

Magma genesis and plumbing in subduction zone: Cargos of heat and water transports

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Mantle-derived primary arc magmas have a particular nature with its large amount of water at average of maximum value of ~4 wt%. These magmas are essentially high temperature $T = 1000-1200$ (C) irrespective of its various silica saturation (basalt, high-Mg andesite, and adakitic dacite). They thus act as cargos of both heat and water from the mantle. The transported heat and water interact first with the lower crust. Some mafic magmas may underplate and solidified to form hydrous lower crust, such as amphibolite. Alternatively, the mantle-derived high-T magmas melt the lower crust and yield secondary lower crustal melt with releasing fluids from both the mantle-derived magma and the lower crust. Generated lower crustal secondary melts vary from basaltic andesite to rhyolite in composition still containing considerable amount of water as much as ~4 wt%. Such the magmas should be upwelled to the new level of neutral buoyancy in the crust and form shallow magma chambers in the middle to the upper crust of 15-3 km depths. Here, a large amount of magma body may be solidified and release heat and water to the crust, if it is not erupted. Arc magmas are the fundamental agent to build the continental crust. At the same time, it remobilizes the pre-existing arc crust by its heat and water. The heat and water in the arc magmas form important cargos of elements and energy. To better understand nature of the cargos, thermal structure and water contents in the arc magma during its genesis and plumbing are examined in the depth range between subducted plate slab, through mantle wedge, and crust.

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