Geophysical Research Abstracts, Vol. 9, 07338, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07338

Sedimentology and quantitative mineralogy of the Danian-Selandian (D-S) transition on the southern Tethyan margin in Egypt: Implications for sequence stratigraphy and eustatic sea-level changes

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The middle Paleocene Danian-Selandian (D-S) transition was suggested to be the earliest one of a series of hyperthermals that peaked in the Paleocene-Eocene Thermal Maximum (PETM). Moreover, in Egypt the pattern of biotic and sea level change at the D-S transition strongly resembles those across the PETM, suggestive of similar operative processes. We provide a high-resolution sedimentological and mineralogical study of four locations in the Nile basin (Qreiya 1 and 3, Aweina, and Gebel Duwi) across the D-S transition in order to understand environmental changes and sequence stratigraphic setting and compare them to the PETM record in the same basin. The studied interval spans part of planktic foraminiferal Zones P2-P4, corresponding to calcareous nannoplankton Zones NP4-NP5. At Qreiya 3, an erosive surface has been encountered at the P3a-P3b zonal boundary that is overlain by cm-thick calcarenite beds. The calcarenite bed is rich in organic carbon and fish-remains and shows anomalously high planktic/benthic foraminifera ratios. Several meters upsection, two additional erosional surfaces have been observed. Occasionally, some m-wide and 0.2-0.5 m thick channel structures filled by calcarenite and bioturbated by Thalassinoides are present along the three erosive surfaces. Quantitative X-ray diffraction analysis by Rietveld refinement shows that the calcarenite beds are enriched in anhydrite and in iron-(hydr-)oxides, and are deprived in clay minerals compared to the enclosing

shales of the Dakhla formation. The highest channel includes also abundant ankerite. Detrital quartz and feldspar, however, show no significant changes in quantity across the calcareous beds and are generally below a few wt%. Analysis of the $<2\mu$m fraction reveals that R0 illite-smectite mixed layers and kaolinite are the predominant clay minerals during biozone P2 and P3, in addition to very few discrete mica. The erosive surface at the biozone P3-P4 boundary marks the beginning of a gradual increase in calcite and a concomitant decrease in kaolinite that peaks in the illite-smectite-dominated chalky marls of the Tarawan Formation. In conclusion, our results support a scenario of rapid sea level lowering associated with enhanced current activity and erosion at the end of biozone P3a. The subsequent rise in sea level during biozone P3b created accommodation space. Contemporaneous high productivity in the water column and temporary anoxic conditions on the sea floor – possibly triggered by enhanced fluvial input – led to deposition of the prominent D-S marker bed at the P3a-P3b zonal boundary. The excellent correlation with similar sequence patterns in Tunisia and in the Danish Basin suggests eustatic controls on their formation.