

## Metal Contents in Bird Feathers (*Columba livia*) from Mt Etna Volcano: Volcanic Plume Contribution and Biological Fractionation

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**Abstract :** Although trace metals are an essential element for living beings, they can become toxic at high concentrations. Their potential toxicity is related not only to the total content in the environment but mostly upon their bioavailability. Volcanoes are important natural metal emitters and they can deeply affect the quality of air, water and soils, as well as the human health. Trace metals tend to accumulate in the tissues of living organisms, depending on the metal contents in food, air and water and on the exposure time. Birds are considered as bioindicators of interest, because their feathers directly reflects the metals uptake from the blood. Birds are exposed to the atmospheric pollution through the contact with rainfall, dust, and aerosol, and they accumulate metals over the whole life cycle. We report on the first data combining the rainfall metal content in three different areas of Mt Etna, variably fumigated by the volcanic plume, and the metal contents in the feathers of pigeons, collected in the same areas. Rainfall samples were collected from three rain gauges placed at different elevation on the Eastern flank of the volcano, the most exposed to airborne plume, filtered, treated with HNO<sub>3</sub> Suprapur-grade and analyzed for Fe, Cr, Co, Ni, Se, Zn, Cu, Sr, Ba, Cd and As by ICP-MS technique, and major ions by ion chromatography. Feathers were collected from single individuals, in the same areas where the rain gauges were installed. Additionally, some samples were collected in an urban area, poorly interested by the volcanic plume. The samples were rinsed in MilliQ water and acetone, dried at 50°C until constant weight and digested in a mixture of 2:1 HNO<sub>3</sub> (65%) - H<sub>2</sub>O<sub>2</sub> (30%) Suprapur-grade for 25-50 mg of sample, in a bath at near-to-boiling temperature. The solutions were diluted up to 20 ml prior to be analyzed by ICP-MS. The rainfall samples most contaminated by the plume were collected at close distance from the summit craters (less than 6 km), and show lower pH values and higher concentrations for all analyzed metals relative to those from the sites at lower elevation. Analyzed samples are enriched in both metals directly emitted by the volcanic plume and transported by acidic gases (SO<sub>2</sub>, HCl, HF), and metals leached from the airborne volcanic ash. Feathers show different patterns in the different sites related to the exposure to natural or anthropogenic pollutants. They show abundance ratios similar to rainfall for lithophile elements (Ba, Sr), whereas are enriched in Zn and Se, known for their antioxidant properties, probably as adaptive response to oxidative stress induced by toxic metal exposure. The pigeons revealed a clear heterogeneity of metal uptake in the different parts of the volcano, as an effect of volcanic plume impact. Additionally, some physiological processes can modify the fate of some metals after uptake and this offer some insights for translational studies.

**Keywords :** bioindicators, environmental pollution, feathers, trace metals, volcanic plume

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