

## **Deposition of trace elements in high temperature volcanic gases from Satsuma-Iwojima volcano.**

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The Satsuma-Iwojima fumaroles have been emitting continuously high temperature (600 to 1000°C) gas discharges for at least 800 years contributing to the atmospheric injection of the metals carried by the gases. The temperatures above which the metals are released as gaseous compounds and below which they condense as solid phases during the cooling of the high temperature gases are estimated. The minerals, which are deposited on the fumaroles conduits on the ground and that may condense as aerosols in the fumarolic plume, are identified. We also consider that after their emission the gases mix with air and thus the volatility of the elements could be modified. For this purpose we studied by SEM and X-ray microdiffraction (GADDS) the mineralogy of the sublimates deposited on silica tubes and we performed thermochemical modeling of the cooling of the high temperature gases and their mixing with air using the program GASWORKS. The minerals deposited inside the tubes, free of atmospheric O<sub>2</sub> contamination, are typically observed at other volcanoes: magnetite, pyrite, halite, sylvite, molybdenite (MoS<sub>2</sub>), ferberite (FeWO<sub>4</sub>). On the outer walls, where the gases mix with air, apthitalite (K,Na)<sub>3</sub>Na(SO<sub>4</sub>)<sub>2</sub>, thenardite Na<sub>2</sub>SO<sub>4</sub>, hematite, palmierite K<sub>2</sub>Pb(SO<sub>4</sub>)<sub>2</sub> and cassiterite (SnO<sub>2</sub>) are observed. Major differences compared with other sites are the occurrence inside the tubes of: (1) wulfenite (PbMoO<sub>4</sub>) which has never been reported in fumarolic deposits and precipitates between 550 and 400°C from a gas with lower sulfur content or/and higher *f*O<sub>2</sub> than the parent gas which composition was estimated by Shinohara et al., 1993; (2) several K, Pb, Fe, Zn, Rb and Cs mixed chlorides which abundance may be explained by the low S/Cl of the Satsuma high temperature gases. Natural sublimates (molybdenite, wulfenite, anglesite, Tl-Pb and Tl-Bi sulfides, and Mo, Pb oxides) are deposited at the ground before atmospheric emission of the metals, under conditions of high to low temperatures and variable *f*O<sub>2</sub> corresponding to different degrees of gas-air mixing. The increase of *f*O<sub>2</sub> due to the mixing of the gases with air, significantly reduces the volatility of several elements (As, Sn, Na, K and Pb) by promoting their condensation at much higher temperatures.