Recovery and diversification of coccolithophores after the Cretaceous/Paleogene boundary mass extinction, IODP Expedition 392, the Agulhas Plateau

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The Cretaceous/Paleogene (K/Pg) boundary (66 Ma) was a pivotal moment in Earth's history when one of the most severe mass extinction events occurred. The bolide impact that triggered this event not only affected terrestrial ecosystems but also had profound effects on the marine biota, biological pump, and global carbon cycle, as is evidenced by community data, diversity records, and geochemical proxies. Calcareous nannoplankton are a key component of the modern global carbon cycle and one of the most important groups of marine primary producers with a key role in sediment formation that stretches back 200 million years. The K/Pg event is associated with the eradication of approximately 90% of Cretaceous nannoplankton species, and post-extinction lineages are characterized by their remarkably small sizes (<3 μm coccolith length) and mixotrophic strategies (Gibbs et al., 2020).

Here, we present data on high-latitude fossil coccolithophore assemblages across a recently recovered K/Pg section that was collected at International Ocean Discovery Program (IODP) Site U1579, drilled on the central Agulhas Plateau during IODP Expedition 392 (Uenzelmann-Neben et al., 2023). The K/Pg interval was initially identified during the expedition by a change in sediment color, magnetic susceptibility, and diagnostic calcareous nannofossil assemblages. We conducted quantitative abundance analyses on the post-K/Pg newly originated calcareous nannofossil lineages, including those that form a series of acmes (genera *Praeprinsius*, *Prinsius*, and *Toweius*), and determined the tempo of Paleocene coccolithophore evolutionary dynamics in the high latitudes. In addition, we used high-resolution calcareous nannofossil biostratigraphy to confirm the presence of the K/Pg boundary interval and bulk carbon and oxygen isotope records to provide a refined age model for correlation with other published Paleocene nannofossil records. These new data provide additional insights into the processes of Danian plankton recovery, biogeographic trends in the high latitudes, and the establishment of marine ecological niches after the mass extinction.

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References:

Gibbs, S.J., Bown, P.R., Ward, B.A., Alvarez, S.A., Kim, H., Archontikis, O.A., Sauterey B., Poulton, A.J., Wilson, J. & Ridgwell, A. 2020. Algal plankton turn to hunting to survive and recover from end-Cretaceous impact darkness. *Science Advances*, **6**(44): eabc9123. https://doi.org/10.1126/sciadv.abc9123

Uenzelmann-Neben, G., Bohaty, S.M., Childress, L.B., Archontikis, O.A., Batenburg, S.J., Bijl, P.K., Burkett, A.M., Cawthra, H.C., Chanda, P., Coenen, J.J., Dallanave, E., Davidson, P.C., Doiron, K.E., Geldmacher, J., Gürer, D., Haynes, S.J., Herrle, J.O., Ichiyama, Y., Jana, D., Jones, M.M., Kato, C., Kulhanek, D.K., Li, J., Liu, J., McManus, J., Minakov, A.N., Penman, D.E., Sprain, C.J., Tessin, A.C., Wagner, T. & Westerhold, T. 2023. Expedition 392 summary. *Proceedings of the International Ocean Discovery Program*, **392**. https://doi.org/10.14379/iodp.proc.392.101.2023