

Nature and timing of brittle structures at the Challenger Gold Mine

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ABSTRACT

The Challenger Gold Mine in the western Gawler Craton exhibits brittle deformation features that post-date mineralisation. This study has looked at the geometric relationships of the observed joint sets and has identified a dominant shallowly north-east dipping thrust fault package with a crosscutting vertical joint set. In the 880rL, a lamprophyric sill is emplaced within the shallowly north-east dipping fault.

Structural observations were made over 40 vertical metres in three of the underground mining levels the 920rL, the 900rL and the 880rL. Observations of these structural features culminated in the production of an interpreted 3D model using goCad® showing the connection of the fault package between the mapped levels. These observations in conjunction with alteration information and structural data showed that the fault network had a consistent dip across the package despite the undulations in the fault plane and that the series of splays observed linked the package together. The displacement and structural data both concluded that the shallowly north-east dipping fault network is a brittle deformation thrust system.

Three biotite samples from the lamprophyre were analysed using $^{39}\text{Ar}/^{40}\text{Ar}$ Argon Thermochronology. Challenger-880-8 shows a plateau with 90% of cumulative ^{39}Ar released between 1750 Ma and 1900 Ma. Challenger-880-9a produced a plateau using 55% cumulative ^{39}Ar realised between 1800 Ma and 2100 Ma. Challenger-880-9b produces a plateau at 1860 Ma using five continuous steps where 45% of Cumulative ^{39}Ar is released. Sample Challenger-880-9a provided an approximate crystallisation age of 1950 Ma. This is a coarser grained sample from close to the lamprophyre centre and produced a poorly defined plateau and consequently is thought to represent the minimum age of crystallisation. Challenger-880-9b and Challenger-880-8 both are fine grained samples from

the chill margin of the lamprophyre and present ages of approximately 1860 Ma. This is interpreted as an age of structural significance associated with the Cornian Orogeny, illustrating reactivation along the fault package during the Paleoproterozoic which had not been previously recognised in the western Gawler Craton.

The lamprophyre intruded into a pre-existing fault indicating that the shallowly north-east dipping fault package is older than 1950 Ma (the age of crystallisation). This provides information regarding the early-mid Paleoproterozoic in the western Gawler Craton.

Key Words: Challenger Gold Mine, Structural Analysis, $^{40}\text{Ar}/^{39}\text{Ar}$ Thermochronology, Paleoproterozoic Gawler Craton