The Pliensbachian Hemipelagites of Ait Moussa (Middle Atlas, Morocco): Petrogenesis of an Effective Source Rock

Rachidi Merouane[1], Fritz Neuweiler[1], and Donna Kirkwood[2]
[1] Departement de Geologie et Genie geologique, Universite Laval, Quebec-City, Canada, G1K 7P4, E-mail:
[2] Commission geologique de Canada, 490 rue de la Couronne, Quebec-City G1K 9A9

Lower Jurassic (Pliensbachian) hemipelagites of Ait Moussa (Middle Atlas, Morocco) consist of an alternation of radiolarian-bearing wackestones and black mudstones. The outcrop expells bitumen at intersections between late diagenetic fractures and veins. This study intends to establish the fluid pathways of this source rock by applying thin-section petrography, fluorescence microscopy, and gas chromatography techniques. The sedimentary matrix of the hemipelagites displays an amorphous-type fluorescence. Features of early diagenesis encompass bioturbation, aragonite dissolution, calcification of skeletal opal, authigenesis of framboidal pyrite, and a 1st generation of subvertical veinlets that were affected by physical compaction. Burial diagenesis includes 5 generations of veins (calcite, Fe-calcite), accompanied by (all replacive) euhedral pyrite, matrix dolomite (fluorescent), chalcedony (fluorescent), saddle dolomite (partly fluorescent), ankerite, and quartz. The onset of primary migration correlates with the reactivation of the vertical dykelet system during the 3rd generation of vein formation. The vein filling calcite is fluorescent and rich in impurities. Subsequent veins display Fe-calcite and are crosscut by tectonic stylolites. Uplift is represented by three generations of calcite veins, locally there is dedolomitization of the saddle dolomite (meteoric-phreatic zone), and calcite dissolution (microkarst). Gas-chromatograms from samples of the host sediment and the expelled bitumen show similar patterns in terms of a monomodal n-alkane distribution in the range C_{12}–C_{24} with a maximum at C_{19}/C_{20}. Pristane/phytane ratios are around unity. These features indicate one autochthonous, marine source of the organic substance. The chromatograms differ with respect to their unresolved complex mixture (UCM hump), i.e., their degree of biodegradation.