SPATIAL DISTRIBUTION OF CONTAMINANTS PRESENT IN THE SURFACE ICE OF SPITSBERGEN GLACIERS (EUROPEAN ARCTIC)

Sara Lehmann-Konera[1], Grzegorz Gajek[2], Stanisław Chmiel[3], Żaneta Polkowska[1]

1. *Gdansk University of Technology, Faculty of Chemistry, Department of Analytical Chemistry, 11/12 Narutowicza St., Gdansk 80-233, Poland; e-mails: sara.lehmann8@gmail.com (S.L), zanpolko@pg.gda.pl (Ż.P)*
2. *Department of Geology and Lithosphere Protection, Faculty of Earth Sciences and Spatial Management, Maria Curie-Skłodowska University in Lublin, 2cd Kraśnicka St., Lublin 20-718, Poland; E-Mail: gajcy@poczta.umcs.lublin.pl (G.G.)*
3. *Department of Hydrology, Faculty of Earth Sciences and Spatial Management, Maria Curie-Skłodowska University in Lublin, 2cd Kraśnicka St., Lublin 20-718, Poland; E-Mail: stanislaw.chmiel@poczta.umcs.lublin.pl(S.C.)*

ABSTRACT

Anthropogenic contaminants transported through the atmosphere (e.g. persistent organic pollutants, heavy metals, SOx and NOx particles) can be deposited in various elements of the ecosystem as a result of wet and dry deposition. A number of scientists focus not only on the presence of pollutants in animate samples but also in inanimate samples. The issues discussed in the world literature show a considerable importance of glaciers in global circulation of water and anthropogenic pollutants present in water. The pollutants are produced on land as a result of accumulation and crystallisation of snow or other solid forms of precipitation remaining in constant movement. The processes are determined by external factors, but they also strongly affect the environment, making glaciers open dynamic systems. An important feature of glaciers is also circulation of the mass of ice, snow, water, and mineral matter (and therefore their components of natural origin and deposited pollutants).

The chemistry of the surface ice of the glaciers is strongly determined by long-distance transport of chemical substances, and their wet and dry deposition on the glacier surface. This paper concerns spatial distribution of metals, ions, and total organic carbon, as well as the differentiation of physicochemical parameters (pH, electrical conductivity) determined in ice surface samples collected from four Arctic glaciers during the summer season 2012. The studied glaciers represent three different morphological types: ground based (Blomlibreen and Scottbreen), tidewater which evolved to ground based (Renardbreen), and typical tidewater glacier (Recherchebreen). All of the glaciers are functioning as a glacial system, hence, are subject to the same physical processes (melting, freezing), and the process of ice flowing resulting from the cross-impact force of gravity and topographic conditions. According to this hypothesis the article discusses the correlation between morphometric parameters, changes in mass balance, geological characteristics of the glaciers and the spatial distribution of analytes in their surface ice. A strong correlation (r=0.63) is recorded between the aspect of glaciers and values of pH and ions, whereas TOC depends on the minimum elevation of glaciers (r=0.55), and most probably also on the development of the accumulation area. The obtained results suggest that although certain morphometric parameters largely determine the spatial distribution of analytes, also the geology of the bed of glaciers strongly affects the chemistry of the surface ice of glaciers in the phase of strong recession.

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