COMMISSIONING AND RAMP UP OF THE ALBION PROCESS AT THE GPM GOLD PROJECT

By

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ABSTRACT

The GPM Gold Project is located in Armenia, and consists of an open cut mine at Zod, near the Azerbaijan border, and a CIL processing plant at Ararat near the Turkish border. Mining at Zod commenced in 1976, and focused on near surface oxide ores, which overlay deeper refractory sulphides. Historical mining has now almost depleted the oxide ores, and the sulphide content of ore delivered to the processing plant at Ararat is increasing. Gold and silver recoveries through the Ararat plant were declining steadily.

GeoProMining, the owners of the project, have expanded the Ararat facility to deal with the increasing sulphide content in the ore. In 2014, GeoProMining refurbished an existing concentrator on site to recover a sulphide concentrate from the ore, and have constructed an Albion Process™ plant to oxidize the refractory concentrate. Glencore Technology (GT) provided the Albion Process™ plant as a technology package.

In July 2014, the progress of the GPM Gold Project Albion Process™ Plant was reported (Hourn, Voigt and Turner, 2014). At the time of writing, the construction of the plant was nearly complete. This paper presents an update of project progress, covering commissioning and ramp up of the GPM Gold Project.

The commissioning phase occurred over June to August 2014, which included an M3,000 IsaMill™ fine grinding plant, a 6 tph limestone milling plant, a 60 tpd vacuum pressure swing adsorption oxygen plant, a 10m residue thickener and a 12tph Albion Process™ oxidative leach plant. Since commissioning was completed, ramp up occurred over the following three months with downstream gold recoveries from cyanide leaching reaching over 98%.

Hourn, M., Voigt, P., & Turner, D., (2014) Development of the Albion Process plant to treat refractory concentrates from the GPM Gold Project, Proceedings – Hydroprocess Conference, 2014.

THE GPM GOLD PROJECT

The GPM Gold Project is owned by GeoProMining Gold LLC and is located in Armenia. The project consists of an open cut mine at Zod, near the Azerbaijan border, and a processing plant at Ararat near the Turkish border. The Ararat plant has a milling and flotation facility built during the soviet era, with a capacity of 1 million tonnes annually, and a CIL plant built in 1997, with a capacity of 1.5 million tonnes annually. The gold bearing ore, mined at the Zod Mine, is transported to the process plant at Ararat via a state owned rail link.

The Zod deposit originally consisted of weathered oxide ores overlying deeper sulphides. Arsenopyrite and pyrite are the major sulphide minerals. Historical mining has depleted the oxide ores, and the processing plant at Ararat currently treats significant quantities of sulphide ore with increasing amounts of gold locked within refractory sulphides.

The mineral reserves for the Zod mine, at August 2011, were estimated to be 14.2 million tonnes at a gold grade of 4.3 g/t. The mineral resources were estimated to contain 28 million tonnes of ore in the indicated category, at a gold grade of 4.2 g/t and 16 million tonnes of ore in the inferred category, at a gold grade of 4.2 g/t.

GeoProMining are expanding the Ararat plant by re-commissioning an existing flotation concentrator to recover a sulphide concentrate from the ore, and constructing an Albion Process (Hourn & Turner, 2012) plant to oxidize the refractory concentrates. The Albion Process plant will convert the sulphides to oxides, breaking down the sulphide matrix and liberating gold and silver for recovery. Tailings from the concentrator and the Albion Process plant will be combined and transferred to an existing CIL plant to recover the gold and silver as bullion.

Refurbishment of the concentrator and construction of the Albion Process plant commenced in 2013, with commissioning completed in August 2014. The Albion Process plant will has a design capacity to process up to 110,000 tonnes per annum of refractory concentrate from the concentrator.

DEPOSIT GEOLOGY

The Zod deposit is located in the Vardenis District of Western Armenia within a setting of volcanogenic and volcanogenic-carbonate sequences, with gabbro-peridotite intrusions that have metamorphosed to serpentinite (Konstantinov & Grushin, 1970).

Gold mineralization is associated with carbonate alteration of ultramafic rocks and is commonly hosted within hydrothermal alteration zones, represented by talc carbonate and quartz-carbonate assemblages. The ore is moderately hard with a medium level abrasion index.

Gold occurs as native free gold, finely dispersed gold in arsenical sulphides, gold tellurides and secondary native gold remaining after oxidation of sulphides and tellurides. Silver occurs in its native form in quartz, chalcopyrite and pyrite, and as silver tellurides.

The deposit has an average sulphur grade of 1.4 % w/w, with an average gold and silver grade of 4.54 g/t and 4.65 g/t, respectively. The arsenic grade across the deposit is 0.3 %w/w. The majority of the sulphides occur as relatively coarse mineral grains. The dominant gangue minerals are quartz, talc and chlorite, with minor magnesite, dolomite and calcite.

DEVELOPMENT TESTWORK

Development testwork for the GPM Gold Project began in 2009 initially with batch testwork, and culminated in a continuous flotation and Albion Process pilot plant run over the months May and June 2010. Approximately 4,600 kg of sulphide ore samples were collected from across the Zod ore body to support the testwork program. The samples were classified by ore type, spatial location and sample type and blended into 163 composites. The composites were then grouped into the four major orebodies identified in the primary sulphide resource – orebodies 1, 4, 16 and 23.

Diagnostic leaching and ore characterization testwork (Rohner & Andreatidis, 2010) confirmed that an average gold recovery of only 48 %w/w was possible from the blended Life of Mine ore adopting conventional carbon in leach (CIL) leaching methods, and that the majority of the refractory gold was present in arsenical minerals, such as arsenopyrite and arsenical pyrite. Laser ablation work showed that the majority of the pyrite had levels of arsenic in the lattice, averaging 0.9 %w/w.

Comminution testwork focused on generating comminution modeling parameters to determine the capacity of the existing crushing and grinding circuit at the Ararat plant. The ore displayed an average Bond Crushing Index of 10 kWh/t, an abrasion index of 0.085 and an unconfined compressive strength of 59 kN. The Bond Ball Mill work Index was 16.5 kWh/t and the Bond Rod Mill work index was 15.8 kWh/t. Modeling work by SMMC (Morrell, 2010) confirmed the milling circuit at the Ararat plant would be capable of processing between 0.9 and 1 Mt/a of ore from the Zod deposit, with minor refurbishment.

Batch and locked cycle flotation campaigns were completed on the testwork samples and a flowsheet consisting of a bulk roughing and single cleaning stage was developed and taken forward into a continuous pilot run. The continuous pilot plant testwork proved a sulphide recovery of 93 % could be achieved from the Zod ores, at a mass recovery of 9 – 10 %. Gold recovery to the sulphide concentrate was 87 %, at a silver recovery of 91 %. The sulphide grade of the concentrate was in the range 16 – 18 %.

The analysis of the blended pilot plant cleaner concentrate is presented in Table 1.

Table 1 Cleaner Concentrate XRD Data

Mineral	Chemical Formula	(%w/w)
Unidentified		20.03%
Arsenopyrite	FeAsS	6.78%
Chalcopyrite	$CuFeS_2$	2.43%
Clinochlore	$(Fe,Mg)_3Fe_3AlSi$	1.58%
Dolomite	$CaMg(CO_3)_2$	1.30%
Galena	PbS	0.40%
Magnesite	$MgCO_3$	2.80%
Plagioclase (Albite)	$NaAlSi_3O_8$	4.50%
Pyrite	FeS_2	36.63%
Pyrrhotite	FeS	5.60%
Quartz	SiO_2	3.90%
Talc	$Mg_3Si_4O_{10}(OH)_2$	17.58%

The flotation tailings contained 13 % of the gold, and CIL testwork indicated a gold recovery of 60 % could be achieved from the flotation tailings at modest reagent demand. The CIL plant at Ararat has a capacity well in excess of the 1 million tonnes per annum treatment rate for the project, and so co-treatment of both the oxidized flotation concentrate and the flotation tailings was incorporated in the design.

IsaMill signature plot testwork on the pilot plant composite concentrate sample returned a specific grinding energy of 59 kWh/t to grind the concentrate to the target 80 % passing size of 10 μm. The current plant is operating at a coarser grind of around 12μm with a specific energy of 45 kWh/t. To date the coarser grind has not impacted precious metals recovery.

Extensive testwork was carried out to determine the best oxidative leach pH for the finely ground concentrates. The testwork examined oxidative leaching under mildly acidic conditions for selective oxidation of the arsenopyrite minerals, and leaching at a more neutral pH. All tests were carried out under atmospheric pressure, with oxygen gas as the oxidant.

Leaching at near neutral pH was ultimately chosen for the oxidative leach. Leaching at near neutral pH allowed lower cost materials of construction to be used in the leaching circuit, and resulted in a final residue with more stable arsenic phases when tested in accordance with the USEPA TCLP protocol. Cyanide and lime demands were lowest for the residue generated under near neutral pH, and the gold and silver recoveries were higher.

The two major oxidative leach reactions observed under the near neutral oxidative leaching conditions were:

Pyrite: $FeS_2 + 15/4O_2 + 9/2H_2O + 2CaCO_3 = FeO.OH + 2CaSO_4.2H_2O + 2CO_2$

Arsenopyrite: $FeAsS + 7/2O_2 + 2H_2O + CaCO_3 = FeAsO_4 + CaSO_4.2H_2O + CO_2$

Confirmatory bench scale oxidative leaching testwork was then carried out on flotation concentrates from the four main orebodies at the Zod deposit. Economic modeling work that compared the capital and operating costs for the Albion Process plant at varying levels of sulphide oxidation was carried out using the batch leach test results. The modeling work showed that a sulphide oxidation of 70% returned the highest Net Present Value for the project, at a hurdle rate of 10 %. The gold recovery at this level of oxidation was 93%.

Continuous pilot plant oxidative leaching testwork was then carried out on a blended concentrate. The continuous pilot testwork confirmed a sulphide oxidation of 70 % was required to achieve an average gold recovery from the blended feed of 93%. The average silver recovery was 80%. A design oxidation target of 75% was taken forward into detailed design of the oxidative leach circuit. The oxygen demand for the concentrate to achieve the design oxidation of 75 % was 336 kg/tonne, and the limestone demand was 326 kg/tonne. Mass and heat balance modeling indicated an average operating temperature in the oxidative leach circuit of 96 ^oC.

PROCESS PLANT DESCRIPTION

Plant General

The Ararat Process Plant experiences a hot, dry summers and cold winters, with an absolute maximum temperature of +42°C; and a minimum of -30°C. The region is classified as semi-desert with an average rainfall of 238mm. The maximum 10 days depth of snow mantle is 35cm, at a design snow load pressure of 70 kg/m². The area is seismically active, and the plant is designed to survive a magnitude 7.2 earthquake. A flowsheet for the GPM Gold Project is shown in Figure 1.

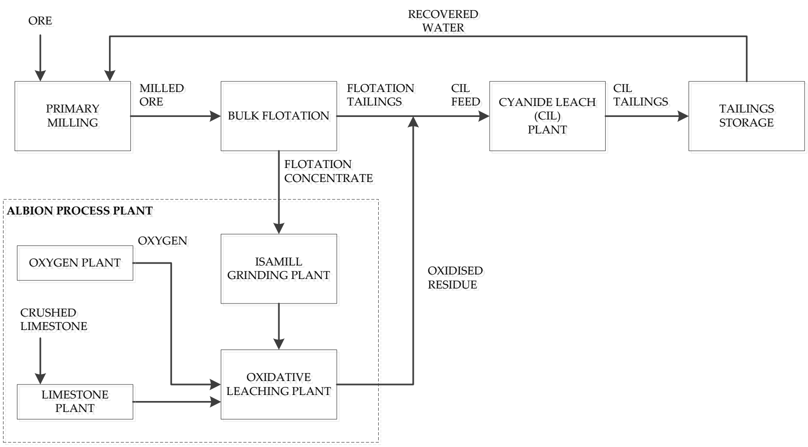

Figure 1 - GPM Gold Project Overall Flowsheet

Comminution and Flotation

Ore is mined at the Zod Mine by open cut methods and delivered to a run of mine stockpile for blending ahead of crushing. Crushed ore is trucked to a stockpile at a rail siding and loaded into rail cars for transport to the Ararat Plant. Ore is recovered at the plant by tippler, into ore storage bins. Ore is recovered from the bins by apron feeder and conveyed to the comminution circuit.

The comminution circuit consists of two parallel milling lines. Each line has a primary 1600 kW Autogenous Grinding mill, operating in closed circuit with spiral classifiers, followed by two secondary 630 kW Ball Mills, each operating in closed circuit with cyclones. The Ball Mills are configured in parallel. Cyclone overflow from the Ball Mills are directed to the flotation feed tank.

The flotation circuit had not been operated for over 10 years and refurbishment works were part of the overall project. The existing flotation plant equipment consisted of two banks with five cells in each, and two banks with four cells in each. Each cell is fitted with dual 45 kW agitators, with a cell volume of approximately 32 m^3. The detailed design, procurement and installation was conducted by GPM and their nominated engineering company separate from Glencore Technology.

Slurry is fed to an agitated 25m^3 flotation feed tank which overflows to the first cell for conditioning with frother. Conditioned slurry then gravitates to Pre-flotation cells, which will be used for pre-flotation of talc and carbonaceous slimes. The pre-flotation concentrate is gravitated to the tailings pumpbox and then to the 15 m diameter Flotation Tailings Thickener.

Tailings slurry from the pre-flotation stage gravitates to a Rougher Conditioner cell, which is used for conditioning of the slurry with copper sulphate and collector prior to rougher flotation. Conditioned slurry flows to the Rougher/Scavenger cells to produce a rougher concentrate for cleaning. The tailings slurry from Rougher/Scavenger flotation is transferred to the Flotation Tailings Thickener, with the thickened underflow slurry pumped to the CIL circuit.

Rougher concentrate will be transferred to the Cleaner Flotation Bank. The two cleaner banks operate in series with both cleaner concentrates combined as the final concentrate. The final Cleaner Concentrate is pumped to the 10 m diameter Flotation Concentrate Thickener, with the thickened underflow concentrate pumped to the IsaMill circuit for fine grinding. Cleaner tails are recycled to the scavenger circuit.

Albion Process

The Albion Process is a combination of ultrafine grinding and oxidative leaching at atmospheric pressure. The Albion Process™ technology was developed in 1994 by Glencore Technology and is patented worldwide. There are five Albion Process plants currently in operation.

The first stage of the Albion Process is fine grinding of the concentrate. Most sulphide minerals cannot be efficiently leached under normal atmospheric pressure conditions. The process of ultrafine grinding results in a high degree of strain being introduced into the sulphide mineral lattice. As a result, the number of grain boundary fractures and lattice defects in the mineral increases by several orders of magnitude, relative to un-ground minerals. The introduction of strain lowers the activation energy for the oxidation of the sulphides, and enables leaching under atmospheric conditions. The rate of leaching is also enhanced, due to the increased mineral surface area.

Fine grinding also prevents passivation of the leaching mineral by products of the leach reaction. Passivation occurs when leach products, such as iron oxides and/or elemental sulphur, precipitate on the surface of the leaching mineral. These precipitates passivate the mineral by preventing the access of oxidants to the mineral surface.

After the concentrate has been finely ground, the slurry is then leached in agitated vessels with oxygen to oxidize the sulphide minerals. Leaching is carried out under atmospheric pressure, and autothermally. Excess heat generated from the oxidation process is removed through humidification of the vessel off gases.

The average nominal throughput for the Albion Process Plant is 94,007 t/a of cleaner concentrate, with a design factor of 15 % applied to the average rate to achieve a design rate of 108,108 t/a. The average gold and silver throughput is 127,000 and 131,000 ounces per annum, respectively.

The feed rate to the IsaMill Fine Grinding circuit is 12.1 t/h, with a design feed rate of 13.9 t/h of concentrate and a final 80 % passing size of 11 μm. Since commissioning, the IsaMill energy demand to achieve this grind size is typically 800 kW. The available drawn power for an M3000 IsaMill is 1,120 kW and this mill was chosen for the ultrafine grinding circuit. The completed IsaMill circuit at Ararat is shown in Figure 2. The current grind size is typically 80% passing size of 11 – 12 μm with a specific energy of 45 kWh/t which results is above target downstream gold recovery.

Finely ground slurry is then pumped to an agitated ground concentrate storage tank. The oxidative leach circuit consists of nine 240 m^3 Albion Leach Reactors, each with a live height of 9.4 meters and a diameter of 5.4 meters. Each reactor is agitated by a 160 kW dual impeller agitator, with oxygen delivered by a bank six HyperSparge oxygen injection lances in each reactor. The HyperSparge units are shown in Figure 3.

The slurry pH is maintained at 5.0 – 5.5 in each reactor by limestone slurry dosing.

Figure 2 - IsaMill Grinding Circuit – GPM Gold Project

Figure 3 - HyperSparge units – GPM Gold Project

The design rate of sulphide oxidation within the oxidative leach is 1800 kg/h. Under the near neutral pH conditions employed in the oxidative leach, sulphate is the reaction product of sulphide oxidation, with a design oxygen requirement of 3750 kg/h. The Albion Leach Reactors have all been designed to achieve an oxygen transfer rate of 4700 kg/h. The design oxygen capture efficiency in the leach train was 80 %. Site survey data collected to date suggests that the oxygen capture efficiency currently being achieved exceeds 90 %.

The oxygen mass transfer rate for the oxidation of the sulphide minerals is defined by the following equation (Shuler and Kargi, 2002):

$$\text{Oxygen Transfer Rate} = K_L a\,(C_{sat} - C) \qquad (1)$$

Where:

K_L = liquid film mass transfer coefficient for oxygen into the slurry, in units of $m.s^{-1}$

a = the specific gas surface area, in units of $m^2.m^{-3} = m^{-1}$

C_{sat} = the solubility of oxygen in the slurry at saturation, in units of $g.m^{-3}$

C = the steady state oxygen level in the slurry, in units of $g.m^{-3}$

The "K_L" and "a" terms are typically combined in the form of a mass transfer coefficient for the system. The design K_La for the Albion Leach Reactors is 0.12 s^{-1}. Oxygen gas has poor solubility in water, and so mechanical devices such as agitators and spargers are required to assist the mass transfer. In the Albion Leach Reactor, oxygen gas is sparged into the vessel using the HyperSparge supersonic gas injection lances. The HyperSparge oxygen injection system achieves very high oxygen mass transfer rates at the interface between the supersonic gas jet and the impinging slurry, reducing the amount of power required from the agitation system.

The agitator drawn power required to achieve the design mass transfer coefficient was determined using an empirical correlation of the form (Nielsen and Villadsen, 1994):

$$K_La = A * U_s^{\alpha} * (P_g/(\ p_{SL}\ V))^{\beta} \quad (2)$$

Where

A = a constant specific to the ionic strength of the leach solution

U_s = the gas superficial velocity in the reactor, in units of $m.s^{-1}$

P_g = the agitator drawn power under gassed conditions, in units of Watts

p_{SL} = the density of the slurry, in units of $kg.m^{-3}$

V = the volume of the slurry, in units of m^{-3}
α, β = dimensionless empirical constants

The A, α and β parameters used for sizing the agitator were determined based on over 900 laboratory and pilot mass transfer tests. This correlation has been used successfully in the scale up of all operating Albion Process plants to date. A drawn power requirement of 120 kW per Albion Leach Reactor was determined using the correlation.

The residence time for the oxidative leaching circuit was designed based on the specific rate constant for pyrite leaching measured in the batch and continuous leaching testwork. Pyrite oxidation under near neutral pH conditions is first order (Singer and Stumm, 1970), allowing a simple scale up. The residence time scale up was based on the method of Henein and Beigler (Henein & Beigler, 1988). A design residence time of 40 hours was calculated for the oxidative leach circuit.

Each Albion Leach Reactor was fabricated from lean duplex alloy steel having a diameter of 5460 mm and a live height in the range 9100 – 8100 mm. The Albion Leach Reactors were supplied in modular sections for rapid assembly on site. Each Reactor was constructed from 15 panels, each with a height of approximately 2 m and an arc length of 5.9 m. These panels were all fabricated off site and imported to the plant site in shipping containers. Baffles, slurry risers, leach tank lids, agitator support platforms and off gas stacks were all provided as part of the modular Glencore Technology equipment supply. Assembly of the oxidative leach train was rapid, with all nine leach reactors and two slurry storage tanks complete within 8 weeks. The final two tanks were erected in approximately three days each. The completed oxidative leach train is shown in Figure 4.

Overflow slurry from the oxidative leaching circuit will gravitate via a slurry sampler to a 10 m diameter thickener and be thickened to 45 %w/w solids prior to transfer to the CIL circuit. Thickener overflow is returned to the leach circuit to compensate for evaporative losses in a density control loop.

Figure 4 - Oxidative Leach Circuit – GPM Gold Project

A limestone plant with a capacity of 6 tph was installed to generate limestone slurry for neutralizing duty. Limestone for the oxidative leach will be milled to an 80 % passing size of 75 microns in a 132 kW overflow ball mill operating in closed circuit with cyclones. Cyclone overflow will report to a 150 m^3 agitated distribution tank and be circulated through the oxidative leach train by a ring main. Individual dosing lines will add limestone slurry to each Albion Leach Reactor. The limestone distribution tank was a 150m^3 ZipaTank zip join tank – the first of its kind the in the world. The tank was erected in approximately 5 days and was internally sealed with specially selected paint. The joins sealed on the first filling. The limestone distribution tank is shown in Figure 5.

Figure 5 - Limestone storage tank – GPM Gold Project

Two 60 t/d VPSA oxygen plants will operate in parallel to provide oxygen to the Albion Process Plant. Oxygen will be delivered from each plant at a maximum flowrate of 1,745 Nm^3/h, at a purity of 93 % v/v.

The thickened oxidative leach residue and thickened flotation tailings will report to a 100 m^3 mixing tank and be blended prior to feed to the CIL plant. The CIL Plant will process 137.5 t/h of feed comprised of oxidized residue and flotation tailings. All six existing CIL tanks will be utilized, providing a total residence time in the CIL circuit of 41 hours. The CIL Plant is expected to consume 5.3 kg/t of sodium cyanide and 10 kg/t of lime. Carbon levels in the CIL Plant will be 10 – 15 kg/m^3, with a design carbon loading of 2,500 g/t. Carbon movements will total 7.5 t/d, and the existing dual AARL elution circuits will be used for carbon processing.

CIL Plant tailing gravitates to a cyanide destruction plant prior to being pumped to tailings. The tailings will be deposited within the existing tailings impoundment, approximately 6 km from the Ararat plant site.

Plant control is achieved through a Distributed Control System (DCS) located in a centralized control room between the concentrator and Albion Process plants. Training for field and control room operators was provided by GT and sub-contractors as part of the commissioning process. The control room is shown in Figure 6.

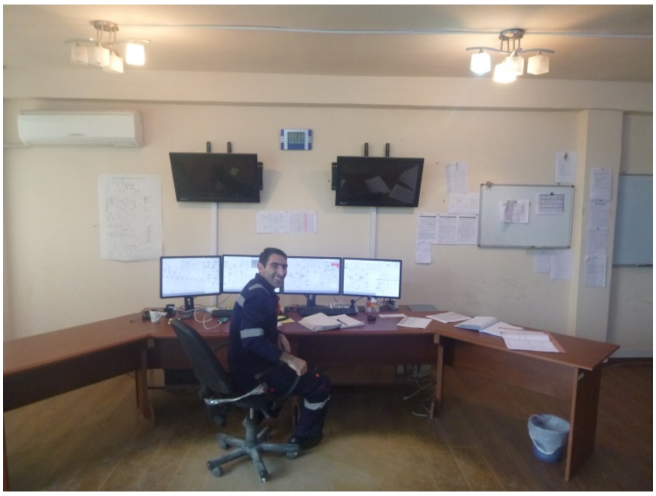

Figure 6 – Central control room for concentrator and Albion Process plant.

PROJECT STATUS AND PLANT PERFORMANCE

The Albion Process plant was provided to the GPM Gold Project as a Lump Sum technology package by GT. The package included all detailed design, mechanical equipment, electrical, instrumentation and control equipment, structural steel, flooring, handrails, piping and valves. The scope of supply includes the fine grinding plant, oxidative leaching and thickening plant and the supporting limestone, oxygen, flocculent and caustic reagent plants.

Mechanical design was completed in December 2012, with the majority of mechanical equipment and fabricated components delivered to site by May, 2013. Site civil works were completed in March 2013. Construction was completed in April 2014.

The pre-commissioning phase was conducted during April/May 2014 with wet commissioning commencing in May/June 2014 and completed in August 2014. The commissioning was managed and coordinated by Glencore Technology. The commissioning team comprised three permanent Glencore Technology personnel (manager/process engineer, mechanical engineer and instrumentation engineer) supported by equipment specialists brought to site during crucial commissioning events. The GPM site team provided all other support.

The main setback during commissioning was the failure of an oxygen plant blower which had a lead time of 12 months to replace. Dual oxygen plants were supplied to the project, each with the capacity to oxidise 70 % of the design sulphide feed, and so the blower failure has not impacted on plant throughput to date. The blower will be repaired and the second oxygen plant will be in service by May 2015.

The main setback for ramp-up has been the lack of feed quantity and quality from the refurbished concentrator. A project is in place to improve concentrator performance with expected results by October 2015.

As of March 2015 the refurbished concentrator was running at around 60% capacity with recent assistance from GT during March increasing throughput by 30%. The Albion Process plant performance has not been impacted by the slow ramp up of the concentrator, with the plant regularly achieving 95% gold recovery with around 50% sulphur oxidation.

A survey of the nine Albion Leach Reactors was collected to determine tank-by-tank sulphur oxidation and resulting gold extraction. The sulphur oxidation was determined using a Leco sulphur analyzer. Gold extraction was determined by subjecting each collected sample to a bottle roll test at the GPM laboratory and cross checked with an agitated CIL test at hrltesting laboratory in Brisbane. The sulphur oxidation against gold recovery from the plant and compared to pilot plant results is shown in Figure 7.

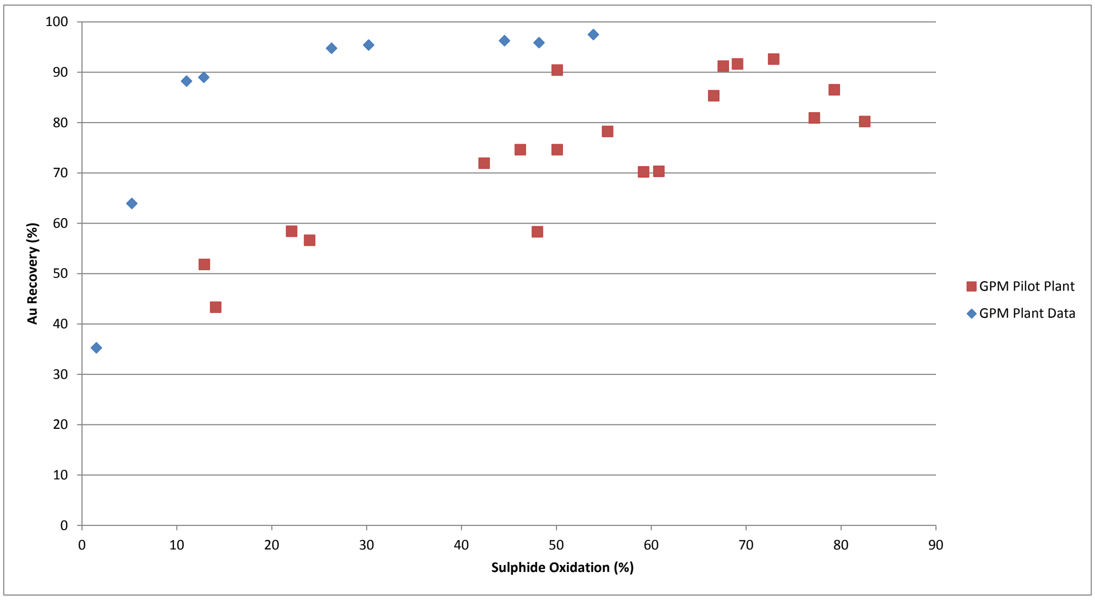

Figure 7 - Sulphide oxidation against gold recovery comparing pilot plant data and actual operating data.

Testwork done on individual components of the pilot plant feed are consistent with this level of oxidation and corresponding gold recovery.

A profile of sulphur oxidation and gold recovery was collected down the nine leach reactors. The data are presented in Figure 8.

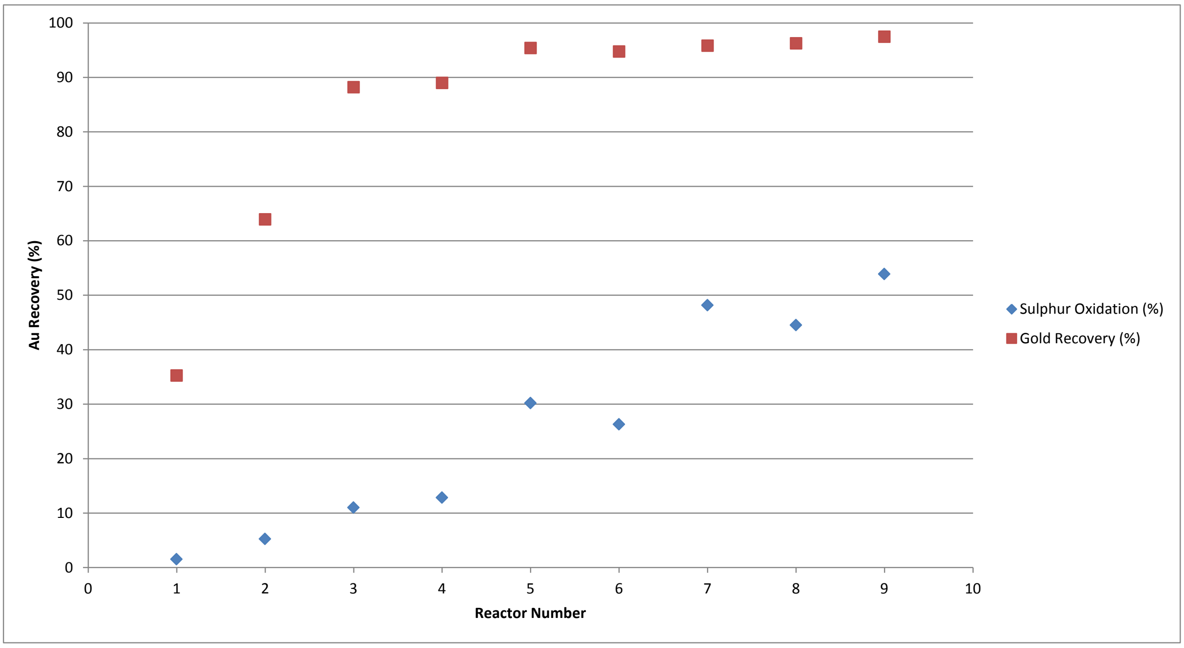

Figure 8 – Profile of sulphuide oxidation and gold recovery down the leaching train. Plant is on reduced rates.

Figure 8 shows the profile of the sulphide oxidation and gold recovery down the leach train. Although one oxygen plant is operating, there is sufficient oxygen available to increase the throughput rate if feed was available from the concentrator.

The current oxygen consumption is operating at around 215 kg / t concentrate which is below the design value of 336 kg / t owing to higher than design oxygen utilization and lower oxidation levels for this feed material compared to the design case.

Current limestone consumption is very low owing to higher entrainment of acid consuming gangue with the flotation concentrate. Steady feed composition at full production rates will allow limestone consumption to be better analysed.

Cyanide consumption in the CIL plant is within the range expected during pilot testwork. The plant is currently operating at 1.8 to 2.2 kg sodium cyanide per tonne of feed to the CIL plant which is the combination of leach residue and flotation feed.

CONCLUSION

The GeoProMining Albion Process™ plant was commissioned successfully over a 14 week period. The plant is achieving greater than 95% gold recovery in the cyanide leaching plant, consuming 1.8 – 2.2 kg cyanide / t combined leach residue and flotation tails.

The plant is running on reduced rates due to concentrate feed availability, as mine development has been slower than planned. GT continues to work with GPM to improve the concentrator performance. At the end of April 2015, GPM achieved a 30% increase in concentrator throughput with the assistance of GT. The second oxygen plant commissioning is scheduled for June 2015, and full plant throughput should be achieved by July 2015. An update will be provided after the plant is at full capacity with more comprehensive performance data including oxygen and limestone consumption as well as sulphur oxidation, oxygen utilization and resulting gold recovery.

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