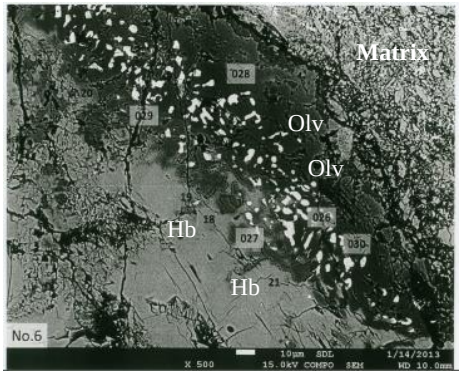
AN INTERESTING PLACE TO SEARCH FOR PRE-SOLAR Ca & Ti

Typhoon Lee[1,2], Bernd Liebig[1], Zan Peeters[1], and Cheng-Kai Wang[3]. [1]Nano-SIMS Lab, Inst. Astron. and Astrophys., Academia Sinica, Taipei, Taiwan typhoon@asiaa.sinica.edu.tw [2] Inst. Earth Sci. [3]Geoscience Dept., Nat'l Taiwan Univ.

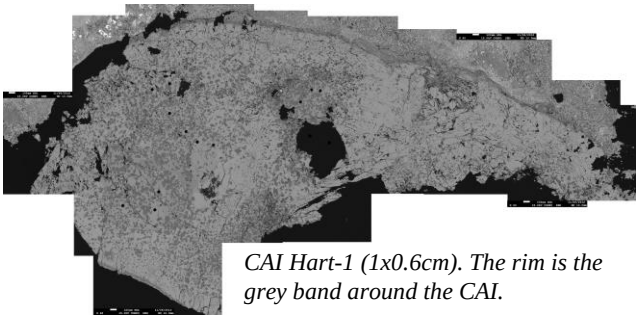
We have found a type-B Allende CAI surrounded by a thick (30~60um) rim. It separates the Mg-spinel + melilite CAI interior from the fine grain matrix. The rim phases include 1) hibonite ($CaO \cdot 6Al_2O_3$) ≤ 30um; 2) perovskite ($CaTiO_3$) ≤ 7um; and 3) coarse-grained forsteritic olivine. We devised the following scenario: the initial temperature was high enough to melt the most refractory major element solid, Al_2O_3 (~1758K), whereas type-B CAIs cooled from molten liquid droplets. Since the spinel were included inside the melilite, their condensation temperature must be lower than that of the spinel (~1513K). Sometime after the formation of CAI, there was again very intense heating of the CAI, either by the solar nebula or by fluid in parent bodies. The highest temperature reached must be also close to that of $CaTiO_3$ (~1647K) and hibonite, as evidenced by the heavily-etched texture. Since condensation temperature of the minerals in the rim spanned a 200K range, they were not in thermal equilibrium. If solar nebula was the reactant, then the reaction must have taken place very close to the hot proto-star. In addition, for some of the solid to survive the trip, the CAI must have traveled fast.

Perovskite was easily identifiable by SEM-BSE. We speculate that the chances of CAIs collecting pre-solar perovskite should be high. Ca 48 and Ti 50 were believed to have been made by neutron-rich equilibrium nucleosynthesis inside a rare type of SN-I. In fact, isotopic anomalies caused by this component have been observed in differentiated meteorites as well as whole rock CAIs.

We have also developed the technique to measure Ca and Ti isotopes on 5um spot with per mil precision. Hopefully, this will shed new light on supernova research.



Area no. 6 of CAI Hart-1. Scale bar is 10um. Bright spots represent $CaTiO_3$. Hb marks hibernate. Olv marks olivine. CAI interior is to the left of the diagonal line.



CAI Hart-1 (1x0.6cm). The rim is the grey band around the CAI.