

Magmatic conditions prior to the 2000 eruption of Usu volcano, Japan

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Usu volcano is one of the most active volcanoes in Japan, which is in the Shikotsu-Toya National Park, Hokkaido. There have been eight recorded eruptions since _{AD} 1663 at a relatively short time interval (ca. 30-50 y). We here focus on the most recent _{AD} 2000 eruption to understand the present conditions of the Usu magma-feeding system, which is important to prepare for the next eruption. The _{AD} 2000 eruption started with a phreatomagmatic (small phreatoplinian) eruption, producing dacitic pumice (Us-2000pm; Tomiya et al., 2001), followed by many small phreatic explosions. Petrographical studies (Tomiya and Miyagi, 2002; Tomiya and Takahashi, 2005) and melting experiments under high pressure and temperature conditions (Tomiya, 2002; Suzuki et al., 2007) of the _{AD} 2000 volcanic products (Us-2000pm) have been performed. However, petrological constraints are still limited.

In this study, we measured the trace element concentration in plagioclase of the _{AD} 2000 volcanic products to reveal the change in magmatic conditions (e.g., temperature, pressure, melt composition) prior to the eruption, using LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry) at the GSJ-Lab (New Wave Research NWR213 + Agilent 7700x) with the method by Yamasaki et al. (2015). We found that the Mg, Ti, Fe contents and Sr content in plagioclase were increased and decreased, respectively, from _{AD} 1663 to 2000 eruption, which were consistent with our SIMS (Secondary Ion Mass Spectrometry) analyses for plagioclase in the former products (e.g., _{AD} 1977, _{AD} 1943-45; Tomiya et al., 1998). We consider that the change was caused by mixing of mafic components.

We are also conducting melting experiments of Us-2000pm to estimate the pressure and temperature of the pre-eruptive magmatic conditions, using an internally heated pressure vessel at GSJ (HARM-200; Tomiya and Miyagi, 2001). At 147 MPa and 950°C, we observed only magnetite and apatite in the experimental product. On the other hand, magnetite, apatite and plagioclase (An=58±5) were formed at 98 MPa, 940°C. Considering that Us-2000pm contains plagioclase (An56-60), orthopyroxene, and magnetite (±apatite) (Tomiya and Miyagi, 2002), the magmatic conditions may be close to 98 MPa and 940°C, but slightly lower temperature.

We will discuss the petrological understanding of Usu volcano, combining these results and previous studies.