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Oxygen and strontium isotopic variations in the Meydan volcanic rocks, Eastern Anatolia, Turkey

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The volcanic rocks of the Meydan area in Eastern Anatolia range from calc-alkaline to transitional to moderately alkaline. The alkaline suite display evolution from alkali olivine basalt to trachyte with lack of ilmenite and Na-rich feldspar. Alkali olivine basalt and hawaiite are fine grained whereas mugearite, benmoreite and trachyte are porphyritic and show disequilibrium textures. Medium-K andesites, trachyandesites and dacites show petrographical textures of contamination and mixing processes. High-K rhyolitic rocks vary in texture from hypocrystalline to glassy. Transitional lavas contain plagioclase, orthopyroxene and Ti-poor augite [1].

O- and Sr-isotopic results range from +7‰ to +10‰, and 0.7048 to 0.7063 respectively in the rocks. Alkali olivine basalt and hawaiite have plagioclase $\delta^{18}O$ about +7‰, comparable with mantle-derived magmas. A $\delta^{18}O$ estimate of around +6.7‰ may represent the original value of the alkaline magma. $\delta^{18}O$ values in the rocks vary much more than expected for closed system fractional crystallization, suggesting the involvement of ^{18}O-rich continental crust. The trends of O- and Sr-isotope data are explained by contamination with ^{18}O-rich crust during intracrustal differentiation, and the degree of contamination is large (≤25%) for evolved rocks. Generally, the alkaline and calcalkaline suites have similar Sr-isotope ratios suggesting that both may have originated from similar sources and/or by similar processes. In the alkaline suite, the slightly increased $^{87}Sr/^{86}Sr$ ratio of the basaltic rocks over typical mantle value suggests that the parental magma may have already undergone interaction with crust prior to its emplacement into a magma chamber or the magma was derived from melting of an only slightly enriched mantle. The element-isotope correlations imply that fractionation proceeded with assimilation of crustal rocks in the evolved rocks. In the calcalkaline suite, data are not consistent with an AFC process. The pattern of isotopic variations in the alkaline suite is similar to that which elsewhere has been attributed to basalt derivation from a contaminated mantle source region. Sr-isotope compositions of partial melts are dominated by composition of the contaminant, whereas the O-isotope composition of the melt is controlled by composition of the mantle source. The two stage process of (a) source contamination gave rise to a range of Sr-isotopes, followed by (b) crustal contamination and fractional crystallization.

References

[1] Arslan, M. 1994. PhD thesis, Glasgow University, 559p.

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Petrology and geochemistry of volcanic rocks from Güvem District, NW Central Anatolia, Turkey

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The Güvem area, which is located in the Galatean Volcanic Province of NW Central Anatolia, Turkey, includes volcanics of Neogene age. The Güvem volcanics are in acidic to basic composition, and these volcanics are observed as lava flows, domes, nuée ardentes, pyroclastic flow and fall deposites. Optical and microprobe studies show that these volcanics contain normal and reverse zoning plagioclase (An_{27-58}), amphibole ($Mg\#_{63-70}$), orthopyroxene (En_{78-79}), clinopyroxene (Wo_{39-47}), biotite ($Mg\#_{57-71}$), olivine, quartz and Fe-Ti oxide phenocrysts. The volcanics are mainly composed of trachybasalt, basaltic trachyandesite, trachyandesite, trachyte, andesite, dacite and rhyolite, and have both alkaline and calc-alkaline affinities. The variation diagrams of SiO2 versus major and trace elements are consistent with fractional crystallization process involved in the formation of these volcanics. MORB-normalized spider diagrams imply the LILE enrichments (such as Rb, Ba, Th, K) and P, Nb, Ti, Ta depletions. This indicates that they are resemble to those of active continentale margin character. Mineral chemistry and geochemical data suggest that the Guvem volcanics may be related to a subducted component and/or crustal contamination and crystal fractionation.