

Rare Earth and other Chemical Elements Accumulation in Vines of Fogo Island (Cape Verde)

Rosa Marques (1), Maria Isabel Prudêncio (1), Fernando Rocha (2,3), Maria Isabel Dias (1), and Dulce Franco (1)
(1) Centro de Ciências e Tecnologias Nucleares (C2TN), Instituto Superior Técnico, Universidade de Lisboa, EN 10 (km 139.7), 2695-066 Bobadela, Portugal (rmarques@ctn.tecnico.ulisboa.pt), (2) GeoBioTec, Universidade de Aveiro, Campus Univ. Santiago, 3810-193 Aveiro, Portugal, (3) Departamento de Geociências, Universidade de Aveiro, Campus Univ. Santiago, 3810-193 Aveiro, Portugal

The Fogo Island is the fourth bigger island of the Cape Verde (central Atlantic Ocean). This archipelago is located 570 kilometres off the coast of West Africa, and is characterized by a semi-arid climate. The volcanic soils of the caldera of this island, with an active volcanism during historical times, have been used for viticulture. The study of uptake of chemical elements by vines - absorption and translocation to grapes - grown in soils developed on alkaline pyroclasts is the main goal of this work.

The concentrations of 27 chemical elements in bark, leaves and grapes of two vines, as well as in the corresponding soils (< 2 mm) were determined by instrumental neutron activation analysis. Irradiations of milled samples and standards were made in the core grid of the Portuguese Research Reactor (CTN/IST, Bobadela).

The distribution patterns of the enrichment factors (EF) in the different parts of the plants are similar for the two sampling sites. Significant EF were found for the majority of the chemical elements studied, in the several parts of the plants, particularly in grapes where Cr, As, Sb and U are accumulated (EF > 50). The bioavailable fraction of Cr and As in these soils may be due to the low percentage of iron oxides (particularly in the form of nanoparticles), which play an important role in the retention of these elements. The factors responsible for the phytoavailability of Sb in soils and its uptake by plants is still poorly known. Although the Sb concentrations in earth's crust are low, higher concentrations of this element in soils may be related with hydrothermal and volcanic processes. Also, the temperature may influence the accumulation of Sb in plants, with an increase of the Sb uptake by plants at higher temperatures, due to an increased desorption rate of Sb from soil particles. Concerning U, its mobility and dispersion in soils is controlled by its oxidation state, its adsorption capacity in clay minerals or iron oxides, and the ability to form more or less soluble complexes. Although U concentrations in these volcanic soils are low, there is a fraction available for absorption and accumulation by grapes. Concerning the rare earth elements (REE), it should be noted that the light REE are not enriched in any part of the vines studied, and only the heavy REE are enriched in grapes (EF = 20-50); this can be explained by the preferential uptake of the heavy REE, after primary minerals breakdown and the formation of more soluble compounds. The significant accumulation of several chemical elements found in grapes of Fogo Island can be mainly explained by a geogenic origin.