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An investigation into the complementary capabilities of the X-ray computed tomography and hyperspectral imaging of drill core in geometallurgy.

Content

The effect of ore variability poses a major challenge to the mining and processing industries. Variability arises from heterogeneity in the mineralogy and textures across an ore deposit. The ability to manage this ore variability requires upfront knowledge of the mineralogy and texture ahead of mining and processing, ideally derived from exploration drill cores. As we head towards the fourth industrial revolution (4IR), machine learning and intensive data, there is also a need for automated data derived from drill cores -Ideally, using non-destructive, rapid, and inexpensive automated scanning techniques.

Hyperspectral imaging (HSI) is one of the key techniques of automated drill core scanning in geometallurgy for mapping problematic minerals in downstream mineral processing, such as the phyllosilicates. X-ray computed tomography (XCT) provides 3D imaging of drill core yet is more routinely applied in research applications and is dependent on other techniques for mineral identification. Mineral discrimination for XCT also requires sufficient mineral density and attenuation coefficient variation (>6%). This opens an opportunity to couple the two techniques, aiming to address and emphasise the image scanning techniques for drill core in geometallurgy and to provide further knowledge on the practicality of the HSI and XCT in drill core from image acquisition to processing. Ultimately, the aim is to investigate how well the techniques complement each other for mineral and texture identifications and if combined would produce additional information. This was achieved by moving HSI cores to a higher resolution than standard practice. The results showed HSI scanning on the PGE drill core to be challenging because of the dark colour of the core. However, useful information on the alteration mineralogy could still be extracted. On the other hand, XCT produced information on high dense (including the possible PGMs) minerals and mineral association in the cores. However, there has been a challenge to discriminating between grey values (especially of silicates) due to intensive alteration of the rocks. Grouping of minerals (segmentation) needed to be carried out for each rock type. For example, plagioclase and opx were discriminated in less altered rocks (feldspathic pyroxenite and anorthosite) than more altered rocks (altered harzburgite and pegmatoidal pyroxenite). Moreover, with careful scanning parameters and segmentation processes, sufficient information on ore variability can be obtained.

Keywords: XCT; HSI; mineralogy; texture

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