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A microbial "bloom" at the onset of the Messinian Salinity Crisis in the Piedmont Basin (NW Italy)

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The Messinian Salinity Crisis (MSC), a severe ecological crisis that occurred in the Mediterranean Basin about 6 myr ago, had drastic consequences for both freshwater and marine ecosystems (Roveri et al., 2014). The response of prokaryotes to the changing conditions at the MSC onset is virtually unknown. In a lipid biomarker study of sediments straddling the MSC onset from the Pollenzo section (NW Italy), we aim to evaluate the response of microbial communities at the transition from normal marine to extreme conditions. In this section, the advent of the MSC does not coincide with the deposition of gypsum; instead shales and intercalated carbonate-rich beds deposited. These deposits are considered as the deep water counterparts of gypsum layers that formed in the shallower parts of the basin (Dela Pierre et al., 2012).

In both pre-MSC and MSC deposits, the molecular fossil inventory is sourced from all three domains of life and is mainly represented by isoprenoidal alcohols, fatty acids, sterols, long chain n-alkanes and n-alcohols. However, after the MSC onset, a sharp increase of the long chains n-alkanes, n-alcohols and fatty acids occurs, indicating a significant increase of terrigenous organic matter, most likely sourced by enhanced riverine runoff. Remarkably, this coincides with an increase of sterols (sitosterol and dinosterol), that are typically interpreted as markers of phytoplankton. The same strata contain filamentous fossils, which have been interpreted as remains of sulfide-oxidizing bacteria (cf., Dela Pierre et al., 2012).

The basal MSC deposits are also typified by an increase of isoprenoidal alcohols, including glycerol dibiphytanyl glycerol tetraethers (GDGTs) and diphytanyl glycerol diethers (DGD). Caldarchaeol and crenarchaeol are the overall most abundant GDGTs. Their almost equal distribution in pre-MSC deposits suggests that they derived from planktic Thaumarchaeota, which are abundant picoplanktonic organisms in modern oceans. In contrast, caldarchaeol predominates over crenarchaeol in the MSC deposits, indicating a change towards harsh environmental conditions. A prominent spread of δ^{13}C values between caldarchaeol- and crenarchaeol-derived biphytanes ($\Delta\delta^{13}$C: 9‰) in the MSC deposits agrees with a profound modification of the archaeal community structure. This is further confirmed by the sharp increase of the DGD archaeol and the appearance of the DGD extended archaeol. The latter is only sourced by halophilic archaea, confirming an increase of seawater salinity after the MSC onset. In conclusion, this study reveals that lipid biomarkers are excellent recorders of the MSC onset. Moreover, they help to reconstruct the Messinian microbial ecosystems in the course of changing environmental conditions.

References

Dela Pierre, F., et al., 2012. Palaeogeography, Palaeoclimatology, Palaeoecology 344/345, 78-93.

Roveri et al., 2014. Marine Geology 352, 25-58.