Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SVC52-04 会場:301A 時間:5 月 21 日 14:30-14:45

1883 年クラカタウ火山噴火とその後の地下構造
The 1883 eruption of Krakatau and its subsurface structure

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The present discussion is composed of 2 parts: The first part deals with the Verbeek s estimation (1885) of volume of the ejecta from the 1883 Krakatau eruption. Finally a balance sheet between the volume of juvenile material and that of lithic material is drawn. The second part discusses the subsurface structure of the Krakatau complex deduced by gravimetric and seismological methods.

In Part 1, the Verbeek s method is criticized from a viewpoint of methodology: Even evaluation of the errors in his surveys is difficult. Using his original data, the present author revises his estimation of the ejecta volume: For an example, volume of the total ejecta should be revised from 18.2 to 16.6 km3. And also volume of the lithic material produced by the eruption is estimated at 11 km3. Further, volume of the caldera deposits is estimated at 5 km3 by gravity anomaly observed on the caldera. As a whole, a balance sheet between volume of the deposits in the Krakatau area and their sources can be shown with unavoidable ambiguity.

In Part 2, development of geophysical study of the subsurface structure of Krakatau caldera is historically reviewed and discussed:

Yokoyama (1981) measured gravity on Krakatau Islands and assumed caldera deposits of funnel-shape, about 5 km3 in volume on the base of gravity anomaly. He calls the deposits fallback that is produced by explosions. He did not discuss magma reservoirs because magma reservoir had not been detected definitely and because cavities in the earth crust do not always collapse due to rigidity of the crust. He emphasized gigantic explosivity of the 1883 eruption that caused strong pressure waves simultaneously occurring with the large tsunami.

Harjono et al. (1989) set up 10 temporary seismic stations on the both sides of the Sunda Straits and one on Anak Krakatau, all being equipped with a single vertical seismometer, and examined wave paths from 14 local earthquakes occurring in summer of 1984 and detected two bodies of shear-wave attenuation near the Krakatau complex: one is about 9 km deep directly beneath the Krakatau complex and the other is voluminous and deeper (about 22 km deep at the top) extending towards the SW.

Deplus et al. (1995) got a detailed bathymetry in the caldera area and supplemented gravity survey on land and sea. They interpreted the gravity anomalies observed at the caldera and reached the similar conclusion to Yokoyama s. They assumed the caldera deposits as the collapsed volcano body, not fallbacks and modeled the deposits by various types of cylinder.

Jaxybulatov et al. (2011) carried out temporary seismometric observation at 14 onshore stations on Krakatau Islands (3 on Anak Krakatau) and on the coasts of Java and Sumatra. During about 8 months, more than 700 local earthquakes were recorded, and tomographic inversions for P and S velocities and for the Vp/Vs ratio were performed. They obtained a zone of high Vp/Vs ratio nearly beneath the Krakatau complex though the network configuration and the distribution of the events were not favorable for high quality tomographic imaging. At depths from the surface down to 4 km deep, they observed Vp./Vs ratio higher than 2 and assumed it as a probable indicator of the presence of partially molten material.

The present author attributes the anomalous values of Vp./Vs ratio deduced by Jaxybulatov et al. (2011) to the caldera deposits proposed by Yokoyama (1981) considering the resolution capacity of their tomography in the Krakatau area. A problem should be what is the origin of the caldera deposits. At many calderas in Japan, we have much knowledge on caldera deposits: They are usually fallbacks of low density deposited in funnel-shape.