NEW COMPOUNDS AND PHASE RELATIONS, IMPLICATIONS FOR REFRACTORY INCLUSIONS IN METEORITES; P. E. D. Morgan and E. A. Pugar, Rockwell International Science Center, Thousand Oaks, California 91360.

Several new compounds that could affect the reaction sequences in refractory inclusions in meteorites have been synthesized.

Studies of the Ca-Ti-Al-O system have revealed a new compound, CaTi3Al8O19 (CTA). A magnetoplibite (MP) related monoclinic compound, it probably has pseudobrookite-like layers replacing the spinel layers of MP. CTA is stable up to ~1400°C, decomposing at higher temperature to CaTiO3, TiAl2O5 and Al2O3. The cell parameters are a = 2.2580 nm, b = 1.1043 nm, c = 0.9744 nm, β = 98.83°, space group C2/c or Cc. Preliminary work indicates that perovskite, CaTiO3, and corundum are not phase compatible below 1400°C although reaction is extremely sluggish. CTA has been best prepared by very slow heating of mixed precursors made from soluble nitrates, alkoxides, etc. (1). The similar structure to MP and recent lattice fringe imaging work (2) strongly suggest that syntactic intergrowths of this compound with hibonite, CaAl12O19, are possible and may explain nonstoichiometries already seen in e.g., the Essebi (CM2) meteorite (3). The CTA appears to be phase compatible with CaTiO3, CaAl4O7, CaAl12O19, TiAl2O5 (above ~1250°C) and TiO2.

Studies in the Ca-Si-Al-O-N system have revealed the potential for coupled substitution of Si-N for Al-O in several compounds including gehlenite, Ca2Si1+xAl1−xO, x = 0–1, and the CaAl4O7 type. The presence of nitrides such as Si2N2O and TiN in carbonaceous chondrites strongly suggests the possibility that such compounds could have played a role, along with "Alon" ("Al3O3N" cubic spinel) solid solutions, in highly reducing environments (e.g., (4)). Surprisingly, a variety of experiments has failed to achieve the coupled substitution of nitrogen into the spinel block of hibonite. Two new unknown oxynitrides have already been discovered in this system and are under study.

N-gehlenite is tetragonal, a = 0.7678 nm, c = 0.5024 nm, N-CaAl4O7, monoclinic, a = 1.2860 nm, b = 0.8845 nm, c = 0.5446 nm, β = 106.98. The substitution of Si-N for Al-O leads always to a unit cell volume reduction as expected from the appropriate radii.

A search for CTA, pure or as syntactic intergrowths (by lattice fringe imaging), and careful analysis of refractory inclusion crystals for nitrogen or high Si/Al ratios is suggested.