

Chlorinated hydrocarbons in soil profiles of two forest sites in the Linz area (Upper Austria)

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Introduction

It is well known that the special filter effect of tree canopies causes some pollutants to accumulate more in forest soils than in agriculturally used areas.

Very little information is available (f.e. 1,2,3,4,5) on the contents of chlorinated hydrocarbons in forest soils and especially on their distribution in the various soil layers. Since forest soils are usually untreated, thus exhibiting an undisturbed profile, they are particularly suitable for investigations of the behaviour of persistent chlorinated hydrocarbons in soil.

Methods

Pooled soil samples were taken from two mixed forest sites in the Linz area, separated into raw humus, and 0–5, 5–10, 10–20, and 20–30 cm soil layers and investigated for their contents of PCDD/F, PCB (6 PCBs according to VDLUFA⁶), HCH (4 isomers), penta- and hexachlorobenzene. The forest site close to the industrial area (Steyregg/Im Weih, site 19) is situated on an emission-receiving slope facing the industrial area (chemical industry and steel works) of Linz; the investigated reference site (Altenberg, site 39) had a comparable stand and soil type and is situated in a background-area, 10 km north of Linz.

Detailed information on the chemical-analytical methods applied is given in ⁷.

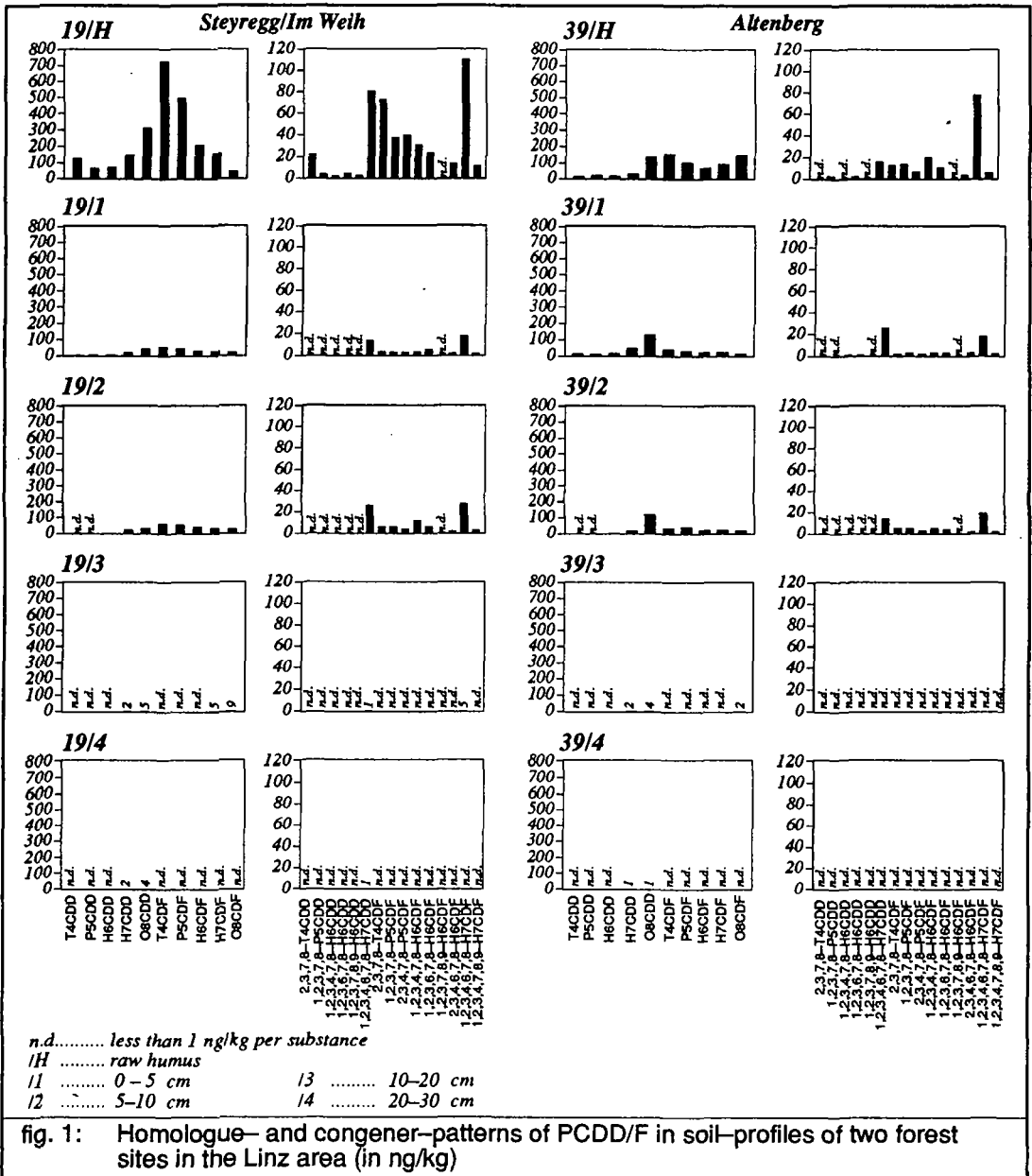
Results

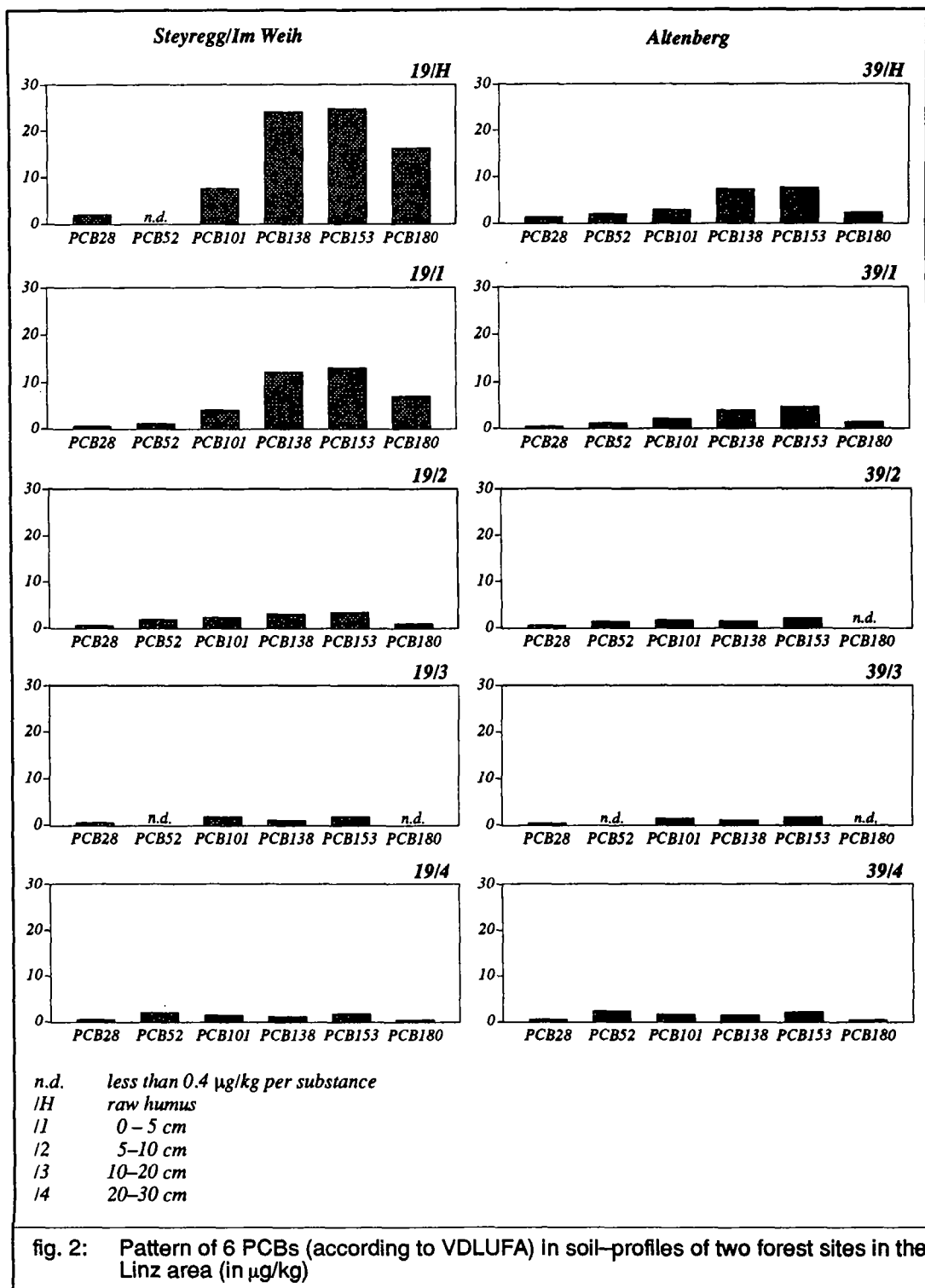
As expected, the raw humus layer showed higher concentrations of all the investigated pollutants than the underlying mineral soil layers. The investigated forest site close to the industrial area was generally more polluted than the reference site (see fig. 1–4) and an investigated grassland site in its immediate vicinity⁷.

As for PCDD/F loads, the raw humus of the site close to the industrial area, contained 63.5 ng TE/kg (I-TEF) as compared to 12.0 ng TE/kg (I-TEF) of the reference site. Both sites showed easily detectable concentrations down to the 5–10 cm layer, whereas below this layer only minimal concentrations of higher chlorinated homologues could be detected (fig. 1). The homologue profiles of the two sites are strikingly different. Compared to the reference site, the site close to the industrial area showed much higher amounts of T4CDD, T4CDF and P5CDF.

Measuring 74.6 µg/kg, the PCB-content (sum of 6 congeners according to VDLUFA) of the raw humus from the forest site close to the industrial area was three times higher than that of the reference site. Easily detectable concentrations could be determined down to the 20–30 cm layer. A decrease in concentrations from the raw humus to the 20–30 cm layer, was established for higher chlorinated PCBs, did not occur in PCBs 28 and 52 with a lower degree of chlorination. Through the whole profile these two congeners showed similar concentrations, which might indicate that it is especially PCBs with a low degree of chlorination which are translocated in soils (fig. 2).

The raw humus layers of these two sites showed similar concentrations of hexachlorobenzene. Pentachlorobenzene could only be detected at the site close to the industrial area. With increasing soil depth, a decrease in the concentrations could be established. At both sites the investigated chlorobenzenes could no longer be detected in the 20–30 cm layer (fig. 3). HCH could only be found in the upper soil layers of site 19 but not below the 0–5 cm layer. Among the investigated isomers gamma-HCH (lindane) showed the highest concentrations (fig. 4).





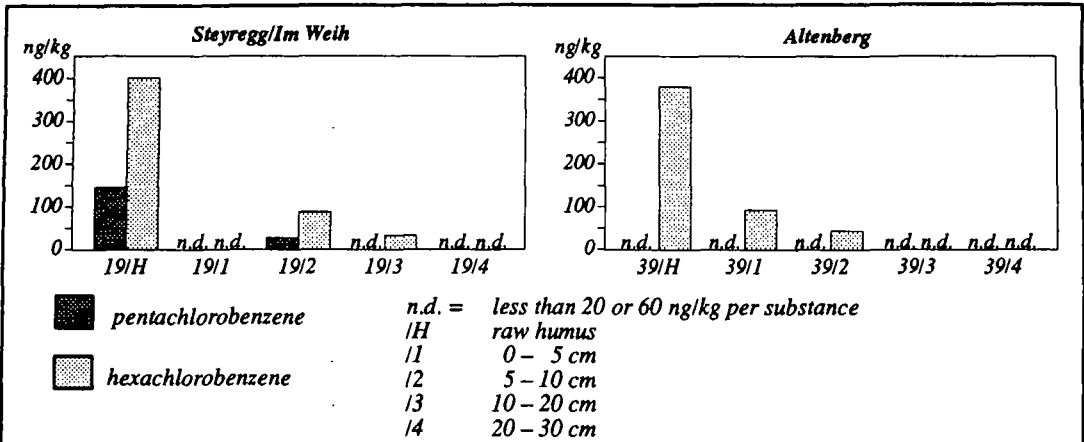


fig.3: Chlorobenzenes in soil-profiles of two forest sites in the Linz area (In ng/kg)

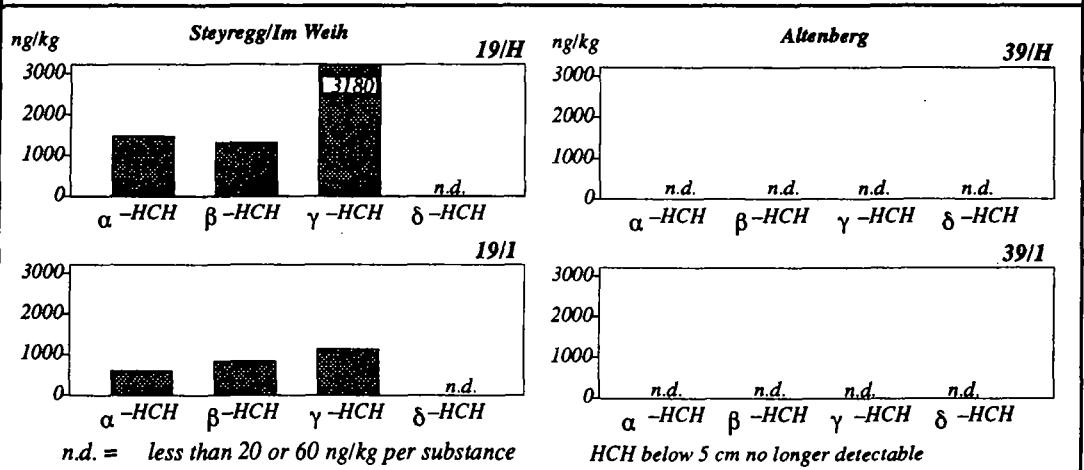


fig. 4: Pattern of HCH-isomers in soil-profiles of two forest sites in the Linz area (In ng/kg)

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