ON THE ABUNDANCE OF PRESOLAR SILICATE AND OXIDE GRAINS IN PRIMITIVE METEORITES.

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Introduction: The discovery of presolar silicates in IDPs and meteorites [1-3] has opened new opportunities. Isotopic analyses of elements other than oxygen are expected to provide new information on nucleosynthesis in the parent stars of the grains. [2, 4, 5]. Identification of the mineralogy and chemical composition of the grains can provide constraints on the stellar atmospheres from which the grains condensed, but only limited information exists [2, 6]. Finally, the abundance of presolar grains in different types of meteorites is expected to provide information on conditions in the early solar system.

Results: Using the experimental approach employed in the analysis of a polished section of Acfer 094 [5] we have extended our NanoSIMS search for presolar silicates to the CO3.0 meteorite ALH77307. This search resulted in the discovery of 9 presolar silicates and 5 presolar oxide grains. While based on the NanoSIMS analysis we tentatively identified two grains as corundum and three as spinel, Auger spectroscopy showed that one of the "corundum" grains is actually a hibonite grain [7]. It is quite possible that some grains from other studies thought to be corundum on the basis of their high Al content are also hibonite. Four silicate grains were also analyzed by Auger spectroscopy. Three of them are Mg- and one is Fe-rich [6]. The abundances of silicates and oxide grains are inferred to be ~75ppm and ~40ppm, respectively. This compares to ~180ppm and ~110ppm for these grain types in Acfer 094 [4, 5].

Discussion: There are considerable uncertainties in estimating the abundances of small presolar grains in primitive meteorites. Analysis of tightly packed spinel grains from Murray acid residues by isotopic raster imaging in the NanoSIMS [8] shows that the detection efficiency of presolar grains <0.5 μm is less than 100% and thus the abundances given above are only lower limits. Detection efficiencies are even lower for direct imaging searches with the IMS 1270 equipped with SCAPS and might not be constant for different searches [9]. The fact that presolar silicate abundances in Acfer 094 and ALH77037 are much higher than in Bishunpur (LL3.1) Semarkona (LL3.0) and Murchison (CM2) [10, 11] has been attributed to destruction in the latter, less primitive, meteorites. However, abundances of oxide grains, believed to be less susceptible to destruction by metamorphism and aqueous alteration, in the former two meteorites are also much higher than in CM2 meteorites [12]. Thus, either destruction processes affect both grain species in a similar way or there are large differences in presolar grain abundances between the formation regions of different meteorite classes.

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