BELGICA 7904, AN EXTREME C2 FROM ANTARCTICA: PETROLOGY AND MINERAL CHEMISTRY, I.M. Steele, R.T. Cox, Jr. and J.V. Smith, Geophysical Sciences, The University of Chicago, Chicago, IL 60637

Belgica-7904 from the Japanese Antarctic Research Expedition of 1979 was described [1] as a fresh C2(CM) chondrite with amoeboid olivine and small, Ca,Al-rich inclusions in abundant dark phyllosilicate matrix. PTS B7904, 92-3 of 19 mm^2 shows the typical distribution of olivine compositions found in C2 meteorites [2], but lacks Ca-Al-rich inclusions; only one pyroxene grain was found after extensive search. All glass at low magnification is crystalline at high magnification but will be termed glass. There is considerable difference in texture, diversity of inclusions and matrix from Murchison [3]. We emphasize below some petrographic-chemical relations of inclusions and matrix and discuss the Cr content and relation to mg olivine. A sequence of complex processes is required to explain the textures and mineral chemistry (cf. review in 4).

Petrography. Matrix. Generally very dark to yellow-brown with rare orange-brown patches; tiny sulfide and metal are dispersed throughout. Mineral clasts. Olivine ranges up to 0.15 mm and is commonly anhedral but several grains show partial morphology. Tiny inclusions of glass(?) are common. Inclusions. Polycrystalline olivine with interstitial glass inclusions range up to 1 mm in dimension and have variable olivine:glass ratios. Commonly single olivine grains have some brown glass attached suggesting relation to larger clasts. Olivine within inclusions is anhedral to subhedral and commonly shows rounded boundaries without angular terminations and tiny metal and glass inclusions. Of 8 large clasts (labeled 1-8), 1 through 6 show a distinctive relation to the adjacent matrix where the inclusion is surrounded by an ~0.1 mm shell of finer-grained matrix uniformly dark in transmitted light in contrast to the general matrix. Each of these shells is rounder than the irregular inclusion and in particular embayments in the inclusion do not appear on the outside of this shell. In contrast, inclusions 7, 8 lack this shell. Numerous smaller inclusions generally, but not always, are elongated by 1:2 or 1:3 and aligned with each other with the possible implication of oriented deposition and/or deformation. Compared to other C2 meteorites which have inclusion:matrix ratios of 1 to 0.15, the ratio in 7904 is 0.10 or less by visual estimation.

The devitrified glass of 7904 contrasts with the abundant undevitrified glass of Murchison indicating a different thermal history. The dark shells do occur around some inclusions in Murchison and possibly indicate a reaction between Mg-rich inclusions and matrix although a pre-accretion origin should be considered.

Mineral chemistry. Olivine is the dominant phase excluding the devitrified glass. Microprobe analyses of grains within the 8 inclusions, the larger single mineral inclusions and olivines from many smaller glass/olivine clasts show a sharp peak at $Fo_{98.5-99.5}$ with a long tail to Fo_{40} matching closely the distribution in Murchison [3]. Both Mg- and Fe-rich olivines occur in each petrographic division, but within any one inclusion only one compositional type is found. Of the 8 larger inclusions, only those showing the matrix shell have Mg-rich olivine while #7 and #8 have Fe-rich olivines; within each of the large inclusions the compositional range is restricted (Figs. 1 & 2).

The figures illustrate the Cr content of olivine in large inclusions, small inclusions and single grains. Notable features include: (1) generally high levels of Cr compared to most other olivine-bearing meteorites except for ureilites. (2) For the Mg-rich olivines (Fig. 1) there is a good positive correlation between Fe and Cr which is not expected for normal

crystal-liquid trends. (3) For Fe-rich compositions there is a poor negative correlation of Cr with Fe.

The high Cr provides an indicator for recognition of foreign olivine in many meteorite types. The unusual grains in some howardites [5] match compositions in Fig. 1 and strongly indicate a C-chondrite component. Possible factors influencing the Cr of olivine are oxidation state and competition with co-crystallizing phases, but kinetic factors may also have an effect. The high Cr suggests the presence of Cr^{+2} by analogy with the Moon while the correlation with Fe could indicate that Cr-bearing phases were not crystallizing. The slight negative correlation with higher Fe suggests competition with other phases such as chromite.

General. The lack of pyroxene, low inclusion/matrix ratio, and devitrified glass are unusual for C2 meteorites and indicate that B-7904 may be an extreme member of this group.

References. [1] Meteorites News, Japanese Collection of Antarctic Meteorites 1982, 1, 26. [2] J.A. Wood 1967, Geochim. Cosmochem. Acta 31, 2095. [3] L.H. Fuchs, E. Olson, K.J. Jensen 1973, Smithsonian Contr. Earth Sci. 10, 39 pp. [4] H.Y. McSween, Jr. 1979, Rev. Geophys. Space Phys. 17, 1059. [5] C. Desnoyers 1982, Geochim. Cosmochem. Acta 46, 667.

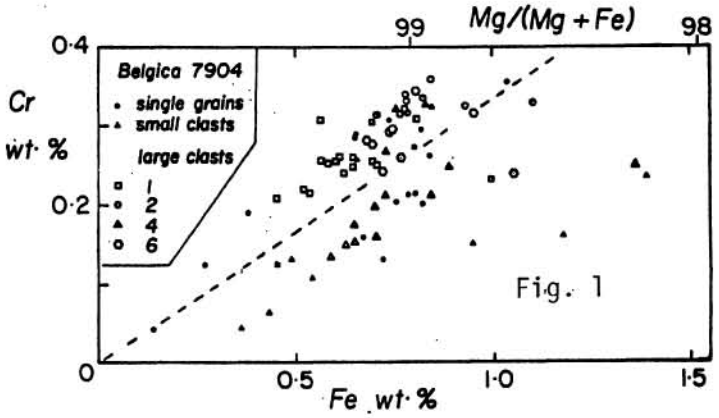

Fig. 1

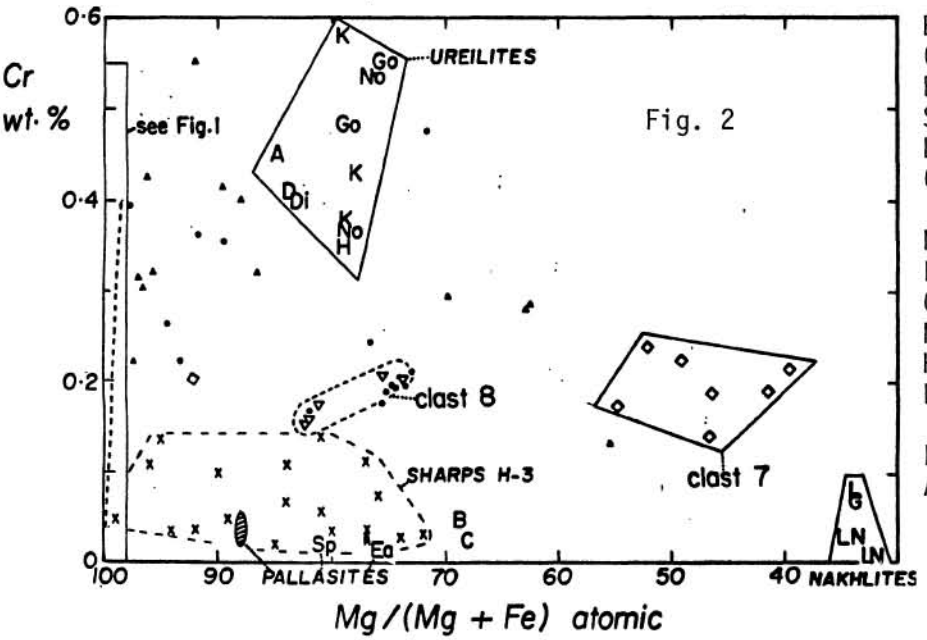

Fig. 2

B = Brachina
C = Chassigny
Ea = Eagle Station
Sp = Springwater
L = Lafayette
G = Governado Valadares
N = Nakhla
K = Kenna
Go = Goalpara
No = Novo Urei
H = Haverö
Di = Dingo Pup Donga
D = Dyalpur
A = ALHA 77257