INTRIGUING DEHYDRATED PHYLLOSILICATES FOUND IN AN UNUSUAL CLAST IN THE LL3.15 CHONDRITE NorthWestAfrica 6925. Jessica M. Johnson[1], Michael E. Zolensky[2], Queenie Chan[2], and David A. Kring[3], [1]Department of Geological Sciences, Central Connecticut State University, New Britain CT 06050, USA (johnsonj@my.ccsu.edu), [2]ARES, NASA Johnson Space Center, Houston, TX 77058, USA, [3]Lunar and Planetary Institute, Houston TX 77058, USA.

Introduction: Meteorites provide us with valuable insights into the conditions of the early solar system. Collisions often occur in our solar system that can result in materials accreting to other bodies as foreign clasts. These foreign pieces may have multiple origins that can sometimes be easily identified as a particular type of meteorite. It is important to interpret the origins of these clasts in order to understand dynamics of the solar system, especially throughout its early history. The Nice Model, as modified, proposes a reordering of planetary orbits that is hypothesized to have triggered the Late Heavy Bombardment [1-3]. Clasts found within meteorites that came from objects in the solar system not commonly associated as an impactor could be indicative of such an event suggested by the Nice Model [4]. Impacts also redistribute material from one region of an asteroid to another, and so clasts are found that reveal portions of the geological history of a body that are not recorded by typical samples. These would be cognate clasts.

The goal of this investigation was to examine meteorites that had particularly interesting foreign and cognate clasts enclosed in them. We focus here on an unusual clast located in the ordinary chondrite, NorthWest Africa 6925. This is one of three clasts analyzed during the LPI summer internship of Jessica Johnson.

Dehydrated clays
abundant in an OC
indicate wet past.

Methods: An initial assessment of mineralogy was conducted using Raman spectroscopy at ARES, NASA Johnson Space Center. The laser of the Jobin-Yvon LabRAM HR800 was calibrated to a silica standard at a wavelength of 514nm. The sample was analyzed in twelve different regions; six points taken within the clast and six in the surrounding host chondrite. The spectra were analyzed with Crystal Sleuth which allowed the raw spectra to be compared to spectra of known minerals. These points provided a preliminary understanding of the mineralogy of the sample before SEM and microprobe analyses were conducted.

The sample was then observed using a JEOL JSM-7600F FEG SEM with beam energy of 15 keV and a current of 900pA at ARES, JSC. Elemental maps were collected to search for possible elemental migration between the surrounding host and the clast as well as any such migration within the clast itself. Microprobe analyses were then carried out using the JXA-8530F Field Emission Electron Probe, also at ARES, JSC. The data were analyzed primarily for compositions of olivine, pyroxene, plagioclase, and any metals or sulfides present.

Results: NWA 6925 is classified as a L3.15 ordinary chondrite. The clast is mainly composed of olivine and pyroxene with areas of dehydrated phyllosilicates, (Figure 1), the latter identified by flaky textures and high probe totals, as is done for thermally metamorphosed CI, CV and CM chondrites [5].

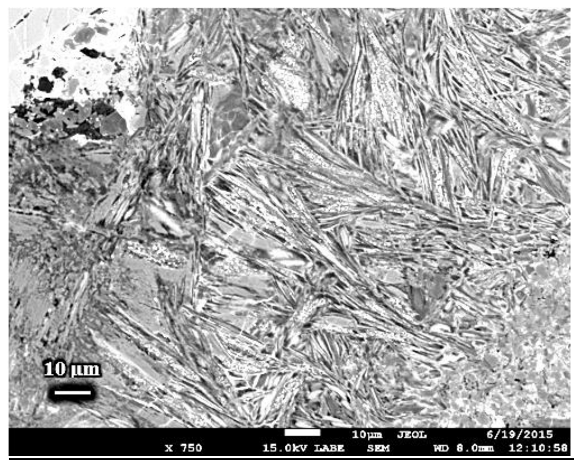

Figure 1: BSE image of a pocket of dehydrated phyllosilicates within the clast. These dehydrated phyllosilicates have been transformed to olivine and pyroxene.

These dehydrated phyllosilicates are seen both as long veins and also within pockets of apparently partially altered pyroxene. The bulk texture of the sample is granular rather than crystalline. The sample is composed of approximately 50% olivine, 40% pyroxene, 5% plagioclase, and 5% Fe-Ni sulfides. Molar values are listed in Table 1.

NWA 6925		
	Average	Range
Fa	40	29-50
En	57	53-67
Ab	36	17-53

Table 1: Molar average and range values for NWA 6925.

The dehydrated phyllosilicate veins are very fine-grained and in some portions have an oriented pattern, (Figure 1). Most of the "dehydrated" phyllosilicates are now olivines and pyroxenes. Some partially altered pyroxenes were found with a poikiolitic texture, (Figure 2).

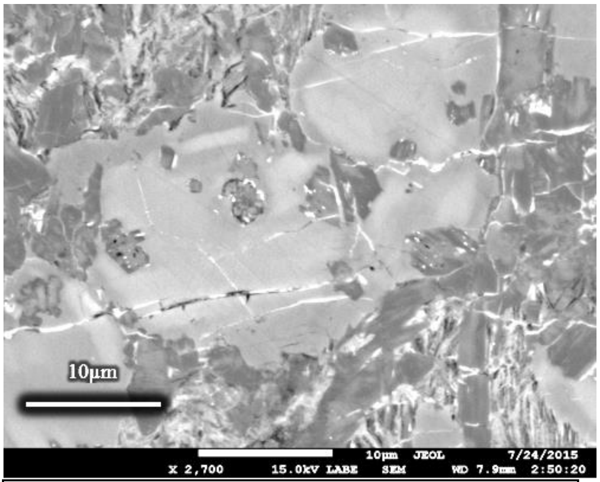

Figure 2: BSE image of partially altered olivine (lighter gray) and pyroxene (darker gray). The dehydrated phyllosilicates are the flaky to acicular, white to grey crystals.

Discussion: Phyllosilicates are known from LL3 chondrites [6], but in very small quantities, reflecting generally low degrees of aqueous alteration of ordinary chondrites [7]. Such hydrous phases are not well known from the L chondrites, which is what NWA 6925 is. The clast in NWA 6925 is most likely an ordinary chondrite lithology that had been altered in an expecially wet region of the L chondrite parent asteroid, a place not sampled by other Ls, or indeed any ordinary chondrite. The dehydration stage could have occurred during an impact event – the existing data permit no firm conclusion. However, it is most likely that the heating was caused by the thermal metamorphic event that affected the bulk of the L chondrite parent asteroid. The phyllosilicates underwent dehydration and transformed into olivine and pyroxene. Further work would need to be done in order to investigate with any certainty the exact affinities of the clast. It remains possible that this clast is foreign, originating from a C-class or other type of asteroid. Oxygen isotopes should be used to identify to which existing meteorite group the clast within NWA 6925 is most closely related.

Our work illustrates the considerable value of examining unusual clasts within meteorites, as they sample a much wider range of early solar system materials than do meteorites in general.

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