

Clay mineralogy in Bahariya area, Egypt – hydrothermal implications on fault-related iron ore deposits

A. M. Afify¹, X. Arroyo², M. E. Sanz-Montero¹, J. P. Calvo¹

¹*Faculty Of Geological Sciences, Ucm, Madrid, Petrology And Geochemistry, Madrid, Spain*

²*CAI de Técnicas Geológicas, Facultad de CC. Geológicas (UCM), Madrid, Spain*

The interpretation of the geologic evolution of the northern part of the Bahariya Depression is more or less controversial. The stratigraphic succession of this area comprises Lower Cenomanian siliciclastic rocks with abundant iron horizons (Bahariya Formation) that are overlain unconformably by Middle Eocene carbonates (Naqb Formation). The latter is characterized by localized occurrence of iron ore bodies at El Gedida, Ghorabi and El Harra areas. They show a spatial relation to the main faults of the area. Two sections were studied at Ghorabi and El Harra areas, where the Bahariya Formation is overlain by the ironstone deposits. A third one was studied at Gabal El-Dist where the Bahariya Formation is overlain by Naqb Formation, which is barren of iron in this location. In this paper, insight provided from the study of clays in the Bahariya Formation is used to ascertain the role played by diagenetic and/or hydrothermal processes in the formation of iron ore deposits in the area.

Petrographic studies, scanning electron microscopy, electron microprobe analyses as well as bulk mineralogy (X-ray diffraction) of some selected samples (ironstone crusts) from the Bahariya Formation show that the clay minerals comprise 20 to 30% of the whole rock. XRD study of <2 µm fractions in oriented mounts reveals that the clay mineral phases are mainly smectite (iron-rich, di-octahedral), mixed layered illite/smectite (I/S) and subordinate kaolinite. Some palygorskite and sepiolite were also determined. Smectite is present in all the studied sections. Ordered mixed-layered I/S, locally co-existing with smectite, occur towards the top of the Bahariya succession in the Ghorabi and El Harra areas. In contrast, the formation of illite associated with smectite is not observed at Gabal El-Dist.

From the preliminary studies, the vertical evolution of the clay mineral assemblages is interpreted as a result of increasing temperature affecting the top of the succession where the iron deposits occur. This supports a thermal origin for the overlying iron ore deposits hosted in the Naqb Formation by migration of hydrothermal iron rich fluids through faults in the Ghorabi and El Harra areas but not in Gabal El-Dist where the capping Middle Eocene beds are not replaced by iron and the area is not traversed by major faults.