# SURVEY OF LARGE, IGNEOUS-TEXTURED INCLUSIONS IN O CHONDRITES

K. Armstrong[1] and A. Ruzicka[1]. [1]Department of Geology, Portland State University, Portland, Oregon, USA

**Introduction:** Uniquely among meteorites, approximately 4% of O-chondrite samples contain "large igneous-textured inclusions" [1-3]. These inclusions have diameters > 3-4 mm [2, 3] but have been observed to be as large as 4 cm [4], an order of magnitude larger than that of chondrules within the same host meteorite [5].

These inclusions have igneous textures and are almost always highly depleted in metal and sulfide [2, 3]. However, they exhibit a large range of textures, mineralogies, bulk compositions, and shapes (rounded to irregular), suggesting a variety of formation processes. Models proposed for their formation include (1) shock melting of ordinary chondrites with loss of metal and sulfide [2, 3, 6-8]; (2) melting of vapor-fractionated condensate mixtures [2, 3]; (3) chondrule formation involving atypically large melt production volume [2, 3, 4, 9]; and (4) igneous differentiation occurring within planetesimals sampled by ordinary chondrite parent bodies [10-13].

**Discussion:** Polished thin sections of nine inclusions from eight O-chondrites have been examined with optical light microscopy using a Leica DM 2500 petrographic microscope at Portland State University. Petrographic data including texture, grain sizes and shapes were collected for the inclusions and their hosts in order to facilitate comparisons. These include inclusions from NWA 869 (L3-6), NWA 7870 (L4), NWA 7873 (H5-6), NWA 4859 (LL5), NWA 7871 (L6), Palo Verde Mine (L6), and two L3 chondrites.

The inclusions can be grouped into one of three distinct textural categories: fine granular, microporphyritic, and skeletal olivine. Mean grain diameters are ~100 μm for the fine granular inclusions. This is broadly similar to microporphyritic inclusions, except that in the latter a bimodal distribution occurs with larger grains ~250 μm across and mesostasis grains <<100 μm across. Skeletal olivine textures are defined as being dominated by olivine crystals that are an order of magnitude longer across in one direction than the other (e.g., 1 mm x 100 μm).

No relationship between shape, texture and host type is apparent among these samples. From this, it follows that the conditions and formation processes that created the inclusions were not isolated or unique, as they appear to have affected more than one parent body.

**References:** [1] Bridges J. and Hutchison R. 1997. *Meteoritics and Planetary Science* 32:389-394. [2] Ruzicka A. et al. 1998. *Geochimica et Cosmochimica Acta* 62:1419-1442. [3] Ruzicka A. et al. 2000. *Antarctic Meteorite Research* 13:19-38. [4] Binns R. 1967. *Mineralogical Magazine* 36:319-324. [5] Hutchison R. 2004. In *Meteorites: A Petrologic, Chemical, and Isotopic Synthesis* [6] Dodd R. and Jarosewich E. 1976. *Meteoritics* 11:1-20. [7] Fodor R. and Keil K. 1976. *Geochimica et Cosmochimica Acta* 40:177-189. [8] Jamsja N. and Ruzicka A. 2010. *Meteoritics and Planetary Science* 45:828-849. [9] Weisberg M. et al. 1988. *Meteoritics* 23:309-310. [10] Hutchison R. et al. 1988. *Earth and Planetary Science Letters* 90:105-118. [11] Ruzicka A. et al. 1995. *Meteoritics* 30:57-70. [12] Ruzicka A. et al. 2012. *Meteoritics and Planetary Science* 47:1809-1829.

.