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知床硫黄山中腹火口の地下浅部構造と溶融硫黄噴火のしくみ
Near surface structure of a Crater on mountain side of Mt. Shiretokoiozan and its mechanism of molten sulfur eruption

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Mt. Shiretokoiozan, located in the middle of the Shiretoko Peninsula in Hokkaido Japan, is famous as molten sulfur eruption. Since 1857, Mt. Shiretokoiozan has erupted with molten sulfur four times. At the last eruption from February through October in 1936, approximately 200,000 tons of molten sulfur welled out of the Crater I, located on the northwestern mountain side, and the brown liquid sulfur flowed into the Kamuiwakka Creek. The eruption was closely observed and documented for ten days in September by Watanabe. He presumed the underground structure and possible existence of a molten sulfur reservoir under the crater based on the periodic activity.

Since 2005 we have implemented further researches to find out the near-surface underground structure of the Crater I for discussing the mechanism of molten sulfur eruption. The methods are various; geological survey, DC resistivity survey, self-potential exploration, and chemical analysis of gas and hot spring.

As a result, we found that the crater had been created by depression due to hydrothermally altering of andesite lava sheet and the following running-off of material. We suggest that there is a chamber under the crater and molten sulfur is supplied from the aquifer at the eruption where the sulfur had been generated during the inter-eruption period by chemical reactions of volcanic gasses.

The geology of the Crater I and its vicinity is mostly composed of hydrothermally altered clay, gravel and onion structured floats. Originally this area was composed of several-meters-thick sheet lava layers of andesite, which had flowed from the summit of mountain. The volcanic gasses, mostly hydrogen sulfide and carbon dioxide, come out through fumaroles and craters located directionally along conjugate faults cutting through this area. Original andesite rocks suffered weathering by the reaction with those acid gasses into onion structured boulders and seems to change to white gravels and clay. Because the small clay particles and the gravel at ground surface have been drained, large boulders in several meters were left on the ground and they covered most of this area.

In the cross section around the Crater I, we conclude that the crater is a depression hole opening in the hydrothermally altered lava. An aquifer among sheet lava goes under the Crater I and hot spring wells in the crater. At the higher elevation than the Crater I, there is a small creek called the Io Creek. And at the lower altitude, the Kamuiwakka Creek is located. We interpret that the underground water comes from the Io Creek and flows through lava-sheet aquifer, and upwells at the Crater I as well as hot springs in the Kamuiwakka Creek.

Volcanic gasses, hydrogen sulfide and sulfur dioxide, dissolve into the underground water, and were involved in the chemical reaction to generate the accumulation of sulfur in the aquifer. At the fumarole in the Crater I, water soluble sulfur dioxide is just barely detected. At the same time, the gas temperature has never been higher than boiling point of water. These are the evidences that most of volcanic gas passed through underground water.

We suggest that the sulfur in the aquifer melts and flows into the chamber under the Crater I at the active term of volcano, and may eject molten sulfur periodically. The amount of the molten sulfur erupted in 1936 was approximately 200,000 tons. If the chamber had reserved all amount of sulfur erupted in 1936, its volume might have been as much as 100,000 cubic meters. We suppose the possible chamber size is much smaller than the estimation. It is concluded that the aquifer supplied the molten sulfur continuously to the chamber, while the chamber made a periodic eruptions.

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the Kamuiwakka Creek