

Depositional environments of the Ordovician Umm Sahm Sandstone Formation in southern Jordan

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Abstract

The Umm Sahm Sandstone Formation crops out in the southern desert, and is characterized by its dark brown weathered colour, tabular bedding, extensive jointing, and steep cliffs. The upper boundary of the Umm Sahm Formation is marked by a sharp contact between the soft, varicoloured claystones of Hiswah Formation and the underlying prominent, hard and cliff form topography. The lower boundary is transitional with the Disi Sandstone Formation. Lithological transition changes from white, friable sandstones to dark hard sandstones. The thickness of Umm Sahm Formation is about 200 m, and is comprised of two facies: fluvial facies and marine facies. The fluvial facies proportion is about 93% of the total thickness. The lower part of the succession passes upward from the Disi Sandstone Formation into similar massive white sandstone facies exhibits similar white colour, fine- to coarse-grained sandstone, pebbly, rounded morphology, trough and planer cross-bedding with graded foresets, and overturned cross-bedding, but is more hard, extensively jointed. Trough and planer cross-bedding are unidirectional and are orientated towards the north and northwest. Some beds contain quartz granules and pebbles (rosy, milky and smoky coloured) up to 2 cm across and flat lying intraclasts up to 3 cm long. Light brown and cream coloured quartzarenite similar to that of Umm Ishrin Sandstone Formation are most common. These are more hard, trough cross-bedded, with overturned cross-bedding, extensive joints and steep cliffs, but the tear-like drop features typical of Umm Ishrin outcrops are absent may be due to the lack of oxidized shales there. Whereas, the marine facies occupies three intervals in the middle part of the succession, and constitutes about 7% of the total thickness. It is composed of laminated and thin bedded fine-grained sandstones, siltstones and mudstones (rhythmites, tidalites). They are varicoloured (white, gray, greenish, maroon) with abundant trace fossils (cruziana, harlania, rozphycus). These are rippled (oscillatory, current, interference), which indicates tidal environment. The presence of hummocky cross stratification indicates the first existed short-lived tempestite conditions during the Paleozoic erathem of Jordan. The vertical arrangement of both fluvial and tidal facies indicates three successive transgressions and regressions. These marine incursions indicate the successive shoreline advance of the Tethys ocean which was located northward to inundate the southern braid plain.