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Comparison of Zircon (Ti) Thermometry and Typology of the Cappadocian Ignimbrites

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The typological study of zircons is a valuable, convenient, reliable and economical tool since this mineral is highly resistant to alteration and post-magmatic heating. The zircon morphology yields information on temperature and the chemistry of magma hence can be a perfect indicator of the origin of material (e.g., crustal, hybrid or mantle). Zircon typology method has been applied to 8 different ignimbrite successions (Kavak-9.3 Ma, Zelve-9.2 Ma, Sarimadentepe-8.4 Ma, Sofular-8.2 Ma, Cemilkoy-7.2 Ma, Tahar-6.1 Ma, Gordeles-6.4 Ma, Kizilkaya-5.2 Ma) of Miocene-Pliocene in Central Anatolian Volcanic Province. The growth of the pyramidal and prismal faces of zircon crystals, extracted from pumices of each ignimbrite, has been examined and plot onto typology diagram. The temperature index (I.T.), which depends on the relative change of the (110) and (100) prismal faces and alkaline index (I.A.), which depends on the change of the (211) and (301) pyramidal faces, are determined. Typological Evolution Trend (T.E.T) which is used for granitoid classification, is drawn based on estimated I.T. and I.A..

Furthermore, Ti-thermometry of zircons has been applied in order to estimate the emplacement temperatures of the magmatic rocks. For that purpose, Ti concentrations of zircons and host rocks are determined. Zircon evolution temperatures and zircon saturation temperatures are calculated according to Ferry and Watson (2007) and Watson and Harrison (1983). Obtained zircon geothermometry data have been correlated with the zircon typology data. Zircon evolution temperature estimated from zircon crystals are 741^{o}C (Tmin=-30^{o}C and Tmax=16^{o}C) for Kavak, 749^{o}C (Tmin=-31^{o}C and Tmax=33^{o}C) for Zelve, 811^{o}C (Tmin=-37^{o}C and Tmax=53 ^{o}C) for Sarimadentepe, 807^{o}C (Tmin=-24^{o}C and Tmax=61^{o}C) for Sofular, 739^{o}C (Tmin=-58^{o}C and Tmax=42^{o}C) for Cemilkoy, 768^{o}C for Tahar, 806^{o}C (Tmin=-37^{o}C and Tmax=29^{o}C) for Gordeles, 805^{o}C (Tmin=-35^{o}C and Tmax=69^{o}C) for Gordeles-B, 765^{o}C (Tmin=-25^{o}C and Tmax=48^{o}C) for Kizilkaya ignimbrites. Temperatures correspond to zircon typology temperature indices are 714.29^{o}C for Kavak, 740^{o}C for Sarimadentepe, 775^{o}C for Sofular, 730^{o}C for Cemilkoy, 830^{o}C for Gordeles, 837.5^{o}C for Gordeles-B, 757.14^{o}C for Kizilkaya ignimbrites.

Consequently, geothermometric assessmentes based on zircon typologies are comparable with the zircon thermometry studies for some ignimbrite units (Gordeles, Gordeles-B, Cemilkoy, Kizilkaya). For some ignimbrites, temperatures show differences between 30-55^{o}C which may be due to physical properties, variation of zircon crystals in the rock, source of rock and generation processes. According to zircon topology, Neogene Cappadocian ignimbrites are calc-alkaline hybrid. Since these units approximate temperature values and alkaline indices, zircon typology studies on Quaternary rhyolitic domes/lavas which are situated in Central Anatolian Volcanic Province, indicate low temperature values and high alkaline indices. Therefore, it can be concluded that from older to younger units, alkalinity increases and it shifts to peralkaline.

Keywords: Zircon, Ti, thermometry, typology, Cappadocia, ignimbrite