# Mercury in soil, plants and lichens in the Anterctic coastal zone

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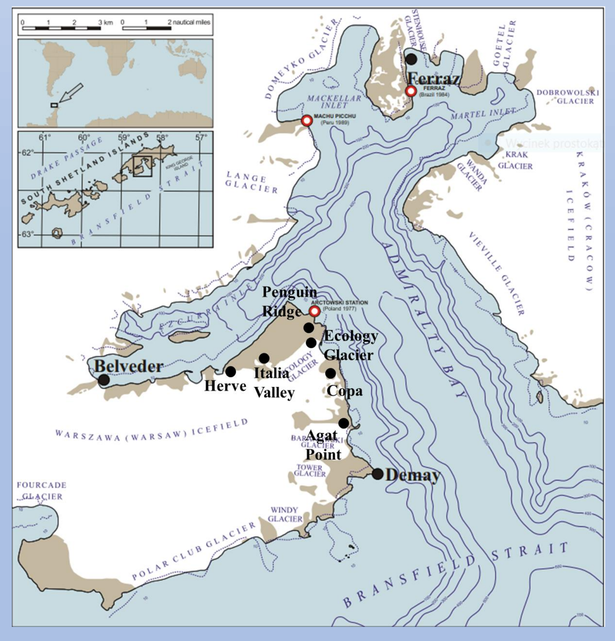
## INTRODUCTION

Mercury (Hg) is considered as a global pollutant because it is persistent in the environment, it is accumulated in living organisms and it biomagnifies up the trophic chain (Liu et al., 2011). Periglacial areas in the northern part of the Antarctic Peninsula have had the highest temperature rise in the southern hemisphere over the past fifty years (Turner et al., 2005). 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. King George Island is formed by rocks of volcanic origin (Kraus et al., 2013). Therefore, this material could be a source of many compounds in the Antarctic coastal zone. The **aim of the study** was to determine the impact of periglacial regions formation on the of Hg to the Antarctic ecosystem. The bioavailability of Hg contained in rocks and soil in the study area was also tested.

## CHARACTERISTIC OF RESEARCH AREA

The research was carried out on King George Island, on the west coast of Admiralty Bay. The area of King George Island is about 1,310 km$^2$, and it is the largest of the South Shetland Islands, 90% of its surface is covered by ice sheet (Rakusa-Suszczewski, 1995). The ice-free area has favorable conditions for permafrost weathering. The entire South Shetland Islands, including King George Island, are volcanic origin. It is the only area in Antarctica that is currently seismically active.




Soil sample during the analysys

## MATERIALS AND METHODS

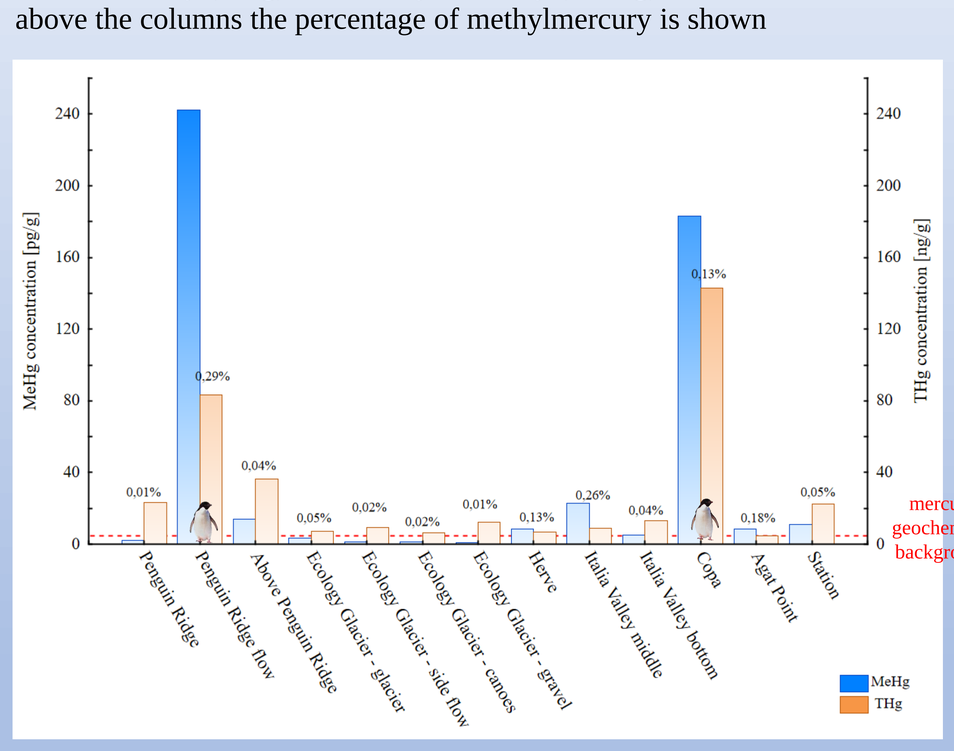
Sampling took place in December 2018 and January 2019. Soil were taken at 13 stations, vascular plants, mosses, lichens and algae samples were collected at 15 stations. Total mercury (THg) concentration was measured by pyrolysis technique with atomic absorption spectroscopy (AAS) on a DMA-80 mercury analyzer. Relative standard deviation does not exceed 10%, the limit of quantification was set at 1 pg Hg. To measure the concentration of methylmercury samples were extracted, MeHg concentration was measured using Automated Methtlmercury System MERX-M.

## CONCLUSION

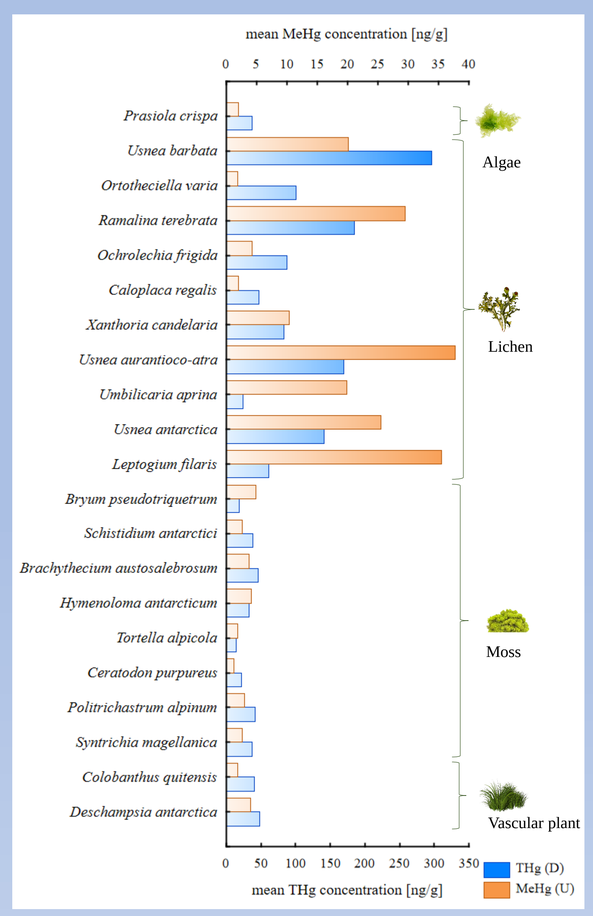
- The measured concentration of total mercury in plants on the King George Island showed that bioavailable mercury is present in soil and rocks.
- The percentage of methylmercury in soil did not exceed 0,3%, however , this value was as high as 80% in lichens, about 12% in mosses and about 8% in vascular plants.
- Based on the high concentrations of mercury in lichens, which had values similar to those measured in other regions of the world, it could be concluded that more important source of mercury in this region was the inflow from the atmosphere than rock weathering.
- The presence of animals had an impact on the increased concentration of total mercury both in soil and in plant samples. The concentration of mercury in the places where penguin colonies occur was significantly different from the concentration at other research stations, the mercury accumulated in these places could be transported with the water from melting snow or ice to the sea, thus contributing to an increase in the concentration of this element in the waters surrounding Antarctica.

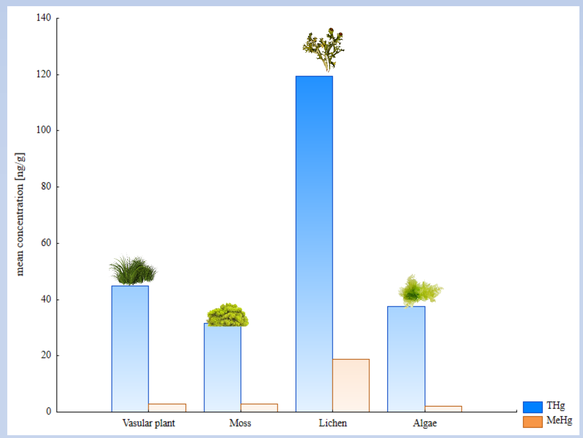
## RESULTS

**Total mercury (THg) and methylmercury (MeHg) concentration in soil**
above the columns the percentage of methylmercury is shown

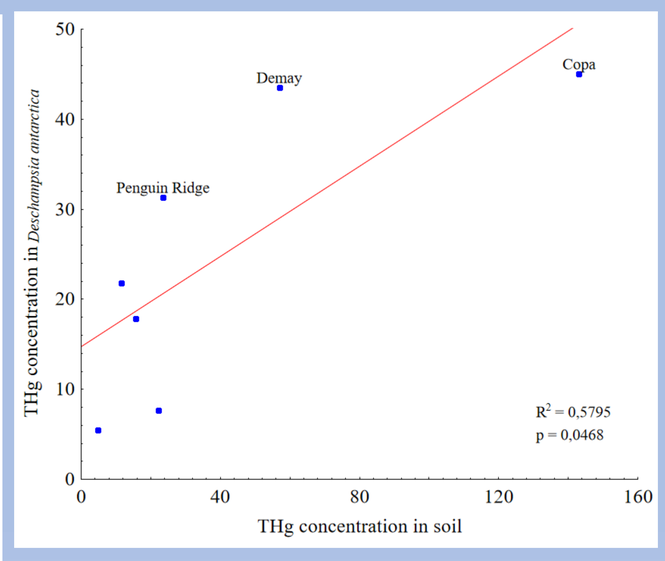



**Total mercury (THg) and methylmercury (MeHg) concentration in plants and lichens**




**Correlation between total mercury (THg) concentration in soil and *Deschampsia antarctica***




Copa station

Hill above Ecology Glacier station

REFERENCES

Kraus S., Kurbatov A., Yates M. (2013). Geochemical signatures of tephras from Quaternary Antarctic Peninsula volcanoes. *Andean Geology*. 40 (1), 1-40. doi: 10.5027andgeoV40n1-a01

Liu G., Cai Y., O'Driscoll N., Feng X., Jiang G. (2011). Environmental Chemistry and Toxicology of Mercury. Chapter 1. Overview of Mercury in the Environment. doi: 10.1002/9781118146644.ch1

Turner J., Colwell S., Marshall G., Lachlan-Cope T., Carleton A., Jones P., Lagun V., Reid P., Iagovkina S. (2005). *National Journal of Climatology*. 25. 279-294. doi: 10.1002/joc. 1130

Rakusa-Suszczewski S. (1995). The hydrography of Admiralty Bay and its inlets, coves and lagoons (King George Island, Antarctica). Polish Polar Research. 16. 61-70.

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