BROAD RANGE OF HIGH-PRESSURE PHASES AND BRIDGMANITE-RELATED MICROSTRUCTURES IN L6 CHONDRITE NORTHWEST AFRICA 5011.

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Introduction: Finding of high-pressure minerals in meteorites and data from static and dynamic high-pressure experiments combined with data on kinetics and element diffusivity as well as direct dating of shocked and unshocked meteorite minerals provide primary information for computation of impact events during early stages of the formation of Solar system [1-2]. In this report we invesigated various high-pressure phases and microstructures in heavily shocked L6 chondrite NWA 5011, which add new data to previously reported results on this meteorite (e.g., [3-4].

Methods: Several thin sections of NWA 5011 were studied using FE-SEM (JEOL, JSM-7000F) equipped by EDS X-Max-80 (Oxford Instr.), Raman spectrometry (Horiba Jobin Yvon LabRAM HR800 with an Nd:Gd 532-nm laser), microfocus X-ray diffraction (Rigaku MicroMax-007 HF), FIB (FEI-Scios) and ATEM (JEOL, JEM-2100F).

Results and discussion: The host-rock minerals are olivine (Fa_{24-26}), orthopyroxene ($Fs_{20}Wo_{1.5}$), clinopyroxene (Fs_8Wo_{44}), plagioclase/maskelynite ($Ab_{83}An_9Or_8$), chromite, apatite, troilite and Fe-Ni metal. The host-rock is cut by the abundant shock-melt veins (SMVs) up to 1 cm thick. The SMVs contains fragments of host-rock mineral grains and aggregates, most of which has been transformed to high-pressure phases. High-pressure minerals are also abundant in the vicinity of the SMVs. Olivine close to the veins is transformed to wadsleyite and ringwoodite, whereas inside the SMVs it is totally replaced by ringwoodite aggregates. Plagioclase grains are transformed to jadeite-lingunite aggregates. Orthopyroxene is transformed to majorite, akimotoite and vitrified glass after bridgmanite (Fig.1). Apatite is replaced by fine-grained tuite aggregates. The SMV matrix is presented by fine-grained majorite/akimotoite, ringwoodite and metallic phases. Rarely we can observe bridgmanite-like patterns, which, however, difficult to characterize (Fig.1c). We studied variety of transformation structures in orthopyroxene, which range from partially to totally transformed grains with or without signs of partial melting. Most transformed grains are represented by fine-grained akimotoite with zones of vitrified glass of similar compositions. We carefully performed search by microfocus X-ray diffraction but did not find clear evidences for crystalline bridgmanite. Similar structures studied by synchrotron X-ray diffraction allowed refinement of about 10% bridgmanite in the SMV matrix [5].

Broad range of high-pressure minerals indicates heavily shocked conditions for studied meteorite with relevant pressures above 25 GPa. Textural observation indicates presence of melting structures of olivine, orthopyroxene and plagioclase, which may correspond to the temperatures above 2500 K. Akimotoite and some other features after orthopyroxene indicate solid state transformation.

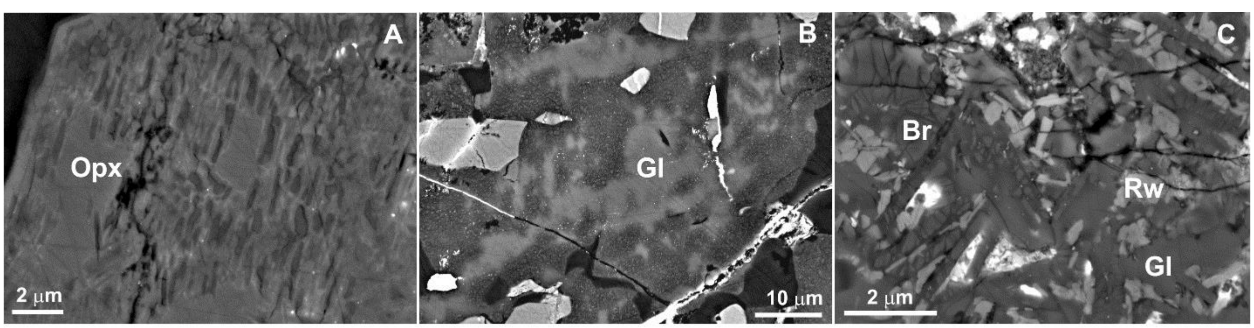

Figure 1. Orthopyroxene (Opx)-related microstructures in heavily shocked L6 chondrite NWA 5011: (A) Majorite-akimotoite aggregates replacing Opx; (B) Vitrified glass (Gl) after bridgmanite with akimotoite aggregates (dark areas); (C) Shock-melt vein background containing bridgmanite (Br), glass after bridgmanite and ringwoodite (Rw).

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