SHOCK-TRANSFORMED OLIVINE TO RINGWOODITE IN THE ANTARCTIC CHONDRITES : MECHANISMS OF TRANSFORMATION AND FE-MG DIFFUSION. Z. Xie[1], X. Li[1], T. G. Sharp[2], and P. S. Decarli[3], [1]Nanjing University, Nanjing, P.R.China, zhidongx@nju.edu.cn, njulxc@163.com; [2]Arizona State University, Tempe, AZ 85287, U.S.A. tom.sharp@asu.edu; [3]SRI International, Menlo Park, CA 94025, paul.decarli@sri.com.

Introduction: High-pressure minerals, produced by shock metamorphism, are common in and around melt veins in highly shocked chondrites. These minerals either crystallized from silicate melt in the shock-vein or solid-state transformed from host-rock fragments entrained in the melt or along shock-vein margins. Olivine-ringwoodite transformation kinetics can be used to constrain shock duration if one knows P-T conditions and transformation mechanisms.

Ringwoodite or wadsleyite rims have been reported in shock-induced melt veins in heavily shocked (S6) chondrites, ALH78003, GRV052049 and Peace River [1-3]. One problem with using transformation kinetics to constrain shock duration is that rates depend on the details of the transformation mechanism. For example, growth of topotaxial ringwoodite in olivine with coherent interfaces is slower than growth of inclusions with incoherent interfaces [4-5]. Similarly, diffusion-controlled growth, where rates are determined by long-range diffusion, is generally much slower than interface-controlled growth, which is only dependent on diffusion across the interface [6]. Therefore, the detailed mechanisms for forming the rim need further microtexture clarification. Here we report EMAP and Raman results to elucidate the transformation mechanisms and Mg-Fe diffusion of olivine to ringwoodite in the Antarctic chondrites GRV 022321.

Results: GRV022321 has a network of black veins which enclose abundant host-rock fragments. Raman data confirm that bigger entrained olivine grains have ringwoodite rim and olivine-ringwoodite mixed core (Fig.1). Small enclosed olivine has been completely transformed to polycrystalline ringwoodite but with higher Fa composition. EMAP data confirm that the ringwoodite rim is richer in Fa than the olivine core (Fig.2), ranging from Fa 50 to 10. The phases of minerals were confirmed by Raman spectroscopy.

Discussion: The complexity of the transformation textures indicates a variety of transformation mechanism that are a function of pressure and temperature. The variable extent of transformation is likely a result of temperature variations during shock, with the hottest olivine forming ringwoodite rim. Because reaction mechanisms and kinetics are strongly dependant on temperature, use of kinetics to constrain shock duration should be done with caution and only using rates for appropriate mechanisms and conditions. More work needed to understand the transformation mechanisms.

References: [1 Ohtani et al. (2006), *Shock Waves*, 16:45-52. [2] Feng et al. (2007), *MAPS 42*, A45. [3] Miyahara et al. (2008) *Proceedings. of NAS 105*,8542-8547. [4] Kerschhofer et al. (1996) *Science 274 (5284)*, 79-81. [5] Kerschhofer et al. (2000*) PEPI 121*, 59-76. [6] Sharp and DeCarli (2006) *MESS II*, 653-677.

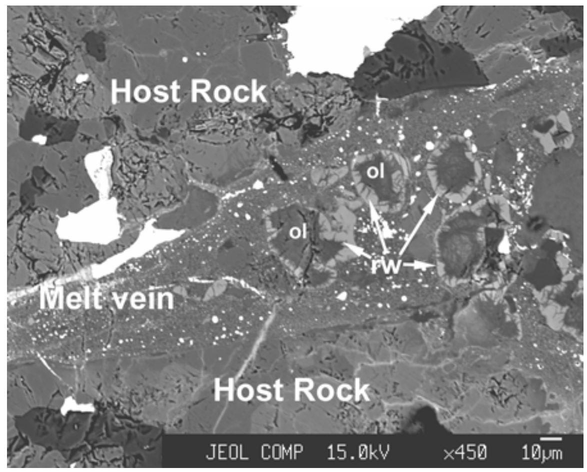

Fig. 1 BSE image of transformed olivine, with a ringwoodite rim and olivine core.

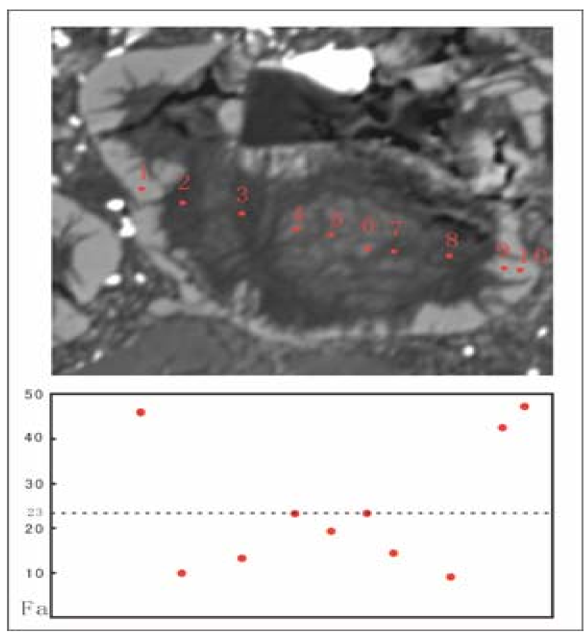

Fig. 2 EMAP data across one grain showing range of Fa from 50 to 10. Fa of host olivine is 23.