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A 150-ka-long record for the volcano-tectonic deformation of Central Anatolian Volcanic Province

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The Anatolian Block represents one of the most outstanding examples of intra-plate deformation related to continental collision. Deformation related to the convergence of the Afro-Arabian continent toward north gives rise to widespread and intense arc volcanism in the Central Anatolia. All the usual studies on dating the volcano-tectonic deformation of the region are performed entirely on volcanic events of the geological record resulted in eruptions. However, without volcanic eruption, magma migration and related fluid pressurization also generate crustal deformation. In the current study has been funded by the Scientific and Technological Research Council of Turkey with the project no. 115Y497, we focused on fracture systems and their carbonate veins around the Ihlara Valley (Cappadocia) surrounded by well-known volcanic centers with latest activities of the southern Central Anatolian Volcanic Province. We dated 37 samples using the Uranium-series technique and analyzed their isotope systematics from fissure veins, which are thought to be controlled by the young volcanism in the region.
Our detailed fracture analyses in the field show that there is a regional dilatation as a result of a NW-SE striking extension which is consistent with the results of recent GPS studies. The Uranium-series results indicate that fracture development and associated carbonate vein deposition occurred in the last 150 ka. Carbon and oxygen isotope systematics have almost remained unchanged in the studied time interval. Although veins in the region were precipitated from fluids primarily of meteoric origin, fluids originating from water-rock interaction also contribute for the deposition of carbonate veins. The age distribution indicates that the crustal deformation intensified during 7 different period at about 4.7, 34, 44, 52, 83, 91, 149 ka BP. Four of these periods (4.7, 34, 91, 149 ka BP) correspond to the volcanic activities suggested in the previous studies. The three crustal deformation periods occurred at 44, 52, and 83 ka BP were dated in addition to the known. They are interpreted to have possibly occurred without any eruption in the late Pleistocene and were controlled by magma movements and/or associated fluid pressure. Such crustal deformation controlled by volcanism is dated for the first time in the literature with a sampling other than extrusive material. The obtained age data revealed that crustal deformation linked to the young volcanism in the Central Anatolian Volcanic Province was repeated in short-term strain cycles of 8-10 ka and that the duration of activity lasted approximately 1100 $\pm$ 1000 years in each period, possibly triggered fracture development without any eruption in some periods.