5 The GeoBiotics GEOCOAT® Technology – Progress and Challenges

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5.1 Introduction

Minerals biooxidation is now accepted as a viable technology for the pre-treatment of refractory sulfidic gold ores and concentrates, and for the leaching of base metals from their ores and concentrates. Tank bioleaching or biooxidation is successful in achieving high metal recoveries, but both capital and operating costs are relatively high. Heap biooxidation has lower costs, but to date has suffered from low metal extraction rates and low ultimate metal recoveries. These disadvantages may outweigh the lower capital and operating costs of heap processes. GeoBiotics has developed and patented the GEOCOAT® biooxidation and bioleaching technology, which combines the high recoveries of tank processes with the low costs of heap-based processes. The process has been commercialized for the pretreatment of a refractory sulfidic gold concentrate. GeoBiotics is also developing the GEOLEACH™ technology for bioleaching and biooxidation of gold and base metal ores in heaps (Fig. 5.1).

5.2 The GEOCOAT® and GEOLEACH™ Technologies

The GEOCOAT® technology offers a unique approach to the application of bacterial minerals processing, combining the low capital and operating costs of heap leaching with the high recoveries obtained in agitated tank bioreactors (Harvey et al. 1998). Both of these technologies are well accepted in the minerals industry and both are in commercial operation worldwide (Brierley 1999). In the GEOCOAT® process, sulfide flotation or gravity concentrate is coated as a thickened slurry onto crushed and size-sorted support rock which may be barren or which also may contain sulfide or oxide mineral values. The coated material is stacked on a lined pad for biooxidation. The process is applicable to the biooxidation of refractory sulfide gold concentrates and to the bioleaching of copper, nickel, cobalt, zinc, and polymetallic base metal concentrates. Mesophilic or thermophilic microorganisms catalyze the sulfide oxidation reactions. In the processing of chalcopyrite concentrates, the higher temperatures associated with the use of thermophilic microorganisms
have proven highly beneficial in increasing the rate and extent of copper leaching.

In the processing of refractory gold sulfide concentrates, the GEOCOAT® process offers significant cost advantages over established processes (roasting, pressure oxidation, and agitated tank biooxidation). In base metals operations, the process is particularly suited to the treatment of “dirty” concentrates, reduces transportation costs by allowing the on-site production of metal at remote operations, and can take advantage of the depletion of oxide reserves through the utilization of existing solvent extraction/electrowinning equipment. The process is simple, robust, and ideally suited to operation in remote locations.

The GEOLEACH™ technology is applicable to whole-ore systems where the metals occur as sulfides, or are occluded within sulfides, as with refractory gold. The incentive for the development of the process is the recognition that oxidation of the sulfides in most whole-ore leaching systems potentially can release enough energy to raise the heap temperature to very high levels; however, in practice, poor, or lack of any, heat management prevents a significant temperature rise. Unless heap temperatures can be raised above ambient, sulfide leaching kinetics is extremely slow; higher temperatures (above 70˚C) appear to be particularly important for the successful bioleaching of chalcopyrite (Stott et al. 2000). The GEOLEACH™ technology is designed to maximize heat conservation through careful control of aeration and irrigation rates. GEOLEACH™ has built upon the best industry knowledge of bioleaching operations. The technology is very similar to that of conventional whole-ore acid