PRELIMINARY IDENTIFICATION OF A HEAVY-NITROGEN-CARRYING PHASE IN IDPs. T. Stephan[1] and F. J. Stadermann[2], [1]Institut für Planetologie/ICEM, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany, e-mail: stephan@uni-muenster.de, [2]Laboratory for Space Sciences, Physics Department, CB 1105, Washington University, St. Louis MO 63130, USA.

Introduction: The investigation of elemental and isotopic heterogeneities within single interplanetary dust particles (IDPs) is a major challenge in cosmochemistry today. Although mainly chondritic in bulk chemistry, these objects often consist of submicrometer sized mineral grains with varying chemical composition. The investigation of isotopic heterogeneities may help to locate possible presolar components in IDPs.

Nitrogen isotopic anomalies up to $\delta^{15}N$=+480 ‰ have been reported for various particles [1] and the highest ^{15}N-enrichment ($\delta^{15}N$=+813 ‰) found in any IDP has been reported recently for a 400 nm sub-grain within the particle 'Aurelian', which was analyzed with the new Washington University NanoSIMS [2].

TOF-SIMS is a powerful tool to analyze elemental compositions of small samples [3]: All secondary ions of a given polarity are measured simultaneously at comparable lateral resolution (~200 nm) and only a few atomic monolayers are consumed during a typical analysis.

Here we report our first results from TOF-SIMS analyses of IDP Aurelian, performed after ims3f [4] and NanoSIMS [2] measurements, in order to identify the carrier of the observed ^{15}N-enrichment.

Sample and Analytical Details: Aurelian was pressed into high-purity Au foil after crushing between quartz plates as part of the previous study [4]. Although most of the particle had been sputtered away during the ims3f analyses, several small remnants were still available for NanoSIMS and TOF-SIMS measurements.

Several areas of Aurelian, including the one with the ^{15}N-excess, were analyzed with TOF-SIMS. To remove surface contaminants the sample was sputter-cleaned with an Ar^+ ion beam prior to these measurements.

Results and Discussion: Quantitative results for four different fragments of Aurelian and the ^{15}N-enriched area are shown in Fig. 1. Si is highly enriched in this particle, possibly due to residual silicone oil from particle collection. From their spatial distribution, Li, Na, and K enrichments can be attributed to contamination effects. Therefore, the major difference between the ^{15}N-rich sub-unit and the rest of the particle is the Mg content. Although a clear identification of this phase based on TOF-SIMS results is not possible, a (Mg+Fe)/Si-ratio of 1.6 and an O/Si-ratio of 4 suggest olivine as a major constituent. This olivine would be almost pure forsterite with Mg/Fe=15.

Compared to the rest of the particle, the ^{15}N-rich area is also C-enriched. Therefore, an organic phase in close connection to the proposed forsterite is the most plausible heavy-nitrogen carrier in Aurelian.

Conclusions: Mg-rich, Fe-poor IDPs have been suggested as possible candidates for cometary particles and carriers of interstellar grains [5,6]. Although the overall particle has an almost chondritic Mg/Fe-ratio (1.4×CI), the strong ^{15}N-enrichment localized in a probably pure forsteritic grain of Aurelian supports the suggested connection between primitive molecular-cloud material and Mg-rich, Fe-poor interplanetary dust.

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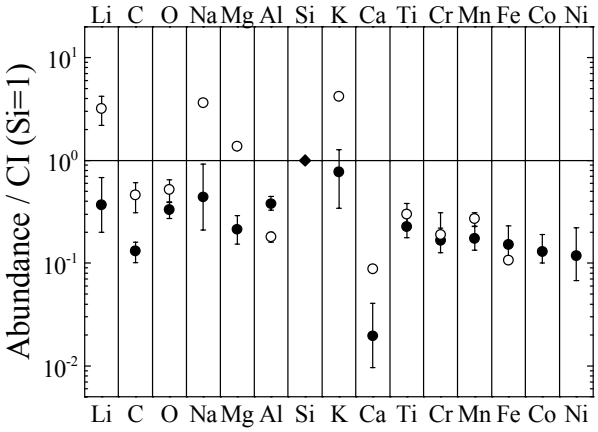

Fig. 1. Relative element abundances normalized to Si and CI chondrites for 'bulk' material (solid symbols; bars give range for four different fragments) and the ^{15}N-enriched area (open symbols; here error bars are statistical 1σ-uncertainties) of particle Aurelian.