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BULLETIN 183

BATHYMETRY AND GEOLOGIC STRUCTURE OF THE NORTH-WESTERN TASMAN SEA - CORAL SEA - SOUTH SOLOMON SEA AREA OF THE SOUTH-WESTERN PACIFIC OCEAN

by

DALE C. KRAUSE

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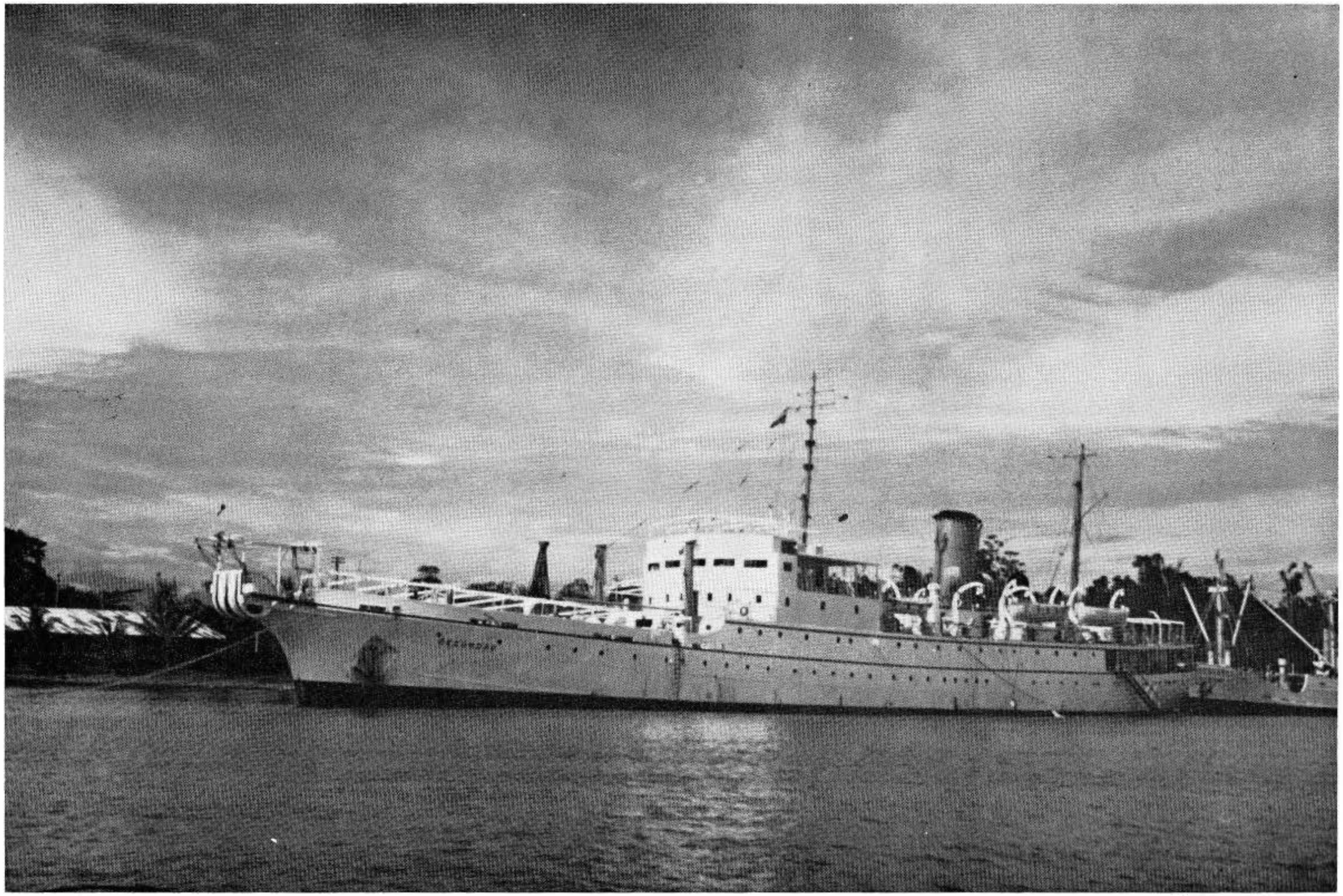

Photo: D. C. Krause

C.S. *Recorder* at Lae, New Guinea.

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Bathymetry and Geologic Structure of the North-western Tasman Sea - Coral Sea - South Solomon Sea Area of the South-western Pacific Ocean

by

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FOREWORD

In 1962 the second of a series of meetings, sponsored by UNESCO, on the oceanography of the Tasman and Coral Seas was convened in Wellington. Australian, French, and New Zealand oceanographers expressed the hope that future definitive studies of the marine geological environment would be extended from the Tasman Sea area to the Coral Sea.

Professor Krause's work as reported in this memoir is the first of such studies to eventuate and provides a basic examination of the sedimentary and structural characteristics of a wide extent of the sea floor from the Tasman Sea northwards.

The text has been prepared for publication by Mrs. P. M. Cullen.

J. W. Brodie,
Director,
New Zealand Oceanographic Institute.

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(In pocket at back)

BATHYMETRY AND GEOLOGIC STRUCTURE OF THE NORTH-WESTERN TASMAN SEA-CORAL SEA-SOUTH SOLOMON SEA AREA OF THE SOUTH-WESTERN PACIFIC OCEAN

ABSTRACT

The area studied can be divided into two major tectonic regions: (1) Tasman Sea - southern Coral Sea and (2) northern Coral Sea - southern Solomon Sea. Tectonism in the former is relatively quiescent. In the latter region, tectonism is extremely active.

The Australian region is characterised by warped continental shelfs on which are developed large sand islands and banks in the south, and by coral reefs in the north. Submarine canyons and channels cut the shelf and slope in several places. Turbidity current deposits are overlain by Recent pelagic clay in the Coral Sea and Tasman Basins. A long range of submarine volcanoes on the deep-sea floor rims the continent on the east and is associated with a rift-like feature, the Cato Trough. The physiography of the region is relatively subdued.

In contrast, the New Guinea - Solomon Islands region is characterised by a sea floor of great complexity and large relief. Earthquakes are frequent, and volcanoes, some of them active, abound. At least one large active fault, the Pocklington Fault, marks the south-eastern border of the region. The south-western border is marked by a large step in the sea floor of the Coral Sea Basin. This whole region seems to be one of east-west trending, left-lateral shear.

Considerations of the morphology and structure of the north-western Tasman Sea, Coral Sea, and southern Solomon Sea are based on soundings, bottom samples and bottom photographs of the *Recorder* Expedition, also other published and unpublished data are presented.

INTRODUCTION

Scope of Study

The tectonics of the south-western Pacific are obscure because in part it is a region of high relief with complex geology. Tectonism is especially active in the northern portion. The sea floor is not as well known as the land. An opportunity to investigate the sea floor of the region came during the southern summer of 1961 when the C.S. *Recorder* (Capt. E. J. M. Reilly, Acting Commander) of Cable and Wireless Ltd., under the scientific direction of the author, made an investigation of the sea floor east of Australia and New Guinea (figs. 1 and 2) concerning submarine telephone cable routes. When the data of the *Recorder* Expedition are combined with information existing at the time of the cruise, a useful picture is obtained of the geological structure of this relatively unknown area.

This is the fourth of a series of publications resulting from the cruise. The sea floor north of New Guinea has been discussed by Krause (1965) and the sea floor in the Celebes Sea - Sulu Sea region by Krause (1966a). Information regarding water temperatures taken by the Expedition has been published by Krause (1962). Publication of data on the New Britain Trench region (by W. C. White) is intended. The basic contribution from the present work is the construction and interpretation of bathymetric charts of the north-western Tasman Sea (Chart 1A) the Coral Sea (Charts 1B, 1C, 1D, 1E) and the southern Solomon Sea (Charts 1F, 1G) from data collected by the *Recorder* Expedition combined with existing information (Chart 2). The present work deals with the interpretation of Chart 1 and therefore no further text reference will be made specifically to that chart.

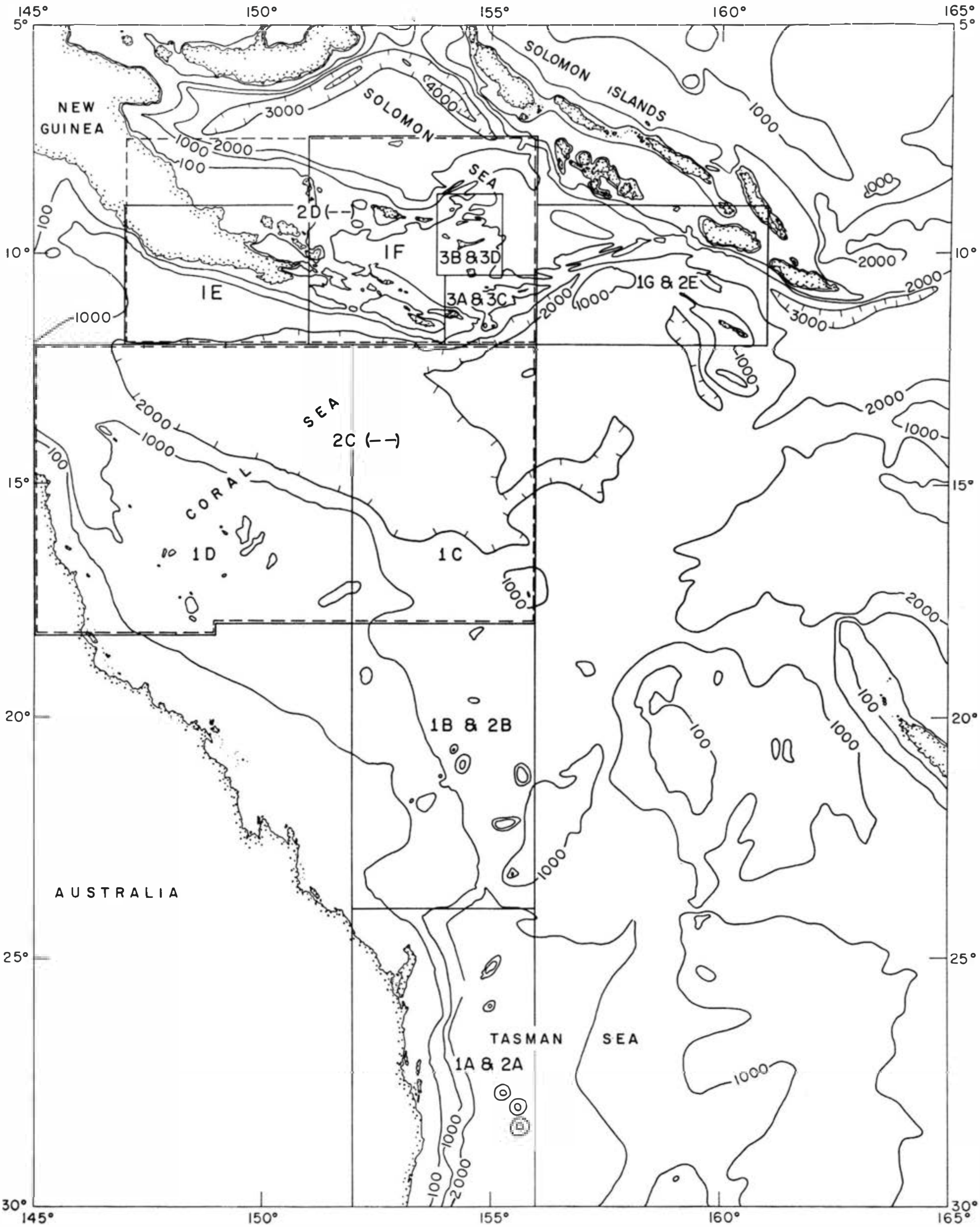


FIG. 1. Index map showing location of charts 1A–1G, 2A–2E, and 3A–3D.

Sources of Information and Reliability

The prime source of sounding information discussed here is that from the *Recorder* Expedition. Earlier soundings by C.S. *Recorder* (frontispiece) and her sister ships of Cable and Wireless Ltd. were also used as sources of data as were British and Australian published charts. Unpublished compilation sheets of the British Admiralty were used which carried information from many sources including the British survey vessel, HMS *Cook*, and various Australian naval vessels. A line of soundings in the Coral Sea was supplied by the R.V. *Argo* of the Scripps Institution of Oceanography (University of California). Published Russian soundings (Anon., 1958) of the E.S. *Vityaz* augmented information on the Solomon Sea. No locations for soundings of less than 100 fathoms (fm) are shown on the source charts because of their excessive number. Soundings have been corrected for variations in sound velocity with Matthew's (1939) tables.

The bathymetric charts utilise all the available data on the sea floor. The contours are in general idealised, but, where detail is shown, it is considered to exist as such. The bathymetric charts must be considered to be reconnaissance charts. At only a few places, where accurate and detailed surveys have been made, is the true detail of the sea floor known. Also the *Recorder* charts contain information of varying reliability dating from mid-19th century to modern times, and varying from casual wire soundings to sounding traverses with precision instruments. These limitations were taken into consideration in the contouring.

Certain depths and traverses shown on unpublished data and published charts have had to be discarded where these are obviously in error. The depths obtained on the *Recorder* Expedition were used to check the information already available and to add more information wherever possible. The charts were roughly contoured before the *Recorder* surveyed a particular area so that individual hypotheses regarding bathymetric trends could be verified or rejected. The completed chart therefore represents better discrimination than would be possible on a chart produced from totally pre-existing soundings.

Along the track of the *Recorder* Expedition, the bathymetric chart is more accurate than any other part of the charts because more surveying was done, echo sounding profiles were available and the navigation was very good. As a result, various parts of the charts along that track show irregularity of the sea floor (e.g., the northern edge of the Queensland Plateau) as opposed to the generally smooth, idealised contours depicted elsewhere where information is sparse. The irregularities in this case are real and indicate that the entire slope may be cut by features such as irregular gullies, canyons, sea slide scars, faults. In areas where no soundings or undefinitive soundings exist, the charts have been left blank.

Aboard the *Recorder* wire soundings of three different types indicated that the corrected echo soundings were about 3% too deep (with perhaps ½% of that error arising from the sound velocity correction tables for the Coral Sea area, Matthews, 1939). All the *Recorder* Expedition soundings have been corrected accordingly.

Previous Work

The geology of the Tasman Sea - Coral Sea - Solomon Sea region has been discussed by several authors so that the general features are known. One of the first modern papers giving an insight into the region is that by Hess and Maxwell (1949). Fairbridge (1950) extensively discussed the Australian coral reefs together with their history and tectonic environment. David (1950) referred to the Tasmantid seamounts, but still believed in a former large land mass lying in the Tasman Sea. This concept was disproved by Officer (1955) who showed the crust underlying the Tasman Sea to be typically oceanic in thickness (2.7 nautical miles (n.m.), 5 kilometres (km)). Earlier Glaessner (1952) had proposed in generalised fashion a concept of a large Tertiary land mass occupying the site of the Tasman Sea basin and since converted to an ocean basin. Brodie (1952) discussed the tectonics of the Tasman region. Standard (1961) forcibly emphasised Officer's point and also described a generalised bathymetric chart of the south Tasman Sea. The area of the present study abuts the northern edge of his chart. Fairbridge (MS.) named and discussed a great many features of the region. Finally Fisher and Hess (1963) produced a reconnaissance bathymetric chart of the Solomon Sea which includes the northern part of the present region under discussion.

Navigation

The navigation aboard the C.S. *Recorder* was excellent and limited only by the general errors of sextant navigation. At best the fixes of position have errors of less than a nautical mile, but often have errors of 2 n.m. and occasionally of 5 n.m. when overcast conditions prevailed. The *Recorder's* navigator, D. O. Ferry, and his assistants produced 66 charts of tracks and soundings from the expedition.

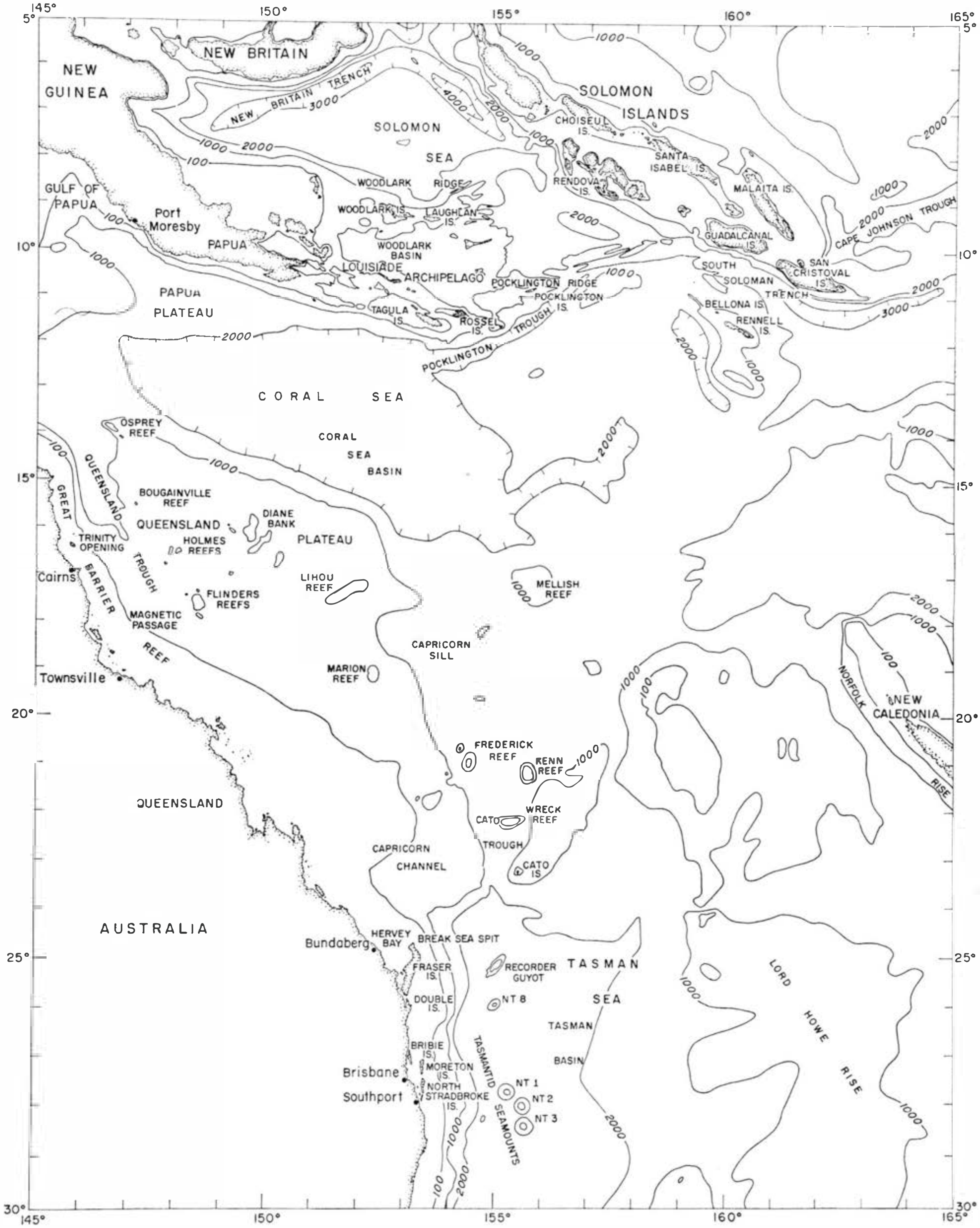


FIG. 2. Index map showing localities mentioned in text. Contours in fathoms corrected for sound velocity.

BATHYMETRIC DESCRIPTION

New names given to topographic features described in the present survey stand subject to confirmation by the International Geographic Board.

TASMAN SEA - SOUTHERN CORAL SEA

Tasman Shelf and Slope

The continental shelf on the east coast of Queensland between lat. 30°S and Fraser Island is 10 – 45 n.m. wide. Late Tertiary to Recent long-shore drift and sedimentation has considerably affected the shelf off Queensland. Large islands of sand such as Fraser Island, Moreton Island, and North Stradbroke Island are built on the shelf. Preliminary investigations of soundings made by the Royal Australian Navy reveal similar submarine features. Break-Sea Spit on the north end of Fraser Island extends over the edge of the shelf (see "Sand Movement along the Eastern Australian coast" below.)

The continental slope of the north-western Tasman Sea Basin is strongly indented because of structural complexities. One of these is the fault that appears to offset the slope in a right lateral sense and that passes toward Recorder Guyot. Near 29°S, 154°E, soundings indicate an unusual terrace at 1,200 fm. The continental slope off Southport (fig. 3) is smooth and regular in profile except for an over-steepening at the base which probably was caused by tectonic deformation. Peaks at 29°15′S, 154°45′E and 24°40′S, 153°48′E are either volcanoes or aberrant soundings. The depression near 27°S suggests a submarine canyon partially filled in at the head.

Tasman Basin

The floor of the Tasman Sea is an abyssal plain sloping gently down to the south. Lying near the foot of the eastern Australian continental slope

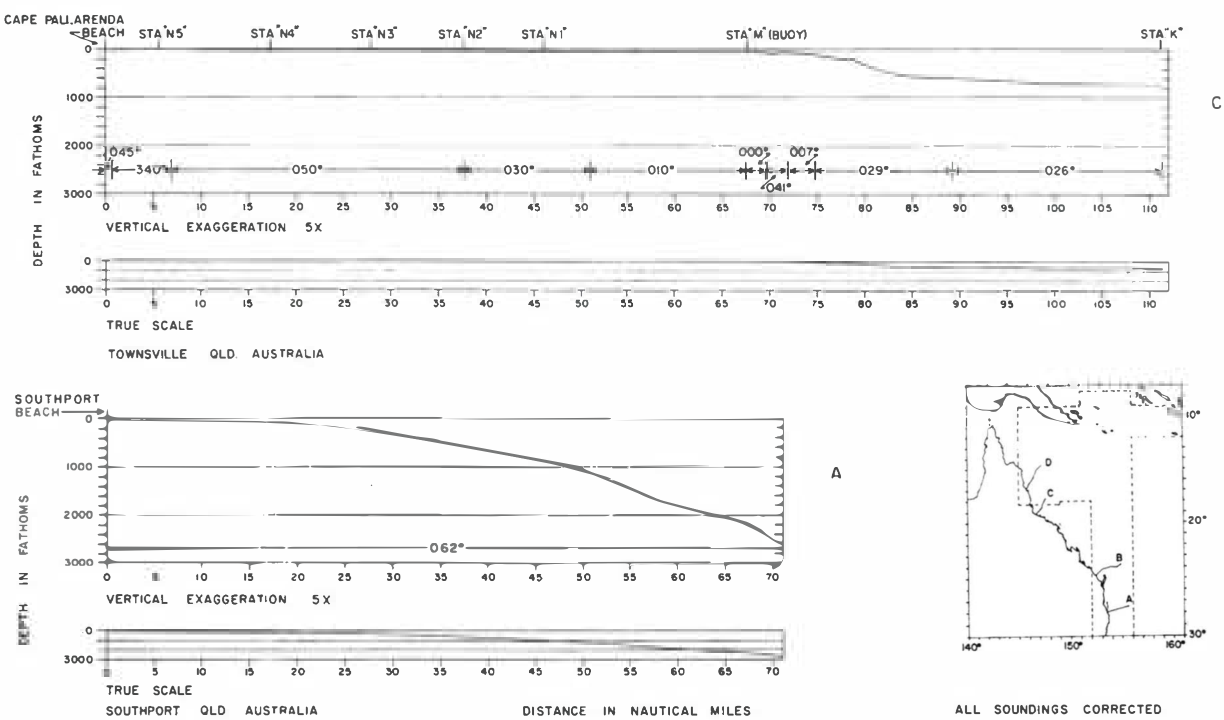


FIG. 3. Sea floor profile off Southport and off Townsville, Australia, made by C.S. *Recorder*.

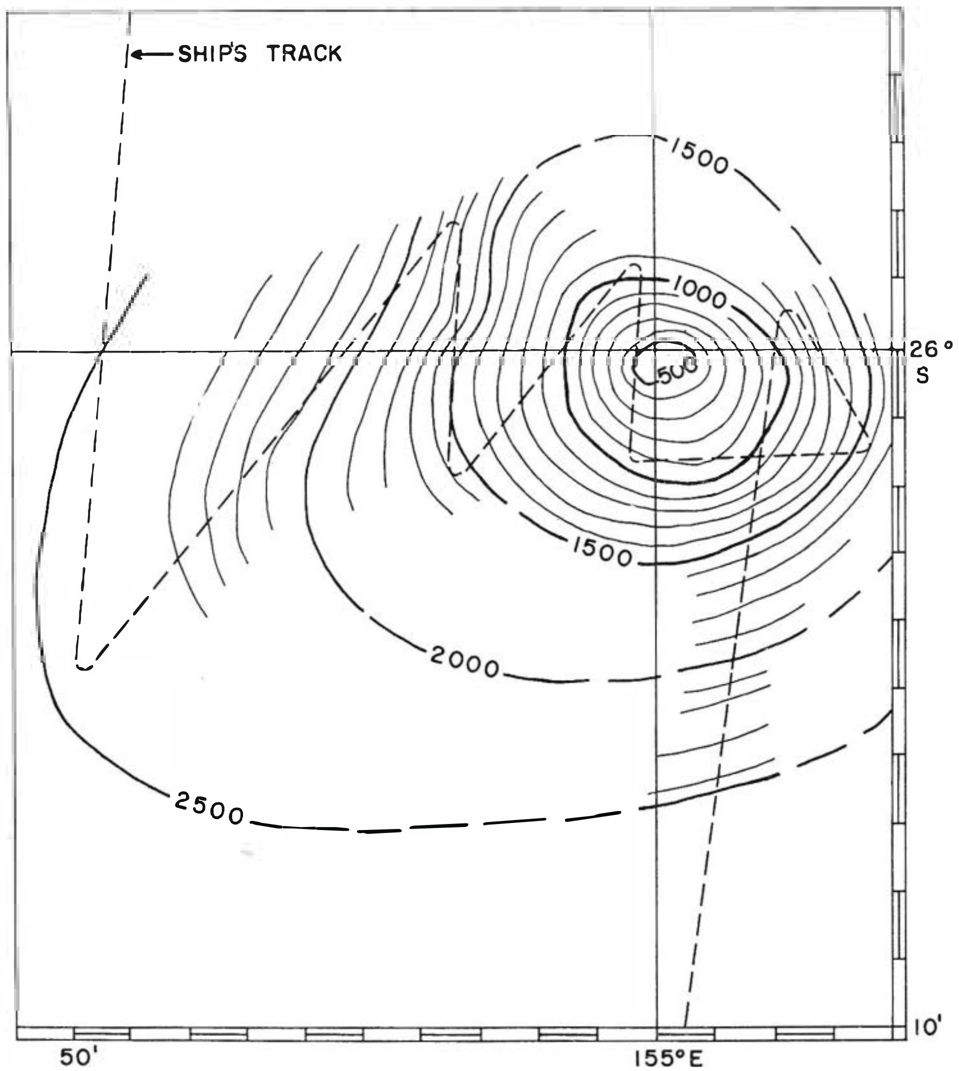


FIG. 4. Bathymetry of Seamount NT-8 off eastern Australia. Surveyed by C.S. *Recorder*, 21 July 1961. Depths in fathoms corrected for sound velocity.

are the Tasmantid seamounts. The Tasmantids were first discovered by the C.S. *Brittania* in 1902 while laying telegraph cable between Brisbane and Norfolk Island (Standard, 1961). Three shoal soundings (B.A. Chart 788) mark almost all that is known of these North Tasman Seamounts 1, 2, and 3 (NT 1, NT 2, NT 3).* David (1932) states that volcanic material has been dredged off NT2 at a depth of 527 fm. Surveys and sampling of these seamounts should prove of interest. North of the seamounts mentioned above, seamounts NT 8* and Recorder Guyot were found by the *Recorder* Expedition. NT 8 (fig. 4) is conical, is 18 n.m. across at the base and has a least depth of 480 fm. The relatively flat top which characterises the Recorder Guyot is 6 n.m. wide and greater than 10 n.m. long. Its base dimensions are $18\frac{1}{2} \times 40$ n.m. (figs. 5 and 6).

*The designations "NT..." follow the sequence established by Standard (1961).

CATO TROUGH - CAPRICORN SILL DEPRESSION

The Tasman Basin is cut off abruptly at 24° N by the junction of the Lord Howe Rise (Brodie, 1952) and the Australian continent. The two do not strictly join, being separated by the Cato Trough (a new name suggested here). The north-trending continental slope of the Brisbane area meets the trend of the Rise at a sharp angle. This conjunction shows as a large re-entrant and a

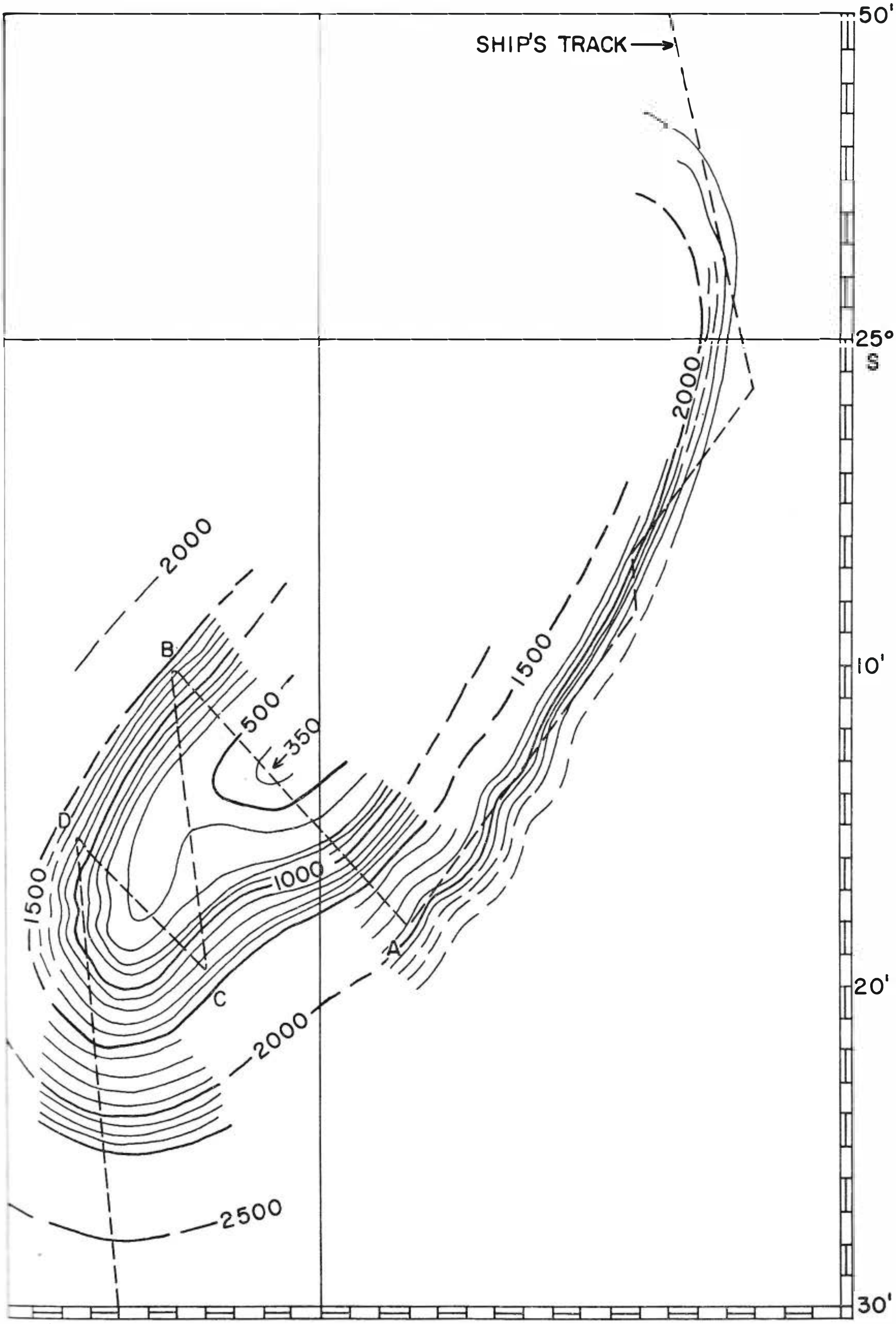


FIG. 5. Bathymetry of Recorder Guyot off eastern Australia. Surveyed by C.S. *Recorder*, 21 July 1961. Depths in fathoms corrected for sound velocity.

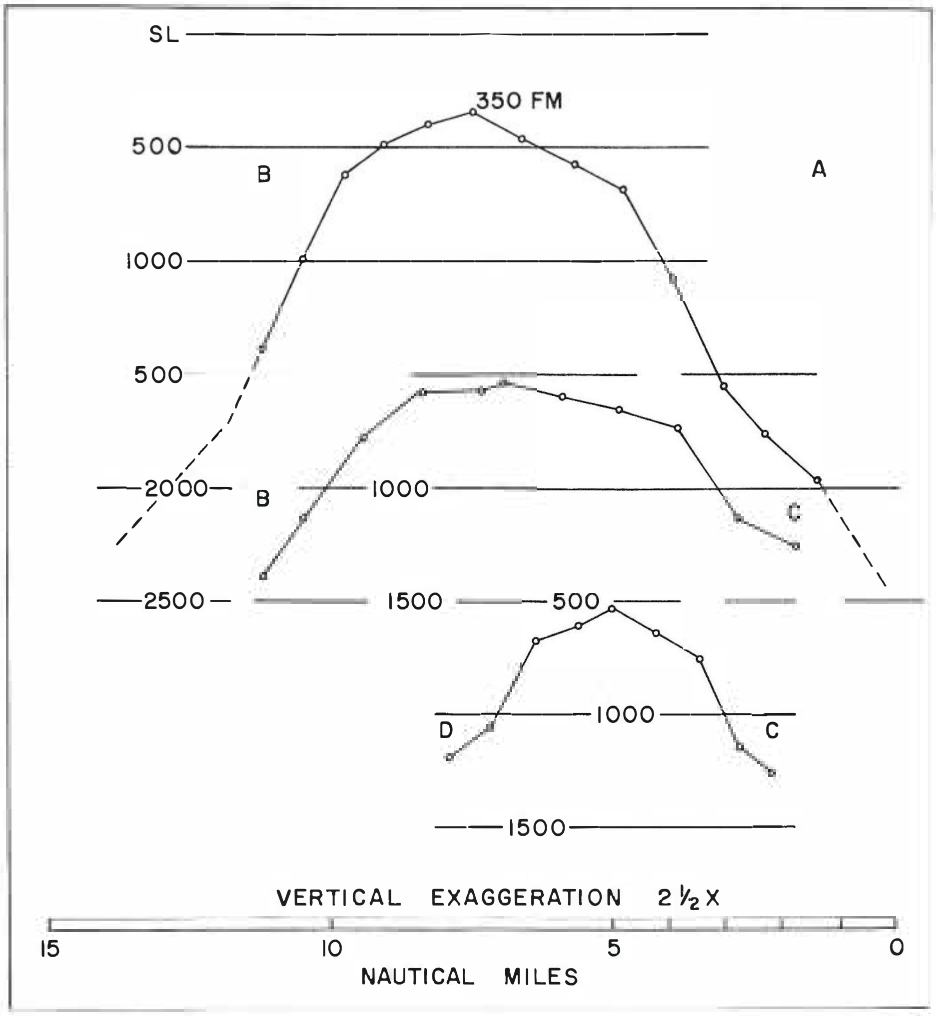


FIG. 6. Profiles of Recorder Guyot. Depths in fathoms for sound velocity.

large submarine canyon occupies its axis. At least one channel of about 40 fm depth leading into the canyon was crossed by the *Recorder* at 24°06′S, 153°E (85 n.m. from coast on fig. 7). The continental slope between the re-entrant and Cato Trough is steep and somewhat irregular becoming very steep at the base. It seems to be bounded by a fault at 24°S. The slope east of Cato Trough is poorly known but seems to be gentler.

Cato Trough is a narrow, relatively steep-sided trough separating the Queensland Plateau and the Lord Howe Rise. The Trough has a southward sloping flat floor with a deep-sea channel which seems to lead on to the Tasman Basin floor. The abyssal plain of the Tasman Basin slopes down southward away from the north sources of sediment in the re-entrant and Cato Trough. A small east-west ridge or fault apparently exists at the southern mouth of Cato Trough.

The Cato Trough broadens out into a larger trough to the north which has a steady southward gradient and a flat floor near 1,700 fm. This trough is evidently a basin that has been filled with sediment to the sill depth of the Cato Trough, and is separated from the Coral Sea Basin by a sill north-east of Marion Reef with a depth of 1,550 fm (2,850 m) based on Wyrtki's (1961) interpretation of hydrographic data. This sill was termed the Capricorn Ridge by Hedley (1912) from temperature studies of the Challenger Expedition in the Coral Sea. Because this is not a ridge but a sill between two troughs, the author proposes to change the name to Capricorn Sill

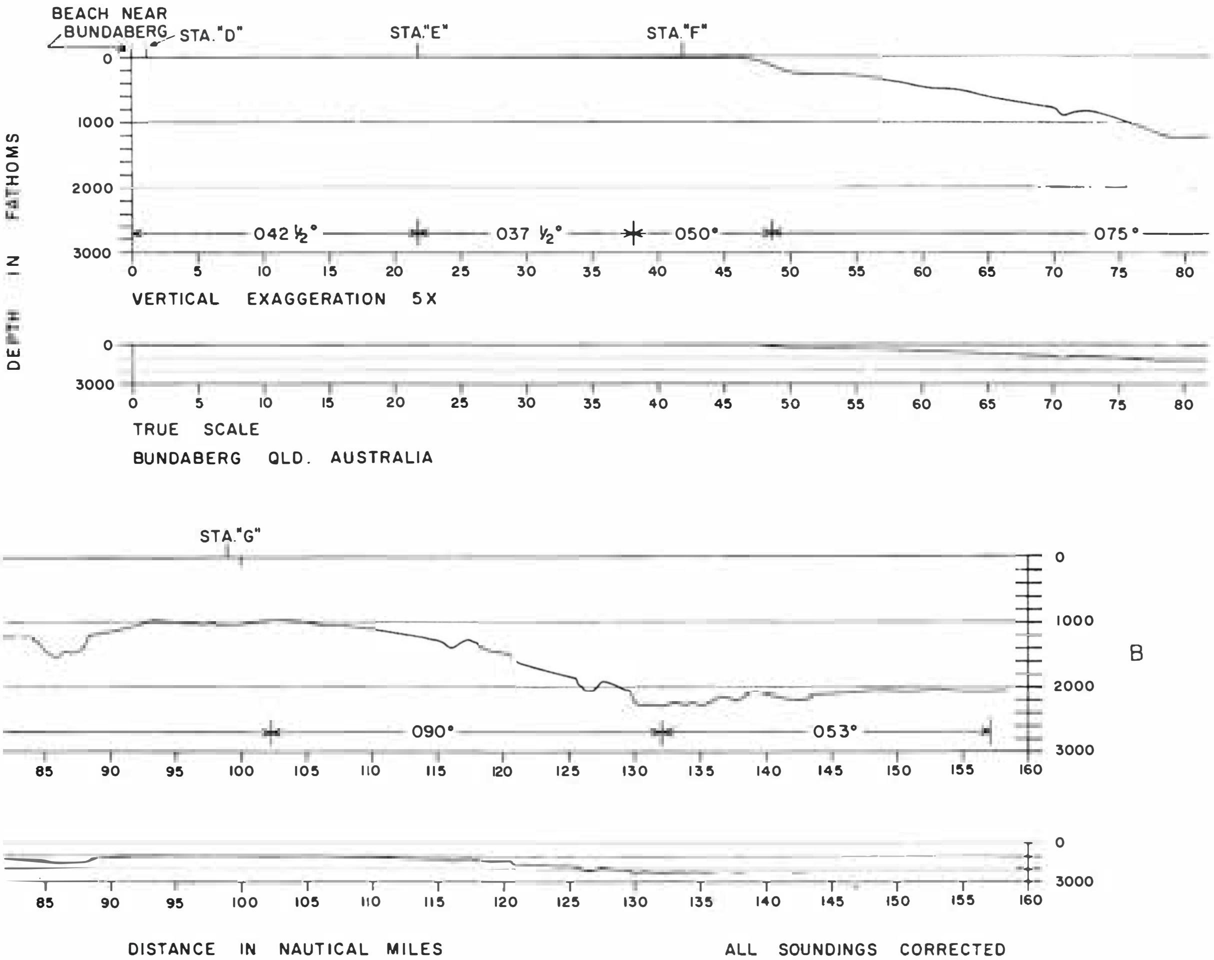


FIG. 7. Sea floor profile off Bundaberg, Australia, made by C.S. *Recorder*. Irregular eastern portion passes along southern edge of Queensland Plateau. Note submarine canyon in western portion.

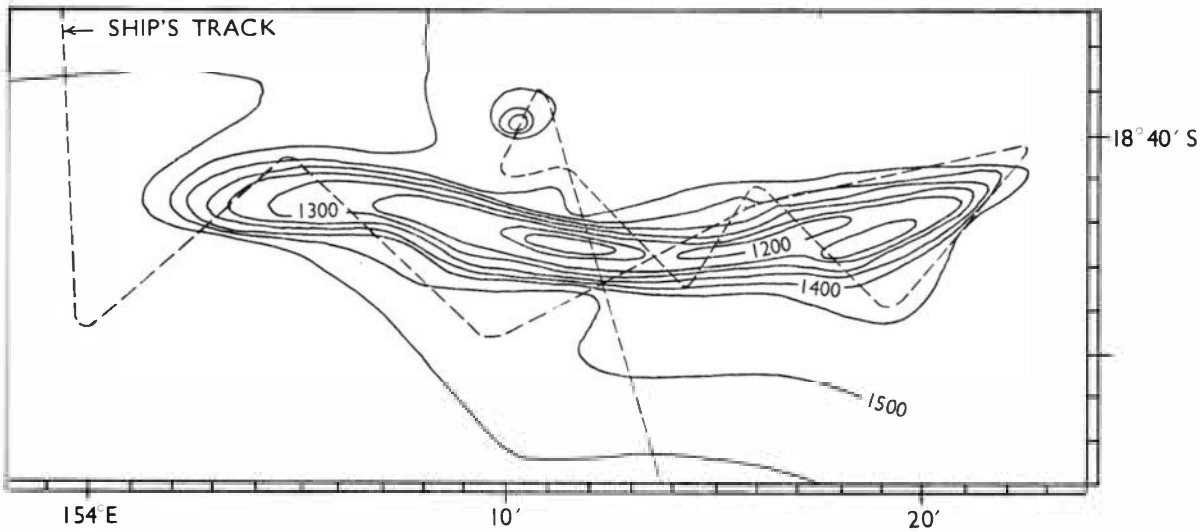


FIG. 8. Ridge in Cato Trough. Surveyed by C.S. *Recorder*, 25 July 1961.

for this feature. No sounding information exists at the Capricorn Sill, but nearby soundings support Wyrtki's conclusion.

In the northern head of Cato Trough, a low but sharp ridge was found trending east-west and associated with a number of small volcanic cones (fig. 8). The ridge dimensions are 2 × 18 n.m. The ridge's crest is at a depth of 1,131 fm which is 360 fm above the surrounding plain.

A number of atolls and reefs (Cato Island, Wreck Reef, Kenn Reef, and Frederick Reef) in and near the aforementioned troughs are the northward extension of the Tasmantid Seamounts. The peaks upon which the reefs lie and the associated seamounts are undoubtedly volcanoes.

Queensland Plateau

The Queensland Plateau occupies the southern Coral Sea as a subcontinental region lying between the north-eastern coast of Australia and the deep Coral Sea Basin. It is separated from the continent by the Queensland Trough. The plateau slopes gradually down to the north-west from a general level of 400 fm near Diane Bank to 800 fm at Osprey Bank. The south-eastern portion of the plateau is very poorly charted and the very few soundings allow no bathymetric interpretation of that area (the blank area in the southern part of Chart 1D). To the north-west, the coral reefs sit on swells and peaks that rise from the very flat or gently undulating main surface of the plateau.

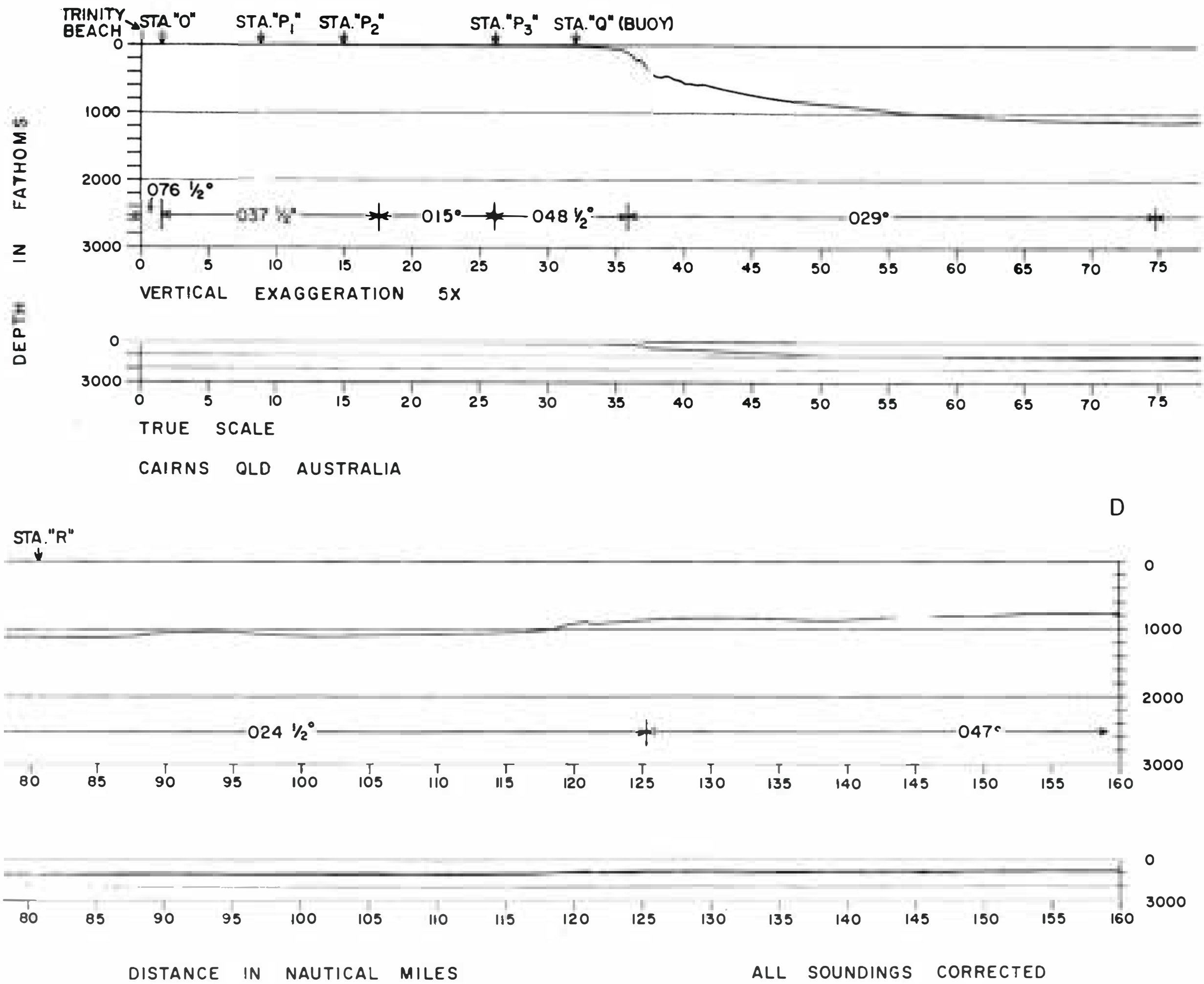


FIG. 9. Sea floor profile off Trinity Opening, Australia. made by C.S. *Recorder*. Note channel in middle of Queensland Trough.

Descending northward toward the Coral Sea Basin, the main surface of the plateau becomes deeper at an increasing rate until, at 1,100–1,200 fm, the slope suddenly increases and the equivalent of the continental slope is encountered. Various irregularities occur on the slope. Tentatively, many look like great slump scars. Near the base of the slope, channel-like features appear and also a low scarp, probably a fault scarp. To the east, the plateau seems to degenerate into an area of irregular topography and thence into the northward extension of Cato Trough, which lies between the plateau and Mellish Reef. Mellish Reef, in turn, rests on the west part of another plateau.

The sharp south-western edge of the Queensland Plateau divides the main surface of the plateau from the slope leading into the Queensland Trough. The *Recorder* crossed a relatively sharp feature on this edge that is 125 fm high and about 1.5 n.m. wide at 17°17′S, 147°50′E. It could be a small volcanic cone, a faulted segment of the plateau or a drowned coral reef. Its top is at 400 fm depth.

The relief on the Plateau is gentle with 40–80 fm hills. Many canyon-like features of up to 200 fm depth and 2 n.m. width exist on the Queensland Plateau, especially on the northern flank. Many minor canyons exist along or on the Plateau on the south-western side.

Queensland Trough

The floor of the Queensland Trough is flat or gently sloping from the sides. Its axis slopes northward. A submarine channel lies in its axis and is 50 fm deep and 16 n.m. wide where it is crossed off Trinity Opening (fig. 9). The eastern side of the trough is relatively steep (1 in 4) near the upper edge and fairly irregular near the base, showing subdued channels and surfaces of various ages, the latter evidenced by gently sloping surfaces abutting against steeper surfaces. The western side of the trough rises gently to the base of the upper continental slope marking the edge of Australia.

The continental slope in various parts of the world often occurs as two units. The units have been defined by Krause (1966b) as follows: "The 'inner slope' is defined as the slope that is bordered at the top by the continental shelf. The 'outer slope' is defined as the slope bordered at the bottom by the deep-sea floor."

To the south-east, the Queensland Trough cannot be traced due to lack of data, but seems to join the Cato Trough north of Marion Reef. In doing so, it crosses a saddle of unknown depth. To the north, the Trough joins the Coral Sea Basin north of Osprey Reef, but soundings do not exist to show the nature of the junction.

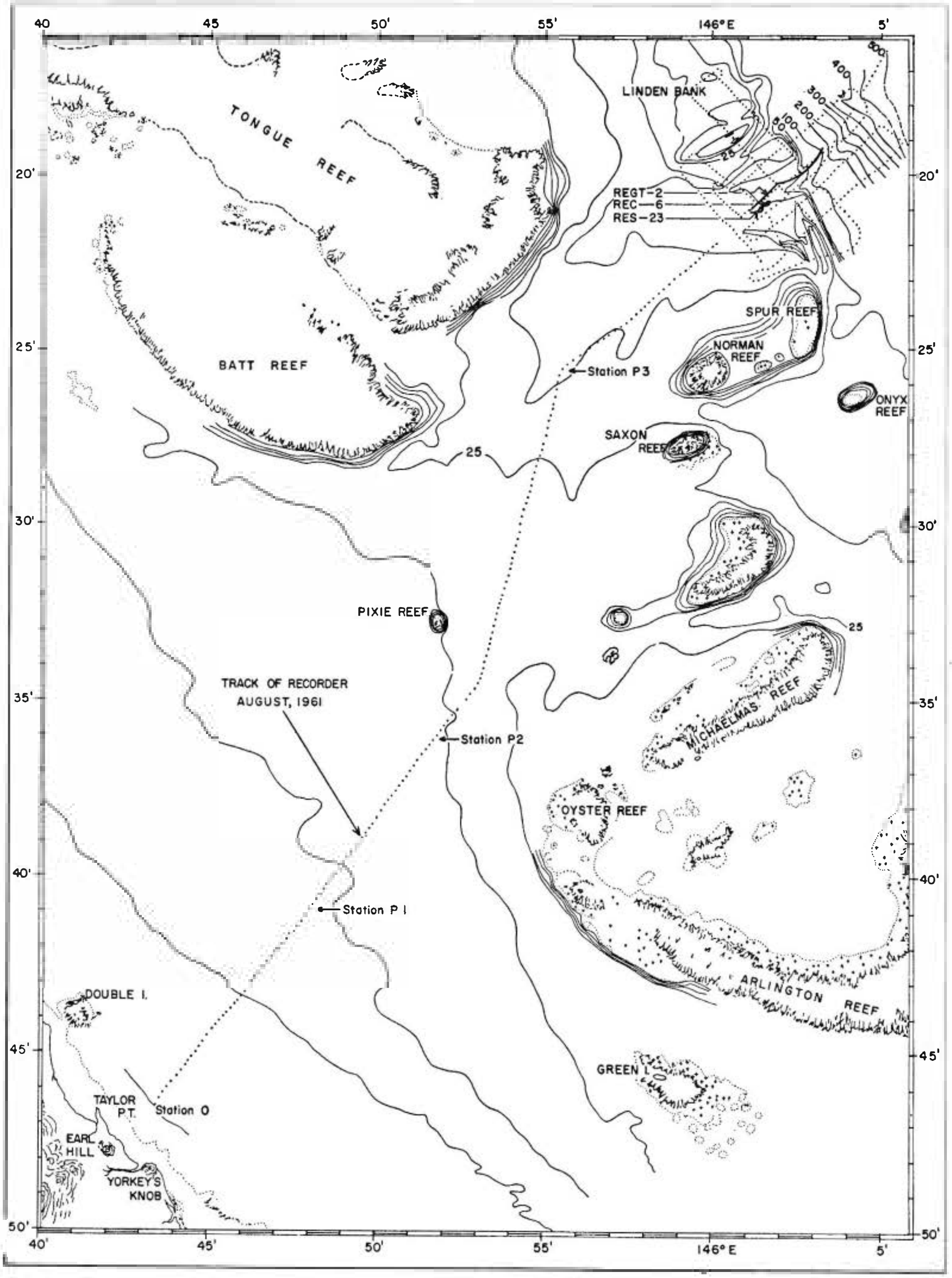
Continental Shelf and Upper Continental Slope of North-eastern Australia

The upper continental slope (~0–1,000 fm) here is extremely steep and merges with the subaerial Great Barrier Reef. The calcareous Great Barrier Reef is cut in several places by navigable channels such as Trinity Opening (fig. 10) and Magnetic Passage. Published Australian charts supplemented by data from the *Recorder* reveals that channel systems exist in the shelf landward of these openings. These channels are eroded into coral at depths where mechanical abrasion would not take place at the present time. Evidently these are river channels that were eroded in the shelf during the Pleistocene lowering of sea level. Sediment came down in these rivers and was dumped at the shelf edge. It was carried as turbidity currents (at present inactive) into the Queensland Trough where it was in part deposited and in part conveyed to the Coral Sea Basin.

Coral Sea Basin

The Coral Sea Basin, 100,000 n.m.^{2} (350,000 km^2) is floored by an extremely flat plain that is a true abyssal plain. It is bordered by the Queensland Plateau to the south-west, the New Guinea lower continental slope to the north and a poorly charted plateau to the east. A few abyssal hills or small seamounts exist, probably of volcanic origin, but these are inconspicuous. There are a few scarps, probably faults, of 1–5 fm height. A small ridge borders the north-eastern margin of the basin.

The pelagic clay that covers the Coral Sea Basin is only a few inches thick: 14 in. (36 cm) in core REG-9, 6 in. (15 cm) in core REG-29. Below the pelagic clay occurs olive coloured silt containing carbonised wood fragments. This silt is a turbidity current deposit that can have but one major source—subaerial New Guinea. A deep channel that probably begins in the Fly River delta leads into the basin from the vicinity of Port Moresby. Also, many canyons exist in the continental slope near Port Moresby. Another (but minor) source of the silt is the Queensland Trough. A third source of sediment, in this instance calcareous material, is the Queensland Plateau, which shows two possible transport channels in its flank. A fourth source of material, both siliceous and calcareous, is the Pocklington Trough which seems to have a graded floor.



SOUNDINGS IN FATHOMS
ALL SOUNDINGS CORRECTED BY HD 282
CONTOURED BY W.S. WHITE AND D.C. KRAUSE
DATA FROM B.A. CHART 2924 AND C.S. RECORDER

FIG. 10. Bathymetry of Trinity Opening, near Cairns, Australia. Survey by C.S. *Recorder* of 2–3 August 1961 added to contours made from BA Chart 2924.
Positions of samples, camera station, and grapnel traverse are plotted.

NORTHERN CORAL SEA - SOUTHERN SOLOMON SEA

Lower and Upper Continental Slope and Continental Shelf off South-eastern New Guinea

The outer edge of the continental shelf off south-eastern New Guinea is usually marked by reefs. The shelf near Port Moresby is very narrow with a minimum width of 3 n.m. and broadens to the south-east to 5–10 n.m. Near Tagula Island, the eastern extension of the Papua Peninsula forms a flat-topped underwater ridge with a reef complex almost awash over most of its 25 n.m.-wide top.

The upper continental slope near Port Moresby is very irregular, being extensively cut by submarine canyons. Much of the Papuan slope is not mapped, but, off the eastern end of the Peninsula, the slope is much smoother and gentler. At 151°E long. it merges with the lower continental slope. Two shallow depths recorded on this upper slope may be errors of observation (11°S, 150°17′E and 11°S, 150°30′E).

A large plateau (here named the Papua Plateau) exists between the upper and lower continental slopes off Papua with minimum depth of about 1,200 fm. A large submarine channel crosses the plateau at 147°30′E long. after trending south-east along the foot of the upper slope. Any sediment flowing over the shelf to as far east as 148°30′E long. would be collected into this channel.

The lower continental slope trends east-west between approximate depths of 1,200 to 2,400 fm with a general slope of 1 in 30. A cross fracture trending parallel to the Papua Peninsula modifies the slope near 150°30′E long. A local trough at 12°S, 149°30′E, appears to be a structural depression or else a region with a lower rate of sediment deposition than the surrounding region. From 147° – 149°E long. a bulging of the contours between 2,000–2,400 fm appears to be a large submarine fan built out from the mouth of the large channel.

East of 151°E long., the upper and lower continental slopes merge at 153°E long., the slope is very steep being an overall 1 in 8. This slope is composed of two very steep segments: 0–500 fm and 1,500–2,100 fm. The upper segment is formed from coral reefs while the lower must be a result of faulting.

To the east of Tagula Island the slope becomes very complex.

Southern Solomon Sea

The very complex floor of the southern Solomon Sea is poorly charted except for certain areas in the Louisiade Archipelago and near Woodlark Island which rests on Woodlark Ridge. The deep Woodlark Basin (new name) between these two ridges was uncharted before the *Recorder* Expedition surveys (Chart 3).

The Louisiade Archipelago rests on the eastward extension of the Papua Peninsula which there becomes a region of parallel structural ridges, troughs and closed basins. Tagula Island, Rossel Island and Pocklington Reef rest on a series of *en echelon* ridges.

The sea floor of the Woodlark Basin between Pocklington Reef and the Woodlark Ridge is very irregular and is a great contrast to the sea floor south of 12°S long. The basin floor is cut into a chaotic arrangement of hills, ridges, and irregular depressions. The hills are generally 100–200 fm high and 1–10 n.m. apart, lying at between 1,700–2,300 fm depth. However, the hills seem to have a general alignment east-west although escarpments cut through the region in various directions. On the average, the basin becomes deeper to the east. Most, if not all, of this sea floor is composed of soft sediment, red clay and globigerina ooze with some interbedded lava flows (see below).

Woodlark Ridge is irregular and seems to be broken by a left-lateral fault (here named the Laughlan Fault) at 8°50′S lat. which is a continuation of a structural depression trending ESE out of the northern part of the Solomon Sea. Just north of the Laughlan Fault and on the Woodlark Ridge lies a high peak, probably a volcano which is flat-topped at 406 fm.

The sea floor to the north of the Woodlark Ridge is again a complete contrast to the basin south of the ridge. The slopes are gentle and covered with extremely fluid fine silt (see below).

The structural rift of the flat-floored Pocklington Trough separates two extremely different areas. The chaotic nature of the area to the north has been described above. The area to the south is a gently undulating plateau of ancient aspect. The trough to the north-east abuts on a very irregular area of east-west-trending structures. This irregular area west of Guadalcanal Island is poorly charted, and the data available allow only diagrammatic contouring. More data will change the details considerably, but it is doubtful whether the general aspect will be much altered. Hence the present conclusions should be valid.

The area is bordered on the south by an extremely steep scarp with a slope of 1 in 2 between 800–2,900 fm that trends directly toward the south coast of Guadalcanal. The scarp also marks the northern end of the South Solomon Trench, and the whole east-west-trending province divides the New Britain Trench from the South Solomon Trench.

Bellona Island and Rennell Island, both uplifted coral reefs (Pudsey-Dawson, 1960, J. H. Hill, 1960a), rest on a south-easterly-trending ridge lying to the south-west of the South Solomon Trench.

THE *RECORDER* EXPEDITION

BOTTOM SAMPLING

Bottom samples (table 1) were obtained with various instruments by the *Recorder* Expedition, varying from samples of a few ounces from the snapper grab and Rutherford tube to one sample of 500 lb from the rock dredge. These samples came from many environments. Most samples were characteristic of the general environment as below:

Shelf Sediments

The coarse sand in sample REP-1 (115 fm) and coarse quartz sand in REP-2 (50 fm) off Southport are relict sands deposited during the Pleistocene lowerings of sea level REP-1 at 115 fm is rather deep for such sands and represents either a very low sea-level stand, local Recent downwarping or exceptional storms which generated very large waves capable of moving sand at that location during the Pleistocene.

Mud and sand samples RES-4A-C, RES-5A-D, RES-18, and RES-19A-M are all characteristic of their very shallow environment. The coarse sediment occurs where wave energy is sufficiently high to stir bottom sediments and to move and/or sort them. The fine sediment represents a low-energy environment and/or a very abundant source of fine sediment and/or a lack of coarse sediment.

Terriginous sand samples RES-X, RES-6, coral sand samples RES-13, RES-14, RES-15, RES-16, and samples RES-17 (terriginous and coral sand), RES-20 (broken shells and terriginous fine sediment), RES-21 (similar to RES-20), RES-22 (silt), and RES-23 (coral sand and shells) may all represent Pleistocene sediment, the difference in composition reflecting the difference in source material. The finer material, silt and clay, may be Recent in age. A mixture of constituents such as in RES-20 indicates that some reworking of the sediment has occurred.

Deep-sea Sediments

Sample REG-12 from 208 fm off Magnetic Passage consists of carbonate mud and sand. Such a sand cannot be formed at that depth at the present time and is interpreted as coming from a fan of coarse materials dumped at the edge of the shelf during the Pleistocene lowering of sea level.

Samples REG-7 (1,001 fm), REG-8 (2,009 fm), REG-10 (600 fm), REG-24 (1,088 fm), REG-25 (770 fm), RES-26 (1,109 fm), RES-27 (1,629 fm), RES-28 (2,170 fm), and RES-31 (2,139 fm) all consist of calcareous globigerina ooze which is characteristic of a pelagic environment of moderate depth. Such an ooze consists predominantly of tests of the Foraminiferida genus *Globigerina* where there is no other source of sediment and the water depth is less than the so-called "compensation depth" of about 2,500 fm. Below that depth, calcium carbonate is dissolved and pelagic clay (the so-called red clay) predominates instead of calcareous ooze. Core REG-7, being pale brown to grey brown, and core REG-31, being dark tan, are darker in colour than the rest.

Cores REG-9 (2,550 fm) and REG-29 (2,494 fm) in the Coral Sea Basin show evidence of a change in the deep-sea sedimentation regime. The upper half of the 28.5 inch (72 cm) core REG-9 consists of pelagic clay and the lower half consists of olive-green silt. Likewise, the upper 6 in. (15 cm) of core REG-29 consist of pelagic clay (also sampled in RES-30) and the lower 32 in. (81 cm) consist of olive-coloured silt with fragments of carbonised wood. The pelagic clay is at the present typical of these depths, but the silt is a terrestrially derived deposit. These features, combined with the overall bathymetric pattern, strongly suggest that the silt is a turbidity current deposit (turbidite) laid down probably during Pleistocene time. Most of the silt probably came from the Fly River delta of Papua although much sediment was probably derived also from the Port Moresby region (see Coral Sea Basin). If it were assumed that the turbidite deposition ended with the onset of the modern rise in sea level, the pelagic clay took roughly 20,000 years to deposit (Curray, 1961). For this time span, the rate of deposition of the pelagic clay in core REG-9 is 0.7 in./1,000 years (1.8 cm/1,000 years) and in core REG-29 is 0.3 in./1,000 years (0.75 cm/1,000 years). These rates are rather excessive in light of what is known of pelagic clay deposition (Goldberg, 1958) and the deposition of the turbidites in these cores may have ceased after the greatest advance of the glaciers, perhaps as long as 100,000 years ago.

TABLE 1: Bottom Samples Taken by the *Recorder* Expedition

Sampler Key:
1. PBS Corer = Phleger Bottom Sampler, similar to the gravity core but one third the size (50 lb)
2. The Rutherford tube and snapper are used on the end of the sounding weight for the Lucas sounding machine
3. Rock Dredge = an open-ended heavy steel frame with a chain bag attached to one end.

Sample	Station	Latitude	Longitude	Locality	Depth (fm)	Type of Sample	Remarks
REP-1	A	27°47.3′S	153°51.5′E	Off Southport	115	PBS corer	Coarse sand.
REP-2	C	27°50.7′S	153°43.2′E	Off Southport	50	PBS corer	Coarse quartz sand.
RED-3	B	27°57.4′S	153°31.3′E	Off Southport	23	Rock dredge—10 lb	Brisbane metatuff (lower Pale-ozoic (?) andesitic metatuff) and a carbonate rock of shell and wormtubes.
RES-4A	D	24°47.08′S	152°27.33′E	Ship, Bundaberg	6	Rutherford tube	Very coarse sand upper layer (2 in.); blue grey sandy clay beneath.
4B	,,	24°47.08′S	152°27.33′E	,,	6	Rutherford tube	
4C	,,	24°47.08′S	152°27.33′E	,,	6	Rutherford tube	
RES-5A	,,	24°47.26′S	152°27.14′E	Survey, Bundaberg	5.7	Snapper	Unsorted grades from clay to small gravel.
5B	,,	24°47.04′S	152°27.03′E	,,	5.7	Snapper	Greenish grey clayey sand.
5C	,,	24°47.63′S	152°26.75′E	,,	4.3	Snapper	Fine brownish quartz sand with abundant ferromag-nesian minerals.
5D	D	24°47.75′S	152°27.70′E	,,	5.7	Snapper	Coarse dark quartz-ferromag-nesian sand with some shell fragments.
RES-X	E	24°32.2′S	152°42.3′E	Curtis Channel	17½	Rutherford tube	A little sand.
REP-6	F	24°17.6′S	152°57.2′E	Curtis Channel	32	PBS corer	Sand.
REG-7	G	23°59.8′S	153°54.3′E	Queensland Plateau	1,001	Gravity corer—60 in.	Pale brown to grey brown calcareous ooze.
REG-8	H	23°12.9′S	154°57.2′E	Cato Trough	2,009	Gravity corer	Globigerina ooze.
REG-9	I	15°03.3′S	154°39.0′E	Coral Sea Basin	2,550	Gravity corer—28½ in.	14 in. red clay over 14½ in. olive green silt.
REG-10	J	15°44.4′S	148°33.9′E	Queensland Plateau	600	Gravity corer—23½ in.	Globigerina ooze.
REG-11	K	17°38.4′S	147°36.3′E	Queensland Trough	737	Gravity corer—57¼ in.	Globigerina ooze.
REG-12	L	18°07.8′S	147°20.3′E	Magnetic Passage	208	Gravity corer—6 in.	Carbonate mud and sand.
RES-13	M	18°16.3′S	147°16.8′E	Magnetic Passage	35	Snapper	Fragments of coral and sand.
RES-14	N-1	18°39.0′S	147°13.1′E	Magnetic Passage	25	Snapper	Coral sand.
RES-15	N-2	18°46.8′S	147°07.8′E	Magnetic Passage	26	Rutherford tube	Coarse coral sand.

RES-16	N-3	18°53.4'S	146°59.5'E	Off Townsville	20	Rutherford tube	Coarse coral sand.
RES-17	N-4	19°00.2'S	146°56.0'E	Off Townsville	14	Rutherford tube	Coarse terrigenous and coral sand.
RES-18	N-5	19°07.5'S	146°44.5'E	Off Townsville	5	Rutherford tube	Olive coloured mud with shell debris.
RES-19A	O	16°47.50'S	145°42.92'E	Off Trinity Beach	2	Snapper	Dark grey silty mud.
19B	..	16°47.11'S	145°43.08'E	Off Trinity Beach	3	Snapper	Dark grey silty mud with fine sand and small shells.
19C	..	16°46.57'S	145°42.74'E	Off Trinity Beach	3.7	Snapper	Same as 19B but shell more abundant.
19D	..	16°46.58'S	145°42.23'E	Off Trinity Beach	2.7	Snapper	Dark olive grey silty mud with some fine sand and small shells.
RES-19E	O	16°47.31'S	145°42.21'E	Off Trinity Beach	8.0	Snapper	Same as 19D.
19F	..	16°47.57'S	145°42.60'E	Off Trinity Beach	1.2	Snapper	Same as 19D.
19G	..	16°46.68'S	145°42.01'E	Off Trinity Beach	1.7	Snapper	Same as 19D.
19H	..	16°47.07'S	145°42.08'E	Off Trinity Beach	0.8	Snapper	Coarse beach sand (quartz and feldspar).
19I	..	16°47.00'S	145°42.27'E	Off Trinity Beach	1.7	Snapper	Same as 19D.
19J	..	16°46.91'S	145°42.49'E	Off Trinity Beach	2.3	Snapper	Same as 19D.
19K	..	16°46.80'S	145°42.79'E	Off Trinity Beach	3.2	Snapper	Same as 19C.
19L	..	16°46.73'S	145°42.98'E	Off Trinity Beach	3.8	Snapper	Same as 19C.
19M	..	16°46.69'S	145°43.18'E	Off Trinity Beach	4.2	Rutherford tube	Same as 19A. Ship anchor site.
RES-20	P-1	16°41.0'S	145°48.0'E	Off Trinity Beach	14	Rutherford tube	Light olive grey silt and fine sand with broken shells.
RES-21	P-2	16°36.2'S	145°51.8'E	Trinity Opening	21½	Rutherford tube	Similar to RES-20 but finer.
RES-22	P-3	16°25.7'S	145°55.6'E	Trinity Opening	31	Rutherford tube	Light olive grey silt.
RES-23	Q	16°33.0'S	146°00.2'E	Trinity Opening	37½	Snapper	Coral sand and shells.
RES-24	R	14°40.0'S	146°26.8'E	Queensland Trough	1,088	Gravity corer—52½ in.	Globigerina ooze.
REG-25	S-1	14°35.2'S	147°15.4'E	Queensland Plateau	770	Gravity corer—48½ in.	Globigerina ooze.
RES-26	S-2	14°10.0'S	147°51.2'E	Queensland Plateau	1,109	Rutherford tube	Globigerina ooze.
RES-27	S-3	14°02.1'S	148°04.4'E	Queensland Plateau	1,629	Rutherford tube	Globigerina ooze.
RES-28	S-4	13°54.5'S	148°18.2'E	Coral Sea Basin	2,170	Rutherford tube	Globigerina ooze.
REG-29	S-5	13°46.8'S	149°39.7'E	Coral Sea Basin	2,494	Gravity corer—38 in.	6 in. red clay overlies 32 in. olive silt with charcoal.
RES-30	S-5	13°46.8'S	149°39.7'E	Coral Sea Basin	2,494	Rutherford tube	Red clay.

TABLE 1: Bottom Samples Taken by the *Recorder* Expedition—*continued*

Sample		Longitude	Latitude	Locality	Depth (fm)	Type of Sample	Remarks
REG-31	T	11°41.0′S	155°20.8′E	Coral Sea	2,139	Gravity corer—60 in.	Dark tan Globigerina ooze (?)
RED-32	U	11°05.6′S	155°10.3′E	Louisiade Arch.	320–430	Rock dredge	Ooze.
REG-33	V-1	8°56.1′S	154°38.2′E	Solomon Sea	1,969	Gravity corer—28 in.	Buff ooze overlies blue volcanic clay with forams.
RED-34	W	9°47.8′S	154°08.8′E	Solomon Sea	2,100–1,400	Rock dredge—600 lb	500 lb ooze with 100 lb basalt stones and one sample indurated ooze. Dragged west 2.0 n.m. to the position.
REG-35	W	9°47.8′S	154°08.8′E	Solomon Sea	1,430	Gravity corer—35½ in.	25½ in. buff ooze overlies 10 in. blue volcanic clay with forams.

TABLE 2: Grapnel Traverses of the *Recorder* Expedition

Traverse	Depth (fm)	Distance Dragged (n.m.)	Latitude	Longitude	Location
REGT-1	36–65±	2	18°16′S	147°17′E	Entrance to Magnetic Passage
REGT-2	75–40	2.1	16°22′S	146°00′E	Trinity Opening
REGT-3	320–430	2	11°06′S	155°10′E	Pocklington Ridge (Louisiade Archipelago)

TABLE 3: Camera Stations of the *Recorder* Expedition

Lowering	Station	Latitude	Longitude	Depth (fm)	Locality	Time Near Bottom	Remarks
REC-1	A	27°47′S	153°51′E	99	Off Southport	24 min	Poor results.
REC-2	F	24°17.6′S	152°57.2′E	32	Curtis Channel	31 min	Sand ripple marks on gravel and fish.
REC-3	G	24°00′S	153°54′E	1,001	Off Bundaberg	35 min	Soft calcareous ooze.
REC-4	J	15°44′S	148°34′E	600	Queensland Plateau	33 min	Debris-covered calcareous ooze with abundant burrows and animals.
REC-5	M	18°16.3′S	147°16.8′E	35	Magnetic Passage	15 min	Debris-covered irregular limestone bottom.
REC-6	Q	16°22.0′S	146°00.2′E	39	Trinity Opening	20 min	Ubiquitous burrows in soft sediment with some animals.

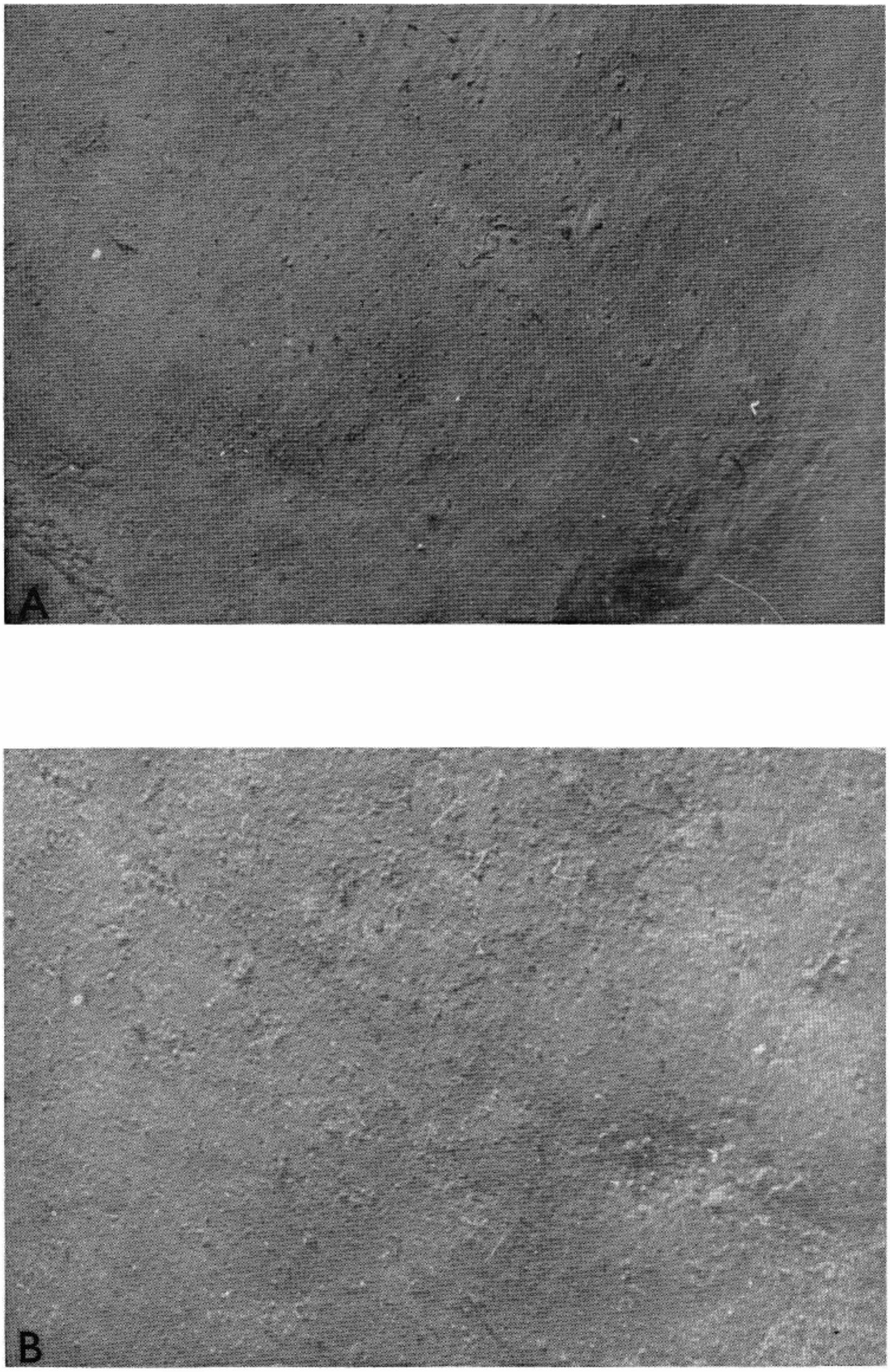


PLATE 1. Camera station REC–3, off Bundaberg, 1,001 fm, note fine debris and structure in calcareous ooze. Animal track occurs at lower left corner of A.

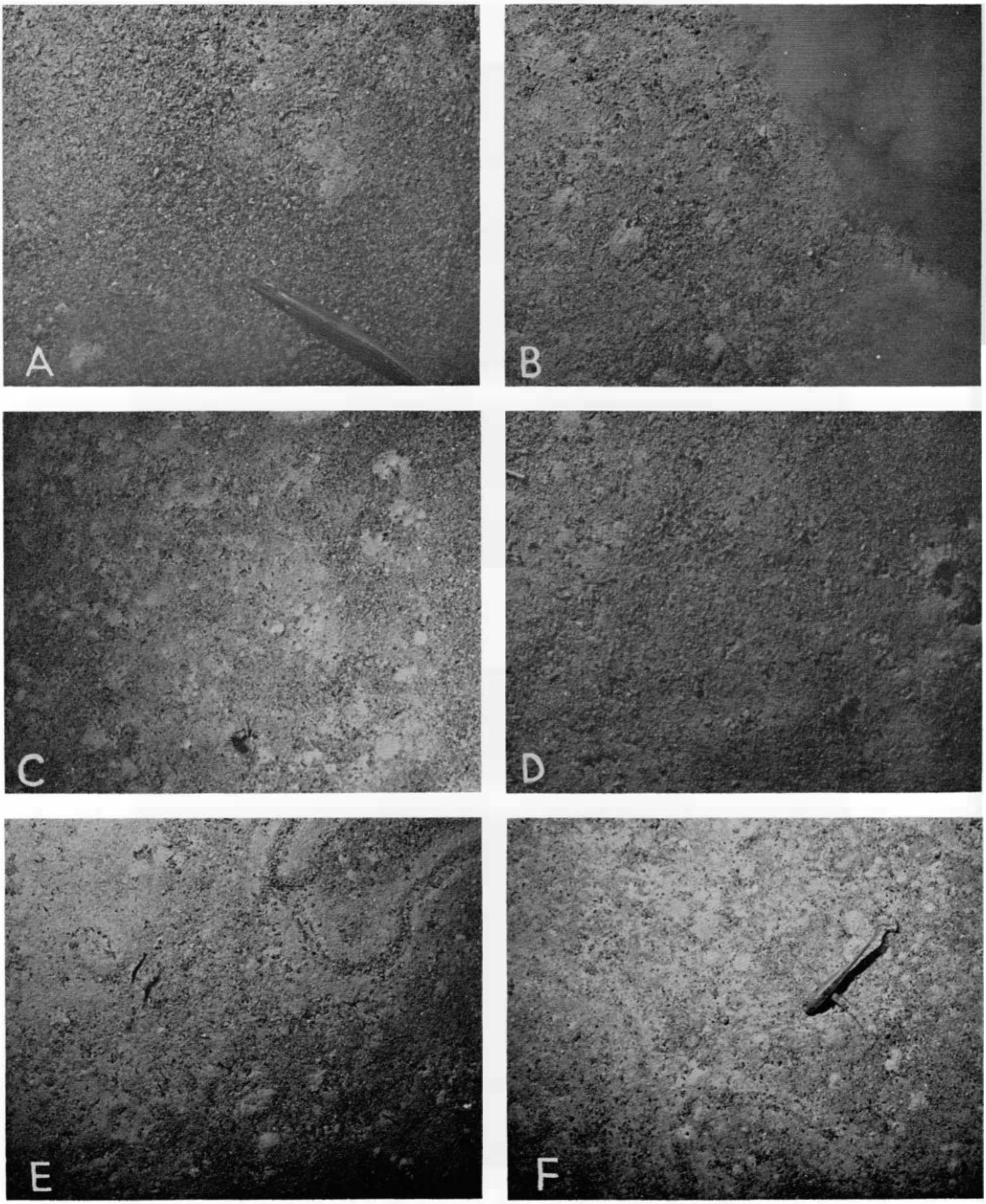


PLATE 2. Camera station REC–4, Queensland Plateau, 600 fm. Abundant evidence of life in and over calcareous ooze. Fish occur in A and F; tracks prominent in E and F; dust cloud raised by camera or fleeing animal in B; small decapods in C and E; burrows prominent in D; fine debris, worms and gastropods (?) ubiquitous.

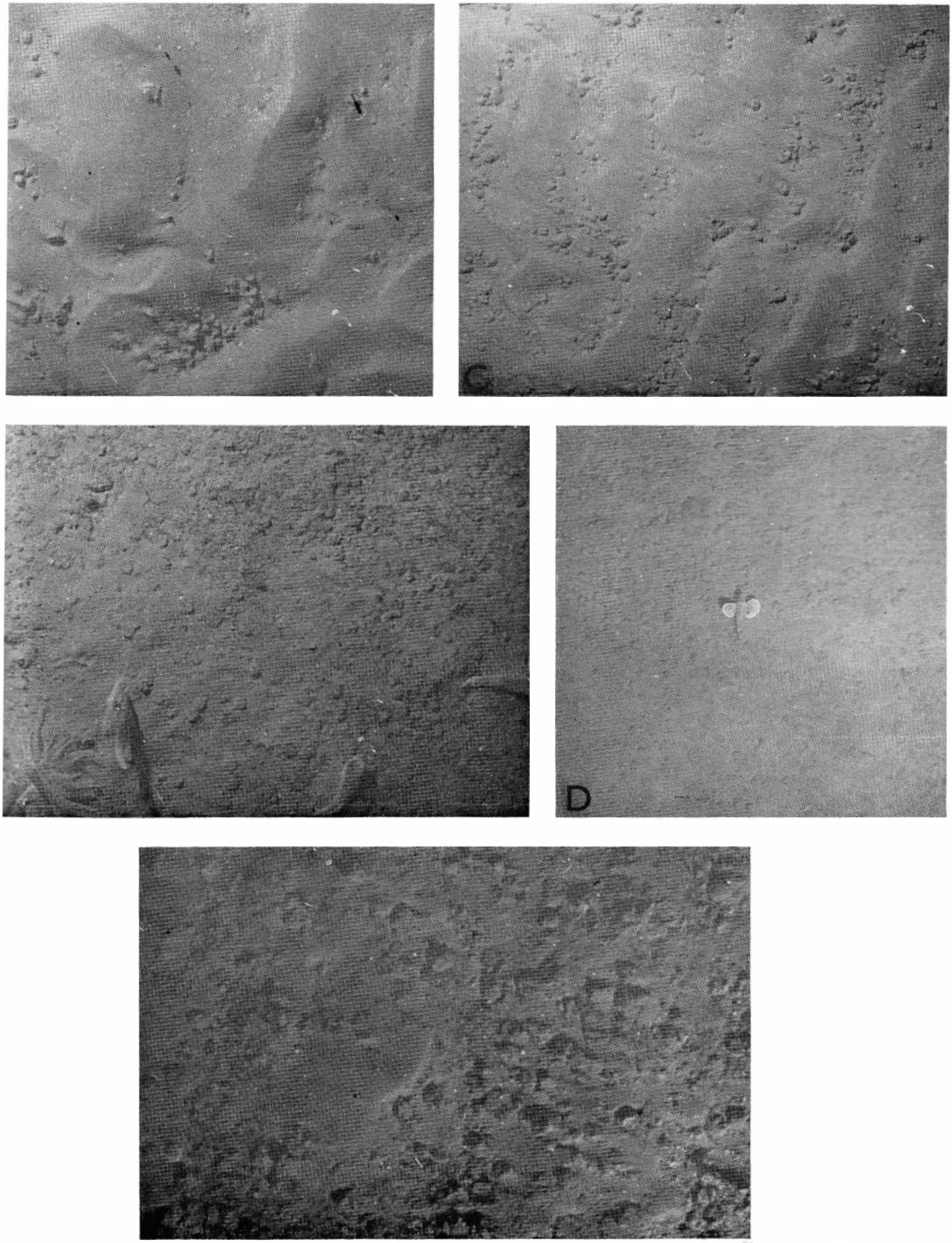


PLATE 3. Camera station REC–2, Curtis Channel, 32 fm. Note sand ripplemarks, gravel, fish, and anemone.

PLATE 4. Camera station REC–5, Magnetic Passage, 35 fm. Dark, irregular, reef limestone is partially covered with debris and coralline algae(?).

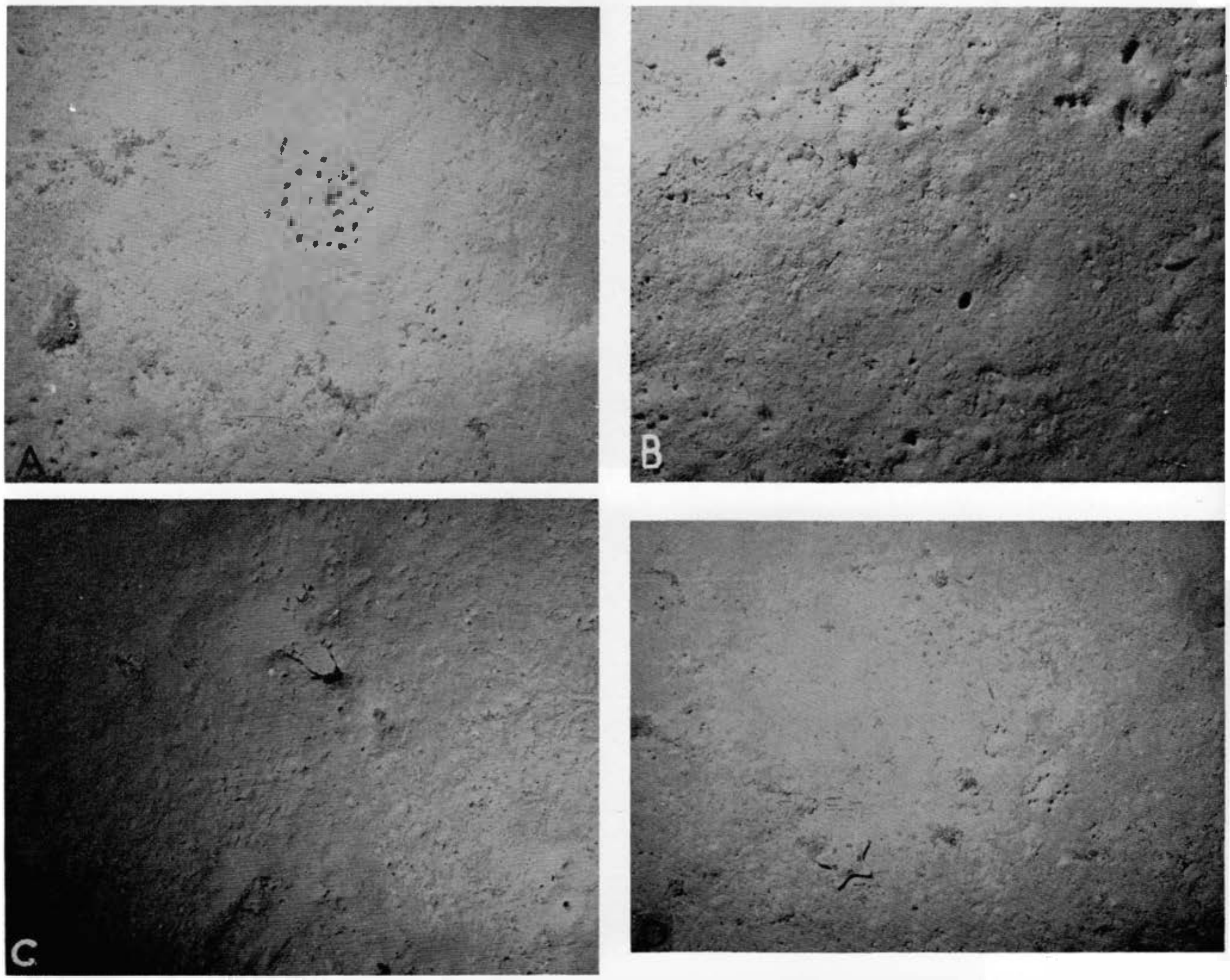


PLATE 5. Camera station REC–6, Trinity Opening, 39 fm. Burrows are ubiquitous in this soft sediment. Starfish present in D.

Cores REG-33 (1,969 fm) and REG-35 (1,430 fm) in the southern Solomon Sea consist of blue volcanic clay with abundant foraminifera which is capped by soft buff-coloured globigerina ooze. (The ridges and peaks to the west and north of this sample are probably partly volcanic in origin.) Dredge haul RED-34 (2,100–1,400 fm) was taken in the area of maximum relief of the region, near the same site as Core REG-35. The dredge was dragged up a steep escarpment (about 1 in 4 slope) to find out if rock outcropped. There was no evidence of an outcrop on the tension of the dredging cable nor were there scratches on the dredge and chain although about 100 lb of basalt stones were brought up in the dredge. The rocks were evidently dispersed in the 500 lb of calcareous ooze that made up most of the haul. The basalt must have existed as either a thin flow, sill or dike in the ooze and had been fractured and dispersed through local movement: alternatively, the basalt had been emplaced by submarine sliding from a longer distance. The soft calcareous ooze carries a large percentage of clay (probably derived from pelagic volcanic ash) and becomes quite stiff if undisturbed. Also in the haul was a sample of chalk-like indurated calcareous ooze.

Rock Outcrops

Rock crops out in various areas covered by this report. Some outcrops are identifiable with the echo sounder, others were identified by the rock dredge hauls already mentioned, still others were examined by what the officers of the *Recorder* termed "grapnel traverses". The tool for this consists of a grapnel of the type used for locating telegraph cables and is attached to a suitable amount of anchor chain which is in turn attached to a large hemp and wire cable. This array is then dragged along the sea floor. Jerking and uneven tension on the cable indicates when the grapnel is crossing rock. The run is made at 2–4 knots. Three grapnel traverses were made in the area concerned (table 2).

Most of traverse REGT-1 encountered smooth bottom or gravel with only an occasional outcrop of rock (probably reef limestone). The grapnel and chain came up polished and with grains and fragments of coral and shell. The traverse crossed the sharp change at the edge of the shelf.

Traverse REGT-2 in Trinity Opening (fig. 10) was made on the only line where the survey by the *Recorder* showed no ridges or hills. The continental slope here is very steep (1 in 6.5 (9°) average between 47–450 fm but 1 in 3.7 (15°) over half the distance). The traverse showed rock (reef limestone) between 75–66 fm and interspaced mud and gravel or sand over the rest of the distance.

Traverse REGT-3 was made over an apparent rock outcrop on Pocklington Ridge west of Pocklington Reef. Some rock was encountered but the bottom was not very rough. The grapnel came up polished and with some small (0.3–0.4 cm) rounded quartz pebbles wedged in the screw threads. A rock dredge (RED-32) was lowered here but currents had moved the *Recorder* away from the outcrop, and the bedrock was thus not identified.

BOTTOM PHOTOGRAPHS

Six camera lowerings (table 3), of which five yielded useful data, were made in the area (see plates). The camera used was a deep-sea camera-pinger system made by Edgerton, Germeshausen, and Grier (Inc.), which took one picture every 12 seconds on 35-mm Kodak Plus-X movie film. An oscilloscope was used with the listening transducer on the ship. With this arrangement, the camera was maintained on the cable $\frac{1}{2}$ – $1\frac{1}{2}$ fm above the bottom.

Stations REC-3 (1,001 fm) and REC-4 (600 fm) were in relatively deep water. Station REC-3 (pl. 1) showed a relatively sterile bottom of soft calcareous ooze with a brittle star, a few burrows, a little debris and a few tracks. One photograph showed weak orientation of debris and fine features that indicated a weak current. In contrast to the relative lack of life at Sta. REC- 3, Sta. REC-4 (Queensland Plateau, pl. 2) showed soft calcareous ooze with abundant life—worms, gastropods, a crab, a prawn, two fish, debris, and many burrows.

Station REC-2 (32 fm, Curtis Channel off Bundaberg, pl. 3) showed several areas of large current ripplemarks in sand, indicating strong currents. Animal tracks occur on some of the ripplemarks showing that the current did not exist at the time of the station. The sand layer at the ripplemarks was not much thicker than the ripplemarks themselves and overlies a gravel bottom. Other pictures showed only fine gravel. The sand is probably being transported across the gravel by the currents, which may be tidal. Only a small amount of fine debris was present among pebble-sized debris, another indication of current strength. Life present included several fish, an anemone and whatever animals had made the tracks.

Station REC-5 (35 fm, Magnetic Passage off Townsville, pl. 4) showed a considerable amount of debris, much of which may have been derived from coralline algae. The debris covers a dark-coloured, irregular bottom that appears to be solution-scarred limestone.

Station REC-6 (39 fm, Trinity Opening off Cairns, pl. 5) showed soft bottom with abundant burrows and some fine debris. Among the abundant evidence of animal life were burrows, tracks, coelenterates, fish and a starfish. No evidence of bottom currents was present.

DEVELOPMENT AND DATING OF SUBMARINE FEATURES

Sand Movement Along the Eastern Australian Coast

Between 24° and 30°S lat. off the coast of Australia, much sand has been moved and is moving in a northerly direction. Fraser, Double, Bribie, Moreton, and North Stradbroke Islands are composed of uplifted oceanic sands (Coaldrake, 1960). Coaldrake considers that these are pre-Pleistocene in age and were only modified during the Pleistocene. He bases this opinion on the occurrence of sands older than 45,000 years B.P. which have been developed in the older sands of the islands. Features similar to the five islands lie submerged off the coast (Australian Hydrographic Charts); these are probably Pleistocene.

Fraser Island marks the northern limit of subaerial evidence for the northward migration of sand. However, Break-Sea Spit is a northerly continuation of Fraser Island that has built out to the edge of the continental shelf. The surface of Break-Sea Spit is composed of sand and dead coral (Australian Chart AUS 161). Much of the spit is shoaler than 2 fm and all of the spit proper is in depths of 3 fm or less. During heavy weather, sand undoubtedly moves along this spit at the present time. An indentation of the contours at the northern extreme of the 3 fm contour represents a submarine canyon. The southern part of the spit is over 15 n.m. long. Beyond the canyon, the spit immediately drops to a depth of 8 fm and then gradually deepens to 20 fm over the next 10 n.m. Over much of this length the 20 fm line represents the edge of the continental shelf because the slope steepens abruptly there. Depths of 100 fm exist only 1 n.m. to the east. One or more submarine canyons may cut this section.

During the Pleistocene, when sea levels occurred down to 50 fm below the present sea level, sand traversing the spit was dumped directly at the edge of the shelf and was undoubtedly conveyed to the deep-sea floor via submarine slumps and/or turbidity currents whenever the accumulation of sand at the edge was great enough. Evidence for this exists in the submarine canyons shown on Chart I and in the abyssal plain and fans of the floor of the Tasman Sea.

At the present time, sand travelling northwards along the Spit must be dumped into the submarine canyon at its head. After a sufficient build-up of sand has occurred, the sand is probably carried down the canyon as a turbidity current or slump to the deep-sea floor. Some evidence for this exists. Hedley (1912) reported that "repairs required by a submarine cable induced Captain Sharp [of the H.M.C.S. *Iris*] to re-examine this district in 1904". The submarine cable was apparently damaged by mass movement of sediment on the bottom. The cable was abandoned in October 1923.

Channels on the Eastern Australian Shelf

Much information about the Quaternary history of the shelf exists in published detailed charts of the Australian Hydrographic Service. The *Recorder* Expedition made studies in three locations on the eastern Australian shelf that give an insight into the recent history of the shelf when supplemented by the chart soundings.

The shelf off Southport is partly rocky with a deep area directly off the mouth of the lagoon (fig. 11). The deep area is probably the remains of a river gorge formed during Pleistocene time. The path of the river (fig. 11) follows a present-day depression. The rocky area is composed of the Brisbane andesitic metatuff (dredge haul RED-3). The dredge also brought up a cobble of carbonate rock composed of shells and worm tubes, a rock which must cover the metatuff in places.

A contouring of Australian Chart AUS 161 (Hervey Bay) by R. R. Long on the *Recorder Expedition* reveals several channels that are undoubtedly Pleistocene river channels of the Burnett River formed during the periods of glacially lowered sea level. The channels lead to the edge of the continental shelf north-west of Break-Sea Spit which is discussed above. Much sediment must have been deposited at the shelf edge during the Pleistocene. This sediment does not seem to exist there at present and has presumably disappeared into abyssal depths via turbidity currents and slumps. The channels seem to be developed with a base level of about –35 fm.

Trinity Opening, a navigable opening in the Great Barrier Reef which lies north-east of Cairns (fig. 10), also shows channels in the shelf according to contours by W. C. White of the *Recorder*

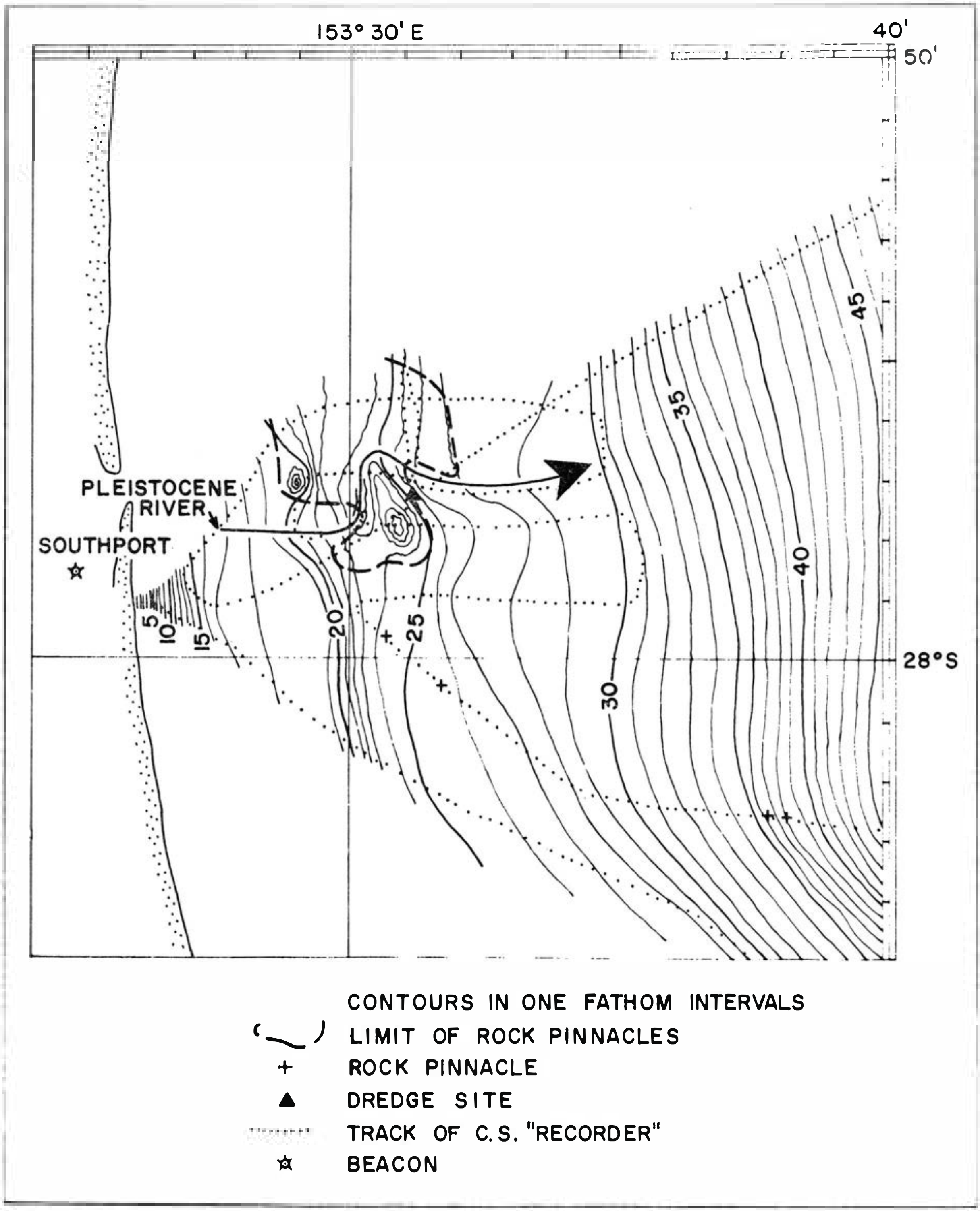


FIG. 11. Shelf bathymetry off Southport. Survey by C.S. *Recorder*, 20 July 1961. Note course of postulated Pleistocene River. Depths in fathoms corrected for sound velocity.

Expedition. The origin of these channels is not as obvious as in the preceding examples. The growth of the coral reefs in post-Pleistocene time complicates the situation. The coral reefs are potentially capable of filling in all of the spaces between the reefs in post-Pleistocene time because of their rapid growth. Any break in the reef is in the nature of an anomaly in this prodigious growth. In lieu of other evidence, the author suggests that the channels exist due to a combination of Pleistocene rivers and present strong marine currents. Muddy waters would have greatly inhibited reef growth. Submarine solution of the coral limestone may have contributed to the formation or preservation of the channels. If such under-saturation occurs it must also be associated with strong currents.

Continental Slope near Brisbane

Considerable deformation of the continental slope exists south of Hervey Bay. Near 29°S lat. a narrow (5.4 n.m.) bench is present at about 1,300 fm depth. North-east of Brisbane, a significantly steepened portion of the slope exists trending south-easterly from Recorder Guyot between 800–1,600 fm and is probably related to the fault. At the foot of the slope (2,200–2,500 fm) east of Brisbane the slope is steepened by faulting or monoclinal folding.

Tasmantid Seamounts

David (1950) has suggested that the Tasmantid Seamounts (NT-1, NT-2, and NT-3) may be Tertiary volcanics. These basaltic volcanoes have not been surveyed, much less adequately sampled. North of these lie the Recorder Guyot and seamount NT-8, both volcanic. The relatively flat top of Recorder Guyot suggests this was an island in its youth, which has since sunk about 350 fm (640 m). The Recorder Guyot seems to lie on a fault trending south-westerly in the direction of Brisbane. If the interpretation of the limited soundings is correct, this fault has offset the continental slope by 14 n.m. in a right-lateral sense and has offset, vertically, the deep-sea floor by 250 fm (460 m).

Great Barrier Reef

Fairbridge (1950) discussed the Great Barrier Reef in detail and the discussion will not be augmented here. Some of his tectonic conclusions are not supported by this study, although he does point out that the Reef is a post-Pleistocene feature built up from the eroded platform formed during an inter-glacial period of rising sea level. He also concludes that the shelf under the Reef is slowly subsiding.

Australian Continental Geology Pertinent to the Sea Floor

The known geologic history of eastern Australia, stretching far into the Precambrian, has included periods of intense deformation, deposition, erosion and intrusion, but the active period of eastern Australian geology essentially ended with the Mesozoic.

Cenozoic (Cainozoic) geology can be briefly characterised by:

1. Extensive basalt flows and volcanoes in Queensland (Best *et al.*, 1960; Stephenson *et al.*, 1960) and the Torres Strait reflecting deep mantle activity.
2. Laterite formation (Connah and Hubble, 1960).
3. Effects of Quaternary sea level changes and climatic changes.
4. Minor warping.
5. Coral reef formation.

The absence of the Tertiary deformation and events so well displayed to the north and in so much of the rest of the world suggests that, at least for the present, eastern Australia and the sea floor east of it is in a state of quiesence after a long period of crustal growth in Australia.

At the moment, little obvious correlation exists between the profound Mesozoic geologic activity of eastern Australia and the present bathymetry east of Australia. Well-defined structural trends occur in Queensland but cannot be correlated with the bathymetry because most of the continental trends are parallel to the coast except for the Broken River Embayment west of Cairns and some structures south-west of Brisbane. Correlations that do exist are discussed in the following instances.

The Broken River Embayment west of Cairns is a term given to a fault re-entrant of the Precambrian Shield (D. Hill, 1960; White, 1961). The fault trends in the direction of Cairns where a bend of the coast and of the Queensland Trough exists.

The present coastline is cut in ancient crystalline rocks of the basement which have been uncovered only after considerable erosion. The structural features therefore have been subaerial for a very long time. The rocks of the north-eastern coast of Queensland are low grade metamorphics (metagreywackes, etc.) and granites (D. Hill, 1960). Some of the islands there are granitic (Gradwell, 1960). The south-eastern coast of Queensland is a structural high (Hill, 1960) largely composed of the Brisbane metamorphics which are pre-Devonian metasediments, metatuffs and metalavas (Bryan *et al.*, 1960). This structural high has remained as a high since it began to furnish sediments to the Yarrol Basin in the Carboniferous. The high extends to the east of the coast, as shown by a rock sample (RED-3) dredged up by the *Recorder* 4 n.m. offshore from Freeport and identified as Brisbane metamorphics by W. C. White (personal communication).

An inspection of Australian topographic maps reveals an east–west trending uplift along 26° – 26°30'S lat. and between 147° – 151°E long. which may be related to the northern termination of the Tasman Sea basin at 24°S lat.

New Guinea Continental Geology Pertinent to the Sea Floor

Some clue to the development of the sea floor around New Guinea can be obtained from the geology of Papua and the islands to the east. Relatively little is known of the area shown on the charts, but much work (Australian Petroleum Co. Proprietary—APCP, 1961) has been done to the east of 147°E long. which usefully characterises the region.

The mountainous Louisiade Archipelago is an extension of the high Owen Stanley Range of Papua which rises to 13,000 ft. Most of the bedrock of the Louisiade Archipelago is metamorphic rock (David, 1950). Rocks of the Louisiade Archipelago include basics and ultrabasic intrusions. Woodlark Island is mostly raised coral limestone (David, 1950).

To the west of the chart area, the Torres Strait and the Fly River delta (Fly-Digoel Depression) are low and flat, but during the Pleistocene epoch, the area was an alluvial plain (David, 1950). Even in post-Pleistocene time, erosion has occurred. Most recently, the Torres Strait has been formed. The southern part of the Fly River delta is still sinking; marshes exist instead of deltas despite the high rate of deposition. The southern part of the area has been a stable shelf throughout much of geologic time and is part of the old land mass of Australia with only broad and gentle folds. The northern part of the area is underlain by very thick sediments, and the region has a complex geologic history, briefly discussed below.

The A.P.C.P. have recently released their extensive geological information on western Papua. From this work the following conclusions can be drawn which are inferred to apply to the sea floor both south and east:

1. Mid-Mesozoic time marked a very profound change in the geology.
2. Basins were forming and material was deposited in them from at least mid-Mesozoic time until mid-Pliocene time.
3. Locally, uplift of former basins occurred but the general tendency of movement was downward.
4. The basins must have filled as fast as they deepened. Because the basement (where exposed) is a weathered granite indicating former subaerial erosion, the deepening must be explained by (a) tectonic processes and (b) the compensating isostatic adjustment brought on by the sediment load made possible by the relative rising of sea level.*
5. The basins must have been open-ended into the Coral Sea.
6. Subaerial uplifted and volcanic sources for the very thick eastern greywackes must have existed which lay to the north-west, perhaps laterally with respect to the trough, because the western limestone lay on a subsiding shelf, precluding sources in that direction.
7. The greatest orogeny of the region occurred in late Pliocene-early Pleistocene time resulting in the present structures.
8. Overall, there was a net addition in thickness of 33,000–65,000 ft. (10–20 km) of material to the region. This demands sub-crustal flow or a net increase in density in the sub-basement rock column. The volume of the original rock also experiences a net increase in the process of erosion due to (a) hydration and other chemical changes giving less dense minerals and (b) granulation of the rock.
9. In the region of thickest sediments, a thickness of 60,000 ft (18 km) of sediment was deposited since Jurassic time ($120 \times 10^6 +$ years). This gives a rate of deposition of 6 in./1,000 years (15 cm/1,000 years). Locally this rate was more than doubled: 10,000 ft (3 km) of limestone were deposited in the central foothills through the Miocene ($12 + 2 \times 10^6$ years) (Kulp, 1961) giving a rate of 10 in./1,000 years (25 cm/1,000 years), while in the east, 20,000 ft (6 km) of greywacke were deposited in Miocene time giving a rate of 20 in./1,000 years (50 cm/1,000 years).

   This is also the rate at which the basins deepened.

*Note that the sediment load cannot cause the deepening by itself because it is of lower density than the material in the mantle or crust being displaced.

10. The above troughs were probably never deeper than present trenches, especially the troughs filled with limestone where the sediment surface must never have been far below sea level. Therefore the rate of deposition approximately represents the rate of deepening of the troughs. If trench formation occurs at the same rate (15–50 cm/1,000 years) then, where a high rate of sedimentation exists, present-day trenches (1.5 km and more below the sea floor) are at least Pliocene in age, perhaps Miocene. They may be older if there has been insufficient sediment to fill them.
11. The maximum rate of deposition is different in other areas such as the Ventura Basin of California where it may be doubled to 12 in./1,000 years (30 cm/1,000 years).
12. A question that remains is whether the filling of the basin with sediment helps or hinders its development.

A very large, active, left-lateral fault of large displacement is said to exist in south-eastern Papua trending parallel to the peninsula (W. White, C. R. Allen, personal communication). Much of the complexity along the northern portion of the Louisiade Archipelago can be associated with the seaward projection of this fault.

Much volcanism has accompanied the development of Papua both past and present (APCP, 1961; Gutenberg and Richter, 1954). Volcanism is similarly important on the sea floor to the east based on results of this study.

Solomon Islands Structures

The Solomon Islands are a series of *en echelon* faulted geanticlines. Malaita, which is the only island whose structure is dominated by folding (Coleman, 1962), is an exception. Two structural trends are apparent in the geology of the islands, one oriented NW-SE, another roughly east-west. The former trend is followed by the regional strike of the bedding, the regional trend of the islands themselves, some large, old fractures in Guadalcanal (Grover *et al.*, 1958, p. 33–34) and at least half of the minor faulting. The east-west trend is apparent in precipitous coastlines, many severe shear zones and much of the minor faulting.

The NW-SE trend is obvious in the field on every scale (Grover, 1955; Grover *et al.*, 1958, 1960). The east-west trend has been treated as playing a subsidiary role in the development of structure. However, some of the main structures are those oriented within a few points either way of east-west. Coleman (1960) indicates that for Guadalcanal the larger faults are confined "to a surprising extent to two orientations: NW-SE and ENE-WSW." Also he points out that the geanticline of Guadalcanal is oriented east-west. J. H. Hill (1960b) reports that the Betilonga area in west central Guadalcanal is extensively faulted and the entire area is the focus of large scale fracturing, much of which is oriented more or less east-west.

Grover (1955, p. 31) points out that in the Sutakiki Valley in central Guadalcanal the older rocks are sheared and heavily fractured throughout. In places, the basalts of the basement (pre-Miocene) have been dynamically metamorphosed. In the valley near Tambalusu, the basement has been mylonitised and fractured, and much veined with quartz. The geologic descriptions of the faults given in the three publications (Grover, 1955; Grover *et al.*, 1958, 1960) of the Geological Survey of the British Solomon Islands Protectorate furnish ample evidence of east-west shear: as well, the geologic maps show abundant evidence of left-lateral movement, the northern block having moved west along these shears.

Other evidence of an east-west trend is also shown in the Pliocene to Recent volcanoes of Guadalcanal which are parallel to the south coast (Grover *et al.*, 1958). On Coleman's (1960, facing p. 12) map of north-central Guadalcanal, the shear zone in the Sutakiki Valley is shown trending west to WSW. This can be interpreted either as a left-lateral, strike-slip fault with an 8 km displacement or as a dip-slip fault with the southern block relatively uplifted more than 500 ft and perhaps 2,000 ft. However, from the vertical nature of the fractures described (Grover 1955, p. 85) and the extensive shearing, the former is the preferable interpretation.

It must be pointed out that Coleman (1960, p. 9) disagrees with this interpretation and states "the relative movement along the fault planes is mainly vertical with slight slip components . . . The overall effects of the large-scale faulting are of successive block uplift from north to south (the most obvious) and of shearing, the northern blocks tending to show movement east with respect to the southern." Of Choiseul to the north, Coleman (1962, p. 156) states "an explanation for the fault patterns can only be a guess: namely, that the patterns could have arisen by major crustal shearing in a roughly west-east direction, the northern block moving east in relation to the southern, accompanied by some north-east to south-west compression. But this is quite conjectural." The evidence is not felt to substantiate either claim, especially since NE-SW compression

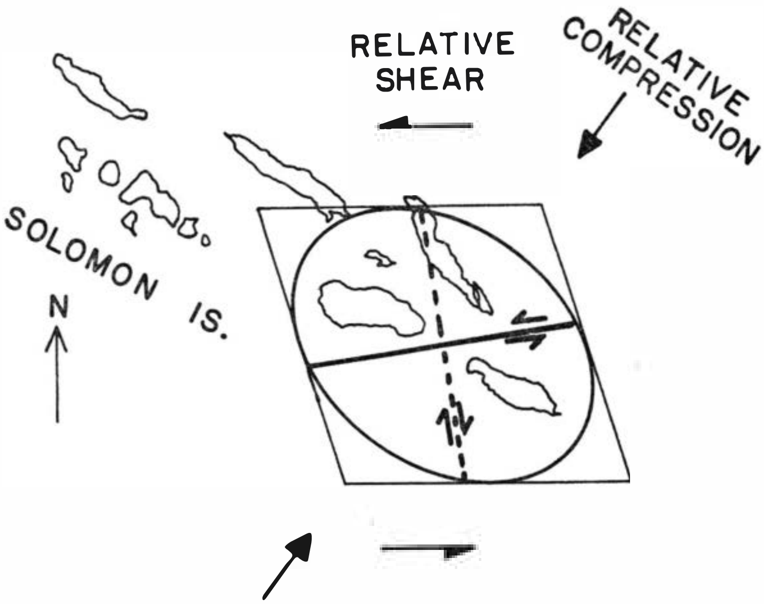


FIG. 12. Strain ellipse showing directions and sense of faulting for the given deformation. The Solomon Islands are superimposed for reference.

would require the opposite displacement (northern block moving west, fig. 12). Recent movements in Guadalcanal may have been mainly vertical and perhaps even right lateral but the evidence suggests much greater movements in a left-lateral sense over a long time span. This modern reversed movement has also occurred in California where major east-west trending fault zones such as the Mendocino fracture zone and the Murray fracture zone show modern movement in the opposite sense to much larger older movement (Menard, 1960). In the case of Choiseul, the movement and compression outlined by Coleman is not dynamically possible, at least in a temporal sense. This disagreement with Coleman does not extend to his field work and other interpretations which, with those of Grover, Pudsey-Dawson and Thompson, were done under difficult jungle conditions. Their work covers a significant area of which little was known previously.

Regarding regional structure, Grover (1955, p. 26) states "the evidence of group-microseism studies at Brisbane by Dr Owen Jones confirms other field evidence that there is a major crustal fault zone to the south-west of the Solomons group. On Rendova, Guadalcanal, and San Cristoval, the Tertiary sedimentary formation dips north-easterly at angles of 10 to 20 degrees. The sharp precipitous drop of the southern coastlines of these islands would lend support to the suggestion of a major ESE trending fault." On the basis of the location of earthquake epicentres and the asymmetry of isoseismals, Grover (in Grover *et al.*, 1958, p. 24) recognised a major east-west structural feature between Guadalcanal and San Cristoval to the south.

Grover *et al.* (1958), Coleman (1960), and Gray (1963) give a geologic history of Guadalcanal as follows. A Tertiary and Mesozoic, dominantly volcanic basement was deposited, metamorphosed and eroded in pre-Miocene time. Calcareous deposits were formed in early and middle Miocene time and in various places and times to the present. Crustal activity giving present structure began, like everywhere else along the circum-Pacific Mobile Belt, e.g., Japan, New Zealand, Alaska, etc., in late middle Miocene with erosion in the upper Miocene epoch. The climax of uplift and faulting occurred in mid-late Pliocene time but has been continuous to the present time. Volcanism has occurred sporadically since the middle Miocene.

East Australian Earthquakes

Australia, as a whole, experiences few earthquakes. A few do occur near the east coast of Australia and cluster near Bundaberg (table 4), within the area affected by the most recent folding of consequence which affected any part of eastern Australia. Their locations are near the change in trend of the continental margin.

An earthquake near Townsville (20°S, 147°E, 18 December 1913, magnitude 5.3 – 5.9, Gutenberg and Richter, 1954) marks the trend of the Broken River fault which displaces the Precambrian rocks there. No obvious correlation between the fault and the offshore bathymetry exists although tenuous speculations could be made.

TABLE 4: Earthquakes near Bundaberg, Australia

The first is reported by Gutenberg and Richter, 1954.
The rest were reported by letter to J. W. Brodie by O. A. Jones, 17 May 1954.

Latitude °S	Longitude °E	Date	Richter Magnitude
24	152	7 June 1918	5¾
26.0	151.1	12 April 1935	5
			Modified Mercalli Intensity
25.5	152.5	11 June 1947	V
approx. 25.7	151.0	30 Dec 1951	approx. IV
25.5	152.5	24 June 1952	V
approx. 24.7	151	6 Feb 1953	approx. III
approx. 24.5	151.4	3 Dec 1953	approx. III

REGIONAL STRUCTURAL INTERPRETATION OF THE BATHYMETRIC CHARTS

SUBMARINE VOLCANOES AND TROUGHS IN NORTH-WESTERN TASMAN SEA AND SOUTHERN CORAL SEA

The long string of volcanoes (NT-1, NT-2, NT-3, NT-8, Recorder Guyot) and probable volcanoes (Cato Island, Wreck Reef, Kenn Reef, Frederick Reef) (fig. 13) on the sea floor east of Australia indicates a common origin. Along with the possible volcanoes of Marion Reef, Flinders Reefs, Holmes Reefs, Bougainville Reef, and Osprey Reef, all of these are a more or less uniform distance away from the continent of Australia and thus seem to be related to the presence of the continent. Little is known about the actual conditions leading to the formation of volcanoes. Tensional conditions may be causative. If this is so, then a zone of tension exists at the outer edge of the continent implying a lateral movement (or stress) between Australia and the adjacent Tasman Sea floor. An alternative less likely hypothesis is that the volcanoes formed in gash features along a north-south-trending, right-lateral fault.

Further evidence of this tensional stress and strain is shown by the Cato Trough - Capricorn Sill depression and possibly by the Queensland Trough. The Cato Trough appears to be a tensional rift. If this hypothesis is true, the Lord Howe Rise (Brodie, 1952) and the Coral Sea Plateau were once a single continuous feature. The Queensland Trough seems to be similar to the Cato Trough – Capricorn Sill Depression but in an earlier state of development.

QUEENSLAND PLATEAU

The Queensland Plateau is a sub-continental block of physiographic antiquity. It may have once been a continuous portion of the Lord Howe Rise and the Australian Continent. Most of the plateau's surface is smooth and only gently undulating. The plateau may have been at the sea surface and had been eroded flat as indicated by the presence of supposed submarine canyons. If so, the plateau has since subsided. It is now a region of mostly pelagic deposition. On the initial leg of the *Recorder* Expedition, between Fiji and Brisbane, the *Recorder* passed south of the island of New Caledonia. New Caledonia appears to be an exposed portion of the Norfolk Rise. The rise has the same gentle characters as the Queensland Plateau except that to the south-east of New Caledonia. There the rise has been simply upfolded and then planed off by erosion and then has subsided. The complexity of New Caledonia is a clue to the complexity of the Norfolk Rise as a whole and, by inference, of the Queensland Plateau.

The coral reefs on the Queensland Plateau probably rest on at least two different types of structures. Osprey Reef and Bougainville Reef are built on rather steep eminences that appear to be extinct and sunken volcanoes. The broad and elongate character of such reefs as Diane Bank and Lihou Reef suggest that these are built on great anticlines that have formed on this shallower part of the Plateau. In each case, the reefs must be older than Pleistocene because their height represents too great a thickness of limestone to have been deposited in Pleistocene time. Fairbridge (1950) has briefly discussed the region.

Menard (1964) used the evidence of guyots, fractures, archipelagic aprons and a rise-like bathymetry to establish the existence of the Darwin Rise in the central Pacific Ocean. The rise is deeper than would be expected from present rises such as the East Pacific Rise and the Mid-Atlantic Rise. Where guyots are present, a rise hypothesis must be considered. Guyots as a class gained their flat tops at sea level and have since sunk to their present depths either by a general sinking of the sea floor or by sinking into the sea floor itself. Menard used the depth and age of the guyots to establish that the Darwin rise was much shallower in Early Tertiary and Cretaceous time at which time the tops of the guyots were at sea level. The rise sank in Early Tertiary time. The existence of the Recorder Guyot at 350 fm and of the Queensland Plateau sloping north at 400–800 fm suggests that the sea floor east of Australia was once at least 400 fm shallower than at the present, perhaps in Mesozoic time. It might have sunk in Miocene time according to the borings in Wreck Island (Travis, 1960) in the barrier reef where 300 fm of Miocene and later sediment

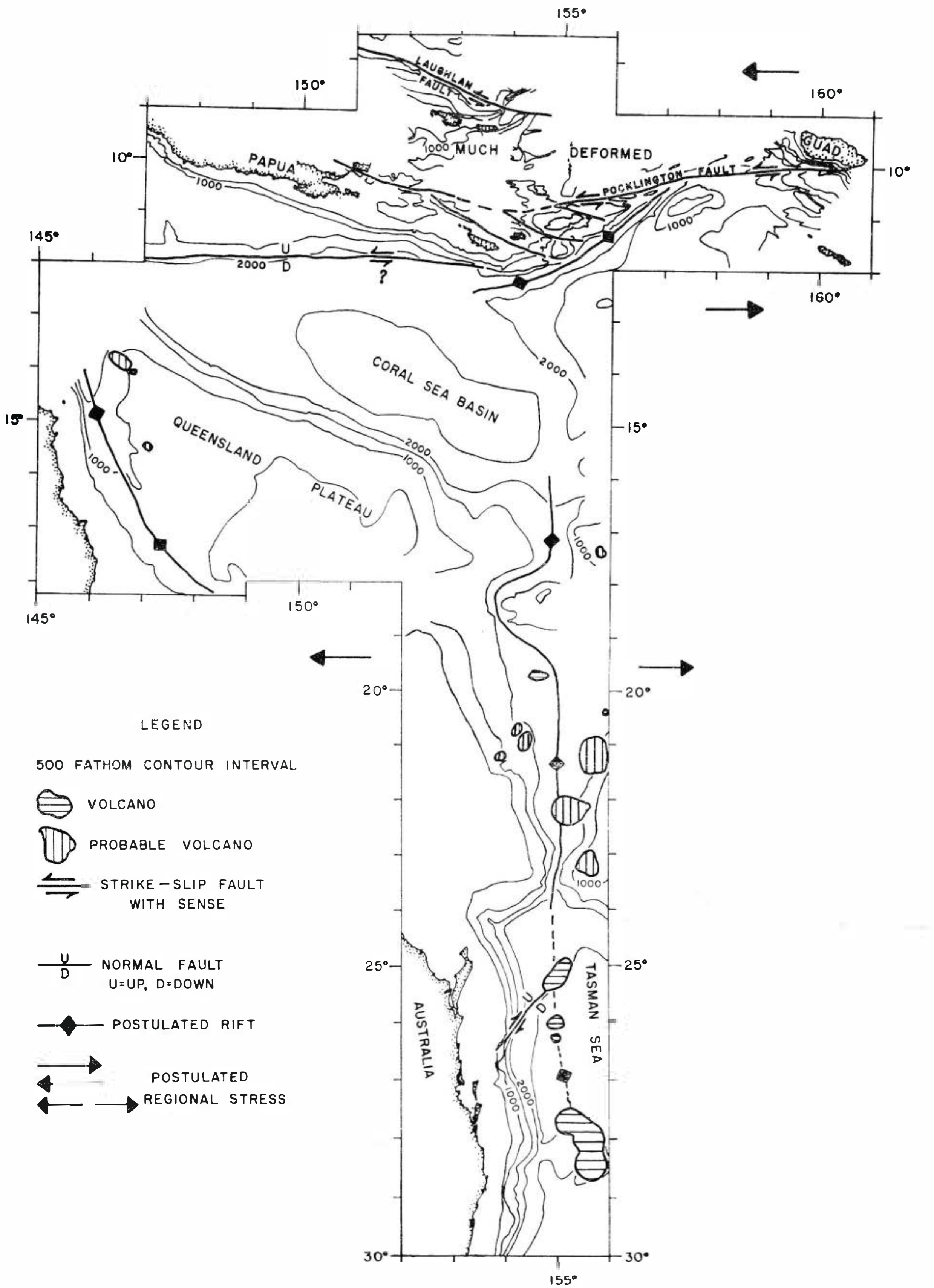


FIG. 13. Structural interpretation of the Australia-Solomon region. Many small geologic structures are not plotted, neither are many large structures of uncertain character. Depths in fathoms corrected for sound velocity.

overlies a pre-Miocene basement. Seamounts NT-1, 2, and 3 would be post-rise because they have shallower depths. The atolls and reefs from Osprey Reef on the north to Cato Island on the south would have slowly built up as the rise subsided. Confirmation of this hypothesis must await evidence showing that the surface of the Queensland Plateau has been eroded.

Coral Sea Basin and the Papua Plateau

The Coral Sea Basin is of true oceanic depth and by inference has a crust of oceanic thickness. The basin now seems to be ringed by continental or sub-continental masses. How could this occur? Did the basin always exist or did it occur by the rifting apart of the masses, or is it only the remainder of a much larger expanse of oceanic structure that has been converted to continental structure? Critical data are non-existent. However, despite the deepness of the basin (over 2,500 fm), the deposition of a considerable thickness of turbidites would be expected. This, added to the present depth, gives a very deep basin. A relatively recent deepening of the basin may have occurred.

The Papua Plateau has an ambiguous relationship to the Coral Sea Basin and a similar ambiguity is present in many other locales. The ambiguity is that the plateau has a depth that, in respect to present concepts, entitles it to neither a continental structure nor a completely oceanic structure. Other similar situations are the Bounty Trough east of South Island, New Zealand, relative to the Pacific Ocean floor and the plateaux off the Sulu Archipelago in the Sulu and Celebes Seas relative to the deep portions of those seas.

Four hypotheses can be developed regarding the origin of the Papua Plateau:

1. The plateau represents turbidite fill behind a ridge running along 12°S lat. that had a sill depth of 1,200 fm. If this is true, the turbidites probably cover a very irregular topography.
2. The plateau was once at the level of the Coral Sea Basin (2,500 fm) and has since been uplifted. This uplift could be caused by one or more of the following:
   (a) Mineralogic phase change in the lower crust and mantle to less dense minerals.
   (b) Thickening of the crust by compressional folds.
   (c) Thickening of the crust due to overthrusting.
3. The Coral Sea Basin was once at the level of the plateau (1,200 fm) and has since been dropped due to mineralogic phase change or tensional dilation of the crust and mantle.
4. The plateau was once at sea level and the present lower continental slope represented the entire slope. Subsequently the plateau has been depressed through mineralogic phase change or tensional dilation.

   The Coral Sea Basin may or may not have taken part in this.

At the present, the writer cannot choose a most likely hypothesis. Facts regarding the plateau that must be ascertained first include the thickness of the crust, the configuration of the upper sediment layers and the top of the basement.

Pocklington Fault

The Bathymetric Chart 1D of the south-eastern Solomon Sea shows a narrow, steep ridge extending from Pocklington Reef to Guadalcanal Island. This ridge is unlikely to be preserved in nature, yet every track shows a high in the position of the ridge. Anomalous depths lie to the north of the ridge. The sea floor to the north is intensely deformed and has diverse morphologic patterns. Only a grid survey on a 5-mile interval could hope to bring out the true pattern of the bathymetry and even that would not elucidate the fine detail already visible on individual sounding lines.

Such a topography could only have formed through regional shear probably coupled with folding and volcanism. The aforementioned ridge is the southern limit of the shearing. Although a zone up to 200 miles wide seems to be involved in the shear, the southern boundary seems to act as a well-defined feature, which is named here the "Pocklington Fault" (fig. 13). To the east, the Pocklington Fault certainly correlates with the seismically active region south and west of Guadalcanal. It further marks the northern end of the South Solomon Trench. To the east of Guadalcanal it correlates with the Cape Johnson Deep (Fisher and Hess, 1963).

Guadalcanal has had a long geologic history. On the island, the Miocene sediments lie on an eroded schistose basement consisting mainly of altered extrusives. The island was land already deeply eroded in pre-Miocene time and the site of deposition during the Miocene. The major NW-SE trending structure of the Solomon Islands was apparently initiated first and has since developed into *en echelon* features. Both NW-SE and east-west trending faults exist on the islands. Interpretation of the publications of the British Solomon Islands Geological Survey indicates extensive east-west faulting on Guadalcanal Island that explains some of the puzzling geological features. The movements along the Pocklington Fault must be largely similar to those mapped on Guadalcanal.

To the west, the Pocklington Fault passes just north of Pocklington Reef and is marked by a prominent scarp. Continuing to the west, it passes up the north side of the Louisiade Archipelago and becomes the fault mentioned in the section on New Guinea Geology. Many large faults splay from this fault zone.

The sense of this fault is left lateral (i.e., the northern side moves west) as evidenced by the offset along the south coast of Guadalcanal, the offset of the 1,500 fm contour north-west of Pocklington Reef, and the observed displacement in Papua. The average displacement is several tens of miles; the displacement of Guadalcanal indicates a shift of 60 n.m. (110 km). The offset of the 1,500 fm contour north-west of Pocklington Reef is roughly 100 n.m. (185 km). The Solomon end and the New Guinea end of the fault are seismically active (Gutenberg and Richter, 1954).

Papua - Solomon Shear Zone

The Pocklington Fault is only an element in a much larger shear zone that at 154°E long. extends from 8°30′S to 12°S lat. (210 n.m. wide) and occupies the whole area of the D'Entrecasteaux Islands and Louisiade Archipelago. The Laughlan Fault on the northern margin which offsets the Woodlark Ridge (see "Southern Solomon Sea") is left-lateral also (fig. 13). In fact the whole shear zone has a left-lateral sense. The entire chain of the Solomon Islands is offset in that sense into segments marked by the individual islands.

The deformation and geologic effects have been very complex. The Pocklington Fault and the Laughlan Fault are relatively simple elements in this zone. The basin between Laughlan Island and Pocklington Reef is extremely irregular. It has apparently been cut into a large number of fault blocks which have been folded especially in an east-west direction. Volcanism has been widespread. The Papua Peninsula is an extension of this zone. The observation (APCP, 1960, p. 112) has been made regarding deformation in the Owen Stanley Mountains that "the country to the north moved westward relative to the country to the south".

The Pocklington Trough is apparently a great gash fracture caused by the crustal block of the Louisiade Archipelago moving relatively more westward than the crustal block which lies to the east. The trough also marks a boundary for deformational intensity. The western block is extremely irregular while the eastern block is low and undulating. Probably much of the lateral deformational strain that deformed the Tagula Island - Rossel Island - Pocklington Reef block has been diverted north by the fracturing in the trough and has been concentrated in the eastern portion of the Pocklington Fault.

The southern boundary of the Papua - Solomon Shear Zone in the Coral Sea is the lower continental slope along 12°S lat. Much of the deformation east of Tagula Island is diverted north to the Pocklington Fault leaving relatively untouched the block on which Rennell Island sits. Little bathymetric information exists east of 156°E long. along 12°S lat. so that the eastward extension of the southern boundary at this latitude is not known.

The left-lateral displacement of the Papua - Solomon Shear Zone can only be estimated. One measure is the apparent segmentation of the Solomon Islands. This is estimated at approximately 300 n.m. (550 km). The Papua - Solomon Shear Zone is only an element in an even larger shear zone. Evidence now under analysis indicates that the shear zone extends north to the Equator.

The deformation has occurred over a long time interval and at a varying rate. The period from the Miocene epoch to the present has been a very active period as seen from the geology of Papua and the Solomon Islands. For New Guinea, the Tertiary sediments lie on Mesozoic limestones and greywackes (David, 1950). Everywhere else in the western equatorial Pacific (Solomons, New Hebrides, Fiji, Tonga), the Tertiary sediments (mainly Miocene and younger) rest on metamorphic or plutonic rocks of undetermined age. Such bedrock implies a long history of deposition, burial, intrusion, uplift, and erosion. The shear certainly extends back to Miocene time and possibly extends back to Early Cretaceous time.

4

SUMMARY OF DISCUSSION

The quiet tectonism of the Tasman Sea - southern Coral Sea contrasts with the active tectonism of the northern Coral Sea - southern Solomon Sea. The most evident tectonic structures of the former are restricted to: (1) Several volcanoes along a line approximately parallel to the continental slope of Australia; (2) troughs (the Cato Trough and Queensland Trough) which may be tensional rifts; and (3) small faults. Sedimentation in the region includes: (1) Pleistocene turbidite deposition in the deep basins of the Tasman and Coral Seas; (2) calcareous ooze and pelagic clay deposition in pelagic regions; and (3) reef formation and erosion and deposition on the shelf. Modern major geologic activity is limited to (a) sand movement along Fraser Island to the edge of the shelf where the sand accumulates and eventually slumps into the Tasman basin, probably as turbidity currents, and (b) coral reef formation. The active Pleistocene turbidite deposition has largely ceased because the modern rise in sea level has forced the rivers to dump their sediment loads near the present shore rather than at the edge of the shelf.

Tectonism of the northern Coral Sea - Solomon Sea region includes: (1) Widespread volcanism; (2) east-west shear; (3) small to large scale folding and faulting (including large vertical movements); (4) earthquake activity; and (5) formation of probable tensional rifts. Sedimentation includes (1) active turbidity current generation presently near Port Moresby and extremely active Pleistocene generation all around New Guinea and (2) pelagic deposition of calcareous ooze, pelagic clay and volcanic ash.

The division between the two regions is about 12°S lat. which marks the southern limit of a broad zone (210 n.m., 400 km wide) of left-lateral shear with a possible 300 n.m. (550 km) displacement. The northern Coral Sea, Solomon Sea, New Guinea, and Solomon Islands take their character from this shear.

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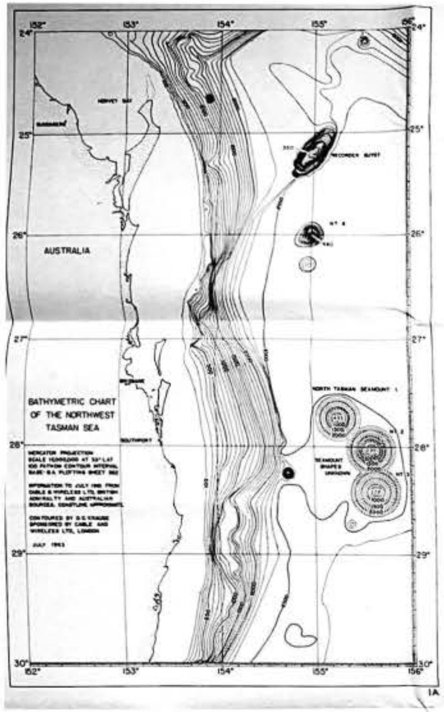
INDEX



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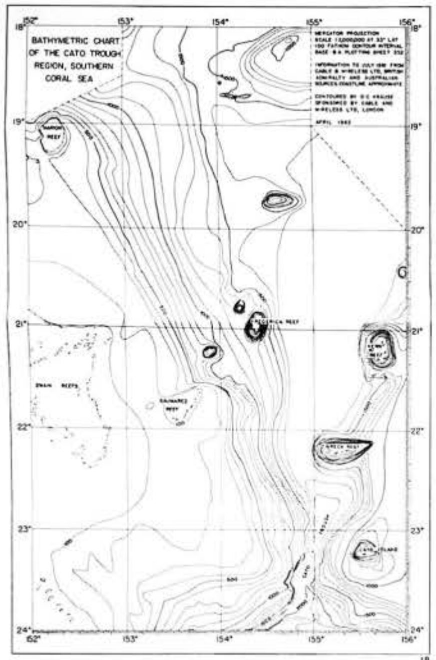

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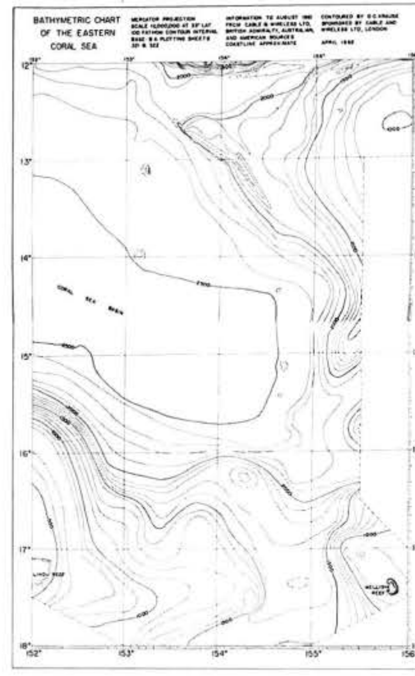

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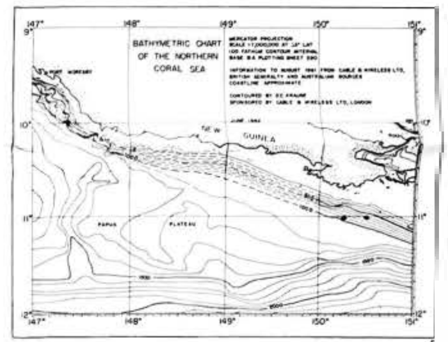

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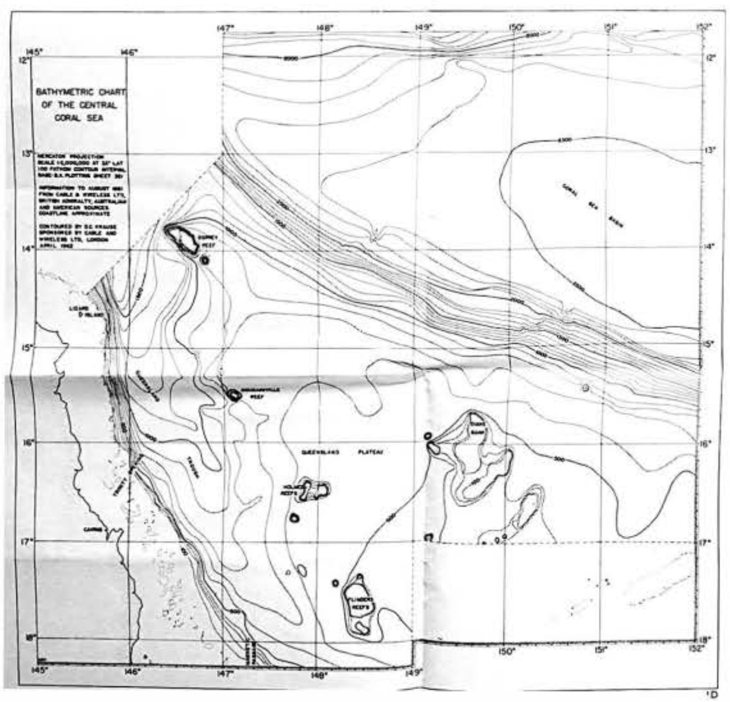

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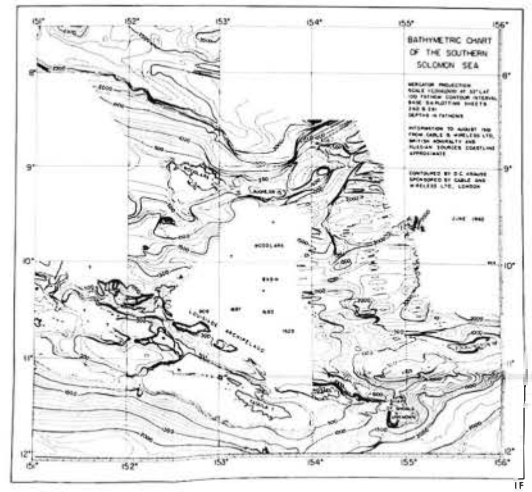

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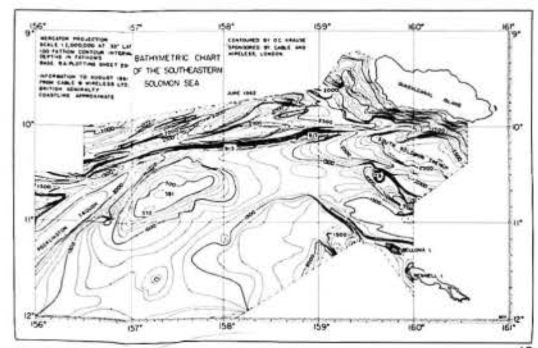
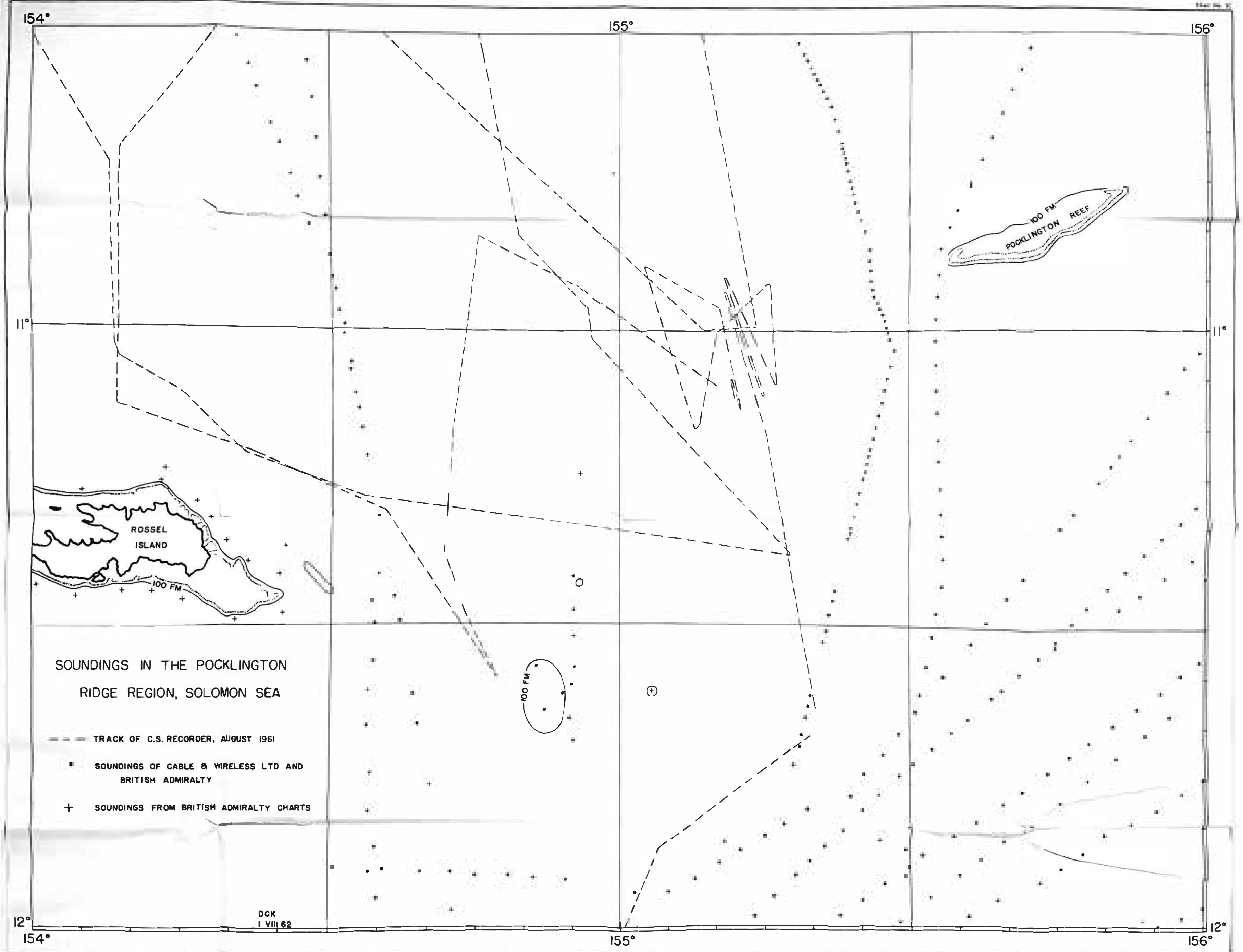


1G

CHARTS IA – IG

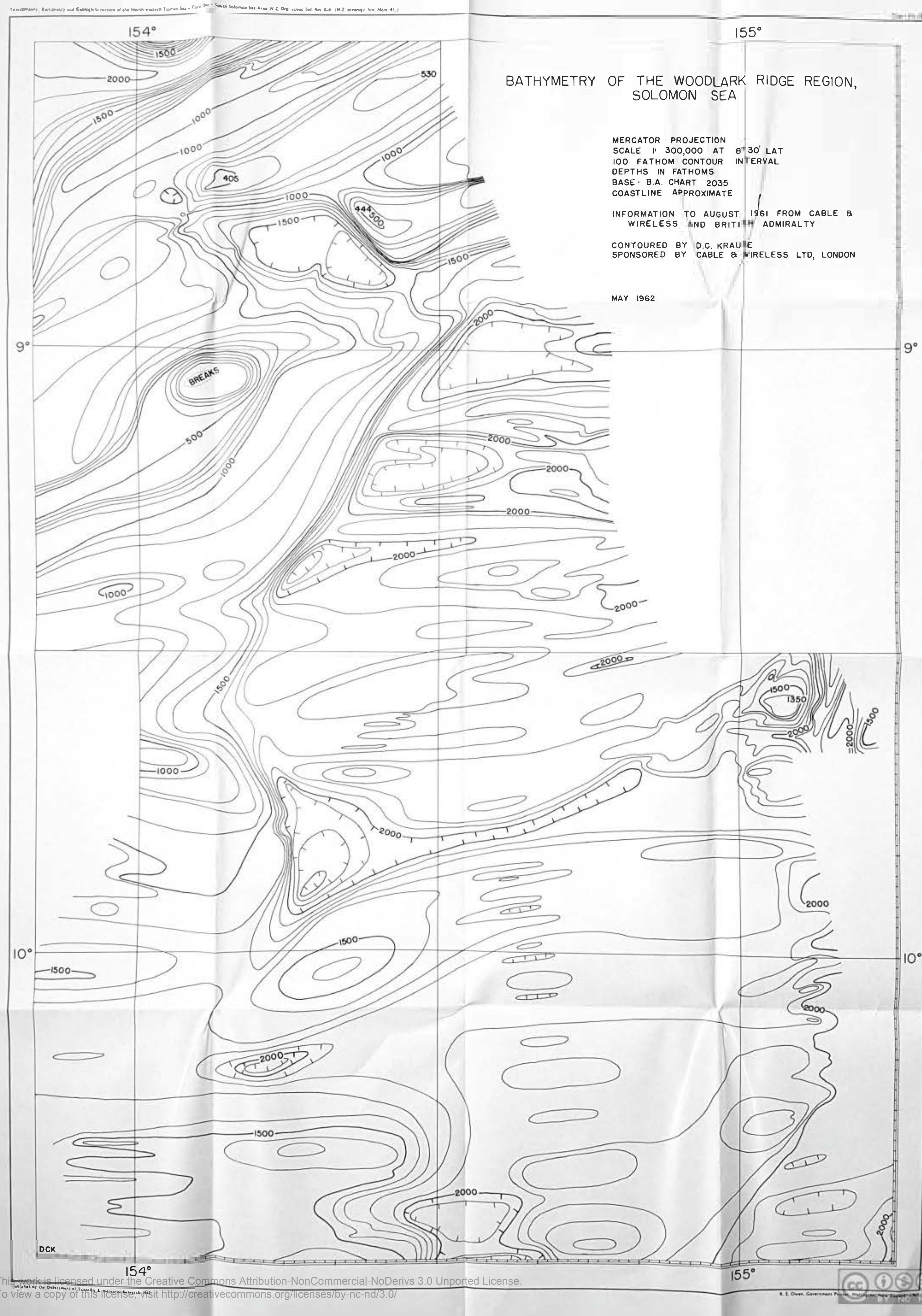
To accompany: Bathymetry and Geologic Structure of the North-western Tasman Sea – Coral Sea – South Solomon Sea Area. *N.Z. Dep. scient. ind. Res. Bull. (N.Z. oceanogr. Inst. Mem. 41.)*

Published by the Department



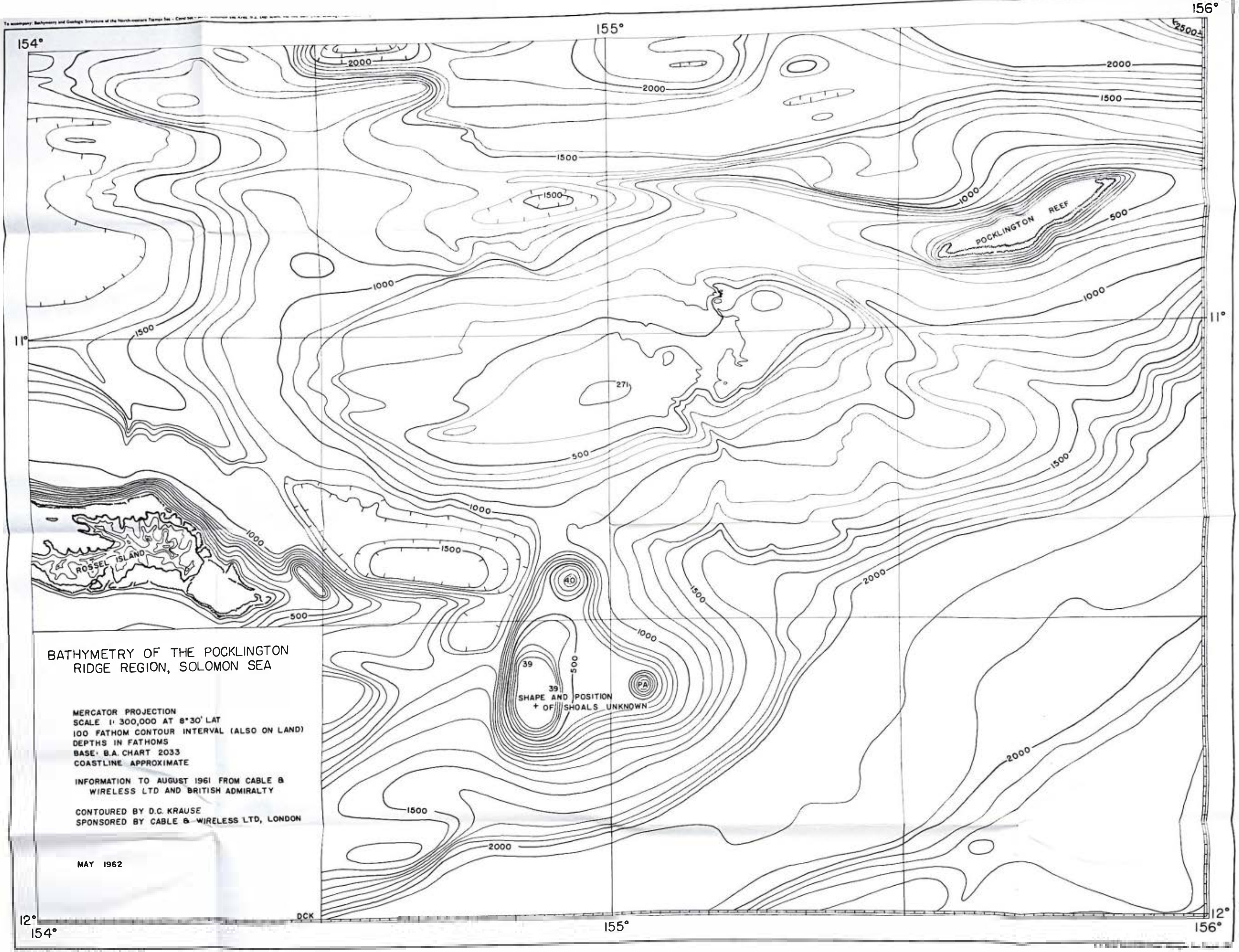
154°
155°
156°
11°
12°
SOUNDINGS IN THE POCKLINGTON
RIDGE REGION, SOLOMON SEA
TRACK OF C.S. RECORDER, AUGUST 1961
SOUNDINGS OF CABLE & WIRELESS LTD AND BRITISH ADMIRALTY
SOUNDINGS FROM BRITISH ADMIRALTY CHARTS
ROSSEL
ISLAND
100 FM
POCKLINGTON REEF
DCK
I VIII 62

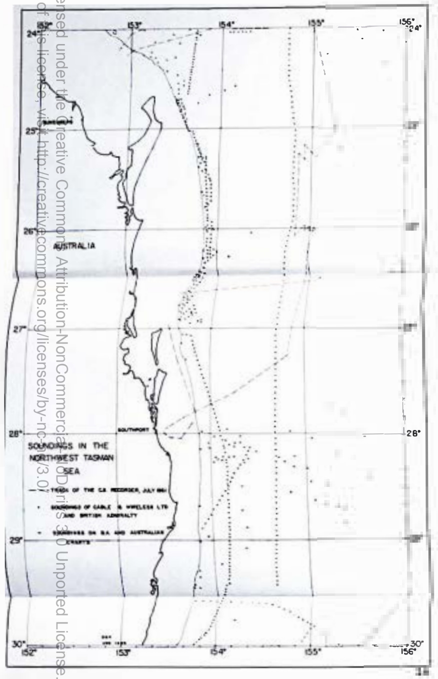
To accompany: Bathymetry and Geologic Structure of the North-western Tasman Sea – Coral Sea – South Solomon Sea Area. N.Z. Dep. scient. ind. Res. Bull. (N.Z. oceanogr. Inst. Mem. 41.)

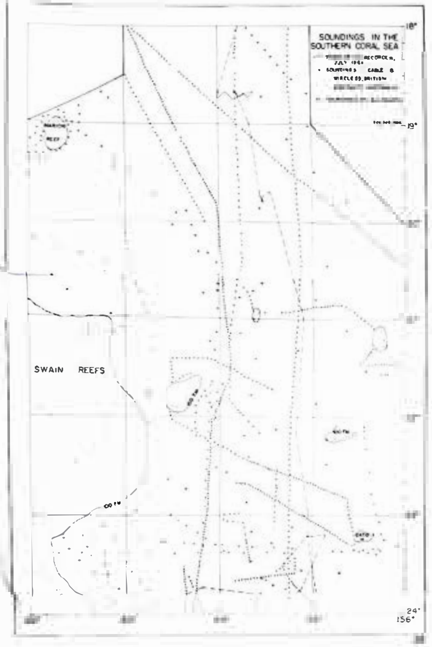


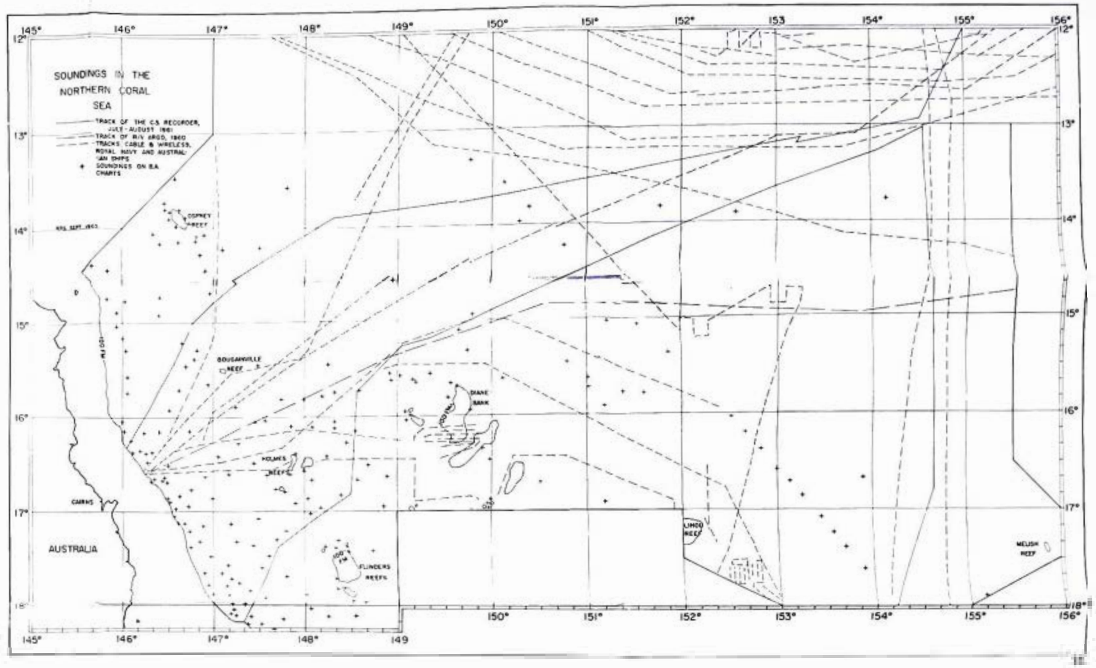
Published by the Department of Scientific & Industrial Research, 1962

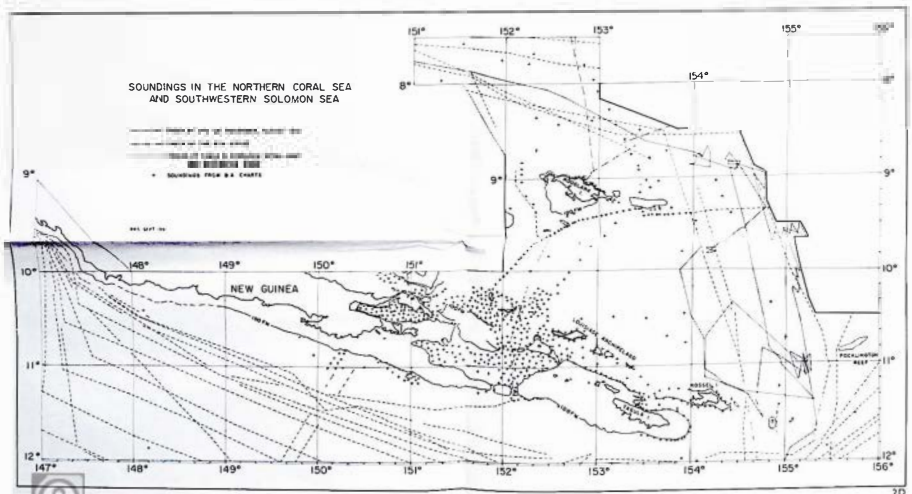
R. E. Owen, Government Printer, Wellington, New Zealand

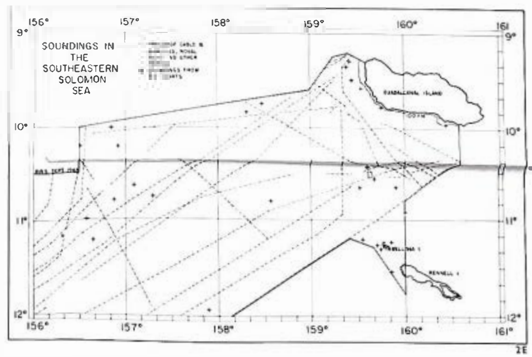

BATHYMETRY OF THE POCKLINGTON RIDGE REGION, SOLOMON SEA
MERCATOR PROJECTION
SCALE 1: 300,000 AT 8°30' LAT
100 FATHOM CONTOUR INTERVAL (ALSO ON LAND)
DEPTHS IN FATHOMS
BASE: B.A. CHART 2033
COASTLINE APPROXIMATE
INFORMATION TO AUGUST 1961 FROM CABLE & WIRELESS LTD AND BRITISH ADMIRALTY
CONTOURED BY D.C. KRAUSE
SPONSORED BY CABLE & WIRELESS LTD, LONDON
MAY 1962
154°
155°
156°
11°
12°
POCKLINGTON REEF
ROSSEL ISLAND
SHAPE AND POSITION OF SHOALS UNKNOWN
PA
271
40
39
2500
2000
1500
1000
500
DCK











CHARTS 2A – 2E

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Published by the Department of Scientific and Industrial Research 1967

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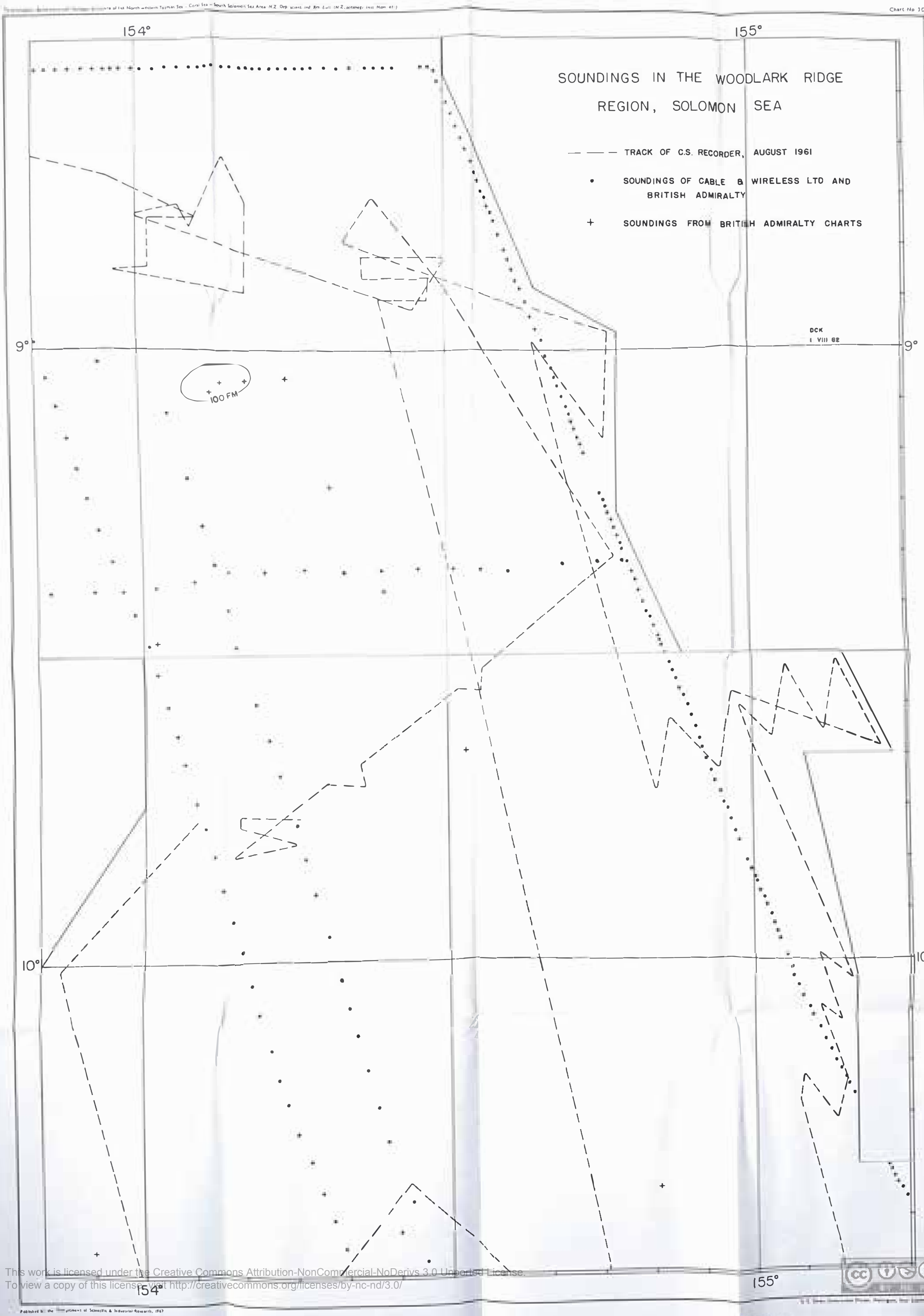

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