

## Petrochemical and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronological evidence of post-collisional Tertiary calc-alkaline volcanism in the Ulubey (Ordu), eastern Pontide, NE Turkey

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Post-collisional Tertiary volcanism in the Ulubey region at the western edge of the eastern Pontides paleo-arc started with sediments in a shallow marine environment in the Paleocene-Eocene time and then continued extensively with sub-aerial andesitic and rare basaltic volcanism during Eocene and Miocene time. The volcanic rocks studied are mainly andesite/trachyandesite and rarely basalt/trachybasalt and pyroclastics, and show porphyric, hyalo-microlitic porphyric and rarely glomeroporphyric, intersertal, intergranular, fluidal and sieve textures.

The volcanic rocks indicate a magma evolution from tholeiitic-alkaline transitional to calc-alkaline, and have medium to high-K in character. Petrochemical data of the rocks suggest a dominant fractional crystallization and less crustal contamination processes in their evolution. Most samples have also low Mg#, Cr, and Ni, which indicates that they have undergone significant fractional crystallization from mantle-derived melts. Generally, major and trace element geochemical variations in the rocks can be explained by fractionation of common mineral phases. E-MORB normalized trace element patterns show that Ulubey volcanic rocks have geochemical patterns with enrichment in LILE and to a lesser extent in LREE, but depletion in HFSE. The volcanic rocks have moderate LREE/HREE ratios relative to E-Type MORB, depletion in Nb, Ta and Ti, and high Th/Yb ratios indicate that these patterns probably reflect magma derived from an enriched source formed by mixing of slab and asthenospheric melts previously modified by fluids and sediments from a subduction zone. The chondrite-normalized REE patterns of these volcanics resemble to each other and spoon-shaped with low to medium enrichment, indicating similar source area for the basaltic and andesitic rocks. The most primitive samples have  $\text{Yb}_N < 10$ , which indicates the presence of garnet as a residual phase in the mantle source.

The  $^{40}\text{Ar}/^{39}\text{Ar}$  dating of the basaltic rocks  $15.1 \pm 0.6$  Ma and the andesitic rocks are between  $44.6 \pm 0.1$  and  $49.4 \pm 0.1$  Ma. The rocks evolved from a parental magma derived from an enriched source formed by subduction induced metasomatism of basaltic rocks formed clinopyroxene  $\pm$  titanomagnetite controlled fractionation whereas andesitic rocks developed hornblende + plagioclase + clinopyroxene  $\pm$  titanomagnetite controlled fractionation and, rare crustal contamination in shallow level magma chamber(s).

## A geochemical approach to formation of the Tinaztepe cave soil, Seydisehir, Konya, Turkey

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The geochemical transformation during cave soil formation in Tinaztepe Cave, and mass- and volume- changes related to them were evaluated geochemically by comparing the limestone of the Upper Cretaceous Mortas formation and the cave soil developed in it by leaching during the Pleistocene - Quaternary period in an area located 20 km to south of Seydisehir (Konya, Central Turkey).

In the study area, recent- and paleo-karstic structures are common especially in the limestone of the Mortas Formation. The entrance of Tinaztepe Cave is located in western slope of Tinaz Hill. It was developed between 1480-1520 m altitude. The length of the cave is approximately 2000 m, and it can be explained as through cave. Sometimes wideness of the cave rises 30 m, but generally participate in 10 m. There is little or much water in the cave all season (Guldali, 1984; Temur *et al*, 2005). There are cave soil and collapse breccia as cave deposit in Tinaztepe Cave. The cave soil is found only 500 m from entrance of the cave. This is muddy, semi-compact, dark brown – black colored soil. The color of the dried cave soil samples is gray, dark gray, dark brown. Their thickness is generally 0.5 m, rarely 1 m. In the process of the transformation from limestone to soil, the element ratios in the cave and limestone show that, P, Ni, Ba, Cu, Si, Rb, Cr, Zr, K, Ga, Nb, Co, Ti, Mn, Fe, Th and Al were enriched together by staying in-situ. All the lanthanides show similar behavior, but the HREEs, were consumed fast during soil formation relative to the LREEs. The association and the enrichment of P as well as Ni, Cu, Si, Rb, Cr, Zr, K, Ga, Nb, Co, Ti, Mn, Fe, Th in soil relative to the limestone are interpreted as being resulted from organic activity and supplement of the Dipsizgol Ophiolite. The averages of Ti/Zr ratio for limestone (147) and cave soil (33) verify the possibility of exotic addition. Ca, Hg, Sb, As, Sr and U were found to be the most mobile elements during soil formation. According to main oxide composition ratios of the limestone and cave soil, the soils were described as representing a partly washed soil progressing the leaching and accumulation phase, but not beginning the silicate chemical decomposition phase. In the processes of soil formation, 73.2% of the limestone was washed away; only 26.8% of the rock was deposited as soil. Therefore, 4 times mass reduction was realized.

### References

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