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Size and abundance variations of *Schizosphaerella* across the Toarcian Oceanic Anoxic Event

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The Toarcian oceanic anoxic event (T-OAE), dated as early Toarcian is considered one of the most extreme paleoenvironmental perturbations in Earth's history. It is characterized by global warming, accelerated weathering, sea level rise, oceanic anoxia and acidification and extensive accumulation of organic matter. In Jurassic times, calcareous nannoplankton was already a most efficient rock-forming group and therefore pelagic sedimentary successions preserve invaluable data to track changes across the T-OAE. In this work, we focus on *Schizosphaerella* across the T-OAE recovered in the uppermost Pliensbachian–lower Toarcian Sogno Core that consists of a fully pelagic, continuous, well-dated record from a deep plateau (~1500 m water depth) in the Lombardy Basin (northern Italy). The objective of this investigation is the quantification of changes in size and abundance of the micrite-forming schizosphaerellids to derive their biocalcification tempo and mode in response to the T-OAE perturbations, to assess the implications of *Schizosphaerella* biocalcification changes, in terms of abundance and size, for the pelagic carbonate sedimentation. Absolute abundances and morphometric changes obtained for " small *Schizosphaerella punctulata*" (valve width < 7 µm), *S. punctulata* (valve width > 7 µm) and "encrusted *S. punctulata*" (all specimens characterized by a crust surrounding the valve) revealed large fluctuations in the investigated interval. We identify an abundance fall caused by the failure of *S. punctulata* and "encrusted *S. punctulata*" during the core of the T-OAE, that along with the increased abundance of small specimens produced the reduction of average dimensions. Thus, the average size decline is not the result of a general valve reduction, but rather derives from the increase in abundance of small specimens (< 7 µm). This is substantiated by absolute abundances of individual *S. punctulata* morphogroups that unambiguously demonstrate that such a pattern is not an artefact of relative abundances (closed sum problem).

We hypothesize that the concomitant drop in abundance and shrinkage of valve size is related to hyperthermal conditions associated with excess CO_2 and ocean acidification.

Finally, the co-occurrence in the same samples of *S. punctulata* specimens (> 7 mm) with and without a crust, is indicative of species-specific diagenetic effects. Based on the *S. punctulata* ultrastructure we conclude that specimens without diagenetic crusts belongs to *S. astrea* while encrusted specimens are attributable to *S. punctulata* and we infer that the presence of the diagenetic crust could be taxonomically diagnostic to distinguish *S. punctulata* from *S. astrea.*