NON-CHONDritic INCLUSIONS IN THE LL CHONDRITE DOM85505; K. C. A. Peterson; A. M. Reid and D. W. Mittlefehldt; 'Department of Geology, Acadia University, Wolfville, Nova Scotia; 2Lunar and Planetary Institute, 3600 Bay Area Blvd., Houston 77058, Texas; 3Department of Geosciences, University of Houston, Houston, Texas 77204-5503; 4Lockheed ESC, 232400 NASA Road 1, Houston, Texas 77058

DOM85505 is a 31g LL Antarctic chondrite that was noted in the preliminary description to contain inclusions lacking chondritic texture [1]. Angular inclusions in the host chondrite (LL5, S4) do not resemble any of the common achondrites in texture or mineral composition. The non-chondritic inclusions have similar bulk compositions and the same mineral compositions as the host chondrite and appear to be from the host chondrite melt. Texturally similar non-chondritic inclusions in the L6 Yamato meteorites 75097 and 793241 derive from an H chondrite source but are also cumulates that have reacted with the host chondrite following incorporation [2-4].

Well-defined chondrules are not abundant in the host meteorite, feldspathic material occurs as fine-grained aggregates, and metal and troilite occur as scattered anhedral grains (Figure 1A, B). The chondrite has homogeneous olivine (Fo 72.2, CaO 0.05 wt. percent) and orthopyroxene (Wo 1.7, En 75.5) that is also homogeneous except in some chondrules where the orthopyroxene immediately adjacent to feldspathic groundmass has developed Ca-enriched rims. Mineral compositions are consistent with an LL classification, the texture and mineralogy indicate an LL5 metamorphic grade, and the presence of slight mosaicism in olivine, planar fractures in larger silicates, and shock veins indicate an S4 shock stage [5].

The angular non-chondritic clasts range in size from a few μm to several mm. They vary in phase assemblage from troctolitic material with euhedral to subhedral olivine poikilitically enclosed in partly isotropic feldspar (Ab77.8), to harzburgitic regions where coarser, partly exsolved orthopyroxene encloses subhedral to anhedral olivine (Figure 1C, D). Though texturally dissimilar the olivine and pyroxene have compositions identical to those in the host chondrite. Metal and sulfide occur as scattered small grains, as does Cr-rich spinel. The texture though fine-grained, appears to be that of a cumulate with segregation into feldspar-rich and pyroxene-rich regions.

Preliminary INAA of a sample of the host and a non-chondritic inclusion support the modal data indicating similar bulk compositions. The inclusion is slightly depleted in lithophile elements and enriched in siderophile elements. This may be mostly a simple modal effect, rather than a geochemical fractionation. However, the inclusion is significantly depleted in the most incompatible lithophile elements (La and Sm) compared to matrix. The preliminary data do not allow firm conclusions as to the cause of this depletion. The inclusion sample is enriched in all siderophile elements, and contains ~30% more metal than the host, which contains LL chondrite abundances for the siderophile elements. Our Se data suggest that the inclusion and host each contain only about 80% of the typical LL chondrite complement of troilite.

DOM85505 appears to be a fairly normal LL5 chondrite with non-chondritic inclusions that match the host in mineral compositions. The inclusions are not exotic fragments of any known achondrite meteorite but presumably derive from the host chondrite. The texture indicates a significantly different thermal history from the host and the simplest hypothesis is that they represent shock-melted host material. However the textures of the clasts do not resemble the textures of impact melts but rather appear to indicate derivation from a total melt that underwent some crystal-liquid differentiation on cooling to produce a heterogeneous cumulate rock. The thermal event that allowed local melting within the LL parent preceded the thermal/metamorphic event that determined the present silicate mineral compositions and left the contrasting textures essentially intact.

Figure 1. Photomicrographs of DOM85505. 1A. Chondritic host. 1B. Boundary between chondritic host and non-chondritic inclusion. 1A and 1B, width of field 1.7mm. 1C. Non-chondritic inclusion, troctolitic portion. 1D. Non-chondritic inclusion, harzburgitic portion (crossed nicols). 1C and 1D, width of field 0.4mm.