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Rare earth element distribution patterns of Bahamian slope rhythmites, ODP 166

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This study investigates the rare earth element distribution patterns of samples from ODP 166 located at the western slope of Great Bahama Bank with sediments ranging from Miocene to Quaternary in age. While the younger deposits are still soft (ooze), in the older deposits intercalations of semi-lithified (chalky) layers and marly layers occur forming light-dark rhythmites. All samples represent lower slope background (non-turbidite) sediment. The marly layers are generally richer in planktic foraminifers than the chalky layers and show abundant coccoliths. The chalky layers show more abundant molds, microspar cement crystals, and recrystallized skeletal fragments. The microspar crystals cementing the matrix are small with about 5 μm in length. The molds are reminiscent of dissolved aragonite skeletal fragments, and in some cases are filled with blocky calcite cement, as are most foraminifer tests. The marly layers also show a clearly higher clay content but the pre-diagenesis clay content is not easily determined from the present-day composition as dissolution of depositional aragonite in the dark layers might have shifted the proportions. Whereas the marly layers are strongly compacted, the chalky layers are slightly compacted as indicated by fitted fabrics and deformed dinoflagellate cysts.

The data are presented normalized to Post-Archean Australian Shale (PAAS). All samples show a high yttrium/holmium ratio with Y/Ho ranging from 38 to 56 as it is expected for fully-marine sediments. The soft ooze (five samples) displays a slightly convex REE distribution pattern with a relative enrichment of middle-weigt REE (MREE/MREE* between 1.5 and 1.6). The marly layers (five samples) show a distinct enrichment of the heavy-weight REE over the light-weight REE with HREE/LREE typically $>$ 2. Locally a positive europium-anomaly is developed (Eu/Eu* = 1.9), and

there are two cases which show strong similarity with respect to the distribution patterns obtained from soft ooze. The chalky material (three samples) show a relatively flat MREE to HREE distribution pattern with a HREE/LREE enrichment that is generally < 2. Again, there is one case with a positive Eu-anomaly (Eu/Eu* = 1.4).

The preliminary results indicate a good correlation between the diagenetic state of the samples and their respective REE distribution patterns. The distribution patterns of the soft ooze probably indicate the presence of relatively mature organic complexes that preferentially sorbed MREE. The marly layers with their pronounced HREE enrichment mirror a general lack of a mineral-producing early diagenesis. The chalky layers with their relatively flat REE distribution patterns indicate a mineral-producing early diagenesis with fluids sourced from remineralisation of particulate organic matter and/or destabilized REE-carbonate complexes. Thus, the REE approach supports the notion that the intercalated chalky and marly layers have undergone differential diagenesis. The positive Eu-anomalies could be due to hydrothermal fluxes or volcanic ash material.