A new model for subduction zone magma genesis in Japan arcs

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Modeling of subduction zone magmatism has progressed with increasing knowledge of subsolidus phase relations of hydrous minerals that supply aqueous fluids necessary for magma genesis and melting phase relations of magma source materials. In addition, thermal structure of subduction zone have been estimated by numerical simulations of solid and liquid flow in mantle wedge. Nevertheless, we do not yet understand thoroughly the whole processes of subduction zone magmatism from aqueous fluid release to magma genesis.

It is now accepted that earthquakes in subducting slab are caused by dehydration reactions of hydrous minerals. This 'hydrous embrittlement' hypothesis allow us to estimate temperature distributions in subducting slab without any numerical calculations. In the context of the hydrous embrittlement hypothesis, we have developed a new model for magma genesis in Northeast Japan arc on the basis of up-to-date hydrous phase relations in peridotite and basaltic systems and seismic structures. The model predicts that partial melting of subducting slab, both oceanic crust and peridotite, is an inevitable consequence of subduction of hydrated oceanic lithosphere. Partial melting widely occur in mantle wedge from just above subducting slab to just below overlying crust. Hydrous minerals in mantle wedge are stable only in shallow areas. The position of volcanic front is not controled by dehydration reactions in subducting slab but is controlled by dynamics of mantle wedge flow. In this talk, we will introduce our new model that is extended to Southwest Japan arc, and will try to explain regional variations of volcano distribution and magma chemistry in Japan with regard to their relevance to seismic and geological structure of subducting slab.