Post-collisional transition from orogenic to within-plate type volcanism in the Kulu-Haymana area (Central Anatolia, Türkiye)

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Introduction

Orogenic type calc-alkaline and continental within-plate type mildly alkaline volcanic rocks occur together in the Kulu-Haymana area (Central Anatolia, Türkiye). The former are represented by voluminous andesitic-dacitic lavas and their pyroclastites whereas the latter include alkali basalt, hawaite, mugearite, benmoreite and trachydacite. Ar-Ar age data indicate that the volcanic activity was formed during Early Miocene (21.3-18.0 Ma) in the area. Also, a transition from the calc-alkaline to the mildly alkaline volcanism was formed in this period.

Geochemistry

The calc-alkaline volcanic rocks are medium-K in composition (K_2O: 1.0-2.2 wt.%) and exhibit enrichment in large ion lithopile elements (LILE) and light rare earth elements (LREE) and depletion in high field strength elements (HFSE). $^{87}Sr/^{86}Sr_{(t)}$ ratios and $\varepsilon^t(Nd)$ values of the calc-alkaline rocks are 0.704452-0.705264 and 0.73-3.86 respectively.

The mildly alkaline volcanic rocks have a sodic tendency (Na_2O/K_2O: 1.5-3.2) and exhibit enrichment in LILEs, LREEs and HFSEs. The mildly alkaline rocks have relatively lower $^{87}Sr/^{86}Sr_{(t)}$ ratios (0.703809-0.705159) and higher $\varepsilon^t(Nd)$ values (2.32-4.50) than the calc-alkaline rocks.

Discussion and conclusions

According to geochemical features of the calcalkaline rocks, it can be deduced that the source of these rocks was a subduction-modified lithospheric mantle. High LILE contents and $^{87}Sr/^{86}Sr$ ratios (up to 0.705264) of the rocks raise possibility of crustal contamination. However, AFC modelling based on equations of De Paolo (1981) shows that the crustal contamination did not play an important role in the genesis of the calc-alkaline rocks (r: < 0.2).

In contrast, alkali basalts show no evidence of subduction signature in their mantle source. The mantle source of the alkali basalts was heterogeneous Two mantle sources were recognized for the alkali basalt samples: 1) depleted mantle (low $^{87}Sr/^{86}Sr$ and intermediate $^{143}Nd/^{144}Nd$ ratios) and 2) enriched mantle (high $^{87}Sr/^{86}Sr$ and low $^{143}Nd/^{144}Nd$). Geochemical variations indicate that fractional crystallization played an important role in the evolution of evolved rocks.

The stratigraphic, petrologic and geohemical features of the volcanic rocks suggest the volcanism occurred in a post-collisional tectonic setting.

References

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Evolution of kimberlite magmatic sources beneath Siberia

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Model for magmatic source and lithoshere structure

The kimberlite magma evolving at the lithosphere base form polybaric magmatic system chambers and melting regions in peridotites at 80 -60 kbar according to thermobarometry of minerals (Ashchepkov *et al*., 2006) from mineral separates and diamond inclusions (DI) (Logvinova *et al*., 2006). At their top the magma-rich mante diapir intrude the lithosphere. The evolved protokimberlite melts create a magma feeding system producing megacrystalline Ilm – Gar – Ol – CrDi aggregates up to 40 kbar (pyroxenite lens) or upper and heat the surrounding peridotite and eclogites followed by Ti–metasomatism. The submelting forms uprising polymictic mush column. Geotherms splits to hot and low-T branches. Relic subduction geotherms refer to dunite– harzburgites and Gar, Opx inclusions in diamonds. Several pulses of melt ascend from the basement beneath satellite pipes like for Ozernaya near Yubileynaya produce strong heating. Magmatic sources may shift to 40 kbar forming diamond- free kimberlites and carbonatites. Geochemical features of mantle peridotites are affected to melt-fluid flows from base and intermediate magma sources.

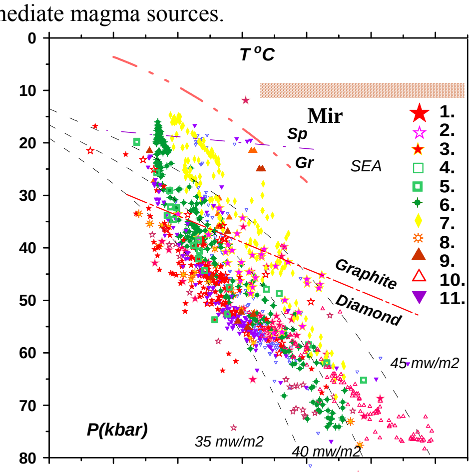

Figure 1: TP diagram for minerals from the Mir pipe according monomineral thermobarometry. 1. Cpx; 2. Cr-low Cpx; 3.Cpx (DI); 4. OPx; 5. OPx (DI); 6.Gar; 7. Gar Pxt; 8. Gar (DI); 9. Chr; 10. Chr (DI); 11. Ilm.

References

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