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Dal'nee lake maar, Uzon caldera
Photo courtesy Marina Belousova

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The lava field in the center of Dzendzur-Zhupanovsky volcanic group, Eastern Kamchatka

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Dzendzur–Zhupanovsky volcanic group (Fig. 1) is situated 70 km north of Petropavlovsk-Kamchatsky in the Eastern Volcanic Belt, Kamchatka. The eastern sector of the volcanic group is occupied by four cones of Late Pleistocene-Holocene Zhupanovsky volcano including Priemysh cone, active from 2013 to 2017. The older eroded edifices of Yur'evskii, Sirenevyi and Dzendzur volcanoes composed the western sector of the volcanic group. The extensive lava field (see Fig. 1) flooded ancient volcanic edifices in the center of volcanic group. The area and volume of Dzendzur-Zhupanovsky lava field are significant compared to other known objects in Kamchatka. For example, its scale is comparable to the biggest object of monogenetic volcanism in Sredinny Range represented by the lava flows from Southern and Nortern Cherpuk cones near the Ichinsky volcano (Pevzner et al., 1999).

The Dzendzur-Zhupanovsky lava field as well as other volcanoes of this group remain poorly studied with respect to the geochemical evolution, age and eruptive history. The chronology of eruptive activity and data on rock composition were described only for the active Priemysh cone (Bazanova et al., 2009; Puzankov et al., 2016; Gorbach et al., 2018). The previous studies of lava field report the geological observation and a few whole rock composition data (e. g., Ermakov et al., 1973; Litvinov and Burmakov, 1993). We present the first geochemical data characterizing andesite and rare basaltic andesite lava from Dzendzur-Zhupanovsky lava field. We compare the obtained geochemical characteristics with the similar data for rocks of the recently erupted Priemysh cone to test the hypothesis of their genetic commonality.

The Dzendzur–Zhupanovsky lava field covered an area about 100 km^2. At least five eruptive centers (e.g., scoria and lava cones) are clearly visible in the aerial photographs. The most of eruptive centers were formed by a single eruption. The exception is Tetyaev crater, which produced multiple lava flows (Ermakov et al., 1973). The longest lava flows extend for 13-15 km from the eruptive centers. The average thickness of lava flows is about 30 m, but for the several lava lobes the thickness increases up to 80-100 m. The most of the flows have well expressed, prominent lava levees along the edges (see Fig. 1). Closer to the eruptive centers, the pressure ridges and huge sharp-angle lava blocks are observed on the surface of lava flows. Based on geological observation, Ermakov et al. (1973) suggested that the lava field has Middle-to-Late Holocene age.

The lavas sampled from the central part of lava field and from Tetyaev crater are mainly of andesitic composition (SiO_2~59-61 wt. %). Basaltic andesite lavas (SiO_2~56 wt. %) compose several flows in the vicinity of Dzendzur volcano edifice.

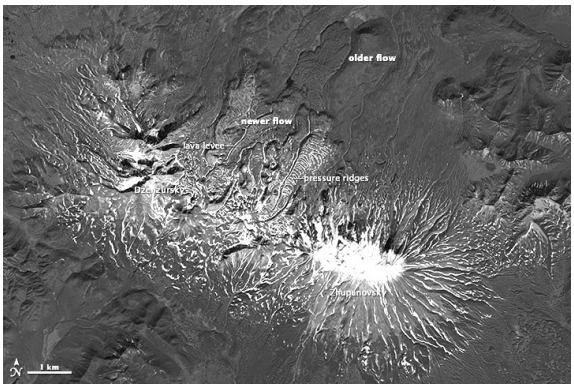

Fig. 1 – The Dzendzur-Zhupanovsky volcanic group with extensive lava field in the center.
Airphoto taken from https://earthobservatory.nasa.gov/

All lavas are crystal-rich with modal abundance of phenocrysts of ~30-35 %. The dominant lava type is plagioclase-two pyroxene andesite with sporadic hornblende and olivine phenocrysts. In lower-SiO_2 rock varieties the amount of olivine increases and hornblende occurs very rarely. The rocks commonly have the complex texture including resorbed phenocrysts and clots of plagioclase and pyroxenes, xenogenic quartz grains, and microxenoliths of plutonic rock.

The basaltic andesite and andesite lavas have calc-alkaline affinity (FeO*/MgO~1.20-1.76) and moderate potassium contents (K_2O~0.97-1.32 wt.%). The basaltic andesites are characterized by elevated Mg-number (Mg/Mg+Fe^{2+} up to ~0.60). With MgO decrease, the compositions of all rocks form narrow, but common evolutional trends suggesting the fractional crystallization processes.

The preliminary comparison of obtained petrographical and geochemical data for the lava field rocks with the known data for the active Priemysh cone (Bazanova et al., 2009; Puzankov et al., 2016; Gorbach et al., 2018) indicates their similarity. Both lava field and Priemysh cone rocks are characterized by the identical patterns of the

rare-earth elements and similar enrichment in the large-ion lithophile elements (e.g., Rb~15-25, Sr~369-437, Ba~285-438 ppm) and in the high field strength elements (e.g., Zr~100-149, Nb~2.4-3.4, Ta~0.19-0.26 ppm). The geochemical similarity and approximately simultaneous Middle-to-Late Holocene eruptive period (e.g., Ermakov et al., 1973; Bazanova et al., 2009) may imply that the rocks of lava field and Priemysh cone are genetically related and originated from a common parental magma. On the contrary, a comparison of the geochemical data for lava field and Priemysh cone rocks with the data reported by Plechova et al. (2011) for primary magma of Zhupanovsky volcano indicates the difference in many petrogenetic indicators (e.g., Mg-number, Zr/Y, Nb/Y, Zr/Nb, Th/La, Ba/Nb, Ba/Th).

The obtained data highlights the complex petrogenetic history of Dzendzur-Zhupanovsky lava field as a part of long-lived and large volcanic system. As has been shown by Smith and Németh (2017) such volcanic setting is transient between polygenetic and monogenetic volcanism and commonly associated with internally complicated plumbing systems. Further studies of Dzendzur-Zhupanovsky lava field may target on mineral composition and zoning patterns for improving of our understanding of processes of magma storage and evolution in the transitional condition between polygenetic and monogenetic volcanoes.

Our preliminary data also may be important for the assessment of the volcanic hazard in Dzendzur-Zhupanovsky volcanic group. The similarity of the composition and the approximately simultaneous past eruptions from lava field and Priemysh cone allow us to suggest a possibility of such a scenario for the future. On resuming of activity in the lava field, long lava flows may spread mainly to the north and the south of the axial part of the Dzendzur-Zhupanovsky volcanic group. In this case, the lava flows and potentially associated lahars may threaten the Zhupanova River valley.

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