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## Origin and Sedimentary Fill of an Upper Ordovician (Ashgillian) Glacial Paleovalley Near Tabuk, Northwest Saudi Arabia

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The Ordovician Sarah Formation in Saudi Arabia crops out as glacial paleovalleys radiating north and east from the Arabian shield. One such paleovalley, including a shallow well down dip from the outcrop, demonstrates the mode of formation, and the nature of the depositional fill of these paleovalleys. The feature is flanked by a series of upthrust blocks of lower Ordovician sediments and Ashgillian Zarqa diamictites that are oriented strike-parallel to the paleovalley length. Other upthrust units, striking orthogonal to the axis, are identified along the length of the paleovalley. These glaciotectonically-induced structures were intimately involved in the formation of the paleovalley: at maximum glacial advance, subglacial ice-surges loaded down into the softened sedimentary substrate, enhancing the resultant elongate trough by lateral thrusting producing lateral 'squeeze' moraines. Subsequent ice-retreat involved minor re-advances that created the cross-valley thrust moraines. These served to 'compartmentalize' the valley feature. This irregular paleovalley floor was draped with extremely coarse-grained, very poorly sorted diamictite, deposited during initial glacial advance. It is overlain by a number of high density gravity flow sandstone facies, exhibiting a hierarchy related to high discharge from a subglacial tunnel valley system. Locally, poorly sorted diamictites also occur. All these sediments represent the products of pulsed glacial retreat, sequentially infilling the thrust-bounded compartments of the paleovalley. The down-valley cores provide evidence for a late stage glacial readvance, with further glaciotectonic deformation, prior to deposition of a thin shallow marine succession suggestive of a final response to post-glacial isostatic uplift.

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