The cause and source of post-subduction arc magmatism in Baja California, Mexico

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Late Miocene to Recent arc-related magmatism occurs in Baja California, Mexico despite the cessation of subduction along its western margin at ~12.5 Ma. It includes calcalkaline and K-rich andesites, tholeiitic basalts and basaltic andesites, alkalic basalts similar to many ocean island basalts (OIB), magnesian and basaltic andesites with adakitic affinity (bajaiites), adakites, and Nb-enriched basalts (NEB). To explain the origin of post-subduction magmatism in Baja, a popular model for the close spatial and temporal association of the latter two rock suites [1] has been extended. That is, the adakite (plus bajaiite) -NEB association is due to melting of the subducted Farallon/Cocos plate, which in turn is caused by the influx of hot asthenospheric mantle through a window created in the subducted slab [2, 3].

Here I propose an alternative model for the cause of post-subduction magmatism in Baja in particular and origin of adakite-NEB association in general. The complicated tectonic configuration of the subducting Farallon/Cocos plate and the generally westward motion of the North American continent caused western Mexico to override the hot, upwelling Pacific mantle that was decoupled from the spreading centers abandoned west of Baja. The upwelling asthenosphere is best manifested east of Baja, beneath what is now Gulf of California, but it also sends mantle materials westward into the mantle wedge beneath the peninsula. These materials provide sources for post-subduction tholeiitic and alkalic magmas in Baja. Alkalic magmas directly erupted at the surface produce OIB-like lavas but those that get contaminated along the way produce NEB. Portions of tholeiitic magmas directly erupted at the surface produce tholeiitic lavas, but some get ponded beneath the crust. Re-melting and/or high pressure fractional crystallization of the ponded tholeiitic magmas generate adakitic rocks. The influx of asthenosphere also provides thermal energy to melt the subduction-metasomatized upper portion of the mantle wedge - producing calc-alkaline lavas, and the amphibolitized deeper portion of the mantle wedge - producing bajaiites, after the cessation of subduction in Baja.

References

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