
Understanding the Origin of Deformed Stratigraphic Blocks inside the Neoproterozoic Patawarta Diapir, Flinders Ranges, South Australia

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ABSTRACT

Petroleum exploration in salt basins may be particularly risky due to the difficulty in imaging stringers and sutures within salt bodies. Occasionally stringers and sutures are invisible on seismic data and contain zones of hydrocarbons, which are only first discovered while drilling and can lead to expensive well complications. In order to better predict the presence of stringers and sutures within salt bodies we must look to detailed outcrop analogs such as the Central Flinders Ranges of South Australia. Deformed carbonate-rich stratigraphic blocks approximately 1km in length have been identified inside the Neoproterozoic Patawarta salt sheet. The exceptional exposures at Patawarta Diapir provide a unique opportunity to test two alternative models for the origin of the blocks: (1) remnant non-evaporite stringer from the autochthonous Calana salt level or (2) suture zone containing the roof strata of a salt sheet, which is now incorporated into a canopy. The block contains tightly folded strata identified as the Patsy Hill Member of the upper Neoproterozoic Bonny Sandstone, which excludes an origin as a salt stringer derived from the autochthonous salt level. The stratigraphic thickness of the Patsy Hill Member within the block is 280 m as compared 1100 m of age-equivalent strata in the adjacent subsalt minibasin and 1942 m in the adjacent suprasalt minibasin. The 3 regional facies types comprising the Patsy Hill Member are green calcareous shales, red fine-grained arkosic sandstones, and various types of carbonates (limestone and dolomite). The carbonates of the Patsy Hill Member vary from an oolitic facies in the suprasalt minibasin to vuggy dolomite, oncolite, and stromatolitic facies interbedded with coarse-grained lithic sandstones directly adjacent to salt diapir flank in the subsalt minibasin. The lithologies in the stratigraphic block contain the lithic sandstones and stromatolitic facies similar to that of the Patsy Hill Member in the subsalt minibasin, which provides constraints on the timing and evolution of canopy formation.

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