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BMR MARINE GEOLOGY CRUISE IN BASS STRAIT AND TASMANIAN WATERS - FEBRUARY TO MAY, 1973

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SUMMARY

Three hundred bottom samples and 4000 km of seismic reflection profiles were obtained from the continental shelf and upper continental slope of Tasmania, and the eastern and western margins of Bass Strait. The Tasmanian continental shelf is 13 to 55 km wide; the eastern and southern shelves have a generally smooth surface in contrast to the rough surface of the western shelf. In Bass Strait the shelf is mainly smooth and featureless. Four different lithofacies have been delineated on the shelf. They range from quartz sand and mixed quartz/carbonate sand, which are generally present on the inner shelf, to carbonate sand and muddy sand which tend to predominate on the outer shelf. In Bass Strait the grainsize of the sediments tends to decrease towards the centre. Seismic profiling has delineated previously known features in Bass Strait; on the Tasmanian shelf a wedge of sediments thickens towards the edge of the shelf. Truncation of upper reflections is common near the present shelf break on the eastern shelf. Seismic basement was not observed on the western shelf; the reflections show relatively steep dips and some contortion.

INTRODUCTION

A geological reconnaissance of the east and west sides of Bass Strait and the continental shelf around Tasmania was conducted from 12 February to 5 May, 1973. Activities carried out on board ship included sediment sampling, water sampling, echo-sounder profiling, underwater photography, and seismic reflection profiling. This report consists of a cruise summary and a brief preliminary assessment of the data collected. The cruise began on 12 February and from that date to 9 March, H.A. Jones acted as cruise leader. P.J. Davies joined the ship as cruise leader on 10 March. Visitors on board for short durations included Mr P. Coleman (Australian Museum), Mr A. Drummond (Flinders University), and Mr G. Holdgate (Geological Survey of Victoria).

Vessel

The motor tug 'Sprightly', 646 tons gross, an ocean-going tug owned by T. Korevaar and Sons, was chartered (Fig. 1). The vessel had an overall length of 43 m and was powered by two G.M. 925 HP diesel engines, giving a cruising speed of 11 knots. A winch capable of 20 tons draw was located midships. The 'Sprightly' was equipped with Kelvin Hughes and Marconi Fishgraph II echosounders, a Kelvin Hughes type 17 radar unit, and a Bemnar Magnetic Automatic Pilot. A 4.7 m Avon rubber dinghy with a 35 HP outboard motor was carried.

The vessel was a good sea boat for its size and was well suited for the purposes of marine survey. Two portable laboratories owned by BMR were welded to the deck of the vessel. A large A-frame with raised platform was positioned on the stern of the vessel to facilitate dredging.

Surveying methods and equipment

Bottom samples were collected with a pipe dredge and a box dredge. Photographs of the bottom were obtained with an E.G. & G. underwater camera. The specifications and operation of the above-mentioned devices have previously been described in Davies & Marshall (1972).

Cores of the bottom sediments were obtained with a 300 kg piston corer with a 2 m core barrel.

Seismic profiling was carried out with a 3-electrode Sparkarray sound source with a maximum energy output of 2000 j. MP7 and MP8 hydrophone arrays were used and records were obtained with an EPC Graphic Recorder.

Water depth profiles were obtained with the two echosounders. Initially the Kelvin Hughes F/B Mark I was used. It operated on 48 Kc/s and had a specified operating maximum depth of 684 m; this was never achieved. Most of the survey was conducted with a Marconi Fishgraph II which operates on a frequency of 24 Kc/s to a maximum depth of 2340 m. This recorder proved very reliable.

Ancillary projects

Mr P. Coleman of the Australian Museum joined the party for Leg 3 to collect live marine organisms recovered in the dredge. In addition, portions of the bottom sample were collected by subsequent visitors, Mr A. Drummond (Flinders University) and Mr G. Holdgate (Geological Survey of Victoria).

Surface water samples were collected for CSIRO at selected stations.

CRUISE NARRATIVE

Leg 1 (12-28 February)

After fitting out in Geelong the ship sailed on 12 February and proceeded to the eastern part of Bass Strait. Seventy seabed sample stations were occupied both in Bass Strait and on the continental shelf east of Flinders Island, and about 1000 km of seismic profiling was completed. In addition 12 sample stations were occupied, and 135 km of combined seismic and magnetometer profiles were obtained in Ringarooma Bay (northern Tasmania). The ship returned to Geelong on 28 February. During this period about one and a half days were lost as a result of bad weather.

Leg 2 (3-8 March)

The ship left Geelong on 3 March and proceeded to a position in the southern Tasman Sea at 39°59'S, 152°02'E to attempt to dredge manganese nodules from a depth of about 4500 m. It was also intended to photograph the nodules on the sea floor. One attempt was made to dredge at this depth, but this was unsuccessful. Poor weather conditions hampered operations, and the project was eventually abandoned because of the worsening weather situation. The ship berthed at Hobart on 8 March.

Leg 3 (12 March-5 April)

The ship sailed from Hobart on 12 March to begin systematic sampling of the shelf off eastern Tasmania. However the vessel was forced to return to port on 14 March because the echosounder transducer was lost from the hull in heavy weather. After repair has been effected, the 'Sprightly' sailed again on 17 March to continue the survey. The ship put into Hobart on 29 March; Mr P. Coleman disembarked and Mr A. Drummond joined the party at Hobart. The party put to sea again on the same day, and proceeded with systematic sampling and seismic profiling of the shelf to the south of Tasmania. Continuous strong winds and heavy seas limited work to the east of the Maatsuyker Group of islands.

During this leg 88 grab-sampling stations and 4 coring stations were occupied and 900 km of seismic reflection profiling were run. The vessel returned to Hobart on 5 April.

Leg 4 (8-26 April)

On 8 April 'Sprightly' sailed from Hobart in excellent weather. Sampling and sparking west of the Maatsuyker Group continued until 10 April, when the ship's generator broke down. Spare parts were picked up at Burnie (northern Tasmania) on 13 April, the intervening period being profitably employed in sampling using the ship's large winch. Continued good weather facilitated the completion of sampling and seismic profiling on the west coast by 18 April, when the weather changed and forced the 'Sprightly' to seek shelter to the east of King Island, where she remained for 3 days. On 22 April, in rough seas and high winds, a seismic line was run from King Island to Wilson's Promontory. During this journey a capacitor in the trigger unit blew up. This was repaired while the vessel was at anchor in Sealers Cove on the east side of Wilson's Promontory. April 24-25 were spent sampling to the southwest and southeast of King Island. The vessel berthed in Burnie on 26 April.

Seventy-five sampling stations were occupied at 1200 km of seismic profiles run.

Leg 5 (28 April-5 May)

'Sprightly' sailed from Burnie at 0800 hours on 28 April, and ran a seismic line westwards towards Cape Grim. The next few days were spent sampling and sparking to the southwest of King Island. Lithified phosphatic limestone was dredged up at a number of localities. From

1-5 May, 'Sprightly' operated on the western side of Bass Strait. Forty sediment samples were collected, and 866 km of seismic profiles run. The cruise ended at Geelong on 5 May.

MORPHOLOGY

Bass Strait

Depths in Bass Strait rarely exceed 80 m, and in those areas which were surveyed water depths were usually less than 65 m. The sea floor is generally smooth and sub-horizontal. A wide terrace at a depth of 55 m is present in eastern Bass Strait. Near Banks Strait and in the channel between King Island and the Tasmanian mainland, both symmetrical and asymmetrical sand waves are common. The maximum amplitude recorded was 20 m.

On the eastern side of Bass Strait a line of islands extends from the northern tip of Flinders Island to Wilson's Promontory. This line of islands marks the Bassian Rise, a basement high which separates the Bass and Gippsland Basins. Between King Island and the Tasmanian mainland a number of small islands and shoals are probably a surface expression of the King Island High.

Eastern Tasmania

The continental shelf of eastern Tasmania ranges in width from 46 km off Cape Naturaliste to 13 km east off Cape Pillar. The average width of the shelf is about 30 km. Much of the coastline along eastern Tasmania is dominated by high cliffs and it is not uncommon to sound depths of 40 to 60 m some 200 m off the coast. The inner shelf has a relatively steep gradient, and bedrock sometimes crops out. On the inner shelf to the south of Banks Strait there are a number of asymmetric sand waves built up on the shelf. They are as high as 10 m, and from their asymmetry it is apparent that they have formed by tidal currents flowing out of Banks Strait in an easterly direction.

General shelf morphology varies from north to south. Off Flinders Island and northeastern Tasmania the shelf is more rugged, and bedrock is possibly exposed over much of the sea floor. To the south it is more subdued. In some traverses a scarp 10-15 m high occurs at a depth of 110-115 m, but it does not appear to be continuous. Commonly there is a slight rise some 8 m high on the edge of the shelf. Between 41°45' and 42°20'S the middle and outer parts of the shelf are dissected, with a relief of 1 to 5 m. This area of rough ground consits entirely of unconsolidated sediments, and its origin is uncertain.

The shelf break is well defined and generally occurs at a depth of 125-135 m, although it may be as deep as 170 m. The upper continental slope is steep with gradients of the order of 10-15°; the gradient decreases slightly farther down the slope. A number of submarine canyons have been recognized on the slope. Two canyons are present to the east of the entrance to Great Oyster Bay and another canyon is present to the east of Maria Island. These canyons are only present on the slope and do not extend across the shelf.

Southern Tasmania

South of Tasmania the shelf varies in width from 13 to 55 km. A number of islands are present on the inner shelf and bedrock commonly crops out on the sea floor in these areas. In some traverses the inner shelf consists of a series of steps which may be related to eustatic processes, but in other traverses they are absent and the inner shelf is gently inclined. The outer shelf consists of a wide, flat plain at a depth of about 160 m. The shelf break is well defined and occurs between 155-165 m. The upper slope is steep in places, but the gradient generally decreases below 250 m. The continental slope off the south coast is not as steep as that off the east coast. Towards South West Cape the width of the shelf decreases rapidly until it is only some 13 km wide. A large submarine canyon occurs on the slope off South West Cape.

Western Tasmania and King Island

The continental shelf of western Tasmania is rugged as a result of rock cropping out over much of the shelf. This rough topography is commonly present over the whole width of the shelf, but in places there are smooth areas, presumably where recent sediments have been deposited. South of King Island there is a wide depression on the middle part of the shelf some 15-20 m deep. This area is smooth and from seismic evidence the depression is related to the underlying structure. West of King Island patches of rock crop out on the sea floor, and the topography varies from rough to smooth.

The shelf break is well defined and occurs between 137 and 175 m. There is a greater variation in the depth to the shelf break on the western Tasmanian shelf, probably as a result of rock cropping out at the shelf break in some places, but not in others. Erosion associated with the formation of submarine canyons has also affected the depth of the shelf break. The upper continental slope is steep and often dissected. There is evidence of a large submarine canyon off Cape Sorell and of another canyon 40 km farther north. Off Sandy Cape a large wide canyon cuts across the shelf. This is the first time that a submarine canyon has been

found to extend across the shelf; most Australian canyons tend to occur only on the continental slope. However, this canyon is atypical in that it is considerably wider than the canyons on the slope, and it has a U-shaped profile rather than the typical V-shape. It is likely that it has originated under different circumstances from those which formed the slope canyons.

SEDIMENTS

The distribution of samples collected during the 1973 cruise is shown in Plate 1, and station data are summarized in the Appendix. Samples were collected at both 18 km and 9 km intervals. An interpretation of the sedimentary facies distribution is shown in Plate 2.

Four principal lithofacies have been identified:

Quartz sand and gravel facies

Mixed Quartz sand /Carbonate sand/shell gravel

Carbonate facies - mollusc/bryozoa sand and gravel

Mud/sand facies.

The quartz facies occurs south of Great Oyster Bay, off the east coast of Tasmania, off the south coast, and sporadically off the west coast. Throughout most of these areas, the sediments consist of medium-grained quartz sand, but south of Great Oyster Bay quartz gravels predominate. South of the D'Entrecasteaux Channel, quartz sands extend as a lobe across the shelf. This is probably due to the channelling of sediment down the D'Entrecasteaux Channel. Sediment samples collected at random in the channel were also of this type. Off the west coast of Tasmania, pure quartz sands are sporadically developed north and south of Port Davey and north and south of Macquarie Harbour.

The mixed quartz sand/detrital carbonate facies is much more widespread than the quartz facies. The carbonate detritus on the east and south coast is predominantly composed of disarticulated, partly comminuted mollusc valves. Gastropods are also locally abundant. The gravel-size carbonate fraction is probably derived from a fauna which is not far removed from its life position. Off the east coast of Tasmania, the mixed quartz/carbonate facies occurs north of Great Oyster Bay. It also covers a wide area of the southeast of Bass Strait, around Flinders Island. In this area it extends eastwards to the edge of the continental shelf.

West of Tasmania, this mixed facies occurs only to the north of Macquarie Harbour. It forms a thin ribbon hugging the coast, but its distribution broadens significantly to the northwest towards King Island. In this area, two subfacies can be delineated; (i) quartz gravel/carbonate subfacies, (ii) quartz sand/carbonate subfacies. The gravel subfacies occurs closer to King Island. Both subfacies form only a narrow band to the west of King Island, but have a wide distribution to the east. A similar pattern occurs around Flinders Island. It is apparent that both King and Flinders Islands form the likely source for the quartz sand and gravel, and the eastward extension in both cases represents the dominant current direction.

One other area of mixed quartz sand/carbonate facies occurs in Bass Strait between Cape Otway and Waratah Bay. In some parts of this area, mud forms a significant proportion of the sediment. Southwest of the Mornington Peninsula an area of quartzose shelly gravels is in the region of the King Island/Mornington Peninsula High. It is likely that the quartz gravel is a residual of Palaeozoic sediments which make up the basement feature.

Off the west coast of Tasmania, the carbonate portion of the sediment is dominantly composed of bivalves and gastropods close inshore, but increasing amounts of bryozoan debris occur farther west. In western Bass Strait the carbonate fraction is a mixture of molluscan and bryozoan material which is generally comminuted to medium to coarse sand-size, but in places forms a carbonate gravel.

Sediments composed of varying admixtures of sands and muds occur only in Bass Strait and on the east side of Tasmania. In Bass Strait they consist of blue-grey to olive green plastic muds with variable amounts of silt and calcareous sand. Cores indicate that thicknesses exceed 1.5 m.

The western boundary of the mud province approximates to the 80-m isobath, and the eastern boundary is close to the 60-m isobath. Data are lacking in the central part of Bass Strait, but it is assumed that similar sediments are present in this area. Little is known about the northern and southern facies boundaries.

In the area between Cape Otway and Waratah Bay muddy sediments occur in two areas, south of the opening of Port Phillip Bay, and south and southeast of Western Port Bay. In both cases the mud is diluting a predominantly mixed quartz/carbonate facies. The mud probably represents outwash material from the bays. It is noticeable that very little mud diluent occurs in the intervening areas. It may be significant that this area straddles the projected position of the King Island/Mornington basement high.

Muddy sediments also cover a large area of the continental shelf off eastern Tasmania. They consist of olive green muds containing abundant bryozoan and molluscan debris. Cores indicate that this sediment is at least 2 m thick.

Clastic carbonates occur predominantly to the north of Flinders Island, on the edge of the continental shelf off eastern Tasmania, over most of the shelf off south and west Tasmania, and over a large part of western Bass Strait. North of Flinders Island they are composed mainly of molluscan debris, while on the continental shelf of eastern Tasmania mixed molluscan/bryozoan assemblages occur. In this area brown iron-stained carbonate gravels are present.

West of Tasmania the carbonates cover a large part of the shelf. They are dominantly composed of bryozoan debris. North of King Island the carbonates extend eastwards as a tongue across western Bass Strait.

STRUCTURE

Forty-one sparker traverses totalling 4000 km were run over the continental shelf and upper continental slope (Plate 3). The depth of penetration varied from area to area. In shallow water, basement limited the penetration to 0.1-0.2 s (two-way time). On the edge of the continental shelf, as much as 0.7 s was attained. Six representative profiles are shown in Figures 2-7.

Eastern Bass Strait

Seismic sections show a maximum penetration of about 0.5 s. The secondary sequence overlying basement along the western flank of the Bassian Rise, west of Flinders Island, is essentially flat-lying, apart from drape structures over basement rises (Fig. 2).

In Ringarooma Bay, seismic profiling has located an infilled river channel which may be an extension of the channel separating Waterhouse Island from the mainland.

Eastern Tasmania

A representative profile across part of the east Tasmanian continental shelf at latitude 41°20'S is shown in Figure 3. Over most of the shelf individual reflectors can be traced for many kilometres. All dip to the east parallel to basement surface and are truncated by the

present shelf plain. The basement is visible down to a depth of 0.52 s. Near the shelf break an unconformity is present at a depth of about 0.2 s, and can be traced beneath the present upper continental slope. Above this surface, sedimentation has resulted in the construction of a sediment wedge on the outer shelf plain over an area about 5 km wide. This deposition has been interrupted by gravitational slumping down the slope resulting in an eastward extension of the shelf.

Southern Tasmania

An example of the profiles across the southern Tasmanian shelf is shown in Fig. 4. Basement crops out on the inner part of the shelf. South of the basement outcrop, the shelf surface is almost smooth, gently inclined and concave upwards. Basement can be traced to approximately 0.5 s. In the sedimentary sequence above basement, a number of disconformities can be identified. Near the shelf break the sediments of the top 0.1 s are irregularly bedded. These assume a more regular bedded attitude when traced northwards across the shelf.

Western Tasmania

The seismic structure of the continental shelf off western Tasmania is illustrated by Fig. 5, which is a west-to-east section along latitude 41°40'S. Basement is nowhere visible in the section. The subsurface structure shows relatively steeply dipping and contorted reflectors. The steep dip is probably due to the steep basement dip.

Western Bass Strait

Throughout most of the western part of Bass Strait, sediment reflectors are flat-lying and penetration was insufficient to reach basement. Gentle flexuring of the sediments in the visible section is sometimes apparent. The illustrated profile (Fig. 6) crosses the King Island/Mornington Peninsula high; basement crops out in 54 m of water and slopes relatively steeply down to the northwest to a depth of about 0.25 s, where it flattens out. In the area between the King Island/Mornington Peninsula High and the mainland, the sediments above basement form an asymmetrical basin. The northwestern margin of the basin is an abrupt fault-scarp (Fig. 7).

REFERENCE

DAVIES, P.J., & MARSHALL, J.F., 1972 - BMR marine geology cruise in the Tasman Sea and Bass Strait. Bur. Miner. Resour. Aust. Rec. 1972/73 (unpubl.).

APPENDIX

STATION DATA

"UPRIGHTLY" 1973 CRUISE

Sample No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73631900	37°57′	147°50	A	22	Pipdred	2/14	0832	10 YR 5/4
1901	38°07	147°50	A	48		2/14	0938	10 Y 6/2
1902	38°17	147°50	A	52		2/14	1110	10 Y 6/2
1903	38°27	147°50	A	60		2/14	1225	5 Y 7/2
1904	38°38.6	147°50	A	64		2/14	1337	5 Y 7/2
1905	38°47	147°50	C	72		2/14	1455	5 Y 7/2
1906	38°59	147°45	C	62		2/14	1615	10 YR 7/4
1907	39°10	147°42	C	56		2/14	1738	10 YR 7/4
1908	39°14	147°35	A	60		2/15	1035	10 YR 7/4
1909	39°04	147°35	B	58		2/15	1205	10 YR 7/4
1910	38°54	147°35	C	61		2/15	1326	10 YR 7/4
1911	38°44	147°35.8	B	54		2/15	1438	10 YR 7/4
1912	38°33	147°36.4	A	49		2/15	1543	10 YR 7/4
1913	38°23.5	147°35	A	45		2/15	1735	5 Y 7/2
1914	38°13	147°35	A	35		2/15	1856	10 YR 4/2
1915	38°18.6	147°20.1	A	16		2/16	1229	10 YR 5/4
1916	38°28.6	147°20.3	A	32		2/16	1340	10 YR 5/4
1917	38°39	147°19.5	C	45		2/16	1453	10 YR 7/4
1918	38°50	147°19	C	57		2/16	1606	10 YR 7/4
1919	39°04	147°18.5	B	57		2/16	1745	10 YR 7/4
1920	39°14	147°18	B	58		2/16	1850	10 YR 7/4
1921	39°20	147°50	A	53		2/17	1203	10 YR 7/4
1922	39°30	147°50	A	42		2/17	1313	10 YR 7/4
1923	39°39	147°50	A	42		2/17	1412	10 YR 7/4
1924	39°48.5	147°46.5	A	38		2/17	1530	5 Y 6/1
1925	39°59.5	147°46	A	40		2/17	1700	5 Y 6/1
1926	40°08.5	147°51	A	34		2/17	1815	10 YR 7/4
1927	40°16	147°45.5	A	42		2/18	1140	10 YR 7/4
1928	40°25.5	147°50	A	36		2/18	1247	10 YR 7/4
1929	40°35.5	147°50.5	A	32		2/18	1347	10 YR 7/4
1930	40°39.5	148°07	A	38	Boxdred	2/18	1445	
1931	40°38.5	148°30.5	A	39	Pipdred	2/18	1733	5 Y 6/1
1932	40°39	148°43	A	56		2/18	1833	10 YR 7/4
1933	40°07	148°23	A	17		2/19	1140	10 YR 5/4
1934	40°10	148°55	A	46		2/19	1252	5 GY 6/1
1935	40°10	148°48	C	118		2/19	1405	10 Y 6/2
1936	40°23	148°50	C	97		2/19	1625	10 Y 6/2
1937	40°20	148°37	B	20		2/19	1830	10 YR 5/4
1938	40°44.7	147°55.5	A	25		2/22	1212	10 YR 6/2
1939	40°54.4	147°51.6	A	28		2/22	1252	10 YR 6/2
1940	40°45	147°49	A			2/23	0900	5 Y 6/1
1941	40°45.8	147°45.1	A	32		2/23	0928	5 Y 6/1
1942	40°46.6	147°41	A	30		2/23	0957	5 Y 6/1
1943	40°49.5	147°42.2	A	15		2/23	1025	5 Y 6/1
1944	40°48.7	147°46	A	25		2/23	1045	5 Y 6/1
1945	40°47.9	147°49.8	A	27		2/23	1110	10 YR 5/4
1946	40°47.2	147°38	A	24		2/23	1139	10 YR 5/4
1947	40°50.3	147°53.4	A	11		2/23	1206	5 Y 6/1

Sample No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73631948	40°50.9	147°50.4	A	13	Pipdred	2/23	1250	
1949	40°51.5	147°47	A	15		2/23	1315	5 Y 6/1
1950	40°48.	147°43.8	A	29	Piscore	2/23	1355	5 GY 6/1
1951	40°10.6	147°35.	A	46	Pipdred	2/24	1103	5 Y 6/1
1952	40°02	147°34.8	A	50		2/24	1201	10 YR 5/4
1953	39°51.5	147°34.5	A	48		2/24	1315	10 YR 7/4
1954	39°51.9	147°21.5	A	58		2/24	1430	10 YR 7/4
1955	40°02	147°21.5	A	63		2/24	1543	10 YR 7/4
1956	40°11.5	147°21.5	B	64		2/24	1647	10 YR 7/4
1957	39°31.6	147°33.	A	52		2/25	0950	10 YR 7/4
1958	39°22.5	147°33.	A	52		2/25	1057	10 YR 7/4
1959	39°23	147°20.3	A	56		2/25	1208	10 YR 7/4
1960	39°33	147°20	A	55		2/25	1320	10 YR 7/4
1961	39°43	147°20	B	59		2/25	1430	10 YR 7/4
1962	39°53	147°07.5	B	70		2/25	1557	10 Y 6/2
1963	40°03	147°07	C	71		2/25	1707	10 Y 6/2
1964	40°13	147°07	C	72		2/25	1820	10 Y 6/2
1965	40°40.7	147°35.5	A	43		2/26	0713	10 YR 7/4
1966	40°31	147°35	B	46		2/26	0820	10 YR 6/4
1967	40°21	147°35	B	46		2/26	0935	10 YR 6/2
1968	40°31	147°21	C	55		2/26	1040	10 YR 6/2
1969	40°31	147°22	A	52		2/26	1200	10 YR 6/4
1970	40°40.6	147°21	A	50		2/26	1308	10 YR 5/2
1971	40°50.5	147°21.4	A	40		2/26	1417	10 YR 5/2
1972	40°50.6	147°08.4	A	52		2/26	1523	10 YR 5/2
1973	40°40.7	147°08.4	A	66		2/26	1637	10 YR 6/2
1974	40°26	147°08	C	70		2/26	1820	10 Y 6/2
1975	39°42	147°05	A	71		2/27	0723	10 Y 6/2
1976	39°31.7	147°05	A	63		2/27	0845	5 Y 7/2
1977	39°21	147°05	A	62		2/27	1005	5 Y 7/2
1978	39°11	147°05	A	54		2/27	1113	5 Y 7/2
1979	39°01	147°05	B	55		2/27	1228	10 YR 7/2
1980	38°51	147°05	A	52		2/27	1328	10 YR 7/2
1981	38°58	146°50	B	52		2/27	1530	10 YR 7/2
1982	43°17.2	148.00.5	A	130		3/13	0745	10 YR 5/4
1983	43°17.4	148°07.2	A	39		3/13	0830	10 YR 7/4
1984	43°10	148°12	A	172		3/13	0943	10 YR 5/4
1985	43°10	148°06.7	A	113		3/13	1025	10 YR 5/4
1986	43°10	148°01.4	A	95		3/13	1058	10 YR 5/4
1987	43°00.6	148°00	A	80		3/13	1222	5 YR 5/2
1988	43°00	148°06.8	A	97		3/13	1300	5 Y 5/6
1989	43°00	148°13.6	A	122		3/13	1338	10 YR 7/4
1990	42°51	148°20.4	A	157		3/13	1505	10 YR 6/6
1991	42°50	148°14	A	99		3/13	1549	5 Y 5/6
1992	42°50	148°07.3	A	84		3/13	1628	5 Y 5/2
1993	42°50	147°59.8	A	58		3/13	1710	5 Y 4/4
1994	42°39.7	148°11.6	A	84		3/14	0914	10 YR 4/2
1995	42°39.6	148°17.2	A	106		3/14	1002	10 Y 6/2

Sample No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73631996	42°39.5	148°24.'	A	130	Pipdred	3/14	1047	5 Y 5/2
1997	42°30.5	148°03.8	A	44		3/18	0705	5 Y 5/2
1998	42°30	148°10.4	A	66		3/18	0741	5 Y 5/2
1999	42°29.8	148°16.6	A	88		3/18	0818	5 Y 5/2
2000	42°29.8	148°23.2	A	106		3/18	0900	5 Y 5/2
2001	42°30.2	148°29.3	A	184		3/18	0938	10 YR 6/2
2002	42°21.2	148°31	B	115		3/18	1137	10 YR 6/2
2003	42°20	148°13	A	45		3/18	1323	10 YR 5/4
2004	42°20	148°07.7	A	42		3/18	1353	5 Y 5/4
2005	42°20	148°03	A	33		3/18	1428	5 YR 5/6
2006	42°14.8	148°02.8	A	18		3/18	1507	5 Y 5/2
2007	42°14.5	148°08.1	A	24		3/18	1536	5 Y 6/4
2008	42°14.6	148°13.6	A	16		3/18	1606	5 Y 5/4
2009	42°10.2	148°14.2	A	15		3/18	1640	5 Y 5/2
2010	42°10.2	148°10.4	A	16		3/18	1704	5 Y 5/2
2011	42°10.2	148°06.2	A	14		3/18	1727	5 Y 5/2
2012	42°00	148°35.5	A	148		3/19	0727	10 YR 6/4
2013	41°59.5	148°29.5	A	88		3/19	0824	10 Y 5/2
2014	42°00	148°23.0	A	70		3/19	0902	5 Y 5/6
2015	42°00	148°18	A	28		3/19	0929	10 YR 6/2
2016	42°10.3	148°21.7	A	64		3/19	1052	10 YR 6/4
2017	42°10	148°34.7	A	205		3/19	1225	5 Y 6/1
2018	42°10.2	148°29.2	A	104		3/19	1321	5 Y 5/2
2019	42°08.2	148°28.6	A	95	Piscore	3/19	1335	5 Y 5/2
2020	42°20	148°26.3	A	100	Pipdred	3/19	1610	5 Y 5/6
2021	42°20	148°21.4	A	73		3/19	1641	10 YR 6/2
2022	42°15.1	148°30	A	113	Piscore	3/20	1356	5 Y 5/2
2023	42°28.5	148°27.5	A	119		3/20	1615	5 Y 5/2
2024	43°14.5	147°27.8	A	53	Pipdred	3/22	1400	5 YR 5/2
2025	41,50	148°17.3	A	33		3/24	0812	5 Y 6/1
2026	41°50	148°23.3	A	60		3/24	0844	10 YR 5/4
2027	41°50	148°28.9	A	84		3/24	0925	10 Y 6/2
2028	41°49.9	148°35.3	A	128		3/24	1000	5 Y 7/2
2029	41°41.6	148°39.	B	823		3/24	1110	
2030	41°39.8	148°32.1	A	113		3/24	1235	5 Y 7/2
2031	41°40	148°25.1	A	69		3/24	131	10 YR 7/4
2032	41°40	148°18.4	A	27		3/24	1355	10 YR 7/4
2033	41°30	148°17.5	A	31		3/24	1518	10 YR 6/6
2034	41°30.2	148°23.6	A	71		3/24	1550	5 Y 6/4
2035	41°30	148°30	A	113		3/24	1627	10 Y 6/2
2036	41°29.8	148°36.3	B	314		3/24	1714	5 Y 6/1
2037	41°20.1	148°23.4	A	73		3/25	0815	5 Y 6/2
2038	41°20.6	148°30	A	110	Pipdrdd	3/25	0854	5 Y 6/2
2039	41°20	148°37.	A	121	Piscore	3/25	0925	5 Y 7/2
2040	41°10	148°38.6	B	161	Pipdred	3/25	1155	10 Y 6/2
2041	41°10	148°32.2	A	110		3/25	1245	5 Y 6/2
2042	41°10.1	148°25.7	A	95		3/25	1320	5 Y 6/2
2043	41°09.8	148°19.2	A	60		3/25	1345	10 YR 4/2

Sample No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73632044	41°00	148°24.3	A	60	Pipdred	3/25	1513	10 YR 5/4
2045	41°02	148°31.5	A	97		3/25	1551	10 Y 6/2
2046	41°00	148°38,3	C	119		3/25	1630	5 Y 7/2
2047	40°48.7	148°20.1	A	33		3/26	1345	10 YR 7/4
2048	40°48.7	148°27.	A	51		3/26	1428	5 Y 6/4
2049	40°49.5	148°32.1	A	62		3/26	1505	10 YR 7/6
2050	40°49.6	148°39.9	B	82		3/26	1543	5 Y 7/2
2051	40°50'6	148°46.5	C	399	Boxdred	3/26	1640	5 Y 6/1
2052	41°45.5	148°31.0	B	113	Boxdred	3/27	0838	5 Y 6/1
2053	41°55.8	148°31.5	A	106	camera Piscore	3/27	1047	5 Y 5/2
2054	43°28.8	147°58.0	A	161	Pipdred	3/28	1430	10 YR 7/4
2055	43°28.6	147°22.6	A	62		3/30	0907	10 YR 6/4
2056	43°35.5	147°32.3	A	121		3/30	1016	10 YR 7/4
2057	43°40.5	147°40.3	A	146		3/30	1115	10 YR 7/4
2058	43°47.0	147°48.5	B	212		3/30	1223	5 Y 7/2
2059	43°58	147°30	C	175		3/30	1526	5 Y 7/2
2060	43°33.6	147°06	A	84		4/01	1033	10 YR 5/4
2061	43°43.5	147°07.1	A	128		4/01	1140	5 Y 7/2
2062	43°53.2	147°08.3	A	148		4/01	1250	10 YR 6/4
2063	44°02.9	147°10	B	168		4/01	1410	5 Y 7/2
2064	43°47.9	147°25.6	B	154		4/01	1650	10 YR 8/6
2065	43°39.5	147°20.5	A	95		4/01	1807	5 YR 6/4
2066	43°40.4	146°50.4	A	104		4/02	0943	10 YR 5/4
2067	43°46'5	146°50.5	A	124		4/02	1033	10 YR 7/4
2068	43°55.0	146°51	A	168		4/02	1140	5 Y 5/2
2069	44°02.2	146°50.5	B	176		4/02	1253	5 Y 7/2
2070	43°35.5	146°33.5	A	58		4/04	0933	10 YR 7/2
2071	43°42	146°33.	A	115		4/04	1025	10 YR 6/4
2072	43°49.5	146°33.5	A	159		4/04	1129	5 Y 6/4
2073	43°57	146°33.7	A	159		4/04	1226	10 YR 7/4
2074	43°58.5	146°19.1	A	168		4/04	1451	5 Y 7/2
2075	43°50.6	146°18.5	A	165		4/04	1555	5 Y 6/4
2076	43°42.2	145°18.6	A	108		4/04	1700	10 YR 7/4
2077	43°20.3	147°37.7	A	97		4/08	1418	5 Y 6/4
2078	43°24.6	147°48.8	A	133		4/08	1550	10 YR 7/4
2079	43°33.5	146°14.2	A	53		4/09	1010	10 YR 7/4
2080	43°38.5	146°07.8	A	119		4/09	1108	5 Y 4/4
2081	43°44.0	146°00.5	A	159		4/09	1212	10 YR 6/4
2082	43°33.5	145°52.1	A	161		4/09	1428	10 YR 7/4
2083	43°31.5	145°55.8	A	104		4/09	1502	10 YR 6/6
2084	43°29.0	145°59.1	A	44		4/09	1530	10 YR 2/2
2085	43°20.3	145°48.2	A	82		4/09	1703	10 YR 7/4
2086	43°22.5	145°44.5	A	144		4/09	1733	10 YR 7/4
2087	43°24.2	145°41.2	A	159		4/09	1806	10 YR 7/4
2088	43°12.2	145°43.3	A	62		4/10	0755	10 YR 6/6
2089	43°13.8	145°36.9	A	132		4/10	0845	10 YR 6/4
2090	43°15.0	145°30.6	A	155		4/10	0930	10 YR 7/4
2091	43°16.2	145°23.7	B	190		4/10	1015	5 Y 7/2

Sampling No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73632092	43°06.4	145°16.1	B	154	Pipdred	4/10	1240	10 YR 7/4
2093	43°05.	145°26.	A	135		4/10	1330	10 YR 7/4
2094	43°04.1	145°35.7	A	73		4/10	1422	10 YR 5/4
2095	42°58.2	145°26.6	A	84		4/10	1532	10 YR 5/4
2096	42°58.1	145°15.5	A	132		4/10	1629	10 YR 7/4
2097	42°58.2	145°05.	A	188		4/10	1725	10 YR 7/4
2098	42°51.1	145°19.5	A	91	Boxdred	4/11	0800	10 YR 5/4
2099	42°51.1	145°09	A	124		4/11	0917	10 YR 7/4
2100	42°51.2	145°00.6	A	146		4/11	1025	10 YR 7/4
2101	42°39.8	144°58.6	B	142		4/11	1237	
2102	42°39.5	145°09.6	A	90	Pipdred	4/11	1352	10 YR 7/4
2103	42°39.8	145°17.6	A	51		4/11	1514	
2104	42°30	145°09.1	A	88		4/11	1642	10 YR 6/6
2105	42°30	145°01.0	A	104		4/11	1739	10 YR 6/6
2106	42°30.2	144°52.5	A	154		4/11	1838	10 YR 7/4
2107	40°30.5	144°37.5	A	44		4/12	0820	10 YR 7/4
2108	40°30	144°23.4	A	50		4/12	0940	
2109	40°29.8	144°09.7	A	71		4/12	1057	10 YR 7/4
2110	40°20	144°10	B	58		4/12	1227	10 YR 7/4
2111	40°20	144°22.9	A	55		4/12	1339	10 YR 7/4
2112	40°20	144°36.4	A	55		4/12	1450	10 YR 7/4
2113	40°19.8	144°49.5	A	49		4/12	1550	10 YR 6/6
2114	40°20.2	145°02.5	A	49		4/12	1652	10 YR 6/6
2115	40°10.2	145°00.7	A	53		4/12	1807	5 Y 7/2
2116	41°00	144°33.7	A	55		4/14	1021	10 YR 5/4
2117	41°01.2	144°21.5	A	80		4/14	1130	10 YT 6/4
2118	41°00	144°07.5	B	104		4/14	1300	10 YR 7/4
2119	41°00	143°55	C	170		4/14	1425	10 YR 7/4
2120	41°09.4	144°10.6	C	132		4/14	1706	10 YR 7/4
2121	41°09.2	144°24.2	B	88		4/14	1835	10 YR 7/4
2122	41°29.5	144°24.4	B	119		4/15	0828	10 YR 7/4
2123	41°29.5	144°36.2	A	91	Boxdred	4/15	0934	10 YR 6/4
2124	41°30.3	144°45.8	A	49	Pipdred	4/15	1040	10 YR 5/4
2125	41°39.8	144°47.3	A	60		4/15	1153	10 YR 5/4
2126	41°39.5	144°37.1	A	130		4/15	1250	10 YR 7/4
2127	41°39.6	144°28.7	B	186		4/15	1355	5 Y 7/2
2128	41°50	144°34.6	B	170		4/15	1540	5 Y 7/2
2129	41°49.5	144°46	A	86		4/15	1710	5 Y 7/2
2130	41°50	144°57.1	A	69		4/15	1809	10 YR 5/2
2131	41°58.3	144°37.3	C	155		4/16	1700	10 YR 7/4
2132	42°00.2	144°51.8	B	132		4/16	0755	10 YR 7/4
2133	42°00.5	145°00.6	A	88		4/16	0855	10 YR 5/4
2134	41°59.8	145°09.0	A	48		4/16	0950	
2135	42°10.2	145°10.4	A	37		4/16	1058	10 YR 6/2
2136	44°10.2	144°57.2	A	128		4/16	1200	10 YR 7/4
2137	44°09.6	144°43.8	B	161		4/16	1258	10 YR 8/2
2138	44°19.8	144°51.0	B	170		4/16	1444	10 YR 8/2
2139	44°20.2	145°00.3	A	122		4/16	1545	10 YR 7/4

Sampling No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73632140	42°20	145°08.3	A	90	Pipdred	4/16	1636	10 YR 7/4
2141	41°11.2	144°35.6	A	80		4/18	0815	10 YR 6/2
2142	41°20.3	144°39.8	A	30		4/18	0924	
2143	41°19.6	144°26.6	B	128		4/18	1030	
2144	40°10.2	144°06.5	A	49		4/24	0816	10 YR 7/4
2145	40°10.5	144°18.6	A	51		4/24	0927	10 YR 8/2
2146	40°10.	144°32.6	A	59		4/24	1042	10 YR 8/2
2147	40°10	144°45.8	B	59		4/24	1145	10 YR 7/4
2148	40°09.2	145°11.6	B	51		4/24	1342	10 YR 7/4
2149	40°09.5	145°25.5	C	64		4/24	1450	10 Y 6/2
2150	40°22.5	143°39.	C	128	Boxdred	4/25	0900	
2151	40°09.4	143°37.5	A	81		4/25	1142	
2152	40°09.5	143°30.6	B	104	Pipdred	4/25	1230	10 YR 7/4
2153	40°20.	143°27.5	C	106		4/25	1345	10 YR 7/4
2154	40°20.5	143°41.	B	86		4/25	1453	10 YR 5/4
2155	40°21.2	143°53.6	B	59		4/25	1551	10 YR 7/2
2156	40°14.5	143°46.4	A	68		4/29	0845	
2157	40°13.8	143°35.7	A	95		4/29	1005	5 Y 7/2
2158	40°24.8	143°34.3	A	110		4/29	1152	10 YR 7/4
2159	40°36.5	143°37.	B	108		4/29	1352	10 YR 7/4
2160	40°36.4	143°47.	C	90		4/29	1530	10 YR 7/4
2161	40°00.1	144°13.7	A	33		4/30	0825	10 YR 7/4
2162	40°00	144°26.5	A	46		4/30	0930	10 YR 7/7
2163	40°00	144°38.5	B	46		4/30	1040	10 YR 7/4
2164	40°00	144°52.6	B	53		4/30	1150	10 YR 7/2
2165	40°00	145°06.0	C	55		4/30	1300	10 YR 7/2
2166	40°00	145°19.0	C	64		4/30	1410	10 YR 6/2
2167	40°00	145°32.5	C		Pipdred Piscore	4/30	1520	10 YR 6/2
2168	39°49'6	144°11.9	A	27	Pipdred	5/01	1800	5 Y 5/2
2169	39°49.9	144°25.3	A	37		5/01	0922	10 YR 7/4
2170	39°50	144°38.7	B	46		5/01	1040	10 YR 7/4
2171	39°50	144°51.3	B	49		5/01	1155	10 YR 7/2
2172	39°50	145°04.6	C	51		5/01	1311	10 YR 7/2
2173	39°50	145°18.0	C	59		5/01	1420	10 YR 7/4
2174	39°50	145°31.0	D	68		5/01	1545	5 Y 6/1
2175	38°40.	144°01.1.	A	71		5/02	0805	10 YR 6/6
2176	38°40.	144°14.0	A	73		5/02	0915	10 YR 5/4
2177	38°40	144°27.0	B	77		5/02	1020	5 Y 5/4
2178	38°40.5	144°39.4	A	77		5/02	1125	10 YR 5/4
2179	38°40.5	144°47.4	A	75		5/02	1206	10 YR 6/6
2180	38°40.0	144°53.8	A	73		5/02	1245	10 YR 5/4
2181	38°40	145°06.7	A	73		5/02	1350	10 YR 5/4
2182	38°40	145°19.2	A	73		5/02	1503	5 Y 5/2
2183	38°40.3	145°30.2	A	44		5/02	1600	5 YR 4/4
2184	38°50	143°58.5	A	77		5/03	0800	10 YR 6/2
2185	38°49.6	144°11.2	A	75		5/03	0902	10 YR 6/2
2186	38°50	144°24.	B	79		5/03	1010	5 Y 7/2
2187	38°50	144°36.6	C	73		5/03	1120	10 YR 5/4

Sampling No.	Latitude	Longitude	Fix	Depth (m)	Sampling Method	Date	Time	Colour
73632188	38°50	144°49.3	C	73	Pipdred	5/03	1230	5 Y 6/1
2189	38°49.2	145°02.4	A	72		5/03	1318	5 Y 6/1
2190	38°49.6	145°14.0	A	73		5/03	1420	10 YR 6/2
2191	38°52.5	145°30	A	71		5/03	1535	5 Y 5/2
2192	39°10.0	144°05.3	B	84		5/04	0835	10 YR 6/6
2193	39°09.5	144°19.0	B	75		5/04	0940	10 YR 7/4
2194	39°09.5	144°33.6	C	66		5/04	1045	10 YR 7/4
2195	39°09.0	144°47.6	C	62		5/04	1150	10 YR 6/4
2196	39°09.0	145°02.2	C	68		5/04	1255	10 YR 7/4
2197	39°08.5	145°15.9	C	71		5/04	1405	10 YR 7/4
2198	39°08.0	145°31.0	B	73		5/04	1515	10 YR 7/4
2199	39°08.	145°39.5	A	71		5/04	1610	10 YR 6/4

Position Grading

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

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

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

D. Approximate: Error maybe as much as nautical 5-8 miles. Interpolation between widely spaced "B" or "C" class fixes.

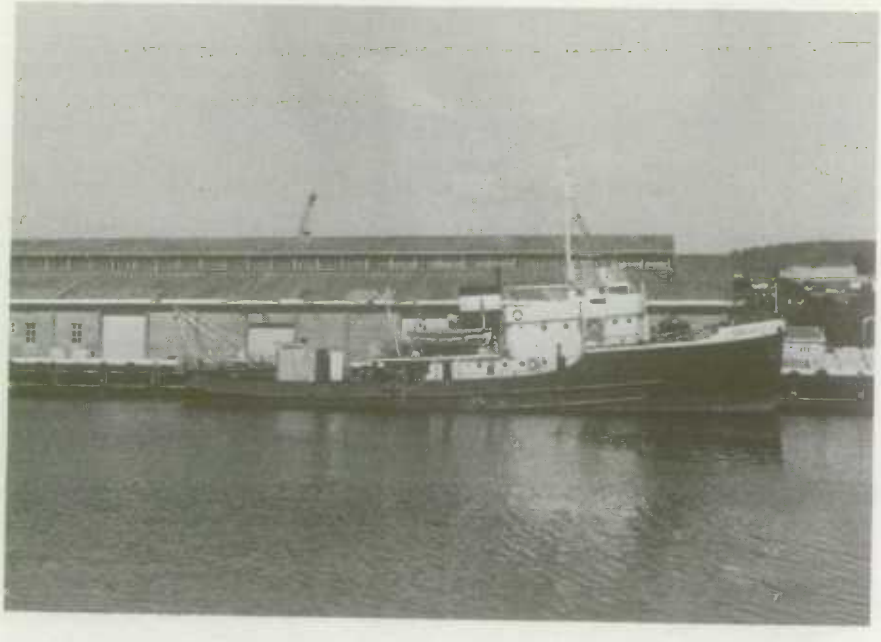
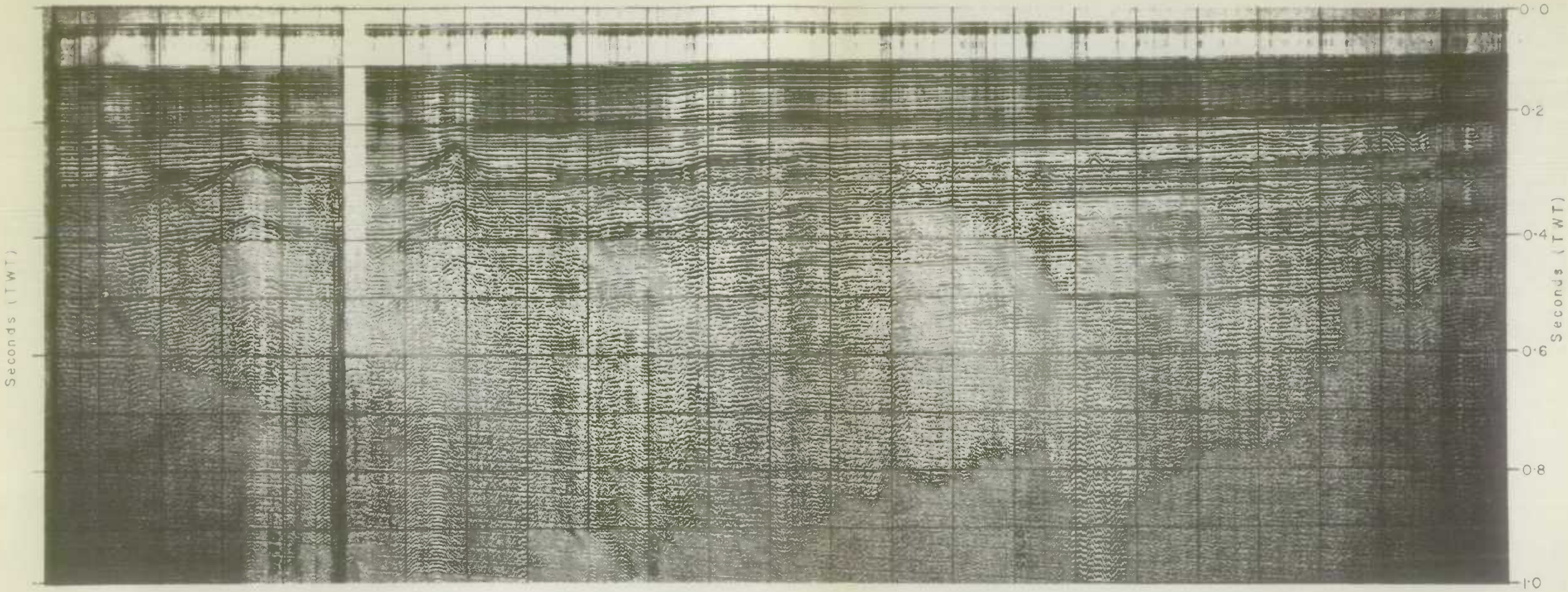


Figure 1. Motor Tug "Sprightly"


WEST
EAST
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0·2
0·4
0·6
0·8
1·0
Seconds (TWT)
Seconds (TWT)
0
5 km

Fig. 2

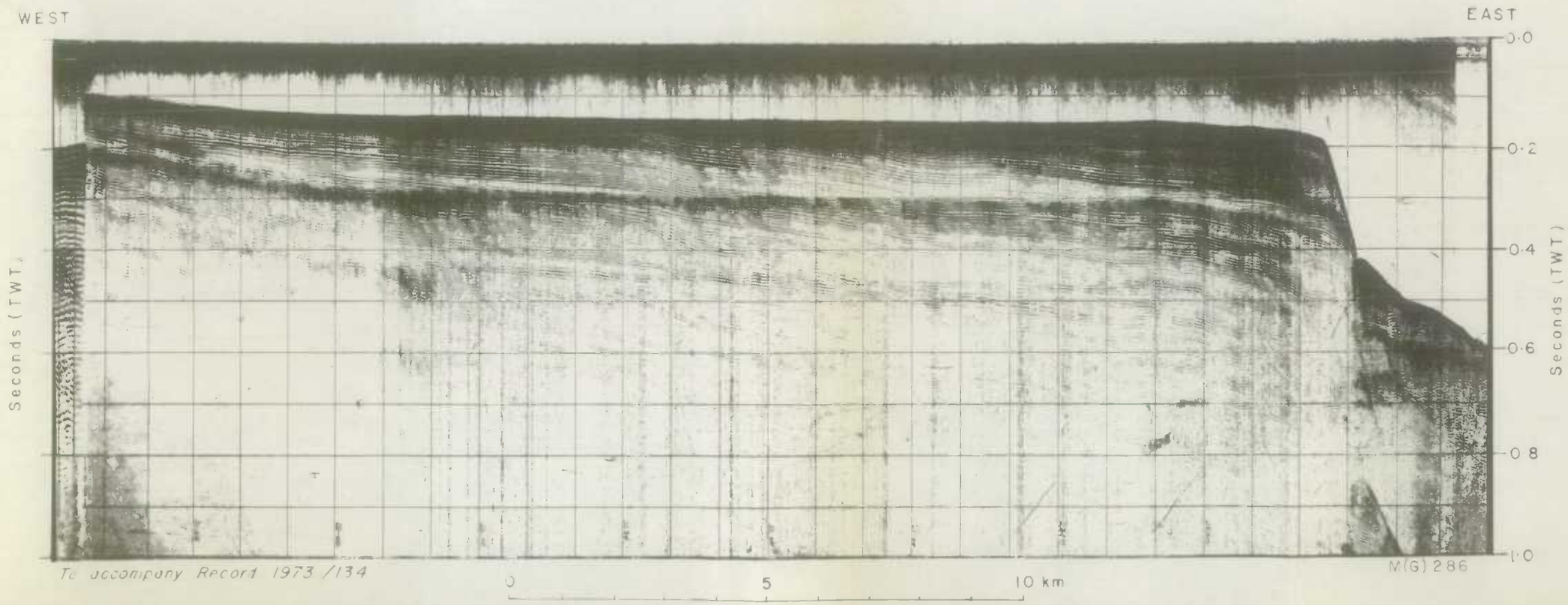

WEST
EAST
0·0
0·2
0·4
0·6
0·8
1·0
Seconds (TWT)
Seconds (TWT)
0
5
10 km
To accompany Record 1973/134
M(G)286

Fig. 3

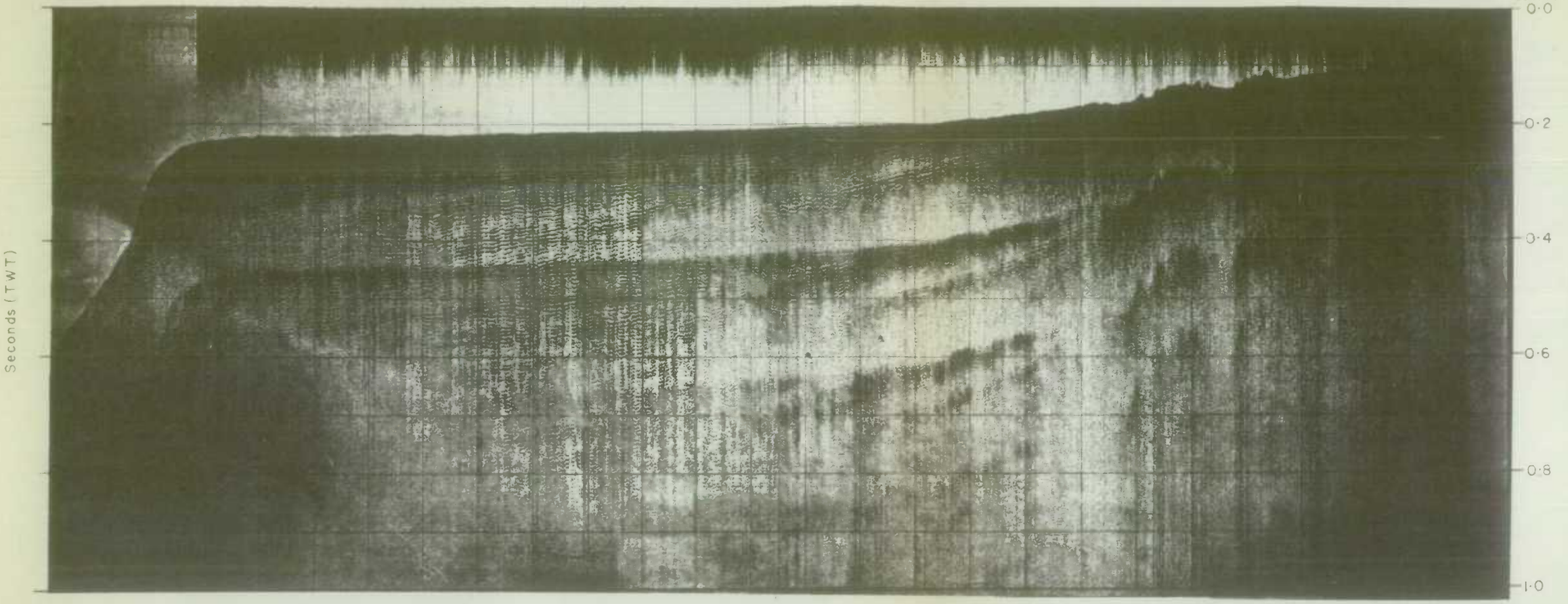
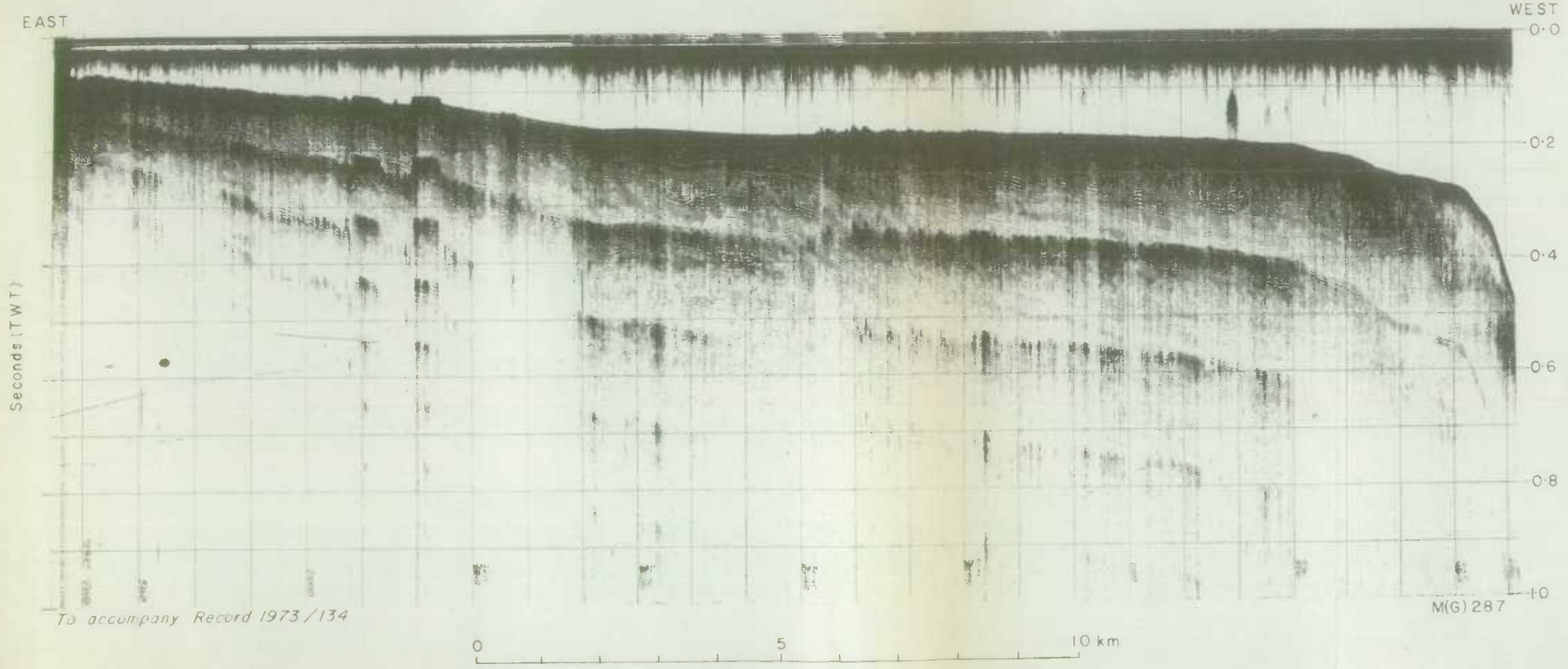


Fig. 4



To accompany Record 1973/134

Fig. 5

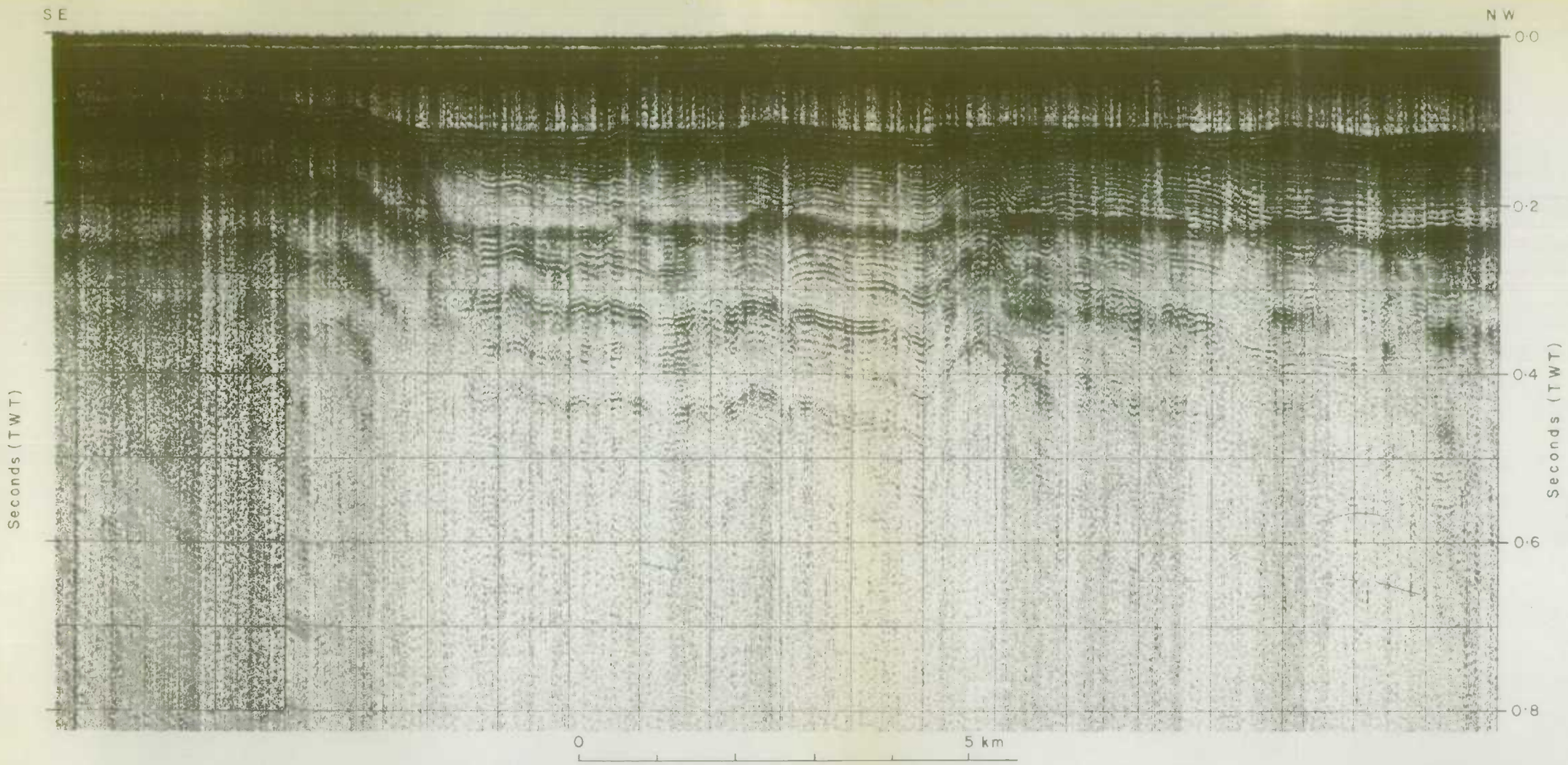

SE
NW
0·0
0·2
0·4
0·6
0·8
Seconds (TWT)
Seconds (TWT)
0
5 km

Fig. 6

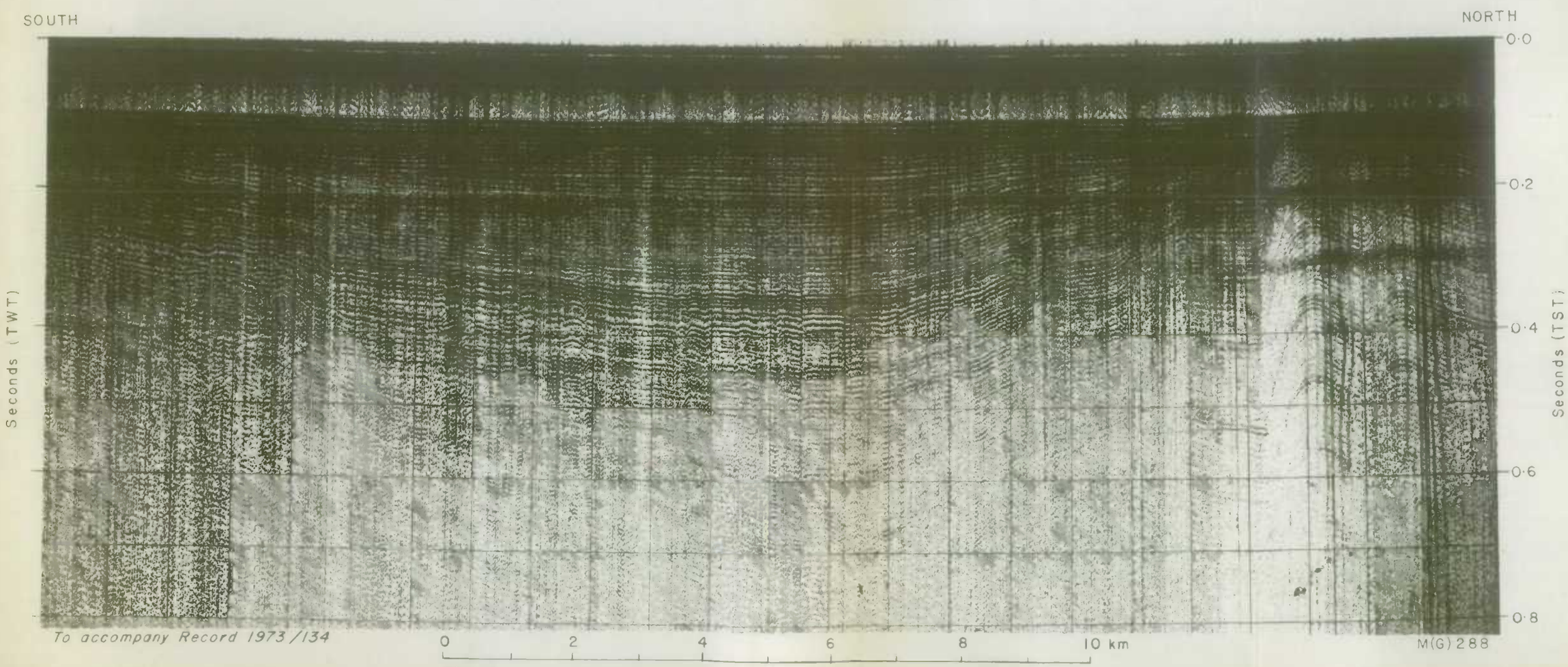

SOUTH
NORTH
0·0
0·2
0·4
0·6
0·8
Seconds (TWT)
Seconds (TST)
To accompany Record 1973/134
0
2
4
6
8
10 km
M(G) 288

Fig. 7

144°
146°
148°
150°
38°
40°
42°
44°

VICTORIA

MELBOURNE

PORT PHILLIP

Geelong

French I

Phillip I

WESTERN PORT

Cape Otway

KING ISLAND–MORNINGTON HIGH

Waratah Bay

Wilsons Prom

Lakes Entrance

200m

Hogan Group

Curtis Group

Kent Group

BASS STRAIT

King I

Flinders I

FURNEAUX GROUP

Cape Barren I

Three Hummock I

HUNTER GROUP

Hunter I

Robbins I

Cape Grim

BANKS STRAIT

Ringarooma Bay

C. Naturaliste

West Pt

Burnie

Launceston

St Helens Pt

Sandy Cape

Cape Sorell

Macquarie Hr

Great Oyster Bay

Low Rocky Pt

Port Davey

South West Cape

South East C

D'ENTRECASTEAUX CHANNEL

HOBART

Storm Bay

Tasman Pen

Cape Pillar

Maria I

TASMANIA

Plate I. Sample stations occupied during 1973
B.M.R. marine geology survey.

SOUTHERN OCEAN

To accompany Record 1973/134.

AUS 6/94

144°
146°
148°
150°
38°
40°
42°
44°

MELBOURNE
PORT PHILLIP
VICTORIA
French I
Phillip I
WESTERN PORT
Lakes Entrance
200m
Wilsons Prom
Hogan Group
Curtis Group
Kent Group
BASS STRAIT
King I
Flinders I
FURNEAUX GROUP
Cape Barren I
Three Hummock I
HUNTER GROUP
Robbins I
West Pt
Launceston
St Helens Pt
Sandy Cape
Great Oyster Bay
HOBART
Storm Bay
Tasman Pen
D'ENTRECASTEAUX CHANNEL
Port Davey
South Cape
TASMANIA
SOUTHERN OCEAN

Plate 2. Facies map - Bass Strait & continental shelf around Tasmania

- Quartz sand / gravel.
- Quartz / carbonate sand / shell gravel.
- Mud / sand - mud with varying amounts of quartz, mollusc shells + Brozoan skeletons.
- Mollusc / Bryozoa sand and gravel.

To accompany Record 1973/134.

AUS 6/92

144°
146°
148°
150°
38°
40°
42°
44°

MELBOURNE
PORT PHILLIP
WESTERN PORT
French I
Phillip I
Lakes Entrance
200m
VICTORIA
Wilsons Prom
Hogan Group
Curtis Group
Kent Group
BASS STRAIT
King I
Flinders I
FURNEAUX GROUP
Cape Barren I
Three Hummock I
HUNTER GROUP
Hunter I
Robbins I
West Pt
Ringarrooma Bay
St Helens Pt
Launceston
Sandy Cape
Macquarie Hr
Great Oyster Bay
TASMANIA
HOBART
Storm Bay
Tasman Pen
D'ENTRECASTEAUX CHANNEL
Port Davey
Low Rocky Pt
South East C

Plate 3. Location of shallow seismic reflection profiles - 1973 B.M.R. marine geology survey.

SOUTHERN OCEAN

To accompany Record 1973/134

AUS 6/91