15 THE MAFRA METEORITE AND ITS LITHIC CLASTS: A GENOMICT L-GROUP CHONDRITE BRECCIA

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The composition and petrology of the Mafra host and 8 of its lithic clasts were studied in detail. Bulk analyses of the clasts and host using broad beam electron microprobe techniques with a Bence-Albee matrix correction via normative mineral compositions show that all of the clasts and the host have L-group compositions. There is some variation in the average olivine and pyroxene compositions from clast to clast, but all lie within the range of L-group values except for clast C which exhibits a wide range; the average olivine composition for this clast falls below the H-group range. However the bulk composition of clast C falls within the L-group range. This clast has been melted and recrystallized which may account for these facts. Thus, Mafra is clearly an L-group and not an H-group chondrite as suggested by Levi-Donati et al (1976). Petrology of the host indicates that it is of petrologic type 3,4, as much of the matrix is microcrystalline and most of the glass is turbid, although the %MD of the FeO in the host olivines is 10.2, indicating type 3. All of the clasts belong to a higher petrologic type (all 4 or 5 except clast C), have been shocked to varying degrees, and are much more coherent than the host. Thus, we conclude that Mafra is a genomict breccia of L-group composition with the host material being L3,4.

Levi-Donati, G. R., M. Shima and G. P. Sighinolfi, 1976. Brazilian Meteorites: The Mafra, Santa Catarina State, Chondrite. Meteoritics 11, 29-41.

16 ELECTRON MICROSCOPE OBSERVATIONS BEARING ON THE EARLY HISTORIES OF ORDINARY CHONDRITES

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Several different patterns of crystal defects in silicates have been observed by high-voltage electron microscopy of ordinary chondrites. Most dislocations in olivine are of deformational origin. Deformation is often strikingly localized, and the observations are consistent with the expected effects of mild shock due to minor impacts. Shock-produced lamellae of clinopyroxene in orthopyroxene are distinguished from the effects of an inversion that is not due to stress. Exsolution of small particles in olivine also occurred independently of, and mostly earlier than, the recorded deformations.

A distinctive type of defect microstructure is well-developed in Butsura (H6); cracks are abundant but, in orthopyroxene, they are associated with dislocations that lie outside the sparse clino-lamellae. In adjacent olivine, dislocations are curved, and often ordered loosely into arrays; dislocation motion by several slip systems can be inferred. Both minerals contain thin, very fine-grained veins.

These effects can be contrasted with the extensively annealed deformation in Saint-Séverin (LL6), and also with the typical effects of late, mild shock, whose products are - in orthopyroxene, mostly clino-lamellae, and in olivine, dislocations of the (hk0) [001] slip system with long straight [001] segments. This latter style of deformation is prevalent in samples of Allegan (H5) and Quenggouk (H4), but they also probably contain relics of earlier deformations. As in Butsura, the distinguishing features of the early deformations are consistent with high-temperature deformation as described by experimental workers. The observations suggest a history of mild shock deformations prior to the final stages of cooling of the parent bodies of ordinary chondrites.

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