OMBROTHROPHIC PEATLANDS AS A TOOL FOR EVALUATION OF CUMULATIVE ANTHROPOGENIC TRACE ELEMENT DEPOSITION FROM LONG-RANGE TRANSPORT

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Introduction

Peat cores from ombrotrophic peat bogs that receive pollutant loads only from dry and wet deposition, may serve for assessment of retrospective air pollution since industrial revolution in 1700s, and specifically of contribution from long–range transport of pollutants (LRTP) in the areas, e.g. in southern Norway, where transboundary long-range transport is the predominant source of spatial contamination. In some areas in Europe, impact of transboundary and national sources is particularly strong, e.g. in the so-called "black triangle" in Lower Silesia area in SW Poland, mostly affected by the emission from large power plants and heavy industries in Poland, Germany, and Czech Republic. In this study, atmospheric deposition of priority pollutants (Pb, Cd and Hg) in two peat bogs from these areas is discussed in relation to emission trends

Methods

Undisturbed peat cores from ombrotrophic peat bogs at Gyland (N58.43102^0, E6.81412^0, 211 m ASL) in southern Norway, far away from industrial activities, and Izera Meadow (N50.85114^0, E15.35466^0, 828 m ASL) in SW Poland, in the "black triangle" area, were collected in 2014. In the laboratory the cores were sliced in layers 2.5-3 cm thick. All samples were air-dried, digested in 14 M HNO_3, and analysed at NTNU for 61 elements using ICP-MS. Core chronology was assessed by ^{14}C dating.

Results

In the Gyland peat bog the 0-14 cm layer, and in the Izera, the 0-33 cm layer corresponds to the industrial period (since 1730), while the contemporary periods since 1945 are represented by the layers 0-4 cm and 0-12 cm, and since 1990 by the layers 0-2 cm and 0-5 cm, respectively. General patterns of Pb, Cd and Hg vertical distribution in both bogs (Fig. 1) were similar and in the uppermost layers reflected reduction of emissions since 1990, which in the EEA-33 countries was 92% for Pb, 75% for Cd, and 73% for Hg (EEA, 2015). In Izera area, 2-fold greater total deposition of Pb, but comparable cumulative loads and enrichment factors for Cd and Hg as at Gyland were assessed (Table 1). Vertical distribution of elements, however, indicates clear downward shift with respect to dating in both cores, apparently influenced by the fluxes of water and particles, and element dissolution.

Table 1. Cumulative loads of Pb, Cd and Hg deposition from natural (CL_N) and anthropogenic sources (CL_A) in S. Norway (Gyland) and SW Poland (“black triangle“ area, Izera) (kg/m^2) and enrichment factors (EF).

Gyland						Izera					
Pb		Cd		Hg		Pb		Cd		Hg	
CL_N	CL_A	CL_N	CL_A	CL_N	CL_A	CL_N	CL_A	CL_N	CL_A	CL_N	CL_A
142.4	3704	4.092	48.712	2.865	6.420	110.7	7514	6.432	54.56	2.123	7.031
EF 27.0		EF 12.90		EF 3.24		EF 68.9		EF 9.48		EF 4.31	

Gyland

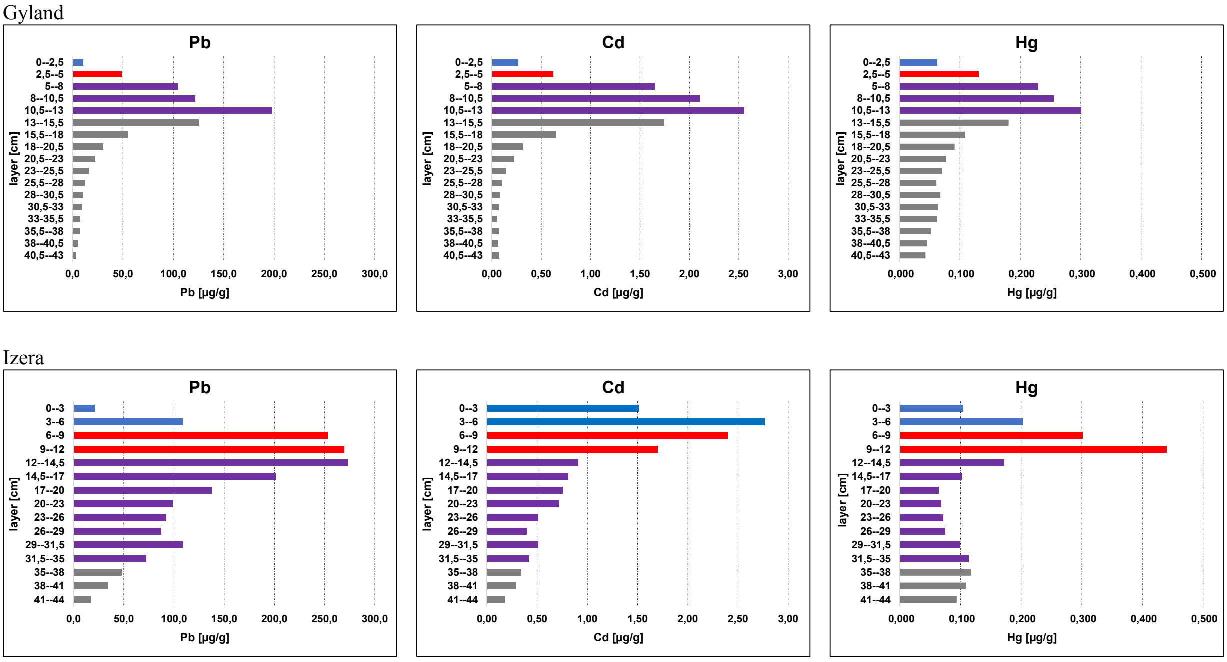

Figure 1. Vertical distribution and transport of Pb, Cd and Hg along peat bog profiles. Layer dating: ■ – 2014-1990; ■ – 1990-1945; ■ – 1945-1730; ■ – older than 1730.

Conclusion

Peat cores provide reliable and exact information on the total anthropogenic deposition. Due to the vertical redistribution on a large time scale, however, lack of conformity of the element concentrations with the actual deposition time may occur and should be considered at historical retrospections.

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