EET 87770: A LIGHT ELEMENT STABLE ISOTOPE STUDY OF A NEW RENAZZO-LIKE CARBONACEOUS CHONDRITE; Monica M. Grady, R. D. Ash and C. T. Pillinger, Planetary Sciences Unit, Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes MK7 6AA.

Among the specimens returned by the 1987/88 ANSMET expedition to Elephant Moraine were seven paired meteorites identified as having affinities to Renazzo and Al Rais [1]. We have undertaken a light element stable isotope study of one of the specimens, EET 87770, as part of an ongoing investigation of carbonaceous chondrites, with particular reference to those exhibiting ^{15}N-enrichment.

Carbon: stepped combustion of 1.86 mg of EET 87770 yields 1.22 wt% carbon with total $\delta^{13}C$ of *ca.* –5.0‰. This is a lower yield than Renazzo (1.50 - 1.70%; [2,3]) and Al Rais (2.38%; [4]), and heavier isotopic composition (Renazzo ≈ –10.0‰; Al Rais ≈ –11.8‰;[2-4]). There are several carbon-bearing components present in the meteorite, which can be identified on the basis of combustion temperature (see Table). The bulk of the carbon combusts below 500°C, and is presumably organic in nature. Variation in $\delta^{13}C$ with temperature in this material indicates at least two components occur; analogy with other carbonaceous chondrites [5] allows that these might be more thermally-labile species (T_{comb} < 300°C; $\delta^{13}C$ *ca.* –1.4‰; [C] ≈ 0.30 wt%) attached as side-chains to a complex, cross-linked macromolecular core (T_{comb} ≈ 300 - 475°C; $\delta^{13}C$ *ca.* –8.6‰; [C] ≈ 0.70 wt%).

Between 500°C and 700°C, $\delta^{13}C$ rises to +14.1‰ at 600°C, as carbonates decrepitate. Dissolution of 16.86 mg of EET 87770 in 100% orthophosphoric acid for 18 hrs at 25°C yielded 555.2 ppm carbon from carbonate minerals (presumably calcite) with $\delta^{13}C$ *ca.* +31.9‰ and $\delta^{18}O_{SMOW}$ *ca.* +23.2‰. After extending the acid treatment to 60 hrs, a further 246.0 ppm carbonate carbon was liberated, presumably from iron/magnesium-containing carbonates, with $\delta^{13}C$ *ca.* +17.9‰ and $\delta^{18}O$ *ca.* +18.4‰. (Total yield = 801.2 ppm; $\delta^{13}C$ ≈ +27.6‰; $\delta^{18}O$ ≈ +21.7‰). Comparison with other Renazzo-like chondrites [6] indicates that the carbonate yield is higher, but $\delta^{13}C$ and $\delta^{18}O$ lighter. These results are consistent with a percentage of the acid-liberated CO_2 deriving from dissolution of Antarctic weathering products in addition to indigenous meteoritic carbonates. Evaporite deposits have been identified on the surface of EET 87850 (one of the meteorites paired with EET 87770) [1]; such deposits are believed to have a $\delta^{13}C$ *ca.* 0 ± 10‰ and $\delta^{18}O$ *ca.* 10 ± 10‰ and are persistently present even in interior specimens of Antarctic meteorites [7]. The occurrence of terrestrial carbonates in EET 87770 implies that the concentration of less oxidation-resistant organics given in the table must be an upper limit, since Antarctic weathering products are thought to be thermally labile and decrepitate at temperatures below 200°C [7].

In CI and CM chondrites, carbon combusting above 650°C with unusual isotopic composition is generally ascribed to the presence of refractory interstellar materials: SiC *etc.* Analyses of whole-rock meteorites can only attempt to ascertain the presence or otherwise of such materials by searching for deviations from the modal $\delta^{13}C$ of the bulk carbon in the meteorite. In EET 87770, carbon combusts above 650°C in decreasing quantities with increasing temperature, and $\delta^{13}C$ gradually rises: from +5‰ (the tail of the carbonate release) to +109‰ at 1150°C. It is thus apparent that this Renazzo-like chondrite contains interstellar components, although only analyses of more highly-processed acid-resistant residues will determine their concentration and isotopic composition, for comparison with CI and CM chondrites.

Nitrogen: stepped combustion of 4.50 mg of whole-rock EET 87770 yielded 504 ppm nitrogen with $\delta^{15}N$ *ca.* +158.5‰. This compares with the range of 500 - 800 ppm N and $\delta^{15}N$ *ca.* +140 to +190‰ exhibited by Renazzo and Al Rais [2 - 4]. The main N-bearing material combusts below 500°C, and variations in $\delta^{15}N$ again, as for carbon, indicate the presence of at least two components. This effect might be due to admixture of terrestrial material to the lower temperature component: adsorbed atmosphere and nitrogen from weathering products. Unlike the carbon isotopic profile, where the maximum $\delta^{13}C$ occurs at the highest temperatures of the extraction, the heaviest $\delta^{15}N$ values are associated with material which combusts below 800°C: between 300°C and 800°C, $\delta^{15}N \approx +174 \pm 10‰$, a plateau isotopic composition very similar to that seen in Renazzo [3]. At 1050°C, $\delta^{15}N$ drops to *ca.* +20‰, possibly due to the influence of isotopically light nitrogen from SiC.

Component	Temp. (°C)	[C] (%)	$\delta^{13}C$ (‰)	[N] (ppm)	$\delta^{15}N$ (‰)
Whole-rock	RT - 1200	1.22	−5.0	504	+158.5
"Organics":					
	RT - 300	0.30	−1.4	138	+128.6
	300 - 475	0.70	−8.6	188	+175.6
Carbonate	H_3PO_4	0.08	+27.6	($\delta^{18}O_{SMOW}$ = +21.7‰)	
High Temp.	> 650	0.04	≥ +100	70	≤ +180

References: [1] Ant. Met. Newsletter (1989) **12** No. 3 14-15; [2] Robert, F. and Epstein, S. (1982) *Geochimica Cosmochimica Acta* **46** 81-95; [3] Grady, M.M. *et al.*, (1983) *Proc. 8th Symp. Ant. Met. Mem. Natl. Inst. Pol. Res.* **Spec. Iss. 30** 292-305; [4] Kerridge, J.F. (1985) *Geochimica Cosmochimica Acta* **49** 1707-1714; [5] Kerridge, J.F. *et al.* (1987) *Geochimica Cosmochimica Acta* **51** 2527-2540; [6] Grady, M.M. *et al.*, (1988) *Geochimica Cosmochimica Acta* **52** 2855-2866; [7] Grady, M.M. *et al.*, (1989) *Meteoritics* **24** 147-154.