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Lower Cretaceous oceanic anoxic event OAE1b: organic matter accumulation mediated by bacterial activity

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The Urbino Level is one of the oceanic anoxic events (OAE's) characterized by high organic carbon burial leading to drawdown of atmospheric carbon dioxide and lowering of bottom-water oxygen concentration. These conditions enhanced the preservation of sedimentary organic matter (SOM). This level, so called the OAE 1b, is located closed to the Aptian-Albian boundary, and has been sampled in Monte Petrano section (Central Italy). SOM is composed mainly of amorphous organic matter (AOM) in palynofacies. The lithology is characterized by laminated shales with well-preserved phosphatic fish fragments.

This study focusses on organic matter (OM) using a microscopical and geochemical approach. The optical study of organic matter is performed after the destruction of the mineral fraction in the rock sample through HCl and HF, whereas geochemical analyses are carried out on bulk rock samples.

All techniques used point to an important microbial activity in SOM. The exceptional preservation of ultralaminae and bacteria demonstrate the major role of the selective preservation pathway for refractory molecules and the existence of local, specific conditions for such a preservation. Moreover, microscopical techniques illustrate that bacterial exopolymeric substances (EPS) also contribute to the preservation of OM, something that cannot be detected through geochemical analyses because of the EPS chemical nature.

Consequently, AOM is related to microbial activity (i.e. to EPS and bacteria) at the ocean bottom, which led to a significant production of biomass, thereby enhancing OM preservation.

This study illustrates the importance of combining optical and chemical analyses when investigating OM preservation pathways. So far, bacteria have always been considered as agents of OM degradation. The results presented here point to the contrary and highlight that bacterial activity could be more of a preservation than a degradation agent in OM fossilization.

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