VOLATILE COMPONENTS IN THE LUNAR MAGMATIC PROCESSES.

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Idea that volatiles did'nt play essential role in formation of the lunar rocks is mainly based on the results of study of the regolith particles and rock samples from the lunar surface. The main part of the lunar surface formations however experienced impact metamorphism. Under this process temperatures arise upto some thousand degrees and shock pressures - upto 1 megabar. In the lunar vacuum conditions the process should be accompanied not only by the complete or partial rock melting but also by the differentiated vaporization of the rock components. The volatiles should be lost with that one of the first and in the most degree. Therefore revealing of the volatile-bearing relict primary mineral phases in the lunar rocks could witness significant role of such components in the primary magmatic process.

One of the volatile elements apparently playing essential part in the lunar mineral genesis is sulphur. In lunar materials are revealed, although in unsignificant quantities, various sulphides: troilite, pyrrhotite, mackinawite, chalcopyrite, pentlandite, cubanite, bornite, talnakhite, chalcosine, sphalerite, oldhamite. Troilite that has been revealed in the Luna 24 Lunar soil in IGEM of the USSR Academy of Science, occurs as the thinnest veinlets in the cryptocrystalline silicate veinlet crossing olivine grain and as the smallest (1-5 μm) rounded grains in complex olivine-plagioclase and ilmenite-plagioclase-pyroxene-olivine fragments. In the IGEM was identified with certainty also the lunar pyrrhotite. This mineral forms closed intergrowths with plagioclase of the bytownite-anorthite composition. In all described cases the rock types in which are revealed these minerals themselves give evidence of their endogenous lunar, magmatic origin.

Glass spheres of the orange soil (Apollon 17), in most of investigators opinion, were formed in fountaining and splashing of outpouring lava. It was established also that the silicate spheres are covered with a film in which elevated concentrations of F, Na, S, Cl, Zn are noted. The film could be formed under

condensation of the endogenous dry fumarolic matter (1). At the same time presence of coexistent S^{-2} and S^{+6} is established in the contact zone of the silicate core and the sulphide film. Relict character of the elements and their valency confirm participation of sulphur also in this magmatogene process and the elevated fugacity of oxygen, fluorine, chlorine.

Participation of chlorine in the lunar petrogenesis recently is also confirmed mineralogically (2). Thus, in pyroxenes of the Luna 24 regolith we have revealed irregular and rounded inclusions. They are unevenly distributed between the pyroxene blocks and are presented by glasses of tabular and rounded shape chemically near to the pyroxenes. In the glasses are noted numerous microvacuoles in which are discovered halite, sylvite and oldhamite. As likely as not this association of glass and chlorides reflects composition of the primary volatile-rich melt from which were formed the pyroxenes under conditions of relatively quick cooling.

Hydroxyl - bearing minerals are very rare found in the lunar formations, yet amongst them are distinguished various genetic types. Established, in particular, are presence of goethite among the silicate grains inside of breccia samples, its association with troilite and sphalerite, its presence in the central parts of fragments covered with glass film. In vartue of these facts some investigators spoke about endogeneous nature of water in these minerals. The presence of $OH(H_2O)$ in the primary melts is also indicated by discovered in the IGEM akaganeite sealed in the glassy fragment (3). In the lunar matter are also discovered amphiboles most likely having magmatogene origin and being formed in presence of water under rather high temperatures. An amphibole was discovered by us in intergrowth with the opaque mineral inside of olivine crystall from fragment of the deepseated magmatic rock.

Thus among the lunar fragments are established good many of relict minerals related to endogeneous magmatic process, every of which contains the volatile components - S,Cl,H_2O et al. In the Earth's magmatic process these volatiles take part side by side with the other similar components. A good many of volatile

elements are also discovered in some lunar fragments. Except the above orange glasses one may still mention the results of analysis of inclusions in the lunar glass, which, judging by their description, also have magmatic genesis with clear signs of liquation processes. Dolgov et al. (4) have established in them by the absorption-volumetric method CO_2, N_2, H_2, H_2S, SO_2, NH_3.

All the cited data suggest as distinct from the existing notions that the volatile components have played significant role in the deep-seated magmatic process having taken place earlier in the Moon.

References:

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