Paper Number: 4675

Geochemistry and ^{10}Be analysis of sediments from Svalbard, Arctic Ocean: A proxy for climate change

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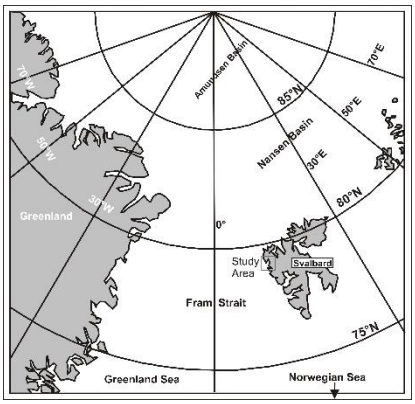
News about glacier retreat in the arctic circumpolar region is common in the recent years and various models were put forward to know the fate of these glacier. Instrumental or historical record of these glacier extent and retreat are limited from decadal to few hundreds of year. To understand the long term change we need to relay on natural archives. The sediment accumulated over a period of time in the glacio-marine environment could provide information about paleoclimate variation. Cosmogenic ^{10}Be in combination with geochemistry of deposited sediment can be used to understand the climatic variation in the recent past. Surface sediments from different water depths have been collected from a Fjordic system, which is made by two fjord systems; Krossfjorden and Kongfjorden situated in the western coast of Svalbard. The common mouth of Kongsfjorden and Krossfjorden open onto a submarine glacial trough, called Kongsfjordrenna. This fjordic system is located between 78° 50' to 79° 30' N and 11° to 13° E [Fig.1]. The major, trace and REE geochemistry, and ^{10}Be concentration measurements have been performed on these sediments [1].

^{10}Be ($T_{1/2}$= 1.39Ma) is produced by interaction of secondary cosmic rays with the certain nuclides present in the atmosphere (called meteoric ^{10}Be) or on the earth's surface (*in-situ* ^{10}Be). After a short residence time meteoric ^{10}Be is removed from the atmosphere by dry and wet precipitation and gets deposited on glacial ice, ocean and land. Melting glaciers in the arctic regions also brings ^{10}Be trapped into the glacial ice and therefore, glacio-marine sedimentary record of ^{10}Be may be used to infer the glacier melting in higher latitude region [2]. REE of the fjord sediments has been used to understand the provenance and their behaviour during weathering of the primary mineral in the source area and subsequent transportation to the fjord system.

The total REE (ΣREE) of the sediments shows better positive correlation with the Al_2O_3 than K_2O wt%, but does not show any correlation with the clay% or clay%/silt% ratio. It indicates that the concentrations of REE are mainly controlled by the presence of less weathered aluminosilicate minerals in these sediments. All the sediment samples show similar REE pattern in the UCC, chondrite, PAAS and NASC normalised plot. The REE patterns are LREE enriched and HREE depleted. Geochemical studies on the sediments indicated that the extent of chemical weathering in the source area is very low but some of the elements have got first order fractionation during the size reduction process of weathering. It inferred that the ^{10}Be present in the derived sediment is of meteoric origin.



The calculated ^{10}Be accumulation rate in the study area varies from 3.1×10^6 atoms cm^{-2} y^{-1} to 8.6×10^6 atoms cm^{-2} y^{-1}, which is higher than the present day global average atmospheric production rate of $1.21 \pm 0.26 \times 10^6$ atoms cm^{-2} y^{-1} [3] and also higher than that observed in deep sea cores of the Arctic Ocean and Norwegian Sea

[2]. Higher ^{10}Be accumulation rate is attributed to the release of atmospherically produced ^{10}Be trapped in the glaciers over a period of time, into the sediments due to faster melting of Svalbard glaciers.

Figure 1: Map of Arctic Ocean showing study area (Svalbard)

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