

## **Hard rock seismic from crustal to deposit scale: case studies from Australia**

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The Kalgoorlie Gold Field of Western Australia contains a number of world class orebodies including the famous Golden Mile shear zone and Mt Charlotte deposit (Vielreicher et al., 2015). Given the level of gold endowment in the region, it is no wonder a number of government organisations as well as mining companies have commissioned reflection seismic surveys over the years.

The Australian National Seismic Imaging Resource (ANSIR) acquired a number of deep crustal surveys in the 1990's in partnership with the Australian Geodynamics Cooperative Research Centre (AGCRC) and Kalgoorlie Consolidated Gold Mines (KCGM). The aim was to better understand the crustal architecture including '...shallow and deep structures, tectonics, and fluid migration pathways' (Owen et al, 2001). However, as technology has advanced over the decades and the ability to acquire larger amounts of data at broader frequency ranges developed, the survey designs have evolved accordingly to incorporate tighter source and receiver spacings capable of imaging more economic depths of the top 2 km. In line with this, HiSeis recently acquired a number of high resolution 2D seismic reflection surveys through the town of Kalgoorlie in 2018.

This presentation will begin by focusing on how deep crustal seismic can be used to inform regional geological models and mineral systems understanding. By reprocessing legacy data using integrated approaches between modern processing constrained by geological understanding even more information can be extracted from the data and a more robust interpretation carried out. A comparison between broad spaced (40 m receiver interval, 80 m source interval) reflection seismic surveys and more densely spaced (5 m receiver interval, 10 m source interval) surveys is then conducted highlighting the benefits of high resolution reflection seismic for deposit scale geological modelling and drillhole targeting.

Subsequent drill testing on the seismic line confirmed the position of the interpreted Boulder Fault, a major thrust known to host gold mineralization within the footwall of the shear zone. Sonic and density measurements taken on core also shed light on the geological causes of reflectivity, namely lithological contacts such as the Kapai shale and ultramafics as well as strongly altered zones.

### References

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Vielreicher, N., Groves, D. I., McNaughton, N. J. 2016. The giant Kalgoorlie Gold Field revisited. *Geoscience Frontiers* 7, 359 – 374.