CONTRASTING Pb-Pb AGES OF THE CUMULATE AND NON-CUMULATE EUCRITES. F.Tera, R.W. Carlson and N.Z. Boctor, Department of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Road N.W., Washington DC 20015.

In our continuing study of the radiometric ages of the eucritic meteorites, we report here new Pb isotopic data for the monomict eucrite Bouvante and two cumulate eucrites, Moama and Serra de Mage. Petrological and geochemical data for Bouvante suggests that it is an Fe- and incompatible element- rich eucrite similar to Stannern[1]. Because the radiometric systems of other members of this group (Stannern, Cachari) have been disturbed by shock metamorphism [2-4], the relatively unshocked nature of Bouvante offers particular promise to provide an undisturbed isotopic age for the high-Fe group eucrites.

Moama and Serra de Mage, along with Moore County, constitute the high-Mg, cumulate-textured eucrite group. Sm-Nd age information for the three cumulate eucrites [5-7] indicate relatively young ages of 4.46 to 4.41 Ga compared to the 4.52 to 4.56 Ga ages obtained for monomict eucrites [3,8]. Our previous Pb isotopic study of Moore County failed to provide definitive age information [5]. The data, however, defined lines on plots of $^{204}Pb/^{206}Pb$ vs $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$ that suggested mixing between 4.55 Ga old radiogenic Pb and Pb with isotopic composition similar to terrestrial blank. In order to resolve the apparent conflict between Sm-Nd and Pb-Pb ages for Moore County, a Pb isotopic study of Moama and Serra de Mage was undertaken, the results of which were presented orally at the 1988 Lunar and Planetary Science Conference. These results are reported here along with the new data for Bouvante. Combined with information for Bereba and Nuevo Laredo presented previously [8], age information for Bouvante, and the cumulate eucrites will allow comparison between the 4 eucrite classes [9] to define the time scale of early melting on the eucrite parent body and examine the possible petrogenetic relationship between the different eucrite classes.

For Bouvante, mineral separates were prepared by magnetic separation and hand–picking techniques on material crushed to less than 100 micron grain size. Mineral separates from Moama and Serra de Mage were obtained by hand-picking alone. Samples for Pb analysis were leached consecutively 3 times in HBr, then in weak HBr-HF prior to dissolution. All samples were spiked with ^{205}Pb and ^{233}U-^{236}U prior to dissolution. Pb processing blanks during the course of this study ranged from 80 to 100 pg.

The whole rock and both plagioclase and pyroxene separates from Bouvante contain very radiogenic Pb ($^{206}Pb/^{204}Pb$ ranges from 210 to 3128). The HF-leaches of the plagioclase separates contained slightly more Pb (5.5 vs 3.5 ng Pb for 28 mg sample) than the residue and was substantially less radiogenic. The best fit line to the residue data alone defines a Pb-Pb secondary isochron age of 4.514 $\pm$ 0.004 Ga. The age obtained for Bouvante thus is nearly identical to the age of 4.522 Ga found for Bereba and only slightly younger than the 4.534 Ga age determined for Nuevo Laredo [8].

The leaching technique employed here substantially increased the observed spread in $^{206}Pb/^{204}Pb$ for mineral separates from Moama compared to that found by Hamet et al.[10] (5-point stars in Fig. 2). This increased spread allows the definition of a reasonably precise Pb-Pb secondary isochron age of 4.43 $\pm$ 0.04 Ga for Moama, in good agreement with its Sm-Nd age [6]. Data for Serra de Mage show an even larger range in Pb isotopic composition (Fig. 2) and define a secondary isochron age of 4.397 $\pm$ 0.007 Ga, which agrees within uncertainty with the Sm-Nd age reported for this eucrite [7]. These results strongly support the conclusion that the cumulate eucrites have resolvably younger

radiometric ages than the non-cumulate groups. Our data suggest that the maximum age spread between the various classes of non-cumulate eucrites is of order 10 Ma, though older ages obtained previously for Juvinas and Ibitira [11] indicate the possibility of a larger age range within the non-cumulate eucrites. The younger ages of the cumulate eucrites relative to the non-cumulate eucrites, if crystallization ages and not cooling ages, place constraints on the petrological models of their origin. Cumulate eucrites could not have formed by fractionation of pyroxene and plagioclase from the same magma from which non-cumulate eucrites originated.

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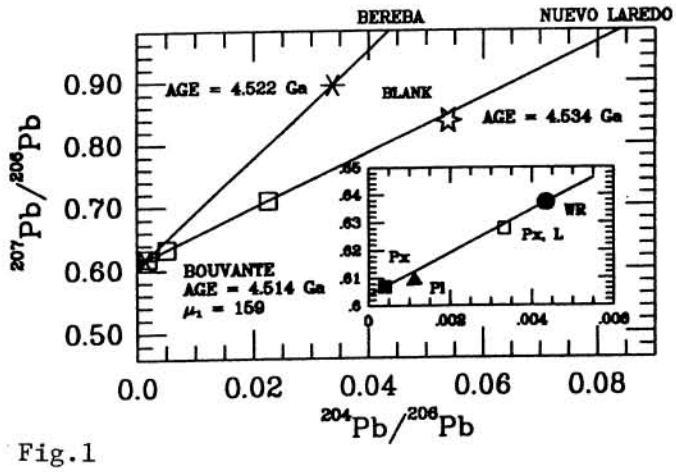

Fig.1

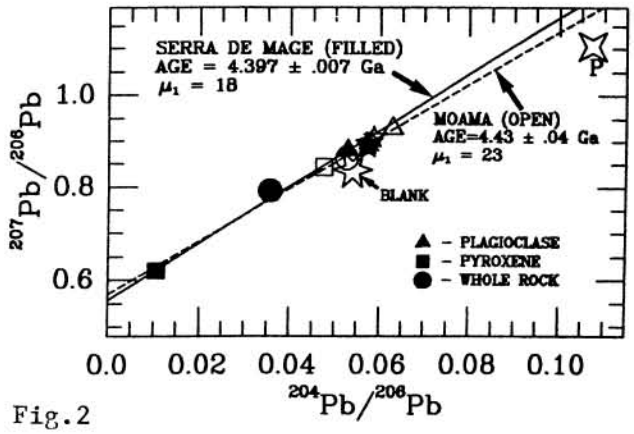

Fig.2