X-RAY AND MINERALOGICAL CHARACTERIZATION OF OLIVINE IN OL-PHYRIC SHERGOTTITES. M. Matthes[1], A. Bischoff[1], B. Heying[2], U. C. Rodewald[2], R.-D. Hoffmann[2], and R. Pöttgen[2]. [1]Institut für Planetologie, WWU Münster, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany. E-mail: bischoa@uni-muenster.de. [2]Institut für Anorganische und Analytische Chemie, WWU Münster, Corrensstr. 36, 48149 Münster, Germany.

Introduction: The olivine-phyric shergottites Dar al Gani (DaG) 476 and Sayh al Uhaymir (SaU) 005 belong to the most strongly shocked basaltic shergottites [1] as indicated from measurements of the refractive indices for maskelynite and the presence of melt pockets (e.g., [1,2]). Several mm-sized olivine megacrysts from DaG 476 and SaU 005 were studied in detail by light and electron microscopy, microprobe and X-ray diffraction in order to find out, why the centers of these olivines have a strong reduction of birefringence combined with significant staining. Did the strong shock event eventually transform the olivine into a high-pressure polymorph like ringwoodite or wadsleyite?

Mineralogy: Olivine megacrysts are characterized by recrystallization, staining, and reduced birefringence (especially in the cores of olivine from DaG 476). In some crystals melt pockets were observed, as well as some small pyroxenes and tiny chromites. The olivines are heavily fractured preferentially within their cores. The crystals in DaG 476 are zoned having a core of ~Fa_{22} and a rim of ~Fa_{38}. The analyzed grains in SaU 005 have a core of ~Fa_{28} and a rim of ~Fa_{36}.

X-ray diffraction: The cores of typical olivines form DaG 476 and SaU 005 were drilled out from the thin section and studied with a IPDS II single-crystal diffractometer. The crystal data and structure refinement for the DaG olivine revealed: $Mg_{1.58(2)}Fe_{0.42(2)}SiO_4$; space group: *Pnma*; lattice parameters: a = 1024.4(3) picometer, b = 602.0(2) pm, c = 476.8(2) pm; cell volume: 0.294 nm^3. Similar results were obtained for the SaU crystal: $Mg_{1.47(1)}Fe_{0.52(1)}SiO_4$; space group: *Pnma*; lattice parameters: a = 1030.5(2) pm, b = 601.9(12) pm, c = 479.6(10) pm; cell volume: 0.297 nm^3. The structural X-ray data are in perfect agreement with chemical data obtained by electron microprobe.

Discussion: Although the olivine-phyric shergottites are severely shocked (>40 GPa [1]; formation of melt pockets within olivine), no indication for the occurrence of high-pressure polymorphs within the olivine was found. The reduced birefringence and staining of olivine has to be caused by other processes. We suggest that these characteristics are caused by a combination of (a) heavy shock-induced brecciation of the olivine cores and (b) Fe-oxidation (Fe^{3+}) at shock-pressures above 44 to 56 GPa [3,4]. We can not be ruled out that nano-particles of Fe,Ni-metal as found in ALH77005 [5] or secondary terrestrial alteration (filling of fractures with very minor amounts of calcites or other secondary minerals) are also responsible for the dull, brownish appearance of the olivine cores.

References: [1] Fritz J. et al. 2005. *Meteoritics & Planetary Science* 40:1393-1411. [2] Bischoff A. and Stöffler D. 1992. *European Journal of Mineralogy* 4:707-755. [3] Reimold W. U. and Stöffler D. 1978. *Proc. 9th Lunar and Planetary Science Conference*, 2805-2824. [4] Ostertag R. et al. 1984. *Earth Planet. Sci. Lett*. 67:162-166. [5] Kurihara T. et al. 2008. *Lunar and Planetary Science Conference* 39:#2478.