CHARACTERIZATION OF Fe-Ni-Co ALLOY EXTRACTED FROM SEYMCHAN PMG METEORITE USING MÖSSBAUER SPECTROSCOPY.

M. V. Goryunov, E. V. Petrova, V. I. Grokhovsky and M. I. Oshtrakh, Institute of Physics and Technology, Ural Federal University, Ekaterinburg, 620002, Russian Federation, E-Mail: evgeniya.petrova@urfu.ru, oshtrakh@gmail.com.

Introduction: Seymchan meteorite was found in 1967 in the Magadan District of the fomer USSR (now Russian Federation). Firstly it was classified as iron meteorite but further it was reclassified as the main group pallasite (PMG). A lot of Seymchan fragments were collected by the Meteoritical Expedition of the Ural Federal University in 2012. Fe-Ni-Co alloy in one fragment of this meteorite has been characterized by using optical microscopy, scanning electron microscopy (SEM) with energy dispersion spectroscopy (EDS) as well as by using Mössbauer spectroscopy with a high velocity resolution for the first time.

Experimental: Polished slice of Seymchan PMG fragment was analyzed by means of 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 metal surface was studied using Mössbauer spectroscopy with a high velocity resolution at room temperature.

Results: Optical microscopy showed the presence of α-Fe(Ni, Co) and γ-Fe(Ni, Co) phases as well as plessite structures α-Fe(Ni, Co)/α_2-Fe(Ni, Co)+γ-Fe(Ni, Co) in metallic matrix of Seymchan PMG (see Fig. 1***a***). The content of Ni in the α-Fe(Ni, Co) matrix was found about 6 at.%. The Mössbauer spectrum of Fe-Ni-Co alloy extracted from Seymchan meteorite is shown in Fig. 1***b***. This spectrum has asymmetrical six-line pattern different from the standard α-Fe foil that is why it cannot be fitted using one magnetic sextet only. The result of the best fit shows the presence of 8 magnetic sextets (1–8) with different relative areas and hyperfine parameters and small paramagnetic doublet (9). Basing on the hyperfine parameters these components were related to α_2-Fe(Ni, Co) (components 1 and 2), α-Fe(Ni, Co) (components 3–6) and γ-Fe(Ni, Co) (components 7 and 8). These assignment is in agreement with the Mössbauer data obtained for some other iron meteorites in [1, 2]. Component 9 may be a result of partial metal oxidation because the hyperfine parameters of this component characterize Fe^{3+} compound.

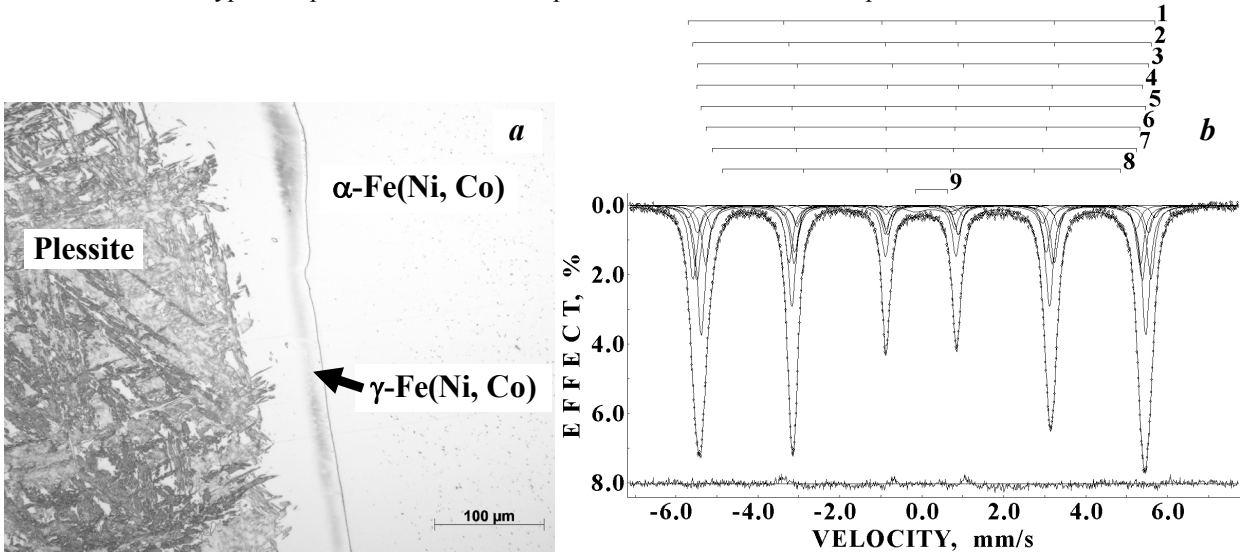

Fig. 1. Fe-Ni-Co alloy from Seymchan PMG: optical microphotograph of the polished slice (***a***) and the room temperature Mössbauer spectrum of extracted Fe-Ni-Co alloy powder, 1–9 are the results of the best fit, differential spectrum is shown below (***b***).

Acknowledgements: This work was supported in part by the Ministry of Education and Science of the Russian Federation (the Project # 3.1959.2017) and by Act 211 Government of the Russian Federation, contract № 02.A03.21.0006. Contribution to the study from M.V.G. was funded by the RFBR according to the research project № 16-32-00151 mol_a.

References:

[1] Dos Santos E. et al. (2015) *Physics of Earth and Planetary Interiors* 242:50–64. [2] Goryunov M.V. et al. (2016) *European Journal of Mineralogy* 28:601–610.