Isotope geochemistry of early Paleogene fossils and sediments from phosphate rich deposits of the Gafsa Basin, Tunisia

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In Tunisia widespread late Cretaceous-early Paleogene marine sediments occur indicating that most of the Tunisian landmass was covered by the southern part of the Tethys Ocean. Only some areas like the Djeffara and Kasserine islands emerged, between which the Gafsa Basin was located. Here the sedimentation took place under semi-closed condition and it was often influenced by sea-level fluctuation. Three main phosphate rich deposits appear in the region: the first is at the base of the El Haria Formation with an early Maastrichtian age, the second and economically most important the Thanetian-early Ypresian Chouabine Formation, while the youngest one is inter-bedded in the carbonate series of the Métlaoui Formation which correspond to Ypresian–Lutetian (Chaabani, 1995, Zaïer et al., 1998).

Our first attempt constraining paleo-environmental and paleo-depositional conditions during sedimentation of these phosphate beds, included rare earth element and stable isotope chemistry of shark teeth and coprolites, yielded very interesting results among them a pronounced negative carbon isotope excursion (CIE) of 3–4‰ in the upper part of the Chouabine Formation (Ounis et al., 2008). The observed CIE was proposed to mark the Paleocene-Eocene boundary in the Gafsa Basin. However the $\delta^{13}C$ values are extremely low maybe due to the local condition and it could relate to phosphatization processes. Hence further investigation is necessary focusing on the connection of the Gafsa Basin with the global ocean and the possible effects of diagenetical processes.

The here presented data include Sr and Nd isotope ratios of samples previously investigated and of phosphatic fossils newly collected from different phosphate layers of the Chouabine and Métlaoui Formations. The ε_{Nd} values are low and they vary between -8.8 and -10.7. The $^{87}Sr/^{86}Sr$ ratios are widely in the expected range of the late Cretaceous and early Paleogene open seawater however the younger samples show more pronounced deviations from the global ocean. This later result indicate either enhanced continental reworking or increased influence of early diagenetic fluid on the samples which is most possibly relating to the gradual closuring of the basin during the Paleogene.

Additionally in the Kef Eddour region sediments and microfossils of a detailed new section of the Chouabine Formation is under investigation especially across the supposed P/E boundary. Some archives show very homogenous distribution along the series, others mimic minor negative CIE. Biostratigraphy is attempted to be improved as well, although the preservation state of the carbonaceous microfossils are very poor making difficult any accurate dating. Preliminary data indicates that the large part of the Chouabine Formation was deposited during the late Paleocene.

References:

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