**Formation of ironstone crusts in the Cenomanian deposits of the Bahariya Depression, Western Desert, Egypt – Environmentally or diagenetically constrained?**

Afify, A.M.[1], Sanz-Montero, M.E.[1], Calvo, J.P.[1]

[1] Departamento de Petrología y Geoquímica, Facultad de CC. Geológicas (UCM), C/ José Antonio Nováis, 12, 28040, Madrid, Spain - adelmady@ucm.es

Ironstone crusts are prominent throughout the lower and upper members, though absent in the middle member, of the Cenomanian Bahariya Formation, north of the Bahariya Depression. This stratigraphic formation is mainly composed of siliciclastic rocks, i.e. cross-bedded and massive sandstone, siltstone, variegated shale and fossiliferous sandstone/sandy limestone. Dark bituminous-rich sandstones occur in the middle member of the formation. Full understanding of the Bahariya ironstones requires not only a clear description and interpretation of sedimentary facies but also the paragenetic mineral sequence forming the ironstones and their host siliciclastic rocks.

Field sedimentological work, XRD mineral determinations, standard petrography and SEM and electron microprobe (EMPA) analyses indicate that the ironstones are composed of a variety of diagenetic minerals formed throughout eo-, meso-, and telodiagenetic stages. New mineral phases formed during early diagenesis, i.e. siderite, barite, Mn-minerals and goethite coatings, are volumetrically less important than those produced during burial and later telodiagenetic stage. These latter diagenetic products comprise Fe-dolomite/ankerite, bitumen, silica/feldspar overgrowths and high amount (up to 65%) of iron oxyhydroxides. During burial, dolomite and ankerite replaced preferentially micrite matrix, bioclasts and several calcrete features as well as infilled vugs. Also during the mesodiagenesis, the decomposition of organic matter resulted in the formation of bitumen and created reducing conditions favourable for the mobilization of iron-rich fluids in divalent stage.

Telodiagenesis of the Cenomanian Bahariya deposits took place during the Turonian-Santonian. Uplift resulted in partial to total dissolution of the Fe-dolomites and subsequent precipitation of iron oxyhydroxides. The preservation of large centers and clear rims with no collapse features of the Fe-dolomites implies alteration by solution. Fe-dolomite and ankerite dissolution was concomitant to iron oxyhydroxide precipitation upon mixing with shallow oxygenated water.

Source of iron for the ironstone crusts of the Bahariya Formation has been debated and various formative sources have been proposed. These include alteration of clay minerals and heavy minerals, extensive weathering of older rocks and further transport of iron in solution or as colloid, whether in the sediment load or by groundwater inflow, etcetera. Circulation of reducing iron-rich fluids through fractures and inter and intrastratal discontinuities is proposed as an alternative model. The origin of iron-rich fluids is probably related to basement rocks but contribution from other underlying formations of Paleozoic, Jurassic or earlier Cretaceous in age is not excluded. This model explains better the lateral continuity and heterogeneous geometries of the ironstones in Bahariya, which are related to main faults in the area.

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