Late Quaternary Carbonate Preservation History and Sea Surface Paleoceanography of the Shatsky Rise, Northwestern Pacific

Leopoldo P. de Silva Jr.

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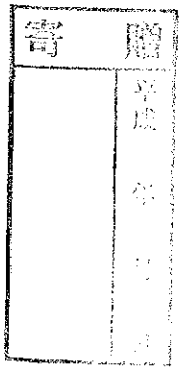

Table of Contents

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Abstract

The planktic foraminiferal records of three sediment core samples from Shatsky Rise were used to reconstruct the late Quaternary sea surface conditions and the carbonate preservation history of the northwestern Pacific. The study area, a narrow zone which lies within the direct path of the Kuroshio Extension, is believed to be a site where profound sea surface paleoceonagraphic changes occurred during the late Quaternary climatic oscillations.

Two planktic foraminiferal based proxies were used to track down-core carbonate preservation history: Berger's (1968, 1971) foraminiferal dissolution index (FDX) and the relative proportion of planktic foraminiferal fragments (FRAG). The down-core patterns exhibit typical carbonate preservation/dissolution pattern of the Pacific (Pacific Carbonate Cycles) with the dissolution maxima occurring during glacial build-up and the dissolution minima (preservation maxima) during deglaciation. In addition, timing and magnitude of the dissolution minima and maxima events recorded in these two cores are remarkably similar to what is observed in the central Pacific suggesting a more regional cause for changes in carbonate preservation (Pacific Deep Water chemistry). Cross-spectral analysis between the oxygen isotope record and FRAG reveals that most of the power of both spectra occur in the 100 kyr cycle with FRAG (dissolution) lagging $\underline{d}^{18}O$ (ice volume) by ~7 kyr.

The results of paleotemperature reconstruction using the FP-12E transfer function suggest a maximum of 2^0C cooling below 35^0N latitude and > than 5^0C above 35^0N latitude during glacial times relative to the present. Sea surface temperatures (SSTs) during the

oxygen isotope stage 5 interglacial were comparable if not warmer than the Holocene. SSTs during the oxygen isotope stage 6 glacial was colder than stage 2 resulting to steeper temperature gradients in the transition region.

The ubiquitous presence of the warm water species *Pulleniatina obliquiloculata* and *Globorotalia truncatulinoides* during peak $\delta^{18}O$ negative events (oxygen isotope stages 1 and 5.5) mark the influence of the Kuroshio Extension and the sub-tropical water mass respectively. Peak abundance of these two species during the oxygen isotope stage 5.5 (~122 kyr) signals a northern retreat of the sub-polar frontal boundary relative to the present position. Southward advance of this front is marked by the appearance of *Neogloboquadrina pachyderma* sinistral in the two northern cores (NGC 106 and NGC 108) during the oxygen isotope stages 2 and 6. The general absence of this species in NGC 102 (~32^{0}N latitude) suggest that this location has remained fully sub-tropical to transitional and that the maximum southward penetration of the cold water mass was restricted to ~34^{0}N latitude. Absolute abundance data of the species *N. pachyderma* dextral and sinistral, and *Globigerina bullloides* suggest a mark difference stage 2 and 6 in terms of primary productivity and thermal structure of the water column.

The effects of temporal changes in carbonate dissolution intensity and productivity are clearly reflected in the sedimentation rates constructed for the three cores. Averaged sedimentation rates, however, mirror the observed south to north productivity gradient observed in the present transition zone.

Key words:

Planktic foraminifera, paleoceanography, carbonate dissolution, Shatsky Rise, Northwestern Pacific

List of Tables

List of Illustrations