CARBON IN DARK CLASTS OF ALLENDE, C.C.A.H. van der Stap, D. Heymann, R. D. Vis & H. Verheul, Laboratorium voor Natuurkunde, Vrije Universiteit, Amsterdam, Netherlands and Dept. of Geology & Geophysics, Rice University, Houston, Texas, USA.

In an earlier study of dark inclusions (DI's) of the Allende meteorite (1), we have determined the areal distribution of carbon in one inclusion, and bulk carbon contents of four DI's. We questioned whether the C-contents of DI's were a single population, or whether the distribution was bimodal, or even multimodal, but could not answer the issue because of the paucity of data available then. The present study was therefore undertaken to generate a survey of carbon in many dark spots of the Allende meteorite, too small for "mining" and C-determination by classical methods. Instead we, again, used the $^{12}C(d,p_0)^{13}C$ nuclear method (see 1), but with a deuteron beam of 0.5 mm diameter. We selected 33 samples, bored from slabs of the Allende meteorite on the basis that they contained a particularly dark spot of at least 1 mm across. We call our samples "dark clasts" instead of "dark inclusions", because we are not certain that all of these would qualify as genuine DI's. All samples were impregnated with sodium metasilicate ("waterglass"), polished, and extensively cleaned before their mounting in the target chamber of a beamtube of the cyclotron of the Vrije Universiteit. The events recorded were from reaction nuclei and elastically scattered deuterons; all events were sorted in about 300 channels from 0 to 3 MeV (lab) energy.

Figure 1 shows the particle spectra from graphite, calcite, and one Allende sample. The events at low energy (channels up to about 100) are Rutherford-scattered deuterons. The events in channels around #150 are nuclei from reactions in oxygen. The events in channels roughly from 290 to 315 are from $^{12}C(d,p)^{13}C$. We have, however, based our analysis on counts from channels 300-309 only. This "cuts out" information from "surface carbon" and possible interference from certain reactions in oxygen. In most runs, there were at least 100 counts in channels 300-309. Counts in channels 20-40 were used for normalization of deuteron doses. We found some problems with using graphite as well as calcite as normalization standards. The problems have not been fully resolved, hence our relative C-contents are more reliable than our absolute values. Duplicate runs were done for 18 samples; the ratios of normalized counts are shown in Fig. 2. The large discrepancies of 20% or greater all occur in "late runs" when there were some troubles with sample positioning in the beam.

To obtain relative C-contents, we have calculated the ratio of counts in channels 300-309 to those in channels 20-40. Duplicates were averaged. The final ratios were then placed in "bins" with widths of $\pm$ 10% of their median values, ranging from 0.0012 to greater than 0.01. Figure 3 presents the results in that form. At a first glance, there appears to be a bimodal distribution (bins 5 & 7), but we cannot exclude the possibility of only a single mode with maximum in bin 7. The C content in this bin is in the range 0.5-0.6 wt % when the graphite standard is used. The smallest C-content of the population would then be between 0.2 and 0.3%; the largest between 0.9 and 1.0%.

(1) C.C.A.H. van der Stap, D. Heymann, R. D. Vis, and H. Verheul, Lunar Planet Sci. XVII (1986), 341.

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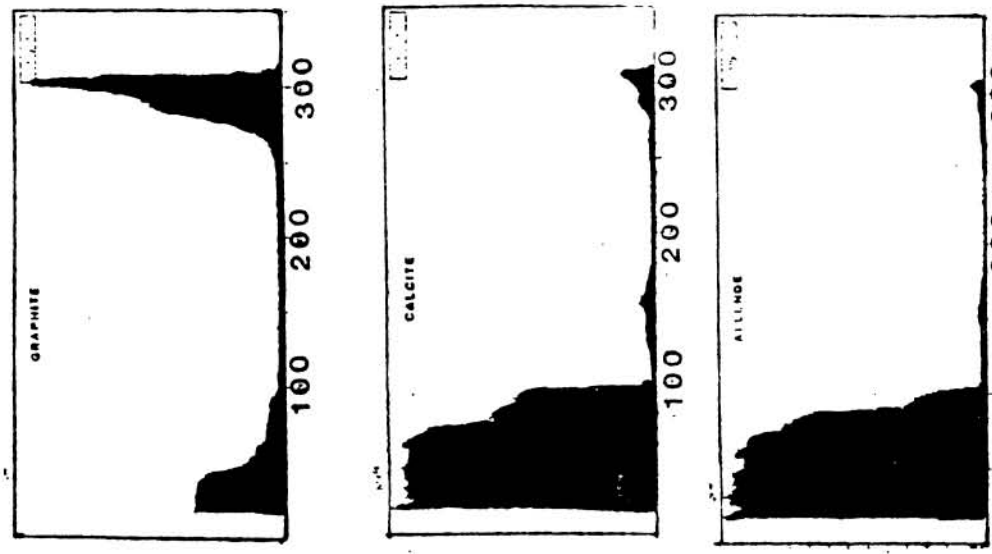

FIGURE 1

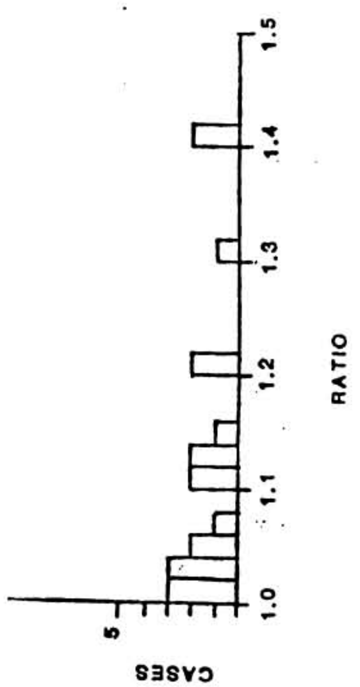

FIGURE 2

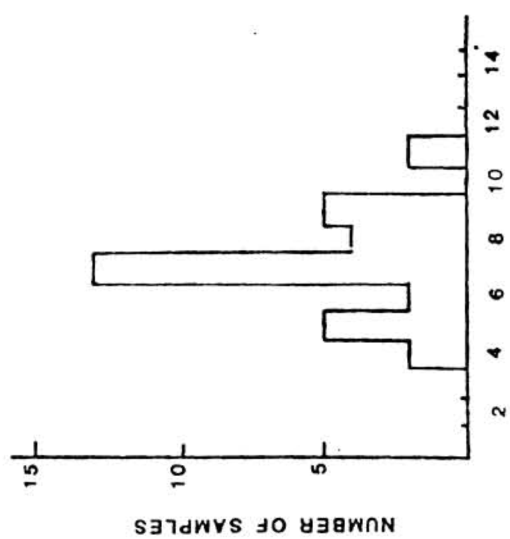

FIGURE 3