



Regularly spaced submarine rhyolitic-calderas on the Tokara volcanic ridge, northern Ryukyu arc, Japan

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The southern part of the Kyushu Island where is the northern end of the 1300 km long Ryukyu arc, has some huge calderas, Aira and Kikai calderas. These calderas are considered to be formed by the Quaternary super-eruptions. Submarine calderas, Kuchinoshima, Takarashima and Amami calderas, which are of the same size as the Aira caldera, on the Tokara volcanic ridge that is the southern extension of the Kyushu Island, have been proposed on the basis of the bathymetric data. To confirm whether the caldera-like topographic expressions are of volcanic or tectonic in origin, we carried out approximately 70 dredge samplings during six ocean research cruises (KT00-15, KT07-2, KT07-21, NAG252, NAG267, and NAG274). Collected rock samples both from the on-land and seafloor of the Tokara Islands were compared to define the genetic correlations.

The weathering condition of the volcanic rocks in the Tokara Islands is different from the main land of Japan due to its hot and humid subtropical weather. Therefore, some samples are probably highly ferrallitized by the weather condition. Indeed volcanic rocks with high loss on ignition value are relatively poorer in K₂O and SiO₂ and richer in Al₂O₃, Fe₂O₃, TiO₂ compared with the low LOI value rocks. The LOI values could be an available threshold for excluding unreliable sample data. Each volcano shows individual trend on the K₂O vs. SiO₂ diagram. We revealed that there is obvious regional variation in their magma chemistry. Not only dense rocks but also highly vesiculated rhyolite samples collected from the seafloor are plotted on the same volcanic trends. The volcanic rocks recovered from the seafloor predominate in acidic rocks, rhyolite and dacite, rather than andesite. The rhyolitic pumice that are highly calcified by biological activity, were also found on the submarine plateaus that are located around the edge of submarine calderas at about 200 m depth. These samples imply that the submarine plateaus are not simply erosional remnant, but a product of caldera forming eruptions. The other submarine acidic rocks preserve fresh volcanic glass and are considered to be young. The measured K-Ar ages for the two representative acidic rocks, porphyritic rhyolite and aphyric dacite are young (0.6 Ma and < 0.20 Ma). Therefore, the rhyolitic volcanism could be active on the present submarine volcanic front of the Tokara volcanic ridge.

Our investigations support the idea that the submarine caldera-like topographies were produced by the Quaternary super-eruptions. If this is valid, the five huge calderas, including well studied Aira and Kikai calderas, align regularly at approximately 100 km interval from the southern Kyushu Island to the central part of the Ryukyu arc.