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Using X-ray Computed tomography (XCT) for the 3D textural analysis of drill core in geometallurgy

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In the last decade, the opportunities offered by X-ray computed tomography (XCT) for the 3D imaging and analysis of geological materials have become increasingly evident. With the possibility for continuous mine-site XCT scanning of drill core being imminent, it is critical to review the nature of the information which the XCT provides and how best this can be used to inform ore body modelling for mine planning, geometallurgy programs and minerals beneficiation. In geometallurgy programs, the objective is the provision of rapid, quantitative data describing the bulk mineralogy and 3D textures and their variability (used to infer ore hardness, breakage characteristics, product liberation and association, separation efficiency), months prior to mining and processing.

This study focuses on the XCT analysis of drill core samples of base metal sulfide and iron ore. Initially, the paper considers the use of quarter, half and full-core samples for the two ore types and discusses how the geometry of the sample affects the resultant radiographs and XCT scans. Once the scan parameters have been optimised, so the grey scale information representing different average atomic weights of minerals can be interrogated to provide a simplistic bulk mineralogy of the volume. The XCT volumes are thereafter processed through an independent image processing methodology which has been customised into 3D for this application (grey level co-occurrence matrices) to provide unbiased quantitative textural information. This textural information is assessed for both ore types and interpreted in terms of potential comminution characteristics. The unique challenges of XCT scanning between the two different ore types are also discussed.