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Inorganic trace element content of aerosols at puy de Dôme, France

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The puy de Dôme research station is located at 1465 m above sea level in central France (45° 46' N, 2° 57' E, 1465 m a.s.l.). The station is surrounded by a protected area where agriculture and forests are predominant. The city of Clermont-Ferrand (150 000 inhabitants) is located 16 km east of the station. At the pdD site, the dominant westerly winds bring background or aged air masses. Despite its relatively low elevation, long-term records of gases and meteorological parameters indicate that in winter the site is mainly located in the free troposphere.
Aerosol physical and chemical properties (particle size, black carbon mass), and gas-phase mixing ratios (SO_2, CO, CO_2, O_3, NO, and NO_2) are measured continuously throughout the year. Since October 2011, inorganic trace element content of aerosols is also monitored weekly. Precisely measured air volumes (typically from 15 to 20 m3) are filtered during two consecutive days and two consecutive nights on high purity teflon filters (47 mm diameter and 1.0 micrometer porosity). The Teflon filters are leached in savillex beakers using HNO_3(0.4M) – HF (0.05M) and trace elements concentrations are analyzed by ICPMS (Agilent 7500, Laboratoire Magmas et Volcans).
Preliminary data were analyzed in logarithmic plots sorting elements according to their decreasing abundance in the upper continental crust. A first group of elements (Al, Na, Fe, Mg, Ti, Mn, Ba, Sr, Zr, V, Cr, Rb, Li, Y, Ga, Co, Sc, Nb, Th, Hf, Cs, U, Be, Ta and Rare Earth Elements) shows a progressive decreasing trend, which suggests a crustal origin. A second group of elements (Zn, Ni, Cu, B, Pb, As, Sn, W, Ge, Mo, Tl, Sb, Bi, Se, Cd, In and Ag) shows strong positive anomalies that superimpose on the smooth trend. With the exception of Ni, all elements from this second group are volatile to some degree. The excess element concentration (i.e. unsupported by crustal input) decreases in the following order: Zn (7.75 ng/m3), B (1.2 ng/m3), Ni (0.44 ng/m3), Pb (0.34 ng/m3), Sn and Ag (0.18 ng/m3), W (0.13 ng/m3), Sb, As, Mo, Bi, Se, Cd, Ge (<0.1 ng/m3). Over the limited time-period yet investigated, the large variations of concentration ratios, such as Al/Ti (5 to 338) and Zn/Pb (0.5 to 196), point to important and rapid changes in element sources. These changes are currently examined in the light of air mass back-trajectories.