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The nitride-sulfide connection in CM chondrites

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CM2 chondrites contain assemblages of chromium nitride (carlsbergite) and nanocrystalline, phosphorus-bearing pentlandite. The physical characteristics of the nitride crystals suggest that they precipitated from Cr-bearing metal immediately prior to a sulfidation event. The most plausible explanation for the high nitrogen enrichments in these assemblages (~1 wt% N) is the reaction of the metal grains with a hot gas containing metastable ammonia (NH_3).

In the CM2 chondrite Yamato 791198, the reduced nitride-sulfide assemblage is found in association with schreibersite, relict grains of Cr-bearing Fe,Ni metal and an outer, oxidized rim of Fe-poor pyrrhotite, normal pentlandite and magnetite. The rim mineralogy is consistent with a formation in a sulfur-enriched and oxidizing gas. The mineralogical disequilibrium indicates a kinetically rapid and incomplete sulfidation process.

Based on the mineralogical constraints and additional isotopic investigations and thermodynamic calculations, we will discuss the formation of the nitride-sulfide assemblages and their implications for the existence of volatile reservoirs in the formation region of the CM chondrites.

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