

3 November 2020

KALKAROO RARE EARTH ELEMENT STUDIES UPDATE

HIGHLIGHTS

- **Bastnasite**, a carbonate-fluoride mineral, is identified as the primary rare earth element (**REE**) host in the West Kalkaroo oxidised copper-gold ore samples currently being studied via the research collaboration with the University of South Australia's Future Industries Institute.
- The bastnasite mineralisation is high in the more valuable REE (e.g. neodymium) and contains no measurable radioactive uranium or thorium (**Th**) and hence should present no handling or waste issues.
- The bastnasite is mostly in the 10-50 micron size fraction and is well suited to concentration by flotation and other methods specific to REE, as the research work has shown.
- Bastnasite is the chief valuable REE mineral in two of the world's largest REE deposits and its metallurgy is therefore well studied.
- Ongoing research work aims to integrate bastnasite recovery in a gold-copper processing circuit and to produce sufficient bastnasite (and REE) concentrate for preliminary marketing studies.

Havilah Resources Limited (Havilah or Company) has identified significant REE discovery potential on its extensive Curnamona Craton exploration tenements in northeastern South Australia ([refer to ASX announcement of 7 January 2020](#)). This was confirmed by an independent international REE expert, Emeritus Professor Ken Collerson, who drew analogies to the large Bayan Obo REE deposit in China ([refer to ASX announcement of 19 February 2020](#)).

Over the past five months Havilah, in collaboration with the University of South Australia's Future Industries Institute, has been conducting research studies into the nature of the Kalkaroo REE mineralisation ([refer to ASX announcement of 1 June 2020](#)). Samples were collected from West Kalkaroo drillholes, drilled especially for this purpose, including drillhole KKAC0491 which showed highly elevated levels of REE including 20 metres of 4,152 ppm TREO*, 1.57 g/t gold and 0.58% copper from 62-82 metres ([refer to ASX announcement of 23 April 2020](#)).

**Total rare earth oxides (TREO) 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: La₂O₃, CeO₂, Pr₆O₁₁, Nd₂O₃, Sm₂O₃, Eu₂O₃, Gd₂O₃, Tb₄O₇, Dy₂O₃, Ho₂O₃, Er₂O₃, Tm₂O₃, Yb₂O₃, Lu₂O₃ and Y₂O₃. ([Refer to Appendix 1 in ASX announcement of 23 April 2020 for further details](#)). Note ppm = parts per million. 1 ppm = 1 g/t (gram/tonne).*

The laboratory research work on the West Kalkaroo samples thusfar is highly encouraging, with the following key results:

1. The primary REE hosting mineral identified is bastnasite, a REE rich carbonate-fluoride mineral (chemical formula REECO₃F, where REE may include variable proportions of the various REE elements). Bastnasite is the chief valuable REE mineral in two of the world's largest REE deposits, namely Bayan Obo in China and Mountain Pass in California. As a result, the REE processing technology for bastnasite is relatively well known. It has the advantage of low radioactivity levels due to generally low uranium and thorium contents, which potentially avoids related handling and/or waste problems, unlike some other common REE minerals such as monazite.
2. Electron microprobe analyses of bastnasite intergrown with clay minerals shows up to 28% of the valuable REE, neodymium (Figure 1).

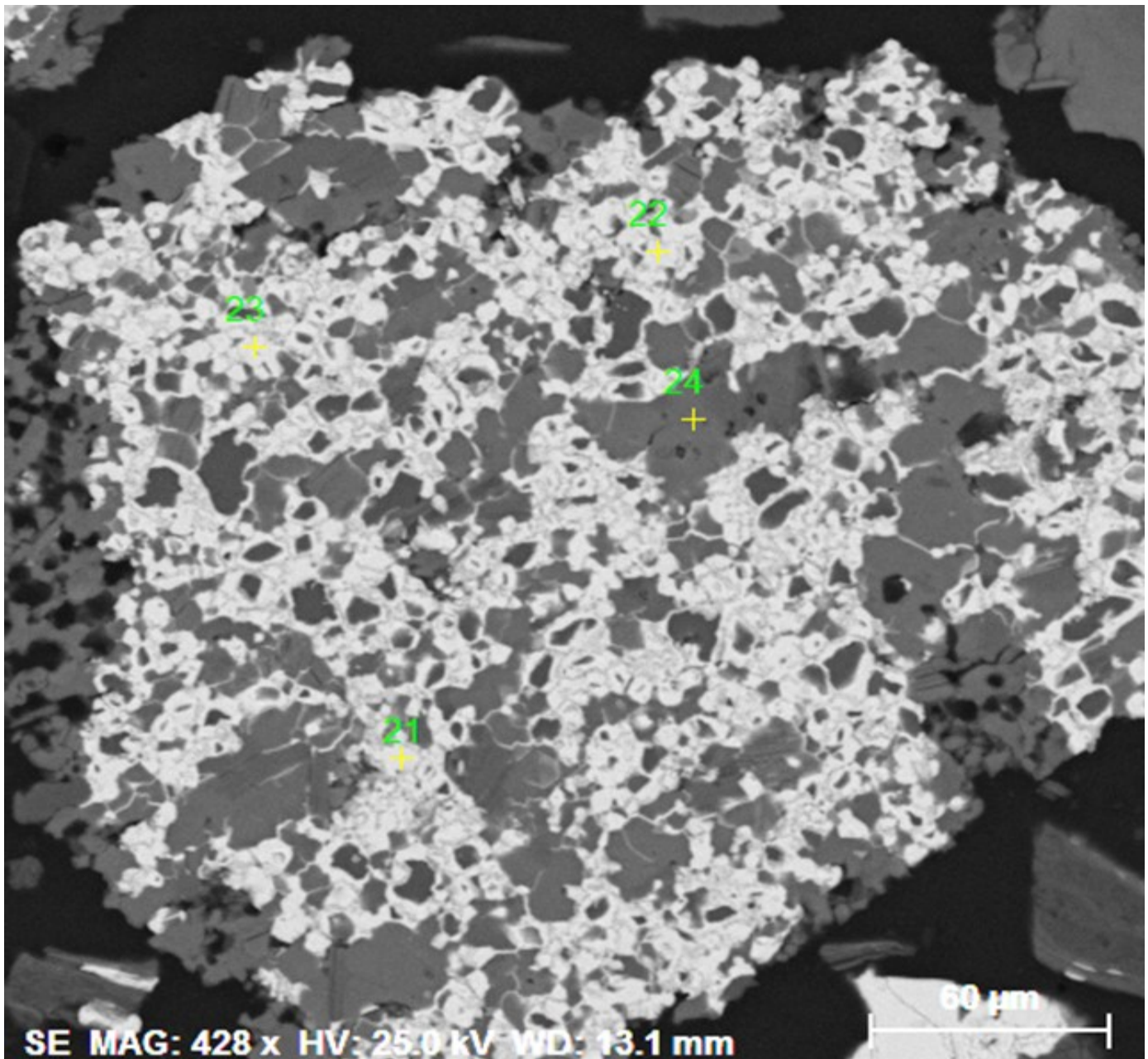


Figure 1 Scanning electron microscope image of bastnasite (white) intergrown with aluminosilicate clay mineral (dark grey). Spot electron microprobe analyses at points 21, 22 and 23 shows 25%, 25% and 26% neodymium (**Nd**) respectively, as detailed in the table below. Point 24 contains no REE because 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 see diagram on page 4.

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

Acknowledgement to Bureau Veritas Adelaide laboratory for the image and the relevant analytical data.

3. Bastnasite is preferentially concentrated in the 10-50 micron size range, which is well suited to concentration by flotation and other methods specific to REE minerals.
4. Desliming, involving removal of the under 10 micron size clay fraction, and flotation significantly concentrates the bastnasite.

The collaborative research work is ongoing with several important objectives currently being pursued:

1. Optimising bastnasite (and REE) recoveries via flotation and other methods suited to the extremely fine, clayey and oxidised nature of the Kalkaroo saprolite ore material.
2. Determining how best to integrate REE recovery into the gold and native copper processing flow sheet that is presently being finalised by Melbourne-based mining process engineering firm, Mincore Pty Ltd ([refer to ASX announcement of 14 October 2020](#)).
3. Obtaining sufficient bastnasite (and REE) concentrate to commence preliminary marketing studies.

The above research work is closely aligned with the Commonwealth government's critical minerals strategy, which recognises security of the critical minerals supply chain (including REE and cobalt) as a high priority for government backing and support. Austrade's [Critical Minerals Prospectus 2020](#) showcases Havilah's Kalkaroo copper-gold-cobalt project on pages 51, 66 and 67.

Commenting on the REE recovery research results Havilah's Technical Director, Dr Chris Giles, said:

"We are very pleased to have undertaken this collaborative research with the University of South Australia, which has allowed us to tap into the Future Industries Institute's highly specialised REE recovery expertise at its well-equipped metallurgical research laboratory in South Australia.

"Identification of bastnasite as the primary REE mineral is an extremely positive outcome of our joint research.

"The West Kalkaroo bastnasite mineralisation is high in the more valuable REE and is unusual in being intimately associated with stratabound copper and gold mineralisation.

"We have demonstrated in the laboratory that we can significantly concentrate the bastnasite due to the fact that most of it is at an optimum mineral size range for various concentration methods.

"Havilah's main focus is getting the Kalkaroo copper-gold project underway, but if we can produce a valuable REE by-product for little additional cost and effort it could provide an economic advantage for the Kalkaroo project compared to those projects that are solely reliant on REE.

"Subject to research work in progress, early REE production may be achieved from the conceptual gold-only starter open pit at West Kalkaroo because of the comparatively shallow depths of the combined REE mineralisation in the extremely fine, clayey and oxidised Kalkaroo saprolite gold ore material.

"The value upside for Havilah is that if REE can be economically recovered in a bastnasite concentrate as a by-product of the standard copper and gold recovery processes it potentially provides a further revenue stream for the Kalkaroo copper-gold-cobalt project, which enhances its development prospects," he said.

About Rare Earth Elements

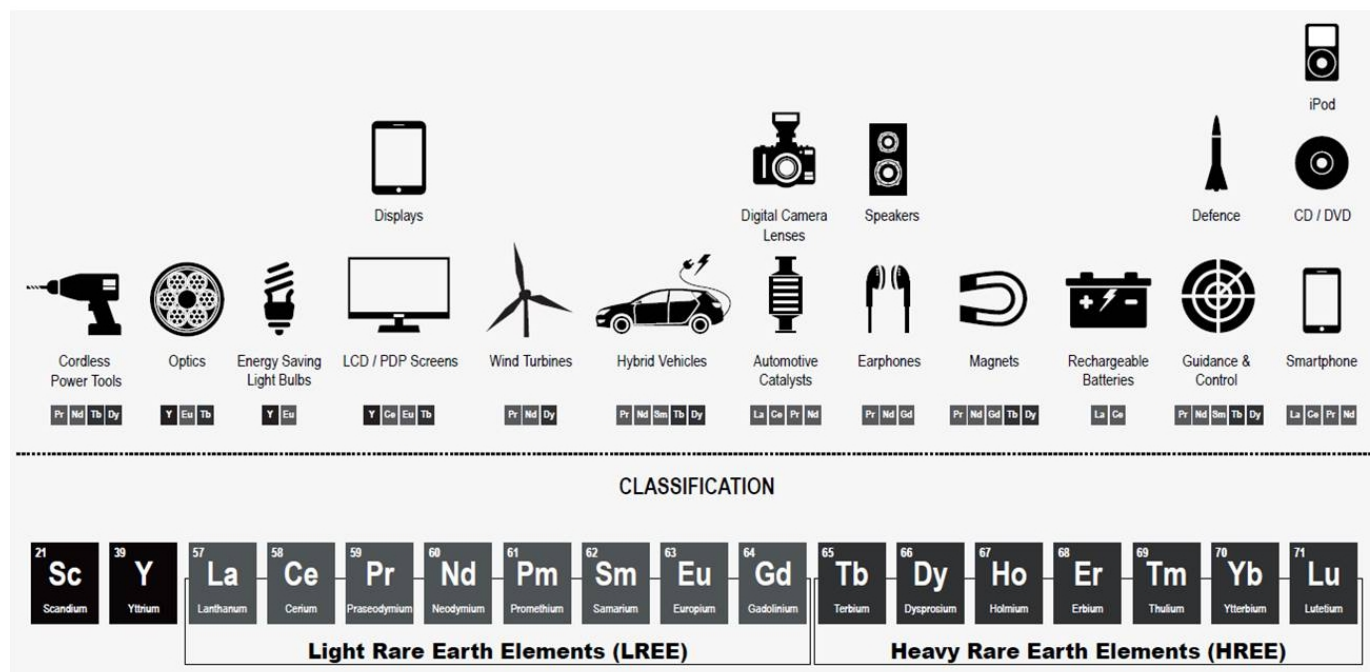
REE are a related group of 16 elements (lanthanides plus yttrium (Y)) that are not particularly rare and are typically widely dispersed in the earth's crust. However, there are limited minerals containing appreciable levels of REE and they tend to only form economic concentrations under rather uncommon geological conditions. For this reason REE are currently strategic and critical minerals for industry.

The lanthanide series of elements can be further subdivided into light-REE and heavy-REE. Light-REE are generally more abundant and less valuable than the heavy-REE.

REE have a wide variety of important and often energy saving modern age uses because of their spectrum of slightly varying chemical behaviours. For example, modern brushless electric motors as used in power tools

and many electric vehicles rely on powerful new generation magnets that use neodymium (**Nd**), dysprosium (**Dy**), praseodymium (**Pr**) and Terbium (**Tb**) compounds as vital components.

Some of the many other uses of REE are summarised in the diagram below, along with their classification, chemical symbols and names.



Acknowledgement of source for above diagram: China Water Risk report “Rare Earths: Shades of Grey-Can China continue to fuel our clean and smart future?” (published June 2016).

About the Kalkaroo Copper-Gold-Cobalt Project (HAV 100% ownership)

The Kalkaroo project is Havilah’s flagship mineral project, located approximately 400 kilometres northeast of Adelaide and 95 km northwest of the regional mining centre of Broken Hill with its skilled workforce, in proximity to the transcontinental railway line and Barrier highway. The project comprises several granted Mining Leases and hosts a JORC Ore Reserve that contains copper and gold amenable to a large-scale open pit mining operation. Havilah also owns the Kalkaroo Station pastoral lease, a non-mineral asset on which the Kalkaroo project is located, reducing land access risks for the project. Havilah is presently advancing the feasibility studies and permitting for a low capital gold-only starter open pit at West Kalkaroo. This will further de-risk the project and provide optionality for development of the larger scale copper-gold project in the event sufficient capital becomes available in the future. (refer to Havilah’s [Annual Report in the ASX announcement of 27 October 2020](#) and the [Kalkaroo project web page](#)).

This release has been authorised on behalf of the Havilah Resources Limited Board by Mr Simon Gray.

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Cautionary Statement

This announcement 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. 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 (including gold), 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 Statements

The information in this announcement that relates to Exploration Targets, Exploration Results, JORC Mineral Resources and Ore Reserves is based on data and information 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 under consideration and to the activities being undertaken 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 announcement of the matters based on his information in the form and context in which it appears.

Except where explicitly stated, this announcement contains references to prior exploration results 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.