LUNAR BASALT METEORITE EET 87521: PETROLOGY OF THE CLAST POPULATION. A.S. Semenova, M.A. Nazarov, and N.N. Kononkova.

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The Elephant Moraine meteorite EET 87521 was classified as a lunar mare basalt breccia which is composed mainly of VLT basalt clasts [1-3]. Here we report about our petrological study of lithic clasts and monomineralic fragments in the thin sections EET 87521, 54 and EET 87521, 47, 1 prepared from the meteorite. The results of the study show that EET 87521 consists mainly of Al-rich ferrobasalt clasts and olivine pyroxenite clasts. The bulk composition of the meteorite can be well modelled by mixing of these lithic components which appear to be differentiates of the Luna 24 basalt melt. KREEP and Mg-rich gabbro components are minor constituents of EET 87521.

Results. The lithological components of EET 87521 are lithic clasts (1-4 mm) and monomineralic fragments (0.1-1.5 mm) which are cemented by a shock glass. The glass makes up nearly 10\% of the studied samples. The ferrobasalt clasts and olivine pyroxenite clasts are dominant in EET 87521. No highland fragments were identified.

Ferrobasalts have a relative coarse-grained ophitic texture and consist of feldspar (An 86-92), olivine (Fo 2-16), and pyroxene of ferroaugite (Wo 33-40, Fs 45-52) and sub-ferroaugite (Wo 17-25, Fs 47-61) compositions (Fig). Accessories are ilmenite, silica and troilite. These ferrobasalt fragments exhibit large compositional variations: feldspar 24-74; pyroxene 10-66; olivine 0-10, silica 0-13 (vol.\%). Average composition of 5 ferrobasalt clasts (SiO2 49.4; TiO2 .26; Al2O3 18.35; Cr2O3 .09; FeO 13.13; MnO .14; MgO 3.33; CaO 14.51; Na2O .72; K2O .06; wt.\%) was calculated on the basis of modal data and mineral compositions.

Olivine pyroxenites are fine-grained rocks as compared to the ferrobasalts. They show an equigranular texture and contain 57-75\% of pyroxene, 18-26\% of olivine, and 2-17\% of feldspar. Ilmenite and troilite are minor phases. Mineral compositions in the pyroxenites are close to those in the ferrobasalts, but feldspar in these rocks is characterized by a limited compositional range (An 91-92). Average composition of 2 pyroxenite clasts is: SiO2 47.1; TiO2 .49; Al2O3 2.18; Cr2O3 .16; FeO 33.84; MnO .45; MgO 5.51; CaO 10.28; Na2O .03; K2O .02 (wt.\%).

Monomineralic fragments of olivine, pyroxene and feldspar are most abundant in EET 87521. Ilmenite (0.5-2.5 wt.\% of MgO) and Al-Ti-chromite fragments are present in very minor quantity in the breccia. Compositions of some monomineralic silicate fragments are similar to those of the silicate phases in the lithic clasts. However some pyroxene and olivine fragments are rich in Mg and plot outside the field of the lithic clasts (Fig). Some monomineralic fragments show a more sodic feldspar (An 68-73, Or 3-4), which were not found in the lithic clasts.

Discussion. This study demonstrates that the ferrobasalts and the olivine pyroxenites are main lithological components in the
EET 87521 breccia. The bulk composition of the breccia [2] can be well modelled by mixing of the ferrobasalt (65%) and the olivine pyroxenite (35%) that supports the petrological observations. Some deviations from this model can be explained by a contribution of a few percents of Mg-rich olivine and ilmenite which are present in EET 87521 as monomineralic fragments. The EET 87521 ferrobasalt is much higher in Al and lower in Fe, Mg and Ti when compared to the Luna 24 VLT basalt. However in chemical and mineral compositions the EET 87521 ferrobasalt is close to the cristobalite gabbro 24170 described in the Luna 24 soil [4]. The EET 87521 olivine pyroxenites were not found in Luna 24 samples. These rocks resemble the Luna 24 metabasalts in their texture, but they are much higher in olivine and pyroxene relative to the metabasals. Because the bulk composition of EET 87521 is close to that of the Luna 24 VLT basalt and can be approximated by mixing of the ferrobasalt and the olivine pyroxenite, we suggest that the main EET 87521 lithologies can be complementary cumulates formed from the Luna 24 VLT magma. The fine-grained, equigranular texture of the pyroxenites assumes that the rocks underwent a thermal metamorphism after their crystallization.

Additional components of the EET 87521 breccia can be inferred from the chemistry of the monomineralic fragments and mixing model calculations. The Mg-rich olivine and pyroxene fragments as well as the Al-Ti-chromite grains can be derived from a Mg-rich cumulate. The olivine gabbro, found in the Luna 24 soil [4], have a similar mineral chemistry and, hence, this rock can be a source for these monomineralic grains. The Na-rich feldspar grains cannot be related also to VLT basalts containing a less sodic plagioclase. These grains could be derived from KREEP or quartz monzodiorite rocks which have the same feldspar compositions [5-7]. A contamination of EET 87521 with a KREEP material has been suggested from trace element data [1,2].

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