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Biogeosciences Discussions

Interactive comment on "Spatial distribution of benthic foraminiferal stable isotopes and dinocyst assemblages in surface sediments of the Trondheimsfjord, central Norway" *by* G. Milzer et al.

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Thank you, Mr. Schmiedl, for your comments and new ideas. I will work on your suggestions as far as possible since a major problem is the lack of information on the species M. barleeanus, chemical composition of the water and the pore water as well as some sedimentological and biogeochemical information.

Response to the general issues

to 1) I agree that it is important to consider recent changes in the present conditions

due to anthropogenic land-use and/or industrial development. So far I did not discuss this aspect regarding the time period of max. 20 year integrated in the surface sediment samples. A proper comparison of the conditions before and after enhanced land-use based on this data set is not possible. I am currently working on sediment samples from the Trondheimsfjord which encompass the past 55 years hoping to gain more information about any anthropogenically induced impact in the fjord. Still, I will discuss the potential of the proxies as analogues for the past in further detail since it is the basic idea of the article.

to 2) Any effects on the stable isotope composition in M. barleeanus such as the oxygenation, the position of the nitrate reduction zone, etc. with regard to the particular fjord topography and hydrology are hard to estimate and to quantify. Considering the impact of both marine and continental waters I already tried to get some information on the most appropriate correction of the vital effect for d18O. In this article I corrected the oxygen isotope ratios in M. barleeanus by +0.4 per mill according to studies in the Norwegian Sea (e.g. Woodruff et al., 1980; Graham et al., 1981; Jansen et al., 1989). Other investigation on this species by e.g. Fontanier et al. (2008) and McCorkle et al.(1990) suggest a correction value of +0.65 per mill and +0.53 per mill, respectively. I will do my best to discuss and evaluate (qualitatively) any effect on tIhe stable isotope composition and take into account the publications you mentioned.

Specific issues

to 2) Unfortunately I do not have all the data which may serve for the comparison, verification or contradiction of the discussed observations but I will consider your suggestions as far as possible.

to 3) Sediment accumulation in the fjord strongly varies as a result of bottom currents, remobilization and riverine input. I think it is impossible (or at least it might add further uncertainty) to estimate the average living depth of M. barleeanus. I will therefore follow the literature and discuss the effects linked to varying habitat depths.

BGD

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to 4) You are right. We have to take into account deviations in the isotopic ratio related to the isotope integration over different time periods. This aspect comes along with the uncertainty on the calcification time as well as the depth in which the M. barleeanus has been living/dying as mentioned in 3).

to 4.2) Unfortunately, I do not have any data of the d13C of DIC in the water masses or d18O in the water. I will consider the suggested literature as well as further geochemical data from the surface samples and amplify the discussion regarding the microhabitat, food supply and additional effects linked to the fjord location.

to 4.3) Dinocyst are considered to be generally well preserved in sediments except of a few species (e.g. Brigantedinium spp.) which may suffer from diagenetic and aerobic decay. In this study I only discussed the four dominant/subordinate species since we have to include a potential transport of the observed cyst in the entire fjord area in addition to winnowing and other sedimentary processes. Similarly to the benthic stable isotopes I think the time period of 4 to 20 years integrated in the surface sediment sample may complicate a straight forward interpretation of the potential preservation differences of certain cysts. Still, the distribution of autotrophic and heterotrophic species in sedimentary archives from the Trondheimsfjord of the past 55 years show a similar distribution of the cysts as observed in the surface samples mainly linked to the food availability, stratification patterns and riverine input. The data also shows a large difference in the cyst assemblages between the fjord entrance and the Middle fjord and the Seaward basin. Nevertheless, I will compare my observations with other research studies and try to work out the impact of the preservation of cysts on the assemblages.

Interactive comment on Biogeosciences Discuss., 10, 5889, 2013.