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The development of a benthic foraminiferal quantitative transfer function in the Barents Sea.

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An important approach being utilised in paleoclimate research is the construction of mathematical transfer functions to quantitatively reconstruct the environmental variables of the past. Recent work within the Barents Sea region, based on the Steinsund and Hald (1994) benthic foraminferal database and with additional work by S. Korsun, attempted to establish a transfer function based on faunal data collated from a number of different studies published over a number of decades. The training set consists of data from over 400 stations covering the entire Barents Sea in an attempt to enable reconstructions of the corresponding environmental variables of this region. The study highlighted the difficulties associated with compiling a large faunal database from varying sources and over a wide range of environmental conditions.

We are currently collating a modern database of benthic foraminiferal data from sediment surface-samples from a more focused area within the central Barents Sea. The stations are located within an area which is influenced by the warm, dense Atlantic water in addition to the colder Arctic water. The faunal samples were obtained in 2005 and 2006 from 27 stations, where bottom water temperatures range from -0.06 to 7.8 oC and salinity varies between 34.7 and 35.14%■. Transfer functions for (August) bottom-water temperature and salinity have subsequently been developed based on the WAPLS (Weighted averaging partial least squares), WA (Weighted averaging), ML (Maximum likelihood) and MAT (Modern Analogue Technique) methods. WAPLS gives the lowest root mean squared error and the temperature based transfer function offers a statistically strong positive correlation between the original temperature measurements and the modelled temperature values.

A marine sediment core recovered from the western Barents Sea in July 2005 is used to test the reconstruction. An overall warming trend of approximately 2.5 oC is observed through the 1500 year record based on a monospecific benthic oxygen isotopic record which has been converted to bottom water temperature using the Shackleton paleotemperature equation. We have applied the new transfer function and back-predicted temperatures for the last 1500 years. The resulting reconstruction shows a broadly similar trend to the oxygen isotope obtained temperatures.

Early results indicate that this more localised Barents Sea benthic foraminifera-based transfer function offers better potential for reconstructing low temperatures at high latitudes. The database will be expanded and further applied to both new and existing benthic foraminiferal records. In addition, benthic faunal samples are currently being analysed from Kongsfjorden, Svalbard to determine whether this approach can be used to reconstruct individual fjord environments.