North Pacific radiolarian assemblages and oceanographic conditions since the Middle Miocene

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Radiolarian faunal composition, productivity, and biogeography in the mid- to high-latitude North Pacific since the Middle Miocene were characterized and correlated with global climatic changes. Temporal changes in radiolarian productivity were associated with diatom abundance changes, which shows that radiolarian productivity is dependent on food supply. Most of the radiolarian events discussed coincided with global cooling events. Progressive decreases in water temperature in the polar regions were therefore significant factors in the observed radiolarian temporal faunal changes. The east-west balance between cold air masses has had an important influence on the evolution of biogeographical variation.

Middle Miocene: Progressive global cooling after the climatic optimum 1 of Barron and Baldauf (1990) gave rise to a series of radiolarian faunal turnovers synchronous at all three observation sites. A latitudinal gradient in faunal composition already existed, while east-west faunal differences in the subarctic region were obscure. Radiolarian productivity was low in periods of reduced diatom sedimentation.

Late Miocene: Longitudinal faunal differences appeared at about 11.7 Ma in association with a climatic gradient marked by air and water temperatures lower toward the east in the subpolar region. A global cooling event at 9 Ma probably played a large role in the initiation of the North Pacific silica blooming, a faunal change, and increased faunal contrasts both north to south, and east to west. From 7 to 6 Ma, a series of notable radiolarian events occurred in association with a major global cooling event at 6.8 Ma. These events included faunal turnover RF7, an east-west switch in diversity, the initiation of cool-water species dominance in the western subarctic, which lasted up to the Recent, and an increase in radiolarian productivity in the high-latitude regions coinciding with increased primary productivity.

Pliocene to Pleistocene: Progressive global cooling and development of the Siberian cold air mass promoted radiolarian biogeographical faunal differences in the North Pacific, with the highest abundance of cool-water species in the Western Subarctic Gyre. This cooling enhanced haloclinal stratification, which finally resulted in a faunal turnover at 2.7 Ma and a rapid decrease in radiolarian productivity in response to the decline in primary production. The climate change to a cyclic glacial-interglacial regime at 0.9 Ma established modern distribution patterns for some radiolarian species.