Traceability of concentrate: characterization of microfacies and consideration of mineral processing

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The demand in mineral resources is strongly increasing, but channels of concentrated raw mineral materials display a worth opacity due to speculation or the financing of armed struggles. Because of the remoteness between the primary extraction sites and the final production stage, it is virtually impossible to check the origin of such products. In order to ensure the traceability of concentrates, an identity card is required to control trades in the mineral industry. This problem looks upon as an inversion: studying the sold products to track out the original ore. Two steps can be distinguished: 1) the characterization of the raw ore by using the parameters observed in the concentrate and 2) the evolution of these parameters during ore processing.

The discriminant parameters are based on microscopic characterization (textural microfacies, mineralogy of rare minerals) and the chemical composition of target minerals. The selected target minerals are pyrite, for its ubiquity and sphalerite for its ability to host numerous minor elements (sometimes valuable) in its lattice than can be discriminant. The comparison between the chemical compositions of the different mineral phases is calculated from the Kolmogorov-Smirnov distance (Press and al., 1986). The evolution of the identified microfacies contents during the mineralurgical process is estimated through a parameter that evaluates the « memory loss » of the raw ore. For a given flow sheet, the parameter « memory loss » is an estimate of the difficulty to realize the inversion. Conversely, this parameter can be used to characterize a given flow sheet. A first application to Volcanic Massive Sulfide deposits ores from the Iberian Pyrite Belt showed that the selected characteristics might help to distinguish pyrite and sphalerite from the Tharsis and the Neves Corvo deposits. Assessment of the « memory loss » in the different mineralurgical process plants is still in progress.