MICRO-SURGICAL FIB-TEM STUDY OF DIVERSE LIQUIDUS WADSLEYITE-RINGWOODITE PAIRS FRACTIONALLY CRYSTALLIZED FROM OLIVINE MELT ENCLAVES IN SHOCK MELT VEINS IN L6 CHONDRITES. A. El Goresy 1, M. Miyahara 2, E. Ohtani 2, T. Nagase 2, M. Nishijima 2, T. Ferroir 3 and Ph. Gillet 3. 1 Bayerisches Geoinstitut, Universität Bayreuth, 95447 Bayreuth, Germany, E-mail: ahmed.elgoresy@uni-bayreuth.de, 2 Graduate School of Science, Tohoku University, Sendai, 980-8758, Japan, 3 ENS Lyon, 69364 Lyon, France.

Introduction: We have recently demonstrated that the formation of coexisting Mg-rich wadsleyite (Wds) and Fe-rich ringwoodite (Rgt) in shocked L6 chondrites didn’t result from solid-state phase transition of olivine, as is generally accepted [1]. Textural settings and the chemical compositions of coexisting Wds-Rgt proven to be characteristic of fractional crystallization from olivine melts at high-pressures and temperatures [2]. We newly discovered that fractional crystallization of the olivine melts proceeds differently, even in the same molten single olivine grain. Settings, textures and compositions dramatically vary across very short distances within the same parental olivine thus revealing a menagerie of Wds-Rgt intergrowths and compositions of individual crystallites. Here, we report novel findings of Wds-Rgt assemblages, textures, compositions and the first natural occurrence of topotaxial Rgt exsolution lamellae in Wds crystallites in former olivine chondrules and olivine fragments entrained in shock-melt veins in the Peace River L6 chondrite.

Results: The assemblage Wds-Rgt occurs in large olivine grains as vein-like arrangements feigning planar intra-crystalline growth of Rgt lamellae. However, TEM study of the FIB-slices revealed symmetric arrangement of liquidus polycrystalline Wds-crystallites (Fa_{14-22}) bordering both wall sides of long fractures in parental olivines. Vein interiors consist of spindle-shaped Rgt pegs (Fa_{44-49}) oriented with the longest axes vertical to the fracture walls. Idiomorphic Wds (Fa_{14-21}) depicts one set of topotaxial Rgt (Fa_{28-37}) lamellae presumably exsolved from parental Fa-rich Wds. In contrast, Wds-Rgt pairs in former olivines in chondrules depict a concentric arrangement: Wds (Fa_{6-10}) occupies the core, whereas Rgt (Fa_{28-39}) encompasses the Wds cores. Also here, few Wds crystallites (Fa_{9,8}) display a set of exsolved Rgt (Fa_{9,11}) lamellae (<60 nm). Fa-contents of both Wds and Rgt in the chondrule former olivines are clearly lower than those in large olivines (Wds = Fa_{6-10} v.s. = Fa_{14-21}; Rgt = Fa_{28-39} v.s. = Fa_{44-49}; respectively). The compositional gap between Wds and Rgt is slightly wider in the veins in individual olivine fragments (Fa_{9,8}) than in chondrule olivines (Fa_{9,8}), although the melts originated from unzoned olivines with similar compositions (Fa_{28-39}) and both Wds and Rgt were produced in both settings by fractional crystallization of pure olivine melts at high-pressure.

Conclusions: Our results demonstrate the complexity of the fractional crystallization schemes, the resulting textures and compositions even within the same melt vein. Estimation of P-T conditions requires a detailed TEM survey of surgically cut FIB-slices in large areas of different olivines. Compositions of exsolved Rgt lamellae (Fa_{9,11}) in host Wds (Fa_{9,8}) crystallites allow bracketing the P-T conditions to 17 - 20 GPa at T < 2000º C.