

Discordant ages of alkaline basalts from the Bakony - Balaton Highland volcanic field, western Hungary

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Bakony - Balaton Highland Volcanic Field (BBHVF) close to the Lake Balaton north shore is located in the western Pannonian Basin, Hungary. The volcanic centers of the BBHVF were active between 7.5 Ma and 2.8 Ma and produced mostly alkaline basaltic volcanic products. These alkali basalt rocks have sometimes given the discordant ages in conventional K-Ar and Ar-Ar analyses. This requires the detailed petrological studies to find what gives the discordant age relations in the concerned rocks.

The alkaline basalt rocks were collected from the Heggetu quarry of the BBHVF in western Hungary and their polished thin sections were prepared for back-scattered electron imaging, composition mapping and quantitative analyses of minerals by Electron microprobe (EMP). The compositional maps consisting of K alpha radiation images of Mg, Si, Fe, Al, Na, K, Ti and Ca indicate porphyritic olivine and groundmass consisting of augite, leucite, labradorite and feldsparthoid (nepheline?), and the xenocrystic quartz, which are deduced from their chemical compositions.

Olivine occurs as euhedral crystals with chemical zoning that the core has 0.80 - 0.87 in Mg/(Mg+Fe) ratio and the rim, 0.77 - 0.86. Augite occurs as euhedral and small crystals with sector zoning and contains Al₂O₃ (6.1 - 10.6wt%) and TiO₂ (2.1 - 4.7 wt%), Mg/(Mg+Fe) ratio (0.71 - 0.86). Labradorite appears in fine and euhedral crystals with lamellar twinning. It has 3.4 - 6.2 wt% Na₂O, 23.6 - 30.4wt% Al₂O₃ and 6.1 - 14.2 wt% CaO. Leucite occurs sporadically as fine-grained crystals and has 21.6 - 22.0wt% Al₂O₃, 18.1 - 18.6 wt % K₂O, 54.3 - 56.6 wt% SiO₂. Feldsparthoid (Nepheline?) occurs as very fine-grained crystals and has 9.3 - 15.2 wt% Na₂O, 21.7 - 27 wt% Al₂O₃, 1.2 - 3.1 wt % K₂O, 52 - 56.6 wt% SiO₂, 0.1 - 6.0 wt% CaO. It may have reacted with other phases to form albite because the chemical data show always the SiO₂ content higher than that of nepheline. The chemical analyses may be of mixed phases of nepheline and albite.

The xenocrystic quartz is pure in the core (95 - 98 wt.% SiO₂, 0.07 - 1.3 wt% Al₂O₃, 0.07 wt% FeO) and has the reaction rim (65 - 82 wt.% SiO₂, 4 - 8.5 wt% Al₂O₃, 2.5 - 5.9 wt% FeO, 1.5 - 2 wt% Na₂O, 1.3 - 3.8 wt % K₂O; the total is 91 - 97 wt.%) with groundmass phases. This suggests that the alkaline basalts have experienced the crustal contamination because olivine and quartz cannot coexist with each other in the magma. The discordant ages are due to the excess argon derived from the crust materials.