CRUISE REPORT

JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

R/V YOKOSUKA YK10-12 CRUISE

COMPOSITION, STRUCTURE AND TECTONIC OF THE SOUTHERN MARIANA FOREARC

SEPTEMBER 17, 2010 TO OCTOBER 1, 2010

(GUAM TO GUAM, USA)

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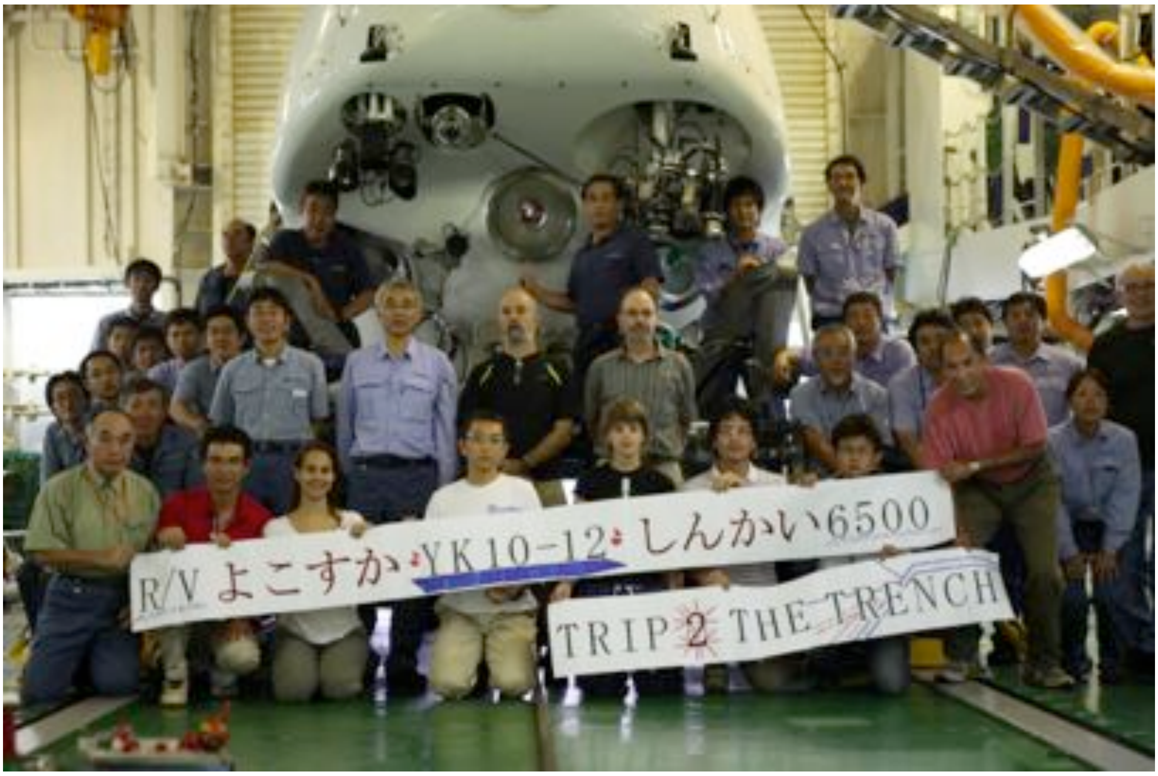

1. Introduction

The 3000-km long Izu–Bonin–Mariana (IBM) arc system is an outstanding example of an intraoceanic convergent plate margin, and has become the particular focus of Japanese and US efforts to understand the operation of the "Subduction Factory" starting in 2004 as YK04-05 cruise in the Bonin Ridge (Ishizuka et al., 2006). We began studying the southern Mariana forearc in 2006. YK06-12 had five Shinaki 6500 dives (973-977) SE of Guam, which sampled many of the igneous rocks associated with subduction initiation in the IBM system. In 2008, YK08-08-Leg 2 continued this effort with seven dives (1091-1097) near Guam that sampled the early arc crust and upper mantle exposed in the inner trench wall.

The fruitful results from the last two cruises in the Mariana forearc include the recovery of the entire suite of rocks associated with what could be termed a "supra-subduction zone ophiolite" that formed during subduction initiation. An important discovery is that MORB-like tholeiitic basalts crop out over large areas. These "fore-arc basalts" (FAB) underlie boninites and overlie diabasic and gabbroic rocks. Potential origins include eruption at a spreading center before subduction began or eruption during near-trench spreading after subduction began at ~ 50 Ma (Reagan et al., 2010). Another important discovery is a region of active forearc rifting at the southern end of the Mariana arc, named Southeast Mariana Forearc Rift (SEMFR). Two dives at SEMFR recovered less-depleted backarc related peridotites (Michibayashi et al., 2009), and fresh basalts and basaltic andesites with petrographic characteristics like backarc basin lavas.

This cruise (YK10-12) was the third time that our Japan-US team has returned to study the southern Mariana forearc near Guam (Fig. 1).

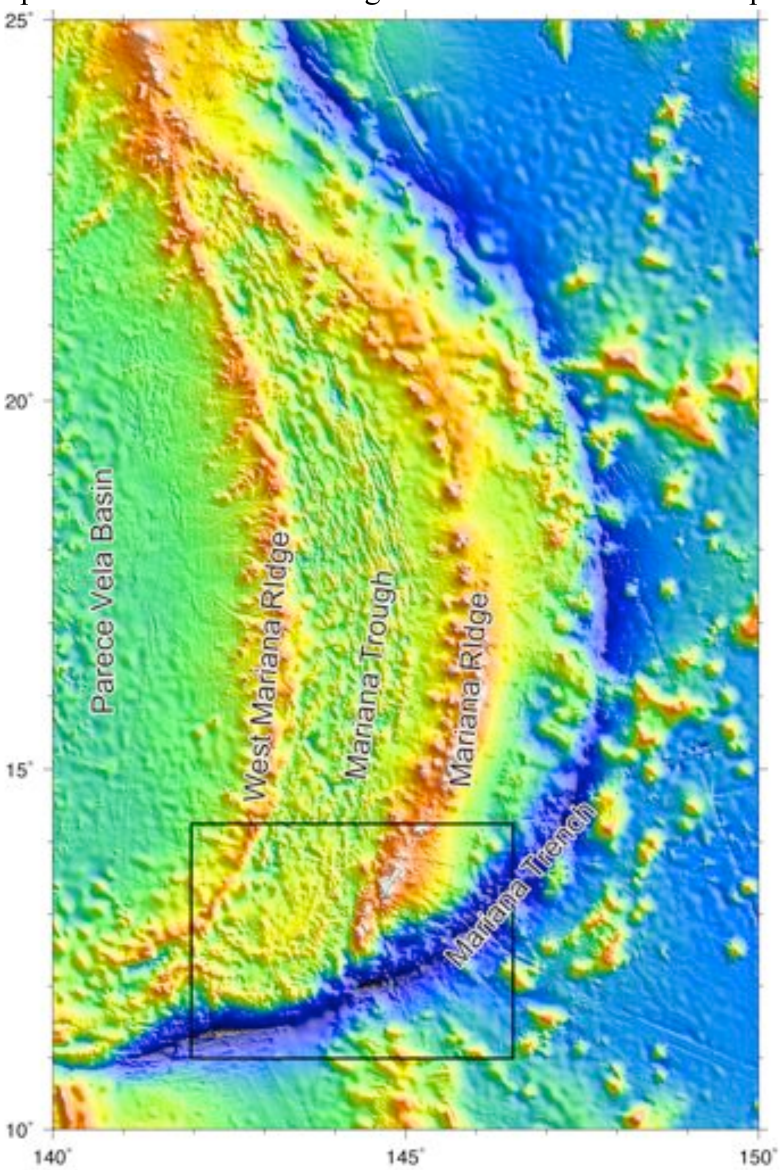

Fig. 1. Index map. The box shows the locations relevant to YK06-12, YK08-08-Leg 2, and YK10-12 cruises (see Fig. 5). The GEBCO 08 gridded data were used to make this map.

2. OBJECTIVES OF THE CRUISE

Our previous studies have produced a number of important new observations about the geology of the southern Mariana forearc, however, our understanding of the region is still primitive. The principal objectives of YK10-12 cruise therefore were to tackle three important problems by in-situ dive operations using the Shinkai 6500 and deep-tow camera (YKDT):

- Increasing the sampling density of FABs along the southern Mariana forearc, thereby providing the clues to subduction initiation processes along the IBM arc.
- Increasing the sampling density of peridotites along the southern Mariana forearc, thereby providing the clues to understand mantle process associated with supra-subduction zone ophiolite.
- Increasing the sampling density in the SEMFR to gain a better understanding of this newly indentified active rift and the origin of its near-trench basalts.

3. RUNNING CRUISE NARRATIVE

Local time (Approximate)	Notes
17-Sep-10	**The Yokosuka YK10-12 cruise began. Bathymetric survey for the southern tip of the Santa Rosa Bank and Southeast Marina Forearc Rift and site survey for the 6K-1229 site.**
11:00	Scientists arrived at the Yokosuka moored in the Apra Harbor.
14:00	YK10-12 cruise began. Ship's clocks used Guam local time (UTC + 9 h) during this cruise.
14:30-15:30	Scientists held a meeting with the Chief Mate and Chief Radio Officer.
15:40-16:10	Scientists got briefed on the Shinkai 6500 by the Shinkai Team.
16:40-17:00	The Kom'pira-san Ceremony, praying for a safe and successful cruise
18:00-18:40	Science meeting was held at the No. 1 laboratory. Yasuhiko Ohara summarized the objectives and logistics of the cruise.
18:40-19:15	Scientist set up the wet laboratory.
19:20	XBT was deployed.
18:40-2:23 (+1 day)	Bathymetric survey for the southern tip of the Santa Rosa Bank and Southeast Mariana Forearc Rift, and site survey for the 6K-1229 site were conducted.
18-Sep-10	**6K-1229 was conducted along the lower western slope of the southern tip of the Santa Rosa Bank. Mark Reagan as the observer. Bathymetric survey for the 6K-1231 area (i.e., east of the Southeast Mariana Forearc Rift).**
08:55	6K-1229 started (the Shinkai opened vent).
11:25	The Shinkai on bottom (6350 m).
14:56	The Shinkai off bottom (5765 m); total 22 rocks were sampled.
17:25	The Shinkai on deck.
19:30-20:30	Science meeting was held at the No. 1 laboratory. Mark Reagan reported the results of the today's dive, and Fernando Martinez talked on the tectonic overview of the Southeast Mariana Forearc Rift.
19:30-02:06 (+1 day)	Bathymetric survey for the 6K-1231 area (i.e., west of the Southeast Mariana Forearc Rift) was conducted.

19-Sep-10	**6K-1230 was conducted along the western slope of a ridge that comprises the Southeast Mariana Forearc Rift. Julia Ribeiro as the observer. Site survey for the 6K-1231 site and bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
08:56	6K-1230 started (the Shinkai opened vent).
10:59	The Shinkai on bottom (4958 m).
15:21	The Shinkai off bottom (4280 m); total 33 rocks were sampled.
17:24	The Shinkai on deck.
18:01	Proton magnetomer was deployed.
19:50-21:00	Science meeting was held at the No. 1 laboratory. Julia Ribeiro reported the results of the today's dive.
18:01-04:15 (+1 day)	Site survey for the 6K-1231 site and bathymetric box survey for the Southeast Mariana Forearc Rift (with proton magnetometer) were conducted.
20-Sep-10	**6K-1231 was conducted along the lower western slope of the southern tip of the Santa Rosa Bank, to the east of the 6K-1229 site. Ignacio Pujana as the observer. Site survey for the Southeast Mariana Forearc Rift (for 6K-1235).**
06:21	Proton magnetometer was on deck.
08:53	6K-1231 started (the Shinkai opened vent).
11:34	The Shinkai on bottom (6393 m).
15:05	The Shinkai off bottom (5932 m); total 25 rocks and 2 scoops were sampled.
17:40	The Shinkai on deck.
19:09-23:06	Site survey for the Southeast Mariana Forearc Rift (for 6K-1235) was conducted.
19:30-20:30	Science meeting was held at the No. 1 laboratory. Ignacio Pujuna summarized the results of the today's dive, and Katsuyoshi Michibayashi talked on the peridotites from the Southern Mariana Forearc.
21-Sep-10	**6K-1232 was conducted along the landward slope of the Mariana Trench, ~40 NM to the east of the Challenger Deep. Katsuyoshi Michibayashi as the observer. Site survey for 6K-1233 & 1234.**
05:28	XBT was deployed.
08:53	6K-1232 started (the Shinkai opened vent).
11:25	The Shinkai on bottom (6425 m).
14:55	The Shinkai off bottom (5751 m); total 22 rocks and one scoop were sampled.
17:30	The Shinkai on deck.
18:19-20:19	Site survey for 6K-1233 & 1234 was conducted.
19:30-20:30	Science meeting was held at the No. 1 laboratory. Katsuyoshi Michibayashi summarized the results of the today's dive, and Maryjo Brounce talked on variations in Fe valence at arc volcanoes.
22-Sep-10	**6K-1233 was conducted along the landward slope of the Mariana Trench, ~35 NM to the east of the Challenger Deep. The site is to the west of 6K-1232. Yasuhiko Ohara as the observer. Heaving-to during the night.**
08:52	6K-1233 started (the Shinkai opened vent).
11:25	The Shinkai on bottom (6394 m).
14:56	The Shinkai off bottom (5930 m); total 25 rocks were sampled.
17:38	The Shinkai on deck.

19:15-20:20	Science meeting was held at the No. 1 laboratory. Yasuhiko Ohara summarized the results of the today's dive, and Teruaki Ishii talked on the peridotites from the Northwest Pacific.
23-Sep-10	**6K-1234 was conducted along the landward slope of the Mariana Trench, ~35 NM to the east of the Challenger Deep and ~2.5 NM to the northeast of 6K-1231. Teruaki Ishii as the observer. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
08:52	6K-1234 started (the Shinkai opened vent).
11:28	The Shinkai on bottom (6079 m).
14:56	The Shinkai off bottom (5540 m); total 17 rocks, one push core and multiple biological samples were sampled.
17:15	The Shinkai on deck.
17:57	Proton magnetometer was deployed.
18:09-4:33 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
19:00-19:40	Science meeting was held at the No. 1 laboratory. Teruaki Ishii summarized the results of the today's dive.
24-Sep-10	**6K-1235 was conducted along the western slope of a ridge that comprises the Southeast Mariana Forearc Rift. Guillaume Girard as the observer. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:21	Proton magnetometer was on deck.
08:52	6K-1235 started (the Shinkai opened vent).
11:29	The Shinkai on bottom (6394 m).
14:50	The Shinkai off bottom (5861 m); total 25 rocks were sampled.
17:20	The Shinkai on deck.
18:00	Proton magnetometer was deployed.
18:00-04:21 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
19:00-19:30	Science meeting was held at the No. 1 laboratory. Guillaume Girard summarized the results of the today's dive, Yasuhiko Ohara talked on the hydrothermal activity on the Mid-Atlantic Ridge.
25-Sep-10	**6K-1236 was conducted along the landward slope of the Mariana Trench, approximately along the upslope section of 6K-1234. Maryjo Brounce as the observer. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:22	Proton magnetometer was on deck.
08:52	6K-1236 started (the Shinkai opened vent).
11:01	The Shinkai on bottom (5309 m).
15:03	The Shinkai off bottom (4646 m); total 21 rocks and 2 push cores were sampled.
17:12	The Shinkai on deck.
17:54	Proton magnetometer was deployed.
20:29-5:45 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
18:45-19:45	Science meeting was held at the No. 1 laboratory. Maryjo Brounce summarized the results of the today's dive, and Robert Stern talked on the ophiolites in Iran.

26-Sep-10	**YKDT-81 & 82 were conducted, however, YKDT-81 was canceled halfway. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:22	Proton magnetometer was on deck.
8:59	YKDT-81 started (the deep-tow camera was put in).
10:38	YKDT-81 was canceled halfway because of malfunctioning of the tether cable (at ~1700 m depth).
13:04	YKDT-82 started (the deep-tow camera was put in).
14:29	The deep-tow camera towing started (4169 m).
15:36	The dredge was released (3911 m).
15:53	The deep-tow camera towing was halted (3959 m).
17:09	YKDT-82 ended (the deep-tow camera was on deck).
17:37	Proton magnetometer was deployed.
19:16-5:00 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
18:30-19:45	Science meeting was held at the No. 1 laboratory. Julia Ribeiro talked on the magmatism in the Southeast Mariana Forearc Rift.
27-Sep-10	**YKDT-83 & 84 were conducted. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:37	Proton magnetometer was on deck.
8:29	YKDT-83 started (the deep-tow camera was put in).
9:38	The deep-tow camera towing started (3052 m).
10:28	The dredge was released (3000 m).
10:35	The deep-tow camera towing was halted (2968 m).
11:40	YKDT-83 ended (the deep-tow camera was on deck).
13:02	YKDT-84 started (the deep-tow camera was put in).
14:14	The deep-tow camera towing started (3487 m).
15:16	The dredge was released (3181 m).
15:55	The deep-tow camera towing was halted (2658 m).
16:56	YKDT-84 ended (the deep-tow camera was on deck).
17:12	Proton magnetometer was deployed.
18:40-2:52 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
18:00-19:00	Science meeting was held at the No. 1 laboratory. Guillaume Girard talked on the Yellow Stone Hot Spot.
28-Sep-10	**YKDT-85 & 86 were conducted. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:36	Proton magnetometer was on deck.
8:19	YKDT-85 started (the deep-tow camera was put in).
9:24	The deep-tow camera towing started (3090 m).
9:42	The dredge was released (3060 m).
10:45	The deep-tow camera towing was halted (2577 m).
11:40	YKDT-85 ended (the deep-tow camera was on deck).

13:02	YKDT-86 started (the deep-tow camera was put in).
14:27	The deep-tow camera towing started (4050 m).
15:05	The dredge was released (3692 m).
15:32	The deep-tow camera towing was halted (3454 m).
16:43	YKDT-84 ended (the deep-tow camera was on deck).
17:00	Proton magnetometer was deployed.
18:47-3:23 (+1 day)	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
18:00-19:00	Science meeting was held at the No. 1 laboratory. Yasuhiko Ohara talked on the Godzilla Megamullion and tectonic of a dying backarc basin.
29-Sep-10	**YKDT-87 & 88 were conducted. Bathymetric mapping of the Southeast Mariana Forearc Rift (with proton magnetometer).**
06:31	Proton magnetometer was on deck.
8:12	YKDT-87 started (the deep-tow camera was put in).
9:26	The deep-tow camera towing started (3630 m).
9:49	The dredge was released (3631 m).
10:34	The deep-tow camera towing was halted (3536 m).
11:48	YKDT-87 ended (the deep-tow camera was on deck).
12:59	YKDT-88 started (the deep-tow camera was put in).
14:14	The deep-tow camera towing started (3475 m).
14:28	The dredge was released (3461 m).
15:02	The deep-tow camera towing was halted (3342 m).
16:14	YKDT-88 ended (the deep-tow camera was on deck).
17:36	Proton magnetometer was deployed.
17:54-Next Day	Bathymetric box survey (with proton magnetometer) for the Southeast Mariana Forearc Rift was conducted.
18:10-19:00	Science meeting was held at the No. 1 laboratory. Robert Stern talked on the geology of Tracey Seamount in the Mariana volcanic arc.
30-Sep-10	**Bathymetric mapping around the Southeast Mariana Forearc Rift (with proton magnetometer)**
Daytime	Bathymetric mapping (with proton magnetometer) around the Southeast Mariana Forearc Rift was conducted.
17:45-18:30	Science meeting was held at the No. 1 laboratory. Scientists discussed the future work plan.
01-Oct-10	**End of the cruise**
09:00	The Yokosuka arrived at the Apra Harbor, Guam.
12:30	YK10-12 scientists disembarked.

4. OPERATIONS AND DATA ACQUISITION

The primary cruise activities were diving operations of DSV Shinaki 6500 (total 8 dives), and deep-towed camera (YKDT; total 8 dives) observations within the Southern Mariana Forearc (Tables 1 and 2; Fig. 2).

We also conducted extensive surface geophysical survey (bathymetry mapping, gravity and magnetics):

- Bathymetric data were collected with the SeaBeam 2112 system installed on R/V Yokosuka. The SeaBeam system uses sound velocity data from XBT data not only for calculating the depth and position of each beam during the ray tracing process, but also for the beam forming process. The sound velocity of the surface layer is very important for this step, so the system measures and uses these surface velocities in real time. Except for the surface layer, data from a CTD installed in the Shinkai 6500 were used for calculating sound velocities. The quality of the obtained bathymetry depends mostly on the sea state, which had been very good during the cruise. The raw bathymetric data were edited onboard by the Shinkai Team using the MB system.

- Gravity data was collected during YK10-12 with a KSS-31 gravimeter (Bodenseewerk Inc.), although it was not processed on board.

- Three-component magnetometer data (Hx, Hy, Hz) were collected during YK10-12 with an SFG-1214 magnetometer (Terra Tecnica Inc.). Figure eight maneuverings to calibrate the effect of the ship's magnetization were performed during the cruise. Proton magnetometer was deployed along selected survey lines during YK10-12 and preliminary analysis was performed onboard by Fernando Martinez.

Track charts for YK10-12 cruise are shown in Fig. 3. Track lines for the magnetics survey is shown in Fig. 4.

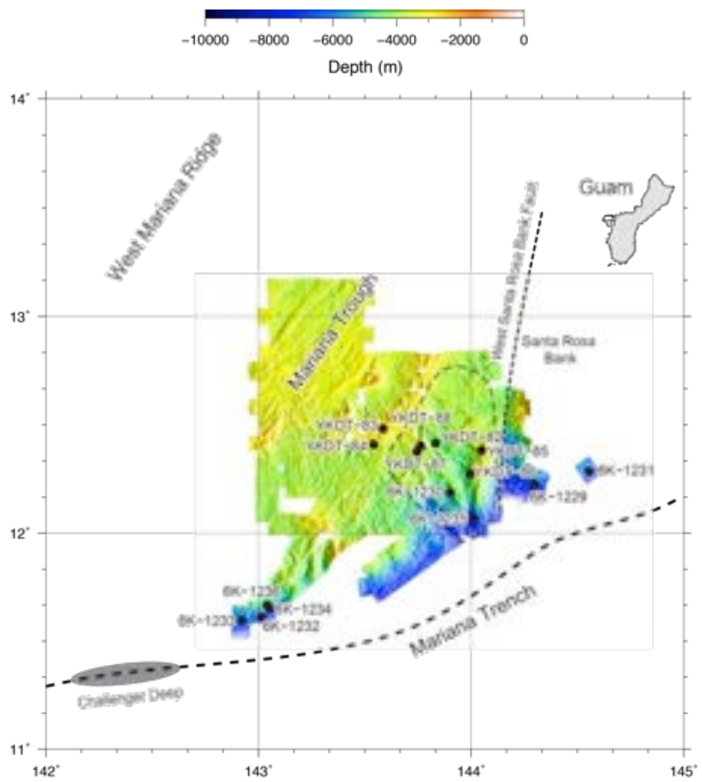

Fig. 2. Bathymetry obtained during YK10-12 cruise. Dive locations completed during YK10-12 cruise are also shown. The region enclosed by dotted line indicates the SEMFR.

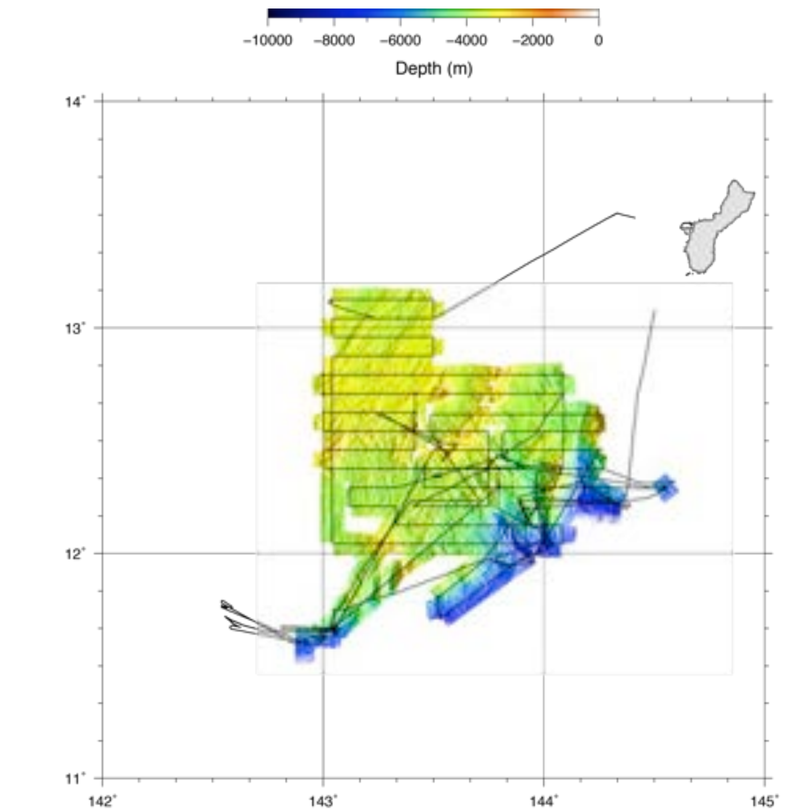

Fig. 3. Track chart for YK10-12 cruise.

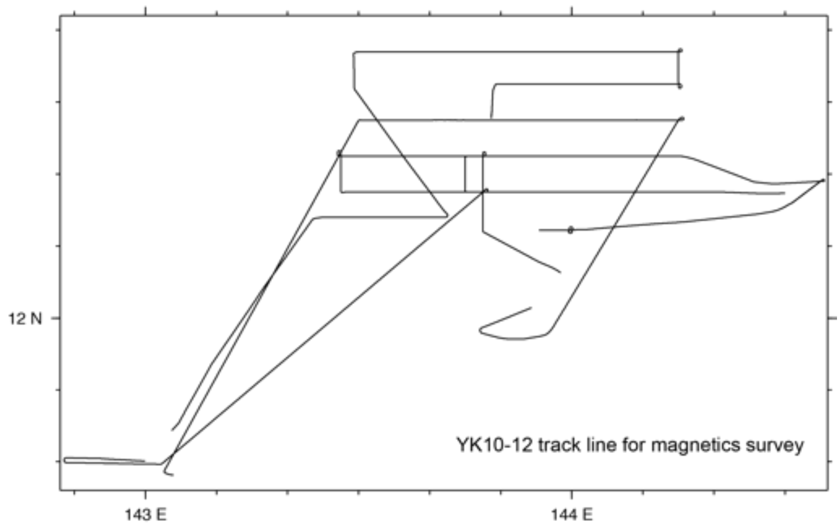

Fig. 4. Track chart for YK10-12 magnetics survery.

Table 1. List of Shinkai 6500 dives completed during YK10-12 cruise

Dive #	Date (2010)	Observer	Pilot	Co-pilot	On bottom / Off bottom	Lat	Lon	Start depth (m) / End depth (m)	Samples	Location
1229	9/18	Mark Reagan	K. Chiba	T. Onishi	11:25	12°13.6115' N	144° 18.0022' E	6350	22 rocks	South Santa Rosa Bank
					14:56	12°14.8034' N	144° 17.9496' E	5765		
1230	9/19	Julia Ribiero	K. Matsumoto	A. Ishikawa	10:59	12°11.3557' N	143°54.1910' E	4958	33 rocks	Southeast Marianas Forearc Rift
					15:21	12°11.9046 N	143°54.6005' E	4280		
1231	9/20	Ignacio Pujana	Y. Chida	K. Iijima	11:34	12°17.3159' N	144° 33.2663' E	6393	25 rocks + 2 scoops	South Santa Rosa Bank
					15:05	12°17.6645' N	144° 33.0923' E	5932		
1232	9/21	Katsuyoshi Michibayashi	K. Chiba	K. Suzuki	11:25	11°36.9051' N	143° 0.7335' E	6425	20 rocks + 1 scoop	Southern Mariana Trench
					14:55	11°37.8414' N	143° 0.2236' E	5751		
1233	9/22	Yasuhiko Ohara	M. Yanagitani	K. Iijima	11:25	11°35.7843' N	142° 55.3148' E	6394	25 rocks	Southern Mariana Trench
					14:56	11°36.8743' N	142° 55.5577' E	5930		
1234	9/23	Teruaki Ishii	Y. Chida	A. Ishikawa	11:28	11°39.0971'N	143°2.9379'E	6079	18 rocks + 1 push core + biological samples	Southern Mariana Trench
					14:56	11°39.5485' N	143° 2.8979' E	5540		
1235	9/24	Guillaume Girard	K. Matsumoto	K. Suzuki	11:29	12°04.1645' N	144° 00.8408' E	6478	25 rocks	Southeast Marianas Forearc Rift
					14:50	12°04.9072' N	144° 01.1973' E	5861		
1236	9/25	Maryjo Brounce	M. Yanagitani	K. Iijima	11:01	11°39.9248' N	143° 2.6044' E	5309	21 rocks + 2 push cores	Southern Mariana Trench
					15:03	11°41.5587' N	143° 2.5035' E	4646		

Ship's navigation: D-GPS + WGS84

Submersible's navigation: SSBL

Table 2. List of YKDT dives completed during YK10-12 cruise

Dive #	Date (2009)	Start towing / Stop towing	Lat	Lon	Start depth (m) / End depth (m)	Samples	Location
81	9/26	10:15	12°25.0' N	143°50.0' E	-	No sample. Dive cancelled due to camera malfunction.	NW region of Southeast Mariana Forearc Rift
		10:30	12°25.0' N	143°50.0' E	-		
82	9/26	14:29	12°25.0266' N	143°50.0014' E	4169	Mn coated sediments	NW region of Southeast Mariana Forearc Rift
		15:53	12°25.4288' N	143°49.5113' E	3959		
83	9/27	09:38	12°29.0059' N	143°35.0174' E	3052	Mn coated sediments	Southeast Mariana Forearc Rift
		10:35	12°28.9990' N	143°35.5591' E	2968		
84	9/27	14:14	12°24.6072' N	143°32.5502' E	3482	Mn coated sediments, 2 small basaltic clasts	Southeast Mariana Forearc Rift
		15:55	12°25.6056' N	143°33.1036' E	2658		
85	9/28	09:24	12°23.0253' N	144°3.0332' E	3090	Small basalt clasts with glassy rinds	Ridge west of Santa Rosa Bank Fault
		10:30	12°23.2061' N	144°3.8340' E	2577		
86	9/28	14:27	12°16.4939' N	143°59.7841' E	4050	Plagioclase basalt clasts with glassy rinds	Ridge west of Santa Rosa Bank Fault
		15:32	12°16.6400' N	144°0.3853' E	3454		
87	9/29	09:26	12°22.6153' N	143°44.6774' E	3630	No sample recovered	Southeast Mariana Forearc Rift
		10:34	12°23.0923' N	143°45.0343' E	3536		
88	9/29	14:14	12°24.1987' N	143°45.7180' E	3475	3 basalt clasts with glassy rinds; olivine and clinopyroxene present	Southeast Mariana Forearc Rift
		15:02	12°24.4536' N	143°45.9875' E	3342		

Ship's navigation: D-GPS + WGS84

5. SCIENTIFIC RESULTS

5-1. DIVE RESULTS

During YK10-12 cruise, we have conducted eight Shinkai and seven YKDT dives (Tables 1 and 2), as well as geophysical mapping of the area shown in Figs. 2 and 3, completed every principal objectives noted in section 2. The main results obtained by diving studies are:

- Gabbroic rocks associated with FAB were sampled along the forearc slope to the south of the Santa Rosa Bank (6K-1229, 6K-1231). This is the first discovery of FAB gabbro in the Mariana forearc.
- We have confirmed the ubiquitous occurrence of fresh basalt in the SEMFR (6K-1230, 6K-1235, YKDT-82, YKDT-85, YKDT-86, YKDT-87, YKDT-88).
- Modern boninite was sampled in the SEMFR (YKDT-88).
- Fresh basalt was sampled in an unnamed ridge northwest of SEMFR (YKDT-84). Since this ridge was totally unexplored so far, the samples from YKDT-84 will give us important clues to understand the genesis of the ridge.
- A garnet-amphibolite was sampled in the forearc slope to the NE of the Challenger Deep (6K-1232).
- Very fresh fertile lherzolites were sampled in the forearc slope to the NE of the Challenger Deep (6K-1233).
- *Calyptogena* clam colonies were discovered in the forearc slope to the NE of the Challenger Deep (6K-1234). This is the first cold-seep vent community in the Southern Mariana forearc, and we named this as the Shinkai Seep Field.
- We have confirmed that the *Calyptogena* colonies rest on the Moho (6K-1234, 6K-1236). During 6K-1236, boninitic volcanics, in stead of peridotites, were recovered.

Reports from each dive are included in Appendix A.

5-2. SYNTHESIS

Figure 5 shows the locations of the dive sites (total 27) conducted through YK06-12 (5 Shinkai dives), YK08-08-Leg 2 (7 Shinkai dives), and YK10-12 (8 Shinkai dives and 7 YKDT dives) cruises. Scientific discoveries and accomplishments in the Southern Mariana forearc based on the YK06-12, YK08-08, YK10-12 cruises are listed below.

(1) Recognition that MORB-like tholeiites (Fore-Arc Basalts, FAB) are the first magmas produced when subduction began in the Marianas (Reagan et al., 2010).
(2) Recognition of Southern Mariana forearc as an active analogue for processes leading to the formation of forearcs due to subduction initiation.
(3) Discovery of high-Mg andesites in the forearc east of Guam.
(4) Recognition of young basaltic volcanism associated with rifting and definition of the Southeast Mariana Forearc Rift (SEMFR).
(5) Distribution of forearc peridotite occurrences and their fabrics and compositions.
(6) Presence of Miocene and perhaps Eocene to Oligocene arc volcanics above peridotites and gabbroic rocks in the Southern Mariana forearc.
(7) Development of the first basement geologic map for ~500 km along the inner trench wall in the southern Marianas and confirmation of lithologies consistent with the presence of an in-situ ophiolite (Fig. 6).

(8) Understanding the different nature of forearcs E (IBM Eocene forearc) and W (Southern Mariana forearc) of tectonic boundary ~144°20’ E (West Santa Rosa Bank Fault; WSRBF) (Fig. 7).
(9) Discovery of the first cold-seep vent community in the Southern Mariana forearc. Recognition that such communities form in places other than serpentine mud volcanoes.

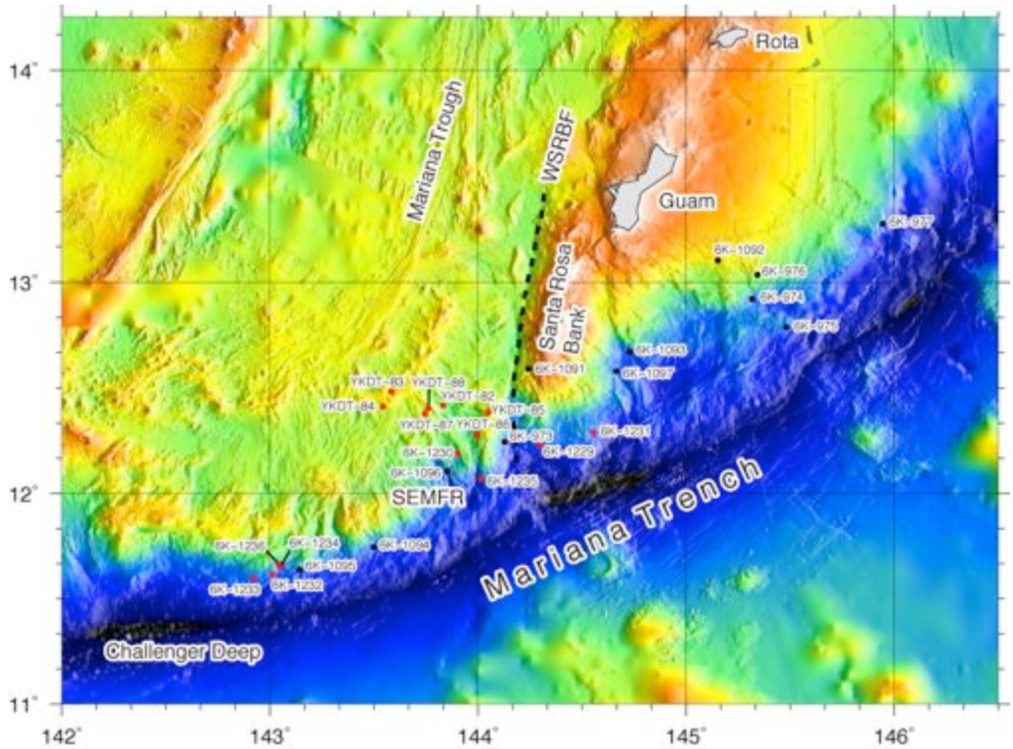

Fig. 5. Dive locations completed during YK06-12, YK08-08-Leg 2, and YK10-12 cruises. The bathymetric data compiled by Susan Merle (NOAA) were used to make this map.

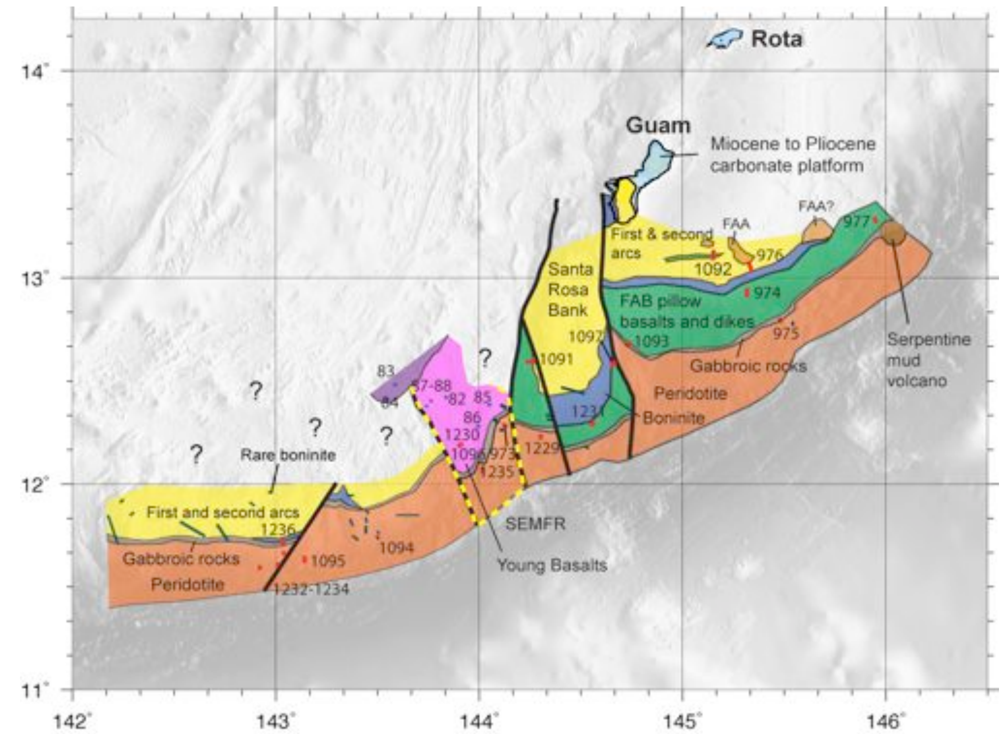

Fig. 6. Geological sketch map of the southern Mariana forearc (by M.K. Reagan).

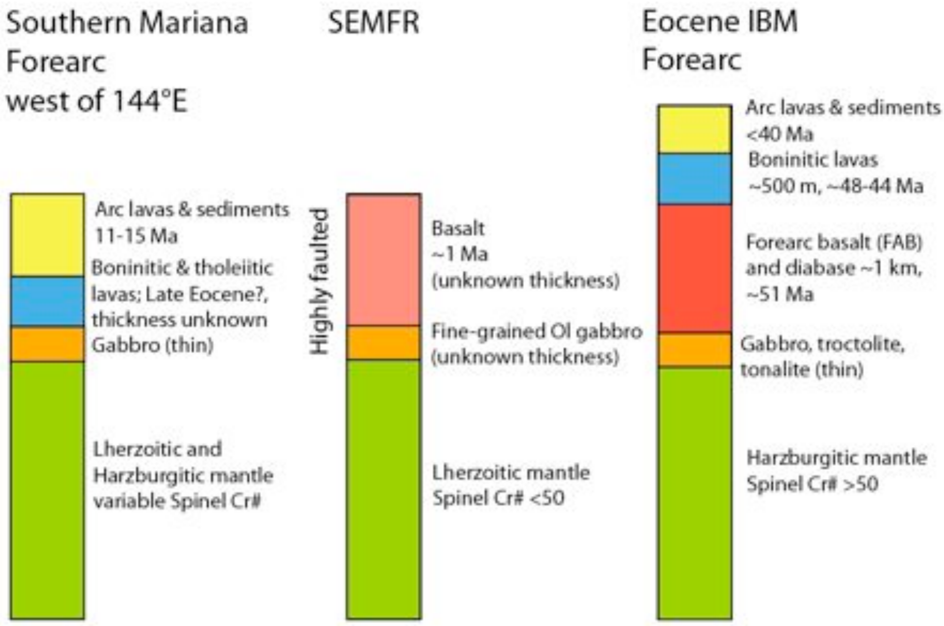

Fig. 7. Schematic cross sections of the southern Mariana forearc (by R.J. Stern).

6. Future studies and analytical tasks

Onboard sample distribution is listed in Appendix K.

On FAB and old volcanics

- MKR: geochemistry, petrology & U-Zr geochronology for old gabbros, tonalites & boninites
- MB: oxidation state of basalt in the Southern Mariana forearc
- Osamu Ishizuka: geochronology on basalts & boninites
- IP: sedimentology & biostratigraphy of the old forearc

On SEMFR

- JR: SEMFR basalts petrology & geochemistry
- JR: YKDT-88 rocks for petrology & geochemistry of modern boninite
- FM: bathymetry, gravity & magnetics of SEMFR
- FM & RJS: sonar backscatter remote sensing & bottom photography as ground truth for SEMFR tectonophysical characterization
- GG: geochemistry & mingling of microgabbros from SEMFR
- MKR, JR & FM: origin of the enigmatic ridge boardering SEMFR

On peridotite sites

- KM: peridotite structural petrology, 6K-1234 peridotite carbonate vein & serpentinization process
- KM, TI & YO: peridotite petrology from the Southern Mariana forearc
- KM & MKR: garnet amphibolite (6K-1232) genesis & metamorphic petrology
- IP: sedimentology & biostratigraphy of the peridotite sites
- Katsunori Fujikura & Hiromi Watanabe: biological analysis on the *Calyptogena* clams

- TI & YO: characterization of the Shinkai Seep Field

Synthesis

- YO, MKR & RJS: synthesis of the study

List of initials:

- YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi
- MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce
- FM: Fernando Martinez

Note:

- Osamu Ishizuka have been collaborating with YO, MKR & RJS since initiation of the project (i.e., YK04-05).
- Katsunori Fujikura and Hiromi Watanabe have been solicited to work on the *Calyptogena* clams.

7. References

Ishizuka, O., J.-I. Kimura, Y.B. Li, R.J. Stern, M.K. Reagan, R.N. Taylor, Y. Ohara, S.H. Bloomer, T. Ishii, U.S Hargrove III, and S. Haraguchi, Early stages in the evolution of Izu-Bonin arc volcanism: new age, chemical and isotopic constraints, Earth and Planetary Science Letters, 250, 385-401, 2006.

Michibayashi K., Y. Ohara, R.J. Stern, P. Fryer, J.-I. Kimura, M. Tasaka, Y. Harigane, and T. Ishii, Peridotites from a ductile shear zone within back-arc lithospheric mantle, southern Mariana Trench: results of a Shinkai 6500 dive, Geochemistry, Geophysics, Geosystems, 10, Q05X06, doi:10.1029/2008GC002197, 2009.

Reagan, M.K., O. Ishizuka, R.J. Stern, K.A. Kelley, Y. Ohara, J. Blichert-Toft, S.H. Bloomer, J. Cash, P. Fryer, B.B. Hanan, R. Hickey-Vargas, T. Ishii, J.-I. Kimura, D.W. Peate, M.C. Rowe, and M. Woods, Fore-arc basalts and subduction initiation in the Izu-Bonin-Mariana system, Geochemistry, Geophysics, Geosystems, 11, Q03X12, doi:10.1029/2009GC002871, 2010.

Appendix A.

Dive reports

A-1. Report for 6K-1229, September-18-2010: M. Reagan

Aim and scope of 6K-1229:

The dive site is located south of the Santa Rosa Bank in an area thought to be underlain by gabbroic rocks (**Figs. 1** and **2**). This supposition was based on previous dredging indicating that forearc basalts (FAB; Reagan et al., 2010) were to the north of this area and at shallower depths (KH03-3-D6 and Dmit. Mend. 17-1404) and peridotite was to the south of the site and deeper (Dmit. Mend. 17-1403). The plan for this dive was to collect the intrusive section of the Mariana forearc in-situ island arc ophiolite (e.g. Bloomer and Hawkins, 1983).

Observations:

The Shinkai landed on the seafloor at 6350 m at 11:25 and we started the scientific operation. The landing point was covered with sparse angular to subrounded Mn-coated rocks ranging from ~10 cm to 2 m across (**Photo 1**).

Sample **stop 1** was near the landing point, and at 11:29 we collected two float blocks (**R01 and R02**) lying in sediment on the slope. R01 is subrounded gabbro; R02 is a large angular block of a felsic intrusive rock, probably a tonalite or "plagiogranite".

The sedimentation on the slope uphill from this location remained similar to that depicted in Photo 1.

At sample **stop 2** (6311 m at ~11:40), we stopped to collect one block at a site with surface lithologies like stop 1 (**R03**). R03 is a fine-grained gabbro with intermingled rounded basaltic clasts that look like they might have quenched against the cooler gabbro.

Upslope from this area, the cobbles and boulders are more abundant and sometimes clustered. The greater abundance of rocks here indicates that large-block deposition from rock-falls was less outpaced by fine sediment deposition than further below.

At sample **stop 3** (6255 m at ~11:55), we collected two blocks (**R04 and R05**) on a slope abundantly littered with subangular boulders, several of which appear to be coarse breccias (**Photo 2**). R04 is a fine-grained aphyric basalt (FAB) with a matrix of finely intergrown radiating acicular crystals of what are likely plagioclase and clinopyroxene crystals. This sample also had a partial carapace of mudstone. R05 is a highly-altered volcanic conglomerate with plagioclase-phyric clasts.

The terrain upslope from here is steeper, but like below, consists of a mud cover with scattered to clustered cobbles and boulders. The video camera failed in this area, and we seemed to lose much of the earlier recorded video.

At sample **stop 4** (6200 m at ~12:25), sampling was difficult due to an upslope current. We were able to collect one block (**R06**) while Shinkai was moving. This sample is a small sample of volcanic sediment. This sample collection was not recorded by video. After some trouble-shooting by the pilots, the video system was restarted.

The terrain upslope from here generally has a shallower slope. Some locations are nearly entirely covered with fine light-colored sediment, whereas other areas are strewn with cobbles and boulders. Several few-meter scale boulders are scattered through this area.

Sample **stop 5** (6200 m at ~12:44) was in an area of abundant cobble to boulder-sized angular clasts. A rock outcrop with decimeter- to meter-scale fracturing, producing boulder-sized angular rubble was nearby. However, this outcrop was below us (**Photo 3**), and could not be sampled. This outcrop looked like outcrops I have seen at other dive sites of fractured isotropic intrusive igneous rock such as gabbro or tonalite. We collected two clasts atop and several meters east of the outcrop on the slope (**R07 and R08**). Both of these rocks were indeed medium-grained gabbro.

Because of the increasingly gentle and sedimented slope, we decided to fly to the steeper area at the top of the planned dive with a goal of locating outcrop. This took about an hour and brought us to a depth of about 6010 m.

Along this traverse, we spotted what appeared to be a large and intact but coarsely fractured outcrop at about 1:23 and 6028 m. Attempts to sample this outcrop were unsuccessful because the robotic claw cut through the material, indicating that it was poorly consolidated sediment.

Sample **stop 6** (6005 m at 13:40) was in a sediment and block covered area like stops 1 and 2. Two angular blocks were collected here (**R09 and R10**). R09 is a serpentinized harzburgite, and sample R10 is a medium-grained troctolite with roundish dark-brown altered olivine surrounded by anhedral plagioclase.

The slope above here became steeper and the subrounded to angular cobbles and boulders on the surface became more abundant. Some locations had clasts with whitish coatings and veins amongst the dark Mn-coated rocks, suggesting that they might be serpentinized peridotite. At approximately 5980 m, there was an area that appeared to be sub-outcrop (**Photo 4**).

Sample **stop 7** (5970 m at ~13:50) was at a location with abundant angular cobbles and boulders littered on the surface above the sub-outcrop. Two small angular blocks were collected here (**R11 and R12**). R11 is an aphyric basalt (FAB); R12 is a medium grained troctolite.
gd
Upslope from this location, the slope was quite steep with varying proportions of most angular cobbles, boulders, and tan sediment. At approximately 5936 m, there appeared to be an outcrop that had some alteration along fractures and surfaces.

Sample **stop 8** (5930 m at ~14:10) was near a massive Mn-stained outcrop that was fractured on several scales (**Photo 5**). Three angular blocks were collected **(R13, R14, and R15)** at the foot of this outcrop. Sample R13 was actually two small clasts caught together in one sampling attempt. Sample R13a is peridotite, whereas R13b is troctolite. Sample R14 is a gabbro, and sample R15 is an aphyric basalt (FAB). I suspect that the outcrop exposed intermingled deep crustal lithologies and the FAB is a talus block from above.

Upslope to stops 9 and 10, the slope is very steep and consists of sediment-draped and fractured outcrop and associated talus.

Sample **stop 9** (5876 m at ~14:27), was at the foot of a massive and fractured outcrop. Two samples (**R16 and R17**) were collected here, both were melagabbro.

Sample **stop 10** (5835 m at ~14:35) was in a sedimented area near outcrop. The two samples collected here (**R18 and R19**) were both troctolites. R18 was brecciated and fell apart when it dropped into the basket.

Upslope from stop 10, the surface had abundant angular to subrounded cobbles and small boulders

The final sample **stop 11** (5787m at ~14:45) was in an area of abundant clasts. Three subangular to angular samples (**R20, R21, and R22**) were collected here. Two (R20 and R21) are a diabase with rare olivine phenocrysts. R22 is an aphyric basalt (FAB).

Shinkai dropped its ballast and left the bottom at 14:55.

Summary of dive observations:
The dive had two relatively steep sections separated by nearly flat seafloor. The lower steep section lacked outcrop, and had variable surface concentrations of angular to subrounded cobbles and pebbles surrounded by mud. The sampled lithologies varied from basalt to gabbro to tonalite. None of the rocks were collected in place. The structurally deepest and therefore most probable lithologies beneath the sediment cover in this lower dive area are gabbro and tonalite.

Most of the rocks found in the upper steep dive area are deep crust and upper mantle lithologies, including harzburgite, troctolite, and melagabbro. The diabases and basalts encountered here probably fell in from above. I suspect that this section of the dive was mostly in rocks from the very deepest levels of crust associated with the proto-Mariana arc. The Moho discontinuity and underlying mantle also might lie near the base of the upper steep section.

The presence of deep-crust lithologies in the upper portion of the dive and shallower crust lithologies in the lower portion of the dive suggests that there is a significant normal fault near the base of the upper steep section of the dive that is down to the south. Alternatively, deeper and shallower crust and upper mantle lithologies might be interleaved in this area.

All of the igneous lithologies in both the upper and lower sections of the dive are likely related to FAB magmatism. The troctolites are probably FAB-derived cumulates from the deepest crust. Gabbros crystallized at shallower crustal level. Diabases and basalts probably represent rocks that fell into the dive area after being shaken loose from sheeted dikes and pillow lavas exposed farther up slope.

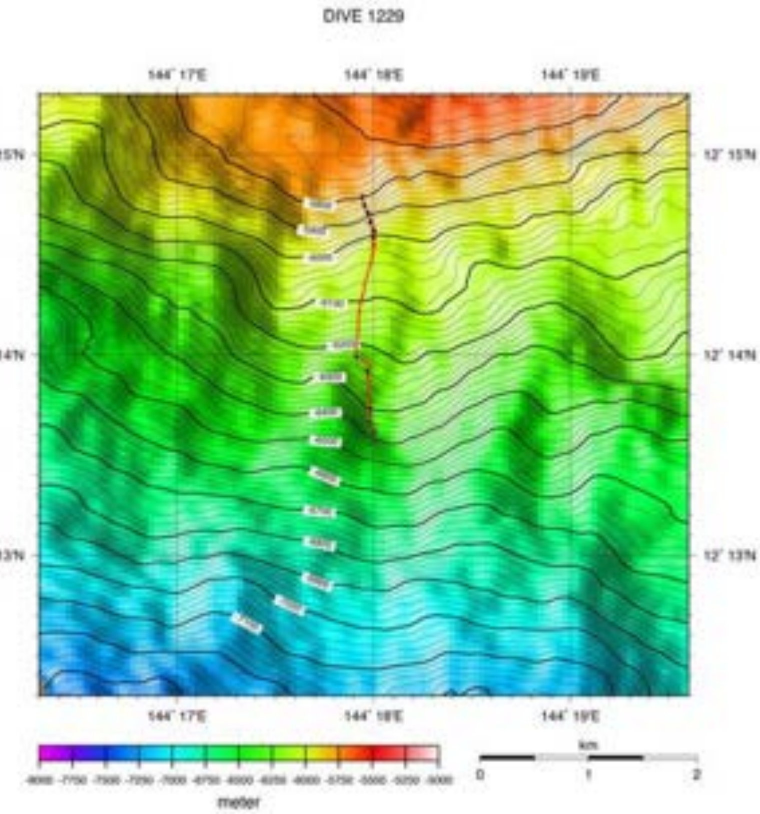

Fig. 1. Locality map showing track of 6K-1229.

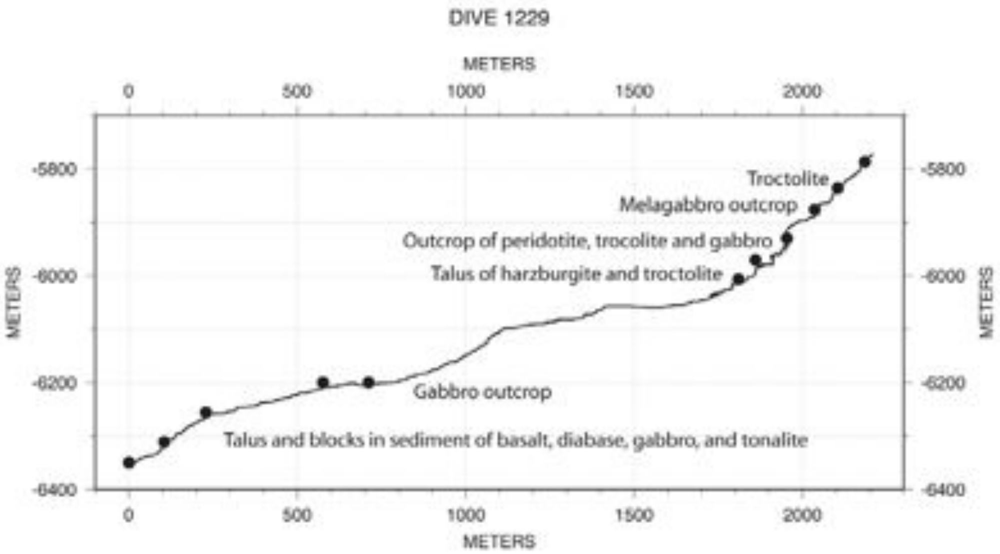

Fig. 2. Profile (no vertical exaggeration) showing track of 6K-1229.

Representative photographs of the dive:

Photo 1. The seafloor covered with talus blocks and tan-colored sediment, observed near sample stop 1 (6350 m).

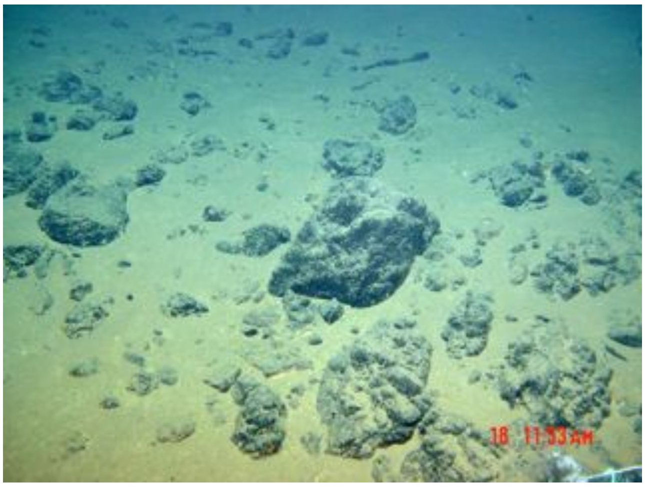

Photo 2. The seafloor near sample stop 3.

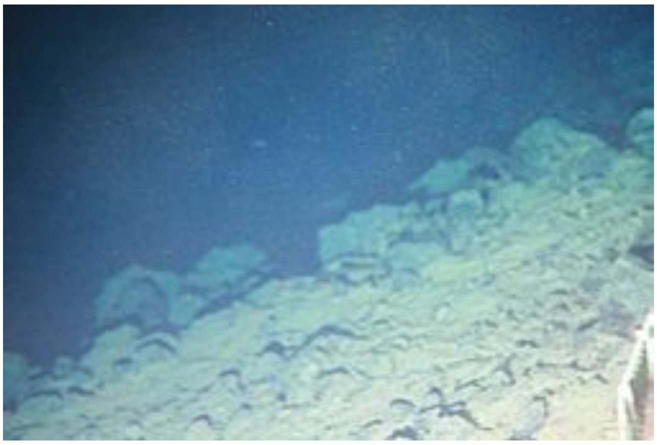

Photo 3. The top of the rubbly outcrop near sample stop 5.

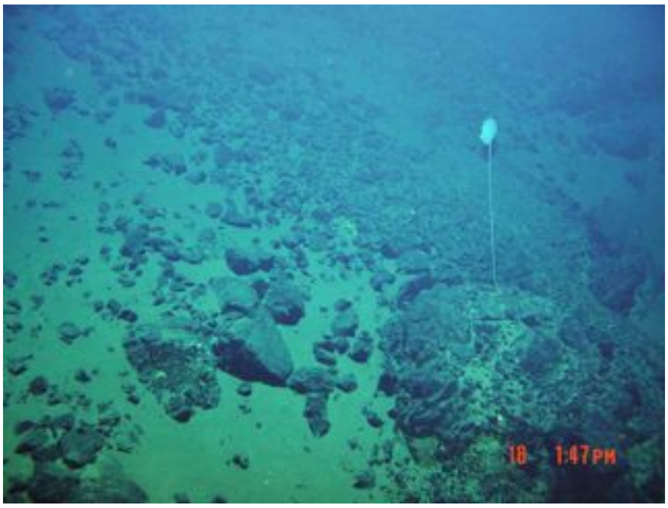

Photo 4. Suboutcrop and creature at ~5980 m depth.

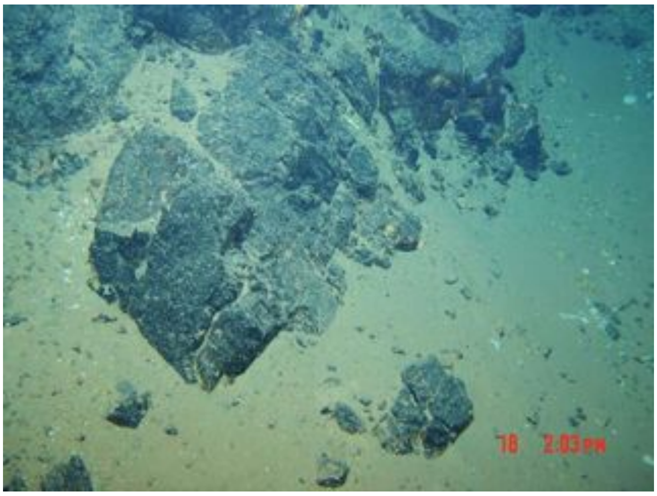

Photo 5. Fractured outcrop at sample stop 8.

Photo 6. Outcrop at sample stop 10.

A-2. Report for 6K-1230, September-19-2010: J. Ribeiro

Aim and scope of 6K-1230:
The purpose of the dive was to investigate the broadly distributed S.E. Mariana forearc rift (SEMFR) composed of sub-parallel ridges (bathymetric highs) and basins (bathymetric lows). SEMFR formed by stretching of the lithosphere of the upper plate due to E-W widening of the southern Mariana Trough backarc basin (Martinez and Stern, 2009) and slab rollback (Gvirtzman and Stern, 2004). The SW flank of the ridge to the west of dive 1230 was investigated in July 2008 (YK08-08, dive 1096) with Shinkai 6500, which recovered fresh tholeiitic pillow lavas composed of upper primitive basalts (Mg # > 60) and lower basaltic andesites (Mg # < 60). Dive 1230 is located on the SW flank of another NNW-SSE trending SEMFR ridge ~45 km from the trench (**Fig. 1**). The dive was planned to examine the lithology of this ridge and compare this with the lithology of dive 1096.

Observations:
Shinkai 6500 landed on the seafloor at 4958 m at 10:55 am. The seafloor was composed of large, subrounded to subangular rocks with Mn film, lying on light colored sediments, representing the distal part of a talus pile. Some rocks appeared to be pillow fragments. At **stop 1** (11:00 am, 4958 m), we collected two samples (**R01, R02**) (**Fig. 2A**). R01 is plagioclase basalt hosting a small piece of hyaloclastite and R02 is olivine basalt. A white coral and some algae were observed at 4950 m.

Stop 2 (4930 m, 11:22 am) was on talus consisting of subangular, Mn-coated basalts (**Fig. 2B**). Samples **R03** and **R04** were collected from the talus. R03 is basalt and R04 is microcrystalline olivine basalt. Upslope of this stop, the talus was composed of coarse, angular basaltic fragments with Mn film.

At **stop 3** (11:34, 4905m), we collected samples **R05** and **R06** from talus. Both samples are aphyric basalt. The size of the Mn-coated rocks increases from stop 2 to stop 4.

At **stop 4** (11:46, 4852 m), we collected subangular, Mn-coated rocks (**R07, R08**). R07 is olivine basalt and R08 is vesicular basalt. Upslope of this stop, rocks became smaller and well-sorted along a steeper slope, but larger blocks were observed upslope.

At **stop 5** (12:07, 4801 m), Shinkai stopped next to a possible outcrop, where rocks **R09** and **R10** were collected. The talus consisted of large, subangular Mn-coated rocks and light-colored, subrounded rocks. We sampled the two different kinds of rocks: R09 is a rounded rock that is a hyaloclastite and R10 is an angular rock that is Mn-coated basalt.

At **stop 6** (12:27, 4752 m), the size of the talus blocks increased, and were associated with scattered, larger blocks. **R11** and **R12** were collected from the talus. R11 is basalt and R12 is basaltic pyroclastic. Upslope from this stop, talus blocks became smaller, but were still associated with scattered, larger blocks.

At **stop 7** (12:44, 4704 m), samples **R13** and **R14** were collected from the talus. R13 and R14 are both basalts. Upslope from this point, the slope became steeper.

At **stop 8** (12:57, 4650 m), Shinkai collected two rocks (**R15, R16).** R15 is basalt and R16 is plagioclase-olivine basalt. Upslope from this stop, we encountered a very steep outcrop, from which **R17** was sampled (**stop 9**, 13:09, 4650 m) (**Fig. 2C**). The outcrop appeared subvertical and faulted, with sharp edges and possible columnar jointing. No boulders were observed along the outcrop. The large and steep outcrop was clearly faulted by stretching, creating a small trough where boulders accumulated.

From **stop 10** (13:21, 4599 m) to stop 11 (13:36, 4554 m), the size of the subangular boulders increased, and were associated with larger rounded blocks. We collected **R18, R19** (**stop 10**), **R20** and **R21** (**stop 11**) among the talus. The samples are Mn-coated aphyric basalts. Upslope from stop 11, the size of the boulders increased and we encountered an outcrop from 4519 to 4501 m (13:43 to 13:49). On top of the outcrop, talus blocks were smaller, and increased in size upslope, until the end of the dive (**Fig. 2D**).

Between 4519 m and 4501 m, we crossed a steep, basaltic outcrop (13:43 to 13:49). Shinkai stopped near the outcrop (**stop 12**, 13:57, 4499 m) to collect two olivine basalts (**R22** and **R23**) from the talus. The top of the outcrop was composed of angular, medium-sized rocks. Upslope of the outcrop, the size of the rocks covering the talus increased and then, slightly decreased until the next sampling stop.

At **stop 13** (14:19, 4451 m), Mn-coated basalt (**R24)** and Mn-coated plagioclase basalt (**R25**) were recovered from the talus. From this point onwards, the size of the angular rocks of the talus decreased at first and started increasing again just before the next sampling point. From stop 13, the texture of the lava fragments changes from aphyric to microporphyritic, or even porphyritic.

At **stop 14** (14:36, 4401 m), Shinkai recovered plagioclase basalts (**R26, R27**), suggesting a clear change in the lithology and composition of the lavas forming the NE of the central rift. Some of the rocks covering the talus had a subrounded shape, which appeared to be pillow fragments.

At **stop 15** (14:51, 4350 m), Shinkai recovered plagioclase basalts (**R28, R29**) from the talus. The samples are small, subangular Mn-coated basaltic rocks. Upslope of this stop, the size of the rocks decreased.

At **stop 16** (15:09, 4303 m), Shinkai sampled plagioclase basalt fragments (**R30, R31**) from the talus. Upslope of this stop, the talus consisted of small-sized, subangular Mn-coated rocks, for which the size appeared to vary slightly until the next stop.

At **stop 17** (15:21, 4280 m), Shinkai recovered smaller, subangular Mn-coated talus fragments (**R32, R33**), which also are plagioclase basalts, before taking off.

Summary:
During this dive, 17 stops were made along the SW flank of a NNW-SSW trending ridge in the SEMFR (from 4958 m to 4280 m). 33 rocks were collected, with one specimen, the precise location of which is unknown. All but one of the samples were recovered from the talus (**Fig. 3**). We collected two samples from each stop except at stop 9. Recovered samples mainly are basaltic lavas, some of which may be pillows, along with one sample of pyroclastic breccia (R12) and one hyaloclastite (R09). A crude sorting of the fragment size was observed for the talus, and these become larger towards outcrops. We crossed three outcrops (stop 4, stop 9 and between stops 11 and 12) and sampled next to them. Only one rock was sampled from an outcrop (R17). Occurrence of steep, sharp and faulted outcrops indicates that the lava flows were tectonically stretched, and perhaps tilted (inferred from the

second outcrop). Examination of recovered samples suggests that most lavas are fresh and petrographically similar to the lavas sampled in dive 1096. However, dive 1230 lavas appear to be more phyric, particularly at the top of the dive track (R22 to R33); while aphyric lavas are mainly observed below 4550 m. Observation of such fresh lavas suggests recent volcanism in the SEMFR. Vesicular textures suggest that lavas were produced by hydrous mantle melting. Aphyric textures suggest that magma rapidly migrated from to the surface, without significant cooling, and erupted with superheat.

References:

Gvirtzman, Z., and Stern, R. J., 2004, Bathymetry of Mariana trench-arc system and formation of the Challenger Deep as a consequence of weak plate coupling: Tectonics, v. 23.

Martinez, F., and Stern, R. J., 2009, The Southern Mariana Convergent Margin: a Pre-Ophiolite Analogue: AGU Fall meeting abstract.

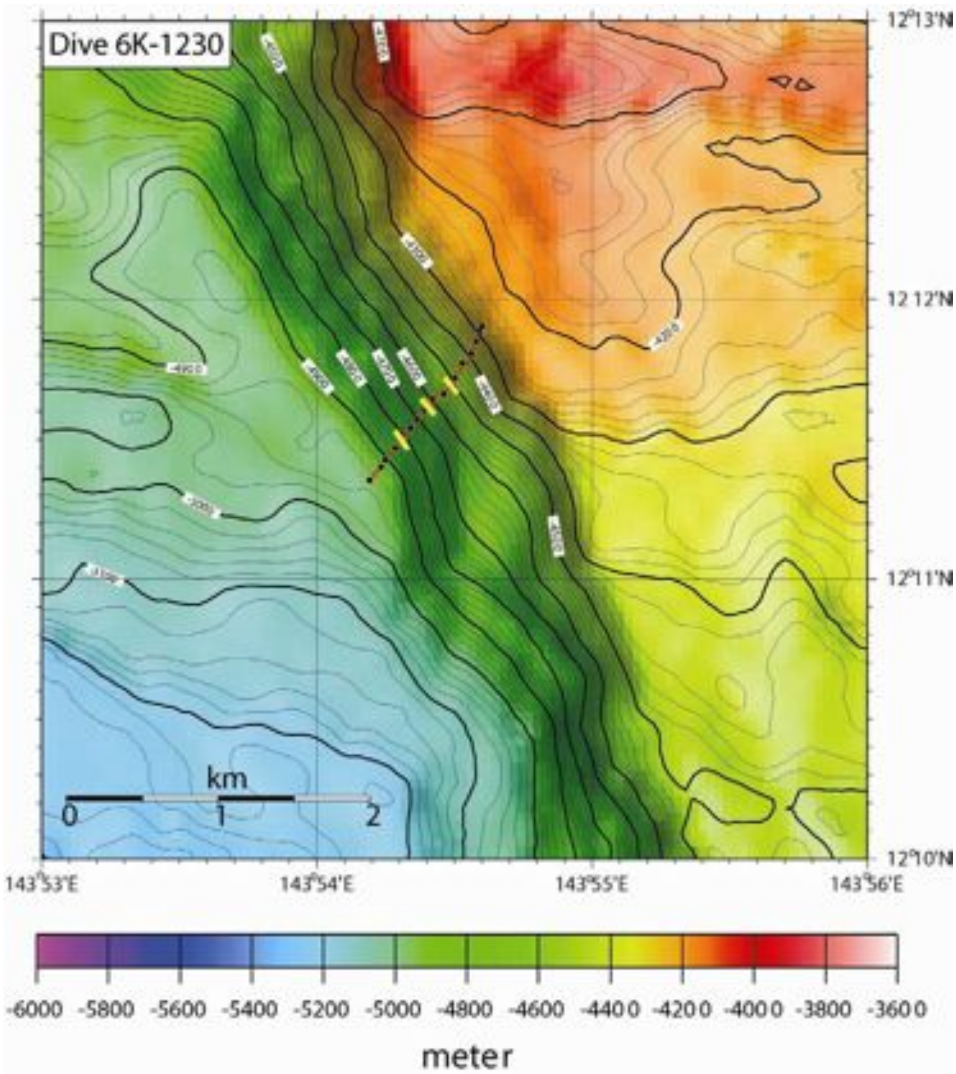

Fig. 1. Map of the studied area, showing track of dive 1230. Here is shown the SW flank of a NNW-SSE trending ridge in the middle of the SEMFR. The dive path (in red) and the dive stops (black points) are also shown. Short thick yellow lines represent faults shown on Fig. 3.

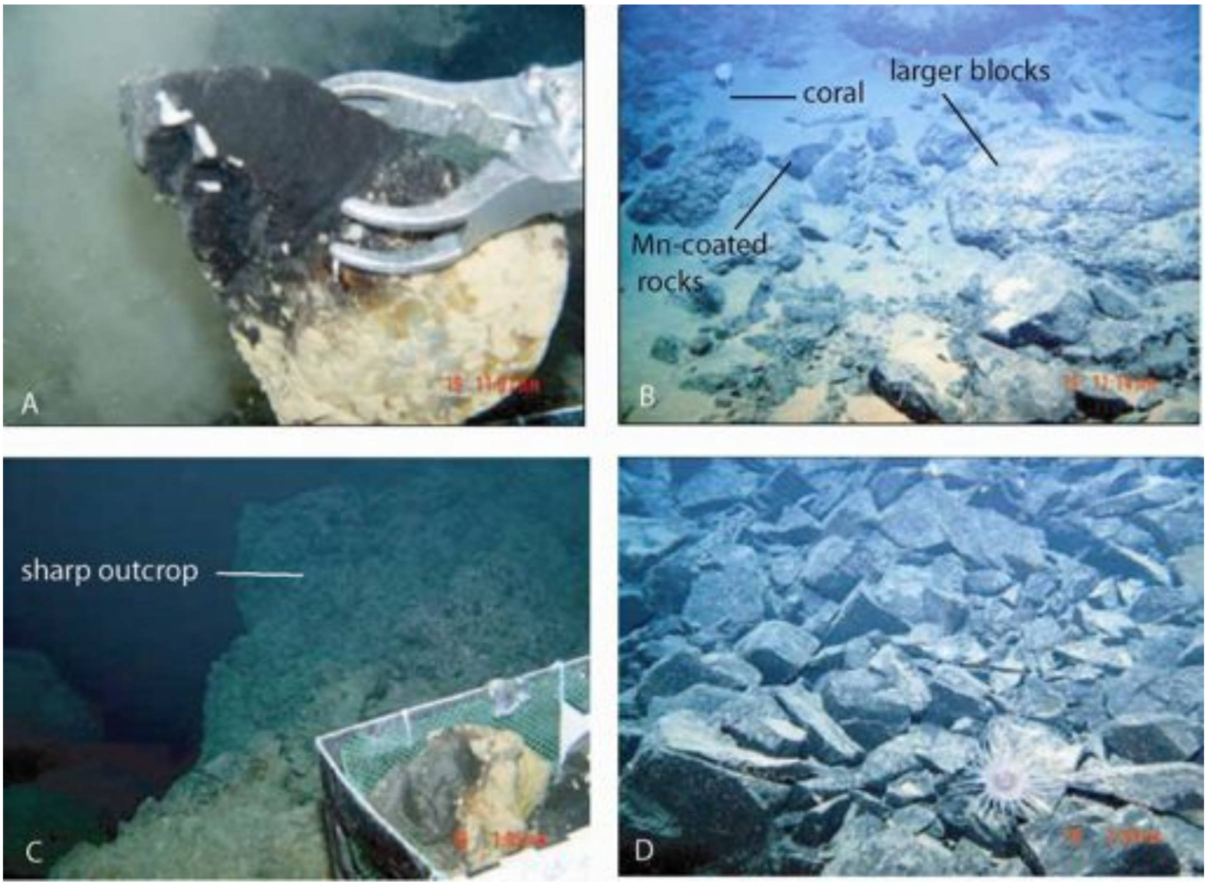

Fig. 2. Pictures taken with the DSC camera of the Shinkai. (A) Sampling pillow lava (R01) (B) The talus of this dive was mainly composed of subangular to subrounded, Mn-coated basaltic rocks associated with larger, subrounded blocks, lying on light-colored sediment. A white coral is also observed on that picture (C) Sampling in the steep and sharp outcrop (stop 9) (D) Subangular Mn-coated rocks mainly composing the talus of dive 1230. An anemone is also observed on the rocks.

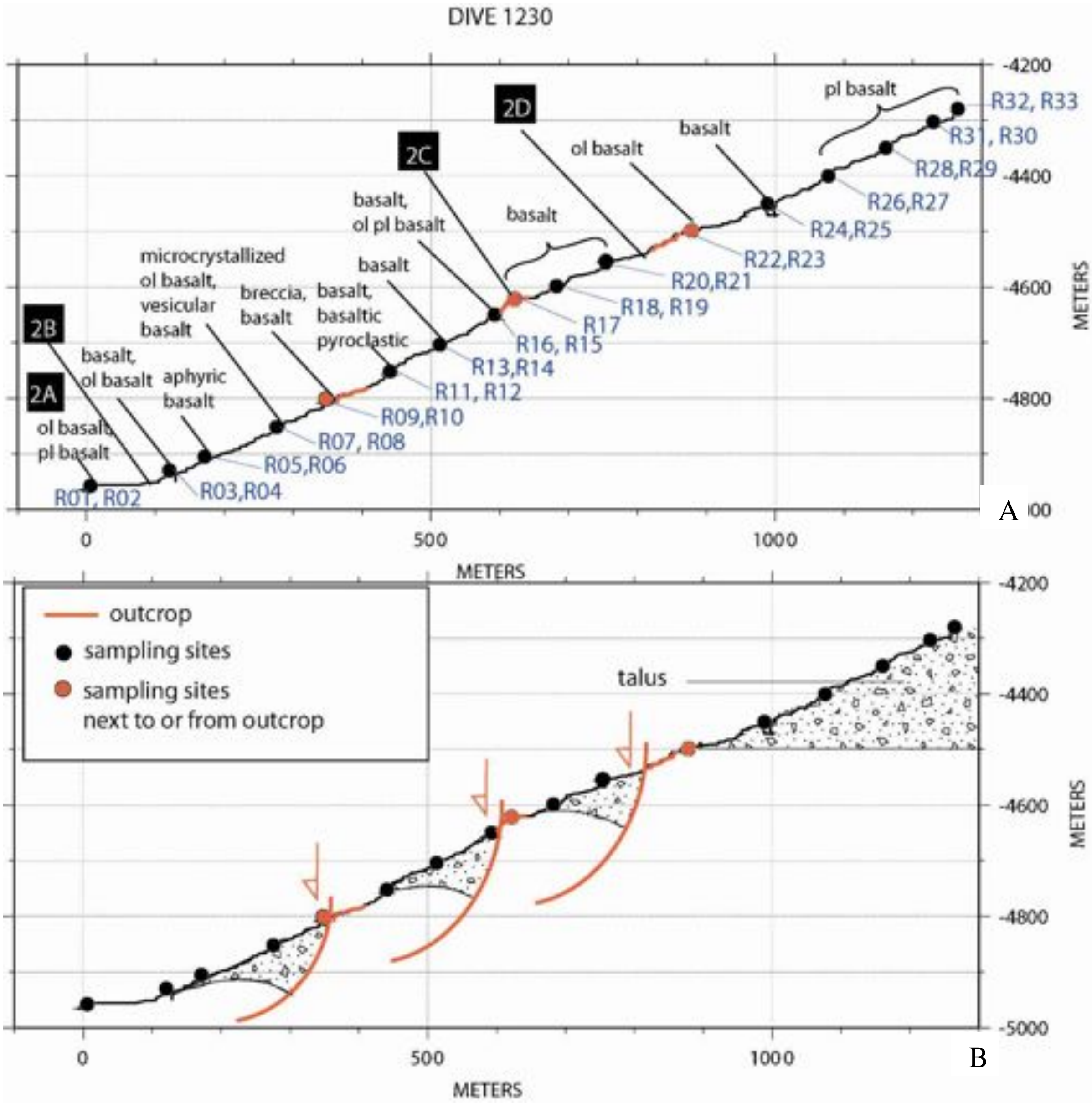

Fig. 3. Bathymetric profile for dive 1230 (no vertical exaggeration). (A) Location of the samples and their lithology. Red points are sampling sites next to or on outcrop. Labelled black boxes show the location of photographs in Fig. 2 (B) Interpretation for the geology observed along dive 1230. Normal faults (red lines) are inferred to mark the downslope limit of outcrops, and talus talus slopes mark the slopes beneath the faulted zones.

A-3. Report for 6K-1231, September-20-2010: I. Pujana

Aim and scope of 6K-1231:

The dive site is located south of the Santa Rosa Banks in an area thought to be underlain by gabbroic rocks and peridotites (**Fig. 1**).

Observations:

Landing was at 6393 m, at 11:34, on an area covered with sand and finer sediments, it was observed abundant life on it. This is the only place with fine sediments on this dive. No rocks where observed, so we moved to the next sample stop, with an azimuth 340 (**Photo 1**).

Sample **stop 1** , depth 6377 m was at the base of the talus, and at 11:51 we collected two blocks (**R01 and R02)** lying in sediment on the slope. R01 is a large angular block of fine grain basalt; R02 is a very large angular block of a basaltic breccia including angular clasts of glassy basalt from 2 cm to 2 mm, it could be term a hyaloclastite (**Photo 2**).

At sample **stop 2** (6333 m at ~12:06), we stopped to collect four blocks at a site on the same talus samples with lithologies like stop 1 (**R03, R04, R05 and R06**). All of them are fine-grained basalt except for R5 a basaltic breccia.

Upslope from this area, the cobbles and boulders are less abundant decreasing to gravel and sand size.

At sample **stop 3** (6245 m at ~12:23), we collected four blocks (**R07, R08, R09 and R10**) on the base of a new talus slope abundantly littered with subangular boulders of fine-grained rock. The sample also had abundant alteration veins and superficial alteration (white mineral). The terrain upslope from about 6229 m consist of an outcrop of fractured fine grained basalt with veins of a fibrous banded white mineral, it becomes very steep (**Photo 3**). Sample attempted using the robotic arm and the scoop, but it was not successful (**Photo 4**).

At sample **stop 4** (6228 m at ~12:51), outcrop very step, sampling was difficult due to lack of loose pieces. However we were able to collect three blocks. The two first samples, **R11,** and **R12** are pyroxenite, and **R13** is basalt (**Photo 5**).

The terrain upslope from here continuous with the very steep slope; some locations are nearly vertical. The area is partially covered with fine light-colored sediment, whereas other areas are strewn with cobbles and boulders. Several few-meter scale boulders are scattered through this area.

Sample **stop 5** (6194 m at ~13:04) was talus area with abundant cobble sized angular clasts and sand. On top of it, there is a rock outcrop with decimeter- to meter-scale fracturing, producing the boulder-sized angular rubble collected. We collected two blocks atop and several meters away from the overlaying of the outcrop on the slope (**R14 and R15**). These rocks were basalt and metagabbro respectively.

Sample **stop 6** (6183 m at 13:26) outcrop steep wall (**Photo 6**), some of the altered rock and the interstitial mineralization was scooped (**R18 = S01**). Two angular blocks were collected here (**R16 and R17**). R16 is a basalt with white surface deposit, pyroxenes rimmed by sulfides (pyrite?); R17 is a metagabbro with groundmass nucleation organized around large crystals and alteration veins.

Sample **stop 7** (6145 m at ~13:42) lava outcrop continues from previous stop with the same abundant white mineralization on the faults, a scoop sample (**R19 = S02**) was obtained here. Upslope from this location, the slope was quite steep, mostly outcrop with areas partially covered by angular cobbles, boulders, and some sediment. The whole area has abundant alteration and or mineralization along fractures and surfaces.

Sample **stop 8** (6085 m at ~14:18). On this stop we see the base of a talus. Three angular blocks were collected (**R20, R21, and R22**); a diabase and two basalts respectively. More outcrop is observed along the steep slope towards sample stop 9 (**Photo 7**).

Sample **stop 9** (5982 m at ~14:44), was at the foot of a massive and fractured outcrop. Three samples (**R23, R24 and R25**) were collected here, R23 is a microgabbro, R24 a pyroxenite and R25 a basalt.

The final sample **stop 10** (5932 m at ~15:00) was in a talus area of abundant blocks. Two subangular to angular samples (**R26, and R27**).

Shinkai left the bottom at 15:05.

Summary of dive observations:
The dive is a very step section, crossed by vertical gullies (**Fig. 2**). Most of it is an outcrop faulted and mineralized, by white fibrous mineral. The sampled lithologies varied from basalt to metagabbro to boninite.

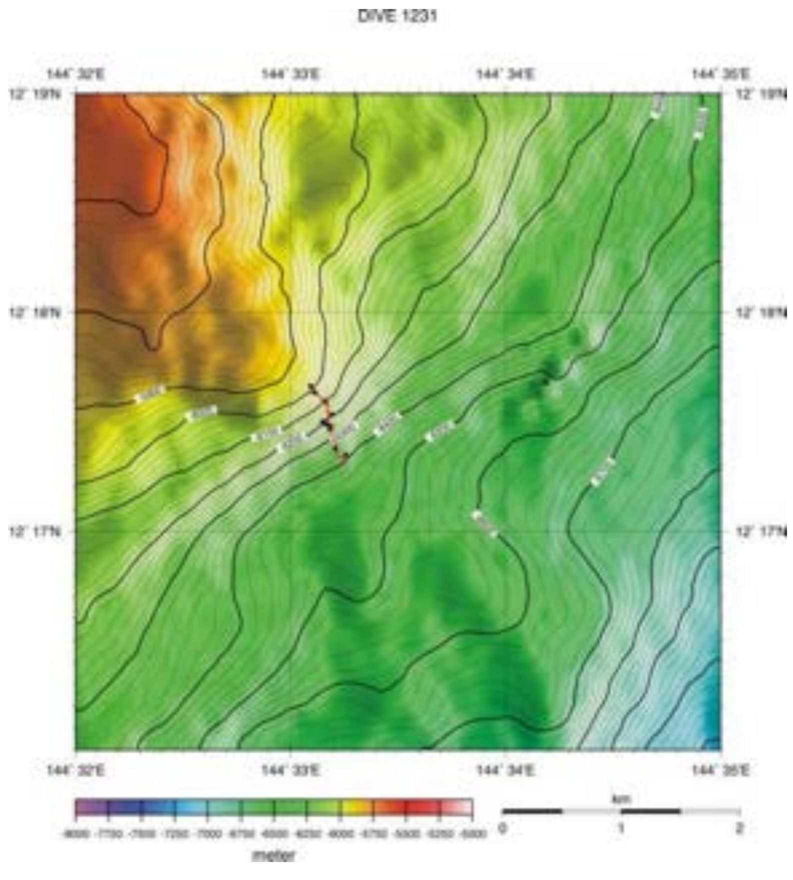

Fig. 1. Locality map showing track of 6K-1231.

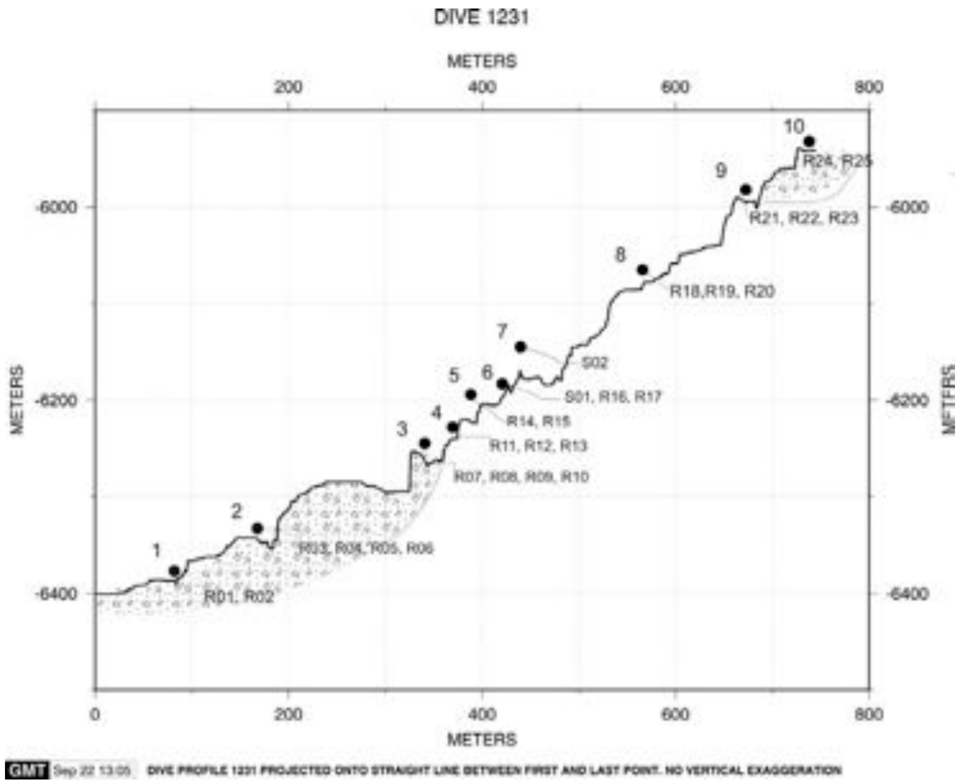

Fig. 2. Profile (no vertical exaggeration) showing track of 6K-1231.

Representative photographs of the dive:

Photo 1. The seafloor covered with sediment, abundant tracks and burrows, testify to life activity. Landing place, this is one of the few places with sediment on this dive. (6393 m).

Photo 2. The seafloor sample stop 1, near base of the talus.

Photo 3. The base of the outcrop with faulted basalt and veins of the white fibrous mineral, near sample stop 4.

Photo 4. Outcrop at ~6227 m depth.

Photo 5. Fractured outcrop at sample stop 4. A fault clearly marked by the white mineral on it.

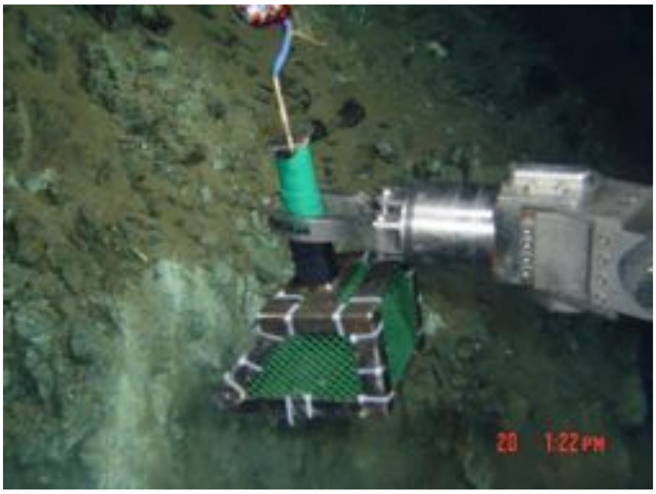

Photo 6. Outcrop at sample stop 6.

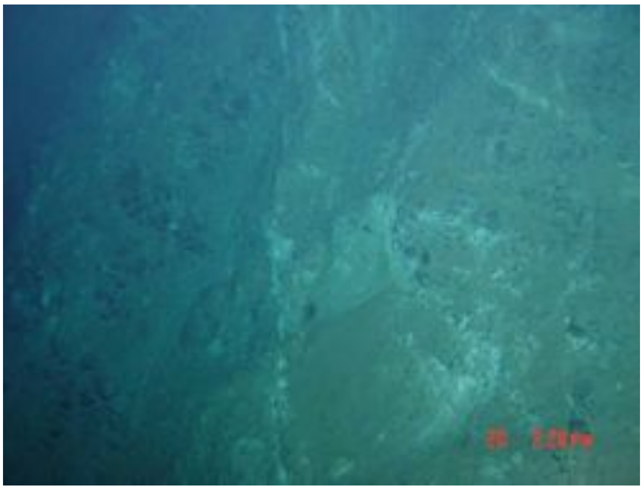

Photo 7. Steep slope before sample stop 9.

A-4. Report for 6K-1232, September-21-2010: K. Michibayashi

Aim and scope of 6K-1232:
The dive site is located southern slope of the Mariana trench where is close to the eastern edge of the Challenger Deep. A NE-trend fault was thought to occur between the peridotite to the east and the gabbro/tonalite to the west. Therefore, the plan for this dive was to confirm lithology (either peridotites or gabbro/tonalite) in this area and to collect them. Regardless of what type of rocks we get, since this area has never been surveyed before, we are able to understand the geology and petrology in this area.

Observations:
The Shinkai landed on the seafloor at 6425 m at 11:25 and we started the scientific operation. The landing point was covered with muddy sediment (**Photo 1**).

Sample **stop 1** was near the landing point, and at 11:43 we collected three float blocks (**R01, R02, and R03**) lying in sediment on the slope. R01 is dunite; R02 is a angular block of harzburgite; R03 is dunite with plagioclase impregnation.

The sedimentation on the slope uphill from this location remained similar to that depicted in photo 1. One outcrop may occur in muddy sediment (**Photo 2**).

At sample **stop 2** (6347 m at ~12:05), we stopped to collect two blocks at a site with surface lithologies like stop 1 (**R04** and **R05**). R04 is a harzburgite which is fresh and may include cleavable olivine grains; R05 is also harzburgite which is probably highly depleted.

Upslope from this area, the cobbles and boulders occur locally in muddy sediments till 6316 m. Muddy sediment with no cobbles and boulders appears till 6290 m. At 6290m, a few small cobbles are observed in the muddy sediment.

At sample **stop 3** (6277 m at ~12:22), we collected two blocks (**R06** and **R07**) on a slope abundantly littered with subangular boulders (**Photo 3**). R06 is a fresh dunite and is partly serpentinized (possibly antigorite). Surprisingly, R07 is a garnet-amphibolite with coarse granular texture. This is the first discovery from the Mariana Trench.

Upslope from this area, the cobbles and boulders occur in muddy sediments till 6239 m. Thick muddy sediment covers the surface with no rock till 6230 m. Angular boulders can be seen in the muddy ground from 6230 m to 6200 m.

At sample **stop 4** (6200 m at ~12:49), we collected two blocks (**R08** and **R09**) on a slope with subangular boulders. Although there is no outcrop, >1m large blocks occur among various sizes of blocks from a few to a few tens centimeters. **R08** is an weathered dunite with weak serpentine foliations. **R09** is a heavily altered harzburgite with serpentine foliations.

Upslope from this area, muddy sediment with few cobbles and boulders continues till 6132 m. We observed a red shrimp at 6145 m on the muddy ground.

At sample **stop 5** (6127 m at ~13:09), we collected two blocks (**R10** and **R11**) in muddy sediments with the cobbles and boulders. **R10** is an altered dunite, but original minerals seem to be preserved; olivine may be fine-grained with a few orthopyroxene. **R11** is an altered harzburgite, but fine olivine grains and rounded orthopyroxene are preserved; maybe this sample is highly depleted. Serpentine mesh texture abundant.

Slope from this area became steeper. Although no outcrops occurred, large (~1m) boulders were observed in the muddy sediment.

At sample **stop 6** (6050 m at ~13:22), we collected two blocks (**R12** and **R13**) in muddy sediments. **R12** is an altered harzburgite with many pyroxene grains (fertile?). **R13** is a foliated amphibolite with coarse banding.

Slope from this area is still steep. The cover sediment was whitish (**Photo 4**); suggesting presence of carbonate?

At sample **stop 7** (5994m at ~13:32), we collected two angular blocks (**R14** and **R15**). **R14** is an altered foliated harzburgite; a few orthopyroxene and one clinopyroxene are observed by a magnifying glass; maybe lherzolite? **R15** is probably also foliated harzburgite; many small orthopyroxene grains seem to be elongated; spinel grains are elongated.

Relatively large (but less than 1m) angular boulders appear among various sizes of rocks from the **stop 7**. At 6200 m, the boulders appear to be larger and they have lighter color than before: gabbro?

At sample **stop 8** (5938 m at ~11:41), we collected one angular block (**R16**). **R16** is amphibolite which contains a few cm-width fine-grained layer in the coarse foliated bands. It is very important to note that one garnet grain was identified in the cut surface, indicating its high-pressure origin.

At 5910m, the white sediment appears which could be hydrothermal origin.

At sample **stop 9** (5900 m at ~13:55), we collected one angular block (**R17**) and performed one scoop to collect the white sediment (**S01**). **R17** is a relatively fresh harzburgite.

At 5886 m, the ground was back to the muddy sediment with no rock. At 5855 m, the cobbles and boulders appeared.

At sample **stop 10** (5849m at ~14:15), we collected one flat block (**R18**), which was a muddy rock.

At 5840 m, flat rocks were common. At 5800 m, muddy sediment were encountered.

At sample **stop 11** (5789 m at ~14:31), we collected one block (**R19**). **R19** is a fresh harzburgite; clinopyroxene is observed by a magnifying glass. Probably **R19** was deformed to develop foliations.

At sample **stop 12** (5760 m at ~14:44), we collected one large flat block (**R20**) that was broken into two parts. **R20** is a muddy rock with some detrital spinel grains.

At sample **stop 13** (5751 m at ~14:55), we collected two angular blocks (**R21**, **R22**). **R21** is a troctlite, that may be a dunite with impregnated plagioclase. This type of rock is commonly found in the Moho transition zone such as in the Oman ophiolite. **R22** is an altered harzburgite with many rounded orthopyroxene; plagioclase included.

Shinkai dropped its ballast and left the bottom at 14:55.

Summary of dive observations:
The dive collected twenty-one rock samples, all of which were taken from floated boulders in the muddy sediment (**Fig. 1**). The dive section had few outcrops. In particular, where the slop is shallow, the ground is completely covered by the muddy sediment as shown in Photo 1. The cobbles and boulders are scatterly distributed in steeper slopes.

The samples were dominated by harzburgites with minor dunites from the bottom to the top. Hence, it is likely that this section represents the peridotite section. Amount of pyroxene grains within harzburgite vary from low to high, suggesting that they resulted from various degree of melting. Some clinopyroxene grains were identified within a few harzburgite, indicating that they are lherzoritic fertile peridotites. This dive section also have the harzburgites with low amount of pyroxene as well as dunite, indicating that some peridotites are depleted due to high degree of melting. Furthermore, the occurrence of the troctlite and the amphibolites indicates that the section was close to the mantle-crust boundary (the Moho). Garnet was observed in one amphibolite block (R16), indicating that the amphibolite could have been experienced high-pressure condition rather than just a low-temperature hydration at shallow depth. A special interest is the garnet-amphibolite (R07), which is rarely found from the ocean floor. It may preserve P-T path information in its chemical composition.

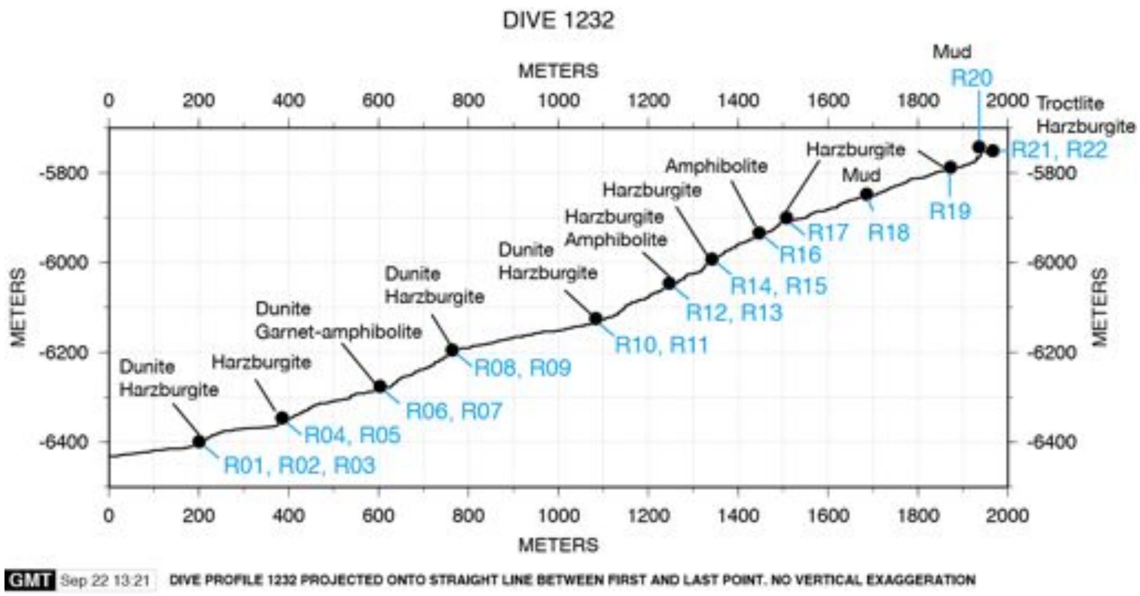

Fig. 1. Profile (no vertical exaggeration) showing track of 6K-1232.

Representative photographs of the dive:

Photo 1. The seafloor covered with whitish-colored sediment, observed at landing site (6425 m).

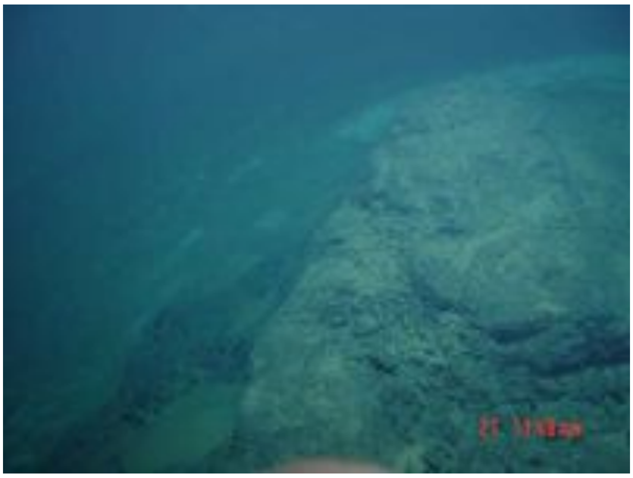

Photo 2. Outcrop? in muddy sediment (6370 m).

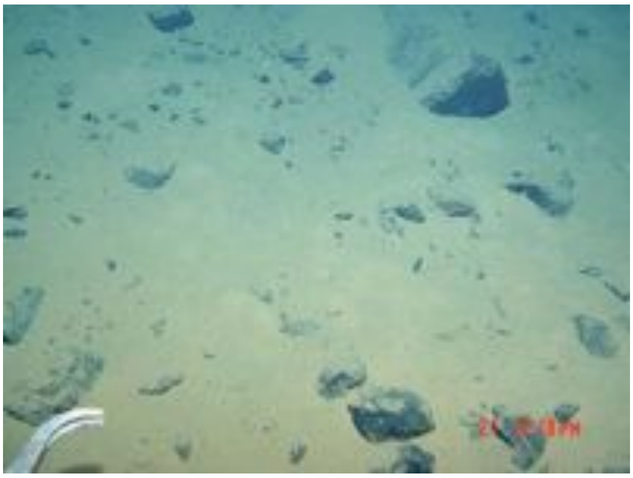

Photo 3. Angular cobbles and boulders were scattered in the muddy sediment.

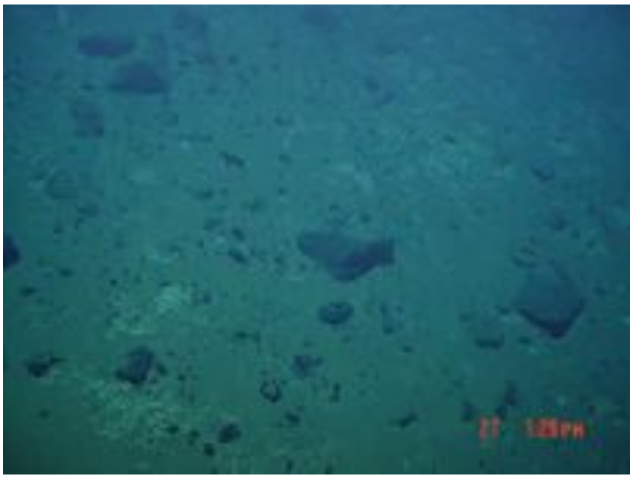

Photo 4. A few angular boulders in the whitish sediment.

A-5. Report for 6K-1233, September-22-2010: Y. Ohara

Aim and scope of 6K-1233:

The dive site is located on the landward slope of the southern Mariana Trench ~55 km to the east of the Challenger Deep (**Fig. 1**). A NE-trend fault was assumed to occur between the peridotite to the east and the gabbro/tonalite to the west (geological map by Mark K. Reagan and also see Ohara et al., 2008, AGU). Therefore, the plan for this dive was to confirm lithology (either peridotites or gabbro/tonalite) in this area and to collect them. Regardless of what type of rocks we get, since this area has never been surveyed before, we are able to understand the geology and petrology in this area.

Observations:

The Shinkai landed on the seafloor at 6394 m at 11:25 and we started the scientific operation. The landing point was covered with muddy sediment.

Sample **stop 1** was near the landing point, and at 11:38 we collected two talus blocks (**R01** and **R02)** lying in sediment on the slope (**Photo 1**). Both are subangular mud blocks that contain numerous detrital spinel grains.

At sample **stop 2** (6320 m at ~11:56), we collected two talus blocks (**R03** and **R04)** lying in sediment on the slope. Both are fresh peridotites, probably having lherzolitic composition.

At sample **stop 3** (6309 m at ~12:13), we collected two talus blocks (**R05** and **R06)** lying in sediment on the slope. Both are fresh peridotites, probably having lherzolitic composition.

The terrain upslope from here is steeper, but like below, consists of a mud cover with scattered to clustered cobbles and boulders.

At sample **stop 4** (6277 m at ~12:28), we collected two talus blocks (**R07** and **R08)** lying in sediment on the slope. Both are weathered peridotites.

At sample **stop 5** (6250 m at ~12:44), we collected three talus blocks (**R09, R10** and **R11)** lying in sediment on the slope. All are subangular mud blocks. Unlike R1 and R2, these contain lesser number of detrital spinel grains.

At sample **stop 6** (6210 m at ~12:59), we collected two talus blocks (**R12** and **R13)** lying in sediment on the slope. Both are fresh peridotites, probably having lherzolitic composition.

The slope above here became steeper (**Photo 2**).

At sample **stop 7** (6199 m at ~13:17), we collected four talus blocks (**R14, R15, R16** and **R17)** lying in sediment on the slope. All are subangular mud blocks. R16 and R17 may contain few detrital spinel grains.

At 13:21, the video camera #2 failed. At 13:27, the talus block become large; at 13:33 and 13:34, the block remains large. At 13:43, the video camera #2 recovered.

At sample **stop 8** (6074 m at ~14:03), we collected two talus blocks (**R18** and **R19)** lying in sediment on the slope. Both are subangular mud blocks, and may contain detrital spinel grains.

Upslope of this location, at 14:15, the talus block is still large.

At sample **stop 9** (6041 m at ~14:20), we collected two talus blocks (**R20** and **R21)** lying in sediment on the slope. Both are fresh peridotites, probably having lherzolitic composition.

At 14:28, sediment-covered bottom is observed. At 14:30, we encountered large boulders of probable peridotite.

At sample **stop 10** (6004 m at ~14:36), we collected two talus blocks (**R22** and **R23)** lying in sediment on the slope. Both are fresh peridotites, probably having lherzolitic composition.

At 6001 m (at ~14:38), we encountered a possible outcrop (**Photo 3**). The slope was quite steep.

At the final sample **stop 11** (5930 m at ~14:55), we collected two talus blocks (**R24** and **R25)** lying in sediment on the slope. Both are subangular mud blocks. R24 may contain few detrital spinels.

Shinkai dropped its ballast and left the bottom at 14:56.

Summary of dive observations:
The dive collected twenty-five rock samples, all of which were taken from floated boulders in the muddy sediment (**Fig. 2**). The dive section had a single possible outcrop.

The samples were dominated by harzburgites with minor dunites from the bottom to the top. Some of the samples are very fresh. This is a first report to describe such very fresh peridotites in the Southern Mariana Trench.

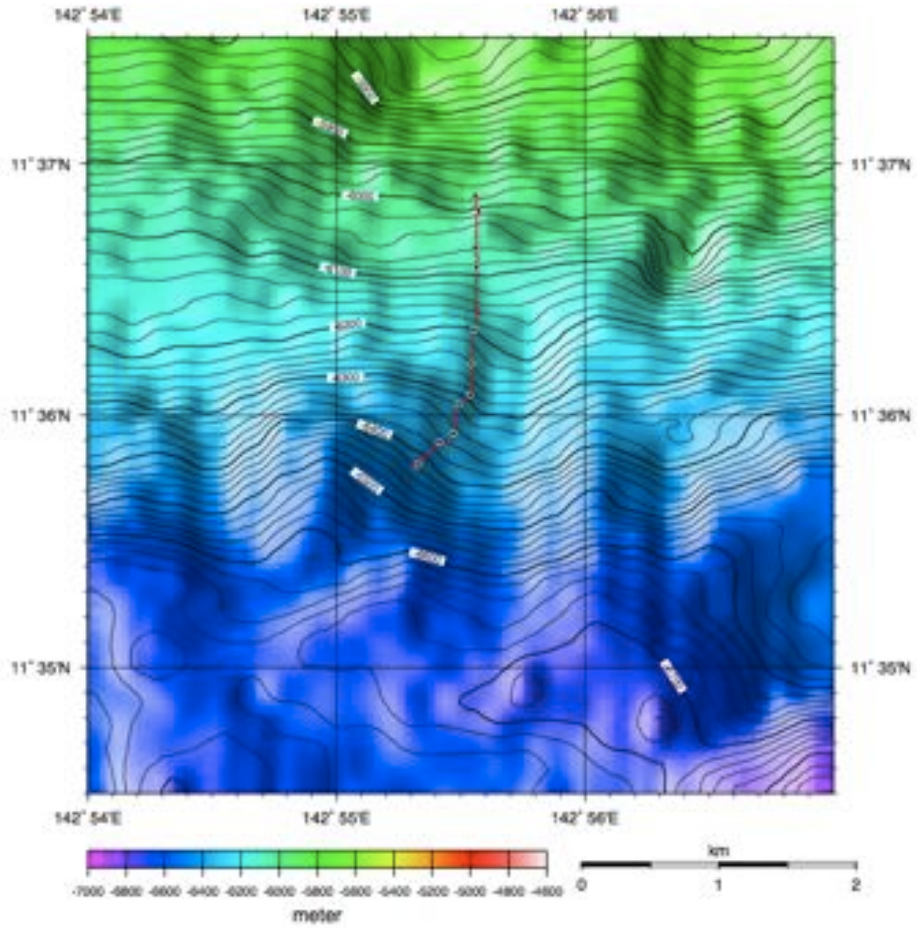

Fig. 1. Locality map showing track of 6K-1233.

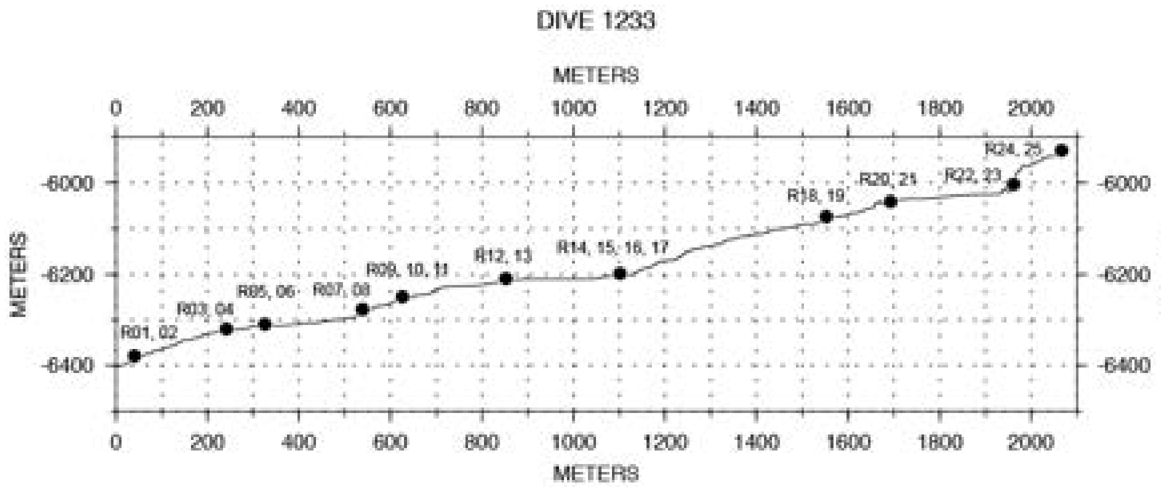

Fig. 2. Profile (no vertical exaggeration) showing track of 6K-1233.

Representative photographs of the dive:

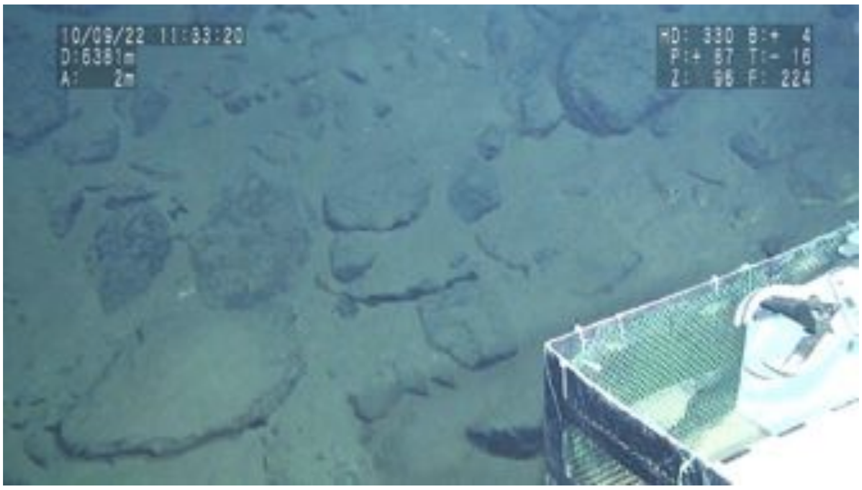

Photo 1. The seafloor covered with talus blocks and tan-colored sediment, observed near stop 1 (6381 m).

Photo 2. The seafloor near sample stop 6.

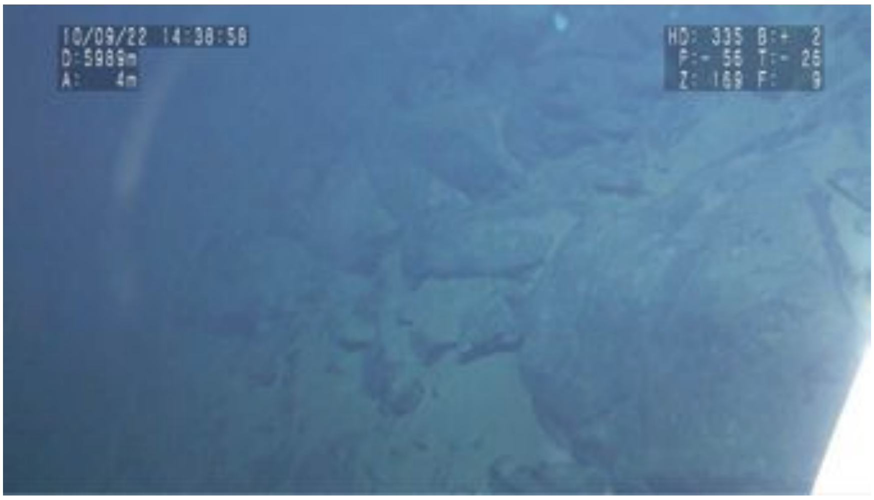

Photo 3. Possible outcrop near sample stop 10.

A-6. Report for 6K-1234, September-23-2010: T. Ishii

Aim and scope of 6K-1234:
The locations for dives 1232, 1233, 1234 and 1236 were chosen to sample in a previously unsampled area near the Challenger Deep, from where it is about 100 km ENE and about 100 km SSW from Guam. The specific dive site for dive 1234 was chosen to continue the stratigraphic section begun at dive site 1232. Based on our preliminary geological map of the southern Mariana forearc, we believed that this area would be a likely location for the Moho and thus, would likely be floored by shallow mantle and deep crustal lithologies.

Observations:
The Shinkai landed on the seafloor (11°39.10'N, 143°02.94'E) at 6079 m at 11:27 and the scientific operation was started. The landing point was in a talus deposit of angular boulders. Some boulders had surfaces stained orange, whereas others had whitish mineral deposits on surfaces and cracks. A few subrounded blocks of carbonate were also in this area (**Photo 1**).

Sample **stop 1** (6079 m; ~11:29): it was near the landing point, and four blocks of talus were collected (**R01, R02, R03**, and **R04**). R01 is an angular serpentinized fine-grained ultramafic rock (harzburgite) with foliation suggesting that it is an ultramylonite (?). It is hurzburgite including cleavable olivine, orthopyroxene, spinel and antigorite according to optical observation. R02 is a large subrounded block of porous carbonate, which is derived from shallow water carbonate (or carbonate chimney ?). This sample had needles of aragonite (?) in some pores and was covered with some sort of algae. R03 is serpentinized harzburgite has distinctive veins and a pale green alteration rind. The sedimentation on the slope uphill from this location remained similar to that depicted in **Photo 1**. R4 is an altered harzburgite shot through with veins of white minerals that could be calcite and also has an unknown white acicular mineral.

Sample **stop 2** (6021 m; ~12:00): one block was collected at the base of a highly fractured and massive outcrop (**R05**). Some fractures at this location contain white minerals and some surfaces are stained orange (**Photo 2**). Surface sediments just upslope this area appear to be partially lithified and have white stained horizons. R05 is an altered and veined harzburgite.

Sample **stop 3** (5945 m; ~12:20): it is in an area of white-stained surface sediment (assumed as serpentine mud) which scattered angular blocks, a push core of whitish sediment was taken. An angular fragment of serpentinized harzburgite was also collected here (**R06**).

Upslope from this site, the slope surface was muddy with scattered angular blocks. White small clam shells (single bulb) of probable genus *Calyptogena* were first spotted widely scattered in this area. None were living or in growth position. Large blocks or suboutcrop of what appears to be poorly sorted debris cemented by a white material are in this area.

Sample **stop 4** (5861 m; 12:35-13:12): it was at the location where *Calyptogena* clams were spotted in living position (**Photo 3**). The about 10 clams formed a tightly-fitting colony with about half of each shell nestled in mud between peridotite clasts, so sampling with scoop was very difficult. A sea anemone was near this cluster of clams. The nearby outcrop is angular blocks cemented with white minerals. The rock sampled immediately next to the colony (**R07**) is serpentinized peridotite interleaved on a cm scale. Finally, several destructed clam shells were collected with the manipulator and stored into Box 1 (in which there were some contamination from sample stop 6, for example, one snail and clam shells without destruction).

Just upslope from this site is poorly sorted debris consisting of angular blocks supported by a muddy matrix as well as poorly sorted consolidated sediments with whitish veining. Clam shells are scattered on the surface. Further upslope at about 5840 m, and continuing for more than 20 m is a large massive outcrop of highly fractured peridotite with a spider web of white veins as well as surface blocks cemented with the same white material (**Photo 4**). The slope above this outcrop is covered by pale colored mud and scattered angular cobbles and boulders.

Sample **stop 5** (5689 m; ~13:36): it was in this area of angular cobbles, boulders, and mud. Three samples were collected here (**R08, R09**, and **R10**). All are altered and serpentinized harzburgite. R08 has rare clinopyroxene.

Upslope from stop 5, the surface is sedimented with rare to abundant cobbles and small boulders. Some of the fragments clearly are veined harzburgite. Rare clam shells are widely scattered on the surface. At 13:43 and 5643 m, a meter-scale massive breccia crops out. The dip of this sediment approximates a dip-slope and it has a white stained horizon at its base. Just above here, shells of deceased clams become much more abundant on the surface. Some areas tens of meters across are almost entirely covered with shells. Many of the shells have ~cm holes at one end and many appear to be partially dissolved (**Photo 5**). Many feeding trails through the sediment are in this area.

At 13:47 and 5625 m depth, the source of the clam shells was seen. It is a horizon wider than 50 m along strike with abundant live clams and other organisms (**Photo 6**). The sea-floor surface in this area consists of fine light sediment with large blocks and boulders. The horizon itself might be the base of a series of interlayed poorly sorted and matrix supported breccias and finer-grained sediments with white-stained horizons of secondary minerals. These sediments nearly form a dip-slope. The clam horizon appears to be along the base of a massive breccia bed exposed by faulting or sliding. This bed is probably the aquatard that focused the fluids needed for the biological community to grow.

The *Calyptogena* clams are in great abundance along this horizon. A sponge-like creature that covers most of the rocks at the clam horizon (**Photo 7**) also is abundant in this area. Small white shrimp and crabs were observed, as well as pale translucent anemones and small snails. Many curvilinear feeding trains are also found in this area. The most bizarre creature seen was a jellyfish, perhaps of the *Beroe* genus. Its main body was oval shaped and darkly colored. Small lights flashed around the periphery of the body as well as along a medial line. The lights along the medial line sometimes appeared to flash in sequence. Two tannish tentacles hung down from the main body.

Sample **stop 6** (5622m; 13:48-14:15): more than 20 clams were taken by trial of twice scoop, when scooped samples stored into the Box 2 of the 6K's basket, some samples were scattered around the Box 2 (attention!). A segmented worm also was found amongst the collected biological materials. Three rocks were collected in this area (**R11, R12**, and **R13**). R11 is a medium grained hormblende gabbro, R12 is a breccia with meta-gabbroic clasts, R13 is a sandstone with the sponge-like creatures on its surface. Marker #117 was set at this location.

Most of the surface upslope from here appears to be variably lithified quasi-dip-slope sediments. Some areas largely have unconsolidated mud covering the surface, whereas other areas have better lithified sandstones and coarse breccias. Some of these lithified sediments form outcrops with north-south weather-out fractures.

Calyptogena clam colonies and scattered shells were observed again between 5560 and 5552 meters depth (14:32-14:38). These colonies were mostly scattered across an area floored mostly by mud with scattered angular cobbles and boulders (**Photo 8**). The colonies are mostly nestled in the lightest colored sediments in the area, suggesting that these areas vent fluids that precipitate pale-colored minerals. Peridotites might again crop out at about 5540 m along a north south trending low ridge. Farther upslope, this ridge is composed of relatively closely spaced large angular to subrounded boulders with interspersed sediment. White brittle stars lie atop several rocks on this ridge.

We named this colony as Shinkai Seep Field.

Sample **stop 7** (5540 m; ~14:45): it was in the area with relatively abundant brittle stars. Five rocks (**R14, R15, R16, R17**, and **R18**) were collected in this location. All of these samples are peridotites, some with clear cumulate textures, suggesting that this location is above the "petrological moho". R14 and R17 appear to be pyroxene-rich lherzolites; R15 is dunite with veins of serpentine and tremolite (?); R16 is a pyroxenite; and R18 appears to be a harzburgite.

Shinkai dropped its ballast and left the bottom at 14:55.

Summary of dive observations:
Most of the rocks collected beneath about 5600 m are harzburgitic, suggesting that this section of the dive was on lithospheric mantle (**Fig. 1**). Outcrops of this mantle were typically highly fractured. These fractures were commonly filled with white minerals, suggesting that they were deposited from circulating fluids. Two potential sources for the limestone block recovered at 6079 m are a collapsed fluid-vent chimney or a reefal limestone from shallow levels. The latter is the higher probability, as no chimneys were discovered, even where the *Calyptogena* clams formed massive colonies. This carbonate was rounded by dissolution and covered by algae. The basalt and gabbro encountered at 5622 m probably fell to their collection site from far upslope. Lithologies above 5600 m were ultramafic, but had cumulate textures suggesting that we crossed the petrological Moho.

The most important discovery of this dive was the abundant *Calytogena* biological communities. The deepest location where *Calytogena* clams were encountered in growth position was 5859 m; the shallowest at 5560 m. The *Calytogena* site at 5622 m is the most extensive and most diverse. The clams abundantly grew at the base of an exposed massive breccia bed, suggesting that the fluids responsible for nourishing the community vented along the base of this bed. The organisms viewed or collected at this site included: *Calytogena* clams, sponges(?), white crabs, white shrimp, anemones, snails, and one *Beroe* jellyfish.

No *Calytogena* community organisms were found at dive site 1236 on the slope above the end of site 1234. This suggests that this community is restricted to the region of the South Mariana Fore-arc underlain by peridotite and is not associated with serpentine mud venting. Two potential origins for the fluids supporting the community are metamorphic dehydration reactions in the subducting plate and serpentinization of peridotite. Choosing between these hypotheses will require geochemical analysis of vein filling materials, isotope analyses of S as well as C of bulbs, and sampling and geochemical analysis venting fluids collected during future submersible visits.

Final conclusion:
(A) Discovery of the Shinkai Seep Field *Calytogena* biological deep sea community.
(B) We crossed the petrological Moho.

Note added on May 31, 2011 by Y. Ohara:

1. Before arriving sample stop 5, at 5730 m (13:26:35), we observed a wood-fall biological community (**Photo 9**). The Shinkai just flew over, and no sampling was attempted.
2. Since some contamination of the specimens from stops 4 and 6 occurred, sampling of the *Calyptogena* specimens for analyses was based on conditions of specimens. So, "crushed" specimens which we assumed to come from stop 4 (taken with manipulator; in Box 1) have number B01, whereas "intact" specimens which we assumed to come from stop 6 (scooped; mostly in Box 2) have number B02.

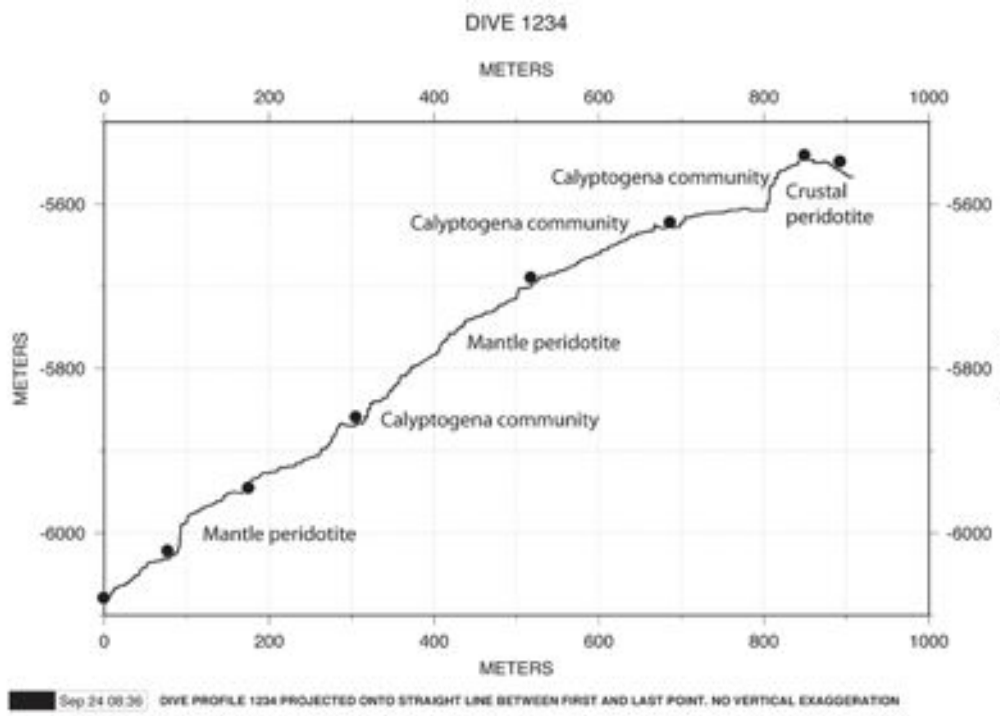

Fig. 1. Profile (no vertical exaggeration) showing track of 6K-1234.

Representative photographs of the dive:

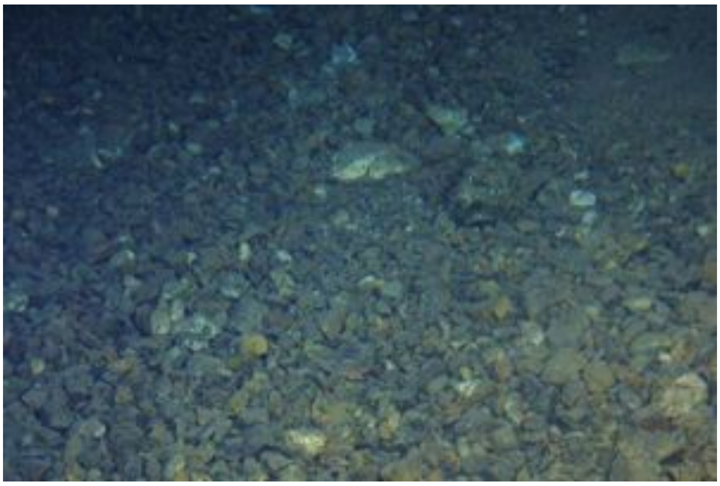

Photo 1. The seafloor covered with talus near stop 1 (6079 m).

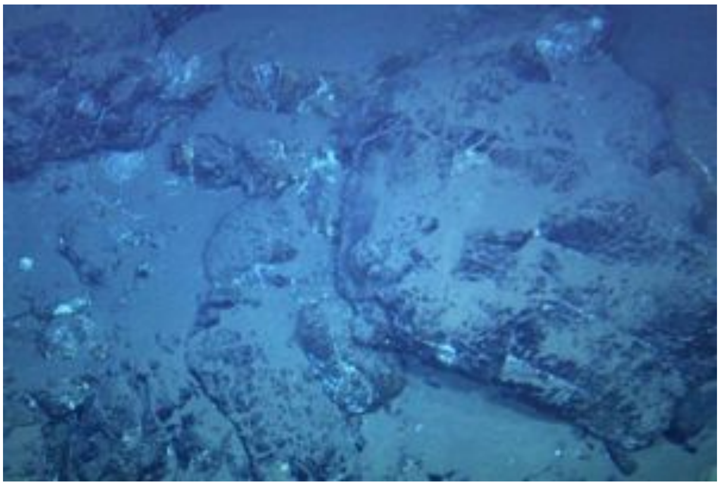

Photo 2. An outcrop near sample site 2 (6025 m).

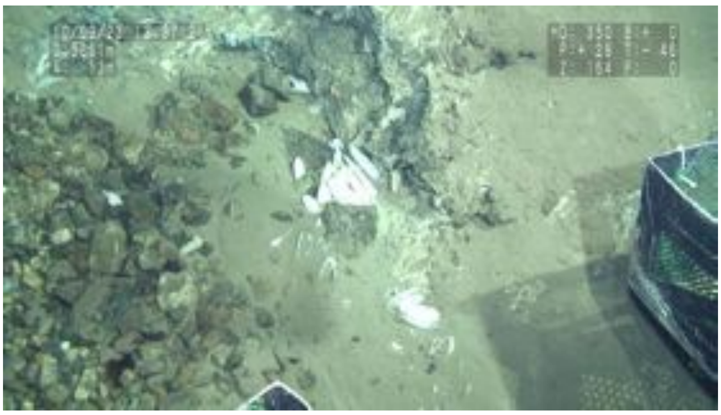

Photo 3. *Calyptogena* clams in growth position with nearby talus and cemented surficial materials at sample site 4 (5859 m).

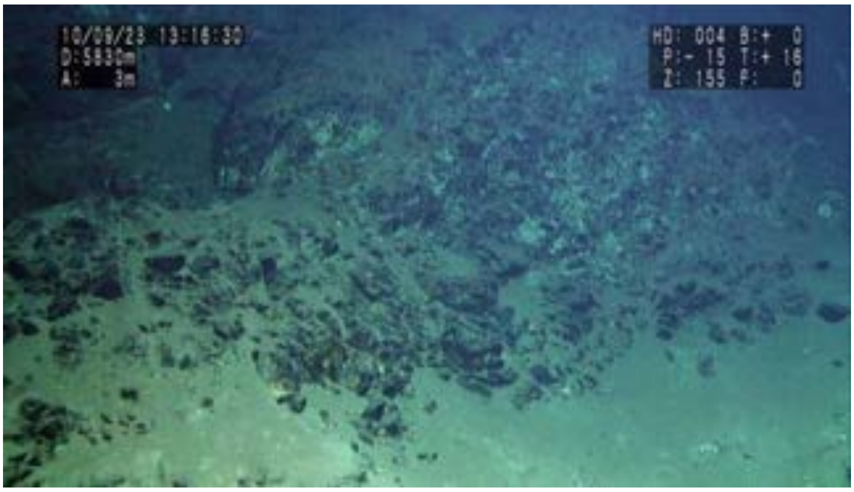

Photo 4. White-veined peridotite outcrop above sample site 4 (5859 m?).

Photo 5. *Calyptogena* shell accumulations below stop 6. Note punctured and partially dissolved shells. Also note the feeding trails through the sediment (5622 m).

Photo 6. *Calyptogena* clam community along a horizon at the base of an exposed sedimentary sequence near stop 6 (5622 m).

Photo 7. *Calyptogena* clams, anemones, snails, sponge like creatures covering rocks, and the jellyfish with illuminated spots at stop 6 (5622 m).

Photo 8. The shallowest *Calyptogena* clam colonies viewed on this dive (5553 m).

Photo 9. A wood-fall biological community observed at 5730 m.

A-7. Report for 6K-1235, September-24-2010: G. Girard

Aim and scope of 6K-1235:

This dive took place on the western flank of the Southeast Mariana forearc rift, a extensional structure at the southeastern end of the Mariana backarc basin immediately west of the Santa Rosa Bank. This locality appears to be an adequate location to identify the contact between the rift basalts investigated during dive 6K-1096 and by J. Ribeiro during this cruise (dive 6K-1230), and the underlying peridotites identified during dive 6K-973 (Michibayashi et al., 2009) (**Fig. 1**). A steep regular south-southwest facing slope was selected to maximize the likelihood of crossing this contact, beginning the dive as deep as technically possible at ~6500 m, and ending ~600 m above (**Fig. 2**). This traverse represents a horizontal displacement of ~1500 m (**Fig. 3**). The slope investigated originates upwards at ~4000 m depth on the edge of the Mariana Trough and continues downwards to > 9000 m depth within the Mariana Trench.

Geological observations:

The Shinkai landed on the seafloor at 6478 m at 11:27, in a steep (~ 40°) slope heterogeneously covered of angular blocks of 5-20 cm in size, gravel-sized angular blocks, and pale brown sediments (**Photos 1**and **2**), which appeared to represent talus deposits. Sampling began immediately after landing, two samples (**R01** and **R02**) were collected at this locality, referred to as sample **stop 1**. R01 is a microgabbro and R02 is finer-grained, a diabase.

The Shinkai then began ascending the slope in similar talus deposits, with occasional metric-sized angular boulders.

At 11:41, at 6435 m depth, a 5-10 m high rocky escarpment was observed in the slope (**Photo 3**), three rock samples (**R03, R04**, and **R05**) were collected at this locality (sample **stop 2**) since such disruption in the slope pattern may indicate an outcrop. It is possible, however, that the samples collected are part of talus deposited on top of this presumed outcrop. All three samples are microgabbro, although R05 has a paler color and is more plagioclase-rich than R03 and R04.

Further up until ~ 6400 m, the slope was essentially muddy, and large rocks were observed again at ~ 6390 m.

Sample **stop 3** was reached at 12:02 at ~6364 m, in angular talus blocks with little sediment, with sizes ranging from ~ 10 cm to ~1 m. Samples **R06** and **R07** were collected at this locality. Both rocks are microgabbro, and R07 exhibits a variety of mingling textures. Abundant rounded enclaves of microgabbro of paler color than the microgabbro matrix form ~30 % of the rock; no reaction rims can be identified on hand sample. Less abundant finer-grained green-colored angular enclaves of microgabbro or diabase form ~10 % of the rock; a thin (~1 mm) reaction rim is observed in their microgabbro host. This reaction rim has a finely crystallized groundmass with no visible phenocrysts. Some of these reaction rims extend as veins into the microgabbro host, and may represent basaltic melt originating from the microgabbro host at the contact with the enclave.

Upslope, similar alternating blocky and muddy terrains were observed.

Sample **stop 4** was reached at 12:18 at ~6295 m, in a blocky area with heterogeneous rocks from < 10 cm to > 1 m in size. Samples **R08** and **R09** were collected at this locality. R08 is an aphyric basalt (with crystallized groundmass) bearing microcrystalline enclaves of microgabbro, and R09 is a microgabbro exhibiting mingling between two phases (referred to as 'host' and 'enclave') of similar grain size and mineralogy (plagioclase, clinopyroxene, olivine), the matrix is green-colored while the enclaves are gray-colored and appear to have more abundant plagioclase than the host. Enclaves are rounded and no reaction rims with the host are observed.

The slope flattened shortly after stop 4, with abundant muddy sediments and few rocks, and it increased again at ~ 6158 m with more abundant rocks.

Sample **stop 5** was reached at 12:41 at ~ 6206 m at the end of this steep slope section before the ground flattens again. Abundant large metric-sized angular blocks were observed, as well as smaller blocks of variable size up to < 10 cm. Samples **R10** and **R11** were collected at this locality. R10 is a microgabbro, and R11 is an aphyric basalt, with crystallized groundmass and small (< 1 cm) enclaves of diabase or microgabbro.

Further up at ~6180-6170 m, fewer rocks were observed, the slope was generally covered of sediments. No change in the color of the sediment has been observed since the beginning of the dive.

Many angular rocks were observed at ~6158 m which were generally homogeneous in size (~50 cm).

Sample **stop 6** (13:12, 6104 m depth) was in a field of large boulders, generally homogeneous in size (~50 cm) and sub-angular (photo 4). Two smaller rocks were taken as samples **R12** and **R13**. R12 is a sub-rounded block of vesicular olivine basalt, and R13 is a microgabbro.

Upslope from sample stop 6 at ~6080 m depth, rocks became smaller again, later followed by an area dominated by sediments. Large round boulders were observed emerging from the sediment at ~ 6046 m. At ~ 6036 m, blocks were frequently covered by a white deposit.

Sample **stop 7** was reached at 13:34 at 6029 m depth, heterogeneously sized angular blocks were exposed. Samples **R14, R15** and **R16** were taken at this locality. R14 and R15 appeared weathered while R16 appeared to have a fresh surface. All samples are microgabbro.

Upslope, smaller-sized blocks (< 10 cm) were encountered at ~5980 m, with occasional larger blocks.

Sample **stop 8** was reached at 13:54. This short steep (> 45°) escarpment at 5959 m was selected for exposing more heterogeneously sized blocks (10-50 cm). However, even there, it was unclear whether this area would constitute an outcrop. Samples **R17** and **R18** were collected at this locality. R17 is a microgabbro and R18 is a plagioclase and olivine basalt which exhibits mingling textures with enclaves of microgabbro.

Another locally steeper portion of the slope was reached at 5908 m at 14:18. Exposures appeared to be talus deposits with angular blocks, heterogeneous in size. Two samples (**R19** and **R20**) were collected at this locality (sample **stop 9**). R19 is a banded basaltic lava, with alternating aphyric and plagioclase-rich bands, and R20 is a microgabbro.

Further up, the slope became more gentle, and we observed a general increase of sediments at the expense of rocks.

At 5868 m, however, in a generally flat sediment-dominated area, two tongues of very angular and apparently fresh small (~10 cm) blocks were observed (**Photo 5**). Visually, these features may be interpreted as a young small landslide deposits. This unusual exposure was selected as our sample **stop 10** (reached at 14:35), and two samples were collected (**R21, R22**). Both samples are microgabbro.

A final sample collection (sample **stop 11**) was made at 14:42 at 5861 m, slightly further upslope from sampling site 10, in a typical boulder field with angular blocks ranging in size from < 10 cm to ~50 cm (**Photo 6**). Three samples, **R23, R24** and **R25** were taken at this locality. R23 is an aphyric basalt in which one small vein (0.5 x 3 cm) of microgabbro is present. R24 is a mingled microgabbro, of which the texture and nature of host and enclaves are strikingly similar to sample R09 collected at sampling site 4. R25 is also a mingled microgabbro, which exhibits the same green-colored and gray-colored phases as sample R24, in different proportions (about equal amounts of each phase).

At 14:51, the Shinkai left the bottom and surface was reached ~ 2 hours later.

Biological observations:
Isolated life forms were observed throughout most of the slope. Several cnidaria (< 10 cm), anemone and jellyfish were encountered, the deepest at ~ 6410 m, next to an echinoderm (*Freyastera*?) (**Photo 7**). Other sea star species and several shrimp-like arthropods were encountered as well. Also, the large patches of muddy sediments commonly exhibited radially-developed bioturbation marks (**Photo 8**).

Geological implications:
Even though the slope investigated had some very steep sections, it never exhibited clear outcrops. Instead, it consisted of talus deposits, with alternating boulder fields (with generally angular blocks of variable size, < 10 cm to > 1 m) and muddy pale brown sediments. No change in the aspect or color of the sediments was observed throughout, however, no sediment samples were collected during this dive. At many localities exhibiting blocks, and in particular at the localities chosen for sampling, the blocks were heterogeneous in size, perhaps suggesting proximity to the outcrop from which they originated.

In this scenario, each of the steeper sections of the slope may represent good approximations of the actual outcrops. If this assumption is correct, we likely sampled a layered microgabbro complex, in which few petrographic variations are observed among individual units. Several of these units also had an eruptive component since basalt is commonly observed also.

However, since we ascended ~600 m of slope over a distance of ~1500 m, we may have observed one single large talus deposit (although also locally reworked into smaller landslides), with none of the deposits being proximal. The following observations support this hypothesis:
(1) At most sampling stops, several lithologies were observed (e.g., microgabbro and basalt, mingled microgabbro and homogeneous microgabbro)
(2) No clear changes in lithology were observed throughout the section, the dominant lithology, a fresh microgabbro, is observed at all sites.

(3) Mingled microgabbro or basalt mingled with gabbro is observed at several localities, including the same textures in several samples such R09 and R24 which were sampled at > 400 m depth difference.
(4) This slope is a small fraction of a much longer slope, which initiates at ~4000 m depth on the edge of the Mariana Trough and ends in the Mariana Trench at ~9000 m depth. This presumably unstable configuration is likely to be prone to very large landslides, similar to those following flank destabilization of large ocean island volcanic edifices such as Réunion Island or the Canaries. Here, subduction and rifting processes may favor large earthquakes, possible triggers for such landslides.
(5) The slope is not regular but instead has a stepped shape, with the steeper parts generally dominated by blocks and the flatter parts generally dominated by sediments. Such a pattern may be explained by the development of sub-horizontal compressional thrusts in the landslide deposit during its emplacement (e.g., Dade and Huppert, 1998; Clavero et al., 2002). The spaces left between the thrusted blocks were later filled with sediments, smoothening the slope profile and leaving the crests of the thrusted blocks better exposed.

In this scenario, we likely sampled the collapsed part of a large microgabbro unit, in which mingling horizons are common. This microgabbro unit may transition into basalt as suggested by the microgabbro enclaves present in some of the basaltic samples.

Summary:

On the one hand, this dive did not help us to localize the top of the peridotite unit as aimed, however, on the other hand, we evidenced large volumes of microgabbro, a lithology previously unrecognized in the Southeast Mariana forearc rift. Obtaining ages and geochemical analyses on these samples will help decipher whether this microgabbro talus deposit originates from one single overlying large intrusive unit or an in place layered complex. Also, the apparent lack of coarser-grained gabbro is striking, and this unusual characteristic may have important petrogenetic implications.

References:

Clavero J, Sparks RSJ, Huppert HE, Dade D (2002) Geological constraints on the emplacement mechanism of the Parinacota debris avalanche, Northern Chile. *Bull Volc* 64, 40–54.

Dade W, Huppert HE (1998) Long run-out rockfalls. *Geology* 26, 803–806.

Michibayashi K, Ohara Y, Stern RJ, Fryer P, Kimura JI, Tasaka M, Harigane Y, Ishii T (2009) Peridotites from a ductile shear zone within back-arc lithospheric mantle, southern Mariana Trench: Results of a Shinkai 6500 dive. *Geochem Geophys Geosyst* 10, doi: 10.1029/2008GC002197

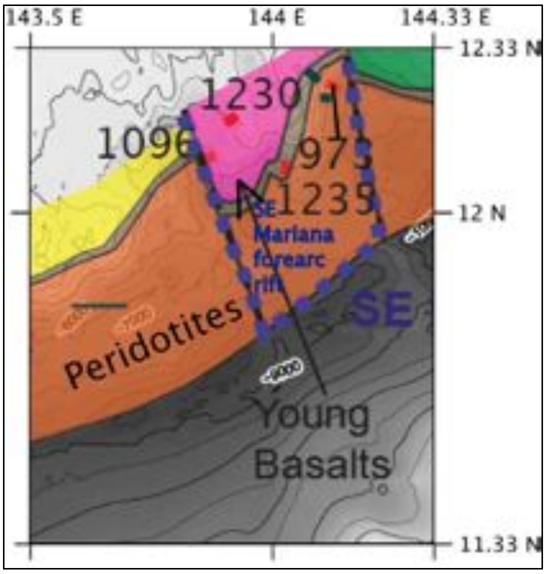

Fig. 1. Simplified map of the Southeast Mariana forearc rift showing the location of the present and previous dive sites. Layer in gray between the basalts and peridodites represent the supposed occurrences of gabbro, which this dive helped better constrain.

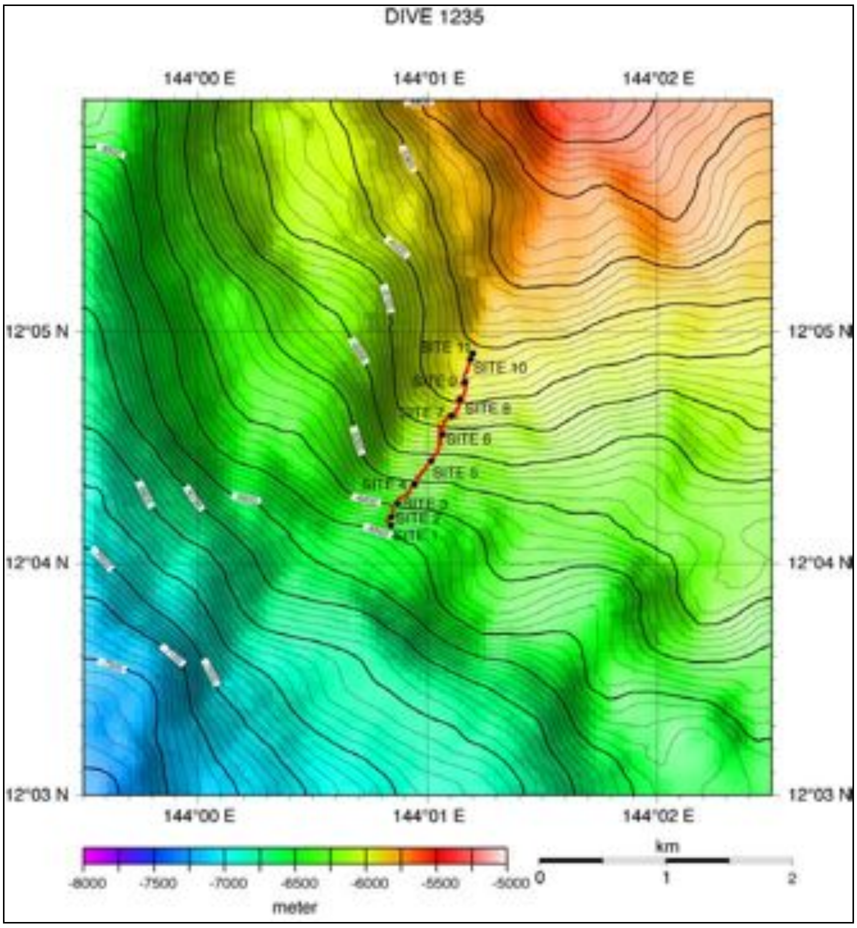

Fig. 2. Bathymetric map of area investigated and traverse covered by dive 6K-1235.

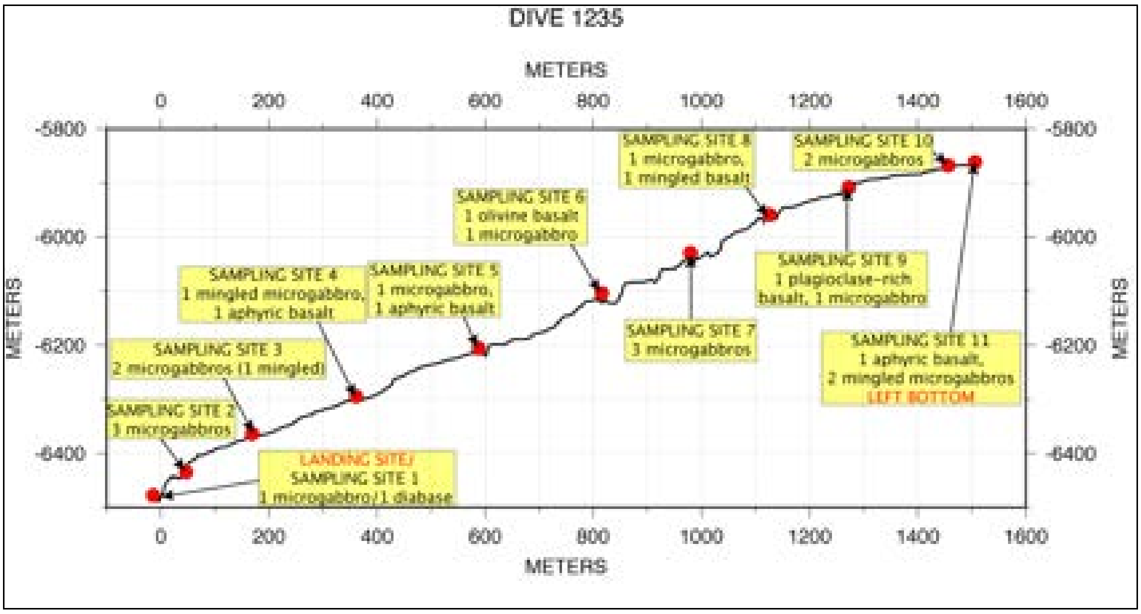

Fig. 3. Profile of dive 6K-1235 and sampling localities.

Representative photographs of the dive:

Photos 1 (upper) and 2 (lower). Views of the landing site through 1) the front and 2) the hand-held cameras. Exposures are typical talus deposits, samples R01 and R02 were collected at this locality.

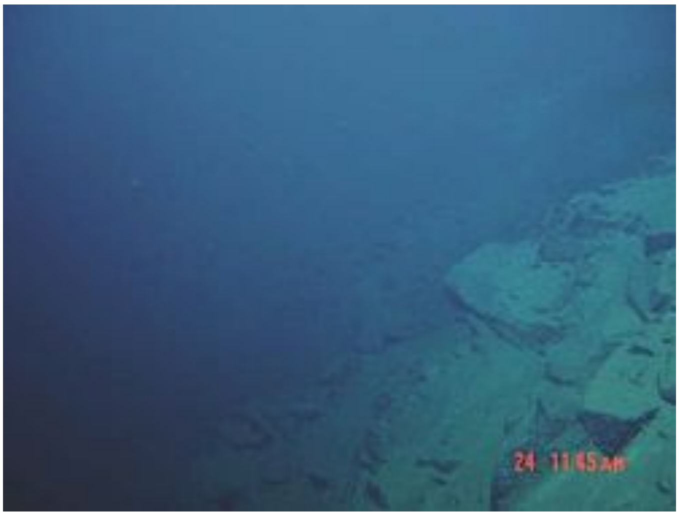

Photo 3. Steep rocky escarpment standing out of the slope at sample stop 2

Photo 4. Typical large sub-angular boulders observed at several localities during the dive, here at ~6110 m depth near sample stop 6. The two red points in the upper right corner indicate 25 cm.

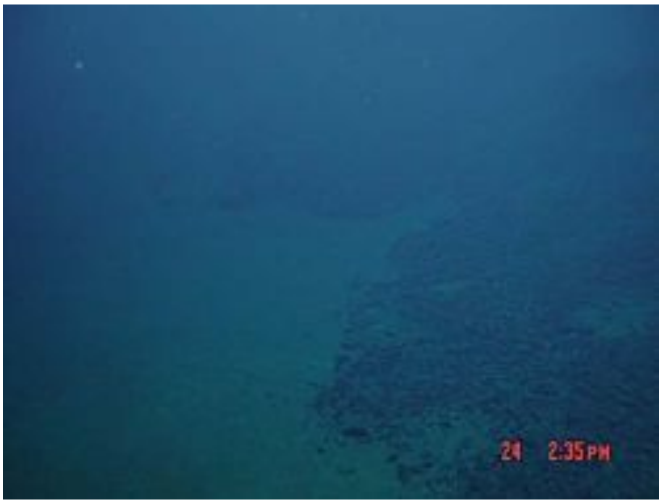

Photo 5. Terminal tongues of a small landslide composed of well-sorted small (< 10 cm) angular fresh blocks, emplaced into a sediment-dominated section in a flatter portion of the slope (sample stop 10).

Photo 6. Final sample stop (stop 11), in the same boulder field as previous sampling site. Size of clasts increased significantly and sorting was poorer.

Photos 7 (upper) and 8 (lower). Some life forms observed during this dive, 7) echinoderm (*Freyastera* sp.) and anemone at ~ 6410 m depth and 8) bioturbations in sediment in a flatter area at ~5880 m depth.

A-8. Report for 6K-1236, September-25-2010: M. Brounce

Aim and scope of 6K-1236:
The dive site is located upslope of Shinkai 6500 dive 1234, where live *Calyptogena* clams were observed at ~5680 mbsl. Dive 1234 also recovered fractured peridotite with numerous veins of serpentine and calcium carbonate. The plan for this dive was to collect a continuous upward section of intrusive rocks with goals of constraining lithologic contacts between mantle rocks and lower oceanic crustal rocks as well as to understand the geologic framework for the unusual appearance of live *Calyptogena* clams in dive 1234.

Observations:
The Shinkai landed on the seafloor at 5309 m at 11:01 and we started the scientific operation (**Figs. 1** and **2**). The landing point was covered with light colored marine sediment and poorly sorted sub angular float blocks (**Fig. 3A**). There was a shallow slope at the landing point (**Fig. 2**).

Sample **stop 1** was at the landing point, and at 11:09 we collected one float block (**R01)** lying in the sediment. R01 is a sub angular boninitic rock with some olivine phenocrysts and about 15 cm of preserved glass. R01 also has vesicles ~1-3 cm in size that are filled with zeolite.

The Shinkai moved rapidly over the shallowly sloped area, as it was covered mostly in light colored marine sediments. Large tabular "rock outcrops" were observed, however their size and the presence of dip slope surfaces parallel to the seafloor slope indicated strongly that these were sedimentary rocks (**Fig. 3B**). No rock sampling was performed here.

At sample **stop 2** (5270 m at ~11:29), we stopped to collect a sediment push core in hopes of determining the sediment's relationship with local lithologies (**C01**, **Fig. 2**).

The Shinkai continued to move over thick marine sediment. Occasional bioturbation was observed.

At sample **stop 3** (5240 m at ~11:48), we collected two small blocks (**R02** and **R03**) from the bottom of a slightly steeper sloped region. The slope was covered with sediment and small, sub angular float blocks (**Fig. 3C**). R02 is a sub angular boninitic rock with plagioclase and olivine phenocrysts with ~20 cm of preserved glass that is possibly slightly altered. R03 is also a sub angular boninitic rock with plagioclase phenocrysts.

The slope of the seafloor continued to steepen as we continued to move along the dive track and the appearance of angular float rock increased slightly (**Fig. 2**).

At sample **stop 4** (5181 m at ~12:00) we collected three rocks (**R04, R05** and **R06**) from a well sorted tallus field sitting in sediment on a moderately sloped section of the sea floor (**Fig. 2**). All three samples are sub angular boninitic rocks, R05 has ~10 cm of preserved glass along its outer rim.

As we continued, the slope became shallower once more and there were fewer float blocks present. Shortly thereafter, the slope became steeper again with an increased appearance of rock. We observed a small octopus swimming above the seafloor here.

At sample **stop 5** (5101 m at ~12:18) we collected two rocks (**R07** and **R08**) from the sparse tallus field. Both were angular boninitic rock. R08 has a rim (~2 cm) of medium grained (~2 – 3 mm) altered clasts that suggests that it may be hyaloclastic in origin.

The slope above **stop 5** became dominated by sediment cover once again. There appeared to be parallel white striations formed with an orientation that is normal to the slope in the sediment, suggesting that some systematic alteration was taking place along this slope (**Fig. 3D**). Continuing upslope, this alteration appeared to become moderately lithified.

At sample **stop 6** (5043 m at ~12:33) we collected two rocks (**R09** and **R10**). R09 is a moderately lithified sedimentary rock that is representative of the alteration we observed in the sediment downslope from here. It is very friable and broke into several pieces in the sample basket. R10 is a coarse grained gabbro with large secondary sulfide minerals. The blocks in the tallus field were larger than previously.

After this, the sediment cover increased and there were occasional sedimentary rock features as described after sample stop 1.

At sample **stop 7** (4983 m at ~12:45) we collected three rocks (**R11, R12** and **R13**) from an area where the rocks became large, blocky and densely populated. These rocks were partially covered in sediment and retained a moderate amount of sediment on them as they were placed in the sample basket, indicating that perhaps these rocks have been "in place" for some time. R11 and R12 are medium grained granites with small sulfide minerals. R13 is an aphyric mylonite with quartzic veins and parallel foliations present.

At sample **stop 8** (4899 m at ~13:06) the rocks became suddenly larger and blockier. We collected one rock (**R14**) from this location. R14 was float on top of the sediment and has a dual texture with coarse grained (2 – 3 mm) granite and aphyric, vesiculated basalt. The contact between these textures is sharp and crenulated in nature. The vesicles in the basalt (2 – 3 mm) are filled with zeolite, as in R01.

We continued briefly upslope and came upon a large blocky outcrop.

At sample **stop 9** (4891 m at ~13:19) we took one sample from this outcrop (**R15**). We attempted to take a second sample but the rock broke into several pieces in Shinkai's manipulator, indicating that this rock was sedimentary in nature. R15 is a volcanic conglomerate with basaltic glass, quartz and possible boninite clasts (~4 mm grain size).

Above this outcrop, the slope of the seafloor became shallower and the sediment became thick once again (**Fig. 2**). We moved quickly over this region in hopes of finding more rock upslope.

At sample **stop 10** (4823 m at ~13:37) we took two samples (**R16** and **R17**) from an area where small angular to sub angular float blocks populated the slope (**Fig. 3E**). R16 is medium grained (1 – 2 mm) granite with a clear gradation in grain size across the hand sample. R17 is vesiculated and boninitic. As in R01 and R14, the vesicles are filled with zeolite.

The dive track after stop 10 traversed a depression in the seafloor, and we descended ~10 meters to find the seafloor and continue upslope on the opposite side of the feature (**Fig. 2**).

Thick sediment cover dominated the seafloor, as well as sedimentary outcrop as after sample stop 1. The slope was very shallow.

At sample **stop 11** (4810 m at ~14:01) we collected a sediment core (**C02, Fig. 3F**).

There continued to be thick sediment cover. At sample **stop 12** (4727 m at ~14:30) we collected one sample (**R18**) that was lithified sediment.

After continuing over more thick sediment cover over a shallow slope, there appeared to be some poorly sorted, blocky float rock.

At sample **stop 12** (4670 m at ~14:52) we collected three samples (**R19, R20** and **R21**). All three samples are volcanic conglomerates with pumice, basaltic glass, quartz and possibly boninite clasts (3 mm grain size).

At 15:02 (4646 m) the Shinkai dropped the remaining ballast and began its ascent through the water column.

Summary:
The dive had two very shallowly sloped, sediment covered seafloor sections at the start and end of the dive. Dissecting these two sections was one steep slope with poorly sorted to sorted, sub angular tallus fields. None of the rocks were collected in place and samples ranged from boninitic to coarse grained gabbro with sulfide minerals.

It seems most likely that in geologic section, gabbro samples underlie the boninitic samples in this area. It is unclear at this time whether the boninites are related to the gabbro sampled in this dive.

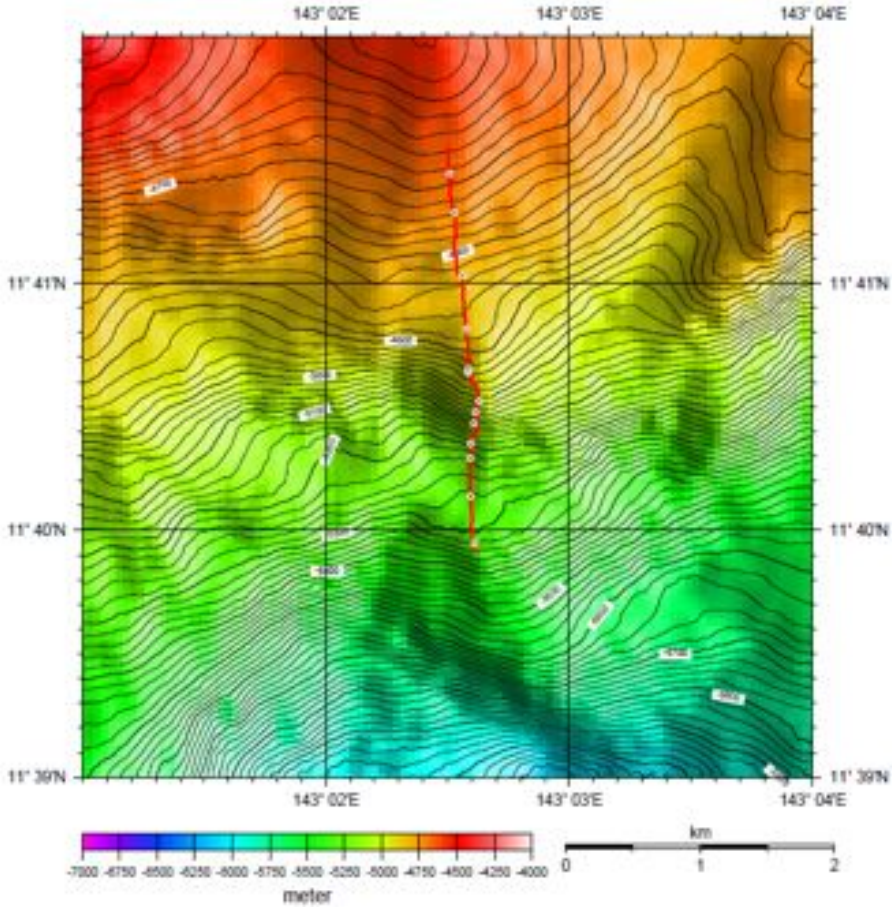

Fig. 1. Locality map showing track of 6K-1236.

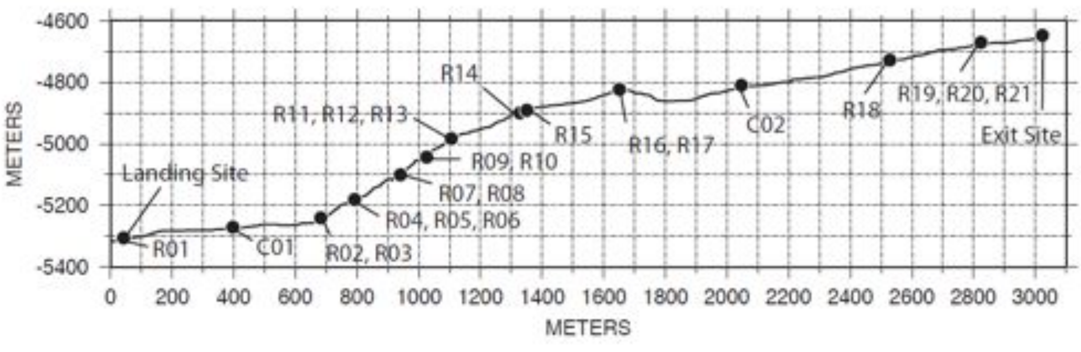

Fig. 2. Profile (no vertical exaggeration) showing track of 6K-1236.

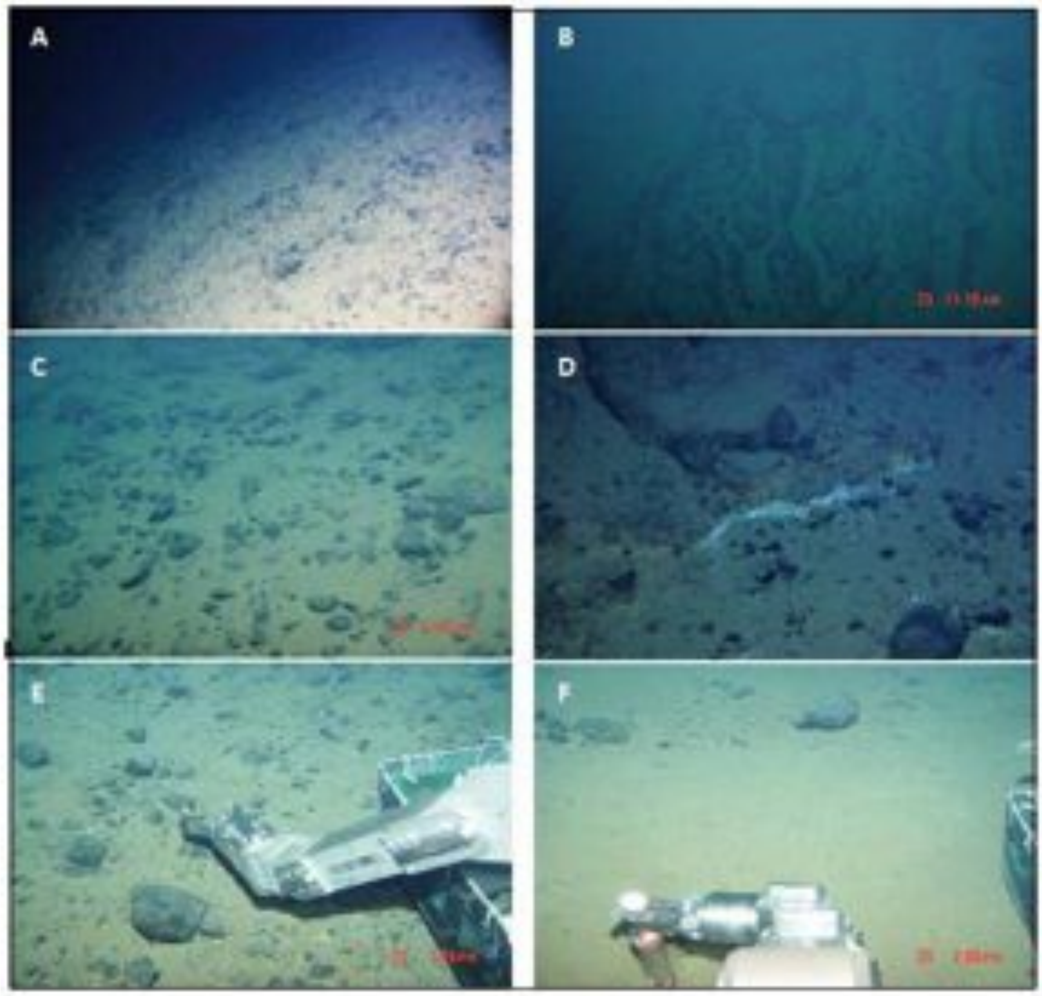

Fig. 3. Representative photos from the dive. (A) landing site, (B) dip slope sedimentary rocks, (C) sample stop 3, (D) white striations before sample stop 6, (E) sample stop 10, and (F) sample stop 11, C02.

A-9. Report for YKDT-81, September-26-2010

Target was the SE end of a small NW-SE ridge, which we thought might be constructed of basalt. However, because of malfunctioning of the camera system, the dive was canceled halfway.

A-10. Report for YKDT-82, September-26-2010: reported by R.J. Stern

Target was the SE end of a small NW-SE ridge, which we thought might be constructed of basalt (**Figs. 1** and **2**). YKDT touched down at 14:29 at 4169 m and traversed a variety of what appears to be basalt talus, with a wide range of fragments, from whole pillows (**Fig. 3A, B**) to more angular fragments (**Fig. 3C, D**). Morphology of the ridge was often quite steep. The ridge did not appear to be highly faulted and we consider that it represents a fissure-type volcano. We deployed the dredge at 15:37 (3910 m) but recovered only a little loose sediment, mostly sand-sized fragments of Mn (**Fig. 4**). YKDT left the seafloor at 15:53, 3953m.

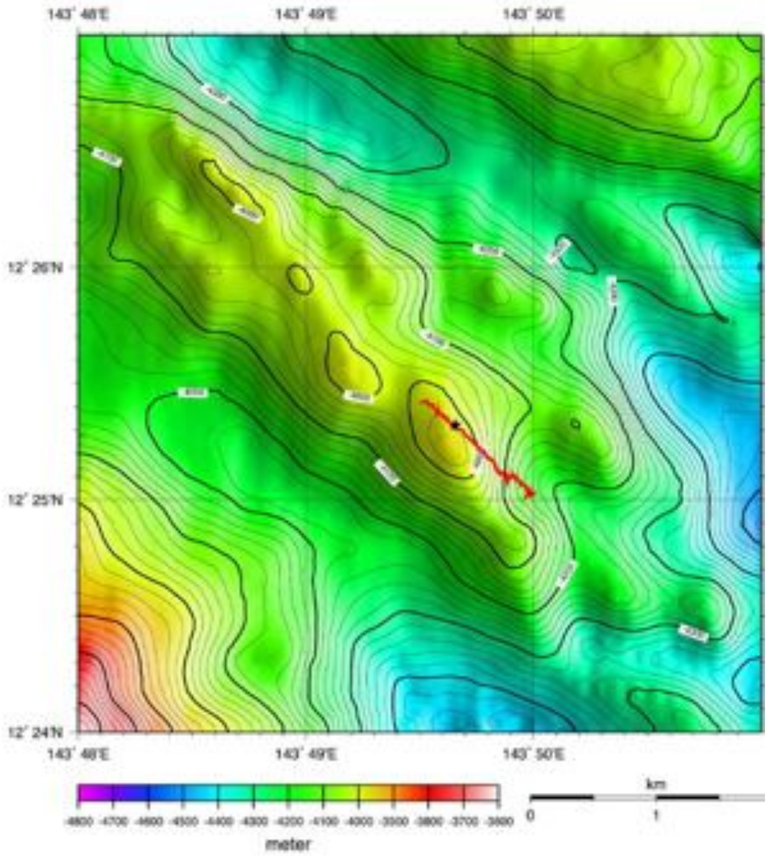

Fig. 1. Locality map showing track of YKDT-82. Black star marks where dredge was deployed.

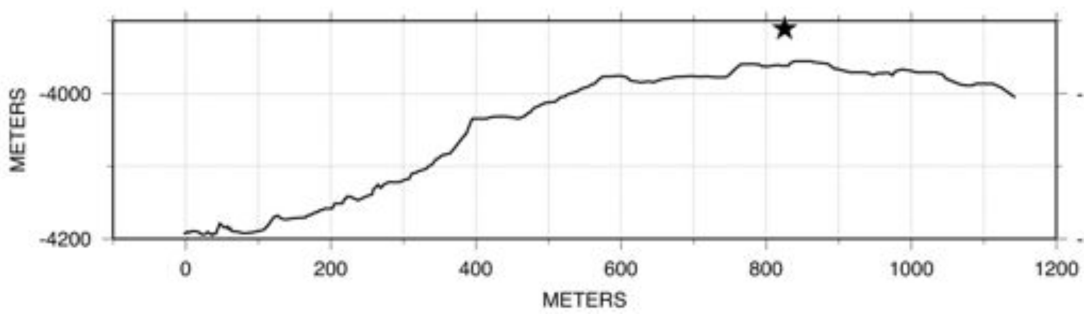

Fig. 2. Profile (no vertical exaggeration) showing track of YKDT-82. Black star marks where dredge was deployed.

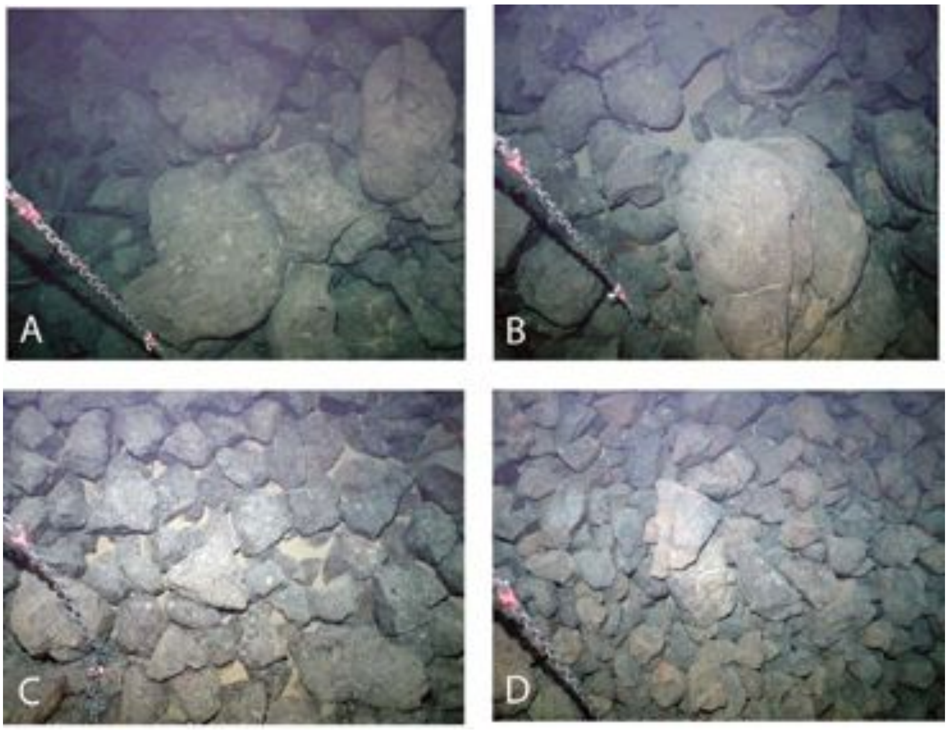

Fig. 3: Photos from YKDT-82. (A) DSCN1502, talus of broken and whole pillow basalts (B) DSCN1516, talus of pillow basalt (C) DSCN1544, blocky lava talus (D) DSCN1557, blocky lava talus with pillow fragment.

Fig. 4. Sediment recovered from YKDT-82 dredge.

A-11. Report for YKDT-83, September-27-2010: reported by M.K. Reagan

The target was the wall of a circular depression at the top of NE-SW trending ridge that has not been previously studied (**Figs. 1** and **2**). The bathymetric morphology of this feature is similar to that of a caldera. YKDT approached the seafloor surface at 9:37 and 3048 m. The seafloor surface here is heavily sedimented with emergent outcrops of pillow lavas. The pillows are relatively intact and on the scale of a meter in diameter (**Fig. 3A, B**), suggesting that they are basaltic. Sediment cover was abundant over much of the dive. This sediment was heavily bioturbated, with feeding trails, darker mats of what might be algae (**Fig. 3C**) and flower-like structures (**Fig. 3D**). Much of the dive was at about 3005-3010 m indicating that the majority of the traversed area is essentially flat. At 10:28 a steeper slope with significant pillow lava outcrop was encountered rising through the sediment, and the dredge was dropped. The dredge was towed through surficial loose sediments and rock outcrop until the end of the dive at 10:35 and 2975 m depth. Collected samples were restricted to siliceous and Mn-stain sediment (**Fig. 4**) and one siliceous pumice (**Fig. 5**).

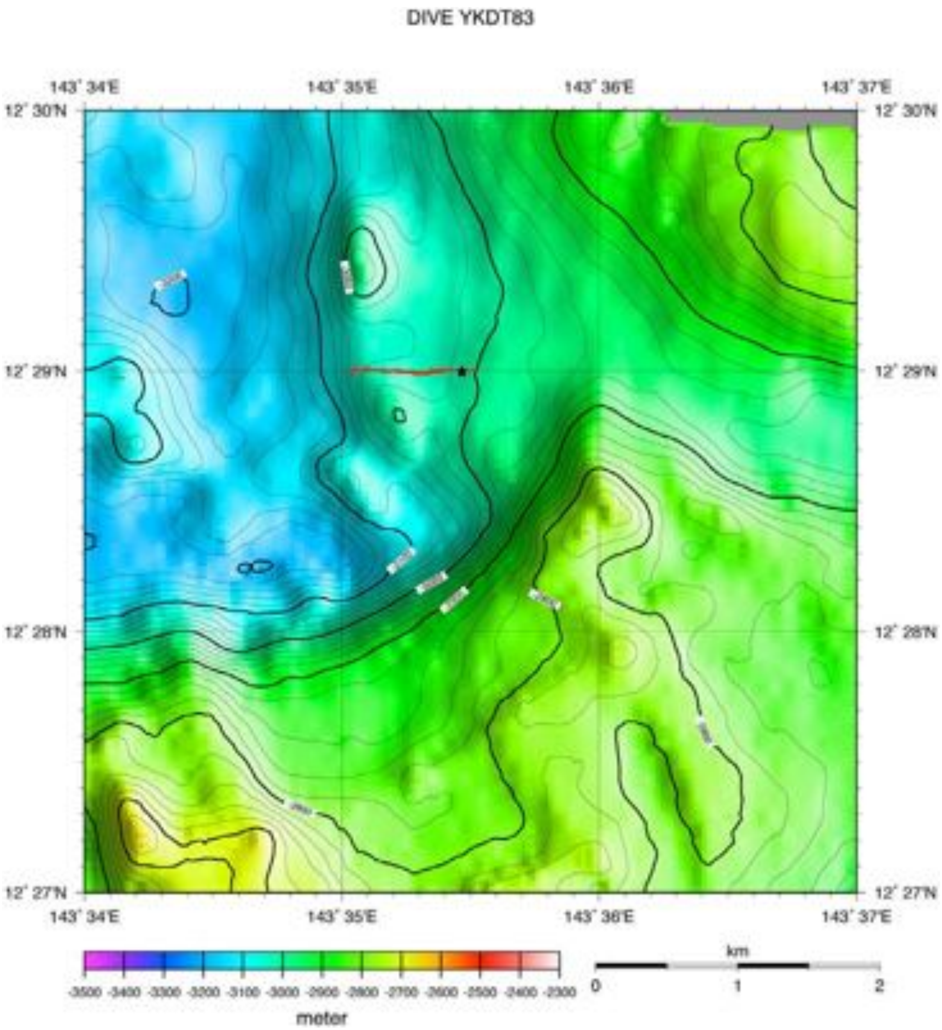

Fig. 1. Locality map for YKDT-83.

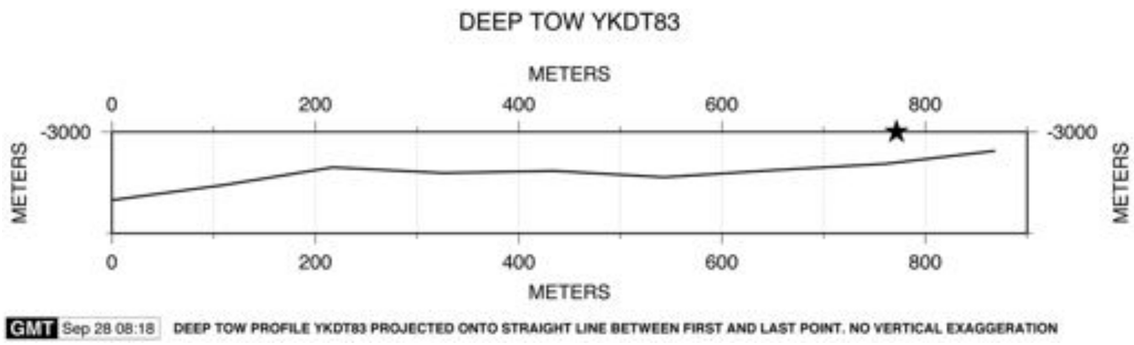

Fig. 2. Profile of YKDT-83.

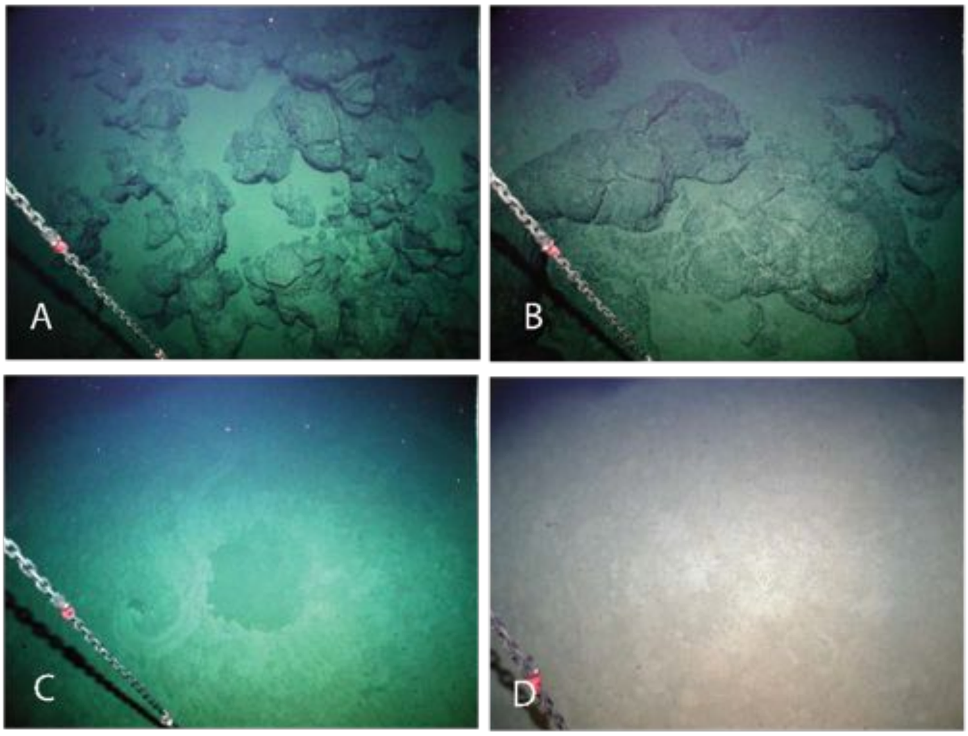

Fig. 3. Photos from YKDT-83. (A) DSCN1822, lower pillow basalts and sediments (B) DSCN2114, upper pillow lavas and sediments (C) DSCN2003, bioturbated sediments and algal mat (?) (D) DSCN2089, sediment with flower structures.

Fig. 4 (left). Mn-crusts and sediment.

Fig. 5 (right). Rounded pumice.

A-12. Report for YKDT-84, September-27-2010: reported by M.K. Reagan

The target was a steep slope on the south side of the ridge previously explored at YKDT-83. The steep bathymetric morphology of this feature suggests that it might be the faulted boundary of a basin (**Fig. 1**). YKDT approached the seafloor surface at 9:37 and 3048 m (**Fig. 2**). The seafloor surface at the landing site consists of outcrops of pillow lavas similar to those found at YKDT-83 that emerge through unconsolidated sediment. The scale of the pillows and their morphologies suggest that they are basaltic. Sediment cover alternated with emergent outcrops over the entire traverse (**Fig. 3. A, B**). The sediment cover in this area often has closely-spaced angular pebbles reminiscent of desert pavement, suggesting that fine sediments had been winnowed by ocean currents (**Fig. 3C**). Sediment atop these surfaces is patchy, and sometimes had dune-like forms. Lithified dip-slope sediments were spotted beneath patchy surface sediment on two occasions. Outcrops in the lower portion of the tow were clearly pillow lavas with intact pillows (**Fig. 3A**). Above about 300 m the outcrops were more fractured and less distinctively pillowed (**Fig. 3D**), although some pillow forms were seen in the emergent outcrops (**Fig. 3B**). At 15:16, the dredge was dropped at the foot of one of the emergent outcrops. Dredging lasted for almost 45 minutes over sediment and outcrop until the end of the dive at 5:55 and 2765 m depth. Most of the fragments recovered by dredging were Mn-encrusted sediment (**Fig 4**). However, two small fragments of basalt also were collected (**Fig. 5**).

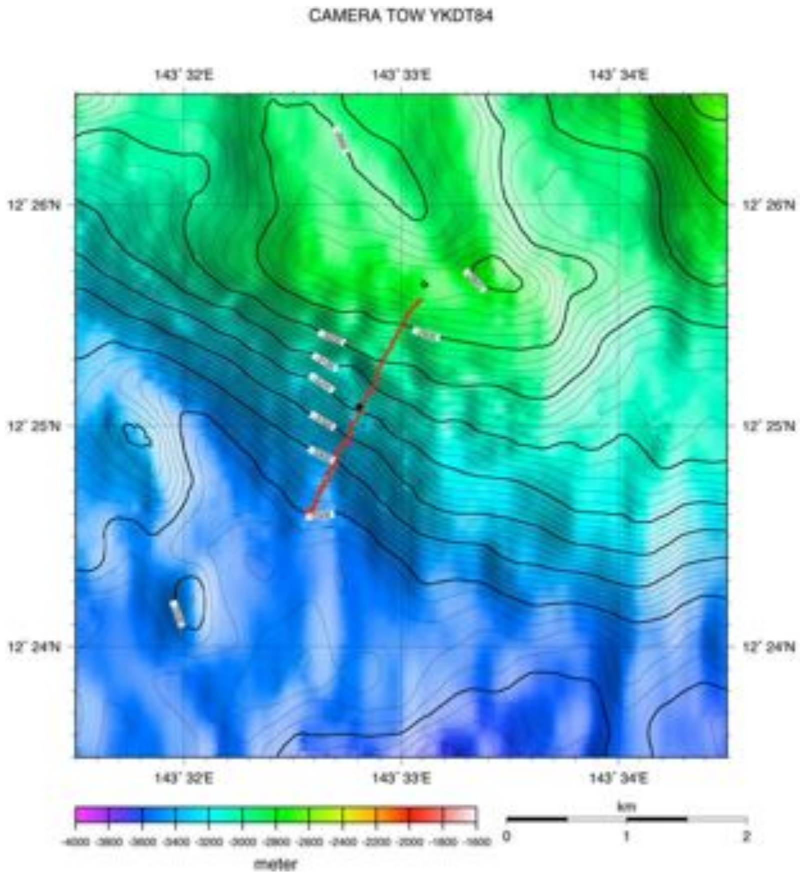

Fig. 1. Locality map for YKDT-84.

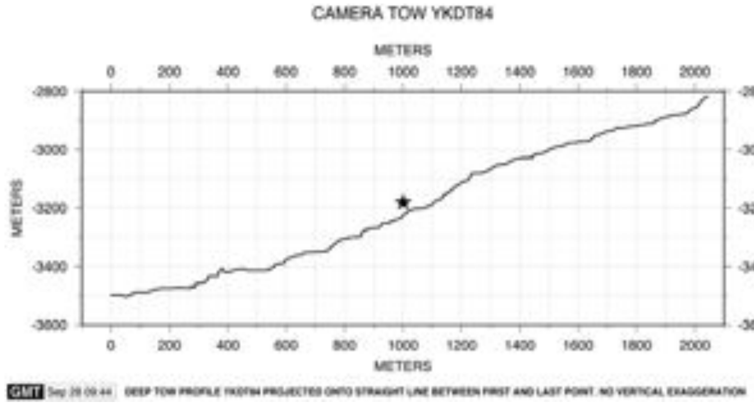

Fig. 2. Profile of YKDT-84.

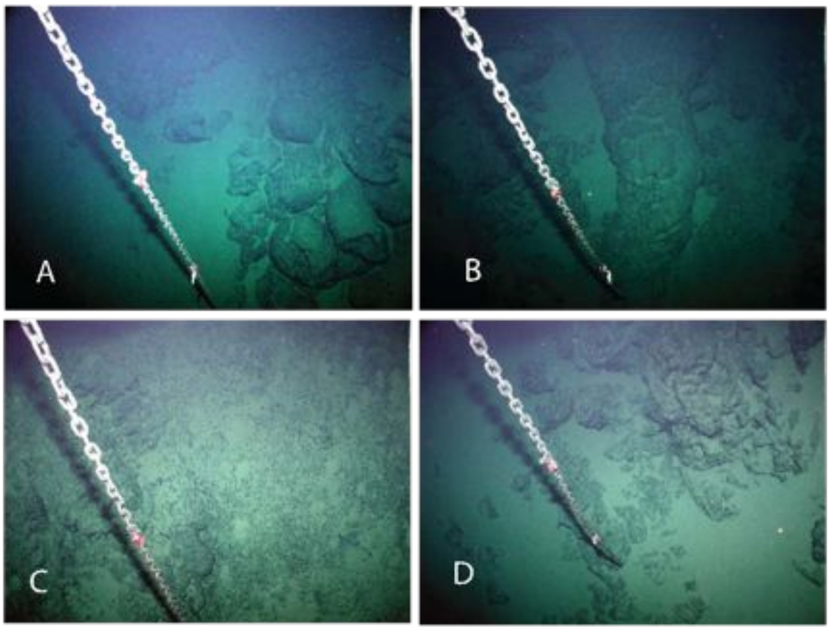

Fig. 3. Photos from YKDT-84 (A) DSCN2165, pillow basalts and sediment from lower portion of the tow (B) DSCN 2361, pillow basalts and sediment from upper portion of the tow (C) DSCN2301, desert-pavement-like surface with emergent Mn-coated outcrop (D) DSCN2346, Mn-coated outcrop and sediments.

Fig. 4 (left). Sediment recovered from YKDT-84 dredge.

Fig. 5 (right). Basalt fragment recovered from YKDT-84 dredge.

A-13. Report for YKDT-85, September-28-2010: reported by M. Brounce

The target for YKDT-85 was a steep slope on a conical feature that sits on the first prominent ridge west of the Santa Rosa Bank Fault. Shinkai dives at ~6500 mbsl observed peridotite and gabbro as forming the lower units of the ridge. YKDT-85 aimed to investigate the more upper units of the geologic section (**Figs. 1** and **2**). YKDT arrived at the seafloor at 09:23 and ~3090 mbsl. There was decimeter to centimeter scaled, sorted, angular tallus cover with a very small amount of light colored sediment forming pockets between the talus (**Fig. 3A**). The tallus was very tightly packed and extended upslope continuously. As YKDT moved upslope, it became apparent that there were distinct deposit sizes from decimeter scale blocks to very large several meter scale boulders (**Fig. 3B**). The larger boulders in places appeared to be deposited on the smaller sized blocks and seemed to be significantly less tightly packed (**Fig. 3C**). The dredge basket was dropped at 09:42 and ~3060 mbsl in hopes of capturing these smaller sized tallus blocks. As the dredge basket dragged along the talus slope, it scraped off a brown to black fine grained particulate that coated the blocks. The larger boulders seemed to lack this dark coating. Small living organisms were observed as YKDT approached the summit of the conical feature, as well as an outcrop with fracturing as in an exposed dike outcrop (**Fig. 3C, D**). A large coral or sponge fan was growing on the top of this outcrop (**Fig. 3C**). From this point and continuing upslope, coral and sponge like life became fairly abundant. The summit of the feature is depressed several tens of meters. As YKDT flew over it, it was lowered 24 m and the bottom was still not visible. The dive was terminated at 10:29 and ~2544 mbsl. The dredge recovered several subangular basaltic clasts (4–8 cm) with plagioclase olivine phenocrysts (≤ 1 mm) as well as one accidental sponge.

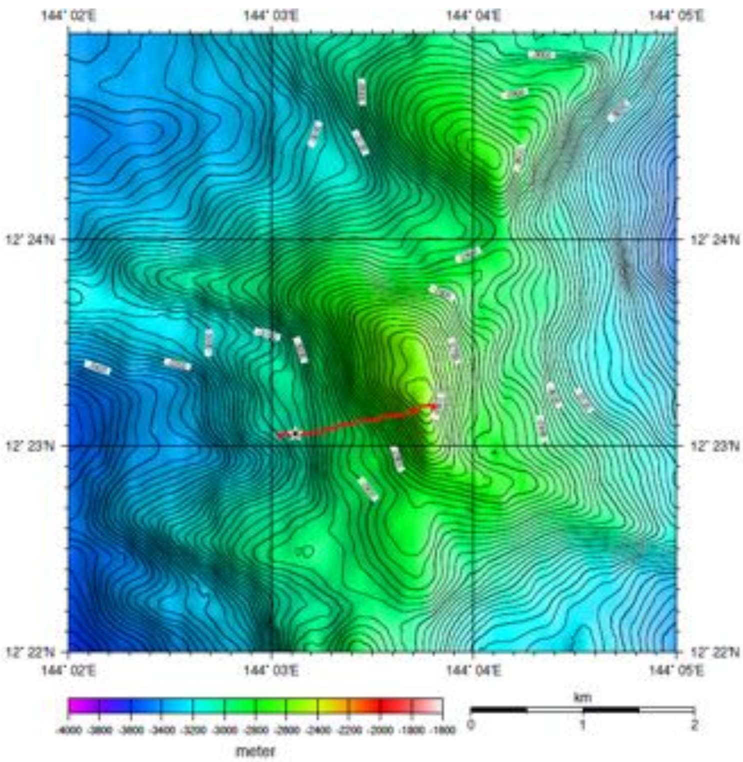

Fig. 1. Locality map for YKDT-85.

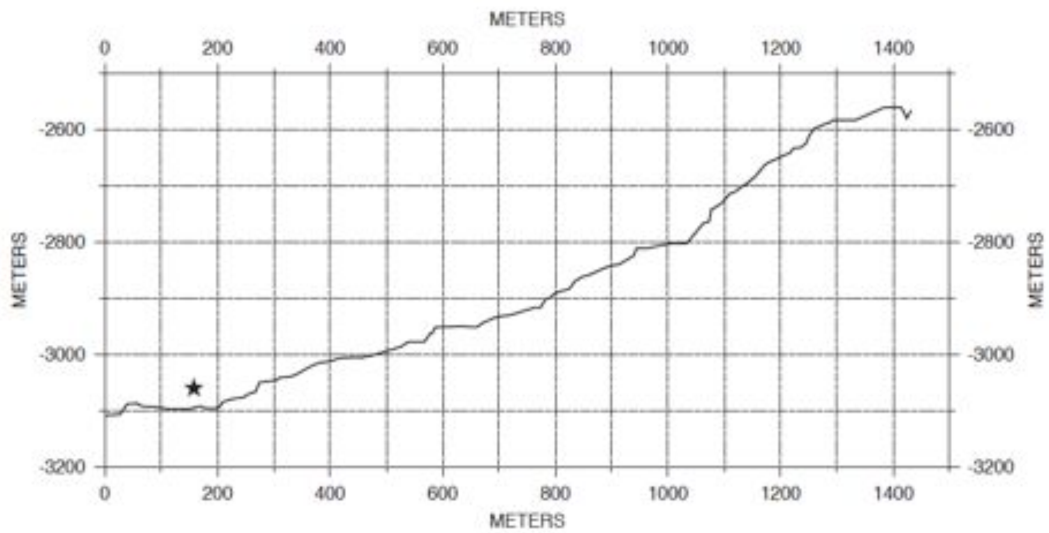

Fig. 2. Profile of YKDT-85.

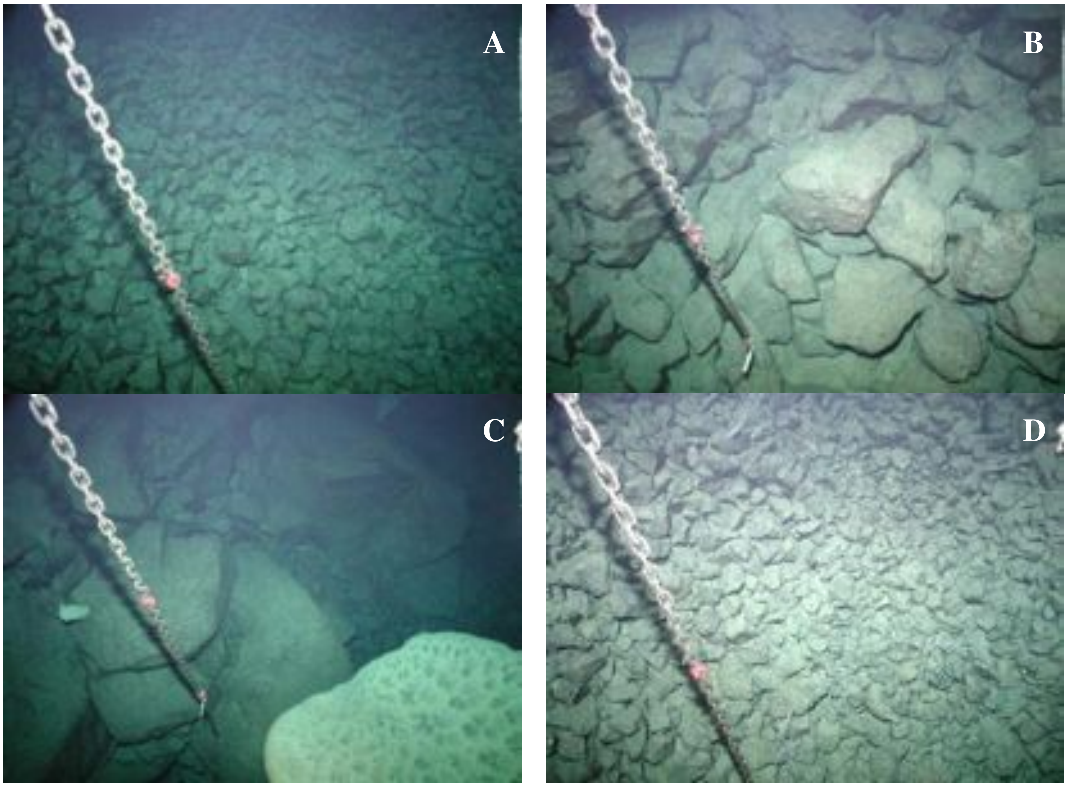

Fig. 3. Photos from YKDT-85 (A) well sorted decimeter to centimeter scaled tallus (B) decimeter scaled tallus (C) meter scaled, large boulder tallus and large sponge (D) various sponges on tallus.

A-14. Report for YKDT-86, September-28-2010: reported by M.K. Reagan

The target was a steep slope on the tall north-south ridge immediately west of the West Santa Rosa Bank Fault (**Figs. 1** and **2**). Shinkai dives 973 and 1025 were on this ridge to the south. Based on the results of these dives, we hypothesized that the tow would be over relatively young lavas of the Southeast Mariana Forearc Rift. YKDT approached the seafloor surface at 14:25 and 4050 m. The seafloor surface at the landing site consists of outcrops of talus with cobble and boulder sized blocks (**Fig. 3A**). All clasts are angular and almost unsedimented. Many of the blocks have platy morphologies and they appeared to be gray. Some have white spots suggesting the presence of plagioclase phenocrysts. Massive fractured outcrops of rock similar to the talus blocks emerged through the talus in several locations. One of these massive outcrops appears to have rubbly base (**Fig. 3B**). These lower tow rocks are most likely andesite lava flows and associated talus. Outcrops and talus of this apparent andesite near its contact with the upper lithologic unit has surfaces stained orange and fractures filled with a white mineral. Some of this rock is pervasively altered to a reddish color (**Fig. 3C**). Beginning at about 3700 m, the rocks forming talus are much more rounded (**Fig. 3D**), and sediment cover is somewhat heavier. Clast sizes in this area are typically smaller: cobbles to small boulders. The dredge was dropped at 15:05 (3692 m) on this material and more than 100 samples were collected ranging from 1 cm to 25 cm in length/diameter These roundish cobbles turned out to be fragments of small basaltic pillows with glassy rinds (**Fig. 4**).

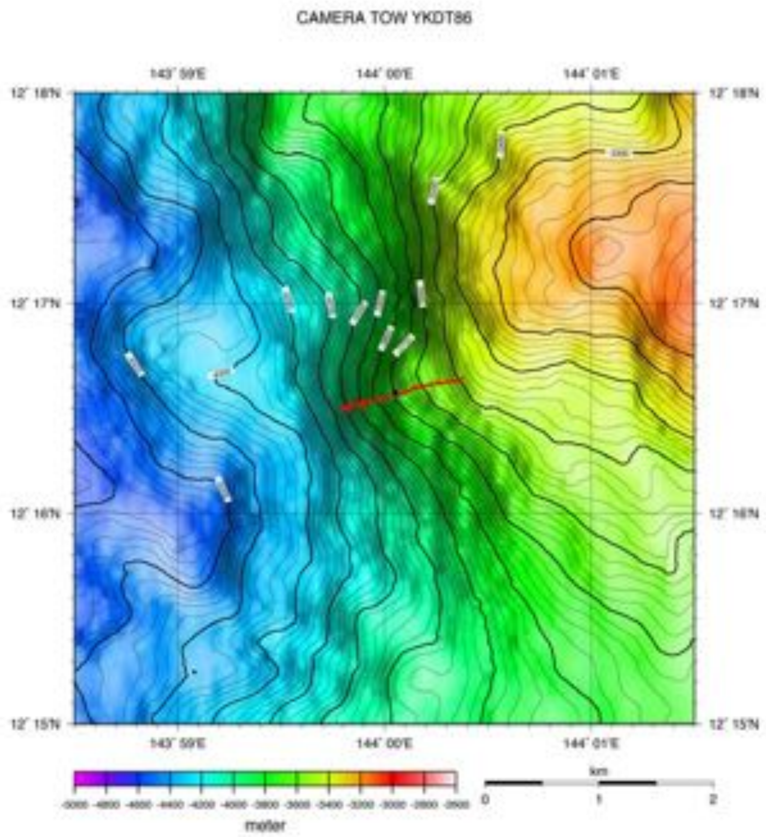

Fig. 1. Locality map for YKDT-86.

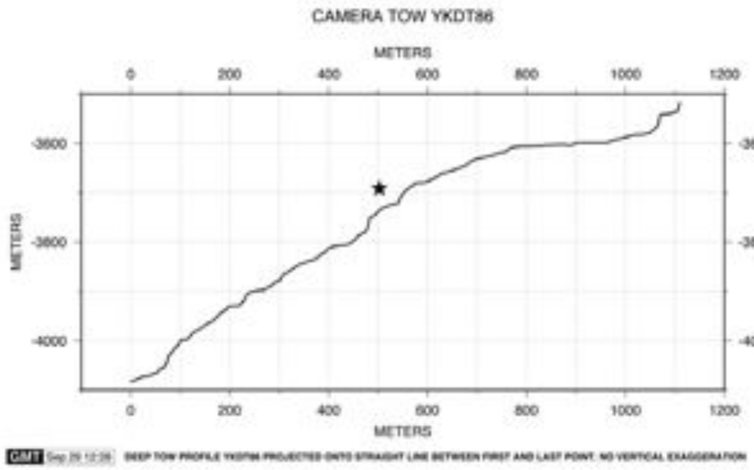

Fig. 2. Profile of YKDT-86.

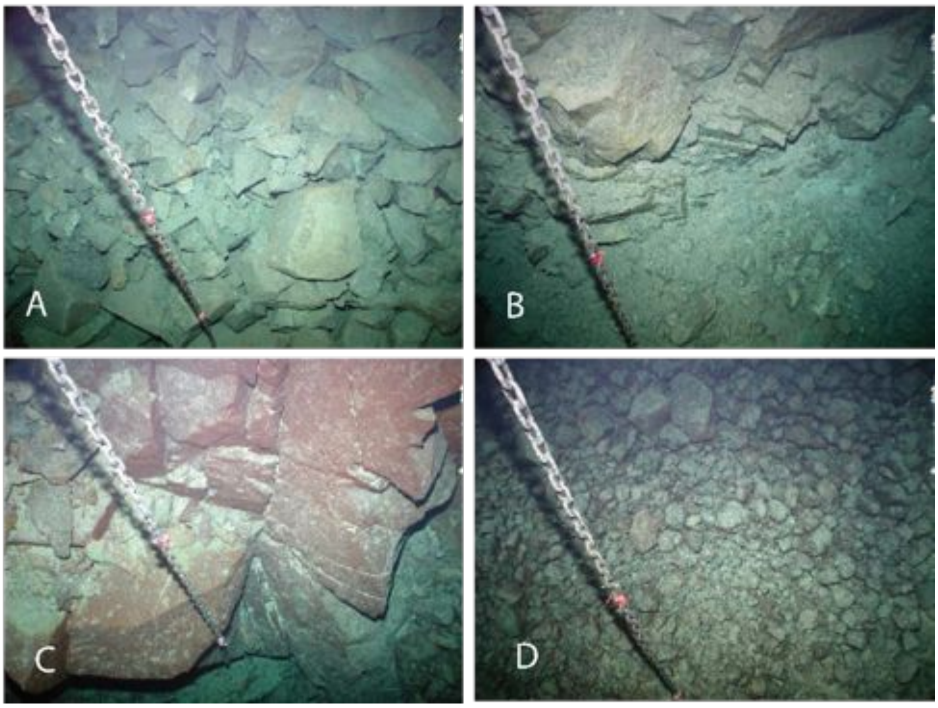

Fig. 3. Photos from YKDT-86 (A) DSCN2811, talus of angular to platy boulders (B) DSCN2883, fractured massive outcrop (C) DSCN2934, pervasively red-stained outcrop (D) DSCN2952, talus of subrounded cobbles.

Fig. 4. Basaltic pillow lava recovered in the YKDT-86 dredge.

A-15. Report for YKDT-87, September-29-2010: reported by M. Brounce

The target for YKDT-87 was a moderately sloped traverse of a ridge in the northwest region of the Southeast Mariana Forearc Rift. YKDT-87 aimed to investigate the geologic units that comprise this ridge (**Figs. 1** and **2**). YKDT arrived at the bottom at 09:26 and ~3631 mbsl. The surface was covered with decimeter sized tallus with very well preserved pillow structures present (**Fig. 3A**). There was a small amount of light colored sediment in pockets between the tallus blocks and some occasional coating of sediment on the rounded pillow structures. White cracks were observed infrequently in the pillow structures. As YKDT moved upslope, the forward facing camera showed an extensive field of pillow tallus with a wide variety of block sizes ranging from centimeter scale to meter scale. There were numerous sights of extremely well preserved pillow structures, such as rounded surfaces, flow parallel striations, pa hoe hoe-like flow banding, and radial fracturing (**Fig. 3B, C**). There was one very steep section with large pillow structures in the middle of the dive. Towards the middle to end of the dive track there were infrequent patches of heavier sediment cover with sharp boundaries between the end of the pillow structures and the start of heavy sediment (**Fig. 3D**). The end portion of the dive had shallower slopes with occasional depressions in the topography. At 10:34 and~3553 mbsl, YKDT began its ascent from the seafloor. YKDT-87 did not retrieve any sample.

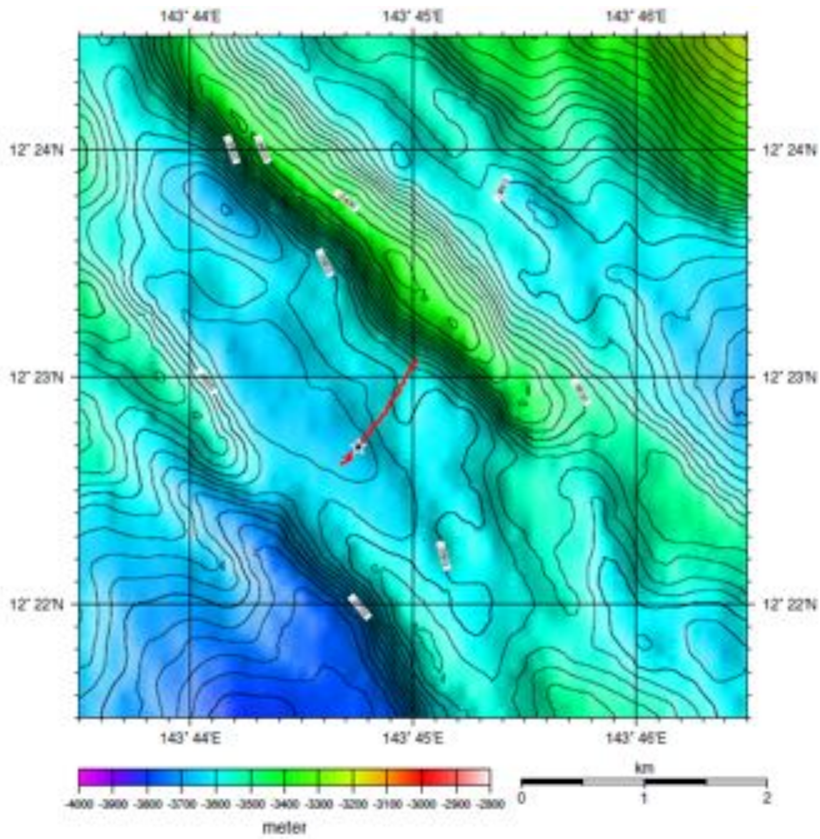

Fig. 1. Locality map for YKDT-87.

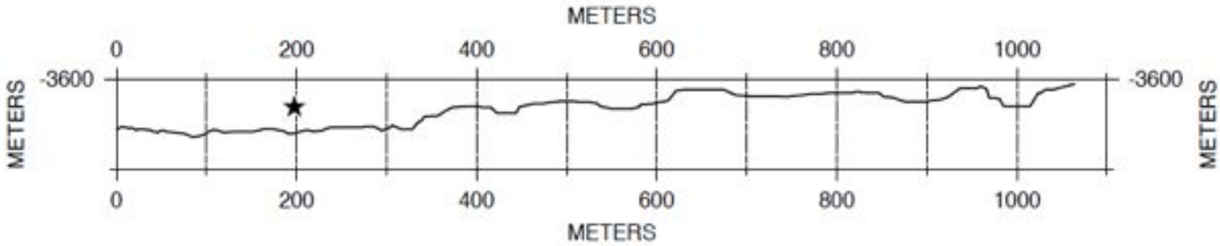

Fig. 2. Profile of YKDT-87.

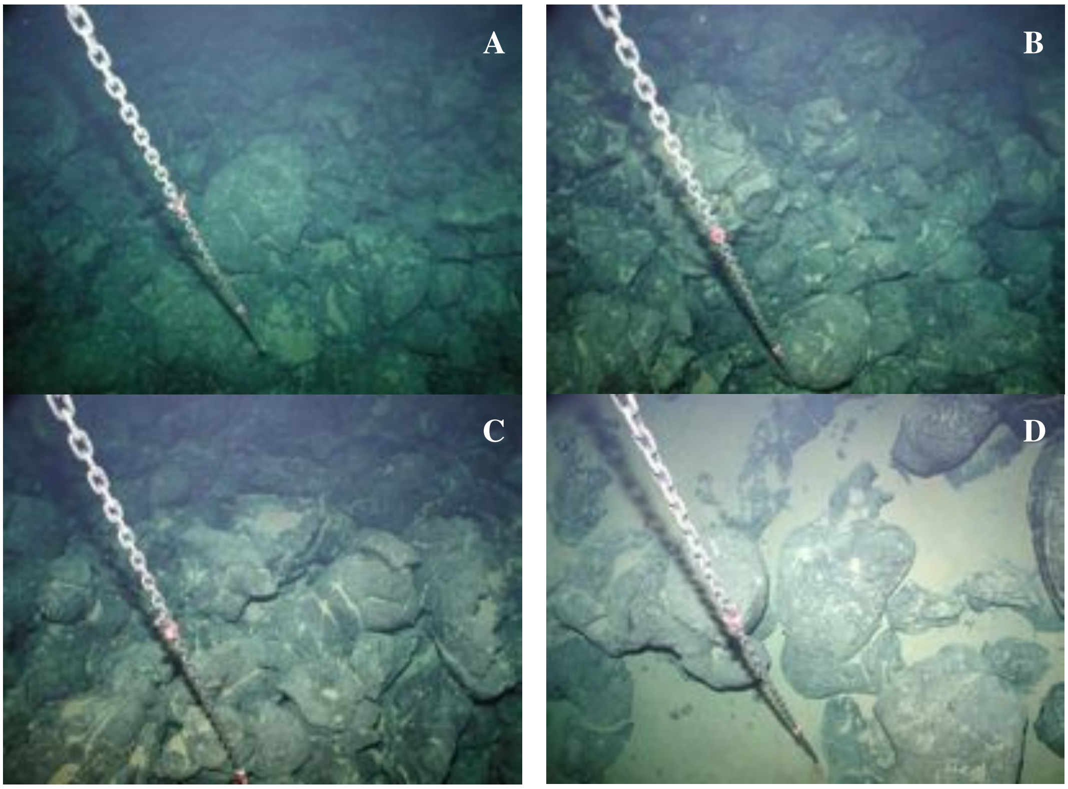

Fig. 3. Photos from YKDT-87 (A) landing site (B, C) examples of pillow structure (D) sediment coverage between pillow structures.

A-16. Report for YKDT-88, September-29-2010: reported by M. Brounce

The target for YKDT-88 was a moderately sloped traverse of a ridge in the northwest region of the Southeast Mariana Forearc Rift very close in location to YKDT-87. YKDT-88 aimed to investigate the geologic units that comprise the ridge (**Figs. 1** and **2**), as in YKDT-87. YKDT arrived at the seafloor at 14:13 and ~3475 mbsl. The seafloor looked very similar to the terrain observed during YKDT-87 (**Fig. 3A**). The surface was covered with centimeter to decimeter scaled, rounded tallus. There were very well preserved pillow structures. There was a small amount of sediment between pillow tallus and the individual pillow sizes seemed to be smaller than in YKDT-87. As YKDT began to move upslope, we observed occasional increases in sediment cover and variation in pillow sizes, from centimeter scale to several meter scaled blocks (**Fig. 3B**). There was some outcrop and tallus comingled along the dive track, as in YKDT-87. YKDT-88 retrieved sample in the smaller sized tallus fields and with concern of losing the dredge with sample among the larger pillow fields, the tow was terminated. YKDT-88 began its ascent from the seafloor at 15:02 and at ~3351 mbsl.

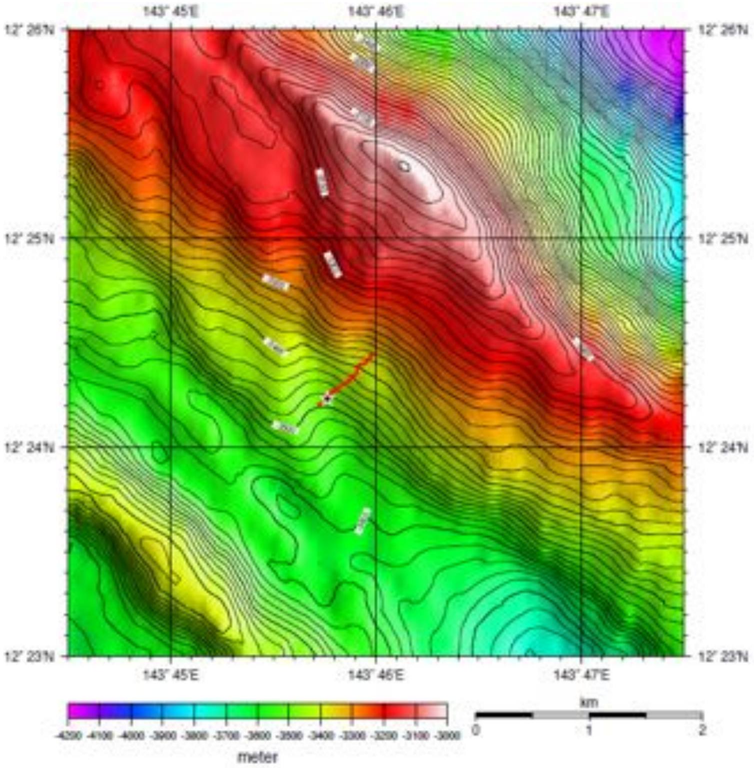

Fig. 1. Locality map for YKDT-88.

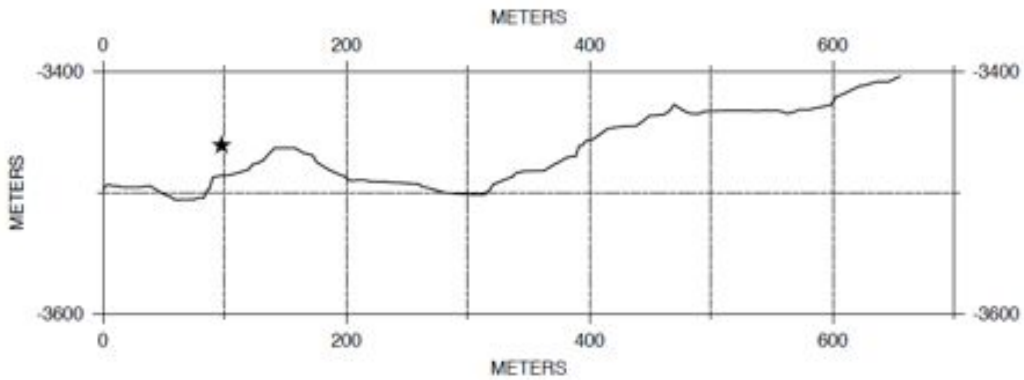

Fig. 2. Profile of YKDT-88.

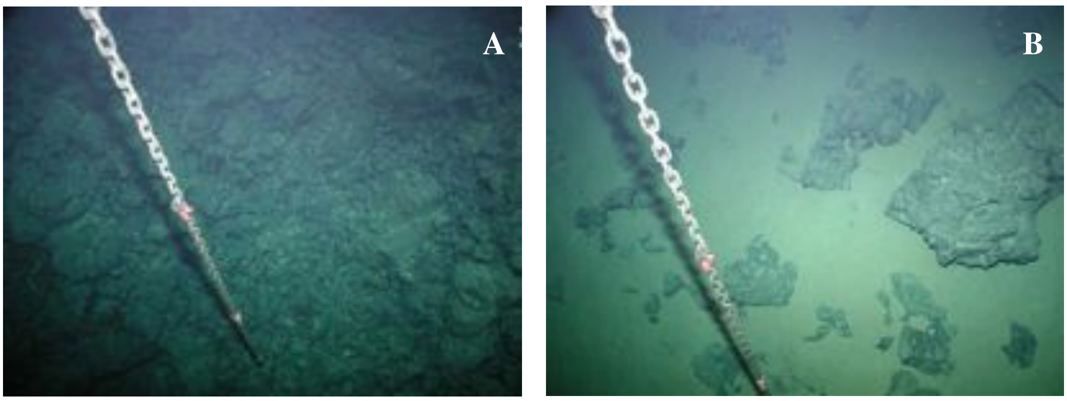

Fig. 3. Photos from YKDT-88 (A) landing site (B) sediment cover.

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Appendix B.

List of waypoints of the dives

Waypoints and sample stops for Dive-1229 (18-September-2010; M.K. Reagan)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target		9:00	12°13.8372'	144°17.7953'	0	-853.1	-8.5
2	1	Landing, 2 rocks (R01, R02)	11:25	11:25	12°13.6115'	144°18.0022'	6350	-1269.2	366.6
3	2	1 rock (R03)	11:42	11:42	12°13.6664'	144°17.9780'	6311	-1168.0	322.7
4	3	2 rocks (R04, R05)	11:54	11:56	12°13.7337'	144°17.9802'	6256	-1044.0	326.7
5	4	1 rock (R06)	12:25	12:27	12°13.9210'	144°17.9669'	6200	-698.7	302.6
6	5	2 rocks (R07, R08)	12:44	12:44	12°13.9912'	144°17.9110'	6200	-569.2	201.2
7	6	2 rocks (R9, R10)	13:40	13:44	12°14.5886'	144°17.9996'	6006	532.0	361.9
8	7	2 rocks (R11,R12)	13:50	13:51	12°14.6153'	144°18.0033'	5970	581.2	368.6
9	8	3 rocks (R13,R14,R15)	14:10	14:10	12°14.6652'	144°17.9827'	5930	673.2	331.2
10	9	2 rocks (R16, R17)	14:20	14:28	12°14.7094'	144°17.9717'	5876	754.7	311.3
11	10	2 rocks (R18, R19)	14:35	14:38	12°14.7455'	144°17.9533'	5836	821.3	277.9
12	11	3 rocks (R29,R21,R22)	14:45	14:49	12°14.7882'	144°17.9408'	5787	900.0	255.2
13	-	Left Bottom	14:55	14:56	12°14.8034'	144°17.9496'	5765	928.0	271.2

Waypoints and sample stops for Dive-1230 (19-September-2010; J. Ribeiro)

Point Number	Sample stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing target	-	9:00	12°11.3589'	143°54.1945'		-75.7	-372.6
2	1	Landing	10:55	10:59	12°11.3557'	143°54.1910'	4958	-81.6	-379.0
3	2	2 rocks (R01, R02)	11:00	11:22	12°11.4024'	143°54.2326'	4930	4.4	-303.5
4	3	2 rocks (R03, R04)	11:19	11:34	12°11.4262'	143°54.2473'	4905	48.3	-276.9
5	4	2 rocks (R05, R06)	11:34	11:46	12°11.4693'	143°54.2844'	4852	127.7	-209.6
6	5	2 rocks (R07, R08)	11:43	12:07	12°11.4993'	143°54.3101'	4801	183.0	-163.0
7	6	2 rocks (R09, R10)	11:58	12:27	12°11.5405'	143°54.3392'	4752	259.0	-110.2
8	7	2 rocks (R11, R12)	12:15	12:44	12°11.5723'	143°54.3623'	4704	317.6	-68.3
9	8	2 rocks (R13, R14)	12:39	12:57	12°11.6059'	143°54.3895'	4650	379.5	-19.0
10	9	2 rocks (R15, R16)	12:52	13:09	12°11.6193'	143°54.3983'	4622	404.2	-3.0
11	10	1 rock (R17)	13:01	13:21	12°11.6443'	143°54.4200'	4599	450.3	36.2
12	11	2 rocks (R18, R19)	13:14	13:36	12°11.6634'	143°54.4605'	4554	485.5	109.7
13	12	2 rocks (R20, R21)	13:31	13:57	12°11.7184'	143°54.4998'	4499	586.9	180.9
14	13	2 rocks (R22, R23)	13:50	14:19	12°11.7723'	143°54.5274'	4451	686.3	231.0
15	14	2 rocks (R24, R25)	14:13	14:36	12°11.8070'	143°54.5616'	4401	750.3	293.0
16	15	2 rocks (R26, R27)	14;30	14:51	12°11.8511'	143°54.5777'	4350	831.6	322.2
17	16	2 rocks (R28, R29)	14:45	15:09	12°11.8873'	143°54.5917'	4303	898.3	347.6
18	17	2 rocks (R30, R31), Left	15:15	15:21	12°11.9046'	143°54.6005'	4280	930.2	363.6

Waypoints and sample stops for Dive-1231 (20-September-2010; I. Pujana)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target	9:00	9:00	12°17.3024'	144°33.2313'	0	-364.2	419.3
2	1	Landing	11:34	11:34	12°17.3159'	144°33.2663'	6393	-339.3	482.7
3	2	2 rocks (R01, R02)	11:51	11:51	12°17.3492'	144°33.2582'	6377	-278.0	468.0
4	3	4 rocks (R03, R04, R05, R06)	12:06	12:06	12°17.3778'	144°33.2081'	6333	-225.2	377.2
5	4	4 rocks (R07, R08, R09,	12:23	12:23	12°17.4685'	144°33.1813'	6245	-58.0	328.6
6	5	3 rocks (R11, R12, R13)	12:51	12:51	12°17.4852'	144°33.1806'	6228	-27.2	327.3
7	6	2 rocks (R14, R15)	13:04	13:04	12°17.4899'	144°33.1659'	6194	-18.6	300.7
8	7	2 rocks (R16, R17) and 1 scoop (S01)	13:26	13:26	12°17.5011'	144°33.1478'	6183	2.0	267.9
9	8	1 scoop (S02)	13:42	13:42	12°17.5325'	144°33.1931'	6145	59.9	350.0
10	9	3 rocks (R18, R19, R20)	14:18	14:18	12°17.5937'	144°33.1625'	6065	172.7	294.5
11	10	3 rocks (R21, R22, R23)	14:44	14:44	12°17.6349'	144°33.1129'	5982	248.6	204.6
12	11	2 rocks (R24, R25), Left	15:05	15:05	12°17.6645'	144°33.0923'	5932	303.2	167.3

Waypoints and sample stops for Dive-1232 (21-September-2010; K. Michibayashi)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target	9:00	9:00	11°36.9192'	143°0.6956'		-701.9	173.7
2	1	Landing	11:25	11:25	11°36.9051'	143°0.7335'	6425	-727.9	242.6
3	2	3 rocks (R01, R02, R03)	11:43	11:43	11°37.0067'	143°0.6932'	6399	-540.6	169.3
4	3	2 rocks (R04, R05)	12:05	12:05	11°37.0993'	143°0.6543'	6346	-369.9	98.6
5	4	2 rocks (R06, R07)	12:22	12:22	11°37.2114'	143°0.6132'	6276	-163.3	23.9
6	5	2 rocks (R08, R09)	12:49	12:49	11°37.2906'	143°0.5765'	6195	-17.3	-42.7
7	6	2 rocks (R10, R11)	13:09	13:09	11°37.4577'	143°0.5226'	6125	290.7	-140.6
8	7	2 rocks (R12, R13)	13:22	13:22	11°37.5336'	143°0.4764'	6046	430.6	-224.6
9	8	2 rocks (R14, R15)	13:22	13:22	11°37.5814'	143°0.4573'	5992	518.7	-259.3
10	9	1 rock (R16)	13:41	13:41	11°37.6291'	143°0.4246'	5934	606.6	-318.7
11	10	1 rock (R17), and 1 scoop	13:55	13:55	11°37.6555'	143°0.4052'	5900	655.3	-354.0
12	11	1 rock (R18)	14:15	14:15	11°37.7332'	143°0.3454'	5848	798.5	-462.6
13	12	1 rock (R19)	14:31	14:31	11°37.8146'	143°0.2827'	5788	948.6	-576.6
14	13	1 rock (R20)	14:44	14:44	11°37.8269'	143°0.2317'	5742	971.3	-669.3
15	14	2 rocks (R21, R22), Left	14:55	14:55	11°37.8414'	143°0.2236'	5751	998.0	-684.0

Waypoints and sample stops for Dive-1233 (22-September-2010; Y. Ohara)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target	09:00	09:00	11°35.7744'	142°55.2000'		-968.9	0.0
2	1	Landing	11:25	11:25	11°35.7843'	142°55.3148'	6394	-950.6	208.6
3	2	2 rocks (R01, R02)	11:39	11:38	11°35.8046'	142°55.3255'	6379	-913.2	228.0
4	3	2 rocks (R03, R04)	11:54	11:56	11°35.8961'	142°55.4146'	6320	-744.5	390.0
5	4	2 rocks (R05, R06)	12:12	12:13	11°35.9304'	142°55.4703'	6309	-681.3	491.2
6	5	2 rocks (R07, R08)	12:29	12:28	11°36.0440'	142°55.4905'	6277	-471.9	527.9
7	6	3 rocks (R09, R10, R11)	12:43	12:44	11°36.0823'	142°55.5364'	6250	-401.3	611.3
8	7	2 Rocks (R12, R13)	12:58	12:59	11°36.2056'	142°55.5433'	6210	-174.0	623.9
9	8	4 Rocks (R14, R15, R16,	13:17	13:17	11°36.3409'	142°55.5558'	6199	75.3	646.6
10	9	2 Rocks (R18, R19)	13:59	14:03	11°36.5886'	142°55.5635'	6074	532.0	660.6
11	10	2 Rocks (R20, R21)	13:55	14:20	11°36.0440'	142°55.5577'	6041	677.2	650.0
12	11	2 Rocks (R22, R23)	14:37	14:36	11°36.8128'	142°55.5720'	6004	945.3	676.0
13	12	2 Rocks (R24, R25)	14:54	14:55	11°36.8743'	142°55.5577'	5930	1058.7	650.0
14	13	Left bottom	14:55	14:56	11°36.8743'	142°55.5577'	5930	1058.7	650.0

Waypoints and sample stops for Dive-1234 (23-September-2010; T. Ishii)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target		9:00	11°39.1300'	143°2.8100'	0	-1050.7	381.5
2	1	Landing, 4 rocks (R01, R02, R03, R04)	11:29	11:28	11°39.0971'	143°2.9379'	6079	-1121.3	613.9
3	2	1 rock (R05)	12:00	12:00	11°39.1348'	143°2.9511'	6021	-1041.9	637.9
4	3	1 rock (R06), 1 push core	12:20	12:21	11°39.1876'	143°2.9463'	5945	-944.5	629.2
5	4	1 rock (R07), multiple biologic samples (B01)	12:35-13:12	13:11	11°39.2581'	143°2.9449'	5859	-814.6	626.6
6	5	3 rocks (R08, R09, R10)	13:36	13:36	11°39.3734'	143°2.9467'	5689	-602.0	626.9
7	6	3 rocks (R11, R12, R13), multiple biologic samples	13:48-14:15	14:15	11°39.4649'	143°2.9482'	5622	-433.4	632.6
8	-	None	14:38	14:38	11°39.5731'	143°2.9111'	5548	-233.9	565.2
9	7	5 Rocks (R14, R15, R16, R17, R18)	14:45	14:56	11°39.5485'	143°2.8979'	5540	-279.2	541.2
9	-	Left Bottom	14:56	14:56	11°39.5485'	143°2.8979'	5540	-279.2	541.2

Waypoints and sample stops for Dive-1235 (24-September-2010; G. Girard)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target	09:00	09:00	12°04.2220'	144°00.7300'		-1249.9	-308.4
2	1	Landing, 2 rocks (R01, R02)	11:27	11:29	12°04.1645'	144°00.8408'	6478	-1355.9	-107.4
3	2	3 rocks (R03, R04, R05)	11:41	11:49	12°04.2003'	144°00.8423'	6435	-1289.9	-104.6
4	3	2 rocks (R06, R07)	12:02	12:07	12°04.2603'	144°00.8699'	6364	-1179.3	-54.6
5	4	2 rocks (R08, R09)	12:18	12:25	12°04.3417'	144°00.9430'	6295	-1029.2	78.0
6	5	2 rocks (R10, R11)	12:41	12:50	12°04.4433'	144°01.0157'	6206	-841.9	209.9
7	6	2 rocks (R12, R13)	13:12	13:23	12°04.5579'	144°01.0620'	6104	-630.6	293.9
8	7	3 Rocks (R14, R15, R16)	13:34	13:42	12°04.6367'	144°01.1025'	6029	-485.4	367.3
9	8	2 Rocks (R17, R18)	13:54	14:05	12°04.7062'	144°01.1414'	5959	-357.2	437.9
10	9	2 Rocks (R19, R20)	14:18	14:24	12°04.7828'	144°01.1642'	5908	-216.0	479.3
11	10	2 Rocks (R21, R22)	14:35	14:39	12°04.8823'	144°01.1870'	5868	-32.6	520.6
12	11	3 Rocks (R23, R24, R25), Left bottom	14:42	14:50	12°04.9072'	144°01.1973'	5861	13.2	539.3

Waypoints and sample stops for Dive-1236 (25-September-2010; M. Brounce)

Point Number	Sample Stop	Samples	Observer Record Time	Pilot Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	-	Landing Target	09:00	09:00	11°39.9500'	143°2.6000'	-	-1198.2	0.0
2	1	Landing	11:01	11:01	11°39.9248'	143°2.6044'	5309	-1244.7	7.9
3	2	1 rock (R01)	11:09	11:09	11°39.9465'	143°2.6114'	5306	-1204.7	20.7
4	3	1 push core (C01)	11:29	11:29	11°40.1375'	143°2.5938'	5270	-852.6	-11.2
5	4	2 rocks (R02, R03)	11:48	11:48	11°40.2915'	143°2.5927'	5240	-568.7	-13.2
6	5	3 rocks (R04, R05, R06)	12:00	12:00	11°40.3508'	143°2.5956'	5181	-459.3	-7.9
7	6	2 rocks (R07, R08)	12:18	12:19	11°40.4326'	143°2.6084'	5101	-308.5	15.2
8	7	2 rocks (R09, R10)	12:33	12:33	11°40.4785'	143°2.6139'	5043	-223.9	25.2
9	8	3 rocks (R11, R12, R13)	12:45	12:45	11°40.5233'	143°2.6316'	4983	-141.3	57.4
10	9	1 rock (R14)	13:06	13:06	11°40.6405'	143°2.5850'	4899	74.6	-27.2
11	10	1 rock (R15)	13:19	13:19	11°40.6528'	143°2.5861'	4891	97.3	-25.2
12	11	2 rocks (R16, R17)	13:37	13:38	11°40.8148'	143°2.5784'	4823	395.9	-39.2
13	12	1 push core (C02)	14:01	14:05	11°41.0278'	143°2.5582'	4810	788.6	-75.9
14	13	1 rock (R18)	14:30	14:31	11°41.2860'	143°2.5299'	4727	1264.6	-127.3
15	14	3 rocks (R19, R20, R21)	14:52	14:52	11°41.4444'	143°2.5090'	4670	1556.6	-165.3
16	15	Left bottom	15:02	15:03	11°41.5587'	143°2.5035'	4646	1767.3	-175.3

Waypoints for YKDT-81 (26-Sep-2010)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing						
2	Released dredge	Because of malfunctioning of the camera system, the dive was canceled halfway.					
3	Stop towing						

Waypoints for YKDT-82 (26-Sep-2010)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	14:29	12°25.0266'	143°50.0014'	4169	-872.7	4532.3
2	Released dredge	15:36	12°25.3210'	143°49.6563'	3911	-330.0	3907.0
3	Stop towing	15:53	12°25.4288'	143°49.5113'	3959	-131.2	3644.2

Waypoints for YKDT-83 (27-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	9:38	12°29.0059'	143°35.0174'	3698	3698.0	1843.2
2	Released dredge	10:28	12°28.9983'	143°35.4664'	3684	3684.0	2656.7
3	Stop towing	10:35	12°28.9990'	143°35.5591'	3685	3685.3	2824.6

Waypoints for YKDT-84 (27-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	14:14	12°24.6072'	143°32.5502'	3482	-4411.3	-2626.6
2	Released dredge	15:16	12°25.0853'	143°32.8078'	3181	-3529.9	-2159.9
3	Stop towing	15:55	12°25.6056'	143°33.1036'	2658	-2570.6	-1624.0

Waypoints for YKDT-85 (28-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	9:24	12°23.0253'	144°03.0332'	3090	-322.0	-845.9
2	Released dredge	9:42	12°23.0579'	144°03.1196'	3060	-261.9	-689.3
3	Stop towing	10:30	12°23.2061'	144°03.8340'	2577	11.2	605.2

Waypoints for YKDT-86 (28-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	14:27	12°16.4939'	143°59.7841'	4050	-379.9	-935.2
2	Released dredge	15:05	12°16.5756'	144°00.0514'	3692	-229.3	-450.6
3	Stop towing	15:32	12°16.6400'	144°00.3853'	3454	-110.6	154.6

Waypoints for YKDT-87 (29-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	9:26	12°22.6153'	143°44.6774'	3630	-1815.3	-1490.6
2	Released dredge	9:49	12°22.6916'	143°44.7547'	3631	-1674.7	-1350.5
3	Stop towing	10:34	12°23.0923'	143°45.0343'	3536	-935.9	-843.9

Waypoints for YKDT-88 (29-May-2009)

Point Number	Events	Record Time	Lat (N)	Lon (E)	Depth (m)	X	Y
1	Start towing	14:14	12°24.1987'	143°45.7180'	3475	1103.7	395.0
2	Released dredge	14:28	12°24.2330'	143°45.7621'	3461	1166.9	474.9
3	Stop towing	15:02	12°24.4536'	143°45.9875'	3342	1573.6	883.4

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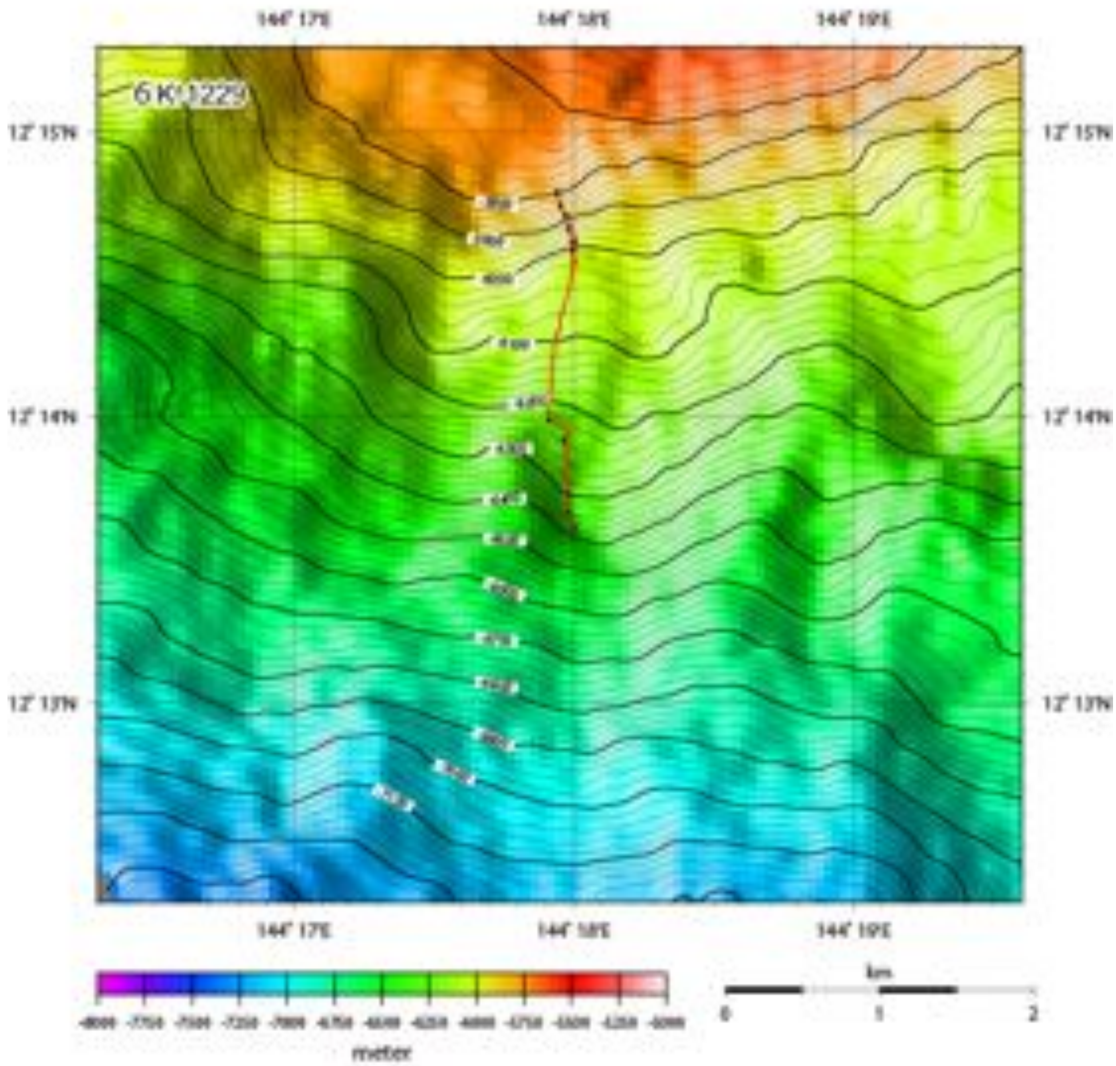
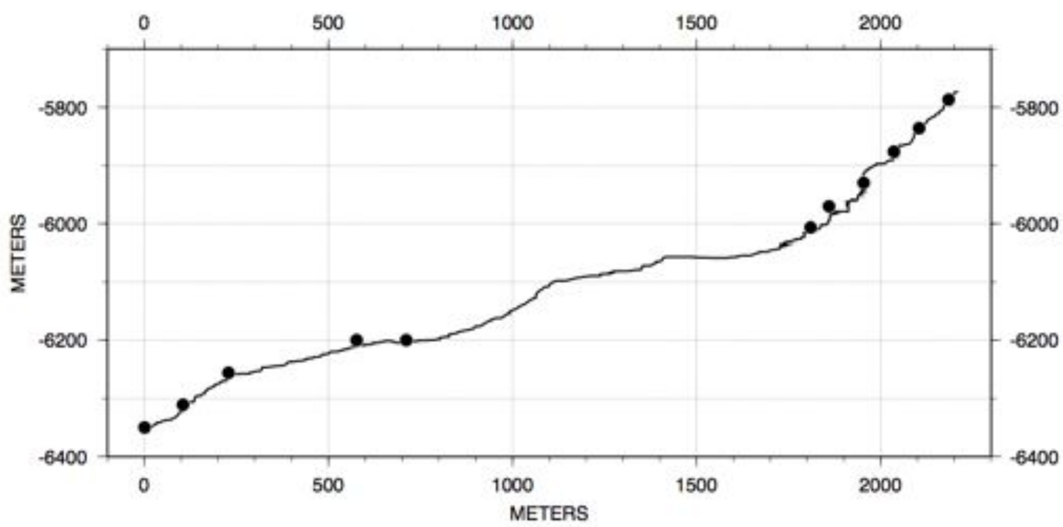
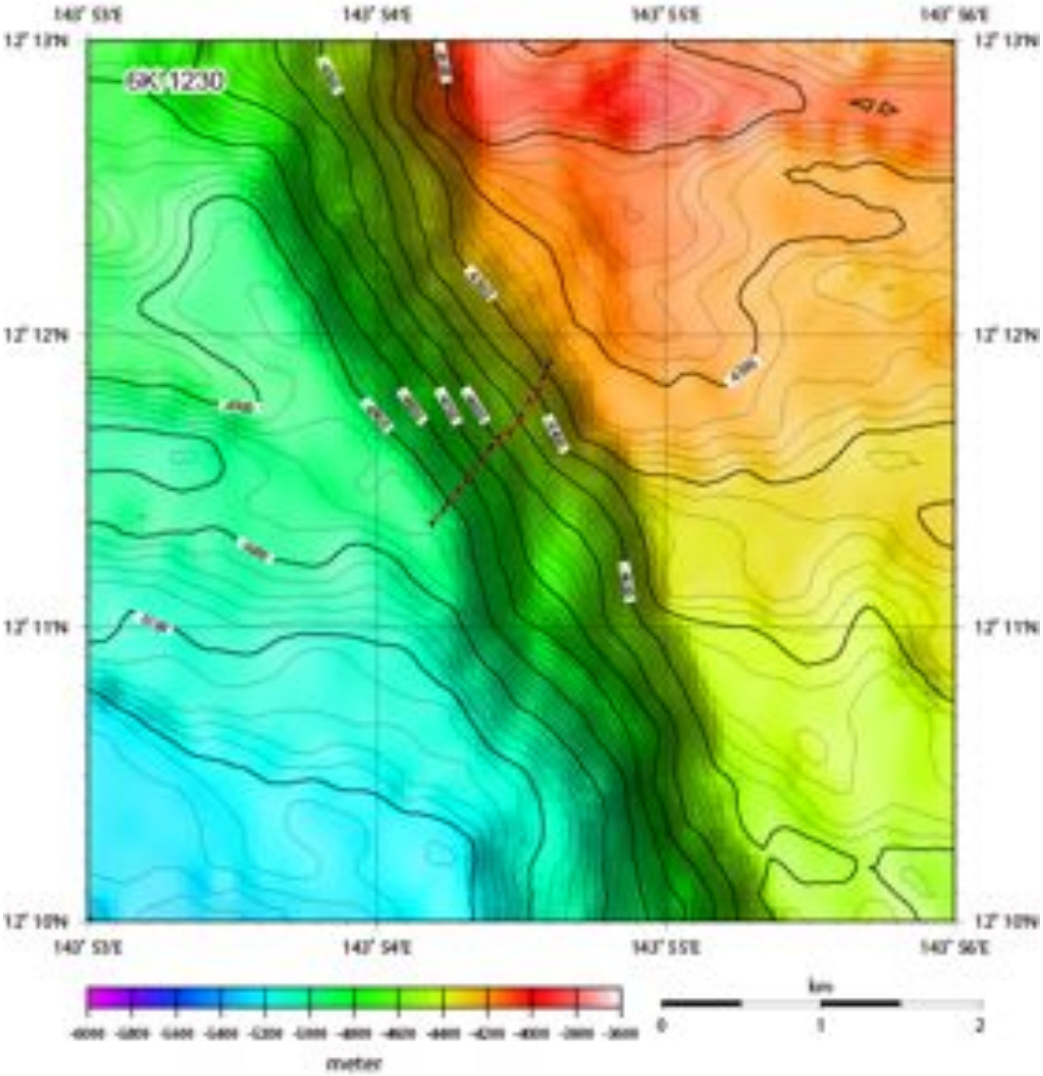
Appendix C.

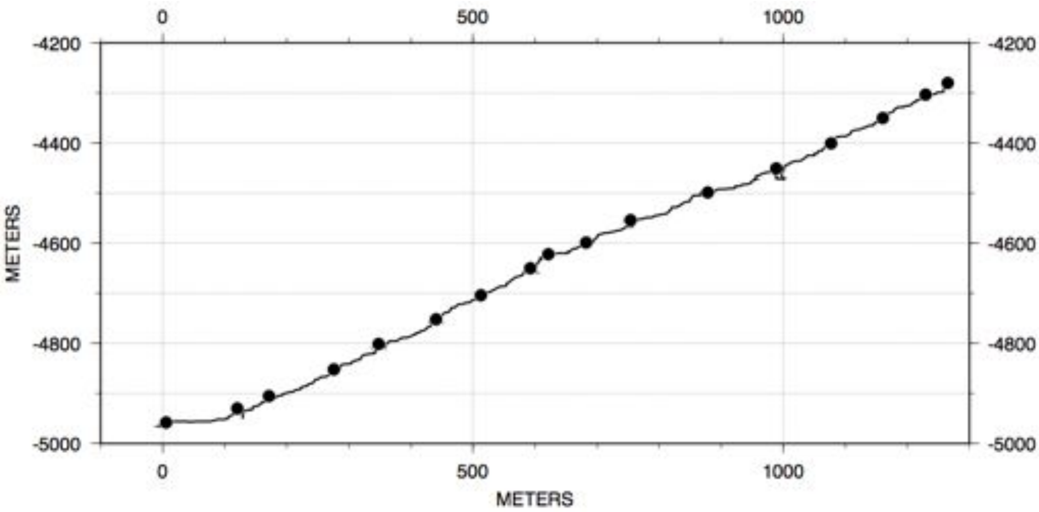
Bathymetric maps and profiles for each dive



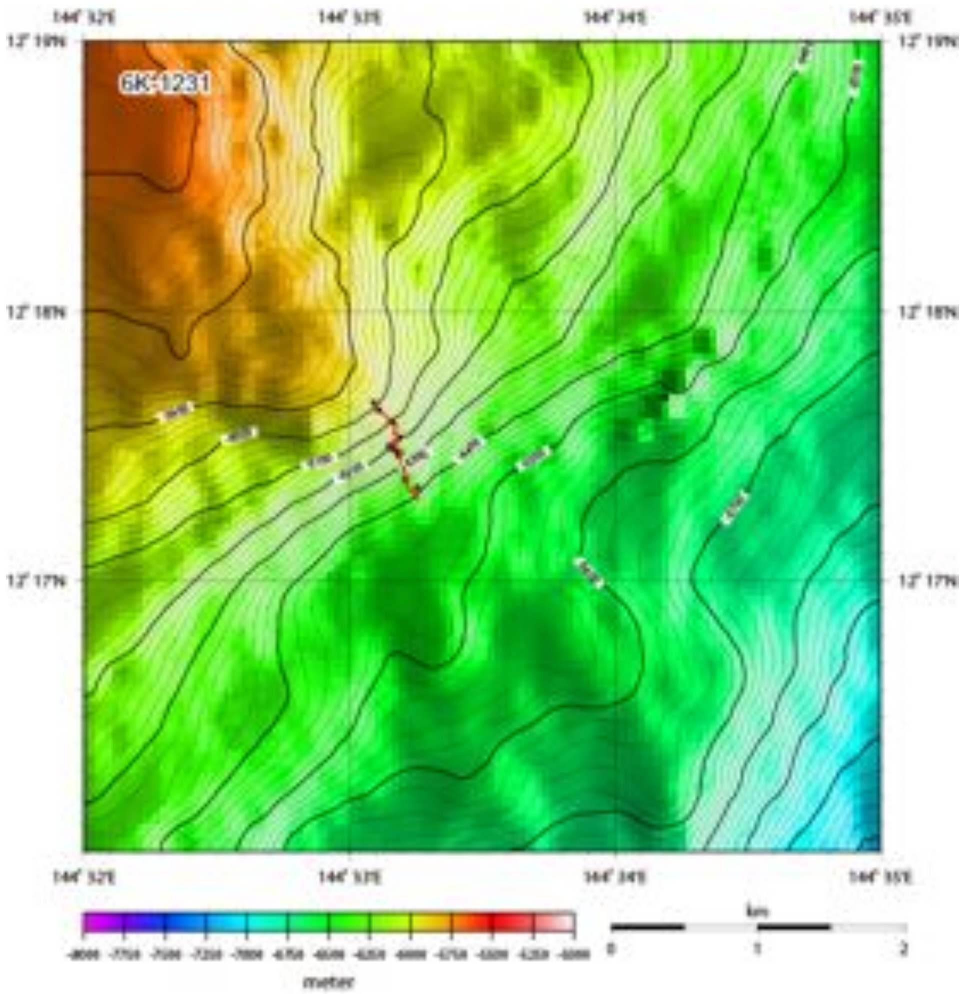


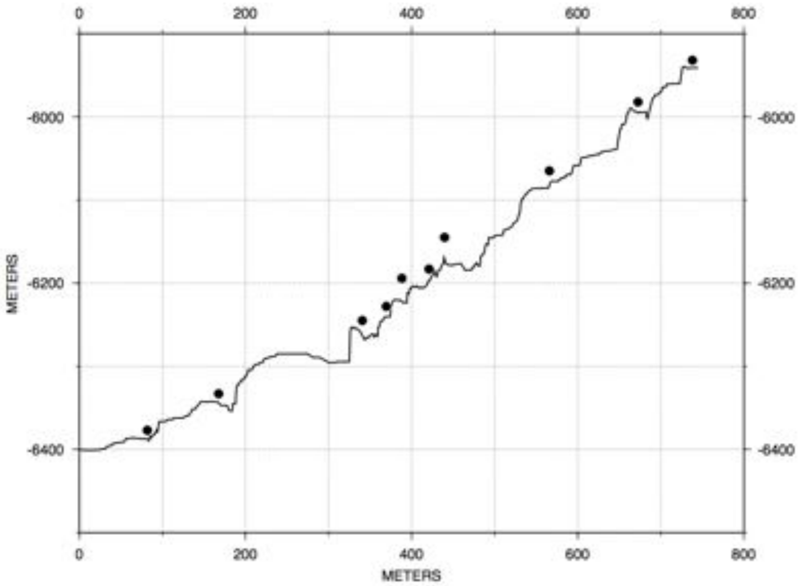
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



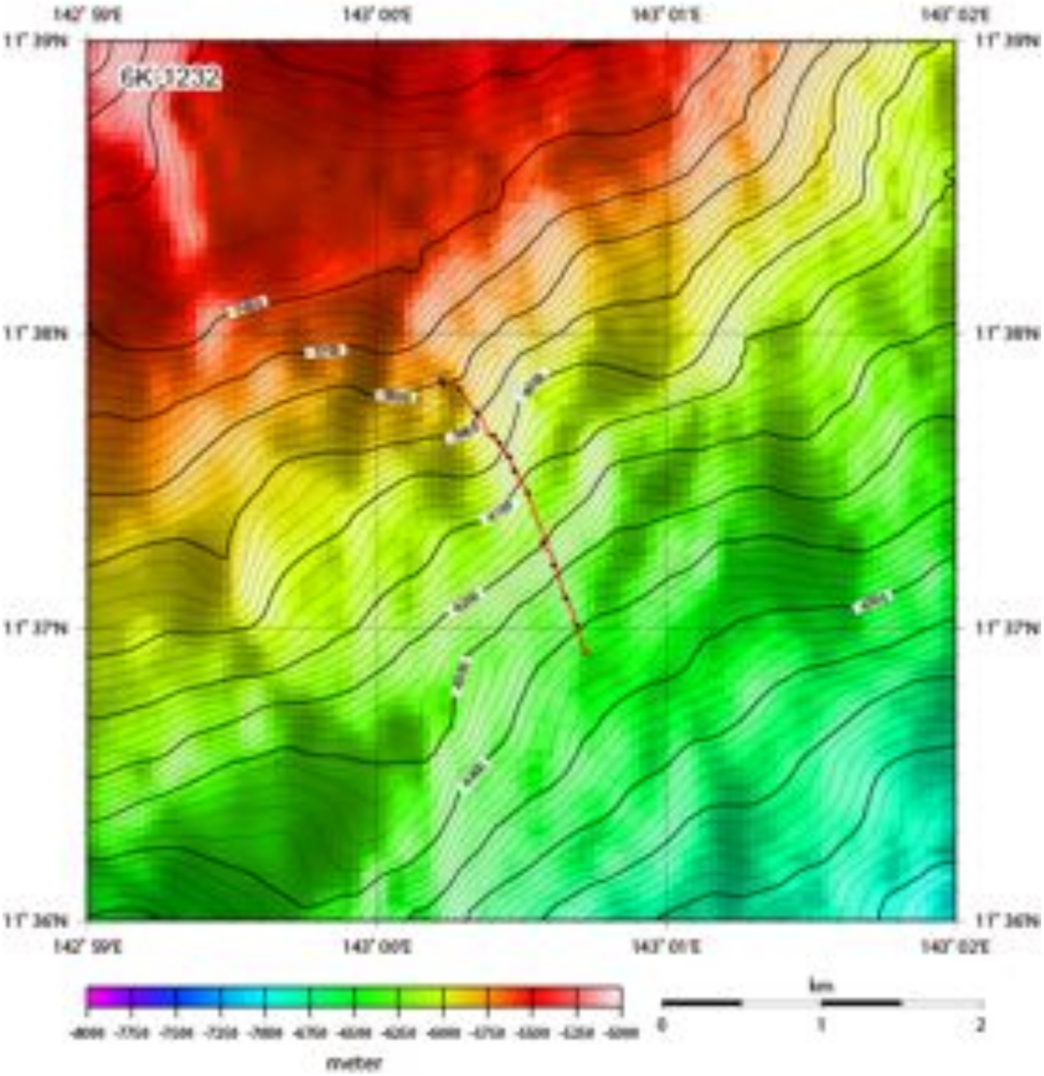


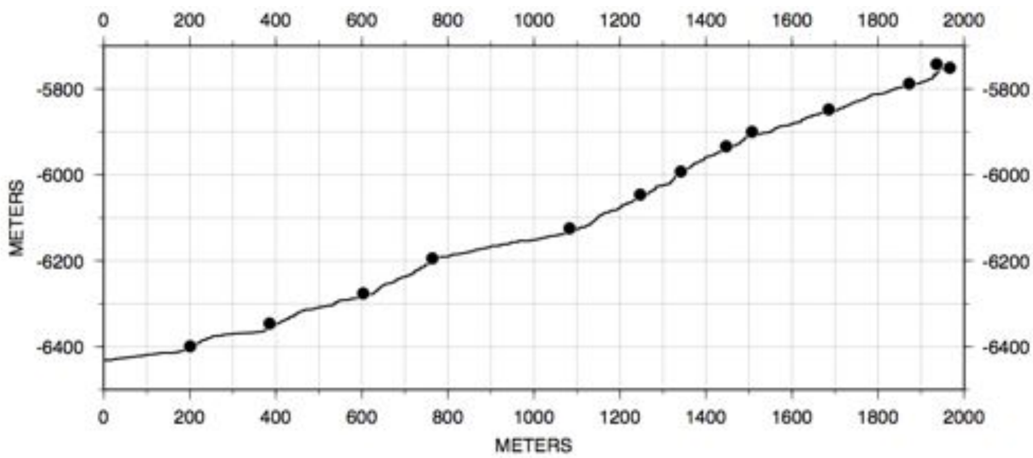
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



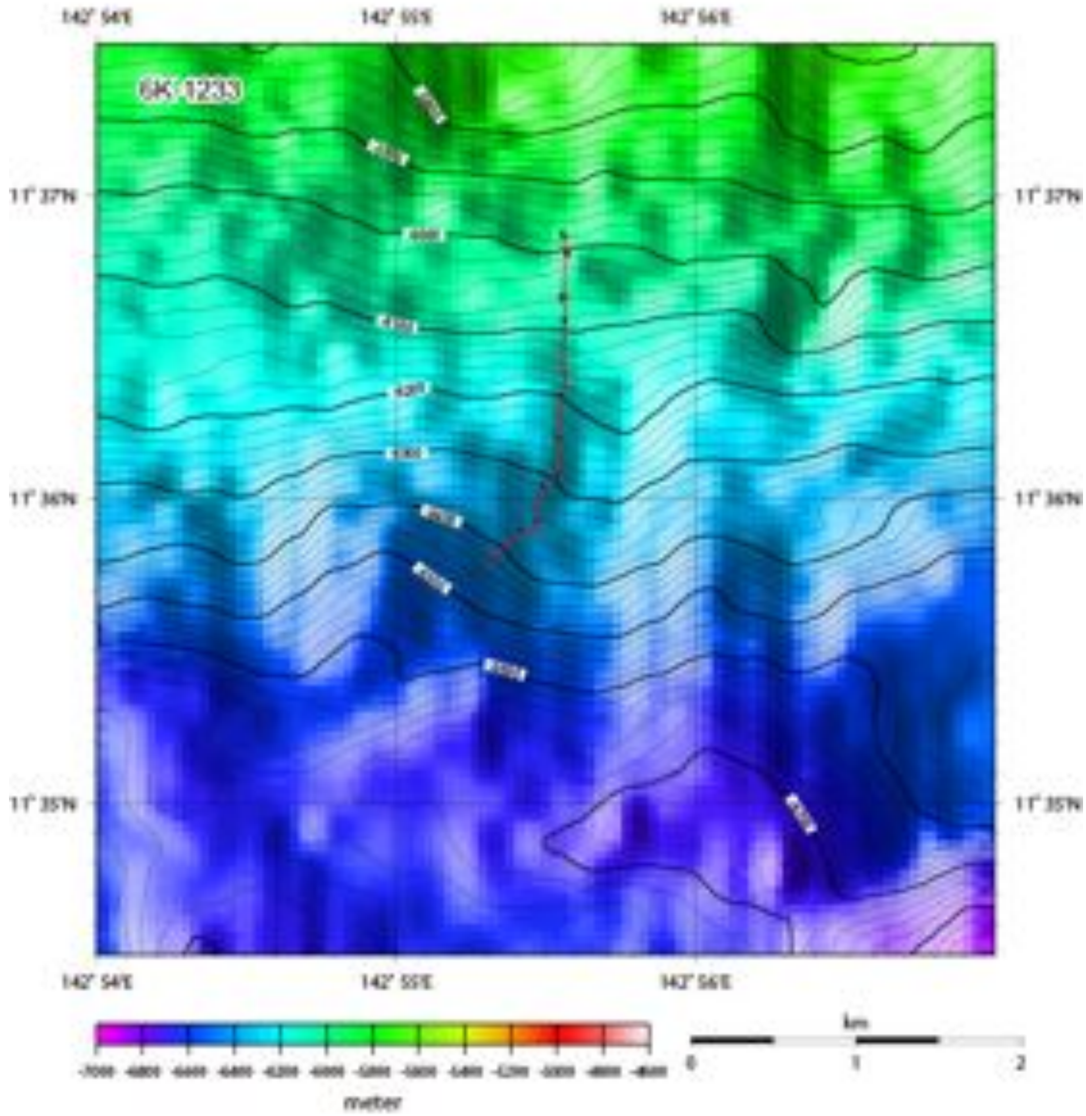


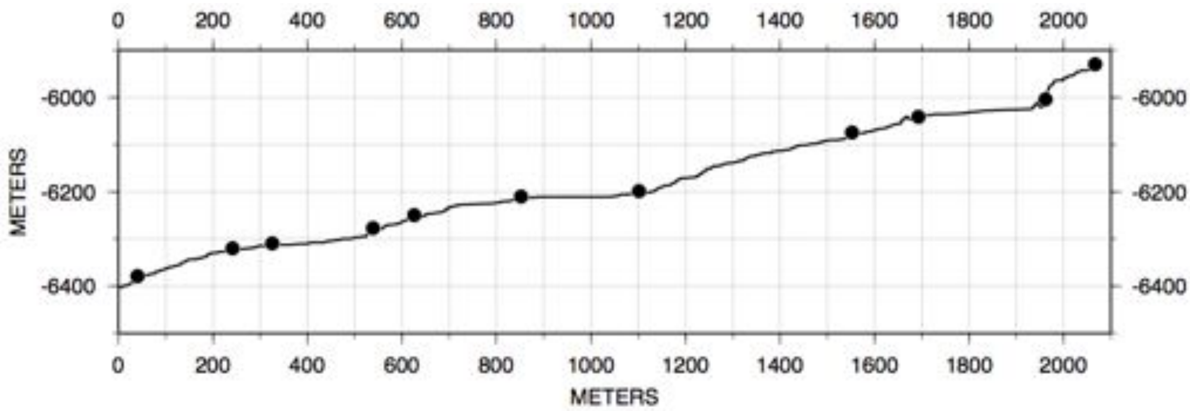
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



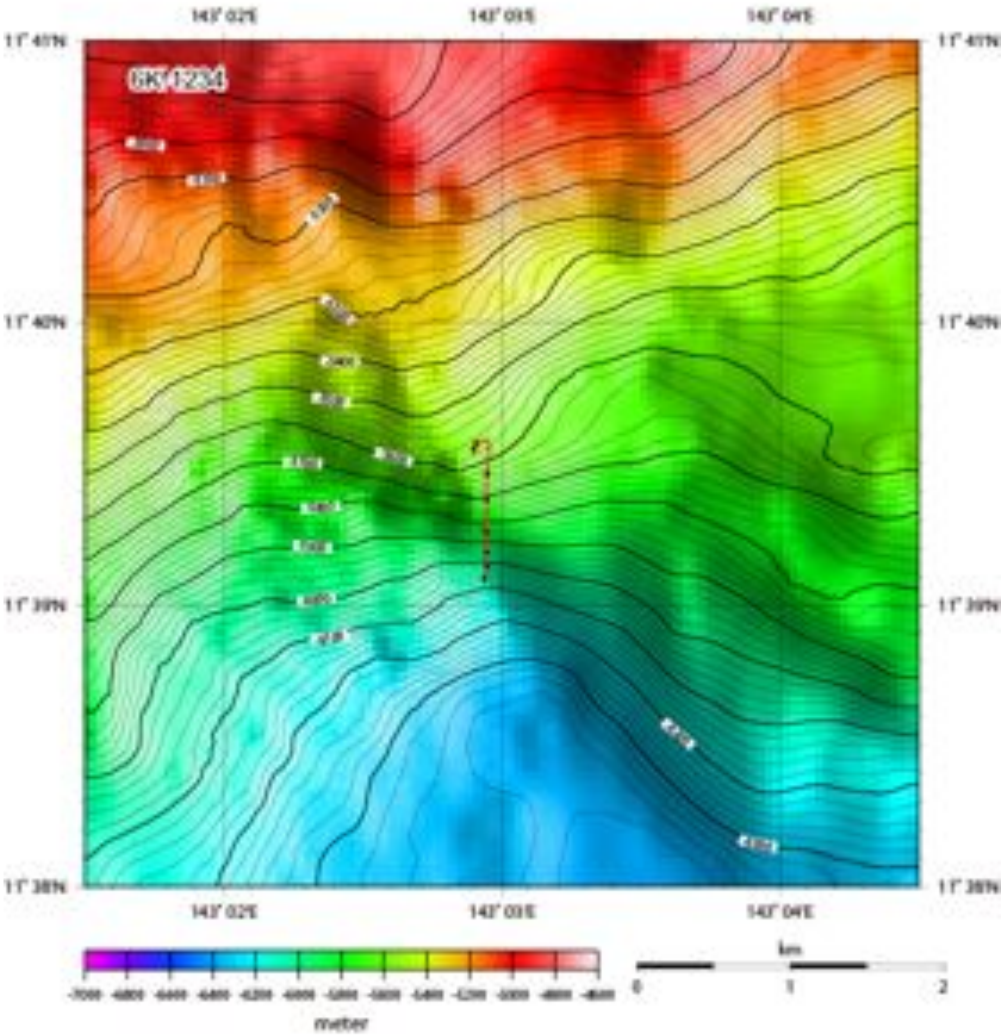


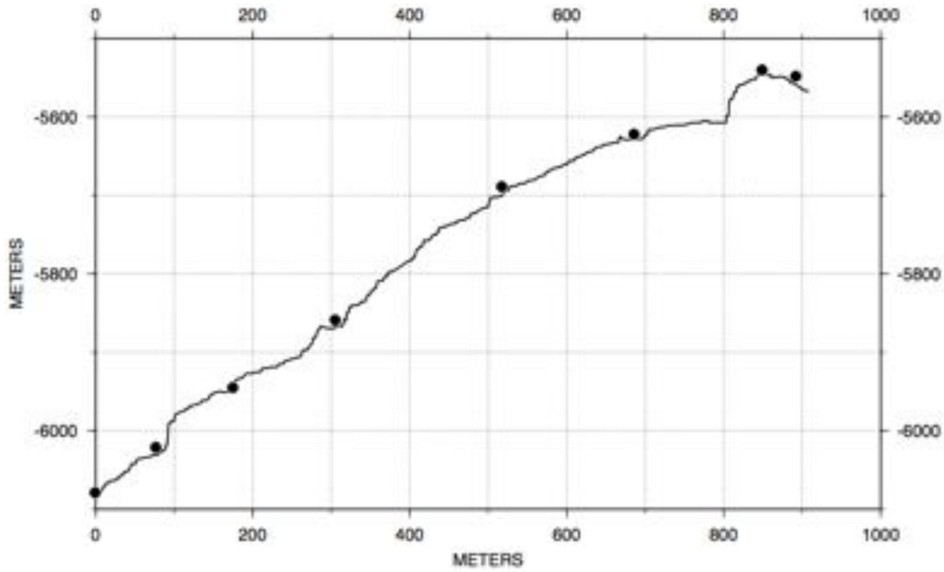
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



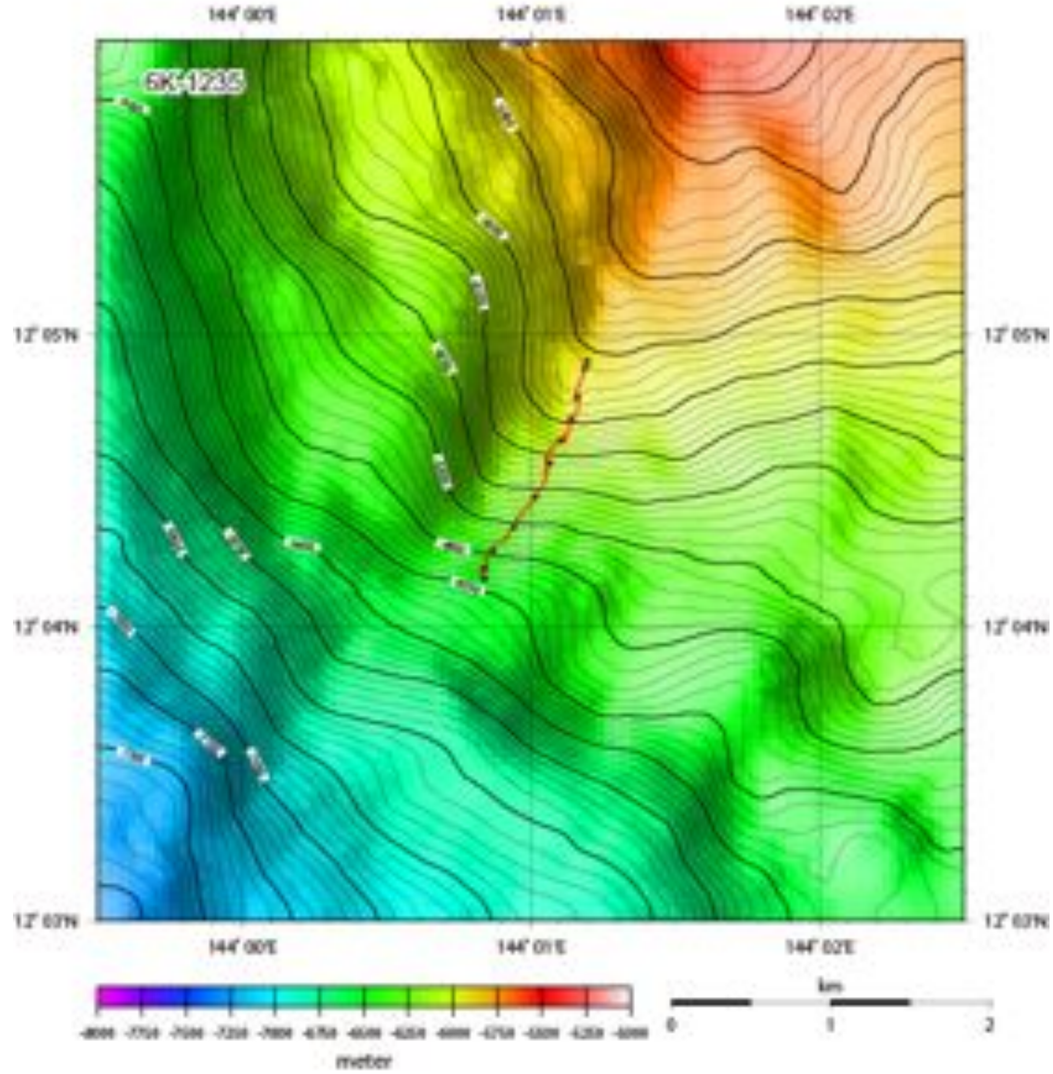


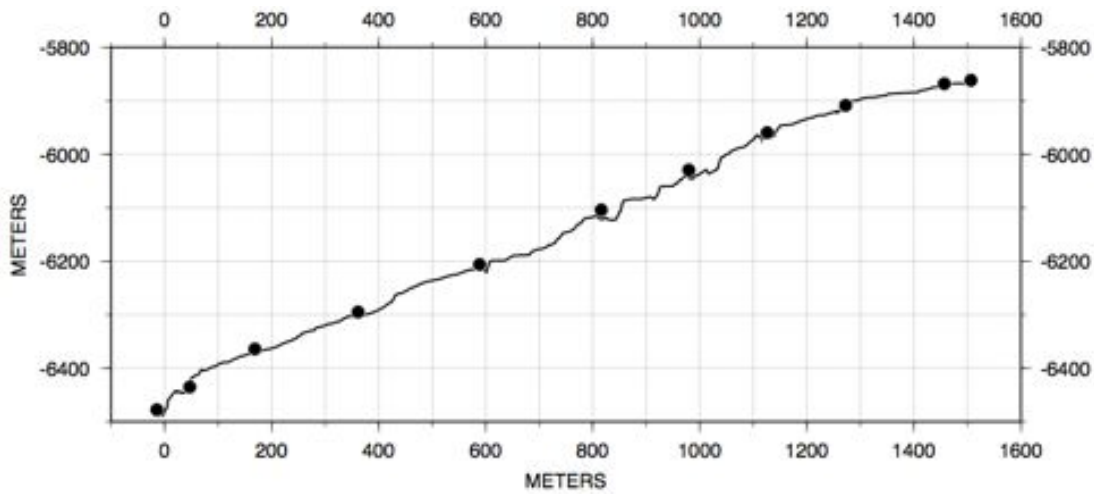
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



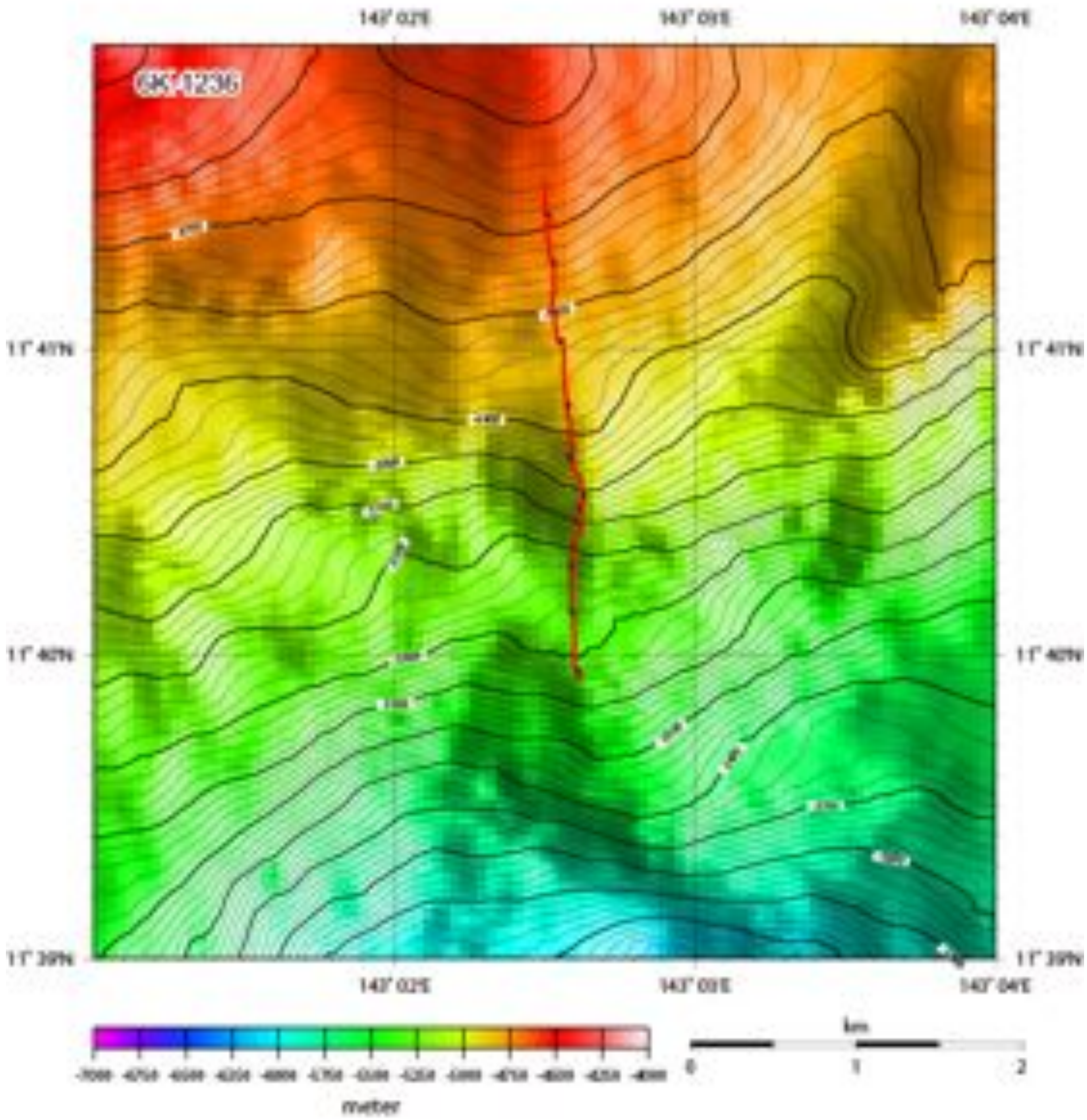


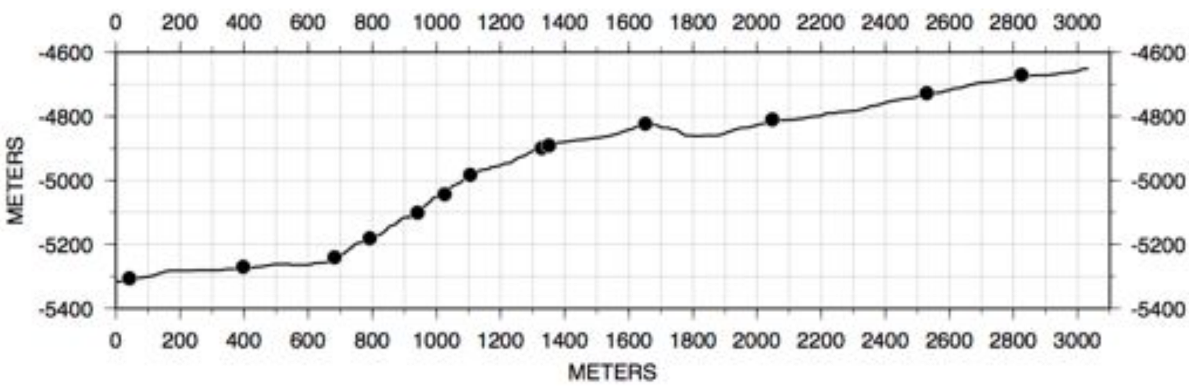
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



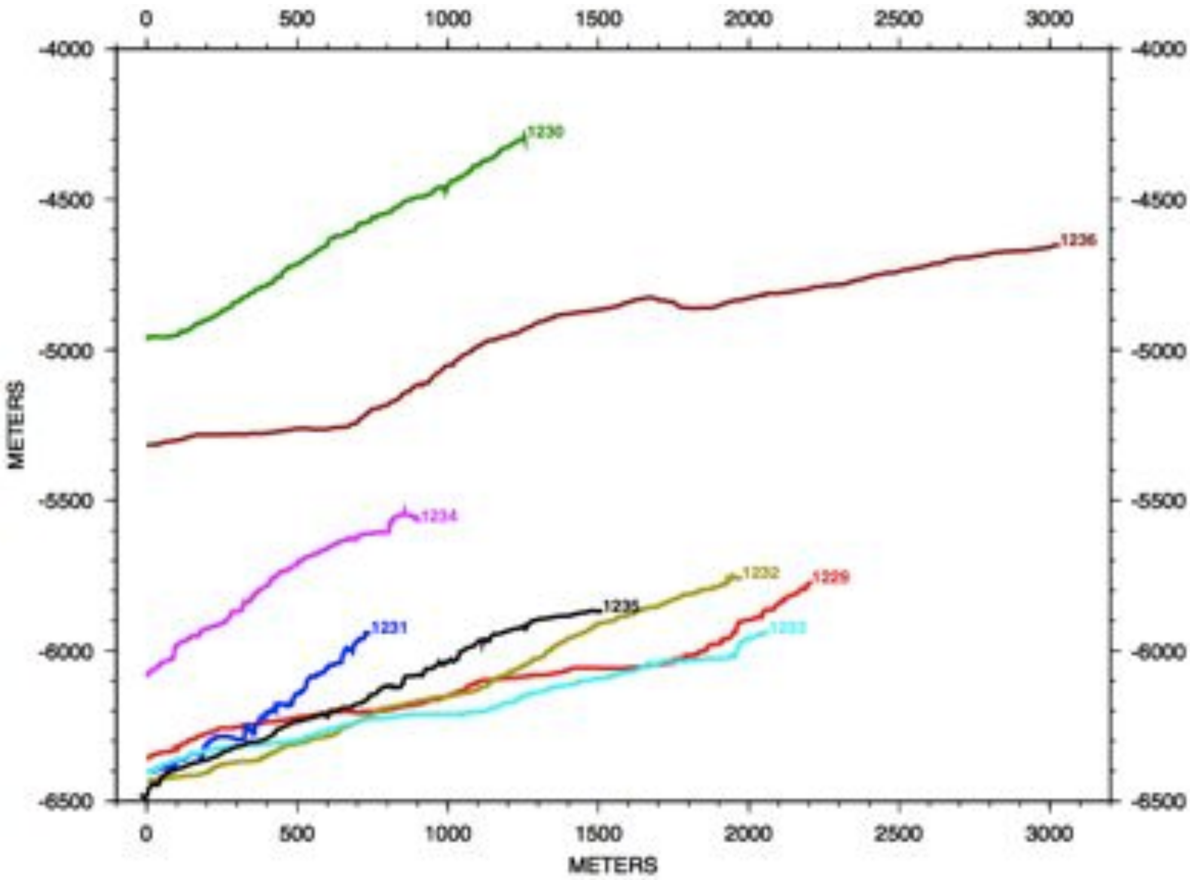


Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



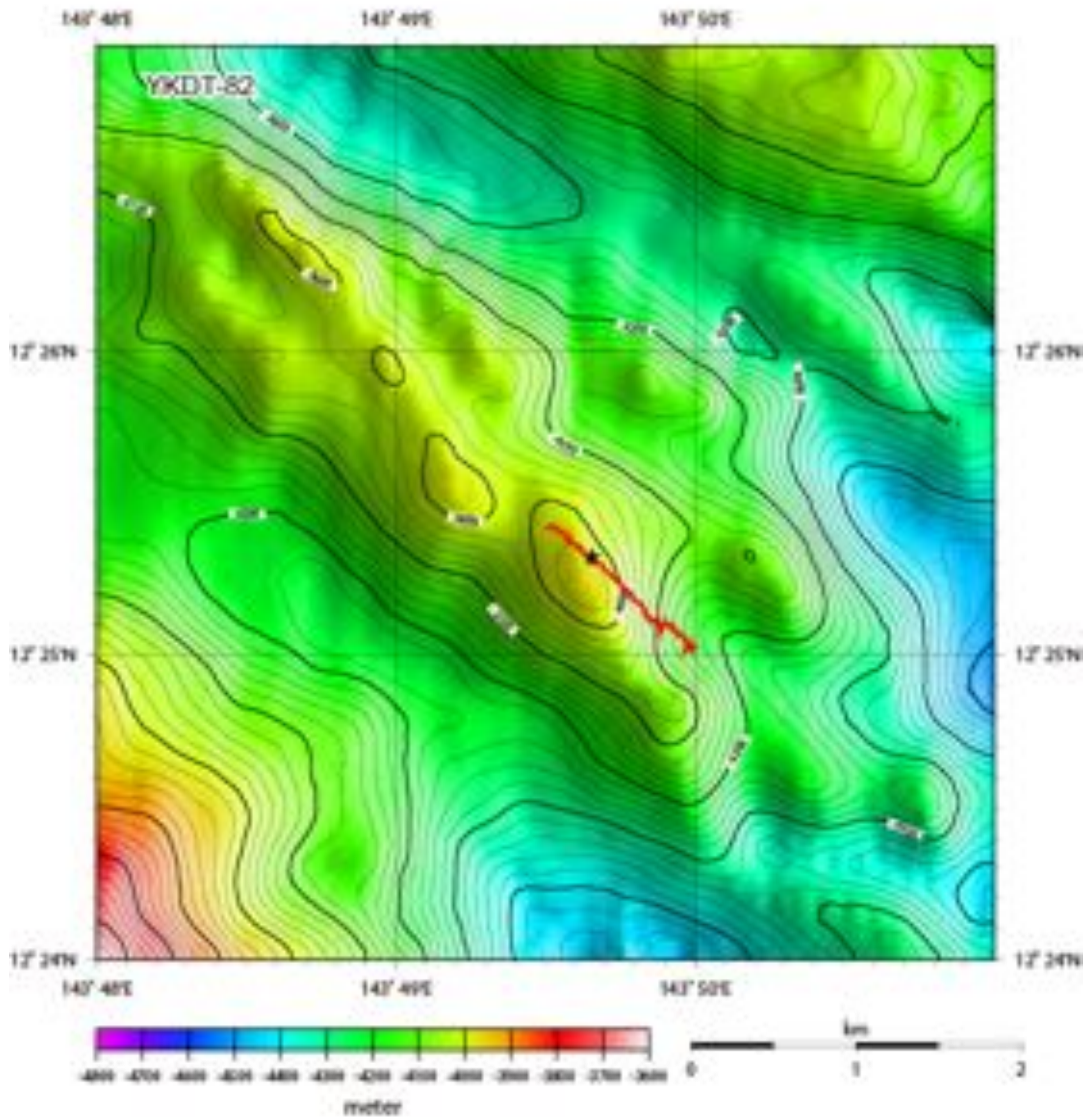


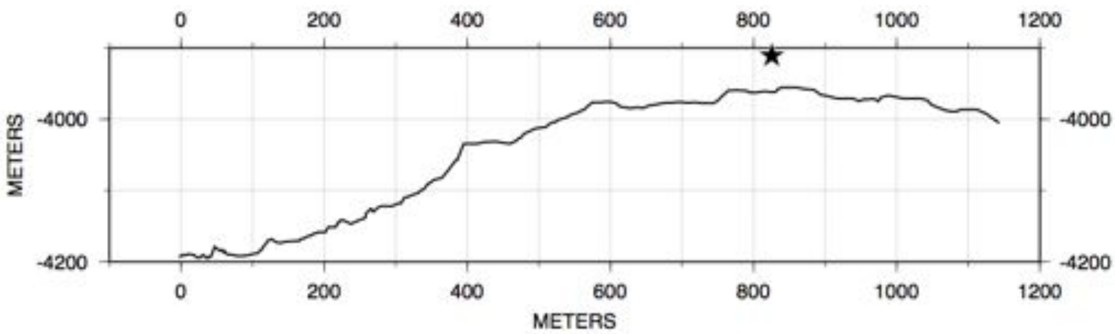
Dive profile projected onto straight line between first and last point.
No vertical exaggeration.



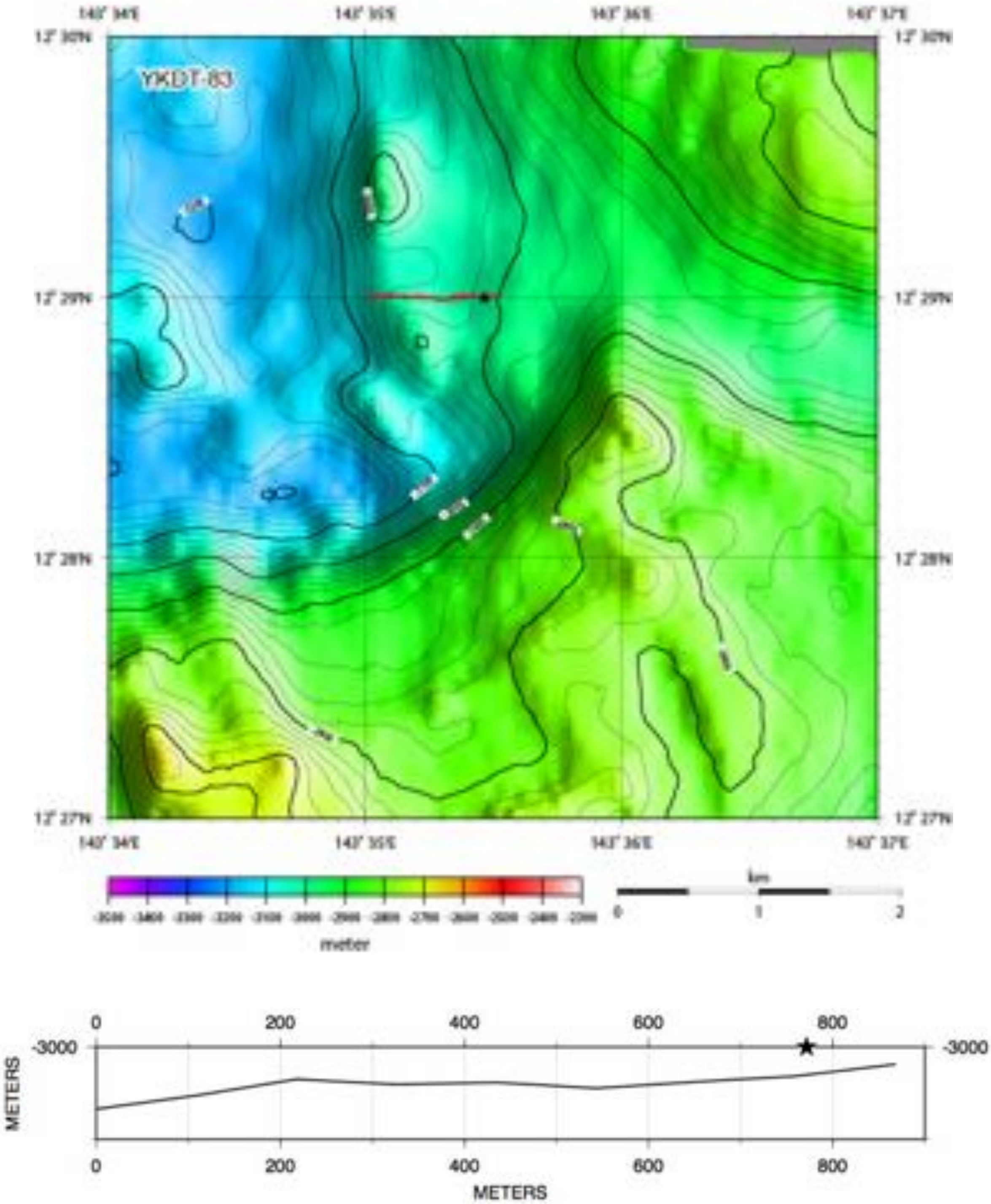
Summary of dive profiles. No vertical exaggeration.

YKDT-81: because of malfunctioning of the camera system, the dive was canceled halfway.

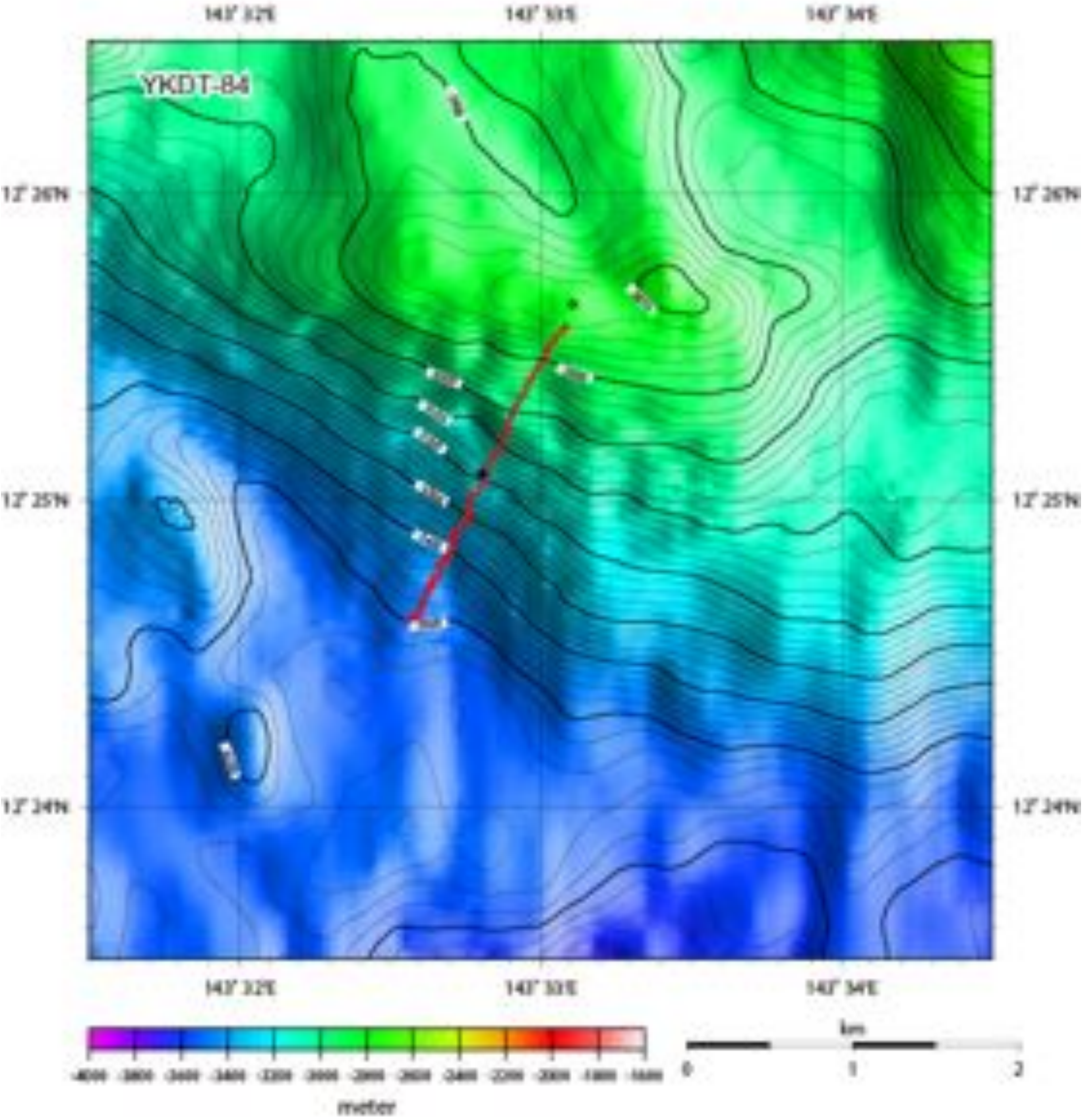


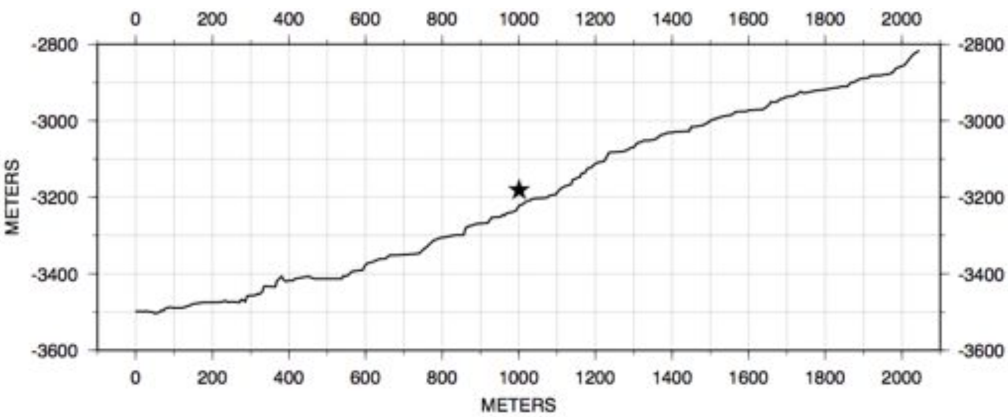


Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.

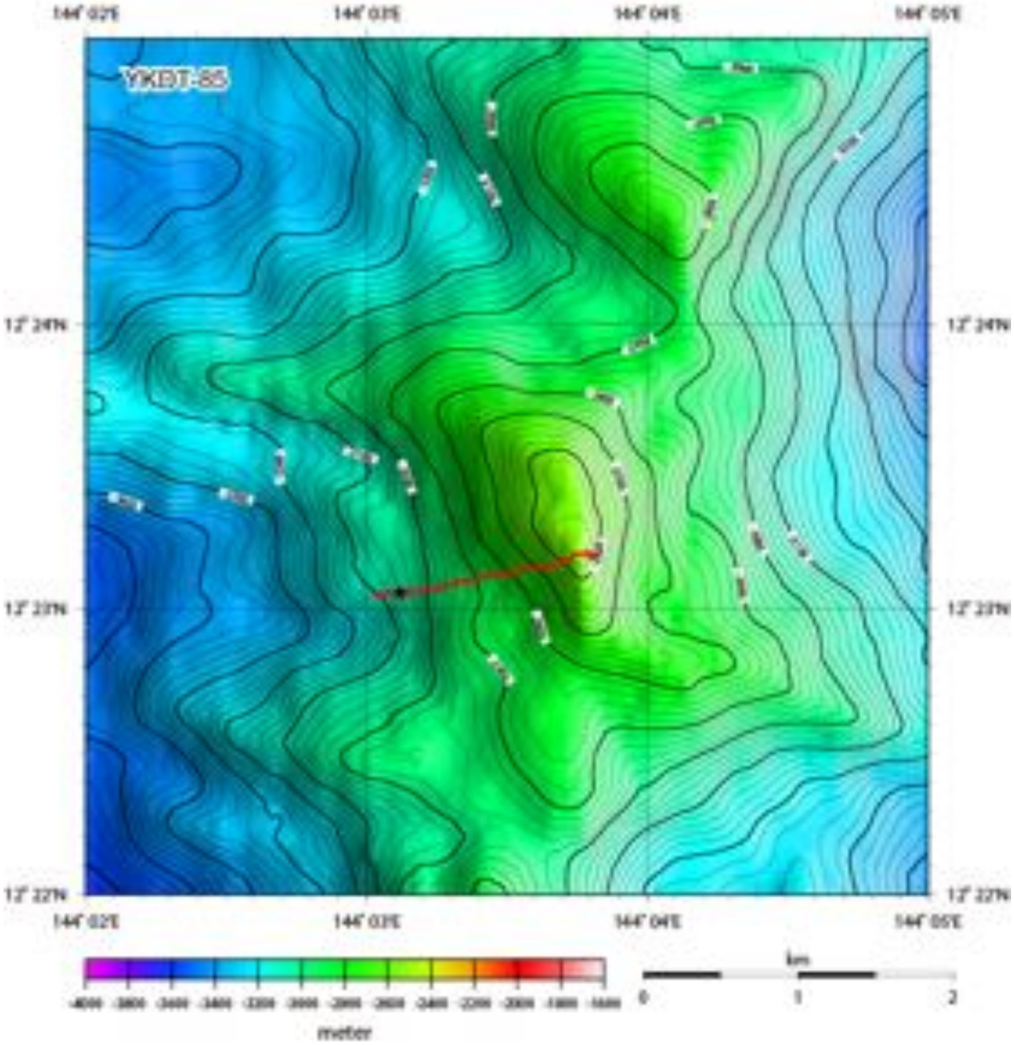


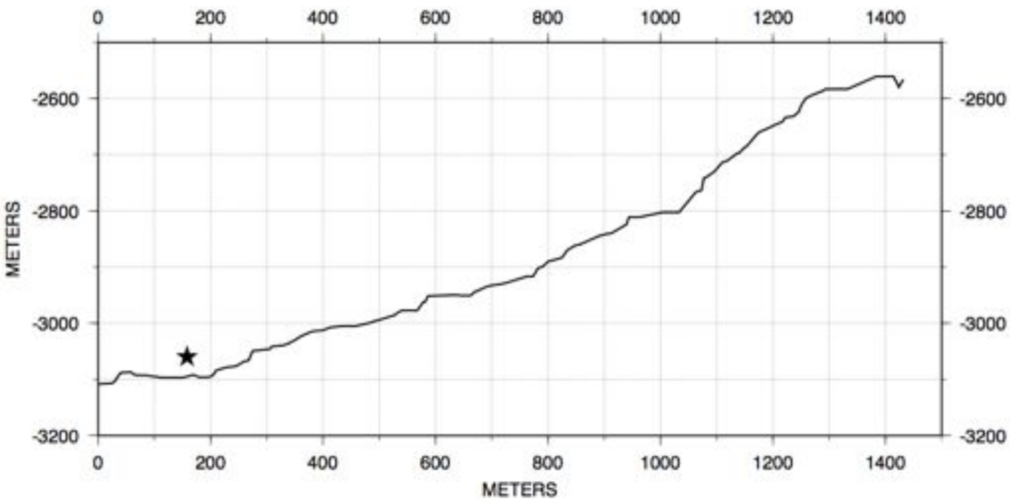
Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.



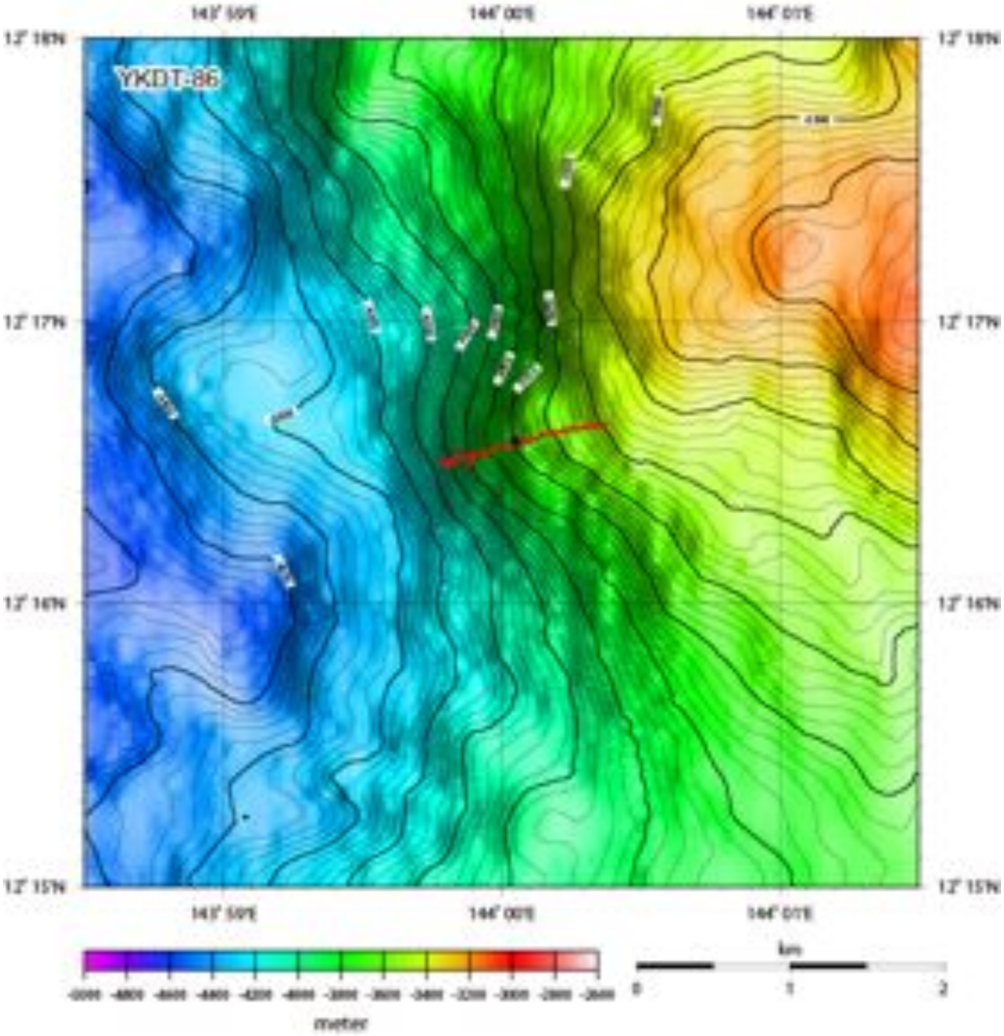


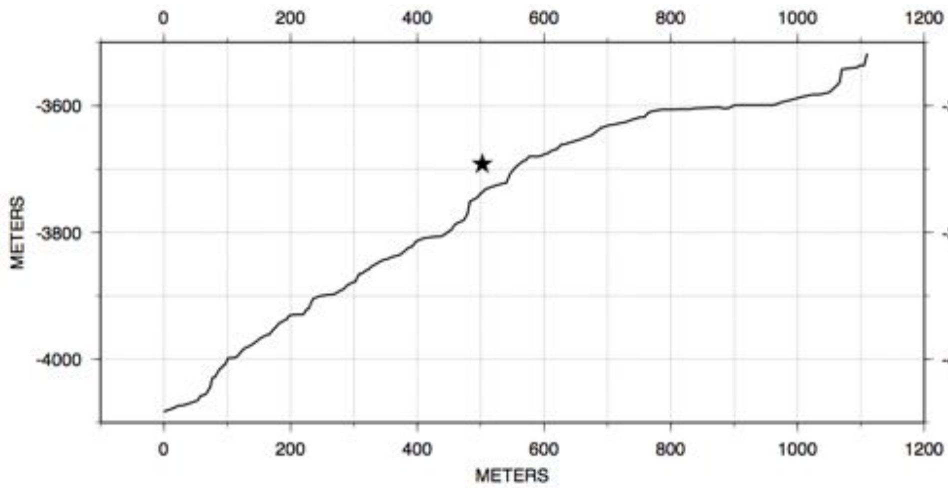
Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.



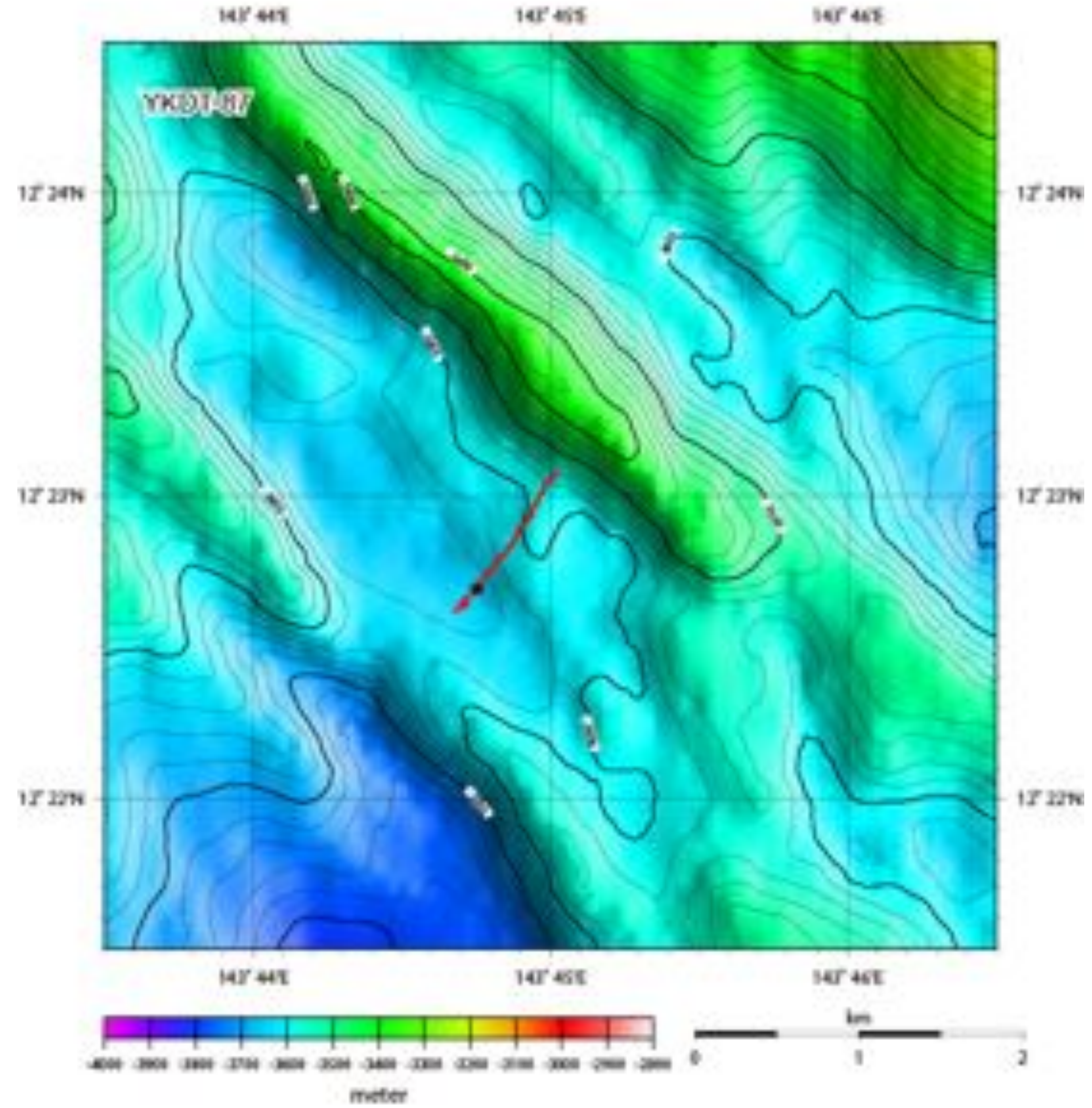


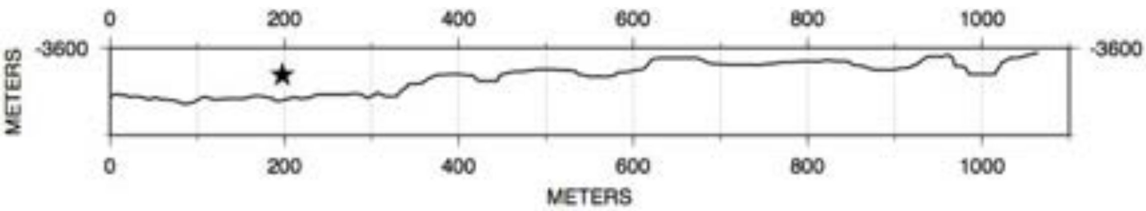
Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.



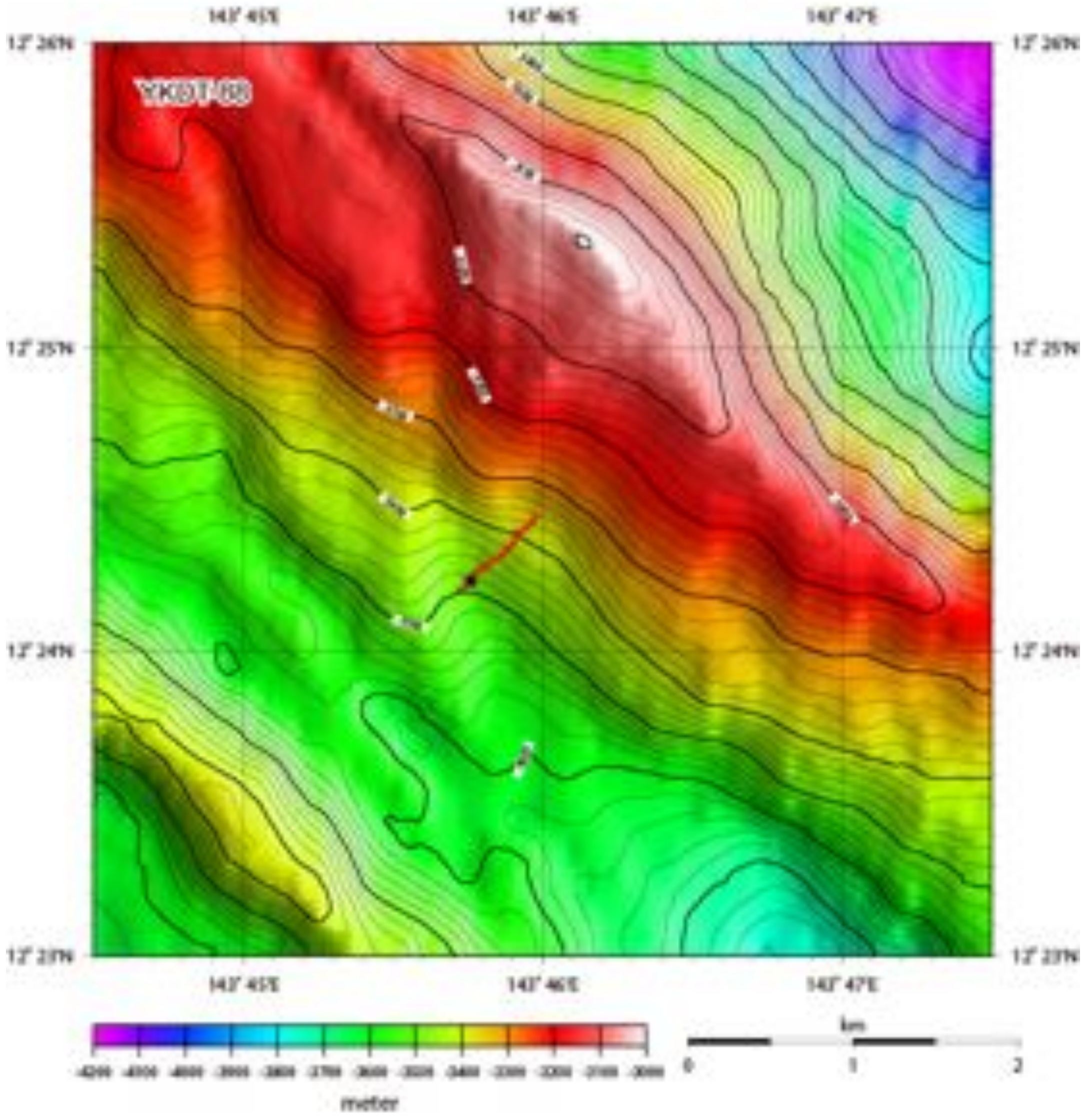


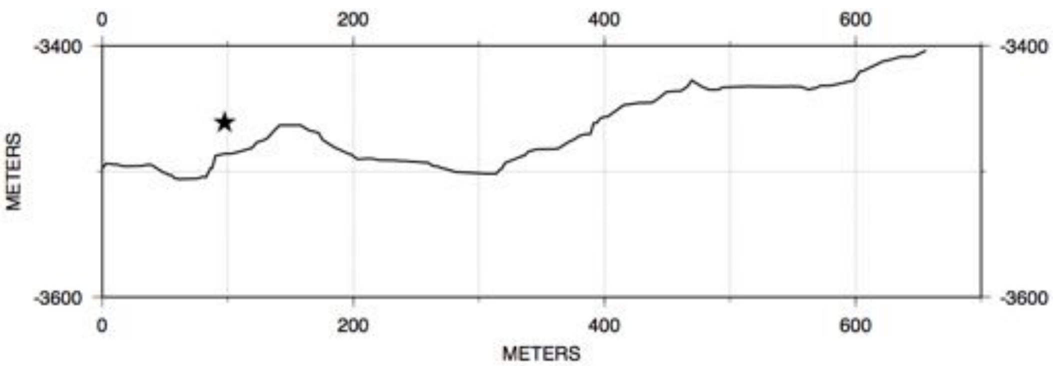
Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.





Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.



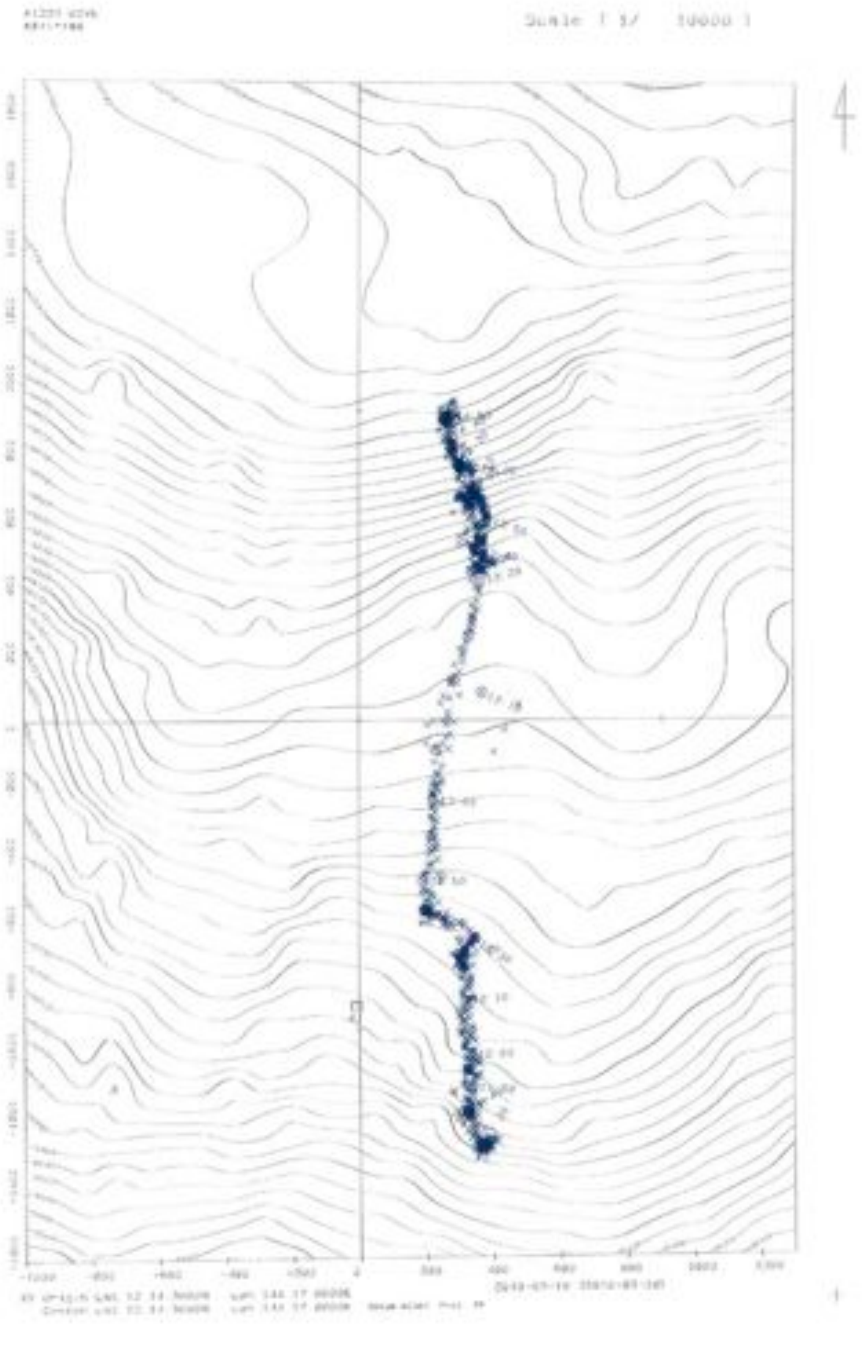


Dive profile projected onto straight line between first and last point. No vertical exaggeration. Black star marks where dredge was deployed.

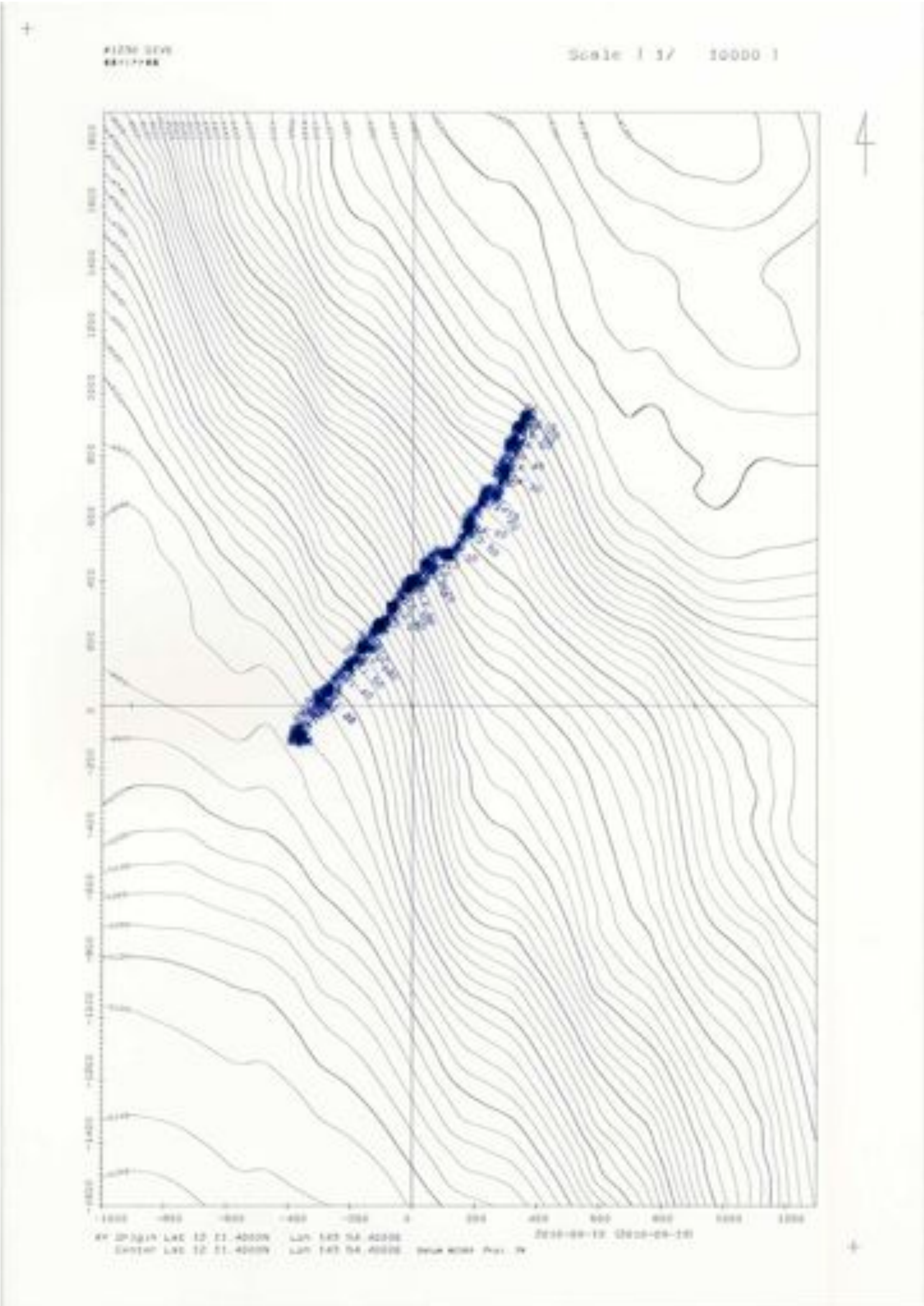
Appendix D.

Onboard X-Y coordinates maps

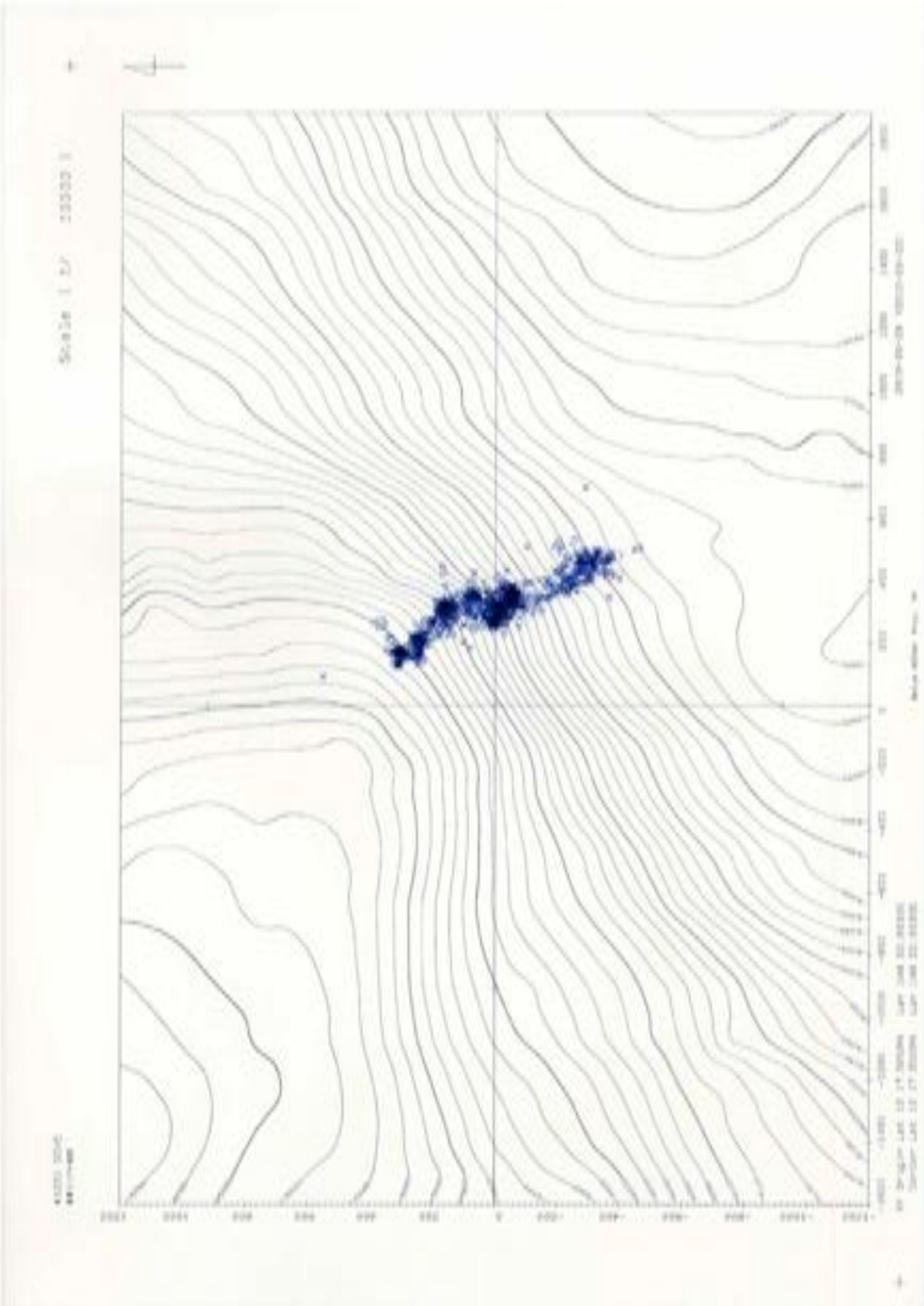
D-1. X-Y map for 6K-1229



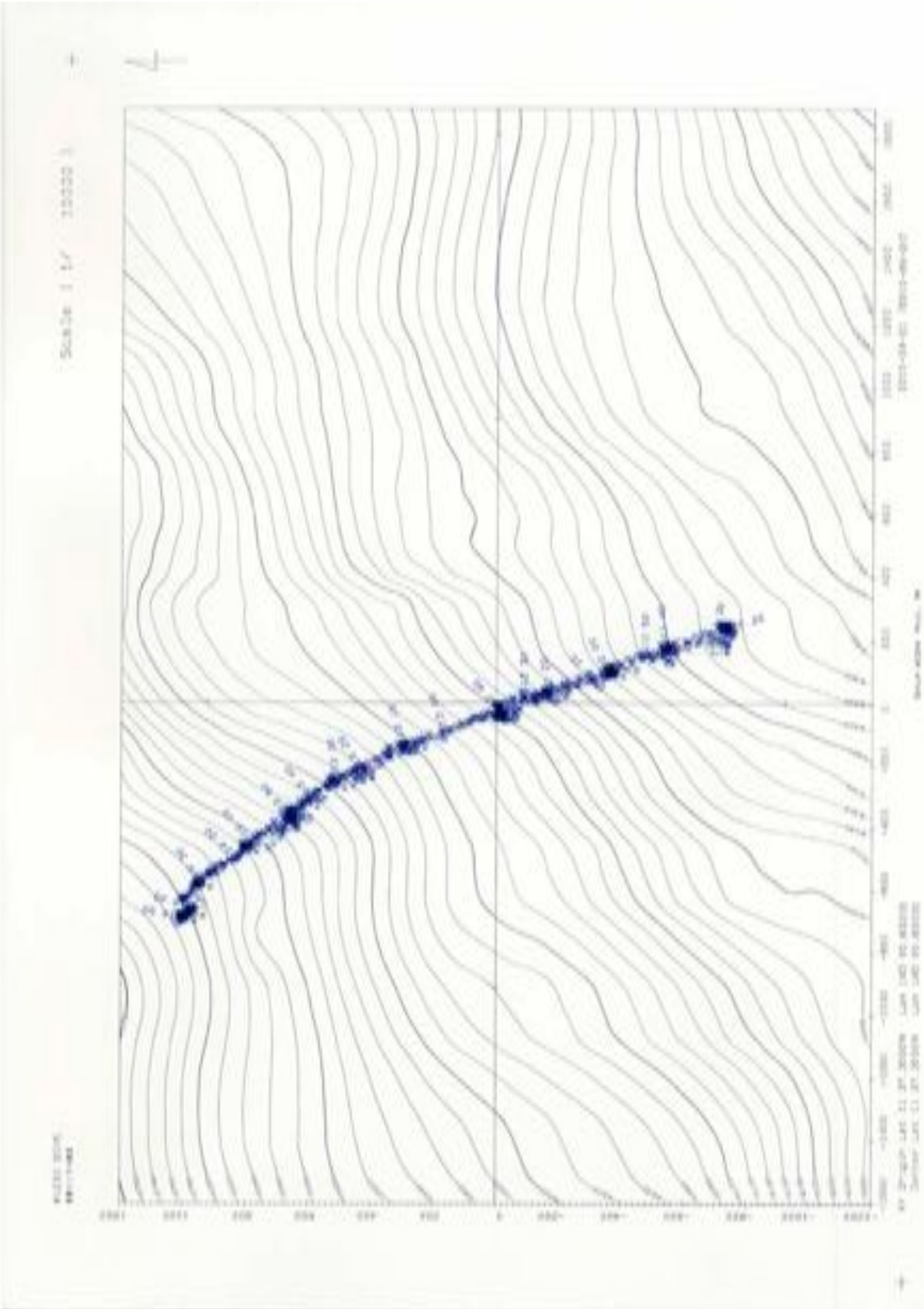
D-2. X-Y map for 6K-1230



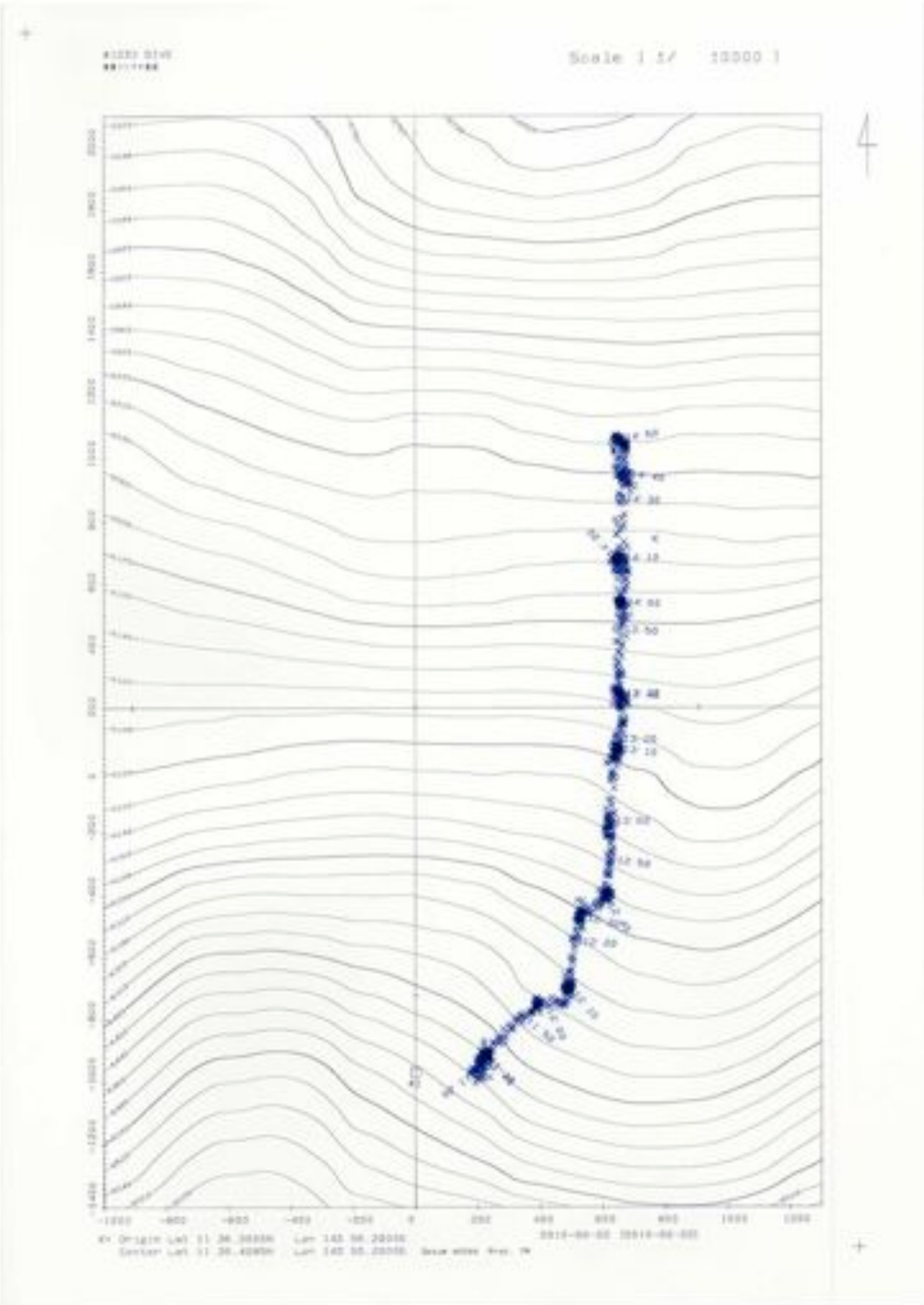
D-3. X-Y map for 6K-1231



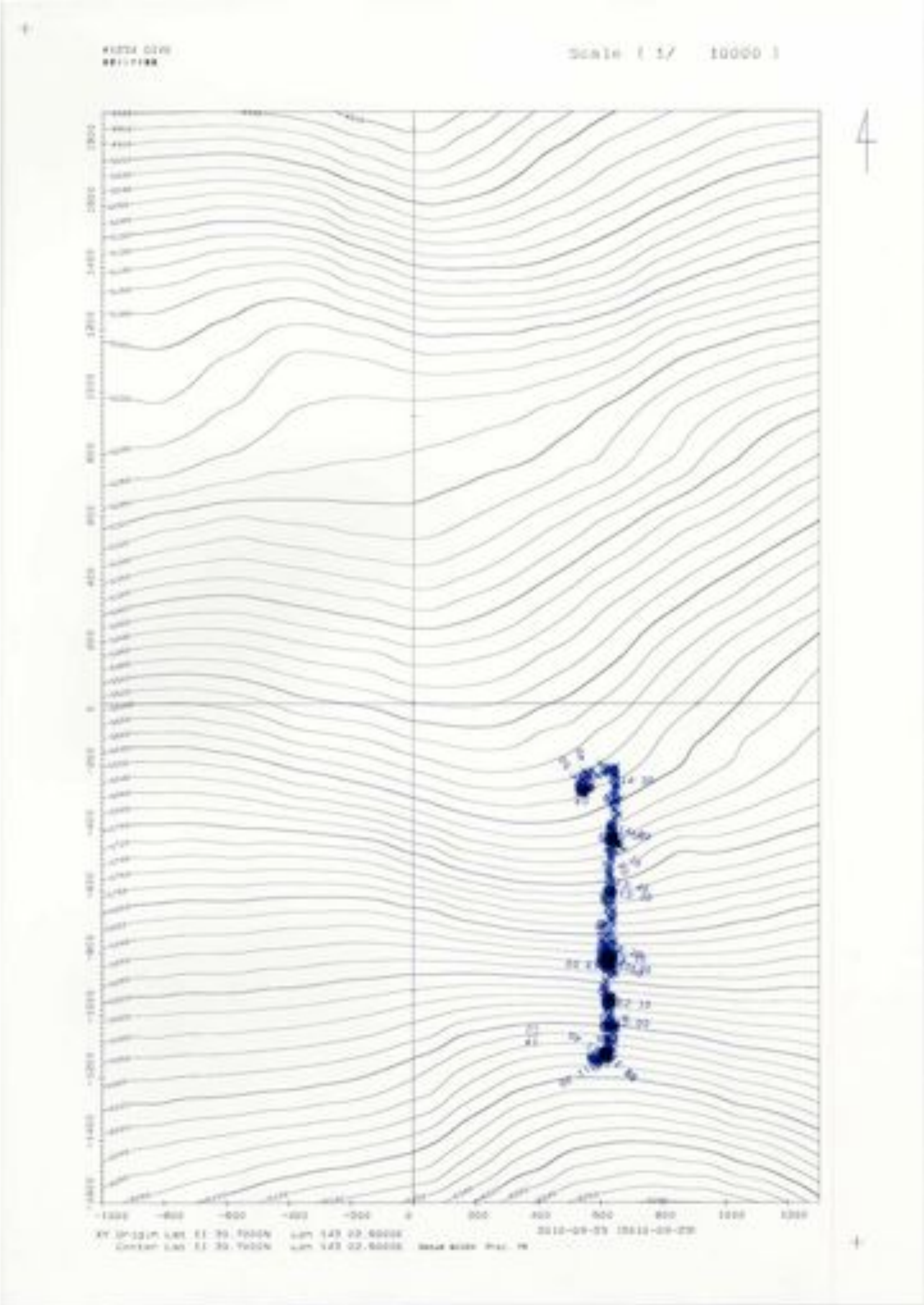
D-4. X-Y map for 6K-1232



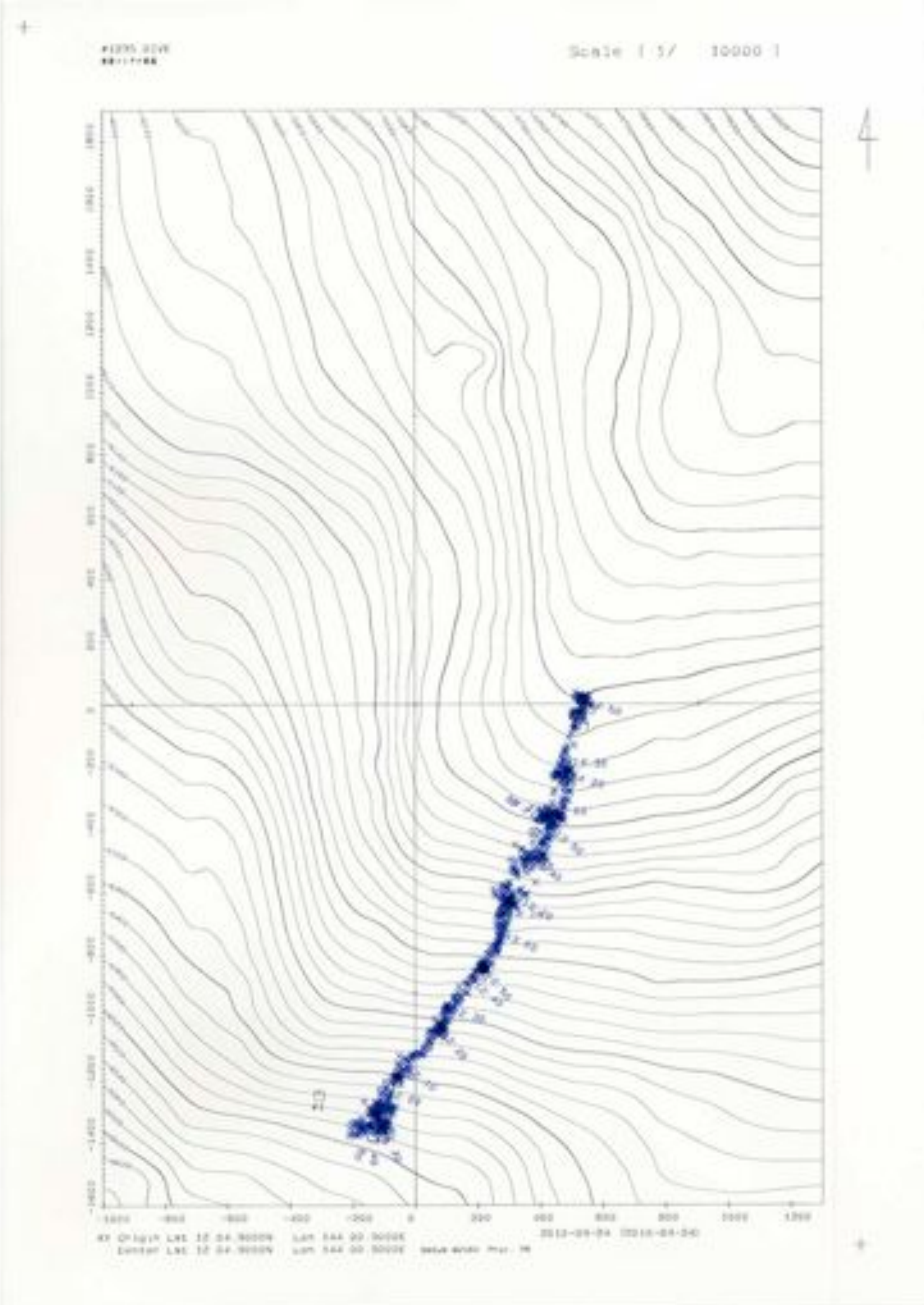
D-5. X-Y map for 6K-1233



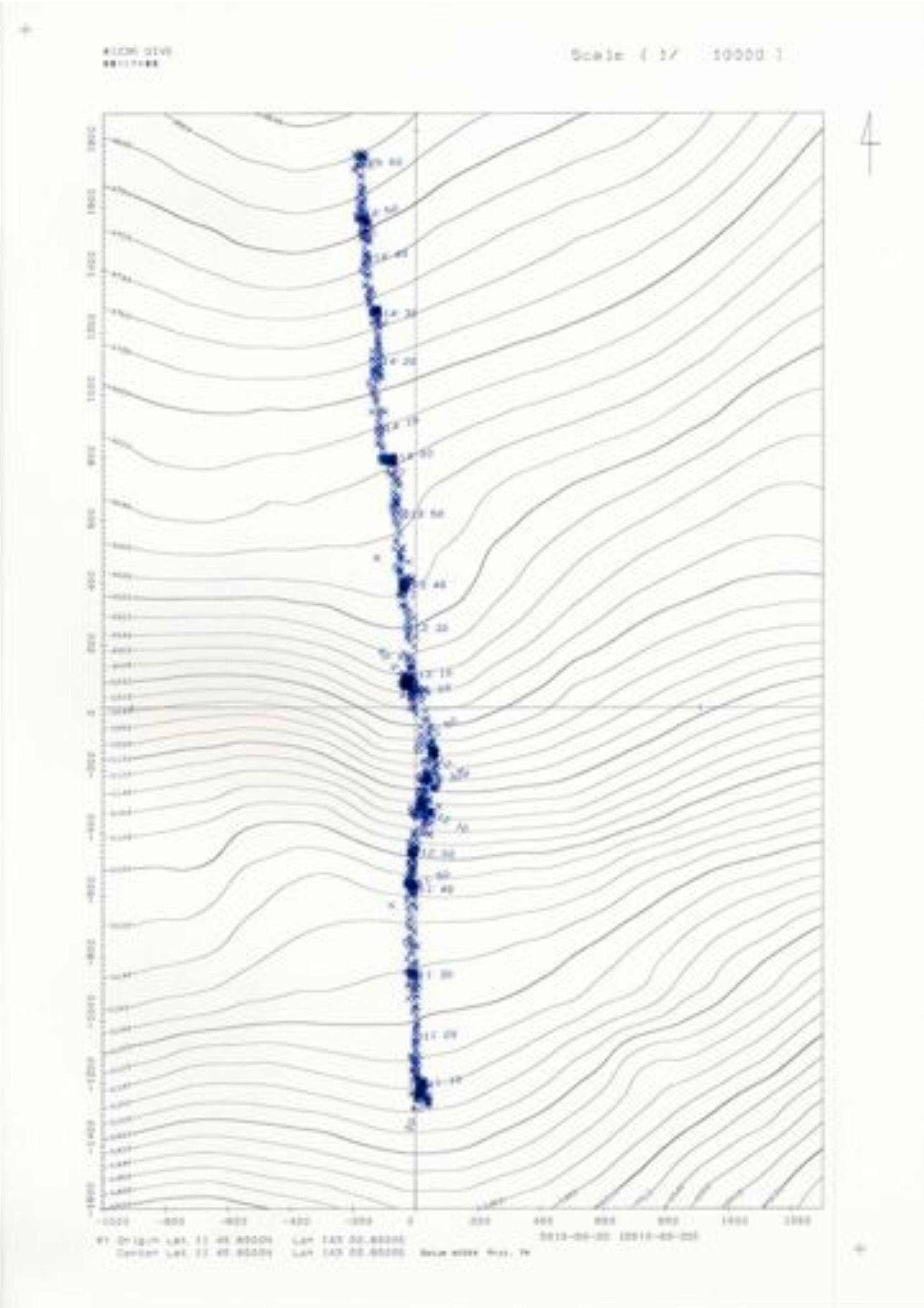
D-6. X-Y map for 6K-1234



D-7. X-Y map for 6K-1235



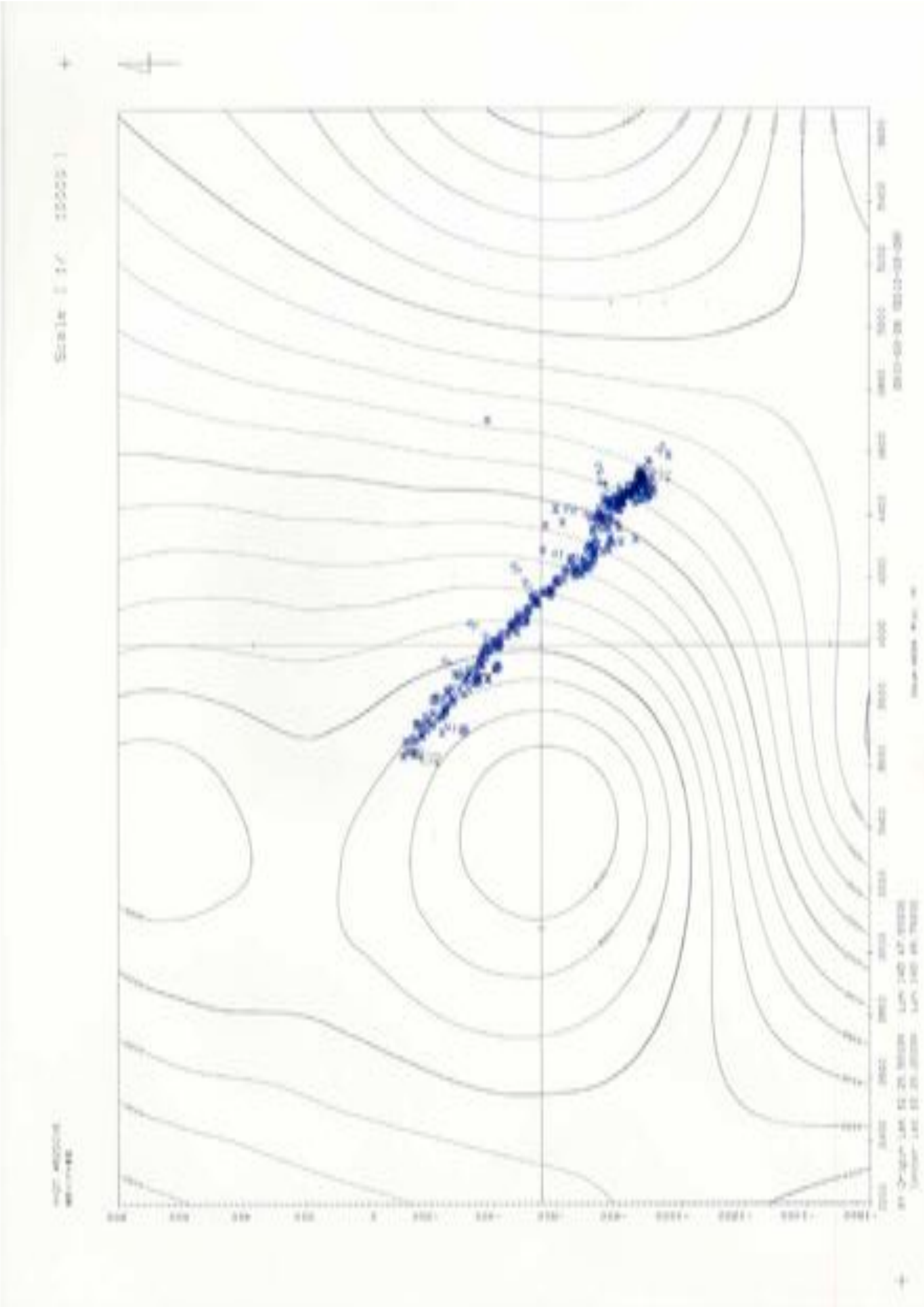
D-8. X-Y map for 6K-1236



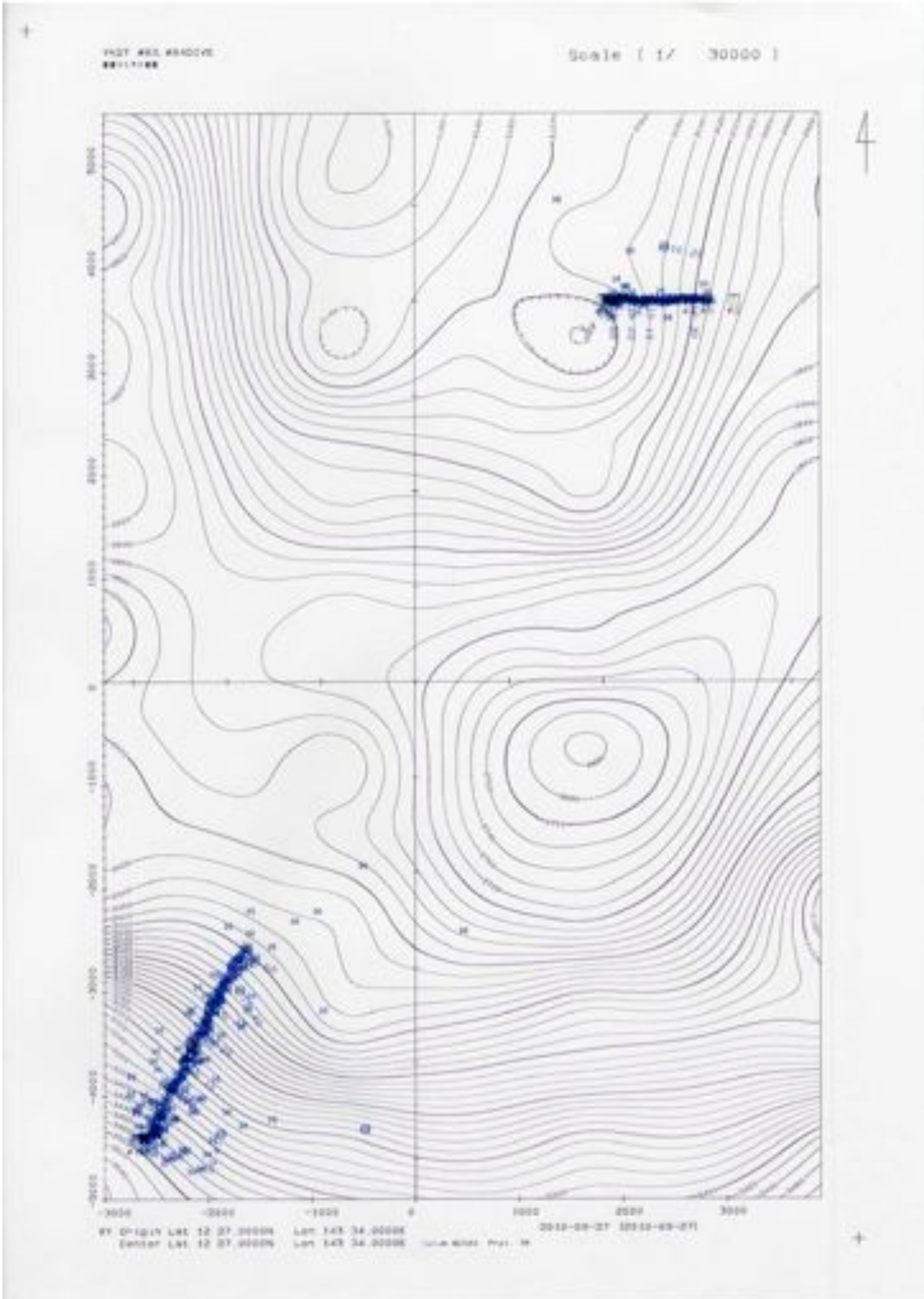
D-9. X-Y map for YKDT-81

Because of malfunctioning of the camera system, the dive was canceled halfway.

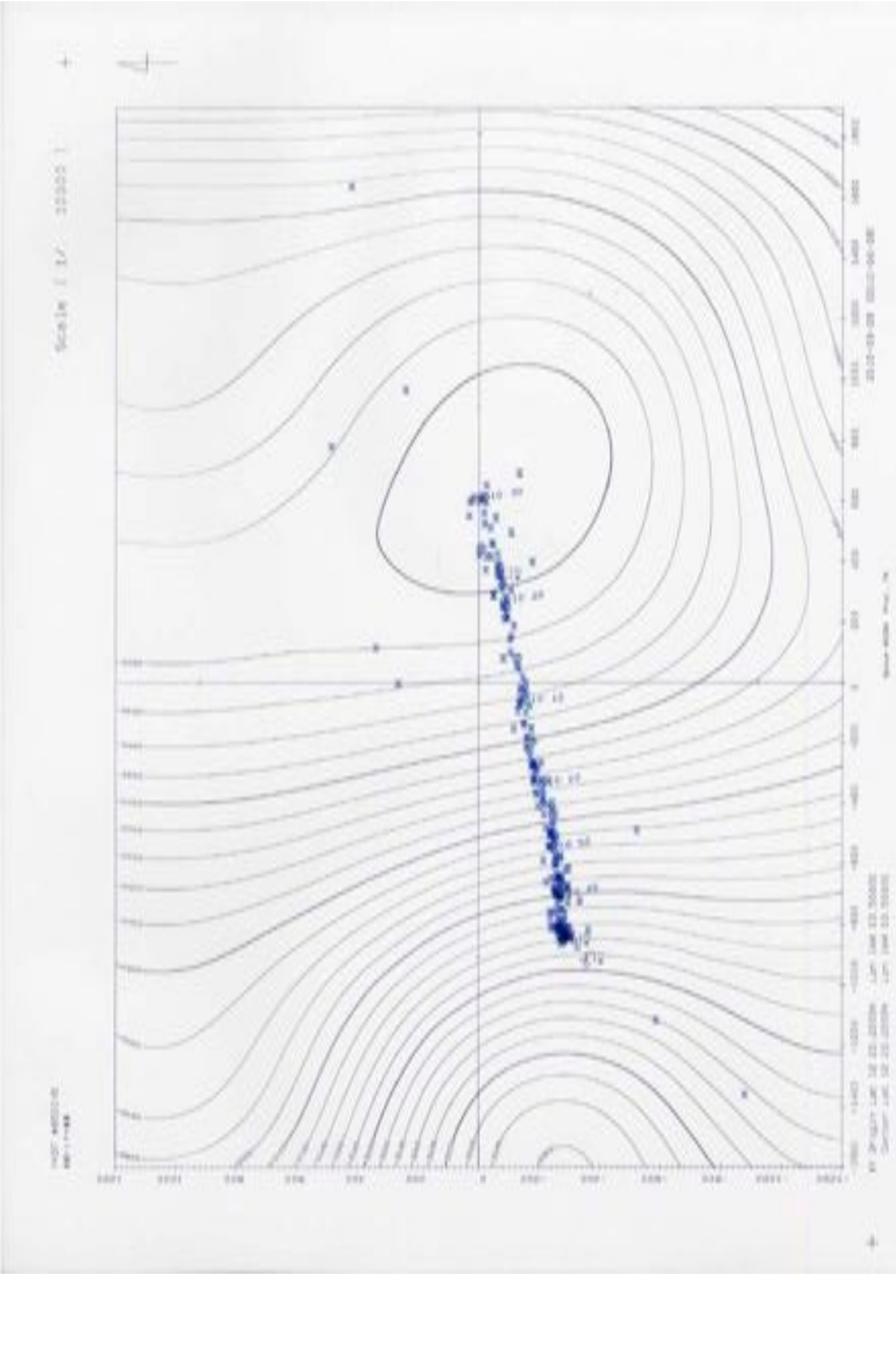
D-10. X-Y map for YKDT- 82



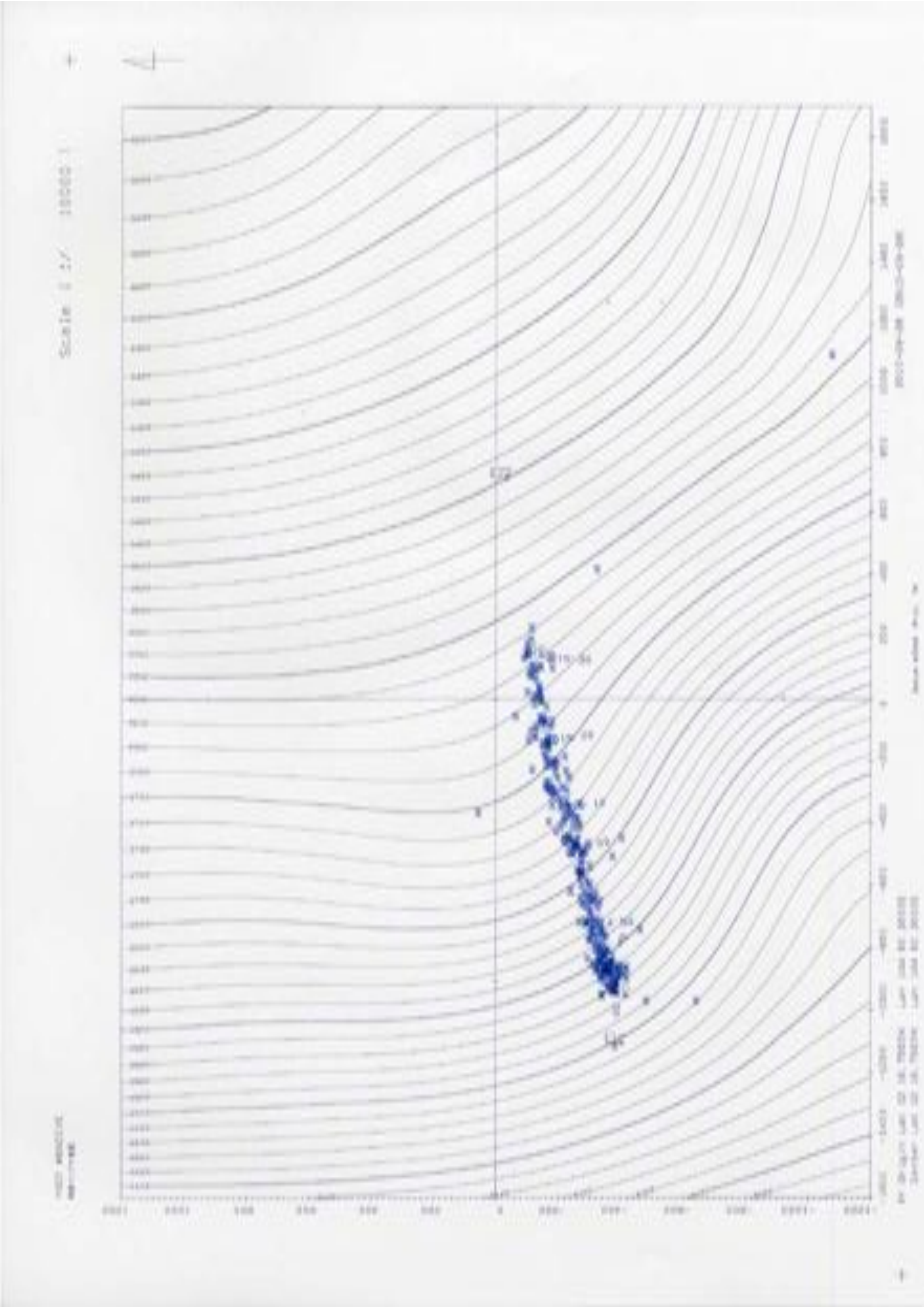
D-11 and 12. X-Y map for YKDT-83 and 84



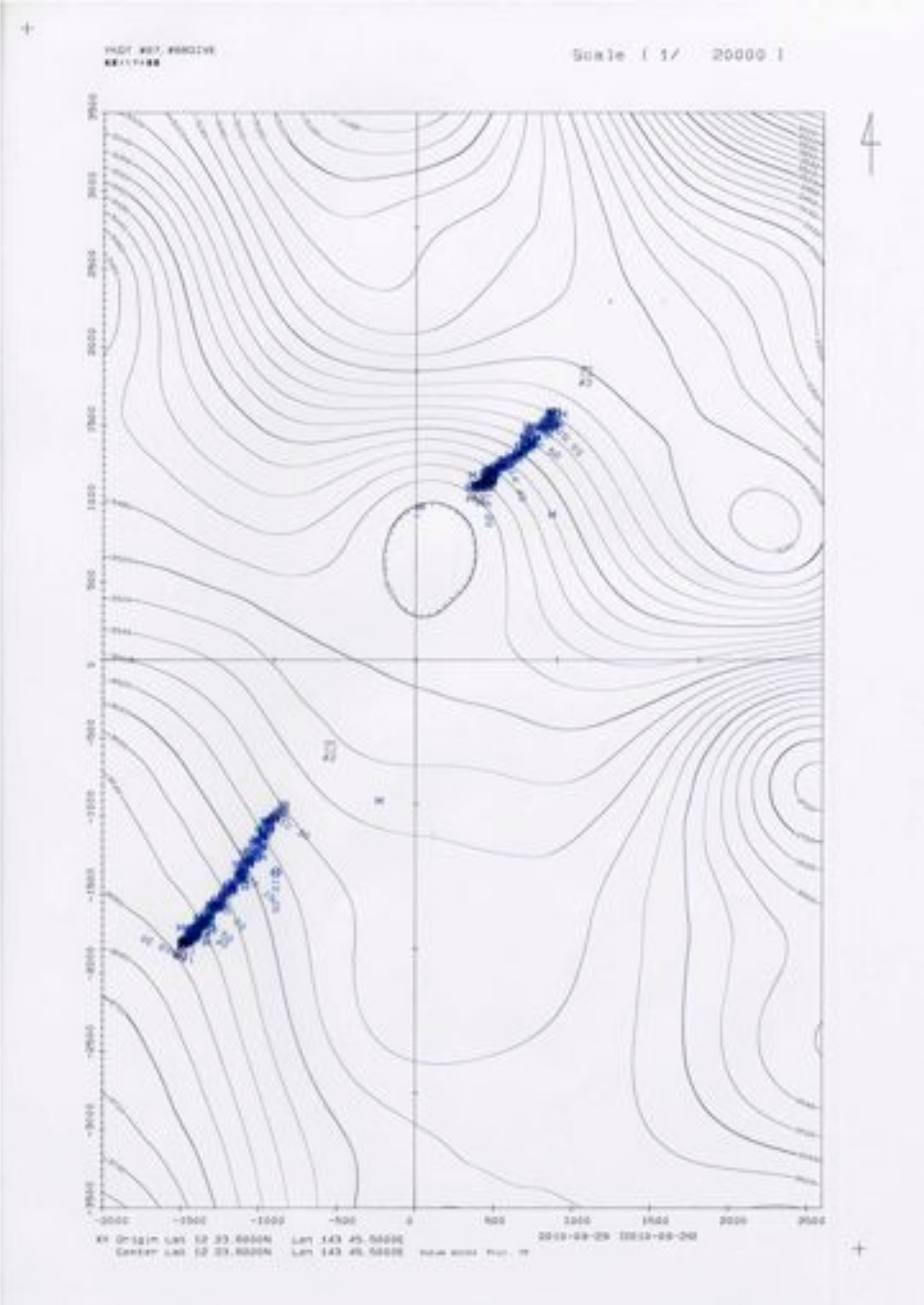
D-13. X-Y map for YKDT-85



D-14. X-Y map for YKDT-86



D-15 and 16. X-Y map for YKDT-87 and 88



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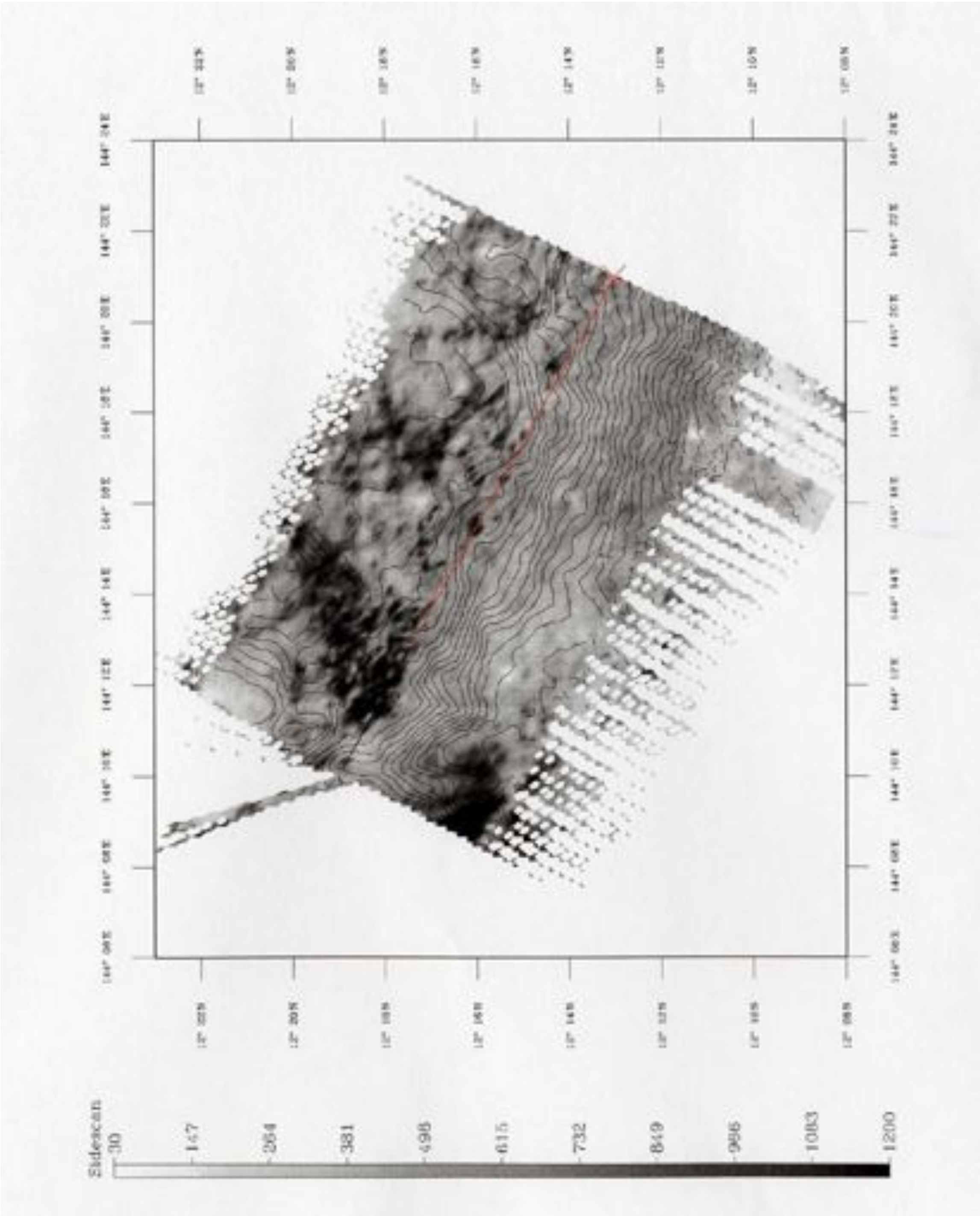
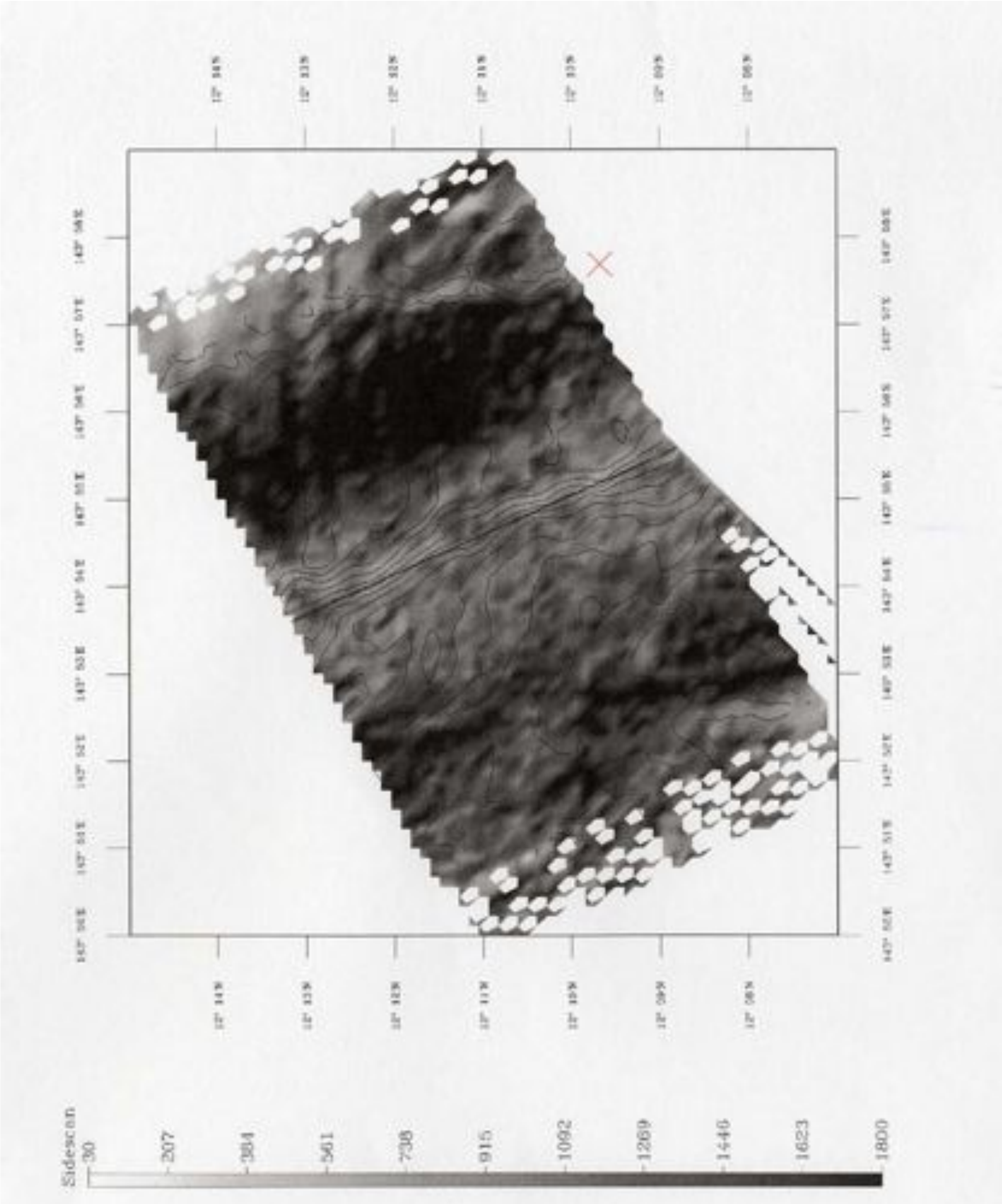
Appendix E.

Side-scan imageries

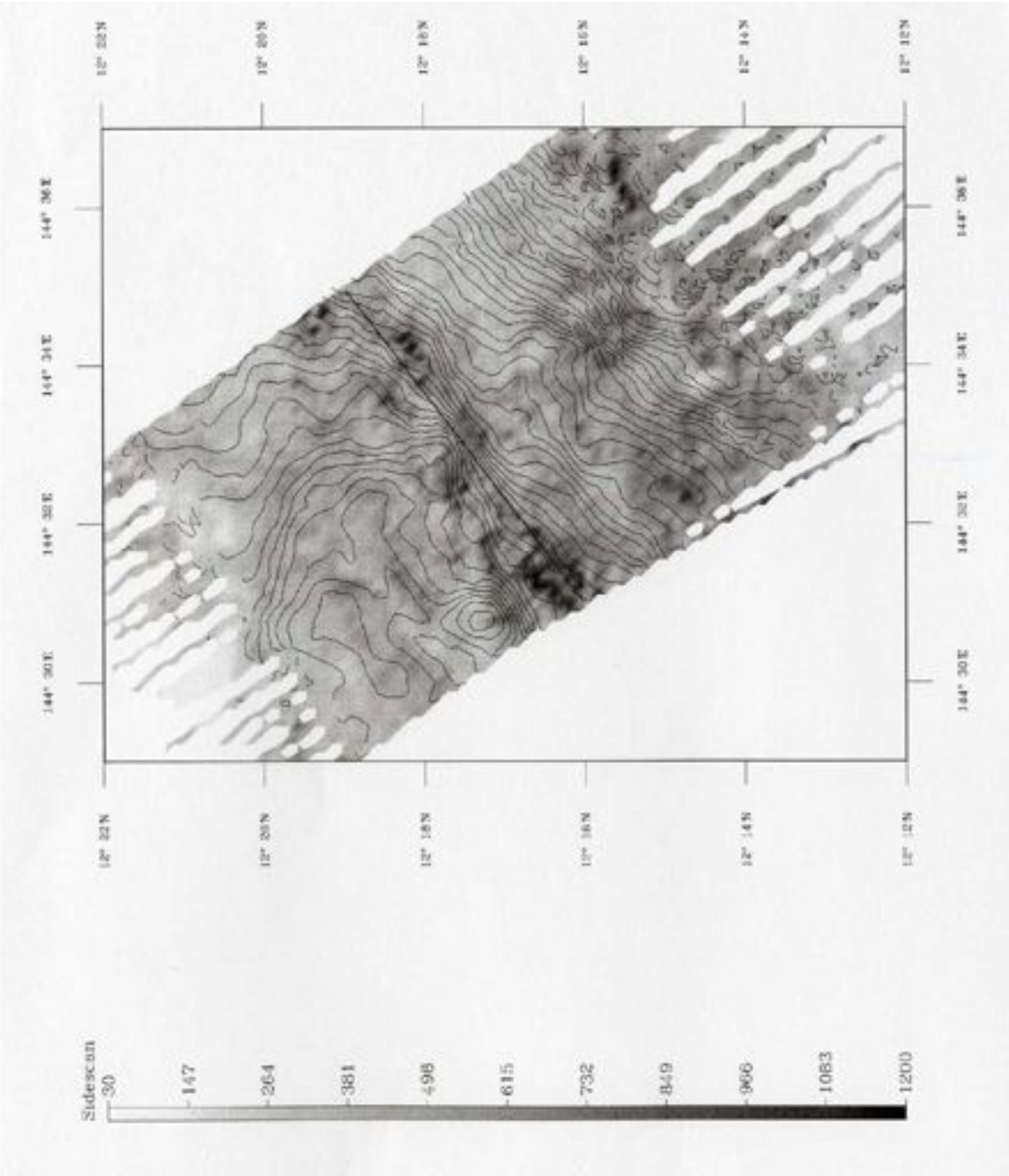
E-1. Side-scan imagery for 6K-1229



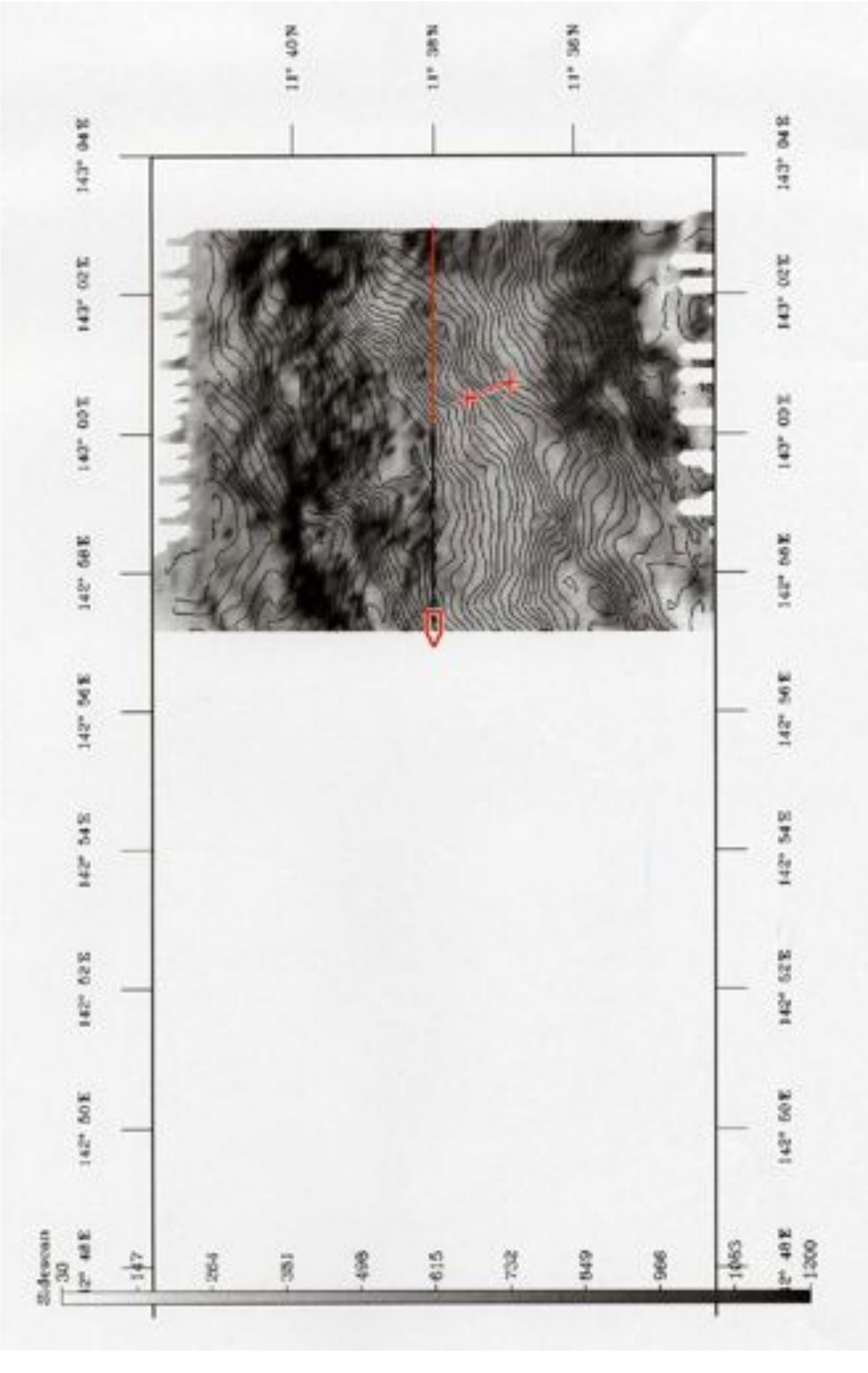
E-2. Side-scan imagery for 6K-1230



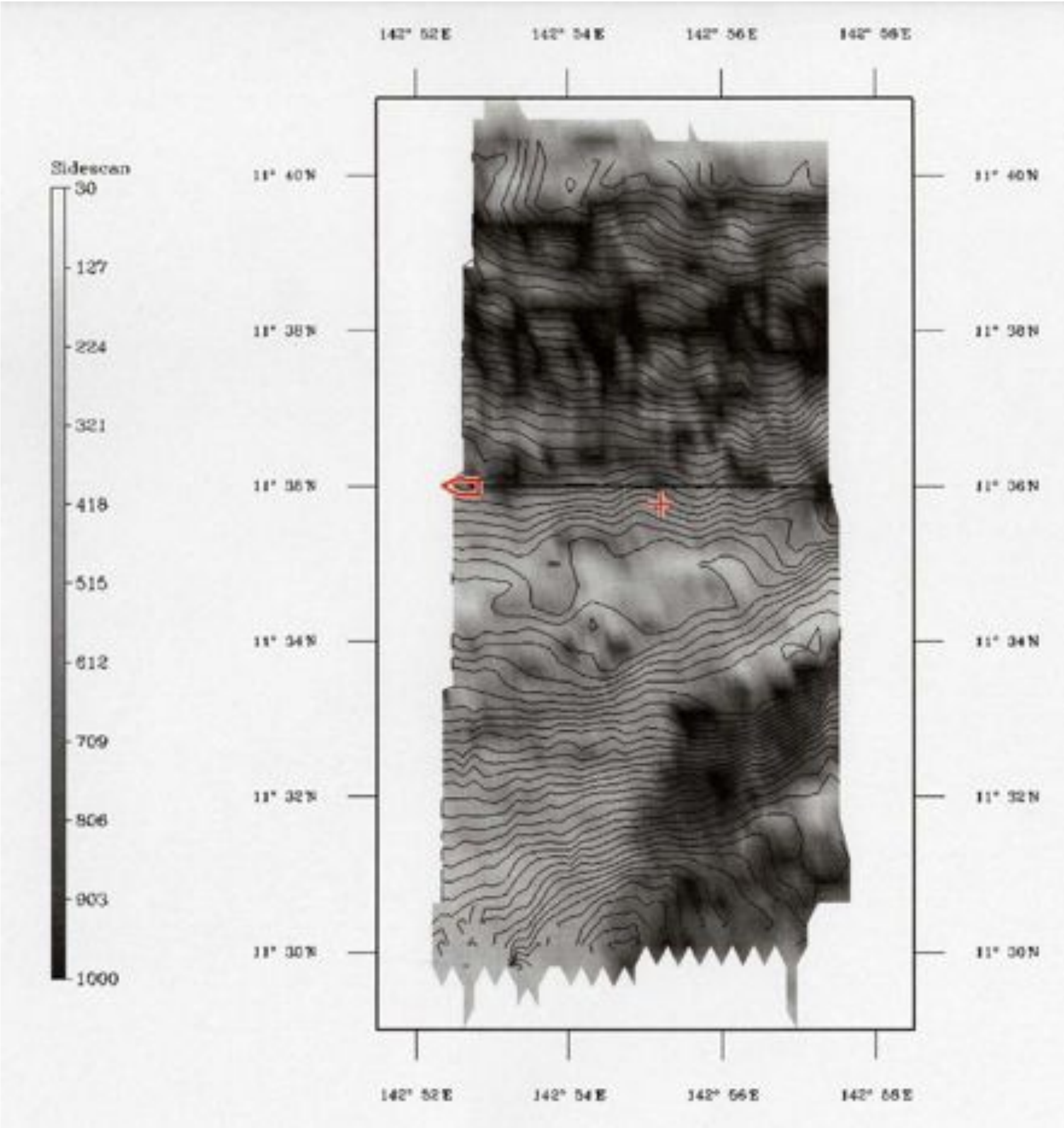
E-3. Side-scan imagery for 6K-1231



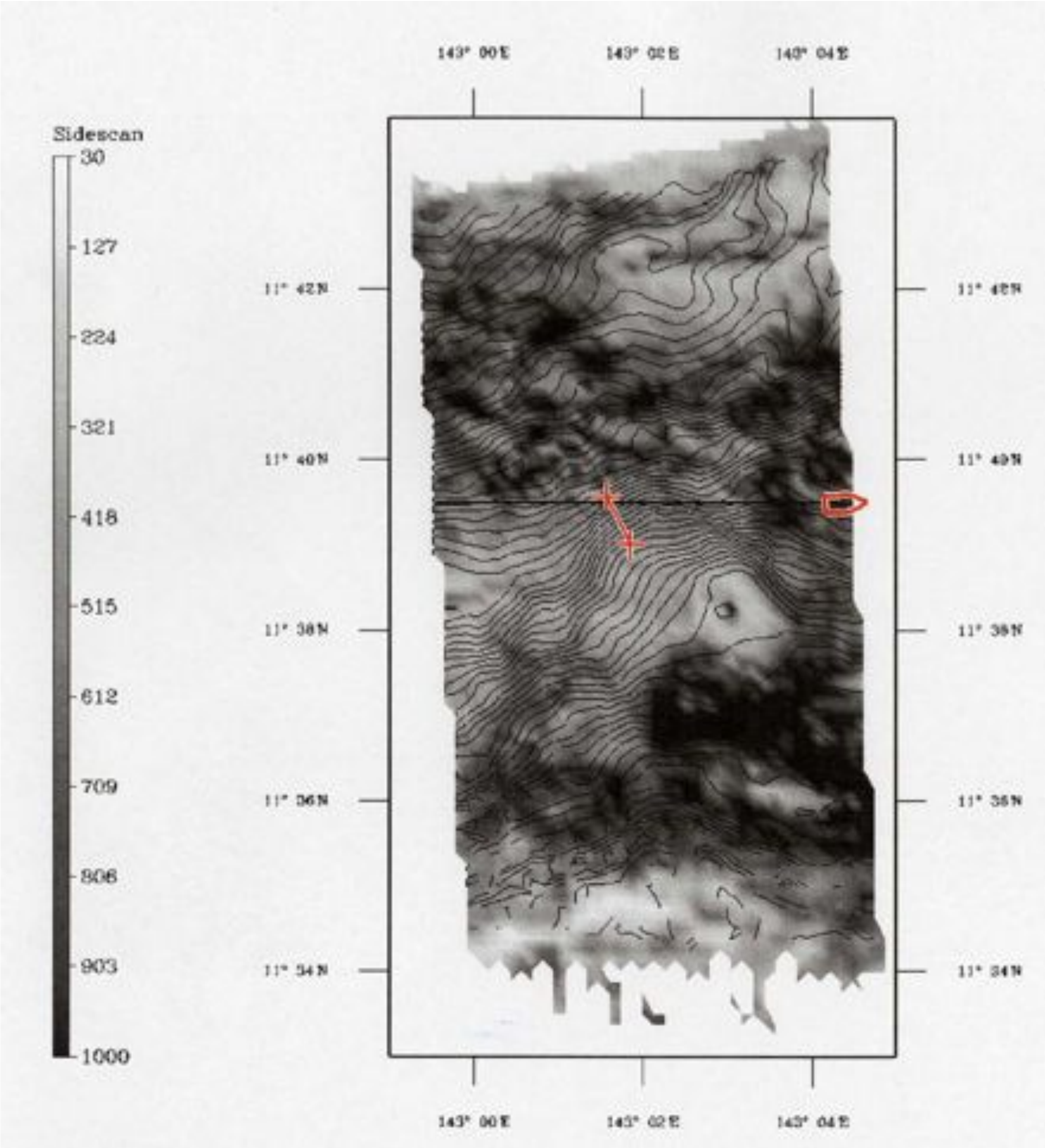
E-4. Side-scan imagery for 6K-1232



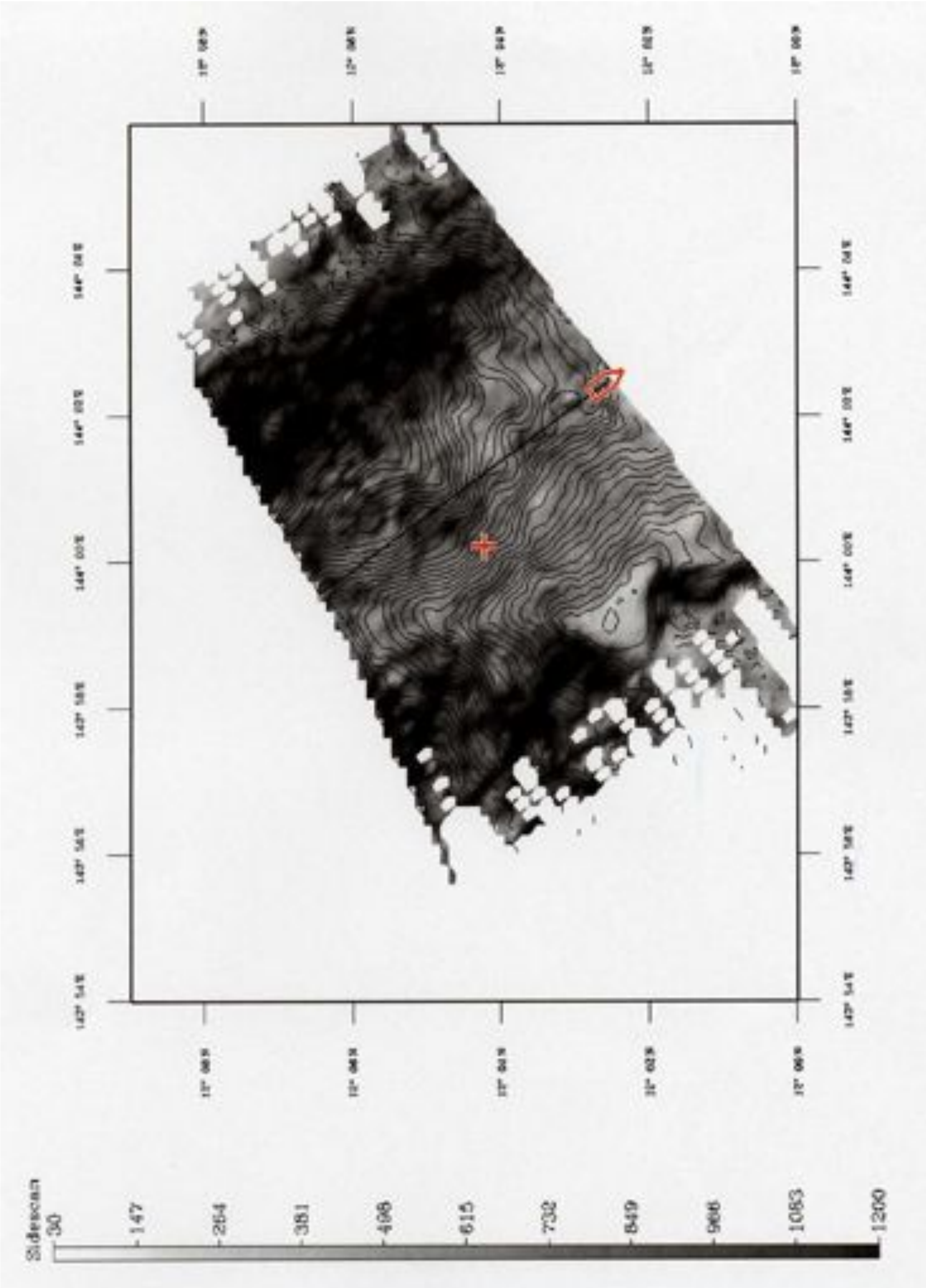
E-5. Side-scan imagery for 6K-1233



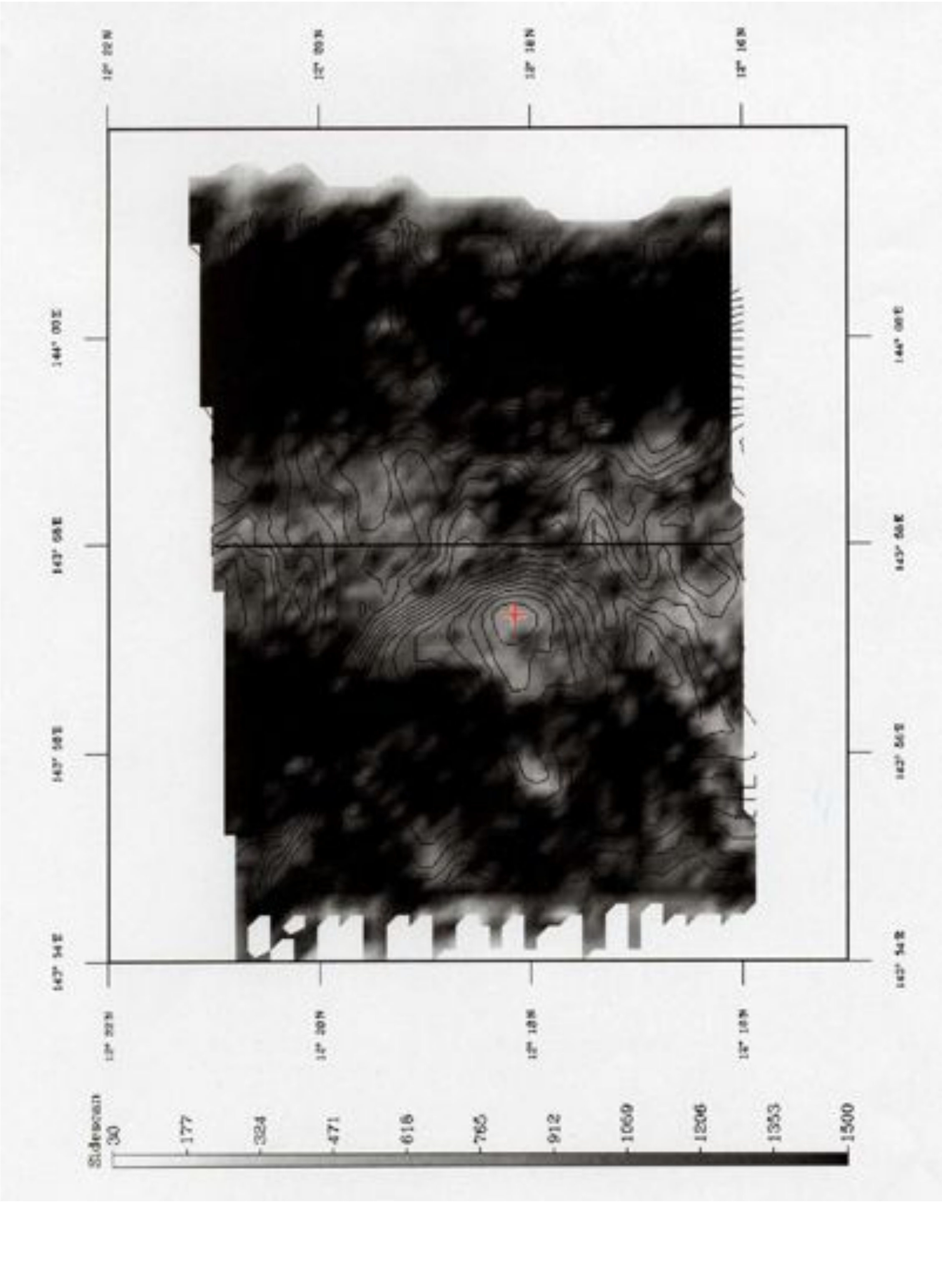
E-6. Side-scan imagery for 6K-1234



E-7. Side-scan imagery for 6K-1235



E-8. Side-scan imagery for 6K-1236



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Appendix F.

List of video logs

6K-1229 **Observer: M. Reagan** **2010/9/18**
Chief-pilot: K.Chiba **Co-pilot: T. Onishi**

Time (hh:mm)	Depth (m)	Observation
8:55	0	Leave surface
11:25	6350	On bottom; sediment with scattered cobbles (landing point; -1270,
11:29	6350	Two cobbles (R1, R2) in box #4
11:31	6347	Moving upslope 344°
11:35	6340	Sediment covered surface
11:36	6318	Location (-1180, 320)
11:42	6311	Location (-1170, 320); one sample (R3)
11:45	6300	Moving over cobbles and sediment, 000°
11:47	6284	Stalked animal - gorgonian coral?
11:52		Location (-1050, 330)
11:56	6255	Two cobbles (R4, R5) in box #5; continue 350°
12:06	6231	Location (-900, 310)
12:07	6227	Turning 030°
12:09	6225	Turning 010°
12:10	6222	Turning 360°
12:14	6208	Video blackout; #2 camera down.
12:17	6207	Switch to #1 camera
12:19	6204	Two big rocks, not stopped
12:22	6203	Whitish, sediment-covered, few cobbles
12:26	6200	Sample R6 in box #8; location (-700, 300); changing course to
12:30	6199	#2 camera recovers; change course to 320°
12:32	6196	Traveling over whitish sediments with few cobbles
12:33	6194	Traveling over sediment with many cobbles
12:34	6194	Location (-590, 300)
12:35	6196	Traveling over whitish sediment with few cobbles
12:37	6196	Traveling over whitish sediment with more cobbles
12:44	6200	Sample R7 and R8 in box #9; location (-570, 200)
12:45	6196	Heading 015° over many cobbles
12:51	6175	Location (-450, 190); heading 010° over sediment with few
12:55	6155	Location (-330, 220); travelling over whitish sediments with few cobbles
13:00	6112	Location (-210, 230); traveling over whitish sediments with few cobbles
13:05	6080	Location (-40, 260); traveling rapidly over whitish sediments with few cobbles
13:09	6065	Location (30, 270); travelling rapidly over whitish sediments with few cobbles
13:14	6049	Flying over sediment-covered seafloor
13:15	6052	Location (220, 320)
13:20	6035	Flying over sediment-covered seafloor
13:25	6028	Stop to sample slabby outcrop but too muddy; location (470, 380)
13:31	6028	Location (520, 340); sampling cobbles in sediment
13:45	6001	Collect two cobble samples in box #1 (R9 and R10)
13:46	5988	Travelling over sediment with many cobbles
13:49	5970	Collect two cobbles (R11, R12) in box #2; location (580, 370)
13:53	5957	Travelling over sediments with many cobbles
14:10	5930	Sample large blocks, maybe outcrop; R13 and R14 in box #11; location (670, 330)
14:12	5920	Travelling over steep outcrops; heading 000°
14:27	5876	Sample near outcrop, samples R15 and R16 in box #10 and #13; location (750, 310)
14:29	5869	Traveling 000° over rubbly slope
14:33	5837	Blocky outcrop
14:38	5833	R17 and R18 in box #14; location (820, 280)

6K-1229 **Observer: M. Reagan** **2010/9/18**
Chief-pilot: K.Chiba **Co-pilot: T. Onishi**

Time (hh:mm)	Depth (m)	Observation
14:41	5808	Traveling 000° over sediment with cobbles
14:49	5787	R19, R20 and R21 in box #12; location (900, 260)
14:52	5781	Travelling over sediment; location (910, 290)
14:55	5765	Off bottom
		Video log by R. J. Stern, N.Komori and J.Reberio

6K-1230 **Observer: J. Ribeiro** **2010/9/19**

Chief-pilot: K. Matsumoto **Co-pilot: A. Ishikawa**

Time (hh:mm)	Depth (m)	
10:59	4958	On the bottom
10:59	4958	Heading 332°
10:59	4958	Rocky ground, no flow
11:04	4957	Sample R01 in box #7
11:06	4957	Sample R02 in box #7
11:08	4954	Field of boulders; headinging 017°
11:09	4950	Sailing 050°
11:10	4951	Stalked creature; beginning of field of rocks
11;12	4950	Sailing 051°
11:13	4948	Field of boulders; heading 051°
11:15	4942	Field of boulders; outcrop; heading 051°
11:17	4931	Location (0, -300)
11:23	4935	Sample R03 and R04
11:28	4904	Trying to touch bottom
11:30	4905	Location (50, -280); sample R05 and R06 in box #5
11:35	4905	Sailing 050°
11:40	4872	Big boulders on a talus of cobbles; heading 050°
11:42	4856	Big boulders; no sediment; heading 050°
11:43	4852	Cobbles; heading 061°; sample R07 and R08 in box #8
11:49	4833	Sailing 051°
11:50	4836	Rocky ground; heading 051°
11:52	4819	Location (160, -180); heading 049°; rock field with cobble and occasional
11:56	4803	Sample R09 in box #9
12:07	4800	Sample R10 in box #9
12:07	4800	Location (180, -160)
12:11	4778	Sailing 050°
12:26	4752	Sample R11 and R12 in box #14
12:26	4752	Location (260, -110)
12:31	4744	Sailing 054°; field of rocks, very steep
12:41	4704	Sample R13 and R14 in box #11; location (321, -70)
12:45	4595	Heading 050°
12:54	4550	Sample R15 and R16; location (380, -20)
13:01	4526	Top of a vertical wall; heading 087°
13:05	4522	Sample R17 (similar samples, from same place) in box #1
13:17	4599	Sample R18 and R19 in box #15 from cobble size field; location (450, 40)
13:17	4599	Note either R04 or R05 moved on box #5, we don't know which.
13:32	4554	Sample R20 and R21 in box #9 (Check this out there are two already in that)
13:40	4550	Sailing 050°; location (490, 110)
13:48	4515	Outcrop; heading 072°
13:50	4499	Outcrop; sample R22 and R23 in box #12; location (590, 180)
13:59	4494	Sailing 044°; field of boulders
14:10	4460	Sailing 050°
14:15	4451	Field of pillows; sample R24 and R25 in box #10
14:15	4451	Location (690, 230)
14:25	4426	Sailing 049°
14:30	4401	Boulder field; sample R26 and R27 in box #2; location (750, 290)
14:40	4380	Sailing 050°
14:46	4350	Rock field; sample R28 and R29 in box #6; location (830, 330)
14:59	4320	Sailing 050°
15:03	4303	Sample R30 and R31 in box #3; location (900, 350)
15:16	4280	Sample R32 and R33 on the claws
15:20	4280	Off bottom
		Video log by I. Pujana and M. Kino

6K-1231 **Observer: I. Pujana** **2010/9/20**

Chief-pilot: Y. Chida **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
11:34	6393	Shinkai arrives at bottom
11:34	6393	Water temperature is 1.6°C
11:35	6393	Location (-340, 480)
11:36	6393	Trouble with camera
11:37	6393	Try restarting camera system
11:37	6393	Moving; heading 340°
11:37	6393	Touched down again, try to sample
11:47	6377	#2 camera on again
11:51		#2 camera off again
11:52	6377	Location (-280, 470)
11:52	6377	Sample R01 and R02 in box #7
12:00		Location (-240, 380)
12:05	6373	Sampl R03 and R04 in box #4
12:05	(no image)	Location (-230, 380)
12:09	(no image)	Problems with #2 camera, taking pictures instead
12:11	(no image)	#2 camera off
12:15	6252	Location (-70, 320)
12:18	6244	Start sampling
12:23	6244	Four samples R05, R06, R07 and R08 in box #5
12:23	6244	Location (-60, 330)
12:26	6239	Start moving
12:29	6228	Stop for observation
12:37	6229	Scoop
12:41	6230	Scooping stopped, no sample taken
12:42	6228	Trying to restart box #2 camera
12:43	6228	Still no box #2 camera
12:45	6228	Start sampling
12:50	6228	Three samples R09, R10 and R11 in box #8
12:51	6228	Location (-30, 320)
12:51	6228	White-blue-ish surfaces; serpentine? hydrothermal deposits?
12:58	6196	Still same surfaces
12:59	6194	Touch down, try to sample, rocks look like serpentine (whitish)
13:04	6194	Samples R12 and R13 in box #9
13:04	6194	Location (-20, 300)
13:11	6183	Stopped to sample
13:15	6183	Samples R14 and R15 in box #13
13:15	6183	Trying to scoop
13:26	6183	Gravel sample in box #1
13:27	6183	Location (0, 270)
13:30	6183	Start moving
13:31	6159	T. Ishii asks I. Pujana to scoop white gravel.
13:41	6145	Sample R16 in box #2
13:41	6145	Location (60, 350)
13:46	6144	Start moving
13:54	6091	Location (130, 300)
14:01	6066	Location (160, 290)
14:03	6065	Stop to sample
14:18	6065	Samples R17, R18, and R19 in box #11
14:18	6065	Location (170, 290)
14:27	6006	Location (230, 230)
14:33	5980	Stop to sample
14:43	5982	Samples R20, R21 and R22 in box #11
14:45	5982	Location (250, 200)
14:47	5961	Y. Ohara calls Shinkai control; operation manager asks Shinkai pilot for clarification with box #11 (6 samples put in?).

6K-1231 **Observer: I. Pujana** **2010/9/20**

Chief-pilot: Y. Chida **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
14:48	5952	Pilot says R17, R18 and R19 put in box #10; R20, R21 and R22 in box #11.
14:51	5934	Location (300, 170)
14:52	5934	Stop to sample
15:03	5932	Sample R23 in box #12; sample R24 in box #15
15:04	5932	Off bottom
		Video log by M. Brounce, Y. Ohara, G. Girard and K.

6K-1232 **Observer: K. Michibayashi** **2010/9/21**

Chief-pilot: K. Chiba **Co-pilot: K. Suzuki**

Time (hh:mm)	Depth (m)	Observation
11:25	6426	Shinkai on bottom; water temperature is 1.7°C; location (-730, 240); no sample; heading 340°
11:35	6404	Stop on sediment with few cobbles for sampling
11:44	6396	Collect cobbles on sediment; sample R1, R2 and R3 in box #6; location (-540, 170)
11:45	6391	Heading 340°
11:48	6369	Boulder in sediment
11:52	6350	Travelling over sediment
11:58	6348	Stopping to sample cobble in sediment
12:05	6343	Sample R4 and R5 in box #5
12:05	6342	Location (-370, 100)
12:05	6342	Start moving
12:08	6322	Heading 340°
12:14	6288	Location (-210, 40)
12:17	6276	Try to sample
12:22	6276	R6 and R7 in box #4
12:22	6276	Location (-160 210)
12:24	6270	Heading 340°, still traveling over sdiment with cobbles
12:32	6226	Location (-080, 0)
12:49	6197	R8 and R9 in box #7; location (-20, -40)
12:51	6190	Moving 340° over cobbles and sediment
13:00	6149	Location (150, -090)
13:09	6126	R10 and R11 in box #8; location (290, -140); heading 330°
13:22	6048	R12 and R13 in box #9; location (430, -220); heading 330°
13:23	6040	Travelling over sediment with cobbles
13:32	5995	R14 and R15 in box #13; location (520, -260)
13:36	5960	Continue traveling over cobbles and sediment; blocks get larger
13:42	5931	R16 in box #12; location (600, -350)
13:44	5920	Heading 330°; travelling over sediment with cobbles
13:51	5900	R17 in box #11
13:55	5900	Sediment sample in scoop #1; heading 330°; location (660, -360)
14:02	5991	Outcrop, partially covered by sediment
14:03	5984	Sediment again
14:07	5958	Sediment with a few cobbles
14:09	5951	Sampling among big blocks in sediment
14:16	5948	R18 in box 10; 800, -460; heading 330°
14:20	5930	Travelling over sediment with cobbles
14:29	5789 (?)	R19 in box #14; location (950, -580); heading 310°
14:35	5772	Travelling over sediment with few cobbles
14:45	5758	R20 in box #15; location (970,- 670); R20 broke into two pieces
14:51	5751	R21 and R22 in box #2; location (1000, -690)
14:55	5751	Bottom is mixed outcrop and sediments
14:56	5750	Off bottom
		The name of the logger is missed.

6K-1233 **Observer: Y. Ohara** **2010/9/22**

Chief-pilot: M. Yanagitani **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
11:24	6394	Shinkai arrives at bottom
11:24	6394	Very silty, video obscured by particles in suspension at landing
11:25	6394	Location (-950, 210); Temp: 1.7°C
11:27	6394	Shinkai begins moving
11:29	6387	Rocky bottom; large, flat boulders
11:38	6379	Sample R1 in box #8; sample R2 in box #9
11:39	6379	Location (-910, 230)
11:41	6375	Shinkai begins moving upslope quickly
11:44	6360	Rocky bottom; smaller, less frequent
11:45	6348	Location (-850, 280)
11:49	6332	Sediment bottom
11:51	6321	Location (-770, 370)
11:52	6320	Rocky bottom, Shinkai stops and tries to sample
11:56	6320	Pilot radios samples R3 and R4 in box #8. Confusion; already sample R1 in box #8?; asking bridge to confirm.
12:01	6320	Confirmed that R3 and R4 are in box #8
12:04	6315	Heading 000°
12:07	6307	Location (-700, 480)
12:08	6309	Start sampling
12:13	6308	Two samples, one in box #5, the other in box #9 (R5 and R6)
12:16	6309	Heading 007°
12:17	6308	Heading downslope, keep north direction
12:22	6282	Location (-490, 530)
12:24	6278	Start sampling
12:29	6277	Samples R7 and R8 in box #6
12:33	6257	Start moving
12:38	6252	Rocky bottom, small boulders
12:39	6252	Start sampling
12:43	6250	Samples R9, R10 and R11 in box #4
12:43	6250	Location (-400, 610)
12:45	6250	Shinkai starts moving 000°
12:51	6218	Sediment bottom?
12:54	6214	Flat rocks/consolidated sediments
12:56	6214	White sediments
12:56	6212	Rocky bottom, poorly sorted
12:57	6210	Shinkai stopped, try to sample; outcrop?
12:59	6210	Samples R12 and R13 in box #7
12:59	6210	Location (-170, 620)
13:01	6210	Shinkai starts moving 000°
13:04	6202	Sediment bottom
13:06	6204	Location (020, 640)
13:07	6203	Rocky bottom
13:09	6199	Shinkai stopped, try to sample
13:17	6199	Samples R14, R15 and R16 in box #13
13:17	6199	Sample R17 broke into two pieces; R17a in box #14, R17b in box
13:17	6199	Location (080, 650)
13:18	6198	Shinkai starts moving 000°
13:22	6179	#2 Camera is down
13:26	6149	Black and white image
13:26	6149	Tabular outcrop? Consolidated sediment? Poor image quality
13:39	6140	Location (250, 640)
13:43	6131	#2 Camera is back
13:44	6128	Some large rocks on bottom
13:45	6120	#2 Camera periodically shows black screen, then refreshes with seafloor image

6K-1233 **Observer: Y. Ohara** **2010/9/22**

Chief-pilot: M. Yanagitani **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
13:48	6102	Location (410, 650)
13:50	6093	#2 Camera is down
13:55	6077	Black and white image, very poor image quality
13:57	6076	#2 Camera is back
13:58	6076	Shinkai stopped, try to sample
14:01	6075	Sample R18 in box #11
14:01	6075	Move a little bit, sample again
14:03	6074	Sample R19 in box #11
14:03	6074	Location (550, 660)
14:05	6067	Shinkai moving 001°
14:06	6064	Sediment bottom
14:10	6045	Shinkai stopped, try to sample
14:20	6041	Samples R20 and R21 in box #12
14:20	6041	Location (680, 650)
14:21	6041	Shinkai starts moving 341°
14:23	6036	Shinkai changes heading to 002°
14:25	6029	Sediment bottom
14:26	6029	Location (730, 670)
14:27	6023	Bioturbation in sediment; worm track?
14:32	6007	Shinkai stopped, try to sample
14:36	6005	Samples R22 and R23 in box #15
14:36	6005	Location (950, 680)
14:44	5934	Shinkai stopped, try to sample
14:44	5934	Location (1030, 670)
14:55	5930	Sample R24 in box #1, sample R25 in box #2
14:55	5930	Off bottom
		Video log by M. Brounce, K. Michibayashi and G. Girard

6K-1234 **Observer: T. Ishii** **2010/9/23**

Chief-pilot: Y. Chida **Co-pilot: A. Ishikawa**

Time (hh:mm)	Depth (m)	Observation
11:27	6079	Shinkai arrives at bottom
11:27	6079	Location (-1120, 610)
11:27	6079	Water temperature 1.6°C
11:32		Rocky bottom
11:45	6079	Sample R01 and R02 in box #13, R03 box #6, R04 in box #14
11:45	6079	Shinkai begins moving 000°
11:49		Small rocks and sediment on bottom
11:52		Larger, tabular rocks, lithified sediment?
11:55		Outcrop? Large, dark rock with sub-vertical fractures
11:56		Shinkai stops, tries to sample
12:00	6025	Sample R05 in box #15
12:04		Location (-1040, 640)
12:10	5945	Location (-960, 630)
12:12		Scoop to sample white clay
12:18		Using green push core
12:21	5945	Gave up using scoop, green push core instead; sample R06 in box #15
12:24		Moving 005°
12:31		Location (-820, 630)
12:32		Shinkai reports sight of clam (?)
12:32		Shinkai stops, tries to sample
12:39		Several clam (?) shells in sediment, maybe ~2-5 cm in length
12:45		Shinkai tries to scoop
12:51		Shinkai still trying to sample
13:02		Shinkai still trying to sample
13:09		Shinkai got clam (?) shell in claw
13:10	5859	Several clam (?) shells, samples labelled B1 in box #1,
13:10	5859	Sample R07 in box #12
13:10	5859	Location (-810, 630)
13:14		Shinkai begins moving 001°
13:17		Rocky and sediment on bottom, light-white deposits?
13:22		Location (-690, 630)
13:26	5730	A wood-fall biological community was seen at 13:26:35. Shinkai just flew over, and no sampling was attempted.
13:32		Shinkai stopped to sample
13:37		Samples R08, R09 and R10 in box #11
13:37	5689	Shinkai begins moving 000°
13:37	5689	Very light colored sediment, occassional small rock
13:37		Location (-600, 630)
13:45		Shinkai reports sight of clam (?)
13:46		Several 1000s of clam (?) shells, similar to before; skinny and elongated
13:48		Shinkai lands, starts to sample
13:49		Clams (?) appear to be alive?
13:51		Nearby rocks appear to have some growth on them
14:02		Yokosuka asks Shinkai to put marker at clam (?) site
14:12		Many living samples in box #2, samples labelled as B2
14:12		Sample R11 (with clams attached) in box #7
14:12		Samples R12 (with clams attached) and sample R13 (no clams?) in box #8
14:12		Shinkai left marker at site
14:12		Location (-430, 630)
14:24		Location (-310, 640)
14:29		Location (-250, 640)
14:35		Location (-210, 610)

6K-1234 **Observer: T. Ishii** **2010/9/23**

Chief-pilot: Y. Chida **Co-pilot: A. Ishikawa**

Time (hh:mm)	**Depth (m)**	**Observation**
14:36		Sediment bottom
14:37	5548	Shinkai reports living colony
14:39		Rock and sediment bottom
14:42		Shinkai lands, starts to sample
14:54		Samples R14 in box #4, R15 and R16 in box #5, and R17 in box
14:55		Off bottom; location (-280, 540)
		Video log by M. Brounce and K. Michibayashi (note: the comment in blue was added by Y. Ohara on June 2, 2011)

6K-1235 **Observer: G. Girard** **2010/9/24**

Chief-pilot: K. Matsumoto **Co-pilot: K. Suzuki**

Time (hh:mm)	Depth (m)	Observation
11:29	6478	Shinkai on bottom; sediment with cobbles; location (-1360, -110); water temerature is 1.7°C; try to sample here
11:32	6476	R1 and R2 in box #4; start moving
11:40		Big angular blocks suggests outcrop nearby; some white rocks
11:44	6435	Sampling near outcrop; R3 in box #9; location (-1290, -100)
11:48		R4 and R5 in box #9; moving up steep slope; cobbles with sediment; some underlying rocks are white
11:51		Heading 020° over slope with gravel and angular blocks
12:01		Location (-1210, -80)
12:03		Sampling in muddy ground with some pebbles
12:07		R6 and R7 in box #5; location (-1180, -50)
		Heading 030°
12:14		Angular blocks
12:16		Location (-1060, 60)
12:19		Sampling in various sizes of angular blocks with no sediment; close to the outcrop?
12:25	6295	R8 and R9 in box #6; location (-1030, 80)
12:28		Heading 030°
12:31		Moving over large angular blocks
12:35		Location (-940, 120)
12:40		Travelling over coarse angular talus
12:50	6206	R10 and R11 in box #8; location (-840, 210)
12:52		Travelling over sediment with large and small blocks; heading 020°
13:00		Location (-740, 270); travelling over sediment with few blocks
13:02		Travelling over sediments with more large, angular blocks
13:04		Travelling over coarse talus with some sediments
13:07		Travelling over sediment with large blocks
13:09		Location (-650, 270)
13:14		Try to sample angular talus blocks
13:22	6102	R12 and R13 in box #14; location (-630, 300)
13:25		Travelling over sediments with lots of big angular blocks
13:32		Location (-500, 360); stop to sample
13:40	6029	R14, R15 and R16 in #13; location (-490, 370)
13:48		Travelling over sediments with angular blocks
13:50		Location (-390, 430); heading 010°
13:56		Stop for sampling, in coarse talus pile
14:05	5959	R17 and R18 in box #2; location (-360, 440); heading 020°
14:13		Travelling over big blocks with sediment
14:15		Location (-270, 480); travelling over sediment covered by recent talus
14:19		Stop for sampling
14:23	5908	R19 and 20 in box #15; location (-210, 480)
14:31		Travelling over large angular blocks
14:32		Location (-130, 510)
14:36		Stop for sampling, gravel and scattered large blocks
14:39	5868	R21 and R22 in box #11; location (-030, 520)
14:40		Heading 020°
14:43		Stop for sampling; mostly sediment but a few large blocks
14:48	5864	R23, R24 and R25 in box #10; location (010, 540)
14:51		Off bottom
		Video log by M. Brounce

6K-1236 **Observer: M. Brounce** **2010/9/25**

Chief-pilot: M. Yangitani **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
11:00	5309	Shinkai on bottom; lots of cobbles and sediment; location (-1240, 010); try to sample
11:08		R1 in box #8; heading 000°
11:10		Moving; location (-1200, 020); sediment and cobles
11:12		Layered outcrop with sediment; heading 000°
11:13		Heading 350°
11:15		Sediment with few cobbles
11:17		Layered outcrop
11:18		Sediment with few cobbles
11:18		Layered outcrop
11:20		Sediment with few cobbles
11:21		Location (-1020, 000)
11:25		Sediment
11:27		Location (-840, -010); push core sample
11:29	5270	Yellow push core C1; start moving 350°
11:30		Sediment with bioturbation
11:42		Unlayered outcrop with sediment; sampling
11:47	5240	R2 and R3 in box #5; location (-570, -010)
11:50		Moving over sediment with few cobbles
11:54		Location (-500, -010), trying to sample
11:59	5181	R4, R5 and R6 in box #4
12:01		Heading 300°
12:07		Location (-370, 40); sampling
12:18	5101	R7 and R8 in box #6
12:23		Heading 300°
12:27		Start sampling
12:33	5043	R9 and R10 in box #7; location (-220, 030)
12:35		Moving over sediments with few cobbles; heading 340°
12:41		Stop to sample large cobbles on sediment-covered slope
12:45	4983	R11, R12 and R13 in box #9; location (-140, 060)
12:47		Heading 340°; moving over sediment covered slope with outcrop and big blocks
12:48		Elongate white patches appear; rocks or clams?
12:56		Location (040, 0109; layered outcrop; start sampling
13:06	4899	R14 in box #11; location (080, -030)
13:09		Heading 340°
13:10		Try to sample here; steep layering in outcrop; maybe dike
13:19	4891	R15 in box #12; location (100, -020)
13:21		Moving ovoer sediment with cobbles; heading 350°
13:28		Location (170, -040)
13:33		Moving over big blocks and smaller cobbles in sediment
13:34		Stopping to sample; location (380, -040)
13:39	4823	R16 and R17 in box #13; location (400, -040)
13:43		Heading 350°
13:48		Location (540, -060)
13:56		Travelling over sediment with cobbles
13:58		Stop for push core
14:05	4810	Red push core (C2); location (790, -080)
14:14		Location (1000, -130), moving over sediment with cobbles
14:15	4868	Octopus
14:22		Traveling over sediment with few cobbles
14:26		Location (1250, -120)
14:28		Stop for sampling big blocks
14:31	4727	R18 in box #14; location (1270, -130)
14:32		Travelling over surface with elongate rocks, maybe layering or dikes?; heading 350°

6K-1236 **Observer: M. Brounce** **2010/9/25**

Chief-pilot: M. Yangitani **Co-pilot: K. Iijima**

Time (hh:mm)	Depth (m)	Observation
14:37		Travelling over sediments with few cobbles
14:39		Location (1430, -170)
14:44		Losition (1520, -160)
14:46		Stop for sampling cobbles in sediment
14:52	4670	R19, R20 and R21 in box #1; location (1560, -170)
14:54		Heading 350° over sediment-covered bottom
15:00		Location (1730, -180); travelling over sediment-covered bottom
15:03	4646	Off bottom
		The name of the logger is missed.

YKDT-81 **09/26/2010**

Time (hh:mm)	Depth (m)	Observation
		Because of malfunctioning of the camera system, the dive was canceled halfway.

YKDT-82 **Observer: M. Reagan** **09/26/2010**

Time (hh:mm)	Depth (m)	Observation
14:29	4166	YKDT on bottom
14:30	4169	Start surveying bottom; very fresh-looking angular blocks; few sediments
14:32	4169	A rubble field, boulders too large for dredging
14:33	4166	Rocks 20-30 cm according to Shinkai team
14:34	4164	No life so far, little sediment
14:36	4161	Bottom not visible
14:37	4160	See bottom again
14:38	4161	Sub-rounded columnar pillows?; no glass visible, but blocks fit together nicely (blocks ~30-50 cm)
14:40	4159	Roundded surface that may be pillow, close to ~1 m in size
14:42	4154	All rocks rounded and sub-rounded, apparent abundant phenocrysts, but no glass visible
14:43	4152	No large animals
14:44	4157	Pillow-shaped structures, well defined
14:45	4154	No real change of rocks so far since dive started
14:47	4154	9 m above bottom; there are requests to try to get closer, but YKDT not moving at the moment
14:48	4155	Elongated and rounded rocks, also some are angular
		May be collapsed pillows (pillow talus?; proximal deposit?)
14:50	4152	Blocks more angular again
14:50	4150	Location (-810, 4450)
14:51	4150	Patches of sedimants, and nice pillows
14:51	4149	Nice radial fractures on the side image, very steep face
14:52	4146	Massive flow is columnar jointing; real outcrop very likely; pockets of sediment still present
14:54	4135	Curved pillow surface may be glassy
14:54		Rocks very fractured which look in place, or have traveled very little
14:56	4131	More rounded blocks, may have traveled a bit
14:57	4132	"Funny"-looking rocks
14:58	4131	Sediment-covered rocks at the bottom
14:59	4128	Bigger blocks (20-50 cm, some up to 1 m)
14:59		Small animal (shrimp?)
15:00		Location (-730, 4400)
15:01	4125	Rounded pillow blocks, not entirely formed, look porpyritic, not many angular surfaces
15:02	4116	Going up through clear pillows
15:04	4109	Very large pillow
15:04	4108	Now lots of sediments between pillows (why?)
15:04	4106	Nice close-view on pillows, plagioclase?
15:05	4101	Blockier and smaller, maybe talus-like
15:06	4090	Big angular blocks, not pillows
15:07	4090	Smaller rocks, a few bigger rocks
15:08	4085	Blocky rocks, smallish clasts, and a few big rocks
15:09	4080	More big blocks
15:10	4072	Fish!; and very rounded pillow rind
15:10	4068	Location (-720, 4260)
15:11	4058	Very large block, isolated in smalll blocks field
15:12	4054	Same
15:13		Still small patches of sediments
15:14	4039	Steep wall
15:14	4033	Rather homogenoeous small blocks
15:!4	4018	Sharp ridge, going up
15:16	3993	Bad image quality, but rocks look small
15:17	3985	Sharp ridge won side screen
15:18	3976	Very steep, can't really see the outcrop but looks massive and fractured
15:19	3970	Outcrop fractured, no blocks

YKDT-82 **Observer: M. Reagan** **09/26/2010**

Time (hh:mm)	Depth (m)	Observation
15:20	3964	Fractured rocks, small, angular
15:20	3962	Location (-540, 4120)
15:21	3946	Mostly fractured
15:22	3942	Massive outcrop
15:23	3936	Spongiate
15:27	3930	Life
15:27	3926	Nice ridges on right
15:28	3920	Not much sediments, mostly rocks
15:30	3926	Big rocks, hard to tell pillow or not, and a litle more sediment
15:30	3924	Location (-420, 3980)
15:31	3922	Little patches of sediment
	3921	Blocks are angular
15:32	3922	Lava flow?; very steep on side camera
15:33	3908	Life (jellyfish?)
15:34	3911	Big block, lots of fractures in it
15:36	3909	Very round blocks
15:37	3910	Dropping the dredge; location (-330, 3900)
15:37	3910	Nice pillow rinds and radial fractures
15:41	3922	Dredging through nice rocky rubble
		Sub-rounded blocks, some of them could be pillows, likely to be in talus
15:43	3925	Nice pillow

YKDT-83 **Observer: M. Reagan** **09/27/2010**

Time (hh:mm)	Depth (m)	Observation
09:37	3052	Bottom in sight, muddy, but outcrop visible just above
09:37	3048	Location (3700, 1840); sediment > rock; sediment more abundant than last dive (YKDT-82); rock are angular; ~20 cm in size (visible part emerged from sediment)
09:41	3045	9 m above bottom
09:43	3042	Outcrop looks like massive, rounded shapes
09:44	3042	Ship is moving, but YKDT not yet moving
09:46	3045	Heading over sediments
09:48	3041	Few angular to sub-rounded blocks above sediment, one looks pillow rind
09:49	3042	Small cm-scale rock fragments lying on top of sediment
		Another isolated rounded shaped block
09:50	3042	Location (3690, 1940)
09:50		Small fish
09:51	3043	Outcrop, rounded features
09:52	3041	Very nice 20-100 cm pillows, very intact, not many fractures
09:53	3035	Shrimp
09:54	3028	Fractured, sub-angular poillows; more intact pillows than YKDT-82, but much more sediment, older probably
09:55	3020	Steep slope, pillows and fragments
09:55	3008	More nice pillows
09:57	3001	Rocks fractured in a dm-scale, rounded shapes as well
09:59	3009	Fractured pillows interspersed sediments
10:00	3004	Location (3680, 2100)
10:01	3014	Area more broken up in small pieces, mostly rocks with sediments in
10:02	3021	Sediment with dispersed cm-sized clasts
10:03	3014	Large metric pillow with well developed surface striation (side camera)
10:03	3009	A few meters thick pile of pillows
10:04	3004	Again, sediments between the rocks
10:06	3011	Sediment rich bottom
10:07	3013	Cm-scaled light colored objects in the sediment, unknown nature
10:07	3012	Star/sun-shaped patterns (bioturbations?) in sediment
10:09	3010	Outcrop again, nice pillow-lava; sea cucumber
10:11	3009	Cm-scale dark clasts in sediment, with tiny white particles; good locality for dredging
10:12	3005	More clasts
10:13	3008	Alternating sediments with clasts, and pillow lavas
10:13	3008	Eel-like fish
10:15	3012	Sediment sometimes has different colors, with darker patches, different
10:17	3012	Feeding trails with darker central band, over a meter long, ~20 cm wide
10:18	3012	Abundant feeding trails
10:20	3011	Still moving over flats with sediment and no rock
10:20	3010	Location (3690, 2550)
10:22	3012	More feeding trails, heavily bioturbated sediment
10:24	3009	Shrimp
10:26	3002	Another brown patch in sediment
10:28	3001	Still bioturbated sediments, very few rocks
10:28	3001	Few cm-sized rocks, angular
10:28	3000	Dredge dropped; location (3680, 2660)
10:30	2992	Pillows with striations, little fracturing
10:31	2986	Dragging the dredge over the outcrop
10:31	2986	Dragging the dredge over sediment
10:32	2983	More pillow lavas, not fractured, and sediment
10:32	2984	Lots of 1-10 cm angular clasts, hopeful they will enter the dredge
10:34	2980	Little bit bigger clasts, still mostly angular, some are sub-rounded
10:35	2975	Off bottom; location (3690, 2880)
		The name of the logger is missed.

YKDT-84 **Observer: M. Reagan** **09/27/2010**

Time (hh:mm)	Depth (m)	Observation
14:14	3483	YKDT on bottom; location (-4410, -2620)
14:19	3481	Sediment cover, occasional lithic fragment (cm scale)
14:24	3483	YKDT begins to move
14:25	3483	Sediment cover continues as before
14:26	3477	Rounded outcrop, clear banding and flow lines, indicating pillow
14:26	3475	Location (-4380, -2520)
14:27	3474	Pillows are meter-scaled; interfingered with sediment
14:28	3469	Radial fractures possibly
14:29	3468	Pillows less frequent and/or sediment thicker
14:31	3463	Fish!; white, needle-like
14:32	3466	Sediment cover, light in color, occasional lithic fragments (cm scale)
14:33	3463	Large blocks, again with flow lines, nice rounded features, indicating
14:34	3460	Really nice pillow
14:35	3460	Sediment cover as before
14:35	3458	Location (-4300, -2500)
14:36	3456	Some bioturbation present in sediment, worm tracks
14:37	3452	Edge of pillow outcrop
14:38	3453	Lack of tallus, all seems to be outcrop covered with sediment
14:39	3450	Small pillow outcrop, submeter scale
14:40	3443	Outcrop, with sediment veneer
14:41	3443	Outcrop does not look entirely volcanic; pillows and sedimentary rock?
14:42	3439	Forward facing camera shows nice pillows in the area
14:42	3434	Nice parallel flow bands
14:44	3430	Sediment cover, where sediment and pillow contact, some small pillow
14:45	3422	Location (-4150, -2450)
14:47	3411	Lithified sediment surfaces
14:50	3404	Sediment grain size changes, coarse grained and containing dark lithics (sub cm scale)
14:50	3404	M. Reagan describes sediment as having "desert texture/veneer"
14:54	3388	Light colored sediment may be dune like
14:55	3383	Location (-3920, -2390)
14:56	3382	Outcrop again, looks more broken up than previously
14:57	3374	Some small, angular blocks in sediment, tallus from above?
14:58	3366	Sediment cover continues as before (desert veneer)
14:59	3356	Larger blocks in forward looking camera, sticking out of sed
15:00	3352	Mountain Dew can on seafloor
15:00	3344	Emergent pillow lavas, m scale outcrop
15:02	3334	Sediment cover continues as before (desert veneer)
15:02	3333	Forward looking camera shows occasional boulders (> 2 m)
15:03	3326	More blocks sitting in sediment, likely tallus?
15:04	3315	Blocks getting more abundant
15:06	3291	Sediment cover continues as before (desert veneer), blocks no longer
15:07	3281	Location (-3760, -2260)
15:10	3448	Forward looking camera spots large blocks again, very infrequent, very
15:11	3230	Outcrop; hyaloclastite?
15:12	3220	Critter!
15:13	3208	Black lithics are diminishing, sediment goes mostly light in color
15:15	3194	More blocks/outcrop perhaps (m scale)
15:15	3188	Location (-3550 , -2170)
15:16	3182	Dredge dropped; coming up on outcrop
15:16	3175	Rocks more broken up, no obvious pillow structures
15:17	3163	Brecciated rock
15:18	3151	Fish!; orange
15:20	3113	Steep wall, outcrop; rounded but not clearly pillow
15:23	3068	Forward looking camera shows some bulbous rock, look like pillow
15:24	3057	Sea cucumber and fish
15:25	3050	Area looks good for dredge; some smaller blocks laying in sed

YKDT-84 **Observer: M. Reagan** **09/27/2010**

Time (hh:mm)	Depth (m)	Observation
15:25	3043	Location (-3340, -2010)
15:26	3030	Outcrop with flow banding ~25° to direction of YKDT track
15:27	3922	Lithified sediment covered in mud?
15:28	3010	Sediment cover, light in color, fine grained
15:30	2991	Forward looking camera sees large outcrop, critter living on top
15:31	2983	Rounded features, forward looking camera shows a long pillow tongue
15:32	2975	Sediment cover
15:33	2970	Outcrop again, looks like there is broken stuff at top of outcrop; dredge?
15:35	2954	Location (-3100, -1940)
15:37	2942	On edge of broken up outcrop, looks rounded and pillow like
15:39	2932	Dredge maybe got a rock?; dragging more, bouncing less
15:40	2925	Back to scraggly look outcrop, broken up, no obvious large rounded
15:44	2891	Lithified sediment?
15:45	2884	Location (-2850, -1780)
15:46	2878	Back into blocky, broken outcrop, small blocks, lots of sediment
15:50	2834	Location (-2680, -1740)
15:51	2810	Outcrop continuing as before; hard to distinguish if pillow like or Mn-
15:53	2787	Dredge hits fish!; fish swims away.
15:55	2765	YKDT off bottom; location (-2600, -1620)
		Video log by M. Brounce

YKDT-85 **Observer: M. Reagan** **09/28/2010**

Time (hh:mm)	Depth (m)	Observation
09:23	3090	YKDT arrives on bottom
09:23	3090	Location (-320, -850)
09:28	3086	Medium sized, sorted tallus pile
09:29	3085	Some sediment between blocks (small amount)
09:30	3083	Blocks are fairly angular
09:30	3083	Location (-280, -840)
09:34	3071	Flatter area, darker in color than sediment; debris flow?
09:35	3072	Very little sediment, blocks getting larger?
09:35	3072	Location (-270, -810)
09:36	3071	7-10 meters above surface, difficult to say what the rock is
09:38	3067	Nothing looks in place
09:39	3071	Dm scale angular to sub rounded blocks in tallus
09:39	3071	Looks like rift sites from Shinkai dives; young?
09:40	3070	Critter!
09:40	3070	Blocks seem tightly piled
09:40	3070	Location (-270, -700)
09:41	3067	Forward looking camera shows extensive tallus field
09:41	3067	Perhaps can see "white things" on surface of rocks
09:42	3060	Dredge dropped; Yas Ohara thinks this area is our best bet for sample
09:42	3060	Location (-260, -690)
09:45	3054	Location (-260, -650)
09:46	3054	Blocks look to be getting larger as we continue upslope
09:47	3047	Just a little bit of sediment; blocks are m to dm scale here, more poorly
09:48	3036	Dredge looks like scraping "black" off of clasts; manganese coating?
09:49	3033	Dredge bouncing on tallus, looking unsuccesful
09:50	3023	Location (240, -540)
09:51	3015	Finer grained tallus, hyaloclastic?
09:51	3015	Yellow staining in light sediment coating rocks
09:54	2988	Coarse tallus, several m scale
09:55	2972	Location (-230, -460)
09:56	2965	Tallus is finer scaled here, m to dm
09:57	2962	Forward looking camera shows extensive tallus field, as before
09:58	2960	Some occasional large (several m) blocks
09:58	2957	Tallus poorly sorted here
09:59	2955	Very large blocks here, most are larger than the size of the dredge
09:59	2942	Large blocks have rounded surfaces
10:00	2942	Then suddenly, small pockets of dm and smaller sized tallus
10:00	2940	Location (-210, -330)
10:01	2932	Finer grained, as in hyaloclastic?
10:02	2927	Back into very large blocks
10:02	2924	Seems to be pockets of internally sorted blocks, very sharp contrast between sizes of pockets compared to one another
10:03	2922	Brown/black powder kicked up by chain and dredge; manganese?,
10:04	2915	No rocks appear to be in place
10:04	2915	Very coarse tallus area (m sized blocks)
10:05	2910	Forward looking camera shows extensive tallus fields, as before
10:05	2908	Location (-170, -220)
10:06	2902	Shrimp!; a red one
10:07	2900	Some fragments floating around in dredge box
10:08	2887	Very large blocks here m scale
10:09	2871	Finer, cobble sized material
10:10	2847	Location (-140, -50)
10:11	2837	Large blocks look to have fallen overtop of previously fallen smaller
10:11	2827	Fish!; white, needle like
10:13	2788	Surface of large boulders look "mottled"; alteration artifact?
10:15	2757	Less brown/black dust coming off with collision?
10:15	2752	Location (-120, 90)

YKDT-85 **Observer: M. Reagan** **09/28/2010**

Time (hh:mm)	Depth (m)	Observation
10:16	2735	Larger blocks again
10:17	2730	Dredge looks like it has a few cm sized clasts
10:18	2696	Perhaps some planar features?; large sheets dipping into hillside at about 30 deg with maybe some fracturing patterns normal to dip slope
10:19	2668	Steep slope, cm scale conglomerates or breccia?
10:19	2662	Back into very coarse tallus
10:20	2639	Location (-90, 270)
10:21	2617	Critters growing on rocks
10:22	2578	Outcrop?; fracturing as in dikes or gabbro
10:23	2553	Large coral?; very large fan, looked soft?
10:25	2528	A lot of life here
10:25	2528	Location (-40, 460)
10:26	2529	At top of feature, all looks to be debris
10:27	2517	Subangular, subrounded tightly interlocked tallus on the dm scale
10:28	2520	White deposite in between clasts?
10:29	2544	Dropped into depression, still about 10 m from bottom
10:30	2573	Off bottom; location (0, 610)
		Video log by M. Brounce

YKDT-86 **Observer: M. Reagan** **09/28/2010**

Time (hh:mm)	Depth (m)	Observation
14:27	4058	Touch down, angular blocks, boulder-size
14:28	4053	Very platy samples
14:30	4050	Some of the boulders several m in length, not very much sediment
14:30	4053	Location (-380, -930)
14:31	4050	Very platy elongated, angular blocks, very little sediment
14:32	4042	Winding cracks, and few crevasses, otherwise all dm-sized talus deposit, very angular
14:34	4037	Some of the cobbles have light stain on their surface, fracture fill?
14:34	4030	Dm scale angular coulders, with dark surface on some
14:35	4027	Location (-370, -870)
14:36	4027	Wild guess of composition based on platiness is andesite
14:37	4020	Nice platy blocks, still similar talus
14:38	4012	Finer clasts, 1-15 cm, m-scale clasts as well
14:39	4006	Some of the blocks look they may have phenocrysts (plagioclase)
14:39	4005	Whitish clasts around
14:39	4005	Nice fresh surface with white minerals
14:40	4000	Location (-370, -840)
14:41	3997	Area with very fine material, sand to cm-scale
14:41	3992	Back in the boulders again
14:41	3989	Nice white block (white veins), hydrothermally altered?
14:42	3981	Maybe some outcrop to the right of our path
14:43	3971	Mass outcrop, with loose surfaces on them
14:44	3948	Area of fine material cm size and more, some are white on surface
14:44	3948	Back in larger blocks again
14:44	3943	Massive angular blocks with white veinig
14:45	3946	Location (-340, -88)
14:46	3932	Slope seems to be dipping right
14:46	3928	Sandy dark colored sediment?; outcrop again
14:47	3925	Now outcrop very highly fractures with sandy dark sediment at the surface
14:47		Lot of fractures filled with white material
14:47	3914	Steep outcrop, platy fractures, angular
14:48	3908	Fine-grained material, cm size in between some boulders
14:48	3908	Angular gravel
14:49	3901	Looks like massive outcrop with sediment on surface, paler color
14:49	3900	Back into talus, angular, cobble size
14:50	3894	Very little sediment
14:50	3891	Location (-330, -740)
14:50	3886	Outcrop
14:52	3869	Cobble boulder size, angular, little sediment
14:52	3864	Platy aspect not so obvious now
14:52	3860	Fish
14:53	3854	Massive fractured outcrop
14:54	3844	Little bit of sediment on top, now back in talus
14:54	3842	Nice fine grained material
14:55	3831	Location (-290, -620)
14:56	3821	Very blocky steep outcrop; sediment on surface, light colored again, more sediment that before
14:56	3809	Outrcop continues
14:56	3806	White veining, brecciation
14:57	3803	Very steep massive rocks, very angular
14:57	3784	Sandy to cm sized white colored material
14:58	3782	Surface now has mere sediment
14:58	3873	Still outcrop, some boulders, some cobbles, some rounded shapes too
14:58	3782	More sediment here
14:59	3775	massive jointed outcrop
14:59	3773	Not seen plating for a while

YKDT-86 **Observer: M. Reagan** **09/28/2010**

Time (hh:mm)	Depth (m)	Observation
15:00	3761	Outcrop with orange surface
15:00	3759	Location (-260 -550)
15:00	3753	Fish
15:01	3750	Angular to sub rounded talus blocks
15:02	3741	Big m sized boulders
15:02	3737	Coarse angular talus
15:03	3721	Lots of rocks with orange stain, sub-outcrops
15:03	3717	A few blocks look more rounded
15:04	3700	Lots of yellows rocks, altered
15:05	3694	Dropping dredge in dm scale blocks
	3964	Location (-230, -450)
15:07	3661	Massive rounded highly fractured blocks with white veins that form big
15:07	3648	Rocks looks quite orange
15:08	3644	Back in the talus, nice exposed poorly sorted sediment, dragging that surface with dredge
15:08	3644	Lots of cobble and pebble that look sub rounded
15:08	3642	Finer blocks
15:09	3645	Well sorted sub angular to sub rounded talus deposit, very different than
15:10	3636	Location (-230, -440)
15:11	3618	Very well sorted blocks, dm scale
15:12	3618	Dregde has rocks!; everybody says ooooooohhhhhhhhhhh
15:12	3614	Big rock stuck in the mouth of the dredge, probably good
15:13	3608	Dredge doing very well, keeping nose down and going through small
15:14	3605	Big rock no longer stuck in the dredge inside; or lost?
15:14	3605	Surface at least 60 % sediment
15:15	3600	Location (-160, -260)
15:15	3592	Sediment on top of large dm to m clasts, sub rounded surfaces
15:18	3575	Rounded, more sediments, bottom looked much younger
15:20	3557	Small cobble pebble shaped clasts that are very rounded, bigger ones are slightly more angular
15:20	3559	Location (-160, -150)
15:20	3557	Good place to collect small gravel size blocks
15:22	3570	Surface pretty old, cobbles quite buried under sediment
15:22	3569	More angular fragments
15:22	3566	Nice curved surface shaped, looks like pillow
15:23	3564	Very coarse talus, 20 cm to 1 m scale
15:23	3562	Lots of curved surfaces, coarse grained pillow breccia?
15:25	3559	Area with 10-100 cm cobbles; pick up a rock?
15:25	3560	Location (-120, -100)
15:26	3558	Coarse talus again, angular blocks
15:27	3552	Back in cobble sized fragments, more rounded
15:27	3549	Dredge picking up rocks!
15:28	3533	Rocks are falling off; everyone say nnnnooooooo!
15:29	3521	Very little life
15:29	3509	Cobbles and boulders, rounded to sub angular, very little Mn
15:30	3492	Location (-110, 110)
15:31	3467	Fine groundmass cobble size clasts
15:31	3454	Off bottom; location (-110, 150)
		Video log by G. Girard

YKDT-87 **Observer: M. Reagan** **09/29/2010**

Time (hh:mm)	Depth (m)	Observation
09:26	3631	YKDT on bottom; nice pillow lavas
09:29	3627	Some tallus present?
09:29	3626	Location (-1820, -1490)
09:29	3624	Nice striations on surfaces
09:31	3624	Rounded tallus
09:33	3625	Sediment in pockets and cracks, washed off of rounded surfaces
09:33	3624	What little sediment is on rounded surfaces maybe dune forms?
09:33	3624	Rounded cobbly tallus
09:35	3622	Pillow tallus with sediment
09:36	3619	Location (-1800, -1450)
09:38	3629	Cracks between pillows with white material
09:38	3629	Critter!
09:40	3628	Location (-1770, -1430)
09:42	3630	Outcrop?
09:44	3630	Wide variety of pillow shapes and sizes
09:44	3630	Most are ~50 cm scale, but large variety
09:44	3630	Critter!; brittle star
09:45	3629	Forward looking camera shows wide tallus field
09:45	3624	Location (-1700, -1380)
09:46	3620	Well sorted tallus blocks, cm scale
09:48	3630	Very round shapes (pillows)
09:48	3629	Slightly larger block size?
09:49	3630	Dredge dropped
09:49	3631	Location (-1670, -1350)
09:51	3623	Meter scale pillows, intact
09:52	3619	Pillows, intact, as before
09:53	3616	Very nice well rounded forms on pillows
09:53	3616	Solid rock, dredge has little chance of collecting
09:55	3620	Really obvious pillows
09:55	3619	Location (-1580, -1290)
09:57	3611	Steep slope
09:58	3606	Large blocks, dm to m scale
09:58	3606	Forward looking camera shows wide tallus field, pretty homogenous in
09:58	3606	Dredge hit pillow!; did it get a piece?
09:59	3593	Top of steep area, a lot of sediment; but very brief
10:00	3592	Back into pillows, very ropey surfaces
10:00	3592	Location (-1550, -1260)
10:02	3588	Small, infrequent pockets of sediment accumulation
10:03	3592	Small blocks here
10:03	3592	Very large sediment pocket
10:04	3592	Back into pillows
10:04	3588	Forward looking camera shows "edge" of something; depression?
10:05	3585	Meter to dm scale rounded/sub angular shapes here
10:05	3585	Location (-1450, -1180)
10:06	3578	Huge blocks several m sized, coarse pillow tallus
10:06	3568	Fish!
10:07	3576	Rounded shape, cm to m size; good sampling opportunity?
10:08	3584	White spots on rocks?; maybe surface growth
10:09	3587	Textbook pillow lavas
10:10	3581	Location (-1370, -1110)
10:11	3579	Larger pillows here
10:13	3579	Sea anenome
10:15	3572	Location (-1280, -1080)
10:16	3579	Dredge in sediment with lithic fragments; sample some?
10:18	3580	Moderately sedimented area with 30 cm to m sized tallus
10:19	3581	These rock shapes are more like manganese crusted sediments?
10:20	3576	Dredge pulling right through sediment

YKDT-87 **Observer: M. Reagan** **09/29/2010**

Time (hh:mm)	Depth (m)	Observation
10:20	3576	Location (-1220, -1010)
10:21	3572	Forward looking camera showing less pillows, maybe some dip slope sediment rocks?
10:25	3578	Lots of tallus, 10 to 30 cm, very rounded, pillow shapes
10:25	3579	Pillows and sediments
10:25	3579	Location (-1120, -970)
10:27	3564	Pillow tallus 10 to 20 cm scale
10:27	3564	A lot of pillows fell to make this tallus
10:29	3572	Thin sediments between pillows
10:30	3575	Location (-1030, -930)
10:30	3575	More sediments
10:31	3574	More beautiful pillows, large dm to m scale
10:34	3553	Off bottom; location (-940, -840)
		Video log by M. Brounce

YKDT-88 **Observer: M. Reagan** **09/29/2010**

Time (hh:mm)	Depth (m)	Observation
14:13	3475	YKDT on bottom
14:13	3475	Location (1110, 400)
14:20	3470	Location (1130, 450)
14:23	3472	Rounded tallus and sediment, similar to YKDT-87
14:23	3472	Smaller pillows than in YKDT-87, but still very obvious pillow structure
14:25	3468	Location (1150, 480)
14:25	3473	Still very intact pillow lavas
14:26	3476	More sediment here
14:26	3476	Fish!
14:27	3471	Pillow tallus with interspersed sediment
14:27	3466	Forward looking camera shows extensive tallus field upslope
14:28	3463	Dredge dropped
14:28	3460	Location (1170, 480)
14:28	3460	Tallus looks like individual broken up pillows
14:29	3458	Steeper slope; more tallus more sampling opportunities?
14:29	3458	More pillow tallus, 10 to 30 cm size pillow fragments, rounded
14:30	3453	Finer tallus sizes?
14:31	3447	Poorly sorted tallus, cm to 50 cm clasts
14:31	3443	Critter!
14:33	3435	Pillow tallus
14:34	3433	Brittle star
14:35	3444	Location (1220, 500)
14:36	3444	Coarser tallus
14:37	3451	Meter scaled tallus, whole pillows?; outcrop?
14:38	3454	Massive outcrop, pillowy, intact
14:39	3453	Very nice pillow forms preserved here
14:39	3458	Sediment packet
14:40	3457	Forward looking cmaera shows extensive sediment field with occasional large blocks
14:40	3457	Location (1280, 570)
14:41	3457	Back into pillow tallus, very nice pillow structures again
14:42	3454	Less pillow density so far
14:43	3445	Intact pillow lava, transitioning into breccia?
14:43	3445	Still sediment in between blocks
14:43	3440	Less sediment now, larger blocks
14:45	3427	More dm scale debris
14:45	3427	Location (1350, 680)
14:46	3407	Coarse pillow debris
14:48	3392	Cobble sized material
14:48	3385	Cobbles to boulders, max size ~40 cm
14:50	3384	Very nice pillow forms, as before
14:50	3384	Location (1400, 720)
14:51	3386	Some pillows have white material on surface; organic?; growth?
14:52	3391	More sediment here, outcrop and tallus?
14:53	3386	Nice ropey pillow shapes
14:54	3381	Poorly sorted here; tallus small, outcrop large?
14:55	3384	More sediment here
14:55	3384	Location (1470, 820)
14:57	3382	Steeper slope here
14:57	3382	Really nice pillow structures again!
14:57	3368	Finer debris in between pillow structure in outcrop?
15:00	3362	Location (1530, 860)
15:02	3351	At suggestion of M. Reagan and with agreement from Y. Ohara, dredge is terminated. Fear of losing dredge with samples inside, pillows continue extensively upslope
15:02	3351	Location (1570, 880)

YKDT-88 **Observer: M. Reagan** **09/29/2010**

Time (hh:mm)	Depth (m)	Observation
		Video log by M. Brounce

Appendix G.

Sample photos

YK10-12 6K-1229 Samples (1/4)

6K-1229-R01

6K-1229-R02

6K-1229-R03

6K-1229-R04

6K-1229-R05

6K-1229-R06

6K-1229-R07

6K-1229-R08

YK10-12 6K-1229 Samples (2/4)

6K-1229-R09

6K-1229-R10

6K-1229-R11

6K-1229-R12

6K-1229-R13a

6K-1229-R13b

6K-1229-R14

6K-1229-R15

YK10-12 6K-1229 Samples (3/4)

6K-1229-R16

6K-1229-R17

6K-1229-R18

6K-1229-R19

6K-1229-R20

6K-1229-R21

6K-1229-R22

6K-1229-unknown

YK10-12 6K-1229 Samples (4/4)

6K-1229-whole view after dive

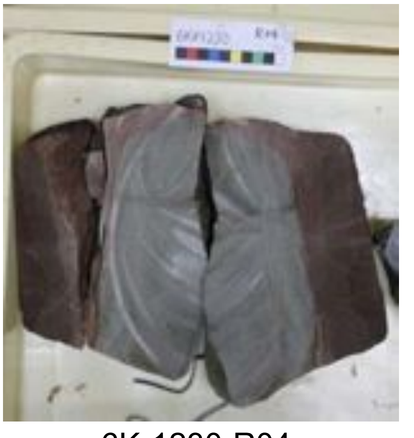
6K-1229-whole samples after cutting

YK10-12 6K-1230 Samples (1/5)


6K-1230-R01


6K-1230-R02

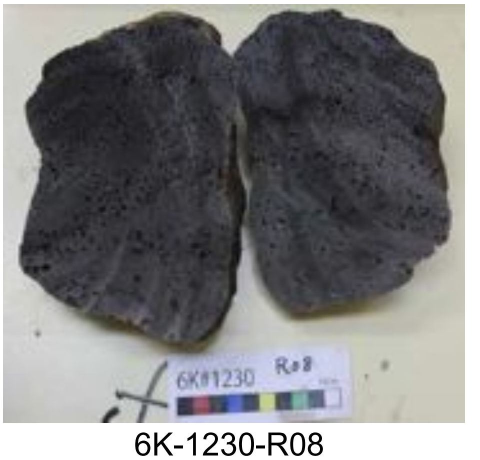
6K-1230-R03


6K-1230-R04

6K-1230-R05

6K-1230-R06

6K-1230-R07



6K-1230-R08

YK10-12 6K-1230 Samples (2/5)

6K-1230-R09

6K-1230-R10

6K-1230-R11

6K-1230-R12

6K-1230-R13

6K-1230-R14

6K-1230-R15

6K-1230-R16

YK10-12 6K-1230 Samples (3/5)

6K-1230-R17

6K-1230-R18

6K-1230-R19

6K-1230-R20

6K-1230-R21

6K-1230-R22

6K-1230-R23

6K-1230-R24

YK10-12 6K-1230 Samples (4/5)

6K-1230-R25

6K-1230-R26

6K-1230-R27

6K-1230-R28

6K-1230-R29

6K-1230-R30

6K-1230-R31

6K-1230-R32

YK10-12 6K-1230 Samples (5/5)

6K-1230-R33

6K-1230-unknown

6K-1230-whole view after dive

6K-1230-whole samples after cutting

YK10-12 6K-1231 Samples (1/4)

6K-1231-R01

6K-1231-R02

6K-1231-R03

6K-1231-R04

6K-1231-R05

6K-1231-R06

6K-1231-R07

6K-1231-R08

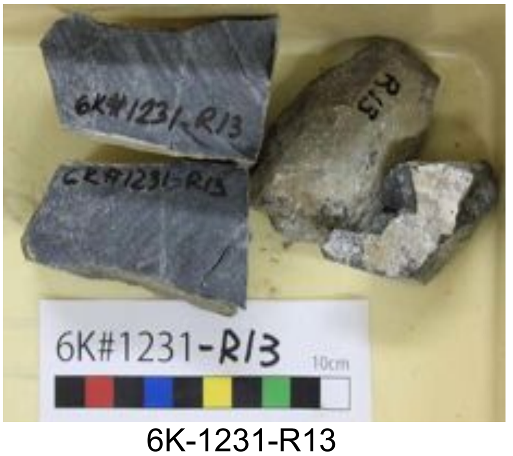
YK10-12 6K-1230 Samples (2/4)

6K-1231-R09

6K-1231-R10

6K-1231-R11

6K-1231-R12



6K-1231-R13

6K-1231-R14

6K-1231-R15

6K-1231-R16

YK10-12 6K-1230 Samples (3/4)

6K-1231-R17


6K-1231-R18 = S01

6K-1231-R19 = S02

6K-1231-R20

6K-1231-R21

6K-1231-R22

6K-1231-R23


6K-1231-R24

YK10-12 6K-1231 Samples (4/4)

6K-1231-R25

6K-1231-R26


6K-1231-R27

6K-1231-Unknown


6K-1231-whole view after dive 1


6K-1231-wholeview after dive 2


6K-1231-whole samples after cutting

YK10-12 6K-1232 Samples (1/4)

6K-1232-R01

6K-1232-R02

6K-1232-R03

6K-1232-R04

6K-1232-R05

6K-1232-R06

6K-1232-R07

6K-1232-R08

YK10-12 6K-1232 Samples (2/4)

6K-1232-R09

6K-1232-R10

6K-1232-R11

6K-1232-R12

6K-1232-R13

6K-1232-R14

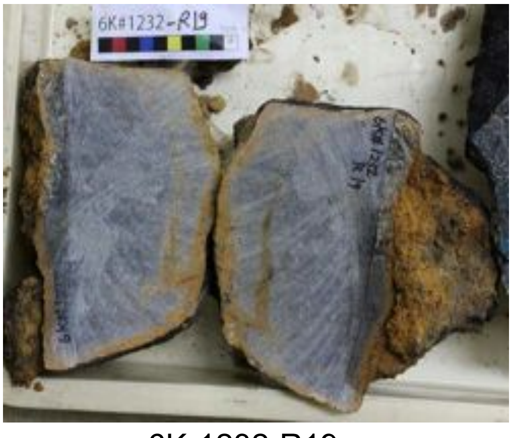
6K-1232-R15


6K-1232-R16

YK10-12 6K-1232 Samples (3/4)

6K-1232-R17

6K-1232-R18



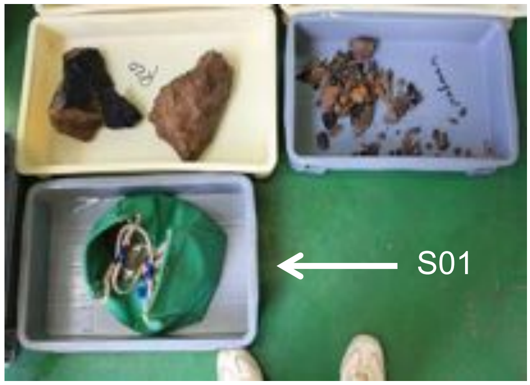
6K-1232-R19

6K-1232-R20

6K-1232-R21

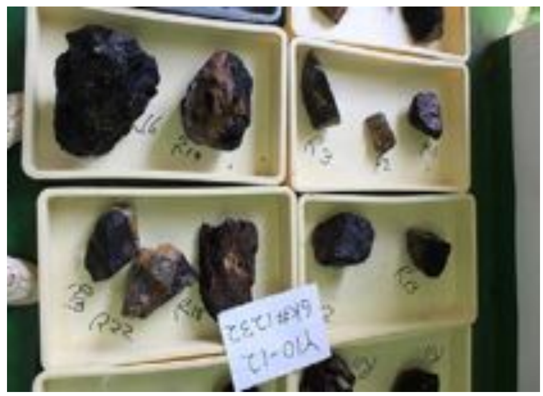
6K-1232-R22

YK10-12 6K-1232 Samples (4/4)

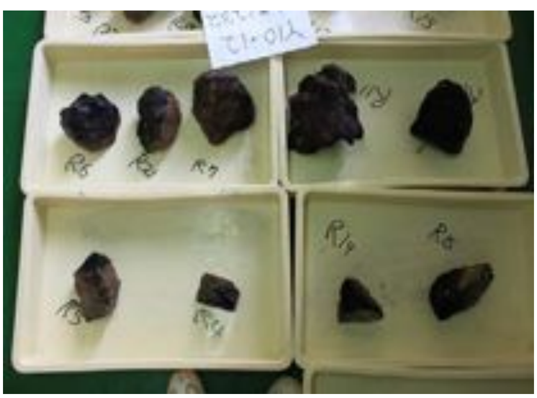


6K-1232-S01

6K-1232-whole view after dive 1



6K-1232-whole view after dive 2



6K-1232-whole view after dive 3

6K-1232-whole samples after cutting

YK10-12 6K-1233 Samples (1/4)

6K-1233-R01


6K-1233-R02

6K-1233-R03

6K-1233-R04

6K-1233-R05

6K-1233-R06

6K-1233-R07

6K-1233-R08

YK10-12 6K-1233 Samples (2/4)

6K-1233-R09

6K-1233-R10

6K-1233-R11

6K-1233-R12

6K-1233-R13

6K-1233-R14

6K-1233-R15

6K-1233-R16

YK10-12 6K-1233 Samples (3/4)

6K-1233-R17

6K-1233-R18

6K-1233-R19

6K-1233-R20

6K-1233-R21

6K-1233-R22

6K-1233-R23

6K-1233-R24

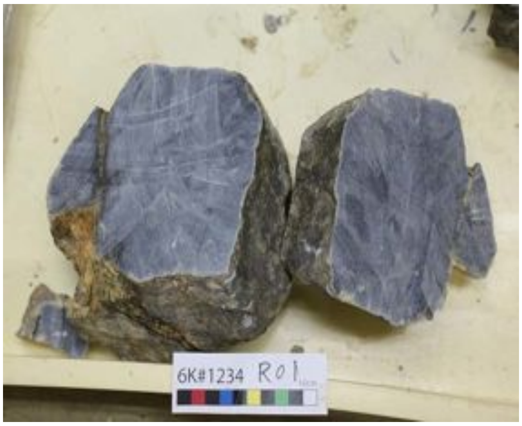
YK10-12 6K-1233 Samples (4/4)

6K-1233-R25

6K-1233-Unknown


6K-1233-whole samples after cutting

YK10-12 6K-1234 Samples (1/5)

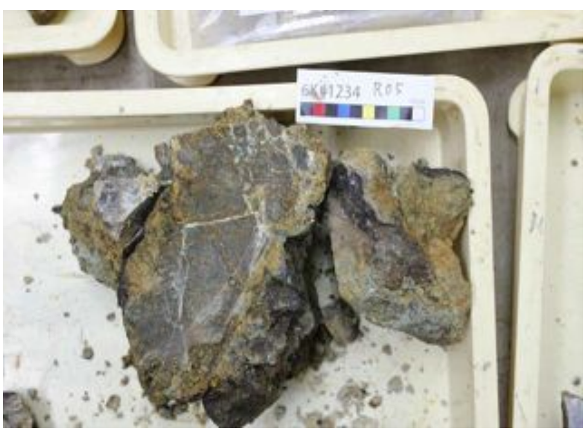


6K-1234-R01

6K-1234-R02

6K-1234-R03

6K-1234-R04



6K-1234-R05

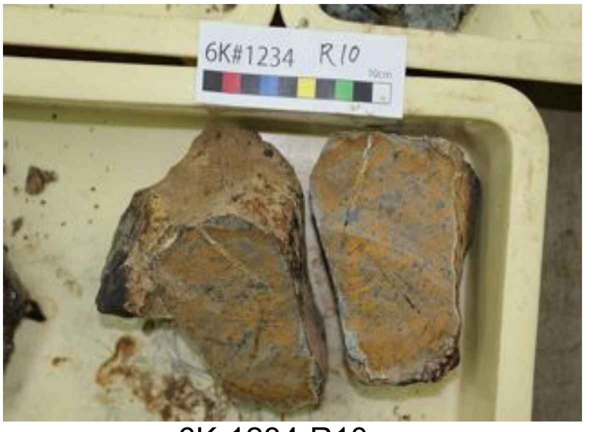
6K-1234-R06

6K-1234-R07

6K-1234-R08

YK10-12 6K-1234 Samples (2/5)

6K-1234-R09



6K-1234-R10

6K-1234-R11

6K-1234-R12

6K-1234-R13

6K-1234-R14

6K-1234-R15

6K-1234-R16

YK10-12 6K-1234 Samples (3/5)

6K-1234-R17

6K-1234-R18

6K-1234-C01

6K-1234-Unknown

YK10-12 6K-1234 Samples (4/5)

6K-1234-B01a

6K-1234-B01a close-up

Muddy sediments
(Photo missing)

6K-1234-B01b

6K-1234-B01c close-up

6K-1234-B02a

6K-1234-B02b

6K-1234-B02c

6K-1234-B02d

YK10-12 6K-1234 Samples (5/5)

Muddy sediments
（Photo missing)

6K-1234-B02e

6K-1234-B02f

6K-1234-R13: this is the view with some animals

6K-1234-Box 1 & 2

6K-1234-whole view after dive

YK10-12 6K-1235 Samples (1/4)

6K-1235-R01

6K-1235-R02


6K-1235-R03

6K-1235-R04

6K-1235-R05

6K-1235-R06

6K-1235-R07

6K-1235-R08

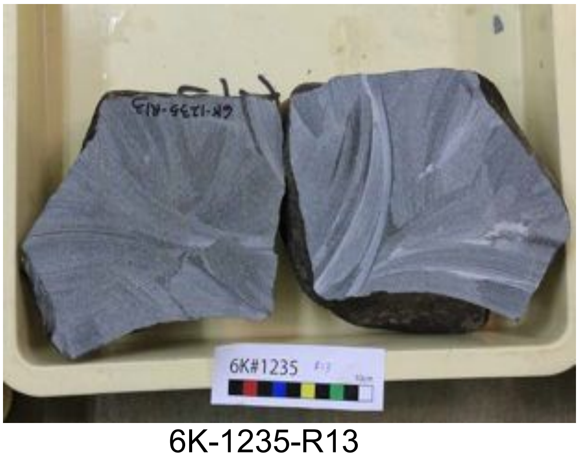
YK10-12 6K-1235 Samples (2/4)

6K-1235-R09

6K-1235-R10

6K-1235-R11

6K-1235-R12



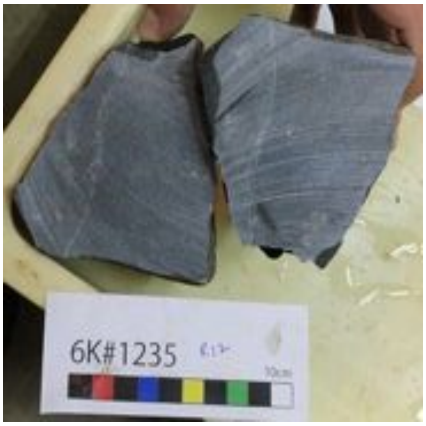
6K-1235-R13

6K-1235-R14

6K-1235-R15

6K-1235-R16

YK10-12 6K-1235 Samples (3/4)



6K-1235-R17

6K-1235-R18

6K-1235-R19

6K-1235-R20

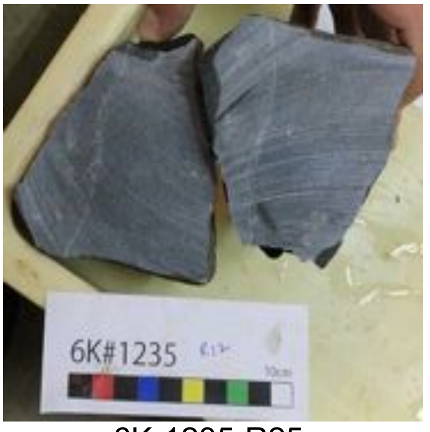
6K-1235-R21

6K-1235-R22

6K-1235-R23

6K-1235-R24

YK10-12 6K-1235 Samples (4/4)



6K-1235-R25

6K-1235-whole view 1

6K-1235-whole view 2

6K-1235-whole samples after cutting

YK10-12 6K-1236 Samples (1/4)

6K-1236-R01

6K-1236-R02

6K-1236-R03

6K-1236-R04

6K-1236-R05

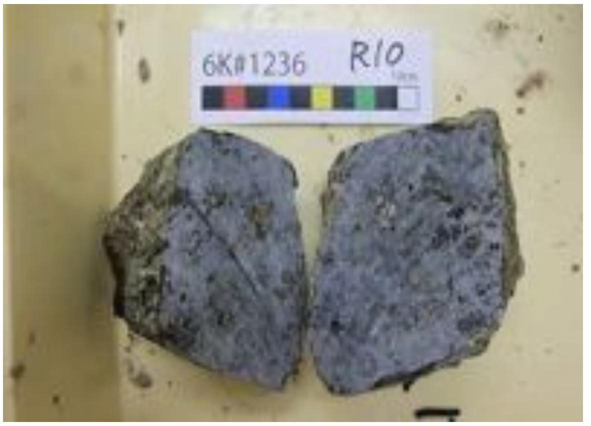
6K-1236-R06

6K-1236-R07

6K-1236-R08

YK10-12 6K-1236 Samples (2/4)

6K-1236-R09



6K-1236-R10

6K-1236-R11

6K-1236-R12

6K-1236-R13

6K-1236-R14

6K-1236-R15

6K-1236-R16

YK10-12 6K-1236 Samples (3/4)

6K-1236-R17


6K-1236-R18

6K-1236-R19

6K-1236-R20

6K-1236-R21

6K-1236-Unknown

Push core
（Photo missing）

6K-1236-C01

Push core
（Photo missing）

6K-1236-C02

YK10-12 6K-1236 Samples (4/4)

6K-1236-whole view

6K-1236-whole samples after cutting

The dive was canceled;
therefore no samples.

YK10-12 YKDT-82 Samples (1/1)

YKDT-82

YKDT-82-whole view

YK10-12 YKDT-83 Samples (1/1)

YKDT-83-R01

YKDT-83-R02

YKDT-83-R03

YKDT-83-R04

YKDT-83-R05

YKDT-83-R06

YKDT-83-R07

YKDT-83-B01

YK10-12 YKDT-84 Samples (1/1)

YKDT-84-R01

YKDT-84-R02

YKDT-84-R03

YK10-12 YKDT-85 Samples (1/2)

YKDT-85-R01

YKDT-85-R02

YKDT-85-R03

YKDT-85-R04

YKDT-85-R05

YKDT-85-R06

YKDT-85-R07

YKDT-85-R08

YK10-12 YKDT-85 Samples (2/2)

YKDT-85-R09

YKDT-85-R10

YKDT-85-R11

YKDT-85-R12

YKDT-85-R13


YKDT-85-whole samples

YKDT-85-B01

YK10-12 YKDT-86 Samples (1/9)

YKDT-86-R01

YKDT-86-R02

YKDT-86-R03

YKDT-86-R04

YKDT-86-R05

YKDT-86-R06

YKDT-86-R07

YKDT-86-R08

YK10-12 YKDT-86 Samples (2/9)

YKDT-86-R09

YKDT-86-R10

YKDT-86-R11

YKDT-86-R12

YKDT-86-R13

YKDT-86-R14

YKDT-86-R15

YKDT-86-R16

YK10-12 YKDT-86 Samples (3/9)

YKDT-86-R17

YKDT-86-R18

YKDT-86-R19

YKDT-86-R20

YKDT-86-R21

YKDT-86-R22

YKDT-86-R23

YKDT-86-R24

YK10-12 YKDT-86 Samples (4/9)

YKDT-86-R25

YKDT-86-R26

YKDT-86-R27

YKDT-86-R28

YKDT-86-R29

YKDT-86-R30

YKDT-86-R31

YKDT-86-R32

YK10-12 YKDT-86 Samples (5/9)

YKDT-86-R33

YKDT-86-R34

YKDT-86-R35

YKDT-86-R36

YKDT-86-R37

Photo missing

YKDT-86-R38

YKDT-86-R39

YKDT-86-R40

YK10-12 YKDT-86 Samples (6/9)

YKDT-86-R41

YKDT-86-R42

YKDT-86-R43

YKDT-86-R44

YKDT-86-R45

YKDT-86-R46

YKDT-86-R47

YKDT-86-R48

YK10-12 YKDT-86 Samples (7/9)

YKDT-86-R49

YKDT-86-R50

YKDT-86-R51

YKDT-86-R52

YKDT-86-R53

YKDT-86-R54

YKDT-86-R55

YKDT-86-R56

YK10-12 YKDT-86 Samples (8/9)

YKDT-86-R57

YKDT-86-R58

YKDT-86-R59

YKDT-86-R60

YKDT-86-R61

YKDT-86-R62

YKDT-86-R63

YKDT-86-R64

YK10-12 YKDT-86 Samples (9/9)

YKDT-86-whole samples

YKDT-86-whole samples after cutting

YK10-12 YKDT-87 Samples

Empty dredge

YK10-12 YKDT-88 Samples (1/1)

YKDT-88-R01

YKDT-88-R02

YKDT-88-R03

YKDT-88-R04


YKDT-86-whole samples

Appendix H.

Sample descriptions

6K-1229 (M. Reagan)		Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R01	Gabbro	0.5-1 cm	M-ph		60		10		10	20			12.3	13	6.5	2.5	L	SR		F				
R02	Tonalite	0.5-1 cm	M-ph		20		20?			40			5.8	18	17.5	24	L	A		F				
R03	Basalt-gabbro	< 1 mm	Fine		50 (gabb)	5-10 (basalt)	70 (basalt) 50 (gabb)						7.2	25	19	14	M	SA		F				
R04	Basalt	< 0.5 mm	Mottled aphyric										0.9	10	7	9	M	R		F				Very fine grained, crystals indistinguishable
R05	Volcanic conglomerate	1.5 cm	Porphyric										1.1	7	9	7.5	M	SA		F				Very altered
R06	Tuff	< 1 mm	Matrix										0.1	8	4	3	H	R		F				Very fine grained, crystals indistinguishable
R07	Gabbro	0.5 cm	M-ph		40	20	40						2.2	7.5	12	13	L	SA		F				
R08	Gabbro	0.5 cm	M-ph		20	?	?						3.3	12	15	8	L	SA		F			Yes	
R09	Harzburgite	0.25-0.5 mm	M-ph			60	40						2.1	17	10	10	M	A		F				
R10	Troctolite	0.5 cm	M-ph		10	50	30						2.2	20	7	7	L	A		F			Yes	
R11	Basalt	1 mm	Fine		< 1	10							1.6	9	12	6	L	SA		F			Yes	Very fine grained
R12	Troctolite	0.5-1 cm	M-ph		35	45	15						1.5	12.5	9	8	L	A		F				
R13a	Peridotite	0.5-1 cm	F-ph			70	30						0.3	8	6	3	M	A		F				
R13b	Troctolite	0.5-1 cm	M-ph		10	60	30						0.1	6	3.9	3.3	M	A		F				
R14	Gabbro or pyroxenite?	0.1-0.2 cm	F-ph		5	< 1	60	10					0.7	8	7	7	L	SA		F			Yes	Pyroxenite vein?
R15	Basalt	< 1 mm	Fine		< 1								0.5	7	5	5	L	A		F				
R16	Melagabbro	0.5- 1 cm	C-ph		5	15	60						10.9	22	27	10	L	A		F				No matrix
R17	Melagabbro	0.25-0.5 cm	M-ph		20		80						6.6	26	14	12.5	L	SA		F				
R18	Troctolite	0.2-0.5 cm	Porphyric		10	10							1.1	13	7	7	Fresh?	A		F				In several small pieces, friable, matrix-basalt-glass, breccia
R19	Troctolite	0.5-1 cm	Porphyric		15	80	5						0.8	7	10	8	L	A		F				
R20	Diabase	<1 mm	Fine		40	1	60						4.8	16	10	12	M to L	R		F				Alteration rim 2 cm, very fine grained
R21	Diabase	< 1 mm	Fine		40	1	60						8.6	13	9	13	M	SA		F				Alteration rim 1 cm, very fine grained
R22	Basalt	< 1 mm	Fine			Trace							2.4	10	12	6	M	SA		F				Alteration rim 1.5 cm, very fine grained

6K-1230 (J. Ribeiro)											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Plagioclase basalt		Aphyric	5.0	2.0								21.2	26	38	25	L	A		None				Glassy rind ~ 5-10 mm, fresh, 10 % vesicles, host a piece of hyaloclastite
R02	Olivine basalt		Aphyric	5.0		<1							11.5	13	19	34	L	SA		F			Yes	Glassy rind ~ 5 mm, fresh, possible olivine xenocrysts
R03	Basalt		Aphyric										7.8	22	16	14	F	A		F				Reddedned rin 2-6 cm, gray core
R04	Olivine basalt		Micro-crystallized										11.4	17	23	15	L	SA		F			Yes	~ 6 cm oxidation rim
R05	Aphyric basalt		Aphyric										2.9	20	21	5	L	A		F				Alteration rim (~ 1 cm) with zeolites in vesicles
R06	Aphyric basalt		Aphyric										0.9	8	10	8	L	SA		None				Altered, 10 % vesicles
R07	Olivine basalt		Aphyric	5.0									2.4	14	8	13	L	A		F				Glassy rind ~ 5 mm, altered olivine
R08	Vesicular basalt		Vesicular, aphyric	5.0									3.7	18	12	13	F	SA		None				Glassy rind ~ 5-10 mm, zeolites, 10 % vesicles
R09	Breccia												4.0	21	13	8	L	A		None				Hyaloclastite, basalt
R10	Basalt		Aphyric										2.4	15	23	12	L	A		F				
R11	Basalt		Aphyric	5.0									8.7	21	16	21	F	A		None				5 % vesicle, minor zeolite, glassy rim
R12	Basaltic pyroclastic												8.4	34	13	15	L to M	A		None				Vesicular clasts, well indurated
R13	Basalt		Sparsely phyric		<1								1.5	14	11	6	L to M	A		None				Alteration rim 0.5-2 cm
R14	Basalt		Sparsely phyric	3.0	<1								3.1	14	15	8	F	SA		None				2 % vesicles
R15	Basalt		Sparsely phyric										8.5	18	23	13	L	A		None				
R16	Olivine-plagioclase basalt				<1	<1							5.5	27	17	10	F	A		None				Sslight alteration, zeolites
R17	Basalt		Aphyric									Yes	0.9	19	6	12	L	A		F				Fresh
R18	Basalt		Aphyric										1.2	14	10	12	L	A		None				Slightly altered
R19	Basalt		Aphyric										8.2	26	16	21	L	A		F				Slightly altered
R20	Basalt		Aphyric										7.0	20	23	14	L	A		F				Somewhat altered
R21	Basalt		Aphyric										3.3	18	22	8	L	A		F				Fresh
R22	Olivine basalt		Aphyric			1.0							9.0	23	17	15	F	A		F				Fresh
R23	Olivine basalt		Aphyric										0.7	6	11	5	F	A		None				Fresh
R24	Basalt		Aphyric, vesicular		1.0								3.6	14	12	13	L	A		None				Fresh, 10 % vesicles
R25	Plagioclase basalt		Aphyric	5.0	10.0								5.0	25	13	15	F	A		None			Yes	Glassy rind ~ 0.5-1 cm (fresh), aligned vesicles
R26	Plagioclase basalt		Porphyritic		15.0								1.3	17	9	6	L	A		None				Fresh, 10 % vesicles
R27	Plagioclase basalt		Porphyritic		10.0								1.4	20	6	6	F	A		None				Very small glass rinds, fresh
R28	Plagioclase basalt		Porphyritic		10.0								1.0	8	10	8	L	SA		None				Little glass, vesicular, slightly altered
R29	Plagioclase basalt		Micro-porphyritic		10.0								0.8	7	15	8	L	A		None				Very small glass blebs, fresh, 2 % vesicles
R30	Plagioclase basalt		Micro-porphyritic		10.0								0.8	7	9	5	L	A		None				Small pockets of glass rinds, fresh, 5% vesicles
R31	Plagioclase basalt		Micro-porphyritic		10.0								0.5	8	8	7	L	SA		None			Yes	Glass rind ~ 1 cm, fresh

6K-1230 (J. Ribeiro)											Alteration		Sample characteristics											
Sample #	**Lithology**	**Ave. grain size**	**Igneous texture**	**Glass (mm)**	**Plag. (%)**	**Oliv. (%)**	**Cpx. (%)**	**Opx. (%)**	**Amp.(%)**	**Qtz.(%)**	**%**	**Sulfide**	**Wt (kg)**	**X (cm)**	**Y (cm)**	**Z (cm)**	**Weathering**	**Angularity**	**Surface**	**Mn (mm)**	**Deformation CP**	**Deformation BR**	**Sectioned onboard**	**Comments**
R32	Plagioclase basalt		Micro-porphyritic		10.0								0.8	12	10	8.5	L	A		F				Small glass rinds < 1 by 0.5 cm, fresh
R33	Plagioclase basalt		Micro-porphyritic		10.0								1.7	14	6	12	L	A		None				Fresh
Unknown													0.5											

6K-1231 (I. Pujana)											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Basalt	< 1 mm	Micro-crystalline										18.0	23	22	20		A		F				Fine groundmass, few alteration veins, individual crystals undistinguishable
R02	Basaltic Breccia	< 1 mm	Breccia										20.0	36	23	22		A		F				Fine groundmass including angular clasts from 2 cmm to 2 mm
R03	Basalt	< 0.5 mm	Micro-crystalline		< 5								1.8	12	9	8	L	A		None			Yes	Not FAB mineralogy
R04	Basalt	< 1 mm	Micro-crystalline		< 1								4.0	13	12	9	L	A		F				Alteration veins, metamorphism in greenschist facies or higher, individual crystals undistinguishable
R05	Boninitic breccia	1-2 mm	Clastic		30		40						2.5	26	11	7	M	A		F				Breccia, basaltic clasts in gabbro, basaltic clasts have greenschist facies
R06	Basalt	1-2 mm	Micro-crystalline		< 5								2.7	20	11	8	L	A		F			Yes	Metamorphism in greenschist facies, individual crystals undistinguishable
R07	Basalt	< 1 mm	Micro-crystalline		< 5							Yes	3.7	20	14	7	L	A		None				White surface deposit alteration veins with scarce sulfides, greenschist facies
R08	Basalt	< 1 mm	Micro-crystalline		< 5								2.0	17	12	8	L	A		None				Almost completely crystallized groundmass, greenschist facies
R09	Basalt	< 1 mm	Micro-crystalline		< 5								2.6	21	11	7	L	A		None				Abundant alteration veins (white), greenschist facies
R10	Basalt	< 1 mm	Micro-crystalline		< 5								5.0	20	15	14	M	A		None				Some alteration veins, greenschist facies
R11	Pyroxenite	1-2 mm	Crystalline				> 60						4.7	20	12	12	F	A		None				
R12	Pyroxenite	1-2 mm	Crystalline				> 60						2.1	17	10	8	L	A		None				Some white surface deposit
R13	Basalt	2 mm	Porphyric		20		30						0.7	10	7	4	M	A		None				Greenschist facies, white surface deposit, individual plagioclase needles in groundmass visible
R14	Basalt	1 mm											8,9	23	23	14	M	A		None				White surface deposit, no phenocrysts visible
R15	Metagabbro	1-2 mm											13.0	29	14	15	M	A		None				White surface deposit, no phenocrysts visible
R16	Boninite	< 1 mm	Micro-crystalline		< 5		< 5					Yes	2.8	13	14	12	L	A		None				Wwhite surface deposit, pyroxenes rimmed by sulfides (pyrite?)
R17	Metagabbro		Porphyric		20		20						3.2	15	15	10	M	A		None				Alteration vein, greenschist facies, groundmass nucleation organized around large crystals
R18	N/A																							R18 and R19 numbers missing, original sample names changed for S01and S02 (scoop)
R19	N/A																							R18 and R19 numbers missing, original sample names changed for S01and S02 (scoop)
R20	Diabase	~ 1 mm	Micro-crystalline		30		30						6.1	25	10	20	L	SA		None				Serpentine surface and white surface deposit, greenschist facies
R21	Basalt												16.0	27	22	19	M	A		None				Abundant alteration veins, white surface deposit
R22	Basalt	< 1 mm	Aphyric										9.1	25	24	11	M	A		None				Fine grained groundmass, no phenocrysts observed, some alteration veins
R23	Microgabbro	2 mm	Crystalline		30		70						5.9	25	15	12	M	A		None				White surface deposit
R24	Pyroxenite	2 mm	Crystalline				> 70						7.9	22	18	12	L	A		None				Some alteration veins, white surface deposit

6K-1231 (I. Pujana)											Alteration		Sample characteristics											
Sample #	**Lithology**	**Ave. grain size**	**Igneous texture**	**Glass (mm)**	**Plag. (%)**	**Oliv. (%)**	**Cpx. (%)**	**Opx. (%)**	**Amp.(%)**	**Qtz.(%)**	**%**	**Sulfide**	**Wt (kg)**	**X (cm)**	**Y (cm)**	**Z (cm)**	**Weathering**	**Angularity**	**Surface**	**Mn (mm)**	**Deformation CP**	**Deformation BR**	**Sectioned onboard**	**Comments**
R25	Boninite	1-2 mm	Porphyric		40	30	10						1.5	12	12	8	M	R		1-2 mm			Yes	
R26	Boninite	~ 1 mm	Phyric		?	10	5						3.8	21	16	12	M	SA		F				Pervasive alteration, but fresh pyroxene (light green)
R27	Basalt												13.5	22	21	20	M	A		F				
S01 (R18)													4.2											Scooped gravel-sized pieces, max 5 x 5 x 5 cm, basalt in greenschist facies?
S02 (R19)													2.8											Scooped gravel-sized pieces, max 5 x 5 x 5 cm, basalt in greenschist facies?
Unknown													1.2											

6K-1232 (K. Michibayashi)		Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R01	Dunite		Coarse granular										21.0	13	10	8		A						Fresh, cleavable olivine?
R02	Harzburgite		Coarse granular										0.6	12	6	6		SA						
R03	Dunite with plagioclase		Coarse granular										3.6	23	13	9		A						Fresh, antigorite
R04	Harzburgite		Porphyroclastic?										0.6	12	7	6		A						Weathered, opx survived, orange-colored
R05	Harzburgite		Porphyroclastic										2.1	15	10	8		A						Weathered, rounded opx, weak serpentine foliation
R06	Dunite		Coarse granular?										2.6	14	13	10		A						Heaviliy weathered, serpentine foliation
R07	Garnet-amphibolite		Coarse granular										5.2	17	15	10		SR					Yes	Garnet + amphibole? + plagioclase, size > 65 mm,
R08	Dunite		Not identified										0.5	9	8	5		A						Heavily altered, texture not indentifiable, several rounded spinel
R09	Harzburgite		Porphyroclastic										0.6	14	5	5		SA						Heavily altered, rounded opx
R10	Dunite		Foliated?										4.5	20	16	15		SA						Altered, olivine seems to be fine grained and foliated, a few opx
R11	Harzburgite		Foliated?										5.4	22	19	10		A						Altered, olivine survived, opx rounded, serpentine mesh texture
R12	Harzburgite		Coarse granular										3.5	20	16	11		SA						Altered, many opx
R13	Amphibolite		Coarse, foliated										3.0	15	12	12		A						Ampibole + plagioclase, foliated, coarse banding
R14	Harzburgite		Foliated										1.0	15	10	9		A						Altered, a few opx and one cpx visible, deformed?
R15	Harzburgite		Foliated?										2.1	20	9	7		A						Many small opx grains, elongated?, spinel is also elongated
R16	Amphibolite		Coarse foliated										16.5	29	25	17		A						A few centimeters-width fine grained layer in the coarse foliated part, one garnet grain in the corase part
R17	Harzburgite		Porphyroclastic										3.7	18	13	12		SR						Relatively fresh, opx rounded, relatively opx-rich
R18	Mud		Graded sorting										3.3	28	15	8		A						Spinel-rich layer occurred in the muddy rock
R19	Harzburgite		Foliated, mylonitic?										11.7	26	19	17		A						Fresh, cpx confirmed, probably deformed to develop foliations
R20	Mud												6.8	25	27	12		A						Spinel included, tmassive tuff?
R21	Troctlite (Dunite + plagioclase)		Coarse granular										1.9	15	12	9		A						Altered, impregnated plagioclase
R22	Harzburgite		Coarse rounded										4.5	22	12	13		A						Altered, many rounded opx and plagioclase
S01	Muddy sand with many pebbles												1.3											Muddy sand. Full of aciculan crystals - Lithic sand grains. No fossils!

6K-1233 (Y. Ohara)											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Muddy rock												2.2	24	15	16								Many spinel grains
R02	Muddy rock												2.7	25	17	13								Many spinel grains
R03	Harzburgite		Coarse granular										1.2	14	9	7								Many opx, fertile, very fresh
R04	Harzburgite		Porphyroclasitc?										5.0	16	16	16								Opx rounded, very fresh
R05	Harzburgite		Coarse granular										0.8	9	7	5								Many opx, fertile?, opx may have two types: rounded and interstitial
R06	Harzburgite, or pyroxenite?		Coarse granular										7.0	25	18	12							Yes	Many opx, fertile, very fresh
R07	Dunite		Foliated?										1.3	14	13	7								Large rounded spinel, plagioclase?, foliation?, heavily weathered
R08	Harzburgite		Foliated										4.0	23	18	11								Weathered, olivine not identified, many opx, one small piece of cpx identified, thin opx dyke is sheared
R09	Muddy rock												0.4	10	7	5								A few spinel grains
R10	Muddy rock												0.7	14	8	7								Fine-grained spinel
R11	Muddy rock												0.4	10	10	8								No spinel
R12	Harzburgite		Coarse granular										10.3	27	19	16								Many opx, fertile?, very fresh
R13	Harzburgite		Foliated										5.2	20	14	13								Many opx, clearly foliated, very fresh
R14	Muddy rock												0.1	5	3	2								
R15	Muddy rock												0.1	10	7	7								
R16	Muddy rock												0.5	13	11	5								
R17	Muddy rock												0.5	17	13	10								
R18	Muddy rock												2.9	31	23	6								
R19	Muddy rock												1.6	16	13	9								
R20	Harzburgite		Coarse granular										11.4	20	18	15								Many opx > 5 mm, foliation, very fresh
R21	Harzburgite		Coarse granular										6.2	24	18	16								Many opx > 5 mm, fertile, spinel aligned
R22	Harzburgite		Foliated										2.2	16	12	12								Spinel forms foliations, grain size reduction, moderately fresh
R23	Harzburgite		Foliated coarse granular										6.5	24	15	15								Many opx, fertile, spinel elongated, foliation can be identified, fresh
R24	Muddy rock												2.4	27	11	10								Some spinel
R25	Muddy rock												4.2	29	20	8								
Unknown													0.8											Mixed pieces from sample baskets

6K-1234 (T. Ishii)											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Serpentinite		Foliated										10.0	24	25	18							Yes	Serpentine mylonite?, serpentine could be antigorite
R02	Carbonate rock												5.2	44	24	6								
R03	Muddy Rock												1.8	18	13	6							Yes	Lithic fragments included. Note by YO on May 25, 2011: based on photograph, this could be serpentinite, not a muddy rock; thin section obervation also suggests serpentinite.
R04	Serpentinized harzburgite												17.5	38	18	22								Intensely serpentinized, opx is now bastite, fault breccia, tiny spinel grains, many cracks and fractures with carbonate infills that show fiber texture
R05	Altered harzburgite												9.6	24	27	15								Serpentinized before weathering?, may be dunite., some spinel
R06	Serpentinized harzburgite												2.1	14	16	9								Granular texture was replaced by serpentine foliation, thin cracks with carbonate infills.
R07	Alternate rock between gabbro and serpentinite												1.5	15	12	5							Yes	Dark part: serpentine, light part: gabbro? Note by YO on May 25, 2011: based on photograph, this could be serpentinite, not includes gabbro.
R08	Lherzolite		Foliated										1.5	22	18	7								A visible CPX grain among many OPX grains, foliated, possiby this rock is very fertile.
R09	Muddy Rock												9	30	22	14								Looks like just a muddy rock. However, it could be heavily weathered dunitic rock. Many spinel grains.
R10	Dunite												2.8	21	12	14								Weathered, scattered spinel grains, may be cumulate in mantle transition zone.
R11	Gabbro		Equigranular										1.4	16	14	6							Yes	Fresh, amphibole?
R12	Basalt in brrecia												5.5	21	18	17							Yes	Diabase, plagioclase phenocryt. Note by YO on May 30, 2011: based on thin section obervation, this could be altered gabbro.
R13	Muddy Rock												3.5	22	12	16								
R14	Pyroxenite		Coarse granular										0.3	6	5	4								Many tremolites that are clearly secondary origin
R15	Dunite with tremolite												0.8	12	9	5								Heavily serpentinized and weathered, many tremolite
R16	Pyroxenite with tremolite												2.5	24	11	7								Pyroxene layer alternated with dunitic (wehrlite?) part, tremolite
R17	Pyroxenite with tremolite		Coarse granular										1.7	11	6	10								Cumulate?, very coarse
R18	Harzburgite												0.4	8	5	6								Heavily serpeninized
B01a	*Calyptogena* clams												0.2											Broken *Calyptogena* clams
B01b	Sediments												0.1											Muddy sediments associated with *Calyptogena* clanms
B01c	Snail																							
B02a	*Calyptogena* clams												0.4											A large *Calptogena* clam in good shape
B02b	*Calyptogena* clams												0.5											*Calyptogena* clams in good shape
B02c	*Calyptogena* clams												0.5											*Calyptogena* clams in ok shape
B02d	*Calyptogena* clams												0.2											*Calyptogena* clams in ok shape
B02e	Sediments												0.5											Muddy sediments associated with *Calyptogena* clanms
B02f	Worm												0.2											
C01	Sediment																							Push core sample
Unknown													0.8											Mixed pieces from sample baskets

6K-1235 (G. Girard)		Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R1	Microgabbro	< 1-2 mm	Microcrystalline		65	10	25				No		0.7	13	7	4.5	F	A		F				
R2	Diabase, or microgabbro?	< 1 mm	Microcrystalline		40	15	35				No		0.9	10	13	5	F	A		No			Yes	Some larger (1-2 mm) plagioclase phenocrysts
R3	Microgabbro	~ 1 mm	Microcrystalline		50	20	30				No		> 20	35	28	18	F	A		No			Yes	1 cm-large lighter-colored pl-rich vein (enclave?) observed
R4	Microgabbro	~ 2 mm	Microcrystalline		40	10	40				No		0.8	15	9	5	F	A		No				
R5	Microgabbro	~ 2 mm	Microcrystalline		65	5	30				No		1.8	22	24	10	F	A		No				Coarser grained and lighter coored than R04
R6	Microgabbro	1-2 mm	Microcrystalline		55	10	35				No		1.3	13.5	13	5	F	A		No				
R7	Microgabbro	1-2 mm	Microcrystalline		50	15	35				No		4.0	14	10	12	F	A		No			Yes	Heterogeneous rock, mingled: --type 1 enclaves: rounded, 1-3 cm, 30-40 % rock surface, light gray, pl > cpx+ol, no visible reaction rim. --type 2 enclaves: angular, 1 x 5 cm, pl, cpx, large ol, 1 mm dark glassy reaction rim in matrix, < 10 % rock. --dark glassy areas (reaction rims + thin veins through the matrix): basalt (melting textures?)
R8	Basalt, or microgabbro?	< 1 mm	Aphyric with microcrystalline enclaves		Aphyric						No		3.5	11	12	7	F	A		F			Yes	Mingled with microgabbro, microcrystalline elongated enclaves (1 x 10 cm), dark thin aphyric reaction rims in matrix
R9	Microgabbro	1-2 mm	Microcrystalline		40	20	40				No		4.5	23	15	11	F	SA		F			Yes	Mingling of two microgabbros: elongated enclaves, 1 x 5 cm, similar apparent mineralogy as matrix but different color (gray vs green-ish matrix), probably more pl, ~ 20 % rock surface, no clear reaction rim
R10	Microgabbro	2 mm	Microcrystalline		40	20	40				No		4.6	20	12	7	F	SR		No				
R11	Basalt	< 1 mm	Aphyric with groundmass			< 1					Rind		13.0	28	15	10	M	A		No				Alteration rind 0.5-3 cm, small (< 1cm) diamond-shaped (with tail-shaped ends) pale gray microcrystalline pl-px-rich enclaves (diabase?)
R12	Olivine basalt	1-2 mm	Vesicular with groundmass		10	5					Yes		3.0	18	16	9.5	L	SR		No			Yes	
R13	Microgabbro	< 1-3 mm	Porphyric		45	15	40				No		10.5	16	12	16	F	A		No				Heterogeneous grain size
R14	Microgabbro	1-2 mm	Microcrystalline		50	15	35				No		2.1	17	13	8	F	SA		No				
R15	Microgabbro	1-2 mm	Porphyric		40	20	40				No		3.2	21	13	12	F	SA		No				Some larger crystals (2-3 mm) stand out
R16	Microgabbro	1 mm	Microcrystalline		60	30	10				No	Yes	7.4	26	16	14	F	A		F				Sulfides observed
R17	Microgabbro	1 mm	Microcrystalline		50	10	40				No		2.6	25	6	10	F	A		F				Mingling textures: a few paler colored enclaves (< 0.5 cm)
R18	Basalt	< 1 mm	Microporphyritic		3	3					No		1.5	14	9	4	F	A		F			Yes	Mingled with microgabbro: ~ 20 % rock surface, microcrystalline with pl > px, large pl seem to be crossing the enclave/matrix contact
R19	Plagioclase basalt	~ 1 mm	Aphyric/sparsely phyric		10	< 1	3				No		1.5	15	13	9	F	SA		F				Banded basalt: pl-rich bands alternate with aphyric bands, bands 2-5 cm large

6K-1235 (G. Girard)		Ave. grain size	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R20	Microgabbro	1 mm	Microcrystalline		40	30	30				No		5.3	18	12	8	F	A		F				
R21	Microgabbro	1 mm	Microcrystalline		60	< 1	40				Yes		1.2	10	14	5	F	SR		F				
R22	Microgabbro	1 mm	Microcrystalline		40	35	25				No	Yes	0.5	8	11	3	F	A		F				
R23	Basalt	< 1 mm	Aphyric with groundmass								No		4.1	18	10	9	F	A		F				One small (0.5 x 3 cm) vein-shaped microgabbro area (enclave?)
R24	Microgabbro	1 mm	Microcrystalline		45	30	25				No		3.8	20	17	11	F	A		F				Mingling between two microgabbro magmas of similar mineralogy: green-colored matrix and gray-colored enclaves (~ 30 % of rock surface), no apparent reaction rims, very similar texture to R09
R25	Microgabbro	1 mm	Microcrystalline		40	20	40				No		3.5	22	14	15	F	A		F				Mingling textures similar to R24, with gray enclaves more abundant (nearly 50 % of rock surface)

6K-1236 (M. Brounce)											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Boninitic rock (?)	1.0	Porphyric	15.0		10.0							9.0	25	20	19	L	SA		N			Yes	Vesicles filled with zeolite
R02	Boninitic rock (?)	1.0	Porphyric	20.0	5.0	10.0	10.0						2.5	20	13	10	L-M	SA		1				Glass maybe slightly altered?
R03	Boninitic rock (?)	2.0	Porphyric		5.0								1.5	10	12	9	M	SA		1				
R04	Boninitic rock (?)	3.0	Porphyric		5.0	5.0							1.4	13	11	8	F	A		< 1				
R05	Boninitic rock (?)	< 1	Porphyric	10.0	5.0	10.0							0.9	11	9	7	M	SA		< 1			Yes	
R06	Boninitic rock (?)	1.0	Porphyric		15.0	45.0							1	15	18	8	M-H	SA		< 1				
R07	Boninitic rock (?)	< 1	Porphyric		5.0	5.0							3	18	14	9	F	A		< 1				
R08	Boninitic rock (?)	< 1	Porphyric		5.0	5.0							2.2	16	12	9	L	A		N				Medium grained rim with altered clasts
R09	Sedimentary	2.0											0.9	15	12	6	H	R		N				Moderately lithified sediment, very altered
R10	Gabbro	3.0	Phaneritic			5.0	40.0			40.0		5.0	1.6	13	10	8	F	SA		N				
R11	Gabbro	1.0	Phaneritic		20.0	5.0	40.0			30.0		1.0	2.2	39	14	15	L	SR		1			Yes	
R12	Gabbro	1.0	Phaneritic		30.0	5.0	40.0			20.0		1.0	2.2	20	13	12	M	A		< 1				
R13	Mylonite	-	Fine										2.5	16	14	8	F	SA		< 1				Veins of quartz (?), folaition present
R14	Granite + basalt (?), or micro-tonalite?	2.0	Phaneritic + porphyric		15.0	5.0	20.0			50.0			7.8	23	17	16	F	SA		< 1			Yes	Mineral assemblage refers to granite; basalt (?) is aphyric with vesicles ~2-3 mm filled with zeolite
R15	Sedimentary	4.0											1.5	17	11	9	L	A		< 1				Volcanic conglomerate with basaltic glass, quartz, possible boninite and sediment clasts
R16	Gabbro	1.0	Phaneritic			10.0	40.0			50.0			1	12	9	8	L	A		< 1				Grain size gradation from ~1 cm to ~2 cm visible in hand sample
R17	Boninitic rock (?)	< 1	Porphyric		10.0	20.0	5.0						1.3	12	9	9	M-H	SA		< 1			Yes	Vesicles filled with zeolite
R18	Mud rock												5.1	30	20	14	H	SA		< 1				Mud with thin Mn coating
R19	Sedimentary	3.0											0.5	11	7	6	L	SA		< 1				Volcanic conglomerate with pumice, quartz, basaltic glass and possible boninite clasts
R20	Sedimentary	3.0											1.5	15	13	9	L	SA		< 1				Volcanic conglomerate with pumice, quartz, basaltic glass and possible boninite clasts
R21	Sedimentary	3.0											1.2	15	14	7	L	SA		< 1				Volcanic conglomerate with pumice, quartz, basaltic glass and possible boninite clasts
C01	Sediment																							Push core sample
C02	Sediment																							Push core sample

YKDT-81		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
N/A																								The dive was canceled; therefore no samples.

YKDT-82		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics											Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
N/A	Mud rock												0.15											Only small amouunt of mud rocks were recovered, not described.

YKDT-83		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R01	Mud rock																							
R02	Mud rock																							
R03	Mud rock																							
R04	Scoria?																							
R05	Mud rock																							
R06	Scoria + mud rock?																							
R07	Mud rock																							All samples other than the above
B01	Biological samples																							Four small shells

YKDT-84											Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Basalt		Aphanitic vesilcular											2	1	1								
R02	Basalt		Aphanitic vesilcular											2	2	1								
R03	Basalt																							All samples other than the above

YKDT-85												Alteration		Sample characteristics											
Sample #	Lithology	Ave. grain size (mm)	Igneous texture	Glass (mm)	vesicles (%)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR	Sectioned onboard	Comments
R01	Ol-Pl-basalt	1 mm	Micro-porphyritic		1.0	5	< 1											F			F				
R02	Pl-basalt	1 mm	Micro-porphyritic		1.0	3												F			F				Slightly altered
R03	Pl-basalt	2 mm	Micro-crystalline		< 1	20	5											SA			F				Iddingsitized olivine
R04	Pl-basalt	1 mm	Micro-porphyritic		< 1	5	< 1											F			F				
R05	Pl-basalt	1 mm	Micro-porphyritic		10.0	3	< 1											F			F				
R06	Pl-basalt	1 mm	Micro-porphyritic		1.0	5	< 1											F			F				
R07	Pl-basalt	1 mm	Micro-porphyritic	2 mm	< 1	3												F			F				
R08	Pl-basalt	1 mm	Micro-porphyritic		< 1	3	< 1											F			F				
R09	Pl-basalt	1 mm	Micro-porphyritic		< 1	2												F			F				
R10	Pl-basalt	1 mm	Micro-porphyritic		2.0	1												F			F				
R11	Pl-basalt	1 mm	Micro-porphyritic		< 1	3												F			F				
R12	Basalt	1 mm	Micro-porphyritic		5.0	3	< 1											F			F				Richer in vesicles in the groundmass
R13	Mud rock?																								
B01	Biological sample																								

YKDT-86		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics								Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	Length (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R01	Basalt	< 1	Porphyric vesicular		5.0	3.0								5-10								
R02	Basalt	< 2	Porphyric vesicular		10.0	1.0								5-10								Glassy rind
R03	Basalt	< 1	Porphyric vesicular		10.0									5-10								Banded more or less vesicualr groundmass, coarsely vesicular
R04	Basalt	< 1	Porphyric vesicular		5.0									5-10								Coarse pl-rich groundmass
R05	Basalt	< 1	Porphyric vesicular		20.0									5-10								Coarse pl-rich groundmass
R06	Basalt	< 2	Porphyric vesicular		5.0									5-10								Fine and coarse vesicles
R07	Basalt	< 2	Porphyric vesicular		10.0									5-10								Glassy rind
R08	Basalt	< 1	Porphyric vesicular		10.0									5-10								Coarsely vesicular
R09	Breccia													5-10								Clasts of basalt < 6 cm
R10	Basalt	< 1	Porphyric vesicular		20.0	< 1								5-10								Patchy variations in vesicularity
R11	Basalt	< 1	Porphyric vesicular		15.0	< 1								5-10								Fine and coarse vesicles, melt sgregations into vesicles
R12	Basalt	< 1	Porphyric vesicular		5.0									5-10								Coarse pl-rich groundmass, fine and coarse vesicles
R13	Basalt	< 1	aphyr. vesicular											5-10								Coarse pl-rich groundmass, fine and coarse vesicles
R14	Basalt	< 1	Porphyric vesicular		20.0	2.0								5-10								Segregation vesicles
R15	Basalt	< 1	Porphyric vesicular		5.0	1.0								5-10								Pl-rich groundmass
R16	Basalt	< 1	Porphyric vesicular		10.0	< 1								5-10								Coarse pl-rich groundmass, fine and coarse vesicles
R17	Basalt	< 1	Porphyric vesicular		5.0									4-7								Mingled fine and coarse-grained pl-rich groundmasses
R18	Basalt	< 1	Porphyric vesicular		2.0									4-7								
R19	Basalt	< 1	Porphyric vesicular											4-7								Mingled fine and coarse-grained pl-rich groundmasses
R20	Basalt	< 1	Porphyric vesicular		10.0									4-7								Glassy pillow rind, segregation vesicles
R21	Basalt	< 1	Porphyric vesicular		10.0									4-7								Glassy pillow rind, segregation vesicles
R22	Basalt	< 1	Porphyric vesicular		10.0									4-7								Pl-rich groundmass
R23	Basalt	< 1	Porphyric vesicular		2.0	1.0								4-7								Large vesicles

YKDT-86											Alteration		Sample characteristics									
Sample #	**Lithology**	**Ave. grain size (mm)**	**Igneous texture**	**Glass (mm)**	**Plag. (%)**	**Oliv. (%)**	**Cpx. (%)**	**Opx. (%)**	**Amp.(%)**	**Qtz.(%)**	**%**	**Sulfide**	**Wt (kg)**	**Length (cm)**	**Weathering**	**Angularity**	**Surface**	**Mn (mm)**	**Deformation CP**	**Deformation BR**	**Sectioned onboard**	**Comments**
R24	Basalt	< 1	Aphyric vesicular											4-7								Basalt breccia rind
R25	Basalt	< 1	Porphyric vesicular		20.0									4-7								Siliceous sediment rind, mingled fine-coarse groundmass
R26	Basalt	< 1	Porphyric vesicular											4-7								Pl-rich groundmass
R27	Basalt	< 1	Porphyric vesicular		1.0									4-7								Segregation vesiclee, pl-rich groundmass
R28	Basalt	< 1	Porphyric vesicular		20.0									4-7								
R29	Basalt	< 1	Porphyric vesicular		15.0	1.0								4-7								Mingled fine-coasrse groundmass
R30	Basalt	< 1	Porphyric vesicular		5.0	1.0								4-7								Segregation vesicles
R31	Basalt	< 1	Porphyric vesicular		5.0	1.0								4-7								Coarse vesicles
R32	Basalt	< 1	Porphyric vesicular		15.0									4-7								Highly altered, vesicles filled with pale minerals
R33	Basalt	< 1	Porphyric vesicular		25.0	3.0								4-7								Light-colored groundmass, irregular vesicles, andesite?
R34	Basalt	< 1	End of detailed descriptions											2-4								Mingled fine-coasrse groundmass
R35	Basalt	< 1												2-4								Altered
R36	Basalt	< 1												2-4								Altered
R37	Basalt	< 1												2-4								
R38	Basalt	< 1												2-4								
R39	Basalt	< 1												2-4								
R40	Basalt	< 1												2-4								Altered
R41	Basalt	< 1												2-4								
R42	Basalt	< 1												2-4								
R43	Basalt	< 1												2-4								
R44	Basalt	< 1												2-4								
R45	Basalt	< 1												2-4								
R46	Basalt	< 1												2-4								
R47	Basalt	< 1												2-4								
R48	Basalt	< 1												2-4								
R49	Basalt	< 1												2-4								Glassy rind
R50	Basalt	< 1												2-4								
R51	Basalt	< 1												2-4								
R52	Basalt	< 1												2-4								
R53	Basalt	< 1												2-4								
R54	Basalt	< 1												2-4								
R55	Basalt	< 1												2-4								
R56	Basalt	< 1												2-4								Glassy rind
R57	Basalt	< 1												2-4								
R58	Basalt	< 1												2-4								
R59	Basalt	< 1												2-4								

YKDT-86		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics								Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	Length (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R60	Basalt	< 1												2-4								
R61	Basalt	< 1												2-4								Altered
R62	Basalt	< 1												2-4								
R63	Basalt	< 1												2-4								
R64	Basalt	< 1												2-4								

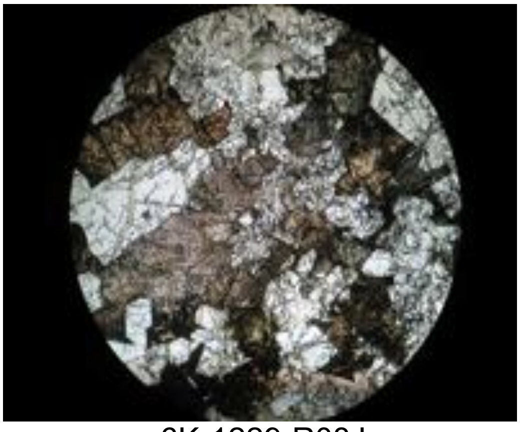
YKDT-87		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
N/A																								Empty dredge

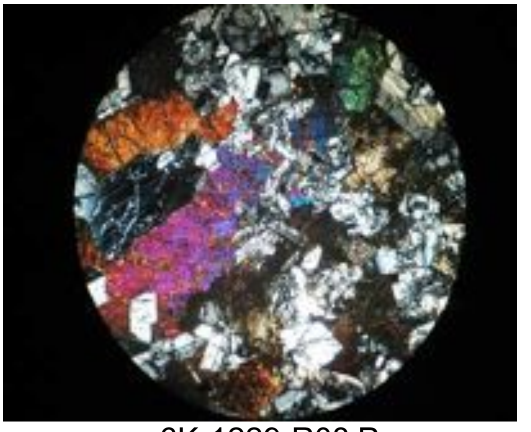
YKDT-88		Ave. grain size (mm)	Igneous texture	Glass (mm)	Plag. (%)	Oliv. (%)	Cpx. (%)	Opx. (%)	Amp.(%)	Qtz.(%)	Alteration		Sample characteristics										Sectioned onboard	Comments
Sample #	Lithology										%	Sulfide	Wt (kg)	X (cm)	Y (cm)	Z (cm)	Weathering	Angularity	Surface	Mn (mm)	Deformation CP	Deformation BR		
R01	Boninite	2	Porphyric vesicular			3.0	5.0							9	5	4								Glassy rind
R02	Boninite	2	Porphyric vesicular			3.0	5.0							20	10	5								
R03	Boninite	2	Porphyric vesicular			3.0	5.0							2	2	0.5								
R04	Muddy rock																							

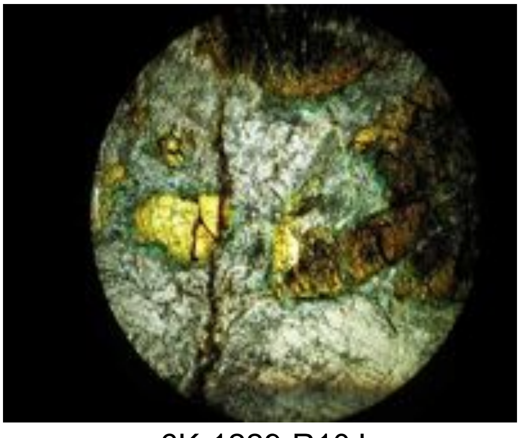
Appendix I.

Thin section photos

YK10-12 Thin sections (1/8)


6K-1229-R08 L


6K-1229-R08 P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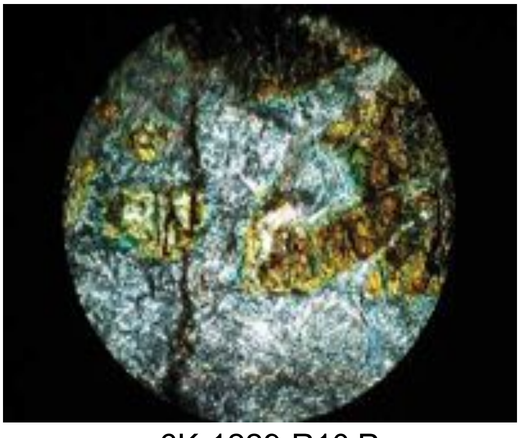
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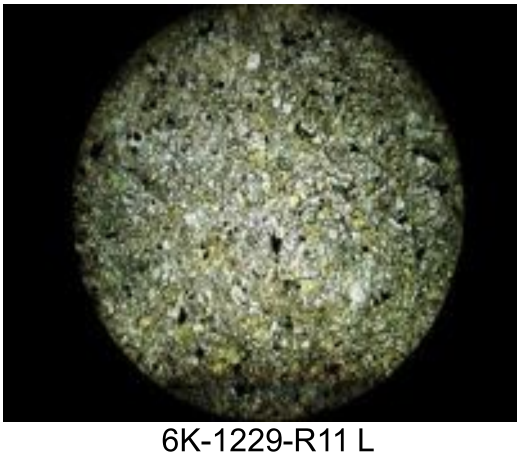
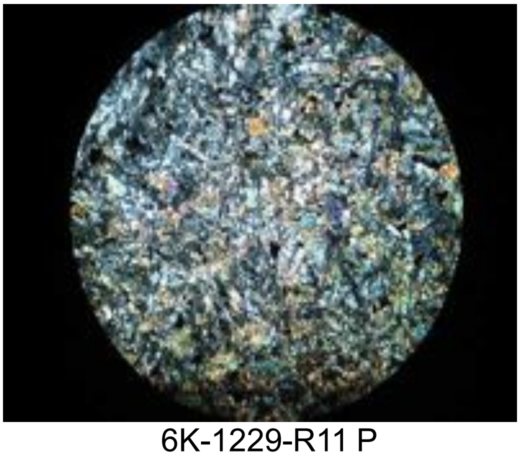
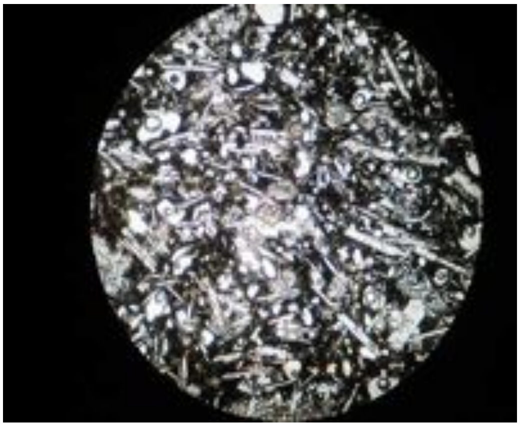

6K-1229-R11 L

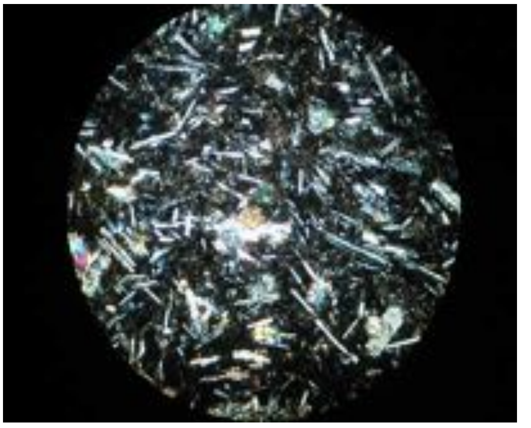

6K-1229-R11 P

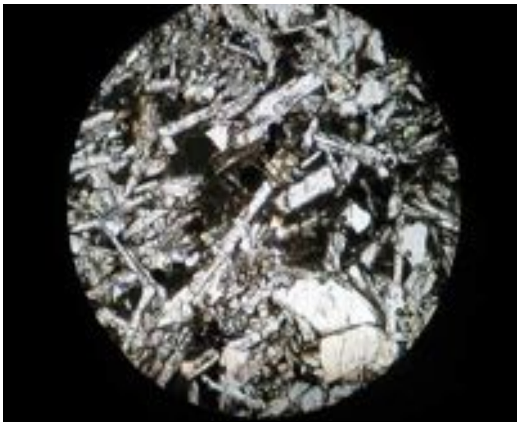

6K-1229-R14 L

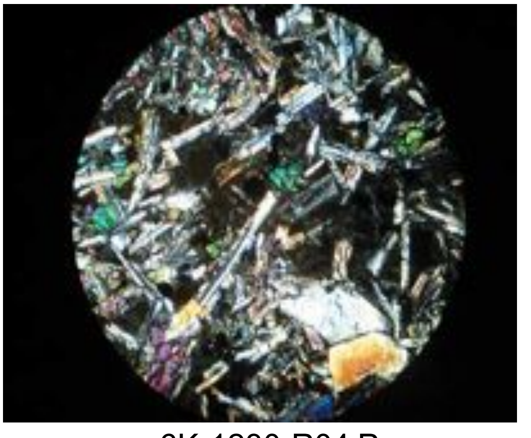

6K-1229-R14 P

YK10-12 Thin sections (2/8)

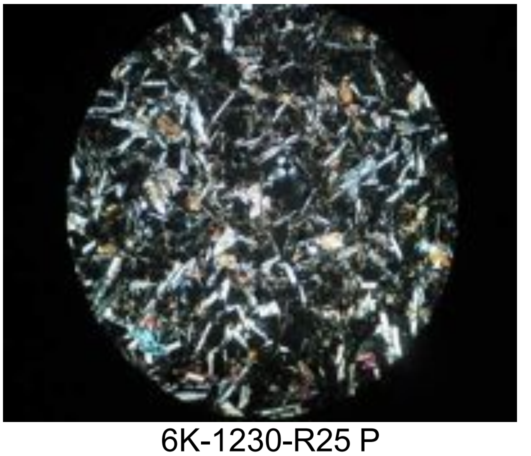

6K-1230-R02 L

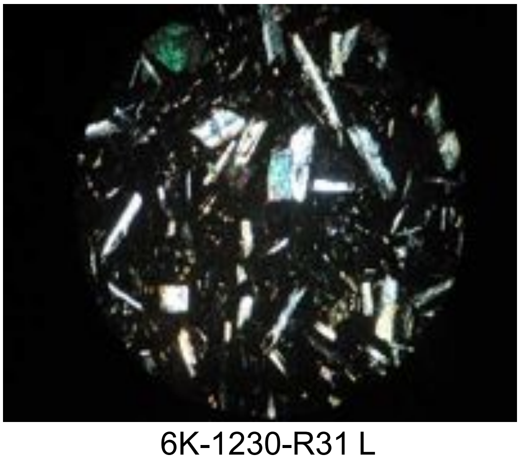

6K-1230-R02 P


6K-1230-R04 L


6K-1230-R04 P

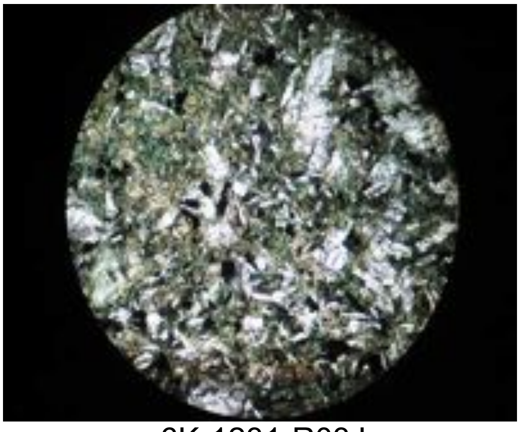

6K-1230-R25 L


6K-1230-R25 P

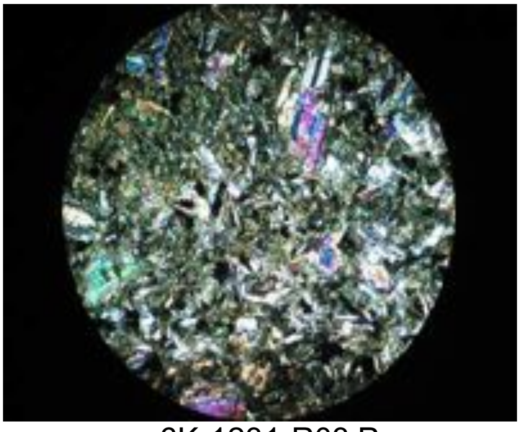

6K-1230-R31 L


6K-1230-R31 P

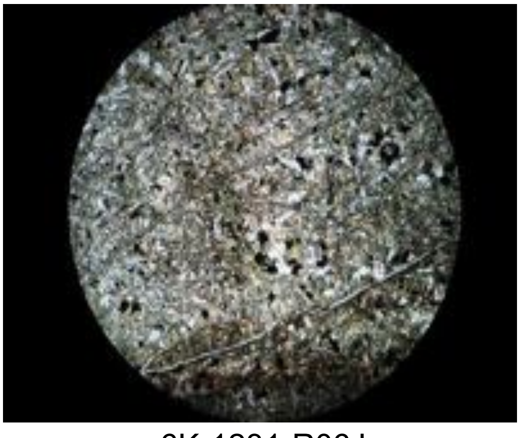
YK10-12 Thin sections (3/8)



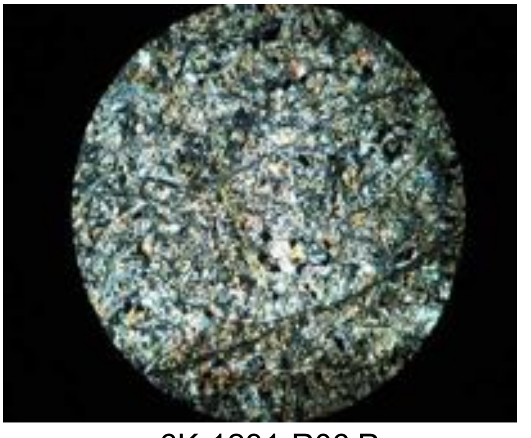
6K-1231-R03 L



6K-1231-R03 P

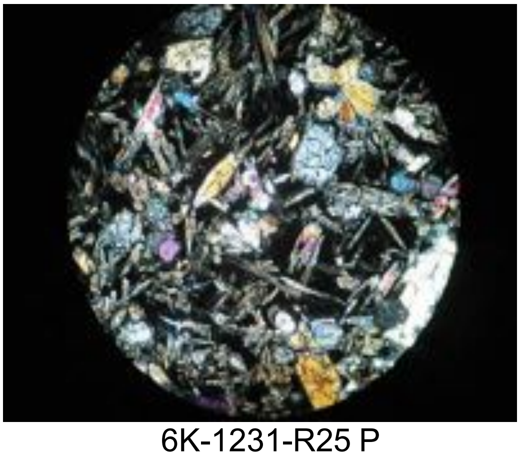


6K-1231-R06 L

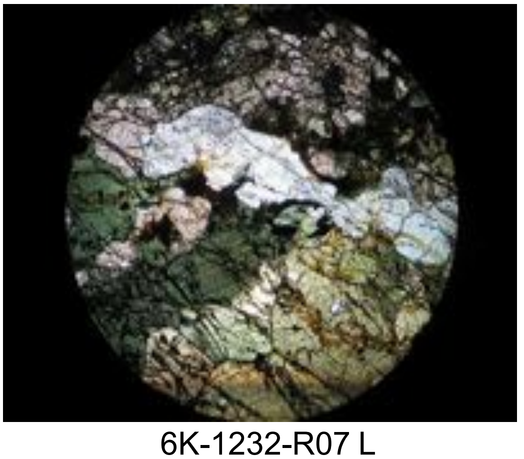


6K-1231-R06 P

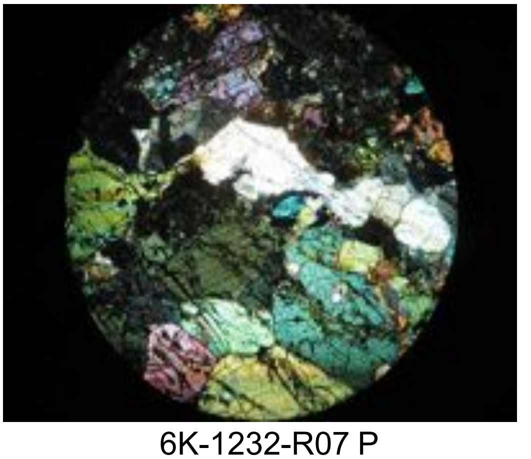
6K-1231-R25 L



6K-1231-R25 P

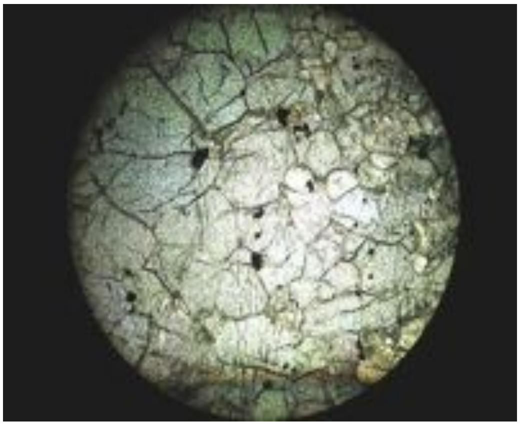


6K-1232-R07 L

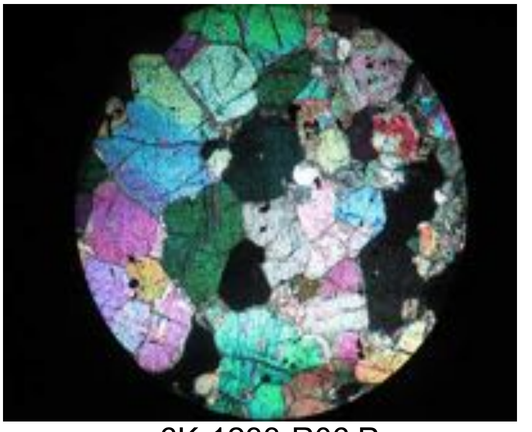


6K-1232-R07 P

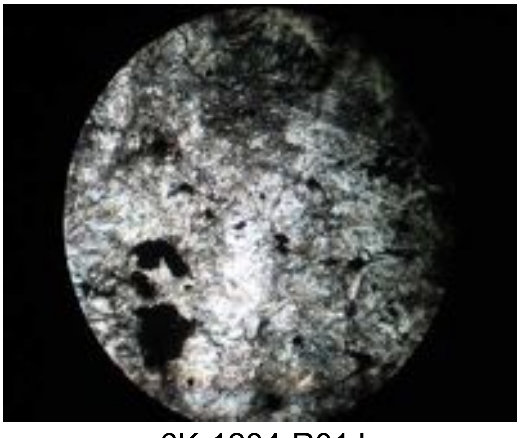
YK10-12 Thin sections (4/8)



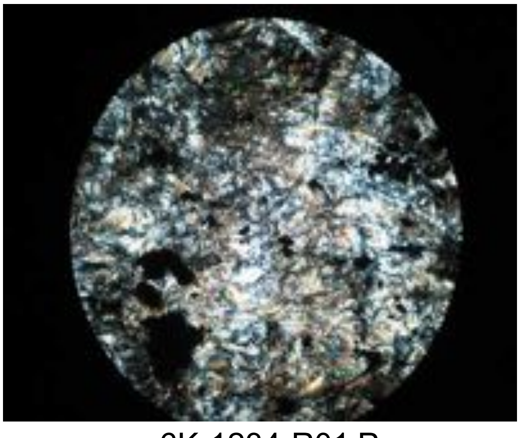
6K-1233-R06 L



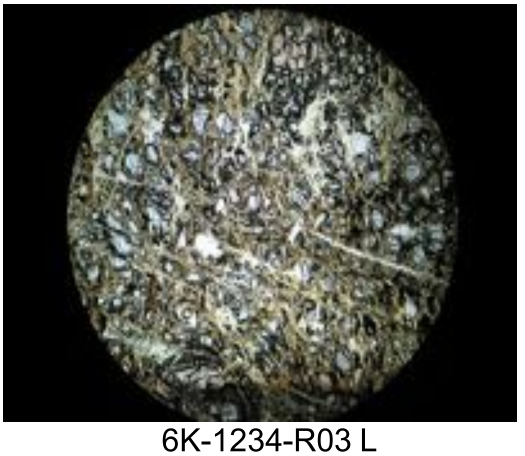
6K-1233-R06 P



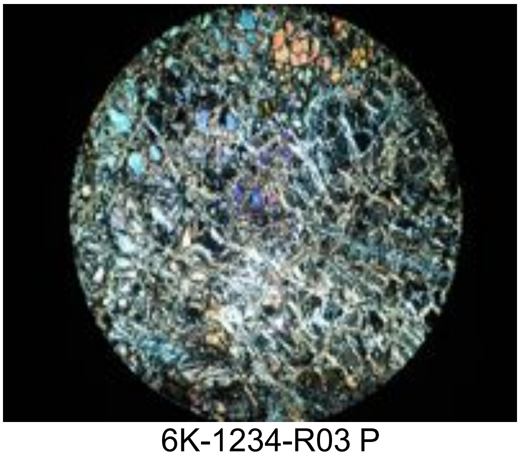
6K-1234-R01 L



6K-1234-R01 P

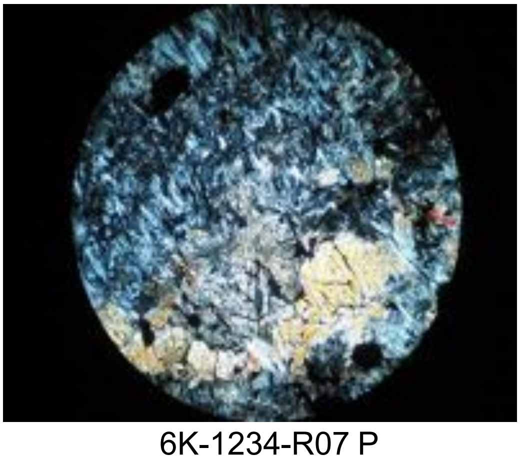


6K-1234-R03 L



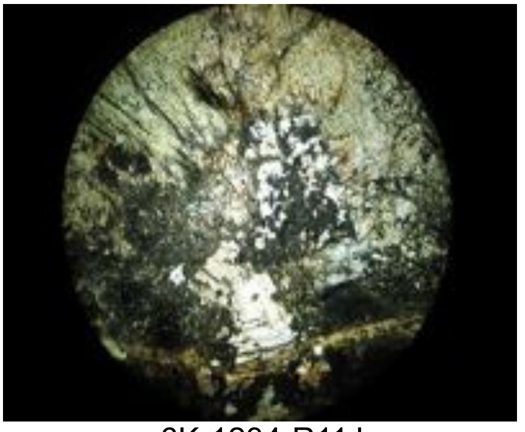
6K-1234-R03 P

6K-1234-R07 L

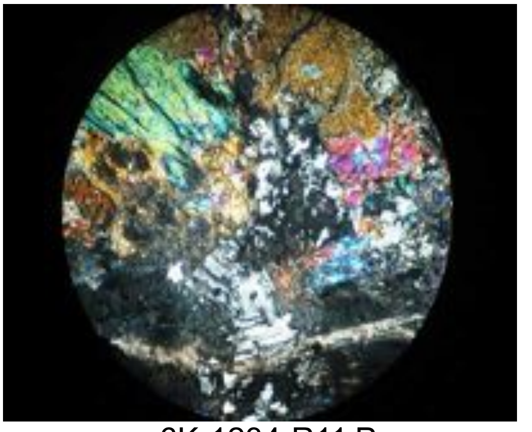


6K-1234-R07 P

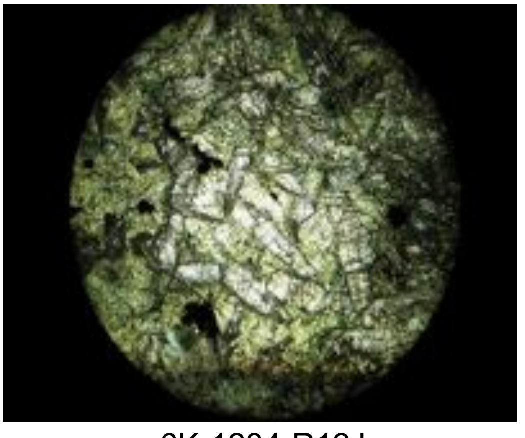
YK10-12 Thin sections (5/8)



6K-1234-R11 L



6K-1234-R11 P



6K-1234-R12 L

6K-1234-R12 P

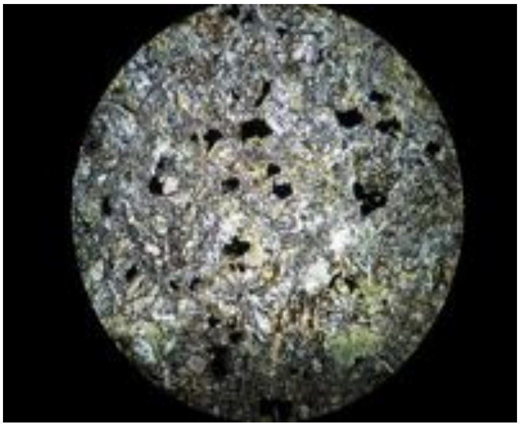
6K-1235-R02 L

6K-1235-R02 P

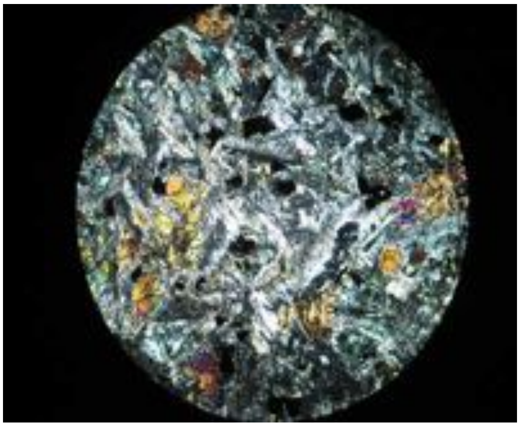
6K-1235-R03 L

6K-1235-R03 P

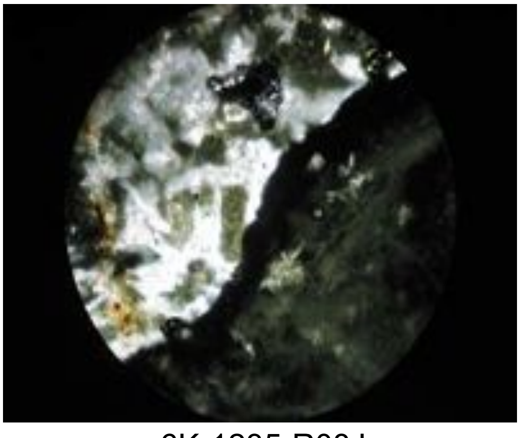
YK10-12 Thin sections (5/8)



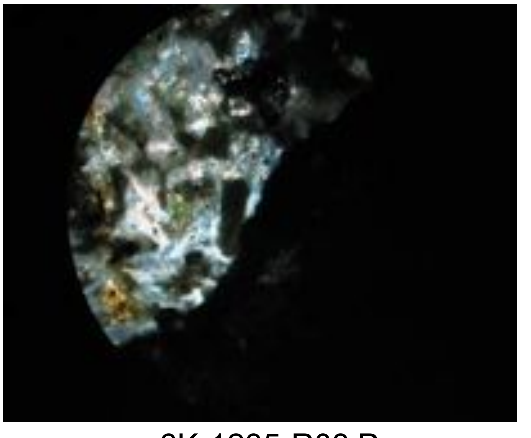
6K-1235-R07 L



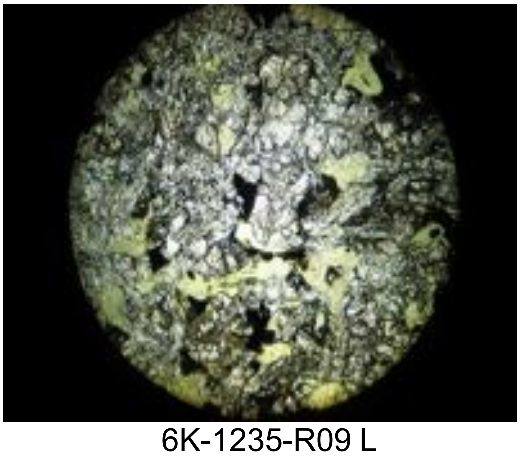
6K-1235-R07 P



6K-1235-R08 L

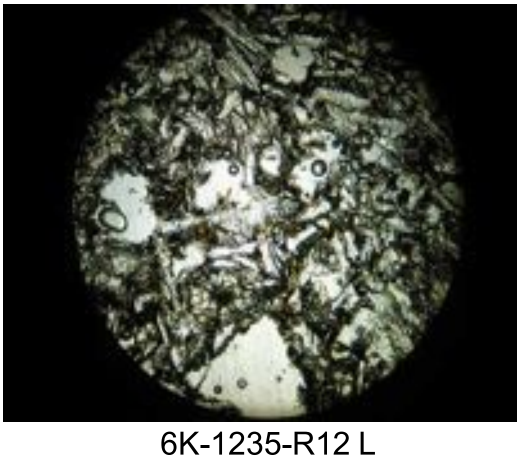


6K-1235-R08 P

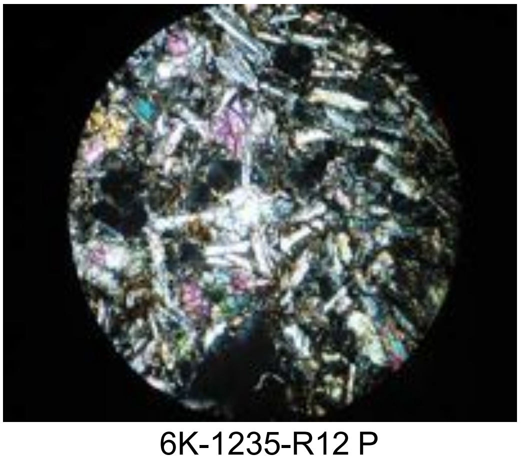


6K-1235-R09 L

6K-1235-R09 P

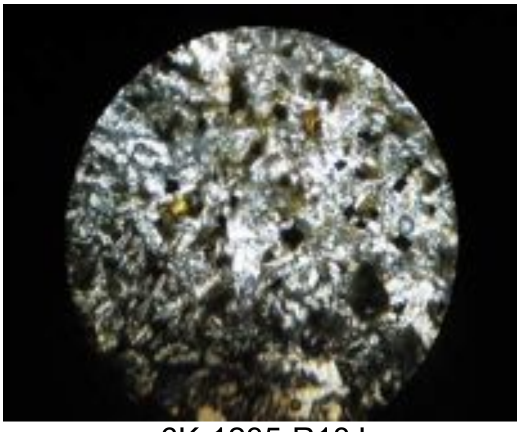


6K-1235-R12 L

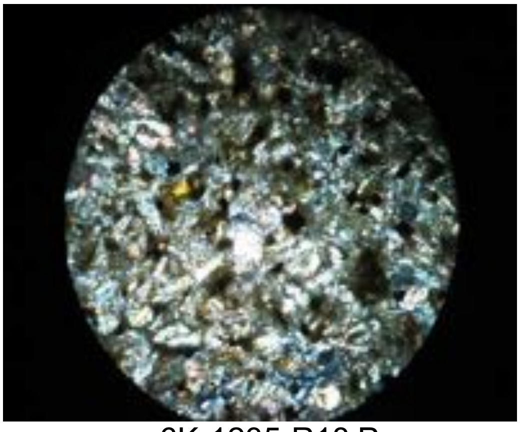


6K-1235-R12 P

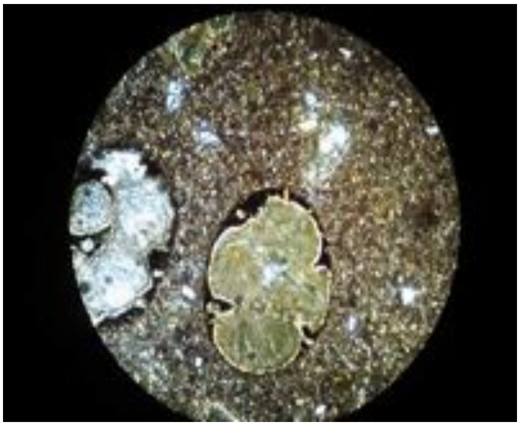
YK10-12 Thin sections (7/8)



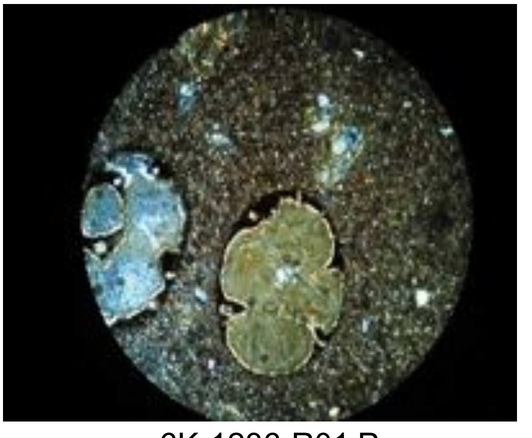
6K-1235-R18 L



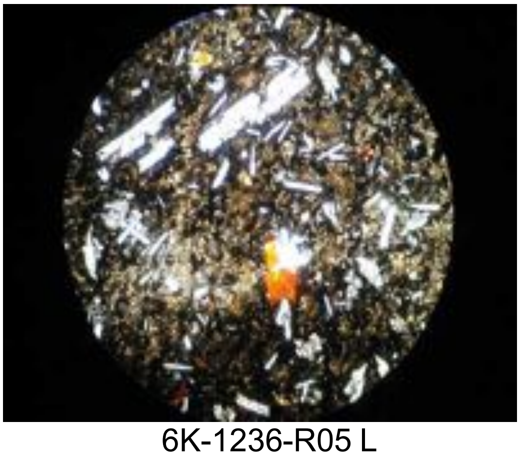
6K-1235-R18 P



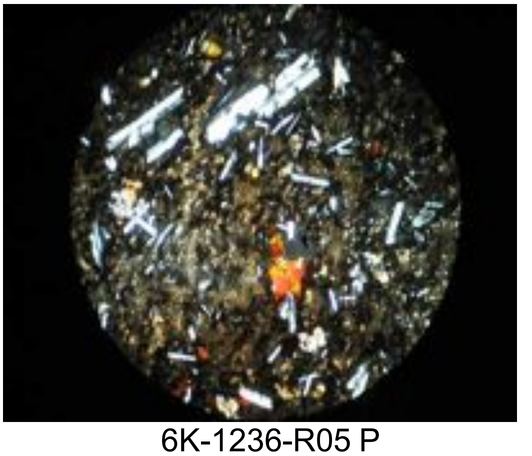
6K-1236-R01 L



6K-1236-R01 P

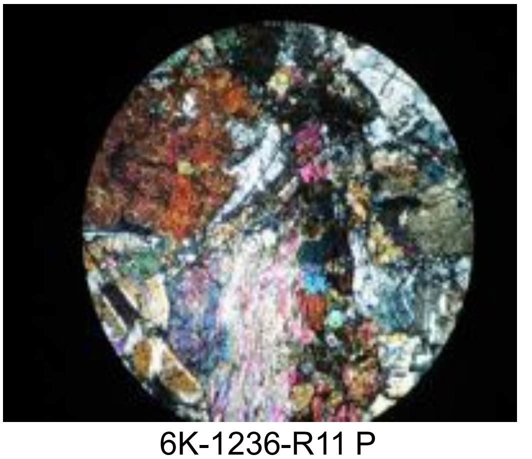


6K-1236-R05 L



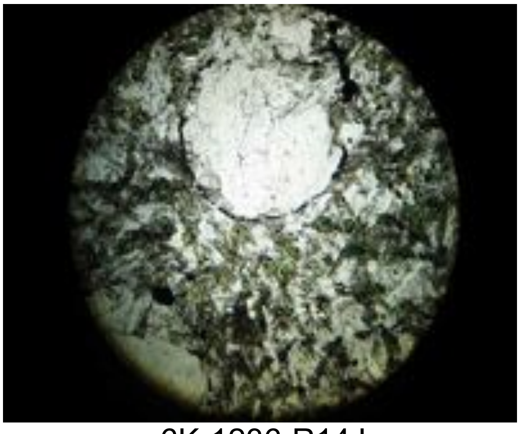
6K-1236-R05 P

6K-1236-R11 L

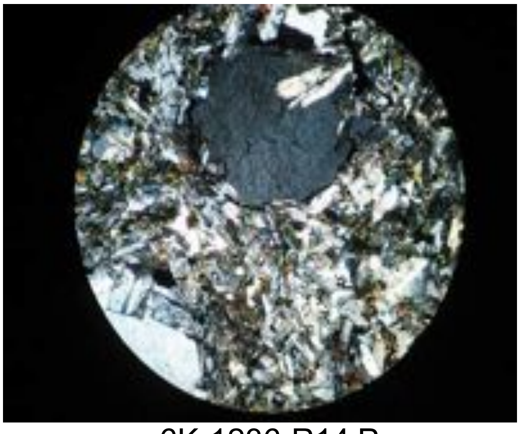


6K-1236-R11 P

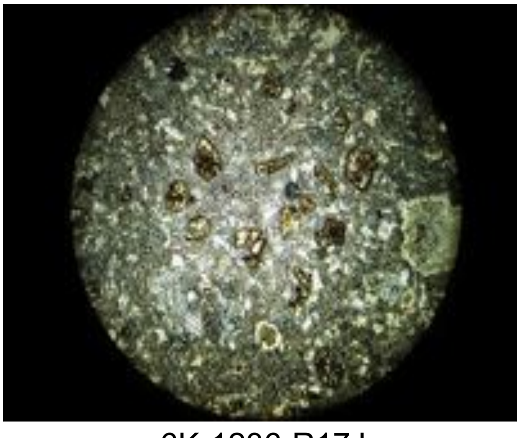
YK10-12 Thin sections (8/8)



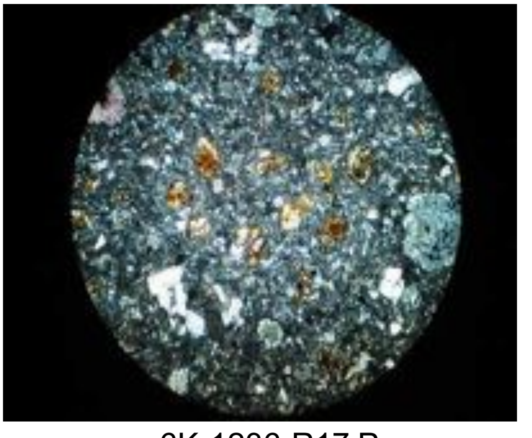
6K-1236-R14 L



6K-1236-R14 P



6K-1236-R17 L



6K-1236-R17 P

Appendix J.

Thin section descriptions (by G. Girard)

6K-1229

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Qz	Ksp	Zeo	Alt	Comment
1	6K-1229-R08	Gabbro	50	30	20						1	
2	6K-1229-R10	Troctolite	20	30	40	10					2	Pl very fine grained, interstitial
3	6K-1229-R11	Basalt	40	20	40						1	Crystallized groudmass or diabase?
4	6K-1229-R14	Pyroxenite	20	5	60	15					1	Rock is a gabbro with pyroxenite vein, only pyroxenite vein selected for thin section, opx exsolution in cpx

6K-1230

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Qz	Ksp	Glass	Alt	Comment
1	6K-1230-R02	Basalt	30	15	15					40	0	Very fresh
2	6K-1230-R04	Basalt	60	25	15						0	Entirely crystallized groundmass with relatively large pl
3	6K-1230-R25	Basalt	50	15	5					30	0	
4	6K-1230-R31	Basalt	20	5	5					70	1	Crystals more altered than the other three sections, some glass still fresh, however pillow lava origin

6K-1231

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Qz	Ksp	Glass	Alt	Comment
1	6K-1231-R03	Basalt	50	10	40						1	Phenocrysts + groundmass
2	6K-1231-R06	Basalt	40	15	45						2	Entirely crystallized groundmass, no phenocrysts, slight greenschist
3	6K-1231-R25	Boninite	20	30	10					40	0	Pl mostly in small needles in groundmass, not true phencrysts. Groundmass mostly pl, phenocrysts mostly ol and cpx

6K-1232

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Qz	Gt	Ox	Alt	Comment
1	6K-1232-R07	Garnet amphibolite			5		40		50	5	1	Large garnet area (may be one single crytal) and large amph area (assemblage of large phenocrysts), some small garnet crystals in amph and vice versa, near the contact. Large oxide crystal. Sphene (?) in garnet

6K-1233

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Qz	Gt	Ox	Alt	Comment
1	6K-1233-R06	Pyroxenite		2	70	25				3	0	Note by YO on May 30, 2011: based on photograph, this could be very fertile lherzolite

6K-1234

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Ox	Serp	Sp	Alt	Comment
1	6K-1234-R01	Serpentinite		15				5	80		4	Most olivine present is being resorbed as serpentine, initial rock probably was a dunite, serpentinization is incipient. Cleavable olivine, with incipient antigorite formation. Foliation: mylonitic texture? Spinel observed also
2	6K-1234-R03	Peridotite		40	10	5			40	5	2	Incipient serpentinization with typical mesh texture
3	6K-1234-R07	Serpentinite		5	25				70		3	Very small remnants of olivine left, cpx much better preserved
4	6K-1234-R11	Gabbro	30		70						2	Large area is made of secondary minerals, pl small, cpx large
5	6K-1234-R12	Gabbro	40		60						3	Largely altered rock, some areas fresher than others, olivine may have been present but not observed as such

6K-1235

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Ox	Serp	Glass	Alt	Comment
1	6K-1235-R02	Microgabbro	55		45			10			3	Very fine grained, could be diabase. Greenschist facies
2	6K-1235-R03	Microgabbro	50	20	30						2	Lots of alteration, but good fresh olivine
3	6K-1235-R07	Microgabbro	40	20	40						2	Mingled microgabbro, with pl-rich areas mingled with px/ol rich areas, greenschist facies
4	6K-1235-R08	Microgabbro	40	20	40						3	Enclaves of microgabbro in aphyric basalt, very few fresh minerals preserved, identification difficult, slight greenschist facies
5	6K-1235-R09	Microgabbro	40	30	30						1	Fresh olivine
6	6K-1235-R12	Basalt	50	30	10					10	0	One area has much smaller pl crystals with a few phenocrsysts, otherwise, generally very phyric basalt with abundant vesicles
7	6K-1235-R18	Olivine basalt		30	5						2	Devitrified groundmass, olivine dominates phenocrysts

6K-1236

Slide	Sample	Lithology	Pl	Ol	Cpx	Opx	Amp	Ksp	Qz	Glass	Alt	Comment
1	6K-1236-R01	Boninite		15		5				50	1	Abundant zeolites, probably filled vesicles, glass devitrified
2	6K-1236-R05	Basalt	10	5						80	1	Large zone of fresh glass (pillow rind), no vesicle
3	6K-1236-R11	Gabbro	45	5	45	5					0	Some opx exsolutionfeatures in cpx?
4	6K-1236-R14	Microtonalite/granite	50				35		15		1	Mineralogy indicates microtonalite, mingled micro(tonalite?/diorite) and porphyric granodiorite, with large feldspar/quartz crystals of the granite transferred into the microtonalite. Granite: 50% qz, 15% amp, 15% k-fspar, 15% pl
5	6K-1236-R17	Boninite		15		15				60	1	Glass is crystallized groundmass, ol not very fresh, some zeolites

Alteration

0	Totally fresh
1	Some secondary phases
2	Abundant secondary phases
3	Complete eradication of a phase
4	Some primary phases left
5	No primary phases left

Appendix K.

List of onboard sample distribution

6K-1229 (M. Reagan)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01	SS	SS	LS		2LS	LS			Yes
R02	SS	SS	SS		Most of this for Zr dating	SS			Yes
R03	SS	SS	LS		LS	LS			Yes
R04	SS	SS	SS	SS	SS	SS	SED		No
R05		SS			TSC				Yes
R06		SS			TSC				No
R07	SS	SS	LS		LS	LS			Yes
R08	SS	SS			2LS				No
R09	SS	LS	LS		LS	SS			Yes
R10	SS	SS			LS				Yes
R11	SS	SS		SS	SS				No
R12	SS	SS	LS		LS	LS			Yes
R13a	SS	LS	LS		TSC	TS			No
R13b		SS			TSC				No
R14	SS	SS	TS		SS	TS			No
R15	SS	SS		SS	SS				No
R16	SS	SS			2LS				Yes
R17	SS	SS	LS		2LS	LS			Yes
R18	SS	SS			SS				Yes
R19	SS	SS			SS				Yes
R20	SS	SS	LS	SS	LS	LS			Yes
R21	SS	SS		SS	SS				Yes
R22	SS	SS		SS	SS				No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1230 (J. Ribeiro)

Sample	YO	TI	KM	OI	MKR	RJS	MB	IP	Archive in JAMSTEC
R01	SSG	SSG		SSG			SSG		Yes
R02	SSG	SSG		SSG	LS	LSG	SSG		Yes
R03		SS				LS			Yes
R04		SS				LS			Yes
R05		SS							Yes
R06		SS				LS			No
R07		SS				LS			Yes
R08		SS				LS	SS		Yes
R09	SS	SS		SS		SS	SS		Yes
R10		SS				LS			Yes
R11	SS	SS		SS		LSG	SSG		Yes
R12	SS	SS		SS			SS		Yes
R13		SS							Yes
R14		SS				LSG	SSG		Yes
R15		SS							Yes
R16		SS				LS			Yes
R17		SS				LS	SS		Yes
R18		SS							Yes
R19		SS				LS			Yes
R20		SS							Yes
R21		SS				LS			Yes
R22		SS				LS			Yes
R23		SS							Yes
R24		SS				LS			Yes
R25	LS	SS		LS	LS	LSG	LSG		Yes
R26	SS	SS		SS		LSG	SSG		No
R27	SS	SS		SS			SSG		Yes
R28		SS							Yes
R29		SS				LS			Yes
R30	SS	SS		SS			SSG		No
R31		SS				LSG	SSG		Yes
R32		SS					SSG		No
R33		SS				LS			Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED); glass (G)

6K-1231 (I. Pujana)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01	SS	TS		LS	LS		LS	LS	Yes
R02	SS	TS			LS	LS		LS	Yes
R03	SS	TS			LS			LS	No
R04	SS	TS			LS			LS	Yes
R05	SS	TS			LS				Yes
R06	SS	TS			LS				No
R07	SS	TS			LS	LS		LS	Yes
R08	SS	TS			LS				Yes
R09	SS	TS			LS				Yes
R10	SS	TS			LS				Yes
R11	SS	TS			LS				Yes
R12	SS	TS		LS	LS			LS	No
R13	SS	TS			LS				No
R14	SS	TS			LS				Yes
R15	SS	TS		LS	LS		LS		Yes
R16	SS	TS			LS				Yes
R17	SS	TS			LS				Yes
R18 (= S01)		SED							Yes
R19 (= S02)		SED					LS		Yes
R20	SS	TS			LS		LS		Yes
R21	SS	TS			LS				Yes
R22	SS	TS		LS	LS				Yes
R23	SS	TS			LS			LS	Yes
R24	SS	TS		LS	LS				Yes
R25	SS	TS		LS	LS	LS		LS	Yes
R26		TS			SS			SS	Yes
R27	SS	TS			LS				Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1232 (K. Michibayashi)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01	SS	TS	LS		TS				No
R02	SS	TS	LS						Yes
R03	SS	TS	LS		TS	SS		SS	Yes
R04	SS	TS	LS						No
R05	SS	TS	LS						No
R06	SS	TS	LS						No
R07	LS	TS	LS		LS	LS		SS	No
R08	SS	TS	LS						No
R09	SS	TS	LS						No
R10	SS	TS	LS						Yes
R11	SS	TS	LS						Yes
R12	SS	TS	LS		TS			SS	No
R13	SS	TS	LS		LS	SS		SS	No
R14	SS	TS	LS						No
R15	SS	TS	LS						Yes
R16	SS	TS	LS		LS	SS		LS	Yes
R17	SS	TS	LS		SS			SS	Yes
R18	SS	TS	SS						Yes
R19	SS	TS	LS						Yes
R20		SS	SS				LS		Yes
R21	SS	TS	LS		TS				No
R22	SS	TS	LS					SS	No
S01		SED							No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1233 (Y. Ohara)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01		SS							Yes
R02		SS							Yes
R03	SS	SS	LS						No
R04	SS	LS	LS						Yes
R05	SS	SS	LS						No
R06	SS	LS	LS					SS	Yes
R07	SS	SS	LS						No
R08	SS	LS	LS						Yes
R09		TS							Yes
R10		SS							Yes
R11		TS							Yes
R12	SS	LS	LS						Yes
R13	SS	LS	LS					SS	Yes
R14		TS							No
R15		TS							No
R16		TS							Yes
R17		TS					LS		No
R18	SS	SS					LS		Yes
R19		SS							Yes
R20	SS	LS	LS		LS	LS		SS	Yes
R21	SS	LS	LS						Yes
R22	SS	SS	LS						No
R23	SS	LS	LS					SS	Yes
R24		SS					LS		Yes
R25		SS					LS		Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1234 (T. Ishii)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	KF	Archive in JAMSTEC
R01	SS	LS	LS		LS					Yes
R02	SS	LS			SS	LS	LS	SS		Yes
R03	SS	SS	LS							No
R04	SS	LS	LS			LS		SS		Yes
R05	SS	SS	LS							Yes
R06	SS	SS	LS							Yes
R07	SS	SS	LS		SS	SS				No
R08	SS	SS	LS							Yes
R09	SS	LS								Yes
R10	SS	SS	LS							Yes
R11	SS	SS	LS		LS					No
R12	SS	LS		LS	LS			SS		Yes
R13	SS	SS				LS				Yes
R14	SS	SS	LS							No
R15	SS	SS	LS							Yes
R16	SS	SS	LS							Yes
R17	SS	SS	LS			SS				No
R18	SS	SS	LS							No
B01a									All	No
B01b									All	No
B01c									All	No
B02a									All	No
B02b									All	No
B02c		Shell	Shell		Shell		Shell	Shell	All	No
B02d									All	No
B02e									All	No
B02f									All	No
C01		SED					LS			No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce
KF: Katsunori Fujikura

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1235 (G. Girard)

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01	SS	TS			SS	LS			No
R02	SS	TS		SS	SS	LS			No
R03	SS	LS			LS	LS			Yes
R04	SS	SS			SS				Yes
R05	SS	SS			LS				No
R06	SS	SS			SS				Yes
R07	SS	LS			LS	LS			Yes
R08	SS	SS		LS	LS	LS			Yes
R09	SS	SS			LS	LS			Yes
R10	SS	SS			SS				Yes
R11	SS	LS	SS	LS	LS	LS			Yes
R12	SS	SS			TS	LS			Yes
R13	SS	LS			SS	LS			Yes
R14	SS	SS			SS	SS			Yes
R15	SS	LS			SS				Yes
R16	SS	SS		LS	LS	LS			Yes
R17	SS	LS		LS	LS	LS			Yes
R18	SS	LS			SS	LS			Yes
R19	SS	SS			SS	LS			Yes
R20	SS	SS			SS	LS			Yes
R21	SS	SS			SS	LS			Yes
R22	SS	TS			SS				No
R23	SS	LS	SS	LS	LS	LS			Yes
R24	SS	LS	SS		LS				No
R25	SS	SS	SS		LS	LS			Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

6K-1236 (M. Brounce)

Sample	YO	TI	KM	OI	SS	RJS	IP	MB	Archive in JAMSTEC
R01	SS	LS			SS	SS		SS	Yes
R02	SS	LS			SS			SS	Yes
R03	SS	SS			SS			SS	No
R04	SS	SS		SS	SS			SS	No
R05	SS	SS	SS		SS			SS	No
R06	SS	SS			TS			SS	No
R07	SS	SS		LS	LS	LS		SS	Yes
R08	SS	SS			SS			SS	No
R09	SS	SS						SS	Yes
R10	SS	SS	SS		SS	SS		SS	No
R11	SS	LS			LS			SS	Yes
R12	SS	SS			SS	SS		SS	Yes
R13	SS	SS	SS		SS			SS	No
R14	SS	LS	SS	LS	LS	LS		SS	No
R15	SS	SS			TS			SS	No
R16	SS	SS			SS			SS	No
R17	SS	SS			SS			SS	No
R18		SS						SS	Yes
R19		SS							Yes
R20	LS	SS	SS		LS	LS			No
R21		SS						SS	Yes
C01		SED							No
C02		SED							No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

YKDT-81

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
N/A									

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

YKDT-82

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
N/A									

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

YKDT-83

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01									Yes
R02									Yes
R03									Yes
R04									Yes
R05									Yes
R06									Yes
R07									Yes
B01									Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

YKDT-84

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01					0.5	0.5			No
R02					0.5	0.5			No
R03		Whole							No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED); 0.5 = half piece

YKDT-85

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01	SS	SS		LS	SS			SS + G	No
R02		SS			SS				No
R03		SS			SS				No
R04		SS			SS				No
R05		SS			SS				No
R06		SS			SS				No
R07		SS			SS				No
R08		SS			SS				No
R09		SS			SS				No
R10		SS			SS				No
R11		SS			SS			SS + G	No
R12		SS			SS				No
R13		SS							No
B01		Whole							No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED); glass (G)

YKDT-86

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R1						SS			No
R2								SS + GL	No
R3									Yes
R4	SS			LS		SS			Yes
R5	SS			LS		SS			No
R6						SS			Yes
R7						SS		SS + GL	No
R8									Yes
R9		SS				SS			Yes
R10		SS							Yes
R11		SS							Yes
R12	SS	SS		LS		SS			No
R13	SS	SS		LS		SS			No
R14		SS							Yes
R15		SS							Yes
R16		SS							Yes
R17									Yes
R18									Yes
R19									Yes
R20						SS?		SS?	No
R21						SS?		SS?	No
R22									Yes
R23									Yes
R24									Yes
R25									Yes
R26									Yes
R27									Yes
R28									Yes
R29									Yes
R30									Yes
R31									Yes
R32									Yes
R33									Yes
R34									Yes
R35									Yes
R36									Yes
R37									Yes
R38						SS?		SS?	No
R39									Yes
R40									Yes
R41									Yes
R42									Yes
R43									Yes
R44									Yes
R45									Yes
R46									Yes
R47									Yes
R48									Yes
R49						SS?		SS?	No
R50									Yes
R51									Yes
R52									Yes
R53									Yes
R54									Yes
R55									Yes
R56									Yes
R57									Yes
R58									Yes
R59									Yes

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R60									Yes
R61									Yes
R62									Yes
R63									Yes
R64									Yes

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED); glass (G)

YKDT-87

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
N/A									

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

YKDT-88

Sample	YO	TI	KM	OI	MKR	RJS	IP	MB	Archive in JAMSTEC
R01					SS	LS		SS	No
R02	SS			LS	SS	LS		SS	No
R03					SS?	SS?			No
R04		Whole							No

YO: Yasuhiko Ohara, TI: Teruaki Ishii, KM: Katsuyoshi Michibayashi, OI: Osamu Ishizuka
MKR: Mark. K. Regan, RJS: Robert J. Stern, IP: Ignacio Pujana, MB: Maryjo Brounce

Needs: small slab (SS); large slab (LS); thin section chip (TSC); sediment (SED)

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Appendix L.

Data for gravimeter calibration (written in Japanese)

重力検定装置計測記録用紙

機器名 G-1039 [LaCoste&Romberg] 計測者 石渡

計測日 2010/8/17 (UTC) オフセット ±0 時間 気象 晴れ

計測場所 JAMSTEC専用岸壁 舷側

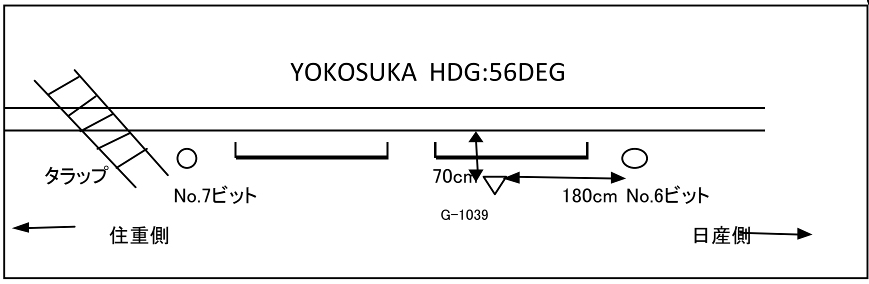
緯度 35 ° − 19.1323' N 35.319 経度 139 ° − 38.9965' E (−139.650)

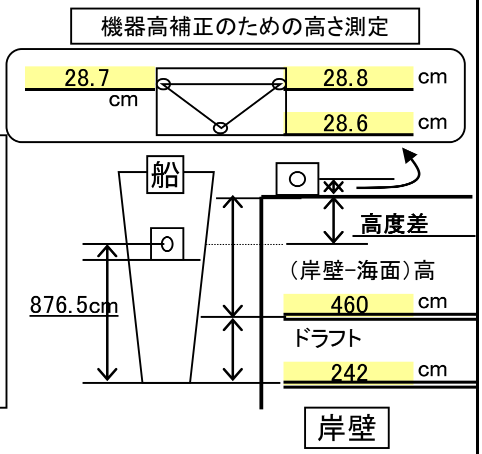
気温 29.0 ℃ ポータブル重力計 機器高 28.7 cm

計測値の特徴等

目標物

概略図





Mode ReadTime

SEISMIC FILTER / CONT. TILT CORR / AUTO REJECTION / TIDE CORRECTION / AUTO-RECORD / AUTO-REPEAT

回	時刻(UTC)	読取重力値(mgal)	X	Y	SD	Temp(℃)	RJ	E.T.C.	重力値(mgal)[YK]	船上重力計値[mgal]	データ選択
1	01:55:00	3243.63				53.5			3349.558	10863.8	☐
2	02:00:00	3243.16				53.5			3349.072	10864.1	☐
3	02:05:00	3243.16				53.5			3349.072	10863.9	☑
4	02:09:00	3243.18				53.5			3349.093	10864.0	☐
5											☐
6											☐
7											☐
8											☐

計測時間	キャリブレーション後の値			岸壁の絶対値		高度補正(機械高補正)			船上重力計
0:00:00	979757.7615	mgal	=	979758.3	+0.3086	×(7.02 高度差(m)	−	8.8 船上(m))=	10863.9mgal

その他特記事項:

岸壁絶対重力値 979758.3 ±0.2 mgal (センター岸壁No.6ビット、2002/3/20現在) 未知の場合は空欄

船上重力計設置場所 8.765 m (「よこすか」7.3【上甲板】+0.465m【機器高】) **固定値**

重力値 G = ki＊(V − 100＊I) + Gi = ki＊v + Gi 、Gi:重力計固有の定数項、ki:1次項の勾配 一覧は別紙参照

YK重力基準点および固定観測基準点用

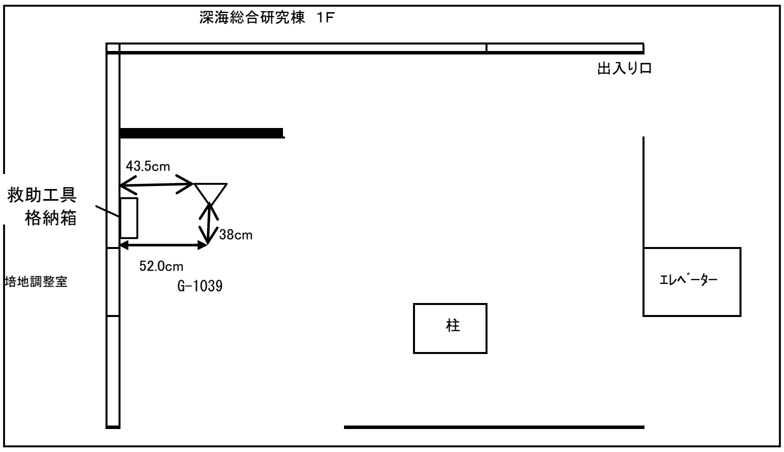
「よこすか」重力検定装置計測記録用紙

計測場所　JAMSTEC 深海研究棟1F	絶対重力値　979758.11mgal
機器名　G-1039 [LaCoste&Romberg]	計測者　石渡
計測日　2010/8/17 (UTC) オフセット ±0 時間	気象　晴れ
緯度　35 °　－ 19.1308'　N　35.319	経度　139 °　－ 38.9961'　E　(−139.650)
気温　24.9　℃	ポータブル重力計　機器高　28.8　cm

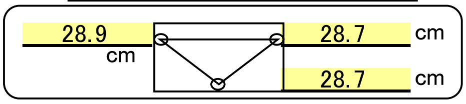
計測値の特徴等

目標物

概略図



機器高補正のための高さ測定



回	時刻(UTC)	読取重力値(mgal)	~~X~~	~~¥~~	~~SD~~	Temp(℃)	~~RJ~~	~~E.T.C.~~	重力値(mgal)[YK]	~~船上重力計値 [mgal]~~	データ選択
1	02:15:00	3242.64				53.5			3348.535		☐
2	02:19:00	3242.66				53.5			3348.556		☐
3	02:23:00	3242.69				53.5			3348.587		☐
4											☐
5											☐
6											☐
7											☐
8											☐

備考

重力値　G ＝ ki＊(V − 100＊I) + Gi = ki＊v + Gi　、Gi:重力計固有の定数項、ki:1次項の勾配　一覧は別紙参照

様式更新:2009.6.11

重力検定装置計測記録用紙

機器名 G-1039 [LaCoste&Romberg] 計測者 石渡

計測日 2010/10/19 (UTC) オフセット ±0 時間 | 気象 曇り

計測場所 JAMSTEC専用岸壁 舷側

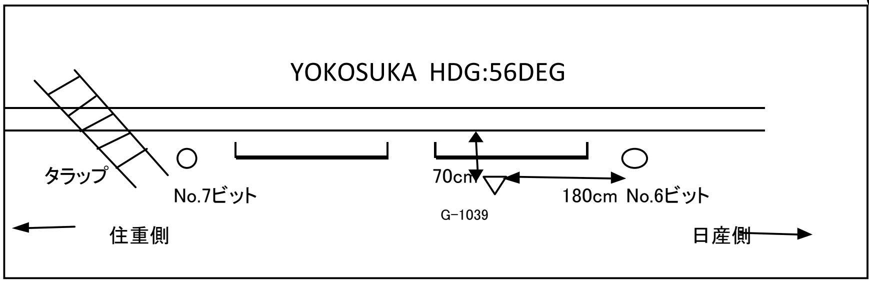
緯度 35 ° − 19.1323' N 35.319 | 経度 139 ° − 38.9965' E (−139.650)

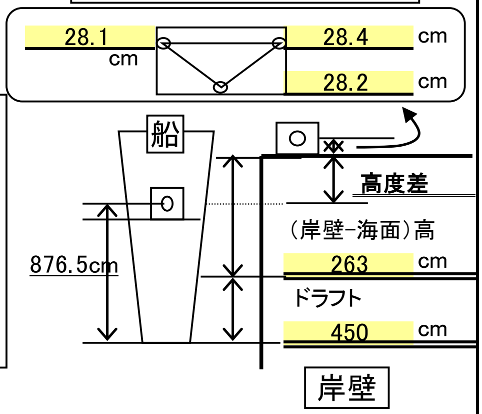
気温 19.0 ℃ | ポータブル重力計 機器高 28.2 cm

計測値の特徴等

目標物

概略図





Mode ReadTime

☐ SEISMIC FILTER ■ CONT. TILT CORR ■ AUTO REJECTION
■ TIDE CORRECTION ■ AUTO-RECORD ■ AUTO-REPEAT

回	時刻(UTC)	読取重力値(mgal)	X	Y	SD	Temp(℃)	RJ	E.T.C.	重力値(mgal)[YK]	船上重力計値 [mgal]	データ選択
1	02:13:00	3242.71				53.5			3348.607	10861.1	☐
2	02:18:00	3242.66				53.5			3348.556	10861.0	☐
3	02:23:00	3242.68				53.5			3348.576	10861.1	☑
4											☐
5											☐
6											☐
7											☐
8											☐

計測時間	キャリブレーション後の値			岸壁の絶対値	高度補正(機械高補正)				船上重力計
0:00:00	979757.7954	mgal	=	979758.3	+0.3086	×(7.13	−	8.8)=	10861.1mgal
						高度差 (m)		船上 (m)	

その他特記事項:

岸壁絶対重力値 979758.3 ±0.2 mgal (センター岸壁No.6ビット、2002/3/20現在) 未知の場合は空欄

船上重力計設置場所 8.765 m (「よこすか」7.3【上甲板】+0.465m【機器高】) **固定値**

重力値 G = ki＊(V − 100＊I) + Gi = ki＊v + Gi 、Gi:重力計固有の定数項、ki:1次項の勾配 一覧は別紙参照

YK重力基準点および固定観測基準点用

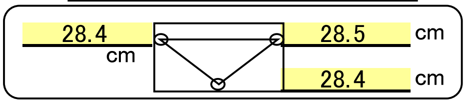
「よこすか」重力検定装置計測記録用紙

計測場所	JAMSTEC 深海研究棟1F	絶対重力値	979758.11mgal
機器名	G-1039 [LaCoste&Romberg]	計測者	石渡
計測日	2010/10/19 (UTC) オフセット ±0 時間	気象	曇り
緯度	35 ° − 19.1308' N 35.319	経度	139 ° − 38.9961' E (−139.650)
気温	23.1 ℃	ポータブル重力計 機器高	28.4 cm

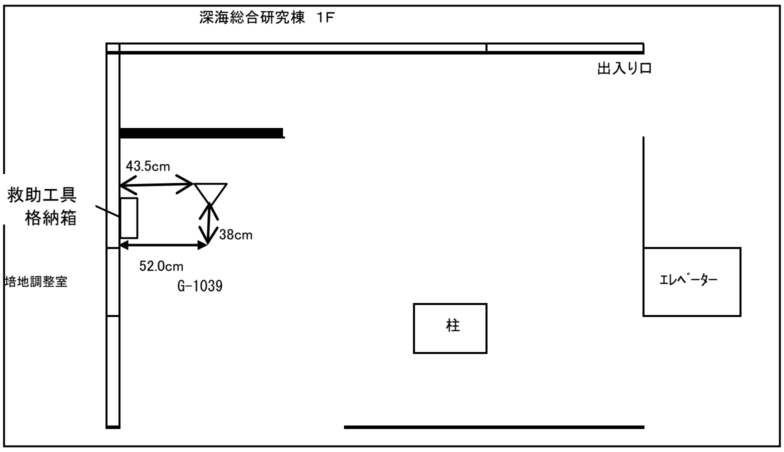
計測値の特徴等

目標物

機器高補正のための高さ測定



概略図



回	時刻(UTC)	読取重力値(mgal)	~~X~~	~~Y~~	~~SD~~	Temp(℃)	~~RJ~~	~~E.T.C.~~	重力値(mgal)[YK]	~~船上重力計値 [mgal]~~	データ選択
1	02:33:00	3241.94				53.5			3347.811		☐
2	02:37:00	3241.89				53.5			3347.760		☐
3	02:41:00	3241.92				53.5			3347.791		☐
4											☐
5											☐
6											☐
7											☐
8											☐

備考

重力値 G ＝ ki＊(V − 100＊I) + Gi = ki＊v + Gi 、Gi:重力計固有の定数項、ki:1次項の勾配 一覧は別紙参照

様式更新:2009.6.11