$(^{87}Sr/^{86}Sr)_0$ isotope and geochemical (F, Cl, REE) heterogeneity in apatite and titanite mineral populations from magmatites of Shakhtama Cu-Mo porphyry deposit, Eastern Transbaikalia, Russia

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$^{40}Ar/^{39}Ar$ and Rb-Sr dating at the Shakhtama Cu-Mo porphyry deposit (Eastern Transbaikalia, Russia) documents complex and prolonged development of magmatic events. Several pulses of magmatic events are established at the deposit (based on $^{40}Ar/^{39}Ar$ analyses): 202±1.8, 193±3, 167±1.6 Ma – host granitoids of plutons; 159-157 Ma –granite porphyries; 151±152 Ma – dikes of ore-bearing diorite porphyries; 147±145 Ma – postore dikes. Rb-Sr dating yielded an age of 187±7 Ma for the host granitoids. A significant time gap between porphyry magmatites and preceding host granitoids determines in many respects geological features of the deposit, heterogeneity of isotope and geochemical characteristics in accessory and rockforming minerals.

Apatites and titanites from unaltered host rocks (granodiorites, aplites) yield $^{87}Sr/^{86}Sr$ range from 0.70717 to 0.70747 close to initial 0.70734 (Rb-Sr isochron). Apatites from hydrothermally altered rocks (potassic alteration, sericitization, argillization) are characterized by $^{87}Sr/^{86}Sr$ ratios between 0.70712 and 0.70802. Early generations of titanites (magmatic) yield $^{87}Sr/^{86}Sr$ range from 0.70772 to 0.70850, late generations of titanites (secondary) - before 0.71232±22.

Elevated $^{87}Sr/^{86}Sr$ values in secondary minerals can be explained as reflecting contamination of radiogenic ^{87}Sr, extracted from biotites and amphiboles of host rocks under the influence of later porphyry magmatic events. The difference in $^{87}Sr/^{86}Sr$ between secondary apatites and titanites can be explained by the difference of forming processes: titanite was formed under the influence of metasomatic solutions; apatite was formed mainly according to topotaxial mechanism.

Igneous and metasomatic minerals differ in Cl, F and REE contents. Metasomatic minerals are characterised by relatively elevated F contents and relatively lowered Cl and REE (especially Ce) contents. F, Cl and REE distribution in minerals is complicated by multistage magmatic processes and the influence of overprinted metasomatic mineralizing processes. Such processes resulted in recrystallization of minerals and redistribution of elements.

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The Impact Of Last Glaciation On Volcanism In N. Pacific Arcs

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Dynamic interaction of glaciations and volcanic activity is seen during the Pleistocene history of the Northern circum-Pacific. Voluminous caldera-forming eruptions, glacial advances, and rapid sea level changes, have affected local and global climate and meteoric/ hydrothermal conditions above sub-volcanic magma chambers. We present results of regional study of petrology and oxygen isotopes in phenocrysts by laser fluorination of Pleistocene to historic volcanism in the Kamchatka Peninsula, Kurile Islands, and Aleutians-Lower Alaska Peninsula, with emphasis on the largest caldera-forming centers. Ages are ^{14}C or fission-track based. Our data show that <u>Kamchatka</u> is a land of isotopic extremes – high $\delta^{18}O$ magmatic source (6.6 to 6.5‰), and low-$\delta^{18}O$ upper crust (<4‰). Voluminous ignimbrites and post-caldera volcanics of three largest caldera complexes: *Kurile Lake* (10x14 km, 7600 BP), *Uzon* (18x9 km, ~39 k.y.), and *Ksudach* (Mid-Pleistocene-Holocene) have produced low-$\delta^{18}O$ magmas ($\delta^{18}O$(magma, calculated)= 4-5‰). Great abundance of low-$\delta^{18}O$ rocks and magmas in Kamchatka is matched only by Iceland. Two calderas in the <u>Aleutians</u>, *Fisher* (9100 BP) and *Okmok* (2050 BP), have produced voluminous low-$\delta^{18}O$ magmas (4.5‰), previously unknown in Alaska. Here, both basaltic andesites and dacites of the same zoned eruptions, and post-caldera volcanics are low in $\delta^{18}O$, while pre-caldera rocks, and neighboring volcanoes had normal-$\delta^{18}O$ magmas. No low-$\delta^{18}O$ magmas have been identified in unglaciated <u>Kurile Island arc</u>. We propose that the last glaciation caused regional lowering of $\delta^{18}O$ in magma and upper crust in N Pacific arcs. Larger continental land masses to the north such as Kamchatka were stronger affected. Poorly dated Pleistocene volcanics of Kamchatka are regionally lower in $\delta^{18}O$ (from 4 to 6‰) than more variable in $\delta^{18}O$ (from 4 to 8‰) Holocene volcanics. We attribute this to the effect of last glaciation on meteoric waters, hydrothermal systems, upper crust, and magmas. In combination with radiogenic isotopes and trace elements, we use oxygen isotope analyses of refractory minerals to provide estimates of subduction-induced vs crustal petrogenetic mechanisms. We speculate on the connection between low-$\delta^{18}O$ signature, the size of hydrothermal system, volcanic explosiveness, and pressure-release due to deglaciation. The low-$\delta^{18}O$ signature of some regional post-glacial tephras is a useful tephrochronologic parameter for correlating and dating volcanic, geomorphological, and archaeological sites.