IMPACT OF LODRANITE CREATED ZHAMANSHIN CRATER IN KAZAKHSTAN. Ivan Vetvicka[1,2], Jan Frank[3], Jan Drtina[4], [1]CTU Prague, Faculty of Nuclear Sciences, [2] Observatory of Prague, corresponding address: Prevoznicka 14, 143 00 Praha 12 – Modrany, Czech republic, nunatak@centrum.cz, [3]Tesarik a Frank – Surveying Services, Ltd., U Stadionu 467, 271 11 Neratovice, CZ, honza.frank@seznam.cz, [4]Zakladani staveb, a.s., jdrtina@email.cz

Introduction: The lodranites are primitive achondrites originated by partial melting of chondrites in early history of our Solar system and their research can help us to understand the processes of early differenciation of primitive asteroids [1] However, lodranites belong among the most rare meteorites on the Earth surface, only 14 pieces were found on the Earth surface and the total weight of all of them exceeds 1 kg [1]. This paper shows evidences, that Zhamanshin impact crater in Kazakhstan (48^o 21,6´ N, 60^o 59,1´E) was created by an impact of a meteorite from the group of lodranites. The diameter of Zhamanshin is 13 km. The age of the crater is 1.0 +- 0.1 Ma [2,3].
The impact melted the terrestrial rocks and changed them into pieces of glass, which are usually classified into two groups: zhamanshinites and irghizites [2] See our another abstract in this book for the morphological description and classification of these glasses and for the description of Lonar impact crater, where samples of impact glasses to be compared with glasses from Zhamanshin were collected.

Methodology: In 2002 we undertook an expedition to the Zhamanshin meteorite crater to collect there samples of impact glasses. Jan Frank collected impact glasses in the Lonar crater in 2006. The carbon coated pollished sections were made of all examined samples. Those cross sections were observed in electron microscope in secondary and back scattered electrons (SE and BSE). Two electron probe microanalysers with wave dispersive spectrometer (EMA-WDS, types: CAMECA – CAMEBAX and CAMECA SX-100 were used for analysing of 27 representative samples of the Zhamanshin impact glasses and 168 point silicate analyses extended by NiO were made. NiO was measured as the last oxide and the detection time was prolonged to make the measurement more accurate. Moreover, 6 samples of impact glasses from Lonar crater were analysed by 40 point silicate anlyses extended by NiO (microanalyser EMA WDS, type: CAMECA SX-100). Total sum of all analyses is in the interval 99 – 101 wt%. Trace elements in glasses from Zhamanshin were measured by the mass spectrometer with inductively coupled plasma equipped by laser ablation (ICP-MS-LA), type WG PQ3.

Results and discussion: Irghizites originated by accretion of fibres and small spheres of glass (see our another abstract in this book for details). Even on cross sections made from some of compact splash-form irghizites, it is possible to observe boundaries between individual fibres. (Fig. a). Those boundaries are clearly visible in BSE because they are bolded by thin layer of glass enriched by FeO and NiO. (It is possible to see those boundaries by naked eye on thin sections, becouse the layer of glass rich in FeO is brown.) The layer metamorfed into schlieren rich by FeO and NiO in irghizites, where glass was more mixed during the formation of samples. Splash-form and massive glasses from Lonar contain schlieren rich in FeO as well. However, the content of NiO is under the detection limit of EMA WDS. These schlieren originated by melting of grains of titanomagnetite (Fig. c,d). In zhamanshinites, there are schlieren rising from magnetite (Fig. b). On the other hand, crystals of magnetite or titanomagnetite were not found in schlieren rich by FeO (up to 10.1 wt%) in irghizites. Moreover, those schlieren contain up to 0.48 wt% of NiO. This can be explained by the contamination of irghizites by the extraterrestrial matter [2,4]. High contents of Ni and Co werre explained by contamination by 8 % of typical chondrite or 1.5 % of typical iron meteorite [4] Necessity of further research was proclaimed by [4,5]. Irghizites contain 0.18 wt% NiO (i.e. 10 x more than other Zhamanshin glasses) and 0.05 wt% Cr_2O_3 in average, the enrichment by Co was found too. The Ir content in irghizites is under the detection limit of ICP-MS-LA, i.e. lower than 0.1 ppm. However, the Ir content for two irghizites: 0.14 and 0.27 ppb is known [6]. A type of meteorite, which can yield higher contents of Ni, Cr and Co, but has low Ir content, was searched in [1]. The next criteria was the convergence of the ratio meteorite / irghizite for contents Ni and Cr to the same value. Possible admixtures of terrestrial Ni and Cr were neglected. The Lodran meteorite fits the best to those requirements. The Ni and Cr contents in Lodran were converted to oxides. Based on 87 point EMA WDS analyses of irghizites, the average value of ratio of NiO and Cr_2O_3 content Lodran / irghizite = 16,71 for NiO and 16,56 for Cr_2O_3. Thus, irghizites contain cca. 6% of primitive achondrite, which chemism was close to the Lodran meteorite. The contamination by extraterrestrial matter was proven only for irghizites.

The ratio Lodran / zhamanshinite does not converge to the same value for NiO and Cr_2O_3. Therefore, the contamination by meteorite was not prooven for zhamanshinites.

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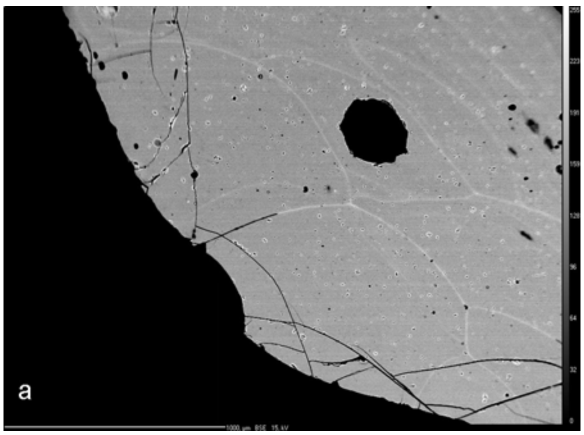

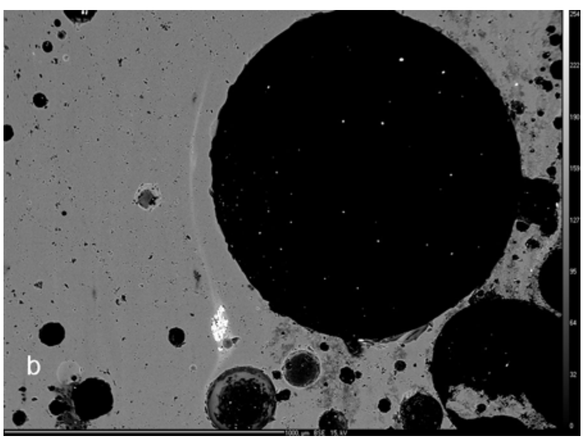

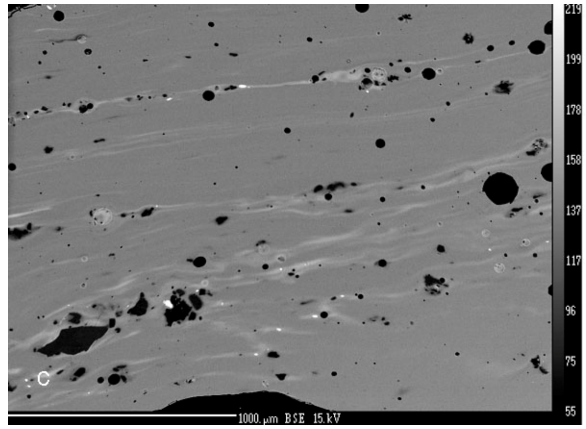

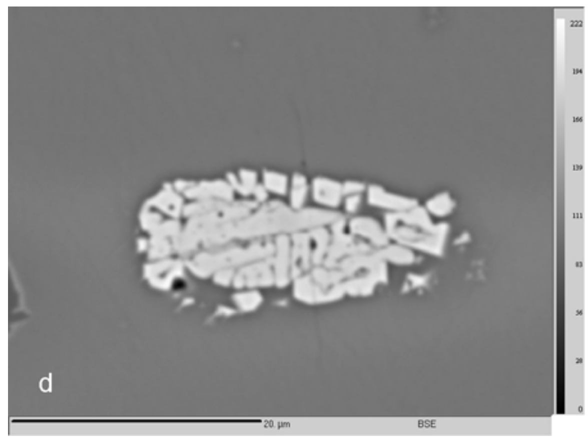

Fig. a - d: Cross sections of impact glasses observed in back scattered electrons by electron microscope of EMA-WDS CAMECA SX-100, photo Korbelova, a: Splash-form irghizite. It is possible to see boundaries between fibres of glass stuck together. Boundaries are marked by layer of glass (white curved polygonal lines) rich by FeO and NiO, b: Zhamanshinite. The light schliere is rising from the grain of magnetite (white). Dark circles are bubbles in the glass., c and d: Massisve glass from Lonar. Light schlieren with grains of titanomagnetite (white) are visible. d: detail of the titanomagnetite grain marked by arrow on fig. c.

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