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Variations in gas isotope compositions of thermal fluids in central Anatolia, Turkey

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As a result of collision between the African and Eurasian plates, a series of tectono-magmatic events have taken place throughout Turkey. This, in turn, gave rise to occurrence of vast number of fossil and modern geothermal systems which are closely associated with Neogene-Quaternary volcanism in areas of seismic unrest. In this study we present new data on the helium (3He/4He) and carbon (δ13C) isotope compositions and their relative abundance ratios (CO_2/3He) in gas samples collected around the Hasandag stratovolcano and the seismically active Tuz Gölü Fault Zone, in central Anatolia. Air-corrected R/RA ratios of samples ranging from 0.42 to 4.12 are significantly higher than the crustal production value of 0.05. The mantle-derived helium component, which is likely transferred to the crust beneath the central Anatolia by recent magmatism, constitutes up to more than 50% of the total He composition in fluids. Samples collected along the Tuz Gölü Fault are generally represented by lower helium isotope compositions compared to those in the areas of historically active volcanoes. CO_2/3He ratios vary over four orders of magnitude from 9x10ˆ7 to 4x10ˆ11. The majority of samples encompass the range of crustal-derived volatiles (10ˆ10 to 10ˆ11). Carbon isotope composition of CO_2 is highly variable and spans a range from –13.38 to 2.16‰ and δ13C of most samples is consistent with values typical of limestone. Our ongoing survey on He-CO_2 isotope systematics of central Anatolian thermal fluids will lead to a better understanding of these anomalies in regard to temporal changes in tectono-magmatic dynamics in the region.