**Impact-Induced Compaction of Primordial Materials and the Effect on the Chondrite Record.**

P. A. Bland¹, G. S. Collins², K. A. Dy³, N. M. Abreu³, T. M. Davison⁴, F. J. Ciesla⁴, A. R. Muxworthy², and J. Moore². ¹Dept. Applied Geology, Curtin University, GPO Box U1987, Perth WA 6845, Australia. Email: p.a.bland@curtin.edu.au, ²IARC, Dept. Earth Science & Engineering, Imperial College London, SW7 2AZ, UK. ³Earth Science Program, Pennsylvania State University—Du Bois Campus, Du Bois, Pennsylvania 15801, USA. ⁴Dept. Geophysical Science, University of Chicago, 5734 South Ellis Av., Chicago, IL 60430, USA.

**Introduction:** We are using 2D ‘mesoscale’ numerical simulations of shock propagation in bimodal mixtures of high (70%) porosity matrix and non-porous chondrules to explore how chondrules and matrix responded during the early phase of impact-induced compaction of primordial asteroids. We vary impact velocity over a range consistent with estimated encounter velocities in the early solar system, and initial matrix abundance so that simulated impacts would generate post-compaction matrix abundances across the range of chondrite types [1]. We have previously discussed the potential significance of our results with respect to the meteorite palaeomagnetic record [2], lithification of chondrites [3], and survival of presolar grains [4]. But our observations are also relevant to chondrite petrography and the variability in shock level between groups.

**Results & Discussion:** Our simulations indicate that P(peak) varies by ×3-4 (5-15GPa) over length scales of 100µm in matrix, and by ×2-3 between chondrule edge and interior. Large impacts caused extensive impact melting on OC asteroids [5]. But we observe that heterogeneity in matrix T(final) (>1000K in 100µm) can generate highly localised (100µm to mm-scale) melts in matrix at velocities as low as 1km/s in ‘OC-like’ matrix:chondrule mixtures. Chondrule temperatures remain low, so these melts would quench rapidly (<10s seconds). We also find that chondrules experience higher P(peak) with decreasing matrix fraction for a given velocity. At a velocity of 2km/s, chondrule interiors in CC-like precursors will experience P(peak) of 4.5GPa; in OC-like precursors ~12GPa; and in non-porous dunite (no matrix) ~24GPa.

These results offer a single explanation for a variety of unusual petrographic features in chondrites: shock-induced mobilisation of sulphides in (apparently) ‘unshocked’ OCs [6]; pyroxene polymorphs in CC matrices that require high temperatures (>1300K) followed by very rapid cooling [7]; and extreme PT heterogeneity in CR matrix [8]. Localised matrix melting may be a formation mechanism for microchondrules – a common feature in UOCs [9]. And PT variability with matrix fraction provides an explanation for the variability in shock level (recorded by chondrule olivines) between CCs, UOCs, and EOCs.