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Pauzhetka Caldera (South Kamchatka), the biggest in Kamchatka for the past 1 Ma: exploring temporal evolution and origin of voluminous silicic magmatism

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The Pauzhetka Caldera (27x18 km) formed during the biggest <1 Myr eruptive event in Kamchatka, with eruption of >200 km^3 of rhyodacitic-dacitic Golygin Ignimbrite 421 ±7 ka by $^{40}Ar/^{39}Ar$ [1] or 448 ±20 ka [2]. It hosts spectacular hydrothermal system and Kamchatka's oldest geothermal power plant. No pre-caldera silicic activity is exposed or known, but Pauzhetka area includes a few much older 3.3 Ma pre-caldera eruptive centers (Mt. Orlinoe Krylo, Mt. Klyuchevskaya). Post-caldera eruptive activity included 0.2 Ma silicic intrusions, formation of a second massive 7.6 ky Kurile-Lake ignimbrite (>150 km^3), silicic Dikii Greben volcano, and basaltic Kambalny Ridge cones. We have characterized the mineralogy and geochemistry (major+ trace elements and some $^{87}Sr/^{86}Sr$, $^{144}Nd/^{143}Nd$, and $\delta^{18}O$ ratios) of the entire 3.1-0 Ma magmatic sequence, including a compositional profile through Golygin ignimbrite and ~200 m thick intracaldera Pauzhetka suite exposed in drillholes. Pauzhetka rocks vary from basalts to rhyolite and have geochemical signatures of typical low-K arc magmas. Mineralogy of silicic rocks includes plagioclase, pyroxenes, amphibole, biotite, quartz, Fe-Ti oxides; crystal content of Golygin Ignimbrite is 15-20%, crystal content increase up section. Petrological and geochemical observation allows us to explain magmatism of South Kamchatka whereby the primary mantle-derived basalts with 1.5-2 wt.% H2O originated by melting of the fluid-altered mantle wedge experienced a fractional crystallization in the relatively thin (25 km) and mafic South Kamchatka crust. MELTS model of two-stage fractional crystallization at ~7-2 kbars could produce all Pauzhetka rocks' diversity, including voluminous Golygin ignimbrite, except for the Holocene Dikii Greben volcano, whose evolution also comprises spectacular mixing processes. Isotopic values do not identify crustal assimilation and are normal $\delta^{18}O$, but later products are modestly depleted in $\delta^{18}O$. We are performing modeling to explain the origin of large spikes of magmatism that has signature of mantle differentiate magmas. We are considering production of large volume rhyolites at normal island arc magma flux rates and the possibility of delamination of cumulates.

[1] Bindeman et al. (2010), *J.Vol.Geot*herm.Res., 189, 57-80

[2] Ponomareva et al. (2018), *J.Vol.Geot*herm.Res., 366, 1-12

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