
Introduction: Northwest Africa 5717 is a primitive (subtype 3.05) ungrouped ordinary chondrite which contains two apparently distinct lithologies. In large cut meteorite slabs, the darker of these, lithology A, looks to host the second, much lighter in color, lithology B (upper left, Fig. 1). The nature of the boundary between the two is uncertain, ranging from abrupt to gradational and not always following particle boundaries. The distinction between the lithologies, beyond the obvious color differences, has been supported by a discrepancy in oxygen isotopes and an incongruity in the magnesium contents of chondrule olivine [1].

Here, quantitative textural analysis and mineralogical methods have been used to investigate the two apparent lithologies within NWA 5717. Olivine grains contained in a thin section from NWA 7402, thought to be paired to 5717, were also measured to re-examine the distinct compositional range among the light and dark areas.

Procedure: Particles from a high-resolution mosaic image of a roughly 13x15cm slice of NWA 5717 were traced in Adobe Photoshop. Due to the large size of the sample, visually representative regions of each lithology were chosen to be analyzed. The resulting layers of digitized particles were imported into ImageJ, which was used to measure their area, along with the axes, the angle from horizontal, and the centroid coordinates of ellipses fitted to each particle following the approach of [2]. Resulting 2D pixel areas were converted to spherical diameters employing the unfolding algorithm of [3], which outputs a 3D particle size distribution based on digitized 2D size frequency data. Spatstat was used to create kernel density plots of the centroid coordinates for each region. X-ray compositional maps, microprobe analyses, and Mossbauer spectroscopy was conducted on a thin section of NWA 7402, tentatively paired to NWA 5717 [4].

Results: The macro textural data produced in this study cannot confirm the presence of two distinct lithologies. As shown in Table 1, neither lithology differs greatly from the other in any textural aspect. While this difference appears to be significant, it becomes important to assess whether it is truly a result of separate lithologies or larger scale heterogeneity within the sample as a whole affecting individual digitized regions.

Table 1. Comparison between proposed lithologies in NWA 5717 and 7402 data (cf. [3]). Angle from horizontal, circular diameter, aspect ratio, and volume percent means are a result of digitization. Reported uncertainties are standard deviation from the mean. Core Fa, rim Fa, Cr$_2$O$_3$, and oxygen isotopes were reported in [1], which contains ranges and multiple measurements.

![Image](https://ntrs.nasa.gov/search.jsp?R=20170001702)
distributions b and c in Figure 2, however, show that within individual digitized regions both the light and dark lithologies are indistinguishable. Due to the possibility of inconsistencies in sampling, regions that appeared unreliable in the smallest size fraction post-processing (<200 μm), cf. [8] are not shown.

In contrast to NWA 5717, shown in Table 1 [1], chromium content of the olivine from NWA 7402 lithologies are indistinguishable. Moreover, they do not fall on the trend established for unequilibrated ordinary chondrites [9] consistent with the work of [4].

Preliminary Conclusions: (1) We were unable to show any significant differences between the light and dark lithologies based on either our textural analyses for chemical data. The inconsistencies between our major element data and that presented by Bunch et al. may be a result of an incorrect pairing with NWA 7402. Additional direct chemical measurements of NWA 5717 are needed.

(2) Could NWA 5717 indicate particle ‘clumping’ and minimal alteration (light) and nebular alteration (dark)? This hypothesis is supported by the “heavy” oxygen signature and the breakdown of the sulfide and iron metal gains in the dark regions of NWA 5717 (Figure 4, and confirmed by Mossbauer). A more thorough examination of the oxygen isotopes within individual chondrules along with further textural analysis of the two lithologies have the potential to provide important insight into nebular alteration and/or accretion (Cuzzi et al., this meeting) of primitive planetary bodies in the protoplanetary disk.