Behavior of subducted water and its role on the arc magma genesis in the NE Japan arc: A combined geophysical and geochemical approach

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Subducted water is carried by downgoing oceanic plate slab and is released by dehydration/melting of the slab in prograde metamorphism. The released water migrates upwards and contributes melting of the mantle wedge to form primary arc magmas. The water is then captured by the arc magmas and eventually solidify/erupt to form arc crust and volcanoes. Water, either in fluids or melts in both the slab and the mantle, promotes dissolution and mobilization of elements truncating material transfer in the subduction factory. Water also affects physical properties of the sub-arc slab and the mantle accelerating/decelerating mantle convection and seismicity. We in this paper try to demonstrate a coherent model that may explain the geophysical and geochemical roles of the water beneath the NE Japan arc. We investigate the dehydration profile of the downgoing slab based on the seismic/geophysical/geochemical data and examine the role of the slab water to form geochemical variations found in the Quaternary magmas erupted on the arc. Arc Basalt Simulator version 4 (ABS4), a petrological/geochemical model developed for to describe the mass balance between the subduction slab inputs and the arc magma outputs, examines the subduction zone processes including behaviors of the water and 33 major/trace elements and Sr-Nd-Hf-Pb isotopes. Intensive/extensive parameters that govern those petrogenetic processes are also estimated by the model calculations and are compared with the geophysical observations. The combined approach between geophysics and geochemistry provides new perspectives in both element behaviors and geophysics in the subduction factory.