

Mid-Cretaceous climatic perturbation in southern high latitude ocean: drastic warming and cooling across OAEs and Mid Cenomanian Event.

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Mid-Cretaceous, especially late Cenomanian through Early Turonian interval, is well known to be a period of climatic optimum of greenhouse earth. On the other hand, less information is available for progressive warming interval before the optimum. How the climatic optimum established? Was it gradual or stepwise development with or without fluctuation? To know the paleoenvironmental fluctuation in higher latitude regions during greenhouse world is especially important as they generally respond sensitively to climatic warming and cooling (IPCC AR6 WG1 report, 2017).

Alkenones are primary proxy for Quaternary paleothermometry whereas they are rare to be applied for deeper geologic time. It is partly because of less information about their producer and of lack of reliable calculation formula for paleotemperature. Though acquiring values of paleotemperature is difficult, it is still available to discuss relative level of paleo-SST, provided the mechanism that produce unsaturation in alkenone molecule is as same as that of the present haptophytes. From southern rim of paleo-Indian Ocean near southwestern Australia (IODP Sites U1513, U1516), alkenones composed of forty carbons with two or three unsaturation sites are solvent-extracted and analyzed with gas-chromatography to obtain C₄₀ alkenone unsaturation index (U^{K'}₄₀). The trend of U^{K'}₄₀ from late Albian through latest Cenomanian is interpreted to reflect that of SST through this interval. U^{K'}₄₀ gradually decreased through late Albian and early Cenomanian, then showed clear and considerable but short-lived drop near MCE horizon, then recorded a maximum within a lower part of the OAE2 interval. Then it dropped clearly within the black mudstone representing OAE2 but not as large as that at MCE. These fluctuation is concordant with paleoceanographic data from other regions of the world. Dramatic paleotemperature response is also suggested by bulk carbonate oxygen isotope data across OAE1b horizon. Southern rim of proto-Indian Ocean is interpreted to be very sensitive region to climatic change.

For the further researches on the alkenone index, it is important to develop the paleotemperature scale for U^{K'}₄₀.

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