UNIVERSITY of CAMBRIDGE

Department of Earth Sciences

CRUISE REPORT

R.R.S. DISCOVERY CRUISE 176

The Chemical Dynamics of Hydrothermal Plumes: hydrothermal activity at 26°N on the Mid Atlantic Ridge.

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RRS DISCOVERY CRUISE 176

JULY 22 - AUGUST 22, 1988

THE CHEMICAL DYNAMICS OF HYDROTHERMAL PLUMES:

HYDROTHERMAL ACTIVITY AT 26°N ON THE MID ATLANTIC RIDGE

The University of Cambridge, Department of Earth Sciences.

The Institute of Oceanographic Sciences, Deacon laboratory.

The Massachusetts Institute of Technology, Department of Earth, Atmospheric and Planetary Sciences.

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CRUISE OBJECTIVES

The purpose of the cruise was to study the area of hydrothermal activity at 26°N on the Mid Atlantic Ridge (MAR) known as TAG. There were 3 objectives:

1. **The chemical dynamics of hydrothermal plumes**: The primary objective was to study the physical and chemical dispersion of the hydrothermal plume from the TAG vent field;

2. **Sampling for hydrothermal deposits**: Samples were to be collected from the TAG field by dredging and cores were to be taken of surrounding sediment within the median valley;

3. **Prospecting for other MAR hydrothermal sites**: If time permitted, adjacent areas of the median valley were to be surveyed for hydrothermal activity.

In addition, sea water samples would be collected in a vertical profile at a station on route to TAG for trace element studies.

Techniques: The techniques to be employed included The I.O.S. Deep Water Particle Sampler (FIDO) and the CTD/rosette sampler both of which would be deployed within a transponder net, FIDO for periods of 12 hours using the TOBI cable and generally at a fixed depth, and the CTD for up to 12 hours within the bottom 500m. "Stand-alone" pumps and current meters on short-term moorings would be employed. Coring and dredging was to be carried out.

The shipboard techniques to be used included analysis for ^{222}radon/^{226}radium, manganese analysis by atomic absorption spectrophotometry, aluminium by fluorimetry, nutrients, Coulter Counter measurement of particle size distribution, filtration of water samples.

STATION LOCATIONS

A "Shakedown station", not assigned a station number, was occupied to test equipment between 1400 and 1842 on Monday July 25 at 32°56′N 25°49′W.

Two stations were worked during the cruise:

Station 11795 Series 1-7

The station was occupied between 1600 on Tuesday July 26 and 1330 on Wednesday July 27 as a second Shakedown station and for the purpose to collect seawater samples. The average location during occupation of the station as determined by transit navigation was:

31°26.5′N 30°16.0′W

The 7 Series of operations worked were all CTD/rosette casts.

Station 11796 Series 1-57

The station was occupied between 1315 on Saturday July 30 and 0608 on Tuesday August 16. The majority of operations were carried out within a transponder net bounded by the 4 locations:

26°06.9124′N 44°51.3822′W
26°07.7309′N 44°48.9935′W
26°09.7095′N 44°49.0968′W
26°08.6854′N 44°52.2891′W

into which a fifth was added later at:

26°08.5841′N 44°49.8259′W

the exceptions being the following adjacent locations, as determined by transit navigation :

Series 1: 26°03.1′N 44°55.5′W

Series 8: 26°13.6′N 44°44.1′W

Series 55: 26°07.6′N 44°52.2′W

Series 56: 26°04.4′N 44°55.5′W

Series 57: 26°03.3′N 44°45.4′W

SUMMARY OF ACTIVITIES

The breakdown of operations between the different activities was as follows:

OPERATION	NUMBER OF OPERATIONS	SERIES NUMBERS
CTD/rosette	25	1,7,8,9,1Ø,11,12,13,15,16,2Ø, 21,24,25,28,31,33,34,36,37,4Ø, 41,42,56,57
FIDO	4	6,7,29,38
Moorings	18	2,3,4,5,14,18,19,22,23,26,27, 3Ø,32,35,39,43,48,53
Coring	7	44,45,46,51,52,54,55
Dredging	3	47,49,5Ø

SCIENTIFIC OPERATIONS

The following different science-linked operations were carried out during the course of the cruise :

1.CTD/rosette system

This was the principal operation performed on the cruise. Although originally intended to alternate with FIDO operations, circumstances (see below) led to the CTD/rosette casts being the major method for detecting and sampling the hydrothermal field.

In general, 3 strategies were employed: (a) the vertical profile, where the system was used in the conventional manner of charting the vertical distributions of properties and sampling; (b) the lateral section approach, where the system was lowered to a predetermined depth (either plume height or near bottom) and then navigated at low speed (~Ø.5 kts) along a predetermined course; (c) the "yo-yo" approach involving the combination of (a) and (b).

A number of different properties were measured in situ: conductivity, temperature, pressure, transmission(attenuation) and nephelometry(light scattering) and the package was equipped with a relay transponder to locate it accurately and a pinger to determine its distance from the sea floor. An insitu chemical sensor designed by Gary Klinkhammer was tested on some deployments. Water samples were collected from the Goflo bottles.

The system worked very well indeed although there were some initial problems with the operation of the Goflo bottles and it proved unreliable to deploy them closed on deck. It is regrettable that this type of bottle is the only one available that satisfies the demands for "clean chemical sampling" . A recommendation in connection with this type of bottle is that a set be retained for such ultra-clean operations because it is very easy for them to become contaminated by use, or storage, under less rigorous conditions.

It was unfortunate that 2 of the bottles were damaged during one near-bottom (sic!) transect; this was the only significant damage/loss to equipment during the cruise.

The details of the CTD/rosette casts are included in the Cruise Narrative.The symbols in these tables refer to the types of samples drawn from the Goflo bottles: R = radon; C = cadmium; N = nutrients; M = manganese and aluminium; H = helium; U = uranium; B = bacteriology; L = 1 litre stored samples; F = 1Ø litres filtered for particulate matter.

The CTD/rosette operations were run mainly by Phil Taylor, Harry

Elderfield, Chris German, Bill Simpson and Gary Klinkhammer.

2.The Deep Water Particle Sampler (FIDO)

The sampler was to be used primarily to map particle size distributions in the range 8-256 um. In the event, many problems were encountered with the system and only 2 casts were successful. The worst of the difficulties was the loss of synchronisation of the data frame since this lead to corruption of multiplexed data.

The FIDO operations were run by Bill Simpson, Les Wright and Nigel Hooker.

3.Transponder Navigation

The transponder navigation system was the cornerstone to the the survey operation and was crucial to it's success. The strategy adopted was to deploy a 4-transponder net surrounding the survey area, each transponder separated by ~5km, and to calibrate the net both relatively, and also absolutely using GPS fixes. A relay transponder was attached to the package whose movement was being monitored (the CTD/rosette, FIDO or the dredge), making it possible to record the position very accurately during the course of the deployment via a towed transducer. Typical accuracies were of the order of a few metres. In addition, a large number of short-term moorings (usually for 1 day) were deployed using a further transponder and position was obtained using a second transducer hand-held over the side of the ship. A further mooring with a transponder , for a current meter, was deployed for ~ 1 week and this was incorporated into the net as a 5th transponder. As an additional reference point, the position of the TAG mound, as deduced from the 1985 work, was marked as a target, the UTM grid location of which is 517659.9E 289Ø83Ø.93N.

The system worked very well indeed and was judged to be a great success. The use of transponders on the moorings was not considered at the cruise planning stage but proved to be an excellent aid. If similar use is contemplated, as seems highly likely, the use of a multi-frequency transducer would simplify operations, allowing use of more than 1 relay transponder at a time.

It is worthy of note that a crucial factor in the successful use of the transponder net was the skill of the officers of the watch in navigating not only the ship but also the towed package on it's predetermined course.

The transponder operations were run by Chris Lee and Dave Booth.

4.Moorings, Stand-alone Pumps and Current Meters

Apart from the moorings for the transponder net, a number of moorings, one or two daily for most of the station time,were deployed holding different combinations of one or two Stand-alone pumps and a current meter, plus a transponder.

The Stand-alone pumps, a new in situ filtration system designed and built at I.O.S. Wormley, were deployed on moorings in order to sample the particulates in the hydrothermal plume. The height-above-bottom was chosen such that the 342Ø and 332Ømplumes, identified by nephelometry and transmissometry from the CTD casts,were sampled. All deployments were made within 1km of the TAG site location but primarily to the west/northwest, what appeared to be the prominant direction of the plume.The positions and depths of the moorings are given in the cruise narrative and are summarised below:

SERIES NO.	WATER DEPTH(m)	PUMP HEIGHT(m)	PUMP DEPTH(m)	PUMP TIME(hr)	VOLUME SAMPLED(l)
14	3722	245	3477	2	1Ø11
18	3639	275	3364	3	1133
19	3667	275	3392	3	123Ø
22	3662	325	3337	2	758
23	3666	325	3341	2	failed timer
26	3672	325	3347	2	failed timer
27	3676	325	3351	2	failed; broken lead
3Ø	3645	325	332Ø	current meter only	
32	3655	325	333Ø	1	516
		225	343Ø	1	76Ø
35	3667	325	3342	2	826
		225	3442	2	1253
39	3632	325	33Ø7	2	85Ø(estimated)
		225	34Ø7	2	1275
43	365Ø	325	3325	2	855
		225	3425	2	1468
48	3788	325	3463	2	1432
		225	3563	2	1342
53	3585	625	296Ø	2	1292
		325	326Ø	2	813

The deployment operations were performed in a very efficient and safety-conscious manner and the team involved are to be congratulated for deploying and recovering 17 moorings with hardly a hitch. The current meters worked well. The Stand-alone pumps were very successful. The pumps failed to sample on 3

occasions only but, in the other cases, the recovered large samples of particles extracted from ~500-1500 litres of sea water. the samples were spectacular, including large amounts of iron oxides and fine sulphides and,on one occasion, >2 mm sulphide fragments. In addition, manganese oxide impregnated fibre cartridges were attached to the pumping system, allowing collection of samples for radionuclide work.

Two buoys were attached to the anchor of the Series 53 mooring, at a water depth of 3385m so that they would remain to mark this location for future submersible work.

The mooring operations were run by Phil Taylor, Les Wright, John Strangwood, Mike Davies and the ship's crew. The pumps were attended by Bill Simpson, Les Wright, Nigel Hooker,Linda Godfrey and Chris German and the current meters by Phil Taylor.

5.Coring and dredging

A number of short, 1m, gravity coring operations were performed and a high success rate of 5/7 was obtained, especially considering the poor sediment cover of the MAR median valley. The following table gives a summary of the coring results:

SERIES NO.	WATER DEPTH(m)	LENGTH OF CORE (cm)
44	3680	100
45	3450	12.5
46	3910	no recovery
51	3681	no recovery
52	3515	35
54	3750	53
55	4030	77

Lithologically, the sediments were all similar, comprising pale brown to yellow calcareous oozes with no conspicuous banding (the cores were stored in their plastic liners). Minor basalt fragments and sulphide fragments were noted in some cases.

Three transponder-navigated dredgings were performed and all were successful, the first the most so in that a large quantity of hydrothermal sulphides were recovered.The following table summarises the contents of the dredge recoveries:

SERIES NO.	CONTENTS
47	polymetallic sulphides of Cu, Fe and Zn; predominant minerals - chalcopyrite,pyrite, wurtzite, sphalerite. Green Cu carbonates, prob. malachite, white cavity fillings (barite or anhydrite?), small crusts of Mn oxides with red-brown Fe oxides. Freshly erupted pillow lavas and fresh basaltic glass.
49	predominantly Fe oxides showing different degrees of alteration, fragments of volcanic glass.
5Ø	ridge basalts, incl. examples with fresh glassy rims; large Mn oxide crusts; sulphide fragments, chiefly pyrite and mostly altered.

The coring and dredging was run by Harry Elderfield, Bill Simpson, Gary Klinkhammer, Arvind Mitra and Yang Yongliang.

6.Winch operations

The winch operations went well. The starboard hydraulic winch used for CTD operations caused some scares with an oil leak and a cut-out and there was some concern that it was getting extremely hot because of the large amount of CTD work. Also, a failure in a hydraulic brake valve led to a mist of oil being sprayed over electrical parts and caused FIDO to be stranded on ~15ØØm of TOBI cable for more than an hour .

The winch operations were run by Mike Davies, John Strangwood, Les Wright and Nigel Hooker.

7.Onboard geochemistry

A number of shipboard techniques were employed on sea water samples collected from Goflo bottles:

Samples were filtered using a peristaltic pump for recovery of particulate matter and for storage of water samples, by Brian Dickie and Tim Lunel.

Samples were analysed for the micronutrients phosphate and silicate, by Linda Godfrey.

Large-volume samples were extracted using chelating ion-exchange resin for recovery of cadmium, by Tim Lunel.

Samples were analysed onboard for manganese by atomic absorption spectrophotometry, by Mervyn Greaves and Arvind Mitra.

Samples were analysed onboard for ^{222}Rn and ^{226}Ra, and stored for $^{3}He/^{4}He$, by Mark Rudnicki and Yang Yongliang.

Samples were analysed on board for aluminium by Tim Lunel and Brian Dickie.

Samples were analysed for particle size distribution using a Coulter Counter by Yang Yongliang and Linda Godfrey.

Cartridge samples for Th and Pa isotopes were collected by Chris German.

8.Computing

Extensive use was made of the shipboard computing system for displaying and logging data and for plotting purposes. Indeed, use was very heavy indeed because of the almost continuous CTD casts during the main part of the station work.

The system worked very well indeed and it was invaluable in the scientific programme to be able to interface the transponder navigation with the insitu data. In general, the displays of data were in "near real time" rather than real time and a faster computer would help to keep pace with the data in future applications. Also, a 3D package to be able to manipulate data would be very valuable in the future.

Computer operations were run by Doriel Jones and Nigel Savidge.

CRUISE NARRATIVE

RRS DISCOVERY sailed from Lisbon at 1ØØØ on Friday 22 July on a course to 26°Ø8.2'N 44°49.4'W,the location of the TAG hydrothermal field. On Monday 25 July the ship stopped at 14ØØ for a Shakedown station. The following transit satellite fixes were obtained during occupation of the station:

DATE	TIME	N	W
25.7.88	1348	32°57.1'	25°47.3'
	1424	32°56.6'	25°46.4'
	152Ø	32°55.5'	25°49.7'
	16Ø9	32°53.5'	25°53.3'

First, the PES fish and the transponder fish were deployed. Next, the CTD/rosette onto which was attached the relay transponder was deployed. An acoustics test showed no measurable noise from the ship on lowering the CTD system to ~5Øm where the Goflo bottles were triggered. Unfortunately, recovery of the CTD showed that few of the bottles had tripped. Therefore, the transponder fish was recovered and the station was terminated at 1842.

The ship continued on passage towards the TAG site , stopping on route for Station 11795.

STATION 11795

Station 11795 was occupied at 16ØØ on Tuesday 26 July at 31°25'N 3Ø°12'W by which time it had been possible to rerig the Goflo bottles. The following transit fixes were obtained during occupation of the station:

DATE	TIME	N	W
26.7.88	1616	31°25.6'	3Ø°11.3'
	1646	31°25.4'	3Ø°11.Ø'
	1811	31°24.3'	3Ø°11.8'
	1832	31°24.3'	3Ø°12.1'

	2142	31°24.7′	30°14.0′
	2157	31°24.9′	30°14.7′
	2330	31°25.7′	30°15.0′
27.7.88	0054	31°26.1′	30°15.8′
	0207	31°26.3′	30°16.3′
	0242	31°26.3′	30°16.6′
	0332	31°26.5′	30°17.2′
	0421	31°26.5′	30°17.5′
	0518	31°26.6′	30°18.2′
	0608	31°26.6′	30°18.5′
	0640	31°26.6′	30°18.7′
	0812	31°26.9′	30°18.5′
	0818	31°26.9′	30°18.7′
	0950	31°27.3′	30°19.3′
	1139	31°27.5′	30°18.8′

Two test dips of the CTD/rosette showed negligable problems at shallow depths. Therefore, the first cast was carried out to a depth of 4290 dB where all 11 bottles were triggered (the 12th space being occupied by the relay transponder). On the second Goflo cast, the manganese probe was pressure tested successfully. A total of 7 water-bottle casts (SERIES 1-7)were carried out for sampling for radon and cadmium with a break for testing FIDO, to which the relay transponder was attached, on the TOBI cable after Cast 4. Two deployments of FIDO were carried out, finally, to a depth of 500m and showed no problems in performance.

The details of the rosette casts are as follows:

SERIES	ROSETTE NO.	DEPTH (dB)	SAMPLING
1	1-12	4292.5	R C N M
2	1-3	4191.2	C N
	4-12	2999.6	R C N M
3	1-12	303.4	R C N M
4	1-12	51.1	R C N M
5	1-12	699.4	R C N M
6	1-6	500.3	R N
	7-9	300.7	C N
	10-12	50.2	C N
7	1-9	1001.9	R C N M
	10-12	500.6	C N

The station work of slightly less than 1 day was completed at 133Ø on Wednesday 27 July and the ship proceeded on course to the TAG area.

The ship arrived in the vicinity of the TAG area on Saturday 3Ø July. At Ø815 there was a blackout of all services and engines and power was lost. Passage was resumed at Ø839 and the ship reached the survey area soon afterwards. On arrival, another ship was observed which was occupying station at the known location of the TAG hydrothermal vent field, the focus of our scientific programme. Contact established that the ship was the ANTARES, a Soviet Research Vessel from The University of Odessa.

STATION 11796

11796-SERIES 1

First, a site was occupied to the south of the region in a water depth of 42ØØm, to carry out a CTD/rosette cast to obtain a sound velocity profile and to test operations at plume depth. The work commenced at 1315 on Saturday July 3Ø and was completed at 1814.Position was fixed by transit satellite navigation and gave the following data during occupation:

DATE	TIME	N	W
3Ø.7.88	134Ø	26°Ø2.7′	44°53.5′
	1529	26°Ø2.8′	44°55.1′
	1627	26°Ø3.1′	44°55.7′
	17Ø2	26°Ø3.5′	44°55.5′
	1724	26°Ø3.7′	44°55.5′

During the course of the cast a ruptured oil line caused the winch to be stopped with over 38ØØm of cable out but, fortunately, the problem was quickly cured.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	SAMPLING
1-3	395Ø.Ø	R M
4	3499.1	M
5-7	3398.3	R M
8	33ØØ.Ø	M
9-11	3ØØØ.Ø	R M

After completion of this cast the ship returned to the centre of the TAG area in order to prepare for deployment of the transponder net. Concern was felt because the Soviet ship was working in the area, often close by, but attempts to learn of their objectives were not fruitful. It was decided to go ahead and lay the transponder net.

11796-SERIES 2

The ship moved to the position chosen for the first deployment on July 3Ø at 21ØØ and awaited GPS navigational fixes.The mooring consisting of a transponder (A) and a current meter was deployed successfully at Ø245 on Sunday July 31 within 2Ømof the target position.

11796-SERIES 3

After having monitored the decent of transponder A, the ship moved to the position chosen for the second deployment. The mooring consisting of transponder B and a current meter was deployed successfully at Ø438, slightly sooner than anticipated and ~15Ømwest of the planned site because of the imminent loss of GPS navigation.

11796-SERIES 4

Next the ship moved to the position of transponder C. The mooring consisting of transponder C and a current meter was deployed successfully at Ø6Ø4 within 9m of the planned site.

11796-SERIES 5

The final mooring consisting of transponder D and a current meter was deployed successfully at Ø81Ø within 2Ømof the planned site.

The deployments of the transponder moorings were carried out smoothly. In each case the decent was monitored and showed that the decent speeds were abot 2m/sec. When the fourth transponder had been deployed the relative calibration of the transponder net was undertaken. This took place between Ø94Ø and1ØØ and involved steaming the ship within the net. Some difficulties were encountered because of the presence nearby of the Soviet vessel.

11796-SERIES 6

The FIDO pumping system was deployed from the TOBI cable at 19ØØ, taken to near bottom and allowed to drift until it was recovered at ØØ1Ø Øn Monday August 1. The Soviet ship was on station at the location of the centre ofthe TAG field ;therefore, it was not possible to deploy FIDO where desired.

When GPS navigation recommenced at Ø2ØØ, the absolute calibration of the transponder net was carried out, finishing at Ø51Ø.The calibrated transponder and current meter locations were as follows:

Transponder No.	Lat	Long
A	26°Ø6.9124'N	44°51.3822'W
B	26°Ø7.73Ø9'N	44°48.9935'W
C	26°Ø9.7Ø95'W	44°49.Ø968'W
D	26°Ø8.6854'W	44°52.2891'W

The equivalent values on the UTM grid are:

Transponder No.	Easting	Northing
A	514360.1Ø	2888450.2Ø
B	518338.3Ø	2889966.1Ø
C	518161.2Ø	2893617.8Ø
D	512845.6Ø	2891721.2Ø

11796-SERIES 7

The first transponder-navigated CTD/rosette cast to survey the

TAG hydrothermal vent plume was started at Ø8ØØ on August 1, on the third anniversary of the discovery of the TAG field (July 31/August 1, 1985) Initially, it was difficult to locate the ship at the centre of the TAG field because of the presence of the Soviet vessel but eventually this was achieved.

The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	LAT N	LONG W	SAMPLING
1-3	3665.3	26.1357Ø	44.8251Ø	F R M
4-6	3362.3	26.1369Ø	44.8244Ø	F R M
7	3333.3	26.139ØØ	44.8243Ø	F L M
8-1Ø	3361.2	26.1392Ø	44.8266Ø	F L R M
11	3282.2	26.1515Ø	44.8368Ø	F L M

As with many subsequent CTD/rosette casts, the package was navigated at very slow speed - in some cases less than 1km over a 12 hour period - on a preselected track and the position of the package (and of the ship) was accurately mapped using the transponder navigation system. A comprehensive set of variables were logged on the shipboard computer. The CTD deployment was completed at 1526.

During the latter part of the deployment a message was recieved from the ANTARES requesting that DISCOVERY move from the TAG mound site for approximately 5 days to allow the Soviet scientists to complete their work , at that time unknown. Following some laborious negotiations by radio, the Soviets accepted an invitation to send a party to visit DISCOVERY which took place between 17Ø5 and 2Ø4Ø. It transpired that the Soviet interest was to dredge the TAG mound but that 15 days of attempts had not been successful. After discussing various options, including our helping the dredging operation, the ANTARES Chief Scientist, Dr Resnick Vladislav, agreed to move from the area if DISCOVERY would vacate the mound site for approximately 1 day. Accordingly,when the visitors had departed, DISCOVERY moved off to the south to allow ANTARES access to the TAG site.

At 23Ø6 FIDO was deployed but a fault developed when it reached a few hundred metres water depth and it was recovered at Ø149 on Tuesday August 2. Therefore it was decided to operate a CTD station outside the transponder net to the north of the area.

11796-SERIES 8

The ship hove to at 1Ø15 on August 2 and completed the CTD cast at 1318. Position was fixed by transit satellite navigation and gave the following data during occupation:

DATE	TIME	N	W
Ø2.8.88	1Ø15	26°13.6′	44°44.1′

Samples were collected on a vertical profile.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	SAMPLING
1-3	4236.9	F M R
4	39ØØ.4	F M
5	37ØØ.3	F M
6	35ØØ.6	F M
7-9	33ØØ.1	F M R
1Ø	3ØØØ.7	F M
11	2499.7	F M

Following the cast a test of the TOBI swivel was made and was found not to be responsible for the failure of FIDO. At around this time an invitation was received to send a party to visit ANTARES and this was done, the lifeboat departing at 174Ø and returning at 21Ø5. Shortly after, ANTARES moved off to the south. Accordingly, the series of transponder-navigated CTD/rosette deployments was continued.

11796-SERIES 9

The cast commenced at 2335 on Tuesday August 2 and was completed by Ø835 on Wednesday August 3.The work involved predominantly a lateral section at plume height.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	LAT N	LONG W	SAMPLING
1	3675.8			R H M
2-3	3427.1			R H M
4-5	3428.3			R H M
6-7	3424.9	26.1332Ø	44.8244Ø	R H M
8-9	3426.8	26.1314Ø	44.8278Ø	R H M
1Ø-11	3427.6	26.1296Ø	44.83ØØØ	R H M

Next, a short test deployment of FIDO was carried out followed by further CTD/rosette deployments.

11796-SERIES 1Ø

The cast commenced at 1259 on Wednesday August 3 and was completed by 2334. Again the cast was a section at plume height. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	344Ø.3	26.136ØØ	44.823ØØ	L M F
2	344Ø.8	26.136ØØ	44.823ØØ	L M F
3	3418.9	26.138ØØ	44.824ØØ	L M F
4	3422.8	26.139ØØ	44.827ØØ	L M F
5	3423.2	26.139ØØ	44.835ØØ	M F
6	342Ø.1	26.139ØØ	44.838ØØ	M F
7-9	3438.3	26.136ØØ	44.843ØØ	R H M F
1Ø	3421.5	26.136ØØ	44.855ØØ	M F
11	3414.Ø	26.137ØØ	44.866ØØ	M F

11796-SERIES 11

The cast, a lateral section at plume height, commenced at Ø1Ø5 on Thursday August 4 and was completed by 1154. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	3422.7	26.145ØØ	44.821ØØ	L F M
2	3419.3	26.141ØØ	44.825ØØ	L F M
3	3417.5	26.137ØØ	44.824ØØ	L F M
4	3667.1	26.135ØØ	44.823ØØ	F M
5	3673.2	26.135ØØ	44.822ØØ	L
6	3423.4	26.123ØØ	44.818ØØ	L F M
7	3425.4	26.125ØØ	44.829ØØ	F M
8	3418.Ø	26.125ØØ	44.831ØØ	F M
9	3422.7	26.126ØØ	44.849ØØ	F M
1Ø	3418.3	26.127ØØ	44.853ØØ	L F M

11796-SERIES 12

The cast, a lateral section at plume height with some yo-yoing, commenced at 13Ø2 on Thursday August 4 and was completed by 2351. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	3426.2	26.1353Ø	44.8251Ø	L F M
2	3697.9	26.1371Ø	44.81Ø6Ø	L F M
3	332Ø.6	26.1389Ø	44.8229Ø	L F M
4	3422.3	26.1393Ø	44.8233Ø	L F M
5	34Ø7.2	26.1418Ø	44.8266Ø	L F M
6-7	3454.6	26.159ØØ	44.8281Ø	R H M
8	3423.7	26.159ØØ	44.842ØØ	L F M
9	3425.2	26.1493Ø	44.8456Ø	L F M
1Ø	3425.1	26.1383Ø	44.8473Ø	L F M
11	3426.7	26.1294Ø	44.8489Ø	L F M

11796-SERIES 13

The cast, mainly a lateral section at plume height, commenced at Ø141 on Friday August 5 and was completed by 1238. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	3664.Ø	26.1386Ø	44.8249Ø	R M
2	3428.6	26.1349Ø	44.8247Ø	L M
3	3422.5	26.118ØØ	44.8369Ø	M
4	3426.1	26.1266Ø	44.8349Ø	L M
5	3416.7	26.1323Ø	44.8403Ø	L M

Next, the ship moved to close to the TAG mound in order to deploy a mooring.

11796-SERIES 14

A mooring consisting of a transponder with a current meter and "stand-alone" pump arranged to be located at plume height was deployed at 1515 on Friday August 5. The location of the mooring, fixed by transponder navigation, was 517104.5E,2891072.ØN, ie.

26.1388501°N 44.8288862°W

or 26°Ø8.33'N 44°49.73'W, in a water depth of 3722m.

Next, the programme returned to CTD/rosette deployments.

11796-SERIES 15

The cast, mainly a lateral section at plume height, commenced at 1712 on Friday August 5 and was completed by Ø153 on Saturday August 6. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	LAT N	LONG W	SAMPLING
1	3420.Ø	26.1426Ø	44.8247Ø	L F M
2-4	3422.2	26.1342Ø	44.8279Ø	R H L F M
5-7	3423.1	26.1329Ø	44.8324Ø	R H F M
8	3423.5	26.1330Ø	44.8428Ø	F M
9	3427.6	26.1338Ø	44.8490Ø	F M
1Ø	3420.7	26.1338Ø	44.8528Ø	F M
11	3430.3	26.1341Ø	44.8572Ø	F M

11796-SERIES 16

The cast commenced at Ø235 on Saturday August 6 and was completed by 1241.The cast mainly involved yo-yoing through the plume.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	3424.6	26.1447Ø	44.8599Ø	L F M
2	3425.5	26.1420Ø	44.8571Ø	L F M
3	3425.2	26.1407Ø	44.8530Ø	L F M
4	3375.4	26.1416Ø	44.8490Ø	L F M
5	3415.8	26.1413Ø	44.8422Ø	L F M
6	3425.2	26.1413Ø	44.8418Ø	L F M
7	3417.5	26.1383Ø	44.8372Ø	L F M
8	3426.8	26.1317Ø	44.8319Ø	L F M
9	3714.5	26.1384Ø	44.8243Ø	L F M
1Ø	3428.3	26.1399Ø	44.8265Ø	L F M
11	3424.7	26.1405Ø	44.8280Ø	R

Immediately following this cast the mooring was recovered. the mooring was released at 1311 and recovered at 1436.

11796-SERIES 17

FIDO was deployed at 1839 on Sunday August 7 and recovered at 2341. Unfortunately it was found not to have pumped.

Next, 2 moorings were laid.

11796-SERIES 18

A mooring consisting of a transponder with a current meter and "stand-alone" pump arranged to be located at plume height was deployed at ØØØ6 on Sunday August 7. The location of the mooring, fixed by transponder navigation, was 517ØØ6E 289Ø784N, ie.

26.1362435°N 44.8238731°W

or 26°Ø7.95′N 44°49.43′W, in a water depth of 3639m.

11796-SERIES 19

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at Ø125 on Sunday August 7. The location of the mooring, fixed by transponder navigation, was 517591.5E 2891Ø15.5N, ie.

26.1383341°N 44.824Ø151°W

or 26°Ø8.3Ø′N 44°49.44′W, in a water depth of 3667m.

Next, the programme returned to CTD/rosette casts.

11796-SERIES 2Ø

The cast, mainly at plume height, commenced at Ø345 on Sunday August 7 and was completed by 1151.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	3426.Ø	26.15Ø9Ø	44.863ØØ	F M
2-4	3451.2	26.15Ø5Ø	44.857ØØ	R F M
5-7	3238.7	26.15Ø9Ø	44.853ØØ	R F M
8	2752.2	26.157ØØ	44.848ØØ	M
9	1999.3	26.16Ø1Ø	44.8488Ø	
1Ø	15ØØ.6	26.16Ø5Ø	44.85ØØØ	
11	1ØØØ.3	26.16Ø6Ø	44.851ØØ	

The 2 moorings were then recovered, that of Series 19 was released at 1249 and recovered at 14Ø7 and that of Series 2Ø was released at 1434 and recovered at 1559.The CTD/rosette casts continued.

11796-SERIES 21

The cast, mainly at plume height, commenced at 171Ø on Sunday August 7 and was completed by 2238. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE (dB)	LAT N	LONG W	SAMPLING
1	37Ø5.1	26.1366Ø	44.8236Ø	F M
2	37Ø8.6	26.137ØØ	44.8245Ø	L F M
3	3373.8	26.1379Ø	44.8256Ø	L F M
4	3341.3	26.138ØØ	44.8257Ø	L F M
5	3256.Ø	26.1392Ø	44.8269Ø	F M
6	369Ø.Ø	26.1386Ø	44.8254Ø	L F M
7-11	3325.Ø	26.1382Ø	44.8248Ø	R L F M

Next, 2 moorings were laid.

11796-SERIES 22

A mooring consisting of a transponder with a current meter and "stand-alone" pump arranged to be located at plume height was deployed at 2217 on Sunday August 7. The location of the mooring, fixed by transponder navigation, was 517412.5E 2890958.5N, ie.

26.1378216°N 44.8258Ø65°W

or 26°Ø8.27′N 44°49.55′W, in a water depth of 3662m.

11796-SERIES 23

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at ØØ52 on Monday August 8. The location of the mooring, fixed by transponder navigation, was 517244E 2891ØØ2.ØN, ie.

26.1391193°N 44.8274853°W

or 26°Ø8.35′N 44°49.65′W, in a water depth of 3666m.

The CTD/rosette casts continued.

11796-SERIES 24

The cast, mainly yo-yoing through the plume, commenced at Ø436 on Monday August 8 and was completed by 1414hrs. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1-3	3317.Ø	26.1375Ø	44.834ØØ	R H L M
4-6	3382.5	26.1385Ø	44.8396Ø	R H L F M
7-9	3361.2	26.1392Ø	44.8353Ø	R H L F M
1Ø-11	3315.1	26.134ØØ	44.8358Ø	R H L M

Next, the 2 moorings were recovered; both were released at 15Ø7 and Series 23 recovered at 1638 and Series 24 recovered at 1816.The programme returned to CTD/rosette casts.

11796-SERIES 25

The cast commenced at 1943 on Monday August 8 and was completed by Ø125 on Tuesday August 9. The details of the rosette cast, involving collection of a vertical section, are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1-3	37Ø4.2	26.1369Ø	44.8237Ø	R F M
4	3742.4	26.1391Ø	44.8Ø93Ø	F M
5	365Ø.Ø	26.1388Ø	44.8257Ø	F M
6	3548.6	26.1389Ø	44.8261Ø	F M
7	345Ø.8	26.139ØØ	44.8265Ø	L F M
8	3398.3	26.1391Ø	44.8268Ø	L F M
9	3327.9	26.1391Ø	44.8273Ø	L F M
1Ø	32Ø6.8	26.1392Ø	44.828ØØ	L F M
11	3158.8	26.1392Ø	44.8283Ø	F M

Next, 2 moorings were deployed.

11796-SERIES 26

A mooring consisting of a transponder with a current meter and "stand-alone" pump arranged to be located at plume height was deployed at Ø221 on Tuesday August 9. The location of the mooring, fixed by transponder navigation was 517Ø6Ø.9E 2891ØØ7.8N,ie.

26.14Ø9798°N 44.8293193°W

or 26°Ø8.46´N 44°49.76´W, in a water depth of 3672m.

11796-SERIES 27

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at Ø238 on Tuesday August 9. The location of the mooring, fixed by transponder navigation was 516747.6E 2891576.3N, ie.

26.1434Ø81°N 44.8324499°W

or 26°Ø8.6Ø´N 44°49.95´W, in a water depth of 3676m.

Next a CTD/rosette cast was deployed.

11796-SERIES 28

The cast commenced at Ø5Ø5 on Tuesday August 9 and was completed by 1153.The work involved making measurements within 1Øm or so of the sea floor and led to observations of significant temperature anomalies of hydrothermal origin. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1	37ØØ	26.1373Ø	44.8246Ø	R
2	37ØØ	26.1373Ø	44.8246Ø	R M
3	37ØØ	26.13731	44.82454	F
4	37Ø6	26.13731	44.82454	R H
5	37Ø6	26.1386Ø	44.8244Ø	R H
6	374Ø	26.1386Ø	44.8244Ø	F M
7-8	3746	26.1386Ø	44.8244Ø	R M
9-11	37Ø4	26.1375Ø	44.8241Ø	R L F M

Next, the 2 moorings were recovered; Series 26 was released at 1218 and recovered at 1345 and Series 27 was released at 1413 and recovered at 1536.

11796-SERIES 29

FIDO was deployed at 1641hrs on Tuesday August 9. At 1831 a failure in a hydraulic brake valve caused the winch to have to be stopped with 15ØØm of cable payed out. The fault was repaired and FIDO recovered at 21Ø1. An electrical fault caused by twisting of a cable caused malfunction of the equipment and the cover protecting the filter rig was found to have been lost.

11796-SERIES 3Ø

A mooring consisting of a transponder with a current meter arranged to be located at plume height was deployed at 2335 on Tuesday August 9. The location of the mooring, fixed by transponder navigation was 516949.4E 2891539.ØN, ie.

26.143Ø688°N 44.83Ø4318°W

or 26°Ø8.5841′N 44°49.8259′W, in a water depth of 3645m. Because this mooring was to be down for some time, it was decided to incorporate the transponder into the net and it was designated as transponder E.

Next a CTD/rosette cast was deployed.

11796-SERIES 31

The cast, also a near-bottom operation, commenced at Ø314 on Wednesday August 1Ø and was completed by 1232.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
1-2	3691	26.1367Ø	44.8267Ø	--------
3-5	3685	26.1369Ø	44.8263Ø	R L F M B
6-8	3357	26.1393Ø	44.8291Ø	R L F M B
9-11	3329	26.1396Ø	44.8293Ø	R L F M B

On recovery of the rosette, 2 Goflo bottles were found to be damaged, presumably by the rosette striking the sea bed in the course of the near-bottom survey operation.The cast produced observation of a ~1°C temperature anomaly.

11796-SERIES 32

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at 1348 on Wednesday August 1Ø. The location of the mooring, fixed by transponder navigation was 516452.85E 2891547.82N, ie.

26.1431542°N 44.8353993°W

ie., 26°Ø8.59′N 44°5Ø.12′W, in a water depth of 3655m.

Next a CTD/rosette cast was deployed.

11796-SERIES 33

The cast commenced at 1643 on Wednesday August 1Ø and was completed by 1937.The details of the rosette cast, at which a vertical profile was obtained, are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2	3664.4	26.1373Ø	44.8265Ø	F M
3	3497.Ø	26.1376Ø	44.8264Ø	F M L
4	3418.Ø	26.1377Ø	44.8266Ø	F M L
5	3392.Ø	26.1375Ø	44.8267Ø	F M L
6	3377.Ø	26.1375Ø	44.8270Ø	F M L
7	3352.Ø	26.1376Ø	44.8272Ø	F M L
8	3296.Ø	26.1375Ø	44.8272Ø	F M L
9	3241.Ø	26.1373Ø	44.8270Ø	F M L
1Ø	3226.Ø	26.1373Ø	44.8269Ø	F M
11	3151.Ø	26.1372Ø	44.8267Ø	F M

Next, the Series 32 mooring was recovered; it was released at 2Ø43 and recovered at 2125.

Next a CTD/rosette cast was deployed.

11796-SERIES 34

The cast commenced at 2135 on Wednesday August 1Ø and was completed by Ø122 on Thursday August 11. The details of the rosette cast, again to obtain a vertical profile, are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2	3695.3	26.1371Ø	44.8235Ø	M
3	3573.Ø	26.1374Ø	44.8239Ø	F M
4	35Ø4.Ø	26.1377Ø	44.8242Ø	L M
5	3473.Ø	26.1377Ø	44.8243Ø	L M
6	3448.Ø	26.1377Ø	44.8246Ø	L F M
7	34Ø6.Ø	26.1376Ø	44.8250Ø	L M
8	3338.Ø	26.1375Ø	44.8253Ø	F M
9	3324.Ø	26.1375Ø	44.8254Ø	L M
1Ø	3285.Ø	26.1375Ø	44.8255Ø	L M
11	3134.Ø	26.1373Ø	44.8256Ø	L F M

11796-SERIES 35

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at Ø148 on Thursday August 11. The location of the mooring, fixed by transponder navigation was 516781.7E 2891225.5N, ie.

26.14Ø24°N 44.8321135°W

or 26°Ø8.41′N 44°49.93′W, in a water depth of 3667m.

Next a CTD/rosette cast was deployed after a break to allow the CTD winch to cool down.

11796-SERIES 36

The cast, involving near-bottom work and collection of a vertical profile, commenced at Ø616 on Thursday August 11 and was completed by 12ØØ.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2	3674.Ø	26.1369Ø	44.8256Ø	M L F B
3	3674.Ø	26.1369Ø	44.8257Ø	M B R
4	3674.Ø	26.1369Ø	44.8257Ø	M L F B
5	3674.Ø	26.1369Ø	44.8258Ø	M R B
6	3689.Ø	26.1367Ø	44.8250Ø	M L F
7-8	3696.Ø	26.1368Ø	44.8244Ø	M R
9-11	3262.Ø	26.1390Ø	44.8226Ø	M R L F

Next, the Series 35 mooring was recovered; it was released at 13Ø4 and recovered at 14Ø5.

Next a CTD/rosette cast was deployed.

11796-SERIES 37

The cast, to obtain a vertical profile, commenced at 1531 on Thursday August 11 and was completed by 18Ø5. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2	3734.Ø	26.1394Ø	44.8222Ø	M L F
3	37Ø7.Ø	26.1397Ø	44.8222Ø	M L F
4	365Ø.Ø	26.1399Ø	44.8219Ø	M L F
5	3547.Ø	26.14Ø2Ø	44.8217Ø	M L F
6	3438.Ø	26.14Ø5Ø	44.8217Ø	M L F
7	3434.Ø	26.14Ø6Ø	44.8217Ø	M L F
8	3235.Ø	26.14Ø6Ø	44.8216Ø	M L F
9	32Ø7.Ø	26.14Ø5Ø	44.8217Ø	M L F
1Ø	3181.Ø	26.14Ø5Ø	44.8218Ø	M L F
11	3ØØ1.Ø	26.14Ø5Ø	44.822ØØ	M F

11796-SERIES 38

FIDO was deployed at 1911 on Thursday August 11 and was recovered at ØØØ2 on Friday August 12.It performed successfully.

11796-SERIES 39

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at ØØ55 on Friday August 12. The location of the mooring, fixed by transponder navigation was 517353.1E 2890915.2N, ie.

26.1374313°N 44.8264Ø13°W

or 26°Ø8.25′N 44°49.58′W, in a water depth of 3632m.

Next 2 CTD/rosette casts were deployed.

11796-SERIES 40

The cast, principally to collect radon and helium samples, commenced at 0401 on Friday August 12 and was completed by 0813. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2-3	3420.8	26.1380	44.8236	R H M L
4-5	3421.8	26.1396	44.8283	R H M L
6-7	3438.3	26.1411	44.8312	R H M L
8-9	3421.1	26.1429	44.8342	R H M L
10-11	3398.0	26.1449	44.8383	R H M L

11796-SERIES 41

The cast, to obtain a vertical profile, commenced at 1005 on Friday August 12 and was completed by 1303.The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LOMG W	SAMPLING
2	3796.7	26.1362	44.8340	F M L U
3	3651.9	26.1361	44.8329	F M L U
4	3550.6	26.1357	44.8324	F M L U
5	3312.2	26.1350	44.8318	F M L U
6	3472.7	26.1350	44.8311	F M L U
7	3397.5	26.1350	44.8308	F M L U
8	3355.9	26.1349	44.8307	F M L U
9	3256.3	26.1351	44.8304	F M L U
10	3095.2	26.1355	44.8306	F M L U
11	3000.4	26.1358	44.8303	F M L U

Next, the Series 39 mooring was recovered; it was released at 1326 and recovered at 14029.

Next a CTD/rosette cast was deployed.

11796-SERIES 42

The cast, for near-bottom studies, commenced at 1606 on Friday August 12 and was completed by 2342. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	LAT N	LONG W	SAMPLING
2	3717.1	26.1385Ø	44.8265Ø	M
3	37Ø9.Ø	26.1387Ø	44.8289Ø	M
4	37Ø9.2	26.1386Ø	44.8293Ø	M
5	3679.Ø	26.1373Ø	44.8260Ø	M
6	368Ø.Ø	26.137ØØ	44.8262Ø	M
7	368Ø.Ø	26.1369Ø	44.8262Ø	M L
8	368Ø.Ø	26.1369Ø	44.8262Ø	M L
9	3695.Ø	26.1368Ø	44.8243Ø	M
1Ø	3697.Ø	26.1369Ø	44.8242Ø	M L
11	3725.Ø	26.1375Ø	44.8259Ø	M L

The above cast was the final CTD/rosette deployment within the transponder net and the programme next moved on to coring and dredging operations with mooring deployments and recoveries as before

11796-SERIES 43

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at ØØ18 on Saturday August 13. The location of the mooring, fixed by transponder navigation was 517163.7E 289Ø97Ø.1N, ie.

26.1379293°N 44.8282954°W

or 26°Ø8.28′N 44°49.7Ø′W, in a water depth of 365Øm.

11796-SERIES 44

The first of the gravity coring operations commenced on Saturday August 13 at Ø31Ø and was concluded at Ø558. A 1m core was recovered at a ship location of 517Ø18E 2893383N, ie.

26.1597186°N 44.8297213°W

or 26°Ø9.583′N 44°49.783′W, in a water depth of 368Øm.

11796-SERIES 45

The corer was deployed on Saturday August 13 at Ø748 and was recovered at 1Ø32. Considerable wash out occurred and a basalt

fragment together with a 12.5cm core was recovered at a ship location of 519524.86E 289Ø838.56N, ie.

26°Ø8.2Ø27´N 44°48.28Ø6´W

in a water depth of 345Ømm.

11796-SERIES 46

The corer was deployed on Saturday August 13 at 1122 and was recovered empty at 14ØØ at a ship location of 26°8.2Ø13N 44°5Ø.6Ø7ØW.

Next, the Series 43 mooring was released at 1424 and recovered at 1553.

11796-SERIES 47

The first dredge operation commenced on Saturday August 13 at 1712 and was completed at 2327. The dredge was allowed to impact the sea bed over the track:

26.1373ØN 44.8388ØW to 26.1371ØN 44,8233ØW

The dredge basket was about 2/3rd full and consisted of a large number of samples, principally of 2 sorts :sulphide deposits (pyrite, chalcopyrite, sphalerite, galena) and their oxidation products (ochre, copper carbonates); and fresh basalt glasses together with pillow lavas.

11796-SERIES 48

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at Ø117 on Sunday August 14. The location of the mooring, fixed by transponder navigation was 516334.ØE 289Ø976.1W, ie.

26.1379931°N 44.8365955°W

or 26°Ø8.28´N 44°5Ø.2Ø´W, in a water depth of 3788m.

11796-SERIES 49

The next dredge operation commenced on Sunday August 14 at Ø25Ø and was completed at Ø73Ø. The dredge was allowed to impact the sea bed over the track:

26.1365ØN 44.8274ØW to 26.1369ØN 44.8215ØW

The dredge basket was about 1/4 full and consisted of ochre stained basalts and sulphides.

11796-SERIES 5Ø

The next dredge operation commenced on Sunday August 14 at Ø844 and was completed at 1456. The dredge was allowed to impact the sea bed over the track:

26.1375ØN 44.1375ØW to 26.1356ØN 44.82Ø3ØW

The dredge basket was about 3/4 full and consisted pricipally of pillow lavas, some samples being very large, together with a few samples of sulphides.

Next, the Series 48 mooring was recovered; the mooring was released at 1542 and recovered at 1645.

11797-SERIES 51

The corer was deployed on Sunday August 14 at 1914 and was recovered empty at 2158 at a ship location of 26°Ø8.2192N 44°49.5Ø12W from 3681m.

11796-SERIES 52

The corer was deployed on Sunday August 14 at 22Ø3 and was recovered at ØØ32 on Monday August 15. A 35cm core was recovered at a ship location of 518338E 2891620N, ie.

26°Ø8.6273´N 44°48.9923´W

in a water depth of 3515m.

11796-SERIES 53

A mooring consisting of a transponder with a "stand-alone" pump arranged to be located at plume height was deployed at Ø144 on Monday August 15. The location of the mooring, fixed by transponder navigation was 517379.7E 289Ø899.5N, ie.

26.1372892°N 44.8261355°W

ie., 26°Ø8.2374´N 44°49.5681´W, in a water depth of 3639m.
The rig of the mooring included buoys at 3385m attached to the

anchor weight so that they would remain to mark this location for future work.The target position for the mooring was the temperature anomaly obtained during Series 31 (ie. UTM location 517363E 2890866N, the position where bottles 3-5 where fired). The actual position is 34m north and 17m west of this target.

11796-SERIES 54

The corer was deployed on Monday August 15 at Ø34Ø and was recovered at Ø617 . A 53cm core was recovered at a ship location of 516Ø49E 289Ø14ØN, ie.

26°Ø7.827´N 44°5Ø.367´W

in a water depth of 375Øm.

Next the operation to recover the 6 moorings that were out - the short-term pump mooring, the current meter mooring and the 4 transponder net moorings - was started. First, the Series 53 mooring was recovered at Ø936 followed by the current-meter mooring (Series 3Ø) at 1Ø58 and the transponder-net moorings at 1251 (Series 5), 1429 (Series 4), 16Ø2 (Series 3) and 18Ø1 (Series 2). During these proceedings, the Z-boat was lowered to allow samples of surface sea water to be collected remote (~ 1km) from the ship.Also during this period radio contact was established with the NOAA ship OCEANOGRAPHER, the next occupant of the TAG area due to arrive at 2ØØØ on Tuesday August 16, 12 hours after the departure time of DISCOVERY.

11796-SERIES 55

The corer was deployed on Monday August 15 at 1912 and was recovered at 2145. A 77cm core was recovered at a ship location determined by transit navigation of:

26°Ø7.6´N 44°52.2´W

in a water depth of 4Ø3Øm.

Finally, 2 CTD/rosette casts were carried out.

11796-SERIES 56

The cast, a vertical profile, commenced at 2359 on Monday August 15 and was completed by Ø2Ø2 on Tuesday August 16. The ship´s position as determined by transit navigation was as follows:

DATE	TIME	LAT	LONG
15.8.88	2359	26°Ø4.4'N	44°54.8'W
16.8.88	Ø159	26°Ø4.4'N	44°56.1'W

The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	SAMPLING
2	356Ø.Ø	M L
3	353Ø.Ø	M L
4	35ØØ.Ø	M L
5	34ØØ.Ø	M L
6	33ØØ.Ø	M L
7	32ØØ.Ø	M L
8	31ØØ.Ø	M L
9	3ØØØ.Ø	M L
1Ø	25ØØ.Ø	M L
11	2ØØØ.Ø	M L

11796-SERIES 57

The final cast, a vertical profile, commenced at Ø246 on Tuesday August 16 and was completed by Ø6Ø8. The ship's position as determined by transit navigation was 26°Ø3.3'N 44°45.4'W. The details of the rosette cast are as follows:

ROSETTE NO.	PRESSURE(dB)	SAMPLING
2	3788.Ø	M
3	3748.Ø	M
4	37ØØ.Ø	M
5	35Ø2.Ø	M
6	34Ø2.Ø	M
7	3299.Ø	M
8	32ØØ.Ø	M
9	3ØØ1.Ø	M
1Ø	25Ø2.Ø	M
11	2ØØØ.Ø	M

RRS DISCOVERY departed Station 11796 at Ø6Ø8 on Tuesday August 16 after 15 days' continuous station work and sailed for Tenerife, arriving on Monday August 22.

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