DARK XENOLITH IN THE UNGROUPED TRACHYANDESITIC ACHONDRITE NORTHWEST AFRICA 11575.
M. A. Habermann[1], C. B. Agee[1] Insititute of Meteoritics, Department of Earth and Planetary Sciences, University of New Mexico, MSC03-2050, Albuquerque, NM 87131, (myahaber@unm.edu).

Introduction: Northwest Africa 11575 is an ungrouped achondrite, with a trachyandesitic bulk composition. Figure 1 shows the main mass, with a cut surface and shiny, black fusion crust (see [1] for further details on NWA 11575). Figure 2 shows an image of the cut surface of NWA 11575, with a dark colored, angular xenolith and a thin shock melt vein visible. We report here preliminary results on this dark lithology and its relationship to the meteorite host rock.

Figure 1. Main mass of NWA 11575. The total known weight is 598 grams. The cut surface is shown in the NE quadrant, and fresh fusion crust is present on the left and right sides, with a broken surface in the center (©2018 Darryl Pitt / MMGM).

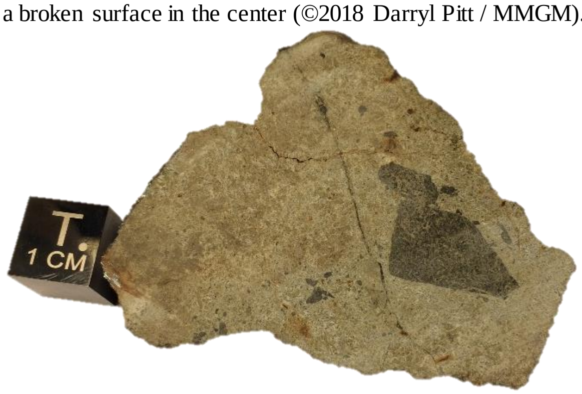

Figure 2. Cut surface of NWA 11575 of the deposit sample held at UNM, with a shock melt vein visible near the center and the dark xenolith visible near the right side. The light colored trachyandesite is the NWA 11575 host rock.

Methods: Composition data and backscatter electron images were collected using a JEOL JXA 8200 electron microprobe at the University of New Mexico.

Petrography of the Dark Lithology: The dark lithology of NWA 11575 consists of a microporphyry of euhedral pyroxenes set in a groundmass of fine grained quench crystals and mesostasis. The pyroxene is interpreted to be the sole liquidus phase and the groundmass is presumed to represent a melt composition. Figure 3 shows the contact between the dark lithology and the NWA 11575 host, light lithology. The pyroxenes in the dark lithology tend to be euhedral (Fig. 3) or have a hopper morphology, in which the outside of the crystal is fairly euhedral but the inner portion of the crystal consists of groundmass, indicating rapid crystallization (Fig. 4).

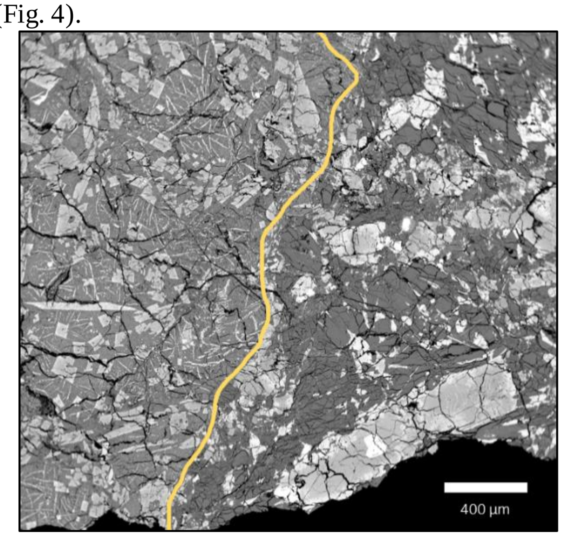

Figure 3. Backscatter electron (BSE) image of the contact (yellow) between the dark xenolith (left) and the host meteorite (right). Plagioclase (dark gray) and pyroxene (lighter gray) are the dominant minerals in the host lithology. Pyroxene microphenocrysts (light gray) and quench groundmass (intermediate gray) make up the dark xenolith.

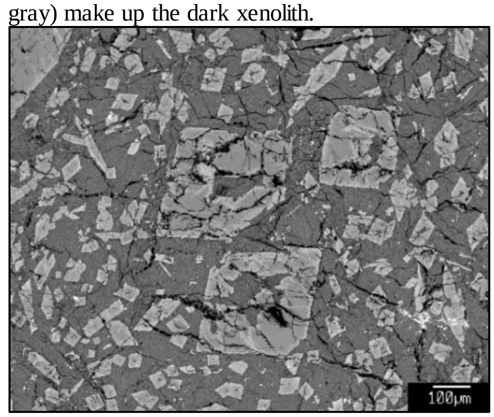

Figure 4. Backscatter electron image of the dark lithology, showing hopper pyroxene crystals (light gray) surrounded by the quench groundmass (darker gray).

The pyroxenes within the dark lithology show igneous zoning (Fig. 4), indicative of an evolving melt composition during crystallization. In contrast, the micro-phenocrysts found in impact melt rocks typically are unzoned. Interestingly, the zoning in pyroxene crystals is similar to the compositional zoning trends observed in the light host lithology (Fig. 5). Within the dark lithology, the early-formed, larger pyroxene crystals are dominated by Mg-rich pigeonite, while the smaller pyroxene crystals have a wider range of compositions that plot within the augite field and are more Fe- and Ca-rich than the large crystals.

The light host lithology, in comparison, has more well-developed zoning profiles, indicating a more prolonged crystallization accompanied by compositional change of the melt. The cores of the pyroxene crystals have a Mg-rich pigeonite composition, mantled by a more Ca-rich, augite composition. The final rim layers of the pyroxenes have a ferroan pigeonite composition.

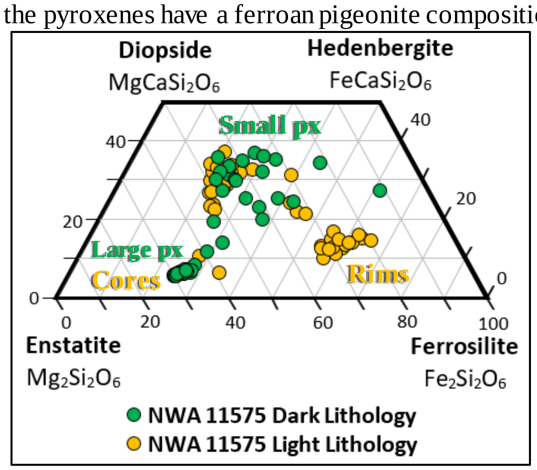

Figure 5. Pyroxene quadrilateral for the dark xenolith (green) and the main light lithology (yellow).

The pyroxene compositions within the dark lithology are magnesian pigeonite $Wo_{(7.4\pm3.8)}$, $Fs_{(27.1\pm2.7)}$ and augite $Wo_{(30.7\pm4.3)}$, $Fs_{(30.1\pm7.1)}$. The main light lithology, in comparison, has pyroxene compositions of magnesian pigeonite $Wo_{(7.3\pm1.6)}$, $Fs_{(28.3\pm3.3)}$, Augite $Wo_{(30.0\pm3.8)}$, $Fs_{(24.4\pm4.2)}$, and ferropigeonite $Wo_{(14.7\pm3.7)}$, $Fs_{(57.3\pm6.2)}$.

The relationship between Fe and Mn in the dark lithology is similar to that of the light lithology, in that they both have similar slopes and occupy the same space (Figure 6). However, the Fe/Mn ratios obtained from the dark lithology are between 30 and 47, with an average of 37, while those of the light lithology are between 29 and 54, with an average of 40. The higher Fe/Mn values are associated with the ferropigeonite rims in the light lithology pyroxenes.

The bulk composition of the light lithology is within error of the bulk composition tie-line for the dark lithology (Fig.7).

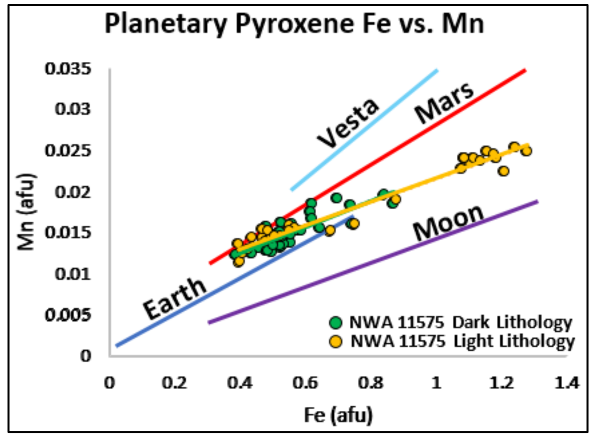

Figure 6. Plot of Fe and Mn for the Earth, Moon, Vesta, Mars, and both lithologies present in NWA11575 [2].

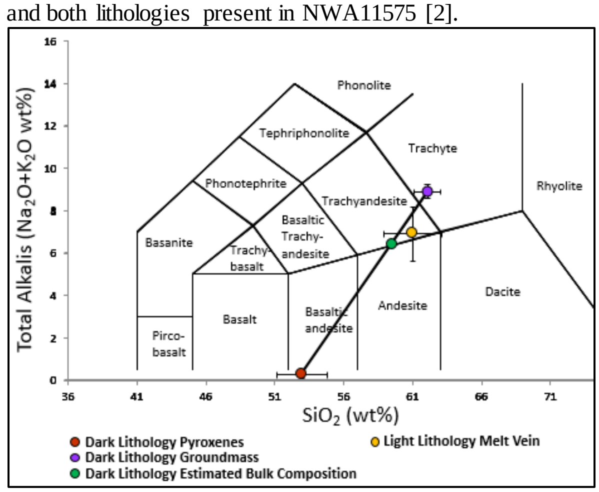

Figure 7. Total Alkalis vs. Silica diagram showing the average compositions of pyroxenes and groundmass from the dark lithology, as well as the average composition of the light lithology's melt vein [1]. The tie-line between the two components of the dark lithology indicates possible bulk compositions. The estimated bulk composition, based upon the percentages of the two components (70% groundmass, 30% pyroxenes) is marked by the green point.

The similarities in pyroxene compositions, Fe/Mn ratios, and bulk compositions, suggests that the dark lithology and the light lithology are derived from the same source, but have undergone different cooling and evolution histories. Given that the dark lithology is enclosed within the light lithology it is assumed that the dark lithology formed first.

Future Work: Further analysis using the JEOL JXA 8200 electron microprobe at UNM is necessary to determine a more precise bulk composition for the dark lithology, as well as to determine whether the phosphates in the light lithology are suitable for obtaining D/H ratios and crystallization ages.

References: [1] Agee C. B. et al. (this conference). [2] Papike J. J. (2009) *GCA, 73*, 7443-7485.