Geophysical Research Abstracts
Vol. 17, EGU2015-13365-7, 2015
EGU General Assembly 2015

Petrogenetic implications from Pleistocene volcanic rocks of Psathoura Island, Greece: Mineral chemistry and geochemical data

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Psathoura Island in the North Aegean area (39.498/24.181) is the only subaerial Quaternary (0.7 Ma) volcanic center along the extension of the North Anatolian Fault (NAF) in the Aegean area. Outcrops consist of a small number of overlapping subaerial basaltic lava flows.

These lavas are enriched in LREE [$(La/Yb)_{CN}$=12.2-18.1], with no Eu anomaly. The Psathoura volcanics are porphyritic with a fine grained holocrystalline trachytic groundmass. Olivine phenocryst cores (Fo=75.4-85.6), differ from phenocryst rims and groundmass olivines, which have lower Fo compositions. Few anhedral olivine xenocrysts are more Fo rich (Fo=86.2-88.5, CaO$<$0.14 wt.%), compositionally comparable with depleted mantle peridotite olivines. Clinopyroxene phenocrysts are mostly augites with some diopsides. Their cores have higher Mg# values (76.5-83.0) and lower Ti contents (TiO_2=0.4-1.6 wt.%; Ti/Al=0.12-0.41), in comparison to rims and groundmass clinopyroxenes. Lath-shaped plagioclase crystals appear in the basaltic groundmass, having mostly labradorite (An50.3-69.8) and also andesine (An34.6-46.7) compositions. Alkali feldspars (Or28.4-57.0) occur in the groundmasses as minor components. Mg-hastingsite phenocrysts have also been identified, locally breaking down to secondary rhönite. Mg-hastingsite corresponds to crystallization conditions of $\sim$1020 ^{o}C and 510 MPa[1]. Oxide minerals include Cr-spinel crystals within olivine, illmenite, titanomagnetite and rare magnetite. Quartz, calcite, apatite and pyrite are present as secondary minerals and mostly as xenocrysts disintegrated from basement xenoliths incorporated in the lava.

The U/Pb (0.16-0.28), Nb/La (0.48-1.81) and Ce/Pb (2.65-8.00) ratio values are generally lower than the average OIB values[2,3]. The PM-normalized incompatible element patterns show negative Nb and positive Pb anomalies, which are prominent for sample PS1. Sample PS1 also displays a negative Ti anomaly. These data, along with slightly high K_2O/Na_2O ratios, indicate that the Psathoura magma genesis is due to the interaction of subduction-related fluids or melts with a possible OIB-like mantle source.

This study was carried out in the frame of the NSRF funded project of "IGME", titled "YPOTHER", (Sub-marine Geological researches, Reference number MIS 351008).

References. [1] Ridolfi et al 2009: Cont Min Petr 160, 45-66; [2] Halliday et al 1995: Earth Plan Sci Lett 133, 379–395; [3] Hoffmann 1997: Nature 385, 219-229.