Geophysical Research Abstracts,
Vol. 11, EGU2009-13056, 2009
EGU General Assembly 2009

Stable Oxygen and Carbon Isotope Characteristics of Live Benthic Foraminifera from the Okhotsk Sea: Effects of Oceanography, Food Supply and Microhabitat Patterns

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Paleoceanographic studies use benthic foraminiferal stable isotopes as proxies for interpretations of numerous parameters such as past oceanic circulation patterns, food supply, primary productivity, etc. However, only few studies have used live (rose Bengal-stained) populations to reliably calibrate stable isotope characteristics to bottom water and sediment chemistry of the surrounding environment. We report data from a study in the Okhotsk Sea, a region characterized by extreme climatic and oceanographic settings. Not only does this marginal basin of the NW-Pacific experience the southermost extent of seasonal ice cover in the entire Northern Hemisphere, it also shows extremely high primary productivity. These boundary conditions lead many to consider the Okhotsk Sea both as a modern analog for ecological and oceanographic conditions in ocean basins during past and a sensitive recorder of potential future climate change in high latitudes.

We compare results of stable oxygen and carbon isotopes from the most abundant taxa to oxygen isotopic compositions of bottom water and carbon isotopes of bottom water DIC, nutrient inventories from the water column and productivity proxy-data from sediment surface profiles (chlorines, TOC, biogenic opal). Multicorer samples from the upper 10 cm at 15 sites were taken from a variety of settings with water depths ranging from less than 100 m to more than 3200 m. Results obtained show a wide range of interspecific carbon isotope values exceeding 2 per mil variability within neighbouring samples. Minimum values occur in deep endobenthic groups like Globobulima spp., whereas species living in a relatively wide depth range like V. sadonica or U. peregrina exhibit intermediate values between –0.7 and –1 per mil. Most measurements conducted to address intraspecific variability remain within a narrow range of less than 0.4 per mil. However, we do observe vertical trends with both increasing and decreasing carbon isotope gradients within the sediment column. Obtained carbon isotope values from both living and dead specimen of widely used the Cibicides spp. group stay within the range of bottom water DIC, with no systematic negative phytodetritus-effect occuring throughout the sample set despite etremely pronounced seasonality in organic matter supply on most sites. Combined with a proxy-dataset about primary productivity, we give an evaluation of benthic–pelagic coupling and the impact on benthic species adaption to the pronounced subarctic seasonal cycle and the strongly pulsed food fluxes to the ocean floor.