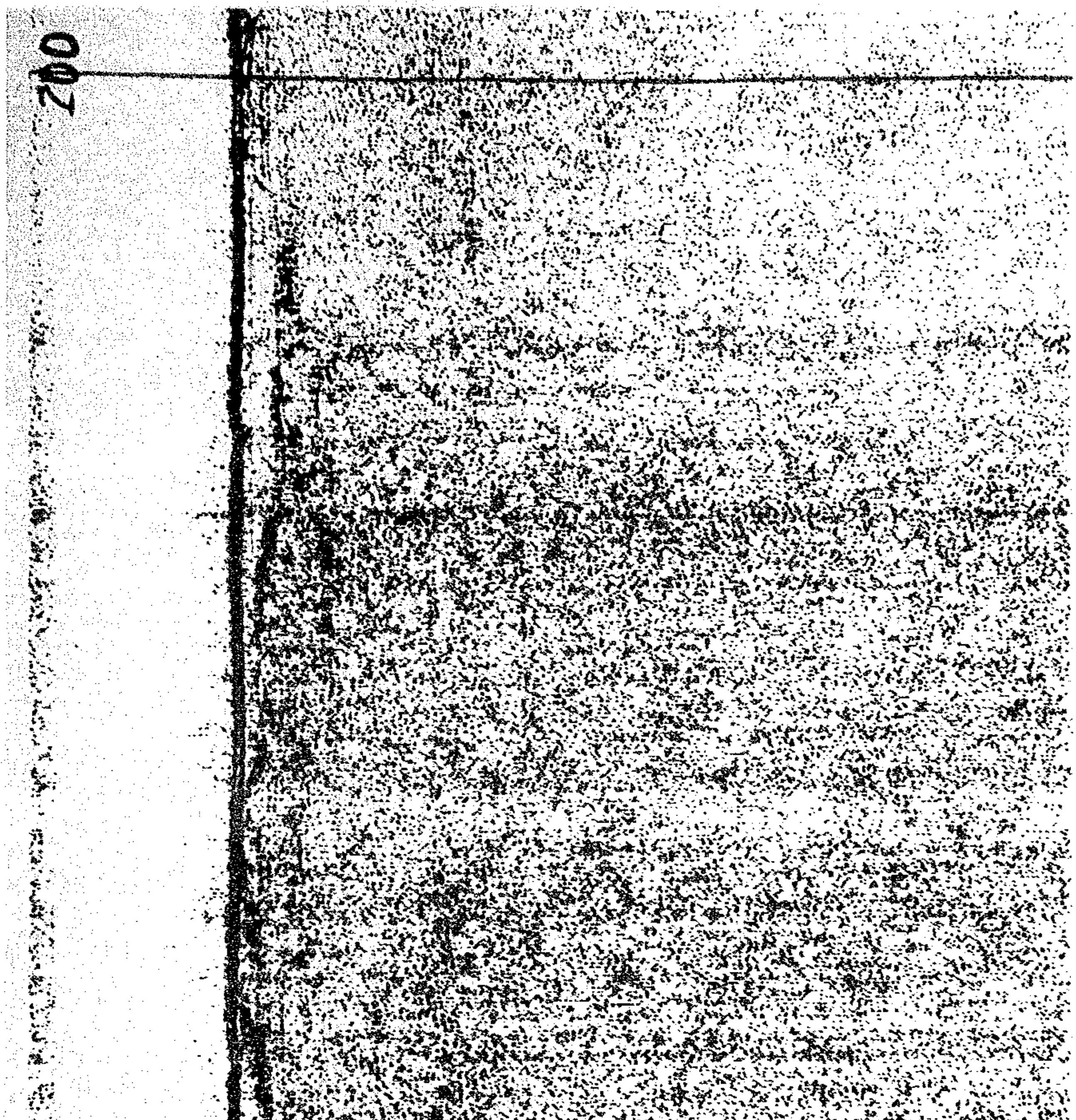


Fig.3.5.15(f) RECORD ON SPARKER

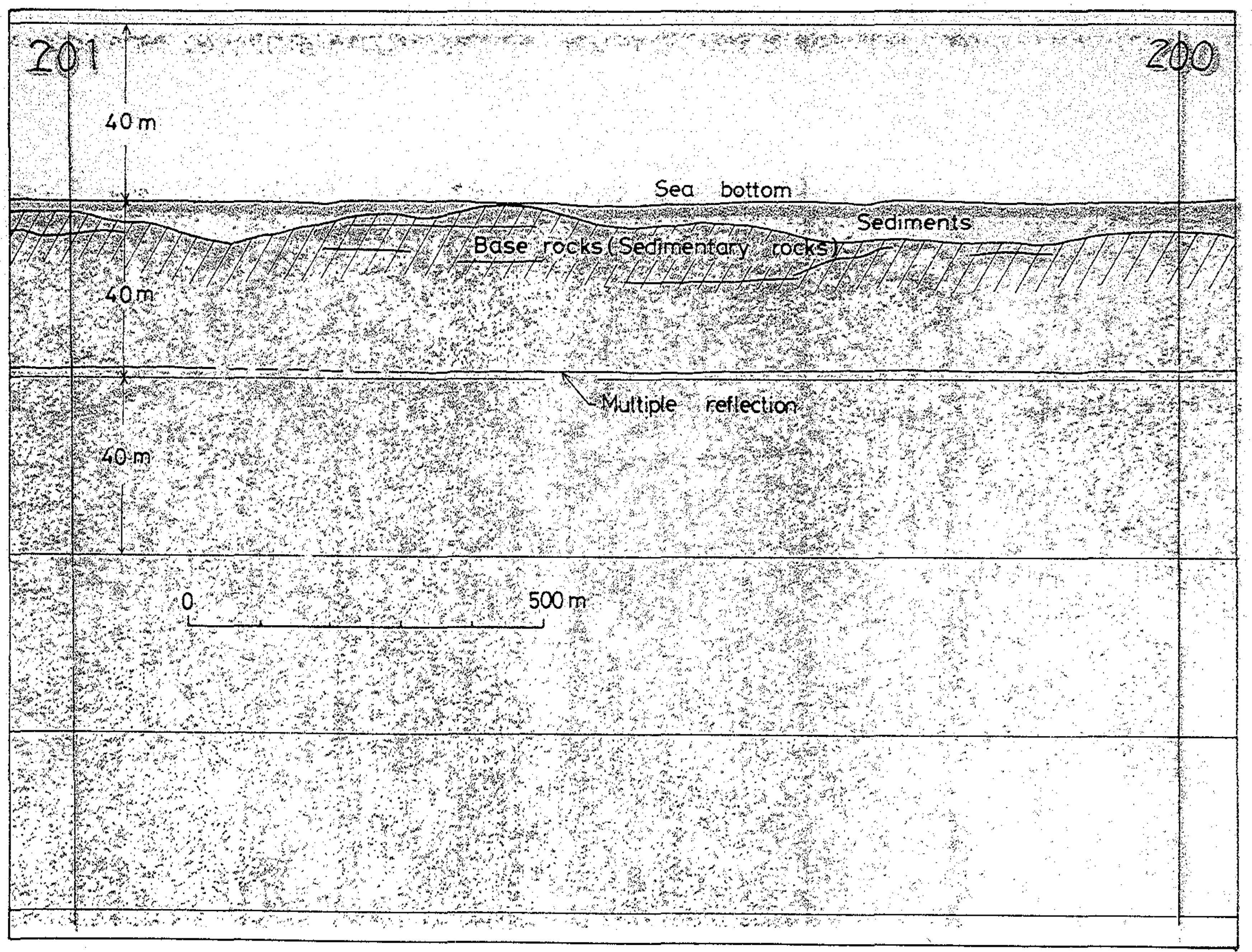


Fig.3.5.15(f) RECORD ON SPARKER

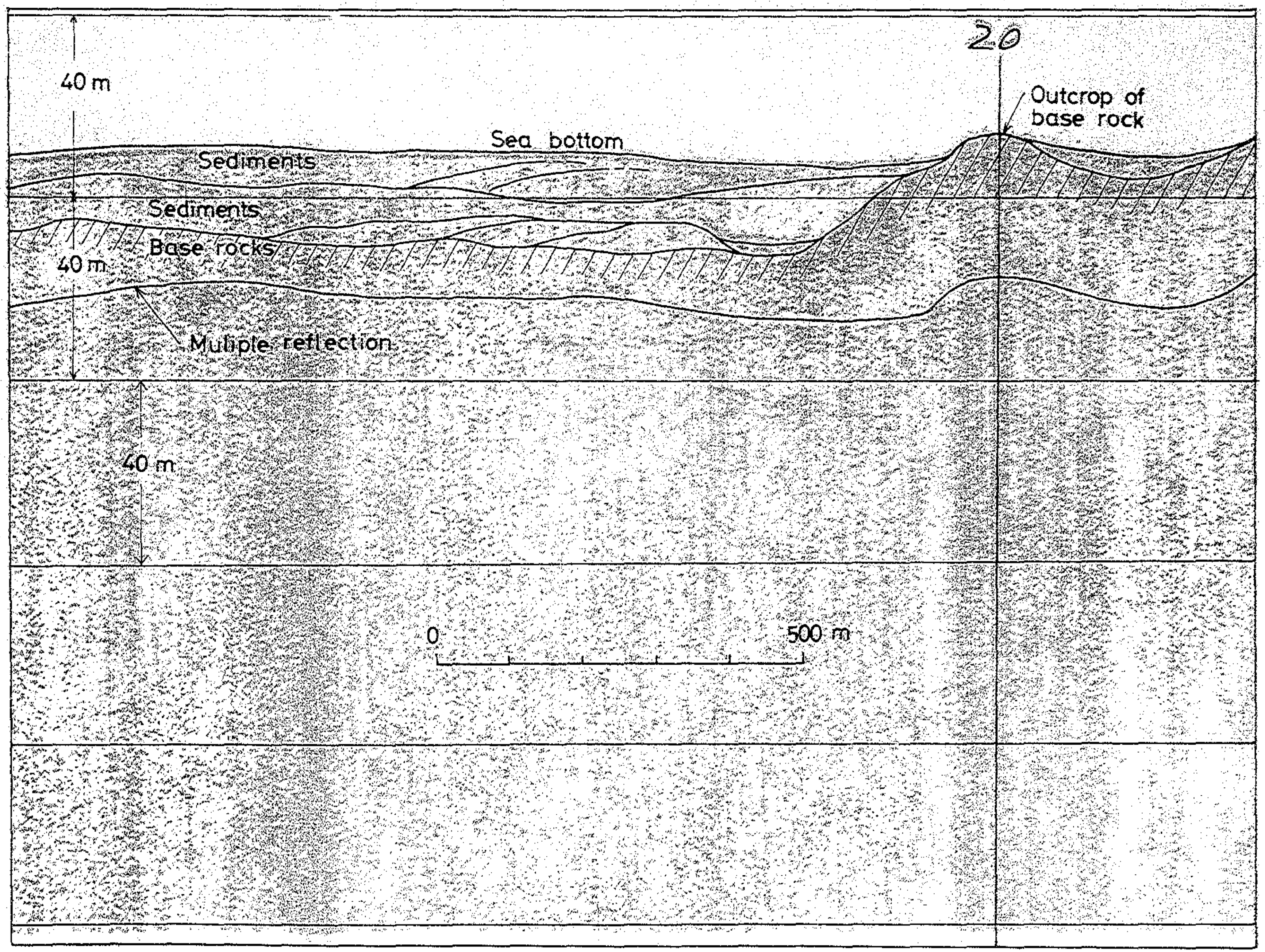


Fig.[illegible].15(g) RECORD ON SPARKER

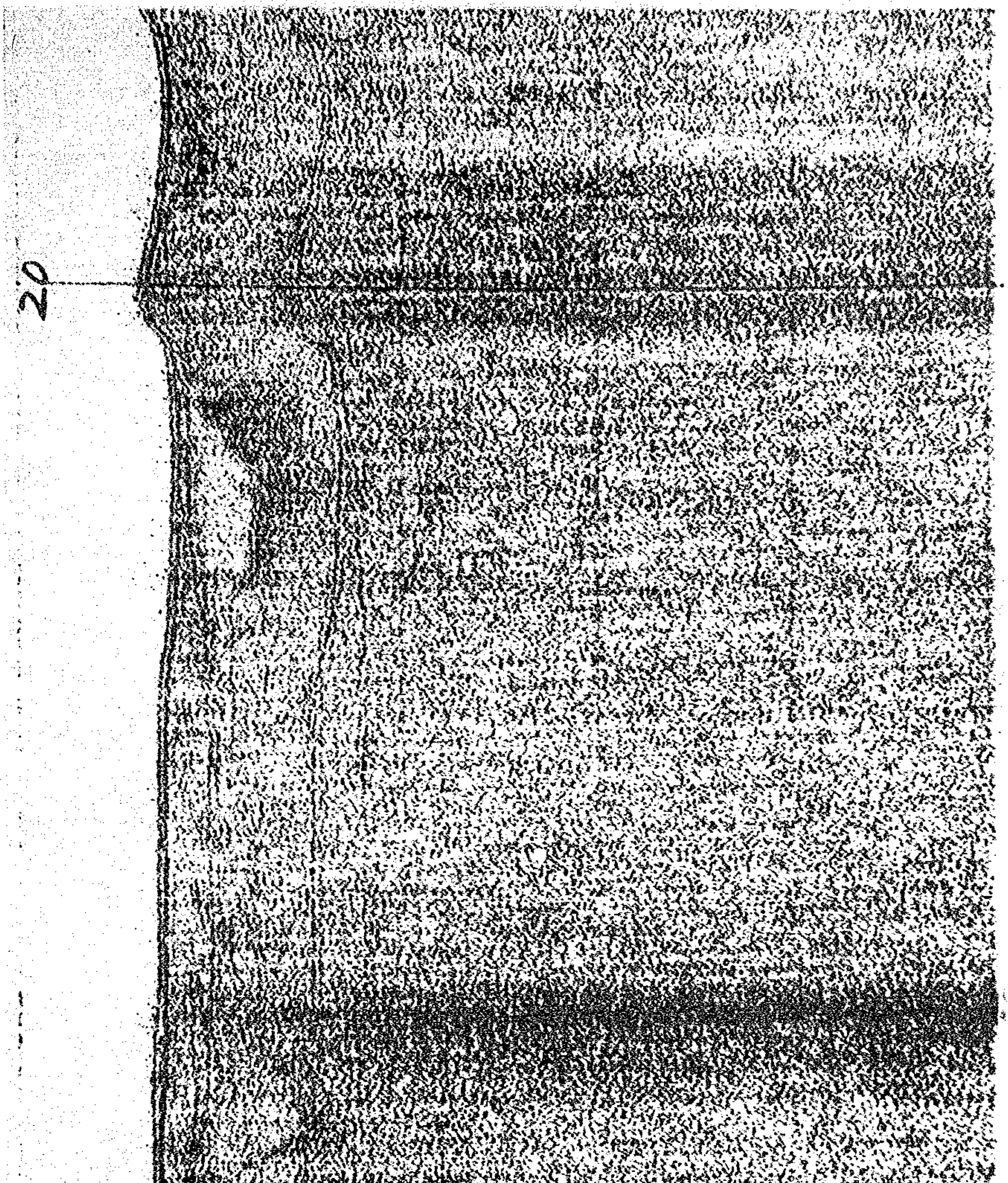


Fig.3.5.15(g) RECORD ON SPARKER

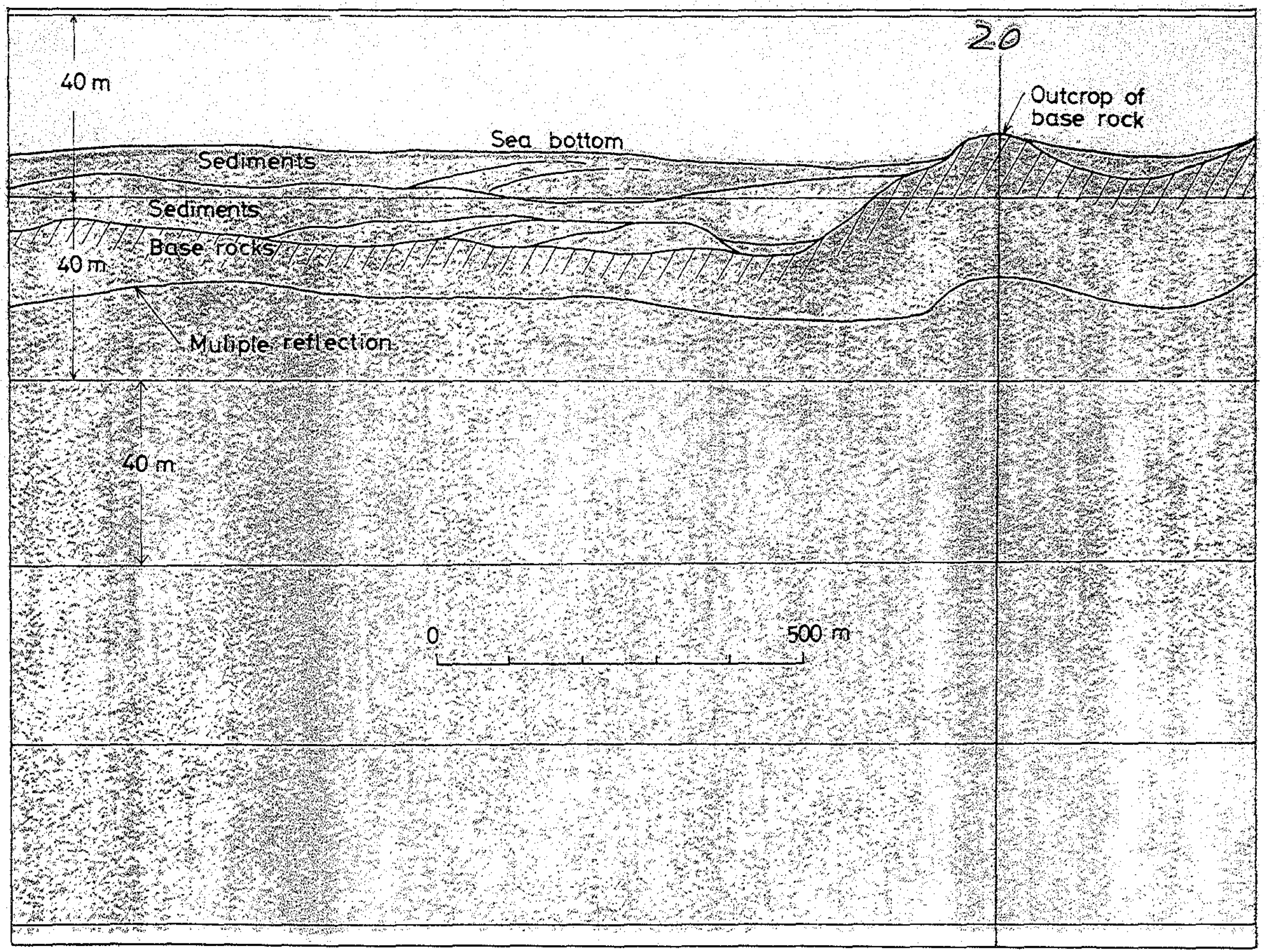


Fig. 3.5.15(g) RECORD ON SPARKER

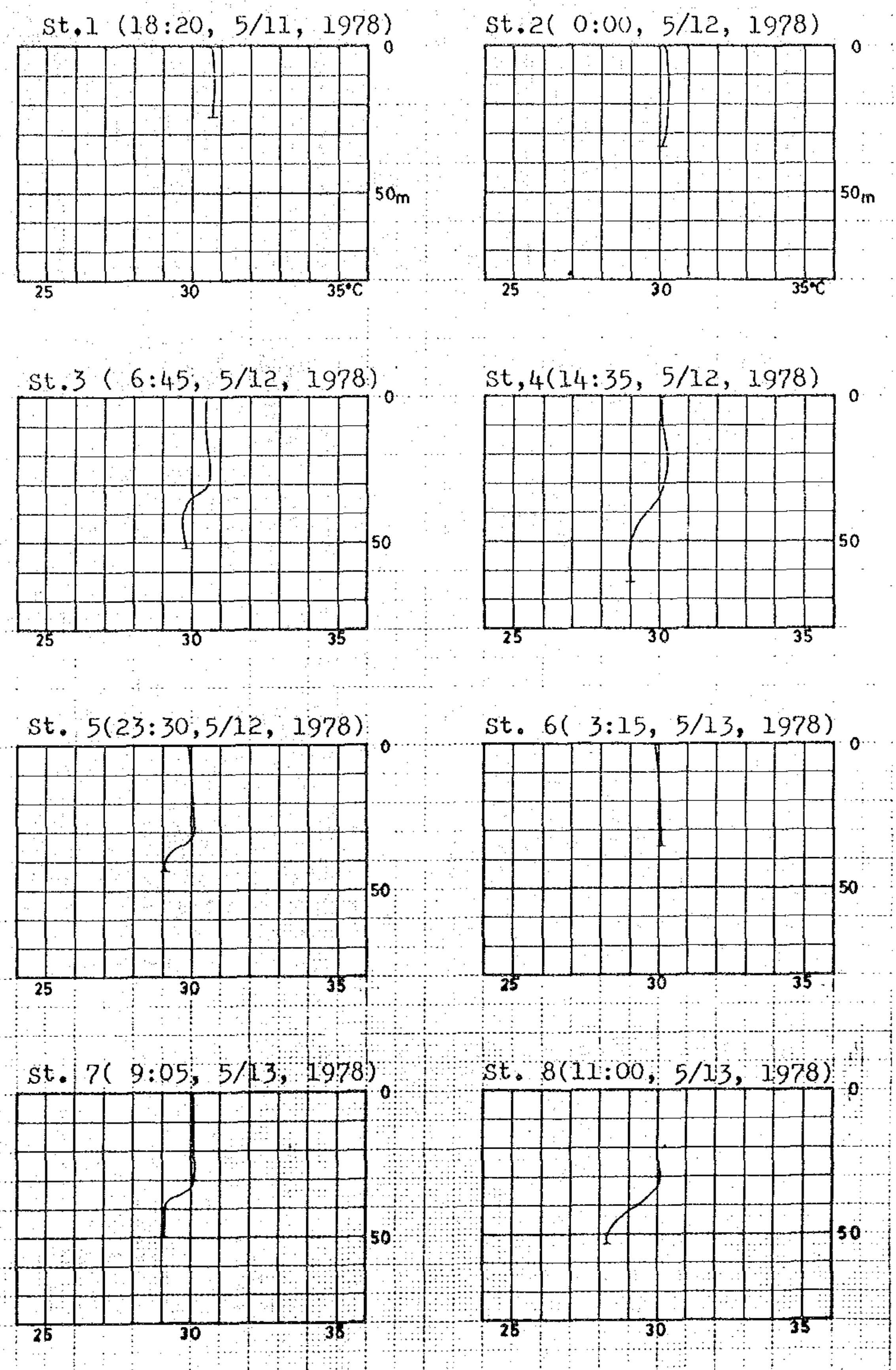


Fig.3.5.16 (a) VERTICAL DISTRIBUTION OF WATER TEMPERATURE (IN °C)

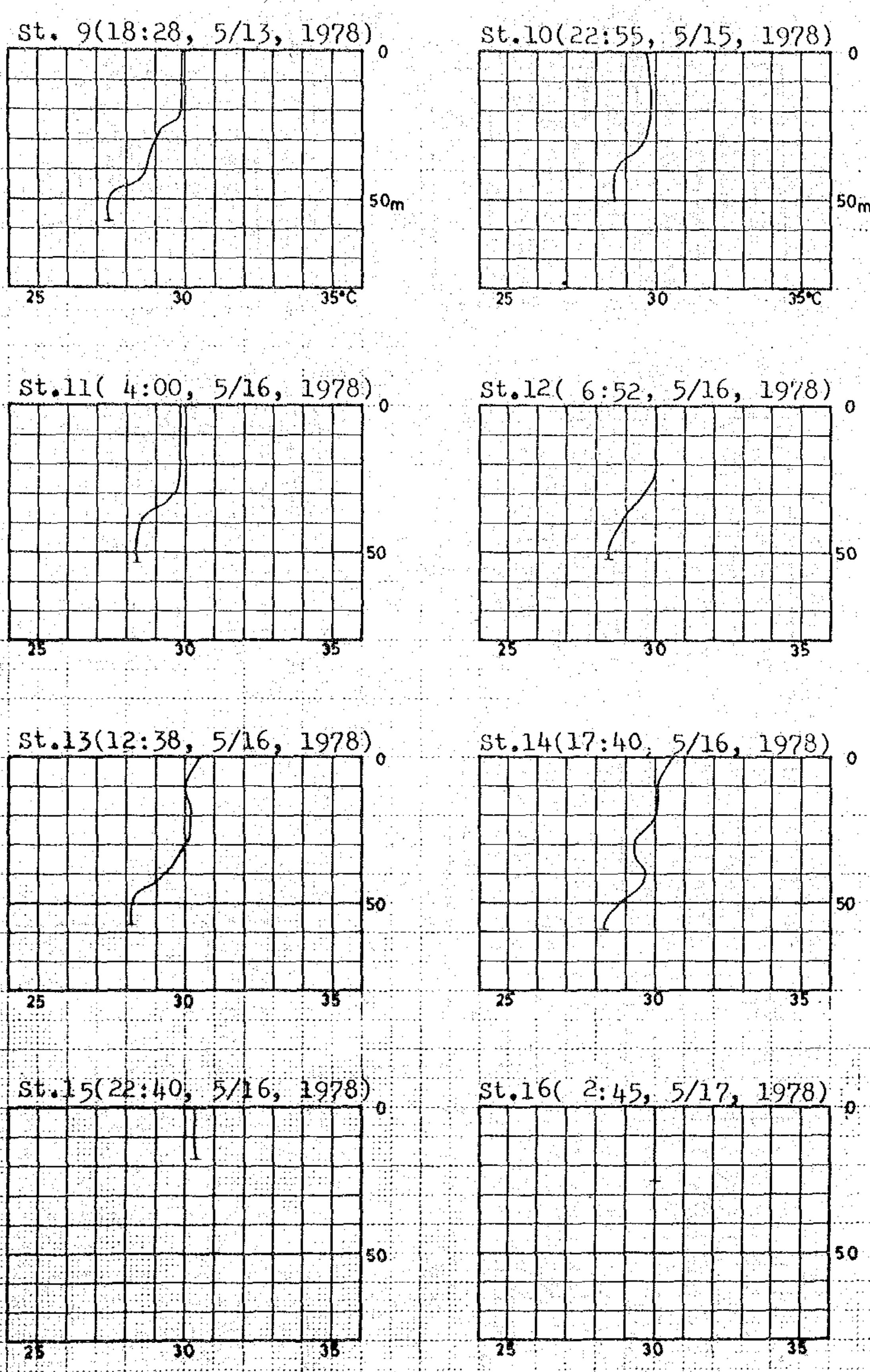


Fig.3.5.16 (b) VERTICAL DISTRIBUTION OF WATER TEMPERATURE (IN °C)

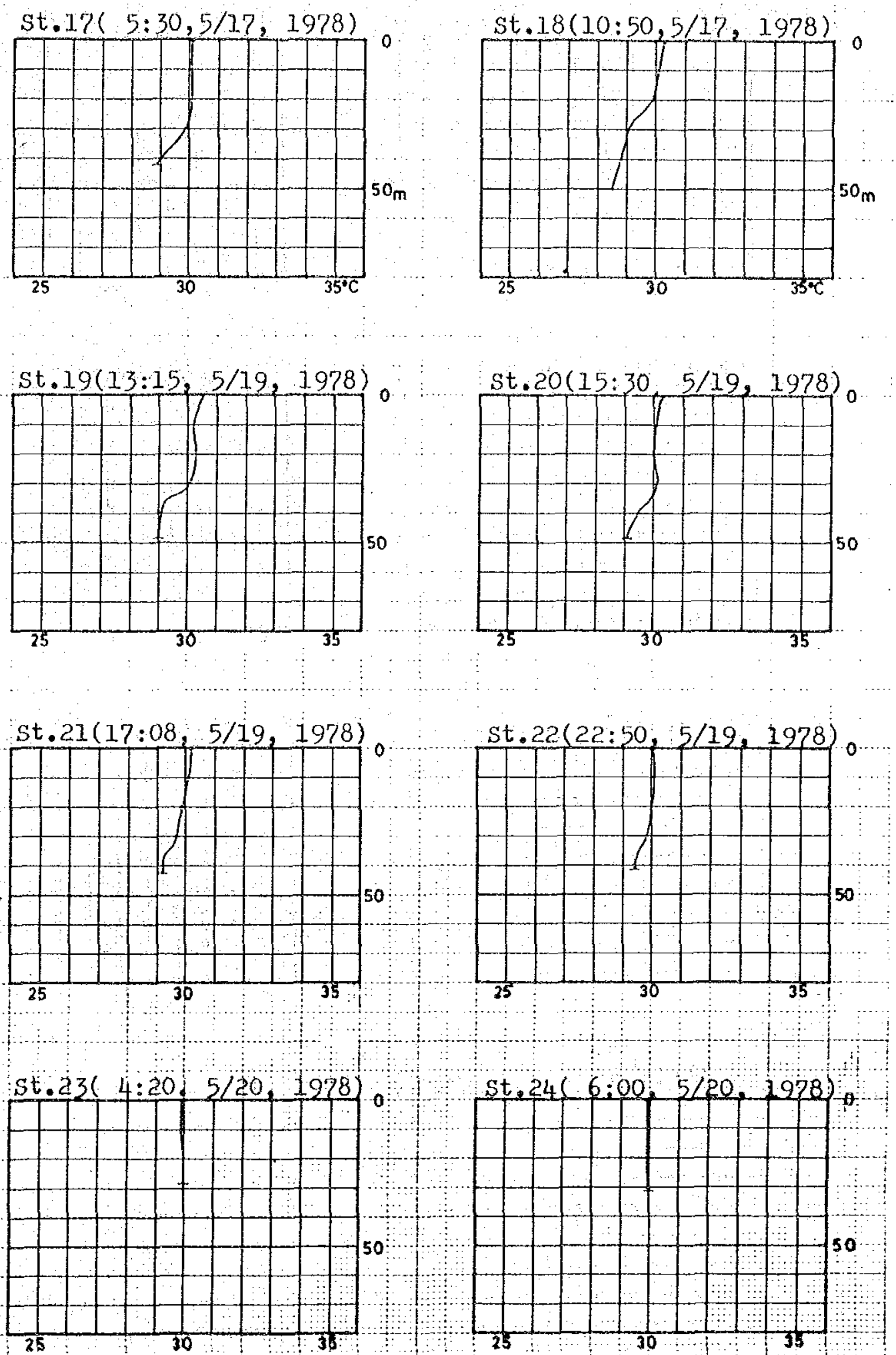


Fig.3.5.16 (c) VERTICAL DISTRIBUTION OF WATER TEMPERATURE (IN °C)

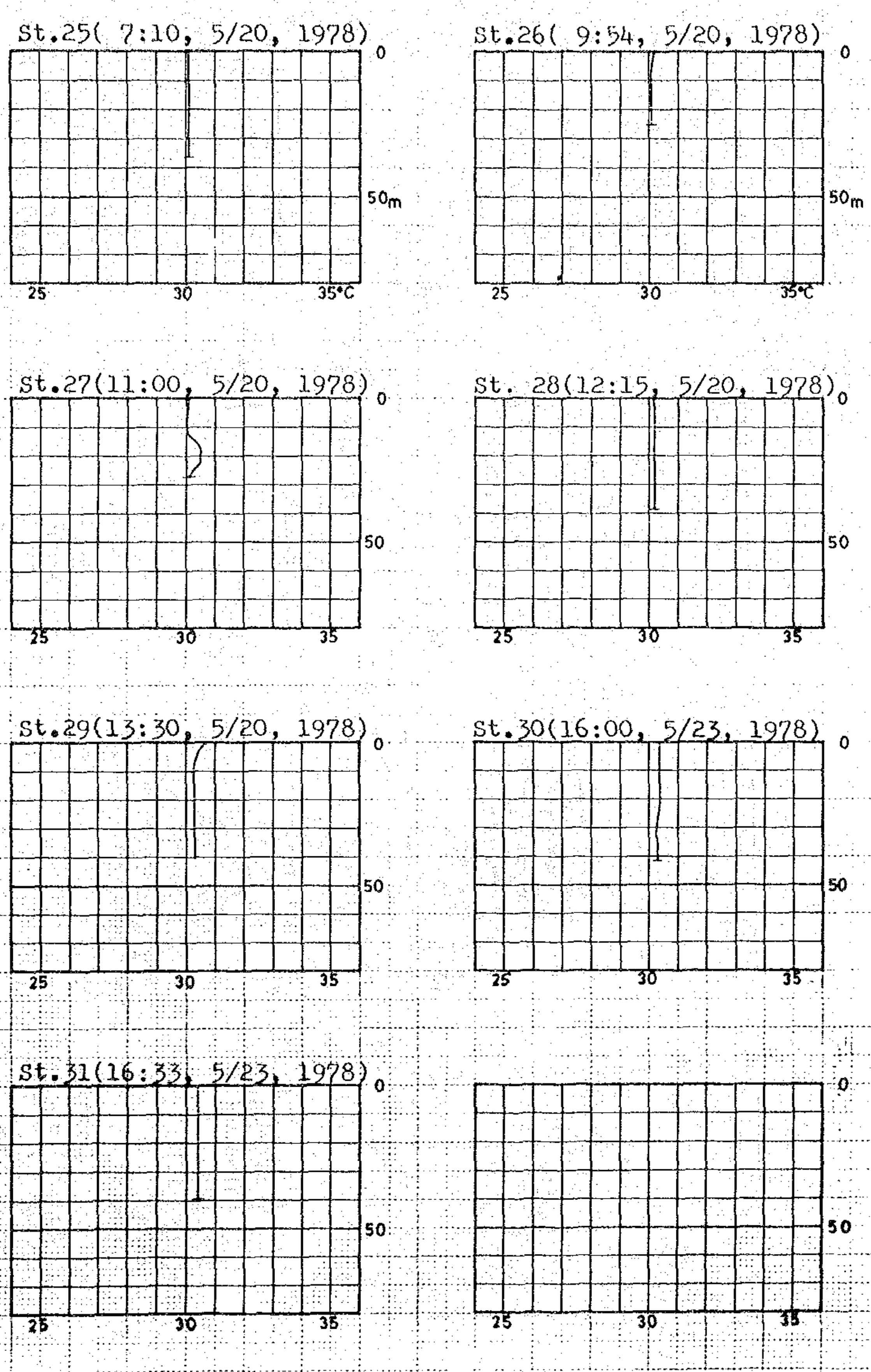


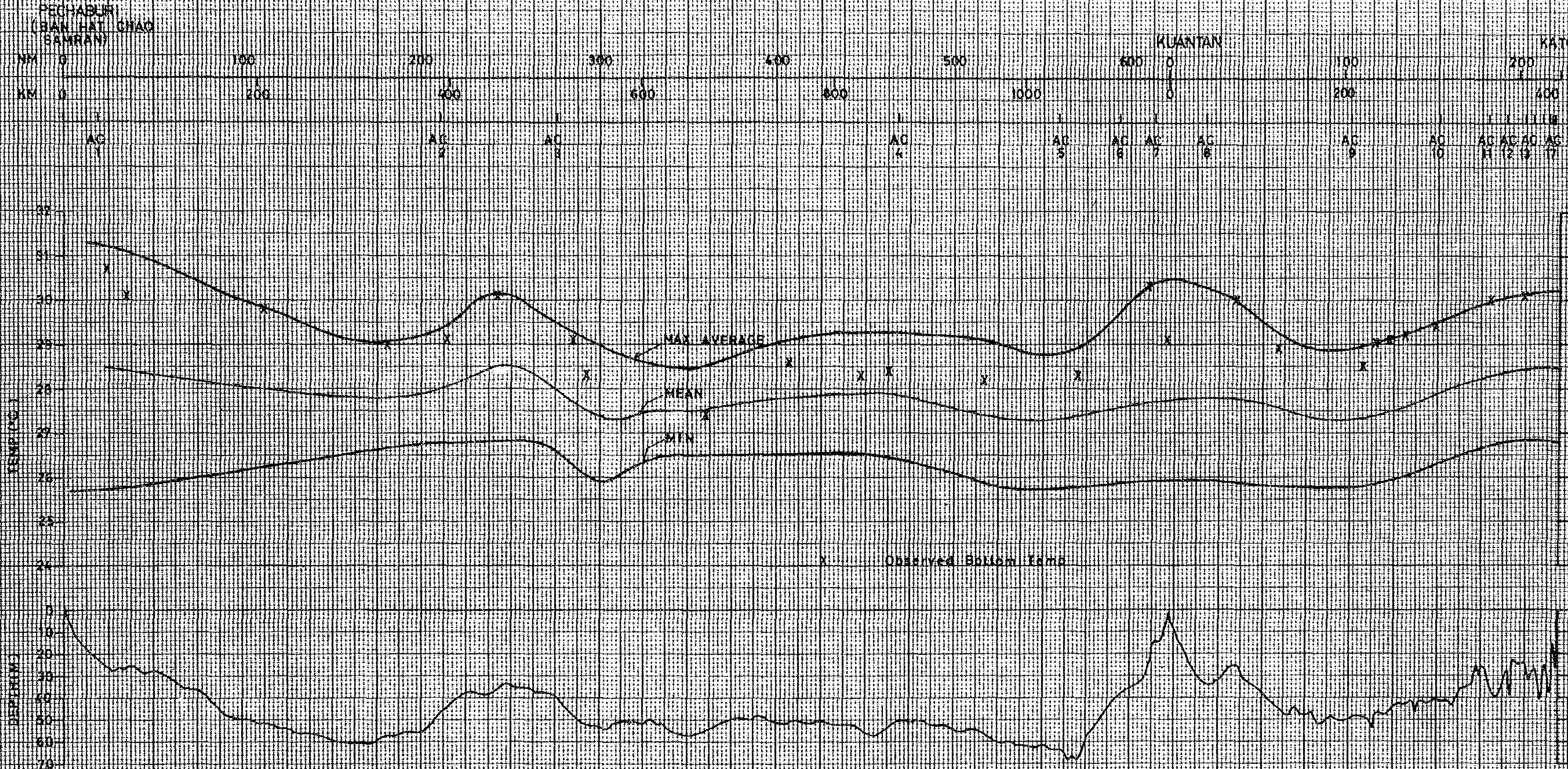
Fig.3.5.16 (d) VERTIC L DISTRIBUTION OF WATER TEMPER TURE (IN °C)

(2) Predictable Temperature variation

Water temperature measurement data provided by the Japan Oceanographic Data Center shows that bottom water temperature variation along the survey route depends on the current of which the direction varies with the seasonal wind, and in general, water temperature variation on the sea surface gives influence to the bottom water temperature in the in-shore portion and the bottom temperature variation in the in-shore portion is much larger than in the offshore portion.

Water temperatures observed this time fell within the data obtained so far. Figure 3.5.17 shows predicted water temperature variations and observed bottom temperatures. 28.0 ± 4°C of the expected temperature variation will be sufficient for the system design.

FIG. 3.5.17 BOTTOM TEMPERATURE AND ITS VARIATION



3.5.7 Current and Tide

(1) Seasonal ocean currents

The major currents in the neighborhood of the South China Sea are mostly those influenced by winds. They are closely related by northeast and southwest monsoons. Figure 3.5.18(a) and (b) shows ocean current in two different seasons.

(a) Northeast monsoom season (November to March)

The northeast monsoon wind blows most heavily in November through March. In this period of the year, a sufficiently developed current runs southward through the South China Sea. Of this current, the SWS-SSW current becomes most prominent, passes through between Sumatra and Borneo and changes its direction to the southeast upon entering the Java Sea. A part of the current having reached the east coast of Peninsular Malaysia is directed northward, enters the Gulf of Thailand, is slightly weakened there, and its main current returns in the clockwise direction. A part of the return current goes southward along the east coast of Peninsular Malaysia and its main current passes to the Java Sea and a branch current goes westward to pass the Singapore Strait. The average current speed is 0.4 - 1.0 knots between Pechaburi and Kuantan and 0.4 - 1.5 knots south of Kuantan.

(b) Southwest monsoon season (June through September)

The ocean current in this season has a tendency nearly opposite to the current in the northeast monsoon season and is considerably remarkable but is somehow weaker than the current in the northeast monsoon season.

A part of the current entered the South China Sea from the Java Sea goes westward through the Singapore Strait. The current passing along the east coast of Peninsular Malaysia and entered the Gulf of Thailand is somehow weakened and tends to return clockwise as the current in the northeast monsoon season. The current speed is $0.2 \sim 0.6$ knots off Pechaburi and 0.5 - 1.5 knots off Kuantan.

In April, May, and October, seasonal winds change and the current speed is decreased. In April and October, the tendency of the northeast monsoon season tendency is exhibited. In May, the tendency of the southwest monsoon season is exhibited.

(2) Tidal current

In the sea area, the diurnal inequality in ebb and flow is large and often only one ebb-and-flow cycle occurs, so that the tidal current is often on the once-a-day basis (although ebb and flow and tidal current are not necessarily in such a relocationship in general). Also, the tidal current is subject to seasonal winds and ocean current. Along the west coast in the Gulf of Thailand the flood current is directed northward and the ebb current southward, their current speeds not exceeding 1 knot. Along the east coast of Peninsular Malaysia the flood current flows southward and ebb current northward, and the current changes its direction 2 ∿ 3 hours after the high or low water.

According to the Survey Report of the Kuantan-Kuching Cable Project, December 1977, a NNW current is dominant with weaker the opposite current being along the coast of Kuantan. The highest current speed observed was 0.74 knots at 19°.

In the Singapore Strait, the diurnal tidal current is rather large and the tide is often on the once-a-day basis. The current speed becomes maximum when the declination of the moon becomes maximum (See Appendix 12). In general, current flows eastward for about 12 hours from the time one hour before the high water and flows westward for another 12 hours. The current speed reaches 2 ∿ 3 knots. When the declination of the moon is small, the flood current flows westward and the ebb current eastward, and their speeds are low.

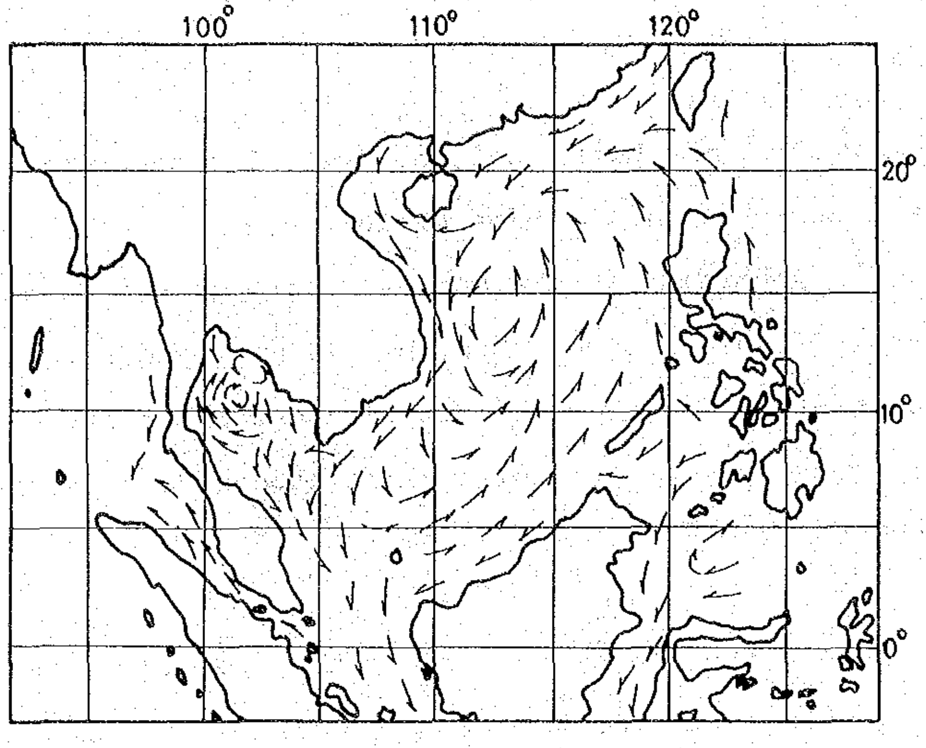


Fig 3 5 18(a) OCEAN CURRENT DURING THE NORTHEAST MONSOON SEASON

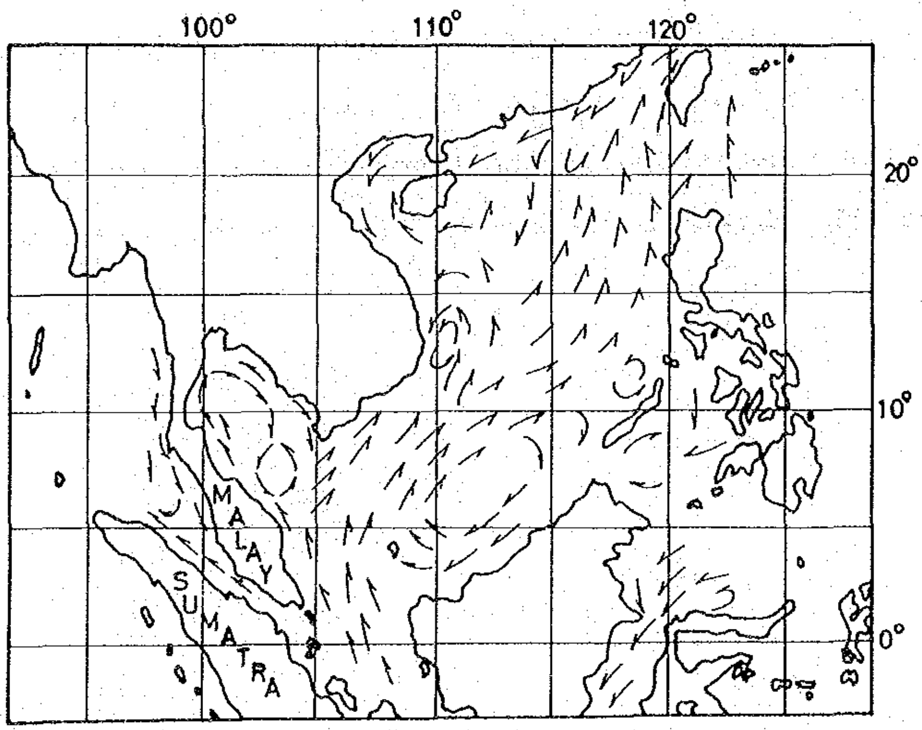


Fig. 3.5.18(b) OCEAN CURRENT DURING THE SOUTHWEST MONSOON SEASON

3.5.8 Landing Sites

The results of survey at the landing sites in Petchaburi (Ban Hat Chao Samran), Kuantan and Katong are respectively shown in Figure 3.5.19(a) ∿ (c). All landing sites were flat involving no marked ups or downs. The ground level at Pechaburi (Ban Hat Chao Samran), Kuantan, and Katong sites were respectively 3.5m, 5.5m, and 3.8m higher than the datum level of water depth. The directions of the cable routes from the landing points to fixed targets at the respective sites are shown in Figure 3.5.20(a) ∿ (c). For the survey results at landing sites, data at Kuantan landing site was obtained from the data of the Kuantan-Kuching Submarine Cable Survey Report 1977 and with some supplementary survey in the topographical features near the coast. Data at Katong landing site was obtained from the Singapore Telecoms.

Fig. 3.5.19(a) CABLE LANDING SITE (PECHABURI; BAN HAT CHAO SAMRAN)

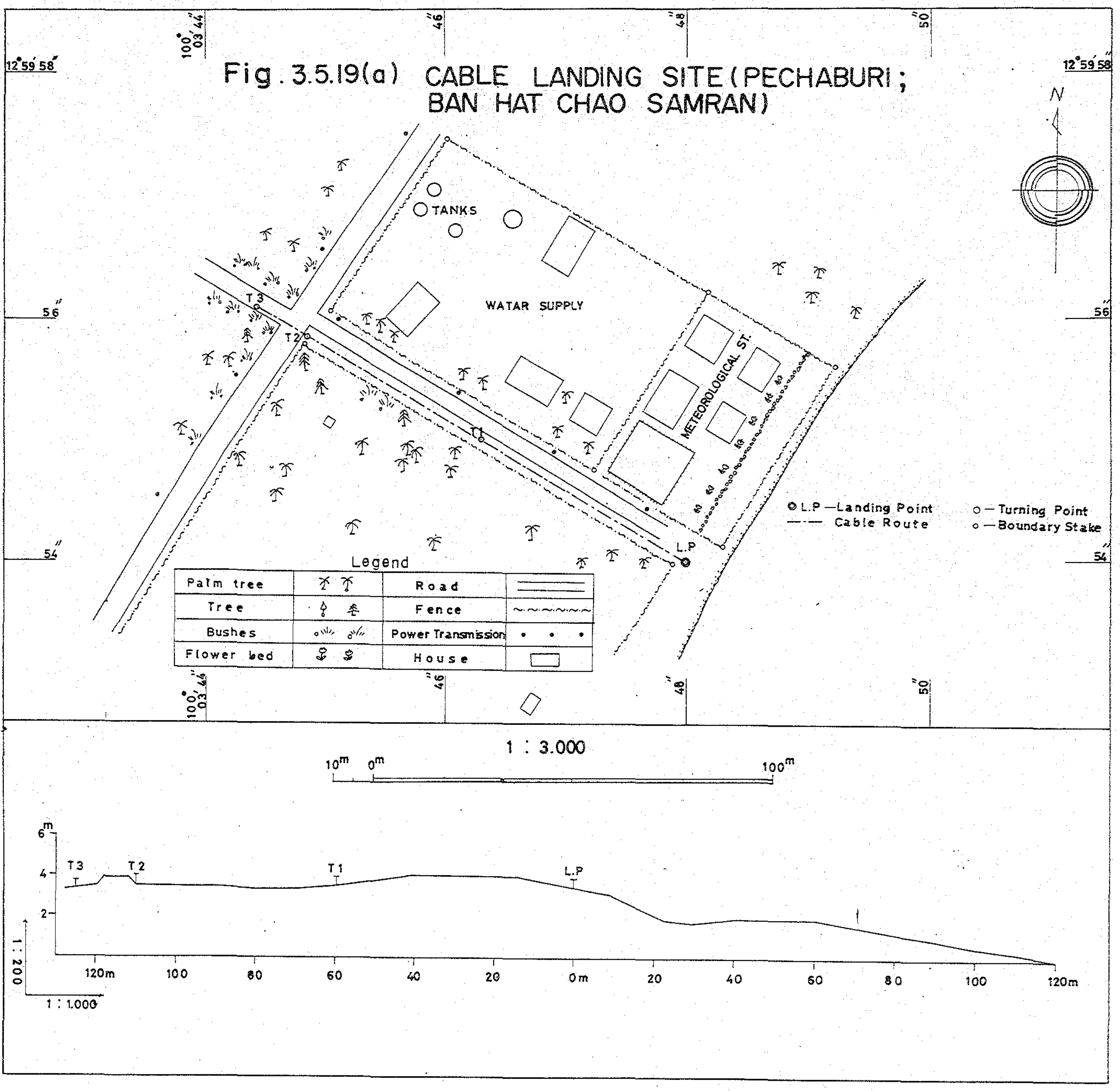


Fig.3 5 19(b) CABLE LANDING SITE (KUANTAN)

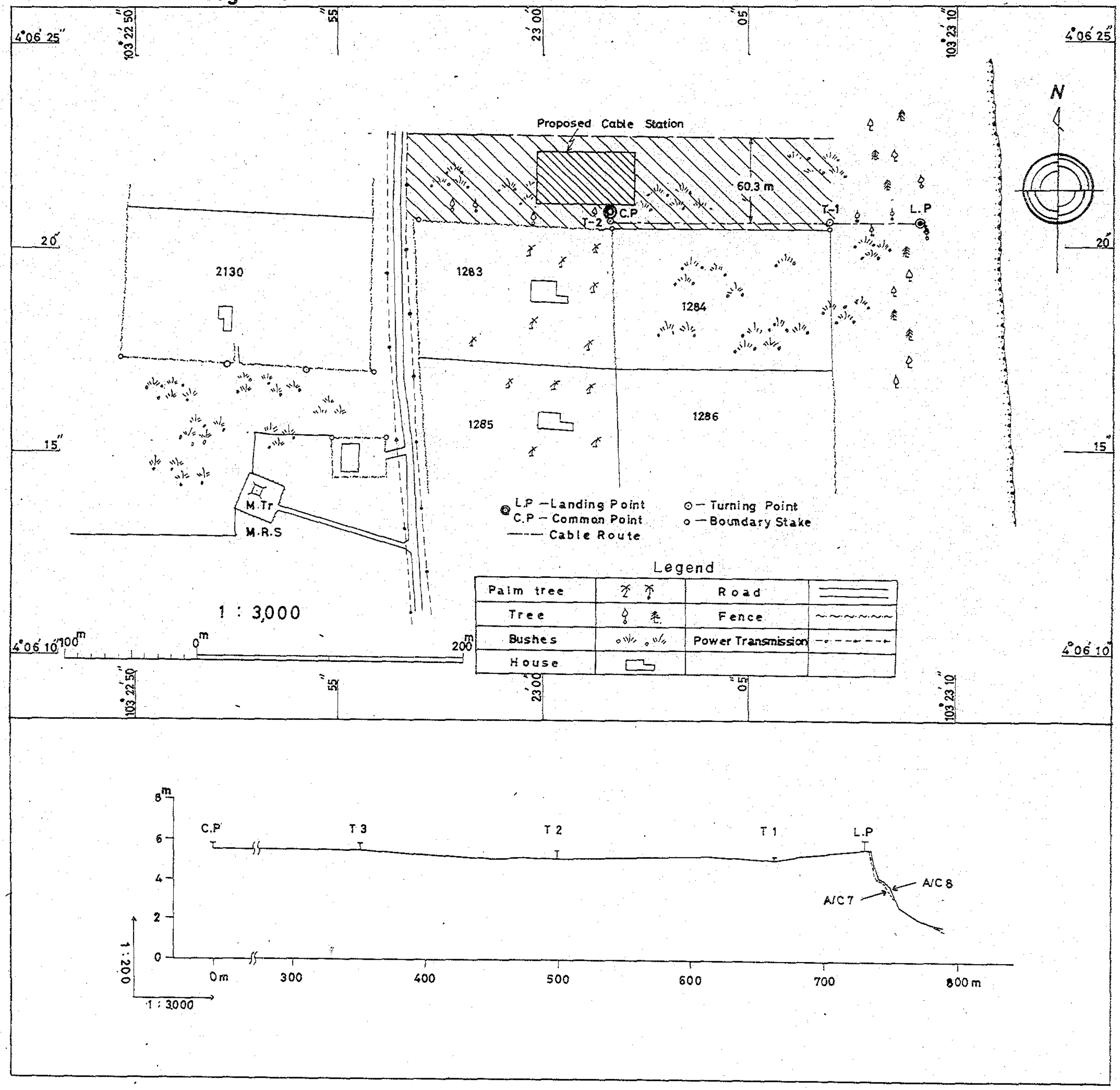


Fig. 3.5.19(C) CABLE LANDING SITE (KATONG)

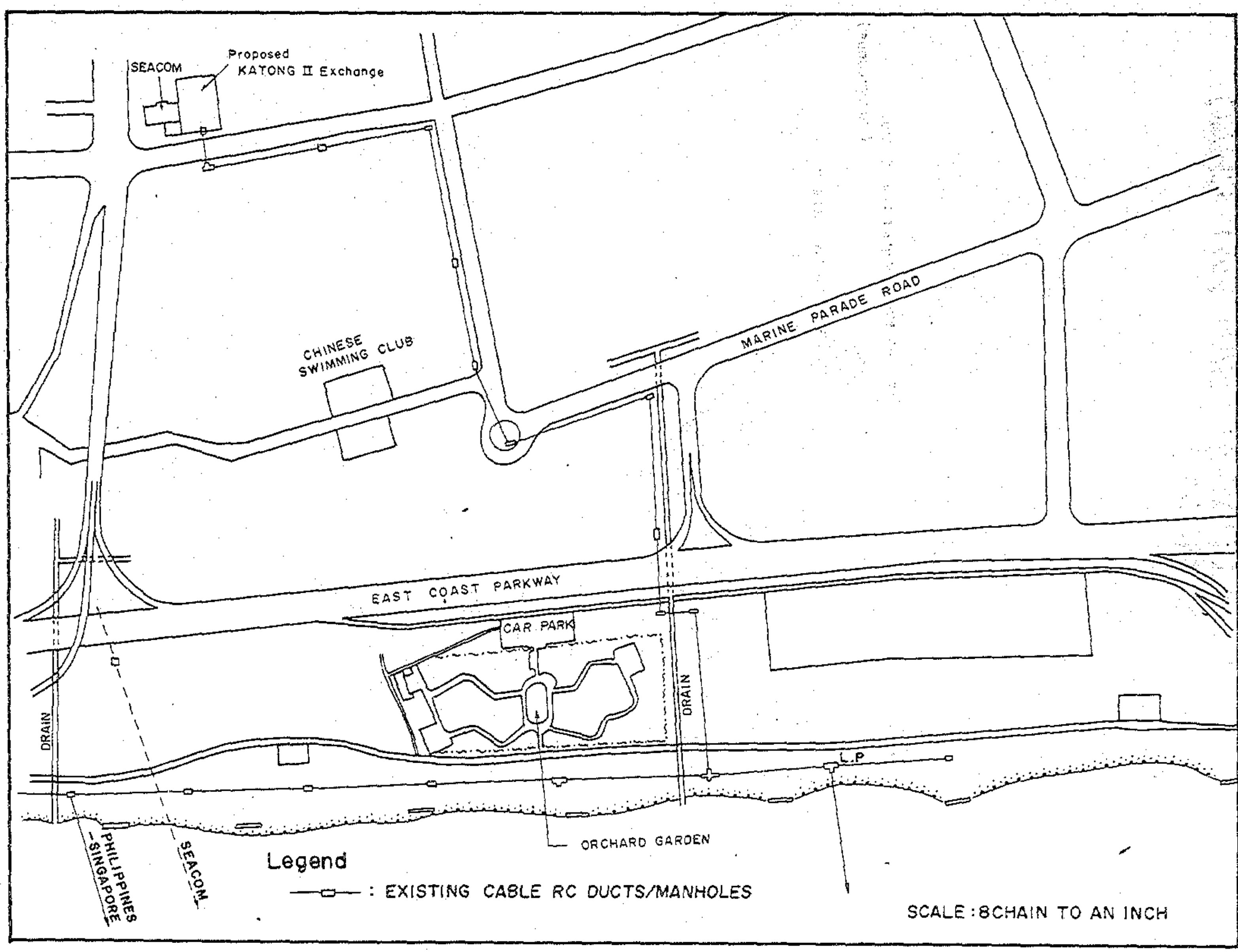


Fig. 3.5.20(a) BEARING OF CABLE ROUTE IN PECHABURI (BAN HAT CHAO SAMRAN)

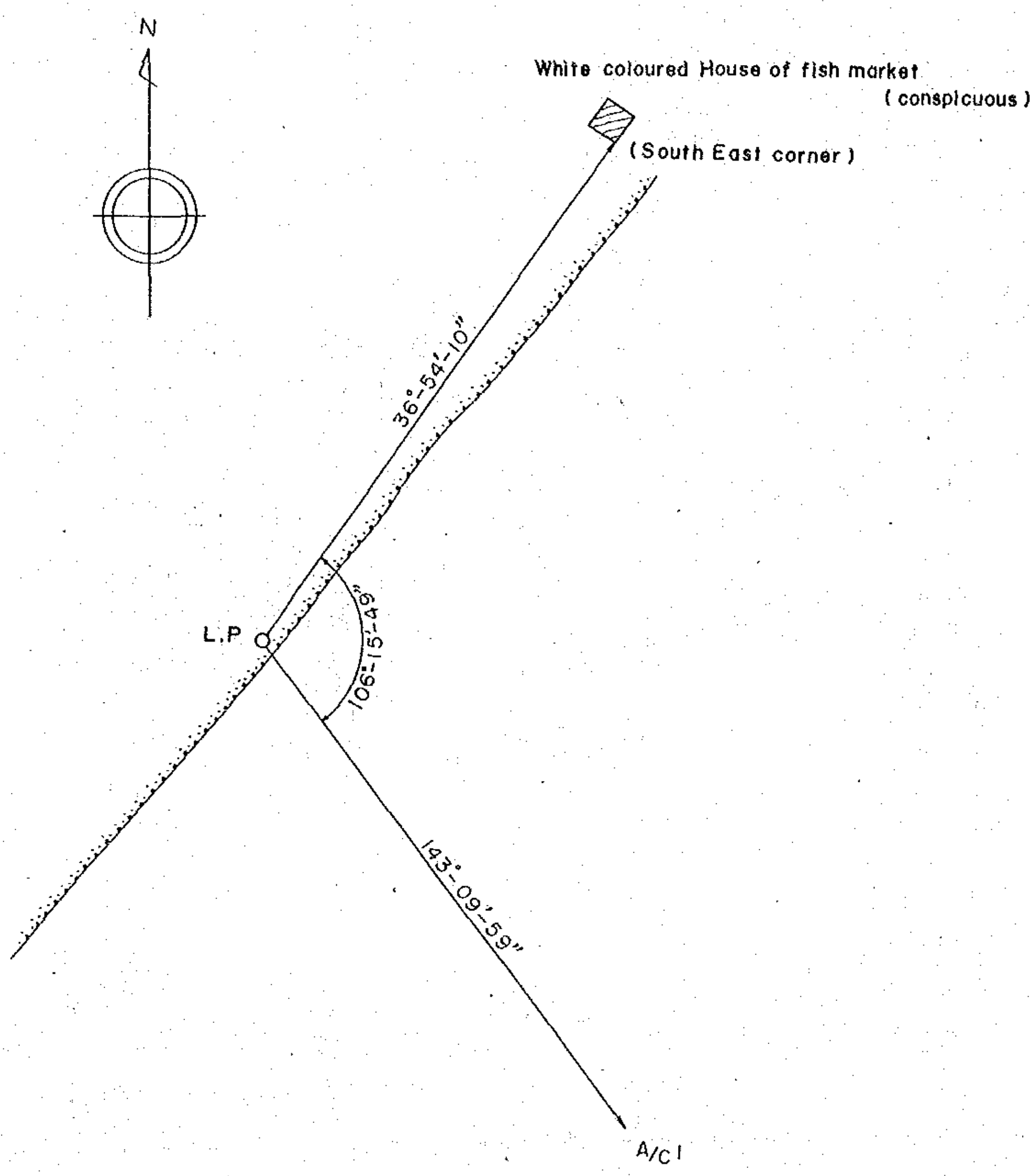


Fig.3.5.20(b) BEARINGS OF CABLE ROUTE IN KUANTAN

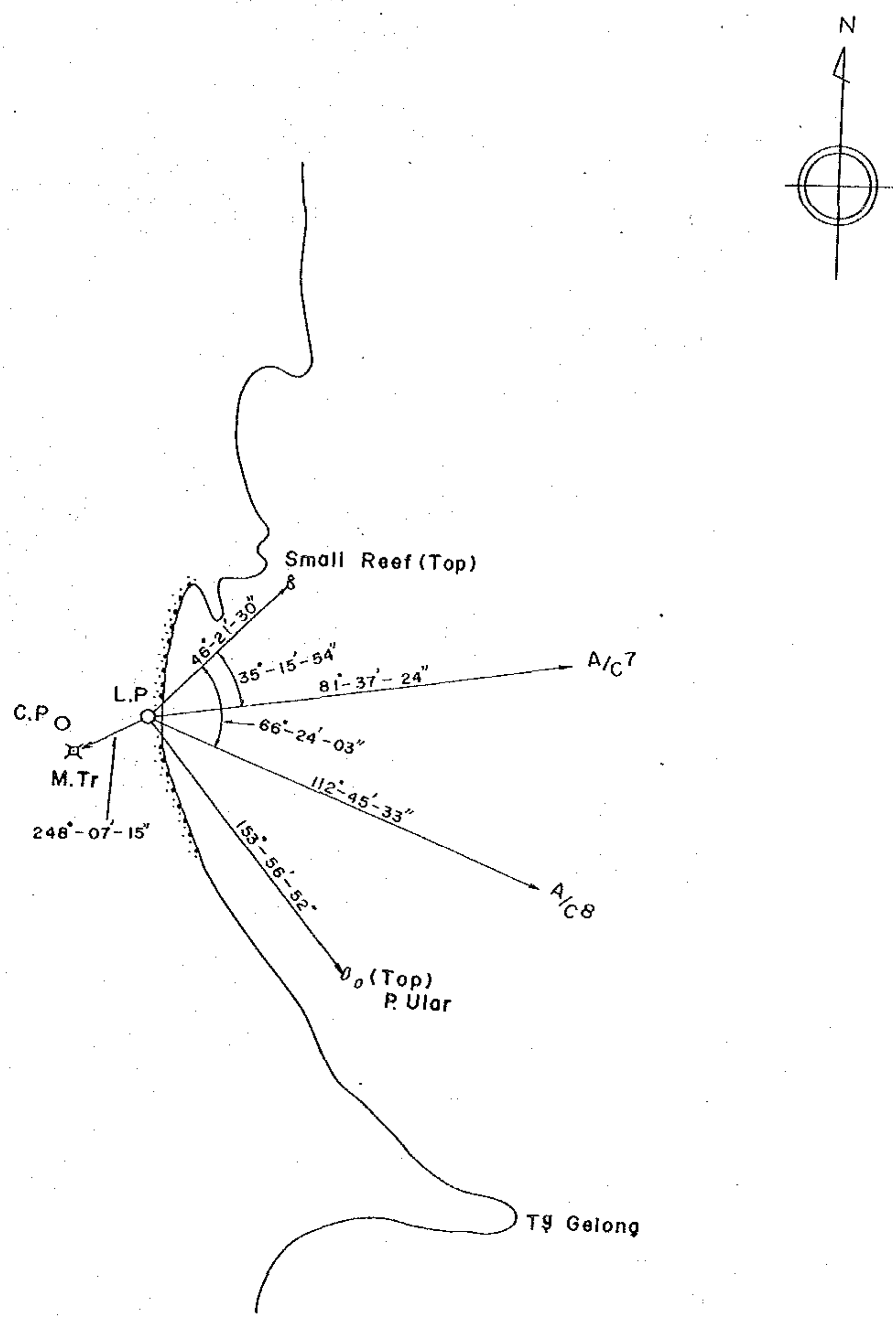
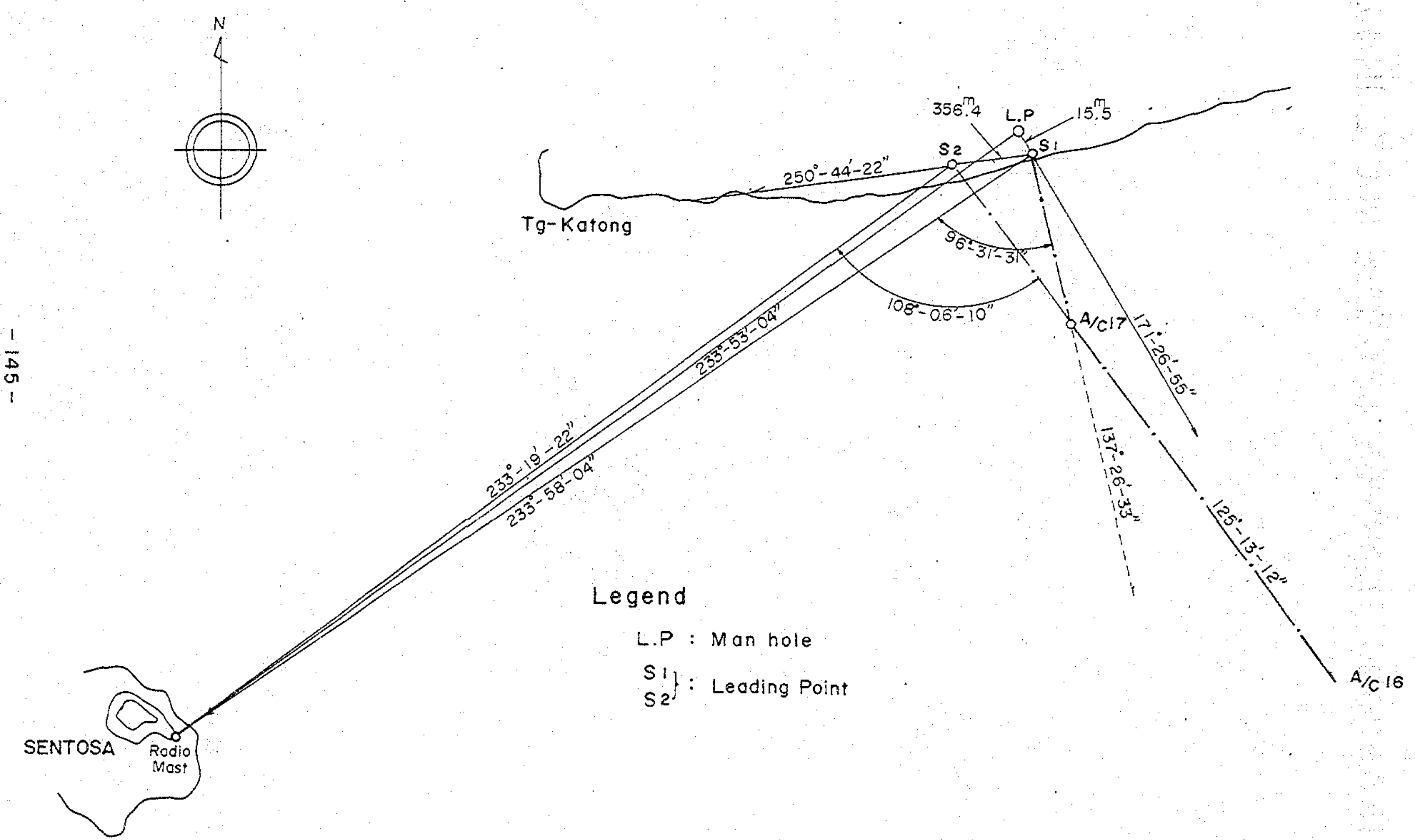


Fig. 3.5.20(c) BEARINGS OF CABLE ROUTE IN KATONG



3.5.9 Submarine Resource Development

Petroleum and natural gas mining areas have been set or developed in the central area of the Gulf of Thailand and in the southern part of the South China Sea and off Kuantan. Also, there is a project of laying a submarine pipeline to pass southward from near Bangkok through the center of the Gulf of Thailand to Songkhla, some part of which (near Bangkok) has been commenced. A similar mining area being developed exists 120 - 130 nm off Trengganu in Malaysia and ranging to Songkhla, a pipeline is also proposed to be laid in the future from the area to the coast of Trengganu.

The survey route of the submarine cable is selected to pass the west side of the pipeline and mining area, keeping away from those. It is however inevitable that the proposed cable route will cross these two proposed pipelines. Unless the pipelines lay preceds the cable lay, it is recommended to lay and leave some excess cable around the cross points. This precaution may enable easy rejointing of the cable which will be severed for the installation of the pipelines under bottom surface. The pipeline project in the gulf of Thailand and the mining area off Trengganu are shown in A-pendix 4(a) and (b) respectively.

3.5.10 Fishing Activities

Fishing are extensively carried on in the area around the survey route. This was verified by the operating conditions of fishing boats observed during the survey, fishing nets (which may be traps or gill nets) set in the area, recording of the side scan sonar, and fishing data and references related to the area. Fishing gears which may damage the submarine cable are otter boards in trawling, nails (flukes) in trolling, etc. The results of survey on trawls are as follows.

(1) Bottom traces estimated to be ascribable to trawling

Numbers of traces ascribable to trawling were found by recording on the side scan sonar. Table 3.5.3 gives the numbers of fishing gear traces found in the respective sections of the area and Figure 3.5.21 shows these numbers on the route.

(2) Fishing in Thailand

Trawling in the Gulf of Thailand has made a rapid Progress since 1961 or so and the annual production in fishing has increased rapidly to occupy 70% of the total fishing production in Thailand (as of 1971). In 1960 or so when trawling was introduced for the first time, the fish catch decreased with increased water depth and fishing was made mostly in depths of 20m ∿ 30m. In the latter half of 1960's, fish in the shallow areas in shore were taken almost thoroughly, the fish catch in shallow area became smaller than that of the area of the increased water depth as shown in Table 3.5.4. However, since fishing products caught at depths exceeding 50m are rather low in economical evaluation, fishing grounds in Thailand are still limited to shallow areas.

Figure 3.5.22 and Table 3.5.5 respectively show the fishing area sectioning and fish catches per hour in the Gulf of Thailand. Table 3.5.6 gives the compositions (boat sizes) and fish catches of trawl boats.

(3) Fishing in Malaysia

Since the introduction of trawling in 1965, the fish catch in Peninsular Malaysia has increased and the fish catch of 1971 amounted to 320,000 tons while that of 1957 was 113,000 tons.

Although fishing is made along all east coasts of Peninsular Malaysia, fishing is extremely limited during the period of the northeast monsoon season.

The fishing products on the east coast in 1965∿1971 are estimated to amount to 23% of all products of Peninsular Malaysia.

Fishing grounds on the east coast of Peninsular Malaysia are located 30 - 40nm off shore. Longlines, drift/gill nets, and trawls are major means of fishing. Of the total number of fishing boats of about 6800, 5400 boats are powered by engines. These fishing boats are mostly less then 50 tons in size and their powers are mostly less than 60 HP. The largest boats are less than 250 tons in size and powered by 100 ∿ 120 HP. Malaysia has plans for enlargement of fishing vessels and expansion of fishing areas. References obtained from JTM are given in Table 3.5.7.

(4) Fishing in Singapore

Fishing in Singapore has exceedingly decreased because of recent industralization. Table 3.5.8 gives the numbers of fishing boat engaged in respective fishing activities in Singapore. The number of otter trawlers was 132 in 1971 but was 117 in 1972. It is still reducing year after year.

Table 3.5.3 Number of Fishing Gear Traces

Stations	Grade
1 - 10	2
10 - 20	1
20 - 140	-
140 - 180	2
180 - 220	1
220 - 310	-
310 - 340	3
340 - 370	-
370 - 380	2
380 - 400	4
400 - 410	3
410 - 480	4
480 - 490	5
490 - 510	4
510 - 520	5
520 - 560	4
560 - 580	5
580 - 590	4
590 - 600	5
600 - 610	4
610 - 670	5
670 - 720	4
720 - 730	3
730 - 740	1
740 - 770	-
770 - 780	2
780 - 830	3
830 - 850	1
850 - 860	2
860 - 870	1
870 - 907	-

Grade	The Number of Fishing Gear Traces
1	1 - 3
2	4 - 15
3	16 - 63
4	64 - 255
5	256 -

Note: Number of traces are counted at every 10 stations.

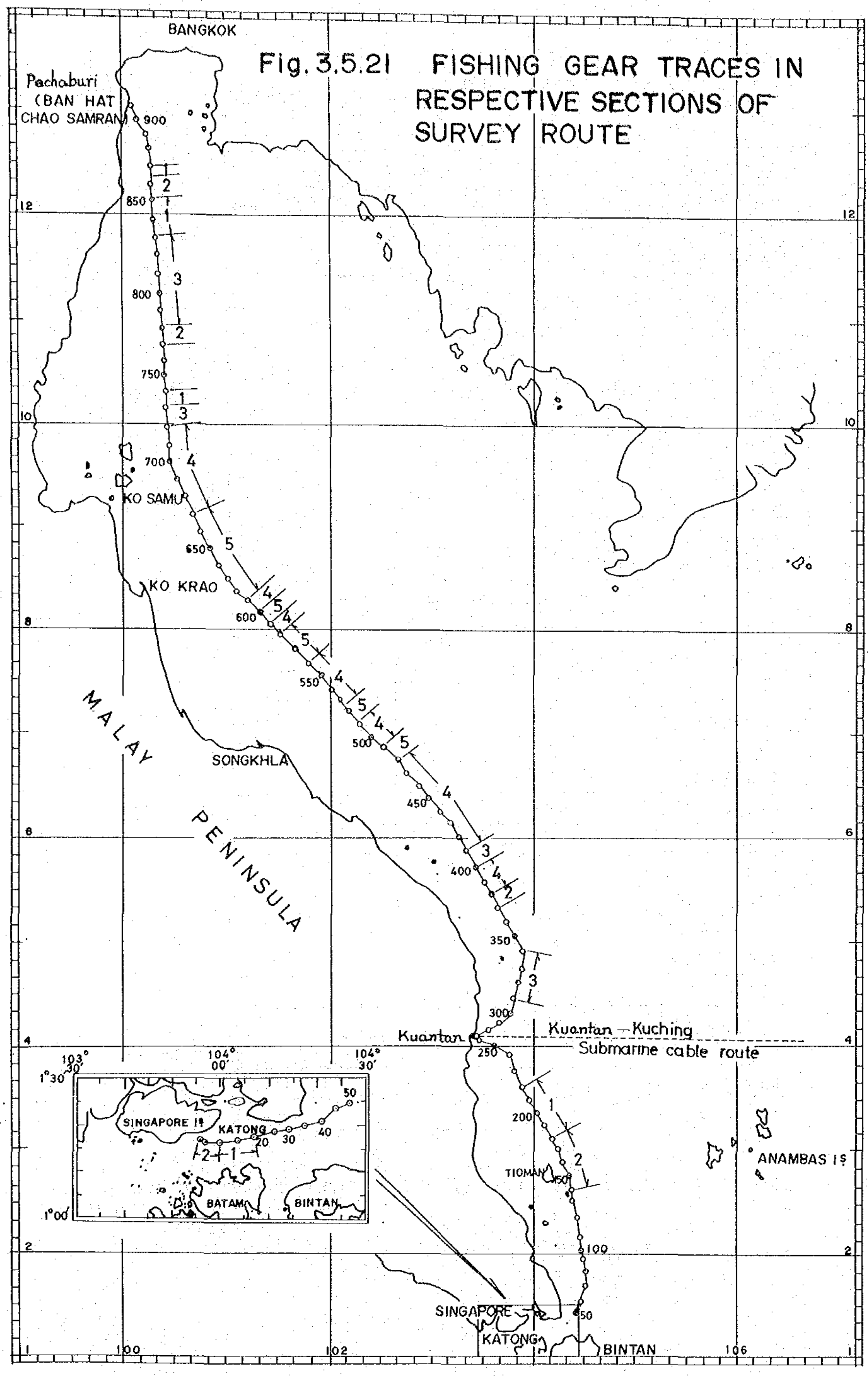


Fig. 3.5.21 FISHING GEAR TRACES IN RESPECTIVE SECTIONS OF SURVEY ROUTE
BANGKOK
Pachaburi (BAN HAT CHAO SAMRAN)
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
KO SAMUI
KO KRAO
MALAY PENINSULA
SONGKHLA
Kuantan
Kuantan — Kuching Submarine cable route
TIOMAN
ANAMBAS IS
SINGAPORE
KATONG
BINTAN
SINGAPORE IS
BATAM
103° 30'
104° 00'
104° 30'
1°30'
1°00'
12
10
8
6
4
2
1
100
102
106

Table 3.5.4 Fish Catches (kg) per Hour by Trawling in Respective Depths in the Gulf of Thailand

Year	Depth				
	10∿19	20∿30	31∿44	more than 44	10∿44 or more
1966	107.19	127.51	144.72	134.80	130.77
1967	95.15	85.25	131.45	180.65	115.05
1968	88.96	98.99	109.16	131.66	105.92
1969	94.83	91.86	112.79	126.64	102.74
1970	102.76	82.68	110.92	103.00	97.44

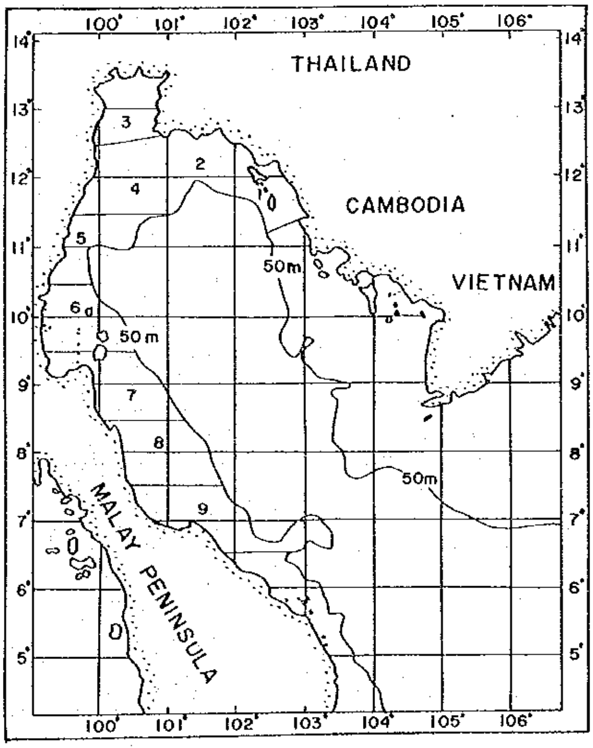


Figure 3.5.22 Fishing Area Sectioning in the Gulf of Thailand

Table 3.5.5 Trend of Fish Catch (kg) per Hour by Trawl in the Gulf of Thailand

Fishing Section	1963	1966	1967	1968	1969	1970	1971	1972
Section 1	341	113	107	66	51	82	33	49
2	230	58	41	55	64	49	30	40
3	264	109	95	68	74	52	46	55
4	260	153	87	72	90	96	70	77
5	201	139	151	100	122	122	80	98
6	286	137	91	187	114	99	76	60
7	190	121	101	93	113	130	97	73
8	247	183	182	172	148	130	75	59
9	212	165	180	142	149	117	82	58
Average	249	131	115	106	103	97	66	63

Table 3.5.6 Number of fishing boat registered by size and by Type of method in Thailand

Size & Year / Method	1975					1976				
	<14m	14-18	18-25	>25	total	<14m	14-18	18-25	>25	total
Other trawl	1,598	1,571	528	119	3,816	1,986	1,523	489	90	4,088
Pair trawl	112	379	356	5	852	104	358	366	4	832
Beam trawl	283	11	-	-	294	277	7	-	-	284
Thai purse seine	55	162	157	-	374	88	162	101	-	351
Chinese purse seine	-	11	7	-	18	-	9	8	-	17
Anchovy purse seine	17	21	2	-	40	37	20	1	-	58
Lurine purse seine	17	56	120	-	193	27	89	183	1	300
Spanish mackerel gill net	63	99	15	-	177	56	93	8	-	157
Pomfret gill net	2	3	-	-	5	11	2	3	-	16
Mackerel encircling gill net	155	32	-	-	187	180	41	5	-	226
Otter gill net	844	3	-	-	847	1,492	6	-	-	1,498
Push net	1,058	17	-	-	1,075	820	24	-	-	844
Luring lift net	-	2	-	-	2	-	1	-	-	1
Shrimp gill net	21	-	-	-	21	527	-	-	-	527
Long line	12	4	-	-	16	30	13	4	-	47
Other nets	46	-	-	-	46	97	1	-	-	98
Squid cast net	-	-	-	-	-	44	-	-	-	44
Total	4,283	2,371	1,185	124	7,963	5,776	2,349	1,168	95	9,388

Table 3.5.7 Fishing Activities in the Sea Area of the East Coast of Peninsular Malaysia

1. Fishing Grounds

i) The fishing grounds in the southern part of the South China Sea with numbers and types of fishing boats licensed in 1976 are as shown in the table below.

Type \ State	Kelantan	Trengganu	Pahang	Johore East	Sub Total
a) Inboard	911	2430	758	930	5029
b) Outboard	102	9	24	232	363
c) Non-powered	181	571	131	613	1496
Total	1194	3006	913	1775	6886

ii) Number of fishermen working in licensed boats.

State	Kelantan	Trengganu	Pahang	Johare East	Sub Total
	4834	11,875	3668	5402	25,779

2. Main Fishing Ports and Vessels

i) Main fishing ports around pertinent areas as follows:

Fishing Port	Total No. of Fishermen	Total No. of Vessels
Johore Bahru	2718	1127
Kota Tinggi	2523	1103
Mersing	2879	672
Kuantan	1771	399
Pekan	1083	288
Kemaman	2164	525
Dungun	1826	478
Marang	1184	239
Kuala Trengganu	3918	1089
Besut	2783	665
Kota Bahru	3444	794
Bachok	1320	400

ii) Number of fishing gears at the East Coast:

State	Kelantan	Trengganu	Pahang	East Johore	Sub Total
Trawl nets	180	436	343	317	1276
Seine nets	52	299	81	97	529
Drift/Grill nets	340	488	205	435	1468
Lift nets	29	23	37	58	217
Traps a) stakes	563	-	12	100	675
b) portable	33	188	138	51	410
Bag nets	-	-	2	267	269
Lines	-	1393	253	22	1668
Barrier nets	-	-	-	28	28
Push nets	-	-	-	-	-
Shell fish	-	-	-	-	-
Miscellaneous	-	-	-	-	-
Total	1197	2897	1071	1375	6540

iii) Sizes, types and powers of fishing vessels:

a) Inboard powered fishing boats

Description	Kelantan	Trengganu	Pahang	East Johore	Total
(Dimension-length) under 25 ft.	233	184	25	86	528
25 - 39	492	1670	547	483	3192
40 - 54	157	512	169	284	1122
55 ft. and over	29	44	17	77	167
Total	911	2410	758	930	5009
(Tonnage) ∿ 4.9 tons	374	431	133	274	1212
5 - 9.9	243	1095	384	205	1927
10 - 14.9	143	573	103	92	911
15 - 19.9	63	167	26	43	299
20 - 24.9	27	61	12	59	159
25 - 49.9	53	103	95	174	425
50 - 99.9	7	-	5	3	15
100 - 249.9	1	-	-	-	1
Total	911	2430	758	930	5029

3. Fishing areas are about 30 ∿ 40 miles offshore.

4. Typical means of fishing are as follows.

   a) Trawling

   b) Traps

   c) Pursening

5. Main base

a) Kuala Sedili (Johore)

b) Nersing

c) Kuantan

d) Chendering

e) Kuala Besut

6. The total number of vessels around the East Coast summarized from the above table is about 6800.

Table 3.5.8 Number of Fishing Boats Engaged in Respective Fishing Activities

	1950	1955	1968	1969	1970	1971	1972
No. of Powered Boats	642	665	1250	480	750	580	535
No. of Non-powered Boats	2402	2209	1335	363	425	221	241
Trolling			101	-	84	89	77
Longlines (inshore)	150	125	53	26	23	-	-
Longlines (offshore)			9	10	12	11	11
Other hook and lines			-	-	-	70	63
Set barriers	28	25	18	11	8	0	0
Filter nets, prawn	271	285	60	49	42	-	-
Traps & pots, (shallow)			39	22	11	-	-
Traps & pots, (deep)	195	170	36	15	24	14	12
Traps & pots, (coral)			15	12	17	-	-
Palisade traps	408	479	272	246	226	200	200
Lift nets	87	78	19	7	6	-	-
Drive-in nets	4	4	-	-	-	-	-
Gill nets	483	485	408	273	260	218	211
Beach seines	104	97	42	18	25	10	8
Purse seines	1	-	1	1	-	-	-
Bag nets	1	7	-	-	-	-	-
Otter trawls	0	0	85	97	118	132	117

3.6 Discussion and Conclusion

3.6.1 Proposed Cable Route and Required Cable Length

It can be concluded from the results of the survey that the main survey track can be proposed as the submarine cable route. This proposed cable route is shown in Figure 3.2.1 and Table 3.2.1. However, the proposed route lies in shallow seas of an average depth of 40m ∿ 50m, measures for cable protection should be taken for the cable along the route.

Cable slack of 1% will be sufficient for laying the submarine cable along the proposed route. Hence, the required cable length between landing points (excluding the cable length for land portions) is as follows.

∘ Pechaburi (Ban Hat Chao Samran)-Kuantan section:	627.9nm(1162.9km)
∘ Kurantan - Katong section:	222.2nm(411.5km)
∘ Entire route:	850.1nm(1574.4km)

The proposed excess cable length to be laid as a detour mentioned on para.3.5.9 is necessary as long as twice of the water depth at least at every crossing, the excess length is included in the above required cable length.

3.6.2 Cable Protection

Most failures in submarine cables in the world are caused by fishing activities or anchoring, as shown in Table 3.6.1. In 1884, an international submarine cable protection treaty was closed for the purpose of protecting submarine cables from fishing and anchoring by vessels. However, it is rather difficult to restrict fishing activities or anchoring on cable routes by treaties and regulations, so that armored cable were used mostly for the sake of self-protection. However, armored cables are not necessarily sufficiently reliable against these failures as understood from Table 3.6.1.

Meanwhile, cable burying technique was developed recently for cable protection and has been employed in shallow areas of major submarine cables in the world. In particular, the Japan-China Submarine Cable completed in 1976 was layed in the East China Sea where fishing activities are extensily carried on. Of the total length of 850km, the cable length of 80% (680km) was buried under the sea bottom. This submarine cable system is indeed an unparalleled one in its buried cable length. Communication service at high reliability has been maintained without causing any trouble at all in the cable system since its completion two years ago. This submarine cable was buried by the multi-plow type burying machine developed by KDD.

Protection of a submarine cable against fishing and anchoring can be achieved by burying the cable much deeper than the depths of scratch or embedment by fishing gears or anchors. Figure 3.6.1 shows the depth of scratch or embedment by fishing gears and anchors vs. bottom softness. For example, an anchor of one ton intrudes about 1m into a soft bottom. It is extremely difficult to physically protect cables from such a heavy anchor. For large vessels, however, legal restriction mentioned can effect much more than for small fishing boats. Accordingly, it can be understood from Figure 3.6.1, in consideration of the depth of scratch or embedment by anchors and fishing gears of 200kg usually employed by small ships of about 100 tons, that the cable should be buried 50cm∿ 60cm under the bottom when the bottom is soft. The depth of scratch or embedment by fishing gears, etc., in a given bottom softness and the depth of intrusion by the cable burying machine in the same bottom softness are related: Where the bottom is hard and sufficient cable burying depth can not easily be obtained, the depth of scratch or embedment by fishing gears, etc., is small accordingly.

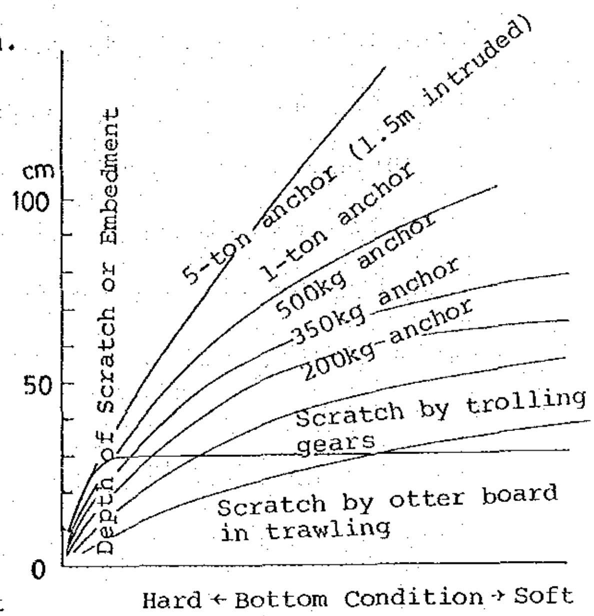


Figure 3.6.1 Depth of Scratch or Embedment vs. Bottom Softness

The results of survey show that the fishing activities in the survey area were extensively carried on and enlargement of fishing boats and expansion of fishing areas are planned, as mentioned in paragraph 3.5.10. Since the cable route is near shore and the ocean is shallow on the whole, anchoring will be inevitable.

Hence, burying the cable is most recommendable for protection.

In some portions of the cable route, the burying effect may not be achieved sufficiently. That is, the bottom ranging from the Pechaburi slope to the flat section in the Gulf of Thailand is mostly of clay but is solid and seems rather hard to bury a cable. The bottom ranging from Kuantan slope to the offing of the southeast coast of Peninsular Malaysia involves Partially sand waves and ripple marks. The Singapore Strait passes rapid tide, involves most marked ups and downs and is characterized by the presence of remarkable ripple marks. In such areas, sand drift may be repeatedly caused, so that it may be caused, depending on a condition upon the initial cable burying, that the buried cable is exposed or friction between the cable seath and sand is caused repeatedly. Armored cable should be used as the second best means in these places where cable burying is much difficult or where the effect of burying can not be expected.

It is also desirable to take due measures for attracting the attention from fishing boats and ships which pass near the cable route.

In consideration of the above-mentioned results of survey and protection of the cable from fishing, anchoring and sand drift for securing high-reliability communication service, it is recommended to bury the cable by using armored or armorless cable depending upon the expected burying depth. The proposed cable configuration is shown in Appendix 5.

Table 3.6.1 Analized Submarine Cable Failures in the Period of September 1953 to November 1964

	Cause of Failure	%
1	Trawlers & ship anchors	44.0
2	Biological & chemical damage	4.0
3	Corrosion or chafe damage	27.0
4	Earthquake related damage	1.6
5	Iceberg damage	1.6
6	Damaged by re-routing or preventative maintenance	8.3
7	Miscellaneous failures (tension, twist, crash, electrical faults, etc.)	13.5

Ref.: Bell Telephone System Technical Pub. 5203
"Analizing Failures of Ocean Communication Cables"
by A.J. Munitz

Table 3.6.2 Buried Submarine Cables in the World

Cable System	Time	Buried Distance (km)	Sea Depth (m)
TAT-4	Jul. 1967	68	54 - 152
TAT-3	Jul. 1967	88	42 - 134
SF-FLORIDA	Apl.∿May 1968	68	16 - 40
TAT-5	Jul. 1969	164	18 - 540
TAT-5	Aug. 1969	53	22 - 558
MAT-1 (Spain)	Aug. 1969	20	40 - 600
MAT-1 (Italy)	Sep. 1969	28	16 - 600
CANTAT-2 (Canada)	Nov. 1973	222	less than 550
CANTAT-2 (U.K)	Apl. 1973	Unknown	less than 550
TAT-6 (Rhode Island)	Aug. 1975	176	less than 180
TAT-6 (France)	Oct. 1975	176	less than 180
Japan - China	Apl.∿May 1976	680	less than 200

Ref.: IEEE Transaction Courm, Technology Vol. COM-19, No.6 1971, Electrical comm. Vol. 49, No.4 1974, BTL Record Sep. 1976, ITU Telecommunication Journal July 1977

4. References

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  1) "Current in the South China, Java, Celebes and Sulu Sea," published by the Hydragraphic Office United State Navy, 1945
  2) Naval Oceanographic Office Special Publication 1404-IN2, "Surface Current," published by the United State Navy, 1977
  3) Manual on International Oceanographic Data Exchange IOC, Technical Series No. 9, UNESCO, 1973

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  Department of Mineral Resources, Ministry of Industry, 1977
- Thai Fishing Vessels Statiatics 1976,

  Department of Fisheries, Ministry of Agriculture and Cooperative

APPENDIX

1	Summary of Discussion on The Route Survey of The ASEAN Submarine Cable Project (Thailand-Malaysia-Singapore Route) Between Thailand and Japan
2	Report of Meetings on The Scope of Work for The Route Survey of Submarine Cable Thailand-Malaysia-Shingapore
3	Report of The Meeting between Japanese Survey Team and Telecoms on the Route Survey of Thailand/Malaysia/Singapore Submarine Cable 10-15 March 1978, Singapore
4(a)	The proposed cable route and the gas pipeline in the Gulf of Thailand
4(b)	The proposed cable route and petroleum exploration blocks off Trengganu
4(c)	Anchorage, existing cables etc. in the Singapore Strait
5	An example of cable types
6	List of Marine Charts used in the route survey
7	A typical example of cable route marker
8	Minimum distance of separation between cables
9	Applicable water depth and burying depth by "Water Jetting method"
10	Repair technique for buried cable
11	Various types of cable used in buried cable systems shown in Table 3.6.2 of the Report
12	The relation with current speed and declination of the moon

SUMMARY OF DISCUSSIONS
ON
THE ROUTE SURVEY OF THE ASEAN SUBMARINE CABLE PROJECT
(THAILAND-MALAYSIA-SINGAPORE ROUTE)
BETWEEN THAILAND AND JAPAN

The Japanese Preliminary Study Team for the ASEAN Submarine Cable Project (Thailand-Malaysia-Singapore Route) and the representatives of the Post and Telegraph Department, the Communications Authority of Thailand, Ministry of Communications met at the office of PTD on February 28, 1978, and discussed on the scope of works and other related matters of the route survey to be carried out by the Japanese International Cooperation Agency under the agreement between the Governments of Thailand, Malaysia, and Singapore, on one hand, and the Government of Japan on the other hand.

The discussions have brought about a "Scope of Work for the Route Survey" (Annex I) and "Supplementary Note to the Scope of Work in Thailand" (Annex II) which attached hereto together with the list of attendants (Annex III) to the discussions.

In the course of discussions the Thai side requested that subject to result of the consultations to be held with the authorities of Malaysia and Singapore, the Japanese team would review the proposed time schedule of the route survey, ...2/

in order that a final report be submitted to the three governments concerned earlier then proposed, if possible by the end of August or September, 1978.
The Japanese side stated in reply that interim report contains all necessary and sufficient information for inviting tenders for construction and that while it will be much difficult to prepare the final report earlier than originally proposed, it will keep in mind the request of the Thai side in preparation of the final report.

(Annex I)

SCOPE OF WORK

FOR

THE ROUTE SURVEY

OF

THE ASEAN SUBMARINE CABLE PROJECT

(THAILAND-MALAYSIA-SINGAPORE ROUTE)

JAPAN INTERNATIONAL COOPERATION AGENCY

1. Introduction

In response to the requests of the governments of Thailand, Malaysia and Singapore, the government of Japan has decided to conduct the route survey for the ASEAN submarine cable project (Thailand-Malaysia-Singapore Route) as a part of its technical cooperation programmes to foreign countries.

Based on this decision, the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the cooperation programmes has organized a team so as to carry out the survey.

The present document sets forth the scope of work in regard to the above mentioned survey which is to be carried out in close cooperation with the governments and authorities concerned.

2. Objective of the survey

The objective of the survey is to select the most suitable route for laying a submarine cable which links the cable landing sites in Thailand, Malaysia and Singapore and to provide these three countries with necessary data for designing and laying the submarine cable system.

3. <u>Outline of survey work</u>

The ocean survey will be made by using a Japanese survey vessel "DAISAN KAIKO MARU" (500t) on the following items.

1) Sounding
2) Subbottom profiling near the bottom surface
3) Observation of bottom surface condition by using Side Scan Sonar and underwater camera
4) Sampling bottom sediment
5) Observation of water temperature

Survey of the land portion from landing point to cable terminal site will also be made, if necessary.

4. <u>Report</u>

4.1 Preparation of report

JICA will prepare and submit required number of copies of the following reports in English to the three governments.

1) Interim report

Within about two weeks after the completion of the ocean survey.

2) Draft final report

Within about three months after submission of interim report. The governments concerned are requested to provide with their comments on the draft final report within two weeks after receiving the report from JICA.

3) Final report

Within two months after receiving comments from the governments concerned.

4.2 Contents of report

The report will contain the following items.

1) Interim report

a. Summarized result of the ocean survey

b. Proposed cable route and route conditions

c. Cable length required for the proposed route and other requirements for designing the cable system

2) Draft final report and final report

a. Descriptions on survey method and equipment used

b. Result of the ocean survey

c. Proposed cable route and route conditions

d. Cable length required for the proposed route and other requirements for designing the cable system

e. Some data or informations for cable laying operation

5. <u>Undertaking of the governments of Thailand, Malaysia and Singapore</u>

1) To provide the survey team with data and information necessary for the survey.

2) To exempt the team from the taxes and duties on the material or equipment associated with the survey and on the personal effects brought into the countries by the team.

3) To assign the official counterparts during the ocean survey.

4) To make necessary arrangements for the team to bring out data or materials relating to the survey to Japan.

5) To grant necessary approvals for the implementation of the ocean survey in the territorial waters.

6) To give necessary notice to fishermen and other people working in the survey area and to take appropriate measures so that the survey work may be carried out without any hindrances.

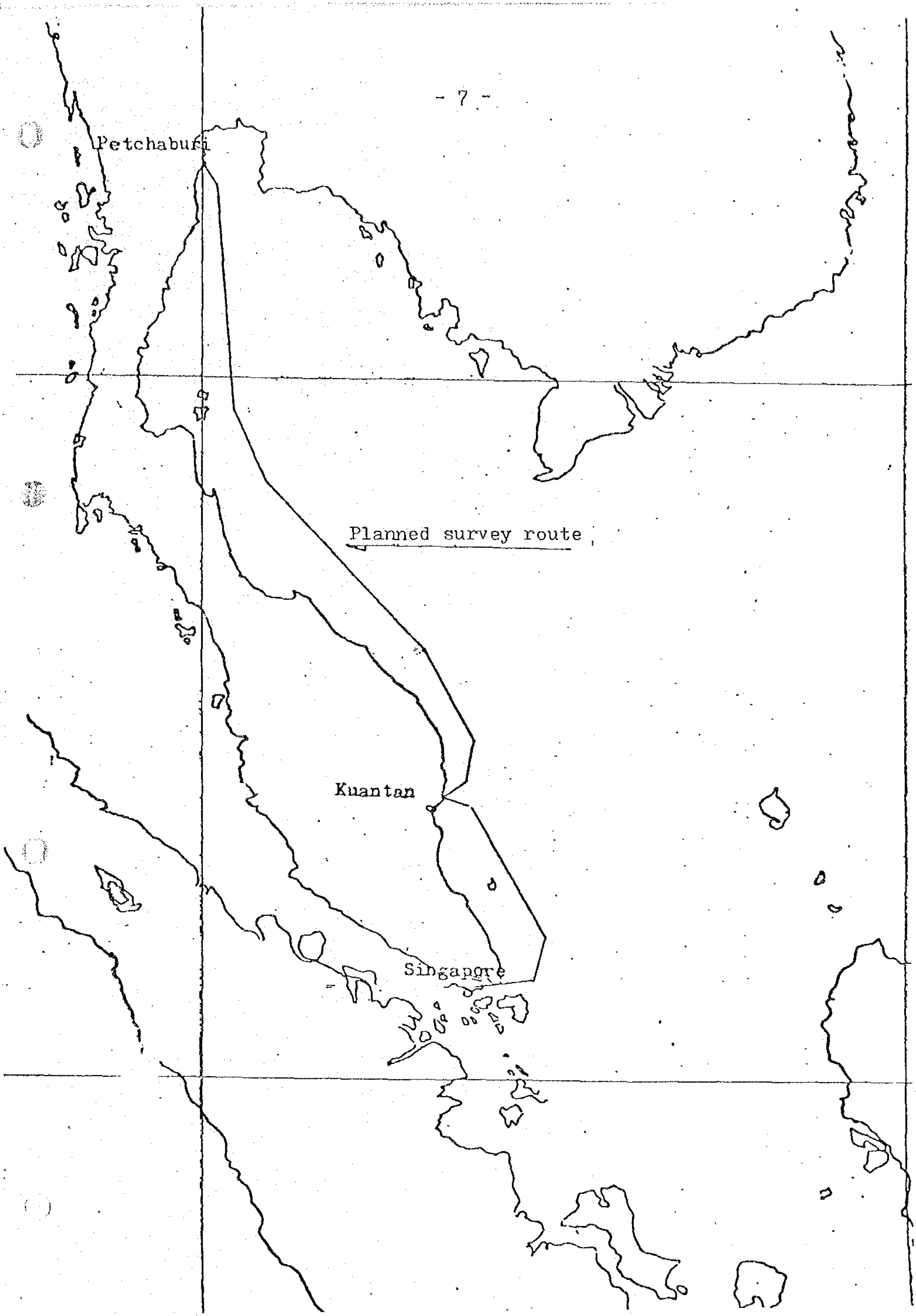
6. <u>Schedule of survey</u>

Refer to the attached paper

Time schedule of the route survey

Item / Month	1978 2	3	4	5	6	7	8	9	10	11	12
Preliminary Study											
Preparation											
Ocean Survey											
Preparation and Submission of Interim Report											
Preparation of Draft Final Report											
Presentation and Discussion of Draft Final Report											
Preparation and Submission of Final Report											

Remarks: Work on the site


Petchaburi
Planned survey route
Kuantan
Singapore

(Annex II)

Supplementary note to the Scope of Work in Thailand

1. Details of work

(1) Ocean survey off the coast of Thailand will be made along the survey route roughly shown in the separate paper.

Survey route off the coast of Malaysia and near Singapore is subject to change according to the result of meetings with the governments of Malaysia and Singapore.

(2) Land portion of the submarine cable route which covers the area between cable landing point on the beach and the site for cable terminal building will be surveyed to clarify its position, distance and ground level along the route.

(3) The beach landing point will be selected in the vicinity of 12° - 59.5N/100° - 03.5E near Ban Hat Chao Samran.

(4) Land survey will be made by some of the survey team members who will go ashore by boat lowered from the survey ship.

The site for cable terminal building will be determined by Thailand authority concerned by the time of the cable route survey.

(5) Cable route conditions necessary for designing and laying the submarine cable system will be clarified in the final report basing upon the result of the cable route survey and informations given by Thailand authorities concerned

(6) Land survey will be made basing upon the fundamental points, if easily available around the land survey area, of which exact position should be known as a result of land survey made in the past.

2. Arrangements for the survey work

The government of Thailand

(1) Will assign two officials as observers of the route survey work.

(2) Will assign some officials who know well of the boundaries of each landed properties in the land survey area and assist the survey team in selecting the land cable route during the land survey.

(3) Will make necessary arrangement so that the survey team, observers and navigation crew on board the survey ship may go through due formalities off the cable landing shore, where the survey ship will stay for several days while the shore survey is made by the team. Passenger and crew list will be sent to the Thai government in advance. The ship schedule or ETA will be kept informed in the course of survey.

(4) Will provide the survey team with maps of large scale in advance of the land survey work.

(5) Will give survey team informations of obstacles, if any, around the survey route in the sea such as explosives, facilities for exploration work, etc in advance of the ocean survey.

3. Informations necessary for the preparation of report

The Government of Thailand will provide the survey team with following informations which will be useful for judging the route conditions

(1) Fishing activities in the Gulf of Thailand

(a) Main fishing ports and fishing grounds.

(b) Number of fishing vessels and size and engine power of biggest type of fishing vessels.

(c) Fishing methods. (with illustrations if available)

(d) Fishing activities in the future.

(2) Exploration activities for underwater resources

(a) Positions where explorations are made.

(b) Future plan of exploration.

(3) Existing data of the sea or sea bed such as seasonal water temperature variation, etc.

(Annex III)

List of Attendants to the Discussion

JAPAN

1. Yozo Kanemitsu (Leader)
   Ministry of Posts and Telecommunications (MPT)
2. Kunito Abe (MPT)
3. Hikaru Chono (MPT)
4. Teruo Shibata
   Kokusai Denshin Denwa Co., Ltd.(KDD)
5. Rokuro Kitsuta (KDD)
6. Taisuke Kitamura (KDD)
7. Akio Itoh
   Japan International Cooperation Agency (JICA)
8. Eiichi Furukawa
   Embassy of Japan
9. Hitoshi Ikeda
   Embassy of Japan
10. Ryo Suwa
    Bangkok Office, JICA.

THAILAND

1. Mr. Mahidol Chantrangkurn (Leader)
   Post and Telegraph Department (PTD)
2. Mr. Sudhorn Limpisthien (CAT)
3. Mr. Pol Kruatrachue (PTD)
4. Mr. Kitti Yupho (PTD)
5. Mr. Preecha Boonprasert (CAT)
6. Mr. Phongsakdi Potsiri (CAT)
7. Mr. Kittin Udomkiat (CAT)
8. Mr. Thosporn Simtrakarn (CAT)
9. Mr. Suthin Susila (DTEC)
10. Mr. Kamrop Varachart
    Ministry of Communications
11. Miss Nuannapha Thiencharoen
    Ministry of Communications

REPORT OF MEETINGS ON THE SCOPE OF WORK FOR THE ROUTE SURVEY OF SUBMARINE CABLE THAILAND-MALAYSIA-SINGAPORE

REPORT OF MEETINGS ON THE SCOPE
OF WORK FOR THE ROUTE SURVEY
OF SUBMARINE CABLE
THAILAND-MALAYSIA-SINGAPORE

At the request of the Governments of Thailand, Malaysia and Singapore, for technical aid to carry out a survey of Submarine Cable route from Thailand-Malaysia-Singapore, the Government of Japan, through Japanese International Cooperation Agency (JICA), despatched preliminary survey team headed by Mr. Kunito Abe, Vice Counsellor of Telecommunications, Ministry of Posts & Telecommunications, to discuss the scope of work to be undertaken by the Government of Japan on the requirement for the survey of the proposed Submarine Cable routes.

Three meetings were held between the Japanese delegations and the Malaysian officials. They were held at the following venues:-

- (i) March 3rd. 1978 at Telecoms Headquarters, Kuala Lumpur
- (ii) March 7th. 1978 at Telecoms Headquarters, Kuala Lumpur
- (iii) March 7th 1978 at The Economic Planning Department, Kuala Lumpur

The list of delegate attending the above meetings appeared in Annexes A, B & C.

The agreed Scope of Work for the Route Survey appeared as in Annex D. It is agreed that one officer from Malaysia shall participate in the survey work. The proposed route for the survey appears as in Annex D. The Malaysian officials requested that the temperature and current variation measurements/data to be included in the Interim Report. The Japanese delegations agreed to the requests.

The Malaysian officials agreed to provide the following information prior to the commencement of the ocean survey scheduled in the middle of April 1978:

- (a) Fishing activities in the Malaysian Territorial Waters.
- (b) Exploration activities for under water resources
  - (i) Positions where explorations are made,
  - (ii) Future plan of exploration,

  within 40 nautical miles from the Malaysian shoreline.

The schedule for submission of the Interim and Final Reports and their contents appear in Annex D.

Kuala Lumpur

Date: 8th March, 1978

K W Goh
....
(GOH KHEN WAH)
Director of Telecommunications
Kuala Lumpur

Kunito Abe
....
(KUNITO ABE)
Vice Counsellor of Telecommunications
Ministry of Posts & Telecommunications
Japan