ZINC CONCENTRATION IN DAUBREELITES IN ENSTATITE CHONDRITES: EVIDENCE FOR DECREASING ABUNDANCE IN HIGHER PETROLOGIC GROUPS AND RELATIVE DEPLETION IN CHONDRULES. J. Chikami1,2, A. El Goresy2, and J. Janicke2, 1Mineralogical Institute, Graduate School of Science, University of Tokyo, Bunkyo-ku, Hongo 7-3-1, Tokyo 113 Japan (chikami@min.s.u-tokyo.ac.jp), 2Max-Planck-Institut fur Kernphysik, Postfach 103980, 69029 Heidelberg, Germany.

Introduction: Zinc is a moderately volatile element. It is expected to mirror the degree of equilibration in chondritic meteorites. Zn is mainly cited in sphalerite in E-chondrites [1]. However, daubreelite is known to contain various contents of Zn in the EH and EL groups [2]. Most of the petrologic criteria used for the classification of ordinary chondrites are not applicable to enstatite chondrites because textures and mineralogy of the E-chondrites reflect different formational histories [3]. We have conducted a detailed optical, SEM, and electron microprobe study of EH and EL chondrites to assess Zn-bearing sulphide assemblages and study the Zn-distribution in coexisting sulphides, specially daubreelite and sphalerite as a function of petrologic type.

Results: We measured major and minor elements including Zn in daubreelites in ALH 77295, Y 74370, Qingzhen (EH3), St. Marks, Kaidun, Indarch (EH4), and MAC 88180 (EL3). In the EH group there is a clear correlation between the Zn-content in daubreelite and the degree of equilibration. Zinc in daubreelites decreases from EH3 (4.0–8.0 wt%) to EH4 (~1.2 wt%). There is also a difference in the Zn-abundance between daubreelites in EH3 and EL3. Zinc concentration of daubreelites in EL3 (~2.8 wt%) is lower than those in EH3 (4.0–8.0 wt%). Daubreelites coexisting with sphalerite in ALH 77295 have higher Zn-contents (7 w%) than counterparts in the same meteorite not associated with sphalerite (4–5 wt%) in the same meteorite. The Zn contents of daubreelites in the matrix of MAC 88180 are distinctly higher than those in chondrules.

Discussion: Although the highly volatile trace elements show no evidence for a decrease in bulk abundance with petrologic [3], the decreasing Zn-contents of daubreelites from EH3 to EH4 seem to be not related with the abundance of sphalerite in these meteorites. Similar relationships were also found for the EL group (this study, and [2]). During equilibration of E-chondrites Zn diffuses from daubreelite to the coexisting minerals (presumably silicates). This may suggest an increase in fO2 during equilibration thus leading to incorporation of Zn in silicates as ZnO.

We find evidence for diffusion of Zn from sphalerite to the coexisting daubreelite in ALH 77295 (EH3). Microprobe Zn-profiles in daubreelites display positive concentration slopes to the neighboring sphalerites. In addition, daubreelites coexisting with sphalerites in ALH 77295 (EH3) show higher Zn contents than daubreelites in sphalerite-free assemblages.

The Zn depletion we find in daubreelite grains of chondrules in MAC 88180 is in excellent agreement with previous reports about Zn depletion in bulk chondrules [4–8]. Since chondrules are barren of sphalerite, the depletion of daubreelite in Zn reflects the bulk depletion of this element in chondrules. We interpret this feature as a result of Zn loss in the precursor material during the fusion process of chondrule formation.

Conclusions: (1) Zinc content in daubreelite decreases from lower to higher petrologic types in enstatite chondrites. (2) Zinc diffused from sphalerite to daubreelite in ALH 77295. (3) The low Zn contents in daubreelite in chondrules of MAC 88180 mimics Zn-depletion during chondrule formation.