SILICATE INCLUSIONS IN ANTARCTIC IRONS. 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.

There are relatively few iron meteorites in the vast Antarctic meteorite collections (31 as of 1990), and a large percentage (39%) are ungrouped. Wasson [1] classified seven new Antarctic irons and two of the ungrouped irons (LEW86211 and ALH84233) contain silicate incusions, as does one that is IAB-anomalous (EET87506). Since most silicate inclusions are found in grouped irons (IAB-IIICD, IIE, IVA) it is of interest to study silicate inclusions in ungrouped irons because they may shed light on the origin and significance of silicate inclusions in irons.

LEW86211. This is a remarkable iron (paired with LEW86498) in that it is a fine grained eutectic intergrowth of FeNi metal (38%) and troilite (62%). It is a troilite-dominated iron, modally similar to Soroti, but the textures and chemical compositions are quite different. LEW86211 is ungrouped, and is most similar to the low-Ni extreme of group IIE irons, but deviant for most elements [1]. There are two silicate inclusions in the polished section (86211,1) studied, one 1.4mm long, the other 0.8mm across. Both inclusions are fine grained (10-30μm), highly reduced (mg #=98 or higher, with Ni-free Fe blebs), and consist mainly of olivine (60.7%), opx (35.8%) and cpx (3.0%), with no plagioclase or feldspathic component present. However, the smaller inclusion has a large (800μm) olivine crystal with reversed zoning, Fo_{78-96}, and similar zoning is found in some of the small (20μm) olivine crystals. Thus, the olivine exhibits reduction-induced zoning, but coexisting pyroxene is all highly reduced (FeO, 1-5%); this is the opposite of commonly found reduction patterns for these two phases. No graphite is found, but it may have been present earlier and may have been consumed in the reduction process; it is similar to Lodran in this regard. The bulk composition is difficult to attain by broad beam probe analysis because of the porous surface of the section. Iron in fine-grained metal cannot be distinguished from FeO in the silicates even with the finest probe beam; thus total Fe is given as FeO. The results (in wt. %) are: 42 SiO_2, trace Al_2O_3, 0.6 Cr_2O_3, 13.3 FeO, 0.6 MnO, 41 MgO, 1.3 CaO, O.1 Na_2O, trace K_2O and P_2O_5. The bulk oxygen isotopic composition of the inclusions are $\delta^{18}O$=6.68, $\delta^{17}O$=2.88. This composition is relatively close to the IAB silicates and winonaites; it is close to an extension of the IAB trend line toward heavier oxygen (Fig.1). It is also close to that for the bulk composition of Renazzo, and therefore falls within the CR chondrite trend line. It is not clear that it is related to either of these groups, but silicate inclusions are found in IAB irons. Petrologically, the LEW86211 silicate inclusions may be distantly related to the modified chondritic IAB silicates. IAB silicates are sometimes modified by minor melting and separation of some plag and/or sulfide. In this case, the plag may have been totally separated. Reduction is prevalent in IAB silicates, but olivine is always more reduced than the coexisting pyroxene, contrary to that in LEW86211. IAB-related silicates also have associated graphite, except for Lodran. Thus, the host iron LEW86211 is ungrouped, possibly distantly related to IIE irons, and the silicate inclusions are anomalous, perhaps distantly related to IAB silicates. The assemblage is anomalous in terms of the metal and silicate compositions, as well as in the pairing of these components.

ALH84233. This ungrouped iron has a similar Ni content to that of mesosiderite metal nodules, but the Ir is low by a factor of 100, and other elements do not correlate [1]. The iron meteorite is teardrop-shaped and the silicate inclusions are small (1mm) and angular. Texturally, the silcates are highly fractured and irregular in shape, with grains up to 400μm. Modally, the silicate assemblage consists (in vol. %) of 27.3 olivine, 53.9 opx, 3.7 cpx, 14.0 feldspar, 0.7 chlorapatite, 0.7 chromite. Minerals are uniform in

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composition, with olivine $Fo_{82.7}$ (CaO, 0.04), opx $Wo_{1.8}$ $En_{82.2}$, cpx Wo_{45} En_{50}, and feldspar can be separated into two compositions, one albitic (An_{9-23} Ab_{71-80} Or_{5-18}), the other alkalic (An_9 Ab_{42-47} Or_{44-49}). The feldspar is texturally present as irregular bodies within olivine or opx. FeNi metal has 7% Ni, as does the host kamacite. The bulk composition is undoubtedly chondritic, as is the mineralogy. Petrologically, the ALH84233 silicates are similar to those in IAB silicates, although they are somewhat more FeO-rich. No oxygen isotopic data are available, and the metal is clearly not IAB. Thus, these are chondritic silicate inclusions, perhaps related to IAB silicates, incorporated in an ungrouped iron.

EET87506. This is a IAB-anomalous iron [1], paired with EET87504 and 87505. It contains silicate inclusions which are irregularly scattered in the iron, with a grain size of 0.3-3.1mm. The texture is equigranular and the silicate inclusions are modally and compositionally typical of IAB silicates, except for the composition of the feldspar. Olivine is $Fo_{96.7}$, opx is Wo_2 En_{92}, and cpx is Wo_{42} En_{56}. The feldspar has two compositions, one highly albitic (An_{0-13} Ab_{85-96} Or_{1-5}), and the other alkalic (An_0 Ab_{8-35} Or_{65-92}). These feldspar compositions are unusual for IAB silicates in that they have much lower An and much higher Or components. This may reflect some minor fractionation in the parent body.

Conclusions. Rare and ungrouped Antarctic irons sometimes contain chondritic and modified chondritic silicate assemblages. These types of silicate assemblages are usually found in IAB-IIICD-winonaite-related assemblages (except for Netschaëvo, which is hosted by a IIE iron and has an H-related oxygen isotopic composition), but in these cases the host iron is not IAB-related. This may indicate a decoupling of the iron host and the silicate inclusions before aggregation, or some other complexity in the primitive parent bodies in which they originate. These Antarctic irons have provided new types of materials which will ultimately be helpful in our understanding of the genesis of silicate inclusions in irons.

References: [1] Wasson, J.T. (1990) Ungrouped iron meteorites in Antarctica: Origin of anomalously high abundance. Sci. 249, 900-902.

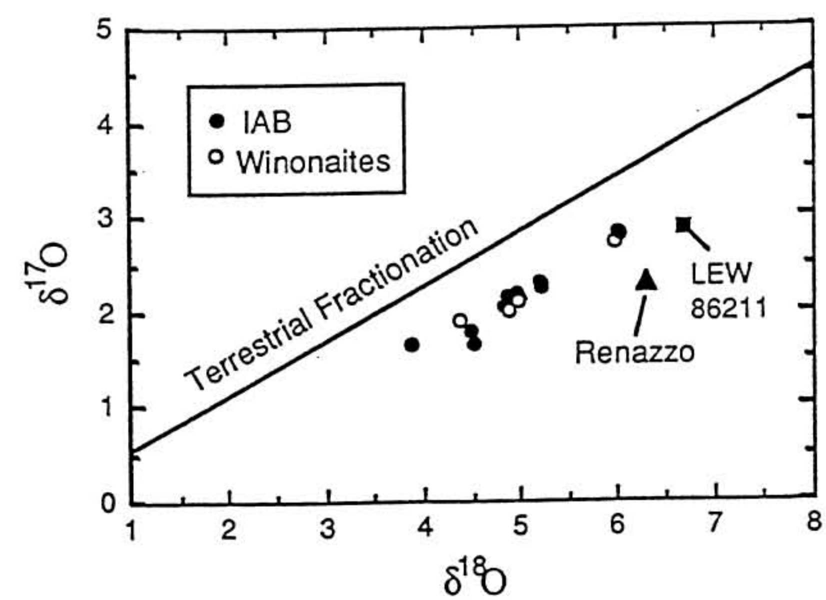

Fig. 1 Oxygen isotopic data for LEW86211 silicate inclusions compared with representative analyses of IAB silicates, and winonaites and Renazzo.