

## ASX Announcement

7 June 2024

### Chlorination refinery pilot plant installed and hot commissioned

**Globe Metals & Mining Limited** (ASX: GBE) ("**Globe**" or "**Company**") is pleased to announce that the chlorination refinery pilot plant for the production of niobium and tantalum product samples has now been installed and hot commissioned<sup>1</sup>.

The chlorination technology has a low environmental impact and low carbon footprint, which is important to Globe's operating philosophy. The plant was designed to produce very high purity – 99.98% – (optical grade) niobium pentoxide samples which will be provided to Globe's key off-takes for their technical assessment. Once the oxide product is produced, Globe will finalise its discussions with key industry off-takers, representing a major step forward in the development of the Kanyika Project.

#### Hot Commissioning

Both the extraction plant (A) and distillation plant (B) have been installed and hot commissioned. A process of optimisation of the refining process is now underway to start processing the Kanyika concentrate to final product.

#### (A) Extraction Pilot Plant

The extraction pilot plant consists of:

- graphite reactor;
- graphite transfer and cooling tube;
- zircon and iron de-sublimers;
- niobium and tantalum condenser; and
- water scrubber for silica, titanium, etc.

The reactor processes 1kg/day of concentrate by heating carbon/concentrate pellets with chlorine gas. Metal chlorides evaporate and condense at different temperatures. Niobium and tantalum chlorides are captured together and transferred to the distillation column.

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<sup>1</sup> Globe's ASX Announcement titled 'Further metallurgical results on chlorination test work – correction' made on 20 March 2024 contains the information required by ASX Listing Rule 5.16 regarding the stated production target. All material assumptions underpinning the production target as announced on that date continue to apply and have not materially changed.



*Image 1: Pilot extraction set up: graphite reactor and transfer tube*

#### **(B) Niobium/Tantalum Distillation Purification Plant**

Purification of the tantalum/niobium chloride mixture is done via distillation. Heated above 250°C, TaCl<sub>5</sub>, with a lower boiling point, concentrates as it ascends. Condensed at 230°C, TaCl<sub>5</sub> is collected. Once TaCl<sub>5</sub> is removed, the remaining condensate, now pure NbCl<sub>5</sub>, is extracted.



*Image 2: First run chloride products*



*Image 3: Two-stage, 2" distillation column with thermal oil cooled condenser*



*Image 4: Operational distillation column after commissioning*

Paul Smith, Globe's CEO commented: *"We are incredibly pleased with the progress in metallurgical test work. The production of high-quality niobium concentrate for the refinery pilot plant is advancing well. Recovering high-quality niobium and tantalum oxides is crucial for finalising offtake agreements and the updated feasibility study. We eagerly anticipate the results of the chlorination extraction test work and the pilot plant's development and operation, which will be reported on shortly."*

### Overview of the Carbochlorination Process

Chlorination metallurgy is a process for recovering and utilising ore resources by reacting metals, metal oxides, sulphides, and other compounds with chlorine under specific conditions using chlorinating agents ( $\text{Cl}_2$ ,  $\text{NaCl}$ ,  $\text{CaCl}_2$ , etc), forming metal chlorides (Minerals Engineering, Vol 154, 1 August 2020).

This method is well-established for recovering high-purity metals:

- Zirconium: ATI Materials in the US pioneered this in the 1950s for zirconium chloride ( $ZrCl_4$ ) and zirconium metal production, with other producers like CNNC Jinghuan, Westinghouse Electric USA, and Framatome 1.
- Silicon: Siemens and Wacker developed hyper-pure polysilicon production via chlorination in the 1950s.
- Niobium and Tantalum: Solikamsk Magnesium Works in Russia extract these from loparite ore.
- Titanium: Tronox processes titanium ore and manufactures high-purity titanium chemicals.

The carbochlorination process involves:

1. Mixing and pelletizing mineral concentrate with carbon powder.
2. Reacting the pellets with chlorine to convert metal oxides to metal chlorides.
3. Purifying niobium and tantalum chlorides using distillation.
4. Oxidizing niobium and tantalum chlorides to oxides.

#### Next Steps

- Niobium/tantalum will be extracted and separated using environmentally sustainable chlorination refining.
- Product samples will be provided to key off-takers as part of the offtake agreement finalisation process.
- The update of the Project Feasibility Study, inclusive of the in-country chlorination refinery.
- The decision to execute and develop Phase 1 of the Project.

#### Technical Partners

As previously announced<sup>2</sup>, Globe is very proud to be working very closely with its key technical service providers in the development of its concentrator and refinery development journey. These refinery partners are TCM Research Ltd and the Resonant Group <https://www.resonant.co.za/>.

#### Authorisation for Release

This announcement has been authorised for release by the Company's Chief Executive Officer, Paul Smith.

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<sup>2</sup> Refer to ASX Announcement titled 'Quarterly Activities/Appendix 5B Cash Flow Report' made on 31 July 2023

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#### About the Kanyika Niobium Project

The Kanyika Niobium Project is located in central Malawi, approximately 55km northeast of the regional centre of Kasangu and is secured by Large-Scale Mining Licence No. LML0216/21 which grants the Company security of tenure and the right to mine niobium, tantalum, and deleterious uranium.

Drilling programs totalling 33.8 kilometres of percussion and core drilling have defined the extent of mineralisation. Structured and progressive engineering studies have resulted in the current (JORC 2012) Mineral Resource Estimate (refer below) and given rise to significant improvements and simplifications in the process flowsheet.



The Kanyika operations will produce a pyrochlore mineral concentrate that contains both niobium and tantalum in commercially valuable volumes to be shipped to a refinery for advanced processing into high purity materials.

A Mineral Resource Estimate for the Kanyika Niobium Project under the 2012 JORC guidelines was reported to ASX on 11 July 2018 as follows:



**Table 1: MRE for KNP using a 1,500 ppm Nb<sub>2</sub>O<sub>5</sub> lower cut**

Category	Resource (Mt)	Nb <sub>2</sub> O <sub>5</sub> (ppm)	Ta <sub>2</sub> O <sub>5</sub> (ppm)
Measured	5.3	3,790	180
Indicated	47	2,860	135
Inferred	16	2,430	120
<b>TOTAL</b>	<b>68.3</b>	<b>2,830</b>	<b>135</b>

**Table 2: MRE for KNP using a 3,000 ppm Nb<sub>2</sub>O<sub>5</sub> lower cut**

Category	Resource (Mt)	Nb <sub>2</sub> O <sub>5</sub> (ppm)	Ta <sub>2</sub> O <sub>5</sub> (ppm)
Measured	3.4	4,790	220
Indicated	16.6	4,120	160
Inferred	2.8	4,110	190
<b>TOTAL</b>	<b>22.8</b>	<b>4,220</b>	<b>190</b>

#### Mineral Resource Estimates

The information in this report that relates to Mineral Resources is extracted from the report titled “Kanyika Niobium Project – Updated JORC Resource Estimate” released to the Australian Securities Exchange (ASX) on 11 July 2018 and available to view at [www.globemmm.com](http://www.globemmm.com) and for which Competent Persons’ consents were obtained. Each Competent Person’s consent remains in place for subsequent releases by the Company of the same information in the same form and context, until the consent is withdrawn or replaced by a subsequent report and accompanying consent.

The Company confirms it is not aware of any new information or data that materially affects the information included in the original ASX announcement released on 11 July 2018 and, in the case of estimates of Mineral Resources, that all material assumptions and technical parameters underpinning the estimates in the original ASX announcement continue to apply and have not materially changed. The Company confirms that the form and context in which the Competent Persons’ findings are presented have not been materially modified from the original ASX announcement.

Full details are contained in the ASX announcement released on 11 July 2018 titled ‘Kanyika Niobium Project – Updated JORC Resource Estimate’ available to view at [www.globemmm.com](http://www.globemmm.com).