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水に飽和した島孤低カリウムソレアイト玄武岩マグマ：斜長石斑晶の OH 含有量からの制約
Polybaric degassing of island arc low-K tholeiitic basalt recorded in OH concentrations of Ca-rich plagioclase

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Among hydrous magmas in subduction zones, island arc low-K tholeiitic basalts have been characterized by low H_2O contents, approximately 1 wt.% H_2O, based on melt inclusion analyses and phase equilibria studies. However, melting experiments of hydrous basaltic magmas require higher amounts of H_2O to crystallize Ca-rich plagioclase, which is commonly observed mineral in island arc low-K tholeiitic basalts. The estimated H_2O content of low-K tholeiitic magma by different approaches are not consistent. Hydrogen in nominally-anhydrous minerals (NAMs) can be an alternative indicator of dissolved H_2O in magma and degassing history of magma during ascent. Plagioclase is one of the NAMs which accommodates hydrogen up to hundreds of wt. ppm H2O in it. The speciation of hydrogen in volcanic plagioclase is demonstrated to be structural OH. In this study, we analyzed OH concentration in Ca-rich plagioclase from the summit eruptions of Izu-Oshima volcano, a frontal-arc volcanic in Izu arc and issues island arc tholeiitic basalt, during 1986 and 1987. The OH concentrations of plagioclase were analyzed by polarized infrared spectroscopy, which ranged from 20 to 300 wt. ppm H_2O. Three distributions of OH concentrations, 20-80 wt. ppm H_2O, 100-180 wt. ppm H_2O, and 220-300 wt. ppm H_2O, were found. Variation in the OH concentrations can be explained by the fact that plagioclase had been finally equilibrated with H_2O-saturated melt at three depths beneath the Izu-Oshima volcano; melt under almost atmospheric pressure (1 wt.% H_2O), at the 4-km deep magma chamber (3 wt.% H_2O), and the 8~10-km deep magma chamber (5 wt.% H_2O), respectively. Assuming such polybaric degassing from H_2O-saturated island arc tholeiitic basalts will explain so-called ”excess SO_2 degassing”, which has been proposed in many arc volcanoes, because SO_2 is preferentially partitioned into degassed H_2O bubbles. We suggest that more H_2O comes from the upper mantle in subduction zones than ever postulated that they are H_2O-undersaturated or H_2O-poor.

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