AN SEM PETROGRAPHIC STUDY OF C3(V) METEORITE MATRIX. Julia A. Peck, Smithsonian Astrophysical Observatory, 60 Garden St. and Department of Geological Sciences, Harvard University, 24 Oxford St., Cambridge, MA 02138.

C3(V) chondrites are aggregates of chondrules and refractory inclusions embedded in a fine-grained, opaque matrix. This matrix has been studied in much less detail than inclusions or chondrules, although it may be an aggregate of nebular material [1,2]. I report the initial results of an SEM petrographic study of C3(V) meteorite matrix in Allende, Mokoia, and Vigarano, and the first description of unusual, zoned clinopyroxene ring structures.

The major minerals in Allende matrix (in order of decreasing abundance) are olivine (ol), salitic clinopyroxene (cpx), FeNi-sulfide (sf), magnetite (mt), sodalite (sd), and nepheline (ne) (Fig. 1A). Euhedral to subhedral plates of ol form a porous aggregate that is probably a mechanical mixture of grains which formed independently. Ol is unzoned and has the same composition ($Fo_{\sim 55}$ [1]) throughout the matrix. Matrix ol can be distinguished from small fragments of olivine chondrules; the latter are usually larger and more equant than the plates, have forsteritic cores, and are normally zoned. Olivine has poor cleavage [3] and does not break into elongated fragments. The morphology of the ol fragment shown in Fig. 1B suggests that these plates are intact crystals [4], not fragments of chondrules (as suggested by [5]). Cpx frequently occurs in unusual zoned, anhedral assemblages of one or more hollow rings (usually with sf grains in the central void). Concentrically surrounding the central void are a Mg-rich zone, an Fe-rich zone, and finally another Mg-rich zone (which may be incompletely developed). Sometimes, several cpx rings are clustered together around sf grains. Opaque minerals (sf, mt) are usually anhedral. Carbonaceous material [6] and tiny opaque grains (especially mt) that adhere to the surface of ol grains contribute to the opacity of meteorite matrix. Feldspathoids often enclose small grains of ol. Like feldspathoids in AOA's [7], they are Fe-bearing.

The mineralogy and texture of Mokoia meteorite matrix resemble those of Allende, but the minerals are less equilibrated (Fig. 1C). Ol has the same crystal habit, but its mineral chemistry varies. Proximate forsteritic and ferroan ol have only thin, zoned rims, even where they meet. Cpx occurs as porous, anhedral grains and as ringed structures that are less complex than those in Allende (often a single ring without opaque minerals). Ca zoning predominates: a Ca-rich zone borders the inner pore space, and Ca-poor cpx forms the outer rim. Mt occurs in spherules that suggest a vapor [8] or liquid origin. Both Ni-bearing and Ni-poor sf are present. As in Allende, sd and ne contain Fe. A Mg-rich phyllosilicate (named LAP by [9]) occurs as porous aggregates of anhedral grains, which contain tiny ol grains that merge with the phyllosilicate.

The texture of Vigarano meteorite matrix differs from Allende and Mokoia matrix (Fig. 1D). It is a groundmass of very fine-grained, anhedral ol, cpx, and opaque mineral grains in which larger ol crystals and cpx rings are embedded. Some large ol crystals are normally zoned; ol in the groundmass is unzoned. Cpx occurs as anhedral grains and as ringed structures with a Mg,Ca-rich zone bordering the hollow core, and a Ca-poor, Fe-rich zone comprising the outer rim. Sf grains cluster in the hollow core. Other opaques in Vigarano matrix are mt, FeNi-metal, ilmenite, and chromite. Except for mt (which is sometimes subhedral to euhedral), all of the opaques occur as anhedral grains that are inhomogeneously distributed in the matrix: several grains of the same mineral tend to cluster together. Fe-bearing ne and sd and a Mg-rich phyllosilicate are present in low abundance.

Two non-random fabrics occur in the matrices of these meteorites. Ol plates sometimes are aligned parallel to adjacent chondrules or inclusions. This foliation is only locally developed, not continuous around the objects. The second texture, described by [10] as a "flow structure" is also mineralogically distinct: it is depleted in sf relative to ordinary matrix. Sulfur could have been volatilized during the thermal metamorphism proposed by [10]. Flow structures appear to be molded around adjacent objects. Ol grains are more equant and slightly larger than in ordinary matrix: they may be recrystallized. The boundary between flow structures and ordinary matrix is sharp in some areas, but transitional in others.

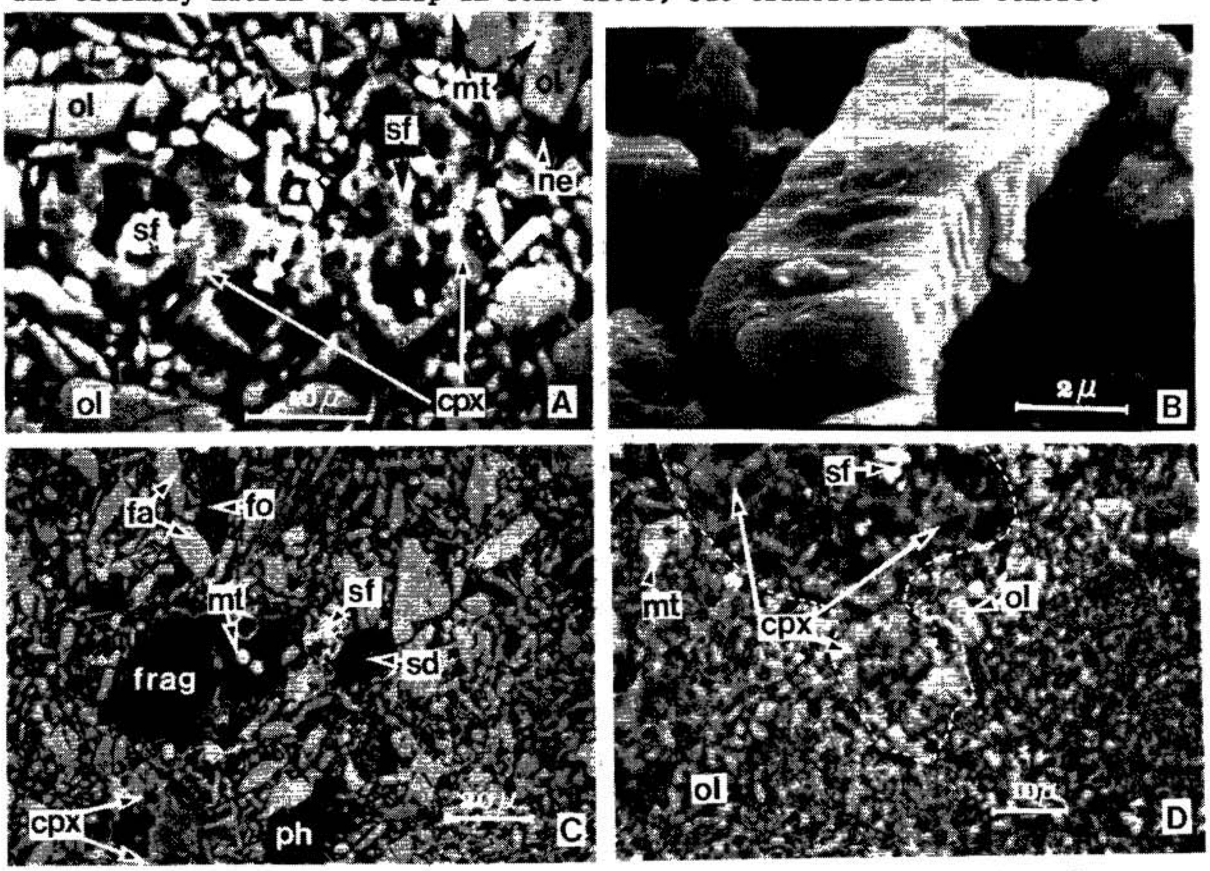

Figure 1. SEM backscattered-electron images of matrix and cpx rings in Allende (A), Mokoia (C), and Vigarano (D) [note cpx zoning in (A)]. (B) SEM image of disaggregated Allende matrix olivine. Ol=olivine, fo=forsteritic olivine, fa=ferroan olivine, cpx=clinopyroxene, ph=phyllosilicate, sf=sulfide, ne=nepheline, sd=sodalite, mt=magnetite, frag=chondrule fragment.

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