

Change in biogenic opal in sediments from South Pacific off New Zealand since middle Miocene

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The Southern Ocean is known as a high nutrient low chlorophyll (HNLC) region. In HNLC, primary production is not proportional to the supply of macro-nutrients such as nitrate, phosphate and silicate. It is suggested that iron deficiency is the reason. In the ocean other than HNLC, macro-nutrients are the limiting factor for primary production. However, in the Southern Ocean, macro-nutrients are abundantly supplied to the surface layer by upwelling. Therefore, iron, a micro-nutrient, is deficient before macro-nutrient. As a result, iron deficiency is the limiting factor for primary production in the Southern Ocean. Diatom is a phytoplankton with biogenic opal frustules and can be preserved in sediments. Therefore, sedimentary biogenic opal content is used as a proxy for past biological productivity. During Ocean Drilling Program (ODP) Leg 181 in 1998, Site 1123 was drilled in South Pacific off New Zealand (41°47.1' S, 171°29.9' W, and 3290 m water depth). In this study, biogenic opal contents for the last 10 Myrs were measured on 219 samples of ODP 1123. Biogenic opal was analyzed by extracting with an alkaline solution (2M Na₂CO₃) and molybdenum yellow colorimetric method. Both biogenic opal contents and fluxes were relatively high during late Miocene from 7 to 5 Ma. Alkenone sea surface temperature (SST) and alkane flux records indicated significant cooling with increased dust occurred during this period. These data were consistent with a scenario that an enhanced primary productivity occurred when increased iron supply by dust by expansion of arid regions by intensified cooling. This suggests the studied area near Site ODP 1123 was a HNLC region during 7-5 Ma.