

ABSTRACT

GEOLOGY AND TECTONICS OF NEOPROTEROZOIC SALT DIAPIRS
AND SALT SHEETS IN THE EASTERN WILLOURAN RANGES,
SOUTH AUSTRALIA

BY

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Cross-sectional geometries of complex allochthonous salt structures and associated sub- and suprasalt minibasins are displayed in plan view in Neoproterozoic strata of the Willouran Ranges, a northwestern extension of the Flinders Ranges near Marree, South Australia. Salt and suprasalt minibasin stratigraphy were deposited in a subsiding aulacogen and were later subjected to the Delamerian orogeny during Late Cambrian-Ordovician (~500 Ma). The Callanna Group (900-850 Ma), the original source of diapiric salt throughout the Willouran Ranges, is an assemblage of brecciated, highly disrupted carbonate, siliciclastic and mafic volcanic rocks that were originally interbedded with evaporites that are now absent. Passive diapirism initiated shortly after deposition of the Callanna Group and continued during loading

by the suprajacent Burra Group strata. At least two salt sheets mobilized from two local diapirs, covering lower Burra Group strata. Loading and subsidence by upper Burra Group strata and younger Sturtian glacial-outwash deposits established multi-level salt welds, causing salt sheets to become welded and discontinuous.

The redefinition of upper Burra Group stratigraphic units produced two newly named formations: the Mount Norwest Formation and the Willouran Creek Formation, which comprise the newly defined Upper Burra Subgroup. Burra Group stratigraphy in the research area includes the Top Mount Sandstone (950 m), the Willawalpa Formation (2250 m), the Witchelina Quartzite (2400 m), the Skilagolee Dolomite (1350 m), the Mount Norwest Formation (1040 m) and the Willouran Creek Formation (1100 m). Atop the Burra Group is the Sturtian-aged Lower Umberatana Group. Remnant allochthonous upper Callanna Group breccia and salt welds are located between the following units: (1) the Mount Norwest Formation and the Lower Umberatana Group; (2) the Skilagolee Dolomite and the Lower Umberatana Group; (3) the Mount Norwest Formation and the Lower Umberatana Group; and (4) the Mount Norwest Formation and the Willouran Creek Formation.

On the basis of detailed mapping (1:10,000), geologic cross sections, stratigraphic sections and thin-section examination, the following allochthonous salt geometries, structures and related stratigraphy were recognized: (1) an autochthonous level of upper Callanna Group breccia; (2) two flanking salt diapirs with associated halokinetic deformation and growth strata; (3) a primary, suprasalt minibasin containing Lower Burra strata; (4) the multi-level Willouran salt weld;

(5) remnant allochthonous bodies of upper Callanna Group breccia; (6) the newly defined stratigraphic units, the Mount Norwest Formation and the Willouran Creek Formation; (7) three suprasalt minibasins, the Mount Norwest, the Willouran Creek and the Lower Umberatana minibasins; (8) two newly named salt diapirs, the Little Creatures diapir and the Willawalpa diapir, both of which are rooted in different levels of upper Burra stratigraphy and flanked by growth strata, halokinetic stratigraphy and folded strata; and (9) folding on the flanks and at the base of the Little Creatures and Willawalpa diapirs that suggests allochthonous salt transport was from the north-northeast to the west-northwest.