Titanium isotopes in the solar system

I. LEYA[1], M. SCHÖNBÄCHLER[2], U. KRÄHENBÜHL[1],
AND A.N. HALLIDAY[3]

[1]University of Bern, Switzerland (ingo.leya@space.unibe.ch)
[2]University of Manchester, UK
[3]University of Oxford, UK

CAIs are considered to be the first objects yet identified that formed in the solar system. It is now established that most of them contain nucleosynthetic anomalies from e-, p-, r-, and/or s-processes. Exactly how and when these heterogeneities in the dust that formed the solar system were established is not yet clear. For a better understanding of the origin of isotope heterogeneities in early solar system objects, studies of correlated anomalies are of great importance.

We studied five CAIs from the reduced CV3 chondrite Allende and two CAIs from the oxidised CV3 chondrite Efremovka. Sample preparation and chemical separation followed the procedure described by [1,2]. Sample aliquots have already been measured for Ni [3] and Zr isotopes [4]. The new data clearly indicate that CAIs are enriched in ^{46}Ti/^{47}Ti relative to the normal, defined by ordinary chondrites, eucrites, mesosiderites, ureilites, Earth, Moon, and Mars. Comparing the CAI data to carbonaceous chondrite bulk data [2,5] indicates that both types of material share the same Ti isotope composition. The ^{48}Ti/^{47}Ti data show, compared to the reproducibility of our measurements, a relatively large scatter and therefore probably indicate some inherent heterogeneity. Note that such heterogeneities have also been observed for this ratio in bulk samples of carbonaceous chondrites [5]. Also the ^{48}Ti/^{47}Ti data indicate that CAIs differ from normal, but they are identical to bulk carbonaceous chondrites. For ^{50}Ti/^{47}Ti the new data indicate that excesses in ^{50}Ti, ^{62}Ni, and ^{96}Zr are correlated. However, among the three isotopes, ^{50}Ti is special, because even samples without anomalies in ^{62}Ni and ^{96}Zr have a ^{50}Ti excess of a few ε-units. This finding is confirmed by bulk measurements for carbonaceous chondrites. While bulk samples are normal in Ni and Zr isotopes [3, 4] they display a ^{50}Ti anomaly of 3.02 ± 0.5 ε-units [5]. Our data therefore indicate that, at least in terms of Ti isotopes, CAIs formed from the same material that formed carbonaceous chondrites. Some inclusions, however, started with an additional excess of up to 8 ε-units in ^{50}Ti (and excesses in ^{62}Ni and ^{96}Zr).

[1] Schönbächler *et al.* (2003) *EPSL* **216**, 467. [2] Leya *et al.* (2007) *Internat. J. Mass Spectr.* **262**, 247. [3] Quitté *et al.* (2007) *ApJ* **655**, 679. [4] Schönbächler *et al.* (2002) *LPSC* **33**, 1283. [5] Leya *et al.* (2008) *EPSL* **266**, 233.

Geochemistry of fault tectonites based on STATISTICA software in the Songliang Lead-zinc deposit, Yunnan, China

BO LI[1], RUN-SHENG HAN[1]*, KANG-HUI ZHONG[2]
AND LEI WANG[1]

[1]Kunming University of Science and Technology, Southwest Institute of Geological Survey, Geological Survey Center for Non-ferrous Metals Resources, Kunming, 650093, China (libo7_211@yahoo.com.cn)
(*correspondence: hrs661@yahoo.com.cn)
[2]Institute of Earth Sciences, Chengdu University of Technology, Chengdu, 610059, China

The Songliang lead-zinc deposit which is controlled by faults strictly, is located in the Sichuan-Yunnan-Guizhou lead-zinc mineralization district. Tectonites in F5 fault containing abundant mineralization information as the F5 fault is the ore-controlling fault of No.1 ore-body. Factor analysis which is one of common multivariate statistical method, can reveal the relationships among variables, samples, material composition and geological processes, and can provide evidence for classification of variables and genesis of deposit.

Based on studing on the geological characteristics of the deposit, R-factor analysis was used by STATISTICA software to analyze the geochemical properties of tectonites in F5 fault. Four principal factors were selected by factor analysis, which represented 70.92% of mineralization information for 40 major elements and trace elements.

The result of R-factor analysis indicate that source of ore-forming minerals such as Zn and Pb are multi-source, which was partly derived from wall rock, mainly derived from deep hydrothermal fluid which associate with basement strata; the ore-forming fluid was not derived from stratic water completely, mainly derived from deep source fluid. Tectonites that locate in fault with developed fissures, was filled and cemented by ore-forming fluid, which lead to the formation of ore-bodies finally, and the Songliang lead-zinc deposit discussed is a hydrothermal type Pb-Zn deposit.

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