**ATEM STUDY OF CA, FE-RICH PYROXENES IN MATRICES OF THE CV CHONDRITES ALLENDE, KABA, AND EFREMOVKA.** F.E. Brenker[1], A.N. Krot[2], H. Palme[1] and K. Keil[2]. [1]Institut für Mineralogie und Geochemie, Universität zu Köln, Zülpicher Str. 49 b, 50674 Köln (brenker@min.uni-koeln.de), [2]Hawai'i Institute of Geophysics and Planetology, University of Hawai'i at Manoa, 1680 East-West Road, Honolulu, Hawai'i 96822, USA.

**Introduction:** The CV3 carbonaceous chondrites have been recently divided into the oxidized, Allende-like and Bali-like, and reduced subgroups largely based on secondary minerals such as nepheline, sodalite, phyllosilicates, ferrous olivine and Ca,Fe-rich silicates (salite-hedenbergite pyroxenes and andradite) [1, 2]. The origin of these secondary minerals remains controversial; high-temperature nebular [3] and low-temperature asteroidal [2] models have been proposed.

The fine grained olivine-rich matrix of Allende accounts for about 45 % of the meteorite. The CaO content of matrix (2.6 %) is similar to that of the bulk meteorite. However, 90% of CaO in matrix is concentrated in comparatively large aggregates of Ca,Fe-rich minerals (salite-hedenbergite pyroxenes and andradite). In an earlier TEM study by Brenker et al. [4] it was concluded, based on pyroxene structures, that the Ca,Fe-minerals in the Allende matrix were formed at 1050°C in the nebula. Krot et al. [5] found that the Ca,Fe-rich minerals in the Allende dark inclusions (DIs) are chemically similar to those in the Allende host, but occur as veins in and as rims around DIs and as precipitates in Allende matrix surrounding DIs. The apparent transport of CaO from DIs into surrounding matrix requires a parent body process for the formation of Ca,Fe-rich minerals. In an attempt to resolve this problem, we have begun a detailed TEM study of the Ca,Fe-pyroxenes and minerals associated with them. The first ATEM-studies were done on Ca,Fe-rich minerals in matrices of the Allende, Kaba (Bali-like CV) and Efremovka (reduced CV) meteorites using a Philips CM12 and CM30 with attached energy disperse microanalyser using analytical transmission electron microscopy (ATEM).

**Results:** TEM analyses of the Ca,Fe-rich pyroxenes in the Kaba matrix revealed that the uncommon structure of hedenbergitic pyroxenes found in the Allende matrix [4] does not occur even in pure hedenbergite. The difference can be explained by lower formation temperatures (below 970°C) or lower cooling rates (<10°/h) of the Kaba Ca,Fe-rich pyroxenes compared to those in Allende. Furthermore, the Kaba pyroxenes are free of voids in contrast to observations in Allende pyroxenes.

In the Efremovka matrix we found, so far, only pyroxenes with comparatively high Mg-contents, which are not indicative of a possible pyroxenoid precursor. Microtwinning of pyroxene was found in all samples and is commonly thought to be related to high stress deformation processes probably during collisions.

Detailed TEM work of the other occurrences of Ca,Fe rich minerals and a new calibration of the EDX system is in progress. Accurate experimental k-factor determinations for the analyses of major elements (Ca, Fe, Mg, Si, O) will allow to estimate minimum temperatures for all analyzed pyroxenes.

**Discussion:** The first results of this study indicate that there are differences in the structure and composition of Ca,Fe-pyroxenes among CV-meteorites. It is thus possible that Ca,Fe-rich phases in the matrix of Allende have formed at high temperatures in the nebula [4], while Ca,Fe-rich pyroxenes in the Kaba matrix formed at lower temperatures or at lower cooling rates than those in Allende.

Accurate measurements of the composition of pyroxenes in different settings should allow a better quantification of the formation condition and a clarification whether the pyroxenes were formed during high temperature processes or aqueous alteration.

**References:** [1] Weisberg M.K., et al. (1997) *Meteoritics & Planet. Sci., 32,* A138-A139; [2] Krot, A.N. et al. (1998) *Meteoritics & Planet. Sci., 33,* 1065-1085; [3] Palme H. and Wark D. A. (1988) *Lunar Planet. Sci., XIX,* 897-898; [4] Brenker, F.E., et al. (2000) *Earth Planet. Sci. Lett., 178,* 185-194. [5] Krot, A.N, et al. (1998) *Meteoritics & Planet. Sci., 33,* 623-645.