doi : 10.17596/0003276

YOKOSUKA Cruise Report

YK08-09

Interdisciplinary survey on a new type volcanism “petit-spot” in northwestern Pacific: Investigation for the distribution of the melt generation and magma extrusion fields
&
Tectonic evolution of the Shatsky Rise

Northwestern Pacific Ocean

July 28 2008 – Aug. 19 2008

Japan Agency for Marine-Earth Science and Technology
(JAMSTEC)

Contents

1. Cruise information

Cruise number & Ship name:

YK08-09 R/V YOKOSUKA

Title of the cruise:

2008 Deep Sea Research YOKOSUKA solo cruise

Title and number of the proposals:

S08-38: Interdisciplinary survey on a new type volcanism "petit-spot" in northwestern Pacific: Investigation for the distribution of the melt generation and magma extrusion fields

S08-35: Tectonic evolution of the Shatsky Rise

Cruise period & Port call:

Jul. 28 2008 (Yokosuka) – Aug. 19 2008 (JAMSTEC)

Research Area:

Northwestern Pacific Ocean (143°~161°E, 30°~40°N)

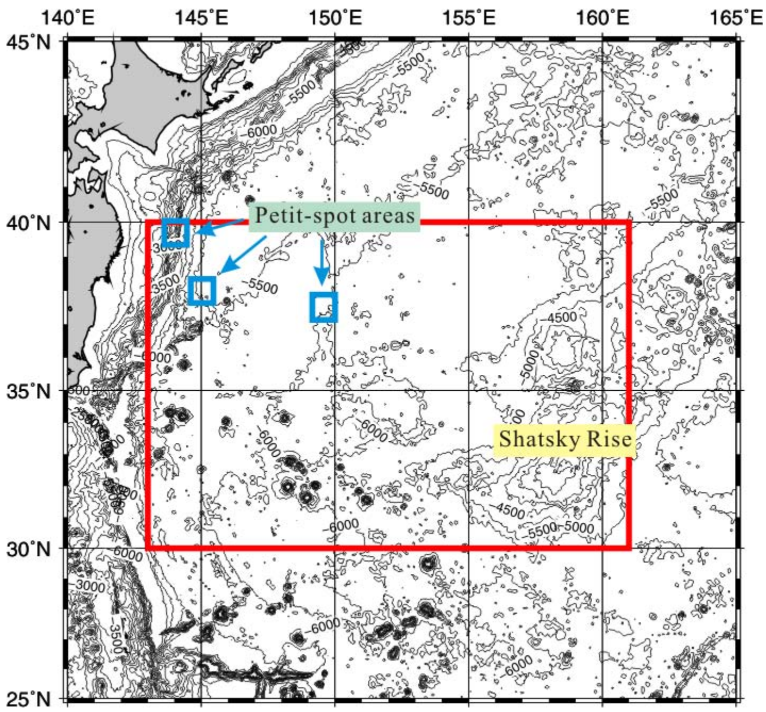

Figure 1.1. Survey area of YK08-09 cruise.

2. Researchers and crew

Chief Scientist:

Baba, Kiyoshi	Earthquake Research Institute, University of Tokyo

Representatives of science party of the research proposals:

S08-38:	Baba, Kiyoshi	Earthquake Research Institute, University of Tokyo
S08-35:	Nakanishi, Masao	Graduate School of Science, Chiba University

Science Party of the research proposals:

S08-38:

Abe, Natsue	(onboard)	Institute for Research on Earth Evolution (IFREE), Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
Fujiwara, Toshiya	(onshore)	IFREE, JAMSTEC
Hamamoto, Hideki	(onshore)	Earthquake Research Institute, University of Tokyo
Hirano, Naoto	(onshore)	Frontier Science Organization, Kanazawa University
Ishii, Teruaki	(onshore)	Fukada Geological Institute
Ito, Aki	(onboard)	IFREE, JAMSTEC
Machida, Shiki	(onshore)	Ocean Research Institute, University of Tokyo
Nakanishi, Masao	(onboard)	Graduate School of Science, Chiba University
Shito, Azusa	(onboard)	IFREE, JAMSTEC
Sugioka, Hiroko	(onshore)	IFREE, JAMSTEC
Takahashi, Ayu	(onboard)	Graduate School of Science, University of Tokyo
Yamamoto, Junji	(onshore)	Woods Hole Oceanographic Institution
Yamano, Makoto	(onshore)	Earthquake Research Institute, University of Tokyo

S08-35:

Abe, Natsue	(onboard)	IFREE, JAMSTEC
Baba, Kiyoshi	(onboard)	Earthquake Research Institute, University of Tokyo
Fujiwara, Toshiya	(onshore)	IFREE, JAMSTEC
Hirano, Naoto	(onshore)	Frontier Science Organization, Kanazawa University
Machida, Shiki	(onshore)	Ocean Research Institution, University of Tokyo
Noguchi, Toru	(onboard)	Faculty of Science, Chiba University
Ogawa, Yujiro	(onshore)	Graduate School of Life and Environmental Sciences, University of Tsukuba
Shimizu, Kenji	(onboard)	IFREE, JAMSTEC

Technical support staff

Hosoya, Shin-ichi	Nippon Marine Enterprise, Ltd.
Iwamoto, Hisanori	Nippon Marine Enterprise, Ltd.
Hashimoto, Yasushi	Marine Works Japan, Ltd.
Matsuura, Yutaka	Marine Works Japan, Ltd.
Nakano, Yukihiko	Marine Works Japan, Ltd.

Crew

Saito, F.	Captain
Kimura, N.	Chief Officer
Hayashi, M.	2nd Officer
Furukawa, Y.	3rd Officer
Kajinishi, K.	Chief Engineer
Funae, K.	1st Engineer
Ota , T.	2nd Engineer
Shirakata, K.	3rd Engineer
Saitake, H.	Chief Radio Operator
Ishiwata, H.	2nd Radio Operator
Yamaguchi, K.	3rd Radio Operator
Abe, K.	Boat Swain
Hirai, S.	Able Seaman
Chimoto, T.	Able Seaman
Yatogo, K.	Able Seaman
Yoshino, Y.	Able Seaman
Ichikawa, N.	Able Seaman
Ueno, S.	Sailor
Matsuda, S.	No.1 Oiler
Higashigawa, Y.	Oiler
Hashimoto, T.	Oiler
Funawatari, K.	Oiler
Nakahara, Y.	Assistant Oiler
Morita, T.	Chief Steward
Kida, K.	Steward
Matsumoto, I.	Steward
Murakami, K.	Steward
Kubota, H.	Steward

3. Observations

3-1. Background and objectives of the research proposals

3-1-1. Interdisciplinary survey on a new type volcanism “petit-spot” in northwestern Pacific: Investigation for the distribution of the melt generation and magma extrusion fields

A petit-spot is a newly recognized type of volcanic activity that is characterized by a cluster of young small knolls not associated with mid-ocean ridges, island arc volcanism, or hot spots (Hirano *et al.*, 2001; 2006). The first example of a petit-spot, named the Kaiko Knolls, was discovered on the oceanward slope of the Japan Trench at 39.4°N, 144.3°W. The plate motion was traced using ages estimated from basaltic rock samples (~6.0 Ma), leading to the discovery a second petit-spot, named the Yukawa Knolls, in the northwestern Pacific Ocean at 37.5°N, 149.8°W, ~600 km offshore from the Japan Trench (Figure 3-1-1.1). The second petit-spot field

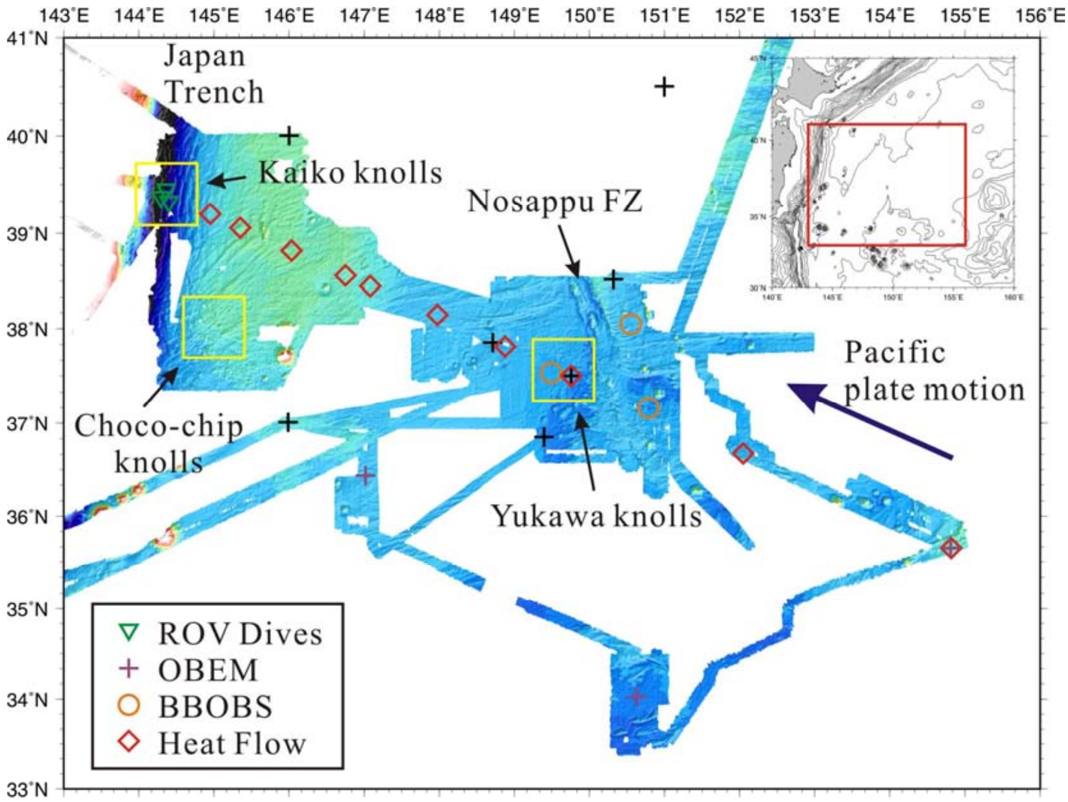

Figure 3-1-1.1. Proposed survey area locates in the northwestern Pacific (Red box in the inset). Bathymetric map collected through previous petit-spot cruises (KR03-07, KR04-08, YK05-06, KR05-10, and KR07-06) is shown. Station locations of the proposed observations (rock samplings, seafloor electromagnetic and seismic observations using OBEMs and BBOBSs, and crustal heat flow measurements are also plotted on the bathymetry map.

is believed to be currently active based on the very young age of the basaltic rock samples (<1 Ma) (Hirano *et al.*, 2006) and the detection of seismic activity in the region over the past 20 years by the Japan Meteorological Agency. The volcanic knolls in the area are typically a few kilometers in diameter, with a relative height of ~100 m. The results of a recent seismic reflection study suggest that the knolls are monogenic volcanoes produced by a small magmatic intrusion of less than 1 km^3 in volume (Fujiwara *et al.*, 2007). A third example, the Choco-chip Knolls, was recently identified on the outer rise at 38.0°N, 145.0°W, a site that deviates from the line of plate motion tracking the Kaiko and Yukawa knolls (Figure 3-3-1.1) (Abe *et al.*, 2007).

The origin of young volcanisms on old, cold, and thick oceanic plates is enigmatic, and should be elucidated. Through analyses of the distribution of the petit-spot fields and geochemical signatures of rock samples, Hirano *et al.* (2006) proposed a hypothesis that the asthenosphere is partially molten layer and the melt leaks through fractures due to plate bending before subduction (Figure 3-3-1.2). This hypothesis implies that, unlike other major types of volcanism on Earth, the melt generation and magma extrusion processes may be considered separately for the formation of petit-spots. Knowledge of both processes in the northwestern Pacific is limited because the basin was previously recognized as a non-tectonic region and thus has not been explored sufficiently. Interdisciplinary research is essential to elucidate the processes and to understand the nature of petit-spot.

An interdisciplinary collaborative research project was funded by Japan Society for the Promotion of Science (Grant-in-Aid for Science Research B, 1, No.17340136; Representative: N. Abe) and was started in 2005. Its continuative research project was funded for four years

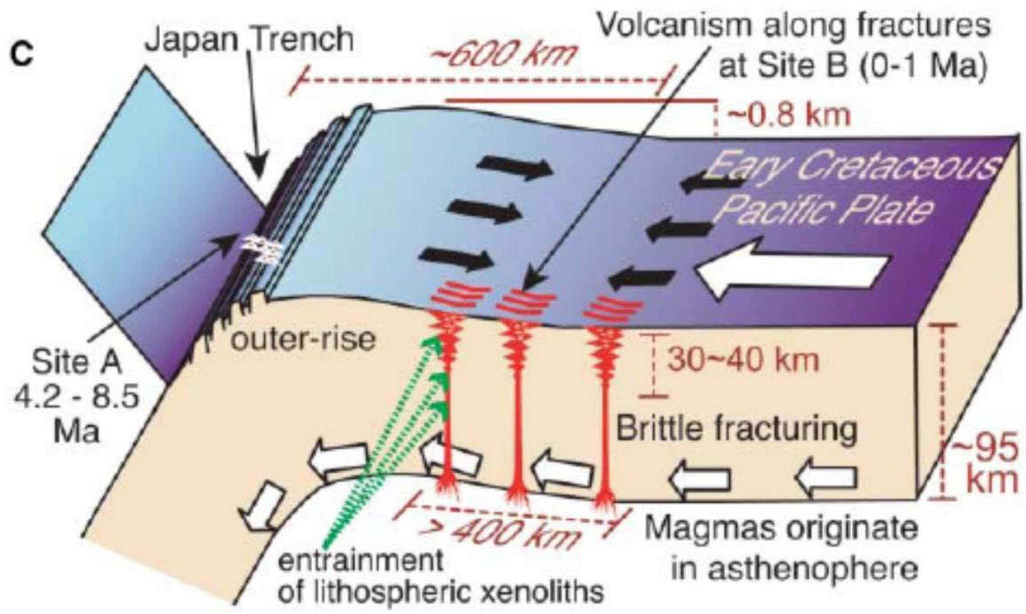

Figure 3-1-1.2. A model of petit-spot generation process. After Hirano *et al.* (2006).

since 2008 (Grant-in-Aid for Science Research B, 1, No. 20340124; Representative: N. Abe). Several research cruises have been proposed and conducted as a part of the project. This proposal "Interdisciplinary survey on a new type volcanism petit-spot in northwestern Pacific" is one of those and aims to investigate the distributions of melt generation field and magma extrusion field associated with the petit-spot. The interdisciplinary survey consists of geophysical surface mapping (bathymetry, back scatter intensity, gravity, geomagnetic fields), rock sampling using ROV KAIKO 7000II, crustal heat flow survey, and seafloor electromagnetic and seismic observations for one year (Figure 3-1-1.1). For these survey, a couple of cruises in 2007 (R/V KAIREI KR07-06 cruise) and 2008 (R/V YOKOSUKA YK08-09 cruise; this cruise) were proposed and adopted by JAMSTEC Deep Sea Research.

The objectives were investigated by each observation as following. 1) Rock sampling at KAIKO knolls was planed and executed in KR07-06. The analysis of the obtained samples can provide us further information about the extrusion ages and the chemical composition of the magma. 2) The seafloor electromagnetic observation using ocean bottom electromagnetometers (OBEMs) images electrical conductivity structure of the asthenosphere. Previously, five stations were deployed in Yukawa knoll area for three months in 2005. In KR07-06, further three stations were deployed to cover the surrounding area. These observations contribute the investigation of the extent and the physical and chemical status of the melt generation fields. 3) The seafloor seismic observation using broad-band ocean bottom seismometers (BBOBSs) attempts to detect earthquakes that occur near Yukawa knolls, which contributes the investigation of the magma extrusion field at present. It is also useful for the investigation of the velocity structure of the melt generation field through the analysis of teleseismic signals. 4) The crustal heat flow measurements along a line connecting Yukawa and Kaiko knolls seek thermal anomaly associated with the petit-spot volcanic activity, which will constrain the history of the magma extrusion field. This plan was carried out during KR07-06. A High density heat flow survey around Yukawa knoll was conducted during YK08-09 to see the thermal circulation of the petit-spot volcano. 5) The mapping of bathymetry and back scatter intensity by multi-narrow beam sounding system seeks further petit spot volcanoes. The distribution of the volcanoes is fundamental information for investigating the both the melt generation and magma extrusion fields. The surface gravity and geomagnetic field measurements contribute a study for background crustal tectonics. The correlation between the magma extrusion fields and the background crustal tectonics can be investigated.

References

Abe, N., H. Fujimoto, N. Hirano, S. Kirby, M. Kido, Y. Osada, R. Hino, H. Tsushima, and Y. Koike (2007), A discovery of another petit spot volcanic field in the Cretaceous Pacific Plate, *Eos Trans. AGU*, **88**(52), Fall Meet. Suppl., Abstract T13A-1127.

Fujiwara, T., N. Hirano, N. Abe, and K. Takizawa (2007), Subsurface structure of “petit-spot” volcanoes on the northwestern Pacific Plate, *Geophys. Res. Lett.*, **34**, L133305, doi:10.1029/2007GL030439.

Hirano, N., K. Kawamura, M. Hattori, K. Saito, and Y. Ogawa (2001), A new type of intra-plate volcanism; young alkali-basalts discovered from the subducting Pacific Plate, northern Japan Trench, *Geophys. Res. Lett.*, **28** (14), 2719–2722.

Hirano, N., E. Takahashi, J. Yamamoto, N. Abe, S. P. Ingle, I. Kaneoka, T. Hirata, J. Kimura, T. Ishii, Y. Ogawa, S. Machida, and K. Suyehiro (2006), Volcanism in response to plate flexure, *Science*, **313**, 1426–1428.

3-1-2. Tectonic evolution of the Shatsky Rise

Shatsky Rise is an oceanic plateau located about 1600 km east of Japan. The rise is elongated southwest to northeast and has an area of 4.8 × 10^5 km^2, about 25 % more than islands of Japan. The rise contains three large volcanic massifs that rise to depths of 3200–2000 m. All three have domes of Cretaceous pelagic sediments up to 1 km thick at their summits (Sliter and Brown, 1993). The southern part of the rise has seismic velocity structures typical of oceanic plateaus: the layers are similar to oceanic crust but several times thicker (Den *et al.*, 1969; Gettrust *et al.*, 1980). The massifs are separated by areas of low plateau (Helios and Sliter basins) that rise less than 1 km above the surrounding seafloor. On the northeast side of the rise a low, linear ridge (Papanin Ridge) trends to the northeast and bends nearly 90° at 43°N to a southeast trend that projects to Hess Rise. Additionally, a cluster of small to medium seamounts is located around and to the east of the rise; it contains a loose chain with a nearly east-west trend (Ojin Rise Seamounts).

Shatsky Rise is important because it is a good example of a plateau formed at a triple junction. It has been shown that Shatsky Rise formed at the Pacific-Izanagi-Farallon triple junction during the Late Jurassic and Early Cretaceous (e.g., Nakanishi *et al.*, 1999). Between chrons M21 and M20 (148–146 Ma) the Japanese lineations reoriented by 25°, indicating a reorganization of spreading on the Pacific-Izanagi ridge (Nakanishi *et al.*, 1999). They concluded that the appearance of a Shatsky hot spot caused a regional reorganization of the Pacific-Izanagi-Farallon plate boundaries. Simultaneously, the triple junction jumped northeast to the location of Shatsky Rise, annexing a piece of the Farallon plate and causing a short-lived microplate nearby (Nakanishi *et al.*, 1999). Subsequently, the triple junction remained near the Shatsky hot spot as shown by the confluence of magnetic lineations along the rise to chron M4 (127 Ma). Shatsky Rise is the trace of the Shatsky hot spot on the Pacific plate (Nakanishi *et al.*, 1999).

On the other hand, Sager (2005) proposed that Shatsky volcanism occurred because the triple junction jumped to a location underlain by a large volume of anomalously fusible shallow mantle. Furthermore, Nd-Pb-Sr isotopic data for the few basalts cored and dredged from Shatsky Rise show a Pacific-MORB-type signature, not the expected ocean-island type signature of a plumehead eruption (Mahoney *et al.*, 2005). Whether or not this MORB affinity is representative of the rise or characterizes only a few minor, late-stage magmas is unknown. To test plume head versus ridge tectonics models of Shatsky Rise formation, it is necessary to expose detailed configuration of the plate boundaries among Pacific, Izanagi, and Farallon plates. This is the reason why we proposed geophysical measurement and dredging around the Shatsky Rise.

References

Den, N., W. J. Ludwig, S. Murauchi, J. I. Ewing, H. Hotta, N. T. Edgar, T. Yoshii, T. Asanuma, K. Hagiwara, T. Sato, and S. Ando (1969), Seismic refraction measurements in the Northwest Pacific basin, *J. Geophys. Res.*, **74**, 1421–1434.

Gettrust, J. F., K. Furukawa, and L. W. Kroenke (1980), Crustal structure of the Shatsky Rise from seismic refraction measurements, *J. Geophys. Res.*, **85**, 5411–5415.

Mahoney, J. J., R. A. Duncan, M. L. G. Tejada, W. W. Sager, and T. J. Bralower (2005), Jurassic-Cretaceous boundary age and mid-ocean-ridge–type mantle source for Shatsky Rise, *Geology*, **33**, 185–188.

Nakanishi, M., W. W. Sager, and A. Klaus (1999), Magnetic lineations within Shatsky Rise, northwest Pacific Ocean: Implications for hot spot–triple junction interaction and oceanic plateau formation, *J. Geophys. Res.*, **104**, 7539–7556.

Sager, W. W. (2005), What built Shatsky Rise, a Plume Head or Ridge Tectonics, in Plates, Plumes, and Paradigms, *Special Paper 388, G. R. Foulger, J. H. Natland, D. C. Presnall, and D. L. Anderson (Eds.), Geological Society of America, Boulder, CO*, 721–733.

Sliter, W. V., and G. R. Brown (1993), Shatsky Rise: Seismic stratigraphy and sedimentary record of Pacific paleoceanography since the Early Cretaceous, *Proc. ODP, Sci. Res.*, **132**, 3–13.

3-2. Description of observations

3-2-1. Surface geophysical surveys

M. Nakanishi & T. Noguchi

Bathymetric, geomagnetic, and gravity measurements were conducted during YK08-09. Most of ship tracks were designed to identify magnetic anomaly lineations and to expose tectonic fabrics around the Shatsky Rise (Figure 3-2-1.1).

<u>Bathymetric measurement</u>

Bathymetric data were collected by a multi-narrow beam echo sounder system, SEA BEAM 2112.004 (L-3 Communications SeaBeam Instruments). SEA BEAM 2112.004 collects

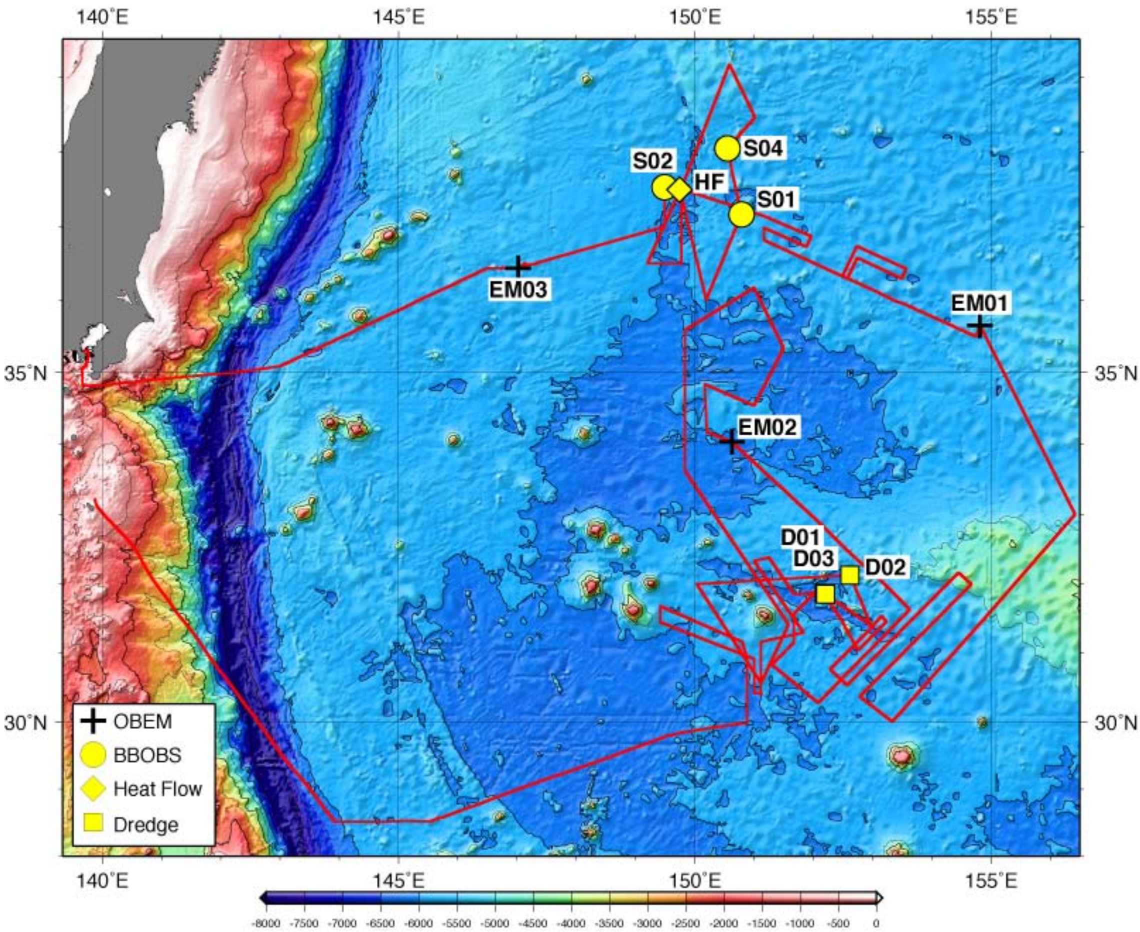

Figure 3-2-1.1. Ship track for the surface geophysical survey superimposed on bathymetric map (after Smith and Sandwell, 1997). The contour interval is 1000 m. Other observation stations are also plotted by crosses, circles, a diamond, and squares.

bathymetric and side scan data to deep sea over a wide swath of up to 150°. The system has sub-bottom profiler using 4 kHz echo. Several tectonic fabrics were exposed by the bathymetric measurement. The results are helpful to reveal the tectonic history around the Shatsky Rise.

Geomagnetic measurement

Geomagnetic total force was measured by using a surface-towed proton precession magnetometer PROTO10 (Kawasaki Geol. Eng. Co.). The sensor is towed approximately 300 m behind the ship, to reduce the effect of the ship's magnetic effect. Vector magnetic field data were collected using a shipboard three-component magnetometer (STCM), Tierra Tecnica SFG-1214. The sensor of the STCM is a three-axis flux-gate magnetometer. The sensors with ring-core coils are fixed on the open deck above the bridge. "Figure eight rotation", a ship runs along an 8-shaped track consisting of two circles, was performed twice during YK08-09. Several Mesozoic magnetic anomaly lineations were newly identified around the Shatsky Rise by the geomagnetic measurement. The results are useful to reconstruct the plate configuration.

Gravity measurement

Onboard gravity measurements were made using a LaCoste & Romberg S-63 air-sea gravity meter. The data were recorded per minute. The "gravity tie" will be conducted after arrival at the JAMSTEC pier to estimate sensor drift of the gravity meter. Gravity data collected during YK08-09 will be used to expose the crustal structure around the Shatsky Rise.

3-2-2. Deep-sea heat flow survey

K. Baba & A. Takahashi

Deep-sea heat flow survey was conducted near Yukawa knoll which is a one of the petit-spot volcanoes at 37° 29.9'N, 149° 44.6'E, (~6000 m depth). A datum was previously obtained in KR04-08 cruise showed a heat flow value that is lower than the average value for 130 Myr old oceanic crust (~50 mW/m^2). The low heat flow may be attributed to sea water circulation associated with the residual heat of the magma beneath the knoll. High density survey near Yukawa knoll was thus planed and carried out to investigate the distribution of heat flow around the knoll.

Instrument

The heat flow probe has a 4.5 m-long lance, along which seven compact temperature recorders are mounted in an outrigger fashion. A tiltmeter is also mounted on the plumb bob. Total weight of the probe is about 500 kg and the lance is strong enough of the multi-penetrations at each station. An acoustic transponder was mounted on the observation winch wire to track the position of the probe in the water (Ewing type; Photo 3-2-2.1, Figure

3-2-2.1). Distance of each temperature sensor is listed in Table 3-2-2.1. Temperature of sediment and two components of the instrument tilt were measured every 30 seconds.

Photo 3-2-2.1. The heat flow probe.

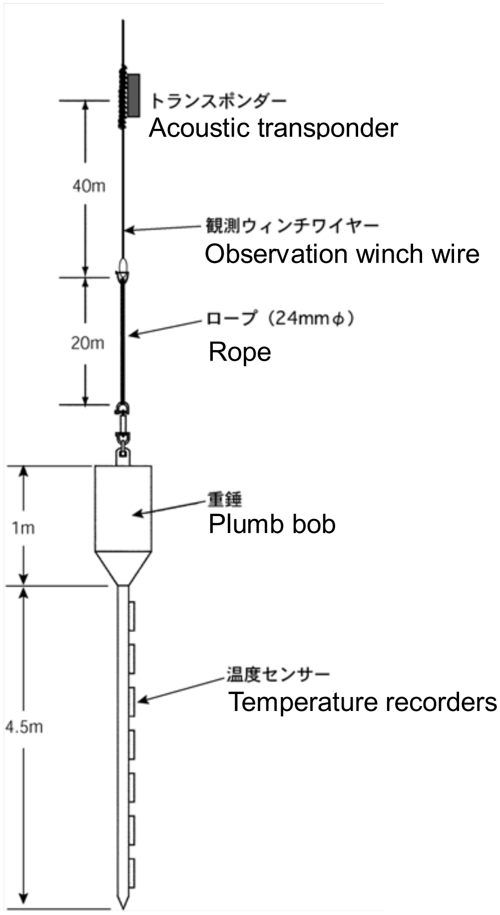

Figure 3-2-2.1. Sketch of the heat flow measurement system.

Table 3-2-2.1. Distance of each temperature censor (cm). From the plumb bob side to the lance tip side, the sensor channels are numbered from 1 to 7, respectively.

	CH1	CH2	CH3	CH4	CH5	CH6	CH7
CH1		64.9	130.2	195.1	260.2	325.5	390.1
CH2	65.0		65.2	130.3	195.4	260.7	325.4
CH3	130.3	65.3		64.9	129.9	195.2	260.0
CH4	195.2	130.3	64.9		64.9	130.3	195.1
CH5	260.2	195.2	129.9	64.9		65.4	130.1
CH6	325.5	260.6	195.2	130.3	65.4		64.8
CH7	390.3	325.4	260.0	195.0	130.2	64.8	

Specifications of the compact temperature recorder are summarized below.

Miniaturized Temperature Data Logger (MTL), ANTARES Datensysteme, GmbH (Photo 3-2-2.2)

Pressure case:	stainless steel
Case length:	160 mm
Diameter:	15 mm
Pressure rating:	6000 m water depth
Number of temperature channel:	1
Temperature resolution:	1.2 mK at 20°C, 0.75 mK at 1°C
Sample rate:	variable from 1 s to 255 min.

Operation

The operation procedure was slightly changed from routine because of the peculiar observation setting, high-density continuous measurement under great water depth.

Photo 3-2-2.2. ANTARES Miniaturized Temperature Data Logger (MTL).

1) The probe is lowered at a winch speed of 30-40 m/min until cable length exceeds 500 m, then winch speed is increased up to 60 m/min.
2) The wire is stopped at the length about water depth minus 120 m.
3) Confirm the transponder depth; adjust the wire length till the probe stop at a depth about 30-50 m above the sea floor, and keep the position for 5-10 minutes to reduce any pendulum motion and to calibrate the thermisters to the water temperature.
4) The wire is reeled out at a maximum speed of 60 m/min until the probe hit the bottom, then stopped about 5 seconds afterwards.
5) Measure the temperatures in sediment for 15 minutes. During measurement, the strain gauge tension meter and the transponder depth should be carefully monitored in case extra wire out is needed.

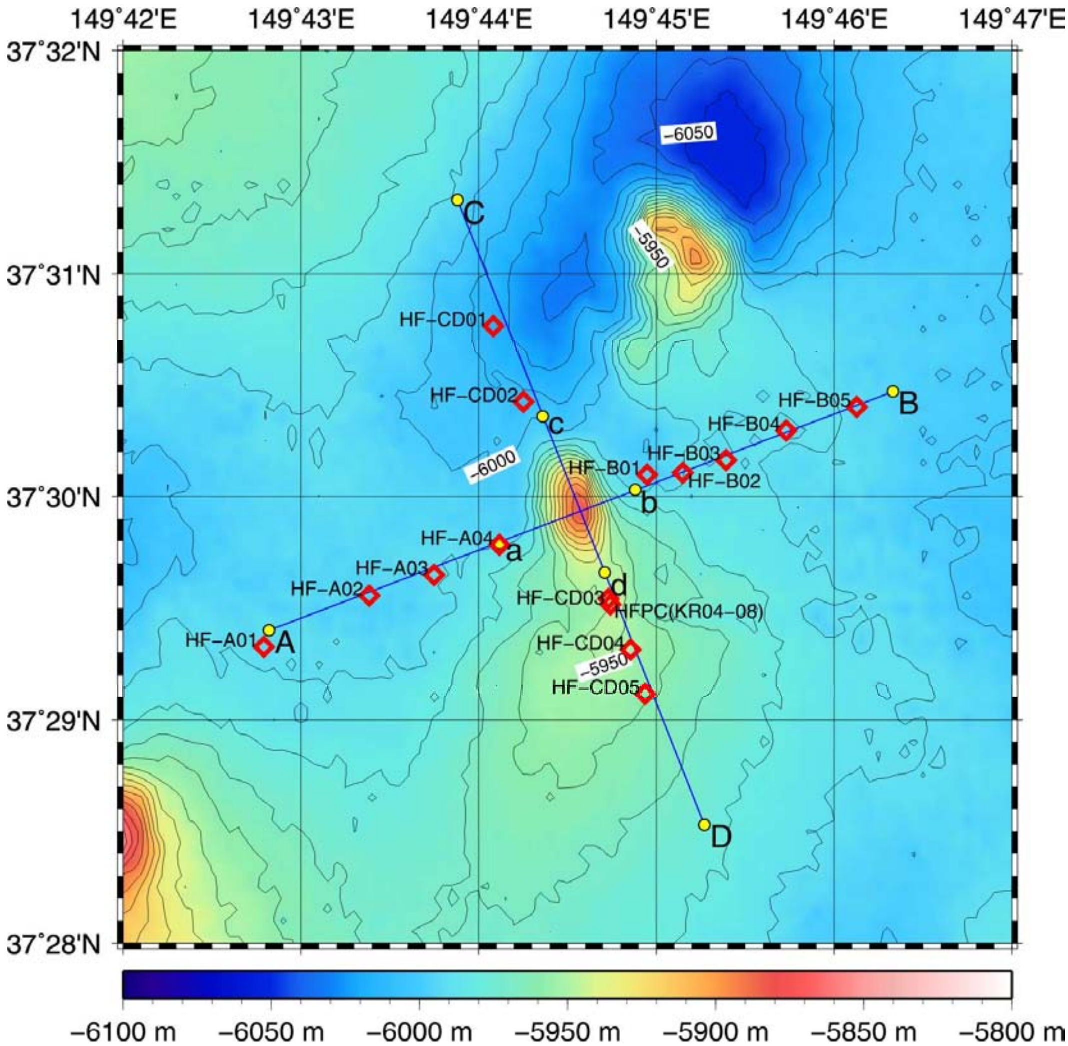

Figure 3-2-2.2. Observation array of the deep-sea heat flow survey on bathymetry map. Topographic high at the center of the array is Yukawa knoll. Diamonds with labels are indicate the site location and name. HFPC is the site that the sediment core and geothermal data were obtained in KR04-08. Sub-Bottom Profiler survey was conducted along AB and CD lines.

6) Rewind the wire at a dead slow speed (10 m/min.).
7) After the probe has lifted off the bottom, keep the winch speed for at least one minute, then increase the wire speed up to 60 m/min.
8) While reeling in the winch about 1200 m, move the ship to the next observation site at the speed of 0.3-0.8 knot. Monitor the strain gauge tension meter and the transponder position, minor adjustment of the ship and the winch speeds are required.
9) When the distance between the ship and the transponder is shortened to about 600 m, reel

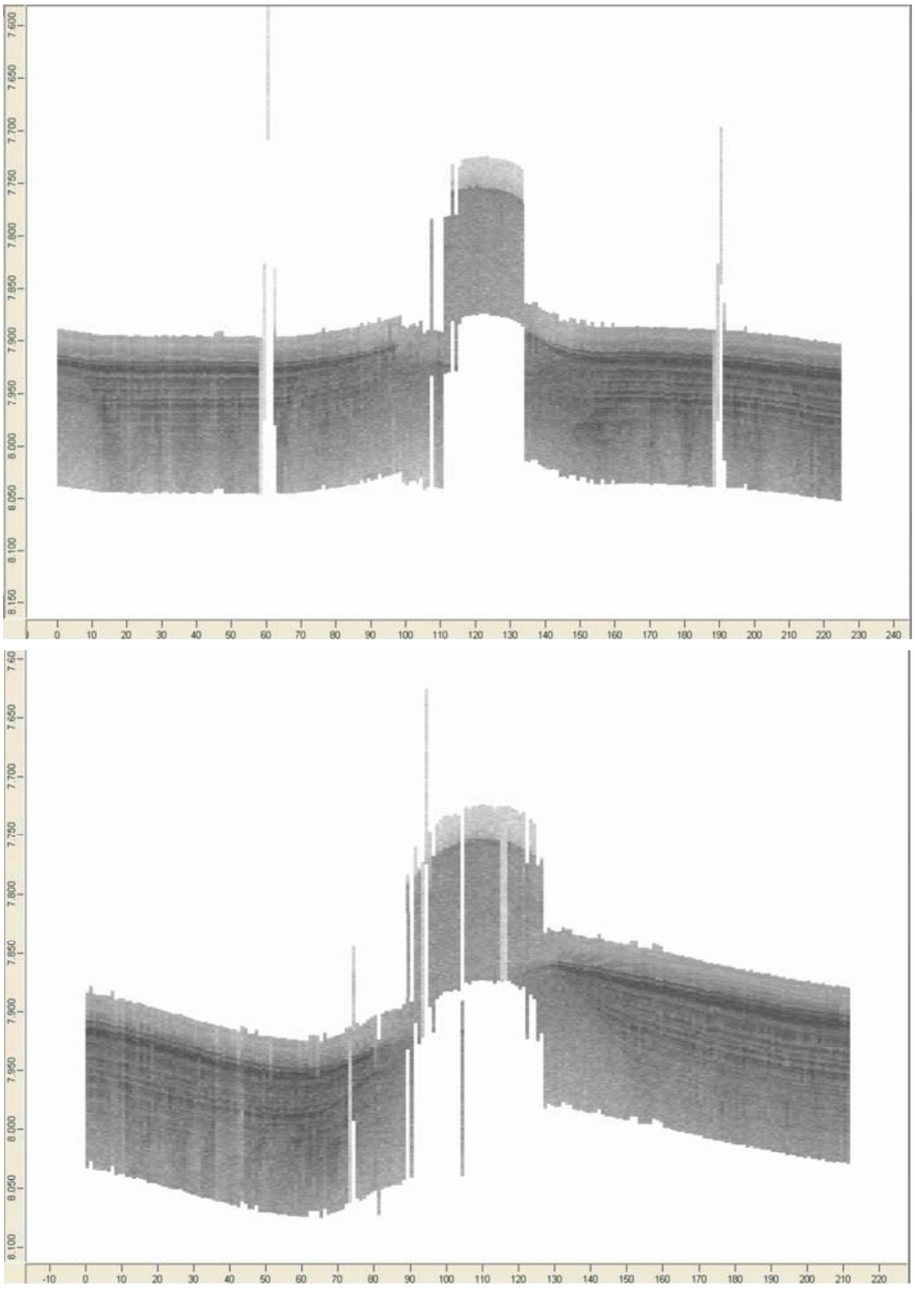

Figure 3-2-2.3. Sub-seafloor structure image for lines AB (top) and CD (bottom) obtained by Sub-Bottom Profiler. The left side is A (C) and the right side is B (D), respectively.

Table 3-2-2.2. Information of the sites and data.

Site	Date	Latitude	Londitude	Depth	Calibration	Measurement	N
HF-A01	1 Aug.	37° 29.325' N	149° 42.790' E	5993 m	09:09 - 09:20	09:22 - 09:38	6
HF-A02	1 Aug.	37° 29.556' N	149° 43.385' E	5994 m	11:47 - 11:53	11:55 - 12:14	5
HF-A03	1 Aug.	37° 29.648' N	149° 43.749' E	5991 m	13:47 - 13:54	13:55 - 14:10	7
HF-A04	1 Aug.	37° 29.784' N	149° 44.117' E	5898 m	15:50 - 15:56	15:57 - 16:13	3
HF-CD01	2 Aug.	37° 30.766' N	149° 44.083' E	6016 m	08:21 - 08:33	08:34 - 08:51	5
HF-CD02	2 Aug.	37° 30.425' N	149° 44.253' E	6010 m	10:23 - 10:28	10:30 - 10:46	6
HF-CD03	2 Aug.	37° 29.516' N	149° 44.742' E	5945 m	13:01 - 13:06	13:08 - 13:24	7
HF-CD04	2 Aug.	37° 29.313' N	149° 44.854' E	5950 m	14:21 - 14:27	14:28 - 14:44	7
HF-CD05	2 Aug.	37° 29.115' N	149° 44.938' E	5960 m	15:34 - 15:39	15:41 - 15:57	6
HF-B01	3 Aug.	37° 30.097' N	149° 44.947' E	5995 m	08:49 - 09:02	09:06 - 09:22	3
HF-B02	3 Aug.	37° 30.105' N	149° 45.148' E	5990 m	10:23 - 10:28	10:29 - 10:45	6
HF-B03	3 Aug.	37° 30.163' N	149° 45.392' E	5985 m	11:28 - 11:34	11:34 - 11:50	5
HF-B04	3 Aug.	37° 30.296' N	149° 45.731' E	5985 m	12:42 - 12:48	12:49 - 13:06	6
HF-B05	3 Aug.	37° 30.401' N	149° 46.128' E	5990 m	14:02 - 14:08	14:09 - 14:30	5

Calibration and measurement time are presented by local time (+10:00).
N is the number of sensors penetrated into sediment

the wire out at a maximum speed of 60 m/min. → back to 2)

Detailed operational logs are presented in Appendix.

Observation and results

The observation array was designed as shown in Figure 3-2-2.2. In advance of the heat flow survey, sediment structure along the lines AB and CD was investigated by Sub-Bottom Profiler. Stratified structure is clearly imaged in the foot of Yukawa knoll (Figure 3-2-2.3), thus the heat flow survey was implemented in the lines Aa, CD, and bB (total 14 sites), respectively on Aug. 1st, 2nd, and 3rd. The heat flow probe was penetrated into the seafloor sediments for all the sites. The information of the site and data are listed in Table. 3-2-2.2. The obtained row data are plotted in Figure 3-2-2.4. Preliminary analysis shows that the most of the geotherm profiles appear to be linear. Heat flow is obtained as the product of geothermal gradient and thermal conductivity. In this cruise, only geothermal gradients were observed by using the heat flow probe. Thermal conductivity was measured from a sediment core that was obtained in the vicinity by piston coring in KR04-08 and its value may be applied for the calculation of the heat flow.

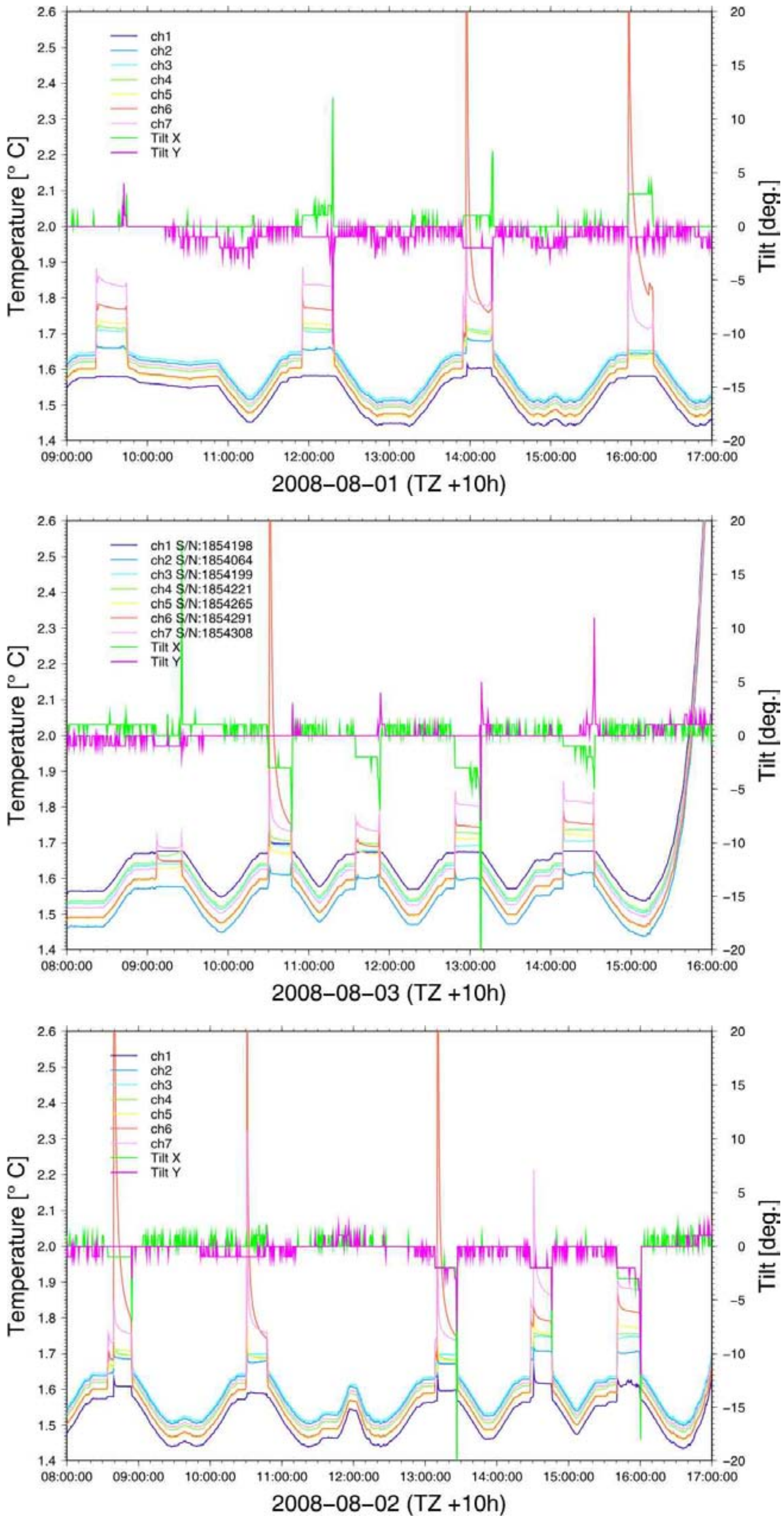

Figure 3-2-2.4. Raw data of the temperature and the instrumental tilt for line Aa, bB, and CD, from the top to the bottom.

3-2-3. Seafloor magnetotelluric survey

K. Baba

Magnetotelluric (MT) soundings provide us an image of electrical feature of Earth's interior. Because electrical conductivity of the mantle materials is strongly dependent of temperature, partial melt, and volatiles such as water, electrical conductivity structure models estimated through seafloor MT surveys are definitely useful to discuss where the source of the petit-spot volcanic activity is and its relation to the mantle dynamics. For these objectives, we have carried out a seafloor MT experiment using ocean bottom electromagnetometers (OBEMs) since 2005. We have acquired available data from seven sites so far. In the previous cruise, KR07-06, we deployed three OBEMs. The OBEMs have measured electromagnetic field variation for one year. In this cruise, we attempted to recover the OBEMs deployed in KR07-06 cruise. The OBEM array which includes the sites that the data were collected in previous experiments covers a thousand km square of the northwestern Pacific (Figures 3-1-1.1, 3-2-1.1). The sites extend the existing survey area to the south and east, which we intended to get reference structure less affected by the plate flexure. Joint analysis of these data will allow us to image the asthenospheric conductivity structure and to discuss the extent of the melt generation field.

<u>Instruments</u>

The OBEMs are made by Tierra Tecnica Ltd., which can measure time variations of three components of magnetic field, horizontal electric field, the instrumental tilts, and temperature. The resolutions are 0.01 nT for flux-gate magnetometer, 0.305 μV for voltmeter, 0.00026 degrees for tiltmeter, and 0.01°C for thermometer. There are two types of instrumental design (Photo 3-2-3.1). Type 1 OBEM equips three glass spheres housing Benthos acoustic transponder, the electromagnetometer, and a Lithium battery pack for the electromagnetometer, respectively. Type 2 OBEM is an improved version of type 1, which equips two glass spheres.

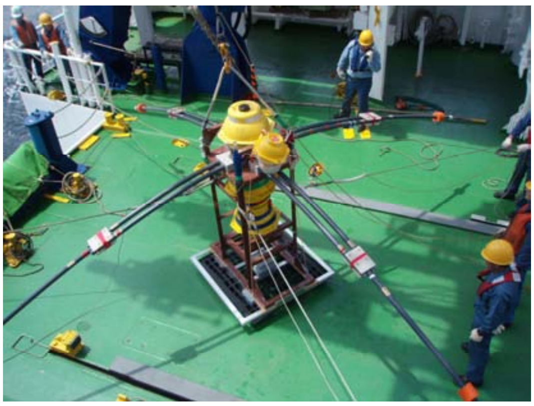
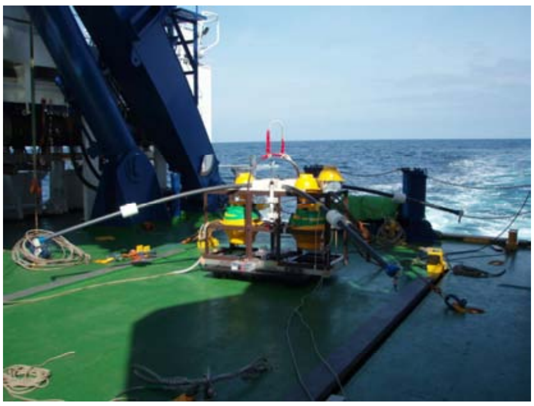

Photo 3-2-3.1. Type 1 OBEM (left) and type 2 OBEM (right).

Table 3-2-3.1. Information of the OBEMs.

Site	EM01	EM02	EM03
OBEM ID	JM7	JM8	TT3
Launched position	35° 38.4574' N 154° 49.1102' E	34° 01.0483' N 150° 37.9962' E	36° 25.8345' N 147° 00.7928' E
Settled position	35° 39.0379' N 154° 48.7279' E	34° 01.5747' N 150° 37.5402' E	36° 26.0197' N 147° 01.1318' E
Depth	5446 m	5964	5622 m
Sampling interval	60 s	60 s	60 s
Dipole length (N-S)	5.19 m	5.21 m	6.38 m
Dipole length (E-W)	5.20 m	5.22 m	6.38 m
Time for clock reset to GPS (TZ ±0h)	2007-05-12 02:42:31	2007-05-09 05:01:29	2007-05-07 10:26:18
Time for recording start (TZ ±0h)	2007-05-16 14:59:00	2007-05-14 14:59:00	2007-05-12 14:59:00
Time for clock check (TZ ±0h)	2008-08-05 01:31:02	2008-08-09 23:59:04	N/A
Clock shift (OBEM-ref)	+ 14 s	+ 46 s	N/A
Acoustic system	Kaiyo Denshi	Nichiyu Giken	Benthos
frequency (Tx, ship side)	10.0 kHz	9.6~10.9 kHz	9.0 kHz
frequency (Rx, ship side)	13.5 kHz	10.24 kHz	12.0 kHz
Release command	3C-1	3-H	F
Radio beacon	NOVATECH	NOVATECH	Taiyo Musen
frequency	159.3 MHz	159.2 MHz	43.528 MHz
ID	N/A	N/A	JS1105
Flash light	NOVATECH	NOVATECH	Taiyo Musen

An acoustic transponder and the battery pack are put together in one glass sphere. We have one type-1 OBEM (TT3) and two type-2 OBEMs (JM7 and JM8). All the OBEMs mount a radio beacon, a flash light, and a catching buoy for easy recovery. See Table 3-2-3.1 for detail of the site and instrument information.

<u>Recovery of the OBEMs</u>

Two of the OBEMs JM7 at site EM01 and JM8 at site EM02 were successfully recovered on Aug. 5th and Aug. 10th, respectively. After sending weight-release command, slant range between the ship and OBEM and ship's position were measured and ascent rate was calculated. By tracking the OBEM, its surface time was accurately predicted. And, it was quickly found with the ship looking into the direction of radio beacon signal immediately after the surfacing. The OBEM were hooked by using a work boat and pulled around the stern, and then lifted on deck using the A-frame and a capstan. The average ascent rates were 37.0 m/min. for JM7 and 34.9 m/min. for JM8, respectively.

The recovery of OBEM TT3 at site EM03 was attempted on Jul. 29 but it was failed. The

OBEM never responded to the acoustic signal from the ship. The weight-release command was sent four times (14:44, 14:49, 14:54, and 14:59; local time, GMT+10:00). The ascending time was predicted between 17:20 and 18:00 for the ascending rate ~35 m/min. and the water depth of 5622 m. We searched the OBEM until 21:00 but could not find it. The radio beacon signal was not catch because of failure of direction finder. We could not find the flashing light mounted on the OBEM. The OBEM may be drifted and lost if the OBEM was successfully

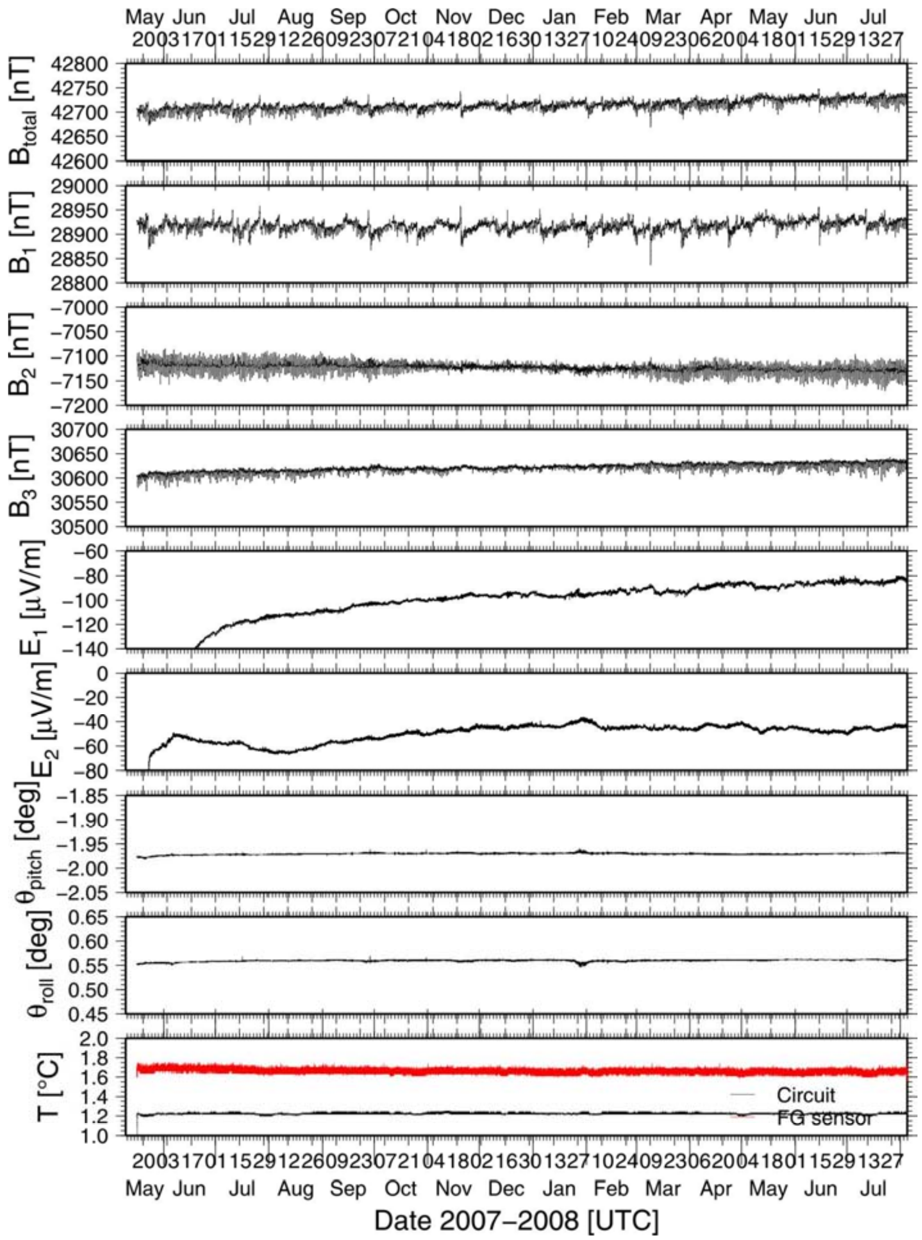

Figure 3-2-3.1. Raw time series data obtained by OBEM JM7 at site EM01. From the top to the bottom, Total magnetic intensity calculated from the three components, three components of the magnetic field, two components of the electric field, two components of the instrumental tilt, and temperatures on the flux gate sensor and circuit, respectively.

released. Otherwise, the OBEM may be still on the seafloor because of failure of the acoustic unit.

Data status

The recovered OBEMs were first calibrated for their clocks. Internal clock was compared with the clock of a laptop computer shift which was adjusted with the GPS time in advance (Table 3-2-3.1). The obtained time shift information will be used for the correction of the time-stamp of the data in analysis. The data were directly copied from the compact flash memory of the OBEM to a hard disk of a computer although the data may be downloaded

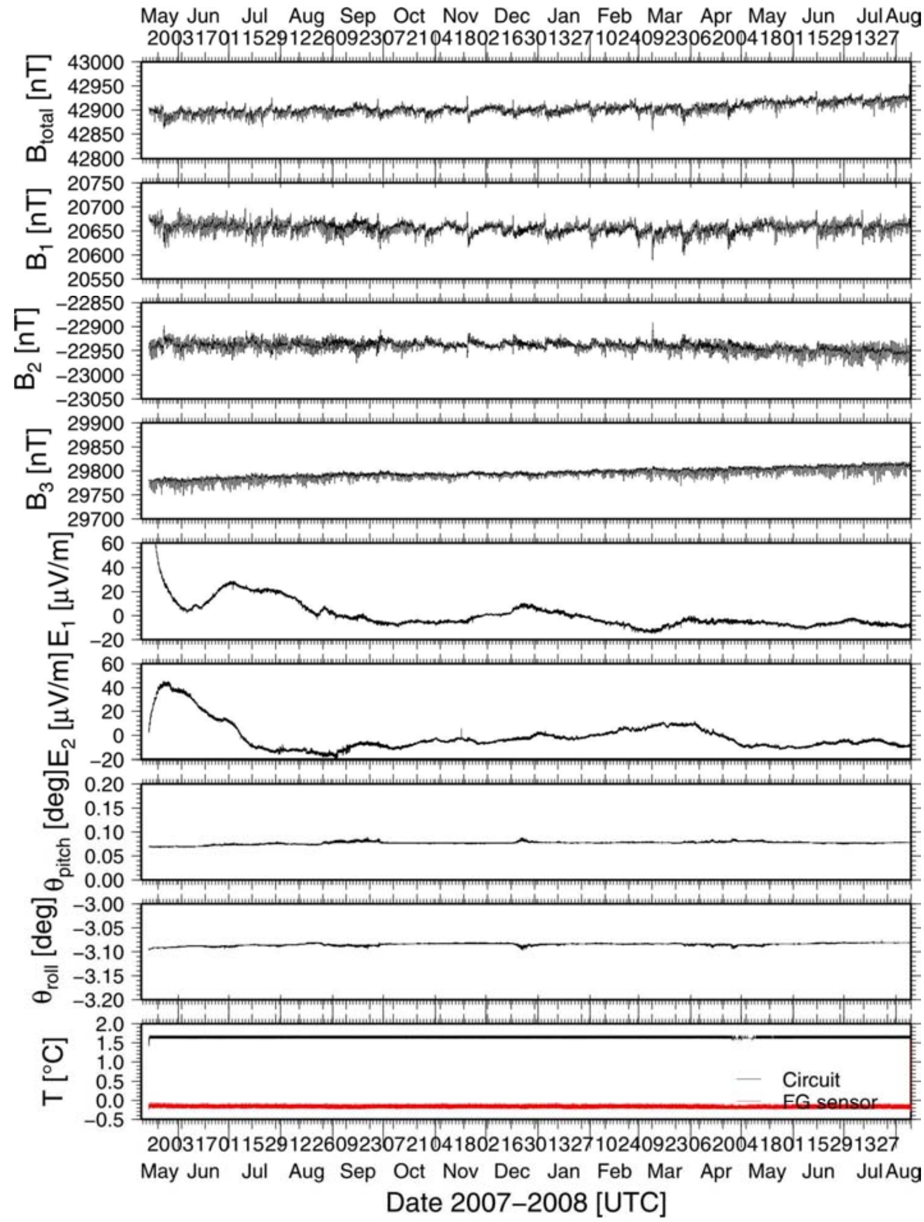

Figure 3-2-3.2. Raw time series data obtained by OBEM JM8 at site EM02. The plotted contents are the same as Figure 3-2-3.1.

through USB communication. Both the OBEMs JM7 and JM8 successfully recorded the data for about 15 months. The raw time series data is plotted in Figure 3-2-3.1 and 3-2-3.2. The quality of magnetic field is good and the electric field is moderate for both the OBEMs.

Future work

The data will be analyzed based on the MT method. The obtained MT responses will be inverted together with the responses that were obtained by previous experiments. I will interpret the electrical conductivity model of the upper mantle obtained by the inversion analysis and contribute on the discussion of the melt generation field of the petit-spot.

3-2-4. Seismological observation

A. Shito & A. Ito

Recovery of BBOBS

We arranged broadband ocean bottom seismographs (BBOBS) array to enclose both Yukawa-Kaikyu and recent seismicity, and deployed three BBOBS at sites S01, S02 and S04 successfully in May 2007 during the KR07-06 cruise (Figure 3-2-4.1, Table 3-2-4.1). We notice that S04 station was renamed to S03 station after the Kairei cruise.

The YK08-09 cruise was planned to recover the BBOBS at S01-S03 by the self pop-up

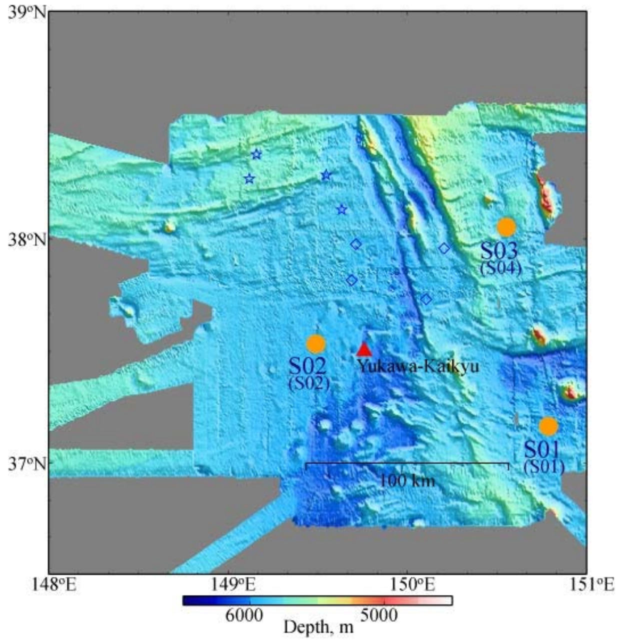

Figure 3-2-4.1. BBOBS array. Circles indicate BBOBS sites. Stars indicate epicenters located JMA. Diamonds are epicenters relocated by using local velocity structure for Northwestern Pacific determined by Fukano *et al.* (2007). A triangle indicates the location of Yukawa-Kaikyu.

Table 3-2-4.1. BBOBS location.

	Settled Position		
Station	Latitude	Longitude	Depth
S01	37° 09.8815' N	150° 47.2048' E	5987.5 m
S02	37° 31.8902' N	149° 29.4093' E	5880.7 m
S03(S04)	38° 03.0029' N	150° 33.0911' E	5776.4 m

method. The release command was sent to detach an anchor from BBOBS, which make BBOBS floating up by buoyancy and the recovery of the existing three BBOBS was successfully made.

Examples of retrieved seismograms

All BBOBS were equipped with three-component sensor (Guralp, CMG-3T), and two of them at S01 and S02 were installed Differential Pressure gauge. We set the recording period to be 13 months from May 2007 to June 2008 at all the sites before the deployments. Thirteen month long continuous waveform data are stored in hard disks successfully and of high quality at S02 and S04 as planned, while vertical component data at S01 are not available for 11months because of a trouble in the sensor control unit. At site S01, one of horizontal component data are not obtained for 2 months either. The causes of the failure are still not clarified.

Figures 3-2-4.1, 3-2-4.2 and 3-2-4.3 show the background noise spectrum of seismographic data at each site for a day, 20th May 2007. We also show the running spectrum throughout observation period in Figure 3-2-4.5 to 3-2-4.13. Examples of waveform data from a global and local event are shown in Figure 3-2-4.14 and Figure 3-2-4.15, respectively.

Reference

Fukano, T. M. Shinohara, K. Nakahigashi, T. Yamada, K. Mochizuki, T. Kanazawa, E. Araki, and K. Suyehiro (2007), Crust and upper mantle velocity structure beneath Northwestern Pacific basin inferred from borehole OBS and OBS data, *23th Shinkai Symposium Abstract,* PS04.

Acknowledgements

We are extremely grateful for helpful advices provided Drs. H. Shiobara, Y. Fukao, and D. Suetsugu. We used BBOBS designed by Drs. T. Kanazawa and H. Shiobara (Earthquake Research Institute, Univ. of Tokyo). We here thank to their great efforts.

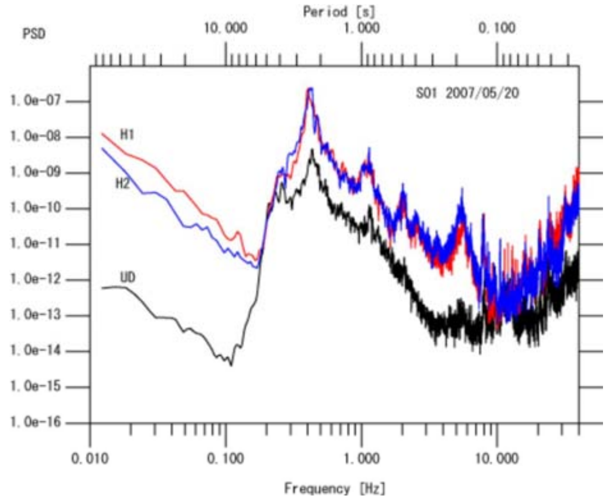

Figure 3-2-4.2. Background noise spectrum at site S01. Black, red and blue lines indicate vertical and two horizontal data, respectively.

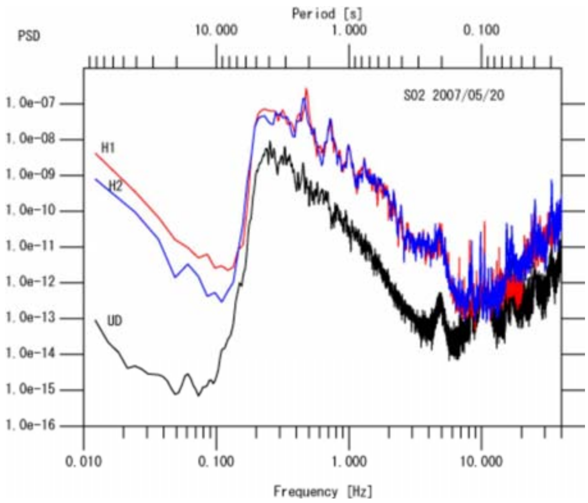

Figure 3-2-4.3. Background noise spectrum at site S02.

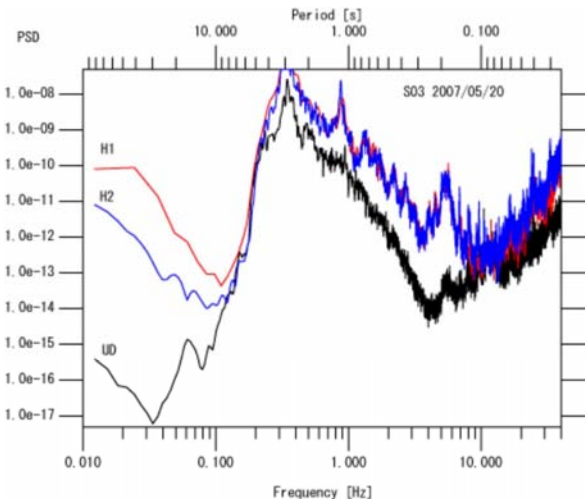

Figure 3-2-4.4. Background noise spectrum at site S03.

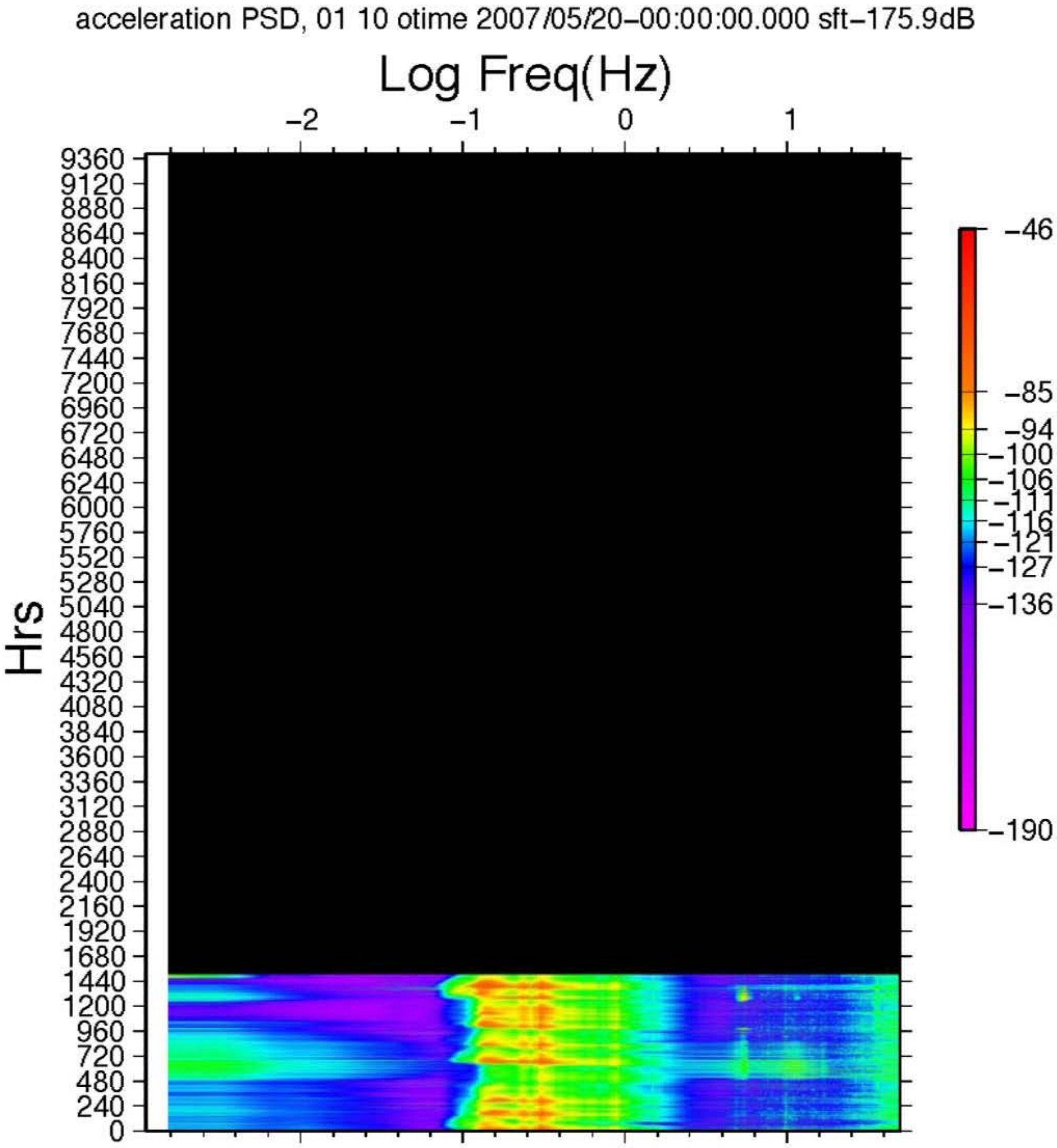

Figure 3-2-4.5. Running spectrum of vertical component data at S01 throughout observation period. Vertical axis denotes elapsed time in hour from the start time of observation.

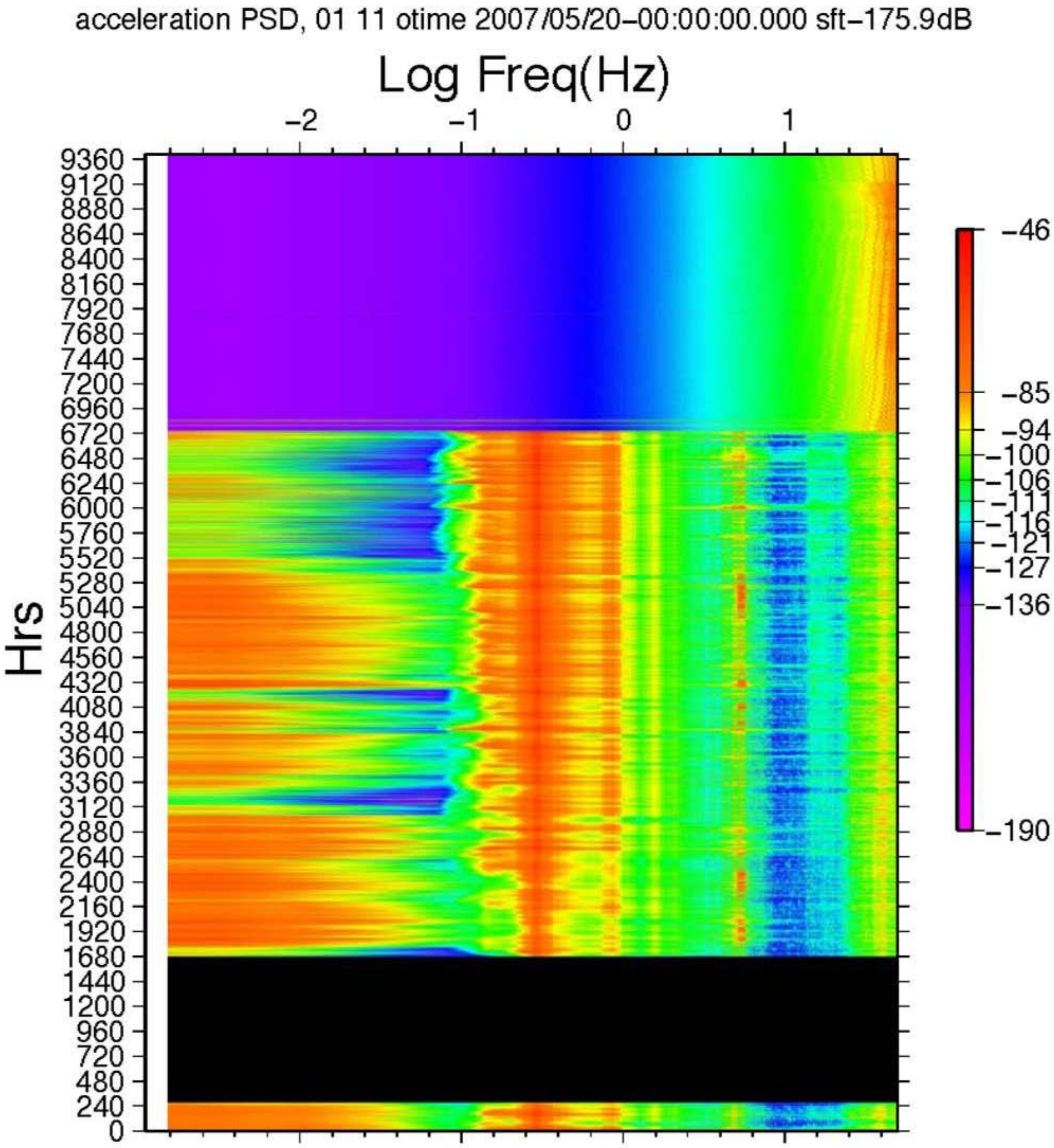

Figure 3-2-4.6. Running spectrum of horizontal component data at S01 throughout observation period.

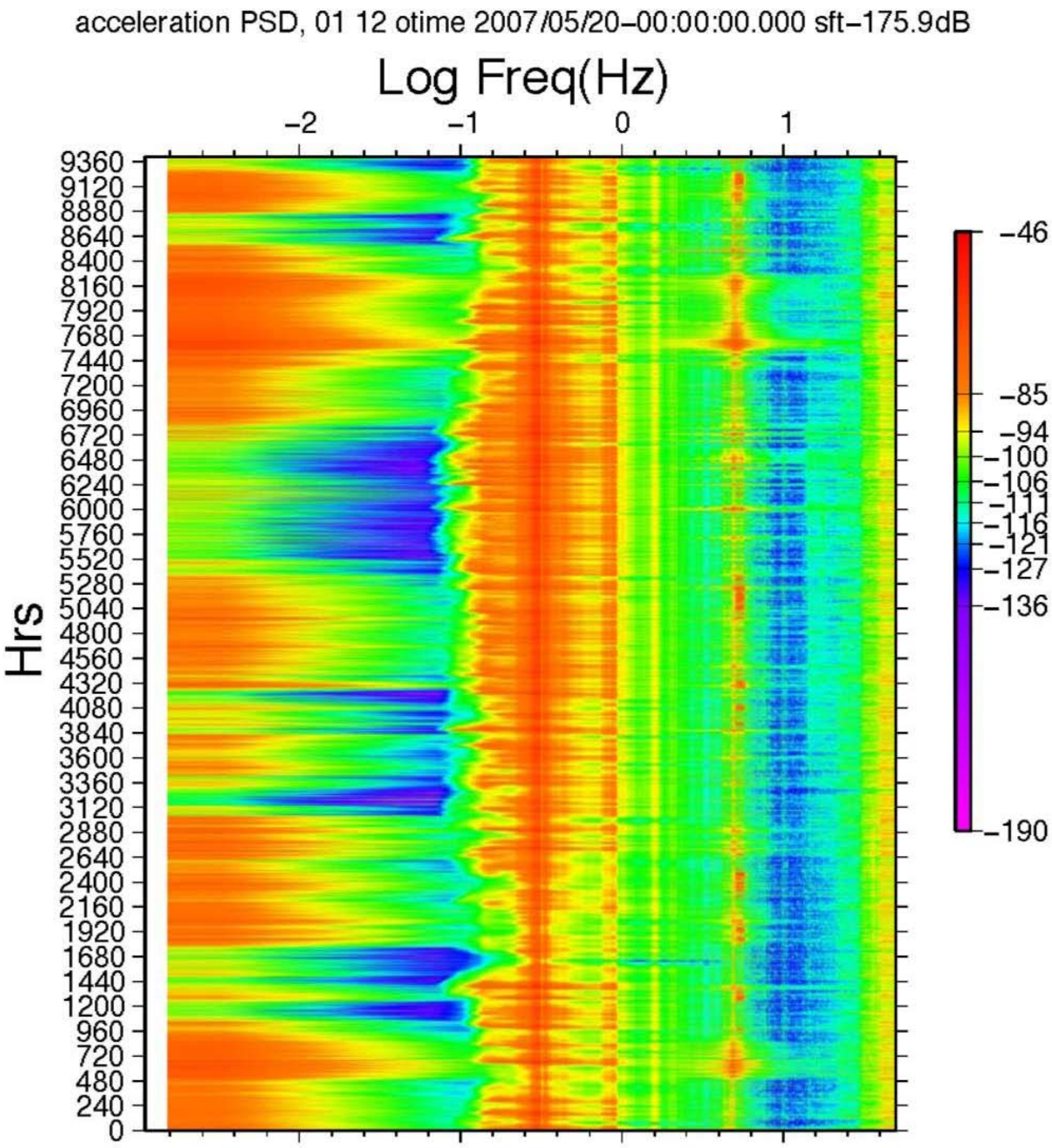

Figure 3-2-4.7. Running spectrum of horizontal component data at S01 throughout observation period.

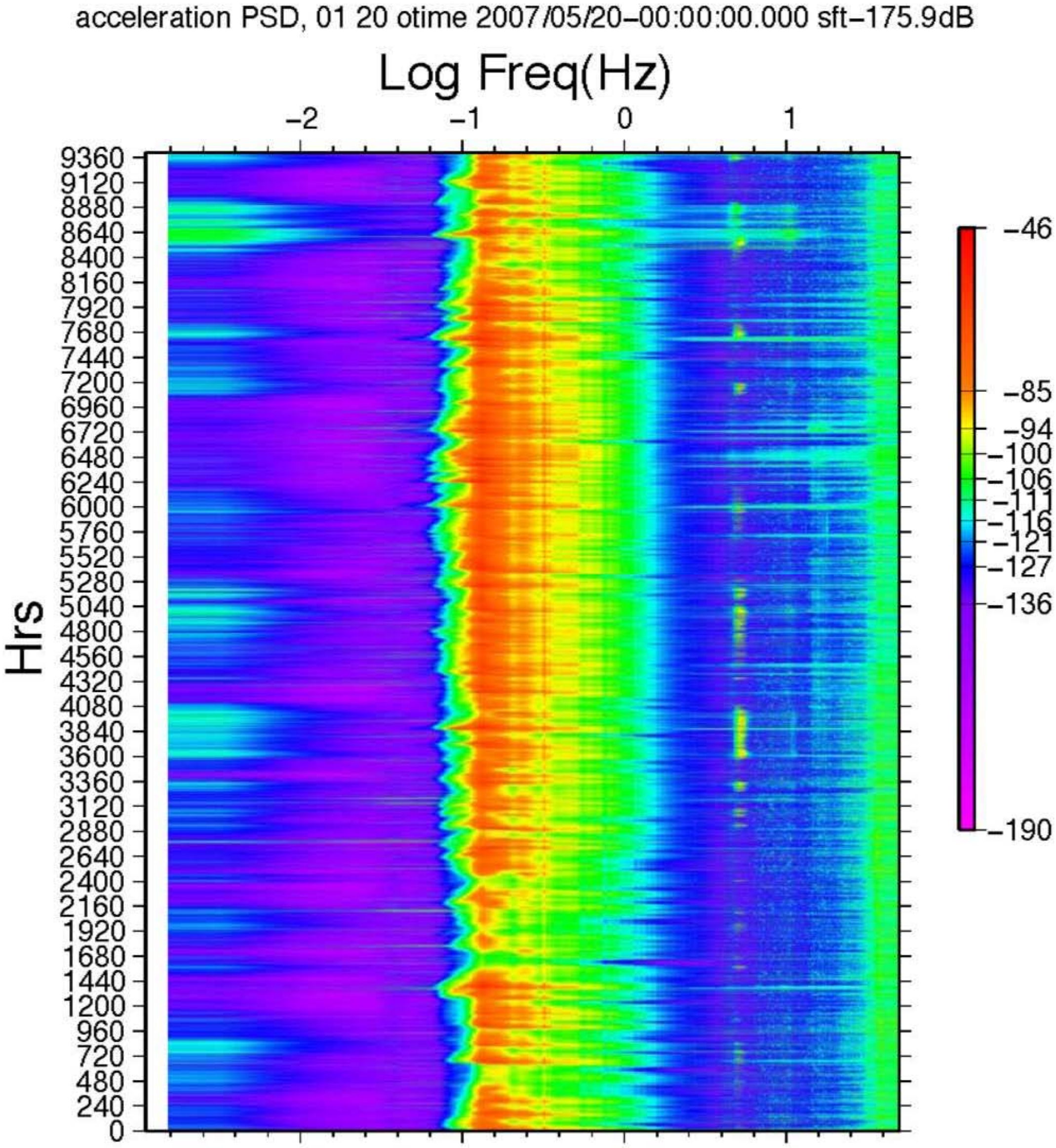

Figure 3-2-4.8. Running spectrum of vertical component data at S02 throughout observation period.

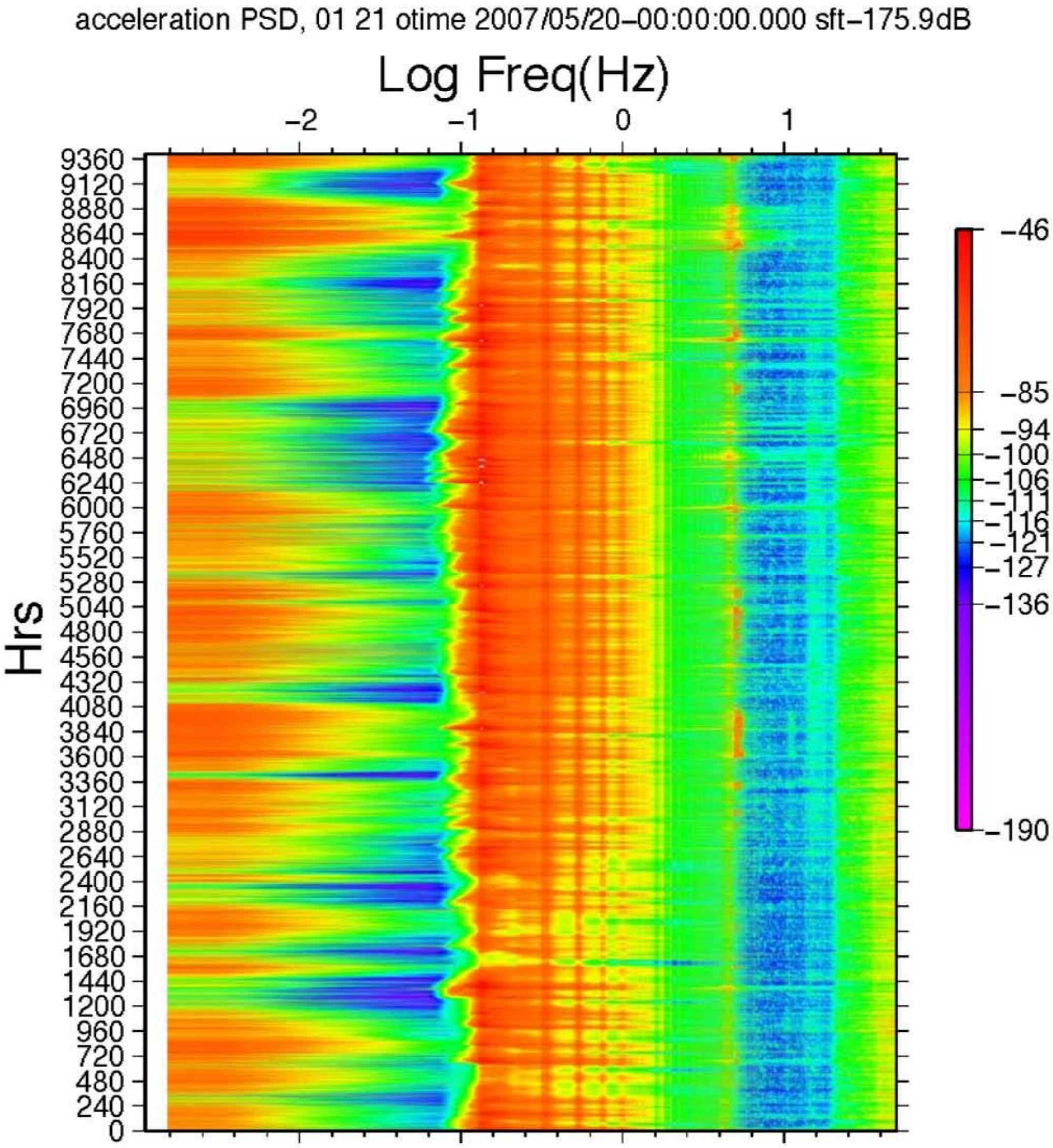

Figure 3-2-4.9. Running spectrum of horizontal component data at S02 throughout observation period.

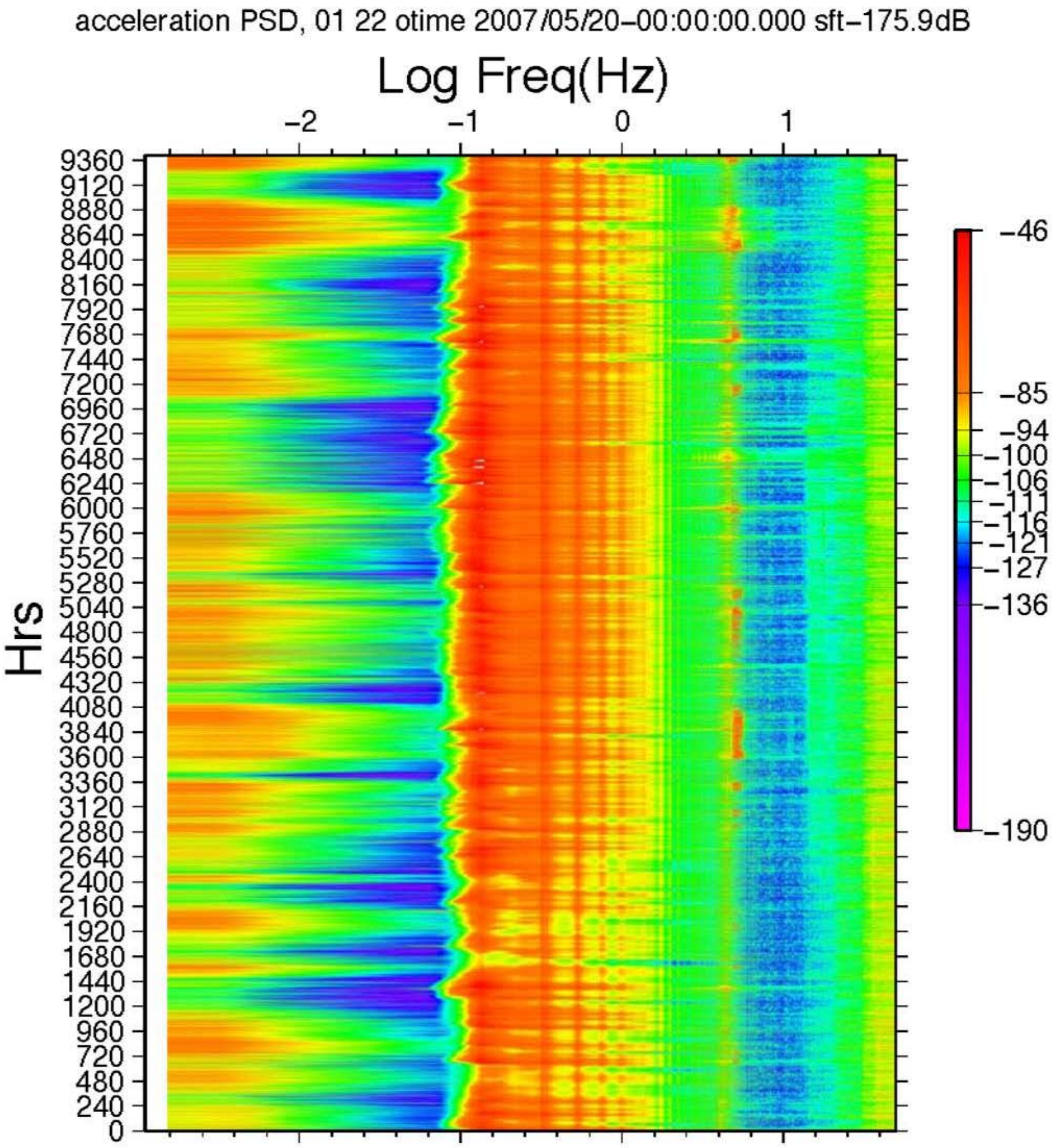

Figure 3-2-4.10. Running spectrum of horizontal component data at S02 throughout observation period.

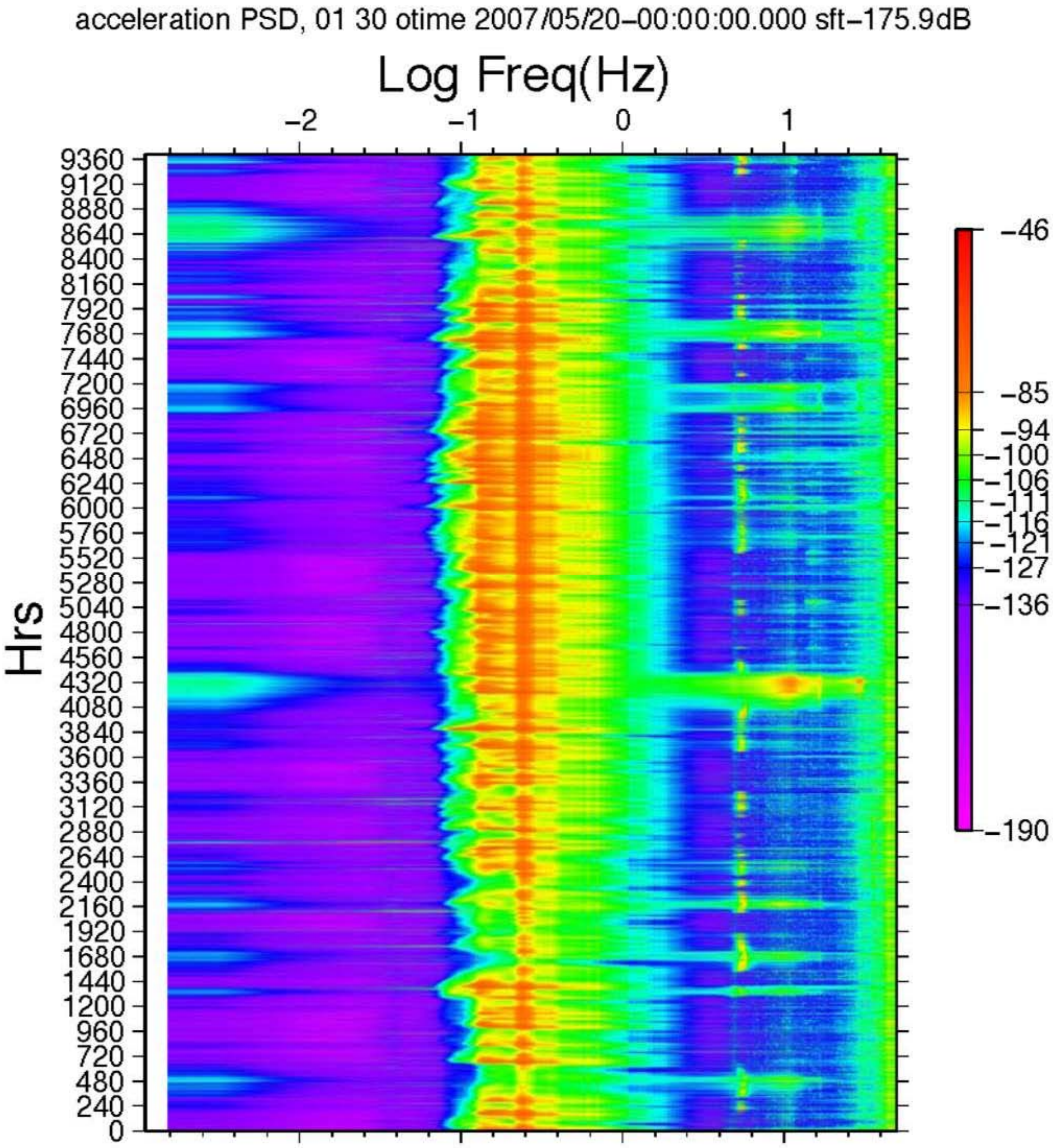

Figure 3-2-4.11. Running spectrum of vertical component data at S03 throughout observation period.

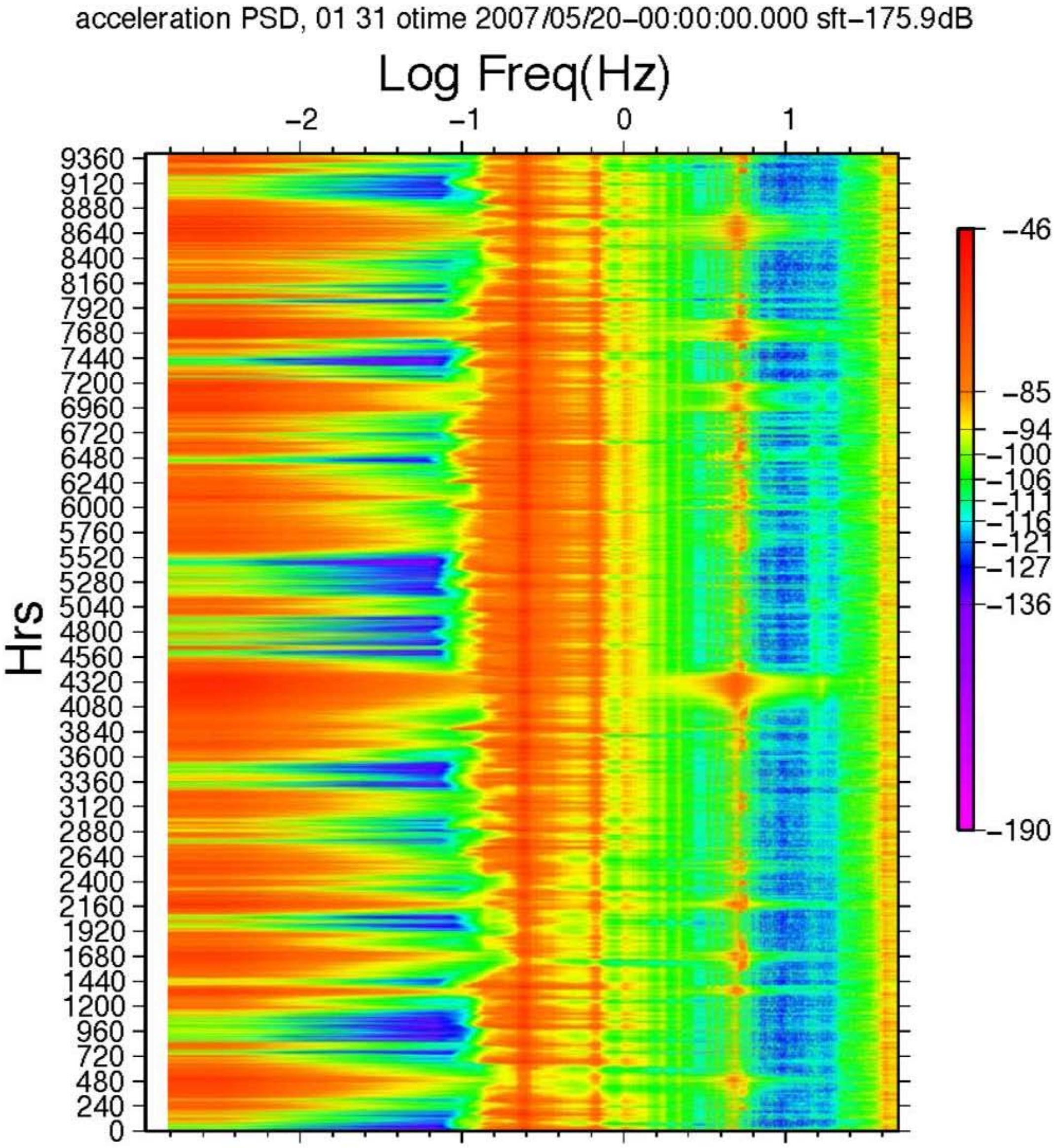

Figure 3-2-4.12. Running spectrum of horizontal component data at S03 throughout observation period.

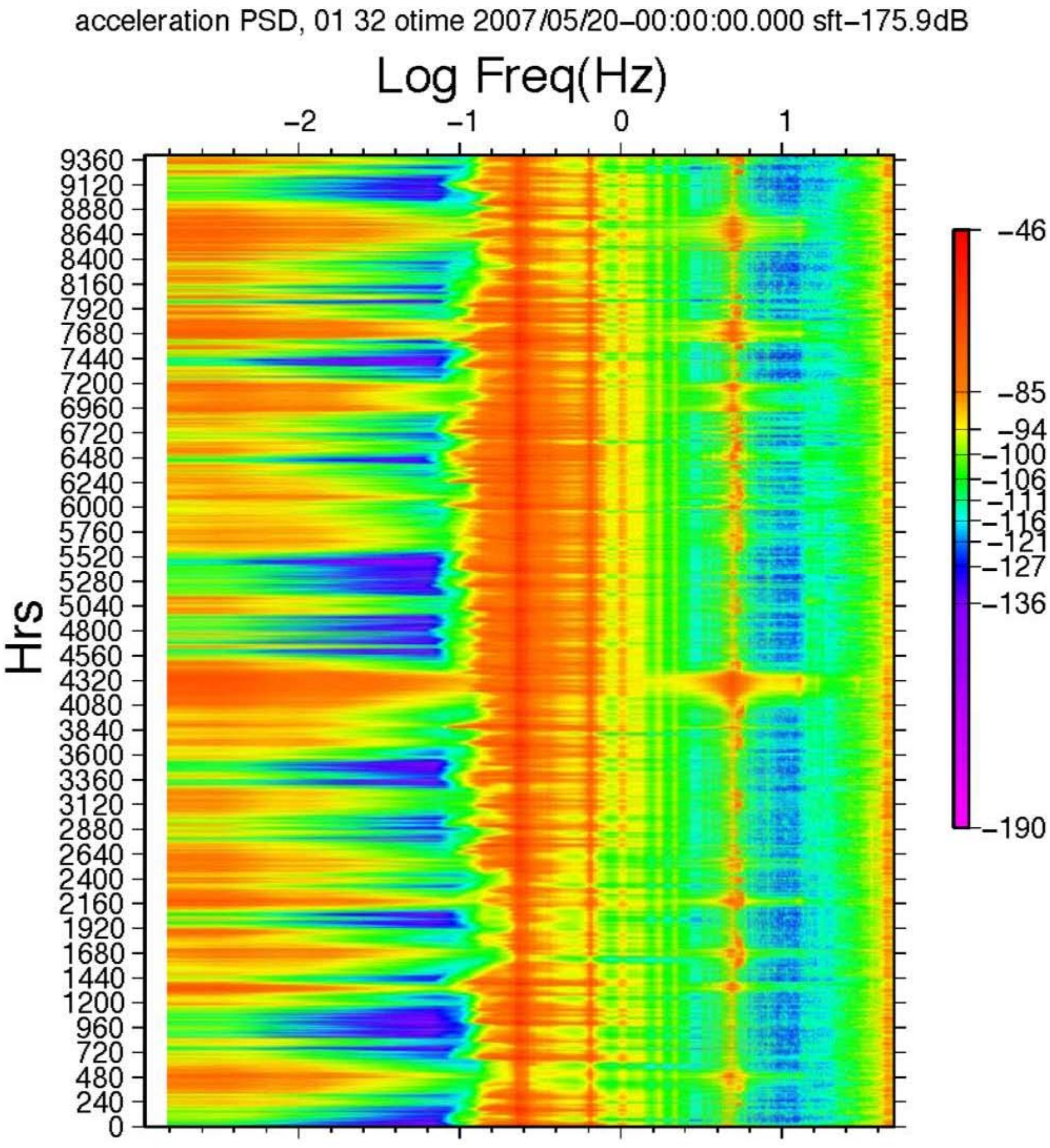

Figure 3-2-4.13. Running spectrum of horizontal component data at S03 throughout observation period.

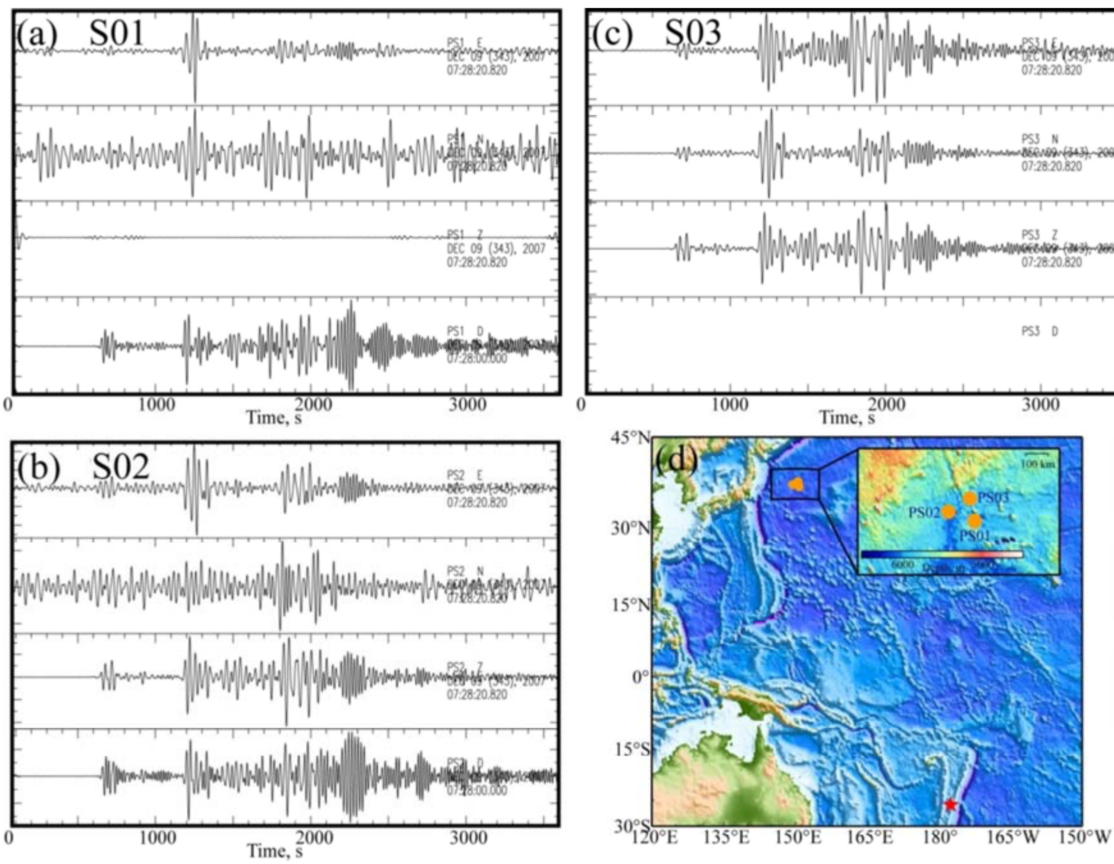

Figure 3-2-4.14. Examples of waveform data from a global event. (a-c) Waveforms recorded at BBOBS stations S01, S02, and S03, which are band-pass filtered from 0.02 to 0.05 Hz. (d) Map showing location of the event (star) and stations (circles). The event is located in the Tonga subduction zone at the depth of 152 km, and the magnitude is Mw 7.8 (from USGS-PDE catalogue).

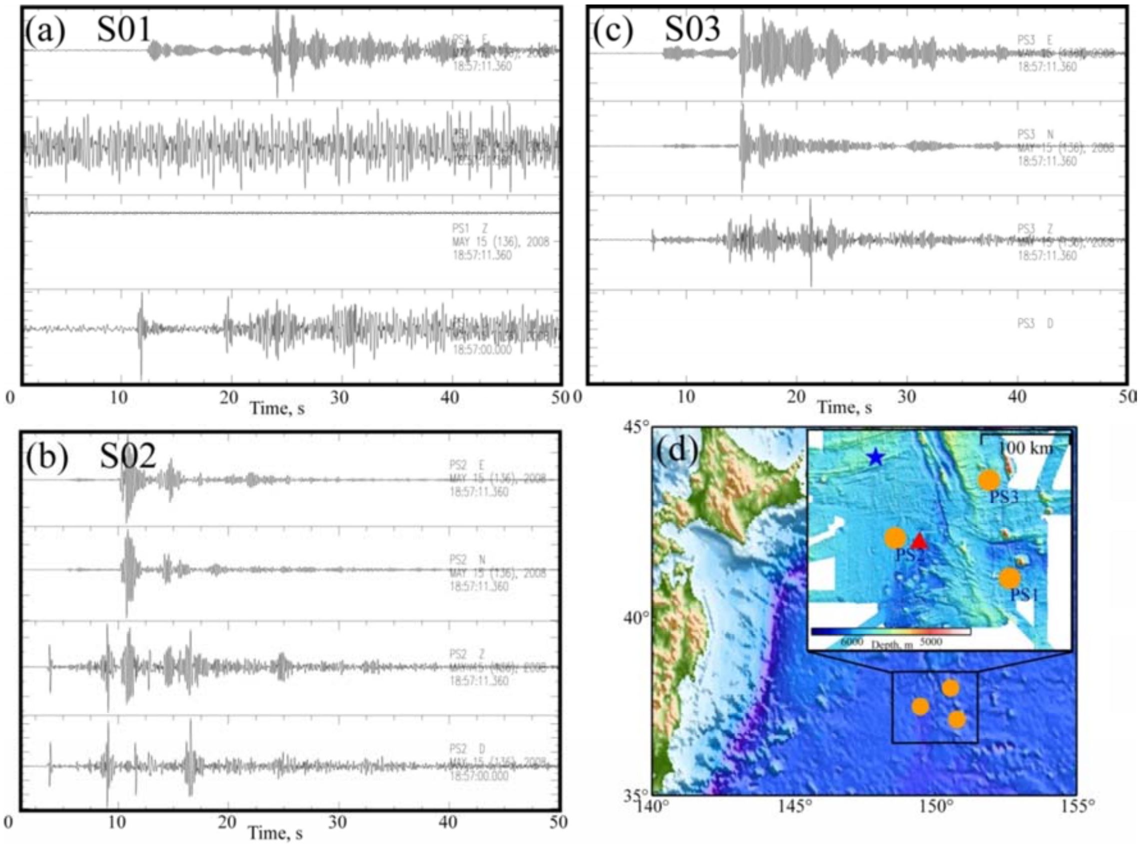

Figure 3-2-4.15. Examples of waveform data from a local event. (a-c) Waveforms recorded at BBOBS stations S01, S02, and S03, which are band-pass filtered from 5.0 to 10.0 Hz. (d) Map showing location of the event (star) and stations (circles). The event is located in Petit-spot region at the depth of 43 km, and the magnitude is M_{JMA} 3.7 (from JMA catalogue). A triangle indicates Yukawa-Kaikyu.

3-2-5. Dredges

M. Nakanishi, N. Abe, & K. Shimizu

Dredging was operated at the three sites during YK08-09 (Figure 3-2-1.1). The assemblages of the dredge used during YK08-09 are illustrated in Figure 3-2-5.1. The system consists of the winch wire, lead wire, chain, weight, pipe dredge, fuse linker, life wire, and chain-bag dredge. The square type dredge, the Nalwalk style, consists of a box type jaw (60 x 45 cm mouth, 60 x 27 cm throat), a handle, 26 mm in diameter and 85 cm long, and steel chain-bag, 100 cm long, and box type bucket, which dimension is 27 x 60 x 50 cm and is made from stainless steel plate, 5 mm thick.

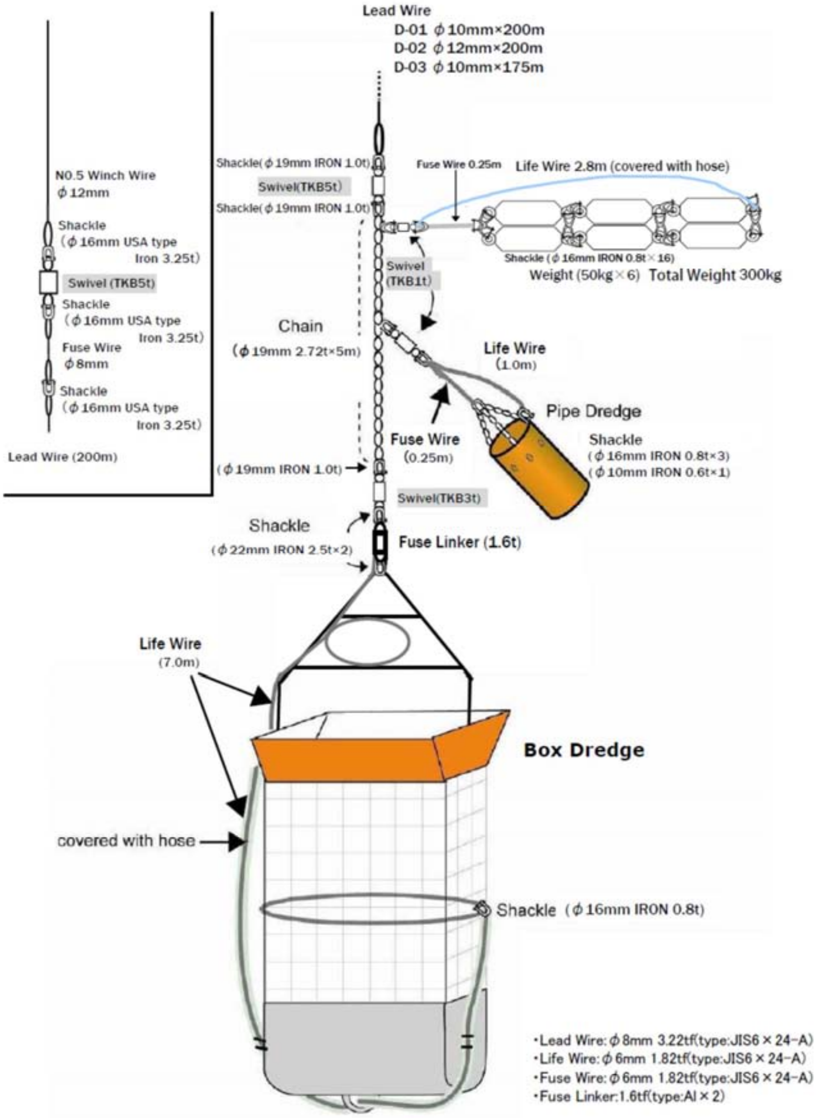

Figure 3-2-5.1. Assemblage of the dredge system.

Dredge sample descriptions

Only manganese nodules, manganese crusts and some allochthonous pumices were sampled by three times dredges during YK08-09 cruise. These rocks are not the target samples of our research. However, several manganese nodules possibly include highly altered basic rocks as their cores (Photo 3-2-5.1). They may be able to use some geochemical study, but we are not sure. It is unable to describe these samples without thin section observations and such detail analyses. Rock sample descriptions will be completed when thin section observations are taken after cruise although preliminary descriptions are attached below.

Photo 3-2-5.1. Representative rock samples taken by dredges during YK08-09. Some of these grayish and yellowish cores included in manganese nodule (black crusts) might be able to use geochemical analyses.

YK08-09 D01 – R001

Aug. 8, 2008
Described by Abe

Sample Size: X= 9 cm, Y= 5 cm, Z= 2.5 cm
Weight: 100 g
Mn coating: 6 mm
Color (inside): brownish gray, brown
Alteration: no weak strong
Vesicularity: 0 %
Lithology: monomict or polymict
Occurrence: massives lavas volcaniclastics sediments others

SKETCH

Igneous & Ultramafic Rocks

Volcanic: basalt basaltic andesite andesite dacite rhyolite
Thickness of glass: --- mm
Phenocrysts= --- %, %, %
Plutonic: gabbro diorite quartz diorite granite
Crystals= %, %, %
Ultramafic: lerzolite harzburgite dunite pyroxenite others
Crystals= %, %, %
Others:

Sedimentary rocks & others (characteristic of the clasts)

Fragments comp.: mono or poly
Rock type:
Grain size (mm): < 1 – 2 – 4 – 8 – 16 – 32 – 64 – 128 – 256 <
Sorting: well--------------------------------poorly
Roundness: round------------------------------angular
Fabric: clast-support ----------------- matrix support
Grading: normal---------------none----------------reverse
Matrix: silt sand others:
Lithic: Lithified or unlithified

Remarks Mn nodule

YK08-09 D02 – R001

Aug. 13, 2008
Described by Shimizu

Sample Size: X= 8 cm, Y= 6 cm, Z= 5 cm
Weight: 250 g
Mn coating: 20 mm
Color (inside): green
Alteration: no weak strong
Vesicularity: %
Lithology: monomict or polymict
Occurrence: massives lavas volcaniclastics sediments others

SKETCH

Igneous & Ultramafic Rocks

Volcanic: basalt basaltic andesite andesite dacite rhyolite
Thickness of glass: mm
Phenocrysts= %, %, %
Plutonic: gabbro diorite quartz diorite granite
Crystals= %, %, %
Ultramafic: lerzolite harzburgite dunite pyroxenite others
Crystals= %, %, %
Others:

Sedimentary rocks & others (characteristic of the clasts)

Fragments comp.: mono or poly
Rock type:
Grain size (mm): < 1 – 2 – 4 – 8 – 16 – 32 – 64 – 128 – 256 <
Sorting: well--------------------------------poorly
Roundness: round------------------------------angular
Fabric: clast-support ----------------- matrix support
Grading: normal---------------none----------------reverse
Matrix: silt sand others:
Lithic: Lithified or unlithified

Remarks Mn nodule
mud stone

YK08-09 D03

Aug. 14, 2008
Described by Shimizu

Sample Size: X= 5 cm, Y= 4 cm, Z= 1.5 cm (maximum)
Weight: ___________ g
Mn coating: ___________ mm
Color (inside): ___________
Alteration: no weak strong
Vesicularity: ___________ %
Lithology: monomict or polymict
Occurrence: massives lavas volcaniclastics sediments others

SKETCH

Igneous & Ultramafic Rocks

Volcanic: basalt basaltic andesite andesite dacite rhyolite
Thickness of glass: ___________ mm
Phenocrysts= %, %, %
Plutonic: gabbro diorite quartz diorite granite
Crystals= %, %, %
Ultramafic: lerzolite harzburgite dunite pyroxenite others
Crystals= %, %, %
Others: ___________

Sedimentary rocks & others (characteristic of the clasts)

Fragments comp.: mono or poly
Rock type: ___________
Grain size (mm): < 1 – 2 – 4 – 8 – 16 – 32 – 64 – 128 – 256 <
Sorting: well--------------------------------poorly
Roundness: round-----------------------------angular
Fabric: clast-support ---------------- matrix support
Grading: normal---------------none----------------reverse
Matrix: silt sand others: ___________
Lithic: Lithified or unlithified

Remarks Mn crust, pumice

3-3. Cruise schedule and log

2008/07/28

Weather: fine but cloudy/ Wind direction: ENE/ Wind force: 2/ Wave: 2 m/ Swell: 1 m/ Visibility: 5 nautical mile (12:00 JST)

09:00	Onboard the R/V YOKOSUKA
10:00	Departure from Yokosuka Shinko port
11:00-11:30	Briefing about ship's life and safety
13:00-13:30	Scientists and ship crew meeting
16:00	Proton magnetometer deployed (not measured)

2008/07/29

Weather: overcast/ Wind direction: SE/ Wind force: 4/ Wave: 2 m/ Swell: 2 m/ Visibility: 9 nautical mile (12:00 JST+1h)

00:00	Change the local time to JST+1h (00:00→01:00)
13:50	Finish surface survey
14:20	Send release command to OBEM(EM03)
15:33	XBT
17:20-20:40	Search OBEM
21:00	Surface geophysical survey start

2008/07/30

Weather: overcast/ Wind direction: East/ Wind force: 5/ Wave: 3 m/ Swell: 2 m/ Visibility: 8 nautical mile (12:00 JST+1h)

09:04	Surface geophysical survey finish
09:18-11:58	BBOBS(S02) recover
12:06	XBT
13:15-15:19	Sub bottom profiler survey
15:20	Surface geophysical survey start
15:34-15:54	Eight figure turn
18:00-18:30	Scientists meeting

2008/07/31

Weather: cloudy/ Wind direction: NE/ Wind force: 4/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

06:09	Surface geophysical survey finish
06:17-08:31	BBOBS(S04) recover
12:56-16:21	BBOBS(S01) recover

16:26-16:35 Sub bottom profiler survey

16:39 Surface geophysical survey start

2008/08/01

Weather: fine but cloudy/ Wind direction: East/ Wind force: 3/ Wave: 2 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

06:04 Surface geophysical survey finish

06:42-18:28 Heat flow survey

2008/08/02

Weather: fine but cloudy/ Wind direction: ENE/ Wind force: 4/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

06:14-18:01 Heat flow survey

18:13 Surface geophysical survey start

19:00-19:25 Scientists meeting

2008/08/03

Weather: fine but cloudy/ Wind direction: East/ Wind force: 2/ Wave: 2 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

05:57 Surface geophysical survey finish

06:24-16:30 Heat flow survey

16:43 Surface geophysical survey start

18:00-18:15 Scientists meeting

2008/08/04

Weather: fine but cloudy/ Wind direction: East/ Wind force: 2/ Wave: 2 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

18:00-18:30 Scientists meeting

2008/08/05

Weather: fine but cloudy/ Wind direction: SSW/ Wind force: 3/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

07:57 Surface geophysical survey finish

08:05-11:04 OBEM(EM1) recover

12:13 Surface geophysical survey start

18:00-18:30 Scientists meeting

2008/08/06

Weather: fine but cloudy/ Wind direction: ESE/ Wind force: 5/ Wave: 3 m/ Swell: 2 m/

Visibility: 10 nautical mile (12:00 JST+1h)

18:00-18:30 Scientists meeting

2008/08/07

Weather: fine but cloudy/ Wind direction: SSE/ Wind force: 4/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

10:00-11:30 Engine room tour

18:00-19:30 Scientists meeting

2008/08/08

Weather: fine but cloudy/ Wind direction: SE/ Wind force: 3/ Wave: 2 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

06:56 Surface geophysical survey finish

08:11-17:03 Dredge survey

17:14 Surface geophysical survey start

18:00-18:30 Scientists meeting

2008/08/09

Weather: overcast/ Wind direction: SSW/ Wind force: 7/ Wave: 5 m/ Swell: 3 m/ Visibility: 6 nautical mile (12:00 JST+1h)

Surface geophysical survey

18:00-18:30 Scientists meeting

2008/08/10

Weather: fine but cloudy/ Wind direction: NNW/ Wind force: 5/ Wave: 4 m/ Swell: 3 m/ Visibility: 9 nautical mile (12:00 JST+1h)

05:56 Surface geophysical survey finish

06:00-09:37 OBEM(EM2) recover

09:57 Surface geophysical survey start

18:00-18:30 Scientists meeting

2008/08/11

Weather: fine but cloudy/ Wind direction: N/ Wind force: 4/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

Surface geophysical survey

18:00-18:45 Scientists meeting

2008/08/12

Weather:cloudy/ Wind direction: NW/ Wind force: 1/ Wave: 1 m/ Swell: 2 m/ Visibility: 10

nautical mile (12:00 JST+1h)

Surface geophysical survey

18:00-18:40 Scientists meeting

2008/08/13

Weather:cloudy/ Wind direction: SW/ Wind force: 3/ Wave: 2 m/ Swell: 2 m/ Visibility: 8 nautical mile (12:00 JST+1h)

06:57 Surface geophysical survey finish

08:13-16:25 Dredge survey

16:25 Surface geophysical survey start

19:00-19:10 Scientists meeting

2008/08/14

Weather: fine but cloudy / Wind direction: N/ Wind force: 4/ Wave: 3 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

05:58 Surface geophysical survey finish

06:23-14:20 Dredge survey

15:32 Surface geophysical survey start

18:00-18:30 Scientists meeting

2008/08/15

Weather: fine but cloudy / Wind direction: SSW/ Wind force: 4/ Wave: 2 m/ Swell: 2 m/ Visibility: 10 nautical mile (12:00 JST+1h)

Surface geophysical survey

09:01-09:19 Eight figure turn

18:00-18:10 Scientists meeting

2008/08/16

Weather: fine but cloudy / Wind direction: SW/ Wind force: 5/ Wave: 4 m/ Swell: 2 m/ Visibility: 9 nautical mile (12:00 JST+1h)

08:00 Surface geophysical survey finish

08:00- Transit to JAMSTEC

09:00-10:10 Onboard seminar

18:00-18:45 Scientists meeting

2008/08/17

Weather: cloudy / Wind direction: W/ Wind force: 4/ Wave: 3 m/ Swell: 4 m/ Visibility: 8 nautical mile (12:00 JST)

00:00 Change the local time to JST+0h (00:00→8/16 23:00)

Transit to JAMSTEC

18:00-19:00 Scientists meeting

2008/08/18

Weather: cloudy / Wind direction: NNW/ Wind force: 4/ Wave: 2 m/ Swell: 2 m/ Visibility: 8 nautical mile (12:00 JST)

Transit to JAMSTEC

19:00-20:00 Scientists meeting

2008/08/19

09:00 Arraival in JAMSTEC

11:00 Leave the R/V YOKOSUKA

4. Notice on using

This cruise report is a preliminary documentation as of the end of the cruise. It may not be corrected even if changes on content (i.e. taxonomic classifications) are found after publication. It may also be changed without notice. Data on the cruise report may be raw or not processed. Please ask the Chief Scientist for the latest information before using.

Users of data or results of this cruise are requested to submit their results to Data Integration and Analysis Group (DIAG), JAMSTEC.

5. Acknowledgements

We gratefully recognize the efforts of the officers and crew (Fusao Saito, captain) of the R/V YOKOSUKA during the cruise. This research is partly supported by Japan Society for the Promotion of Science (Grant-In-Aid for Scientific Research B, No. 20340124).

6. Appendices

Two DVDs are distributed to the science party. They include the data obtained by this cruise so that only the science party can use them by a priority.

YK08-09 DVD-1

01. Documents
02. SOJ_SOQ
03. OBEM
04. BBOBS
05. Heat_Flow
06. Dredge
07. Gravity
08. Geomag
09. MBES
10. Misc

YK08-09 DVD-2

11. Movies
12. Photos