[EE] Evening Poster | U (Union) | Union

[U-02]Pacific-type orogeny: From ocean to mantle

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Pacific-type convergent margins (ocean - continent) and their related orogenic belts exist/form over subduction zones, which are the only ways to deliver surface materials to the deep mantle. Pacific-type orogens keep records of the evolution of paleo-oceans, formation and transformation of continental crust at their active margins, and generation of hydrous-carbonated plumes in the mantle transition zone (MTZ) and its related intra-plate magmatism. An approach linking paleo-oceans, active margins and plume magmatism stands on three "whales": the model of Ocean Plate Stratigraphy (OPS), the parameters of active convergent margins and the model of hydrous-carbonated plumes. The OPS model was created by many detailed studies of western Pacific, in particular Japanese, accretionary complexes; it allows recognizing different oceanic plates within one paleo-ocean and evaluating their sizes and ages. Pacific-type convergent margins are places of major continental growth by island-arc juvenile magmatism and accretion, but they are also places of strong plate interactions and crust destruction. There are two contrast types of those margins: accreting ones accompanied by the formation of accretionary complexes, and eroding ones accompanied by the tectonic and subduction erosion of accretionary wedge, fore-arc prism and volcanic arc. The materials of oceanic and continental crust, which are eroded at Pacific-type convergent margins, can accumulate in the MTZ and affect mantle conditions. All those processes, the subduction of hydrated and carbonated oceanic crust, the destruction of continental crust at eroding margins, and the accumulation of mafic and sialic materials in the MTZ can synergistically trigger the generation of hydrous-carbonated mantle plumes in the MTZ, mantle melting and upwelling, and intra-plate continental magmatism. We welcome papers on results from Pacific-type orogenic belts worldwide and from Archean to Cenozoic ages.

[U02-P04]Nature of slab-derived fluids in Pacific-type subduction zone: Oxygen and hydrogen isotope studies of phengites from Renge and Sambagawa metasedimentary rocks

★ Invited Papers

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Phengite is the most common metamorphic mineral in HP–UHP metasedimentary rocks, which can convey H_2O and LILEs (especially K, Ba, Cs and Rb) plus Li, B and N to subarc and/or rear arc depths. The breakdown of phengite in a downgoing slab would cause fluid-induced element transport into overlying hangingwall mantle. What are the oxygen and hydrogen isotope signatures of phengite in metasedimentary rocks in Pacific type subduction zone? What are the stable isotopic compositions of metamorphic fluids equilibrated with phengites? Do they evolve during continuous dehydration reactions? We have investigated the $^{2}H/^{1}H$ (D/H) and $^{18}O/^{16}O$ ratios of twenty-three phengites from pelitic schists of the Devonian–Carboniferous Renge and Cretaceous Sambagawa belts, SW Japan.

We found the presence of the very light hydrogen isotope (δD <–95‰) in blueschist-facies phengites in two different metamorphic belts. Fourteen phengite separates from the lawsonite- and epidote-grade pelitic schists of the Osayama serpentinite mélange (central Chugoku Mountains) of the Renge belt are characterized by very negative hydrogen isotope compositions (δD values relative to VSMOW) ranging from –113 to –93.9‰; oxygen isotope compositions (δ^{18}O values relative to VSMOW) range between +12.9 and +14.6‰. Nine samples from the garnet-bearing pelitic schists along the Sarutagawa River (central Shikoku) of the Sambagawa belt show δD = –95.6 to –60.5‰ and δ18O = +12.3 to +14.4‰.

High-Si features and K–Ar ages of the investigated phengites deny the possibility of meteoric-hydrothermal alteration to have caused the low δD values. The light values might be attributed to isotopic fractionation during progressive metamorphic dehydration. Using the observed values and applying muscovite–H_2O oxygen and hydrogen isotope fractionation factors for nominal temperature, we estimated the isotopic composition of metamorphic fluids equilibrated with phengites. Assuming 250–350°C and 450°C for metamorphic temperatures of the Osayama schists and Sarutagawa schists respectively, the inferred metamorphic fluid compositions in ‘blueschist-facies’ depth in fossil slabs have a range of δD = ~–40 to –75‰ and δ^{18}O = ~+13 to +15‰. These values are significantly lighter than the slab-fluid induced from the Arima hot spring water in a forearc region of modern SW Japan subduction. Our study suggests that slab-derived fluids in Pacific-type subduction zone are characterized by light hydrogen isotope and also suggests that the phengite breakdown can affect hydrogen isotope of nominally anhydrous minerals (NAMs) in deep mantle.