

Life cycle of a catchment from weathering to human impact traced by lead isotopes

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We present a series of lead isotopes in volcanic rocks, soils and sediments on a small watershed flowing through the Massif Central (France).

The present study investigates the lead isotopes in rock, soil and sediment for constraining the life cycle of a catchment, covering erosion processes and products, and anthropogenic activities. For this, we investigated the Allanche river drainage basin in the Massif Central, the largest volcanic areas in France that offers opportunities for selected geochemical studies since it drains a single type of virtually unpolluted volcanic rock, with agricultural activity increasing downstream.

Weathering processes were investigated at catchment scale through the continuum bedrock-soil-sediment sampled along the river and the metal contamination in soil and sediment was further investigated with chemical and lead isotope profiles throughout the catchment. Lead enrichment in soil and sediment is accompanied by lead-isotopic signatures lower than those of the bedrock, implying another lead source. This external lead supplied to the basin was constrained by both lead content and lead-isotopic composition. Two distinct lead sources were highlighted, both transported as aerosols into the basin: (1) Mining and mineral processing of ores in the Massif Central, and (2) Deposition of lead-rich particles resulting from gasoline combustion, the latter influence being still visible through tetraethyl lead additives.

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