CARBON ISOTOPE DATA FOR SOME SNC METEORITES

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The common late crystallisation age for the achondrite Shergottites, Nakhlites and Chassignites (SNC) of ca 1.3 AE has led to the postulation of a Martian origin for these meteorites (1) although dynamical problems of ejecting large objects from a major planet still exist (2). The possibility that SNC meteorites do derive from Mars led us to suggest some interesting opportuniti es for stable isotope analysis (3). The first of these, a search for a trapped component of nitrogen gas having an isotopic composition akin to the high value measured by Viking for the Martian atmosphere, has already proven fruitful (4). The finding of $\delta^{15}N$ values of +200‰ (4) in glass from EETA 79001 seems to be consistent with the proposed Martian provenance for SNC meteorites and leads us to believe our second prediction that a measure of the carbon isotopic composition of CO_2 in our sister planet's atmosphere can be obtained by an analogous experiment. In persuance of this aim, we have now measured, with high sensitivity mass spectometric techniques, the isotopic compositions of carbon released by stepped combustion from Shergotty, Chassigny and EETA 79001,115. Our previous studies of the former two meteorites by conventional mass spectrometry (5) were limited to averaging the $\delta^{13}C$ for carbon dioxide obtained from steps at temperatures greater than 600°C.

Profiles for gas release and isotopic composition are shown plotted individually in Fig. 1. An obvious common feature of the three samples, confirming our previous findings (3), is that the vast majority of the carbon (ca 90%) is released at temperatures below 500°C with $\delta^{13}C$ values which are suggestive of terrestrial contamination. In keeping with such an interpretation, we note that the bulk carbon content of Shergotty and Chassigny are considerably higher than 79001,115 (compare 0.060 and 0.038 wt % with 0.015 wt %) as might be expected, since the latter sample was recovered from the less contamination prone Antarctic environment. Sample EETA 79001,115 has a small component of isotopically heavy C at less than 200°C which seems to be a distinguishing feature of Antarctic meteorites but for the most part its low temperature carbon is extracted over a wider range of temperatures (up to 600°C). Since 79001,115 has the lowest absolute amounts of carbon, this cannot be an oxygen deficiency problem. It may be that the sample moved relative to the furnace or the thermocouple during the experiment. Assuming that some such problem has arisen, the isotopic composition for the three specimens should be considered with EETA 79001,115 displaced 100°C to lower temperatures when the release of low temperature carbon corresponds more directly with Shergotty and Chassigny. Under these circumstances, we note a strong similarity between the pattern of $\delta^{13}C$ values for the extracted carbon from the three meteorites. After removal of terrestrial contaminants, $\delta^{13}C$ drops to a minimum in the temperature range 800-1000°C and then rises to a maximum, in each case corresponding to a peak in the carbon release, at 1100°C, before falling again. The slightly ^{13}C enriched phase at 1100°C could be due to a spallogenic component which needs to be explored in greater detail. The light carbon between 800-1000°C is presumably indigenous to the samples and characteristic of the SNC parent body. This component is most abundant in Chassigny when its isotopic composition is -41‰, a value which is unusually light for a meteorite sample and very different from any igneous carbon phase in a terrestrial rock. At temperatures between 500 and 800°C, Shergotty exhibits a fluctuating isotopic

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composition. In this region for Shergotty there is evidence for a peak in the carbon release which might indicate another component. This was seen even more clearly in our earlier investigation (3) although no isotopic data were obtained.

Although the results reported here have been obtained as a preliminary to an investigation of atmospheric carbon species trapped in glass from EETA 79001, they are also providing information about phases which may have originated during planetary scale magmatic processes.

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