
THE CHEMICAL COMPOSITIONS OF OLIVINES AND PYroxENES FROM ANTHROTIC MICROMETEORITES. J. Walter, G. Kurat, F. Brandstätter, T. Perner, C. Köcherl, and M. Maurette, Naturhistorisches Museum, A-1014 Vienna, Austria; Institut für Geochemie, Universität Wien, A-1010 Vienna, Austria; Centre de Spectrométrie Nucléaire et de Spectrométrie de Masses, Bo 104, F-91405 Orsay-Campus, France.

In the course of a systematic investigation of micrometeorites (MM) from Antarctica [1], we have investigated selected particles from the 100–400-μm size fraction by INAA, ASEM, EMPA, and optical microscopy. Of the 50 particles analyzed so far, 35 turned out to be of extraterrestrial origin. This collection comprises 7 unmelten phyllosilicate-dominated MM, 6 unmelten coarse-grained crystalline MM, 19 partially melted scintillate MM, and 8 cosmic spheres.

The mineralogy and geochemistry of the unmelted MM population indicates that this most common extraterrestrial matter being sampled by the Earth is similar, but not identical, to those CM chondrites [e.g., 2.3]. One of the differences believed to be primary is the high abundance of pyroxenes in MM and the lack of an olivine and pyroxene population very poor in Fe and rich in refractory elements [e.g., 4–7]. Eight of our unmelted and partially melted MM contained olivine, 7 pyroxene, 11 olivine and pyroxene, and 0 neither phase. The chemical composition of the phases large enough to be analyzed by EMP are plotted in the Fig. 1. As is evident, both olivine and pyroxene compositions cluster at low Fe contents. However, the range of both minerals is not as low in FeO as that known from CM chondrites [e.g., 8, 9]. Correspondingly, the MM phases are also not as rich in refractory elements, as are the most refractory olivines from CM chondrites. Otherwise, their compositions are very similar exhibiting the enrichments in Mg and Cr typical of extraterrestrial olivines and pyroxenes.

According to the model of [10] we can interpret the difference as indicating different intensities in processing of constituents of MM and CM chondrites in the solar nebula. The more intense reworking (anastomosis and metasomatic elemental exchange between mineral grains and the gas phase) of the MM constituents did not allow some primitive phases to survive. Furthermore, unmelted and partially melted MM are on average richer in low-Ca pyroxene than as olivines as are the CM chondrites. In addition, Carbonates have been found to be higher in phyllosilicate MM than in Orgueil [11]. Thus, the MM from the size fraction 100–400 μm are the fraction...
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that delivers the main mass of extraterrestrial material onto the Earth, is mineralogically and chemically different from any of the known meteorite classes. It is an extraterrestrial matter of its own but seems to be related to the rare CM-type chondrites.


The texture of SC is in most areas highly brecciated, with sufficient diversity in grain size (e.g.) to raise doubts as to whether the rock is even monomineral. Most of the unbrecciated portion is extremely coarse-grained. In a large unbrecciated clast, we find grains blocky and up to 5 mm across. Studying a large piece, BVSP [2] noted grains up to 1 cm. We find the pyroxenes are mostly poikilitic that have thoroughly exolved, with augite lamellae typically 4-6 μm wide, although roughly 10% have widths >6 μm, and the thickest are 12 μm; also, one grain of primary augite with 3-mm-wide optic lamellae. Most analyses have Wo<2.0 or >24 mole%. Cpx mgs ratios are 36-85, 0.0 mol%. In addition, the SC bulk composition (literature data) is displaced from the average Nareae olivine ecritic toward higher mg and V, and lower Sc and REE, which is also true (except for greater degree) of all the obvious nectomaculcute ecritics. We interpret SC as an orthocumulate. The parent melt was considerably more evolved (lower mg, lower V, higher REE, etc.) than the observed SC composition, and had a slight (~5%) Eu anomaly. Any compositional similarity between SC and Murchison partial melts [3] must be largely coincidental.

We note a general tendency for the more slowly cooled monomineral ecritics, including such Main Group "monometamulcute" ecritics as Chervonk Kut, Heranay, Juvinas (literature data), and the texturally comparable EET 87520, RKPA 80204 (monomitic), RKPA 80224, Y 791 186, and Y 80207 (our new data), to feature compositions like SC, with higher mg, higher V (Y 791 186, at 62 g/pg, is an interesting exception), and lower REE than their more rapidly cooled counterparts. We suspect that all of the above-mentioned ecritics are at least mildly accumulative. If pyroxene exsolution is any indication, they cooled far more slowly than any of several lunar mare gabbros that are known from field context to be orthocumulates. These ecritics are texturally comparable to the main mass of the Palaeolithic Sill unit (except for the famous olive layer, no "cumulate framework" textures are discernible, yet geochemical layering requires that the rocks are mildly accumulative. Another factor causing "noncumulate" ecritic breccias to display relatively primitive compositions may be that they are actually polycyclic, with substantial contributed cumulative components in their matrices.

Only a relatively few ecritics are likely to be compositionally close to the melts from which they crystallized. Most monomineral ecritics, including SC and other orthocumulates (except Pomozonitic), crystallized from melts more ferron than any nectomaculate [1]. The same parent body has also yielded many orthopyroxenites (digenites) with mg ratios implying parent liquids more magnesian than any nectomaculate (at least, on average—some diffusive or even convective homogenization of the digenite mg ratios may have occurred). Intermediate melts presumably once existed, and either evolved into cumulate parent melts, or were quenched into the Main Group ecritics. Absence of quenched liquids as ferron as the cumulate parent melts suggests that the cumulates formed fairly deep within the crust.


FIELD RECOVERY OF LAYERED TECTITES IN NORTHEAST THAILAND: EVIDENCE OF A LARGE-SCALE MELT SHEET. J. T. Watson, J. Phukhapan, P. Fiske, P. Puttipipat, S. Saitogoro, B. Phaethip, J. P. McHenry, University of California, Los Angeles CA, USA. (Geological Survey Division, GMR, Bangkok, Thailand. Lawrence Livermore National Laboratory, Livermore CA, USA. (Arizona State University, Tempe AZ, USA.

Field searches and interrogation of farmers in Thailand has led to the...