Havilah Resources

Strategic Minerals in South Australia

CRITCON 2023

The Kalkaroo Copper-Gold Deposit: A Critical Minerals Treasure Trove

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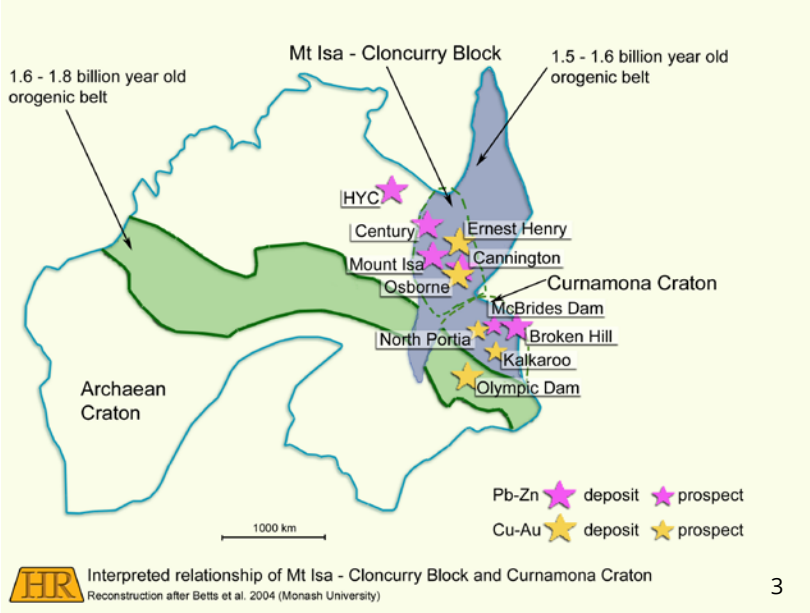
Kalkaroo Critical Minerals – Key Points

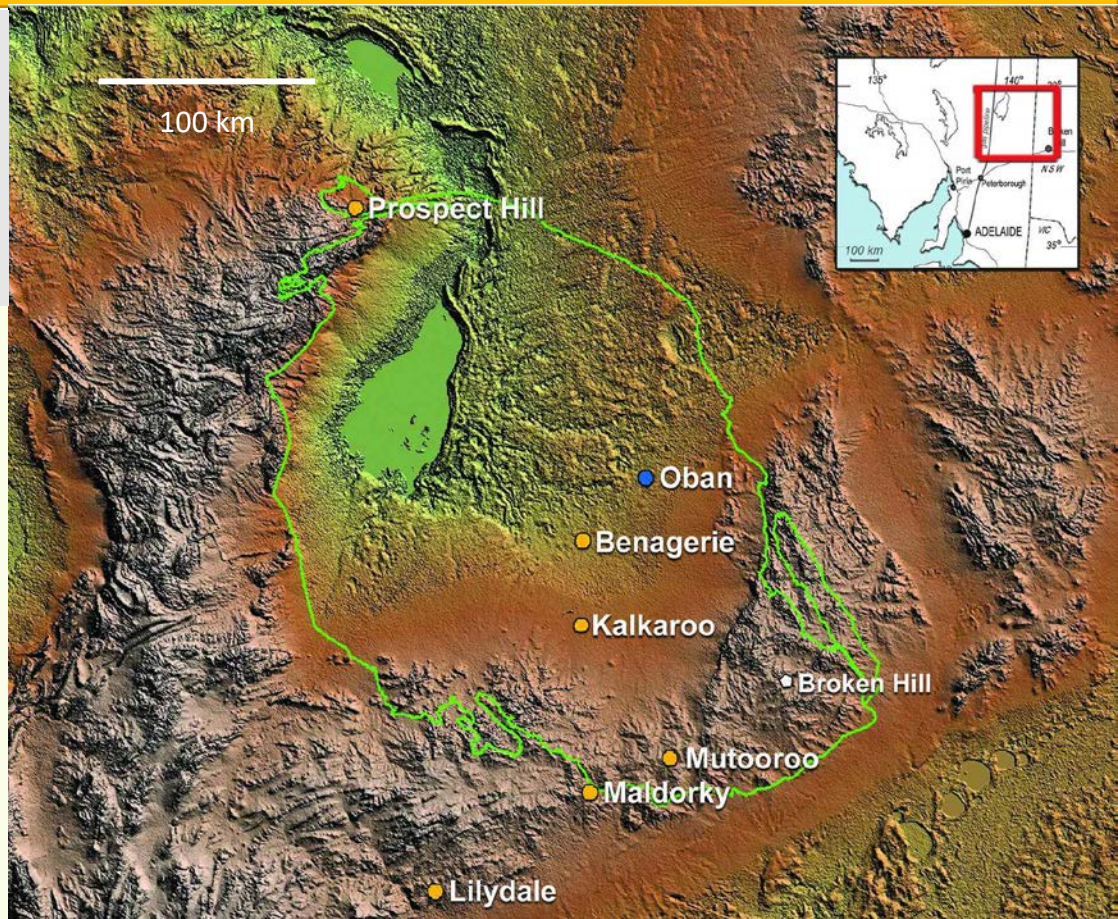
- The Kalkaroo copper-gold mineralisation has associated appreciable levels of critical minerals, including cobalt (**Co**), molybdenum (**Mo**), rare earth elements (**REE**) and tungsten (**W**).
- This critical minerals association is seen at many other copper prospects drilled by Havilah in the surrounding region highlighting the exceptional potential for material new critical minerals discoveries in the Curnamona Province.
- Metallurgical test work to date indicates that the critical minerals in Kalkaroo can potentially be recovered in part by conventional minerals processing technology with some added innovations.
- Critical minerals produced as a by-product of copper-gold mining operations such as Kalkaroo are likely to be a more reliable long-term source of supply as compared to single commodity mining operations because the viability is not affected by the historically widely fluctuating critical minerals prices.
- Conceptually, recovery of critical minerals from an existing copper-gold mining operation is similar to tailings treatment because much of the capital and operating cost has been sunk. The critical minerals potentially provide an additional revenue stream for a reduced cost as compared to a single commodity operation.

Curnamona Province Geological Setting

- Hosts the giant Broken Hill lead-zinc-silver orebody.
- Curnamona Province (ca1720Ma) may have once been joined to the similar age Gawler Craton and Mt-Isa Cloncurry Block – hence sharing similar prospectivity.
- Little outcrop in the Kalkaroo area, hence exploration relies mainly on geophysics and drilling.

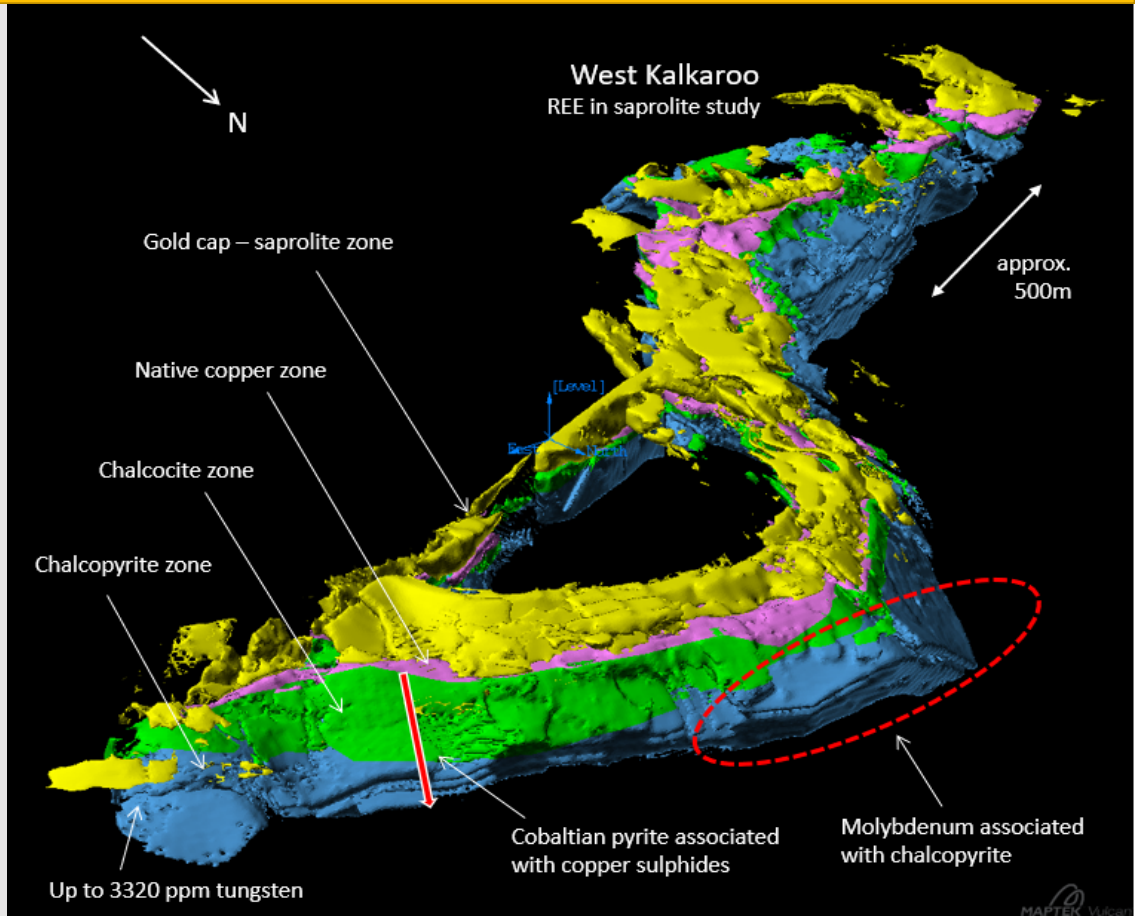


Interpreted relationship of Mt Isa - Cloncurry Block and Curnamona Craton
Reconstruction after Betts et al. 2004 (Monash University)



Kalkaroo Critical Minerals – Co, Mo, REE and W

- Kalkaroo is a moderately large copper-gold-cobalt deposit containing 1.1 million tonnes of copper, 3.1 million ounces of gold and 23,200 tonnes of cobalt in JORC resources (refer to table at end).
- Classified as a structurally controlled stratabound replacement deposit. Key features are a feeder fault structure and reactive carbonate-rich units at a major regional redox boundary.
- Critical minerals associated with copper-gold mineralisation at Kalkaroo include:
- **Cobalt** – JORC Inferred Resource of 23,200 tonnes. Contained entirely within pyrite that is associated with the primary chalcopyrite (refer to table at end).
- **Molybdenum** – occurs as frequent molybdenite in late fractures mainly in the central part of the orebody.
- **REE** – widely distributed both in the weathered zone and within fresh rock. Occurs in the areas of most intense fracturing in proximity to faults.
- **W** – an historic drillhole at the eastern end contains up to 3,320 ppm tungsten in high temperature calc-silicate altered zones.

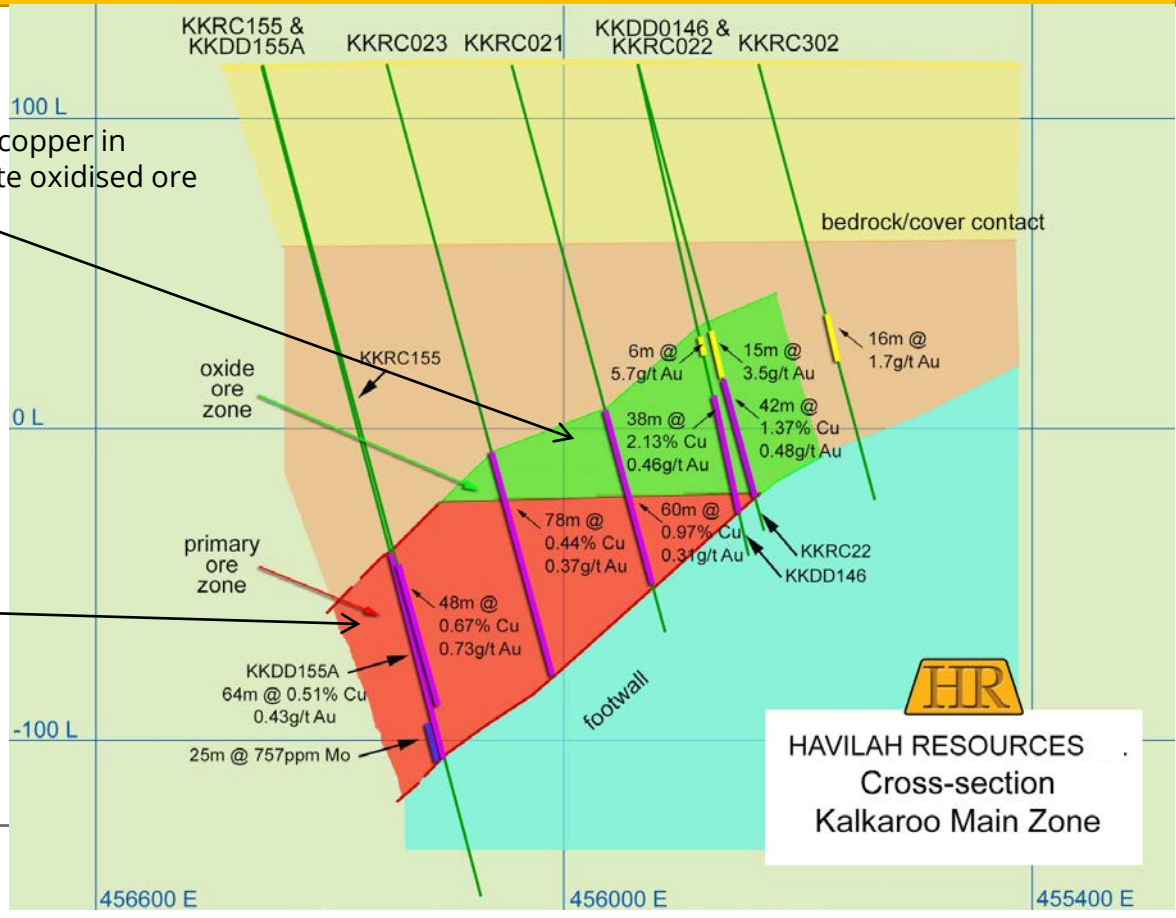


Supergene and Primary Sulphide Replacement Ore

Deep supergene weathering is superimposed on the primary sulphide ore

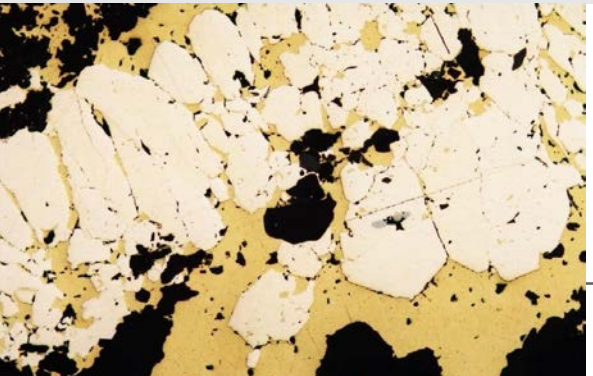
Native copper in saprolite oxidised ore

Primary sulphide ore (chalcopyrite and pyrite)



Cobalt in Pyrite at Kalkaroo

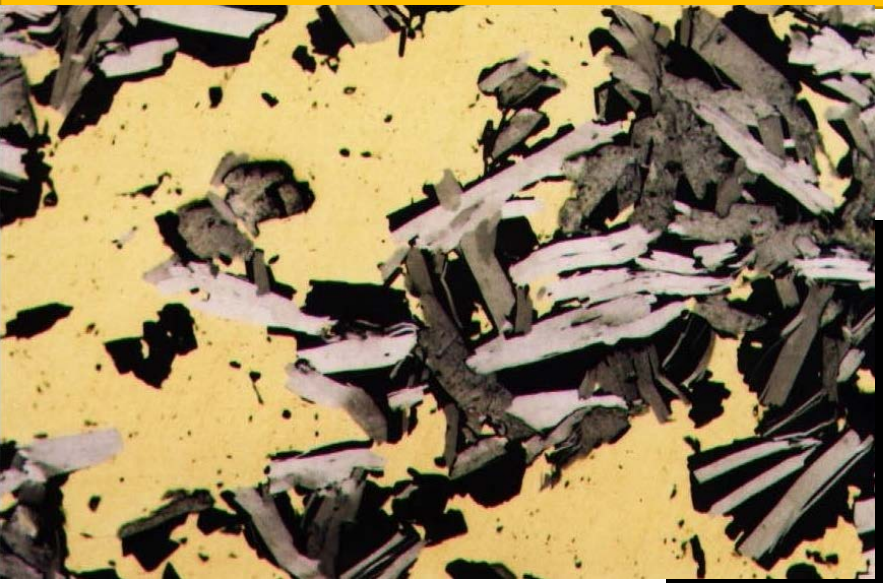
- Extensive metallurgical testwork shows Kalkaroo pyrite contains appreciable amounts of the critical metals **cobalt** (0.28 - 0.40%) and **nickel** (up to 0.1%) as well as **gold** (1.8 - 3.5ppm) and **copper** (0.9 - 1.8%) (ASX announcement 9 May 2019).
- Kalkaroo ore primary sulphide ore mineralogy is typically 1 chalcopyrite : 1.5 pyrite.
- Assuming 120,000 tpa copper concentrate production (per PFS, refer to ASX announcement 18 June 2019) then approximately 180,000 tpa of associated pyrite concentrate has more than 600 tonnes of contained cobalt, some of which is potentially recoverable (or saleable in pyrite concentrate form), as shown in the table below.
- Metallurgical testing established > 90% cobalt recoveries by conventional roasting of the pyrite. Addition of an acid plant could produce sulphuric acid and cogenerate sufficient heat for meaningful electric power production.
- Conceptually the pyrite concentrate (and contained cobalt) could potentially be produced for little additional processing cost by cleaning the copper concentrate tails in a conventional flotation circuit.



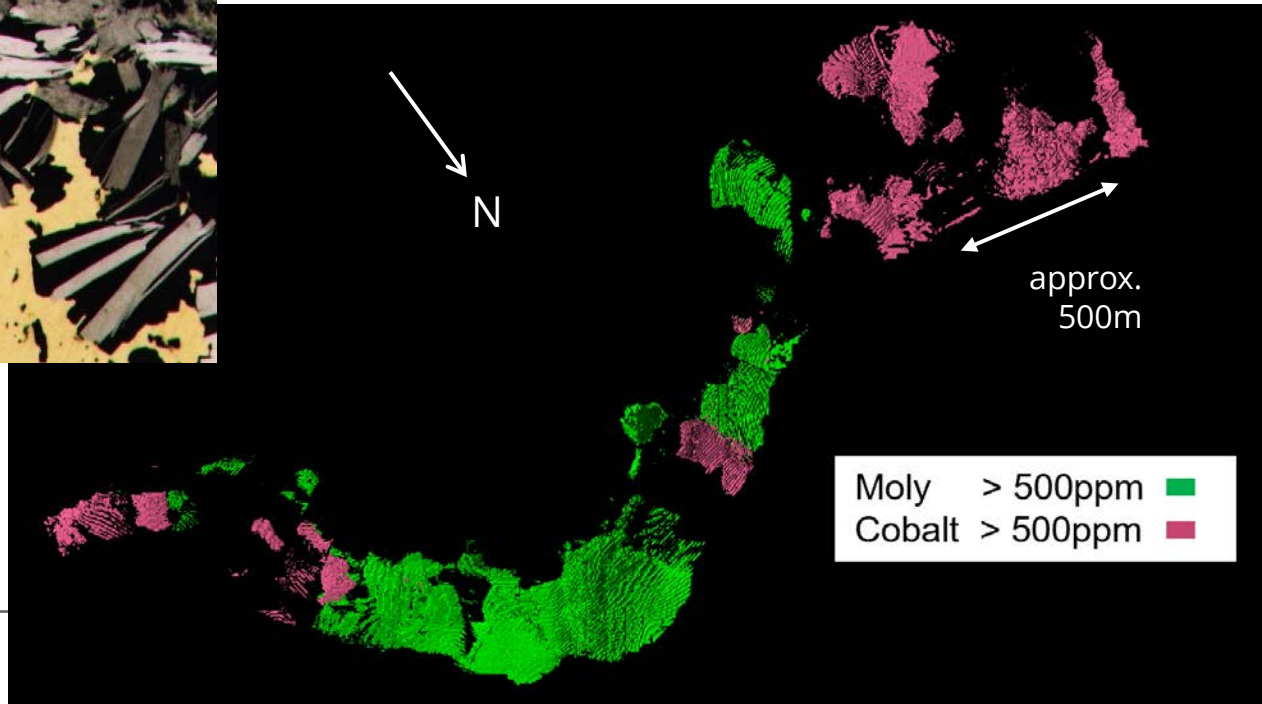
Per annum	Cu%	Fe%	Co ppm	Au ppm	Ni ppm	S%
180,000 tpa pyrite	0.61	39.66	3400	2.43	700	48.5
Contained metal	1,098 t	71,388 t	612 t	14,110 oz	126 t	87,300 t

Vein of chalcopyrite (yellow) intergrown with pyrite (white). Length of photomicrograph is 1.3mm. Reflected light.

Molybdenum at Kalkaroo



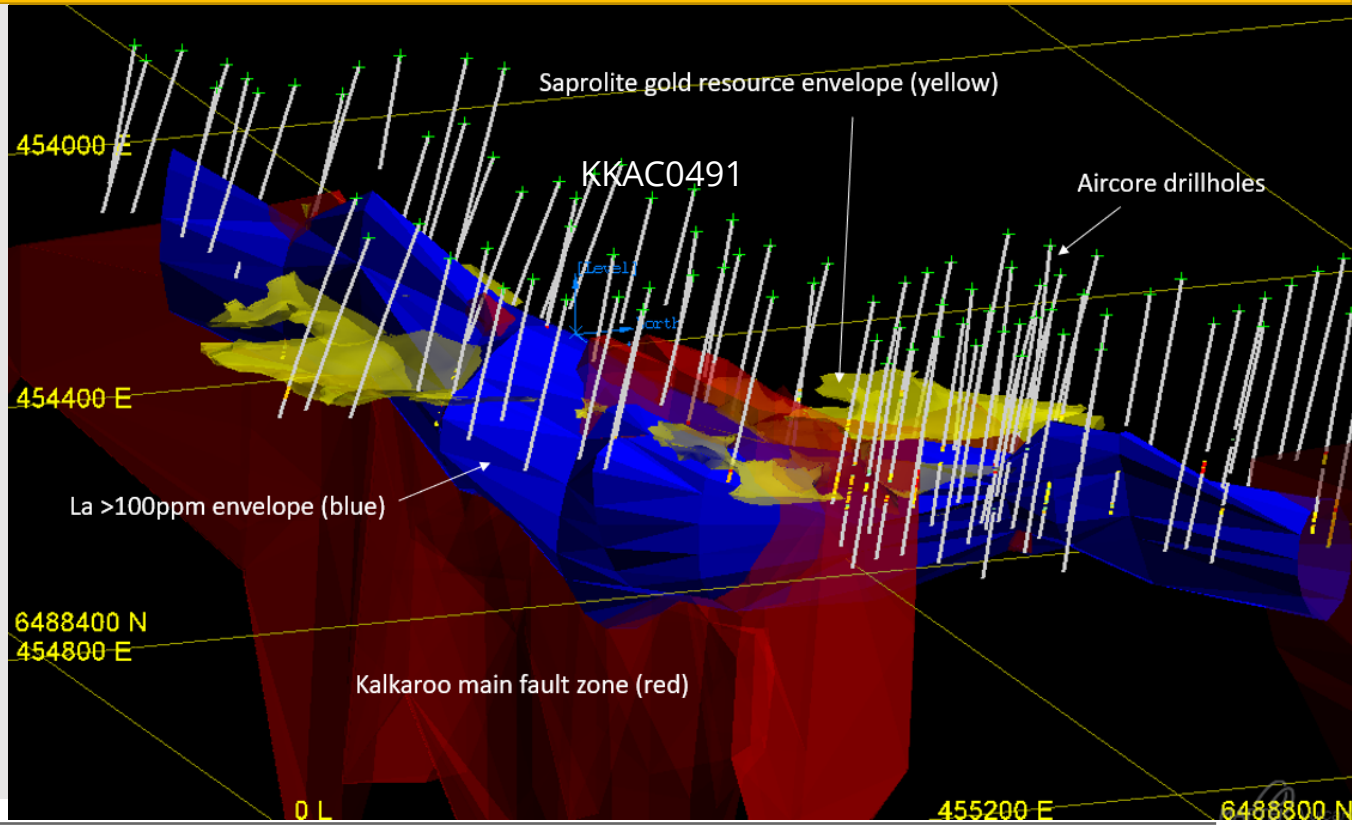
Coarse molybdenite (light grey) intergrown with chalcopyrite (yellow) and biotite (dark grey). Length of photomicrograph is 1.3mm. Reflected light.
Metallurgical test work indicates the molybdenite floats readily.



The central part of the Kalkaroo orebody is richer in molybdenum (green) while the eastern and western ends are depleted in molybdenum and enriched in cobalt.

REE at Kalkaroo

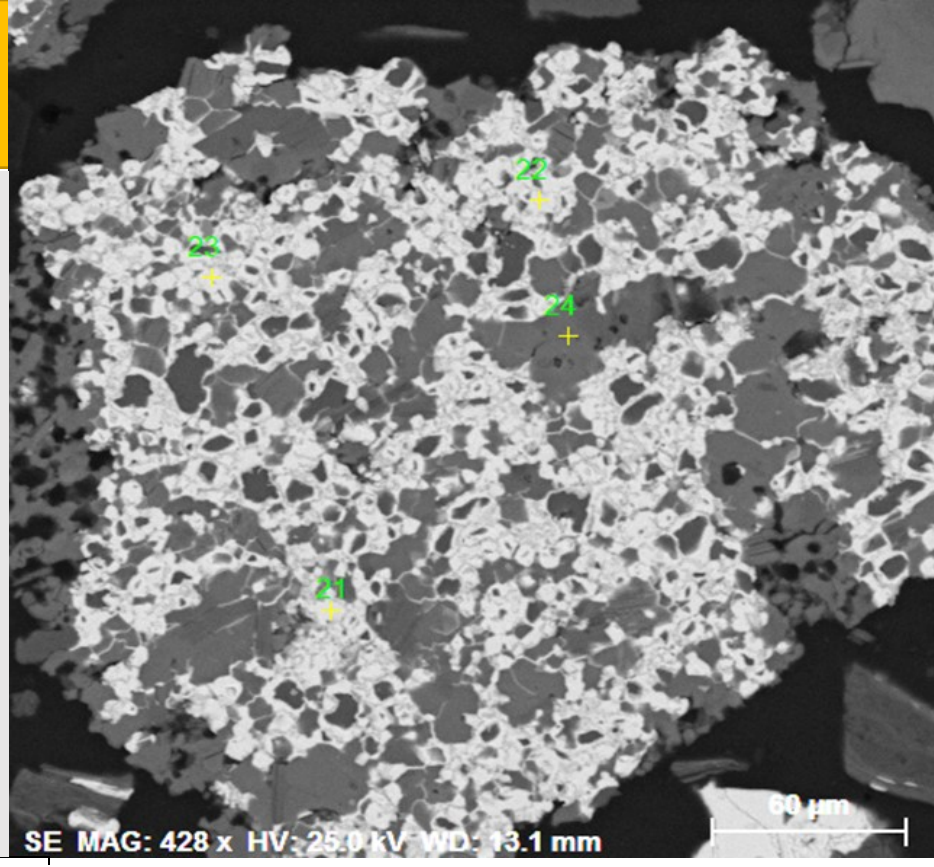
- Re-assaying of earlier drillholes in saprolite gold ore from West Kalkaroo confirmed elevated REE including drillhole KKAC0491: **20 metres of 4,152 ppm TREEO***, 1.57 g/t gold and 0.58% copper from 62-82 metres. (ASX announcement 23 April 2020).
- This included **10 metres of 6,746 ppm TREEO** from 62 to 72 metres, with the higher value magnet metal REE (**MREE**) namely **Dy** + **Nd** + **Pr** + **Tb**, comprising 29% of the TREEO.
- A study of REE in West Kalkaroo saprolite gold ore funded by an ADI grant established that **La** and **Y** were good proxies for the MREE due to the consistent REE ratios.
- The >100 ppm La envelope coincides closely with the > 30 ppm Y envelope and together they show that the REE are proximal to the main Kalkaroo fault zone.
- The study is being expanded to the primary sulphide ore.



Total rare earth oxides (TREEO) is the industry standard and accepted norm for reporting REE and is based on the sum of the estimated grades for the following 15 rare earth oxides: La_2O_3, C_eO_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 Lu_2O_3 and Y_2O_3. Refer to Appendix 1 in ASX announcement 23 April 2020 for details. Note 1 ppm (part per million) = 1 g/t.

REE Research Collaboration

- A fruitful research collaboration with the University of South Australia's Future Industries Institute identified bastnasite, a carbonate-fluoride mineral, as the primary REE host (ASX announcement 3 November 2020)
- Electron microprobe analysis of the bastnasite mineralisation shows it is high in the valuable MREE, Neodymium (Nd), and contains no measurable radioactive uranium or thorium.
- The bastnasite is mostly in the 10-50 micron size fraction and has been concentrated in the laboratory by desliming, flotation and magnetic separation (via WHIMs) due to its paramagnetic properties.
- Research is continuing on REE distribution in the primary sulphide ore and optimization of REE recoveries, including via magnetic separation.
- Bastnasite is the main REE mineral in two of the world's largest REE deposits, namely Bayan Obo (China) and Mountain Pass (USA).

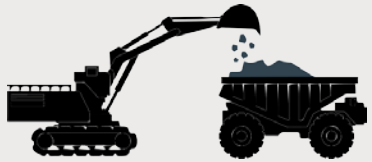


Point	Spot Mineral Analysis - % normalised to 100														Total
Analysis	O	F	Na	Al	Si	K	Ca	Y	Ba	La*	Pr*	Nd*	Sm*	Th	
21	23	8		1	1		2	3		28	6	25	3		100
22	23	8	0	1	0		2	3		28	6	25	3		100
23	22	8	1	1	0		2	3		27	6	26	4		100
24	38			14	29	13			5						100

Scanning electron microscope image of bastnasite (white) intergrown with alumino-silicate clay mineral (dark grey). Spot electron microprobe analyses at points 21, 22 and 23 shows 25%, 25% and 26% Neodymium (Nd) respectively, as detailed in the table. Point 24 contains no REE because it is an analysis of the intergrown clay mineral that comprises oxygen (O), aluminium (Al), silicon (Si), potassium (K) and barium (Ba) but no sodium (Na) or calcium (Ca). *For REE names *Refer to Appendix 1 in ASX announcement 23 April 2020*

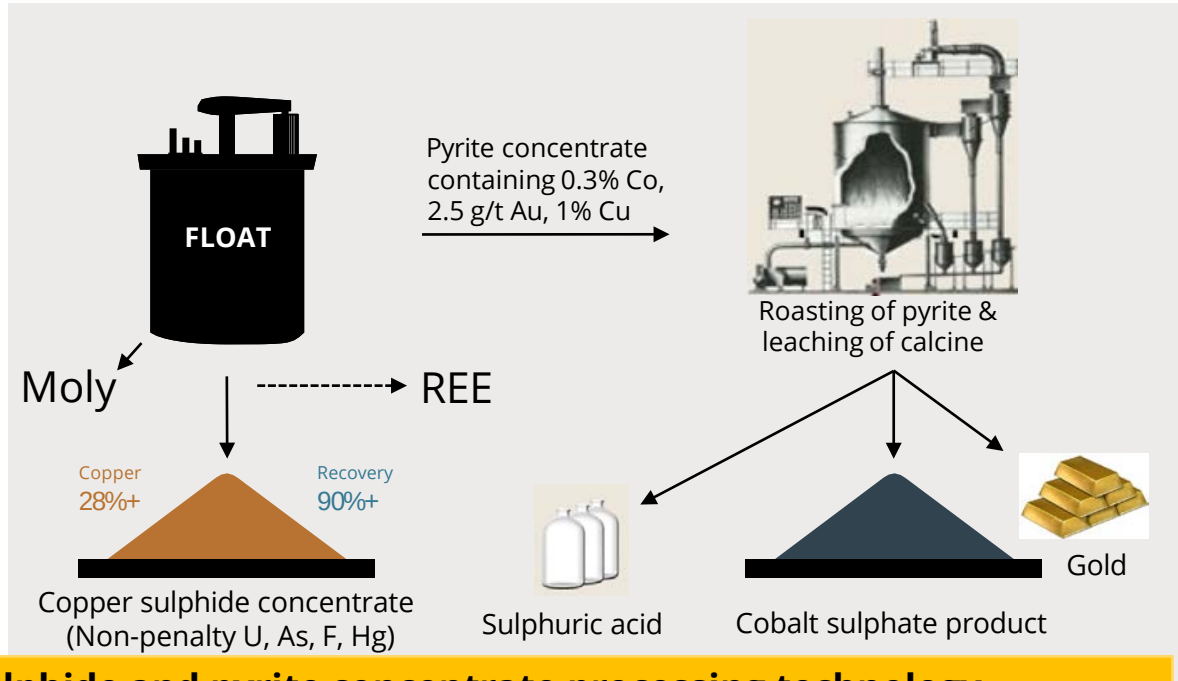
Conventional Sulphide Ore Processing Technologies Applicable

1 Open pit mining



2 Ore crushing / grinding

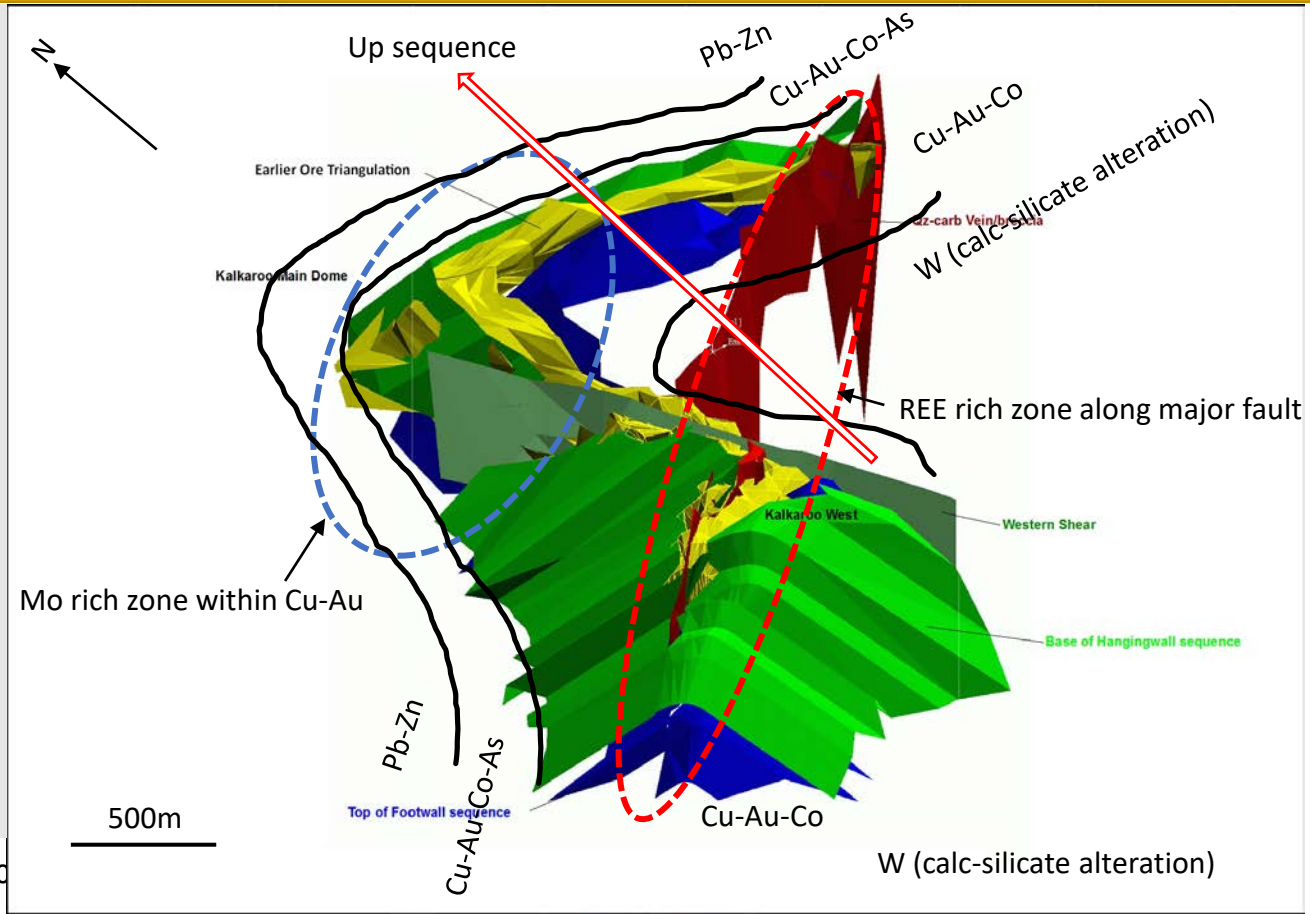
3 Conceptual processing of Kalkaroo sulphide ore



Established copper sulphide and pyrite concentrate processing technology

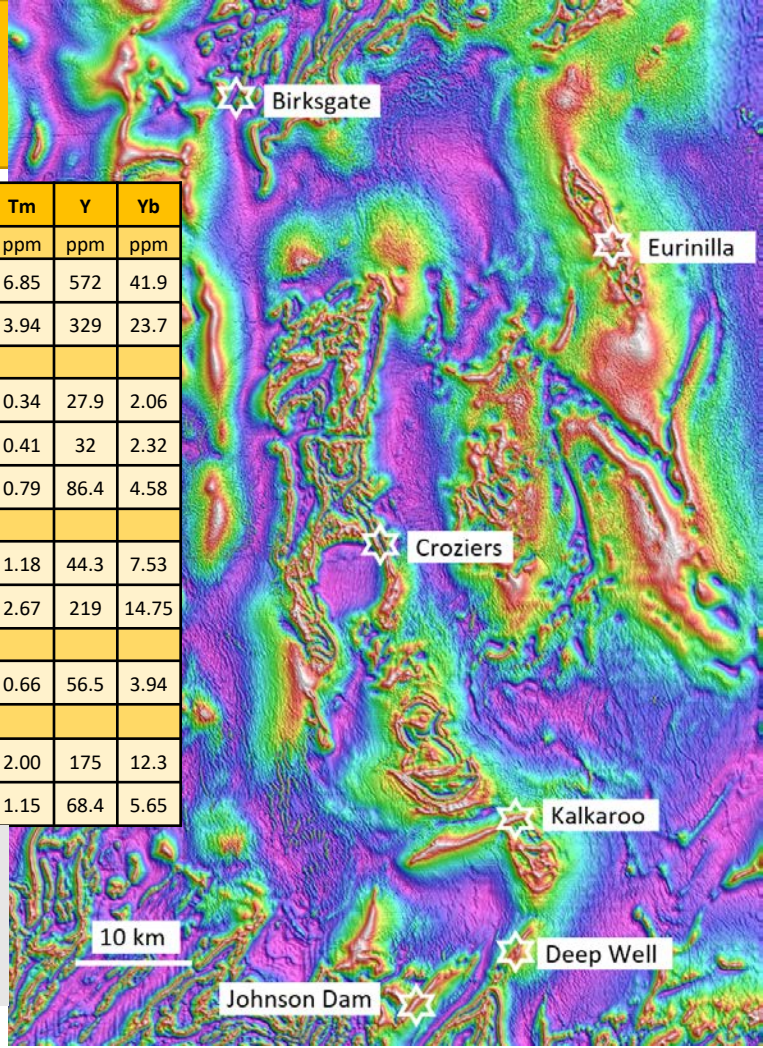
Metal Zonation Within Kalkaroo Orebody

- The arrow indicates the general direction of the inferred temperature gradient, which is interpreted to have controlled the sequence of metal deposition.
- Because the temperature gradient was also up stratigraphy the metals tend to be confined to certain parts of the stratigraphy.
- For example W is generally found deeper in the footwall, Cu-Au-Co-Mo in the prospective sequence and Pb-Zn in the hangingwall rocks.
- REE occur with Cu-Au-Co but are probably focused along or near the major mineralised Kalkaroo fault zone in possibly the last mineralising event.



Critical Minerals in the Wider Curnamona Province

DRILLHOLE	FROM	TO	Cu	Au	Ce	Dy	Er	Eu	Gd	Ho	La	Lu	Nd	Pr	Sm	Tb	Tm	Y	Yb
KALKAROO[1]	(metres)		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
KKAC0421	72	73	3990	0.67	2030	103.5	51.3	51.2	186	18.8	2150	6.58	1355	366	236	21	6.85	572	41.9
KKAC0421	74	75	1890	5.96	480	47.7	28.3	21.8	76.8	9.32	1140	3.82	602	172	99.1	9.2	3.94	329	23.7
CROZIERS[1]																			
CRRC004	75-77 & 82-87		5349	0.09	6104	7.63	2.67	8.92	21.0	1.09	5443	0.28	953	425	67.5	2.26	0.34	27.9	2.06
CRRC007	27	31	120	0.01	2395	7.9	3.12	7.86	17.79	1.27	1730	0.31	400	157	41.2	1.97	0.41	32	2.32
BNG13DD001	244.5	245	210	0.004	5960	19.5	6.77	10.55	43.4	3.01	5410	0.78	1075	426	88.9	4.86	0.79	86.4	4.58
EURINILLA[1]																			
EUR14DD008	137.5	139.5	5645	2.67	501	25.3	8.32	30.9	73.6	3.54	1775	1.30	2408	808	254	7.0	1.18	44.3	7.53
EUR14DD003	180.5	181.5	1550	0.089	500	65.9	24.5	31.9	117.5	10.5	340	2.02	897	197.5	172.5	15.4	2.67	219	14.75
BIRKSGATE[1]																			
BRK14DD007	291	292	253	0.008	501	17.65	5.02	17.65	66.9	2.36	2490	0.7	1585	537	193	5.5	0.66	56.5	3.94
JOHNSON D[2]																			
KKRC0621	62	63	2000	0.01	731	40.9	16.2	14.1	76.4	6.36	209	1.68	543	110	104	8.96	2.00	175	12.3
KKRCO624	15	16	148	0.01	6900	45	11.3	35.8	126	5.78	1590	0.70	1500	414	226	14.1	1.15	68.4	5.65



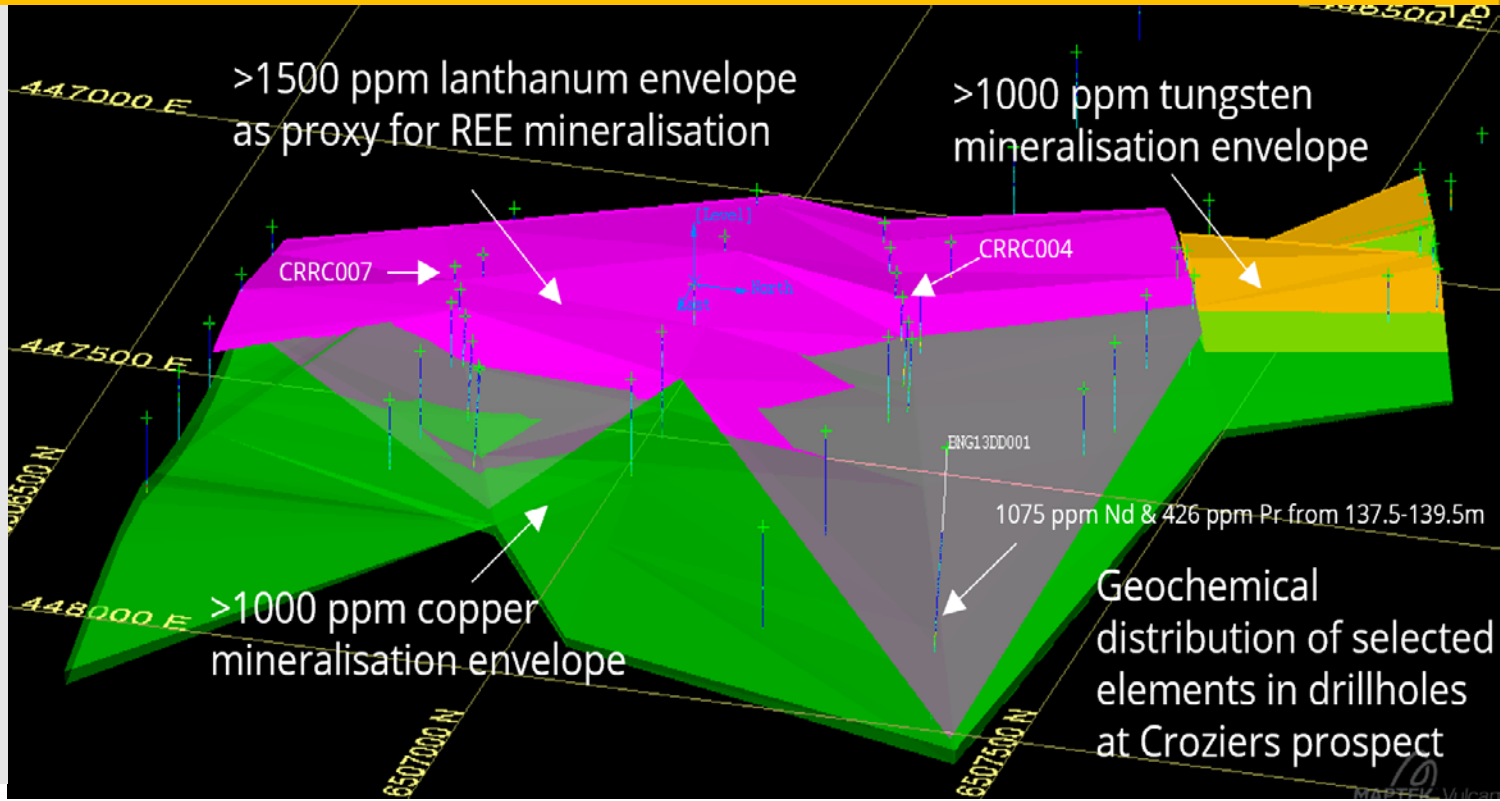
- The critical minerals associated with Kalkaroo style copper-gold mineralisation are widespread in the Curnamona Province, especially cobalt and REE.
- The table above shows highly elevated REE in drilling from four regional prospects

[1] Refer ASX announcement 7 January 2020 [2]Refer ASX announcement 17 May 2023

Croziers Copper Prospect

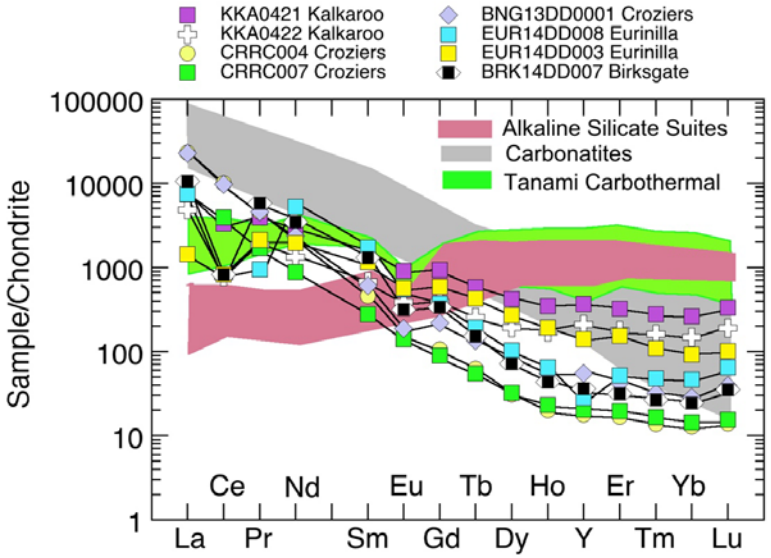
- Results for a single drillhole (BNG13DD001) at the Croziers copper prospect show elevated levels of the higher value MREE (ASX announcement 7 January 2020).

- Using the light-REE lanthanum as a proxy for these elements there is a broad REE mineralisation envelope at Croziers (pink and grey). This envelope partially overlaps a copper mineralised envelope (green) and abuts a tungsten mineralised zone (yellow).

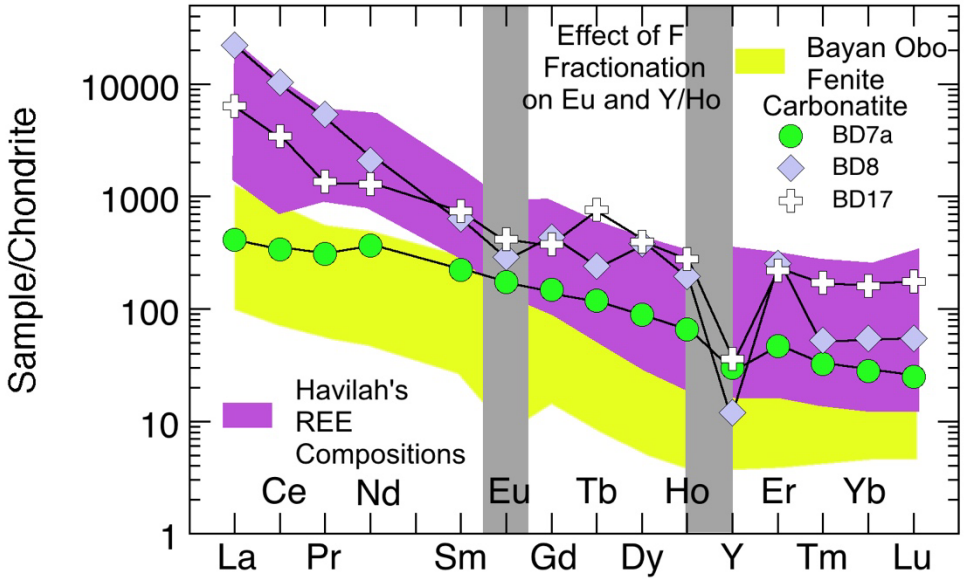


Characterisation of Curnamona Province REE

Based on the work of Emeritus Professor Ken Collerson



Havilah REE patterns superimposed on typical field exhibited by carbonatites, agpaitic undersaturated alkaline suites and carbothermal secondary deposits. The smoothly fractionated shape of the Havilah data is remarklably similar to that shown by carbonatites



Havilah REE field superimposed on the REE patterns for Bayan Obo carbonatites and fenites (data from Wang et al., 2018). Note the similarity in shape of the Bayan Obo and Havilah REE patterns.

Diagrams taken from Emeritus Professor Ken Collerson's report - refer to ASX announcement 19 February 2020 (Appendix 1)

Kalkaroo Critical Minerals – Key Conclusions

- The Kalkaroo copper-gold mineralisation has associated appreciable levels of critical minerals, including cobalt, molybdenum, rare earth elements and tungsten.
- This critical minerals association is seen at many other copper prospects drilled by Havilah in the surrounding region and is considered to be a fundamental metallogenic feature of this part of the Curnamona Province.
- Metallurgical test work conducted to date indicates that the critical minerals can potentially be recovered in large part by conventional minerals processing technology.
- As a by-product, critical minerals production will be less affected by the historically widely fluctuating critical minerals prices compared to single commodity operations. Conceptually, additional processing recovery costs would be incremental to any sunk capital and operating costs of a mining operation, hence favouring the potential recovery and sale of critical minerals as an additional source of mining revenue.
- All metals in Kalkaroo are considered to have deposited sequentially according to a temperature gradient that has progressively decreased as the mineralising fluids have moved up stratigraphy along major faults, similar to that observed in porphyry copper systems. Reactive host rocks, including the carbonate-rich prospective sequence and graphitic pelite hangingwall, have provided chemical traps resulting in a gross stratabound control on mineralisation. There is strong structural overprinting in the form of local cross-cutting breccia/vein hosted mineralisation in fault zones.

Kalkaroo JORC Ore Reserve and Mineral Resources

Kalkaroo JORC Ore Reserves as at 31 July 2022 from Havilah 2022 Annual Report

Project	Classification	Tonnes (Mt)	Copper %	Gold g/t	Copper tonnes (Kt)	Gold ounces (Koz)
Kalkaroo [1]	Proved	90.2	0.48	0.44	430	1,282
	Probable	9.9	0.45	0.39	44	125
	Total	**100.1**	**0.47**	**0.44**	**474**	**1,407**

Kalkaroo JORC Mineral Resources as at 31 July 2022 from Havilah 2022 Annual Report

Project	Classification	Resource Category	Tonnes	Copper %	Cobalt %	Gold g/t	Copper tonnes	Cobalt tonnes	Gold ounces
Kalkaroo [2]	Measured	Oxide Gold Cap	12,000,000			0.82			
	Indicated	Oxide Gold Cap	6,970,000			0.62			
	Inferred	Oxide Gold Cap	2,710,000			0.68			
	Total	**Oxide Gold Cap**	**21,680,000**			**0.74**			**514,500**
	Measured	Sulphide Copper-Gold	85,600,000	0.57		0.42			
	Indicated	Sulphide Copper-Gold	27,900,000	0.49		0.36			
	Inferred	Sulphide Copper-Gold	110,300,000	0.43		0.32			
	Total	**Sulphide Copper-Gold**	**223,800,000**	**0.49**		**0.36**	**1,096,600**		**2,590,300**
		Total Kalkaroo	**245,480,000**				**1,096,600**		**3,104,800**
	Inferred	Cobalt Sulphide[3]	193,000,000		0.012			23,200	

Numbers in above tables are rounded. **Ore reserves are a subset of the Mineral Resources**

Footnotes to 2022 JORC Ore Reserve and Mineral Resource Tables

[1] Details released to the ASX: 18 June 2018 (Kalkaroo)

[2] Details released to the ASX: 30 January 2018 and 7 March 2018 (Kalkaroo)

[3] Note that the Kalkaroo cobalt Inferred Resource is not added to the total tonnage

Cautionary and Competent Person's Statements

Cautionary Statement

The information contained in this presentation is not financial product advice and does not constitute an offer. The presentation is for information purposes and is of a general and summary nature only. Neither Havilah Resources Limited (Havilah) nor any member of the Havilah Group of companies, gives no warranties in relation to the statements and information in this presentation. Investors should seek appropriate advice on their own objectives, financial situation and needs.

It is not recommended that any person makes any investment decision in relation to Havilah or the Kalkaroo project based on this presentation. This presentation should be read in conjunction with the latest Annual Report together with any announcements made by Havilah in accordance with its continuous disclosure obligations arising under the *Corporations Act 2001*.

This presentation contains certain statements which may constitute 'forward-looking statements'. Such statements are only predictions and are subject to inherent risks and uncertainties which could cause actual values, performance or achievements to differ materially from those expressed, implied or projected in any forward-looking statements. Havilah disclaims any intent or obligation to update publicly any forward-looking statements, whether as a result of new information, future events or results or otherwise. Investors are cautioned that forward-looking statements are not guarantees of future performance and investors are cautioned not to put undue reliance on forward-looking statements due to the inherent uncertainty therein.

Given the ongoing uncertainty relating to the duration and extent of the global COVID-19 pandemic, and the impact it may have on the demand and price for commodities, on our suppliers and workforce, and on global financial markets, the Company continues to face uncertainties that may impact its operating and financing activities.

Competent Person's Statement

The information in this presentation that relates to Exploration Results, Mineral Resources and Ore Reserves is based on data compiled by geologist Dr Chris Giles, a Competent Person who is a member of The Australian Institute of Geoscientists. Dr Giles is Technical Director of the Company, a full-time employee and is a substantial shareholder. Dr Giles has sufficient experience, which is relevant to the style of mineralisation and type of deposit and activities described herein to qualify as a Competent Person as defined in the 2012 Edition of *'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'*. Dr Giles consents to the inclusion in the presentation of the matters based on his information in the form and context in which it appears.

Information for the Kalkaroo Ore Reserve & Mineral Resource complies with the JORC Code 2012. Havilah confirms that all material assumptions and technical parameters underpinning the reserves and resources continue to apply and have not materially changed. Except where explicitly stated, this presentation contains references to prior exploration results and JORC Mineral Resources, all of which have been cross-referenced to previous ASX announcements made by Havilah. The Company confirms that it is not aware of any new information or data that materially affects the information included in the relevant ASX announcements.