A METAMORPHOSED IGNEOUS INCLUSION IN THE ORO GRANDE H5 ORDINARY CHONDRITE.
Rhian H. Jones. Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, NM87131, U. S. A. rjones@unm.edu

Introduction: Robert Hutchison was a persistent proponent of the idea that chondrules are the result of disruption of partially molten planetesimals [1]. He argued that the existence of young igneous inclusions in ordinary chondrites [e.g. 2] supports this model. A lithic inclusion in the Oro Grande H5 chondrite was originally described by [3], who interpreted it as an impact melt clast. I have revisited this inclusion to see what insights it offers into the discussion of chondrule formation by planetary melting.

Petrographic description: [3] described the 5 mm Oro Grande inclusion as a micro-crystalline mixture of olivine and plagioclase, with minor orthopyroxene, clinopyroxene and metal. This description belies an extremely complex texture. The inclusion is indeed dominated by a fine-grained mixture of barred olivine and plagioclase, with olivine bar widths <10 μm. However, throughout the inclusion there are also numerous objects (~50 vol%) that appear to be relics of euhedral phenocrysts, 100 to 500 μm in length. These relic phenocrysts have complex internal textures. Some are dominated by diopside, with minor low-Ca pyroxene and plagioclase. Some of these regions have ~20 μm wide rims of apatite. Other relic phenocrysts consist of fine-grained intergrowths of low-Ca pyroxene, diopside, olivine, plagioclase, pigeonite and minor chromite. These regions have thin rims of diopside, overgrown with plagioclase. Throughout the inclusion, iron metal and troilite are minor phases, and chromite is present as finely dispersed sub-micrometer crystals. Compositions of all phases are essentially identical to those in the host chondrite [3], and typical of equilibrated ordinary chondrites [4]: olivine is Fa18; low-Ca pyroxene is En82Fs17Wo1; diopside is En48Fs6Wo46; feldspar is An12Ab82Or6; apatite has 0.75 wt% F and 5.1 wt% Cl. Our SIMS analyses of plagioclase show comparable REE abundance patterns in inclusion and host chondrite.

Origin of the inclusion: Fodor et al. [3] concluded that the lithic inclusion is an impact melt formed from the silicate portion of equilibrated H5 material. However, the relic phenocryst texture rules out such an origin. The inclusion appears to have originated as a porphyritic igneous rock. The original rock was likely subjected to a significant shock event, during which pyroxene phenocrysts, possibly diopside and pigeonite, broke down into multi-phase assemblages. An olivine / plagioclase impact melt was generated, which quenched into a barred olivine texture. Essentially complete chemical equilibration of the inclusion with the Oro Grande host chondrite indicates that formation of the original porphyry, as well as the impact event, occurred prior to parent body metamorphism. Although the groundmass texture of the inclusion is comparable to barred olivine chondrules, no features like the relic phenocrysts are ever observed in chondrules. Hence, one cannot argue that this inclusion is simply a large version of a chondrule. It extends the known range of igneous rock types that were present in the early stages of accretion.