Development of Progradational Sequences on the Flank of an Evolving Salt Wall: Controls on Salt-Sediment Interaction, Salt Valley-Fisher Valley Salt Wall, SE Utah

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The northern Paradox Basin evolved during the Late Pennsylvanian-Permian as an immobile foreland basin: the result of flexural subsidence in the footwall of the growing Uncompahgre Ancestral Rocky Mountain uplift. During the Desmoinesian (~309.4-305.6 Ma) a thick sequence of evaporites (Paradox Formation) was deposited in the foreland basin, interfingering with course clastics in the foredeep and carbonates around the basin margins. Cyclic deposition of the evaporites produced a repetitive sequence of primarily halite (~71 %), with minor clastics, organic shales, and anhydrite. Sediment loading of the evaporites subsequently produced a variety of salt-related structures ranging from deeply buried salt pillows to faulted diapirs and linear salt walls up to 4500 m high. Seismic, well and field data define the proximal Cutler Group (Pennsylvanian-Permian) as a basinward prograding unit derived from the growing Uncompahgre uplift that caused underlying mobile salt layers to flow in the same direction, i.e., towards the southwest.

Sequential structural restorations indicate that the more proximal salt structures evolved earlier than the more distal ones. The degree of salt withdrawal was highly dependent on the amount of mobile salt available within the Paradox Formation, which varied with complex facies development across the basin.

Faults at the top Mississippian level (base salt) localized the development of linear salt walls along a NW-SE trend. A crosscutting NE-SW structural trend was also important in controlling facies variations in original salt deposition and the abrupt termination of salt wall structures. Localized changes in along strike salt wall growth and evolution were critical in the development of facies and thickness variations in the late Pennsylvanian to Triassic stratigraphic sequences in the downbuilding rim synclines. Subsequent dissolution and collapse of the salt walls during recent uplift of the Colorado Plateau renewed diapiric flow of the salt, and initiated the growth of complex collapse faulting.

This analysis of an evolving salt-sediment system is an important test of salt diapirism driven by sediment loading as opposed to extension during gravity gliding. Understanding the relationship between salt diapirism and sediment progradation in this setting improves both reservoir prediction and structural interpretation in analogous salt-sediment systems.