Haag, H., Kirsten, T. and Schlotz, R., 1977. Unpublished data.

Herpers, U., Herr, W. and Wölfe, R., 1967. Determination of cosmic ray-produced nuclides ^{53}Mn, ^{45}Sc and ^{26}Al in meteorites by neutron activation and gamma coincidence spectroscopy. In Radioactive Dating and Methods of Low-Level Counting, IAEA, Vienna, 199-205.

Imamura, M., Matsuda, H., Horie, K. and Honda, M., 1969. Applications of neutron activation method for ^{53}Mn in meteoritic iron. *Earth Planet. Sci. Lett.* **6**, 165-172.

PYROXENE RELATIONS IN THE SERRA DE MAGÉ METEORITE

G.E. Harlow and M. Prinz, *American Museum of Natural History, New York, NY 10024*

C.E. Nehru, *American Museum of Natural History, New York, NY 10024 and Brooklyn College, Brooklyn, NY 11210*

G.J. Taylor and K. Keil, *University of New Mexico, Albuquerque, NM 87131*

Pyroxenes of the Serra de Magé eucrite exhibit complex exsolution features. These have been studied by single-crystal X-ray diffraction, optical, and microprobe techniques. The host is hypersthene (~85 vol%), Pbca. Several types of augite, C2/c occur: A1 – thick lamellae ($\lesssim$25 μm thick) are relict (001) exsolution from pigeonite; A2 – usually fine (< 1 μm thick) but sometimes blebby (100) lamellae from hyp; A3 – septa and lenses (~5 μm thick) on ~(052) of hyp; and A4 – irregular small (3-7 μm) blebs. A2 aug is ubiquitous; Al lamellae are common, spaced from 90 to ~250 μm apart; and A3 and A4 are common but occur in local discrete volumes. Al and hyp share b^*, while the a^* directions are normally separated by 2-3°; it was 17° in one case. A2 appear to be partially coherent with hyp, having common b^*, a^* directions, and c^*_{A2} parallel to $[101]^*_{hyp}$. The relations have features of opx of both the "Stillwater" and "Kintoki-San" types (*c.f.* Ishii and Takeda, 1974). However, the existence of four types of aug in one host grain does not fall into any existing model of pigeonite exsolution, suggesting complexities in its origin. Conclusions. The following thermal history of pyx in Serra de Magé is proposed: 1) Crystallization of pig ($Wo_{6.6}En_{54.0}$; 9 vol % A1) above the pig eutectoid reaction temp, ~1130 °C; 2) Exsolution of A1 lamellae begins at ~1060 °C on cooling below the metastable pig-aug solvus; 3) As (001) lamellae grow, pig changes to clinohyp by removal of Ca; 4) Inversion of clinohyp to hyp ($Wo_{2.7}En_{55.5}$) near the intersection of the metastable aug solvus with the hyp solvus (~900 °C) is nearly ideal (small degree of misorientation) but may incur some recrystallization; 5) Exsolution of A2 aug on (100) occurs on further cooling. Relations of the A3 and A4 aug are unclear but the crystallographic orientation suggests growth from hyp. Comparison of the exsolution textures and initial pig compositions of Serra de Magé with the cumulate eucrites Moama ($Wo_{3.0}En_{56.7}$) and Moore County ($Wo_{10.1}En_{45.6}$) shows that Serra de Magé crystallized with an intermediate cooling rate and at a cumulate depth of ~ 10 km in an achondrite parent body (*c.f.* Miyamoto *et al.*, 1977).

H AND E CHONDRITES REVISITED

J. Hertogen, J.W. Morgan,* H. Takahashi and M.J. Janssens, *Enrico Fermi Institute and Department of Chemistry, University of Chicago*
**Present address: U.S.G.S., Reston, VA*

Ten H-chondrites and six E-chondrites were analyzed by radiochemical neutron activation for 20 trace elements (Chondrites-H3: Bremervörde, Tieschitz; H4: Menow, Quenggouk, Beaver Creek, Monroe; H5: Ambapur Nagla, Allegan; H6: Butsura, Kernouvé; E4: Abee, Adhi Kot, St. Sauveur; E6: Hvittis, Pillistfer, Daniel's Kuil.).

H-Chondrites. (Au, Ni, Pd, Ge)/Si ratios support the suggestion of Dodd (*EPSL* **28**, 1976, 479) that the metal/Si ratio is lower in H3 chondrites than in H4-6. There is, however, no clear-cut, monotonic trend from H3 to H6; Menow has a metal/Si ratio intermediate between H3 and H5-6, whereas the three other H4 chondrites have a higher ratio than H5-6. Admittedly, heterogeneities in small samples (100-200 mg) could have blurred these subtle trends. (Re, Os, Ir)/Si ratios follow exactly the same trend as the metal/Si ratios, suggesting that depletion or enrichments of metal and refractory siderophiles are caused by the same process. Aerodynamic sorting of chondrule and metal particles (Dodd, *EPSL* **30**, 1976, 281) could account for part of the observed variations in absolute trace element abundances. (Os, Ir, Ni, Pd)/Au ratios do not change systematically with petrologic type and deviations from the C1 ratios are generally smaller than 15%. However, Re/(Os, Ir) ratios cluster around 1.5 × C1.

E-Chondrites. The 6 E-chondrites show more varied trends. (Ni, Pd, Au)/Si ratios, like Fe/Si ratios, are higher in E4 than in E6. The refractory siderophiles Ir and Os are deficient relative to Ni, Pd and Au for both E4 and E6 types (~ 0.75 C1). Re/(Os, Ir) ratios are consistently higher than the C1 ratio, as in H-chondrites. A noteworthy feature of the refractory elements is the significant anti-correlation between U and Os, Ir, pointing towards fractionation of the highly refractory lithophiles and siderophiles, either during condensation or accretion. Whereas the volatile and highly volatile elements in St. Sauveur and Abee (E4) slightly decrease with decreasing condensation temperature, no such regular trend is observed in the volatile depleted E6 chondrites. Adhi Kot is a somewhat anomalous E4, since Zn, In, Cd and Br abundances are intermediate between E4 and E6, or even lower than E6 for Bi. Bivariate correlation and factor analysis showed quite strong