

## 48-CHANNEL SEISMIC OPERATIONS

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## INTRODUCTION

This section describes the 48-channel seismic reflection system used during KH98-1 Leg 2, and significant observations thereof. This section is primarily a technical description; other sections address scientific aspects of the seismic data. We collected ≈27,000 shotpoints (50+ Gbytes) of 48-channel data during the cruise.

## DESCRIPTION OF EQUIPMENT

The cable reel on *Hakuho Maru* was located on the port side afterdeck ≈20 m forward from the stern. The rubber coated drum is 1.2 m diameter by 1.6 m wide, and it is driven by an electrically powered hydraulic motor system. An Innovative Technology Inc. ST-5 48-channel, 1200 m active length cable was loaded on the reel before Leg 1. The ITI cable is a solid, 3 cm diameter, reinforced, floatation cable with bulbous hydrophones every 5 m. Inside each molded bulb, a flat, pressure sensitive, plastic sheet is coiled around an axially positioned aluminum cylinder. Each group consists of 5 such phones, yielding a 25 meter active channel. The outboard phone bulb of each channel is labeled with the channel number within the section (1E-24E) for the individual 600 m active cable sections. Each group has a single preamplifier located inside the cylinder of the near offset bulb, powered by 12 volt batteries

in the recording room. The cable used consisted of two 600 m active sections plus a 185 m leader, 12 m trailer, and 100 m tail rope and 0.25 m diameter tailbuoy ("Norwegian buoy"). The cable was towed directly off the reel, to minimize sharp radius turns as much as possible, straight back to a narrow 10 cm diameter stern roller with side rollers on the port quarter rail. Tow height at the stern was  $\approx 3$  meters above the water. Plastic chafing gear ( $\approx 1$  cm thick) around the area exposed to the roller served to minimize the bend radius.

There are 5 bird coil bulbs per 24-channel section, at equal spacing along the section, midway between phones. Five Syntron Multitrak depth control units ("birds"), each with compass, temperature sensor, and wing angle feedback, were installed in equal intervals along the two sections. Bird bulbs have no black and white wires visible in the clear part of the bulb, but otherwise look exactly like phones. They were not labeled; some had red vinyl tape on them for identification.

The inboard end of the leader has an amphibious connector, and the deck cable connected to it led up one level and  $\approx 20$  m forward into Laboratory 3, where it was connected to an OYO ST-5 breakout box, the OYO DAS-1 recorder, and two 48 amp-hour, 12 volt lead acid batteries.

Bolt 1500C air guns with 1000 in<sup>3</sup> and 1200 in<sup>3</sup> barrels and I/O SS8 shuttle motion detectors were towed at equal offset behind the stern from deck level,  $\approx 2$  m above the water. Up to three guns were deployed simultaneously. Each could be retrieved and launched independently with little change in the tow characteristics of the other two. The two center guns were retrieved using stainless wire rope from winches at the top of the stern A-frame. The third starboard gun was retrieved with  $\approx 2.5$  cm rope using a snatch block on a hanger outboard of the A-frame, about halfway up, and a capstan. Depth could be adjusted by changing the tow length or the ship speed. Guns depths

could not be determined directly, and in contrast to standard air gun deployment techniques for MCS work, no floats were used.

Up to 2000 psi air from two LMF-200 compressors located in the winch room below the afterdeck supplied air via permanent piping to a valve box forward of the reel. Flexible hose led aft across the entire deck, a safety issue on the well-traveled fantail, to each gun tow point. Except for a short test period, the guns were fired at 1600-1700 psi throughout KH98-1 Leg 2, significantly below the nominal 2000 psi usually used in air gun reflection seismology.

According to the manufacturer, operating the 1500C air guns at less than 2000 psi results in overall reduced energy into the water as well as power loss at higher frequencies., thus skewing the air guns' peak energy output toward lower frequencies.

The air guns were fired from a countdown timer derived from the ORI master OBS timing clock with auxiliary logic and level converters. The start signal derived from this chain was routed to a True Time GPS clock, which provided a sub-ms accuracy time stamp for each start. The start signal was routed to all analog recorders, the OYO digital recorder, and a relay box which triggered two IO Auto Sync I WG (lines 101-404) or IO Auto Sync I "AG" (lines 501-601). Important differences in characteristics of the two kinds of boxes only became apparent midway through KH98-1 Leg 2. Each introduces some additional delay between the start time and the actual acoustic pulse, with the goal of adjusting some measured signal to a common aiming point. This was 90 ms for the WG box, and 50 ms for the AG box.

One or more seismic channels from the ST5 breakout box were routed via a differential preamplifier, then single ended gain and bandpass filter, to the ship's EPC 9800 , or the UTIG EPC 3212 graphic recorders. We fed sonobuoy signals from an ICOM 8500 radio receiver into the OYO auxiliary channel, as well as displaying them on the UTIG EPC 3212 recorder.

## CABLE OPERATIONS

UTIG purchased 3 rolls of lead sheet ("lead dampcourse" of 300 mm x 20 k x 6 m dimensions), rolls of 0.4 mm x 5 cm plastic tape, and tie wraps at BBC Hardware and Ideal Electrical Suppliers in Cairns to ballast the cable, which as manufactured has significant positive buoyancy in water. The cable was run out in large loops on the aft and starboard deck in port, and 528 g weights attached every other phone, according to specifications supplied to UTIG by the manufacturer, beginning with the two tail channels. After weighting the two tail channels, we floated them alongside the ship to determine their approximate buoyancy. Although the Cairns harbor water was less salty than water over the Ontong Java Plateau observed during KH98-1 Leg 1, temperatures were about the same. This test convinced us that the predicted amount of weight would be too great, so we adjusted the calculated amount by half on all other channels, putting 264 g weights on every other phone. This plan was followed for the rest of the cable, except where a mistake was made in the pattern, in channel 8 of the outboard section. We weighted channels with a bird bulb, which are slightly heavier than birdless channels, the same as birdless channels. Two tie wraps on the front end of the tape wrap were used to keep the plastic tape from unwinding in the water stream, instead of tying off the plastic tape. These were much faster to install, but probably less secure than tying off the tape. About half seemed to loosen during each deployment. We were unsure if the thinner tape we purchased in Cairns—no friction ("bulldog") tape could be located—would tie well.

Once tested at sea, we found the cable to be slightly positively buoyant. At 3-5 kts through the water, wing angles averaged  $<4^\circ$ , except at the ends. The greater the tow speed, the more correction was needed by the head and tail birds. To reduce this effect, we put more weight on the leader, adding  $\approx 8.5$  kg. This reduced but did not eliminate the problem. The 1st bird was always at

full dive ( $-14^\circ$ ), which should generate  $\approx 35$  pounds of downward force at 5 kts. Except for this, the birds maintained the 10 m set depth most of the time with small angles. Following seas with a 2+ m swell caused some instability in the bird feedback scheme. Generally, with the slow dynamics of the 48-channel cable, we found 30 s non-averaged updates to be quite stable. We placed the nearest bird in full down wing angle on one occasion because it tended to oscillate, as we also observed with the 24-channel cable.

Tow noise was not quantitatively evaluated, but the cable seemed to be quieter than a similar ITI cable used aboard RVIB *Nathaniel B. Palmer* 9507. In particular, high velocity noise coherent across many channels was absent from this cable. The weather was better during KH98-1 Leg 2, and tow speed generally lower, so a direct comparison is difficult. Some noise characterization will be done as part of MCS processing at UTIG.

Channels 30, 42, and 48 were faulty at some times. The far offset, channel 48, could have been power starved; ITI suggested that 36 volts might be needed to power the cable to full signal/noise at the far channels, where voltage drop would be greatest. We saw no direct evidence of this need. The channel 48 problem looked more like a broken wire or a bad sensor. If the center tap were not well attached to the battery half voltage point, the outboard 12 or 14 channels only would latch with no signal. ITI says this effect is characteristic of the OYO response if common mode voltage is too great.

A spare 600 m cable section (ITI sn 974002) of the same construction was stored on a wooden reel; it was neither ballasted nor tested during KH98-1 Leg 2. One of us (M. Wiederspahn) had participated, however, in a test of the spare section and the outboard section (ITI sn 974001) used during KH98-1 Leg 2 undertaken from Galveston on 22 December 1997. The inboard section (ITI sn 974003) used during KH98-1 Leg 2 had not been field tested in Galveston or elsewhere prior to the cruise.

Safety problems could be considerable in high seas in manually lifting the birds over the stern rail when deploying and retrieving the streamer. A gently curved ramp over the rail might permit a single person to handle this task, and securely capture the cable as well to limit its movement.

In one instance during KH98-1 Leg 2, the head of an ITI streamer section was observed being secured during towing by figure eighting around the port aft mooring bollards. As the diameter of the figure eights was well below that recommended by the manufacturer for winding the streamer—the diameter of the wooden reels on which the streamer sections were shipped is a good guide to the minimum recommended diameter for winding the streamer—extreme care should be used to avoid such practice in the future, thus minimizing the chance of wire breakage inside the cable. Additional guidelines for care and preservation of the ITI cable are given in the manuals supplied by the manufacturer.

We deployed the cable at  $\approx 3$  kts through the water, and retrieved it at  $\approx 1.5$  kts. This seemed to provide enough tension to wind the cable on the drum gently but securely.

## CABLE LAYOUT

B = bird location, with no collar  
 BC = bird location, with collars installed  
 Bn = bird location, with programmable bird ID we used

w = 8.8 x 15 cm 20 kg/m\*\*2 lead weight = 264 g  
 W = 8.8 x 30 cm 20 kg/m\*\*2 lead weight = 528 g  
 (note: cable circumference is ≈9.4 cm)

p = hydrophone bulb  
 X = patch over small hole in cable jacket, channel 2, outboard

leader marked with black marker at drum wrap intervals, 3.78 m.  
 15 each 8.8 x 30 cm 528 g weights at 5 m interval at the outboard end.

Inboard section, sn 974003  
 connector

|    |    |   |   |   |   |   |   |   |   |   |   |
|----|----|---|---|---|---|---|---|---|---|---|---|
| 1  | B3 | p | w | p | w | p | w | p | w | p |   |
| 2  |    | p | w | p |   | p | w | p |   | p |   |
| 3  |    | w | p |   | p | w | p |   | p | w | p |
| 4  |    | p | w | p |   | p | w | p |   | p |   |
| 5  |    | w | p |   | p | w | p |   | p | w | p |
| 6  |    | p | w | p |   | p | w | p |   | p |   |
| 7  | BC | p |   | p | w | p |   | p | w | p |   |
| 8  |    | p | w | p |   | p | w | p |   | p |   |
| 9  |    | w | p |   | p | w | p |   | p | w | p |
| 10 |    | p | w | p |   | p | w | p |   | p |   |
| 11 |    | w | p |   | p | w | p |   | p | w | p |
| 12 |    | p | w | p |   | p | w | p |   | p |   |
| 13 | B4 | p |   | p | w | p |   | p | w | p |   |
| 14 |    | p | w | p |   | p | w | p |   | p |   |
| 15 |    | w | p |   | p | w | p |   | p | w | p |
| 16 |    | p | w | p |   | p | w | p |   | p |   |
| 17 |    | w | p |   | p | w | p |   | p | w | p |
| 18 |    | p | w | p |   | p | w | p |   | p |   |
| 19 | B  | p |   | p | w | p |   | p | w | p |   |
| 20 |    | p | w | p |   | p | w | p |   | p |   |
| 21 |    | w | p |   | p | w | p |   | p | w | p |
| 22 |    | p | w | p |   | p | w | p |   | p |   |
| 23 |    | w | p |   | p | w | p |   | p | w | p |
| 24 |    | p | w | p |   | p | w | p |   | p |   |

B  
 connector

Outboard section, sn 974001  
 connector

|    |    |   |   |   |   |   |   |   |   |   |    |    |
|----|----|---|---|---|---|---|---|---|---|---|----|----|
| 1  | B5 | p |   | p | w | p |   | p | w | p | 25 |    |
| 2  |    | p | w | p | X | p | w | p |   | p | 26 |    |
| 3  |    | w | p |   | p | w | p |   | p | w | p  | 27 |
| 4  |    | p | w | p |   | p | w | p |   | p |    | 29 |
| 5  |    | w | p |   | p | w | p |   | p | w | p  | 29 |
| 6  |    | p | w | p |   | p | w | p |   | p |    | 30 |
| 7  | BC | p |   | p | w | p |   | p | w | p |    | 31 |
| 8  |    | w | p |   | p | w | p |   | p | w | p  | 32 |
| 9  |    | p | w | p |   | p | w | p |   | p |    | 33 |
| 10 |    | w | p |   | p | w | p |   | p | w | p  | 34 |
| 11 |    | p | w | p |   | p | w | p |   | p |    | 35 |
| 12 |    | w | p |   | p | w | p |   | p | w | p  | 36 |
| 13 | B6 | p | w | p |   | p | w | p |   | p |    | 37 |
| 14 |    | w | p |   | p | w | p |   | p | w | p  | 38 |
| 15 |    | p | w | p |   | p | w | p |   | p |    | 39 |
| 16 |    | w | p |   | p | w | p |   | p | w | p  | 40 |
| 17 |    | p | w | p |   | p | w | p |   | p |    | 41 |
| 18 |    | w | p |   | p | w | p |   | p | w | p  | 42 |
| 19 | BC | p | w | p |   | p | w | p |   | p |    | 43 |
| 20 |    | w | p |   | p | w | p |   | p | w | p  | 44 |
| 21 |    | p | w | p |   | p | w | p |   | p |    | 45 |
| 22 |    | w | p |   | p | w | p |   | p | w | p  | 46 |
| 23 |    | p | W | p |   | p | W | p |   | p |    | 47 |
| 24 |    | W | p |   | p | W | p |   | p | W | p  | 48 |

B7  
 connector  
 tail section with swivel  
 tail rope with buoy

## AIR GUN OPERATIONS

The air guns were towed from the deck on stainless wire rope with a slant distance from deck to gun port of 27.3 m. Each gun could be retrieved individually for repairs and redeployed without changing ship speed (at least in good weather), or altering the tow points of the guns still firing. However, the tow points were close enough together so that several snarls developed in quartering seas. As the depth of each gun was not well controlled, surfacing times of the three bubbles differed at least sometimes by 0.5 to 1 s. Often the guns towed so they fired within a meter or so of each other, even though the tow points were 3-5 m apart.

Generally, our tow speed was 3.5-5.5 kts through the water. The longest line (400) was shot at the slower speed due to a strong accompanying current, and this probably limited wear and tear on the hose bundles and guns.

Gun bundles should contain rugged hydrophones (blast phones), as is standard in MCS operations, to unambiguously monitor the firing time of each gun in case there is doubt about the correct working of the I/O SS8 shuttle motion detector. Not having phones available in the harnesses available for monitoring made detection of the gun mis-timing much more difficult, and logging of such problems for treatment in subsequent data processing impossible. In addition, a storage oscilloscope or other display device should be part of the air gun quality control package so that every gun phone can be monitored simultaneously for every shot, and logged. Ideally, such gun phone data should be recorded for all shots as well.

## SYSTEM TIMING AND AIR GUN ELECTRONICS

The OBS master clock provided a stable, accurate 1 Hz signal to the countdown timer, which then sent the master start signal either directly to



buffer and level converters to distribute to all the recording devices, or routed it through a PC based software randomizer (designed, constructed, tested, and installed during the first few days of KH98-1 Leg 2) which delayed the trigger by 0 to 0.5 s for all devices. We shot all the data with the randomizer enabled. This randomized start signal time was logged by the True Time clock, and closed a relay, with a delay of 10 ms, which caused the AutoSync gun fire boxes to output a pulse of high voltage which fired the solenoids in the air guns.

Use of the AutoSync I WG gun controllers caused significant air gun mistiming during lines 101-404. The WG model, which is intended to fire water guns, differs in several important ways from the airgun ("AG") AutoSync model, even when the WG is internally jumpered for airgun operation. The most important is that the WG misses the initial shuttle motion, and instead, synchronizes the shuttle return. The actual gun peak pressure point is  $\approx 465$  ms after start, rather than the expected 500 ms after start. This was measured by looking at the raw shuttle motion signal. The jitter was anywhere from a few ms to 20 ms, the latter when the trigger picked a different part of the waveform (probably the inductive kick when the solenoid pulse turned off).

Other differences between WG and AG models include:

- 1) WG waits 32-40 ms after shot before trigger possible, AG waits 8 ms;
- 2) WG charges to 60 v, AG to 110 v;
- 3) WG fires 60 ms pulse, AG 40 ms pulse;
- 4) WG aims at 90 ms, AG at 50 ms;
- 5) WG has 3 v sensor detect with filter, AG has 0.5 v detect, no filter.

Thus, because air guns and water guns function in fundamentally different ways, the AutoSync I WG controllers should only be used for synchronization of water guns, and the AutoSync "AG" controllers should only be used for synchronization of air guns.

## RECORDING

We used the OYO DAS-1 without any significant problems. It is tricky to configure initially, but once set up in a particular configuration, is quite reliable. All problems resulted from a configuration change, or switching between two different production modes. We were able to record 16 seconds of data every 20 seconds without problem to an HP 1533 DAT drive internal to the OYO. The output to tape overlaps the start of the next shot by 2 or 3 s. We carefully tested this by injecting known data for each shot (before shooting began), and verifying the content on tape, and believe the OYO worked as expected. About 6 shots were missed at each tape change, with one shot being buffered in memory during the transition. For example, if 100 shots/tape were recorded, tape 2 would have shot 101, then shot 107, 108, etc. on it.

On occasion, the shot header was not recorded on the first shot of the first tape of a line. This seemed to be a function of configuration, but we never learned the exact cause(s).

The OYO time drifts significantly; this must be monitored and logged to permit correction of the shot time of the raw seismic data so it can be merged with the navigation. We did so at the end of each line.

Overdriving the AUX input causes data glitches on all seismic channels, coincident with the direct wave arrival on the AUX input. Interestingly, this glitch was observed on the analog EPC monitor attached to the breakout box.

The cable depths, wing angles, and compass readings from each bird are logged by the Syntron controller. We experienced significant problems with data loss due to inexperience with the program. Not recording is altogether

too easy with the Syntron software, potentially causing problems with subsequent MCS data processing. The first half of line 401 seems not to have been saved, or was saved and then erased by operator error. The bird interrogation was set to occur 18 s after start. At the start of line 403 the trigger was disconnected and a default cycle occurred during a recording window, inductively coupling the bird commands into all the seismic channels across the display until the problem was corrected.

The EPC 9800 worked quite well as a single channel monitor. We generally ran it at a 4 second sweep, with varying non-zero delay from channel 5 at a  $\approx 200$  m offset from the guns.

#### NAVIGATION

We recorded the ship's "system" filtered position, from connector J106 of the JRC data LAN as the only available real-time navigation. The initial ship velocity estimates from this source at one minute time intervals look quite variable. Raw GPS fixes from Leica/Magnavox 9212 receivers at 5 second intervals may have been recorded by the ship's logging system and will be extracted post-cruise from the master log tapes. Raw GPS from the OBS group GPS Trimble VX6 receiver were also recorded each second. The antenna for this receiver was poorly located beneath a large ship's mast, so may have biases due to invisible satellites or multipath from time to time.

We recorded the Truetime GPS clock output to obtain the time of each shot. On other cruises, this might not be available, and one would have to trust the OYO time to interpolate navigation in locating each shot. Since the OYO does not output, nor can it input, either time, file number, or shot, some unique label needs to be common to the navigation and the seismic data.

It would be extremely useful to have raw GPS available, or to have someone on the ship who understands the system filter characteristics so navigation quality control can be accomplished during the cruise. This especially affects gravity quality, but also MCS shot navigation.

We were unsuccessful in determining the location of the guns relative to the streamer or stern. From geometry, we expected the gun to 1st active section distance to be  $\approx 110$  m. From travel time calculations of the direct wave traveling down the cable, the distance seems to have been  $\approx 75$  m. We can't reconcile such a large error or find a timing error which could cause this. However, while doing the moveout analysis for the stacks, an airgun-1st channel offset of 110 m and a water velocity of 1505-1510 m/s resulted in a flat water bottom. This will be further investigated post-cruise.

From tow angle and other geometry, we think that the guns were  $\approx 12$  m deep, but this too is ambiguous. We will look for ghost notches in the spectrum of recorded data to see if we can determine gun depth. Use of floats for the air guns would eliminate ambiguity in gun depths.

We produced raw stacked sections on the ship for selected areas of interest for  $\approx 20$  hours of shooting. We estimated the average velocity by plotting WGS-84 great circle distance from the lines' endpoints vs. each minute of time. We used 50 m bins, giving a fold of 30+ for a standard simple marine sort. Velocities were estimated by examining moved out gathers.

## TABLE OF GEOMETRY AND TIMING

|                              |                                    |
|------------------------------|------------------------------------|
| nav antenna to stern         | 58 m (from ship's plans, frame 82) |
| obs gps antenna to stern     | 17 m (from ship's plans, frame 27) |
| gun slant range stern to gun | 27.3 m (from gun tech report)      |
| stern to gun offset          | 18 m (? see discussion)            |
| gun depth                    | 12 m (? see discussion)            |
| stern to center first active | 123 m (? see discussion)           |
| gun to center first active   | 105 m (? see discussion)           |

Autosync WG start to pressure peak 465 ms nominal; much jitter  
 Autosync AG start to pressure peak 460 ms; jitter ~3 ms

## 48 CHANNEL LINE SUMMARY

| line | day.hrmn | file  | tape |
|------|----------|-------|------|
| 301  | 46.0345  | 570   | 8    |
|      | 46.0517  | 842   | 8    |
| 401  | 46.0517  | 843   | 8    |
|      | 47.2238  | 8259  | 15   |
| 402  | 47.2345  | 8438  | 15   |
|      | 48.0430  | 9296  | 16   |
| 403  | 48.0501  | 9391  | 16   |
|      | 49.1421  | 15383 | 21   |
| 404  | 49.1423  | 1     | 22   |
|      | 59.2017  | 3578  | 23   |
| 501  | 51.1122  | 1     | 27   |
|      | 53.0100  | 6767  | 32   |
| 601  | 53.1516  | 1     | 33   |
|      | 54.0420  | 2324  | 35   |

# KH98-1 LEG 2 SEISMIC LINE SUMMARY

| <i>Line</i> | <i>Area</i>     | <i>Length</i> | <i>Shot Interval</i> | <i>Record Length</i> | <i>Streamer</i>        | <i>Source</i>             | <i>Sonobuoys</i> |
|-------------|-----------------|---------------|----------------------|----------------------|------------------------|---------------------------|------------------|
| 101         | Eastern Salient | 149 km        | 10 s                 | 8 s                  | 24-channel, 300 m ITI  | 4.5 liters                | 0                |
| 102         | Eastern Salient | 96 km         | 10 s                 | 8 s                  | 24-channel, 300 m ITI  | 4.5 liters                | 0                |
| 103         | Eastern Salient | 27 km         | 10 s                 | 8 s                  | 24-channel, 300 m ITI  | 4.5 liters                | 0                |
| 201         | Nauru Basin     | 41 km         | 20 s                 | 16 s                 | 24-channel, 300 m ITI  | 3400 in <sup>3</sup>      | 1                |
| 301         | Gun Tests       | 2 km          | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 2200 in <sup>3</sup>      | 0                |
| 401         | Nauru-OJP       | 550 km        | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 1000-3400 in <sup>3</sup> | 11               |
| 402         | Nauru-OJP       | 29 km         | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 2200-3200 in <sup>3</sup> | 1                |
| 403         | Nauru-OJP       | 438 km        | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 2200-3400 in <sup>3</sup> | 12               |
| 404         | Nauru-OJP       | 260 km        | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 2400-3400 in <sup>3</sup> | 2                |
| 501         | OJP             | 364 km        | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 1200-3400 in <sup>3</sup> | 5                |
| 601         | OJP             | 152 km        | 20 s                 | 16 s                 | 48-channel, 1200 m ITI | 2200-3400 in <sup>3</sup> | 5                |

**KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG**

|                      |  |
|----------------------|--|
| <b>Line</b>          | <b>101</b>                                 |
| <b>Vessel</b>        | <b>R/V Hakuho Maru</b>                     |
| <b>Area</b>          | <b>Ontong Java Plateau—Eastern Salient</b> |
| <b>Survey Number</b> | <b>KH98-1 Leg 2</b>                        |

| <b>LINE INFORMATION</b>  | <b>Time (UTC)</b> | <b>Shot Point</b> | <b>Tape Number</b> |
|--------------------------|-------------------|-------------------|--------------------|
|                          |                   |                   |                    |
| <b>Acquisition Start</b> | <b>43.1602</b>    | <b>571</b>        | <b>1</b>           |
| <b>Acquisition Stop</b>  | <b>44.0118</b>    | <b>3894</b>       | <b>4</b>           |

| <b>LINE DETAILS</b>         | <b>Start of Line (FSP)</b> | <b>End of Line (LSP)</b> |
|-----------------------------|----------------------------|--------------------------|
|                             |                            |                          |
| <b>Wind Direction/Speed</b> |                            |                          |
| <b>Feather Angle</b>        | <b>Hdg=31°</b>             | <b>Hdg=33°</b>           |
| <b>Water Depth</b>          | <b>3478</b>                | <b>1976</b>              |
| <b>Primary Navigation</b>   | <b>GPS</b>                 | <b>GPS</b>               |
| <b>Latitude</b>             | <b>5°59.87'S</b>           | <b>4°54.00'S</b>         |
| <b>Longitude</b>            | <b>163°37.15'E</b>         | <b>164°18.06'E</b>       |
| <b>Source Volume</b>        | <b>4.5 l</b>               | <b>4.5 l</b>             |
| <b>Bad Traces</b>           |                            |                          |

| <b>UNDERWAY GEOPHYSICAL DATA</b>             |                         |
|--|-------------------------|
|  |                         |
| <b>SeaBeam</b>                               | <b>Center Beam Only</b> |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                         |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | <b>Yes/</b>             |
| <b>Gravity</b>                               | <b>Yes</b>              |
| <b>Magnetics</b>                             | <b>Yes</b>              |
| <b>Magnetometer Distance from Stern</b>      |                         |

**COMMENTS**

# **KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |                               |
|--|-------------------------------|
| <b>Line</b>  | <b>101</b>                    |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                 |
| <b>Sample Length</b>                                       | <b>8.0 s</b>                  |
| <b>Trace Length</b>  | <b>12.5 m</b>                 |
| <b>Seismic Traces on Tape</b>                              | <b>24</b>                     |
| <b>Seismic Channels</b>                                    | <b>24</b>                     |
| <b>Gun Sensors</b>   | <b>0</b>                      |
| <b>Sonobuoy Channels</b>                                   | <b>0</b>                      |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                   |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                 |
| <b>First Group Offset (source midpoint to first group)</b> |                               |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>≈10 m (get precise #)</b>  |
| <b>Tow Leader Length</b>                                   | <b>≈300 m (get precise #)</b> |
| <b>Shot Interval</b>                                       | <b>10 s</b>                   |
| <b>Shot Spacing</b>  | <b>variable</b>               |
| <b>Ship Speed</b>  | <b>nominal 8 kts</b>          |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b> |
| <b>Area</b>  | <b>Ontong Java Plateau</b>    |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>           |
| <b>Number of Airguns</b>                                   | <b>1</b>                      |
| <b>Volume of Airguns</b>                                   | <b>4.5 l</b>                  |
| <b>Total Source Volume</b>                                 | <b>4.5 l</b>                  |
| <b>Airgun Pressure</b>                                     | <b>1800 psi</b>               |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>                 |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (±250 ms)</b>       |
| <b>Number of Birds</b>                                     | <b>2</b>                      |
| <b>Location(s) of Birds</b>                                | <b>before channels 1, 13</b>  |
| <b>Cable Depth</b>   | <b>10 m</b>                   |
| <b>Gun Depth</b>   | <b>≈ 5 m</b>                  |
| <b>Tail Rope Length</b>                                    |                               |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                   |



# **KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG**

|                      |  |
|----------------------|--|
| <b>Line</b>          | <b>102</b>                                 |
| <b>Vessel</b>        | <b>R/V Hakuho Maru</b>                     |
| <b>Area</b>          | <b>Ontong Java Plateau—Eastern Salient</b> |
| <b>Survey Number</b> | <b>KH98-1 Leg 2</b>                        |

| <b>LINE INFORMATION</b>  | <b>Time (UTC)</b> | <b>Shot Point</b> | <b>Tape Number</b> |
|--------------------------|-------------------|-------------------|--------------------|
|                          |                   |                   |                    |
| <b>Acquisition Start</b> | <b>44.0329</b>    | <b>4664</b>       | <b>5</b>           |
| <b>Acquisition Stop</b>  | <b>44.0936</b>    | <b>6864</b>       | <b>5</b>           |

| <b>LINE DETAILS</b>         | <b>Start of Line (FSP)</b> | <b>End of Line (LSP)</b> |
|-----------------------------|----------------------------|--------------------------|
|                             |                            |                          |
| <b>Wind Direction/Speed</b> |                            |                          |
| <b>Feather Angle</b>        | <b>Hdg=302°</b>            | <b>Hdg=302°</b>          |
| <b>Water Depth</b>          | <b>1706</b>                | <b>1571</b>              |
| <b>Primary Navigation</b>   | <b>GPS</b>                 | <b>GPS</b>               |
| <b>Latitude</b>             | <b>5°05.71'S</b>           | <b>4°39.02'S</b>         |
| <b>Longitude</b>            | <b>164°25.26'E</b>         | <b>163°40.72'E</b>       |
| <b>Source Volume</b>        | <b>4.5 l</b>               | <b>4.5 l</b>             |
| <b>Bad Traces</b>           |                            |                          |

| <b>UNDERWAY GEOPHYSICAL DATA</b>             |                         |
|--|-------------------------|
|  |                         |
| <b>SeaBeam</b>                               | <b>Center Beam Only</b> |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                         |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | <b>Yes/</b>             |
| <b>Gravity</b>                               | <b>Yes</b>              |
| <b>Magnetics</b>                             | <b>Yes</b>              |
| <b>Magnetometer Distance from Stern</b>      |                         |

**COMMENTS**

**KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |                               |
|--|-------------------------------|
| <b>Line</b>  | <b>102</b>                    |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                 |
| <b>Sample Length</b>                                       | <b>8.0 s</b>                  |
| <b>Trace Length</b>  | <b>12.5 m</b>                 |
| <b>Seismic Traces on Tape</b>                              | <b>24</b>                     |
| <b>Seismic Channels</b>                                    | <b>24</b>                     |
| <b>Gun Sensors</b>   | <b>0</b>                      |
| <b>Sonobuoy Channels</b>                                   | <b>0</b>                      |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                   |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                 |
| <b>First Group Offset (source midpoint to first group)</b> |                               |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>≈10 m (get precise #)</b>  |
| <b>Tow Leader Length</b>                                   | <b>≈300 m (get precise #)</b> |
| <b>Shot Interval</b>                                       | <b>10 s</b>                   |
| <b>Shot Spacing</b>  | <b>variable</b>               |
| <b>Ship Speed</b>  | <b>nominal 8 kts</b>          |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b> |
| <b>Area</b>  | <b>Ontong Java Plateau</b>    |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>           |
| <b>Number of Airguns</b>                                   | <b>1</b>                      |
| <b>Volume of Airguns</b>                                   | <b>4.5 l</b>                  |
| <b>Total Source Volume</b>                                 | <b>4.5 l</b>                  |
| <b>Airgun Pressure</b>                                     | <b>1800 psi</b>               |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>                 |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (±250 ms)</b>       |
| <b>Number of Birds</b>                                     | <b>2</b>                      |
| <b>Location(s) of Birds</b>                                | <b>before channels 1, 13</b>  |
| <b>Cable Depth</b>   | <b>10 m</b>                   |
| <b>Gun Depth</b>   | <b>≈ 5 m</b>                  |
| <b>Tail Rope Length</b>                                    |                               |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                   |

# **KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG**

|                      |  |
|----------------------|--|
| <b>Line</b>          | <b>103</b>                                 |
| <b>Vessel</b>        | <b>R/V Hakuho Maru</b>                     |
| <b>Area</b>          | <b>Ontong Java Plateau—Eastern Salient</b> |
| <b>Survey Number</b> | <b>KH98-1 Leg 2</b>                        |

| <b>LINE INFORMATION</b>  | <b>Time (UTC)</b> | <b>Shot Point</b> | <b>Tape Number</b> |
|--------------------------|-------------------|-------------------|--------------------|
|                          |                   |                   |                    |
| <b>Acquisition Start</b> | <b>44.1116</b>    | <b>7460</b>       | <b>5</b>           |
| <b>Acquisition Stop</b>  | <b>44.1300</b>    | <b>8084</b>       | <b>6</b>           |

| <b>LINE DETAILS</b>         | <b>Start of Line (FSP)</b> | <b>End of Line (LSP)</b> |
|-----------------------------|----------------------------|--------------------------|
|                             |                            |                          |
| <b>Wind Direction/Speed</b> |                            |                          |
| <b>Feather Angle</b>        | <b>Hdg=30°</b>             | <b>Hdg=33°</b>           |
| <b>Water Depth</b>          | <b>1585</b>                | <b>1819</b>              |
| <b>Primary Navigation</b>   | <b>GPS</b>                 | <b>GPS</b>               |
| <b>Latitude</b>             | <b>4°48.26'S</b>           | <b>4°35.78'S</b>         |
| <b>Longitude</b>            | <b>163°46.09'E</b>         | <b>163°53.53'E</b>       |
| <b>Source Volume</b>        | <b>4.5 l</b>               | <b>4.5 l</b>             |
| <b>Bad Traces</b>           |                            |                          |

| <b>UNDERWAY GEOPHYSICAL DATA</b>             |                         |
|--|-------------------------|
|  |                         |
| <b>SeaBeam</b>                               | <b>Center Beam Only</b> |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                         |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | <b>Yes/</b>             |
| <b>Gravity</b>                               | <b>Yes</b>              |
| <b>Magnetics</b>                             | <b>Yes</b>              |
| <b>Magnetometer Distance from Stern</b>      |                         |

**COMMENTS**

## KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS

|   |                        |
|---|------------------------|
| Line  | 103                    |
| Sample Interval                                     | 2.0 ms                 |
| Sample Length                                       | 8.0 s                  |
| Trace Length  | 12.5 m                 |
| Seismic Traces on Tape                              | 24                     |
| Seismic Channels                                    | 24                     |
| Gun Sensors   | 0                      |
| Sonobuoy Channels                                   | 0                      |
| Low Cut Filter                                      | 3 Hz                   |
| High Cut Filter                                     | 125 Hz                 |
| First Group Offset (source midpoint to first group) |                        |
| Energy Source Offset (stern to source midpoint)     | ≈10 m (get precise #)  |
| Tow Leader Length                                   | ≈300 m (get precise #) |
| Shot Interval                                       | 10 s                   |
| Shot Spacing  | variable               |
| Ship Speed  | nominal 8 kts          |
| Vessel  | R/V <i>Hakuho Maru</i> |
| Area  | Ontong Java Plateau    |
| Survey Number                                       | KH98-1 Leg 2           |
| Number of Airguns                                   | 1                      |
| Volume of Airguns                                   | 4.5 l                  |
| Total Source Volume                                 | 4.5 l                  |
| Airgun Pressure                                     | 1800 psi               |
| Gun Fire Time (initial firing delay)                | 465 ms                 |
| Firing Randomizer Limits                            | 500 ms (±250 ms)       |
| Number of Birds                                     | 2                      |
| Location(s) of Birds                                | before channels 1, 13  |
| Cable Depth   | 10 m                   |
| Gun Depth   | ≈ 5 m                  |
| Tail Rope Length                                    |                        |
| GPS Antenna to Stern Distance                       | 58 m                   |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                 |
|----------------------|-----------------|
| <b>Line</b>          | 201             |
| <b>Vessel</b>        | R/V Hakuho Maru |
| <b>Area</b>          | Nauru Basin     |
| <b>Survey Number</b> | KH98-1 Leg 2    |

| LINE INFORMATION  | Time (UTC) | Shot Point | Tape Number |
|-------------------|------------|------------|-------------|
|                   |            |            |             |
| Acquisition Start | 45.0406    | 1          | 7           |
| Acquisition Stop  | 45.1000    | 1023       | 7           |

| LINE DETAILS         | Start of Line (FSP) | End of Line (LSP) |
|----------------------|---------------------|-------------------|
|                      |                     |                   |
| Wind Direction/Speed | 62°/7 kts           | 65°/7 kts         |
| Feather Angle        | Crs=28°, Hdg=46°    |                   |
| Water Depth          | 4434 m              | 4430 m            |
| Primary Navigation   | GPS                 | GPS               |
| Latitude             | 1°33.13'S           | 1°13.65'S         |
| Longitude            | 165°23.76'E         | 165°34.43'E       |
| Bad Traces           | 1, 10, 24           | 1, 10, 24         |

| UNDERWAY GEOPHYSICAL DATA             |                  |
|---------------------------------------|------------------|
|                                       |                  |
| SeaBeam                               | Center Beam Only |
| 12 kHz Echo Sounder/Transducer Depth  |                  |
| 3.5 kHz Echo Sounder/Transducer Depth | Yes/             |
| Gravity                               | Yes              |
| Magnetics                             | Yes              |
| Magnetometer Distance from Stern      |                  |

### COMMENTS

#### Airgun Summary

45.041720-45.043600: 1 x 20 l, 1 x 17 l, 1 x 20 l @ 1600 psi  
 45.043600-45.080523: 1 x 20 l, 1 x 17 l, 1 x 20 l @ 1500 psi  
 45.080523-45.100000: 1 x 20 l, 1 x 17 l, 1 x 20 l @ 1800 psi

## KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS

|  |                        |
|--|------------------------|
| <b>Line</b>  | 201                    |
|  |                        |
| <b>Sample Interval</b>                                     | 2.0 ms                 |
| <b>Sample Length</b>                                       | 16 s                   |
| <b>Trace Length</b>  | 12.5 m                 |
| <b>Seismic Traces on Tape</b>                              | 24                     |
| <b>Seismic Channels</b>                                    | 24                     |
| <b>Gun Sensors</b>   | 0                      |
| <b>Sonobuoy Channels</b>                                   | 1                      |
| <b>Low Cut Filter</b>                                      | 3 Hz                   |
| <b>High Cut Filter</b>                                     | 125 Hz                 |
| <b>First Group Offset (source midpoint to first group)</b> |                        |
| <b>Energy Source Offset (stern to source midpoint)</b>     |                        |
| <b>Tow Leader Length</b>                                   |                        |
| <b>Shot Interval</b>                                       | 20 s                   |
| <b>Shot Spacing</b>  | variable               |
| <b>Ship Speed</b>  | nominal 5 kts          |
| <b>Vessel</b>  | <i>R/V Hakuho Maru</i> |
| <b>Area</b>  | Nauru Basin            |
| <b>Survey Number</b>                                       | KH98-1 Leg 2           |
| <b>Number of Airguns</b>                                   | 3                      |
| <b>Volume of Airguns</b>                                   | 2 x 20 l, 1 x 17 l     |
| <b>Total Source Volume</b>                                 | 57 l                   |
| <b>Airgun Pressure</b>                                     | 1500-1800 psi          |
| <b>Gun Fire Time (initial firing delay)</b>                | 465 ms                 |
| <b>Firing Randomizer Limits</b>                            | 500 ms ( $\pm 250$ ms) |
| <b>Number of Birds</b>                                     | 2                      |
| <b>Location(s) of Birds</b>                                | before channels 1, 13  |
| <b>Cable Depth</b>   | 10 m                   |
| <b>Gun Depth</b>   | $\approx 10$ m         |
| <b>Tail Rope Length</b>                                    |                        |
| <b>GPS Antenna to Stern Distance</b>                       | 58.4 m                 |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 301                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION         | Time (UTC) | Shot Point | Tape Number |
|--------------------------|------------|------------|-------------|
|                          |            |            |             |
| <b>Acquisition Start</b> | 46.0345    | 570        | 8           |
| <b>Acquisition Stop</b>  | 46.0517    | 842        | 8           |

| LINE DETAILS                | Start of Line (FSP) | End of Line (LSP) |
|-----------------------------|---------------------|-------------------|
|                             |                     |                   |
| <b>Wind Direction/Speed</b> |                     |                   |
| <b>Feather Angle</b>        | Hdg=99°             | Hdg=262°          |
| <b>Water Depth</b>          | 4335 m              | 4338 m            |
| <b>Primary Navigation</b>   | GPS                 | GPS               |
| <b>Latitude</b>             | 0°27.20'N           | 0°26.14'N         |
| <b>Longitude</b>            | 166°15.78'E         | 166°15.77'E       |
| <b>Bad Traces</b>           |                     |                   |

| UNDERWAY GEOPHYSICAL DATA                    |                  |
|--|------------------|
|  |                  |
| <b>SeaBeam</b>                               | Center Beam Only |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                  |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | Yes/             |
| <b>Gravity</b>                               | Yes              |
| <b>Magnetics</b>                             | Yes              |
| <b>Magnetometer Distance from Stern</b>      |                  |

**COMMENTS**—Gun tests - no useful information.

### Airgun Summary

46.0345-46.034700: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1500 psi

46.034700-46.051721: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi

## KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS

|  |   |
|--|---|
| <b>Line</b>  | <b>301</b>  |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>   |
| <b>Sample Length</b>                                       | <b>16 s</b>   |
| <b>Trace Length</b>  | <b>25 m</b>   |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>   |
| <b>Seismic Channels</b>                                    | <b>48</b>   |
| <b>Gun Sensors</b>   | <b>0</b>  |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>  |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>   |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>   |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 field)</b>                          |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>   |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>  |
| <b>Shot Interval</b>                                       | <b>20 s</b>   |
| <b>Shot Spacing</b>  | <b>variable</b>   |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                                    |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                           |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                              |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                                     |
| <b>Number of Airguns</b>                                   | <b>2</b>  |
| <b>Volume of Airguns</b>                                   | <b>1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup></b> |
| <b>Total Source Volume</b>                                 | <b>2200 in<sup>3</sup></b>                              |
| <b>Airgun Pressure</b>                                     | <b>1500-1600 psi</b>                                    |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>   |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (±250 ms)</b>                                 |
| <b>Number of Birds</b>                                     | <b>5</b>  |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>                       |
| <b>Cable Depth</b>   | <b>10 m</b>   |
| <b>Gun Depth</b>   | <b>≈10 m</b>  |
| <b>Tail Rope Length (+ 12 m trailer)</b>                   | <b>100 m</b>  |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>   |

Gun tests - no useful MCS data.



## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 401                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION  | Time (UTC) | Shot Point | Tape Number |
|-------------------|------------|------------|-------------|
| Acquisition Start | 46.0517    | 843        | 8           |
| Acquisition Stop  | 47.2238    | 8259-8349* | 15          |

| LINE DETAILS         | Start of Line (FSP) | End of Line (LSP) |
|----------------------|---------------------|-------------------|
| Wind Direction/Speed | 120/8 m/s           |                   |
| Feather Angle        | 261.5/258.7         |                   |
| Water Depth          | 4338                | 3543              |
| Primary Navigation   | GPS                 | GPS               |
| Latitude             | 0°26.12'N           | 0°24.43'S         |
| Longitude            | 166°15.77'E         | 161°23.10'E       |
| Bad Traces           |                     |                   |

| UNDERWAY GEOPHYSICAL DATA             |                  |
|---------------------------------------|------------------|
| SeaBeam                               | Center Beam Only |
| 12 kHz Echo Sounder/Transducer Depth  |                  |
| 3.5 kHz Echo Sounder/Transducer Depth | Yes/             |
| Gravity                               | Yes              |
| Magnetics                             | Yes              |
| Magnetometer Distance from Stern      |                  |

### COMMENTS

\*use time

#### Gun Summary

46.051721-47.043200: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 47.043200-47.043240: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1600 psi  
 47.043240-47.051620: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 47.051620-47.052820: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 47.052820-47.222600: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 47.222600-47.223820: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1650 psi  
 47.223820 (end): 1 x 1000 in<sup>3</sup> @ 1650 psi

**KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |  |
|--|--|
| <b>Line</b>  | <b>401</b>                                     |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                                  |
| <b>Sample Length</b>                                       | <b>16 s</b>                                    |
| <b>Trace Length</b>  | <b>12.5 m</b>                                  |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>                                      |
| <b>Seismic Channels</b>                                    | <b>48</b>                                      |
| <b>Gun Sensors</b>   | <b>2</b>                                       |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>                                       |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                                    |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                                  |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 m field)</b>               |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>                                    |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>                                   |
| <b>Shot Interval</b>                                       | <b>20 s</b>                                    |
| <b>Shot Spacing</b>  | <b>variable</b>                                |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                           |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                  |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                     |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                            |
| <b>Number of Airguns</b>                                   | <b>variable</b>                                |
| <b>Volume of Airguns</b>                                   | <b>variable</b>                                |
| <b>Total Source Volume</b>                                 | <b>1000 in<sup>3</sup>-3400 in<sup>3</sup></b> |
| <b>Airgun Pressure</b>                                     | <b>1600-1650 psi</b>                           |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>                                  |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (<math>\pm 250</math> ms)</b>        |
| <b>Number of Birds</b>                                     | <b>5</b>                                       |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>              |
| <b>Cable Depth</b>   | <b>10 m</b>                                    |
| <b>Gun Depth</b>   | <b><math>\approx 10</math> m</b>               |
| <b>Tail Rope Length</b>                                    | <b>100 m</b>                                   |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                                    |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 402                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION  | Time (UTC) | Shot Point       | Tape Number |
|-------------------|------------|------------------|-------------|
| Acquisition Start | 47.2345    | >8438 (use time) | 15          |
| Acquisition Stop  | 48.0430    | 9296             | 16          |

| LINE DETAILS         | Start of Line (FSP) | End of Line (LSP) |
|----------------------|---------------------|-------------------|
| Wind Direction/Speed | 45°/10 kts          |                   |
| Feather Angle        | Hdg=79°             | Hdg=78°           |
| Water Depth          | 3459                | 3648              |
| Primary Navigation   | GPS                 | GPS               |
| Latitude             | 0°26.27'S           | 0°24.11'S         |
| Longitude            | 161°15.76'E         | 161°31.43'E       |
| Bad Traces           |                     |                   |

| UNDERWAY GEOPHYSICAL DATA             |                  |
|---------------------------------------|------------------|
| SeaBeam                               | Center Beam Only |
| 12 kHz Echo Sounder/Transducer Depth  |                  |
| 3.5 kHz Echo Sounder/Transducer Depth | Yes/             |
| Gravity                               | Yes              |
| Magnetics                             | Yes              |
| Magnetometer Distance from Stern      |                  |

### COMMENTS

#### Airgun Summary

47.234520-48.021000: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1650 psi  
 48.021000-48.035700: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 48.035700-48.041040: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 48.041040-48.043000: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1700 psi

## KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS

|   |  |
|---|--|
| Line  | 402  |
| Sample Interval                                     | 2.0 ms                                     |
| Sample Length                                       | 16 s                                       |
| Trace Length  | 12.5 m                                     |
| Seismic Traces on Tape                              | 50   |
| Seismic Channels                                    | 48   |
| Gun Sensors   | 3  |
| Sonobuoy Channels                                   | 1  |
| Low Cut Filter                                      | 3 Hz                                       |
| High Cut Filter                                     | 125 Hz                                     |
| First Group Offset (source midpoint to first group) | calculate (105.5 field)                    |
| Energy Source Offset (stern to source midpoint)     | 20 m                                       |
| Tow Leader Length (stern to first group midpoint)   | 115 m                                      |
| Shot Interval                                       | 20 s                                       |
| Shot Spacing  | variable                                   |
| Ship Speed  | nominal 5 kts                              |
| Vessel  | R/V <i>Hakuho Maru</i>                     |
| Area  | Ontong Java Plateau                        |
| Survey Number                                       | KH98-1 Leg 2                               |
| Number of Airguns                                   | variable                                   |
| Volume of Airguns                                   | variable                                   |
| Total Source Volume                                 | 2200 in <sup>3</sup> -3200 in <sup>3</sup> |
| Airgun Pressure                                     | 1600-1700 psi                              |
| Gun Fire Time                                       | 465 ms                                     |
| Firing Randomizer Limits                            | 500 ms ( $\pm 250$ ms)                     |
| Number of Birds                                     | 5  |
| Location(s) of Birds                                | pre-1, 13, 25, 37; post-48                 |
| Cable Depth   | 10 m                                       |
| Gun Depth   | $\approx 10$ m                             |
| Tail Rope Length                                    | 100 m                                      |
| GPS Antenna to Stern Distance                       | 58 m                                       |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 403                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION         | Time (UTC) | Shot Point | Tape Number |
|--------------------------|------------|------------|-------------|
|                          |            |            |             |
| <b>Acquisition Start</b> | 48.0501    | 9391       | 16          |
| <b>Acquisition Stop</b>  | 49.1421    | 15383      | 21          |

| LINE DETAILS                | Start of Line (FSP) | End of Line (LSP) |
|-----------------------------|---------------------|-------------------|
|                             |                     |                   |
| <b>Wind Direction/Speed</b> | 20°/5.7 kts         |                   |
| <b>Feather Angle</b>        | Hdg=263°            | Hdg=254°          |
| <b>Water Depth</b>          | 3118                | 1871              |
| <b>Primary Navigation</b>   | GPS                 | GPS               |
| <b>Latitude</b>             | 0°23.29'S           | 1°04.47'S         |
| <b>Longitude</b>            | 161°29.33'E         | 157°36.40'E       |
| <b>Bad Traces</b>           |                     |                   |

| UNDERWAY GEOPHYSICAL DATA                    |                  |
|--|------------------|
|  |                  |
| <b>SeaBeam</b>                               | Center Beam Only |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                  |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | Yes/             |
| <b>Gravity</b>                               | Yes              |
| <b>Magnetics</b>                             | Yes              |
| <b>Magnetometer Distance from Stern</b>      |                  |

## COMMENTS

### Airgun Summary

48.050152-48.1310: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1700 psi

48.1310-48.152400: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1700 psi

48.152400-48.1730: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

48.1730-48.1902: frequent changes of combination

48.1902-49.1421: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

**KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |  |
|--|--|
| <b>Line</b>  | <b>403</b>                                     |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                                  |
| <b>Sample Length</b>                                       | <b>16 s</b>                                    |
| <b>Trace Length</b>  | <b>12.5 m</b>                                  |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>                                      |
| <b>Seismic Channels</b>                                    | <b>48</b>                                      |
| <b>Gun Sensors</b>   | <b>3</b>                                       |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>                                       |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                                    |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                                  |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 field)</b>                 |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>                                    |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>                                   |
| <b>Shot Interval</b>                                       | <b>20 s</b>                                    |
| <b>Shot Spacing</b>  | <b>variable</b>                                |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                           |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                  |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                     |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                            |
| <b>Number of Airguns</b>                                   | <b>variable</b>                                |
| <b>Volume of Airguns</b>                                   | <b>variable</b>                                |
| <b>Total Source Volume</b>                                 | <b>2200 in<sup>3</sup>-3400 in<sup>3</sup></b> |
| <b>Airgun Pressure</b>                                     | <b>1700 psi</b>                                |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>                                  |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (<math>\pm 250</math> ms)</b>        |
| <b>Number of Birds</b>                                     | <b>5</b>                                       |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>              |
| <b>Cable Depth</b>   | <b>10 m</b>                                    |
| <b>Gun Depth</b>   | <b><math>\approx 10</math> m</b>               |
| <b>Tail Rope Length</b>                                    | <b>100 m</b>                                   |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                                    |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 404                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION  | Time (UTC) | Shot Point | Tape Number |
|-------------------|------------|------------|-------------|
|                   |            |            |             |
| Acquisition Start | 49.1423    | 1          | 22          |
| Acquisition Stop  | 50.1017    | 3578       | 25          |

| LINE DETAILS         | Start of Line (FSP) | End of Line (LSP)  |
|----------------------|---------------------|--------------------|
|                      |                     |                    |
| Wind Direction/Speed |                     | 38°/4.4 kts        |
| Feather Angle        | Hdg=254°            | Crs=260°, Hdg=257° |
| Water Depth          | 1871 m              | 2147 m             |
| Primary Navigation   | GPS                 | GPS                |
| Latitude             | 1°04.47'S           | 1°28.16'S          |
| Longitude            | 157°36.40'E         | 155°18.13'E        |
| Bad Traces           |                     |                    |

| UNDERWAY GEOPHYSICAL DATA             |                  |
|---------------------------------------|------------------|
|                                       |                  |
| SeaBeam                               | Center Beam Only |
| 12 kHz Echo Sounder/Transducer Depth  |                  |
| 3.5 kHz Echo Sounder/Transducer Depth | Yes/             |
| Gravity                               | Yes              |
| Magnetics                             | Yes              |
| Magnetometer Distance from Stern      |                  |

### COMMENTS

#### Airgun Summary

49.142340-50.003320: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

50.003320-50.003940: 1 x 1200 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

50.003940-50.101743: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

## KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS

|  |  |
|--|--|
| <b>Line</b>  | <b>404</b>                                     |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                                  |
| <b>Sample Length</b>                                       | <b>16 s</b>                                    |
| <b>Trace Length</b>  | <b>12.5 m</b>                                  |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>                                      |
| <b>Seismic Channels</b>                                    | <b>48</b>                                      |
| <b>Gun Sensors</b>   | <b>3</b>                                       |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>                                       |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                                    |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                                  |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 field)</b>                 |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>                                    |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>                                   |
| <b>Shot Interval</b>                                       | <b>20 s</b>                                    |
| <b>Shot Spacing</b>  | <b>variable</b>                                |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                           |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                  |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                     |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                            |
| <b>Number of Airguns</b>                                   | <b>variable</b>                                |
| <b>Volume of Airguns</b>                                   | <b>variable</b>                                |
| <b>Total Source Volume</b>                                 | <b>2400 in<sup>3</sup>-3400 in<sup>3</sup></b> |
| <b>Airgun Pressure</b>                                     | <b>1700 l</b>                                  |
| <b>Gun Fire Time</b>                                       | <b>465 ms</b>                                  |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (<math>\pm 250</math> ms)</b>        |
| <b>Number of Birds</b>                                     | <b>5</b>                                       |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>              |
| <b>Cable Depth</b>   | <b>10 m</b>                                    |
| <b>Gun Depth</b>   | <b><math>\approx 10</math> m</b>               |
| <b>Tail Rope Length</b>                                    | <b>100 m</b>                                   |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                                    |



## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                            |
|----------------------|----------------------------|
| <b>Line</b>          | <b>501</b>                 |
| <b>Vessel</b>        | <b>R/V Hakuho Maru</b>     |
| <b>Area</b>          | <b>Ontong Java Plateau</b> |
| <b>Survey Number</b> | <b>KH98-1 Leg 2</b>        |

| <b>LINE INFORMATION</b>  | <b>Time (UTC)</b> | <b>Shot Point</b> | <b>Tape Number</b> |
|--------------------------|-------------------|-------------------|--------------------|
|                          |                   |                   |                    |
| <b>Acquisition Start</b> | <b>51.1122</b>    | <b>1</b>          | <b>27</b>          |
| <b>Acquisition Stop</b>  | <b>53.0100</b>    | <b>6767</b>       | <b>32</b>          |

| <b>LINE DETAILS</b>         | <b>Start of Line (FSP)</b> | <b>End of Line (LSP)</b> |
|-----------------------------|----------------------------|--------------------------|
|                             |                            |                          |
| <b>Wind Direction/Speed</b> | <b>15°/11 m/s</b>          | <b>15°/10 m/s</b>        |
| <b>Feather Angle</b>        |                            |                          |
| <b>Water Depth</b>          | <b>1720</b>                | <b>2112</b>              |
| <b>Primary Navigation</b>   | <b>GPS</b>                 | <b>GPS</b>               |
| <b>Latitude</b>             | <b>2°51.28'S</b>           | <b>0°22.4'N</b>          |
| <b>Longitude</b>            | <b>157°08.79'E</b>         | <b>156°35.03'E</b>       |
| <b>Bad Traces</b>           | <b>1 noisy, 48 dead</b>    |                          |

| <b>UNDERWAY GEOPHYSICAL DATA</b>             |                         |
|--|-------------------------|
|  |                         |
| <b>SeaBeam</b>                               | <b>Center Beam Only</b> |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                         |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | <b>Yes/</b>             |
| <b>Gravity</b>                               | <b>Yes</b>              |
| <b>Magnetics</b>                             | <b>Yes</b>              |
| <b>Magnetometer Distance from Stern</b>      |                         |

## COMMENTS

### Airgun Summary

51.112200-51.1125: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
 51.1125-51.121600: 1 x 1200 in<sup>3</sup> @ 1650 psi  
 51.121600-51.1225: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
 51.1225-51.1236: 1 x 1200 in<sup>3</sup> @ 1650 psi  
 51.1236-51.133000: 1 x unstable, 1 x 1200 in<sup>3</sup> @ 1650 psi  
 51.133000-52.005740: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
 52.005740-52.010000: 1 x 1200 in<sup>3</sup> @ 1650 psi

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52.010000-52.010120: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.010120-52.010820: 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.010820-52.010900: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.010900-52.040240: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi  
52.040240-52.053620: 1 x 1200 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi  
52.053620-52.053900: 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.053900-52.053940: 1 x 1200 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.053940-52.133420: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi  
52.133420-52.150000: 1 x 1200 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi  
52.150000-52.1606: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
52.1606-52.171340: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1600 psi  
52.171340-53.010000: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650-1700 psi

Check channel 30: dead at start, appears active @ 51.2315

# **KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |  |
|--|--|
| <b>Line</b>  | <b>501</b>                                     |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                                  |
| <b>Sample Length</b>                                       | <b>16 s</b>                                    |
| <b>Trace Length</b>  | <b>12.5 m</b>                                  |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>                                      |
| <b>Seismic Channels</b>                                    | <b>48</b>                                      |
| <b>Gun Sensors</b>   | <b>3</b>                                       |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>                                       |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                                    |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                                  |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 field)</b>                 |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>                                    |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>                                   |
| <b>Shot Interval</b>                                       | <b>20 s</b>                                    |
| <b>Shot Spacing</b>  | <b>variable</b>                                |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                           |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                  |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                     |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                            |
| <b>Number of Airguns</b>                                   | <b>variable</b>                                |
| <b>Volume of Airguns</b>                                   | <b>variable</b>                                |
| <b>Total Source Volume</b>                                 | <b>1200 in<sup>3</sup>-3400 in<sup>3</sup></b> |
| <b>Airgun Pressure</b>                                     | <b>1600-1700 psi</b>                           |
| <b>Gun Fire Time</b>                                       | <b>460 ms</b>                                  |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (<math>\pm 250</math> ms)</b>        |
| <b>Number of Birds</b>                                     | <b>5</b>                                       |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>              |
| <b>Cable Depth</b>   | <b>10 m</b>                                    |
| <b>Gun Depth</b>   | <b><math>\approx 10</math> m</b>               |
| <b>Tail Rope Length</b>                                    | <b>100 m</b>                                   |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                                    |

## KH98-1 LEG 2 SEISMIC REFLECTION LINE LOG

|                      |                     |
|----------------------|---------------------|
| <b>Line</b>          | 601                 |
| <b>Vessel</b>        | R/V Hakuho Maru     |
| <b>Area</b>          | Ontong Java Plateau |
| <b>Survey Number</b> | KH98-1 Leg 2        |

| LINE INFORMATION         | Time (UTC) | Shot Point | Tape Number |
|--------------------------|------------|------------|-------------|
|                          |            |            |             |
| <b>Acquisition Start</b> | 53.1516    | 1          | 33          |
| <b>Acquisition Stop</b>  | 54.0420    | 2324       | 35          |

| LINE DETAILS                | Start of Line (FSP) | End of Line (LSP) |
|-----------------------------|---------------------|-------------------|
|                             |                     |                   |
| <b>Wind Direction/Speed</b> | 59°/6.6 kts         |                   |
| <b>Feather Angle</b>        | 198°                |                   |
| <b>Water Depth</b>          | 2213                |                   |
| <b>Primary Navigation</b>   | GPS                 | GPS               |
| <b>Latitude</b>             | 0°10.9851'S         | 1°24.30'S         |
| <b>Longitude</b>            | 158°39.645'E        | 158°02.40'E       |
| <b>Bad Traces</b>           |                     |                   |

| UNDERWAY GEOPHYSICAL DATA                    |                  |
|--|------------------|
|  |                  |
| <b>SeaBeam</b>                               | Center Beam Only |
| <b>12 kHz Echo Sounder/Transducer Depth</b>  |                  |
| <b>3.5 kHz Echo Sounder/Transducer Depth</b> | Yes/             |
| <b>Gravity</b>                               | Yes              |
| <b>Magnetics</b>                             | Yes              |
| <b>Magnetometer Distance from Stern</b>      |                  |

## COMMENTS

### Airgun Summary

53.151600-53.1532: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1100 psi  
 53.1532-53.160000: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1100 psi  
 53.160000-53.161200: no guns  
 53.161200-53.170820: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup> @ 1600 psi  
 53.170820-54.025920: 1 x 1200 in<sup>3</sup>, 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1650 psi  
 54.025920-54.042040: 1 x 1000 in<sup>3</sup>, 1 x 1200 in<sup>3</sup> @ 1700 psi

**KH98-1 LEG 2 SEISMIC ACQUISITION RECORDING PARAMETERS**

|  |  |
|--|--|
| <b>Line</b>  | <b>601</b>                                     |
| <b>Sample Interval</b>                                     | <b>2.0 ms</b>                                  |
| <b>Sample Length</b>                                       | <b>16 s</b>                                    |
| <b>Trace Length</b>  | <b>12.5 m</b>                                  |
| <b>Seismic Traces on Tape</b>                              | <b>50</b>                                      |
| <b>Seismic Channels</b>                                    | <b>48</b>                                      |
| <b>Gun Sensors</b>   | <b>3</b>                                       |
| <b>Sonobuoy Channels</b>                                   | <b>1</b>                                       |
| <b>Low Cut Filter</b>                                      | <b>3 Hz</b>                                    |
| <b>High Cut Filter</b>                                     | <b>125 Hz</b>                                  |
| <b>First Group Offset (source midpoint to first group)</b> | <b>calculate (105.5 field)</b>                 |
| <b>Energy Source Offset (stern to source midpoint)</b>     | <b>20 m</b>                                    |
| <b>Tow Leader Length (stern to first group midpoint)</b>   | <b>115 m</b>                                   |
| <b>Shot Interval</b>                                       | <b>20 s</b>                                    |
| <b>Shot Spacing</b>  | <b>variable</b>                                |
| <b>Ship Speed</b>  | <b>nominal 5 kts</b>                           |
| <b>Vessel</b>  | <b>R/V <i>Hakuho Maru</i></b>                  |
| <b>Area</b>  | <b>Ontong Java Plateau</b>                     |
| <b>Survey Number</b>                                       | <b>KH98-1 Leg 2</b>                            |
| <b>Number of Airguns</b>                                   | <b>variable</b>                                |
| <b>Volume of Airguns</b>                                   | <b>variable</b>                                |
| <b>Total Source Volume</b>                                 | <b>2200 in<sup>3</sup>-3400 in<sup>3</sup></b> |
| <b>Airgun Pressure</b>                                     | <b>1100-1700 psi</b>                           |
| <b>Gun Fire Time</b>                                       | <b>460 ms</b>                                  |
| <b>Firing Randomizer Limits</b>                            | <b>500 ms (<math>\pm 250</math> ms)</b>        |
| <b>Number of Birds</b>                                     | <b>5</b>                                       |
| <b>Location(s) of Birds</b>                                | <b>pre-1, 13, 25, 37; post-48</b>              |
| <b>Cable Depth</b>   | <b>10 m</b>                                    |
| <b>Gun Depth</b>   | <b><math>\approx 10</math> m</b>               |
| <b>Tail Rope Length</b>                                    | <b>100 m</b>                                   |
| <b>GPS Antenna to Stern Distance</b>                       | <b>58 m</b>                                    |