**THERMAL PROCESSING OF ALLENDE COMPONENTS IN A TRANSIENT PARENT BODY ATMOSPHERE;** T.E.Bunch, S.Chang, D.Blake, Planetary Biology Branch, P.Cassen, R.Reynolds, Theoretical Studies Branch, NASA - Ames Research Center, Moffett Field, CA. 94035, M.Podolak, Dept. of Geophysics and Planetary Sciences, Tel Aviv Univ.,Ramat Aviv, Israel 69978,and J. Erlichman, TMA Corp.,2030 Wright Ave.,Richmond, Ca. 94804.

Postulates have been made to the effect that CAI's in Allende were thermally altered during a steep thermal gradient event of short duration (1,2,3,e.g.). Particular attention has focused on Wark-Lovering rims. Murrell and Burnett (4) critiqued various hypotheses for the origin of these rims and stated that while the ablation theory (5) was an interesting concept, it faced petrographic problems, namely (a) "fluffies"or FTA's (6) were too fragile to survive deceleration; (b) can spontaneous volatilization be accompanied by chemical fractionation (?) and, (c) where is the vesicular structure common to meteorite ablation in the earth's atmosphere(?). To address these problems, we have examined large (2-3cm) fluffies, which are analogous to our thermally processed stage 4 classification (2) and conclude that they became "fragile" during thermal processing, possibly in a parent body atmosphere. These objects are convoluted masses of refractory rims and nodules, with little remaining precursive material. They represent a refractory residuum from the conversion of primary minerals, gehlenite + spinel + perovskite to secondary products, grossular + anorthite + hibonite + fassaite + diopside and, with later incorporation of Fe and alkalies, Fe- bearing spinel + nepheline + hedenbergite + olivine + andradite. Petrographic characteristics clearly indicate extreme plastic distortion during and after the formation of secondary products. The growth of hibonite from gehlenite and perovskite with subsequent conversion to spinel + second generation perovskite in arrested thermal fronts is clearly indicated (Fig.1) and is analogous to similar reactions and textures in used ceramic linings in steel furnace components. Further, thermal decomposition of spinel + perovskite resulted in the formation of a new unidentified phase ($TiO_2$ = 27; CaO = 21; $Al_2O_3$ = 34; MgO = 16; $ZrO_2$ = 0.3 )(Fig.1). Residuum masses are bordered by diopside + hedenbergite and finally olivine. Further reactions created large clumps of vesiculated, choatic material that surroundes FTA's in a discontinuous manner. Multiple physicochemical conditions prevailed, apparently due to highly localized conditions. Definitive answers to (b), await simulation experiments. As for (c), vesicular, choatic-like material is present and may have formed in response to ablation heating. Moreover, conditions of a transient, small body atmosphere were considerably different compared to the earth's and may not have produced extensive vesicular textures. We have noted aerodynamically shaped tear drop objects on the surfaces of rounded CAI's and Allende chondrules. In addition, we observe that all Allende components, even mineral fragments, show external high- temperature modifications. The thermal event that was responsible for processing CAI's was also common to other chemically and texturally distinct objects. All modifications involved high $fO_2$, relative to the nebula, and Fe and alkali enrichments during short-term heating. Lastly, Fe-rich olivine in processed mantles of chondritic objects, commonly contain minor element contents (Cr, Ti, Al, P, S, Na ) consistent with olivine in rimmed objects (7) and may have contributed heavily to the matrix population by comminution in the regolith.

We conclude that the above characteristics,among others,are inconsistent with condensation formation. Murrell and Burnett are probably correct in their conclusion that thermal modifications involved multiple processes. We prefer to account for many of these modifications by ablation heating in a dusty environment consistent with (5).Simple mathematical models have been constructed for an isothermal atmosphere about an accreting body to study the conditions for melting of CAI's (8). For these calculations, equilibrium was assumed between the atmospheric flux being librated at the surface by the impact outgassing of accreting objects and the blow-off flux of an escaping atmosphere. Representative parameters suggest a surface pressure of a few millibars for a growing body of some 1000 km radius. This is sufficient to cause melting of incoming objects. The scale height of such an atmosphere would be about 35 km, consistent with that needed for rapid melting.

The 1000km radius estimated above could be considerably smaller in reality. Constant impacts on the body would insert a considerable amount of fine dust into the atmosphere. This dust would tend to concentrate at altitudes where the sedimentation speed of the dust particles equals the blowoff speed of the escaping atmosphere. This has two important effects. First, by blocking the escaping gas, the dust would increase the amount of temporary atmosphere around a body of given size, i.e.,bodies smaller than 1000 km could still be able to retain a temporary atmosphere capable of melting small particles. Second,