PETROLOGY AND OXYGEN ISOTOPES OF NWA 5492, A NEW METAL-RICH CHONDRITE. Michael K. Weisberg[1,2] Ted E. Bunch[3], Doug Rumble III[4] and Denton S. Ebel[2]. [1]Kingsborough Community College, CUNY, Brooklyn, NY 11235 (mweisberg@kbcc.cuny.edu), [2]American Museum of Natural History, NY, NY 10024, [3]Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011, [4]Geophysical Laboratory, Carnegie Institution, Washington, DC 20015.

Introduction: NWA 5492 is a remarkable new metal-rich chondrite. Ever since the first descriptions of ALH 85085 [1-4], metal-rich, matrix-poor chondrites such as the CB and CH chondrites have been among the most perplexing meteorite groups. Their origin and relationship to other chondrites remains an open issue. Did their chondrules and other components form in the early solar nebula [e.g., 5-10] or are they products of late stage protoplanetary collisions [e.g., 4, 11-13]. Study of new metal-rich meteorites with textural similarities to CH or CB may provide a better understanding of the origins of these unusual meteorites. We previously reported on GRO 95551, a metal-rich chondrite initially thought to be a CB chondrite but which has more reduced mineral compositions and formed from a different oxygen reservoir than CB and CH [5]. Here we present initial results of a petrologic and oxygen isotopic study of NWA 5492, a new metal-rich chondrite that does not appear to be related to CH or CB. Our goals are to characterize this unusual chondrite in order to assess its origin and relationship to other chondrite groups.

Figure 1. Cut surface of NWA 5492 showing metal nodules (white), chondrules and angular lithic fragments. Oxygen isotope compositions were determined for objects labeled 1 and 2.

Results:. ***Texturally*** NWA 5492 is a breccia composed of metal nodules, chondrules and lithic fragments (Fig. 1, 2). Chondrules are up to about 1.8 mm across and show a variety of textures including barred (BO), glassy to cryptocrystalline, Al-rich and porphyritic olivine and pyroxene. Some lithic fragments are large (several mm in size) and some contain chondrules which are smaller (~200-500 μm) than those in the rest of the meteorite. Some of the large angular fragments are fine-grained intergrowths of enstatite and FeNi metal. Similar textures have been observed in enstatite chondrites. However, the metal is not Si-bearing like that in the E chondrites. Large barred olivine clasts are present in one chip. No matrix was observed between chondrules and fragments in NWA 5492, but weathering rinds associated with metal might obscure original matrix. ***Modally*** NWA 5492 contains (vol.%) 5.9 olivine, 39.7 low-Ca pyroxene, 3.7 Ca-pyx, 13.5 glass (feldspathic), 2.5 silica, 19.8 low-Ni metal, 1.8 high-Ni metal, 2.4 sulfide and 10.9 unidentified materials. The latter may be associated with weathering, holes in the section and fine-grained components. The mode is for the whole rock including all objects. The abundance of olivine is considerably lower than in O or C chondrites and more similar to that in some E3 chondrites. Metal abundance is similar to CH chondrites and the occurrence of large metal clasts is similar to CB and GRO 95551 [1, 2]. Some multigranular metal has intergranular arcuate entrainments of diopside, similar to textures in some CBs.

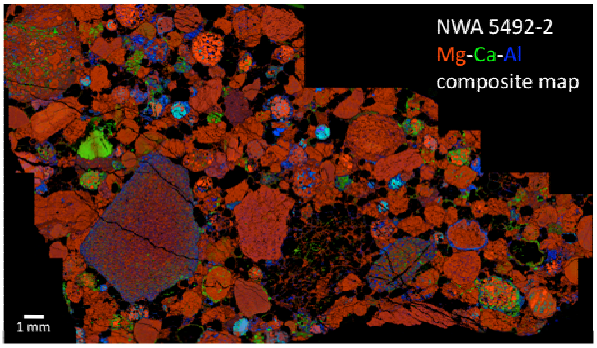

Figure 2. Mg-Ca-Al (red-green-blue) map of NWA 5492 showing metal (black), chondrules and fragments. Brighter red areas are olivine, darker reds are pyroxene. The red color of nearly all ol and pyx indicates their magnesian compositions. Blue areas show Al-rich glassy to cryptocrystalline chondrules.

Mineral compositions of silicates in NWA 5492 are highly reduced. Average low-Ca pyroxene (26

analyses) is $Fs_{0.8}$ $Wo_{0.4}$ with a range of $Fs_{0.3\text{-}1.6}$ $Wo_{0.3\text{-}0.8}$. Average olivine (43 analyses) is $Fa_{0.3}$ with a range of $Fa_{0.1\text{-}0.7}$. These compositions are more reduced than in other metal-rich chondrites such as CH and CB [7]. However, the compositions are similar to those in the GRO 95551 metal-rich chondrite [7]. Average (range) of the mesostasis in chondrules is (wt. %) 61.4 (53.6-64.3) SiO_2, 21.8 (19.2-27.0) Al_2O_3, 4.0 (2.4-8.6) CaO, and 5.9 (2.1-8.6) Na_2O. Low-Ni metal is fairly uniform in composition. Average (range) metal (wt. %) is 5.5 (5.0-5.8) Ni, 0.33 (0.30-0.35) Co, and <0.03 Cr, P, Si. Rare large barred clasts have olivine ($Fa_{\sim 2.0}$) with compositions similar to that in CB chondrites.

Oxygen isotope compositions were determined for eight objects from NWA 5492. $\Delta^{17}O$ values range from -2.367 to 0.525. The analyses cluster in two distinct regions on the 3-isotope diagram (Fig. 3). Six of the objects plot in a region above the terrestrial fractionation line, below ordinary chondrite compositions. The only other chondritic materials that plot in this region are chondrules from the GRO 95551 ungrouped metal-rich chondrite. The other 2 objects are barred olivine clasts and they plot along the CR mixing line.

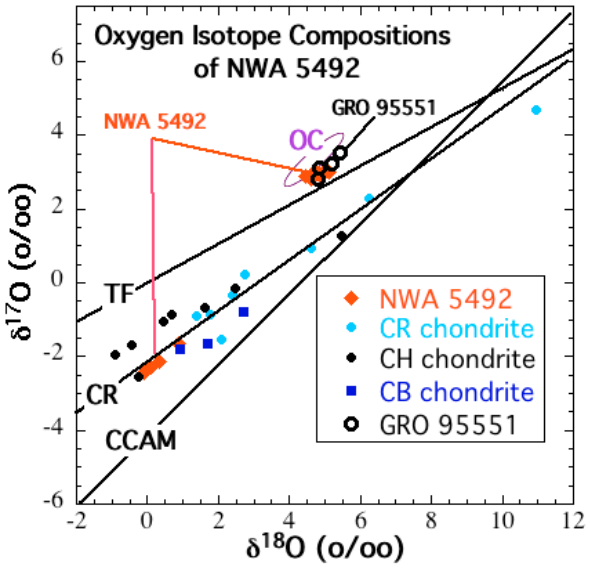

Figure 3. Oxygen 3-isotope diagram showing that clasts from NWA 5492 are from at least two distinct oxygen reservoirs. One type of clast plots near the CR mixing line (CR) and the other just below the OC field but above the terrestrial fractionation (TF) line. CCAM - carbonaceous chondrite anhydrous mixing. Fig. 1 shows two of the clasts (labeled 1 and 2) that were analyzed.

Discussion: NWA 5492 is a metal-rich chondrite breccia. Although it is metal-rich and shares some textural similarities to CB and CH chondrites, its silicate compositions are mainly more reduced and it contains a higher abundance of sulfides than CH or CB. Additionally, the plagioclase-rich mesostasis in the chondrules has higher Na contents than in CH or CB chondrules. Chondrules in CH and CB are generally depleted in Na [7]. The oxygen isotope compositions of NWA 5492 indicate that its components (chondrules and lithic fragments) formed in at least two different oxygen reservoirs. On the 3-isotope diagram some objects plot above the TF line, just below the ordinary chondrites, a region previously unoccupied by any other chondrite group. The only other chondrite that plots in that region is the metal-rich GRO 95551. Other objects (barred clasts) plot on the CR line near CB chondrites. Therefore, we conclude that NWA 5492 represents a new type of chondrite possibly related to GRO 95551. However, some of the components may be related to the CB chondrites as suggested by their barred textures and oxygen isotope compositions. Further work, specifically *in situ* oxygen isotope analysis is needed to better resolve the relationship of this chondrite and its components to other chondrite groups, CB chondrites and to GRO 95551.

The origin of components in NWA 5492 and other metal-rich chondrites, such as GRO 95551, CH and CB, is an unresolved issue. Both nebular and impact origins have been suggested [e.g., 5-13]. For NWA 5492, the chondrules show a wide range of textures including porphyritic olivine and pyroxene. These chondrules are typical of most chondrite groups. The mesostais in many chondrules is Na-rich. Mafic silicates are highly reduced. All of these characteristics seem inconsistent with an impact scenario that might be expected to result in mainly cryptocrystalline or barred textures, volatile depleted chondrules, and more oxidized silicate compositions. It is possible that some components, such as the cryptocrystalline or barred clasts, are impact-formed materials. However, the reduced composition of these clasts suggests a similar nebular origin for all the components in NWA 5492.

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