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## **Sedimentology of the Incised Valleys and Their Associated Lowstand Deltaic Sequences in the Ash-Shiqqah Formation of the Unayzah Reservoir, Saudi Arabia**

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The incised valleys and their associated lowstand deltaic sequences occur in the Permian Ash-Shiqqah Formation of the Unayzah Reservoir, and provide significant reserves of Arabian super light oil, condensate, gas in Saudi Arabia.

The incised valley-fill sequence, more than 37 km wide, is fully exposed in the Qasim area. Fluvial-dominated, estuarine-dominated, and tide-dominated lithofacies associations were identified in various parts of the valley-fill. In the subsurface, four incised valley-belts, extending northeast-southwest directions, were encountered and mapped in many producing fields. The valleys cut into the Arabian Shield in the west and becomes wider and deeper towards east. The base of the valleys represents an erosional unconformity surface. Tectonic uplift in the Arabian Shield was a significant factor for the high gradient. During this time, existing fluvial systems extended their courses and carried huge amounts of very coarse-grained sediments beyond the shelf edge into the basin. Uplifting also continued during the following sea level rise and kept providing fresh coarse-grained sandstones. The valley-fill is a more than 100 ft thick fining-upward sequence, consisting of fluvial-dominated, estuarine-dominated, and marine-dominated facies associations.

The lowstand deltaic sequences are always encountered at the mouth of their genetically associated incised valleys. Their thickness may reach up to 585ft, and covers large areas in Central Saudi Arabia. They generally rest directly on the erosional unconformity surface. They consist of one single coarsening- and thickening-upward, lobate-shaped progradational sequence. Basin floor-fan sediments, less than 50ft thick, were sometimes found below this section. The incised valleys and lowstand deltaic sequences are overlain conformably by thin shallow marine sediments of transgressive systems tract. They are conformably overlain by the Khuff Formation, representing the highstand system tract.

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