

Highly variable marine reservoir age correction for the fjords of North Svalbard during the period preceding rapid Arctic warming

Dmitry V. Divine (1), Arto Miettinen (1), Katrine Husum (1), Matthias Moros (2), Harikrishnan Guruvayoorappan (3,1), Svetlana Divina (1), and Rahul Mohan (3)

(1) Norwegian Polar Institute, Fram Centre, Tromsø, Norway (dima@npolar.no), (2) Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany, (3) National Centre for Polar and Ocean Research, Vasco-da-Gama, Goa, India

An accurate attribution of the timings of features/events observed in marine sediment core – based series depends on a reliable knowledge of a marine reservoir age correction. It is well known that the reservoir ages can vary both locally and temporally. Deviations from the typically used marine model-average 400 years reservoir age depend on a number of factors, including changes in prevalent water masses as well as a source balance of radiocarbon in species used in analysis. Determination of this local age offset (ΔR) is particularly challenging in marine environments subject to the incursions of Polar and Arctic water masses depleted for radiocarbon with respect to the surface water masses from lower latitudes.

A current estimate of ΔR for Svalbard of 105 ± 24 years is based on the ^{14}C analysis of four living molluscs with known ages of C fixation collected off the west coast of Spitzbergen between 1870-1925 CE. In order to extend the knowledge about a local ΔR we conducted an analysis of five radiocarbon dates with alternative age determinations using a network of sediment cores from the two fjords of north-western Svalbard: Kongsfjorden and Krossfjorden.

Our analysis relies on ^{137}Cs and ^{241}Am measurements along the core depths where the onset of ^{137}Cs activity associated with the 1954 nuclear test could easily be identified. For three of the cores the radiocarbon ages from these horizons were measured using samples of benthic foraminifera. As an additional indirect time marker we used Hg concentration changes that marks the onset of mercury pollution in the fjords in late 1960s-early 1970s. Comparison of radiocarbon dates with the well constrained ^{137}Cs -dated levels reveals the marine reservoir age deviations substantially higher than typically used values of ΔR for the region. In particular, three dates from the two cores recovered in the inner parts of the fjords have shown ΔR values of > 400 years for the period of 1940s-1950s associated with this core depth. The remaining two dates from the core recovered in the outlet of the two fjords, i.e. the site more distant from potential sources of “old” carbon, have demonstrated even higher ΔR values of > 800 years for the same time period. We suggest an expansion of Arctic waters into the region to be behind the inferred high values of ΔR , though in the case of even larger values, changes in sediment accumulation rates should not be ruled out.