

The evolution of fasciculiths in the Danian Bottaccione section (Italy): a glance at biotic and geochemical evolution

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The Danian Stage is characterized by profound perturbations in biogeochemical cycles, which are documented by a number of negative carbon isotope excursions (CIEs). Calcareous nannofossils have been a primary component of marine calcareous phytoplankton since at least 200Ma and thus have played a primary role both as carbonate and organic carbon producers. This group, which was deeply affected by the Cretaceous-Paleogene mass extinction, began recovery immediately after the event, but a full reorganization of the calcareous nannofossil assemblages was not completed until the middle-late Danian, when the restoration of a new equilibrium in the global carbon cycle was achieved. Here, we present a high-resolution calcareous nannofossil dataset from the Bottaccione and Contessa Road pelagic sections (Gubbio, central Italy), two classical successions that have been used as references for the Paleogene geomagnetic polarity time scale. This study provides insights into the evolutionary relationship among fasciculiths and sheds light on the mode and timing of the appearances and disappearances of species belonging to the genera *Gomphiolithus*, *Diantholitha*, and *Lithoptychius* during the Danian (Zones NP1-NP4 or CNP1-CNP7, Martini, 1971; Agnini *et al.*, 2014). These data strengthen the available biostratigraphic-biochronologic framework, but their main value is through comparison with $\delta^{13}\text{C}$ and CaCO_3 records (Coccioni *et al.*, 2012;

Galeotti *et al.*, 2015), which provided new insights into how a new equilibrium in the carbon biogeochemical cycles, which was reached after the K-Pg boundary, fits with the appearance of a new bauplan in calcareous nannoplankton.

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