Core formation in planetary bodies: constraints from siderophile element concentrations of solar system basalts

Holzheid, Astrid[1] Kegler, Philip[1] Palme, Herbert[2]
[1]Universität Kiel, Institut für Geowissenschaften, 24098 Kiel, Germany [2]Universität Köln, Institut für Geologie und Mineralogie, 50674 Köln, Germany

When comparing the chemical compositions of the terrestrial planets and smaller differentiated asteroidal planetesimals we have to rely on basalts for comparison, as we have suitable mantle rocks only for the Earth. We are comparing major, minor, and trace element abundances of representative basalts from Earth (MORB), Mars (Shergotty), Moon (low Ti basalt) and Vesta (Eucrites): (1) SiO2 and MgO concentrations of all studied basalts cover only a small compositional range (SiO2: 48.9-51.3 wt.%; MgO: 7.0-9.7 wt.%) and (2) absolute Ni and Co contents as well as the Ni/Co ratios increase with the radius of the planet, with very low Ni and Co concentrations and a small Ni/Co ratio in Vesta (Ni: 4 ppm; Co: 6 ppm; Ni/Co: 0.7), increasing values through Moon (Ni: 50 ppm; Co: 45 ppm; Ni/Co: 1.1) and Mars (Ni: 80 ppm; Co: 40 ppm; Ni/Co: 2) and high concentrations and Ni/Co ratio in terrestrial basalts (Ni: 150 ppm; Co: 50 ppm; Ni/Co: 3) (Kegler et al., 2006; Holzheid and Palme, 2007). The small differences in SiO2 and MgO contents suggest a similar extent of fractionation, while the variations in absolute Ni and Co contents as well as Ni/Co ratios provide information of core formation processes within the planetary bodies. Ni and Co metal/silicate partition coefficients strongly increase with pressure and temperature, i.e. increasing lithophility with higher pressure and temperature (Kegler et al., 2008). The increase of Ni and Co contents with the radius of the planetary body might be therefore an indication for simple metal separation at increasingly higher pressures and temperatures. However, it is still unclear if Ni and Co contents in basalts from Earth, Mars, and Moon can be achieved solely by metal separation as conditions of core formation may also depend on other variables. But it is beyond doubt that eucrites show the very low Ni and Co contents expected from metal/silicate equilibration at low pressures (Holzheid and Palme, 2007).

References

Holzheid A, Palme H (2007) The formation of eucrites: Constraints from metal-silicate partition coefficients. Meteoritics Planet Sci 42: 1817-1829.

Kegler Ph, Holzheid A, Palme H (2006) The FeO, NiO and CoO contents of solar system basalts and their significance for core formation in planetary bodies. Lunar Planet. Sci. XXXVII, Abstract #1785, Lunar and Planetary Institute, Houston (CD-ROM)

Kegler Ph, Holzheid A, Frost DJ, Rubie DC, Dohmen R, Palme H (2008) New Ni and Co metal-silicate partitioning data and their relevance for an early terrestrial magma ocean. Earth Planet Sci Lett 268: 28-40

→

Abs. No. **248**
Meeting: **DMG 2008**
submitted by: **Holzheid, Astrid**
email: **holzheid@min.uni-kiel.de**
date: **2008-05-30**
Req. presentation: **Vortrag**
Req. session: **S02**