Julia Ribeiro

Guangzhou Inst. of Geochemistry

'Cycling water at subduction zones '

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Water is a key element in sustaining a habitable and dynamically active planet. Subduction zones efficiently cycle seawater from the Earth's surface into its deep interior. But whether subducted seawater is cycled beyond the generation depth of subduction zone magmas has remained an open question. Recycling subducted water into the lower mantle ultimately depends on the extent to which the slab dehydrates beneath the fore-arc, the volcanic arc front and the back-arc basin. Our current understanding of slab dehydration mostly derives from the slab thermal state model, which predicts that cold slabs have released most of their subducted water (≥ 60%) beneath the arc front; while warmer slabs mostly dehydrate (> 90%) beneath the fore-arc. As such, cold subducted plates, such as the Pacific plate (> 100 Ma) subducting in the Izu-Bonin-Mariana (IBM), are predicted to dehydrate a little underneath the fore-arc, resulting in a nearly dry fore-arc mantle. This scenario is, however, challenged by the observations of serpentinite mud volcanoes erupting in the IBM fore-arc. Additionally, the extent to which the slab dehydrates beneath the fore-arc mostly derives from an untested theory. As one step forward, here I propose to examine slab dehydration in the Southern Mariana fore-arc, where the pre-existing Eocene crust has recently been stretched within 90 kilometres from the trench. The near-trench magmas thus captured the water-rich slab fluids released from the shallow part of the subducted plate; and they can provide critical insights into slab dehydration in the fore-arc of one typical end-member of a cold subduction zone (IBM).

Laboratoire de Géologie de Lyon
Terre planètes Environnement
Université Claude Bernard Lyon 1
ENS DE LYON
UNIVERSITÉ JEAN MONNET SAINT-ÉTIENNE