

## SODIUM-RICH PHOSPHATE AND SILICATE INCLUSIONS IN TROILITE NODULE IN DARINSKOE IRON METEORITE (IIC)

V. V. Sharygin<sup>1,2,3</sup>, <sup>1</sup>V.S.Sobolev Institute of Geology and Mineralogy, SB RAS, Novosibirsk, 630090, Russia; <sup>2</sup>Novosibirsk State University, Novosibirsk, 630090, Russia; <sup>3</sup>ExtraTerra Consortium, Institute of Physics and Technology, Ural Federal University, Ekaterinburg 620002, Russia; E-mail: sharygin@igm.nsc.ru.

**Introduction:** Meteorite Darinskoe (1 sample, 11.2 kg) was found in 1984 in Ural'sk district of Kazakhstan. It is plessitic octahedrite (IIC group) [1], which contains two troilite nodules (up to 3 cm). In addition to large troilite nodules and plessite aggregate the Darinskoe iron consists of small troilite isolations (up to 1 mm), kamacite, chromite, schreibersite (rhabdite), pentlandite and cobaltpentlandite. The terrestrial alteration phases are represented by goethite, Cl-bearing Fe-hydroxides (akaganeite, droninoite) and siderite. According to LA-ICP-MS data [2] the bulk composition of the Darinskoe meteorite is: Ni – 11.4 wt.%; Co – 0.59 wt.%; Cu – 147; Ga – 44; Ge – 90; As – 5.6; Mo – 18.3; Ru – 25.1; Rh – 1.6; Pd – 2.9; Ir – 12.8; Pt – 13.5; Au – 0.6, Re – 1; W – 3.3 ppm.

**Experimental:** Polished samples of the Darinskoe meteorite were examined using optical microscope Olympus BX51, scanning microscope TESCAN MIRA 3MLU SEM with EDS/WDS system and LabRAM HR 800 mm spectrometer.

**Results and Discussion:** The studied troilite nodule (2.5 cm) contains rounded chromite grains (50-100  $\mu\text{m}$ ), euhedral schreibersite (10-100  $\mu\text{m}$ ), phosphate and silicate inclusions (10-30  $\mu\text{m}$ ) (Fig. 1). Sulfides (Cl-free djerfisherite, pentlandite, chalcopyrite, cubanite) and unidentified micron-sized Ni-Te-phase (Ni - >16, Te - >32 wt.%) sometimes associated with the inclusions. Host troilite is rich in Cr (0.4-1.0 wt.%). Average composition of djerfisherite is (n=15, in wt.%): Fe – 44.48; Ni – 9.31; Co – 0.15; Cu – 3.04; K – 8.90, S – 34.01; Cl – 0.00. Phosphate inclusions are mainly composed by hydrated Ca-Mn-Fe phosphates (supported by Raman), which seems to be alteration products of initial alkali-rich anhydrous phosphates in the terrestrial conditions. Only buchwaldite  $\text{NaCa}(\text{PO}_4)$  has been found as a primary phase in some phosphate inclusions. Its composition is (n=6, in wt.%):  $\text{Na}_2\text{O}$  – 19.50;  $\text{K}_2\text{O}$  – 0.16;  $\text{CaO}$  – 35.57;  $\text{FeO}$  – 1.26;  $\text{P}_2\text{O}_5$  – 43.75;  $\text{SO}_3$  – 0.32. It is very closely to buchwaldite observed in troilite nodules of another iron meteorites [3]. The silicate inclusions have very specific and variable composition (range in wt.%):  $\text{SiO}_2$  – 60.7-72.6;  $\text{TiO}_2$  – 3.5-11.2;  $\text{Cr}_2\text{O}_3$  – 2.1-3.4;  $\text{Al}_2\text{O}_3$  – 0.05-0.15;  $\text{FeO}$  – 2.3-2.4;  $\text{MgO}$  – 0.3-0.4;  $\text{CaO}$  – 0.3-0.4;  $\text{Na}_2\text{O}$  – 11.5-12.9;  $\text{K}_2\text{O}$  – 2.4-4.0;  $\text{P}_2\text{O}_5$  – 0.51;  $\text{SO}_3$  – 0.4-0.5. We did not find any similar compositions among known mineral species and thus suggest that it maybe a Na-rich silicate glass.

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**References:** [1] Wlotzka F. 1995. *Meteoritics* 30:792-796. [2] Chernozhkin S. M. et al. 2014. *Journal of Analytical Atomic Spectrometry* 29:1001-1016. [3] Olsen E. et al. 1977. *American Mineralogist* 62: 362-364.

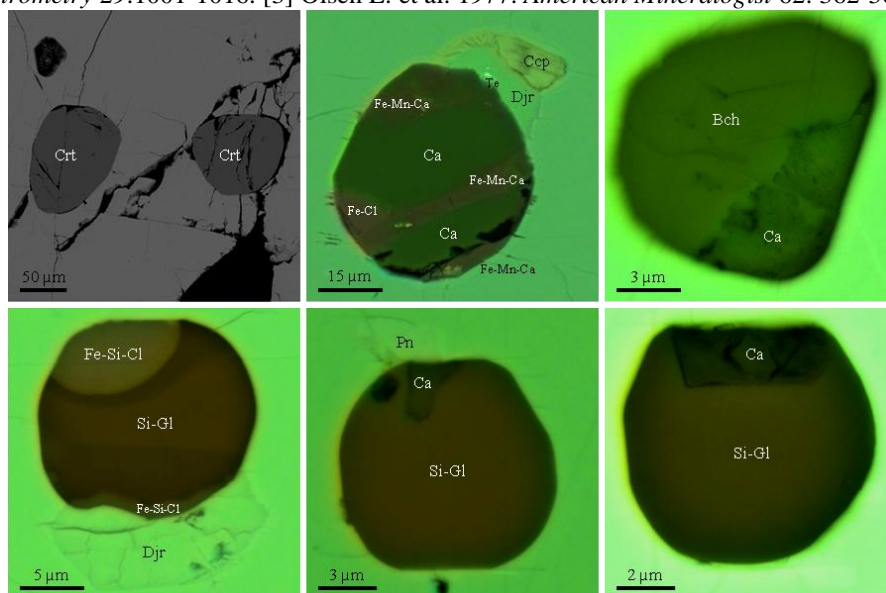


Figure 1. BSE images of chromite, phosphate and silicate inclusions in troilite nodule of the Darinskoe iron meteorite. Symbols: Crt – chromite; Ccp - chalcopyrite; Djr – Cl-free djerfisherite; Te – Te-Ni-rich phase; Bch – buchwaldite; Pn – pentlandite; Ca - hydrated Ca-phosphate after buchwaldite; Fe-Mn-Ca, Fe-Cl – hydrated phosphates after alkali-rich anhydrous phosphates; Si-Gl – Na-Ti-rich silicate glass ?; Fe-Si-Cl – Fe-Cl-rich silicate ?.