ULTRA-FINE GRAINED EUCRITE NWA 999, AND THE PARADOX OF THOROUGH EQUILIBRATION, WITHOUT MUCH TEXTURAL MATURATION, IN TYPICAL NONCUMULATE EUCRITES. Paul H. Warren and Wonhie Choe. Institute of Geophysics, UCLA, Los Angeles, CA 90095, USA; pwarren@ucla.edu

The Northwest Africa 999 eucrite is perhaps without precedent for being unusually fine-grained. Apart from a percent or so of scattered relict phenocrystic (or xenocrystic?) matter, it consists of a groundmass of grains mostly well under 50 µm in maximum dimension; 40×20 µm is most typical. Compositionally (based on our customary combination of INAA with fused-bead e-probe analysis [1]), this meteorite is uncommonly ferroan (mg = 37 mol%) and as indicated by the plot of La vs. Sc (cf. [2]), appears linked to the Nuevo Laredo trend, although also not far from the “Main Group” (which appear closely related, anyway).

NWA999 contains 12±3 µg/g Ni, which is very low but ordinarily would be enough to indicate a polymict eucrite. However, it is crisscrossed by thin (typically only about 5 µm), widely scattered veins of shock-melt glass. Compositionally, this glass resembles the bulk rock, except for enrichments in Al₂O₃ (15 wt%) and CaO (11.5 wt%), possibly derived by preferential shock melting of feldspar in the vein-source material. The shock veins, which clearly postdate and have no connection with scattered relict phenol/xenocrysts, might be the only repository of high Ni in the rock; which thus might still be practically monomict.

Despite the very shallow origin implied by its grain sizes, NWA999 shows a high degree of metamorphic equilibration. Its pyroxenes cluster tightly at En₁₂₋₁₃,Wo₂ and En₁₅₋₁₉,Wo₄₄. Like other typically equilibrated non-Stannern trend, noncumulate eucrites, NWA999 does not show a high degree of textural equilibration (development granulitic texture with abundant 120° triple junctions). Delicate volcanic structures have not been completely overprinted. In rare places, a relict variolitic texture is discernible. This stands in sharp contrast with the typical status of lunar granulitic breccias, which in general have not equilibrated (mineralogically) nearly as thoroughly as NWA999 [e.g., 3]. As noted by [4], the paradox of thorough equilibration, without much textural maturation, in typical noncumulate eucrites is enigmatic; probably some form of dry autometamorphism is required.