MAC88177: A NEW TYPE OF ACHONDRITE? M. Prinz[1]; N. Chatterjee[1,2]; M.K. Weisberg[1,2], R.N. Clayton[3] and T.K. Mayeda[3]. (1) Dept. Mineral Sci., Amer. Museum Nat. Hist., New York, NY 10024. (2) Dept. Geology, Brooklyn College (CUNY), Brooklyn, NY 11210 (3) Enrico Fermi Inst., Univ. Chicago, Chicago, IL 60637

MAC88177 was classified as a ureilite by Mason [1] although he recognized its unusual nature; it lacks carbonaceous material typical of ureilites, and the olivine has low CaO and Cr_2O_3 whereas these elements are notably high in all other ureilites. Lack of these characteristics in a ureilite requires justification for this classification, or a new classification.

Petrographically, our section (,18) reveals an equigranular texture dominated by olivine and pyroxene, with many triple junctions. This texture is typical of cumulate achondrites or ureilites (except for the lack of carbon). **Modally**, the meteorite has (in vol.%) 51.3 olivine, 38.4 opx, 7.4 cpx, 0.2 SiO_2-rich feldspathic glass, 0.3 chromite, 0.5% FeNi metal, 1.9 troilite, and a trace of merrillite. Pigeonite, typical of ureilites, is absent; chromite, typically absent in ureilites, is present. Although augite and opx are found in ureilites, pigeonite is always present as well. Olivine is sometimes poikilitically included in opx, cpx and chromite, and the opx and cpx are sometimes poikilitically included in one another. FeNi metal and troilite are present as small inclusions. SiO_2-rich feldspathic glass occurs as melt inclusions (5-100μm), and also occurs along grain boundaries (1-5μm wide), especially on the grain boundaries of poikilitically included phases. The latter is typical of ureilites, whereas achondritic cumulates have more abundant plag as crystals. MAC88177 contains less olivine and more pyroxene than in most ureilites. The modal abundance differs from that of known achondritic cumulates, and is near chondritic (except for the lack of 10-15% plag). **Mineralogically**, the olivine is Fo_{87} and uniform in composition; there is no reverse zoning typical of ureilites because of the absence of carbonaceous material. The opx is $Wo_{3.5}$ $En_{84.4}$ $Fs_{12.2}$ and the cpx is Wo_{42} En_{52} Fs_6. SiO_2-rich feldspathic glass in the melt inclusions differs somewhat from glass along grain boundaries. Melt inclusions have (in wt. %) 80 SiO_2, 12-15 Al_2O_3, 0.2 CaO, 0.7-2.9 Na_2O, 1.4-2.2 K_2O, and 0.3-1.0 FeO. Glass along the grain boundaries has 70 SiO_2, 16-19 Al_2O_3 0.6-5.9 CaO, 0.6-2.5 Na_2O, 1.4-1.7 K_2O, 0.7-1.9 FeO, and 0.1-4.0 MgO. Melt inclusions have higher excess SiO_2 and more alkalic feldspathic component. Melt inclusions have not been reported in ureilites, but thin layers of intergranular SiO_2-rich feldspathic glass are present in most, if not all ureilites. The composition of this glass in ureilites is highly variable [2, 3] and the glass in MAC88177 is comparable with some of the glass found in ureilites. The **bulk composition** of MAC88177 was calculated from modal abundances. The results (in wt.%) are: 47.4 SiO_2, 0.07 TiO_2, 0.35 Al_2O_3, 0.48 Cr_2O_3, 10.1 FeO, 0.45 MnO, 38.7 MgO, 2.24 CaO, 0.06 Na_2O, 0.01 K_2O, 0.05 P_2O_5. These data differ from those of ureilites in SiO_2, FeO and MgO, as a result of the higher pyroxene/olivine ratio, and the abundance of opx and cpx.

The **oxygen isotopic composition** of MAC88177 is $\delta^{18}O = 3.25$ and $\delta^{17}O = 0.47$. This composition is significantly different from that of other ureilites (Fig. 1). It does not correlate with any meteoritic group, and is similar to the silicate inclusions in the Sombrerete iron; however, Sombrerete is petrologically extremely different [5].

Discussion and Conclusions. Ureilites are a unique meteoritic group with unusual characteristics that are difficult to reconcile with more conventional chondritic or achondritic models. They have been modeled as partial melt residues, igneous cumulates, nebular condensates that recrystallized during planetesimal collisions, paracumulates from disrupted partially molten planets, and as impact melt products. They have nebular oxygen isotopic compositions, anticorrelated Fe/Mn ratios, high abundances of planetary-

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type noble gases, and unusual trace element abundances. Nevertheless, their characteristics are fairly well constrained for all samples, except for the polymict ureilites. The petrologic and oxygen isotopic characteristics of MAC88177 are unique, and it does not correlate with any of the ureilites or cumulate achondrites. It appears to be a new type of meteoritic material but this hypothesis is subject to modification when further data are accumulated. There are only two hypotheses that we consider at this time, neither of which is satisfying. These are: (1) It is a cumulate rock from which the feldspathic component has been essentially completely separated and this is the first sample from a newly recognized achondritic planet. (2) It is a highly unusual ureilite with characteristics that differ significantly from other ureilites and extends the range of properties of this group. Arguments for hypothesis (1) are: (1) The low abundances of CaO and Cr_2O_3 in olivine are not characteristic of ureilites. (2) Feldspathic melt inclusions have not been found in ureilites. (3) The modal abundances of ol, opx and cpx and the lack of pigeonite and carbonaceous material are not characteristic of ureilites, and the high percentage of olivine is not found in cumulate achondrites (except Chassigny). (4) Oxygen isotopic data do not allow it to be either a ureilite or a cumulate rock from a previously recognized planet. Arguments for hypothesis (2) are: (1) MAC88177 is texturally similar to ureilites, including the absence of crystalline feldspar, and it contains thin SiO_2-rich feldspathic intergranular material typical of ureilites; it has a similarly extreme plagioclase depletion from a chondritic composition (2) Some ureilites contain augite and opx, along with pigeonite, and this meteorite may lack pigeonite due to a different cooling history. (3) The missing carbonaceous material may have been separated (as was the plag component), or it may never have been intruded into this portion of the parent planet. (4) The highly differing oxygen isotopic composition may be due to local heterogeneities in a CV3 parent, prior to complete homogenization of the planetary characteristics. As stated above, neither of these hypotheses is satisfying. This meteorite appears to be unique, but it may be premature to propose a new, wholly unsampled, achondritic planet. Further data, especially noble gases, will allow a more definitive evaluation of the significance of MAC88177.

References: [1] Mason, B. (1990) Antarctic Meteorite Newsletter, 13, No. 2, 23. [2] Berkley, J.L. et al. (1978) Geophys. Res. Lett. 5, 1075-1078. [3] Goodrich, C.A. et al. (1987) Meteoritics 22, 191-218. [4] Goodrich, C.A. et al. (1987) GCA 51, 2255-2273. [5] Prinz, M. et al. (1983) LPSC XIV, 618-619.

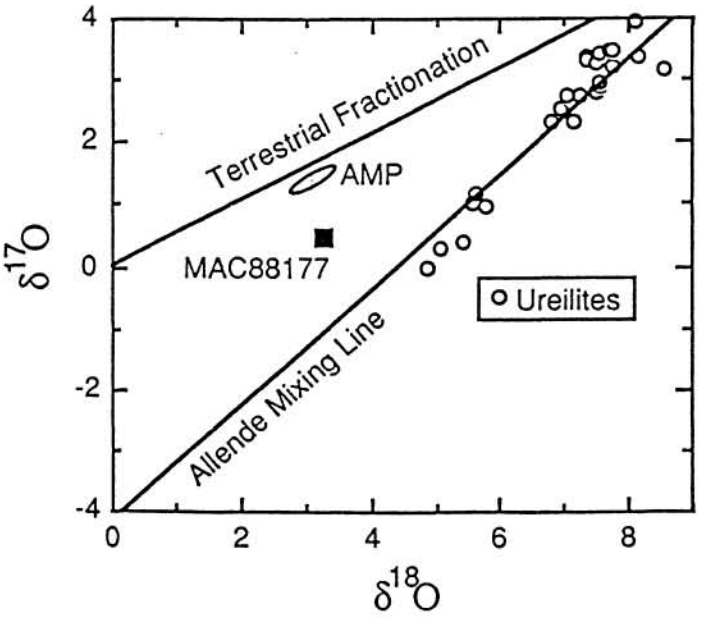

Fig. 1 Oxygen isotopic data for MAC88177 compared with ureilites and basaltic achondrites (AMP).