KHOR TEMIKI: AN ENSTATITE ACHONDRITE WITH EVIDENCE OF MIXING OF METAL AND SULFIDES FROM SEPARATE SOURCES. Ntaflos Th., K. Keil and H. E. Newsom. Institute of Meteoritics and Department of Geology, University of New Mexico, Albuquerque, NM 87131

The Khor Temiki aubrite is a regolith breccia with highly variable REE contents [1,2]. Newsom et al. [2] studied numerous clasts (dark and light) and found that the dark clasts consist of enstatite and have variable REE contents, probably attributable to variable oldhamite contents. They conclude that the dark clasts were probably formed by impact blackening of Khor Temiki material and they are not the basaltic complement of the aubritic pyroxenites as suggested by [1]. We used thin sections from the irradiated clasts for further petrographic and microprobe studies and found new evidence, supported by the earlier data, that Khor Temiki contains material from at least two different sources that may or may not have formed in the same parent body.

Petrology: Thin sections of four irradiated clasts (KTG, KTR, KTC, KTK) and one nonirradiated sample (USNM 1551) consist mainly of enstatite with little olivine, diopside or plagioclase. Opaque phases enclosed by enstatite or embedded in the matrix, are troilite, kamacite, oldhamite, daubreelite, ferroan alabandite, djerfisherite and osbornite. Coarse grained enstatite up to 2 mm in length are rich in micron-sized vesicles. Many vesicles contain sulfides, like troilite, djerfisherite or Fe-Ni metal occupying less than 20 vol % of the vesicle area. These vesicles, found by SEM procedures, appear to be largly empty and are probably the same as those described by [3].

Unlike enstatite, olivine and diopside, which are compositionally homogeneous, plagioclase is slightly variable from An_7 to An_0. But the opaque phases and especially kamacite and troilite are highly variable in Si, Ni and Ti, Fe, Cr contents, respectively. The Si concentrations within kamacite range between <.02 (detection limit) and 1.81 wt % and the Ni concentrations between 0.10 and 5.2 wt % (Fig.1). There is no correlation between kamacite grain size and Si or Ni concentration. Likewise, there is no correlation between Ni concentration and whether the kamacite is enclosed by silicates or not. The variation in the Si content is large compared to the Ni variation. Like kamacite, troilite is highly variable in composition. Ti content varies between <.02 (detection limit) and 14.3 wt %. In Fig 1. Ti plotted against Fe illustrates a negative correlation which is the result of Ti^{3+} replacing Fe^{2+} and at least two populations: one with low Ti content up to 3.2 wt % and one with high Ti from 8.2 to 14.3 wt %. Daubreelite has been found to be Zn- rich (2.2 wt % Zn) like those from the enstatite chondrites [4]. Osbornite appears to be pure TiN and alabandite varies in Fe content between 12.5 and 18.5 wt %.

Discussion and conclusion: Keil [5] pointed out that the Ti distribution in enstatite achondrites is highly variable from meteorite to meteorite and within single meteorites. The only enstatite achondrite which has been found to be homogeneous with respect to the Ti in the troilite is Shallowater [6] with a Ti average of .62 wt %. We found also that Si in kamacite from Khor

Temiki is variable. Fig 2 shows at least two groups: one with Si less than .10 wt %, one between .70 and 1.10, and one metal grain with 1.81 wt %. The Ni content within the groups is variable, with almost constant Si concentrations.

The presence of at least two populations of troilite (high and low Ti content), the high and low Si content in kamacite, the high variability of the REE concentrations of the different clasts (some with positive and some with negative Eu anomalies) suggest mixing of at least two lithologies, i.e. metal and sulfides from one source with metal and sulfides from yet another source.

A magmatic origin for the enstatite achondrites, as opposed to a condensation origin is supported by our observation of vesicles in the enstatite which are now largely empty, but which also contain a small amount of metallic Fe-Ni or sulfides similar to vesicles are observed in many terrestrial magmatic environments [3].

References: [1] Wolf et al. (1983) GCA, 47, 2257, [2] Newsom et al. (1986) Meteoritics, 21, 469, [3] Roeder E., (1981) Bull. Mineral. 104, 339, [4] Keil K., (1968), J. Geophys. Res., 73, 6954, [5] Keil K., (1969) EPSL, 7, 243, [6] Ntaflos et al. in preparation

Fig. 1

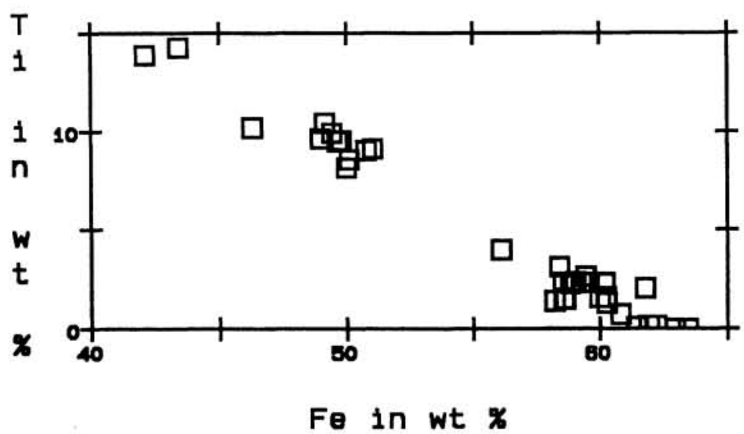

Fig. 2