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Origin and characteristics of different generations crystal in the basanites of the Black Rock volcanic center, the monogenic Lunar Crater field.

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We present data on systematic EPMA and LA-ICPMS study of major and minor element content in megacrysts, phenocrysts and xenocrysts from Black Rock lavas of the Lunar Crater monogenic field, Nevada. The rocks are represented by basalts, basanites, trachybasalts [Cortes et al., 2015] and contain several generations of olivine, clinopyroxene, feldspar crystals, which differ in morphology and composition.
Morphological and chemical features of rock-forming minerals let us to distinguish several generations among them. Megacrysts form crystals up to several centimeters in size, chemically homogeneous with numerous fluid inclusions. Olivine megacrysts are Fo86.2-87.7 and contain 0.3 wt.% of NiO, 0.2 wt.%. of CaO. Clinopyroxene megacrysts have Mg# = 87.1 – 90.7, TiO_2 0.4-0.5 wt.%, CaO 16.7-17.0 wt.%. Other generations of olivine and clinopyroxene are much more diverse in composition. Megacrysts and phenocrysts of olivine are close in composition. In contrast to other generations megacrysts of clinopyroxene are high-Cr ($Cr2O_3$ is about 1.2 wt.%). The phenocrysts are also chemically homogeneous. The rim of phenocryst contains TiO_2 up to 4 wt.%, that correlates with the content of titanium in microlites. Other generation have more low magnesium number, than megacrysts. Clinopyroxene from crystal clots and xenocrysts have large variations in the contents of the main elements than megacrysts and phenocrysts.
Occurrence of compositionally and morphologically different crystals indicate their formation in several magmatic reservoir. According to REE and other trace elements content, clinopyroxene may be divided to megacrysts, phenocrysts and xenoliths. All clinopyroxenes are enriched in LREE more than in HREE. The specters on the spider-diagram for different generation of clinopyroxene similar, but megacrysts are less enriched than phenocrysts and xenocrysts on absolute content in 3-4 times. Chemical composition of crystal evidence for formation of all crystals from similar magma in several magmatic reservoirs. For different generations of clinopyroxene crystallization pressure was calculated according [Nimis, 1999]. The estimated pressure for megacrysts of clinopyroxene corresponds to the level of the upper asthenospheric mantle (19-20 kbar), where the crystals have spent a relatively long time, which led to homogeneous in composition. The phenocrysts crystallized at similar pressures and corresponds to 17-20 kbar. Other generations crystallized gradually at lower pressures. Pyroxenes from crystal clots and xenoliths refer to rocks from the walls of the conducting channels (11-20 kbar). Microlites correspond to near-surface conditions, it is 2-13 kbar. The results of calculations on pressure and temperature confirm the crystallization at different levels. As it moved upward along the conducting channel, magma captured the earlier formed fragments of the magmatic system.

Cortés J. A. et al. Intrinsic conditions of magma genesis at the Lunar Crater Volcanic Field (Nevada), and implications for internal plumbing and magma ascent //American Mineralogist. – 2015. – . 100. – №. 2-3. – . 396-413. Nimis P. Clinopyroxene geobarometry of magmatic rocks. Part 2. Structural geobarometers for basic to acid, tholeiitic and mildly alkaline magmatic systems //Contributions to Mineralogy and Petrology. – 1999. – . 135. – №. 1. – . 62-74.