**P12A-01**

Reconstruction of shock conditions and recovery paths in shock melt veins

and pockets in martian and chondritic meteorites

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Recent advancements in micro-diffraction analysis in combination with SEM- and EPM-based chemical analysis provide us with a rapidly increasing set of high-pressure metamorphic minerals that occur in shocked meteorites. This includes bridgmanite (1), ahrensite (2), tissintite (3), liebermanite (4) and others. I will briefly introduce the methodology of synchrotron-diffraction/spectroscopy based identification and characterisation of shock-generated high pressure minerals. Then I will show how the high-pressure mineral paragenesis, their spatial distribution, and constraints from shock-physics provide us with surprisingly narrow constraints for peak shock conditions, and shock release paths (in P-T space). Finally, I will address the issue of shock duration in martian meteorites such as Tissint and in ordinaray chondrites.

1: Discovery of bridgmanite, the most abundant mineral in Earth, in a shocked meteorite, O. Tschauner, C. Ma, J. Beckett, C. Prescher, V. Prakapenka, G.Rossman, Science 346, 110-1102, DOI: 10.1126/science.1259369 (2014);

2: Chi Ma, Oliver Tschauner, John R. Beckett, Yang Liu, George R. Rossman, Stanislav V. Sinogeikin, Jesse S. Smith, Lawrence A. Taylor, Geochim Cosmochim Acta #082614, in revision;

3: IMA No. 2013-027, 4: IMA2013-128

**Previously Published**

Yes - Discovery of bridgmanite, the most abundant mineral in Earth, in a shocked meteorite, O. Tschauner, C. Ma, J. Beckett, C. Prescher, V. Prakapenka, G.Rossman, Science 346, 110-1102, DOI: 10.1126/science.1259369 (2014)