Environmental availability of heavy metals in ashes from Popocatépetl volcano during its current eruption.

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Popocatépetl, in central México is an active volcano posing a risk to a large population. Since 1994 it started an eruption episode that has included numerous ash emissions. Metals in volcanic gas exist manily as sulphates, halides and oxides, but chlorides and fluorides are considered the main transporters of metals. During the tephra ejection, part of the erupted gases and volatiles are adsorbed on the ash particles. Elements scavenged by ashes may be mobilized and affect the environment. Still, the actual environmental hazard of toxic elements depends not only on their concentrations and toxicity, but also on their chemical form and prevailing physico-chemical conditions. Various procedures have been developed to assess the environmental availability of metals and metalloids from solid samples such as sediments and soils. Sequential extractions are widely used for exploration purposes and to assess the environmental mobility of metals and metalloids from solid samples. In this work, the potential environmental effects of lead, cadmium, copper, manganese and zinc carried by ashes emitted by Popocatépetl volcano is estimated based on soluble total concentrations and a sequential fractionation scheme. Samples from various Popocatépetl volcano eruptions occurred between 1996 and 2005 were collected at different distances from the vent, in the range from about half a kilometer to 39 km. Concentrations of Pb, Zn, Cu, Cd, Cu, Mn were analyzed by atomic absorption spectrometry and inductively coupled plasma ¬mass spectrometry. Chemical fractionation was done in six samples (selected according to the available ash amount), following the sequential extraction procedure developed by Tessier et al. (1979) and using the reactants proposed by Kersten and Förstner (1986) to extract the most mobile exchangeable fraction. Metal contents have reached high values only in some eruptions at Popocatépetl. No trends with distance were found for lead, zinc, manganese, cadmium, and copper. Manganese was the most abundant metal (up to 4.4 mg/kg), followed by zinc (up to 2.3 mg/kg), copper (up to 1.7 mg/kg), lead (0.25 mg/kg), and cadmium (0.2 mg/kg). Although clear differences exist among samples, geochemical fractionation showed a general behavior for each element. Lead was mostly present in fraction 2 (bonded to carbonates), zinc in fraction one (exchangeable) and manganese in fractions 3 (bonded to Fe and Mn oxy-hydroxides) and 4 (bonded to organic matter or sulfides). This fractionation indicates a higher mobility for zinc followed by lead and manganese.

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