Orbital-scale changes in redox condition and biogenic silica/detrital fluxes of the Jurassic Radiolarite: Possible link with glaciation?

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Orbital forcing has been shown to be a fundamental driver of climate change through both icehouse and greenhouse periods. To reveal the impact of orbital-forcing on the oceanic environment through a greenhouse-icehouse transition, we established ~ 4 Myr-long cyclostratigraphy of the Bajocian-Callovian (Middle Jurassic; ~ 160 Ma) Basal Radiolarites at the Torre De Busi and Corre Di Sogno sections in the Lombardian Basin, N-Italy. Stratigraphic changes in chertabundance (chert/shale thickness ratio) and color (darkness) of Radiolarites show hierarchal periodicities of 8 cm, 16 cm, 40 cm, 160 cm, and ~ 4 m, corresponding to ~ 20 kyr, 40 kyr, 100 kyr, 400 kyr, and ~ 1 Myr cycles based on the biostratigraphic age model. Black cherts in intervals with high chert abundance might reflect oxygen-depleted conditions due to orbital-scale high productivity. On the other hand, black cherts in intervals with low chert abundance (high detrital input) might reflect oxygen-depleted conditions, probably due to orbital-scale sea-level drop and stratification. On 40 kyr and 100 kyr cycles, the anoxic condition occurred in low chert abundance intervals across ~ 8 m above (~ 2 Myr after) the base of the Radiolarites. These results imply that the formation of the restricted basin resulted from tectonic and/or eustatic sea-level drop, which is consistent with increased black chert deposition and redox-sensitive elements abundances (Mo/TOC, Mo/U). Their out-of-phase relationships on the 405 kyr cycle throughout the sequence (~ 4 Myr-long) with increasing amplitude above −8 M level would be caused possibly by tectonic activity, or more likely by glacio-eustatic sea-level changes reported from sequence stratigraphy, similar to those of the Oligocene to Pliocene glacial cycles, but probably with less amplitude.

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