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ASX Release

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## PILOT TESTWORK HIGHLY SUCCESSFUL - EXPECTED RECOVERIES CONFIRMED

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### Highlights:

- **Pilot plant confirms niobium recoveries consistent with previous results:**
  - **71% recovery in Fresh Carbonatite rock, as expected**
  - **62% recovery in Moderately Oxidised Carbonatite rock, as expected**
- **Consistent, predictable recoveries obtained – results considered definitive**
- **Flotation circuit stable and repeatable – flowsheet confirmed**
- **DFS progressing well with completion on track for April 2016**

**Cradle's Project Director, Keith Bowes commented:** "The pilot plant results have confirmed the niobium recoveries and concentrate grades previously achieved at bench scale. What is particularly pleasing is the consistent, predictable recoveries obtained. The circuit was stable and adjusted quickly to changes in inputs. It is clear we have the right circuit and flowsheet, definitively producing the right recoveries. These results will be used to fine tune the design and cost estimates for the Definitive Feasibility Study."

### Integrated Flotation Pilot Plant

The integrated pilot plant test has confirmed that the results seen previously at bench scale in the laboratory test program can be replicated at a larger scale, with 35 tonnes of material processed successfully. The work was undertaken at SGS, Lakefield in Canada using the optimised flowsheet and consisted of the following stages:

- Bulk crushing of the sample with collection and blending of the crushed ore
- Continuous two-stage milling with de-sliming (primary deslime)
- Pyrite flotation and magnetic separation
- Carbonate flotation
- Further desliming/dewatering (secondary de-slime)
- Niobium flotation
- Concentrate collection

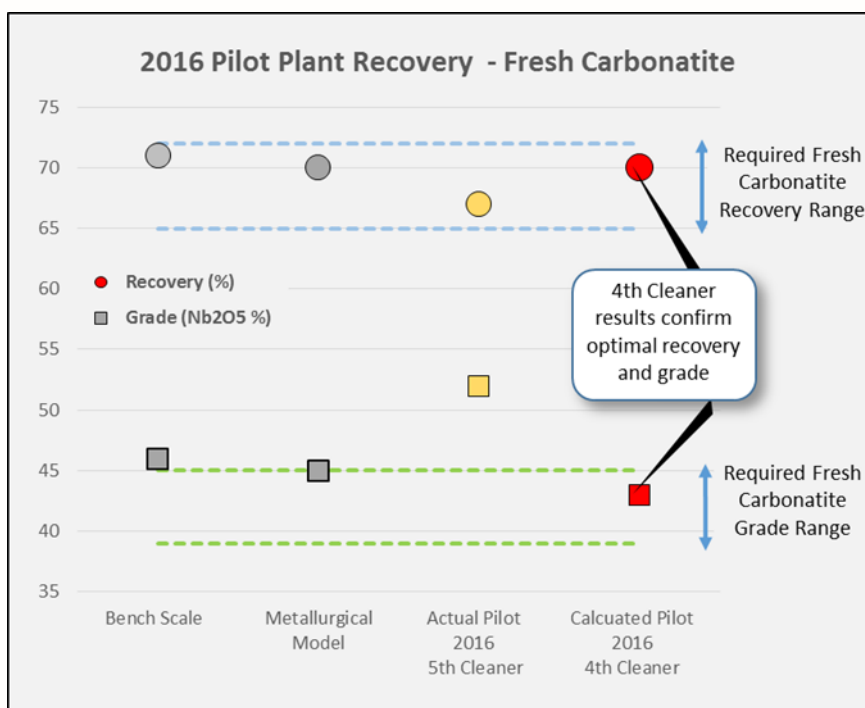
The feed to the pilot plant consisted of approximately 15 tonnes of fresh carbonatite and 20 tonnes of moderately oxidised carbonatite fed sequentially to the process. The plant was operated over a period of two weeks during which 10 separate runs were performed, five on each of the samples. The feed rate to the plant was set at 250kg/hour and achieved the targeted final concentrate production rate of 1.0 to 1.5 kg/hour.

### Fresh Carbonatite

This material performed the best in the laboratory tests. It is “clean” with limited impurities and is less prone to generate fines.

The detailed results are presented in the Appendix at the end of this document and are summarised in Figure 1. The data includes the results from the bench scale locked cycle tests, the prediction from the metallurgical models previously developed, the final result the concentrate produced from the 5<sup>th</sup> Cleaner, and the calculated recovery from the 4<sup>th</sup> Cleaner.

The 4<sup>th</sup> Cleaner is an important result in this analysis, as this stage produced the concentrate at the preferred niobium grade (40-45% Nb<sub>2</sub>O<sub>5</sub>). Operating at this lower concentrate grade allows better recoveries in the flotation circuit, with the final stages of concentrate upgrading to be undertaken in the subsequent leaching step.



**Figure 1: Fresh Carbonatite Results**

### Moderately Oxidised Carbonatite

This material has lower recoveries than fresh carbonatite due to higher fines content and more oxidised niobium minerals. The detailed results are presented in the Appendix at the end of this document and are summarised in Figure 2.

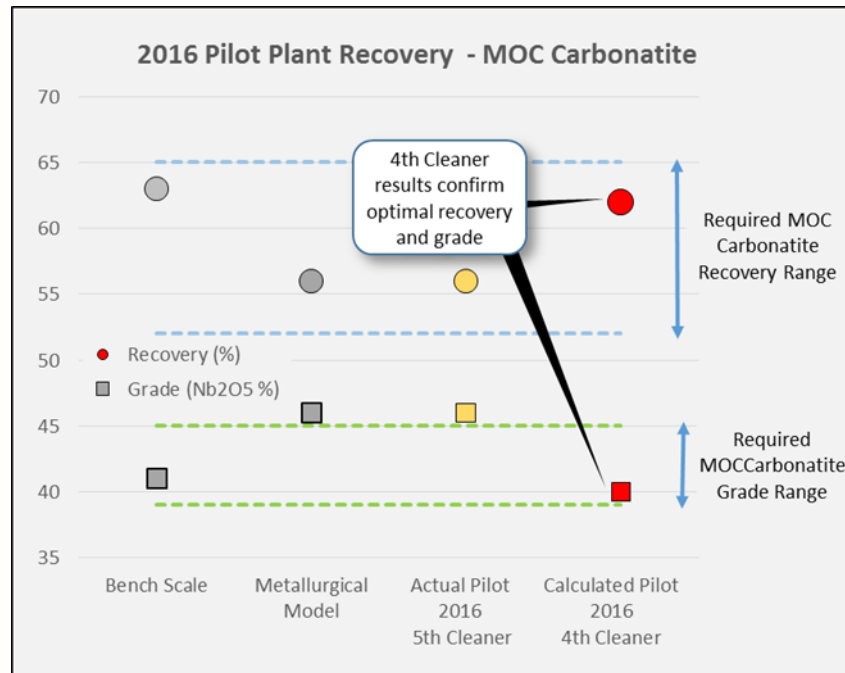


Figure 2: Moderately Oxidised Carbonatite Results

### Concentrate Leaching

The next step in the metallurgical testwork is the leaching of the concentrate to remove phosphate and silicate.

The niobium concentrate produced from the pilot plant testwork is being prepared for use in a continuous leaching test that will be run over a period of 5 days. The development work for this process is complete and the optimal conditions identified.

A semi-continuous test has already confirmed that concentrates grading around 40% Nb<sub>2</sub>O<sub>5</sub> can be upgraded to greater than 45% Nb<sub>2</sub>O<sub>5</sub>, which is preferred for our converter process. This upgrade occurs with no niobium losses.

### Ferro-niobium Production (Converter)

As a final step in the metallurgical testwork, samples of the “clean” concentrate (post the above leaching) will be converted into ferro-niobium using a laboratory scale version of the aluminothermic process. This test work will be carried out by ANSTO (Australian Nuclear Scientific & Technology Organisation) Laboratories in Sydney during March 2016. ANSTO has previously carried out this work for other niobium producers and has the necessary equipment and procedures to undertake this work.

*By order of the Board*

## APPENDIX

### Fresh Carbonatite

**Table 1: Pilot Plant – Locked Cycle Test Comparison (FC)**

	Pilot Plant Fresh Carbonatite					
	Benchscale (LCT)			Pilot Plant Run 03		
	Mass %	Grade %Nb <sub>2</sub> O <sub>5</sub>	Nb Department %	Mass %	Grade %Nb <sub>2</sub> O <sub>5</sub>	Nb Department %
Plant Feed	100%	0.48%	100%	100%	0.48%	100%
Primary Deslime	22.0%	0.26%	12.2%	22.3%	0.31%	13.7%
Pyrite Concentrate	1.4%	0.31%	0.9%	1.4%	0.39%	1.1%
Magnetic Concentrate	0.4%	0.50%	0.4%	0.8%	0.08%	0.1%
Densifying Cyclone	-	-	-	2.2%	0.37%	1.6%
Carbonate Concentrate	51.1%	0.07%	7.1%	26.4%	0.08%	3.5%
Dewatering Cyclones	0.3%	0.74%	0.5%	1.7%	0.96%	3.2%
Rougher Tails	12.3%	0.06%	1.6%	39.6%	0.07%	5.5%
Densifying Cyclone	-	-	-	1.0%	0.59%	1.2%
Cleaner Tails	10.0%	0.20%	6.1%	5.5%	0.32%	3.5%
Final Recovery	0.7%	46.2%	71.2%	0.6%	52.9%	66.6%

**Table 2: Fresh Carbonatite Performance**

	Pilot Plant Fresh Carbonatite		
	Mass %	%Nb <sub>2</sub> O <sub>5</sub>	Nb Recovery %
Locked Cycle Test – 5 <sup>th</sup> Cleaner Concentrate	0.73%	46.2%	71.2%
Pilot Plant PP03 – 5 <sup>th</sup> Cleaner Concentrate	0.63%	52.2%	66.6%
<b>Pilot Plant PP03 – 4<sup>th</sup> Cleaner Concentrate (at target grade)</b>	<b>0.85%</b>	<b>42.6%</b>	<b>71.2%</b>
Grade - Recovery Curve prediction (at target grade)	-	42.0%	69.4%
Metallurgical Model Recovery	-	45.3%	70.1%

Moderately Oxidised Carbonatite

**Table 3: Pilot Plant – Locked Cycle Test Comparison (MOC)**

	Pilot Plant Moderately Oxidised Carbonatite					
	Benchscale (LCT)			Pilot Plant Run 07		
	Mass %	Grade %Nb <sub>2</sub> O <sub>5</sub>	Nb Department %	Mass %	Grade %Nb <sub>2</sub> O <sub>5</sub>	Nb Department %
Plant Feed	100%	0.75%	100%	100%	0.78%	100%
Primary Deslime	21.6%	0.51%	13.9%	23.2%	0.43%	12.5%
Pyrite Concentrate	1.0%	0.86%	1.1%	1.2%	0.65%	1.0%
Magnetic Concentrate	1.2%	0.91%	1.3%	1.0%	0.11%	0.1%
Densifying Cyclone	-	-	-	2.0%	0.64%	1.6%
Carbonate Concentrate	31.5%	0.08%	3.1%	24.5%	0.14%	4.3%
Dewatering Cyclones	0.4%	0.63%	0.4%	1.8%	1.10%	2.5%
Rougher Tails	29.7%	0.25%	9.6%	38.1%	0.36%	17.2%
Densifying Cyclone	-	-	-	0.5%	2.12%	1.4%
Cleaner Tails	1.7%	1.65%	7.8%	9.0%	0.30%	3.3%
Final Recovery	1.2%	40.6%	62.8%	1.0%	45.5%	56.1%

**Table 4: Moderately Oxidised Carbonatite Performance**

	Pilot Plant Mod Oxidised Carbonatite		
	Mass %	%Nb <sub>2</sub> O <sub>5</sub>	Nb Recovery %
Locked Cycle Test – 5 <sup>th</sup> Cleaner Concentrate	0.8%	40.6%	62.8%
Pilot Plant PP07 – 5 <sup>th</sup> Cleaner Concentrate	0.8%	45.5%	56.1%
<b>Pilot Plant PP07 – 4<sup>th</sup> Cleaner Concentrate (at target grade)</b>	<b>1.1%</b>	<b>40.2%</b>	<b>62.0%</b>
Grade - Recovery Curve prediction (at target grade)	-	40.0%	62.8%
Metallurgical Model Recovery	-	46.1%	55.5%