

CARBON, NITROGEN AND XENON COMPONENTS IN THE ALLENDE CARBONACEOUS CHONDRITE. Urs Frick, R. H. Becker and R. O. Pepin, School of Physics and Astronomy, University of Minnesota, Minneapolis MN 55455, and D. J. DesMarais, NASA-Ames Research Center, Moffett Field CA 94035.

We have previously reported (1) noble gas and nitrogen data from stepwise combustion of an acid demineralized, H₂O₂-treated Allende residue. Traces of s-Xe and Ne-E, not previously seen in Allende, were resolved in this experiment, though at much lower levels than for Murchison (2). Isotopically light N, as low as $\delta^{15}\text{N} = -114\%$, was seen in association with the prominent DME-Xe (CCF-Xe) component (Fig. 1). The CO₂ produced at each combustion step, saved in glass tubes, has now been analyzed for $\delta^{13}\text{C}$ by dynamic mass spectrometry. Integrated $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ are -17.1% and -27% respectively, in good agreement with previous measurements in Allende (3,4).

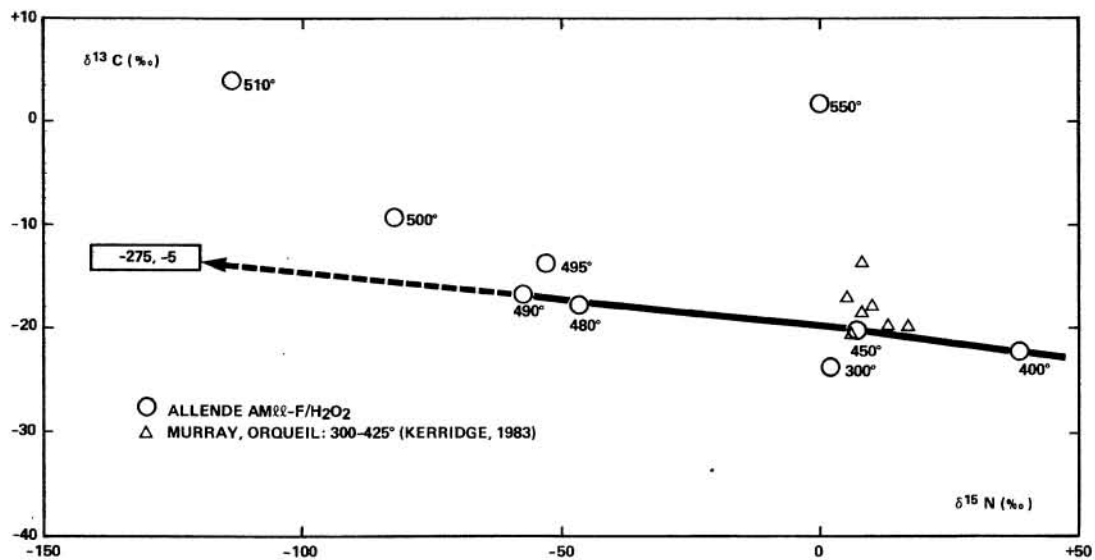
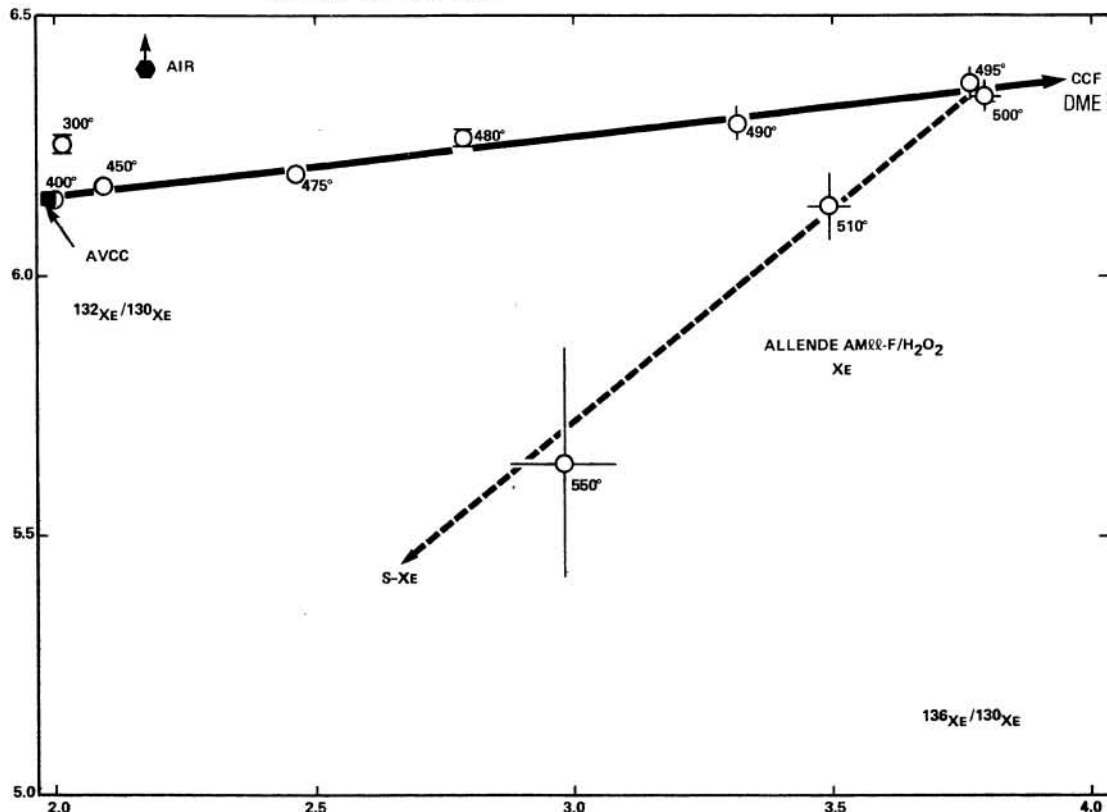
In the lower half of Fig. 1, $\delta^{13}\text{C}$ is plotted vs. $\delta^{15}\text{N}$. The linear correlation from 400 to 490°C, where $\sim 80\%$ of the C and N and $\sim 70\%$ of the DME-Xe were evolved, suggests simultaneous and proportional release of C and N from two carbonaceous phases different in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$, one containing AVCC-Xe and the other DME-Xe. The AVCC carrier, best resolved at 400°C ($\delta^{13}\text{C} = -21.9\%$, $\delta^{15}\text{N} = +38.5\%$), resembles CI-CM carbonaceous matter (5) minus its water-soluble heavy carbon. The correlation suggests that the composition of the DME carrier lies to the left of the 490°C point, toward much lighter N and somewhat heavier C. $\delta^{13}\text{C}$ values above the correlation line at T>490°C signal combustion of a third, minor phase. The mixing trend towards 550°C points to heavy C and N in this phase; the upper part of Fig. 1 suggests that this is the s-Xe carrier.

The Chicago and Cambridge groups, in joint analyses of Murchison, have recently found very light N ($\delta^{15}\text{N} \approx -275\%$) associated with DME-Xe, and very heavy C ($\delta^{13}\text{C} \approx +1100\%$) associated with s-Xe (6). Assuming their $\delta^{15}\text{N}$ value for the DME carrier in Allende, the correlation in Fig. 1 yields $\delta^{13}\text{C} \approx -5\%$ in this phase. This is very different from the $\delta^{13}\text{C} \sim -38\%$ assigned to the Murchison and Allende DME carriers by these groups (3,6,7). Our Allende data show no evidence for such light C; $\delta^{13}\text{C}$ at all temperatures of DME-Xe release is $> -20\%$.

The s-Xe carrier in Allende is too small in amount to obtain a $\delta^{13}\text{C}$ for it independently, but its signature is roughly consistent with the $+1100\%$ from Murchison (6). The abundance ratio of s-Xe to heavy C in Murchison is 4.2×10^{-14} ccSTP-g⁻¹/ppm (6). About 500 ppm of $+1100\%$ C ($\sim 0.4\%$ of the total C released above 490°C) is needed to displace the T>490°C $\delta^{13}\text{C}$ values above the AVCC-DME correlation; the s-Xe in the 510-550°C steps is $\sim 12 \times 10^{-12}$ ccSTP/g. The resulting ratio, 2.4×10^{-14} ccSTP-g⁻¹/ppm, is somewhat less than in Murchison, but is probably low. The $\delta^{13}\text{C}$ pattern in Fig. 1 indicates that combustion of the heavy C phase begins at 495°C. However, any s-Xe released at 495-500°C is probably masked by the ~ 4 -fold higher total Xe in these steps, compared to the 510°C step.

The Chicago-Cambridge results for Murchison suggest that heavy C in the s-Xe carrier is accompanied by heavy N (6). This is consistent with the excursion of the 550°C Allende datum toward higher $\delta^{15}\text{N}$, and with heavy N ($+93\%$) found by Kerridge in association with heavy C in high-temperature combustion steps of a Murray acid residue (8). The principal discrepancy presently seen is in the differing $\delta^{13}\text{C}$ values deduced for the DME carrier in this work ($\sim -5\%$) and in the Cambridge analyses of Allende carbon ($\sim -38\%$) (3,6,7). It is in any case clear that the host phases of the nucleosynthetic DME and s-Xe components in carbonaceous chondrites are composed of elements isotopically very unlike normal solar system matter, and thus carry clues about the stellar environments where these phases formed.

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