

we also noticed two groups of (LT/HT) ratios: one group with a short decay period had sample weights greater than $3w_{1/2}$ while the other group, with longer decay period, had sample weights less than $3w_{1/2}$. However, repeated experiments have given large fluctuations in the (LT/HT) ratios: this fact casts doubt on the reliability of this method of interpreting the TL glow curves for chronology.

If a grouping dependent upon sample weight does exist, the process by which the ratios are altered could possibly be described by the 'transfer of energy' (Curie, 1960) from the 160°C TL centres in the lower layers in the powder sample to the 240°C TL centres in the upper layers. One possible mechanism for energy transfer is photo-transfer of thermoluminescence (PTTL); such properties have been noticed for quartz by Bailiff (1977) and Schlesinger (1965). Preliminary studies with Allende have indicated that illumination with uv radiation (256 nm ; $0.03\text{ Joule cm}^{-2}$) can produce an alteration in the (LT/HT) ratio. Such effects as PTTL could also, if not properly allowed for, lead to fluctuations in the (LT/HT) ratios. Mills *et al.* (1977) report that their experiments were conducted in room lighting and with sample weights greater than $7w_{1/2}$. It is possible that, under their experimental conditions, the effect noted above with Allende was also present in their data. Further work is continuing to decide whether the 'two groups' may be explained by the presence or absence of this effect in particular meteorite samples, or whether the effect leads to uncertainties or changes in (LT/HT) ratios for all meteorite samples.

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CONDENSATION IN SUPERNOVA EJECTA

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Pre-supernova stars are thought to consist of concentric spherical shells, containing unburned fuel in the outermost zone and products of static H-, He-, C-, O- and Si-burning in progressively deeper interior zones. Supernova detonation causes explosive burning of the matter in each zone and its ejection from the star. The gaseous ejecta may expand and cool to condensation temperatures before appreciable mixing occurs between adjacent zones. Because each zone has a different elemental and isotopic composition, the condensation sequence and isotopic compositions of

condensates are different in each. Full equilibrium condensation calculations have been carried out for compositions representative of the various zones, taking into account the pressure decrease due to adiabatic expansion and condensation and variations in the C/O ratio and initial total pressure. Explosive H- and He-burning zones have similar compositions and condensation sequences. They resemble the familiar solar sequences but are displaced to higher temperatures relative to them as the same total pressure and C/O ratio. This is due to the absence of H which, in solar cases, dilutes the partial pressures of other elements and, at $C/O < 1$, binds available O in the stable molecule H_2O . In the explosive C-burning zone, the Ca/Al ratio is much less than the solar ratio. Al condenses mostly as corundum and spinel and Ca as melinite, diopside, perovskite and merwinite. Forsterite coexists with MgO but enstatite does not form due to the low Si/Mg ratio. Fe condenses directly in silicate solid solutions at high temperature. At $C/O > 1$, CaS forms instead of Ca-silicates and C, Fe, SiC and TiC form at high temperature. In the explosive O-burning zone, Ca/Al and Si/Mg ratios are much higher than solar. Most Ca condenses as Ca_2SiO_4 , $CaSiO_3$ and CaS and most Si as Ca-silicates, SiO_2 and metallic Si. Al and Mg form relatively minor phases, such as corundum, melilite, perovskite, grossular, anorthite, diopside, enstatite and MgS. Metallic Fe condenses. In the explosive Si-burning zone, Fe, Si, Ti and CaS form. Many of the condensates from supernova ejecta are also stable against evaporation in a gas of solar composition at high temperature. Grains which formed in supernova ejecta were thus potential sources of exotic isotopic compositions in the early solar system.

THE ALLENDE METEORITE: A NEW TITANATE IN CONDENSATES FROM THE EARLY SOLAR NEBULA

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A new titanium-bearing opaque mineral oxide which has optical properties that approach that of perovskite but with purple internal reflections, orthorhombic symmetry, and having both Ti^{3+} and Ti^{4+} , has been identified in two coarse grained Ca-Al-Ti (CAT)-rich inclusions in Allende. Associated minerals are olivine ($Fe_{0.97-88}$), anorthite (An_{100}), spinel ($MgAl_2O_4$, containing 0.2-0.6 wt % FeO), Ti^{3+} -bearing armalcolite ($FeMgTi_2O_5$), diopside ($Wo_{39.6}En_{59.7}Fs_{0.7}$), enstatite ($Wo_{6.2}En_{93.2}Fs_{0.6}$), and Ti-fassaite (Al-clinopyroxene with $Ti_2O_3 < 1-7$ wt %). Electron microprobe analyses of 16 crystals (10-100 μm) of the new phase and computed Ti^{3+} contents, show that it is a member of the solid solution series $R^{2+}R_3^{4+}O_7R_2^{3+}R_2^{4+}O_7$; where $R^{2+} = (Mg, Ca, Mn, Fe)$; $R^{3+} = (Al, Cr, Ti)$; and $R^{4+} = (Ti)$. Solid solution between these end members is accomplished by $2R^{3+} \rightarrow R^{2+} + R^{4+}$: the divalent component is essentially a substitution between Ca and Mg