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How to turn monotonous fossil-barren siliciclastic sediments to environmental archive?

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Most information on climate changes that preceded and finally triggered the Miocene climatic optimum (MCO, ca. 17-15 Ma) has been obtained from pelagic sediments. The interpretation of stable isotopic changes in those sediments in terms of global climate change is to certain extent hindered by coeval variations of oceanic circulation, disturbance of carbon cycle, and instability of Antarctica ice sheets (AIS), all interrelated in a complex manner. Past studies on possible triggers of the MCO, quantification of the continental climatic impacts of the MCO warming, and attempts to model that warming and AIS reduction, have revealed considerable gaps in our knowledge on interpreting sedimentary records and climate modelling.

We report on deposits of the Most Basin, Eger Graben, a part of the European Cenozoic Rift System (ECRIS), in aim to identify and date the milestones of environmental changes preceding the MCO peak warmth. While evolution of other basins in the ECRIS have mostly been controlled by tectonics, the Most Basin is an incipient rift sufficiently remote from the Alpine-Carpathian belt and it was exposed to only a weak local post-rift volcanism, which created a relatively quiet sedimentary environment. The pre-MCO clastic sediments were deposited over the entire basin (>1000 km2) since ca. 17.8 Ma within a former vast peat swamp. The accommodation space for the early clastic deposits was thus created not only by tectonic subsidence but also by compaction of up to 200 m thick peat strata. The lacustrine deposition then lasted with no hiatuses at least until 15.9 Ma (the Burdigalian/Langhian boundary) producing ca. 300 m thick composite clastic sequence. The sediment record is practically fossil barren, but the geochemistry/mineralogy variations in sediment strata are well pronounced, laterally correlated at the basin scale (ca. 50 km), and they recorded orbital forcing. Combination of chemostratigraphy, cyclostratigraphy, and magnetostratigraphy (yet 5 magnetochrons identified) allowed for their dating supported by details such as identification of C5Cr.1n excursion and an eccentricity nod near 17.0 Ma. The most considerable misfit between orbital forcing and geochemical record was probably caused by local volcanism witnessed by three calcium aluminophosphate (crandallite) horizons. The combination of geochemical, magnetic polarity, and frequency analyses was necessary for turning apparently featureless sediment sequences to the environmental archive.