THE KAIDUN METEORITE: AN ENSTATITE CLAST WITH NININGERITE AND HEIDEITE AS TRACE ELEMENT CARRIERS. G. Kurat[1], E. Zinner[2], F. Brandstaetter[1], and A. Ivanov[3]; [1]Naturhistorisches Museum, Postfach 417, A-1014 Vienna, Austria, [2]McDonnell Center for the Space Sciences and Department of Physics, Washington University, St. Louis, MO 63130, USA, [3]Vernadsky Institute of Geochemistry and Analytical Chemistry, Kosigyn Str. 19, 117334 Moscow, Russia

The Kaidun heterogeneous breccia [1] contains, beside a large variety of oxidized and reduced meteoritic rocks, aggregates consisting mainly of pure enstatite (En>99). These aggregates, with apparent diameters from 0.5 mm to 1.5 mm, have roundish to irregular, angular shapes and a porous, granular texture with grain sizes around 100 µm. Two such aggregates contain ellipsoidal to irregularly shaped niningerite up to 650 µm in length which usually contain abundant grains of heideite of varying sizes (5-80 µm) and of highly variable, commonly irregular shapes. In addition, some oxidation products of heideite, (Fe,Ti,Si) oxides or hydroxides, a (Mn,Cl)-rich alteration phase, and some Ca carbonate are hosted by the niningerite.

The enstatite is very FeO-poor (0.1 wt%, in places up to 0.7 wt%) and fairly rich in TiO_2 (0.08 wt%), Al_2O_3 (0.25), and MnO (0.06).The niningerite is rich in Mn (18.0 wt%), Fe (9.1), Ca (5.1), Cr (1.8), and Ti (0.3) and contains Na (0.26). The heideite has 43.0 wt% S, 29.0 Ti, 22.0 Fe, 6.9 Cr, 0.5 Ni, and 0.3 Mn. The trace element contents of enstatite, niningerite, and heideite as determined by ion probe analysis are shown in the Figure.

Heideite has previously been described to occur in the Bustee aubrite [2,3] and in Kaidun [4], mostly isolated or in association with oldhamite. This is the first time heideite has been found in association with niningerite. Perhaps this is the reason for the somewhat different chemical composition, in particular its enrichment in Cr, Mn, and Ni, of this heideite compared to those previously described. Our trace element data, the first ones obtained for heideite, show that this mineral is also a major carrier of trace elements in enstatite meteorites, albeit to a lesser extent than oldhamite, niningerite, and others [e.g.,5]. As is evident from the Figure, the sulfides are enriched in all trace elements (except Be) relative to co-existing enstatite, demonstrating strongly chalkophile behaviour of common lithophile elements. As a result, the enstatite is extremely poor in trace elements, much poorer than, e.g., enstatite from the Bustee aubrite [3]. Abundances of Ce and Y also indicate that the REE pattern of the enstatite is fractionated with respect to that of chondrites and the Bustee enstatite. The fractionation pattern is similar to that of niningerite, which has trace element abundances similar to those of alabandite [e.g., 5]. Highly O-deficient and S-dominated formation conditions are indicated by the preferential partitioning of pyroxene-philic elements, such as Sc, Li, and Sr, into the sulfide phases.

Ninigerite has Eu and Sr depletions, a feature it shares with all other phases. The lack of an Yb depletion suggests that the Eu and Sr anomalies are not the result of incomplete condensation but rather of a diffusional communication between the aggregate phases and a Ca-rich reservoir (olhamite or plagioclase).

Because niningerite has not yet been found in aubrites, it appears that the Kaidun enstatite aggregates belong to the EH chondrite population previously described from Kaidun [1]. The niningerite composition overlaps with that of the high-MnS EH chondrite subgroup as identified by [6].

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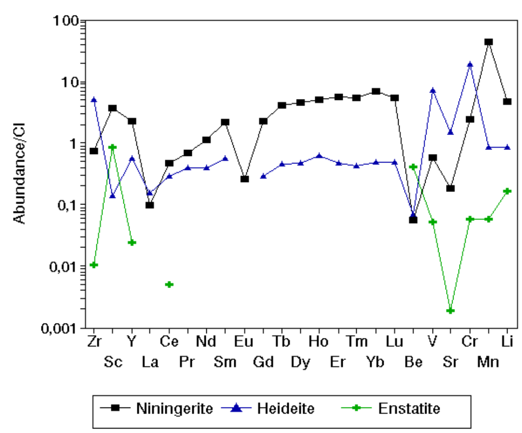

Figure: CI-normalized abundances of selected trace elements in co-existing enstatite, niningerite, and heideite in an enstatite aggregate from the Kaidun chondrite.