CHROMIUM ISOTOPIC ANOMALIES IN STEPWISE DISSOLUTION OF ORGUEIL; U. Ott[1,2], F. A. Podosek[1], J. C. Brannon[1], T. J. Bernatowicz[1], and C. R. Neal[3], [1]McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130, USA, [2]Max-Planck-Institut für Chemie, D-55020 Mainz, Germany, [3]Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN 46556, USA.

The Cr in carbonaceous chondrites such as Orgueil displays isotopic anomalies of both signs in a pattern which suggests that essentially all the Cr is anomalous. This suggests at least partial preservation of presolar carriers of types not yet identified. So far, however, there is no evidence for corresponding anomalies in other elements nor for the chemical/mineral identity of the putative carriers.

It is well recognized that surviving interstellar grains are preserved in primitive meteorites. Grain types thus far known are characterized by chemical inertness which allows them to be isolated by survival through extremely harsh chemical treatments; identification as interstellar grains follows primarily from observation of radical isotopic anomalies (see reviews [1,2]). It is also well recognized that some types of meteoritic material display nucleosynthetic isotopic anomalies which are more modest but still substantial and experimentally well-defined. Such effects are generally interpreted to reflect specific nucleosynthetic components carried by interstellar grains diluted by admixture of "normal" materials. In some cases such anomalies evidently represent disproportionate sampling of interstellar carriers in materials which were made in solar nebular processing; other cases may represent preserved or partially preserved interstellar grains which are diluted only by mechanical admixture. It is possible that primitive chondrite matrices contain presolar grains which have not yet been identified as such because they are too small for isotopic analysis of individual grains and because they are not so chemically resistant that they can be concentrated by dissolution of other constituents.

Here we report the first progress in a project intended to explore this latter possibility. The initial experimental focus is based on the results of Rotaru *et al.* [3], who found large (up to about 100 ε-units at ^{54}Cr) isotopic anomalies in Cr obtained in progressive dissolution of carbonaceous chondrites, mostly unaccompanied by anomalies in other iron-group elements (except for a few cases of small anomalies at ^{66}Zn). Besides isotopic analyses, our study includes SEM/EDX characterization of residues and ICP-MS analysis (currently in progress) of solutions to try to constrain the nature of anomaly-bearing phases.

Bulk Orgueil (202 mg) was sequentially dissolved in the series of steps indicated in Table 1. Steps 1-3 are the same as in the Rotaru *et al.* [3] study (these steps should account for >90% [3] of total Cr in Orgueil); the remaining steps are more elaborate, particularly the inclusion of HCl steps 4-6 before introduction of HF. We have thus far obtained Cr isotopic results for steps 2-4 and 6-8 (Figures 1, 2). Analyses were performed on a VG Sector 54 thermal ionization mass spectrometer at Washington University, using ^{50}Cr/^{52}Cr (≡.051859) normalization with ^{53}Cr and ^{54}Cr deviations calculated relative to the normal composition

Table 1. Steps in sequential dissolution of bulk Orgueil

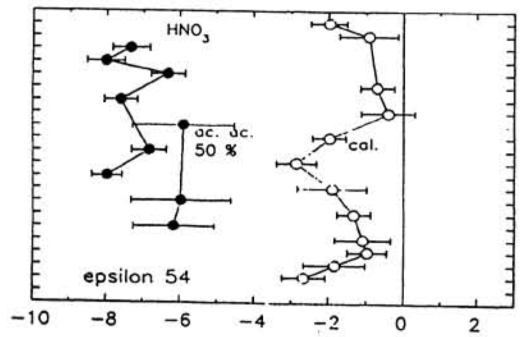
1	2.5 % acetic acid, 35 min., room temperature
2	50% acetic acid, 1 day, room temperature
3	4N HNO_3, 5 days, room temperature
4	6N HCl, 3 days, room temperature
5	6N HCl, 1 day, ~36°
6	6N HCl, 1 day, ~80°C
7	HF/HCl, 1 day ~ 100°C
8	HF/HCl, 1 day, ~ 100°C (repeat)
9	CS_2 extraction
10	4N NaOH, 3 hours, ~80°C
11	conc. $HClO_4$, 2.5 hrs, ~185°C.
12	conc. H_2SO_4, 2 hrs, ~195°C

reported by Rotaru *et al.*[3]. Our normals (e.g. open symbols in Fig. 1) are somewhat lighter than the Rotaru *et al.* composition (by about 1ε at ^{53}Cr and 2 ε at ^{54}Cr) but this evident bias effect does not hamper identification of anomalies.

Our results confirm the basic features observed previously [3]. The most easily dissolved phases show negative ^{54}Cr anomalies of a few ε units, complemented by positive anomalies of several permil in subsequent steps. There is a small (1-2 ε) positive ^{53}Cr anomaly in step 2; ^{53}Cr is otherwise normal within errors. We observe that the largest positive anomaly in ^{54}Cr occurs in an HCl step (Fig. 2), before major silicate dissolution attendant on introduction of HF.

Since there are anomalies of both signs, there must be at least two carriers of anomalous Cr; the mass balance and the absence of a "preferred" normal composition suggests that nearly all the Cr in Orgueil is anomalous. The major problems to be addressed in the future are assessment of what other isotopic anomalies (if any) accompany those in Cr and identification of the anomaly-bearing phases. It is noteworthy that the phases most readily expected to dissolve in the initial steps are alteration phases, which would not be considered prime candidates to host anomalies; since (unknown) additional phases may also be dissolving in the acetic acid steps, it remains to be determined whether the alteration phases actually contain anomalous Cr.

References: [1] Ott U. (1993) *Nature* **364**, 25 [2] Anders E. and Zinner E. (1993) *Meteoritics* **28**, 490 [3] Rotaru M., Birck J-L. and Allegre C. J. (1992) *Nature* **358**, 465.



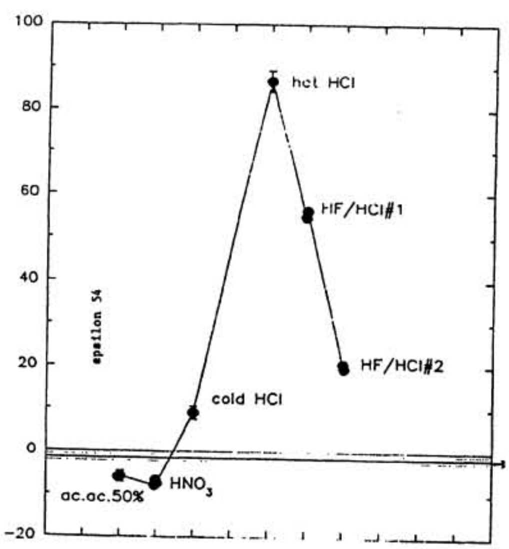


Fig. 1. ^{54}Cr data for normals (open symbols) and replicate analyses for bulk Orgueil dissolution steps 2 and 3 (solid symbols)

Fig. 2. ^{54}Cr anomalies in sequential dissolution (Table 1) of bulk Orgueil.