

Anthropogenic and lithologic Pb behaviours in acid atmospheric polluted catchment (the Strengbach case study, Vosges, France)

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Two main reasons lead us to study the behaviour of lead in an equipped natural catchment - the Strengbach bassin in the Vosges massif, France.

(1) Like other radiogenic isotopes, Pb is an interesting tracer to provide insights on the functioning the natural system.

(2) Lead is also one of the most significant and dangerous polluting agent. Therefore the knowledge of its behaviour in environmental systems is primordial. In such natural systems Pb has two origins: a natural one and an anthropogenic one. In an interesting way Pb isotopic composition allows to distinguish these two origins.

Geochemical characteristics of open field rain water, throughfall, soil solution, spring and stream-waters in the small granitic Strengbach catchment (Vosges, France) have been regularly determined for ten years (Probst *et al.*, 1995; Dambrine *et al.*, 1995)

and specifically during hydrological event (Ladouche *et al.*, 1995). Major elements, dissolved organic carbon (DOC), trace element contents were particularly analysed. The different water fluxes distinguish one another by specific geochemical features. Following these previous studies, a specific analysis of the Pb absolute content and isotopic signature was undertaken in these different water fluxes in order to identify the behaviour of this element in such an acid atmospheric polluted catchment and to distinguish the anthropogenic Pb from the substratum Pb.

The following main points were reached:

Isotopic compositions of the atmospheric anthropogenic Pb (from the rain) and of the substratum (granite) distinguish clearly one another. The water fluxes display Pb isotopic compositions in between these two extremum values ($17.8 < {}^{206}\text{Pb}/{}^{204}\text{Pb} < 18.9$) (Fig. 1).

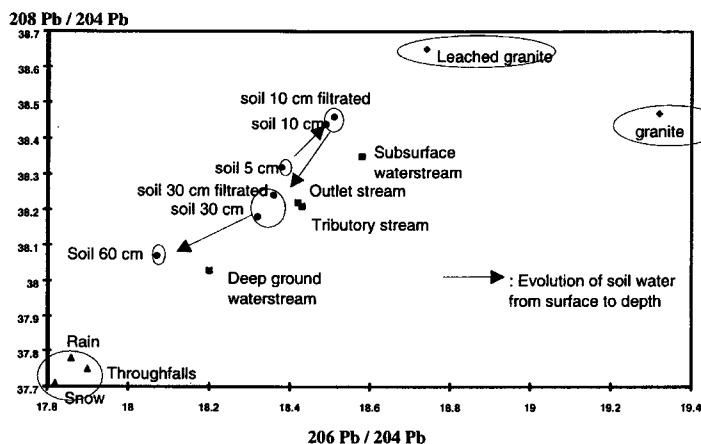


FIG. 1. (${}^{208}\text{Pb}/{}^{204}\text{Pb}$) vs (${}^{206}\text{Pb}/{}^{204}\text{Pb}$).

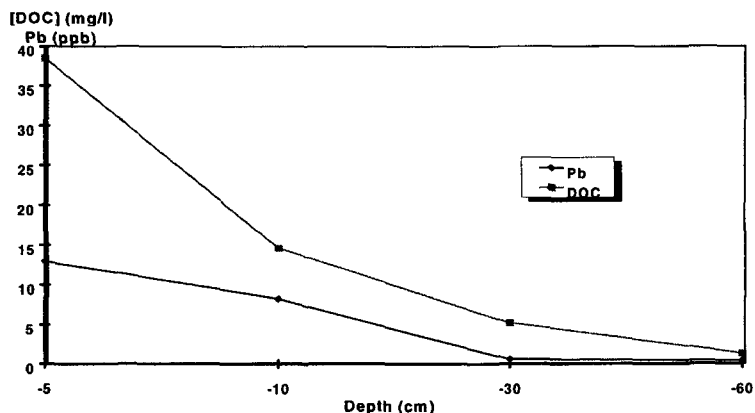


FIG. 2. Lead and DOC concentration in soil solutions (depth 5, 10, 30, 60 cm).

(2) Pb isotopic compositions evolve from surface to depth. However in a surprising way, waters draining the subsurface compartments display compositions close to those of the substratum. Waters from the deeper soil profile or saprolites (Springs) are close to Pb atmospheric signature (i.e. anthropogenic origin)(Fig. 1).

(3) In water fluxes, Pb content decreases significantly with depth and Pb content is correlated with DOC (Fig. 2)

A preferential complexation of Pb by organic compounds explains the specific behaviour of this element within the basin. Fluxes analysis show that Pb is selectively removed from the basin with subsurface

water fluxes.

Various hypotheses can explain the surprising Pb isotopic evolution with depth: water pathway, low complexation kinetics, distinct complexation forms of Pb in rain and soil solution.

References

- Dambrine *et al.*, (1995) In: *Forest decline and atmospheric deposition effects in the french mountains*, Landmann, G.& Bonneau, M. (eds), 233–58.
 Ladouche *et al.*, *DBT II*, (1995) 51.
 Probst *et al.*, *WASP*, (1995)79, 39–59.