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Potentially harmful elements released by volcanic ashes: examples from the Mediterranean area

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Abstract

We have performed leaching experiments on the fine (< 2 mm) particulate sampled in seven active and quiescent volcanic systems in the Mediterranean area. We reacted the particulate both in pure water and in a synthetic gastric solution. The amount of As, Mn, Pb, Ba, U and Ni leached by pure water exceeded the MAC limits for drinking water in all the materials under investigation. We defined a tolerable ash intake index (TAI) to evaluate the impact of ash ingestion, and we find that 0.2 g and 12 g of ingested fine ash from Vesuvius and Vulcano are enough to exceed the safety limits for Pb and As. Six grams of fine ashes from Stromboli are sufficient to overstep the safety limits for As. Based on our mineralogical characterisation of the particulate, we expect that the submillimetric ash fraction, with a higher surface/volume ratio, releases a greater relative amount of trace metals, which are concentrated in the thin surface layer produced by the reaction of the pristine volcanic particles with coexisting volcanic gases. This means that our measurements represent lower bounds to the actual amount of metal released in aqueous solutions by the volcanic ashes from the locations under investigation.

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