Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SIT05-07 会場:303 時間:5 月 27 日 09:30-09:45

Water in glassy volcaniclastics recovered during IBM IODP Exp. 350: can it help fingerprint eruption sites?

Water in glassy volcaniclastics recovered during IBM IODP Exp. 350: can it help fingerprint eruption sites?

NICHOLS, Alexander[1*] ; TAMURA, Yoshihiko[1] ; BUSBY, Cathy[2] ; BLUM, Peter[3] ; JUTZELER, Martin[4] ; SCHINDLBECK, Julie[5] ; MCINTOSH, Iona[1] ; IODP, Expedition 350 scientists[6]
NICHOLS, Alexander[1*] ; TAMURA, Yoshihiko[1] ; BUSBY, Cathy[2] ; BLUM, Peter[3] ; JUTZELER, Martin[4] ; SCHINDLBECK, Julie[5] ; MCINTOSH, Iona[1] ; IODP, Expedition 350 scientists[6]

[1]JAMSTEC, Yokosuka, Japan, [2]Department of Earth and Planetary Sciences, UC Davis, USA, [3]IODP, Texas A&M University, USA, [4]National Oceanography Centre, Southampton, UK, [5]GEOMAR, Helmholtz Centre for Ocean Research, Kiel, Germany, [6]n/a
[1]JAMSTEC, Yokosuka, Japan, [2]Department of Earth and Planetary Sciences, UC Davis, USA, [3]IODP, Texas A&M University, USA, [4]National Oceanography Centre, Southampton, UK, [5]GEOMAR, Helmholtz Centre for Ocean Research, Kiel, Germany, [6]n/a

The Izu-Bonin-Mariana arc system (IBM) extends over 2800 km south from the Izu Peninsula (Japan) to beyond Guam (USA). During 2014 the Izu segment was the focus of three IODP drilling expeditions (350, 351 and 352) that investigated different aspects of this intra-oceanic arc system. This work focuses on material recovered in the first of these expeditions that took place from March 30 to May 30 2014.

IODP Expedition 350 drilled at two sites (Tamura et al., In Press). Site U1436 in the fore-arc at 1776 meters below sea level (mbsl), ~60 km east of the arc-front volcano Aogashima, is a geotechnical hole drilled in preparation for proposed deep drilling at site IBM-4. This was followed by Site U1437 at 2117 mbsl in the rear-arc, the main focus of the expedition, located in a volcano-bounded basin between the Manji and Enpo rear-arc seamount chains, ~90 km west of the arc-front volcanoes Myojinsho and Myojin Knoll. Hole U1436A reached 150 meters below seafloor (mbsf), recovering 71.6 m of Pleistocene to Pliocene sediments consisting of a single lithostratigraphic unit of tuffaceous mud (~60%) intercalated with ~150 volcaniclastic layers. Volcaniclastics range from ash to lapilli-ash size, and record mafic (~80 layers, ~60% of the recovered volcaniclastics) to more evolved volcanism. A distinctive glassy mafic ash layer that may record a large-volume eruption was recovered at ~50 mbsf; in order to recover the layer less disturbed by coring, three additional holes (U1436B, C, and D) were drilled at the site to better constrain its thickness and thus its origin. Drilling at Site U1437 across Holes U1437B, D and E, reached 1806.5 mbsf and recovered 1120.76 m of Pleistocene to Miocene tuffaceous mud and mudstone (~60%) intercalated with volcaniclastic layers (~2500 layers) that were divided into seven lithostratigraphic units. The proportion of the volcaniclastics and their dominantly fine grain size (ash/tuff) is surprisingly low for an intra-volcano basin and suggest distal sources. In Units VI and VII, below 1320 mbsf, the volcaniclastics included a greater proportion of coarser material (lapilli-tuff to tuff-breccia) that may originate more proximally. Within Unit I a record of mafic and more evolved volcanism could be identified, but this became more difficult with depth.

Water is being measured in glassy material from the volcaniclastic layers. As water solubility increases with increasing pressure, if water is saturated in the melt on eruption, the water left in the glass provides a means to estimate the pressure at the time of quenching. This can then be used to infer whether or not the eruption that generated the volcaniclastics was submarine, and if so at what water depth it occurred. We will examine whether water can be used to constrain eruption depths and help to locate possible sources of the volcaniclastics recovered in IODP Expedition 350. One possible issue that may overprint the water signal even in fresh-looking glass is post-eruption hydration of the glass by seawater at ambient temperature at their site of deposition. Water added in this way enters the glass as molecular water because at sub-magmatic temperatures the species interconversion reaction between molecular water and hydroxyl species is negligible. This results in anomalously high concentrations of molecular water compared to the speciation expected at eruption temperature. If this is recognized in the glassy volcaniclastics from IODP Expedition 350, we will examine whether it is possible to restore eruption water contents using their measured hydroxyl content and water speciation models. If successful, we will then infer from the restored water contents whether the eruptions that generated the glasses were submarine, and if so the depth of eruption required for the melts to be saturated at the time of quenching.

Tamura, Y. et al., In Press. Proceedings of the International Ocean Discovery Program, Expedition 350. doi:10.14379/iodp.proc.350.2015

キーワード: Izu-Bonin-Mariana drilling, volcaniclastics, glass, water content, water speciation, vent conditions
Keywords: Izu-Bonin-Mariana drilling, volcaniclastics, glass, water content, water speciation, vent conditions