DISCOVERY OF PURPLE-BLUE RINGWOODITE WITHIN SHOCK VEINS OF AN LL6 ORDINARY CHONDRITE FROM NORTHWEST AFRICA. A. Bischoff, Institut für Planetologie /ICEM, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany (bischoa@nwz.uni-muenster.de).

Introduction: The purple-blue, mainly in L6 chondrites occurring high-pressure-polymorph of olivine is known since many years and named ringwoodite after A. E. Ringwood (e.g., [1-3]). Within the last ten years high-pressure phases in chondrites have been studied in great detail and many suggestions were made concerning their impact-induced formation, as well as about the reason for the coloration of ringwoodites (e.g., [4-10]). Most high-pressure phases in ordinary chondrites were reported from L-group chondrites; only very few occurrences are known from H-group samples. The only positive identification of a high-pressure phase in an LL-chondrite (jadeite) has been reported by Kimura et al. [8] in Y-8410 (LL5) using Raman laser techniques. The Saharan LL6 ordinary chondrite Northwest Africa (NWA) 757 (provisional name) contains purple-blue ringwoodite in melt veins. This is the first discovery of this phase in an LL-chondrite.

Results: NWA 757 was purchased from nomads in Rissani (Morocco) and probably found in 2000 as a single piece of 714g [11]. The bulk sample contains a network of dark veins indicating significant shock metamorphism. In thin section it is visible that the rock is moderately weathered (W2) having abundant oxide veins. Metals are partly oxidized, but most metals are still preserved. Based on the composition of the main minerals NWA 757 is clearly an LL-chondrite. Olivine has a mean Fa-content of 28.1 ± 0.7 mol% and low-Ca pyroxene contains 23.4 ± 0.8 mol% Fs. The bulk rock is well recrystallized typical for chondrites of petrologic type 6. Close to the shock veins plagioclase is often amorphous, but at a distance of some mm from the veins it is mainly crystalline. This may indicate that the bulk rock has shock features of degree S4 [12]. The width of the shock veins is highly variable ranging from some µm up to approximately 1 mm. The veins contain abundant clasts and round metal-troilite particles (Figs. 1 and 2). Ringwoodite mainly occurs in the fragments within the veins, but also at the contacts of the melt veins to the host chondrite (Figs. 3 and 4). This is very similar to observations made in many L6-chondrites [5]. Some areas within the fragments have a greenish appearance, sometimes also surrounding purple-blue ringwoodite. This greenish occurrence has been also reported by Lingemann and Stöffler [5].

Discussion: As pointed out by Stöffler et al. [12] the frequency distribution of shock stages within the main groups of ordinary chondrites (H, L, LL) and within the petrologic types (3-6) of all classified chondrites indicates some interesting characteristics. The main feature is that with increasing petrologic type the frequency of higher shock stages (S4, S5, and S6) is increasing: Samples with shock stage S5 and S6 are lacking in ordinary chondrites of low petrologic type (types 3 and 4 [12]). This is very obvious for the L-chondrites: All type 6 chondrites shock-classified by Stöffler et al. [12] have been shocked to stage S4 or higher. These authors suggest that this finding could be explained by differences in the physical properties of the unshocked samples prior to the (ringwoodite-forming) shock event: Porous samples (types 3 and 4) vs. coherent, unporous rocks (types 5 and 6).

Considering the occurrence of ringwoodite in the LL6 chondrite NWA 757 the results clearly confirm previous interpretations ([5,12,13]) that ringwoodite was formed at locations, where localized melting of the host meteorite produced melt veins and pockets due to localized shock-pressure and temperature excursions. The finding of ringwoodite in NWA 757 proves that the LL chondrite parent body also suffered strong shock metamorphism similar to that of the L-chondrite parent body. The rarity of ringwoodite-bearing LL-chondrites in our meteorite collections may be due to sampling reasons: Highly-shocked LL-chondrite meteoroids must exist, but collide less often with the Earth.

References: [1] Mason B. et al. (1968) *Science* 160, 66-67. [2] Binns R. A. et al. (1969) *Nature* 221, 943-944. [3] Smith R. A. and Mason B. *Science* 168, 832-833. [4] Lingemann C. M. and Stöffler D. (1995) *LPSC* XXVI, 851-852. [5] Lingemann C. M. and Stöffler D. (1998) *LPSC* XXIX, #1308. [6] Chen M. et al. (1996) *Science* 271, 1570-1573. [7] Xie X. et al. (2001) *EPSL* 187, 345-356. [8] Kimura M. et al. (2001) *Meteorit. Planet. Sci*. 36, A99. [9] Sharp T. G. et al. (1997) *Science* 277, 352-355. [10] Langenhorst F. et al. (1995) *Geochim. Cosmochim. Acta* 59, 1835-1845. [11] The Meteoritical Bulletin, *Meteorit. Planet. Sci.* 37 (in preparation). [12] Stöffler D. et al. (1991) *Geochim. Cosmochim. Acta* 55, 3845-3867. [13] Bischoff A. and Stöffler D. (1992) *Eur. J. Mineral*. 4, 707-755.

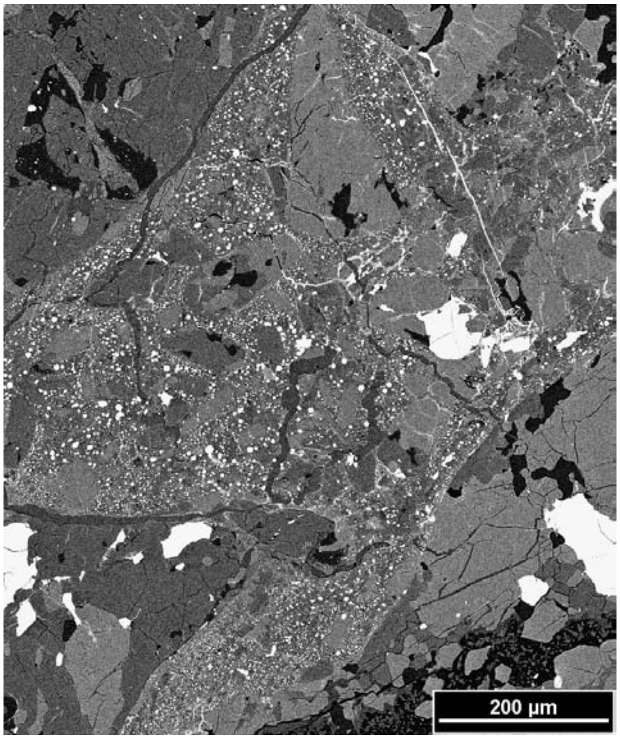

Fig. 1: Backscattered electron (BSE) image of a broad shock vein within the LL6 ordinary chondrite NWA 757. The shock vein contains abundant clasts of the host rock and small round metal-sulfide particles (white).

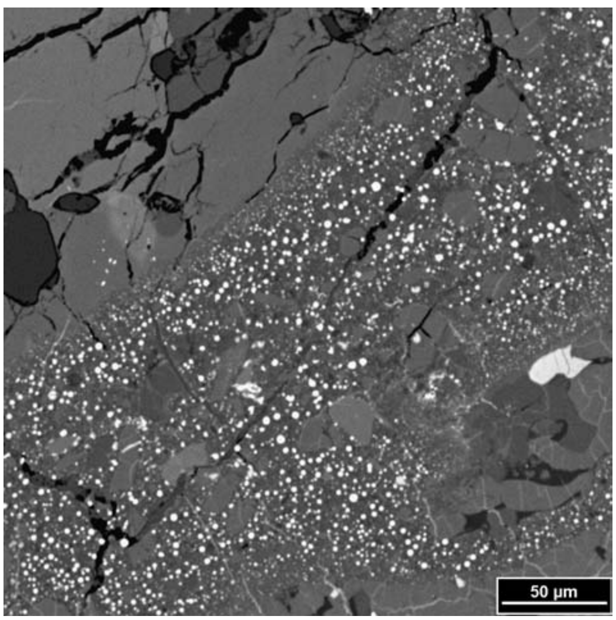

Fig. 2: BSE-image from a shock vein in NWA 757 showing the distribution of mineral clasts (grey) and round metal-sulfide particles (white).

Fig. 3: Occurrence of purple-blue ringwoodite in a shock vein of the LL6 ordinary chondrite NWA 757. Transmitted, plane polarized light (width of photograph: ~0.35 mm).

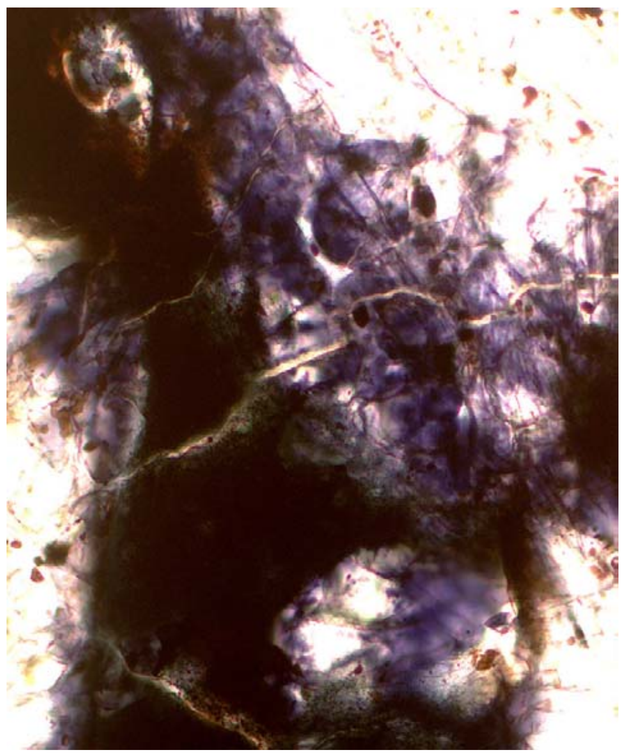

Fig. 4: Occurrence of purple-blue ringwoodite in a shock vein of the LL6 ordinary chondrite NWA 757. Transmitted, plane polarized light (width of photograph: ~0.3 mm).