

Hydrogeological and Geothermal studies around Nankai Trough (KR02-10 Nankai Trough Cruise Report)

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In recent studies on seismogenic zone or active faults, it has become clear that it is necessary to understand fluid circulation in and out of the seismogenic zones. Parameters related to hypotheses include fault materials, stress state around the faults, fluid pressure distributions, temperature distributions, permeability, chemical composition of fluid, etc., on top of the other elastic properties of rocks. As one step towards understanding the seismogenic mechanism at the Nankai Trough, a research cruise was conducted in summer of 2002 using the JAMSTEC R/V Kairei and ROV Kaiko to address the following questions: (1) if fluid drains out through thrust faults, (2) if biological communities are directly related to fluid discharge, and (3) if pressure transient in the oceanic sediments on top of the crust are consistent with fluid flow along the decollement zone. For the first two questions, intensive heat flow measurements were planned at two transects, Muroto and Kumano, for understanding fluid discharge at the sea floor. The results from the heat flow measurements indicated that the peak of heat flow is located at the thrust-sea floor intersection but not at the location of the seep at the Muroto transect. Question (3) is strongly related to hypotheses presented for ODP leg-196 during which two long-term hydrogeological observatories (Advanced-CORKs) were installed. During the Kairei/Kaiko cruise, we accessed the observatories and succeeded in re-setting the valves for the ACORKs to function properly for many years into the future. It was confirmed that a build-up of pressure in the sediments started and data from the instruments would be retrieved in further cruises. Further studies are currently on-going using SSS, SBP what's SSS and SBP of the ROV system, geological/geochemical studies on push-core samples, biological dating of calyptogena shells, hydrogeological analysis of the heat flow data, etc., would give us certain boundary conditions at the shallowmost sediments on fluid circulation in and around the Nankai accretionary prism.

Keywords : Nankai Trough, Seismogenic Zone, Advanced CORKs, Hydrogeological Studies, Geothermal Studies, Ocean Drilling Program

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1. Introduction

Nankai Trough is a famous plate boundary between Philippine Sea and Eurasian Plates in their frequent and periodical occurrence of giant megathrust earthquakes in the recorded history (Ando, 1976). Recent Studies have indicated a strong coupling between the two Plates from a land geodetic observation network (Miyazaki and Heki, 2001), a 100 to 200 yaers of periodicity of tsunamigenic megathrust earthquakes in the past 1300 years from historical records (Sangawa, 1998), well developed decollement in the subducting sediments on the top of the Philippine Sea Plate (Shipboard Scientific Party, 2001, 2002), and the step down of the decollement to the oceanic basement around the seismogenic zone (Park, 2002). Materials above the oceanic plate are conveyed down to the seismogenic zone and it is of great importance to study how materials are scraped off the down-going plate along the plate-boundary thrust and its relation to earthquake mechanisms along the Nankai trough of SW Japan. Especially, fluid either squeezed out from conveyed oceanic sediments or produced during geochemical material reactions is thought one of irreplaceable physical properties for understanding physical circumstances at the seismogenic zone. Two legs of the Ocean Drilling Program were planned and conducted for understanding materials incoming to the subduction zone (Shipboard Scientific Party, 2001) and for installation of fluid circulation sensors, i.e., Advanced CORKs (Shipboard Scientific Party, 2002). Recent studies on seismogenic zones at convergent margins have indicated the importance of fluid below the seafloor (Saffer and Bekins, 1998; Moore and Silver, 2002), in terms of geochemical and hydrothermal conditions possibly controlling the behavior of seismogenic faults at depth (Hyndman *et al.*, 1995). Also, time-variant fluid flow in and around accretionary prisms was hypothesized through geochemical and hydrogeological studies (Sa Although intensive efforts to understand the role of fluid at the Nankai accretionary prism through submersible operations (Ashi *et al.*, 2001 for example), long-term monitoring of fluid behavior is indeed a fundamental approach to understand quantitatively the role of fluid in the accretionary complex and around the Nankai seismogenic zone.

The objectives of the cruise KR02-10 include, (1) data download from the installed Advanced CORKs (abbrevi-

ated as ACORK, hereafter), (2) conducting geothermal surveys at the seafloor, and (3) possibly investigate the relationship between the location of biological communities and thermal anomalies at the toe and at the thrust fault systems of the accretionary prism. Although hard seafloor has precluded heat flow measurements from the vessel at some places, overall surveys went through smoothly as planned before the cruise. We would like to summarize the cruise in this report.

2. Study Area

During KR02-10 cruise, we carried out our survey in two regions, shown in Fig.1, one off Muroto and the other off Kumano. In the Muroto region (Fig. 2) we already have detailed survey data, including 3D-MCS survey, seabeam data, heat flow data, and piston core samples. Also two borehole pressure monitoring systems (ACORK) were deployed during ODP Leg196 near the toe of accretionary prism.

Accretionary complex off Kumano area is proposed for IODP drilling into seismogenic zone (Fig. 3). Site surveys are being conducted recently, and this cruise served for that, too. Especially, diving surveys integrated with sidescan/SBP imaging with KAIKO launcher/vehicle system could be a robust tool for surface mapping of active processes. Also, intensive heat flow survey in this region is planned, for we have little heat flow data across Kumano accretionary complex.

3. Scientific questions and methods

Before conducting the survey, we have set the following hypotheses first for future understanding of seismogenic mechanisms:

- (1) Systematic, progressive material and state changes control the onset of seismogenic behavior and locking of subduction thrusts.
- (2) Megathrust earthquakes in the seismogenic zone take place along weak faults under conditions influenced by fluid in the course of seismic behavior.
- (3) Physical properties of materials in the seismogenic zone changes with time in earthquake recurrence cycle.

These hypotheses clearly indicate the necessity to understand fluid circulation in and out of the seismogenic zones, since they are directly or indirectly related

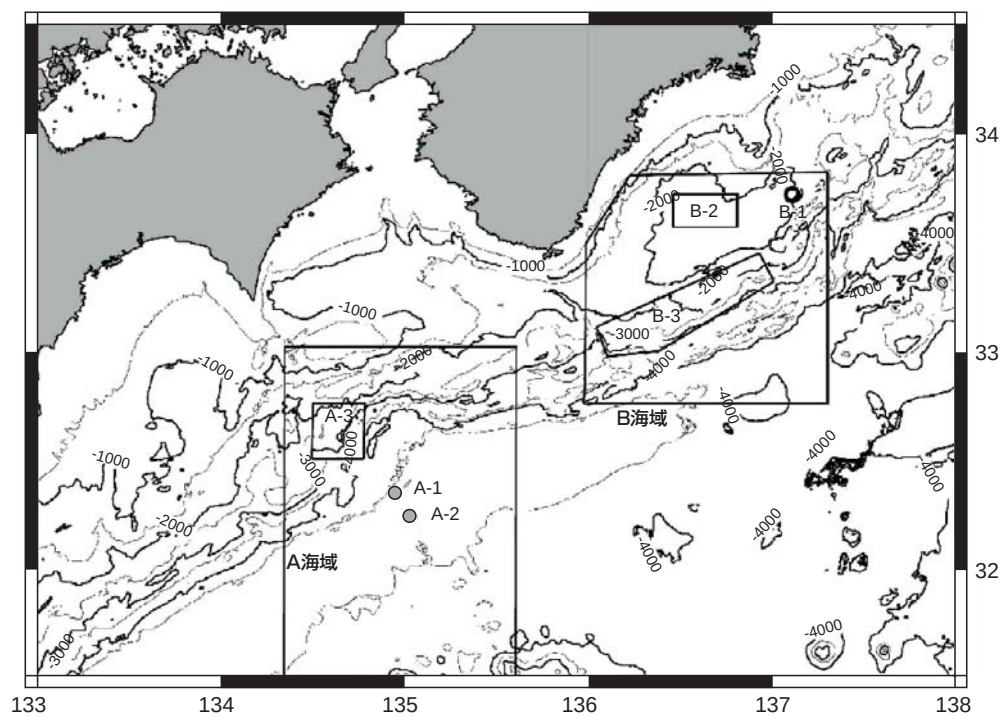


Fig. 1 Study area of KR02-10 cruise. A: Muroto, B: Kumano.

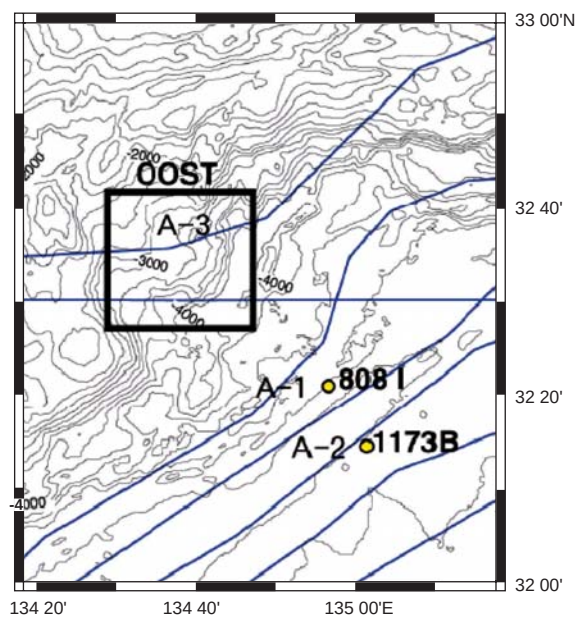


Fig. 2 Blowup of KR02-10 study area off Muroto. A-1 through A-3 stand for dive areas. Thick lines show trails of deep-sea communication cables.

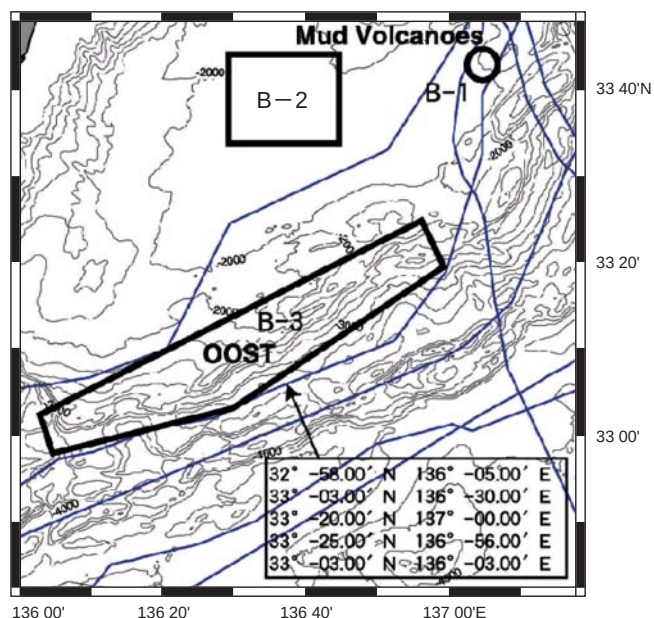


Fig. 3 Blowup of KR02-10 study area off Kumano. B-1 through B-3 stand for dive areas. Thick lines show trails of deep-sea communication cables. No dive was finally conducted to B-1 during this cruise.

to the generation of earthquakes. Parameters related to the above hypotheses include fault materials, stress state around the faults, fluid pressure distributions, temperature distributions, permeability, chemical composition of fluid, etc., on top of the other elastic properties of rocks.

As one step towards the above hypotheses, we have set the following questions to solve:

- (1) If fluid drains out through thrust faults,
- (2) If biological communities are directly related to fluid production, and
- (3) If Pressure transient in the oceanic sediments on top of the crust can be explain by horizontal flow so that fluid movement may take place along decollement zone.

For the above questions, (1) and (2), intensive heat flow measurements were planned at two transects, Muroto and Kumano, for understanding fluid expulsion at the sea floor. Question (3) is strongly related to hypotheses presented for ODP leg-196 in which they installed two long-term hydrogeological observatories. During this leg KR02-10, one of the main objectives is to recover the pressure data from these two sites. Also, detailed heat flow mapping across the frontal thrust and out-of-sequence-thrust (OOST) area was planned as primary objectives using submersible-deployable heat flow

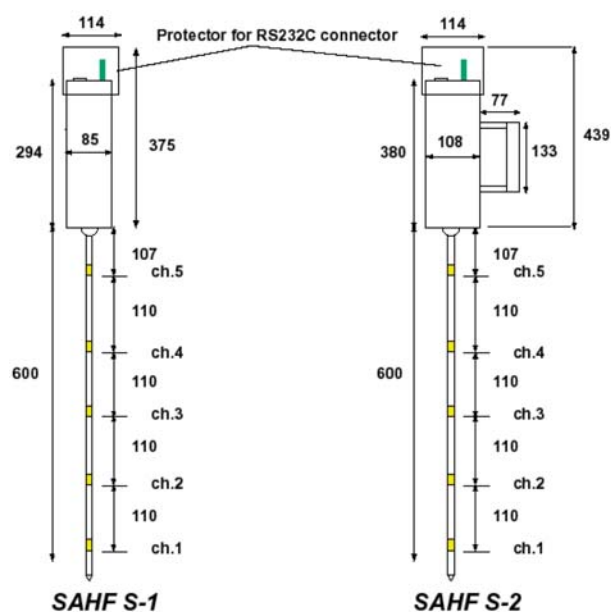


Fig. 4 Schematic illustration of SAHF, submersible-deployable heat flow meter. Numbers are in millimeters. Five thermistors are aligned vertically and indicated by channel numbers.

meters (SAHF: Stand-Alone Heat Flow meter: Fig. 4) and ordinary heat flow meter (HF: Fig. 5). Since heat flow measurements at seafloor are known unstable where there are fluctuations in water-temperature, such fluctuations and heat flow must be monitored along for at least a year to obtain heat flow estimates.

Along with these heat flow measurements, During KR02-10 we conducted SeaBeam surveying of the seafloor bathymetry during the night of August 11-12th, 2002. This surveying was conducted in Area B off Kii Peninsula and was intended to fill in existing SeaBeam data gaps at the southern end of Area B. The survey



Fig. 5 Heat flow meter (HF) deployed in KR02-10.

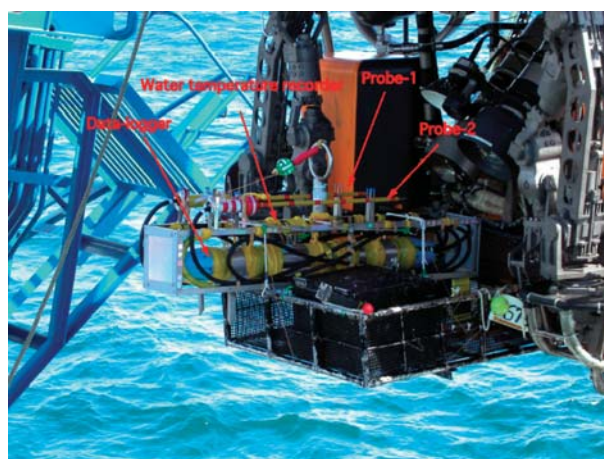


Fig. 6 Long-term Measurement System (LTMS) in the basket of KAIKO at her launch. Two probes equipped with five thermistors were deployed to run into sediments to measure heat flow by KAIKO or the other submersibles. Water temperature is monitored at the same time as heat flow.

included a west to east transect from 32° 38' N by 136° 00' E to 32° 38' N by 137° 30' E followed by an east to west transect from 32° 32' N by 137° 30' E to 32° 32' N by 136° 00' E. This surveying effectively completes that data coverage for the southern end of Area B. Sub-Bottom-Profiler (SBP) and Side-Scan-Sonar (SSS) attached to KAIKO launcher have run to acquire seafloor backscattered acoustic waves to see if these sensors are capable to provide meaningful geological characteristics of surrounding seafloor.

4. ACORKs

The Advanced CORKs (ACORKs) installed during Leg 196 are the first implementation of a concept that

represents an important advance over the simple CORK hydrogeological observatories successfully installed by ODP in many locations since 1991 (Fig. 7). CORKs and ACORKs represent different approaches to scientific objectives which range from assessing background state of the formation fluids to detecting transients (possibly due to fluid flow or earthquakes) to utilizing the propagation of tidal loading signals into the subsurface to constrain elastic and hydrological properties of the formation.

As shown in Figs. 7-9, the original CORKs include only a single seal at the seafloor and therefore integrate hydrogeological signals from the open (uncased) section

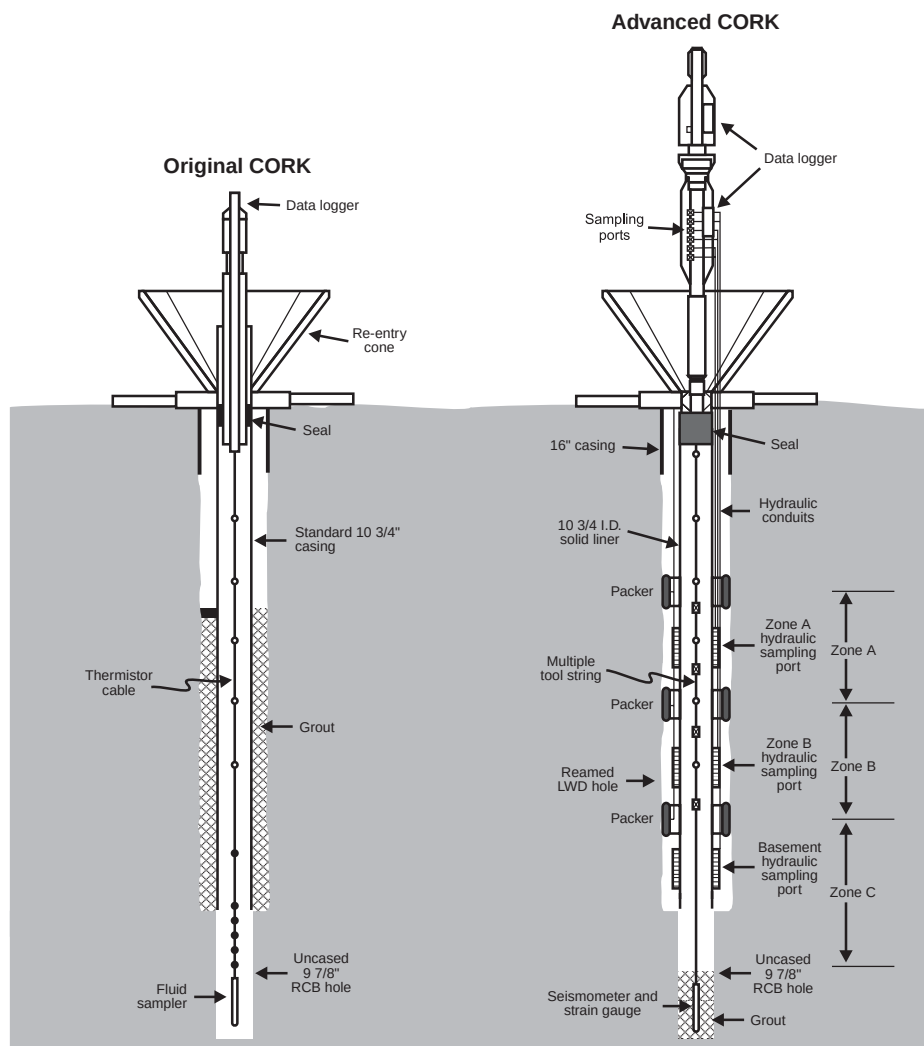


Fig. 7 Schematic diagram of CORK and Advanced CORK borehole observatories. Exchange between permeable subsurface formations and the ocean is prevented in the CORK by a seal within solid liner (casing) that is grouted into impermeable sediment, and in the ACORK by multiple packer seals assembled on the outside of a solid casing.

of drilled interval beneath. On the other hand, the ACORK concept involves multiple seals and monitoring intervals in a single hole, designed to understand processes in a hydrologically stratified system with distinct hydrogeological formations, as might be expected in a subduction system like Nankai Trough. Prior CORK results and the ACORK concept are described in more detail in a workshop report (Becker and Davis, 1998) and in two recent summary articles (Becker and Davis, 2000, and Davis and Becker, 2001).

A particular aim of the Nankai ACORKs is monitoring of strain and earthquake-related hydrologic signals as recorded in subseafloor pressures and ancillary instrumentation still to be emplaced near the sites. See Davis and Becker (2001) for a summary of recent CORK results illustrating fluid pressure transients arising from earthquakes. Further details of the actual ACORK installations at Holes 1173B and 808I are presented below. The ACORK operations were based on utilizing the reentry cones and holes drilled during LWD operations. At Site 1173, LWD operations were quite successful through the entire sediment column, and the planned four-packer, five-screen ACORK was installed in Hole 1173B to full depth of 728m. However, the final step - installation of a bridge plug to seal the central bore - met with some complications (described below) that left the hole properly sealed but with broken off drill pipe that precluded planned installation of a thermistor cable supplied by JAMSTEC.

At Site 808, LWD operations penetrated decollement zone only with great difficulty and risk, so the ACORK in Hole 808I was configured with two packers and six screens and was intended to penetrate just to decollement zone, with an emphasis on determining the hydrogeological state and processes in three zones: the frontal thrust, a fractured zone ~160m below frontal thrust, and decollement zone. Owing to extreme deterioration of drilling conditions and failure of the underreamer, actual penetration concluded ~36m short of the goal of 964m, but the ACORK remains a viable installation.

The ACORKs installed at Nankai Trough are very long-term experiments, designed to last for at least 10 years. Thus, the Kaiko dives in 2002 were considered

the first of a series of revisits to be requested over the next decade. Past experience with CORKs has clearly demonstrated the value of an initial data download approximately a year after installation, for reasons including: (1) because much of the recovery to truly in-situ conditions typically occurs within the first year after installation and (2) to assess the status of the installations and design complementary follow-on experiments. Subsequent data revisits can then be justified (on annual or two-year intervals) based on early demonstration of a properly functioning installation, for many objectives including: to capture the full recovery to in-situ conditions; to install additional experiments; and to recover the long time series that are necessary (a) to reveal natural transients (earthquake effects, fluid flow events) and (b) for proper spectral analysis of the subseafloor response to tidal loading.

4.1 ACORK at Hole 1173B

A four-packer, five-screen, 728-m-long ACORK casing string was deployed through the entire sediment section in Hole 1173B (Fig. 8), configured to emphasize long-term observations of pressures in three principal zones, as follows:

a. Oceanic basement below 731 mbsf, to determine permeability and pressures in the young oceanic crust being subducted, and thereby assess the role of oceanic crust in the overall hydrogeology at Nankai Trough. A screen was installed immediately above the ACORK shoe, centered at 722 mbsf, with a packer immediately above.

b. Lower Shikoku Basin formation, well below the stratigraphic projection of the decollement zone, to assess the hydrological properties of a reference section of the Lower Shikoku and test for fluid pressure propagation from basement or possibly higher in the section. A packer was centered at 495 mbsf to isolate a screen centered at 563 mbsf.

c. The stratigraphic equivalent of decollement zone in the upper part of the Lower Shikoku formation seaward from Sites 1174 and 808. The Leg 190 cores and wireline logs and Leg 196 LWD data showed only the slightest physical properties variations across this zone at about 390 to 420 mbsf, about 50-80m below the bound-

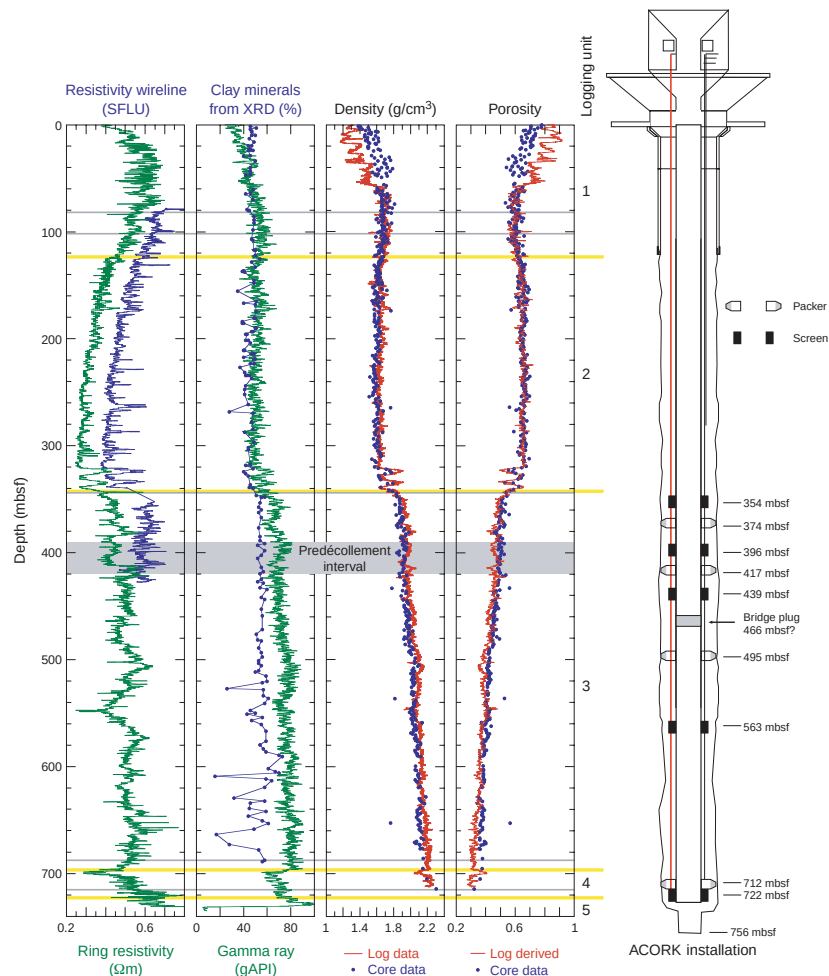


Fig. 8 Logs from Hole 1173B and configuration of the ACORK installed during Leg 196.

ary between Upper and Lower Shikoku Basin formations. A symmetric array about 100m long, comprising 3 screens separated by 2 packers, was built into the ACORK string such that the three screens were centered at 439, 396, and 353 mbsf. Objectives of this array include (a) documenting the variation of hydrogeological properties across and away from this zone as a reference for the state of the formation before the decollement zone actually develops closer to the trench axis and (b) detecting the possibility of fluid flow along the stratigraphic equivalent of the decollement zone. In addition, the central screen in this array, i.e., the screen that spans the stratigraphic equivalent of the decollement zone, includes a second small-diameter line for eventual sampling of formation fluids from the wellhead.

After installation of the ACORK casing string, the RCB coring system was successfully deployed through

it, with the principal objective of deepening the hole into basement to assure that the signal of basement hydrogeological processes will be transmitted to the deepest screen.

Following the basement coring, the final step in the ACORK installation at 1173B was deployment of a bridge plug to seal the bore of the casing and isolate the basement section to be monitored by the deepest screen. This was intended to be set very near the bottom of the ACORK string, allowing future deployment of other sensor strings within the central bore. However, the bridge plug apparently set prematurely at 466 mbsf; this was not sensed at the rig floor and ensuing operations resulted in breaking the pipe off at the ACORK head. Detailed analysis of the operational parameters indicates that the bridge plug is indeed set. A video inspection at the end of Leg 196 confirmed that the pipe broke off

precisely at the ACORK head and there is no damage to the ACORK head itself.

4.2 ACORK at Hole 808I

Pre-cruise planning for the ACORK in Hole 808I was based on complete penetration through the decollement zone to basement, with an intended packer and screen placement for long-term hydrogeological monitoring within upper oceanic crust and the decollement zone. However, during the LWD operations extremely poor drilling conditions were encountered immediately below the decollement zone, which dictated that the ACORK configuration be modified to eliminate the basement objective and penetration below the decollement zone. Hence, the actual configuration included two packers and six screens in a 964-m-long ACORK string, to emphasize long-term observations of pressures in three principal zones, as follows:

a. Decollement zone and overlying section of Lower Shikoku Basin formation. A screen was placed immediately above the casing shoe, with a packer immediately above the screen. The hole was opened with the intent of emplacing the screen just into the decollement zone, with the packer positioned in a competent zone immediately above the decollement zone. Three other screens were configured above the packer, to span the upper section of Lower Shikoku formation to study the variation of physical properties and propagation of any pressure signals away from the decollement zone.

b. A fractured interval at 560-574 mbsf in the Upper Shikoku Basin formation, as identified in images from the resistivity-at-bit LWD tool. A single screen was intended to be deployed in this zone.

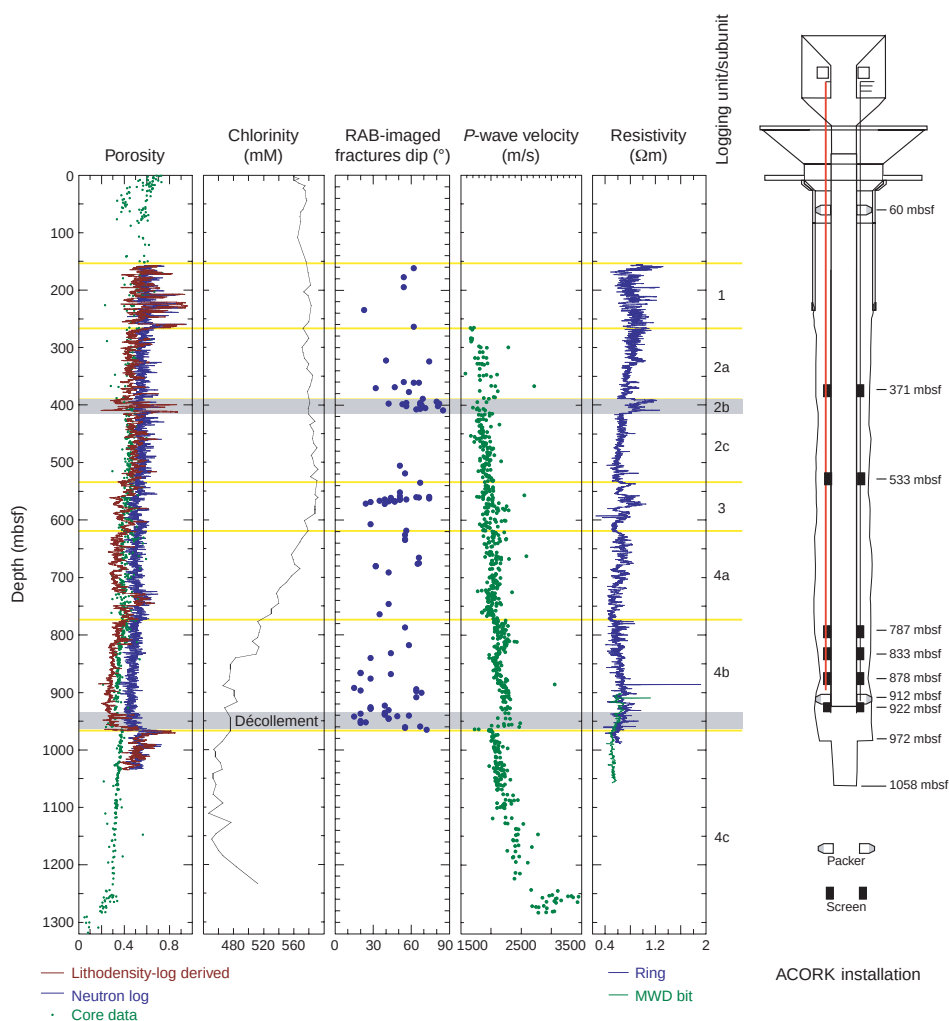


Fig. 9 Logs from Hole 808I and configuration of ACORK installed during Leg 196.

c. The frontal thrust centered at about 400 mbsf. A single screen was intended to be deployed in this zone.

Unfortunately, drilling conditions during installation of the ACORK steadily worsened starting about 200m above intended depth. Despite a heroic effort by the rig crew and application of every available technique, progress stopped 37m short of the intended installation depth. This left the screen sections offset above the intended zones (Figure 9) - not an ideal installation but still viable in terms of scientific objectives. In addition, this left the ACORK head 42m above seafloor - again not ideal, because engineering calculations indicated that the exposed ACORK casing string was probably not strong enough to support its own weight. Indeed, when the drillstring was pulled out of the ACORK, the VIT feed showed the ACORK slowly tipping over within seconds.

Fortuitously, the exposed ACORK components tipped gently and in the best possible direction. Careful video inspection showed the casing not broken, but bent.

4.3 A-CORK Head - Physical Configuration

The ACORK head is a 30" diameter cylindrical frame fabricated from 3/8" steel around a section of 11-3/4" casing. It houses components in each of three 120° - wide, 60"-high bays that are bounded above and below by circular horizontal bulkheads and divided from one another by radial webs (Figure 10). The bays contain the following components described in more detail below: 1) the sensor/logger/underwater-mateable connector assembly on a demountable frame, 2) the spool valves and pumping/sampling valves and ports, and 3) the 3-way pressure sensor valves and the geochemical sampling valve and port. The lowermost bulkhead is positioned approximately 16" above the submersible landing platform that covers the reentry cone. Pairs of 3" o.d., 2.75" i.d. docking tubes, 12" center-to-center, are welded immediately beneath the lower bulkhead to provide an aid for maintaining submersible or ROV stability during site visits. Numerous cut-outs on the vertical webs can be used as manipulator "hand-holds" for the same purpose. At the top of the ACORK head is a 30" reentry cone for drill-bit, sub-casing, or wireline tool delivery systems.

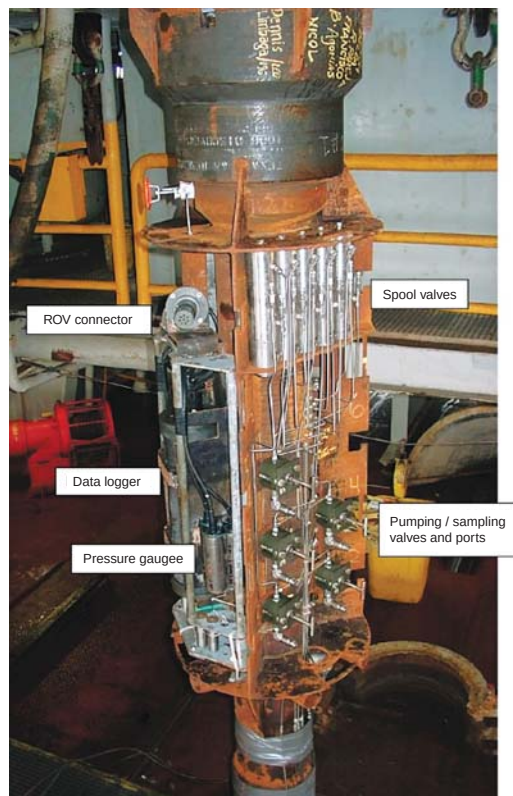


Fig.10 Detail of ACORK head photographed on the rig floor. Vertical scale is about 2m. This photo shows the side of the Hole 808I ACORK head which is facing up in Figure 7. The ROV connector is a SEA CON 8-contact Nautilus connector.

5. Dive Logs and Sample Descriptions

Note: Color codes from Revised Standard Soil Chart

5.1 Dive 261 (8/2/02)

Visit to ODP Hole 808I, frontal thrust and decollement. Kaiko was launched for the first dive of the cruise without delay, and landed within easy sonar range of the ACORK head and upper casing which were both well imaged. The first operation involved cleaning the underwater-mateable connector (UMC) of a very light dusting of sediment, making the electrical connection, powering up the ROV RS-232 communication port, and downloading data (2.2 MByte binary file at 38,400 Baud). No problems with this operation were encountered. After powering the port down and disconnecting, a visual inspection of the upper casing string and hydraulic umbilical was completed while data were being reviewed. No breaks or unreasonable strain could be seen. This, and the highly fortuitous positioning of the ACORK head with the connector facing directly up and

the pump valves fully accessible, could hardly be believed. What had seemed to be an ill-fated installation was looking very good. The luck did not continue to hold up, however, as inspection of the data showed that only pressure gauge 4 (see Table 1 for corresponding screen position) showed signs of formation pressure. All others registered hydrostatic seafloor conditions (Fig.11).

Note: Pressure gauges, screens, and valves are numbered with the deepest being #1, and with the seafloor gauge being #6 at 1173B and #7 at site 808I. The order of appearance of pressure data in all logger output lines and formatted data files is Pn, Pn-1, ..., P1 where Pn is the seafloor gauge. See Shipboard Scientific Party (2002) for other details.

Completion of the round trip visual inspection brought Kaiko to where the pump valves and spool valves are located in ACORK Bay 1, adjacent to the data logger in Bay

3. All spool valves had stroked properly (although valve 6 was buried by sediment and could not be seen), but the pump valve handles of all but valve 4 were in rotated positions. This was almost certainly the cause of the observed hydrostatic pressures. Angles were approximately 20, 20, 35, 0, 45, and 60 degrees from original

horizontal for valves 1 - 6, respectively. Valves were closed in the following order: 5, 3, 6, 1, 2. Pressure gauge valves and the geochemical sampling valve could not be inspected, as Bay 2 lay face down in the seafloor sediment. The electrical connector was re-mated, and data were collected manually (via logger DRO command) at roughly 10 s intervals for roughly 10 minutes with little indication of a change in pressure. Communications were terminated, and we ended the ACORK operation with considerable disappointment. Other causes for the hydrostatic conditions had to be

Table 1 Screen depths and pressure gauge assignments

Hole 808I		Hole 1173B	
Gauge	Scree Depth	Gauge	Screen Depth
SF	0 mbsf	SF	-5 mbsf
6	371	5	359
5	533	4	402
4	787	3	445
3	833	2	569
2	879	1	728
1	922		
		Basement	731
	Decollement		940-960

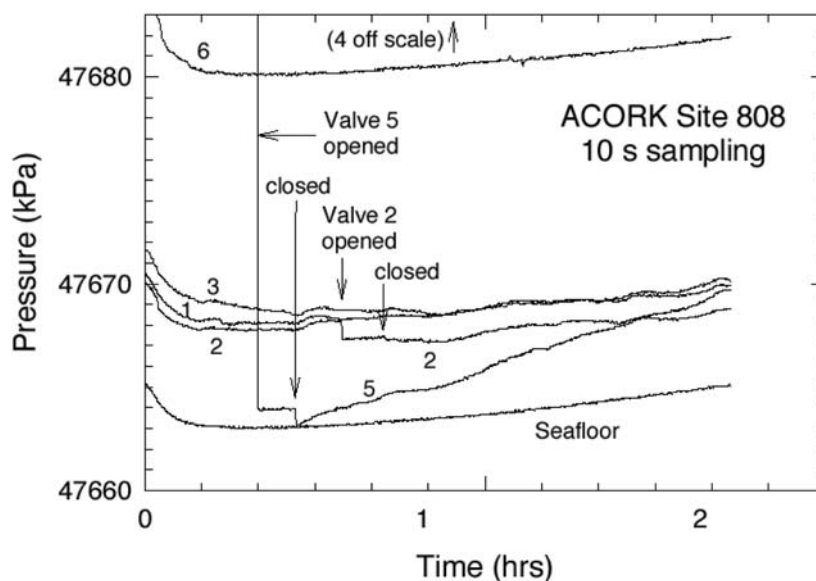


Fig.11 First two days of pressure record at Site 808. Only gauge 4 records formation pressure; all other valves had vibrated open during deployment and gauges recorded hydrostatic pressure. All pressures increased by roughly 37 kPa at the time the ACORK running tool was released and the incompletely drilled in installation fell to the seafloor

considered. The cause for the rotation of the valves was speculated to be the heavy vibrations suffered by the instrument as a consequence of pipe strum in the Kuroshiro Current. Tom Pettigrew was notified of this problem so that it can be avoided with future CORK installations, particularly during upcoming Leg 205 in September. The dive continued with side-scan and visual observations of the thrust fault exposure landward of Site 808.

Dive log

Arrive on site: 10:03 local time (UT + 9 hrs)
 Data download: ~10:25 local
 Time check: 020802 01:21:20 UT logger was 01:53 FAST
 ACORK clock reset: 020802 01:41:00 UT
 Pump valves closed: 11:34 - 11:40 (02:34:00 - 02:40:00)

Following samples were obtained during the dive:

- PC-1: 15cm core, olive (Hue 10Y, Value 3, Chroma 2), clay-sized mud, no fragments, poorly consolidated, uniform color, and no distinctive smell.
- PC-2: 15cm core, olive (Hue 10Y, Value 4, Chroma 2) at top, bottom 7cm is Greenish Black (Hue 10Y, Value 2, Chroma 1), clay sized with no obvious fragments, sulfurous smell, contact between olive upper section and black sulfurous lower O₂ reduced section streaky and not discrete.
- Bio-1: Living Calyptogena. Length 14cm. Width: 5
- Bio-2: Living Calyptogena: Length 12cm. Width 5.5
- Bio-3: Living Calyptogena: Length 12cm. Width 5.

5.2 Dive 262 (8/3/02)

Visit to ODP Hole 1173B, 13km seaward of Site 808 on incoming Philippine Sea plate. As in the case of dive 261, preparations and launch at this location went extremely smoothly, and the ACORK installation was found immediately. Visual inspection of the well head showed that the spool valves had shifted properly, and that the pressure gauge and geochemical sampling valves were in their correct positions, but that some of the pump valves were rotated as at Site 808. Positions were approximately 0, 0, 80, 85, and 75 degrees from horizontal at valves 1 - 5, respectively. Valves were closed (with some difficulty, as Kaiko was hovering in

relatively strong current) in the following order: 4, 3, 5. After data were recovered and preliminarily reviewed, Kaiko was moved around to Bay 3 where gauge valves 1 and 2 were opened for a brief (20 min) hydrostatic check, then closed. Consistent with the angle of the valves, only gauges 1 and 2 showed signs of being connected to the formation. Others showed hydrostatic pressure (Fig.12). Many features of the early part of the record can be interpreted in light of installation operations at this site, where inadvertent overpressuring during packer setting operations caused the spool valves to be shifted prematurely, exposing the gauges to screen pressures during packer inflation (with no ill effects). The final portion of the record (Fig.13) shows positive signs of proper sealing of screens 4 and 5 at the time of Kaiko-manipulated valve closure. Pressure at screen 3 dropped below hydrostatic at the time of its valve closure, then began to recover, but apparently back towards hydrostatic. Most enigmatic was an even larger pressure drop (also to a sub-hydrostatic level) at screen 1; its valve was not handled during the valve closure operations. It may have been inadvertently bumped by the Kaiko basket, although upon later review of dive videos, there was no visible sign that it had been moved significantly away from a horizontal position. The gauge-valve hydrostatic test was successful, although no sign of recovery was seen at gauge 1 after the closure of its valve. As in the case of Site 808, we ended operations at this site with a less than satisfying feeling that all was well, even after having checked and closed all valves.

Dive log

Arrive on site: 09:50 local time (UT + 9 hrs)
 Data download: ~13:21 local
 Time check: 020803 04:20:30 UT logger @ 13:18:55 local => logger was 01:35 FAST
 ACORK clock reset: 020803 04:32:30 UT
 Pump valves closed: 10:07 - 10:13 (01:07 - 01:13 UT)
 Hydrostatic check, gauges 1 and 2:

Samples:

- PC-1: Core barrel empty
- PC-2: 15cm core, clay sized mud throughout, upper 10-11cm is ish Olive (Hue 5y, Value 6, Chroma 2), lower 4-5cm is Dark Greenish Grey (Hue

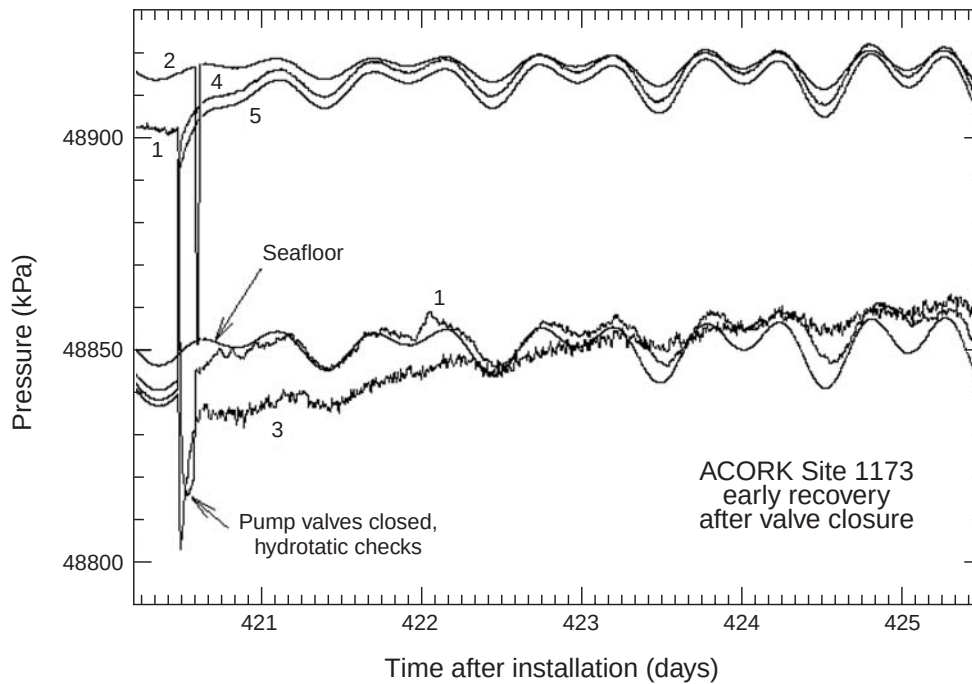


Fig.12 First 7 days of pressure record at Site 1173. Only gauges 1 and 2 record formation pressure; all other valves had vibrated open during deployment and gauges recorded hydrostatic pressure. Several features of the record are correlated with installation and post-installation activities. The deepest screen located in a very short and relatively tight interval below the deepest packer was particularly sensitive to packer inflation. This included a negative transient (A) as the packer mandrel began to shift upwards, then a positive one (to a peak of 2.9 Mpa, a substantial fraction of the total packer inflation pressure) as the packer filled (B). RCB drilling produced substantial noise at both levels (C), and the hopefully complete setting of the bridge plug (D) caused a clear transient at the deepest screen. Other aspects of the record, particularly the negative pressures seen in several instances including the long-lived final bridge-plug transient at screen 2, are not understood at this time.

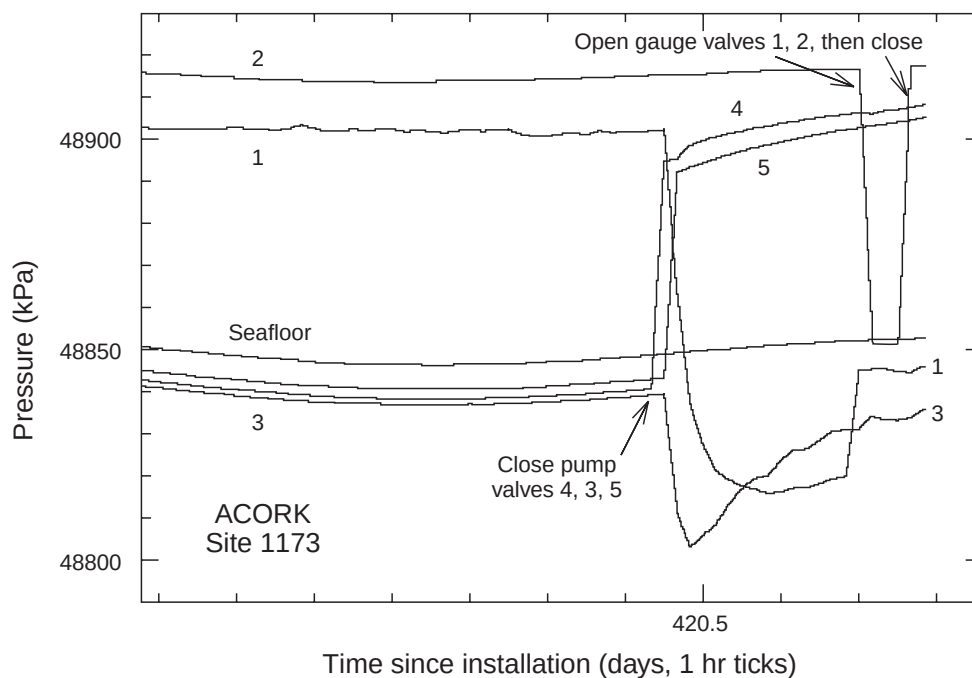


Fig.13 Detailed record at the time of pump valve closure and hydrostatic checks at Site 1173. The cause of the negative transients at the time of closure of pump valve 3 at gauge 3 and particularly gauge 1 (whose valve was not altered) is unknown.

10GY, Value 3, Chroma 1). The colors are not observed to be similar to Dive 261 samples. No fragments observed or distinctive smell.

- PC-3: 15cm core with upper 7-8cm Olive (Hue 5Y Value 4 Chroma2) with a thready look possibly indicative of algal growth and an abrupt contact with lower 7-8cm of Dark Greenish (Hue 7.5GY, Value 3, Chroma 1). Again clay-sized with no fragments or smell.

5.3 Dive 263 (8/4/02)

Sampling and expedition dive was conducted:

- PC-1: 15cm core, clay sized with upper 11cm being a deep brown (Hue 5Y, Value 4, Chroma 2) and lower 4cm being an olive (Hue 10Y, Value 3, Chroma 1), no fragments or smell. Lower clay is like modeling clay. Clay seems drier than previous samples.
- PC-2: 11cm core (upper 4cm empty), of the 11cm upper 8cm is brown and thready (algal growth?) (Hue 2.5Y, Value 5, Chroma 2), and lower 3cm is olive (Hue 5.5Y, Value 2, Chroma 1). Lower mud is again like modeling clay. No fragments or smell throughout.
- PC-3: 10cm core with upper 5cm empty. Core pierced through a clam so contains blood, shell fragments, and clam parts. Of 10cm upper 7cm is brown and thready (7.5Y, Value 5, Chroma 1) and lower part is olive and again like modeling clay (Hue 10G, Value 3, Chroma 1). Core does not smell sulfurous and black reduced part not encountered. Does smell bad due to slain clam.
- HS-1: Dense, olive mudstone with consistency of partly hardened clay. Can be cut with a knife but not easily.
- HS-2: Mud from base of tubeworm hummock. Mixture of olive, faintly consolidated, material, and black reduced sediment. Tubeworm bodies averaging 3mm in diameter found throughout.
- HS-3: Small bag full of tubeworms from bottom of bio box.
- HS-4: Indurated black rock with tubeworm casts or dried bodies attached.
- HS-5: Collection of small mudstones (Hue 2.5Y, Value 4, Chroma 3)
- HS-6: Small pebbles 1-2cm in diameter, identical in

color to HS-5

- HS-7: Possible filled burrow 3mm in diameter, 4cm long, nearly black in color
- HS-8: 5cm long, 1cm diameter clay/mudstone tube, from crust area, might be burrow also (Hue 5Y, Value 3, Chroma 2).
- Bio-1: Living Large Calyptogena, 19cm long, 8cm wide.
- Bio-2: Living large Calyptogena, 17.5cm long, 8cm wide.
- Bio-3: Living. Large Calyptogena, 16.5cm long, 6.5cm wide.
- Bio-4: Calyptogena shell fragments gathered from bio box.
- Bio-5: Very small shells

5.4 Dive 264 (8/6/02)

KAIKO returned to site 808. Efficient deployment and operations rapidly became taken for granted; as with the previous two ACORK dives, the talents of the Kaiko team and the capabilities of the vehicle made finding and working at Site 808 again seem effortless. A 4-m extension made for the UMC communications cable allowed the vehicle to be moved safely to the pump-valve bay after the ROV connector was mated to the ACORK. Data were downloaded, and it was found upon viewing the data collected in the three days since the previous visit that all gauges now seemed to be responding slowly but resolutely to the closure of the valves. This is apparent in both small changes in average pressures of several of the gauges, and distinct changes in the response to tidal loading at all gauges. This was good news indeed, for it appeared that the monitoring experiment at this site could now properly begin.

The results demonstrate two things quite clearly: 1) The "noise" seen in several of the gauge records in Figure 4 is probably coherent among the levels, and 2) the frequency-content of the "noise" is well characterized by the 10 s sampling rate; it extends little higher than 0.1 Hz. Thus we believe that the noise is generated either in the formation itself or, more likely, by flow in the annulus between the ACORK casing string and the formation. The results of the hydrostatic checks showed that there had been no detectable drift in the gauge pressures over the 1 yr since deployment. Slow response fol-

lowing valve closure at screen 2 shows the formation to be extremely tight.

After approximately two-hours of rapid-rate recording, the data rate dropped back to 10 minutes (as programmed). We monitored the first 10-min primary-rate data sample to verify proper functioning of the logger, did a time check, and shut down communications. This ended the ACORK operations at this site, and the dive continued with a detailed "leap-frog" heat-flow transect.

Dive log

Arrive on site: ~09:45 local
 Data download: ~09:59 local
 Time check: 020806 01:03:50 UT (within manual error limits) Rapid sampling initiated: 020806 01:16:50 UT (10 s rate for 1.5 hrs)
 Pump valves cycled: 5 open @ 01:36:40 UT, closed 01:43:102 open @ 01:51:20 UT, closed 01:59:00
 First 10-min sample: 020806 03:10:00 UT
 All valves checked for full closure: 5, 3, 1, 2, 4 @ 11:22 local
 264-PC-01: Top 8cm: grish olive clay-sized sediment (Hue 5Y, Value 4, Chroma 2. Bottom 7cm: Dark greenish grey. Hue 10J, Value 3, Chroma 1.
 264-PC-01: Core Catcher. Bottom of 164-PC-1 placed in small sampling bag
 264-PC-02: Top 11cm: Dark Greenish Grey, clay-sized sediment (Hue 10J, Value 3, Chroma 1). Bottom 4cm: ish olive, clay-sized. Hue 5Y, Value 4, Chroma 2.
 264-PC-02: Core Catcher. Bottom of 264-PC-02 placed in small sampling bag.

5.5 Dive 265 (8/7/02)

Sampling was conducted.

265-PC-01. 15cm core. Clay-sized sediments. A few (less than 3%) silt-sized grains, but not quartz as they can be chewed. The whole core is a Dark Olive (Hue 5Y, Value 4, Chroma 3). Upper half slightly 'thready'

relative to bottom half. Bottom half is more consolidated like modeling clay. Top half is very unconsolidated. Sample catcher bag was also taken

265-PC-02. 13cm long. Upper 9cm. Are a grayish olive color. Hue 7.5Y, Value 4, Chroma 2. Clay sized but no thready textured. Bottom 4cm. A Dark Greenish Gray (Hue 10G, Value 3, Chroma 1). Clay sized.
 265-PC-03. 15cm long. Top 6cm are clay-sized. Olive Black (Hue 7.5 Y, Value 3, Chroma 2). Bottom 9cm. DARK Greenish Gray (Hue 5G, Value 3, Chroma 1). Core catcher bagged.
 265-Bio-01. Single large bent Calyptogena shell. White. Dead. 24cm. Long. 7cm wide. Long dead (no biological material in them).
 265-Bio-02. Bag of dead Calyptogena shells. Average 13cm long, 6cm wide.
 265-Bio-3. Mud Tubes. Perhaps tube worms.
 265-Bio-4. Shell fragment.
 265-Bio5: A living small clam shell extracted from the 265-Bio-2 sample.

5.6 Dive 266 (8/8/02)

Return to ACORK Hole 1173B. The Site 1173 well-head was found quickly, although some time was required to establish stable station keeping with the ship because of an awkward combination of wind and current. Current on the bottom was relatively weak, so when a final approach to the site could be made, the Kaiko team used the left manipulator to steady the vehicle by holding onto the instrument frame web while the connector was mated with the right hand. This made the operation much easier than in a hovering mode. With the connector mated with the long extension, Kaiko was backed away and set to rest on the seafloor next to the reentry cone for the data recovery and logger repro-

gramming (for 2.5 hrs of 10 s recording). The connector was then removed, and Kaiko was used for local heat flow measurements. Following the temporary rapid-sampling interval and one normal 10-min sample, the connector was once more connected, data were retrieved and reviewed, the logger memory was cleared, the time checked, the communication line was powered down, and the connector was removed, all in what had become a routine manner. Before leaving the site, all valves were once again visually inspected, as well as the top of the instrument hanger. The latter showed the broken pipe to be fairly well centralized in the upper reentry cone, and the crimp to be relatively minor. In a fit of enthusiasm, it was felt that a tool string could possibly be gotten inside the pipe, and that a fishing tool gotten over the outside, although in reality, either one would require considerable luck and ingenuity!

As at Site 808, the data recorded during the 5 days since the valves at this site were closed showed clear signs that formation pressures are now being properly recorded (Fig. 6). Pressures at the gauges connected to upper screens 4 and 5 (which had previously been hydrostatic) jumped quickly by more than 50 kPa, and showed signs of continuing transient recovery. Pressures at screens 1 and 2, which had enigmatically dropped in pressure at the time of valve closure (Fig. 3) began a slow climb and reached super-hydrostatic levels by the end of the 5 day recording period. Various levels of attenuation of the seafloor tidal loading signal were also apparent in the post-valve-closure records, further attesting to the fact that the installation is probably now fully functional. The "noise characterization" provided by the 10 s data showed the high frequency content at some of the levels that was aliased at a 10 min recording rate to be smooth at 10 s (Fig. 7). Hence the noise appears to be neither associated with the gauges nor caused by leakage dynamics anywhere in the plumbing of the seafloor ACORK installation. This high-frequency component reflects either real formation variations or leakage dynamics in the annulus outside the screens.

We look forward to returning to the sites in a year or two for the first "real" data; this will be a very exciting time! In the meantime, we must wait patiently, and congratulate all who contributed much hard work to making these installations a success. We hope that in the years to come these observatories will lead to a better under-

standing of the mechanical, hydrologic, seismic, and geodynamic behavior and associated hazards of this subduction zone accretionary prism. We also hope that the experience we have gained will benefit the development of other installations in the future.

Dive log

Arrive on site: ~10:00 local
 Data download: ~10:25 local
 Time check: 020808 01:26:01 UT
 (within manual error limits)
 Rapid sampling initiated: 020808 01:26:50 UT
 (10 s rate for for 2.5 hrs)
 First 10-min sample: 020808 04:10:00 UT
 Data pointer cleared: 020808 04:20:28 UT
 Final inspection and departure: ~13:30 local

266-PC-01: Full 15cm core. Top 12cm Dark Greenish Gray Clay (Hue 7.5GY, Value 4, Chroma 1), Basal 3cm Olive Black (Hue 5Y, Value 3, Chroma 2)

266-PC-02: Taken adjacent to PC-01, split it open to examine, upper gray zone is very unconsolidated (soup), whereas basal zone is more consolidated (paste), Located at A-Cork

5.7 Dive 267 (8/9/02)

267-HS-01: Coarse grained litharenite. Some grains more than 1mm in diamter. Lots of rock fragments, some feldspar, some quartz. Fresh face: predominantly a green (chloritic) color,. On weathered face, it is black...almost a manganese oxide black. Lightly cemented (can crumble with your hand). Lots of silt-sized sediment. Probably a classic greywacke. Extremely poorly sorted, but definitely grain supported. 19cm×18cm×12cm in size. Location: 3 39.2783; 136 37.9464.

267-HS-02: gray indurated claystone. Weathered face is gray to manganese black in color. Snail-like animals cling to the outside:

- Size 11cm×8cm×6cm. Location: 38 39.3026 136 37.9326
- 267-HS-03: Silty mudstone. One rock is broken into 2 pieces. Size of whole rock: 14cm×14cm×9.5cm. Microfractured mudstone has very thin calcite (?) (0.1mm in width) veins. Fractures are apparently orthogonal and preassembly present. Fresh face: grayish olive (5Y, v=5, c=2). Location: 38 39.3026 136 37.9326 (same as HS-02).
- 267-HS-04: Extremely indurated, silty (?) claystone. Grayish olive color. 16cm×10cm×9cm. Weathered face has black on one side and gray on the other. Location: 3 39.2783; 136 37.9464. (same as HS-02).
- 267-HS-05: One block that split into 3 pieces, each piece was named: HS-05a, 5b, 5c. The total block when pieced back together is 21cm×15cm×8cm. HS-05a: 16cm×15cm×7cm, HS-05b: 15cm×10cm×7.5cm, HS-05c: 9cm×5cm×3cm, This sample is a claystone bounded above and below by fine-grained sandstone, the claystone color is dark greenish gray (Hue 5G, Value 4, Chroma 1). Location: 38 39.367', 136 37.9409
- 267-HS-06: Approximately one kilogram bag of small ~1cm claystone pebbles. These samples are from the basket and are dark olive gray (Hue 2.5GY, Value 3, Chroma 1).
- 267-HS-07: From bottom of basket, similar to HS-06, approximately 0.5kg bag of 1-3cm pebbles.
- 267-HS-08: 0.5cm-1cm olive black claystone pebbles.
- 267-HS-09: Grayish olive (Hue 7.5Y, Value 6, Chroma 2) claystone, six fragments, 1cm - 3cm.
- 267-HS-10: Lithified sulfurous claystone. 2 fragments: 1) 5cm, 2) 3cm
- 267-HS-11: Bag of rocks, 3-10cm in size, from bottom of bio box.
- 267-Bio-01: Living Calyptogena 20cm×6.5cm, living
- 267-Bio-02: Living Calyptogena 14.5cm×6.5cm, living
- 267-Bio-03: Living Calyptogena 13.5cm×5cm, living with little calcareous growth on outside of shell
- 267-Bio-04: Living Calyptogena 16cm×5.5cm, living
- 267-Bio-05: Living Small Clam 4cm×2.5cm, looks like beach clam in shape
- 267-Bio-06: Dead Calyptogena shells from first sample point. Location: 33 39.3036, 136 37.9410
- 267-Bio-07: Dead Calyptogena shells from second sample point 33 39.3697, 136 37.9409
- 267-Bio-08: Dead Calyptogena shall fragments from unknown location
- 267-Bio-09: Tubeworms living on Calyptogena shells, originally attached to Calyptogena shells
- 5.9 Dive 268 (8/9/02)**
Rescue dive.
- 5.10 Dive 269 (8/11/02)**
The last dive at Kumano. KAIKO visited seafloor around Out-Of-Sequence-Thrust faults.
- 269-PC-01: Mud composed of approximately 90% clay, and 10% silt- and sand-sized fragments. Color: top 2cm are Olive Gray (hue 107, Value 4, Chroma 2). Bottom 8cm: Hue 7.5y, Value 5, Chroma 3. Grayish Olive. Strikingly coarser than previous samples at Muroto. Core catcher also bagged and stored with same label.
- 269-PC-02: 5cm long. Top 1cm: Dark Olive 9Hue

7.5y, Value 4, Chroma 2. Bottom 4cm: Hue 7.5Y, Value 4, chroma 2. Grayish Olive. 20% silt and fine-grained sand. Matrix supported.

269-PC-03. 10cm long. Top 3cm: Dark Olive (Hue 7.5, Value 4, Chroma 3). Top has approximately 20% silt and sand sized fragments. Bottom 7cm. Grayish Olive. (Hue 7.5, Value 4, chroma 2. Bottom has approximately 10% sand- and silt-sized fragments. The size distribution of the sand and silt is about the same on top and on the bottom. It is possible the sea floor is winnowed by current thus increasing the fraction of coarser grains as we observe.

269-HS-01: Bioturbated claystone. 11cm × 7cm × 3cm. Bio turbation is as large as _cm, but there are holes of many different sizes

down to less than a mm. Weathered surface has a manganese black color. Fresh surface Hue 7.5y, value 5, chroma 2. Grayish live. Bioturbation is at all angles, no preferred orientation. It is striking how bioturbated this sample is.

269-HS-02: 17 × 10 × 7cm. Biggest hole is 1cm in diameter. Rock description is same as 169-HS-01.

The traces of Kaiko on the seafloor are drawn in Figs.14 which have been resolved by this time.

5.11 General Description of the Survey

A list of the ship crews, Kaiko operation team members and trainees who have joined the research cruise is summarized in the Appendices 1 through 3. Time logs for all the Kaiko dives are chronologically ordered in the Appendix 4. Manipulator arms of the Kaiko were

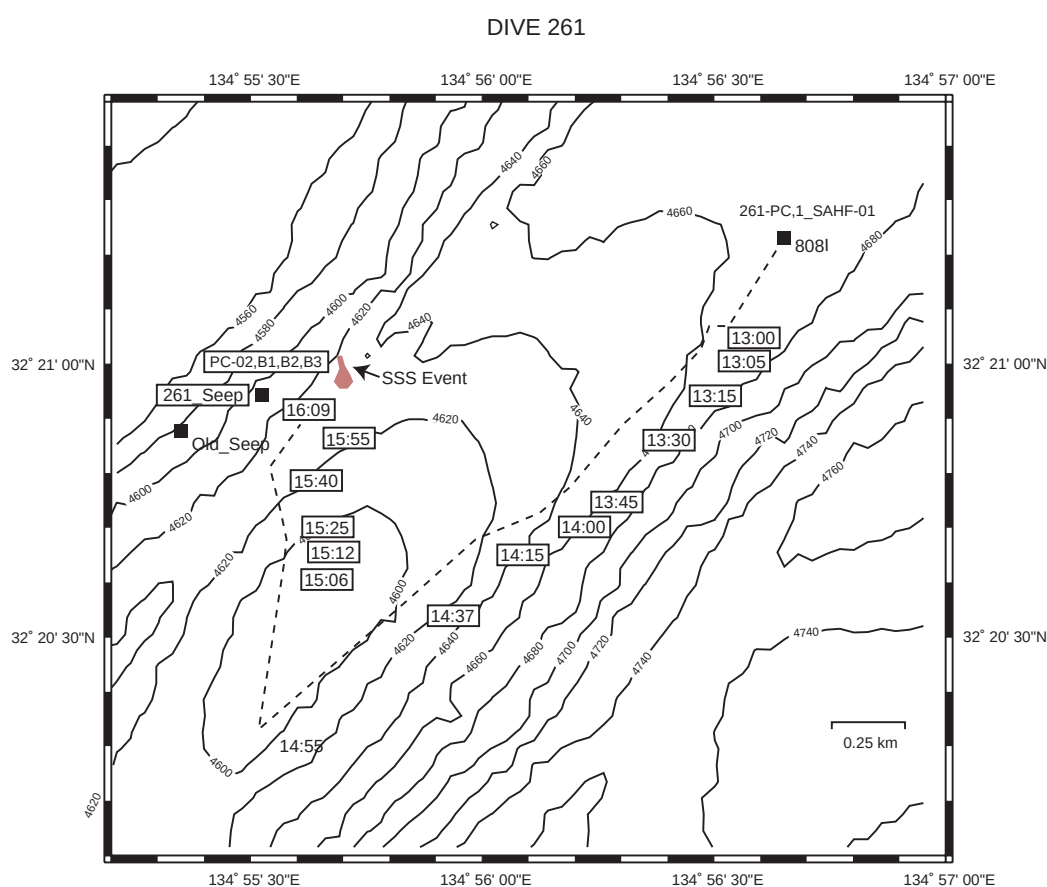


Fig.14 (a) Summary of figure of the KR02-10 Dive 261. Dashed line delineates the path of the ROV. Bathymetry is interpreted from 3-D seismic data in 20m contours. SSS Event delineates event found in side-scan sonar data.

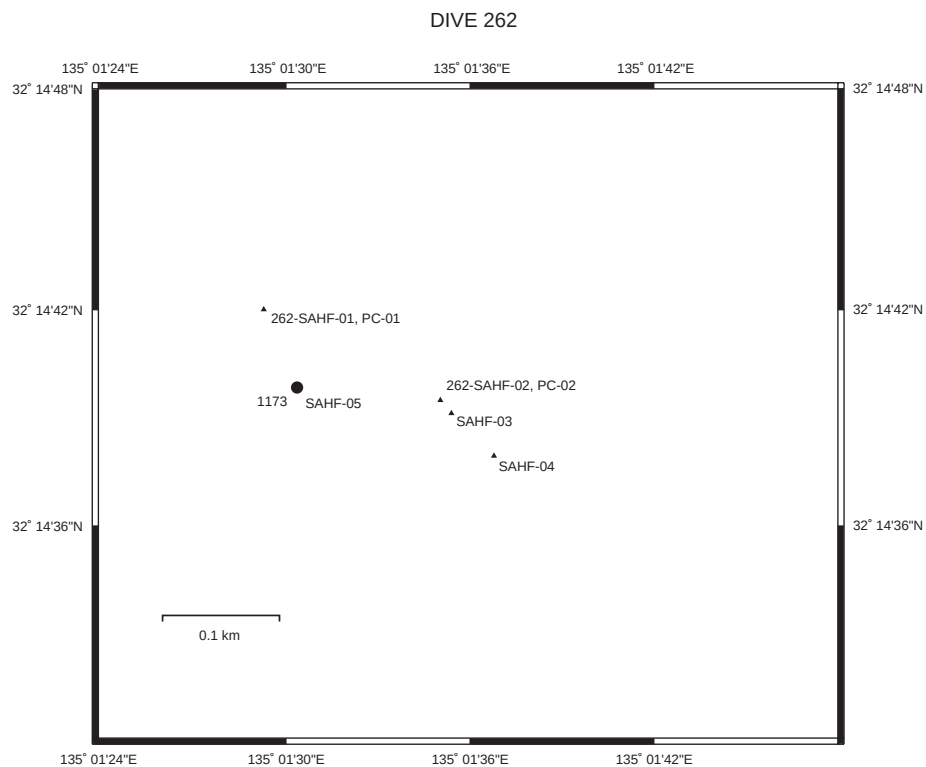


Fig.14 (b) Summary of figure of the KR02-10 Dive 262. SAHF heat flow measurements and push core sampling are denoted as SAHF and PC, respectively.

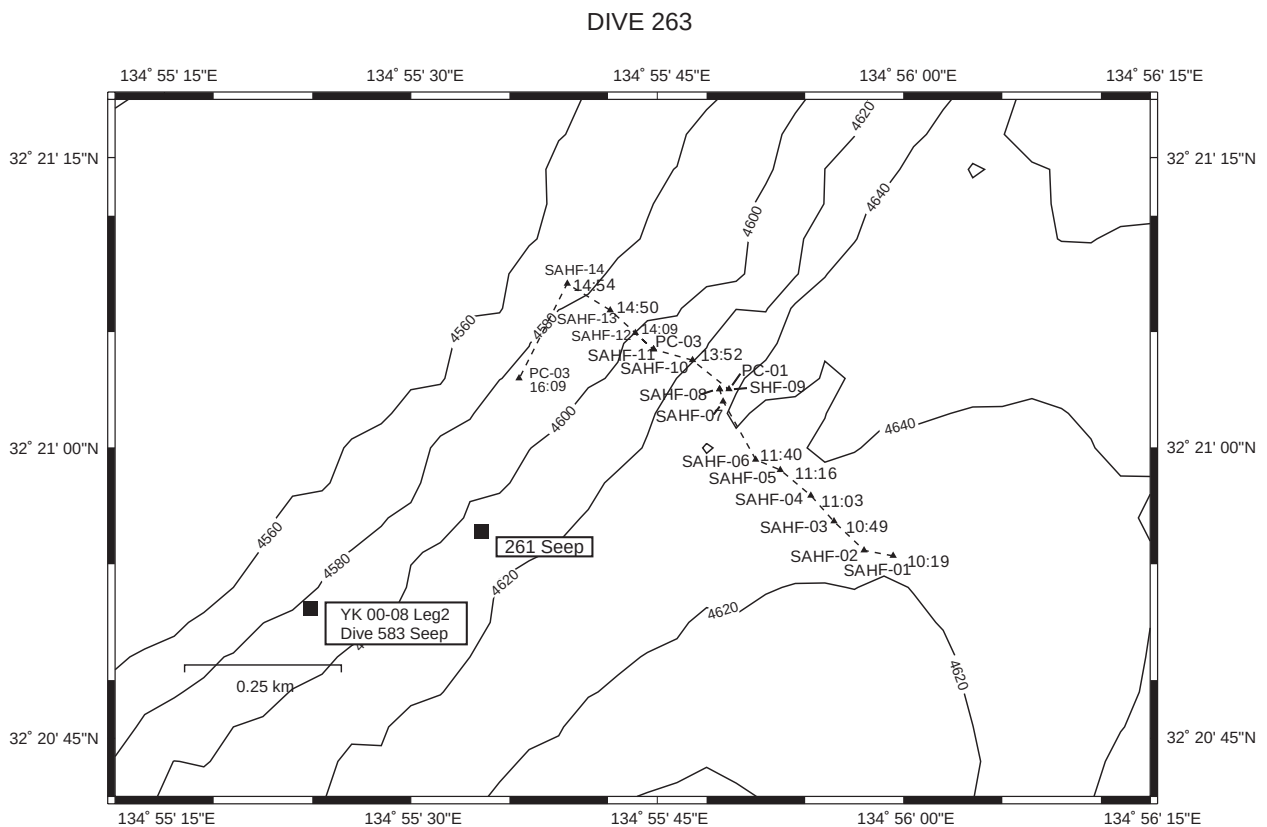


Fig.14 (c) Dive path, sample locations, and time for KR02-10 Dive 263. Locations are approximate and taken by observer during dive. 'YK00-08 Leg 2 Seep' refers to seep found by Tanahashi and Matsubayashi (2000).

DIVE KR002-264

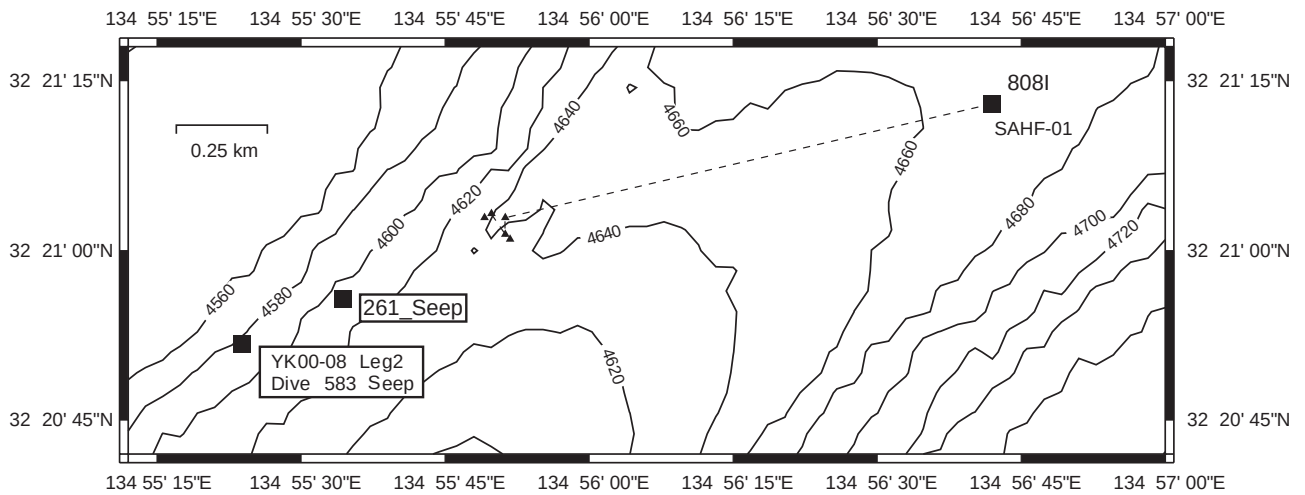


Fig.14 (d) Overview of Dive 264 track. Triangles mark position of SAHF measurements.

DIVE KR264

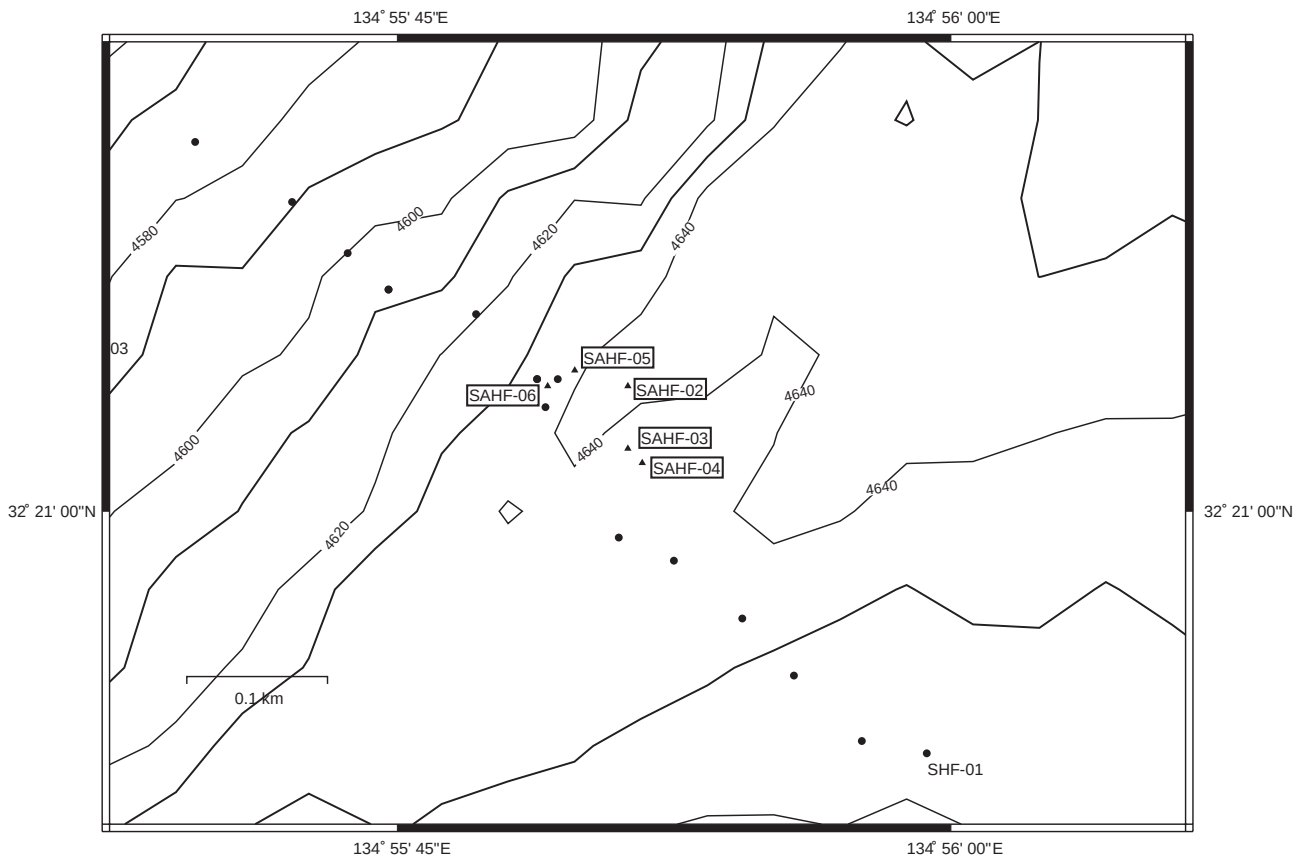


Fig.14 (e) Location of SAHF measurements made on Dive 264 delineated with triangles and labeled. Location of SAHF measurements from Dive 263 delineated with solid circles. At this scale, the ROV navigation is very imprecise and these locations are very approximate.

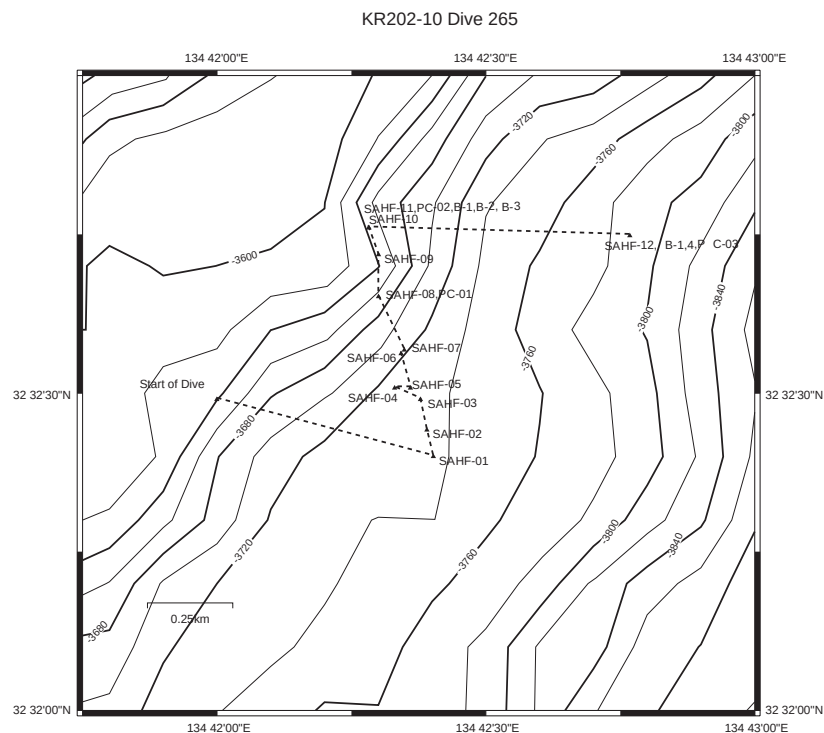


Fig.14 (f) Summary of figure of the KR202-10 Dive 265 around Out-Of-Sequence Thrust zone(OOST). As in Fig. 14 (e), high resolution SAHF measurements were performed to transect a large thrust fault.

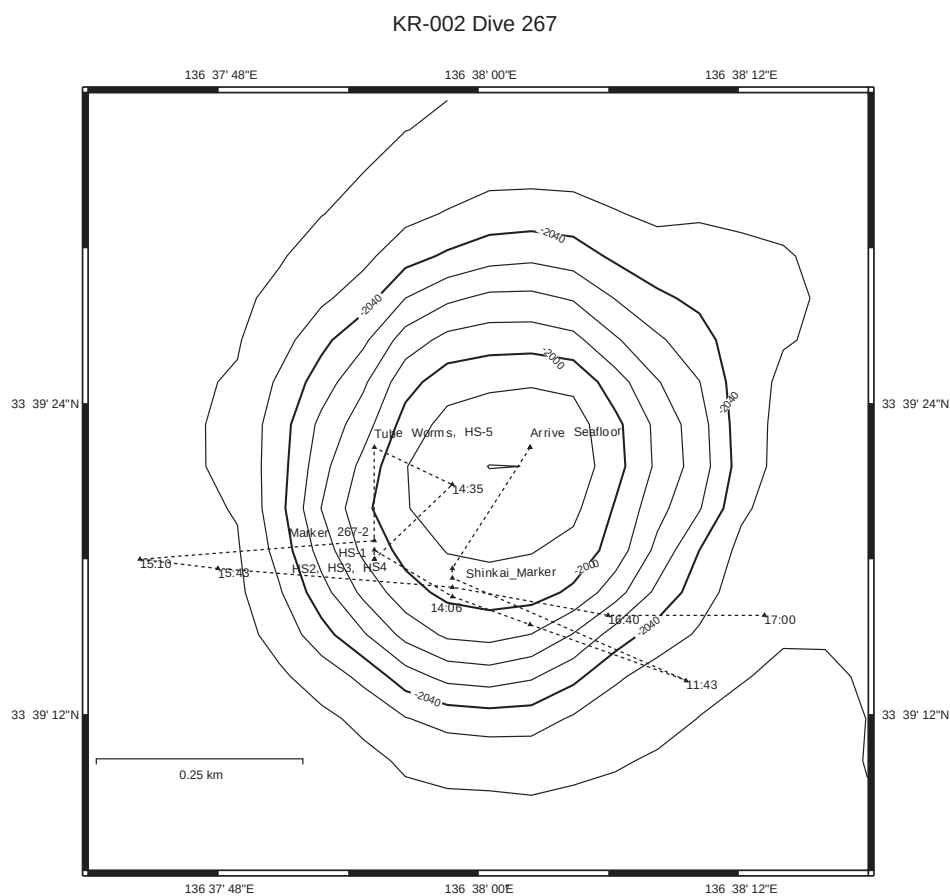


Fig.14 (g) Map of Dive 267. Dashed line marks ROV path.

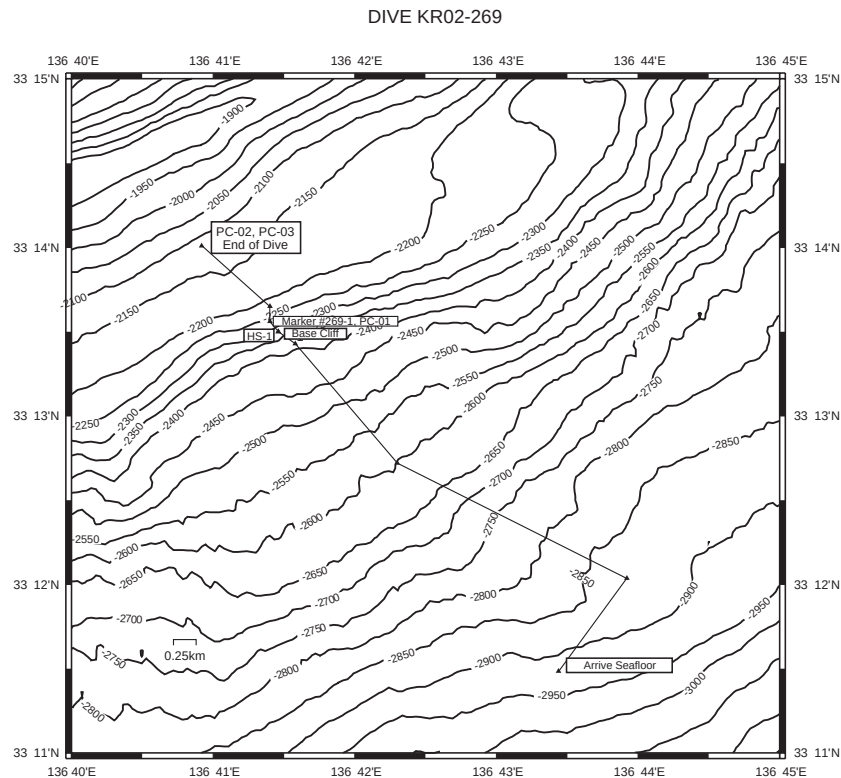


Fig.14 (h) Summary of figure of the KR02-10 Dive 269. ROV path intersects with Kumano OOST where new base cliff was found (See Appendix 8).

frequently used to acquire biological and geological samples as listed in the Appendix 5. All heat flow data measured during the cruise are displayed in the Appendix 6. The daily activity during the cruise can be summarized as in the Appendix 7. Some photos taken by the Kaiko are found in the Appendix 8.

6. Summary

We have conducted a survey by KAIREI/KAIKO for the following objectives:

- (1) Visiting two ACORK sites for instrument maintenance and data retrieval,
- (2) Conducting geothermal surveys using the submersible and surface deployable heat flow meters, and
- (3) Making a series of submersible observations for precise location of seafloor thermal anomalies.

Through the course of the scientific cruise, we have identified:

- (1) Monitoring of formation fluid pressure below the seafloor was successfully initiated using the ACORK systems for hydrogeologically-isolated sections, and,

- (2) Heat flow measurements using submersible has turned out really efficient for dense, pin-pointing, high resolution surveys.

Analyses on acquired SSS/SBP are on-going and will be published separately. The two ACORK systems are now functioning to monitor time-variant formation fluid pressure in the sediments. The data obtained will surely be exploited to understand the role of fluids in the accretionary complex and around the seismogenic zone. One of the major goals of the Integrated Ocean Drilling Program has been stated as understanding of seismogenic zones. We think that it is very important to constrain geophysical and geochemical conditions at depth for understanding the Nankai seismogenic zone.

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Acknowledgments

The authors could not give enough thanks and praise to the Captain and crew of Kairei and the leader and crew of Kaiko during the cruise. Ship handling and station keeping appeared as if we were constantly under the control of dynamic positioning. Challenging manipulations at the ACORK installations were done with extreme dexterity and efficiency by the Kaiko pilots, and many small things that were not requested (such as the production and installation of a dust cap for the connector at Site 808) did not go unnoticed. Also, we would like to express our special gratitude to Mr. Uchiyama, editor of the journal, for his patient inspiration to finalize the manuscript, and to Ms. Mezaki for her efficient support to produce the figures in this document.

Appendices

A-1. KR02-10 Ship Crew

Captain: Osamu Yukawa

Chief Officer: Masayoshi Ishiwata

Junior Chief Officer: Toshinobu Miyata

Second Officer: Kenji Yano

Junior Second Officer: Naoto Kimura

Third Officer: Tatsuo Adachi

Chief Engineer: Hiromi Kikkawa

First Engineer: Minoru Tsukada

Junior First Engineer: Akimitsu Fukuda

Second Engineer: Kazunori Noguchi

Seaman: Harumitsu Sato

Chief Oiler: Masaru Murano

Third Engineer: Yasuyuki Oyama

Chief Radio Operator: Satoshi Watase

Second Radio Operator: Hiroyasu Saitake

Third Radio Operator: Akihisa Ishikawa

Boatswain: Kingo Nakamura

Able Seaman: Sakae Sasaki

Able Seaman: Yukihiro Fujimura

Able Seaman: Seiji Hosokawa

Seaman: Naoto Oka

Seaman: Kengo Fujino

Oiler: Takayuki Todoroki

Chief Chef: Kaoru Takashima

Oiler: Makoto Kobayashi
Oiler: Kazuaki Nakai
Oiler: Kozo Miura
Oiler: Shuichi Sonou

Cook: Hidetoshi Kamata
Cook: Shuji Kobayashi
Cook: Jihei Nakatsuka
Cook: Kiyotaka Kosoji

A-2. Kaiko Operation Team

Chief ROV Operator: Kazuyoshi Hirata
ROV Operator: Mitsuhiro Ueki
ROV Operator: Kiyoshi Takishita
ROV Operator: Houji Miura
ROV Operator: Homare Wakamatsu

ROV Operator: Hiroshi Yamanishi
ROV Operator: Hideki Setoko
ROV Operator: Katsutoshi Fuji
ROV Operator: Hiroshi Ito
ROV Operator: Jun Takenouchi

A-3. Trainees

Touki Kajitani (Tokyo University of Mercantile Marine)
Takima Daniel Hosokawa (Tokyo University of Mercantile Marine)
Hisako Noda (Tokyo University of Mercantile Marine)

A-4. Time Logs

Dive 261
Dive near 808I
Date: 8/2/02

09:58	Arrived at Seafloor, search for 808I ACORK
10:03	Find 808I ACORK
10:05	On Bottom (4539 MBSL).
10:13	Brush off U.M.C. (Underwater Mateable Connector)
10:21	ROV connects to 808I ACORK and data are downloaded
11:02	Disconnect
11:07	261-SAHF-01 inserted.
11:12-11:15	Inspect umbilical at ACORK
11:34-11:40	Sample port valves are closed.
11:45	ROV connects to 808I and data are downloaded.
12:01	ROV disconnects.
12:09	261-PC-1 taken (Green Core)
12:16	261-SAHF-01 extracted.
12:17	ROV begins Side Scan Survey (SSS) and Sub Bottom Profile (SBP) in south-easterly direction. (Fig. 1).
12:55	134° 56.5824', 32° 21.0557'
13:00	134° 56.5396', 32° 21.0531'
13:05	134° 56.5188', 32° 21.0092'
14:35	Turning to the north still collecting SSS/SBP.
13:10	134° 56.4836', 32° 20.9838'
13:15	134° 56.4550', 32° 20.9492'
13:30	134° 56.3941', 32° 20.8711'
13:45	134° 56.2544', 32° 20.7844'

14:00	134° 56.1711', 32° 20.7136'
14:15	134° 56.0346', 32° 20.6630'
14:37	134° 55.8819', 32° 20.5524'
14:55	134° 55.5668', 32° 20.3165'
15:12	134° 55.6267', 32° 20.6614'
15:25	134° 55.6142', 32° 20.7148'
15:40	Stopped SSS, since system is down, 134° 55.6117', 32° 20.8239'
15:45	Restarted SSS.
15:46	In trough at base of 2 nd thrust
15:48	Dead Calyptogena colonies (approximate location: 134° 55.8819', 32° 20.8746')
15:55	134° 55.6576', 32° 20.8746'
16:03	Dead Calyptogena, 1 in life position, tubeworms
16:05	More Dead Calyptogena colonies
16:07	Living Calyptogena colonies located (approximate location: 134° 55.5728', 32° 20.9272'). Sample 261-PC-2 (Red Core) taken in clam colony. Samples 261-B-1, 261-B-2, and 261-B3 taken (living clams grabbed by ROV arm). 134° 55.5728', 32° 20.9272°
16:14	Scattered groups of living Calyptogena colonies, one clump of tubeworms
16:16	Dive Terminated.

Dive 262
Dive Near 1173B
Date: 8/3/02

09:53	On Bottom, 4787 m water depth, proceeding to search for ACORK
09:50	1173 ACORK found
10:00	Examination shows all pressure gauge valves (also called 3-way sensor valves) are closed and the sample port valve is closed. However, of the five pump port valves (2-way) #1 (position = 0°) and #2 (0°) are closed but #3 (80°), #4 (85°), and #5 (75°) are open.
10:07	#4 valve closed
10:09	#3 valve closed
10:13	#5 valve closed
10:17	Leave ACORK to do heat flow transect and collect push cores.
10:21	Insert SAHF-01
10:28	Green Push Core PC-1 (Empty): 32 14.6994 , 135 1.4908
10:45	Extract SAHF-01
10:54	SAHF-02: : 32 14.6592 , 135 1.5815
10:57	PC-02 (Blue): 32 14.6592 , 135 1.5815
11:15	SAHF-02 extracted
11:21:42	Insert SAHF-03: 32 14.6495 , 135 1.5927
11:43	Move from SAHF-03 location
11:47:08	Insert SAHF-04. 50m SE of SAHF-03.
11:48	Yellow Push Core PC-02: 50m SE of SAHF-03
12:11	Moved
12:49	Insert SAHF-05 at 1173 ACORK. Lower current observed relative to 808 dive
13:00	Waiting for SAHF-05

13:02	SAHF-05 extracted
12:42	Back at 1173 ACORK, Opened Pressure Gauge Valves #1 and #2 for hydrostatic check on these gauges.
13:08	Closed Pressure Gauge Valves #1 and #2.
13:11	Done closing both valves.
13:17	Plugged in Connector and turned power on. Download data
13:40	Data transfer finished
13:41	Disconnect
13:41-13:43	Recover Connector cable.
13:57	Black Shadow line seen. Most likely imprint of drill pipe in sea floor when working bridge plug.
14:00	End of Dive

Dive 263
Near 808I
Date: 8/4/02

10:00	Arrive at sea floor
10:22	Insert <i>SAHF-01</i> , put ROV homer. D=4628m.
10:30	Insert <i>SAHF-02</i>
10:36	Return to SAHF-01
10:40	Recover ROV homer
10:43	Extract SAHF#1, go to SAHF-03.
10:49	Insert <i>SAHF-03</i> , put ROV homer
10:53	Return to SAHF02.
10:56	Recover ROV homer
10:58	Extract SAHF-02. Go to SAHF-04.
11:02	Insert <i>SAHF-04</i> .
11:03	Return to SAHF-03
11:08	Recover ROV homer
11:10	Extract SAHF-03. Go to SAHF-05
11:07	Retrieve SAHF-03
11:15	Insert <i>SAHF-05</i> (Instrument #1), put ROV homer
11:11	Return to SAHF-04.
11:20	Recover ROV Homer
11:23	Extract SAHF-04
11:24	Examine a strong sonar reflector that turns out to be a can.
11:40	Arrive SAHF-06. Measure water temperature.
11:42	Insert <i>SAHF-06</i> . Instrument #1
11:43	Return to SAHF-05
12:03	Recovered ROV Homer
12:05	SAHF 05 extracted, go to SAHF-07.
12:10	Arrive SAHF-07. Measure Water Temperature.
12:12	Insert <i>SAHF-07</i> , put ROV homer
12:13	go to SAHF-06
12:15	Arrive at SAHF-06. Recover ROV homer
12:17	Recover SAHF-06, Move to SAHF-08.

12:21 Arrive SAHF-08. Kashioni-shrimp passes in front of monitor.
 12:23 Insert *SAHF-08*
 12:24 Put ROV homer
 12:26 *PC-01* taken (Green Push Core)
 12:33 Examine indurated Ridge. Ridge is oriented at approximately 310 degrees.
 12:35 On bottom, examined sea floor.
 12:39 Move to SAHF-07.
 12:44 Arrive at SAHF-07
 12:45 Recover ROV homer and SAHF -07.
 12:48 Head NW to emplace SAHF-09
 12:54 Arrive SAHF-09. Measure water temperature.
 12:56 Insert *SAHF-09*
 12:58 Put ROV homer, move to SAHF-08. Examined sea floor
 13:05 Arrive at SAHF-08, pickup ROV homer
 13:08 SAHF-08 recovered.
 13:11 Move to SAHF-10.
 13:19 Arrive at SAHF-10.
 13:20 Examine Tool #1 and saw that little green LED was working indicating Tool #1 was working.
 13:22 Insert *SAHF-10*. Tool #1. Put ROV homer. Move to SAHF-9.
 13:29 Arrive at SAHF-09. Recover ROV Homer
 13:31 Extract SAHF-09. Move to SAHF-11.
 13:37 Pass rubbly material on the sea floor. A few live clams are present. A lot of dead clams are present. We are trying to insert SAHF-11. However, it is difficult to get it to penetrate.
 13:51 *SAHF-11* inserted. Put ROV homer
 13:58 Return to SAHF-10
 14:04 Extract SAHF-10, Recover ROV homer
 14:07 Pass SAHF-11
 14:09 Take water temperature.
 14:10 Insert *SAHF-12*. Nice deep insertion. Put ROV Homer, move to SAHF-11.
 14:17 Arrive at SAHF-11.
 14:19 *PC-2*. (Blue push core). Took push core at white color sea floor.
 14:20 Recover SAHF-11.
 14:23 Shovel sample taken. Put a bunch of material in bio box. In empty hole for push core samples a small sample was placed.
 14:40 Depart SAHF-11 location
 14:45 Arrive SAHF-13. Measure water temp.
 14:48 Insert *SAHF-13*, put ROV Homer
 14:50 Return to SAHF-12
 14:52 Arrive SAHF-12. Recover ROV Homer.
 14:53 Extract SAHF-12.
 14:54 Head NW to SAHF-14.
 14:58 Arrive at SAHF-14. Measured Water Temp.
 15:00 Insert *SAHF-14*. Put ROV Homer.
 15:01 Move to SAHF-13
 15:09 Recover ROV Homer. Extract SAHF-13. A live crab is present.
 15:19 Decide to do no more heat flow measurements

15:26 Arrive at SAHF #14. Recover ROV Homer.
 15:27 Remove SAHF-14
 15:30 Head S.E. to go back to seep community. Most dead but some live patches. Big Calyptogena patch at 134 50.7808, 32 21.0752.
 15:42 Moving southwest along seep community.
 15:46 134 55.7628, 32 21.0393.
 134 55.70 32 21.03. Calyptogena community
 16:12 PC-3. Yellow core taken. Core taken in middle of Calyptogena community. Appears that Calyptogena was crushed and is in core barrel.
 16:21 Tube Worms located. 134 55.5639 32 21.0381.
 16:30 Dive Terminated.

Dive 264
Near 808I
Date: 8/6/02

09:43 Approaching ACORK
 09:49 Reached sea floor
 09:54 Brushing of UMC (Underwater Mateable Connector)
 09:57:24 Mated with Connector, downloaded file 02k808a.raw
 10:18 Finished downloading. Re-set sampling rate to 10 seconds. Moved vehicle to other side of ACORK to see the pumping port valves.
 10:31 Cut plastic bag off Pumping port valve handle for Screen#3.
 10:37 Opened Screen 5 (Pressure guage 3=P3).
 10:44 Closed Screen 5 (P3)
 10:52 Opened Screen #2 (P6)
 10:50 Closed Sc #2 (P6)
 Downloaded 02k808b.raw
 11:20 Tapping all valves to make sure they are closed
 11:27 Inserted SAHF-01. Instrument #2
 located at 1173 ACORK location
 12:02 Remove SAHF-01
 12:07 Waiting for 12:10 to assure that sampling was re-set to 10 minutes.
 12:12 Power down and disconnect ACORK.
 12:15 Moving away from ACORK and proceeding toward vent sites
 12:33 Casing located on seafloor. (134° 56.6171', 32° 21.1298'). Quick examination suggests this is from Leg 131 drilling casing for either 808C or 808D.
 12:47 134° 56.5626', 32° 21.1200', 4658 mbsl
 12:57 Sea anemones colony 1 foot in diameter located 134° 56.4713', 32° 21.1043'
 13:05 134° 56.4125', 32° 21.0813'
 13:16 134° 56.3455', 32° 21.0761'
 13:28 134° 56.2601', 32° 21.0479'
 13:40 134° 56.1375', 32° 21. 0283', 4646 mbsf
 14:00 134° 56.9623', 32° 21. 0008', 4650 mbsf
 14:11 134° 55.8729', 32° 21.0316'. At small dead clam community

14:22 134° 55.83', 32° 20.94'
 14:28 134° 55.81' 32° 21. 00'
 14:32 134° 55.83' 32° 21. 02', 4651 mbsf
 14:36 prepare to insert SAHF-02
 14:42 Insert *SAHF-02*
 14:46 Launcher and ship are to far from ROV and it is being pulled to the west.
 14:58 134° 55.8309' 32° 21. 0223', 4641 mbsl
 15:17 Moving in an easterly direction. Trying to locate SAHF-02
 15:21 Extracted SAHF-02 134° 55.8543' 32° 21.0472, 4652 mbsl
 15:32 Insert *SAHF-03*. 134° 55.8514' 32° 21. 0231'. This is approximately 7 meters to SE of SAHF -02.
 15:31 Heading SE to get another sample location.Insert *SAHF-04*
 15:35 Planted marker.
 15:40 Returned to SAHF-03 (Inst. #2) and removed it. 4652 mbsl
 15:46 134° 55.8316' 32° 21. 0516' . 4645 mbsl. SAHF-05 inserted.
 15:57 Extracting SAHF-04, 4652 mbsl
 16:00 4637 mbsl. Inserting SAHF-06. 134° 55.8157' 32° 20. 0467' *PC-01*. Yellow core taken into base of indurated elevated 'ridge' section. *PC-02* Blue taken in softer sediment on top of same elevated ridge.
 16:36 Retrieved SAHF-06. Retrieved SAHF-05.
 End of Dive

Dive 265
Cruise: KR02-10
Near 808I
Date: 8/7/02

9:35 Start of Dive. At bottom of steep slope. 134° 42.2728' 32° 32.4889'
 9:37 Observed friable pavement on slope
 9:40 Ballast from Shinkai 6500 found.
 9:40 Still looking for Marker #29 (YK00-10), on steep slope
 9:58 134° 42.2606' 32° 32.4888'. [Comment: in the Shinkai dive, live clams found at 3706 meters water depth. However, there was a greater than 40 meter error in Shinkai instruments. So live clams should be at 3660 meters]
 10:09 134° 42.22' 32° 32.5'
 10:21 SHINKAI tracks found at 134° 42.35' 32° 32.4'
 10:27 134° 42.4' 32° 32.4'
 10:32 *SAHF-01*. Instrument #2. 134° 42.39' 32° 32.4'
 10:35 Finished inserting SAHF-01. Dropped ROV Homer. Now heading north to make new station
 10:39 54 meters from SAHF-01. We are now at SAHF-02.
 10:42 Installing *SAHF-02*. Instrument #1. 134° 42.39' 32° 32.44'
 10:44 Moving back to SAHF-01.
 10:47 At SAHF-01. Waiting for 7 minutes
 10:55 Recover SAHF-01. Recover ROV Homer
 11:01 Install *SAHF-03*. Instrument #2. 75 meters from SAHF-02. 134° 42.38' 32° 32.49'
 11:04:30 Install *SAHF-03*. Drop ROV Homer. Head back to SAHF-02.
 11:08 Recover SAHF-02 and Rov Homer

11:10 Move to SAHF-04.
 11:22 *SAHF-04* inserted . Instrument #1. 62 meters from SAHF-03. Water depth = 3708 meters. 134° 42.33' 32° 32.51'
 11:26 Recovering SAHF-03 and ROV Homer
 11:34 At base of slope. Very small bacterial mat.Live clam. Perhaps found single tube worm
 11:36 *SAHF-05*. Inst. #2. Inserted through small mat. 44 meters from SAHF-04. 134° 42.36' 32° 32.51'
 12:30 Have now spent 1 hour search for SAHF-04. It is lost in dust
 13:17 Still in dust, but can see SAHF-04.
 13:19 Recover SAHF-04.
 13:20 Recover ROV Homer
 13:27 Dead Clam 134° 42.35' 32° 32.58'
 13:24 Observed a searching clam and a dead clam.
 13:25 *SAHF-06*. Inst. #1. 74 meters from SAHF-05.
 13:28:30 *SAHF-06* inserted. 134° 42.34' 32° 32.56'
 13:35 Returned to SAHF-05. 134° 42.38' 32° 32.51'
 13:37 Recovered SAHF-05 and ROV. Homer.
 13:42 Seafloor getting steeper with small cemented section
 13:43 Really steep section
 13:47 Located at Site SAHF-07. Sea floor has 'hairy' look.
 13:49 *SAHF-07*, Inst. #2. Inserted. 134° 42.35' 32° 32.57'
 13:56 Small clam colony live on slope 134° 42.33' 32° 32.54'
 13:58 Rocks on slope, possibly mass wasting features.
 14:07 Live clam and SAHF-06 134° 42.38' 32° 32.56'
 14:09 Recovered SAHF-06 and Homer.
 14:15 At SAHF-07. Going to remove probe and bring both probes to place at 2 new sites. 134° 42.35' 32° 32.59'
 14:16 Recovered SAHF-07 and Homer.
 14:20 134° 42.38' 32° 32.62'
 14:30 On way to seep. Having to stop to move ship.
 14:32 *SAHF-08*. Inst. #1. On 45 degree slope. 134° 42.3' 32° 32.65'
 14:52 Extract SAHF-08.
 14:34 *PC-01*. Yellow. Same site as SAHF-08.
 14:53 Head north to see if we can find seep site.
 15:06:30 Inserted *SAHF-09*. Inst. #1. 134° 42.3' 32° 32.72'. Left Homer
 15:09 Heading East downhill to look for seep.
 15:16 134° 42.36' 32° 32.467. Now heading back to SAHF-09
 15:24 Steep cliff.
 15:39 Large clam field, mostly dead. 134° 42.28' 32° 32.76'
 15:41 3634 meters water depth. Installed *SAHF-10*. Inst #1, between dead clams.
 Same location as at 15:39.
 15:43 Installed *SAHF-11*. Inst #2, away from clams. Still located 134° 42.28' 32° 32.76'
 15:45 Took *PC-2* (Blue). Still located 134° 42.28' 32° 32.76'
 16:02 After losing position, now back in position and grabbing dead clams for bio box using scoop. Bio-1, Bio-2, Bio-3 samples taken.
 16:10 Leaving *Marker 265-1*.
 16:11 Removing SAHF-11.
 16:12 Removing SAHF-10.

16:13 Lifting off to survey extent of dead vent site. Clam field seems aligned in rows, roughly east west. Within the large dead clam field that is approximately 100 meters across, there are 2 to 3 small living colonies of clams. Each colony is composed of only 2 or 3 live clams. . 134° 42.26' 32° 32.77' . 3615 mbsl

16:17 Still in clam field. . 134° 42.29' 32° 32.8'

16:20 Left clam field. Returning to look for one of live clam colonies found at 16:13.

16:45 Still searching. . Still located 134° 42.265' 32° 32.71'

16:52 Found edge of clam field. 3628 mbsl. Installed SAHF-12.. 134° 42.277' 32° 32.75'

16:54 Shoveling single dead clam (Bio-4).

16:56 PC-03. Green. Same position as SAHF12. Observed large gastropod on dead clam shell.

17:12 Recovering SAHF-12.

17:13 Place *Marker* 265-02.

17:14 End of dive.

Dive 266
Cruise: KR02-10
Near 1173B

Date: 8/8/02

9:49 Reached seafloor

9:55 Moving towards 1173 ACORK

10:07 ACORK in view

10:15 Manipulator arm picks up female part of UMC

10:21 Left arm grips ACORK

10:23:39 Mate with UMC

10:24 Release left arm

10:24:54 ROV on seafloor

10:25 Turned on RS-232 power and downloaded 02K1173p.raw

10:27 Reset sample rate to 10 seconds

10:29:30 Time check

10:32 Left arm grabs ACORK

10:32:40 Right arm grabs UMC

10:32:50 UMC disconnected

10:37 Pulling UMC cable into basket

10:41:28 Preparing to insert SAHF-01 (Instr 2)

10:44:31 Inserting *SAHF-01*

10:46:01 SAHF-01 was jostled hard by arm during release

10:47 SAHF-02 prepared Instrument 1

10:49 SAHF-02 inserted Location 32 14.6771, 135 1.5153

10:50:57 PC-01 (Blue)

10:52:30 PC-02 (Yellow)

11:06 SAHF-01 ended

11:10 SAHF-02 ended

Put marker on bottom,

11:13 Measured water temp.

11:17 Inserted *SAHF-03* and moved to SAHF-04.

11:27	Inserted <i>SAHF-04</i> (Inst 2)
11:37	Recovery SAHF-03
12:03	Put " <i>Kaiko 266-3</i> " marker on the bottom
12:04	<i>SAHF-05</i> insert (inst. 1)
12:06	Recovery SAHF-05 (INST 2)
12:15	On bottom. Measured water temp.
12:18	Inserting <i>SAHF-06</i>
12:25	Recovery SAHF-05
12:29	Water becomes muddy. SAHF-06 was missed. Search for it
12:37	SAHF-06 found.
12:38	Recovery SAHF-06
12:42	<i>SAHF-07</i> (Inst 2) inserted
13:03	Head back to Site 1173B
13:03:30	1173B in view
13:05	<i>SAHF-08</i> (yellow) inserted
13:05	<i>SAHF-09</i> (white) inserted.
13:05:30	Lift off
13:07:00	Start untangling UMC cable.
13:12	Cable is tangled trying to untangle it
13:13	Cable untangled
13:14:30	Left hand grabs ACORK
13:15	Right hand starts to mate UMC
13:15:45	Connected
13:16:20	Set down on bottom
13:17	Download file 02K1173q.raw
13:17:49	Download done
13:19	Reset sampling rate
13:20:12	Data sample arrived
13:22:20	Log Off
13:23:20	Move ROV up to disconnect UMC
13:23:45	Left hand grabs ACORK
13:24:08	Right hand disconnects UMC
13:24:50	Rotating around ACORK
13:26:30	Looking at pressure gauges
13:28	Done at ACORK
13:32	Extract SAHF-08(Instr 1) Location 32 14.6555, 135 1.4921
13:34	Extracted SAHF-09 (Instr 2)
13:35	Lift off seafloor, final view 1173B
13:38	End of Dive

Dive 267
Cruise: KR02-10
Dive on Mud Volcano 4.5

Date: 8/9/02

10:19	Arrive seafloor Location 33 39.3715, 136 38.0371, Near summit of mud volcano, lots of Calyptogena shells some living
10:21	Sit down on bottom
10:23	Picking up long term monitoring system (LTMS). Waiting 10 minutes to take reference bottom water temperature
10:35:35	Place LTMS on seafloor
10:36:25	Reposition ROV
10:36:45	Grab red probe from LTMS with right arm
10:40:20	Recognized that we are about to put probe in SHINKAI 6500 track
10:42:35	Moving ROV
10:43	Lost in dust
10:44	Moving ROV
10:45	Landed ROV Location 33 39.3747, 136 38.0343
10:46	Moving LTMS
10:49	Passed clam area
10:51	Observe SHINKAI 6500 tracks
10:54:17	Location 33 39.3784, 136 38.0274
10:58:11	Location 33 39.3807, 136 38.0243, set down on seafloor
11:00	Scrapping sediment to see if bacterial mat but failed to produce sulfurous smoke so interpreted to be just light colored mud
11:04	Sit down on seafloor and discuss plan
11:05	Life off again
11:06	Looking at SHINKAI 6500 track, dead clam, possible carbonate crust, Location 33 39.3654, 136 38.0111
11:13	Location 33 39.3233, 136 37.9888
11:18	Sited SHINKAI marker
11:19:30	Location 33 39.2962, 136 37.9503
11:20	Marker sits at top of small ridge, clams are in depression below ridge and on crest of ridge, observed possible ejecta on edge of depression in the form of pebbles and small boulders
11:22:39	Setting LTMS on seafloor
11:25	Positioning probe (red)
11:27-11:32	Trying to inserting probe in depression
11:33	<i>Probe inserted</i> in small clam colony ~1 m from center of depression
11:33:48	Moving LTMS data logger to rim of depression
11:34:14	Placed LTMS on rim
11:36:18	Grab 2 nd probe (yellow)
11:36:54	Yellow probe released from LTMS
11:37:20	<i>Inserted probe</i> into rim of depression
11:38	Moving back from LTMS, crater is ~5 m across and ~0.75 m deep
11:41	Possible small crater
11:43	Location 33 39.2871, 136 37.9654

11:44 Small depression with clams (living), passed some dark rocks
 11:45 Location 33 39.2765, 136 37.9942
 11:50 Location 33 39.2720, 136 38.0120
 11:58 Location 33 39.2332, 136 38.1001
 12:10 Found Drill In Heat Flow (DIHF)
 12:21 Location 33 39.2362, 136 38.1407
 12:30 Location 33 39.2246, 136 38.1342
 12:59 Arms connects with DIHF
 12:59:23 Arm pulls string
 12:59:36 String released
 13:13:27 Pick up magnet
 13:20:40 Use magnetic switch on blue arm. *Started drilling.*
 13:30:20 Use magnetic switch on red arm to turn off drill.
 13:31:46 Left arm grabs knife
 13:35 Moving ROV
 13:36:20 Cut rope.
 13:37:40 Knife returned to basket
 13:43:10 Hold magnet to blue arm to turn drill back on. Dust appears indicating drilling commenced.
 13:45:17 Touch magnet to red arm to turn off drill.
 13:48 Start returning to mud volcano, lots of small rocks on slope and dead clams observed
 13:53 Location 33 39.2553, 136 38.0593
 14:00 Location 33 39.2784, 136 37.9963, On summit
 14:05 Location 33 39.3008, 136 37.9618
 14:06 Back at site with LTMS, Location 33 39.3036, 136 37.9410
 14:08 Searching on ridge near rim
 14:09 Landing on rim, *putting clams in bio box*
 14:13 *More shell collecting.*
 14:17 Can see 1m long LTMS in background showing crater to be 4-5 meters across.
 14:22:53 Grabbed *HS-1*. Location 33 39.2973, 136 37.9484
 14:24 More rocks spotted. Location 33 39.3026, 136 37.9326
 14:29 Getting rocks that look as if they were blown out of crater and broke apart on seafloor. Collecting *HS-2*, *HS-3*, *HS-4*.
 14:30 Circling west to do east-west SSS/SBP transect.
 14:35 Heading north, then west. Location 33 39.3466, 136 37.9576
 14:37 Observed another pit on flank, live clams and possible mat, tube worms: looked like thick hairs and mud colored.
 14:39 *Sampling tube worms*. Location 33 39.3697, 136 37.9409
 14:42 Sampling clams and tube worms. Observed black smoke.
 14:47 Finished sampling
 14:49 Grabbing rock. *HS-5*. Sample broke when it was placed in bio box.
 14:51 Lifting off to go west and then back east to start survey
 14:55 Very large dead clam field on slope
 14:56 Landing at field: Location 33 39.3144, 136 37.9032. Placing marker 265-2.
 15:00 Location 33 39.3107, 136 37.8896. Heading: 270 degrees.
 15:05 Location 33 39.3042, 136 37.8446. Going to continue west 200 meters before turning east.
 15:10 Heading: 270 degrees. Location 33 39.3005, 136 37.7685

15:15 Location 33 39.3005, 136 37.7225

15:18 Arrived with vehicle (Keiko) at start of survey. Waiting for launcher to catch up. Location 33 39.3030, 136 37.7030

15:35 Vehicle and launcher in same position. Starting survey heading 90. Launcher slowly turning east. Currently facing SSW.

15:43 Vehicle and launcher on same heading
Vehicle Location 33 39.2946, 136 37.8108.
Launcher Location 33 39.2807, 136 37.7344

15:40 Vehicle Location 33 39.2830, 136 37.8823
Launcher Location 33 39.2761, 136 37.7870. Sea floor has some dead clams on it.

15:53 Large rock observed.

16:00 Vehicle Location 33 39.2834, 136 37.9083
Launcher Location 33 39.2675, 136 37.8473.
Sea floor rubbly with scattered dead clams

16:03 Keiko stopped trying to let launcher and ship catch up.

16:05 Launcher Location 33 39.2710, 136 37.8825
Dead clams on sea floor and a couple live ones in small pock marks.

16:10 Vehicle Location 33 39.2822, 136 37.9230
Launcher Location 33 39.2713, 136 37.9134

16:12 Medium rock on slope

16:18 More rocks.

16:19 Crinoid, rocks, and scattered dead shells.

16:10 Vehicle Location 33 39.2826, 136 37.9912
Launcher Location 33 39.2717, 136 37.9639

16:30 Vehicle Location 33 39.2820, 136 38.0649
Launcher Location 33 39.2678, 136 38.0389.
Yagi observed.

16:35 Many clams on slope.

16:40 Vehicle 33 39.2793, 136 38.1095
Launcher: 33 39.2656, 136 38.0919

16:45 Sonar shows concave topography ahead despite the fact we are going down the east side of mud volcano.

16:50 Vehicle 33 39.2818, 136 38.1793
Launcher 33 39.2656, 136 38.1424

17:00 Vehicle 33 39.2798, 136 38.2392
Launcher 33 39.2618, 136 38.1975
Launcher now past mud volcano to the east. Survey over.

17:02 End of Dive.

Dive 269
Cruise: KR-02
Kumano Out of Sequence Thrust

Date: 8/11/02

09:25 On bottom. Position: 136 43.4192 33 11.4831
09:40 136 43.4372 33 11.4443
09:51 136 43.2632 33 12.1824 (imprecise position)
10:10 136 43.4443 33 11.7632
10:23 136 43.2165 33 11.7393
10:27 136 43.2005 33 11.7381 (heading towards hanging wall of first fault)
10:32 Launcher position: 136 43.2251 33 11.7407
10:34 Vehicle position: 136 43.2336 33 11.8187
10:40 Vehicle position: 136 43.1345 33 11.8638
10:46 Gastropod sighted
10:49 Vehicle position: 136 43.0802 33 11.9556
11:13 Vehicle position: 136 43.9257 33 12.0380. So far, a gently sloping sea floor and no evidence of chemosynthetic life. A few pits observed in slope, but no life in them.
11:23 Vehicle Position: 136 42.8892 33 12.1482
Launcher: 136 42.7398 33 12.3136
11:38 Penetration of the SBP suddenly dropped down to less than 10 meters. Prior to this the penetration was about 30-40 meters. Depth 2700 mbsl at vehicle.
11:41-11:48 The data of SBP is noisy.
12:02 Penetration of SBP increases to 20-30 meters.
12:23 Penetration of SBP over 50 meters.
12:28 Some round crater-like depressions (1-2 meters in diameter) appear on surface. A big flat fish goes by.
12:20 SSS anomaly appears on starboard side
12:41 SSS anomaly on starboard lasts until this time. Anomaly is about 800 meters from the nadir.
12:48 Vehicle Position: 136 42.3279 33 12.7175. Depth 2590 meters
12:57 Rapidly decreased down to 10 meters. Depth 2570 at vehicle.
13:00 Found tree. Sub-bottom profiler penetration dropped at around 2575 meters. Vehicle position: 136 42.2123 33 12.8188
13:01 SBP penetration increases up to 30 meters.
13:10 Vehicle Position: 136 42.0219 33 12.9019. Depth 2525 meters.
13:20 Veh. Position: 136 42.0610 33 12.9818
13:30 Veh. Position: 136 42.0038 33 13.0030
13:40 Veh. Position. 136 41.9632 33 13.0505. Sub bottom penetration profiler dropped once again.
13:50 Veh. Position: 136 41. 9326 33 13.0746. Observed rock next to holothurians.
14:01 Veh. Position: 136 41.8528 33 13. 1449
14:10 Veh. Position: 136 41.8350 33 13.1819. North dipping reflection appears on sub-bottom profile. It seems to be a fault.
14:20 Veh. Position: Veh. Position: 136 41.7747 33 13. 2547
14:31 Veh. Position: 136 41.6889 33 13.3295
14:35 Sea floor has rubbly look in spots. Sonar shows hanging wall of 2nd fault approaching
14:40 Veh. Position: 136 41.6227 33 13.3729
14:50 Veh. Position: 136 41.5885 33 13.4264

14:54 Spotted sonar target due west. Going to check it out.
 14:56 Found cemented and/or consolidated sediments on slope.
 Veh. Position: 136 41.5326 33 13.4534
 15:01 Return to 320 degree heading.
 Veh. Position: 136 41.4872 33 13.4888
 15:04 A few more rocky patches on slope.
 15:07 Stopping at a rocky patch to sample material. Manipulator breaks through much of it.
 15:12 Grabbed *HS-1*. Veh. Position: 136 41.4524 33 13.5015, having to move on so launcher keeps moving
 15:14 More blocky pavements
 15:15 Really rocky
 15:16 Cliff-like rocky ledge. Setting down at foot of cliff to grab rocks. Grabbed *HS-02*. Veh. Position: 136 41.4642 33 13.5647
 15:20 Looking at cliff. Very porous looking. Perhaps 2 meters high.
 15:23 Moving at 322 degree heading over top of cliff
 Veh. Position: 136 41.4169 33 13.5799
 Lcr. Position: 136 41.4793 33 13.5739
 15:26 Going a little further north so that we can get sub-bottom profiler to cross over cliff.
 15:29 Returning to cliff to leave marker.
 15:32 *Marker #269-1* left at foot of cliff.
 15:37 Veh. Position: 136 41.4213 33 13.5601. Took *PC-01* on top of cliff (Blue). Tough penetration. Core only 1/2 to _ full.
 15:42 Turning north.
 15:50 Heading towards ridge top.
 Veh. Position: 136 41.3025 33 13.6680
 Launcher Position: 136 41.3667 33 13.6535
 15:52 Launcher Position: 136 41.3893 33 13.650, Heading NW flat and smooth
 15:57 Amplitude on SBP increased significantly.
 16:00 Launcher Position: 136 41.3261 33 13.6908
 16:21 Launcher Position: 136 41.2118 33 13.8057
 16:32-16:50 Sidescan anomaly appears on port side. As time goes on it comes closer. Starts at 800 meters away and converges to nadir.
 16:41 Launcher Position: 136 41.0831 33 13.9361
 16:50 Launcher Position: 136 41.0378 33 13.9815. SBP penetration suddenly drops to less than 10 meters. SSS anomaly is now at the nadir (see comment at 16:32).
 16:52 Seafloor is rougher, set down for core, Launcher Position: 136 41.0090 33 14.0109, Vehicle Position: 136 40.9333 33 14.0184, took *PC-02* (Yellow)
 16:55 Took *PC-03* (Green)
 17:02 EOD

A-5. Sample Table

KR02-10

DIVE 261

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:06	4539	32 21.2018	134	56.7089	ON BOTTOM
261-PC-1	10:15	4539	32 21.2145	134	56.7003	808I ACORK, (green)
261-SAHF-01	11:07	4539	32 21.2145	134	56.7003	1 Insert @ ACORK
261-PC-2	16:10	4601	32 20.9392	134	55.5717	at vent site (red)
261-Bio-1	16:10	4601	32 20.9392	134	55.5717	Clam by ROV arm
261-Bio-2	16:10	4601	32 20.9392	134	55.5717	Clam by ROV arm
261-Bio-3	16:10	4601	32 20.9392	134	55.5717	Clam by ROV arm
	16:14	4601	32 20.9392	134	55.5717	END DIVE

KR02-10

DIVE 262

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:20	4792	32 14.6863	135	1.5138	on bottom
262-PC-01	10:28	4792	32 14.6863	135	1.5138	PC-01(green)
262-SAHF-01	10:45	4792	32 14.6863	135	1.5138	1 Near 1173
262-SAHF-02	10:54	4792	32 14.6636	135	1.5724	1 Near 1173
262-PC-02	10:57	4792	32 14.6636	135	1.5724	PC Blue taken at SHF-2
262-SAHF-03	11:21	4792	32 14.6463	135	1.5915	1 near 1173
262-SAHF-04	11:48	4792	32 14.6301	135	1.6157	1 near 1173
262-PC-03	11:48	4792	32 14.6301	135	1.6157	PC Yellow taken at SAHF-5
262-SAHF-05	12:49	4791	32 14.6387	135	1.5036	1 near 1173
	13:17	4790	32 14.6593	135	1.4552	1173 ACORK-Connect cable
	14:00	4790	32 14.6171	135	1.4985	End of Dive

KR02-10

DIVE 263

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:20	4628	32 20.9051	134	55.9853	on bottom
263-SAHF-01	10:22	4628	32 20.9051	134	55.9853	2 Approaching 2nd Thrust
263-SAHF-02	10:30	4632	32 20.9127	134	55.9509	1 Approaching 2nd Thrust
263-SAHF-03	10:52	4639	32 20.9343	134	55.9305	2 Approaching 2nd Thrust
263-SAHF-04	11:03	4646	32 20.9603	134	55.9101	1 Approaching 2nd Thrust
263-SAHF-05	11:16	4643	32 20.9711	134	55.8871	2 Approaching 2nd Thrust
263-SAHF-06	11:40	4642	32 20.9939	134	55.8655	1 Approaching 2nd Thrust
263-SAHF-07	12:10	4652	32 21.0220	134	55.8361	2 Approaching 2nd Thrust
263-SAHF-08	12:23	4640	32 21.0350	134	55.8196	1 more consolidated ridge

263-PC-01	12:26	4640	32 21.0350	134	55.8196	PC (Green) on ridge
	12:35	4636	32 21.0393	134	55.8234	on bottom (View seafloor)
263-SAHF-09	12:54	4627	32 21.0534	134	55.8196	2 on 2nd ridge
263-SAHF-10	13:18	4625	32 21.0703	134	55.7873	1 Beginning 2nd Thrust
263-SAHF-11	13:51	4614	32 21.0869	134	55.7567	2 H.W. of 2nd Thrust
263-SAHF-12	14:12	4593	32 21.0949	134	55.7227	1 Hanging wall 2nd Thrust
263-PC-03	14:19	4614	32 21.0862	134	55.7524	PC-2 (Blue)
263-Bio-01	14:23	4614	32 21.0862	134	55.7524	biological sample
263-SAHF-13	14:49	4583	32 21.1244	134	55.6955	2 Hanging wall 2nd Thrust
263-SAHF-14	15:01	4578	32 21.1389	134	55.6691	1 Hanging wall 2nd Thrust
263-PC-03	16:12	4580	32 21.0508	134	55.5943	PC (Yellow)
263-Bio-02	16:24	4579	32 21.0422	134	55.5739	biological sample(shell, etc.)
	16:31	4562	32 21.0848	134	55.5841	End of Dive

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DIVE 264

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	09:52	4671	32 21.2105	134	56.6873	On bottom (A-Cork:808)
264-SAHF-01	11:28	4671	32 21.2105	134	56.6873	2 SHF @ 808I location
264-SAHF-02	14:42	4651	32 21.0240	134	55.8373	SHF
	14:43	4651	32 21.0240	134	55.8373	KAIKO264-1 maker
264-SAHF-03	15:23	4652	32 21.0283	134	55.8411	2 SHF 7m SE of SHF-02
264-SAHF-04	15:32	4652	32 21.0218	134	55.8513	9m SE of SHF-03
	12:38	4652	32 21.0218	134	55.8513	KAIKO264-2maker
264-SAHF-05	15:46	4645	32 21.0305	134	55.8470	
264-SAHF-06	16:00	4637	32 21.0384	134	55.8275	
264-PC-01	16:03	4636	32 21.0384	134	55.8275	Yellow push core
264-PC-02	16:05	4635	32 21.0384	134	55.8275	Blue Push core.
	16:40	4645	32 21.0305	134	55.8470	End of Dive (SAHF-05)

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DIVE 265

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:30	3714	32 32.4079	134	42.4152	On bottom
265-SAHF-01	10:34	3714	32 32.4079	134	42.4152	2 SAHF
265-SAHF-02	10:43	3712	32 32.4436	134	42.4024	1
265-SAHF-03	11:04	3709	32 32.4858	134	42.3679	2
265-SAHF-04	11:22	3708	32 32.5205	134	42.3488	1
265-SAHF-05	11:36	3705	32 32.5508	134	42.3424	2 Installed through small mat
265-SAHF-06	13:28	3686	32 32.5659	134	42.3488	1
265-SAHF-07	13:49	3850	32 32.5886	134	42.3360	2
265-SAHF-08	14:31	3626	32 32.6601	134	42.2977	1 45 degree slope

265-PC-01	14:34	3626	32 32.6601	134	42.2977	1 Yellow
265-SAHF-09	15:07	3631	32 32.7380	134	42.2977	1
265-SAHF-10	15:42	3634	32 32.7769	134	42.2913	1 In dead clams
265-SAHF-11	15:43	3634	32 32.7769	134	42.2913	2 Outside of dead clams
265-PC-02	15:44	3634	32 32.7769	134	42.2913	blue
265-Bio-01	16:04	3634	32 32.7769	134	42.2913	Dead clam
265-Bio-02	16:04	3634	32 32.7769	134	42.2913	Dead clam
265-Bio-05	16:04	3634	32 32.7769	134	42.2913	live small clam from Bio-2
265-Bio-03	16:02	3634	32 32.7600	134	42.2800	Dead clam
	16:10	3634	32 32.7769	134	42.2913	KAIKO265-1 maker
265-SAHF-12	16:51	3628	32 32.7683	134	42.2823	edge of dead clam field
265-Bio-04	16:54	3628	32 32.7683	134	42.2823	
265-PC-03	16:56	3628	32 32.7683	134	42.2823	Green push core
	17:14	3628	32 32.7683	134	42.2823	KAIKO265-2 maker

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DIVE 266

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:25	4788	32 14.6455	135	1.4816	On Bottom
266-SAHF-01	10:44	4789	32 14.6722	135	1.5088	2 SAHF (jostled by arm)
266-SAHF-02	10:49	4789	32 14.6722	135	1.5088	1
266-PC-01	10:51	4789	32 14.6722	135	1.5088	Blue
266-PC-02	10:52	4789	32 14.6722	135	1.5088	Yellow
266-SAHF-03	11:17	4790	32 14.6830	135	1.5147	SAHF-03
266-SAHF-04	11:29	4790	32 14.6830	135	1.5147	2 SAHF-04
266-SAHF-05	12:01	4790	32 14.6758	135	1.5249	1 SAHF-05
	12:03	4790	32 14.6758	135	1.5249	KAIKO266-3 Marker
266-SAHF-06	12:18	4796	32 14.6758	135	1.5249	SAHF-06
266-SAHF-07	12:42	4789	32 14.6707	135	1.5113	SAHF-07
266-SAHF-08	13:05	4789	32 14.6599	135	1.5011	SAHF-08
266-SAHF-09	13:05	4789	32 14.6599	135	1.5011	SAHF-09
	13:16	4785	32 14.6498	135	1.4918	conect cable(A-Cork:)
	13:36	4789	32 14.6541	135	1.4943	End of Dive

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DIVE 267

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:20	1971	33 39.3729	136	38.0410	On bottom
267-LTMS	11:32	1979	33 39.2993	136	37.9522	LTMS (red)
267-LTMS	11:37	1979	33 39.2993	136	37.9522	LTMS (yellow)
267-DIHF	13:21	2053	33 39.2228	136	38.1351	
	14:12	1979	33 39.2993	136	37.9367	biological sample

267-HS-01	14:23	1980	33 39.2978	136	37.9436	R-1: rock sample
267-HS-02	14:24	1982	33 39.2978	136	37.9436	rock sample
267-HS-03	14:28	1982	33 39.2978	136	37.9436	rock sample
267-HS-04	14:29	1982	33 39.2978	136	37.9436	rock sample
	14:42	1979	33 39.3606	136	37.9384	biological sample (shell, etc.)
	14:42	1979	33 39.3606	136	37.9384	biological sample (shell, etc.)
	14:46	1979	33 39.3606	136	37.9384	biological sample (shell, etc.)
267-HS-05	14:49	1979	33 39.3606	136	37.9384	rock sample-3 Pieces: A, B, &C
	14:56	1999	33 39.3151	136	37.9030	KAIKO267-2 maker
	16:10	1992	33 39.2661	136	37.9134	LCL: HD=90deg. AL=134m
	16:13	1981	33 39.2639	136	37.9418	80m south of ST2
	16:20	1983	33 39.2668	136	37.9807	LCL:HD=95deg. AL=131m
	16:30	1984	33 39.2690	136	38.0445	LCL: HD=93deg. AL=129m
	16:40	2008	33 39.2603	136	38.0919	LCL: HD=101deg. AL=136m
	17:00	2052	33 39.2827	136	38.2032	LCL: HD=118deg. AL=131m
	17:02	2052	33 39.2668	136	38.2058	LCL: HD=111deg. AL=131m
	17:02	2052	33 29.2827	136	38.2524	End of Dive
267-HS-06	?	?	?	?	?	pebbles from basket
267-HS-07	?	?	?	?	?	pebbles from basket
267-HS-08	?	?	?	?	?	olive black pebbles from basket
267-HS-09	?	?	?	?	?	gray-olive baset fragments
267-HS-10	?	?	?	?	?	sulfurous black fragments
267-HS-11	?	?	?	?	?	pebbles from bio-box
267-Bio-01	?	?	?	?	?	Living Calyptogena
267-Bio-02	?	?	?	?	?	Living Calyptogena
267-Bio-03	?	?	?	?	?	Living Calyptogena
267-Bio-04	?	?	?	?	?	Living Calyptogena
267-Bio-05	?	?	?	?	?	living unknown clam
267-Bio-06	14:12	1979	33 39.2993	136	37.9367	Dead Calyptogena shells
267-Bio-07	14:42	1979	33 39.3606	136	37.938	Dead Calyptogena shells
267-Bio-08	?	?	?	?	?	Calyptogena Shell frags
267-Bio-09	?	?	?	?	?	Tubeworms

KR02-10

DIVE 268

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	10:45	2053	33 39.2278	136	38.1404	On Bottom
	10:51	2053	33 39.2278	136	38.1404	End of Dive

KR02-10**DIVE 269**

Sample#	Time	W.D.	Lat. Deg.	Long. deg.	Long. Min	Inst.#Description
	9:26	2905	33 11.4798		136 43.4357	Arrival at seafloor
269-HS-01	15:12	2305	33 13.5015		136 41.4524	rock sample
269-HS-02	15:18	2260	33 13.5556		136 41.4374	rock sample
269-1 Marker	15:32	2259	33 13.5484		136 41.4181	Marker
269-PC-01	15:37	2258	33 13.5574		136 41.4288	Blue
269-PC-02	16:53	2103	33 14.0058		136 40.9355	Yellow
269-PC-03	16:55	2103	33 14.0058		136 40.9355	Green
	17:00	2078	33 14.0732		136 40.9055	End of Dive

A-6 Heatflow Measurements Summary

Date	Time	Meas. ID	Latitude	Longitude	Depth	Instrument	Status	# Penet. Probes	Heatflow (mW/m2)	STD (mW/m2)
1-Aug-02	8:18	KR02-10HF01A	32°49.7938'N	136°52.9724'E	3846mbsl	Surface HF	fell	0		
1-Aug-02	8:38	KR02-10HF01B	32°49.8041'N	136°52.9090'E	4110mbsl	Surface HF	one sensor	1		
1-Aug-02	9:11	KR02-10HF01C	32°49.8052'N	136°52.9077'E	3878mbsl	Surface HF	one sensor	1		
1-Aug-02	11:14	KR02-10HF01D	32°50.0444'N	136°52.8757'E	3847mbsl	Surface HF	one sensor	1		
1-Aug-02	11:40	KR02-10HF01E	32°50.0433'N	136°51.8923'E	3834mbsl	Surface HF	fell	0		
1-Aug-02	11:54	KR02-10HF01F	32°50.0368'N	136°52.8949'E	3660mbsl	Surface HF	one sensor	1		
1-Aug-02	16:41	KR02-10HF01G	32°50.5449'N	136°52.5439'E	4159mbsl	Surface HF	one sensor	1		
1-Aug-02	17:55	KR02-10HF01H	32°50.5689'N	136°52.5186'E	4165mbsl	Surface HF	one sensor	1		
2-Aug-02	11:07	261-SAHF-01	32°21.2145'N	134°56.7003'E	4539mbsl	SAHF1	penetrate	5	162.67	1.03
3-Aug-02	10:45	262-SAHF-01	32°14.6863'N	135°01.5138'E	4792mbsl	SAHF1	penetrate	5	213.81	3.46
3-Aug-02	10:54	262-SAHF-02	32°14.6636'N	135°01.5724'E	4792mbsl	SAHF1	penetrate	5	207.14	1.26
3-Aug-02	11:21	262-SAHF-03	32°14.6463'N	135°01.5915'E	4792mbsl	SAHF1	penetrate	5	200.85	1.52
3-Aug-02	11:48	262-SAHF-04	32°14.6301'N	135°01.6157'E	4792mbsl	SAHF1	penetrate	5	205.71	1.46
3-Aug-02	12:49	262-SAHF-05	32°14.6387'N	135°01.5036'E	4791mbsl	SAHF1	penetrate	5	212.65	8.00
3-Aug-02	18:28	KR02-10HF02A	32°20.3205'N	134°56.5850'E	4758mbsl	Surface HF	penetrate	3	184.66	0.60
3-Aug-02	19:55	KR02-10HF02B	32°20.3993'N	134°56.4908'E	4743mbsl	Surface HF	penetrate	3	192.14	12.08
3-Aug-02	21:14	KR02-10HF02C	32°20.4413'N	134°56.3900'E	4678mbsl	Surface HF	penetrate	5	226.15	2.56
4-Aug-02	10:22	263-SAHF-01	32°20.9051'N	134°55.9853'E	4628mbsl	SAHF2	penetrate	5	160.40	4.18
4-Aug-02	10:30	263-SAHF-02	32°20.9127'N	134°55.9509'E	4632mbsl	SAHF1	penetrate	5	164.92	2.03
4-Aug-02	10:52	263-SAHF-03	32°20.9343'N	134°55.9305'E	4639mbsl	SAHF2	penetrate	5	182.64	8.41
4-Aug-02	11:03	263-SAHF-04	32°20.9603'N	134°55.9101'E	4646mbsl	SAHF1	penetrate	5	191.68	2.89
4-Aug-02	11:16	263-SAHF-05	32°20.9711'N	134°55.8871'E	4643mbsl	SAHF2	penetrate	5	186.93	3.04
4-Aug-02	11:40	263-SAHF-06	32°20.9939'N	134°55.8655'E	4642mbsl	SAHF1	penetrate	5	184.61	2.20
4-Aug-02	12:10	263-SAHF-07	32°21.0220'N	134°55.8361'E	4652mbsl	SAHF2	penetrate	5	261.68	5.14
4-Aug-02	12:23	263-SAHF-08	32°21.0350'N	134°55.8196'E	4640mbsl	SAHF1	penetrate	5	176.41	7.14
4-Aug-02	12:54	263-SAHF-09	32°21.0534'N	134°55.8196'E	4627mbsl	SAHF2	penetrate	5	264.98	4.88
4-Aug-02	13:18	263-SAHF-10	32°21.0703'N	134°55.7873'E	4625mbsl	SAHF1	penetrate	5	195.57	4.37
4-Aug-02	13:51	263-SAHF-11	32°21.0869'N	134°55.7567'E	4614mbsl	SAHF2	penetrate	3	186.04	5.10
4-Aug-02	14:12	263-SAHF-12	32°21.0949'N	134°55.7227'E	4593mbsl	SAHF1	penetrate	5	114.38	3.09
4-Aug-02	14:49	263-SAHF-13	32°21.1244'N	134°55.6955'E	4583mbsl	SAHF2	penetrate	5	144.37	6.51
4-Aug-02	15:01	263-SAHF-14	32°21.1389'N	134°55.6691'E	4578mbsl	SAHF1	penetrate	5	148.63	6.12
5-Aug-02	9:07	KR02-10HF03A	32°20.4843'N	134°56.3302'E	?	Surface HF	penetrate	2	207.32	1.47

Date	Time	Meas. ID	Latitude	Longitude	Depth	Instrument	Status	# Penet. Probes	Heatflow (mW/m2)	STD (mW/m2)
5-Aug-02	10:31	KR02-10HF03B	32°20.5378'N	134°56.3119'E	4582mbsl	Surface HF	one sensor	1		
5-Aug-02	12:06	KR02-10HF03C	32°20.5730'N	134°56.2331'E	?	Surface HF	penetrate	2	169.88	13.16
5-Aug-02	13:29	KR02-10HF03D	32°20.6322'N	134°56.2278'E	?	Surface HF	one sensor	1		
5-Aug-02	14:56	KR02-10HF03E	32°20.6699'N	134°56.1410'E	4560mbsl	Surface HF	penetrate	2	152.32	3.56
5-Aug-02	16:27	KR02-10HF03F	32°20.7254'N	134°56.0800'E	4766mbsl	Surface HF	penetrate	3	131.92	4.48
5-Aug-02	17:54	KR02-10HF03G	32°20.7882'N	134°56.0082'E	4630mbsl	Surface HF	fell	0		
5-Aug-02	18:09	KR02-10HF03H	32°20.7919'N	134°56.6071'E	4689mbsl	Surface HF	penetrate	2	169.15	9.12
6-Aug-02	11:28	264-SAHF-01	32°21.2105'N	134°56.6873'E	4671mbsl	SAHF2	penetrate	5	151.11	6.40
6-Aug-02	14:42	264-SAHF-02	32°21.0240'N	134°55.8373'E	4651mbsl	SAHF2	penetrate	5	236.30	2.17
6-Aug-02	15:23	264-SAHF-03	32°21.0283'N	134°55.8411'E	4652mbsl	SAHF2	penetrate	5	276.24	5.49
6-Aug-02	15:32	264-SAHF-04	32°21.0218'N	134°55.8513'E	4652mbsl	SAHF1	penetrate	5	249.04	3.17
6-Aug-02	15:46	264-SAHF-05	32°21.0305'N	134°55.8470'E	4645mbsl	SAHF2	penetrate	5	203.60	2.93
6-Aug-02	16:00	264-SAHF-06	32°21.0384'N	134°55.8275'E	4637mbsl	SAHF1	penetrate	5	151.86	1.29
7-Aug-02	10:34	265-SAHF-01	32°32.4079'N	134°42.4152'E	3714mbsl	SAHF2	penetrate	5	95.19	4.77
7-Aug-02	10:43	265-SAHF-02	32°32.4436'N	134°42.4024'E	3712mbsl	SAHF1	penetrate	5	80.52	3.74
7-Aug-02	11:04	265-SAHF-03	32°32.4858'N	134°42.3679'E	3709mbsl	SAHF2	penetrate	5	81.86	3.77
7-Aug-02	11:22	265-SAHF-04	32°32.5205'N	134°42.3488'E	3708mbsl	SAHF1	penetrate	5	82.49	0.48
7-Aug-02	11:36	265-SAHF-05	32°32.5508'N	134°42.3424'E	3705mbsl	SAHF2	penetrate	5	151.55	0.82
7-Aug-02	13:28	265-SAHF-06	32°32.5659'N	134°42.3488'E	3686mbsl	SAHF1	penetrate	5	141.54	1.78
7-Aug-02	13:49	265-SAHF-07	32°32.5886'N	134°42.3360'E	3850mbsl	SAHF2	penetrate	5	42.73	7.98
7-Aug-02	14:31	265-SAHF-08	32°32.6601'N	134°42.2977'E	3626mbsl	SAHF1	penetrate	4	63.09	13.51
7-Aug-02	15:07	265-SAHF-09	32°32.7380'N	134°42.2977'E	3631mbsl	SAHF1	penetrate	4	81.13	9.84
7-Aug-02	15:42	265-SAHF-10	32°32.7769'N	134°42.2913'E	3634mbsl	SAHF1	penetrate	5	201.10	2.97
7-Aug-02	15:43	265-SAHF-11	32°32.7769'N	134°42.2913'E	3634mbsl	SAHF2	penetrate	5	210.28	6.74
7-Aug-02	16:51	265-SAHF-12	32°32.7683'N	134°42.2823'E	3628mbsl	SAHF2	penetrate	5	253.32	12.05
8-Aug-02	10:44	266-SAHF-01	32°14.6722'N	135°01.5088'E	4789mbsl	SAHF2	penetrate	5	208.55	6.44
8-Aug-02	10:49	266-SAHF-02	32°14.6722'N	135°01.5088'E	4789mbsl	SAHF1	penetrate	5	204.28	2.70
8-Aug-02	11:17	266-SAHF-03	32°14.6830'N	135°01.5147'E	4790mbsl	SAHF1	penetrate	5	212.57	3.70
8-Aug-02	11:29	266-SAHF-04	32°14.6830'N	135°01.5147'E	4790mbsl	SAHF2	penetrate	5	210.54	3.54
8-Aug-02	12:01	266-SAHF-05	32°14.6758'N	135°01.5249'E	4790mbsl	SAHF1	penetrate	5	222.84	9.07
8-Aug-02	12:18	266-SAHF-06	32°14.6758'N	135°01.5249'E	4796mbsl	SAHF2	penetrate	5	213.60	7.08
8-Aug-02	12:42	266-SAHF-07	32°14.6707'N	135°01.5113'E	4789mbsl	SAHF2	penetrate	5	214.95	2.83
8-Aug-02	13:05	266-SAHF-08	32°14.6599'N	135°01.5011'E	4789mbsl	SAHF2	penetrate	5	222.91	5.74
8-Aug-02	13:05	266-SAHF-09	32°14.6599'N	135°01.5011'E	4789mbsl	SAHF1	penetrate	5	222.69	2.50
8-Aug-02	17:53	KR02-10HF04	32°26.2067'N	135°13.9810'E	4891mbsl	Surface HF	penetrate	5	169.79	1.04
10-Aug-02	14:57	KR02-10HF05A	33°19.0030'N	136°40.1136'E	2086mbsl	Surface HF	penetrate	6	55.30	0.38
10-Aug-02	16:32	KR02-10HF05B	33°18.6690'N	136°40.3495'E	2137mbsl	Surface HF	penetrate	4	52.83	9.44
10-Aug-02	18:50	KR02-10HF05C	33°16.4140'N	136°41.2959'E	2758mbsl	Surface HF	penetrate	5	51.80	2.91
12-Aug-02	8:16	KR02-10HF06A	33°00.3157'N	136°48.3941'E	4347mbsl	Surface HF	penetrate	6	77.29	1.08
12-Aug-02	10:09	KR02-10HF06B	32°59.9983'N	136°48.5578'E	4380mbsl	Surface HF	fell	0		
12-Aug-02	10:16	KR02-10HF06C	32°59.9983'N	136°48.5578'E	4347mbsl	Surface HF	fell	0		
12-Aug-02	10:22	KR02-10HF06D	32°59.9983'N	136°48.5578'E	4348mbsl	Surface HF	fell	0		
12-Aug-02	11:54	KR02-10HF06E	32°59.6715'N	136°48.6924'E	4354mbsl	Surface HF	fell	0		
12-Aug-02	12:03	KR02-10HF06F	32°59.6824'N	136°48.7012'E	4386mbsl	Surface HF	fell	0		
12-Aug-02	12:08	KR02-10HF06G	32°59.6815'N	136°48.6925'E	4361mbsl	Surface HF	fell	0		
12-Aug-02	14:34	KR02-10HF06H	32°57.3108'N	136°49.1881'E	4391mbsl	Surface HF	fell	0		

A-7 Survey Summary

1. Daily Activity

Date	01-Aug-02	02-Aug-02	03-Aug-02	04-Aug-02	05-Aug-02	06-Aug-02	07-Aug-02	08-Aug-02	09-Aug-02	10-Aug-02	11-Aug-02	12-Aug-02
Dive Number		261	262	263		264	265	266	267	268	269	
Area	B	A-1	A-2	A-1	A	A-1	A-3	A-2	B-2	B	B-3	B
A-CORK Site		808I	1173B	(808I)		808I		1173B				
SAHF Meas.		Conducted	Conducted	Conducted		Conducted	Conducted	Conducted				
SSS/SBP		Near 808I	Near 1173B	Near 808I		Near 808I	Muroto OOST		Mud Volcano		Kumano OOST	
LTMS Deployment					Acoustics Test				Deploy			
Drill-In HF Meter									Deploy	Rescue Dive		
Push Core		Taken	Taken	Taken		Taken	Taken	Taken	Taken		Taken	
Surface HF Meter	Kumano Deformation Front		Muroto Deformation Front		Kumano Deformation Front			Muroto Deformation Front		Kumano Basin		Kumano Deformation Front

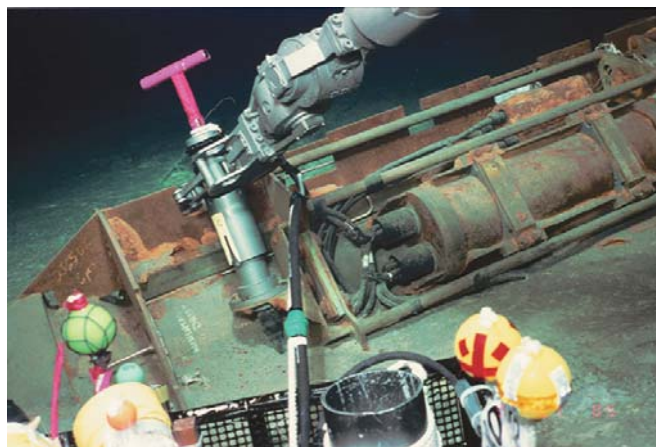
2. Location of Advanced CORKs, long -term hydrogeological observatories

ACORK Site	Latitude	Longitude	Water Depth
A-1 (808I)	32° 21.217'N	134° 56.700'E	4685.4mbsl
A-2 (1173B)	32° 14.6831' N	135° 1.4845' E	4801.9mbsl

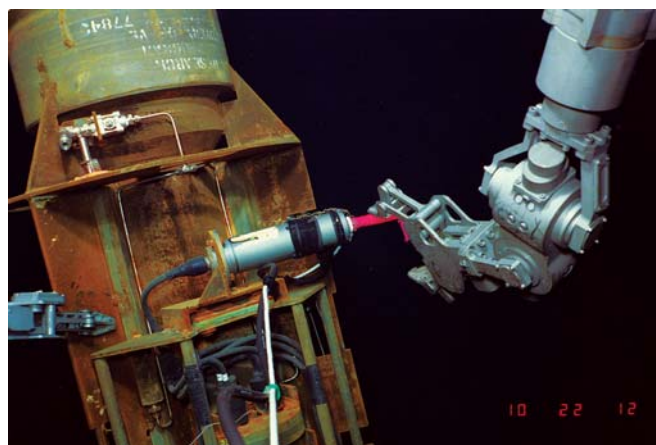
3. Seafloor Topology Mapping by Multi- Narrow Beam

Multi Narrow Beam	Latitude	Longitude	Remarks
Starting Point	32° 53.5'N	136° 32.5'E	Conducted on Aug. 1
End Point	32° 21.2'N	134° 56.7'E	
Starting Point	32° 38'N	136° 00'E	Conducted on Aug. 10 & 11
End Point	32° 38'N	137° 30'E	
Starting Point	32° 32'N	136° 00'E	
End Point	32° 32'N	137° 30'E	

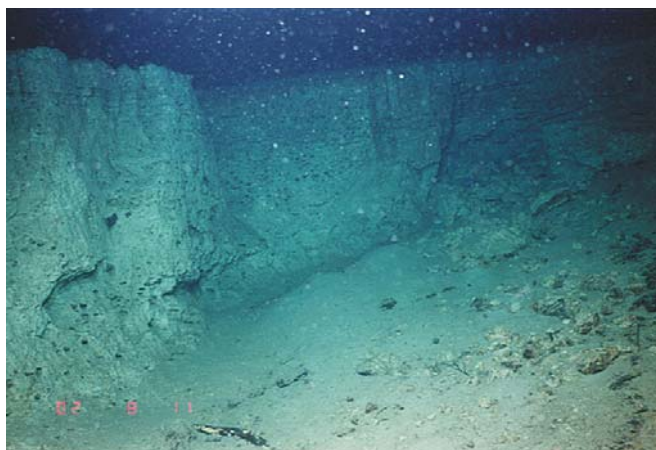
A-8 Photo Gallery



Kaiko Operation at the ACORK site 808I in the dive 264. Top of the instrument casing fell down on the seafloor during the installation in the ODP leg-196 but the instruments functions well. Also, the UMC is located upside so that the KAIKO operates for further data retrieval or control of the instruments.



Kaiko Operation at the ACORK site 1173B in the dive 266. Top of the instrument is located about 3 meters above the seafloor. The right manipulator mated the UMC to the instrument while the left manipulator grabs the casing to hold the Kaiko against any current. Probably, this is the first operation in the history of ROV operation ever using the both manipulator at the same time.



Base cliff was found during the dive 269 at the out of sequence thrust zone of the Kumano area. Relative height of the cliff was seen about one to two meters (See Fig.14(h)).

Dive261 Biological sample



Dive261 samplingsite overview



Dive261 samplingsite closeup



Sampling with manipulator



Dive261 Bio1 Living Calyptogena
Broken by manipulator



Dive261 Bio2 Living Calyptogena
Broken by manipulator



Dive261 Bio3 Living Calyptogena

Dive263 Biological sample



Dive263 samplingsite overview 1



Dive263 samplingsite overview 2



Dive263 samplingsite closeup



Sampling with pitchfork



Dive263 Bio-1 Living Calyptogena



Parts of Dive263 Bio-2 shell fragments

Dive265 Biological sample



Dive265 sampling site1



Dive265 sampling site2



Sampling with pitchfork



Dive265 Bio-1 Big Calyptogena shell



Dive265 Bio-4 Shell fragments of site2



Dive265 Bio-5 Small living clam

(Manuscript received 15 January 2003)

