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MEDCALF PROJECT INTERIM METALLURGICAL TESTWORK RESULTS

ANNOUNCEMENT **26 OCTOBER 2017**

- **Interim metallurgical test work now completed, allowing the revised flowsheet to be finalised for inclusion in planned Definitive Feasibility Study (DFS).**
- **A combined process is developed consisting of magnetic separation – magnetising roasting – magnetic separation**
- **Two marketable products produced from the developed process, namely vanadium bearing iron concentrate, and titanium concentrate.**
- **The vanadium bearing iron concentrate contains 60% TFe and 1% V_2O_5, suitable for blast furnace.**
- **The titanium concentrate contains >50%TiO_2, suitable for the production of TiO_2 pigment by sulphate process.**
- **The economic value of vanadium, titanium and iron is all realised in this process.**

Audalia Resources Limited (ASX: **ACP**) is pleased to announce that the interim metallurgical testwork program of its 100% owned **Medcalf Vanadium-Titanium-Iron Project** in the Western Australia has been successfully completed by Guangzhou Research Institute of Non-ferrous Metals (GZRINM), delivering excellent results which have either met or exceeded expectations in all areas.

The major objectives of the interim metallurgical testwork were to provide an in-depth understanding on the characteristics of Medcalf mineralisation, overhaul the beneficiation circuit and identify a cost-effective process flowsheet for the recovery of all three valuable metals, vanadium, titanium and iron.

GZRINM has been commissioned to investigate a process of producing marketable product(s) from the Medcalf mineralisation. GZRINM has confirmed the ability to recover all three valuable metals, vanadium, titanium and iron, from the Medcalf mineralisation with two market products:

1. Vanadium bearing iron concentrate, containing 60% TFe and 1% V_2O_5; and
2. Titanium concentrate, containing >50% TiO_2.

MEDCALF PROJECT

The Medcalf Project is a vanadium-titanium-iron project located some 470 kilometres south east of Perth near Lake Johnston, Western Australia. The Medcalf Project comprises two granted Exploration Licences E63/1133 and E63/1134, one Miscellaneous Licence L63/75 as well as mining lease M63/656. Together these licences covering a total area of 24 km^2.

The Medcalf Project lies in the southern end of the Archaean Lake Johnston greenstone belt. This greenstone belt is a narrow, north-northwest trending belt approximately 110 km in length. It is located near the south margin of the Yilgarn Craton, midway between the southern ends of the Norseman-Wiluna and the Forrestania-Southern Cross greenstone belts.

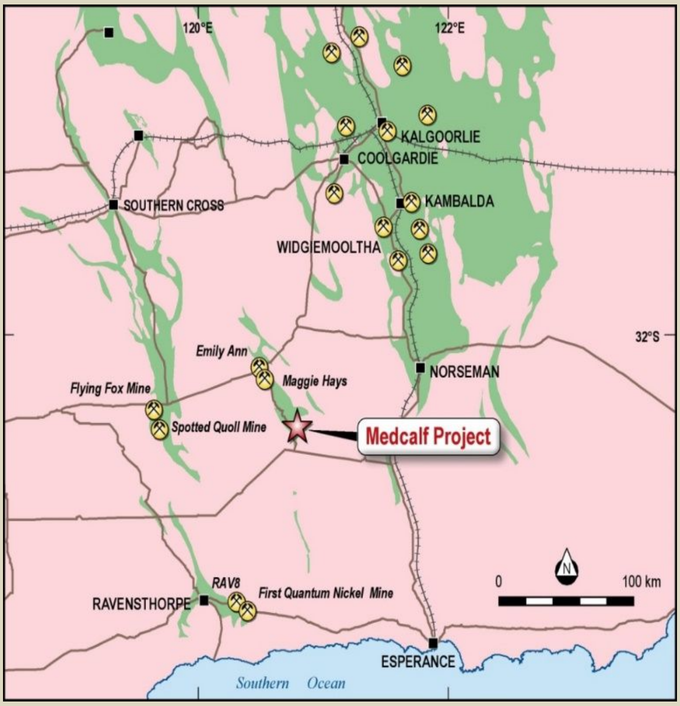

Figure 1: Medcalf Project - Location Map

Overview

The testwork was conducted using composite core samples drilled from the November 2015 PQ core drilling program (refer to ACP ASX announcement of 13 October 2016), and was designed to systematically investigate the extraction of vanadium, titanium and iron products from the Medcalf mineralisation. The chemical analysis of the composite is listed in Table 1.

Table 1: Chemical analysis results of the composite

Size (mm)	Mass (%)	Grade (%)				
		TFe	V_2O_5	TiO_2	Al_2O_3	SiO_2
+2.0	6.63	49.36	0.76	13.81	5.65	4.69
+1.0	11.68	50.14	0.78	14.40	5.33	6.73
+0.5	19.90	49.94	0.78	14.37	5.20	6.28
+0.25	13.69	48.92	0.83	14.75	7.08	8.06
+0.1	13.44	48.34	0.75	12.74	7.48	8.35
+0.075	4.11	45.64	0.69	15.99	10.00	7.90
+0.038	8.35	42.91	0.64	17.03	7.66	9.19
+0.02	8.9.	40.45	0.68	15.07	9.25	11.77
+0.01	3.26	30.59	0.44	9.48	14.78	19.69
+0.005	1.86	24.75	0.41	6.64	20.89	22.86
-0.005	8.15	15.45	0.30	3.52	25.50	32.80
Total	**100.00**	**44.05**	**0.70**	**13.33**	**8.83**	**10.46**

The testwork phases were conducted as follows:

+ **Mineralogical characterisation**: to quantitively identify the mineralogical composition of Medcalf mineralisation and the distribution of vanadium, titanium and iron in different minerals;
+ **Beneficiation testwork**: to investigate the concentration of valuable minerals and the removal of gangue materials by gravity separation, magnetic separation or flotation; and

- **Metallurgical testwork**: to investigate the extraction and separation of vanadium, titanium and iron minerals from beneficiated concentrate by pyrometallurgical process.

Mineralogical Characterisation

The mineralogical composition of the mineralised samples was determined by MLA (Mineral Liberation Analyser) coupled with SEM (Scanning Electron Microscope) quantitative analysis.

The results show that the mineralisation is heavily oxidised and contains a series of minerals spreading from primary to oxidised zone. The iron contained minerals are dominated with hematite, Ti-hematite, limonite, minor magnetite and maghemite. The titanium contained minerals are mainly ilmenite, alteration ilmenite, minor leucoxene and rutile. The gangue minerals are dominated with kaolinite and minor illite and serpentine. Vanadium is mainly distributed in the iron minerals, i.e. hematite and limonite. The content of deleterious elements, i.e. sulphur and phosphor, is very low.

Table 2: Mineralogical composition of Medcalf mineralisation

Mineral	Percentage (%)	Mineral	Percentage (%)	Mineral	Percentage (%)
Magnetite-maghemite-hematite (Ti-hematite)	40.85	Ilmenite-alteration ilmenite	15.82	Limonite	22.95
Leucoxene	0.22	Rutile	0.01	Kaolinite	18.24
Illite	0.30	Quartz	0.22	Amesite	0.26
Montmorillonite	0.19	Pyrophyllite	0.12	Others	0.82

The magnetism analysis results show that the magnetism of iron minerals (hematite and Ti-hematite) is overlapped with titanium minerals (ilmenite and alteration ilmenite). Therefore, the iron minerals cannot be effectively separated from titanium minerals by magnetic separation technique.

Key Points:

- The valuable elements of Medcalf mineralisation include vanadium, titanium and iron; and the content of deleterious elements sulphur and phosphor is very low.
- Vanadium mainly exists in the iron minerals, i.e. magnetite – hematite (Ti-hematite) and limonite.
- The occurrence of TiO_2 in the mineralisation is dispersed and exists in various minerals, such as ilmenite – alteration ilmenite, magnetite – hematite (Ti-hematite), limonite and etc.
- The magnetism range of iron minerals is overlapped with titanium minerals resulting in difficult separation of iron and titanium minerals by magnetic separation.

Beneficiation Testwork

Due to the magnetism intervals of hematite, ilmenite and limonite are overlapped, and furthermore, the specific gravity and floatability of hematite, ilmenite and limonite are very closed, it is almost impossible to obtain individual iron and titanium concentrate by physical beneficiation methods, such as gravity separation, magnetic separation or flotation. Therefore, the main objective of the beneficiation testwork was to provide a clean V-Ti-Fe concentrate for the subsequent metallurgical processing with as much of gangue materials removed.

Based on the abovementioned mineralogical characterisation testwork results, the following beneficiation techniques were examined individually or combined.

+ Magnetic separation, including LIMS and WHIMS;
+ Gravity separation, including shaking table and spiral; and
+ Flotation, including reverse flotation.

The beneficiation testwork results show that magnetic separation and gravity separation have achieved satisfactory results amongst all tested beneficiation methods. The beneficiation testwork results are listed in Table 3.

Table 3: Testwork results of two different beneficiation methods

Method	Products	Mass (%)	Grade (%)			Recovery (%)		
			TFe	V_2O_5	TiO_2	TFe	V_2O_5	TiO_2
Magnetic separation	Fe-V conc. (LIMS)	5.84	60.28	0.99	10.08	8.15	8.56	4.47
	Fe-V-Ti conc. (WHIMS)	68.40	49.48	0.77	15.60	78.37	77.94	81.03
	Bulk concentrate	74.24	50.32	0.79	15.17	86.52	86.50	85.50
Gravity separation	Fe-V-Ti conc.	67.29	49.07	0.78	15.60	75.53	74.65	78.86

Key Points:

+ Over 85% recovery for all vanadium, titanium and iron achieved by magnetic separation.
+ The combined concentrate produced by magnetic separation contains 50.32% TFe, 0.79% V_2O_5 and 15.17% TiO_2. The mass recovery is 74.24% with 25.76% removed as tailings.
+ Concentrate produced by gravity separation exhibits similar product grades for vanadium, titanium and iron, but with lower product recovery. The mass recovery reported is also lower than the magnetic separation.
+ Flotation is not considered due to its technical complexity and lower metal recovery compared to magnetic separation and gravity separation.
+ Based on the above results, a bulk concentrate was produced by magnetic separation for the subsequent metallurgical testwork.

Metallurgical Testwork

The metallurgical testwork was undertaken using the bulk concentrate produced by the magnetic separation testwork. The following four types of roasting techniques were examined to investigate the separation and enrichment of vanadium, titanium and iron on the beneficiated concentrate.

+ Oxidation roasting
+ Magnetising roasting
+ Direct reduction roasting, and
+ Two stage roasting

It is identified from the testwork that 'magnetising roasting – magnetic separation' process can produce the products (**vanadium bearing iron concentrate and titanium concentrate**) suitable for downstream processing with excellent recovery of vanadium and iron. The selected process consists of the following steps:

+ Magnetising roasting
+ Magnetic separation to separate vanadium bearing iron concentrate and titanium concentrate
+ Shaking table to upgrade titanium concentrate.

The key process developed by GZRINM is a low temperature roasting (LTR) with short roasting time of 60 minutes. This process significantly reduces the energy demand compared to the conventional salt roasting technique of V_2O_5 production. Other process parameters, including reductant type and dosage, magnetic field intensity and etc. have been optimised during the program as well. The metallurgical testwork results are listed in Table 4.

Table 4: Metallurgical testwork results

Products	Mass (%)	Grade (%)			Recovery (%)		
		TFe	V_2O_5	TiO_2	TFe	V_2O_5	TiO_2
Fe-V concentrate	52.68	59.22	1.00	8.38	74.14	77.30	33.68
Ti concentrate	8.11	30.45	0.23	50.32	5.64	2.72	31.13

Key Points:

+ The grade of V, Ti and Fe in the bulk concentrate has little effect on the metallurgical separation and enrichment results. But the total content of SiO_2 and Al_2O_3 should be controlled below 12%, or will have adverse effect on the results.
+ A low temperature magnetising roasting process is developed and the process parameters are optimised.
+ Two market acceptable products are produced from the developed process with excellent recovery of vanadium and iron.
+ The vanadium bearing iron concentrate meets the feedstock requirement for blast furnace ironmaking, and vanadium can be recovered in the steelmaking process.
+ The titanium concentrate can be used for the production of TiO_2 pigment by conventional sulfate process.
+ The developed process is a combined beneficiation and metallurgical process consisting of 'magnetic separation - magnetising roasting – magnetic separation – gravity separation'.
+ The process exhibits advantages of simple and reliable, technically mature and excellent product specification.
+ Simple processing could mean significantly lower CAPEX and OPEX against peers as well as shorter construction time.

Production of Titanium Dioxide Pigment

The above magnetising roasting – magnetic separation process produced two products, namely V-bearing iron concentrate and low grade Ti concentrate. The low grade Ti concentrate contained about 35% TiO_2 with 65% recovery, and it can be further upgraded using shaking table to the final Ti concentrate with >50% TiO_2 and 31% recovery. The production of titanium dioxide pigment by sulphate process was investigated using both low grade and final Ti concentrates for comparison.

The sulphate process consists of two stage acid baking – leaching, reduction and crystallisation of titanyl sulphate solution, hydrolysis and calcination of meta-titanic acid. The testwork results are listed in Table 5.

Table 5. Results of TiO_2 pigment production

Feedstock	Feedstock Spec.		TiO_2 Pigment	
	TiO_2 (%)	Recovery[1] (%)	TiO_2 (%)	Recovery[2] (%)
Low grade Ti conc.	35.66	65	98.28	83.94
Final Ti conc.	50.32	31.13	99.20	86.78

1. Recovery of TiO_2 in the beneficiation and metallurgical process.
2. Recovery of TiO_2 in the TiO_2 pigment production process.

Key Points:

- Both low grade and final titanium concentrate can be used to produce TiO_2 pigment by sulfate process.
- Good TiO_2 purity and recovery achieved for both type of concentrates.
- The TiO_2 pigment produced by the testwork is identified as rutile TiO_2.

Reflux Classifier Testwork by Nagrom

Gravity separation has been identified as an effective beneficiation method for Medcalf mineralisation in all testwork programs undertaken by Audalia. Reflux Classifier was preliminarily tested in the previous testwork with encouraging results. It was then decided to further investigate the applicability of Reflux Classifier in a systematic manner. A local laboratory, Nagrom, was commissioned by Audalia to develop and undertake the testwork program. The same composite sample used in the GZRINM test program is also used in the Reflux Classifier testwork.

Reflux Classifier is a form of gravity based mineral separation equipment developed by FLSmidth Ludowici. The equipment separates small particles based on the difference in density or particle size. This equipment incorporates the new 'laminar high shear rate' mechanism, along with advancements in channel spacing and width, resulting in more efficient and more compact separation of mineralisation compared to conventional gravity based separation equipment, i.e. spiral.

The results of Reflux Classifier testwork is listed in Table 6.

Table 6. Results of Reflux Classifier testwork.

Products	Mass (%)	Grade (%)			Recovery (%)		
		TFe	V_2O_5	TiO_2	TFe	V_2O_5	TiO_2
Fe-V-Ti concentrate	73.03	51.16	0.72	14.78	80.57	81.60	82.34

Key Points:

- Reflux Classifier is effective in upgrading the valuable elements (V, Ti and Fe) of the Medcalf mineralisation.
- Over 80% recovery is achieved for all vanadium, titanium and iron.
- The concentrate mass recovery and grade is comparable to the results obtained by magnetic separation in GRZINM.
- The product recovery is slightly lower than magnetic separation, but higher than gravity separation (spiral).

Future Testwork

Given the promising and excellent testwork results achieved by GZRINM and Nagrom, the following work will be carried out in the next stage of the project development.

- Evaluation of magnetic separation and Reflux Classifier for the beneficiation circuit. Factors to be considered will include capital and operating costs, maturity and reliability of the technology, operator requirements, manufacturer support, and etc.
- Pilot scale testwork of the combined beneficiation – metallurgical process developed by GZRINM. The pilot testwork will provide critical technical parameters for engineering and plant design. Audalia has already received the Programme of Work (PoW) approval for the construction of a bulk sample pit to supply samples for the pilot testwork.

About GZRINM and Nagrom

The interim metallurgical testwork programme was carried out at the reputational Guangzhou Research Institute of Non-ferrous Metals (GZRINM) research facilities in Guangzhou, China. GZRINM is the largest scientific research organisation engaging in research and development of resource comprehensive utilisation and new materials in southern China. GZRINM have been working on many overseas mineral projects, including the Lynas Corp. Mt Weld Rare Earth project and the Syrah Resources Balama Graphite project.

Nagrom is a privately owned Western Australian company and has been providing metallurgical services to the mining industry for over 30 years. Located in Kelmscott WA, Nagrom is specialised in all aspects of mineral separation and concentrates preparation.

END

Authorised by:

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CEO and Executive Director

Forward Looking Statements and Cautionary Statements

Some statements in this summary regarding estimates or future events are forward-looking statements. They include indications of and guidance on, future earnings, cash flow, costs and financial performance. Forward-looking statements include, but are not limited to, statements preceded by words such as “planned’, “expected”, “projected”, “estimated”, “may”, “scheduled”, “intends”, “anticipates”, “believes”, “potential”, “could”, “nominal”, “conceptual” and similar expressions. Forward-looking statements, opinions and estimates included in this announcement are based on assumptions and contingencies which are subject to change without notice, as are statements about market and industry trends, which are based on interpretations of current market conditions. Forward-looking statements are provided as a general guide only and should not be relied on as a guarantee of future performance. Forward-looking statements may be affected by a range of variables that could cause actual results to differ from estimated results, and may cause the Company’s actual performance and financial results in future periods to materially differ from any projections of future performance or results expressed or implied by such forward-looking statements. These risks and uncertainties include but are not limited to liabilities inherent in mine development and production, geological, mining and processing technical problems, the inability to obtain mine licences, permits and other regulatory approvals required in connection with mining and processing operations, competition for among other things, capital, acquisitions of reserves, undeveloped lands and skilled personnel; incorrect assessments of the value of acquisitions, changes in commodity prices and exchange rates; currency and interest rate fluctuations; various events which could disrupt operations and/or the transportation of mineral products, including labour stoppages and severe weather conditions; the demand for and availability of transportation services; the ability to secure adequate financing and management’s ability to anticipate and manage the foregoing factors and risks. There can be no assurance that forward-looking statements will prove to be correct.

Statements regarding plans with respect to the Company’s mineral properties may contain forward-looking statements. Statements in relation to future matters can only be made where the Company has a reasonable basis for making those statements.