Structural Insights of the Olympic Dam Cu-U-Au-Ag Deposit, South Australia Provided by Hardrock 3D Seismic Data

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The supergiant Olympic Dam breccia hosted Fe-oxide Cu-U-Au-Ag deposit is located in the Olympic Cu-Au province, on the eastern margin of the Gawler Craton. The deposit is hosted in a hydrothermal breccia system known as the Olympic Dam Breccia Complex which occurs within the Roxby Downs Granite and is unconformably overlain by ~350 metres of undeformed Neoproterozoic-Cambrian sedimentary successions. The deposit has undergone a complex tectonic, magmatic, and hydrothermal evolution, with much of the early structural architecture overprinted by physical, chemical, and volcanic brecciation mechanisms. The deepest part of the deposit (Olympic Dam Deeps) extends to >2 kilometres depth southeast of the Mashers Fault Zone.

The Olympic Dam Deeps was drilled extensively prior to receiving fully processed hardrock 3D seismic data. This drilling has helped characterise features observed in the seismic data including the extents of the Deeps Fe-oxide breccias and associated structural architecture. High seismic reflectivity coincides with drilled Fe-oxide breccias. The seismic reflectors are discontinuous and comprise high and low amplitude reflectors as expected for heterolithic breccias. These breccias are structurally bound by northeast-southwest and northwest-southeast faults including the Mashers Fault Zone (western extent) and Woodall Junior Fault (southern extent).

Continuous linear seismic reflectors also exist in the seismic data across the deposit. These reflectors are interpreted to be mafic and felsic dykes and sill intrusions, associated with high or low amplitude reflectors depending on primary composition and subsequent alteration. The steeply dipping northwest-southeast trending Gairdner Dolerite dyke swarm is the dominant feature imaged by the seismic data.

Other interpreted intrusions are also imaged in the seismic data including moderately dipping north-south trending dyke intrusions, shallow dipping dykes and sill intrusions. These dykes and sills have been identified in areas surrounding the deposit but are not observed in the deposit suggesting they may have formed pre- or syn-mineralisation.