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Benthic foraminifera as indicators of pollution in high latitude marine environments

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An increasing number of studies demonstrate the potential of benthic foraminifera to characterize ecological status. However, the use of benthic foraminifera as bio-indicators has previously not been tested in high latitudes. This research contributes to the development of foraminifera as a bio-monitoring technique for the Arctic region, as industrial activities in this region will increase in the coming years.

Surface sediments (0-1 cm) from sites close to gas fields in the SW Barents Sea were studied. In addition, to elucidate the range from less to very affected, surface sediments from the harbor of the town of Hammerfest (70° N) were studied. At least 300 living benthic foraminifera from the size fraction 100 μm–1 mm were counted and identified at species level. Pollution levels (heavy metals and persistent organic pollutants) and sediment properties (grainsize and TOC) were also analyzed.

Pollution levels at the sea floor in the SW Barents Sea are of background to good level (level I-II) according to the definitions by the Water Framework Directorate (WFD). Benthic foraminiferal assemblages are influenced by natural environmental parameters such as water mass properties, water depth, nutrient availability, bottom current strength, and grain size. Surface sediments from the Hammerfest harbor are of moderate environmental status (WFD level II-III) based on heavy metal concentrations and of bad environmental status (WFD IV-V) based on persistent organic pollutant concentrations. Opportunistic benthic foraminifera are dominating the assemblages. The most polluted areas in the harbor are barren for foraminifera or have high amounts of deformed shells.
In both environments the foraminiferal diversity of the samples, does not correspond to expected environmental status based on the pollution levels of the sediments. Environmental status classes, based on benthic foraminifera instead of macrofauna, would allow rapid analyses of the environmental impact of pollution.