

GEOCHEMICAL AND MINERALOGICAL EVOLUTION OF THE ISLAND OF S. JORGE (AZORES)

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RESUMO: The island of S. Jorge, in the archipelago of Azores, is 55 km long and 7 km wide. It represents the emerged portion of a 100 km long, 2200 m tall, linear volcanic structure trending WNW-ESE. The island corresponds to an active fissural volcano, with eruptive activity concentrated along WNW-ESE elongated volcanic axes composed of numerous successive and superposing hawaiian–strombolian cinder cones (with occasional phreato-magmatic and surtseyan tuff rings). The accumulation of the correlative lava flows on either side of the volcanic rift axes produced a triangular prismatic volcanic ridge. The volcanostratigraphy of S. Jorge is composed of three main volcanic complexes (V.C.): the older (Pleistocene) Topo V.C. forming the eastern half of the island, a middle unit, the Rosais V.C., which constitutes the basement of the western part, and the Holocene Manadas V.C., unconformably overlying the Rosais volcanic sequence in central S. Jorge. The referred ages of the two lower V.C. are constrained by new ⁴⁰Ar/³⁹Ar data for basaltic whole-rocks while ¹⁴C ages indicate a Holocene age younger than 6 ka for the younger V.C.

The geochemical evolution of this linear island volcano, based on stratigraphically controlled sampling of the three units, is presented. Clear, systematic mineralogical and geochemical differences are observed among the three V.C., e.g., Topo lavas and dykes are characterized by the prevailing of plagioclase phenocrysts and relatively rare olivine and clinopyroxenes, while Rosais rocks are generally poor in plagioclase and rich in mafic minerals. The analyzed Rosais rocks show poorly zoned phenocrysts, whereas zoning (including reverse zoning) is observed in Topo and Manadas phenocrysts. Olivine and clinopyroxene phenocrysts indicate relatively low crystallization pressure (2-8 kbar) and temperature (1100-1200 °C) for Rosais when compared with the other two V.C. (up to 1300 °C and 10 and 12 Kbar for Topo and Manadas, respectively). Rosais samples are also peculiar, for example, in terms of their whole-rock high La/Yb (>15) and K₂O/Na₂O (0.4-0.6) and low Ce/Pb and U/La (58-88 and 0.02-0.03) compared to the other series (La/Yb < 15; K₂O/Na₂O = 0.3-0.5; Ce/Pb = 50-240; U/La = 0.03-0.05). These mineralogical and geochemical data suggest that the three volcanic units were fed by distinct parental magmas, generated at distinct depth (or from a mineralogically distinct mantle) and evolved in a simple shallow magma chamber system (Rosais) and in a complex polybaric plumbing system (Topo and Manadas).

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