CHONDRULE FRAGMENTS IN STARDUST TRACKS 113 AND 154

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Introduction: Recent studies of terminal grains collected by the *Stardust* mission from Comet Wild2 have unexpectedly revealed fragments of Fe-Mg chondrules, an Al-rich chondrule [1-3] and a CAI [4]. Here we show further evidence for two different types of chondrules in Tracks 113 and 154. These studies have the potential to show affinities between Wild2 and known chondrite groups and components.

Samples and Techniques: Three TEM sections prepared by NASA-JSC from terminal grain #5 of Track 113 and three sections from terminal particle #2 from Track 154 have been studied with a Jeol 2100 ATEM at 200 kV. Mineral compositions were calculated using a PGT-EDS system and Cliff-Lorimer technique.

Mineral Assemblages: Track 113 terminal grain 5 is predominantly low-Ca pyroxene (En 86-87% Wo 3-4%) with lesser amounts of a Na-rich phase. The composition of the most Na-rich areas analysed within the Track 113 grain is 19-25 wt% Na_2O, 27-29 wt% Al_2O_3 and 40-41 wt% SiO_2, giving atomic ratios of Na:Al:Si:O 0.9-1.2: 0.8: 1.0: 4.O This is close to nepheline $NaAlSiO_4$ stoichiometry. Al_2O_3 contents in the Track 113 grain pyroxene range up to 2 wt% and TiO_2 was not detected. In contrast the Track 154 pyroxene (diopside, pigeonite and enstatite) has up to 15.5 wt% Al_2O_3 and 1.5 wt% TiO_2. No relict mesostasis has yet been identified in this sample.

Similarities to Chondrule Mineral Assemblages: The nepheline-like phase in Track 113 is similar to mineral assemblages found within the mesostases of some chondrules. About 7% of Chainpur (LL3) chondrules contain Na-, REE-rich phases formed by partial devitrification of silica-undersaturated mesostases. Feldspathoids like nepheline may be even more common in carbonaceous chondrites [5]. Typically Na-rich, silica undersaturated mesostasis is present within enstatite-rich chondrules and that is also consistent with the Track 113 assemblage. It may have resulted from the presence of Na-rich fluids whilst the chondrule was still molten [5] although low temperature hydrothermal alteration has also been invoked to explain concentrations of Na within chondrules [6]. The Track 113 sample differs from the chondrule mesostasis identified in a Comet Wild2 chondrule fragment by [1], some of which was silica oversaturated. The Track 154 grain pyroxene assemblage and composition shows that it is a fragment of an Al-rich chondrule whereas we suggest that Track 113 terminal grain #5 is a fragment of an enstatite-rich chondrule with patches of nepheline-like mesostasis. Thus our work and that of other researchers is showing that Comet Wild2 contains a diverse range of chondrule and CAI types similar to those present in carbonaceous chondrite groups.

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