Simultaneous generation of multiple silicic magmas and their zoned magma chamber related to a caldera-forming eruption: Case studies of Shikotsu and Mashu volcanoes, Japan

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It has been widely believed that a large scale, caldera-forming eruption was derived from a zoned magma chamber, which was composed of single, voluminous silicic magma associated with a small amount of mafic magma. In almost all the cases, the mafic magma injected into the silicic magma before the eruption to erupt as mixed or mingled magma with the silicic one. This is consistent with both of the temporal change of eruptive magma during the eruption and evidence of magma mingling and/or mixing. However, there also exist several eruptions in which distinct types of slicic to intermediate magmas erupted with mafic magmas. In this study, we show three examples from Hokkaido, Japan, in which ditinct silicic magmas coexisted in addition to mafic magma. During caldera-forming eruption of Shikotsu volcano, voluminous rhyolitic magma erupted accompanied with distinct two or three dacitic magmas. In addition to these silicic magmas, mafic magma also erupted. The most voluminous rhyolitic magma mixed with not the mafic magma and but one of the dacitic magmas. Other dacitic magmas were injected with the mafic magma before the eruption. In the case of Mashu volcano, silicic magma during caldera-forming eruptions was mixing products of rhyolitic and dacitic magmas. These silicic magma was not related with the mafic magma of the volcano. The silicic magma during caldera-forming eruptions of these volcanoes was composed of several distinct types. These coexisted silicic magmas in both volcanoes can be distinguished by Sr isotope ratios, suggesting that one of these silicic magma is not the product of fractional crystallization of the other magma. The similar example is also shown by Matsumoto et al. (in this session). It has been widely believed that mafic magma plays as a heat source to produce silicic magma. If the silicic magmas were produced by crustal melting, partial melting of heterogeneous crustal materials might occur to produce several distinct silicic melts. It should be noted that the simultaneous generation of several types of felsic magma would be common especially in the case of large scale silicic magmatism such as caldera-forming eruptions. In such a case, mafic magma as a heat source would be enough large to melt crustal materials extensively.