

The North Onion Creek Salt Diapir Revisited: Deformation and Deposition at the Salt-Sediment Interface

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Abstract

The Onion Creek salt diapir is a 1.5 km wide by 3.5 km long exposure of mostly gypsiferous caprock located in Fisher Valley approximately 20 km NE of Moab, Utah. The northern side is in contact with folded and faulted siliciclastic terrestrial beds of the undifferentiated Permian Cutler Fm. Previous workers variably attribute the deformation to Neogene extension, salt dissolution, and salt withdrawal followed by collapse. We apply a well-correlated stratigraphy within the Permian Cutler Fm. to determine relationships across the exposed outcrop belt. 3D photogrammetric outcrop models are combined with field mapping and measured sections. Isopachs generated from the integrated model using code document the Permian-aged syndepositional folding and growth strata in the Permian Cutler Fm. The data suggests that deformation is localized across a 600 m wide zone from the edge of exposed salt, likely occurring on an instep of the diapir margin early in the diapir rise history, forming a salt shoulder. The Permian Cutler has been divided into 30 mappable subunits in the area between the diapir contact and the overlying erosional contact with the Triassic Moenkopi Fm. Mapped folds trend E/NE-W/SW with variable wavelength and axial width. The oldest and tightest folds are located within 100-200 m from the exposed diapir margin. Asymmetric synclines, located 200 - 400 m away from the exposed salt and form microbasins. The youngest folds are broader anticlines that extend up to the edge of the 600m-wide zone of deformation. Further than 600m away beds homoclinally dip 20° away from the diapir into the adjacent minibasin. Radial faults terminate in younger stratigraphy eastward while stratigraphic units thicken eastward

with age, indicating that parallel to deformation, accommodation space increased eastward. Internal truncations within subunits suggest deformation sediments into local microbasins that sat on a shallow salt detachment. As these basin filled they contributed to differential loading on an instep at the diapir margin and recorded syndeformational accommodation space changes. Geologic cross sections are restored to show the syndepositional deformation and accommodation space variation across a buried instep at the Onion Creek salt diapir margin. Characterizing deformation as syndepositional in the Onion Creek diapir fundamentally changes how this area is used as a structural and sedimentological analog for petroleum exploration and drilling.