STUDY OF STONY (NON-METALLIC) PART FROM SEYMCHAN PMG METEORITE USING X-RAY DIFFRACTION AND MÖSSBAUER SPECTROSCOPY.

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Introduction: Seymchan meteorite was found in 1967 in the Magadan District of the fomer USSR (now Russian Federation) and classified as the main group pallasite (PMG). The first study of olivine mechanically extracted from Seymchan fragment by means of X-ray diffraction (XRD) and Mössbauer spectroscopy was done in [1]. Recently, a lot of Seymchan fragments were collected by the Meteoritical Expedition of the Ural Federal University. Therefore, we continue the study of stony (non-metallic) part of new Seymchan fragment by means of optical microscopy, scanning electron microscopy (SEM) with energy dispersion spectroscopy (EDS), XRD and Mössbauer spectroscopy with a high velocity resolution.

Experimental: Polished slices of Seymchan PMG fragments were analyzed using optical microscope Axiovert 40 MAT (Carl Zeiss) and scanning electron microscope ΣIGMA VP (Carl Zeiss) with an X-max 80 energy dispersive spectroscopy device (Oxford Instruments). Then thin powder obtained from the non-metallic surface was studied using PANalytical X'Pert PRO MPD diffractometer (The Netherlands) and Mössbauer spectroscopy with a high velocity resolution at room temperature.

Results: Optical microscopy showed the presence of silicate and chromite phases in the metallic matrix. SEM with EDS analysis demonstrated that the stony part of Seymchan PMG contains olivine $(Fe, Mg)_2SiO_4$ as the main phase as well as chromite $FeCr_2O_4$, probably clinopyroxene $(Fe, Mg, Ca)SiO_3$, tiny amount of troilite FeS and weathered phases (see Fig. 1***a***). XRD analysis identified the presence of these phases also. The Mössbauer spectrum of stony part extracted from Seymchan meteorite is shown in Fig. 1***b***. This spectrum appeared to be slightly different from previously measured one shown in [1]. The best fit revealed 5 quadrupole doublets (1–5) and one singlet peak (6). Components 1 and 2 were related to the M1 and M2 sites in olivine, components 3 and 4 were assigned to the M1 and M2 sites in clinopyroxene while component 5 was associated with Fe^{3+} probably in the M2 sites in olivine as a result of weathering. Component 6 was related to chromite. Troilite peaks were not found in this spectrum due to small amount of FeS and the necessity to measure this spectrum for a longer time. On the basis of XRD and Mössbauer results it is possible to estimate the iron partitioning between the M1 and M2 sites in olivine.

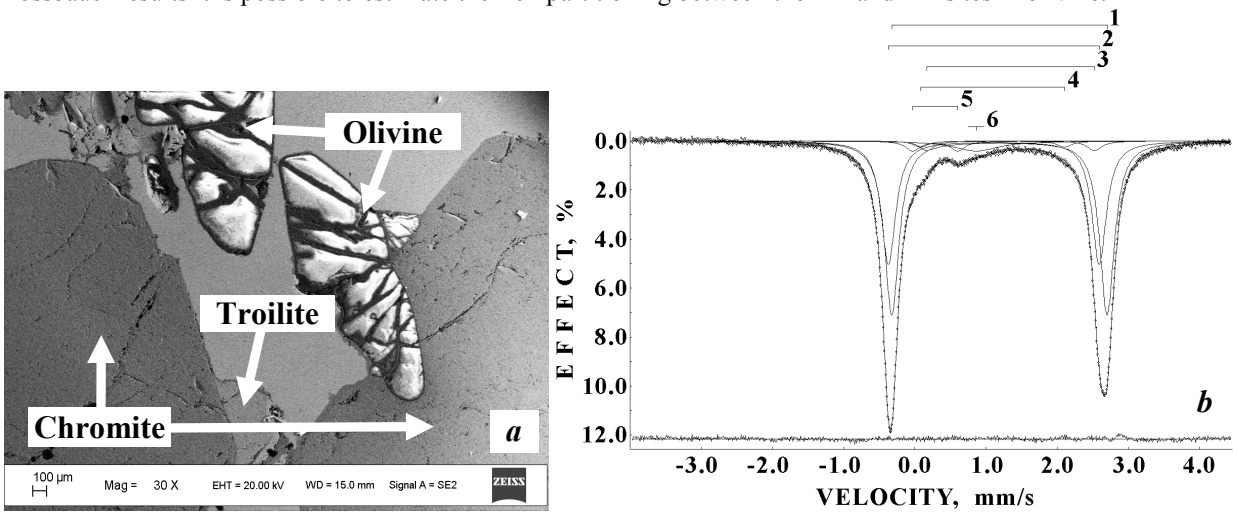

Fig. 1. Stony (non-metallic) part of Seymchan PMG: SEM microphotograph of the polished slice (***a***) and the room temperature Mössbauer spectrum of extracted stony part, 1–6 are the results of the best fit, differential spectrum is shown below (***b***).

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References:

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