

Behaviour of anthropogenic radionuclides in the proglacial environment

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Retreating Arctic glaciers uncover areas that are sites of intense biogeochemical and geomorphic activity. Analyses of fine-grained deposits from proglacial zones of two Spitsbergen glaciers revealed unexpectedly high concentrations of fallout radionuclides reaching 3000 Bq/kg, 1 Bq/kg and 20 Bq/kg for ¹³⁷Cs, ²³⁸Pu and ²³⁹⁺²⁴⁰Pu, respectively. Airborne anthropogenic radionuclides are efficiently retained in cryoconites – accumulations of dust and organic matter on glacier surfaces. This highly active material is washed down as melting of glacier surface proceeds and may be redeposited in the proglacial zone. Upon entering the subglacial drainage system the cryoconite material becomes diluted with large volumes of water carrying fine-grained mineral material derived from weathering of rocks. Therefore, the extremely high activities of fallout radionuclides might be found only in those parts of the proglacial zone that receive direct runoff from glacier surface. Activities measured at other sites were similar to values reported for Arctic soils. Granulometric, mineralogical, and chemical properties showed no significant vertical variability in the collected proglacial deposits. The observed distribution of radionuclides with depth in the deposits must thus reflect changes in their delivery to particular sites. Finally, development of vegetation on these hot-spots of radioactivity will lead to introduction of fallout radionuclides into the Arctic food web.

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