The Urumieh-Dokhtar volcanic arc, extending ∼1500 km across Iran, is one of the most impressive yet understudied volcanic arcs on earth. Despite a constant subduction rate of Neoethyan oceanic crust beneath Iran from at least late Paleocene to early Miocene time (McQuarrie et al., 2003), volcanism within the arc is dominated by an Eocene pulse. Volcanic rocks comprising the Lut arc in eastern Iran as well as eastern Tertiary volcanic and volcanioclastic deposits in the Alborz Mountains in northern Iran are also primarily Eocene in age. Recently discovered middle Eocene metamorphic core complexes in central (Verdel et al., 2007) and western (Moritz et al., 2006) Iran raise the question of whether the magmatic pulse may be related to extension. Our new U-Pb and 40Ar/39Ar age data suggest that the oldest Tertiary volcanic arc pre-dated the onset of extension in the central Iranian core complex by several mya, and that continued volcanism overlapped with extension in both the central and western core complexes. Iranian Eocene basins are enriched in large ion lithophile elements, but are depleted in high field strength elements (HFS), a pattern typical of volcanic arc basalt suites. In contrast, some latest Eocene to Oligocene basins from Urumieh-Dokhtar and the Alborz Mtns. are enriched in HFS, a feature more consistent with back arc basin basins that suggests a smaller input from slab-derived fluids. Taken together, these geochronological and geochemical data suggest a 3 phase history of Tertiary volcanism: (1) a latest Paleocene-early Eocene phase of pre-extensional arc magmatism; (2) a middle-Eocene syn-extensional period during which extension has invaded volcanic output, but the continued influx of slab-derived components nonetheless produced basaltic rocks which are indistinguishable in their trace-element geochemistry from basaltic rocks of the first period; and (3) relatively limited latest Eocene-early Oligocene, back-arc extensional volcanism which has a back-arc basin geochemical affinity.

(U-Th)/He apatite ages from a tilted section of Eocene volcanic and sedimentary rocks in the Tafresh area within the Urumieh-Dokhtar arc are uniformly ∼10 Ma and do not vary with depth in the section. This age is similar to some apatite (U-Th)/He ages in the Alborz Mtns. north of Tehran (Guest et al., 2006), but contrasts with apatite (U-Th)/He ages of ∼20-25 Ma from the central Iranian core complexes (Verdel et al., 2007), Zagros Mtns. (Gaviliot et al., 2006), and a potential core complex in northwest Iran (Stoeckli et al., 2004). The regional variation may suggest that initial uplift and exhumation of essentially the entire Iranian plateau occurred at ca. 20 Ma and was followed by deformation focused along the northern and southern margins of the country, such that topographically high areas at the margins produce young (10 Ma and younger) apatite (U-Th)/He ages whereas lower areas in the center of the country still preserve the ∼20 Ma ages resulting from initial exhumation.

REFERENCES

