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The salinity:δ^{18}O water relationship in Kongsfjorden, western Spitsbergen, Svalbard.

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The stable oxygen isotope composition of foraminifera is one of the fundamental tools in palaeoclimatology; providing palaeotemperatures, a relative time scale for deep sea cores, a proxy for sea level, as well as evaluation of polar ice volume. It is an important proxy for the fact that oxygen isotopes are used in interpretations of marine, terrestrial, and cryospheric archives.

Crucial to our use of this proxy is an understanding of the physical distribution of oxygen isotopes and their fractionation in the hydrological cycle. The distribution of δ^{18}O in Arctic coastal waters is controlled primarily by the hydrological cycle, i.e. the ratio of evaporation and precipitation acting on the surface waters, seasonal snow melt and the quantity meteoric water stored in continental ice caps. In conjunction, the complex fjordic circulation directly impacts the distribution of δ^{18}O. This study investigates how the mixing of oceanic waters and fresh waters influence the oxygen isotope composition of fjordic water. Thus providing a modern analogue that defines the salinity:δ^{18}O relationship in the fjordic waters for comparison with the proxy records from foraminifera.

Here we present results from the analysis of vertical and horizontal profiles of the oxygen isotope composition in the tidewater glacier dominated fjord of Kongsfjorden, western Svalbard. A distinct freshwater cap within the inner and central fjord during the late summer was identified from the oxygen isotope measurements. This water mass was interpreted as a glacial meltwater plume produced by the large tidewater glacier complex at the head of the fjord. However, the inner fjord basin profiles did not reveal the presence of a subsurface meltwater intrusion, in contrast to the reported

‘cold tongue’ in Antarctic fjords. In the outer fjord, the oxygen isotope data suggest a different source of freshwater with the dominance of freshwater runoff from snow melt and river water.

The isotopic composition of the fjord waters suggest a mixing line for Kongsfjorden of 0.40 permil for a salinity change of 1. The freshwater samples were not used in the calculation of the mixing because of the large differences in the isotopic composition of the glacier ice and large seasonal differences of precipitation.