

K-Ar Age Determination of USDP-1 and -2 Cores in Unzen Scientific Drilling Project

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K-Ar age determinations have been made on the USDP-1 and -2 cores. The samples were collected from lavas or pyroclastic flow deposits, and debris flow or debris avalanche deposits. In the USDP-1 core, the bottom of Unzen volcanic rocks appears at about 684 m depth. The K-Ar ages of samples between 104 and 601 m depth represent the latest stage of Older Unzen volcano, and no or very small amount of volcanic products of the earliest stage of Unzen Volcano between 270 and 450 ka reached the drill site. Only one pyroclastic flow deposit at 20 m depth gave K-Ar age of 11 ± 9 ka suggesting the age of Myoken or Fugen-dake stage of Younger Unzen Volcano. The USDP-2 core samples are now analyzing. Based on K-Ar ages and petrographic descriptions, we identify the units between USDP-1 and -2.

A systematic K-Ar age determination has been made on the two boring cores (USDP-1: Minami-Senbongi, Shimabara, 752 m in total length; USDP-2: Kami-Onokoba, Fukae, 903 m in total length) from the eastern flank of Unzen Volcano, SW Japan.

In the USDP-1 core, the nineteen samples were collected from lavas or pyroclastic flow deposits, and debris flow or debris avalanche deposits, which were identified between 20 and 707 m below the surface. In the USDP-2 core, the five samples were collected from lavas, which were found between 233 and 298 m below the surface. Core samples were crushed and sieved to 0.25-0.50 mm in diameter, and soaked into 1 M HNO₃ solution for 10 minutes using an ultrasonic bath. Such chemical treatment allowed us to remove secondarily formed minerals (e.g., carbonates) and reduce large amount of active gasses adsorbed onto the rock surface less than 1/50 to 1/1000. In the determination of radiogenic ⁴⁰Ar, initial ⁴⁰Ar/³⁶Ar ratios of the samples were estimated from the stable ³⁸Ar/³⁶Ar ratios determined by the unspiked technique, assuming that the initial argon isotopic ratios of all the samples should lie on a theoretical mass fractionation line of argon in the atmosphere. All the USDP-1 core samples gave significant K-Ar age information, and the ages obtained from the nine samples for which analyses were independently replicated had good reproducibilities within uncertainties.

On the stratigraphic results of USDP-1 core, the bottom of Unzen volcanic products appears at about 684 m below the surface. The Pre-Unzen pyroxene andesites from 702 and 707 m below the surface gave K-Ar ages of around 500 ka. The K-Ar ages of sixteen samples between 104 and 601 m below the surface were accumulated relatively short periods between about 180 and 270 ka. These ages represent the latest stage of the Older Unzen volcano (active period: 190-450 ka), and no or very small amount of volcanic products of the earliest stage of Unzen Volcano between 270 and 450 ka reached the drill site. Such information may suggest that the formation of graben became accelerated after about 250 ka with intensive volcanism. A essential material from one pyroclastic flow deposit at 20 m below the surface gave K-Ar age of 11 ± 9 ka suggesting the age of Myoken-dake or Fugen-dake stage of the Younger Unzen Volcano (0-100 ka).

We are now analyzing the five lava samples from the USDP-2 core, and preparing some pyroclastic flow and debris flow samples to be dated. Based on K-Ar ages and petrographic descriptions of the USDP-1 and -2 core samples, we will try to identify the volcanic units between USDP-1 and -2, and discuss the active history of Unzen Volcano.