Extremely high volatiles of petit-spot

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Submarine petit-spot volcanoes induced by lithospheric flexure were first reported on the subducting northwestern Pacific Plate[1] and the erupted lavas are either completely alkaline or strongly alkaline with extremely high vesicularity; examples of such volcanoes have recently been discovered on the plates subducting along the Chile[2], Sunda[3] and Mariana[4] trenches. High levels of CO_2 in the magma prior to degassing[6] cause the high vesicularity observed in spite of the eruptions occuring under high submarine hydrostatic pressures. As a carbonatite melt has been proposed as the key material to explain the electrical conductivity of the oceanic asthenosphere[7], the extremely high CO_2 contents of petit-spot volcanoes raises the possibility that CO_2 affects the source components and their melting. We report the volatile contents of carbon, water and halogens in the quenched glass rinds and melt inclusions to recognize the mantle source and magma ascension process in the subduction of an old Pacific plate.

Extremely high CO_2 contents (up to 2,000 ppm) were strongly correlated with the SiO_2 contents in the volcanic glasses even though these glasses were sampled from several volcanoes that were independently distributed in terms of their eruptive ages and locations on the NW Pacific Plate. The higher CO_2 contents of the olivine-hosted melt inclusions indicate the magma compositions prior to exsolution. The ratios of water and halogens, on the other hand, clearly indicate an “enriched mantle” component, as do the data represented by the Nd and Pb isotopic compositions.[8,9] Our data provide a new understanding of the source components of the asthenosphere below the NW Pacific Plate prior to subduction.

Refernces:

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