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プチスポット火山の揮発成分の重要性
Role of volatiles on petit-spot volcanoes

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The newly found volcanoes, petit-spot, occur in a region of oceanic plate that is susceptible to fracturing prior to plate subduction into the trench off NE Japan and Chile, where the volcanoes locate far from tectonic plate boundaries (e.g., mid-oceanic ridges and volcanic arcs) and hotspots. The magmas produced by these volcanoes originate from the asthenosphere immediately under the plate (Hirano *et al.*, 2006). It is clear that the surface morphology and distribution of petit-spot volcanoes are influenced by cracks in the lithosphere that reach the surface. Monogenetic petit-spot volcanoes located on the NW Pacific Plate are less than 2 km in diameter and yield ages of 1.8, 4.2, 6.0, 6.5, and 8.5 Ma by $^{40}Ar/^{39}Ar$ datings, suggesting the episodic eruption of magma over a period involving 600 km of plate motion, without any systematic spatial trend in age such that seen along oceanic island/seamount chains moving over a hotspot (Hirano *et al.*, 2010). Moreover, these volcanoes represent 8 million years of activity over a large eruption area but with low volumes of magma production. The petit-spot magmas, therefore, could represent the first discovery of melting product transported directly to the surface from the asthenosphere below an old plate prior to subduction.

The most important feature of petit-spot lavas is their high vesicularity (up to 60 vol.%) in spite of the eruption under submarine hydrostatic pressure encountered at 6000 mbsl (Hirano *et al.*, 2006). This observation is caused by CO_2, as the solubility of CO_2 is very low in alkaline magmas (Dixon, 1997) compared with the high solubility of H_2O (ca. 300 ppm versus 0.5-1.0 wt%, respectively). Because a few percent of melt might be present if small amounts of H_2O or CO_2 are present in the asthenosphere (Wyllie, 1995), it is anticipated that petit-spot magmas originate in the asthenosphere as incipient partial melts that form as a result of the presence of H_2O and CO_2. More recently, carbonatite melt has been proposed as a key material in explaining the electrical conductivity of oceanic asthenosphere (Gaillard *et al.*, 2008; Yoshino *et al.*, 2010). The preliminary observation of high CO_2 contents in petit-spot lavas raises the possibility that CO_2 affects the source components and their melting. Petit-spots on the Pacific Plate, therefore, provide a potential window into the geochemical characteristics and occurrence of partial melting in the asthenosphere.

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