The significance of the surface excavation in the Kikai caldera, southern Kyushu

*Keiko Suzuki-Kamata[1], ¥oshiyuki Tatsusmi[1], Kouji Kiyosugi[3], Reina Nakaoka[1], Nobukazu Seama[2], Tetsuo Matsuno[1], Satoshi Shimizu[1], Mamoru Sano[1], Hikaru Iwamaru[1]

1. Kobe Ocean-Bottom Exploration Center , 2. Graduate school of Science, Kobe University , 3. Organization of Advanced Science and Technology, Kobe University

The latest catastrophic caldera-forming eruption (CCFE) in the Japanese Archipelago occurred at 7.3 ka and created the Kikai submarine caldera to the south of Kyushu Island. This Kikai-Akahoya CCFE is one of the three largest (>*M*8) eruptions in Japan for the last 120 ky. Kikai caldera with a size of 19×22 km is located in the East China Sea to the south of the Kyushu island and lies astride the volcanic front of the SW Japan arc that is built by subduction of Philippine Sea plate at Nankai trough and Ryukyu trench. This caldera is created in the southern extension of the Kagoshima graben across the southernmost part of Kyushu Island and exhibits a double caldera structure. Two islands, Take-shima and Satsuma Iwo-jima, represent subaerial parts of the northern rim of this submarine caldera. Two post-caldera stratovolcanoes, Iwo-dake and Inamura-dake with a volume of 1.1 and 0.1 km^3, respectively, are developed on Satsuma Iwo-jima Island (Ono et al., 1982). At least three supereruptions, Koabi, Kikai-Tozurahara, and Akahoya euptions occurred at 140, 95 and 7.3 ka, respectively, in this caldera (Ono et al., 1982; Machida et al., 2001; Maeno and Taniguchi, 2007; Hayakawa, 2016). Recent surveys by Kobe Univeristy R/V Fukae Maru, including multi-beam mapping of the volcano morphology, side-scan sonar acoustic and ROV imaging, multi-channel seismic reflection survey, and rock sampling by dredging and diving, confirmed that a giant rhyolitic lava dome is situated on the inner caldera floor, i.e., by a post-CCFE magmatic activity and it exhibits several water column anomalies. It may be thus suggested that an active large magma-plumbing system is lurking beneath this volcano even at this ‘post-caldera’ stage. In order to understand the caldera cycle evolution and further to predict a future CCFE in this supervolcano, therefore, the volume of ignimbrite discharged at 7.3 ka CCFE, Koya ignimbrite, is needed.

The 7.3-ka Koya ignimbrite, is widely distributed over the proximal/adjacent islands and the mainland of southern Kyushu. It has been suggested that this ignimbrite shows a rather low aspect ratio with rather thin (<2m) and wide (~100km) deposition (Ui, 1973), which provided a volume estimate for this ignimbrite (<50km^3). However, our recent on-land survey revealed that both the ignimbrite thickness and the maximum pumice size tend to decrease with increasing the distance from the caldera. The thickness of ignimbirite is thinner in the area deposited crossing the sea longer than the area near the source area. This may lead to a hypothesis that a significant amount of pyroclastics including large pumices and ashes was lost during traveling over the sea and deposited on the sea floor. Revealing the mass of Koya-ignimbrite-derived pyroclastics on the sea floor should be thus a key to estimating the total volume of this ignimbrite.
Koya ignimbrite contains essential pumices and volcanic glasses, both exhibiting a bimodal compositional distribution, e.g., ~60 and ~70 wt.% SiO_2, and showing a chemical trend different from those of post-caldera volcanics such as stratovolcanoes and lava domes of Kikai supervolcano. These chemical characteristics of Koya ignimbrite should provide a better chance for discrimination of this ignimbrite from other ejecta.

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