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Changes in Carbonate Compensation Depth in the western North Pacific over the past 500 kyrs

ERIKA TANAKA[1], YUKI YOSHIZUMI[1], JUNICHIRO KURODA[2], KAZUTAKA YASUKAWA[2], YOICHI USUI[3], MINORU IKEHARA[1], KOICHI IIJIMA[4] AND YUSUKE KUWAHARA[5]

[1]Kochi University
[2]The University of Tokyo
[3]Kanazawa University
[4]Japan Agency for Marine-Earth Science and Technology
[5]Kwansei Gakuin University

The carbon cycle is closely linked to global climate change and its feedback mechanisms. During the Quaternary, concurrent variations have been documented in atmospheric CO_2 concentrations, changes in global average temperatures, and repeated expansions and contractions of ice sheets [1]. Although it was known that atmospheric CO_2 concentrations decreased approximately 100 ppm during glacial periods, the mechanisms of carbon sequestration from the atmosphere remain unclear [2]. Pelagic deep-sea sediments represent one of the largest carbon reservoirs, in conjunction with neritic carbonate shelves [3]. Previous research has reported that the lysocline periodically deepened over the past 500 kyr around the Ontong Java Plateau and in the equatorial Pacific, corresponding to the glacial intervals [4–6]. However, the variability of carbonate dissolution in the mid-latitude Pacific Ocean, particularly in the Kuroshio Extension regions of the western North Pacific, remains poorly understood.

Here, we reconstruct variations in carbonate compensation depth (CCD) over the past 500 kyrs, utilizing four piston cores obtained from the southwestern slope of Tamu Massif, Shatsky Rise, covering multiple depths across the present CCD. The nannofossil ooze constituted the primary lithology of the shallowest cores, whereas pelagic clay was the dominant lithology of the deepest cores. The $CaCO_3$ concentrations of the cores suggest that carbonate preservation was notably high during glacial periods, and that the carbonate compensation depth (CCD) varied by over 1000 m between glacial and interglacial periods. Given that the CCD and Carbonate Critical Depth (CCrD, defined as the depth containing 10% of $CaCO_3$) have remained relatively stable in the equatorial Pacific [4, 5], the Kuroshio Extension region could have functioned as a more substantial carbon reservoir in the Pacific Ocean.

[1] Petit et al. (1999) Nature, 399(6735), 429-436. [2] Kohfeld and Ridgwell (2009) In Surface ocean-lower atmosphere processes, 251-286. [3] Wood et al. (2023) Annu. Rev. Mar. Sci., 15, 277–302. [4] Wu and Berger, (1991) Marine Geology, 96(3-4), 193-209. [5] Farrell and Prell, (1989) Paleoceanography, 4(4), 447-466. [6] Murray et al., (2000) Paleoceanography, 15(6), 570-592.