Submission date　2014/07/14

Cruise Summary

１．Cruise Information

Cruise ID: KR14-07
Name of vessel: R/V Kairei
Title of the cruise: Magma genesis of Ojin Rise seamounts east of Shatsky Rise
Chief scientist: Takashi Sano [Department of Geology and Paleontology, National Museum of Nature and Science]
Representative of the Science Party: Takashi Sano [Department of Geology and Paleontology, National Museum of Nature and Science]
Title of proposal: Magma genesis of Ojin Rise seamounts east of Shatsky Rise
Cruise period: June 28, 2014~July 14, 2014
Ports of call: Tokyo Harumi~Hakodate
Research area: Ojin Rise seamounts, east of Shatsky Rise
(an area at N36°30'~37°50', E164°00'~167°00')

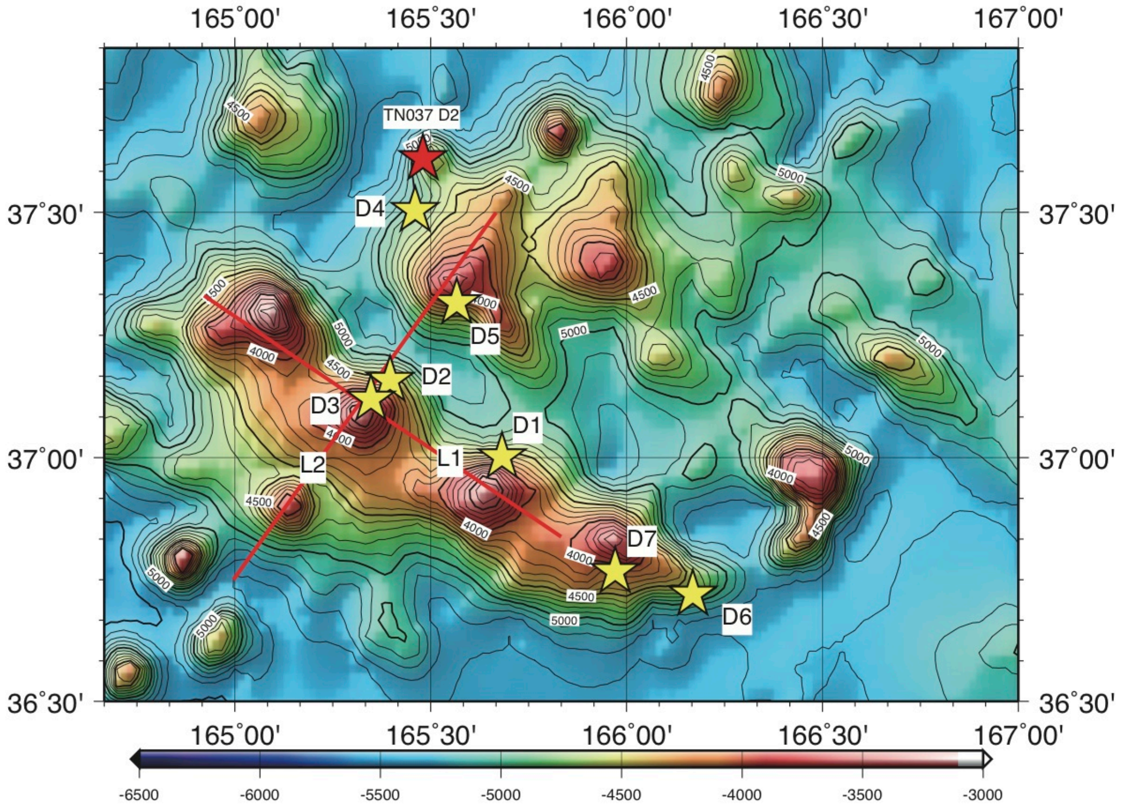

Figure 1. Bathymetry map of the survey area (Smith and Sandwell, 1997). Dredge sites (D1 to D7) are indicated by yellow stars and single-channel seismic survey lines (L1 and L2) are shown by red lines. A previous dredge site (red star) is also shown (TN037 D2: Sager *et al*., 1999).

２. Overview of the Observation

2-1. Background and Purpose

Enormous volcanism forming oceanic plateaus are thought to occur within relatively short periods (e.g., within a few hundred million years), but post-emplacement volcanoes are evident on some oceanic plateaus such as Ontong Java Plateau, Manihiki Plateau, and so on (e.g., Tejada *et al*., 1996). A possible explanation for the post-emplacement volcanism is underplating of magma for an extended period of time beneath the plateaus (e.g., Ito and Clift, 1998), but supporting geological information is poor. This is due to the difficulty of taking such geological information because the original setting of the plateau, relative to the post-emplacement volcanoes, is poorly known in most cases. Most of the plateaus were formed during the mid-Cretaceous when no magnetic reversals formed ridge-parallel anomalies to record the original spreading ridge locations.

Shatsky Rise, located ~1500 km east of Japan, is unique in being the only large oceanic plateau formed during a time of magnetic reversals, permitting its tectonic setting to be resolved (Figure 2). Magnetic lineations show that the plateau formed during the late Jurassic and Early Cretaceous along the trace of a triple junction (Nakanishi *et al*., 1999). The plateau extends laterally from SW toward NE direction. The post-emplacement volcanism on Shatsky Rise is likely present because several seamounts can be identified on the plateau and along the margins and basins surrounding the edifices. Among the seamounts on and near Shatsky Rise, most are concentrated in Ojin Rise. The number of Ojin Rise seamounts is more than 60 and many seamounts occur along a NW-SE direction that intersects at right angle to the direction of the plateau extension. We will investigate the possibility that Ojin Rise seamounts formed as a result of post-emplacement volcanism on Shatsky Rise, although previous work did not discuss relationships between Ojin Rise seamounts and Shatsky Rise.

References

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Sano, T., Shimizu, K., Ishikawa, A., Senda, R., Chang, Q., Kimura, J.-I., Widdowson, M., and Sager, W.W. (2012), Variety and origin of magmas on Shatsky Rise, northwest Pacific Ocean: *Geochemistry Geophysics Geosystems*, 13, Q08010, doi:10.1029/2012GC004235.

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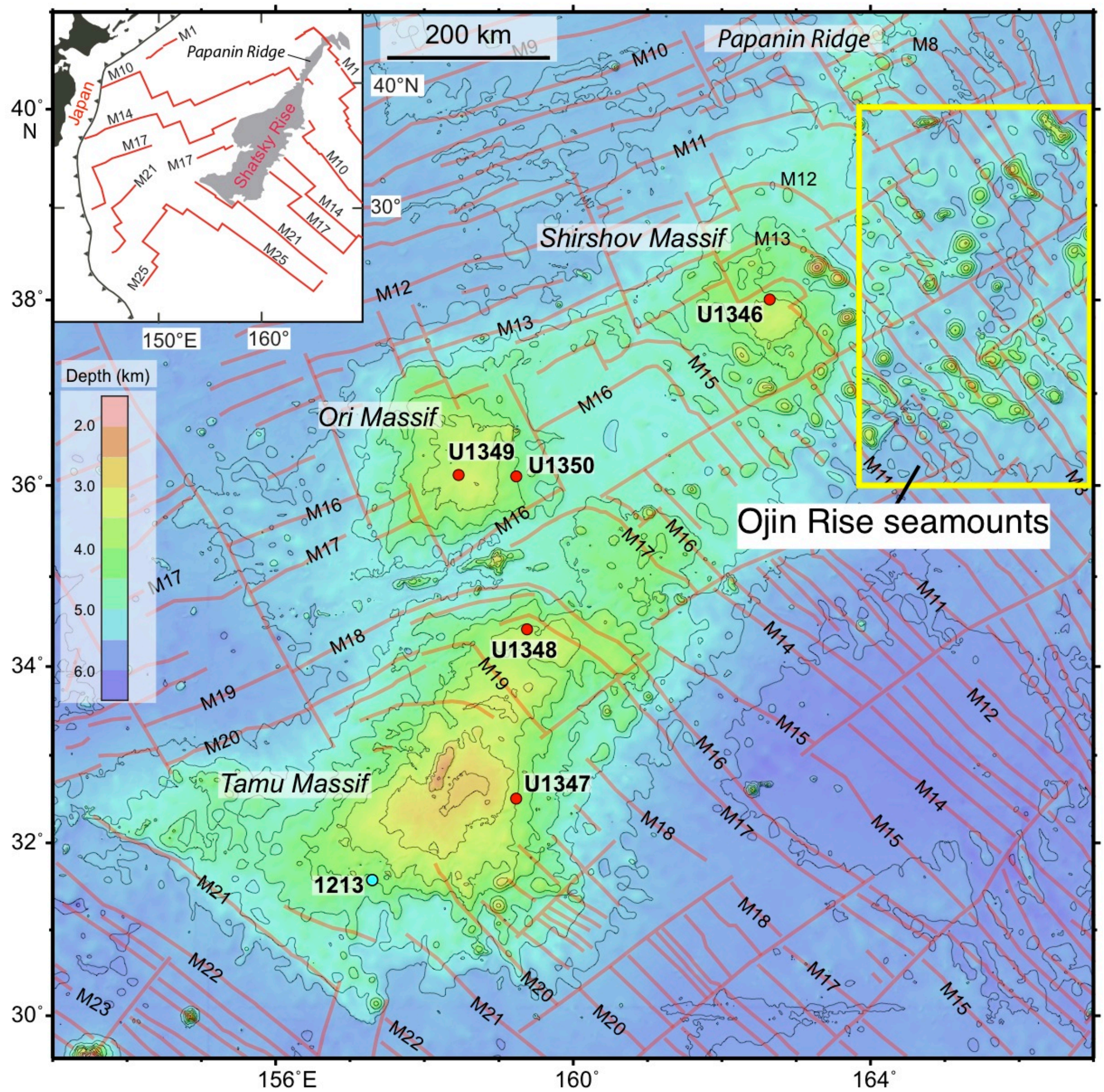

Figure 2. Map of Shatsky Rise, Ojin Rise seamounts (within yellow box), surrounding magnetic lineations (red lines), IODP Expedition 324 drill sites (red dots) and ODP Site 1213 (blue dot) after Sager *et al*. (2010) and Sano *et al*. (2012). Inset shows the location of Shatsky Rise relative to Japan. Note that research area (Figure 1) is a part of the area of Ojin Rise seamounts.

2-2. Observation and activities

To achieve the purpose of this study, we have conducted the following observation.

(1) Surface geophysical measurement to reveal the tectonic structure of the Ojin Rise seamounts.

(2) Basement rock sampling to gain information about the type and source of volcanism for the Ojin Rise seamounts.

(3) Single-channel seismic (SCS) survey to delineate the structures of volcanic layers of the Ojin Rise seamounts.

2-3. Instruments and Methods

(1) Surface geophysical measurement

Bathymetry, geomagnetic and gravity data were recorded during the cruise. We used a proton magnetometer, a shipboard three components magnetometer for the geomagnetic measurement, multi-narrow beam echo sounder with a sub-bottom profiler with Bathy-2010P and SeaBeam 3012 system for the bathymetric measurement, and a shipboard gravimeter for the gravity measurement. The degree of survey area was about 120° (auto system) and the ship speed was 8 knot at the dredge sites and 12 knot in other areas.

(2) Dredge

The dredge system consisted of the winch wire, lead wire, chain, weight, pipe dredge, fuse linker, life wire, and chain-bag dredge (box- or cylinder-type). The dredge assemblages were connected with the ship-board winch wire.

(3) SCS survey

The SCS system consisted of two GI guns, firing controller, streamer, recording system, and post-processing system. The air compressor system installed in R/V KAIREI was used during KR14-07.

2-4. Preliminary results

(1) Suface geophysical measurement

The survey line for the surface geophysical mapping was designed mainly to see the detailed topography of each seamount and to identify the alignment direction of the seamounts. The result shows that many of the seamounts are flat-topped guyots, with summit depths of about 3000 m. Many guyots are likely capped by shallow-water carbonate platform sediments overlying volcanic substrate, but this possibility should be examined by post-cruise studies. Also, obvious NW-SE arrangement of four seamounts has been confirmed (Figure 1). The gravity measurements are useful to examine underground structure of each seamount (e.g., area of volcanic vent), and the geomagnetic measurements would be utilized to identify magnetic anomaly lineations and to expose tectonic fabrics in the survey area. The obtained data were good and will contribute to the understanding of the origin of Ojin Rise seamounts.

The sub-bottom profilers were deployed within the areas of the five dredge sites (D1, D2, D3, D6 and D7) before dredging, and the data were very important for determining the dredge points.

(2) Dredge

The dredges were carried out at seven sites (D01 to D07 in Figure 1). At all sites, our expected volcanic rocks were recovered. Sediments, manganese nodules, and some allochthonous pumices were sampled, too. Although all volcanic rocks are coated by thick and hard manganese crusts, some of them are not highly altered ones. They are presumably good for age dating and geochemical studies.

(3) SCS survey

The SCS reflection data were acquired along two lines (L1 and L2) with a total length of approximately 200 km (Figure 1). In both tracks, well-recognized reflection from the seafloor was clearly recorded. Igneous basement structures were confirmed except beneath the summits of the guyots, covering large amplitude reflection signals at the surface. In the basin area with near flat topography, some clear reflections were also recognized within both sediments and basements associated with normal-fault-like sharp displacements. Further descriptions and investigation results will be reported later.