Depositional facies and environments in the Permian Umm Irna formation, Dead Sea area, Jordan

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Abstract

The Permian Umm Irna Formation in central Jordan consists of a 60 m thick sequence of clastic sediments which can be divided into two fluvial sedimentary facies. The lowermost facies (1) is characterized by the presence of five sandstone-dominated fining-upward sequences, each sequence comprising an erosively based coarse- to fine-grained, trough cross-bedded sandstone, overlain and laterally intertonguing with maroon siltstone and silty-shale, containing locally abundant carbonaceous plant material. The overlying facies (2) also consists of up to five fining-upward sequences, each comprising an erosively based coarse-grained pebbly sandstone grading up through fine-grained sandstone and siltstone into silty-shale. The sandstones are tabular, and laterally persistent, internally complex units structured by erosively bounded trough cosets. The thickness and grain size of the sandstones and the proportion of siltstone and silty-shale is much greater than in facies (1); it also contains abundant ferruginous concretions (glaebules).

Deposition occurred on an unconfined braidplain sloping northwestwards away from an elevated provenance (Arabo-Nubian Shield) in the south and east. The lowermost facies (1) is regarded as a distal environmental equivalent of the overlying facies (2). Deposition was largely controlled by periodic shifts of the active channel tract, influenced by a gradual increase in the elevation of the source area, thereby promoting basinwide progradation and vertical stacking of the two major facies components. The ferruginous concretions (glaebules) in facies (2) are thought to have resulted from diagenetic processes in the
vadose zone of a humid, possibly tropical climate, characterized by alternating wet and dry seasons and strong leaching. The fluvial depositional system drained basinwards into a shallow-water marine depository along the southern margin of the Tethys Ocean. The ocean may have exerted a maritime influence on the climate of the alluvial plain.

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