Environmental Rheology

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EXTENDED ABSTRACT

To the community at large, the term 'rheology' has little meaning and in fact is often confused with theology (because the "t" key is next to the "r" key!!). However, as soon as one mentions 'environment' many thoughts are conjured up in people's minds. Combining the two terms into 'environmental rheology' perhaps would focus more attention on rheology as a discipline. This is not the purpose of this paper.

In countries like Canada and Australia where there is extensive mineral wealth, the mining industry is one of the largest producers of waste. In fact, in Australia this is the case where the minerals industry is the biggest single producer of solid waste in the country. In a large mining operation as much as 800,000 tonnes per day of material will be moved from the mining pit. In fact, in Canada in the tar sands in Alberta I believe the figure is even higher. In these mining operations, if we take copper for example, a two percent copper ore body is a good one, hence 98 percent of the material is waste. In a gold mining operation, particularly of the type that takes place in Australia where open pit mines are common, extraction technology is so good that two grams per tonne of gold is an economical ore body. i.e. the ore body contains two parts per million of gold. Thus, staggering amounts of waste are produced, not only in the gold industry, but in the minerals industry in general. This waste is produced as a suspension and traditional practice has been to pump the suspension at low concentrations to large dams, which are used as storage facilities. Clearly, at the end of a mining operation these storage facilities need to be rehabilitated, which often requires huge expenditure not planned for in the establishment of the mine, i.e. life cycle analysis for the waste is generally not used.

The trend today in the industry, driven by environmental legislation, the need to conserve water, and perhaps by being a good environmental citizen, is to minimise the amount of waste produced by dewatering the waste product and storing the material as a solid, if possible. In this process rheology is of paramount importance. The presentation discusses in detail how shear and compression rheology is exploited for waste minimisation in the minerals industry. The results are applicable in other areas, such as in water and sewage treatment. The term 'environmental rheology' evolves simply because waste minimisation in these industries is not possible without an understanding of basic rheological concepts.