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Introduction The recent accretionary flux of extraterrestrial matter onto the Earth is dominated by meteoroides in the size-range 50-500μm [1]. Theory predicts [2,3] that almost all of these meteoroids should in entering the Earth's atmosphere, be frictionally heated to such an extend that total melting will take place and thus the original mineralogy be destroyed and the chemical composition be severely altered. Fortunately, this seems not be the case because the Antarctic blue ice contains large amounts of unmelted extraterrestrial matter of just the particle size mentioned above [4-6]. This offers us the oportunity to study in detail the extraterrestrial matter which accounts for 99% of the daily infall on Earth. We are well aware of the chemical, physical, and mineralogical features of the rare large pieces of extraterrestrial matter we call meteorites. We are also fairly well informed about the features of objects which have been dubbed Interplanetary Dust Particles (IDPs) [7] and which cover the size-range <50μm. The most common matter of the size-range 50-500μm is the least known one. Earlier studies of these micrometeorites (MMs) gave as a result that they are similar to CM chondrites in mineralogy and chemical composition [5,8-14]. However, the match is not perfect and we need to study much more MMs in order to be able to answer the many questions arising from this differences. The most important question to be answered is wether the differences between MMs and CM chondrites are primary ones or of secondary origin [e.g., 11-18]. Here we make an attempt to give some answers by studying the major and trace element contents and the mineralogy of a selection of MMs.

Results Extraterrestrial matter from the Antarctic ice in the size-range 50-500μm consists of a variety of objects which represent all stages of possible alterations due to frictional heating during atmospheric entry. A surprisingly large porportion consists of unmelted micrometeorites which comprises phyllosilicate-dominated MMs or anhydrous coarse-grained silicates or mixtures of phyllosilicates with anhydrous silicates. The phyllosilicates are dominated by smectites and the anhydrous silicates by Fe-poor olivine and low-Ca pyroxene. Phyllosilicate-dominated MMs grade with increasing thermal exposure from slightly recrystallized to partial and total foamy melts. We call such particles scoriaceous MMs. The ultimate products of atmospheric heating are the degassed and droplet-shaped cosmic spherules. Among all objects there is present a considerable proportion which contains solar energetic particles Ne [5] proving that they existed as small objects, true micrometeoroids, in space.

Chemical bulk analyses of unmelted phyllosilicate-rich MMs obtained by electron micropobe (EMP) (Table) and instrumental neutron activation analysis [10,12,14,15,19] are compared to CI chondrites in Figures 1-3. Relative to CI chondrites MMs are depleted in Ca, Na, Ni, Co, S, and occasionally also in Mg and Mn and are enriched in K, Au, As, and occasionally in Br and Fe. The refractory and volatile lithophile elements have abundances very similar to that of CM chondrites (Fig.2).

Discussion. The mineralogical composition of unmelted MMs is quite similar to that of CM chondrites but differs from the latter in the small olivine/pyroxene ratio, the predominance of smectites over serpentine, and the lack of refractory very low-Fe olivines [5, 8, 9, 12, 13, 19]. The bulk major and trace element contents of MMs also match the CM chondrite composition with the exception of some elemental depletions (Ca, Ni, Co, S, Mg, Mn) and enrichments (K, Au, As, Br, Fe). The mineral chemical differences between MMs and CM chondrites appear to be primary and set the MMs apart from all known meteorite classes. Also, the abundances of olivine and low-Ca pyroxene are unusual for CM chondrites but comparable to that of the unique Kaidun carbonceous chondrite [22]. However, the total lack of carbonates and sulfates in MMs is very probably due to terrestrial leaching processes and is very likely the cause of most of the elemental depletions observed in the MMs. Carbonates and sulfates are very common in CM chondrites [23] and are major sinks for Ca, Mg, Mn, Ni, Co, and S [14, 24 - 25]. Leaching of these phases from the MMs must result in measurable depletions in the elements mentioned and this is exactly what we observe. Similar depletions in IDPs [26 - 28] seem to be the result of the very same processes.

Enrichments of some volatile elements (K, Br, As, Au, Fe) in MMs very probably have also terrestrial causes. It has been shown by [29] for the Br enrichment of IDPs to be the result of terrestrial atmospheric contamination. A similar process - recondensation of meteoritic vapors in the atmospheric E-layer - is probably responsible for all the enrichments observed. The condensation of Fe has a visible effect: many MMs are enveloped by magnetite covers of variable thickness.

Conclusion. The most common extraterrestrial matter accreting onto the Earth today appears to be related to a rather rare class of meteorites, the CM chondrites. The match between MMs and CM chondrites is not perfect and warrants the establishment of a distinct class of MM carbonaceous matter. However, a variety of mineralogical and chemical pecularities of MMs appear to be due to terrestrial alteration process.

There is evidence for condensation processes in the high atmosphere (the base of the ionosphere) and of leaching processes in the lower atmosphere, the ice, and the melt ice water.

Beside the common CM-like MMs described in this contribution there is a variety of other rocks present in the Antarctic dust collection. Certainly at least a few of the mineralogically and chemically fractionated objects present are of extraterrestrial origin and possibly even of a planetary origin. Also some intestellar matter could be present. Much more work needs to be done to extract the wealth of information hidden in this dust sample which - for strange reasons - was so efficiently protected that is only very recently became available for study. Let's take up the challenge.

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Table: EMP bulk analyses of selected phyllosilicate-rich MMs.

	91/2-024	91/2-073	91/3-022	91/3-031	91/3-038	91/3-108
SiO2	28,20	30,10	37,90	33,80	32,90	24,40
TiO2	0,08	0,07	0,13	0,07	0,07	0,10
Al2O3	1,71	1,35	2,05	1,92	1,70	2,04
Cr2O3	0,32	0,28	0,53	0,35	0,50	0,60
FeO	45,80	30,40	25,00	33,80	30,90	31,40
MnO	0,06	0,55	0,06	0,15	0,20	0,18
NiO	0,04	0,17	0,11	0,18	0,44	0,64
MgO	2,98	16,40	17,30	13,70	18,30	9,64
CaO	0,12	0,66	0,34	0,12	0,17	0,24
Na2O	0,23	0,21	0,26	0,17	0,28	0,26
K2O	0,91	0,21	0,42	0,17	0,19	0,78
SO3	1,29	0,94	6,81	2,02	2,97	7,04
sum	81,30	81,40	90,91	86,34	88,59	76,44

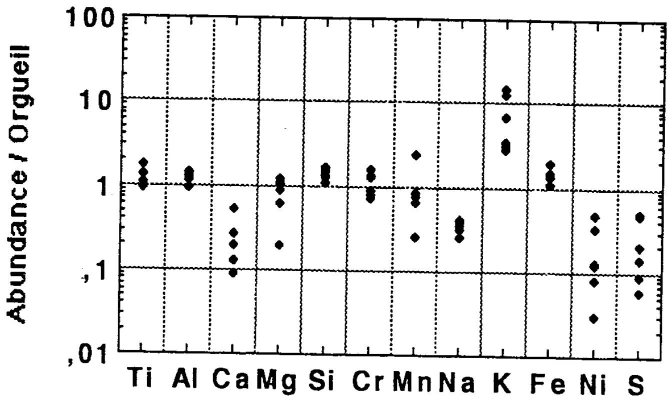

Figure 1: Bulk major and minor element contents of phyllosilicate-rich MMs as determined by EMP normalized to CI chondrites [20].

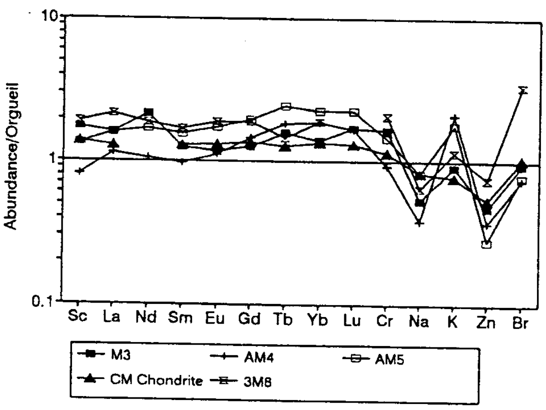

Figure 2: Bulk lithophile trace element contents of phyllosilicate-rich MMs as determined by INAA normalized to CI chondrites [20]. Elemental abundances fo CM chondrites [21] are shown for comparison.

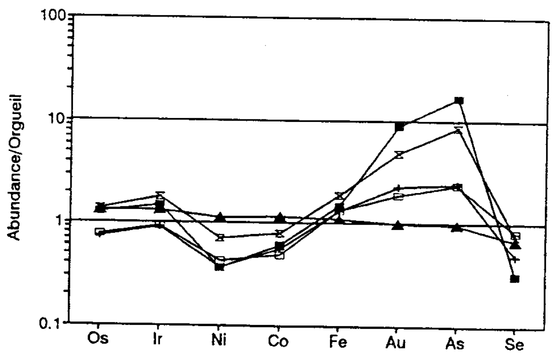

Figure 3: Bulk siderophile trace element contents of phyllosilicate-rich MMs as determined by INAA and of CM chondrites [21] normalized to CI chondrites [20].