2.

During the second year of exploration (1979) Uranerz formed a JV with Marathon Petroleum Australia Ltd

[214] Delta Gold, June 1994. 1st annual report EL8104. 4.(a), pp3.
[215] Aquitane, March 1974. Final report.
[216] Aquitane, March 1974. Final report. Plate 1.
[217] CEGBEA, July 1987. Annual report. 5.2, pp5.
[218] Uranerz, October 1978. 1st annual report. Map 1 (NT-3134-2Y).

(Marathon) and exploration from the 3rd year (1980) on was carried out by Marathon. The original 4 ELs formed part of the Marathon / Uranerz JV. Marathon also had a concurrent JV with Australian Ores and Minerals Ltd (AOM), which added a series of other ELs and considerably increased the Project footprint. Those new ELs were all to the E and SE of EL1668 and EL1669.

Figure 124 Uranerz EL1668



Objective: Uranerz stated that no uranium deposits were known in the area but that uranium mineralisation in chloritic shales had been intersected in drill-holes at a local gold mine[219]. Uranerz's targets were "Alligator River vein-like-type uranium deposits" – located near the Tomkinson / Warramunga unconformity within ELs 1669 and 1669. Marathon's targets were uranium, copper, gold and bismuth – in the Tennant Creek-style ironstones.

Exploration: Uranerz initially (year 1, 1978) carried out regional geological mapping with help from previous BMR and other work. Detailed local mapping was undertaken near the angular unconformity between the Tomkinson (referred to as Carpentarian) and Warramunga Formations. The base of the Tomkinson in the area was marked by a conglomerate layer. Folding, faulting and jointing was studied. Ground-based radiometric traverses were undertaken – finding several anomalies attributed to thorium in 4 settings – basal grit heavy mineral accumulations; iron-enriched laterites; ironstones; and dolerite sills. Ground-based magnetometer traverses were run over some of the radiometric traverses. Results were "not spectacular, but Uranerz desired to continue".

Uranerz's 2nd year (1979) exploration[220] continued the same type of exploration as before and added "Track-Etch" surveys. Results were "less than encouraging, leaving only 2 possible targets to test further". Further geological mapping indicated that the unconformity in the area was only slightly angular and probably more transitional. Furthermore the steep north dipping sediments differed from the Alligator Creek uranium deposit model of flat-lying sequences. Uranerz also studied the local Last Hope Mine, the only example in the Tennant Creek Goldfield where gold mineralisation occurred in a quartz reef system. Quartz veins were numerous and up to 1.5 m wide. Old drill holes were radiometrically logged without success. A Track-Etch survery was carried out on 38 traverses – with the cups left in place for a month before analysis. The Trak-Etch results were generally low, 4 areas of higher values were delineated, 3 of them near the Last Hope Mine and the other to the east. These poor results, together with the unfavourable re-evaluation of the unconformity, downgraded the Project.

3rd year (1980) exploration[221] was taken over by Marathon and picked up, and comprised geological mapping, geochemical sampling, various geological studies, and also very limited percussion drilling (4 holes). The new ELs in the SE moved the Project effectively into a magmatic intrusive and extrusive geological environment and away from HRE's model. Marathon studied the regions geological structure carefully and made several points (described in 13.5.3) that may have relevance to HRE's vein REE model.

4th year (1981) exploration[222] by Marathon consisted of geological mapping, ground mag surveys, regional gravity surveys, and geochemical sampling. Their conclusion was that no obvious "Tennant Creek type" targets exised within EL1668. However they did note that a "target akin to Olympic Dam may exist", due to the local mineralogy (heamatite±magnetite±copper±gold±uranium). To fully understand the area Marathon considered that a great deal more effort was required, and hence decided to withdraw from the Project.

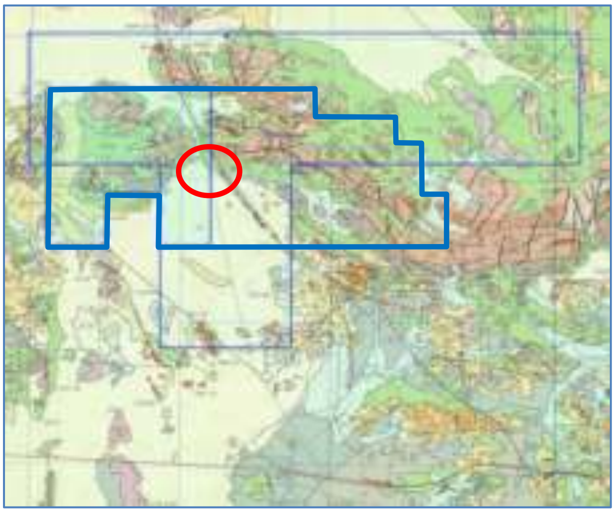
14.8 CRA EXPLORATION (1979-1983)[223] – EL1877 (SHORT RANGE)

Background: CRA Exploration Pty Ltd (CRAE) explored for uranium in the area in the early 1980s within tenement EL1877 (452 km^2). EL1877, called Short Range, is shown in Figure 125[224] by the thin blue polygon and it covered the central portion of HRE's tenements (marked by the thick blue polygon). CRAE also conducted exploration around the same time on adjacent tenement EL2353 (Section 14.9) to the south west (plotted in Figure 129) and EL2662 (Section 14.10) to the south east (plotted in Figure 130).

[219] Uranerz, October 1978. 1st annual report. 2., pp1.
[220] Uranerz, December 1979. 2nd annual report.
[221] Marathon, January 1981(?). 3rd annual report.
[222] Marathon, November 1981. 4th annual report.
[223] CRAE, 1980-1983. 4 annual reports.
[224] CRAE, 7/1980. 1st annual report.

Objectives: Exploration was prompted by the discovery of high grade uranium (U) mineralisation in the old Northern Star Gold Mine (6 km SSE of Phillip Creek homestead) and Peko's Warrego and Juno Mines. CRAE were looking for an Alligator River-style deposit. CRAE identified a 2-3 km wide belt of high magnetics across their tenement, following the southern outcrop of the Hayward Creek Formation (Tomkinson Creek Beds). They were also cognoscente of the unconformity with this Formation and the lower Warramunga Group meta-sediments (mentioned above).

Figure 125 CRAE EL1877 (Short Range)



Exploration: CRAE commenced exploration with airborne spectrometer and magnetometer surveys, and found a number of anomalies. Anomaly 12A was considered significant and was explored further by ground geophysics. Soil samples were collected over the centre of the anomaly (the small area of sampling immediately east of EL33101 in Figure 113) and assayed for U and Th, followed by a program of 15 shallow (~55 m) vertical percussion drill-holes (RD79SR01 to 15, for 805 m).

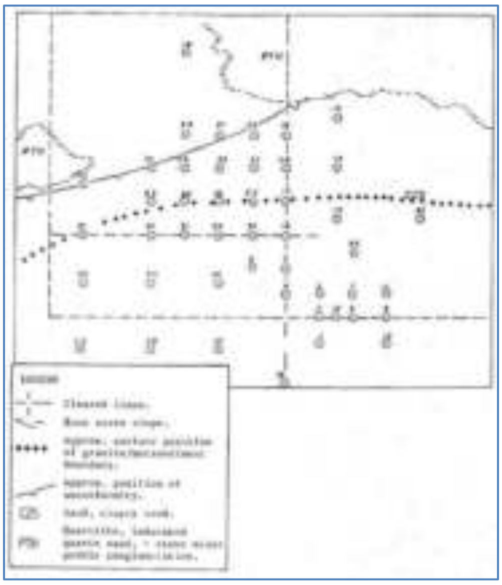
Figure 126 CRAE drill holes

Those hole locations (and all subsequent holes) are plotted in Figure 126[225] above geology. The holes straddle the N/S boundary (blue line) separating HRE's tenements, (within the red oval in Figure 125). They are due south of the Inter-Copper holes in Area VI. Those holes encountered barren granite below 4-6 m of surface aeolian sand and silcrete. Some holes were sampled for U and Th. However water samples from 3 holes were highly anomalous in U.

20 more holes were then drilled to the NW (RD79SR16-35, for 980 m, ~50 m deep), also predominantly encountering barren granite. Further water sampling defined the uranium-in-water anomaly (Figure 128). At this point the CSIRO undertook a water sampling programme and confirmed CRAE's uranium anomalies. 10 more holes (RD80SR36-45, for 300 m, 30 m deep) were drilled in the 2nd year (1981) which extended the anomaly. Further geophysics delineated the anomaly above an axis of ground-water flow and deep granite weathering.

2 inclined diamond drill-holes (DD81SR46 (179 m) and DD81SR47 (164 m), drilled near the SE part of the percussion hole grid) were drilled in the 3rd year (1982), encountering fine to coarsely crystalline granite, finely fractured throughout, with several broad zones of shearing and hydrothermal alteration coincident with high radiometrics. 10 more shallow (26-35 m deep) holes (RD81SR51, 52, and 57-64) were drilled in the 4th year (1983) in a pattern at least 800 m outside previous holes. All of the CRAE drill hole locations are plotted again in Figure 127[226], with CRAE's brief geological surface mapping. This anomaly was later further explored by CEGB (see 14.11 below) who gave a full bedrock later interpretation (Figure 132).

Figure 127 CRAE holes & mapping



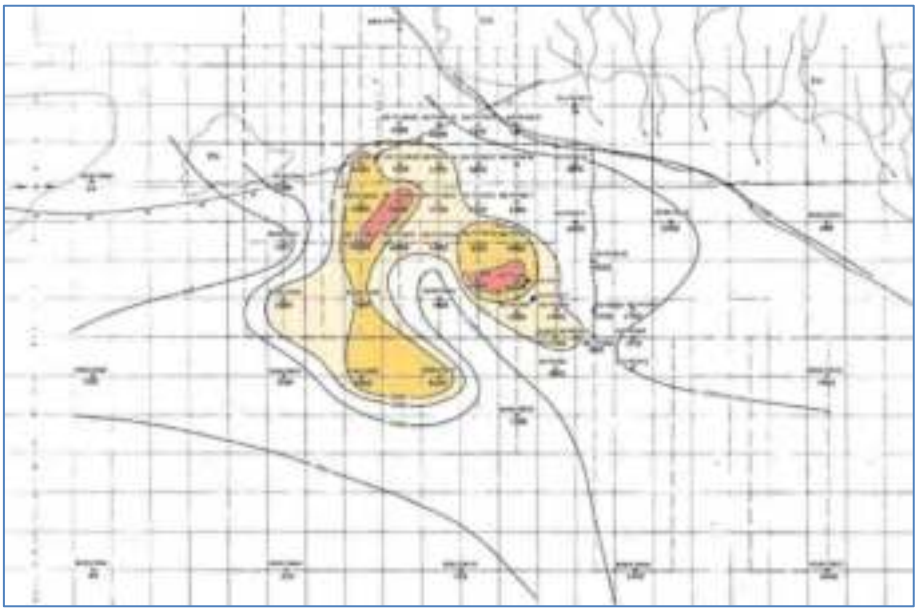
For HRE here a relevant detail from this Figure is the mapping of the unconformity between the Tomkinson and the Warramunga formations.

Conclusions: The gamma ray uranium-in-water at Anomaly 12A (Figure 128[227]) was interpreted as a concentration through a ponding

[225] Captured February 2022 online from STRIKE, NT DITT. Drilling.
[226] CRAE, 9/1983. 4th annual report. Fig 1.
[227] CRAE, September 1983. 4th annual report. Plate 2.

and evaporation effect, being derived from the granite, leached hydrothermally and re-deposited in the fracture zone. CRAE noted[228] that "the outstanding feature of Anomaly 12A is the presence of one of the highest uranium contents in water yet recorded (16,400 ppb uranium)".

Figure 128 Uranium-in-water at Anomaly 12A



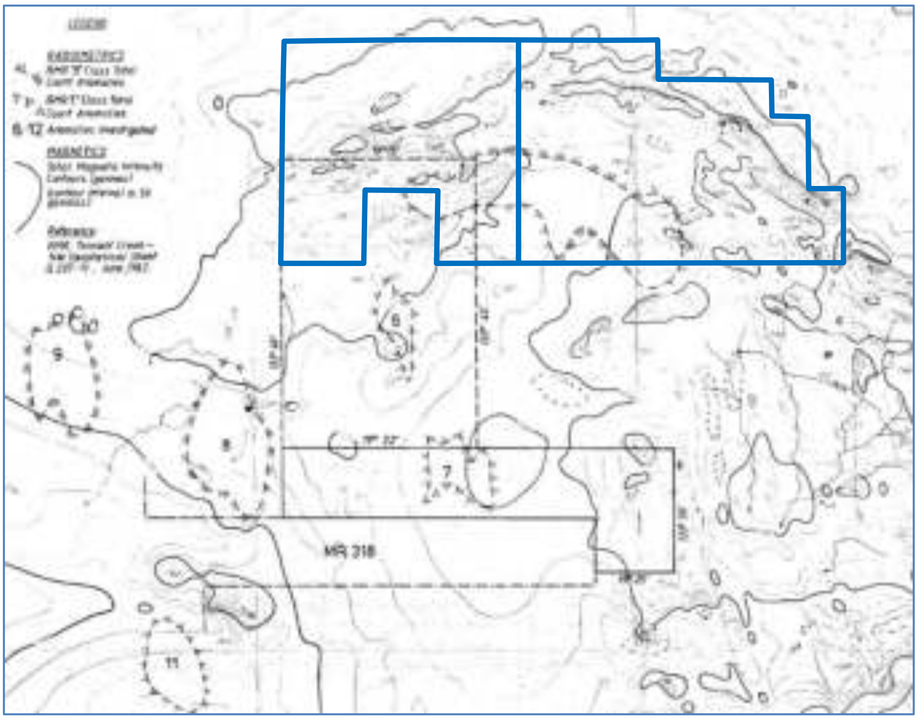
However the chances of finding an economic accumulation of uranium was then assessed as "very low". They had found examples of abnormally high uranium values in water associated with granitic rocks but not with economic mineral deposits. These conclusions were supported by the CSIRO study (however see also the CEGBEA conclusions below).

Radiometric Anomaly 13B, to the south, was never followed up with drilling.

14.9 CRA Exploration (1980-1981)[229] – EL2353

Background: Because of the significant radiometric response found in EL1877 (see Section 14.8) to the north and east CRAE applied for immediately adjacent EL2353, which was granted in 1980. Figure 129 illustrates the L-shaped EL2353 overlapping the southern part of HRE's blue EL33101 (approximate position). The Figure also plots the BMR's 1962 airborne magnetic contours and their numbered radiometric anomalies.

Figure 129 CRAE EL2353 radiometric anomalies on magnetics



Exploration & conclusions: Areas of high radiometrics, outlined by the BMR survey, were inspected. These were over the granite/sediments contact. Anomalies were mainly due to potassium and/or thorium.

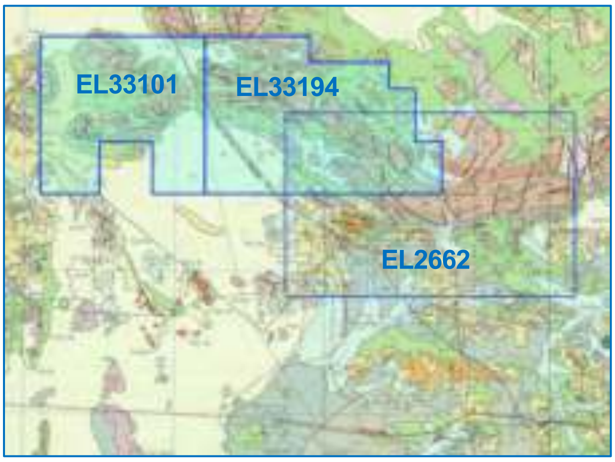
However 2 anomalies contained uranium (Anomalies 8 and 9), were found to be thin haematitic mudstones, for which assays produced insignificant values.

[228] CRAE, September 1983. 4th annual report. 5, pp12.
[229] CRAE, June 1981. EL2353 final report.

14.10 CRA Exploration (1980-1982) – EL 2662 (Last Hope)

Background: CRAE also obtained EL2662 (they named last Hope) at around the same time as their uranium exploration on adjacent tenements EL1877 (to the NE, Section 14.8) and EL2353 (to the west, Section 14.9). EL2662 is shown in Figure 130[230], covering the SE corner of HRE's tenement EL33194 and extending further south and east.

Figure 130 CRAE EL2662 (Last Hope)



Objectives: CREA took up this EL[231] expecting that the water-borne uranium anomaly on EL1877 could be sourced from immediately to the SE.

CRAE also had an eye on gold given the location of the Last Hope Gold Mine withing the EL near its western side (near the No 5 Alluvial Bore next to the railway line). They were following a concept off dolerites and associated quartz-haematite lodes hosting gold.

Exploration: CRAE studied and described the local Warramunga and younger northern Tomkinson sediments. Of use here was their description of a claystone marker bed near the unconformable contact between the two units. They also mentioned quartz feldspar dykes intruding the sediments adjacent to the central granite. Diorite sills and dykes were described intruding the lower Tomkinson beds, which post-date the major folding and faulting in the area. The sinuous folded valleys in the Short Range were described as weathered out diorite sills. The sills are highly weathered and altered and form a thick pisolitic laterite (possibly also of interest for REEs).

Conclusions: Continued work on EL1877 (to the NW) eventually showed that the source of the uriniferous water was unlikely to be from within EL2662 (Last Hope).

No anomalous gold was detected in geochemical sampling of the dolerites near the Old Hope Gold Mine. Mineralisation at the Mine was interpreted as being associated with intensive quartz veining and shearing in ferruginous dolerite intrusions, themselves on the northern limb of an east plunging anticline.

14.11 Geopeko (1985-1985) – EL3573/4179

Geopeko explored EL3573 and EL4179 in the mid-1980's looking for copper-gold deposits[232]. They flew aero-magnetics and radiometrics and located 3 anomalies. The tenements were then relinquished. No other details or results are at hand.

14.12 CEGBEA / Poseidon Gold (1986-1992) – EL4895 (Short Range)

Background: The Central Electricity Generating Board Exploration (Australia) Pty Ltd (CEGBEA or CEGB) conducted exploration on a large EL4895 (called Short Range, comprising 500 blocks for 1,545 km^2) NW of Tennant Creek from 1986. EL4895 was granted in May 1986 with a term of 6 years – and was held contiguously with two other ELs. EL4896 (called Warrego) was directly to the south and was reported jointly with EL4895. EL5255 was further south again. Figure 131[233] illustrates EL4895 with the red boundary, with HRE's tenements approximate position in blue. EL4896 is marked in black directly south of EL4895. Tennant Creek is shown in the bottom right corner.

CEGB operated the exploration for ~3 years until the tenement ownership changed[234] to Golden Plateau NL in early 1989 as part of a JV arrangement[235]. Subsequently Australian Development Limited purchased Golden Plateau's interest in the JV. Golden Plateau changed name to Poseidon Gold Limited (PosGold) at about that time, PosGold purchased the tenements in February 1990, and from then on became the Project operator and reporter until 1992.

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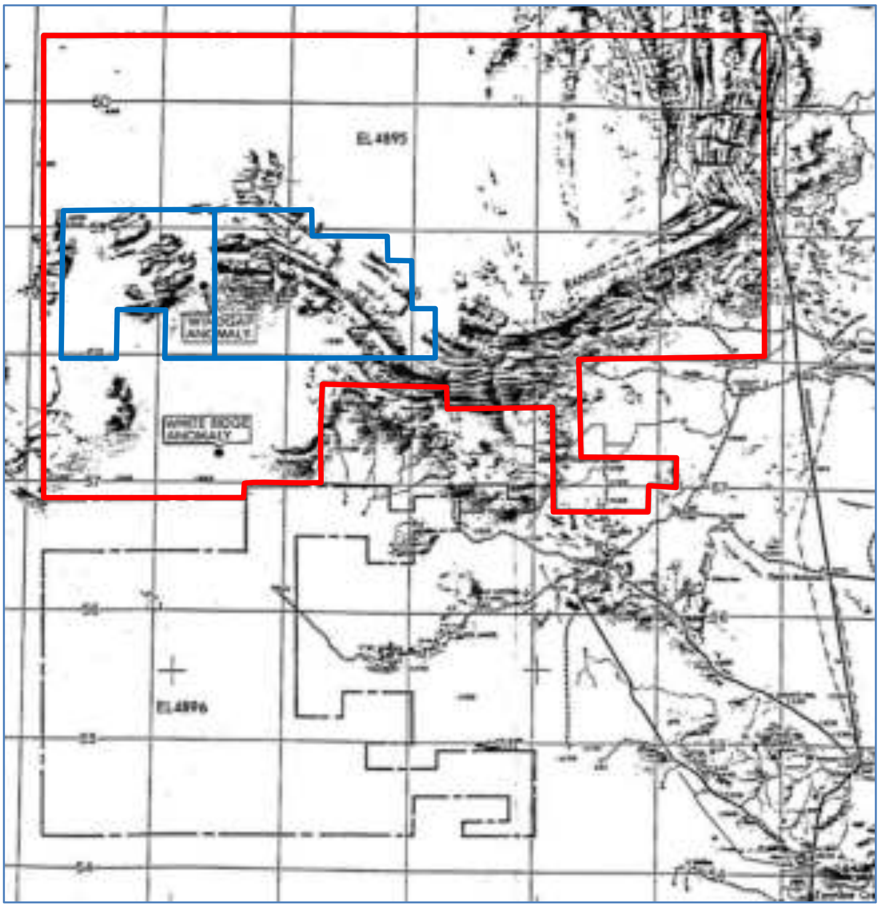
[230] Captured May 2022 online from STRIKE, NT DITT. Titles and 1:250K geology.
[231] CRAE, February 1982. EL2662 final report.
[232] Castile Resources, March 2009. Annual report on EL26034. Pp6.
[233] CEGBEA, December 1986. Progress Report etc. Fig 1, pp26. Clearer version 1987 report.
[234] Pos Gold, May 1990. Annual report to May 1990. 5.1, pp13.
[235] Pos Gold, June 1992. Final annual report. 2., pp4.

Objectives: CEGB explored for uranium[236] and gold[237]. They also paid particular attention to the Warramunga / Tomkinson contact. For uranium they initially looked at CRAE's anomalies (14.8) – believing they had been prematurely dropped by CRAE.

Figure 131 CEGBEA / Pos Gold EL4895 & EL4896



CEGB's exploration followed shortly after CRAE's, and they renamed the anomalies[238] (the CRAE northern Anomaly 12A to Windgap Anomaly, and the CRAE southern Anomaly 13B to White Ridge Anomaly – locations labelled in Figure 131). In terms of gold CEGB noted trace gold shedding off the southern flanks of the Short Range. The source was likely placer deposits within the basal Tomkinson Creek quartzites. Interestingly (for HRE's REE search) they also noted concentration of heavy minerals (most noticeably thorium-bearing monazite and zircon) outcropping in poorly-sorted sandstones and conglomerates along the Short Range.

Windgap & White Ridge justification: CEGB concluded[239] that Windgap's uranium-in-water anomaly appeared to be related to zones of deep weathering and chloritic alteration along a gravity, airphoto and topographic lineament at its intersection with the granite-sediment contact. Their further exploration at Windgap was probably spurred by their disagreement with CRAE's earlier conclusion that the groundwater anomaly was solely a ponding and evaporation concentrating mechanism – saying that was inconsistent with the merely moderate levels of other minerals usually also produced by evaporation (although CRAE might have attributed that by subsequent flushing). CEGB presumed CRAE's down-grading of the prospect may have been strongly influenced by the CSIRO study pointing to the radionuclide ratio not being those of producing mines – a statement CEGB put down to the study working on semi-tropical groundwater conditions and therefore not clearly relevant to central Australian granitic terranes. CEGB re-interpreted CRAE's drill logs of granite weathering depths – concluding that particularly deeply weathered zones in several places gave the appearance of alteration pipes, which existed upstream of groundwater anomalies. These recognised features supported further exploration. At White Ridge: CEGB concluded at White Ridge that uranium appeared to be concentrated in a long narrow phosphatic iron-rich sediment, with radiometric highs possibly related to sub-surface granite fracturing.

Exploration: CEGB explored the two uranium anomalies, Windgap and White Ridge (both lying near the edge or within the Warrego Granite), from 1986 to 1989. Their exploration included:

- Literature review and re-interpretation of existing airborne data.
- Foot and vehicle reconnaissance.
- Detailed ground magnetic, electromagnetic, radiometric, ROAC, geochemical and biogeochemical surveys.
- Drilling of eighteen percussion holes in 1987.
- Regional groundwater studies.
- Drilling two hole diamond hole programs in 1988-1989.
- CSIRO personnel, Bruce Dickson and Angela Giblin conducted research on the Windgap groundwater uranium anomaly.

[236] CEGBEA, December 1986. Progress Report etc. Uranium, pp3-6.
[237] CEGBEA, December 1986. Progress Report etc. Gold, pp7.
[238] Pos Gold, May 1990. Annual report to May 1990. 4.4, pp13.
[239] CEGBEA, December 1986. Progress Report etc. Summary, pp4.

Year 1 (1987)[240]: The Consultant found it difficult to separate CEGB's actual exploration from its intended exploration. The earliest CEGB report[241] the Consultant located was a "progress and work proposal". That report contained details of planned geophysical surveys and drilling programs.

Work done in Year 1 to July 1987 included a literature review; re-interpretation of existing data; and rock chip and scintillometer surveying regionally. That was followed by detailed geophysical, soil and bio-geochemical surveying over selected areas, including Windgap and White Ridge.

CEGB's geological re-interpretation of CRAE's anomalies were presented in plans and cross-sections. Figure 132[242] shows CRAE's drill hole (SR1 to 58) locations at Windgap in plan with CEGB's interpreted bedrock geology. The uranium-in-water anomaly was related to degree and depth of granite weathering, centred on the "very weathered granite". CEGB interpreted the depth of granite weathering to be far greater than interpreted by CRAE.

Figure 133 shows the E/W cross-section 5900N at Windgap (location shown by the solid red line in Figure 132). Figure 134 shows the N/S cross-section 3900E (dashed red line in Figure 132).

As well as showing the fresh, weathered and very weathered granite the cross-sections also show the granites relation to the Warramunga (labelled W in brown) and the Tomkinson Creek (labelled T in brown) Formations sediments and meta-sediments to the north-west.

A detailed reappraisal of BMR ground magnetic and radiometric survey data by CEGB in April 1987[243] mentioned that in the Windgap area radioactive zones exist within a magnetic lineament cutting the granite and extending to the NNE. That could be indicative of a zone in tension and that within it faults or joints could have provided pathways for mineralised fluids. *This thesis could have positive implications for HRE's search for REE-bearing vein systems.*

Figure 132 CEGB's Windgap bedrock geology interp

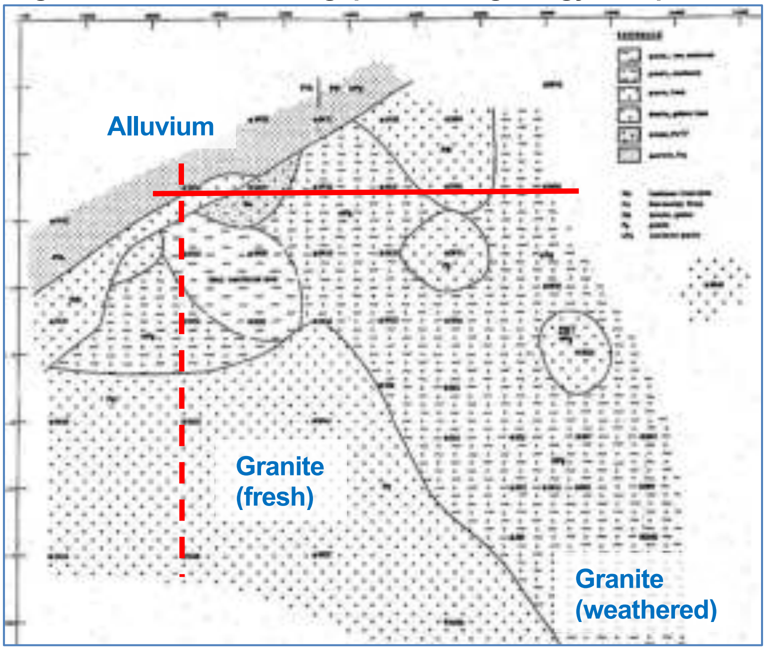


Figure 133 CEGB's Windgap E/W cross-section 5900N

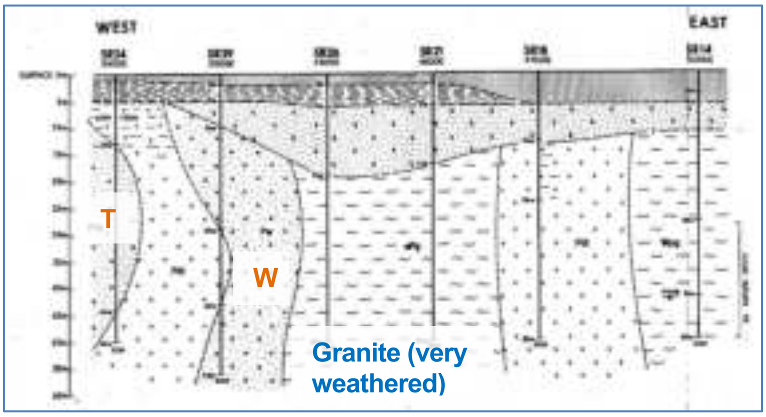
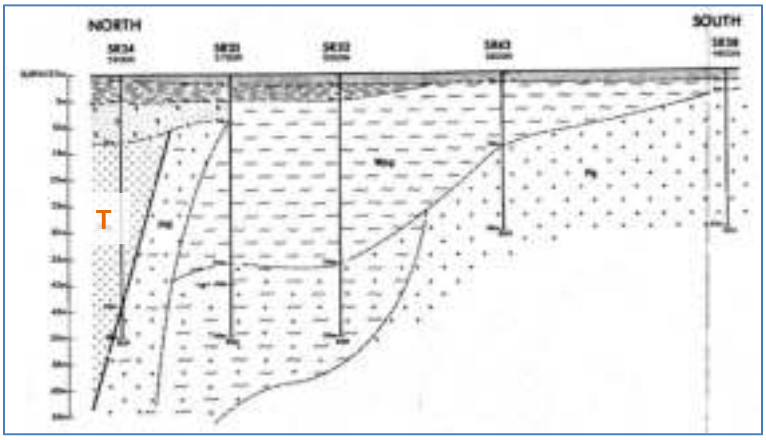


Figure 134 CEGB's Windgap N/S cross-section 3900E



Year 2 (1988)[244]: Percussion and diamond drilling (1,971 m) tested the White Ridge and Windgap radiometric anomalies further. A third anomaly, Black Rock (formerly Railway Ridge) between and slightly east of Windgap and White Ridge and near the railway, was briefly investigated with the radioactivity interpreted as emanating from a

[240] CEGBEA, July 1987. Annual report.
[241] CEGBEA, December 1986. Progress report and work proposal etc.
[242] CEGBEA, December 1986. Progress report and work proposal etc. Plate 3.
[243] CEGBEA, Starkey, L.J., April 1987. 4.1 iii), pp8. Included in CEGBEA, July 1987. Annual report.
[244] CEGBEA, June 1988. Annual report.

dolerite sill rather than a mineralised magnetite body.

13 percussion holes (for 1,138 m) were drilled on 4 lines at White Ridge (TCP1-18). A diamond hole (for 174 m) was also drilled there (TCPD6). Radioactivity results were weak to moderate. Geology was interpreted as a Warramunga sediment roof pendant above the Warrego Granite. Uranium was interpreted as mobilised by "pegmatitic" activity along a pegmatite front (Consultant – possibly the ridge itself). The conclusion was that large uranium veins would be unlikely, and that the anomaly should be dropped.

4 percussion holes with diamond tails (for 833 m) were drilled at scattered locations at Windgap (TCPD11-14) – where past exploration indicated shears and/or deep weathering. The holes highlighted pink are the 4 southern ones marked in Figure 135[245] amongst the older CRAE holes. All holes encountered granite, with shearing and fluid movement evident. Radioactivity was moderate. A uranium-enriched groundwater flow and precipitation model was developed to explain the uranium-in-water anomaly. The flow occurs north westwards along a structural corridor in the granite, ponding in the dry season and mixing with up-welling waters in the fractures which are reducing and cause precipitation of uranium salts. *This fracture-associated mineralisation model has similarities to the Browns Range REE deposition style*.

Figure 135 CEBG Windgap drill holes & bedrock geology

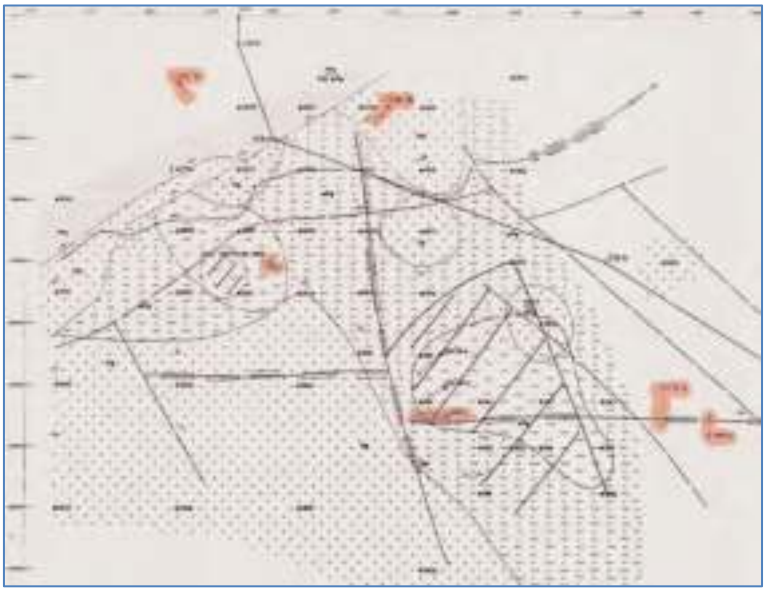
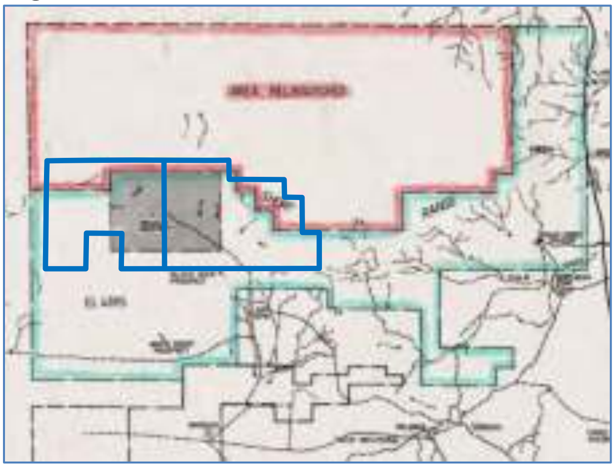


Figure 136 CEGB EL4895 reduction



CEGB invited Total Mining Australia Pty Ltd to investigate extraction of uranium from the groundwater – but the aquifer flow rate was judged insufficient.

At the end of the second year CEBG relinquished 250 blocks of tenement EL4895 in the NW, north of the Short Range ridge (red area in Figure 136[246]). HRE's tenements are approximately shown in blue. The black hatched area is the area reserved for CEGB's uranium exploration.

Year 3 (1989)[247]: A regional groundwater survey was undertaken to assess uranium levels in the area. Further detailed geochemical, biogeochemical, ROAC and ground geophysical surveys were undertaken at Windgap. Two further diamond drill holes (for 245 m) were drilled at Windgap (TCPD19-20) to test for carnotite near the northern margin of the anomaly. No carnotite was found, but anomalous radioactivity was encountered at the edge of a dolerite sill. The 2 holes are the upper ones marked in pink in Figure 135. The Figure also shows the solid geology (at ~30 m RL) updated with fault interpretations.

CSIRO conducted further test-work at Windgap, extending that done previously for CRAE. Their work included examining core in detail. Amongst other things they showed that biotite in the weathered granite was extensively replaced by chlorite; alteration appeared to be related to folding; alteration causes major loss of sodium and calcium; groundwater in the granite has ppm level uranium in uranyl phosphates; the granite itself showed nu uranium enrichment; the Short Range granite is thorium-rich, present as thorite (not sphene or xenotime); the granite is apatite-rich; the groundwater axis is SE/NW; uranium rations showed transfer of uranium from rock minerals to solution rather than dissolution of uranium minerals.

Year 4 (1990)[248]: *New background*: In 1990 Poseidon Gold Limited (PosGold) became the operator of the Project

[245] CEGBEA, June 1989. Annual report. Map 6, plan no 1320/030.
[246] CEGBEA, September 1988. Final report for relinquished blocks. Plan1320/078.
[247] CEGBEA, June 1989. Annual report.
[248] Pos Gold, 1990. Annual report.

in tenements EL4895 and EL4896.

Refocussed objectives: PosGold re-stated the possible commodities and mineralisation styles in the area as:

- Tennant Creek-style ironstone-associated gold-copper-bismuth deposits.
- Unconformity-related gold-copper-uranium mineralisation.
- Structurally emplaced mineralisation – multicommodity.
- Granite-hosted/contact mineralisation – multicommodity.
- Porphyry-related – copper-gold-base metal deposits.

Exploration: The 1990 PosGold program aimed to identify smaller areas of interest within the tenement. A 1989 aero-mag survey (commissioned by new intermediate owner Golden Plateau NL) was flown to identify magnetic expressions of "Tennant Creek-style" gold-copper deposits. Part of that aero-mag is shown in Figure 151 with Meteoric's later exploration. The final owner PosGold took over in early 1990 and interpreted the survey. It proved extremely useful in delineating magnetic stratiform/stratabound units withing the Short Range sequence. It also highlighted several N/S striking major radiating fault or shear zones extending from the Warramunga Formation to the Tomkinson Creek Formation. Strike of faults in the east was NW, those in the west NNE – interpreted as reflecting the broad area folding resulting from E/W compression.

Three circular areas west of the Warrego Granite (to the SW and S of HRE's tenement) were identified (one (Parakeet Prospect, S of HRE) having outcropping ironstones). A regional stream sediment survey was undertaken to investigate the large area of quartz outcrop in the central and northern areas. This identified 3 areas with multi-element signatures The focus of exploration in the Period was the 3 mag anomalies west of the Warrego Granite and the other 2 stream sediment anomalies. The Wren Prospect stream sed anomaly was followed up with soil sampling and then RC drilling of 7 short holes (for 470 m) to test for gold. Drilling results were disappointing, producing moderate base metal but low gold values, insufficient encouragement for further work.

A second round of blocks were relinquished in late 1990 (approximately half), leaving separate areas in the west and the east.

Year 5 (1991)[249]: During the period 2 of the western mag anomalies (Parakeet and Chook) were drilled using RC (14 holes for 2,297 m), with only Chook (SW of HRE) providing some encouragement. The 8 holes (for 1,362 m) at Parakeet (S of HRE) intersected haematitic shales and greywackes with disseminated magnetite. Assay results were very low. However 4 holes (for 566 m) at Chook intersected sub-economic copper mineralisation in chloritically altered magnetite-quartzite. The best result was 4 m @ 2.4% copper. The potential area at Chook was considered too small to encourage further work. The last hole at another anomaly was abandoned.

Year 6 (1992)[250]: In 1991 PosGold tested four air-mag anomalies areas for gold. These were names Couger, Tiger, Leopard and Cheeta. All were distantly SE or S of HRE's tenement. Two RC holes were drilled at Tiger. Drilling results were poor, and ground surveys at the other 3 areas provided no further encouragement.

In terminating their involvement in the Project PosGold summarised their 3 years as initial exploration focus on radiometric (uranium) anomalies in the Tomkinson Creek rocks and the lower unconformity with the Warramunga rocks, followed by gold and copper mineralisation in Tennant Creek-style mag anomalies.

14.13 WESTERN MINING (1990-1994) – EL7153

Background: Western Mining Corporation Limited (WMC) was granted EL7153 (20 blocks, and called Alaska) in 1990 for 4 years. STRIKE lists the tenement holder as BHP Billiton Nickel West Pty Ltd. Figure 137[251] illustrates the tenement south of HRE's. Figure 138[252] illustrates the tenement's reductions over time, it straddling the gas pipeline, and its position the north of the Warrego Mine. Exploration was grouped with 2 other ELs, 7151 (to the south of the Warrego Mine) and 7413 (over the Warrego Mine).

Objective: WMC was targeting classic Tennant Creek-style ironstone gold/copper deposits – whilst keeping in mind the possibility of oxidised non-magnetic ironstones (hence IOCGU deposits). EL7153 was a lower-order target with interest centred on areas of magnetic complexity in the south-central part. The Quartz Hill fault to the north and the Navigator Fault to the south (shown in the later Delta Gold lease Figure 144 below) added to the potential in the area of magnetic anomalism.

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[249] Pos Gold, June 1991. Annual report.
[250] Pos Gold, June 1992. Final report.
[251] Captured May 2022 online from STRIKE, NT DITT. Titles and 1:250K geology.
[252] Western Mining, February 1995. Final report on EL7153. Fig 1 (plan 7005/91).

Exploration: WMC's initial exploration comprised geological interpretation of Austirex International Limited's multi-client airborne magnetic data, ground follow-up, and ground magnetic and gravity surveys. No compelling drilling targets were defined. The mag anomalies did not have corresponding gravity anomalies and thus were interpreted as probably not ironstones but more likely stratigraphy.

Figure 137 WMC EL7153

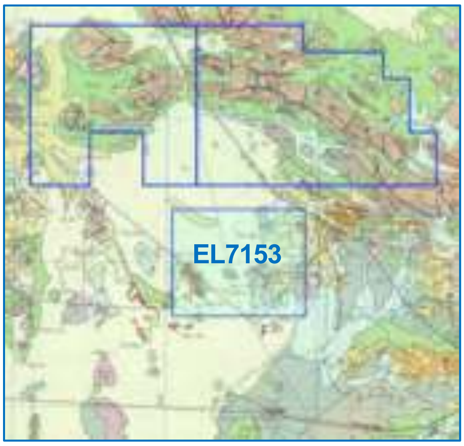
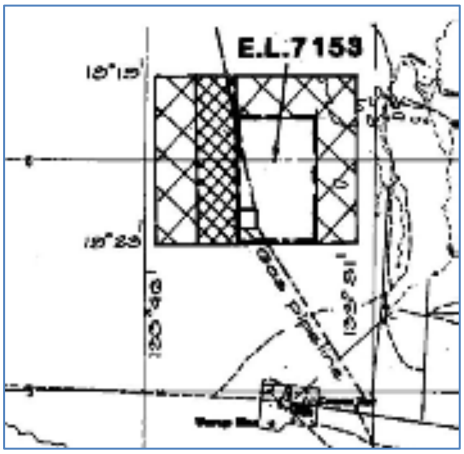


Figure 138 WMC EL7153 reductions



A series of old percussion drill holes were found in the mid-west of the tenement – apparently to test "a series of quartz blows and greisens (?) along the contact of the Warrego Granite".

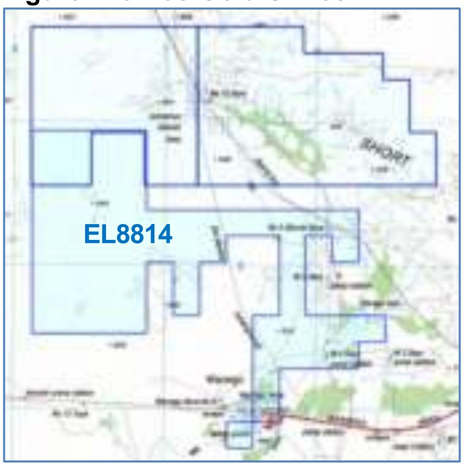
Subsequently broader more detailed regional mag and radiometric surveys were undertaken by Austirex in 1993. A gravity survey also covered the entire EL. A distinct gravity ridge was found striking across the centre of the EL, coincident with an aeromag anomaly, but was held by others under a Mineral Claim. Still no compelling drilling targets (higher ranked than those on other tenements elsewhere in the region) were defined and that, combined with WMC's decision to withdraw from the Tennant Creek Field, prompted the decision to discontinue exploration and let the EL lapse in 1994.

14.14 Poseidon / Normandy / Santexco (1992-2002) – EL7896/SEL8814

Background: EL7896 (Western Range Prospect) was granted to Poseidon Gold Limited (PosGold) in 1993 for 6 years. The 40 block EL is shown in Figure 139[253], due south of and slightly overlapping HRE's tenement EL33101. EL7896 was cancelled in April 1995 and replaced with SEL8814 (Substitute EL), also held by PosGold (which by that time had changed its name to PosGold Limited). SEL8814 is seen in Figure 140[254], extended greatly to the east and south of HRE's EL33194. The original EL7896 was combined with EL6795 (Wren Prospect), EL7896 (Western Range Prospect), EL7897 (Headframe Prospect), EL8080 (Mars Prospect), EL8535 (Cascade Prospect), EL8667 (Asteroid Prospect) and EL8668 (Meteorite Prospect). SEL8144 comprised 69 blocks for 224 km^2.

Figure 139 Pos Gold EL7896

Figure 140 Pos Gold SEL8814



PosGold operated the Project from 1992 to 1996. In 1996 PosGold changed name to Normandy Gold Pty Limited (Normandy) and Normandy operated the Project from 1996 to 2001. Then Giants Reef Mining Ltd bought Normandy, renamed Normandy to Santexco Pty Ltd, and operated the Project by Santexco until closure in 2002.

PosGold's involvement with EL7896 commenced shortly after PosGold's earlier exploration (after CEGB) of EL4895 immediately east of HRE's tenement (see 14.11 above).

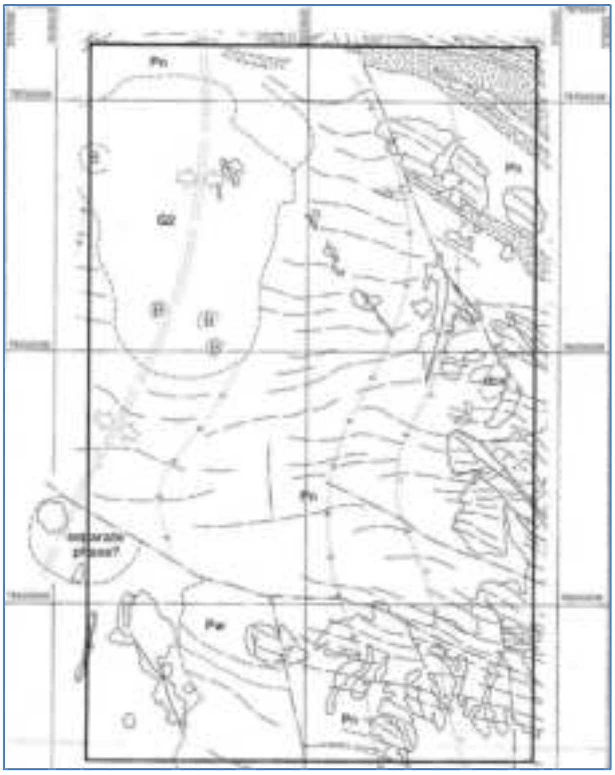
Objectives: By the time the tenement had become SEL8144 Pos Gold's target was Au/Cu/Bi ironstone type mineralisation (Tennant Creek-type) with gold and copper the principal minerals sought.

Exploration: Early work is unknown (the Consultant could not locate reports). However between the EL4895 exploration and this PosGold acquired a detailed photo-geological interpretation of the EL7896 area (Figure 141[255]).

[253] Captured May 2022 online from STRIKE, NT DITT. Titles and 1:250K topography.
[254] Captured May 2022 online from STRIKE, NT DITT. Titles and 1:250K topography.
[255] Pos Gold, March 1994. Annual report on EL7896. Figure 2.

On the map was also plotted geophysical interpretations such as a N/S gravity low axis (2 dotted lines with inward pointing arrows), inferred granite boundary (dotted line with G), and break lines.

Figure 141 EL7896 photogeological interp



From 1993 to 1995[256] a large 451 hole (for 2,164 m) programme of vacuum drilling was undertaken in the central part of EL7896. Holes were on 250 m spaced N/S lines and 100 m centres. Best assays were 0.21% copper, 0.17% zinc, 0.14% molybdenum and 143 ppm silver. In-fill vacuum holes were drilled at the Parakeet Prospect in the centre of the EL. In 1994/5 Rab drilling commenced on structural targets (12 inclined holes for 663 m) at Chook Prospect. Best results were 6 m @ 1.3% copper and 3 m @ 0.2% copper. Ground magnetic surveys were undertaken at Chook, Toucan and Parakeet Prospects. At that point Pos Gold considered the Chook Prospect (copper anomalism) a high priority target for the future.

From 1995 on the tenement was renamed SEL8814 and incorporated a number of small tenements which had been explored separately by Pos Gold. Exploration on those other tenements had included ground and airborne magnetic surveys, vacuum drilling and RAB drilling. On SEL8814 in 1995/6 a further 1,016 vacuum holes were drilled. 22 RAB holes were drilled (3 at Cascade, 13 at Parakeet, and 6 at Central and Toucan). Results were considered to have revealed significant anomalies worthy of further work.

All (or most?) of PosGold's vacuum holes are plotted in PosGold's Figure 142[257] (HRE's approximate tenements position shown in blue). Figure 143[258] from STRIKE shows all drilling (blue dots) within EL8814 above geology, all holes likely to be by PosGold.

Figure 142 PosGold vacuum drilling

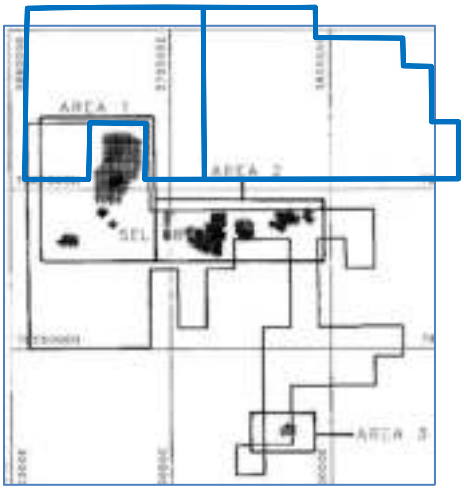
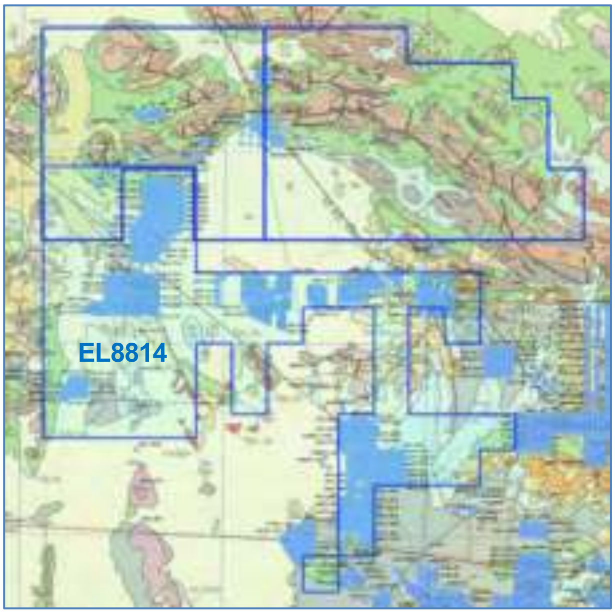


Figure 143 PosGold drilling (STRIKE)



By 1996/7 PosGold had become Normandy. 22 tenement blocks were relinquished in 1997.

In the 1996/7 year 6 RAB holes (for 316 m) were drilled into Warramunga sediments – results indicated a weakly mineralised system identified by the vacuum drilling. 2 RC holes (for 289 m, and apparently abandoned short) were also drilled into Warramunga siltstones with significant ironstone alteration and local sulphide. Assay results for SRPK001 were poor, those for SRPK002 were better but not high enough tenor to justify further drilling.

Details from 1997 to 2001 are sparse, and exploration was becoming increasingly limited. 22 more blocks were relinquished in 1997, leaving 18 remaining. RC and diamond drilling occurred on Explorer 68 and 70 (Geopeko) mag anomalies, results were poor, and the SE part of the tenement was down-graded. Another hole was drilled on Explorer 68 in 2000.

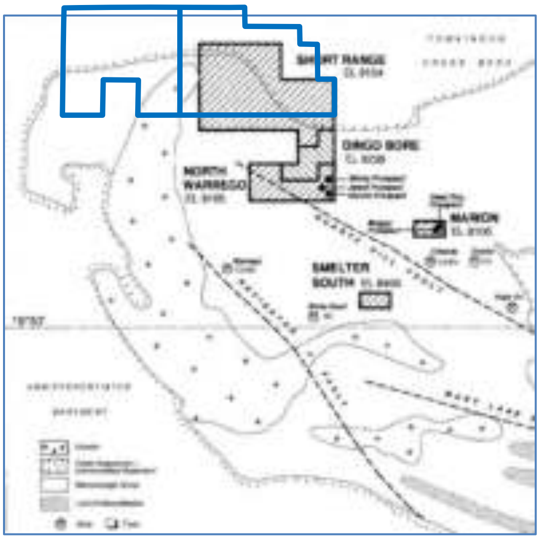
256 Pos Gold, July 1995. Final report on EL7896.
257 Pos Gold, May 1996. 1st annual report for SEL8814. Figure No. 2.
258 Captured May 2022 online from STRIKE, NT DITT. Titles, drilling and 1:250K geology.

Santexco's[259] take-over of the Project in 2001 saw them review the Project and consider that the latter Project focus – the Explorer 68 and 70 anomalies near Warrego Mine – had been identified and explained, and that the tenement be dropped.

14.15 DELTA GOLD / BHP / GIANTS REEF (1993-2001)[260] – EL8104+

Background: Delta Gold Exploration Pty Ltd (Delta Gold) was granted ELs 8104 (Short Range), 8105 (North Warrego), 8106 (Marion) and 8238 (Dingo Bore) in 1993. The ELs are shown with black oblique hatching in Figure 144[261] with HRE's blue tenements approximate position. Annual reports for the 4 leases were combined under EL8104. Originally 35 block successive relinquishments saw EL8104 reduced to 5 blocks by the 5th year.

Figure 144 Delta Gold EL8104



Delta Gold operated the exploration for 4 years. In 1997 EL8104 (now called Epsilon) was sold to Giants Reef Exploration Pty Ltd (Giants Reef) when Delta Gold withdrew from the Tennant Creek Goldfield. Giants Reef then operated the exploration for 2 years until they formed a JV with BHP Minerals Exploration Pty Ltd (BHPM) in 1999. BHPM operated the exploration for a short period until it reverted to Giants Reef in 2000. BHPM withdrew from the JV in 2001. The EL was relinquished in 2002.

Objectives: The area was considered prospective by Delta Gold for typical "Tennant Creek-style" ironstone mineralisation. It was also prospective for structurally controlled stockwork-type mineralisation (such as at Pine Creek) and shear zone hosted mineralisation (such as in the Tanami region).

Giants Reef re-worded the targets as dolerite-hosted gold, shear-related gold occurrences, and Tennant Creek-style ironstone-associated gold-copper orebodies. Under the Joint Venture with BHPM, the targets were very large gold-copper orebodies, not necessarily hosted within the Warramunga Formation.

Figure 145 Delta Gold early prospects & Geochem areas

Exploration: . Work in years 1 and 2 included auger sampling, gravity and magnetic surveys, and surface geochem sampling – at 5 prospects (Dead Roo and Muggy in EL8106; Windy, Humid and Jewel in EL8105) – areas shown in Figure 145[262]. RAB drilling followed – 12 holes (for 265 m) at Jewel, 10 holes (for 426 m) at Windy, and 7 holes at Humid. No significant results were found at Jewel or Windy. Humid was interpreted as an anomaly along an E/W fracture system, with best results of 3 m @ 1.4 g/t gold and 6 m @ 0.2 g/t gold. Gold anomalism was ascribed to dolerite intruding though mineralisation at depth.

Two new prospects were established in EL8104 – Jupiter and Shoemaker-Levy, from regional magnetics and surface geochemistry. RAB drilling followed – 19 holes (for 219 m) at Jupiter, 15 holes (for 903 m) at Shoemaker-Levy. At Jupiter the gold-in-soil anomaly with a 1 km diameter was over fresh unaltered granite and no anomalous results came from the drilling. At Shoemaker-Levy, the target was the

[259] Santexco, August 2002. Final report for SEL8814.
[260] Giants Reef, July 2002. Final report on EL8104 (Epsilon).
[261] Delta Gold, June 1994. 1st annual report on EL8104 (Short Range). Fig 1., pp2.
[262] Delta Gold, June 1995. 2nd annual report on EL8104 (Short Range). Plan 2.

intersection of two surface geochemical trends, and the RAB holes all intersected dolerite, with a horizontal layer of copper enrichment at a depth of 40 m. The highest copper result was 0.24% Cu over 15 m. No gold assays of any significance were reported, but bismuth was high in many samples, around 50 ppm Bi. The dolerite did not appear to be altered or visibly mineralised. The overall conclusion was that work had failed to define any results of significance. A few targets remained from the surface geochem.

Mercury Prospect was identified in the SW of EL8104 in the 3rd year. It was based on copper-anomalous rock chip sample results in the area of an aeromagnetic anomaly. It was interpreted as a deep-seated intrusive igneous body with "possible" economic potential. The anomalous surface Geochem could have resulted from leakage structures down into the intrusive[263] (*of note to HRE's REE model*).

Delta Gold's full exploration over 4 years did not produce any results warranting further work at Jupiter and Mercury.

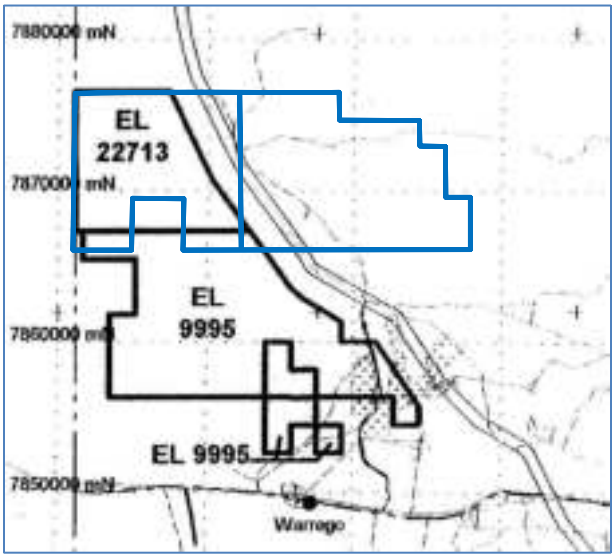
Drilling at the Shoemaker-Levy Prospect (the focus of most work) by Giants Reef in the 6th year (2 holes for 181 m) indicated that the flat-lying zone of anomalous copper values was probably caused by supergene enrichment of low-level copper in the host dolerite (within which matchhead-size gold nuggets had been metal-detected in the past), and no further work was thought justified.

With the JV with BHPM the exploration focus shifted to a large regional mag anomaly which slightly fell in EL8104, centred on the Warrego Granite intrusion. The targets were very large copper-gold orebodies. In the 7th year BHPM carried out a geological and aeromagnetic interpretation exercise over the Tennant Inlier, using the 1999 AGSO aeromagnetic coverage of the Tennant Creek 1:250,000 sheet. No magnetic targets were identified within EL8104. Final assessments of the prospectivity of EL8104 by Giants Reef did not produce any specific prospects or geophysical targets within the Licence area, and it was decided surrender the Licence soon after the end of its ninth year in 2001.

14.16 GIANTS REEF (2001-2002) – ELS 9995/22713

Background: Giants Reef Mining Limited, through Giants Reef Exploration Pty Ltd (Giants Reef) acquired EL9995 (57 blocks, 168 km^2) and EL22713 (32 blocks, 82 km^2) through Giants Reef Exploration Pty Ltd in 2001. These tenements (called Warrego Granite and Phillip Creek respectively) are shown in Figure 146 and together cover all but the NE corner of HRE's tenement EL33101 (approximately shown by the blue polygon).

Figure 146 Giants Reef ELs



Objectives: Their objective was to search for iron oxide copper gold (IOCG) mineralisation associated with broad large magnetic flare ups and alteration zones adjacent to a fundamental structural zone. Their first and final report[264] in January 2003 was a combined report for both ELs. The ELs had been applied for during Giants Reef's alliance with BHP Minerals Pty Ltd, the alliance dissolving prior to the EL's approval.

Exploration: Work done during the first and final year on both ELs consisted of literature searches, geological and geophysical assessment and various target identification. That work downgraded the prospectivity of the Licence areas.

Geophysical assessment of the magnetic flare due to the Warrego Granite concluded that potential economic mineralisation (indicated by the magnetics anomaly) was from a deep source. Their assessment was that the combination of the area's previous disappointing exploration results with the area's anomaly proximity to the traditional Tennant Creek goldfield (on its NW flank) indicated the gold exploration potential to be low.

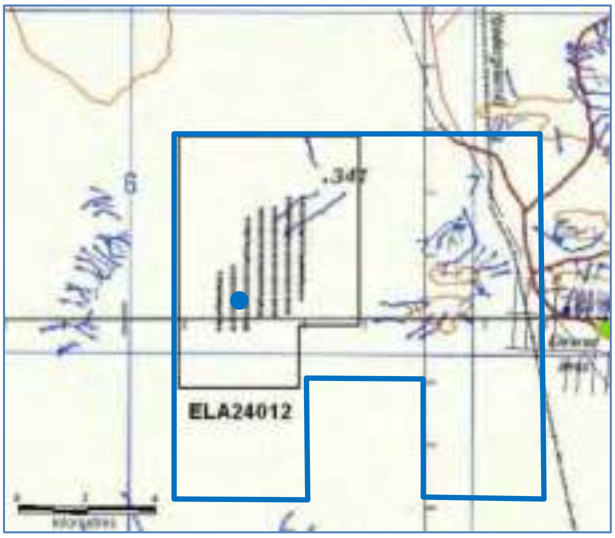
Giants Reef literature reviews of previous gold exploration following magnetic anomalies revealed that targets had all been tested and were not worth more follow-up. Furthermore no alteration mineralogy, reflecting IOCG type mineralisation, has been noted in the literature, drill logs or outcrop testing. Lack of alteration significantly downgraded potential for IOCG deposits.

[263] Delta Gold, June 1996. 3rd annual report on EL8104 (Short Range).
[264] Giants Reef, January 2003. 1st and final annual report on EL22713.

14.17 RED METAL (2004-2007) – EL24012

Background: Red Metal Limited (Red Metal) acquired EL24012 (70 km NW of Tennant Creek, 11 blocks, 355 km^2) in 2004 (and relinquished it in 2007). Figure 147[265] illustrates EL24012 (black line polygon) in the NW portion of HRE's EL33101 (blue line polygon).

Figure 147 Red Metal EL24012 & gravity survey



Objectives: Red Metal's objective was to investigate intense magnetic anomalies within the basement rocks with potential for ironstone associated gold-copper-bismuth mineralisation[266].

Exploration: Red Metal initially undertook a gravity survey. Figure 147 shows the gravity survey in the centre of the EL, with the black N/S gravity survey lines 400 m apart and survey points every 100 m on the lines.

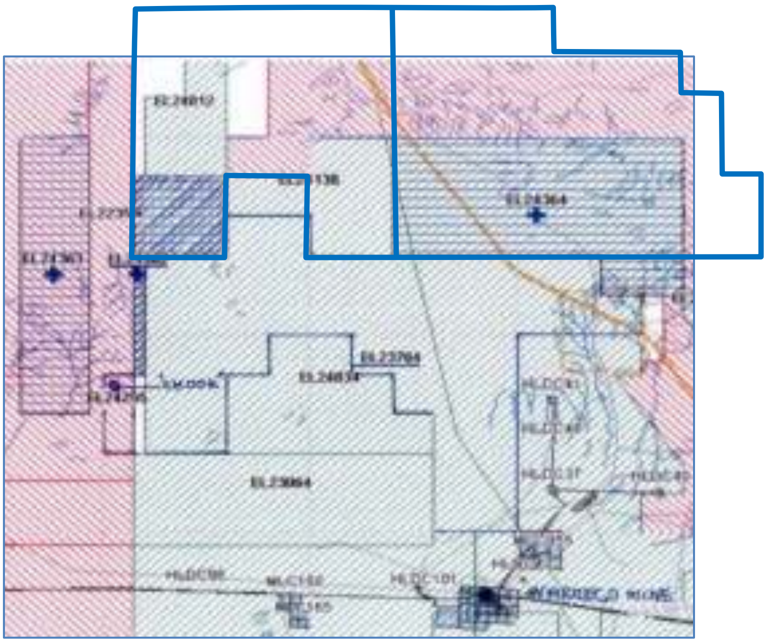
Subsequently they drilled one inclined RC hole (RMTCK06) to 50 m, oriented towards 330° and dipping 70°. The hole was towards the southern end of their gravity survey and on the mid-W side of HRE's tenement (blue oval Figure 115 and blue dot Figure 147). Composite 6 m samples were assayed for a limited number of precious (Au, Ag) and base metals (Cu, Mo, Pb, W and Zn). The hole encountered a thin sandy overburden and then a gabbroic intrusive. The intrusive contained magnetite, interpreted to cause the geophysical anomaly.

14.18 METEORIC RESOURCES / SIPA EXPLORATION (2003-2013)[267]

Background: Meteoric Resources NL (Meteoric) acquired a series of tenements for their *Warrego North* Project which kicked-off in ~2003. Those ELs were due north of the largest mine in the field, the Warrego Mine (which produced ~1.2 Moz of gold), and the Last Hope Mine near the Project. Figure 148[268] shows the Warrego North ELs in relation to HRE's tenements (thick blue line polygons). Those tenements included:

- EL24364 (65 km^2) – horizontally hatched blue in the southern half of HRE's EL33194.
- EL24138 – obliquely hatched green over the southern parts of HRE's EL33101.
- EL23764 – obliquely hatched green south of HRE's tenements.

Figure 148 Meteoric ELs in Warrego North & West Projects



Over time the Warrego North Project evolved into an east and a west side with the ground dropped in-between.

Meteoric also acquired a series of tenements for their *Warrego West* Project which began in ~2005. These *West* tenements were just west of the *North* tenements and are also shown in Figure 148. Those tenements included:

- EL24362 (14 km^2) – thickly cross-hatched blue over the SW corner of HRE's EL33101. Included in JV with Image Resources NL.
- EL24363 – horizontally hatch blue within the obliquely hatched red to the W of HRE's EL33101.
- EL24255 – obliquely hatched red well SSW of HRE's EL33101.

265 Red Metal, June 2005. 1st annual report. Fig 3, pp6.
266 Red Metal, June 2005. 1st annual report. Pp1.
267 Meteoric, December 2013. Annual and final report (2004 to 2013) for EL24138.
268 Meteoric, July 2006. Annual report on EL24362. Figure 1, pp5.

In 2010 Sipa Exploration NL (Sipa) reported[269] that EL24138 was included in a JV farm-in agreement with Messrs Hosking, Le Brun and Allender. Sipa also reported that they had also negotiated another JV farm-in in 2009 with Image Resources and Meteoric Resources that concerned EL24138 and EL23764 and ELA24363, ELA24255 and ELA24257 (local ELs mostly shown in Figure 148). From then on it became the Tennant Creek Project. The JV was withdrawn in early 2013 and the Project reverted to Meteoric. At that point Meteoric's Warrego North tenement package looked like that presented in Figure 150[270] (HRE's thick blue polygon tenements approximate position). In 2013/4 Meteoric entered a farm-in JV with Bulletin Resources Ltd (Bulletin).

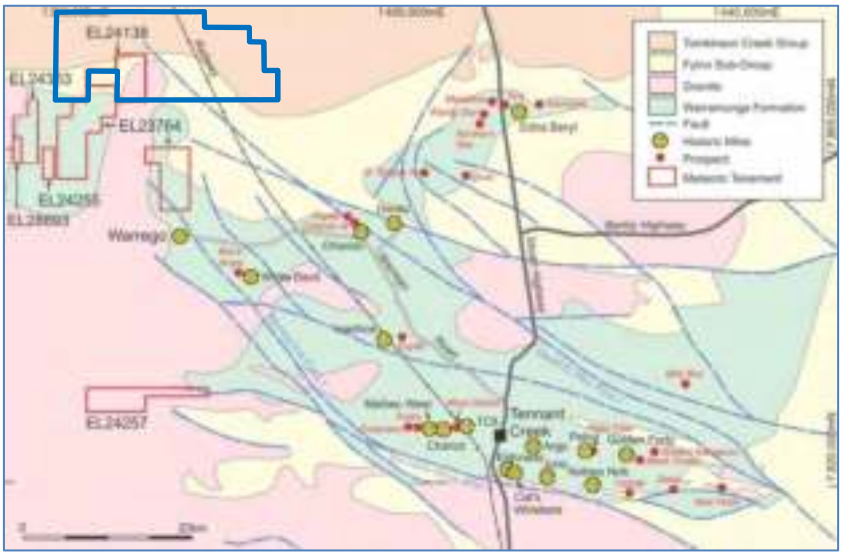
Figure 149 Sipa West Warrego ELs

Somewhat separately Sipa operated its *West Warrego* Project from 2008 until at least 2011 (termination date unclear). The project was also in JV with Messrs Hosking, Le Brun and Allender and with them concerned ELs 22359, 23063, 23065, 23992 and 26822. Sipa also incorporated its own Els 26823 and 26824 into the Project. Figure 149[271] shows Sipa's West Warrego tenement package (black polygons) in relation to and SW of HRE's EL33101 (red polygon). Sipa subsequently integrated this tenement package with the others included in the Meteoric / Image Resources JV in the single Tennant Creek Project.

Objectives: Meteoric's objective was to find gold-copper-bismuth mineralisation typical of the Tennant Creet-style ironstone mineralisation. Sipa, a JV partner, had the same objectives. The Warrego North and West Project tenements were interpreted to cover the north western extension of the favourable stratigraphy hosting the Warrego Mine (due south of HRE).

Meteoric's exploration model recognised that copper-gold ore bodies in the Tennant Creek goldfield were commonly associated with magnetite-rich ironstones within the Warramunga Formation. Figure 150 illustrates the concentration of known significant mines (yellow circles) and prospects (red dots) within the Warramunga Formation (light green area). Meteoric's Warrego North tenements are seen concentrated in one of the large remaining prospective areas of the Warramunga, the NW corner, possibly an extension of the stratigraphy hosting the Warrego Mine.

Figure 150 Meteoric's Tennant Creek Project geological setting



The mineral deposits were structurally controlled and occur within more ferruginous horizons of the Warramunga Formation.

More recent evidence indicates that copper-gold mineralisation is also associated with less magnetic, haematite rich ironstones. Meteoric recognised that while the use of magnetics has been the primary exploration tool in the past it is becoming increasingly important to use it in conjunction with gravimetric surveying.

Meteoric considered structural controls of mineralisation to be important in the Tennant Creek area and noted that in the Warrego North Project area there exist pronounced and prospective structural corridors (interpreted from aero-magnetics) trending NW through the Warrego Mine and NW/SE through the Gecko Mine to the east. Their Parakeet Prospect (seen in Figure 151 below) was interpreted as lying on the NW-trending Navigator Fault (seen in Figure 150).

2009 JV partner Sipa considered that soil sampling was not a reliable tool to detect geochemical anomalies.

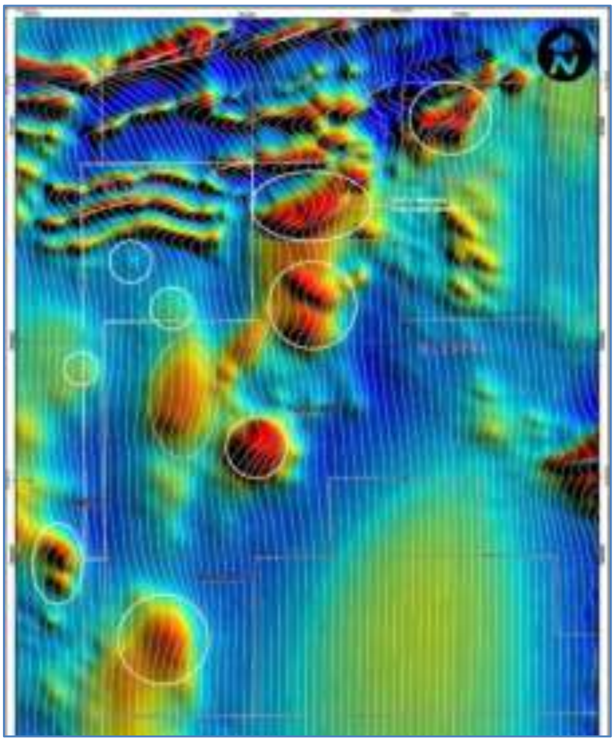
[269] Sipa, November 2010. Annual report on EL24138. Summary.
[270] Meteoric, January 2014. Annual report on EL23764. Figure 1, pp2.
[271] Sipa, January 2011. Combined annual report. Figure 1.

Isolated anomalous samples may indicate the presence of geochemically anomalous structures, but absence of anomalous soil samples does not sterilize the ground. Vacuum sampling seemed to produce better results.

In the local area Sipa considered that an anomalous copper and weaker gold anomaly was offset from a major magnetic ridge in regional data – which could be interpreted as a lateral leakage zone away from the magnetic ridge. The anomaly had not yet been drilled.

Exploration in Warrego North and West: Meteoric initially carried out extensive gravity and ground magnetic surveys over target areas identified from review and re-interpretation of data from past explorers. Meteoric compiled aero-mag survey data from previous explorers (probably Pos Gold) for the full Warrego North Project, which also covered part of the Warrego West Project. Figure 151[272] shows that aero-mag over the Warrego West tenements with targets highlighted within white circles. The Pos Gold anomalies Parakeet, Bustard and Chook are labelled. A ground-mag survey was also carried out to the west of EL24362. It is unclear if Meteoric performed physical exploration on EL24364 or on EL24362.

Figure 151 Meteoric's aero-mag & targets

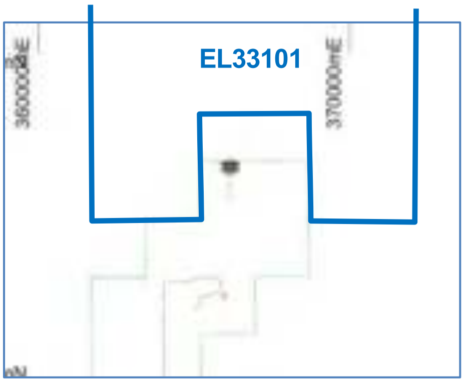


During 2004/5 Meteoric carried out an extensive programme of RC drilling (21 RC holes for 3,937 m), mapping and down hole geophysical surveys on the western parts of EL23764. Significantly, of 8 holes drilled at Parakeet–Bustard, 7 holes intersected anomalous copper values, some with anomalous gold. Drilling of several gravity and magnetic targets east of the Warrego Granite and north of the Warrego mine intersected generally weak copper mineralisation associated with minor ironstone.

Subsequently the aero-mag anomaly below Parakeet was re-assessed as the anomaly's high tenor did not match the modest drilling results. Modelling then indicated that the source of the larger Parakeet magnetic anomaly was at a depth of ~400 m and well below the drilling.

In 2007/8 geochemical soil sampling was carried out on the western leg of EL24138[273] (not recorded in the NT STRIKE service) but gold results were poor. The eastern part of EL24138 and much of the NW part of EL23764 was relinquished in 2008 (with the remaining part of EL24138 directly south and adjacent to the middle of HRE's tenement). No on-ground field work had been done on those parts. From 2008 to 2011 Sipa reported no exploration on EL24139.

Figure 152 Meteoric geochem 2009



In 2009 a program of geochemical soil and rock chip sampling was carried out on EL23674 to validate the historical geochemistry. Figure 152[274] shows the sample area (black crosses) in the southern embayment in to HRE's EL33101 (blue line). Results were disappointing with gold below detection levels. At that point Meteoric cast about for a JV partner and teamed up with Sipa.

During 2010 Sipa carried out an "extensive programme" of reverse circulation and diamond drilling in EL23764 – the details of which have not been located.

Sipa also reviewed all previous work then, deciding that soil geochemistry was of limited use in the area but vacuum drill sampling produced more consistent results. Most samples returned gold values below detection limit, but copper defined areas of interest and structural trends.

Figure 153[275] shows all vacuum drill holes over ELs 23764 and 24138, coloured on copper values. Other holes in-

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[272] Meteoric, July 2006. Annual report on EL24362. Appendix 1.
[273] Meteoric, October 2008. Annual report on EL24138.
[274] Meteoric, December 2009. Annual report on EL23764. Fig 6.
[275] Sipa, January 2011. Annual report on EL23764. Figure 1.

between those tenements were drilled by PosGold (Section 14.14).

In 2011/2 a Sipa aero-mag survey was completed over EL24138 and a number of anomalies were identified. Whilst some may hve been stratigraphically-related a number appeared structure-related with at least one classic "bulls eye" of Tennant Creek-style.

Figure 154[276] shows the aero-mag targets identified at Warrego North (HRE's tenements to the north of the red line and covering the E side of EL24138). The date of this survey is not clear as it was repeated over numerous Annual Reports ~2008 to 2014.

Figure 155[277] illustrates Sipa's aero-mag over the narrow western lobe of EL24138 (black polygon), with copper results in soil samples (circles) and vacuum drilling (diamonds). The vacuum drilling results match the mag highs well. EL24138 is immediately surrounded by HRE's tenement to the W, N and E.

Figure 153 Vacuum drilling copper results

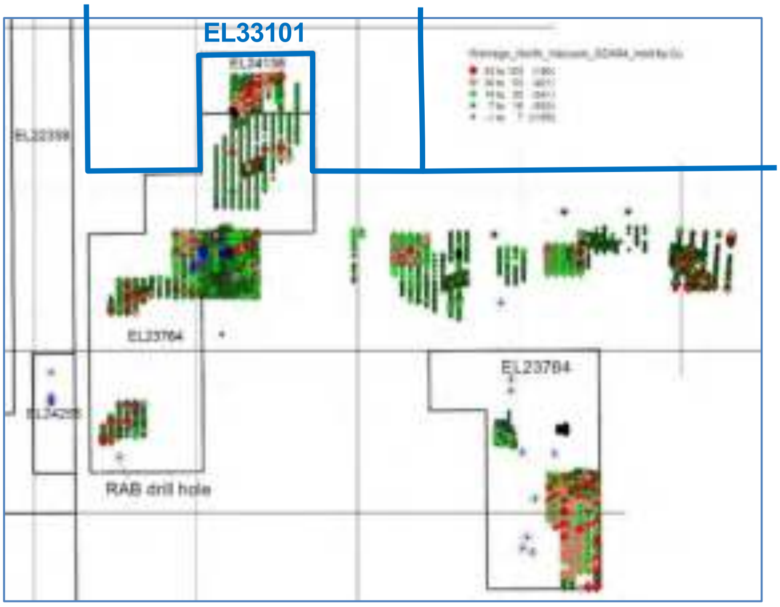
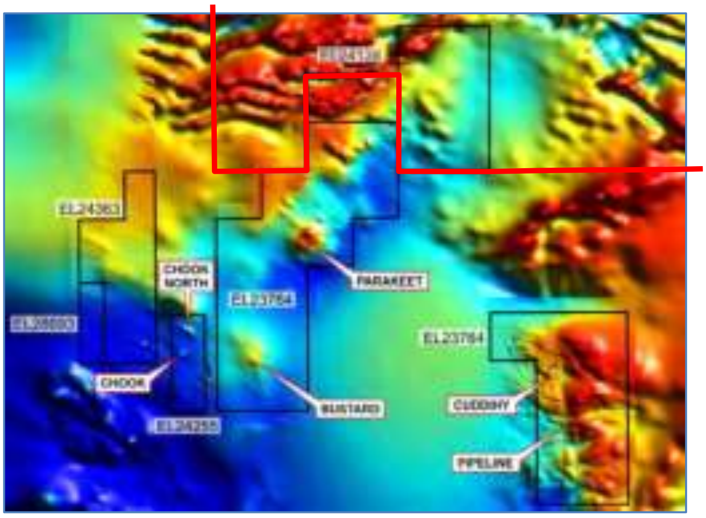


Figure 154 Warrego North aero-mag targets

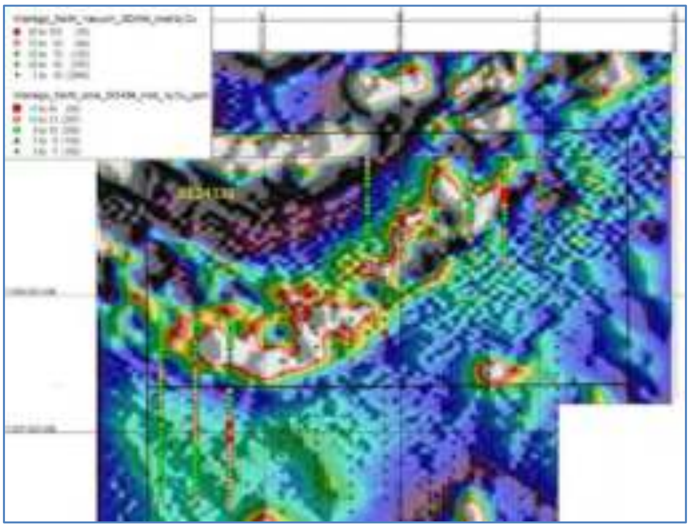


In late 2013 Meteoric concluded that results on EL24138 did not warrant further exploration and the tenement was surrendered.

Meteoric drilled holes at Parakeet, Bustard, Cuddihy and Pipeline.

On EL23764 Meteoric concluded in 2012/3 that as well as the still highly prospective Parakeet Prospect to the west of the Warrego Granite there were four probable ironstone bodies east of the Warrego Granite at depths of 300–400 m below surface which remain untested. Their overall conclusion was that the real potential of the anomalies was at depth.

Figure 155 Sipa aero-mag/soils/vacuum EL24138



In 2013/4 Meteoric re-processed their geophysics through Spinifex Geophysics to increase resolution and incorporate drilling results. That work clearly showed in sections through their mag susceptibility models that previous drilling at Parakeet had not tested the major ironstone targets (PKT1 and PKT2) and that they appeared to have intersected what could be the copper halo over a large copper–gold system at depth. Depth to the top of target PKT1 was estimated to be 170 m and depth to the top of target PKT2 was estimated to be 230 m, significantly shallower than estimated by modelling of the aero-mag data. Interpretation of aeromagnetic data suggested the presence of a strong NW-trending structure through Parakeet which could be a parallel structure to, or the extension of, the Navigator Fault (a major structure associated with the Warrego deposit), indicating a favourable structural setting for Parakeet.

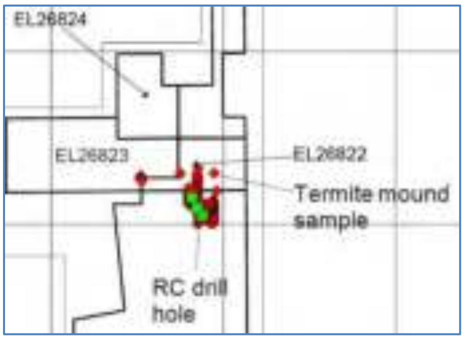
[276] Meteoric, January 2014. Annual report on EL23764. Figure 2, pp4.
[277] Sipa, October 2012. Annual report on El24138. Figure 1.

In 2013/4 Meteoric entered a farm-in JV with Bulletin. Their overall conclusion remained that potential lay at depth, below the 200 m they had already tested by drilling. The future lay with diamond drilling.

Exploration in West Warrego: Sipa explored their West Warrego Project in 2008/9 through ground-based magnetics and gravity surveys; surface geochemistry samples from old drill sumps; and diamond drilling (4 holes for 1,092 m). The ground gravity and magnetic resulted in a number of "bulls-eye" targets, three of which were tested with diamond drill holes. The drilling confirmed the geophysical approach by intersection ironstones in all holes. The ironstones were anomalous for Au and Cu especially at the edges of the ironstone body.

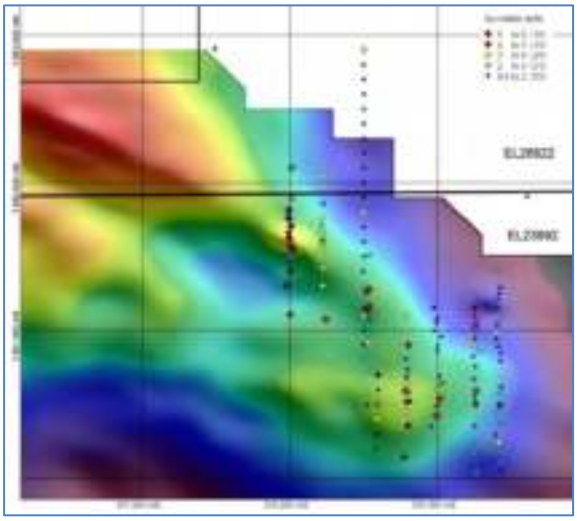
In 2009/10 Sipa's exploration included Geochem sampling and drilling. Figure 156[278] shows the sampling and drilling locations – all centred on the centre of the Project (and well to then SSW of HRE).

Figure 156 Sipa exploration 2009/10



Geochemical assays of 194 termite mound samples formed reasonably coherent anomalies for copper and gold. The theory is that termites sample bedrock clays and deposit them in mounds at surface. Figure 157[279] shows the termite mound gold samples above gravity, with the higher gold samples aligning with the gravity ridge. The anomalies were not necessarily centred on gravity anomalies, which indicated that the termite mound sampling method had the potential to add value beyond the gravity and magnetic information.

Figure 157 Termite mound gold geochem



Three more ground magnetic "bulls-eye" targets were tested with three RC drill holes (for 861 m). All RC drill holes intersected, beneath shallow sand cover, sandstones and shales of the Warramunga Formation. Two holes intersected ironstones with strong chlorite alteration and anomalous gold-bismuth. The third intersected ironstones with strong epidote alteration but no anomalous assays.

In 2010/11 Sipa's exploration was focussed on acquisition of aero-magnetic data. The survey was flown in a N/S direction over the eastern tenements (area outlined in blue in Figure 149 above). The survey was completed in 2011/2 and generated numbers of targets for testing.

It is unclear how exploration on the West Warrego Project concluded (the tenements were expiring in 2014).

14.19 URANIUM WEST / RUM JUNGLE URANIUM (2006-2012)

Project background: Uranium West Pty Ltd (Uranium West) and Rum Jungle Uranium Ltd (Rum Jungle) jointly explored for IOCGU deposits NW of Tennant Creek in the late 2000s. This initially centred on the large EL24835 (called Phillip Creek) held by Uranium West. Other tenements were added by Rum Jungle (called Short Range) and then parts of both were successively relinquished. Separate annual exploration reporting means that information presented here my be lacking for some years.

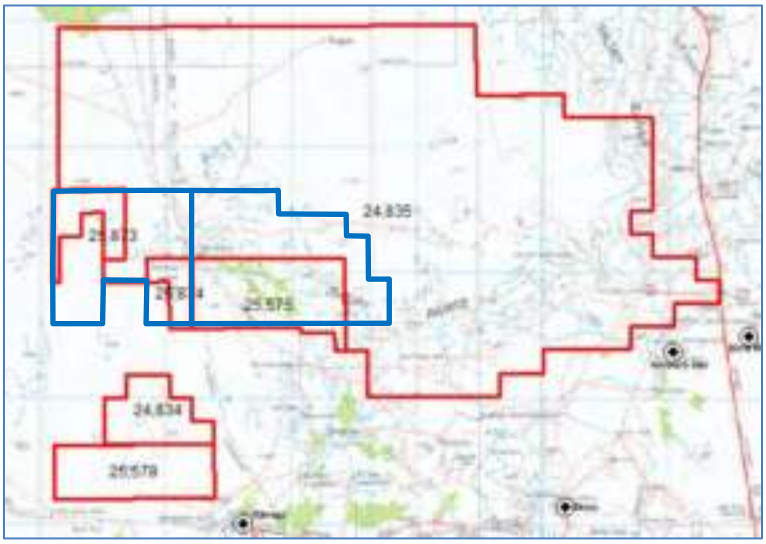
Uranium West had a 7 year exploration program for IOCGU deposits in the wider area from 2006 to 2012. The Project ended up with a variety of tenements (see Rum Jungle below) which at one time or another covered all of HRE's tenement EL33101 except for the SW corner. Project tenements at about their greatest extent are shown in red in Figure 158[280] with HRE's tenements superimposed on the mid-west side. Tenements relevant to HRE were EL24835, EL25575, EL25873, EL25874 and EL26656 (label missing from Figure, in the western embayment of EL25874). Circled black dots south of the tenements are old gold mines.

The biggest and first tenement EL 24835 (309 blocks) was granted to Uranium West in 2006. In August 2007 an Exploration Joint Venture Agreement (JVA) was signed with Rum Jungle over two EL's in Rum Jungle (EL 24866 and EL 24898) and two in Tennant Creek (EL 24835 and EL 24834). Rum Jungle was operator of the JV.

[278] Sipa, November 2010. Combined annual report. Figure 1.
[279] Sipa, November 2010. Combined annual report. Figure 4.
[280] Uranium West, 2008. 2nd annual report. Fig 1, pp4.

By 2011 only EL24835 remained in the JV. In December 2011 Rum jungle notified Uranium West that it no longer wanted involvement in the tenement and Uranium West took over the management. December 2012 saw Focus Minerals Limited (Focus) [the parent company of Focus Minerals (Laverton) Limited (formerly Crescent Gold Limited of which Uranium West was a wholly owned subsidiary] complete a share placement whereby Shandong Gold International Mining Corporation Limited become a 51% shareholder. In turn Focus decided to divest some non-gold projects, including EL 24835. At the time of surrender in 2012 EL 24835 covered 37 blocks.

Figure 158 Uranium West / Rum Jungle ELs



Project objectives & associated geology: The EL24835 tenement was pegged to explore for IOCGU mineralisation and vein and unconformity-type uranium mineralisation. EL 24835 was located immediately north of the unconformity between the Warramunga Province and the Tomkinson Creek Province around 40 km north of Tennant Creek. At the unconformity the Flynn Group overlies the older deformed Warramunga Formation which hosts the Tennant Creek goldfield. At the Northern Star mine site there are a number of haematitic ironstone knobs, which are common occurrences around Tennant Creek in the Warramunga Formation. Chloritic schists are known to host uranium mineralisation at depth below the Northern Star open cut mine but occur at such a depth they are not mapped in Warramunga Formation anywhere as outcrop. Chlorite is mapped in alteration haloes and shear zones around a number of Tennant Creek ore bodies.

The area had historically been explored for Tennant Creek style IOCG mineralisation with hundreds of shallow pattern vacuum and RAB holes drilled along the southern boundary of the tenement in the 1980's and 1990's by previous operators over small magnetic anomalies near the regional unconformity.

Exploration: Year 1 (2007):[281] Limited ground work was conducted by Uranium West during the first year of tenure. For this Uranium West engaged geological consultants Ravensgate Pty Ltd (Ravensgate) to conduct a geological assessment of the economic potential of the tenement, concentrating on uranium. Ravensgate identified potential for sandstone-hosted, unconformity-related paleochannel uranium mineralisation in Tertiary sediments that overlie or are proximal to the Warrego Granite and other source rocks within EL24835. A number of uranium-dominant radiometric anomalies were identified, the westernmost one being in the centre of HRE's tenement. Ravensgate also noted that CRAE's earlier drilling (on HRE's tenement) for uranium found in the groundwater (see Figure 128 above) did not consider sandstone-hosted unconformity-related uranium mineralisation. Ravensgate identified an area in the south of EL24835 as prospective for IOCG mineralisation.

Later in the year Southern Geoscience Pty. Ltd. (Southern Geoscience) were engaged to study the area's geophysical data. Southern Geoscience considered the tenement area moderately prospective for epigenetic (intrusion-related) and re-mobilised, sandstone-hosted (roll-front) type uranium mineralization. However they went on to note that the deformational history in the region was considered to have eliminated the potential for direct analogues to the Arnhem Land unconformity-related mineralization. They also noted that the geological setting for characteristic Tennant Creek Au ± Cu (IOCG) mineralization did not occur within the tenement areas. Recommendations from this study were that the tenement should be flown with high-resolution airborne magnetics and radiometrics. A small portion of EL24835 was included as part of a fixed wing detailed aeromagnetic/ radiomagnetic survey conducted by UTS during February-March 2007.

Year 2 (2008):[282] During the second year of tenure, eight RC drill holes were drilled for 1,392m. Holes PCRC001 to 5 targeted a gravity high feature in the eastern part of the tenement. Drill holes intersected Warramunga Group siltstone and mafic magnetic dykes but no mineralisation. The gravity high was ascribed to the mafic intrusions.

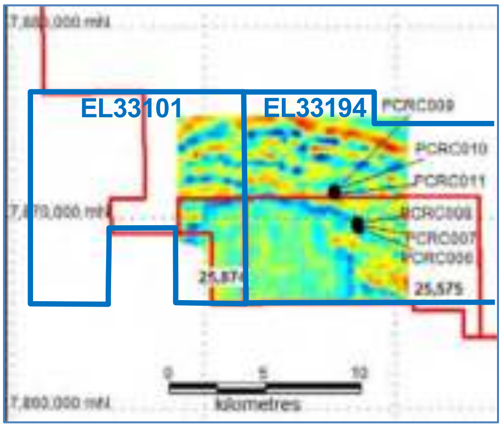
Holes PCRC006 to 11 were drilled into another gravity high in the western part of the tenement on the southern fringe of the Short Range. These holes, shown in Figure 159[283], were towards the western side of HRE's EL33194

[281] Crescent Gold, August 2007. 1st annual report. 5.0, pp7+.
[282] Rum Jungle, August 2008. 2nd annual report.
[283] Rum Jungle, August 2008. 2nd annual report. Fig 3, pp7.

(blue polygon). They intersected sediments of the Flynn Sub Group, possibly in the hornfels zone on the northern tip of the Warrego Granite. No mineralisation was intersected.

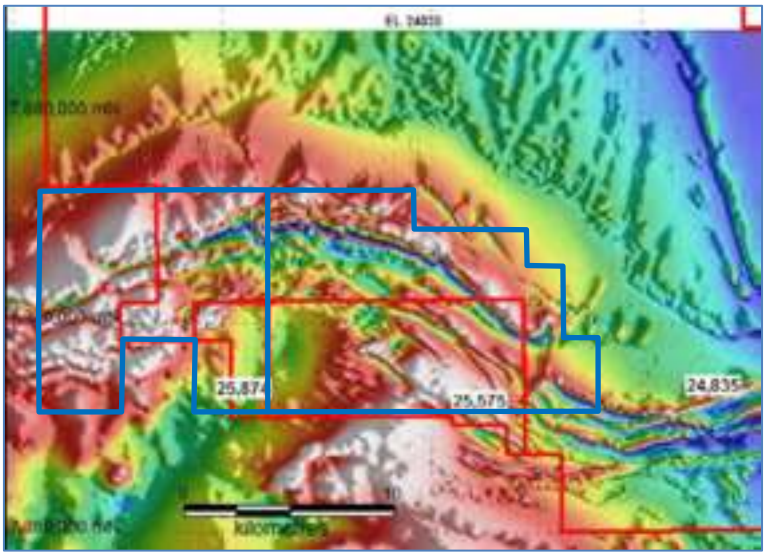
A ground gravity survey was conducted by Fugro over two areas of the tenement which consisted of gravity station spacing at 200 m. The western ground gravity survey is shown in Figure 159 under the drill holes. A number of gravity high features were evident in the data with initial drilling results indicating the highs may be due to mafic intrusives at depth.

Figure 159 UW/RJ Year 2 RC drill-holes & ground gravity survey



4,348 line km of high-resolution airborne geophysics (magnetic and radiometrics) were flown by UTS Geophysics at 100 m line spacing in a north south orientation at 40 m flying height. This was carried out over EL24835, EL25575 and EL25874. Figure 160[284] shows the magnetics under the red Uranium West tenements, Figure 161[285] the radiometrics. HRE's tenement boundaries are blue in Figure 160 and yellow in Figure 161.

Figure 160 Uranium West magnetics

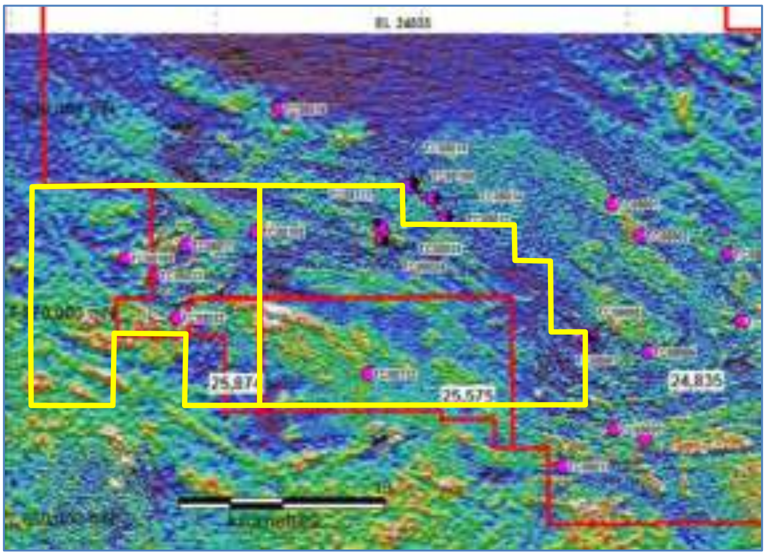


Rock chip samples were collected in a helicopter supported sampling program targeted on radiometric anomalies. No outstanding results were achieved.

Year 3 (2009):[286] During the third year of tenure, five RC drill holes were drilled for 679 m in the SE part of the EL (~30 km east of HRE's tenement). The best result was 26 m at 512 ppm Cu in a hematite quartz breccia unit from 71-96 m in hole PCRC019. No uranium or gold mineralisation was encountered.

1,330 line km of airborne geophysics (magnetics and radiometrics) were flown by UTS Geophysics at 100 m line spacing in a north south orientation at 30 m flying height over the south east corner of the tenement. A ground gravity survey was conducted over the south eastern part of the tenement by Fugro Ground Surveys with station spacings at 200 m and 100 m infill. Data was collected from a total of 1,207 gravity stations. Both gravity and magnetic surveys in the south east corner of the tenement were conducted to try and identify structures hosting known uranium mineralisation in the nearby Northern Star open cut mine and to try and locate mineralisation extending west into EL 24835.

Figure 161 Uranium West radiometrics



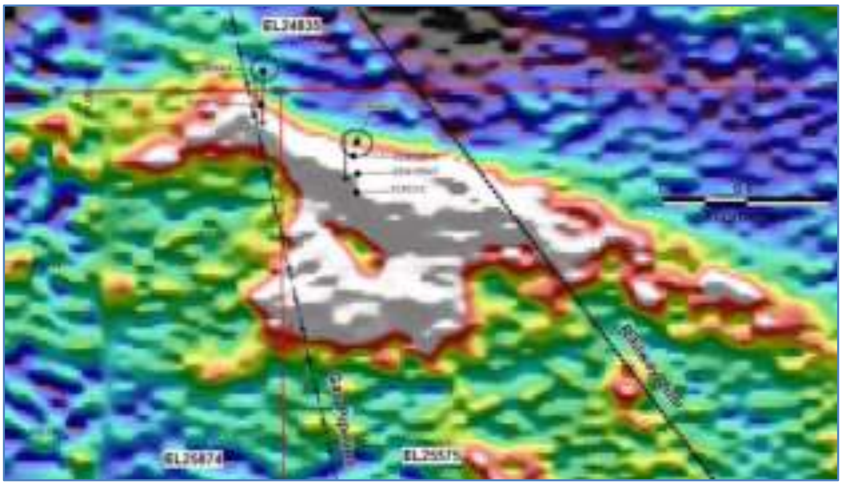
In year 3 (2009) the northern part of EL24835 (well north of HRE's tenement) was relinquished.

Year 4 (2010)[287]: Diamond drill hole PCRD001 (also referred to as PCRDDH1) was drilled (dipping ~60° southwards) to 475.5 m in 2009 on the southern border of EL 24835 into a radiometric anomaly called the Windgap

[284] Rum Jungle, August 2008. 2nd annual report. Fig 4, pp8.
[285] Rum Jungle, August 2008. 2nd annual report. Fig 5, pp8.
[286] Rum Jungle, September 2009. 3rd annual report.
[287] Rum Jungle, September 2010. 4th annual report EL24835.

Uranium Prospect. This hole was mid-way down HRE's tenement eastern boundary and in the middle of CRAE's magnetic Anomaly 12A and percussion drilling (Figure 126). It was drilled to be underneath historic hole TCPD11 (CEGBEA drilling ~1988, see Section 14.11) which went to 201 m deep. Both holes are plotted (with radiometrics) at the top left in Figure 162[288] (in which the boundary between HRE's tenements runs down the divide between EL2584 and EL25575). TCPD11's position was subsequently found to be further west than shown. The white radiometric area marks the Windgap anomaly. Hole PCRD001 stayed entirely in granite. No mineralisation was encountered. The hole was drilled to test E/W faulting and shearing (between the Warrego Granite and the meta-sediments to the north) – but may not have reached it. Two small ground gravity surveys were completed on the mid-east side of the tenement by Atlas Geophysics during May 2010.

Figure 162 Uranium West Year 4 diamond drill holes



In year 4 (2010) 77 blocks of the north and north-western parts of EL24835 (parts adjacent to HRE's tenements) were relinquished (leaving 78 blocks). The hardly explored ELs 25873 and EL25874 were also relinquished.

Year 5 (2011)[289]: Eleven RC holes (PCRC) were drilled for a total of 1,266m. The Consultant is not clear where the holes were drilled, but they would have been distant to HRE's tenements because of the relinquishments. The holes targeted various gravity, magnetic and geochemical anomalies as well as haematitic and volcanic outcrops. These targets were generated through regional gravity and magnetic surveys, ground gravity surveys and soil/lag geochemical sampling completed in the previous years.

In year 5 (2011) 41 blocks of the northern part of EL24835 were relinquished (leaving 37 blocks).

Rum Jungle's EL25575 (in the southern part of HRE's EL33194 was relinquished in 2011. They put their original interest in the area in context by commenting[290] "*After two large exploration programs by CRAE and CEGBEA in the 1980's, the uranium groundwater anomaly was still not fully explained. It was believed that the uranium is not coming from the host Warrrego Granite which contains low level uranium and higher thorium counts, but is believed to be transported in spring water which surfaces in the area of the anomaly*"

Year 6 (2012)[291]: Three more RC holes were drilled for 204 m, close to those from year 5. At this point Rum Jungle withdrew from the JV to focus on other tenements and Uranium West relinquished the tenement shortly afterwards to focus on gold assets elsewhere.

14.20 CASTILE RESOURCES (2008-2013) – EL26034

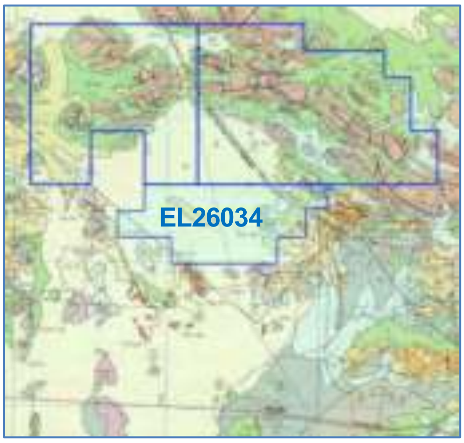
Background: Westgold Resources Limited (Westgold), through its wholly-owned subsidiary Castile Resources Pty Ltd (Castile), had a large tenement holding in the Tennant Creek region, mostly over the Rover field lying to the west and southwest of Tennant Creek. Castile was granted EL26034 (19 blocks for ~58 km^2) in 2008 and it formed part of its Tennant Creek Project. Figure 163[292] illustrates EL26034 above 1:250K geology and immediately south of HRE's tenements.

Objectives: Castile's targets were Tennant Creek-style copper-gold deposits. From consideration of past exploration of the tenement Castile determined that the potential for deeper targets had not been tested.

Exploration: Exploration for the period 2008 to 2013 included high resolution air borne (helicopter) magnetics, locating, analysing and assaying historic drill core, continuous review of historic data and negotiations for a heritage agreement over the tenement.

[288] Rum Jungle, September 2010. 4th annual report EL24835. Fig 4, pp8.
[289] Uranium West, January 2013. 7th and final annual report for EL24835. Pp7-8.
[290] Rum Jungle, September 2011. 4th annual and final report for EL25575. Pp 8, 2nd para.
[291] Uranium West, January 2013. 7th and final annual report for EL24835. Pp8-11.
[292] Captured May 2022 online from STRIKE, NT DITT. Titles, Geology 250K.

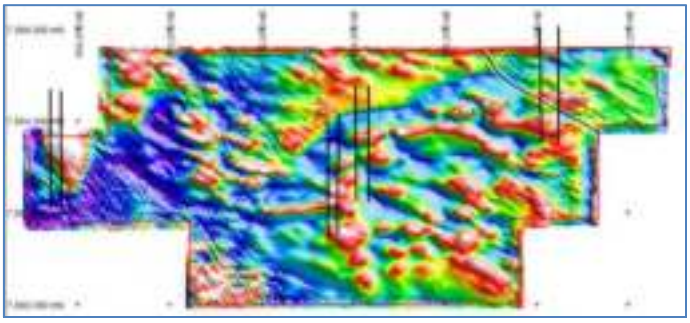
Figure 163 Castile EL26034



Processing of the 2010 high-resolution heli-mag survey identified several ENE-trending anomalies, including the historic Explorer 27, 35, 36, and 60 anomalies. Figure 164[293] displays the heli-mag survey results. Modelling of these anomalies in conjunction with regional structural interpretation and correlation against historic on-ground exploration programs indicated the need to apply additional geophysical techniques to better rank and define confidence in potential targets.

Fugro Airborne Surveys where contracted (as part of Castile Resources regional Rover and Tennant Creek Field exploration program) to trial the deep penetrating, 3-component directional time domain Helicopter-borne EM (HeliTEM) system. The four targets identified by the 2010 heli-mag survey each had two 2.5 km HeliTEM lines flown over them (vertical black lines in Figure 164). Results indicated several potential conductive anomalies.

Figure 164 Castile heli-magnetics



Castile concluded that one mid-order magnetic anomaly occurred within the tenement, with modelling indicating the magnetic target at depths >500 m. Potential for new styles of mineralisation away from the more classic magnetite rich ironstone host remained promising.

No on-ground field work was completed on the tenement as the company has agreed with the Central Land Council not to undertake ground disturbing activities until a heritage agreement was finalised. Castile remained focussed on their Rover 1 deposit and decided to surrender EL26034.

14.21 UNIVERSAL SPLENDOUR / BLIGH RESOURCES (2010-2015) – ELS 27651/27654

Background: Universal Splendour Investments (USI) is a private investment company with a portfolio of exploration licenses throughout Australia. EL27651 (51 blocks for 165 km^2) was granted to USI in 2010. Bligh Resources Ltd (Bligh) subsequently acquired an 80% interest in the tenement and held the neighbouring tenement EL27654 to the NE of EL27651. The tenement formed their Tennant Creek Project, later renamed to Bootu Creek Two project.

Figure 165 USI/Bligh EL27651

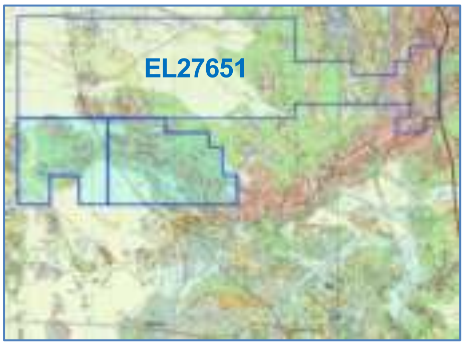


Figure 165[294] illustrates USI's EL27651, above 1:250K geology, immediately north and NE of HRE's tenements and extending well to the east up to the Stuart Highway.

Figure 166[295] shows Bootu Creek Mine (red oval) ~60 km to the NNE of HRE's tenements. It exists withing the Tomkinson Province sediments (light brown area)

Objectives: USI's exploration target was strata-bound manganese, as in the local Bootu Creek and Mucketty deposits slightly (~35 km) to the NE of their EL.

At the Bootu Creek Mine [296] the manganese is located at the contact between underlying dolomite-siltstone and overlying ridge forming sandstone of the Bootu Formations in the Tomkinson Formation. Manganese mineralisation is located in supergene enriched marine sediments within a deeply weathered profile. In these deposits[297] manganese is deposited in shallow marine sediments; has subsequently been remobilised by low-temperature hydrothermal solutions; and (at the Bootu Creek and Mucketty (to the west) deposits) has also undergone a process

[293] Metals X for Castile Resources, June 2013. Final surrender report on EL26034. Figure 4, pp9.
[294] Captured May 2022 online from STRIKE, NT DITT. Titles, Geology 250K.
[295] Captured May 2022 online from STRIKE, NT DITT. Mineral titles; mines & minerals; 1:2.5M geological regions.
[296] OM Holdings Limited, March 2019. Bootu Creek Mineral Resource, Ore Reserve and Exploration Update. ASX Market Announcement. Geology summarised in JORC Table 1.
[297] Ahmad, M. and Khan, M., November 2012. In Geology and mineral resources of the Northern Territory. NTGS. Chapter 3: Commodity Reviews. Manganese – Deposit types - Hydrothermal deposits, 3:27.

of supergene enrichment.

At Bootu (Scriven & Munson[298]) ore-grade manganese mineralisation occurs as shallowly dipping seams around the edges (both sides) of the NNW-trending Bootu Syncline. The seams typically consist of a basal 2–6 m thick, higher-grade, manganiferous shale overlain by a similar width of lower-grade, medium-grained manganiferous sandstone.

Figure 166 Bootu Creek Mine

Figure 167[299] illustrates a manganiferous outcrop before mining at Bootu. The manganese occurs as epigenetic lens and vein replacements of interbedded quartz arenite, dololutite and dolomitic siltstone. Manganese oxides predominantly consist of amorphous and massive cryptomelane, with minor psilomelane, pyrolusite and hollandite. The mineralisation is stratiform, regionally widespread and occurs near the base of the Bootu Formation. The orebodies formed by the cumulative influence of a combination of processes, including low-temperature hydrothermal replacement and supergene enrichment. A primary sedimentological origin for at least some of the manganese is also possible. Abetting HRE's REE models the "bleached sediments above the manganese mineralisation are probably the result of supergene processes occurring in warm, relatively wet, acidic weathering conditions under alluvial or laterite cover of moderate relief".

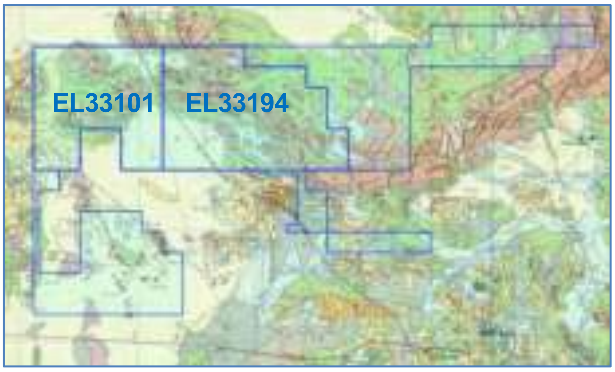
Figure 167 Manganese outcrop at Bootu

Exploration: USI's exploration commenced with an "Assessment of Mineral Potential" by International Geoscience[300] in 2011. The assessment found that a study of the local geology indicated suitable conditions for the deposition of manganese. They commented that very little exploration had previously been done within the EL, only Carpentaria Exploration had rock-chipped the eastern side for base metals. A regional VTEM™ survey was carried out over the eastern part of the EL in 2012, with anomalies identified in both ELs. In 2013 the western half of the tenement was relinquished and in 2014 a number of blocks along the SE edge were relinquished. In 2015 commodity prices and Bligh's exploration focus shift to gold caused the surrender of the tenements.

14.22 MANTO MINING (2012-2022) – EL28904

Background: Manto Mining Pty Ltd (Manto) operated their Pine Creek Project on EL28904 from 2012 until 2022[301]. This Project was the immediate antecedent on the ground HRE acquired in late-2021 and early-2022. Manto's Project operator was Australia China Corporation of Coal Geology Engineering Pty Ltd (ACCCGE) and then Manto. In ~2013 Manto was purchased by ACCCGE (60%) and Anhui Honren Co (Group) Ltd (40%).

Figure 168 Manto EL28904



EL28904 was granted for six years to on 27 March 2012 and originally comprised 170 blocks (513.14 km^2). Figure 168[302] shows (probably the original extents) of EL28904 (within the blue boundaries) above geology. HRE's tenements are both fully contained within the original north-western part of EL28904. The EL28904 title was reduced to 139 blocks (429.47 km^2) on 26 July 2016 and to 69 blocks on 29 March 2021. HRE subsequently

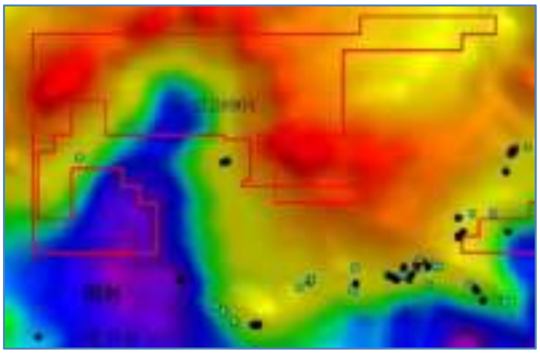
[298] Scriven & Munson, May 2007. Pp60.
[299] Scriven & Munson, May 2007. Figure 7, pp65.
B[300] Street & Finn, August 2011.
[301] Manto, June 2021. Partial relinquishment report.
[302] Captured May 2022 online from STRIKE, NT DITT. Titles, Geology 250K.

acquired EL33101 over the western portion of the last 70 blocks dropped. All remaining 69 blocks in EL28904 were dropped by 26 March 2022 with HRE subsequently acquired EL33194 over the western parts of those blocks.

Objectives: Manto believed the area to have long been a target for exploration and highly prospective for an economic IOCG deposit. Initial reporting referred to mineralisation as "vein type". Reporting listed Fe, Cu and Au as the commodities sought. It would appear that they aimed to follow Meteoric's exploration method of aero-mag surveying and target definition followed by drilling.

Exploration: Exploration activity across EL28904 between March 2012 and March 2021 included multiple short episodes of field reconnaissance, with geophysical surveys (aero-mag and radiometric) being conducted in 2014/15 and 2016/17. The last several years of exploration seem to have been confined to reviews of historic data, partly Covid 19 related. Results of the geophysics surveys, and a site visit to check them (during which they found no mineralisation), allowed Manto to drop blocks to the NE and SW (outside Figure) which they did not consider had any further exploration potential. No details are available of the geophysics conducted in 2016/7.

Figure 169 Manto Bouguer gravity



Geophysics: The 2015/6 geophysics was described in a stand-alone report[303]. Regionally the EL area was interpreted as having a high magnetic field intensity, indicating the presence of magnetite. The sinuous high magnetic anomaly area crossing the tenements E/W (Figure 170) was coincident with a gravity anomaly high (red areas in Figure 169[304]) and north of a distinct gravity low (blue areas in Figure 169, coincident with granites).

Manto noted that existing gold mines and occurences to the south (dots in Figure 169) occurred in an edge band between gravity lows and highs. A similar edge existed across the centre of the tenement.

Figure 170 Manto aero-mag 2016

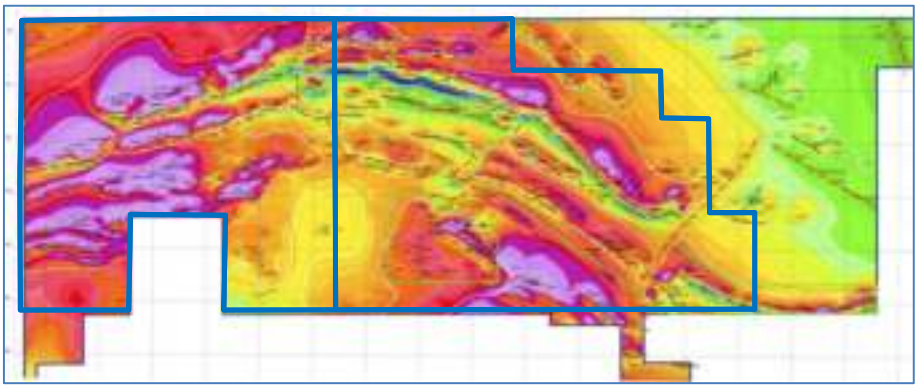
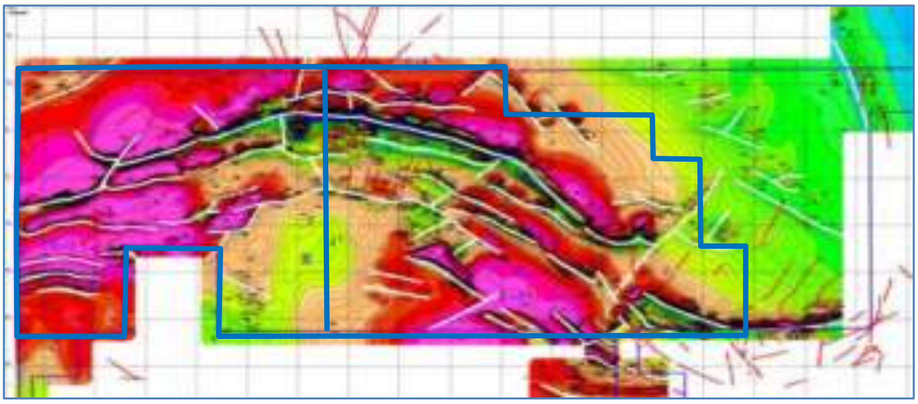


Figure 170[305] shows part (coincident with HRE's blue polygon tenements) of the aero-mag survey data processed in 2016. This data looks high-resolution and completely covers HRE's tenements. Manto identified four anomalous areas (green polygons) with numerous drilling targets.

The sinuous high gravity and magnetic anomaly areas were particulaly coincident with the Short Range geology (Figure 168).

Figure 171 Manto fault interpretation from aero-mag



Manto also used the aero-mag data to interpret fracturing and/or faulting across the area. Figure 171[306] shows the intderpreted faults in red above the aero-mag data.

Conclusions: The penultimate 70 tenement blocks dropped in March 2021 (covering HRE's EL33101) were eventually considered by Manto to be "non-prospective". No reporting is available on why they dropped the final 69 blocks (covering HRE's EL33194) in March 2022.

[303] Manto, August 2016. Airborne geophysics survey results report.
[304] Manto, August 2016. Airborne geophysics survey results report. Fig 1, pp1.
[305] Manto, May 2016. Fourth annual report. Fig 4, pp8.
[306] Manto, August 2016. Airborne geophysics survey results report. Fig 4, pp9.

15 DUKE PROJECT – GEOLOGICAL POTENTIAL FOR A HREE DEPOSIT

15.1 BROWNS RANGE HREE STYLE POTENTIAL

A strong case may be made that HRE's tenement has many geological similarities with the significant **Browns Range** HREE deposits in WA and thus has similar potential for an HREE deposit. The HREE Browns Range deposits are of the "Vein REE Deposit" type (see Section 5.9). Prerequisite settings for the formation of that style of REE deposit are discussed, followed by the overall potential.

Geological rock type setting: An important basis for the NT REE Project geological location is its position in Tennant Region sedimentary and meta-sedimentary rocks (light brown and brown in Figure 107 and Figure 108) which are analogous to similar age and type rocks in the Tanami Region to the west (red oval in Figure 107) which hosts Browns Range.

Structural setting: It is argued that the Browns Range "Vein REE Deposit" type is actually a new "Unconformity-related REE Deposit" type (see Section 5.9) where the REE-bearing vein setting is in meta-sediments containing unconformities. HRE's NT tenement too has sedimentary sequences separated by regional unconformities – and the target would be the unconformity between the Tomkinson and Warramunga Province rocks.

Mineralogical setting: The Browns Range REE deposits are dominated by xenotime (an REE phosphate dominated by the HREE yttrium). It is therefore argued that, for the formation of the Browns Range REE deposits in the "Unconformity-related REE Deposit" style (see Section 5.9), the host sediments should be rich in phosphorus (such as apatite). The style does not require an igneous source in itself (although a granite exists near the tenement. It is not yet known if sediments within HRE's NT tenement are P-rich.

Vein setting: The Browns Range deposits contain xenotime found in narrow steeply dipping intrusive breccia-hosted hydrothermal systems, or "veins". These systems are controlled by faults, often conjugate sets, with deposits often found at intersections. The Geological Survey geological interpretation map (Figure 112) shows multiple faults (black lines) in and around the Project area – which appear well supported by Manto's recent 2015/6 aero-mag interpretations (Figure 171). CRAE also mentions the presence of dolerite sills and dykes as well as lamprophyre sills and dykes – their intrusion controlled by local faults and shears. The area therefore has the structural potential for the formation of veins and pegmatites, and thus potentially for REE deposits.

Potential to host a HREE deposit: Geologically the Duke Project tenement would appear to have most of the requirements to form HREE deposits similar to xenotime-rich Browns Range in WA – namely similar meta-sedimentary host rocks, presence of unconformities, and presence of conjugate fault systems. It is yet to be determined if the host sediments are phosphorus rich (to cater for xenotime formation) although the nearby granite could provide an alternative mineral source. Similarly it is yet to be determined if the area contains any fault-controlled pegmatites, but the indication of numerous faults, dykes and sills is encouraging.

15.2 OTHER REE STYLE POTENTIAL

Several other potential styles of REE mineralisation exist within the Duke Project region. These are hinted at, and possibly implicit in, the existing gold and particularly uranium mineralisation deposit styles known in the area. Any structurally emplaced mineralisation style, particularly vein-type, associated with nearby granites, with deposition controlled in some way by unconformities, could host REEs. And IOCGU deposits certainly contain REEs in places (such as Olympic Dam).

The Consultant also considers that the Bootu Creek manganese deposit is interesting in HRE's context as mineralisation starts with hydrothermal mineralisation processes (akin to the vein REE deposit-style at Browns Range) followed by surface supergene enrichment processes (akin to those operating in IAC REE deposits).

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APPENDIX 1 – CONSULTANT STATEMENTS

Consultant Statements are made to provide context to this Document and to detail declarations, conditions and qualifications governing the Document. They also address requirements of reporting according to the JORC Code[307] (JORC) or in the context of Canada's National Instrument 43-101 (NI 43-101).

- Consultant, Client and Project definitions
- Key dates
- Confidentiality
- Qualifications & experience
- Professional accreditation
- Competent/Qualified Person (CP/QP)
- Competent Person Statement
- Independence
- Consulting fee basis
- Validity
- Issuer, public issue & consent
- Prior knowledge
- Site inspections
- Full data supply assumption
- Legal access assumptions
- Reliance on other experts
- Limitations
- Disclaimer

CONSULTANT, CLIENT & PROJECT DEFINITIONS

Consultant & Author: **Robin Rankin** (the Consultant) is the Author of this Document and performed the consulting work behind it (the Consulting). He is Principal Consulting Geologist and operator (since 2006) of independent geological consultancy **GeoRes** and issues the Document through GeoRes.

GeoRes's Client: GeoRes's Client here was Heavy Rare Earths Limited (HRE, the Client). HRE is registered in Melbourne, Victoria, and its ABN is 35 648 991 039. HRE's Projects are i) exploration and development of the Cowalinya REE Project in WA and ii) exploration of the Duke HREE Project in the NT. HRE holds a three year option to purchase 100% of the Cowalinya Project's WA tenement E63/1972. HRE has applied for NT tenements EL33101 and EL33194. HRE intends an IPO through the ASX, managed by Taylor Collison Limited (ABN 53 008 172 450, registered in Adelaide, South Australia). Details of GeoRes's engagement appear in the Engagement Section.

Consulting Project: GeoRes's consulting Project here (the Consulting Project) was research into the Client's two REE Projects (Cowalinya REE Project in WA and Duke HREE Project in the NT) and the authoring of an Independent Geologist's Report (IGR, the Report) on them.

KEY DATES

Dates covering this Consulting Project and Document are given in the Background Section. They define the Consulting work period, the Effective Date of the input Information behind the Document (listed in the Sources and details of Information Section), and the Publication Date of the Document. The Consultant is not aware of any material information change (except as qualified in the Background Section) since the Effective Date although he is aware that the Client was expecting various results after that date.

CONFIDENTIALITY

This Document is confidential. Prior written consent from GeoRes is required before it, or extracts, may be disclosed, and notice of that consent must be included with the disclosure (see also CP Statement and Issue below). That consent applies to the "form and context" of the disclosure, requiring the Client to show the full disclosure to GeoRes before its release.

QUALIFICATIONS & EXPERIENCE

Robin Rankin graduated with a Bachelor of Science (BSc) degree in Geology from the University of Cape Town, South Africa, in 1980. Subsequently he obtained a Master of Science (MSc) degree in Mineral Production Management from the University of London (Royal School of Mines) in 1988 and a Diploma of the Imperial College (DIC) from Imperial College London in 1988.

[307] The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the 'JORC code'), 2012 Edition. Prepared in 2012 by the Joint Ore Reserves Committee (JORC) of the Australasian Institute of Mining and Metallurgy (AusIMM), Australian Institute of Geoscientists (AIG) and Minerals Council of Australia (MCA).

Robin has practiced geology professionally virtually continuously since 1981 (+40 years). General geological experience in a wide range of minerals and countries has ranged from grass-roots mineral exploration, through project evaluation and development, and into consulting. He has +30 years specific experience in computerised Mineral Resource estimation. He has reported Mineral Resources according to JORC since at least 2000.

PROFESSIONAL ACCREDITATION

Robin Rankin is a Member (#110551, since 1992) of the Australasian Institute of Mining and Metallurgy (MAusIMM). He is accredited (since 2000) by the AusIMM as a Chartered Professional in the Geology discipline (CP(Geo)).

COMPETENT/QUALIFIED PERSON (CP/QP)

The Consultant's long-term professional involvement in geology and with Mineral Resource evaluation in general, together with his specific geological training, current professional affiliations, relevant field experience and wide geological knowledge, qualifies him to be considered a "Competent Person" (CP, as set out in the JORC Code) or a "Qualified Person" (QP, as set out in Canada's NI 43-101) for a wide range of minerals in various geological settings. That experience includes computerised geological modelling, Mineral Resource estimation and reporting.

CP for this Document: The Consultant is the CP for this Document and for the research behind it. His specific relevant experience with REEs commenced with several years working on exploration and development of the Mt Weld REE deposit in WA before continuing with evaluation of a series of individual REE and REE-related deposits.

COMPETENT PERSON STATEMENT (JORC 2012 EDITION FORMAT)

Requirement: The JORC 2012 Code requires that public reports concerning Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves require inclusion of a formatted "Competent Person Statement" detailing the responsible CP's compliance with the Code (the CP's competence, affiliations and relevant experience), the relationship of the CP with the issuing company, and the CP's consent to disclose the information in the "form and context" that it appears in the report.

CP Statement – IGR: The information in this **Independent Geologist's Report** (IGR), that presents historic details which may relate to Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves (*and which summarises Inferred Mineral Resources contained in a Resource Estimation report attached at Appendix 7 for which the Report's author **Mr John Tyrrell** takes responsibility, and in which CP responsibility for Exploration Results is taken by **Mr David Ross** and CP responsibility for Mineral Resources is taken by **Mr John Tyrrell***), is based on information compiled by **Robin Rankin**, a Competent Person who is a Member (#110551) of the Australasian Institute of Mining and Metallurgy (MAusIMM) and accredited since 2000 as a Chartered Professional by the AusIMM in the Geology discipline (CP(Geo)). Robin Rankin provided this information to his Client as paid consulting work in his capacity as Principal Consulting Geologist and operator of independent geological consultancy GeoRes. He and GeoRes are professionally and financially independent in the general sense and specifically of their Client and of the Client's project. This consulting was provided on a paid basis, governed by a Scope of Work and a fee and expenses schedule. Results and conclusions reported were not contingent on payments. Robin Rankin has sufficient experience that is relevant to the style of mineralization and type of deposit under consideration and to the activity being undertaken to qualify as a Competent Person (CP) as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves' (the JORC Code). Robin Rankin consents to the inclusion in the Client's Report of the matters based on his information in the form and context in which it appears.

INDEPENDENCE

GeoRes and the Consultant are professionally and financially independent and are non-aligned. That independence particularly applies in all senses which might compromise geological consulting work for Clients. GeoRes consults to a range of Clients annually and is not reliant on any.

Independence from Client and Other Consultants: The Consultant and GeoRes are independent of the Client, of the Clients' Projects, and of the Other Consultants (to the Client) who have provided input. If relevant this includes applying all of the tests in Section 1.4 of Canada's NI 43-101.

CONSULTING FEE BASIS

GeoRes's consulting is provided on a paid fee basis. This is governed by Scopes of Work agreed with the Client and fee and expense schedules. Results or conclusions reported are not contingent on payments.

VALIDITY

This Document and it findings will become invalid, not publicly honoured, and have all consents withdrawn, if consulting fees owed to GeoRes by the Client are outstanding for an unreasonable period (taken here to be more than one month).

ISSUER, PUBLIC ISSUE & CONSENT

Issuer: GeoRes's Client will potentially be the Issuer of this Document to third parties or to the public.

Public issue: It was generally understood (at the time of the Consultant's engagement for the Project) by the nature of the Document's purpose that it could be for public issue of some type.

Issue consent: Notwithstanding the Consent already given in the CP Statement above, GeoRes consents in general to the issue of this Document, or extracts from it (providing that they do not mis-represent the overall results of the Document **and** that they are fully attributed), by the Client. The consent requires the Client obtain GeoRes's specific written consent to the issue (including to the "form and context" of the issue) and to include the consent within the issue. These consent conditions aim to fulfill requirements of the JORC 2012 Code.

Future re-issue consent: Each future re-issue of this information (again JORC 2012 Code requirement) will either require GeoRes's written consent and requirements as in the initial release (as above) or require the Client to fully reference the initial issue (name, date and location) and to make statements essentially to the effect that the information continues to apply and that no new information or data exists that would materially affect it.

PRIOR KNOWLEDGE

The Consultant had no knowledge of the Client or of the Client's Projects prior to the initial engagement communications in late October 2021.

SITE INSPECTIONS

The Consultant has not visited either the Cowalinya Project site or the Duke Project site. With Cowalinya a site visit was not contemplated during the engagement communications due to the current Covid 19 pandemic travel restrictions creating difficulty in visiting WA from the Consultant's home in NSW. To counter this difficulty the Client facilitated independent WA based personnel to provide validation of site data (see Other Experts below and Validation in body of Report above). The green-field nature of the Duke Project did not necessitate a site visit.

FULL DATA SUPPLY ASSUMPTION

GeoRes presumes and trusts that the Client supplies all data conceivably relevant to the Project. That would obviously include all geological data (without omissions), all existing reporting, and all typical ancillary data involved with a mineral development project.

Client data statement: Regarding the Cowalinya Project data HRE confirmed on 16 November 2021 (see Warranties) that as of that date the HRE data room contained all currently available information regarding the Project. HRE also stated that analytical work was continuing and would be supplied when available. HRE supplied the independently produced Mineral Resource Report for Cowalinya in February 2022.

LEGAL ACCESS ASSUMPTIONS

GeoRes is not qualified to determine legal access situations (and how they might impact on its ability to legally work on the Projects). Access matters would include (but may not be limited to) the Client's ownership of the Projects, data, and mineral tenure. In all instances GeoRes assumed that the Client "fully owned" the Projects – that it had full legal right to access and operate on the Properties; owned or had the right to share the Property's data; and possessed the right (through the State) to explore for minerals. That assumption assured GeoRes's right to work on the Project for the Client.

RELIANCE ON OTHER EXPERTS

Excluding consultations with the Client (and Other Consultants to the Client) on Project information, Project data, and the Cowalinya site inspection (see above), the Consulting work itself did not rely on other technical experts.

Of all of the external sources of Project data that the Consulting used the Consultant was of the professional opinion that it originated from suitably qualified and experienced personnel and/or organisations. That impression was either gained first-hand or was assumed through their professional standing or reputation.

LIMITATIONS

GeoRes's opinions, conclusions and results (when concerning evaluation (implying the size and grade) of a mineral deposit) essentially deal with a forward-looking "geological estimation" – which would only be proved by a more quantitative method such as actual future mining. A geological estimation is not a precise quantification – and so carries the risk that a quantitative study could result in either a lower or higher quantity. So the nature of geological estimation introduces inherent limitations to the absolute accuracy of GeoRes's opinions, conclusions and results – and they cannot be assured.

DISCLAIMERS

The opinions and conclusions GeoRes gives in this Document are in direct response to its Client's request for an IGR on their Projects. The request stemmed from GeoRes's general geological experience and specific experience with similar Projects/deposits. The opinions and conclusions have been based on information supplied by the Client and/or the Client's representatives prior to the date of this Report (see Full Data Supply above). GeoRes has reviewed and considered the Client's information with due care and used its experience to assess it against expectations of data from similar Projects/deposits.

GeoRes makes the following generalised disclaimer statements concerning supplied Project information (notwithstanding the Client's statement mentioned in Warranties and Full Data Supply above):

Supplied data accuracy and omissions: The accuracy of GeoRes's reported opinions and conclusions ultimately rests on the accuracy and completeness of the information supplied. GeoRes does not take responsibility for, or give a warranty to, the accuracy and completeness of the information supplied and therefore GeoRes disclaims responsibility for its opinions and conclusions should the source information prove unreliable in those ways (particularly where it was incomplete). For that reason GeoRes does not accept liability for other parties' commercial or other decisions based on the reported opinions and conclusions.

Time relevance: The opinions and conclusions given are only relevant to Project information supplied up to the date of this Report and to conditions as they could be reasonably foreseen at that time. Subsequent changes in the Projects and/or its information could quickly alter the validity of those opinions and conclusions to a point where they would no longer apply.

APPENDIX 2 – PROJECT INFORMATION LISTING

Technical Information specific to the Projects was supplied to the Consultant by HRE and is listed here by type. Individual documents are listed in **date order** to follow the project history. NB: Other external sources of Information are given in the References Section 16.

COWALINYA REE PROJECT

HRE DECLARATIONS

- WA Department of Mines, Industry Regulation and Safety, 15 November 2021. *Mining tenement register search – Exploration Licence 63/1972* (PDF).
    - Print-out of details on Exploration License 63/1972 through an on-line search of WA tenement register.
    - Included as Appendix 4 – Tenement report on WA EL 63/1972.
- HRE, 16 November 2021. *Cowalinya Project E63/1972 – data room statement* (PDF).
    - Letter to the Consultant confirming that the HRE data room contained all available information regarding the Project.
    - It also mentioned that results of ongoing work would be added to the data room as it became available.
- Brescianini, R., 7 December 2021. *Cowalinya REE Project – on the ground verification* (PDF). Email from Total Rare Earth Solutions to GeoRes certifying site visit and drill hole verification. Attachments included AIG Membership Certificate 2021/2022 for Richard Brescianini MAIG (#2976) and site photographs.
- Tyrrell, J., 11 February 2022. Consent for Robin Rankin to receive a copy of the Resource Report by JMCT Consulting. In an email forwarded on by HRE's Consultant Mr Richard Brescianini.

REPORTS (ALL)

- Rogers, KA., 16 March 2012. **Salazar Gold Pty Ltd**. *Esperance Splinter Project Exploration Licence E63/1415 – Annual Technical Report for the period 12 January 2011 to 11 January 2012* (PDF).
    - Tenement E63/1415 annual report by Salazar Gold Pty Ltd to WA Department of Mines and Petroleum.
    - For the period 12/1/2011 to 11/1/2012.
    - Tenement ~70 km south of Cowalinya.
    - Project seen as REE genesis template for Cowalinya.
    - Exploration:
        - Desk-top research.
        - Very detailed regional geology.
        - Long list of references.
        - Potential for gold, ionic REE clay, IOCG, iron, mineral sands, lignite, uranium.
        - Discovered ionic REE above REE enriched basement granites.
        - Bio-geochemical survey for REE.
    - Background REE research and various deposit grade comparisons. Local HREE concentrations most valuable. See last paragraphs on pp36-9 and Fig 23 in particular.
    - REE research based on re-evaluation of Azure Minerals Ltd (previously Nickel Australia Ltd) calcrete sampling and air-core drilling (2004-8) on EL to east of E63/1415. Some samples were assayed for Lanthanum (seen as good proxy for Total REE) and other REE.
    - Performed metallurgical test work on Azure samples to evaluate REE exctraction (HCl).
    - Performed bio-geochemical survey over E63/1415 (assaying leaf litter) for REE.
    - Results were good in region for shallow ionic clay REE (regolith saprolite clay) above relevant granites (correct mineralogy and also those with alteration and REE enrichment).
- Rogers, KA., 5 July 2013. **Salazar Gold Pty Ltd**. *Esperance Project Exploration Licences E63/1415,EL63/1469, E63/1496, E69/2783, E69/2784, E69/2944 and E69/3010 – Combined Annual Technical Report for the period 6 May 2012 to 5 May 2013* (PDF).
    - Tenement E63/1415 and others annual report by Salazar Gold Pty Ltd to WA Department of Mines and Petroleum.
    - For the period 6/5/2012 to 5/5/2013.
    - Same as previous year, but more tenements.
    - Exploration:
        - Similar to previous year, mostly research.

        - Air-core drilling (101 holes, 2,703 m). Some to confirm earlier Azure results.
    - More background REE research. See pp30-32.
- Hardwick, B., 3 February 2013. **AngloGold Ashanti Australia**. *Viking Project – Viking 3 Project E63/1271-1272 Surrender Report* (PDF).
    - Tenements E63/1271 and 1272 surrender report by AngloGold Ashanti Australia to WA Department of Mines and Petroleum.
    - For the period 9/12/2009 to 10/12/2013.
    - Rectangular tenements called "Double Tank" – within current Cowalinya area.
    - Exploration for gold included:
        - Aero-mag data collection and analysis.
        - Auger drilling (2.5 m deep, initial pattern 200 * 1,000 m pattern, follow-up pattern 50 * 250 m).
        - Follow-up air-core drilling (~40 m deep, 155 holes, 6,522 m total).
    - Surface gold anomaly (1 * 2 km) found in surface calcrete by shallow auger drilling.
    - Anomaly follow-up air-core drilling failed to find gold in saprolite below calcrete.
    - More regional air-core drilling found weak gold anomalism at the lower calcrete contact.
    - Report accompanied by data (see below).
- Sharp, J., 5 April 2017. **Great Southern Gold Pty Ltd**. *Final surrender report E63/1409 – 1410* (PDF).
    - Tenements E63/1409 and 1410 surrender report by Great Southern Gold Pty Ltd to WA Department of Mines and Petroleum.
    - For the period 8/2/2011 to 27/1/2017.
    - Prospects called "Nightwatch" and "Jezabeel" – within current Cowalinya area.
    - Exploration for gold included:
        - Surface sampling (2011 – 2015).
        - Air-core drilling (2015 – 2017: 99 holes, 2,623 m ?). 80 Holes at Nightwatch, 19 holes at Jezabeel.
- Ross, D., August 2020. *Cowalinya Prospect supergene heavy rare earths* (PDF).
    - Summary of prospect with notes on heavy rare earths.
    - Details of past air-core drilling by AngloGold Ashanti Australia Ltd (2010/1, 65 holes following-up auger drilling anomalies) and by Great Southern Gold Pty Ltd (2015/6, 80 holes testing calcrete anomalies).
    - Also details of metallurgical test work by Salazar Gold Pty Ltd on prospect 55 km SE of Cowalinya.
- Ross, D., 17 February 2021. *Cowalinya heavy Rare Earth Prospect E63/1972 2020 Annual Report* (PDF).
    - Annual exploration report to the Mines Department (DMIRS).
    - For the period 9 January 2020 to 8 January 2021.
- **eMetals Limited**, 4 February 2021. *Acquisition of Cowalinya Ionic Rare Earth Project*. Press Release.
- **eMetals Limited**, 15 June 2021. *Exploration update* (PDF).
    - Letter to shareholders summarising exploration activity at four projects, including drilling at Cowalinya.
    - Air-core drilling of 29 holes for 1,243 m.
    - Contains air-core drill hole collar table (holes CWAC001-29).
- **HRE**, October 2021. *Cowalinya Rare Earths Project* (PDF).
    - Pre-IPO summary of the Project in slide-show format.
    - Included air-core drilling program plans.
- Tyrrell, J.,11 February 2022. *Report - Cowalinya Mineral Resource Estimate.* (PDF)
    - Report issued to HRE by JMCT Consulting, Perth WA.
    - Various aspects of the estimation work and details were sourced in December 2021 and January 2022 from draft versions of the Report.

HRE PHOTOGRAPHS

- Site-visit proof:
    - AC47 site photographs (PDF). HRE, 17 November 2021.
    - Proof of recent independent site-visit.
    - Compilation of 4 labelled photographs of HRE drill hole AC47 showing the immediate hole locality; the location stake (with coordinates and hole name) on the side of the track; sample bags on the side of the track; and the hole collar peg (after rehabilitation of the hole) in the middle of the track).
- Selection of air-core drill-hole sites photographs (.JPG).
    - Supplied November 2021.
    - Each site shown by photos of:
        - Rehabilitated collar position peg (~centre of track)
        - Location peg with hole name, E and N coordinates (side of track adjacent to collar)

    - Collection of green sample bags in depth order (side of track)
    - Site (showing collar, location peg and samples)
- Selection of photographs of 2021 drilling activities (.JPG)
  - Supplied January 2022.

DRILL HOLE DATA (ALL)

- AngloGold Ashanti (2009 – 2013):
  - Tenements E63/1271-1272.
  - Collar, assay, geology.
  - Separate auger and air-core data files:
    - AUGER:
      - E63_1271_1272_SG3_SSASSAY_2013S_A.txt
      - E63_1271_1272_SG3_SSASSAY_2013S_B.txt
      - E63_1271_1272_SS.csv
    - AIRCORE:
      - E63_1271_1272_DG3_DHASSAY_2013S_A.txt
      - E63_1271_1272_DG3_DHASSAY_2013S_B.txt
      - E63_1271_1272_DL3_ALT_2013S.txt
      - E63_1271_1272_DL3_GEOLOGY_2013S.txt
      - E63_1271_1272_DL3_MAGSUS_2013S.txt
      - E63_1271_1272_DL3_METRE_GEOLOGY_2013S.txt
      - E63_1271_1272_DL3_SAMPLE_2013S.txt
      - E63_1271_1272_DL3_WEATHERING_2013S.txt
      - E63_1271_1272_DS3_SURV_2013S.txt
      - E63_1271_1272_WASL3_COLL_2013S.txt
      - E63_1271_1272_Collars.csv
- Great Southern Gold Pty Ltd (2011 – 2017):
  - Tenements E63/1409-1410.
  - Surface sampling and air-core drilling data files:
    - Attachment 1 Surface Sampling Attachments
      - C173-2011_SR_WASG4_SURF2017A.txt
      - C173-2011_SR_WASG4_SURF2017B.txt
      - C173-2011_SR_WASG4_PXRF2017A.txt
    - Attachment 2 Drilling Attachments
      - C173-2011_SR_WADG4_ASS2017A.txt
      - C173-2011_SR_WADL4_GEO2017A.txt
      - C173-2011_SR_WASG4_COLL2017A.txt
- HRE (2020-2021):
  - Separate air-core drilling data files.
  - Collar spreadsheet.
  - Sample spreadsheet.
  - Geological logging spreadsheet.
  - Assay:
    - Raw assay spreadsheets and PDFs.
    - Processed assay spreadsheets.
    - Standards and duplicates details.
    - Assay methods comparisons.
    - Twin hole details.

PLOTS

- HRE (2020-2021):
  - Area 1 (Great Southern "Night Shade Prospect") – plans and cross-sections.
    - Area 1 hole location plans
    - 6,360,600N E/W cross-section
    - 6,359,400N E/W cross-section
    - 6,359,000N E/W cross-section
    - 6,358,600N E/W cross-section
    - 6,358,200N E/W cross-section

  - Area 2 (AngloGold Double "Tank Prospect") – plans and cross-sections.
    - Area 2 hole location plan
    - 6,361,750N E/W cross-section
    - 6,361,500N E/W cross-section
    - 6,361,250N E/W cross-section
    - 6,361,000N E/W cross-section
    - 6,360,750N E/W cross-section
- HRE (1-2/2022):
  - Forwarding of figures from draft V5 of the Cowalinya Resource estimate report.
  - Plan of colour-coded total saprolite layer computer model thickness.
  - Plan of colour-coded TREO * saprolite thickness.
- HRE (11/2/2022):
  - Final drafted versions of figures from the Cowalinya Resource estimate report.

DUKE HREE PROJECT

REPORTS

(Supplied directly by HRE)

- NT Government Department of Industry, Tourism and Trade, reported 20 December 2021. *Title summary report*. Application or EL33101.
  - HRE's application for EL33101 (38 blocks).
  - Application handled through AMETS.
  - Effective start 21/12/2021, period 6 years.
- NT Government Department of Industry, Tourism and Trade, reported 27 April 2022. *Title summary report*. Application for EL33194.
  - HRE's application for EL33194 (45 blocks).
  - Application handled through AMETS.
  - Effective start 26/4/2022, period 6 years.
- AMETS, 17 December 2021. *Heavy Rare Earths Limited – Exploration Licence application – Block map – 38 blocks*. Prepared by Exploration Mining & Exploration Title Services.
  - Map of individual blocks within Exploration Licence application EL33101
- Heavy Rare Earths Limited, 20 December 2021. *Exploration rationale & commodities sought*.
  - Attachment to application for EL33101.
  - Summary of exploration objectives.
  - Listing of intended exploration.
  - Estimation of exploration expenditure.
- NT Government Department of Industry, Tourism and Trade, 22 December 2021. *Confirmation of Application*.
  - Letter acknowledging receipt of EL33101 application.
- NT Government Department of Industry, Tourism and Trade, 22 December 2021. *EL33101*.
  - Map showing Exploration Licence EL33101 and adjacent licences.
- NT Government Department of Industry, Tourism and Trade, 22 December 2021. *Title Summary Report*.
  - General details of EL33101.
  - Title type (Exploration Licence) and number of blocks (38).
  - Title effective start date (21/12/2021) and period (6 years).
  - Holder – HRE.

(Accessed by the Consultant, in exploration date order)

- MAT (1970-1972):
  - McMahon & Partners, February 1971. *Westmoreland Joint Venture – Tennant Creek Area – Authorities to Prospect 2090, 2092, 2093 – Report on 1970 Exploration Programme*. Report by Kenneth McMahon & Partners Pty Ltd. to M.A.T. Exploration Pty Ltd for MAT Westmoreland JV
    - Introduction to project.
    - Good geological maps.
    - Comprehensive and well-presented geophysical mapping.
  - McMahon & Partners, 1971. *M.A.T. Westmoreland Joint Venture – Prospecting Authority 2090 – Tennant Creek N.T. – Final Report 1971 Field Programme*. Report by Kenneth McMahon &

Partners Pty Ltd. to M.A.T. Exploration Pty Ltd for MAT Westmoreland JV.

- Inter-Copper (1970-1972):
    - Geotechnics (Aust) Pty Ltd, December 1971. *Report on Investigation of Aeromagnetic Anomalies in the SouthEast part of P.A. 2892 – Tennant Creek Area – Northern Territory.*
        - Introduction.
        - Mapping of 8 target areas.
    - Geotechnics (Aust) Pty Ltd, June 1972. *Report on percussion drilling of aeromagnetic anomalies on EL59 (formerly PA2892)*.
        - Introduction to project in a missing earlier report.
        - Description of drilling phase.
        - Illustration of geophysics.
    - Geotechnics (Aust) Pty Ltd, September 1972. *Report on reinterpretation of aeromagnetic survey and proton magnetometer survey of EL59 – Tennant Creek NT.* Report for Inter-Copper NL.
        - Overall interpretation map.
- Nobelex (1972-1974):
    - Australian Development Limited, 1973. *Annual Exploration Report – Exploration License 375 – Short Range II – Tennant Creek, Northern Territory – for the year ending 22nd August 1973.* Report for Nobelex N.L.
        - Introduction.
    - Australian Development Limited, 1974. *Completion Exploration Report – Exploration License 375 – Short Range II – Tennant Creek, Northern Territory – for the two years ending 22nd August 1974.* Report for Nobelex N.L.
- Aquitane (1972-1974):
    - Haddock, D., March 1974. *Exploration Licence 87 'Warrego' – Final Report – For the year ending 20th May, 1974*. Aquitane Australia Minerals Pty Ltd. Final report to NT DME.
- Uranerz / Marathon (1977-1981):
    - Jones, W.R., October 1978. *Annual Report for Exploration Licence No. 1668 – Tennant Creek, Northern Territory – covering the period 28 October 1977 to 27 October 1978*. Uranerz Australia Pty Ltd. Annual report to NT DME.
        - Exploration by Uranerz.
        - Project introduction.
        - Initial mapping and ground geophysics.
    - Taylor, K.S.., December 1979. *Annual Report for Exploration Licences No's 1668 and 1669 – Tennant Creek, Northern Territory – covering the period 28 October 1978 to 27 October 1979*. Uranerz Australia Pty Ltd. Annual report to NT DME.
        - 2nd annual report.
        - Continuation of previous work, plus a Track-Etch survey.
    - McPhee, K., January 1981 (?). *Annual Report on Exploration Activities for EL1668 – Tennant Creek – for period 28.10.79 – 27.10.80*. Marathon Petroleum Australia Ltd. Annual Report to NT DME.
        - Exploration continued by Marathon.
        - 3rd annual report.
        - Considerable background geological information on the region.
    - McPhee, K. and Seidl, G., November 1981. *Annual Report on Exploration Activities – EL1668 Tennant Creek – 28.10.80 – 27.10.81*. Marathon Petroleum Australia Ltd. Annual Report to NT DME.
        - 4th annual report.
        - Further new detailed geological descriptions.
    - McPhee, K., December 1981. *Final Report on Exploration Activities – EL1668 – Tennant Creek, Northern Territory – 28.10.1977 – 31.12.1981*. Marathon Petroleum Australia Ltd. Final Report to NT DME.
        - Final report.
        - Very brief summary.
- CRAE (1979-1983):
    - Snelling, A.A. and Jenke, G.P., July 1980. *EL 1877 Short Range NT – Annual Report for period ending 14/5/1980*. CRA Exploration Pty Ltd. Annual report to NT DME.
        - 1st annual report.
        - Project introduction.
        - Geology.
        - EL plan.
        - Aeromag plans.
        - Data for 2 drilling programs,

- Snelling, A.A. and Jenke, G.P., June 1981. *EL 1877 Short Range NT – Second Annual Report for year ending 14/5/1981*. CRA Exploration Pty Ltd. Annual report to NT DME.
  - 2nd annual report.
  - Data for 3rd drilling program.
- Newell, B.H., and Jenke, G.P., March 1982. *EL 1877 Short Range NT – Third Annual Report for year ending 14/5/1982*. CRA Exploration Pty Ltd. Annual report to NT DME.
- Dunn, P.R., September 1983. *EL 1877 Short Range NT – Fourth and Final Report*. CRA Exploration Pty Ltd. Annual report to NT DME.
  - 4th annual and final report.
  - Overall project summary.

- CRAE (1980-1981):
  - Snelling, A.A., June 1981. *EL 2353 Warrego, N.T. – Final Report Period ending 22nd April 1981*. CRA Exploration Pty Limited. Annual report to NT DME.
    - Final report.
- CRAE (1980-1982):
  - Newell, B.H., February 1982. *EL 2662 Last Hope NT – Final Report*. CRA Exploration Pty Ltd. Annual Report to NT DME.
    - Final report.
    - Very brief.
    - Listed 3 rock chip samples around last Hope Mine.
- CEGBEA / Poseidon Gold (1986-1992):
  - Fordyce, I.R., December 1986. *Progress report and work proposal for exploration on EL4895 (Short Range) and EL4896 (Warrego), Tennant Creek*. Central Electricity Generating Board Exploration (Australia) Pty Ltd. Annual report to NT DME.
    - Project introduction.
    - Description of some objectives.
    - Future exploration in detail.
  - Fordyce, I.R., July 1987. *EL4895 Tennant Creek (Short Range) Annual Report to the NT Department of Mines for the First Year of Tenure ending 13 May 1987.* Central Electricity Generating Board Exploration (Australia) Pty Ltd. Annual report to NT DME.
    - Exploration in year 1.
    - Details of geophysics review.
  - Fordyce, I.R., June 1988. *EL4895 Short Range Annual Report to the NT Department of Mines for Second Year of Tenure ending 13 May 1988.* Central Electricity Generating Board Exploration (Australia) Pty Ltd. Annual report to NT DME.
    - Exploration in year 2.
    - Details of drilling and interpretations.
  - Fordyce, I.R., September 1988. *EL4895 Short Range Final Report to the NT Department of Mines and Energy for the 250 blocks relinquished at the end of the second year of tenure.* Central Electricity Generating Board Exploration (Australia) Pty Ltd. Report to NT DME.
    - 1st relinquishment plans.
  - Fordyce, I.R. (presumed), June 1989. *EL4895 Short Range Annual Report to the NT Department of Mines and Energy for the third year of tenure ending 13 May 1989.* Central Electricity Generating Board Exploration (Australia) Pty Ltd. Annual report to NT DME.
    - Exploration in year 3.
    - Details of limited drilling.
    - Details of CSIRO study.
  - Lindsay-Park, K., 1990. *Annual Exploration Report for EL4895, Short Range and EL4896, Western Field – Tennant Creek District Northern Territory – May 1989 to May 1990*. Prepared for Poseidon Gold Limited. Annual report to NT DME.
    - Exploration in year 4 by new owners Pos Gold.
    - Detailed aero-mag plans.
  - Lindsay-Park, K., June 1991. *Annual Exploration Report for EL4895, Short Range and EL4896, Western Field – Tennant Creek District Northern Territory – May 1990 to May 1991*. Prepared for Poseidon Gold Limited. Annual report to NT DME.
    - Exploration in year 5.
    - Limited drilling south west of EL33101.
  - Lindsay-Park, K., June 1992. *Final Exploration Report for EL4895, Short Range and EL4896, Western Field – Tennant Creek District Northern Territory – From 20/5/1991 to 19/5/1992.* Prepared for Poseidon Gold Limited. Final report to NT DME.
    - Final report.
- Western Mining (1990-1994):

- Barratt, R.M., February 1995. *Final Report on E.L. 7153 (Alaska) – November 14th, 1990 to November 13th, 1994*. Western Mining Corporation Limited, Exploration Division. Final report to NT DME.
  - Brief project description.
  - Geophysical maps.
- Poseidon Gold / Normandy Gold / Santexco (1992-2002):
  - Hunter, T.J., March 1994. *Annual Report for Exploration Licence 7896 for the Period 5/2/93 to 4/2/94 – Tennant Creek District, Northern Territory – Western Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Poseidon Gold Limited. Annual report to NT DME.
    - Photo-geological maps.
    - Start of vacuum drilling.
  - Evans, R., March 1995. *Annual Report for Exploration Licence 7896 for the Period 5/2/94 to 4/2/95 – Tennant Creek District, Northern Territory – Western Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Poseidon Gold Limited. Annual report to NT DME.
    - Vacuum drilling results.
    - RAB hole details.
  - Evans, R., July 1995. *Final Report for Exploration Licence 7896 for the Period 5/2/93 to 28/4/95 – Tennant Creek District, Northern Territory – Western Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Poseidon Gold Limited. Final report to NT DME.
    - Final report on EL7896 before becoming SEL8814.
    - Minor additions to vacuum drilling.
  - Mouchet, P.O.J., May 1996. *Annual Report for Substitute Exploration Licence 8814 for the Period 28/4/95 to 27/4/96 – Tennant Creek District, Northern Territory – Short Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 2. PosGold Limited. Final report to NT DME.
    - 1st annual report for SEL8814.
    - Vacuum drilling plan.
  - Clifford, B.A., May 1997. *Second Annual Report for Substitute Exploration Licence 8814 for the Period 28/4/96 to 27/4/97 – Tennant Creek District, Northern Territory – Short Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Normandy Gold Pty Limited. Annual report to NT DME.
    - Now Normandy Gold.
    - 2nd annual report for SEL8814.
    - Limited numbers of RAB and RC holes.
  - Clifford, B.A. & Stott, J.E., July 1997. *First Partial Relinquishment Report for Substitute Exploration Licence 8814 for the Period 28/4/96 to 27/4/97 – Tennant Creek District, Northern Territory – Short Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Normandy Gold Pty Limited. Partial relinquishment report to NT DME.
    - Remaining vacuum hole maps.
    - RAB/RC hole sections.
  - Orton, V., June 2000. *Fifth Annual Report for Substitute Exploration Licence 8814 for the Period 28/4/99 to 27/4/2000 – Tennant Creek District, Northern Territory – Short Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Normandy Tennant Creek Pty Limited. Annual report to NT DME.
    - Very few details of 2 RC holes.
  - Orton, V., May 2005. *Annual Report for Substitute Exploration Licence 8814 for the Period 28/4/2000 to 27/4/2001 – Tennant Creek District, Northern Territory – Short Range Prospect*. Tennant Creek 1:250,000 Sheet – Volume 1 of 1. Normandy Tennant Creek Pty Limited. Annual report to NT DME.
    - No exploration in the period.
  - Russel, S.C., August 2002. *Substitute Exploration Licence 8814 – Short Range – Final Report – 28 April 1995 – 27 April 2002*. Giants Reef Mining Limited – for licensee Santexco Pty Ltd. Formerly Normandy Tennant Creek Pty Ltd. Final report the NT DME.
    - Giants Reef report for licensee Santexco.
    - Final report (1995-2002).
- Delta Gold / BHP / Giants Reef (1993-2001):
  - Collis, G.D., June 1994. *First Annual Report – Exploration Licences – 8104 – Short Range – 8105 – North Warrego – 8106 – Marion – 8238 – Dingo Bore – Northern Territory – Tennant Creek Region*. Delta Gold Exploration Pty Ltd. Annual report to NT DME.
    - 1st annual report.
    - Project introduction.
    - Good geological descriptions, including of mineralisation in the Goldfield.
    - Initial Geochem sampling at 5 prospects.

- Collis, G.D., June 1995. *Second Annual Report – Exploration Licences – 8104 – Short Range – 8105 – North Warrego – 8106 – Northern Territory – Tennant Creek Region*. Delta Gold Exploration Pty Ltd. Annual report to NT DME.
  - 2nd annual report.
  - Geochem sample plans.
- Collis, G.D., June 1996. *Delta Gold NL – Third Annual Report on Exploration Licences – 8104 – Short Range – 8105 – North Warrego – 8106 – Northern Territory – Tennant Creek Region*. Delta Gold Exploration Pty Ltd. Annual report to NT DME.
  - 3rd annual report.
  - Interesting comments on Mercury deposit just SE of HRE's tenement.
- Simpson, P.G. & Russell, S.C., July 2002. *Exploration Licence 8104 – Epsilon – Final Report – 11 June 1993 – 10 June 2002*. Giants Reef Mining Limited for Giants Reef Exploration Pty Ltd. Final report the NT DME.
  - Brief project overview and evolving JV/ownership details.
  - No details on later drilling.

- Giants Reef (2001-2002):
  - Cahill, J.L., January 2003. 1982. *Exploration Licence 9995 – Warrego Granite – Exploration Licence 22713 – Phillip Creek – Final Report 24 July 2001 – 24 July 2002*. Giants Reef Mining Ltd / Giants Reef Exploration Pty Ltd. Annual report to NT DME.
    - 1st and final report.
- Red Metal (2004-2007):
  - McKay, G., June 2005. *EL24012 Annual Report for period May 23, 2004 to May 24, 2005*. Red Metal Limited. Annual report to NT DME.
    - 1st annual report.
    - Project introduction.
    - Gravity survey points map.
  - McKay, G., June 2006. *EL24012 Annual Report for period ended May 23, 2006*. Red Metal Limited. Annual report to NT DME.
  - McKay, G., April 2007. *EL24012 Final Relinquishment Report for period ended April 16, 2007*. Red Metal Limited. Annual report to NT DME.
    - Final report.
    - Conduct gravity survey.
    - Drill one RC hole to 50 m.
- Meteoric Resources (2003-2013):
  - Dance, B., July 2006. *Annual Report – Warrego West Project – EL24362 – Reporting Period 22 June 2005 to 22 June 2006*. Meteoric Resources NL. Annual report to NT DME.
    - Annual report.
  - Dance, B., 2006. *Relinquishment Report – Warrego North Project – EL24364 – Period 23 May 2005 to 23 May 2006*. Meteoric Resources NL. Relinquishment report to NT DME.
    - 1st and final report.
  - <u>EL24138</u>:
  - *Annual Reports on EL24138 from 10/2004 to 10/2007*. Meteoric Resources NL. Annual reports to NT DME.
    - No exploration reported.
  - Reddy, D., October 2008. *Annual Report – Warrego North Project – EL24138 – Northern Territory – Reporting Period 8 October 2007 to 7 October 2008*. Meteoric Resources NL. Annual report to NT DME.
    - First actual description of exploration in EL24138.
    - Geochemical soil sampling program.
  - Neumayr, P., November 2010. *Annual Report for EL24138 for the Period 8 October 2009 to 7 October 2010*. Sipa Exploration NL. Annual report to NT DME.
    - Annual report.
    - First report by Sipa.
    - Described objectives.
  - Neumayr, P., October 2012. *Annual Report for EL24138 for the Period 8 October 2011 to 7 October 2012*. Sipa Exploration NL. Annual report to NT DME.
    - Results of new aero-mag survey.
  - Reddy, D., December 2013. *Annual and Final Report for EL24138 – for the Period 8 October 2004 to 15 October 2013 – Warrego, Tennant Creek, Northern Territory*. Meteoric Resources NL. Annual and final report to NT DME.
  - <u>EL23764</u>:
  - Reddy, D., December 2009. *Annual Report – Warrego North Project – EL23764 – Tennant Creek, Northern Territory – Reporting Period 26 November 2008 to 25 November 2009*. Meteoric

Resources NL. Annual report the NT DME.
    - Geochem sampling 2008/9.
    - Geophysics maps.
  - Neumayr, P., January 2011. *Annual Report for EL23764 for the Period 25 November 2009 to 24 November 2010*. Sipa Exploration NL. Annual report to NT DME.
    - Vacuum drilling plan.
  - Reddy, D., January 2014. *Annual Report on EL23764 – for the Period 26 November 2012 to 25 November 2013 – Warrego, Tennant Creek, Northern Territory*. Meteoric Resources NL. Annual report to NT DME.
    - Useful geological setting map.
    - Geophysical maps.
    - Section through Parakeet.
  - Reddy, D., January 2014. *Annual Report on EL23764 – for the Period 26 November 2013 to 25 November 2014 – Warrego, Tennant Creek, Northern Territory*. Meteoric Resources NL. Annual report to NT DME.
    - Geophysical re-interpretation by Spinifex.
  - West Warrego:
  - Neumayr, P., December 2009. *Combined Annual Report for Period ending 12/11/2008 – ELs 22359, 23063, 23065, 23992, 26822*. Sipa Exploration NL. Annual report to NT DME.
    - Project introduction.
  - Neumayr, P., November 2010. *Combined Annual Report for Period ending 12/11/2009 – ELs 22359, 23063, 23065, 23992, 26822*. Sipa Exploration NL. Annual report to NT DME.
    - Termite mound geochem results.
    - RC drilling results.
  - Neumayr, P., January (?) 2011. *Combined Annual Report for Period ending 12/11/2011 – ELs 22359, 23063, 23065, 23992, 26822*. Sipa Exploration NL. Annual report to NT DME.
    - Airborne mag survey.
  - Neumayr, P., December 2012. *Combined Annual Report for Period ending 12/11/2012 – GR139 (ELs 22359, 23063, 23065, 23992, 26822)*. Sipa Exploration NL. Annual report to NT DME.
    - Air-mag survey completed.
    - Detailed TMI image.
- Uranium West / Rum Jungle (2006-2012):
  - EL24835:
  - De Luca, K., August 2007. *Annual Report EL24835 – Tennant Creek NT – Reporting Period 16 August 2006 to 15 August 2007*. Crescent Gold Limited. Annual report to NT DME.
    - Summary of Project start.
  - Doyle, N., August 2008. *Second Annual Report for EL24835 – Phillip Creek – Period ended 15 August 2008*. Rum Jungle Uranium Ltd. Annual report to NT DME.
    - Details of year 2 exploration.
    - Drill hole and geophysical maps.
  - Doyle, N., September 2009. *Third Annual Report for EL24835 – Phillip Creek NT – Period ended 15 August 2009*. Rum Jungle Uranium Ltd. Annual report to NT DME.
    - Details of year 3 exploration.
  - Doyle, N., September 2010. *Fourth Annual Report for EL24835 – Phillip Creek NT – Period ended 15 August 2010*. Rum Jungle Uranium Ltd. Annual report to NT DME.
    - Details of year 4 exploration.
    - Diamond drill holes.
  - Ion, J., January 2013. *Year 7 Annual and Final Report – EL24835 Phillip Creek – for period 16 August 2006 to 14 December 2012*. Uranium West Limited. Annual report to NT DME.
    - Full Project summary.
  - EL25575:
  - Dunster, J., September 2011. Fourth annual and final surrender report for EL25575, Short Range, Tennant Creek, NT. Rum Jungle Resources Ltd. Annual report to NT DME.
    - Warrego North Project.
  - EL25873:
  - Doyle, N., 2008. *First Annual Report for EL25873 – Blue Bush – Period ended 17/9/2008*. Rum Jungle Uranium Ltd. Annual report to NT DME.
    - West side of Warrego West Project.
    - First report and introduction to EL.
    - Effectively no exploration. Dropped.
  - EL25874:
  - Doyle, N., 2008. *First Annual Report for EL25874 – Short Range West – Period ended 17/9/2008*. Rum Jungle Uranium Ltd. Annual report to NT DME.

        - West side of Warrego North Project.
        - First report and introduction to EL.
        - Effectively no exploration. Dropped.
    - EL26656:
    - Doyle, N. & Nowland, J., September 2010. *Second Annual and Final Annual Report for EL26656 – Pipeline West, Tennant Creek NT – Period ended 10/8/2010*. Rum Jungle Uranium Ltd. Annual report to NT DME.
        - West side of Warrego North Project.
        - Effectively no exploration. Dropped.
- Castile Resources (2008-2013):
    - Coles, R., March 2009. *EL26034 – Tennant Creek Project – Annual Report – Reporting Period 25 February 2008 to 24 February 2009*. Castile Resources Pty Ltd. Annual report to NT Department of Regional Development, Primary Industries, Fisheries & Resources.
        - Project introduction.
        - Good list of past explorers.
    - Burke, R.J., June 2013. *Final Surrender Report – EL26034*. Tennant Creek. Reporting Period 25 February 2008 to 3 July 2013. Metals X Limited for Castile Resources Pty Ltd. Final surrender report to NT DME.
        - Heli-mag survey plan.
- Universal Splendour Investments / Bligh Resources (2010-2015):
    - Street, G. & Finn, M., August 2011. *Tenement Summary Report for the Period August 30 2010 to August 29 2011 for EL27651*. Report by International Geoscience for Universal Splendour Investments. Annual report to NT DME.
        - Project introduction.
- Manto Mining (2012-2022):
    - Dai, D. & Shao, M., 30 May 2013. *First Annual Report for EL 28904, Tennant Creek 1, period ended 26/03/2013*. Prepared by Project operator ACCCGE. First annual report to NT DME.
        - First report.
        - Initial site inspection.
        - Introduction – no technical information.
    - Shao, M., 14 May 2014. *Second Annual Technical Report – Exploration Licence 28904 – 27 March 2013 – 26 March 2014*. Prepared by Manto Mining Pty Ltd. Second annual report to NT DME.
        - No exploration conducted.
        - Apparently will follow Meteoric's geophysical methods.
    - Shao, M., 2 June 2015. *Third Annual Technical Report – Exploration Licence 28904 – 27 March 2014 – 26 March 2015*. Prepared by Manto Mining Pty Ltd. Third annual report to NT DME.
        - Conducted aero-mag and radiometric surveys.
        - Awaiting results.
    - Edgar, H., May 2016. *Fourth Annual Technical Report – Exploration Licence 28904 – 27 March 2015 – 26 March 2016*. Report prepared by AMETS. Fourth annual report to NT DME.
        - Aero-mag survey results.
    - Edgar, H., August 2016. *Partial Relinquishment Report – Exploration Licence 28904 – 27 March 2015 – 26 March 2016*. Report prepared by AMETS. Relinquishment report to NT DME.
        - Detailed block being dropped.
    - August 2016. *Exploration Licence 28904 – Airborne Geophysical Survey Results Report*. Report prepared by ACCCGE. Part of relinquishment report to NT DME.
        - 2015/6 geophysics survey results.
    - Zhang, S., June 2021. *Partial Relinquishment Report – Exploration Licence 28904 – 27 March 2012 – 29 March 2021*. Report prepared by AMETS. Relinquishment report to NT DME.
        - Partial relinquishment report (covered HRE's EL33101).
        - Details of blocks released.
        - No other information.

MAPS

- Northern Territory Government – Department of mines and Energy, 1989. Tennant Creek Sheet SE 53-14 1:250 000 geological Map.

APPENDIX 3 – COWALINYA SITE DATA VERIFICATION – RICHARD BRESCIANINI

Cowalinya site data was verified through a visit by Mr Richard Brescianini (Total Rare Earth Solutions) on 10th November 2021. Documents are copied here containing details of his professional affiliation (Australasian Institute of Geoscientists (AIG)), his data certification email, and the photographs he took during the visit of a drilling site contained within HRE's data.

AIG MEMBERSHIP (#2976)

AUSTRALIAN INSTITUTE OF GEOSCIENTISTS

Supporting Geoscientists

Annual Membership Certificate 2021/2022

The Council of the Australian Institute of Geoscientists hereby certifies that

Mr Richard Francis Brescianini MAIG

(# 2976)

is a current, financial member of the Institute, as stipulated in the Articles of Association, has agreed to be bound by the Institute's Code of Ethics, and holds the membership level of Member.

Dale Sims
President

Beau Nicholls
Councillor for Membership

Current to 30th June 2022

Joining date: 12nd February 2004

Australian Institute of Geoscientists
www.aig.org.au

DATA CERTIFICATION EMAIL

Subject: FW: Cowalinya REE Project - on the ground verification
Attachments: HRE Corporation AC47 site photos.pdf; CERT_2976_28792.pdf

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From: richard.b@node1.com.au <richard.b@node1.com.au>
Sent: Tuesday, 7 December 2021 10:55 PM
To: Robin Rankin <robin.rankin@geores.com.au>
Cc: 'Ryan Batros' <ryan@brcapital.com.au>; 'dircar' <dircar@bigpond.com>
Subject: FW: Cowalinya REE Project - on the ground verification

Hi Robin,

I provided Ryan the following statement by email on 16 November, and expect you've seen it.

I can confirm evidence of a systematic shallow drilling program at the HRE Corporation exploration site I visited on Wednesday 10 November 2021, east of the Coolgardie-Esperance Highway and south-east of Norseman in WA. During the visit I observed tens of drilling sites which were identified as shown in the photos at one of the sites (drill hole AC47 – find attached): a location stake, bagged air core drilling samples and a dumpy peg indicating the location of the drill hole. I personally visited and photographed 10 of the drilling sites, all of which have been uploaded to HRE Corporation's Teams data room.

I am a professional geoscientist of 34 years' standing in the private and public sector, which includes a four-year term as Director of the Northern Territory Geological Survey. I am a Member of the Australian Institute of Geoscientists (find attached membership certificate).

Please let me know at your earliest convenience if you need anything else.

Regards.

****

Nd Tb Dy Pr
TOTAL RARE EARTH SOLUTIONS

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COWALINYA DRILL HOLE (AC47) VERIFICATION PHOTOGRAPHS

Figure 172 Site verification – AC47 pad

HRE Corporation AC47 site showing location stake, air core drilling samples and drill hole dumpy peg (foreground)

Figure 173 Site verification – AC47 location

HRE Corporation AC47 location stake

Figure 174 Site verification – AC47 samples

HRE Corporation AC47 air core drilling samples

Figure 175 Site verification – AC47 collar peg

HRE Corporation AC47 drill hole dumpy peg

APPENDIX 4 – TENEMENT REPORT ON WA EL 63/1972

Included here is the tenement report (PDF) on WA Exploration License 63/1972 provided to Mr David Ross by the WA DMIRS on 15 November 2021.

WESTERN AUSTRALIA

MINING TENEMENT REGISTER SEARCH

EXPLORATION LICENCE 63/1972

This Register Search issued pursuant to Section 103F(4) of the Mining Act, 1978 at: **16:11:35 15/11/2021**

Fiona Knobel
Executive Director
Resource Tenure
Department of Mines, Industry Regulation and Safety

Tenement Summary

Identifier :	E 63/1972	**District :**	DUNDAS M.F.
Current Area :	80 BL	**Status :**	Live
Mark Out :		**Received :**	06/06/2019 10:58:42
Term Granted :	5 Years	**Lodging Office :**	ONLINE
Commence :	09/01/2020	**Expiry :**	08/01/2025
Purpose :		**Death :**	

Rent Status

Due for Year End 08/01/2022 :
Previous Amount Outstanding : $0.00
Current Due : $0.00
Rent for Year End 08/01/2023 : $11,680.00

Expenditure Status

Expended Year End 08/01/2021 : EXPENDED IN FULL
Current Year (08/01/2022) Commitment : $80,000.00

OWNERSHIP DETAILS

Current Holders

Name and Address	Shares
ROSS, David Ian DAVID IAN ROSS, 3 DRIVER WAY, BULL CREEK, WA, 6149, dircar@bigpond.com, 0427084235	50
ROSS, Christine Ann DAVID IAN ROSS, 3 DRIVER WAY, BULL CREEK, WA, 6149, dircar@bigpond.com, 0427084235	50
Total Shares:	**100**

Created 15/11/2021 16:11:35 — Requested By: David Ross Page 1 of 5

Holder Changes

Dealing	Status Date	From (Shares)	To (Shares)

Applicants on Receival

Name and Address	Shares
ROSS, David Ian DAVID IAN ROSS, 3 DRIVER WAY, BULL CREEK, WA, 6149, dircar@bigpond.com, 0427084235	50
ROSS, Christine Ann DAVID IAN ROSS, 3 DRIVER WAY, BULL CREEK, WA, 6149, dircar@bigpond.com, 0427084235	50
Total Shares:	100

DESCRIPTION DETAILS

Description

Block Type : **Effective From :**

Type	Start Date	No. of Blocks	Remaining Blocks – Graticules: Million Plan	Primary	Blocks
Granted	09/01/2020	80	ESPERANCE	673	uz
			ESPERANCE	674	lmnopqrstuvwxyz
			ESPERANCE	675	qstuvwxyz
			ESPERANCE	676	v
			ESPERANCE	746	abcdeghjkp
			ESPERANCE	747	abcdefghjklmnoprstuyz
			ESPERANCE	748	abcfghjlmnoqvwx
			ESPERANCE	820	abcdhjk
Applied For	06/06/2019	80	ESPERANCE	673	uz
			ESPERANCE	674	lmnopqrstuvwxyz
			ESPERANCE	675	qstuvwxyz
			ESPERANCE	676	v
			ESPERANCE	746	abcdeghjkp
			ESPERANCE	747	abcdefghjklmnoprstuyz
			ESPERANCE	748	abcfghjlmnoqvwx
			ESPERANCE	820	abcdhjk

Description of Land NOT included in the grant of the Licence.

RELATIONSHIPS

Relationships

Relationship	Dealing No	Dealing Status	Tenement ID	Tenement Status

State Agreement Conversions

Applicable Legislation	Effective Start	Effective End

SURVEY DETAILS

Survey

Surveyed Area	Surveyed Date	Surveyor's Name	Field Book	Instruction Date	Project

Standard Plan	Diagram

MINING TENEMENT REGISTER SEARCH — EXPLORATION LICENCE 63/1972 - Live

GENERAL DETAILS

General

Objection Closing Date : 11/07/2019
File Reference :
Receipt Number : 94215353127
Application Fee : $1,430.00
Survey Fee :

Special Indicator

Special Indicator	Start	End

SHIRE DETAILS

Shire

Shire	Shire No	Start	End	Area
ESPERANCE SHIRE	3290	06/06/2019		80.00000 BL

NATIVE TITLE DETAILS

Native Title Referrals

Date Referred	Referral Type	Procedure	Current Status
22/07/2019	Tenement Application	Expedited Procedure	Expedited Procedure : Native Title Cleared - Expedited Applies

Expedited Procedure Details

Sec 29 Notification Date : 09/08/2019
Sec 29 Notification Close Date : 09/12/2019
Procedure Outcome : Native Title Cleared - Expedited Applies
Clearance Notification Date : 06/01/2020
Proposed Area to Grant : 80 BL
Centroid Latitude : 32° 51' 14" S
Centroid Longitude : 122° 12' 8" E
Locality : 83.1km SE'ly of Norseman
Purposes :

Objections

Claims

Determination Areas

Native Title Holder : NGADJU(WCD2014/004)
NNTT Number : WC1999/002
Federal Court Number : WAD6020/1998
Determination Number : WCD2014/004
Folio Number :
Full Determination : No
Determination Decision : Exists
Determination Date : 21/11/2014
Wholly Within : Yes
PBC Name/Address : NGADJU NATIVE TITLE ABORIGINAL CORPORATION RNTBC
PO BOX 2710, CLOISTERS SQUARE PO, PERTH, WA, 6001

Aboriginal Representative Area Bodies

Code	Region	Representative Body
13	Goldfields	Native Title Services Goldfields

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GRANT DETAILS

Recommendation

Recommended for : Grant 19/07/2019

Grant

Granted : 09/01/2020 **Holder Notified :** 09/01/2020 **Licence/Lease issued :**

Term

Term : 5 Years **From :** 09/01/2020 **To :** 08/01/2025

ENDORSEMENTS/CONDITIONS DETAILS

Endorsements and Conditions

#	ENDORSEMENTS	Start Date	End Date
1	The Licensee's attention is drawn to the provisions of the Aboriginal Heritage Act 1972 and any Regulations thereunder.	09/01/2020	
2	The Licensee's attention is drawn to the Environmental Protection Act 1986 and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, which provides for the protection of all native vegetation from damage unless prior permission is obtained.	09/01/2020	
	In respect to Water Resource Management Areas (WRMA) the following endorsements apply:	09/01/2020	
3	The Licensee's attention is drawn to the provisions of the: • Waterways Conservation Act, 1976 • Rights in Water and Irrigation Act, 1914 • Metropolitan Water Supply, Sewerage and Drainage Act, 1909 • Country Areas Water Supply Act, 1947 • Water Agencies (Powers) Act 1984	09/01/2020	
4	The rights of ingress to and egress from, and to cross over and through, the mining tenement being at all reasonable times preserved to officers of Department of Water and Environmental Regulation (DWER) for inspection and investigation purposes.	09/01/2020	
5	The storage and disposal of petroleum hydrocarbons, chemicals and potentially hazardous substances being in accordance with the current published version of the Department of Water and Environmental Regulation (DWER) relevant Water Quality Protection Notes and Guidelines for mining and mineral processing.	09/01/2020	
6	The taking of groundwater from an artesian well and the construction, enlargement, deepening or altering of any artesian well is prohibited unless current licences for these activities have been issued by Department of Water and Environmental Regulation (DWER).	09/01/2020	
7	Measures such as drainage controls and stormwater retention facilities are to be implemented to minimise erosion and sedimentation of adjacent areas, receiving catchments and waterways.	09/01/2020	
8	All activities to be undertaken so as to avoid or minimise damage, disturbance or contamination of waterways, including their beds and banks, and riparian and other water dependent vegetation.	09/01/2020	

#	CONDITIONS	Start Date	End Date
1	All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, Department of Mines, Industry Regulation and Safety. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, Department of Mines, Industry Regulation and Safety.	09/01/2020	
2	All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.	09/01/2020	
3	Unless the written approval of the Environmental Officer, Department of Mines, Industry Regulation and Safety is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of	09/01/2020	

#	CONDITIONS	Start Date	End Date
	costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.		

DEALINGS DETAILS

Dealings

Encumbrances

BOND DETAILS

Bond	Surety	Amount	Bond date	Bond status	Bond status date

RENT DETAILS

Rent Payments

Type	Year	Receipt Date	Payment No	Receipt No	MR Lodged	Amount	Rental Area	Effective Date	Amount Due	Discrepancy
Payment	2022	11/01/2021	5178005396	10177900	OL	$11,280.00	80 BL	09/01/2020	$11,280.00	$0.00
Payment	2021	06/06/2019	1551077322	94215353127	OL	$10,880.00	80 BL	09/01/2020	$10,880.00	$0.00

EXPENDITURE/EXEMPTION DETAILS

Expenditure/Exemptions

Year	Minimum Expenditure	Expenditure Lodged	Total Expenditure	Exemption Amount	Exemption Lodged	Exemption Number	Exemption Status	Outcome Date
2022	$80,000.00							
2021	$80,000.00	17/02/2021	$49,564.15	$30,435.85	17/02/2021	596088	Granted	24/05/2021

Expenditure Details

Year	Lodged	Exploration Activities	Mining Activities	Aboriginal Survey	Rent/Rates	Admin.	Prospecting	Total Expenditure
2021	17/02/2021	$21,525.00	$0.00	$0.00	$12,039.15	$16,000.00	$0.00	$49,564.15

COMBINED REPORTING DETAILS

C Number :

Project :

Reporting Date :

Affecting Period :

End of Search

APPENDIX 5 – HRE COWALINYA DRILL HOLE LOCATION PLANS

The following Figures are HRE's original drill hole location plans for HRE's drilling in Area 1 and Area 2 at Cowalinya. HRE's holes are marked by red stars, previous holes by black dots. NB: The two plans are **not** at the same scale.

Figure 176 HRE hole locations - Area 1 / South

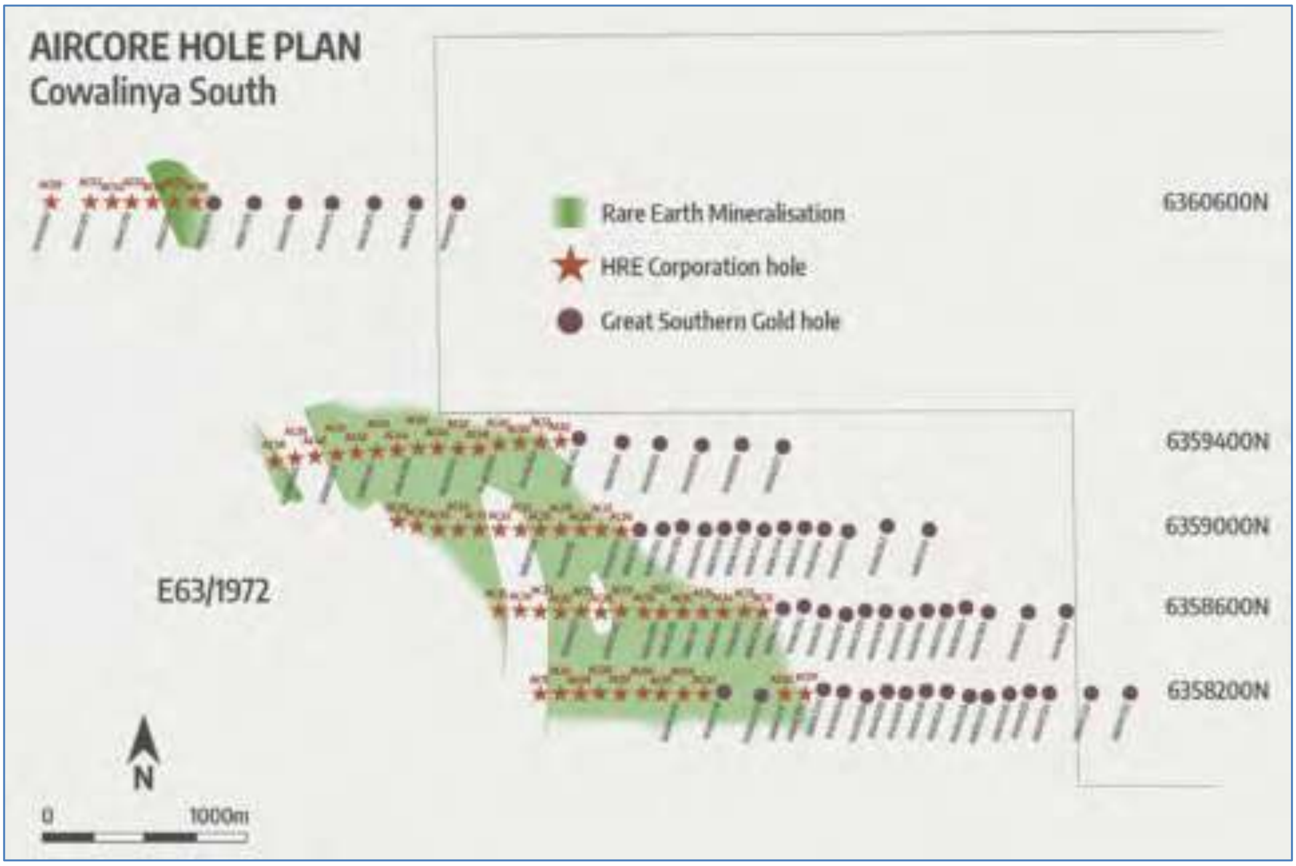

Figure 177 HRE hole locations - Area 2

APPENDIX 6 – TENEMENT SUMMARY REPORTS ON NT EL33101 & EL33194

Included here is the summary tenement report (PDF) on HRE's application for NT Exploration Licence 33101, provided to HRE by the NT Government – Department of Industry, Tourism and Trade on 22 December 2021.

Northern Territory Government

DEPARTMENT OF INDUSTRY, TOURISM AND TRADE

www.nt.gov.au

GPO Box 4550
Darwin NT 0801
AUSTRALIA
www.minerals.nt.gov.au

Title Summary Report

General Information

Legislation:	*Mineral Titles Act*
Title Type:	Exploration Licence (EL)
Title Number:	33101
Status:	Application
Area:	38 Blocks

Holders Information

Name	Contact Information	Ownership
HRE CORPORATION LIMITED		100.00%

Contact Information

Name	Contact Details
HRE CORPORATION LIMITED	Level 21, 459 Collins Street Melbourne 3000
AUSTRALIAN MINING & EXPLORATION TITLE SERVICES PTY LTD	PO Box 4123 Palmerston 0831

Most Recent Transactions

Transaction	Effective/Start Date	Expiry/End Date	Period	Area/Blocks	Area (Km2)
Application	21/12/2021		6 Years	38 Blocks	0

Historical Titles, Open Filed Reports (GEMIS)

Printed on: 22 December 2021 11:18 1 General Enquiries - 1300 308 144

Included here is the summary tenement report (PDF) on HRE's application for NT Exploration Licence 33194, provided to the Consultant by the NT Government – Department of Industry, Tourism and Trade on 27 April 2022.

Northern Territory Government

DEPARTMENT OF INDUSTRY, TOURISM AND TRADE www.nt.gov.au

GPO Box 4550
Darwin NT 0801
AUSTRALIA
www.minerals.nt.gov.au

Title Summary Report

General Information

Legislation:	*Mineral Titles Act*
Title Type:	Exploration Licence (EL)
Title Number:	33194
Status:	Application
Area:	45 Blocks

Holders Information

Name	Contact Information	Ownership
HEAVY RARE EARTHS LIMITED		100.00%

Contact Information

Name	Contact Details
HEAVY RARE EARTHS LIMITED	Level 21, 459 Collins Street Melbourne 3000
AUSTRALIAN MINING & EXPLORATION TITLE SERVICES PTY LTD	PO Box 4123 Palmerston 0831

Most Recent Transactions

Transaction	Effective/Start Date	Expiry/End Date	Period	Area/Blocks	Area (Km2)
Application	26/04/2022		6 Years	45 Blocks	0

Historical Titles, Open Filed Reports (GEMIS)

Printed on: 27 April 2022 10:59 1 General Enquiries - 1300 308 144

APPENDIX 7 – COWALINYA RESOURCE REPORT

This Appendix includes in full the JORC 2012-edition compliant February 2022 Cowalinya REE Mineral Resource Estimate report by **Mr John Tyrrell** of JMCT Consulting, for which Mr Tyrrell takes responsibility**. Mr David Ross** is the Competent Person (CP) for the Report's Exploration Results and **Mr John Tyrrell** is the Competent Person (CP) for the Report's Mineral Resources. The Report includes CP Statements and a JORC Table 1.

Report

Cowalinya Mineral Resource Estimate

HRE Corporation Limited

11 February 2022

Executive summary

At the request of HRE Corporation Limited (HRE) in November 2021, independent consultant JMCT Consulting (JMCTC) prepared a Mineral Resource estimate for the company's Cowalinya Rare Earth (Cowalinya) project, near Norseman in Western Australia. This report documents the data collection by HRE and the resource estimate completed by JMCTC in December 2021.

The estimate is based on drill hole assay data available to November 2021. Drilling, sampling, assaying and initial geological interpretation was carried out by HRE, with minor updates to better fit a block modelling framework by JMCTC. The Mineral Resource estimation and reporting was completed by JMCTC.

No previous estimates have been completed for Cowalinya, however historical exploration for gold was carried out in the area by Great Southern Gold Pty Ltd (GSG) in 2015 to 2017 and by AngloGold Ashanti Australia Ltd (Anglo) in 2010 to 2011.

JMCTC received a Microsoft Excel database with 109 drill holes from HRE with tables for collar positions (no RL), geology logging, quality control, assay standards and assay data for the rare earth elements (REEs) lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu) and yttrium (Y), as well as scandium (Sc), thorium (Th) and uranium (U). JMCTC reviewed the geological data and created a new interpretation based on the 2021 drilling by HRE and additional historical drilling by Anglo and GSG.

JMCTC completed a statistical and geostatistical study of the data and produced variograms for the key variables in the estimate. Domaining of data was primarily based on the geological interpretation and the wireframing and volume modelling based upon that.

An ordinary kriged estimate was completed for La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y and Sc, as well as Th and U as potentially deleterious elements. Upon completion of the estimate, the grades were converted to oxides for reporting, using industry standard conversion factors. A combined grade of all of the rare earth oxides (TREO) was used as the main reported variable. The Mineral Resource has been reported in accordance with the 2012 JORC Code. Tonnes and grade were reported above a 300 ppm TREO minus CeO_2 cut off. This was chosen after consideration of similar projects, as well as initial mining, metallurgical and pricing assumptions by HRE.

The Mineral Resource estimate is reported in Table A.

Table A 2021 Cowalinya Mineral Resource estimate

Prospect	Classification	Mt	TREO (ppm)	TREO-CeO_2 (ppm)	Sc_2O_3 (ppm)	Magnet REOs/TREO (%)	Magnet REOs/(TREO-CeO_2) (%)	Bulk Density (t/m^3)
Cowalinya North	Inferred	7	635	450	26	25	36	1.63
Cowalinya South	Inferred	22	620	430	32	25	37	1.63
Total	**Inferred**	**28**	**625**	**435**	**31**	**25**	**36**	**1.63**

Notes:
** TREO = $La_2O_3+CeO_2+Pr_6O_{11}+Nd_2O_3+Sm_2O_3+Eu_2O_3+Gd_2O_3+Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3$*
** "Magnet REOs" = $Pr_6O_{11}+Nd_2O_3+Tb_4O_7+Dy_2O_3$*
**Totals may not add due to rounding*
**Reported above a cut-off grade of 300 ppm TREO-CeO_2*

No mining has occurred to date at Cowalinya, so there are no production records for reconciliation and no depletion by mining.

Technical risks and recommendations

The areas of technical risk for the Cowalinya resource estimate are considered to be the following:

- The geological interpretation at Cowalinya is based on 50 m by 250 m and 100 m by 400 m spaced drill holes. There is a risk that the current interpretation is not correct and that the currently interpreted mineralised domains are not as continuous and as consistently thick as shown in the model. JMCTC considers this risk as low.

- The samples used in the estimate have been assayed using a multi-acid digest method and several checked using alternative methods. The alternative methods appear to be reporting grade of up to 12% over the original assays. There is a risk of assays being under reported if the most appropriate method is not chosen. JMCTC considers this risk as moderate.

- The assay standards used for the data upon which this estimate is based, appear to only address the very high and very low grades in the data. JMCTC considers this risk as low.

- Density determinations are predominantly pycnometer readings from sample pulps from few samples. Moisture content readings are similarly sparse. As all of the drilling at Cowalinya is aircore, this is expected. The pycnometer readings do not take into account the porosity of the sample. The data needs to be factored (lower), as the original weathered rock samples have some inherent porosity that is not accounted for in the pycnometer process. HRE has factored the pycnometer readings based on few moisture content measurements and an additional arbitrary factor for pore space. JMCTC considers the uncertainty around the factored densities applied to the mineralised units in the model to be a potential risk to the tonnage calculations for the resource. As the potential tonnage is very large and the grade is more likely to be the limiting factor for the resource expansion, JMCTC considers this risk as low to moderate.

- Samples have been drilled at one metre intervals but assayed using four metre composites. This was done to make the most of the available budget at a very early stage of the project. Some compromises were made as a result of this in the interpretation of the mineralised units. Some of the samples crossed geological boundaries and grade was assigned to divisions both above and below where they should have been. Some high grade has been introduced from bedrock and some low grade has been introduced from material overlying the mineralisation. This is a moderate risk.

Recommendations for further work on the Cowalinya resource estimate are as follows:

- In order to increase confidence in future estimates, JMCTC recommends infill drilling at Cowalinya North and South, to reduce the spacing to a more consistent 100 m by 100 m, with smaller gaps between the drill fences. This should be a progressive, staged approach as more information on the project geology and geochemistry is acquired.

- Further definition of the top of mineralisation may be possible with either re-assaying of the original one-metre sampled intervals, or sampling at one metre intervals in future drilling programmes. The four metre composite samples used currently, have potentially blurred the contacts between mineralisation and waste material, particularly in the upper saprolite. Sampling at finer intervals and comparing with geology may help to remove some dilution in the upper saprolite and increase the grade in certain areas.

- JMCTC recommends a programme of bulk density determinations. This could initially be focused on acquiring additional and more accurate data for moisture content from existing samples. Density determinations may have to be made using diamond core samples or with borehole wireline logging.

- JMCTC recommends HRE maintain ownership of the QAQC process from drilling rig to assay, to ensure the best possible unbiased results. All QAQC samples should as much as possible be anonymous and indistinguishable from the rest of the sample stream.

- JMCTC recommends the use of more assay standards, with proper certification and applicability to the Cowalinya grade ranges other than the extremes.

- JMCTC recommends that, where possible, any blank material used for QAQC samples should at least have zero values for the mineralisation and for any potential deleterious elements.

- JMCTC recommends a ratio of approximately 1:20 (5%) for pulp duplicates, blanks and umpire assays. JMCTC also recommends that the type of QAQC sample is accurately recorded and documented to allow for confidence in evaluation of like samples.

- JMCTC recommends assaying to geological boundaries and matching the drilled metres in future programmes. It may also be possible, depending on the amount of sample degradation, to re-assay the original drilled samples at one metre intervals.

Competent persons

The information relating to the geological setting and data review, including data collection, quality assurance and quality control (QAQC) and verification was compiled by Mr. David Ross. Mr. Ross is a member of the Australasian Institute of Mining and Metallurgy (AusIMM) and the Australian Institute of Geoscientists (AIG). He works as a geological consultant to HRE Corporation Ltd. Mr. Ross has more than 35 years' experience in mineral exploration and has sufficient experience relevant to the style of mineralisation and type of deposit under consideration to qualify as a Competent Person as defined in the 2012 JORC Code.

The information relating to the Cowalinya Mineral Resource estimate was compiled by Mr. John Tyrrell. Mr. Tyrrell is a member of the Australasian Institute of Mining and Metallurgy (AusIMM) and a full time employee of JMCT Consulting. Mr. Tyrrell has more than 30 years' experience in the field of Mineral Resource estimation. He has sufficient experience relevant to the style of mineralisation and type of the deposit under consideration, and in resource model development, to qualify as a Competent Person as defined in the 2012 JORC Code.

Important information about this report

Confidentiality

This document and its contents are confidential and may not be disclosed, copied, quoted or published unless JMCTC Consulting (JMCTC) has given its prior written consent.

No liability

JMCTC accepts no liability for any loss or damage arising as a result of any person other than the named client acting in reliance on any information, opinion or advice contained in this document.

Reliance

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Recommendations

JMCTC accepts no liability for any matters arising if any recommendations contained in this document are not carried out, or are partially carried out, without further advice being obtained from JMCTC.

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Public reporting requirements

If a Client wishes to publish a Mineral Resource estimate prepared by JMCTC, it must first obtain the Competent / Qualified Person’s written consent, not only to the estimate being published but also to the form and context of the published statement. The published statement must include a statement that the Competent / Qualified Person’s written consent has been obtained.

Contents

Tables

Figures

Appendices

Distribution list

1 e-copy to Mr. R. Brescianini, Total Rare Earth Solutions
1 e-copy to Mr. D. Ross, HRE Corporation Ltd

1 Introduction

1.1 Scope of work

At the request of HRE Corporation Limited (HRE) in November 2021, independent consultant JMCT Consulting (JMCTC) prepared a Mineral Resource estimate for the company's Cowalinya Rare Earth (Cowalinya) project, near Norseman in Western Australia (WA). This report documents the data collection by HRE and the resource estimate completed by JMCTC in December 2021.

The estimate is based on drill hole assay data available to November 2021. Drilling, sampling, assaying and initial geological interpretation was carried out by HRE, with minor updates to better fit a block modelling framework by JMCTC. The Mineral Resource estimation and reporting was completed by JMCTC.

No previous estimates have been completed for Cowalinya, however historical exploration for gold was carried out in the area by Great Southern Gold Pty Ltd (GSG) in 2015 to 2017 and by AngloGold Ashanti Australia Ltd (Anglo) in 2010 to 2011.

JMCTC received a Microsoft Excel database with 109 drill holes from HRE with tables for collar positions (no RL), geology logging, quality control, assay standards and assay data for the rare earth elements (REEs) lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu) and yttrium (Y), as well as scandium (Sc), thorium (Th) and uranium (U). JMCTC reviewed the geological data and created a new interpretation based on the 2021 drilling by HRE and additional historical drilling by Anglo and GSG.

JMCTC has completed an ordinary kriged estimate for La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y and Sc, as well as Th and U as potentially deleterious elements. The Mineral Resource has been reported in accordance with the 2012 JORC Code[1]. No mining has occurred to date at Cowalinya, so there are no production records for reconciliation and no depletion by mining.

1.2 Project location

The Cowalinya project is located approximately 90 km southeast of Norseman, WA (Figure 1-1).

Access is by sealed road to Salmon Gums, approximately 100 kms south of Norseman along the Coolgardie-Esperance Highway and then east by gravel road and bush tracks to the project site.

[1] Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, The JORC Code 2012 Edition. Effective 20 December 2012 and mandatory from 1 December 2013. Prepared by the Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australasian Institute of Geoscientists and Minerals Council of Australia (JORC).

Figure 1-1 Cowalinya Rare Earth Project location

The project related to this Mineral Resource estimate is located wholly within granted tenement E63/1972. E63/1972 is 100% owned by David and Christine Ross, with HRE holding an option to acquire the tenement.

The Ngadju people have granted native title rights over the area of the tenement. A heritage survey undertaken prior to drilling of the project in 2021, located isolated artefacts but no significant archaeological sites.

1.3 Participants

JMCTC resource geologist, Mr. John Tyrrell, has not visited the project site as part of the Mineral Resource estimation process, however Mr. David Ross of HRE has visited on multiple occasions and has supervised all of the drilling and data collection to date. The site has also been visited by Mr. Richard Brescianini and Mr. Patrick Harford, both consultants to HRE.

1.4 Independence

In undertaking the assignments referred to in this document, JMCTC acted as an independent party, has no interest in the outcome of the Cowalinya project and has no business relationship with HRE other than undertaking those individual technical consulting assignments as engaged, and being paid according to standard per diem rates with reimbursement for out-of-pocket expenses. Therefore, JMCTC and the Competent Person for the Mineral Resource believe that there is no conflict of interest in undertaking the assignments which are the subject of this Mineral Resource estimate.

1.5 Competent persons, qualifications and experience

The information relating to the Cowalinya geology, sample and data collection and data quality assurance and quality control (QAQC) was compiled by Mr. David Ross. Mr. Ross is a Member of the Australasian Institute of Mining and Metallurgy (AusIMM) and Australian Institute of Geoscientists (AIG). He works as a consultant for HRE. Mr. Ross has more than 35 years' experience in the field of Mineral Exploration and data collection. He has sufficient experience relevant to the style of mineralisation and type of the deposit under consideration, and in geological modelling, to qualify as a Competent Person as defined in the JORC Code.

The information relating to the Cowalinya Mineral Resource estimate was compiled by Mr. John Tyrrell. Mr. Tyrrell is a Member of the Australasian Institute of Mining and Metallurgy (AusIMM). Mr. Tyrrell has more than 30 years' experience in the field of Mineral Resource estimation. He has sufficient experience relevant to the style of mineralisation and type of the deposit under consideration, and in resource model development, to qualify as a Competent Person as defined in the JORC Code.

1.6 Principal sources of information

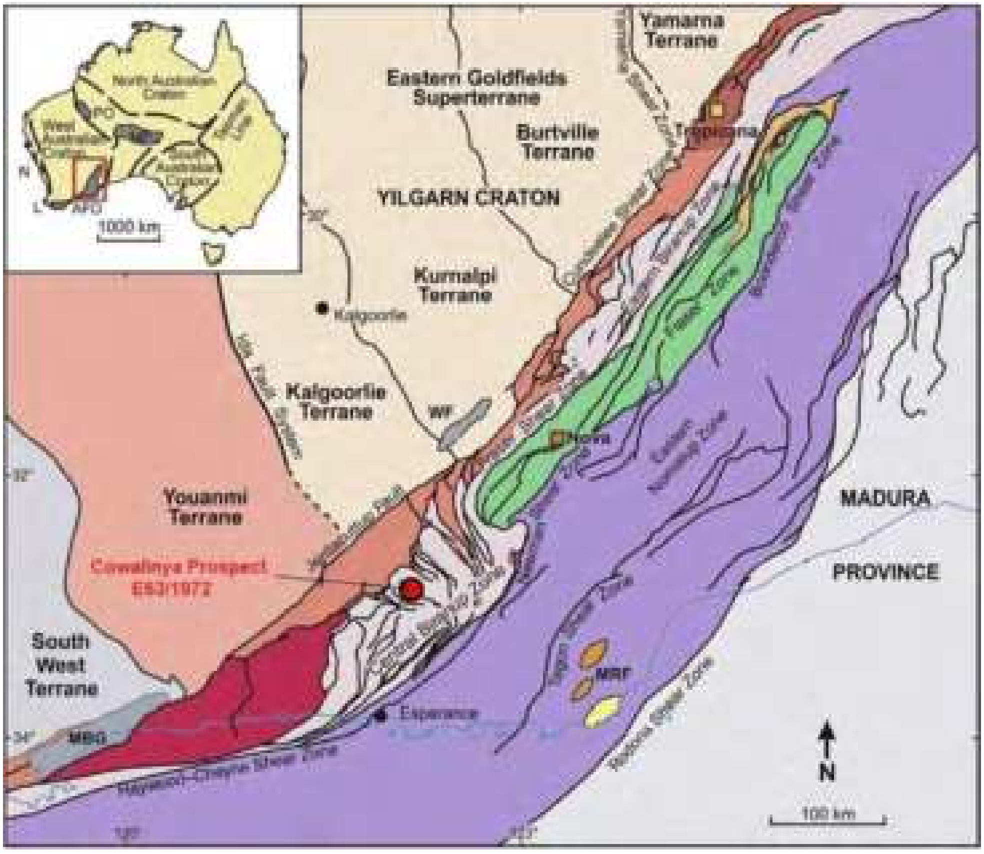
JMCTC was supplied with a drill hole database and preliminary cross-sectional geological interpretation by HRE. HRE also supplied data for QAQC and details of the historical drilling programmes.

2 Geological setting

2.1 Regional setting

The project lies within the Paleoproterozoic Central Biranup Zone of the Albany - Fraser Orogen, which is oriented approximately southwest - northeast, and abuts the southern ends of the Youanmi and Kalgoorlie Terranes of the Yilgarn Craton. It can be found on the Geological Survey of WA (GSWA) Norseman 1:250,000 scale map sheet. It is located approximately 90 km southeast of Norseman and 110 km north-northeast of Esperance in WA. Figure 2-1 is a simplified regional geological map of the area, showing the location of the project.

Figure 2-1 Simplified regional geology of the Central Biranup Zone and surrounds



*From Spaggiari et al, 2014b; GSWA Report 133.

The Cowalinya project covers an area of granitic gneisses, granites and minor amphibolite which have generally undergone upper amphibolite to granulite facies metamorphism.

2.2 Project geology

The project geology is a subset of the regional area, but the focus for this project is on the non-bedrock units.

2.2.1 Lithology

The lithology of interest at Cowalinya is saprolitic clay grading to saprock overlying fresh bedrock. The upper and lower saprolites overlie granites and granitic-gneiss to occasional amphibolite bedrock and average a combined thickness of approximately 17 m. They commence approximately ten metres below surface, but this ranges from three metres to sixteen metres.

Locally the geology is dominated by an upper and a lower saprolite unit, overlain by Eocene mixed transported material comprised of sands, clays and occasional silcrete and calcrete layers.

The saprolites which host the REE mineralisation are generally massive, with the upper saprolite khaki in colour and the lower saprolite green-grey in colour.

The mineralised package is essentially flat lying and thickens and thins along its east to west and north to south extents mirroring the minor undulations of the underlying fresh bedrock. It is currently intercepted by drilling in two areas totalling a combined area approximating 3.5 km^2.

2.2.2 Alteration

The bedrock in the area has undergone upper amphibolite to granulite facies metamorphism.

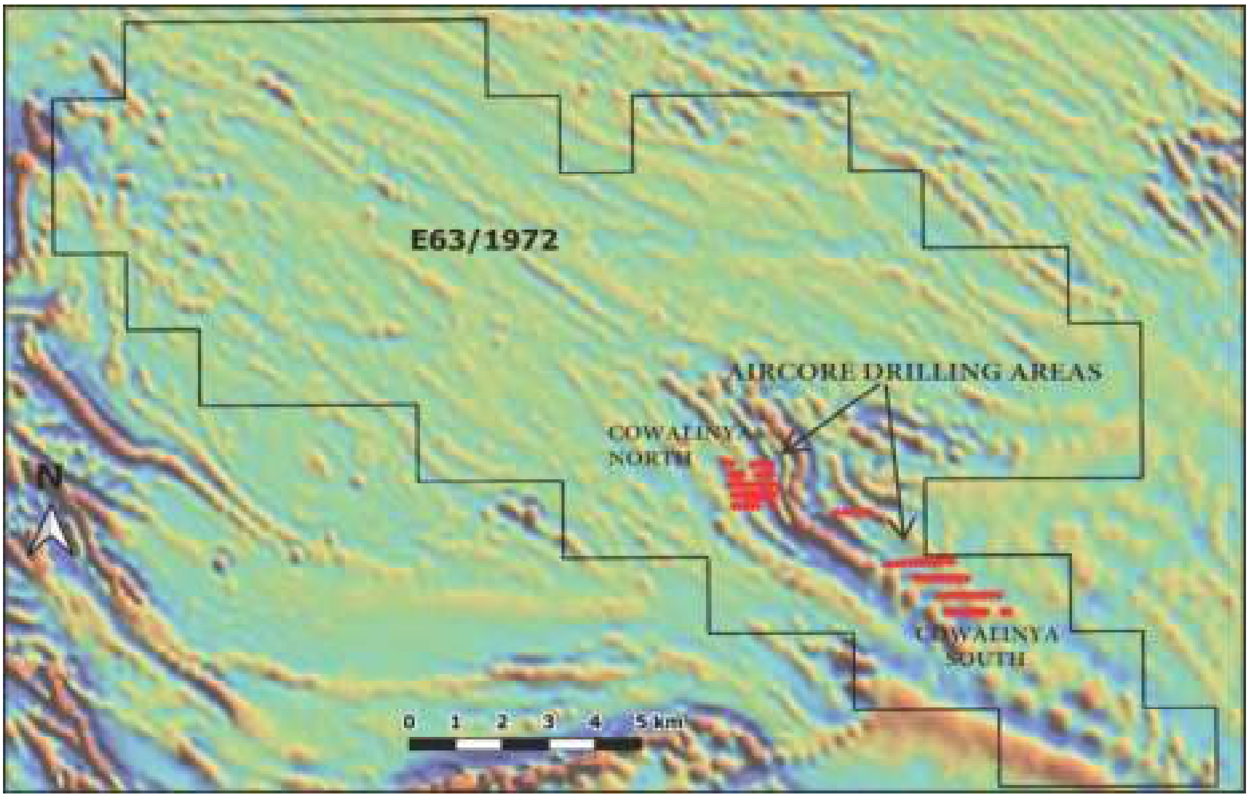
2.2.3 Structure

There is negligible bedrock outcrop on E63/1972 but regional airborne magnetic data reveals bedrock lithological units having a north-westerly strike. The magnetics also reveal prominent open folding in the southern part of the tenement. Figure 2-2 shows a plan view with the folding in the magnetics and the HRE drill hole collars superimposed. The dips of the bedrock units are unknown at present.

The geological sequence in the two areas drilled by HRE comprises on average:

0 – 1m	soil + calcrete	transported cover
2 – 6m	puggy clay	
6 – 10m	sand + silcrete	
10 – 20m	upper saprolite	
20 – 29m	lower saprolite/saprock	
29 – 30m	fresh bedrock	

Figure 2-2 Plan View of Total Magnetic Intensity at Cowalinya



2.2.4 Mineralisation

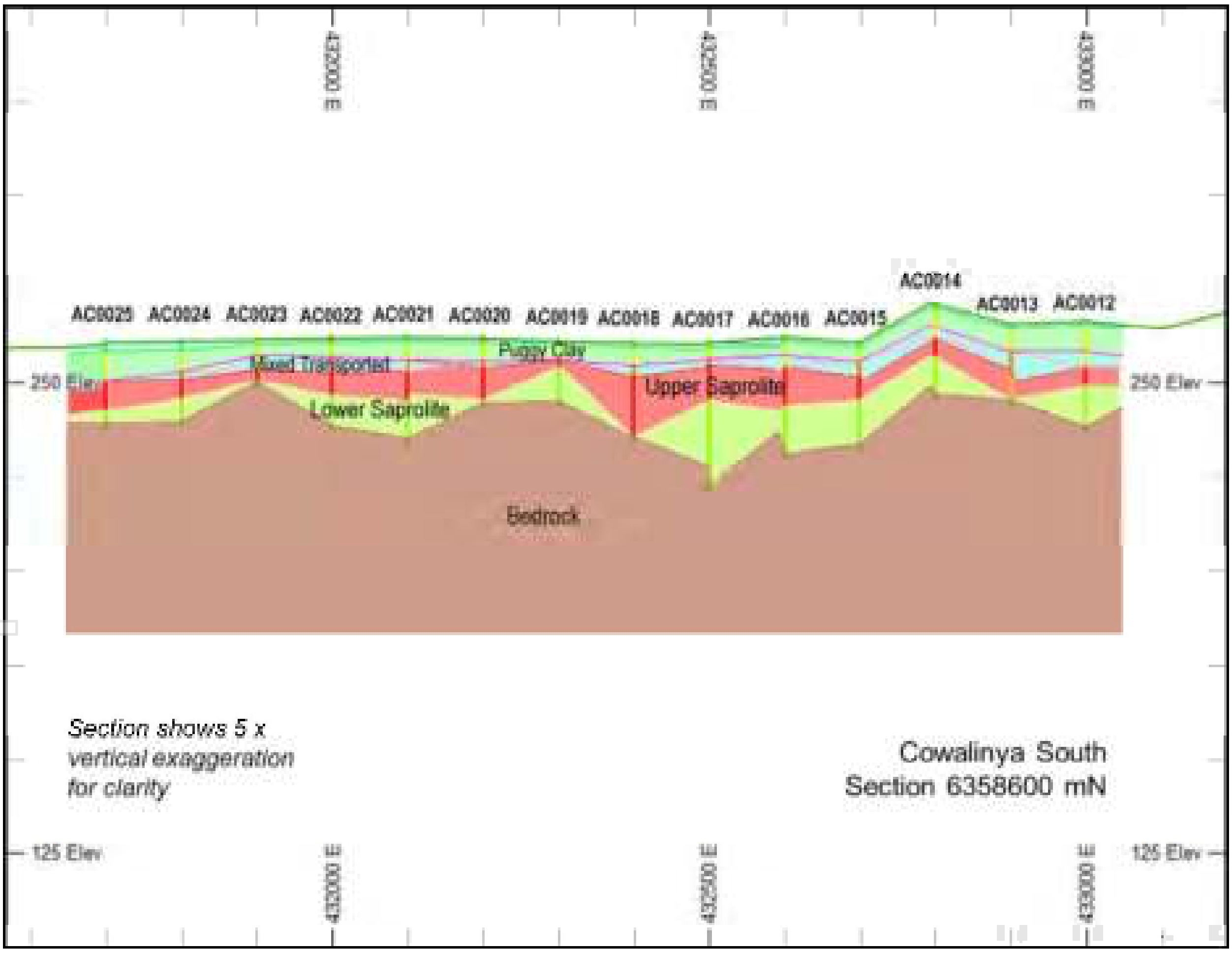
Historical exploration by several companies, including drilling by Anglo and GSG, as well as data collation and drilling by HRE has led to the discovery of the Cowalinya project. Anglo and GSG were primarily exploring for gold, but assayed for a full suite of elements at the bottom of every hole when bedrock was reached.

Mineralisation consists of supergene REE enrichment in saprolitic clays above a mixed granitic gneiss/granite/amphibolite basement (Figure 2-3). The mineralisation style appears to be similar to the ionic clay-type deposits (ionic adsorption REE) known in southern China as well as Uganda, Madagascar, Myanmar, Chile and Brazil.

The mineralisation is hosted within clay-rich saprolite. The mineralised units, upper and lower saprolite, show varying thickness and grade, both laterally and down dip and have a clearly defined sharp boundary on the footwall where it stops at bedrock. The grade generally increases with depth, although there are some lower grade areas just above bedrock. There is generally a lower grade top to the upper saprolite and the boundary to the higher grade material is diffuse and irregular in many places.

Figure 2-3 shows a type cross section of the mineralisation at Cowalinya.

Figure 2-3 Type cross section of Cowalinya geology, showing Upper and Lower mineralised Saprolite units

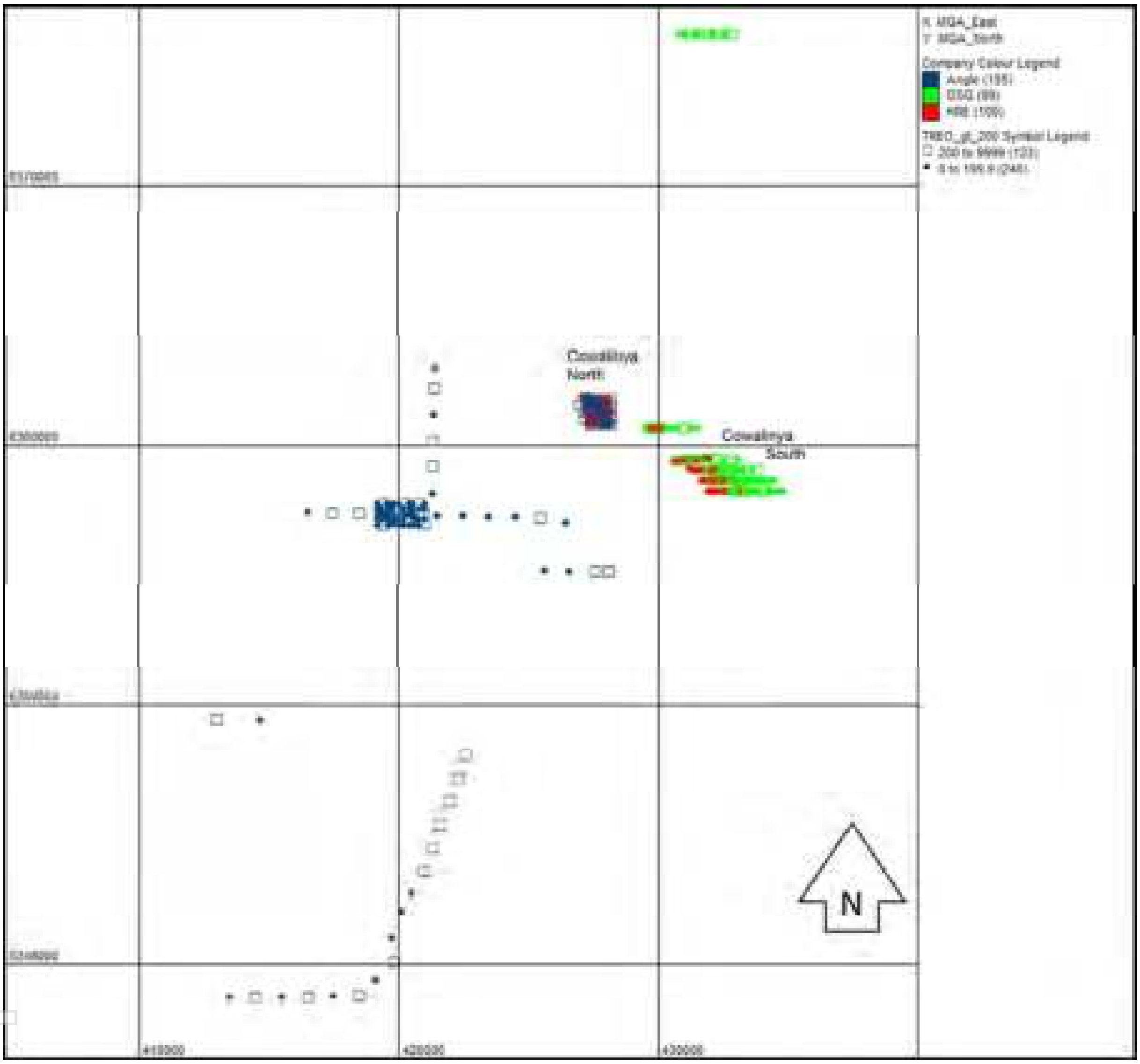


The interpreted mineralisation currently only extends to the limits of HRE drilling, being approximately 1.2 x 1.2 km at Cowalinya North and 2.5 km in northing by 1.5 km in easting at Cowalinya South.

When targeting positions for the 2021 drilling, HRE used the end-of-hole data from Anglo and GSG historical drilling, as they had assays for REEs. Many of the historical holes, some well outside the area of HRE drilling and beyond the tenement boundary, show greater than 200 ppm total rare earth elements (TREE) at end-of-hole. These locations are more than 12 km to the north, 10 km to the west and 25 km to the south-west of

Cowalinya North and South, showing potential for expansion of the current resource. Figure 2-4 shows the extent of all of the historical drilling in the area compared to the HRE drilling. Open squares on the plot are TREE assays greater than 200 ppm.

Figure 2-4 Extents of historical drilling at the greater Cowalinya area with end-of-hole assays highlighted



2.2.5 Weathering and oxidation

The weathering profile at Cowalinya ranges from 11 m to greater than 43 m, averaging 26 m deep from surface, topped by approximately 10 m of Eocene transported sediments.

The main mineralised units are two highly weathered saprolite units, named upper and lower, with the lower unit grading to saprock near the contact with the granitic gneiss/granite bedrock.

The upper saprolite is highly oxidised, with the lower saprolite grading from transitional to almost fresh at the base.

The supergene weathering processes have enriched the saprolites with REEs derived from the bedrock.

3 Data review

3.1 History of drilling programmes

The Cowalinya project was identified in the early part of 2010 as a potential gold prospect (north area) by Anglo and investigated with shallow drilling and surface sampling. In 2015, GSG, also exploring for gold, identified the south area. Both these companies also completed selected sampling for a full suite of elements, including REE assays, which led to the interest of HRE/Mr. David Ross in 2019 – 2021.

HRE assumed management of the lease in 2021 and proceeded to drill 109 aircore holes to test for REE mineralisation in the non-bedrock units. The location of the holes drilled by HRE was influenced by the bedrock REE grades in the historical drilling at the north and south areas.

Table 3.1 lists the type of holes and the number drilled for each significant programme at Cowalinya.

Table 3.1 Historical and HRE drillhole types and number by programme

Company	Hole Number	Drill Type	Number of Holes	Metres
AngloGold (2010-2011)	SGA001 - 249	Aircore	155	6,522
GSG (2015-2017)	NWAC001 - 079; JBAC001 - 019	Aircore	99	2,623
Historical sub total			**254**	**9,145**
HRE (2021)	AC0001 - 0109	Aircore	109	3,089
All drilling to date Total			**363**	**12,234**

Of the 363 holes with data available, only the 109 HRE holes were used for grade estimation, as the historical holes only had total REE assays for the last sample at the bottom of the hole. All of the historical drilling that overlapped with the HRE drilling was used for geological interpretation.

Figure 3-1 shows the drill hole collar locations for HRE drilling on the greater Cowalinya project. Some of the HRE hole collars are overlain by Anglo and GSG collars in the figure, but the Cowalinya North area includes 50 HRE drilled holes, with the remaining 59 at Cowalinya South. Figure 3-2 shows a closer view of Cowalinya North and the Anglo drilling in that area and Figure 3-3 shows drill hole collar locations for HRE and GSG drilling at Cowalinya South.

Figure 3-1 Overview of HRE and Historical drilling to date at Cowalinya

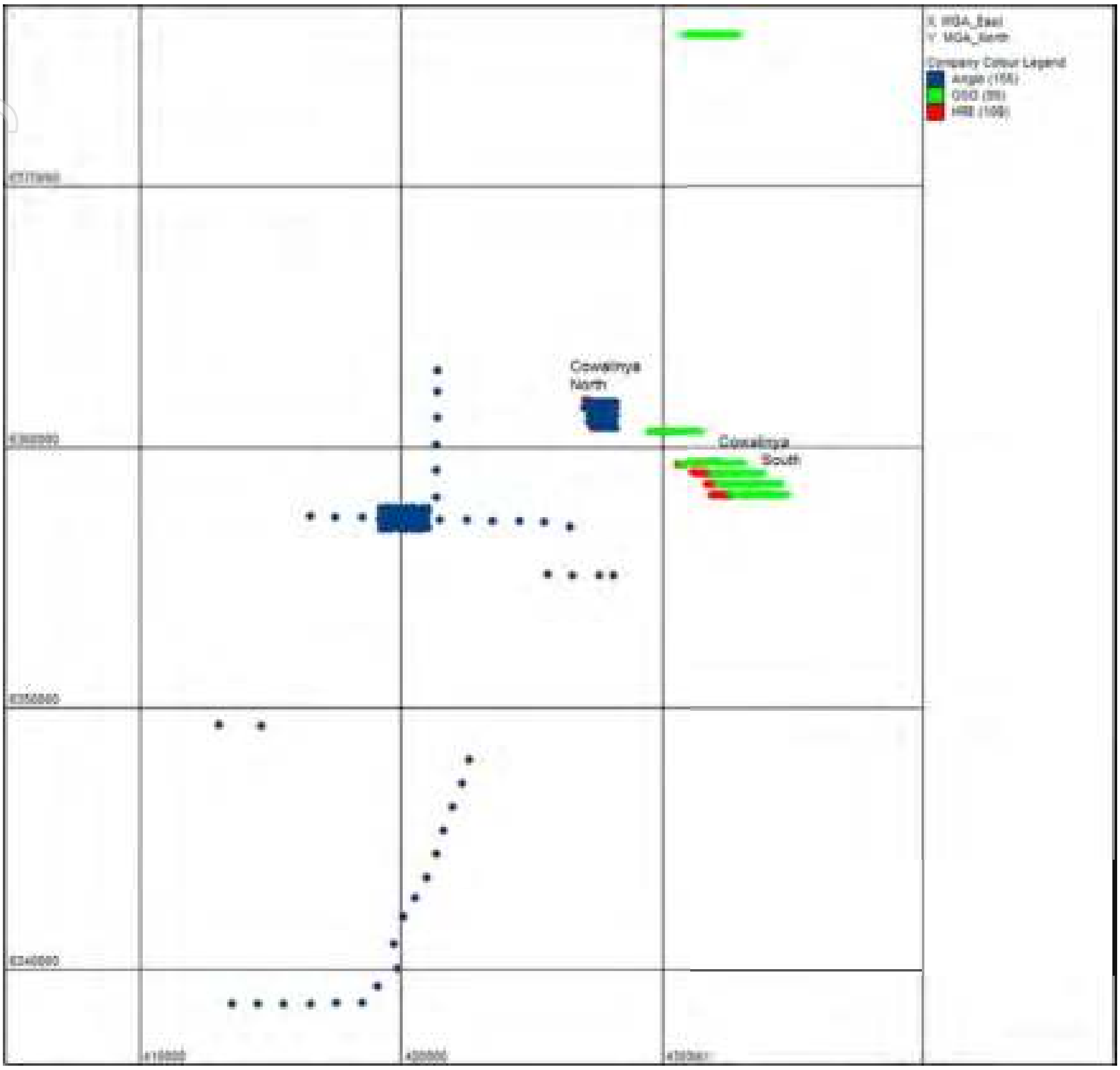


Figure 3-2 HRE and historical Anglo drill hole collar positions at Cowalinya North

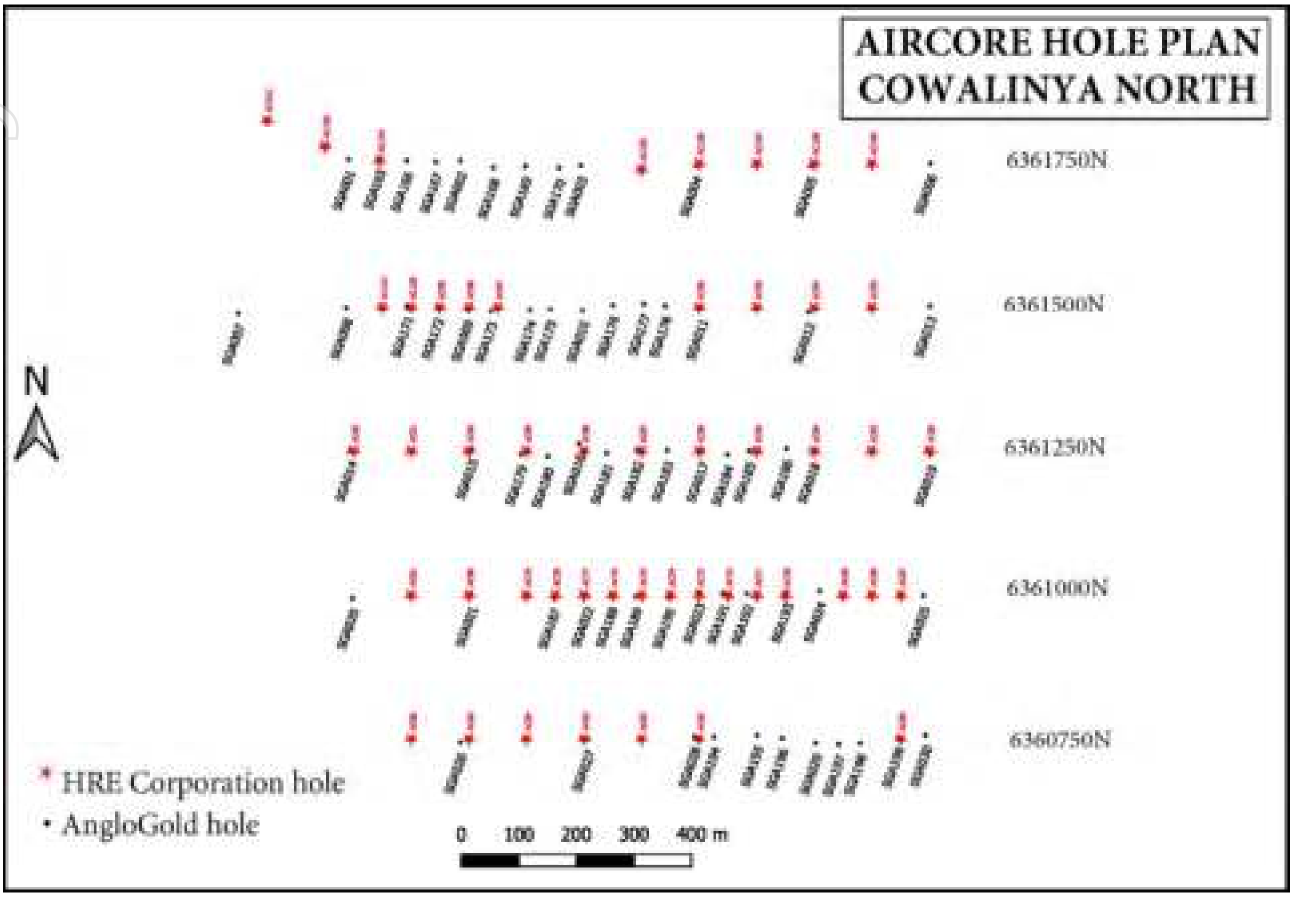
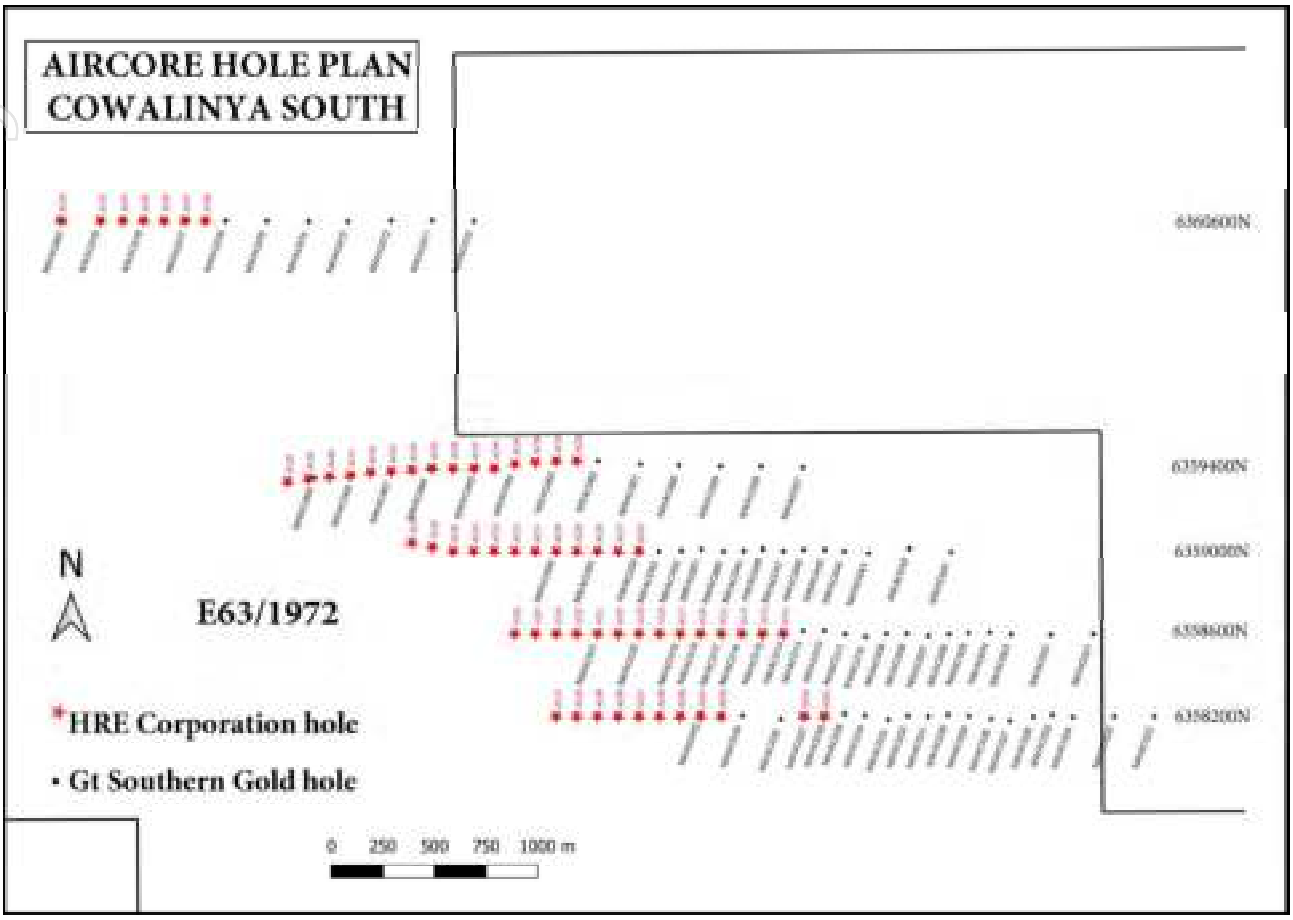


Figure 3-3 HRE and historical GSG drill hole collar positions at Cowalinya South



3.2 Site visits

The Competent Person for the data and geology, Mr. David Ross of HRE has visited the site on five occasions. The first three visits involved geological reconnaissance, a heritage survey and drill line clearing.

Mr. Ross then supervised the HRE aircore drilling program, logging the holes and undertaking the sampling. A follow up visit was subsequently made to obtain further samples for metallurgical testwork. On this visit he was accompanied by Mr. Richard Brescianini and Mr. Patrick Harford, both consultants to HRE.

JMCTC has not visited the Cowalinya project site as of the date of this report.

3.3 Drilling methods

The Cowalinya deposit has been sampled using aircore drilling from surface.

3.3.1 Aircore drilling

Aircore samples were collected on the recent HRE drilling programme (2021) by Gyro Drilling Pty Ltd, using an Edson drilling rig. A 3.5-inch blade bit was the predominant size drilled for this programme. Percussion hammer drilling took place occasionally when hard silcrete bands were encountered. Drill samples were collected every metre down hole into plastic bags.

All aircore holes were drilled from the surface. On completion of drilling, all of the holes were plugged to avoid washouts and injury to local wildlife. A labelled wooden peg remains at the collar locations.

3.4 Surveying

3.4.1 Grid control

The grid projection used for Cowalinya is MGA_GDA94, Zone 51. All reported coordinates are referenced to this grid.

The drill hole fence line azimuth is approximately 090° magnetic, with all holes dipping 90°. The drill fence lines are arranged parallel (to sub-parallel) to each other at differing northings (Figure 3-2 and Figure 3-3).

3.4.2 Drillhole collars

For the recent drilling, all of the collars were set out using a hand-held Garmin Etrex 10 GPS, which has an accuracy of ± 3.65 m. After completion of drilling all of the collars were re-surveyed using the same tool.

Historical drill holes were surveyed with RTK GPS and DGPS from 2010 to 2017. Traces of these holes were still visible at Cowalinya and these were used to help site the HRE drilling collars prior to drilling.

The orientation of drilling with respect to mineralisation is not expected to introduce any sampling bias. Drillholes are planned to intersect the mineralisation at an angle of approximately 90°.

3.4.3 Downhole surveying

No downhole surveys were completed for any of the HRE drilling to date. All holes were given a nominal -90° dip measurement. The drill holes were almost all 40 m or less in depth and relative deviation is unlikely to be a problem for sample location and proposed open pit mining.

3.4.4 Surface topography

A local topographic surface has been generated using surveyed drill hole collars from the previous drilling campaigns by GSG and Anglo. The topography at Cowalinya is very flat with almost no changes in elevation.

3.5 Logging, sampling, assaying and data management procedures

3.5.1 Geological logging

The aircore chip logging was completed on site using paper logging sheets by the responsible geologist, Mr. David Ross, and later entered into a Microsoft Excel drillhole database. JMCTC checked the data for accuracy when transferred to ensure that correct information was recorded.

The chips were logged using lithological and physical characteristics (such as colour, weathering and texture); logging codes and logged intervals were based on lithological intervals. Recoveries and moisture content were also recorded.

In the historical holes drilled prior to 2021, the database generally only has information for lithology type and colour. If additional information is available on the original logging sheets for these earlier holes, JMCTC recommends digitizing it and recoding it into the database.

The earlier aircore data, collected by Anglo and GSG, has not had its geological logging officially verified, however the logged geology matches the HRE drilled hole logged geology in nearly all cases and the older logging was used to assist in the current interpretation.

All of the aircore chip samples have been logged to a level of detail to support a preliminary Mineral Resource estimation and classification under the JORC Code.

3.5.2 Sampling

A total of 109 aircore holes were drilled into the deposit by HRE. All were geologically logged and assayed for the full suite of REEs; La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y, as well as Sc, Th and U. Holes were not usually assayed from surface, but from within a few metres above the top of the Upper Saprolite unit. This was commonly around 8 m from surface.

The historical 254 aircore drill holes drilled by GSG and Anglo were not used in the Cowalinya grade estimation, as these were predominantly only assayed for gold. The GSG holes had La, Ce and Sc assays only down the length of the holes, with only the last sample in each hole (bedrock sample) having assays for the full REE suite as well as Sc, U and Th. The Anglo holes had only one sample per hole with REE assays, again the end-of-hole sample.

Both the GSG and Anglo drilling were geologically logged, and this was used to aid in the interpretation for the Cowalinya estimate. A total of 44 GSG holes and 65 Anglo holes were used in the interpretation. The drilling used in the grade estimation totalled 2,481 m at the cut-off date for the resource estimate.

All of the HRE drilling sampled both high and low grade material.

Drilling was generally dry with a few damp and wet samples. All drill samples were collected from a cyclone into large green plastic bags. Splitting was not used due to the high clay content expected in many of the samples.

Aircore chip sample recovery was gauged by how much of the sample was collected from the cyclone as monitored by the responsible geologist whilst drilling. This was recorded as good, moderate or poor. HRE has recorded that no significant sample recovery issues were encountered during the aircore drilling.

Aircore samples for assay were collected by spear sampling. Aircore chip sample calico bags were then collected and grouped into green plastic bags before being transported to the assay laboratory. The sample reject green bags have mostly been left at site with a few transported to Perth for storage.

In order to ensure no loss of data or material and that the correct samples were submitted to the laboratory, all chip samples were personally delivered by the responsible geologist.

3.5.3 Sample preparation

Samples were submitted to LabWest Laboratory in Perth, WA. Their sample preparation procedure for REEs is as follows:

- Sort and dry samples at 110°C
- Crush to <2mm using LM1 mill and then rotary split to ~500gm (a coarse duplicate is taken every 40th sample)
- Pulverise the 500gm split to 85% passing 75µm (pulveriser bowls are routinely cleaned with a barren charge between samples).

The sample preparation techniques used for the 2021 drilling appear to be of industry standard and appropriate for the sample types and proposed assaying methods.

3.5.4 Assaying

For the 2021 drilling programme all aircore samples were assayed for the REE suite (La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y), as well as Sc, Th and U. The method used is the LabWest MMA-04 technique which consists of a microwave assisted hydrofluoric acid based multi-acid digest with ICP-MS/OES finish. This is considered a near total digest. The assay procedure used is as follows:

- Digest 0.1gm of pulverised sample in a hydrofluoric based multi-acid mixture under high pressure and temperature (microwave assisted)
- Analyse resulting solution for all required elements using ICP-MS and ICP-OES.

LabWest also used certified standards, blanks and sample repeats for quality control, with acceptable levels of accuracy achieved.

The laboratory procedures all appear to be in line with industry standards and appropriate for rare earth deposits, and LabWest is industry recognized and certified.

3.5.5 Twinned drillholes

At Cowalinya South, many HRE drill holes were drilled in an area where previous drilling had been undertaken by GSG in 2015.

All of the GSG holes had been buried for rehabilitation after being picked up with a hand held GPS. Their drill lines were still discernible however and HRE rehabilitated these drill lines for use in siting its drilling in 2021. HRE also used a hand-held GPS to locate its drill collars, so the locations are accurate to within 3 to 4 m.

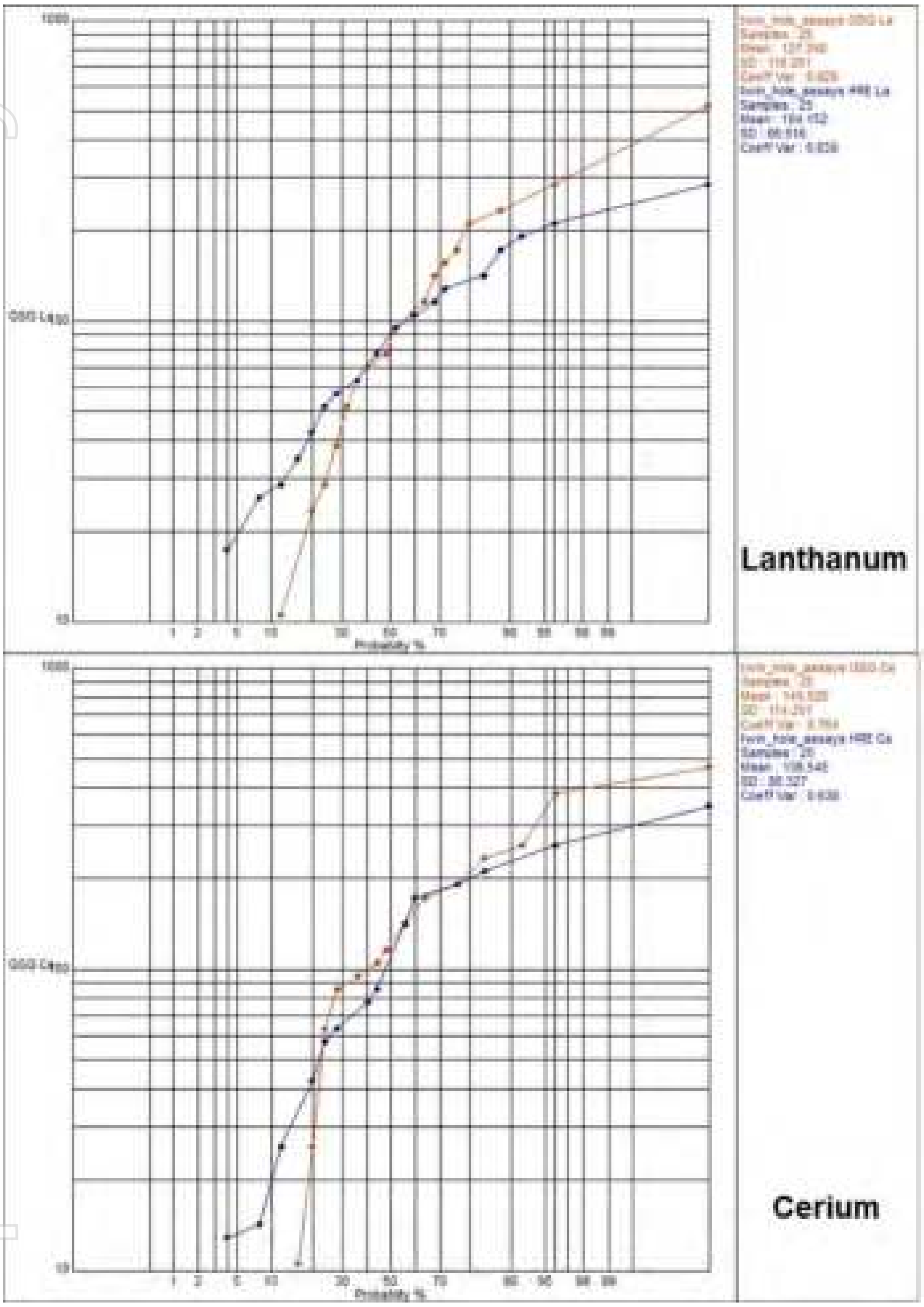
As GSG generally sampled their holes using three metre composite samples and HRE with four metre composites, a direct assay comparison between many holes in the two drilling programs is difficult.

Three HRE drillholes (AC0004, AC0016 and AC0028) were drilled very close (within 10 – 15 m) to three historical GSG holes (NWAC018, NWAC040 and NWAC055 respectively). HRE sampled these holes at one metre intervals and created three metre composite samples in order to compare the assays from the two sets of holes.

Both HRE and GSG assayed their samples using similar methods, HRE by four acid digest method at LabWest and GSG assayed their samples by four acid digest at Intertek Genalysis (formerly Genalysis).

La and Ce were the only REEs assayed for every sample in the three chosen historical holes and these were compared to the HRE assays. The mean grades for La and Ce are generally within 15% of each other and the log probability plots in Figure 3-4 show that the populations for both elements are similar. JMCTC generated similar plots separately for each pair of twinned holes, and although there are few data points, the results are very similar.

Figure 3-4 Twinned drillholes – Log probability plots for all samples; La and Ce



The logged geology in each pair of drill holes was also very similar.

3.5.6 Bulk densities

Dry bulk density testwork was completed on 48 samples from 13 drill holes from the north and south areas at Cowalinya. Samples were taken from the upper and lower saprolite units only. Forty of the samples were LabWest pulps and eight were pulps from metallurgical testwork. Three of the metallurgical samples were from the same drill hole and sample intervals respectively as three of the LabWest pulps.

As these were chip samples from aircore drilling, Archimedean density determinations were not possible and the samples were dried and underwent pycnometer testing. Pycnometer testing was completed using xylene displacement and all the pulp samples were dried, crushed and pulverised prior to testing.

As the pycnometer tests give a reading close to a specific gravity measurement, rather than a bulk density, allowance has to be made for moisture and porosity in each sample. Samples from the green plastic aircore sample bags were taken from 4 holes (8 samples) to determine average moisture content for the upper and lower saprolite units. These samples were weighed when wet, dried in an oven at 80˚C for 24 hours, then re-weighed.

The three LabWest pulps from the same intervals as the metallurgical pulps returned slightly lower specific gravity measurements. This is probably due to LabWest drying their samples at 110˚C compared to the 80˚C used by the metallurgical lab. This could lead to extra loss of water of crystallisation, leading to a lower overall specific gravity.

The moisture content measurements ranged from 9.06% to 24.92%, averaging 16.89%. As there were few samples, and in order to be conservative, the highest moisture content reading was rounded and used, with an extra allowance of 10% for air (porosity) in the samples. This gave an equation for calculation of bulk density of solids 65%, moisture 25% and air 10%. Removing the moisture for a dry bulk density measurement, results in a calculated average dry density for the saprolite units of 1.63 t/m^{-3}.

Table 4.10 in Section 4.2.4 below lists the final density values used in the block model for each geological unit.

3.5.7 Analytical quality control (QA/QC) procedures and data

There are 827 assays in the Cowalinya database as presented to JMCTC for this estimate. HRE has incorporated field duplicates, pulp repeats, standards and blanks into the sampling stream. The laboratories that completed the assaying also added standards and umpire assays for their internal QAQC.

Table 3.2 shows the number of different QAQC sample types and the percentage of the sample stream they represent for the overall drilling programme.

Table 3.2 QAQC sample types and numbers

QAQC Sample Type	Number of Samples	Percentage of sample stream
Standards (including laboratory inserted standards)	84 (68)	10.2
Blank	5	0.6
Laboratory Blank	52	6.3
Field Duplicate	10	1.2
Coarse Duplicates (Coarse Splits)	22	2.7
Pulp Duplicates	50	6
Umpire Samples	46	5.6
Umpire Lab Standards	14	1.7
Assay Method Comparison	46	5.6

QAQC results from both the primary and secondary assay laboratories show no material issues with the main variables of interest for the recent assaying programmes.

The most recently used laboratory, Bureau Veritas, calibrates the ICP-MS machine once per shift using specially prepared calibration beads.

The aircore chip samples have been duplicate sampled at the rig and then submitted to the laboratories. QAQC samples were inserted into the sample stream prior to delivery of samples to the laboratory. In JMCTC's opinion, this is good practice, as all QAQC samples should, as much as possible, be anonymous and indistinguishable from the rest of the sample stream.

3.5.7.1 Standards

In the QAQC reporting for Cowalinya, seven separate standards have been used over time. Three of these were used by HRE and four by the laboratory. All were commercially available, certified Ore Research & Exploration P/L (OREAS) standards. Standards used were 20a, 24b, 47, 120, 460, 461 and 920. Most have certified values and expected standard deviation values recorded for a four-acid digest method, apart from two. Standard 24b and 120 had no values for Nd and 24b had no values for Dy for four-acid digest. Certified expected values and standard deviations were used from the results of the sodium peroxide or lithium borate fusion with ICP-OES and ICP-MS methods.

Standards 20a, 460 and 461 were inserted into the stream by HRE and, although quite different grain size to the chip samples, were blind. JMCTC believes that it is important that all QAQC samples are as anonymous as possible to the laboratory to ensure lack of any potential bias in their treatment.

The standards all appear to be testing for very high (>5,000 ppm) total rare earth oxides (TREO) or low TREO (approximately 200 ppm or lower) and there are not any for mid-range above-cut-off grade TREO values. The highest grade standards (460 & 461) are from carbonatite REE sources and have values from 5,300 ppm to over 10,000 ppm, which are probably a bit high for the grade at Cowalinya.

Standards used generally showed good precision, usually plotting within plus or minus 2 standard deviations (±2SD) of the expected values, particularly in the laboratory inserted standards. There does appear to be an apparent trend of less precision for many of the samples in the more recent results, with many of the plots showing more irregularity and a wider range of values for the data on the right-hand side of the plots.

While the numbers of standard samples submitted by HRE was low, only four to six per standard, they do not appear to have performed as well as the laboratory submitted standards, particularly for standards 460 and 461. Many of the results plot well outside the ±2SD limits. The laboratory submitted standards had more results for comparison, with 15 to 19 per standard.

Two obvious issues are apparent when looking at the standard plots, with the first being the performance of Sc. Nearly all of the plots show very poor precision and poor accuracy for the Sc plotted results. The second obvious issue is the performance of Dy for standard 24b, where all samples plot well below the -2SD line. Precision is good for Dy, with most samples returning assays within 8% of the mean, but the mean of the batch is over 30% below the expected value for Dy. This may be an issue with the certified value relating to a different assay method however, but should have been checked with the laboratory as soon as the sample results were returned.

Figure 3-5 shows the standard plots for the HRE inserted standard OREAS 460, for La, Ce, Nd, Dy, Sc, Th and U.

Figure 3-5 HRE inserted standard OREAS 460 – La, Ce, Nd, Dy, Sc, Th & U

Figure 3-6 shows the plots for the LabWest inserted standard OREAS 24b, for La, Ce, Nd, Dy, Sc, Th and U. Of note are the Dy and Sc plots.

Figure 3-6 LabWest inserted standard OREAS 24b – La, Ce, Nd, Dy, Sc, Th & U

The additional plots for the HRE inserted standards 20a and 461, as well as the plots for LabWest inserted standards 47, 120 and 920 are presented in Appendix E.

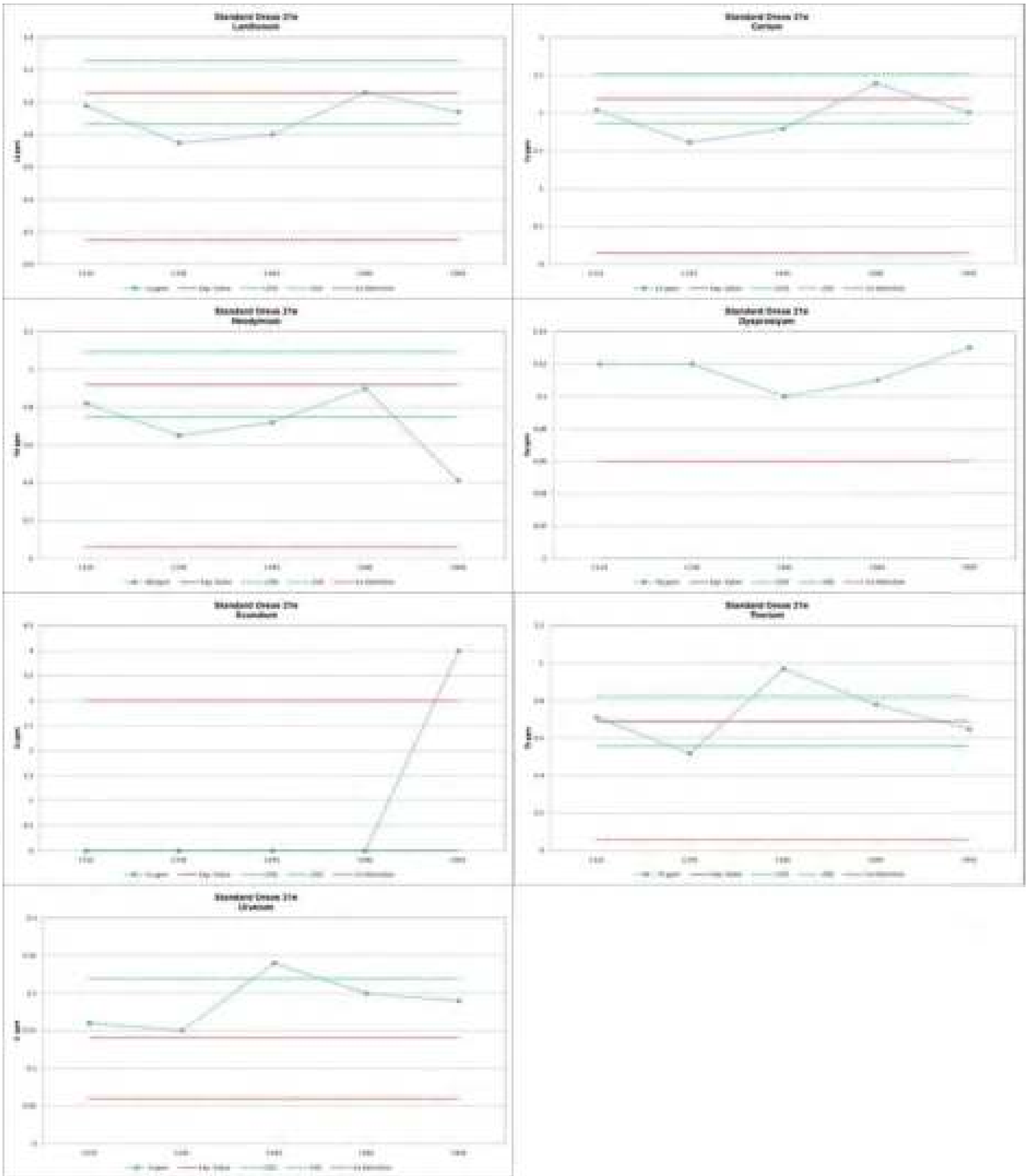
3.5.7.2 Blanks

Blanks have been inserted into the sample stream by HRE and LabWest. HRE submitted five samples of an oxide quartz blank OREAS standard (21e) to account for approximately 0.6% of the QAQC data. LabWest also inserted blanks into the stream. It is unclear as to what this material was and what the actual results were, as all of the results are recorded in the database as “X”. LabWest submitted 52 samples as blanks.

OREAS standard 21e has no certified values for Dy or Sc, and while the other results are generally within ±2SD, they are all well above three times detection limit values. Usually they are an order of magnitude higher, although they are all at the very low end of mineralisation grades at Cowalinya and can be considered a proxy for “blank” material.

Figure 3-7 shows the results for the OREAS standard 21e submitted by HRE.

Figure 3-7 HRE inserted standard OREAS 21e (“blank”) – La, Ce, Nd, Dy, Sc, Th & U



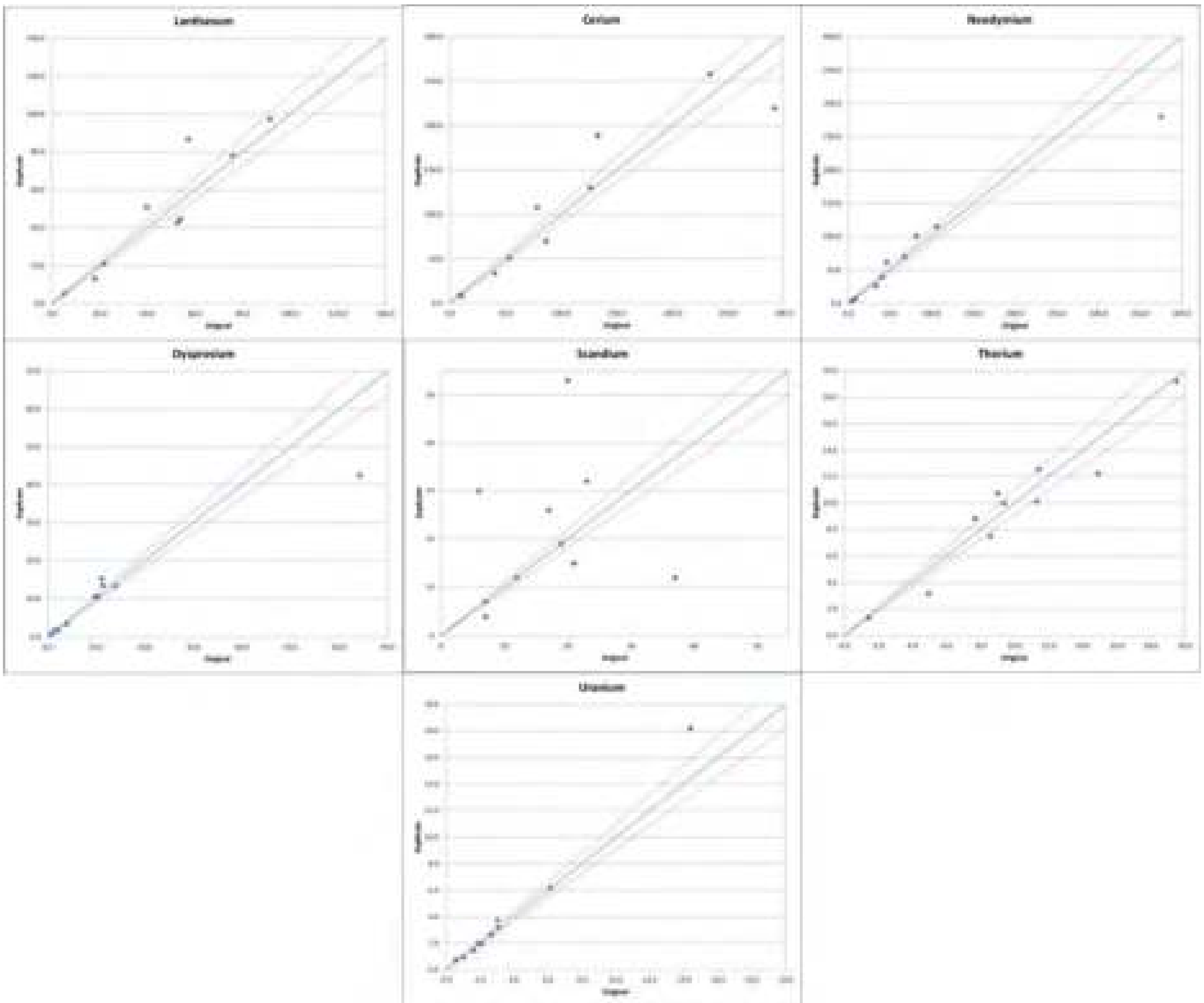
Blanks are important in the sample stream to detect any background contamination, or cleanliness issues with the lab sample preparation practices. It is important to try to source material that has zero values for any expected variables of economic interest, or penalty or potential deleterious elements.

3.5.7.3 Field duplicates

Aircore samples are re-speared at the collection stage to get representative (2 kg to 3 kg) duplicate samples for field duplicate assay.

To date, only ten pairs of data have been collected at Cowalinya, which is just over 1% of the data. Figure 3-8 shows scatterplots for the field duplicates for all samples in the 2021 drilling programme.

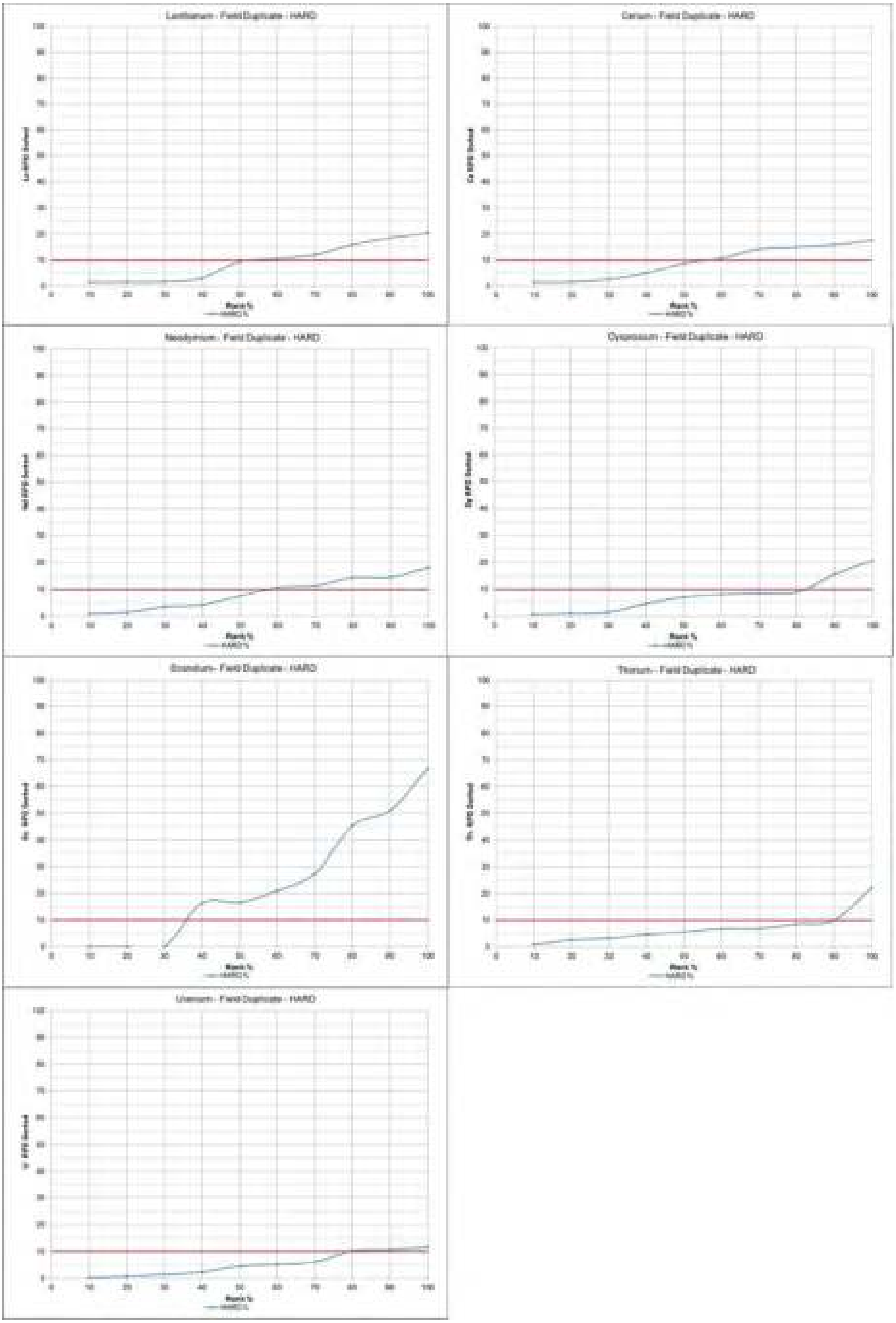
Figure 3-8 Field duplicates, scatterplots – La, Ce, Nd, Dy, Sc, Th & U; all samples



The plots show reasonable accuracy and precision, apart from Sc, with no obvious bias towards any assay. Most samples do however, plot outside the ±10% error, which may be in part due to the sample method.

Figure 3-9 shows half absolute relative difference (HARD) plots for the same elements as above, which gives better indication of how alike or different the two sets of data are.

Figure 3-9 Field duplicates, HARD plots - La, Ce, Nd, Dy, Sc, Th & U; all samples



The plots nearly all show good repeatability, with generally over 55% of the data pairs with differences of 10% or more. Some are a bit lower than would be expected for minerals with very low variance in the statistics, and are a little bit lower than the expected range of field duplicate results. Of the REEs plotted, only Dy has HARD values in the expected range or better. Generally it is expected that field duplicates will have 70% or more of samples with differences of 10% or less.

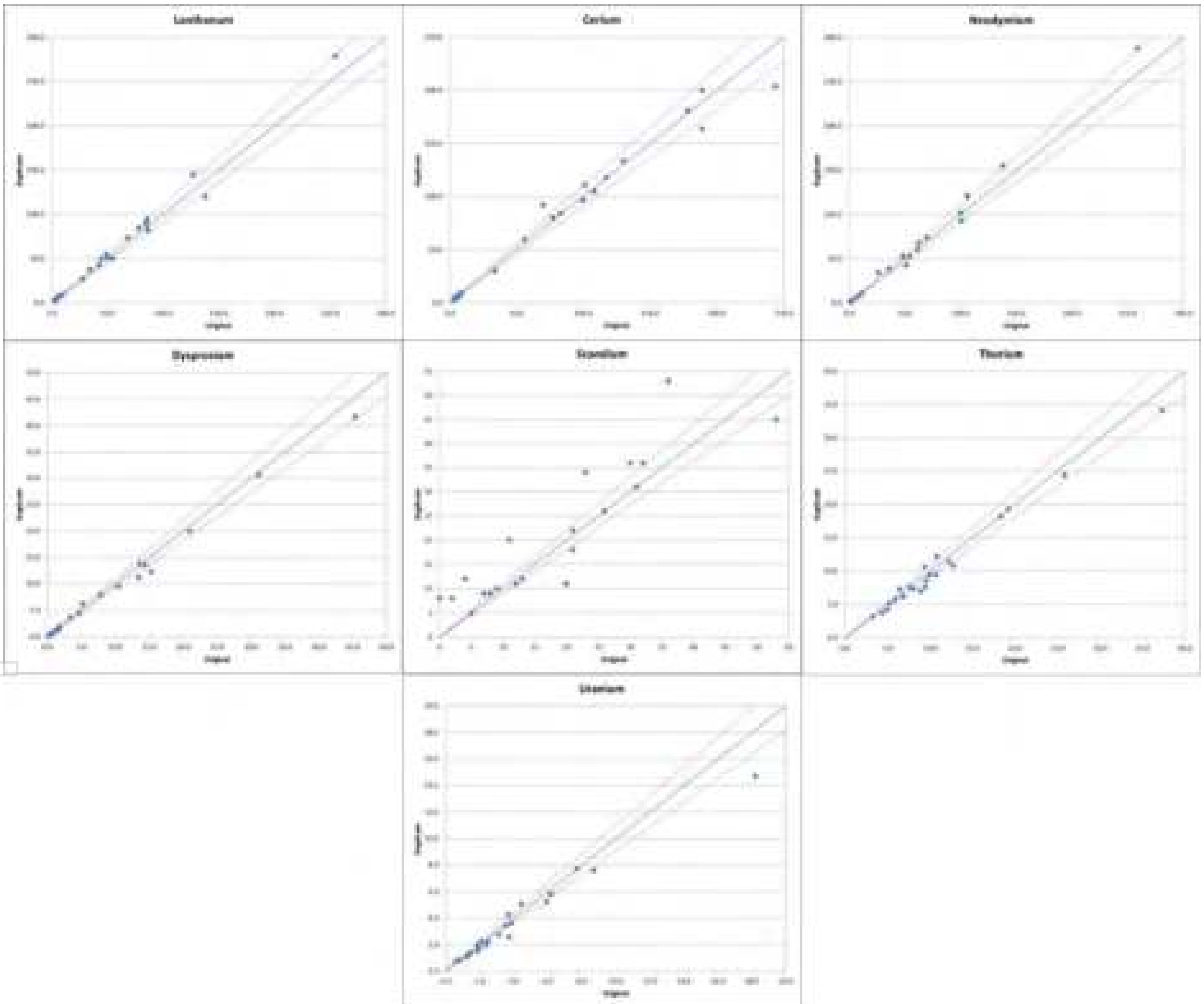
Sc results are very poor and there may be some issues with the accuracy and precision of the assay technique for this element.

3.5.7.4 Coarse Duplicates

HRE instructed the assay laboratory (LabWest) to take a second split sample after the sub-2 mm crushing stage after every 40 samples. These coarse duplicates (or splits) were then pulverised and assayed along with the other pulps. This split stage gives an indication of how good the homogenisation of the crushed samples are, but will be affected by the natural variability of the assayed element.

Figure 3-10 shows scatter plots for the coarse duplicates for La, Ce, Nd, Dy, Sc, Th and U in all samples.

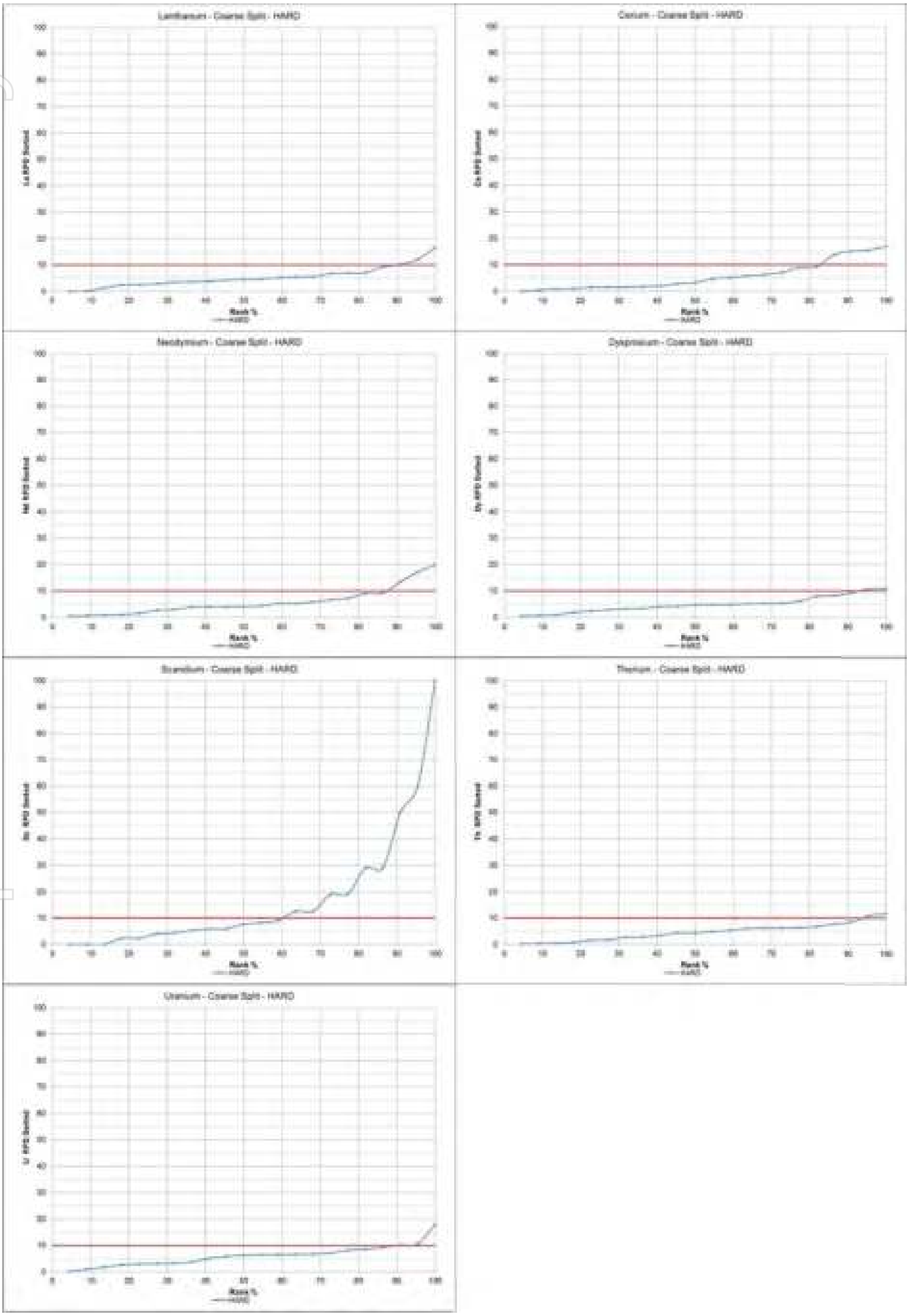
Figure 3-10 Coarse duplicates, scatterplots – La, Ce, Nd, Dy, Sc, Th & U; all samples



As with the field duplicates, there is a spread of data points, although no obvious bias. Sc again performs poorly, with a much larger spread of points than the other elements. For most elements, apart from Sc, there are less plotted points outside the ±10% ranges, suggesting closer correlation between the original and duplicate as expected.

Figure 3-11 shows the HARD plots for the same elements for all coarse duplicate samples.

Figure 3-11 Coarse duplicates, HARD plots - La, Ce, Nd, Dy, Sc, Th & U; all samples



Performance is as expected or better for all elements, apart from Sc again, with all showing 80% or more pairs with differences of less than 10%. This performance is on par with expected coarse duplicates and even matches expected pulp duplicate performance in some cases (over 90% of pairs with <10% difference).

3.5.7.5 Pulp duplicates

Fifty pulp duplicate samples are in the database, making up approximately 6% of the dataset. This is a good ratio to maintain for ongoing QAQC work.

These are selected by the laboratory at specified intervals. JMCTC would only recommend that HRE randomly selects remaining pulp from some of these samples and re-submits them to the laboratory for re-assay at a later date. The samples would give an idea of any assay precision or accuracy drift over time, or may help identifying bad batches of assays.

Figure 3-12 shows a scatter plot of pulp duplicates. There appears to be a slightly greater spread of points from the coarse duplicates, suggesting lower precision, particularly at the middle to higher grades. As with the coarse duplicates there appears to be no obvious bias, with some elements tending slightly towards the original and some towards the duplicate. Sc again is the outlier with relatively poor precision shown, although accuracy is acceptable.

Figure 3-12 Pulp duplicates, scatterplots – La, Ce, Nd, Dy, Sc, Th & U; all samples

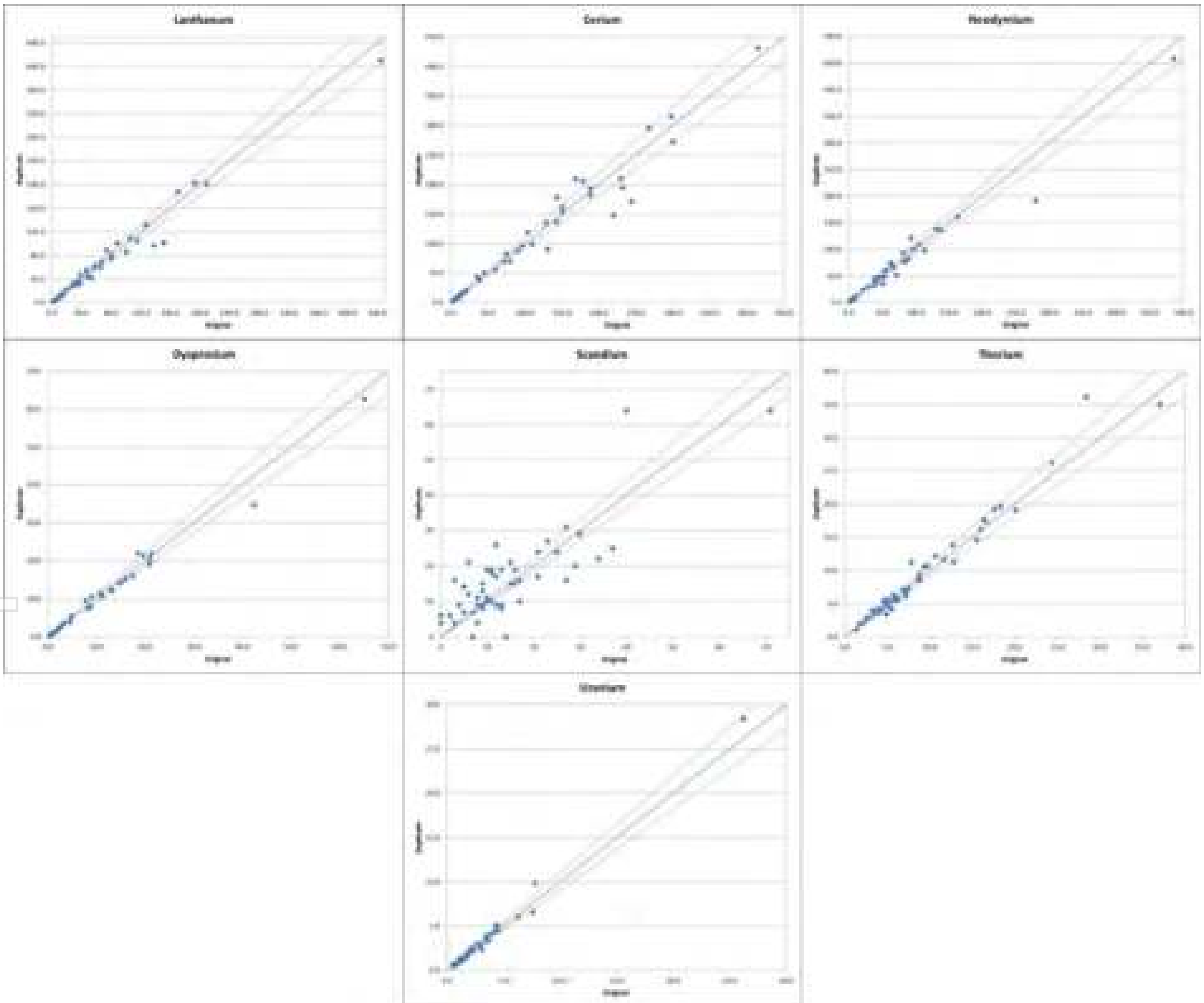
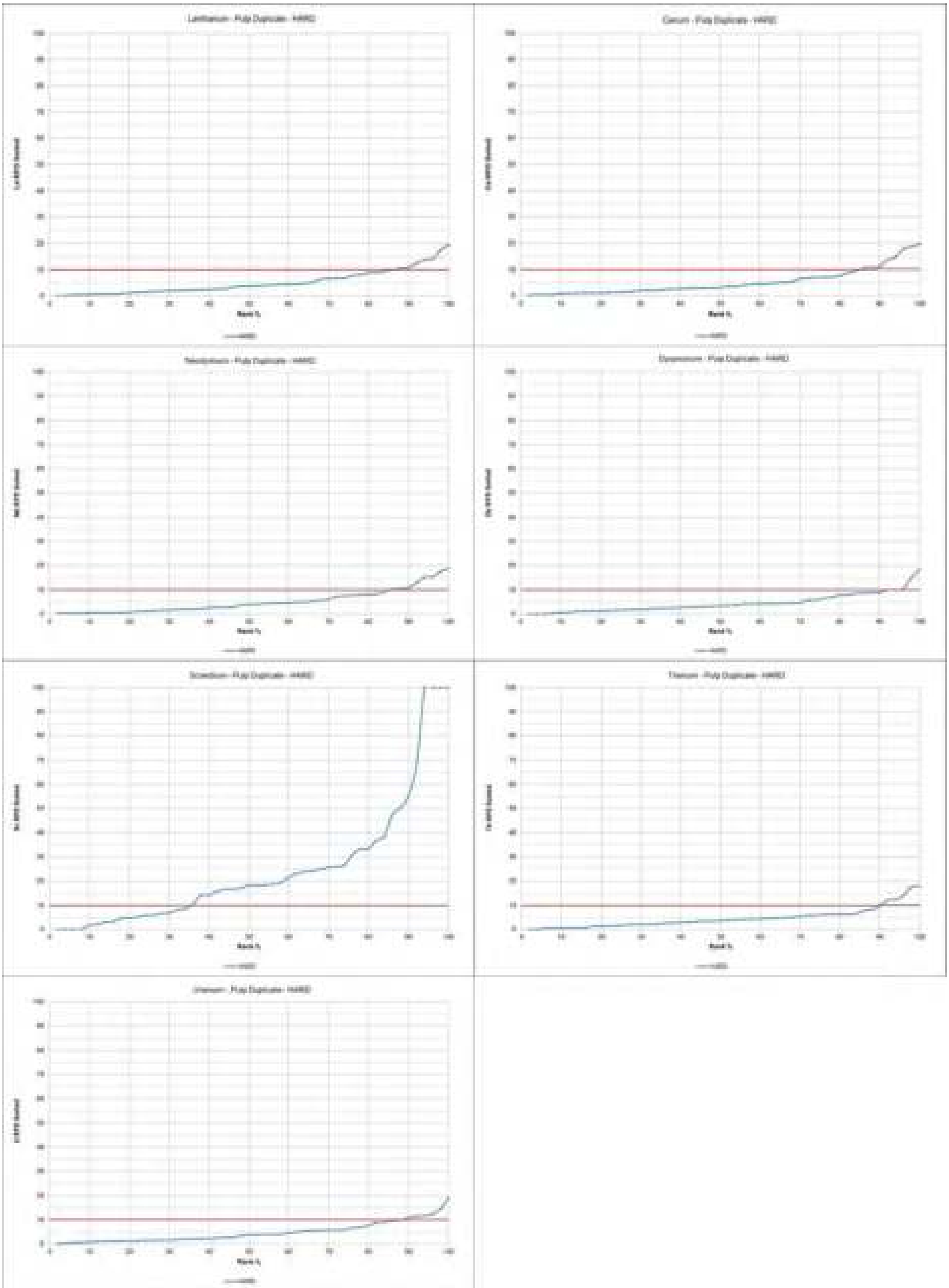


Figure 3-13 shows the HARD plots for the pulp duplicates. They show almost 85% of pairs have less than 10% difference, which is a bit lower than expected for pulp, which ideally should be 90% or more with less than 10% difference.

Figure 3-13 Pulp duplicates, HARD plots - La, Ce, Nd, Dy, Sc, Th & U; all samples



Sc again performs very poorly and even performs worse than the coarse duplicates, with 35% of sample pulp pairs with 10% or less difference, compared with approximately 60% of the coarse duplicates. There is clearly a problem with precision for Sc using the current assay method. JMCTC recommends HRE is more vigilant in future assaying campaigns to ensure that the laboratory can be notified of the poor performance and potential corrections can be made as soon as they are aware. Trying to sort out unexpected results at a later date is less than ideal and usually extremely difficult.

3.5.7.6 Umpire and check assaying

Bureau Veritas (BV) Laboratory in Perth, WA conducted 46 check assays on samples from Cowalinya South containing greater than 300 ppm TREO. These samples were taken from two drill holes, AC0016 (19 samples) and AC0028 (27 samples). These assays were completed primarily to check on different assay methods, to determine which was best for the Cowalinya REEs. BV used two methods for comparison; sodium peroxide (Na_2O_2) fusion with an inductively coupled plasma mass spectrometry (ICP-MS) finish and fused bead laser ablation with an ICP-MS finish. The laser ablation technique involves using a lithium borate ($Li_2B_4O_7$) flux to make a fused bead, which is then laser ablated rather than dissolved in acid prior to reading in the mass spectrometer.

Whilst these were not technically umpire assays, as the method changed from the primary assays and they could not be directly compared, they provide a useful check.

Six standards were included in the test assay stream, four were OREAS 460, two were OREAS 461 and one was the “blank” OREAS 21e. Plots show that the standards performed very well, with all of the laser ablation assay stream matching expected values almost precisely, apart from Dy in standard OREAS 460. Figure 3-14 shows the results from the OREAS 460 standard used for the laser ablation method assaying and Figure 3-15 shows the results from OREAS 461. Of note is the performance of Sc for these two standards using this assay technique. Although there are very few samples, the results are very good, being accurate and precise in both cases. This compares much more favourably than the Sc performance in the four-acid digest as seen in Figure 3-5 above.

Figure 3-14 BV Pulp Checks; Standard OREAS 460 – La, Ce, Nd, Dy, Sc, Th & U

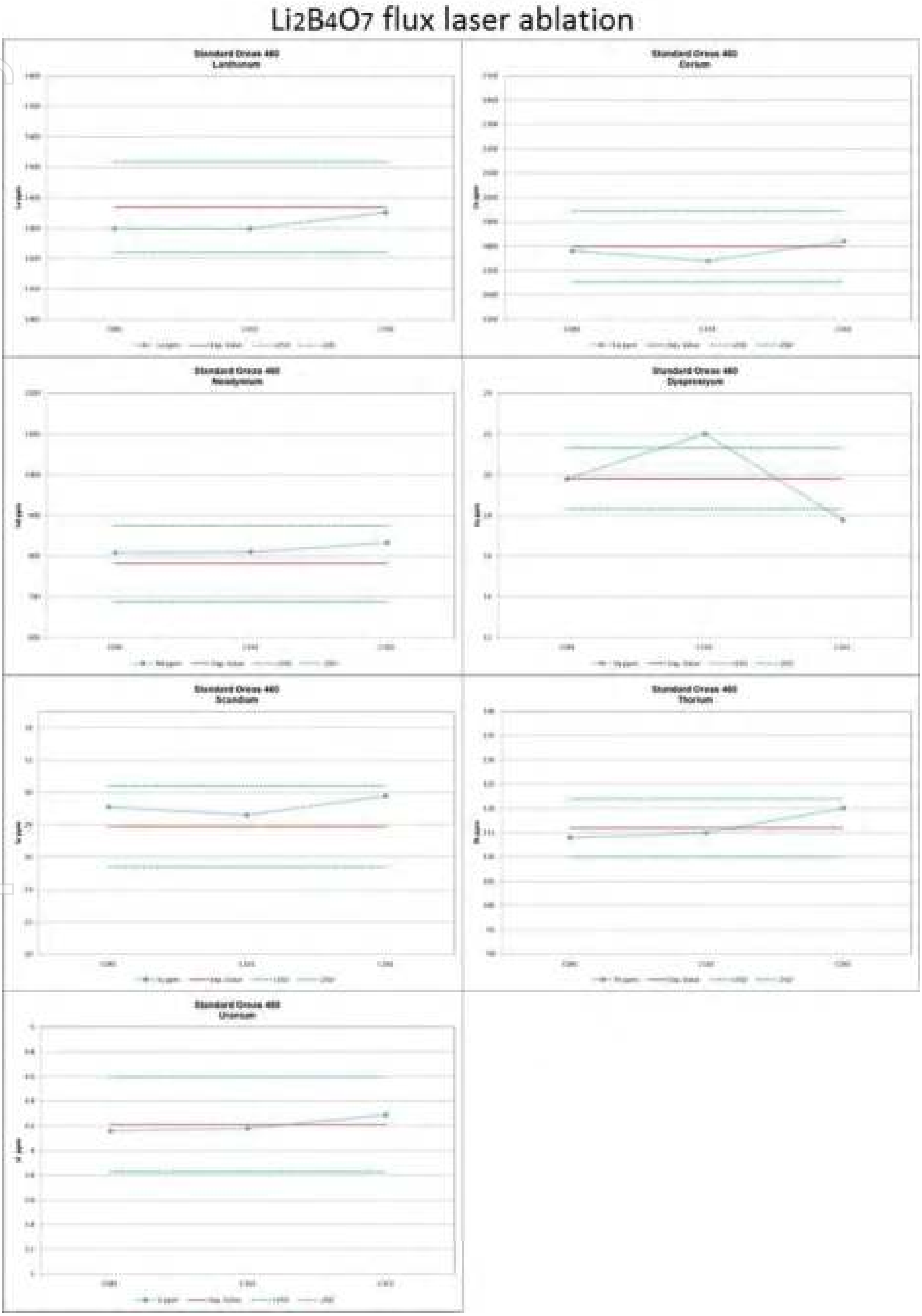


Figure 3-15 BV Pulp Checks; Standard OREAS 461 – La, Ce, Nd, Dy, Sc, Th & U

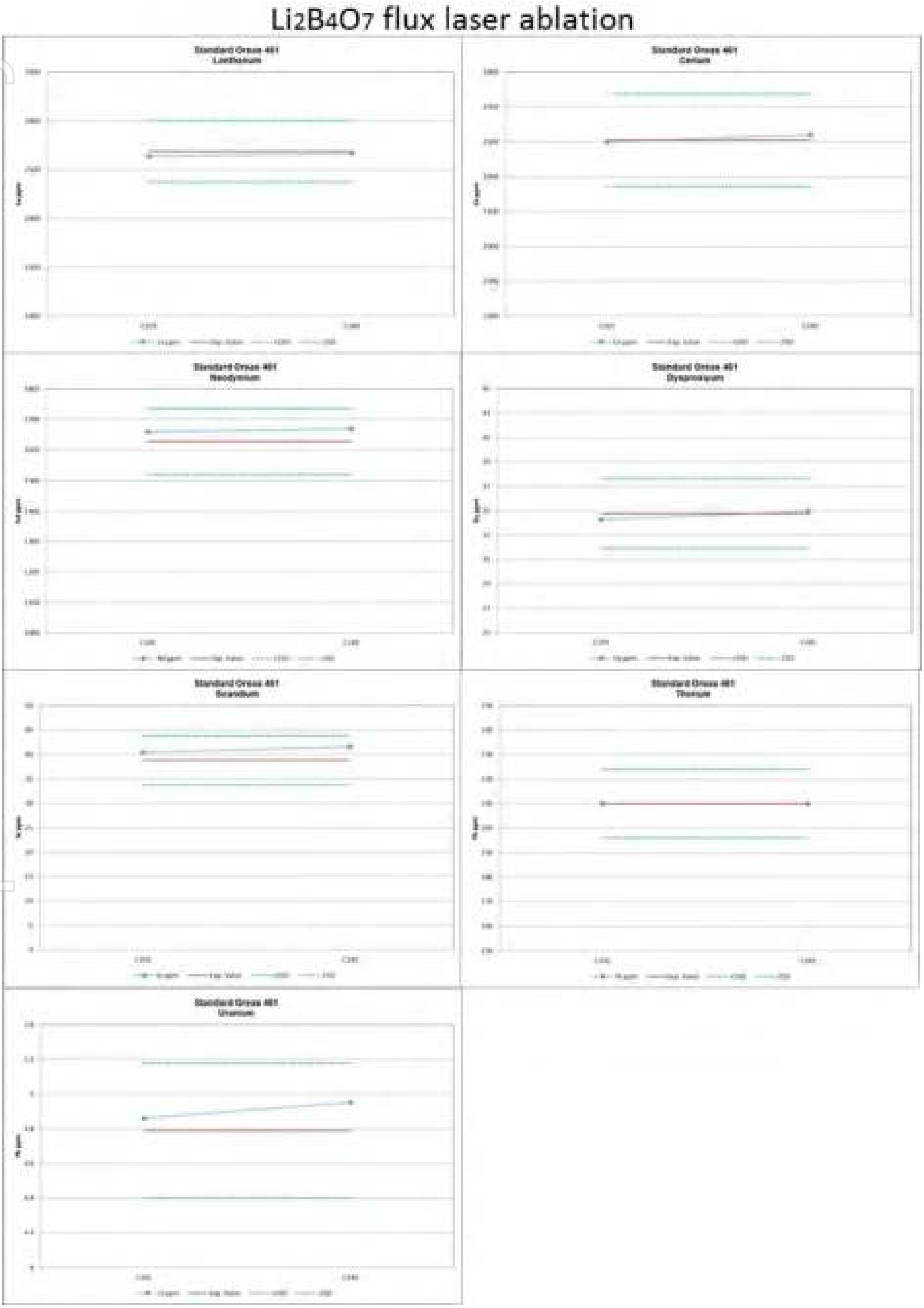
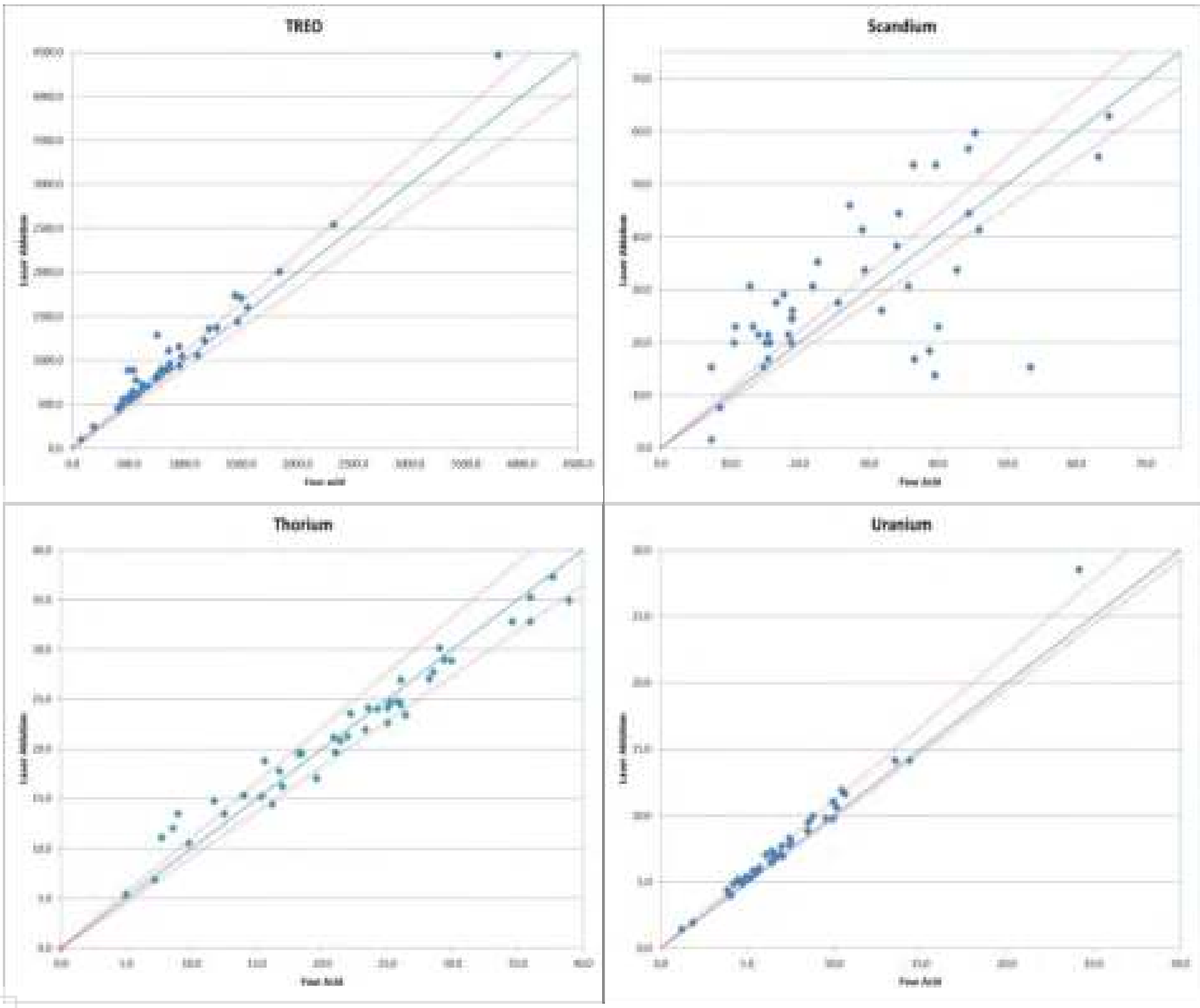


Figure 3-16 shows scatterplots for combined TREO grades as well as Sc, Th and U. The figure shows the original LabWest four-acid digest assays plotted on the X axes and the BV $Li_2B_4O_7$ laser ablation assays plotted on the Y axes. The TREO and U plots clearly show a bias towards the BV assays, with an approximate 10 – 12% increase in average grade. Th appears to have a slight bias towards the BV assay values at the lower end but a move to the LabWest assays as the grade increases.

Figure 3-16 BV check pulp assays, laser ablation scatterplots – TREO, Sc, Th & U; All samples



The BV laser ablation assays resulted in an average of approximately 12% higher TREO (approximately 8% median increase) than the original assays by LabWest, reflecting a total digest by the $Li_2B_4O_7$ fusion/laser ablation method as opposed to the 'near' total digest by the HF/multi-acid digest method.

BV also assayed the same pulps using a Na_2O_2 fusion technique, which also used an ICP-MS finish after dissolving the fused bead in hydrochloric acid. The same standards, OREAS 460 and 461 were used in this batch as well. Results for the standards are in Figure 3-17 and Figure 3-18 below. OREAS 461 performed very well, with all assays very close to expected values. OREAS 460 however, was not so accurate for the non-REEs, with Sc results being almost twice the expected result.

Figure 3-17 BV Pulp Checks; Standard OREAS 460 – La, Ce, Nd, Dy, Sc, Th & U

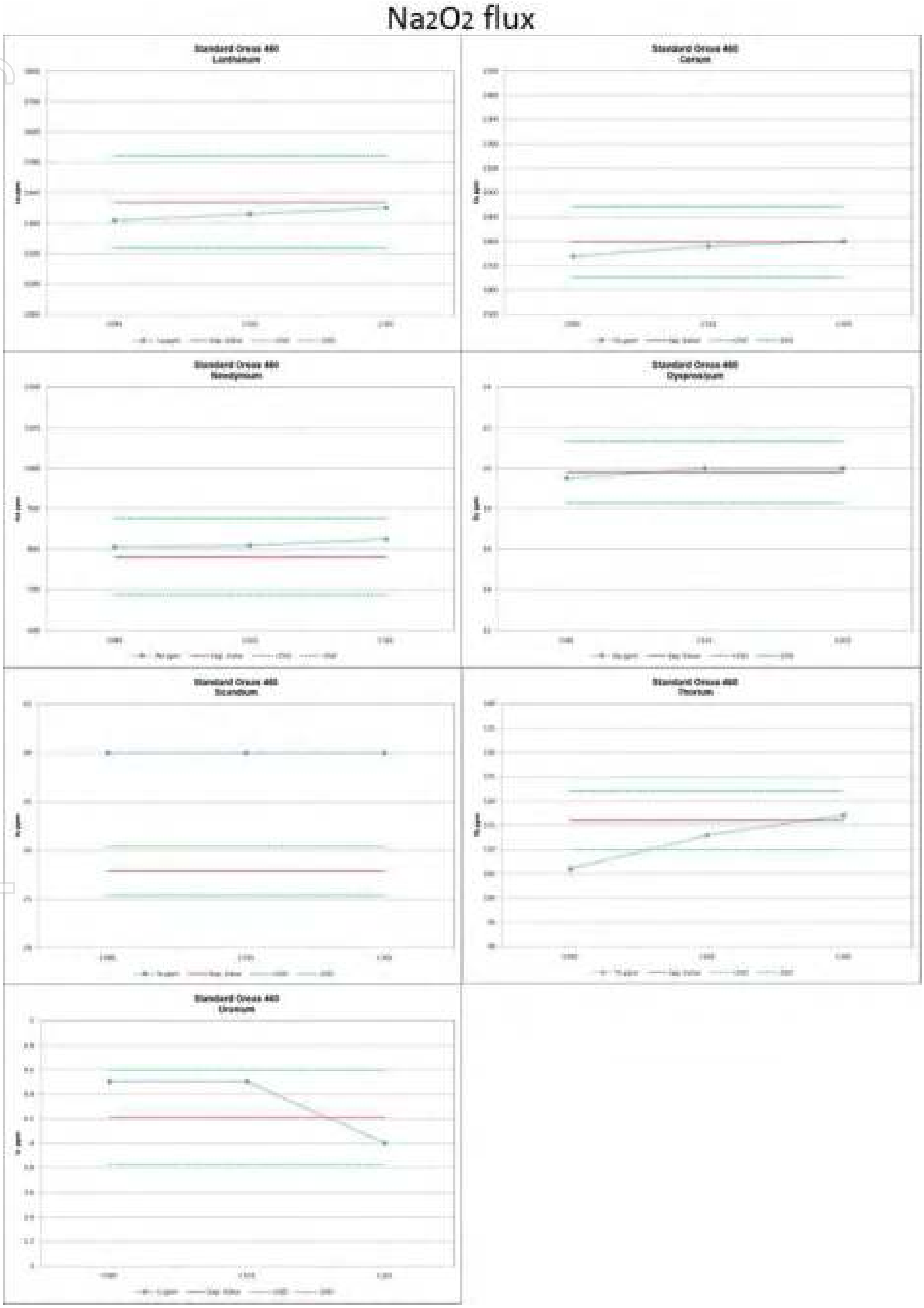
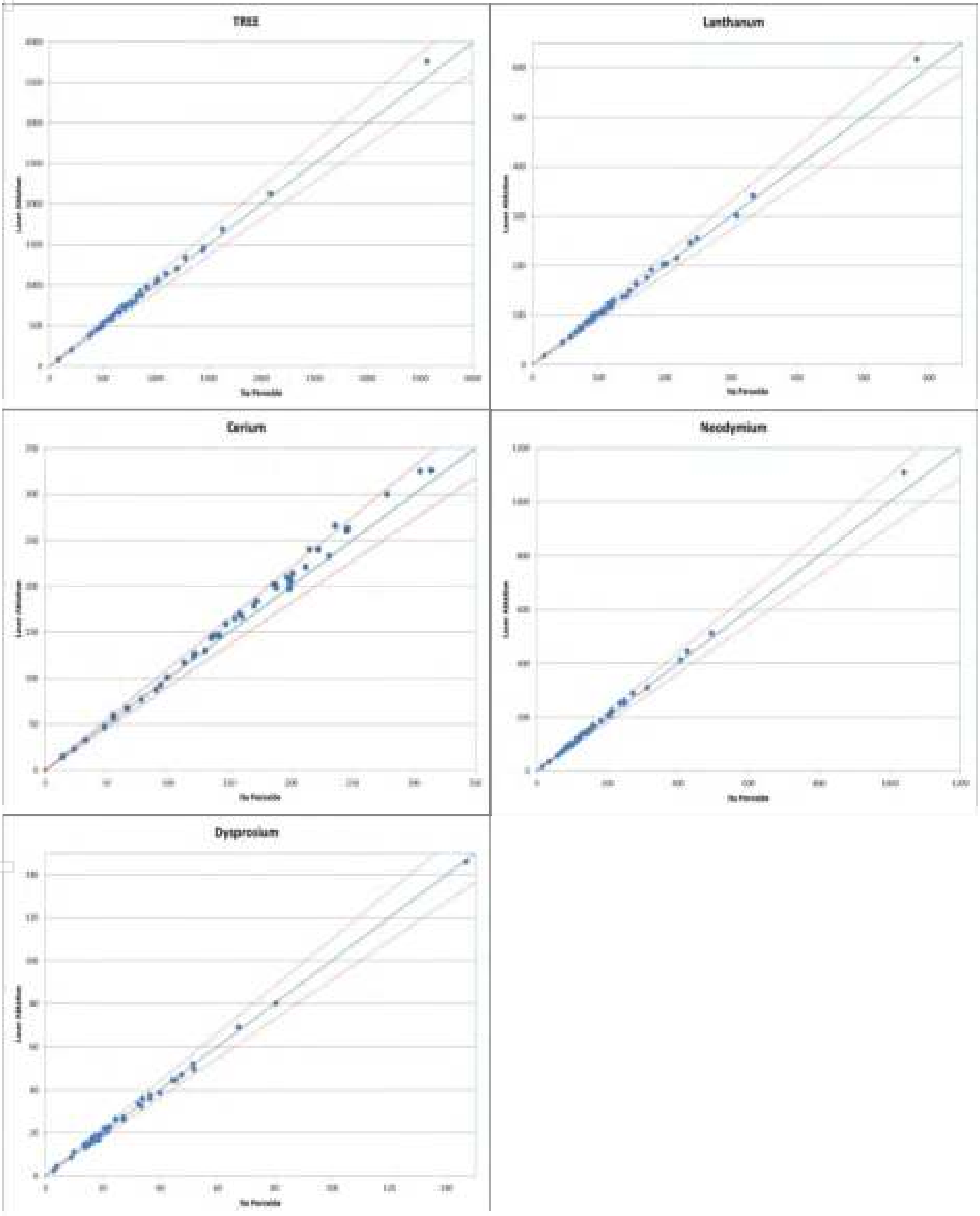


Figure 3-18 BV Pulp Checks; Standard OREAS 461 – La, Ce, Nd, Dy, Sc, Th & U

Figure 3-19 shows scatter plots comparing the Na_2O_2 fusion assay results with the laser ablation results. Results are plotted for total REE (TREE), as well as selected REE variables. There is a slight bias towards the laser ablation results, which are approximately 2.8% higher grade on average (2.3% higher median value).

Figure 3-19 BV check pulp assays, Na_2O_2 fusion scatterplots – TREE, La, Ce, Nd & Dy; All samples



It would appear that laser ablation is reporting most of the REEs within each sample, based on the results from the three assay methods. Sc seems to be more precisely measured using the laser ablation technique based on the standard plot results for OREAS 460 and 461 (Figure 3-14 and Figure 3-15 above). JMCTC recommends using the laser ablation assay method for future programmes if possible, as Sc is one of the most valuable components of the mineralisation at Cowalinya (based on prices at the time of this report).

3.5.8 Data management

During the drilling programmes, an experienced geologist was present and any issues noticed were rectified.

When samples were received by the laboratories, HRE were notified of samples received. Sample despatch sheets were compared against received samples and any discrepancies reported and corrected.

All of the drilling was logged onto paper and has been transferred to a digital form and loaded into a Microsoft Excel database. Logging information was reviewed by the responsible geologist when transferring from the paper copies.

All assay results were received as digital files (Excel spreadsheets and PDF files), as well as the collar and survey data. This data was transferred directly from the received files into the Excel spreadsheets. All other data collected for Cowalinya is recorded in Excel spreadsheets.

To JMCTC's knowledge, no adjustments or calibrations were made to any assay data, apart from JMCTC resetting below detection limit values to half positive detection values where required, prior to the statistical evaluation for the estimate.

3.5.9 Data verification

JMCTC has not visited the Cowalinya project site, nor physically viewed the samples. However, photographs of the drill collars as well as samples recovered have been viewed. JMCTC has relied on two independent HRE consultants, who have both visited the site and viewed the samples and drill hole collar positions, for verification of the data being collected.

The recorded data validation was initially completed by the responsible geologist logging the aircore chips and marking up the samples for assaying. The paper geological logs were transferred to Excel spreadsheets and compared with the originals for error. Assay dispatch sheets were compared with the record of samples received by the assay laboratories.

Prior to estimation, validations were completed when data was loaded into spatial software for geological interpretation and resource estimation. Data was checked for overlapping intervals, missing samples, "FROM" values greater than "TO" values, missing stratigraphy or rock type codes, downhole survey deviations of ±10° in azimuth and ±5° in dip, assay values greater than or less than expected values and several other possible error types when loading the data into CAE Studio 3 (Datamine) software. Furthermore, each assay record was examined and Mineral Resource intervals were picked by the Competent Person.

Only one minor error was discovered and corrected, with an incorrect "FROM" value in one geological logging record (drill hole AC0066 at 34m). JMCTC has not audited the database.

QAQC data and reports were also checked by JMCTC. The results and findings are presented in Section 3.5.7 above.

JMCTC concludes that the data integrity and consistency of the drill hole database shows sufficient quality to support Mineral Resource estimation.

3.5.9.1 Summary

Overall, the quality and quantity of QAQC samples for the Cowalinya database is acceptable for Mineral Resource estimation. The numbers of some QAQC types are a bit low however, although total drilling metres are low at this stage of the project as well. JMCTC recommends collecting a number of samples representing approximately 5% of the total database for each type.

JMCTC also recommends HRE take as much ownership as possible of the QAQC process to ensure the most unbiased results.

The number of standards used is adequate, although one or two standards that would match the mid-grade portion of the data (within 500 – 700 ppm TREO for example), would be useful in addition to the currently used ones. JMCTC recommends HRE use a couple of the LabWest used standards as well, in order to get an additional unbiased match to these samples.

Relying on the assay laboratory to add blanks is not best practice and HRE should source a "true blank", if possible, rather than a very low grade standard. They should be added to the sample stream in greater numbers than has been done so to date.

While the BV assays gave an indication of the accuracy of the LabWest assays, they were less of a check of precision and were not technically umpire assays. JMCTC recommends regularly selecting up to 5% of the pulp residues from the original assays, in the range of expected economic interest, and sending them to a certified external laboratory as umpire assay checks.

There is clearly an issue with Sc assays, whichever method is used, although the laser ablation technique appears to be more precise than the four-acid digest. The standards used are not certified for Sc for the laser ablation technique however and the values used for plotting the standards performance were the four-acid digest method certified expected values.

4 Cowalinya grade estimate

4.1 Geological modelling

The geological logging by HRE for all of the recently drilled holes was used in conjunction with the geological logging from the historical Anglo and GSG drilling to provide an interpretation for the block modelling and grade estimate. The geology of the project is in simplified form, a series of layered sands and clays, with the occasional duricrust or silcrete zone. These are relatively thin above the primary mineralisation domains, the upper and lower saprolite units, averaging approximately two metres in thickness, apart from the puggy clay which averages just over five metres. The combined saprolite units range in thickness from two metres to 32 m, averaging just over 17 m.

Figure 4-1 shows a regularised version of the final grade model with 25 m east-west by 50 m north-south blocks coloured by total saprolite thickness. This shows the combined thickness of the upper and lower saprolite units, as each coloured rectangle on the plot is one block high.

Figure 4-1 Total Saprolite thickness per 25 m by 50 m blocks

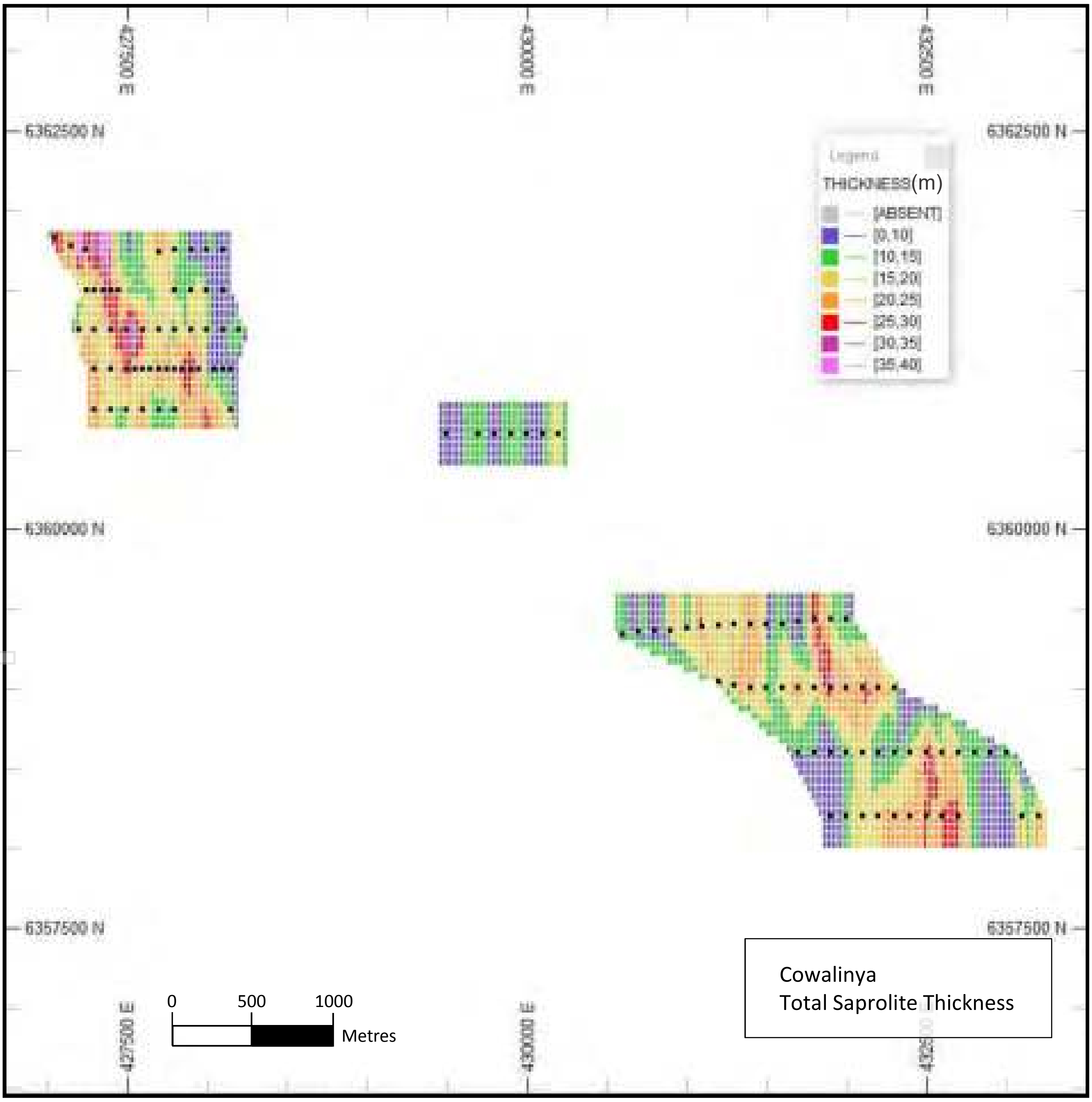


Table 4.1 shows the ZONECODE numbers assigned to the specific geological units for the north and south areas.

Table 4.1 Main Geological Units at Cowalinya with Numeric ZONECODE Assigned

Numeric ZONECODE	Geological Unit	
	North Area (DOMAIN 1000)	***South Area (DOMAIN 2000)***
100	Calcrete/Soil	Calcrete/Soil
200	Upper Clay	Upper Clay
300	Upper Sand	n/a
400	Puggy Clay	Puggy Clay
500	Middle Sand	Middle Sand
600	Silcrete	Silcrete
700	Silcrete-Sand (Lower sand)	n/a
800	Upper Saprolite	Upper Saprolite
900	Lower Saprolite	Lower Saprolite
1000	Bedrock (Fresh Rock)	Bedrock (Fresh Rock)

The focus for the geological interpretation was on the upper and lower saprolite units, as these hosted the interpreted mineralisation. Boundaries were defined by the logged geology, incorporating the historical drilling where appropriate.

Figure 4-2 shows a type cross section for the Cowalinya North area at 6361000 mN, with the view looking north, and Figure 4-3 shows a type cross section for the Cowalinya South area at 6358600 mN, also looking north.

Figure 4-2 Type cross-section at 6361000 mN showing simplified geology with drill holes

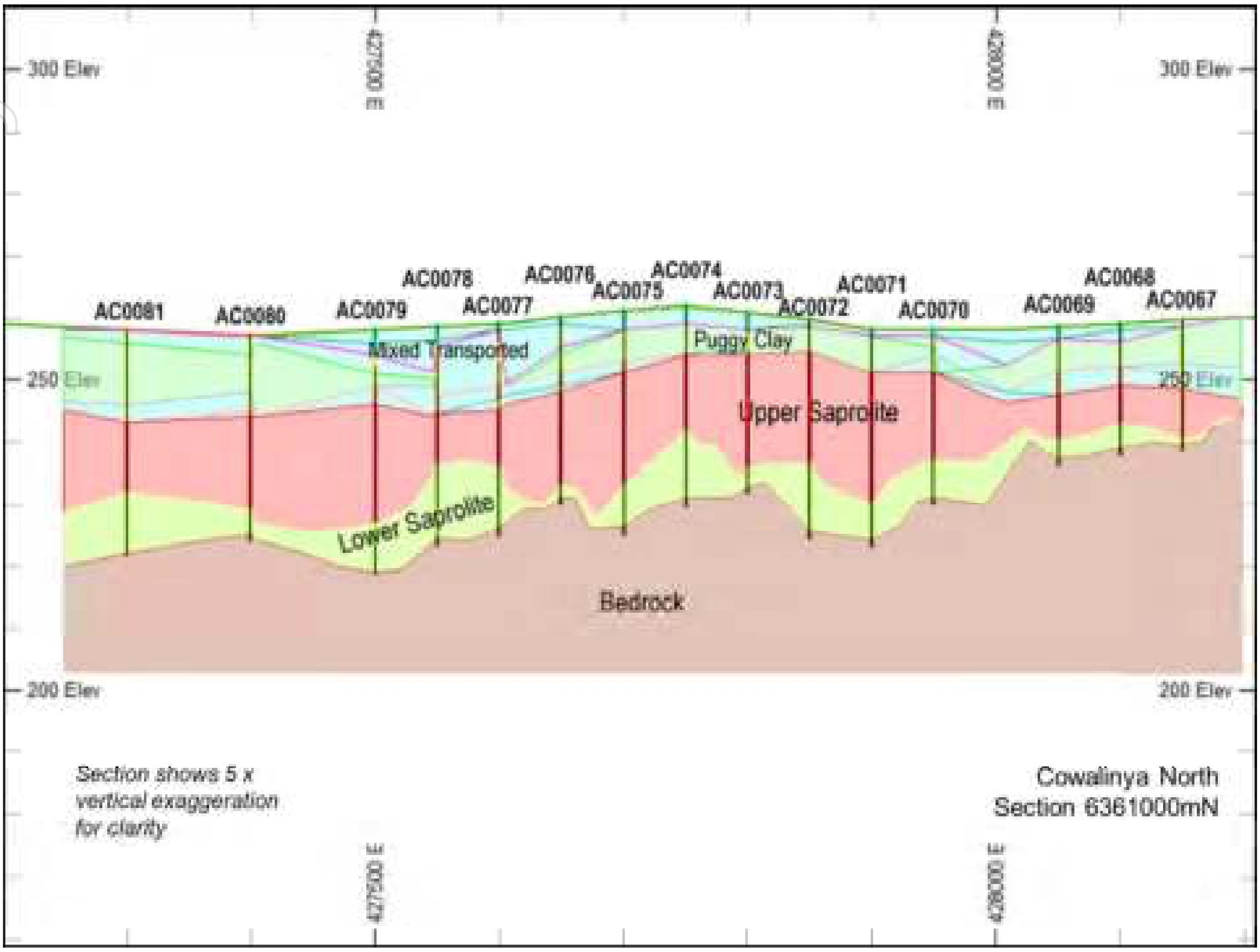
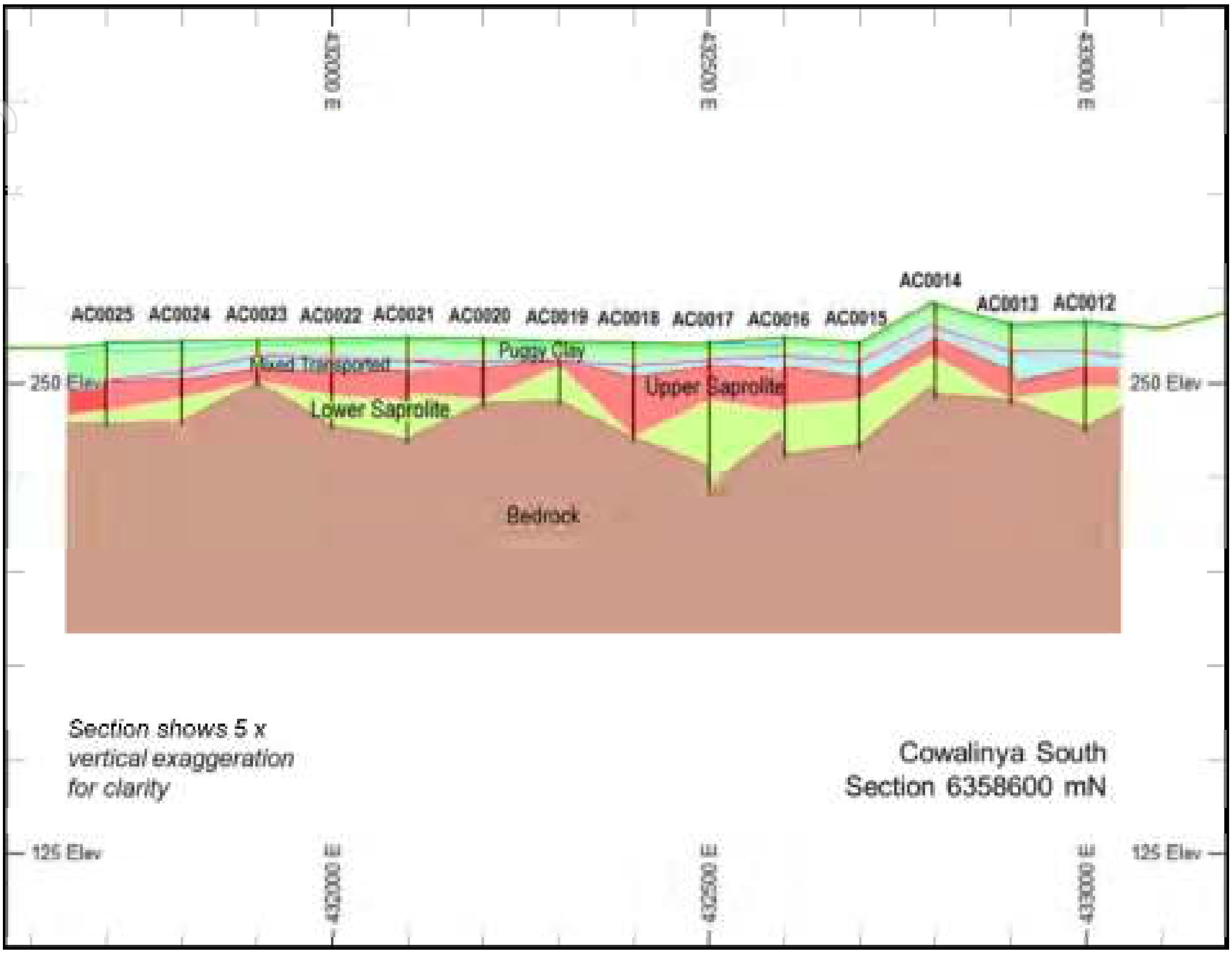


Figure 4-3 Type cross-section at 6358600 mN showing simplified geology with drill holes



As the assayed intervals were generally four metres in length and would occasionally cross the geological boundaries, a grade cut-off was not used to define the modelled unit boundaries or limits of mineralisation.

The extents of the geological interpretations were constrained by the locations of the available drilling. Geological boundaries had limited extrapolation beyond the drilling in line with the expected resource classification of Inferred Resource at best. This extrapolation was approximately half the drill hole distances north to south and east to west, between sections and along the drill fence lines respectively. In the north area this was 125 m north-south and 50 m east-west and in the south area, 200 m north-south and also 50 m east-west.

The continuity of mineralisation at Cowalinya is likely to be affected primarily by:

- The thickness and presence of the upper and lower saprolite units, which appear to be reasonably consistent in continuity from section to section where currently sampled, although the units are not consistent thickness.
- The presence or absence of topographic highs in bedrock, thinning the saprolite units beneath the overlying transported material.
- Changes in underlying bedrock type and changes in the geochemistry of the saprolite units.
- Faulting.

The first two of the above observations can reasonably be applied to the current interpretation of the geology, but the extent of potential faulting and changes in bedrock and geochemistry can only be determined by the use of closely spaced infill drilling, including core drilling, or test pit mining in selected key areas.

4.1.1 Lithology

The lithologies below the mineralised saprolite units are logged as granitic gneiss, granite, biotite schist or granodiorite. Most of the drill holes terminate at or within a metre of the top of the bedrock units.

4.1.2 Alteration

The granite and granitic-gneiss bedrock in the region has undergone upper amphibolite to granulite facies metamorphism, but the bedrock is not considered part of the resource due to different metallurgical considerations. No alteration sub-divisions have been considered in the block model.

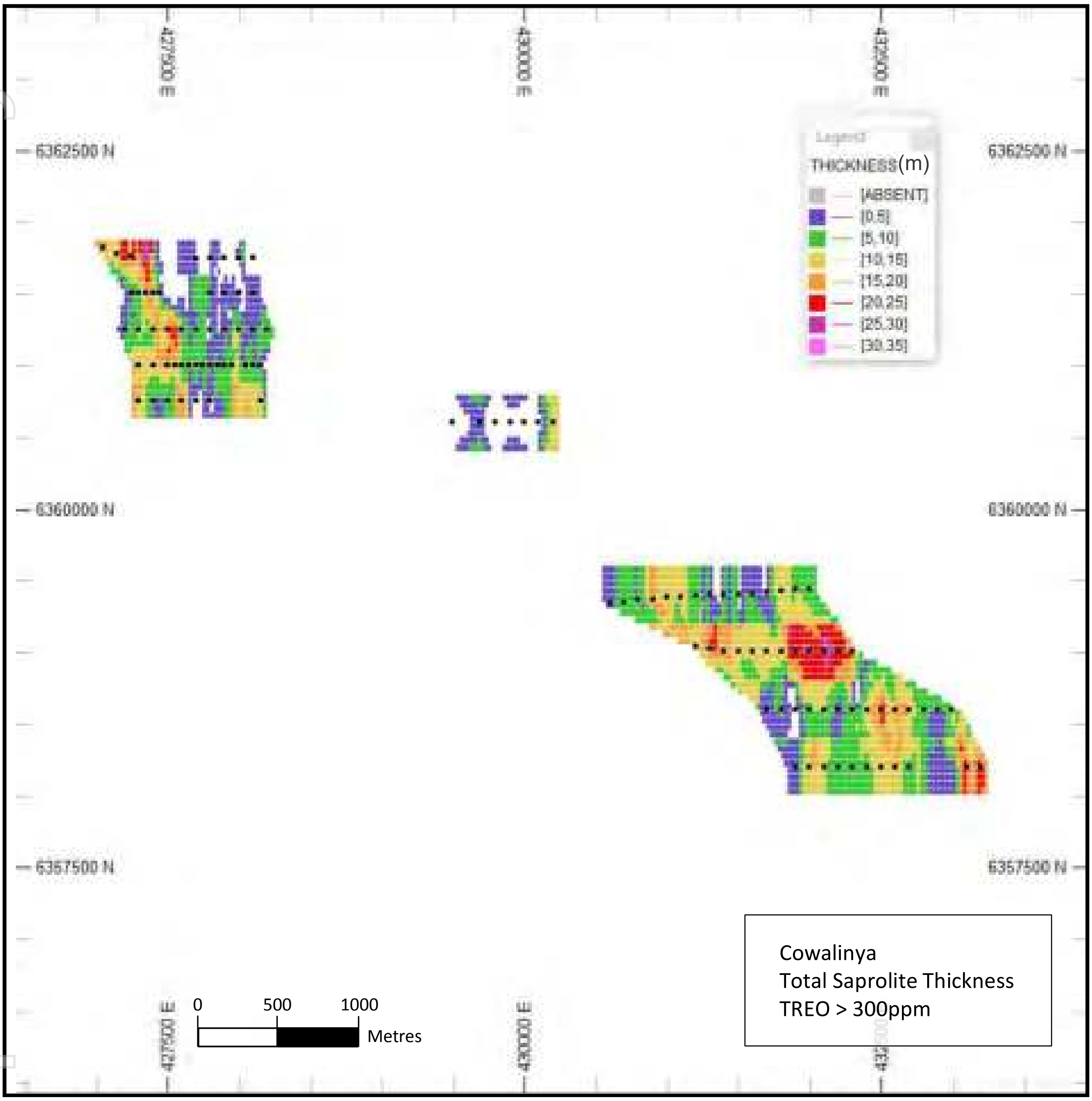
4.1.3 Mineralised zones

The rare earth mineralised zones at Cowalinya are interpreted as being due to supergene enrichment within the saprolite weathering zone.

The interpreted mineralised upper and lower saprolite units used in this model are contained in an area defined by the recent HRE drilling. At Cowalinya North the extents are approximately 1,200 m by 1,200 m in northing and easting, while at Cowalinya South, the extents are greater being approximately 2,500 m in northing and 1,500 m in easting. The mineralised units are stratiform and range in thickness from approximately one metre to over 24 m true thickness. The average thickness of the upper saprolite is nearly 12 m, while the lower saprolite averages approximately 7 m in thickness. There are no non-mineralised sub-domains currently interpreted in the saprolite domains.

Figure 4-4 shows the total saprolite thickness where modelled grade is greater than 300 ppm TREO. As with Figure 4-1 above, each rectangular block is regularised to 25 m x 50 m. Where there is no TREO grade greater than 300 ppm in any column, the block is blank (not coloured) in the plot.

Figure 4-4 Total Saprolite thickness – TREO greater than 300 ppm



The upper saprolite is currently interpreted to be approximately 10 m below surface, ranging from 3 m to 16 m in the existing drilling. Mineralisation is currently open on all sides, apart from depth, where it transitions to bedrock.

Figure 4-5 shows a plan view of regularised 25 m x 50 m blocks coloured on total thickness of overburden (transported cover) to the top of upper saprolite unit. Each block represents a column of cells which have been added together (accumulated) to get the total thickness. Figure 4-6 shows the depth to the top of the mineralisation, defined as greater than 300 ppm material (in either the upper or lower saprolite). Again, as in Figure 4-4, if there is no TREO grade greater than 300 ppm, the block is not coloured.

Figure 4-5 Total overburden depth to top of Upper Saprolite

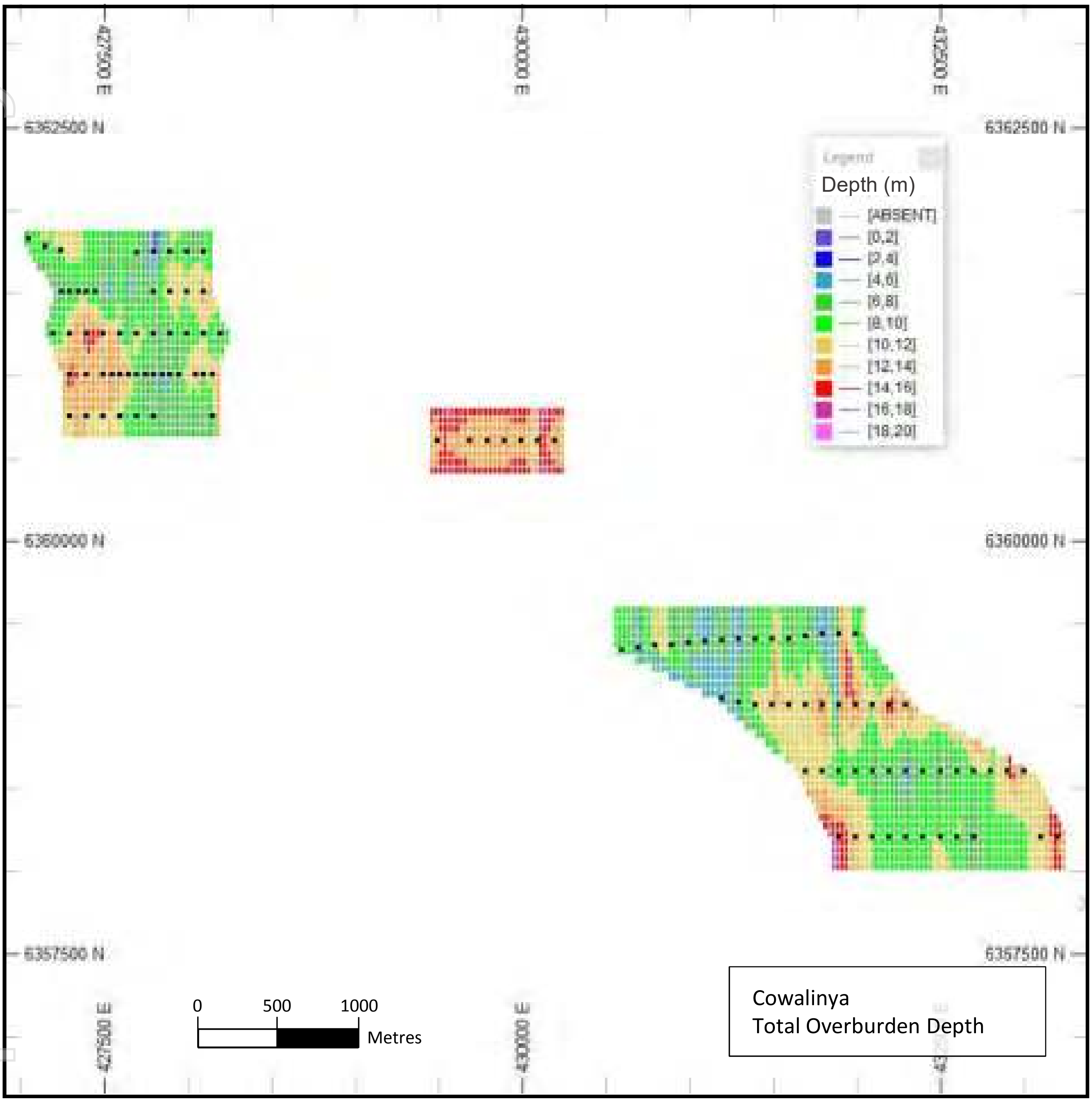
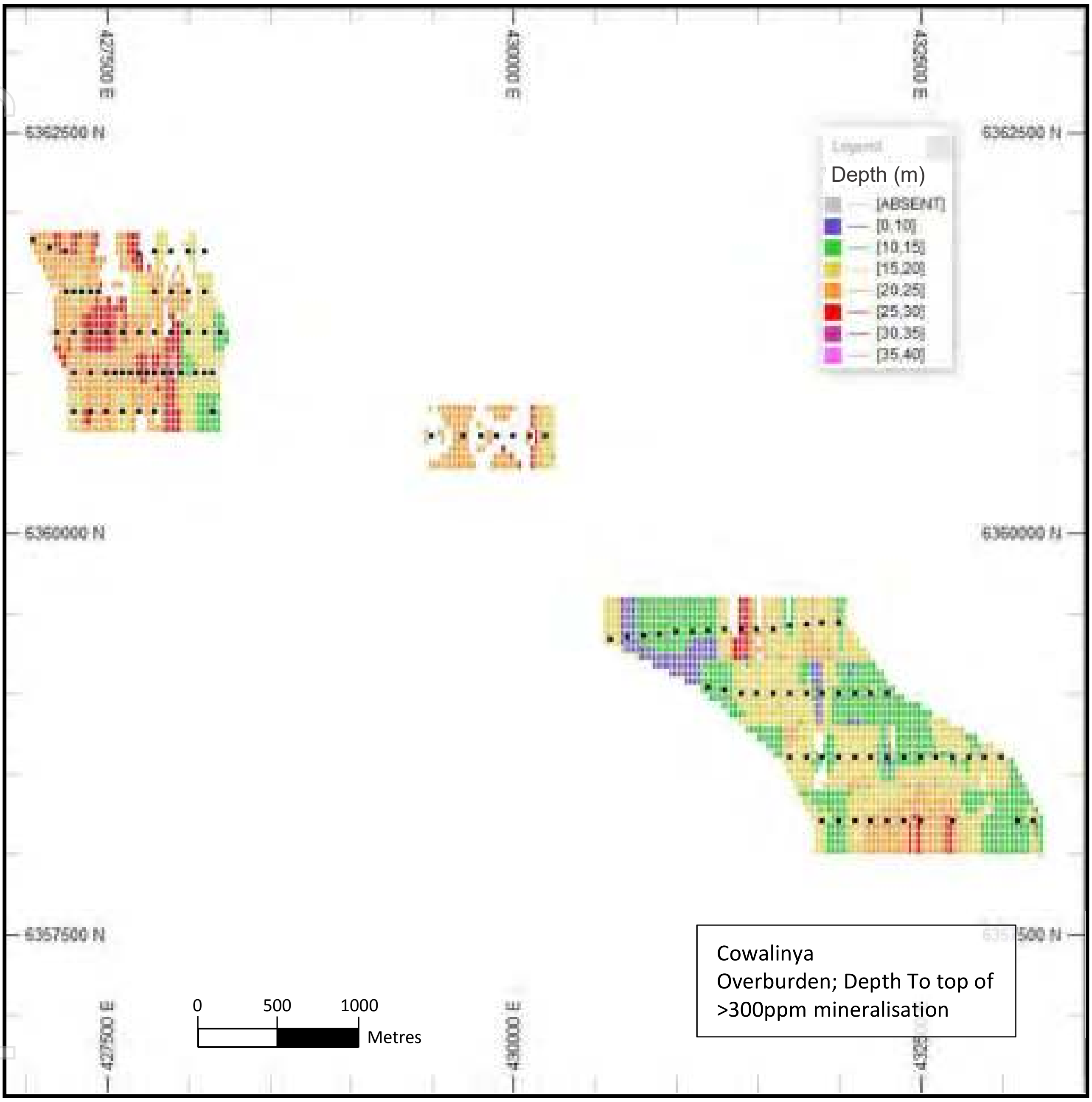


Figure 4-6 Depth to top of mineralisation (> 300 ppm TREO) in saprolite



4.1.4 Oxidation divisions

Oxide divisions have not been recorded at Cowalinya per se, although the upper saprolite is likely to be predominantly oxide material, with the lower saprolite being transitional to fresh as it grades into bedrock. Oxide divisions specifically are not coded into the block model, only the saprolite lithological divisions.

4.1.5 Structure

As the primary targets for mineralisation and focus for the resource estimate are saprolite clay units, no structure has been interpreted at Cowalinya for this estimate.

4.1.6 Domains

Grade estimates are keyed on the combined ZONECODE and DOMAIN codes, using a combined code labelled ESTDOM. The DOMAIN relates to the Cowalinya North and South areas and the ZONECODE relates to the interpreted geological units. These are restricted to the vicinity of the drilling, with a nominal surrounding area of background waste. The background is only currently defined as waste due to lack of sampling. The mineralisation is not currently closed off on any direction apart from depth.

Table 4.2 lists the key ZONECODE, DOMAIN and ESTDOM code combinations used to sub-divide the block model for grade estimation.

Table 4.2 Numeric codes assigned to the Cowalinya block model

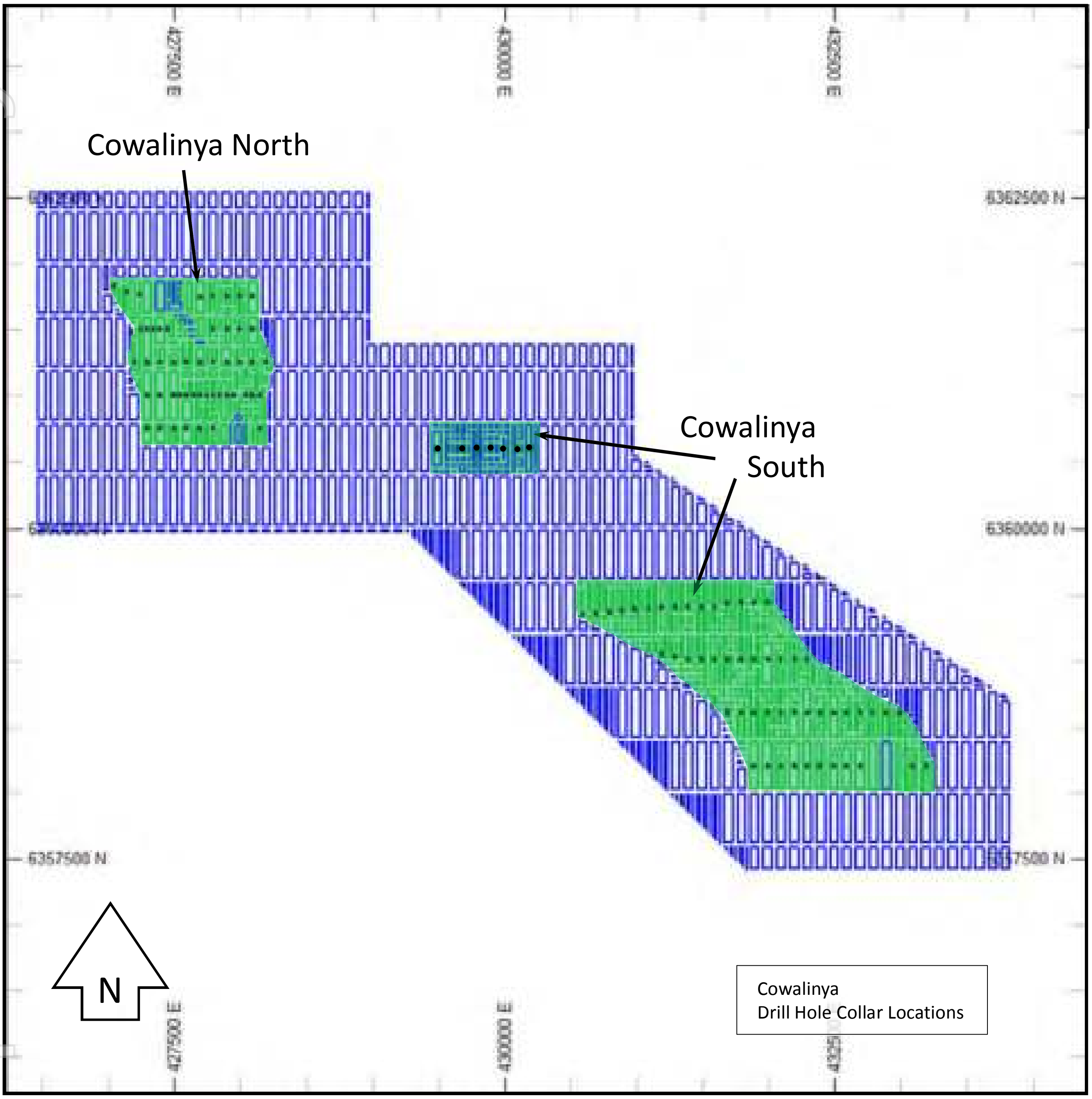
Lithology/Mineralisation	DOMAIN Code	ZONECODE	ESTDOM Code
Transported soils, sands and clays	1000 (North) 2000 (South)	100, 200, 300, 400, 500, 600, 700 100, 200, 400, 500, 600	300 (North) 200 (South)
Upper Saprolite	1000, 2000	800	800
Lower Saprolite	1000, 2000	900	900
Bedrock	1000, 2000	1000	1000
Background Waste	9999	-	9999

4.1.7 Drillhole data

In the north area the drill hole spacing is a reasonably regular 100 m in easting by 250 m in northing pattern, with four drill fences completed. In the south, the easting spacing is the same, but the northing spacing extends to 400 m. Outside of these two main drilled areas there is a single fence approximately 1.3 km to the east and slightly south of the north area drilling containing seven drill holes.

The total drilling for the grade estimation at Cowalinya is 109 holes, with a total of 3,089 m logged and 2,481 m sampled for 827 samples. Figure 4-7 shows the position of the drill holes and fences for Cowalinya North and South areas.

Figure 4-7 Plan view of HRE drill hole positions at Cowalinya



4.1.8 Raw data

For the grade estimate, only the 109 HRE drillholes were used, which had 827 samples. The raw data was flagged with the interpreted mineralisation and other relevant sub-division wireframes. Descriptive statistics are discussed in Section 4.2.

4.1.9 Sample flagging

All samples were flagged using the wireframes generated by JMCTC, with the unique numeric DOMAIN and ZONECODE codes being applied to the drill holes. A separate numeric code (ESTDOM) was also applied to denote whether the sample was grouped or not grouped for estimation.

The key numeric coding applied to the drill holes is presented in Table 4.3. The scheme is identical to the block model coding, to ensure that only samples with the correct codes get used in the different sub-divisions of the block model. Table 4.1 and Table 4.2 above show which geological unit is coded with which ZONECODE. Where numeric ZONECODE values are not present, either that geological unit was not present or not assayed.

Table 4.3 Numeric coding assigned to drill holes

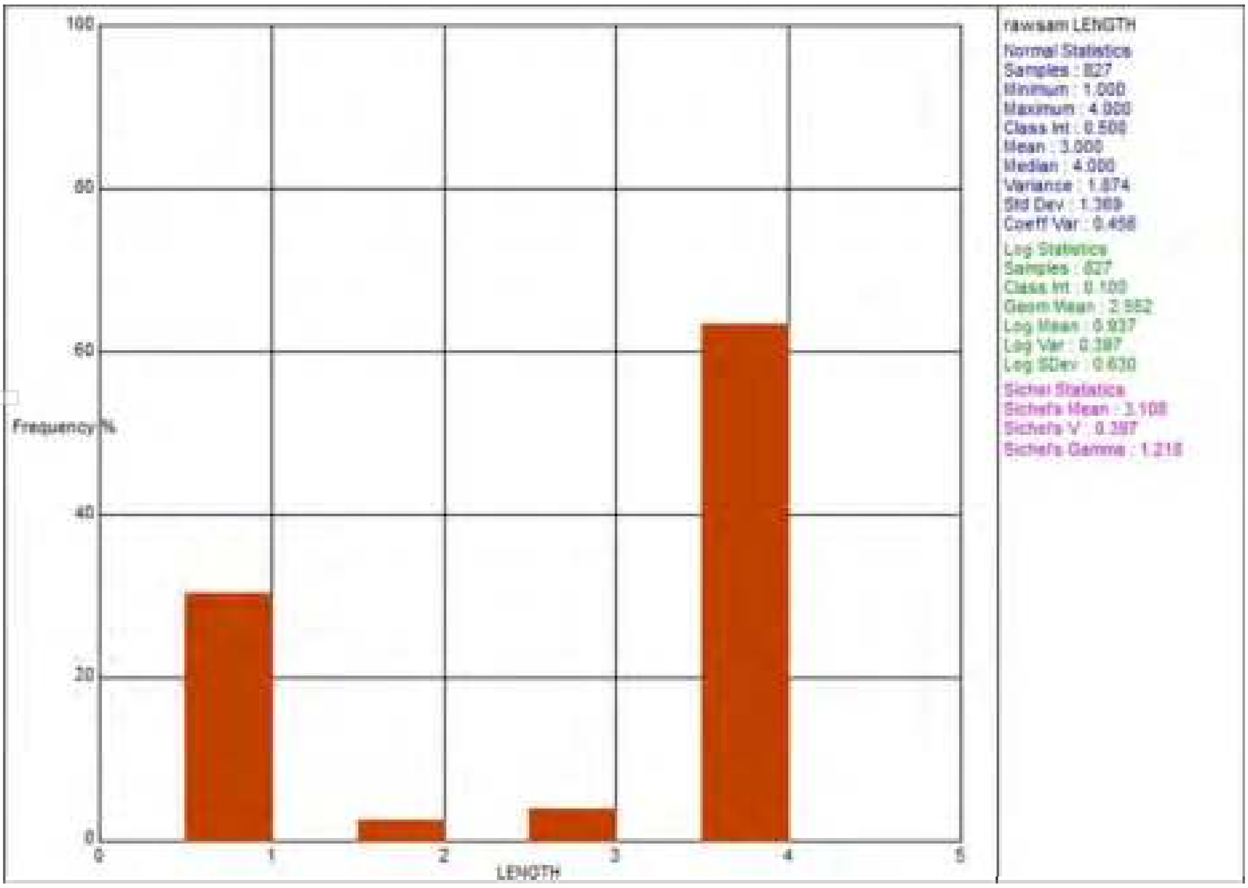
DOMAIN Code	ZONECODE (Lithology)	ESTDOM Code
1000 (Cowalinya North)	300, 400, 500, 600	300
	800	800
	900	900
	1000	1000
2000 (Cowalinya South	200, 400, 500, 600	200
	800	800
	900	900
	1000	1000

After initial statistical evaluation, the low grade Eocene transported unit assays were grouped together for grade estimation. The Cowalinya North area assays were re-coded as ESTDOM 300, with the south area assays as ESTDOM 200.

4.1.10 Compositing

The assay results have been composited to four metre lengths, as over 60% of samples were four metres, with approximately 30% being one metre (Figure 4-8). These proportions are virtually the same when looking at the mineralised units only (ZONECODE 800 & 900).

Figure 4-8 Normal histogram for length – All raw samples



Data was composited to four metres downhole length, and where possible, composites started and ended at the interpreted geological boundaries. This was not always possible due to the nature of the sampled intervals.

Occasionally the centre point of a flagged sample was inside a specific unit, but its length extended, due to composite assaying, outside that unit. This sample then crossed the division boundary and included sample either above or below the unit in question. The converse is also the case, where apparent mineralisation has been coded into the upper transported or bedrock units. However, this is not as common as upper transported or bedrock material being included in the saprolite layers.

This has the overall effect of diluting the mineralised samples to some degree and makes a lower-grade top boundary to the upper saprolite difficult to determine other than based purely on existing geological logging.

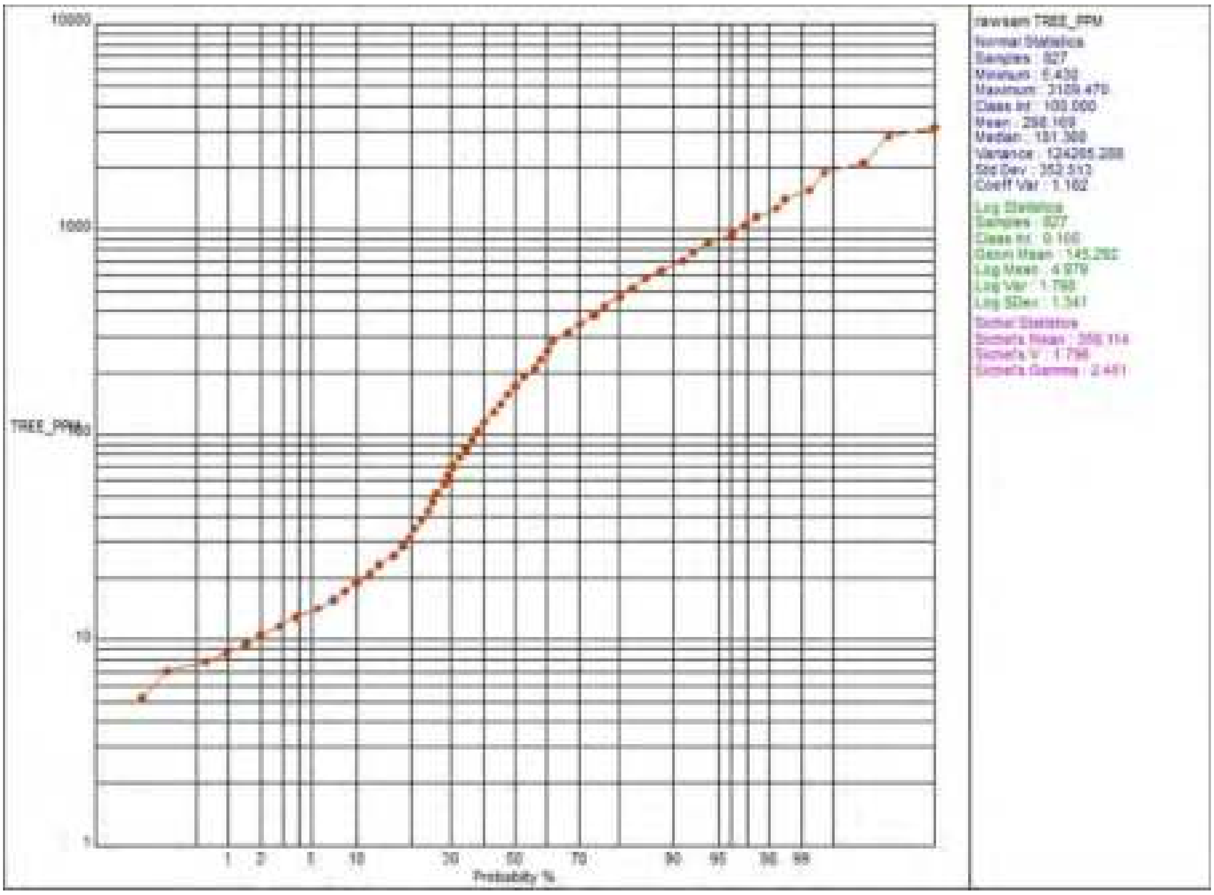
4.2 Statistical analysis

4.2.1 Summary statistics – raw data

The raw assay data was flagged with numeric codes for DOMAIN, ZONECODE and ESTDOM.

The initial review of data suggested that the mineralised data was an obvious different population than the background and using the geological boundaries for modelling would be appropriate. The log probability plot for total rare earth elements (TREE), that is all of the assays for individual REEs added together, shows three distinct grade populations, with inflections at approximately 25 – 30 ppm and approximately 300 ppm. Figure 4-9 shows the log probability plot for all TREE data from all sub-divisions.

Figure 4-9 Log probability plot for raw samples – TREE; All data



The inflection at approximately 300 ppm is reasonably clear, but this is almost equal to the expected reporting cut-off grade for the model and would be too high to use as a low grade boundary. The lower grade cut-off point at approximately 30 ppm is very low, given the crustal abundance of REEs is reported to be in a range from 180 to 220 ppm. With this in mind, JMCTC decided to use the logged geological boundaries for upper and lower saprolites as the mineralisation boundaries.

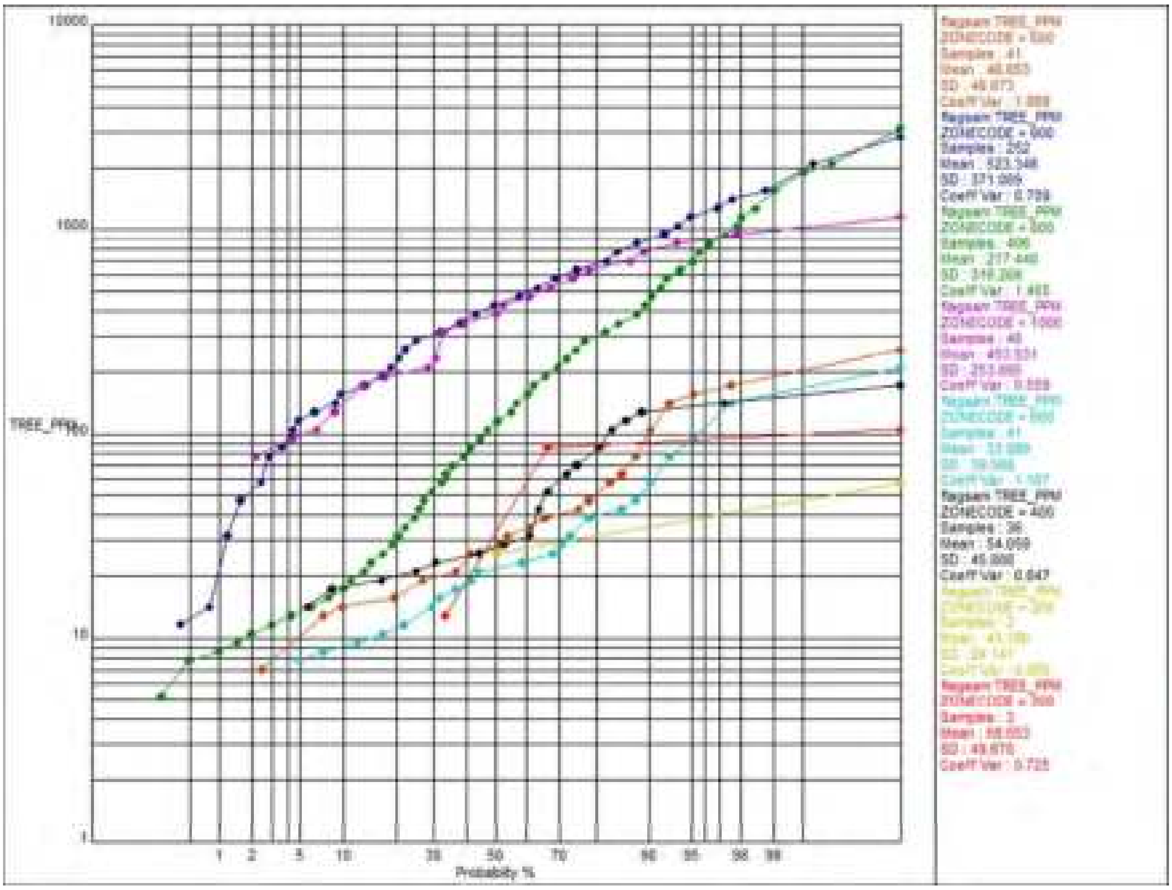
JMCTC initially reviewed statistics for the low grade transported units separately, but concluded that they were very similar in their grade distribution. Several had too few samples for variography as standalone divisions and so they were grouped together for further analysis and estimation.

Figure 4-10 shows a log probability plot for TREE for Cowalinya, with a separate trace for each ZONECODE sub-division. Each of the transported material units (ZONECODE 200 – 600) has only 40 or so or less samples, split between north and south areas, a very low mean TREE grade and a similar distribution.

The plot shows two relatively distinct groupings, lower saprolite plus basement (900 & 1000), the Eocene transported material (200 - 600), with the upper saprolite crossing between the two. Further work is required to better separate the lower grade material from the upper saprolite for future estimates.

Some of the transported material sub-divisions are slightly under represented due to sampling not starting at surface.

Figure 4-10 Log probability plot – TREE by ZONECODE



Most of the key elements show the same three groupings, with some overlap of the mixed sands and upper saprolite in the lower grade range for cerium.

Scandium does not show these groupings. Uranium does not show any distinct divisions, with overlap between all ZONECODE divisions plotted and thorium shows even greater overlap than uranium.

Table 4.4 shows the key statistics for the flagged sample groupings prior to compositing.

Table 4.4 Summary statistics – raw flagged sample file

Domain	Zonecode	Statistic	LENGTH	TREE_PPM	La_PPM	Ce_PPM	Pr_PPM	Nd_PPM	Sm_PPM	Eu_PPM	Gd_PPM	Tb_PPM	Dy_PPM	Ho_PPM	Er_PPM	Tm_PPM	Yb_PPM	Lu_PPM	Y_PPM	Sc_PPM	Th_PPM	U_PPM
1000	300, 400, 500, 600	Number	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
		Minimum	1	7.33	1.26	2.27	0.27	1.15	0.31	0.07	0.15	0.02	0.24	0.04	0.17	0.02	0.1	0.02	1.19	3	2	0.28
		Maximum	4	173.92	28	69.1	8.07	32.3	6.31	1.47	5.09	0.7	4.36	0.82	2.48	0.34	1.71	0.27	24.9	17	15.5	5.36
		Mean	3.59	40.67	7.02	12.69	1.72	6.85	1.41	0.33	1.16	0.18	1.14	0.23	0.69	0.10	0.61	0.10	6.45	8.32	7.48	1.38
		Median	4.00	27.32	5.22	8.26	1.12	3.98	0.85	0.23	0.73	0.12	0.78	0.16	0.52	0.08	0.56	0.08	4.63	7.00	7.23	1.19
		CV*	0.29	0.88	0.80	1.00	1.00	1.03	0.96	0.81	0.98	0.90	0.82	0.78	0.73	0.67	0.56	0.55	0.80	0.40	0.42	0.56
1000	800	Number	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
		Minimum	1	5.43	0.8	1.44	0.18	0.82	0.25	0.07	0.15	0.03	0.19	0.03	0.11	0.02	0.12	0.005	0.85	0.5	1.37	0.46
		Maximum	4	623.66	209	270	47.2	163	21.9	5.83	18.8	2.89	18.4	3.83	11.4	1.57	9.75	1.43	114	55	38	7.7
		Mean	3.27	134.76	33.17	46.26	6.73	23.38	3.86	0.92	3.04	0.43	2.30	0.43	1.25	0.17	1.09	0.17	11.57	13.94	7.23	1.94
		Median	4.00	80.46	23.75	26.20	3.50	11.25	1.80	0.57	1.45	0.21	1.13	0.22	0.65	0.10	0.73	0.11	5.84	12.00	6.16	1.76
		CV	0.39	0.98	0.98	1.07	1.16	1.22	1.21	1.07	1.21	1.20	1.21	1.22	1.17	1.14	1.05	1.02	1.27	0.60	0.65	0.53
1000	900	Number	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
		Minimum	1	11.27	0.8	4.12	0.37	1.73	0.6	0.05	0.17	0.03	0.37	0.07	0.33	0.04	0.13	0.03	2.43	4	0.88	0.21
		Maximum	4	2881.2	640	544	194	768	162	39	142	19.1	106	20.3	53.4	6.99	41.6	6.65	533	40	34.6	40.9
		Mean	3.02	523.77	74.38	143.67	23.96	102.53	21.56	3.26	16.47	2.38	16.29	3.28	9.35	1.13	5.63	1.03	98.85	16.51	10.42	3.65
		Median	4.00	435.82	61.15	130.00	18.75	80.25	17.10	2.68	12.15	1.80	11.75	2.33	6.45	0.82	3.96	0.66	60.35	13.50	7.19	2.75
		CV	0.43	0.84	1.08	0.65	1.07	1.05	1.06	1.31	1.09	1.06	1.05	1.09	1.09	1.11	1.20	1.13	1.11	0.51	0.74	1.14
1000	1000	Number	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
		Minimum	1	75.04	17.8	30	2.14	6.21	1.34	0.54	1.06	0.16	0.8	0.16	0.44	0.05	0.37	0.05	3.5	7	0.97	0.47
		Maximum	2	906.14	153	234	56.2	220	44	6.98	32.4	4.43	33.9	6.94	20.8	2.73	8.94	1.69	209	39	18.4	5.48
		Mean	1.43	392.33	58.06	115.18	18.42	75.83	14.88	2.74	12.10	1.75	11.77	2.33	6.66	0.85	4.39	0.73	66.64	16.52	7.30	2.73
		Median	1.00	367.16	49.85	105.50	14.95	65.00	13.30	1.89	9.88	1.35	9.34	1.83	5.34	0.70	4.11	0.64	49.10	17.00	6.21	2.40
		CV	0.36	0.56	0.58	0.52	0.67	0.66	0.69	0.65	0.66	0.66	0.75	0.77	0.78	0.77	0.61	0.66	0.88	0.49	0.60	0.51
1000	200, 400, 500, 600	Number	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
		Minimum	1	7.54	1.01	1.65	0.23	0.83	0.2	0.05	0.23	0.03	0.22	0.04	0.17	0.02	0.16	0.02	0.89	0.5	2.21	0.37
		Maximum	4	258.78	129	108	20.7	53.7	6.43	1.28	3.66	0.53	3.09	0.58	1.62	0.23	1.53	0.22	15.4	28	11.4	4.37
		Mean	3.12	49.95	15.65	17.26	2.06	6.32	1.06	0.30	0.88	0.14	0.85	0.17	0.50	0.08	0.55	0.08	4.05	7.85	5.58	1.32
		Median	4.00	26.03	5.61	8.32	1.02	3.43	0.64	0.19	0.56	0.10	0.63	0.13	0.41	0.07	0.48	0.07	3.25	7.00	5.04	1.10
		CV	0.44	1.08	1.50	1.21	1.49	1.31	1.08	0.93	0.93	0.80	0.71	0.65	0.58	0.52	0.48	0.47	0.68	0.78	0.35	0.56
1000	800	Number	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209	209
		Minimum	1	7.79	1.32	2.21	0.24	0.93	0.24	0.09	0.21	0.04	0.26	0.05	0.14	0.02	0.14	0.005	0.86	0.5	1.76	0.62
		Maximum	4	3189.47	524	899	185	869	189	55.4	193	27.8	141	24	60.5	7.86	45.5	6.58	665	71	42	9.03
		Mean	2.95	295.38	66.18	83.50	14.55	54.30	9.91	2.48	8.88	1.31	7.18	1.33	3.70	0.50	3.13	0.46	37.95	18.57	11.84	3.04
		Median	4.00	159.24	41.90	54.25	6.68	19.15	2.84	0.75	2.33	0.32	1.85	0.35	1.03	0.15	1.02	0.14	8.43	15.00	9.22	2.73
		CV	0.48	1.38	1.17	1.25	1.58	1.82	2.06	2.30	2.30	2.25	2.19	2.17	2.11	2.01	1.90	1.90	2.31	0.75	0.66	0.55
1000	900	Number	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145
		Minimum	1	14.61	3.15	5.15	0.53	1.88	0.42	0.31	0.37	0.06	0.41	0.08	0.23	0.03	0.27	0.04	1.68	0.5	2.82	1.22
		Maximum	4	2095.37	302	758	100	432	90.5	18.6	66.4	9.34	52.7	10.8	31.5	4.24	24.4	3.48	322	51	32.7	40.4
		Mean	2.86	523.03	83.58	166.83	23.17	93.37	18.67	3.86	17.11	2.57	14.91	2.87	8.18	1.11	6.88	1.01	78.91	18.70	13.18	5.14
		Median	4.00	458.99	71.75	150.50	19.25	82.05	16.15	3.35	14.20	2.11	11.60	2.22	6.23	0.85	5.40	0.78	59.30	16.00	11.75	4.13
		CV	0.49	0.60	0.61	0.60	0.67	0.71	0.75	0.75	0.76	0.76	0.77	0.80	0.81	0.80	0.77	0.77	0.86	0.61	0.44	0.88
1000	1000	Number	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
		Minimum	1	99.99	16.8	36.6	4.4	15.7	2.21	0.44	1.12	0.16	0.78	0.13	0.33	0.04	0.27	0.04	2.98	4	3.36	1.16
		Maximum	4	1119.76	179	458	43.9	182	36.8	8.69	41	7.1	39.1	8	22.7	2.98	18.4	2.92	251	63	40.4	20.9
		Mean	1.56	505.68	78.94	168.48	21.36	82.08	15.87	3.56	15.60	2.44	14.36	2.83	8.06	1.10	6.80	1.02	83.17	25.40	12.96	4.88
		Median	1.00	459.38	69.05	141.50	19.05	72.85	15.05	3.46	14.05	2.13	12.45	2.34	6.68	0.90	5.70	0.78	60.35	20.50	8.28	3.12
		CV	0.46	0.54	0.54	0.58	0.54	0.56	0.61	0.65	0.70	0.74	0.76	0.80	0.81	0.81	0.79	0.82	0.87	0.66	0.76	0.88

*CV = Coefficient of Variance

4.2.2 Summary statistics – composite data

After compositing the flagged sample file to 4 m lengths to provide equal support in the grade estimate, JMCTC investigated descriptive statistics for the mineralised saprolite units, the grouped low to waste grade transported material and the bedrock units.

Table 4.5 shows the key statistics for the mineralised units, in the north and south areas. The mean grade of the lower saprolite units is clearly higher than the corresponding upper saprolite.

Table 4.6 shows the key statistics for the grouped transported material and bedrock unit composites. Of note are the very low mean grades for most elements in the grouped transported material and the small number of samples overall. The bedrock unit (ZONECODE 1000), both north and south, show very high grades, but also low sample numbers. The grade in these units is unlikely to be recovered by the mining and recovery processes expected to be used for the saprolite units and is not considered as part of the Mineral Resource.

Table 4.5 Summary statistics – Composites for mineralised saprolite units; north and south

Domain	Zonecode	Statistic	TREE_PPM	La_PPM	Ce_PPM	Pr_PPM	Nd_PPM	Sm_PPM	Eu_PPM	Gd_PPM	Tb_PPM	Dy_PPM	Ho_PPM	Er_PPM	Tm_PPM	Yb_PPM	Lu_PPM	Y_PPM	Sc_PPM	Th_PPM	U_PPM
1000	800	Composites	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162
		Minimum	9.06	1.09	2.01	0.27	1.04	0.27	0.07	0.15	0.03	0.19	0.03	0.11	0.02	0.12	0.02	0.85	2	1.902	0.61
		Maximum	623.66	142	270	41.5	155	20	5.83	18.8	2.89	18.4	3.83	11.4	1.57	9.75	1.43	114	55	38	7.7
		Mean	142.66	34.89	50.60	6.94	24.00	3.94	0.99	3.16	0.45	2.39	0.45	1.31	0.18	1.16	0.18	12.05	14.31	7.65	2.01
		Median	97.51	26.60	31.20	4.00	13.40	2.09	0.58	1.64	0.22	1.16	0.23	0.75	0.10	0.75	0.11	5.88	12.13	6.39	1.82
		CV	0.92	0.86	1.02	1.04	1.11	1.13	1.05	1.13	1.12	1.15	1.17	1.14	1.11	1.05	1.01	1.24	0.56	0.63	0.51
1000	900	Composites	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
		Minimum	11.27	0.8	4.12	0.37	1.73	0.6	0.05	0.17	0.03	0.37	0.07	0.33	0.04	0.13	0.03	2.43	4	1.83	0.368
		Maximum	2881.2	640	379.857	194	768	162	39	142	19.1	106	20.3	53.4	6.99	39.6	5.81	499	40	26.214	15.225
		Mean	453.52	68.47	126.24	21.64	90.14	18.51	3.18	14.90	2.15	13.68	2.70	7.64	0.95	4.92	0.84	77.56	17.15	8.40	3.14
		Median	381.15	59.80	123.30	17.35	74.15	15.16	2.30	11.66	1.69	10.59	2.08	5.57	0.72	3.42	0.62	53.19	14.32	6.57	2.53
		CV	0.84	1.09	0.57	1.13	1.11	1.12	1.40	1.13	1.08	1.06	1.08	1.08	1.09	1.14	1.09	1.08	0.51	0.64	0.69
2000	800	Composites	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157
		Minimum	7.79	1.32	2.21	0.24	0.93	0.24	0.09	0.21	0.04	0.26	0.05	0.17	0.028	0.206	0.03	1.32	0.5	1.76	0.62
		Maximum	1873.78	371	899	115	417.878	88.361	25.873	92.856	13.531	70.522	12.482	32.413	4.216	24.341	3.523	380.21	71	36.5	8.82
		Mean	246.26	57.73	80.96	11.86	42.28	7.36	1.76	6.22	0.92	5.06	0.94	2.61	0.36	2.30	0.34	25.55	17.89	10.99	2.72
		Median	139.64	41.30	55.26	6.10	17.20	2.27	0.73	1.90	0.31	1.71	0.34	0.98	0.14	0.92	0.14	7.76	15.00	8.71	2.39
		CV	1.21	1.02	1.30	1.40	1.55	1.68	1.81	1.85	1.81	1.77	1.75	1.69	1.60	1.49	1.49	1.93	0.77	0.61	0.53
2000	900	Composites	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
		Minimum	14.61	3.15	5.15	0.53	1.88	0.42	0.31	0.37	0.06	0.41	0.08	0.23	0.03	0.27	0.04	1.68	0.5	2.82	1.22
		Maximum	2095.37	302	758	100	432	90.5	18.6	66.4	9.34	51.5	9.13	25.3	3.36	21.1	3.03	273.78	51	32.7	40.4
		Mean	489.81	79.37	160.20	21.50	85.89	16.99	3.59	15.67	2.36	13.63	2.61	7.39	1.00	6.19	0.91	72.51	18.63	12.27	4.91
		Median	417.59	70.32	133.00	18.05	74.40	15.05	3.07	13.35	2.00	10.60	2.03	5.63	0.73	4.56	0.66	51.95	16.72	11.37	3.76
		CV	0.64	0.59	0.66	0.69	0.75	0.81	0.80	0.79	0.79	0.81	0.83	0.83	0.82	0.81	0.81	0.88	0.60	0.44	0.90

Table 4.6 Summary statistics – Composites for grouped transported & bedrock units; north and south

Domain	Zonecode	Statistic	TREE_PPM	La_PPM	Ce_PPM	Pr_PPM	Nd_PPM	Sm_PPM	Eu_PPM	Gd_PPM	Tb_PPM	Dy_PPM	Ho_PPM	Er_PPM	Tm_PPM	Yb_PPM	Lu_PPM	Y_PPM	Sc_PPM	Th_PPM	U_PPM
1000	300, 400, 500, 600	Composites	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59
		Minimum	7.33	1.26	2.27	0.27	1.15	0.31	0.07	0.15	0.02	0.24	0.04	0.17	0.02	0.1	0.02	1.19	3	2.38	0.28
		Maximum	173.92	28	69.1	8.07	32.3	6.31	1.47	5.09	0.7	4.36	0.82	2.48	0.34	1.71	0.27	24.9	17	15.5	5.36
		Mean	41.69	7.26	13.03	1.77	7.05	1.45	0.35	1.19	0.18	1.16	0.23	0.70	0.10	0.62	0.10	6.50	8.36	7.72	1.40
		Median	27.12	5.25	8.30	1.12	3.98	0.85	0.24	0.73	0.12	0.79	0.16	0.53	0.08	0.57	0.08	4.73	7.00	7.32	1.20
		CV	0.89	0.80	1.01	1.01	1.04	0.97	0.79	0.99	0.92	0.83	0.80	0.74	0.68	0.56	0.56	0.80	0.41	0.40	0.57
1000	1000	Composites	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
		Minimum	75.04	17.8	30	2.14	6.21	1.34	0.54	1.06	0.16	0.8	0.16	0.44	0.05	0.37	0.05	3.50	7	0.97	0.47
		Maximum	906.14	153	234	56.2	220	44	6.98	32.4	4.43	33.9	6.94	20.8	2.73	8.94	1.69	209	39	18.4	5.48
		Mean	392.33	58.06	115.18	18.42	75.83	14.88	2.74	12.10	1.75	11.77	2.33	6.66	0.85	4.39	0.73	66.64	16.52	7.30	2.73
		Median	367.16	49.85	105.50	14.95	65.00	13.30	1.89	9.88	1.35	9.34	1.83	5.34	0.70	4.11	0.64	49.10	17.00	6.21	2.40
		CV	0.56	0.58	0.52	0.67	0.66	0.69	0.65	0.66	0.66	0.75	0.77	0.78	0.77	0.61	0.66	0.88	0.49	0.60	0.51
2000	200, 400, 500, 600	Composites	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
		Minimum	10.77	1.71	2.82	0.34	1.3	0.27	0.08	0.29	0.05	0.36	0.07	0.24	0.037	0.27	0.04	1.83	0.5	2.35	0.5
		Maximum	258.78	129	108	20.7	53.7	6.43	1.28	3.66	0.53	3.09	0.58	1.62	0.23	1.53	0.22	15.4	28	11.4	3.09
		Mean	54.24	17.20	18.78	2.25	6.87	1.13	0.32	0.94	0.15	0.89	0.17	0.52	0.08	0.57	0.09	4.27	8.36	5.72	1.37
		Median	26.27	5.86	8.63	1.07	3.79	0.67	0.19	0.57	0.10	0.64	0.13	0.42	0.06	0.48	0.07	3.48	7.00	5.37	1.16
		CV	1.05	1.45	1.18	1.45	1.28	1.05	0.88	0.88	0.74	0.68	0.64	0.57	0.52	0.48	0.47	0.67	0.74	0.34	0.49
2000	1000	Composites	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
		Minimum	99.99	16.8	36.6	4.4	15.7	2.21	0.44	1.12	0.16	0.78	0.13	0.33	0.04	0.27	0.04	2.98	4	3.36	1.16
		Maximum	1119.76	179	458	43.9	182	36.8	8.69	41	7.1	39.1	8	22.7	2.98	18.4	2.92	251	63	40.4	20.9
		Mean	505.68	78.94	168.48	21.36	82.08	15.87	3.56	15.60	2.44	14.36	2.83	8.06	1.10	6.80	1.02	83.17	25.40	12.96	4.88
		Median	459.38	69.05	141.50	19.05	72.85	15.05	3.46	14.05	2.13	12.45	2.34	6.68	0.90	5.70	0.78	60.35	20.50	8.28	3.12
		CV	0.54	0.54	0.58	0.54	0.56	0.61	0.65	0.70	0.74	0.76	0.80	0.81	0.81	0.79	0.82	0.87	0.66	0.76	0.88

Correlation studies on the composite data showed strong correlation (0.8 or above) between the light REEs (LREE), but no real correlation between the LREEs and the heavy REEs (HREEs), apart from Tb. Most of the HREEs correlated very well with the other HREEs, although as atomic weight increased, the strength of correlation seemed to wane. Correlation matrices for Cowalinya North and Cowalinya South are presented in Appendix C.

Figure 4-11 shows the Ce statistics plots for the upper saprolite and Figure 4-12 shows the lower saprolite Ce plots. The upper saprolite shows potentially two populations, as suggested by the log probability plots for TREE in Section 4.2.1 (Figure 4-10). The lower saprolite appears to be a more cohesive population, albeit with a moderate negative skew in the log histogram.

Figure 4-11 Ce statistics plots – Upper Saprolite; Cowalinya North

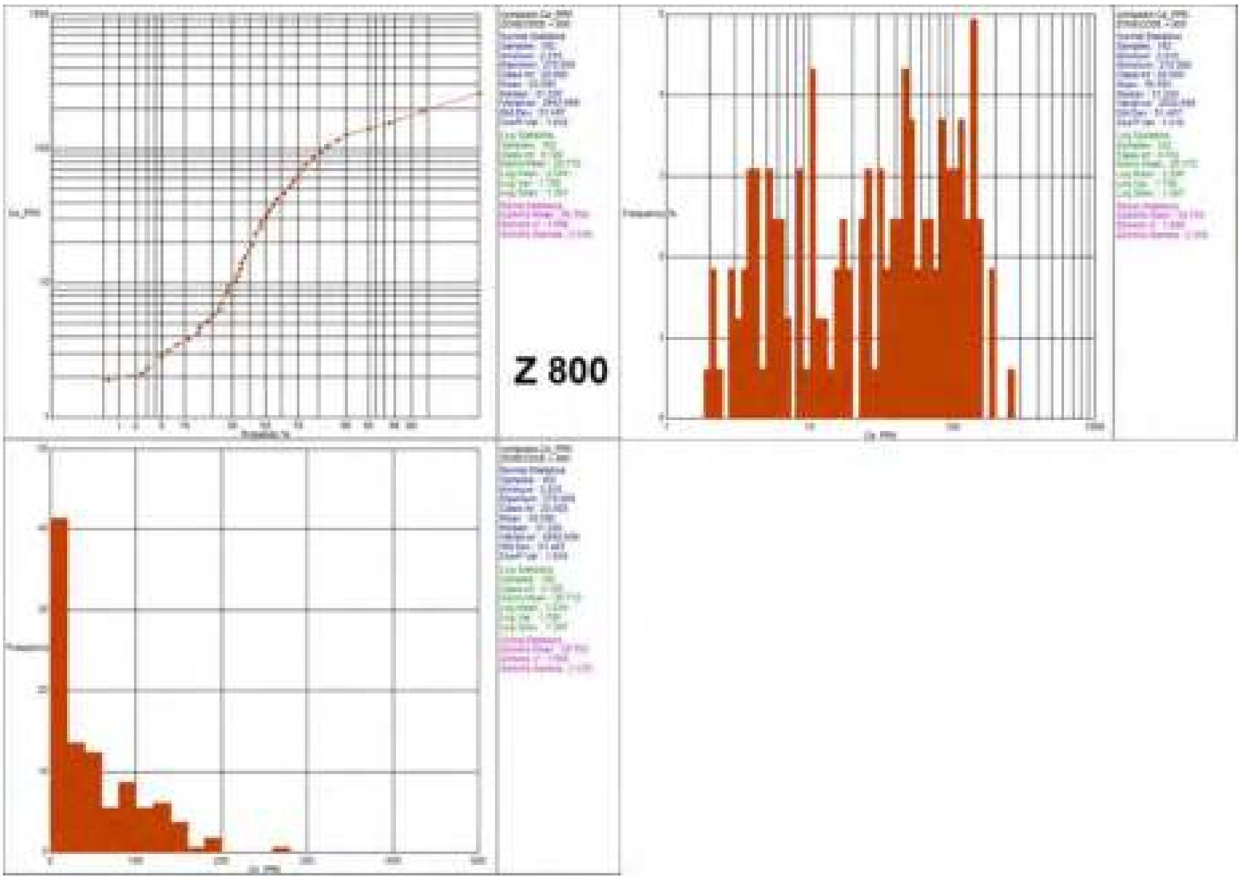


Figure 4-12 Ce statistics plots – Lower Saprolite; Cowalinya North

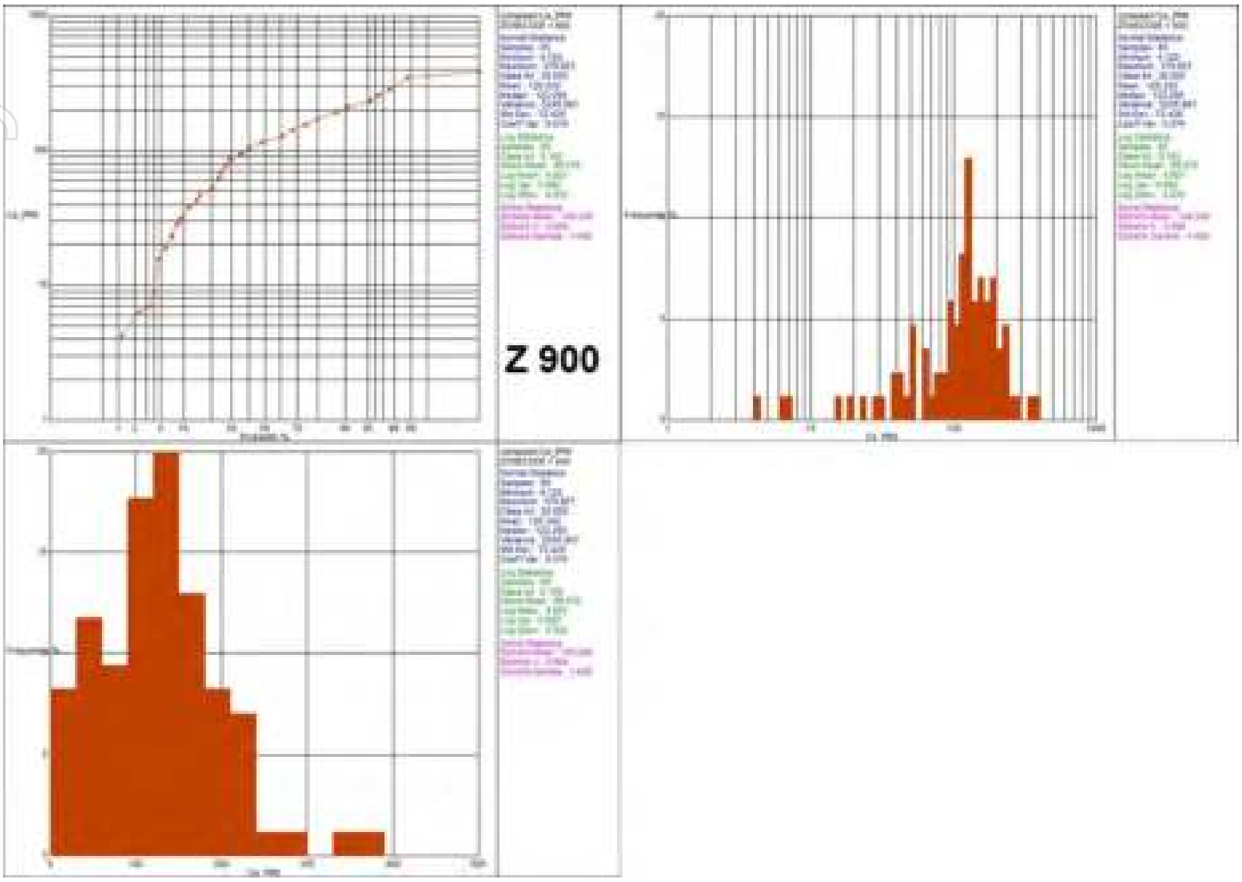


Figure 4-13 and Figure 4-14 show the statistics plots for Ce for the Cowalinya South saprolite units. As with the north area, the upper saprolite has more spread in the population than the lower saprolite.

Figure 4-13 Ce statistics plots – Upper Saprolite; Cowalinya South

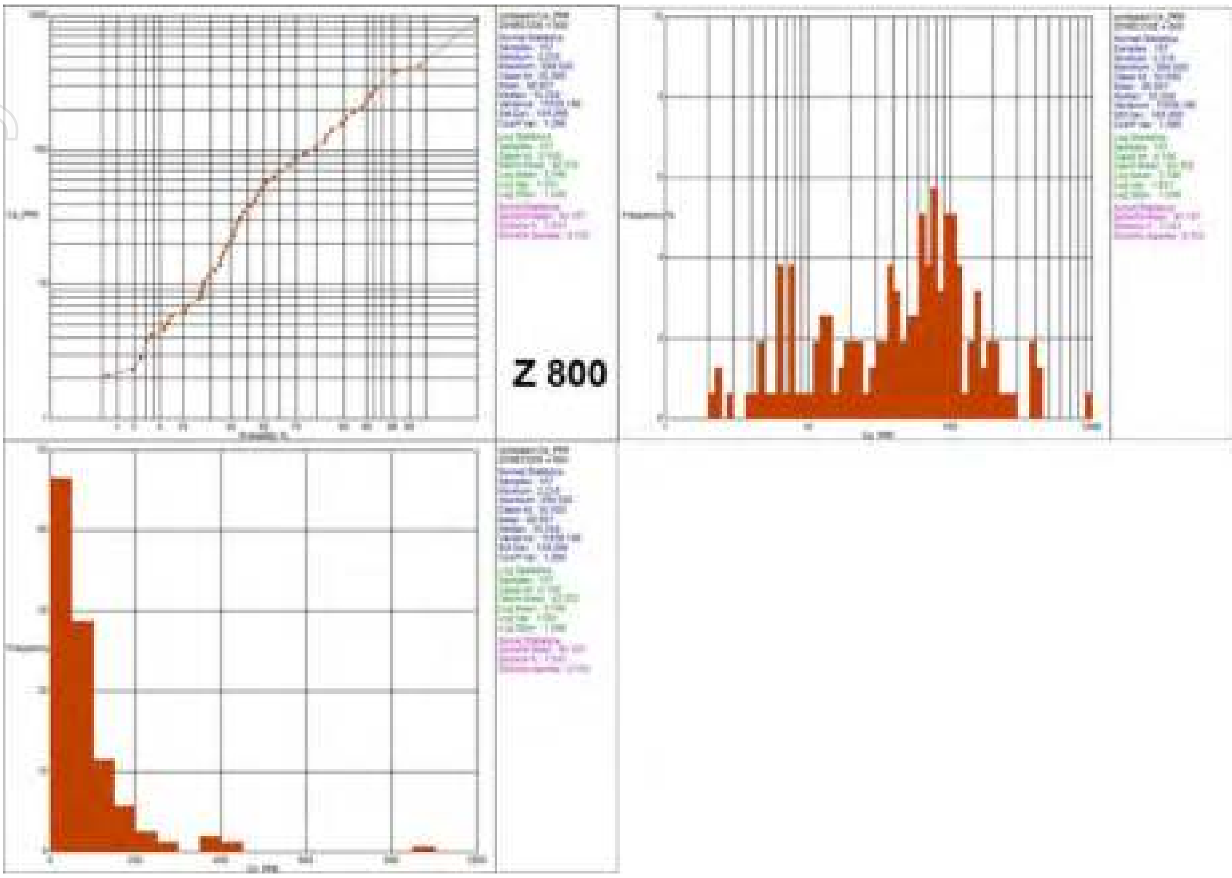
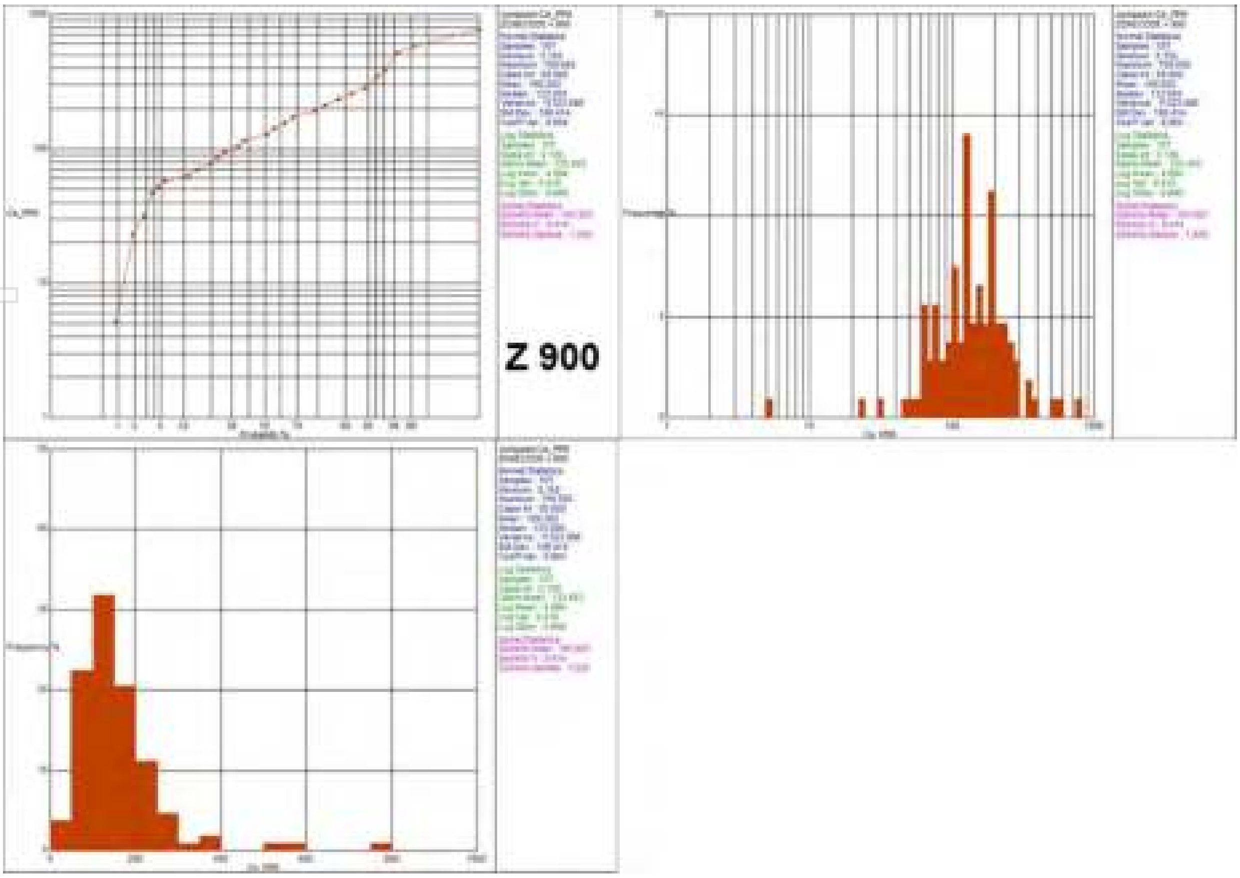


Figure 4-14 Ce statistics plots – Lower Saprolite; Cowalinya South



Further composite statistics plots are presented as Appendix D.

4.2.3 High-grade cutting

High grade top cuts were applied where required on the following elements only; La, Ce, Pr, Nd, Tb, Dy, Sc, Th and U. These were the two with the highest proportion in the TREE (La and Ce), plus the five of most relative value and the two potential deleterious elements Th and U.

Top cuts were only applied to extreme outliers, identified by statistical plots and by examining the location of the samples in three dimensions using Datamine software. The grade top cuts applied were generally very light, being in the top one to two percentiles.

Table 4.7 and Table 4.8 list the elements and the respective top cuts applied, the number of samples cut and the amount of metal removed from the population groupings.

Table 4.7 Grade top cuts applied at Cowalinya North

DOMAIN	1000	Cowalinya North			
ZONECODE	**Element**	**Top cut**	**No. of comps cut**	**% Metal Cut**	**Percentile Cut**
800	La	9999	0	0	-
	Ce	186	2	1.0	99.3
	Pr	27	1	1.3	99.3
	Nd	104	2	1.3	99.3
	Tb	1.9	4	2.1	97.8
	Dy	12	1	1.7	99.4
	Sc	33	3	1	98.7
	Th	22	2	2.3	98.7
	U	5.5	2	0.3	99.3
900	La	240	1	7.2	98.8
	Ce	9999	0	0	-
	Pr	50	3	12.2	96.5
	Nd	188	3	14	96.4
	Tb	5	5	11	94.9
	Dy	40	4	8.5	95.7
	Sc	9999	0	0	-
	Th	9999	0	0	-
	U	8.5	1	2.7	98.8

Table 4.8 Grade top cuts applied at Cowalinya South

DOMAIN	2000	Cowalinya South			
ZONECODE	**Element**	**Top cut**	**No. of comps cut**	**% Metal Cut**	**Percentile Cut**
800	La	210	3	2.99	98.1
	Ce	300	6	8.6	96.3
	Pr	53	3	5.9	98.1
	Nd	205	4	7.4	97.5
	Tb	6	3	7.7	98.0
	Dy	34	3	6.5	98.1
	Sc	9999	0	0.0	-
	Th	32	1	0.3	99.5
	U	9999	0	0	-
900	La	225	1	1.2	99.1
	Ce	375	3	4.1	97.2
	Pr	65	1	1.5	99.1
	Nd	210	5	4.1	95.4
	Tb	7	2	1.2	98.4
	Dy	40	2	1.2	98.1
	Sc	9999	0	0	-
	Th	27	1	0.4	99.2
	U	17	1	4.9	99.0

Table 4.9 compares the composites and the cut composites for the two mineralised saprolite units in the north and south areas. The coefficients of variance (CV) are generally very low or less than one, which suggests good stationarity and should also allow for better variography.

Table 4.9 Composite and cut composite statistics – upper and lower saprolite

Domain	Zonecode	Statistic	La	La Cut	Ce	Ce Cut	Pr	Pr Cut	Nd	Nd Cut	Tb	Tb Cut	Dy	Dy Cut	Sc	Sc Cut	Th	Th Cut	U	U Cut
1000	800	Composites	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162	162
		Minimum	1.09	1.09	2.01	2.01	0.27	0.27	1.04	1.04	0.03	0.03	0.19	0.19	2	2	1.90	1.90	0.61	0.61
		Maximum	142	142	270	186	41.5	27	155	104	2.89	1.9	18.4	12	55	33	38	22	7.7	5.5
		Mean	34.89	34.89	50.60	50.08	6.94	6.85	24.00	23.69	0.45	0.44	2.39	2.35	14.31	14.14	7.65	7.48	2.01	1.99
		Median	26.60	26.60	31.20	31.20	4.00	4.00	13.40	13.40	0.22	0.22	1.16	1.16	12.13	12.13	6.39	6.39	1.82	1.82
		CV	0.86	0.86	1.02	0.99	1.04	1.01	1.11	1.07	1.12	1.06	1.15	1.09	0.56	0.52	0.63	0.54	0.51	0.48
1000	900	Composites	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
		Minimum	0.8	0.8	4.12	4.12	0.37	0.37	1.73	1.73	0.03	0.03	0.37	0.37	4	4	1.83	1.83	0.37	0.37
		Maximum	640.00	240.00	379.86	379.86	194	50	768	188	19.1	5	106	40	40	40	26.21	26.21	15.23	8.50
		Mean	68.47	63.77	126.24	126.24	21.64	18.97	90.14	78.21	2.15	1.92	13.68	12.54	17.15	17.15	8.40	8.40	3.14	3.07
		Median	59.80	59.80	123.30	123.30	17.35	17.35	74.15	74.15	1.69	1.69	10.59	10.59	14.32	14.32	6.57	6.57	2.53	2.53
		CV	1.09	0.71	0.57	0.57	1.13	0.62	1.11	0.60	1.08	0.64	1.06	0.76	0.51	0.51	0.64	0.64	0.69	0.59
2000	800	Composites	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157
		Minimum	1.32	1.32	2.21	2.21	0.24	0.24	0.93	0.93	0.04	0.04	0.26	0.26	0.5	0.5	1.76	1.76	0.62	0.62
		Maximum	371	210	899	300	115	53	417.88	205	13.53	6	70.52	34	71	71	36.5	32	8.82	8.82
		Mean	57.73	56.04	80.96	74.09	11.86	11.17	42.28	39.19	0.92	0.85	5.06	4.72	17.89	17.89	10.99	10.96	2.72	2.72
		Median	41.30	41.30	55.26	55.26	6.10	6.10	17.20	17.20	0.31	0.31	1.71	1.71	15.00	15.00	8.71	8.71	2.39	2.39
		CV	1.02	0.93	1.30	0.99	1.40	1.21	1.55	1.34	1.81	1.51	1.77	1.50	0.77	0.77	0.61	0.60	0.53	0.53
2000	900	Composites	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
		Minimum	3.15	3.15	5.15	5.15	0.53	0.53	1.88	1.88	0.06	0.06	0.41	0.41	0.5	0.5	2.82	2.82	1.22	1.22
		Maximum	302.0	225.0	758.0	375.0	100	65	432	210	9.34	7	51.5	40	51	51	32.70	27.00	40.40	17.00
		Mean	79.37	78.65	160.20	153.53	21.50	21.17	85.89	82.29	2.36	2.33	13.63	13.46	18.63	18.63	12.27	12.22	4.91	4.69
		Median	70.3	70.3	133.0	133.0	18.05	18.05	74.40	74.40	2.00	2.00	10.60	10.60	16.72	16.72	11.37	11.37	3.76	3.76
		CV	0.59	0.56	0.66	0.52	0.69	0.63	0.75	0.63	0.79	0.76	0.81	0.78	0.60	0.60	0.44	0.42	0.90	0.64

Figure 4-15 to Figure 4-20 show the top cuts applied to La and Ce in the upper and lower saprolite (where applied). Additional plots showing the other grade top cuts applied are with the composite statistic plots in Appendix D.

Figure 4-15 La top cut – Lower Saprolite, Cowalinya North

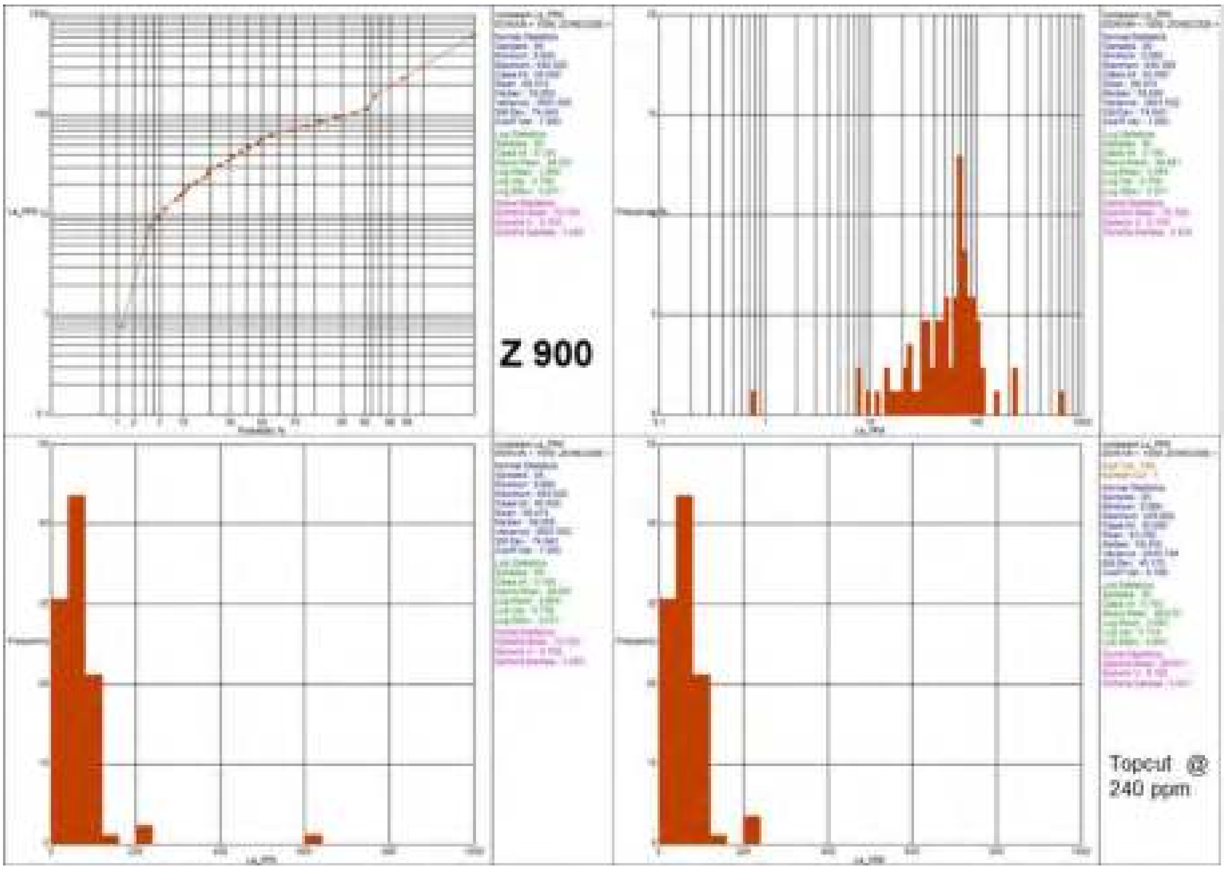


Figure 4-16 La top cut – Upper Saprolite, Cowalinya South

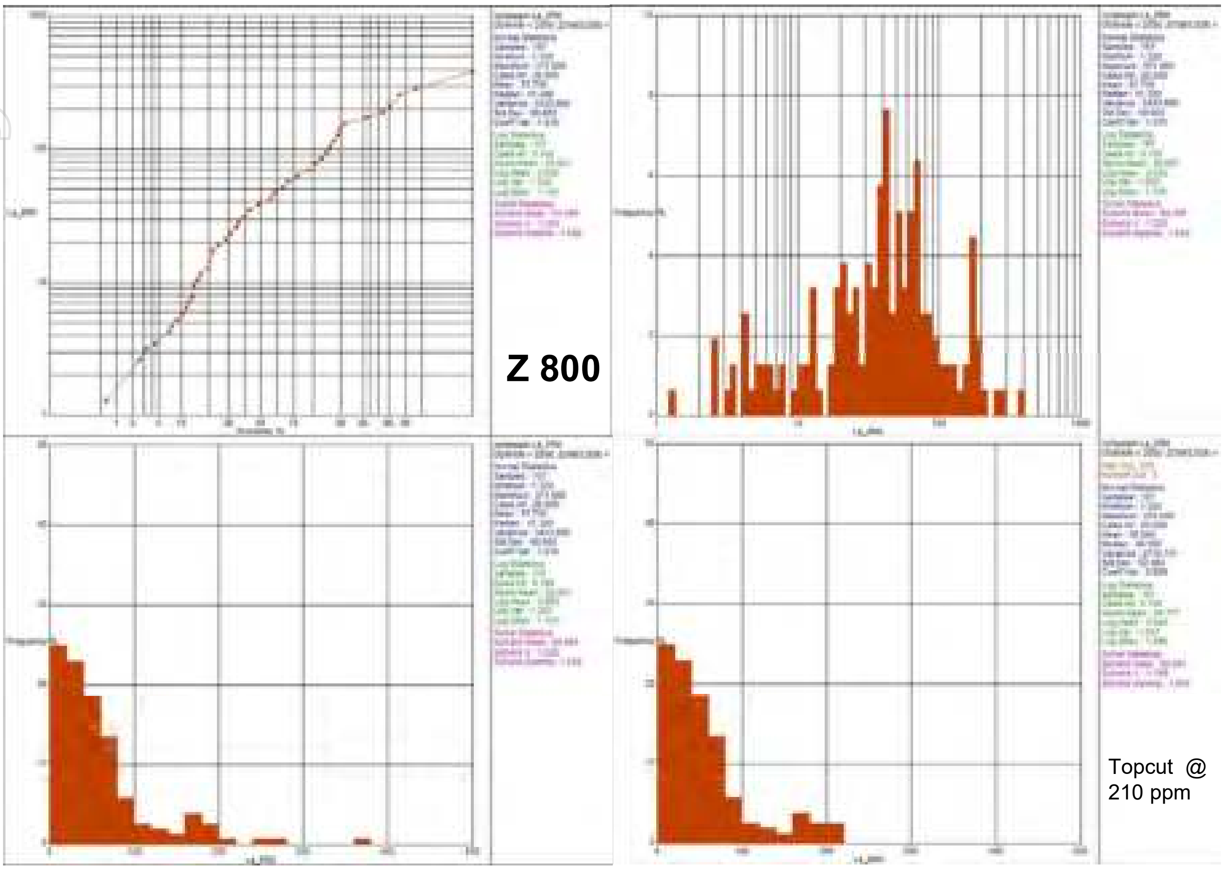


Figure 4-17 La top cut – Lower Saprolite, Cowalinya South

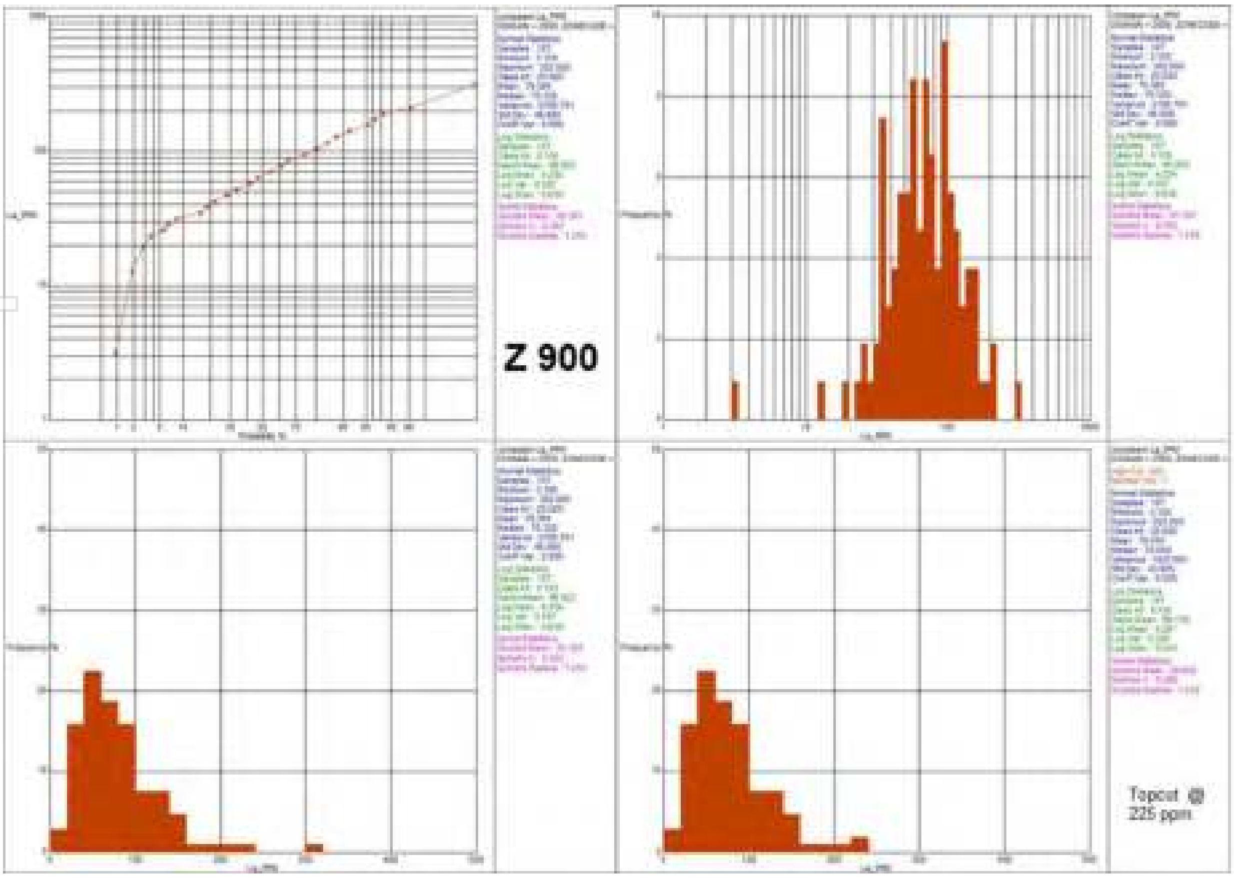


**Figure 4-18	Ce top cut – Upper Saprolite; Cowalinya North**

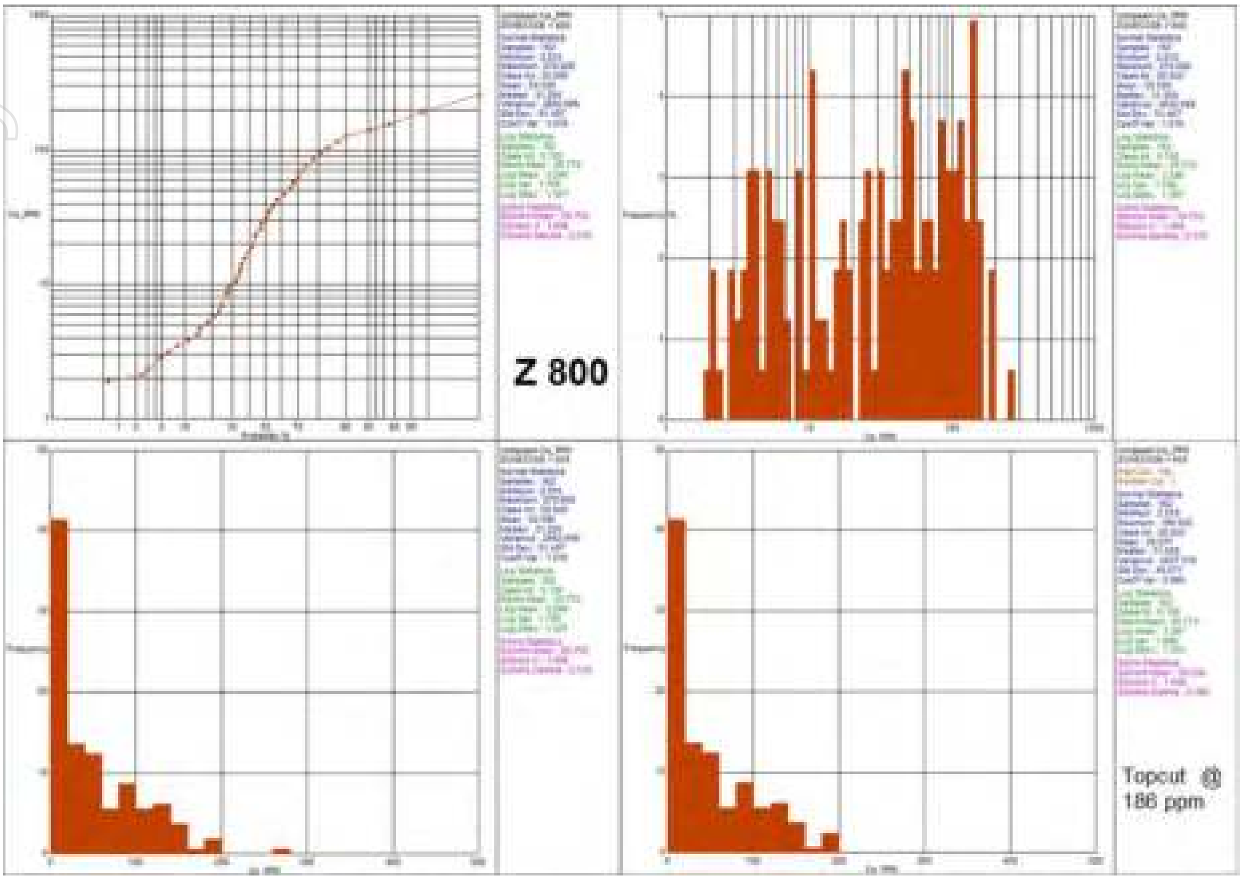


**Figure 4-19	Ce top cut – Upper Saprolite, Cowalinya South**

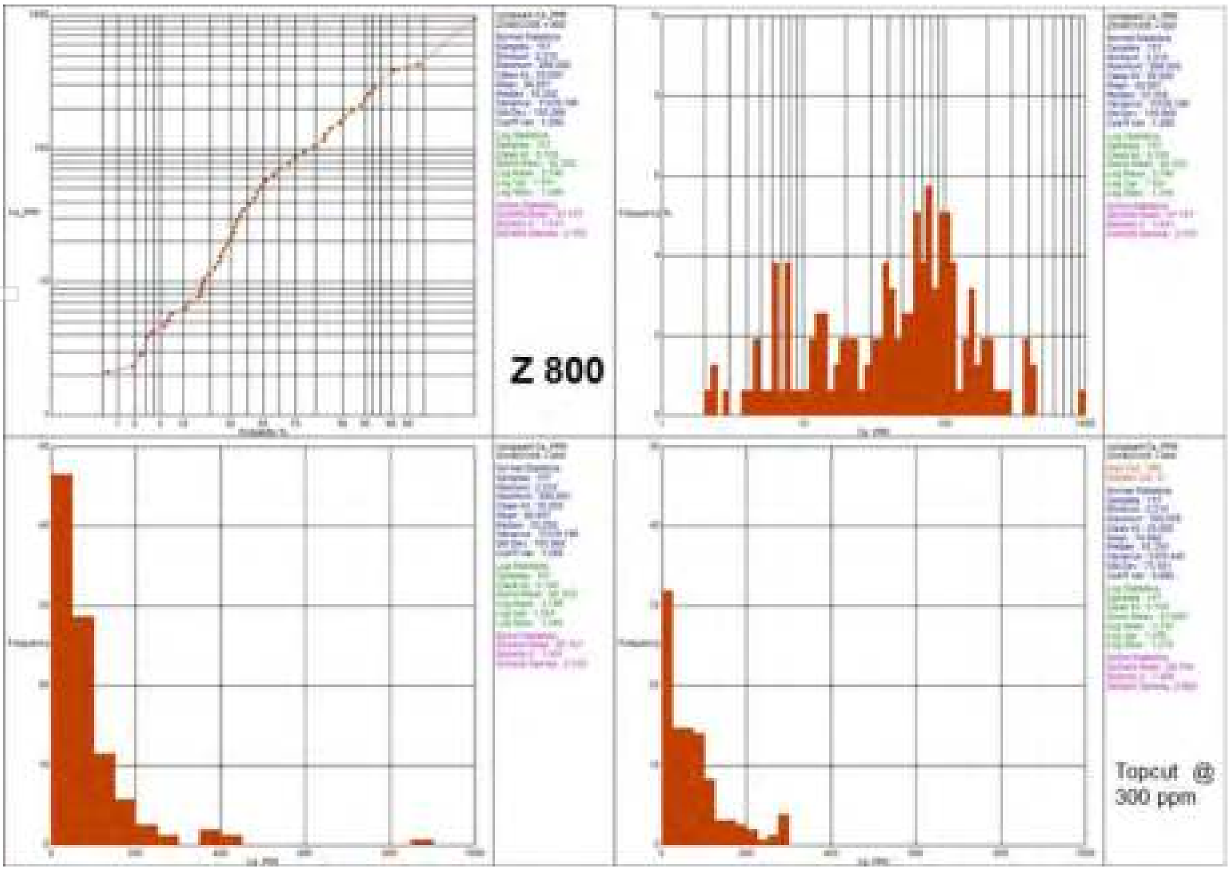
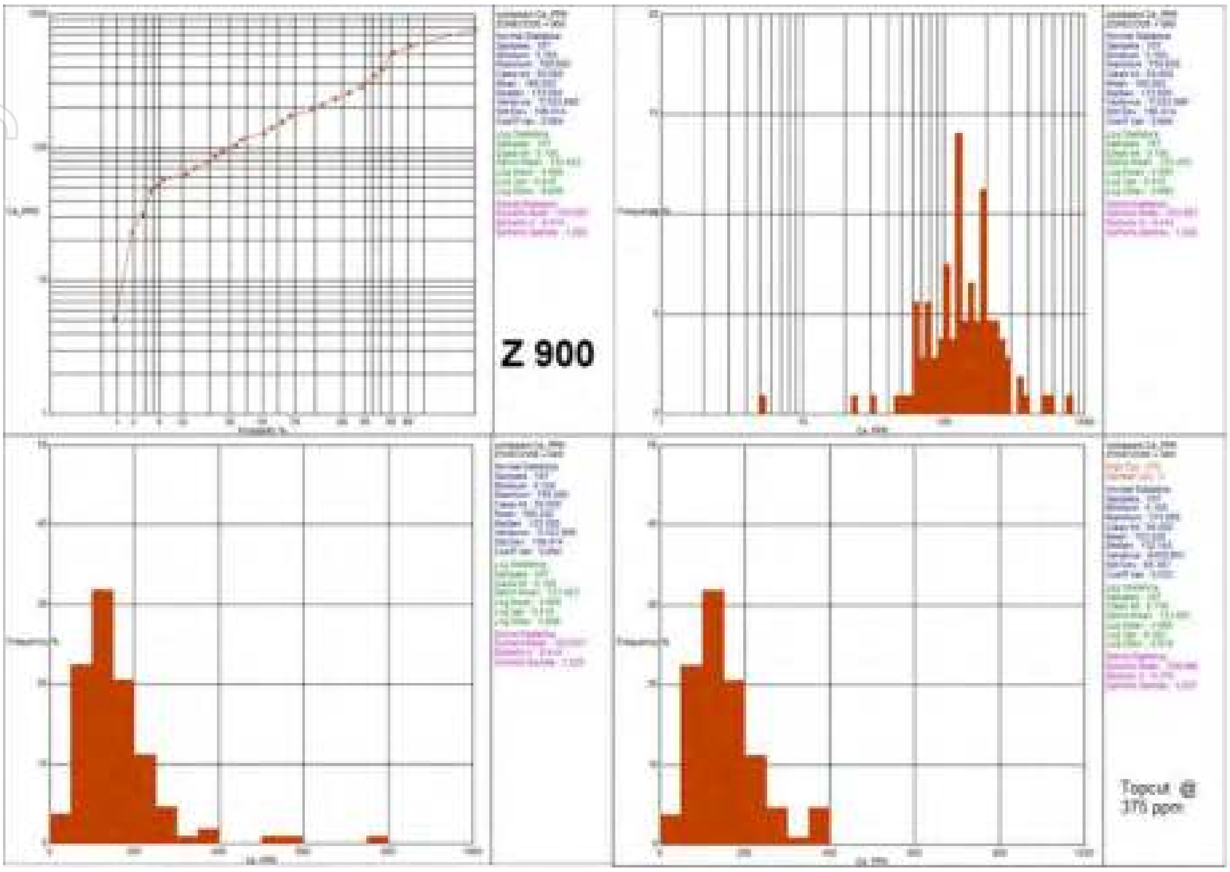


Figure 4-20 Ce top cut – Lower Saprolite, Cowalinya South



4.2.4 Bulk densities

Bulk densities were assigned to each geological unit based on published information or measured data from aircore sampling. Section 3.5.6 has a full description of how the assigned densities were either calculated or assigned.

The values applied are listed in Table 4.10.

Table 4.10 Bulk density values applied to block model

ZONECODE	Geological Unit	Density t/m^{-3}
100	Calcrete/Soil	1.95
200	Upper Clay	2.2
300	Upper Sand	1.6
400	Puggy Clay	2.2
500	Middle Sand	1.6
600	Silcrete	2.3
700	Silcrete-Sand (Lower sand)	1.6
800	Upper Saprolite	1.63
900	Lower Saprolite	1.63
1000	Bedrock (Fresh Rock)	2.5

4.3 Variography

After reviewing statistics of the composites, both for single elements and in various groupings, variograms were completed for two groupings, combined light rare earths (LREE) and combined heavy rare earths (HREE) and three of the individual elements Sc, Th and U. The LREE group comprises the elements La, Ce, Pr, Nd and Sm, whilst the HREE grouping consists of Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y.

Variograms were only completed for the upper and lower saprolite units (ZONECODEs 800 & 900) in Cowalinya North and Cowalinya South areas, as the remaining ZONECODE divisions had too few samples, or were waste grade areas.

The individual interpreted geological units of transported material (ZONECODEs 100 – 700) above the upper saprolite were grouped together for estimation and used the borrowed variograms from the upper saprolite. The bedrock units, north and south, used the borrowed variograms from their respective adjacent lower saprolite for estimation.

Downhole and directional variograms were modelled in each case. Two structure spherical models were applied to the experimental variograms in all cases, apart from downhole variograms which were modelled with single structures.

Contouring of the various assayed elements suggested only a modest anisotropy for most, with the major axis direction generally north to south, or at most five to ten degrees either side of north. There appears to be a strong information effect, particularly in the semi-major axis direction, as the continuous 100 m-spaced drilling in this direction has a pronounced impact on the direction of the experimental variograms produced with the most continuity. Drillhole spacing for the major axis direction is 250 m in the north area and 400 m in the south area. If the variograms were not modelled on cardinal point directions, the semi-major axis in particular lost continuity very quickly as the apparent spacing between drill holes increased five to sixfold very rapidly once the orientation diverged from directly east-west.

Figure 4-21 to Figure 4-24 show the downhole and directional variograms for LREE in the upper and lower saprolite units for Cowalinya North and Cowalinya South. Additional variograms are presented as Appendix F.

Figure 4-21 Downhole and directional variograms – Grouped LREEs; Upper Saprolite North

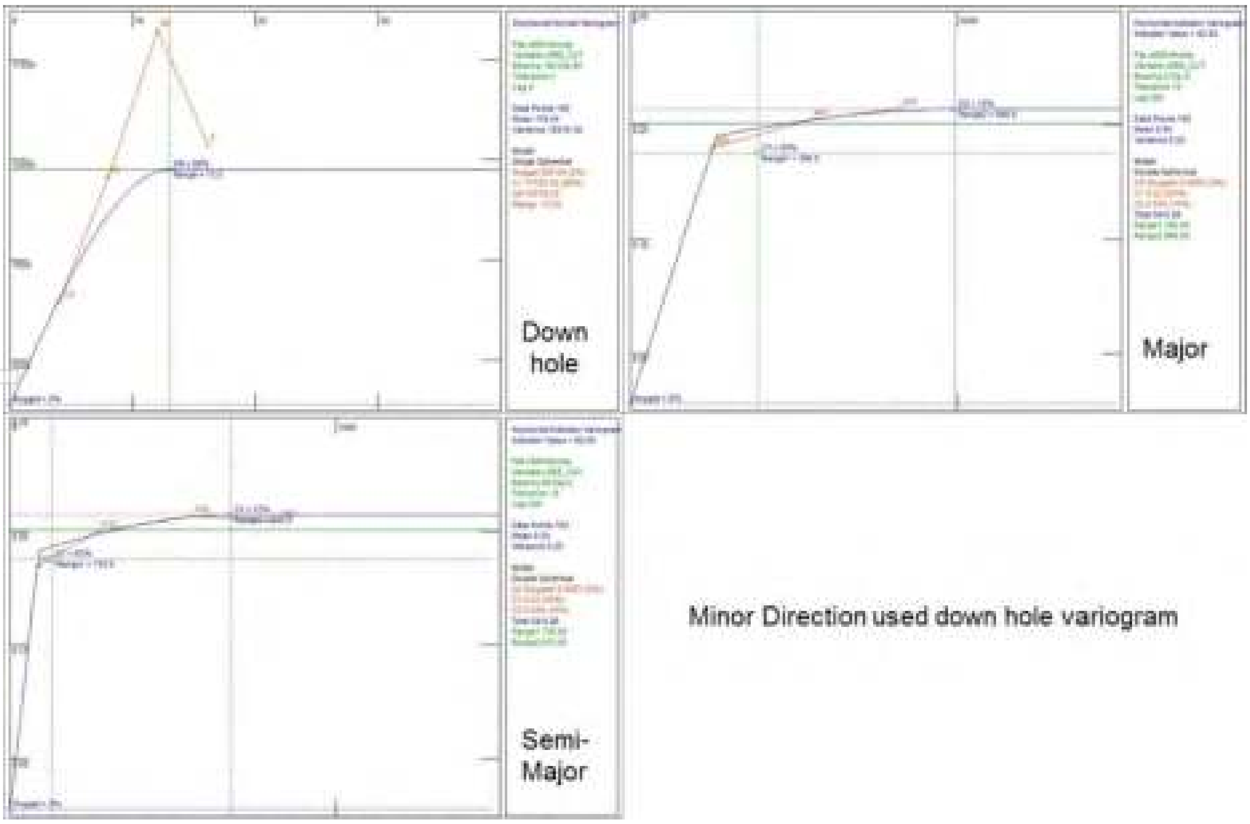


Figure 4-22 Downhole and directional variograms – Grouped LREEs; Lower Saprolite North

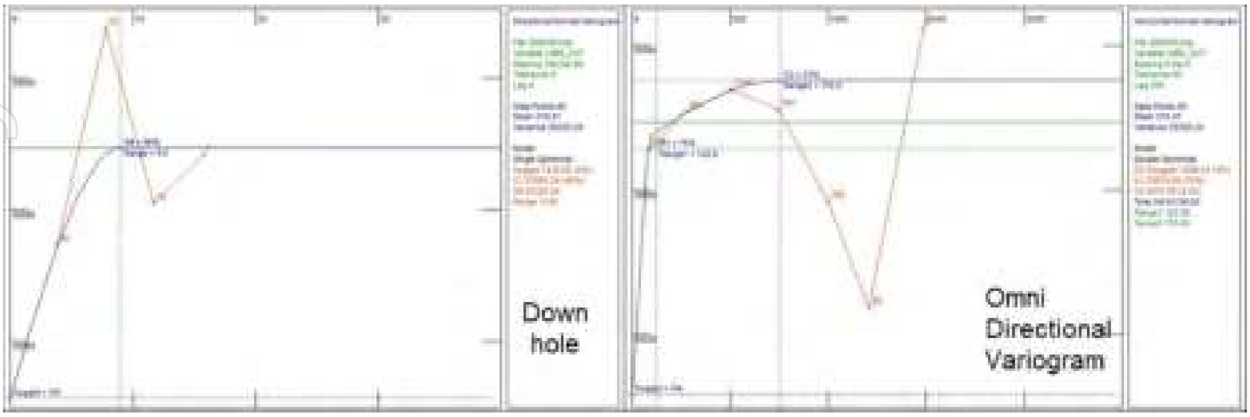


Figure 4-23 Downhole and directional variograms – Grouped LREEs; Upper Saprolite South

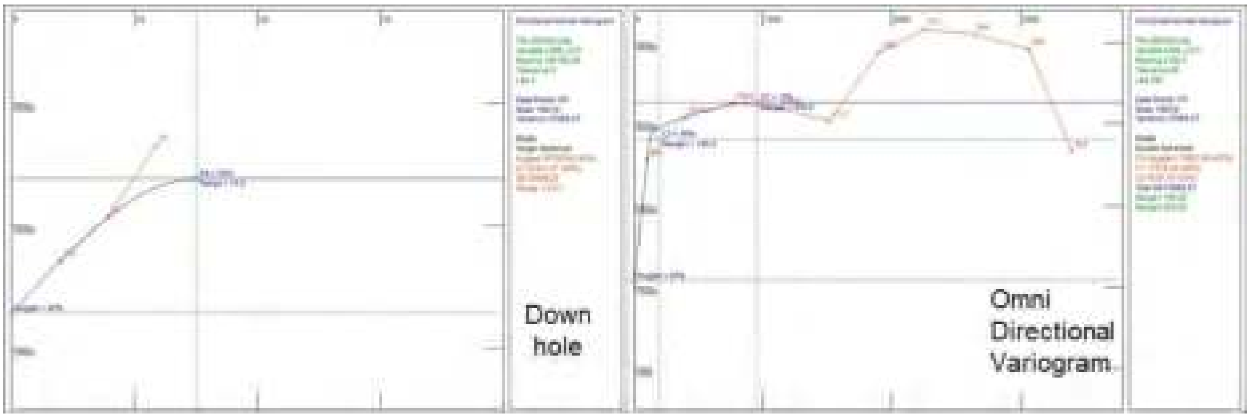
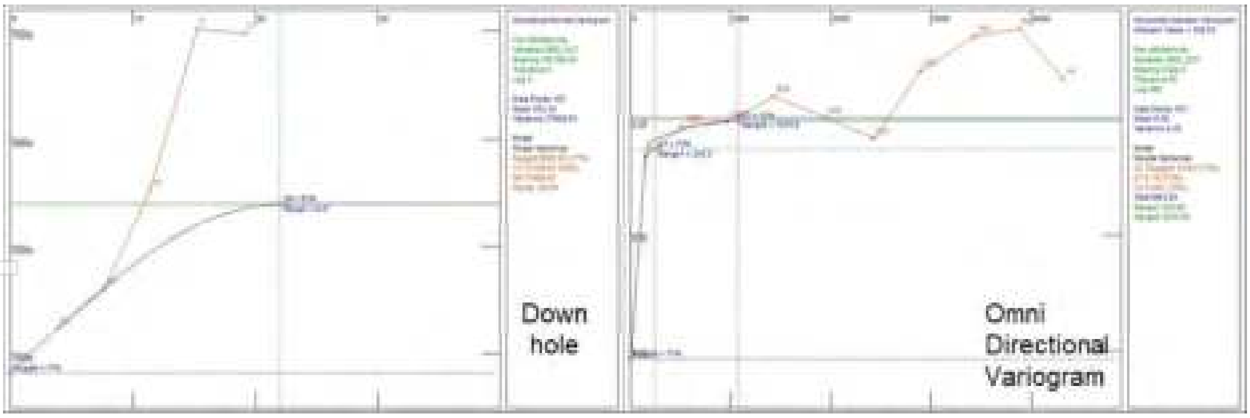


Figure 4-24 Downhole and directional variograms – Grouped LREEs; Lower Saprolite South



Where possible the variograms were modelled as normal variograms, but due to poor structure in some, these were modelled as Median Indicator variograms. The modelled major directions generally aligned with the strike of the mineralisation, with the semi-major directions aligned across strike.

All of the variogram structures were scaled to the data variance for the estimation process. Table 4.11 lists the parameters modelled for each estimated variable for the estimated DOMAIN and ZONECODE groupings.

Table 4.11 Variogram models

Grouping	Variable	Major Axis		Semi Major Axis		Minor Axis		Relative Nugget	Sill 1	Range Structure 1 (m)			Sill 2	Range Structure 2 (m)		
		Dip (º)	**Azimuth** (º)	**Dip** (º)	**Azimuth** (º)	**Dip** (º)	**Azimuth** (º)	(C_0%)	(C_1%)	**Major Axis**	**Semi Major Axis**	**Minor Axis**	(C_2%)	**Major Axis**	**Semi Major Axis**	**Minor Axis**
Upper Saprolite & Grouped Transported; North	Ce, La, Nd, Pr, Sm	0	5	0	95	-90	5	2	83	390	130	5	15	990	675	13
	Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Y & Yb	0	10	0	100	-90	10	2	87	370	130	5	11	1300	415	11
	Sc	0	0	0	90	-90	0	21	51	215	215	10	28	540	540	25
	Th	0	0	0	90	-90	0	2	62	165	165	7	36	450	450	15
	U	0	0	0	90	-90	0	2	73	195	195	7	25	485	485	14
Lower Saprolite and Bedrock; North	Ce, La, Nd, Pr, Sm	0	0	0	90	-90	0	4	75	122	122	4	21	755	755	9
	Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Y & Yb	0	155	0	65	-90	155	46	33	395	140	5	21	870	730	11
	Sc	0	0	0	90	-90	0	13	48	160	160	15	39	870	870	33
	Th	0	0	0	90	-90	0	1	74	75	75	15	25	400	400	35
	U	0	0	0	90	-90	0	1	68	155	155	7	31	1400	1400	14
Upper Saprolite & Grouped Transported; South	Ce, La, Nd, Pr, Sm	0	0	0	90	-90	0	42	46	195	195	7	12	950	950	15
	Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Y & Yb	0	10	0	100	-90	10	23	72	240	240	7	5	1080	1080	13
	Sc	0	0	0	90	-90	0	60	32	175	175	7	8	675	675	14
	Th	0	0	0	90	-90	0	3	80	195	195	6	17	735	735	12
	U	0	0	0	90	-90	0	5	89	180	180	6	6	910	910	12
Lower Saprolite and Bedrock; South	Ce, La, Nd, Pr, Sm	0	0	0	90	-90	0	17	73	245	245	11	10	1075	1075	22
	Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Y & Yb	0	10	0	100	-90	10	2	84	245	245	8	14	960	960	16
	Sc	0	0	0	90	-90	0	64	21	220	220	7	15	995	995	15
	Th	0	0	0	90	-90	0	3	75	130	130	7	22	1050	1050	14
	U	**0**	**0**	**0**	**90**	**-90**	**0**	**38**	**45**	**185**	**185**	**6**	**17**	**710**	**710**	**12**

Notes: 1) Orientations for the major, semi major and minor axes are supplied as dips and azimuths.
2) Two structure spherical models were applied to the experimental variograms.

4.4 Volume modelling/block model development

The Cowalinya block model was initially built on two prototypes; the main model which contains the Cowalinya South grade estimate and background waste and the smaller Cowalinya North model. Subsequent to grade estimation, the two models were combined onto the main prototype.

The main model has a parent block size of 400 m in northing, 100 m in easting and 4 m in RL, whilst the smaller north model has 250 m in northing by 100 m in easting by 4 m in RL parent blocks. This effectively matches the drill hole spacing at both areas in the northing and easting directions and matches an assumed bench height for open pit mining in the RL direction. The blocks are arranged so that their centroids are on the drill fence lines, with most blocks having a drill hole at or near its centre.

After grade estimation, the north model prototype was re-set to the main model prototype, before adding it to the main model to create the final Cowalinya 2021 model. The block sizes and the amount and size of sub-blocks allowed in each model were chosen for better estimation of each area and ease of combination after estimation.

The stacked surface wireframes created from the geological interpretation were filled below each surface successively from the topography surface to below the bedrock surface. This created a layered block model where each layer was given a unique ZONECODE identifier. Sub blocks were allowed to form down to 25 m x 25 m in the northing and easting directions and one metre in RL.

The volume contained by the combined upper and lower saprolite units (between the upper saprolite surface and the bedrock surface) for each area, north and south, was recorded from the wireframes and compared with the volume filled by model blocks. This was to ensure the amount of sub-blocking was appropriate and no volume was being lost in the final model. Both the north and south areas filled to within 0.5% of the wireframe volumes.

The top and bottom boundaries of the saprolite and bedrock units were used as hard boundaries for grade estimation, with the grouped transported material units having an outer hard boundary, but soft internal boundaries. This allowed all of the transported unit data to be used for each individual transported unit block estimate.

Table 4.12 and Table 4.13 show the parameters used to create the block volume models.

Table 4.12 Main volume model (combined background and South) parameters

Parameter	Value
East origin (X) (mE)	426450
North origin (Y) (mN)	6356800
Level origin (Z) (mRL)	160
X parent cell size (m)	100
Y parent cell size (m)	400
Z parent cell size (m)	4
Number of parent cells in X	74
Number of parent cells in Y	15
Number of parent cells in Z	35
X split cell (Minimum) (m)	25
Y split cell (Minimum) (m)	25
Z split cell (Minimum) (m)	1
X model range (m)	7,400
Y model range (m)	6,000
Z model range (m)	140

Table 4.13 North volume model parameters

Parameter	Value
East origin (X) (mE)	426450
North origin (Y) (mN)	6359875
Level origin (Z) (mRL)	160
X parent cell size (m)	100
Y parent cell size (m)	250
Z parent cell size (m)	4
Number of parent cells in X	74
Number of parent cells in Y	12
Number of parent cells in Z	35
X split cell (Minimum) (m)	25
Y split cell (Minimum) (m)	25
Z split cell (Minimum) (m)	1
X model range (m)	7,400
Y model range (m)	3,000
Z model range (m)	140

4.5 Grade estimation

4.5.1 Estimation methods

JMCTC completed ordinary kriged estimates for all of the REEs, plus Sc, Th and U. The interpreted geological units were used to guide grade estimation, with multi-element estimates generated for the two saprolite, grouped transported and bedrock units.

All of the DOMAIN and ZONECODE divisions flagged in the block model are used to select sample populations for grade estimation, with each grouping only using drill hole samples with the same DOMAIN and ZONECODE coding.

Grade was estimated separately in the north and south areas, as they had different drill hole spacing and different volume models. The two sub-models were added together on completion. All of the north area estimated model parent and sub blocks were retained in the final model as sub blocks. Details of the block model dimensions and extents are in Section 4.4. In all cases, grade was estimated into parent cells with all sub blocks being assigned the same grade as its original parent.

The estimation process treated the upper and lower saprolite as separate divisions as there was markedly better grade for most variables in the lower saprolite units. Lower grade material at the top of the upper saprolite units were estimated as part of the overall grade population in those units as there was no clear geological or grade boundary to enable sub-domaining the top part of the upper saprolite.

Estimates were undertaken for Th and U, which are non-commodity variables, but are potentially deleterious elements and estimates are required for a full understanding of the processing options. Estimated grades were all converted to oxides for reporting purposes on completion of the estimates. Table 4.14 lists the element to oxide conversion factors used in the model.

Table 4.14 List of estimated elements and their oxide conversion factors

Element	Conversion Factor (multiplier)	Oxide
La	1.1728	La_2O_3
Ce	1.2284	CeO_2
Pr	1.2082	Pr_6O_{11}
Nd	1.1664	Nd_2O_3
Sm	1.1596	Sm_2O_3
Eu	1.1579	Eu_2O_3
Gd	1.1526	Gd_2O_3
Tb	1.1762	Tb_4O_7
Dy	1.1477	Dy_2O_3
Ho	1.1455	Ho_2O_3
Er	1.1435	Er_2O_3
Tm	1.1421	Tm_2O_3
Yb	1.1387	Yb_2O_3
Lu	1.1371	Lu_2O_3
Y	1.2699	Y_2O_3
Sc	1.5338	Sc_2O_3
Th	1.1379	ThO_2
U	1.1792	U_3O_8

4.5.2 Estimation parameters

4.5.2.1 Variogram models

Variogram parameters were used as tabulated in Section 4.3 (Table 4.11), with the grouped Eocene transported units and the upper saprolite sharing the same parameters, and the lower saprolite and bedrock units sharing the same parameters. Variances for each ZONECODE division were scaled by the proportions of the modelled variograms to the local variance of the composites in that ZONECODE division.

4.5.2.2 Search and estimation parameters

Grade continuity varied from several to tens to hundreds of metres in the across strike and along strike directions. Down dip continuity was proportionally very short, due to the thin geological unit layering, being generally in the 10 m to 15 m range, although extending to as much as 30 m.

Search ellipse dimensions and directions for each ESTDOM grouping were initially set to approximately two-thirds the major axis range and scaled according to the variograms for the other directions. These were reviewed and rounded where required prior to the final estimate.

Generally, two search passes were used for estimates in the primary mineralised units, ZONECODE 800 and ZONECODE 900, with 95 to 99 percent of estimates occurring in the first or second pass. The grouped transported and bedrock units had three passes allowed to ensure that a small number of blocks at the extremities of the model were also estimated. The surrounding background waste had default grade values applied. Table 4.15 shows the search parameters used.

The input values for the grade estimate were the top cut grade fields from the composite file. The ZONECODE divisions were assigned a numeric estimation code, ESTDOM, which matched their ZONECODE number, apart from the overlying transported units. The transported units were grouped together for estimation, as most did not have enough samples for a separate estimate and they were generally very low or waste grade. Table 4.16 shows the ZONECODE divisions and their corresponding ESTDOM codes.

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Table 4.15 Search neighbourhood parameters used for resource model estimation

DOMAIN	Variable	Search Ellipse Ranges			Search Ellipse Orientation			First Pass		Second Pass			Third Pass			Maximum N° of Composites from any Drillhole
		Major Axis	**Semi-Major Axis**	**Minor Axis**	**Major Axis (º)**	**Semi-Major Axis (º)**	**Minor Axis (º)**	**Minimum N° of Composites Used**	**Maximum N° of Composites Used**	**Search Volume Factor**	**Minimum N° of Composites Used**	**Maximum N° of Composites Used**	**Search Volume Factor**	**Minimum N° of Composites Used**	**Maximum N° of Composites Used**	
Upper Saprolite & Transported; North	LREE	450	659	9	0 to 360*	0 to 90	-90 to 360	4	7	2.5	3	7	4 (Except LREE, HREE, Sc in transported)	3 (Except LREE, HREE, Sc in transported)	7 (Except LREE, HREE, Sc in transported)	3
	HREE	275	865	7	0 to 010	0 to 100	-90 to 010									
	Sc	360	360	17	0 to 360	0 to 90	-90 to 360									
	U	300	300	10												
	Th	325	325	9												
Lower Saprolite and Bedrock; North	LREE	500	500	6	0 to 340	0 to 70	-90 to 340									
	HREE	485	580	7	0 to 335	0 to 65	-90 to 335									
	Sc	580	580	22	0 to 340	0 to 70	-90 to 340									
	U	265	265	25	0 to 360	0 to 90	-90 to 360									
	Th	930	930	9												
Upper Saprolite & Transported; South	LREE	635	635	10	0 to 340	0 to 70	-90 to 340	4	6	2.5	4	6	4 (Transported, Bedrock, Th & U only)	4 (Transported, Bedrock, Th & U only)	6 (Transported, Bedrock, Th & U only)	
	HREE	720	720	9												
	Sc	450	450	9												
	U	250	250	8	0 to 360	0 to 90	-90 to 360									
	Th	300	300	8												
Lower Saprolite and Bedrock; South	LREE	715	715	15	0 to 320	0 to 50	-90 to 320									
	HREE	640	640	11												
	Sc	665	665	10												
	U	350	350	10	0 to 360	0 to 90	-90 to 360									
	Th	240	240	10												

**Notes:* LREE in Transported (North) had a 5 degree rotation around the Z-axis, not 10 as in the Upper Saprolite
LREE and Sc in Bedrock (North) have a major axis towards 360^0 (no rotation)

Table 4.16 ZONECODE groupings for ESTDOM numeric coding

Area	Unit	ZONECODE	ESTDOM
Cowalinya North	Mixed transported	100, 200, 300,400, 500, 600, 700	300
	Upper Saprolite	800	800
	Lower Saprolite	900	900
	Bedrock	1000	1000
Cowalinya South	Mixed transported	100, 200, 400, 500, 600	200
	Upper Saprolite	800	800
	Lower Saprolite	900	900
	Bedrock	1000	1000

Apart from the LREEs in the overlying transported units (ESTDOM 200 & 300), estimation was by ordinary kriging. The LREEs (La, Ce, Pr, Nd and Sm) in the transported units were estimated by the inverse distance squared method.

Several geostatistical fields are also generated during the estimate and were stored in the output model. These fields assist in the model validation and the resource classification. The fields related to each parent block and are the number of samples used for the grade estimate, the dynamic search volume number (pass) in which the block estimate was generated, the kriging variance of the block and the geostatistical distance to the nearest sample. Table 4.17 list these fields and the names they were given in the estimated model file. For the LREEs in ESTDOM 200 and 300, only the number of samples and search volume number were captured in the model.

Table 4.17 Estimation parameters used for resource model estimation

ESTDOM	Input Value	Output Value	Geostatistical Fields captured in Estimated Model			
			Number of Samples Used	**Search Volume Number**	**Variance**	**Geostatistical Distance**
200, 300 (apart from LREEs) 800, 900, 1000	LA_CUT	LA_EST	NSLA	PASSLA	VARLA	DSLA
	CE_CUT	CE_EST	NSCE	PASSCE	VARCE	DSCE
	PR_CUT	PR_EST	NSPR	PASSPR	VARPR	DSPR
	ND_CUT	ND_EST	NSND	PASSND	VARND	DSND
	SM_CUT	SM_EST	NSSM	PASSSM	VARSM	DSSM
	EU_CUT	EU_EST	NSEU	PASSEU	VAREU	DSEU
	GD_CUT	GD_EST	NSGD	PASSGD	VARGD	DSGD
	TB_CUT	TB_EST	NSTB	PASSTB	VARTB	DSTB
	DY_CUT	DY_EST	NSDY	PASSDY	VARDY	DSDY
	HO_CUT	HO_EST	NSHO	PASSHO	VARHO	DSHO
	ER_CUT	ER_EST	NSER	PASSER	VARER	DSER
	TM_CUT	TM_EST	NSTM	PASSTM	VARTM	DSTM
	YB_CUT	YB_EST	NSYB	PASSYB	VARYB	DSYB
	LU_CUT	LU_EST	NSLU	PASSLU	VARLU	DSLU
	Y_CUT	Y_EST	NSY	PASSY	VARY	DSY
	SC_CUT	SC_EST	NSSC	PASSSC	VARSC	DSSC
	TH_CUT	TH_EST	NSTH	PASSTH	VARTH	DSTH
	U_CUT	U_EST	NSU	PASSU	VARU	DSU

Figure 4-25 shows a plan view of the block model after estimation, coloured on the product of TREO grade and total saprolite thickness, to get a ppm metres plot for Cowalinya North and South. This highlights the areas of the model with the highest accumulation of rare earths.

Figure 4-25 TREO grade - thickness product (ppm metres)

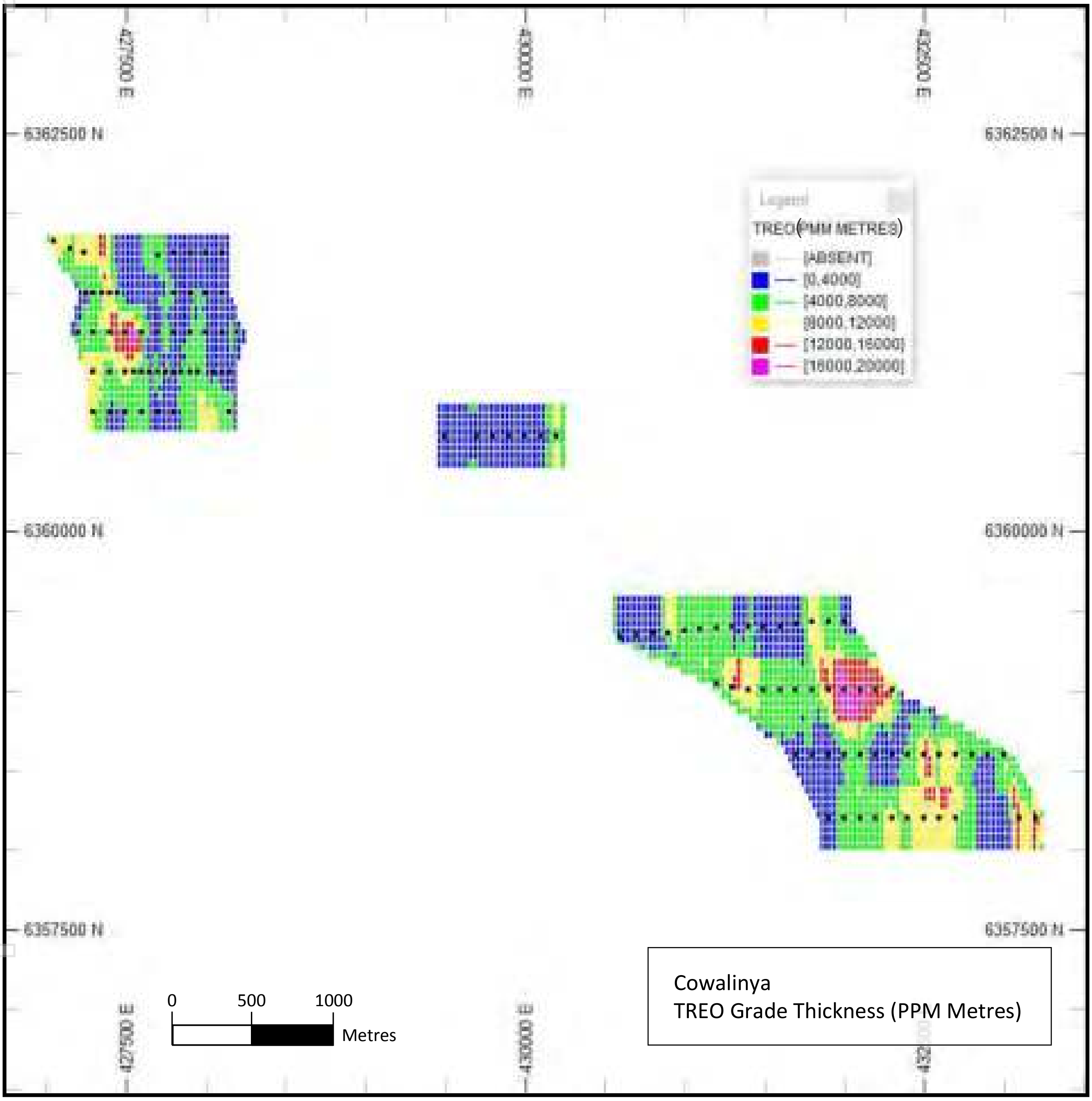
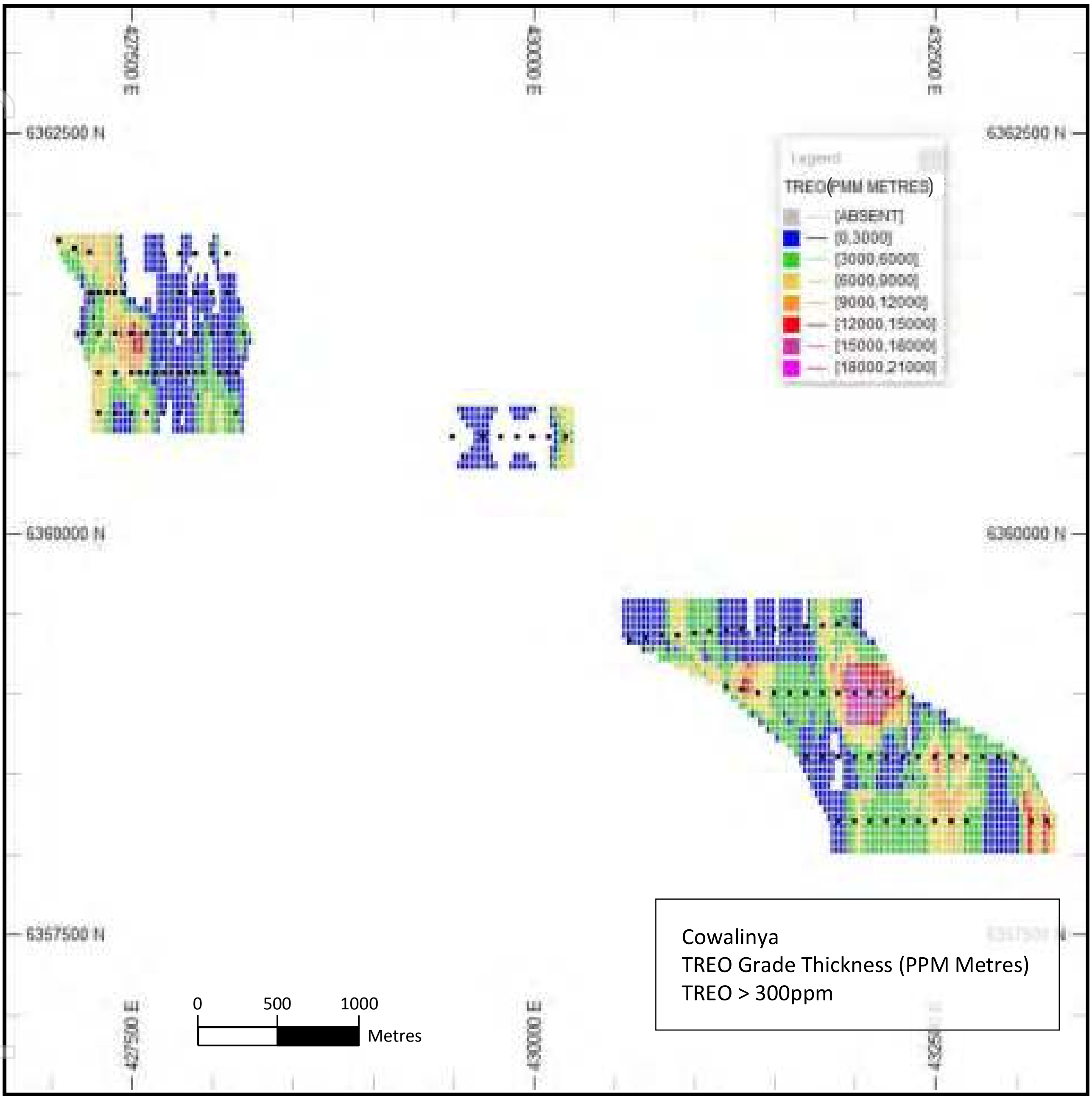


Figure 4-26 shows the same type of plot as Figure 4-25 above, but coloured on the grade - thickness product for blocks in the model with a TREO grade greater than 300 ppm. The blank (non-coloured) blocks represent areas of the model with no blocks of 300 ppm TREO or greater in that accumulated column of blocks.

Figure 4-26 TREO grade (>300 ppm) - thickness product (ppm metres)



4.5.3 Model validation

Validation of the block model consisted of:

- Volumetric comparison of the mineralisation wireframes to the block model volumes.
- Visual comparison of estimated grades against composite grades.
- Comparison of block model grades to the input data using swathe plots.
- Comparison of block model grades to the input data using quantile plots.

To compare the model volume versus the wireframes, a temporary volume wireframe was built for the upper and lower saprolite units in the north and south areas. The wireframes linked the top of the upper saprolite to the bedrock surface in each area. The blocks that filled the wireframe were measured by multiplying their X by Y by Z increment dimensions and accumulating all of those within the wireframe volume. Table 4.18 lists the measured volume inside the wireframe versus the volume of modelled blocks.

Table 4.18 Block Volume versus wireframe volume – Saprolite units; north and south

DOMAIN	Wireframe Volume (m^3)	Block Volume (m^3)	Difference (%)
1000	23,410,958	23,371,250	0.2
2000	35,645,721	35,645,000	0.002

The block model was stepped through, on screen in Datamine, from north to south and from east to west to check for error. The blocks and composites were displayed together, coloured on matching grade variables. No obvious error was observed, with the general colour scheme of the blocks and composites matching by area.

Figure 4-27 shows a cross-section through the model at 6361000 mN in the north area and Figure 4-28 shows a cross-section at 6358600 mN in the south area. Both sections only show the upper and lower saprolite units for clarity. Overlying waste and bedrock units have been removed.

Figure 4-27 Block model and composites coloured on TREO – Section 6361000 mN, looking North

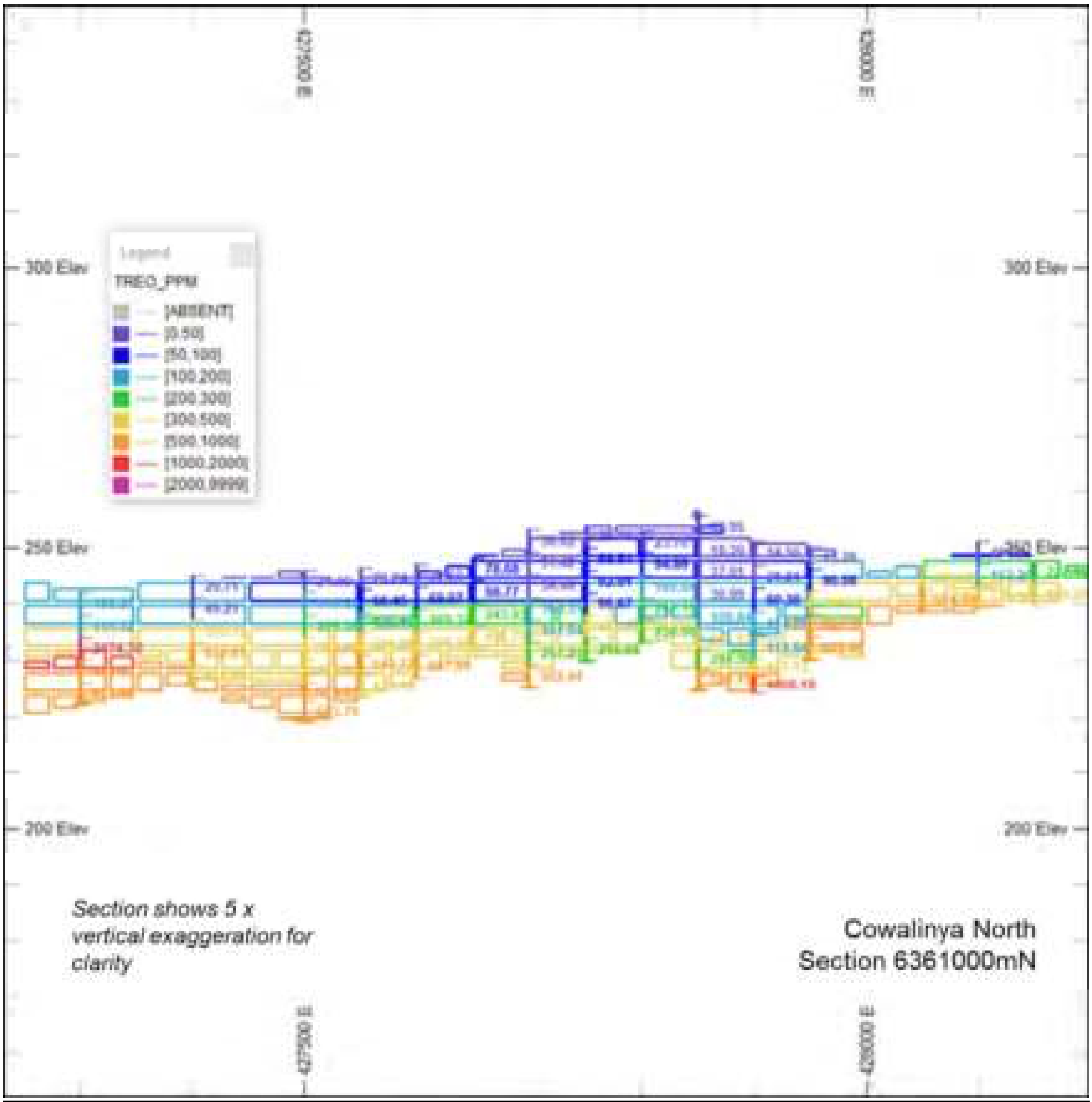
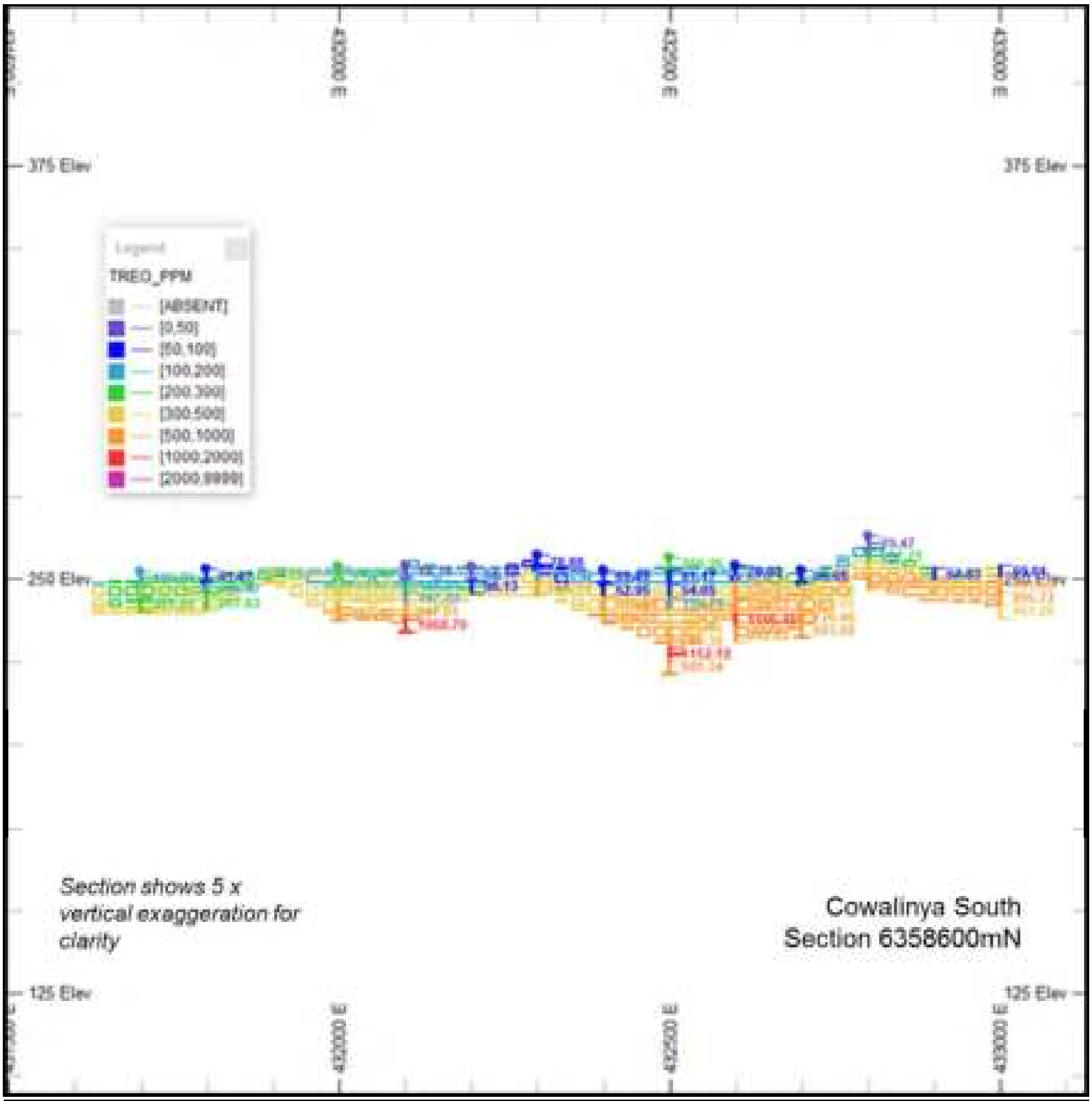


Figure 4-28 Block model and composites coloured on TREO – Section 6358600 mN, looking North



Profile plots were generated for the key estimated variables of the block model and compared with the cut composites used as input to the estimation process. Plots were generated for the estimated elements La, Ce, Nd, Dy and the combined REEs as oxides (TREO), as well as Sc, Th and U.

Plots were generated by northing and easting slices through the Cowalinya North and Cowalinya South sub-models. The northing slices were not as informative as hoped, as there were only four in the south (averaged over 400 m) and five in the north (averaged over 250 m). The estimated grades and the composite grades came out very close, as they were essentially one quarter to one fifth of all of the data, trending towards a global mean, and didn't show enough variance between data sets from slice to slice. The easting slices showed the expected trends however, with the model showing a general smoothing of the input composite data, but the overall peaks and troughs formed by high and low grade being followed.

Figure 4-29 shows the TREO by Northing slice for the upper and lower saprolites, Cowalinya North and South. The estimated model grade, the cut composite grade and the number of samples per slice are displayed. The north model area shows apparent slight over estimation and the south model area shows apparent slight under estimation. The average difference between model and composites in the north is just under 8% whilst in the south it is just under 3%.

Figure 4-29 TREO by northing slice – Cowalinya North and South; upper and lower saprolites

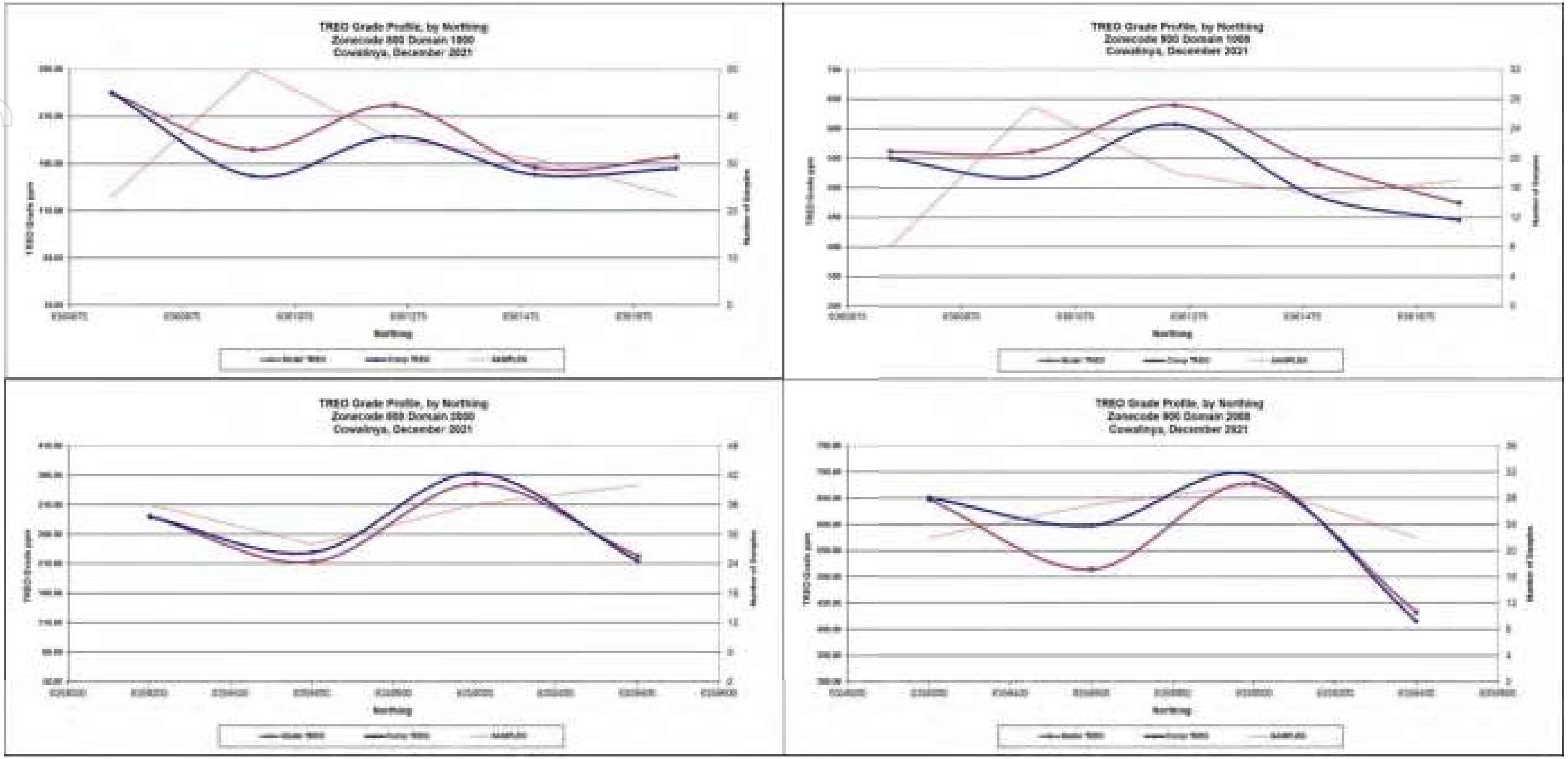
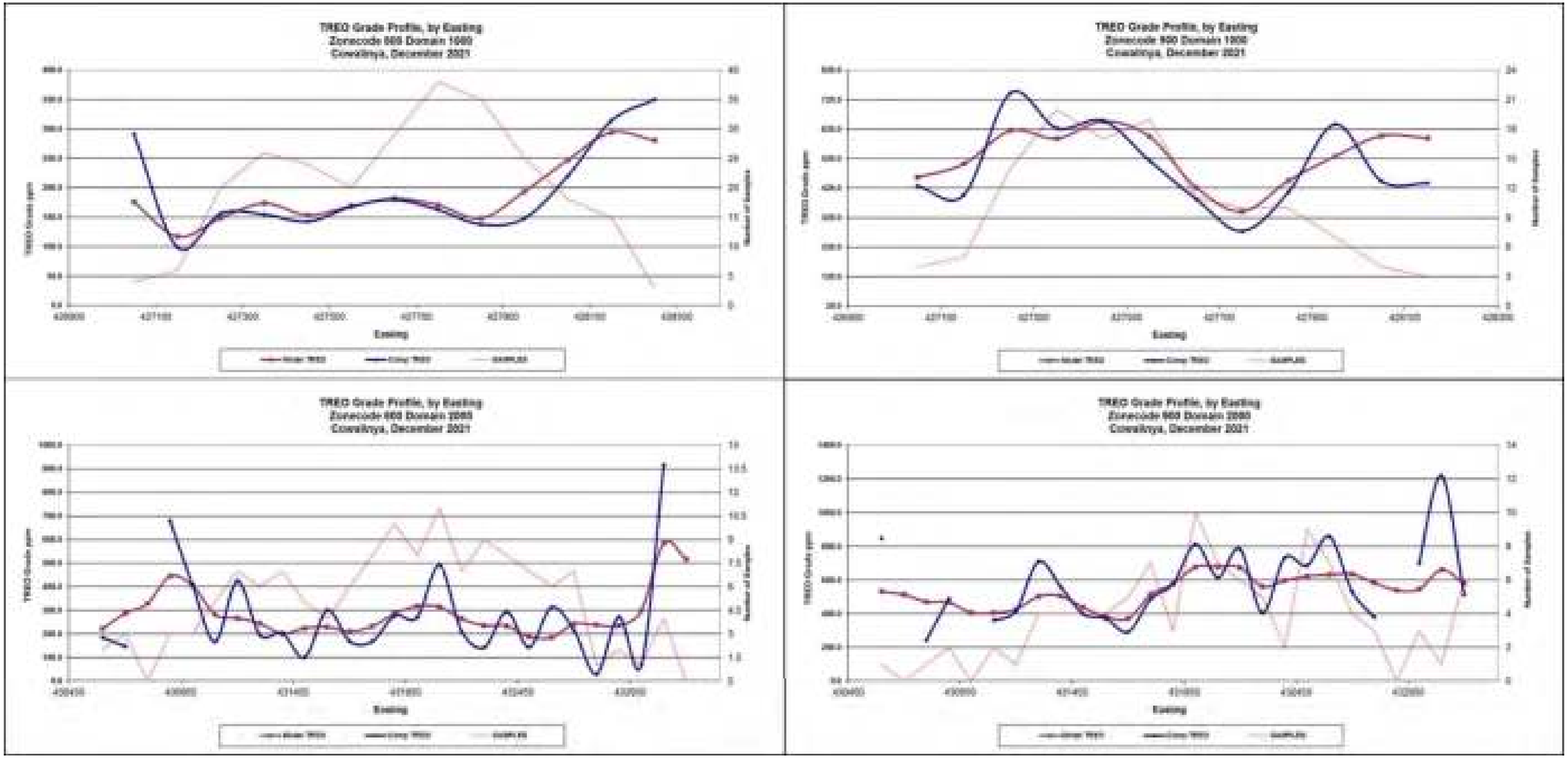


Figure 4-30 shows the profile plots by 100 m Easting slice, with the estimated grade, the input cut composite grade and the number of samples plotted.

Generally, the profile plots show the expected trends, with the estimated grades showing a smoother trend than the composite data, but still constrained by the limits of the composite data. The very high peaks and troughs in the composite data are generally represented by more modest peaks and troughs in the model curve. The amount of composite data can also be seen to have an effect on the divergence of the two plotted curves.

Additional profile plots for La, Ce, Nd, Dy, Sc Th and U, for Cowalinya North and Cowalinya South are presented in Appendix G.

Figure 4-30 TREO by 100 m Easting slice – Cowalinya North and South; upper and lower saprolites



Percentile plots were also examined as an aid to validating the block model output. Plots were produced for the grouped saprolite units in the north and south areas, comparing block model values per percentile with composite grades. The plots show generally good correlation of modelled grade to composites apart from the upper grade end of the plots. Both plots (Figure 4-31 and Figure 4-32) show apparent under-estimation of higher grades, but good correlation for the low to medium grade, particularly at Cowalinya North.

Figure 4-31 TREO percentile plot – Cowalinya North

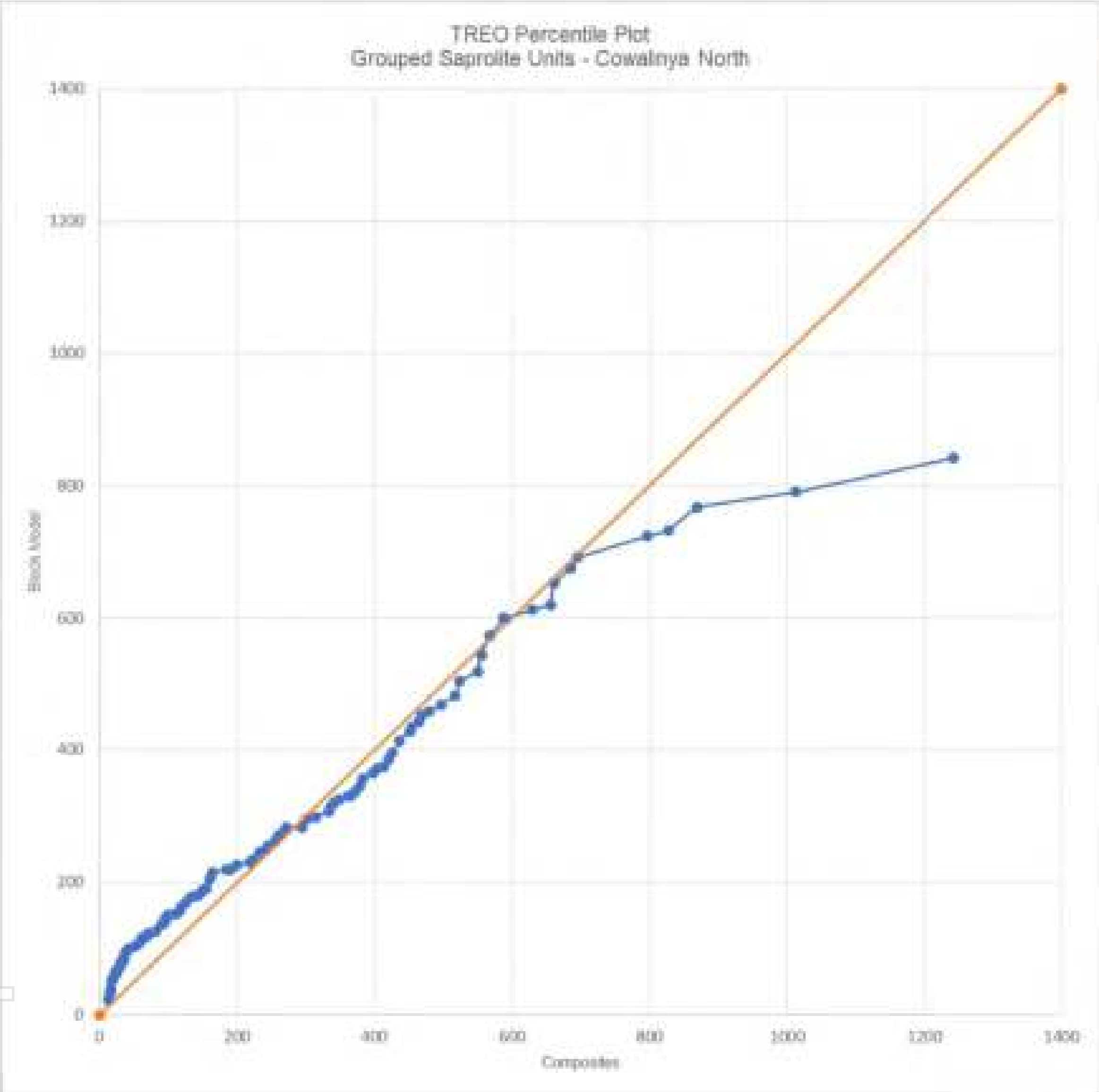
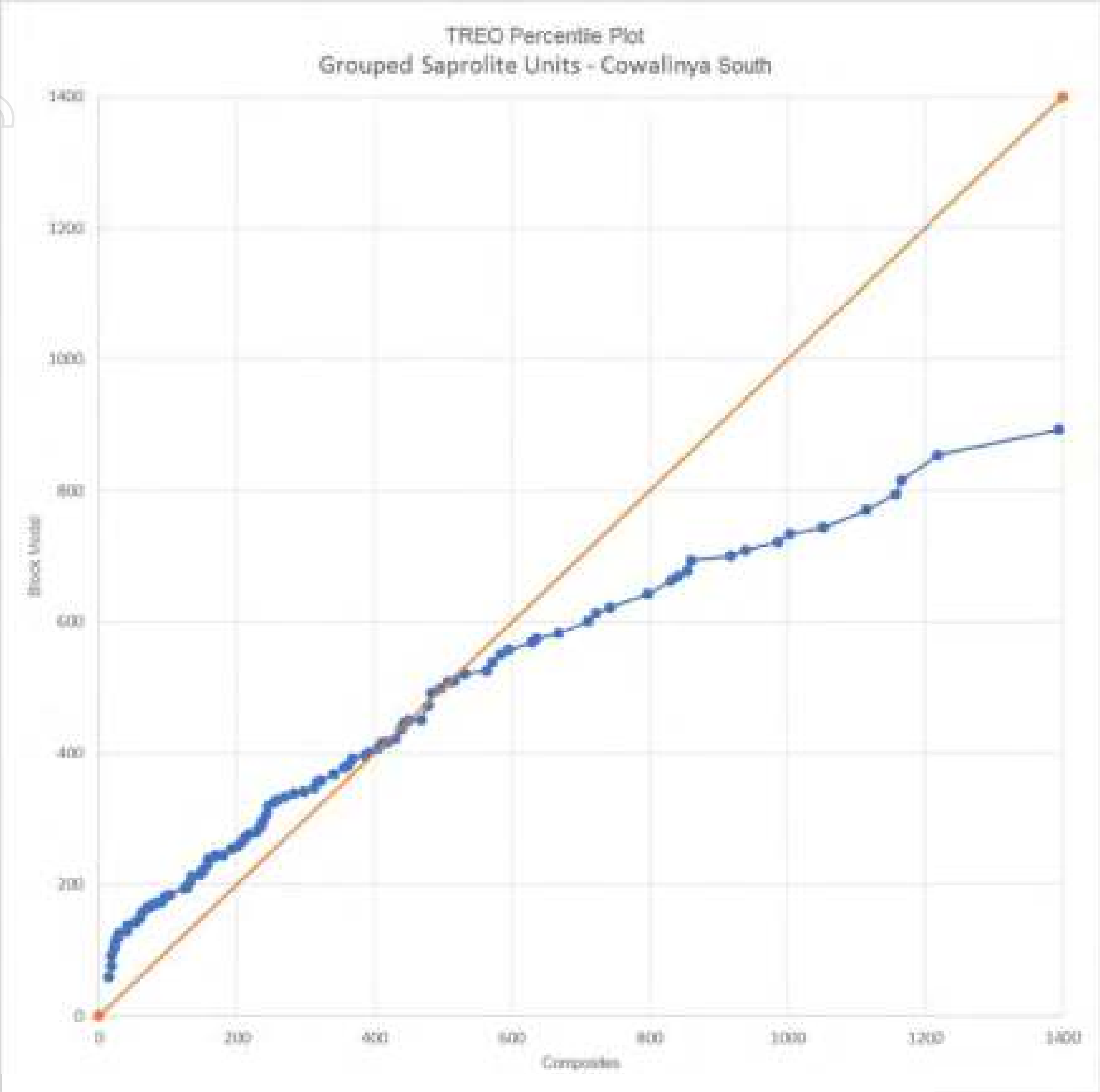


Figure 4-32 TREO percentile plot – Cowalinya South



Modifying the grade estimation parameters, particularly the number of samples allowed per estimate, to move the upper part of the curve closer to the diagonal and avoid apparent under-estimation of high grade, had the opposite effect on the swathe plots. Where they had shown slight apparent over-estimation, particularly on the northing slice plots, this became more pronounced. The converse was also true.

Multiple iterations of model estimate were compared using the swathe plots, visual validation and percentile plots to determine the best unbiased outcome.

It is expected that in future revisions of the Cowalinya model, sampling will be more selective, particularly in the upper saprolite unit, to help remove some of the potential dilution and to allow for the higher grades to be better domained. This should help to alleviate some of the apparent under-estimation of the higher grades.

4.6 Ancillary fields

4.6.1.1 Bulk density

Bulk density values were applied to the block model after grade estimation according to the scheme set out in Table 4.10, Section 4.2.4.

4.6.1.2 Depletion for Open Pit and Underground workings

The model has been coded with two additional binary fields, TOPO and INSITU, to allow for future depletion flagging.

These codes relate to the block position above or below the topographic surface and whether it has been mined out. As no mining has occurred to date at Cowalinya and no surface stockpiles exist, all blocks are currently coded 0 (below) for TOPO and 1 for INSITU.

4.6.1.3 Resource classification and criteria

The estimate is classified according to the guidelines of the 2012 JORC Code as Inferred Mineral Resource. The classification has taken into account the relative confidence in tonnage and grade estimations, the reliability of the input data, JMCTC's confidence in the continuity of geology and grade values and the quality, quantity and distribution of the drill hole and supporting input data.

Although the variography studies for the primary mineralised units at Cowalinya have shown very little variance in the data for most of the estimated variables and primary ranges in the order of several hundred metres, the raw samples were four metre composites, combined from the initially sampled one metre intervals. This has artificially reduced the natural variance of the data. The four metre samples have also crossed geological boundaries in several cases. Some of the QAQC data implies issues with some samples, particularly in the area of repeatability of assayed grades. JMCTC believes that to classify the block model any higher than Inferred Resource, the original one metre samples need to be assayed to match the logging and to get a more accurate picture of the data variability.

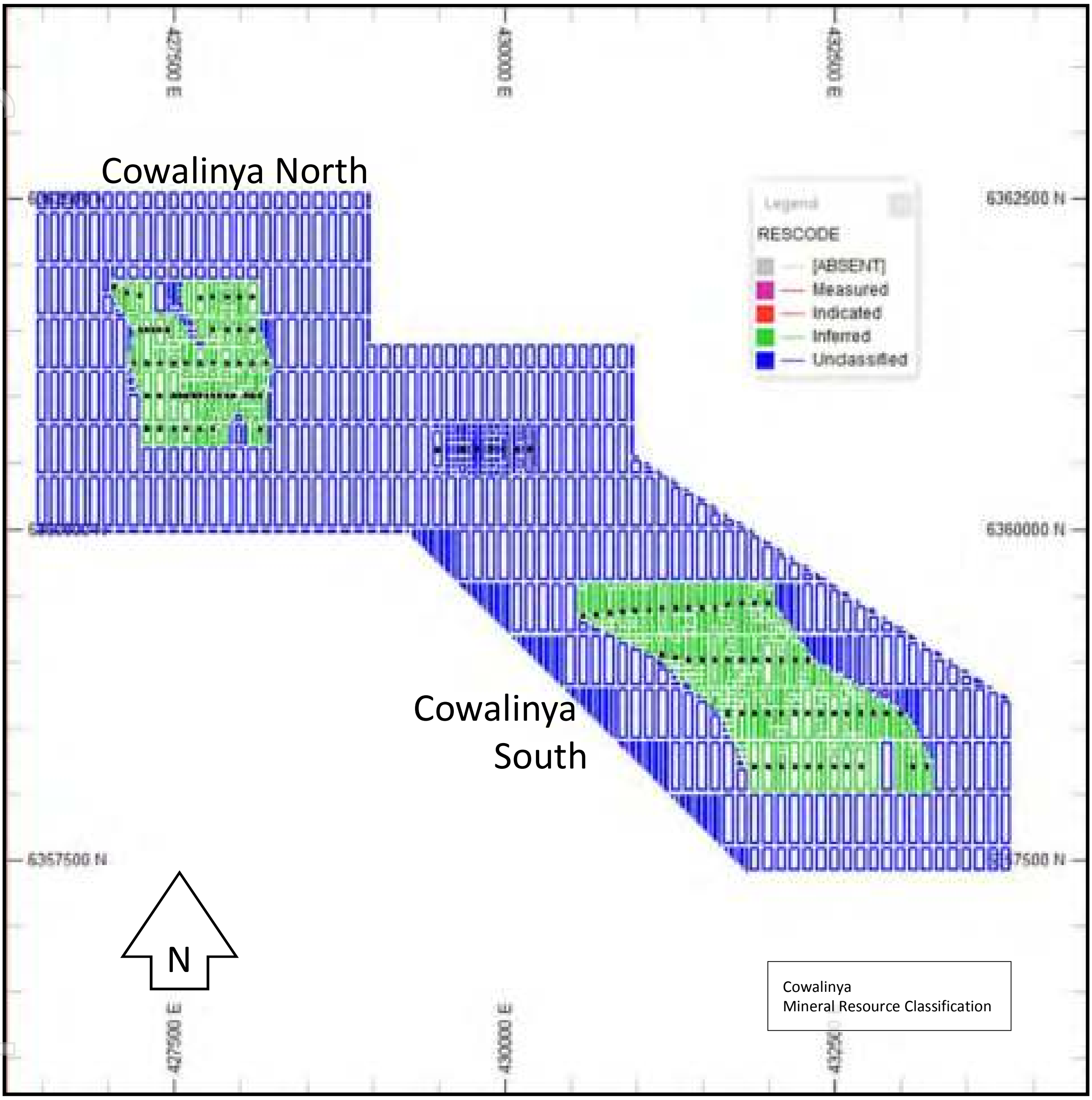
Very few data have been recorded for density determinations at Cowalinya, with the sampled material proving difficult to measure accurately without more expensive drilling techniques, such as diamond drilling. Pycnometer readings have to be modified for porosity and moisture. There were few moisture determinations and more data is required to fully understand the distribution of moisture and its effect on dry bulk density determinations in the high-clay environment at Cowalinya.

The confidence levels based upon drilling density are reasonably uniform throughout the north and south areas, with regular 100 m spacing along the drill fence lines. With only minor deviation, the drill fence lines are spaced at 250 m in the north area and 400 m in the south.

In applying the classification, Inferred Mineral Resource has generally been restricted to the drilled portion of the upper and lower saprolite units, and restricted to approximately 50 m from the nearest drill hole. The classification applied relates to the global estimate of TREO minus CeO_2 and at the reported cut-off grade only. At different TREO minus CeO_2 grade cut-offs, the applied classification scheme may not be valid.

Figure 4-33 shows a plan view of the block model with the classification scheme applied. The classified areas are limited to the mineralised units (ZONECODEs 800 & 900). The drill hole collar positions are superimposed as black dots.

Figure 4-33 Block model Plan View showing Mineral Resource classification.



The overlying, grouped transported units and the bedrock unit estimates have not been classified, due to the very low possibility of economic extraction and limited data. The background waste was not estimated, but had default values assigned, and is also not classified.

JMCTC believes that the classification appropriately reflects its confidence in the grade estimates and robustness of the interpretations.

JMCTC expects that additional infill drilling, with assaying matching original sampling and geological boundaries, more rigour in QAQC and further investigation into bulk density determination will be required to raise the level of resource classification in any future updates.

4.7 Summary of model fields and expected values

Table 4.19 lists the model fields and the default or expected values.

Table 4.19 Block model fields and descriptions

Field Name	Description	Default Values
IJK	Datamine Internal block ordering number	0
XC	X coordinate of block centre point	0
YC	Y coordinate of block centre point	0
ZC	Z coordinate of block centre point	0
XINC	Block dimension in X direction	25 – 100 m
YINC	Block dimension in Y direction	25 – 400 m
ZINC	Block dimension in Z direction	1 – 4 m
DOMAIN	Numeric field identifying North or South sub-areas of the block model, or background waste	1000, 2000,9999
ZONECODE	Numeric field identifying geological unit	100,200,300,400,500,600,700,800, 900,1000, 9999
ESTDOM	Numeric code identifying DOMAIN and ZONECODE combinations	200,300,800,900,1000
INSITU	Depletion field	1= insitu (ie not mined), 0=not insitu (ie mined)
TOPO	Depletion field	1=above surface/pit topography, 0=below surface topography
RESCODE	Numeric assigned Mineral Resource classification field	3=inferred, 4=unclassified
DENSITY	Density value applied by geological unit	1.6 – 2.5 t/m-3
LA_EST CE_EST PR_EST ND_EST SM_EST EU_EST GD_EST TB_EST DY_EST HO_EST ER_EST TM_EST YB_EST LU_EST Y_EST SC_EST TH_EST U_EST	OK estimated grade - ppm (for La, Ce, Pr, Nd & Sm in ESTDOM 200 & 300; ID^2 estimated grade)	–
La_2O_3 CeO_2 Pr_6O_{11} Nd_2O_3 Sm_2O_3 Eu_2O_3 Gd_2O_3 Tb_4O_7 Dy_2O_3 Ho_2O_3 Er_2O_3 Tm_2O_3 Yb_2O_3 Lu_2O_3 Y_2O_3 Sc_2O_3 ThO_2 U_3O_8	Calculated; Oxides of estimated elements; - ppm La_2O_3 = La * 1.1728 CeO_2 = Ce * 1.2284 Pr_6O_{11} = Pr * 1.2082 Nd_2O_3 = Nd * 1.1664 Sm_2O_3 = Sm * 1.1596 Eu_2O_3 = Eu * 1.1579 Gd_2O_3 = Gd * 1.1526 Tb_4O_7 = Tb * 1.1762 $D_{y2}O3$ = Dy * 1.1477 Ho_2O_3 = Ho * 1.1455 Er_2O_3 = Er * 1.1435 Tm_2O_3 = Tm * 1.1421 Yb_2O_3 = Yb * 1.1387 Lu_2O_3 = Lu * 1.1371 Y_2O_3 = Y * 1.2699 Sc_2O_3 = Sc * 1.5338 ThO_2 = Th * 1.1379 U_3O_8 = U * 1.1792	–
TREO	Calculated (ppm); TREO = La_2O_3 + CeO_2+ Pr_6O_{11} + Nd_2O_3 + Sm_2O_3 + Eu_2O_3 + Gd_2O_3 + Tb_4O_7 + Dy_2O_3+ Ho_2O_3+ Er_2O_3 + Tm_2O_3 + Yb_2O_3 + Lu_2O_3 + Y_2O_3	–

TREONOCE	Calculated (ppm); TREONOCE = TREO - CeO_2	–
TREO_SC	Calculated (ppm); TREO plus Sc_2O_3	–
Field Name	**Description**	**Default Values**
LREO	Calculated (ppm); LREO = $La_2O_3 + CeO_2 + Pr_6O_{11} + Nd_2O_3 + Sm_2O_3$	–
HREO	Calculated; HREO = $Eu_2O_3 + Gd_2O_3 + Tb_4O_7 + Dy_2O_3 + Ho_2O_3 + Er_2O_3 + Tm_2O_3 + Yb_2O_3 + Lu_2O_3 + Y_2O_3$	–
MREO	Calculated (%); "Magnet REOs" = $Pr_6O_{11} + Nd_2O_3 + Tb_4O_7 + Dy_2O_3$	–
MREODVTR	Calculated (%); MREO divided by TREO	–
MREDVTRC	Calculated (%); MREO divided by TREO - CeO_2	–
NS(LA, CE, PR, etc)	Number of samples used to generate the block estimate (eg. NSLA)	3 – 7
PASS(LA, CE, PR, etc)	The pass or search expansion used to generate the block estimate (eg. PASSPR)	1, 2, 3
DS(LA, CE, PR, etc)	The geostatistical distance to the nearest sample use to generate the block estimate (eg. DSGD)	–
VAR(LA, CE, PR, etc)	The normalized estimation variance for the block (eg. VARND)	–
XMORIG	X origin coordinate of the block model, lower southwest corner of the model	426450
YMORIG	Y origin coordinate of the block model, lower southwest corner of the model	6356800
ZMORIG	Z origin coordinate of the block model, lower southwest corner of the model	160
NX	Number of parent cells in the X direction of the model	74
NY	Number of parent cells in the Y direction of the model	12
NZ	Number of parent cells in the Z direction of the model	35

5 Reporting

All mineralisation tonnages are estimated on a dry basis. The moisture content in mineralisation requires more sampling in future programmes and is currently calculated at approximately 25%. This is a conservative number as the sampling to date has recorded values from a minimum of 9% to a maximum of 25%.

A 300 ppm TREO minus CeO_2 cut off has been used to report the Mineral Resource at Cowalinya. Consideration of similar ionic clay-type projects, as well as the current mining, metallurgical and pricing assumptions, while not rigorous, suggest that the currently interpreted mineralised material has a reasonable prospect for eventual economic extraction at this cut-off grade.

The Mineral Resource estimate is reported in Table 5.1.

Table 5.1 2021 Cowalinya Mineral Resource estimate

Prospect	Classification	Mt	TREO (ppm)	TREO-CeO_2 (ppm)	Sc_2O_3 (ppm)	Magnet REOs/TREO (%)	Magnet REOs/(TREO-CeO_2) (%)	Bulk Density (t/m^3)
Cowalinya North	Inferred	7	635	450	26	25	36	1.63
Cowalinya South	Inferred	22	620	430	32	25	37	1.63
Total	**Inferred**	**28**	**625**	**435**	**31**	**25**	**36**	**1.63**

Notes:
** TREO = $La_2O_3+CeO_2+Pr_6O_{11}+Nd_2O_3+Sm_2O_3+Eu_2O_3+Gd_2O_3+Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3$*
** "Magnet REOs" = $Pr_6O_{11}+Nd_2O_3+Tb_4O_7+Dy_2O_3$*
**Totals may not add due to rounding*
**Reported above a cut-off grade of 300 ppm TREO-CeO_2*

Table 5.2 below shows the further break down of the block model, by area and geological unit, showing grades of individual REO proportions as well as the potentially deleterious U_3O_8 and ThO_2.

Table 5.3 below shows the block model at a range of TREO and TREO-CeO_2 cut offs, with Figure 5-1 and Figure 5-2 showing grade tonnage curves for the model, split by north and south areas.

Table 5.2 Block model reported above 300 ppm TREO-CeO_2, showing individual REOs and potential deleterious elements

Prospect	Classification	Zone (Numeric Code)	Tonnes (Mt)	TREO (ppm)	Light Rare Earths				Middle Rare Earths			Heavy Rare Earths								Other					
					La_2O_3 (ppm)	CeO_2 (ppm)	Pr_6O_{11} (ppm)	Nd_2O_3 (ppm)	Sm_2O_3 (ppm)	Eu_2O_3 (ppm)	Gd_2O_3 (ppm)	Tb_4O_7 (ppm)	Dy_2O_3 (ppm)	Ho_2O_3 (ppm)	Er_2O_3 (ppm)	Tm_2O_3 (ppm)	Yb_2O_3 (ppm)	Lu_2O_3 (ppm)	Y_2O_3 (ppm)	Sc_2O_3 (ppm)	ThO_2 (ppm)	U_3O_8 (ppm)	TREO-CeO_2 (ppm)	Magnet REOs /TREO (%)	Magnet REOs/(TREO-CeO_2) (%)
Cowalinya North	Inferred	Upper Saprolite (800)	0.1	485	93	167	24	84	15	3	12	1	8	2	6	1	5	1	65	22	18	3	320	24	37
		Lower Saprolite (900)	6	640	92	185	28	113	27	4	20	3	18	4	11	1	6	1	126	26	11	3	455	25	36
		All	7	635	92	185	28	112	27	4	20	3	18	4	11	1	6	1	125	26	11	3	450	25	36
Cowalinya South	Inferred	Upper Saprolite (800)	6	495	110	127	26	93	19	4	15	2	11	2	6	1	5	1	72	35	17	4	365	27	36
		Lower Saprolite (900)	16	665	106	215	30	113	24	5	22	3	18	3	10	1	8	1	105	31	15	6	450	25	37
		All	22	620	107	192	29	108	23	5	20	3	16	3	9	1	7	1	96	32	16	5	430	25	37
Total	Inferred	All	28	625	104	190	29	109	24	5	20	3	17	3	9	1	7	1	103	31	15	5	435	25	36

Notes:
** TREO = $La_2O_3+CeO_2+Pr_6O_{11}+Nd_2O_3+Sm_2O_3+Eu_2O_3+Gd_2O_3+Tb_4O_7+Dy_2O_3+Ho_2O_3+Er_2O_3+Tm_2O_3+Yb_2O_3+Lu_2O_3+Y_2O_3$*
** "Magnet REOs" = $Pr_6O_{11}+Nd_2O_3+Tb_4O_7+Dy_2O_3$*
** U_3O_8 and ThO_2 are potentially deleterious elements*
** Totals may not add due to rounding*
** Reported above a cut-off grade of 300 ppm TREO-CeO_2*

Table 5.3 Block model reported at a range of TREO and TREO-CeO$_2$ cut off grades

Cut-Off Grade (ppm)	Tonnes (Mt)	TREO (ppm)	TREO-CeO2 (ppm)	Sc2O3 (ppm)
Total material within the Inferred Resources boundary at TREO-CeO2 Cut-Off Grades				
100	71	425	284	28
200	47	525	360	29
300	28	625	435	31
400	16	715	505	31
500	7	795	575	30
Total material within the Inferred Resources boundary at TREO Cut-Off Grades				
100	83	385	260	27
200	64	455	305	28
300	48	520	355	29
400	33	600	410	30
500	23	665	460	31

Figure 5-1 Grade Tonnage curves, Cowalinya North

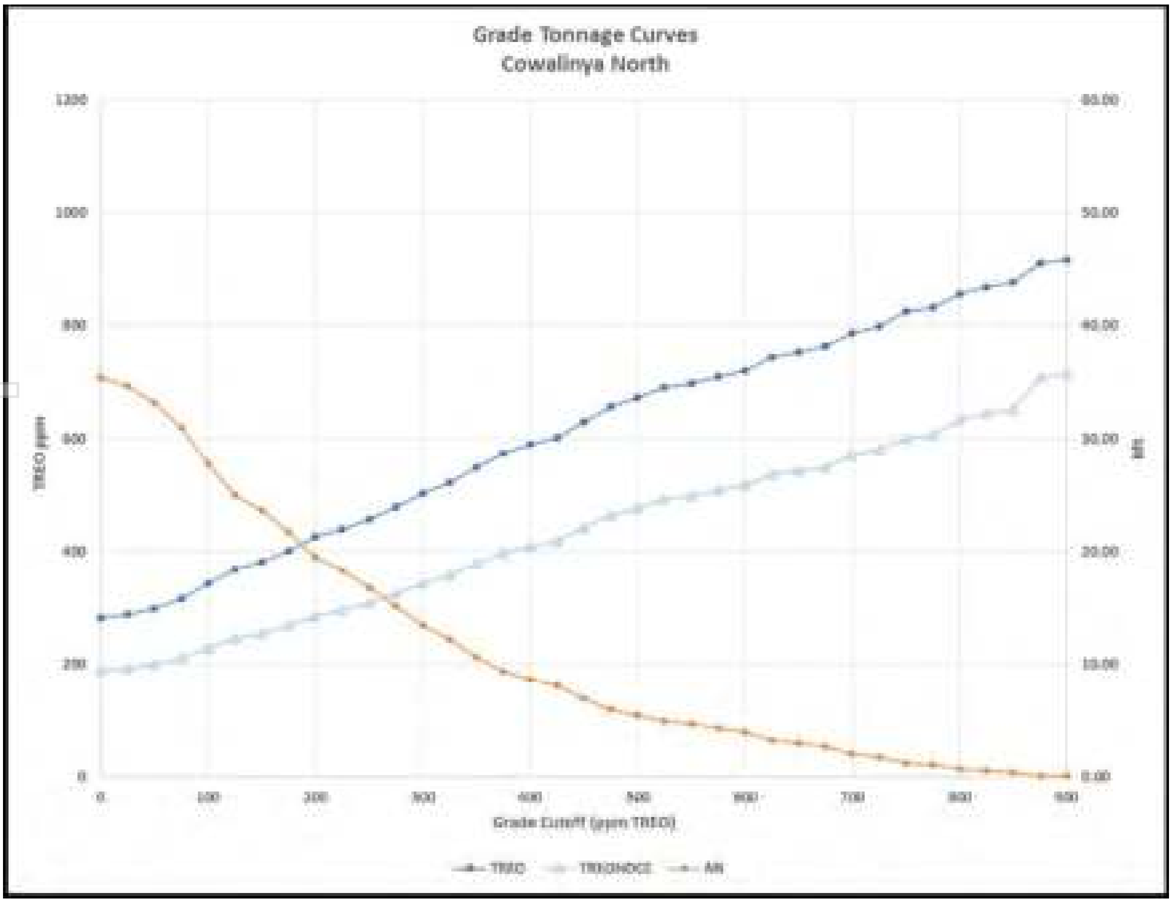
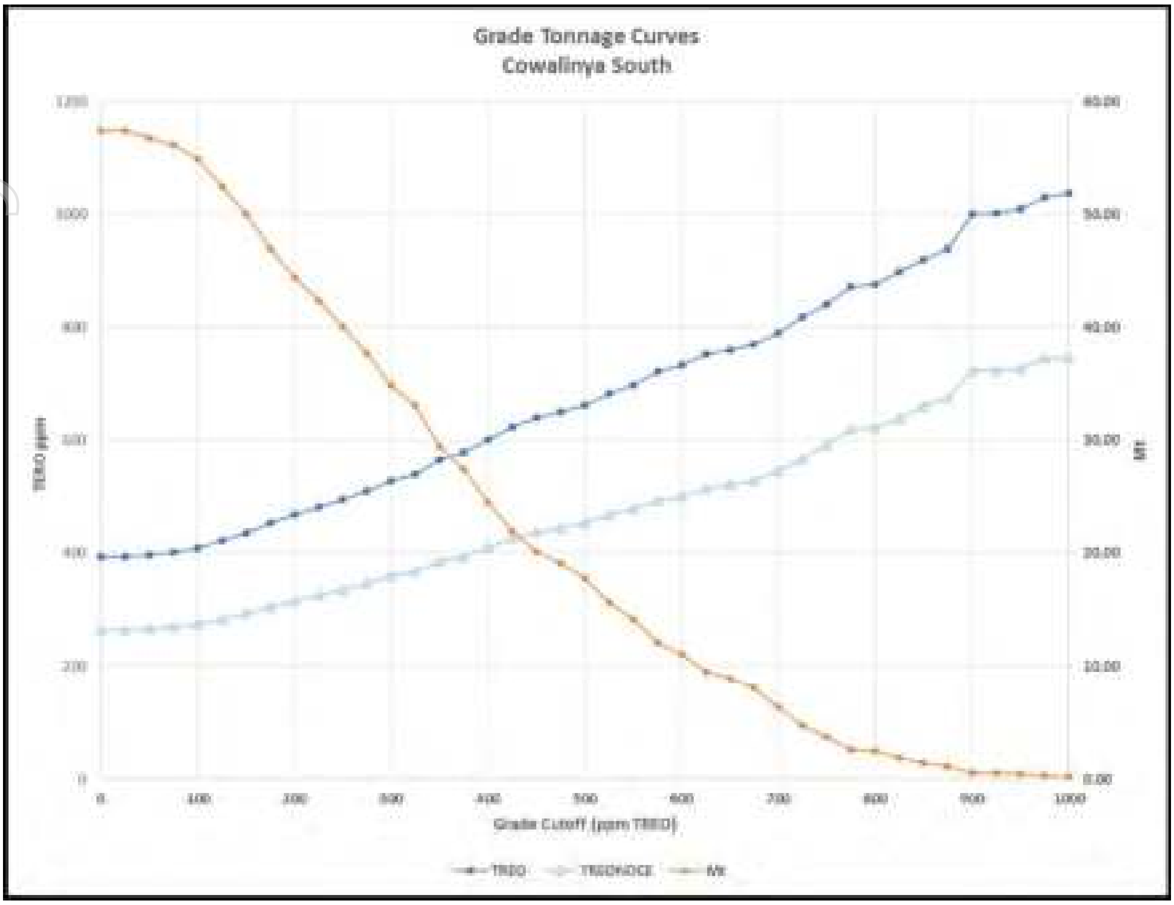


Figure 5-2 Grade Tonnage curves, Cowalinya South



HRE has assumed, based on initial concept study work and the similarities to similar ionic clay-type projects, that Cowalinya is amenable to open-pit mining methods.

6 Previous estimates

There have been no prior Mineral Resource estimates completed for Cowalinya. The 2021 Mineral Resource estimate is a maiden resource.

7 Areas of technical risk

The areas of technical risk for the Cowalinya resource estimate are considered to be the following:

- The geological interpretation at Cowalinya is based on 50 m by 250 m and 100 m by 400 m spaced drill holes. There is a risk that the current interpretation is not correct and that the currently interpreted mineralised domains are not as continuous and as consistently thick as shown in the model. JMCTC considers this risk as low.
- The samples used in the estimate have been assayed using a multi-acid digest method and several checked using alternative methods. The alternative methods appear to be reporting grade of up to 12% over the original assays. There is a risk of assays being under reported if the most appropriate method is not chosen. JMCTC considers this risk as moderate.
- The assay standards used for the data that this estimate is based upon, appear to only address the very high and very low grade in the data. JMCTC considers this risk as low.
- Density determinations are predominantly pycnometer readings from sample pulps from few samples. Moisture content readings are similarly sparse. As all of the drilling at Cowalinya is aircore, this is expected. The pycnometer readings do not take into account the porosity of the sample. The data needs to be factored (lower), as the original weathered rock samples have some inherent porosity that is not accounted for in the pycnometer process. HRE has factored the pycnometer readings based on few moisture content measurements and an additional arbitrary factor for pore space. JMCTC considers the uncertainty around the factored densities applied to the mineralised units in the model to be a potential risk to the tonnage calculations for the resource. As the potential tonnage is very large and the grade is more likely to be the limiting factor for the resource expansion, JMCTC considers this risk as low to moderate.
- Samples have been drilled at one metre intervals but assayed using four metre composites. This was done to make the most of the available budget at a very early stage of the project. Some compromises were made as a result of this in the interpretation of the mineralised units. Some of the samples crossed geological boundaries and grade was assigned to divisions both above and below where they should have been. Some high grade has been introduced from bedrock and some low grade has been introduced from material overlying the mineralisation. This is a moderate risk.

8 Recommendations for further work

Recommendations for further work on the Cowalinya resource estimate are as follows:

- In order to increase confidence in future estimates, JMCTC recommends infill drilling at Cowalinya North and South, to reduce the spacing to a more consistent 100 m by 100 m, with smaller gaps between the drill fences. This should be a progressive, staged approach as more information on the project geology and geochemistry is acquired.
- Further definition of the top of mineralisation may be possible with either a re-assaying of the original one-metre sampled intervals, or sampling at one metre intervals in future drilling programmes. The four metre composite samples used currently, have potentially blurred the contacts between mineralisation and waste material, particularly in the upper saprolite. Sampling at finer intervals and comparing with geology may help to remove some dilution in the upper saprolite and increase the grade in certain areas.
- JMCTC recommends a programme of bulk density determinations. This could initially be focused on acquiring additional and more accurate data for moisture content from existing samples. Density determinations may have to be made using diamond core samples or borehole wireline logging.
- JMCTC recommends HRE maintain ownership of the QAQC process from rig to assay, to ensure the best possible unbiased results. All QAQC samples should as much as possible be anonymous and indistinguishable from the rest of the sample stream.
- JMCTC recommends the use of more assay standards, with proper certification and applicability to the Cowalinya grade ranges other than the extremes.
- JMCTC recommends that, where possible, any blank material used for QAQC samples should at least have zero values for the mineralisation and for any potential deleterious elements.
- JMCTC recommends a ratio of approximately 1:20 (5%) for pulp duplicates, blanks and umpire assays. JMCTC also recommends that the type of QAQC sample is accurately recorded and documented to allow for confidence in evaluation of like samples.
- JMCTC recommends assaying to geological boundaries and matching the drilled metres in future programmes. It may also be possible, depending on the amount of sample degradation, to re-assay the original drilled samples at one metre intervals.

9 References

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Appendix A

JORC Table 1

2021 Cowalinya Mineral Resource Estimate (2012 JORC Code – Table 1)

Section 1: Sampling Techniques and Data

Sampling techniques	Nature and quality of sampling (e.g. cut channels, random chips, or specific specialized industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling.	A total of 109 vertical aircore holes were drilled in two areas in July 2021:- 59 holes in Cowalinya South and 50 holes in Cowalinya North. Maximum hole depth was 44m. All holes were testing for supergene rare earth element (REE) mineralisation hosted by saprolitic clays. Both areas drilled overlapped extensively with areas previously aircore drilled by two other companies exploring for gold (AngloGold Ashanti Ltd and Great Southern Gold Pty Ltd). One metre samples were collected from a cyclone into plastic bags. 100 holes were 4m composite sampled with shorter composites at end of hole; 9 holes were sampled on a 1m basis. Overlying transported sediments were not routinely sampled as they were not thought to contain anomalous amounts of REEs – where they were assayed low values were returned.
	Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used.	For aircore drilling, regular air and manual cleaning of cyclone was undertaken. Certified standards and duplicate samples were submitted with drill samples.
	Aspects of the determination of mineralisation that are Material to the Public Report.	Aircore drilling was used to obtain 1m samples which were collected in plastic bags. Samples ranging from 1m to 4m composites were taken for analysis. Sample size was 2 - 3kg in weight. At LabWest Laboratory, Perth, Western Australia, samples were dried, crushed, split and pulverized with a 0.1gm sub-sample assayed for 14 REEs; lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu), and yttrium (Y), plus scandium (Sc), thorium (Th) and uranium (U) by microwave multi-acid digest with ICP-MS/OES finish.
Drilling techniques	Drill type (e.g. core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc.) and details (e.g. core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc.).	Aircore. A type of reverse circulation drilling using slim rods and a 3.5-inch blade bit. The samples recovered are typically rock chips and powder, similar to reverse circulation drilling.

Drill sample recovery	Method of recording and assessing core and chip sample recoveries and results assessed.	Aircore recovery was visually assessed by comparing drill chip volumes in sample bags for individual metres. Estimates of sample recovery were recorded on drill logs. Routine checks for correct sample depths were undertaken. Aircore sample recoveries were visually checked for recovery, moisture and contamination and considered to be acceptable within industry standards. The cyclone was routinely cleaned ensuring no material build up.
	Measures taken to maximize sample recovery and ensure representative nature of the samples.	Due to the generally good drilling conditions through dry saprolite the responsible geologist believes the samples are reasonably representative. Poor sample recovery was regularly recorded in the first couple of metres of a hole and often when hard bedrock was intersected – usually less than a full metre was recovered. Wet samples with moderate recoveries were encountered most often in the transported sand/silcrete layer lying immediately above saprolite.
	Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	No sample bias has been identified to date. Future studies will be undertaken.
Logging	Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.	Chip/clay samples were geologically logged in enough detail to discern lithological units. Logging was appropriate for this style of drilling and current stage of the project.
	Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc.) photography.	Logging was qualitative in nature.
	The total length and percentage of the relevant intersections logged.	All aircore holes were completely geologically logged.
Sub-sampling techniques and sample preparation	If core, whether cut or sawn and whether quarter, half or all core taken.	Not applicable.
	If non-core, whether riffled, tube sampled, rotary split, etc. and whether sampled wet or dry.	1m samples were collected from a cyclone into plastic bags. 4m composite and single metre samples were collected by spearing each plastic bag with a scoop down the side of the bag and dragging it back up the side of the bag so as not to lose any sample – this achieved a representative sample from top to bottom through the entire bag. The vast majority of samples were dry sampled.
	For all sample types, the nature, quality and appropriateness of the sample preparation technique.	Sampling technique is appropriate for the sample types and stage of the project.
	Quality control procedures adopted for all sub-sampling stages to maximize representivity of samples.	QAQC procedures involved the use of certified standards every 40^{th} sample.

	Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling.	A field duplicate was taken every 80th sample.
	Whether sample sizes are appropriate to the grain size of the material being sampled.	The sample size of 2-3kg is considered appropriate to the grain size and style of mineralisation being investigated.
Quality of assay data and laboratory tests	The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total.	Analyses were done at LabWest Laboratory, using their MMA-04 technique: microwave assisted HF/multi-acid digest with ICP-MS/OES finish. This technique is considered to be a near total digest. A suite of 14 REEs + Y, Sc, Th and U were measured.
	For geophysical tools, spectrometers, handheld XRF instruments, etc, the parameters used in determining the analysis including instrument make and model, reading times, calibrations factors applied and their derivation, etc.	Not applicable.
	Nature of quality control procedures adopted (e.g. standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (i.e. lack of bias) and precision have been established.	OREAS standards and/or blanks were inserted every 40th sample in the field. Field duplicates were taken every 80th sample. LabWest Laboratory used OREAS standards, blanks and sample repeats. Acceptable levels of accuracy were achieved. Bureau Veritas conducted check assays by lithium borate fusion/laser ablation/ICP-MS on 46 samples containing >300ppm total rare earth oxide (TREO) from Cowalinya South – these on average gave 12.9% higher TREO values than the original HF/multi-acid digests reflecting total digest by the fusion method as opposed to 'near' total digest by the multi-acid method. Correlation coefficient between the two methods was 0.985.
Verification of sampling and assaying	The verification of significant intersections by either independent or alternative company personnel.	Significant intersections have yet to be verified by an independent geological consultant. They have been verified by alternative company geological personnel.
	The use of twinned holes.	Three current aircore holes were drilled close enough to historical aircore holes to be able to compare downhole Ce and La assays. The distribution profiles and values were similar for two of the holes.
	Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols.	All data has been entered into Excel spreadsheets.
	Discuss any adjustment to assay data.	No data has been adjusted.

Location of data points	Accuracy and quality of surveys used to locate drillholes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation.	Hole collars were surveyed using a hand-held Garmin Etrex 10 GPS with ±3m accuracy. Only northings and eastings were recorded using the hand-held GPS.
	Specification of the grid system used.	GDA94 z51.
	Quality and adequacy of topographic control.	Cowalinya North and South are located in relatively flat terrain. Collar RL's have been obtained from a surface wireframe constructed using collar RL information contained in historical drill logs from AngloGold Ashanti and Great Southern Gold.
Data spacing and distribution	Data spacing for reporting of Exploration Results.	Cowalinya North: a mixture of 250m x 100m and 250m x 50m. Cowalinya South: 400m x 100m.
	Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied.	Data spacing sufficient for this style of mineralisation to establish an Inferred Mineral Resource at both Cowalinya North and South. The mineralisation occurs as extensive, generally flat lying supergene blankets hosted in saprolitic clays.
	Whether sample compositing has been applied.	100 holes out of 109 were assayed by 4m composite samples, compiled from one metre drilled samples. 2m and 3m composites were sometimes created at the end of a hole depending on the final depth. The remaining 9 holes were sampled on a 1m basis.
Orientation of data in relation to geological structure	Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type.	Sampling is likely to be unbiased as vertical holes are intersecting flat lying mineralisation.
	If the relationship between the drilling orientation and the orientation of key mineralized structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	It is unlikely to be biased.
Sample security	The measures taken to ensure sample security.	The responsible geologist undertook the sampling and delivery of samples to the laboratory.
Audits or reviews	The results of any audits or reviews of sampling techniques and data.	No audits or reviews have been commissioned to date.

Section 2: Reporting of Exploration Results

Mineral tenement and land tenure status	Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings.	Tenement E63/1972 is located 55 km east-north-east of Salmon Gums, Western Australia. It consists of 80 graticular blocks comprising an area of 224sq.km. It is situated on Vacant Crown Land. The registered holders are David and Christine Ross. HRE Corporation Ltd (HRE) currently holds an option to purchase the tenement and pay a production royalty. Mr. David Ross was the responsible geologist who supervised the drilling and undertook the sampling. Full native title rights have been granted over the area to the Ngadju people.
	The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	The tenement is in good standing. There are no impediments to operating on the tenement other than requirements of the DMIRS and the Heritage Protection Agreement, all of which are industry standard.
Exploration done by other parties	Acknowledgment and appraisal of exploration by other parties.	AngloGold Ashanti and Great Southern Gold both previously worked in the area of E63/1972 exploring for gold mineralisation. Surface geochemical sampling and aircore drilling was undertaken by both companies but no significant gold mineralisation was discovered. Both companies assayed bottom of hole samples for a suite of multi-elements including REEs. Anomalous bedrock REE values were recorded in numerous holes from their drilling.
Geology	Deposit type, geological setting and style of mineralisation.	The deposit type being investigated is low grade saprolite clay hosted supergene rare earth mineralisation. This style of supergene rare earth mineralization is developed over bedrock granitic rock types (granites and granitic gneisses) which contain anomalous levels of REEs. Although low grade, low mining and processing costs can make this type of deposit profitable to exploit.
Drillhole Information	A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drillholes: easting and northing of the drillhole collar elevation or RL (Reduced Level – elevation above sea level in metres) of the drillhole collar dip and azimuth of the hole down hole length and interception depth hole length.	All relevant data for the drilling is tabulated in Appendix B.

Data aggregation methods	In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (e.g. cutting of high grades) and cut-off grades are usually Material and should be stated.	All REE assay results have been converted to oxide (REO) values using industry standard conversion factors. Minimum grade cut-off used is 300ppm TREO (Y_2O_3 is included in the TREO). Maximum internal dilution is 2m @ <300ppm TREO. No high cut-off has been applied. Length weighted averages have been applied to intersections.
	Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.	Intervals reporting >1000ppm TREO are reported separately.
	The assumptions used for any reporting of metal equivalent values should be clearly stated.	No metal equivalent values have been used.
Relationship between mineralisation widths and intercept lengths	If the geometry of the mineralisation with respect to the drillhole angle is known, its nature should be reported. If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	To date the targeted mineralisation appears to occur in flat lying sheets and drill holes have all been drilled at 90^0 vertically. The down hole length of intercept is effectively a true thickness of mineralisation.
Diagrams	Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drillhole collar locations and appropriate sectional views.	Refer to; Figure 3-1 Overview of HRE and Historical drilling to date at Cowalinya, Figure 4-2 Type cross-section at 6361000 mN showing simplified geology with drill holes, Figure 4-3 Type cross-section at 6358600 mN showing simplified geology with drill holes and Figure 4-7 Plan view of HRE drill hole positions at Cowalinya.
Balanced reporting	Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	Intersections of TREO > 300ppm are reported in Appendix B.
Other substantive exploration data	Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	Preliminary metallurgical testwork has shown up to 91% TREO recovery from Cowalinya South using 5% hydrochloric acid at 30°C. U and Th values are reported as these are considered deleterious elements in rare earth deposits. The highest values recorded for these elements were 48ppm U_3O_8 and 48ppm ThO_2. Weighted averages for all intersections reporting >300ppm TREO were 5ppm U_3O_8 and 15ppm ThO_2.

Further work	The nature and scale of planned further work (e.g. tests for lateral extensions or depth extensions or large-scale step-out drilling).	Further aircore drilling will be undertaken to test for lateral extensions to mineralisation. Further extensive metallurgical testwork will also be undertaken and petrological studies will be completed to identify REE-bearing mineral species.
	Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	HRE deems this to be commercially sensitive.

Section 3: Estimation and Reporting of Mineral Resources

Database integrity	Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes.	Logging information was reviewed by the responsible geologist prior to loading into spreadsheets. All assay results were received as digital files, as well as the collar, survey and geological logging data. This data was transferred directly from the received files into the modelling database. The data has been periodically checked by HRE personnel and was validated by JMCT Consulting (JMCTC) whilst importing the data for this estimate.
	Data validation procedures used.	The data validation was initially completed by the responsible geologist logging the chips and marking the sample bags for assaying. The paper geological logs were transferred to Excel spreadsheets and compared with the originals for error. Assay dispatch sheets were compared with the record of samples received by the assay laboratories. Currently, all of the drillhole data has been collected and input into Microsoft Excel spreadsheets, keyed on drillhole identifier (BHID) and assay sample number. All of the data was verified at the time of import to Datamine and one minor error found was corrected. JMCTC checked the data for overlapping intervals, missing samples, FROM values greater than TO values, missing stratigraphy or rock type codes, downhole survey deviations of ±10° in azimuth and ±5° in dip, assay values greater than or less than expected values and several other possible error types when loading the data into CAE Studio 3 (Datamine) software. QAQC data and reports were normally also checked by the responsible geologist. JMCTC also checked the QAQC reports and briefly validated some of the raw QAQC data.
Site visits	Comment on any site visits undertaken by the Competent Person and the outcome of those visits.	The responsible geologist, who is the Competent Person for the data collection, geological logging, assaying and QAQC, has visited the Cowalinya project site on multiple occasions, as well as supervising all of the drilling and sampling undertaken. He has also visited the laboratories responsible for the assaying and QAQC. The Competent Person for the Mineral Resource estimate, Mr. John Tyrrell of JMCTC, has not yet visited the project site, but has seen photographs of the drill locations and samples taken by a third party. He has also discussed the drilling and sampling procedures with the responsible geologist and how they might affect the current Mineral Resource.
	If no site visits have been undertaken indicate why this is the case.	Not applicable.
Geological interpretation	Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit.	The geological interpretation at Cowalinya is based on multiple drill holes (over 100) drilled by HRE, as well as historical drilling by AngloGold Ashanti and

<table>
<tr><td></td><td></td><td>Great Southern Gold. The logging of the two sets of data matches very closely.
The geology is fairly simple at Cowalinya, being a series of flat-lying sands and clays, overlying an upper and lower saprolite unit above bedrock. The mineralisation is hosted in the saprolite layers. No obvious folding or faulting occurs in the local area to disrupt the currently interpreted layers.
Further work will be completed to better define a precise upper boundary for the higher grade material in the upper saprolite unit, but for the current expectation of the model, the geologically logged boundary is acceptable for inclusion in an Inferred Resource.</td></tr>
<tr><td></td><td>Nature of the data used and of any assumptions made.</td><td>No assumptions are made regarding the input data.</td></tr>
<tr><td></td><td>The effect, if any, of alternative interpretations on Mineral Resource estimation.</td><td>Neither alternative interpretations nor estimations have been undertaken by JMCTC to date. It is expected that in future programmes a more refined upper boundary can be determined, which could increase the grade of the deposit by removing some potential dilution.</td></tr>
<tr><td></td><td>The use of geology in guiding and controlling Mineral Resource estimation.</td><td>Geological observation has underpinned the resource estimation and geological model. The mineralised saprolite units have clear and sharp boundaries and have been tightly constrained by interpreted wireframe shapes. The low grade mineralisation overlying the saprolites, in Eocene transported material, is also constrained within wireframes, which are defined and guided by geological logging. The resource estimate is constrained by these wireframes.
The extents of the geological model are constrained by drilling. Geological boundaries had only minimal extrapolation beyond drilling in line with the expected resource classification of Inferred Resource.
The numeric coding for the Cowalinya project is as follows:
<table><tr><th>Lithology/Mineralisation</th><th>Numeric ZONECODE</th></tr><tr><td>Transported</td><td>100 – 700 model; 200 – 600 drilling</td></tr><tr><td>Upper Saprolite</td><td>800</td></tr><tr><td>Lower Saprolite</td><td>900</td></tr><tr><td>Bedrock</td><td>1000</td></tr><tr><td>Background (waste)</td><td>9999</td></tr></table>A separated numeric code, DOMAIN, was also applied to differentiate the north and south areas (1000 = North, 2000 = South).
The Mineral Resource estimate treated the upper and lower saprolite as separate domains and also differentiated between the transported and bedrock units.</td></tr>
<tr><td></td><td>The factors affecting continuity both of grade and geology.</td><td>Key factors that are likely to affect the continuity of grade are:
• The thickness and presence of the upper and lower saprolite units, which appear to be reasonably consistent in continuity from section to section</td></tr>
</table>

		where currently sampled, although the units are not consistent thickness. • The presence or absence of topographic highs in bedrock, thinning the saprolite units beneath the overlying transported material. • Differing geochemistry of the surrounding weathered material or changes in the porosity or permeability that may have affected the supergene enrichment processes. • Changes in the underlying bedrock. • Faulting.
Dimensions	The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	The interpreted mineralised upper and lower saprolite units used in this model are contained in an area defined by the recent HRE drilling. At Cowalinya North the extents are approximately 1,200 m by 1,200 m in northing and easting, while at Cowalinya South, the extents are greater being approximately 2,500 m in northing and 1,500 m in easting. The mineralised units are stratiform and range in thickness from approximately one metre to over 24 m true thickness. The average thickness of the upper saprolite is nearly 12 m, while the lower saprolite averages approximately 7 m in thickness. The upper saprolite is overlain by approximately 10 m of Eocene transported material. Mineralisation is currently open along and across strike, but closed off at depth.
Estimation and modelling techniques	The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used.	Grade estimation was completed using ordinary kriging (OK) for the Mineral Resource estimate. Datamine software was used to estimate grades for a full suite of REEs (La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y), as well as Sc, Th and U using parameters derived from statistical and variography studies. The majority of the variables estimated have coefficients of variation of close to or less than 1.0, apart from some of the light REEs (LREEs, being La, Ce, Pr, Nd and Sm) in the very low grade transported material units. Drillhole spacing varies from approximately 50 m by 250 m at Cowalinya North, to 100 m by 400 m at Cowalinya South. Drillhole sample data was flagged with numeric domain codes unique to each mineralisation domain. Sample data was composited to 4 m downhole length and composites were usually terminated by a change in geological unit. Grade top cuts were applied to nine of the estimated variables as statistical studies showed that there were occasional extreme outliers present in the data groupings. These were few and generally very light, usually in the 98^{th} to 99^{th} percentile or above. Grade was estimated into two separate mineralisation domains, upper and lower saprolite, in two separate areas of the project, Cowalinya North and Cowalinya South. Low to sub-grade material was also estimated in the overlying Eocene material in both areas. Although not considered part of the resource, due to metallurgical constraints, grade was also estimated into the bedrock units.

		Downhole variography and directional variography were performed for the estimated variables for the saprolite units and these were borrowed by the transported and bedrock units for estimation. Grade continuity varied from tens to hundreds of metres in the across strike directions, to hundreds of metres in the along strike directions. Down-dip was limited by the saprolite unit thickness of a maximum 24 m. Major, semi-major and minor search axis lengths were determined by variogram range lengths, initially set to 2/3 length, and modified as required.
	The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data.	No previous estimates have been completed at Cowalinya and no mining has occurred to date, so there are no production records.
	The assumptions made regarding recovery of by-products.	No assumptions were made regarding recovery of by-products.
	Estimation of deleterious elements or other non-grade variables of economic significance (e.g. sulphur for acid mine drainage characterisation).	Estimates were undertaken for U and Th, which are non-commodity variables, but are potential deleterious elements.
	In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed.	The Cowalinya main block model uses a parent cell size of 400 m in northing, 100 m in easting and 4 m in RL, while the north model uses the same dimensions in easting and RL, but with a parent cell size of 250 m in northing. This corresponds approximately to the respective distances between drill holes in the northing and easting directions and matches an assumed bench height in the RL direction. The smaller north model is added to the main model after estimation to produce one model. Accurate volume representation of the interpretation was achieved with less than 0.5% volume difference in the two mineralised domains. Grade was estimated into parent cells, with all sub-cells receiving the same grade as their relevant parent cell. Search ellipse dimensions and directions for each domain were set based on the variography studies and contouring of raw grade data to determine best search orientations. Generally, two search passes were used for estimates in the primary mineralised units, ZONECODE 800 and ZONECODE 900, with 95 to 99 percent of estimates occurring in the first or second pass. The grouped transported and bedrock units had three passes allowed to ensure that a small number of blocks at the extremities of the model were also estimated. The surrounding background waste had default grade values applied. The first pass used 4 to 7 samples per estimate, with the second and third, 3 to 7 samples. A limit of three composites from a single drill hole were permitted.
	Any assumptions behind modelling of selective mining units.	No selective mining units were considered in this estimate apart from an assumed four metre bench height for open pit mining. Model block sizes were determined primarily by drillhole spacing and statistical analysis of the effect of changing block sizes on the final estimates.

	Any assumptions about correlation between variables.	Correlation studies on the composite data showed strong correlation (0.8 or above) between the LREEs, but no real correlation between the LREEs and the heavy REEs (HREEs, being Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Y), apart from Tb. Most of the HREEs correlated very well with the other HREEs, although as atomic weight increased, the strength of correlation seemed to wane. Sc, Th and U did not show good correlation with any other variable.
	Description of how the geological interpretation was used to control the resource estimates.	The geological interpretation is used to define the mineralisation, overlying transported and bedrock units. All of the divisions are wireframed and used as hard boundaries to select sample populations for variography and grade estimation.
	Discussion of basis for using or not using grade cutting or capping.	Analysis of the highest proportion and highest value elements (La, Ce, Nd, Dy and Sc), as well as Th and U, showed that top cutting was required for relatively few samples in the four primary mineralisation domains (upper and lower saprolites in the north and south). Values chosen were few and usually in the 99^{th} percentile. Values chosen were also reviewed spatially with reference to other samples in the immediate neighbourhood.
	The process of validation, the checking process used, the comparison of model data to drillhole data, and use of reconciliation data if available.	Validation of the block model consisted of: • Volumetric comparison of the mineralisation wireframes to the block model volumes. • Visual comparison of estimated grades against composite grades. • Comparison of block model grades to the input data using swathe plots. • Comparison of block model grades to the input data using quantile plots. As no mining has taken place at Cowalinya to date, there is no reconciliation data available.
Moisture	Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	All mineralisation tonnages are estimated on a dry basis. Moisture content has been measured for eight samples by weighing when wet, then drying and re-weighing to calculate moisture content. Moisture determinations for Cowalinya are at an early stage and further work is required to determine it more accurately.
Cut-off parameters	The basis of the adopted cut-off grade(s) or quality parameters applied.	A 300 ppm minus CeO_2 grade cut off has been used to report the Mineral Resource at Cowalinya. Consideration of similar clay hosted REE mineralised projects, in Australia as well as overseas, as well as the current mining, metallurgical and pricing assumptions, while not rigorous, suggest that the currently interpreted mineralised material has a reasonable prospect for eventual economic extraction at these cut off grades.
Mining factors or assumptions	Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider	The primary mining scenario being considered is conventional open pit mining. HRE and JMCTC have assumed, based on similar projects in Australia and overseas, that the Cowalinya deposit is amenable to open-pit mining methods.

	potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	
Metallurgical factors or assumptions	The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	Metallurgical studies are at a very early stage, but have shown encouraging results for recoveries of REEs from the saprolite using hydrochloric acid.
Environmental factors or assumptions	Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfield project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	Environmental studies will be undertaken as part of a scoping study in the future.
Bulk density	Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples.	Dry bulk density test work was completed on 48 samples from 13 drill holes from the north and south areas at Cowalinya. These were taken from the saprolite units only and were determined by xylene pycnometer testing. To allow for moisture content, the maximum moisture content of 25% (rounded) from recent testing, was applied, along with a further 10% allowance for void space. Using these factors and an average mineral SG of 2.5 t/m^3 from the pycnometer testing, a dry bulk density of 1.63 t/m^3 was determined for the combined saprolite units.
	The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc.), moisture and differences between rock and alteration zones within the deposit.	Allowances were made for moisture content and void space in determining the 1.63 t/m^3 values for the saprolite density. This number correlates well with other published clay or clay weathered rock densities.

<table>
<tr>
<td>Bulk density</td>
<td>Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.</td>
<td>The bulk density values applied for the resource estimate at Cowalinya are as follows:
<table>
<tr><th>ZONECODE</th><th>Geological Unit</th><th>Density t/m^{-3}</th></tr>
<tr><td>100</td><td>Calcrete/Soil</td><td>1.95</td></tr>
<tr><td>200</td><td>Upper Clay</td><td>2.2</td></tr>
<tr><td>300</td><td>Upper Sand</td><td>1.6</td></tr>
<tr><td>400</td><td>Puggy Clay</td><td>2.2</td></tr>
<tr><td>500</td><td>Middle Sand</td><td>1.6</td></tr>
<tr><td>600</td><td>Silcrete</td><td>2.3</td></tr>
<tr><td>700</td><td>Silcrete-Sand (Lower sand)</td><td>1.6</td></tr>
<tr><td>800</td><td>Upper Saprolite</td><td>1.63</td></tr>
<tr><td>900</td><td>Lower Saprolite</td><td>1.63</td></tr>
<tr><td>1000</td><td>Bedrock (Fresh Rock)</td><td>2.5</td></tr>
</table>
All values are in t/m^3. Values for saprolites and bedrock have been determined by some measurements taken at Cowalinya, whereas values for all other geological units are taken from published data.</td>
</tr>
<tr>
<td rowspan="2">Classification</td>
<td>The basis for the classification of the Mineral Resources into varying confidence categories.</td>
<td>Classification for the Cowalinya Mineral Resource estimate is based upon continuity of geology, mineralisation and grade, considering drill hole and density data spacing and quality, variography and estimation statistics (number of samples used and estimation pass).

The current classification of Inferred Resource at best, is considered valid for the global resource and applicable for the nominated grade cut-offs. Revision of the resource classification should be considered if different reporting cut-off grades are to be applied.</td>
</tr>
<tr>
<td>Whether appropriate account has been taken of all relevant factors (i.e. relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data).</td>
<td>At Cowalinya, the modelled portions of the deposit are reasonably well drilled for a flat lying REE deposit, having a drill hole spacing from a nominal 100 m x 250 m to 100 m x 400 m in northing and easting. The geology is fairly simple and continuous where it is currently sampled. Drilling has been completed on one metre intervals, but assaying was completed using four metre composite samples, which didn't always match the geological interval exactly. Some dilution has occurred due to this and the precise location of any possible internal boundaries is difficult to determine without further analysis.

The estimate has been classified as Inferred Mineral Resource in an area restricted to approximately 50 m to the nearest drill hole, outside the areas defined by the gridded HRE drill holes and wireframed interpretations.</td>
</tr>
</table>

		The background waste and the overlying transported material units have not been classified, due to very low possibility of economic extraction and limited data. The bedrock unit, whilst being very good grade, does not meet the metallurgical requirements for the expected processing route.
	Whether the result appropriately reflects the Competent Person's view of the deposit.	JMCTC believes that the classification appropriately reflects its confidence in the grade estimates and robustness of the input data and interpretations.
Audits or reviews	The results of any audits or reviews of Mineral Resource estimates.	The current Mineral Resource estimate has not been audited.
Discussion of relative accuracy/ confidence	Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the Competent Person. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate.	The resource classification represents the relative confidence in the resource estimate as determined by the Competent Person. Issues contributing to or detracting from that confidence are discussed above. No quantitative approach has been conducted to determine the relative accuracy of the resource estimate. The Ordinary Kriged estimate is considered to be a global estimate with no further adjustments for Selective Mining Unit (SMU) dimensions. Accurate mining scenarios are yet to be determined by mining studies. No production data is available for comparison to the estimate. The local accuracy of the resource is adequate for the expected use of the model in preliminary mining studies. Further investigation into bulk density and moisture content determination, finer sub-sampling and additional infill drilling will be required to further raise the level of resource classification.
	The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used.	These levels of confidence and accuracy relate to the global estimates of grade and tonnes for the deposit.
	These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	There has been no production from Cowalinya to date.

Appendix B

Drillhole data used in the resource estimate

Table B-1 Drillholes used in estimate

COWALINYA PROJECT - AIRCORE COLLARS

HOLE ID	NORTHING	EASTING	DIP	EOH Depth (m)	Date Drilled	Logged By	Close to historical hole
	GDA94 z51						
AC0001	6358200	433200	-90	39	15/07/2021	DR	NWAC036
AC0002	6358200	433100	-90	34	15/07/2021	DR	NWAC037
AC0003	6358200	432700	-90	33	15/07/2021	DR	
AC0004	6358200	432600	-90	36	15/07/2021	DR	NWAC040
AC0005	6358200	432500	-90	36	15/07/2021	DR	
AC0006	6358200	432400	-90	32	15/07/2021	DR	
AC0007	6358200	432300	-90	32	15/07/2021	DR	
AC0008	6358200	432200	-90	29	15/07/2021	DR	
AC0009	6358200	432100	-90	30	16/07/2021	DR	
AC0010	6358200	432000	-90	27	16/07/2021	DR	
AC0011	6358200	431900	-90	19	16/07/2021	DR	
AC0012	6358600	433000	-90	29	16/07/2021	DR	NWAC014
AC0013	6358600	432900	-90	21	16/07/2021	DR	NWAC015
AC0014	6358600	432800	-90	25	16/07/2021	DR	NWAC016
AC0015	6358600	432700	-90	28	16/07/2021	DR	NWAC017
AC0016	6358600	432600	-90	32	16/07/2021	DR	NWAC018
AC0017	6358600	432500	-90	39	16/07/2021	DR	NWAC019
AC0018	6358600	432400	-90	26	17/07/2021	DR	
AC0019	6358600	432300	-90	17	17/07/2021	DR	NWAC020
AC0020	6358600	432200	-90	18	17/07/2021	DR	
AC0021	6358600	432100	-90	28	17/07/2021	DR	NWAC021
AC0022	6358600	432000	-90	24	17/07/2021	DR	
AC0023	6358600	431900	-90	12	17/07/2021	DR	
AC0024	6358600	431800	-90	22	17/07/2021	DR	
AC0025	6358600	431700	-90	22	17/07/2021	DR	
AC0026	6359000	432300	-90	33	17/07/2021	DR	NWAC054
AC0027	6359000	432200	-90	39	18/07/2021	DR	
AC0028	6359000	432100	-90	39	18/07/2021	DR	NWAC055
AC0029	6359000	432000	-90	39	18/07/2021	DR	
AC0030	6359000	431900	-90	39	18/07/2021	DR	NWAC056
AC0031	6359000	431800	-90	32	18/07/2021	DR	
AC0032	6359000	431700	-90	35	18/07/2021	DR	
AC0033	6359000	431600	-90	31	18/07/2021	DR	
AC0034	6359000	431500	-90	30	18/07/2021	DR	
AC0035	6359000	431400	-90	33	19/07/2021	DR	
AC0036	6359020	431300	-90	31	19/07/2021	DR	
AC0037	6359040	431200	-90	21	19/07/2021	DR	
AC0038	6359335	430600	-90	22	19/07/2021	DR	
AC0039	6359350	430700	-90	15	19/07/2021	DR	NWAC069
AC0040	6359360	430800	-90	16	19/07/2021	DR	
AC0041	6359365	430900	-90	30	19/07/2021	DR	NWAC068
AC0042	6359380	431000	-90	22	19/07/2021	DR	
AC0043	6359385	431100	-90	32	19/07/2021	DR	NWAC067
AC0044	6359392	431200	-90	26	20/07/2021	DR	
AC0045	6359400	431300	-90	21	20/07/2021	DR	NWAC066
AC0046	6359400	431400	-90	32	20/07/2021	DR	
AC0047	6359400	431500	-90	28	20/07/2021	DR	NWAC065
AC0048	6359400	431600	-90	23	20/07/2021	DR	
AC0049	6359420	431700	-90	15	20/07/2021	DR	NWAC064
AC0050	6359430	431800	-90	35	20/07/2021	DR	

HOLE ID	NORTHING	EASTING	DIP	EOH Depth (m)	Date Drilled	Logged By	Close to historical hole
	GDA94 z51						
AC0051	6359435	431900	-90	26	20/07/2021	DR	NWAC063
AC0052	6359435	432000	-90	20	21/07/2021	DR	
AC0053	6360600	429692	-90	28	21/07/2021	DR	NWAC079
AC0054	6360600	429800	-90	19	21/07/2021	DR	
AC0055	6360600	429900	-90	27	21/07/2021	DR	NWAC078
AC0056	6360600	430000	-90	24	21/07/2021	DR	
AC0057	6360600	430100	-90	21	21/07/2021	DR	NWAC077
AC0058	6360600	430200	-90	30	21/07/2021	DR	
AC0059	6360600	429500	-90	21	22/07/2021	DR	NWAC080
AC0060	6360750	428150	-90	27	22/07/2021	DR	SGA199
AC0061	6360750	427800	-90	21	22/07/2021	DR	SGA028
AC0062	6360750	427700	-90	20	22/07/2021	DR	
AC0063	6360750	427600	-90	34	22/07/2021	DR	SGA027
AC0064	6360750	427500	-90	27	22/07/2021	DR	
AC0065	6360750	427400	-90	30	22/07/2021	DR	SGA026
AC0066	6360750	427300	-90	35	22/07/2021	DR	
AC0067	6361000	428150	-90	21	23/07/2021	DR	
AC0068	6361000	428100	-90	21	23/07/2021	DR	
AC0069	6361000	428050	-90	22	23/07/2021	DR	
AC0070	6361000	427950	-90	28	25/07/2021	DR	SGA193
AC0071	6361000	427900	-90	35	25/07/2021	DR	SGA192
AC0072	6361000	427850	-90	35	25/07/2021	DR	SGA191
AC0073	6361000	427800	-90	29	25/07/2021	DR	SGA023
AC0074	6361000	427750	-90	32	25/07/2021	DR	SGA190
AC0075	6361000	427700	-90	36	25/07/2021	DR	SGA189
AC0076	6361000	427650	-90	30	25/07/2021	DR	SGA188
AC0077	6361000	427600	-90	34	25/07/2021	DR	SGA022
AC0078	6361000	427550	-90	35	25/07/2021	DR	SGA187
AC0079	6361000	427500	-90	39	26/07/2021	DR	
AC0080	6361000	427400	-90	33	26/07/2021	DR	SGA021
AC0081	6361000	427300	-90	36	26/07/2021	DR	
AC0082	6361250	428200	-90	22	26/07/2021	DR	
AC0083	6361250	428100	-90	20	26/07/2021	DR	
AC0084	6361250	428000	-90	24	26/07/2021	DR	SGA018
AC0085	6361250	427900	-90	31	26/07/2021	DR	SGA184
AC0086	6361250	427800	-90	21	26/07/2021	DR	SGA017
AC0087	6361250	427700	-90	30	26/07/2021	DR	SGA182
AC0088	6361250	427600	-90	36	26/07/2021	DR	SGA016
AC0089	6361250	427500	-90	44	27/07/2021	DR	SGA179
AC0090	6361250	427400	-90	36	27/07/2021	DR	SGA015
AC0091	6361250	427300	-90	32	27/07/2021	DR	
AC0092	6361250	427200	-90	27	27/07/2021	DR	SGA014
AC0093	6361500	428100	-90	19	27/07/2021	DR	
AC0094	6361500	428000	-90	24	27/07/2021	DR	SGA012
AC0095	6361500	427900	-90	30	27/07/2021	DR	
AC0096	6361500	427800	-90	31	27/07/2021	DR	SGA011
AC0097	6361500	427450	-90	31	27/07/2021	DR	SGA173
AC0098	6361500	427400	-90	37	27/07/2021	DR	SGA009
AC0099	6361500	427350	-90	39	28/07/2021	DR	SGA172

HOLE ID	NORTHING	EASTING	DIP	EOH Depth (m)	Date Drilled	Logged By	Close to historical hole
	GDA94 z51						
AC0100	6361500	427300	-90	27	28/07/2021	DR	SGA171
AC0101	6361500	427250	-90	25	28/07/2021	DR	
AC0102	6361825	427050	-90	39	28/07/2021	DR	
AC0103	6361780	427150	-90	35	28/07/2021	DR	
AC0104	6361755	427245	-90	39	28/07/2021	DR	SGA165
AC0105	6361740	427700	-90	30	28/07/2021	DR	
AC0106	6361750	427800	-90	23	28/07/2021	DR	SGA004
AC0107	6361750	427900	-90	19	28/07/2021	DR	
AC0108	6361750	428000	-90	20	28/07/2021	DR	
AC0109	6361750	428100	-90	13	28/07/2021	DR	

Table B-2 Significant Mineralised Intersections greater than 300 ppm TREO

Cowalinya South; Intersections > 300ppm TREO*

Hole ID	Hole Depth (m)	From (m)	To (m)	Interval (m)	TREO (ppm)	Sc2O3 (ppm)	Th (ppm)	U (ppm)	Comments
AC0001	39	20	36	16	539	23.0	14.0	4.5	
AC0002	34	8	32	24	892	23.5	14.6	3.4	
	includes	16	32	16	1155	30.7	17.5	4.1	
AC0003	33	32	33	1	759	69.0	7.8	1.9	still in saprolite @ EOH
AC0004	36	17	35	18	719	28.1	17.2	5.7	
	includes	25	27	2	1263	32.2	19.8	5.1	
	includes	31	34	3	1067	49.1	13.3	4.1	
AC0005	36	24	36	12	699	40.9	12.5	4.6	still in saprolite @ EOH
	includes	32	36	4	1154	23.0	16.5	3.0	
AC0006	32	16	32	16	527	41.8	14.7	5.4	still in saprolite @ EOH
AC0007	32	28	32	4	551	16.9	9.7	3.5	still in saprolite @ EOH
AC0008	29	16	28	12	827	57.3	9.8	4.6	
	includes	24	28	4	1360	67.5	6.4	7.8	
AC0009	30	24	28	4	431	46.0	4.8	6.5	
AC0010	27	16	24	8	542	40.6	20.2	2.9	
AC0011	19				no significant assays				
AC0012	29	16	28	12	782	46.5	21.9	2.6	
	includes	20	24	4	1165	36.8	32.7	3.1	
AC0013	21	16	20	4	476	87.4	16.4	4.3	
AC0014	25	16	24	8	450	44.5	22.0	2.6	
AC0015	28	12	24	12	530	13.8	19.5	3.5	
AC0016	32	12	31	19	839	22.9	23.9	4.8	
	includes	24	29	5	1335	22.4	21.9	6.0	
AC0017	39	20	36	16	761	42.6	10.8	3.0	
	includes	28	36	8	1102	54.4	5.2	2.2	
AC0018	26	16	24	8	718	17.6	23.7	2.9	
AC0019	17	12	16	4	563	19.9	13.6	1.7	
AC0020					no significant assays				
AC0021	28	20	24	4	554	49.1	11.8	6.9	
AC0022	24	12	20	8	439	48.3	14.7	1.8	
AC0023					no significant assays				
AC0024					no significant assays				
AC0025	22	12	16	4	356	13.8	8.6	1.6	
AC0026	33	20	32	12	399	20.5	20.4	3.6	
AC0027	39	20	36	16	670	41.8	9.6	4.7	
AC0028	39	12	39	27	951	38.1	17.9	6.8	still in saprolite @ EOH
	includes	15	25	10	1511	38.0	24.1	7.0	
AC0029	39	20	39	19	1445	33.4	14.9	7.2	still in saprolite @ EOH

Hole ID	Hole Depth (m)	From (m)	To (m)	Interval (m)	TREO (ppm)	Sc2O3 (ppm)	Th (ppm)	U (ppm)	Comments
AC0030	39	20	36	16	453	24.9	16.3	8.5	
AC0031	32				no significant assays				
AC0032	35				no significant assays				
AC0033	32	16	20	4	2249	16.9	9.0	1.9	
		24	28	4	635	62.9	11.6	5.0	
AC0034	30	24	28	4	434	13.8	7.3	3.7	
AC0035	33	16	20	4	1035	53.7	21.1	3.2	
		24	33	9	853	21.5	11.8	4.2	still in saprolite @ EOH
AC0036	31	16	28	12	631	22.5	14.5	7.1	
AC0037	21	8	20	12	733	19.9	23.0	3.1	
	includes	12	16	4	1149	10.7	36.5	4.2	
AC0038	22	16	20	4	846	49.1	14.5	4.1	
AC0039	15				no significant assays				
AC0040	16				no significant assays				
AC0041	30	11	29	18	669	23.3	11.7	3.3	
	includes	11	16	5	1186	11.0	13.0	2.5	
AC0042	22	12	16	4	985	108.9	16.5	4.0	
AC0043	32	24	28	4	317	41.4	6.3	3.7	
AC0044	26	12	24	12	346	55.2	9.5	4.0	
AC0045	21	11	14	3	366	29.7	6.9	5.1	
AC0046	32	28	32	4	367	27.6	9.1	40.4	still in saprolite @ EOH
AC0047	28	16	24	8	339	24.5	10.2	7.3	
AC0048	23	16	20	4	340	27.6	11.7	3.5	
AC0049	15	8	12	4	387	7.7	11.8	2.0	
AC0050	35	16	32	16	541	21.5	7.3	3.2	
AC0051	26	20	24	4	587	66.0	18.4	3.8	
AC0052	20				no significant assays				
AC0053	28				no significant assays				
AC0054	19				no significant assays				
AC0055	27				no significant assays				
AC0056	24				no significant assays				
AC0057	21	14	18	4	591	35.3	16.7	2.9	
AC0058	30	20	30	10	1005	25.1	27.4	2.6	still in saprolite @ EOH
AC0059	21				no significant assays				

*TREO = oxides of Ce, La, Nd, Pr, Sm, Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Yb, & Y

Maximum internal dilution 2m @ <300ppm TREO

Table B-2 Contd,

Cowalinya North; Intersections > 300ppm TREO

Hole ID	Hole Depth (m)	From (m)	To (m)	Interval (m)	TREO (ppm)	Sc2O3 (ppm)	Th (ppm)	U (ppm)	Comments
AC0060	27	12	24	12	512	39.4	8.8	2.5	
AC0061	21	8	12	4	339	84.4	6.0	1.8	
AC0062	20				no significant assays				
AC0063	34	16	32	16	419	21.5	13.1	2.5	
AC0064	27	20	27	7	475	14.9	15.5	4.1	still in saprolite @ EOH
AC0065	30				no significant assays				
AC0066	35	16	32	16	501	17.3	9.3	1.8	
AC0067	21	16	20	4	480	16.9	6.2	3.4	
AC0068	21	16	20	4	346	15.3	11.4	4.1	
AC0069	22	12	20	8	436	13.8	9.6	1.8	
AC0070	28	16	24	8	517	40.6	4.5	2.0	
AC0071	35	29	34	5	858	39.6	6.1	1.9	
	includes	31	33	2	1286	41.4	5.0	1.3	
AC0072	35	24	28	4	314	52.1	3.7	4.3	
AC0073	29				no significant assays				
AC0074	32	24	28	4	454	38.3	3.6	2.9	
AC0075	36				no significant assays				
AC0076	30	24	28	4	501	38.3	9.0	4.7	
AC0077	34	24	32	8	506	48.3	9.9	4.4	
AC0078	35	24	32	8	494	54.4	9.1	4.0	
AC0079	39	24	39	15	488	20.8	15.2	2.5	still in saprolite @ EOH
AC0080	33	20	32	12	435	17.9	13.0	3.9	
AC0081	36	24	36	12	1580	41.9	6.5	2.9	still in saprolite @ EOH
	includes	24	28	4	3428	46.0	11.6	5.1	
AC0082	22	12	20	8	458	23.8	12.1	3.0	
AC0083	20				no significant assays				
AC0084	24	12	20	8	502	24.5	28.8	2.3	
AC0085	31	16	28	12	352	34.8	7.6	2.4	
AC0086	21				no significant assays				
AC0087	30	20	28	8	397	33.7	8.3	3.0	
AC0088	36	28	36	8	536	18.4	9.6	8.1	still in saprolite @ EOH
AC0089	44	16	20	4	324	15.7	7.4	2.3	
		26	43	17	1205	18.1	24.5	5.0	
AC0090	36	32	36	4	1864	47.5	6.7	2.6	still in saprolite @ EOH
AC0091	32	24	28	4	686	10.7	11.4	2.1	
AC0092	27				no significant assays				
AC0093	19				no significant assays				
AC0094	24				no significant assays				
AC0095	30	24	28	4	366	13.8	10.9	2.7	
AC0096	31	20	28	8	389	26.8	5.5	2.4	
AC0097	31	20	28	8	415	34.5	4.6	1.1	
AC0098	37	24	36	12	639	13.3	9.8	2.1	
AC0099	39	20	32	12	582	18.4	7.8	4.0	

Hole ID	Hole Depth (m)	From (m)	To (m)	Interval (m)	TREO (ppm)	Sc2O3 (ppm)	Th (ppm)	U (ppm)	Comments
AC0100	27	20	26	6	732	23.5	5.7	3.4	
AC0101	25	20	24	4	827	24.5	5.8	2.4	
AC0102	39	20	39	19	417	16.4	14.2	1.8	still in saprolite @ EOH
AC0103	35	20	28	8	524	16.1	12.5	1.4	
AC0104	39	20	32	12	744	15.8	6.7	3.2	
		36	39	3	525	16.9	4.8	1.0	still in saprolite @ EOH
AC0105	30	8	12	4	383	19.9	9.9	1.1	
AC0106	23				no significant assays				
AC0107	19				no significant assays				
AC0108	20				no significant assays				
AC0109	13				no significant assays				

*TREO = oxides of Ce, La, Nd, Pr, Sm, Dy, Er, Eu, Gd, Ho, Lu, Tb, Tm, Yb, & Y

Maximum internal dilution 2m @ <300ppm TREO

Appendix C

Correlation matrices for composite data

Table C-1 Correlation matrix – Composites Cowalinya North

Table C-2 Correlation matrix – Composites Cowalinya South

Table C-1 Cowalinya North Composites – Correlation Matrix

Correlation Matrix - Compsam (4m Compsites) - Domain 1000 (North)																			
	TREE_PPM	TREE_CE	Ce_PPM	Dy_PPM	Er_PPM	Eu_PPM	Gd_PPM	Ho_PPM	La_PPM	Lu_PPM	Nd_PPM	Pr_PPM	Sc_PPM	Sm_PPM	Tb_PPM	Th_PPM	Tm_PPM	U_PPM	Y_PPM
TREE_CE	0.98																		
Ce_PPM	0.80	0.67																	
Dy_PPM	0.93	0.96	0.58																
Er_PPM	0.89	0.93	0.54	0.99															
Eu_PPM	0.79	0.83	0.46	0.81	0.76														
Gd_PPM	0.93	0.97	0.59	0.96	0.92	0.91													
Ho_PPM	0.91	0.95	0.56	1.00	1.00	0.79	0.95												
La_PPM	0.92	0.92	0.70	0.80	0.73	0.78	0.86	0.77											
Lu_PPM	0.87	0.91	0.52	0.97	0.99	0.79	0.92	0.98	0.71										
Nd_PPM	0.97	0.98	0.69	0.91	0.86	0.80	0.93	0.88	0.92	0.83									
Pr_PPM	0.96	0.97	0.70	0.88	0.81	0.80	0.92	0.85	0.95	0.79	0.99								
Sc_PPM	0.26	0.25	0.22	0.24	0.23	0.32	0.26	0.23	0.20	0.24	0.25	0.25							
Sm_PPM	0.97	0.99	0.64	0.95	0.91	0.83	0.96	0.93	0.90	0.88	0.99	0.97	0.24						
Tb_PPM	0.93	0.96	0.59	0.97	0.94	0.90	1.00	0.96	0.84	0.94	0.92	0.90	0.26	0.95					
Th_PPM	0.32	0.27	0.41	0.21	0.21	0.16	0.20	0.21	0.33	0.22	0.25	0.26	-0.10	0.24	0.20				
Tm_PPM	0.88	0.92	0.52	0.98	0.99	0.78	0.93	0.99	0.72	0.99	0.84	0.80	0.23	0.89	0.95	0.19			
U_PPM	0.33	0.30	0.35	0.27	0.25	0.26	0.28	0.26	0.28	0.23	0.31	0.30	0.22	0.30	0.28	0.32	0.24		
Y_PPM	0.88	0.91	0.54	0.97	0.99	0.71	0.89	0.98	0.70	0.97	0.83	0.79	0.22	0.88	0.90	0.22	0.98	0.25	
Yb_PPM	0.83	0.87	0.48	0.94	0.94	0.86	0.94	0.95	0.70	0.97	0.79	0.76	0.25	0.84	0.95	0.19	0.97	0.22	0.91

Table C-2 Cowalinya South Composites – Correlation Matrix

Correlation Matrix - Compsam (4m Compsites) - Domain 2000 (South)																			
	TREE_PPM	TREE_CE	Ce_PPM	Dy_PPM	Er_PPM	Eu_PPM	Gd_PPM	Ho_PPM	La_PPM	Lu_PPM	Nd_PPM	Pr_PPM	Sc_PPM	Sm_PPM	Tb_PPM	Th_PPM	Tm_PPM	U_PPM	Y_PPM
TREE_CE	0.97																		
Ce_PPM	0.88	0.75																	
Dy_PPM	0.87	0.94	0.58																
Er_PPM	0.82	0.90	0.52	0.99															
Eu_PPM	0.90	0.95	0.63	0.92	0.87														
Gd_PPM	0.90	0.96	0.62	0.99	0.96	0.96													
Ho_PPM	0.84	0.92	0.54	1.00	1.00	0.89	0.97												
La_PPM	0.90	0.86	0.83	0.66	0.59	0.75	0.72	0.62											
Lu_PPM	0.79	0.87	0.49	0.97	0.99	0.84	0.93	0.99	0.56										
Nd_PPM	0.97	0.97	0.81	0.87	0.81	0.94	0.92	0.83	0.88	0.77									
Pr_PPM	0.97	0.95	0.85	0.80	0.73	0.89	0.86	0.76	0.93	0.69	0.99								
Sc_PPM	0.29	0.27	0.29	0.23	0.23	0.21	0.23	0.23	0.28	0.22	0.24	0.26							
Sm_PPM	0.95	0.98	0.74	0.93	0.87	0.97	0.97	0.90	0.81	0.84	0.98	0.94	0.23						
Tb_PPM	0.89	0.96	0.61	1.00	0.97	0.95	1.00	0.98	0.69	0.94	0.90	0.83	0.24	0.95					
Th_PPM	0.57	0.54	0.55	0.43	0.39	0.40	0.45	0.40	0.61	0.39	0.53	0.56	0.23	0.50	0.45				
Tm_PPM	0.81	0.89	0.51	0.98	1.00	0.86	0.95	0.99	0.58	1.00	0.79	0.72	0.23	0.86	0.96	0.40			
U_PPM	0.36	0.35	0.32	0.33	0.30	0.35	0.35	0.31	0.28	0.29	0.35	0.33	0.30	0.37	0.35	0.24	0.30		
Y_PPM	0.80	0.89	0.48	0.98	0.99	0.86	0.94	0.99	0.58	0.98	0.78	0.70	0.23	0.85	0.96	0.37	0.99	0.29	
Yb_PPM	0.81	0.89	0.51	0.98	1.00	0.85	0.94	0.99	0.58	1.00	0.79	0.71	0.23	0.86	0.96	0.40	1.00	0.30	0.98

Appendix D

Basic statistics for composite data; including top cuts

Figure D-1 Statistics Plots – Cowalinya North - Upper Saprolite; La

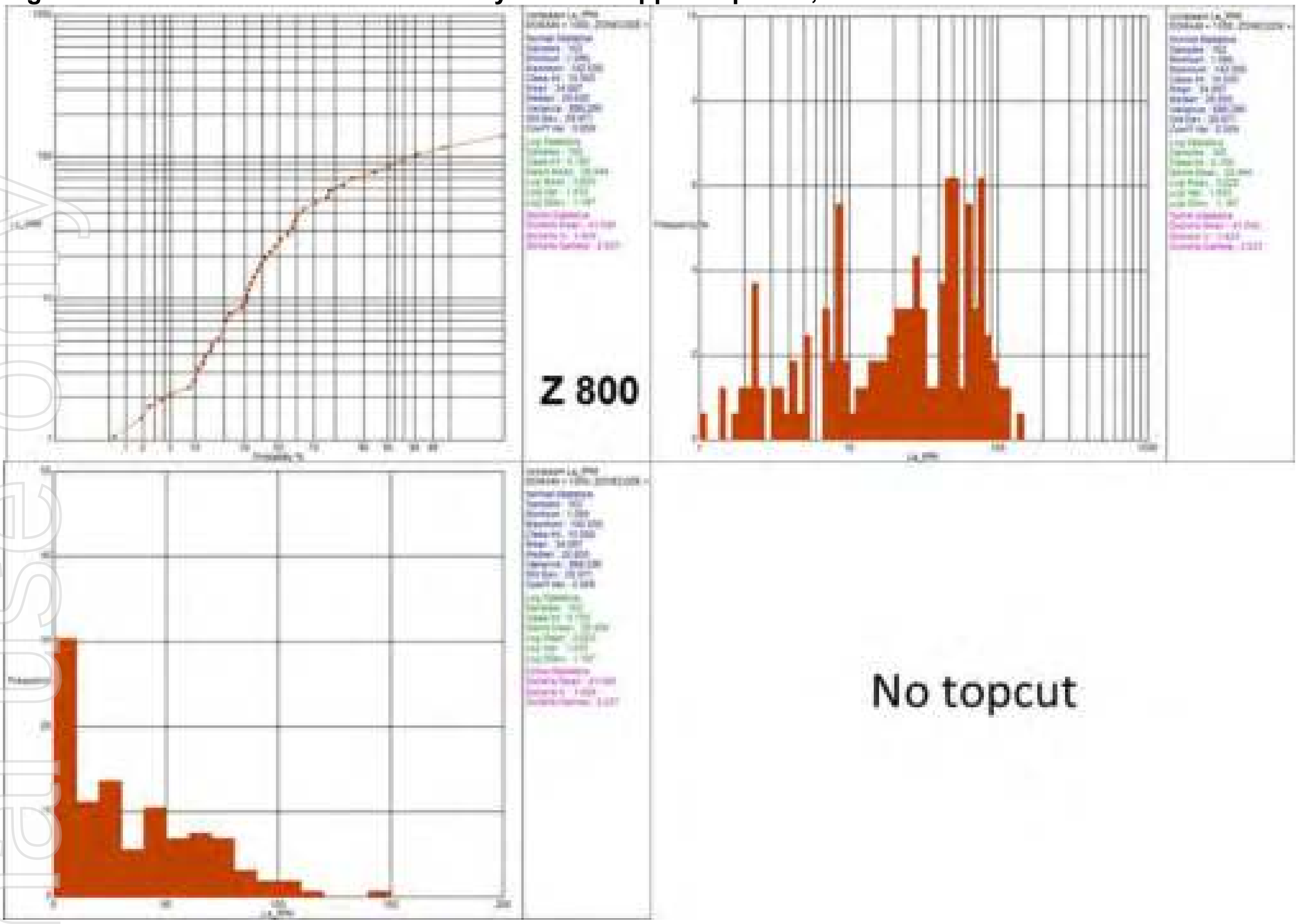


Figure D-2 Statistics Plots – Cowalinya North - Lower Saprolite; La

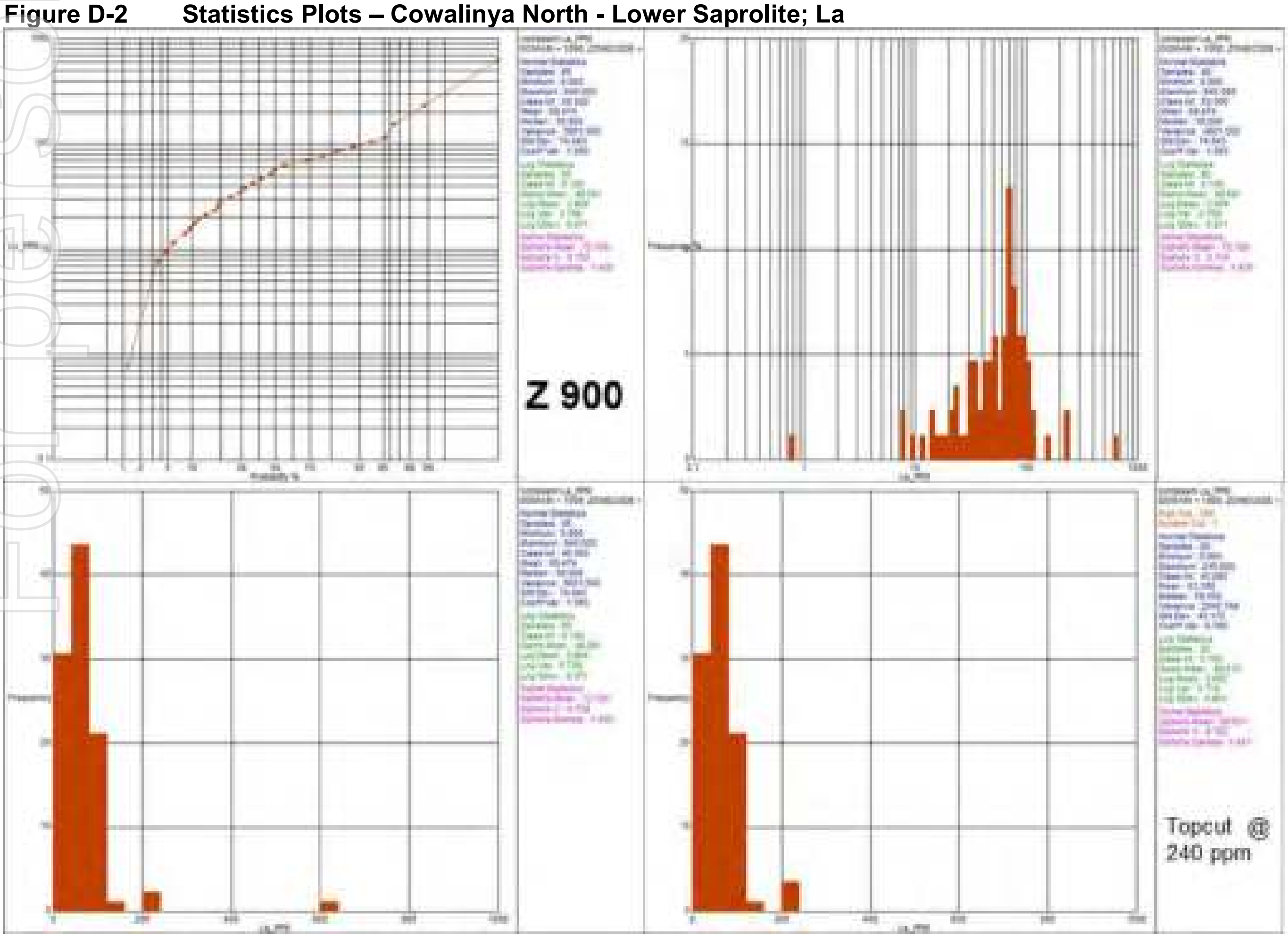


Figure D-3 Statistics Plots – Cowalinya North – Other ZONECODEs; La

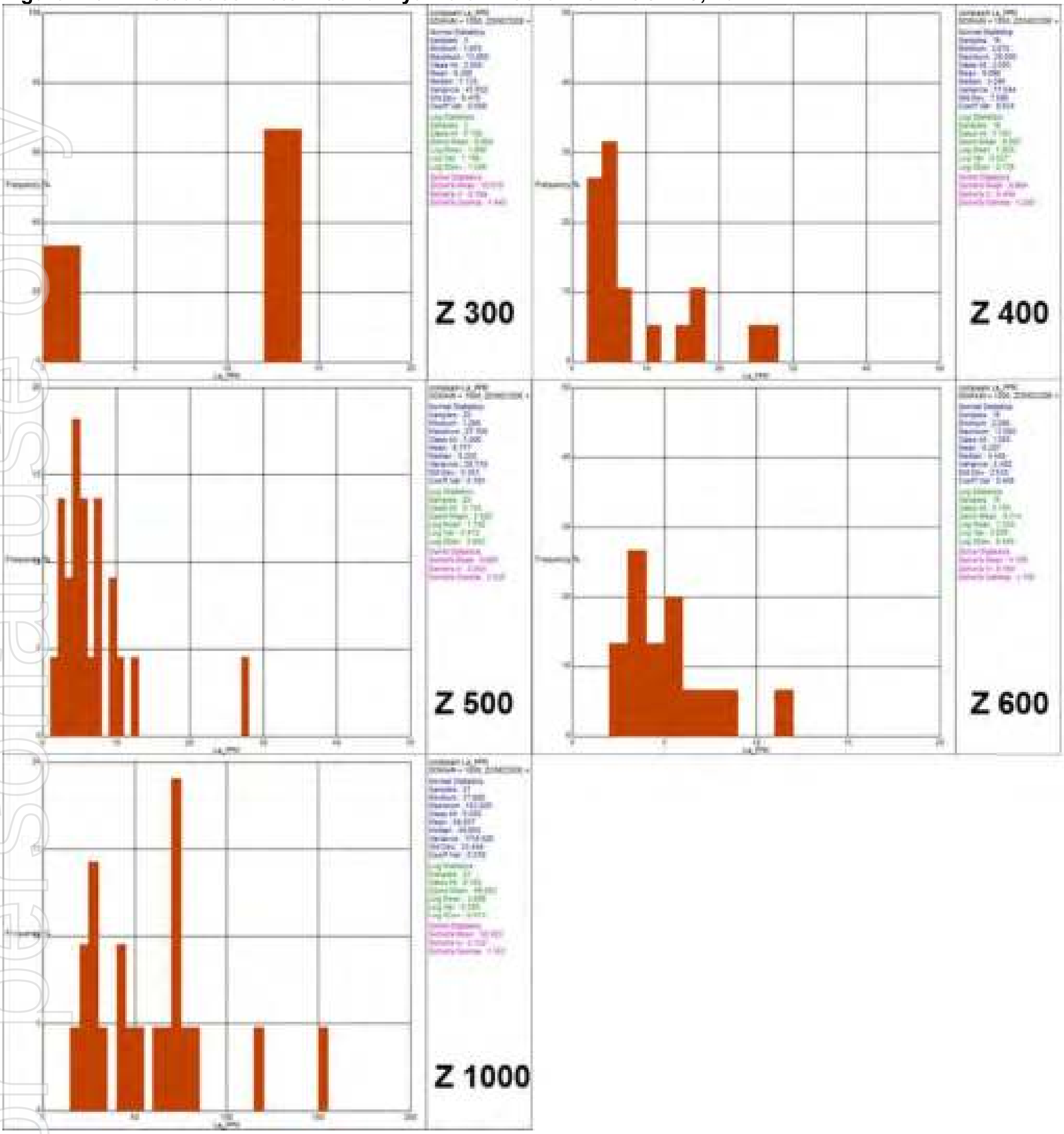


Figure D-4 Statistics Plots – Cowalinya North – Other ZONECODEs; Ce

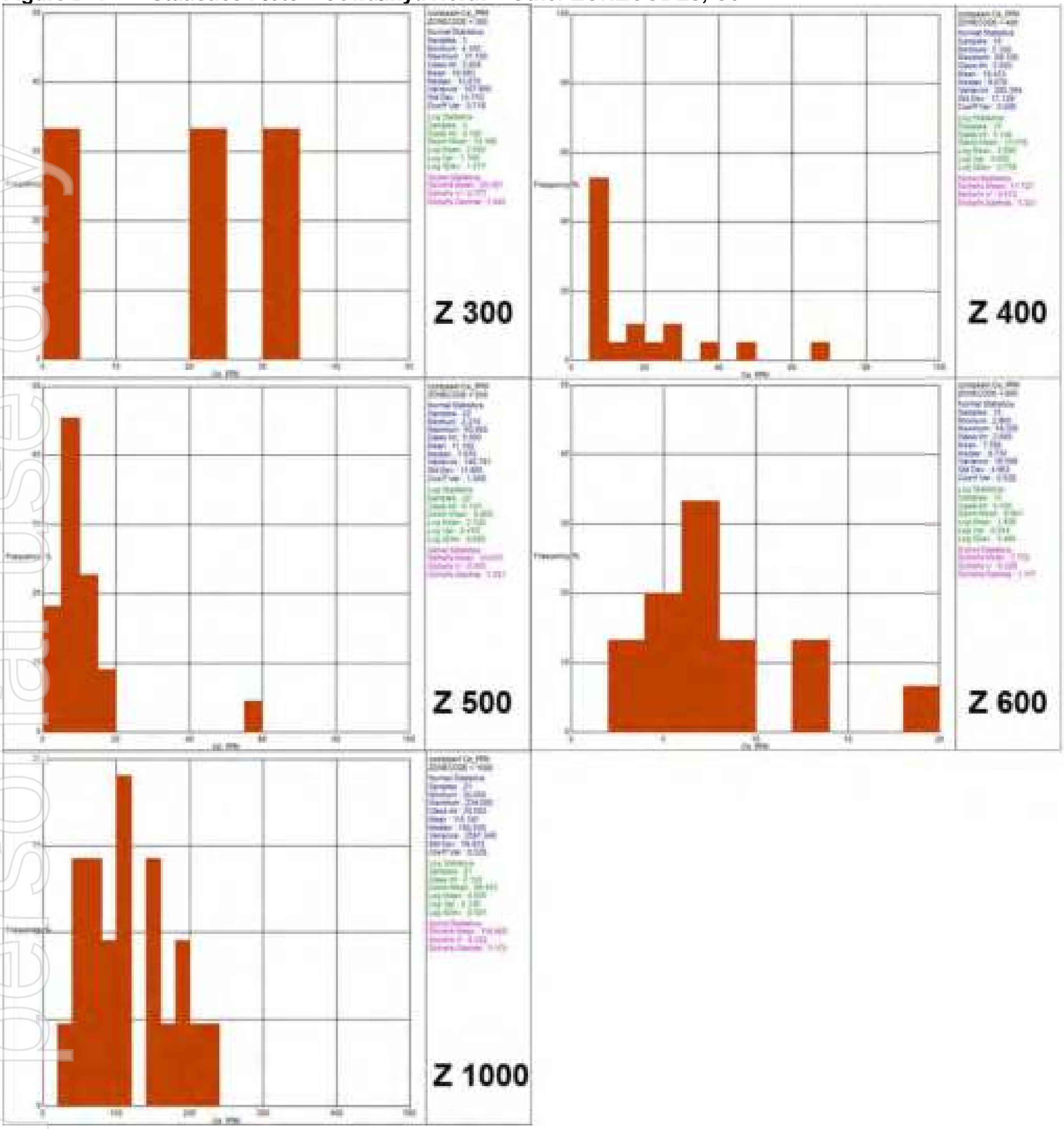


Figure D-5 Statistics Plots – Cowalinya North - Upper Saprolite; Pr

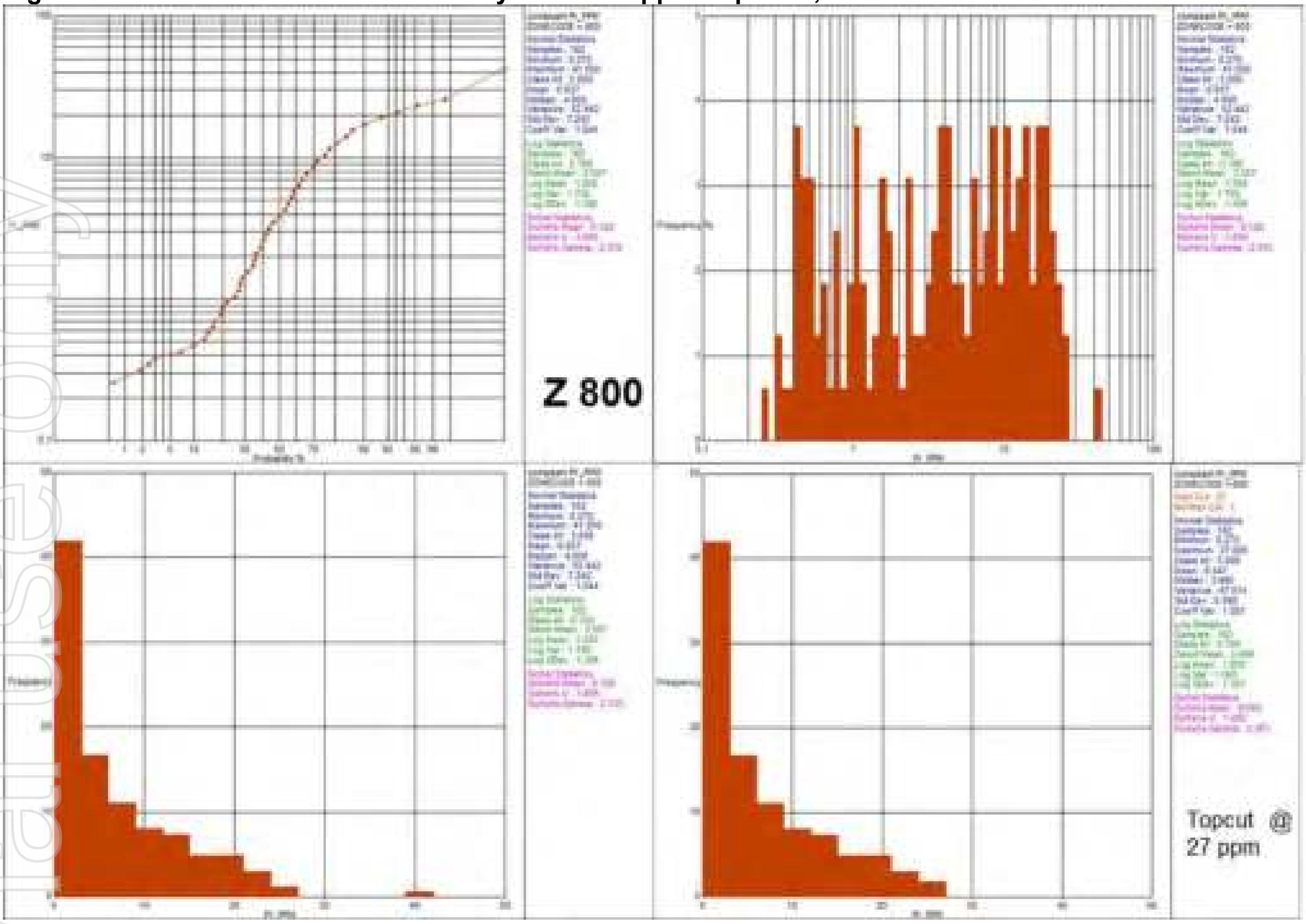


Figure D-6 Statistics Plots – Cowalinya North - Lower Saprolite; Pr

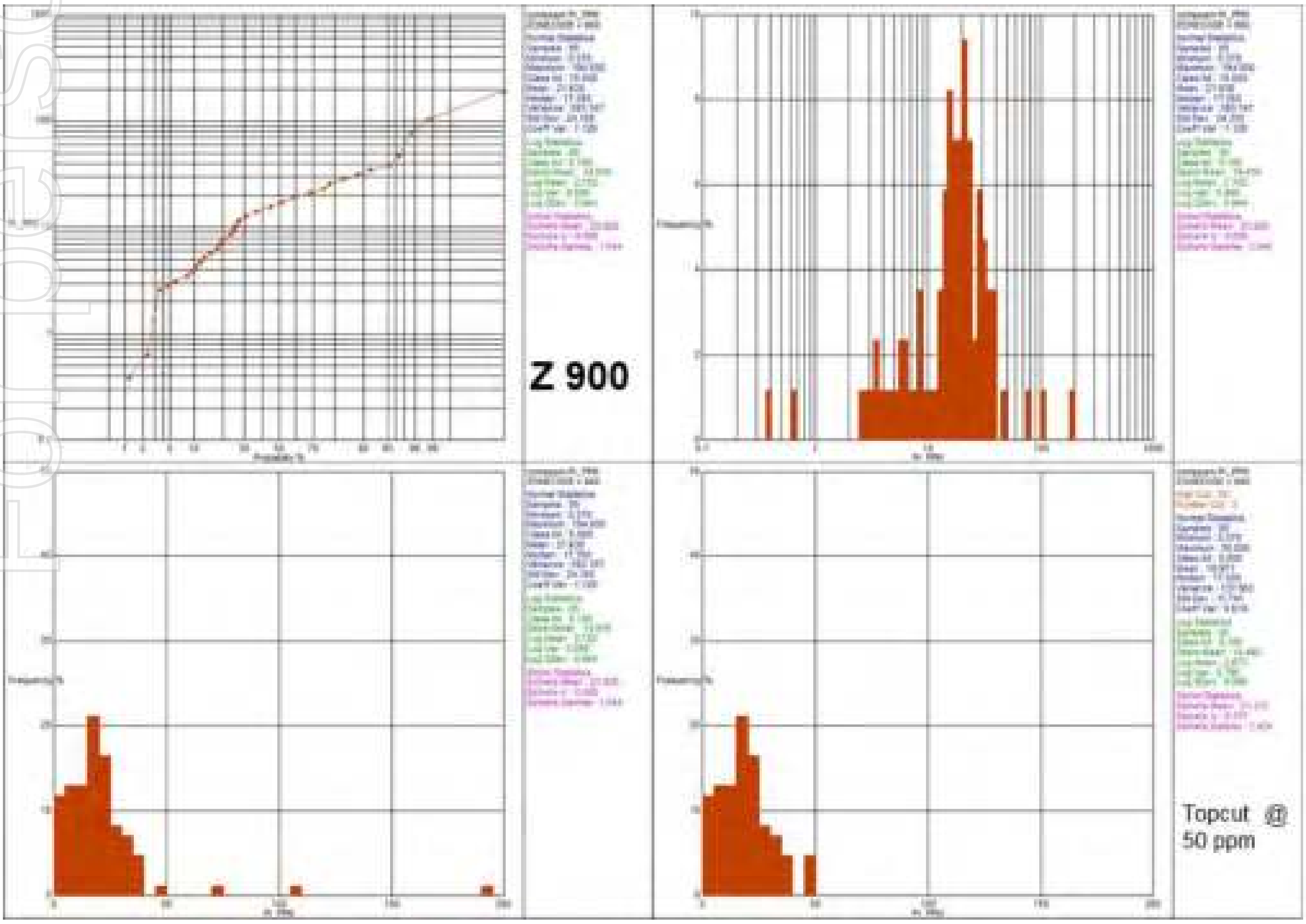


Figure D-7 Statistics Plots – Cowalinya North - Upper Saprolite; Nd

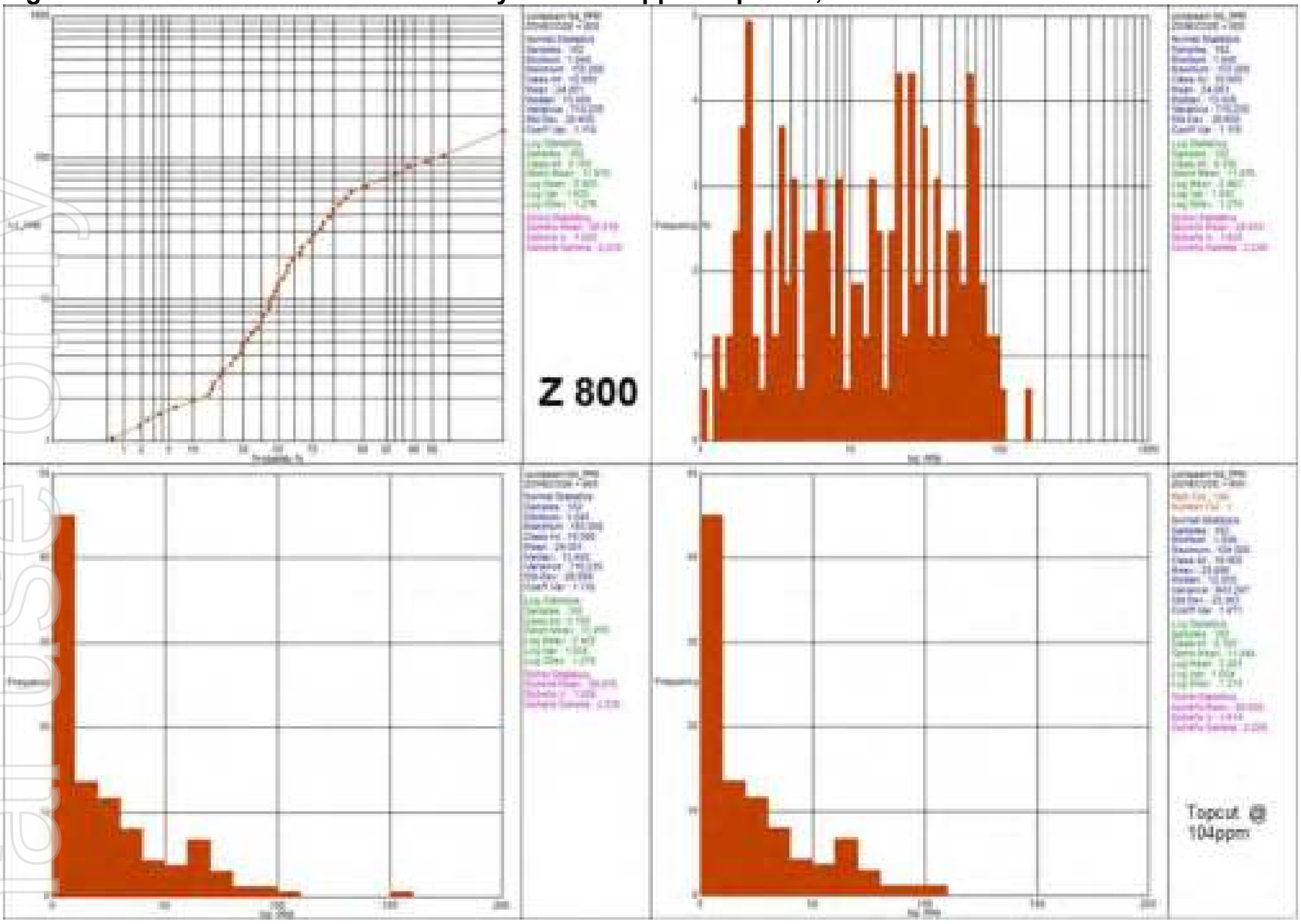


Figure D-8 Statistics Plots – Cowalinya North - Lower Saprolite; Nd

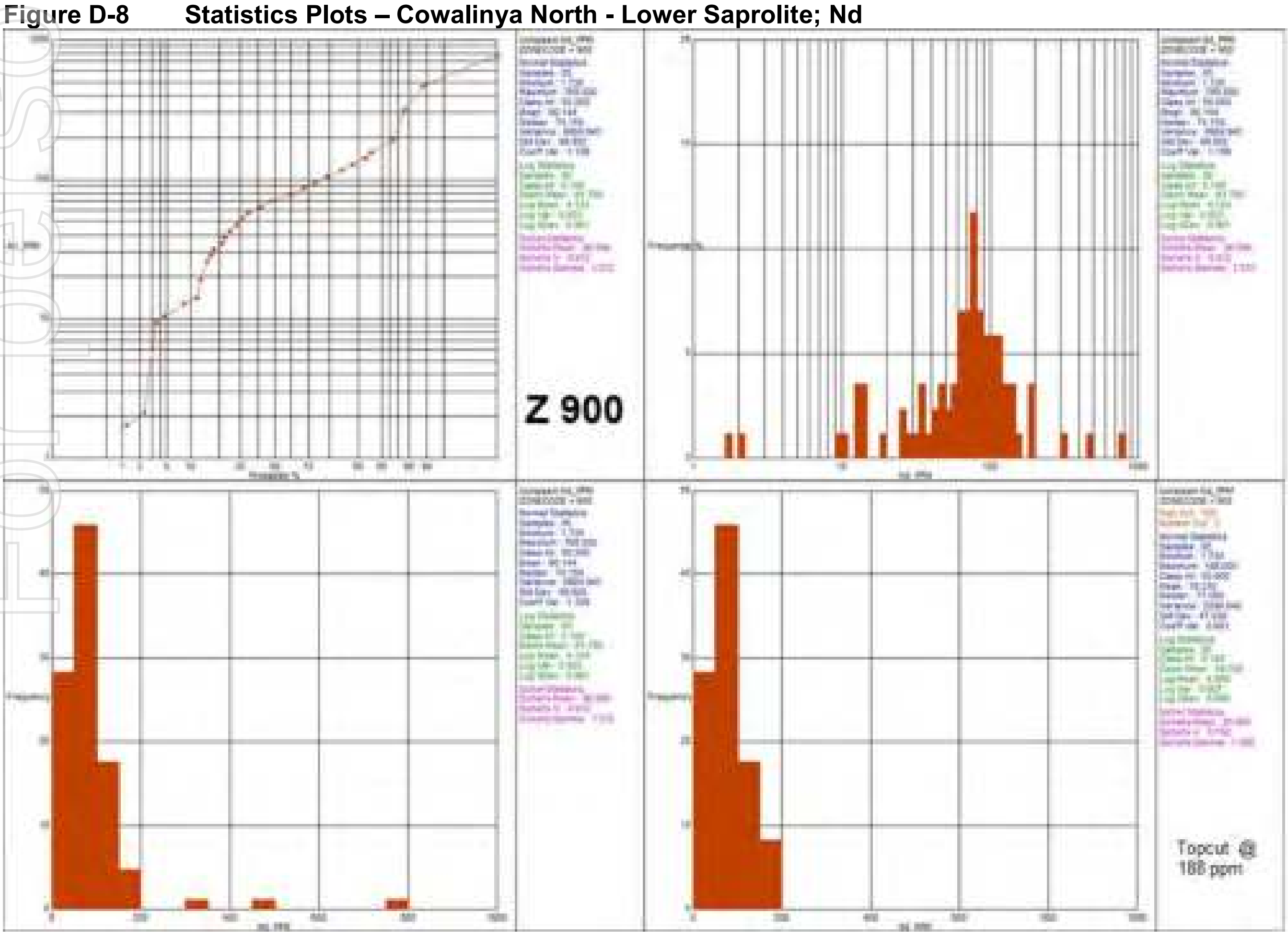


Figure D-9 Statistics Plots – Cowalinya North – Other ZONECODEs; Nd

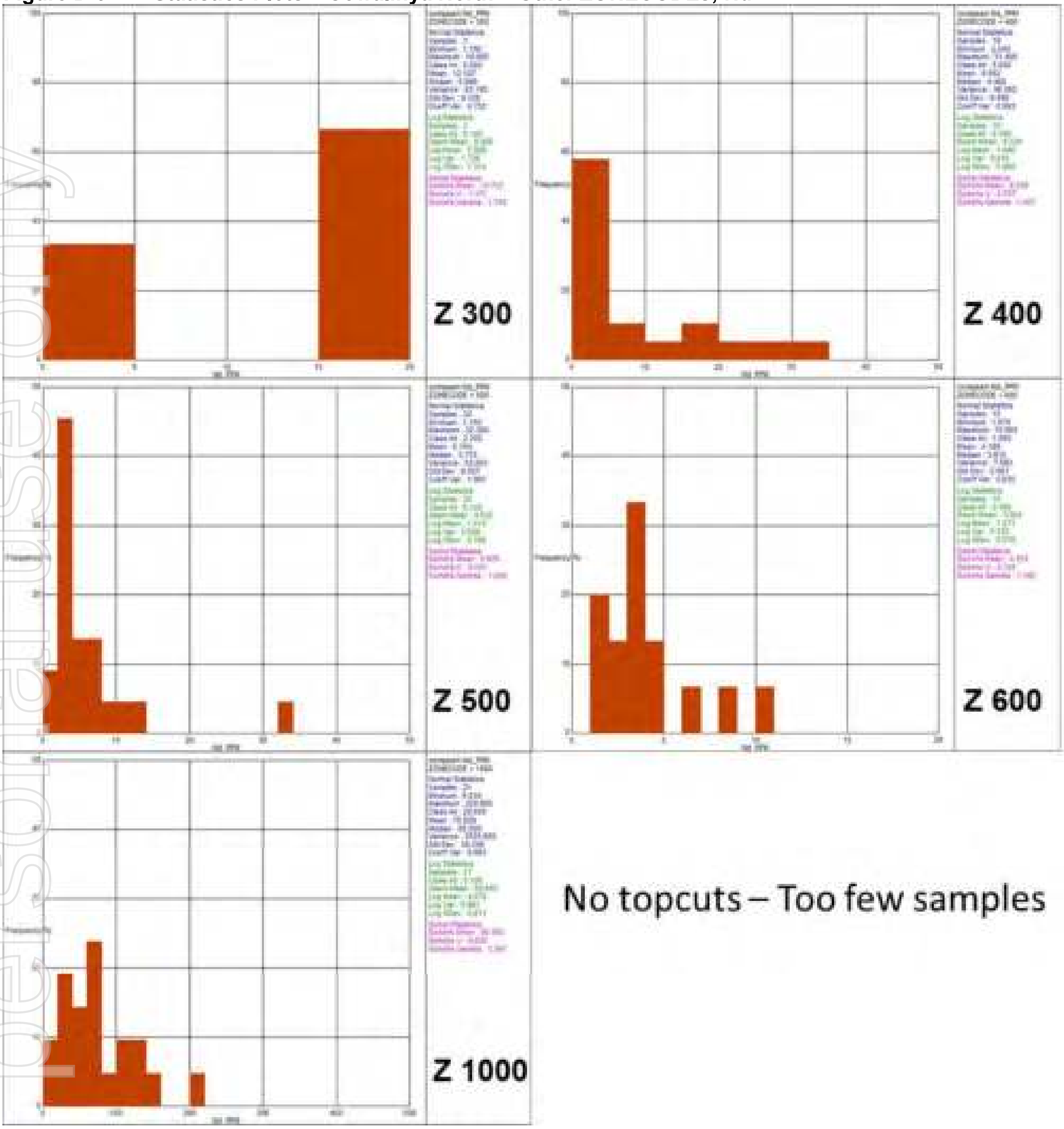


Figure D-10 Statistics Plots – Cowalinya North - Upper Saprolite; Tb

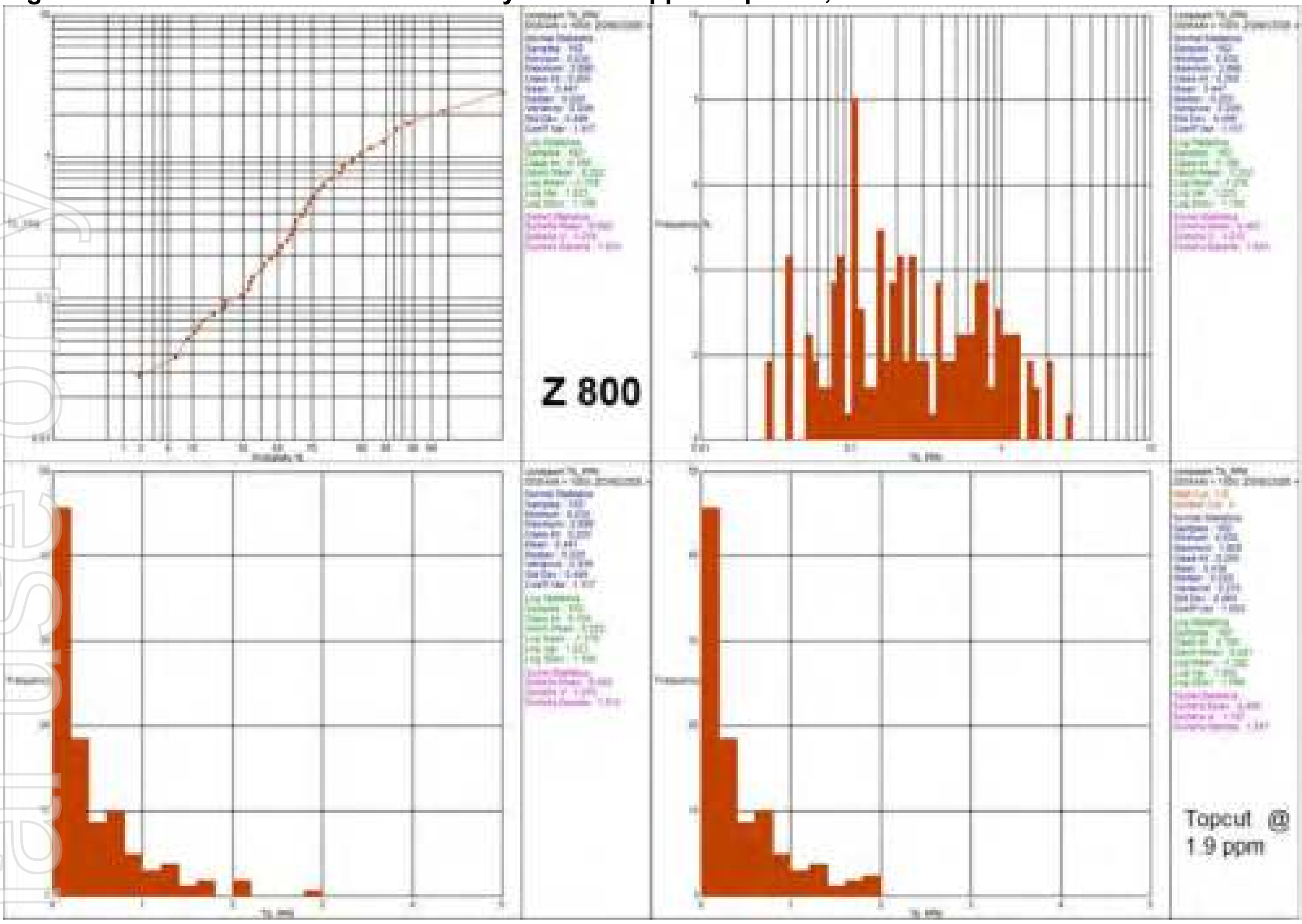


Figure D-11 Statistics Plots – Cowalinya North - Lower Saprolite; Tb

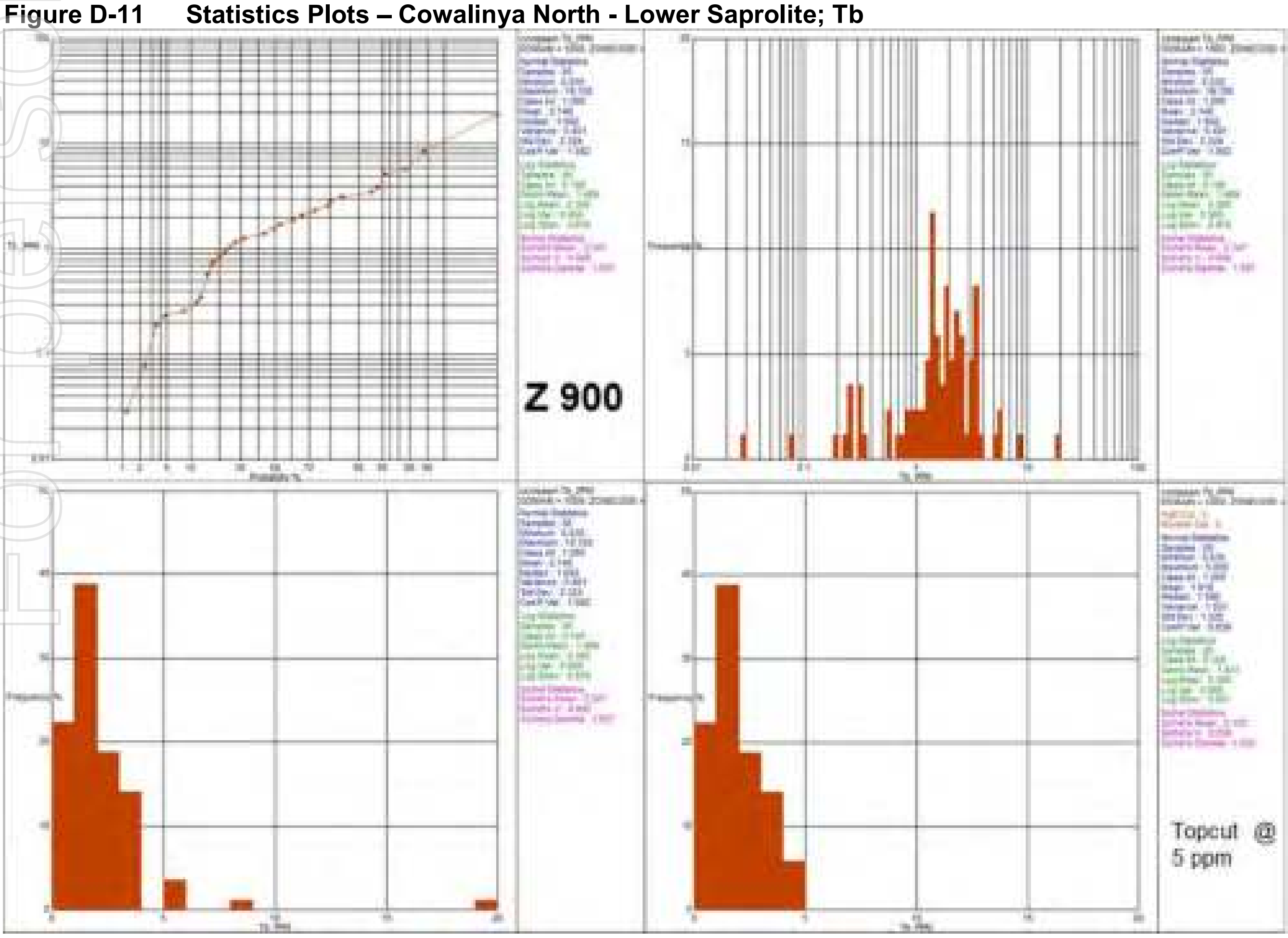


Figure D-12 Statistics Plots – Cowalinya North - Upper Saprolite; Dy

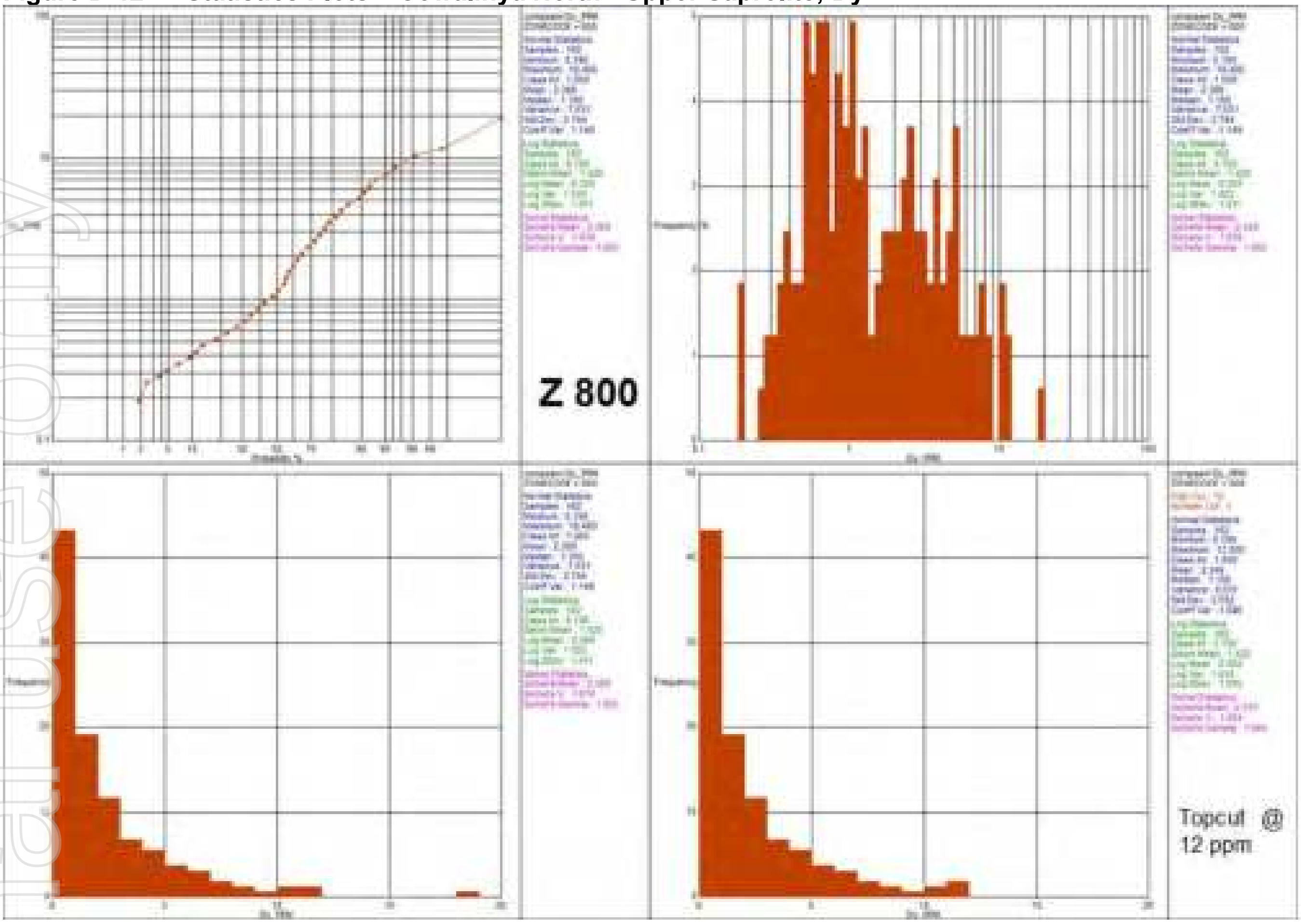


Figure D-13 Statistics Plots – Cowalinya North - Lower Saprolite; Dy

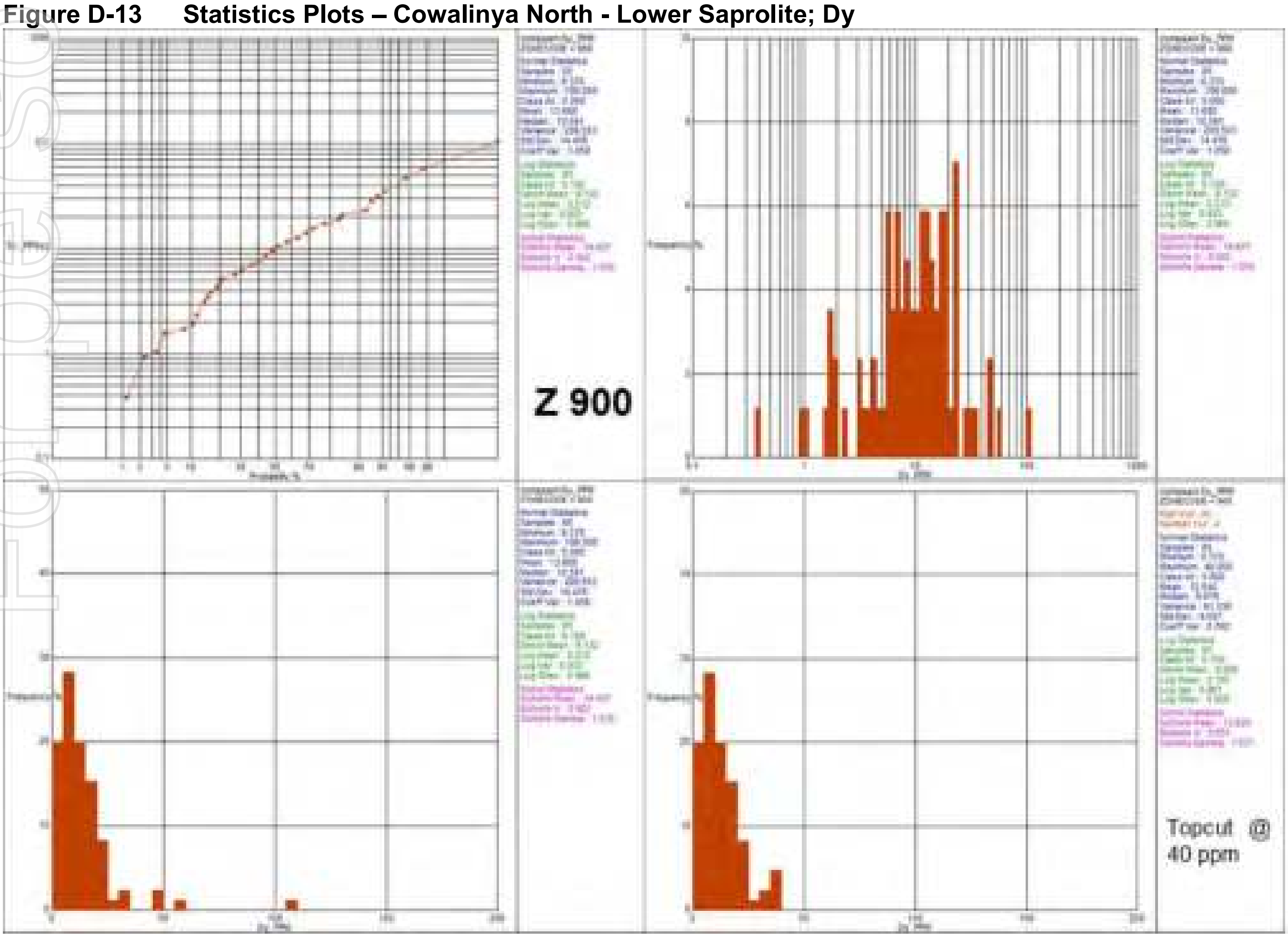


Figure D-14 Statistics Plots – Cowalinya North - Upper Saprolite; Sc

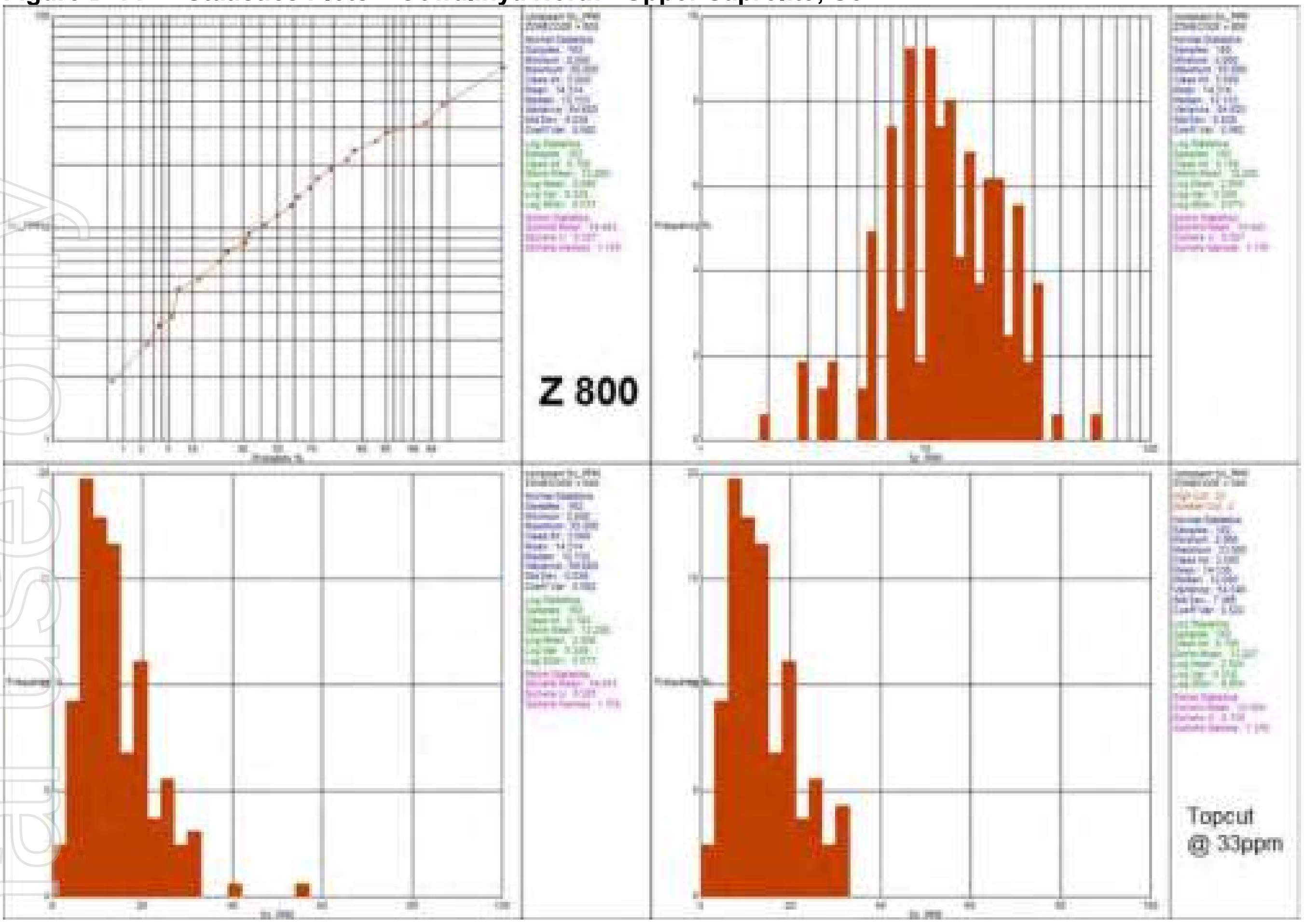


Figure D-15 Statistics Plots – Cowalinya North - Lower Saprolite; Sc

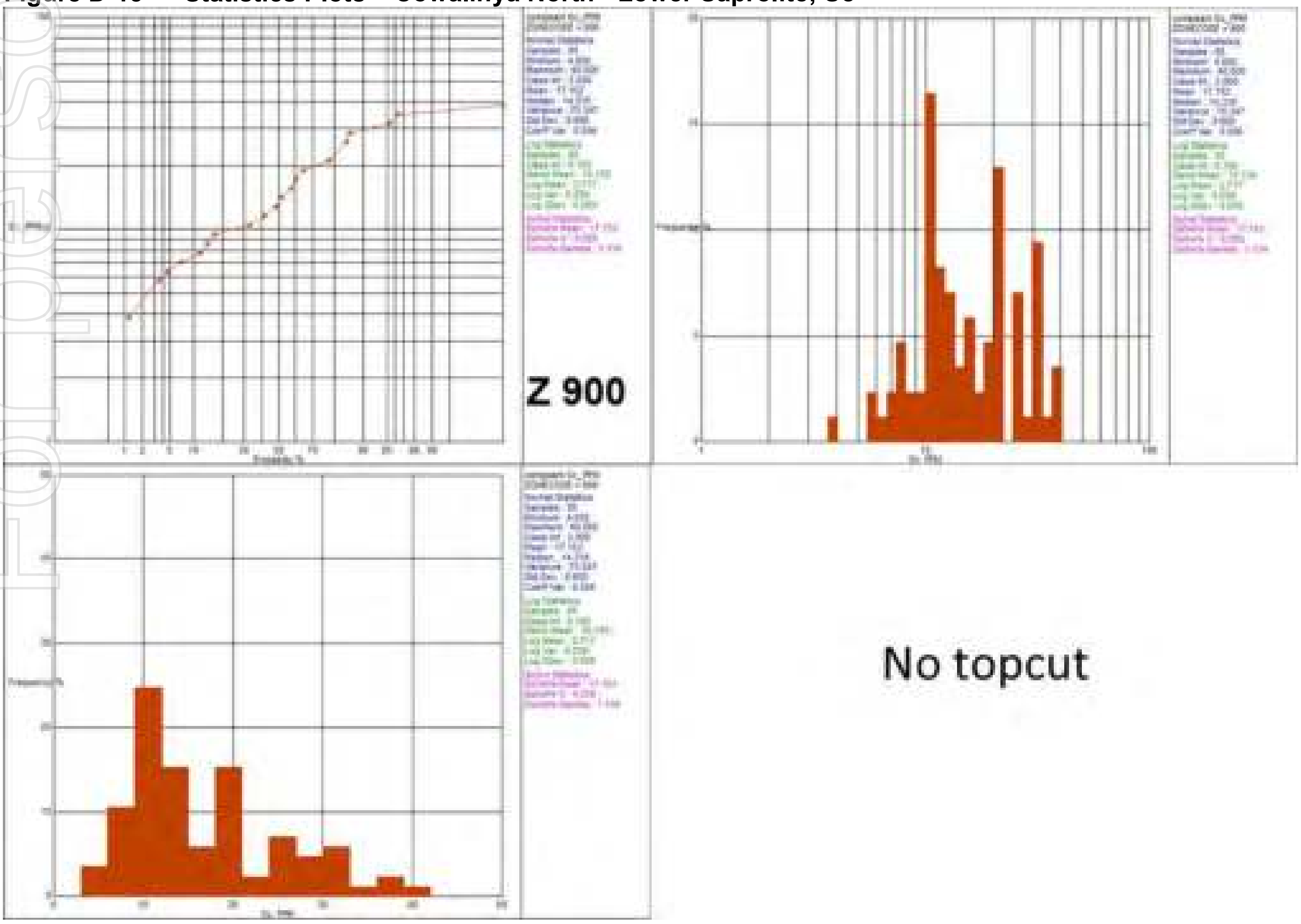


Figure D-16 Statistics Plots – Cowalinya North – Other ZONECODEs; Sc

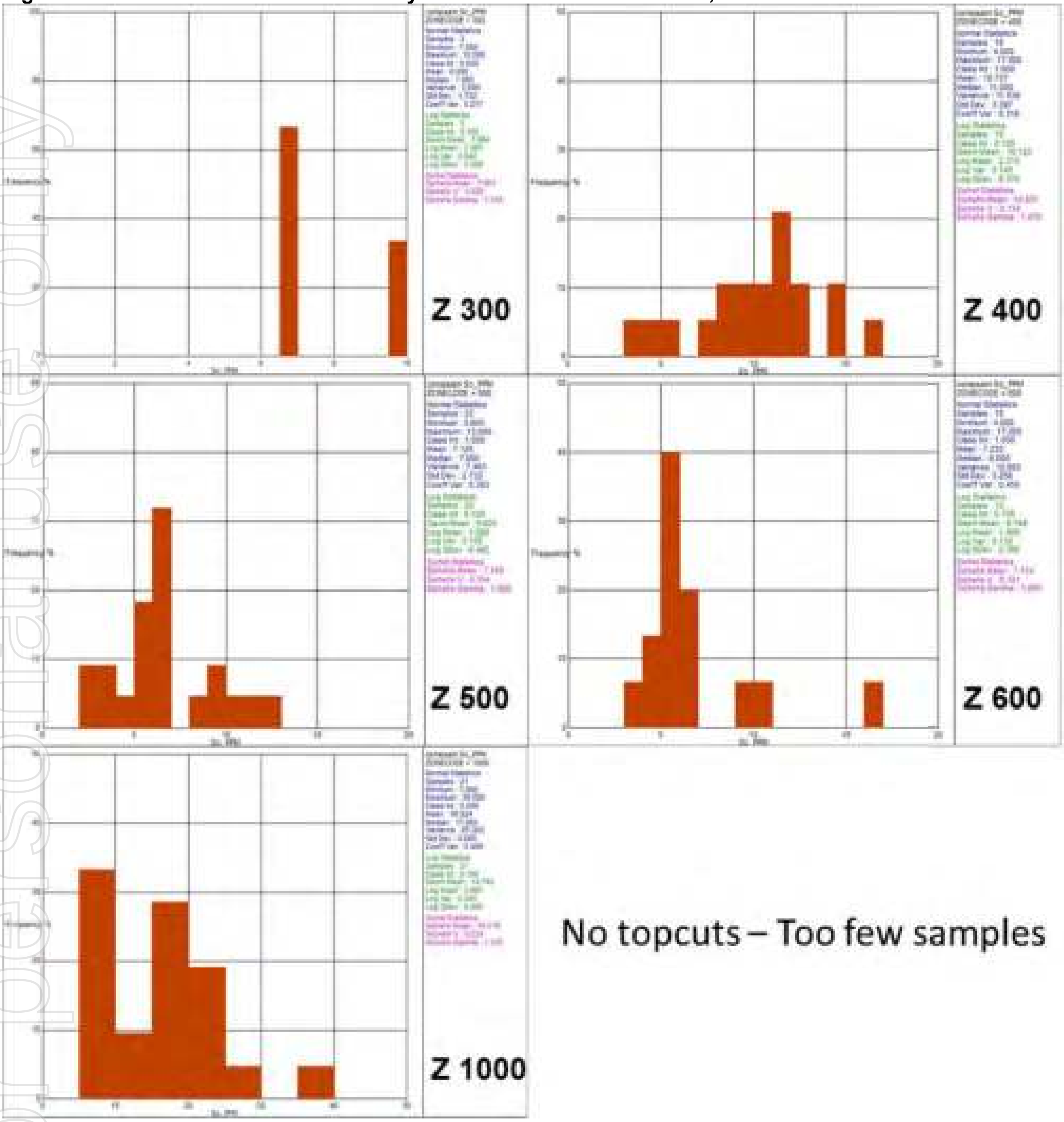


Figure D-17 Statistics Plots – Cowalinya North - Upper Saprolite; Th

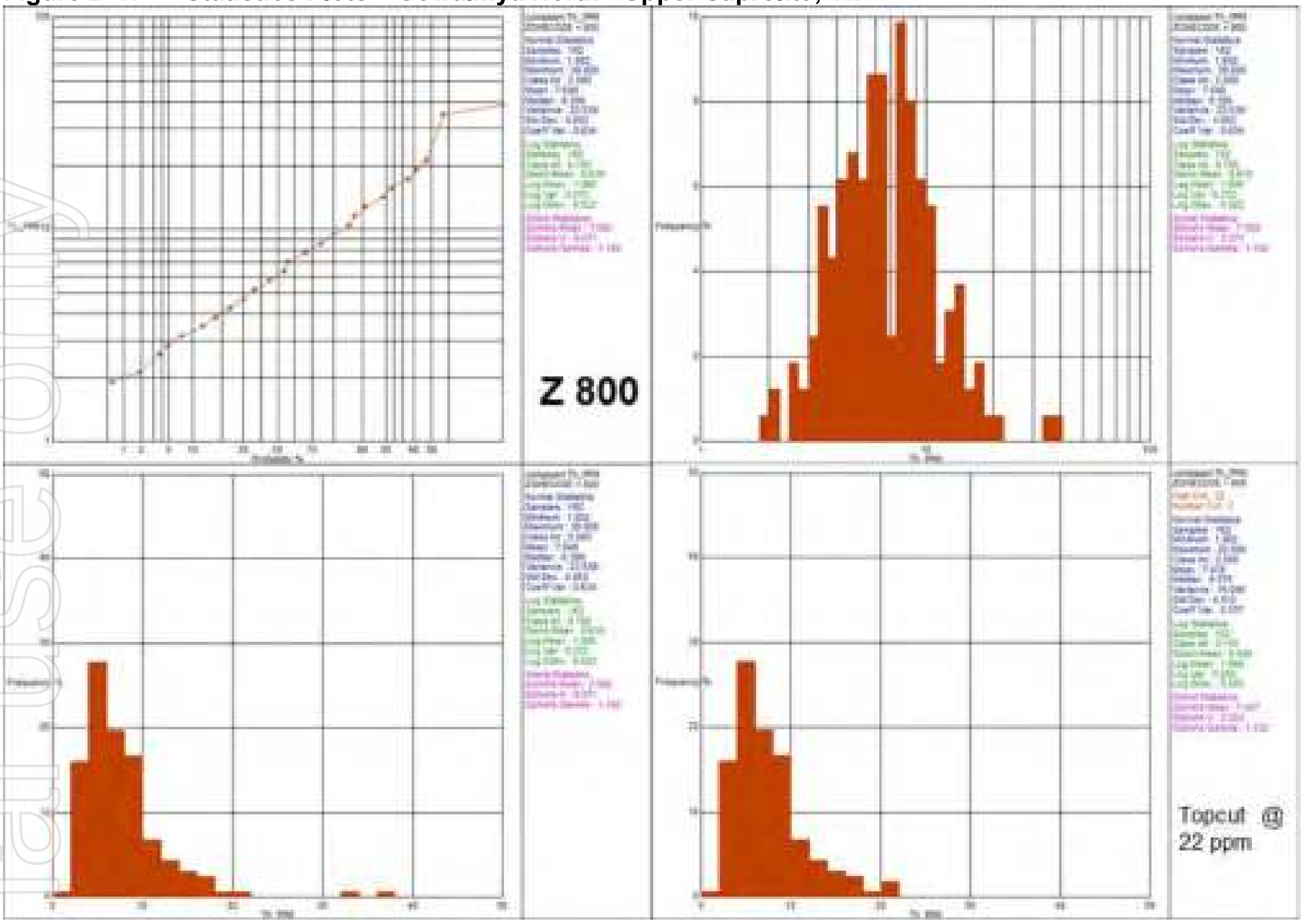


Figure D-18 Statistics Plots – Cowalinya North - Lower Saprolite; Th

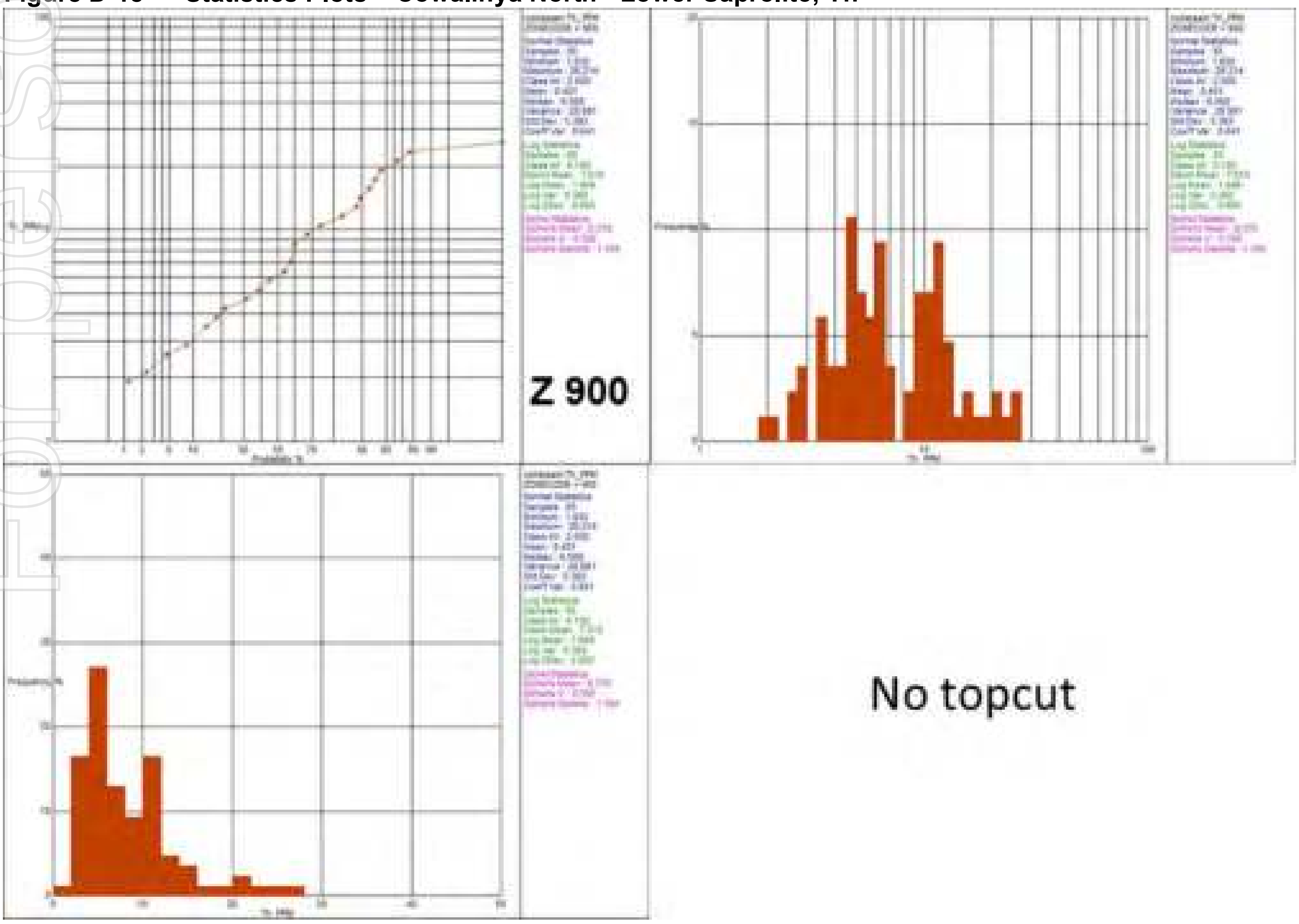


Figure D-19 Statistics Plots – Cowalinya North - Upper Saprolite; U

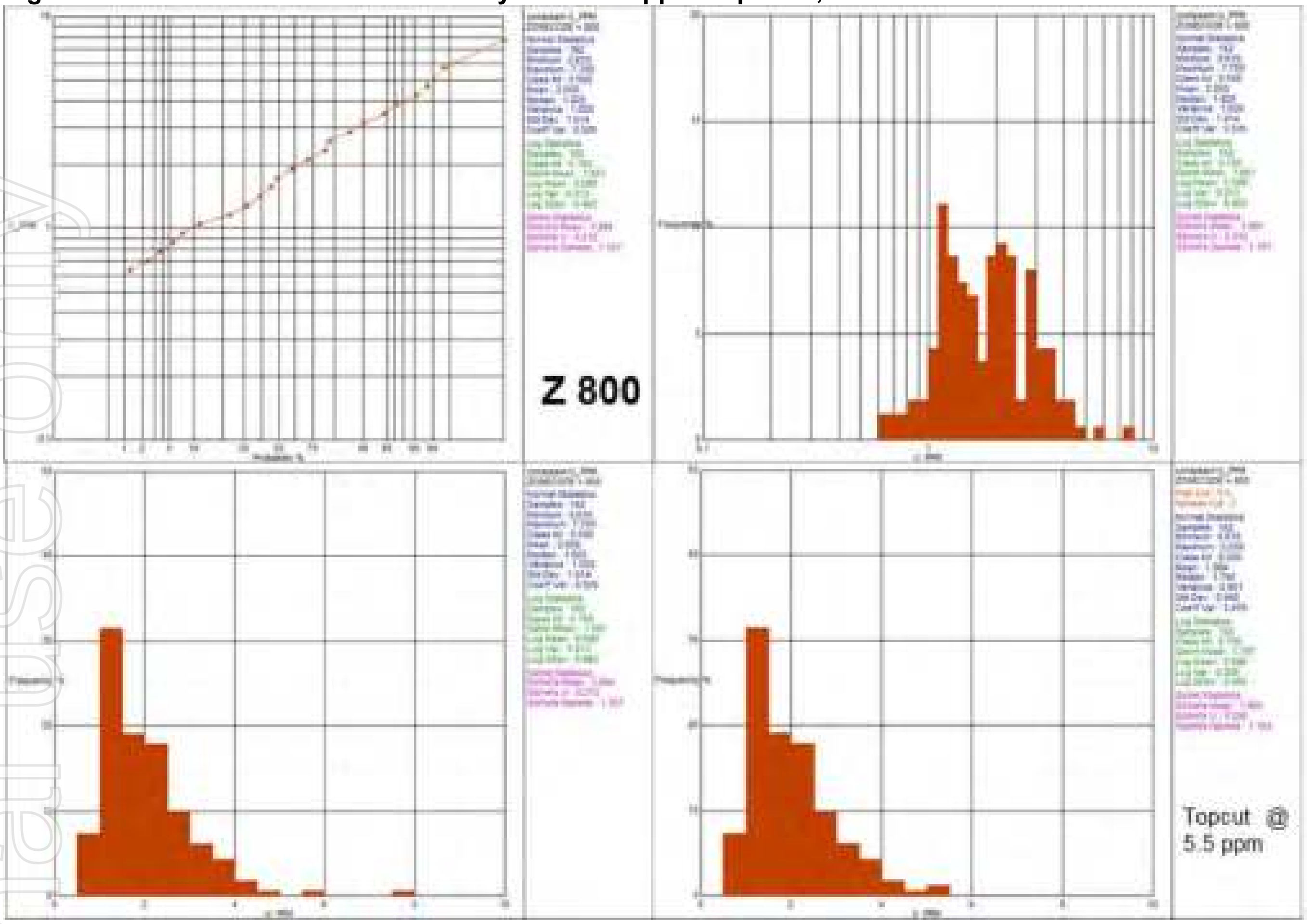


Figure D-20 Statistics Plots – Cowalinya North - Lower Saprolite; U

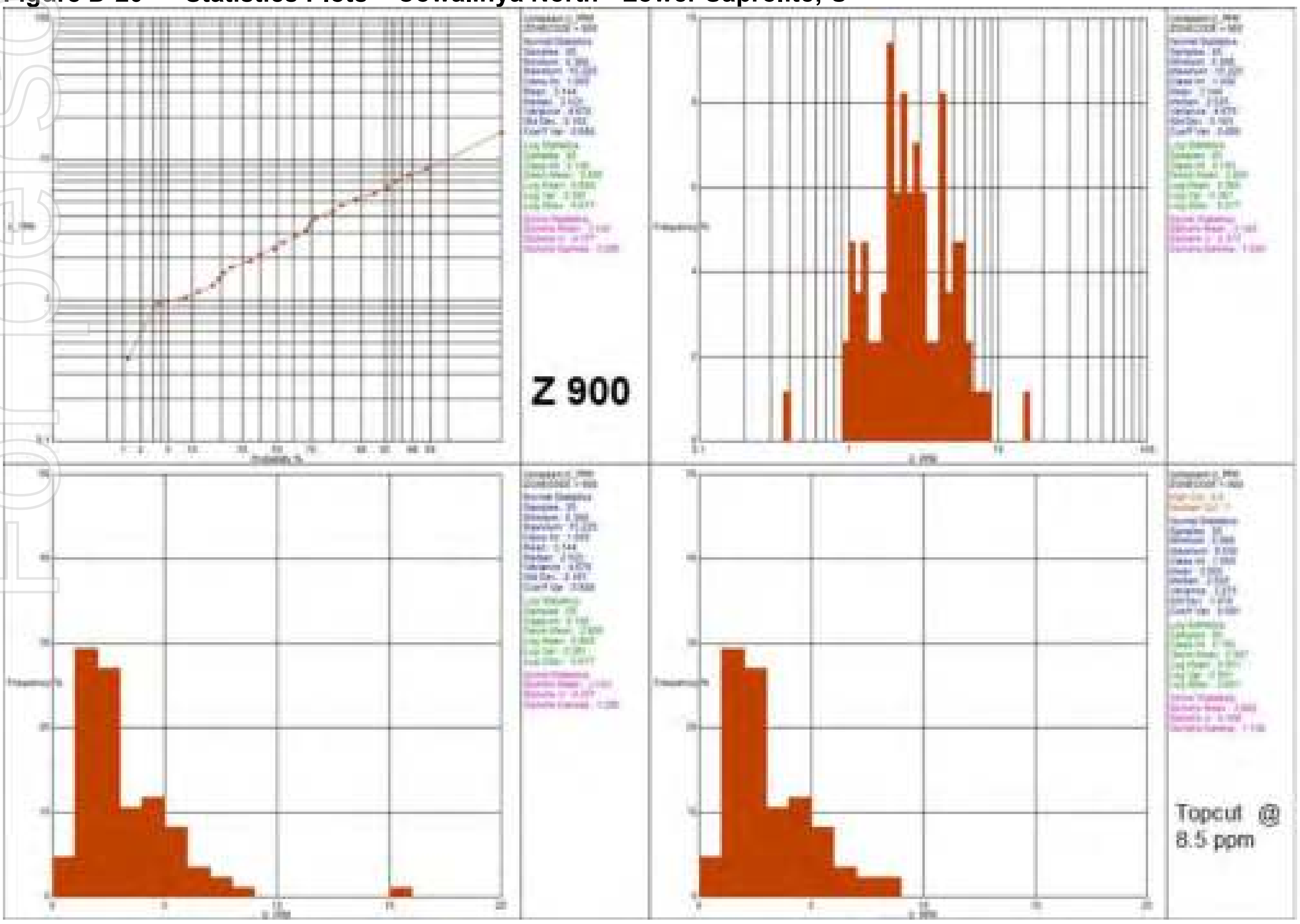


Figure D-21 Statistics Plots – Cowalinya South – Other ZONECODEs; La

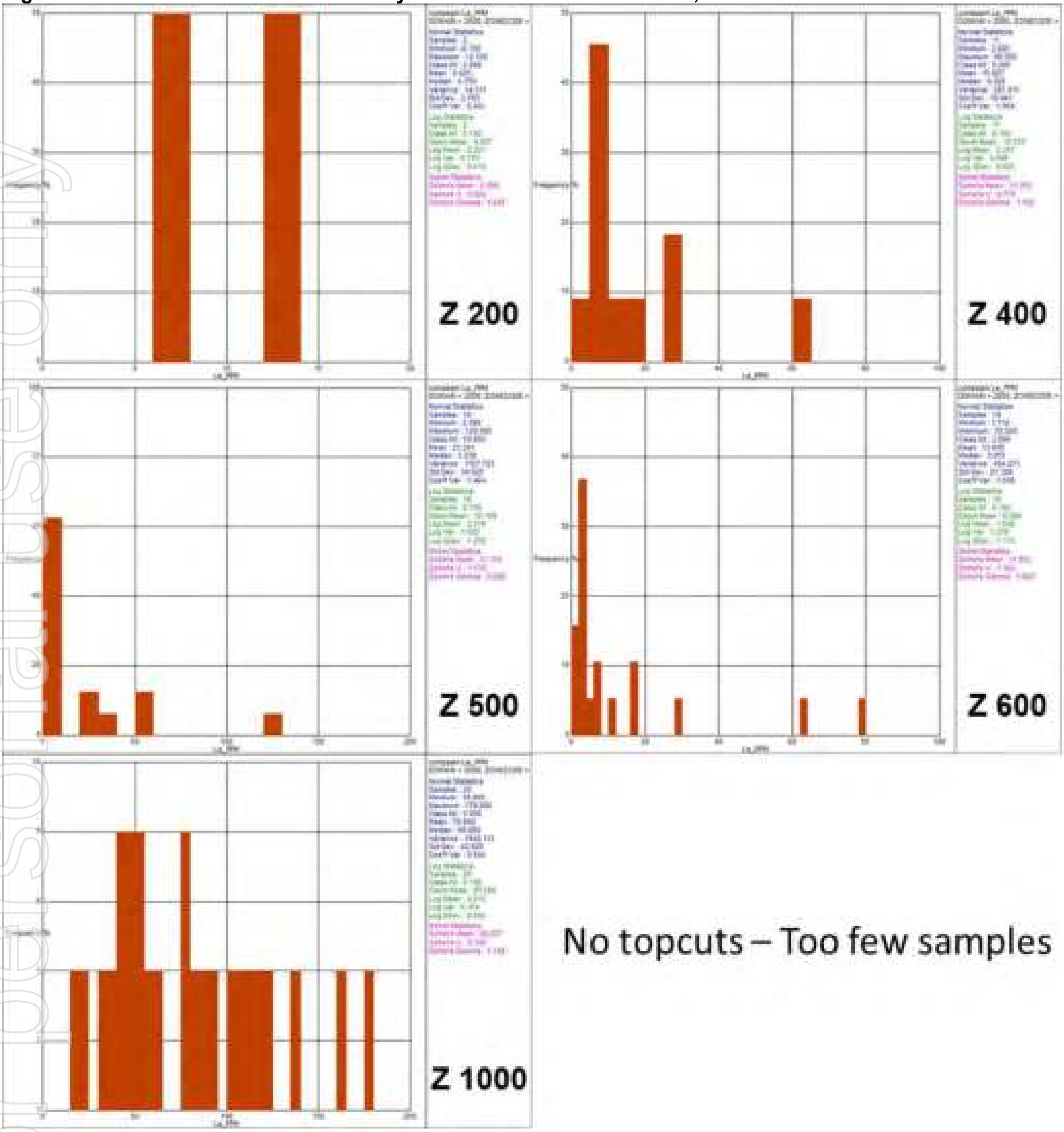


Figure D-22 Statistics Plots – Cowalinya South – Other ZONECODEs; Ce

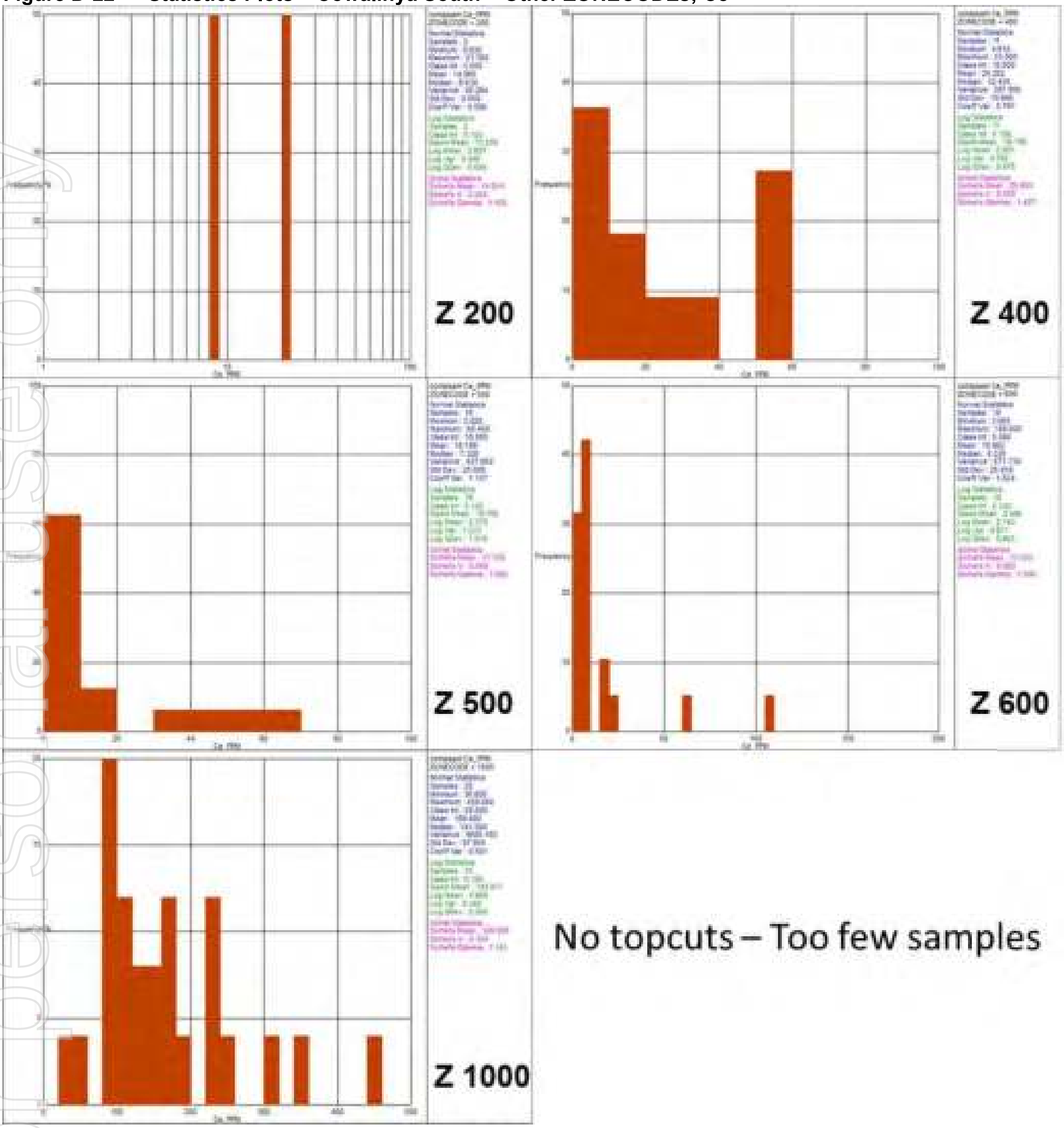


Figure D-23 Statistics Plots – Cowalinya South - Upper Saprolite; Pr

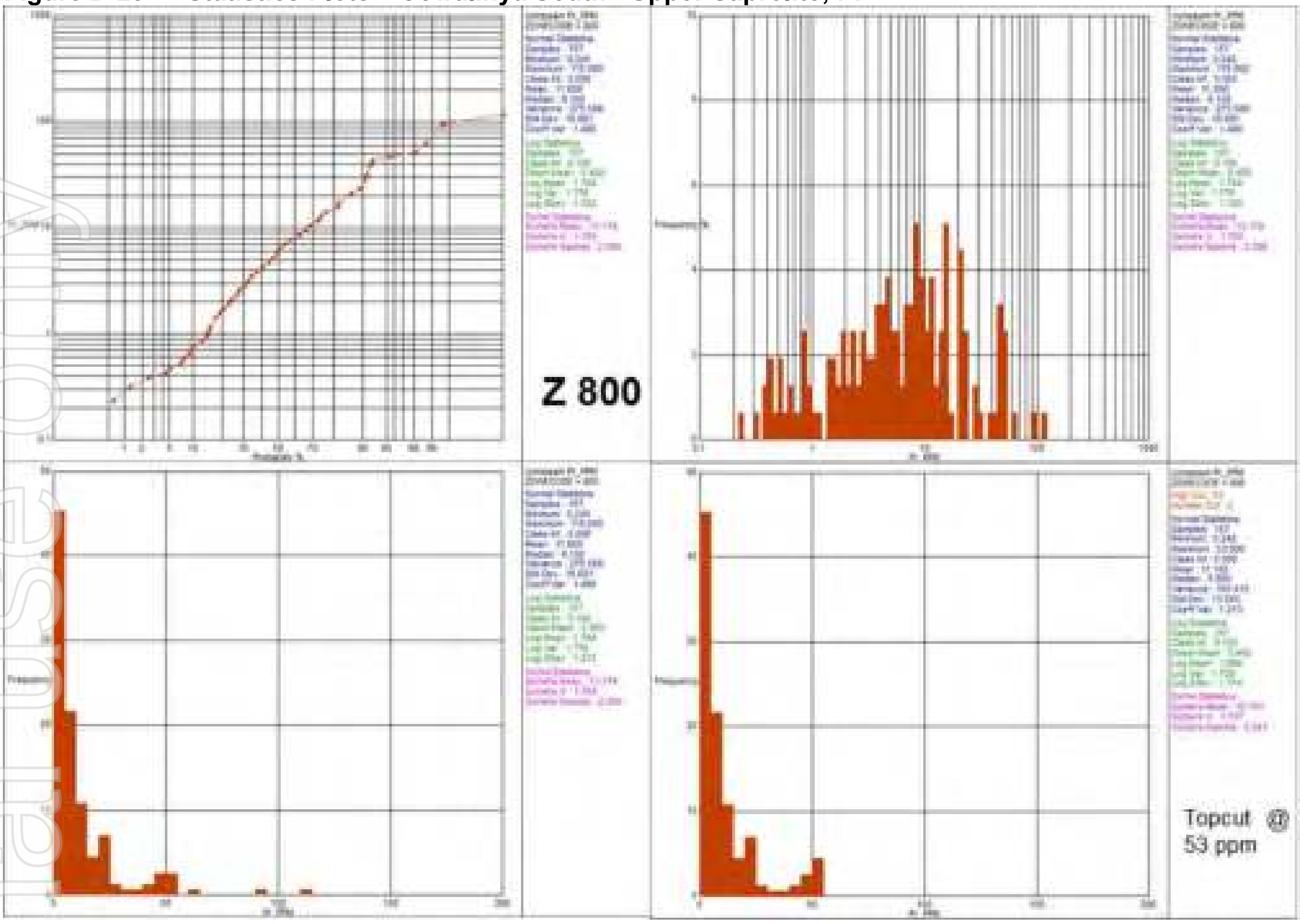


Figure D-24 Statistics Plots – Cowalinya South - Lower Saprolite; Pr

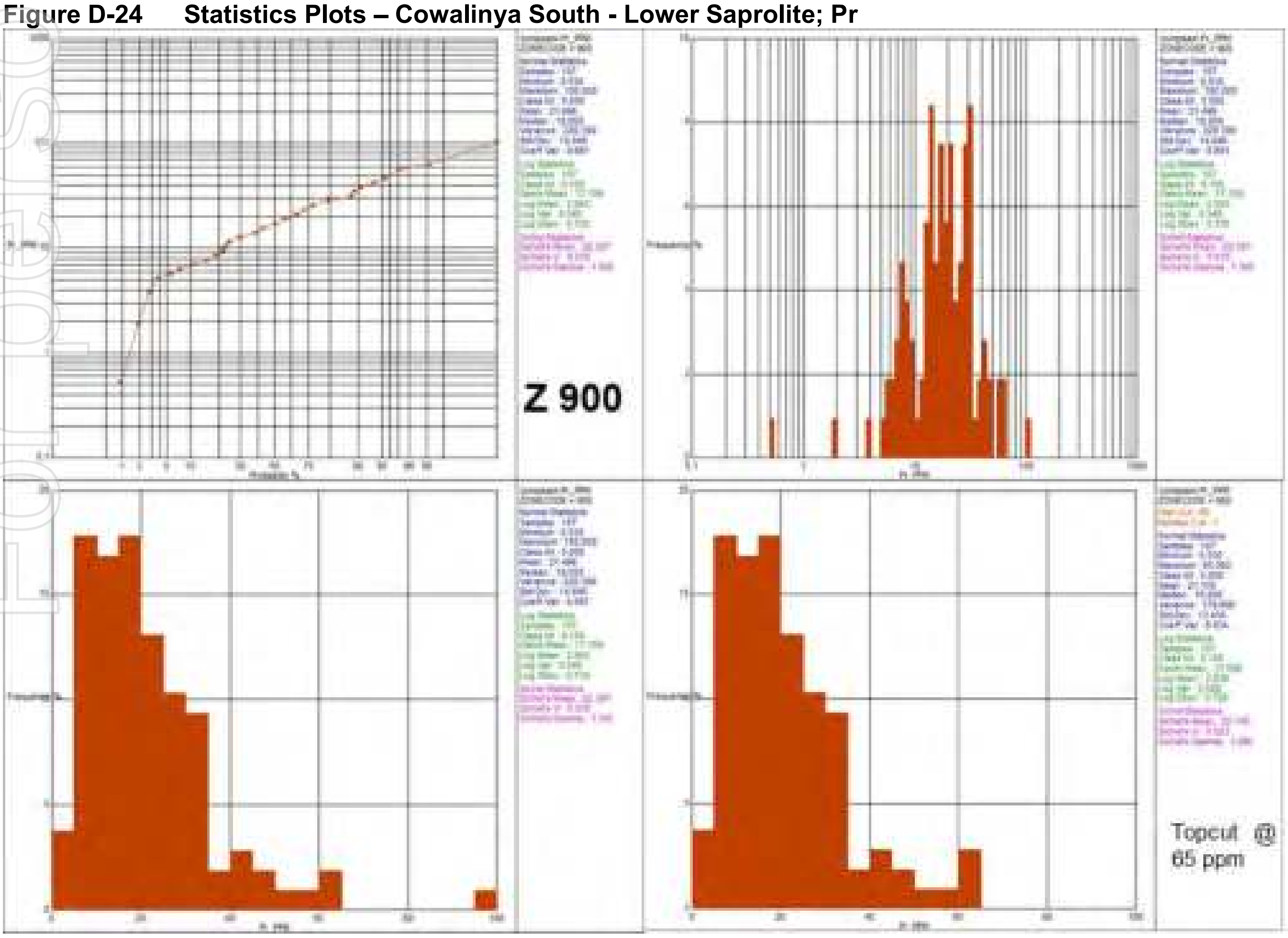


Figure D-25 Statistics Plots – Cowalinya South - Upper Saprolite; Nd

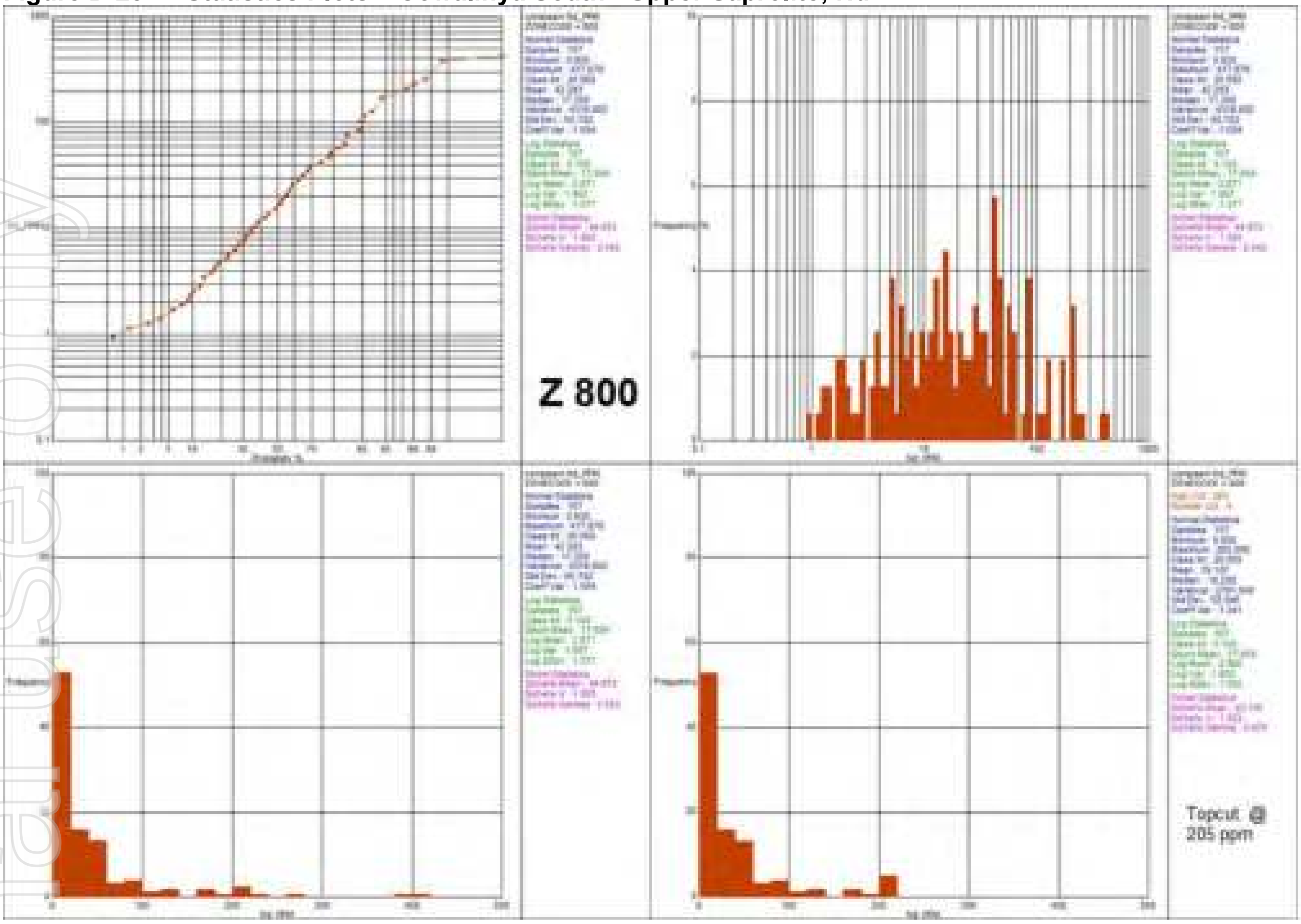


Figure D-26 Statistics Plots – Cowalinya South - Lower Saprolite; Nd

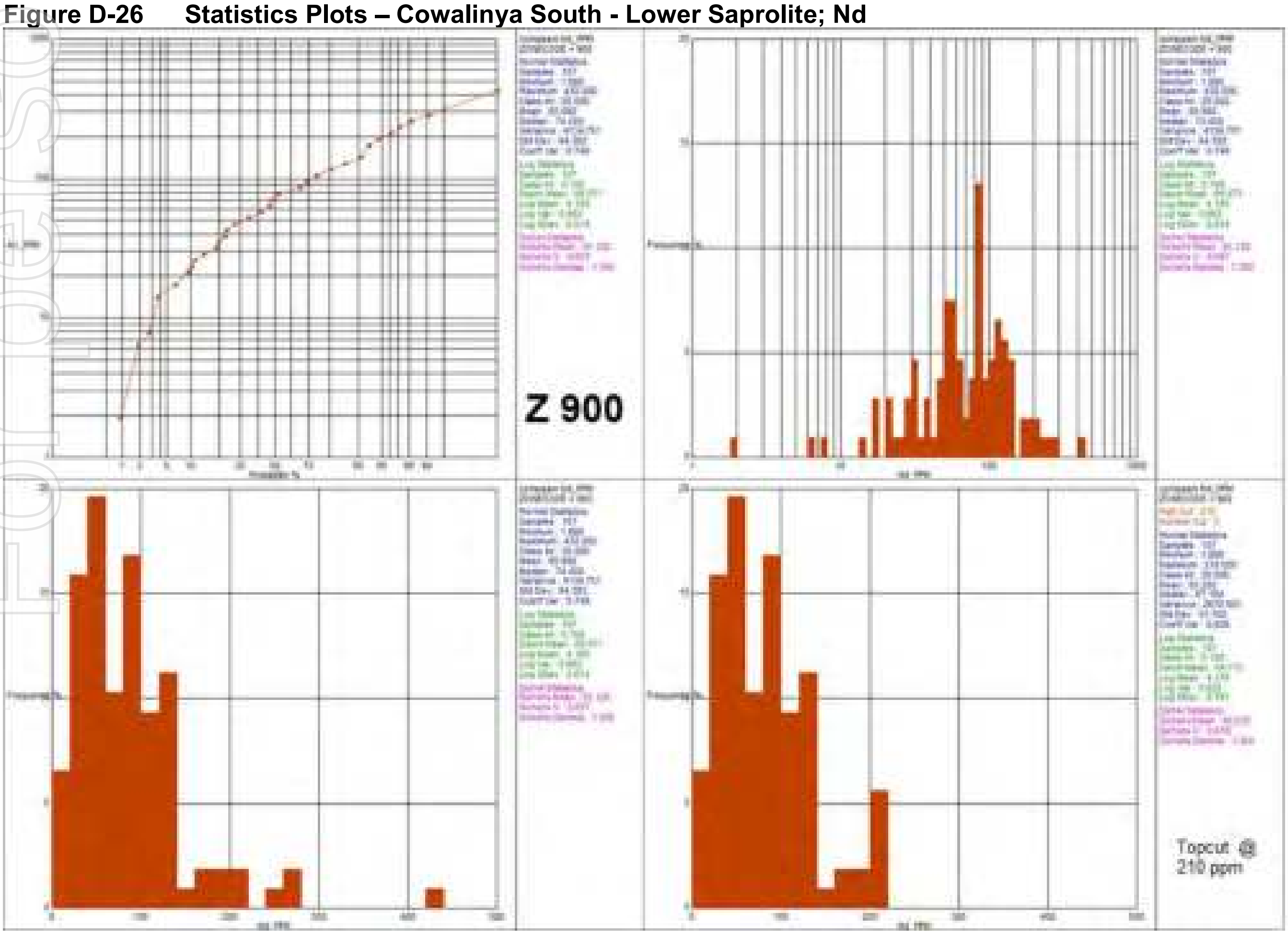


Figure D-27 Statistics Plots – Cowalinya South – Other ZONECODEs; Nd

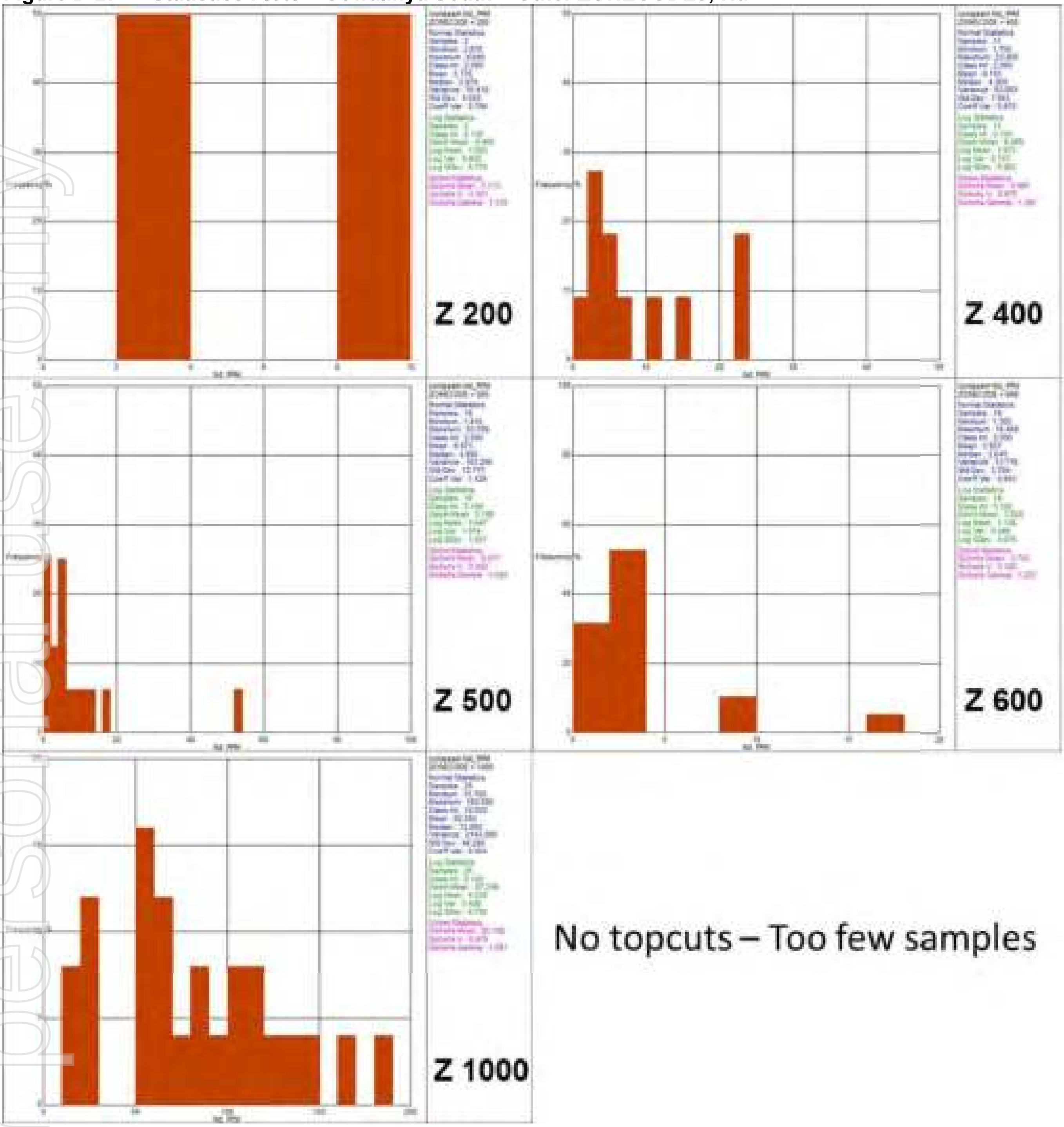


Figure D-28 Statistics Plots – Cowalinya South - Upper Saprolite; Tb

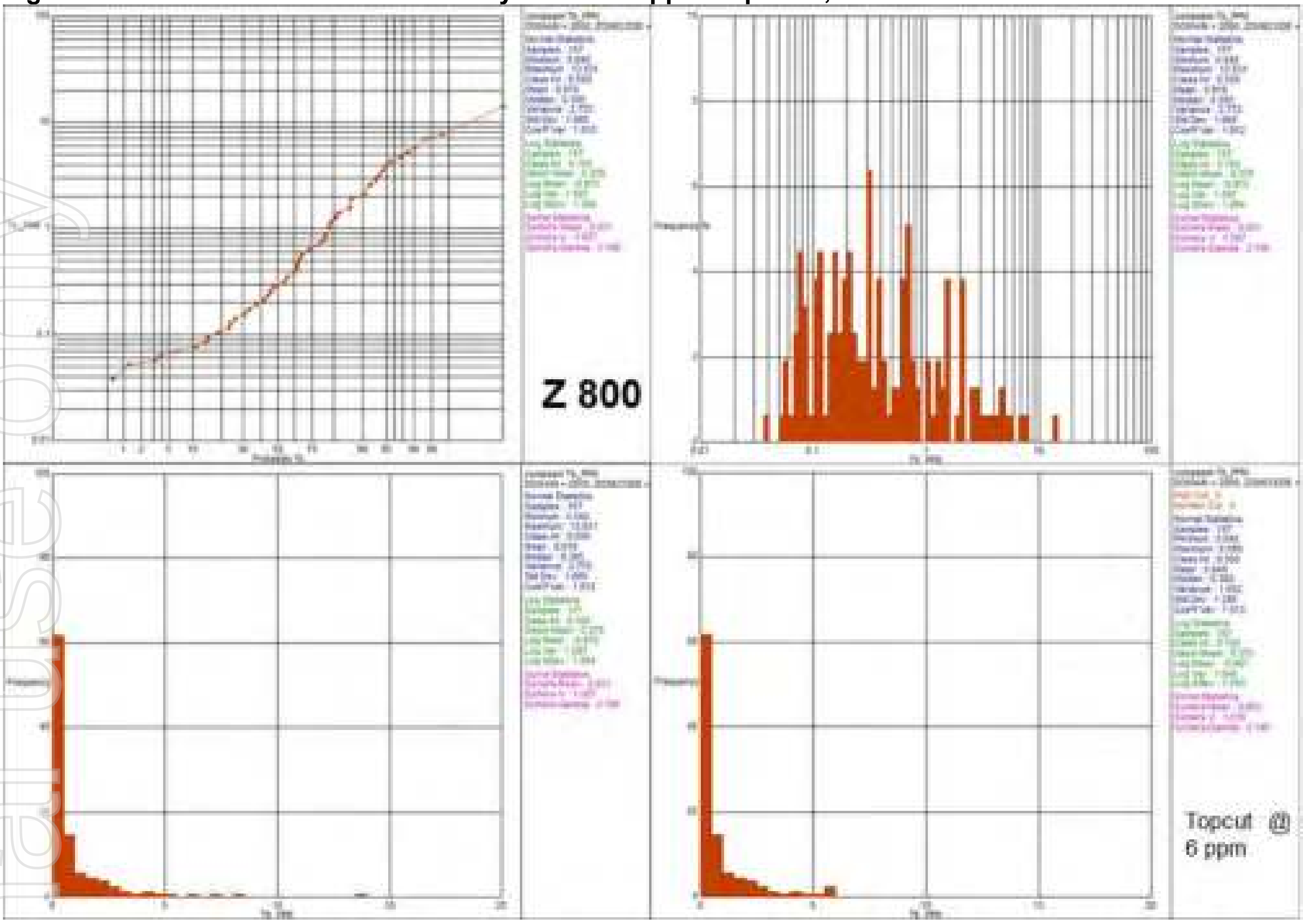


Figure D-29 Statistics Plots – Cowalinya South - Lower Saprolite; Tb

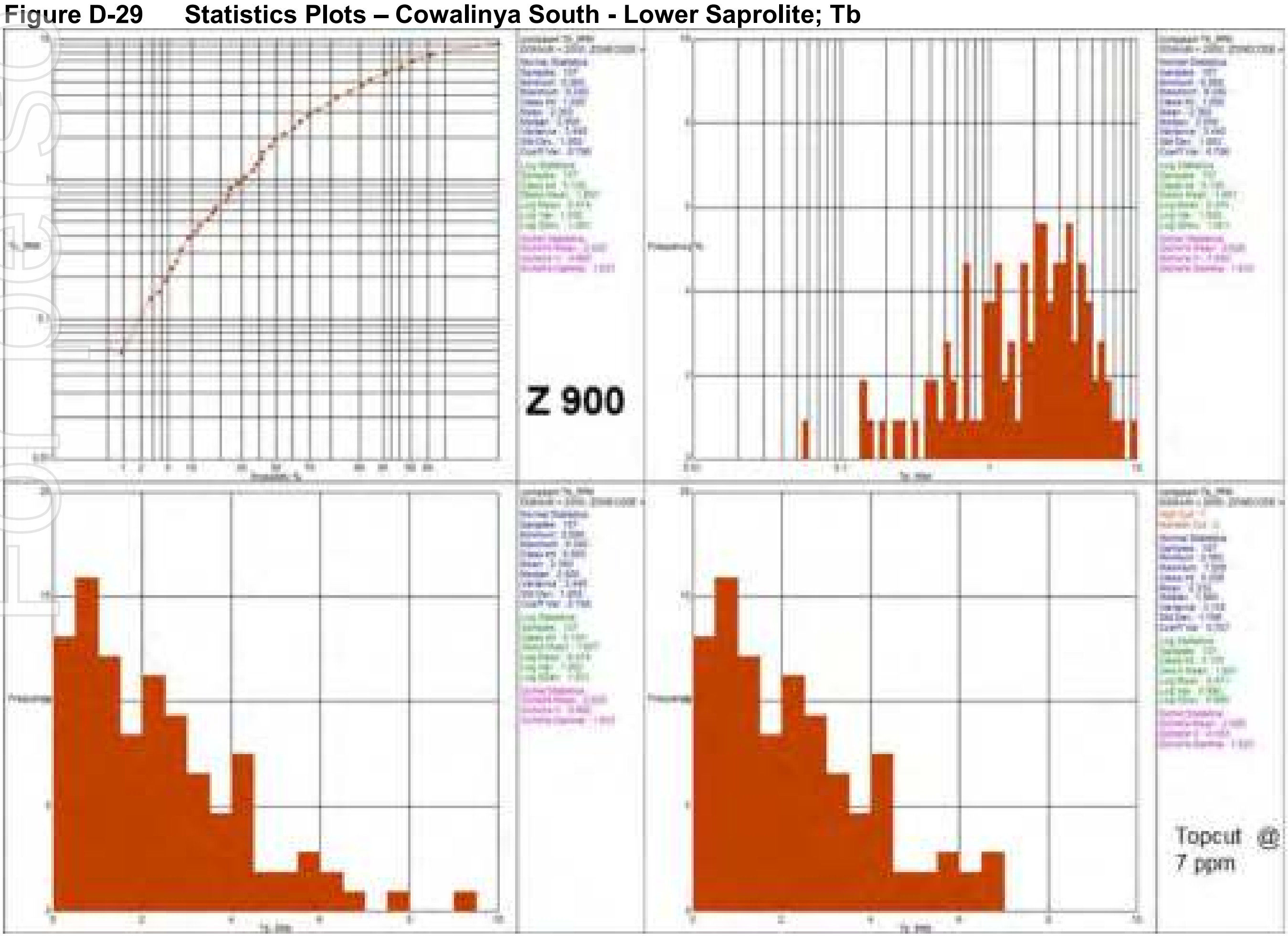


Figure D-30 Statistics Plots – Cowalinya South - Upper Saprolite; Dy

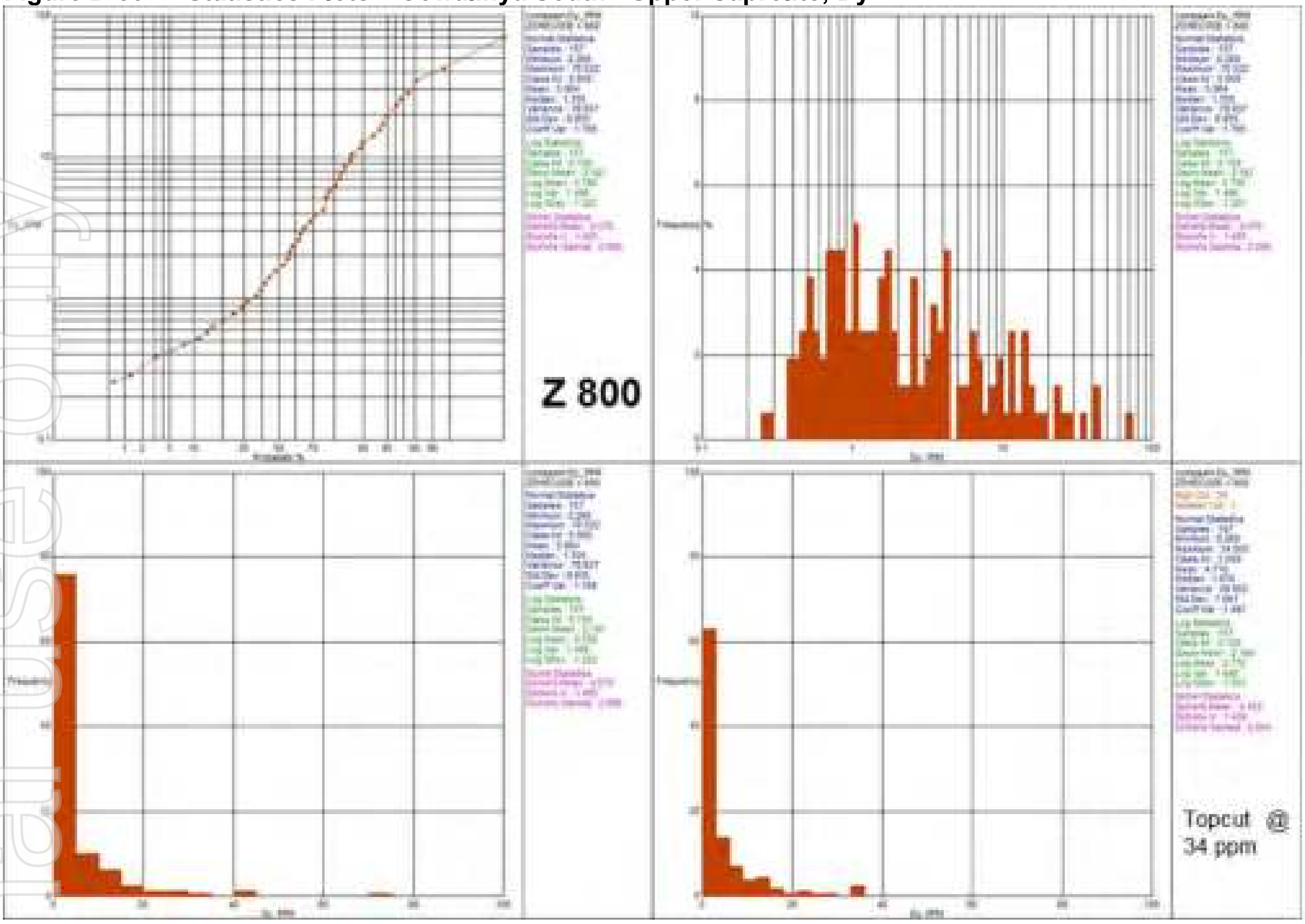


Figure D-31 Statistics Plots – Cowalinya South - Lower Saprolite; Dy

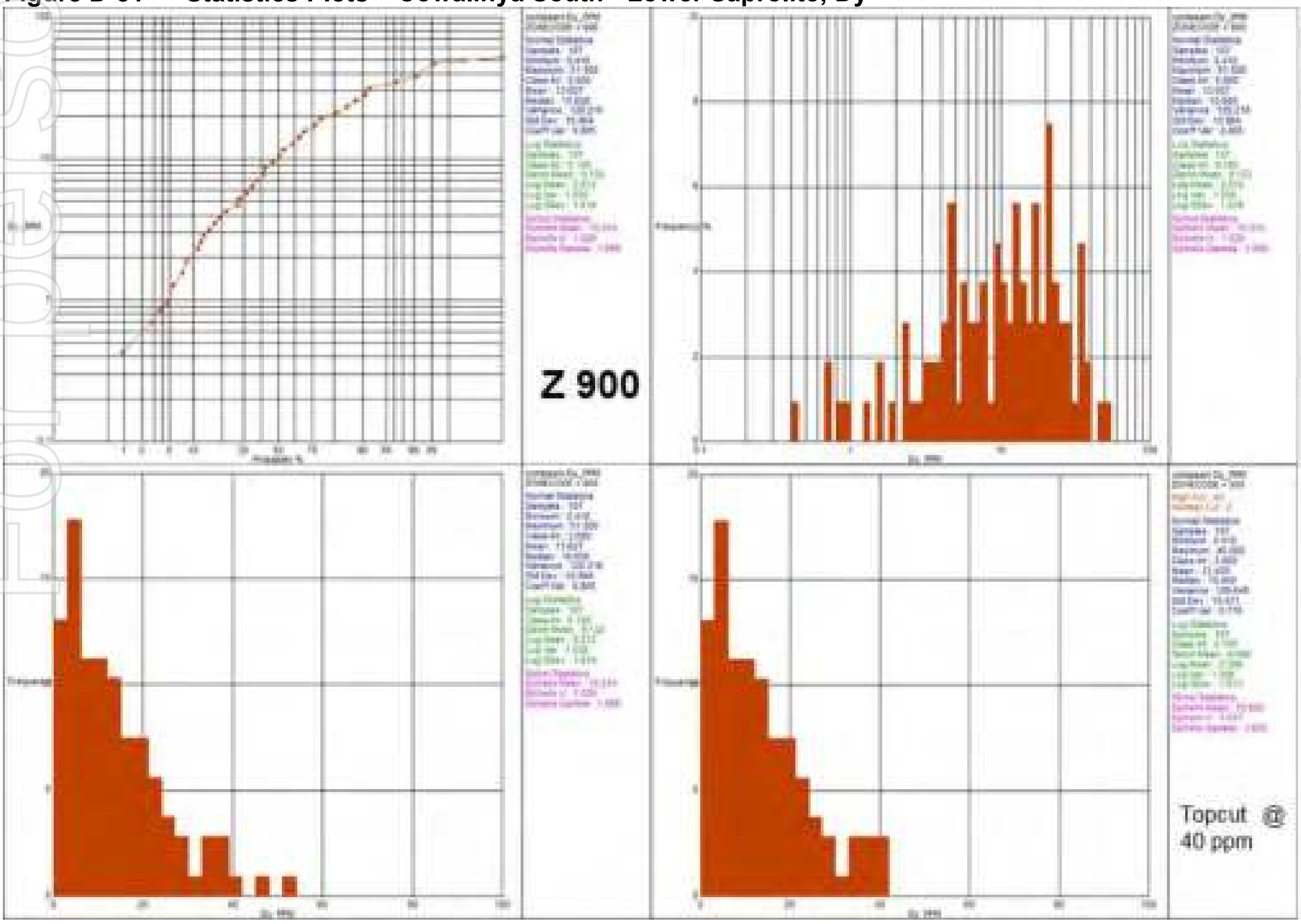


Figure D-32 Statistics Plots – Cowalinya South - Upper Saprolite; Sc

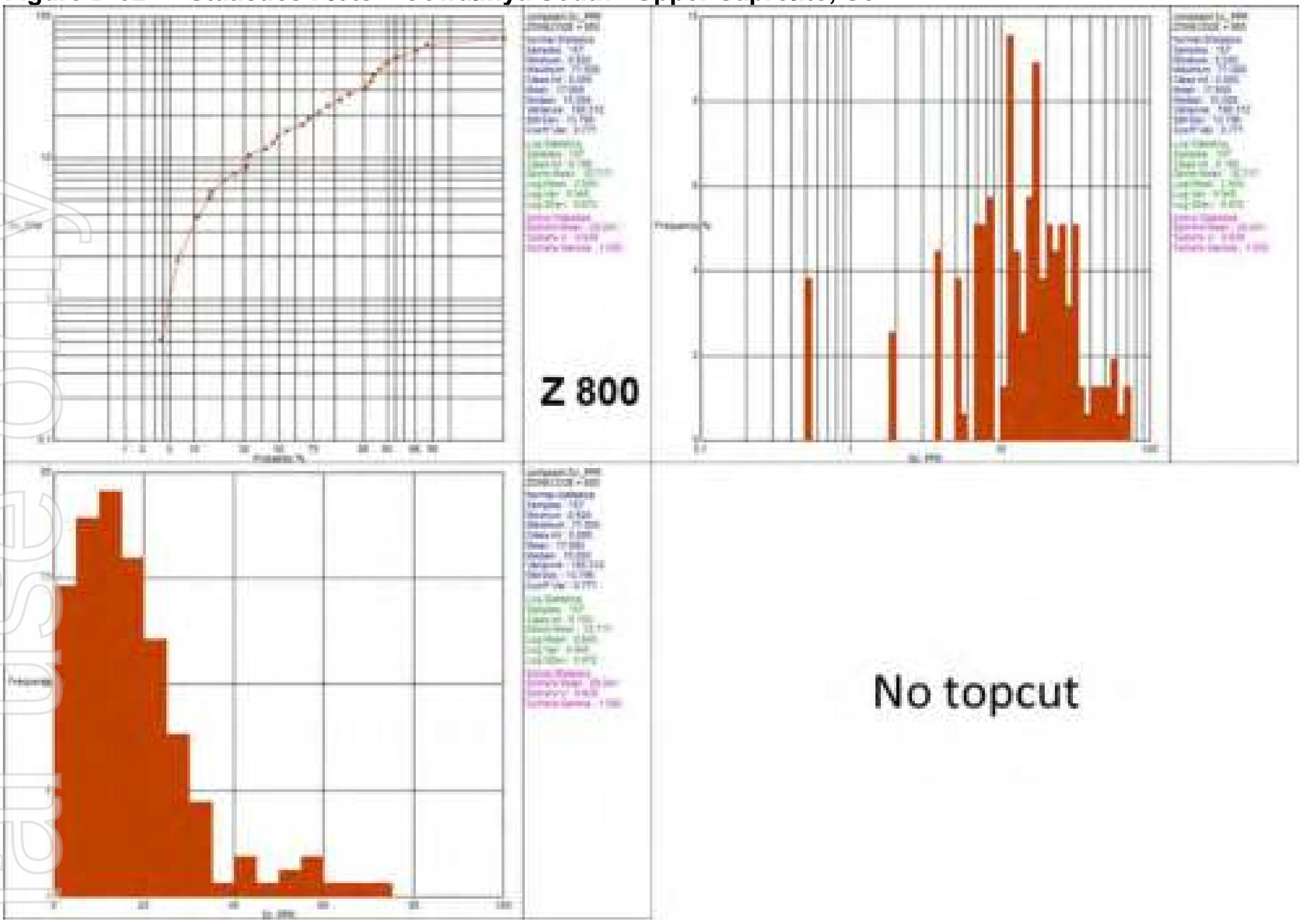


Figure D-33 Statistics Plots – Cowalinya South - Lower Saprolite; Sc

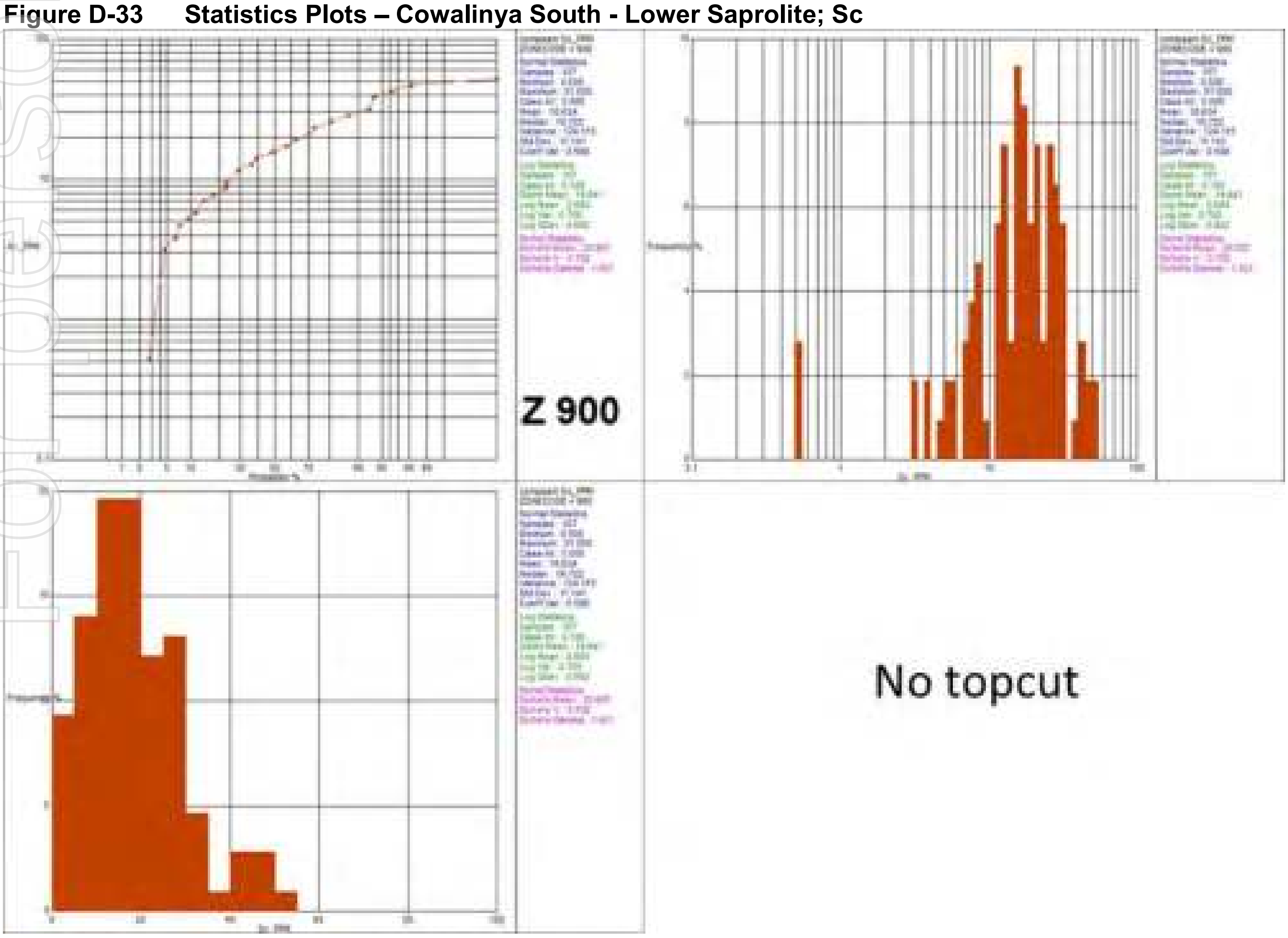


Figure D-34 Statistics Plots – Cowalinya South – Other ZONECODEs; Sc

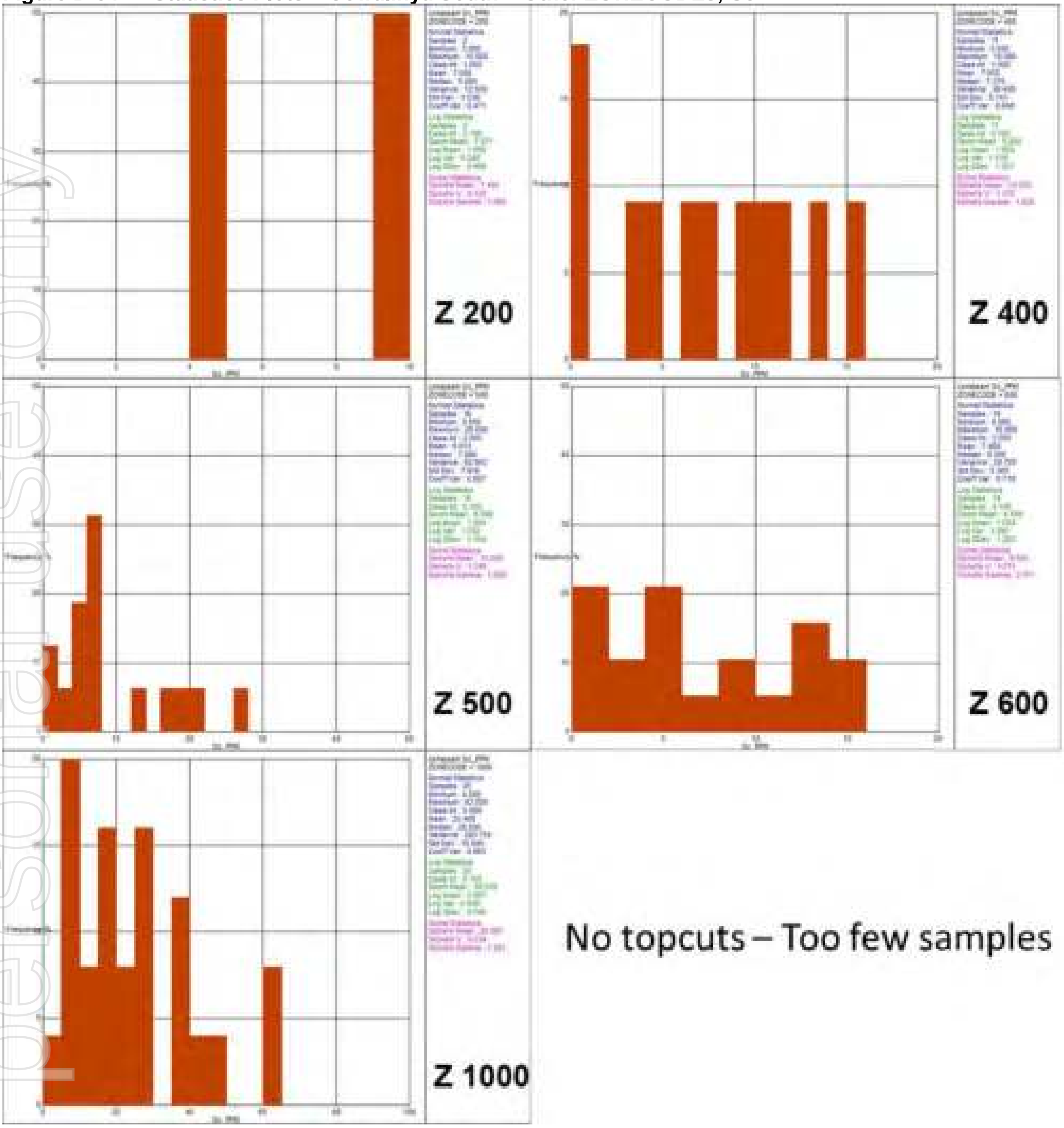


Figure D-35 Statistics Plots – Cowalinya South - Upper Saprolite; Th

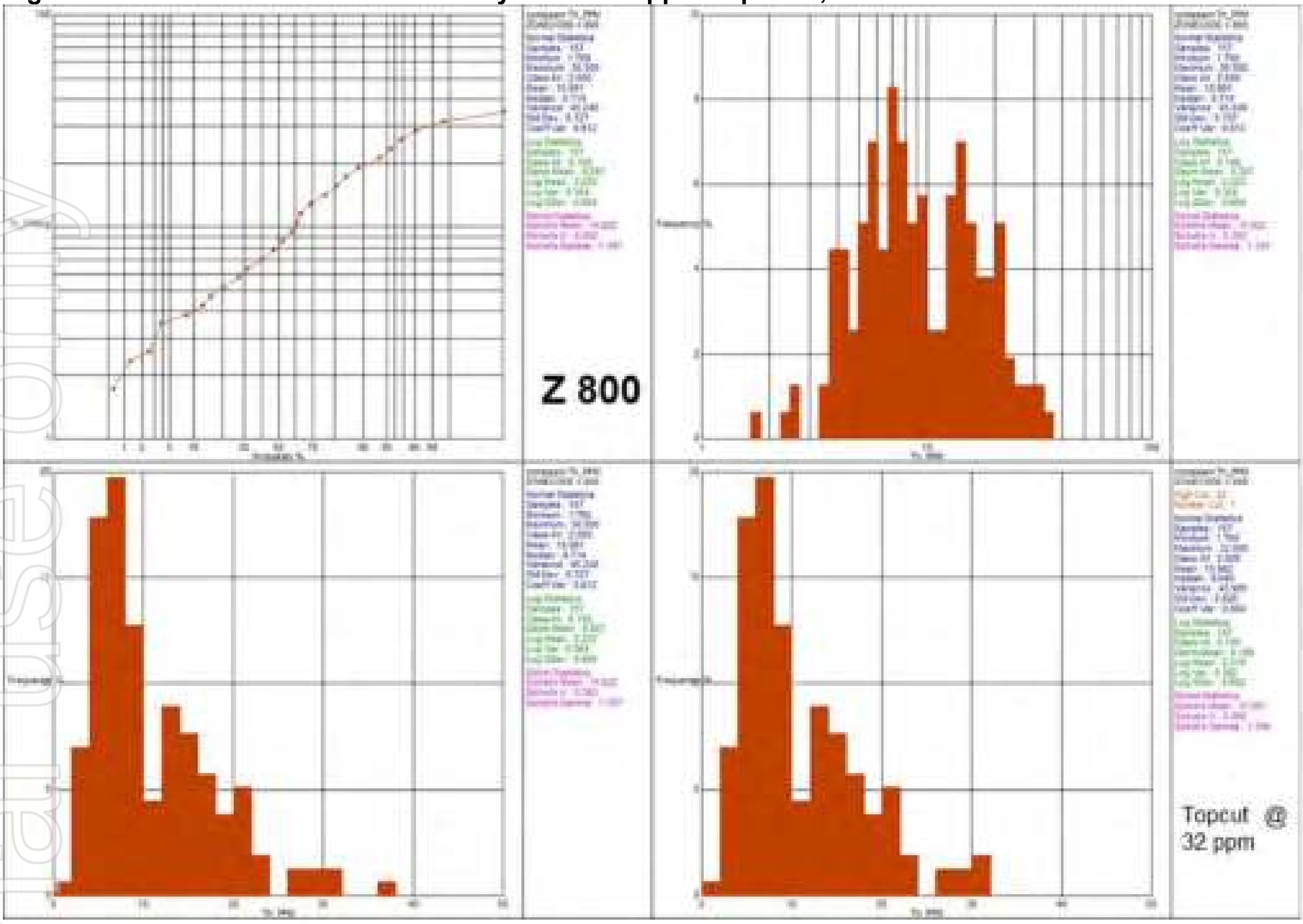


Figure D-36 Statistics Plots – Cowalinya South - Lower Saprolite; Th

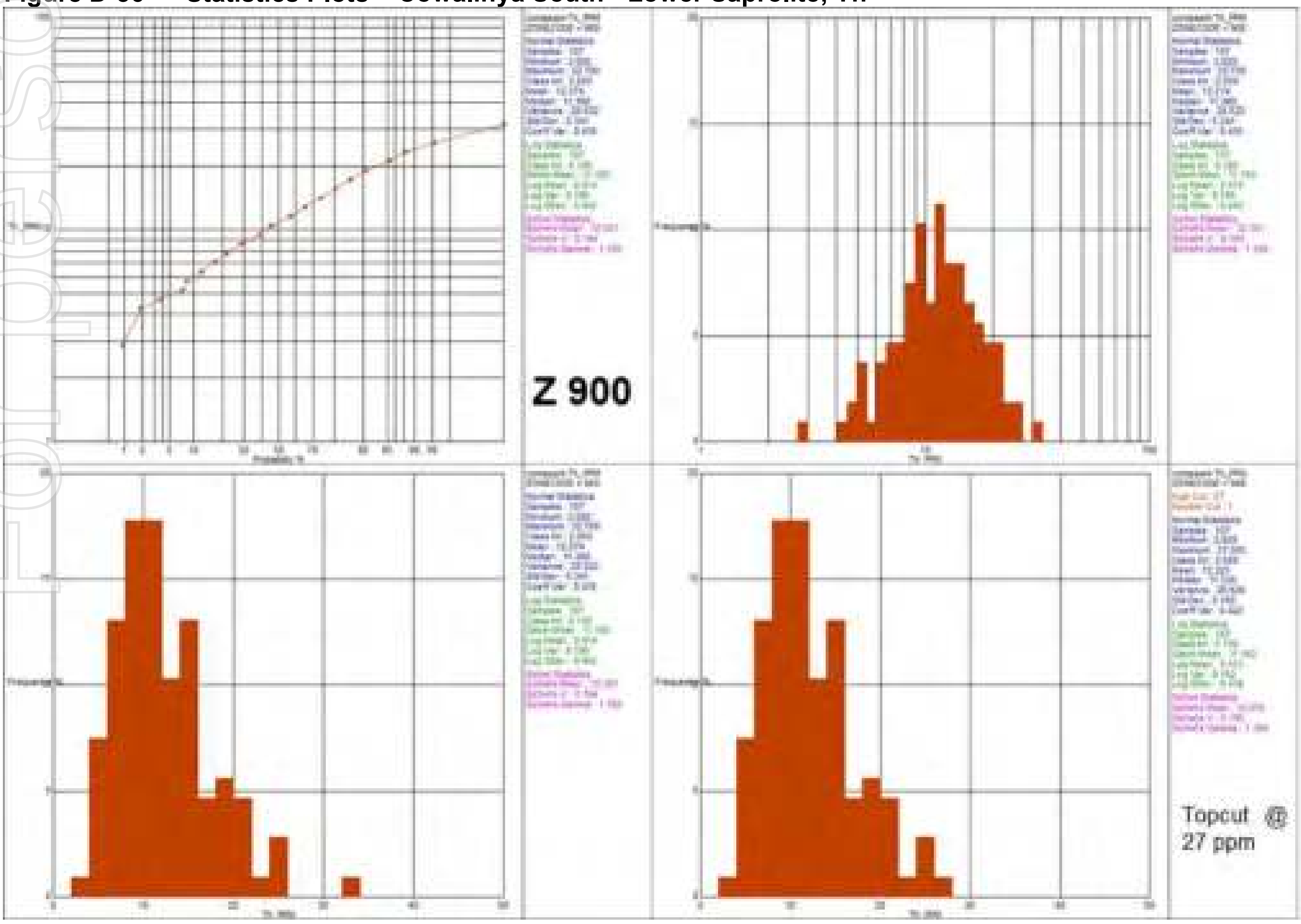


Figure D-37 Statistics Plots – Cowalinya South - Upper Saprolite; U

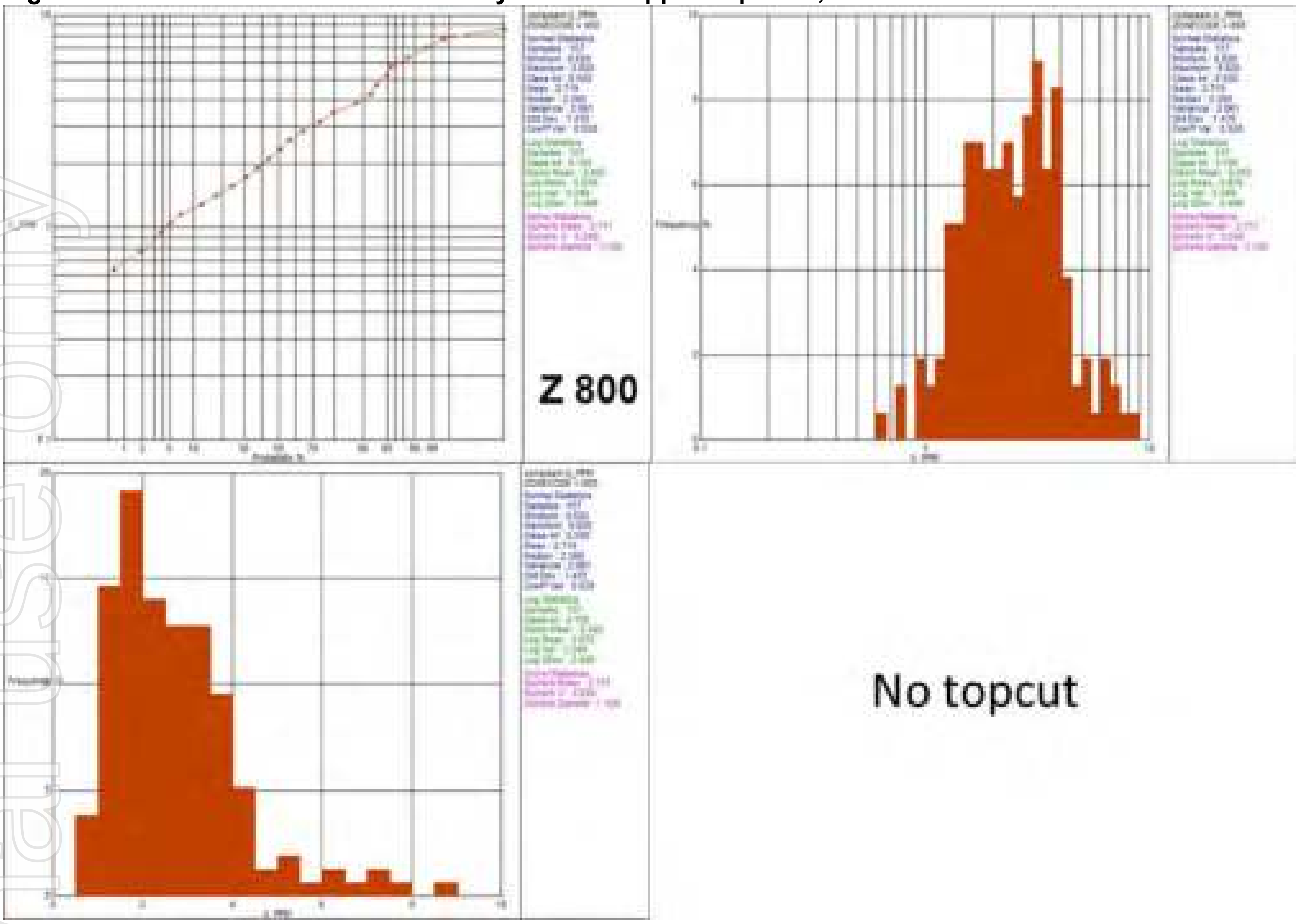
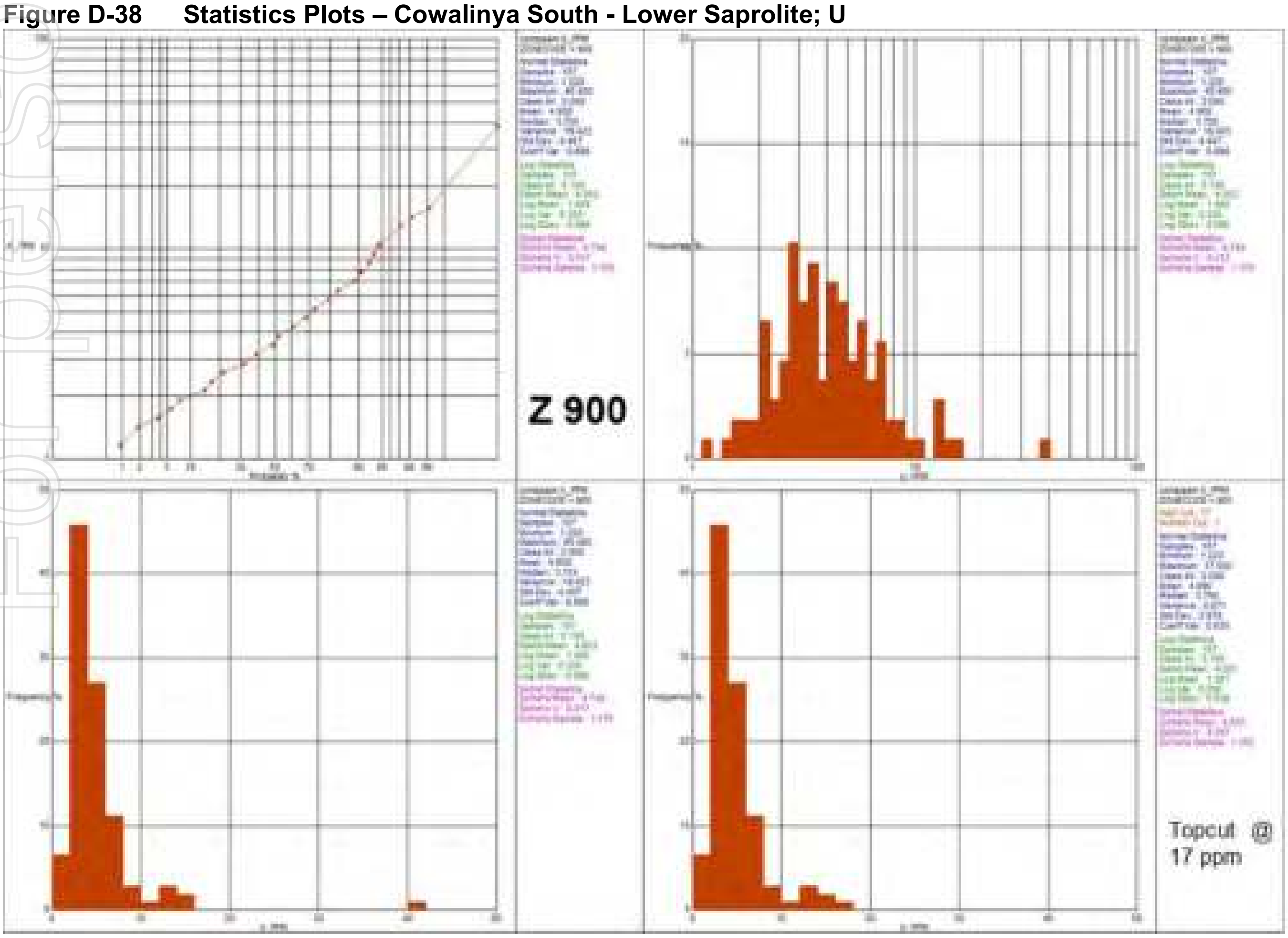


Figure D-38 Statistics Plots – Cowalinya South - Lower Saprolite; U



Appendix E

Additional QAQC analysis plots

Figure E-1 HRE inserted standard OREAS 20a – La, Ce, Nd, Dy, Sc, Th & U

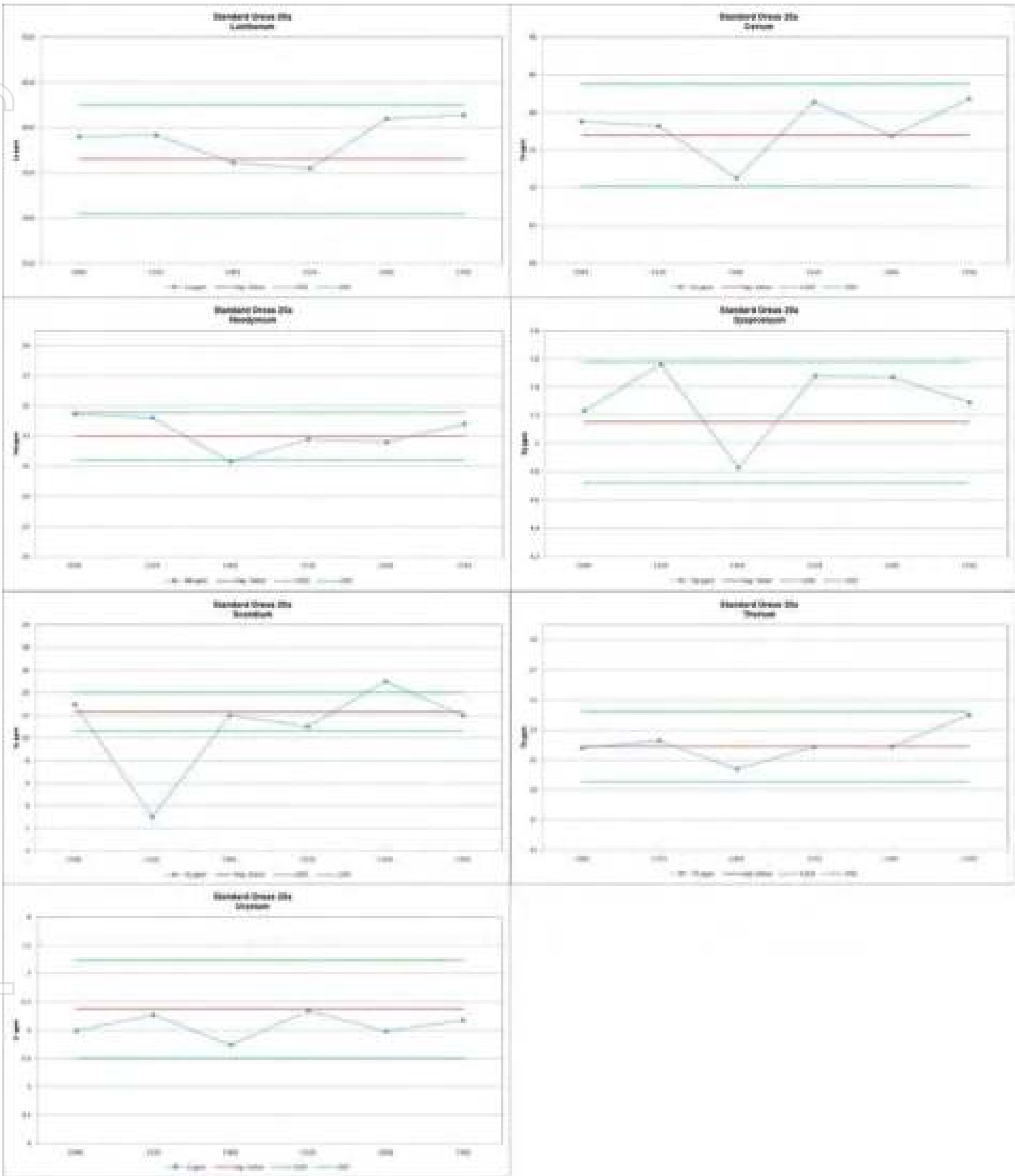


Figure E-2 HRE inserted standard OREAS 461 – La, Ce, Nd, Dy, Sc, Th & U

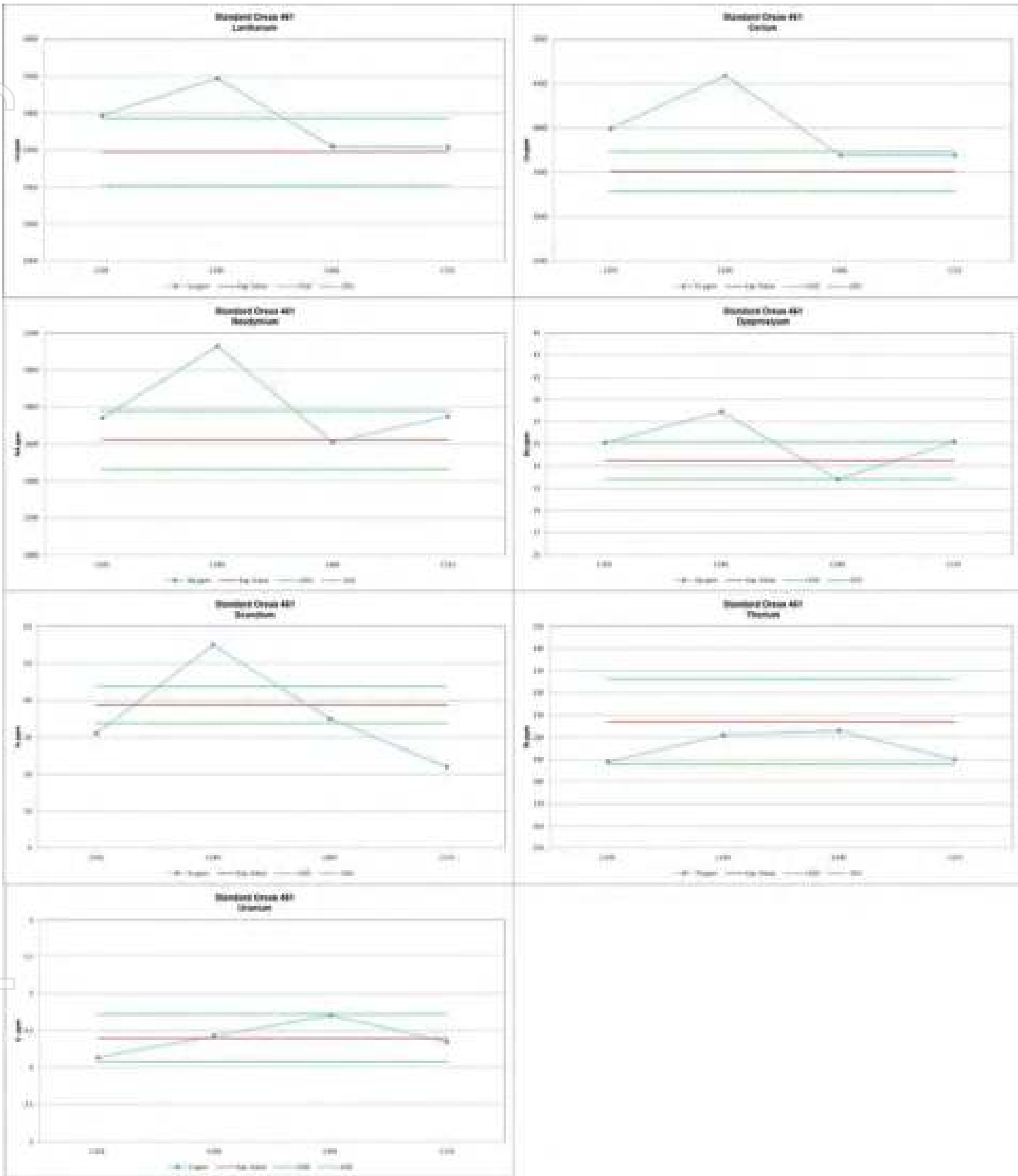
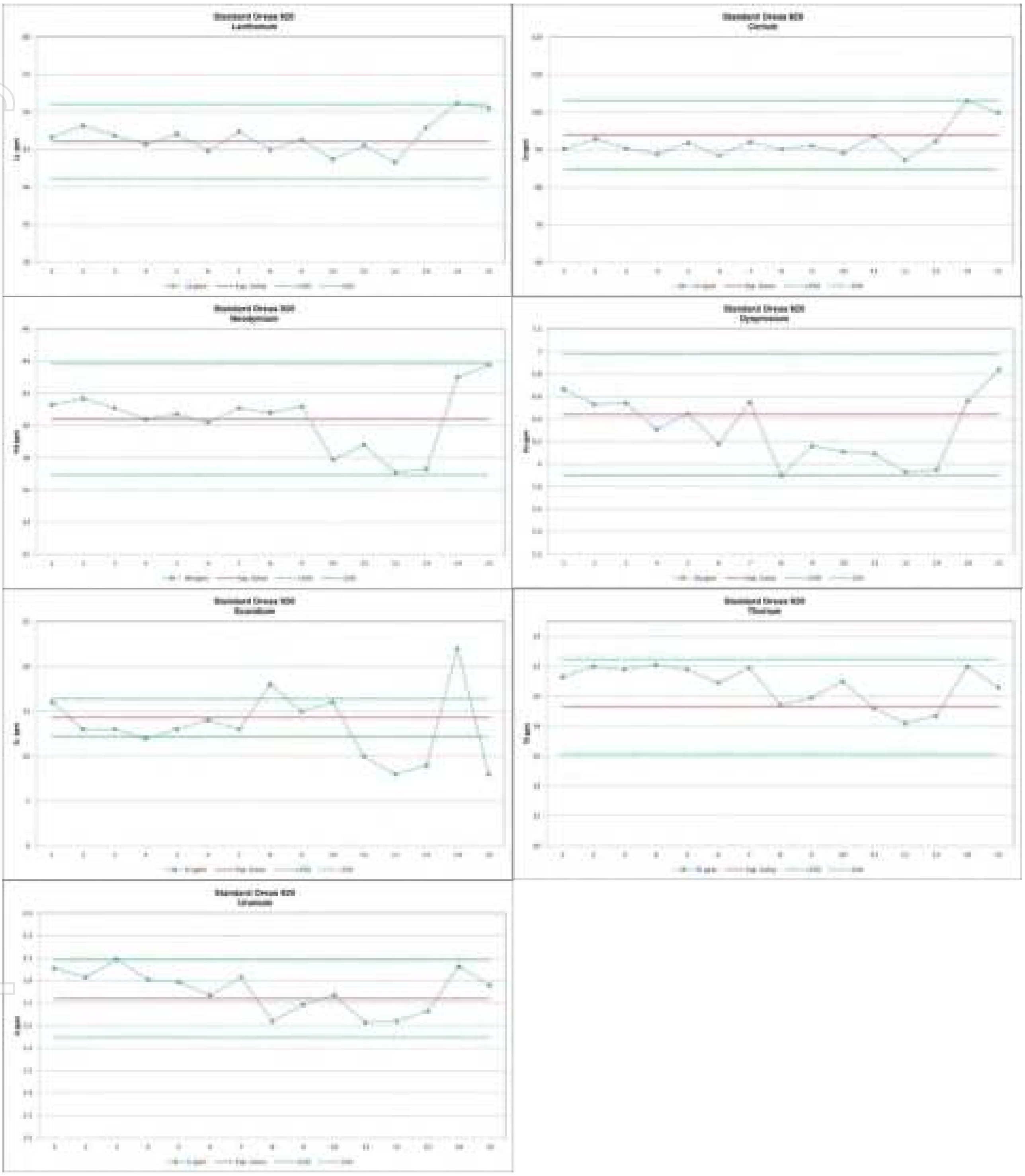


Figure E-3 LabWest inserted standard OREAS 47 – La, Ce, Nd, Dy, Sc, Th & U

Figure E-4 LabWest inserted standard OREAS 120 – La, Ce, Nd, Dy, Sc, Th & U

Figure E-5 LabWest inserted standard OREAS 920 – La, Ce, Nd, Dy, Sc, Th & U



Appendix F

Variography

Figure F-1 Downhole and directional variograms – Grouped HREEs; Upper Saprolite North

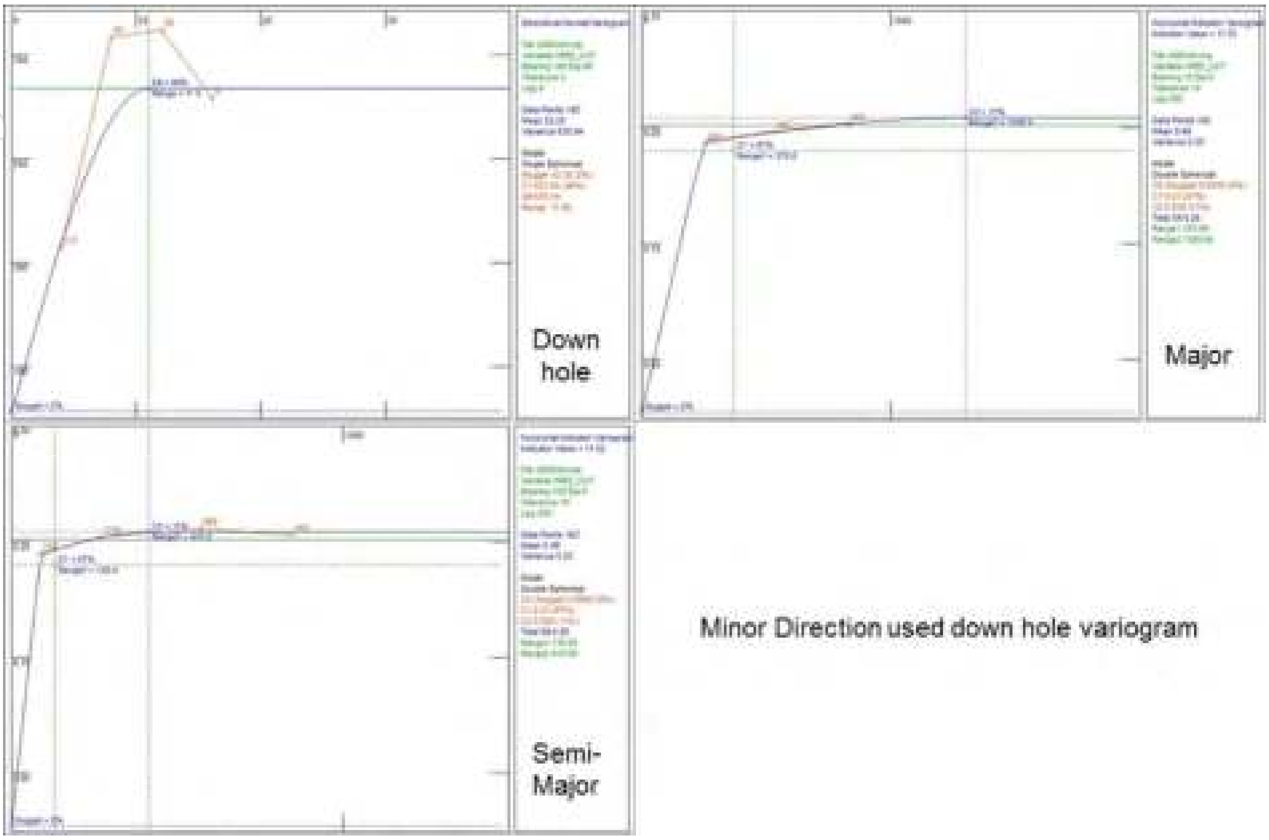


Figure F-2 Downhole and directional variograms – Scandium; Upper Saprolite North

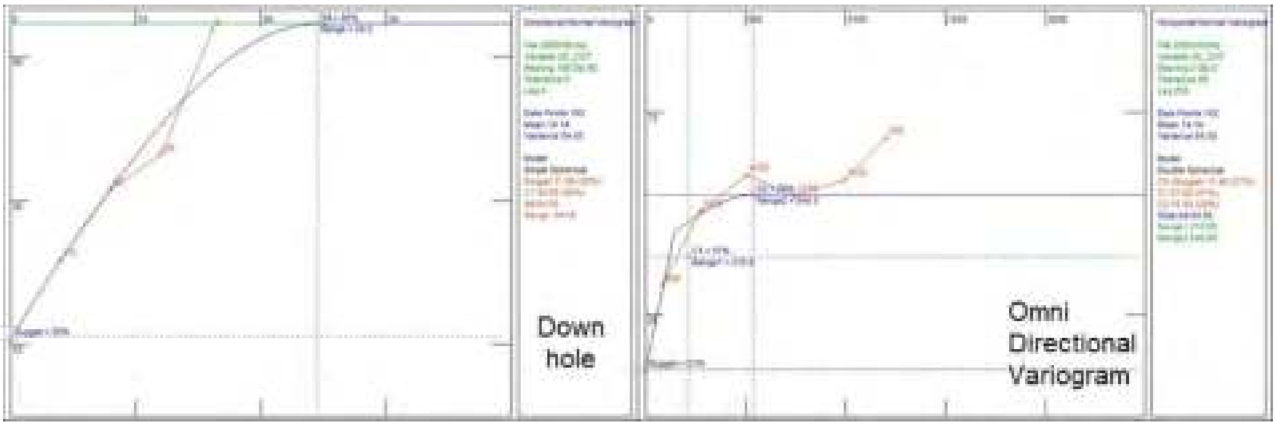


Figure F-3 Downhole and directional variograms – Thorium; Upper Saprolite North

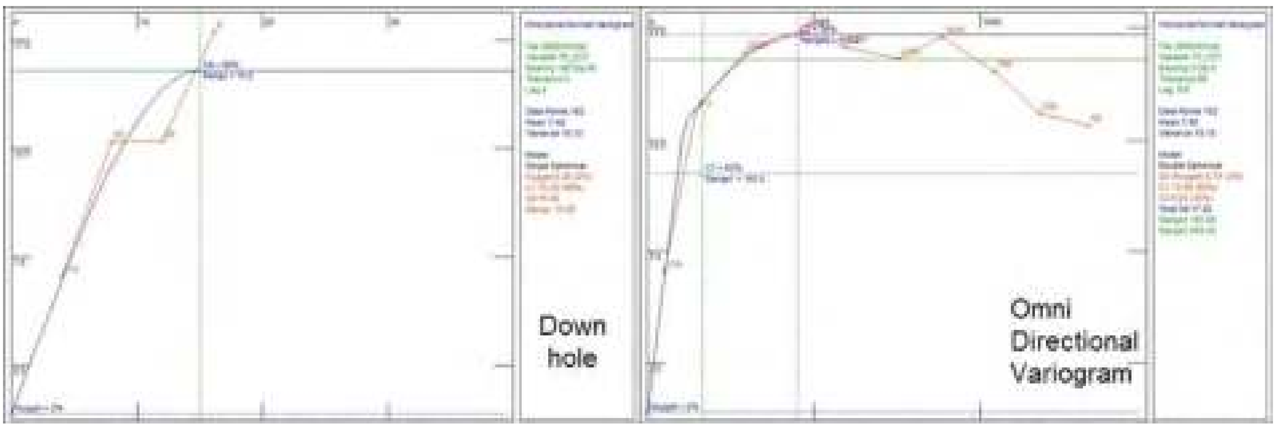


Figure F-4 Downhole and directional variograms – Uranium; Upper Saprolite North

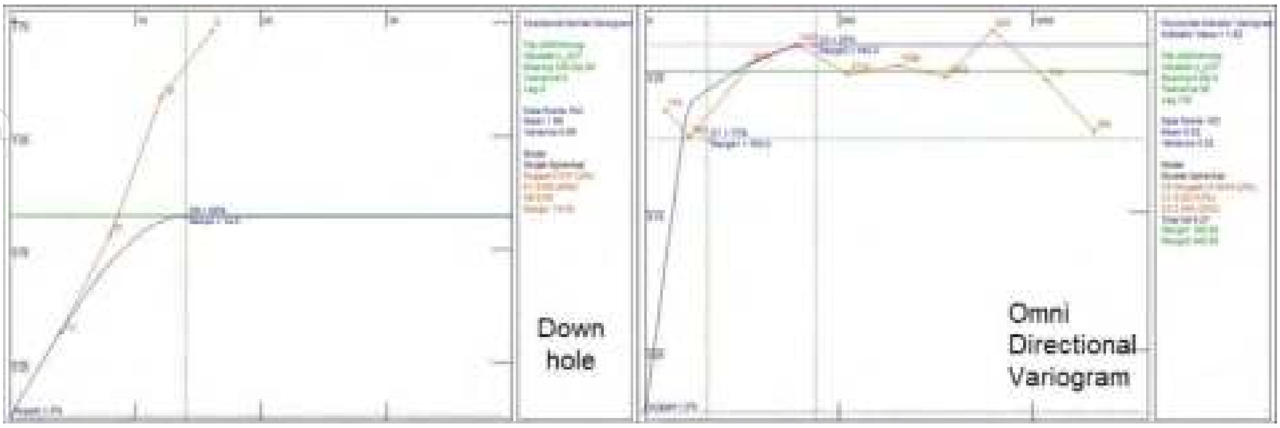


Figure F-5 Downhole and directional variograms – Grouped HREEs; Lower Saprolite North

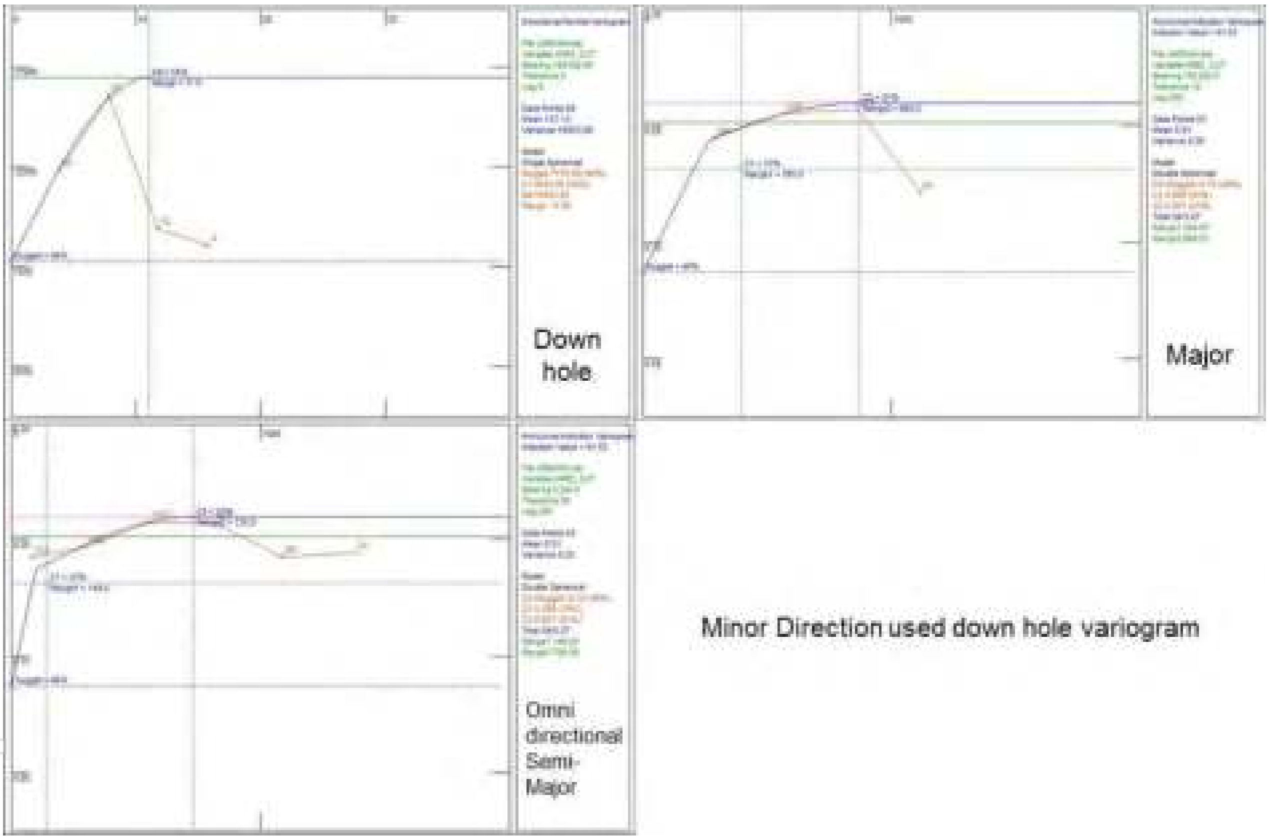


Figure F-6 Downhole and directional variograms – Scandium; Upper Saprolite North

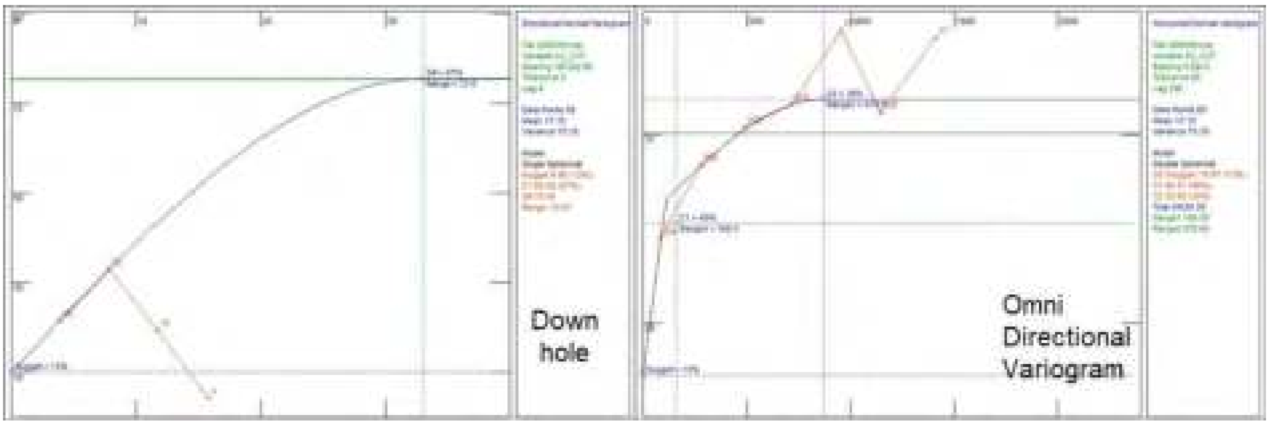


Figure F-7 Downhole and directional variograms – Thorium; Upper Saprolite North

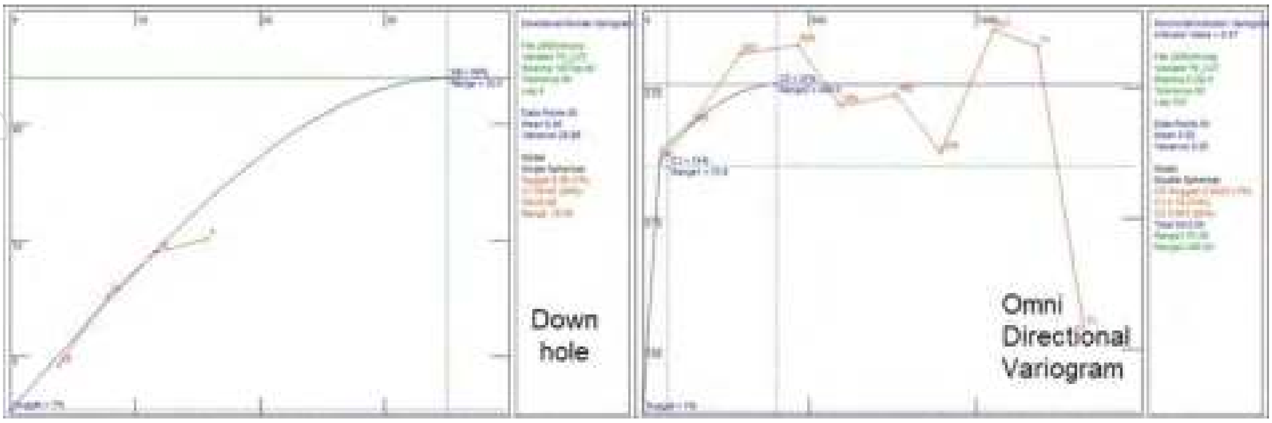


Figure F-8 Downhole and directional variograms – Uranium; Upper Saprolite North

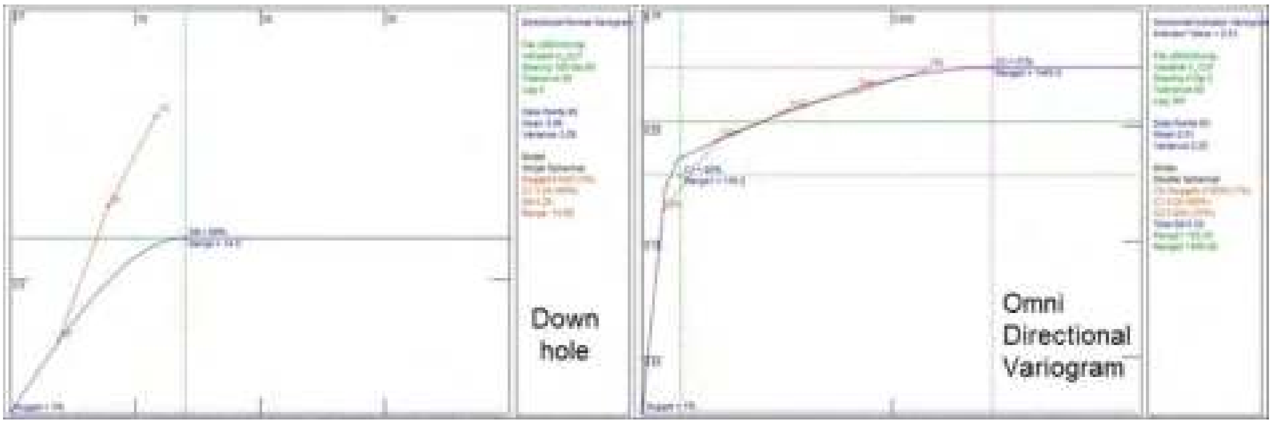


Figure F-9 Downhole and directional variograms – Grouped HREEs; Upper Saprolite South

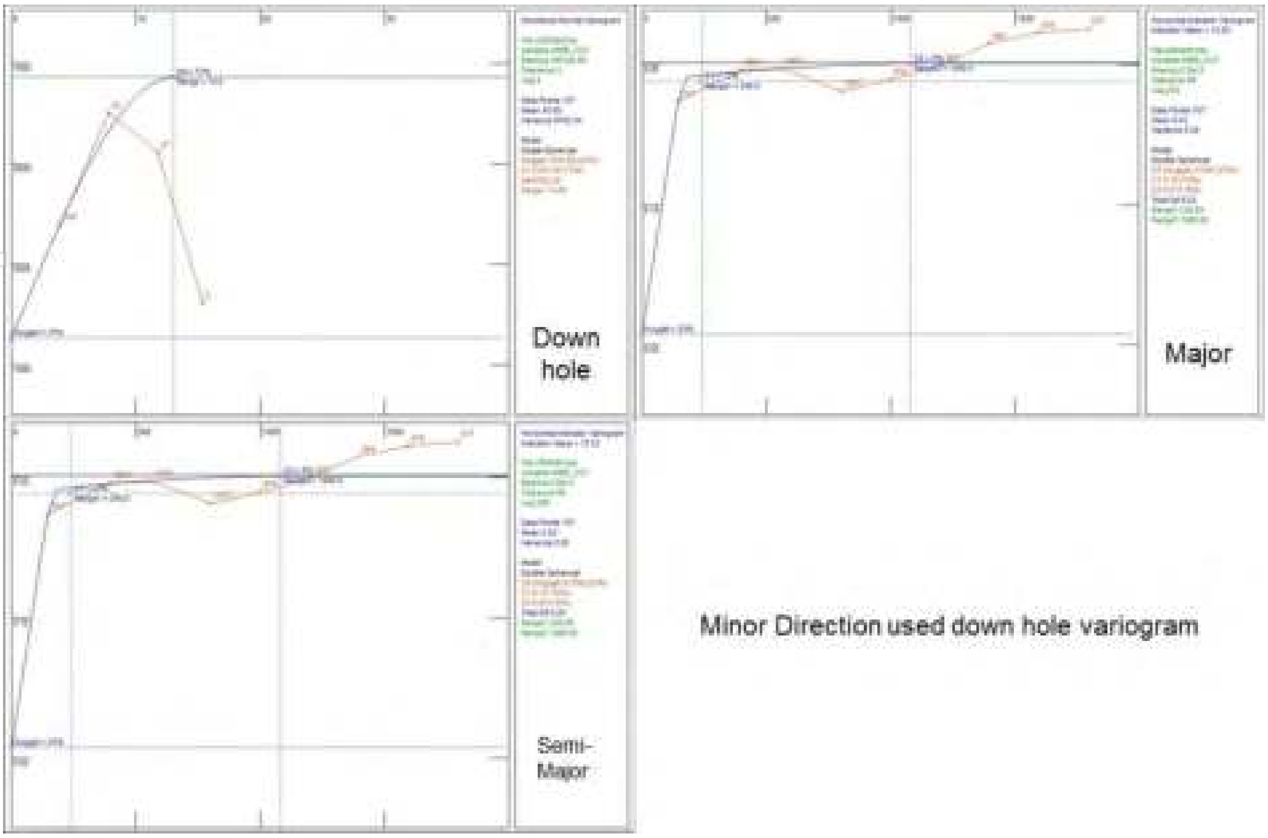


Figure F-10 Downhole and directional variograms – Scandium; Upper Saprolite South

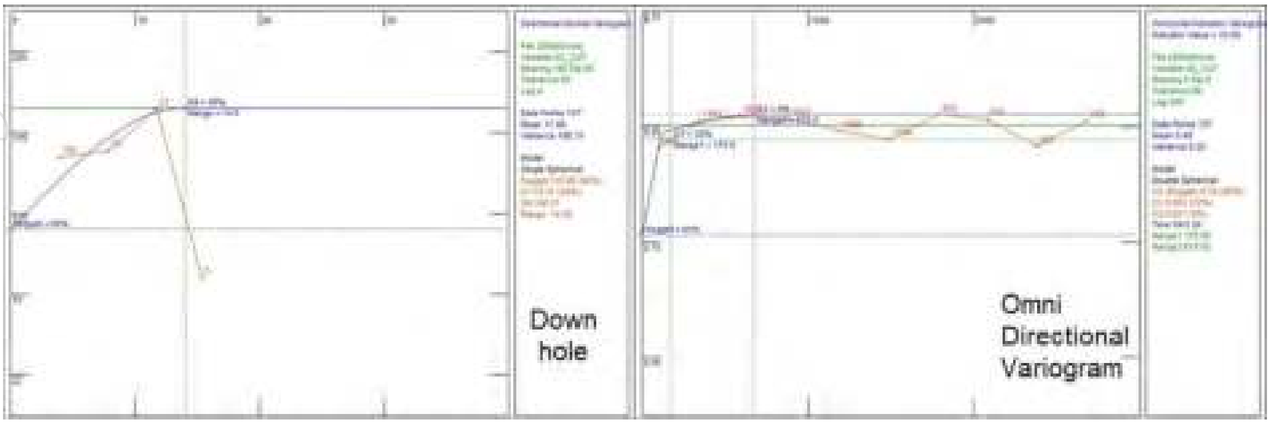


Figure F-11 Downhole and directional variograms – Thorium; Upper Saprolite South

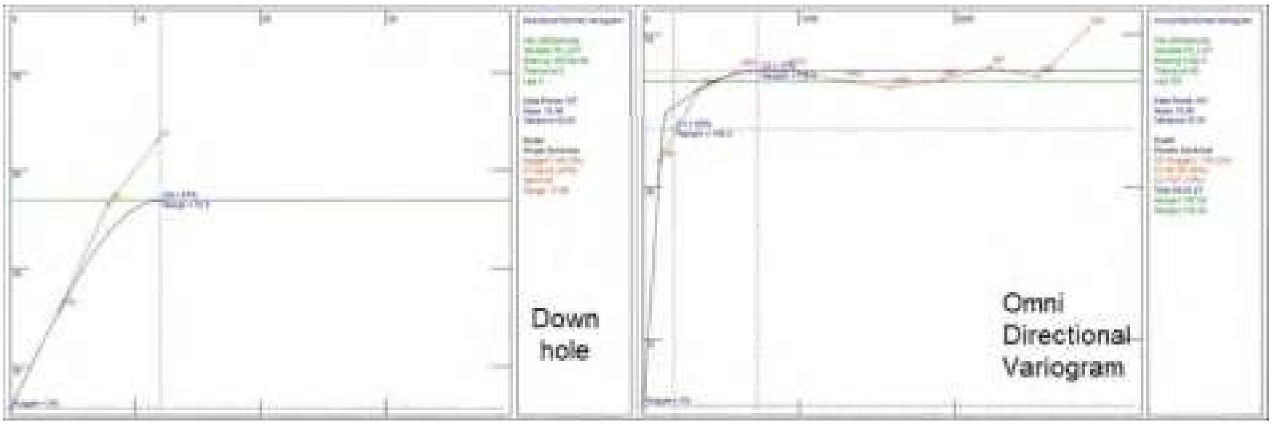


Figure F-12 Downhole and directional variograms – Uranium; Upper Saprolite South

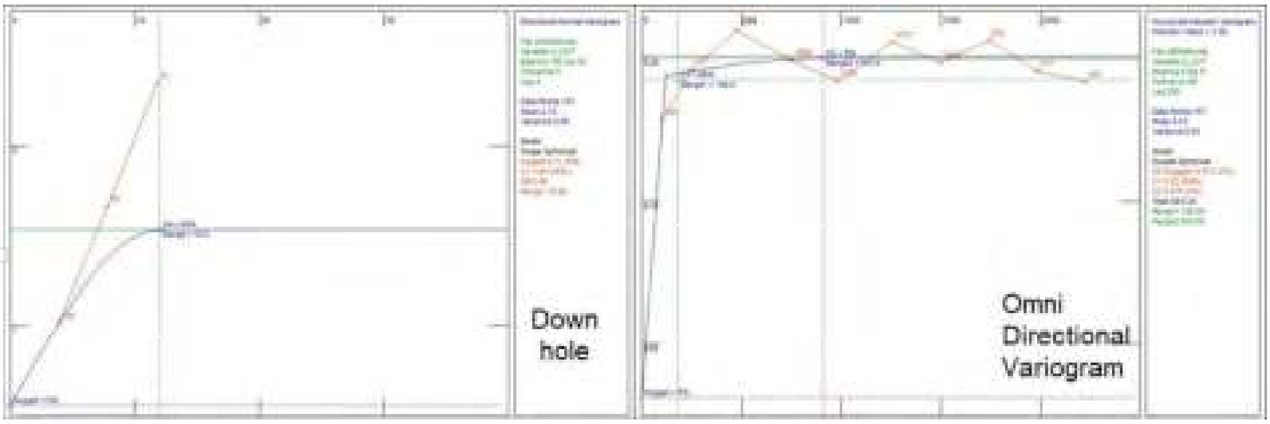


Figure F-13 Downhole and directional variograms – Grouped HREEs; Lower Saprolite South

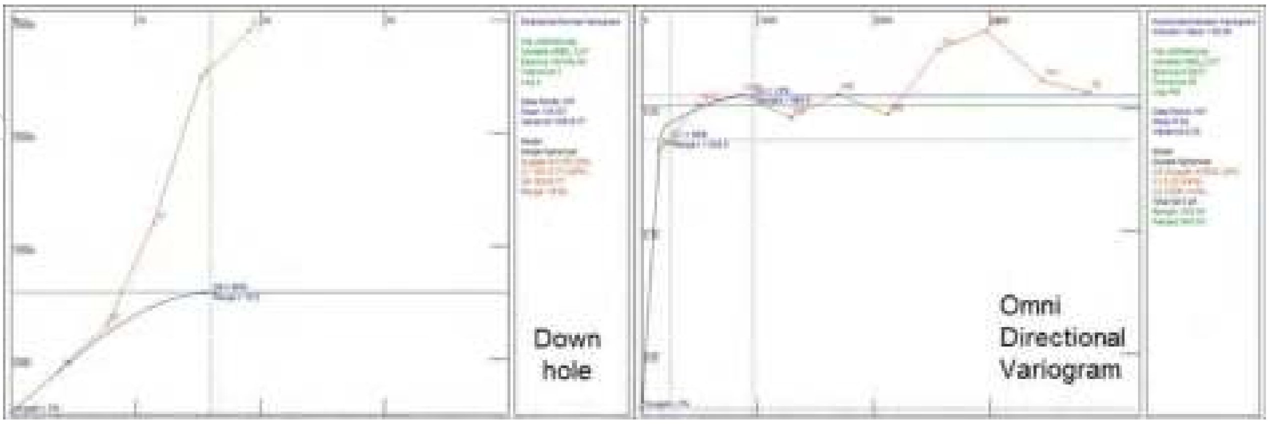


Figure F-14 Downhole and directional variograms – Scandium; Lower Saprolite South

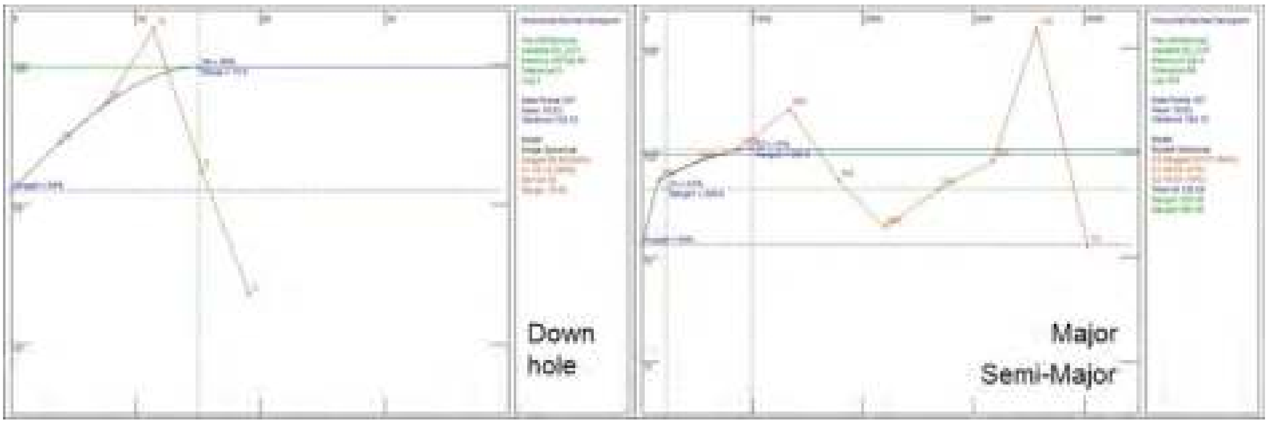


Figure F-15 Downhole and directional variograms – Thorium; Lower Saprolite South

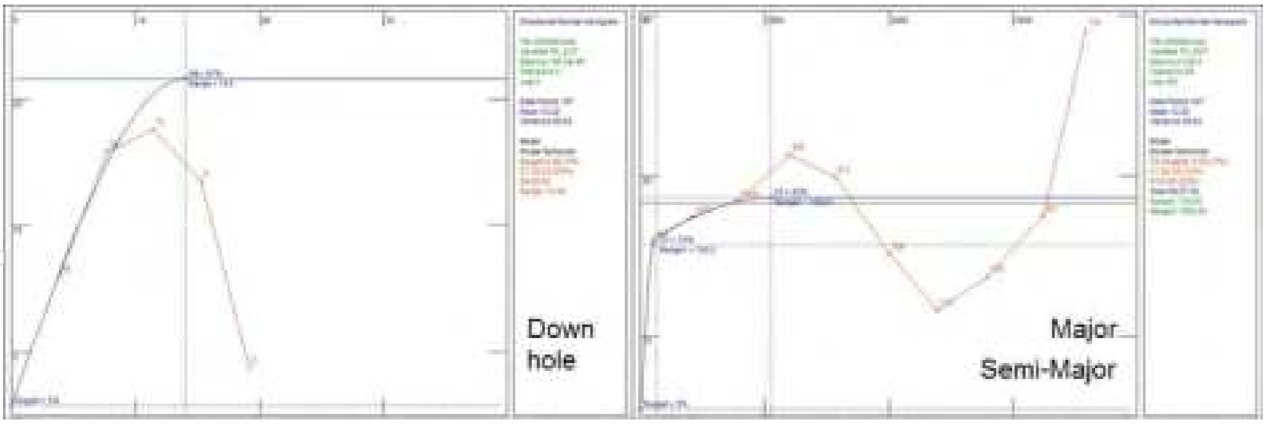
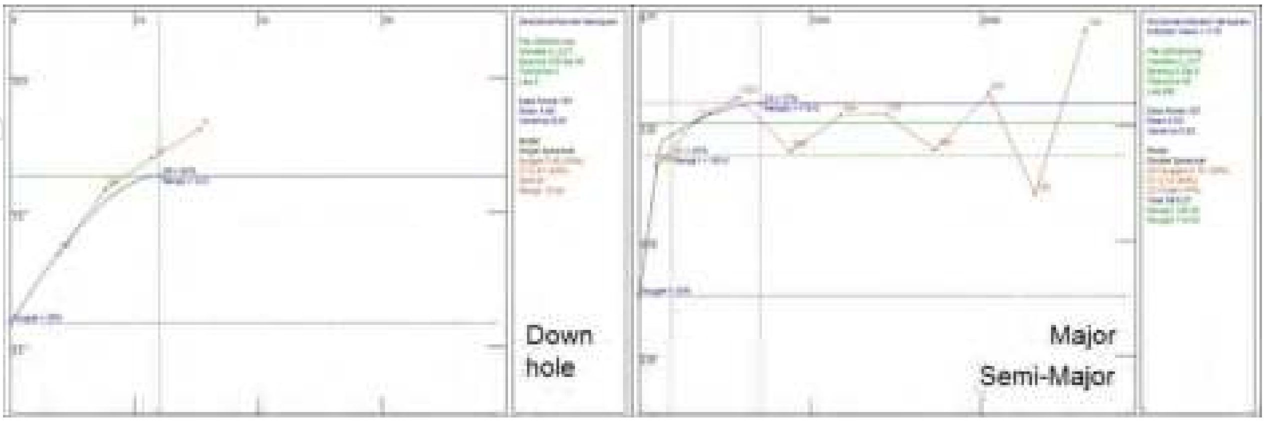


Figure F-16 Downhole and directional variograms – Uranium; Lower Saprolite South



Appendix G

Model Validation Plots

Figure G-1 Grade profile validation plots – Cowalinya North; Upper Saprolite

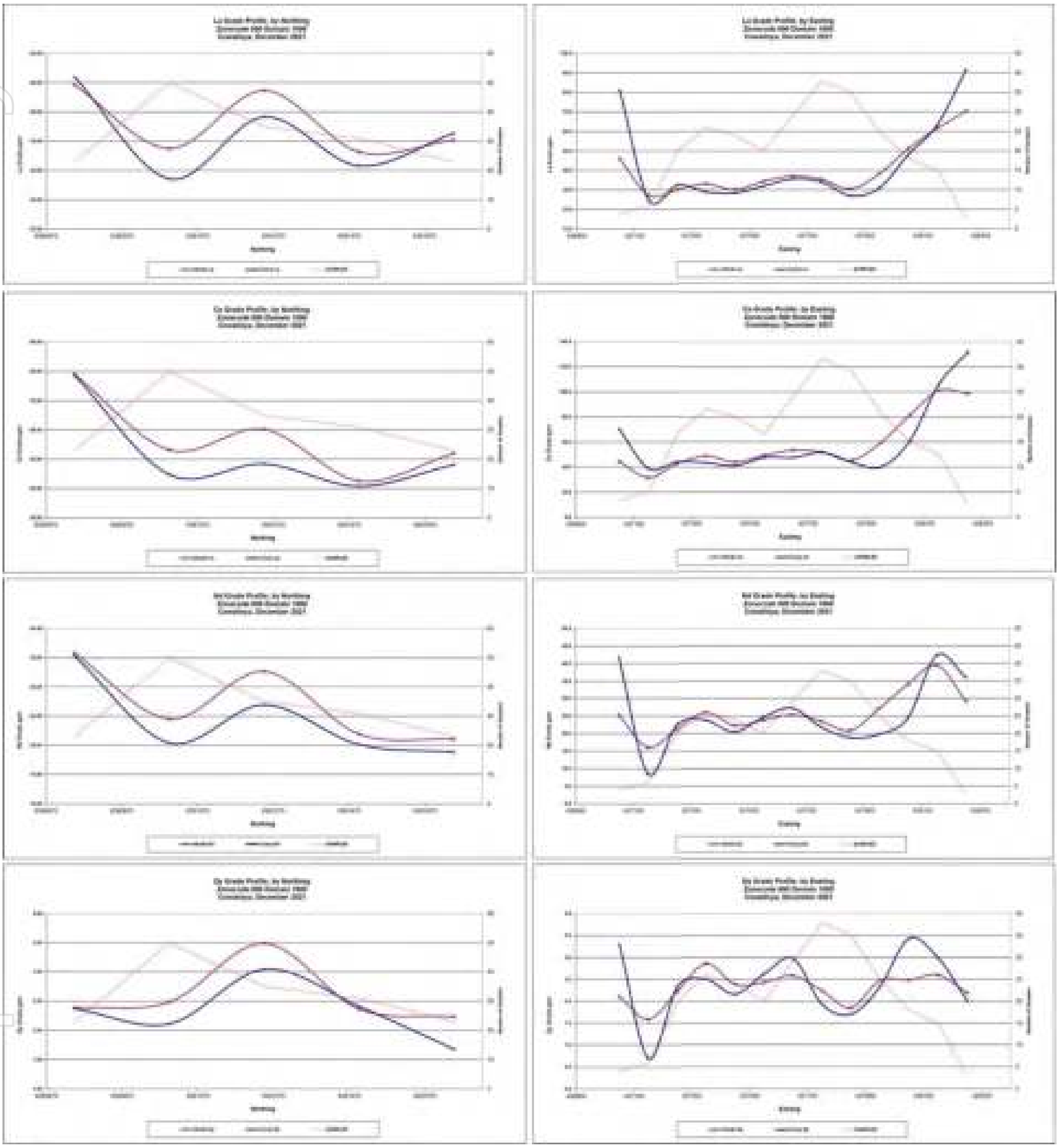


Figure G-1 Contd.

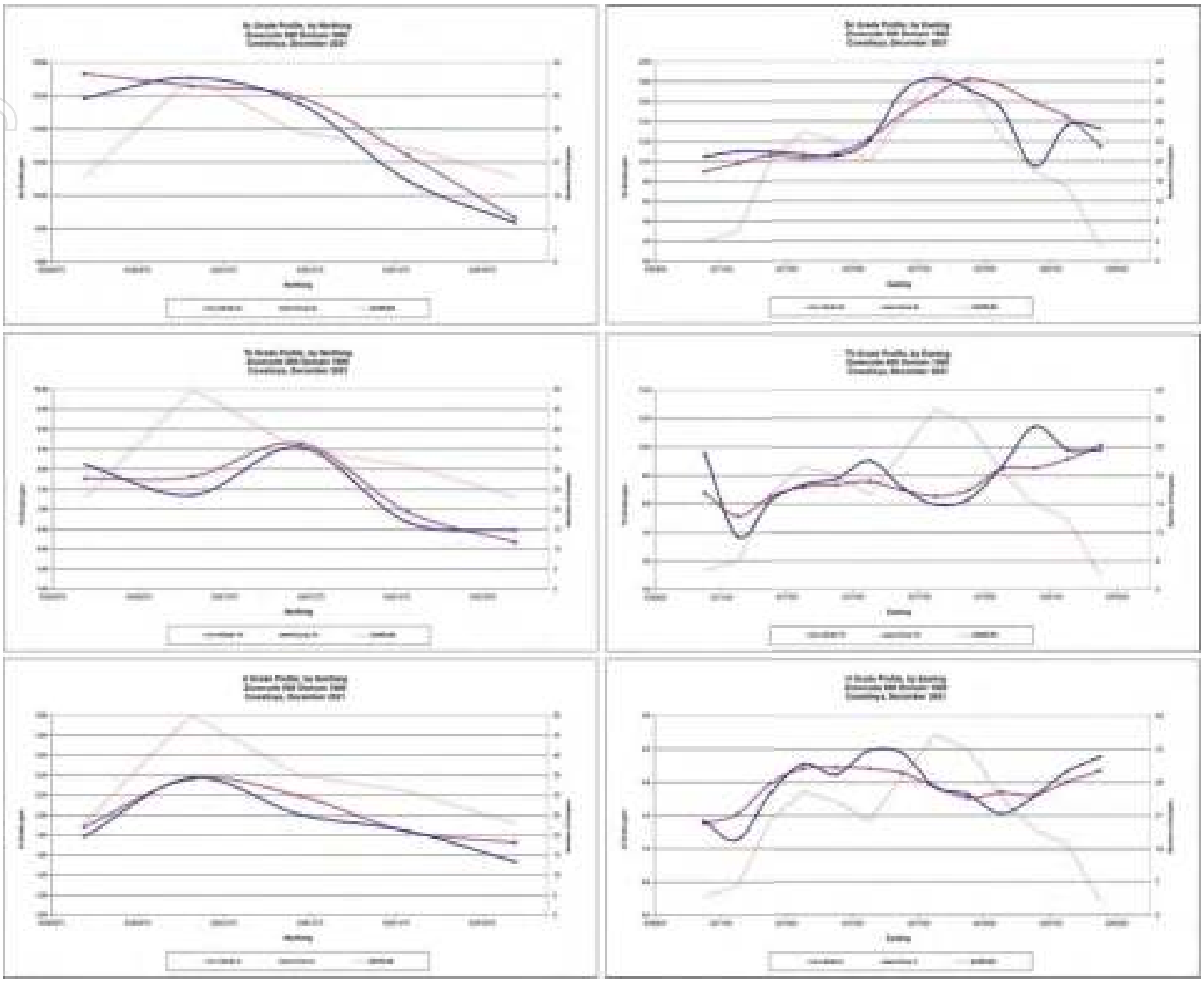


Figure G-2 Grade profile validation plots – Cowalinya South; Upper Saprolite

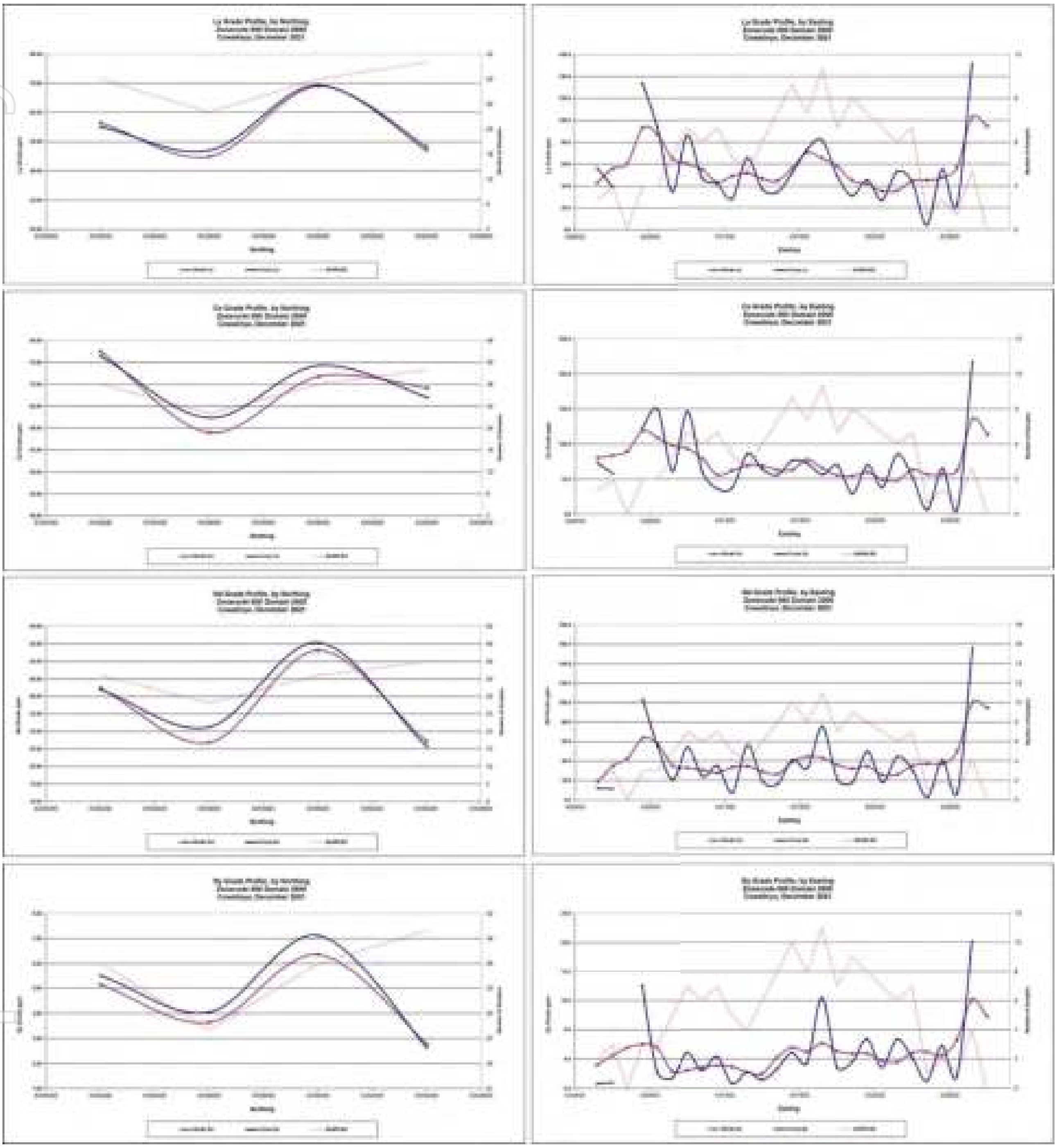


Figure G-2 Contd.

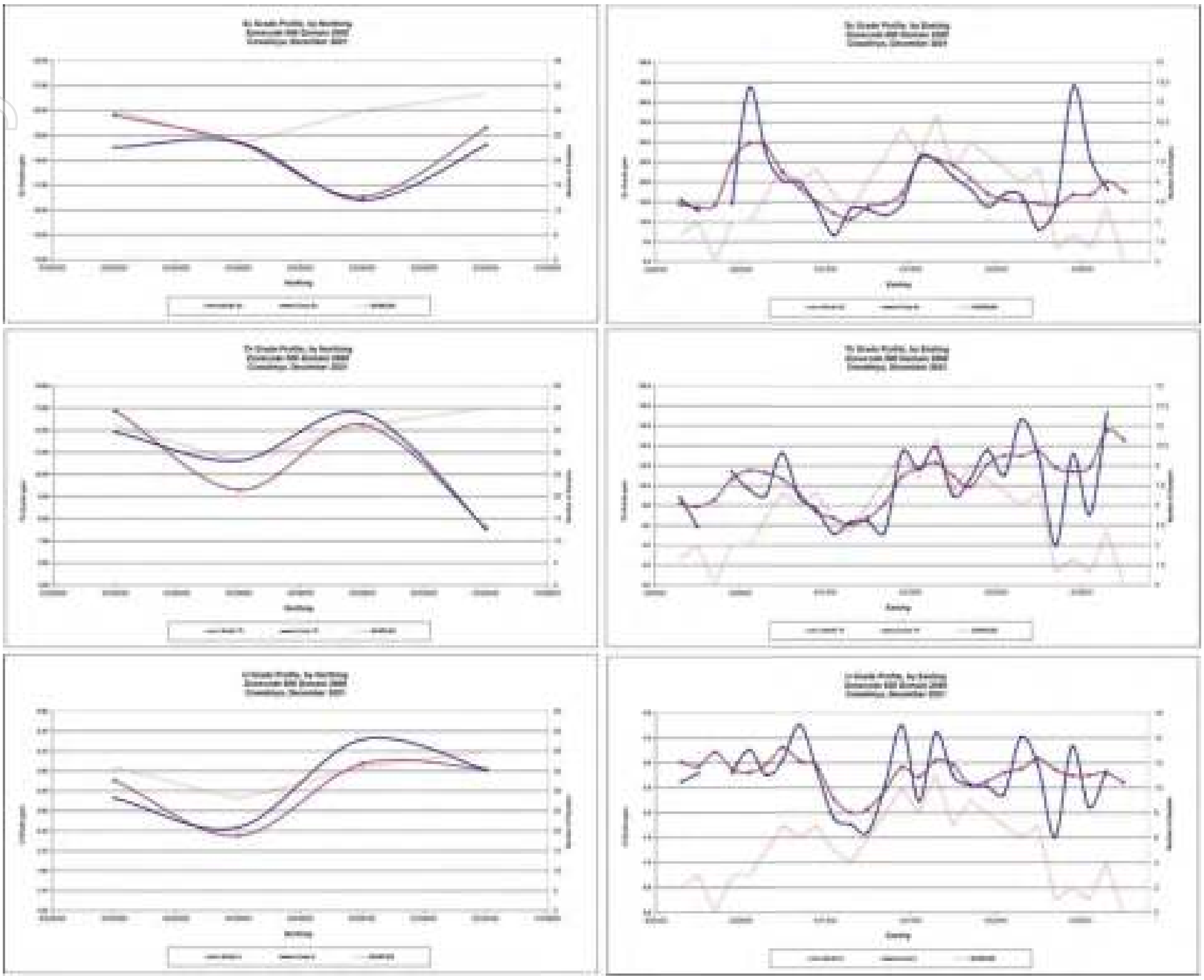


Figure G-3 Grade profile validation plots – Cowalinya North; Lower Saprolite

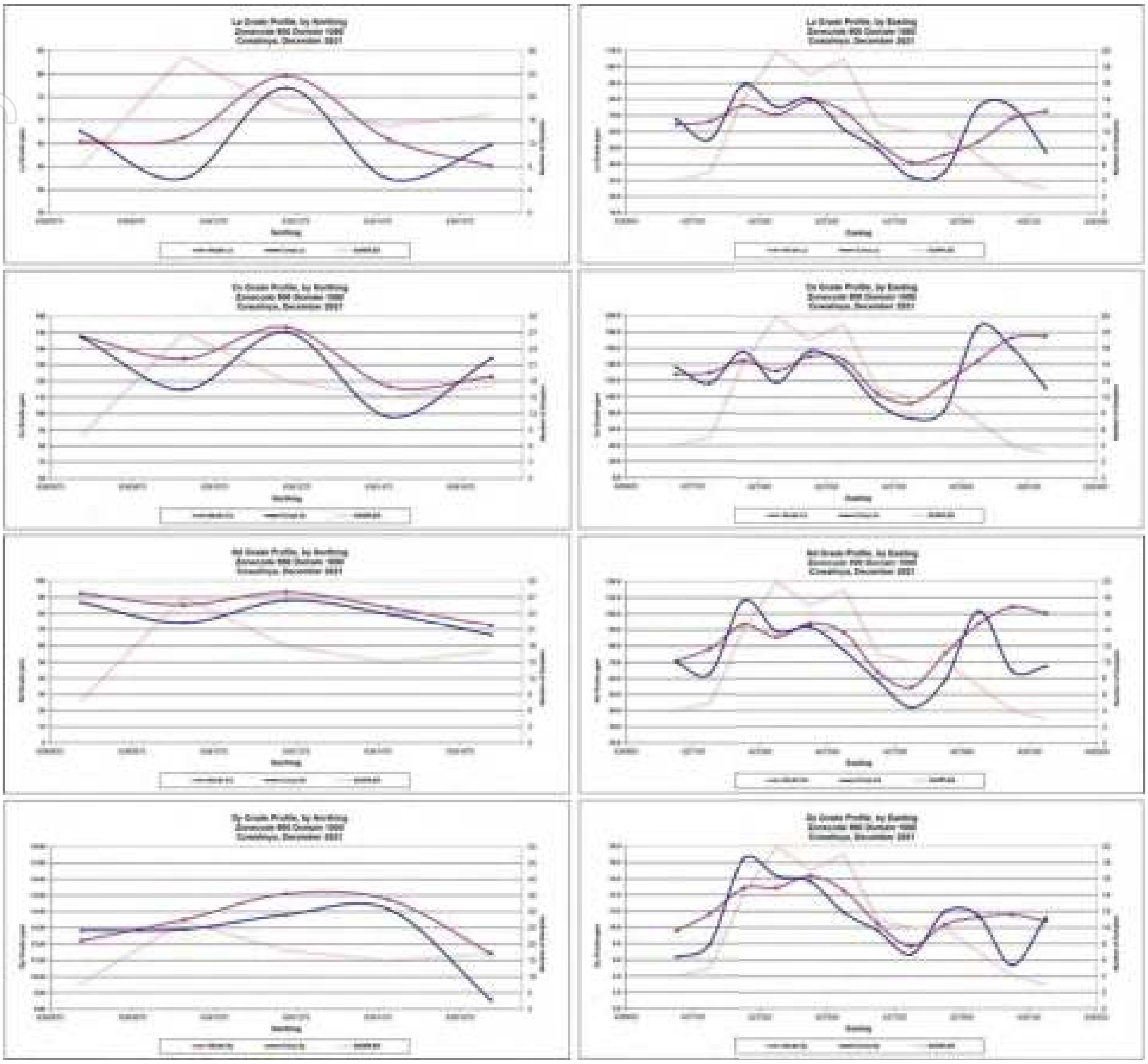


Figure G-3 Contd.

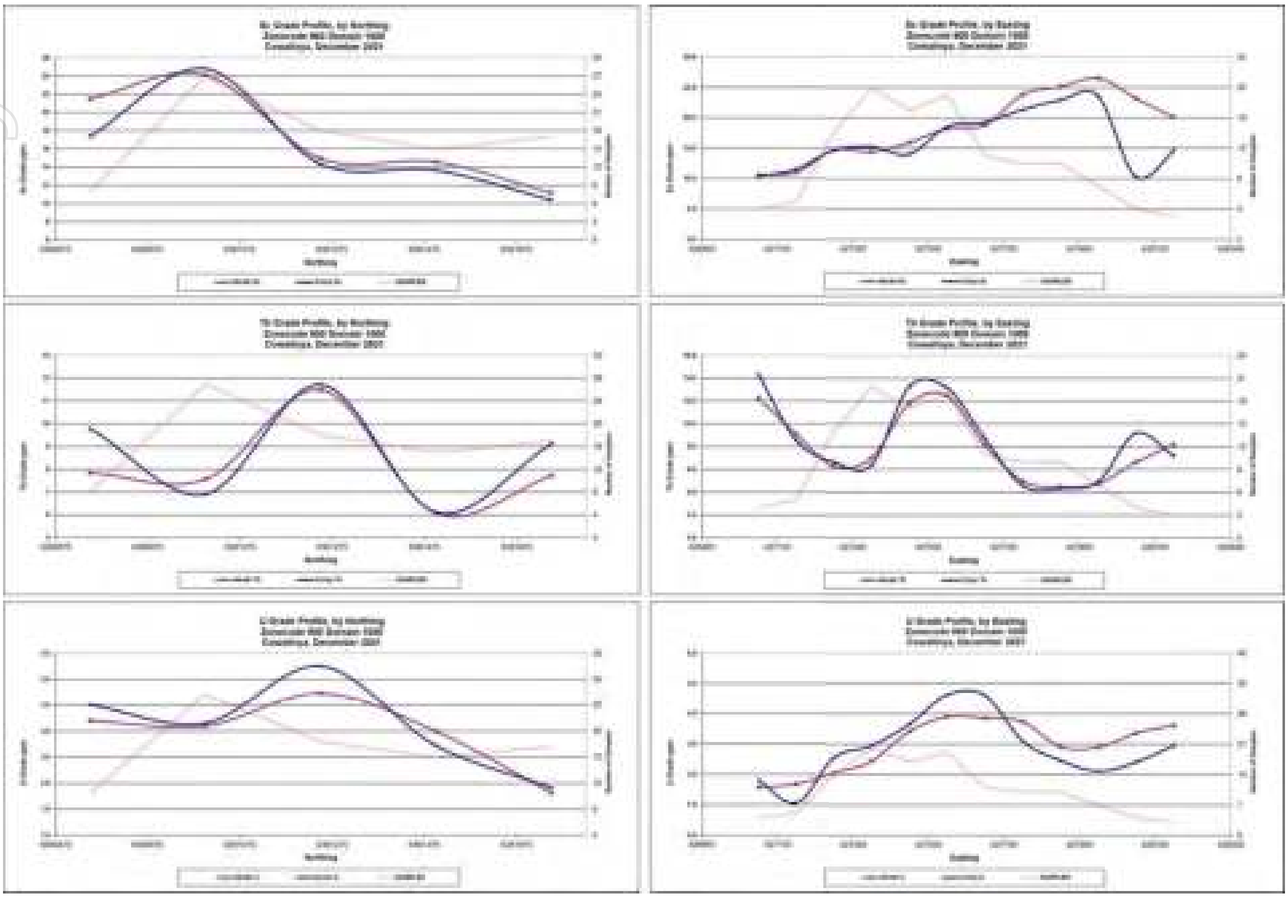


Figure G-4 Grade profile validation plots – Cowalinya South; Lower Saprolite

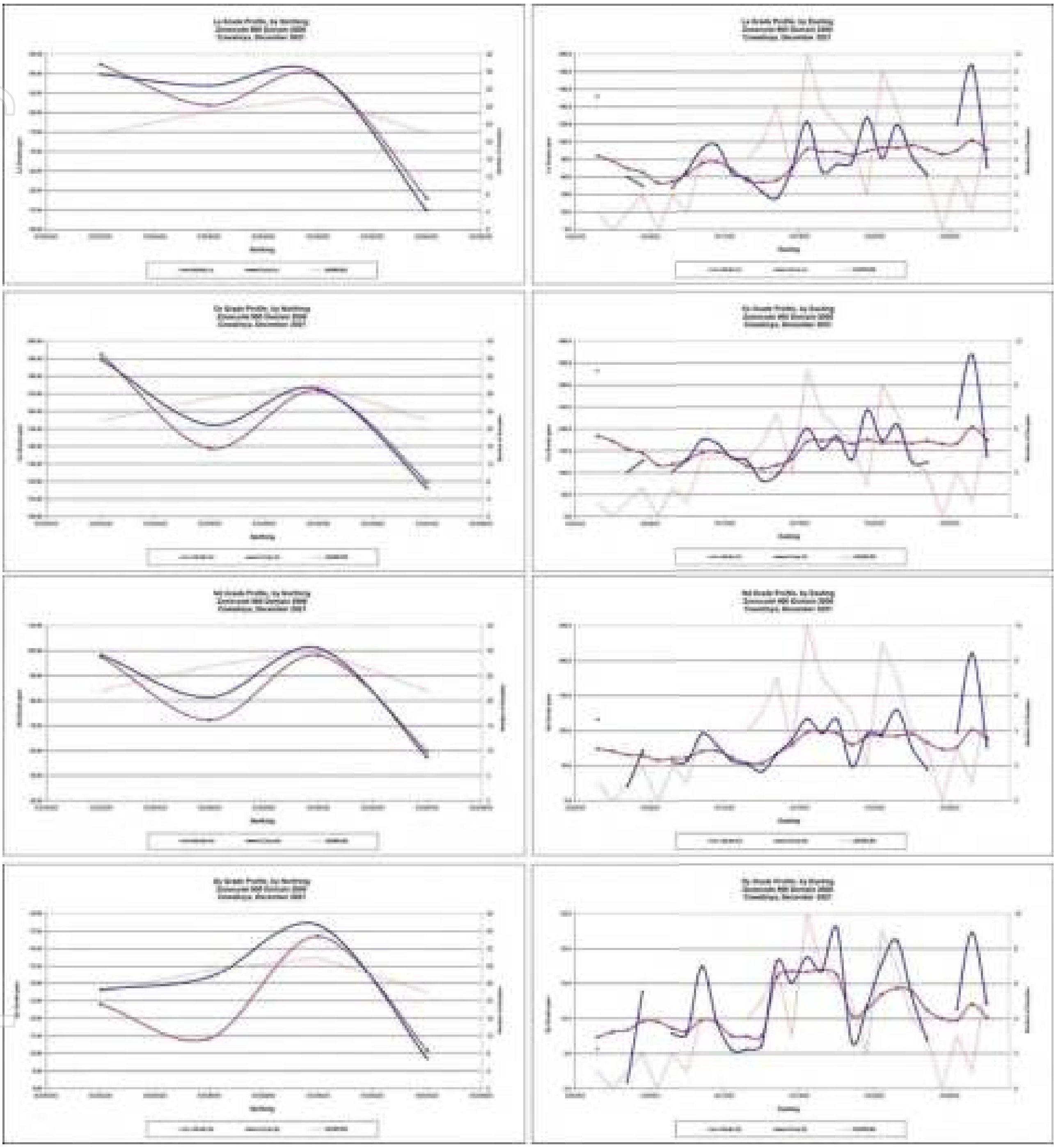
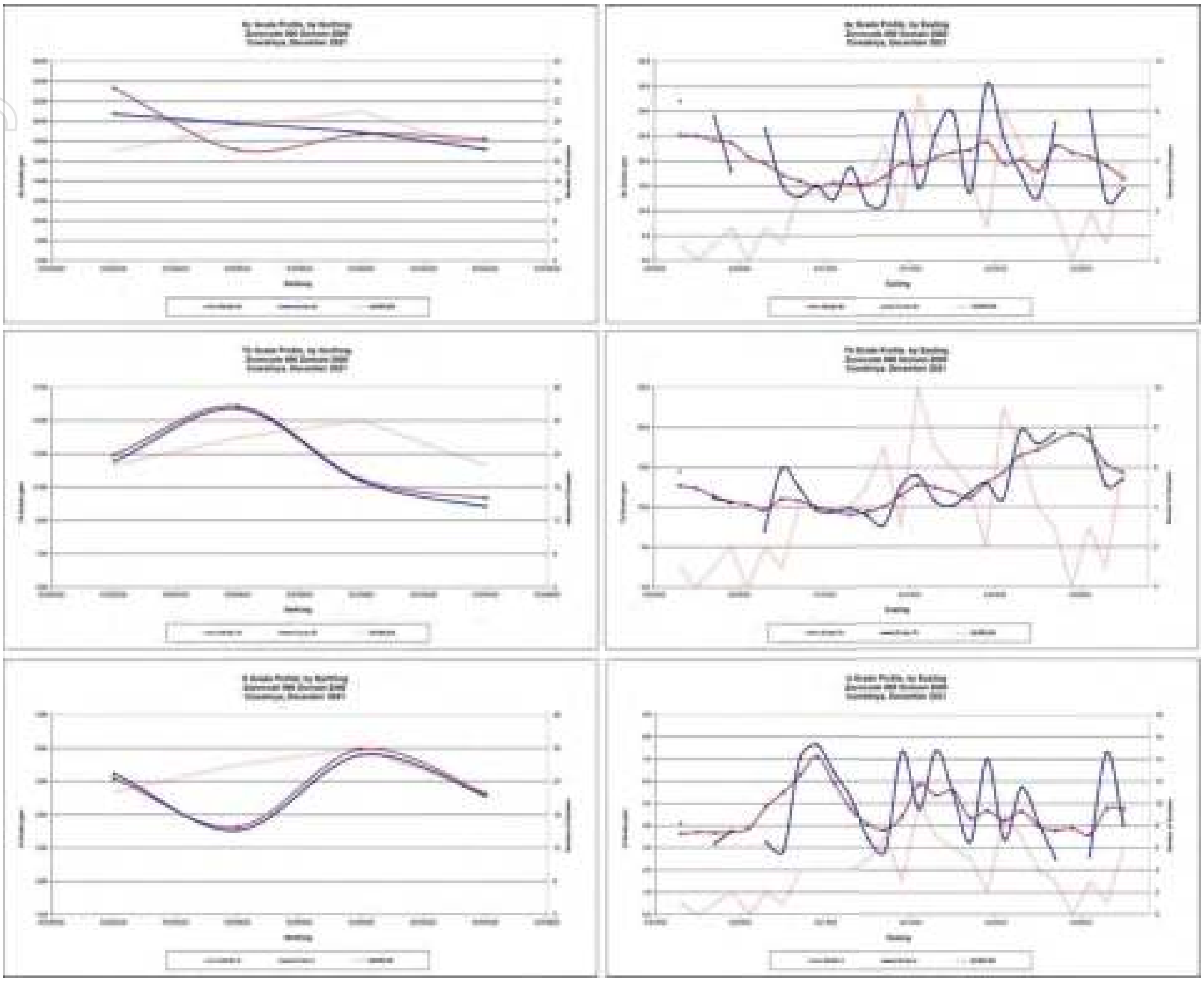


Figure G-4 Contd.



1 July 2022

The Directors
Heavy Rare Earths Limited
Level 21, 459 Collins Street
Melbourne Vic 3000

Dear Sirs

SOLICITOR'S REPORT

1. Introduction

This report is prepared for inclusion in a prospectus (**Prospectus**) to be dated on or about 4 July 2022 for issue by Heavy Rare Earths Limited ACN 648 991 039 (formerly HRE Corporation Limited) (**HRE**) of 30,000,000 shares at an issue price of $0.20 per share to raise $6,000,000 (before costs) (**Report**).

The Report relates to mining tenements in both Western Australia (**WA Tenement**) and the Northern Territory (**NT Tenements**) (collectively, the "**Tenements**") in which HRE holds an interest. The attached Tenement Schedule (**Schedule)** and notes to the Schedule, contain an overview of the Tenements. Section 9.2 of the Prospectus, which does not form part of this Report set out technical information and summaries of material contracts that relate to HRE's interest in the Tenements.

This Report has been prepared by House Legal incorporating opinion received from Ward Keller, a law firm based in Darwin with specialist expertise in mining tenure. Ward Keller's opinion relates to all sections marked as such or marked as relating to the Northern Territory, including the notes on the Northern Territory tenure in the Schedule.

2. Opinion

House Legal Opinion

Based on our searches and enquiries in respect of the Western Australian Tenement referred to in the Schedule (**WA Tenement**) and subject to the assumptions and qualifications set out below, House Legal confirms that as at 29 May 2022:

House Legal Pty Ltd ACN 619 683 395
86 First Avenue, MOUNT LAWLEY WA 6050
M: 0413 481 525
E: stuart@houselegal.com.au

(a) the details of the WA Tenement is accurate as to the status and registered holders of those Tenements;

(b) unless otherwise specified in this Report, the WA Tenement is in good standing and all applicable rents have been paid;

(c) the WA Tenement is not subject to any unusual conditions of a material nature other than as disclosed in the Schedule;

(d) this Report provides accurate statements as to third party interests, including encumbrances in relation to the WA Tenements ascertainable from our searches and the information provided to us; and

(e) subject to the comments below relating to standard, administrative authorisations (which are normally applied for only at the time of finalising the details of individual exploration plans), or as otherwise detailed in the Schedule or the Prospectus, there are no legal, regulatory or contractual impediments to HRE undertaking exploration on the WA Tenement.

Ward Keller Legal Opinion

Based on our searches and enquiries in respect of the Northern Territory Tenements referred to in the Schedule (**NT Tenements**) and subject to the assumptions and qualifications set out below, Ward Keller confirms that as at 13 May 2022:

(f) the details of the NT Tenements are accurate as to the status and registered holders of those tenements;

(g) unless otherwise specified in this Report, the NT Tenements are in good standing and all applicable application fees and rents have been paid;

(h) native title has been determined over the area covered by the NT Tenements;

(i) aboriginal sacred sites exist in the area covered by the NT Tenements;

(j) the NT Tenements overlay NT Portion 408, the subject of Perpetual Pastoral Lease 1030 known as Phillip Creek Station;

(k) upon grant of the NT Tenements, notice will be required to be given to landowners before HRE may access the land; and

(l) this Report provides accurate statements as to third party interests, including encumbrances in relation to the NT Tenements ascertainable from our searches and the information provided to us.

3. Searches

Western Australian Tenements

For the purpose of this Report, House Legal has conducted the following searches and enquiries for the WA Tenement on 29 May 2022:

(a) search of the WA Tenement in the mining tenement register (**DMIRS Register**) maintained by the Department of Mines, Industry Regulation and Safety of Western Australia (**DMIRS**) pursuant to the *Mining Act 1978* (WA) and *Mining Regulations 1981* (WA) (**WA Mining Act**); and

(b) quick appraisal search of the WA Tenement summarising information obtained online from the 'TENGRAPH' system maintained by the DMIRS; and

(c) searches of the Aboriginal Heritage Inquiry System of the Department of Planning, Lands and Heritage (**DPLH**) for Registered Aboriginal Sites and Other Heritage Places.

Northern Territory Tenements

For the purpose of this Report, Ward Keller has conducted the following searches and enquiries for the NT Tenements:

(a) searches of the Spatial Territory Resources Information Kit (**STRIKE**) database maintained by DITT, on 9 May 2022;

(b) searches of the mineral titles register (**DITT Register**) maintained by the Northern Territory Department of Industry, Tourism and Trade (**DITT**) under the *Mineral Titles Act 2010* (NT) (**MTA**), on 10 May 2022;

(c) a search of the Northern Territory's Integrated Land Information System (**ILIS**) in respect of the underlying pastoral lease, on 9 May 2022;

(d) a search of the National Native Title Tribunal registers and databases for native title applications and determinations, discontinued native title claims and Indigenous Land Use Agreements, on 12 May 2022;

(e) searches of the sacred sites register maintained by the Aboriginal Areas Protection Authority (**AAPA**) under the *Northern Territory Aboriginal Sacred Sites Act (NT),* on 9 May 2022;

(f) searches of the Heritage Register maintained by Heritage NT under the *Heritage Act 2011* (NT), on 9 May 2022;

(g) searches of the Australian Heritage Database maintained by the Commonwealth Department of Agriculture, Water and Environment under the *Environment Protection and Biodiversity Conservation Act* (1999) (Cth), on 9 May 2022; and

(h) the mineral titles advertising database maintained by DITT, on 12 May 2022.

4. Assumptions and qualifications

In preparing this Report in respect of the WA Tenements, House Legal:

(a) have assumed the accuracy and completeness of results of the searches of the DMIRS Register and other information obtained from the DMIRS and DPLH;

(b) have assumed all contracts, agreements or arrangements have been supplied to us and were within the capacity and powers of, and were validly authorised, executed and delivered by and binding on each party to them, and where applicable, duty has been paid;

(c) have, where any agreement, dealing or act (including disturbing the land for exploration or mining) affecting the Tenements requires an authorisation, approval, permission or consent (**Authorisation**) under the WA Mining Act, or any other relevant legislation, assumed that Authorisation has been or will be granted in due course;

(d) where any dealing in a WA Tenement has been lodged for registration but is not yet registered, expresses no opinion as to whether the registration will be effected, or the consequences of non-registration;

(e) have assumed that HRE and the holders of the WA Tenements referred to in Schedule 1 of this Report have each complied with all applicable provisions of the WA Mining Act and all other legislation relating to the WA Tenement;

(f) have not researched the underlying land tenure in respect of the WA Tenement to determine if native title rights have or have not been extinguished, or the extent of any extinguishment, other than as disclosed in the "quick appraisal" searches referred to in paragraph 3(b) above; and

(g) other than as can be ascertained from the database maintained by the DPLH (as set out in paragraph 3(c) above, have not researched the area of the Tenements to determine if there are any additional or unregistered sites of significance to aboriginal people within the area.

In preparing this Report in respect of the NT Tenements, Ward Keller:

(a) have assumed the accuracy and completeness of results of the searches of the DITT Register, all information obtained from DITT and all publicly searchable registers and databases;

(b) have not, unless otherwise state, independently verified material obtained as a result of searches undertaken;

(c) expresses no opinion as to whether the NT Tenements will be granted;

(d) have assumed that HRE has complied with all applicable provisions of the any applicable law in respect of the NT Tenements; and

(e) other than as can be ascertained from our searches of the Sacred Sites Register, the Heritage Register and the Australian Heritage Database, have not researched the NT Tenements to determine if there are any additional sacred sites, heritage places or objects or Aboriginal or Maccassan heritage places or objects within the area.

All Tenements

Schedule 1 of this Report sets out a brief description of the WA Tenement and the NT Tenements and a summary of any encumbrances, conditions and endorsements on title. In relation to the Schedule, we make the following comments:

(a) references to the areas of the WA Tenement are taken from the details shown on the tenement searches, it is not possible to verify those areas without conducting a survey which has not been undertaken;

(b) the area of the WA Tenement, as shown in the Schedule, might be reduced by the existence of pre-existing mining tenements situated within the boundaries of the relevant Tenement resulting in the area of the earlier mining tenement being excised from the grant of the Tenement; and

(c) the rights of a holder of a mining tenement are subject to compliance by that holder with the terms and conditions attached to each WA Tenement and generally under the WA Mining Act and other relevant legislation.

(d) The NT Tenements are in the application stage. Upon grant, the rights of a holder of an exploration licence are subject to compliance by that holder with any conditions attached to the licence together with the conditions set out in and the provisions of the *Mineral Titles Act 2010* (NT) (**MTA**), the *Mining Management Act 2000* (NT) (**MMA**) and any other legislation relevant to authorised activities.

5. Western Australia Tenements

Mining tenements in Western Australia comprise prospecting licences (prefixed "P"), exploration licences (prefixed "E") and mining leases (prefixed "M") granted pursuant to the WA Mining Act as well as certain ancillary titles.

In accordance with the WA Mining Act, the holder of a mining tenement is permitted to explore for all minerals including oil shale but excluding sand or clay occurring on private land. Exploration or mining for iron is also excluded unless it has been authorised by the responsible Minister and endorsed on the mining tenement title. Under the Petroleum and Geothermal Energy Resources Act 1987 (WA), petroleum and geothermal energy resources are also excluded from the grant of a mining tenement.

In addition to the Authorisations and approvals descried below, it is a requirement that any ground disturbing work carried out on a mining tenement has been approved by the DMIRS. Such approvals may involve referral by the DMIRS to other Government agencies and any approvals given may be subject to special conditions. Approvals are generally required for an exploration program to be undertaken and are submitted to the DMIRS for approval at an administrative level.

(a) WA Prospecting Licences

A prospecting licence authorises the holder to enter land for the purpose of prospecting for minerals. 'Prospecting' includes the use of vehicles, machinery and equipment, and permits the undertaking of operations and works such as digging pits, trenches and holes, sinking bores and tunneling, for the purpose of prospecting for minerals in, on, or under the land. The holder of a prospecting licence may excavate, extract or remove earth, soil, rocks, stone, fluid or mineral-bearing substances not exceeding 500 tonnes over the term of the licence.

Prospecting licences are granted for a term of four years. The Minister has discretion to extend the prospecting licence for one further four year period if satisfied that a prescribed ground for extension exists.

There are no prospecting licences held by HRE.

(b) **WA Exploration Licences**

An exploration licence permits the holder to explore over land up to a maximum 200 graticular blocks in designated areas of Western Australia and a maximum of

70 graticular blocks elsewhere. Graticular blocks comprise one minute of longitude by one minute of latitude and therefore range in area from approximately 2.8km^2 to 3.3 km^2. There is no limit to the number of exploration licences which may be held by any one person.

An exploration licence authorises the holder to enter land using vehicles, machinery and equipment as may be necessary or expedient for the purpose of exploring for minerals in, on or under the land.

Exploration licences are granted with five year terms which may be extended by one period of five years and then by further two year periods if the Minister is satisfied that a 'prescribed ground' for extension exists.

'Prescribed grounds' for extension include circumstances when the holder experienced difficulties or delays arising from governmental, legal, climatic or heritage reasons, where work carried out justifies further prospecting, or where the Minister considers the land has been unworkable for whole or a considerable part of any year of the term.

Exploration licences are subject to a requirement that the holder relinquishes 40% of the tenement area at the end of the initial five year period. The Minister may defer the relinquishment requirement for one further year if satisfied that a prescribed ground for deferral exists. No exemption from the relinquishment requirement is available.

During the first year of grant of an exploration licence, a legal or equitable interest in or affecting the exploration licence cannot be transferred or otherwise dealt with, whether directly or indirectly, without the prior written consent of the Minister. A transfer after the first anniversary of the grant of an exploration licence requires no such approval.

During the term of an exploration licence, the holder may apply for and have granted subject to the WA Mining Act, one or more mining leases over any part of land subject to the exploration licence. Where an application for a mining lease is made, and the term of the exploration licence is due to expire prior to the mining lease application being determined, the exploration licence will continue in force over the land subject to the mining lease application pending the outcome of that mining lease application.

Annual rent and shire rates are payable in respect of exploration licences. Exploration licences are subject to minimum annual expenditure requirements which are set out in the Schedule. The holder of an exploration licence may apply for exemption from compliance with minimum expenditure requirements on certain grounds set out in the WA Mining Act or at the discretion of the Minister. A failure to comply with expenditure requirements, unless exempted, renders the exploration licence liable to forfeiture.

Forfeiture of WA Exploration Licences

The Minister may make an order for the forfeiture of an exploration licence for any of the following reasons:

(i) failure to pay rent or royalty;

(ii) non-compliance with conditions of an exploration licence such as lodgment of a report as required by the WA Mining Act;

(iii) failure to comply with certain provisions of the WA Mining Act;

(iv) failure to satisfy minimum expenditure conditions; or

(v) if the holder is convicted of an offence under the WA Mining Act.

A third party may also make an application to have an exploration licence forfeited due to a failure by the holder to comply with the terms of the exploration licence (most commonly, a failure to meet statutory minimum expenditure requirements). Such application for forfeiture in respect of expenditure conditions must be made during the tenement year in which there is non-compliance, or within eight months thereafter.

The Minister may only make an order for forfeiture if the Minister is satisfied that non-compliance is of sufficient gravity to justify the forfeiture of the exploration licence.

The Minister may impose a penalty instead of forfeiting the exploration licence. The penalty must not exceed $10,000 in a case where minimum expenditure conditions have not been complied with, and not exceed $50,000 in any other case.

(c) WA Mining Leases

There are no mining leases applied for or held by HRE. A mining lease, if applied for, will authorise the holder to work and mine the land, and take and remove from the land any minerals and dispose of them, and to do all acts and things necessary to effectually carry out mining operations in, on, or under the land subject to the mining lease.

A mining lease is commonly applied for after exploration within an exploration licence or prospecting licence has revealed the existence of mineralisation and often as a "conversion" of the applicable exploration or prospecting licence.

A mining lease may only be granted if the application is accompanied by either a mining proposal or a 'statement' setting out information about the mining operations that are likely to be carried out on the mining lease together with a mineralisation report prepared by a qualified person. If a statement and mineralisation report are lodged, the Director, Geological Survey must be satisfied that there is significant mineralisation in, on, or under the land to which an application for a mining lease relates. For the purposes of the WA Mining Act 'significant mineralisation' is defined as a deposit of minerals where exploration results indicate that there is a reasonable prospect of minerals being obtained by mining operations.

Every granted mining lease is subject to a condition requiring the lessee, before carrying out mining operations of a prescribed kind on any part of the land the subject of the lease (including open-cut, underground, quarrying, dredging, harvesting, scraping, leaching and tailing treatment operations together with incidental construction activities), to lodge (and have approved) a mining proposal. Mining proposals are required to detail all matters relating to the environmental management of a proposed project including mine closure and rehabilitation.

A mining lease is granted for a term of 21 years and may be renewed for successive terms upon application to the Minister. A term of renewal must not exceed 21 years.

Annual rent and shire rates are payable in respect to mining leases and the holder of a mining lease must expend or cause to be expended $100 per hectare (with a minimum of $10,000) annually during each year of the term of the lease. If the mining lease does not exceed 5 hectares the minimum annual expenditure will be $5,000.

Forfeiture of WA Mining Leases

The Minister may forfeit a mining lease in the same manner and for the same reasons as apply to an exploration licence (described above).

6. Northern Territory Tenements

A summary of the current status of the NT Tenements and relevant grant processes with respect to Exploration Licences (**EL**), Exploration Licence in Retention (**ELR**) and Mineral Leases (**ML**) granted under the MTA is set out below.

(a) NT Exploration Licences

In the Northern Territory the rights conferred on the holder of an exploration licence are, in broad terms, the general right to access and occupy the title area and the exclusive right explore for minerals in the title area, conduct exploration activities and apply for a mineral lease over all or part of the title area.

The grant of an EL is subject to conditions, including notice to landowners and occupiers prior to entry or commencing exploration activities. Exploration activities must be carried out substantially in accordance with the technical work program and expenditure commitments set out in the EL, which must be updated annually. Annual rent is payable on ELs, however under *the Local Government Act 2019* (NT) (**LGA**), local council rates are not. Where water or a mineral of economic or scientific interest is discovered, the titleholder is required to notify the Minister within 28 days of such discovery. The holder of an EL is prohibited from removing or selling minerals from the title area unless so authorised under the MTA.

At the time of grant, an EL must be a minimum of 4 adjoining graticular blocks and a maximum of 250 graticular blocks and must not constitute more than 3 discrete areas. A graticular block is measured by one minute of latitude by one minute of longitude, each having an area of approximately 310 hectares. There is no limit on the number of exploration licences held and no waiting period to apply for an ML. An exploration licence is granted for a maximum term of 6 years and must be reduced by half every two years of the initial term by notice to the Minister. ELs are renewable with the consent of the Minister responsible for administering the MTA (**Minister**) for up to 2 years at a time, without compulsory reduction periods. There is no limit on the number of renewals that may be granted.

Before making a decision about the grant of the NT Tenements, the Minister must give public notice of the application under section 71 of the MTA and section 29 of the *Native Title Act 1993* (Cth) (**NTA**). Under the MTA, within 30 days of the publication date, any landowner of land the subject of an application may make an objection to an application and any other person may make a submission in relation to the application.

NT Tenements application status

Ward Keller obtained copies of the applications made to the Minister in respect of the NT Tenements on 10 May 2022. Ward Keller reviewed the application documents against the application criteria set out under the MTA and advise no material issues of concern were identified in respect of statutory compliance. The technical work programs within the applications propose the following expenditure commitments during the first two operational years:

(i) EL(A) 33194: $13,000 in the first year of operation and $20,000 in the second year of operation; and

(ii) EL(A) 33101: $10,000 in the first year of operation and $16,500 in the second year of operation.

The application for EL33194 was made on 21 December 2021 and the Territory published the required notice under on 9 March 2022 (**Notification Day**). No objections or submissions were received by the Minister within the 30-day period required under section 71 of the MTA. The application for EL33194 was made on 26 April 2022 and as at 24 May 2022, no public notice had been given in respect of that application.

The granting of the NT Tenements are future acts for the purpose of the NTA and subject to the future act provisions set out in that Act. The relevant processes are discussed later in this Report. It is the policy of the NTG that applications for exploration licences attract the expedited procedure under section 273 of the NTA.

(b) NT Exploration Licence in Retention

The holder of an EL may apply to convert all or part of its interest to an ELR if there is a known mineralisation within the licensed area and it is either not yet commercially viable to commence mining or it may be commercially viable but further work is required to assess its feasibility. This gives the title holder the right to continue conducting authorised activities for an EL while allowing for further feasibility studies to be undertaken and, if necessary, development to be postponed until it becomes economically viable.

The application must include a description of the land in the proposed title area, a technical work program for the first operational year of the ELR and the applicant must satisfy the Minister that it has sufficient technical and financial resources to continue to carry out the technical work program.

The granting of an ELR has the effect of cancelling that portion of the EL covered by the ELR, while the remainder of the EL continues in force. An ELR may be issued (and subsequently renewed) for terms not exceeding 5 years. There is no limit on the number of renewals. An ELR is not subject to the compulsory relinquishment requirements that apply to an EL, however if the mining and processing of minerals becomes commercially viable, the title holder must apply for the grant of an ML. As for an EL, annual rent is payable on an ELR, however under the LGA, local council rates are not.

As for an EL, the granting of an ELR is a future act for the purpose of the NTA and is subject to the future act provisions set out in that act. The relevant processes are discussed later in this Report.

(c) **NT Mineral Leases**

The holder of an EL or an ELR may apply in the approved form to the Minister for the grant of an EL where there is evidence of a known mineralisation of likely economic value (other than where a mineral lease is required for ancillary to mining under another ML granted to the titleholder).

The rights conferred on the holder of a mineral lease include the general right to access and occupy the title area and the exclusive right to conduct exploration, mining, evaluation, processing, refining, treatment, storage and removal of minerals in and from the title area. A titleholder must conduct activities in relation to a title area in a way that interferes as little as possible with the rights of other occupiers of land in the title area.

An application for an ML must include a description of the land in the title area, evidence of mineralisation of likely economic value and a summary of the work proposed to be carried out. The grant (and renewal) of an ML may be for any term the Minister considers appropriate. There is no limitation on the number of renewals available.

Annual rent is payable in respect of an ML, as are local council rates under the LGA. As for an EL and an ELR, the granting of an ML is a future act for the purpose of the NTA and is subject to the future act provisions set out in that act. The relevant processes are discussed later in this Report.

7. Royalties

Western Australia

Holders of Tenements in Western Australia must pay royalties on minerals (including material containing minerals) obtained from a mining tenement to the state government. Royalties are payable quarterly and must be accompanied by a royalty return in an approved form. The holder of a mining tenement must provide a quarterly production report commencing at the expiration of the first quarter during which any mineral is produced or obtained from that mining tenement. Royalty rates and methods of calculation differ depending on the type of mineral produced or obtained from a mining tenement.

Northern Territory

The *Mineral Royalty Act (NT) (***MRA**) levies a royalty on the recovery of mineral commodities from mining in the Northern Territory. The MRA is a profit-based royalty regime that uses the Net Value of a mine's production to calculate the royalty payable to the Territory. The MRA levies royalties at a rate which is the greater of:

(a) 20 per cent of the net value of mineral commodities sold or removed from a production unit, less $10 000; or

(b) the percentage of the gross production revenue applying to the royalty year as follows:

  (i) 1 per cent for the royalty payer's first royalty year that begins on or after 1 July 2019

  (ii) 2 per cent for the royalty year that follows the royalty year mentioned in subparagraph (i)

  (iii) 2.5 per cent for each royalty year that follows the royalty year mentioned in subparagraph (ii).

Net Value = GR – (OC + CRD + EEE + AD).

Where:

- GR is the gross realisation from the production unit in the royalty year.
- OC is the operating costs of the production unit for the royalty year.
- CRD is the capital recognition deduction.
- EEE is any eligible exploration expenditure (this must occur on a ML or an ELR, it is not deductible if conducted under an EL).
- AD is additional deductions under section 4CA.

Royalties are only payable where the annual gross production revenue of a production unit exceeds $500,000. Royalties are payable to the Territory and liability for royalty is a joint and several liability of the tenement holder(s). Returns and payments are due every 6 months with annual audited reconciliation. Royalties are payable regardless of the type of mineral commodity or whether the mine is situated on vacant Crown land, freehold land, leasehold land or Aboriginal land.

8. Rehabilitation levies or securities

Western Australia

In Western Australia a mining rehabilitation levy system applies which requires a tenement holder to pay a levy based on the area it has disturbed on a tenement (and on the estimate of the cost of rehabilitation of such area). In certain circumstances, a tenement holder may also be required to lodge a bank guaranteed performance bond to secure the performance of a tenement holder's rehabilitation obligations on a mining tenement.

The holder of a tenement in Western Australia may also be liable to pay a safety levy based on the number of hours spent working on a group of tenements (including all employees or contractors).

Northern Territory

In the Northern Territory, operators carry out mining activities under an Authorisation granted under the MMA and must provide the Minister with a security in relation to those activities in accordance with the conditions of such Authorisation (**Security**). The Minister is required to calculate the amount of the Security by reference to the level of disturbance likely to be caused by the mining activities to be carried out under the Authorisation. In practice, it is policy of DITT that the Security covers 100% of rehabilitation costs, payable in the form of cash or bank guarantee.

In addition, an annual levy equal to 1% of the Security is payable by the operator to address the impacts of legacy mining in the Territory.

9. Native Title

Native Title or claims for native title exist over large areas of both Western Australia and the Northern Territory and will likely affect new mining tenements. The Schedule sets out relevant native title claims (if any) affecting the WA Tenement and the NT Tenements. The existence of a lodged claim does not necessarily mean that native title exists over the area claimed, nor does the absence of a claim necessarily indicate that no native title exists in an area. The existence of native title will be established pursuant to the determination of claims by the Federal Court.

The grant of a mining tenement is a 'Future Act' for the purposes of the *Native Title Act 1993* (Cth) (**NTA**). A Future Act is an activity or development on land or waters that affects native title. Native title claimants' gain the 'right to negotiate' in relation to the grant of certain mining tenements if their native title claim is registered at the time the government issues a notice (known as a section 29 notice), stating it intends to do the act (ie grant the mining tenement), or if their claim becomes registered within four months after that notice. The right to negotiate might apply to the grant of any type of mining tenement, but in practice, it applies predominantly to the grant of a mining lease. The right to negotiate describes a process whereby the tenement applicant and native title claimant must negotiate in good faith to attempt to resolve any potential concerns the native title claimants may have arising from the mining lease application or its grant.

10. Validity of titles – Western Australia

(a) Expedited Procedure

In some cases (predominantly in respect of exploration or prospecting licences) the Western Australia State Government applies a 'fast track' procedure (the 'expedited procedure') in place of the right to negotiate process. If the proposed grant of a mining tenement is advertised under the expedited procedure, native title parties can lodge an objection to the use of the expedited procedure for the grant of the mining tenement. If there is no objection lodged, the mining tenement can be granted. If an objection is lodged, the parties may either negotiate and reach agreement, or apply to the National Native Title Tribunal (**NNTT**) for a determination of the matter.

It is a policy of the DMIRS to apply the expedited procedure to the grant of exploration and prospecting licences where the applicant has executed a Regional Standard Heritage Agreement (**RSHA**) or has an existing Alternative Heritage Agreement (**AHA**) in place. In the absence of such an agreement, applications will be subject to the right to negotiate procedure.

A RSHA or AHA is intended to address potential Aboriginal heritage concerns with respect to work on the area subject to a mining tenement. The agreements generally provide for a native title party to withdraw their objection to the expedited procedure and consent to the grant of the mining tenement upon the terms of the agreement. Agreements commonly include a procedure for the carrying out of surveys ahead of ground disturbing activities to determine if any sites or objects of significance to Aboriginal people exist in the area. Other terms such as compensation payable to the native title party might be included.

(b) **Right to Negotiate Procedure**

Mining tenements granted in Western Australia after 23 December 1996 that affect native title will be valid only if the applicable processes of the NTA have been complied with. Under the right to negotiate procedures, parties are required to negotiate in relation to the grant of the proposed Future Act, eg the grant of a mining tenement. Negotiations are initiated to obtain the agreement of the relevant native title parties to the carrying out of the proposed Future Act. The right to negotiate procedure consists of a statutory minimum six month period of negotiation between the relevant government party, the native title party and the grantee, during which time the parties must negotiate in good faith with a view to reaching agreement about the doing of the Future Act.

If parties cannot reach agreement as to the terms of grant, a negotiation party may apply to the NNTT (as the arbitral body) to make a determination as to whether the grant may proceed (and if so, on what conditions).

(c) **Compensation**

The WA Mining Act makes mining tenement holders liable for any native title compensation that may be payable as a result of the grant of the mining tenement. If the existence of native title is proven over any of the land subject to the WA Tenement, and the native title holders make an application to the Federal Court for compensation, the tenement holder may be liable to pay any compensation awarded.

(d) **Conversion to Mining Lease**

In relation to the tenements in Western Australia undergoing a conversion from an exploration licence or prospecting licence to a mining lease over an area where native title claims are lodged and registered, the mining lease will be subject to the right to negotiate process, unless HRE has earlier entered into an agreement with the claimants that permits such conversion.

11. Native Title – Northern Territory

(a) Before making a decision about the grant of the NT Tenements, the Territory is required under section 29 of the NTA to publish a notice of the proposed grant. In the case of an EL and ELR, DITT's practice is to assert that the expedited procedure applies by publishing a statement to that effect in its section 29 notice of intention to grant.

(b) In respect of EL(A)33101, the Territory published the required notice on 9 March 2022 (**Notification Day**). The notice included a statement that the act is one that attracts the expedited procedure. As at the date of writing, the statutory notice in respect of EL(A)33194 is yet to be published.

(c) In response to the notice, any native title party (usually represented by the Central Land Council (**CLC**)) must:

(i) under section 71(3)(d) of the MTA, lodge any objection it has to the grant of EL(A) 33101 by 8 April 2022 (DITT confirmed via email on 13 May 2022 that no such objection has been received); and

(ii) under section 32(4) of the NTA, lodge any objection it has to the inclusion of the statement that the grant of EL(A)33101 is once which attracts the expedited procedure (for determination by the National Native Title Tribunal (**NNTT**)) by 9 July 2022.

If no objection to the expedited procedure statement in the Notice is lodged by the CLC by 9 July 2022, then the Territory may grant EL(A) 33101. If an objection to the expedited procedure is lodged and upheld by the NNTT, then Aboriginal people who hold, or have claimed, native title rights over land must be consulted about proposed activities on the land and formal agreement about those activities will be required in accordance with the right to negotiate procedures set out in Part 2, Division 3, Subdivision P of the NTA.

(d) The grant of any future ML over the area the subject of the NT Tenements will be a 'future act' and will be valid subject to compliance with the right to negotiate provisions of the NTA.

Search Results

The NT Tenements are subject to the determination of the Federal Court of Australia on 3 August 2017 in *Freddie v Northern Territory* [2017] FCA 867 (NTD50/2014; DCD2017/005) (Phillip Creek Pastoral Lease).

The Phillip Creek Pastoral Lease determination lists a broad range of non-exclusive native title rights and interests of native title holders, possessed under and exercisable in accordance with the traditional laws acknowledged and customs observed by the native title holders. Such rights and interests are subject to and exercisable in accordance with the valid laws of the Northern Territory of Australia and the Commonwealth of Australia.

The NT Tenements fall within the area covered by, but are not subject to, the *Tennant Creek Pastoral Lease Phillip Creek Pastoral Lease Partta Land Indigenous Land Use Agreement* made between the Central Land Council (on behalf of the Native Title Holders) and Giants Reef Exploration Pty Ltd and dated 15 September 2000 (**Giants Reef Exploration ILUA**), registered on the Register of Indigenous Land Use Agreements maintained by the National Native Title Tribunal on 15 March 2001.

12. Aboriginal Heritage

(a) Commonwealth

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) (**Commonwealth Heritage Act**) is aimed at the preservation and protection of any Aboriginal areas and objects that may be located on the Tenements.

Under the Commonwealth Heritage Act, the Minister for Aboriginal Affairs may make interim or permanent declarations of preservation in relation to significant Aboriginal areas or objects, which can affect exploration activities. Compensation is payable by the Minister to a person who is, or is likely to be, affected by a permanent declaration of preservation.

(b) Western Australia

Holders of mining tenements in Western Australia are subject to the *Aboriginal Heritage Act 1972* (WA) (**WA Heritage Act**), which protects sites that may be of spiritual, cultural or heritage significance to Aboriginal people (**Aboriginal Site**). The Western Australia Department of Planning, Land and Heritage (which incorporates the former Department of Aboriginal Affairs) maintains a register of Aboriginal Sites but registration of an Aboriginal Site is not required by the WA Heritage Act.

To alter or damage an Aboriginal Site without approval is an offence under the WA Heritage Act that can lead to prosecution. Any party disturbing an area of the State has an obligation to avoid interfering with an Aboriginal Site. To satisfy this obligation, tenement holders commonly undertake Aboriginal heritage surveys which involve the relevant traditional owners and as necessary, an archaeologist or anthropologist walking the land identifying sites and discussing the impact of proposed exploration activity. The costs of a heritage survey are met by the tenement holder.

The Government of Western Australia has passed the new *Aboriginal Cultural Heritage Act 2021 (***ACH Act**). The new ACH Act is not yet in force but will, when it commences, fundamentally changes the way Aboriginal Cultural Heritage is managed in Western Australia. The practice described above, being the conduct of surveys to identify areas that may contain or constitute areas of Aboriginal Cultural Heritage before conducting exploration, will likely continue under the new ACH Act.

Surveys to identify sites and objects of significance to Aboriginal people are commonly carried out in accordance with terms set out in an RSHA or AHA (both described in Part 8 above). Where native title has been determined to exist, the obligation to carry out such survey, and the terms by which they must be carried out, may be set out in an "indigenous Land Use Agreement" (**ILUA**). ILUA's range from very detailed agreements negotiated by the State and the relevant native title holders to cover entire native title areas to agreements between individual companies and the native title holders. The National Native Title Tribunal maintains a register of ILUA's.

(c) **Western Australian Search Results**

Aboriginal Sites within the Tenements

Other than the search of the DPLH register described in part 3(c) of this Report, House Legal has not undertaken any searches or investigations as to whether there are or may be any sites protected by the Commonwealth Heritage Act or the WA Heritage Act within the area of the WA Tenement. It is common practice for an explorer to undertake heritage surveys only over areas about to be disturbed and only when work is imminent.

(d) **Northern Territory**

Sacred Sites in the Northern Territory are protected under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) (**Sacred Sites Act**). The Aboriginal Areas Protection Authority (**AAPA**), a statutory authority established under the *Sacred Sites Act*, is responsible for registering, recording and overseeing the protection of sacred sites on land and sea across the whole of the Northern Territory. It is an offence under the Sacred Sites Act to enter, remain on, carry out works on or make use of or desecrate a known sacred site. With the exception of desecration, works carried out on or use of scared sites conducted in accordance with the conditions of an Authority Certificate issued by AAPA provides a defence to prosecution under Sacred Sites Act.

The *Heritage Act 2011* (NT) (**Heritage Act**) protects and conserves cultural heritage places and objects within the Northern Territory. The Heritage Council is responsible for keeping a register of declared heritage places and objects (**Heritage Register**). All places and objects listed on the Heritage Register are protected under the Heritage Act, making it an offence to undertake works on or interfere with such places and objects. Aboriginal or Macassan archaeological places and Aboriginal or Macassan archaeological objects are protected without the requirement for registration under the Heritage Act.

(e) **Northern Territory search results**

(i) A search of the Heritage Register undertaken by Ward Keller on 9 May 2022 did not reveal any declared heritage places or objects in respect of the NT Tenements. Ward Keller has not undertaken any further searches or investigations to determine whether any Aboriginal or Maccassan archeological places or objects exist within the tenement area.

(ii) Searches of the Australian Heritage Database undertaken on 9 May did not reveal any information about natural, historic or Indigenous places included in the World Heritage List, the National Heritage List, the Commonwealth Heritage List, or the Register of the National Estate, within the area of the NT Tenements.

(iii) Searches of the Register of Sacred Sites maintained by AAPA under the Sacred Sites Act were undertaken on 9 May 2022 in respect of the NT Tenements. The searches identify that there are two registered sacred sites, being 5659-6C and 5659-2, located within the area of EL(A)33194 and four registered sacred sites, being 5659-6A, 5659-6B, 5659-6C and 5659-6D, located in the area of EL(A)33101.

Ward Kelller has not undertaken any searches or investigations as to whether there are or may be any sites protected by the Commonwealth Heritage Act.

13. Northern Territory landholder compensation and land access agreements

Section 107(1) of the MTA provides a person who has an interest in land with a general entitlement to compensation from the holder of a mineral title for damage and loss suffered as a result of mining activities conducted under that title. A landowner for the purpose of the MTA includes native title holders and the owners of the underlying pastoral lease. The NT Tenements overlay NT Portion 408, the subject of Perpetual Pastoral Lease 1030 known as Phillip Creek Station.

This general entitlement is qualified by section 107(2) of the MTA in respect of exploration activities undertaken on pastoral land. The effect of this provision is that, if HRE's exploration activities cause no more damage to the land than is reasonably necessary to carry out the exploration activities, no compensable liability will arise.

Landholder access agreements are not required by law to undertake exploration activities in the Northern Territory; however, it is the policy of the DITT that where activities on a pastoral lease will involve substantial disturbance, the parties enter into such an agreement before a Mining Management Plan is approved and an Authorisation granted under the MMA.

Regardless of the level of disturbance, HRE required to give 14 days' notice to a Landholder of its intentions to start (a) conducting authorised activities and (b) entry onto the land to start conducting those activities. The written notice must include:

(a) the name and contact details of the title holder;

(b) the name and contact details of the person who will be in charge of conducting the authorised activities;

(c) the nature of the exploration to be conducted on the land;

(d) the intended start date, and an estimate of the duration, of the exploration;

(e) a map of the land on which the exploration is to be conducted, clearly indicating its location and boundaries; and

(f) details of the proposed place of entry onto the land.

14. Consent

House Legal

This Report is given on 1 July 2022 and unless specified to the contrary, speaks only to the laws in force on that date. This Report was prepared by House Legal only in respect of the WA Tenements. House Legal has consented to the inclusion of this Report in the Prospectus in the form and context in which it is provided to HRE and has not withdrawn that consent before the lodgment of the Prospectus with ASIC.

Ward Keller

This Report is given on 1 July 2022 and unless specified to the contrary, speaks only to the laws in force on that date. This Report was prepared by Ward Keller only in respect of the NT Tenements. Ward Keller has consented to the inclusion of this Report in the Prospectus in the form and context in which it is provided to HRE and has not withdrawn that consent before the lodgment of the Prospectus with ASIC.

15. Disclosure of Interest

House Legal and Ward Keller will be paid normal and usual professional fees for the preparation of this Report and related matters, as set out elsewhere in the Prospectus.

Yours faithfully

Stuart House
Principal

SCHEDULE 1 TENEMENTS

Tenement	Holder/s	Status	Area	Application Date	Grant Date	Expiry Date	Required Expenditure	Notes
Cowalinya Project – Western Australia								
E63/1972	DI Ross 50% CA Ross 50%	Live	80 blocks	06/06/2019	09/01/2020	08/01/2025	$80,000.00	1 to 8
Duke Project – Northern Territory								
EL(A) 33194	HRE	Application	45 blocks	26/04/2022	N/A	N/A	$13,000	9, 10, 11 and 12
EL(A) 33101	HRE	Application	38 Blocks	21/12/2021	N/A	N/A	$10,000	9, 10, 11 and 13

<u>Holders</u>

CA Ross	Christine Ann Ross
DI Ross	David Ian Ross
HRE	Heavy Rare Earths Limited

<u>Notes</u>

Western Australian Tenement

The Western Australian Tenement is subject to standard statutory conditions. These standard conditions compel the tenement holder to promptly report to the Minister responsible for the administration of the Mining Act all minerals of economic interest discovered within the Tenements. The standard conditions also stipulate that a tenement holder obtain the consent of an officer of the DMIRS prior to conducting any ground disturbing work, basic environmental and rehabilitation conditions (such as filling or otherwise making safe all holes, pits, trenches and other disturbances to the surface of the land which are made whilst exploring for minerals) and a requirement to prevent fire, damage to trees or other property, damage to livestock. In addition to these standard conditions, the following applies:

1. All disturbances to the surface of the land made as a result of exploration, including costeans, drill pads, grid lines and access tracks, being backfilled and rehabilitated to the satisfaction of the Environmental Officer, DMIRS. Backfilling and rehabilitation being required no later than 6 months after excavation unless otherwise approved in writing by the Environmental Officer, DMIRS.

2. All waste materials, rubbish, plastic sample bags, abandoned equipment and temporary buildings being removed from the mining tenement prior to or at the termination of exploration program.

3. Unless the written approval of the Environmental Officer, DMIRS is first obtained, the use of drilling rigs, scrapers, graders, bulldozers, backhoes or other mechanised equipment for surface disturbance or the excavation of costeans is prohibited. Following approval, all topsoil being removed ahead of mining operations and separately stockpiled for replacement after backfilling and/or completion of operations.

4. In respect to Water Resource Management Areas (**WRMA**) (which affect all of the licence) the following endorsements apply:

   a. The Licensee's attention is drawn to the provisions of the:

      i. Waterways Conservation Act, 1976;

      ii. Rights in Water and Irrigation Act, 1914;

      iii. Metropolitan Water Supply, Sewerage and Drainage Act, 1909;

      iv. Country Areas Water Supply Act, 1947; and

      v. Water Agencies (Powers) Act 1984.

   b. The rights of ingress to and egress from, and to cross over and through, the mining tenement being at all reasonable times preserved to officers of Department of Water and Environmental Regulation (**DWER**) for inspection and investigation purpose.

   c. The storage and disposal of petroleum hydrocarbons, chemicals and potentially hazardous substances being in accordance with the current published version of the DWER relevant Water Quality Protection Notes and Guidelines for mining and mineral processing.

d. The taking of groundwater from an artesian well and the construction, enlargement, deepening or altering of any artesian well is prohibited unless current licences for these activities have been issued by DWER.

e. Measures such as drainage controls and stormwater retention facilities are to be implemented to minimise erosion and sedimentation of adjacent areas, receiving catchments and waterways.

f. All activities to be undertaken so as to avoid or minimise damage, disturbance or contamination of waterways, including their beds and banks, and riparian and other water dependent vegetation.

5. This tenement overlays unallocated crown land.

6. This tenement the Ngadju (WCD2014/004) native title determination.

7. This tenement overlies the Ngadju (WAD6020/1998) determined native title claim.

8. The Company's rights to this tenement are described in the agreement titled "Deed of Option" between David Ross and Christine Ross (**Vendors**) and Cobold Metals Limited (**Cobold**) dated 27 October 2020, which was assigned by Cobold to HRE with the consent of the Vendors by an agreement titled "Assignment of Option to Acquire Exploration Licence" (**Assignment**) dated 9 June 2021. The transaction is summarised in Section 9.2 of the Prospectus under the heading "(a) Deed of Option and Deed of Assignment – Cowalinya Project" which does not form part of this report.

Northern Territory Tenements

9. This tenement application was made in accordance with the *Mineral Titles Act 2010* (NT), which operates in conjunction with the *Mining Management Act 2001* (NT) which deals with the authorisation and management of exploration for, and extraction and processing of, minerals or extractive minerals to ensure the protection of the environment.

10. This tenement application overlaps NT Portion 408, the subject of Perpetual Pastoral Lease 1030 and known as Phillip Creek Station.

11. This tenement application is subject to the determination of the Federal Court of Australia on 3 August 2017 in *Freddie v Northern Territory* [2017] FCA 867 (NTD50/2014; DCD2017/005) (Phillip Creek Pastoral Lease).

12. Two registered sacred sites, being 5659-6C and 5659-2, exist in the tenement application area.

13. Four registered sacred sites 5659-6A, 5659-6B, 5659-6C and 5659-6D, exist in the tenement application area.

CORPORATE DIRECTORY

Heavy Rare Earths Limited

ABN: 35 648 991 039
ACN: 648 991 039

Directors
John Byrne – Non-Executive Chairman

Richard Brescianini – Executive Technical Director

Ryan Skeen – Non-Executive Director

Chief Financial Officer and Company Secretary

Justin Mouchacca

Proposed ASX Code:

HRE

Lead Manager of the Equity Offer

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Heavy Rare Earths Limited
ACN 648 991 039

Offer Application Form

This is an Application Form for Shares in Heavy Rare Earths Limited (**Company**) under the Equity Offer on the terms set out in the prospectus dated 5 July 2022 (Prospectus). Defined terms in the Prospectus have the same meaning in this Application Form. You may apply for a minimum of 10,000 Shares and multiples of 2,500 Shares thereafter. This Application Form and your cheque or bank draft must be received by **on or before the Closing Date**.

This Application Form is important. If you are in doubt as to how to deal with this Application Form, please contact your accountant, lawyer, stockbroker or other professional adviser. The Prospectus dated 5 July 2022 contains information relevant to a decision to invest in the Shares of the Company and you should read the entire Prospectus carefully before applying for Shares under the Equity Offer. If you are seeking to acquire securities under one of the other Offers under the Prospectus please contact the Company.

The Share Registry's Privacy Policy (**Privacy Policy**) also sets out important information relating to the collection, use and disclosure of all personal information that you provide to the Company. Please ensure that you and all relevant individuals have read the Privacy Policy carefully before submitting this Application Form. The Privacy Policy can be found on the website https://boardroomlimited.com.au/corp/privacy-policy/

To meet the requirements of the *Corporations Act 2001* (Cth), this Application Form must not be distributed to another person unless included in or accompanied by the Prospectus. A person who gives another person access to this Application Form must, at the same time and by the same means, give the other person access to the Prospectus. During the Offer period the Company will send you a free paper copy of the Prospectus if you have received an electronic prospectus and you ask for a paper copy before the Offer closes on 2 August 2022 (which date may change without notice).

PLEASE FOLLOW THE INSTRUCTIONS TO COMPLETE THIS APPLICATION FORM (SEE REVERSE) AND PRINT CLEARLY IN CAPITAL LETTERS USING BLACK OR BLUE PEN.

A **Number of Shares you are applying for**

Minimum of 10,000 Shares to be applied for and thereafter in multiples of 2,500 Shares

x $0.20 per Share =

B **Total amount payable**

$

C **Write the name(s) you wish to register the Shares in *(see reverse for instructions)***

Applicant #1

Name of Applicant #2 or <Account Designation>

Name of Applicant #3 or <Account Designation>

D **Write your postal address here**

Number/Street

Suburb/Town

State

Postcode

E **CHESS participant – Holder Identification Number (HIN)**

X

Important please note *if the name and address details above in sections C and D do not match exactly with your registration details held at CHESS, any Shares issued as a result of your Application will be held on the Issuer Sponsored subregister.*

F **Enter your Tax File Number(s), ABN, or exemption category**

Applicant #1

Applicant #2

Applicant #3

G **Cheque payment details –** PIN CHEQUE(S) HERE. Cheque to be made payable to "Heavy Rare Earths Limited" and crossed Not Negotiable. Enter cheque details below.

Alternatively you can apply online www.hreltd.com.au/prospectus **and pay by BPAY.**

Name of drawer of cheque	Cheque no.	BSB no.	Account no.	Cheque Amount A$

H **Contact telephone number (daytime/work/mobile)**

Contact Name

E-mail Address

Declaration

By submitting this Application Form with your Application Monies, I/we declare that I/we:

- ✓ have read the Prospectus in full;
- ✓ have received a copy of the electronic Prospectus or a print out of it;
- ✓ have completed this Application Form in accordance with the instructions on the form and in the Prospectus.
- ✓ declare Form and declare that all details and statements made by me/us are complete and accurate;
- ✓ agree and consent to the Company collecting, holding, using and disclosing my/our personal information in accordance with the Prospectus;
- ✓ where I/we have been provided information about another individual, warrant that I/we have obtained that individual's consent to the transfer of their information to the Company;
- ✓ acknowledge that once the Company accepts my/our Application Form, I/we may not withdraw it;
- ✓ apply for the number of Shares that I/we apply for (or a lower number allocated in a manner allowed under the Prospectus);
- ✓ acknowledge that my/our Application may be rejected by the Company in its absolute discretion;
- ✓ authorise the Company and their respective officers and agents to do anything on my/our behalf necessary (including the completion and execution of documents) to enable the Shares to be allocated to me/us;
- ✓ am/are over 18 years of age;
- ✓ agree to be bound by the constitution of the Company;
- ✓ acknowledge that neither the Company nor any person or entity guarantees any particular rate of return on the Shares, nor do they guarantee the repayment of capital;
- ✓ represent, warrant and agree that I/we am/are not in the United States or a US Person and am/are not acting for the account or benefit of a US Person; and
- ✓ represent, warrant and agree that I/we have not received this Prospectus outside Australia and am/are not acting on behalf of a person resident outside Australia.

Guide to the Application Form

YOU SHOULD READ THE PROSPECTUS CAREFULLY BEFORE COMPLETING THIS APPLICATION FORM.

Please complete all relevant sections of the appropriate Application Form using BLOCK LETTERS. These instructions are cross-referenced to each section of the Application Form.

Instructions

A If applying for Shares insert the ***number*** of Shares for which you wish to subscribe at Item **A** (not less than 10,000 Shares representing a minimum investment of $2,000.00). Multiply by A$0.20 to calculate the total Application Monies for Shares and enter the ***A$amount*** at Item **B**.

C Write your ***full name***. Initials are not acceptable for first names.

D Enter your ***postal address*** for all correspondence. All communications to you from the Company will be mailed to the person(s) and address as shown. For joint Applicants, only one address can be entered.

E If you are sponsored in CHESS by a stockbroker or other CHESS participant you may enter your CHESS HIN if you would like the allocation to be directed to your HIN. **NB: your registration details provided must match your CHESS account exactly.**

F Enter your Australian ***tax file number*** (TFN) or ABN or exemption category, if you are an Australian resident. Where applicable, please enter the TFN/ABN of each joint Applicant. Collection of TFN(s) and ABN(s) is authorised by taxation laws. Quotation of your TFN or ABN is not compulsory and will not affect your Application Form.

G Complete ***cheque details*** as requested. Make your cheque payable to "Heavy Rare Earths Limited". Cross it and mark it 'Not negotiable'. Cheques must be in Australian currency, and must be drawn on a bank or financial institution in Australia. **Alternatively you can apply online at** www.hreltd.com.au/prospectus **and pay by BPAY. If you apply online, you do not need to complete a paper Application Form. See below.**

H Enter your ***contact details,*** *including name, phone number and e-mail address,* so we may contact you regarding your Application Form or Application Monies.
By providing an e-mail address you are electing to receive notices of meetings, annual reports and other communications from the Company electronically to the provided e-mail address.

Payment by BPAY

You may apply for Shares under the Equity Offer online and pay your Application Monies by BPAY. Applicants wishing to pay by BPAY should complete the online Application Form accompanying the electronic version of the prospectus available at **www.hreltd.com.au/prospectus** and follow the instructions on the online Application Form. When completing your BPAY payment please ensure you use the specific Biller Code and Unique CRN provided in the online Application Form and confirmation e-mail. If you do not use the correct Biller Code and CRN your Application will not be recognised as valid. It is your responsibility to ensure payment is received on or before the Closing Date. Applicants should be aware that their own financial institution may implement earlier cut off times with regards to electronic payment and should therefore take this into consideration when making payment. Neither Boardroom Pty Limited nor Heavy Rare Earths Limited accepts any responsibility for loss incurred through incorrectly completed BPAY payments.

Correct Form of Registrable Title

Note that ONLY legal entities can hold the Shares. The Application must be in the name of a natural person(s), companies or other legal entities acceptable to the Company. At least one full given name and surname is required for each natural person. Examples of the correct form of registrable title are set out below.

Type of Investor	Correct Form of Registrable Title	Incorrect Form of Registrable Title
Individual	Mr John David Smith	J D Smith
Company	ABC Pty Ltd	ABC P/L or ABC Co
Joint Holdings	Mr John David Smith & Mrs Mary Jane Smith	John David & Mary Jane Smith
Trusts	Mr John David Smith <J D Smith Family A/C>	John Smith Family Trust
Deceased Estates	Mr Michael Peter Smith <Est Lte John Smith A/C>	John Smith (deceased)
Partnerships	Mr John David Smith & Mr Ian Lee Smith	John Smith & Son
Clubs/Unincorporated Bodies	Mr John David Smith <Smith Investment A/C>	Smith Investment Club
Superannuation Funds	John Smith Pty Limited <J Smith Super Fund A/C>	John Smith Superannuation Fund

Lodgment

Mail or deliver your completed Application Form with your cheque(s) or bank draft attached to one of the following addresses:

Mailing address:
Heavy Rare Earths Limited
C/-Boardroom Pty Limited
GPO Box 3993
SYDNEY NSW 2001

Delivery address:
Heavy Rare Earths Limited
C/-Boardroom Pty Limited
Level 12, 225 George Street
SYDNEY NSW 2000

The Offer closes on 2 August 2022, unless changed without notice as indicated in the Prospectus.

It is not necessary to sign or otherwise execute the Application Form.

If you have any questions as to how to complete the Application Form, please contact Boardroom Pty Limited on 1300 737 760 within Australia and +61 2 9290 9600 outside Australia.

Privacy Statement

Heavy Rare Earths Limited advises that Chapter 2C of the Corporations Act requires information about its shareholders (including names, addresses and details of Shares held) to be included in the Company's share register. Information is collected to administer your security holding and if some or all of the information is not collected then it might not be possible to administer your security holding. Your personal information may be disclosed to the Company. To obtain access to your personal information or more information on how the Company collects, stores, uses and disclosures your information please contact the Company at the address or telephone number shown in the Prospectus.