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SAHUL SHOALS PROCESSES: NEOTECTONICS AND CAINOZOIC ENVIRONMENTS - CRUISE 122

POST-CRUISE REPORT

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BY J. MARSHALL, P.J. DAVIES, I. MIHUT, A. TROEDSON, D. BERGERSON, AND D. HADDAD

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Marine Geoscience and Petroleum Geology Program

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SAHUL SHOALS PROCESSES: NEOTECTONICS AND CAINOZOIC ENVIRONMENTS

CRUISE 122

POST CRUISE REPORT

Project 121.41

John F. Marshall, Peter J. Davies, Ilie Mihut, Alexa Troedson, Doug Bergerson, and David Haddad

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DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: The Hon. David Beddall, MP

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Executive Director: Harvey Jacka

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CONTENTS

Page 5 is missing from the hardcopy of Record 1994/33.

APPENDICES

TABLES

FIGURES

EXECUTIVE SUMMARY

The ship departed Berth 1 at North Quay, Fremantle at 1510 on Saturday 9 October, 1993. The safety meeting and cruise briefing was held for all AGSO and Sydney University personnel soon after the ship left the wharf. The ship then proceeded for the next six and a half days to make its way north to the survey area.

The ship arrived at the survey area just after midnight of Friday, 15 October. The first current meter station was reached at 0110 hrs on Saturday 16 October. Prior to the current meter being deployed, a CTD cast was made in 195 m water to measure temperature, salinity, pH, dissolved oxygen, and light transmission. The first current meter was deployed in 200 m, followed by two others on the top of one of the banks, in water depths of 30-40 m.

After the three current meters were deployed, the ship proceeded to the first seismic waypoint nearby. The 1200 m cable was deployed and balanced by late morning of Saturday 15 October and shooting commenced at 1220 hrs. A total of 830 km of multichannel seismic data was recorded over 15 lines covering the area on and between the Sahul Banks and the Cartier Trough. This was the first survey that the GI gun array has been used to any extent, and the array behaved superbly, with very little down-time resulting from malfunctions in the gun array itself.

Because most of the banks have a flat top around 70 ms (TWT), with the first multiple at 140 ms, it is difficult to interpret the seismic events beneath the first multiple. However, in some crossings it was possible to interpret lower horizons that show relief beneath the bank. This relief, while significant, is not as great as that of the present bank. However, it does appear that these carbonate platforms have been in existence since at least the Late Miocene.

Most of the lines (13 out of 15) cross the inter-bank areas. Here, it is possible to tie certain horizons to wells such as Sahul Shoals 1 and Pokolbin 1. Again, because of multiples, it was only possible to tie the Top Miocene Unconformity with any confidence, and to tie from one side of a bank to the other is difficult. However, it does appear that the latest Miocene was a time of subaerial exposure, producing a regional erosional unconformity. This was presumably a result of a substantial fall in sea level at this time (the Messinian event?).

The Cartier Trough has subsided substantially since the Late Miocene, and it contains a very thick Miocene to Recent sequence. Some structures within the trough appear to have resulted from a combination of tectonic activity and sea level change. They consist of a series of

backstepping onlap features, that are structurally high. Similar structures deeper in the trough could have some petroleum potential, if sealed adequately. What has been interpreted as the Top Miocene Unconformity can be traced with some certainty across the trough.

The multichannel seismic leg of the cruise was completed at midnight on Thursday 21 October.

After the cable was retrieved, a series of gravity cores and palaeomagnetic cores were taken across the Cartier Trough. The longest core was 5.8 m. Susceptibility measurements on the palaeomagnetic cores showed minimal (<10) values, indicating that very little leakage of material from the continent is occurring. This was confirmed on subsequent analyses both here and on the shelf.

From 22 to 27 October the ship was engaged in sampling on and between the Sahul Banks. Grab samples on top of the banks recovered mainly coarse material that was dominated by the green calcareous alga *Halimeda* and larger benthic foraminifera. Camera stations on the top of the banks often showed luxuriant growth of soft green algae and/or seagrass. Other than solitary hermatypic types (mainly *Fungia* sp.), corals were noticeably absent from the tops of the banks. This was not the case in the dredge samples from the sides of the banks. Recovered rocks included *Halimeda* rudstones, coral heads, rhodolith limestones and coral/algal framestones. The presence of reef framework from many of the dredge hauls indicates that reef growth did occur in the past. However, its extent is unknown. The seismic sections do not indicate any biohermal buildups, so the reef framework seems to be confined to the very periphery of the banks. The age of the limestones is unknown at present, but we suspect that they must be Pliocene or Pleistocene.

Gravity cores and vibrocores from the inter-bank regions, mainly in water depths of 200-350 m, recovered finely comminuted bank material. In places a series of aprons or fans extend behind the banks, and these are readily identified from the seismic sections. Coring of the proximal and distal parts of these fans produced sediments of varying texture. Some coarser material in the cores is considered to represent high energy events.

A total of 270 km of boomer seismic data was acquired in the Sahul Banks region. This data confirmed that the very tops of the banks are essentially layered, with some erosional events in places. The layering is indicative of the dominance of biostromal as opposed to biohermal sedimentation on the banks.

The current meters were retrieved on Thursday 28 October. While the two current meters on the top of the bank were recovered with no difficulty, the float of the third current meter was

missing. Many small fishing craft had been sighted over the past two weeks, and it is possible that the buoy had been removed. The rest of the day was spent grappling for the current meter, but without success.

Friday 29 October was spent sampling one of the banks on the eastern side of the Cartier Trough. A series of grabs, camera stations cores and dredges produced similar results as on the Sahul Banks.

The ship transited to the Lambert Shelf Valley on Saturday 30 October, and sparker traverses across the valley were commenced that day. Two current meters were deployed near the centre of the valley on Sunday 31 October. The outer part of the Lambert Shelf Valley was crossed by a series of sparker lines, followed by sampling. Cores in the valley showed a mainly uniform succession of sandy muds. Core recovery averaged about 4 m. Sparker lines were then run across the southern part of the valley to complete the coverage. Up until this time,. we had been using Sydney University's three electrode sparker with a 1000 joule power supply. However, on testing AGSO's previously untried multi-electrode sparker off the 500 joule power supply, it was found that this produced superior results, and this was subsequently employed for the remainder of the survey.

By this stage, the ship was only capable of producing 40% pitch. This was not a serious problem when running the sparker lines, but when we started to undertake coring operations at about 1800 hrs on Friday 5 November, it was apparent that the situation with the pitch control had worsened. On the advice of the ship's captain, it was decided to suspend operations at 2330 hrs and head for Darwin to determine the exact cause of the problem and make repairs. The ship limped back to Darwin at about 3.5 knots, eventually reaching port at 1030 on Monday 8 November. When the ship tried to come alongside at about 1500 hrs, she had insufficient power to berth successfully, and had to anchor off that evening. The ship, assisted by a tug, berthed at 0800 hrs on Tuesday 9 November. Repairs to the ship's pitch control were effected immediately, but by the evening of Wednesday 10 November, the exact cause of the problem was still unknown, and so, in consultation with the Acting Chief, it was decided to abandon the remainder of the cruise.

Despite this setback the cruise had achieved 80% of its objectives, and the following statistics represent an excellent result. The total amount of data collected on Cruise 122 consists of:

830 km of multichannel seismic data
270 km of boomer data
725 km of sparker data
22 dredge sites
43 gravity cores
3 palaeomagnetic cores
31 vibrocores
95 grab samples
22 camera stations
5 current meter deployments.

This is the first survey in which the GI guns have been used, and the results are excellent. The effective suppression of the bubble pulse, coupled with the higher frequency range of the new amplifiers, has produced a high resolution seismic record far superior to other air gun and water sources that have been tried in the past on *Rig Seismic*. Initially, it was intended to use only one or two guns, with the others as spares. However, the firing of all four guns simultaneously produced significantly better penetration, and, because of the relatively low maintenance required, this method was adopted for the entire period of multichannel shooting. The multi-electrode sparker was used extensively in shooting seismic in the vicinity of the Lambert Shelf Valley. Compared to the conventional three electrode sparker, it produced greater penetration and better resolution. Some care had to be taken with the electrodes, as it was obvious that there was deterioration of the record if the sparker was run too long without maintenance. While the sparker bubble pulse is still typically wide, this type of source appears to be ideal for surveys where relatively shallow (0.25-1.00 sec. TWT) penetration is required.

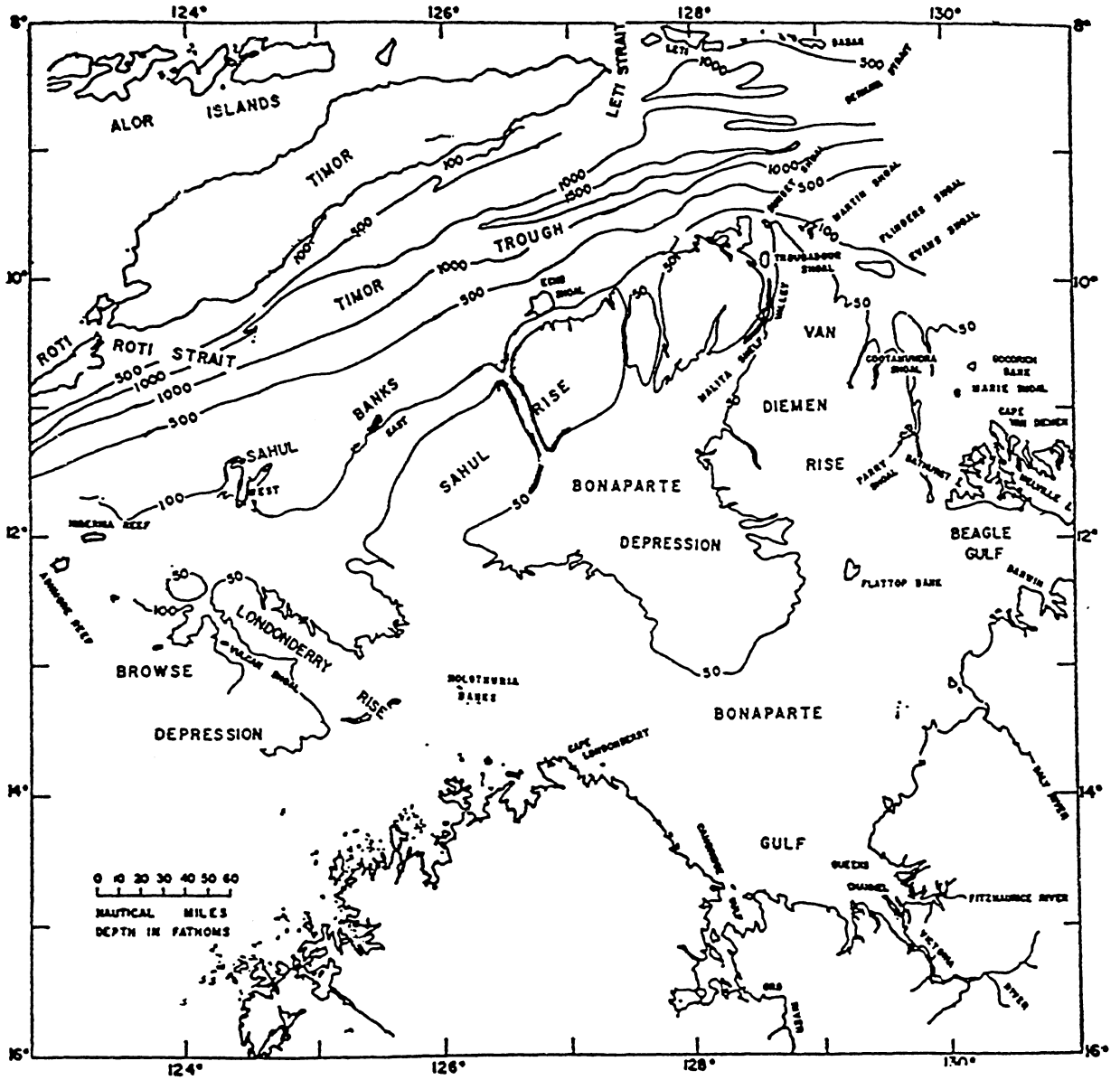

Figure 1. Map of the Timor Sea showing the major physiographic provinces (after van Andel and Veevers, 1967)

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parameters such as sequence velocities and true depth determination of key horizons?

3. What has been the effect of collisional reactivation since the Miocene on sedimentation and structure in the Sahul region? Are tectonic processes continuing at present, and what are their manifestation?

4. Compared with the Great Barrier Reef of northeastern Australia, the northwest shelf has virtually no coral reefs. However, there are a series of carbonate platforms on the edge of the Sahul Shelf, and the shelf is mantled by tropical carbonates (including ooids). From well data in the region, it is suspected that some platforms may have commenced development by the Late Miocene. The platforms rise from depths of 200-350 m to 25-30 m below sea level. However, with few exceptions, there are no coral reefs developed on top of these platforms. What is the major carbonate producer on these platforms? What are the rates of production? The seafloor between the platforms is covered by periplatform oozes, which should contain both high resolution sea level and palaeoceanographic signals. The Cartier Trough should contain a lower resolution, but longer record. Are we seeing a Bahamian analogue or a completely new type of carbonate buildup that has significance for petroleum exploration models?

5. The Sahul Shelf is dissected by a number of narrow depressions. The most prominent is the Malita Shelf Valley. These depressions or shelf valleys appear to be part of a major palaeo-drainage system. Some of the valleys appear to have drained seawards, but others, including the Malita and the Lambert Shelf Valleys, drained towards the Bonaparte Depression, a large topographic low on the mid shelf, . Other valleys are blind at both ends. How have these valleys formed? What controlled and maintained the drainage pattern? How old is the Bonaparte Depression, and has it been a region of organic carbon accumulation in the past?

6. What is the history of development of carbonate buildups during the Cainozoic in the Timor Sea, and what is their potential for hydrocarbon accumulation?

Previous Work

The first regional geological survey in the region was undertaken in 1960-61 by van Andel and Veevers (1967), during which sea floor sediments, morphology and shallow structure were examined on the Sahul Shelf and in the Timor Trough. A similar survey of the North West Shelf was undertaken by Jones (1973). Since then most geological work has been in

relation to hydrocarbon exploration, mainly related to the stratigraphy, structure and petroleum potential of the region (e.g. Powell, 1976; Patillo and Nicholls, 1990; O'Brien and others, 1992)

Acknowledgments

The Captain and crew of *Rig Seismic*, plus AGSO technical staff, as usual, performed to a high standard of efficiency and cooperation during Cruise 122. Professor P.J. Davies and staff and students from the Department of Geology and Geophysics, University of Sydney participated willingly in all aspects of the cruise, and provided additional equipment. See Appendix 3 for the list of personnel involved in the cruise. We thank Neville Exon and Jim Colwell for their review of this report.

REGIONAL GEOLOGY

Morphology

The Sahul Shelf is an extremely broad, shallow platform, some 300 to 500 km in width. This shelf is atypical of most modern continental shelves in three ways:

(i) there are a series of shelf-edge banks which rise to depths of 20-30 m
(ii) the presence of a number of narrow, but relatively deep valleys
(iii) instead of uniformly increasing in depth from the shoreline, the shelf forms a broad shallow depression

However, while the shelf is unusual in these ways, it does appear to be analogous to some ancient shelves, such as those bordering Tethys in the Jurassic.

In places, the banks form a nearly continuous barrier along the shelf edge. Others form a complex of banks that are grouped together. Individual banks can be as small as 1-2 km in diameter, whereas the larger banks are of the order of 10-30 km wide. Some of the larger banks, such as Echo Shoal, appear to be an amalgamation of several smaller banks. The characteristics of the banks have been tabulated by van Andel and Veevers (1967). In general, they are steep-sided (15-20°) and rise from 200-300 m water depth to 20-30 m. The depth of the top of the banks is remarkably uniform and they are typically flat-topped, with very few indications of pinnacles. Other than Ashmore, Cartier and Hibernia Reefs near the southern end of the Sahul Shoals, none of the banks support coral reefs.

The outer part of the shelf is cut by a series of narrow channels. These channels vary in length from about 10 km to over 150 km in the case of the Malita Shelf Valley. While the larger

valleys tend to extend across the Sahul Rise from the edge of the shelf to the Bonaparte Depression, many of the smaller channels are "blind" at both ends. The two largest channels are the Malita Shelf Valley and the Lambert Shelf Valley. The Malita Shelf Valley extends from Troubadour Shoal, at the northern end of the Sahul Rise, to the Bonaparte Depression (Fig.1). The Lambert Shelf Valley extends from the shelf edge to the south of Echo Shoal to the Bonaparte Depression. The alignment of the shelf valleys as a whole tends to suggest some form of drainage pattern extending from the Sahul Rise and Van Dieman Rise into the Bonaparte Depression on one hand and to the shelf edge on the other. While van Andel and Veevers (1967) and van der Kaars (1991) have related these channels to subaerial exposure in the Late Pleistocene, the bathymetry suggests that this was not a simple drainage system. The valleys tend to be deeper in the middle than at either end. For example, the Lambert Shelf Valley has a depth of about 100 m at the ends, but is up to 240 m deep in the middle. The impression is that the valleys are narrower and deeper where they cross the Sahul Rise.

The Bonaparte Depression covers some 15 000 km^2 of the mid shelf. The depression is a relatively gentle downwarp with depths of 100-160 m (av. depth 120 m) in the centre compared to 60-100 m at the margins. According to van Andel and Veevers (1967), the margins are bounded by small stepped scarps. Previous shoreline positions on the Sahul Shelf west of the Van Diemen Rise at 110 to 130 metres below sea level were dated at 18 000 years B.P. (van Andel & Veevers, 1967). At that time most of the shelf was exposed and the carbonate banks on the shelf edge formed a string of islands seaward of the coastline. It is believed that the Bonaparte Depression, formed an estuarine embayment with a depth of up to 28 metres. This was connected to the sea by a number of narrow and sinuous channels up to 150 kilometres long and 5 kilometres wide (Lavering, 1993). The orientation of the embayment and the size of the channels connecting it with the Timor Sea suggest that only a minor amount of seawater circulation was possible in the Bonaparte Depression during the last glacial maximum. The presence of brackish-water bivalves in the embayment supports such a view (van Andel & Veevers, 1967).

Climate and Oceanography

All of northern Australia's coastal regions are presently subject to a monsoon climate, with a wet season during the austral summer and a dry season from May to October during which the southeast trade winds prevail. Rainfall varies from 720 mm to 1920 mm per year. Mean temperatures in the wet season are in the high 20 to 30's (°C) with high humidity, down to 18 to 20 °C in the dry season (low humidity). Thunderstorms occur on average 85 days per year in Darwin (summer). At sea, the mean average evaporation rate is approximately twice the average annual rainfall (Wyrtki, 1961); the Timor Sea has a mean annual precipitation of 900

mm and a mean annual evaporation of 1716 mm. Tropical cyclones lasting from 12 to 24 hours occur in the period December to April. Wind velocities of 50 to over 90 knots are common, and may reach speeds as high as 140 knots. Squalls in the dry season rarely last longer than 3 hours and develop winds of 30 to 100 knots (van Andel & Veevers, 1967). The trade winds can generate moderate to rough seas, the main swell being from the southeast. During much of the monsoon season seas are calm and smooth, except for the disturbance caused by tropical cyclones. Swells developed during cyclones come from the southwest, west and northwest.

The Sahul Shelf is one of the world's largest tidally dominated shelf environments (Harris and others, 1991). The shelf is macro-tidal between Dampier and Darwin, with mean spring tides increasing up to 9 m towards the coast. The tidal currents flow northeast-southwest across the shelf. Surface circulation is driven by the southeasterly trade winds from April to November, and modified somewhat by the northwest monsoon in summer.

Surface Sediments

Surficial sediments on the Sahul Shelf are largely coarse grained, particularly on the rises and the shelf edge banks; the only area of fine grained sediments is restricted to the Bonaparte Depression. Gravel-size components within the sediments consist of relict carbonate nodules, and biogenic components, such as molluscs, *Halimeda*, bryozoans, corals and larger foraminifera. Most of the non-carbonate components are fine-grained. The carbonate content of the sediments varies between 15 to 100 percent (van Andel and Veevers, 1967).

Of the 17 variables measured by van Andel and Veevers (1967) for the Sahul Shelf sediments, correlation coefficient measurements of positive and negative covariance found the following groupings between the various major components of the samples:

corals/bryozoans
algae/forams
molluscs/echinoids

Halimeda cluster separately to the other calcareous algae. The mollusc/echinoid group is dominant in and around the Bonaparte Depression and may be partly a remnant late Quaternary estuarine assemblage (van Andel & Veevers, 1967). The coral/bryozoan group is present on the banks and rises of the western Sahul Rise and Van Diemen Rise, although it is limited to the seaward edge of the major groups of banks. The algal/foraminifera group, together with *Halimeda*, is present only on the tops of the shelf-edge banks and the shoals of the Van Diemen Rise. There is a notable absence of corals on these banks.

Since most of the shelf appears to be covered by relict deposits and there appears to be little modern sedimentation over large areas of the shelf, van Andel and Veevers (1967) concluded that the post-glacial transgression was a significant factor in the distribution pattern of the surficial sediments. In terms of modern sedimentation on the shelf, the effects of tidal currents are strongest on the inner shelf and possibly on the tops of the shelf edge banks. Elsewhere, deposition appears to be confined to drift deposits within the shelf valleys and fine-grained accumulation in the Bonaparte Depression.

Tectonic Development

The oldest basin in the Timor Sea is the Petrel Sub-Basin, a NW-trending rift basin located within the Joseph Bonaparte Gulf. This sub-basin was initiated during crustal extension (rifting) in the Late Devonian to Early Carboniferous (Lee and Gunn, 1988; O'Brien and others, 1993) and contains numerous salt diapirs and other salt-related structures. Two large, but undeveloped, gas-condensate accumulations (the Tern and Petrel fields) have been discovered within the Petrel Sub-Basin. Both fields produce from Late Permian sandstones.

Further offshore, the Petrel Sub-Basin is orthogonally overprinted by NE- and ENE-trending tectonic provinces (O'Brien and others, 1993), which traditionally have been related to the rifting and ultimate break-up of Gondwanaland in the Middle Jurassic. One of these provinces is the Malita Graben, an ENE-trending depression which defines the known north-western limit of the Petrel Sub-Basin. The Sahul Platform was structurally positive throughout much of the Late Jurassic, with sediments of this age being thin due to non-deposition and/or erosion (Botten and Wulff, 1990). The south-west margins of both the Sahul Platform and the Malita Graben are defined by the NW-trending Sahul Syncline (Fig. 1). Immediately to the south-west is the Vulcan Sub-Basin, a NE-trending Late Jurassic depocentre which is flanked by two Permo-Triassic blocks, the Londonderry High and the Ashmore Platform (Pattillo & Nicholls, 1990).

AGSO's deep seismic data indicate that the principal crustal extension in the Timor Sea region was not in the Jurassic, as originally believed, but took place prior to the Late Permian, probably in the Late Carboniferous to Early Permian. This probably occurred during the formation of the Westralian Superbasin (Yeates and others, 1986). While the exact age of the initiation of the Westralian Superbasin is not well-constrained, a number of observations point to a Late Carboniferous age for the initiation of the rift/crustal extension stage (O'Brien, in press).

The post-rift Permo-Triassic sequence was deposited on moderately to highly extended

continental crust beneath virtually the whole of the northwest Australian margin. In the Timor Sea region, the rift system is considered to have had an upper plate geometry which developed orthogonally to, and overprinted, the northern part of the older, NW-trending Petrel Sub-Basin rift system (O'Brien and others, 1993). There appears to have been comparatively little crustal-scale deformation since that time. The Jurassic event, which traditionally has been considered the major rifting event in the area, was relatively minor. However, the present day structural disposition of the major tectonic elements within the Timor Sea is essentially the result of reactivation of the basic geometry established during the Westralian Superbasin event during the Mesozoic and Cainozoic.

Low strain reactivation of the deeper architecture during the Mesozoic strongly shaped the structures which are presently being actively explored in the Timor Sea. The Mesozoic reactivation events ranged from compressional (Late Triassic/Early Jurassic; Tithonian-Berriasian) to extensional (Late Callovian-Early Oxfordian). The Late Callovian-Early Oxfordian event, while of small magnitude, was critical because the transtensional reactivation of the older faults produced rapidly subsiding grabens at the same time as eustatic and post-breakup thermal subsidence was producing a relatively rapid rise in sea-level.

The post-rift sequence ranges in age from late Valanginian to Quaternary. This sequence reflects the thermal subsidence phase development of a passive continental margin, with the sequence becoming progressively more marine with time. During the Late Miocene, the northward-moving Australasian plate collided with the Eurasian plate, introducing a compressional regime in the Timor Sea. This collision reactivated many of the earlier faults, particularly in the more northerly part of the Vulcan Sub-Basin, where the collisional effects are most pronounced. The collision resulted in the formation of the Cartier Trough and mobilised the Palaeozoic salt which is present within the Paqualin and Swan Grabens (Patillo and Nicholls, 1990).

CRUISE PLAN

The cruise was intended to be broken into three components related to three distinct geographic regions (Fig. 2). These areas are:

1. The Sahul Banks and Cartier Trough
2. The Lambert Shelf Valley
3. The Bonaparte Depression

Area 1 - Sahul Banks and Cartier Trough

Most effort was focussed in Area 1, where the majority of the sampling and all the multichannel high resolution seismic profiling were undertaken. Three current meters were deployed at specific sites one metre above the seafloor, in order to measure bottom currents and their effect on sedimentation. Two of the current meters were positioned on top of the large carbonate platform on the eastern side of the Sahul Banks complex (informally referred to as Warb Bank in this report), one in the middle (122/TG/003) and the other (122/TG/002) on the southwestern edge of the bank. The third current meter (122/TG/001) was deployed in 190 m of water, 12 km southwest of 122/TG/002 (Appendix 4).

After the seismic system had been deployed and tested, a series of multichannel lines were run that covered the banks, the inter-bank regions and part of the Cartier Trough (Fig. 3). A total of 15 lines were shot, covering a distance of 830 km. The seismic lines tied to 5 exploration wells in the area (Sahul Shoals 1, Pokolbin 1, Rutherglen 1, Voltaire 1, Warb 1 and Dillon Shoals 1; see Figure 3 and Appendix 8 for location). The lines were also tied to high resolution lines shot previously in the area as part of Survey 97 (O'Brien and Marshall, 1991).

The multichannel seismic leg was followed by a sampling program, commencing in the Cartier Trough and extending across to the eastern and northern Sahul Banks. This first phase of the sampling program concentrated on and around Warb Bank and Berri Bank, where a series of grab samples and camera stations were occupied on the tops of the banks, while several dredge stations were sited on the flanks of the banks, and cores were sited in deeper water off the banks (Table 1). Most sites were selected from the on-board seismic monitors. Several boomer lines were interspersed with the sampling in order to better define the top section of the banks (lines 122/016 to 122/025; see Table 8 for waypoints and Figure 4 for location). However, the boomer results were only of marginally good quality. Sites 33 to 39, which are not listed in Table 1, were grab and camera stations from the top of Warb Bank. This was followed by a series of boomer lines to the south to help pinpoint coring targets (lines 122/026-31; Table 8 and Figure 4).

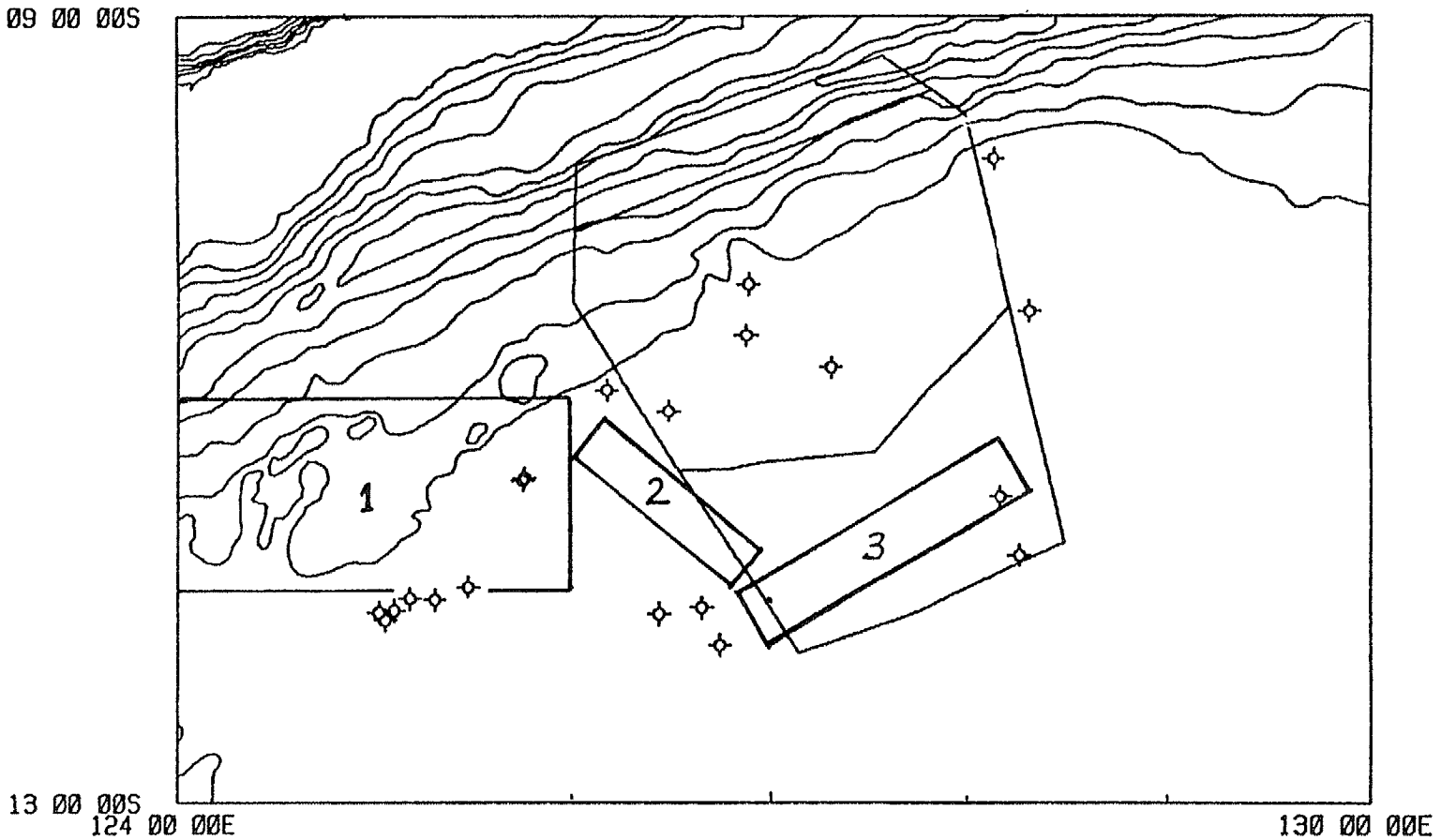


Figure 2. Map showing the general locations of Areas 1, 2 and 3, and their proximity to the Zone of Cooperation (ZOC)

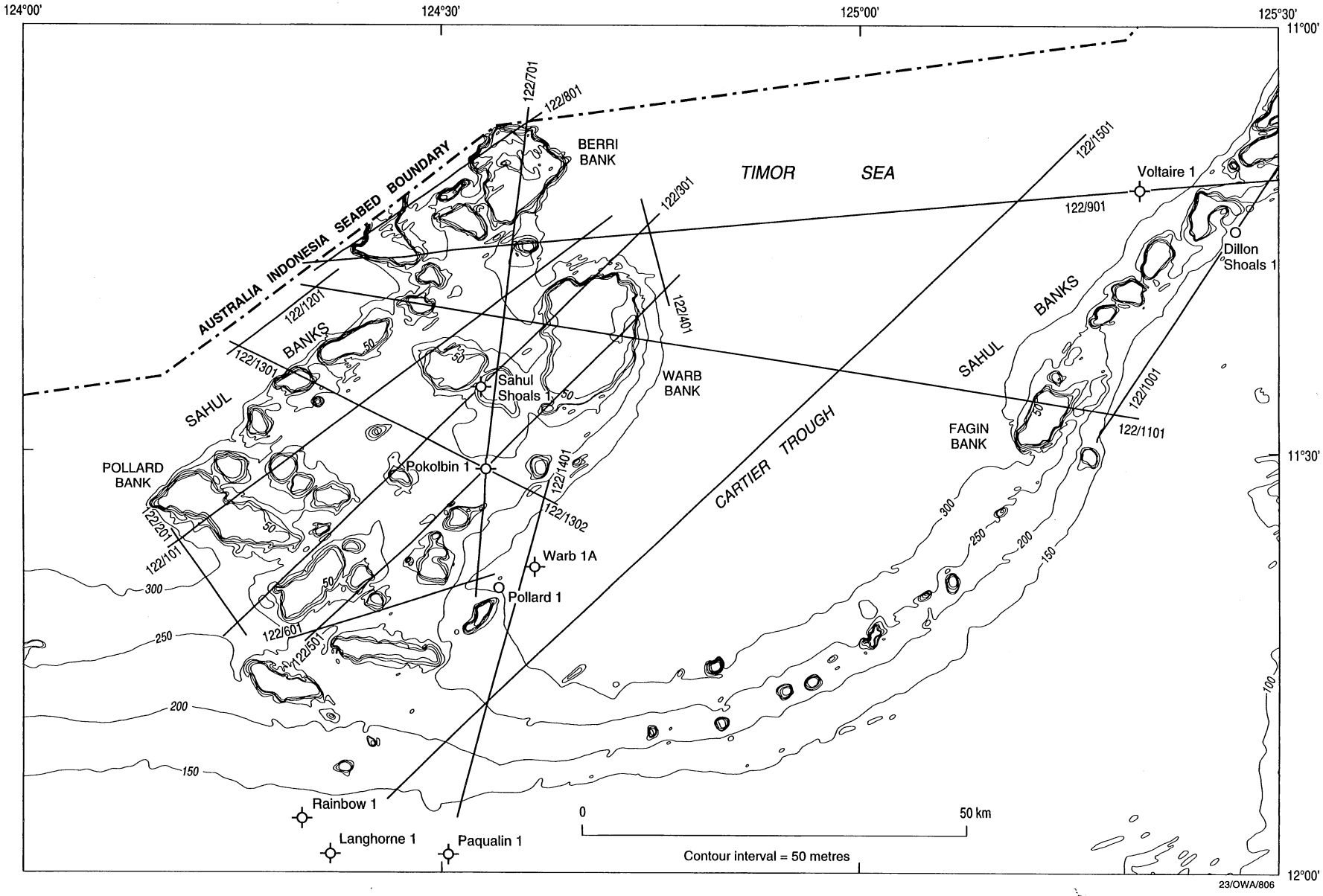


Figure 3. Location of multichannel seismic lines acquired on Cruise 122 in the Sahul Banks/Cartier Trough region

Table 1. Sampling Sites -Phase 1

Site No.	Latitude	Longitude	Depth	Sampling Mode[1]	Seismic Line	Day/ Time	Location
1	11° 11.80'S	125°16.34'E	385	GC	122/09	291.2327	Cartier Trough
2	11° 12.74'	125° 05.62	458	PM	"	291.2120	"
3	11° 13.12'	125° 01.43'	463	PM	"	291.2030	"
4	11° 13.86'	124° 52.95'	417	GC	"	291.1850	Edge of trough
5	11° 14.69'	124° 43.52'	346	GS, GC	"	291.1700	
6	11° 11.93'	124° 35.61'	34	GS, VC	122/07	291.0435	Top of bank
7	11° 09.89'	124° 35.86'	70	GS, VC	"	291.0500	Depression in bank top
8	11° 07.60'	124° 36.14'	39	GS, VC	"	291.0527	Edge of bank
9	11° 06.69'	124° 36.57'	512-240	DR	122/08	291.0720	Side of bank
10	11° 07.58'	124° 35.24'	304	DR	122/08	291.0738	Upper side of bank
11	11° 06.55'	124° 36.28'	521-140	DR	122/07	291.0540	Side of bank
12	11° 07.92'	124° 34.75'	63	GS, CM	122/08	291.0745	Top of bank
13	11° 15.57'	124°33.47'	205	GR, DR?	122/09	291.1500	Mounded topography
14	11° 19.96'	124° 33.47'	227	GR, VC	122/01	289.0555	Distal end of off bank fan
15	11°21.22'	124° 31.73'	207	GR/VC	"	289.0620	Middle of off bank fan
16	11° 22.50'	124° 30.02'	164	GR, VC	"	289.0645	Proximal part of fan
17	11° 23.46'	124° 34.18'	184	GR, VC	122/07	291.0215	Back bank fan
18	11°20.91'	124° 36.84'	217	GR, VC	122/11	292.2139	Ponded sediments
19	11° 18.00'	124° 37.60'	300-30	DR			Side of bank
20	11°18.70'	124°38.10'	30	GR/CM			Edge of bank
21	11° 19.20'	124° 40.70'	30	GR/CM			Middle of bank
22	11° 18.90'	124° 43.00'	30	GR/CM			Edge of bank
23	11°20.40'	124° 43.00'	75	GR/CM			Depression in bank
24	11° 20.50'	124° 43.70'	40	GR/CM			Edge of bank
25	11° 23.01'	124° 50.38'	360	GR/GC	122/11	292.1900	Western edge of Trough
26	11° 22.51'	124° 47.71'	313	GR/GC	"	292.1938	Distal end of fan
27	11° 22.02'	124° 44.12'	201	GR/VC	"	292.2014	Bottom of bank
28	11° 21.94'	124° 43.61'	47	GR/CM	"	292.2020	Edge of bank
29	11° 21.28'	124° 39.31'	54	GR/CM	"	292.2110	Middle of bank
30	11°19.08'	124°25.25'	327	GR/GC	122/11	293.0010	Proximal
31	11°18.90'	124°24.02'	397	GR/GC	122/11	292.2355	Distal
32	11°22.55'	124°15.52'	464	GR/GC	122/13	293.1000	Basin

1. Refer to Appendix 4 for an explanation of the symbols

A second phase of sampling on the Sahul Banks (sites 40-66) was concentrated on the southern part of the banks, particularly Pollard Bank, where a series of grab stations were occupied on top of the bank, while several cores were taken in the inter-bank areas and dredge stations on the flanks of the platform (Table 2).

Table 2. Sampling Sites - Phase 2

Site No.	Latitude	Longitude	Depth	Sampling Mode	Line	Day/ Time	Location
40	11°35.42	124°12.56	252-89	DR	122/01	289.1100	Side of bank
41	11°32.1	124°10.2	320-80	DR			Side of bank
42	11°33.8	124°10.2	<30	GR/CM			Edge of bank
43	11°32.5	124°11.3	<30	GR			Edge of bank
44	11°32.8	124°13.1	<30	GR			Edge of bank
45	11°33.4	124°12.2	<30	GR			Top of bank
46	11°34.20	124°14.27	52	GR/VC	122/01	289.1035	Top of bank
47	11°33.23	124°15.51	180	GR/VC	122/01	289.1017	Prograding sequence
48	11°32.88	124°15.99	196	GR/VC	122/01	289.1010	Off bank fan
49	11°34.2	124°12.5	<30	GR			Edge of bank
50	11°36.0	124°14.5	<30	GR/CM			Edge of bank
51	11°36.2	124°15.3	120	GR			Edge of bank
52	11°35.3	124°15.8	<30	GR			Top of bank
53	11°35.0	124°17.1	35	GR			Edge of bank
54	11°35.5	124°18.2	100	GR			Edge of bank
55	11°36.1	124°18.6	<30	GR/CM			Edge of bank
56	11°35.41	124°22.62	218	GR/VC	122/03	289.1840	Distal fan
57	11°33.94	124°24.15	198	GR/VC	122/03	289.1905	Middle fan
58	11°32.13	124°17.00	226	GR/VC	122/01	289.0955	Scour in fan
59	11°30.88	124°18.72	95	GR/VC	122/01	289.0930	Top of bank
60	11°29.09	124°21.13	205	GR/VC	122/01	289.0855	Off bank fan
61	11°24.38	124°19.22	279-23	DR	122/13	293.1350	Side of bank
62	11°24.84	124°20.13	21	GR/VC	122/13	293.1402	Top of bank
63	11°26.68	124°24.37	219	GR/VC	122/01	289.0808	Off bank fan
64	11°24.99	124°26.64	213	GR/VC	122/01	289.0735	Off bank fan
65	11°27.66	124°33.67	183	GR/VC	122/07	291.0125	Proximal fan
66	11°30.38	124°33.32	190	GR/VC	122/07	291.0052	Distal fan

Towards the end of the second sampling phase, the current meters were retrieved. While CM2 and 3 were recovered, at the deeper station (CM1) the surface buoys were missing, and attempts to grapple were unsuccessful.

Two sparker lines were run (lines 122/32 &33; Fig. 4) to test the equipment and to see if better results could be obtained than from the boomer. To this purpose, part of boomer line 122/23 was re-shot using Sydney University's three electrode sparker. Results were reasonably good, and the sparker gave better results in the deeper water off the banks.

The third phase of sampling (Table 3) included coring in the Cartier Trough (sites 67-69), and sampling the top and sides of a 7 km x 3 km bank on the eastern edge of the Cartier Trough. This bank is informally referred to as Fagin Bank in this report. A series of grabs and camera stations were occupied on top of the bank and on the adjacent shelf, while several dredge stations were sited on the flanks of the bank, and coring took place on the flanks of the bank and on the shelf.

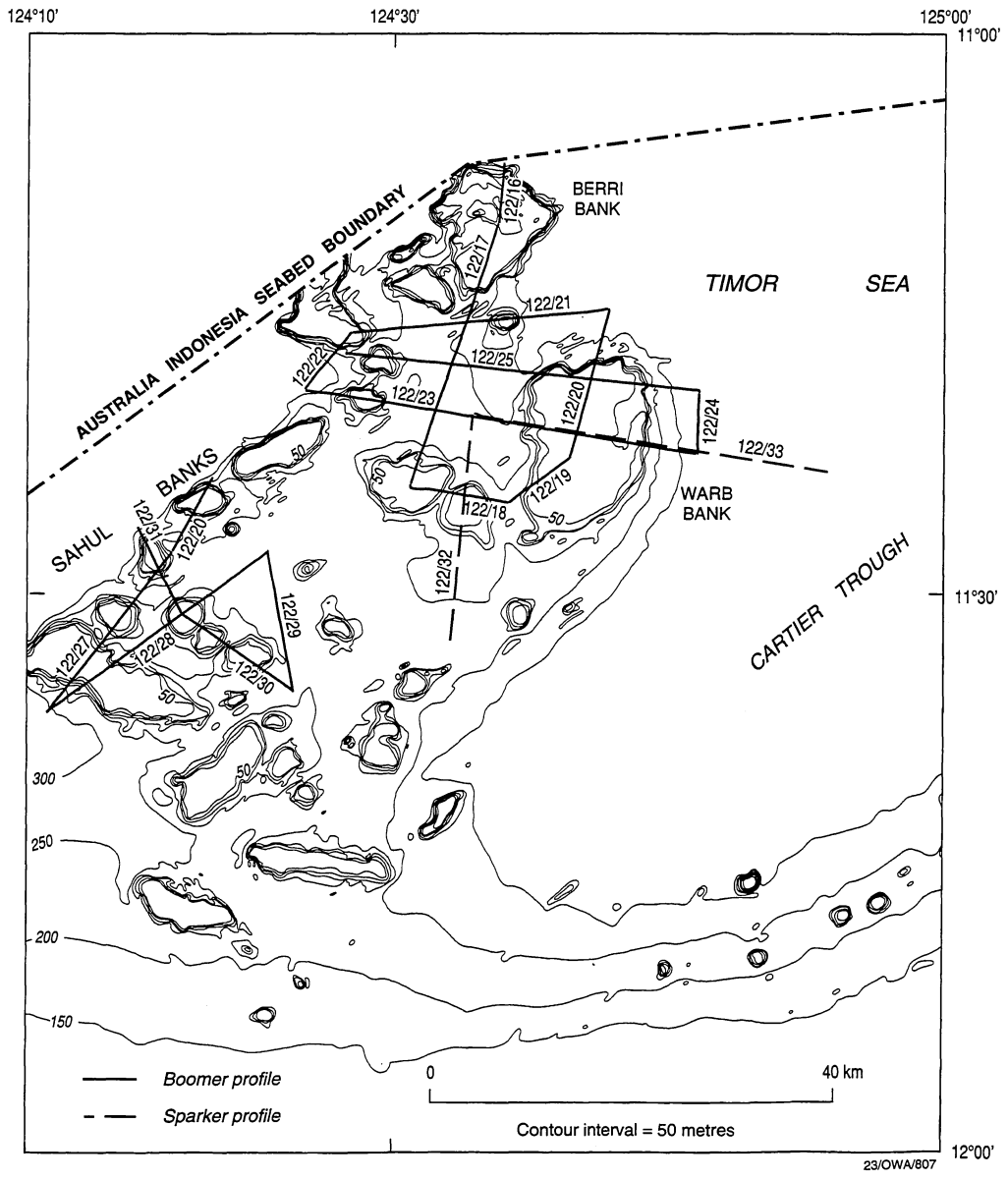


Figure 4. Location of boomer and sparker lines shot across the Sahul Banks during Cruise 122

Table 3. Sampling Sites - Phase 3

Site No.	Latitude	Longitude	Depth (m)	Sampling Mode	Line	Day/Time	Location
67	11°24.24'S	124°58.23'E	436	GC	122/11	292.1728	Cartier Trough
68	11°25.01'	125°03.13'	407	GC	"	292.1630	Cartier Trough
69	11°25.13'	125°03.97'	395	GC	"	292.1620	Cartier Trough
70	11°26.34'	125°11.64'	249	VC	"	292.1448	Western slope of bank
71	11°26.46'	125° 12.38'	33	GR/CM	"	292.1439	Edge of bank
72	11°26.60	125° 13.30	39	GR	"	292.1428	Top of bank
73	11°26.70'	125° 13.97'	58	GR	"	292.1420	Depression in top of bank
74	11°26.82'	125° 14.70	26	GR	"	292.1411	Edge of bank
75	11°26.88'	125° 15.11'	160	GR	"	292.1406	Side of bank
76	11°26.98'	125° 15.76'	245	VC	"	292.1358	Bottom of depression
77	11°27.06'	125° 16.27'	235	VC	"	292.1352	Edge of progradation
78	11°27.26'	125° 17.60'	146	VC	"	292.1336	Upper slope
79	11° 29.25'	125° 11.00'	300-50	DR			Side of bank
80	11°28.90	125° 12.10'	30	GR/CM			Edge of bank

Area 2 - Lambert Shelf Valley

On completion of the work in the Sahul Banks/Cartier Trough area, the ship moved to the northern end of the Lambert Shelf Valley and commenced seismic acquisition using the three electrode sparker and single channel streamer. Seismic lines 122/34 to 122/41 (Table 10; Fig. 5) were shot along the axis of the valley from the outer shelf to the middle of the valley. Two current meters were deployed, one (122/TG/004) was deployed in the middle of the valley at a depth of 178 m, while the other (122/TG/005) was deployed some 5 km away on the shelf in 65 m water depth (Appendix 3).

A series of sparker lines (122/052 to 122/070) were shot as short lines across the valley, back out to the upper slope (Fig. 5; Table10). AGSO's multi-electrode sparker was used in tandem with the Sydney University three electrode sparker, and this produced superior results than those obtained previously. However, it was found that the multi-electrode sparker by itself was the best option, even when using only the 500 joule power supply. This system was used for the remainder of the survey.

From the monitors, a series of sampling sites were delineated. These included dredging sites on the flanks of one of the carbonate banks in front of the shelf break, and coring sites in front of the shelf valley, as well as core sites in the valley itself (Table 4). By the end of this sampling phase, the ship's propellor had been reduced to 40 percent pitch. A series of sparker lines were shot in the southern part of the Lambert Shelf Valley, both across the valley and

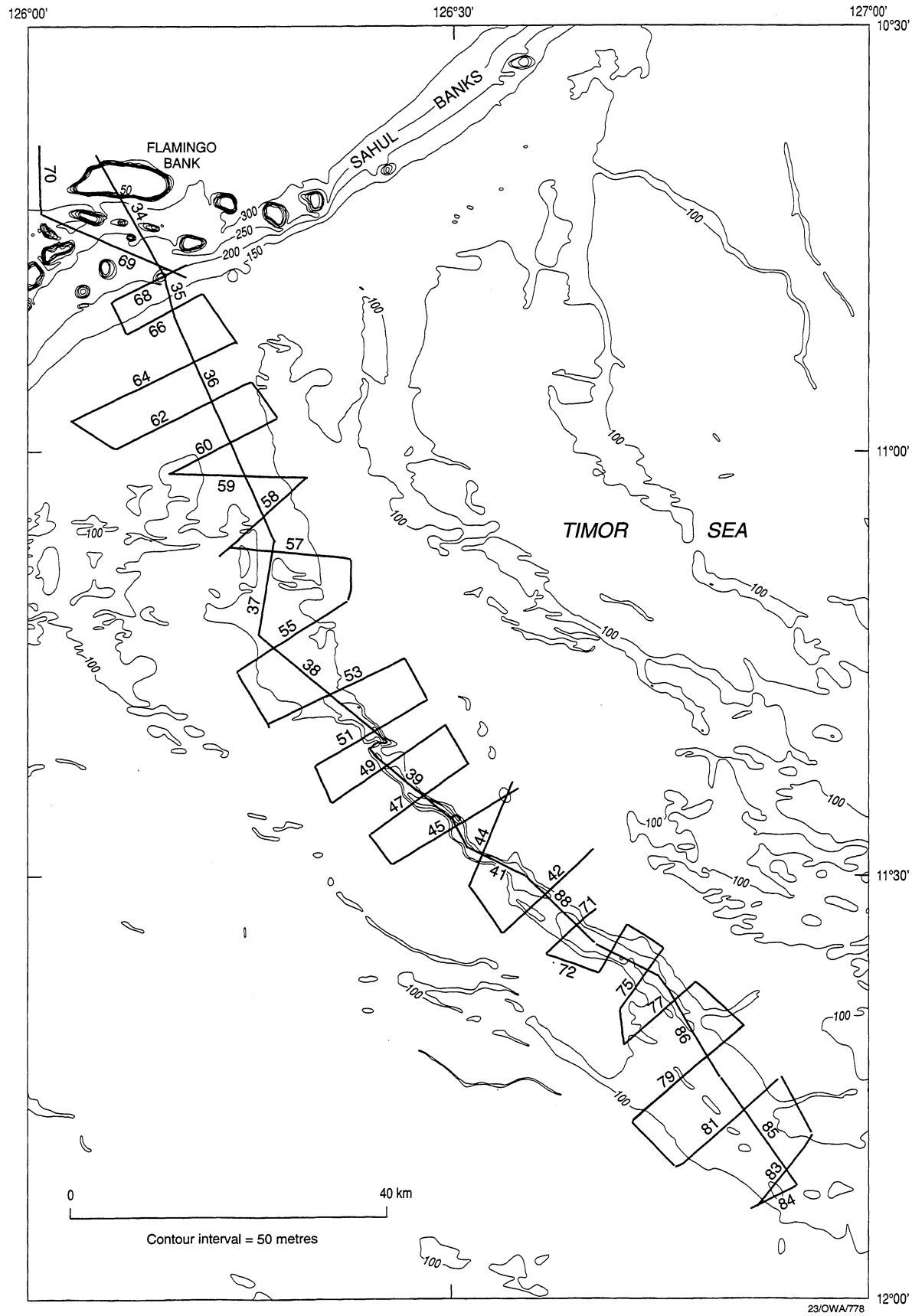


Figure 5. Location of sparker lines (122/34 to 122/88) across the Lambert Shelf Valley

along the thalweg (Fig. 5; Table10). An attempt to sample the southern part of the valley was abandoned after only three coring sites because of the ship's mechanical problems.

Table 4 Sampling Sites - Phase 4

Site	Latitude	Longitude	Depth (m)	Sampling Mode	Line	Day/Time	Location
82	10°39.6'	126°05.0'	300-50	DR	not on line	-	Side of bank
83	10°42.0'	126°05.0'	300-50	DR		-	Side of bank
84	10 42.30	126 6.65'	312	GC	122/34	303.0742	Side of bank
85	10°42.88'	126°06.97'	261	GR/GC	122/34	303.0750	Top of mounded seds.
86	10°46.32'	126°08.94'	224	GR/GC	122/34	303.0837	Sed. wedge below bank
87	10°47.21'	126°09.45'	200-50	DR	122/34	303.0849	Side of bank
88	10°47.71'	126°09.70'	41	GR/CM	122/35	303.0855	Top of bank
89	10°48.68'	126°09.92'	168	GR/VC	122/35	303.0907	Sed. pile below bank
90	10°50.44'	126°10.39'	125	GR/VC	122/35	303.0927	Shelf edge
91	10°51.33'	126°10.77'	104	GR/CM/VC	122/36	303.0939	Top, small drowned bank
92	10°53.04'	126°11.55'	108	GR/VC	122/36	303.1001	Channel infill
93	10 53.87'	126 11.30'	107	VC	3.5 kHz	305.1000	Channel
94	10 56.63'	126 12.61'	115	VC	3.5 kHz	305.0553	Channel
95	10 59.58'	126 13.90'	113	VC	3.5 kHz	305.0340	Shelf
96	11 1.70'	126 16.46'	111	VC	3.5 kHz	305.0115	Channel
97	11 3.82'	126 17.57'	105	VC	3.5 kHz	304.2345	Channel
98	10°58.04	126°13.83	107	VC	122/36	303.1106	
99	11°07.30	126°20.77	91	GR/VC	122/57	304.2108	
100	11°10.68	126°22.44	89	GR/VC	122/55	304.2006	
101	11°12.49	126°16.53	105	VC	122/37	303.1435	
102	11°12.49	126°19.53	102	VC	122/55	304.1925	
103	11°13.81	126°17.52	98	GR/VC	122/55	304.1857	
104	11°16.09	126°20.24	104	VC	122/38	303.154	
105	11°16.57	126°22.60	105	GR	122/53	304.1556	
106	11°18.03	126°22.54	181	VC	122/38	303.1617	
107	11°19.76	126°24.49	134	GR/VC	122/51	304.1324	
108	11°19.97	126°24.15	169	GR/VC	122/51	304.1319	
109	11°19.99	126°24.85	132	VC	122/38	303.1653	
110	11°22.08	126°25.54	128	GR	122/49	304.1055	
111	11°23.35	126°26.83	187	VC	122/39	303.1802	
112	11°24.00	126°27.70	192	VC	122/39	303.1815	
113	11°26.36'	126°30.45	196-59	DR	122/45	304.0559	
114	11°24.39	126°33.85	115	GR/VC	122/44	304.0408	
115	11°28.24	126°31.63	217	VC	122/40	303.1951	
116	11°28.87	126°31.98	196-67	DR	122/44	304.0309	
117	11°31.45'	126°36.48'	149	GR/VC	122/42	304.0105	

Area 3 - Bonaparte Depression

The intention was to run a sparker transect across the depression from about 12° 00'S, 127° 05'E to 11° 30'S, 128° 15'E and sample back along the seismic line. However, this phase of the work had to be abandoned.

The two current meters (stations 122/TG/004 and 122/TG/005) were unable to be recovered at

the end of cruise 122. An attempt to recover them was made in December, using a chartered vessel. Of the two current meters, only one (122/TG/005) was recovered.

RESULTS

CURRENT METER MEASUREMENTS

Three current meters were deployed at five stations in the Timor Sea, three on the Sahul Banks and two in and around the Lambert Shelf Valley. The location of the current meter stations is shown in Table 5 and Figures 8 and 10. Of the three deployed in the Sahul Banks area, only two were recovered, while another was lost from the Lambert Shelf Valley.

Table 5. Current Meter Locations

Station Number	Latitude	Longitude	Depth (m)	Recording Period
122/TG/001	11° 28.7S	124° 32.2E	190	Lost
122/TG/002	11° 25.0	124 °37.7	35	12.4 days
122/TG/003	11° 22.6	124 °40.4	32	12.2 days
122/TG/004	11° 30.7	126° 35.2	178	Lost
122/TG/005	11° 29.4	126° 37.3	65	16.1 days

The following is a preliminary report on the data compiled by Peter Harris . The currents are definitely tidal, but are not very strong. Station 122/TG/003, which is located at the centre of Warb Bank, has a strong N-S component, whereas station 122/TG/005, on the shelf near the Lambert Shelf Valley, has a dominant E-W component. At station 122/TG/002, on the edge of Warb Bank, the flow appears to be rectilinear. The currents here might be being steered by the bathymetry of the bank, with the N-S tidal current being superimposed on a more local "geostrophic" or edge current, such as occurs off headlands or prominent bathymetric features. The progressive vector plots for 122/TG/002 and 122/TG/003 support the notion of a westward flowing non-tidal component of flow, whereas the net current at 122/TG/005 was towards the north.

Maximum and minimum velocities varied from 1.5 to 44.6 cm sec^{-1} for all recovered stations (Table 6). Station 122/TG/003 at the centre of Warb Bank had the lowest maximum of 29.5 cm sec-1, with the statistics showing higher velocities at the edge of the bank (122/TG/002).

Table 6. Current Meter Statistics

Station Number	122/TG/002	122/TG/003	122/TG/005
Minimum Speed (cm sec^{-1})	3.18	1.50	1.50
Maximum Speed (")	39.02	29.50	44.62
Sum	63094.56	37468.08	72358.58
Points	3572	3524	4627
Mean	17.66	10.63	15.64
Median	17.18	9.34	14.38
RMS	19.11	12.25	17.45
Std Deviation	7.29	6.09	7.75
Variance	53.14	37.14	60.11
Std Error	0.1220	0.1027	0.1140
Skewness	0.2599	0.6459	0.6675
Kurtosis	-0.6367	-0.4642	-0.0904

SEISMIC REFLECTION PROFILING

Multichannel Seismic Interpretation

The following is a preliminary classification and interpretation of the multichannel seismic data in the Sahul Shoals area, using the 1.5 seconds (TWT)[1] on board single channel monitor records. The seismic data covers four different types of morphology: the Sahul Banks; the inter-bank areas; the Cartier Trough; and the banks on the eastern side of the Cartier Trough (see Fig. 3 for line and well locations and Table 7 for waypoints).

Line 122/01. Oriented NE-SW, starts at 289.0350 and ends at 289.1130.

Inter-bank

From 289.0350 to 289.0650 the most prominent horizon (Yellow) occurs at a depth of between 640-680 ms, and at 289.0620 dips beneath the first multiple[2]. Two normal faults occur at 289.0505. Both fault planes dip NE (in section), and they have a throw of about 20 ms (F 1.1). The second fault zone (F 1.2) occurs at 289.0550 and has two main faults like the preceding zone. One fault dips NE, whereas the other dips SW. In between the faults, at the level of the Late Miocene horizon, the sediments are slightly uplifted. The antithetic fault geometry suggests either reactivation or wrenching (or both).

[1] All times, whether in seconds or milliseconds (ms) are expressed as two way time (TWT).

[2] The Yellow horizon has been correlated from well data to the Top Miocene Unconformity.

Table 7. Multichannel Seismic Waypoints

Line No.	Waypoint Number	Latitude	Longitude	Comments	Distance n.m..
122/01	1	11° 13.92	124 °41.57	SOL Line 122/01	37.00
	2	11° 36.42	124 °11.23	EOL Line 122/01	
122/02	2	11° 36.42	124 °11.23	SOL Line 122/02	7.20
	3	11° 42.41	124° 15.39	EOL Line 122/02	
122/03	3	11° 42.41	124° 15.39	SOL Line 122/03	41.00
	4	11 °25.52	124 °32.87	Sahul Shoals 1	
	5	11°14.01	124°44.87	EOL Line 122/03	
122/04	5	11°14.01	124°44.87	SOL Line 122/04	5.00
	6	11° 18.58	124° 46.08	EOL Line 122/04	
122/05	6	11° 18.58	124° 46.08	SOL Line 122/05	35.10
	7	11° 31.30	124° 33.21	Pokolbin 1	
	8	11°36.31	124 °28.17	Rutherglen 1	
	9	11°42.92	124°21.07	EOL Line 122/05	
122/06	9	11°42.92	124°21.07	SOL Line 122/06	11.60
	10	11° 39.32	124 °32.57	EOL Line 122/06	
122/07	10	11° 39.32	124 °32.57	SOL Line 122/07	32.50
	11	11° 31.30	124 °33.21	Pokolbin 1	
	12	11 ° 06.92	124 °36.23	EOL Line 122/07	
122/08	12	11 ° 06.92	124 °36.23	SOL Line 122/08	16.90
	13	11 °16.58	124°21.97	EOL Line 122/08	
122/09	13	11 °16.58	124°21.97	SOL Line 122/09	66.80
	14	11 °11.49	125 °19.95	Voltaire 1	
	15	11° 10.71	125 °29.57	EOL Line 122/09	
122/10	16	11°09.92	125°29.77	SOL Line 122/10	21.75
	17	11 °14.24	125°26.85	Dillon Shoals 1	
	18	11° 27.82	125°17.81	EOL Line 122/10	
122/11	19	11° 27.42	125 °18.57	SOL Line 122/11	57.10
	20	11 °18.42	124° 21.07	EOL Line 122/11	
122/12	20	11 °18.42	124° 21.07	SOL Line 122/12	6.85
	21	11° 22.58	124 °15.57	EOL Line 122/12	
122/13	21	11° 22.58	124 °15.57	SOL Line 122/13	24.20
	22	11° 31.30	124 °33.21	Pokolbin 1	
	23	11°33.42	124°37.40	EOL Line 122/13	
122/14	23	11°33.42	124°37.40	SOL Line 122/14	22.40
	24	11 °48.02	124°33.36	Angaston 1*	
	25	11°55.12	124°31.42	EOL Line 122/14	
122/15	26	11°52.52	124°28.57	SOL Line 122/15	63.30
	27	11° 51.16	124 °30.00	Margaret River 1*	
	28	11° 48.02	124°33.36	Angaston 1	
	29	11°08.42	125°15.32	EOL Line 122/15	
					448.70

*Sites of projected wells, but never drilled.

From 289.0710 to 289.0915 the Late Miocene horizon is situated between 480-520 ms . Above this horizon (at around 400ms) is an unconformity, of unknown age (possibly late Early Pliocene), which shows both onlap and downlap. On this horizon, between 289.0755 to 289.0810 and 289.0835 to 28908.40 there are two small bumps (40ms high). No faults occur on this part of the section.

From 289.0950 to 289.1023, the Late Miocene horizon is present at 520-540ms. Above this the other erosional unconformity persists, again showing both onlap and downlap. No faults occur on this part of the section.

Banks

Between 289.0650 and 289.0710 the seismic line crosses the NW edge of a relatively large bank. The top of the bank is flat and at a depth of 70 ms, and it seems that the seismic horizons directly beneath it are parallel with the bank top. Between two of these parallel horizons there is a zone with irregular reflections with some downlap, indicating periodic erosion on parts of the bank.

Another bank occurs between 289.0918 and 289.0942. Like the majority of banks in this area it has a flat top, at a depth of around 70ms. From the sea floor to the first multiple there are no significant changes in the seismic facies. Another bank, Pollard Bank, is present from 289.1023 to 289.1050. Its top is situated at 70ms.

Upper Slope

The end of the Line 122/01 is situated west of the banks area, on the upper part of the continental slope. Despite the decreasing quality of the seismic data for this portion of the line, the Late Miocene horizon can be seen at around 560ms. A fault occurs at 289.1111, dipping SW and with a throw of 20ms.

Line 122/02 . Starts at 289.1320 and ends at 289.1500.

This line is oriented NW-SE on the upper slope to the west of the banks. The Late Miocene horizon occurs between 560-570 ms. From 289.1342 to 289.1345 there is a downthrown block, bounded by two normal faults. A fault in the middle of the downthrown block is probably secondary.

Line 122/03. Starts at 289.1630 and ends at 290.0210. The line is oriented SW-NE.

Inter-bank

From the beginning of the line to 289.1938 the Late Miocene horizon occurs between 500-580ms. Above this horizon, from 360 to 400 ms is an erosional unconformity. Between 289.1720 and 289.1750 the Late Miocene horizon is uplifted. At 289.1834, there is a normal fault, whose fault plane dips to the southwest and has a throw of 40 ms. At 289.1930 there is a small downthrown block bounded by normal faults. (The Late Miocene horizon is used as a reference horizon for the faults).

Between 289.2020 and 289.2125 there is another inter-bank area. The Late Miocene horizon can be traced between 420-480 ms. Above this is the erosional unconformity. No major faults occur in this area.

Between 289.2157 and 289.2240, the Late Miocene horizon occurs from 440 to 500 ms. The correlation of the Late Miocene horizon between the banks was done using its seismic character (a risky business it now appears; particularly from the monitor sections).

The end of Line 122/03 is east of the banks area. The Late Miocene horizon is between 580-600 ms. At 290.0004, 290.0010 and 290.00.20 there are three normal faults with small throws, dipping NE.

Banks

A small bank occurs between 289.1938 and 289.2000. It has a flat top on the SW flank, but is gently inclined on the NE flank.

Between 289.2124 and 289.2157 is another bank. The top is flat (70 ms). Both flanks have terraces at 140ms. At 289.2128, on the SW flank, is the tie with the Sahul Shoals 1 well. Because it is on the edge of the bank, the intersection with the well makes it possible to correlate the Late Miocene horizon at 390 ms with the Top Miocene Unconformity from the well report.

From 289.2250 to 289.2350 the line crosses the SW edge of Warb Bank.

Line 122/04. Starts at 290.0210 and ends at 290.0330. It is oriented NW-SE.

This is a short line to the east of the banks. The Late Miocene horizon is situated between 520 and 580 ms. From 290.0258 to 290.0314 there is an uplifted area bounded by normal faults. A much smaller uplifted area occurs between 290.0325 and 290.0329.

Line 122/05. Starts at 290.0930 and ends at 290.1650, and is oriented NE-SW.
East of the banks, from 290.0930 to 290.1030 the Late Miocene horizon can be seen between 480 and 640 ms. No faults are apparent .

Banks

Warb Bank was crossed from 290.1013 to 290.1210. The top is flat with an erosional area between 290.1030 and 290.1210. Another small bank occurs from 290.1158 to 290.1210.

From 290.1530 to 290.1553 the seismic line crosses the SE edge of a bank at a depth of 160 ms.

Inter-bank

This area starts at 290.1210 and ends at 290.1530, with a very small bank between 290.1358 and 2901404. The Late Miocene horizon is present between 440-500 ms. The first fault area (F5.1) is at 290.1221. There are two normal faults dipping SW. The throw is 80 ms. If the picked Late Miocene horizon in the seismic sections is everywhere the same as the Top Miocene Unconformity in the wells, this significant offset highlights some questions about the neotectonics and fault reactivation in this area. At 290.1318 is the tie of Lines 122/05, 07 and 13 and the Pokolbin 1 well. In this well, the Top Miocene Unconformity was found at 493 m below sea level (528 ms). The Late Miocene horizon was correlated at this depth for all three lines. In Pokolbin 1, the Top Miocene Unconformity separates the Miocene Oliver Formation from the Pliocene Barracouta Formation. Lithologically, it is the separation between Miocene calcarenite with marl and dolomite and Pliocene bioclastic calcarenite. At 290.1224 is the tie of Line 122/05 with Line 97/43. On both lines the Late Miocene horizon was picked at 500 ms. Since on the earlier line this horizon was interpreted as the Top Miocene Unconformity from ties to wells on the shelf, this is another confirmation that the Late Miocene horizon is the equivalent of the Top Miocene Unconformity.

At 290.1310 there are two normal faults (F5.2), dipping SW, with a significant throw of 60 ms. Another normal fault (F5.3) occurs at 290.1320 and is dipping SW with a small throw of 5 ms. At 290.1425 there is another uplifted block (F5.4), bounded by normal faults. The fault zone F5.5 is at 290.1440. This is another upthrown block between normal faults. The throw on these faults is relatively small (15-20 ms), but their frequency suggests the importance of reactivation of older faults as a result of the post-Miocene collision phase.

Between 29015.53 and 290.1650 is another inter-bank area, but there is no indication of faulting here, and the Late Miocene horizon can be seen at a very constant depth of 480 ms.

Line 122/06. Starts at 290.1840 and ends at 290.2120, and it is oriented WSW-ENE. It is situated in an inter-bank area, with the Late Miocene horizon between 440-560 ms. At 290.2047 there is a normal fault dipping ENE.

Line 122/07. Starts at 290.2250 and ends at 291.0540, and is oriented SSW-NNE.

Inter-bank

The first inter-bank area on this line is situated between 290.2250 and 291.0005. The Late Miocene horizon occurs between 500-550 ms. The fault zone F7.1 is at 290.2323, and consists of two faults whose fault planes dip to the south. At the Late Miocene horizon level both are normal faults, but approximately 100 ms beneath this horizon, one of the faults appears to be reversed.

The next area starts at 291.0015 and ends at 291.0137. The Late Miocene horizon occurs between 400-500 ms. At 291.0040 is the tie with Lines 122/05 and13 and Pokolbin 1. As on Line 122/05, the Late Miocene horizon can be correlated with the Top Miocene Unconformity from the well. There are a number of fault zones in this vicinity: The fault zone F7.2 occurs between 291.0035 and 291.0045, and is a downthrown block, bounded by normal faults. In the middle of this small graben there are another two normal, secondary faults. The fault zone F7.3 is situated between 291.0045 and 291.0049. It is a small uplifted area between two normal faults. The throw on these faults is about 80 ms. At 291.0110 there is another normal fault (F7.4), downthrown to the south by about 100 ms.

From 291.0210 to 291.0420 is another inter-bank area. The Late Miocene horizon occurs between 480-550 ms. From 291.0210 to 291.0245 it disappears beneath the first multiple. An uplifted area bounded by normal faults was mapped from 291.0302 and 291.0316.

Banks

From 291.0005 to 291.0015 there is a small bank, with a flat top at 70 ms.

From 291.0138 to 291.0210 there is another bank with a flat top at 70 ms. Immediately beneath the top can be seen an horizon with the aspects of an erosional surface. On this bank is the tie of Line 122/07 with Line 122/03 and Line 97/43. Because the first multiple occurs at 140 ms, and on line 97/43 the Top Miocene Unconformity was interpreted at 330 ms, it is difficult to make the correlation between this unconformity and the Late Miocene horizon.

Berri Bank occurs between 291.0420 and 291.0530. The southern half of the bank has a flat top, whereas the northern half has an erosional surface.

Line 122/08. Starts at 291.0720 and ends at 291.1050, and is oriented NE-SW.

Banks

The line crosses the western edge of Berri Bank from 291.0725 to 291.0820. Its top is an erosional surface with depths between 80-120 ms. Another bank occurs from 291.0918 to 291.1003. Its top has an eroded surface between 70-120 ms

Inter-bank

From 291.0820 to 291.0930 there is an inter-bank region with a small bank at 291.0900.This bank has a sharp top at 180 ms. Because the ties with Lines 122/07 and 122/09 are on the slope of the bank, it was not possible to correlate the Late Miocene horizon.

On the upper slope to the west of the banks, at 291.1003 (the tie with Line 122/09), four unconformities can be seen at 880, 960, 1140 and 1280 ms. A normal fault (F8.2), dipping SW can be seen at 291.1020.

Line 122/09. Starts at 291.1240 and ends at 292.0210, and is oriented approx. W-E.

From 291.1240 to 291.1320 the depth to the sea floor on the upper slope is around 500 ms. The unconformities observed at the end of Line 122/08 can be seen here too, but at this stage is difficult to correlate them

Banks

From 291.1320 to 291.1405 is a large bank with a flat top at 70 ms.

Another small bank is present from 291.1527 to 291.1542, with a flat top at 70 ms.

Inter-bank

Between 291.1405 and 291.1527 there is a wide inter-bank zone. At 291.1520 is the tie with Line 122/07, and the Late Miocene horizon was correlated at 640 ms. This horizon is present between 291.1510 (where it disappears beneath the first multiple) and 291.1.27 (the beginning of another bank).

Between 291.1542 and 291.1850 there is another inter-bank area extending into the Cartier Trough. The ties with Lines 122/01, 03 and 04 are at 291.1620, 291.1707 and 291.1717 respectively. The Late Miocene horizon was correlated from all these lines, and it appears at 680 ms at the tie with Line 122/01, at 640 ms at the tie with Line 122/03 and at 600 ms at the tie with Line 122/04. Between 291.1614 and 291.1647 there is a downthown block bounded by two normal faults (F9.1 and F9.2), with a throw of 40 ms. The normal faults F9.4 and F9.5

occur at 291.1758 and 291.1809 respectively and both are downthrown to the west. The faults F9.6 and F9.7 (at 291.1830 and 291.1840) are normal faults also downthrown to the west. Between faults F9.4 and F9.7 there is an uplifted block. The uplift is more accentuated in the middle of this block between faults F9.5 and F9.6. The total throw across the faults is about 130 ms

On the eastern edge of the Cartier Trough, between 292.0047 and 292.0210, the Late Miocene horizon can be seen at 500 ms and at 400 ms in the inter-bank zone. At 292.0115 there is another small downthrown block bounded by normal faults. At the tie with Line 122/10 (292.0200) there is another normal fault dipping to the west.

Cartier Trough

From 291.1850 to 292.0046 Line 122/09 crosses the Cartier Trough. In the trough the sediments thicken rapidly. The Late Miocene horizon was traced across the trough at depths of between 640 and 800 ms, where it is a distinctive erosional unconformity, with evidence of downlap and onlap along the section. From 291.2100 to 291.2210 the unconformity has a distinctly erosional aspect with a small high between 291.2150 and 291.2210. The tie with Voltaire 1 occurs at 292.0010. At this stage the intersection with the well is not very useful because the well completion report describes only the Base Miocene Unconformity (1180 ms). The normal fault F9.8 occurs at 291.2327 dipping west. The tie with Voltaire 1 is situated in a downthrown block bounded by normal faults (F9.9). At 292.0047 there is another west dipping normal fault, which can be considered to be the structural boundary between Cartier Trough and the Londonderry High.

Line 122/10. Starts at 292.0640 and ends at 292.1110, and it is oriented NE-SW.
This line is situated at the SE edge of the Dillon Shoals Banks, in relatively shallow water, and because of the first multiple, the correlation of the Late Miocene horizon from Line 122/09 is not possible. At 292.0752 is the tie with line 97/52 and Dillon Shoals 1. Again the presence of the first multiple makes correlation difficult. From 292.0830 to 292.0950, above the first multiple (between 200-300 ms TWT), there is evidence of erosion and channelling.

Line 122/11. Starts at 292.1320 and ends at 293.0050, and it is oriented ESE-WNW.

Inter-bank

On the eastern side of the Cartier Trough, between 292.1320 and 292.1405, there is an inter-bank area in relatively shallow water of 100-150m. There is evidence of outbuilding of the upper part of the section on the edge of the shelf. The foresets of this prograding section are

fairly steep. No horizon was mapped on this part of the line, but a very distinctive unconformity can be seen between 300-380 ms.

West of the Cartier Trough, there is an inter-bank zone between 292.2130 and 292.2307. The tie with Line 122/07 is at 292.2207 and the tie with Line 122/01 is at 292.2210. The Late Miocene horizon was correlated with both this lines where it is present between 540 and 580 ms. At 292.2233 it disappears beneath the multiple. Between F11.4 (292.2143) and F11.5 (292.2201) there is a downthrown area bounded by these normal faults.

Banks

Fagin Bank is present on this line from 292.1405 to 292.1442. It has a flat top at a depth of 60-70 ms.

The line crosses Warb Bank between 292.2018 to 292.2140. The bank typically has a flat top situated at 70 ms, but on the eastern edge of the bank, between 292.2030 and 292.2040, there is a depression in the bank surface, with a depth of 100 ms. Another small bank, whose top is at 70 ms, is crossed between 292.2305 and 292.2334

Cartier Trough

From 292.1442 to 292.2020 the seismic line crosses the Cartier Trough. Between 292.1630 and 292.2016 there is a fairly prominent horizon that could be the Late Miocene horizon. On the other side of the trough, it was possible to correlate this horizon with the Late Miocene unconformity at the intersection of this line with Line 122/01 and Line 122/07. The Late Miocene horizon is as deep as 1100 ms in the centre of the trough, rising to 560 ms on its western edge. From 292.1500 to 292.1800 there is an horizon with small channels developed above the Late Miocene horizon. At 292.1818 there is a fault zone (F11.1), bounded by normal faults. Another fault zone (F11.2) occurs at 292.1840 and has some small normal faults. Another zone (F11.3) occurs at 292.1930.

Continental Slope

From 292.2334 to 293.0050 the seismic profile extends down the upper slope of the Timor Trough to the west of the Sahul Banks. What is considered to be the Late Miocene horizon was traced between 740-760 ms. At 293.0000 there is a small downthrown block bounded by normal faults. Another normal fault (F11.8) occurs at 293.0051, whose fault plane dips to the west.

Line 122/12. Starts at 293.0250 and ends at 293.0440, and is oriented NE-SW. This line is situated in relatively deep water on the slope at around 640 ms. The Late Miocene horizon is

considered to be present at about 940 ms. At 293.0324 there is a normal fault whose apparent dip is to the southwest.

Line 122/13. Starts at 293.0950 and ends at 293.1800, and is oriented NW-SE. Except for one small bank, on its western side, the line crosses the wide inter-bank area in the middle of the bank complex. The tie with Line 122/01 occurs at 293.1410, and the tie with Lines 122/05, 122/07 and Pokolbin 1 occurs at 293.1655. The Late Miocene horizon, correlated from Pokolbin 1, was traced between 480-600 ms. From 293.1540 to 293.1606 there is a downthrown block bounded by normal faults. Another downthrown block is present between 293.1640 and 293.1705, where the line intersects Pokolbin 1. Two smaller downthrown areas occur at 293.1735 and 293.1750.

Line 122/14. Starts at 293.1940 and ends at 294.0020, and is oriented NNE-SSW. This line is situated at the southwestern limit of the Cartier Trough. At 293.2051 is the tie with Warb 1. In this well the Top Miocene Unconformity occurs at 715 ms. The Late Miocene horizon, correlated with the well, was traced from 293.1940 to 293.2130 where it disappears beneath the multiple. The horizon occurs between 680 and 880 ms. At 293.2025 there is an uplifted block bounded by normal faults. The fault zone F14.2 is a small downthrown block at 293.1940. Warb 1 is situated (293.2051) on a slightly uplifted block (F14.3).

Line 122/15. Starts at 294.0220 and ends at 294.1550, and is oriented SW-NE down the axis of the Cartier Trough. At 294.1105 is the tie with Line 122/11, and the Late Miocene horizon could be correlated from this tie with both lines. The horizon does appear to represent a distinct unconformity in the trough. At 294.0725 is the tie with line 97/42, but on this line the unconformity was interpreted only as a "late Miocene event" at 1300 ms. From 294.1133 to 294.1255 there is a downthrown block with a relatively small throw. At 294.1320 there is a normal fault with an apparent dip to the south.

Boomer Results

A total of 146.5 n. miles of boomer data were shot in the vicinity of the Sahul Banks using either a modified EG&G Uniboom system (with an ORE-type plate) and a surface towed ORE type boomer with a Benthos 6 element, single channel streamer. Power output for both systems was 350-400 joules. The location of the boomer lines is shown in Figure 4 and the waypoints are listed in Table 8.

Penetration tended to be generally poor in the deeper inter-bank areas, while across the banks most reflections were only imaged above the first seafloor multiple. The following summary is divided into bank-top and inter-bank categories for convenience.

Table 8. Boomer Waypoints

Waypoint	Latitude	Longitude	Line Number	Distance (n.m.)
B1	11° 07.0'S	124° 36.2'E	SOL Line 122/16	4.1
B2	11° 10.2'	124° 35.9'	EOL Line 122/16	
B2	11° 10.2'	124° 35.9'	SOL Line 122/17	13.9
B3	11° 24.3'	124° 31.0'	EOL Line 122/17	
B3	11° 24.3'	124° 31.0'	SOL Line 122/18	6.0
B4	11° 25.2'	124° 36.5	EOL Line 122/18	
B4	11° 25.2'	124° 36.5	SOL Line 122/19	4.1
B5	11° 22.8'	124° 39.8'	EOL Line 122/19	
B5	11° 22.8'	124° 39.8'	SOL Line 122/20	7.9
B6	11° 14.9'	124° 42.0'	EOL Line 122/20	
B6	11° 14.9'	124° 42.0'	SOL Line 122/21	13.7
B7	11° 16.1'	124° 27.8'	EOL Line 122/21	
B7	11° 16.1'	124° 27.8'	SOL Line 122/22	4.1
B8	11° 19.1'	124° 25.2'	EOL Line 122/22	
B8	11° 19.1'	124° 25.2'	SOL Line 122/23	21.3
B9	11° 22.6'	124° 46.8'	EOL Line 122/23	
B9	11° 22.6'	124° 46.8'	SOL Line 122/24	3.4
B10	11° 19.2'	124° 46.9'	EOL Line 122/24	
B10	11° 19.2'	124° 46.9'	SOL Line 122/25	18.8
B11	11° 17.2'	124° 27.5'	EOL Line 122/25	
B12	11° 24.8'S	124° 19.6'E	SOL Line 122/26	3.9
B13	11° 27.9'	124° 17.9'	EOL Line 122/26	
B13	11° 27.9'	124° 17.9'	SOL Line 122/27	10.2
B14	11° 36.3'	124° 11.2'	EOL Line 122/27	
B14	11° 36.3'	124° 11.2'	SOL Line 122/28	14.9
B15	11° 27.8'	124°23.2'	EOL Line 122/28	
B15	11° 27.8'	124°23.2'	SOL Line 122/29	7.9
B16	11° 35.2'	124° 24.6'	EOL Line 122/29	
B16	11° 35.2'	124° 24.6'	SOL Line 122/30	7.2
B17	11° 31.1'	124° 18.5'	EOL Line 122/30	
B17	11° 31.1'	124° 18.5'	SOL Line 122/31	5.1
B18	11° 26.5'	124° 16.1'	EOL Line 122/31	

Banks

A series of crossings of several banks shows that water depths range from 23-30 m across their tops. While, in general, the bank tops are flat and smooth, some gentle undulations are apparent, as well as broad gullies of the order of 10 m deep. Another noticeable feature is that some banks, or parts of banks, are slightly raised at their edges. For example, on Line 122/20, Warb Bank is some 30 m deep in the centre, but it rises to 24 m at the edge.

Above the first multiple, it could be seen that most reflections are parallel, indicative of an aggradational style of accumulation, and are planar to slightly undulating. In places, some of the reflections could be described as hummocky, with a wave length of 400-900 m. Cut-and-fill structures can also be detected in the very shallow subsurface, with infill of up to 8 m of sediment.

In most lines across the tops of the banks, it is apparent that there is a subtle erosional unconformity at a depth of about 7.5-15 m below the bank top. This unconformity varies in its reflection character; from a strong reflector, showing a marked disconformable geometry, to a weak conformable horizon. This variability makes it difficult to trace the unconformity across the entire top of the bank. On the basis of its depth, and that it is the uppermost unconformity, it is assumed that it represents the Holocene/Pleistocene boundary. Another, more marked, unconformity was observed beneath three of the banks on Line 122/28. This unconformity occurs at a depth of about 50 ms (≈40 m) below the top of the banks. This unconformity is not as prominent in the other lines, presumably because of the multiple, but it was observed in places. The age of this unconformity is unknown.

Beneath the edge of the banks there is often a thinning of the sediment blanket where the unconformity appears to rise slightly, similar to some of the present bank-edge topography. On the sides of the banks, the seafloor is generally too steep to detect any coherent reflections. In places on the upper slope, where there is a narrow ledge, usually about 100 m water depth, there is some reasonably good subsurface information. On the upper slope of Warb Bank, Line 122/25 shows the following features:

(i) horizons cropping out on the slope

(ii) at least two unconformities in the shallow subsurface

(ii) draping of Holocene (?) sediment across the brow of the bank.

Some build up of a wedge of sediment can usually be observed at the base of the banks, and there is often evidence of slumped material surrounding the base.

Inter-bank

Despite the generally poor penetration by the boomer in the inter-bank areas, it was possible to observe some features in the shallow subsurface. There is often a shallow unconformity in the immediate subsurface, usually at a depth of 0-60 ms beneath the sea floor. This unconformity is distinctly erosional in character, and has relief of the order of 10-30 ms. In one or two lines, the unconformity tends to deepen as it approaches the base of a bank. Horizons above the unconformity are mainly conformable with the sea floor.

It is possible to detect areas of hardground development in the inter-bank areas by the amount of ringing, particularly in the multichannel seismic records where virtually no penetration occurs in such places. From the boomer records it is possible to discern that the hardgrounds occur where the shallow unconformity is exposed on the sea floor.

Sparker Results

A total of 725 km of sparker data was shot during the survey. The majority of this data was acquired in the area of the Lambert Shelf Valley. However, two lines were shot over parts of previous multichannel and boomer lines in the area of the Sahul Banks (Fig. 4; Table 9). Those parts of the lines over the banks do not show as much detail as the boomer lines; the uppermost unconformity being barely discernible. However, in the inter-bank areas the sparker gives better penetration; of the order of 100-200 ms penetration.

Table 9. Sparker Waypoints - Sahul Banks

Waypoint	Latitude	Longitude	Line Number
S1	11°33.050	124°33.160	SOL 122/32
S2	11°20.503	124°34.394	EOL122/32
S2	11°20.503	124°34.394	SOL 122/33
S3	11°23.804	124°55.484	EOL 122/33

The part of Line 122/33 to the east of Warb Bank shows a prominent unconformity at a depth of 70-160 ms beneath the sea floor. The attitude of this unconformity is relatively parallel, whereas the wedge of sediments above tend to downlap onto it. Along the western edge of the Cartier Trough the unconformity appears to be disrupted by faults with a small amount of throw (10 ms). Faulting appears to stop at this level. Towards the centre of the trough the unconformity is less disrupted, and it begins to deepen into the trough.

A series of sparker lines were acquired both along and across the Lambert Shelf Valley in order to determine the origin of this unusual feature (Fig. 5; Table 10). The initial sparker lines were shot with a three electrode sparker, using a 1000 joule power supply. The later lines were shot with a multi-electrode sparker using a 500 joule power supply.

Table 10. Sparker Waypoints - Lambert Shelf Valley

Waypoint	Latitude	Longitude	Line Number	Distance (n.m.)
S1	10° 39.4'S	126° 05.00'E	SOL Line 122/34	9.10
S2	10° 47.55'	126° 09.65'	EOL Line 122/34	
S2	10° 47.55'	126° 09.65'	SOL Line 122/35	3.50
S3	10° 50.50'	126°10.40'	EOL Line 122/35	
S3	10° 50.50'	126° 10.40'	SOL Line 122/36	15.80
S4	11° 06.24'	126° 17.55'	EOL Line 122/36	
S4	11° 06.24'	126° 17.55'	SOL Line 122/37	6.90
S5	11° 12.90'	126° 16.45'	EOL Line 122/37	
S5	11° 12.90'	126° 16.45'	SOL Line 122/38	11.50
S6	11° 20.45'	126° 25.40'	EOL Line 122/38	
S7	11° 21.40'	126° 24.50'	SOL Line 122/39	7.30
S8	11° 26.00'	126° 30.00'	EOL Line 122/39	
S8	11° 26.00'	126° 30.00'	SOL Line 122/40	2.30
S9	11° 28.00'	126° 31.10'	EOL Line 122/40	
S9	11° 28.00'	126° 31.10'	SOL Line 122/41	4.60
S10	11° 30.00'	126° 35.22'	EOL Line 122/41	
S11	11° 28.20'	126° 40.00'	SOL Line 122/42	8.60
S12	11° 34.1'	126° 33.6'	EOL Line 122/42	
S12	11° 34.1'	126° 33.6'	SOL Line 122/43	4.00
S13	11° 30.7'	126° 31.2'	EOL Line 122/43	
S13	11° 30.7'	126° 31.2'	SOL Line 122/44	8.00
S14	11° 23.3'	126°34.3'	EOL Line 122/44	
S15	11° 23.8'	126° 34.7'	SOL Line 122/45	10.30
S16	11° 29.2'	126° 25.8'	EOL Line 122/45	
S16	11° 29.2'	126° 25.8'	SOL Line 122/46	2.70
S17	11° 27.1'	126° 24.2'	EOL Line 122/46	
S17	11° 27.1'	126° 24.2'	SOL Line 122/47	8.80
S18	11° 22.0'	126° 31.2'	EOL Line 122/47	
S18	11° 22.0'	126° 31.2'	SOL Line 122/48	3.20
S19	11° 19.3'	126° 29.6	EOL Line 122/48	
S19	11° 19.3'	126° 29.6	SOL Line 122/49	9.50
S20	11° 24.8'	126° 21.6'	EOL Line 122/49	
S20	11° 24.8'	126° 21.6'	SOL Line 122/50	2.90
S21	11° 22.2'	126° 20.4'	EOL Line 122/50	
S21	11° 22.2'	126° 20.4'	SOL Line 122/51	9.20
S22	11° 17.5'	126° 28.3'	EOL Line 122/51	
S22	11° 17.5'	126° 28.3'	SOL Line 122/52	3.60
S23	11° 14.6'	126° 26.7'	EOL Line 122/52	
S23	11° 14.6'	126° 26.7'	SOL Line 122/53	10.40
S24	11° 19.2'	126° 17.1'	EOL Line 122/53	
S24	11° 19.2'	126° 17.1'	SOL Line 122/54	4.40
S25	11° 15.5'	126° 14.9'	EOL Line 122/54	
S25	11° 15.5'	126° 14.9'	SOL Line 122/55	9.30
S26	11° 10.4'	126° 22.9'	EOL Line 122/55	
S26	11° 10.4'	126° 22.9'	SOL Line 122/56	3.00
S27	11° 07.5'	126° 22.9'	EOL Line 122/56	
S27	11° 07.5'	126° 22.9'	SOL Line 122/57	8.20
S28	11° 06.7'	126° 14.4'	EOL Line 122/57	
S28	11° 06.7'	126° 14.4'	SOL Line 122/58	7.50
S29	11° 01.8'	126° 19.8'	EOL Line 122/58	
S29	11° 01.8'	126° 19.8'	SOL Line 122/59	10.60
S30	11° 01.5'	126° 10.1'	EOL Line 122/59	
S30	11° 01.5'	126° 10.1'	SOL Line 122/60	8.40
S31	10° 57.6'	126° 17.8'	EOL Line 122/60	

Waypoint	Latitude	Longitude	Line Number	Distance (n.m.)
S31	10° 57.6'	126° 17.8'	SOL Line 122/61	3.10
S32	10° 55.0'	126° 15.9'	EOL Line 122/61	
S32	10° 55.0'	126° 15.9'	SOL Line 122/62	10.40
S33	10° 59.8'	126° 06.2'	EOL Line 122/62	
S33	10° 59.8'	126° 06.2'	SOL Line 122/63	3.60
S34	10° 57.8'	126° 03.1'	EOL Line 122/63	
S34	10° 57.8'	126° 03.1'	SOL Line 122/64	12.70
S35	10° 52.2'	126° 14.8'	EOL Line 122/64	
S35	10° 52.2'	126° 14.8'	SOL Line 122/65	4.00
S36	10° 48.8'	126° 12.4'	EOL Line 122/65	
S36	10° 48.8'	126° 12.4'	SOL Line 122/66	6.20
S37	10° 51.7'	126° 07.0'	EOL Line 122/66	
S37	10° 51.7'	126° 07.0'	SOL Line 122/67	2.50
S38	10° 49.4'	126° 05.9'	EOL Line 122/67	
S38	10° 49.4'	126° 05.9'	SOL Line 122/68	5.80
S39	10° 46.8'	126° 11.2'	EOL Line 122/68	
S40	10° 47.7'	126° 11.3'	SOL Line 122/69	11.20
S41	10° 43.2'	126° 00.9'	EOL Line 122/69	
S41	10° 43.2'	126° 00.9'	SOL Line 122/70	4.60
S42	10° 38.4'	126° 00.8'	EOL Line 122/70	
S43	11°32.0	126°40.5	SOL Line 122/71	5.00
S44	11°35.5	126°36.7	EOL Line 122/71	
S44	11°35.5	126°36.7	SOL Line 122/72	3.90
S45	11°36.9	126°40.5	EOL Line 122/72	
S45	11°36.9	126°40.5	SOL Line 122/73	4.10
S46	11°33.4	126°42.5	EOL Line 122/73	
S46	11°33.4	126°42.5	SOL Line 122/74	3.10
S47	11°35.1	126°45.2	EOL Line 122/74	
S47	11°35.1	126°45.2	SOL Line 122/75	5.40
S48	11°39.5	126°42.0	EOL Line 122/75	
S48	11°39.5	126°42.0	SOL Line 122/76	2.60
S49	11°42.0	126°42.3	EOL Line 122/76	
S49	11°42.0	126°42.3	SOL Line 122/77	7.00
S50	11°37.5	126°47.6	EOL Line 122/77	
S50	11°37.5	126°47.6	SOL Line 122/78	4.50
S51	11°40.6	126°51.0	EOL Line 122/78	
S51	11°40.6	126°51.0	SOL Line 122/79	10.50
S52	11°47.5	126°42.8	EOL Line 122/79	
S52	11°47.5	126°42.8	SOL Line 122/80	4.60
S53	11°50.8	126°46.1	EOL Line 122/80	
S53	11°50.8	126°46.1	SOL Line 122/81	9.70
S54	11°44.3	126°53.6	EOL Line 122/81	
S54	11°44.3	126°53.6	SOL Line 122/82	4.70
S55	11°48.5	126°56.0	EOL Line 122/82	
S55	11°48.5	126°56.0	SOL Line 122/83	6.50
S56	11°53.5	126°51.8	EOL Line 122/83	
S56	11°53.5	126°51.8	SOL Line 122/84	3.60
S57	11°51.9	126°55.0	EOL Line 122/84	
S57	11°51.9	126°55.0	SOL Line 122/85	9.90
S58	11°44.5	126°49.4	EOL Line 122/85	
S58	11°44.5	126°49.4	SOL Line 122/86	8.80
S59	11°37.2	126°44.8	EOL Line 122/86	
S59	11°37.2	126°44.8	SOL Line 122/87	4.50
S60	11°34.8	126°40.1	EOL Line 122/87	
S60	11°34.8	126°40.1	SOL Line 122/88	5.40
S61	11°30.0	126°35.22	EOL Line 122/88	

The data from the Lambert Shelf Valley show that there is very little build up of sediment on the shelf on either side of the valley, whereas in the valley itself there is a thick fill of sediment whose depositional geometry shows variation of the depositional axis with time. In places, the fill geometry is quite complex, and most of this data awaits more careful analysis. The area of the shelf and slope in front of the Lambert Shelf Valley also shows a fairly complex relationship between valley deposition, outer shelf progradation and upper slope bank development.

SAMPLING RESULTS

Surface Sediments

Banks

Three of the banks were sampled in detail, two banks: Warb Bank and Pollard Bank, on the western side of the Cartier Trough, and Fagin Bank on the eastern side (Fig 6). The tops of the banks are dominated by gravel-size sediments, consisting of abundant segments of various species of the green alga *Halimeda*, plus a variety of skeletal elements that include solitary corals (*Fungia* sp), larger benthic foraminifera, coralline algae and bryozoans (Appendix 6). Associated with this exclusively calcareous sediment is an abundant living flora consisting of soft green algae (seagrass) and calcareous algae, as seen in many of the underwater photographs (Appendix 5).

There appear to be gradations in grainsize across the larger banks, such as Warb Bank, whereas this does not appear to be the case on the smaller banks. On Warb Bank the gradient is from southeast to northwest. The eastern and southern edges of the bank are dominated by sandy gravel, with *Halimeda* being the dominant constituent, but corals (including genera such as *Goniastrea*, *Pocillopora* and *Seriatopora*) are present, along with coralline algal encrusted fragments. This does seem to be related to bathymetry, with the slightly raised rim, as observed in the boomer sections, containing more *in situ* coarse material, whereas medium to fine sand is present at the bottom of a prominent depression (67 m) on this eastern side of the bank. The central part of the bank is dominated by a gravelly sand which is *Halimeda*-rich, but most of the skeletal material has fragmented. Much of the west and northern parts of the bank are dominated by medium to coarse sand with only small amounts of gravel. However, *Halimeda* is still dominant even though it has been largely broken down to sand-size frgments.

Inter-Bank

The areas of sea floor between the banks are mainly mantled by carbonate sands with small (<15%), but varying amounts of gravel. Sediments near the pedestals of the banks tend to be

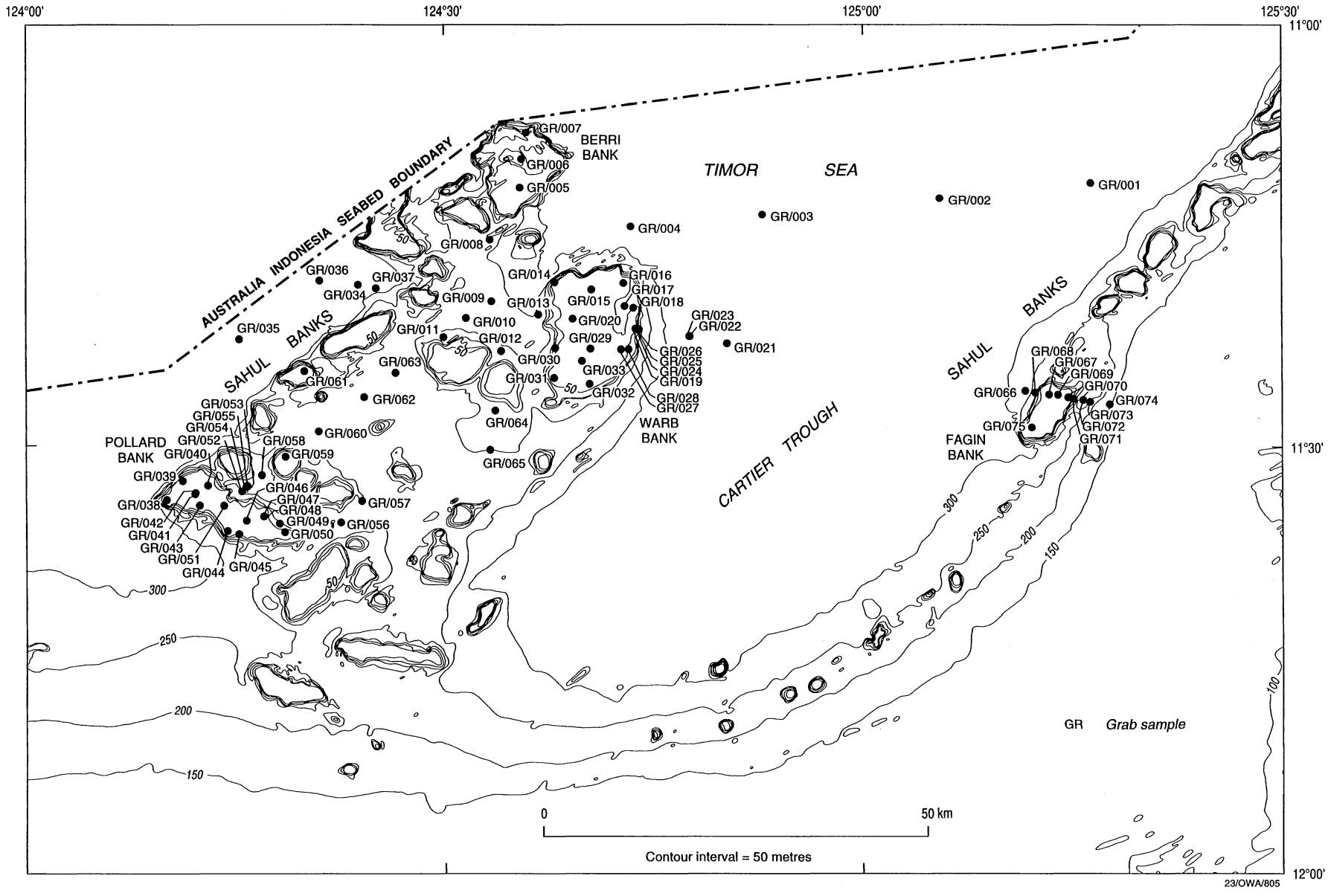


Figure 6. Location of grab samples in the Sahul Banks and Cartier Trough region

coarser, but this is not necessarily so in every case. Overall, the inter-bank sediments can be classified as fine to coarse sands consisting mainly of comminuted skeletal material. Recognisable skeletal elements include *Halimeda*, large benthic forams, small benthic forams, planktonic forams (in places) and pteropods. Much of the finer comminuted skeletal material, along with the *Halimeda* and large benthic forams, are considered to be derived from the banks, whereas the smaller forams and pteropods are derived off the banks. Some glauconite is present in sediments from the central inter-bank area.

Lambert Shelf Valley

A series of grab sampling stations (122/GR/076-095; Appendix 4) were occupied on the upper slope and outer shelf in front of the Lambert Shelf Valley (Fig. 7). The sediments consist of olive to olive grey muddy sands and sandy muds with smaller amounts of gravel. The coarse fraction consists of abraded skeletal material, plus benthic and planktonic forams, and pteropods. In some samples there appear to be 'relict' grains, consisting of brownish cemented limestone fragments. On the upper slope there is some indication of friably cemented mudstone clasts that may be slump material or represent *in situ* cementation. One sample (122/GR/079), from the top of a small bank on the upper slope, is a gravel, typically dominated by *Halimeda* and large benthic forams, with some coarse coral fragments.

Dredge Results

Twenty two dredge sites were occupied during the survey, twelve of which successfully recovered material that is considered to be outcrop. The material recovered in the dredges is described in more detail in Appendix 7. Dredges 122/DR001 to 004 were from the northern edge of Berri Bank (Fig. 9). Collectively, these recovered some 200 Kg of rock, consisting of *Halimeda* grainstone/rudstone, corals (including many coral heads), algal boundstones and rhodoliths. The rocks are friably to well cemented, and many have the appearance of reef rock. The other dredge samples from the sides of the other banks, both on the western and eastern edges of the Cartier Trough, contain similar material, with varying degrees of lithification.

The dredge material is very different from the grab samples from the bank tops because, despite the abundance of *Halimeda* in both, the dredge material contained more abundant corals, in particular largish coral heads such as *Porities* and *Goniopora* sp, as well as abundant evidence of reef framework construction. This suggests that at an earlier stage of bank development, there was a substantial amount of reef growth involved, at least around the perimeter of the banks. This style of growth is absent in the modern banks.

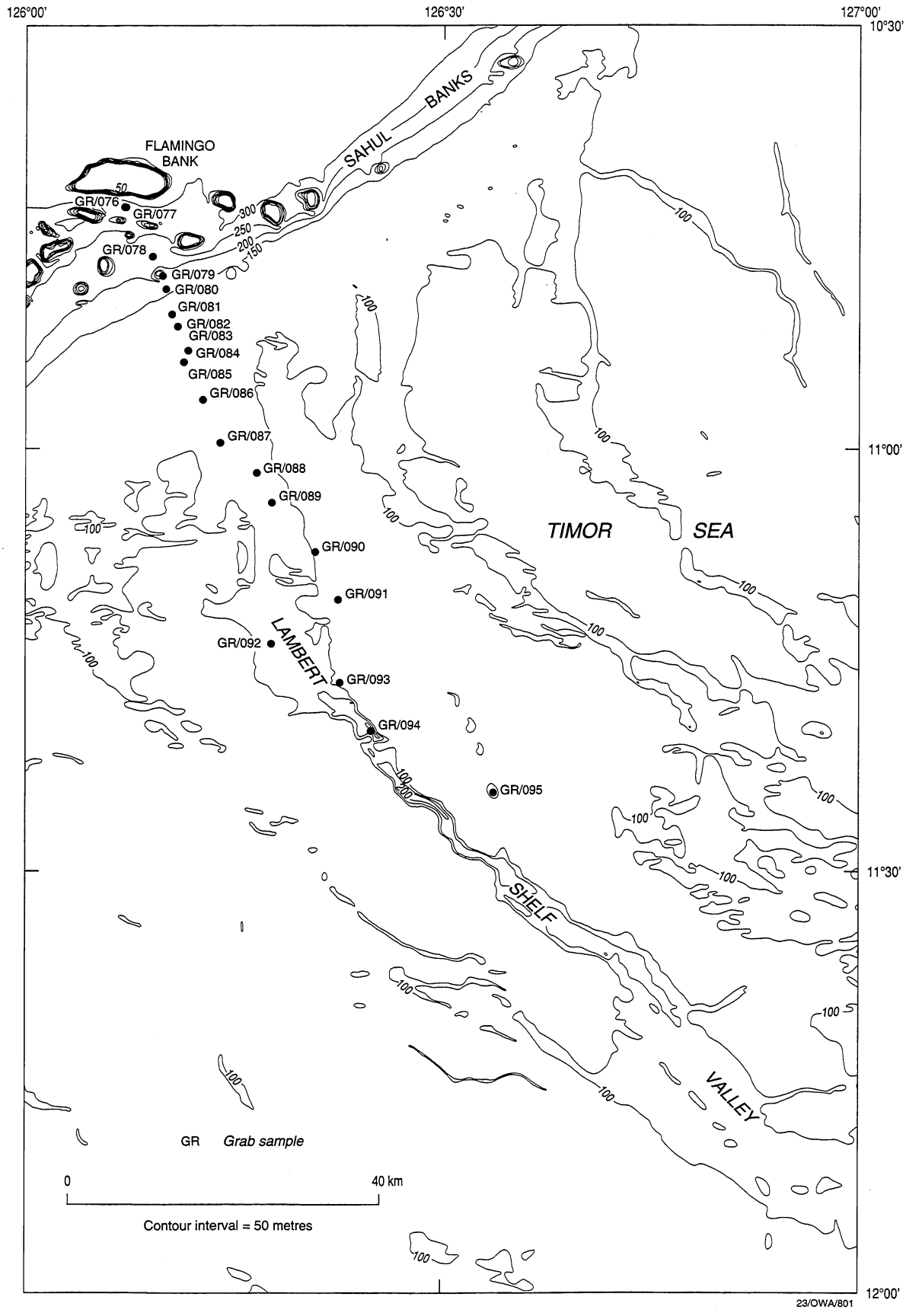


Figure 7. Location of grab samples in the region of the Lambert Shelf Valley

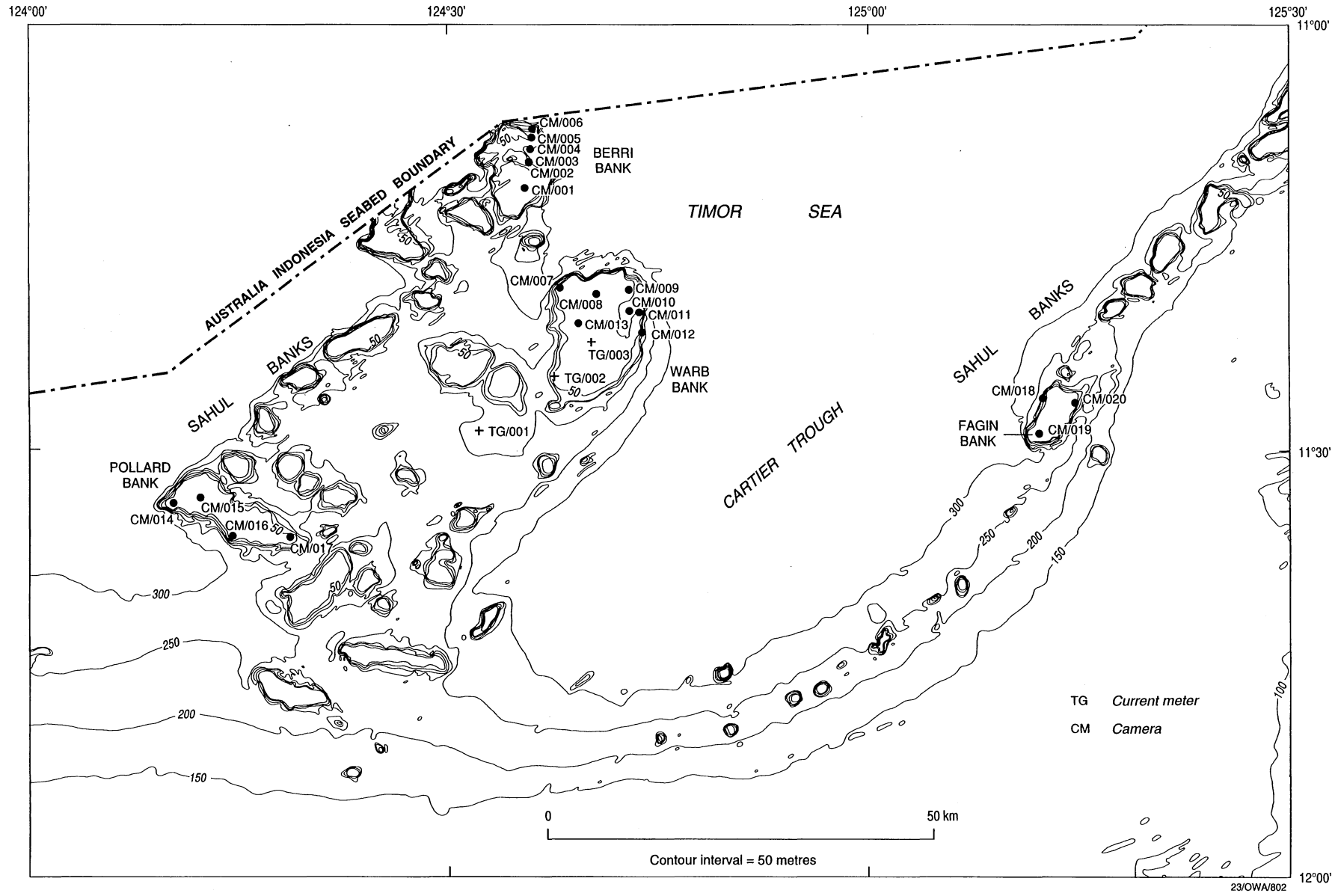


Figure 8. Location of camera and current meter stations in the Sahul Banks region

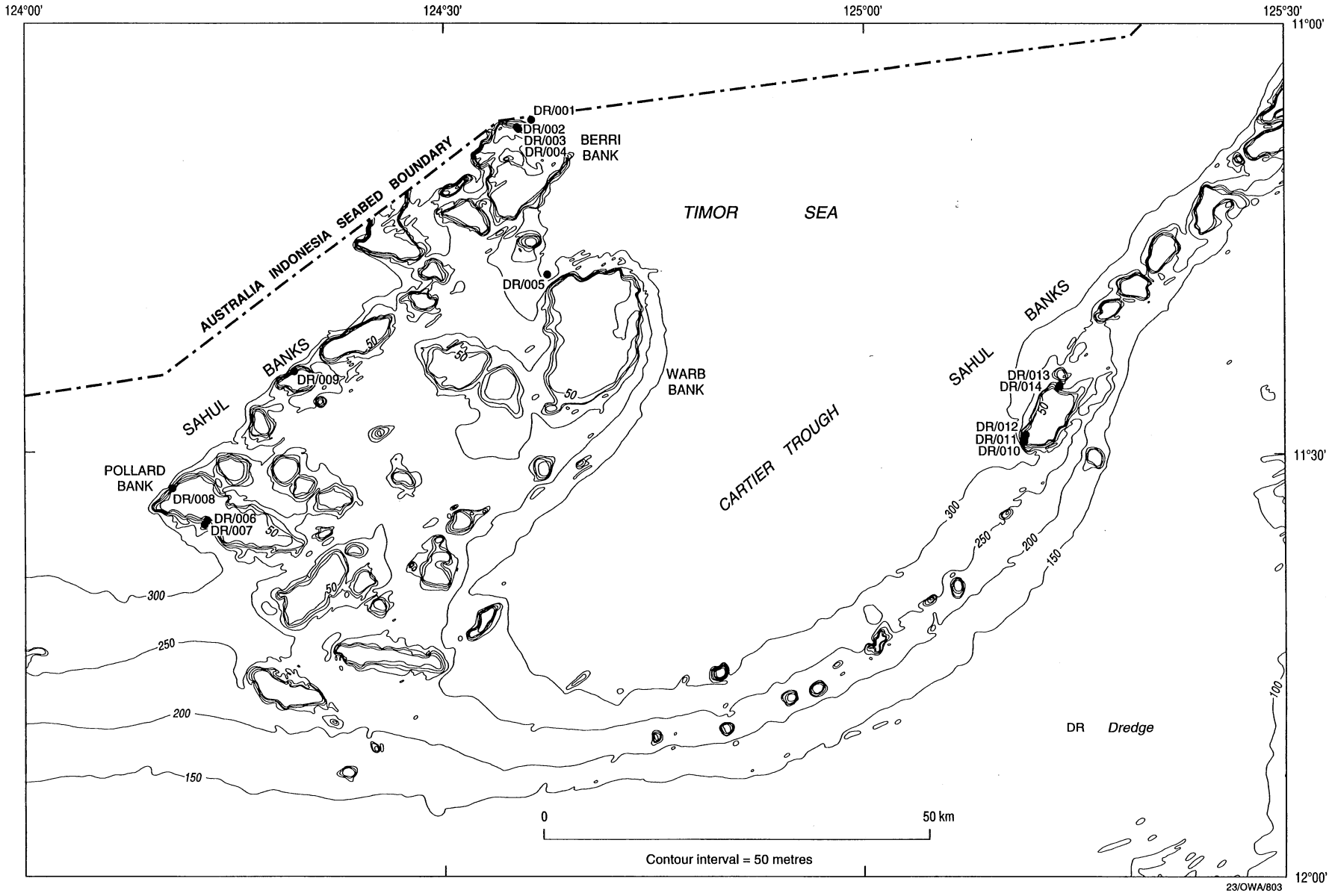


Figure 9. Location of dredge sampling stations in the Sahul Banks region

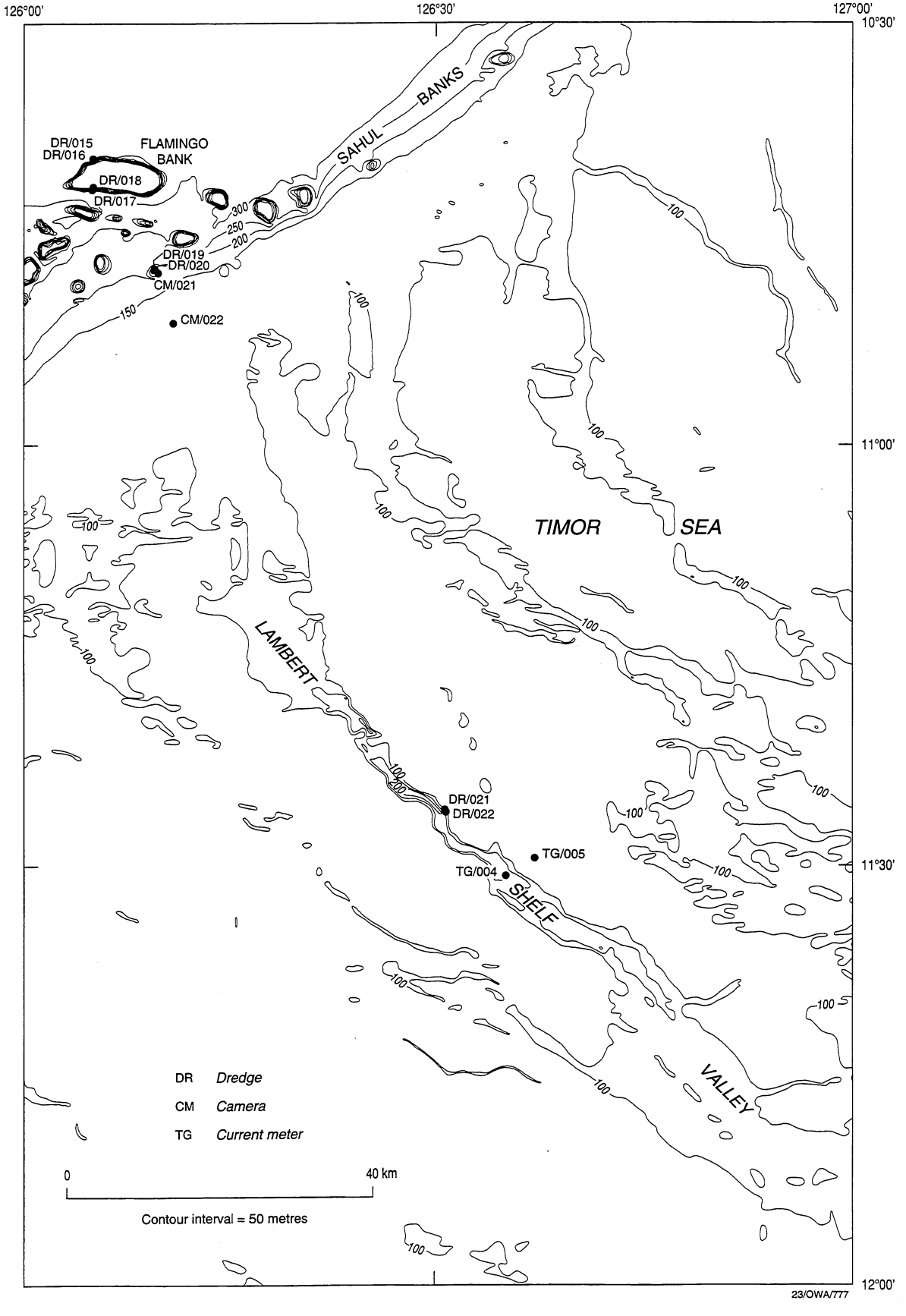


Figure 10. Location of dredge, camera and current meter stations in the region of the Lambert Shelf Valley

Sediment Cores

Three palaeomagnetic core, 43 gravity core and 31 vibrocore stations were occupied during the survey. In total, some 211 m of core were collected during the survey, averaging around 2.75 m per station. Core recovery varied between 0 and 8.6 m, with recovery somewhat higher from gravity cores which were taken in deeper water than the vibrocores (see Appendix 4). Logs of most cores are illustrated in Appendix 9.

Cartier Trough

Three palaeomagnetic cores were taken in the Trough (Fig. 11), but susceptibility values were extremely low, with some negative values indicating diamagnetic conditions. Most of the cores in the trough consist of olive grey muds and sandy muds, with some intercalated coarser layers. Contacts can be either sharp or gradational, with some bioturbation evident in places. Cores close to the edges of the trough contain a higher proportion of sandy material, sometimes with thin lenses of what appear to be shallow water (i.e. bank top) material.

Bank and Inter-Bank

Only two cores were taken from the top of the banks (122/VC/001 & 002; Fig. 11), and these had relatively low recovery. Some sort of fining-upward sequence was observed in 122/VC/002 (Appendix 9), but this could have been a result of the vibration from the corer. The core was graded from gravel to fine sand, with the gravel fraction consisting of large benthic forams, *Halimeda* segments, coralline algal fragments and bryozoans.

Cores near the banks are mainly sandy, but with some gravel layers either at the base or at the top of the core. Both fining-upward and coarsening-upward cycles are apparent in these cores, the former being more common. Often these cores were stopped by a gravel layer of bivalves, corals and carbonate rock fragments. These layers are obviously bank-derived debris flow material, but it is considered that a large proportion of the sand fraction in these cores is also allochthonous.

Those cores from more remote inter-bank locations (e.g. 122/VC/015-017; Fig. 11) are composed of fine to medium sand-size material, including pteropods and planktonic forams. A minor amount of glauconite is also present in these cores. Some well-cemented grainstone clasts occur in places. At this stage it is not obvious whether they represent bank-derived material or *in-situ* cementation.

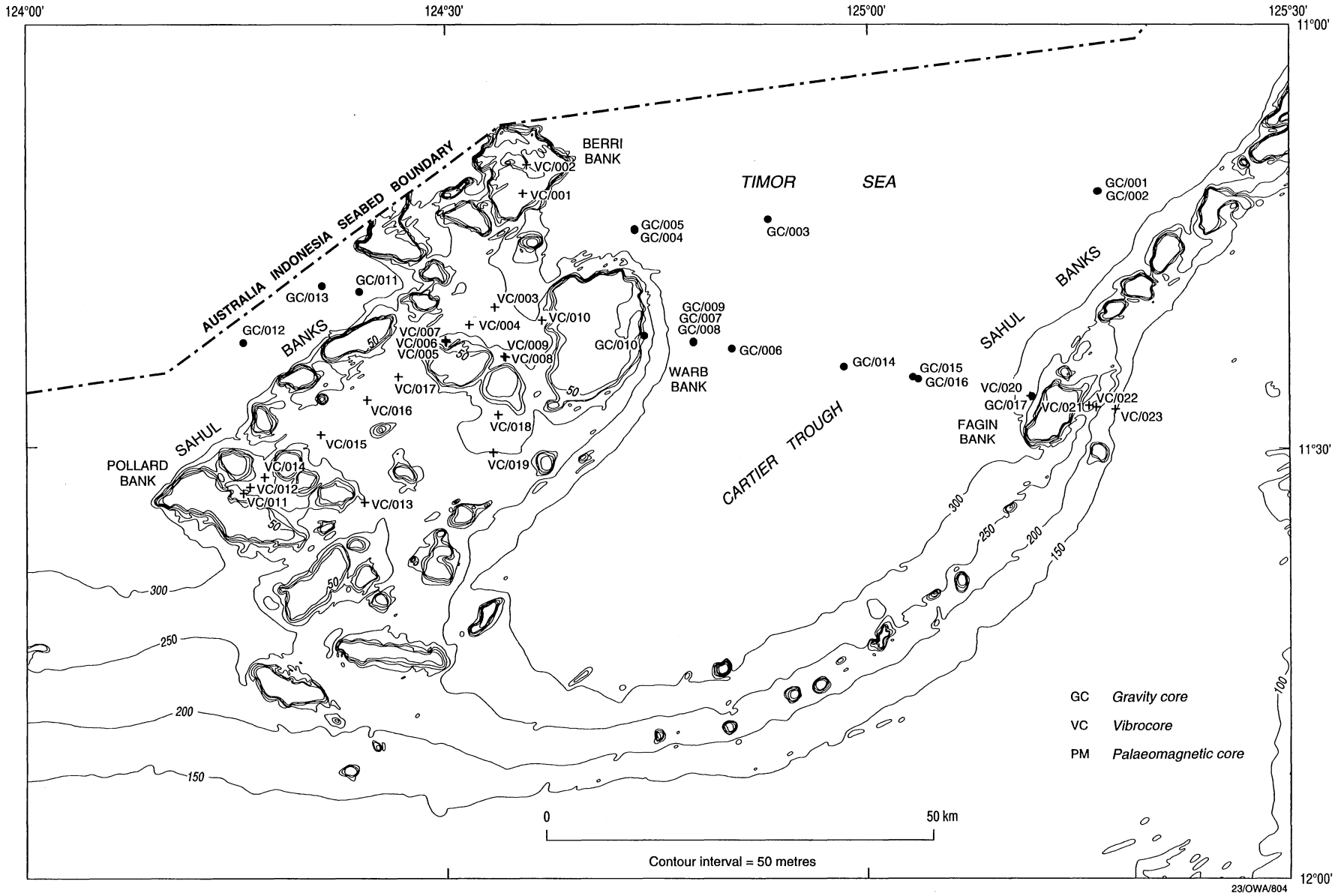


Figure 11. Location of gravity cores, vibrocores and palaeomagnetic cores in the Sahul Banks region

Lambert Shelf Valley

Cores from the slope in front of the valley are predominantly fine grained (mud to sandy mud) and, except for some burrows, are fairly featureless. On the outer shelf, a series of cores along the thalweg of the valley (122/GC/023-26; 122/VC/025-29; Fig. 12) shows a remarkably uniform sequence of olive grey muddy sand to fine sand overlying a greenish grey mud (Appendix 9). The upper sandy section tends to be fairly homogeneous and varies from about 0.5 to 2.2 m in thickness. Both fining-upward and -downward sequences are apparent, and there is a lag carbonate gravel deposit at the base of this unit in several cores. The underlying muddy unit is fairly homogeneous; there are some sandier layers or lenses in places, mainly fine shelly fragments with one or two coarser shelly layers. In only one core (122/VC/028; Appendix 9) was the unit below this mud layer (at least 4 m thick in places) penetrated. In this core the lowest unit consists of muddy sandy gravel, the coarse fraction consisting of shells and shell fragments.

On the inner part of the outer shelf, just before the valley begins to narrow and deepen, the cores there show a reasonably uniform fining upward sequence of sandy mud (122/GC/027-30; 122/VC/030-31; Appendix 9). In the deep, incised part of the valley itself, there is a remarkably uniform, almost featureless sequence of greenish to greenish grey mud, with only rare shell fragments or whole shells.

CONCLUSIONS

Cruise 122 was the first geological cruise to be conducted in this area since the Scripps' cruises in 1960 and 1961 (van Andel and Veevers, 1967). While these earlier cruises concentrated on the surface sediment distribution over the entire Sahul Shelf, the present cruise was focussed on a much smaller area, in order to address specific questions, and made use of more sophisticated geological techniques that were not available to earlier expeditions. In particular, this cruise was the first to use a GI gun array for high resolution multichannel seismic reflection work. Previously, in this area and elsewhere, we had used either a single water gun or water gun array (5 guns). Processing of the multichannel water gun data has proved to be difficult, and generally ended up with a fairly poor result. The minimum phase signal of the GI gun, coupled with the suppression of the bubble pulse, produces a much sharper signal that is more amenable to high resolution multichannel seismic reflection profiling. Subsequent processing of the data has also shown a superior product.

The resultant seismic data have displayed the Tertiary sequence at a much greater resolution than has been achieved previously, not only in the area of the carbonate banks, but also in the Cartier Trough. Preliminary processed data have indicated the presence of buried carbonate

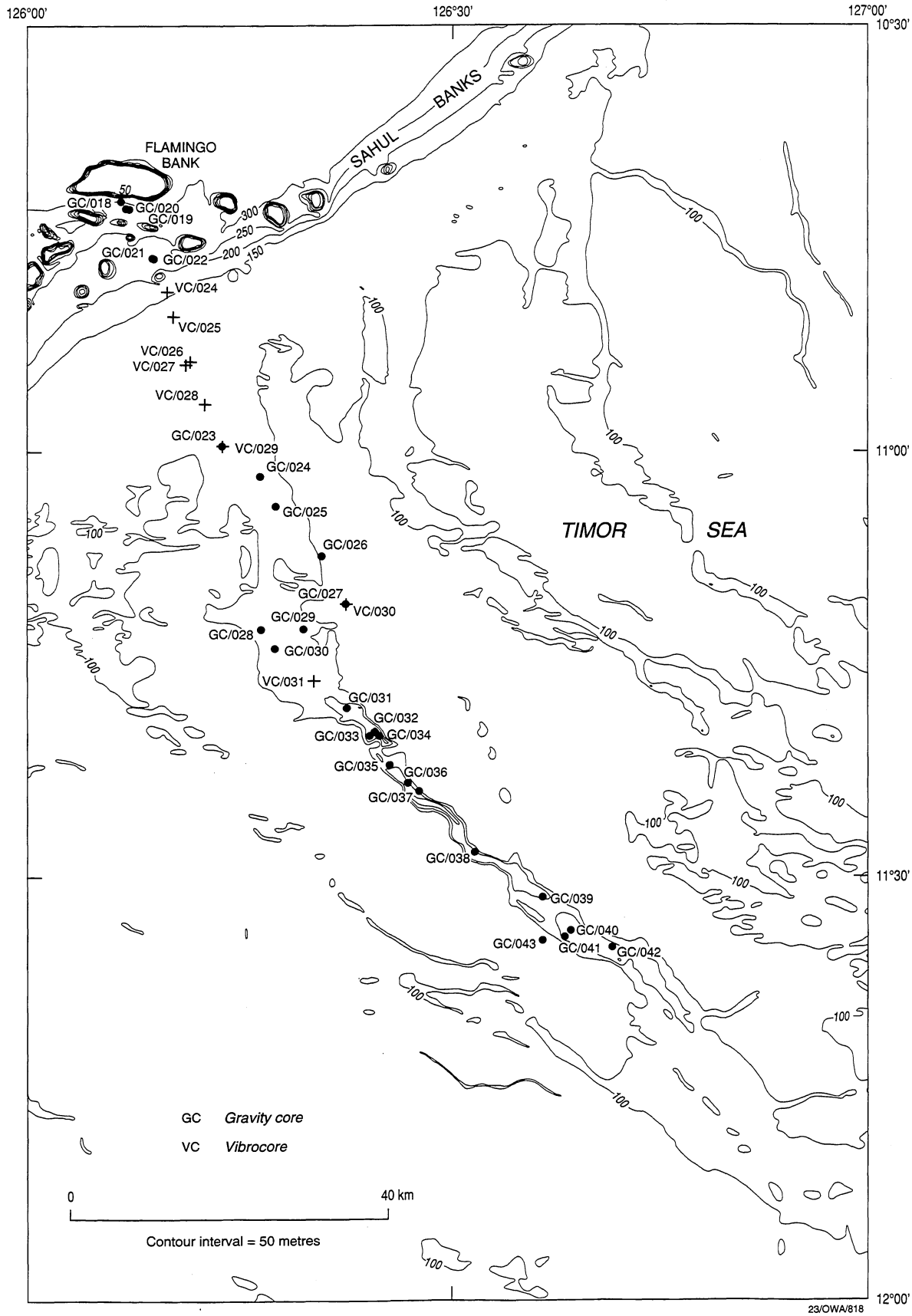


Figure 12. Location of gravity cores and vibrocores in the region of the Lambert Shelf Valley

banks in one or two places, and they also clearly show subtle onlapping and downlapping sequences that would not be readily resolved in conventional seismic data. The high resolution data have enhanced the fault geometry in the upper part of the section. These faults are the result of reactivation of the post-breakup sequence, whereby earlier (breakup and pre-breakup) faults have been extended into the Tertiary section. Fault analysis of these reactivated segments remains to be undertaken, but the high resolution of the fault planes and offsets will hopefully produce an unequivocal tectonic interpretation.

On the monitor sections it was possible to observe that in the Cartier Trough these reactivated faults did not reach the seafloor, but terminated about 100-200 ms beneath. This could suggest that, unlike the Londonderry High where the faulting has reached the seafloor and often only residual oil is found, some hydrocarbons could have been trapped in the post-breakup section.

Sampling of the carbonate banks has indicated that a vast "carbonate factory" exists along the edge of the Sahul Shelf, and that this factory is dominated by *Halimeda*. From grab samples and camera stations, it is apparent that the banks are covered mainly by macro algae, which in places produces a low, lush vegetation. This vegetation also attracts an epibenthic fauna such as foraminifera and bryozoans. Corals are mainly restricted to solitary forms, such as *Fungia* sp. Where other corals are present, they tend to be delicate branching forms like *Seriatopora* sp. This imbalance in carbonate production, whereby *Halimeda* dominates over hermatypic corals has not been well documented for shelf seas. *Halimeda* bioherms or banks have been described from the Great Barrier Reef and elsewhere (e.g. Marshall and Davies, 1988; Roberts and others, 1988), but these exist in areas that can still be considered as coral-reef dominated.

Dredging the sides of the banks recovered large quantities of corals and reef rock, as well as *Halimeda*-rich grainstones. While the age of this material is unknown at present, it does suggest that at an earlier phase of bank development there was a more mixed assemblage of corals and *Halimeda* than there is today; at least around the margins of the banks. The presence of well-cemented reef rock, consisting of fragments of corals, coralline algae (sometimes as rhodoliths), *Halimeda*, echinoids and large benthic forams in a cemented sand- and silt-size matrix, is indicative of framework construction at an earlier phase of the banks' development. However, the seismic sections show a series of well bedded, aggradational sequences building the majority of the banks' interior. This suggests that in the past, while there may have been some vertical framework construction around the edges of the banks, the main part of the bank was being built up by non-framework carbonates, presumably *Halimeda* etc, much as is occurring at the present time. The framework-dominated edge facies may have acted as a "bucket" (Schlager, 1981), whereby the competent rim contained and constrained the incompetent lagoonal deposit. However, there do appear to be several profound differences between the banks and atolls that suggest that the bucket principle does not

necessarily apply. For example, the inter-bank areas appear to be built up of sediment, much of which was derived from the banks. In places, this inter-bank accumulation is almost as thick as the banks themselves. This suggests that large volumes of material were being transported off the banks into deeper water.

In terms of the carbonate budget of what appears to have always been an algal-dominated system rather than a coral-dominated system, these banks have probably produced (and partly transported) more $CaCO_3$ than does the average coral reef. While numerous studies have shown that coral reefs accumulate vertically at the rate of around 3-12 m kyr $^{-1}$ during a transgression (e.g. Schlager, 1981 and references within), the data for *Halimeda* accumulation is not so well known. A rate of 1-2 m kyr $^{-1}$ was measured for *Halimeda* bioherms in the northern Great Barrier Reef (Marshall and Davies, 1988). The boomer data over the Sahul Banks shows a potential vertical accumulation of 7.5 to 15 m during the Holocene (i.e. 0.75-1.50 m kyr $^{-1}$); broadly in agreement with the Great Barrier Reef rates. However, only in the framework-dominated parts of a coral reef do such high rates, far in excess of *Halimeda* accumulation occur, yet this facies occupies only a small proportion of the reef. Recently, Milliman (1993) calculated the carbonate budget for the world ocean. He computed that the $CaCO_3$ flux for a coral reef complex is of the order of 1.5 kg m^{-2} yr $^{-1}$, whereas the flux for *Halimeda* bioherms is 3.0 kg m^{-2} yr $^{-1}$. This latter figure is equally applicable to the Sahul Banks, and would support the contention that these shelf edge banks are one of the areas of highest carbonate production in the world.

REFERENCES

Botten, P.R. and Wulff, K., 1990. Exploration potential of the Timor Gap Zone of Co-operation. *APEA Journal*, 30, 53-68.

Harris, P.T., Baker, E.K. and Cole, A.R., 1991. Physical sedimentology of the Australian continental shelf with emphasis on Late Quaternary deposits in major shipping channels, port approaches and choke points. *Ocean Sciences Institute Report* No. 51, University of Sydney, 505 pp.

Jones, H.A., 1973. Marine geology of the Northwest Australian continental shelf. *Bureau of Mineral Resources, Australia, Bulletin* 136.

Lavering, I. H., 1993. Quaternary and modern environments of the Van Diemen Rise, Timor Sea, and potential effects of additional petroleum exploration activity. *BMR Journal of Australian Geology and Geophysics*, 13, 281-292.

Lee, R.J. and Gunn, P.J., 1988. Bonaparte Basin. *Petroleum in Australia: The First Century.* Australian Petroleum Exploration Association Limited, pp. 252-269.

Marshall, J.F. and Davies, P.J., 1988. *Halimeda* bioherms of the northern Great Barrier Reef. *Coral Reefs*, 6, 139-148.

Milliman, J.D., 1993. Production and accumulation of calcium carbonate in the ocean: budget of a nonsteady state. *Global Biogeochemical Cycles*, 7, 927-957.

O'Brien, G.W., 1993. Timor Sea geology: the big picture revealed. *Australian Journal of Mining*, May 1993, pp 47-50.

O'Brien, G.W., 1993. Some ideas on the rifting history of the Timor Sea from the integration of deep crustal seismic and other data. *PESA Journal*, 21, 95-113.

O'Brien, G.W. and Marshall, J.F., 1991. Vulcan Sub-Basin, Timor Sea, Survey 97. High resolution seismic reflection profiling and direct hydrocarbon detection (Vulcan 1) post-cruise report. *Bureau of Mineral Resources Australia Record*, 1991/68, 44 pp.

O'Brien, G.W., Etheridge, M.A., Needham, D.J., Pridmore, D., Norman, C. and Cowan, D., 1992. Vulcan Sub-Basin, Timor Sea: an integrated structural study of image processed aeromagnetic and selected seismic data. *Bureau of Mineral Resources, Continental Margins Program Folio*, 6, 134pp.

O'Brien, G.W., Etheridge, M.A., Willcox, J.B., Morse, M., Symonds, P., Norman, C. and Needham, D.J., 1993. The structural architecture of the Timor Sea, north-western Australia: implications for basin development and hydrocarbon exploration. *APEA Journal* ,33, 258-278.

Pattillo, J. and Nicholls, P.J., 1990. A tectono-stratigraphic framework for the Vulcan Graben, Timor Sea region. *APEA Journal*, 30, 27-51.

Powell, D.E., 1976. The geological evolution of the continental margin off northwest Australia. *APEA Journal*, 16, 13-23.

Roberts, H.H., Aharon, P. and Phipps, C.V., 1988. Morphology and sedimentology of *Halimeda* bioherms from the eastern Java Sea (Indonesia). *Coral Reefs*, 6, 161-172.

Schlager, W., 1981. The paradox of drowned reefs and carbonate platforms. *Geological Society of America Bulletin*, 92, 197-211.

van Andel, T.H. and Veevers, J.J., 1967. Morphology and sediments of the Timor Sea. *Bureau of Mineral Resources, Australia, Bulletin*, 83, 173 pp.

van der Kaars, W.A., 1991. Palynology of eastern Indonesian marine piston-cores: a Late Quaternary vegetational and climatic record for Australasia. *Palaeogeography, Palaeoclimatology, Palaeoecology,* 85, 239-302.

Wyrtki, K., 1961. Physical oceanography of southeast Asian waters. *Naga Report* 2. *Scripps Institution of Oceanography, La Jolla, California.*

Yeates, A.N., Bradshaw, M.T., Dickens, J.M., Brackel, A.T., Exon, N.F., Langford, R.P., Mulholland, S.M., Totterdell, J.M. and Yeung, M., 1987. The Westralian Superbasin: an Australian link with Tethys. **In:** McKenzie, K.G. (Ed.), *Proceedings, Second Shallow Tethys Conference*, Wagga Wagga, N.S.W., Australia, pp. 199-214. A.A. Balkema, Rotterdam, Boston.

APPENDIX 1. GENERAL DETAILS:-RESEARCH VESSEL *RIG SEISMIC*

R.V. *Rig Seismic* is a seismic research vessel with dynamic positioning capability, chartered and equipped by AGSO to carry out the Continental Margins Program. The ship was built in Norway in 1982 and arrived in Australia to be fitted out for geoscientific research in October 1984. It is registered in Newcastle, New South Wales, and is operated for AGSO by the Australian Maritime Safety Authority.

Gross Registered Tonnage:		1545 tonnes
Length, overall:		72.5 m
Breadth:		13.8 m
Draft:		6.0 m
Engines:	Main: Norma KVMB-12	2640 HP/825 rpm
	Aux: 3x Caterpillar	564 HP/482 KVA
	1x Mercedes	78 HP/56 KVA
	Shaft generator:	AVK 1000KVA; 440 V/60 Hz
Side Thrusters:		2 forward, 1 aft, each 600 HP
Helicopter Deck:		20 m diameter
Accommodation:		36 single cabins
		3 double cabins

APPENDIX 2. SCIENTIFIC EQUIPMENT

GEOPHYSICAL SCIENTIFIC EQUIPMENT

NON-SEISMIC SYSTEMS

General
Raytheon echo sounders: 3.5 Khz (2 KW) and 12 Khz (2 KW)
Geometrics G801/803 magnetometer/gradiometer
Bodenseewerk Geosystem KSS-31 marine gravity meter

Navigation
Differential GPS System - 2 Trimble model 4000DL receivers
MX100 Magnavox GPS receiver
Magnavox MX 610D and Raytheon DSN 450 dual axis sonar dopplers
Arma Brown and Robertson gyro-compasses; plus Ben paddle log

SEISMIC SYSTEM

Seismic cable:
Fjord Instruments, transformerless coupling
Maximum of 288 seismic channels, 12 auxiliary channels
10 Teledyne T-1 hydrophones per 6.25 metre group
Nominal sensitivity 20 Volts/Bar for standard group
Oil blocks to reduce low frequency noise
6.25, 12.5, (18.75), and 25.0 metre groups available
288 seismic channels, 12 auxiliary channels

Energy Source:
SSI GI gun array, allowing for single or multiple (up to 5) configuration
Gun depths 3 to 5 metres, spacing 2.5 metres
16 x 150 cu. in. HGS sleeve gun array (2 arrays)
Gun depths 5 to 15 metres, spacing 0.5 metres
Gun groups separated by 2.5 metres
Various gun groupings available
Configured as 6, 5, 3, and 2-gun groups
Usually fired as 4, 3, 2, and 1-gun groups
Compressor capacity 1200 scfm nominal at 2000 psi

Recording Parameters:
Low noise charge-coupled preamplifiers
Preamplifier gain from 1 to 128 in 6 dB steps
Maximum of 320 channels including seismic and auxiliaries
LC filters 4, 8, 16, and 32 Hertz at 18 dB/octave
HC filters 90, 180, 360 and 720 Hertz at 140 dB/octave
Sampling rates of 0.5, 1, 2, and 4 millisecs
Record lengths from 2 secs to 20 secs
SEG-Y recording format with extension
IFP operating at 200 khz with special floating point format
Data recorded as 4-bit binary exponent and 12-bit mantissa

SEISMIC SYSTEM CONFIGURATION FOR HIGH RESOLUTION PROGRAM

Source
SSI GI gun array (4 guns)
2000 psi air pressure
gun spacing 2.5 metres
gun depth 3 to 5 metres.

Streamer
Fjord Instruments transformerless.
10 Teledyne T-1 hydrophones per 6.25m group.
1200 m cable, 144 seismic channels,
group interval 6.25 m.
depth 5m nominal.

Field Data
8 Hz - 360 Hz passband
1 ms blocked multiplexed
2.5 sec record length
nominal 4.85 second shot rate
shot interval 12.5m for 36 fold CDP coverage
Shot-to-group 1 offset : 100 m if achievable

Seismic data supplied in SEG-Y format, special floating point format, 4 bit binary exponent, 12 bit mantissa. Conversion routines supplied.

GEOLOGICAL SCIENTIFIC EQUIPMENT

Australian Winch and Haulage deep-sea winch with 10 000 m of 18 mm wire rope
Australian Winch and Haulage hydrographic winch with 4000 m of 6 mm wire rope
Gravity/piston corer, 1000 kg weight stand, 5-15 m barrel length, 90 mm core diameter
Palaeomagnetic corer, 1000 kg weight stand, 6-9 m barrel length, 50 mm core diameter
Submersible Services (Aust.) vibrocorer, 3-6 m barrel, 75 mm core diameter
Van Veen-type grab samplers, capacity 20 litre
Pipe dredges
Chain bag rock dredges
Aanderaa RCM-4 and RCM-7 model self-recording current meters
Yeo-Kal submersible data logger, temp. salinity, dissolvedO_2, pH and turbidity
Benthos deep sea camera and flash
EG&G Uniboom deep tow single channel boomer (modified with ORE-type plate)
ORE boomer with Benthos single channel hydrophone streamer
EG&G. model 990 side scan sonar with 1000 m coaxial cable

APPENDIX 3. LIST OF CRUISE 122 PARTICIPANTS

Mike Gusterson	Master	Aust. Maritime Safety Authority
John Harvey	Chief Engineer	AMSA
Peter Robinson	Chief Officer	AMSA
Danny Watson	2nd Officer	AMSA
Rod O'Leary	2nd Engineer	AMSA
Kerry Jones	Electrician	AMSA
Donnie Brown	Integrated Rating (IR)	AMSA
Nobby Clarke	IR	AMSA
Michael Chalk	IR	AMSA
Henk Dekker	Chief Steward/Cook	AMSA
Ken Bea	Cook	AMSA
George Lilja	Steward	AMSA
Adrian Clark	Steward	AMSA
John Marshall	Cruise Leader	AGSO
Peter Davies	Geologist	Sydney University (SU)
David Sewter	Mechanical Technician	AGSO
Simon Milnes	Mechanical Technician	AGSO
Andrew Hislop	Mechanical Technician	AGSO
Dapper Davis	Geological Technician	AGSO
Mark James	Mechanical Technician	AGSO
Colin Tindall	Geological Technician	AGSO
David Haddad	Postgraduate Student	SU
Doug Bergerson	Postdoctoral Fellow	SU
David Mitchell	Electronics Technician	SU
Richard Schuller	Mechanical Technician	AGSO
Leo Kalinisan	Quality Control Officer	AGSO
Greg Sparksman	Geological Technician	AGSO
Ilie Mihut	Postgraduate Student	SU
Jim Bedford	Seismic Observer	AGSO
Jon Stratton	Geological Technician	AGSO
Tiernan McNamara	Navigation Observer	AGSO
Ed Chudyk	Quality Control Officer	AGSO
Alexa Troedson	Postgraduate Student	SU
Martin Callaway	Electronics Technician	AGSO
Voytec Wierzbicki	Electronics Technician	AGSO

APPENDIX 4. CRUISE 122 STATION DATA

Gravity Core Sites

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery (m)
122/GC/001	1	11 11.73' S	125 16.29' E	390	0.22
122/GC/002	1	11 11.72' S	125 16.36' E	390	0.05
122/GC/003	4	11 13.84' S	124 52.95' E	416	5.78
122/GC/004	5	11 14.62' S	124 43.50' E	346	0.01
122/GC/005	5	11 14.53' S	124 43.50' E	359	0.15
122/GC/006	25	11 22.97' S	124 50.37' E	359	5.20
122/GC/007	26	11 22.52' S	124 47.62' E	319	0
122/GC/008	26	11 22.54' S	124 47.63' E	320	2.80
122/GC/009	26	11 22.48' S	124 47.63' E	319	8.60
122/GC/010	27	11 22.07' S	124 44.14' E	179	0
122/GC/011	30	11 18.90' S	124 23.89' E	400	0.02
122/GC/012	32	11 22.54' S	124 15.55' E	464	5.59
122/GC/013	33	11 18.50' S	124 21.24' E	494	0.70
122/GC/014	67	11 24.26' S	124 58.30' E	433	5.64
122/GC/015	68	11 24.99' S	125 03.20' E	403	5.44
122/GC/016	69	11 25.14' S	125 03.57' E	401	5.79
122/GC/017	70	11 26.35' S	125 11.66' E	250	0
122/GC/018	84	10 42.34' S	126 06.63' E	302	3.46
122/GC/019	85	10 42.88' S	126 07.23' E	264	5.67
122/GC/020	85	10 42.84' S	126 06.98' E	263	6.59
122/GC/021	86	10 46.38' S	126 09.00' E	225	0
122/GC/022	86	10 46.34' S	126 08.90' E	225	3.63
122/GC/023	95	10 59.58' S	126 13.82' E	115	4.85
122/GC/024	96	11 01.70' S	126 16.46' E	111	4.90
122/GC/025	97	11 03.81' S	126 17.55' E	107	2.74
122/GC/026	99	11 07.32' S	126 20.77' E	95	4.76
122/GC/027	100	11 10.69' S	126 22.46' E	87	0.87
122/GC/028	101	11 12.50' S	126 16.54' E	102	2.08
122/GC/029	102	11 12.46' S	126 19.53' E	103	2.87
122/GC/030	103	11 13.85' S	126 17.49' E	101	1.85
122/GC/031	106	11 18.04' S	126 22.54' E	183	3.89
122/GC/032	107	11 19.76' S	126 24.50' E	137	4.07
122/GC/033	108	11 20.02' S	126 24.15' E	171	4.26
122/GC/034	109	11 20.01' S	126 24.83' E	131	4.44
122/GC/035	110	11 22.08' S	126 25.56' E	132	0
122/GC/036	111	11 23.35' S	126 26.83' E	188	4.74
122/GC/037	112	11 23.92' S	126 27.64' E	215	4.00
122/GC/038	115	11 28.25' S	126 31.60' E	223	2.85
122/GC/039	117	11 31.43' S	126 36.49' E	146	1.45
122/GC/040	118	11 33.79' S	126 38.51' E	166	4.78
122/GC/041	119	11 34.24' S	126 38.08' E	147	4.29
122/GC/042	120	11 34.97' S	126 41.58' E	171	4.20
122/GC/043	121	11 34.48' S	126 36.49' E	137	4.28

Palaeomagnetic Cores

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery (m)
122/PM/001	2	11 12.74' S	125 05.63' E	459	2.58
122/PM/002	2	11 12.76' S	125 05.61' E	458	3.15
122/PM/003	3	11 13.12' S	125 01.43' E	463	3.92

Vibrocores

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery (m)
122/VC/001	6	11 11.92 S	124 35.57' E	34	0.46
122/VC/002	7	11 09.86' S	124 35.83' E	72	1.35
122/VC/003	14	11 20.01' S	124 33.52' E	225	4.93
122/VC/004	15	11 21.27' S	124 31.71' E	207	1.42
122/VC/005	16	11 22.50' S	124 30.07' E	161	0
122/VC/006	16	11 22.45' S	124 29.99' E	171	0
122/VC/007	16	11 22.35' S	124 30.01' E	181	4.73
122/VC/008	17	11 23.56' S	124 34.27' E	183	1.93
122/VC/009	17	11 23.51' S	124 34.17' E	182	3.20
122/VC/010	18	11 20.94' S	124 36.88' E	217	0
122/VC/011	47	11 33.26' S	124 15.49' E	179	0.59
122/VC/012	48	11 32.82' S	124 15.96' E	197	1.86
122/VC/013	57	11 33.91' S	124 24.16' E	199	1.98
122/VC/014	58	11 32.12' S	124 17.00' E	227	1.47
122/VC/015	60	11 29.07' S	124 21.06' E	205	1.79
122/VC/016	63	11 26.62' S	124 24.38' E	216	2.27
122/VC/017	64	11 24.99' S	124 26.63' E	212	2.66
122/VC/018	65	11 27.63' S	124 33.72' E	184	0.61
122/VC/019	66	11 30.40' S	124 33.36' E	193	2.54
122/VC/020	70	11 26.34' S	125 11.64' E	250	2.45
122/VC/021	76	11 26.99' S	125 15.79' E	243	2.24
122/VC/022	77	11 27.10' S	125 16.30' E	234	1.63
122/VC/023	78	11 27.24' S	125 17.65' E	146	0.78
122/VC/024	89	10 48.71' S	126 09.95' E	171	2.93
122/VC/025	90	10 50.44' S	126 10.37' E	123	1.9
122/VC/026	92	10 53.62' S	126 11.55' E	111	4.36
122/VC/027	93	10 53.85' S	126 11.25' E	109	4.4
122/VC/028	94	10 56.61' S	126 12.58' E	110	2.55
122/VC/029	95	10 59.58' S	126 13.84' E	114	4.12
122/VC/030	100	11 10.70' S	126 22.48' E	88	1.64
122/VC/031	104	11 16.11' S	126 20.23' E	104	1.45

Grab Stations

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery
122/GR/001	1	11 11.61' S	125 16.39' E	390	12 Kg
122/GR/002	2	11 12.71' S	125 05.61 E	441	12 Kg
122/GR/003	4	11 13.86' S	124 52.95 E	416	6 Kg
122/GR/004	5	11 14.70' S	124 43.53' E	344	6 Kg
122/GR/005	6	11 11.85' S	124 35.62' E	33	10 Kg
122/GR/006	7	11 09.83' S	124 35.75' E	105	6 Kg
122/GR/007	8	11 07.95' S	124 36.09' E	27	10 Kg
122/GR/008	13	11 15.64' S	124 33.45' E	217	10 Kg
122/GR/009	14	11 20.02' S	124 33.55' E	226	6 Kg
122/GR/010	15	11 21.19' S	124 31.69' E	208	6 Kg
122/GR/011	16	11 22.52' S	124 30.07' E	158	6 Kg
122/GR/012	17	11 23.49' S	124 34.22' E	183	6 Kg
122/GR/013	18	11 20.95' S	124 36.88' E	217	6 Kg
122/GR/014	20	11 18.71' S	124 38.07' E	30	15 Kg
122/GR/015	21	11 19.21' S	124 40.69' E	23	15 Kg
122/GR/016	22	11 18.77' S	124 42.99' E	21	15 Kg
122/GR/017	23	11 20.38' S	124 43.06' E	67	15 Kg
122/GR/018	24	11 20.50' S	124 43.69' E	21	12 Kg
122/GR/019	28	11 21.96' S	124 43.83' E	34	15 Kg
122/GR/020	29	11 21.26' S	124 39.34' E	26	15 Kg

Grabs (cont.)

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery
122/GR/021	25	11 23. 01' S	124 50.37' E	360	3 Kg
122/GR/022	26	11 22.51' S	124 47.71' E	321	0
122/GR/023	26	11 22.51' S	124 47.67' E	320	12 Kg
122/GR/024	27	11 22.01' S	124 44.09' E	195	0
122/GR/025	27	11 22.03' S	124 44.07' E	194	2 Kg
122/GR/026	27	11 22.03' S	124 44.07' E	193	6 Kg
122/GR/027	33	11 23.40' S	124 43.34' E	42	3 Kg
122/GR/028	34	11 23.40' S	124 42.78' E	24	6 Kg
122/GR/029	35	11 23.34' S	124 40.61' E	30	6 Kg
122/GR/030	36	11 23.30' S	124 38.09' E	47	6 Kg
122/GR/031	37	11 25.38' S	124 37.99' E	46	6 Kg
122/GR/032	38	11 25.80' S	124 40.52' E	25	10 Kg
122/GR/033	39	11 24.21' S	124 40.00' E	29	6 Kg
122/GR/034	30	11 18.84' S	124 23.98' E	404	15 Kg
122/GR/035	32	11 22.61' S	124 15.45' E	464	15 Kg
122/GR/036	33	11 18.51' S	124 21.22' E	494	15 Kg
122/GR/037	31	11 19.08' S	124 25.26' E	331	15 Kg
122/GR/038	42	11 33.79' S	124 10.17' E	23	15 Kg
122/GR/039	43	11 32.48' S	124 11.32' E	23	15 Kg
122/GR/040	44	11 32.81' S	124 13.13' E	22	15 Kg
122/GR/041	45	11 33.39' S	124 12.21' E	23	0
122/GR/042	45	11 33.32' S	124 12.24' E	23	15 Kg
122/GR/043	49	11 34.19' S	124 12.52' E	19	30 Kg
122/GR/044	50	11 35.97' S	124 14.51' E	33	15 Kg
122/GR/045	51	11 36.19' S	124 15.33' E	164	10 Kg
122/GR/046	52	11 35.25' S	124 15.87' E	22	6 Kg
122/GR/047	53	11 34.95' S	124 17.13' E	22	0
122/GR/048	53	11 34.95' S	124 17.12' E	22	6 Kg
122/GR/049	54	11 35.46' S	124 18.24' E	22	6 Kg
122/GR/050	55	11 36.06' S	124 18.61' E	19	0.2 Kg
122/GR/051	46	11 34.21' S	124 14.27' E	23	4 Kg
122/GR/052	47	11 33.22' S	124 15.57' E	180	6 Kg
122/GR/053	48	11 32.91' S	124 15.89' E	196	0
122/GR/054	48	11 32.87' S	124 15.97' E	197	0
122/GR/055	48	11 32.84' S	124 15.94' E	197	6 Kg
122/GR/056	56	11 35.40' S	124 22.63' E	219	0.5 Kg
122/GR/057	57	11 33.92' S	124 24.16' E	199	6 Kg
122/GR/058	58	11 32.11' S	124 17.00' E	228	6 Kg
122/GR/059	59	11 30.83' S	124 18.70' E	21	15 Kg
122/GR/060	60	11 29.07' S	124 21.09' E	205	12 Kg
122/GR/061	62	11 24.84' S	124 20.11' E	21	20 Kg
122/GR/062	63	11 26.67' S	124 24.36' E	216	15 Kg
122/GR/063	64	11 24.99' S	124 26.63' E	211	10 Kg
122/GR/064	65	11 27.65' S	124 33.75' E	184	6 Kg
122/GR/065	66	11 30.40' S	124 33.37' E	193	6 Kg
122/GR/066	70	11 26.33' S	125 11.66' E	250	15 Kg
122/GR/067	72	11 26.58' S	125 13.36' E	34.2	3 Kg
122/GR/068	71	11 26.45' S	125 12.36' E	35?	6 Kg
122/GR/069	73	11 26.61' S	125 13.99' E	26	6 Kg
122/GR/070	74	11 26.79' S	125 14.72' E	25	6 Kg
122/GR/071	75	11 26.89' S	125 15.12' E	159	0.3 Kg
122/GR/072	76	11 26.97' S	125 15.79' E	243	6 Kg
122/GR/073	77	11 27.10' S	125 16.29' E	234	6 Kg
122/GR/074	78	11 27.27' S	125 17.69' E	144	6 Kg
122/GR/075	80	11 28.90' S	125 12.12' E	28	15 Kg

Grabs (cont.)

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery
122/GR/077	85	10 42.87' S	126 07.06' E	263	0.1 Kg
122/GR/078	86	10 46.36' S	126 08.95' E	225	6 Kg
122/GR/079	88	10 47.73' S	126 09.68' E	44	6 Kg
122/GR/080	89	10 48.67' S	126 09.93' E	170	6 Kg
122/GR/081	90	10 50.46' S	126 10.37' E	123	6 Kg
122/GR/082	91	10 51.32' S	126 10.79' E	106	0
122/GR/083	91	10 51.32' S	126 10.78' E	107	6 Kg
122/GR/084	92	10 53.03' S	126 11.54' E	106	9 Kg
122/GR/085	93	10 53.85' S	126 11.23' E	108	9 Kg
122/GR/086	94	10 56.52' S	126 12.61' E	110	9 Kg
122/GR/087	95	10 59.57' S	126 13.85' E	114	9 Kg
122/GR/088	96	11 01.70' S	126 16.46' E	111	9 Kg
122/GR/089	97	11 03.81' S	126 17.56' E	106	6 Kg
122/GR/090	99	11 07.31' S	126 20.77' E	94	6 Kg
122/GR/091	100	11 10.70' S	126 22.46' E	88	6 Kg
122/GR/092	103	11 13.83' S	126 17.53' E	100	6 Kg
122/GR/093	105	11 16.59' S	126 22.59' E	105	6 Kg
122/GR/094	109	11 20.02' S	126 24.82' E	134	6 Kg
122/GR/095	114	11 24.40' S	126 33.79' E	104	9 Kg

Dredge Sites

Sample Number	Site No.	Latitude	Longitude	Depth (m)	Recovery
122/DR/001	9	11 07.01 S	124 36.34' E	512-240	140 Kg
122/DR/002	10	11 07.56' S	124 35.31' E	155-117	10 Kg
122/DR/003	10	11 07.62' S	124 35.37' E	54-42	10 Kg
122/DR/004	11?	11 07.64' S	124 35.41' E	61-42	40 Kg
122/DR/005	19	11 17.81' S	124 37.44' E	310	40 Kg
122/DR/006	40	11 34.77' S	124 13.06' E	105-68	35 Kg
122/DR/007	40	11 35.05' S	124 12.87' E	211-78	30 Kg
122/DR/008	41	11 32.50' S	124 10.60' E	170-58	30 Kg
122/DR/009	61	11 24.47' S	124 19.32' E	116-31	40 Kg
122/DR/010	79	11 29.28' S	125 11.40' E	300-100	18 Kg
122/DR/011	79	11 29.06' S	125 11.40' E	285-30	3 Kg
122/DR/012	79	11 28.80' S	125 11.50' E	98-46	45 Kg
122/DR/013	81	11 25.40' S	125 13.90' E	204-76	15 Kg
122/DR/014	81	11 25.50' S	125 13.90' E	184-60	200 Kg
122/DR/015	82	10 39.60' S	126 04.95' E	269-308	0.5 Kg
122/DR/016	83	10 39.69' S	126 04.99' E	60-310	200 Kg
122/DR/017	83	10 41.80' S	126 04.90' E	70-320	3 Kg
122/DR/018	83	10 41.61' S	126 04.98' E	70-190	30 Kg
122/DR/019	87	10 47.42' S	126 09.42' E	130-150	5 Kg
122/DR/020	87	10 47.46' S	126 09.44' E	90-140	50 Kg
122/DR/021	113	11 25.97' S	126 30.75' E	65-71	20 Kg
122/DR/022	113	11 26.14' S	126 30.83' E	57-60	200 Kg

Current Meter Stations

Station Number	Latitude	Longitude	Depth (m)	Recording Period
122/TG/001	11 28.77' S	124 32.21' E	190	Lost
122/TG/002	11 24.97' S	124 37.64' E	35	12.4 days
122/TG/003	11 22.61' S	124 40.30' E	32	12.2 days
122/TG/004	11 30.70'S	126 35.20'E	178	Lost
122/TG/005	11 29.40'S	126 37.30'E	65	16.1 days

Camera Stations

Station Number	Site Number	Latitude	Longitude	Depth (m)	Comments
122/CM/001	12	11 11.79' S	124 35.58' E	33	15 Shots
122/CM/002	near 7	11 09.94' S	124 35.87' E	79	15 Shots
122/CM/003	6 to 7	11 09.93' S	124 35.88' E	77	15 Shots
122/CM/004	6 to 7	11 09.04' S	124 35.94' E	36-39	15 Shots
122/CM/005	near 8	11 08.20' S	124 36.06' E	65	15 Shots
122/CM/006	8	11 07.60' S	124 36.14' E	26-27	15 Shots
122/CM/007	20	11 18.72' S	124 38.07' E	21	10 Shots
122/CM/008	21	11 19.20' S	124 40.69' E	22	10 Shots
122/CM/009	22	11 18.87' S	124 42.99' E	21	15 Shots
122/CM/010	23	11 20.38' S	124 43.05' E	67	10 Shots
122/CM/011	24	11 20.45' S	124 43.70' E	22	10 Shots
122/CM/012	28	11 21.92' S	124 43.89' E	35-65	5 Shots
122/CM/013	near 29	11 21.22' S	124 39.43' E	26	10 Shots
122/CM/014	42	11 33.71' S	124 10.31' E	23	10 Shots
122/CM/015	45	11 33.35' S	124 12.21' E	23	5 Shots
122/CM/016	50	11 35.98' S	124 14.51' E	34-36	5 Shots
122/CM/017	55	11 36.06' S	124 18.64' E	20	5 Shots
122/CM/018	71	11 26.45' S	125 12.40' E	35	5 Shots
122/CM/019	80	11 28.91' S	125 12.13' E	28	10 Shots
122/CM/020	74	11 26.76' S	125 14.71' E	18-26	20 Shots
122/CM/021	88	10 47.73' S	126 09.69' E	42-43	7 Shots
122/CM/022	91	10 51.30' S	126 10.81' E	106	7 Shots

APPENDIX 5. CAMERA SITE DESCRIPTIONS

The position of camera stations is shown in Figures 8 and 10.

122/CM/001

This occurs in 40m of water on the southern edge of Berri Bank. Nineteen shots were taken. Descriptions of each photo follow:
1. The bottom is 80% sediment covered and 20% by soft algae.
2. There is a 5% cover by algae and 95% by sediment. Some coralline encrusted cobbles are visible, some of which are 5cm across.
3. A coralline encrusted cobble pavement covers 30% of the surface. Soft algae occur in one patch and small branching organisms are visible which may be corals or bryozoans.
4. A sediment dominated bottom with algae covering 10%. Cobbles covered by encrusting corallines occur.
5. Coralline covered cobbles over 30% of the surface and most are 2-6cm across. No soft algae are visible. The sediment is gravel.
6. Corallines cover 40% of the surface. Some fleshy algae are visible. Most of the surface is gravel.
7. As for shot 6, but in addition, a starfish and a sponge are visible on the gravel sediment surface. Coralline encrusted cobbles also visible.
8. Sediment is now gravel in upper right corner of photograph. Cobbles occur in patches.
9. Very coarse gravel with coralline covered cobbles in patches.
10. As for photo 9, with in addition a Holothurian and a starfish (*A.planckii*) and some soft algae.
11. As for 10 but with no animals.
12. Sediment bottom with one clump of soft algae. A few coralline covered cobbles. The sediment appears to be finer grained than noted above.
13. 80% sediment as in photograph 12; a little soft algae and a few clumps of coralline cobbles.
15+16. As for photograph 13.
17. As for 15, but also soft algae and a sponge are visible in the photograph. The sediment may contain a little mud. In patches however, the sediment is a gravel.
18. As for 17, but the sediment is coarser, and with little mud.
19. A sediment dominated bottom with one soft algal colony. The sediment is coarser grained in patches.

Summary
This is a highly varied sedimentary bottom. It is mainly gravel and very coarse sand with substantial variations in the cover of soft algae from 0-20%. Patches of coralline encrusted cobbles up to 6cm in diameter cover up to 40% of the surface. Macro benthos include holothurians, starfish and sponges. There is little evidence of burrowing.

122/CM/003

Note that camera station 3 is the same site as station 2 where the camera malfunctioned.
Site 3 is in the middle of Berri Bank in 28m of water.
1. Dominated by a sandy bottom with cobbles strewn around. No algae.
2. As above but with a little mud in the sediment. Patches of cobbles cover 10% of the surface with most cobbles about 5cm diameter.
3. Sand covers only 50% of the bottom and the rest by cobbles.
4. Sandy bottom with a few fungia strewn around.
5. As above.
7. Fungia clearly visible on a sandy bottom which contains some mud.
8. As above.
9. Fungias common as are cobbles . The sediment is a fine gravel with some mud.
10. Sandy bottom with fewer fungias.
11. As above.

12. As above but with only two sparse clumps of algae.
13. As above, but with more Fungia and more weed.
14. As above.
15. As above.
16. As above.

Summary
Site 3 is dominated by a sand substrate populated by abundant *Fungia* sp., with one specimen every 0.5 m^2. Few algae and few pebbles occur although one patch of coralline pebbles was seen. Little visible macro benthos other than two corals and a few fleshy algae.

122/CM/004
This occurs in 65m of water, in a depression on the northern edge of Berri Bank.
1. Very coarse sand and gravel substrate populated by large sponges and *Fungia* sp.
2. As above. One sponge colony is 1m long.
3. Very coarse sand and gravel with fungias about 7cm long.
4. Gravel strewn surface.
5. As above.
6. As above. Some fleshy algae occur.
7. As above, but macro benthos includes an elongated Fungia some 20cm long, and an echinoid.
8. Gravel surface with fungias and sponges.
9. As above.
10. As above.
11. Slipper fungia some 25cm long on a sandy substrate.
12. Holothuria on gravel surface.
13. Gravel surface and two clumps of algae.
14. Gravel surface.
15. Large sponge on gravel surface.
16. Large sponge and gravel substrate.
17. Gravel surface with Fungia.
18. Some soft algae.

Summary
This central part of the bank is covered by a very coarse sandy gravel surface. The macro benthos include abundant *Fungia* sp., holothurians and sponges. The sponge species are distinctive. The environment is clearly very different to sites on the southern margin.

122/CM/005
This camera site occurs in 65m, in a depression on the northern margin of Berri Bank.
1. Gravel strewn surface with patches of fleshy algae and corallines, a few corallines and a sponge.
2. As above but with fungias common.
3. As above but with sponges also present.
4. As above.
5. As above.
6. As above but with larger patches of sand.
7. Excellent photograph showing fungias and sponges. Otherwise as above.
8. As above.
9. As above.
10. As above.
11. Fungias particularly abundant.
13. Fleshy algae and a few fungias on a gravelly surface with some sand.
14. As above with abundant fungias.
15. As above.
16. As above.

17. As above.
18. As above.
19. As above.

Summary
This site occurs on the northern margin of Berri Bank in a depression in 65m of water. It is a gravel strewn surface with a few patches of fleshy algae, sponges and fungias.

122/CM/006
This site occurs in 28m of water on the northern edge of the bank.
1. Partially algal covered surface with the covering no more than 20%. The sediment appears to be a very course sand and fine gravel.
2. Sediment surface partially covered by algae with dead fungias scattered amongst the algae. Branching bryozoan in the top left of the photograph.
3. As above but with sediment dominating. At least three different types of fleshy algae visible; fungias also occur. The sediment appears to be a fine gravel..
4. As above but with sediment defining 80% of the photograph.
5. Surface dominated by dead algal covering. A substantial mat exists over much of the sediment. A few fungias.
6. Exposed sediment comprises 60% of the photograph. Areas of new and previous algal cover identifiable.
7. Gravel covered by a dominantly dying soft algal cover.
8. As above with sediment occupying 60% of the photograph.
9. As above with echinoids and fungias defining the main macro benthos.
10. As above but with dead fungias and a dead algal covering.
11. A sediment dominated surface but with different varieties of living algae scattered over the surface. The sediment appears to be fine gravel with little mud.
12. Sediment surface with little algae.
13. A sediment and dominantly dead algal surface. Living and dead fungias. Some matting of a gravelly sediment by roots of dead algae while some algae are alive.
14. Dead soft algae forming a mat over a sediment surface with many fungias both living and dead.
15. As above but with sediment cover probably around 40%. Living and dead fungias in different states of preservation.
16. Gravel surface varying in size from pebbles to cobbles with living and dead fungias strewn around.

Summary
Very coarse sand and pebbly to cobbly gravel covered by living and dead algae, the roots of which form a mat. Macro benthos are dominantly fungias.

122/CM/007
This site occurs in 22m of water on the northwestern edge of Warb Bank.
1. The surface is 70% covered by algae and *Halimeda* and maybe some coralline covered cobbles.
2. As above and in addition a fungia.
3. As above but a spiny echinoid prominent in the upper right. *Halimeda* is not prominent and the algal cover is probably about 50%
4. As above.
5. Algal cover is sparser but the matting effects of the roots are visible on the right side. Clumps of cobbles may also occur.
6. Sediment cover is now 85% and with little mud. An outcrop of coralline encrusted pavement occurs in the top left of the photograph. Tracks are visible in the bottom right.
7. The patchy nature of the algal cover is noted where the lower third has a 70% cover and the rest only a 10% cover. However, it is clear that the sediment has previously been covered by algae. There may therefore be something of an ephemeral nature in the percentage cover by

algae.
8. This is almost a type photograph for much of the above. Cover varies; the sand has been covered previously; matting of sediment by roots is common. A holothurian occurs in the bottom right.
9. As above.
10. As above but with the total cover by algae approximately 80%.
11. As above but with total algal cover 90%. Fungias are conspicuously absent.

Summary
An environment where the ephemeral nature of the algal covering is clearly seen. Sediments may be totally covered or totally exposed. Living *Halimeda* is contributing substantially to the sediments.

122/CM/008
This station is in 23m of water in the middle of Warb Bank.
1. Less than 5% soft algal cover on a sediment surface that is mounded indicating bioturbation. This is the first site where such activity has been recognised.
2. Large clump of soft algae with a coarse gravel around it. The rest of the photograph shows very coarse sand and fine gravel with a very sparse covering of algae only in the left side.
3. Very coarse sand and fine gravel with a 25% cover of soft algae. Little mud. The binding /matting action of the algae are seen by the runners along the right side. Some impression of mounding in the middle/left of the photograph.
4. As above but with a more regular but still sparse covering of leafy algae. Small mounds of "new" sediment are seen in the lower left.
5. As above.
7. As above. The matting effect of the runners well exhibited.
8. As above. The spreading of the algae along runners and the consequent matting effect is well seen.
9. As above.
10. As above. In addition the photograph also shows the spread of the runners in lines
11. This shows even better the spreading linear lines of runners. Mounding is indicated by the pockmarks which occur in the lower and lower left parts of the photograph.

Summary
Sand and gravel with up to 25% of soft algae. The spreading and matting effect of the runners and bioturbation are characteristic features of this site.

122/CM/009
This station is in 21m of water on the northern edge of Warb Bank.
1. *Halimeda* gravel with a 25% cover of live and dead leafy algae with runners. A few pebbles. No mud.
2. As above with small shrimp mounds in the lower right of the photograph.
3. As above.
4. As above.
5. As above.
6. As above but algal cover has increased gradually to about 35%.
7. Soft leafy algal cover has now increased both in the area covered and in the height at which it stands above the sandy bottom. What happens to all this organic carbon?
8. A forest of leafy algae.
9. As above with only one patch of sand.
10. An almost complete covering of leafy algae standing a meter high above the sandy bottom. The trigger weight and scale are completely obscured amongst the algae.
11. As above.
12. As above.
13. As above. An excellent photograph.
14. As above. An excellent photograph.

15. A sand patch amongst the jungle of leafy algae.
16. Either initial spread or die-back of the leafy algae with sediment and algae uniformly spread.
17. As above.

Summary
Thick forests of "sea-grass" producing large amounts of organic carbon must be having a substantial effect upon the ecosystem. The amount of sediment that is exposed at the surface is very little, which must increase its stability. To what extent is the sea-grass oxidised and to what extent is it incorporated in the sediment?

122/CM/010
This station is in 67 m of water at the bottom of the depression at the northeastern edge of Warb Bank.

1. Sandy bottom containing a little mud and very little algal cover. There appears to be some evidence for bioturbation in small mounds and tracks.
2. Similar to the above.
3. Similar to the above but with a sponge and an alga in the photo indicating their presence in this environment.
4. As above but with abundant trails on the sediment surface.
5. As above.
6. As above.
7. As above and with some organic detritus on the sediment surface.
8. Excellent photograph showing the rare feathery algae and some small mounding.
9. As above.

Summary
This environment is sand and gravel dominated but contains a little mud. Soft algae and other macro benthos are rare. The sediment is bioturbated and criss-crossed by trails indicating grazing. Organic detritus covers some of the sedimentary surface.

122/CM/011
This station is in 22m of water on the east northeastern side of Warb Bank.
1. Soft algae forms a low growth covering 70% of the sediment bottom. A few coralline encrusted pebbles are visible.
2. As above but with a large patch of sediment becoming visible probable due to die-back of the algae or an initial incomplete cover. The sediment appears to be fine gravel in the centimetre range. There is no mud visible.
3. As above.
4. As above with a starfish and a sponge completing the picture.
5. Almost the same picture as above and showing that much of the algae is a low branching variety.
6. The algae are forming a thick mat over the sediment. *Halimeda* is also present. A few pebbles are visible in the lower right of the photograph.
7. As above.
8. As above but with sediment not totally covered. However feather and larger algae occur in the lower right.
9. Excellent photograph showing at least five different sorts of algae forming a low "scrub" on the sediment surface.
10. As above.

Summary
This environment shows very little variation across the photographs. It is one where a number of low, but thickly growing algae have formed an extensive mat across the sediment surface. *Halimeda* is growing amongst these algae and contributing to the sediment. Pebbles are not

common.

122/CM/012
This site occurs in 40-70m of water on the eastern margin of Warb Bank. Unfortunately, a current continually moved the ship eastwards off station and down the outer slope of the bank. Consequently the photographs are taken of a relatively steep slope.
1.Coarse sand and fine gravel covered slope with a little organic detritus on the sediment surface.
2. Out of focus but coralline encrusted pebbles are visible in the lowest left of the photograph.
3. Coarse sand and pebbly gravels with a little organic detritus. "New" sediment in the upper left indicates burrowing activity.
4. As above and with a sponge and a coralline encrusted outcrop in the lower part of the photograph.
5. As above.

Summary
This is a sediment dominated environment with soft algae rarely visible. Some organic detritus occurs on the sediment surface and burrowing is indicated by patches of "new" sediment. Coralline covered cobbles occur in patches. Most of the photographs were taken in the upper part of the slope between 40 and 70m.

122/CM/013
This site occurs in the centre-west of Warb Bank in 26m of water.
1. A sediment dominated bottom composed of coarse sand with some mud. Low soft algae are scattered thinly over the bottom.
2. As above.
3. As above but with the algae forming a more abundant but still thinly spread cover.
4. As above and with a holothurian grazing. Longer leaved "seagrass"-like leaves making an appearance. Runners are starting to develop over the sand surface.
5. Holothurian on the sandy surface, There appears to be very little gravel in this environment.
6. As in earlier photos but with the addition of a starfish. The algae are growing in clumps which give the appearance that they could coalesce and totally cover the sediment.
7. Out of focus.
8. Sediment dominated surface with only a few fleshy macro-algae.
9. Sand and algal substrates are about fifty-fifty in this photograph.
10. As in earlier photographs, the substrate is dominantly sand.
11. As above.
12. A above.
13. The substrate is 50-50% algae and sediment.

122/CM/014
This site occurs close to the south west margin of Pollard Bank in 24m of water.
1. Algal covered surface with sediment representing 40% of the bottom.
2. Soft algal dominated surface with a large Fungia in the centre left of the photograph. Sponge encrustation occurs in the top left. Exposed sediment represents les than 25% of the surface.
3. As above but with dead Fungia and leaves from the seagrass variety lying lose on the bottom. Sediment exposed over 30% of the bottom.
4. As above. A holothurian is grazing and seagrass leaves more common. Sediment exposed over 15% of the bottom.
5. As above with sediment exposed over about 30%.
6. As above.
7. As above.
8. As above with sediment exposed over less than 10% of the surface. The cover of algae is developing thickly in patches.

9. As above.
10. As above with sediment patches at 30% of the bottom.

Summary
This environment is one where the sediment is exposed to a maximum of 40% and is usually covered by a turf of low growing algae. Seagrass leaves are scattered over the sediment and algal surface. Fungias are rare as are most other macro benthos.

122/CM/015
This site occurs in 23m of water on the north western margin of Pollard Bank.
Six shots were taken.
1.Algal mat covered surface with less than 20% sediment exposed. A few seagrass leaves recognisable.
2. A little more sediment exposed than in the previous shot. Seagrass leaves prominent.
3. Fleshy algae more prominent. Seagrass leaves seem to be singly rooted. Sediment exposed for about 25%.
4. As above. A spiny branching algal type in top left corner. Sediment cover exposed for a total of 35% but uniformly over the whole area.
5. As above but there is now more sediment exposed than algal cover. The most prominent algal component are the singly rooted seagrass .

Summary
Algal covered sediment surface with the most prominent alga being the single rooted seagrass. Sediment exposure varies from greater than 50% to less than 25%.

122/CM/016
This site occurs in 33m of water along the southern margin of Pollard Bank. Five shots were taken.
1. Gravel and very coarse sand cover with a nearly continuous low algal turf. *Linkia* sp. in centre of photograph.
2. A stunning photograph of a turf surface with abundant living and dead fungias (over 30 counted). Also two Linkia-like starfish and one large holothurian.
3. As above. Very little sediment exposed at all.
4. As above.
5. As above.

Summary
A very uniform environment where the sediment surface is covered by an algal turf and fungias, starfish and holothurians are grazing the surface.

122/CM/017
This station was in 20m of water on the eastern side of Pollard Bank.
1. Seagrass thickly covering a sediment bottom which is only visible in one patch.
2. Seagrass thicket but with more sediment visible.
3. As above.
4. Seagrass with all the leaves orientated in one direction. suggesting current movement. *Halimeda* appears to be scattered on the seagrass leaves.
5. Seagrass and one patch of sediment showing. These sediment appears to be gravel made up of *Halimeda* plates.
6. As above.
7. Lush covering of seagrass.
8.The surface looks like a pavement of dead fungias with seagrass growing on and around it. The fungias appear to be all the same size at about 10cm.

Summary
Very little sediment exposed except in a few patches; the sediment in most shots appears to be *Halimeda*. In one shot the surface is a pavement of fungias. Most of the location is covered by a thick and luxuriant covering of seagrass to the exclusion of all other fleshy algae.

122/CM/018
This station is in 35m of water on Fagin Bank.
1. This environment is one of nearly 90% algal cover, the algae forming a low branching turf. Living *Halimeda* forms part of this turf. Older and dead Fungia occurs in the left of the photograph.
2. As above.
3. As above with a flat encrusting soft alga also occurring in the left of the photograph. *Halimeda* is abundant.
4. As above. *Halimeda* abundant.
5. As above. The fungias live on the algal turf.

Summary
Another bank environment where the sediment is totally covered by an algal turf of low "scrub". *Halimeda* is part of this turf and is abundant at this location. Fungias appear to grow and live on the turf.

122/CM/019
This station is in 28m of water on Fagin Bank.
1. The surface appears to be a pavement which is almost totally covered by an algal turf which includes *Halimeda*. Dead fungias occur on this surface. Spiny echinoids are seen in abundance on this surface also (i.e.4 in the photograph).
2. Overlaps with 1 above and shows enormously abundant *Halimeda* and another spiny echinoid.
3. Abundant *Halimeda* and other algae (low branching forms), and spiny echinoids. The substrate appears to be made of small pebbles about 2cm diameter. These may in fact be rhodoliths.
4. A pebbly pavement, framed by living *Halimeda* thickets and seven spiny echinoids. Coarser gravel pebbles also occur up to about 6cm diameter.
5. As above. Also a Linkia like starfish in the top right.
6. As above.
7. Small pebble pavement with little or no algal covering. *Halimeda* is however abundant down the right side and in the upper left. The pebbles are sub-rounded
8. As above. Also contains another starfish.
9. Excellent photograph showing the abundant and tiered soft algal growths and the trapping effect on the sediments.
10 As above. A very large variety of soft algae completely covering and sheltering the sediment beneath which is a fine gravel.

Summary
From an organic viewpoint, this location is the most densely covered substrate photographed on any of the banks. It is an environment where the algal cover is tiered and is many times greater than 100% cover. The sediment is a pebble conglomerate made up of rounded to subrounded pebbles up to 6cm diameter. *Halimeda* is abundant and macro benthos include spiny echinoids and other starfish.

APPENDIX 6. DESCRIPTION OF GRAB SAMPLES

122/GR/001
The gravel fraction is dominated by pteropods and bivalve fragments. The fine sand fraction is mainly broken pteropod fragments.

122/GR/002
Olive (5Y5/3) muddy sand (much more mud than previous sample). There is very little gravel, and this is entirely pteropods and thin-shelled clams. The sand fraction consists mainly of planktonic and benthic forams. The planktonic forams are much more abundant than the previous site.

122/GR/003
Greenish muddy sand containing abundant small planktonic forams with a variety of genera present. Ostracods also seem to be fairly abundant.

122/GR/004
Fine to medium carbonate sand with some mud (<20%). Mainly small planktonic forams and comminuted skeletal fragments. The coarse sand fraction (20%) is mainly pteropods with some larger planktonic forams. The gravel fraction (<1%) is made up mainly of pteropods, with some faecal pellets and minor planktonic forams.

122/GR/005
Coarse sandy gravel consisting of *Halimeda* segments and large benthic forams, with minor amounts of bryozoans, echinoids, gastropods and bivalve fragments. No identifiable corals or coralline algae.

122/GR/006
Gravelly sand, mainly medium to coarse sand with about 25% gravel. The sand fraction is predominantly forams plus a high proportion of comminuted skeletal material. The gravel fraction is composed mainly of *Halimeda*, but with some bryozoans and large benthic forams, and possibly some coral fragments. A solitary coral was recovered in the grab.

122/GR/007
Very coarse sandy gravel, consisting predominantly of *Halimeda* with coralline algal coated clasts (up to cobble size), some solitary corals (small 4 cm diameter, round *Fungia* sp.). The sand is mainly forams and fragments of *Halimeda* and shell hash. The coarser material appears to be algal encrusted branching corals. Some maerl-type rhodoliths (about 20 cm diam.) are present, some with living red algae.

122/GR/008
Olive (5Y5/3) gravelly sand with possibly some mud. The fine to medium sand fraction consists of comminuted skeletal material, plus numerous benthic forams and some planktonic forams. The coarse sand fraction is predominantly *Halimeda* fragments and large benthic forams, with minor echinoid and mollusc fragments. The fine gravel fraction (granule to pebble) consists of *Halimeda* segments (approx. 10% of total sample), plus rods of unknown origin (they could be coral branches, but they are light and so may be bryozoan), plus some solitary corals (*Fungia* sp. about 1 cm diam.) and lacy bryozoans. The larger rods (from 2-5 cm long) appear to be hollow in parts, and do not appear to be coral branches. The larger clasts (?) are coarse pebble to cobble size, and consist of hollowed (bored?) indeterminate fragments, others are limestones, and one is possibly a coral.

122/GR/009
Olive (5Y5/3) muddy sand consisting of very fine- to fine sand-size comminuted skeletal material and small benthic forams. Some medium to coarse sand (approx. 10%) consists of forams and pteropods. The mud fraction is around 10-15%. The small (<1%) gravel fraction consists of pteropods.

122/GR/010
Olive (5Y6/3) sand with clasts. The sand is fine to coarse (mostly med.-coarse) and consists of forams, pteropods and comminuted skeletal material. The clasts are similar in composition, but are friably cemented. Both the clasts and sediment have brown (goethite?) pellets and foram fillings, whereas the sediment has glauconite as well.

122/GR/011
Olive (5Y7/3) gravelly sand (approx. 15-20% gravel) consisting of medium to coarse sand made up of subrounded skeletal fragments and forams. many red-coloured skeletal fragments are encrusting forams. The gravel fraction consists of *Halimeda*, large benthic forams (including *Sorites*), bryozoans, echinoid plates and spines, and bivalves.

122/GR/012
Olive (5Y5/3) slightly muddy, fine to medium sand, consisting mainly of comminuted skeletal material, some small benthic forams and pteropods.

122/GR/013
Sandy gravel, composed mainly of carbonate rock fragments, pteropods and *Halimeda*. The gravel fraction is greater than 50%. The sand fraction consists of highly angular rock fragments, benthic forams, pteropods and echinoid spines.

122/GR/014
Very coarse sand composed of rock fragments, *Halimeda*, and some benthic forams (including encrusting types) and pteropods. The grab also recovered green leaves of some type of algae or sea grass. The gravel fraction consists mainly of *Halimeda* , with some gastropods and branching coral (*Seriatopora*?) in different stages of being encrusted by coralline algae. There are also large benthic forams, including disc-like types.

122/GR/015
Very coarse sand, with a pinkish colour because of the abundance of encrusting forams and possibly coralline algae. The sand fraction is coarse to very coarse, consisting mainly of angular grains. Sorting is moderate. *Halimeda* is dominant, mainly as broken segments, and there may be some coral fragments. The gravel fraction is about 90% *Halimeda* segments and about 5% bryozoans (commonly lacy types). There are one or two large coral clasts (3 cm) encrusted by coralline algae and forams. The soft green algae (sea grass) has quite long and strong roots and these seem to be stabilising the sediment.

122/GR/016
Halimeda gravel with some lacy and a few branching bryozoans. The red colour in the sediment is due to early stages of encrustation by coralline algae. A few large, disc-like forams are present. Two larger clasts consist of corals with pink encrusting forams and bryozoans. The bryozoans appear to be more common than corals. The sand fraction is poorly sorted, medium to very coarse sand. The brown/pink colouration is due to encrusting bryozoans. *Halimeda* and benthic forams are the dominant constituents.

122GR/017
Medium to fine sand with only a small (<10%) amount of gravel. The sand is moderately sorted. It is white with little pink colouration. Only *Halimeda* can be recognised, the remainder, with the exception of pink encrusting forams, are unrecognisable. The gravel fraction is mainly *Halimeda* and round, flat large benthic forams, with fragments of solitary corals. The grainsize of the gravel fraction is fine (3-4 mm) and reasonably well sorted.

122/GR/018
The grab contained 5 genera of corals, e.g. *Goniastrea*, *Pocillopora*, *Seriatopora*, a pink flat form and another with extent septa. There are some bulbous coralline algal growths on the dead corals. *Halimeda* is still abundant in the gravel fraction, but corals are also reasonably common (<20%). The red colouration is from encrusting forams (probably *Homotrema*).

There are also many disc-like, almost translucent large benthic forams. One large cobble (3-4 cm) is red coloured and encrusted by coralline algae. The algae consist of both encrusting and branching forms. This is in the process of becoming a rhodolith. The sand is very coarse and well sorted. There is very little fine to medium sand present. Benthic forams are relatively common in the sand fraction while lacy bryozoans are present, but not abundant.

122/GR/019
The sample is 90% gravel, of which 70% is *Halimeda*. Corals, bryozoans and benthic forams are also present. There are a lot of pink encrusting forams, but it should be checked to see if they are bryozoans rather than *Homotrema*.

122/GR/020
This sample is 10% gravel and 90% sand. The gravel fraction contains *Halimeda*, bryozoans, benthic forams and some coral. The bryozoans are lacy types. Some broken gastropods are also present. The sand fraction is poorly sorted, mainly coarse to very coarse sand with a medium sand fraction as background. There are echinoid spines and pink bryozoan fragments in the sand.

122/GR/021
Not described

122/GR/022
No recovery

122/GR/023
Not described

122/GR/024
No recovery

122/GR/025
Very little sample. Recovered muddy sand with one large part of an echinoid.

122/GR/026
Fine to medium sand with some coarse sand and granule size sediment. The fine to medium sand is mainly comminuted skeletal material and small benthic forams. The gravel fraction (approx. 10%) contains *Halimeda*, large benthic forams, pteropods, bryozoans, bivalves, and small intact echinoids.

122/GR/027
Pale yellow (10YR8/2) sandy gravel (although possibly about 50:50). The gravel fraction consists mainly of *Halimeda*, with subordinate large benthic forams, branching coral fragments etc. The sand fraction is medium to coarse, and consists of benthic forams, fragments of *Halimeda* segments and other comminuted skeletal material.

122/GR/028
Pale yellow (10YR8/2) gravelly sand consisting of intact benthic forams (around 2 mm diam.), plus med.-coarse sand to fine gravel size comminuted skeletal material, particularly *Halimeda*. The sand fraction is mainly smaller benthic forams and skeletal material. The gravel fraction includes *Halimeda*, plus coral and bryozoan fragments, and some larger bivalves (*Pecten*). The grab also recovered the leaves, stems and roots of a soft green algae or sea grass

122/GR/029
The grab recovered somewhat finer pale olive (2.5Y8/2) gravelly sand than previously, plus soft green algae on top. The sediment is *Halimeda*-rich, with moderate sized (3 mm) large benthic forams, and comminuted skeletal material in the medium to coarse sand size range. The gravel fraction is predominantly *Halimeda*, but there are some coralline algal coated

grains, larger bivalves, gastropods, large benthic forams and bryozoans.

122/GR/030
Olive (5Y8/3) medium to coarse sand with some gravel (15%). The sand is mainly comminuted skeletal material, with some intact benthic forams. The gravel fraction is dominated by *Halimeda* segments, with minor bryozoans and large benthic forams.

122/GR/031
Olive (5Y8/3) gravelly sand to sandy gravel, with fragments and segments of *Halimeda* plus 2-4 mm benthic forams dominating the coarse sand and gravel range and comminuted skeletal material predominantly in the fine to medium sand fraction. The gravel fraction is mainly composed of *Halimeda* segments, with minor molluscs and bryozoans.

122/GR/032
The grab recovered a lot of living material on the surface, including *Halimeda* and seaweed, as well as very fine specimens of lacy bryozoans. The pale yellow (10YR8/2) sandy gravel is dominated by *Halimeda* and foraminifera. The medium sand fraction is mainly comminuted skeletal material, whereas the forams are 1-4 mm in size or larger. the gravel fraction is made up predominantly of *Halimeda* segments, with some large benthic forams and minor molluscs and bryozoans. The very coarse fraction (cobble-size) includes two rather unusual corals, echinoids and solitary corals.

122/GR033
The grab recovered a finer type of bank top deposit, with soft weed and some green leaf-like weed. The pale yellow (10YR8/2) gravelly sand contains fragments and segments of *Halimeda*, together with benthic forams and comminuted skeletal material. The sand fraction is medium to coarse, with skeletal fragments dominant in the medium sand and forams in the coarse sand. The gravel fraction is mainly *Halimeda* segments, with minor bryozoans, large benthic forams and molluscs.

122/GR/034
No description

122/GR/035
Olive (5Y5/3) muddy sand with <20% mud. The sand is bank derived, and also contains pteropods.

122/GR/036
No description

122/GR/037
Very sandy with very little mud.

122/GR/038
No description

122/GR/039
Gravel composed of *Halimeda* and abundant coralline algae.

122/GR/040
Very coarse. Gravel predominates and is composed of coralline algae and *Halimeda*. Long leaf plant growing on *Halimeda*.

122/GR/041
Lost grab

122/GR/042
Gravel composed of coralline algae and *Halimeda*. Small boulder with lacy bryozoans and living *Halimeda*.

122/GR/043
No description

122/GR/044
Gravel consisting mainly of *Halimeda*. Solitary corals (*Fungia* sp.) and coralline algal crusts.

122/GR/045
Pale olive (5Y6/3) fine to coarse sand with 20% gravel. The sediment consists of comminuted skeletal material, forams and *Halimeda*., plus some unknown whorl-like skeletons that are flat on one side. There is a small amount of plant remains in the sediment. The gravel fraction is dominated by *Halimeda*, with algal coated clasts that could be bryozoan fragments, plus gastropods, large benthic forams and echinoids. The cobble-size fraction consists of large coralline algal coated clasts of unknown origin (one is rounded like a rhodolith) and a specimen of a colonial coral with zoantharian attributes.

122/GR/046
Colour of sediment is 2.5Y7/2. The grab recovered abundant soft green algae with long curved leaves; a sample was collected and frozen. The sediment is a sandy gravel consisting mainly of *Halimeda* segments and some cobble-size clasts (old corals?) that have been encrusted by coralline algae. Many of the *Halimeda* segments and other clasts have been encrusted by red-coloured forams (*Homotrema*?). The sand-size fraction is coarse and has a speckled appearance because of the abundance of red encrusting forams. Other grain types include comminuted skeletal material and forams. The fine (granule-pebble) gravel fraction is dominated by *Halimeda* and algal encrusted clasts. The larger gravel consists of living coralline algal coated cobbles of possible coral origin. One platey coral is encrusted by a living encrusting coral.

122/GR/047
Did not trigger

122/GR/048
The grab brought up an almost undisturbed sample that consists of a veneer of rubble that is encrusted by living coralline algae, with living *Halimeda* growing on top. The rubble is held together, apparently by soft tissue and possibly by *Halimeda* holdfasts. Much of the rubble appears to be coral. Associated is a *Halimeda*-rich sandy gravel (colour is 2.5Y8/2). There are quite a few encrusting forams on the *Halimeda* segments, and large benthic forams are also present. The sand fraction is very poorly sorted, with fine sand and coarse sand in about equal proportions. There seems to be fine plant material associated with the fine sand fraction, giving it a "dirty" appearance. The sand fraction is predominantly comminuted skeletal material, encrusting forams and other benthic forams. The gravel fraction is essentially *Halimeda*, with some pebble-size algal coated fragments (either coral or bryozoan) and larger fragments of encrusted dead solitary corals.

122/GR/049
The grab recovered *Halimeda* gravel, with living *Halimeda*, bryozoans and soft algae attached to clasts of solitary corals that have been encrusted by living coralline algae. One specimen consists of a living branching bryozoan, about 5 cm high, growing on top of a dead encrusted *Fungia*. The sediment is a *Halimeda*-rich sandy gravel. Other constituents include coated clasts, forams (red encrusting types are fairly abundant) and bryozoan fragments. The sand fraction is mainly coarse, and consists of abraded skeletal material and forams (including encrusters). The gravel faction consists of the ubiquitous *Halimeda*, plus coated clasts, bryozoan fragments and large benthic forams. Larger material, such as solitary corals and molluscs have been encrusted by living coralline algae.

122/GR/050
The grab recovered long curved leaf green algae (seagrass) and not much sediment, but a lot of rocks. The sediment is essentially a coarse algal encrusted gravel consisting mainly of large shells and corals (solitary type), with some *Halimeda* attached (but minor compared to elsewhere on top of the bank). There is very little sand, but it is poorly sorted and is "dirty" because of finely divided plant (algal?) organic material within the fine sand fraction.

122/GR/051
The grab recovered long curved leaf seagrass, plus *Halimeda*-rich gravel and larger algal encrusted clasts. The small amount of sand present is poorly sorted, with the fine sand seemingly associated with the seagrass. Apart from comminuted skeletal material, there are benthic forams in the sand fraction. The coarser clasts consist of corals (rounded, flat solitary types) that have been bored and encrusted by living coralline algae.

122/GR/052
This is a fine to medium sand with a small amount of mud. The sand appears to be well sorted abraded skeletal fragments. Most grains are unidentifiable.

122/GR/053
Did not trigger

122/GR/054
Did not trigger.

122/GR/055
Fine to medium sand mainly, but with some minor coarse material, and possibly some mud. The sand is predominantly skeletal debris, with some benthic forams and pteropods.

122/GR/056
Coarse sandy gravel containing *Halimeda* fragments, granule- to cobble-size clasts, forams and comminuted skeletal material. The sand fraction is fine to coarse. One large fragment appears to be a packstone. The rest of the gravel fraction consists of a variety of skeletons, including *Halimeda*, corals/bryozoans? and molluscs.

122/GR/057
Pale olive (5Y6/3) sand, with about 10% mud and a similar amount of gravel. The sand is fine to coarse, consisting of comminuted skeletal material and forams (a reasonable proportion of which are planktonic). The gravel fraction consists of abraded granules of *Halimeda*, bryozoans, bivalves, forams and corals (all looking the worse for wear).

122/GR/058
Fine to medium carbonate sand (5Y6/3). This size fraction makes up 95% of the sample. The gravel fraction (5%) consists of comminuted molluscs and pteropods.

122/GR/059
Halimeda gravel with a very coarse sand fraction comprised of *Halimeda* fragments, benthic forams, and pink coloured encrusting bryozoans.

122/GR/060
Medium grained sand with less than 1% gravel.

122/GR/061
Rubble, covered by red algae and living *Halimeda*, together with other green algae (seagrass), especially the long leaved variety. The texture is a sandy gravel with fine gravel and very coarse sand. *Halimeda* dominates in both fractions. Some of the sands are being stabilised by roots and possibly seafloor cementation. The sands are very poorly sorted. The gravel is composed of *Halimeda* and semi-translucent Peneropilid-type benthic forams.

122/GR/062
Slightly muddy sand (< 5% mud), consisting of fine to medium sand comprised of benthic forams and pteropods. Bank material may occur in the fine sand fraction.
The gravel content is less than 5%.

122/GR/063
Fine sand with mud.

122/GR/064
Olive (5Y5/3) fine to coarse sand with a minor amount of mud and gravel. The sample is primarily abraded skeletal material with some intact benthic forams. The gravel fraction consists of pteropods and shell material, plus some abraded clasts (packstone?).

122/GR/065
Olive (5Y5/3) fine to medium sand consisting of skeletal fragments and forams (some planktonic types are evident). Dark grains appear to be glauconite (~5%).

122/GR/066
Olive green sandy mud. Lots of pteropods.

122/GR/067
Halimeda gravel consisting almost exclusively of *Halimeda,* apart from some large (8-10 cm diam.) solitary corals (*Fungia*). These are partly encrusted by thin living coralline algae. Other constituents include benthic forams (noticeably *Baculogypsina*) and red encrusting forams. What sand fraction there is, is poorly sorted; the coarse sand being dominated by forams, while the fine sand contains organic (seagrass) flecks.

122/GR/068
Halimeda gravel consisting of about 90% *Halimeda* segments plus others, including algal coated clasts and maerl rhodoliths. The sand fraction is poorly sorted, with a coarse sand of *Halimeda* fragments and forams, and a fine sand that is possibly root-protected.

122/GR/069
The grab recovered delicate branching corals, solitary corals and heaps of living *Halimeda*, along with *Halimeda* gravel. The meagre sand fraction is again a poorly sorted mixture of coarse and fine sand-size material.

122/GR/070
Lush, living *Halimeda* with lots of delicate branching corals and some platey types living amongst it. The grab hardly recovered any sediment.

122/GR/071
Gravelly muddy sand (2.5 Y6/1) consisting of coarse fragments of *Halimeda* and other shells, plus large benthic forams. The gravel fraction consists of a mixture of *Halimeda* segments, abraded coral? fragments and large benthic forams.

122/GR/072
Fine, slightly muddy sand (5Y5/3) consisting mainly of abraded skeletal material with some relatively coarse pteropods.

122/GR/073
Foram-rich medium sand. The forams show high diversity and include planktonics. However, fine to medium sand fraction, composed mainly of abraded skeletal material, is more abundant.

122/GR/074
Foram-rich sand with about 25% gravel. The sand is fine to coarse, consisting mainly of comminuted skeletal material and benthic and planktonic forams. The gravel fraction consists

of comminuted skeletons of bivalves, bryozoans and corals, plus granule-size relict? clasts (brown). *Halimeda* is noticeably absent.

122/GR/075
Halimeda gravel and rhodoliths. There was a 0.5 knot current across this edge. Lots of living *Halimeda*. Sand fraction is <5%.

122/GR/076
Did not trigger.

122/GR/077
Grab triggered , but there was only mainly suspension load in the water, and very little sediment. Olive (5Y5/3) muddy sand. Poorly sorted, with fine sand consisting of abraded skeletal material, medium sand consisting of skeletal material plus forams, including planktonics, and coarse sand consisting of fragments of bivalves, *Halimeda*? and intact forams. Several gravel (granule)-size fragments of *Halimeda* and bivalves are also present.

122/GR/078
Light olive grey (5Y6/2) muddy sand to sandy mud with some coarse material included. The sand fraction is fine to coarse, with abraded skeletal fragments making up the fine sand fraction, and, together with benthic and planktonic forams, the medium to coarse sand fraction. The gravel fraction contains clasts of muddy sand that may be rip-up clasts of *in situ* cementation on the sea floor. Another possibility is that have been part of the walls of burrows. They vary from almost soft to fairly friable.

122/GR/079
Halimeda gravel with some very fine to coarse sand, plus some larger fragments of a fragile, leaf-like coral (possibly two species). The sand fraction is poorly sorted, with the fine sand fraction being dominated by comminuted skeletal material, whereas the coarse sand fraction is dominated by fragments of *Halimeda*, plus benthic forams. Both sizes are about in equal proportion. The gravel fraction consists of fragments of the above mentioned coral plus abundant *Halimeda* segments and some large benthic forams.

122/GR/080
Olive (5Y5/3), slightly muddy sand (~10% mud) consisting of fine to coarse carbonate sand, consisting of abraded skeletal material, generally small benthic and planktonic forams, and pteropods. The sand fraction contains a fair proportion of what could be termed "relict grains". These are generally brown and vary from fine to coarse. The gravel fraction contains worn and abraded skeletal fragments, bivalves, echinoids and pteropods.

122/GR/081
Brownish olive medium to coarse sand with some gravel size shell fragments. The gravel is composed of rock fragments, benthic forams, shell fragments, calcified borings, and many unidentifiable fragments. The sand fraction is very poorly sorted, and is composed of shell fragments and rock fragments.

122/GR/082
Triggered, but very little sediment. Repeat.

122/GR/083
Once again, very little sediment, other than fine sand on the bottom of the grab.

122/GR/084
Olive grey sandy mud with some shell fragments, especially bivalves. The sand fraction is reasonably well sorted. Larger fragments are rock and pteropods.

122/GR/085
Muddy sand. Abundant planktonic forams in the sand fraction. The gravel fraction is made up of pteropods.

122/GR/086
Muddy sand with very few shell fragments of gravel size. The gravel contains bivalves, bryozoans, benthic forams and pteropods. The sand is fine, but with some coarse sand consisting of mollusc fragments and benthic forams.

122/GR/087
Greenish grey sandy mud; the gravel is mainly pteropods. The sand is quite fine, and is made up entirely of broken shell material and limestone rock fragments.

122/GR/088
Sandy mud with pteropods forming the only gravel fraction. The sand fraction is dominated by benthic and planktonic forams. Sorting is into two fractions - fine and coarse sand.

122/GR/089
Very soft and squelchy sandy mud.

APPENDIX 7. DESCRIPTION OF DREDGE SAMPLES

122/DR/001
140kg of rocks consisting a variety of corals most of which are head corals. No branching corals were recovered. Other samples include *Halimeda* grainstones and rhodolith grainstones with cementation varying from poor to well cemented. Some show evidence of mouldic porosity.

122/DR/002
Ten kilograms consisting of corals, bryozoans, red algae and *Halimeda*. Mostly individual pieces with very little cement. The algal boundstones also contain prominent benthic foraminifera. Most of the larger fragments are light grey in colour although a few of the corals are red. The gravel from the pipe dredge was comprised of *Halimeda*, Seriatopera-like corals, and benthic foraminifera which are principally *Amphistegina* and *Calcarina*. Shear pin broke.

122/DR/003
The haul was similar to that in the previous dredge. Three fragments were recovered in the dredge basket and they were red coralline algae, poorly cemented *Halimeda* grainstone and a massive coral. The two pipe dredges yielded corals including Fungias, a platey variety and some branching forms, sponges binding *Halimeda*. Rhodoliths up to 7cm across with the red algae coating many cobble sized particles. Shear pin broke.

122/DR/004
Forty kilos of rocks with many large blocks broken off and indicating *in situ* material. The dredge actually recovered *in situ* materials from 150-120m on the slope and not off the top of the bank. The large blocks are very well cemented *Halimeda* grainstones containing abundant large benthic foraminifera. The *Halimeda* appear to be floating in a "cement".
Coralline algae appear to have played a large part in the cementation process. One large sample is comprised entirely of coral, rhodoliths (2cm across) and *Halimeda* in a cement. Some of the *Halimeda* slabs have a more open texture where the macro-porosity appears to be mud infilled. Eight photographs were taken of this dredge material.

122/DR/005
Forty kilos comprised of branching corals and massive corals many of which are extensively bored; coralline crusts covering corals, *Halimeda* grainstones and bioclastites. Rhodoliths also occur. The bioclastites are bioclastic grainstones which are very dense. The *Halimeda* grainstones also contain large foraminifera and are very well cemented.

122/DR/006
No big bites and the dredge was half full of rubble comprised of corals, *Halimeda* and coralline encrusted fragments. Seven photographs were taken of this dredge material.

122/DR/007
The main hits occurred in depths of 230-210 m where it is believed the corals, coralline crusts, rhodoliths and bryozoan framework came from. Two photographs were taken of this dredge material.

122/DR/008
Came off the bottom in 105 m of water, but the large blocks in the haul came from 250m. These are corals, grainstones comprised of *Halimeda*, coralline crusts and large foraminifera. The grainstones are well cemented. The corals show multiple growth stages with crusts between successive growths. Some of the float material contains rhodoliths. Nineteen photographs were taken of this dredge material.

122/DR/009
Large blocks obtained on the second try at this site. Most are massive corals containing what look like fresh water cements. There may also be some dolomitisation. Rhodoliths, crusts and *Halimeda* grainstones also occur, but are less prominent than in earlier dredges. This haul is essentially that of an earlier shallow water reef. Seven photographs were taken of this dredge material.

122/DR/010
Recovered only float from the base of the scarp.

122/DR/011
Broke the shear pin and recovered nothing.

122/DR/012
No recovery other than float. The current at this site was particularly difficult. It was setting to the north so that *Rig Seismic* could not stay on station long enough to deploy a dredge to any depth before she found herself in shallow water on top of the bank.

122/DR/013
The bottom was torn out of the dredge after a series of very hard bites.

122/DR/014
Many very large bites and the dredge stayed together so as to provide an absolutely full dredge with many large blocks. The main blocks were comprised of cemented *Acropora* stick rubble, head corals (*Goniopora*), coral framework with coralline crusts, superb coralline crusts atop *Millepora* and showing geopetal cavities, and *Halimeda* packstones. Many of the frameworks are extensively bored by sponges. Eleven photographs taken of this dredge material.

122/DR/015
An excellent dredge with a hang-up at 290m and another at 280m, and then pulled off. Unfortunately, only five pieces of very old reef rock and coral. The coral is a Goniopora-type which appears to be recrystallised. One cut piece of reef rock shows shallow water coral and coralline crust. The rocks and corals are serpulid encrusted.

122/DR/016
A few light bites between 300 and 160m and then hung up on a ledge at 150m. Pulled back over it and pulled off. Dredge contained large blocks of shallow water reef limestone presumably obtained from the ledge at 160m.. Blocks of colonial coral - Faviids. Also large blocks of corallines encrusting *Millepora*. Very shallow original water depths.

122/DR/017
Broke a 7 tonne shear pin at a depth of 145m when hung up on a ledge. Three small samples in the dredge on recovery consisted of corals, coralline crust and reef rock.

122/DR/018
Targeting the wall at 150m, hung up for quite a while. Pulled off with wire vertical and 114m of wire out. Unfortunately, the dredge appeared to contain only float.

122/DR/019
Shear pin broke and no recovery.

122/DR/020
Dredge hooked up and brought ship back to vertical wire at a water depth of 136m where it came off. Mainly float.

122/DR/021
Shear pin broke with 114m of wire out. Few corals in the bag after excellent hits from 175-150m.

122/DR/022
Good dredge through to 150m. Hung up and came off. Good haul of rocks and mud off the side of the valley. Corals and algae, grainstones. Eight photographs taken.

APPENDIX 8. WELLS DRILLED IN THE TIMOR SEA

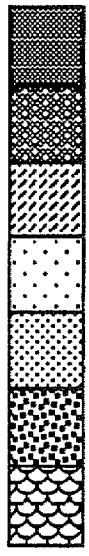
WELL NAME	LATITUDE (oS)	LONGITUDE (oE)	WATER DEPTH (m)
Allaru 1	12.093406	124.798173	-125
Anderdon 1	12.646416	124.796593	-97
Anson 1	12.502971	124.8035	-99
Arunta 1	11.975496	124.951508	-122
Ashmore Reef 1	12.180472	123.086277	-39
Asterias 1	13.152305	124.119998	-194
Avocet 1	11.373053	125.755	-105
Avocet 1A	11.372813	125.755068	-105
Avocet 2	11.364093	125.757075	-106
Barita 1	11.443318	125.728188	-94
Bassett 1	13.31111	123.42667	-372
Bassett 1A	13.311583	123.425222	-372
Bilyara 1	12.684654	124.505886	-82
Bilyara 1 ST1	12.684654	124.505886	-82
Birch 1	12.460841	124.495348	-87
Brewster 1	13.91361	123.2589	-256
Brewster 1A	13.913706	123.259511	-256
Brown Gannet 1	12.108056	123.856111	-110
Browse Island 1	14.112555	123.549193	2.9
Buccaneer 1	13.616666	124.016666	-149
Cartier 1	12.244166	123.940276	-100
Cassini 1	12.146501	124.968138	-116
Cassini 1	12.146498	124.968136	-116
Cassini 2	12.148551	124.949416	-113
Casuarina 1	12.052446	125.098658	-95
Challis 1	12.123753	125.00446	-108.2
Challis 2	12.121666	125.018333	-98
Challis 2A	12.121286	125.018568	-105
Challis 3	12.115125	125.022888	-102
Challis 4	12.129268	124.995086	-108
Challis 5	12.122263	124.996666	-107.3
Challis 6	12.109661	125.034593	-99
Challis 7	12.105366	125.040561	-104
Challis 8	12.102161	125.047823	-103
Challis 9	12.1091	125.035398	-100
Challis 10	12.126736	125.017348	-98
Challis 11	12.099143	125.054613	-101
Champagny 1	12.487223	124.312601	-70
Cockell 1	11.667278	125.039228	-265.5
Cockell 1ST1	11.667278	125.039228	-265.5
Crane 1	12.125766	125.628168	-78
Cygnet 1	11.896123	125.939029	-80
Delamere 1	12.000475	125.304193	
Delta 1	12.649066	123.970348	-205
Dillon Shoals 1	11.239264	125.446997	-125
Discorbis 1	12.882476	123.812796	-199
Drake 1	11.285013	125.835438	-103
Dromana 1	12.274998	124.9125	-96
East Swan 1	12.301968	124.582249	-103
East Swan 2	12.292674	124.583496	-104
Echuca Shoals 1	13.750342	123.723617	-194
Eclipse 1	12.271388	124.618609	-109
Eclipse 2	12.238423	124.643611	-109

Eider 1	11.389167	125.746389	-100
Fagin 1	11.571388	125.137776	
Flamingo 1	11.026111	126.481944	-96
Fulica 1	11.088891	125.875183	-136
Garganey 1	11.356651	125.91643	-100
Grebe 1	12.451111	124.249444	-69
Gryphaea 1	12.810646	123.739321	-200
Heywood 1	13.462683	124.066725	-35
Ibis 1	12.062021	125.346491	-95
Jabiru 1	11.932181	125.005222	-120
Jabiru 1A	11.933561	125.004081	-120
Jabiru 2	11.934864	124.988837	-118
Jabiru 3	11.925583	125.00885	-115
Jabiru 4	11.921625	125.019882	-119
Jabiru 5	11.940204	124.989593	-120
Jabiru 5A	11.939861	124.990171	-120
Jabiru 6	11.930321	125.012855	-118
Jabiru 7	11.920548	125.017303	-119
Jabiru 7 ST1	11.917991	125.017401	-119
Jabiru 8	11.936518	125.01038	-118
Jabiru 8A	11.936526	125.010388	-118
Jabiru 9	11.951113	124.980398	-118
Jabiru 10	11.922358	125.026016	-118
Jabiru 11	11.942079	124.993308	-118
Jarrah 1	11.289238	125.70328	-108
Jarrah 1A	11.289333	125.703166	-108
Kalyptea 1	13.032998	123.872388	-214
Katers 1	12.675416	124.744416	-90
Keeling 1	12.620576	124.165043	-189
Kite 1	12.067793	126.436761	
Londonderry 1	13.614769	124.51183	-90
Lorikeet 1	11.173676	125.617996	-108
Lucas 1	12.260361	124.133804	-90
Maple 1	12.019916	124.538716	-125
Montara 1	12.689346	124.531661	-85.1
Mount Ashmore 1	12.560276	123.20667	-623
Mount Ashmore 1A	12.560276	123.20639	-623
Mount Ashmore 1B	12.560081	123.20781	-623
Nancar 1	10.988741	125.757818	
Nome 1	11.655268	125.221291	-122
North Hibernia 1	11.671953	123.324741	-33
Octavius 1	11.847221	124.910555	-155
Oliver 1	11.644804	125.008801	-305
Osprey 1	12.219167	125.22084	-101
Paqualin 1	11.980638	124.5069	-125
Parry 1	12.270646	124.337516	-96
Pascal 1	12.203	124.221898	-100
Peewit 1	12.656144	126.020894	-85.8
Pengana 1	11.891433	125.029043	-117
Plover 1	12.7125	126.368611	-58
Plover 2	12.958056	126.174444	-59
Plover 3	12.818156	126.115833	-74.7
Pollard 1	11.664444	124.56889	
Prion 1	12.404444	124.151944	-70
Prudhoe 1	13.748819	123.864203	-175
Puffin 1	12.308333	124.333611	-102
Puffin 2	12.363056	124.275277	-78
Puffin 3	12.288783	124.35825	-98

Puffin 4	12.292226	124.360668	-98
Rainbow 1	11.937958	124.331913	-135
Rainier 1	12.062463	125.023008	-110
Rob Roy 1	13.971	124.199194	-112
Rowan 1	12.498298	124.393698	-300
Sahul Shoals 1	11.426667	124.54723	-28
Skua 1	12.505278	124.432777	-80
Skua 2	12.509516	124.404346	-81.7
Skua 3	12.506121	124.414663	-78.5
Skua 4	12.493136	124.425766	-81
Skua 5	12.473918	124.443666	-85
Skua 6	12.487498	124.438498	-82
Snowmass 1	11.994708	125.179466	-112
Swan 1	12.188056	124.492777	-109
Swan 2	12.194727	124.495677	-108
Swift 1	12.537356	124.451507	-81
Talbot 1	12.453138	124.881616	-111
Talbot 2	12.457133	124.870329	-103
Taltarni 1	12.612863	124.579529	-76
Tamar 1	11.870924	126.211144	-64
Tancred 1	11.734743	125.323429	-108
Turnstone 1	11.736944	125.295833	-118
Voltaire 1	11.193351	125.331983	-331
Vulcan 1	12.241993	124.549474	-108
Vulcan 1A	12.242261	124.549964	-108
Vulcan 1B	12.242642	124.550339	-109
Whimbrel 1	12.482778	125.378055	-77
Willeroo 1	12.027721	124.897891	-114
Woodbine 1	12.645206	124.147072	-189
Yering 1	12.612888	124.517098	

APPENDIX 9. GRAPHIC CORE LOGS

LEGEND



mud

sandy mud

muddy sand

fine sand

sand

coarse sand

gravel

"a" grades into "b"

burrow

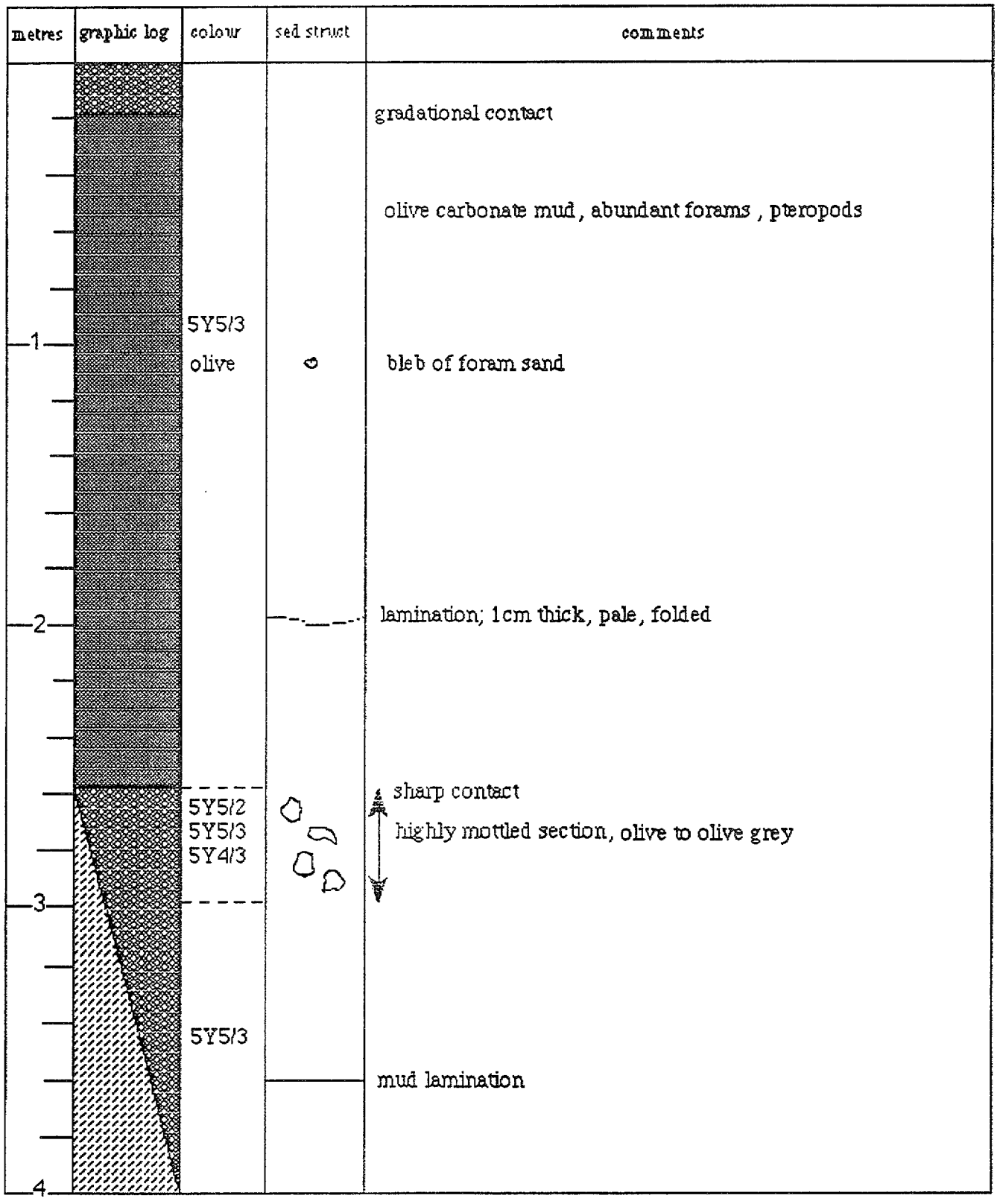
shell lag

△ fining upwards

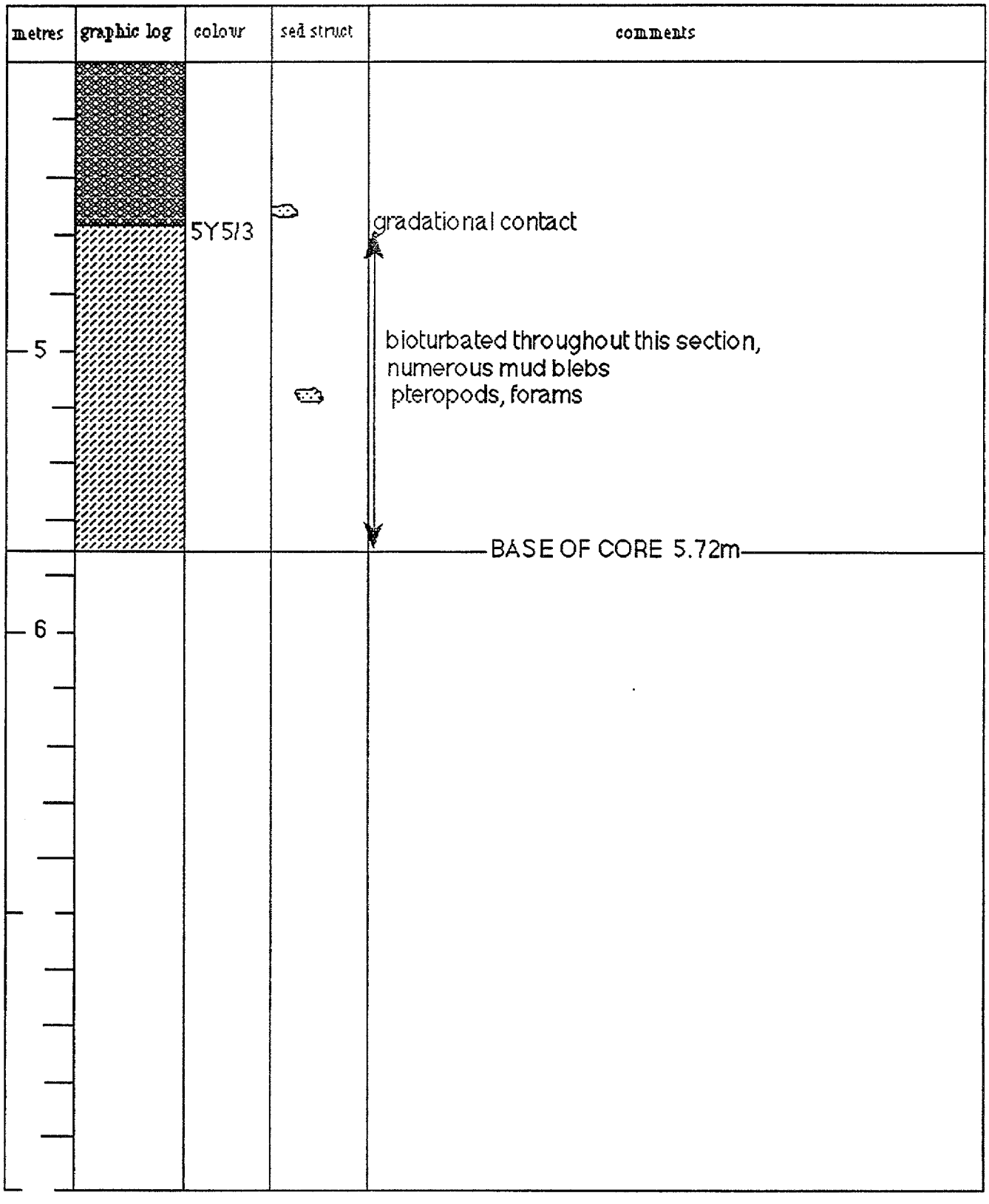
▽ coarsening upwards

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 4	**Lat.** 11°13.84' S	**Long.** 124°52.95'E	**Water depth** 416m
Core 122/GC/003	**Described by** A. TROEDSON	**Date** 22/10/93	**Length** 5.78m

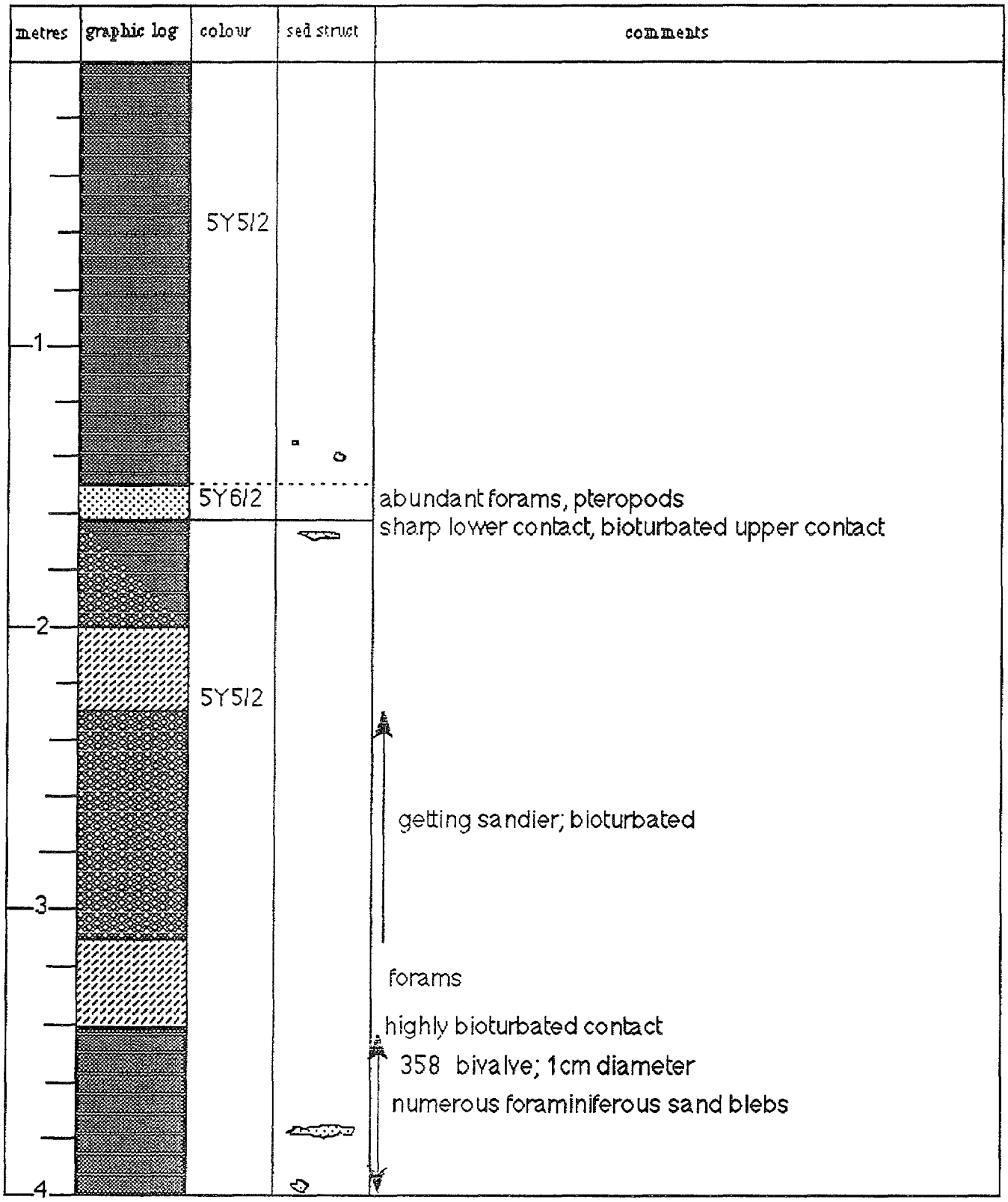


Site 4	Lat. 11°13.84S	Long. 124°52.95E	Water depth 416
Core 122/GC/003	Described by A.Troedson	Date 22/10/93	Length 5.78



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 25	**Lat.** 11°22.97	**Long.** 124°50.37	**Water depth** 359m
Core 122/GC/006	**Described by** A Troedson	**Date** 25/10/93	**Length** 5.2m



Site 25	Lat. 11°22.97	Long. 124°50.37	Water depth 359m
Core 122/GC/006	Described by A.Troedson	Date 25/10/93	Length 5.2m

metres	graphic log	colour	sed struct	comments
5		5Y5/2 olive grey		numerous sand blebs some forams core bottom 5.2m
6				

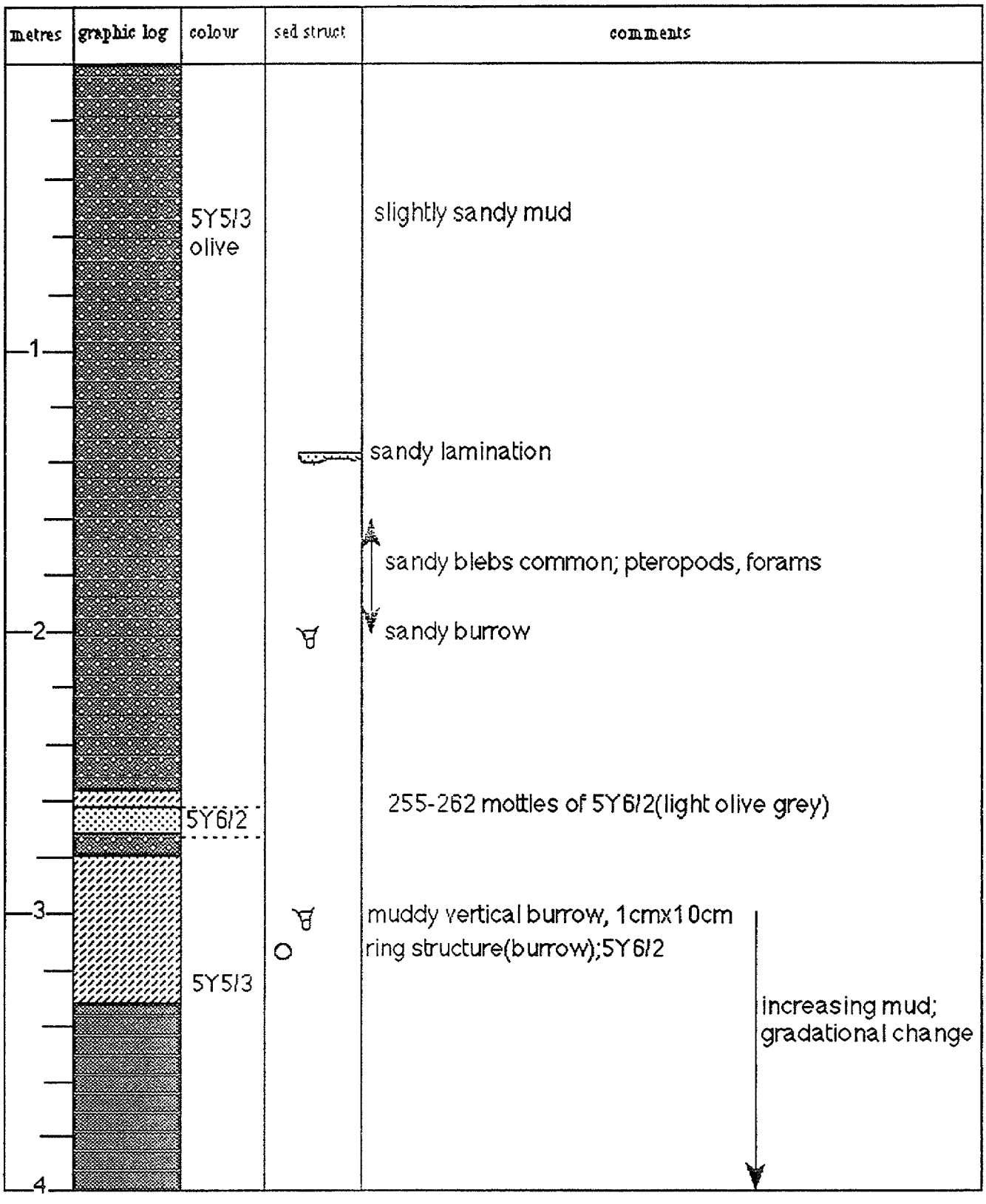
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 26	**Lat.** 11°22.54	**Long.** 124°47.63	**Water depth** 320m
Core 122/GC/008	**Described by** A. Troedson	**Date** 25/10/93	**Length** 2.8m

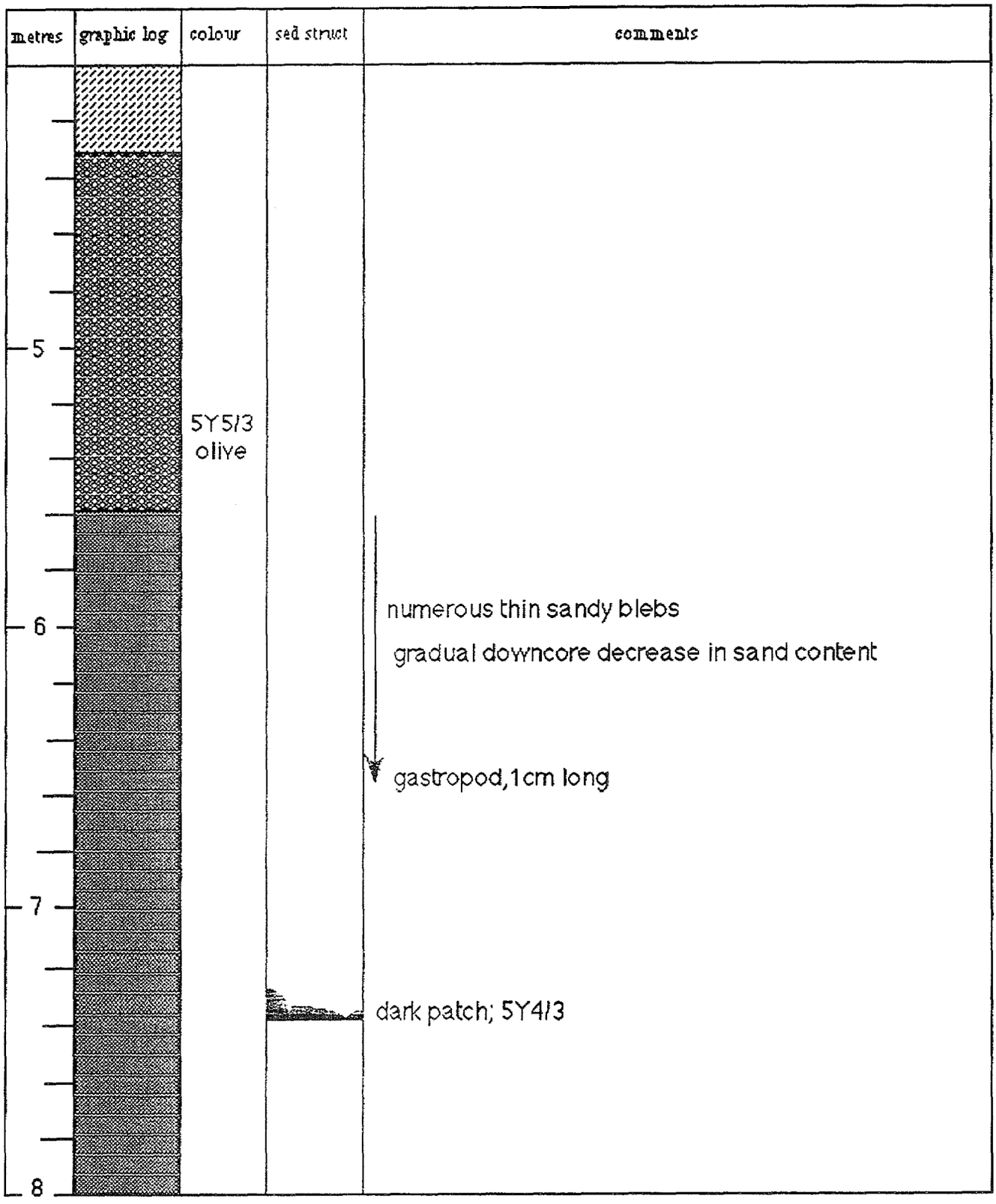
metres	graphic log	colour	sed struct	comments
1		5Y5/3 olive	none	15 bivalve
2				carbonate dominated mud throughout core, gradational increase in sand content downwards
				core bottom 2.8m
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 26	**Lat.** 11°22.48	**Long.** 124°47.63	**Water depth** 319m
Core 122/GC/009	**Described by** A.Troedson	**Date** 25/10/93	**Length** 8.61m



Site 26	Lat. 11°22.48	Long. 124°47.63	Water depth 319m
Core 122/GC/009	Described by A.Troedson	Date 25/10/93	Length 8.61m

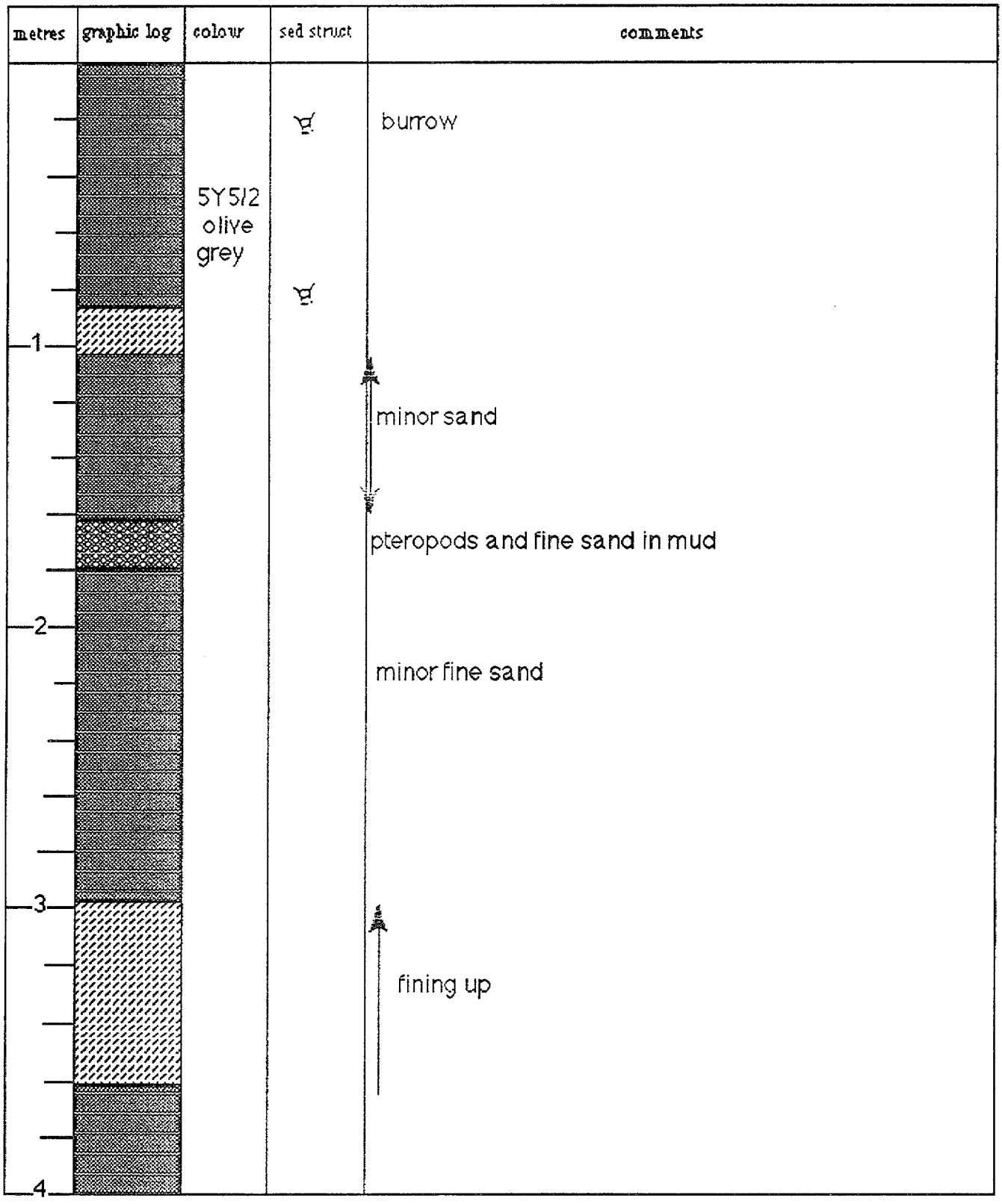


Site 26	Lat. 11°22.48	Long. 124°47.63	Water depth 319m
Core 122/GC/009	Described by A.Troedson	Date 25/10/93	Length 8.61m

metres	graphic log	colour	sed struct	comments
		5Y5/3	none	homogeneous
				core bottom 8.61m
9				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 32	**Lat.** 11°22.54	**Long.** 124°15.55	**Water depth** 464m
Core 122/GC/012	**Described by** D. Haddad	**Date** 26/10/93	**Length** 5.59m



Site 32	Lat. 11°22.54	Long. 124°15.55	Water depth 464m
Core 122/GC/012	Described by D. Haddad	Date 26/10/93	Length 5.59m

metres	graphic log	colour	sed struct	comments
5		5Y5/2 olive grey		mud with some sand blebs
				core bottom 5.59m
6				

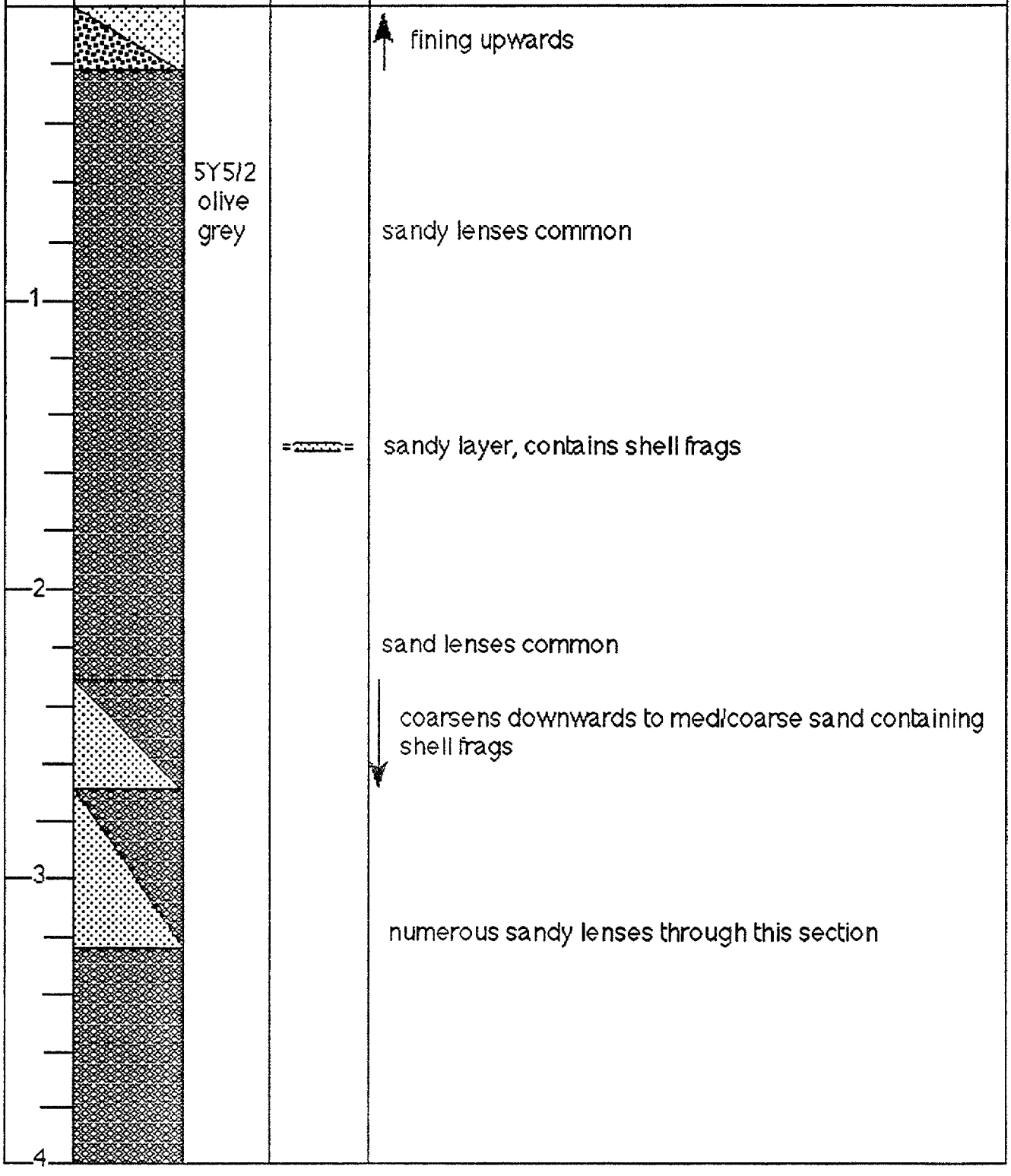
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 33	**Lat.** 11°18.50	**Long.** 124°21.24	**Water depth** 494m
Core 122/GC/013	**Described by** D. Bergersen	**Date** 26/10/93	**Length** 0.71m

metres	graphic log	colour	sed struct	comments
		5Y4/3 olive		0-10 core disturbed forams throughout, no primary sedimentary structures
				core bottom 0.71m
1				
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 67	**Lat.** 11°24.24	**Long.** 124°58.21	**Water depth** 426m
Core 122/GC/014	**Described by** D. Bergersen	**Date** 29/10/93	**Length** 5.64m

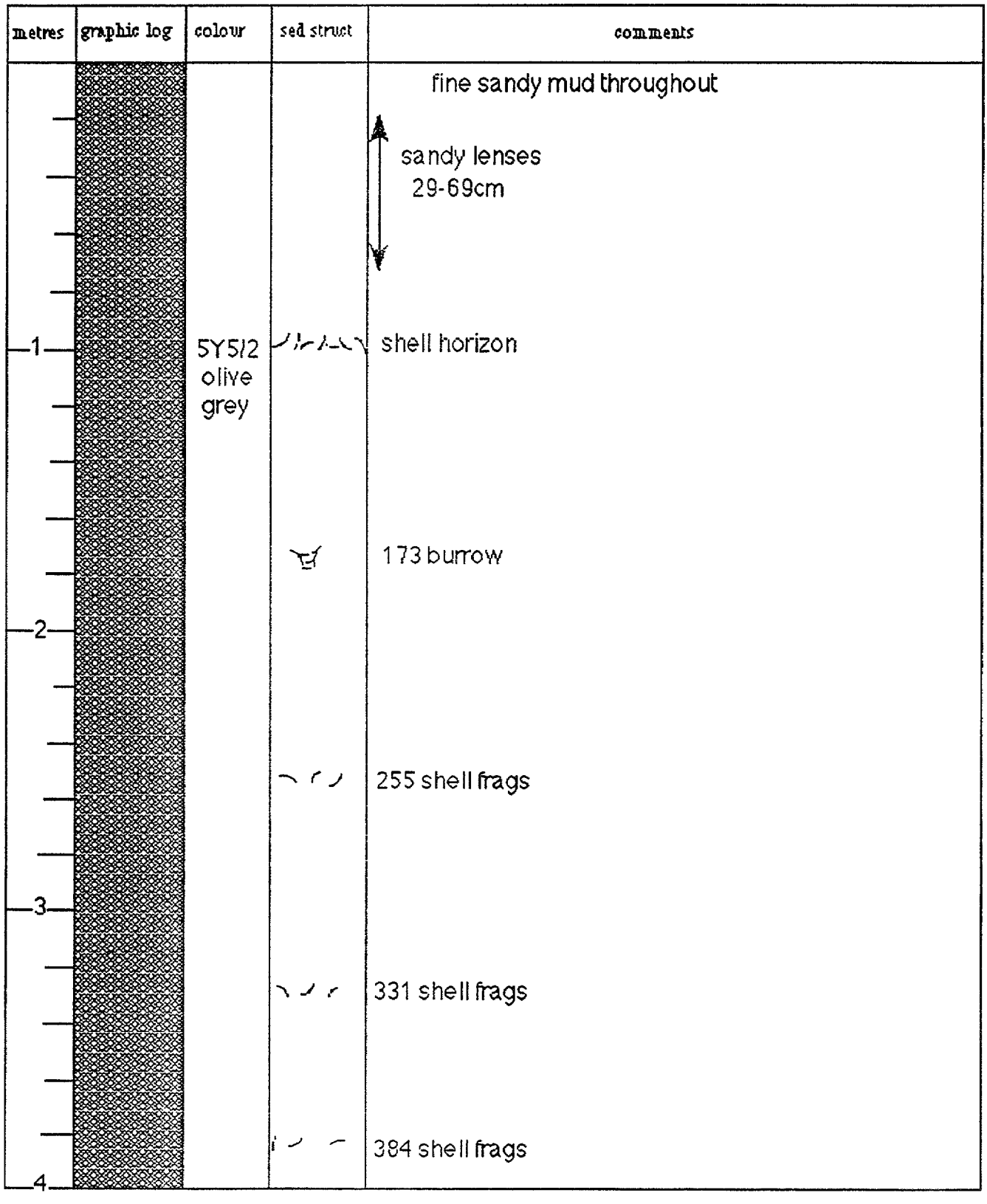


Site 67	Lat. 11°24.24	Long. 124°58.21	Water depth 426m
Core 122/GC/014	Described by D. Bergersen	Date 29/10/93	Length 5.64m

metres	graphic log	colour	sed struct	comments
5		5Y5/2 olive grey		414-424 pale mottling 430-439 organic debris, woody plant material? fine sandy mud with rare sand lenses some shell fragments core bottom 5.64m
6				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 68	**Lat.** 11°25.01 S	**Long.** 125°03.13 E	**Water depth** 407m
Core 122/GC/015	**Described by** D. Bergersen	**Date** 29/10/93	**Length** 5.44m

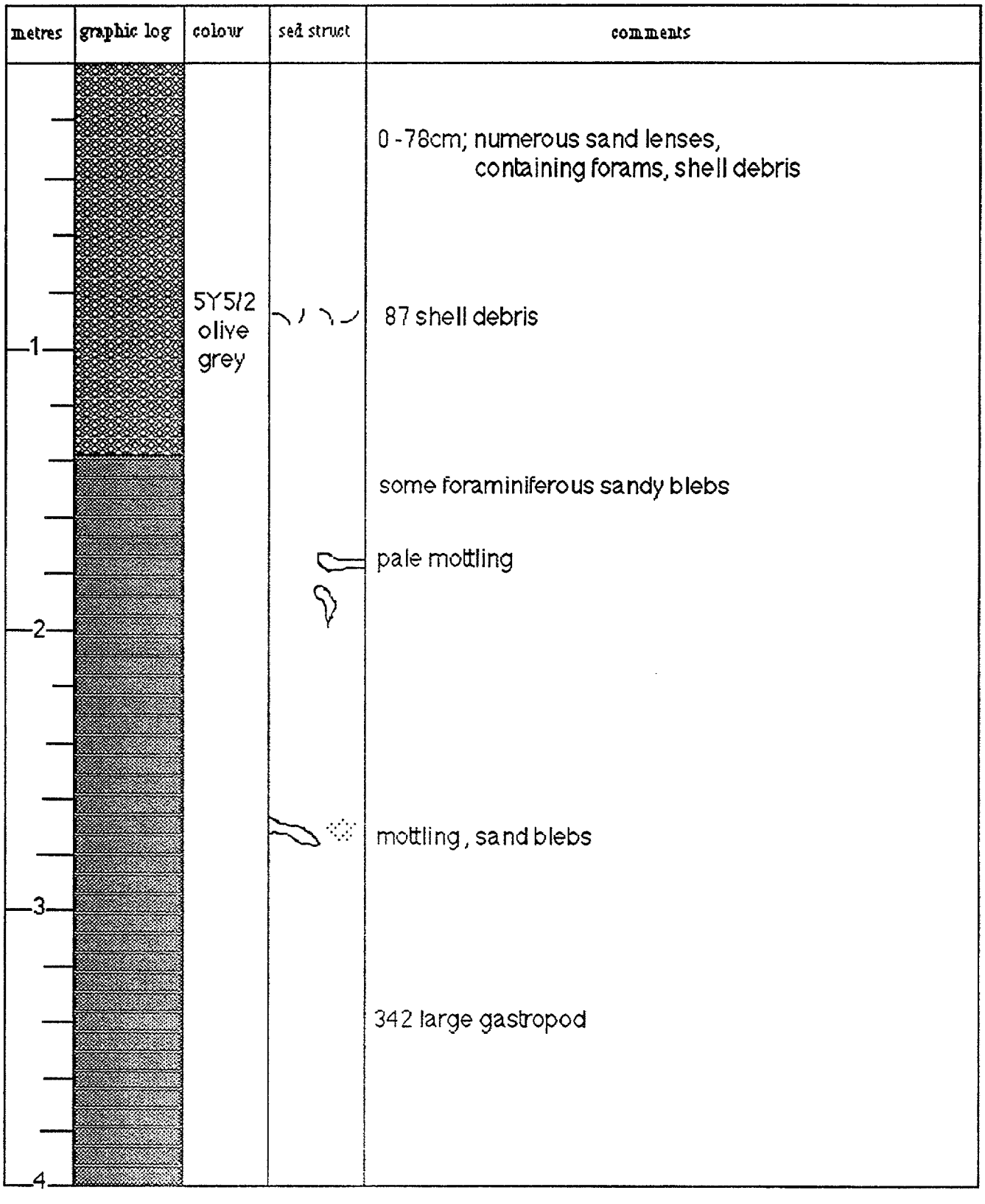


Site 68	**Lat.** 11°25.01	**Long.** 125°03.13	**Water depth** 407m
Core 122/GC/015	**Described by** D. Bergersen	**Date** 29/10/93	**Length** 5.44m

metres	graphic log	colour	sed struct	comments
5		5Y5/2 olive grey		silty mud throughout
				494-504 minor mottling
				core bottom 5.44m
6				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 69	**Lat.** 11°25.13 S	**Long.** 125°03.57 E	**Water depth** 395m
Core 122/GC/016	**Described by** D. Bergersen	**Date** 29/10/93	**Length** 5.57m



Site 69	Lat. 11°25.13 S	Long. 125°03.57 E	Water depth 395m
Core 122/GC/016	Described by D. Bergersen	Date 29/10/93	Length 5.57m

metres	graphic log	colour	sed struct	comments
5		5Y5/2 olive grey		
				shell debris
				core bottom 5.57m
6				

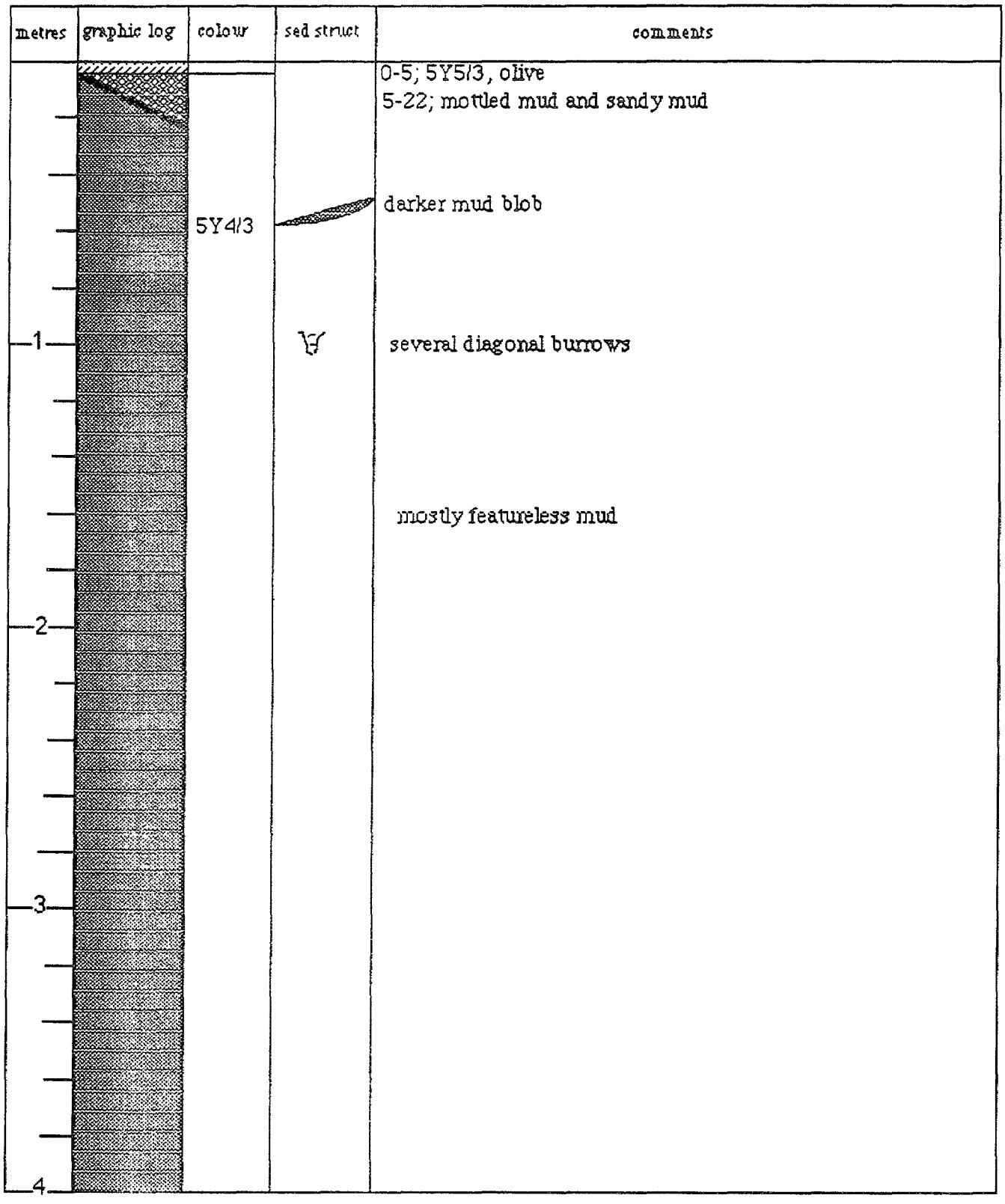
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 84	**Lat.** 10°42.34	**Long.** 126°06.63	**Water depth** 302m
Core 122/GC/18	**Described by** A. Troedson	**Date** 2/11/93	**Length** 3.45m

metres	graphic log	colour	sed struct	comments
				sandy mud blebs and wisps
				Fairly featureless olive grey mud throughout; minor burrowing.
1				
		5Y5/2 olive grey		burrow, infilled with sandy mud, vertical
2				
3				
				core bottom 3.45m
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 85	**Lat.** 10°42.88 S	**Long.** 126°07.23 E	**Water depth** 264m
Core 122/GC/19	**Described by** A. Troedson	**Date** 2/11/93	**Length** 5.67m

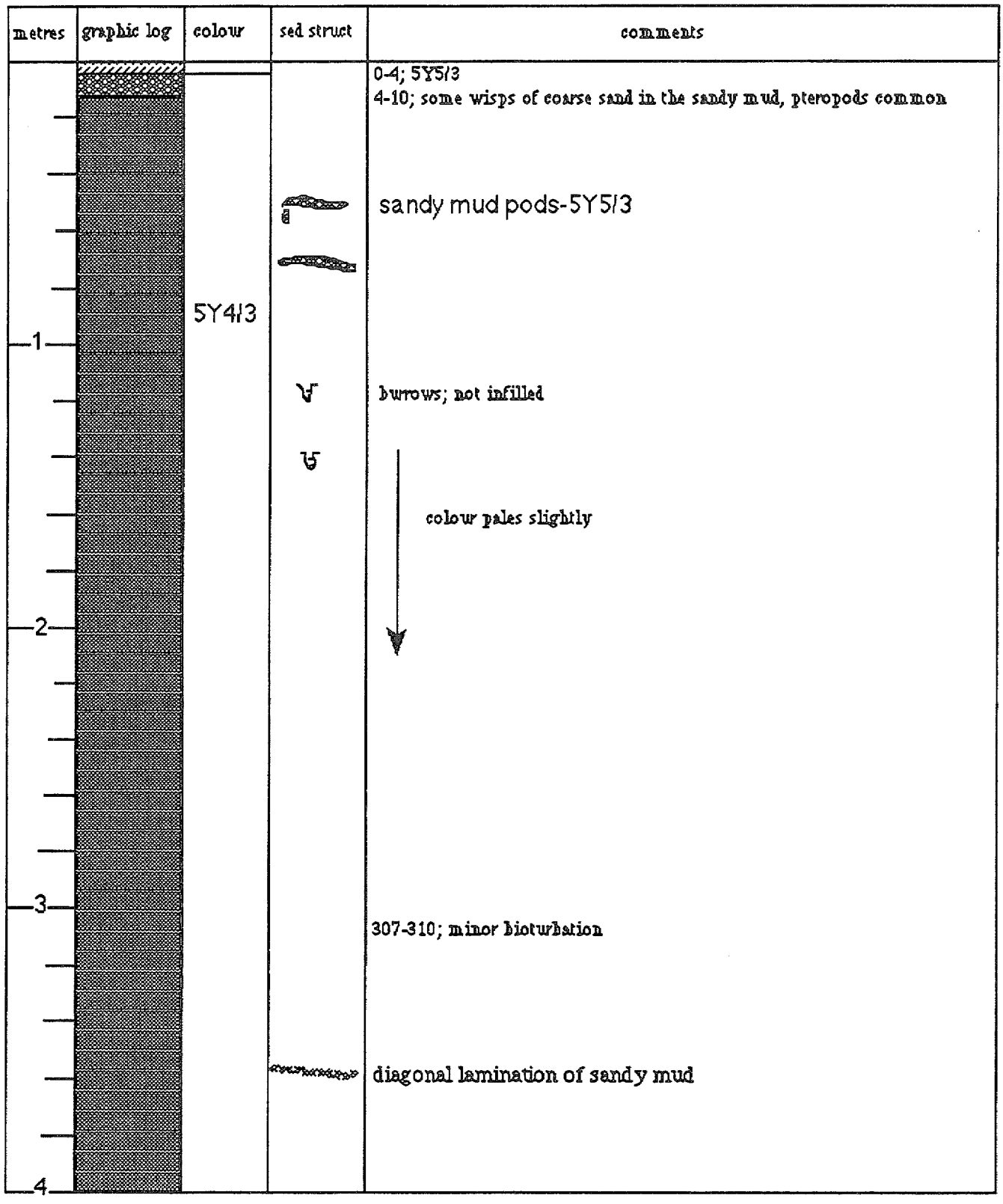


Site 85	**Lat.** 10°42.88 S	**Long.** 126°07.23 E	**Water depth** 264m
Core 122/GC/19	**Described by** A. Troedson	**Date** 2/11/93	**Length** 5.67m

metres	graphic log	colour	sed struct	comments
5		5Y4/3		a few small sandy blebs, pteropods
				core bottom 5.67m
6				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 85	**Lat.** 10°42.84	**Long.** 126°06.98	**Water depth** 263m
Core 122/GC/20	**Described by** A. Troedson	**Date** 2/11/93	**Length** 6.59m



Site 85	Lat. 10°42.84	Long. 126°06.98	Water depth 263m
Core 122/GC/20	Described by A. Troedson	Date 2/11/93	Length 6.59m

metres	graphic log	colour	sed struct	comments
				pteropods
		5Y4/3		
				No structures in this section
5				
6				slightly coarser lamination
				core bottom 6.59m
7				

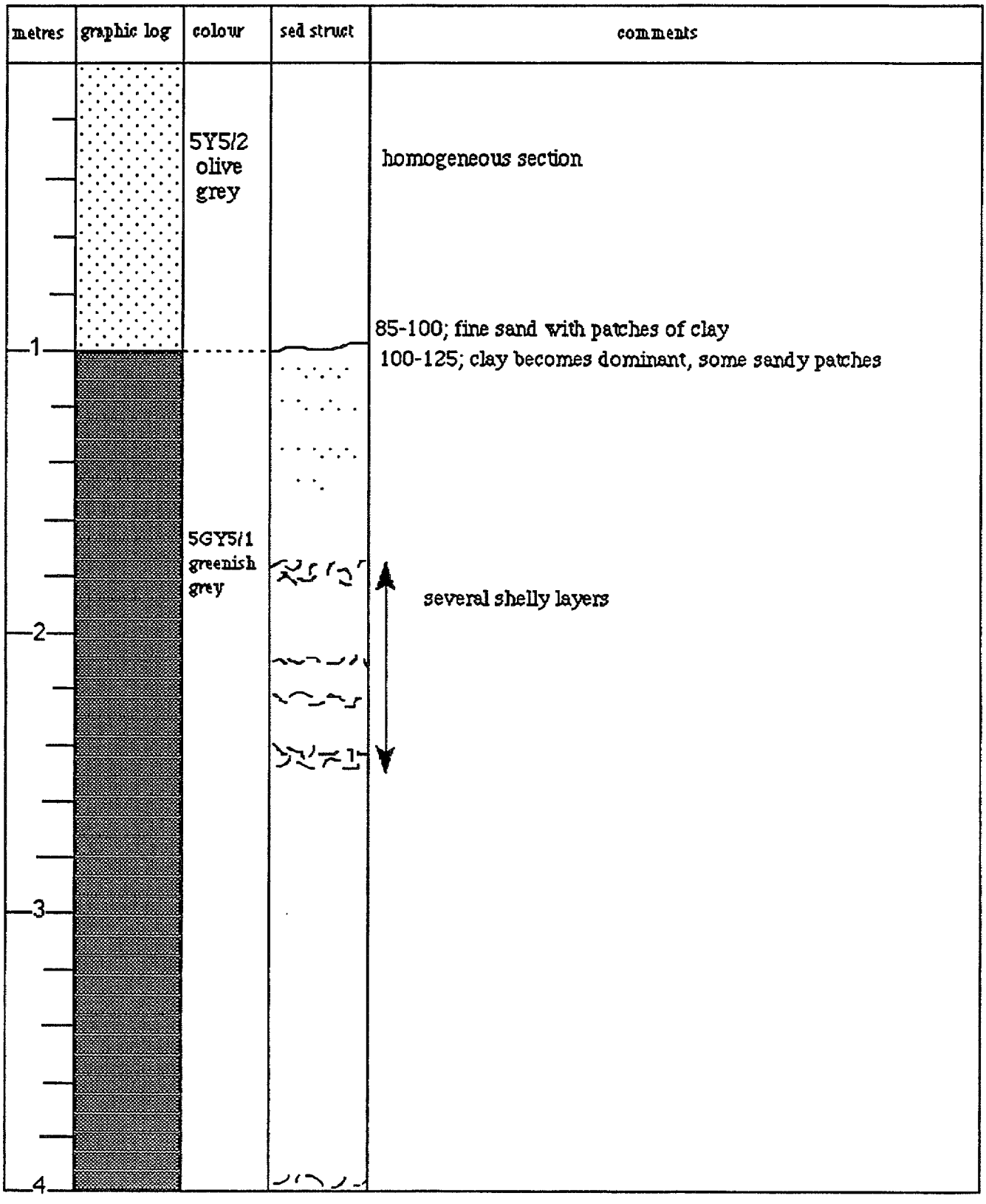
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 86	**Lat.** 10°46.33	**Long.** 126°08.90	**Water depth** 225m
Core 122/GC/22	**Described by** A.Troedson	**Date** 2/11/93	**Length** 3.65m

metres	graphic log	colour	sed struct	comments
				13-18; burrow infilled with muddy sand, 1cm wide, sand includes pteropods, pellets, forams.
		5GY6/1 greenish grey		
1			none	homogeneous mud
2				
3				
				core bottom 3.65m
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 95	**Lat.** 10°59.58	**Long.** 126°13.90	**Water depth** 115m
Core 122/GC/23	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.85m



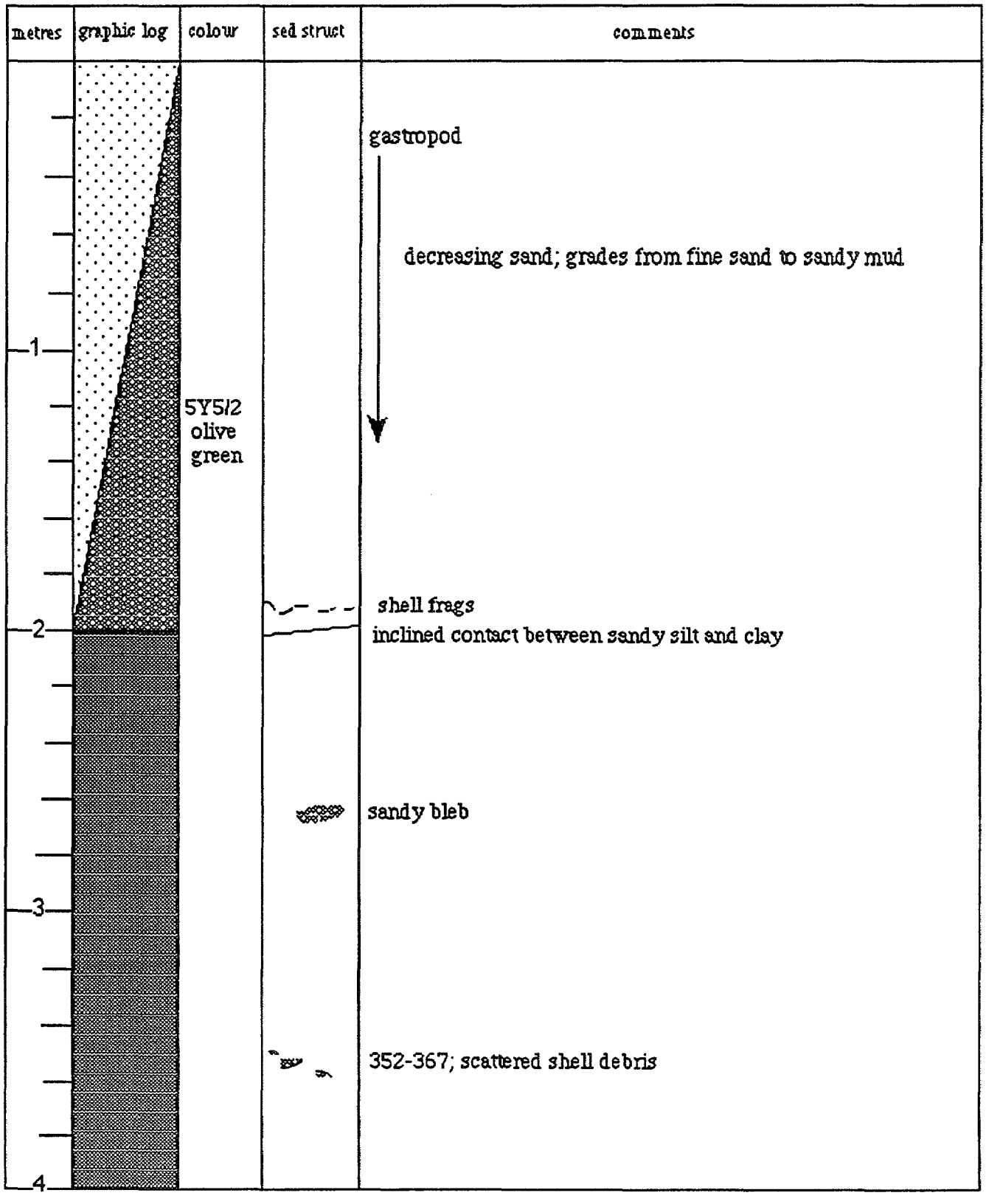
R9403302

Site 95	Lat. 10°59.58	Long. 126°13.90	Water depth 115m
Core 122/GC/23	Described by D. Bergersen	Date 3/11/93	Length 4.85m

metres	graphic log	colour	sed struct	comments
		5GY5/1 grey	none	core is predominantly grey clay
				bottom of core 4.85m
5				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 96	**Lat.** 11°01.70	**Long.** 126°16.46	**Water depth** 113m
Core 122/GC/024	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.9m

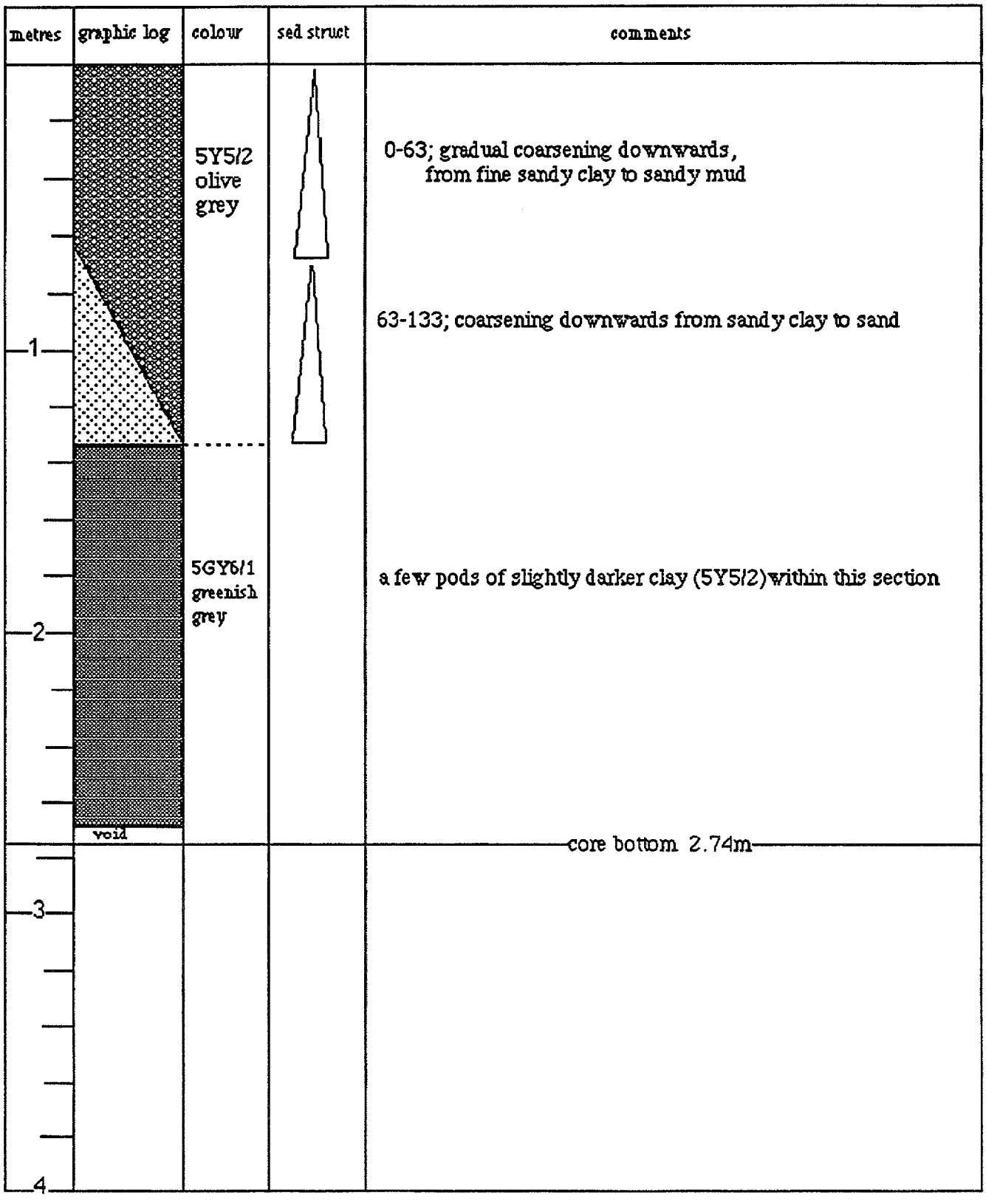


Site 96	**Lat.** 11°01.70	**Long.** 126°16.46	**Water depth** 113m
Core 122/GC/024	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.9m

metres	graphic log	colour	sed struct	comments
		5Y5/2 olive green		437 shell debris
	void			core bottom 4.90m
5				

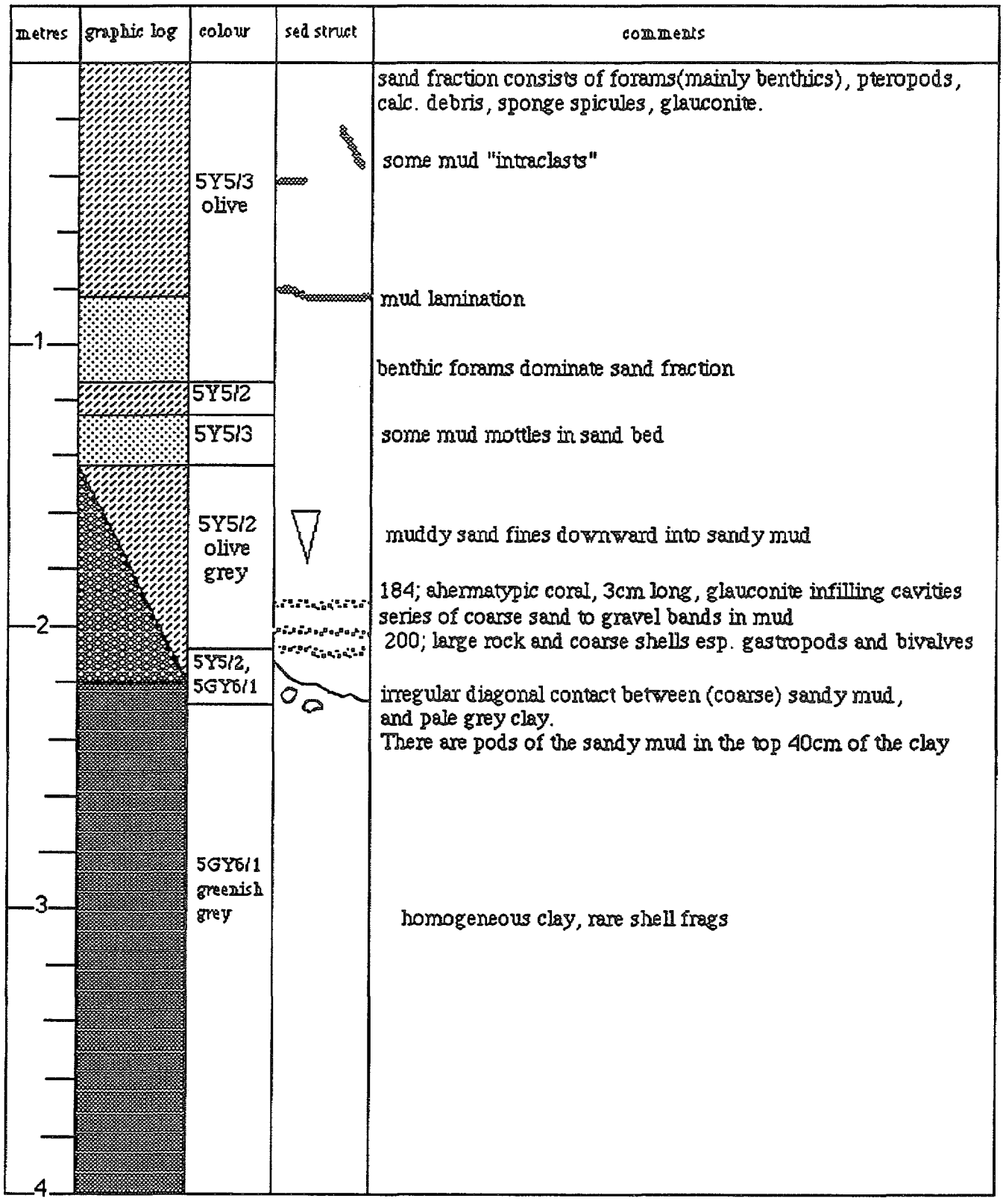
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 97	**Lat.** 11°03.82	**Long.** 126°17.57	**Water depth** 105m
Core 122/GC/25	**Described by** A. Troedson	**Date** 3/11/93	**Length** 2.74m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 99	**Lat.** 11°07.32	**Long.** 126°20.77	**Water depth** 95m
Core 122/GC/26	**Described by** A. Troedson	**Date** 3/11/93	**Length** 4.76m



Site 99	Lat. 11°07.32	Long. 126°20.77	Water depth 95m
Core 122/GC/26	Described by A. Troedson	Date 3/11/93	Length 4.76m

metres	graphic log	colour	sed struct	comments
		5GY6/1		pale grey clay
				minor sandy laminations
				457-464; 5GY7/1, light greenish grey
		5Y6/2		464; abrupt colour change; darker clay
5				

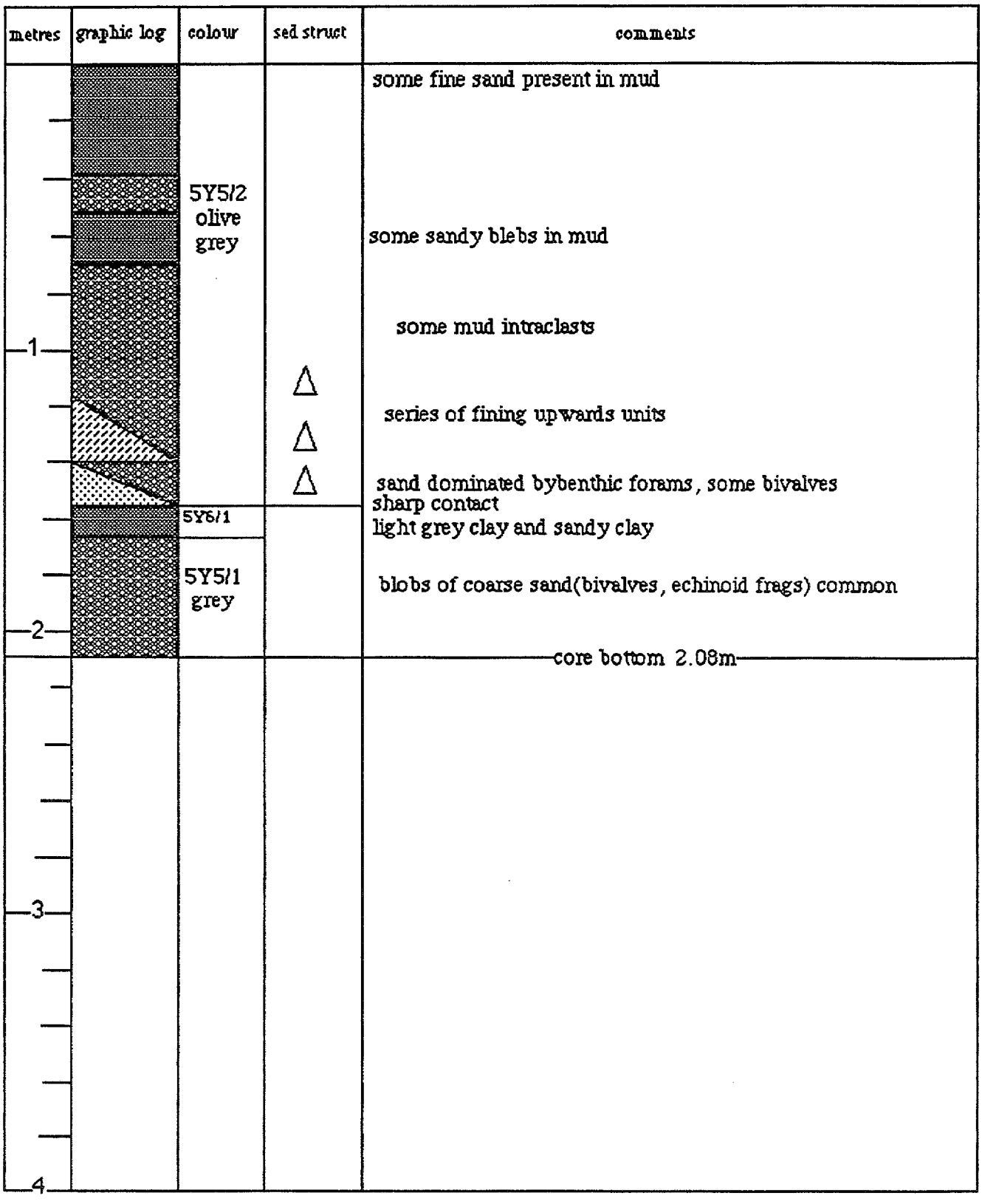
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 100	**Lat.** 11°10.70	**Long.** 126°22.46	**Water depth** 87m
Core 122/GC/27	**Described by** A. Troedson	**Date** 3/11/93	**Length** 0.86m

metres	graphic log	colour	sed struct	comments
		5Y5/2 olive grey		sandy mud throughout abundant coarse sand within the mud in some sections benthic forams dominate sand fraction
				80-84; large rock and other coarse material incl. coral frags.
				core bottom 0.86m
1				
2				
3				
4				

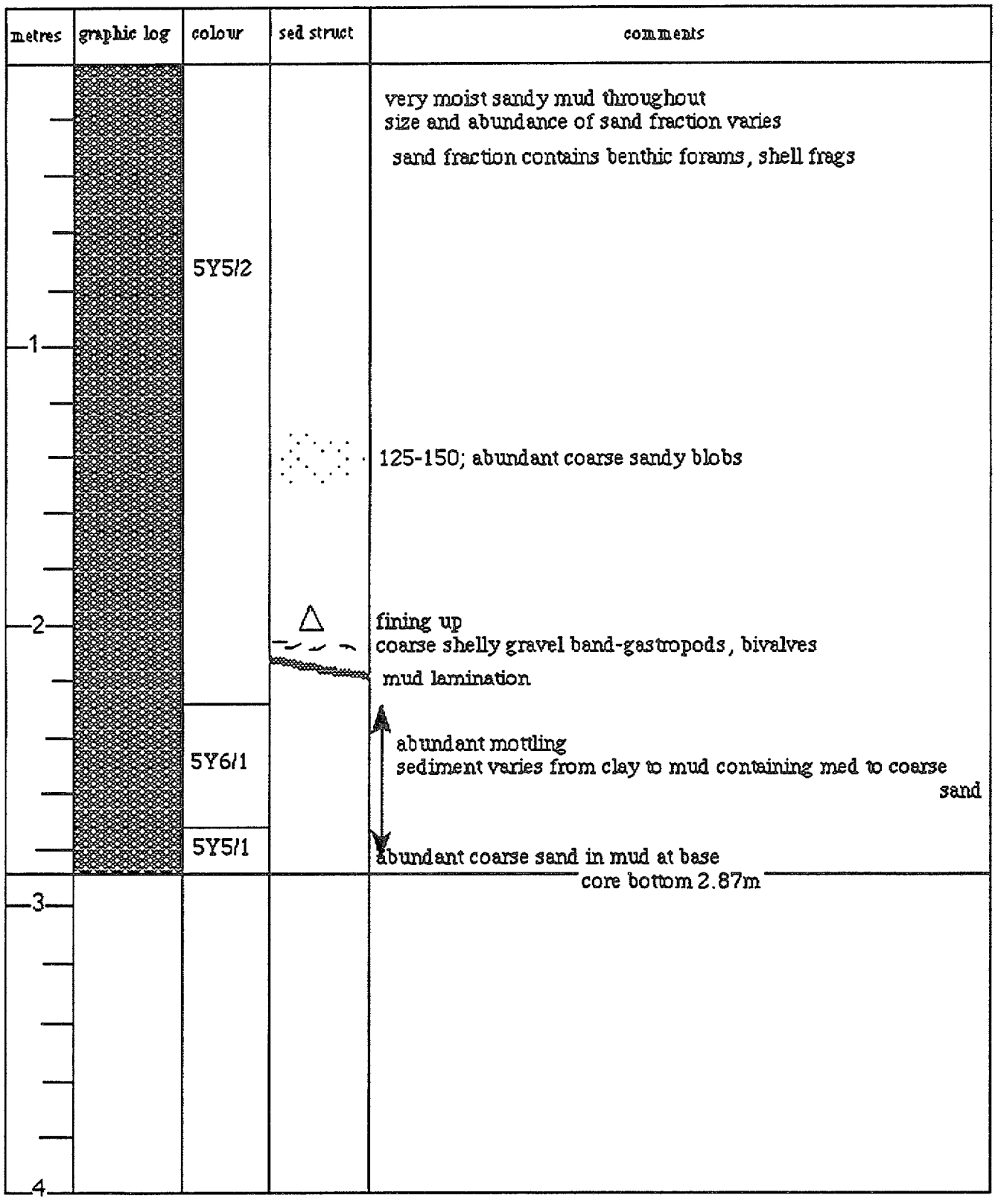
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 101	**Lat.** 11°12.50	**Long.** 126°16.54	**Water depth** 102 m
Core 122/GC/28	**Described by** A.Troedson	**Date** 3/11/93	**Length** 2.08m



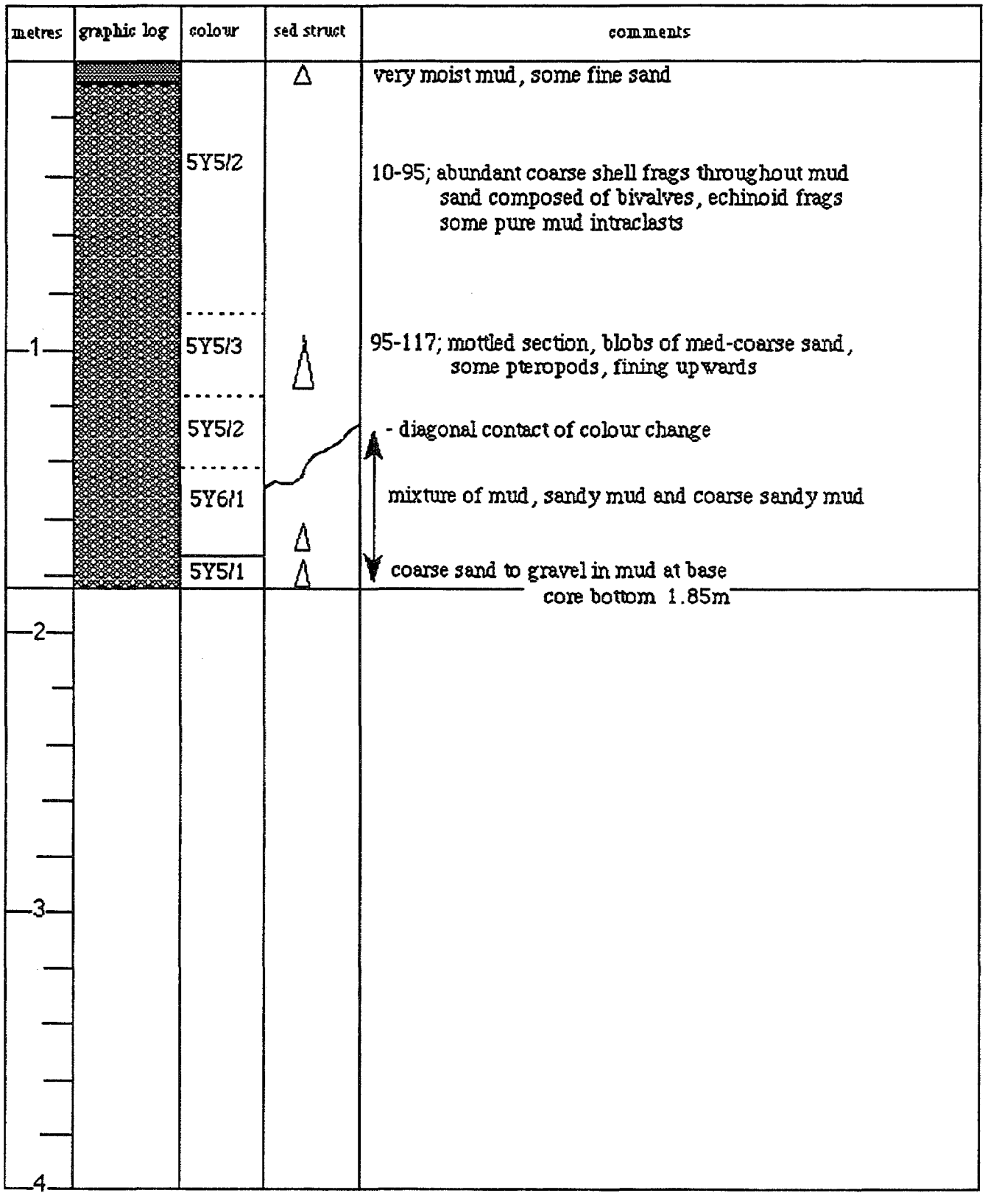
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 102	**Lat.** 11°12.46	**Long.** 126°19.53	**Water depth** 103m
Core 122/GC/29	**Described by** A. Troedson	**Date** 3/11/93	**Length** 2.87m



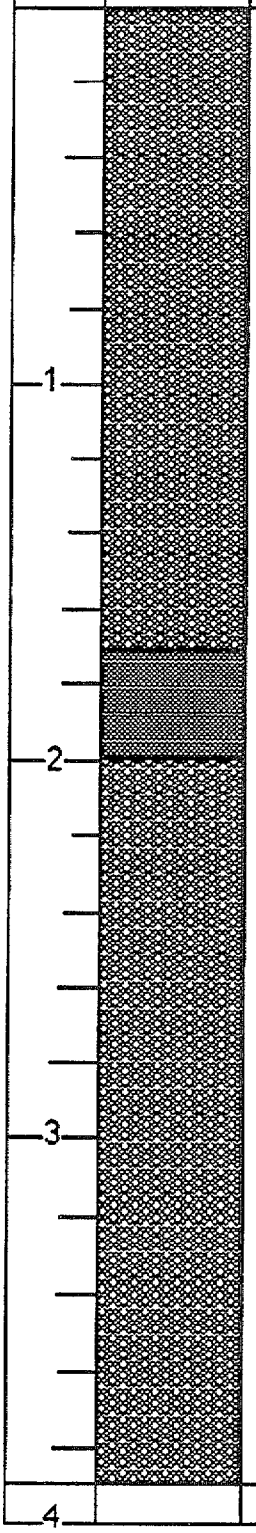
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 103	**Lat.** 11°13.85	**Long.** 126°17.49	**Water depth** 101m
Core 122/GC/30	**Described by** A. Troedson	**Date** 3/11/93	**Length** 1.85m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 106	**Lat.** 11°18.04	**Long.** 126°22.54	**Water depth** 183m
Core 122/GC/31	**Described by** A. Troedson	**Date** 3/11/93	**Length** 3.89m



metres	graphic log	colour	sed struct	comments
				Fairly featureless green/grey slightly sandy mud throughout
			none	
1				
		5GY5/1 greenish grey		
2				199-base; minor fine to med. gr. sandy wisps
3				
				331 gastropod
				core bottom 3.89m
4				core cutter and catcher contained greenish grey mud also

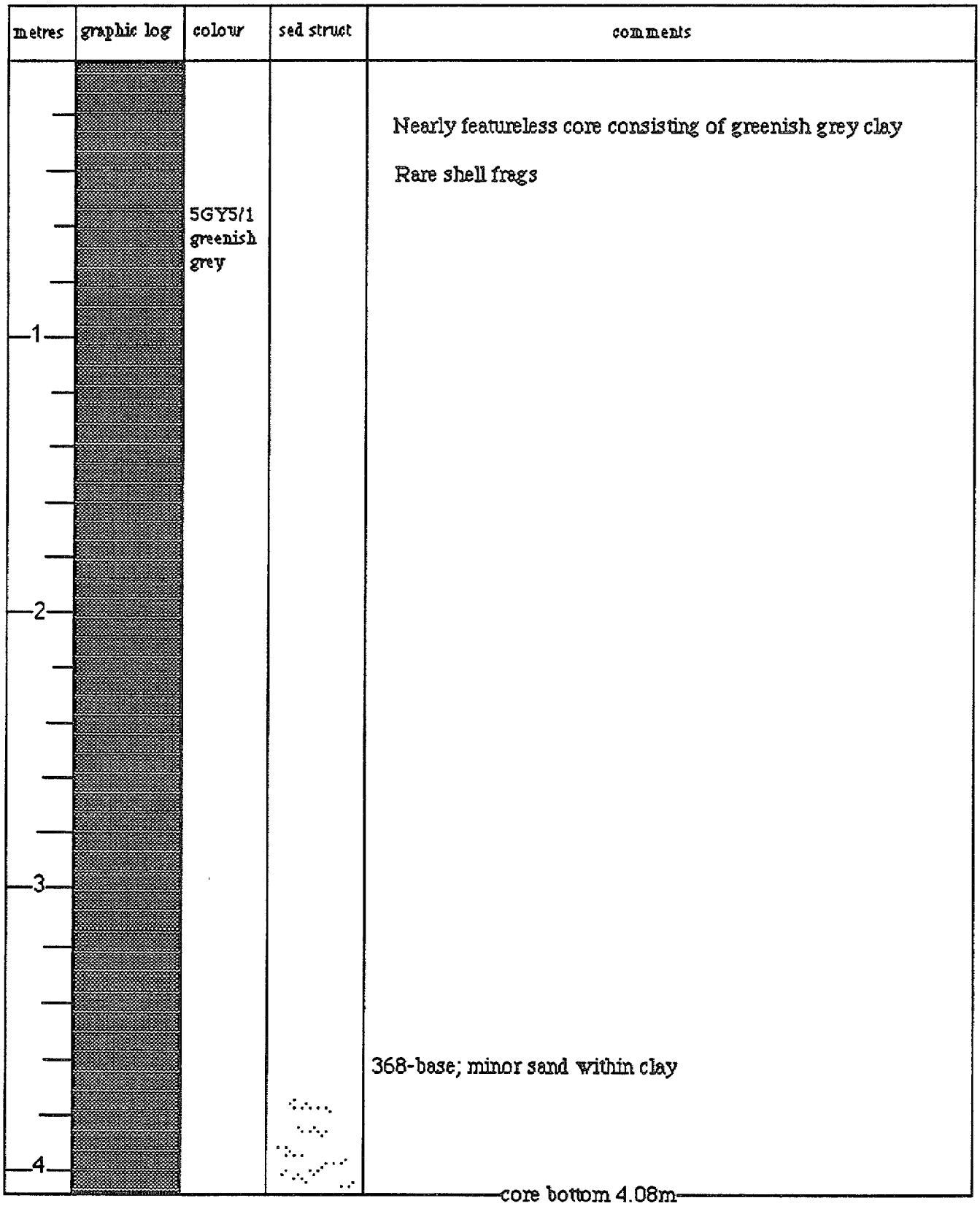
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 107	**Lat.** 11°19.76	**Long.** 126°24.50	**Water depth** 137m
Core 122/GC/32	**Described by** A. Troedson	**Date** 3/11/93	**Length** 3.81m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey	none	Featureless green/grey mud thoughout very minor sand fraction a few large pteropods
2				
3				
				core bottom 3.81m
4				core cutter and catcher- same as above, with some minor fine black mud in catcher

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 108	**Lat.** 11°19.97	**Long.** 126°24.15	**Water depth** 169m
Core 122/GC/33	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.08m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 109	**Lat.** 11°19.99	**Long.** 126°24.85	**Water depth** 132m
Core 122/GC/34	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.44m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey	none	Homogeneous greenish grey clay throughout
2				
3				
4				

Site 109	Lat. 11°19.99	Long. 126°24.85	Water depth 132m
Core 122/GC/34	Described by D. Bergersen	Date 3/11/93	Length 4.44m

metres	graphic log	colour	sed struct	comments
		5GY5/1 greenish grey		shell debris
				core bottom 4.44m

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 111	**Lat.** 11°23.35	**Long.** 126°26.83	**Water depth** 187m
Core 122/GC/36	**Described by** D. Bergersen	**Date** 4/11/93	**Length** 4.75m

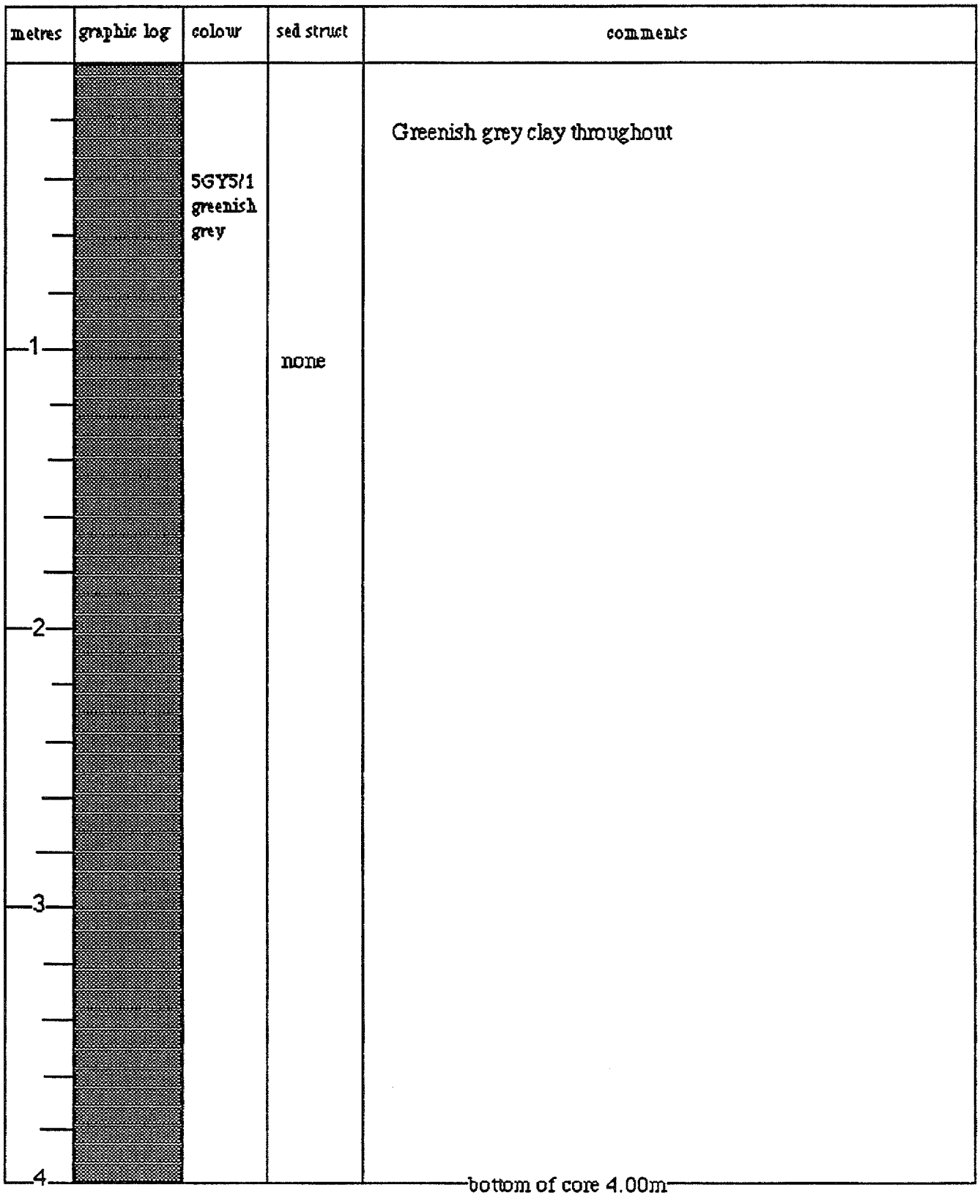
metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey		Greenish grey clay throughout, some small pods of shell debris present
2				
3				some fine sand horizons from here down
4				

Site 111	**Lat.** 11°23.35	**Long.** 126°26.83	**Water depth** 187m
Core 122/GC/36	**Described by** D. Bergersen	**Date** 4/11/93	**Length** 4.75m

metres	graphic log	colour	sed struct	comments
	void	5GY5/1 greenish grey		several sandy layers containing shell debris
				core bottom 4.75m
5				

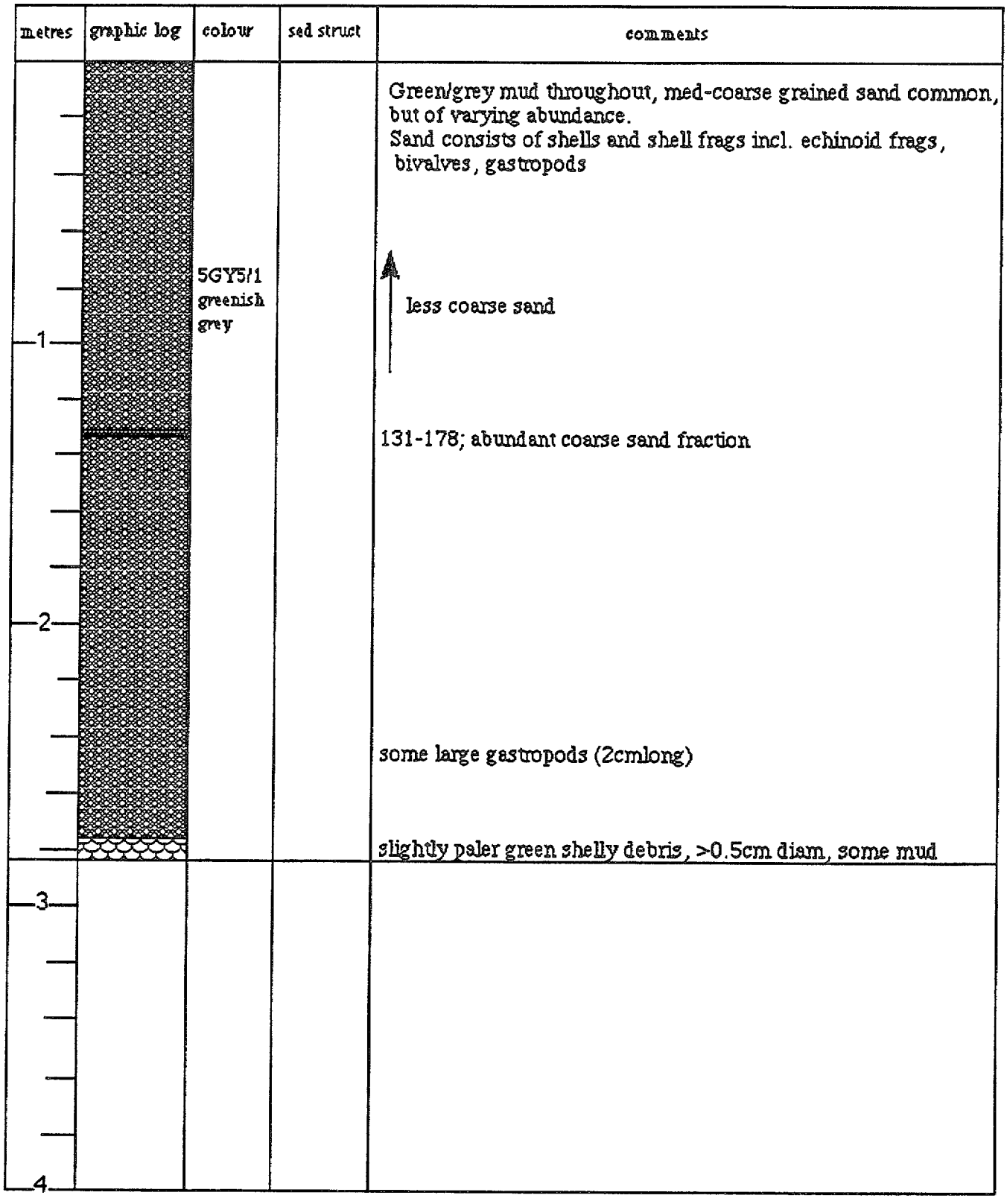
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 112	**Lat.** 11°24.00	**Long.** 126°27.70	**Water depth** 192m
Core 122/GC/037	**Described by** D. Bergersen	**Date** 4/11/93	**Length** 4.00m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 115	**Lat.** 11°28.25	**Long.** 126°31.60	**Water depth** 223m
Core 122/GC/38	**Described by** A. Troedson	**Date** 4/11/93	**Length** 2.85m



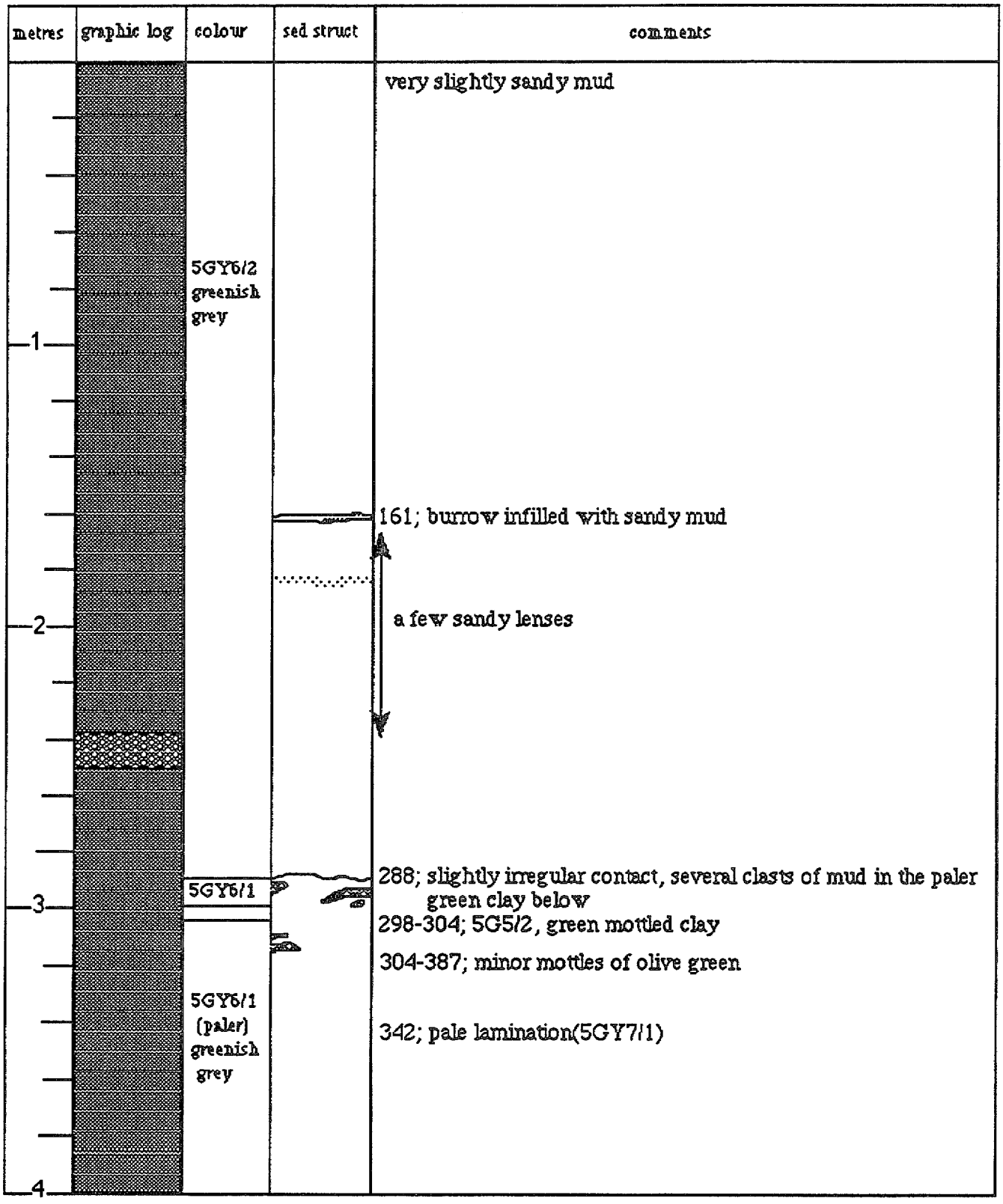
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 117	**Lat.** 11°31.43	**Long.** 126°36.49	**Water depth** 146m
Core 122/GC/39	**Described by** A. Troedson	**Date** 4/11/93	**Length** 1.45m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey	none	minor fine sand in green/grey mud throughout a few coarse shell frags and whole shells core bottom 1.45m
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 118	**Lat.** 11°38.51	**Long.** 126°38.51	**Water depth** 166m
Core 122/GC/40	**Described by** A. Troedson	**Date** 5/11/93	**Length** 4.57m



Site 118	Lat. 11°38.51	Long. 126°38.51	Water depth 166m
Core 122/GC/40	Described by A. Troedson	Date 5/11/93	Length 4.57m

metres	graphic log	colour	sed struct	comments
		5GY6/1 greenish grey		438-445; 5Y5/1 mottles
				core bottom 4.78m
				12cm - core cutter; 5GY6/1 mud 9cm - core catcher; " "

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 119	**Lat.** 11°34.24	**Long.** 126°38.08	**Water depth** 147m
Core 122/GC/41	**Described by** A. Troedson	**Date** 5/11/93	**Length** 4.29m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey		0-9; still in uncut tube Featureless green/grey clay throughout, rare shell frags (echinoids, gastropods) 125-145; a few small hollow burrows
2				
3				
4				

core catcher - 8cm; 5GY5/1 mud
core cutter - 12cm; " "

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 120	**Lat.** 11°34.97	**Long.** 126°41.58	**Water depth** 171m
Core 122/GC/42	**Described by** A. Troedson	**Date** 5/11/93	**Length** 4.2m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey		very minor sand in mud and hollow burrows near top Featureless green/grey mud throughout
2				
3				
4				

core catcher - 13cm; 5GY5/1 mud
core cutter - 13cm; " "

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

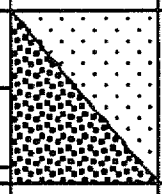
Site 121	**Lat.** 11°34.48	**Long.** 126°41.87	**Water depth** 137m
Core 122/GC/43	**Described by** A. Troedson	**Date** 5/11/93	**Length** 4.28m

metres	graphic log	colour	sed struct	comments
1		5GY5/1 greenish grey		Featureless green/grey mud throughout No sand; a few small hollow burrows
2				
3				
4				

core catcher - 13cm; 5GY5/1 mud
core cutter - 15cm; " "

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 6	**Lat.** 11°11.92 S	**Long.** 124°35.57	**Water depth** 34.3m
Core 122/VC/001	**Described by** A.Troedson	**Date** 22/10/93	**Length** 0.46m

metres	graphic log	colour	sed struct	comments
		2.5Y 8/2 white	△	Graded bed, (due to vibrocoring process?), consisting of fine through to coarse sand. Abundant larger forams and Halimeda frags in coarse sand
				core bottom 0.46m
1				
2				
3				
4				

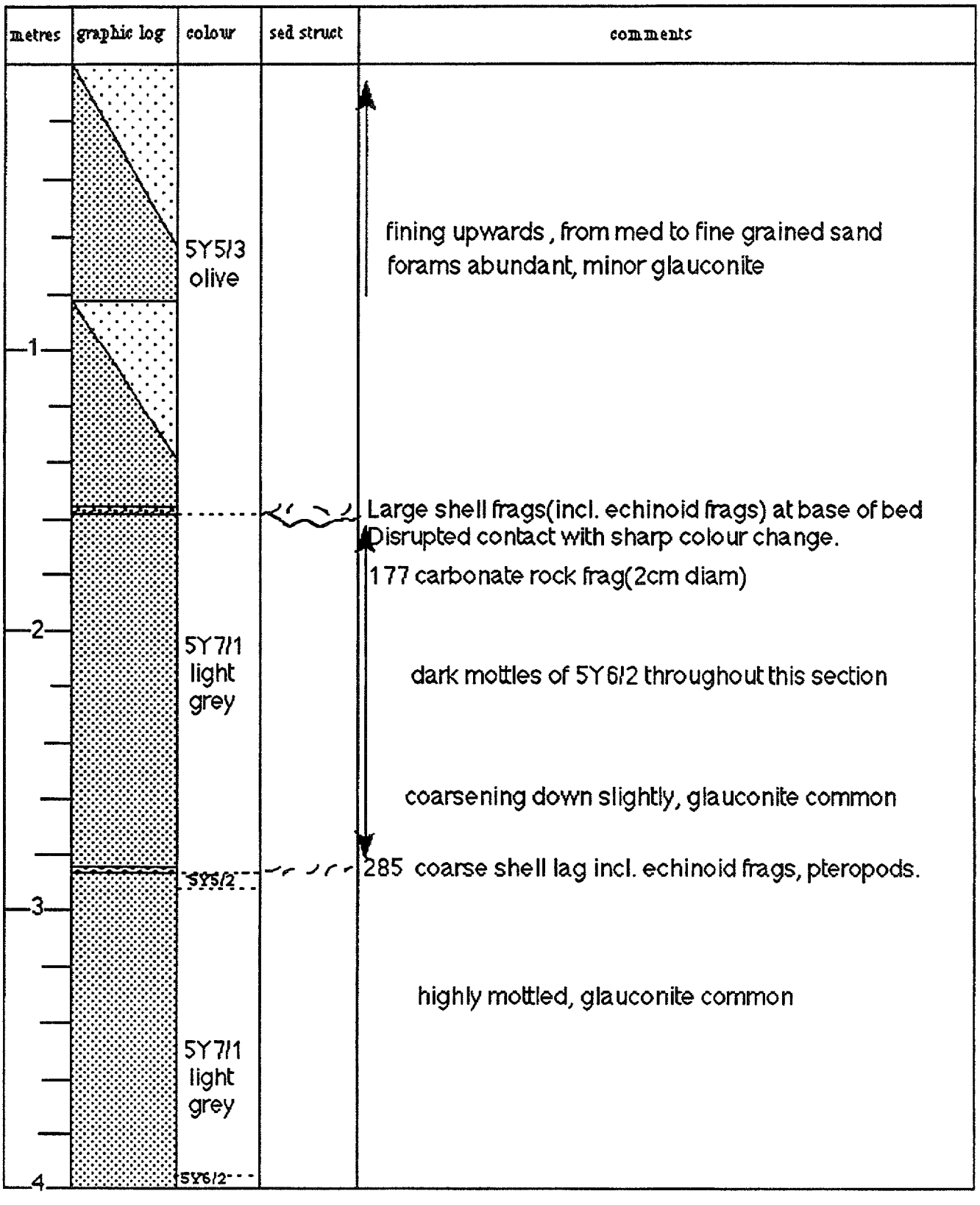
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 7	**Lat.** 11°09.86	**Long.** 124°35.83	**Water depth** 72.1
Core 122/YC/002	**Described by** A. Troedson	**Date** 22/10/93	**Length** 1.35m

metres	graphic log	colour	sed struct	comments
1		2.5Y 8/2 white	△	Graded bed from gravel to fine sand gravel includes larger foraminifera, Halimeda, coralline algae up to 3cm diam., bryozoan frags.
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 14	**Lat.** 11°19.96 S	**Long.** 124°33.47 E	**Water depth** 227m
Core 122/VC/003	**Described by** A. Troedson	**Date** 24/10.93	**Length** 4.93m

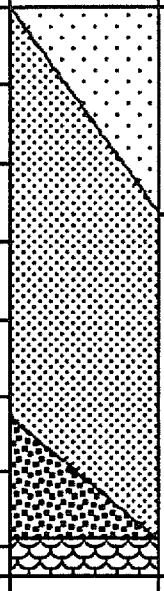


Site 14	Lat. 11°19.96 S	Long. 124°33.47 E	Water depth 227m
Core 122/VC/003	Described by A. Troedson	Date 24/10.93	Length 4.93m

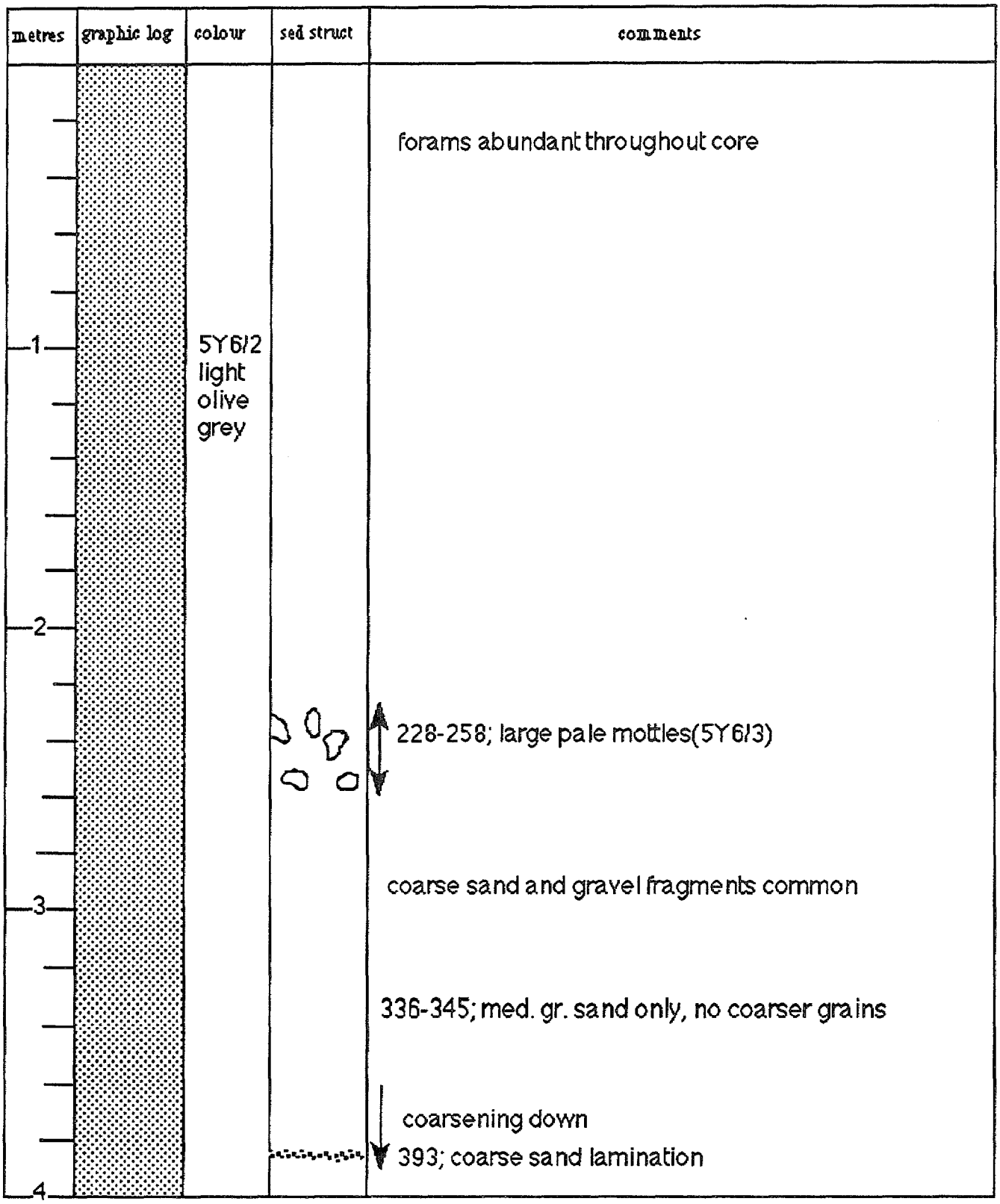
metres	graphic log	colour	sed struct	comments
		5Y6/2		378-435 slightly coarser sand
		5Y7/1		minor mottling(5Y6/2)
				core bottom 4.93m
5				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 15	**Lat.** 11°21.27	**Long.** 124°31.71	**Water depth** 225m
Core 122/VC/004	**Described by** A. Troedson	**Date** 24/10/93	**Length** 1.47m

metres	graphic log	colour	sed struct	comments
1		5Y7/2 5Y6/2	△	core consists of a single graded bed from fine/med carbonate sand to gravel forams abundant gravel consists of pteropods, rock frags(max 2cm diam), bivalves, echinoid frags core bottom 1.47m
2				
3				
4				

Site 16	Lat. 11°22.35	Long. 124°30.01	Water depth 180.5m
Core 122/VC/007	Described by A. Troedson	Date 24/10/93	Length 4.73m



Site 16	Lat. 11°22.35	Long. 124°30.01	Water depth 180.5m
Core 122/VC/007	Described by A. Troedson	Date 24/10/93	Length 4.73m

metres	graphic log	colour	sed struct	comments
		5Y6/2		coarsening downwards
				gravel includes bivalves, solitary coral
				core bottom 4.73m
5				

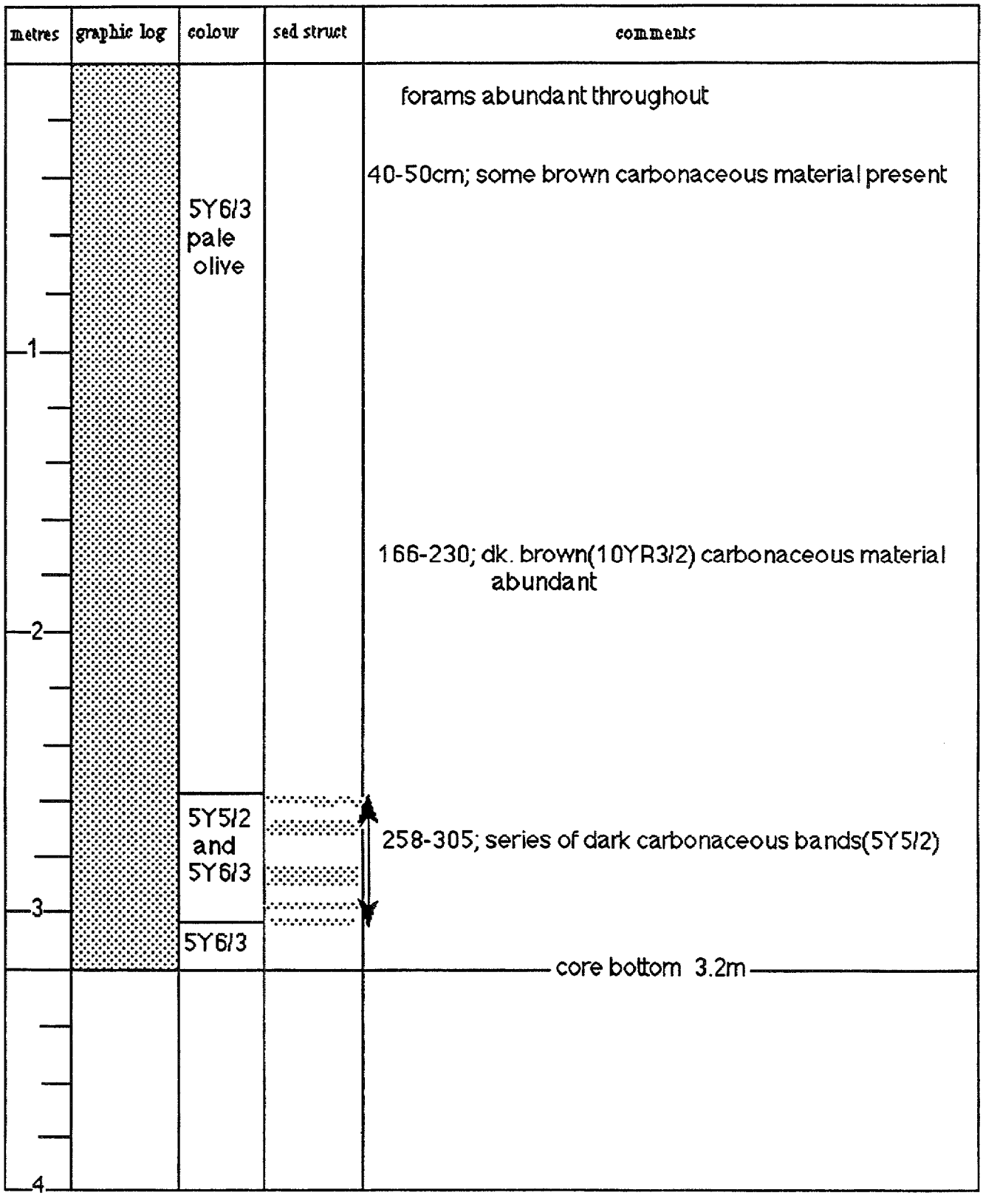
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 17	**Lat.** 11°23.56	**Long.** 124°34.27	**Water depth** 182.9m
Core 122/VC/008	**Described by** A. Troedson	**Date** 24/10/93	**Length** 1.93m

metres	graphic log	colour	sed struct	comments
1		5Y6/3	none	carbonate sand, abundant foraminifera
				core bottom 1.93m
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 17	**Lat.** 11°23.51	**Long.** 124°34.17	**Water depth** 182.3m
Core 122/VC/009	**Described by** A. Troedson	**Date** 24/10/93	**Length** 3.2m



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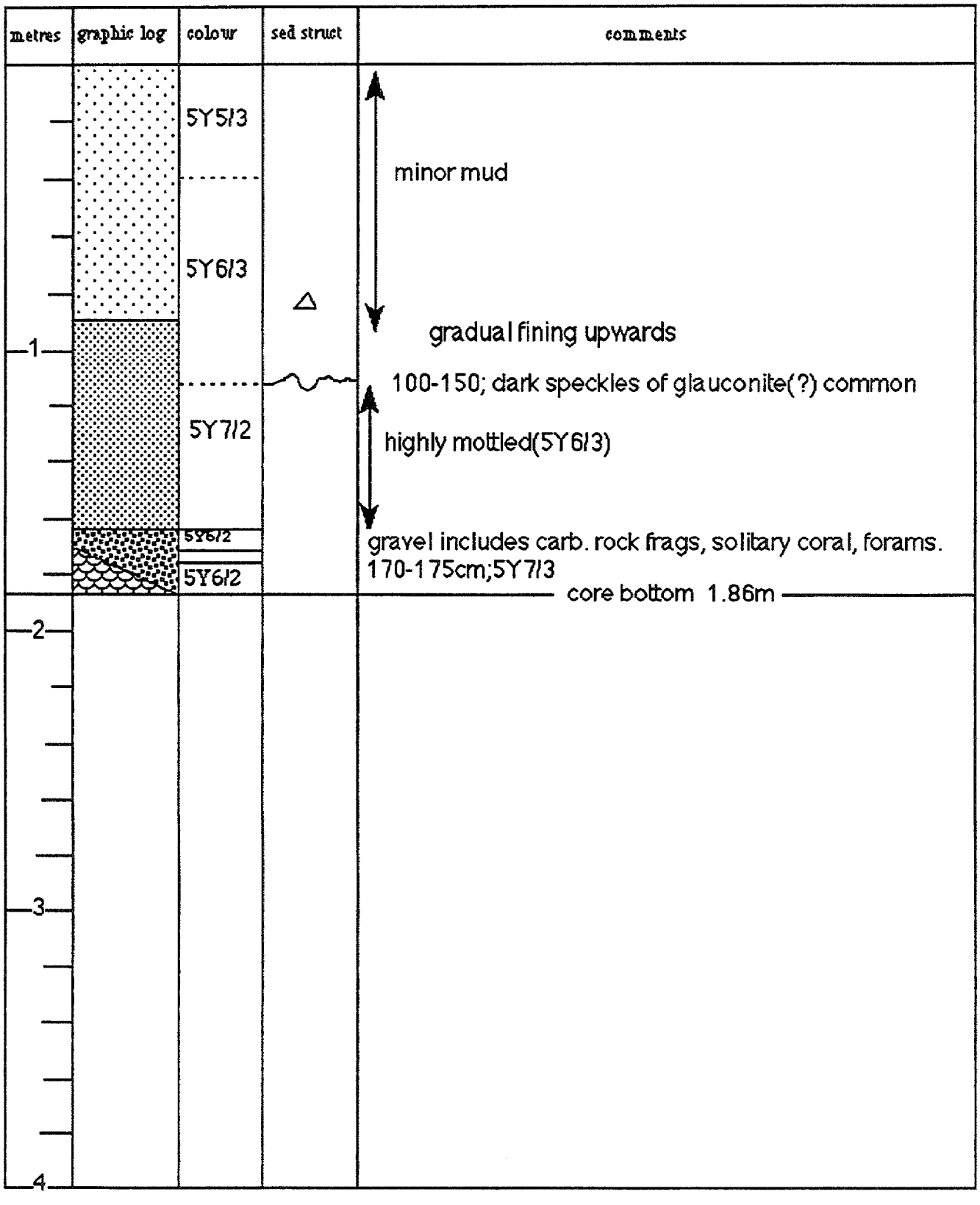
Site 46	**Lat.** 11°33.26	**Long.** 124°15.49	**Water depth** 179.3m
Core 122/VC/11	**Described by** A. Troedson	**Date** 27/10/93	**Length** 0.59m

metres	graphic log	colour	sed struct	comments
		5Y6/3 pale olive		0-5; 5Y5/3 carbonate sand containing forams, pteropods, sponge spicules, minor cabonaceous plant matter
		5Y5/3		slightly darker
				core bottom 0.59m
1				
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 47	**Lat.** 11°32.82	**Long.** 124°15.96	**Water depth** 197.1
Core 122/VC/012	**Described by** A. Troedson	**Date** 27/10/93	**Length** 1.86



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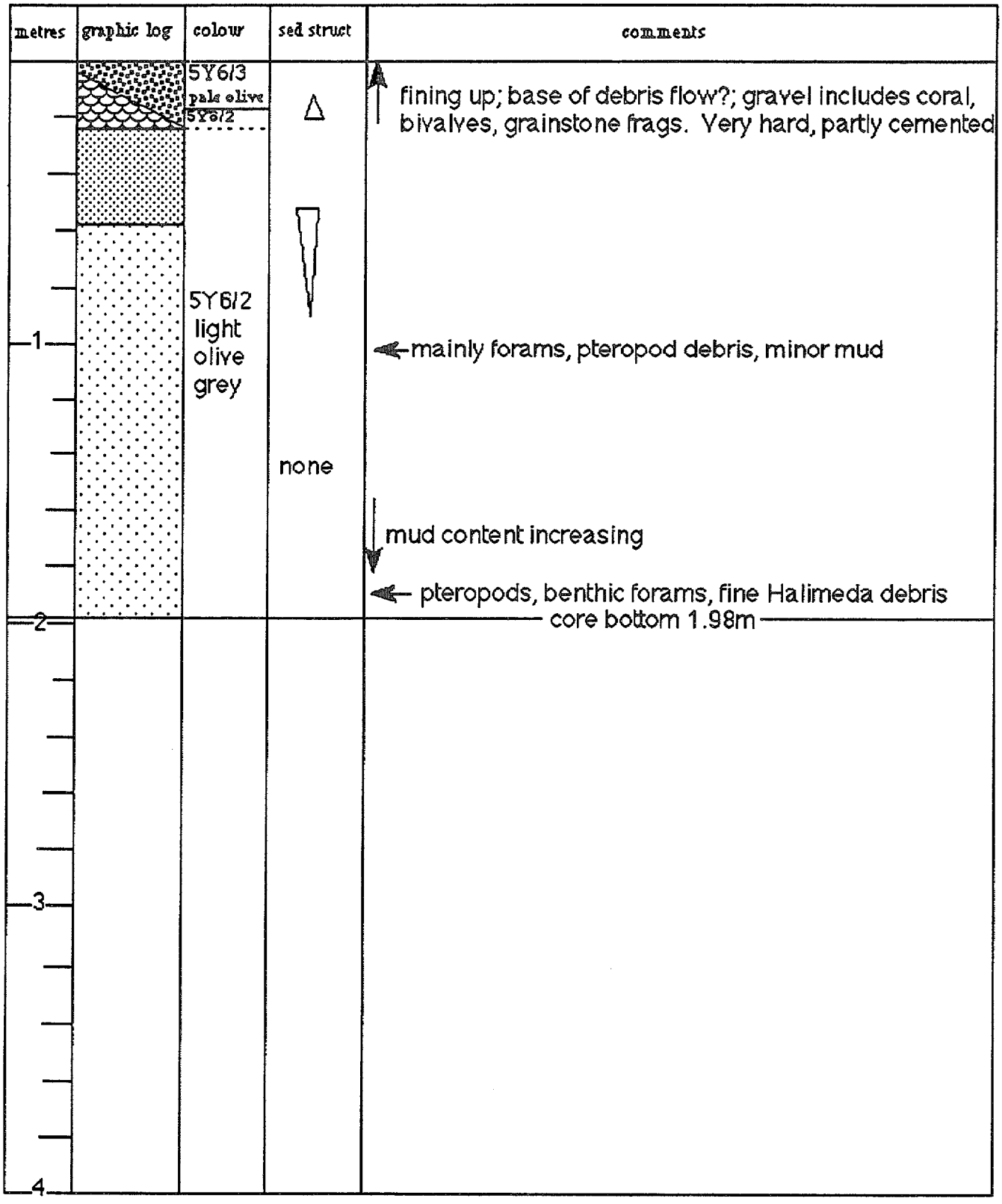
Site 57	**Lat.** 11°33.91	**Long.** 124°24.16	**Water depth** 199.1m
Core 122/VC/013	**Described by** A. Troedson	**Date** 27/10/93	**Length** 1.98m



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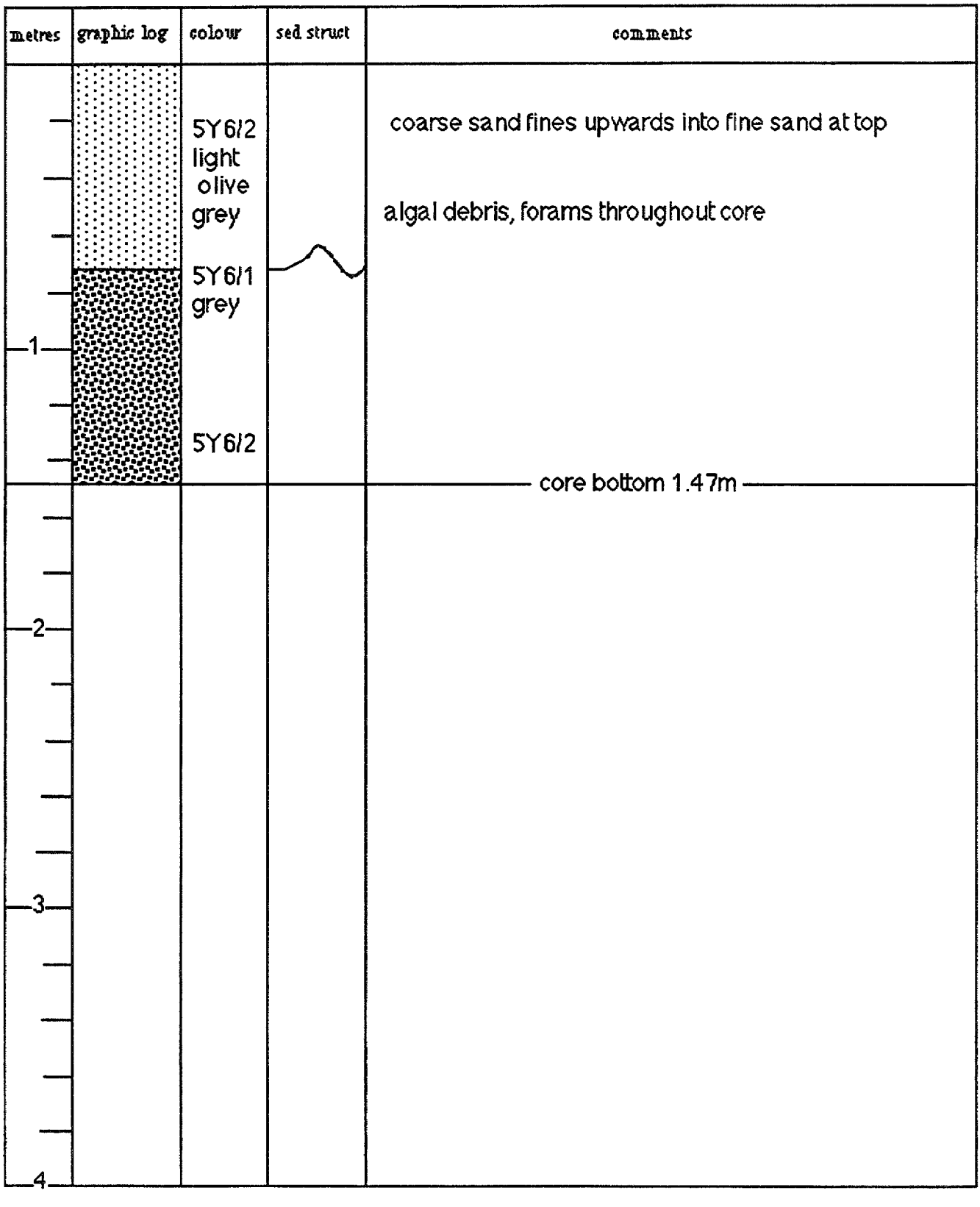
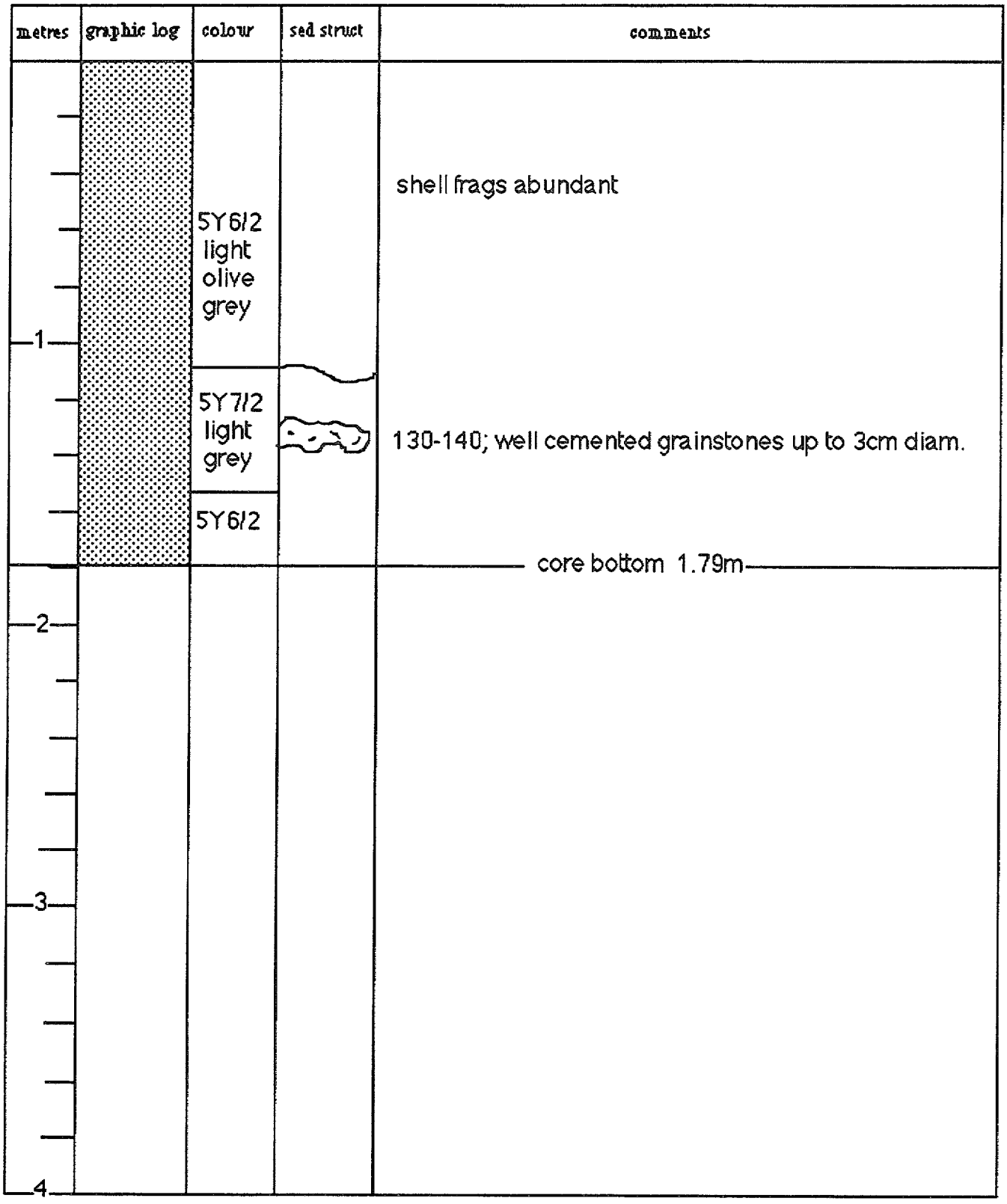
Site 58	**Lat.** 11°32.12 S	**Long.** 124°17.70 E	**Water depth** 226.6m
Core 122/VC/014	**Described by** D. Bergersen	**Date** 28/10/93	**Length** 1.47m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 60	**Lat.** 11°29.07 S	**Long.** 124°21.05 E	**Water depth** 204m
Core 122/VC/015	**Described by** D. Bergersen	**Date** 28/10/93	**Length** 1.79m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 63	**Lat.** 11°26.68 S	**Long.** 124°24.35 E	**Water depth** 216m
Core 122/VC/016	**Described by** D. Bergersen	**Date** 28/10/93	**Length** 2.27m

metres	graphic log	colour	sed struct	comments
1		5Y6/2 light olive grey		coarsens and becomes paler in colour downcore
				82; burrow
				pteropods, forams
2				core bottom 2.27m
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 64	Lat. 11°24.99 S	Long. 124°26.62 E	Water depth 175m
Core 122/VC/017	Described by D. Bergersen	Date 28/10/93	Length 2.66m

metres	graphic log	colour	sed struct	comments
				rather disturbed core, no sed. structures visible fine sand, coarsening down slightly
		5Y6/2 light olive grey		
				86-88; burrow
1				
2				
				core bottom 2.66m
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 65	**Lat.** 11°27.63 S	**Long.** 124°33.72 E	**Water depth** 183.8m
Core 122/VC/018	**Described by** A. Troedson	**Date** 28/10/93	**Length** 0.61m

metres	graphic log	colour	sed struct	comments
		5Y5/3		pteropods, forams, minor mud, calc. debris
		5Y6/2		fines, darkens, mud content increases
		5Y7/2		35-50; several grainstone pebbles, max. 4cm diam.
				pteropods, forams, minor glauconite
				core bottom 0.61m
1				
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 66	Lat. 11°30.40 S	Long. 124°33.36	Water depth 192.9m
Core 122/VC/19	Described by A. Troedson	Date 28/10/93	Length 2.54m

metres	graphic log	colour	sed struct	comments
		5Y5/3		minor mottling
				bioturbated contact at colour change
				28-32; some grainstone pebbles(white, max. 1cm diam.)
		5Y6/2		← benthic forams, calc frags(algal debris?), pteropods, glauconite
				burrow
				mud content decreases downwards throughout core
1				
		5Y7/2		115-125 vertical burrow, 10cm long
				highly mottled(5Y6/2 and 5Y8/2 mottles)
2				
		5Y8/2 white		← planktic foram>benthics, fine sand sized calc debris(Halimeda?)
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 70	**Lat.** 11°26.24 S	**Long.** 125°11.64	**Water depth** 250m
Core 122/VC/20	**Described by** A. Troedson	**Date** 29/10/93	**Length** 2.49m

metres	graphic log	colour	sed struct	comments
1		5Y5/3 olive		pteropods, forams(esp, benthics) abundant slightly muddy olive carbonate sand throughout minor mottling
2				
3				
4				

Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 76	**Lat.** 11°26.99 S	**Long.** 125°15.79 E	**Water depth** 243m
Core 122/VC/021	**Described by** A. Troedson	**Date** 29/10/93	**Length** 2.23m

metres	graphic log	colour	sed struct	comments
		5Y5/3 olive		← pteropod/foram ooze; minor mud
1			none	← pteropods, benthic forams, calc debris(algal?)
2				slightly finer and muddier at base than at top, also less pteropods, more benthic forams
				core bottom 2.23m
3				
4				

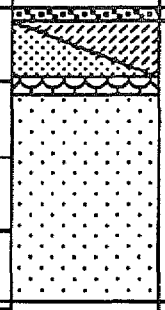
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 77	**Lat.** 11°27.10 S	**Long.** 125°16.30 E	**Water depth** 234m
Core 122/VC/022	**Described by** A. Troedson	**Date** 29/10/93	**Length** 1.63m

metres	graphic log	colour	sed struct	comments
1		5Y5/3 olive	none	← planktonic forams, pteropods, benthic forams (in order of abundance) minor coarse sand throughout, little mud present ← less pteropods ← pteropods, forams, misc, carb debris(algal?)
2				core bottom 1.63m
3				
4				

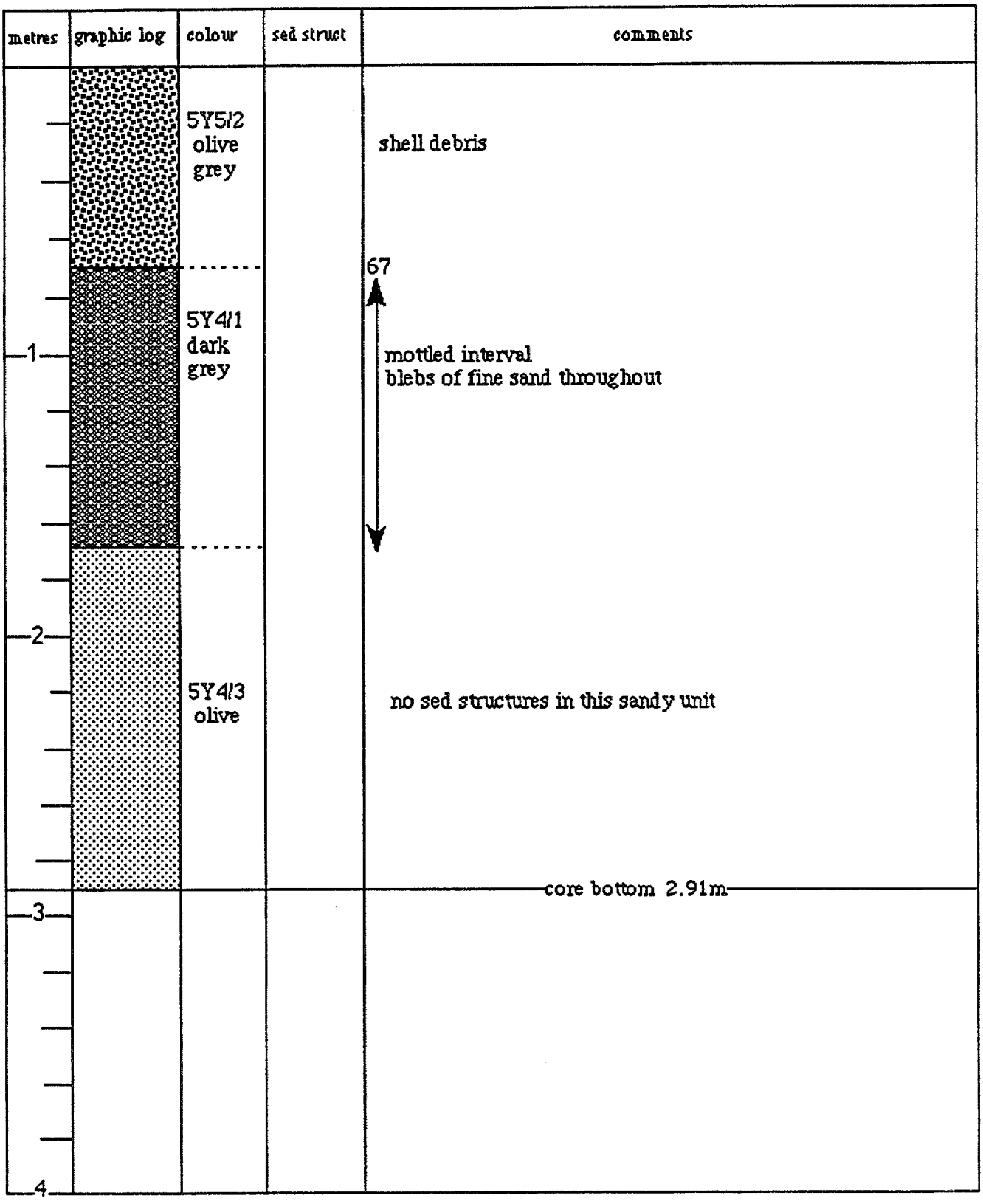
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 78	**Lat.** 11°27.24 S	**Long.** 125°17.65 E	**Water depth** 146m
Core 122/VC/23	**Described by** A. Troedson	**Date** 29/10/93	**Length** 0.78m

metres	graphic log	colour	sed struct	comments
		5Y6/2		0-4cm; 5Y6/3, benthic forams, calc debris(algal?) 4-16; grades from muddy sand to sand;some black grains(glauc?) 16-23; large shells(esp. gastropods), max. 2cm diam. sharp contact at 23cm. slightly muddy fine sand, colour pales downcore minor mottling ← dominated by white calc debris(algal?), benthic forams core bottom 0.78m
1				
2				
3				
4				

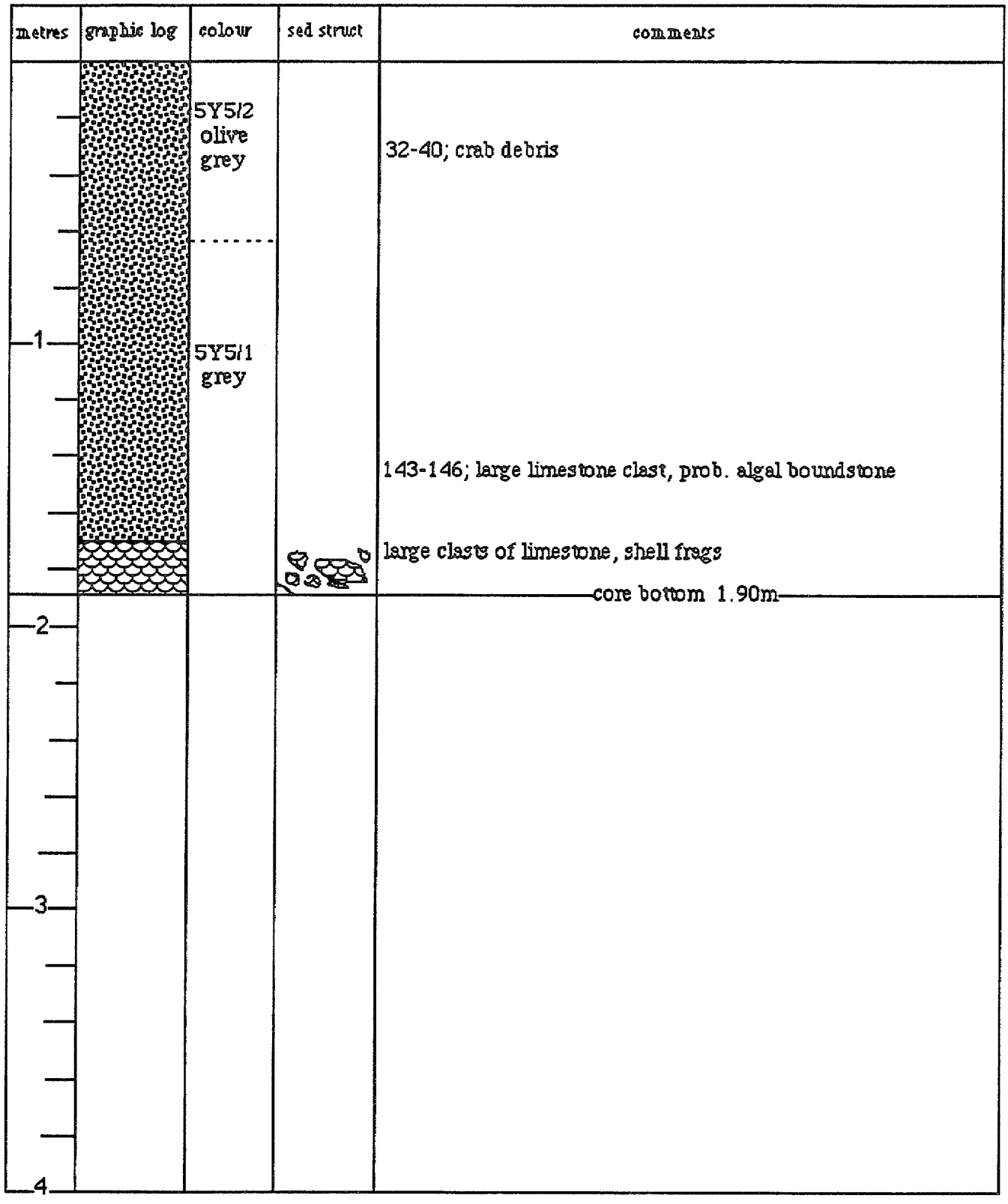
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 89	**Lat.** 10°48.68	**Long.** 126°09.92	**Water depth** 168m
Core 122/VC/024	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 2.91m



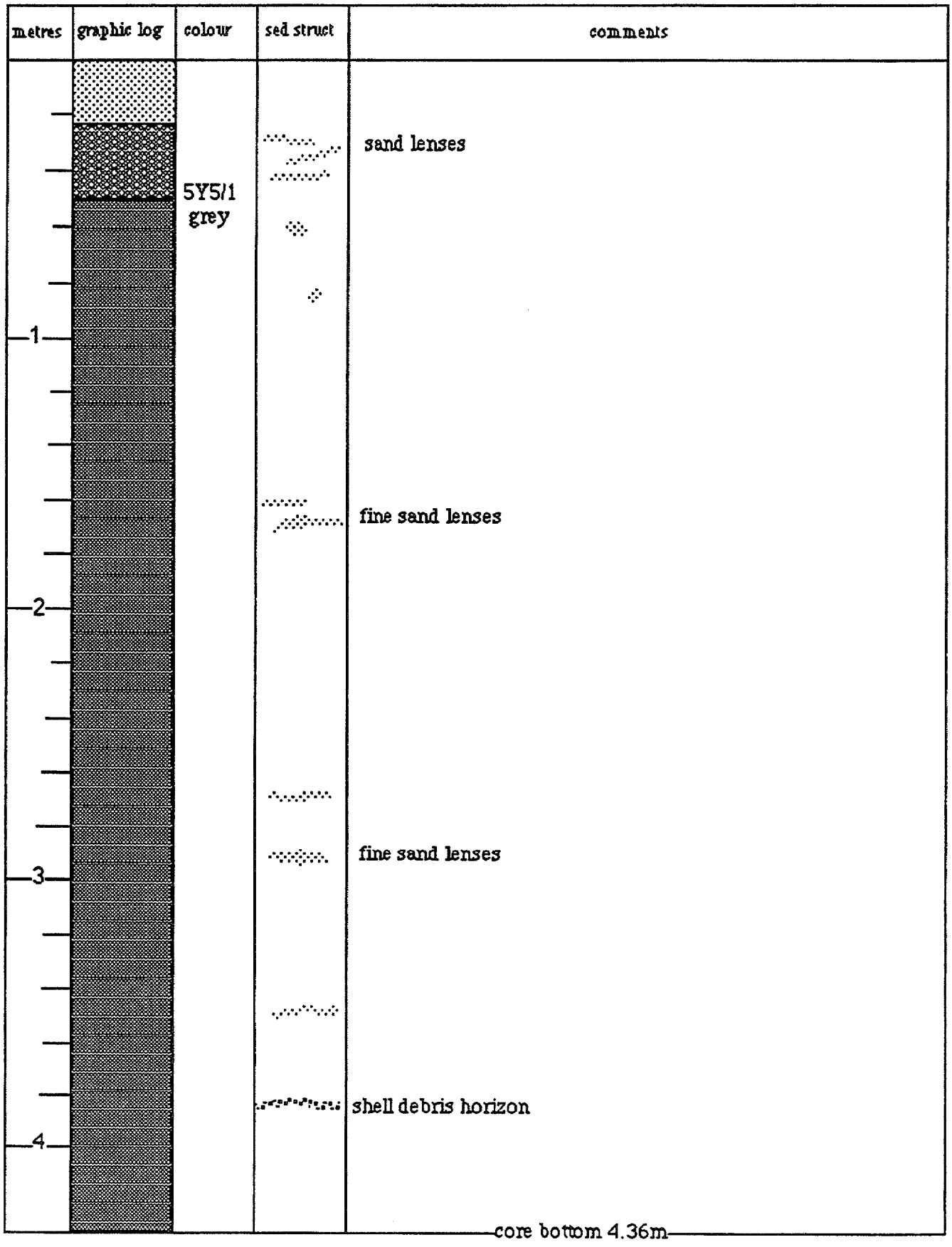
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 90	**Lat.** 10°50.44	**Long.** 126°10.39	**Water depth** 125m
Core 122/VC/25	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 1.9m



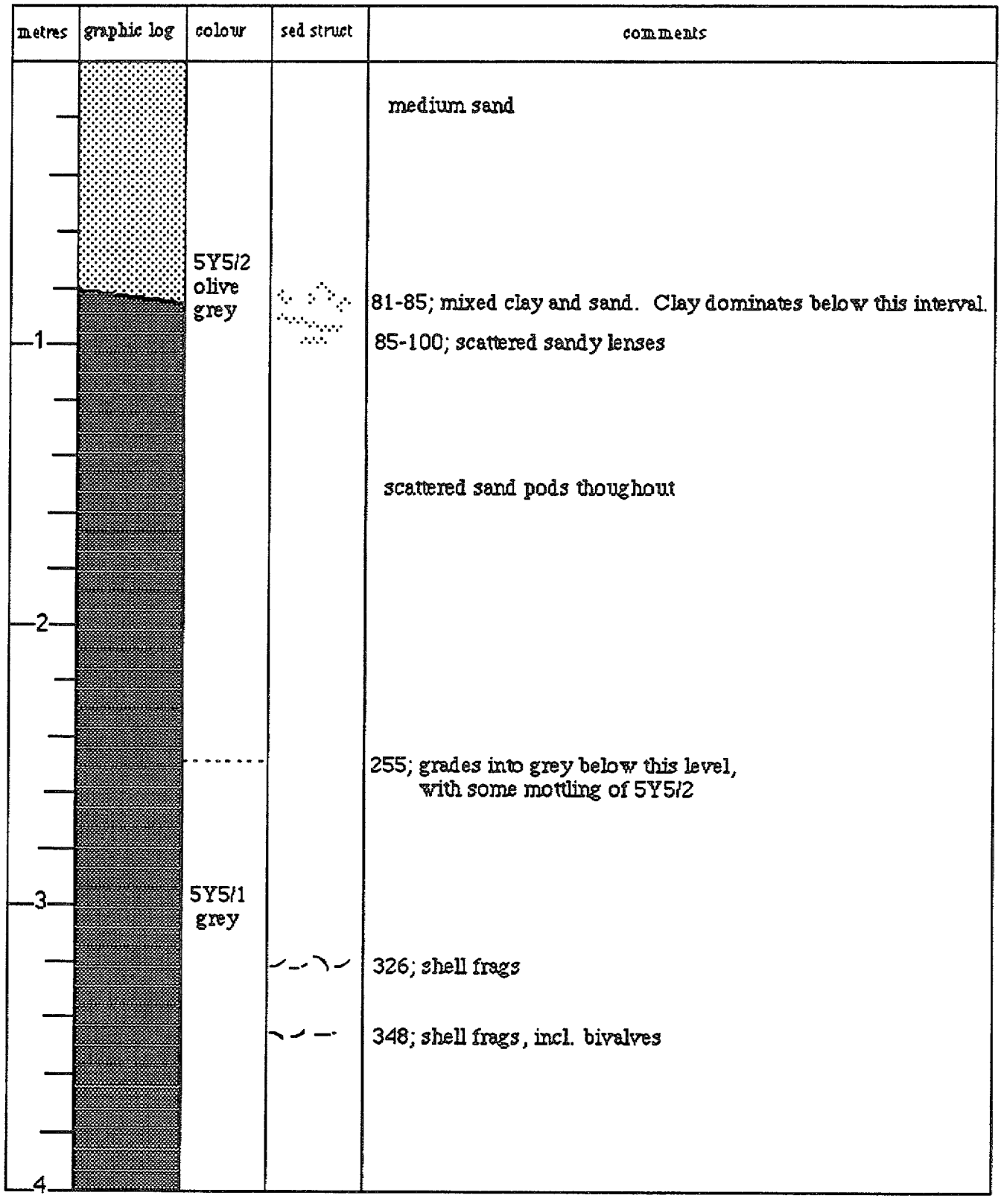
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 92	**Lat.** 10°53.04	**Long.** 126°11.55	**Water depth** 108m
Core 122/VC/026	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.36m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 93	Lat. 10°53.87	Long. 126°11.30	Water depth 107m
Core 122/VC/27	Described by D. Bergersen	Date 3/11/93	Length 4.40m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 93	**Lat.** 10°53.87	**Long.** 126°11.30	**Water depth** 107m
Core 122/VC/27	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.40m

metres	graphic log	colour	sed struct	comments
		5Y5/1 grey	none	grey clay
				core bottom 4.40m
5				

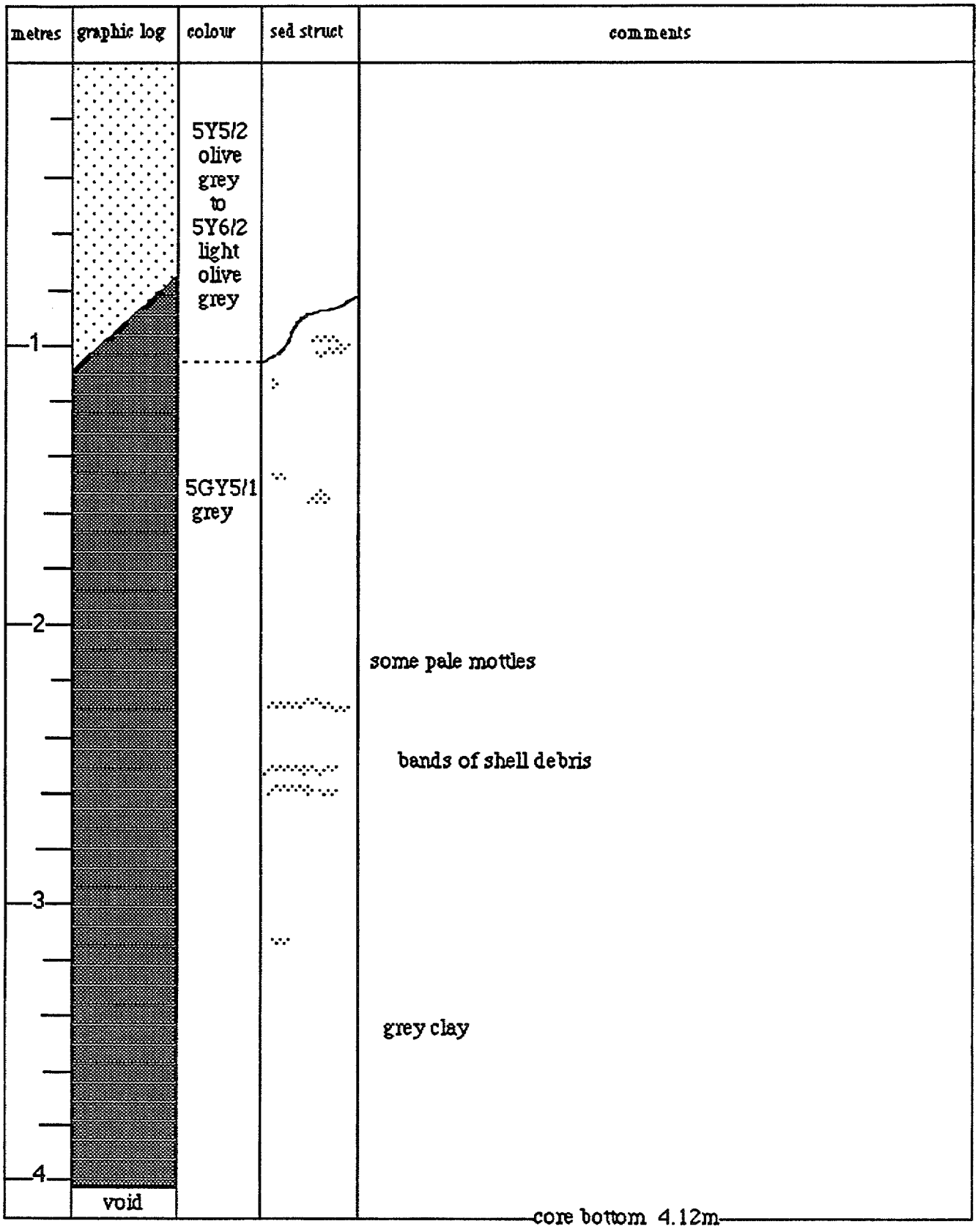
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 94	**Lat.** 10°56.63	**Long.** 126°12.61	**Water depth** 115m
Core 122/VC/028	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 2.55m

metres	graphic log	colour	sed struct	comments
		5Y4/3 olive		medium sand
				76-95; clay dominates, numerous sandy lenses
1				
				155-165; mottles of 5Y4/1
		5Y4/1 dark grey		numerous sandy bands, containing shell frags
2				228-base; muddy sand and gravel, consists of shells and shell frags
				core bottom 2.55m
3				
4				

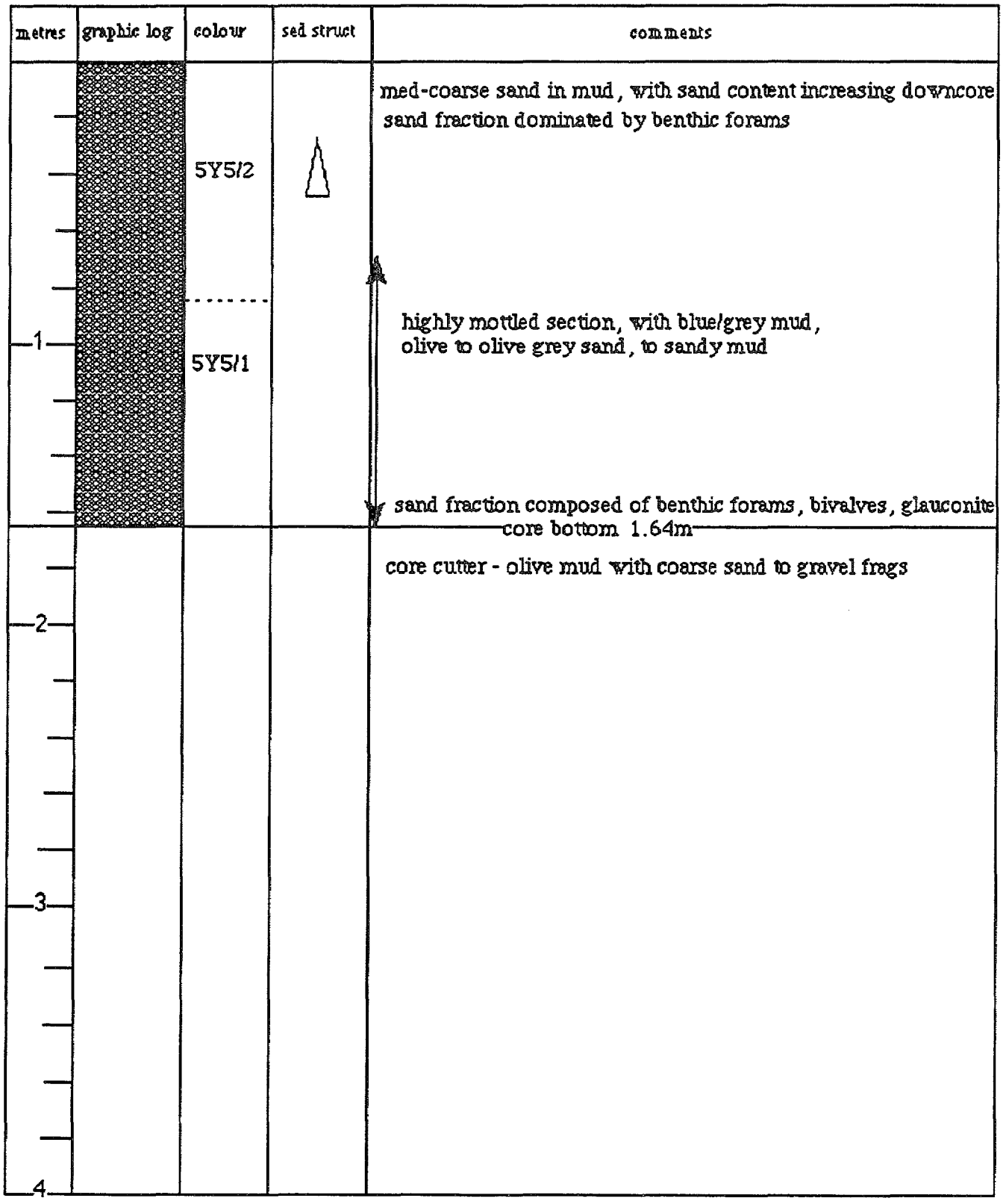
Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 95	**Lat.** 10°59.58	**Long.** 126°13.90	**Water depth** 115m
Core 122/VC/29	**Described by** D. Bergersen	**Date** 3/11/93	**Length** 4.12m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 100	**Lat.** 11°10.70	**Long.** 126°22.48	**Water depth** 88m
Core 122/VC/30	**Described by** A. Troedson	**Date** 3/11/93	**Length** 1.64m



Sahul Shoals - Survey 122 - R/V RIG SEISMIC

Site 104	**Lat.** 11°16.11	**Long.** 126°20.23	**Water depth** 104m
Core 122/VC/31	**Described by** A. Troedson	**Date** 3/11/93	**Length** 1.45m

metres	graphic log	colour	sed struct	comments
1		5Y5/2		very sandy mud forams, gastropods, brown stained calc. debris in sand fraction some mud intraclasts
				70; gravel band including large rock/shell frag?, 3cm long
				87-110; mottled 90-95; fine sandy mud
		5Y6/2		coarse frags of coral, gastropods, echinoids, bivalves minor mud
				core bottom 1.45m
2				core catcher - slightly muddy shelly gravel
3				
4				