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GEOCHEMICAL SIMILARITIES BETWEEN THE PRE-CALDERA AND MODERN EVOLUTIONARY SERIES OF ERUPTIVE PRODUCTS FROM GORELY VOLCANO, KAMCHATKA

*Gavrilenko, M
max.gavrilenko@gmail.com
Active Volcanism Lab, Institute of volcanology and seismology, Petropavlovsk-Kamchatsky, Russian Federation
Ozerov, A
ozerov@ozerov.ru
Active Volcanism Lab, Institute of volcanology and seismology, Petropavlovsk-Kamchatsky, Russian Federation

Gorely volcano, in southern Kamchatka, is a large, long-lived shield-type volcano that is currently in an eruptive phase. Prior eruptions occurred in 1980 and 1984. It is comprised of three structural units: Pra-Gorely volcano; thick ignimbrite complex, associated with a caldera forming eruption; modern edifice named ‘Young Gorely’. An integrated mineralogical-geochemical have been conducted on all structural units of the Gorely volcanic edifice to determine their genetic conditions. After geochemical analysis two evolution series were found. First, Pra-Gorely volcano is represented by a suite of compositions ranging from basalt to rhyolite, with in this series, high-Mg basalts were discovered. Second, Young Gorely edifice is composed of only basalt, andesite and dacite. The reconstruction of chemical evolution trends shows that both volcanic series of Gorely volcano share the same genetic history with similar evolutionary stages. We suggest fractionation of an upper mantle peridotite as a common means to produce both volcanic series as a result of which the evolution of all rocks was generated. The magmatic series of Pra-Gorely and Young Gorely volcanoes were formed under different geodynamic conditions. Between these two series was a powerful stage of caldera formation, during which 100 km^3 of ignimbrites were emplaced. The 12-km diameter caldera collapse was the catalyst for large-scale reorganization of the volcanic feeding system. Nevertheless following caldera collapse, Young Gorely was formed by activity inside the caldera and shows very similar evolutionary trends to that of Pra-Gorely. It can be confidently stated that crustal components are practically absent in the evolution of the series, and the compositional range is attributed directly to the evolution of the magmatic melts of Gorely volcano. Microprobe analyses conducted on olivine and pyroxene phenocrysts of Gorely volcano lavas, show that there were at least two stages of crystallization during the evolution of magmatic melt. In addition, accessory minerals enclosed as mineral inclusions in olivine and pyroxene phenocrysts were studied in order to reconstruct the magmatic melts evolution. The chemical composition of spinel crystals, which were found within the host-minerals, shows definite trends of mineral phase’s evolution and confirm the two-stage nature of the magmatic melt evolution, which was detected by microprobe analysis of the phenocrysts of the Gorely volcano lavas. Cr-spinels (Cr_2O_3 is about 25wt.%) were found in high-Mg olivines (Mg# 87-77). Fe-Ti spinels (TiO_2 is about 15wt.%) were found in low-Mg pyroxenes (Mg# 72-69). The two-stage character of initial magmatic melt evolution is also confirmed by computer simulation results. The first stage is characterized by comparatively high pressures (6-8 kbar),

which corresponds to formation at depth and low rates of oxygen fugacity (1% Fe^{3+} in total Fe). In contrast, the magmatic evolution of the second stage occurred in near-surface conditions (1-1.5 kbar) with high rates of oxygen fugacity (Ni-NiO buffer). The existing of this stage of crystallization testifies to shallow magmatic chamber presence which is responsible for generation of caldera and thick ignimbrite complex.

[1031] GEOCHEMISTRY / Subduction zone processes
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