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Airborne radionuclides in cryoconite from the Northern and Southern Hemispheres

Edyta Łokas (1), Piotr Zagórski (2), Ireneusz Sobota (3), Krzysztof Zawierucha (4), Łukasz Pawłowski (5), Shiv Mohan Singh (6), Wiesław Ziaja (7), and Paweł Gaca (8)

(1) Institute of Nuclear Physics PAS, Department of Nuclear Physical Chemistry, Krakow, Poland (edyta.lokas@ifj.edu.pl), (2) Marie Curie Sklodowska University, Faculty of Earth Sciences and Spatial Management, Lublin, Poland, (3) Nicholas Copernicus University, Faculty of Earth Sciences, Polar Research Center Toruń, Poland, (4) Adam Mickiewicz University in Poznań, Faculty of Biology, Department of Animal Taxonomy and Ecology, Poznań, Poland, (5) Uniwersytet Wrocławski, Institute of Geography and Regional Development, Wrocław, Poland, (6) Earth System Science Organisation, National Centre for Antarctic and Ocean Research, Headland Sada, Goa- 403804 India, (7) Jagiellonian University in Cracow, Institute of Geography and Spatial Management, Kraków, Poland., (8) Ocean and Eart Science, University of Southampton, Southampton, United Kingdom

Airborne pollutants on glacier surfaces concentrate in cryoconite granules and related micro-fauna. Cryoconite granules are aggregates of mineral and organic components associated with biological consortia composed of archaea, algae, cyanobacteria, fungi and heterotrophic bacteria. The activity concentrations of airborne radionuclides (137Cs, Pu isotopes, 210Pb) in cryoconite material were determined for fourteen glaciers representing four glacierized regions of the world (Spitsbergen, Greenland, Caucasus Mountains in Georgia and Antarctic). Observations conducted in such different locations influenced by diverse environmental conditions provide an opportunity to study the impact of glaciological factors on contaminant accumulation in cryoconite material.
The activity concentrations of the analysed radionuclides in Greenland cryoconite samples were the lowest among the studied regions. All Greenland cryoconite granules samples were collected at the peak of the ablation period and showed signs of mechanical erosion which could be responsible for the removal of the accumulated radionuclides. In the remaining samples activity concentrations of all airborne radionuclides significantly correlate with organic matter contents and the surface areas of cryoconite holes. The role of glacier surface morphology in effective trapping and storing of cryoconite granules was observed for the Georgian glacier. For the Waldemar Glacier (W Spitsbergen) the increase of activity concentrations with altitude was found. Activity concentrations of 210Pb and Pu isotopes correlate with the depth of cryoconite holes. The highest activity concentrations of the airborne radionuclides were found for Spitsbergen glaciers where they reached 4500 Bq/kg, 14 Bq/kg, 179 Bq/kg and 13000 Bq/kg for 137Cs, 238Pu, 239+240Pu and 210Pb, respectively.
Glaciers are only temporary repositories for radionuclides and other airborne contaminants (eg. heavy metals). Retreat of glaciers results in release of these contaminants to downstream ecosystems where they can be accumulated by biota, with further consequences along the trophic chain.

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