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Does climate change affect mercury inflow to periglacial regions? (King George Island, Antarctica)

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Mercury (Hg) is considered as a global pollutant. It is persistent in the environment and in organic compounds, mainly as methylmercury (MeHg), is accumulated in living organisms and it biomagnifies up the trophic chain. Periglacial areas in Antarctica have had the highest temperature rise in the southern hemisphere over the past fifty years (+3 °C). The loss of the ice cover and the exposure of larger and larger ground surfaces caused by the increasing temperature, enable the initiation of rock erosion and soil formation processes. The King George Island is formed by rocks of volcanic origin. Therefore, this material could be a source of many compounds in the Antarctic coastal zone. In turn, these new periglacial areas are places where more life (flora and fauna) appears. Both of these factors disturb the circulation of many elements in the polar region. The aim of the study was to determine the impact of periglacial regions formation on the inflow of Hg to the Antarctic ecosystem. The bioavailability of Hg contained in rocks and soil in the study area was also tested.

Sampling took place in December 2018 and January 2019 in the King George Island. The samples of soil, lichen, moss, vascular plant and algae were collected and stored at -20 °C until analysis. The concentration of total mercury (THg) was measured by pyrolysis with the technique of atomic absorption spectroscopy on a direct mercury analyser DMA-80. To measure the concentration of methylmercury samples were extracted, MeHg concentration was measured using Automated Methylmercury System MERX-M.

Research carried out on the King George Island has shown that mercury concentrations in soil and in rocks were slightly higher than those measured in continental Antarctica, but lower than in other parts of the world. However, concentrations of mercury in lichens were similar to those in urbanized regions worldwide. The research confirmed the correlation between the weathering processes of volcanic rocks in the studied area and the concentration of THg in the soil. Measured concentration of THg and MeHg in plants and lichens on King George Island indicated that bioavailable Hg was present in soil and rocks but weathering of rocks was only one of mercury sources. Methylmercury accounted for, on average, 15% of total mercury in lichens and plants samples but 0.1% in soil samples. The presence of animals - penguins and sea elephants had an impact on the increased concentration of THg and MeHg both in soil and in plant/lichen samples.

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