***IN SITU* Ar/Ar DATING OF SHOCKED METEORITES: REDISTRIBUTION OF K AND Ar AND THE SOURCE OF LATE-RELEASE AGES IN STEP HEATING.** T. G. Sharp, M. E. Karageozian, M. Van Soest, and C. McDonald. The School of Earth and Space Exploration, Arizona State University, 781 Terrace Mall, Tempe, AZ 85287 (tom.sharp@asu.edu).

Introduction: $^{40}Ar/^{39}Ar$ geochronology of extraterrestrial samples is fundamental to interpreting the impact history of the solar system. A major challenge in $^{40}Ar/^{39}Ar$ dating of shocked samples is the fact that shock effects, including shock heating, are heterogeneous on a mesoscale [1-3] resulting in non-uniform release of radiogenic $^{40}Ar^*$ [4]. Anomalous $^{40}Ar/^{39}Ar$ shock ages were first reported for the Peace River L chondrite in 1988 [5], but implications of these results have not been addressed in subsequent dating of highly shocked meteorites. Here we present *in situ* UV laser ablation microprobe (UVLAMP) argon mass spectrometry data from Mbale to illustrate how the complex behavior of K and Ar during shock results in anomalous $^{40}Ar/^{39}Ar$ ages.

Sample and methods: Mbale is an L5/6 ordinary chondrite fall [6] with shock stages including S5 and S6 [7] and a bulk $^{40}Ar/^{39}Ar$ age of 479 ± 7 Ma [8]. A thick section was irradiated for 100 hrs in the OSU CLICIT reactor. The slab was loaded into the UV laser chamber attached to a Nu Instruments Noblesse noble gas mass spectrometer. Argon was extracted from the slab using a Teledyne/Photon Machines Analyte Excite UV (193nm). The facing section was characterized with a JEOL JXA-8530F electron microprobe.

Results: Our Mbale sections are composed of ~25% melt vein and ~75% host rock. The melt vein lithology consists of majoritic garnet and wadsleyite with sulfide/metal droplets, with entrained clasts of olivine and enstatite partially transformed to wadsleyite and majorite. Maskelynite is abundant in the host adjacent to the melt vein, with remnant plagioclase increasing with distance from the vein. Three UVLAMP profiles were made across the melt vein sampling quenched shock melt, entrained clasts and adjacent host rock, producing dates from 444 ± 10 Ma to 6145 ± 137 Ma. The oldest ages occur within the shock vein and the youngest ages in the host material outside the vein. WDS and EDS maps and spot analyses show that the shock vein is nearly K_2O-free and the maskelynite along the vein boundary is enriched with ~ 2.0 wt% K_2O, decreasing to the baseline 0.7 wt% at 1.5 mm from the vein.

Discussion: In general, the combination of shock heating and deformation result in release of radiogenic ^{39}Ar and effective resetting of $^{40}Ar/^{39}Ar$ ages in shocked meteorites. However, the behavior of K and Ar in the shock melt are quite different at high pressure, which result in anomalously old ages of S6 shock-melt veins and pockets, as demonstrated here in Mbale and in the Peace River L6 chondrite [5]. Shock veins that contain high-pressure minerals quench rapidly during the shock pulse. The nearly complete loss of K_2O from quenched shock veins produces ages that are much older than the ~480 Ma impact event that shocked Mbale and formed the shock-melt vein [9].

Although anomalous $^{40}Ar/^{39}Ar$ ages were previously described [5], the implications for $^{40}Ar/^{39}Ar$ dating have not been fully recognized is subsequent $^{40}Ar/^{39}Ar$ dating of shocked meteorites. $^{40}Ar/^{39}Ar$ step heating of shocked L chondrites consistently shows well-defined plateau ages of ~ 500 Ma, corresponding to the breakup of the L-chondrite parent body [8]. These plateaus represent release from the bulk samples, which are effectively reset by shock deformation, heating and slow post-shock cooling. The anomalous shock-melt ages do not appear to affect the ~500 Ma plateau age. However, many step-heating data sets also have late-release ages that that are much older than 500 Ma. The late release phase has a low K/Ca ratio and has been inferred to be pyroxene [10] or possibly a high-pressure polymorph of feldspar [11]. We propose that the late release of radiogenic ^{39}Ar, commonly measured highly shocked L chondrites, comes from the shock-vein minerals, which have low K/Ca ratios. This suggests that the older late-release ages are artifacts of Ar retention and K loss from high-pressure shock melt. Additional research is needed to confirm this.

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