A "CHONDritic" EUCRITE PARENT BODY: INference FROM TRACe ELEMENTS
John W. Morgan*, H. Higuchi†, H. Takahashi and Jan Hertogen
Enrico Fermi Institute and Department of Chemistry
University of Chicago, Chicago, Illinois 60637

Analytical. Thirty-three elements (Ag, Al, Au, Bi, Br, Cd, Ce, Co, Cr, Cs, Eu, Fe, Ge, Hf, Ir, Lu, Na, Ni, Os, Pb, Re, Sb, Sc, Se, Si, Sm, Tb, Te, Tl, U, Yb, Zn) in four eucrites were analyzed by radiochemical and instrumental neutron activation.

Nebular and Planetary Fractionation. Data were normalized to C1 chondrites and arranged by volatility to distinguish nebular and planetary effects. The stepped lithophile pattern (Fig. 1) shows the dominance of nebular processes; elements of similar volatility have similar abundances. The depletion of Tl relative to other volatile lithophiles may be inherent to the eucrite parent body (EPB) and not entirely due to surface volatilization.
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(Stolper, 1977). Consistent abundance differences between eucrites (Serra da Magé < Moore Co. < Juvinas < Ibitira) result from igneous fractional crystallization. The siderophile pattern (Fig. 2) does not reflect nebular processes but results from planetary differentiation (metal silicate partition). Of the chalcophiles, the marked depletion of Te relative to Se mirrors that of lithophile Tl relative to Bi and Cs and suggests that the EPB accreted volatiles as a fractionated component, similar to C3 chondrites (Anders et al., 1976).

Composition of the EPB. We base our estimates of EPB composition on modifications of the 7 Ganapathy/Anders components (Table 1; Ganapathy and Anders, 1974). The composition of the high-temperature condensates (HTC) was aligned with a mean refractory abundance of 17.7 × Cl. Total refractory abundances in eucrite source material were estimated assuming 10% partial melt (Consolmagno and Drake, 1976). The HTC comprises 0.074 of the source material. Low T1 suggests that the volatile-rich components (VRC) resemble C3 material; the weight fraction of VRC in source material is 0.0053. Metallic Fe/Ni was estimated assuming 1) refractory siderophiles and lithophiles have similar abundances. 2) IIE irons approximate EPB metal. With Ir as our indicator element, we find the metal abundance of 0.13. (This yields and EPB density of 3.5 compared to -3.6 for Vesta, an apparently eucritic asteroid). Since the sulfide content of the EPB is probably very low, the total Mg silicates can be found by difference, to be 0.79 of the source material. From the Na/A1 ratio in source plagioclase (Ang4; Stolper, 1975), we find unmelted Mg silicate to be 0.029; the remainder is remelted silicate (chondrules). The Fe/Mg ratio in Mg silicates was raised to correspond to Stolper's source material mineralogy.

The derived major element composition may be compared with other estimates (Table 2). Our estimate is higher in FeO than most others, and Mg and Si are correspondingly lower. The high Ca and A1 of Dreibus et al. (1976) results from their high estimates of HTC.
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A Chondritic EPB. In Table 3, compositions of EPB and of other solar system material are compared. The resemblance of EPB and H-chondrites is very close except for volatiles (Na, K, Mn). Volatile depletion in EPB results from an high original abundance of chondrule material and a high chondrule formation temperature. The EPB is more chondritic than the Earth and much more so than the Moon. The unusual composition of the Moon probably reflects its formation as a satellite.

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References: