A CARBON AND NITROGEN ISOTOPE STUDY OF CARBONACEOUS VEIN MATERIAL IN UREILITE METEORITES: S.S. Russell, J.W. Arden*, I. A. Franchi, and C.T. Pillinger, Dept. Earth Sciences, Open University, Milton Keynes, MK7 6AA, U.K. *Dept. Geological Sciences, Parks Rd, Oxford OX1 3PR, U.K.

The ureilite meteorite group is known to be rich in carbon (*e.g.* Vdovykin, 1970) in the form of graphite/diamond veins that are associated with planetary type noble gases (Weber *et al.*, 1971). This paper reports preliminary data from a systematic study of the carbon and nitrogen isotopic composition of this carbonaceous vein material. A previous study (Grady *et al.*, 1985) focused on the whole rock signatures and reported that the carbon inventory appeared to be dominated by the graphitic/diamond intergrowths whereas the nitrogen was clearly composed of several distinct components, including one that that was isotopically light, possibly associated with the carbonaceous material. Recent studies (*e.g.* Russell *et al.*, 1992; Gilmour *et al.*, 1992; Yates *et al.*, 1992) have demonstrated that diamonds in the solar system formed in many different environments. C and N measurements from ureilitic diamond made in a similar way would be a useful addition to this overall study. The methods used for isolating diamonds of possible presolar origin from primitive meteorites are equally applicable to the processing of carbon bearing components in the ureilite meteorite group so that their stable isotopic composition can be determined.

Herein we discuss conjoint C and N stepped combustion measurements made on crushed whole rock ureilite samples that have been treated with 1M HCl/9M HF to dissolve silicates and free metal. In addition, two samples have been further treated with oxidising acids to leave a diamond rich residue. The results to date are presented in table 1. The major release of both carbon and nitrogen was between 600° and 900°C. The carbon isotopic composition for six samples varied between 0 and -5‰, in accordance with the results presented for bulk ureilites by Grady *et al.*, 1985. The nitrogen release patterns were similar for all the samples so far analysed; $\delta^{15}N$ values varied from around 0‰ for the low temperature steps, (which could represent an input from terrestrial contamination), to a ^{14}N enriched value of typically of -100 to -120 ‰ (-83‰ for Nilpena), released at temperatures >600°C; figure 1. This enrichment in ^{14}N suggests that the carbonaceous material may represent an early condensate that has preserved a primitive isotopic signature, and is distinct from nitrogen within other meteoritic diamond sources. The C/N ratios of the four HF/HCl insoluble residues (which are dominated by graphite) and the two diamond concentrates all fall between 1000 and 1500, so that at present we cannot say whether there is any difference between the two carbon bearing components. Isotopically light nitrogen exists in both graphite and diamond, in contrast to the noble gases, which are thought to be

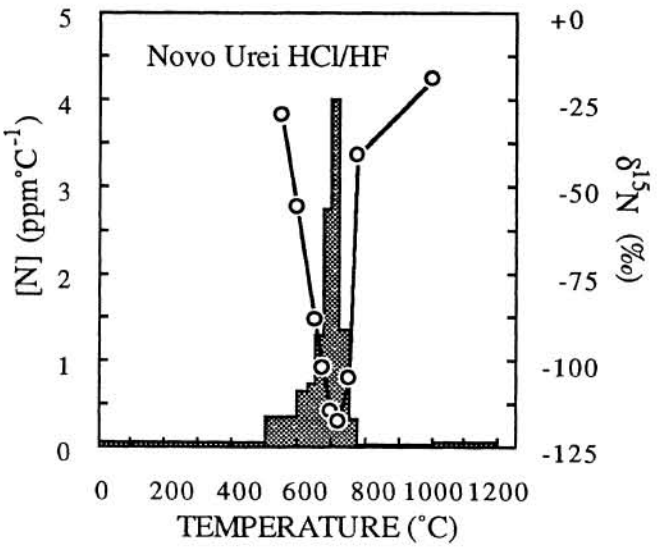
concentrated in the diamond phase (*e.g.* Gobel *et al.*, 1978).

The noble gas signature of carbon in ureilites has been compared to that of "phase Q" (Ott *et al.*, 1985). Light nitrogen may also be present in phase Q thus providing a further link between these two primitive components. Data for ^{36}Ar, ^{38}Ar and ^{40}Ar can now be obtained conjointly to the nitrogen and carbon information to determine whether the light nitrogen correlates with the enrichment in ^{36}Ar that is representative of a planetary noble gas signature (Weber *et al.*, 1975), and thus determine whether the ^{14}N enrichment may be linked to this distinctive noble gas pattern of the ureilitic carbonaceous material.

Table 1

Meteorite	Residue	$\delta^{15}N$ (mean)	$\delta^{15}N$ (min)	$\delta^{13}C$ (mean)	C/N
Novo Urei	HF/HCl	-110‰	-118.1±0.5‰	-4.4‰	1580
Y 790981	HF/HCl	-80‰	-111.3±0.3‰	-2.2‰	1410
Y 74123	HF/HCl	-104‰	-115±5.0‰	-1.1‰	1140
Nilpena	HF/HCl	-74‰	-83±5.0‰	-4.8‰	1460
Y 791538	Diamond	-94‰	-112±4.0‰	-5.0‰	1516
Novo Urei	Diamond	-86‰	-104±5.0‰	-1.8‰	1060

Figure 1



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