

Refractory lithophile element fractionation in chondrites - rare earth elements

Pack, Andreas¹

¹Georg-August-Universität, Geowissenschaftliches Zentrum, Goldschmidtstraße 1, 37077 Göttingen

Refractory lithophile elements (RLE) are defined by their high condensation temperatures under solar nebular conditions (Lodders, 2003; Palme and Jones, 2004). Here, it is reported on high-precision rare earth element (REE) analyses of bulk chondrites. 0.1 – 1.5 g chips of chondrites were ground to powder. 10 – 20 mg aliquots were melted to a sphere by means of a 50 W CO₂ laser. The spheres were then placed on top of a levitating gas stream for CO₂ laser-assisted melting and chemical homogenization (Nordine and Atkins, 1982; Pack et al., 2007). Spheres were quenched, embedded into resin and polished for EPMA (major elements) and LA-ICPMS. Latter analyses were conducted at the ANU RSES in Canberra (193 nm excimer laser, Aligent 7500s quadrupole mass spectrometer, Ca as internal standard). Bulk chondrite REE abundances were normalized to the respective intensities that were measured on the Orgueil (CI1, 432 mg aliquot, 4 spheres) samples. The relative REE abundances for Orgueil are, within error, identical to the data published by (Lodders, 2003). The error of a single analysis was $<\pm 5\%$ relative. Most bulk CC, OC and EC show variable “non-chondritic” REE abundances and inter-REE fractionation relative to Orgueil (CI1). CV3 chondrites Mokoia and one aliquot of Allende show distinct group-II REE patterns. Most OC and EC show heavy > light REE fractionation, often with indication of negative Tm and/or Yb anomalies. Such patterns are known from ultra refractory CAI (Boynton, 1989). Unusual patterns with distinct positive Ce- anomaly are observed in Karoonda (CK4) and Lake Labyrinth (LL6). The REE fractionation in bulk CVs and ECs is in agreement to observed Y/Ho fractionation between these groups (Pack et al., 2007) and supports the proposed presence of a complementary composition (with respect to REE+Y) of CVs and ECs. ECs are depleted in a component with group-II REE patterns, whereas CV3 chondrites show excess in this component. Analyses of Zr and Hf have been conducted and will be presented along with new REE data.

References

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