POLISH POLAR RESEARCH	12	1	129—131	1991

Preliminary observations on the content of heavy metals in thalli of *Usnea antarctica* Du Rietz (Lichenes) in the vicinity of the "H. Arctowski" Polish Antarctic Station

Introduction

Among many plants which are good indicators of environmental conditions lichens seem to be especially sensitive to antropogenic environmental changes. They exhibit great ability to accumulate many inorganic ions from the air which are absorbed by the whole surface of thallus. Lichens are the first ones which signal all pollutions of the natural environment.

In hitherto published literature on the contamination of the Antarctic natural environment relatively little attention was paid to the local pollution of the environment caused by the Antarctic station activity. However, there were registered the levels of pollution caused by sulfur dioxide and fluorine (Molski, Byttnerowicz and Dmuchowski 1981) and by trace elements (Meanhaut et al. 1979, Brzezińska and Samp 1981, Pęcherzewski 1987). The topic becomes more actual since many new Antarctic stations are being built, especially on King George Island.

In this preliminary paper, in order to determine the local environment pollution by heavy metals in the region of the "H. Arctowski" Polish Antarctic Station, a lichen *Usnea antarctica* was used.

Material and methods

To determine the content of heavy metals (Ti, Cr, Mg, Fe, Cu, Ni, Zn, Pb) in the thalli of lichens the material was collected in the area of the "H. Arctowski" Antarctic Station located at the shore of the Admiralty Bay (King George Island, South Shetland Islands) in January 1987. Samples of *Usnea antarctica* wer collected on the moraine slope located in the direct vicinity (several meters SE) of the incinerating plant, in the direction of winds blowing here most frequently from W and NW.

For purposes of comparison the thalli of *Usnea antarctica* were collected on Jersak Hills in the area quite distant from the station.

To determine the content of trace elements PIXE method was used, i.e. X-rays fluorescence analysis where activation was caused by proton beam 2.6 mV accelerated in cyclotron C-48 IFJ (Hrynkiewicz et al. 1980). The analyses were performed in the "H. Niewodniczański" Institute of Nuclear Physics, in the Laboratory of Applied Nuclear Spectroscopy.

Results and discussion

The results are shown in Table 1. The concentration of trace elements in lichen thalli collected near the incinerating plant at the "H. Arctowski" Station is evidently higher in comparison with materials coming from the sites quite distant from the station. The content of Pb in thalli of *Usnea antarctica* growing near the incinerating plant was up to 12 ppm, whereas in the thalli growing on Jersak Hills only about 2 ppm. Much higher concentrations of Zn and Cu were also observed in lichens occurring near the incinerating plant in comparison to those growing on Jersak Hills (Zn: 35 ppm and 7 ppm, Cu: 22 ppm and 2.9 ppm, respectively). Of course, it has to be emphasized that those studies are of preliminary character and should be repeated.

Table 1

Amount of trace elements in the samples of *Usnea antarctica* (ppm)

Locality	Element	Ti	Cr	Ma	Fe	Cu	Ni	Zn	Pb
Jersak Hills		54	5.6	7.8	170	2.9	2	7	2
"H. Arctowski" Station (near the incineration plant)		95	15	20	414	22	1	35	12

The studies carried out so far in the region of the Admiralty Bay on King George Island concerned mainly the amount of dust in the air and concentration of heavy metals in the samples of ice, rain water and snow (Brzezińska and Samp 1981, Pęcherzewski 1987). These data were compared with those obtained in other regions of the Earth. On the basis of literature available so far, it should be noted that pollution caused by heavy metals comes from the global atmospheric contamination and is lower than in other regions of the earth. For example: contents of Cu, Pb and Zn in snow and rain water in the region of the Admiralty Bay ($mg \cdot dm^{-3} \cdot 10^{-3}$) were 1.40, 0.84 and 2.60 respectively, whereas precipitations in the region of the North Sea contained 30.00, 35.00 and 160.00 respectively (after Pęcherzewski 1987).

References

Brzezińska A. and Samp R. 1981. Wstępne badania nad występowaniem metali śladowych w Zatoce Admiralicji. — Stud. Mat. Oceanolog., 34: 113—126.

Hrynkiewicz A. Z., Szymczyk S., Kajfosz J. and Olech M. 1980. PIXE and NRA environmental studies by means of lichen indicators. — Nuclear Instruments and Methods, 169: 517—521.

Meanhaut W., Zoller W., Duce R. A. and Hoffman G. L. 1979. Concentration and size distribution of particulate trace elements in the South polar atmosphere. — J. Geophys. Res., 84: 2421—2431.

Molski B., Byttnerowicz A. and Dmuchowski W. 1981. Air pollution with sulphur dioxide and fluorine compounds in the vicinity of the "Arctowski" Station, King George Island, South Shetland Islands. — Pol. Polar Res., 2: 87—93.

Pęcherzewski K. 1987. Air pollution and natural sedimentation from the atmosphere in the region of the Admiralty Bay (South Shetland Islands). — Pol. Polar Res., 8: 145—151.

Received May 7, 1990
Revised and accepted October 15, 1990

Maria OLECH
Institute of Botany,
Jagiellonian University,
ul. Lubicz 46
31-512 Kraków, POLAND