

A benthic perspective on Cretaceous climate evolution in the southern high latitudes

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We present an evaluation of southern high-latitude Cretaceous foraminiferal data collected at several sites during Integrated Ocean Discovery Program (IODP) Expedition 369 (Naturaliste Plateau/Mentelle Basin, Indian Ocean, SW Australia, Sites U1513, U1514, U1516, and Great Australian Bight, Site U1512). The study sites were located at a paleolatitude between 57°S and 62°S during the mid-Late Cretaceous. The objectives of IODP Expedition 369 were to gain a better understanding of the rise and collapse of the Cretaceous greenhouse, the controls on Cretaceous oceanic anoxic events, Cretaceous palaeoceanography, and the break-up of Eastern Gondwana. During the Late Cretaceous, benthic foraminiferal data from southern high latitudes recorded palaeoenvironmental changes in the bottom waters - from the Cretaceous greenhouse climate during the Cenomanian–Turonian transition to the onset of Late Cretaceous cooling in the Santonian.

We present an overview of four case studies covering most of the Upper Cretaceous, based on a calcareous nannofossil and planktonic foraminiferal biostratigraphic framework: 1) Biostratigraphy and palaeoenvironments of the Cenomanian/Turonian transition at IODP Site U1516 and the response of microfossils to climatic degradation during Oceanic Anoxic Event 2; 2) Benthic foraminiferal assemblage changes in the Upper Cretaceous of the Great Australian Bight, focusing on foraminiferal biostratigraphy and a palaeoecological assessment of a marginal marine basin characterised by the interplay of estuarine and marine influence and the progressive opening of the Austral-Antarctic Gulf; 3) an assessment of benthic foraminiferal responses to surface and bottom water cooling in the Santonian; and 4) an approach to a Cretaceous benthic foraminiferal biostratigraphic zonation for the southern high latitudes.

In addition, the Australian foraminiferal data provided insights into the emergence of the Austral bioprovince and the waning of Tethyan influence following the break-up of Eastern Gondwana during the Late Cretaceous. Contributions to the understanding of Australian Cretaceous biostratigraphy and palaeoenvironments during phases of extreme climatic deterioration highlight possible future research paths of interest. The results on biostratigraphy, chemostratigraphy, palaeoecology and oceanography were published as part of an Erwin Schrödinger Fellowship awarded by the Austrian Science Fund (Project No. J4444).