Thallium isotope evidence for protracted cooling of the acapulcoite-lodranite parent body

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Recent work on iron meteorites [1] and carbonaceous chondrites [2] demonstrated the presence of live ^{205}Pb, which decays to ^{205}Tl with a half-life of 15 Myr, in the early solar system. In this investigation, the Pb-Tl chronometer was applied to the study of acapulcoite NWA 725 and lodranite NWA 2714. Acapulcoites and lodranites are thought to originate from a parent body with approximately chondritic composition that was affected by strong thermal metamorphism and (at least) incipient partial melting [3]. Ages of <10 Myr after the start of the solar system have been obtained for acapulcoites, based on Hf-W [4], Mn-Cr [5] and Pb-Pb [6] chronometry.

In this study, Tl isotope compositions and ^{204}Pb/^{203}Tl ratios were determined for mineral separates and whole rock samples of NWA 725 and NWA 2714. The analyses of NWA 725 yielded low Tl abundances (<1 ppb) and the data define a slope, which corresponds to an initial ^{205}Pb/^{204}Pb ratio of 4.7 ± 7.8 x 10^{-5}. When combined with our revised estimate for the initial solar system abundance of ^{205}Pb from carbonaceous chondrites, the NWA 725 isochron corresponds to an age of >50 Myr. This is in accord with the ~4.51 Ga Ar-Ar ages that were obtained for acapulcoites and lodranites in previous studies [3, 7]. These ages are thought to reflect slow cooling during an extended period of metamorphism, which followed an initial period of rapid cooling recorded by other chronometers [4,5,6].

The mineral separates of the lodranite NWA 2714 have high Tl contents of 10-20 ppb and variable Tl isotope compositions that do not correlate with ^{204}Pb/^{203}Tl. Taken together these features are best explained by isotope fractionation of Tl, as a consequence of Tl mobility during thermal metamorphism.

[1] Nielsen *et al.* (2006) *GCA* **70**, 2643. [2] Baker *et al.*, (2007) LPSC XXXVIII, #1840 [3] McCoy *et al.* (1997) *GCA* **61**, 639. [4] Touboul *et al.* (2007) LPSC XXXVIII #2317 [5] Lugmair and Shukolyokov (1998) *GCA* **62** 2863[6] Zipfel et al., (1995) *GCA* **59** 3607 [7] Mittlefehldt *et al*. (1996) *GCA* **60**, 867.

Post-collisional shoshonitic volcanism in NW of Iran: Constraints from REE geochmistry

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Basalts, andesites, trachyandesites and latites with shoshonitic affinity are the main volcanic pile of Eocene age in NW of Iran (Ardabil). Plagioclase, K-feldspar, biotite and amphibole associated with clinopyroxne are the main constituents of trachyandesites (shoshonites) while clinopyroxene, plagioclase and biotite are the rock-forming minerals of basalts (absarokites). The volcanic rocks show enrichment in LREE and characterized by enrichment in LILE and depletion in HFSE. Petrographical observations along with geochemistry of rare earth and trace elements of these lavas suggest shoshonitic affinity and derivation from a subduction zone. The geochemical behaviour of the lavas reveals the role of the trench sediments in the source region and genesis of the volcanic rocks. These lavas exhibit low degree of partial melting from a garnet-spinel lherzolite mantle source. The comparison between shoshonitic volcanic rocks with other calc-alkaline and alkaline lavas from NW of Iran highlights the different mantle source and degree of partial melting for the genesis of the shoshonites. The formation of these lavas is linked to slab steepening and breakoff in Eastern Anatolian collision zone, proposed by Keskin (2003).