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# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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## SHALLOW SEISMIC STRUCTURE OF THE CONTINENTAL SHELF, SOUTH EAST AUSTRALIA



by

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## ABSTRACT

Continuous seismic profiles have been obtained over 3000 km of traverse across the continental shelf and upper slope of southeast Australia between Sugarloaf Point and Gabo Island. Acoustic basement consists of Lower Palaeozoic or Permo-Triassic rocks underlying relatively unconsolidated sediments of Tertiary to Holocene age. The profiles show the basement surface sloping eastwards from the coast to the middle or inner part of the shelf where there is either a ridge (offshore Sydney Basin) or a step (offshore from the Southern Highlands fold belt). This basement ridge or step separates thin or non-existent sedimentary cover to the west from a sequence to the east thickening seawards. Much larger basement highs cross the shelf in the Sugarloaf Point and Shoalwater areas. The former is oriented southeast and the latter southwest. Major basement depressions occur southeast of Newcastle and off Disaster Bay.

In the offshore Sydney Basin, a marked disconformity is identifiable in the sedimentary sequence above seismic basement: it may be due to erosion in the lower to middle Pliocene, and if so the rate of sedimentation since has been approximately 2cm/1000 years.

## INTRODUCTION

During a geological reconnaissance of the southeast Australian continental shelf (February - May 1972), 3000 km of seismic reflection profiles were obtained across the shelf and upper continental slope between Sugarloaf Point, 32°30'S, and Gabo Island, 37°40'S. The area covers 700 km of continental margin, along which the width of the continental shelf ranges from 17 to 72 km. A brief description of the structure based on a preliminary appraisal of the seismic data has already been given by Davies & Marshall (1972). Information on the continental slope has been obtained from the deep seismic traverses of Survey 12 of the multisensor geophysical survey of the continental margin carried out by Compagnie Générale de Géophysique for the Bureau of Mineral Resources.

The shallow seismic profiling system consisted of a 3-electrode Sparkarray sound source coupled to an Edgerton Germehausen & Grier Type 232A power supply unit, 2000-joule capacitor bank Type 233, and trigger unit model 231. Energy levels of 500, 1000, and 2000 joules were employed. The Sparkarray was modified for use in shallow water by means of bubble suppressors consisting of rubber hose fitted over the electrodes. A 7-element Aquatronics single channel hydrophone and E.P.C. and Ocean Sonics Recorders were used for receiving and recording acoustic signals.

## PREVIOUS WORK

A description of the structure in the area offshore from the Sydney Basin has been published by Kamerling (1966). He concluded that acoustic basement could be traced across the continental shelf; that it dips to the east, and that it underlies a sequence of Tertiary to Pleistocene sediments up to 500 m thick. He also described a depression in the basement and the accompanying local thickening of the unconsolidated sediments which he suggested may indicate the Pleistocene course of the Hunter River.

Phipps (1963, 1966, 1967), using echosounder data showing the morphology of the shelf, postulated late Pleistocene tectonic warping of the continental shelf about two structural highs, one to the east of Sugarloaf Point, and one to the east of Jervis Bay, which Gill & Hopley (1972) regard as indicating that eastern Australia has undergone isostatic readjustment, the movement being of regional significance. Phipps (in Thom et al., 1972) later revised his estimate of the age of the warping, and suggested that it could have occurred at any time from the Tertiary to the Pleistocene. Connolly (1969) published a synthesis of marine data outlining the morphological variation on the western Tasman Sea floor, but said little about the continental shelf. Hayes & Ringis (1973) suggested an age of 60–80 m.y. for the opening of the central Tasman sea; they stated that the greatest thicknesses of sediment occur next to the Australian continental margin, and that the sediment load has aided in the depression and warping of oceanic basement.

SHALLOW STRUCTURE - SUGARLOAF POINT TO GABO ISLAND

In Figures 2 - 6, 11, and 12, reflectors numbered S1 and S2 are shown in most east-west sections. S1 is a major unconformity within the sedimentary sequence. It can be traced from about the mid-shelf position across the outer shelf in each east-west section between Sugarloaf Point and latitude 35°10'S. It is the only major unconformity to occur within the wedge of unconsolidated sediments forming the middle and outer shelf in this area.

S2 represents a marked contrast between the overlying sediments and consolidated rock below. It can be traced westwards into the coastal cliffs; a reflector showing similar characteristics appears in all the sections studied and it is likely to form the basement surface on which the shelf sediment sequence has been built. It is thought to represent the bedrock surface of Permo-Triassic rocks off the Sydney Basin, and Lower Palaeozoic sediments, metamorphics, and intrusives to the south.

THE S1 REFLECTOR

The S1 reflector is a promenent unconformity present in almost all sections between Sugarloaf Point and Latitude 35°10'S (Figs 3A, B, C; 4A, B, C, D, E; 5A, B; 11B, C; 12B). It is not certain that it is the same unconformity in each section because it cannot be identified in the tie lines, which are essentially strike sections; however, it displays broadly similar characteristics throughout the area, and it is reasonable to postulate that it is a single event.

S1 truncates the underlying sediments and slopes to the east. In places, it shows a marked downward inflection near the present shelf break, above a similar downward inflection in basement (Figs, 3A, B). S1 crops out on the upper slope in one place (Fig. 4E) and it is presumed to do so in others (Figs 5B, 11C); it is truncated in the middle or inner shelf by the westward rising basement surface (Figs 3A, B, C; 4A, B, C, D, E; 5A, B; 11B, C; 12B). S1 divides the sedimentary pile above basement into two distinct sections. Structures within the lower part of the lower sequence appear to transgress the basement surface; those in the upper sequence indicate that the sediments prograde on S1.

To the north of the area described (Davies, in prep.) and to the south of Latitude 35°20'S (Figs 5C, D; 6A, B; 11A) more than one reflector showing unconformable relations with underlying reflectors occur above basement. Which one correlates with S1, therefore, is not known.

THE S2 REFLECTOR

S2 represents a marked contrast between the sediments forming the shelf wedge, and consolidated sediments, volcanics, and metamorphics representing the offshore extension of the onshore geology.

In most sections examined very little seismic penetration below S2 was achieved, except for a few profiles between Sydney and Port Stephens (Figs 3B, C; 11D; 12E). These show gentle dips in basement of $2^{\circ}$–$9^{\circ}$, mostly to the west, with some very gentle folding. This is consistent with the onshore geology near these sections, which consists of gently dipping Permo-Triassic sediments.

Throughout the rest of the area, the lack of penetration below S2 make it impossible to define the offshore junction of the Permian-Triassic of the Sydney Basin and the Palaeozoic rocks of the Southern Fold Belt.

The east-west sections depicted in Figures 2 - 6 show marked variations in the attitude of the S2 reflector. In the simplest case, S2 dips to the east at 0.5 - 1.0$^{o}$ (Figs 2B; 4D; 11B). In many places, however, a basement ridge, or ridges (Figs 2A, C; 3A, B, C; 4A, C, E; 5A; 12A, F) occur in about the mid-shelf position. These structures separate the inner part of the shelf, where basement is very shallow and sediments thin (Figs 12A, F) from the outer part, where the basement dips to the east at up to 2$^{o}$ under a thickening wedge of sediments (Figs 11B, 12A, B, and F). Sediments overlying the ridge are thin or absent; water depths over the ridge vary from 100 - 110m. In other sections there is no basement ridge, but a basement step occurs in approximately the same position (Figs 5B, C, D; 12C, D). The step represents a change in slope of up to 10$^{o}$, and separates the inner part of the shelf where basement is shallow and sediments thin from the outer shelf where basement depth and sediment thickness increase eastwards. The mid-shelf basement ridge system occurs only north of latitude 35$^{o}$10'S and the mid-shelf step system only south of this latitude.

A rise in basement is also present beneath the shelf break, in a few sections (Figs 2A, 6D). Sediments may be thin over the rise (Fig.2A) or may give marked indications of a basement rise by draping (Fig.6D).

In most of the shallow seismic sections, basement surface is obscured by multiples below 600 ms reflection time. However, in the vicinity of the shelf edge, S2 can be followed in the deep seismic sections of Survey 12 of the BMR continental margin study. Every section examined (lines I - VII Fig.1) showed a major inflection of S2 under the upper continental slope. S2 crops out in places on the continental slope at depths ranging from 1300 to 1700 m.

The structure contour map (Fig.7) drawn on S2 shows the broad variations in its attitude. The eastward slope of basement is steeper to the south than to the north of Jervis Bay. Over much of the area between Shoalhaven

Bight and Sydney S2 stands at a fairly uniform depth of 500 ms at the shelf edge. Northeast of Sydney major basement undulations are shown by all contours from 200 - 600 ms, especially southeast of Port Stephens and Sugarloaf Point, where basement highs and lows are indicated. East of Shoalhaven Bight, prominent eastward bulges of the 200 and 300 ms contours coincide with the more general eastward bulge of the 500 ms contour; in this area, basement is shallower on the outer shelf than in areas north and south.

To the south of Jervis Bay basement slopes more steeply to the east, and becomes progressively deeper on the outer shelf in a southerly direction. This is especially noticeable to the south of Montagu Island, where basement is deeper closer to the coast than in areas to the north. In addition, to the southeast of Disaster Bay, a major basement low is indicated by the contour configuration. Isopachs of the sedimentary sequence overlying S2 (Fig. 8) show that the thickest sediments occur in this area, and also that a thick sequence occurs in the basement lows east of Newcastle. Between Jervis Bay and Sydney, the sediments obtain a maximum thickness of 200 - 250 m at the outer edge of the shelf.

The mid-shelf basement ridge coincides with the zone of marked sediment thinning shown in Figure 8. Except in the Newcastle area, no isopachs have been drawn to the west of the zone of sediment thinning, because of very rapid variations in sediment thickness in the range 0 - 50 m. The basement step is well shown in Figure 7 by the very close spacing of the 100 - 300 ms contours northeast of Eden. The map also shows that the contours trend towards the coast southwards from near Montagu Island. Sections across the close inshore basement step are shown in Figures 12C, D. The distribution of all the features described above is shown in Figure 9.

THE MIDSHELF BASEMENT RIDGE AND STEP

Both ridge and step separate an inner shelf region, where sediments are thin (0-60m), from an outer shelf region, where sediments thicken eastwards. These structures could have formed in three ways: they may be the result of erosional processes, and may therefore represent a subaerial surface developed before the continental margin was drowned; they may be tectonic features initiated by the original continental break-up, or formed later by differential subsidence of the continental shelf under the combined load of increasing sedimentary thickness and overlying water column; or they may be the result of tectonic modification of a previously eroded surface.

Figures 7 and 11D provide some evidence that erosional processes affected the formation of the basement ridge system. Where major river systems occur onshore, northeast seismic sections show major basement depressions offshore. These may be channels representing the eastward extensions of such river systems. Figure 11D shows the feature which occurs offshore from the Hunter River; the limited number of available sections indicates that the depression trends WNW across the basement ridge. The ridge could represent a particularly resistant Triassic lithology, either sedimentary or volcanic, or possibly the boundary zone of Triassic/Permian rocks.

There is little evidence to support an erosional origin for the basement step system. However, both ridge and step may owe their origin to faulting associated with the rifting of the Tasman Basin, or to warping and step-faulting at a later time under the combined loads of sediment and water on the outer shelf.

THE PORT STEPHENS/SUGARLOAF POINT HIGH AND THE NEWCASTLE LOWS

Basement lows are present to the southeast of Newcastle, and to the southeast of Port Stephens (Fig. 7). The two are separated by a basement high, but a more prominent high occurs to the east and ESE of Port Stephens. The larger high is here informally termed the Port Stephens/Sugarloaf Point High, and the lows are termed the Newcastle Lows. It is possible that the Port Stephens/Sugarloaf Point High coincides with the southeast extension of the southern part of the New England Massif (Fig. 9), which is bounded on the south by the Mooki-Hunter fault system. Just as the Mooki-Hunter fault system, utilized by the Hunter River, forms a depression bordering the New England Massif, so offshore a deep basement depression (Newcastle Low) borders the Port Stephens/ Sugarloaf Point High. The offshore depression aligns with a possible southeast extension of the Mooki-Hunter fault system.

THE SHOALHAVEN BIGHT/JERVIS BAY HIGH

Phipps (1966, 1967) suggested that a basement high trends southeast across the shelf near Jervis Bay. Evidence has already been presented indicating that to the east of Shoalhaven Bight, basement is shallower on the outer shelf than in areas to the north and south. Corroborative evidence is shown by the bathymetry in the Jervis Bay area (Fig. 10), which shows a series of topographic highs trending to the northeast.

THE DISASTER BAY LOW

The structure contour map (Fig. 7) shows a large basement depression to the southeast of Disaster Bay, which trends southeast. It aligns with the projected extension of the Berridale Fault (Lambert & White, 1965), which according to these authors is 'one of the most significant major structures of the Snowy Mountains of New South Wales'. In this area, therefore, as in the Newcastle area, the basement structure may be related to a major fault system which has been active since the Late Silurian and Early Devonian, during the Tertiary, and possibly in the Holocene.

DISCUSSION

Many problems remain unsolved in spite of the seismic data presented above. Such problems include the formation and post-formational development of the S2 and S1 reflectors, especially that of S2 after continental break up, and also the relative ages of both reflectors. Deep cores would help enormously in solving such problems, but until these are available, published work in other areas offers the only guide towards an interpretation.

Daly (1925), Lawson (1932), Bourcart 1938, Veatch & Smith (1939), and Jesson (1943) have all indicated that continental shelves have subsided eperiogenically. Dietz (1952) and Curray (1969) consider that the wedge of sediments that forms the present-day shelves forms as a result of the close interplay of subsidence and sedimentation. Van Andel & Calvert (1971) propose a model of shelf sedimentation involving transgressive onlap of sediment onto an erosion surface, followed by regressive progradation terminated by subsidence. Falvey (1974) described Atlantic type shelves as typified by subsidence of basement during the development of a transgressive sediment sequence, followed by a regressive progradative sedimentary phase during which subsidence would diminish exponentially, and cites the east Australian shelf as a typical example. Rona (1973) relates shelf subsidence to major episodes of mid-ocean rift development. Bloom (1967), Walcott (1972), and Chappell (1974a, b) conclude that growing continental shelves have subsided as a consequence of major Quaternary transgressions, while Chappell (op. cit.) states that subsidence will diminish towards the coast, that the axis of tilt should be recognizable, and that between this area and the coast, a zone of basement depression should occur as the result of movements compensating for the tilting of the outer shelf. He further states that the hinge-line of tilting would migrate on to the continent wherever continental shelves are narrow.

Many of the features described by the above authors are revealed in our seismic sections. These include:

a. A wedge of sediments thickening seawards is everywhere present.

b. The basal part of the sediment sequence is transgressive on basement (Figs 2C, 11B, 12A, B, F) in the manner described by Van Andel & Calvert (1971) and Falvey (1974).

c. Above the transgressive sequence, a prograding sequence is recognizable (Fig. 12B), as suggested in the model of Van Andel & Calvert (1971).

d. A mid to inner shelf area where sediments are thin or absent is usually recognizable (Figs 12A, B, C, D, F); this may correspond with Chappell's (1974b) hinge-line of tilting.

e. On the widest part of the shelf, basement is depressed in the near-shore zone and is overlain by more than 50 m of sediment (Fig. 8); a section across this area is shown in Figure 2C.

It may correspond to Chappell's zone of basement depression immediately behind his hinge line.

The conclusion follows that on the east Australian shelf sediment has accumulated on a subsiding basement, which hinges about a recognizable zone in the mid to inner shelf area. Sedimentation has occurred during transgressive and regressive prograding cycles, which were concluded by a period of erosion (S1). Further sedimentation has occurred, principally as a further progradative unit on the S1 surface (Figs. 12B, C; 13E).

There is no direct evidence of the age of basement or of the overlying sediments. Hayes & Ringis (1973) conclude that the central Tasman Sea formed by a process of sea floor spreading between 60 and 80 m.y. ago. If this is true, the continental edge probably forms one side of the original rift, which opened in the Late Cretaceous or Early Tertiary. Rona (1973) calculates average sedimentation rates of 2 cm/1000 years for the shelves of eastern USA and northwest Africa. Such values if extended to the southeast Australian shelf would place the first marine transgression in the Eocene, but such an estimate must be highly speculative, particularly in view of the unknown duration of gaps in the succession. Browne (1969) describes Eocene uplift of a Cretaceous peneplain in the onshore. These movements may well be complimentary to the general subsidence accompanying rifting and sea floor spreading, S2 being the offshore representative of the Cretaceous peneplain.

The age of S1 is unknown, but a tentative estimate can be made by comparison with the east Gippsland section, where unconformities occur in the Upper Cretaceous, the Eocene, and the lower or middle Pliocene. The Eocene unconformity is at a depth of 1500 m in the section, which is about 10 times the depth of S1 in the area studied. Middle and lower Pliocene unconformities have been reported at 61m and 91m in the Bairnsdale No.1 and Duck Bay No.1 well. Taylor (1966) also reports shallowing of the upper Miocene sequence in the Gippsland No.1 well, which implies a possible late Miocene or early Pliocene unconformity, at a depth shallower than 122 m sediment thickness. James & Evans (1971) and Griffith & Hodgson (1971) report a maximum Pliocene to Holocene sequence of 304 m, in the Gippsland Basin. The maximum sediment thickness above S1 at the continental edge in the present study area ranges from 120 to 212 m. These figures place the S1 surface in the same depth range as the middle to lower Pliocene unconformity in Gippsland. If S1 is of this age, then the rate of sedimentation above S1 in areas unaffected by the Shoalhaven - Jervis Bay High or the Newcastle Lows is 2.0 - 2.5 cm/1000 years. This is very close to the sedimentation rates calculated by Rona (1973) for the whole of the sediment section on the eastern USA and northwest African shelves. It is, however, faster than the rates calculated by the same author for the Quaternary parts of the sections, but is much slower than the sedimentation rates on the continental shelf of New Zealand (Lewis, 1973) where 150 - 300 cm/1000 years are suggested.

# REFERENCES


BLOOM, A.L., 1967: Pleistocene shorelines: A new test of isostasy: Bull. geol. Soc. Am., 78, pp 1477-1493.

BOURCART, J., 1938: Le marge continentale: essai sue les regressions et transgressions marines. Bull. Soc. geol. Franc., Ser. 5, 8, pp 393-474.

BROWNE, W.R., 1969: Geomorphology; in Packham, G.H., (Ed.) The geology of New South Wales. J. geol. Soc. Aust., 16 (1), p. 654.

CONOLLY, J.R., 1969: Western Tasman Sea floor. N.Z.J. Geol. Geophys., 12, pp 310-343.

CHAPPELL, J., 1974a: Upper mantle rheology in a tectonic region. J. geophys. Res., 79, pp 390-98.

CHAPPELL, J., 1974b: Glacio and hydro isostasy with loads varying spacially and temporarily on a layered visco-elastic earth. Quatern. Res. (in press).

CURRAY, J.R. 1969: History of continental shelves; in The new concepts of continental margin sedimentation. A.G.I. Short Course Lecture Notes, 7-9 Nov., Philadelphia.

DALY, R.A., 1925: Pleistocene changes of level. Am. J. Sci. 10, pp 281-313.

DAVIES, P.J., & MARSHALL, J.F., 1972: BMR marine geology cruise in the Tasman Sea and Bass Strait. Bur. Miner. Resour. Aust. Rec. 1972/93 (unpubl.).

DIETZ, R.S., 1952: Geomorphic evolution of continental terrace (continental shelf and slope). Bull. Am. Assoc. Petrol. Geol., 36, pp 1802-1820.

FALVEY, D., 1974: The development of continental margins in plate tectonic theory. APEA J., 14, pp 95-106.

GRIFFITH, B.R., & HODGSON, E.A., 1971: Offshore Gippsland Basin fields. APEA J., 11 (1), pp 85-89.

GILL, E.D., & HOPLEY, D., 1972: Holocene sea levels in eastern Australia - a discussion. Mar. Geol., 12, pp 223-233.

HAYES, D.E., & RINGIS, J., 1973: Seafloor spreading in the Tasman Sea. Nature, 243, pp 454-458.

JAMES, E.A., & EVANS, P.R., 1971: The stratigraphy of the offshore Gippsland Basin. APEA J. 11 (1), pp 71-74.

JESSON, O., 1943: Die Randschwellen der Kontinente. Petermanns geogr. Mitt., ERG. No. 241.

KAMERLING, P., 1966: Sydney Basin Offshore. APEA J. pp 76-79.

LAMBERT, I.B., & WHITE, A.J.R., 1965: The Berridale wrench fault: A major structure in the Snowy Mountains of New South Wales. J. geol. Soc. Aust., 12, pp 25-34.

LAWSON, A.C., 1932: Insular arcs, foredeeps, and geosynclinal seas of the Asiatic coast. Bull. geol. Soc. Am. 43, pp 353-381.

LEWIS, K.B., 1973: Erosion and deposition on a tilting continental shelf during Quaternary oscillations of sea level. N.Z.J. geol. Geophys., 16, pp 281-301.

PHIPPS, C.V.G., 1963: Topography and sedimentation of the continental shelf and slope between Sydney and Montagu Island, N.S.W. Aust. Oil Gas J. 12, pp 40-46.

PHIPPS, C.V.G., 1966: Evidence of Pleistocene warping of the New South Wales continental shelf. Geol. Surv. Can. Pap. 66-15, pp 280-93.

PHIPPS, C.V.G., 1967: The character and evolution of the Australian continental shelf. APEA J. 7 (2), pp 44-49.

RONA, P.A., 1973: Relations between rates of sediment accumulation on continental shelves, sea-floor spreading, and eustacy inferred from the central north Atlantic. Bull. geol. Soc. Am., 84, pp 2851-2872.

TAYLOR, D.J., 1966: Esso Gippsland Shelf No.1: The mid-Tertiary Foraminiferal sequence: Bur. Miner. Resour. Aust. Petrol. Search Subs. Acts. Publ., 76, pp 31-4.

THOM, B.G., HAILS, J.R., MARTIN, A.R.H., and PHIPPS, C.V.G., 1972: Postglacial sea levels in eastern Australia - a reply. Mar. Geol. 12, pp 233-242.

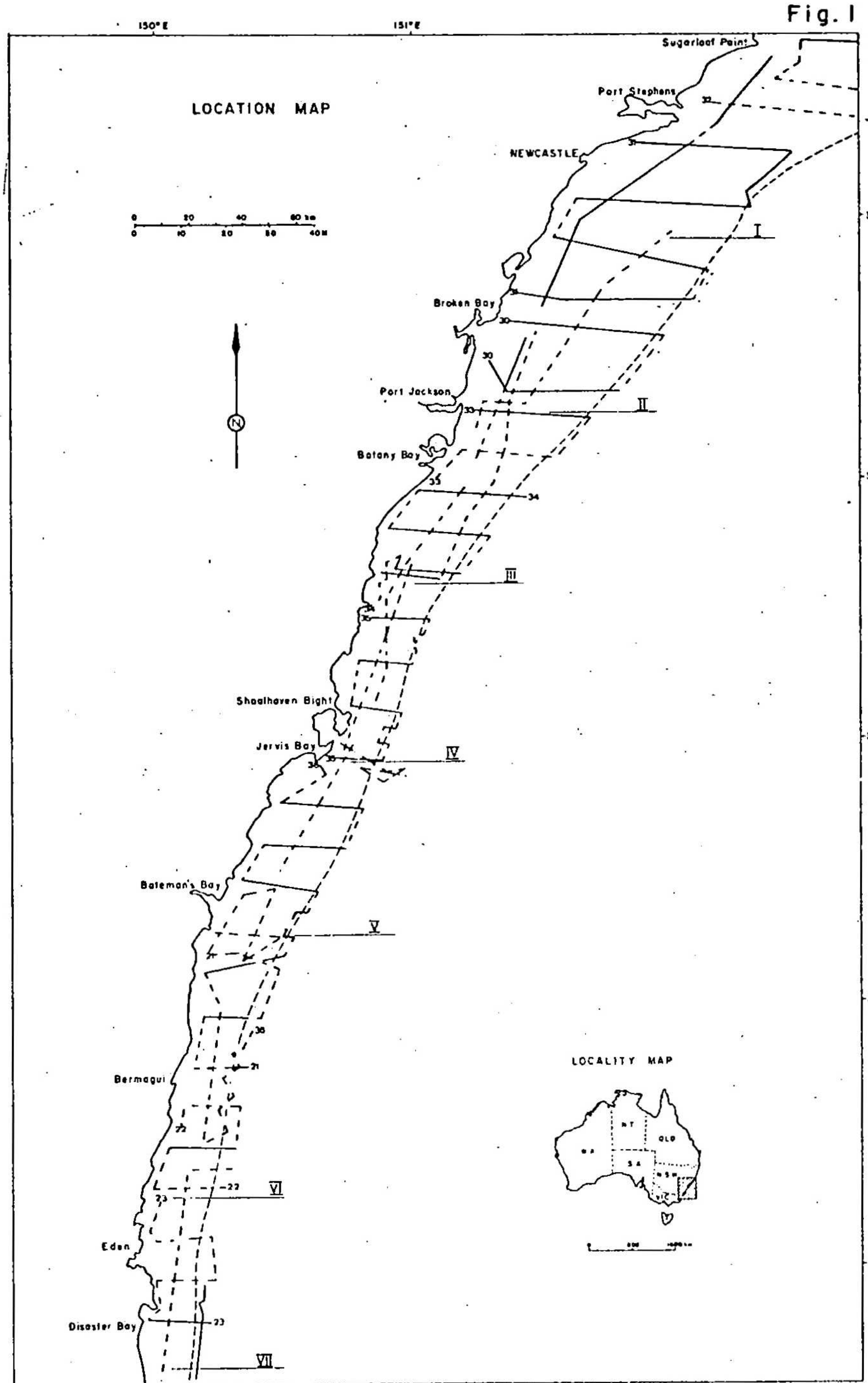
VAN ANDEL, J.H. & CALVERT, S.E., 1971: Evolution of sediment wedge, Walvis Shelf, south west Africa. J. Geol., 79, pp 585-602.

VEATCH, A.C. & SMITH, P.A., 1939: Atlantic submarine valleys of the United States and the Congo submarine valley: Geol. Soc. Am. spec. Pap. 7, 101 p.

WALCOTT, R.I., 1972: Past sea levels, Eustasy and deformation of the earth. Quatern. Res., 2, pp 1-14.

FIG. 1. Location of the area studied showing the seismic coverage. Roman numerals refer to selected seismic sections from the multisensor geophysical survey of the continental margin.

Fig. I




To accompany Record 1974/66

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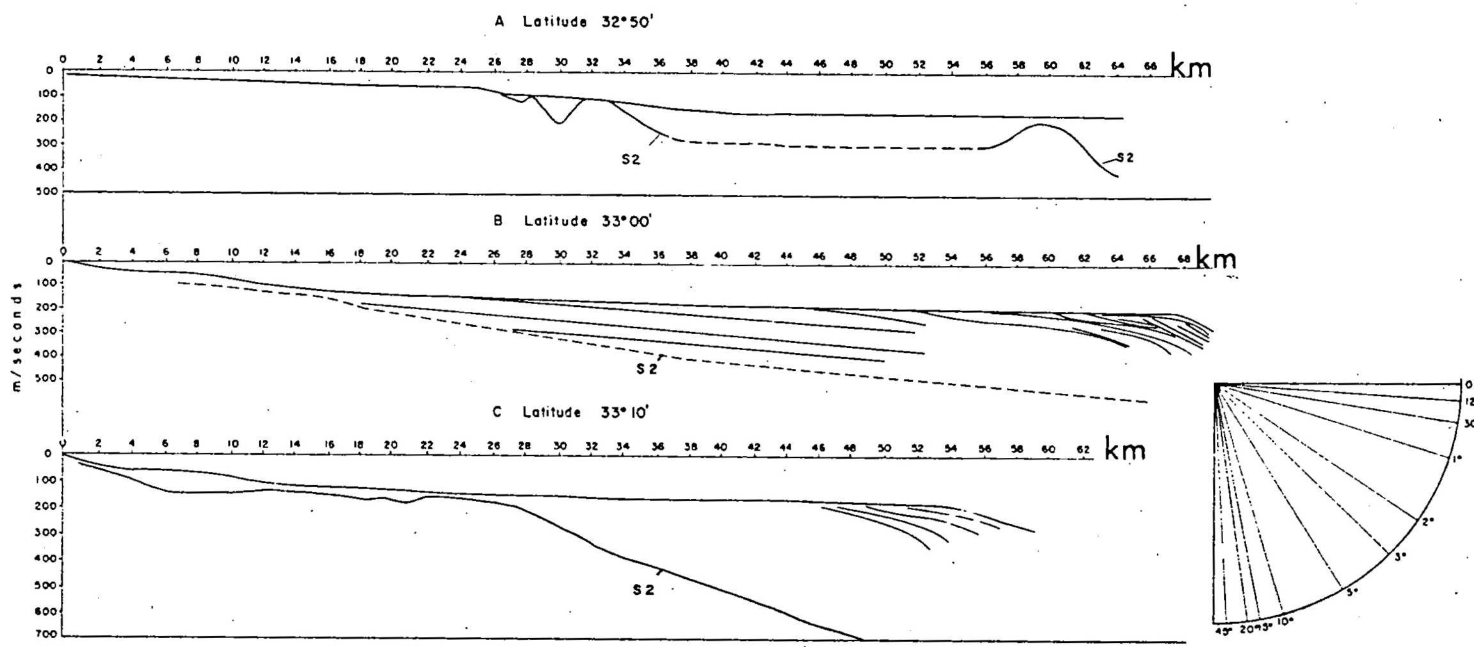
FIG. 2. Line Drawings of seismic sections across the continental shelf between Latitudes 32° 50' S and 33° 10' S.




To accompany Record 1974/66

Aus 6/199

Fig. 2

FIG. 3. Line Drawings of seismic sections across the continental shelf between Latitudes $33^{\circ}$ 28' S and $33^{\circ}$ 50' S.

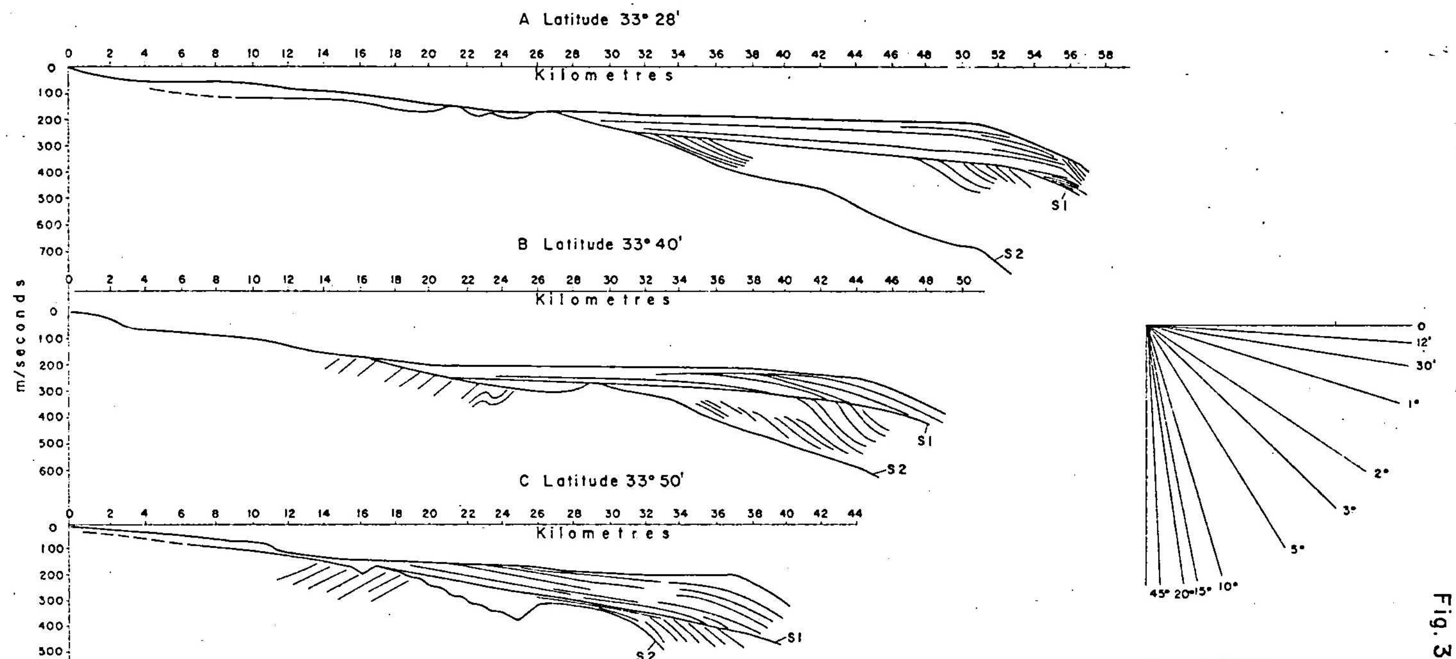



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Fig. 3

FIG. 4. Line Drawings of seismic sections across the continental shelf between Latitudes $34^{\circ}$ 12' S and $34^{\circ}$ 50' S.

Fig. 4

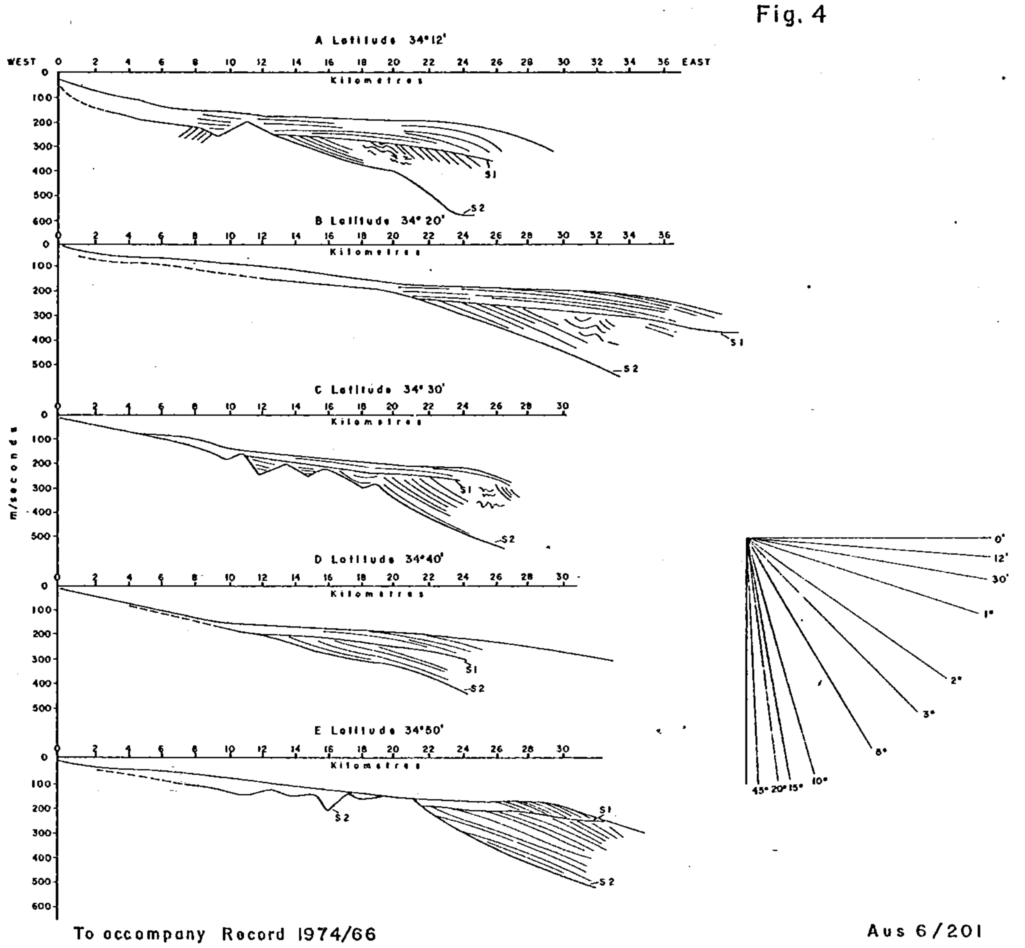


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FIG. 5. Line Drawings of seismic sections across the continental shelf between Latitudes $35^{\circ}$ 00' S and $35^{\circ}$ 30' S.

To accompany Record 1974/66

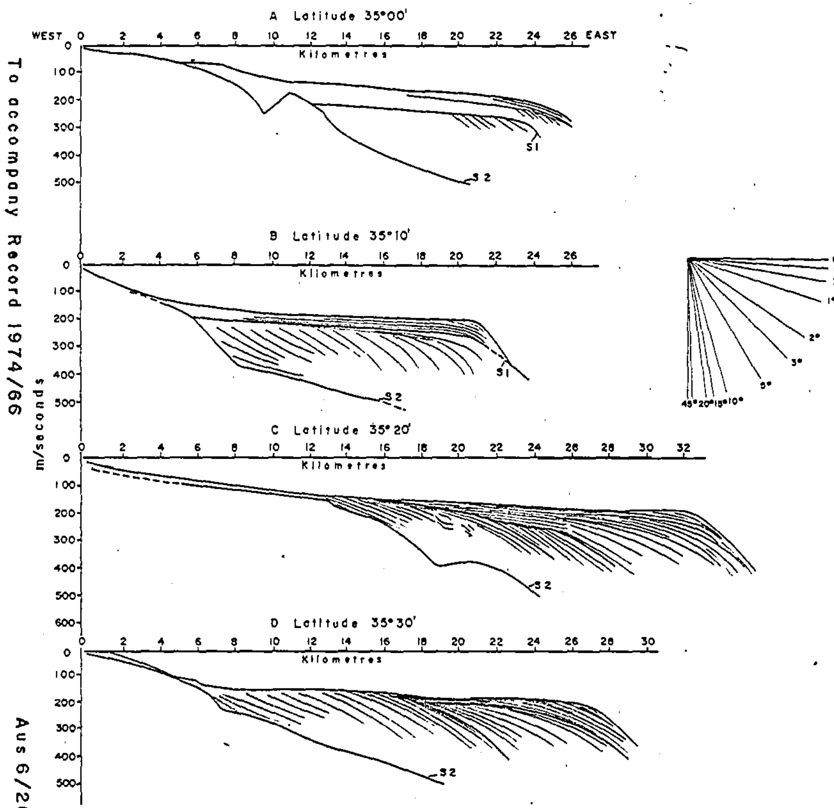


Fig. 5

Aus 6/202

FIG. 6. Line Drawings of seismic sections across the continental shelf between Latitudes $35^{o}$ 50' S and $36^{o}$ 40' S.

Fig. 6

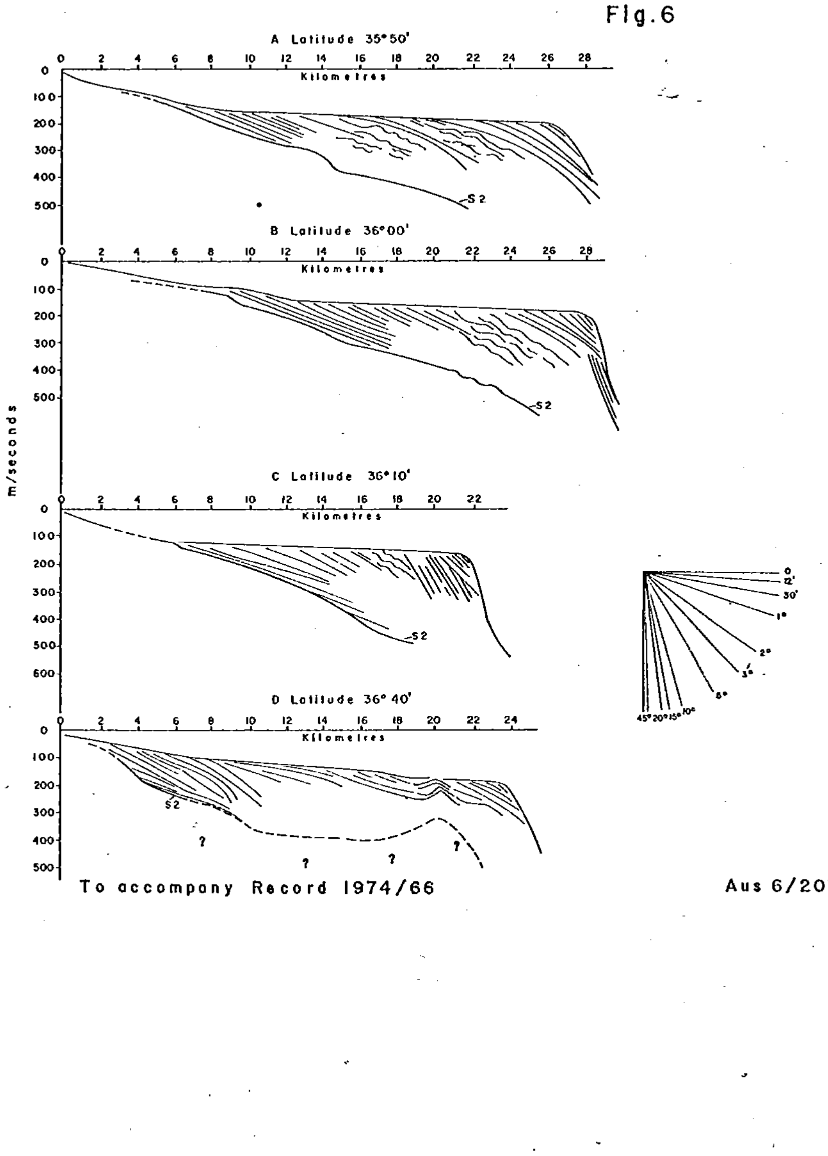


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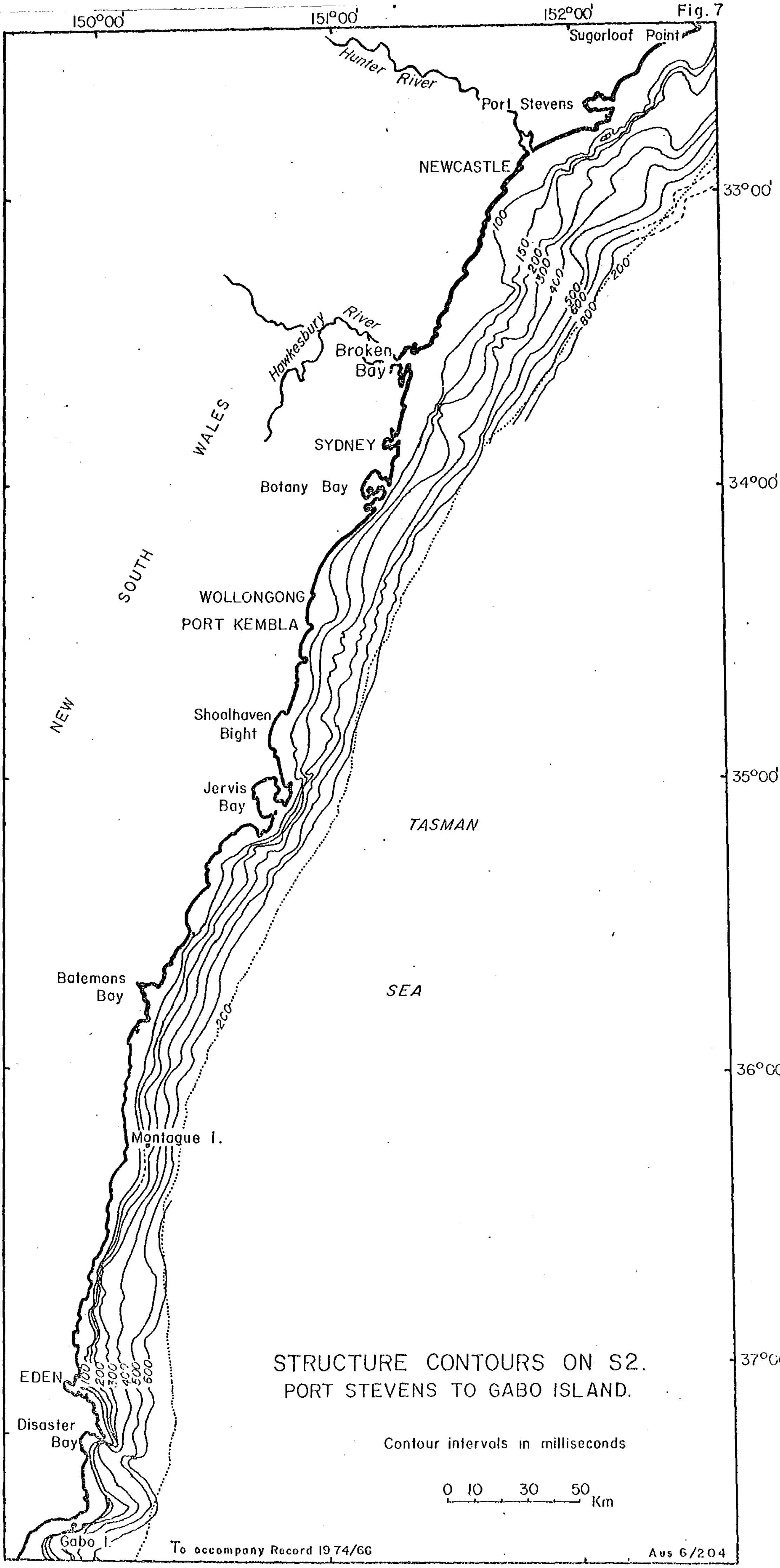
FIG. 7. Structure contours on S2, between Port Stephens and Gabo Island. Contour intervals in milliseconds reflection time.

Fig. 7




STRUCTURE CONTOURS ON S2.
PORT STEVENS TO GABO ISLAND.

Contour intervals in milliseconds

To accompany Record 1974/66

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FIG.8. Isopachs (metres) of the sequence resting on S2, between Port Stephens and Gabo Island.

Fig. 8

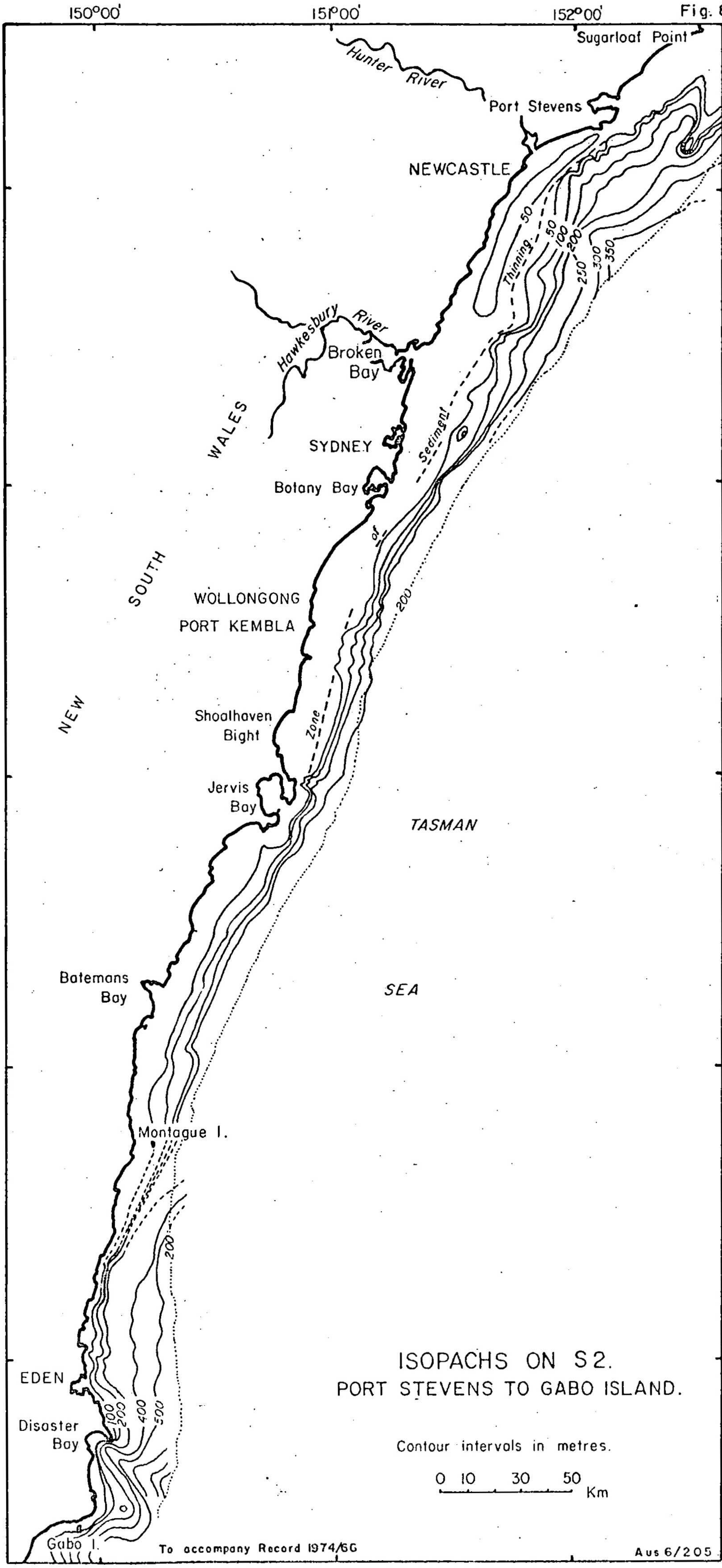


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FIG. 9. Major structural features of the continental shelf.

Fig. 9

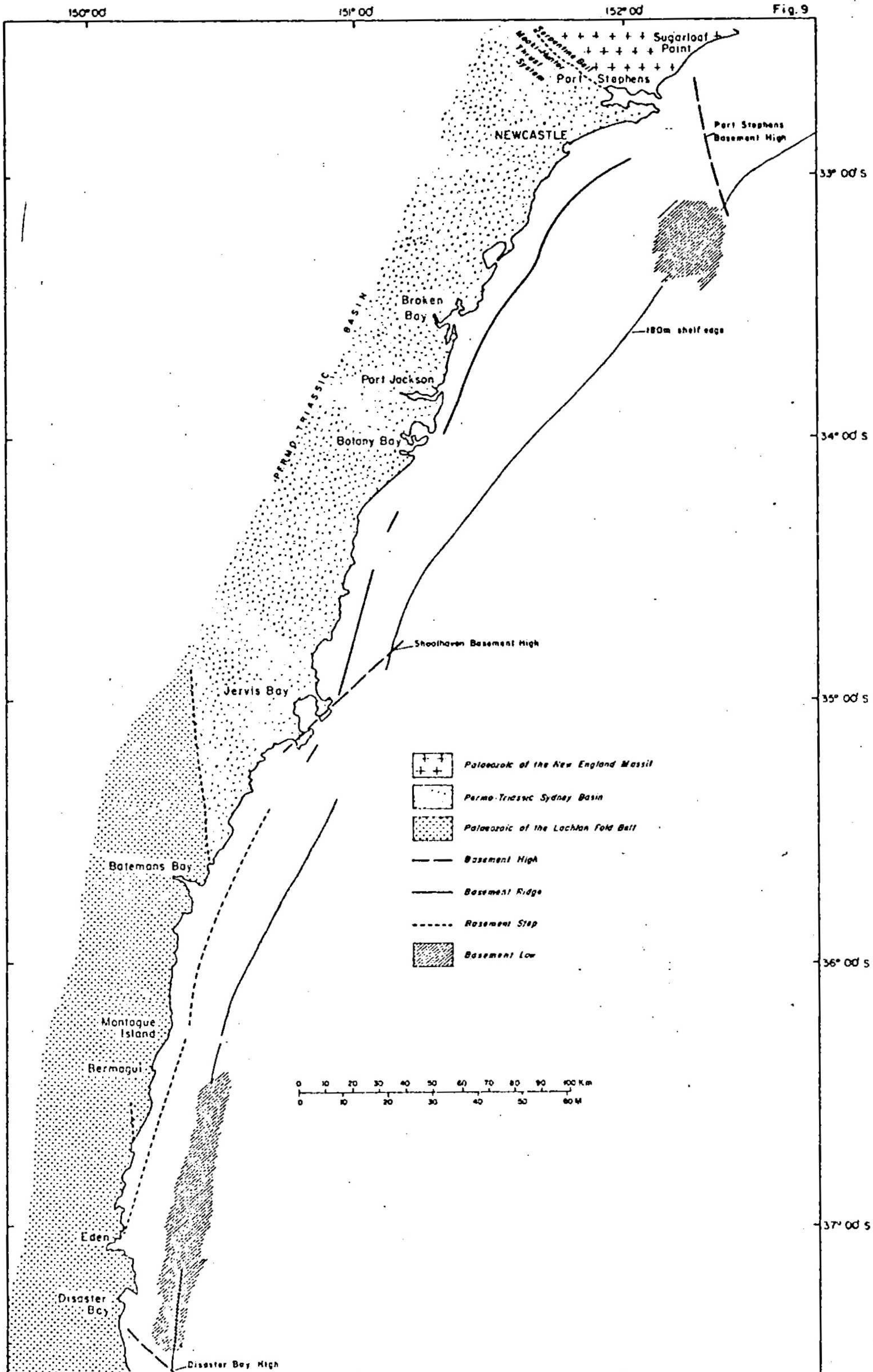


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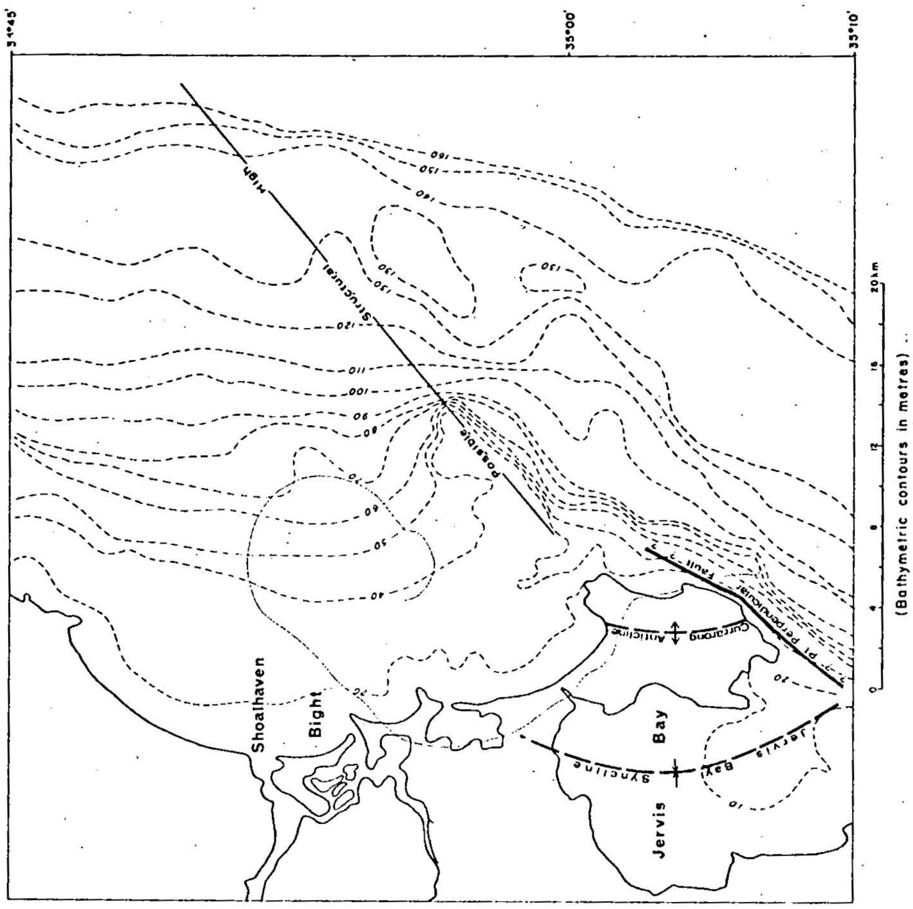
FIG. 10. Bathymetric configeration and onshore structure in the Jervis Bay/Shoalhaven area.

Fig. 10




BATHYMETRIC AND ONSHORE STRUCTURE IN THE JERVIS BAY-SHOALHAVEN AREA

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FIG. 11. A. Steep continental slope, massive truncation of sediments, and thick sediment pile. Basement is deep and not visible in the section. East to west section south of Jervis Bay. The position of the arrow represents a change of course. It is not a submarine canyon.

B. Basement (S2) and disconformity (S1) in west to east section along latitude 32°15'S, north east of Port Stephens.

C. Possible outcrop of S1 on upper continental slope in east to west section along latitude 34°20'S. The outcrop occurs outside the picture.

D. Folds in the basement along a SW-NE section to the south east of Newcastle. The maximum dip of the beds is approximately 9°. Note also the channel cut into S2.

E. Topographic variations in basement in a SW-NE profile in the mid shelf position, east of Port Stephens.

Fig.11

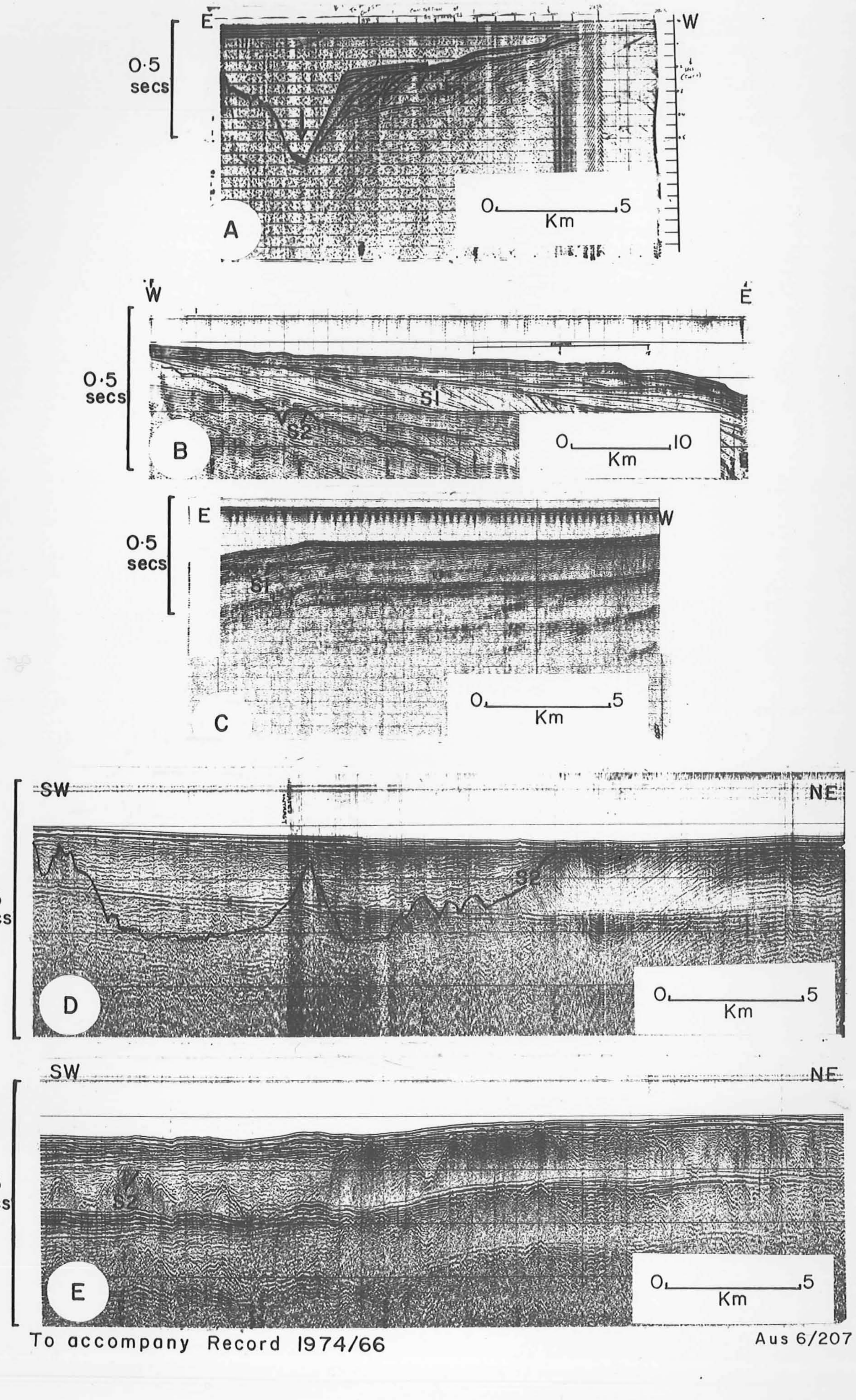


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FIG. 12. A. Basement (S2) variations in a west to east section along Latitude $33^{\circ}30'$S.

B. Basement (S2) variations in a west to east section along Latitude $34^{\circ}30'$S, east of Port Kembla.

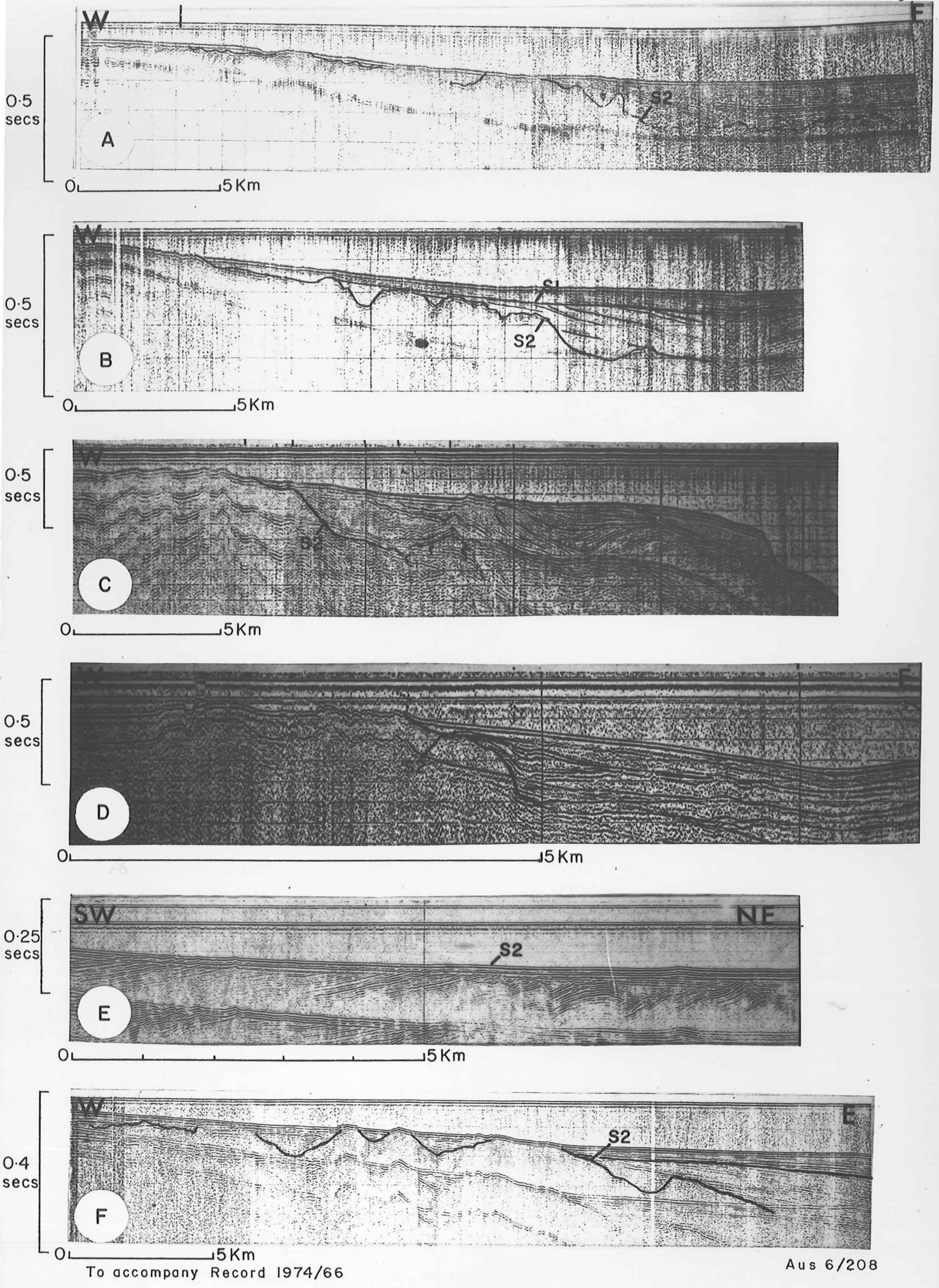
C. Step in the basement (S2) in a west to east section to the east of Disaster Bay in Latitude $37^{\circ}20'$.

D. Step in the basement (S2) in a west to east section to the north east of Gabo Island in Latitude.

E. Sub-basement (S2) structure to the south east of Broken Bay.

F. Basement (S2) structure in a section to the east of Shoalhaven Bight.

Fig.12

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