Petrology and Geochronology of Iran Tepe volcano, Eastern Rhodopes, Bulgaria: Age relationship with the Ada Tepe gold deposit (preliminary data).

Peter Kibarov[1], Peter Marchev[1], Maria Ovtcharova[2], Raya Raycheva[1] & Robert Moritz[2]
[1]Geological Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria
p.kibarov@abv.bg; pmarchev@geology.bas.bg; raya@geology.bas.bg
[2]Institute of Earth Sciences, University of Geneva, Geneva, Switzerland,
maria.ovtcharova@terre.unige.ch; robert.moritz@terre.unige.ch

The Iran Tepe paleovolcano is situated in the Eastern Rhodopes, immediately N-NE of Krumovgrad, 3-4 km N of the35 Ma-old sedimentary-hosted Ada Tepe gold prospect. On the basis of stratigraphic relationships and available K-Ar data (35-39 Ma), Iran Tepe has been considered as one of the oldest volcanic structures in the region. The proximity of the volcano with the Ada Tepe prospect makes it a possible candidate for the source of fluids and metals for the Ada Tepe hydrothermal system. We report results of detailed petrological and geochemical investigations undertaken on the Iran Tepe volcano, along with the first reliable U-Pb zircon age, in order to constrain the genesis of the magmas and their relationship with the Ada Tepe prospect.

The volcano is built up of massive and brecciated lava flows, epiclastic rocks and rare tuffs. A swarm of WNW striking dykes and subvolcanic bodies are the most likely vent structure. The lavas are porphyritic, with phenocrysts mineralogy dominated by normally and reversely zoned plagioclase, clinopyroxene, orthopyroxene, and amphibole, with biotite in the more evolved compositions. Ti-magnetite is ubiquitous as pheno- and microphenocrysts. Accessory minerals are apatite and zircon. The groundmass consists of same minerals, set in a feldspar or glassy mesostasis. Small metamorphic xenoliths or xenocrysts of quartz and garnet have been observed in some samples. The topmost lava flows are characterized by abundant amphibole-biotite andesitic enclaves. Crystallization temperature, using amphibole-plagioclase geothermometry is between 920 and 990ºC, slightly lower than that obtained by two-pyroxene thermometry (980º-1080ºC). Calculated pressures are between 3.5 and 9 kb.

Lavas are basaltic andesites to dacites (55 - 66 wt% SiO_2). The rocks are medium- to high-K calc alkaline, except a later shoshonitic dike. FeOt, MgO, TiO_2, and CaO generally decrease with increasing SiO_2 and K_2O, whereas Na_2O has a flat distribution. Trace elements display a negative correlation with silica and Sr, V, Co, Ni, Cr and weak positive trends for Ba, Ce. LREE patterns are fractionated LREE, whereas HREE are flat. The Eu anomaly is weak. $^{87}Sr/^{86}Sr$ ratios between 0.7075 and 0.7068 and $^{143}Nd/^{144}Nd$ ratios between 0.51244 and 0.51255 decrease and increase with increasing SiO_2., respectively.

U-Pb zircon dating from a stratigraphically low lava flow demonstrates that the volcanic activity began at *c*. 33 Ma. The lower intercept of the discordia yields an age of 32.7 ± 1.4 Ma and the upper intercept an age of 307.8 ± 1.1 Ma. The latter is interpreted as the age of inherited zircons from the Variscan basement.

Petrographic observation along with the major, trace element and isotopic variations and zircon geochronology data reveal multistage polybaric evolutionary processes for the Iran Tepe magmas. Magma mixing and crystal-liquid fractionation processes determined many of the petrological and geochemical characteristics of the volcanic rocks. Isotopic data, metamorphic xenocrysts along with the complex zircon morphology and age data suggest that magma with more primitive characteristics underwent crustal contamination during their ascent to the surface.

The recent more reliable U-Pb age data show that ore formation at Ada Tepe was 1.7-2.5 my older than igneous activity at Iran Tepe, thus indicating that Iran Tepe was not the source of hydrothermal activity at AdaTepe.