THE HIGH-TEMPERATURE RELEASE OF CARBON AND NITROGEN IN THE ANGRITES AND ITS RELATIONSHIP TO PARENT BODY DEGASSING.

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Introduction: Angrites are a relatively small group of ancient basaltic achondrites (21 currently recognized stones, including pairings). They have a remarkable volatile poor, silica undersaturated composition and a characteristic mineralogy of Ca-rich olivine, Al-Ti bearing pyroxene and anorthite [1-2]. We are interested in using the light element chemistry of this group to study their magmatic history. Here we report on updated carbon and nitrogen abundance and stable isotope data from a suite of 8 angrites analyzed by stepped oxidation.

Analytical: Samples were wrapped in Pt foil and progressively heated at increasing temperatures using oxygen derived from the heating of CuO. Gases were collected and separated for each step by use of a cryotrap cooled to -160ºC prior to isotope analysis in the Finesse static vacuum mass spectrometer.

Results: Distinct releases of both carbon and nitrogen can be observed in all samples based either on abundance peaks or isotopic compositions. The high temperature component begins to be released at between 750 and 1100 ºC for carbon and between 750 and 1000 ºC for nitrogen with yields ranging from 1 – 80 ppm and 0.3 – 18 ppm respectively. This is similar to the carbon release from HED [3] and Martian [4] meteorites. The $\delta^{13}C$ mostly falls within the – 20 to – 30 ‰ while the $\delta^{15}N$ ranges from – 10 to + 20 ‰. In both cases D'Orbigny and NWA 1296 display further enrichment of the heavy isotope. When the two elements are plotted against one another, two distinct trends can be seen in the isotopic composition.

Discussion: The high temperatures required in order to release the components combined with the lack of shock and brecciation in the angrite group as a whole [1-2] suggest indigenous carbon and nitrogen. Isotopically, with the exceptions of D'Orbigny and NWA 1296, the nitrogen falls within the range of ordinary chondrites [5] while the carbon is largely within the same range as HEDs [3] again with the exception of D'Orbigny. The variability of nitrogen isotopes can be accounted for by using a simple open source Rayleigh fractionation model assuming N_2 dissolution within the silicates and using a molecular N_2 diffusion fractionation factor [6]. CO_2 has been modelled using a variety of graphite – CO_2 fractionation factors [7]. It is difficult to account for the variability in $\delta^{13}C$ through simple degassing, suggesting further fractionation of the carbon isotopes.

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