

**Strato-tectonic evolution of a large subsidence
structure associated with the late Proterozoic Wonoka Formation
at Wilpena Pound, central Flinders Ranges, South Australia.**

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ACKNOWLEDGEMENTS

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LIST OF ENCLOSURES

- Geological map of the Wilpena area
- Detailed stratigraphic sections of Unit 2, Wonoka Formation

ABSTRACT

The coincidence between the timing of the subsidence of a trough-like structure adjacent to Wilpena Pound and the initiation of canyons associated with the late Proterozoic Wonoka Formation in other parts of the Flinders Ranges provides circumstantial but not necessarily compelling evidence for a tectonic control being involved with the formation of the canyons. The trough, here termed The Wilpena Trough, is characterised by the presence of a deep central sag and shoulder sags bounded by steep north-easterly trending faults. Other canyons may have marginal faults; and the numerous reversals of current indicators within them, rather than simple unidirectional current trends such as expected with turbidite erosion, substantiate a tectonic influence in their generation.

Small scale faulting in the Wearing Dolomite Member of the Wonoka Formation reflects the dominantly extensional regime in which the Wilpena Trough was formed. A phase of warping prior to deposition of the Wonoka Formation may have provided the necessary trigger to produce stress zones in strata, where growth faults controlling the sedimentation in the Wilpena Trough were initiated.

After deposition of the Wearing Dolomite Member in a shallow water palaeoenvironment, Units 2 and 3 of the Wonoka Formation were deposited in deeper water settings on a shelfal slope. This idea supports a submarine environment prior to subsidence of the Trough. Measured stratigraphic thickness changes give a precise timing for the initiation of fault movement that caused thickened packages of sediments. Major fault movement and corresponding sediment subsidence became active near the Unit 2 / Unit 3 transition and dominated the deposition of Unit 3 through to Unit 7. Units 4 to 9 represent a wedge of prograding shelf sediments. Unit 10 is a shallow transgression sequence and a sequence boundary has been proposed for the base of this unit, due to the marked change in sedimentary style.

Stable carbon and oxygen isotopic data from the sediments of the Wonoka Formation in the central Flinders Ranges shows an initial low negative plot which is succeeded by an interval showing a strong negative excursion which then makes a shift back to low negative values. A possible correlation between late Proterozoic units in the

Adelaide Fold Belt and the eastern Officer Basin enables the data from the Wonoka Formation to be added to information which Pell (1989) obtained from the Rodda Beds to show a continuous trend from the negative excursion to a broad positive one. Comparison with corresponding overseas data provides a potential tool for late Proterozoic inter-regional basin correlation.