SEG 100 Conference: Celebrating a Century of Discovery

ST.192

A Near-Mine Discovery Revealed by 3D Seismic Data and a New Integrated Structural Model at the Darlot Gold Deposit, Yilgarn Craton, Western Australia

Ashleigh L. Ball
University of Tasmania, Mosman Park, WA, Australia

A 3D seismic survey was completed across the Darlot gold deposit of the world-class Yilgarn Craton, Western Australia, with the aim of improving the understanding of the structural setting and controls on mineralization. The survey was highly successful in delineating structure and provided significant insights into the relative timing of mineralized structures as well as their extents away from the known deposit. When integrated with existing data sets a new structural and geologic model was generated that was extrapolated into the regional exploration space. This facilitated the generation of numerous near-mine and greenfields targets, the testing of which led to a near-mine discovery.

The 3D seismic survey was completed across a 5- x 5-km area to a 5-km depth with a seismic line resolution of 30 m. The seismic lines successfully depicted structure of various orientations as well as regional folds in the stratigraphy. Known ore-bearing structures could be traced for considerable distances and depths away from the deposit in conjunction with new, previously unidentified parallel structures. A significant insight was the identification of a large EW-striking structure that hosted a large lamprophyre dike around which the deposit was centred. This structure was far more extensive than previously recognized, and the localization of mineralization as well as the lamprophyre dike and a suite of fractionated granites along the intersection of this structure with a regional shear suggested this intersection may have been fundamental to the deposit's formation.

The 3D seismic data was integrated with existing geophysical, geochemical, drilling, and mapping data sets to generate a new structural and geologic model. This model could be extrapolated into the regional space with the 3D seismic providing a higher confidence in interpretation than existing 2D data sets. The extrapolated model gave new context to known geochemical anomalies, historical workings, and mineralized drill intercepts and rejuvenated exploration. Numerous new near-mine and regional targets were generated, including along previously overlooked EW-striking structures.

One of the near-mine targets to be tested was a newly identified structure situated parallel to a known mineralized fault. Seismic reflectors formed a sigmoidal pattern that was analogous to the geometry of known vein lodes in the existing deposit. This was drill tested, and a significant new zone of mineralization was identified, resulting in a near-mine orebody discovery. Due to the depth of required holes to test the structure, the 3D seismic data was not only key in identifying the broad target area but also in the design of drill holes to ensure the target was accurately intercepted.

The 3D seismic survey across the Darlot deposit was pivotal in the creation of a new structural and geologic model and the generation of multiple new exploration targets. Although still a relatively new tool in hard-rock exploration, when combined with existing geologic data sets it proved to be highly valuable in adding to and expanding the understanding of the Darlot deposit and ultimately in exploration success.