Quantitative Analysis of Mineral Orientation in Sulphide Ore Deposits

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Numerous ore deposits within the globally significant base metal province of the North West Queensland Mineral province are complicated by multiple deformation events. Interpretations for timing of mineralisation vary from during, and after tectonic activity.

Detailed surficial and underground mapping and observations of ore bodies aim to identify key deformation structures such as regional foliations, shear zones, and fault zones to assist in the structural paragenesis for each deposit. Sometimes due to numerous over printing relationships interpretation is not always clear.

Traditionally, structural investigations of these deposits have relied on methods such as regional mapping, hand sample analysis, thin-section petrography, and scanning electron microscopy (SEM). However, Electron Backscatter Diffraction (EBSD) has recently emerged as a powerful tool in structural and metamorphic geology, enabling high-resolution, quantitative analysis of crystallographic orientation, microstructure, and deformation processes down to the nanometre scale.

Despite the complex deformation histories of many sulphide deposits, EBSD has not yet been widely applied to examine the microstructural evolution of sulphide ore minerals in relation to well-characterised regional structures.

This study investigates the potential of EBSD as a microstructural characterisation technique for sulphide ore deposits. We start with a case study of the Dugald River Zn-Pb-Ag deposit in the Eastern Succession of the Mt Isa Inlier. This deposit is subject to at least three deformational-metamorphic events. Previous research conclusions differ in the assessment of how deformation has affected sulphide precipitation. Using EBSD we will assess deformational features across the ore lode including curious massive sulphide textures. We aim to better constrain the microstructure, microchemistry, and mineral assemblages of the deposit, elucidate the timing and nature of deformation events, and refine the structural paragenesis and mineralisation history through the dating and characterisation of key mineral assemblages.