

Recent organic matter accumulation in ombrotrophic peat bogs exposed to heavy metal load

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Although metal contents of age-dated peat cores from ombrotrophic peat bogs have successfully been used to establish records of atmospheric heavy metal pollution in the past, the impact of metal pollution itself on the organic matter (OM) accumulation in peatlands has barely been studied. We studied accumulation of OM in four ombrotrophic peat bogs in Finland (Fig. 1): Harjavalta (vicinity of a Cu-Ni smelter), Outokumpu (near a closed Cu-Ni mine), Alkkia (Ni treated site) and Hietajärvi (a background). At each sampling site two peat cores (15x15x100cm) were taken. Age-dating of peat was determined using ²¹⁰Pb method (CRS model). Our aim was to compare recent (last 125 years) OM accumulation rates of heavy metal polluted ombrotrophic peat bogs with those of a pristine bog.

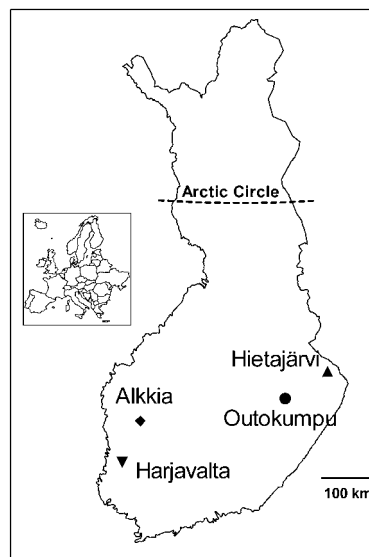
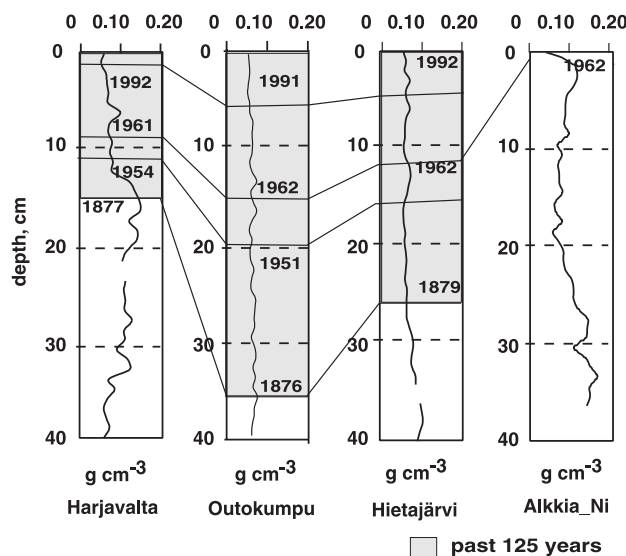


Fig 1. Location of study sites in Finland.

Based on ²¹⁰Pb age-dating, the upper 16cm peat layer at Harjavalta, 35cm at Outokumpu and 25cm at Hietajärvi represents 125 years of peat formation, yielding the following average OM accumulation rates at Harjavalta 1.3 mm a⁻¹, 2.8 mm a⁻¹ at Outokumpu and 2.0 mm a⁻¹ at Hietajärvi (Fig 2). At the Alkkia site, the Ni treatment in 1962 had completely stopped the peat accumulation. The lower OM accumulation rate at Harjavalta compared to the other study sites gives some support to the

hypothesis of retarded NPP due to the moss growth interference by metal toxicity (Table 1). Hence smelter derived pollutants might have caused reduced peat growth. In contrast at the Outokumpu site, even though it is in the vicinity of an old Cu-Ni



mine, such a effect could not be observed. On the contrary OM accumulation rates were greatest at the Outokumpu site, even exceeding those at the background site Hietajärvi.

Fig 2. Bulk density of peat from surface layer to the depth of 40 cm at Harjavalta, Outokumpu, Hietajärvi and Alkkia sites. Connecting line between cores indicates peat of same age.

Table 1. As, Cu, Ni, Pb and Zn average concentrations (mg kg^{-1}) in the 125-year-old peat layer (min and max in parenthesis).

	As		Cu		Ni		Pb		Zn	
Harjavalta	5.9	(3.4-8.5)	280	(18-1268)	152	(31-278)	40	(21.4-59.8)	136	(76.8-187.5)
Outokumpu	2.6	(0-4.4)	21	(5.5-68.8)	6	(0-20.8)	13	(3.2-24.3)	62	(38.8-89.3)
Hietajärvi	4.1	(0-6.3)	3	(0-5.6)	2	(0-6.1)	17	(2.3-27.0)	60	(27-110.8)
Alkkia	4.0	(1.9-128.4)	17	(13.5-21.9)	717	(268-1043)	56	(31.5-70.9)	104	(67.9-128.4)

Conclusions:

- At the Ni treated site at Alkkia the Ni treatment in 1962 had completely stopped the peat accumulation.
- Harjavalta site, net OM accumulation rate was considerably less than at the Outokumpu and Hietajärvi sites --> the emissions released from the nearby Cu-Ni smelter might have reduced the net OM and peat accumulation rates.
- No remarkable difference in peat accumulation rates between Outokumpu and the background site Hietajärvi.