

HEAVY NITROGEN IN THE BELLS CARBONACEOUS CHONDRITE; R. H. Becker, School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455.

In a recent compilation of C, H and N elemental and isotopic abundances for carbonaceous chondrites, Kerridge (1) reported a  $\delta^{15}\text{N}$  value for the Bells meteorite of +335‰. This value is strikingly higher than for a second Bells sample analyzed in the same study, as well as for the CI and CM meteorites in general, to which Bells is related (2). In order to determine whether this unusual  $\delta^{15}\text{N}$  value was due to admixture of some exotic nitrogen component into an otherwise "normal" carbonaceous chondrite, we obtained from Dr. Kerridge the remainder of his Bells B sample (84.2 mg) for the purpose of analyzing its N and noble gases by stepwise combustion. In the course of the combustion, the  $\text{CO}_2$  produced in a number of the steps was saved, and analyses of the carbon isotopes in these  $\text{CO}_2$  samples were also provided to us by Dr. Kerridge.

Our bulk sample values for nitrogen are 451 ppm N with a  $\delta^{15}\text{N}$  value of +360‰, which represents a yield about 60% of that given in (1), with a shift in  $\delta^{15}\text{N}$  of 25‰. Preliminary data for Ar, Kr and Xe yields are similarly low with respect to abundances given by Zadnik (3) for two samples of Bells, which themselves differ by 20-30% for these three gases. Our measured carbon yield is 2.38%, similar to that in (1), but as there may be  $\text{SO}_2$  included in some of our  $\text{CO}_2$  samples, and as a comparison between our  $\text{CO}_2$  amounts and those of Kerridge on the same gas samples suggests we are about 8% high for  $\text{CO}_2$ , the yield for C is probably low as well. From these comparisons, it appears that differences between our N data and those for Bells B in (1) are due to sample heterogeneity rather than something specific to nitrogen. Considering that most of the several pieces of Bells collected, including the one from which our sample comes (4), were exposed to several inches of rainfall (5) and may therefore be somewhat altered, variations attributable to loss of components should not be unexpected for this meteorite.

The  $\delta^{15}\text{N}$  values obtained in the individual steps are presented in the figure below as a function of the cumulative yield. The first 1% of nitrogen

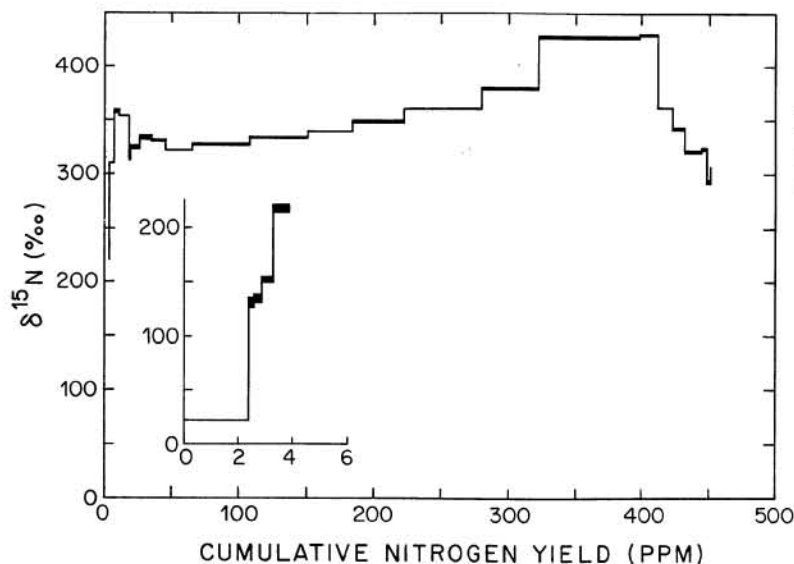


Fig. 1. Nitrogen data from the Bells carbonaceous chondrite.

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shows what is probably the result of terrestrial contamination superimposed on heavy meteoritic nitrogen. The remainder of the nitrogen is more or less uniformly heavy, showing evidence for a component with  $\delta^{15}\text{N}$  above 430‰ released around 600°C superimposed on a ubiquitous component with  $\delta^{15}\text{N}$  around 300‰. To avoid contamination the sample, which consisted of several chunks and about 30% powder, was run without crushing. This has the unfortunate effect of reducing the resolution of components and shifting release temperatures to higher values than would otherwise be the case. However, it is extremely unlikely that the pattern seen in the figure could be the result of a minor nitrogen component with a very high 15/14 ratio reacting in almost constant proportion with typical CI or CM nitrogen components of around 40‰. It seems more likely that the heavy component was present and already mixed in the reservoir out of which the organic matter that presumably carries the nitrogen was formed. It can be noted in (1) that Bells B carries a signature of heavy hydrogen similar to that in Renazzo and Kaidun, other carbonaceous meteorites which have high nitrogen isotopic ratios, suggesting a possible connection between the organic components of these meteorites.

At present, there is no obvious connection between the high  $\delta^{15}\text{N}$  in Bells and any unusual noble gas components. The most notable effects seen are a bulk  $^{84}\text{Kr}/^{132}\text{Xe}$  ratio below 0.8, atypically low for carbonaceous chondrites, and an increase in Ar/Kr and Ar/Xe ratios of about 50% accompanying the heavier N component seen at around 600°C. Light noble gas data have not yet been worked up. It is perhaps also notable that the heavier N component is associated with light carbon (-34‰) and Xe isotopic ratios that appear to show an increased contribution of the component termed CCF-Xe. This contrasts with the findings of light nitrogen associated with light carbon and CCF-Xe in Allende and Murchison residues (6), but as we are dealing with a bulk sample, the presence of minor nitrogen components may very easily be masked.

Further work on Bells, including work on acid residues, would seem to be indicated, in order to see whether there are different nitrogen components present than in other types of carbonaceous chondrites. In addition, it is important to know if the Bells A sample analyzed in (1) is in fact from Bells or not. The difference between Bells A and B reported in (1), and indeed the very presence of the high  $\delta^{15}\text{N}$  values seen in Bells, is not likely to be due to the exposure of the meteorite to terrestrial rainfall, and must presumably therefore be primary. Such a large difference in the presumed organic carrier of nitrogen over relatively small distances in a meteoritic body would have important consequences for the origin of the organic matter. The possibility that Bells A is a mislabeled sample would reduce those consequences.

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