A TRAPPED NITROGEN COMPONENT IN ANGRITES

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Introduction: Angrites are a small group of silica undersaturated achondrites notable for their apparent lack of shock features or brecciation and their characteristic unusual mineralogy [1-3]. We are interested in studying their magmatic history, as reflected by their light-element chemistry. Here, we report on the abundance, distribution and isotopic composition of nitrogen in a suite of 5 angrites. We employed the technique of stepped oxidation, which has previously been used to determine the nitrogen chemistry of a variety of meteoritic [4] and terrestrial rocks [5].

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 -160 ºC prior to isotope analysis in the Finesse static vacuum mass spectrometer.

Results: Many of the angrites have a bimodal release of nitrogen, with a low temperature component combusting below 600 ºC (presumably a mixture of air and organic matter) and a second component combusting around 1000 ºC. The high temperature component consistently has a $\delta^{15}N$ in the range of -5 to +5 ‰ and an N/C ratio less than 1. Nitrogen abundance varies from ~ 20 ppm in NWA 2999 to ~1 ppm in LEW 86010. No distinct release at the higher temperature was observed in D'Orbigny.

Discussion: The low N/C ratios of the high temperature nitrogen component suggest that it is not organic matter. Surface contamination is most likely to have been removed at temperatures ≤ 600 ºC [6]. It may be possible, given the range of nitrogen isotopic composition, that the peaks represent a trapped terrestrial component rather than nitrogen indigenous to the Angrite Parent Body. However it is difficult to envisage a suitable mechanism to trap high temperature nitrogen in a solid sample other than by impact (at much higher pressures than experienced during impact with Earth). Regardless, it would be useful to identify the host of this high –T N-component in order to confirm if it is indigenous to the sample. Nitrogen is normally present in igneous rocks in the form of NH_4^+ ions substituting for K in micas and orthoclase feldspar [7]. However as these are not present in angrites, another host must be identified, possibly metal. Such an undertaking would assist in understanding the role of nitrogen in the volatile evolution of the APB and allow conclusions to be drawn regarding the conditions under which it was incorporated.

References: [1] Mittlefehldt D.W. et al. 1998. In: *Planetary Materials*, Min. Soc. America, *Reviews in Mineralogy 36*, Ch. 4; [2] Mittlefehldt D.W. & Lindstrom M.M. 1990. *GCA* 54:3209-3218; [3] Mittlefehldt D.W. et al. 2002. *MAPS* 37:345-369; [4] Grady & Wright. 2003. *Space Science Reviews* 106:231-248; [5] Exley et al. 1987. *EPSL 81:*163-174; [6] Becker & Pepin. 1986. *GCA 50:*993-1000; [7] Stevenson. 1962. *GCA*. 26:797-809