

GEOCHEMISTRY OF PARTICULATE AND DISSOLVED INORGANIC CARBON IN
THE CENTRAL NORTH PACIFIC

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

OCEANOGRAPHY

MAY 1992

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ABSTRACT

An understanding of the global biogeochemical cycle of carbon is fundamental to an evaluation of global climate change. One important aspect of the global carbon cycle is the relationship between carbonate particles and the dissolved carbon chemistry of the world oceans. The carbon-carbonate system of the open ocean is still not completely understood today. This investigation incorporated both sediment trap data and measurements of the concentration and distribution of marine carbon species in the water column in an attempt to evaluate some of the fundamental questions of the marine carbon system. These include the relationship between particulate and dissolved inorganic carbon and the importance of bank-derived carbonate particles on the carbon chemistry of the open ocean. The marine carbon-carbonate system, monitored for 15 months at the Hawaii Ocean Time-series station, ALOHA, was predominantly controlled by the decomposition of organic matter in the upper 700 m of the water column and by the dissolution of aragonite between 700 and 2200 m. Calcite particle dissolution does not appear to be significant at depths shallower than 3200 to 3500 m. Although mixed layer $p\text{CO}_2$ calculations suggest that the central North Pacific waters are a very small sink for anthropogenic CO_2 , this CO_2 has penetrated to a depth of 700 m at Station ALOHA and may already be dissolving aragonite particles at this depth. Magnesian calcite particles comprise as much as 15% of the carbonate flux at 400 m at Station ALOHA and may also be reacting with anthropogenic CO_2 in the water column. Dissolution of these magnesian calcites may contribute to the alkalinity maximum observed in the North Pacific.

Carbonate fluxes near banks of the Hawaiian Archipelago were up to two orders of magnitude greater than open ocean fluxes with significant contributions of bank-derived material.

The magnitude and composition of the near-bank fluxes suggest that significant percentages of the benthic carbonate production are transported to the open ocean where they may dissolve or accumulate as slope sediments. Alkalinity anomalies near the banks indicate that dissolution of highly soluble magnesian calcite particles can occur at depths shallower than the aragonite saturation horizon and may be acting as a small sink for anthropogenic CO₂.