A new perspective on subduction zone magmatism from the viewpoint of dehydration embrittlement hypothesis

Tetsu Kogiso[1]; Soichi Omori[2]; Shigenori Maruyama[3]

[1] Kyoto Univ.; [2] Res. Centr. Evolving Earth and Planets, Tokyo Tech.; [3] Earth and Planetary Sci., Tokyo Institute of Technology

It is now being accepted that earthquakes in subducting slab are caused by dehydration reactions of hydrous minerals. In the context of this 'hydrous embrittlement' hypothesis, a new model to explain key features of subduction zone magmatism has been proposed on the basis of hydrous phase relations in peridotite and basaltic systems and seismic structures of Northeast Japan arc revealed by latest seismic studies. The model predicts that partial melting of subducting slab, both oceanic crust and peridotite, is an inevitable consequence of subduction of hydrated oceanic lithosphere. Aqueous fluids released from subducting slab also cause partial melting widely in mantle wedge from just above subducting slab to just below overlying crust. Hydrous minerals in mantle wedge are stable only in shallow (less than 80 km) areas, and are absent in the layer that is dragged into deep mantle by subducting slab. The position of volcanic front is not restricted by dehydration reactions in subducting slab but is controlled by dynamics of mantle wedge flow, which governs the thermal structure and partial melting in mantle wedge.