

Degassing process of the magma at Mt.Unzen based on volcanic gas observation

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The Mt.Unzen eruption in 1990 to 95 was a typical non-explosive eruption producing a lava dome, although a few vulcanian eruption took place in the early stage of eruptive period. The effusion of lava started on May 1991. The effusion rate increased up to $4 \times 10^5 \text{ m}^3 \text{ day}^{-1}$ as the first maximum on the September. After the maximum, the effusion rate decreased linearly. The effusion of lava almost stopped on the December. On Feb. 1992, the effusion of lava resumed. The effusion rate increased up to $2 \times 10^5 \text{ m}^3 \text{ day}^{-1}$ on the July as the second maximum. After the second maximum, the effusion rate of lava decreased. On Feb. 1995, the effusion of lava stopped completely. We have sampled volcanic gases six times on May 1992 to Sep. 1993. The sampling period overlaps the period when the lava effusion rate varied largely. The volcanic gases were sampled at the base of lava dome. We also sampled a volcanic gas after the complete stop of lava effusion at the base of a lava spine built on the summit of Mt.Unzen. The temperature of volcanic gases were higher than 360C. The chemical composition and H₂O stable isotope ratio of volcanic gas showed a typical magmatic features. From May 1992 to Feb. 1993, the CO₂/H₂O ratio of volcanic gas varied significantly. The CO₂/H₂O ratio showed a positive correlation to the lava effusion rate. On the other hand, S/H₂O, HCl/H₂O and HF/H₂O ratios of volcanic gas was stable over the period. The above changes in volcanic gas could be brought by a presence of bubbles in magma. A magma chamber has been detected at -11km under Mt.Unzen. The bubble fluid in magma at the depth is enriched in CO₂ generally. The magma trapped in the chamber ascended resulting in a decompression and a subsequent partial degassing (Shinohara, 2002). When the lava effusion rate was high, there would be much bubbles in magma chamber, leading a high CO₂/H₂O ratio in an exsolved gas at the partial degassing. Although the lava effusion rate varied significantly, the depth of the partial degassing would be constant, producing the stable S/H₂O, HCl/H₂O and HF/H₂O ratios. At the partial degassing, the most of CO₂ and S in magma was exsolved. The amount of H₂O, HCl and HF exsolved at the partial degassing is limited. The exsolved gas would ascended along the conduit and it was discharged as volcanic gas on the base of lava dome. After the partial degassing, the magma ascended to shallow place and it was decompressed, leading a secondary degassing at less than -1km. At the secondary degassing, the most of H₂O, and a part of HCl and HF were exsolved. After the secondary degassing the magma emerged as lava.