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Geofluid dynamics in subduction zones

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Fluid processes in subduction zones are key to understanding a wide spectrum of geological and geophysical structures and dynamics: e.g., seismicity and seismic structures, crustal deformation, magmatism and metamorphism, hydrothermal activity and mineralization, and in a longer time scale, orogeny and evolution of the arc/continental crust. Geochemical analyses of ocean island basalts detect signatures of `fluid component' from subduction zones, possibly reflecting global material circulation connecting subduction and the subsequent convective recycling (e.g., Iwamori and Albarede, 2008), for which fluid processes in subduction zones again play essential roles. In spite of its importance as above, actual details of these processes have been poorly constrained at present. Clearly we need to combine all the available data and modeling to constrain the processes. In this talk I will briefly review the key aspects, observations and models. One of the critical parameters is the amount of fluid released from the subducting slab. Its spatial variation and the subsequent distribution within the mantle wedge and the overlying crust may affect significantly seismic velocity, electrical conductivity, melting temperature, chemical-isotopic compositions of fluid and melt. Therefore, various types of observations can potentially resolve the distribution of fluid in subduction zones, among which geochemical observations would have the best resolution. Such geochemical probes include the arc volcanic rocks and hydrothermal materials (including ore deposits and hot springs). Accordingly, as one of the applications to arc volcanic rocks, regional variation of fluid distribution along the Japan arcs (Nakamura and Iwamori, 2009) is discussed making a comparison with different and independent types of observations and models.