

Role of water in subduction zone magmatism

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Arc magmas are hydrous reflecting water from the subducted oceanic plate and subsequent hydrous melting of the mantle. Both water and water-mobile elements are rich in the arc magmas which exert formation of the arc's crust thus the Earth's continent. Arc magmatism is a complex process occurring in such the dynamic system with the enigmatic water-bearing chemical reactions. This presentation aims to describe the processes of arc magma genesis based on chemical mass balance between the magmas and their source materials. The petrology/geochemistry-based mass balance model uses elemental-isotopic compositions and explores intensive-extensive parameters which control the chemistries. The determined parameters are then used to constrain the genetic conditions of the arc magmas and the dynamics of both the liquids and solids. The examinations focus on the contrasting NE and SW Japan arcs where the globally coldest and the hottest endmember subductions are taking place.

Keywords: Subduction zone, Water, Magma

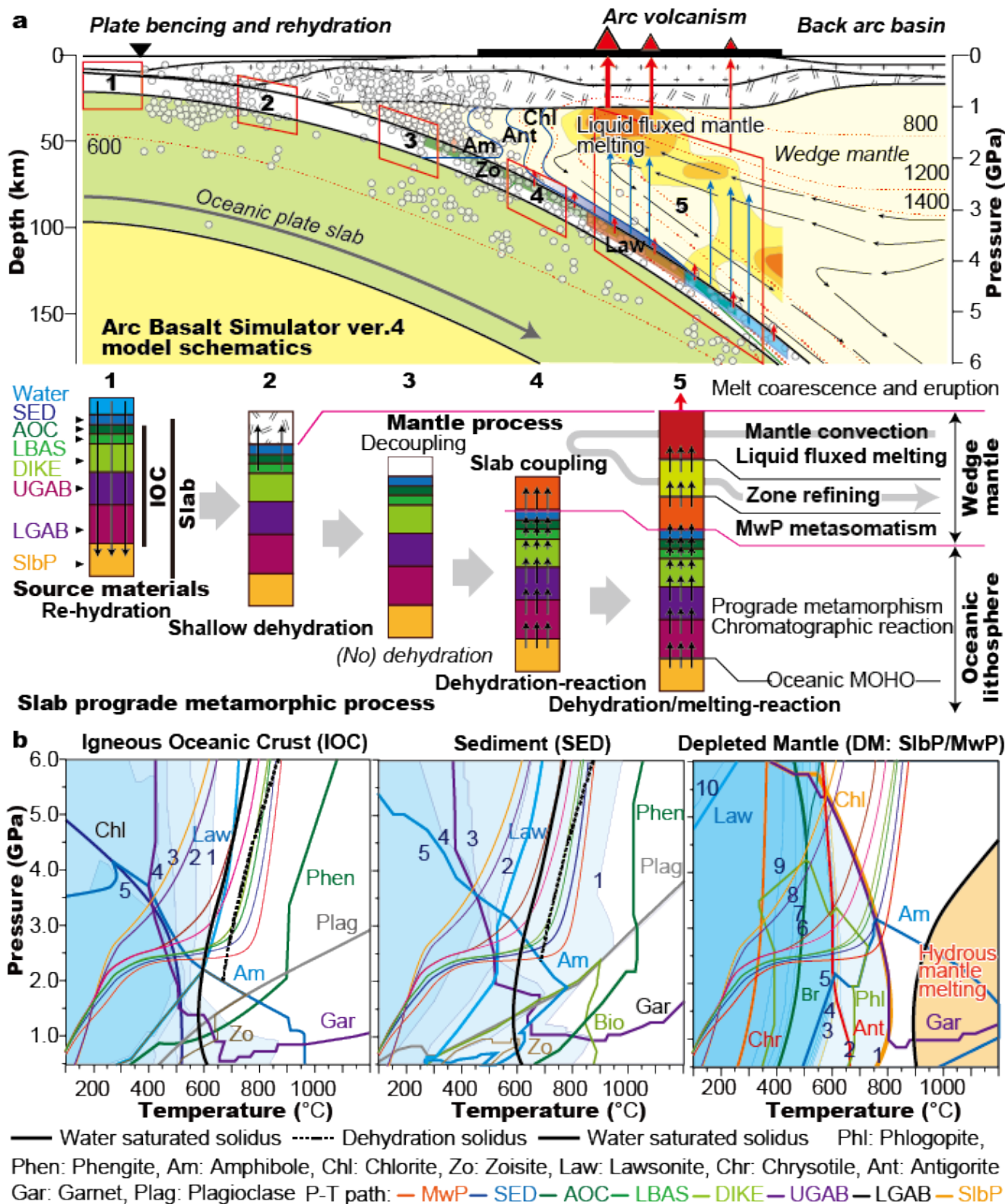


Fig. 4.4.1 Schematic cross section of a subduction zone and the Arc Basalt Simulator ver.4 model description (panel a). Phase relations and maximum bound water in igneous oceanic crust, sediment, and depleted peridotite (panel b), modified from Kimura et al. (2012). Acronyms of the slab layers are MwP: mantle wedge peridotite, SED: sediment, AOC: altered oceanic crust, LBAS: lower basalt, DIKE: dike, UGAB: upper gabbro, LGAB: lower gabbro, and SlbP: slab peridotite.