EBSD STUDIES OF RINGWOODITE MICROCRYSTALLINE FABRICS IN THE SHOCKED NWA 5011 L6 CHONDRITIC METEORITE. Sz. Bérczi[1], Sz. Nagy[1,3], I. Gyollai[2], S. Józsa[1], K. Havancsák[1], Z. Dankházi[1], G. Varga[1], K. Ratter[1], E. Pál-Molnár[3], K. Fintor[3], A. Gucsik[4,5]. [1]Eötvös University, Institute of Physics, Department of Materials Physics, CMSRG, H-1117, Budapest, Pázmány Péter sétány 1/a, Hungary, (berczi szani@ludens.elte.hu); [2]University of Vienna, Department of Litospheric Research, A-1090, Vienna, Althanstrasse 14., Austria, [3]Szeged University, Dept. Mineralogy and Petrology, H-6722, Szeged, Egyetem u. 2-6., Hungary, [4]Osaka University, 1-1 Machikaneyama, Toyonaka, Osaka 560-0043, Japan, [5]Konkoly Observatory of the Hungarian Academy of Sciences, H-1121 Budapest, Konkoly Thege Miklós út 15-17., Hungary

Introduction: Shock metamorphism transforms olivine $(Mg,Fe)_2SiO_4$, as one of the main rock-forming minerals in ordinary chondrites [1], into its high pressure polymorph: ringwoodite. In the abundantly vein crossed NWA 5011 L6 chondrite ringwoodite is a common constituent in and adjacent to the melt veins [2,3]. Some ringwoodite aggregates can reach 500 μm in diameter, and individual large grains of 50 μm can also be found. Earlier studies [4,5] revealed the existence of ringwoodite in this sample by Raman spectroscopy. This spectroscopical method can analyse local bond characteristics of atomic neighbours while the EBSD measurements of the SEM makes it possible to observe the global crystal structure of the transformed minerals. In order to reveal ringwoodite's inner micrograins, the EBSD measurements were carried out on a 2 mm x 2 mm sample of NWA 5011 in which optically homogeneous large ringwoodite minerals occurred (Fig. 1). Here we report our measurements of the microstructural inner fabrics of several large ringwoodite grains.

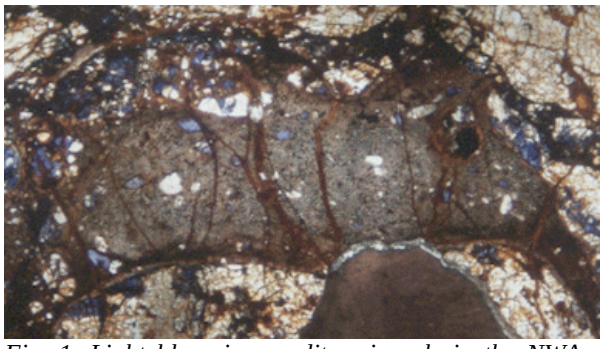

Fig. 1. Light blue ringwoodite minerals in the NWA 5011 L6 chondritic thin section. The width of the picure is 3 mm. (OM-image)

Methods: After textural observations (by NICON E200 optical microscope) and micro-Raman spectrometry (by Renishaw RM-2000 Raman spectrometer and Leica DM/LM microscope) a 3D FEI Quanta SEM and its Hikari camera were used for EBSD measurements.

Results: The first SEM investigation was revealed an olivine-ringwoodite transitional state region in the vicinity of the shock melt vein (SMV's). One large olivine contains ringwoodite in lamellar shape. Widths of lamellae fall into the range of (0.5 - 4) μm. In most cases the lamellae showed jagged, cloudy boundaries (Figs. 2 and 3).

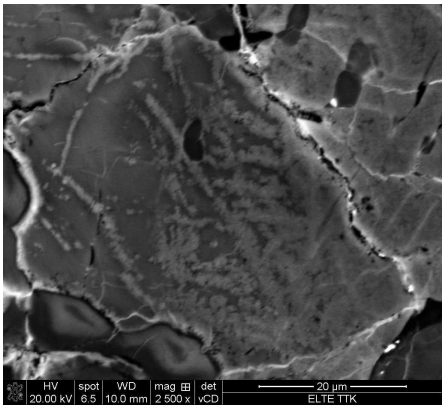

Fig. 2. Large lamellar olivine in the NWA 5011 L6 chondrite. (SEM-BSE image).

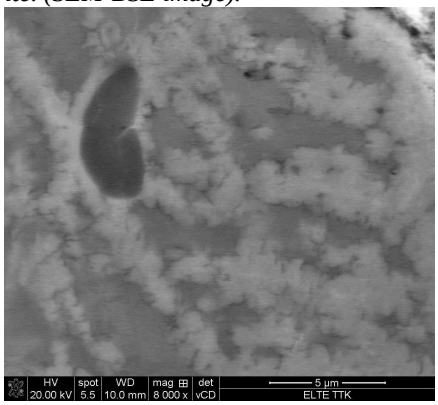

Fig. 3. High resolution image of the lamellar region shows transformed lamellar ringwoodite (light

gray)(bottom). 8000X magnification SEM-BSE image.

Distinct Fe-poor zones were observed between some lamellae and host olivine. The SEM composition analysis indicated that lamellae contained slightly higher FeO than the host olivine grain. The thickness of the Fe-poor zones was proportional with thickness of lamellae, which indicate the Mg-Fe interdiffusion during the shock transformation.

EBSD observations: Blue ringwoodites of the NWA 5011 chondrite (Fig. 1) were identified by Raman spectroscopy [3,4], which were also observed by EBSD (Fig. 4). Their average size was 50 μm (Fig. 5).

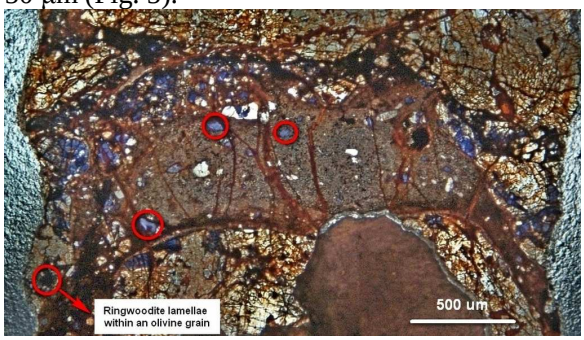

Fig. 4. Ringwoodite minerals in the NWA 5011 L6 meteorite, where EBSD measurements were shown Fig.6a is the upper, Fig. 6b is the second from left mineral grain marked with red circle. (OM-image).

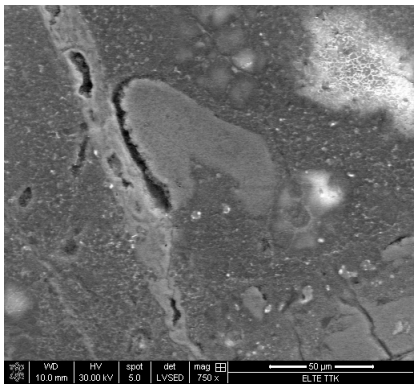

Fig.5. Large ringwoodite grain at the boundary of the vein. Its width is 50 μm. A 7 μm x 7 μm portion is enlarged and shown on EBSD fabrics on Fig. 6b. (SEM-BSE image.)

Summary: Our EBSD studies have shown the microstructural fabrics of the large, optically homogeneous ringwoodite grains in the NWA 5011 L6 chondrite. Several 50 μm sized homogeneous grains were observed as consisting of 2-5 μm sized, variously oriented micrograins (Figs. 6a and 6b). This observation suggests that the rapid crystal structure transformation inside the host olivine formed according to the initiation of nucleations at great number of centers. In further studies we intend to study the microcrystalline fabrics of other, yet identified high pressure minerals of the NWA 5011 chondrite [6,7].

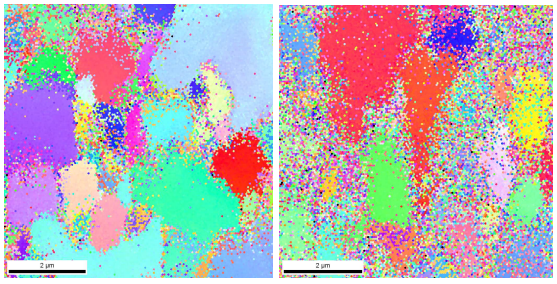

Fig.6a. *Fig. 6b.*
EBSD orientation maps show that ringwoodite grains consist of 2-4 micrometer sized ringwoodite minerals with various orientation.

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