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November 26, 2020

Haoma Mining Shareholder Update

To all shareholders,

This shareholder report updates the November 12, 2020 Shareholder Update. It includes updated information on Haoma's Rare Earths project at Spear Hill. For completeness, data from the November 12 release has been repeated with updated information now added in red.

Haoma's Spear Hill Tenement Group C145/2016 comprising M45/1286, E45/4586, E45/4587, P45/2974, P45/2975, E45/5834 (under application) and E45/5835 (under application) are shown in Figure 7. The figure 'overviews' approximately **2 million tonnes of Spear Hill Tailing Sands** which were deposited in the 1970s by **Endeavour Resources Ltd** after recovering tin and tantalum. Figure 4 shows approximately 284,000 tonnes of untreated **Spear Hill Stockpiles**.

Cyanide leaching of a sample of Spear Hill Tailings Sands at Bamboo Creek gave an AAS gold reading of 17.75 g/t. AAS gold readings for gravity split fractions of the Spear Hill Tailings Sands are shown in Table 3b. **No significant radioactivity** was detected in any of the **Spear Hill Tailing Sands** samples.

Table 1 below shows assays of **Spear Hill Stockpiles A & B** and **Spear Hill Tailing Sands**. The grades (in ppm) of numerous **Rare Earths** and **other elements** (**not common)** were measured by ALS assays from acid solutions.

1. Processing ore through the Bamboo Creek Plant

The following is a summary of the different ores which have recently been processed through the Bamboo Creek Plant (i.e. since September 14, 2020). **Additional equipment is being installed** in the Bamboo Creek Plant. Shareholders will be advised of the gold production rate in the next few weeks.

1.1 Bamboo Creek stockpiled 'Kitchener' low grade ore

To date approximately 500 tonnes of Bamboo Creek stockpiled **'Kitchener' low grade ore** has been processed through the Bamboo Creek Plant. Gravity separation resulted in approximately **7.8 tonnes of Concentrates** being recovered by the Knelson concentrator, Spiral concentrator and Falcon concentrator.

1.2 Bamboo Creek stockpiled 'Bamboo Queen Pit' low grade ore

As in early September approximately 500 tonnes of a 2,000 tonne **'Bamboo Queen Pit' stockpiled low grade ore** was processed through the Bamboo Creek Plant. Gravity separation resulted in approximately **5.2 tonnes of Concentrates** being recovered by the Knelson concentrator, Spiral concentrator and Falcon concentrator. The remaining 1,500 tonnes of stockpiled low grade ore is being processed and gold will be recovered from the Concentrate over the next 3 weeks.

1.3 Bamboo Creek 'Alluvial ore'

In late August approximately 1,000 tonnes of **Bamboo Creek 'Alluvial ore'** was processed through the Bamboo Creek Plant. Gravity separation resulted in approximately **8 tonnes of Concentrates** being recovered by the Knelson concentrator, Spiral concentrator and Falcon concentrator. No further work has been conducted on these concentrates.

2. Bamboo Creek Concentrates are now being processed through the Plant

Presently 7.3 tonnes of **Concentrates** produced from the combined 500 tonnes of 'Kitchener' low grade ore (See 1.1 above) and 500 tonnes of 'Bamboo Queen Pit' low grade ore (See 1.2 above) is being **bulk cyanide leached in the Bamboo Creek Plant**.

To date **187.96 g** (est.) **of gold** in bullion has been produced; and **680g of gold** in cyanide solution **(40 tonne of solution at 17ppm = 680g gold).** The gold so far recovered (estimate of **867.96g** in bullion and in cyanide solution) to date equates to **0.87g/t. Processing is continuing. Additional gold will be recovered into solution; and gold contained in the electro-win 'cell sludge' will also be added.**

The remaining **5.7 tonnes of Concentrates** produced from the 'Kitchener' low grade ore and 'Bamboo Queen Pit' low grade ore is yet to be processed.

3.0 Rare Earths Activities Update

In December 2018 Haoma Shareholders were first advised that numerous **Rare Earths** and **other elements (not common)** were measured in samples collected (in some cases concentrates of those samples) from Haoma's Pilbara tenements at **Bamboo Creek** and **Spear Hill** (near Mt Webber). See **Appendix A**.

Appendix B describes in some detail the **17 rare earth and other elements (not common)**.

Figure 1 is an overview map of Haoma's Pilbara tenements within the Marble Bar-Normay-Mt Webber-Spear Hill districts. Spear Hill is located approximately 15kms north-east of Mt Webber.

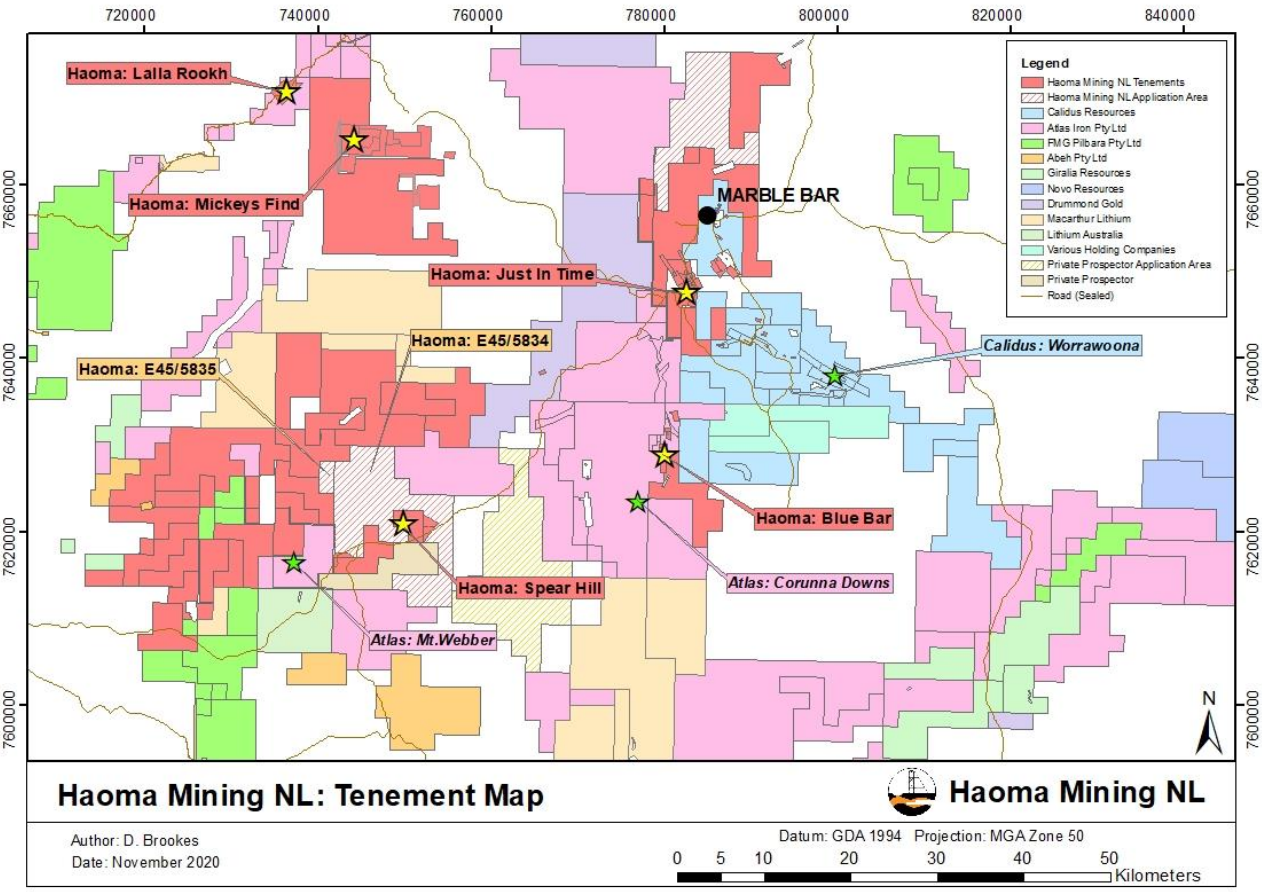


Figure 1: Haoma's Marble Bar-Normay-Mt Webber-Spear Hill tenement groups showing E45/5834 (under application) and E45/5835 (under application).

Figure 2 is a map of Haoma's Spear Hill Tenement Group C145/2016 comprising M45/1286, E45/4586, E45/4587, E45/5834 (under application) and E45/5835 (under application), P45/2973, P45/2974 and P45/2975. It also shows the location of Haoma's Soansville and North Shaw tenement groups.

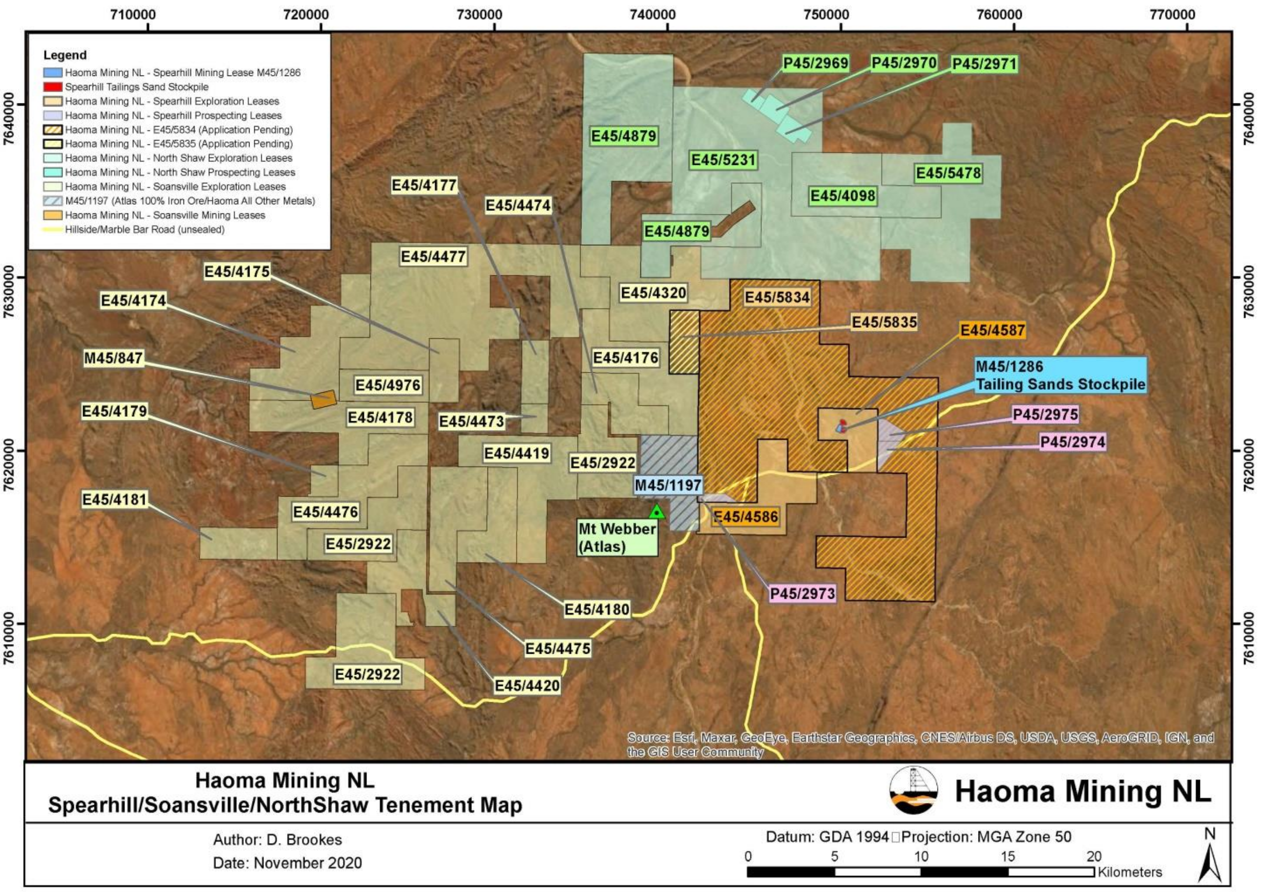


Figure 2: Haoma's Spear Hill Tenement Group C145/2016 comprising M45/1286, E45/4586, E45/4587, P45/2974, P45/2975, E45/5834 (under application) and E45/5835 (under application), P45/2973, P45/2974 and P45/2975.

Shareholders were advised of Haoma's Rare Earths activities in the following Shareholder Updates:

- **Haoma Shareholder Activities Update: Rare Earths**, **May 8, 2019**, (See copy, **Appendix C)**, and
- **Haoma Shareholder Activities update: Rare Earths, September 19, 2019**, (See copy, **Appendix D).**

3.1 Assays of Spear Hill Stockpiles A & B and Spear Hill Tailing Sands

Since **Haoma's Rare Earths Activities update** of **September 19, 2019 test work on measuring and recovering Rare Earths** and **other elements** has continued at **Bamboo Creek** and the **University of Melbourne.**

Analysis of samples of **Spear Hill Tailing Sands** has recently been completed at independent laboratory, Australian Laboratory Services, and by XRF at Haoma's laboratory at Bamboo Creek.

Samples from **Spear Hill Tailing Sands** (See Figures 7 & 8) were obtained by drilling approximately 12 meter holes to base rock. There are approximately **2 million tonnes of Spear Hill Tailing Sands** which were deposited in the 1970s by **Endeavour Resources Ltd** after recovering tin and tantalum.

Table 1-3 below shows assays of **Spear Hill Stockpiles A & B** and **Spear Hill Tailing Sands**. The grades (in ppm) of numerous **Rare Earths** and **other elements (not common)** were measured by:

ALS assays from acid solutions - see following links for full results:

Spear Hill Stockpiles A & B, ALS assay, July 6, 2019

Spear Hill Tailing Sands, ALS assay May 27, 2020

Spear Hill Tailing Sands and sample fractions, ALS assay November 20, 2020and

- XRF readings at Bamboo Creek and the University of Melbourne, and
- **Cyanide leaching of a sample of Spear Hill Tailings Sands at Bamboo Creek gave an AAS gold reading of 17.75 g/t. AAS gold readings for 6 gravity split sub-group fractions, from Spear Hill Tailing Sands, are shown in Table 3b**.

The detailed element analysis of samples from Spear Hill Stockpiles A & B and Spear Hill Tailing Sands are presented in Table 2 below.

Earlier exploration reports filed at the WA Department of Mines and Petroleum show the potential of areas in E45/5834 and E45/5835 to contain deposits with Rare Earths and other elements considered of value.

Different **elements considered of value** from ALS solution grades and Bamboo Creek XRF grades (ppm) are presented in **red** font in Tables 1, 2 and 3a&3b below.

The final value of the **Spear Hill Stockpiles A & B** and **Spear Hill Tailing Sands** will depend on the **cost of extracting** the numerous **Rare Earths** and **other elements (not common).**

Table 1: **Assays of Nuggety Gully Scree, Spear Hill Stockpiles A&B and Spear Hill Tailing Sands**

Element	Symbol	Atomic #	Nuggety Gully Scree Uni of Melb XRF May, 2019	Spear Hill Stockpiles A&B ALS July, 2019	Spear Hill Tailing Sands ALS May, 2020	Spear Hill Tailing Sands Bamboo Creek XRF Nov, 2020	Spear Hill Tailing Sands ALS Nov. 20, 2020
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Scandium	Sc	21	196	NR	3.2	NR	2.70
Yttrium	**Y**	**39**	**1,128**	**48.1**	**30.0**	**30**	**28.73**
Lanthanum	**La**	**57**	-	**26.2**	**11.1**	NR	**10.0**
Cerium	Ce	58	2,659	60.6	39.4	NR	33.27
Praseodymium	Pr	59	-	6.8	2.3	NR	2.07
Neodymium	Nd	60	-	21.6	8.6	NR	7.33
Samarium	Sm	62	554	5.2	1.9	NR	1.65
Europium	Eu	63	>1,000(*)	0.3	0.5	NR	0.47
Gadolinium	Gd	64	>1,000(*)	4.1	1.95	NR	1.92
Terbium	Tb	65	>1,000(*)	0.8	0.4	397	0.46
Dysprosium	Dy	66	-	6.2	3.6	1,491	3.84
Holmium	Ho	67	-	1.2	1.0	NR	0.97
Erbium	Er	68	1,680	4.9	4.0	NR	3.78
Thulium	Tm	69	-	0.9	0.8	1,491	0.78
Ytterbium	Yb	70	-	8.3	7.1	NR	7.21
Lutetium	**Lu**	**71**	-	**1.4**	**1.2**	NR	**1.11**
Other Elements (not common)							
Rubidium	Rb	37	**597**	**215.4**	**235.3**	**965**	**211.96**
Niobium	Nb	41	149	38.0	13.9	NR	6.37
Hafnium	Hf	72	2,964	NR	5.4	835	4.97
Caesium	**Cs**	**55**	-	**8.7**	**6.1**	NR	**5.38**

(*) Conclusive identification and quantification not ascertained NR: Not recorded

Table 2: Elements measured by ALS assays in Spear Hill Stockpiles A&B and Spear Hill Tailing Sands

Spear Hill Stockpiles A&B	
Total weight of all Stockpiles A&B samples assayed	**122,505 grams**
Total tonnes estimate (based on area of Stockpiles A&B)	**150,158**
	Weighted Average Grade (ppm)
Ag	4.5
Al	NR
As	3.3
Au	**NR**
Ba	378.2
Be	2.8
Bi	0.5
Ca	1.4
Cd	0.7
Ce	60.6
Co	7.1
Cr	95.5
Cs	**8.7**
Cu	15.4
Dy	6.2
Er	4.9
Eu	0.3
Fe	NR
Ga	22.9
Gd	4.1
Ge	1.3
Hf	NR
Ho	1.2
In	0.2
K	2.2%
La	**26.2**
Li	30.4
Lu	**1.4**
Mn	676.5
Mo	1.6
Nb	38
Nd	21.6
Ni	21.4
P	NR
Pb	23.2
Pr	6.8
Rb	**215.4**
Re	0
S	NR
Sb	0.6
Sc	NR
Se	2.6
Sm	5.2
Sn	997.4
Sr	116
Ta	50.9
Tb	0.8
Te	0.4
Th	21.4
Ti	0.1%
Tl	1.5
Tm	0.9
U	5.5
V	141.2
W	1.6
Y	**48.1**
Yb	8.3
Zn	127.6
Zr	NR

Spear Hill Tailing Sands			
Total weight of all Spear Hill Tailing Sands samples assayed		**167,669 grams**	
Total tonnes estimate (based on area of Tailing Sands)		**1,944,306**	
	May 27, 2020: Average Grade (ppm)	**Nov. 20, 2020: Assay of Head Sample (ppm)**	**Weighted Av Grade of Tabled Products (ppm)**
Ag	0.09	0.13	0.12
Al	6.41%	6.30%	5.73%
As	0.85	0.70	2.80
Au	**NR**	**0.07**	**0.46**
Ba	778.77	733.0	683.08
Be	2.55	3.54	2.29
Bi	0.27	0.18	0.16
Ca	0.96	0.90	0.84
Cd	0.03	0.03	0.02
Ce	41.77	37.35	33.27
Co	3.72	3.70	3.28
Cr	155.85	194.5	150.22
Cs	**6.1**	**5.81**	**5.38**
Cu	9.79	6.0	5.15
Dy	3.63	3.16	3.84
Er	3.96	3.48	3.78
Eu	0.47	0.49	0.47
Fe	1.29%	1.26%	1.13%
Ga	17.43	17.43	16.62
Gd	1.95	1.72	1.92
Ge	0.06	0.09	0.08
Hf	5.35	5.35	4.97
Ho	0.96	0.84	0.97
In	0.02	0.02	0.02
K	3.04%	2.79%	2.63%
La	**11.1**	**11.6**	**10.0**
Li	23.33	23.2	20.83
Lu	**1.17**	**1.10**	**1.11**
Mn	0	400	384.88
Mo	0.22	0.24	0.33
Nb	13.94	7.30	6.37
Nd	8.63	8.4	7.33
Ni	NR	10.7	10.61
P	61.97	70.0	50.67
Pb	20.89	19.7	19.88
Pr	2.34	2.36	2.07
Rb	**235.25**	**216.5**	**211.96**
Re	0	0	0
S	0.01%	0.01%	0.01%
Sb	0.12	0.07	0.14
Sc	3.22	3.10	2.70
Se	1.05	1.0	0.95
Sm	1.94	1.72	1.65
Sn	18.24	11.3	6.15
Sr	227.29	225.0	217.54
Ta	3.41	3.65	4.48
Tb	0.44	0.41	0.46
Te	NR	0.05	0.05
Th	9.73	9.19	8.80
Ti	NR	0.10%	0.09%
Tl	1.98	1.76	1.72
Tm	0.81	0.71	0.78
U	2.03	2.19	2.03
V	22.03	20.0	19.11
W	0.94	0.65	1.28
Y	**29.95**	**25.65**	**28.73**
Yb	7.06	6.76	7.21
Zn	NR	23.0	20.41
Zr	208.71	175.0	134.38

NR: Not recorded

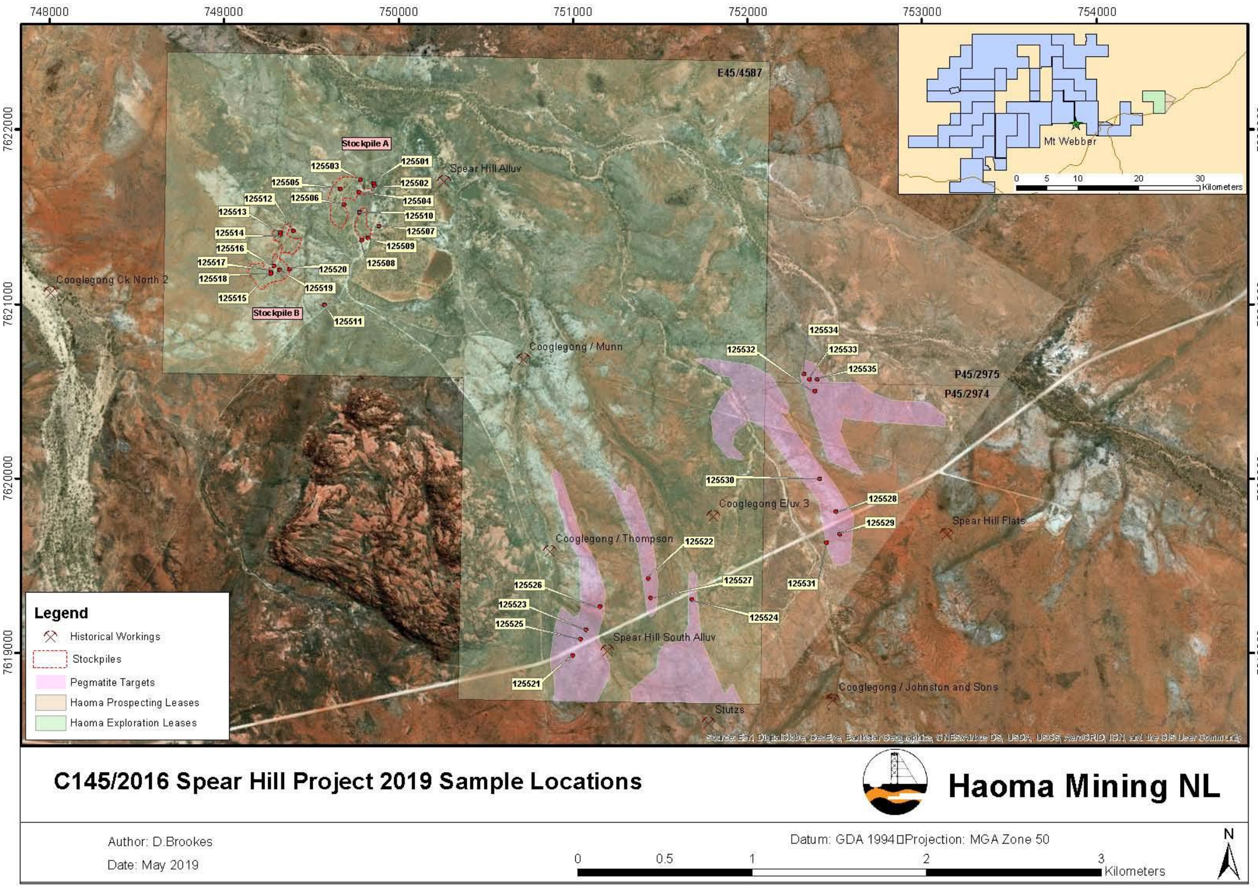


Figure 3: Spear Hill Stockpiles A&B and pegmatite sample locations – May 2019

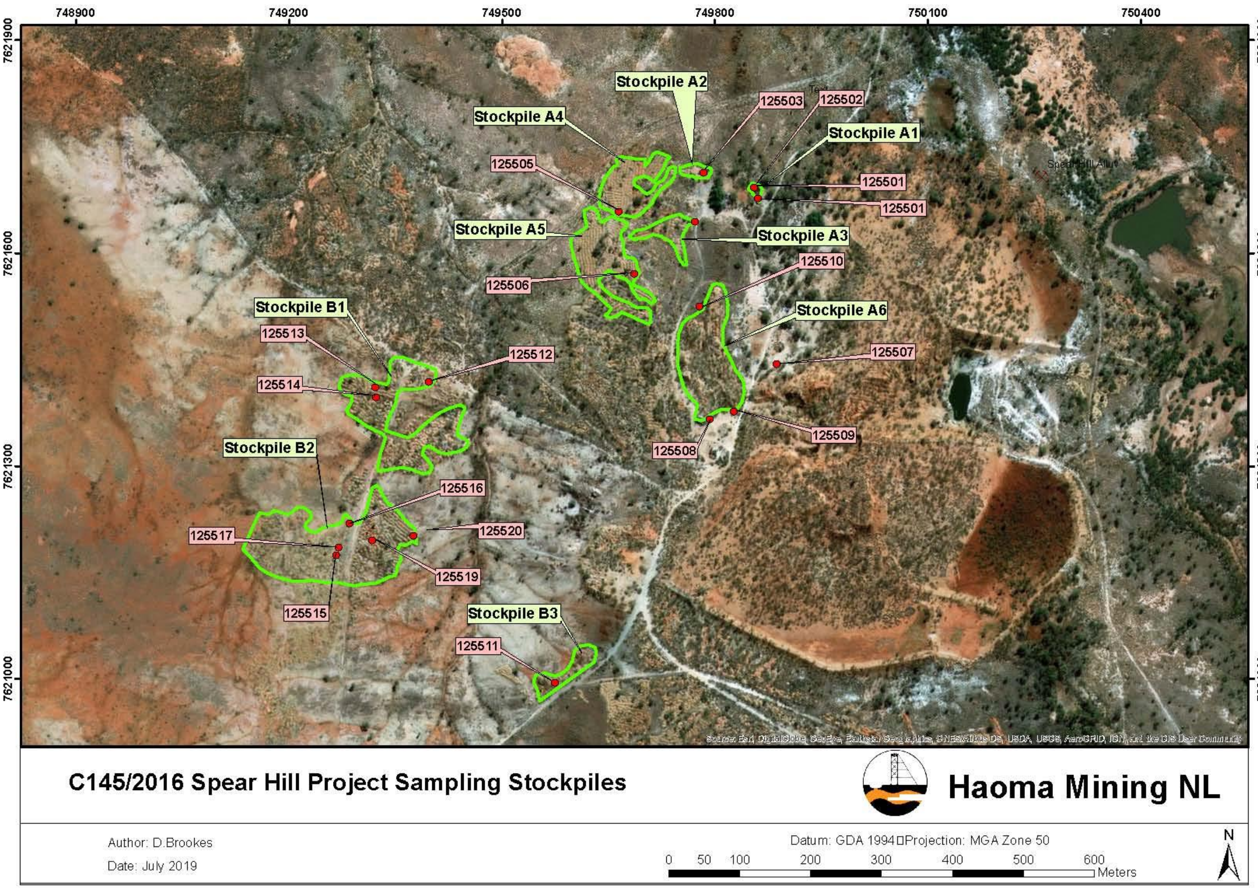
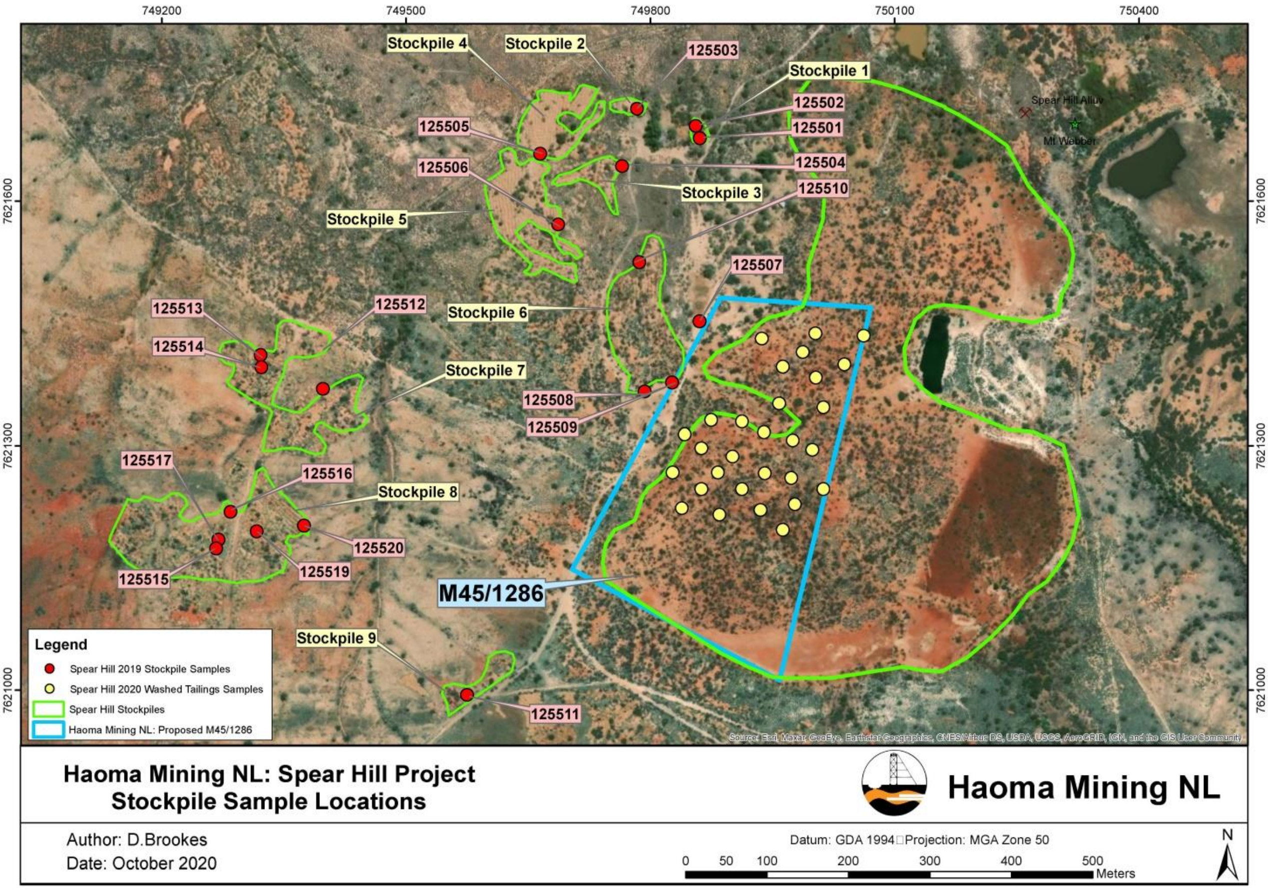


Figure 4: Spear Hill Stockpiles A&B sample locations July 2019

<u>Figure 5</u>: Spear Hill Stockpile A

<u>Figure 6</u>: Spear Hill Stockpile B (with Spear Hill in background)



<u>Figure 7</u>: Spear Hill Stockpiles A&B sample locations (July 2019) with Spear Hill M45/1286 Tailing Sands sample locations (October 2020) shown inside blue mining lease boundary.

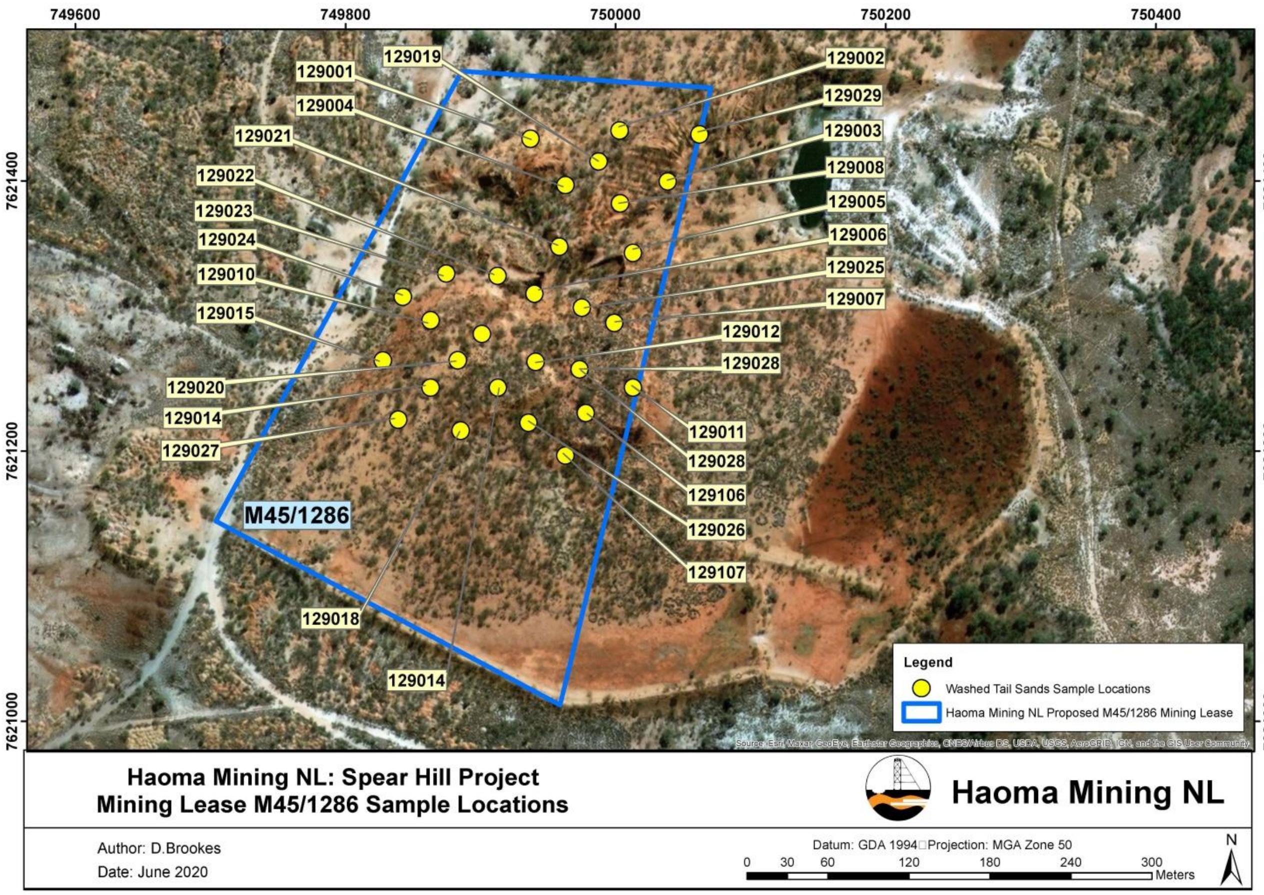


Figure 8: Spear Hill M45/1286 Tailing Sands sample locations (May 2020).

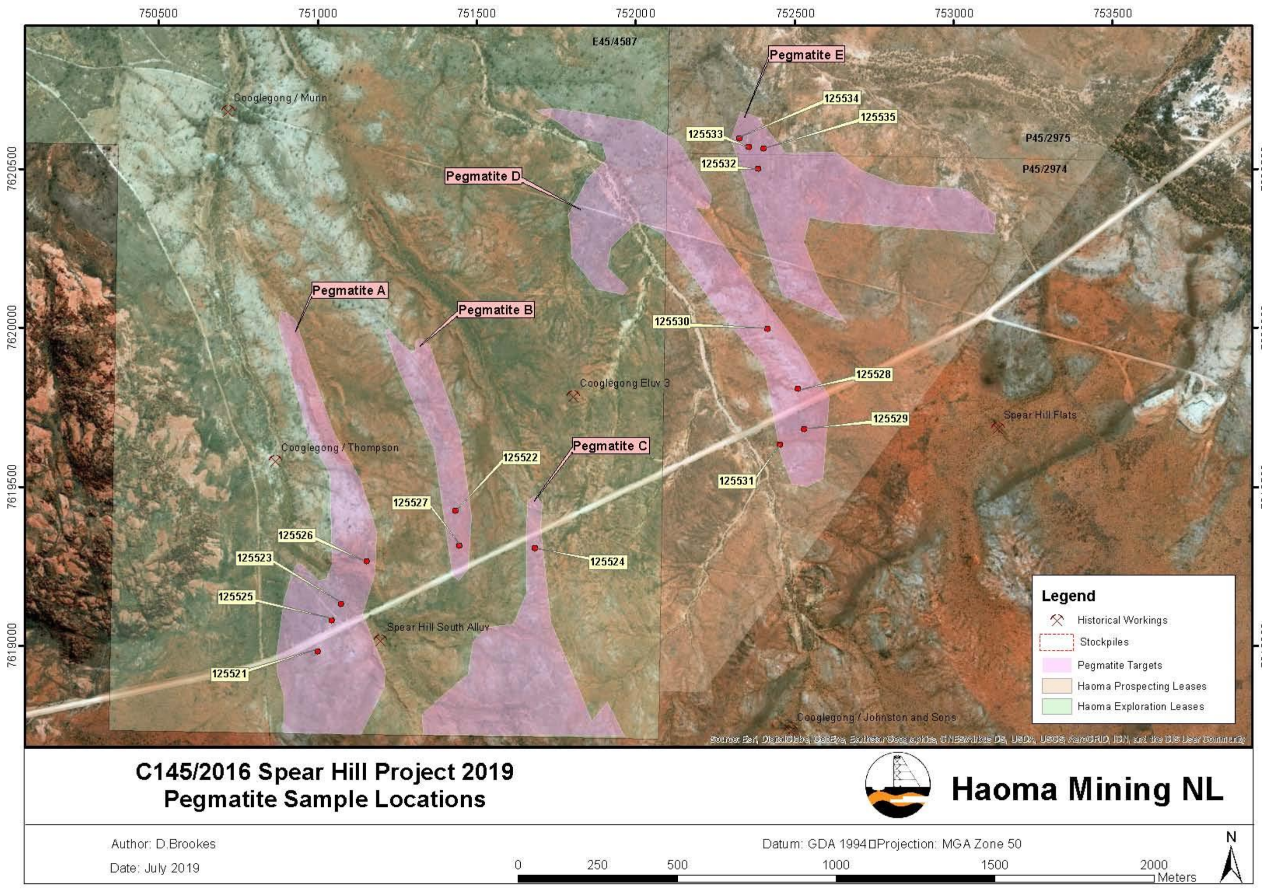


Figure 9: Spear Hill Pegmatite sample locations (July 2019).

3.2 Assays of Concentrates produced from the above Spear Hill Tailing Sands

In November 2020 a 15.9kg sample of **Spear Hill Tailing Sands** was split by gravity into 6 groups. **Table 3a** below lists the significant Bamboo Creek XRF results for each of the 6 groups.

Table 3b below shows the **elemental abundance (ALS) for the Spear Hill Tailings Sands along with 6 sub-group process fractions & Bamboo Creek cyanide leach assays on the same.**

Table 3a: Significant Bamboo Creek XRF results for each of the 6 sub-group fractions

Element	Symbol	Feed Head grade (ppm)	Con 1 22% of Feed (ppm)	Con 2 0.74% of Feed (ppm)	Con 3 0.44% of Feed (ppm)	Con 4 0.15% of Feed (ppm)	Con 5 2.55% of Feed (ppm)	Con 6 69.36% of Feed (ppm)
Scandium	Sc	NR	-	-	509	412	-	-
Yttrium	**Y**	**30**	**307**	**100**	**2959**	**2,814**	**479**	**-**
Cerium	Ce	NR	2,880	504	2,287	893	2,282	2,096
Terbium	Tb	397	567	3,398	-	-	-	-
Dysprosium	Dy	1,491	1,633	-	-	-	1,301	-
Holmium	Ho	NR	-	-	-	-	362	-
Thulium	Tm	1,140	407	991	1299	2,061	691	1,533
Lutetium	**Lu**	**NR**	**-**	**778**	**-**	**1,067**	**20**	**-**
Other Elements (not common)								
Rubidium	**Rb**	**965**	**1,632**	**370**	**160**	**338**	**434**	**853**
Niobium	Nb	NR	-	-	466	215	-	-
Hafnium	Hf	835	484	674	-	840	498	420

NR: Not recorded

Table 3b: Elemental abundance (ALS) for the Spear Hill Tailings Sands along with 6 sub-group process fractions & Bamboo Creek cyanide leach assays for the same.

Element	Symbol	Feed Head grade (ppm)	Con 1 22% of Feed (ppm)	Con 2 0.74% of Feed (ppm)	Con 3 0.44% of Feed (ppm)	Con 4 0.15% of Feed (ppm)	Con 5 2.55% of Feed (ppm)	Con 6 69.36% of Feed (ppm)
Scandium	Sc	3.1	1.2	6.2	44.0	37.8	10.4	2.7
Yttrium	**Y**	**25.65**	**37.05**	**39.7**	**1097.5**	**700.5**	**125.5**	**1.15**
Cerium	Ce	37.35	24.9	90.4	591.5	190.25	44.7	33.95
Terbium	Tb	0.41	0.56	0.8	19.8	8.6	1.35	0.28
Dysprosium	Dy	3.16	4.59	5.64	171.5	82.7	13.35	2.26
Holmium	Ho	0.84	1.12	1.29	46.8	25	3.97	0.53
Thulium	Tm	0.71	0.82	0.85	40.7	24.1	4.09	0.4
Lutetium	**Lu**	**1.1**	**1.03**	**1.01**	**60.8**	**38.1**	**6.43**	**0.56**
Lanthanum	**La**	**11.6**	**5.8**	**31.1**	**335**	**79.65**	**15.05**	**9.4**
Other Elements (not common)								
Rubidium	**Rb**	**216.5**	**399.5**	**140.75**	**79.5**	**96.4**	**133.5**	**171.75**
Niobium	Nb	7.3	5.45	19.35	205	91.35	16.35	5.15
Hafnium	Hf	5.35	1.9	11.4	305	105.95	17.15	3.65
Caesium	**Cs**	**5.81**	**9.04**	**5.54**	**2.87**	**3.26**	**3.81**	**4.67**
Gold	**Au**	**0.07**	**0.08**	**4.61**	**51.0**	**>10**	**2.74**	**0.15**

Gold (Bamboo Creek cyanide leach g/t)	**Au**	**17.75**	**4.17**	**7.64**	**45.33**	**40.08**	**4.7**	**11.76**

NR: Not recorded

3.3 Initial radioactivity analysis of the Spear Hill samples

Professor Peter Scales (University of Melbourne) has advised the following regarding initial radioactivity analysis of seven Spear Hill samples.

"Initial radioactivity analyses of the Spear Hill samples are shown below. They were determined using a handheld meter and are in counts per second (CPS) of the feed, oversize, the magnetic fraction and a series of gravity separation products from a Wilfrey Table. Using an indicative scale that <100 counts per minute (CPM) requires no additional precautions relative to materials containing background levels of radiation, then concentrate sample 4, the highest density of the samples, representing 0.44% of the total mass, showed a reading of 4 CPS or 240 CPM. Concentrate sample 6 of the table showed no activity and all other fractions were less than 100 CPM. ***The data indicates that initial assessment of the Spear Hill resource should avoid concentration of the highest density materials in the deposit into to very discrete fractions unless you wish to put in place procedures that recognize that these materials represent a low radiation hazard."***

Table 4: Radioactivity Analysis

Description	**Net Weight**	**Radioactive count (CPS)**
Feed Head Grade	300.4821	1
Concentrate 1	170.1621	1
Concentrate 2	100.4921	1
Concentrate 3	59.9217	4
Concentrate 4	20.1482	1
Concentrate 5	300.2421	1
Concentrate 6	230.4821	0

3.4 Additional mineralogy work on Spear Hill samples

Professor Peter Scales (University of Melbourne) has advised that additional mineralogy work has been commissioned to **analyse samples of Spear Hill ore by QEM SCAN.** The information will define the mineralogy phases and abundance present in the different Spear Hill ores as a function of size.

4. Mt Webber Reserve Upgrade Advice from Atlas Iron Pty Ltd

The 2012 Tenement Sale Agreement by which Haoma sold its Mt Webber iron ore rights to Atlas Iron Limited includes a 'Reserve Uplift Payment' entitlement. The uplift payment entitlement is triggered whenever reserve development work on the tenements which were subject to the Sale Agreement (E45/2186 and M45/1197) result in Atlas Iron releasing a JORC compliant iron ore reserve in excess of 24 million tonnes inclusive of any iron ore tonnes already mined.

Atlas Iron Pty Ltd has recently advised Haoma that at June 30, 2020 the remaining JORC ore reserve at Mt Webber within M45/1197 is 9,545,168 tonnes. Atlas also advised that it has mined 14,828,278 tonnes from M45/1197.

The combined amount of remaining reserve and tonnes mined is 24,373,446 tonnes meaning a reserve uplift payment is due to Haoma. The uplift payment per Excess Reserve is $1.38 per tonne (indexed by CPI from the Sale Agreement date of March 23, 2012). **Haoma will receive approximately $600,000 from Atlas pending confirmation of final calculations.**

The reserve update from Atlas Iron shows that **there is a further 4 million tonnes of 'probable' iron ore reserve (grade 56.9% Fe) that is not included in the above reserve calculations** and an **approximate 3 million tonnes of waste stockpile that has not been classified**.

Yours sincerely

Gary C. Morgan, Chairman

Appendix A:

Haoma Shareholder: Rare Earths, Activities update, December 19, 2018

https://haoma.com.au/wp-content/uploads/2018/12/Haoma-issue-of-shares-and-share-options-and-advice-on-rare-earths-exploration-December-19-2018.pdf

Rare earths are crucial to the supply of elements used in modern technologies including medical uses, mobile phone components, electric cars, magnetic power generators, magnetic separators, batteries, etc.

Lynas Corporation is one of the few companies which processes concentrate which produce rare earths outside of China. Much of the concentrates processed by Lynas are sourced from materials mined in Western Australia.

Recent commentary and media reporting has covered the concerns of the Japanese Government and others regarding Lynas Corporation continuing and expanding its rare earth processing facility in Malaysia. Japan obtains around one-third of its rare earths needs from Lynas.

Lynas is having difficulties obtaining approval to operate in Malaysia from the Malaysian Government who has made it clear that Lynas's future licence is contingent on Lynas getting rid of 400,000 tonnes of radioactive waste.

Since Lynas first announced the discovery of rare earths in the Pilbara Haoma has been aware of the value of 'rare earth elements'. For this reason Haoma has over the last few years sought to measure 'rare earth elements' in concentrates recovered from Haoma's Pilbara tenements.

Using XRF and/or SEM Haoma has identified the following 'rare earth elements' in concentrates from its tenements held at Spear Hill (near Mt Webber) and at Bamboo Creek (check assays on some concentrates samples are now being conducted by ALS Perth).

Scandium or Sc (21)
Yttrium or Y (39)
Lanthanum or La (57)
Cerium or Ce (58)
Praseodymium or Pr (59)
Neodymium or Nd (60)
Holmium or Ho (67)
Erbium or Er (68)
Thulium or Tm (69)

Appendix B:

Rare Earths and Other Elements Explained

https://haoma.com.au/wp-content/uploads/2018/12/Haoma-issue-of-shares-and-share-options-and-advice-on-rare-earths-exploration-December-19-2018.pdf

Rare Earths are a series of chemical elements found in the Earth's crust that are vital to many modern technologies.

There are 17 elements that are considered to be Rare Earth elements: 15 elements in the lanthanide series and two additional elements that share similar chemical properties. They are listed below in order of atomic number:

Scandium or Sc (21)

Scandium, a silvery-white metal, is a non-lanthanide rare earth. It is used in many popular consumer products, such as televisions and fluorescent or energy-saving lamps. In industry, the primary use of scandium is to strengthen metal compounds. The only concentrated sources of scandium currently known are in rare minerals such as thortveitite, euxenite, and gadolinite from Scandinavia and Madagascar.

Yttrium or Y (39)

Yttrium is a non-lanthanide rare earth element used in many vital applications, such as superconductors, powerful pulsed lasers, cancer treatment drugs, rheumatoid arthritis medicines, and surgical supplies. A silvery metal, it is also used in many popular consumer products, such as color televisions and camera lenses.

Lanthanum or La (57)

This silver-white metal is one of the most reactive rare earth elements. It is used to make special optical glasses, including infrared absorbing glass, camera and telescope lenses, and can also be used to make steel more malleable. Other applications for lanthanum include wastewater treatment and petroleum refining.

Cerium or Ce (58)

Named for the Roman goddess of agriculture, Ceres, cerium is a silvery-white metal that easily oxidizes in the air. It is the most abundant of the rare earth elements and has many uses. For instance, cerium oxide is used as a catalyst in catalytic converters in automotive exhaust systems to reduce emissions, and is highly desirable for precision glass polishing. Cerium can also be used in iron, magnesium and aluminum alloys, magnets, certain types of electrodes, and carbon-arc lighting.

Praseodymium or Pr (59)

This soft, silvery metal was first used to create a yellow-orange stain for ceramics. Although still used to color certain types of glasses and gemstones, praseodymium is primarily used in rare earth magnets. It can also be found in applications as diverse as creating high-strength metals found in aircraft engines and in flint for starting fires.

Neodymium or Nd (60)

Another soft, silvery metal, neodymium is used with praseodymium to create some of the strongest permanent magnets available. Such magnets are found in most modern vehicles and aircraft, as well as popular consumer electronics such as headphones, microphones and computer discs. Neodymium is also used to make high-powered, infrared lasers for industrial and defense applications.

Promethium or Pm (61)

Although the search for the element with atomic number 61 began in 1902, it was not until 1947 that scientists conclusively produced and characterized promethium, which is named for a character in Greek mythology. It is the only naturally radioactive rare earth element, and virtually all promethium in the earth's crust has long ago decayed into other elements. Today, it is largely artificially created, and used in watches, pacemakers, and in scientific research.

Samarium or Sm (62)

This silvery metal can be used in several vital ways. First, it is part of very powerful magnets used in many transportation, defense, and commercial technologies. Second, in conjunction with other compounds for intravenous radiation treatment it can kill cancer cells and is used to treat lung, prostate, breast and some forms of bone cancer. Because it is a stable neutron absorber, samarium is used to control rods of nuclear reactors, contributing to their safe use.

Europium or Eu (63)

Named for the continent of Europe, europium is a hard metal used to create visible light in compact fluorescent bulbs and in color displays. Europium phosphors help bring bright red to color displays and helped to drive the popularity of early generations of color television sets. Fittingly, it is used to make the special phosphors marks on Euro notes that prevent counterfeiting.

Gadolinium or Gd (64)

Gadolinium has particular properties that make it especially suited for important functions, such as shielding in nuclear reactors and neutron radiography. It can target tumors in neuron therapy and can enhance magnetic resonance imaging (MRI), assisting in both the treatment and diagnosis of cancer. X-rays and bone density tests can also use gadolinium, making this rare earth element a major contributor to modern health care solutions.

Terbium or Tb (65)

This silvery rare earth metal is so soft it can be cut with a knife. Terbium is often used in compact fluorescent lighting, color displays, and as an additive to permanent rare earth magnets to allow them to function better under higher temperatures. It can be found in fuel cells designed to operate at elevated temperatures, in some electronic devices and in naval sonar systems. Discovered in 1843, terbium in its alloy form has the highest magnetostriction of any such substance, meaning it changes its shape due to magnetization more than any other alloy. This property makes terbium a vital component of Terfenol-D, which has many important uses in defense and commercial technologies.

Dysprosium or Dy (66)

Another soft, silver metal, dysprosium has one of the highest magnetic strengths of the elements, matched only by holmium. Dysprosium is often added to permanent rare earth magnets to help them operate more efficiently at higher temperatures. Lasers and commercial lighting can use dysprosium, which may also be used to create hard computer disks and other electronics that require certain magnetic properties. Dysprosium may also be used in nuclear reactors and modern, energy-efficient vehicles.

Holmium or Ho (67)

Holmium was discovered in 1878 and named for the city of Stockholm. Along with dysprosium, holmium has incredible magnetic properties. In fact, some of the strongest artificially created magnetic fields are the result of magnetic flux concentrators made with holmium alloys. In addition to providing coloring to cubic zirconia and glass, holmium can be used in nuclear control rods and microwave equipment.

Erbium or Er (68)

Another rare earth with nuclear applications, erbium can be found in neutron-absorbing control rods. It is a key component of high-performance fiber optic communications systems, and can also be used to give glass and other materials a pink color, which has both aesthetic and industrial purposes. Erbium can also help create lasers, including some used for medical purposes.

Thulium or Tm (69)

A silvery-gray metal, thulium is one of the least abundant rare earths. Its isotopes are widely used as the radiation device in portable X-rays, making thulium a highly useful material. Thulium is also a component of highly efficient lasers with various uses in defense, medicine and meteorology.

Ytterbium or Yb (70)

This element, named for a village in Sweden associated with its discovery, has several important uses in health care, including in certain cancer treatments. Ytterbium can also enhance stainless steel and be used to monitor the effects of earthquakes and explosions on the ground.

Lutetium or Lu (71)

The last of the rare earth elements (in order of their atomic number) has several interesting uses. For instance, lutetium isotopes can help reveal the age of ancient items, like meteorites. It also has applications related to petroleum refining and positron emission tomography. Experimentally, lutetium isotopes have been used to target certain types of tumors.

Other elements (not common but strategic):

Rubidium and Caesium can be used interchangeably in many applications. There is significant global demand for Rubidium and Caesium products owing to the complete lack of mining and the slowly dwindling stockpiles of ore.

Rubidium or Rb (37)

https://www.webelements.com/rubidium/

Rubidium is a very soft, silvery-white metal in the alkali metal group. Rubidium metal is similar to Potassium metal and Caesium metal in physical appearance, softness and conductivity. Rubidium and its compounds include biomedical research, electronics, specialty glass, and pyrotechnics. Specialty glasses are the leading market for rubidium; rubidium carbonate is used to reduce electrical conductivity, which improves stability and durability in fiber optic telecommunications networks. The United States imports some concentrate for further processing. Industry information during the past decade suggests the USA domestic consumption rate is approximately 2,000 kilograms per year. The United States is 100% import reliant for rubidium minerals. In 2019, one company offered 1-gram ampoules of 99.75%-grade rubidium (metal basis) for $87.80, a 4% increase from $84.40 in 2018, and 100-gram ampoules of the same material for $1,592.00, a 3% increase from $1,546.00 in 2018.

Caesium or Cs (55)

https://www.webelements.com/caesium/

Caesium is a soft, silvery-golden alkali metal with a melting point of 28.5 °C, which makes it one of only five elemental metals that are liquid at or near room temperature. Caesium minerals are used as feedstocks to produce a variety of Caesium compounds and Caesium metal. The primary application for Caesium is in Caesium formate brines used for high-pressure, high-temperature well drilling for oil and gas production and exploration. Caesium metal is used in the production of Caesium compounds and potentially in photoelectric cells. Caesium bromide is used in infrared detectors, optics, photoelectric cells, scintillation counters, and spectrophotometers. Caesium carbonate is used in the alkylation of organic compounds and in energy conversion devices, such as fuel cells, magneto-hydrodynamic generators, and polymer solar cells. Caesium readily combines with oxygen and is used as a 'getter', a material that combines with and removes trace gases from vacuum tubes. It is estimated that only a few thousand kilograms of Caesium chemicals are consumed in the United States every year. The United States is 100% import reliant for its Caesium needs. In 2019, one company offered 1-gram ampoules of 99.8% (metal basis) Caesium for $63.00, a slight increase from $61.80 in 2018, and 99.98% (metal basis) Caesium for $81.10, a 3% increase from $78.70 in 2018.

Appendix C:

Rare Earths, Activities update, May 8, 2019

https://haoma.com.au/wp-content/uploads/2019/05/Haoma-Mining-NL-Activities-Update-May-8-2019.pdf

Rare Earths

Haoma, in conjunction with consultants at the University of Melbourne, School of Engineering, is continuing to evaluate the extent of Rare Earths located on its Pilbara tenements at Bamboo Creek, Mt Webber and surrounding areas with a view to assessing the viability of extracting Rare Earths for commercial sale.

Recent analysis of subsamples of concentrates and treated concentrates from the processing of Nuggety Gully Scree by X-ray Fluorescence at the University of Melbourne identified a number of Rare Earth and other elements. The grades identified are based on the sample grade and are not reflected to 'Head Grade' although the concentrates represent more than 0.5% of the ore. Some of the elements are reported with a higher level of certainty than others. Work has commenced to ascertain if these Rare Earths and non-PGM elements can be extracted and isolated.

Rare Earths	Symbol	Atomic #	XRF (ppm)
Scandium	Sc	21	196
Yttrium	Y	39	1128
Lanthanum	La	57	0
Cerium	Ce	58	2659
Praseodymium	Pr	59	0
Neodymium	Nd	60	0
Promethium	Pm	61	0
Samarium	Sm	62	554
Europium	Eu	63	>1000*
Gadolinium	Gd	64	>1000*
Terbium	Tb	65	>1000*
Dysprosium	Dy	66	0
Holmium	Ho	67	0
Erbium	Er	68	1680
Thulium	Tm	69	0
Ytterbium	Yb	70	0
Lutetium	Lu	71	0
Other Elements			
Titanium	Ti	22	69894
Rubidium	Rb	37	597
Niobium	Nb	41	149
Hafnium	Hf	72	2964

(*) Conclusive identification and quantification not ascertained

Rare Earths are crucial to the supply of elements used in modern technologies including medical uses, mobile phone components, electric cars, magnetic power generators, magnetic separators, batteries, etc.

A description of all 17 Rare Earths and their uses is shown in Appendix B above.

Appendix D:

Rare Earths, Activities update, September 20, 2019

https://haoma.com.au/wp-content/uploads/2019/09/Haoma-Mining-NL-Shareholder-Activities-Update-September-20-2019.pdf

Rare Earths (Descriptions shown in Appendix B above)

During the last week numerous quantities of valuable Rare Earths including **Terbium or Tb (65)**, **Thulium or Tm (69) and Europium or Eu (63)** have been measured by XRF at the University of Melbourne in samples of Bamboo Creek Tailings; and a Bamboo Creek Tailings Concentrate (about 6.33% of the Bamboo Creek Tailings).

1) Rare Earths measured in **Bamboo Creek Tailings** were as follows:

- **0.73% Terbium or Tb (65);** and
- **0.32% Europium or Eu (63)**

2) Rare Earth measured in **Bamboo Creek Tailings Concentrate** was as follows:

- **0.27% Thulium or Tm (69)**

Test work at Bamboo Creek and the University of Melbourne on measuring and recovering Rare Earths is continuing on samples from Bamboo Creek Scree, Bamboo Creek Tailings and 'low grade' Mt Webber iron ore.

In addition potential European, UK, US and Asian refineries of Rare Earths are being investigated.