Structural Modelling of the Au Mineral System Using 2D Seismic, Yamarna Greenstone Belt, Eastern Goldfields, Western Australia

Armelle Kloppenburg[1], Jamie Robinson[2]
1. 4DGeo | Applied Structural Geology, The Hague, Netherlands, 2. Gold Road Resources, Perth, WA, Australia

Developing an understanding of the 3D architecture and structural evolution is a key part of building terrane-scale geological framework to support exploration targeting within the Yamarna Terrane. Three bespoke 2D seismic lines (approx. 25 km long and 7 km deep) have been used to constrain the internal greenstone belt architecture and recognise interconnected fault pathways that have focussed mineralising fluids. This belt-scale seismic data was integrated with a nearby government crustal-scale seismic line (approx. 45 km deep; L154-N1) as well as geological and geophysical maps to provide context during interpretation in 3D structural modelling space.

Most of the Yamarna gold deposits are located around structures that define the greenstone belt's architecture today; the thin-skinned fold-and-thrust belt. However, structures in the belt are not continuous along length, and this complexity appears favourable for gold mineralization.

A scenario is proposed in which deep-seated inherited extensional faults and related transfer faults played a significant role. Reactivation and inversion of these extensional faults occurred during subsequent crustal shortening, influencing the geometry and linking to the newly formed structures at upper crustal levels. A rotated, non-ideal angle of shortening has resulted in the complex but systematic pattern seen today.

This combination of "tramlined" and newly formed structures contributed to focussing of mineralising fluids by forming connected fluid pathways and structural traps. At Yamarna, understanding how these fault zones interconnected in 3D and to depth at critical moments in time informs ongoing exploration.