X RAY MICROCOMPUTED TOMOGRAPHY APPLIED TO THE IDENTIFICATION OF ORE MINERALS

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Microfocus X ray computed tomography (microCT) is a novel three dimensional visualization and phase contrast quantification technique, widely used in medicine and engineering. In geosciences, the interest on microCT is recent, and most papers discuss internal determination of porous space and mineral separation. However, the principles involved in microCT for mineral separation are not totally understood, and more information relative to mineral identification can be explored. In this study, microCT is applied to the mineral investigation of rock samples from the Perau mine, located in Adrianópolis, state of Paraná; Schramm mine, located in Gaspar, state of Santa Catarina; and the Urucum mine, located in Corumbá, state of Mato Grosso do Sul. The aim of this paper is to employ microCT as a mineral identifying tool, testing different settings of the device (Bruker-Skyscan model 1172) that best work to sort out distinct mineral phases. The X ray signature of each mineral has been compared and added to a database. MicroCT is a non-destructive high resolution (pixel size up to 1μm) technique that can aid on the detection of micrometric particles of economic interesting elements, such as metals. Besides, it is possible to investigate how minerals are arranged inside the sample. This can provide important information regarding the mineralization. MicroCT produces 3D images based on the X ray attenuation coefficients (μ) of the materials (generating a histogram with the distribution of μ values of the sample), which translates into the opacity of minerals to X rays, represented by 256 shades of grey. It is a function mainly of mean electronic density and thickness of the analyzed object. When materials have similar μ, the peaks in the histogram can overlap, making it difficult to identify different phases. However, when a rock is made up by minerals with considerable distinct densities, the segmentation is straightforward. Analysis have been performed on five samples from the Perau mine, which is characterized by layers mineralized with Pb-Zn-Cu, formed by millimetric sulfide beds hosted by calcsilicate rocks; two samples from the Schramm mine, where gold is the ore, and it is associated with Ni, As and Co sulfides, contained in massive veins of siderite, ankerite and quartz; and one sample from the Urucum deposit, characterized by banded iron formations with manganese oxide layers hosted in arkosean rocks. The samples were reconstructed and binarized individually for each phase, producing tridimensional models for each mineral that, when combined, result in a final model. As an outcome, minerals are identified in different colors, so it is possible to observe their distribution through the sample, in addition to the textures and structures in three dimensions, yielding high definition images.

KEYWORDS: MICROTOMOGRAPHY, ORE MINERALS.