Geophysical Research Abstracts
Vol. 15, EGU2013-7366, 2013
EGU General Assembly 2013

Combination of Methods for the Fractionation, Investigation, and Analysis of Micro/Nano Particles in Volcanic Ash

Shkinev Valeriy (1), Ermolin Michail (), Fedotov Peter (), Rudnev Aleksander (), Bulychev Nikolay (), Linnik Vitaliy (), and Moreno Gerardo ()

(1) Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Science , Moscow, Russian Federation (vshkinev@mail.ru), (2) Advanced Innovation Center , Viña del Mar, Chile

Micro and nanoparticles play a very important role in environment, in biology and medicine, in various technologies. The investigation of particles is often based on the fractionation according to particle size, density and charge followed by the analysis of the separated fractions. Such studies are needed in the analysis of environmental samples (natural and waste waters, soils, sediments, ashes) to assess the soil formation processes as well as distribution, transport, and biological uptake of pollutants. Recently, the review dealing with the fractionation and investigation of particles in liquid media has been published [Anal. Bioanal. Chem., 2011, v. 400, no 6, p. 1787-1804]. The present report gives a brief overview of the state-of-the-art and describes some new methods, approaches, and devices developed in the Laboratory for Concentration Methods of Vernadsky Institute for the studies of volcanic ash samples.

The ash is attributed to the volcanic activity of Cordón Caulle. Puyehue and Cordón Caulle (40°35′25″S - 72°07′02″W) are two coalesced volcanic vents that form a major mountain massif in Puyehue National Park in the Andes of Ranco Province, Chile. In volcanology, this group is known under the name of Puyehue-Cordón Caulle Volcanic Complex. Four different volcanoes constitute the volcanic group or complex, the Cordillera Nevada caldera, the Pliocene Mencheca volcano, Cordón Caulle fissure vents, and the Puyehue stratovolcano. Most stratovolcanoes on the Southern Volcanic Zone of the Andes, Puyehue and Cordón Caulle are located along the intersection of traverse fault with the larger north-south Liquiñe-Ofqui Fault. A new eruption started on 04 June 2011. By 15 June a dense column of ash (9 km height) was still erupting into the air, with the ash cloud spreading across the Southern Hemisphere. Actually the volcano activity continues. The samples were collected before and after the acidic rain which occurred due to the release of sulfur gases resulted in the formation of sulfuric acid under atmospheric conditions.

A combination of methods were used for the fractionation (dry sieving, membrane filtration, sedimentation field-flow fractionation in a rotating coiled column), investigation (capillary electrophoresis, scanning electron microscopy), and analysis (ICP MS, ICP-AES) of volcanic ash samples. The combination of fractionation techniques were chosen taking into account that (1) the efficiency of separation of particles for the subsequent technique should be higher than for the preceding one; (2) the separation principles of methods should be different (separation according size, density, charge etc.); (3) the initial separation should be carried out according to size, that makes possible to create an even scale for various samples. It has been shown experimentally that the combination of fractionation methods give a possibility to separate and analyze the fractions from 10 nm to 100 [U+F06D]m and to obtain an information about the distribution of elements. In particular, it is founded that nearly 20% of Be, K, Bi, Th, Fe, As, Tl, Ti, W, Hf, and Zr are removed from the ash into the s