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Depositional and burial history controls on the diagenetic evolution of interbedded sandstones and shale: evidences from the Ordovician Khabour Formation, western Iraq.

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Petrographic, mineralogic and chemical analysis of interbedded sandstones and shale from the Ordovician Khabour Formation of western Iraq were investigated using standard petrographic and scanning electron microscopy, backscattered electron image with EDAX, XRD and XRF analyses to verify the diagenetic evolution of these successions. The Khabour sandstones are generally quartzarenite with less subarkose and sublitharenite that were deposited in an environment ranging from near-shore (inner shelf) through tidal-storm transgressive (middle shelf) to tidal-storm regressive offshore shelf environments. Several digenetic events have affecting on Khabour sandstones including compaction, cementation, replacement, dissolution and alteration as well as authigenesis. Early diagenetic events was closely related to depositional environment as revealed from the effect of the controls; composition of depositional water (especially oxygen and sulphate content), Fe and organic content of the sediments, rate of sedimentation, and proximity of the shoreline. Late diagenetic events are closely affected by the burial history of the sandstones and shale that were deposited in a subsiding shelf setting. Shale commonly alternated with sandstones and these are well examined by XRD and SEM techniques. The main clay minerals include, illite, chlorite, kaolinite, and illite-smectite mixed layers.

In basin-ward inner shelf sediments, early diagenesis was generally minor, probably because of the limited availability of organic matter. However, in sands deposited proximal to the shoreline, mixing of marine and meteoric water promoted early diagenesis and resulted in the formation of Fe-rich chlorite and siderite.

Late stage diagenetic events are strongly affected by increasing burial depth and temperature which include; quartz overgrowth, authigenic kaolinite, chlorite and illite formation, albitization, and Fe-dolomite and titanium and ferruginous cementation that decreased permeability by reducing pore-throat opening in the studied sandstones. Chloritic coating around detrital quartz grains which is mainly formed as authigenic chlorite inhibits intense quartz cementation and reduces pressure dissolution during deep burial and in turns affects on porosity preservation