"CHEMICAL" SEARCH FOR COMETARY GRAINS IN ANTARCTIC MICROMETEORITES.
M.Maurette[1], C.Engrand[1,2], G.Kurat[3]. [1] CSNSM, Bat.104, F-91405 Orsay, France; [2] LEM, ONERA, BP 72, 92322 Chatillon, France; [3] Naturhistorisches Museum, Postfach 417, A-1014 Wien, Austria.

The chemical composition of dust grains with sizes ≈100nm released by comet Halley, and analyzed by mass spectrometers on board of the Giotto and Vega spacecrafts are compositionally different from CI chondrites. In particular they are much richer in C and apparently poorer in Al, Mg, and Fe with respect to CI chondrites. About 15% of Antarctic micrometeorites (AMMs) show also high C-contents (> 4xCI) and a wide dispersion of Al, Mg and Fe concentrations between CI and the distinct Halley zone. We screened AMMs with the lowest Al, Mg and Fe concentrations for high C-contents, thus tentatively identifying possible cometary grains. We compared these grains to another subclass of AMMs with Al, Mg and Fe contents now clustering around the CI average. In both subclasses we observed either low or high C contents, as well as striking similarities concerning textural features, major silicate compositions, and a general depletion in Ca, S and Ni. Chemical data alone do not constitute a reliable criterium to identify cometary grains in the micrometeorite flux. It might be that most of the "chondritic" material trapped in either C-rich asteroids found outside the main asteroidal belt or cometary nuclei are rather similar with respect to their chemical and mineralogical composition.

One advantage of AMMs is their large size, allowing splitting them into several fragments for coordinated studies: (a) one of the fragments is crushed into micron-size grains onto a gold electron microscope grid, and about 30 grains are selected at random for the measurement of C/O ratios on ≈100nm-sized spots with the electron spectrometer of a TEM (see ref. 1). The scale of the analyzed volume (≈100nm x 50nm) is comparable to the size of Halley grains. Simultaneously the chemical composition of major elements in the same spot is characterized with the EDS of the TEM; (b) another fragment is polished and analyzed with an analytical SEM and an electron microprobe, for determining the textural group, the mineralogy of the major crystalline phases, and the bulk composition of the fine grained matrix of the parent AMMs on a scale of ≈10μm.

The following conclusions can be inferred from the best Halley data (see the discussion of S.Ross in ref. 2): (a) ≈30% of the Halley grains contains C contents much higher than bulk CI value; (b) this carbonaceous material is most frequently associated with a fine grained "stony" matrix with grain-sizes down to ≈100nm; (c) Al/Si , Mg/Si and Fe/Si ratios lower than those of CI chondrites clearly separate cometary grains from the "chemically" most primitive meteorites.

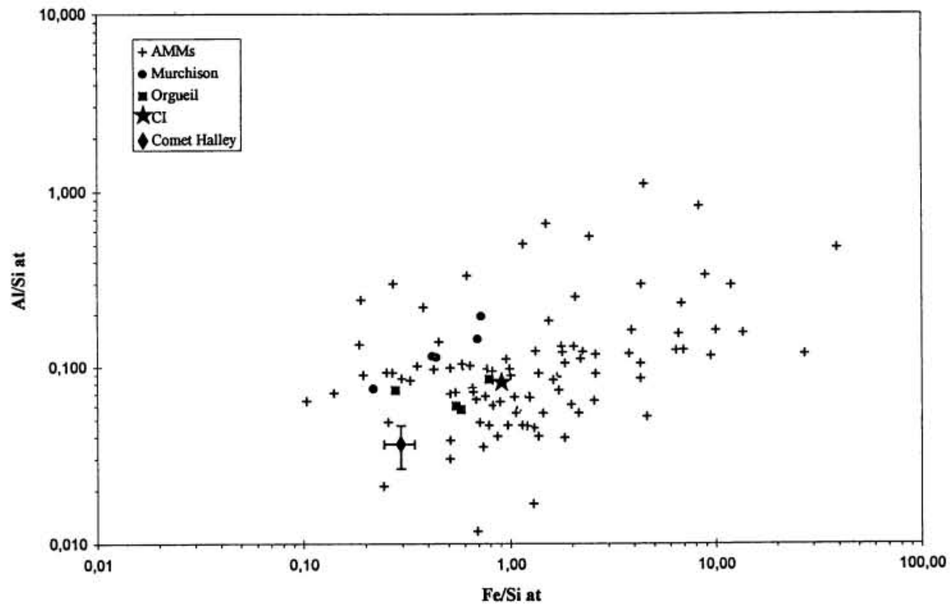
For AMMs <u>analyzed on a scale of ≈100nm</u>, we observe a very broad cluster of all data points extending from <u>bulk CI</u> values into the Halley "cometary" zone: (a) ≈15% of AMMs show C contents much higher (> 4xCI) than bulk CI value (1), thus reaching the lower end of the Halley values; (b) in AMMs >95% of the carbonaceous material is intimately associated with a very fine grained mineral matrix on a scale <100nm (1); (c) Al/Si, Mg/Si and Fe/Si ratios measured for AMMs (fig. 1a and 1b), show a very broad distribution of data points defining two grain subclasses, belonging to a "cometary" and a "CI" zone, respectively.

From Halley data we could assume that low Al, Mg and Fe concentrations, when coupled to high C contents contents "screen" a selection of cometary grains. But high C contents are not reliable as they are found in both the Halley and CI zones of the correlation plots reported in fig.1. Low values of Al, Mg and Fe concentrations cannot be trusted either, because they have also been observed in a selection of 27 carbonaceous chondrites analyzed with an electron microprobe on a much larger scale of ≈10μm (3). Finally, AMMs found in the Halley and the CI zones look very similar with regard to other important characteristics including: textural features (i.e. scoriaceous type chondritic particles representing partially melted AMMs are found in both zones); the composition of their major silicates; and a general depletion of Ca, S, and Ni.

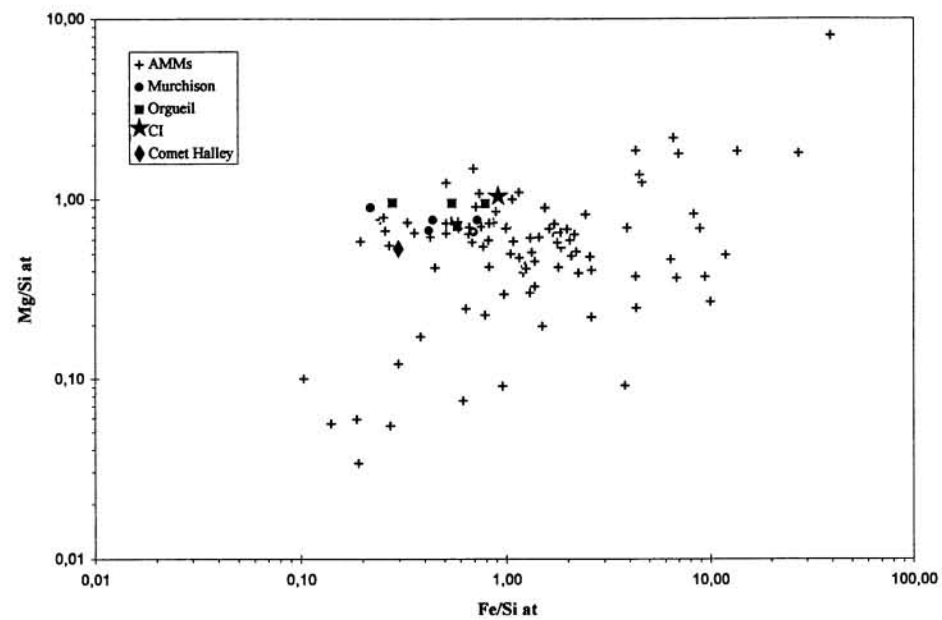
At the present, there is no simple clear cut "chemical" criteria, based on either major or minor element distributions in the fine grained matrix, that can be used to separate cometary from asteroidal grains in the collections of highy unequilibrated AMMs. So one should further assess the validity of other criteria, including the existence of the GEMS glassy grains discovered by J.P.Bradley (4), and H and N isotopic anomalies, only observed as yet in IDPs (5).

The C-rich AMMs and IDPs should contain a mixture of asteroidal and cometary grains. The present work would rather suggest that there are no marked chemical differences in the "chondritic" material trapped in either C-rich asteroids found outside the main asteroidal belt or cometary nuclei.

Figure 1



(a)



(b)

Acknowledgements. This work has been supported in France by CNES (Division des Sciences de la Vie) and IN2P3, and by FWF (project no. P8125-GEO) in Austria.

References: (1) C.Engrand and M.Maurette, *this abstract volume (1995)*; (2) S.R.Ross, in *"Solar System Evolution"*, Cambridge University Press (1992); (3) M.Maurette et al, *Nature* 328, 699 (1987); (4) J.P.Bradley, *Science* (1994); (5) F.G.Stadermann and C.T. Olinger, *Meteoritics* 27, 291 (1992).