in other areas of micrometeorite research. For example, because of the numerous dust rings recently discovered around nearby stars [e.g. Vega (Weissman, 1984)], the ability to measure track densities in small IDP's enables determination of actual lifetimes of particles orbiting stars.

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Mg ISOTOPIC MEASUREMENTS IN FINE-GRAINED Ca-Al-RICH INCLUSIONS

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A study of the Mg isotopic composition and mineralogy of fine-grained, Ca-Al-rich inclusions has been initiated, to search for isotope fractionation and for excess $^{26}Mg^*$ due to the decay of ^{26}Al. It is important to establish whether there is evidence, in these inclusions, of isotopic heterogeneity, whether $^{26}Mg^*$ is correlated with Al/Mg, and whether there is a correlation of the isotopic effects with mineralogy. Fine-grained inclusions were identified in slabs of Allende; half of each inclusion was used for a thin-section and the other half was sampled and analyzed for Mg, either by the direct-loading technique or after dissolution and chemical separation. Analyses of both acid soluble phases and residues were obtained. The mineralogy of most of the inclusions, determined on the SEM, consists of sodalite, nepheline, and Mg-spinel, with minor plagioclase and Fe-Mg-pyroxene. One inclusion (BG82D-I) is distinctive, and consists primarily of hibonite, sodalite, and nepheline with trace anorthite and hercynite; no Mg-spinel was observed. We show (Table 1) Mg isotope fractionation factors (F_{Mg}) and $\delta^{26}Mg$ values. Most inclusions display small isotope fractionation favoring the lighter isotopes (negative F_{Mg}) and hints of excesses in ^{26}Mg. The small $\delta^{26}Mg$ in bulk aggregates are consistent with relatively high Mg concentrations and low Al/Mg (3.4% Mg for BG82C-M and 3.7% for A47-2). The hibonite-rich inclusion (BG82D-I) displays a significant isotope fractionation factor and a large $^{26}Mg^*$; the latter is correlated with high Al/Mg (0.2% Mg for the soluble portion and 0.1% Mg for the hibonite residue). There is a hint of intrinsic isotopic heterogeneity in this inclusion as seen by the small differences in F_{Mg} between the residue and soluble parts. The significant differences in $\delta^{26}Mg$ show that this inclusion was not homogenized after ^{26}Al decay. In summary, one halogen-rich inclusion with a high Al/Mg displays large excesses in ^{26}Mg and large isotope fractionation favoring the lighter isotopes, while most other fine-grained inclusions show small F_{Mg} in the same direction (Niederer and Papanastassiou, 1984; Papanastassiou *et al.*, 1984; Esat and Taylor, 1984). This is in contrast to the positive fractionation factors typical of coarse-grained CAI. It is difficult to reconcile the fractionation effects and low Mg content of BG82D-I with a replacement process, originating from a coarse-grained CAI. Fractionation factors favoring the lighter isotopes may be indicative of kinetic effects due to formation of the fine-grained inclusions by "early" condensation or by later condensation from a vapor phase enriched in lighter isotopes (Niederer and Papanastassiou, 1984).

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Table 1
Mg Analytical Results

Sample[a]	F(Mg)[b] ‰ amu^{-1}	$\delta(^{26}Mg)$[c] ‰	DLT[d]
BG82D-I-s	− 5.6 ± 0.7	21.0 ± 0.1	N
-r	− 9.3 ± 0.5	47.2 ± 0.2	Y
-t[e]	− 6.3 ± 1.9	35.2 ± 0.6	Y
A47-2 -s	− 0.2 ± 0.3	1.0 ± 0.1	N
-r	− 1.5 ± 0.3	0.74 ± 0.07	Y
BG82C-M-s	− 1.8 ± 0.3	1.1 ± 0.2	N
-r	− 3.6 ± 0.3	1.3 ± 0.2	Y
A47-1 -t	− 1.6 ± 0.6	0.6 ± 0.1	Y
BG82I-C-t	− 2.7 ± 0.5	1.4 ± 0.2	Y
BG82I-I-t	− 3.0 ± 0.2	0.98 ± 0.07	Y

[a]s = Soluble; r = Residue; t = Total.
[b]Fractionation factor (2σ) is calculated from the measured values for $^{25}Mg/^{24}Mg$ relative to the raw measured value for normal, $(^{25}Mg/^{24}Mg)_N$ = 0.12475. Reproducibility for F_{Mg} is ± 1.5‰ amu^{-1}.
[c]Deviations in $^{26}Mg/^{24}Mg$ (2σ mean) from normal after fractionation correction.
[d]Y: Samples analyzed by the direct loading technique (DLT). For these samples a bias of 1.5‰ has been added to the reported $^{26}Mg/^{24}Mg$ due to high $^{27}Al^{+}/^{24}Mg^{+}$. N: Mg chemically separated; not subject to bias.
[e]From Papanastassiou *et al.*, 1984.

SAMPLE RETURN FROM A COMET FLYBY

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Sample collection and return to the Earth from a fast fly through of a cometary coma is the simplest sample return mission possible from any extraterrestrial body. The mission can provide valuable laboratory samples from a known cometary body and it can do it at low cost, within our lifetimes. In the flyby mission, dust particles and possibly some gas samples are collected at high velocity and then sealed into a capsule until return to the laboratory. The spacecraft itself is launched on a free return trajectory and the capsule is recoverable, either by direct entry into the atmosphere or by aerobraking and recovery from Earth orbit.

In comparison with a robotic surface collection approach, such as was used with the Soviet Luna missions, the coma collection is straightforward and simple, but the return is also limited and the science must be focused only on few aspects of sample analysis. On the coma mission only a small mass of sample is collected and it is not returned in pristine condition. The primary goal of the coma collection is to collect several hundred individual particles ranging in size up to 0.5 mm. It may also be possible to collect some coma gas. The particles are collected either as debris in the bottoms of craters in selected substrates or as material trapped in individual sealed "capture cells" that particles enter by penetration of a thin metal diaphragm. Although the physical forms of particles are altered during collection, their bulk composition does not change. The fundamental scientific output from the mission will be the precise elemental and isotopic compositions for a large set of individual particles. This data set will provide a very powerful means for comparing a bona fide comet sample with known types of meteoritic materials.

PLATINUM GROUP NUGGETS IN DEEP SEA SEDIMENTS

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The existence of "iron" meteor ablation spheres in deep sea sediments has been known for over a century. These spheres have generally been believed to be composed either of pure magnetite and wustite or an oxide shell surrounding a NiFe metal core, usually smaller than half the size of the sphere. In a study of a large number of 300 μm-600 μm spheres we found that the "pure oxide spheres," the most common in sediments, usually contain a solitary < 10 μm