Geophysical Research Abstracts
Vol. 18, EGU2016-2630, 2016
EGU General Assembly 2016

Paleoenvironmental signals and paleoclimatic condition of the Early Maastrichtian oil shales from Central Eastern Desert, Egypt

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Early Maastrichtian oil shales are hosted in the Duwi Formation of the Central Eastern Desert, Egypt. The examined member represents up to 20% of the total Duwi Formation. This interval is mainly composed of siliciclastic facies, phosphorites facies and carbonate facies. Oil shales microfacies is mainly composed of smectite, kaolinite, calcite, fluorapatite, quartz and pyrite. They are enriched in a number of major elements and trace metals in particular Ca, P, V, Ni, Cr, Sr, Zn, Mo, Nb, U and Y compared to the post-Archaean Australian shale (PAAS). Chondrite-normalized REEs patterns of oil shales for the studied area display light rare earth elements enrichment relatively to heavy rare earth elements with negative Ce/Ce* and Eu/Eu* anomalies. The most remarkable indicators for redox conditions are enrichments of V, Mo, Ni, Cr, U content and depletion of Mn content. Besides, V/V+Ni, V/Ni, U/Th, Ni/Co, authigentic uranium ratios with presence of framboidal shape of pyrite and its size are reflecting the deposition of these shales under marine anoxic to euxinic environmental conditions. Additionally, the ratio of Strontium (Sr) to Barium (Ba) Sr/Ba reflected highly saline water during deposition. Elemental ratios critical to paleoclimate and paleoweathering (Rb /Sr, $Al2O_3/TiO_2$), CIA values, binary diagram between ($Al2O_3$+K2O+Na2O) and SiO_2 and types of clay minerals dominated reflect warm to humid climate conditions prevailing during the accumulation of these organic-rich petroleum source rocks.