# GEOCHEMICAL AND MINERALOGICAL FEATURES OF CHONDRULE AND MATRIX OLIVINE FROM THE BUSCHHOF ORDINARY CHONDRITE

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**Introduction:** Buschhof meteorite is L6 ordinary chondrite. Substance of the meteorite for research was provided by Mining museum (Saint-Petersburg Mining University), where it was stored since 1920's as part as Edward Kupffer meteoritical collection [1]. In this research we are measured major and trace elements contents for understanding formation differences between chondrule and matrix in ordinary chondrites. Olivine is the common mineral in chondules and matrix of ordinary chondrites and also stable in impact metamorphism conditions. Trace elements, including REE, are well known as sensitive indicators of geochemical processes.

Major elements content was detected by SEM-EDS method on JEOL JSM-6510 LA electron microscope in IPGG RAS. Content of trace elements in olivine was determined by the SIMS method on a Cameca IMS-4f ion microprobe in VALIEV IPT RAS using the procedure described in [2] .

Chondrules in Buschhof meteorite are different by mineral composition, size and morphology and occupy around 20% of meteoritical volume. The largest chondrule is around 2 mm, GOP type and has troilite and chromite rim. In meteorite also occurs small barred and radial chondrules (no more than 0.5 mm) without any rim and with indistinct character of chondrules border. The matrix is consist of finegrained silicate minerals (olivine, pyroxene, plagioclase) with large (to1mm) tanite, kamacite, troilite and chromite grains.

In Buschhof meteorite were identified: olivine, Ca-rich pyroxene, Ca-low pyroxene, plagioclase, apatite, merrillite, chromite, troilite, tetratenite, kamacite and taenite. Ca-rich pyroxene, apatite, merrillite and tetrataenite were diagnosed for the first time in Buschhof meteorite.

**Results:** Olivine (Fo 74-76) in Buschhof meteorite is located in structurally different chondrules and in the matrix. In the GOP chondrule isometric rounded olivine grains vary greatly in size from 20 to 200 mkm. The BO chondrule is represented by a single skeletal crystal of olivine, the intercrystalline space of which is filled with pyroxene and plagioclase. Size of the RP chondrule is 0.5 mm. In the matrix olivine has a coarse-grained short-prismatic shape (300-700 mkm).

There is no noticed relation between contents of the major elements in olivine and its location in chondrule. It can be caused either real absence of variation of contents of major elements or insufficient accuracy of the analysis method SEM-EDS.

Olivine from the center of GOP chondrule is enriched by HFSE Zr (the average content 0.56 ppm) and Nb (0.31 ppm) regarding olivine from the chondrule rim (0.20 и 0.11 ppm, respectively) and the matrix of meteorite (0.05 и 0.12 ppm). Hf behavior does not demonstrate reliable patterns, but in the chondrule center Hf contents in olivine above detection level and below detection level in the chondrule rim.

Content of the LILE Ba (the average content 2.21 ppm) and Sr (3.72 ppm) goes down in olivine from the chondrule center to the chondrule rim (0.36 и 0.24 ppm, respectively) as well and further to meteoritical matrix (0.11 и 0.14 ppm).

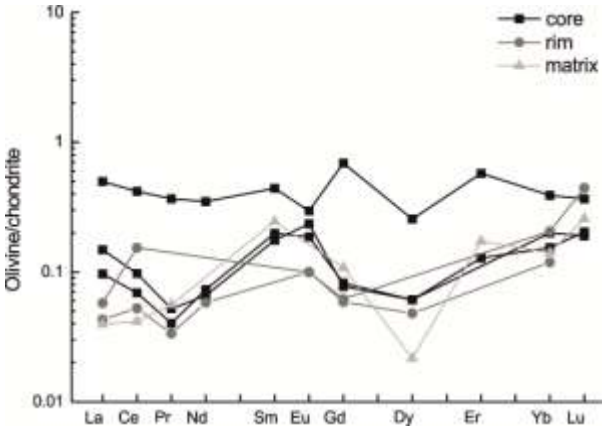


Fig. 1. The REE spectra in olivine from Buschhof meteorite

Maximum amount of Cr (the average content 538 ppm) is contained in olivine from the chondrule center compared to the chondrule rim (456 ppm) and meteoritical matrix (349 ppm). Ni behavior in olivine is more complicated – Ni abundance is greatly reduced from the chondrule center to the rim (avg from 158 to 26.2 ppm) and then a little bit increases in matrix (avg to 44.8 ppm).

Olivine is generally deplete in REE (Fig. 1), total content does not exceed about 1 ppm. On average, olivine from the central part of the chondrule contains 0.50 ppm REE with excess of LREE over HREE, in chondrule rim and matrix abundance of REE reduced to 0.15-0.16 ppm. The REE spectra are practically not differentiated.

**References:** [1] Obolonskaya E.V., Popova E.E. (2014). Meteorite Chelyabinsk - a year on Earth, 355-363, [2] Sobolev, A.T., Batanova, V.G. (1995). Petrology, 3(5), 440-448.