The relationship between magma transition and changes in magma discharge for Ohachi volcano, Kirshima volcanoes

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Ohachi volcano in Kirishima volcanoes, located on the volcanic front in south Kyushu, has erupted many times since 8th century. Before starting its volcanic activity, the volcano had a long repose period (more than 3000 years). Present pyroclastic cone has been made by large twice eruptions in 8th (KzS) and 13th (ThS) century. After ThS eruption the small-scale eruption has occurred periodically at 100-200 year interval. A magma-discharge stepdiagram is useful for estimating the evolution of the magma plumbing system and magma supply rate beneath the volcano. Because of decreasing the magma discharge rate after ThS eruption, the shape of stepdiagram for Ohachi volcano is divided into two segments. The Ohachi volcano is composed of three magma series, which are tholeiite (TH), subordinate tholeiite (S-TH) and calc-alkaline series (CA). In the early stage (KzS) TH series magma has been only erupted. The transitions from TH series to S-TH have occurred on the ThS eruption. After ThS episode S-TH series is dominant magma suite, the most recent activity is only Calk-alkaline rock. The time variation of eruptive magma series implies the evolution of magma plumbing system beneath Ohachi volcano. Thus we see that the timing of transition of magma series is accord with changes in magma-discharge stepdiagram. This suggests that magma process is concerned with the magma eruption pattern. The purpose of this report is to discuss about the relationships between magma transition and changes in magma discharge.

Based on the whole rock chemical composition and mineralogy of the three magma series, temporal evolution of magma reservoir system beneath Ohachi volcano is as follows. Magma plumbing system, deriving TH series such as KzS, has a few separated magma chamber, the each size are small. Magma chamber, erupting only S-TH series or both TH series basalt and S-TH series andesite such as ThS eruption, is sole and large. This diversity shows the difference of magma process playing an essential role in the generation of both rock series. The genesis of TH series is assimilation fractional crystallization (AFC). S-TH is magma mixing products between TH basalt and CA andesite made by crustal melting.

The time variation from AFC to magma mixing may imply that crustal physico-chemical conditions have evolved with time. The crust beneath Ohachi volcano was cooled because there was a long dormancy before starting the volcanism. When KzS magma was injected in the cool crust, KzS (TH series) magma are rapidly cooled and crystallized. By the effective magma cooling and magma separation, TH magma composition has become the wide range. On the other hand when the stable supplying system has been established, the continuous magma injections heat up the wall rock of the magma chamber. This heating of surrounding crustal rocks has caused not only keeping the injected magma temperature but also melting of crustal materials. Finally S-TH magma has become not to remove from the magma chamber because of increasing ductility of wall rocks. The changing of magma-discharge stepdiagram can be explained by crust heating, caused by intermittent magma supplying.