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Highly magnesian pyroxenite xenoliths from Avacha volcano, Kamchatka arc, as a result of mantle metasomatism beneath a volcanic front

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Mantle peridotites beneath the volcanic front represented by the Avacha peridotite xenolith suite, Kamchatka, are highly depleted and metasomatized to various degrees. The Mg# (= Mg/(Mg +Fe) atomic ratio) of olivine and Cr# (= Cr/(Cr + Al) atomic ratio) of chromian spinel vary from 0.90 to 0.92 and from 0.50 to 0.70, respectively, in the Avacha harzburgites. They are metasomatized by SiO2-oversaturated melts/fluids to form secondary orthopyroxenes replacing olivine, and then we can find some olivine orthopyroxenite as highly metasomatic product. We also found clinopyroxene-rich lithologies, e.g. clinopyroxenite, websterite and olivine websterite, which are possibly metasomatic products resulted from reaction between harzburgite and melt (or fluid) based on microscopic observations. Both secondary clinopyroxene and orthopyroxene of the clinopyroxene-rich rocks have extremely high Mg#, up to 0.98, and remnant olivines also have high Mg# (up to 0.97). This strongly suggests an involvement of a high-Mg# metasomatic agent. Removal of iron in deeper parts needs either of extremely high or low oxygen fugacities or high sulfur fugacity. Detailed petrological and geochemical examinations for these clinopyroxene-rich lithologies could provide us the redox state and activities of metasomatic melts and fluids within the mantle wedge through the characteristics of the metasomatic agent.