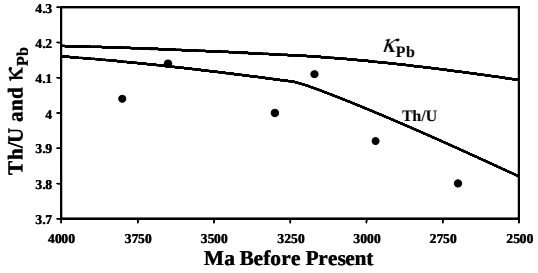
Earth's mantle Th/U and U/Pb evolution in the Archean

J. MATA[1], R. KERRICH[2] AND M. A. GONÇALVES[1]

[1]CeGUL; Creminer; Dep. Geologia, Faculdade Ciências, Universidade Lisboa, Portugal (jmata@fc.ul.pt; mgoncalves@fc.ul.pt)

[2]Dept. Geological Sciencies, University of Saskatchewan, Canada (robert.kerrich@usask.ca)

The present Th/U ratio of depleted mantle at $\kappa \approx 2.5$ is clearly lower than the time-integrated value as calculated from Pb isotope ratios ($\kappa_{Pb} \approx 3.75$) or the estimates for the κ value of the primitive mantle. This Th/U decrease has been ascribed to post-Archean deep-mantle U recycling. However, such models are not compatible with: 1) increasing geochemical evidence severely limiting the amount of recycled U; 2) the Collerson and Kamber (1999) compilation showing that Th/U decrease in the upper mantle started in the Archean, an eon whose anoxic atmospheric conditions were not suitable for U mobilization and subsquent recycling. Archean continental crust formed dominantly from TTG liquids generated by slab melting under higher geothermal gradients. For slab melting, $D_U > D_{Th}$ such that Archean arc crust has high Th/U and a complementary residual slab was recycled, decreasing mantle Th/U and κ_{Pb} down to circa 3.82 and 4.09, respectively. The feasibility of this hypothesis was numerically tested by box-modelling. The obtained results (lines) compare favourably with the observed (black dots) Th/U variation in the upper mantle.



Archean crustal extraction being dominated by slab melting also caused a significant U-Pb fractionation ($D_U < D_{Pb}$) which was responsible by the U enrichment of Archean crust as testified by the relatively high $^{207}Pb/^{204}Pb$ signatures of sediments. The recycling of the complementary low U/Pb residue can explain the Archean μ decrease from ≈ 9.2 to < 8 inferred from the two-stages model for recent oceanic basalts. In conclusion, the Archean mantle evolution was characterized by Th/U and U/Pb decrease caused by the extraction of continental crust through slab melting.

This is a contribution of the FEDER/FCT project PLINT (POCTI/CTA/45802/2002)

Reference

Collerson, K. D., and Kamber, B. S. (1999) *Science*, 283, 1519-1522.

Mineralogy and genesis of Lashak plain clay deposit in the North of Alborz Mountain, Iran

E. MATAJI AND R. ANSARI

Islamic Azad University, Chalus Branch, Iran

The studied area is situated in North of Alborz Mountains. Expound of drainage basin is 75 Km2 and its cirque is 15 km2. The purpose of this study is investigation of mineralogy and genesis of Lashak plain clay deposit. Fifty profiles pedology are provided and three boreholes (360m) are excavated. Pedology profiles are shown three groups of inceptisol, mollisol and antisol. XRF and ICP analysis show that TiO_2 and K_2O oxide and Ag, V, Ni, Mo, Cr, Co elements are dominant. Illite, Mica and kaolin are main mineral percentage in the upper top soil. Minerals size is less than 2 micron that originate from bed rock and alluvium deposit. Boreholes sedimentlogy studies indicate that pasadenian orogeny phase effect on this area and filling cirque since 500,000 years. Usually, boreholes lithofacies is high thickness mud, gravelly mud and muddy gravel. Illite, mica and kaolin are major minerals in the boreholes samples and X-Ray analysis show that their crystalline shape. Chlorite, Smectite, Palygorskite and Nontronite are existed in the samples, occasionally. Abundance of these minerals and lack of sedimentary are shown that basal bed rock changing to clay minerals in a burial stages. Palygorskite subhedral crystalline and Illite as a result upper soil PH and lower aluminum oxide in this area.