PROGRAM & ABSTRACTS

Geofluid 3

Nature and Dynamics of fluids in Subduction Zones

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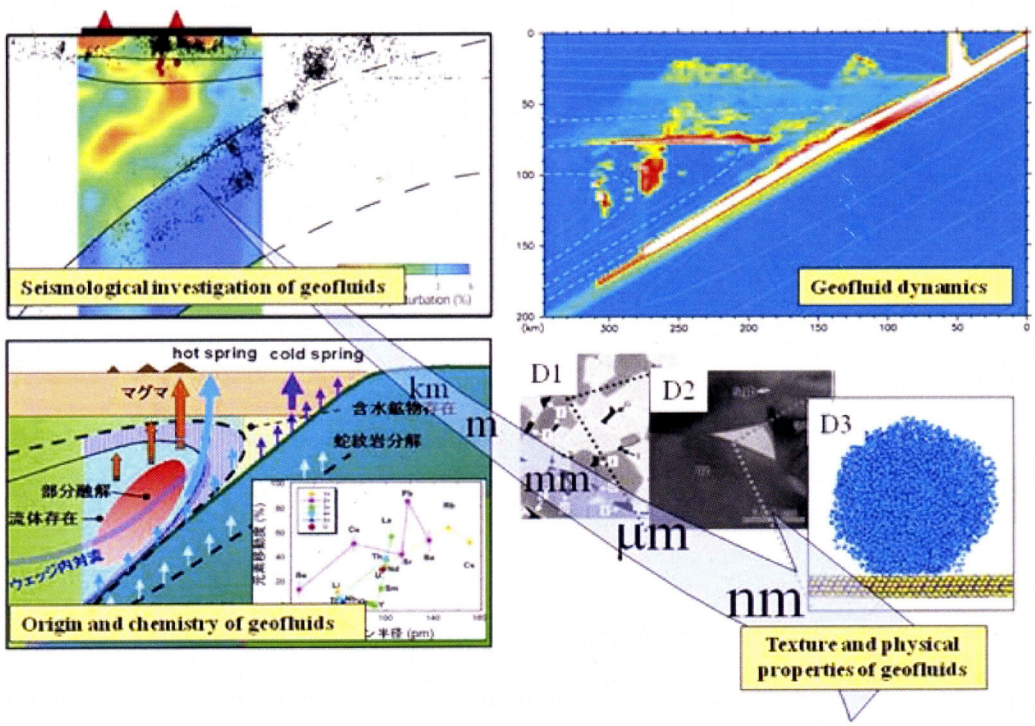

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MANTLE AND FLUID SOURCES BELOW KLYUCHEVSKOY-KAMEN-BEZYMIANNY LINE (KAMCHATKA)

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Introduction: Kamen volcano is an extinct volcanic complex located in the central part of the Klyuchevskaya group of volcanoes (KGV) between active Klyuchevskoy, Bezymianny, and Ploskie Sopky volcanoes. Kamen volcano was mapped by V.A. Ermakov only in the 1970s. However the modern geochemical studies of Kamen volcano have not been previously carried out and its relationship and petrogenesis in comparison to other active neighbors are unknown. A modern geochemical study of Kamen volcano is needed because it will shed light not only on the history of the volcano itself and its closest neighbours, but also on the history and magmatic evolution of the KGV melts in general. The distance between the summits of Kamen and Klyuchevskoy is only 5 km, the same as between Kamen and Bezymianny. The close relationship in space and time of the KGV and the common zone of seismicity below them [1] suggests a common source and a possible genetic relationship between their magmas. However, the Late-Pleistocene-Holocene lavas of all these neighbouring volcanoes are very different: high-Mg and high-Al Ol-Cpx-Pl basalts and basaltic andesites occur at Klyuchevskoy volcano, and Hbl-bearing andesites and dacites dominate at Bezymianny volcano. The rocks of Ploskie Sopky volcano, situated only 10 km NW of Kamen, are represented by medium-high-K subalkaline lavas.

Results: In order to define the place of Kamen volcano in the KGV hystory and to constrain the compositional spectrum of lavas from Kamen stratovolcano, its central dike complex, and the surrounding monogenetic cinder and cinder–lava cones, we present geological, petrographical, petrological, mineralogical, and geochemical data from Kamen volcano rocks as well as major- and trace element data in glass inclusions in olivine and compare these to its surrounding volcanic centers.

Discussion: Our data show:

1) Data on major and trace elements in rocks from Kamen volcano and neighbouring volcanoes fall into three distinct geochemical groups: (a) lavas from the Kamen stratovolcano and its dikes; (b) Klyuchevskoy magmas and cinder cones situated at Kamen slopes and (c) lavas of Ploskie Sopky massif.

2) A genetic relationship exists between Kamen and Bezymianny volcanoes in which the Bezymianny lavas comprise the more evolved part of the common trends. This Kamen–Bezymianny trend is dominated by fractional crystallization and magma mixing and is typical for many arc magma series. This trend suggests that Kamen volcano shares the magma source and a common magma plumbing system with Bezymianny volcano.

3) Monogenetic cinder and cinder-lava cones situated on the W-SW slopes of Kamen volcano are compositionally similar and thus genetically related to Klyuchevskoy medium-Mg lavas.

4) Klyuchevskoy lavas are geochemically different from the Kamen-Bezymianny trend and define three distinct magma compositions that are not genetically related by simple low-pressure fractionation and/or mixing. Rather, these magmas either (a) represent high-P fractionated melts from common arc basalt, or (b) are derived from the same mantle source with different degrees of melting and magma mixing, or (c) are derived from distinct sources in the mantle wedge.

5) Ploskie Sopky volcano rocks are systematically different from Kamen and Klyuchevskoy rocks in major elements and mineral composition and could not have originated from the same primary melts by fractional crystallization.

6) The geochemical diversity of KGV rocks and their relationship to underlying plateau lavas results from both (a) gradual depletion with time of the mantle NMORB-type source due to previous magmatic events, and (b) the addition of distinct and variable fluids to this mantle source.

7) It was shown before that three distinct fluid compositions were identified across the Kamchatka arc [2]: B-rich fluid at the arc front, U and Sr-rich fluid at central part of the arc and Li-rich fluid in the back arc. The KGV appears to be a place where these three fluids occur together, suggesting a large heterogeneity in the fluid-modified mantle. This is implied by the fact that Kluchevskoy and Kamen volcanoes, which are situated nearby each other and have rather similar mantle derived components, show quite different fluid patterns (Fig. 1).

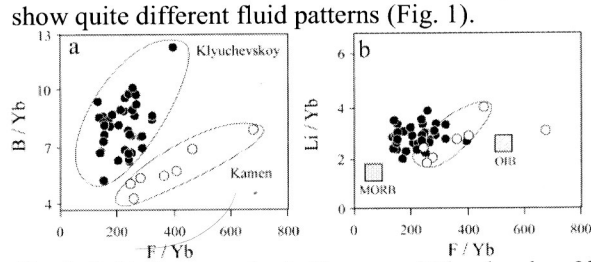

Fig. 1. B–Li–F systematics in Kamen and Klyuchevskoy Ol melt inclusions. Data are from [2]. MORB — mid-ocean ridge basalt; OIB — ocean island basalt.

References: [1] Tokarev, P.I., Zobin, V.M. 1970. *Bull. Volcanol. Stations*, N 4, pp. 17-23 (in Russian); [2] Churikova, T., Wörner, G., Mironov, N., Kronz, A., 2007. *Contr. Min. Petr.* **154**, pp. 217–239.