[Invited]Central Japan as a cold subduction zone and its implications for deep dehydration of subducted slab beneath the Noto peninsula

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The Japan arcs consist of several arc segments accompanied by two subducting slabs (the Pacific and the Philippine Sea slabs), with different subduction materials/parameters and physicochemical conditions of the mantle wedge beneath the arc segments. The geochemistry of lava reflects these differences and conditions. Based on the five isotopic ratios ($^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$, $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$) of 747 basaltic lavas over the Japan arcs (including Kuril, NE Japan, Central Japan, SW Japan, Ryukyu, Izu-Bonin arcs), five geochemical clusters have been identified using the whitened data-based k-means cluster analysis, a type of unsupervised machine learning approach (Iwamori and Nakamura, under review). The five clusters show geographical provenance, as well as correlations with the trace element concentrations and ratios. By combining the isotopic and trace element data, the mass balance and melting model provided constraints on the following points: the intrinsic composition of the mantle wedge, the amount and distribution of slab-derived fluid, degree of melting, and the depth extent of melting. Within this context, the Central Japan arc is characterized by a large amount of added fluid (>1 %) and a few percent of melting of spinel-garnet peridotite, suggesting a low potential temperature of the mantle wedge. Such a fluid-rich low-temperature condition was proposed also by the numerical simulation (Iwamori, 2000) and the petrological study (Nakamura and Iwamori, 2013), and indicates a significant deepening of dehydration of the subducting Pacific slab, compared to the other arc segments. This deepening of slab dehydration may explain the remarkable bend of the volcanic front around Asama Volcano and the volcanic zone towards the back-arc area below which the Pacific slab surface is deeper than 250 km. Such deep dehydration can supply a significant amount of fluid to the non-volcanic back-arc area such as the Noto peninsula, possibly causing the earthquake swarm and the crustal uplift in the peninsula since December 2020 (Iwamori and Nakamura, under review). The fluid flux calculated based on the numerical simulation (Iwamori, 2000) suggests that a fluid accumulation for 2000 to 3000 years accounts for the volume of crustal uplift since 2020 estimated by the geodetic study (Nishimura et al., 2022). When combined with the on-going regional compressional field that has lasted for at least 3 million years (Okamura, 2007), more than 100 m uplift is expected and could have contributed to formation of the Noto Peninsula itself.

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