A simple recipe guide to gravity concentration

Duncan Bennett[1]

[1]FAusIMM, Principal Consultant, Mineralis Consultants Pty Ltd, PO Box 818, Toowong Qld 4068. Email: dbennett@mineralis.com.au

ABSTRACT

Gravity concentration as a mineral processing technique was well established on a large scale by the first century AD Romans during the hydraulic gold mining of the mountains in north-western Spain.

Gravity concentration has diminished as a first-choice beneficiation process in favour of flotation, magnetic separation and hydrometallurgy, and this has resulted in an industry loss of practical knowledge of gravity concentration design and practice. Gravity concentration is almost unique as a purely physical beneficiation process. In practice, the large size and specific gravity range of particles generated in comminution processes, particularly for hard rock processing, can prevent efficient separation.

Improvements in technology, such as high capacity and high gravitational force concentrators, has assisted in standardising laboratory testing, reducing gravity circuit complexity, and both capital and operating costs. This has now made gravity separation more attractive particularly as a complementary process for gold recovery prior to cyanide leaching. However, it is common for gravity circuits to be designed and operated without having a clear understanding of the nature of valuable mineral occurrence and the practical aspects of the process. This can lead to inefficiencies in separation of the valuable minerals from the gangue. In the case of a stand-alone gravity process, process inefficiency has a direct and visible impact on project economics. For a complementary gravity process, expectation of high gravity recovery can lead to poor design decisions, and inefficiency can lead to transfer of gravity recoverable mineral and associated problems to downstream process stages that have a higher unit cost.

This paper describes some of the practical aspects of gravity processing and simple “recipe” terms and “rules” to assist in the effective design and operation of gravity circuits.