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Quantifying the resource potential of flotation tailings storage facilities – the role of geometallurgical characterization

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Flotation is the most widely applied separation process in today's raw materials industry. Billions of tons of flotation tailings are produced every year. As fine-grained residues these are usually deposited in large -scale tailings storage facilities (TSLs) . With recoveries commonly below 90%, a significant portion of the value contained in the primary ore finds its way into such TSLs. In addition, commodities that were not targeted by the primary exploitation process may later become valued products. There are many well-known examples of historic tailings (or other mining-related residues) becoming economically attractive targets of renewed exploitation. Arguably the most prominent of these examples is the recovery of gold and uranium from slimes and sand storage facilities of the Witwatersrand goldfields, South Africa. TSLs are thus best described as large, low-grade anthropogenic ore bodies; they are also a prime example of an urban mine.

Retreatment of tailings offers some significant advantages. Very large tonnages of readily milled material are available at surface. Volume and average grade are usually well-known, thus reducing exploration expenses and technical risk. Added economic benefit may be the release of land previously covered by TSLs for development. There are also environmental benefits as particular components identified as environmental risk may be removed and remaining residues transferred into TSLs that comply with modern environmental legislation.

There are, however, also some tangible risks associated with retreatment of materials from TSLs. Most importantly, the value components that have escaped previous separation efforts are likely to be difficult to concentrate. Reasons for losses are manifold, but may include poor liberation or very fine grain size of ore minerals or complex deportment of target metals into various minerals. Furthermore, ore minerals may experience surface alteration processes whilst contained in TSLs for extended periods of time. Such processes result in the development of surface coatings or even complete transformation of primary ore mineral assemblages into a complex paragenesis of secondary products. Ultimately, such processes lead to a complex overprint of the inherent primary stratification related to tailings deposition by a secondary stratification that resembles supergene oxidation and cementation zones.

Given the above it appears only reasonable that TSFs should be exposed to careful geometallurgical characterization prior to retreatment [1]. This contribution will present two examples from the Ore Mountains, Germany [2]. Two large TSLs were systematically drilled; the tailings materials were subjected to comprehensive characterization. 3D models were constructed for the TSLs based on novel recoverability indices that take into account not only grade, but also other tangible characteristics of the tailings material, such as liberation and grain size of value components. In this manner, opportunities and limitations of intended retreatment can be constrained – and an optimal retreatment strategy

developed.

References:

1 Louwrens E et al. (2015) in: Tailings and mine waste management for the 21st Century, AUSIMM, 99-106
2 http://www.r3-innovation.de/de/15499