

A new lease of life

GeoProMining explains how it plans to maximise gold recovery from low-grade refractory ores at its Zod mine in Armenia using an innovative processing technology

Armenia's mining industry has been a cornerstone of the national economy for centuries. International mining group GeoProMining (GPM) began operating there in 2007.

The company saw promise in developing the Zod gold deposit in the Zangezur Range of the Lesser Caucasus region in the east of Armenia.

Outcroppings of the deposit are thought to have been exploited as far back as 1200BC, with the richest ores exhausted by 200AD when the site was abandoned. The near-surface oxidised ore and deep primary sulphide ores extracted today were identified in 1951.

By the time GPM acquired the Zod mine in 2007, ores with a low sulphide content had been nearly depleted, and the extraction technology at the associated Ararat plant was not adequate to process the remaining refractory sulphide ores.

To tackle this problem, GPM decided to take advantage of internationally recognised expertise. The company is



Construction work at Ararat for GPM's Albion Process gold-recovery plant

currently upgrading the Ararat gold plant with Xstrata Technology's innovative Albion Process, with support from engineering specialist Core Process Engineering.

ABOUT ALBION

The Albion Process was developed in 1993 and is patented worldwide. The technology is expected to enable GPM Gold, an Armenia-based subsidiary of the GeoProMining group that operates the Zod mine and Ararat gold processing plant, to significantly increase gold extraction from the sulphide-bearing ores and raise its average gold production from 44,500oz/y to 125,000oz/y.

Construction of the Albion Process plant began in July 2011 and is expected to be completed later this year. The total investment in this project to date is more than US\$100 million.

As well as enhancing gold recovery, the Albion Process is also compliant with high environmental protection standards. This has been confirmed by leading experts in

environmental impact assessments, including Fraser Alexander (South Africa), Epoch (South Africa) and Digby Wells Environment (South Africa).

GeoProMining is one of the first companies to apply the Albion Process for refractory gold ore processing. There are currently three Albion Process plants in operation worldwide; two plants treat a zinc-sulphide concentrate and are located in Spain and Germany, while a third plant is operating in the Dominican Republic treating a refractory gold/silver concentrate.

HOW DOES IT WORK?

The Albion Process is remarkably simple in design and offers high productivity. The technology was initially developed for processing zinc concentrate and refractory copper within the Xstrata group.

The system consists of an IsaMill fine grinding plant coupled with Albion Leach Reactors to oxidise the ore and enable a high percentage of gold recovery. The ▶

“The use of atmospheric pressure leaching offers considerable capital cost savings over alternative technologies”



GPM's new processing plant is expected to enable a significant increase in gold extraction from the refractory ore

The president of Armenia, Serzh Sargsyan, attended the ground-breaking ceremony for the new gold-extraction line in Ararat in July 2011, illustrating the importance attached to the project in Armenia

finely ground concentrate is leached with oxygen at atmospheric pressure in agitated tanks.

The use of atmospheric pressure leaching offers considerable capital cost savings over alternative technologies, such as pressure or bacterial leaching. Pilot testing has demonstrated 92% gold recovery from oxidised concentrates and overall gold recovery of 88%.

The first stage of the Albion Process involves fine grinding of the concentrate, which introduces a high degree of strain into the sulphide mineral lattice.



The number of grain boundary fractures in the mineral increases, enabling leaching under atmospheric conditions. Fine

grinding is carried out in energy-efficient IsaMills, which were commercialised by Xstrata Technology in 1994.

The most common barrier to leaching of mineral sulphides is passivation of the leaching surface by precipitates – most commonly iron hydroxides. Passivation is minimised by the ultrafine grinding. Typically, precipitates that form on the surface of a leaching mineral would passivate the mineral by preventing access of chemicals to the mineral surface. Ultrafine grinding of a mineral would prevent passivation, as the leached mineral would disintegrate prior to the precipitate layer becoming thick enough to passivate the mineral.

After the concentrate has been finely ground, the slurry is then leached in agitated vessels, and oxygen is introduced to the slurry to oxidise the sulphide minerals. The agitated leaching vessels are designed by Xstrata Technology and are known as the Albion Leach Reactor. The Reactor is agitated using dual hydrofoil impellers and oxygen is introduced to the leach slurry at supersonic velocity to improve mass-transfer efficiency and ensure efficient oxidation of the sulphides.

The Albion Leach Reactor is designed to operate at close to the boiling point of the slurry, and excess heat generated from the oxidation process is removed through humidification of the vessel.

Leaching is carried out autothermally, in that the temperature of the leach slurry is set by the amount of heat released by the leaching reaction. Heat is not added to the leaching vessel from external sources. Temperature is controlled by the rate of addition of oxygen, and by the leach slurry density, with excess heat removed by direct evaporative cooling.

DELIVERING RESULTS

The ability to treat lower-grade concentrates, reasonable capital and operating costs, no cooling requirements and simple operation, control and maintenance are only a few advantages of the Albion Process. The technology is flexible and can process ores with a wide range of sulphur contents.

Control of the process plant at Zod will be fully automated and, from an ecological point of view, it is intended that the plant will become a national standard.

The Albion Process project is considered to be of national importance in Armenia; the president of the republic, Serzh Sargsyan, attended the ground-breaking ceremony for the new gold-extraction line in Ararat in July 2011 and is reported to be closely following the construction process. ♥

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