Geophysical Research Abstracts
Vol. 14, EGU2012-2887-1, 2012
EGU General Assembly 2012

Benthic Foraminiferal Stable Isotope and Dinocyst Assemblages in Sediments of the Trondheimfjord Area (Mid-Norway): Proxies for Regional Oceanographic and Climate Changes?

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The Trondheimfjord is located at the west coast of Mid-Norway and is characterized by local environmental and hydrological changes that are linked to regional oceanographic and atmospheric processes in the Norwegian Sea. The North Atlantic Current (NAC) and the Norwegian Coastal Current (NCC), two major northward flowing sea surface/intermediate currents, strongly contribute to the oceanography of the Norwegian Sea and thus, to the hydrological settings of the fjord. Instrumental records indicate that the renewal of the fjord water by Atlantic-derived water masses occurs twice a year and that bottom water temperature and salinity changes reflect NAC variability. Sedimentation rates in the fjord basin exceed several mm/yr. Hence, the Trondheimfjord is an ideal location for high resolution studies of important climate-sensitive parameters such as characteristics of Atlantic-derived waters, freshwater discharge and sedimentary patterns. We measured stable isotope ratios in tests of the benthic foraminifera Melonis barleanus from surface sediments of the Trondheimfjord; δ18O ratios vary according to circulation and stratification patterns in the fjord which are linked to the topography. Based on these surface sediment measurements, as well as previous sediment core studies (Milzer et al, unpublished), we assume that benthic δ18O ratios in sedimentary archives from the Trondheimfjord reflect ocean circulation changes in the Norwegian Sea. In order to examine to which extent physico-chemical characteristics of the prevailing water masses are affecting the benthic signal in the Trondheimfjord, and how these findings can be related to oceanographic changes in the Norwegian Sea, we analyze benthic δ18O ratios from three multi-cores distributed along the fjord axis. According to 210Pb and 137Cs chronology these multi-cores contain undisturbed sedimentary records for the last 10 to 50 years, with sedimentation rates ranging from 2.5 to 7 mm/yr. We perform this analysis by comparing our stable isotope data with instrumental time-series from hydrological stations in the fjord area and over the Norwegian margin. On a decadal scale the variability of the benthic δ18O signal concurs with the temperature and salinity variability of the bottom water of the Trondheimfjord measured at different stations along the fjord axis. On a multidecadal scale, benthic δ18O variability and the instrumental datasets show different patterns, and point out the peculiarity of each core location in terms of topographic and hydrological settings. In addition, we present dinocyst census counts on the same sedimentary archives as tracers of changes in water mass characteristics induced both by NAC ventilation of the Trondheimfjord and regional climate patterns. The results show characteristic dinocyst assemblages for estuaries including seasonal hydrological variations in the Trondheimfjord which result in changes of food availability as well as mixing of water masses in the fjord.