COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



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# B.M.R. Marine Geology Cruise in the Southern Barrier Reef and Northern Tasman Sea 12·9·1970 to 14·12·1970



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*D. Jongsma and J. F. Marshall*

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Record No. 1971/17

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## 12/9/1970 to 14/12/1970

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CONTENTS



ILLUSTRATIONS

## SUMMARY

Two hundred and ninety bottom samples and 3500 km of sparker profiles were obtained from the Continental shelf and upper Continental slope off eastern Australia between the Swain Reefs and Port Macquarie. The wide Continental shelf and gently inclined upper slope of the northern part of this area is mantled by reef-derived organic carbonates. Quartz sands dominate on the much narrower shelf and steep slope to the south. The seismic profiles indicate an undisturbed conformable sequence 300 to 400 metres thick in the Capricorn Channel thinning landwards. Farther south off Fraser Island the prism of superficial sediments thins seawards and phosphatic limestone bedrock, possibly of Miocene age, crops out on the upper Continental slope. Platy slabs of phosphatic limestone, probably derived from the same horizon, were dredged from a number of localities on the upper slope south of Cape Moreton.


## INTRODUCTION

The geological reconnaissance of the Australian Continental Shelf by the Bureau of Mineral Resources was continued during 1970 off the central and southern Queensland and northern New South Wales coasts. The shelf from the Capricorn Channel southwards to 32°S was covered and in addition off lying seamounts and islands were studied.

This report consists of a cruise summary and a brief preliminary assessment of some of the data collected.

### Personnel

The B.M.R. scientific personnel who took part in the 1970 marine geological cruise were,

| | |
|---|---|
| Dr H.A. Jones | Supervisor |
| Mr D. Jongsma | Party leader |
| Mr J.F. Marshall | Geologist |
| Mr R. Dulski | Technical Officer |
| Mr M. Tratt | Technical Officer |
| Mr D.M. Foulstone | Technical Assistant |

In addition a number of visitors from other institutions joined the vessel. Dr V. Palmeri and Dr H. Hekel both from the Queensland Geological Survey joined the cruise from 1/10/70 to 20/10/70, Dr P. Roy from the New South Wales Geological Survey participated in the cruise from 1/12/70 till 14/12/70. From 22/10/70 to 26/10/70 a Commonwealth Film Unit Crew of four men, filmed the shipboard operations.

## Vessel

For this survey the B.M.R. chartered the Motor Vessel San Pedro Strait, 330 tons gross, an oil rig supply vessel owned by San Pedro (Offshore) Pty Ltd (Plate 1). The vessel has an overall length of 36.6 metres and is powered by two 456 H.P. diesel engines giving a cruising speed of 10 knots. Two winches capable of 5 tons draw are located on the main deck aft of the superstructure. The San Pedro Strait was equipped with a Simrad "Skipper" echosounder, a Decca 202 radar unit, and an automatic "Arkas" Pilot. A 3.5 metre Quintrex alluminium dinghy with a 20 H.P. outboard motor was carried.

This type of vessel was well suited for the purposes of this survey although she tended to pound heavily in moderate seas. Ample room on the deck gave the party plenty of working space. Two portable laboratories owned by the B.M.R. were welded to the deck on the starboard side of the vessel. A large A frame with a raised platform was positioned on the stern of the vessel to facilitate dredging operations.

## Surveying methods and equipment

Most bottom samples were collected with a small conical dredge and a pipe dredge. A canvas bag was clamped over the open lower end of the dredge to retain the sample. To get better recovery of sediment where the bottom consisted of hard packed sand or cemented shell detritus, a doubled 1-metre length of 20 mm chain was passed through the towing bridle and welded to the bridle link to link; this helped the lip of the dredge to bite into the sediment surface and was found to be more effective than a much heavier weight not rigidly attached to the dredge. The small dredge was worked on 4-mm wire from a fast running, 3 h.p. diesel winch mounted on the stern of the ship.

Where hard sea bottom was suspected, conventional rock dredges with mouth openings of 60 cm were used. These were towed on 9 mm steel wire using the ship's 5-ton winch and the large A frame on the stern of the vessel.

Water depth profiles were obtained with the ship's Simrad "Skipper" 38.5 Kc/sec echo-sounder. This instrument has a straight line dry paper recorder with a 2-range scale to a maximum depth of 1097 metres. Seismic reflection profiles were obtained with a 1000-joule, 3-electrode Sparkarray sound source, a 7-element MP 7 hydrophone, and an Ocean Sonics GDR-T recorder using 48 cm wet paper. Traverses were run at a speed of 5 to 6 knots.


Plate 1A. The m.v. "San Pedro Strait".

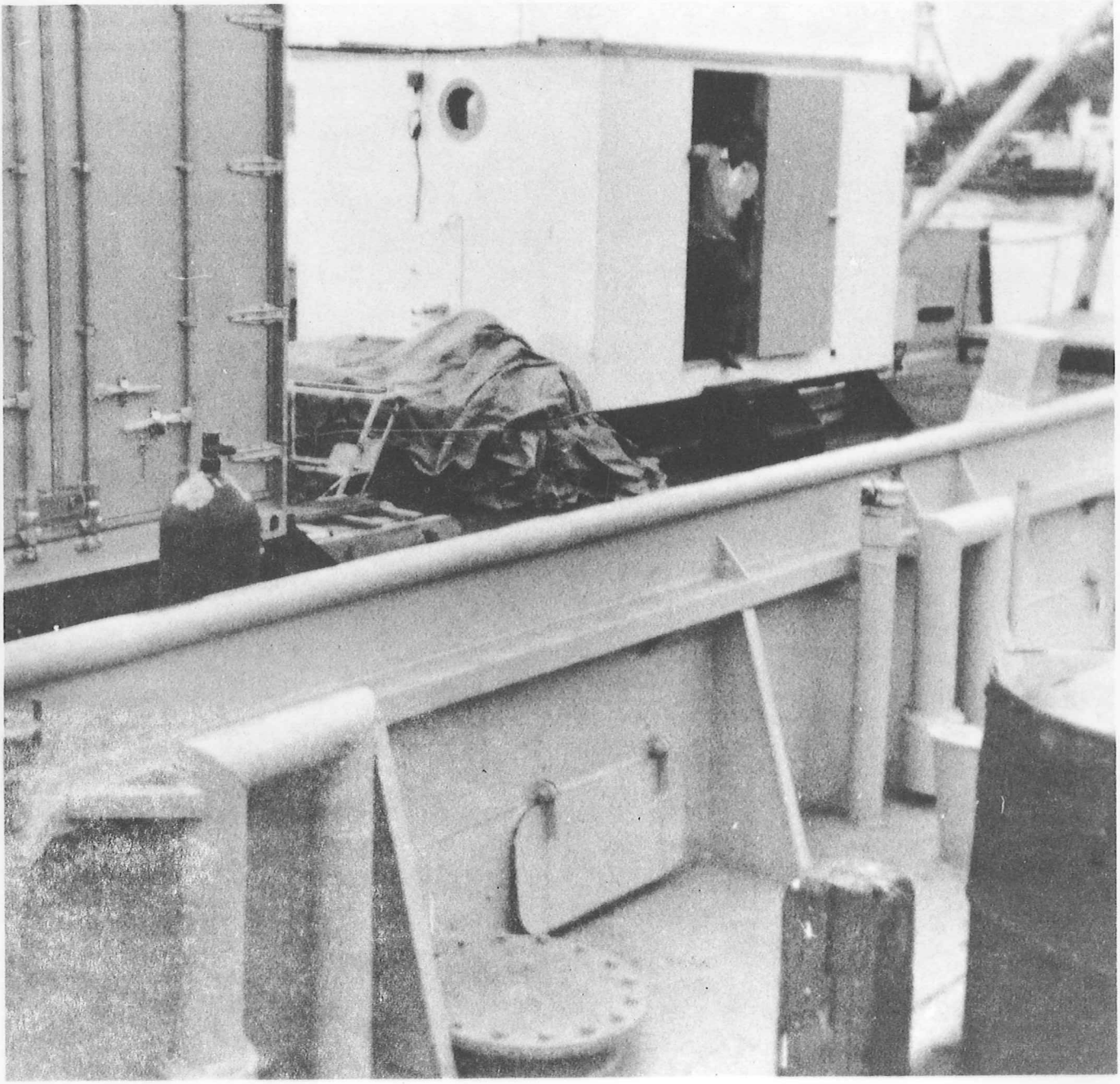

Plate 1B. The B.M.R. portable laboratories are shown welded to the deck of the "San Pedro Strait". Part of the A frame on the stern of the vessel can be seen in the top left hand corner.

Photographs of the seabed were obtained with an Edgerton Germehansen and Grier Model 205 underwater camera and a Model 206 light source. The shutter opening and synchronized flash were triggered by a weight slung 3 metres below the frame in which the camera and light source were mounted. This arrangement gave a field of view of about four square metres.

Positioning of stations and seismic traverses relied upon celestial navigation and dead reckoning when out of radar range of land. Maximum radar range was 45 kilometres. The accuracy of positioning achieved is detailed in the Appendix.

## ANCILLARY PROJECTS

Samples of live marine organisms recovered in the dredges were preserved for the Zoology Department of the University of Queensland, and a collection of living and dead molluscs from the dredge hauls was made for the Australian Museum, Sydney. Sediment samples for micropaleontological work were collected in the Capricorn Channel and Curtis Channel areas by geologists from the Queensland Geological Survey. Sediment samples from the southern Queensland Continental shelf were collected for the marine geology section of the University of Queensland. During the last leg of the cruise Dr Roy retained a portion of the bottom samples recovered for the Geological Survey of New South Wales.

## CRUISE NARRATIVE

The ship sailed from Sydney on 12/9/70, and reached Broad Sound on 16/9/70. The next day was spent in testing the continuous seismic profiling equipment and transferring this equipment to the Estuary Study Party's vessel the "Bali Hai". H.A. Jones and R. Dulski stayed in Broad Sound to assist the Estuary Study Party in their seismic profiling work while the San Pedro Strait commenced systematic sampling of the Capricorn Channel.

The vessel returned to Broad Sound on 21/9/70 and worked for one day in Broad Sound on gravity coring. J.N. Casey joined the vessel when it left Broad Sound on the evening of the 22/9/70 and transferred to the Pilot boat off Gladstone on 24/9/70. Sampling and seismic profiling of the Capricorn Channel continued until 25/9/70. On 26/9/70 the flanks of Cato Bank were dredged. The vessel returned to the Capricorn Channel by 27/9/70 and continued work until 30/9/70. Bunkering took place in Gladstone from 30/9/70 to 2/10/70.

The second leg of the cruise started in Gladstone on the 2/10/70, Drs V. Palmeri and H. Hekel, both from the Queensland Geological Survey, participated in this leg of the cruise. Sampling and seismic work continued outside the Bunker Group until 6/10/70.

The flanks of Swains Reef and Saumarez Reef were dredged on 6/10/70 and 8/10/70 respectively. Sampling and seismic profiling of the Curtis Channel started on 9/10/70 and continued into Hervey Bay till 12/10/70, after which the continental shelf east of Fraser Island was surveyed from 13/10/70 till 14/10/70. Rough seas and strong winds forced the vessel into shelter behind Lady Musgrave Island for one day (15/10/70).

The area inside the Capricorn and Bunker Groups was sampled from 16/10/70 to 18/10/70. A core, a large box dredge and underwater photographs were taken on a submarine terrace and trough feature in the Capricorn Channel in a water depth of about 200 m, on 19/10/70. The "San Pedro Strait" arrived in Gladstone on the morning of 20/10/70.

Jones, Palmeri and Hekel left the ship in Gladstone and a Commonwealth Film Unit Crew joined to film the shipboard operations. Bunkering was completed on 22/10/70 and the vessel left Gladstone that afternoon on course for Fraser Island. Sparker traverses were run off Sandy Cape on the 23/10/70 and sampling continued down to Noosa Head till 25/10/70. The film crew was put ashore in Mooloolooobah on the morning of 26/10/70. Surveying of the continental shelf continued but was hampered by rough weather. Two nights were spent in shelter at Noosa Heads and Mooloolooobah.

On 31/10/70 course was set for Kelso Bank, which was reached on the morning of 1/11/70. Two days dredging, echosounder and sparker profiling of this bank was undertaken after which the vessel returned to Cape Moreton on 4/11/70. Systematic sampling and seismic profiling continued from Cape Moreton to Danger Point until 6/11/70. Failure of the vessels steering gear necessitated arrival in Brisbane on 7/11/70, which was earlier than planned.

The San Pedro Strait stayed in Brisbane for repairs and bunkering for one week and left on 14/11/70. Sparker traverses were run across two canyons off Noosa and Cape Moreton until 16/11/70. Systematic work south of Danger Point commenced on 17/11/70, but extremely rough weather necessitated sheltering in Byron Bay from 18/11/70 to 21/11/70. Work on the continental shelf down to Coffs Harbour continued until 26/11/70. The San Pedro Strait went north on 27/11/70 to occupy stations missed earlier due to bad weather. Dredges on the edge of the shelf off Cape Byron and sparker traverses of this region were taken during the next few days, with rough seas hampering operations. On 29/11/70 course was set for Brisbane for a final bunkering stop. Brisbane was reached on 30/11/70.

The vessel left Brisbane on the afternoon of 2/12/70, with Dr P. Roy from the New South Wales Geological Survey on board for the final leg of the cruise. On 3/12/70 a search was made for Moreton Seamount with a view of dredging its flanks. This seamount was not located. Automatic pilot trouble caused a return to Noosa for repairs on 4/12/70. An echosounder profile parallel to the shelf edge south of Cape Moreton was made the next day and some large dredge hauls on the shelf edge south of Cape Byron were made on 5/11/70. The area for systematic sampling just south of Coffs Harbour was reached on 6/12/70 and surveying continued. Rough weather made work difficult and with the onset of gale force winds the vessel was forced to shelter until 10/12/70. From 10/12/70 to 13/12/70 systematic sampling and seismic work continued down to latitude 32°.

The cruise terminated on the morning of 14/12/70 in Sydney.

## RESULTS

Two hundred and ninety stations were occupied during this cruise (Fig. 1) and about 3500 kilometres of sparker profiles were run (Fig. 2). Continuous echosounding was normally carried out between bottom sample stations.

### Morphology

The morphology of the area is characterised by a wide continental shelf and gentle upper continental slope in the north and a narrow continental shelf and relatively steep upper continental slope in the south. In the north many coral reefs are present near the edge of the shelf. In the south any reefs that exist are submarine features and tend to occur at or below the shelf break. Because of these differences, and others, the area has been divided into a northern province and a southern province for descriptive purposes.

The northern province is that part of the continental shelf and upper continental slope north of Sandy Cape. It includes the Capricorn and Curtis Channels, Hervey Bay, the Capricorn and Bunker Groups, and the southern part of the Swain Reefs. The inner shelf tends to have a smooth topography except to the northwest of North Reef where a number of banks and shoals occur. These can be considered to be an extension of the Capricorn Group. The inner shelf extends out to a depth of about 50 metres. On the outer shelf there is a line of coral reefs which comprise the Bunker and Capricorn Groups. From Lady Musgrave Island in the south the reefs run in a northwesterly direction as far as North Reef. To the north the Swain Reefs rise abruptly from the sea floor which here stands at a little over 100 metres depth. Near Hixson Cay soundings of 110 metres were recorded as close as the ship could safely approach the reefs in the prevailing weather conditions, a distance of a few hundred metres.

From the Swain Reefs the edge of the shelf swings to the southwest. It skirts the Capricorn and Bunker Groups, and then trends southeast past Lady Elliot Island. This embayment of the shelf in the Capricorn Channel is a manifestation of a large trough which slopes down to the northwestern Tasman abyssal plain.

In the Capricorn Channel the upper part of the continental slope has a very gentle gradient of about $0.3^{\circ}$. This smooth slope is broken at a depth of about 180 metres by a step which ranges in height from 11 to 36 metres; a well defined depression or trough is usually present at the foot of the step and there is some evidence that these features constitute a modified terrace and step form related to a low sea level stand.

East of the Capricorn and Bunker Groups the shelf extends seawards for approximately 15 kilometres. The sea floor then drops away relatively steeply from about 55 metres to 200 metres at an inclination of $4^{\circ}$. At 200 metres the sea floor then slopes down more gently with a gradient of about $0.5^{\circ}$. No step is found off the Capricorn and Bunker Groups between 180 and 200 metres but a distinct change in slope can be detected at this depth. This suggests that a terrace and step feature was originally present and is now obscured by a mantle of coral debris transported from the edge of the shelf.

North of Breaksea Spit the upper continental slope and outer shelf are incised by a number of erosional channels. One channel crossing the outer shelf-upper slope zone near the 100-metre isobath was found to be 70 metres deep and 3 kilometres wide, but most are much smaller than this at this depth. These channels would appear to be the submerged remnants of an ancient river system but the data have not yet been evaluated in sufficient detail to enable correlations with existing onshore drainage patterns to be made.

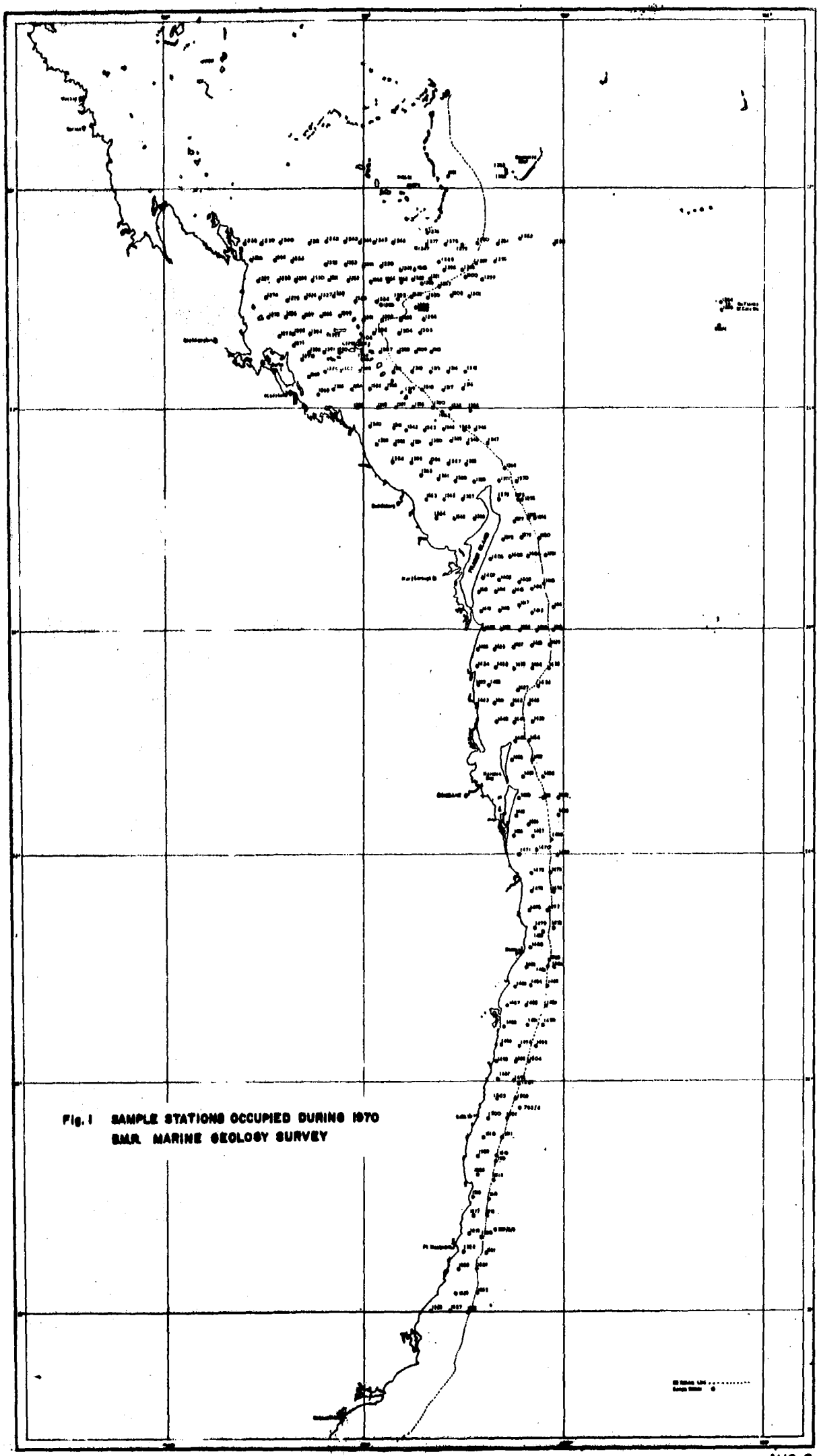

Fig. 1 SAMPLE STATIONS OCCUPIED DURING 1970 BMR MARINE GEOLOGY SURVEY

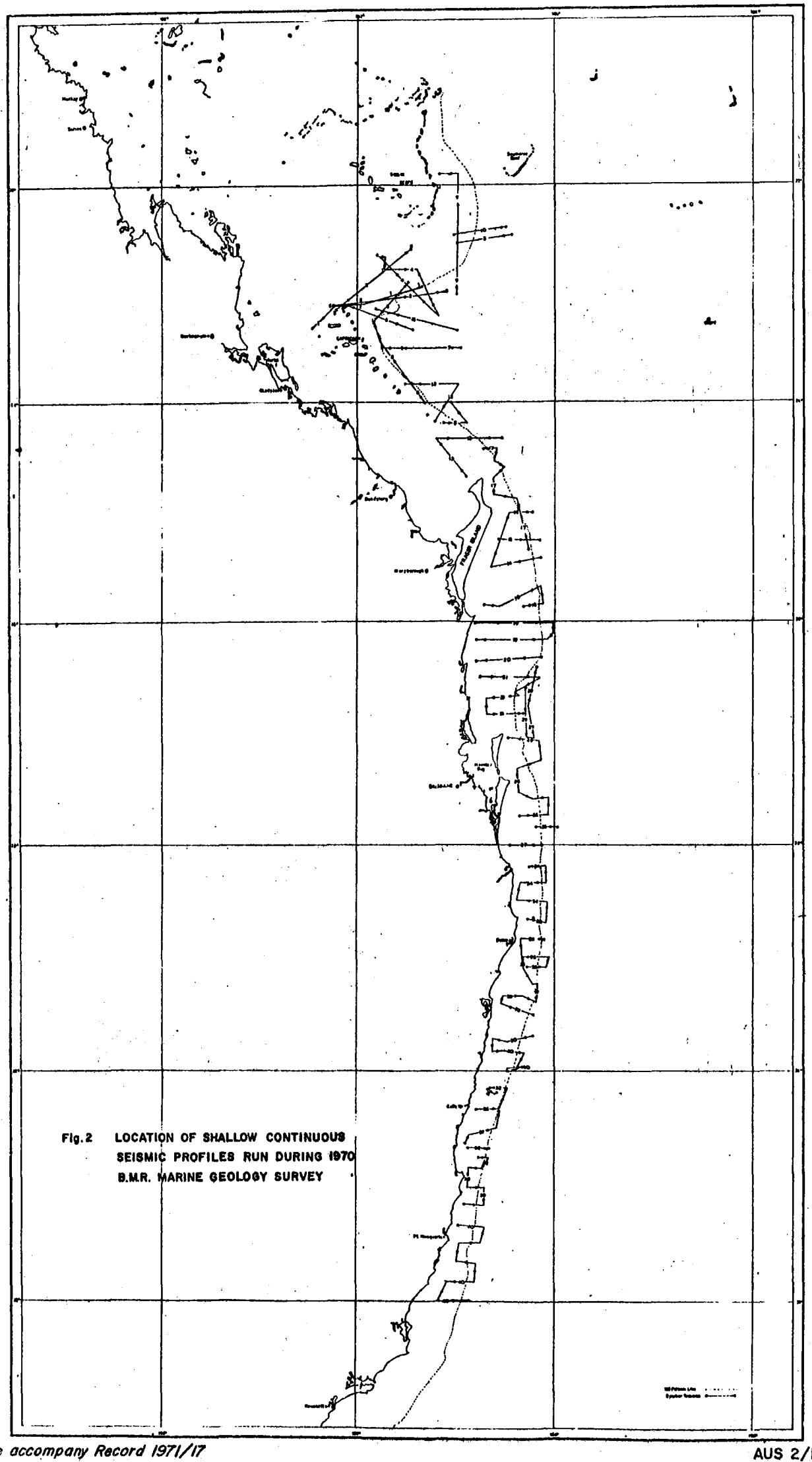

Fig. 2 LOCATION OF SHALLOW CONTINUOUS SEISMIC PROFILES RUN DURING 1970 B.M.R. MARINE GEOLOGY SURVEY

The continental shelf off Breaksea Spit and the northern part of Fraser Island is only 16 to 20 kilometres wide. A line of banks (Gardiner Banks) occurs 16 kilometres off Fraser Island. There is evidence to suggest that these banks were exposed during a low sea level stand, probably during the Pleistocene, and that they formed low lying offshore islands during that time.

From Cape Moreton south to Port Macquarie the topography of the shelf is smooth and the gradient very gentle, $\frac{1}{2}^{\circ}$. At about 70 metres the gradient increases slightly to about $0.3^{\circ}$. This gentle gradient continues to a depth between 250 and 300 metres at which point the slope steepens abruptly and the sea floor descends rapidly to the Tasman abyssal plain. Sometimes at this change in gradient reef-like structures are observed.

A number of submarine canyons occur between Noosa Heads and Coffs Harbour. No trace of these canyons appears on the shelf, and the heads of these canyons occur at a depth of about 200 metres. Canyons encountered on this survey were found off Noosa Heads, Cape Moreton, and just north of Coffs Harbour. There are some indications to suggest that at least another two canyons occur between Cape Moreton and Coffs Harbour.

Sediments

The superficial sediments show a distinct variation from north to south as well as varying from the inner shelf to the continental slope. The northern province is characterised by an abundance of coralline material and a deficiency of quartz, whereas the southern province is quartz-rich with only isolated patches of coralline material. There is a size gradation of coarse to fine from the inner shelf to the continental slope. Anomalies exist where banks and reefs occur near the edge of the shelf; coarse sands and gravels are usually present in these areas. At a few localities on the upper part of the continental slope currents have scoured away the sediment and bedrock is exposed. In two localities where bedrock was encountered, and dredged successfully, indications of phosphate were found.

In the Capricorn Channel the sediments are calcareous sandy clays consisting of abraded mollusc shells, foraminifera, coral fragments and fine terrigenous material. Around the banks and drowned coral reefs in the Capricorn Channel the sediments are coarse shelly sands and coral gravel. In the near-shore regions there is an increase in terrigenous material, mainly quartz and clay minerals. In depths greater than 80 metres the sediments are very fine grained, except for mollusc shell fragments, and typically consist of highly plastic blue-grey clay. Close to the Swain Reefs, however, reef-derived coarse material extends at least to 350 metres depth.

In the Curtis Channel, between the mainland and the Capricorn and Bunker Groups, the near-shore sediments contain a large amount of terrigenous material, and the rest is usually made up of abraded mollusc shells. Further offshore white and grey calcareous sands are dominant. These consist of coral sand, abraded mollusc shells and foraminifera. Near the reefs, coral sand and gravel are present. Some of the sands have a speckled appearance due to the presence of white coral and black foraminifera. The black colour of the foraminifera is due to bacterial reduction of the fine sediment filling the tests.

On the seaward side of the Capricorn and Bunker Groups the sediments are very coarse near the reefs and even at the edge of the shelf, 15 kilometres further east, the sediments are still fairly coarse. They consist of abraded mollusc shells, coral sands, pebbles and boulders, and foraminifera. From the shelf break the seafloor drops quite rapidly to 200 metres. Beyond 200 metres the sediments are plastic sandy clays and calcareous silty clays containing abundant pelagic foraminifera.

In the Curtis Channel to the north of Hervey Bay the sediments contain a fairly high proportion of quartz in the near-shore areas, and become increasingly calcareous towards the edge of the shelf. Most of the calcareous material is shell debris; coral is only a minor constituent in most places. On the slope the sediments are predominantly calcareous sandy silts containing a high proportion of pelagic foraminifera.

In Hervey Bay the sediments are chiefly coarse sands composed of quartz and rock fragments with coarse abraded mollusc shells on the banks.

The upper slope off Sandy Cape supports little or no sediment and bedrock has been recovered by dredge between 300 and 500 metres. The rock consists of a conglomerate with brown pebbles of phosphatic algal material cemented by a calcareous fossiliferous micrite. Analyses of this rock indicate up to 5 percent $P_2O_5$ is present.

On the shelf south of Sandy Cape and north of Cape Moreton the sediments consist of quartz sands with a substantial amount of shell material. About 30 kilometres offshore a band of coarse shelly grit extends from the southern end of Fraser Island to Caloundra Head. Barwon Bank southeast of Noosa Heads supports live coral, seaweed and molluscs. The outside edge of the shelf and the upper part of the slope are covered by foraminiferal sands and silt.

Between Cape Moreton and Port Macquarie the sediments are nearly all sand-size with some silty material near river-mouths. The sand contains generally quartz, brown ferruginised sand grains and abraded mollusc shells. Other constituents, present in some but not all samples, are rock fragments and glauconite. The deeper water samples tend to be finer grained, but sediments with clay as the dominant fraction are very rare. The deeper samples usually contain a high proportion of pelagic foraminifera. At a number of localities on the upper continental slope nodules were dredged together with sediment. Some of these nodules were phosphatic. Analyses indicate irregular and generally very low grades, but one nodule assayed at 26 percent $P_2O_5$.

Sparker Traverses

Forty sparker traverses were run over the continental shelf and upper continental slope in the area surveyed (Fig. 3). In shallow depths penetration of only 0.1 to 0.2 seconds of two way travel time was achieved; multiple reflections usually obscured any deeper horizons. On the edge of the shelf, and on the slope, penetration was of the order of 0.5 seconds two way travel time.

In the Capricorn Channel the continuous seismic profiles show undisturbed layers of sediment down to depths of 300 to 400 metres below the sea floor. This wedge of undisturbed sediment thins towards the coast. A deep strong reflecting horizon is present in most of the profiles in this area, and it prevents further penetration of the sub-bottom strata. This strong reflector which is of undulating character in places may prove to be bedrock.

Between Cape Capricorn and Cape Moreton seismic profiles run over the edge of the shelf show a strong sub-bottom reflector. This reflector is an unconformable horizon and occurs between 40 and 60 metres below the sea floor. This reflector is acoustically impenetrable and most probably represents bedrock. The strata above this unconformable reflector exhibit conformability with some penecontemporaneous cut and fill structures. Foreset bedding can often be observed in this upper sequence.

In the sparker profiles off Sandy Cape and Fraser Island the more recent sediments thin towards the edge of the shelf and a strong reflector emerges and crops out on the sea floor.

The seismic profiles between Cape Moreton and Port Macquarie show a sediment wedge thickening seaward with a strong reflector beneath it. This reflector tends to fall away sharply just before the shelf break indicating that it represents an ancient sea floor. Figure 3 is a line drawing of the first leg of traverse 30 which runs from east to west over the edge of the shelf. Two distinct unconformities can be observed in this profile. Horizon 1 is the present sea floor, whereas horizon 2 in a previous sea floor with a more pronounced break in slope at about 0.75 seconds. Horizon 2 is present in other traverses north and south of this one. Horizon 3 is presumably bedrock with no evidence of stratification below it and it has a very irregular attitude. Foreset bedding is observed on the edge of the shelf between horizons 1 and 2. Further north opposite Stradbroke Island hard packed sand on the continental slope prevents seismic penetration.

Kelso Bank

Kelso Bank forms part of the Lord Howe Island seamount chain. It lies approximately 400 miles due east of Bustard Head (Lat. 29°S. Long. 159°E). A survey of this bank showed it to consist of a steep sided seamount with its base between 4000-5000 metres. Three distinct surfaces are seen to occur at the top of the bank. Figure 4 shows continuous seismic profiles and sample stations on Kelso Bank. The bank is elliptical in plan, the most extensive surface is at 55 metres, a small patch on the southeast side has a depth of 18 m while around the eastern side a very smooth flat terrace occurs at 275 metres. These different surfaces may reflect the changes in relative sea level due to isostasy and eustasy which have affected the erosion of this bank.

In the sparker traverses a wedge of sediment occurs on the inner margin of the 275-metre platform. Dredges on Kelso Bank recovered no bedrock or phosphatic material. The edge of the seamount at 55 m and the 18-metre patch support live coral. The inner part of the bank is covered with coarse coral sand and calcareous algae. From the 275-metre platform white calcareous foraminiferal ooze was recovered by the dredge.

Cato Bank

Cato Banks occurs about 240 miles east of Cape Capricorn. (Lat. 23°14'S, Long. 155°32'E). The base of this bank is at around 3000 to 4000 metres. A small island surrounded by a circular fringing reef occurs on the southeastern side of the bank. Five large box dredge stations on this bank recovered mainly coral algae, calcareous sands and some live coral. No phosphatic material or bedrock was brought up in the dredges.

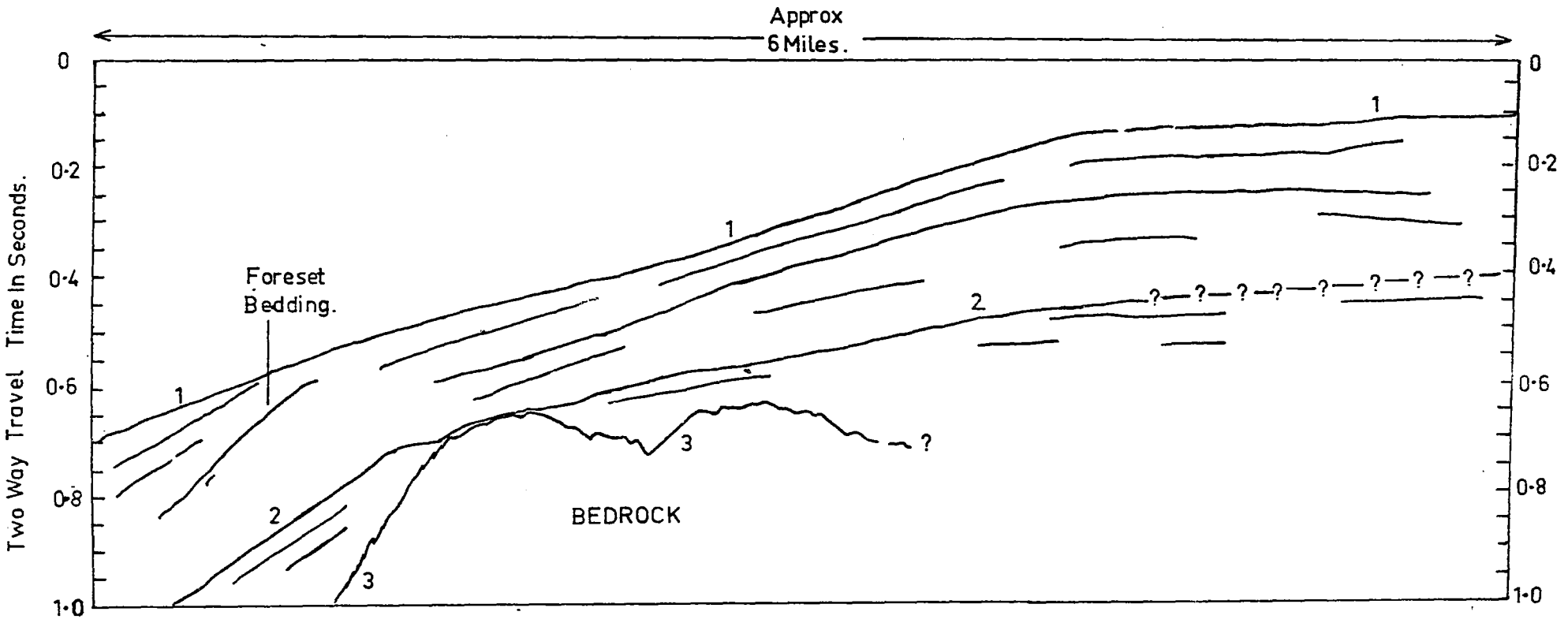


FIG 3 SKETCH OF START OF SPARKER TRAVERSE 30

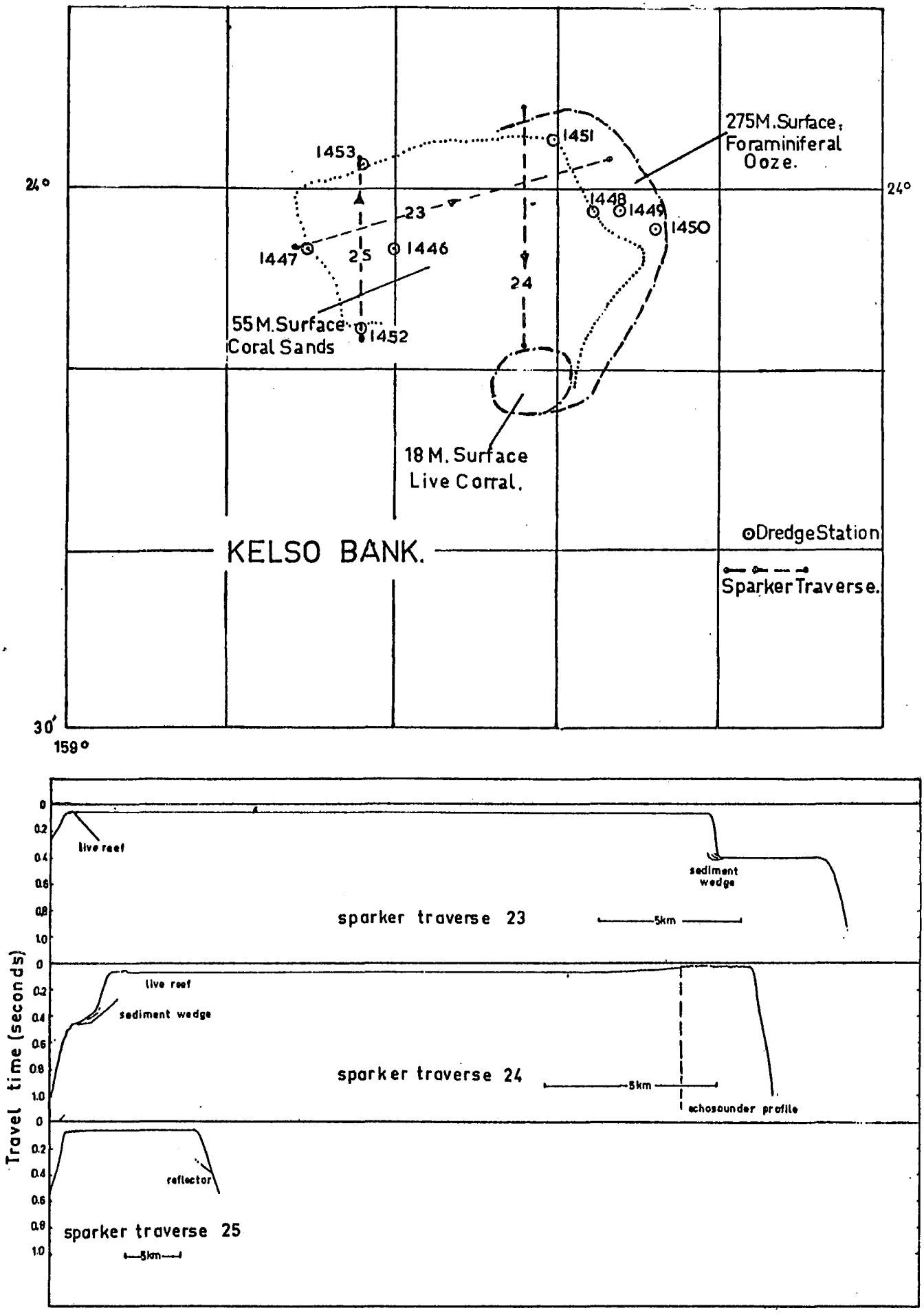


Fig.4 KELSO BANK DREDGE STATIONS AND SPARKER TRAVERSES SHOWING THREE DISTINCT SURFACES

# APPENDIX

## PHOSPHATE SECTION DATA SHEET

| Locality | Sample No. | Latitude | Longitude | Fix* | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | 870 - 1238 | 22°30.1 | 150°47.5 | A | 33 | Condred | 9/19 | 0656 | 5 GY 3/2 |
| | - 1239 | 22°30.2 | 150°58 | A | 51 | | 9/19 | 0803 | 5 Y 5/2 |
| | 1240 | 22°30.1 | 151°10 | A | 62 | | 9/19 | 0912 | 5 Y 6/1 |
| | 1241 | 22°30 | 151°26 | B | 55 | | 9/19 | 1044 | 10 YR 6/2 |
| | 1242 | 22°29 | 151°37 | C | 73 | | 9/19 | 1158 | 5Ø GY 6/1 |
| | 1243 | 22°29 | 151°48 | C | 77 | | 9/19 | 1305 | 5Ø GY 6/1 |
| | 1244 | 22°29.5 | 151°58 | C | 79 | | 9/19 | 1420 | 5Ø GY 6/1 |
| | 1245 | 22°29.5 | 152°06.5 | C | 91 | | 9/19 | 1530 | 5 GY 6/1 |
| | 1246 | 22°30 | 152°17 | C | 99 | | 9/19 | 1635 | 5 GY 6/1 |
| | 1247 | 22°33 | 152°21 | C | 90 | | 9/19 | 1815 | 5 GY 6/1 |
| | 1248 | 22°45 | 152°30.05 | C | 132 | | 9/20 | 0642 | 5 GY 6/1 |
| | 1249 | 22°45 | 152°21 | C | 123 | | 9/20 | 0804 | 5 GY 6/1 |
| | 1250 | 22°43 | 152°10.5 | C | 93 | | 9/20 | 0914 | 5 GY 6/1 |
| | 1251 | 22°43 | 151°59.5 | C | 69 | | 9/20 | 1026 | 5 Y 6/1 |
| | 1252 | 22°42 | 151°48.6 | C | 68 | | 9/20 | 1136 | 5 GY 6/1 |
| | 1253 | 22°42 | 151°37.4 | C | 68 | | 9/20 | 1241 | 5 GY 5/2 |
| | 1254 | 22°40 | 151°16. | B | 58 | | 9/20 | 1345 | 5 GY 5/2 |
| | 1255 | 22°39.1 | 151°06.3 | A | 55 | | 9/20 | 1450 | 5 GY 5/2 |
| | 1256 | 22°38.4 | 150°52.3 | A | 43 | | 9/23 | 0556 | 5 GY 5/2 |
| | 1257 | 22°50 | 150°56 | A | 37 | | 9/23 | 0705 | 5 Y 6/1 |
| | 1258 | 22°50 | 151°08 | A | 42 | | 9/23 | 0813 | 5 Y 6/1 |
| | 1259 | 22°50 | 151°19 | B | 53 | | 9/23 | 0920 | 5 Y 6/1 |
| | 1260 | 22°50.5 | 151°29 | C | 53 | | 9/23 | 1036 | 5 Y 6/1 |
| | 1261 | 22°50.5 | 151°39 | C | 64 | | | | 5 Y 6/1 |
| | 1262 | 22°50.5 | 151°51 | C | 32 | | 9/23 | 1247 | 5 Y 6/1 |
| | 1263 | 22°50.5 | 152°03 | C | 113 | | 9/23 | 1357 | 5 GY 6/1 |
| | 1264 | 22°51 | 152°12 | C | 128 | | 9/23 | 1507 | 5 GY 6/1 |
| | 1265 | 22°52 | 152°22.5 | C | 137 | | 9/23 | 1620 | 10 Y 6/2 |
| | 1266 | 22°53 | 152°34.5 | C | 179 | | 9/23 | 1731 | 10 Y 4/2 |
| | 1267 | 22°54 | 152°44 | C | 323 | | 9/23 | 1856 | 5 Y 6/1 |
| | 1268 | 23°53 | 151°32 | A | 22 | | 9/24 | 1020 | 5 Y 5/2 |
| | 1269 | 23°44 | 151°27.5 | A | 24 | | 9/24 | 1125 | 10 YR 5/4 |
| | 1270 | 22°34.5 | 151°22.5 | A | 28 | | 9/24 | 1230 | 10 YR 4/2 |
| | 1271 | 23°25.5 | 151°17.5 | A | 33 | | 9/24 | 1336 | 5 Y 6/1 |
| | 1272 | 23°20/5 | 151°09.5 | A | 24 | | 9/24 | 1444 | 10 YR 5/4 |
| | 1273 | 23°10 | 151°02. | A | 24 | | 9/24 | 1548 | 10 YR 5/4 |

Phosphate Section Data Sheet.



| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 - 1274 | 22°59 | 161°01 | A | 33 | Condred | 9/24 | 1700 | 5 Y 6/1 |
| | 1275 | 23°01 | 151°14 | A | 38 | | 9/24 | 1815 | |
| | 1276 | 22°24 | 152°37 | B | 110 | | 9/25 | 0815 | 5 Y 6/1 |
| | 1277 | 22°30 | 152°37 | C | 95 | | 9/25 | 0908 | 5 GY 6/1 |
| | 1278 | 22°30 | 152°48 | C | 137 | | 9/25 | 1020 | 5 GY 6/1 |
| | 1279 | 22°30 | 152°58 | C | 152 | | 9/25 | 1132 | 5 Y 6/1 |
| | 1280 | 22°30 | 153°08 | C | 174 | | 9/25 | 1245 | 5 Y 5/6 |
| | 1281 | 22°30 | 153°20 | C | 252 | | 9/25 | 1415 | 5 Y 5/2 |
| | 1282 | 22°30 | 153°32 | C | 324 | | 9/25 | 1645 | 5 Y 6/1 |
| | 1283 | 22°30 | 153°54 | C | 346 | | 9/25 | 1835 | |
| | 1283 | 22°27.5 | 153°33 | C | 357 | Boxdred | 9/27 | 1830 | 10 YR 6/2 |
| Cato I | 1284 | | | | 300 | Boxdred | 9/26 | 0845 | N 9 |
| | 1285 | | | | 538 | | 9/26 | 1015 | N 9 |
| | 1286 | | | | 155 | | 9/26 | 1130 | N 9 |
| | 1287 | | | | 165 | | 9/26 | 1315 | N 9 |
| | 1288 | | | | 146 | | 9/26 | 1500 | |
| Tasman | 1289 | 22°42 | 152°46 | B | 146 | Condred | 9/28 | 0705 | 5 GY 6/1 |
| | 1290 | 23°04 | 152°13 | A | 137 | | 9/28 | 1055 | 5 Y 6/1 |
| | 1291 | 23°11.6 | 151°59.5 | A | 57 | | 9/28 | 1232 | 10 YR 7/4 |
| | 1292 | 23°11.5 | 152°10.5 | B | 179 | | 9/28 | 1340 | |
| | 1293 | 23°11.5 | 152°22.2 | C | 283 | | 9/28 | 1510 | 10 Y 6/2 |
| | 1294 | 23°11 | 152°35.5 | C | 327 | | 9/28 | 1637 | 10 Y 6/2 |
| | 1295 | 22°45 | 152°48 | C | 155 | | 9/29 | 0742 | 5 GY 4/1 |
| | 1296 | 22°45 | 152°58 | C | 225 | | 9/29 | 0900 | 5 GY 6/1 |
| | 1297 | 22°45 | 153°07 | C | 234 | | 9/29 | 1045 | 5 GY 6/1 |
| | 1298 | 22°40 | 153°18 | C | 311 | | 9/29 | 1205 | 5 GY 6/1 |
| | 1299 | 22°50 | 153°10 | C | 344 | | 9/29 | 1344 | 5 GY 6/1 |
| | 1300 | 22°48 | 153°00 | C | 333 | | 9/29 | 1512 | 5 GY 6/1 |
| | 1301 | 22°58 | 153°02 | D | 377 | | 9/29 | 1637 | 5 GY 6/1 |
| | 1302 | 22°58 | 152°52 | C | 365 | | 9/29 | 1840 | 5 GY 6/1 |
| | 1303 | 23°19 | 152°33 | C | 322 | | 10/03 | 0820 | 5 GY 6/1 |
| | 1304 | 23°19 | 152°20.5 | B | 283 | | 10/03 | 1000 | 5 Y 6/1 |
| | 1305 | 23°19 | 152°06 | A | 64 | | 10/03 | 1107 | 10 YR 7/4 |
| | 1306 | 23°23.5 | 151°56.5 | A | 40 | | 10/03 | 1219 | 10 YR 7/4 |
| | 1307 | 23°30 | 152°09.5 | A | 66 | | 10/03 | 1355 | 10 YR 7/4 |
| | 1308 | 23°30 | 152°20.5 | B | 289 | | 10/03 | 1518 | 10 Y 6/2 |

## Phosphate Section Data Sheet

| Locality | Sample No. | Latitude | Longitude | Fix | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 1309 | 23°30 | 152°30 | C | 322 | Condred | 10/03 | 1635 | 5 Y 6/1 |
| | 1310 | 23°30 | 152°39.5 | C | 357 | Condred | 10/03 | 1800 | 5 Y 6/1 |
| | 1311 | 23°40.2 | 152°17.7 | A | 59 | Condred | 10/04 | 0610 | 5 Y 7/2 |
| | 1312 | 23°40 | 152°28.6 | B | 296 | Condred | 10/04 | 0725 | 5 Y 6/1 |
| | 1313 | 23°40 | 152°39.4 | C | 335 | Condred | 10/04 | 0844 | 5 Y 6/1 |
| | 1314 | 23°40 | 152°50.4 | C | 388 | Condred | 10/04 | 1008 | 5 Y 6/1 |
| | 1315 | 23°40 | 153°00 | C | 453 | Condred | 10/04 | 1138 | 5 Y 6/1 |
| | 1316 | 23°50 | 152°59 | C | 426 | Condred | 10/04 | 1336 | 5 Y 6/1 |
| | 1317 | 23°51 | 152°47 | C | 315 | Condred | 10/04 | 1458 | 5 Y 6/1 |
| | 1318 | 23°51 | 152°34.2 | B | 91 | Condred | 10/04 | 1612 | 10 YR7/4 |
| | 1319 | 23°51.8 | 152°26.2 | A | 55 | Condred | 10/04 | 1701 | 5 GY7/2 |
| | 1320 | 24°00 | 152°40.5 | A | 60 | Condred | 10/04 | 1842 | 10 YR7/4 |

Phosphate Section Data Sheet



| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S/O - 1321 | 22°30 | 152°39.5 | C | 357 | Condred | 10/05 | 1010 | 5 GY 6/1 |
| | 1322 | 22°50 | 152°28.5 | C | 135 | | 10/05 | 1121 | 5 GY 6/1 |
| | 1323 | 23°01 | 152°20 | D | 141 | | 10/05 | 1310 | 5 Y 5/2 |
| | 1324 | 23°02 | 152°75 | B | 130 | | 10/05 | 1430 | 10 YR 5/4 |
| | 1325 | 23°022 | 151°55 | A | 69 | | 10/05 | 1550 | 10 YR 7/4 |
| | 1326 | 23°00 | 151°25 | C | 44 | | 10/06 | 0836 | 5 YR 6/1 |
| | 1327 | 23°00 | 151°33 | B | 49 | | 10/06 | 0938 | 5 Y 6/1 |
| | 1328 | 23°03 | 151°42.4 | A | 51 | | 10/06 | 1040 | 5 Y 7/2 |
| | 1329 | 23°00 | 152°28 | C | 225 | | 10/06 | 1543 | 5 GY 5/2 |
| | 1330 | 23°00 | 152°38 | C | 304 | | 10/06 | 1710 | |
| | 1331 | 21°43 | 152°51 | D | 113 | Boxdred | 10/07 | 0900 | 10 Y 6/2 |
| | 1332 | 21°51 | 153°26 | A | 128 | | 10/07 | 1350 | N/9 |
| | 1333 | 21°50 | 153°26 | A | 219 | | 10/08 | 1525 | N/9 |
| | 1334 | 24°02 | 153°03 | B | 493 | Condred | 10/09 | 0840 | 5 Y 6/1 |
| | 1335 | 24°01 | 152°52.4 | A | 329 | | 10/09 | 1000 | 10 Y 6/2 |
| | 1336 | 23°59.5 | 152°29.5 | A | 48 | | 10/09 | 1200Ø | 10 YR 7/4 |
| | 1337 | 24°00 | 152°19 | A | 46 | | 10/09 | 1325 | 5 Y 6/1 |
| | 1338 | 24°00 | 152°08 | B | 42 | | 10/09 | 1435 | 5 Y 6/1 |
| | 1339 | 24°00 | 151°56.5 | A | 27 | | 10/09 | 1538 | |
| | 1340 | 24°10.5 | 152°03.5 | A | 27 | | 10/09 | 1710 | N/4 |
| | 1341 | 24°11.5 | 152°17 | A | 33 | | 10/09 | 1815 | 5 Y 6/1 |
| | 1342 | 24°12 | 152°24.5 | B | 37 | | 10/10 | 0648 | 5 Y 6/1 |
| | 1343 | 24°12.0 | 152°36 | A | 27 | | 10/10 | 0802 | 5 Y 6/1 |
| | 1344 | 24°11.8 | 152°47 | A | 40 | | 10/10 | 0908 | 5 y 6/1 |
| | 1345 | 24°11.7 | 152°59.5 | A | 82 | | 10/10 | 1027 | 5 Y 6/4 |
| | 1346 | 24°11.5 | 153°06. | A | 479 | | 10/10 | 1138 | 5 Y 5/2 |
| | 1347 | 24°20 | 153°14.8 | B | 290 | Boxdred | 10/10 | 1443 | 5 Y 6/1 |
| | 1348 | 24°19.4 | 153°01.8 | A | 49 | Condred | 10/10 | 1555 | 10 YR 7/4 |
| | 1349 | 24°18.6 | 152°51.5 | A | 38 | | 10/10 | 1704 | 5 Y 6/1 |
| | 1350 | 24°20.0 | 152°39.7 | A | 25 | | 10/10 | 1807 | 5 Y 6/1 |
| | 1351 | 24°20 | 152°28.5 | A | 31 | | 10/11 | 0710 | 5 Y 6/1 |
| | 1352 | 24°20 | 152°17.5 | B | 28 | | 10/11 | 0810 | 10 YR 5/4 |
| | 1353 | 24°20 | 152°07.5 | A | 26 | | 10/11 | 0915 | 5 Y 4/1 |
| | 1354 | 24°29.5 | 152°16.5 | A | 22 | | 10/11 | 1040 | 10 YR 5/4 |
| | 1355 | 24°29.5 | 152°28.5 | A | 22 | | 10/11 | 1150 | 10 YR 5/4 |
| | 1356 | 24°30 | 152°39.5 | B | 27 | | 10/11 | 1258 | 5 Y 6/1 |

Phosphate Section Data Sheet



| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 - 1357 | 24°31 | 152°50.5 | C | 46 | Condred | 10/11 | 1404 | 5 Y 6/1 |
| | 1358 | 24°30.5 | 153°00.5 | A | 26 | | 10/11 | 1512 | N8 |
| | 1359 | 24°40 | 153°05.4 | A | 24 | | 10/11 | 1610 | 5 Y 6/1 |
| | 1360 | 24°40 | 152°54.9 | A | 26 | | 10/12 | 0759 | 5 Y 6/1 |
| | 1361 | 24°38.4 | 152°44 | B | 29 | | 10/12 | 0904 | 5 Y 6/1 |
| | 1362 | 24°37.2 | 152°33.0 | A | 22 | | 10/12 | 1003 | 10 YR 4/2 |
| | 1363 | 24°50.2 | 152°36.6 | A | 20 | | 10/12 | 1134 | 10 YR 4/2 |
| | 1364 | 25°00 | 152°42.8 | A | 18 | | 10/12 | 1247 | 10 Y 4/2 |
| | 1365 | 25°00 | 152°53.8 | A | 18 | | 10/12 | 1355 | 5 GY 4/1 |
| | 1366 | 25°00.8 | 152°59.2 | A | 24 | | 10/12 | 1624 | 5 GY 4/1 |
| | 1367 | 24°50 | 152°59.2 | A | 24 | | 10/12 | 1624 | 5 Y 5/2 |
| | 1368 | 24°50. | 152°47.5 | B | 38 | | 10/12 | 1725 | 5 Y 5/2 |
| | 1369 | 24°33 | 153°24 | A | 174 | Boxdred | 10/13 | 1025 | 5 Y 5/2 |
| | 1370 | 24°40 | 153°31 | B | 512 | Condred | 10/13 | 1205 | 10 YR 8/6 |
| | 1371 | 24°40 | 153°21 | A | 18 | | 10/13 | 1309 | 5 Y 6/1 |
| | 1372 | 24°50 | 153°21 | A | 27 | | 10/13 | 1414 | 5 Y 6/1 |
| | 1373 | 24°50 | 153°32.5 | A | 100 | | 10/13 | 1522 | 10 YR 7/4 |
| | 1374 | 24°50 | 153°34.5 | A | 197 | Camera | 10/13 | 1540 | |
| | 1375 | 25°00 | 153°39 | B | 113 | Condred | 10/13 | 1725 | |
| | 1376 | 25°00 | 153°42.6 | A | 293 | Boxdred | 10/14 | 0825 | |
| | 1377 | 25°01.4 | 153°30 | A | 59 | | 10/14 | 1002 | 10 YR 7/4 |
| | 1378 | 25°10.6 | 153°23.4 | A | 26 | | 10/14 | 1105 | 10 YR 5/4 |
| | 1379 | 25°09.6 | 153°34 | A | 48 | | 10/14 | 1200 | 5 YR 7/2 |
| | 1380 | 25°10 | 153°34.5 | C | 329 | | 10/14 | 1555 | 5 Y 7/2 |
| | 1381 | 25°20 | 153°49 | C | 289 | | 10/14 | 1744 | 10 YR 5/4 |
| | 1382 | 23°50 | 152°13 | A | 37 | Pipdred | 16/16 | 1345 | N/9 |
| | 1383 | 23°50 | 152°03 | B | 40 | | 10/16 | 1455 | 5 Y 6/1 |
| | 1384 | 23°50 | 151°52 | C | 36 | | 10/17 | 0809 | 5 Y 6/1 |
| | 1385 | 23°50 | 151°41.5 | A | 35 | | 10/17 | 0855 | 5 Y 5/2 |
| | 1386 | 23°40.5 | 151°36 | A | 20 | | 10/17 | 0957 | 10 YR 8/2 |
| | 1387 | 23°40.5 | 151°46.5 | A | 38 | | 10/17 | 1100 | 5 (y) 6/1 |
| | 1388 | 23°40 | 151°57.2 | A | 44 | | 10/17 | 1200 | 5 Y 7/2 |
| | 1389 | 23°30 | 151°58.5 | A | 42 | | 10/17 | 1310 | 5 Y 8/1 |
| | 1390 | 23°30 | 151°45 | A | 27 | | 10/17 | 1444 | 5 Y 8/1 |
| | 1391 | 23°30 | 151°36 | A | 31 | | 10/17 | 1537 | 5 Y 8/1 |
| | 1392 | 23°30 | 151°27 | A | 31 | | 10/17 | 1805 | 5 Y 6/1 |

Phosphate Section Data Sheet



| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| ~~S70x~~ Tasman | S70 - 1393 | 23°19.5 | 151°38 | A | 36 | Pipdred | 10/17 | 1805 | 5 Y 6/1 |
| | 1394 | 23°20 | 151°28 | A | 35 | | 10/18 | 0745 | 5 Y 7/2 |
| | 1395 | 23°20 | 151°16.8 | A | 31 | | 10/18 | 0840 | 10 YR 4/2 |
| | 1396 | 23°10.3 | 151°12.7 | A | 31 | | 10/18 | 0948 | 5 Y 6/1 |
| | 1397 | 23°09.6 | 151°23.2 | A | 38 | | 10/18 | 1056 | 5 Y 6/1 |
| | 1398 | 23°09.6 | 151°34.3 | A | 41 | | 10/18 | 1023 | 10 YR 7/4 |
| | 1399 | 23°09.6 | 151°45.4 | A | 49 | | 10/18 | 1311 | 10 YR 7/4 |
| | 1400 | 23°05 | 152°30 | C | 237 | Bigcore | 10/19 | 1015 | |
| | 1401 | 23°05 | 152°30 | C | 197 | Boxdred | 10/19 | 1120 | 5 Y 5/2 |
| | 1402 | 23°05 | 152°30 | C | 192 | Camera | 10/19 | 1125 | |
| | 1403 | 24°02.5 | 152°46.5 | A | 218 | Bigcore | 10/23 | 1335 | |
| | 1404 | 25°20 | 153°38.2 | C | 55 | Pipdred | 10/24 | 0620 | 5 YR 8/1 |
| | 1405 | 25°21 | 153°27 | B | 51 | | 10/24 | 0730 | 5 Y 6/1 |
| | 1406 | 25°22 | 153°15 | B | 37 | | 10/24 | 0837 | 10 YR 5/4 |
| | 1407 | 25°33 | 153°21 | B | 27 | | 10/24 | 0941 | 5 Y 5/2 |
| | 1408 | 25°33 | 153°21 | B | 48 | | 10/24 | 1045 | 5 Y 5/2 |
| | 1409 | 25°34.5 | 153°33 | B | 58 | | 10/24 | 1200 | 10 YR 6/2 |
| | 1410 | 25°35 | 153°48 | C | 154 | Boxdred | 10/24 | 1420 | |
| | 1411 | 25°48 | 153°53 | D | 196 | | 10/24 | 1644 | 10 YR 5/4 |
| | 1412 | 25°51 | 153°40 | C | 69 | Pipdred | 10/24 | 1830 | 10 YR 6/2 |
| | 1413 | 25°4. | 153°07.5 | A | 35 | | 10/25 | 0611 | 10 YR 4/2 |
| | 1414 | 25°39.7 | 153°19 | A | 51 | | 10/25 | 0718 | 10 YR 5/4 |
| | 1415 | 25°40 | 153°29 | B | 59 | | 10/25 | 0828 | 5 Y 5/2 |
| | 1416 | 25°38 | 153°40.5 | C | 64 | | 10/25 | 0934 | 5 Y 7/2 |
| | 1417 | 25°47 | 153°33 | C | 64 | | 10/25 | 1046 | 5 Y 5/2 |
| | 1418 | 25°50 | 153°20.4 | A | 51 | | 10/25 | 1205 | 5 Y 5/2 |
| | 1419 | 25°50 | 153°09.3 | A | 35 | | 10/25 | 1357 | 5 GY 3/2 |
| | 1420 | 26°00 | 153°11.5 | A | 55 | | 10/25 | 1532 | 5 GY 3/2 |
| | 1421 | 25°59.2 | 153°22.5 | A | 59 | | 10/25 | 1641 | 5 GY 5/2 |
| | 1422 | 26°00 | 153°33.5 | B | 64 | | 10/25 | 1803 | 5 Y 5/2 |
| | 1423 | 26°30 | 153°08.5 | A | 27 | | 10/26 | 1150 | 10 YR 5/4 |
| | 1424 | 26°20 | 153°07.5 | A | 27 | | 10/27 | 0725 | 10 YR 4/2 |
| | 1425 | 26°10 | 153°07 | A | 27 | | 10/27 | 0825 | 10 YR 5/4 |
| | 1426 | 26°09.5 | 153°18.5 | A | 56 | | 10/27 | 0936 | 5 Y 5/2 |
| | 1427 | 26°09 | 153°29.5 | B | 64 | | 10/27 | 1058 | 10 Y 4/2 |
| | 1428 | 26°08 | 153°40.5 | C | 71 | | 10/27 | 1215 | 5 Y 6/1 |

Phosphate Section Data Sheet



| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 -1429 | 26°08 | 153°52 | C | 201 | Boxdred | 10/27 | 1409 | 10 YR 5/4 |
| | 1430 | 26°00 | 153°44.5 | C | 64 | Pipdred | 10/27 | 1517 | 10 YR 7/4 |
| | 1431 | 26°00 | 153°53.5 | D | 230 | | 10/27 | 1620 | 10 YR 5/4 |
| | 1432 | 26°20.4 | 153°18.5 | A | 55 | | 10/28 | 0802 | 5 Y 5/2 |
| | 1433 | 26°20 | 153°30 | B | 64 | | 10/28 | 0909 | 5 Y 5/2 |
| | 1434 | 26°20 | 153°41 | C | 113 | | 10/28 | 1019 | 5 GY 3/2 |
| | 1435 | 26°20 | 153°51 | C | 293 | | 10/28 | 1150 | 5 GY 5/2 |
| | 1436 | 26°31 | 153°45 | C | 283 | | 10/28 | 1404 | 5 Y 5/2 |
| | 1437 | 26°33 | 153°32 | C | 60 | Boxdred | 10/28 | 1615 | |
| | 1438 | 26°30 | 153°19.3 | A | 59 | Pipdred | 10/28 | 1722 | |
| | 1439 | 26°49 | 153°41 | C | 329 | | 10/29 | 0845 | 10 YR 6/2 |
| | 1440 | 26°49.7 | 153°19.2 | A | 46 | | 10/29 | 1121 | 5 Y 4/1 |
| | 1441 | 26°40.0 | 153°18.5 | A | 48 | | 10/29 | 1245 | 5 Y 5/2 |
| | 1442 | 26°40 | 153°30. | A | 79 | | 10/29 | 1350 | 5 Y 5/2 |
| | 1443 | 26°40 | 153°30.80 | A | 18 | | 10/29 | 1555 | 10 YR 6/2 |
| | 1444 | 26°50 | 153°30 | A | 84 | | 10/30 | 1231 | 5 Y 5/2 |
| | 1445 | 26°40 | 153°39 | C | 220 | | 10/30 | 1417 | 10 YR 5/4 |
| Kelsobk | 1446 | 24°03 | 159°20 | B | 55 | Boxdred | 11/01 | 0640 | N9 |
| | 1447 | | | | 220 | | 11/01 | 0708 | |
| | 1448 | 24°04 | 159°34 | C | 91 | | 11/01 | 1545 | |
| | 1449 | 24°04 | 159°38.5 | C | 274 | | 11/01 | 1700 | N9 |
| | 1450 | 24°02 | 159°35 | B | 274 | | 11/01 | 1900 | N9 |
| | 1451 | 23°57.5 | 159°31 | C | 182 | | 11/02 | 0955 | N9 |
| | 1452 | 24°06.5 | 159°17 | C | 128 | | 11/02 | 1453 | N9 |
| | 1453 | 23°59 | 159°17 | C | 330 | | 11/02 | 1715 | N8 |
| Tasman | 1454 | 27°00 | 153°39.2 | A | 184 | Pipdred | 11/04 | 0610 | 5 Y 5/2 |
| | 1455 | 27°00.1 | 153°31.5 | A | 102 | | 11/04 | 0700 | 5 Y 5/2 |
| | 1456 | 27°098 | 153°28.6 | A | 42 | | 11/04 | 0800 | 5 Y 5/6 |
| | 1457 | 29°097 | 153°41.0 | A | 170 | | 11/04 | 0915 | 5 Y 5/2 |
| | 1458 | 27°18.7 | 153°47.4 | A | 220 | | 11/04 | 1044 | 10 Y 6/2 |
| | 1459 | 27°19.5 | 153°35.5 | A | 75 | | 11/04 | 1143 | 5 Y 5/6 |
| | 1460 | 27°30 | 153°35.0 | A | 31 | | 11/04 | 1252 | 10 YR 6/2 |
| | 1461 | 27°29.8 | 153°47.7 | A | 137 | | 11/04 | 1415 | 5 Y 5/2 |
| | 1462 | 27°30 | 153°56.7 | B | 392 | | 11/04 | 1530 | 5 Y 7/2 |
| | 1463 | 27°40 | 153°56.6 | C | 225 | | 11/04 | 1646 | 5 Y 5/6 |
| | 1464 | 27°44.5 | 153°38.8 | | 86 | | 11/04 | 1802 | 5 Y 6/1 |

| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 - 1465 | 27°40 | 153°31.0 | A | 42 | Pipdred | 11/06 | 1105 | 10 YR 4/2 |
| | 1466 | 27°50.5 | 153°29.5 | A | 47 | | 11/06 | 1207 | 10 YR 5/4 |
| | 1467 | 27°51.0 | 153°41.0 | A | 80 | | 11/06 | 1307 | 10 YR 6/2 |
| | 1468 | 27°52.5 | 153°52.0 | C | 190 | | 11/06 | 1417 | 10 YR 5/4 |
| | 1469 | 28°05 | 153°56 | C | 256 | | 11/06 | 1550 | 10 YR 5/4 |
| | 1470 | 27°58.5 | 153°43.5 | A | 86 | | 11/06 | 1805 | 10 YR 5/4 |
| | 1471 | 27°59.5 | 153°33.0 | A | 47 | | 11/06 | 1915 | 10 YR 5/4 |
| | 1472 | 28°10.1 | 153°40.2 | A | 62 | | 11/17 | 0731 | 5 Y 5/6 |
| | 1473 | 28°10.5 | 153°51.8 | B | 184 | | 11/17 | 0852 | 10 YR 5/4 |
| | 1474 | 28°20.2 | 153°53.5 | C | 338 | | 11/17 | 1010 | 5 YR 5/2 |
| | 1475 | 28.20 | 153°40.5 | A | 58 | | 11/17 | 1127 | 10 YR 5/4 |
| | 1476 | 28°30 | 153°39.5 | A | 49 | | 11/17 | 1225 | 5 YR 5/6 |
| | 1477 | 28°30 | 153°50.2 | A | 157 | | 11/17 | 1336 | 5 Y 5/6 |
| | 1478 | 28°40 | 153°53.7 | B | 234 | | 11/17 | 1513 | 10 YR 5/4 |
| | 1479 | 28°40 | 153°42.3 | A | 58 | | 11/17 | 1621 | 5 Y 5/6 |
| | 1480 | 28°50 | 153°40 | A | 58 | | 11/18 | 0705 | 10 YR 5/4 |
| | 1481 | 28°41.5 | 153°47.5 | A | 99 | | 11/22 | 1000 | 10 YR 6/2 |
| | 1482 | 28°59.5 | 153°37.5 | A | 48 | | 11/22 | 1147 | 10 YR 4/2 |
| | 1483 | 29°10.5 | 153°31 | A | 42 | | 11/22 | 1305 | 10 YR 4/2 |
| | 1484 | 29°09.5 | 153°40 | A | 71 | | 11/22 | 1420 | 10 YR 4/2 |
| | 1485 | 29°09.5 | 153°50 | C | 219 | | 11/22 | 1533 | 10 YR 4/2 |
| | 1486 | 29°00 | 153°50 | C | 179 | | 11/22 | 1640 | 10 YR 4/2 |
| | 1487 | 29°20 | 153°26 | A | 42 | | 11/23 | 0737 | 5 Y 3/2 |
| | 1488 | 29°20 | 153°37.4 | A | 77 | | 11/23 | 0849 | 10 YR 4/2 |
| | 1489 | 29°20 | 153°48.6 | C | 240 | | 11/23 | 1017 | 10 YR 2/2 |
| | 1490 | 29°30 | 153°47 | C | 256 | | 11/23 | 1125 | 10 YR 4/2 |
| | 1491 | 29°30 | 153°37.9 | C | 77 | | 11/23 | 1230 | 10 YR 4/2 |
| | 1492 | 29°31.1 | 153°24.1 | A | 51 | | 11/23 | 1411 | 10 YR 2/2 |
| | 1493 | 29°40 | 153°21.7 | A | 42 | | 11/23 | 1512 | 10 YR 4/2 |
| | 1494 | 29°40.2 | 155°33.1 | A | 77 | | 11/23 | 1624 | 10 YR 4/2 |
| | 1495 | 29°40 | 153°43.4 | C | 260 | | 11/23 | 1733 | 10 YR 4/2 |
| | 1496 | 30°00.2 | 153°29.2 | A | 88 | | 11/24 | 0803 | 10 YR 4/2 |
| | 1497 | 29°59.8 | 153°21.2 | A | 49 | | 11/24 | 0852 | 10 YR 6/2 |
| | 1498 | 29°49.9 | 153°19.1 | A | 31 | | 11/24 | 1000 | 10 YR 6/2 |
| | 1499 | 29°50.3 | 153°30.8 | A | 80 | | 11/24 | 1107 | 10 YR 4/2 |
| | 1500 | 30°20 | 153°14.6 | A | 59 | | 11/25 | 1405 | 5 Y 5/2 |

Phosphate Section Data Sheet
8.

| Locality | Sample No. | Latitude | Longitude | | Depth (m) | Sampling Method | Date | Time | Colour |
|---|---|---|---|---|---|---|---|---|---|
| Tasman | S70 - 1501 | 30°20 | 153°26.2 | A | 201 | Pipdred | 11/25 | 1615 | 5 Y 4/4 |
| | 1502 | 30°10 | 153°31.0 | A | 187 | | 11/25 | 1830 | 5 Y 5/2 |
| | 1503 | 30°10 | 153°19.6 | A | 66 | | 11/25 | 1935 | 5 Y 5/2 |
| | 1504 | 29°50 | 153°39 | A | 165 | | 11/26 | 1818 | 10 YR 4/2 |
| | 1505 | 28°56.4 | 153°50.7 | A | 220 | | 11/29 | 1150 | 10 YR 4/2 |
| | 1506 | 29°01 | 153°54. | A | 229 | Boxdred | 12/05 | 0740 | 10 YR 6/2 |
| | 1507 | 30°02.3 | 153°32.5 | A | 164 | | 12/05 | 1250 | 10 YR 4/2 |
| | 1508 | 30°49.8 | 153°07.3 | A | 69 | Pipdred | 12/06 | 0830 | 5 Y 5/2 |
| | 1509 | 30°40 | 153°08.7 | A | 58 | | 12/06 | 0940 | 10 YR 4/2 |
| | 1510 | 36°30 | 153°12. | A | 55 | | 12/08 | 1400 | 10 YR 4/2 |
| | 1511 | 30°30 | 153°23.0 | B | 219 | | 12/08 | 1505 | 10 YR 4/2 |
| | 1512 | 30°39.6 | 153°19.8 | A | 197 | | 12/10 | 1033 | 10 YR 4/2 |
| | 1513 | 30°42.4 | 153°18.6 | A | 200 | Boxdred | 12/10 | 1156 | |
| | 1514 | 30°52.5 | 153°17.5 | A | 278 | | 12/10 | 1300 | |
| | 1515 | 31°01.9 | 153°13.9 | A | 274 | | 12/10 | 1502 | 10 YR 4/2 |
| | 1516 | 31°10.6 | 153°13.9 | A | 241 | | 12/10 | 1630 | 10 YR 4/2 |
| | 1517 | 31°10.1 | 153°05.0 | A | 82 | Pipdred | 12/10 | 1830 | 10 YR 4/2 |
| | 1518 | 31°00.4 | 153°04.7 | A | 46 | | 12/10 | 1955 | 5 Y 4/4 |
| | 1519 | 31°20.0 | 153°02.7 | A | 64 | | 12/11 | 0730 | 10 YR 4/2 |
| | 1520 | 31°22 | 153°10.4 | A | 174 | Boxdred | 12/11 | 0940 | 10 YR 4/2 |
| | 1521 | 31°30 | 153°12.8 | A | 274 | | 12/11 | 1212 | |
| | 1522 | 31°29.5 | 152°59.8 | A | 62 | Pipdred | 12/12 | 0830 | 5 YR 4/4 |
| | 1523 | 31°40 | 152°57 | A | 71 | | 12/12 | 0932 | 10 YR 4/2 |
| | 1524 | 31°39.7 | 153°07.6 | A | 183 | Boxdred | 12/12 | 1210 | 10 YR 4/2 |
| | 1525 | 31°50.5 | 153°07.6 | A | 220 | | 12/12 | 1430 | 5 Y 5/2 |
| | 1526 | 32°01.0 | 153°02.7 | A | 164 | | 12/12 | 1625 | |
| | 1527 | 31°59.6 | 152°51.8 | A | 108 | Pipdred | 12/12 | 1730 | 10 YR 4/2 |
| | 1528 | 31°59.4 | 152°40.1 | A | 42 | | 12/12 | 1837 | 10 YR 5/4 |
| | 1529 | 31°51.2 | 152°54.4 | A | 91 | | 12/12 | 2010 | 10 YR 5/4 |

* POSITION GRADING

A. Accurate: Error less than one mile. Fixed by direct reference to charted position.

B. Good: Error less than two miles. Short D.R. run from "A" class fix or first class celestial fix.

C. Fair: Error probably less than three miles. Standard celestial fix or short to moderate D.R. run from "B" class fix.

D. Approximate: Error may be as much as five to eight miles. Interpolation between widely spaced "B" or "C" class fixes.