

The tectonic-magmatic characteristics in the Kamchatka: Implications for the dynamics around the northern edge of Pacific Plate

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The northern slab edge of Pacific Plate (PAP) defined by the transform zones is subducting below Kamchatka and forms a very active volcanic arc, which consists of several volcanic belts: the Eastern Volcanic Front (EVF), the Central Kamchatka Depression (CKD), and the Sredinny Range (SR). In the central part of Kamchatka, the volcanic arc has a width of ~250 km, while in the northern part it decreases to a width of ~50 km, which is associated with transition in several tectonic-magmatic features. The Kamchatka-Aleutian triple junction located off the east coast of Kamchatka is a triple junction where PAP, the Bering Plate (BP), and the Okhotsk Plate meet. Between PAP and BP, three major transform zones with right lateral faults, i.e., Aleutian, Bering and Alpha transform faults, accommodate the differential motion between the two plates (e.g., Kogan et al., 2017; Lay et al., 2017). These right-lateral patchy strike-slip motions are decaying to the northward. In the central part of CKD, an extremely active and massive volcanic group has been formed, which includes the 4750 m high Klyuchevskoy Volcano with a mean eruption rate of 1 m³/s over the last 10 kyr (Fedotov et al., 1987). The Shiveluch volcano is located in the north of the volcanic group, which defines the northern limit of the currently active volcanoes in Kamchatka, and erupted the adakitic lavas which could indicate slab melting at the edge of PAP slab (e.g., Yagodzinski et al., 2001).

In order to constrain the magmatic-tectonic processes in response to subduction of the northern edge of the PAP, we compiled the published geochemical data of the Quaternary lavas containing more than 5 wt.% MgO in Kamchatka (Churikova et al., 2001; Portnyagin and Manea, 2008; Volynets et al., 2010; 2018). Based on the geochemical data, we estimated the physical-chemical conditions of dehydration of slab and melting in the mantle wedge. As a result, we found several geochemical trends in both along-arc and across-arc directions, which implies that the conditions for fluid-magma processes in the slab and the mantle systematically change in space, particularly along the arc. Combining these analyses with the geophysical observations, tectonic models and numerical simulations, we will discuss the dynamics around the northern edge of PAP.

Keywords: Pacific Plate, volcanic arc, arc lavas, Kamchatka