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# MINERALOGY OF STARDUST COMETARY GRAIN T112: SIMILARITY TO AMOEBOID OLIVINE AGGREGATES.

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Introduction:

The successful analysis of comet 81P/Wild 2 particles returned by the Stardust mission has revealed that the Wild 2 dust contains abundant silicate grains that are much larger than interstellar grains and appear to have formed in the inner regions of the solar nebula [1]. Wild 2 particles include minerals which are isotopically and mineralogically similar to CAIs [e.g., 2], chondrules [e.g., 3], and amoeboid olivine aggregates (AOAs) [e.g., 4] in chondrites. In this study, we have examined the mineralogy of the Track 112 particle and compared the possible relationships between T112 and AOAs.

Results and Discussion:

Our two TEM grids from T112 are dominated by 4 micron -sized forsteritic olivine. Submicron sized chromite is associated with the olivine. The olivine from T112 is near end-member forsterite, but shows a slight enrichment of Fe toward the grain rim. In the least metamorphosed chondrites, most AOAs consist of forsterite. Enrichment of olivine in fayalite component is correlated with petrologic subtype of a host meteorite [5]. In CV chondrites, Fe-enrichment is distinct in Allende (petrologic type $>3.6$). The Fe enrichment on the rim of T112 olivine may have been caused by a minor degree of thermal processing after the condensation of forsterite.

From EDS analyses, the chromite grains have high Cr2O3 content (up to 65 wt. %), and yield Al-absent compositions with intermediate Mg# ; however, it is likely that some Mg detected by EDS is from neighboring olivine and that the grains are closer to pure chromite in composition. Chromite is a minor phase in Wild 2 particles. Cr-rich spinels have been identified in the chondrule-like particle Torajiro [3] and associated with Coki-B Kool fragments (T141 [6]); however, these spinels have significant Al2O3.

Three possibilities for the formation of chromite can be considered: (i) direct condensation from a gas; (ii) crystallization from chondrule melt; (iii) metamorphism/aqueous alteration. (i) Modeling by [7] predicts that Cr-rich spinel crystallizes in mixed vapor + silicate liquid + refractory solid reactions at high temperatures in dust enriched systems, but always with significant Al2O3. (ii) This modeling [7] also shows that chromite is stable with silicate liquid at high dust enrichment, but textures of T112 particle do not appear to be typical of chondrules. Furthermore, the 16O-rich composition of olivine in the potted butt sample from (T112) is more consistent with AOAs than chondrules. (iii) Tiny Cr-rich grains surrounding olivine in type 3 ordinary chondrites were identified by [8] as products of incipient metamorphism. The T112 chromite might have a similar origin.

The forsteritic, 16O-rich composition of T112 olivine suggests a condensation origin. Slight enrichment in Fa-content along the olivine rim suggests some metamorphism. At this point, we consider metamorphism the most likely origin of T112 chromite.

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