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Tellurium in active volcanic environments: Preliminary results

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Tellurium is a toxic metalloid and, according to the Goldschmidt classification, a chalcophile element. In the last years its commercial importance has considerably increased because of its wide use in solar cells, thermoelectric and electronic devices of the last generation. Despite such large use, scientific knowledge about volcanogenic tellurium is very poor. Few previous authors report result of tellurium concentrations in volcanic plume, among with other trace metals. They recognize this element as volatile, concluding that volcanic gases and sulfur deposits are usually enriched with tellurium.

Here, we present some results on tellurium concentrations in volcanic emissions (plume, fumaroles, ash leachates) and in environmental matrices (soils and plants) affected by volcanic emissions and/or deposition. Samples were collected at Etna and Vulcano (Italy), Turrialba (Costa Rica), Miyakejima, Aso, Asama (Japan), Mutnovsky (Kamchatka) at the crater rims by using common filtration techniques for aerosols (polytetrafluoroethylene filters). Filters were both eluted with Millipore water and acid microwave digested, and analyzed by inductively coupled plasma mass spectrometry (ICP-MS). Volcanic ashes emitted during explosive events on Etna and Copahue (Argentina) were analyzed for tellurium bulk composition and after leaching experiments to evaluate the soluble fraction of tellurium. Soils and leaves of vegetation were also sampled close to active volcanic vents (Etna, Vulcano, Nisyros, Nyiragongo, Turrialba, Gorely and Masaya) and investigated for tellurium contents.

Preliminary results showed very high enrichments of tellurium in volcanic emissions comparing with other volatile elements like mercury, arsenic, thallium and bismuth. This suggests a primary transport in the volatile phase, probably in gaseous form (as also suggested by recent studies) and/or as soluble salts (halides and/or sulfates) adsorbed on the surface of particulate particles and ashes. First estimates of volcanic flux of tellurium from Etna range from 1 to 5 tons per year, confirming that this volcano is one of the biggest point sources of trace elements to the atmosphere. Analysis of tellurium in soils and plants close to active vents allowed to highlight the impact of this toxic elements, particularly evident close to the craters. Especially, the leaves of plants used as bioaccumulators of trace metals, showed also high enrichment of tellurium in comparison with other toxic elements.