MODERATELY VOLATILE ELEMENTS IN ENSTATITE CHONDRITES

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Bulk chemical analyses of enstatite chondrites indicate systematic trends in the abundances of lithophile, siderophile and chalcophile elements with class and petrologic type. For example, the abundances of moderately volatile elements Mn, Se, and Zn decrease from EH4,5 to EH3, EL3 and EL5,6 [1]. This continuous decrease of moderately volatile elements has been explained by heterogeneous accretion of a single enstatite parent body [1]. Metal-rich (EH5) material accreted in the core and silicate-rich material (EL3 and 5,6) in the outer layers.

Motivated by our chemical data of the fresh and unweathered meteorite fall Neuschwanstein (EL6) we have studied moderately volatile element abundances in enstatite chondrites in more detail [2]. We initially concentrate on the behavior of Mn and Na. In carbonaceous and ordinary chondrites Na/Mg and Mn/Mg ratios are positively correlated at a constant Na/Mn ratio reflecting similar condensation temperatures. EH chondrites of all petrologic types have variable Na/Mg and Mn/Mg ratios with a chondritic Na/Mn ratio (Fig. 1). This is also the case for EL chondrites of low petrologic type 3. However, EL4,5 and 6 chondrites show a different behavior, constant Na/Mg ratios like EL3s but variable and mostly lower Mn/Mg ratios leading to variable and subchondritic Na/Mn ratios. This apparently indicates variable loss of Mn in EL4,5,6 relative to EL3s (Fig. 1)

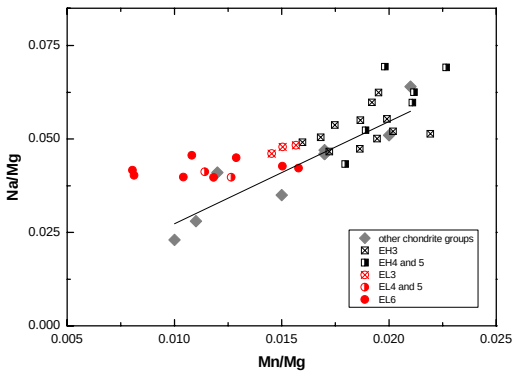

Fig. 1. Na/Mg and Mn/Mg ratios in individual EH and EL chondrites and in other chondrite groups.

A major carrier of Mn in EL chondrites of higher petrologic types is ferroan alabandite [3] with up to 46 wt.% Mn. Removal of about 0.1 wt. % alabandite would be sufficient to account for the maximum Mn depletion observed in EL6 chondrites. Similar observations hold for Zn which also is depleted in EL chondrites of higher petrologic type but not in type 3 enstatite chondrites. The major host phase of Zn in these meteorites is sphalerite. Thus the unusually low contents of Mn and Zn in high petrologic types of EL chondrites may be explained by inhomogeneous distribution or even some loss of Mn- and Zn-rich sulfides during parent body processes.

References: [1] Kong P., et al. 1997. *Geochim. Cosmochim. Acta* 161:4895-4914. [2] Zipfel J., et al. 2010. *Meteoritics & Planetary Science* submitted. [3] Keil K. 1968. *J Geophys Res* 73:6945-6976.