What control the position of volcanic arc?

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To understand physical and chemical processes in subduction zones, I use 2D numerical model that include the dehydration of subducting slab, hydration of mantle wedge, water fluxed melting of mantle wedge, change in peridotite composition through melt extraction and addition, solid flow of mantle wedge with temperature, pressure, stress and water content dependent rheology and migration of aqueous fluid and melt through permeable flow. I present the calculation results for five subduction zones that span normal ranges in subducting slab age, convergence velocity, and slab dip angle. The model shows the following general features. A hydrous layer saturated with water in NAMs and rich in aqueous fluid is developed just above the subducting slab surface due to the dehydration of the slab. This layer consists of harzburgite formed by the melt extraction from lehrzolite. The high solidus temperature of the harzburgite suppresses melting of the mantle wedge just above the slab surface and results in melt distribution nearly parallel to and separated at some distance from the subducting slab surface. The depth for slab dehydration and the melt distribution in mantle wedge show general agreement with the seismological observations. The comparison between the results of present model and the geophysical and geological observations indicates variable melting mode for the formation of volcanic front: the flux melting caused by the dehydration of oceanic crust for NE Japan and N Chile, the flux melting caused by the dehydration of mostly slab mantle for Nicaragua and Bonin, and slab melting (slab-melt flux mantle melting) for SW Japan. This variation may be a cause for the wide range of depth to the slab surface below the volcanic front.

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