A new biostratigraphic marker for the Latest Danian Event (Paleocene): The last consistent occurrence of Praemurica spp.

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Abstract

During the Paleocene, about 60 million years ago, the earth's temperature was about 10∘C higher than today (Westerhold et al., 2020). Throughout several transient warming events as the Paleocene-Eocene Thermal Maximum (PETM, 56 Ma) and the Latest Danian Event (LDE, 62.1 Ma) temperatures rose even higher. These warming events, or hyperthermals, may have had various causes: 1. methane release by a change in ocean water circulation (Dinarès-Turell et al., 2012), 2. mantle plume volcanism of the North Atlantic Igneous Province emitting CO2 (Pagani et al., 2006), and/or 3. a variation in the Milanković variables (eccentricity of earth's orbit, axial tilt and precession of the earth) changing the intensity and distribution of solar insolation (Bornemann et al., 2021).
Throughout the LDE, the deep ocean and surface waters warmed with respectively 1.6-2∘C and 2.8∘C (Jehle et al., 2019). Temperature reconstruction and the recognition of these climatic events can be conducted by carbon and oxygen isotope studies in foraminifera (unicellular organisms with a calcareous test). δ13C and δ18O negative excursions result from the input of light carbon (12C) in the ocean and the preference of foraminifera to take up less of the heavy oxygen 18O isotope in their skeleton due to the higher water temperature.

Besides these geochemical indicators, biotic changes in the fossil record contribute to locate and date events in geological history. Planktic foraminifera are useful due to the fast evolution of distinctive species and widespread occurrence in marine sediments. The first and last occurrences of species can function as stratigraphic marker for an event, but are vulnerable to sporadic occurrences and reworking of material by other organisms (e.g., burrowing) may bring older fossils up and relocates the time marker. A more reliable marker can be provided by the use of first and last consistent occurrences rather than focus on the ultimate first or last species in the record.

The base of Paleocene planktic foraminiferal Subzone P3b, currently marked by the lowest occurrence (LO) of *Igorina albeari*, is set at 61.5 Ma in Geologic Time Scale 2020, which is 600 kyrs younger than the LDE (Speijer et al., 2020). However, the LO of this small but distinct biconvex and keeled planktic species correlates with the LDE in the former Tethys Ocean and lower latitudes. For the South Atlantic and Pacific Ocean the LO of *Igorina albeari* is 500

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kyrs older than the LDE (Bornemann et al., 2021). The last consistent occurrence (LCO) of *Praemurica* spp., a planktic foraminifera genus, is a better stratigraphic marker on a global level based on our current study in the former Tethys Ocean, North Pacific Ocean, North and South Atlantic Ocean and Indian Ocean. Therefore, a revision of planktic foraminiferal Zone P3 is proposed, which consists of a lowered base of Subzone P3b to the onset of the LDE at 62.1 Ma marked by the LCO of *Praemurica* spp. instead of the LO of *Igorina albeari*.

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