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T/11P part-II*

FINAL REPORT
of
CAPE PILLAR MARINE SEISMIC SURVEY
TASMANIA TENEMENT T11/P

Prepared by

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089002

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ABSTRACT

Amoco Australia Exploration Company carried out a marine seismic survey in Permit Area T/11P, between the dates of December 22, 1969 and January 6, 1970. Approximately 600 miles of 24 fold CDP Aquapulse information was digitally recorded and processed.

Results of the survey indicate a shallow unconformity that appears to be economic basement over the entire permit area. Some anomalies have been mapped at the unconformity level but appear to be of little consequence within the overlying sedimentary section.

I. INTRODUCTION

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A. Location

The survey is located offshore from the southeast coast of Tasmania in the area bounded by Permit T/11P licensed to Amoco Australia Exploration Company (see Fig. 1).

B. Object

The object of the survey was to provide reconnaissance control for assessment of sedimentary thickness and structural potential.

C. Results of Previous Geophysical Surveys

There has been no previous seismic exploration reported in the area covered by Permit T/11P. However, an aeromagnetic survey conducted by Aero Services Ltd. was flown in 1966 and 1967. The survey covered a total of 9250 miles in T/7P, T/8P and T/11P. A depth to magnetic basement map prepared by Geophysical Associates Pty.Ltd. indicated an average sedimentary section of about 5000', and thickness in excess of 10,000' in some areas of T/11P. A very abrupt character change is apparent on all the aeromagnetic dip lines. The locus of points coincident with this change trends approximately N-S along the eastern coastline extending offshore at the southern tip of the Tasman Peninsula. This line is now interpreted to represent the separation between the shallow, highly magnetic Jurassic diabase basement onshore and the older, metamorphosed Paleozoic or Devonian granite basement which extends offshore.

D. Regional Geology

Tasmania was part of the Tasman Geosyncline of Eastern

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Australia wherein Pre-Cambrian to Lower Devonian strata were laid down in a marine environment, and subjected to several periods of orogenic activity with resultant metamorphism. The Middle Devonian Tabberabberan Orogeny folded all older strata and was accompanied by large-scale granitic intrusions which outcrop today along the eastern and western peripheries of Tasmania.

Prolonged erosion took place until the Lower Permian Sakmarian ice age occurred, accompanied by the deposition of tillites and basal conglomerates unconformably over the older metamorphic and granitic terrain. Permian deposition continued in the present Tasmania Basin which is situated in central to southeastern Tasmania and bounded by the Devonian and older metamorphics and intrusive belts. Cyclic shallow marine and nonmarine carbonates and clastics were laid down on the basal beds to a total Permian thickness in excess of 5500 feet. Nonmarine deposition continued disconformably into the Triassic with at least 2000 feet of sands, mudstones and coals being laid down.

Middle Jurassic time was a period of vast tholeiitic diabasic (dolerite) intrusion to 1500 feet in thickness which penetrated the older section and buried the southeastern Tasmania landscape adjacent to T/11P.

It appears probable that in southeastern Tasmania, the marginal Devonian granitic belt did restrict both the Permo-Triassic deposition and the Jurassic igneous activity to Tasmania Basin lying to the west of the present day eastern continental shelf underlying both T/7P and T/11P tenements. The low magnetic Devonian granites and associated metamorphics, such as outcrop on Schouten and Maria Islands

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are therefore thought to extend offshore to represent the shallow basement mapped by the recent geophysical surveys.

No evidence for Cretaceous deposition exists in Tasmania; however, late Mesozoic or basal Tertiary block faulting took place. This age of faulting is demonstrated in the current offshore survey where the sharp uneroded fault scarps at the top of the basement horizon are buried by a thin wedge of probably Tertiary sediments mapped along this continental shelf. This north-south set of horsts and grabens would constitute the early or pre-Tertiary breakup and subsidence of the shelf just prior to Tertiary deposition.

Tasmanian Tertiary sediments are restricted to sporadic outcrops of continental clastics throughout the island and marine limestones in the northwest ranging in age from Oligocene to Pliocene, accompanied by a mid-Tertiary period of subaerial basic volcanic eruption throughout the northern, central and southeastern regions.

The wedge of probable Tertiary sediments resting on the continental shelf underlying T/11P probably contain equivalents of the Oligocene and younger clastic rocks onshore, but may include older Tertiary strata which occurs in the Bass and Gippsland Basins to the north.

II. FIELD OPERATIONS

The energy source used in the offshore S.E. Tasmania T/11P survey is known as Aquapulse. Four aquapulse guns in a rectangular array are towed at a depth of 20-25 feet below sea level. A mixture of propane and oxygen is injected into the guns and simultaneously fired by an electrical impulse.

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The normal operating technique for the survey was to use a 7590', 24 group neutrally buoyant streamer cable with a firing rate of 4 equally spaced pops per group. The distance between group centers was 330', and the distance from the center of the gun array to the center of the nearest group was 969 '. An on-board variable density display section was obtained by recording the output of trace 23 (located approximately 1300' from the gun array center) on a Raytheon Precision Depth Recorder. Field monitors of all 24 traces were recorded every 40 pops. Shoran radio positioning was used for maintaining boat position on a pre-plotted course.

A detailed report by Western Geophysical Co. on seismic operations is included in the appendix. The radio location operations report by Offshore Navigation Inc. is also included.

III. PROCESSING

The data was processed by Seismic Computing Corp. in Houston, Texas, U.S.A., under Amoco supervision. The processing was divided into two phases: a preliminary phase (Phase I), conducted on lines 302 and 334, to determine the optimum processing flow and parameters, and a final phase (Phase II) resulting in the final processed section for each line.

Phase I - Preliminary Processing Investigation

An examination of the on-board short trace sections and field monitors indicated a shallow unconformity below which no reliable primary reflections were apparent. Numerous velocity spectra were analyzed and several combinations of vertical and horizontal compositing compared in an attempt to minimize the multiple interference and enhance deeper reflections, if present. In most cases, multiple attenuation was

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effective, but deeper reflections remained vague or absent.

However, most of the basic processing parameters could be selected for final processing.

Phase II - Final Processing

Aside from normal editing, the final processing was performed as follows:

1. 2-fold vertical summation (shots separated by approximately 165')
2. Gain recovery
3. T-V digital filtering
4. Correction for NMO
5. 24 CDP stack
6. T-V Deconvolution (250 m.s. operator)
7. Trace Amplitude Equalization or Digital AGC as required.

The velocity function used for each line was determined from velocity spectra computed every 3 miles. The velocity spectra locations for each line are indicated on the sections. Final sections were referenced to sea level and played with a variable area display at a horizontal scale of 12 traces per inch and a vertical scale of 5 inches per second.

IV. INTERPRETATION

A. Record Quality

The final processed record sections show only one generally continuous event which is unconformable and clearly identifiable on inspection over most of the area. A ghost reflection which computes to be a first order water bottom reverberation accompanies the unconformable reflection in most cases. Numerous discontinuous reflections, generally

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conformable with the water bottom, appear above the unconformity, but few, if any, recognizable primary reflections appear below the unconformity. On some sections, generally played with a lower velocity, spurious events below the unconformity can be seen, but in practically every case these events fit multiple reflection patterns.

B. Refraction Method

No normal refraction profiling was performed in this survey. However, to assist in the identification of economic basement, time-distance plots from the refracted first arrivals were obtained and velocity and depth estimates computed. Assuming small dips, the velocity of the high speed refractor is merely the inverse of the slope of the time-distance plot. The depth to the refractor below the shotpoint is obtained by the formula:

$$Z = \frac{T_o V_1}{2 \cos \theta} \quad ; \qquad \theta = \sin \left(\frac{V_1}{V_2}\right)$$

where

Z = depth to basement

V_1 = average velocity of overburden

V_2 = velocity of refractor

T_o = intercept time obtained when the time distance plot is projected back to the time axis.

The average velocity of the high speed refractor was found to be 16,175 ft/sec. with velocities ranging from 13,300 ft/sec. to 20,600 ft/sec. being obtained.

The reflection horizon corresponding to this high speed refractor was the unconformity horizon as anticipated. Graphs of the time-distance plots obtained for lines 242 and 254

are shown in Figs. 2 and 3. The computed depths to the refractor are tabulated on the graphs and plotted on display sections of the two lines (Plate 5).

C. Depth Conversion

Approximately 50 reflection velocity spectra were analyzed to compute an average time-depth curve (Plates 2, 3) from water bottom to the top of the unconformity horizon. Depth conversion of the subsurface structure map was then computed as follows:

1. Reflection times from water bottom to the unconformity horizon were obtained by subtracting 2x(water depth)/5000 feet per second from the record section reflection times.
2. Depth of the horizon below water bottom was obtained from the average time-depth curve using the time obtained in (1).
   Note: The data from this step was used to construct the isopach map.
3. Total depth of the unconformity horizon below sea level was obtained by adding the water depth.

D. Structure

(a) Water Depth (Plate 1)

Water depth contours indicate very gentle ESE dip from the coastline to a depth of 600' after which the depths increase rapidly to below 6000'. A small trough off Cape Pillar having maximum depth slightly greater than 600' is the only interruption to this trend. Approximately 400 sq.miles or less than 1/5 of the total area of T/11P has water depth greater than 600 feet.

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(b) Depth to Unconformity (Economic Basement?) (Plate 2)
The subsurface unconformity map shows a gentle eastern regional dip to the point where it apparently becomes coincidental with the continental shelf edge. The maximum depth reached within the continental shelf is about 3800'. The erosional topographic nature of the unconformity surface is evident in many places on the seismic sections.

Numerous small anomalies have been mapped, most of them depending on fault closure. The faulting appears to have occurred just prior to post-unconformity deposition, generally having an approximately North-South strike. Some minor faulting and/or gentle folding is not reflected in the unconformity map.

The refraction studies discussed earlier indicate that the velocity of the unconformity is about 16,000 feet per second, suggesting that the unconformity horizon be tentatively identified as economic basement. The absence of reflections below the unconformity supports this conclusion.

(c) Sea Bed - Unconformity Isopach (Plate 3)
Assuming the unconformity horizon represents economic basement, the isopach map represents total sediment thickness. The isopach map shows a general thickening of sediments out to the edge of the continental shelf as a result of the stronger east dip of the basement. Beyond the shelf, sediments thin rapidly due to the strong dip of the shelf slope. The maximum sedimentary thickness recorded is about 3250' in a very localized area. The zone where thickness exceeds 2500' has been shaded to facilitate recognition of the maximum sediment axis; however, no significance has been placed on this value.

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V. CONCLUSIONS

The seismic survey indicates shallow economic basement throughout T/11P. Due to the absence of subsurface control, positive geological identification of the basement is not possible. However, with the addition of the seismic, it is instructive to refer again to the aeromagnetic survey discussed previously. The total magnetic intensity curves for two flight lines, one crossing Maria Island and the other crossing the Tasman Peninsula, have been plotted for reference in the ensuing discussion (Plate 4). Geological cross sections paralleling these lines are also shown.

It is obvious upon inspection that a major change in magnetic basement depth, composition, or both, occurs approximately where the vertical dashed line is drawn in Plate 4. West of the dashed line, the intensity curves are characterized by high amplitude, high frequency anomalies, indicating a shallow magnetic source. Comparing this portion of the curves with their corresponding parts on the geologic cross section, it is apparent that the magnetic anomaly source onshore is the highly magnetic, Jurassic diabase. The aeromagnetic depth estimates confirm this identification.

By contrast, the magnetic intensity curve east of the dashed line is virtually featureless; affording only limited reliable depth control, but optimistically indicative of a much deeper magnetic basement. However, the seismic indicates a shallow, regionally tilted basement with only minor depressions. Correlating the extensively outcropping Jurassic diabase onshore with the seismic basement offshore is tempting, but the resulting subtle change in basement depths across the dashed line would appear insufficient to account for the

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drastic change observed on the magnetic intensity curve.

A change in magnetic basement composition with sufficient change in susceptibility could satisfactorily explain the aeromagnetic phenomena and still be compatible with the seismic interpretation. In particular, an abrupt termination of the highly magnetic Jurassic diabase onshore coincident with an extension of the less magnetic, metamorphosed Paleozoics or Devonian Granite offshore is considered a likely possibility which is consistent with previous interpretation of the area north of T/11P.

VI. RECOMMENDATION

The Cape Pillar T/11P Seismic Survey indicated that the permit area is underlain by shallow economic basement, and therefore is unlikely to have hydrocarbon potential. No further exploration is recommended at this time.

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REFERENCES

Esso Exploration Australia, "Aeromagnetic Survey, Offshore Tasmania, 1967"

Esso Exploration Australia, "East Tasmania T69B Marine Seismic Survey, 1969"

The Geology of Tasmania, J. of Geol. Soc. of Aust., Vol. 9, Part 2, 1962

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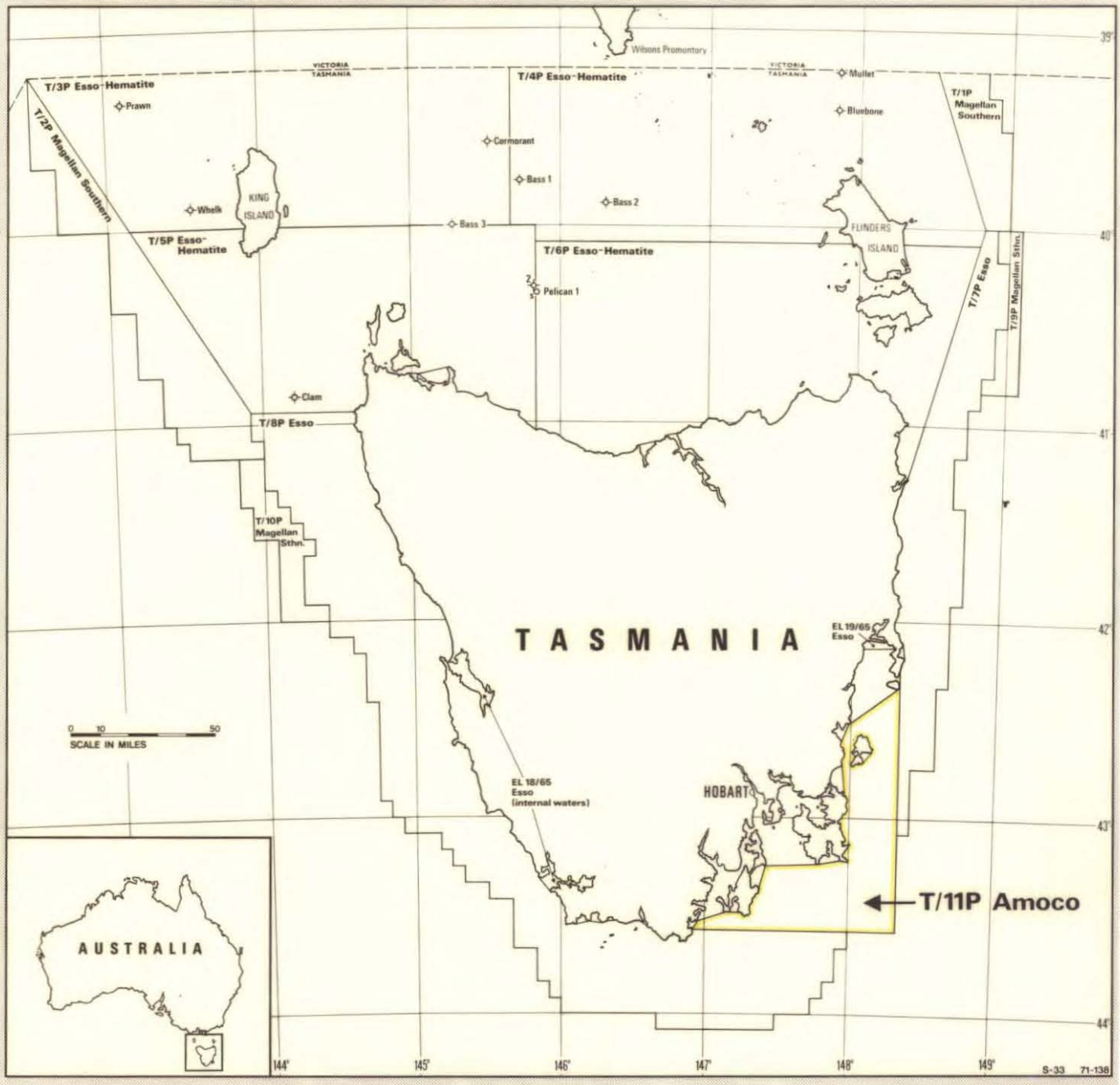
location map



5 cm

fig. 1

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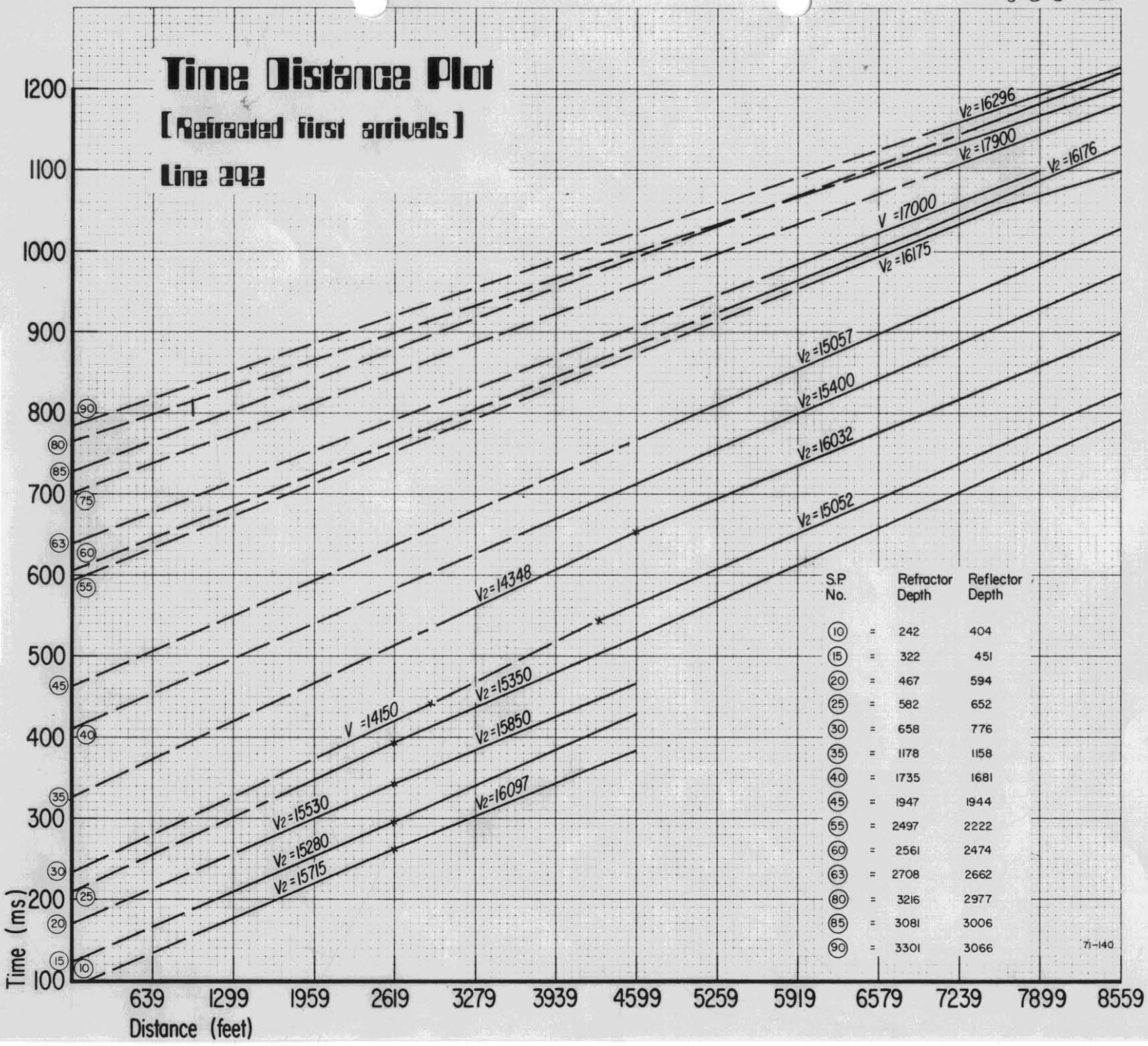
Time Distance Plot
[Refracted first arrivals]
Line 242
Time (ms)
Distance (feet)
1200
1100
1000
900
800
700
600
500
400
300
200
100
639
1299
1959
2619
3279
3939
4599
5259
5919
6579
7239
7899
8559
V2 = 16296
V2 = 17900
V2 = 16176
V = 17000
V2 = 16175
V2 = 15057
V2 = 15400
V2 = 16032
V2 = 15052
V2 = 14348
V = 14150
V2 = 15350
V2 = 15850
V2 = 15530
V2 = 15280
V2 = 15715
S.P. No. | Refractor Depth | Reflector Depth
(10) = 242 404
(15) = 322 451
(20) = 467 594
(25) = 582 652
(30) = 658 776
(35) = 1178 1158
(40) = 1735 1681
(45) = 1947 1944
(55) = 2497 2222
(60) = 2561 2474
(63) = 2708 2662
(80) = 3216 2977
(85) = 3081 3006
(90) = 3301 3066
71-140
5 cm

fig. 2

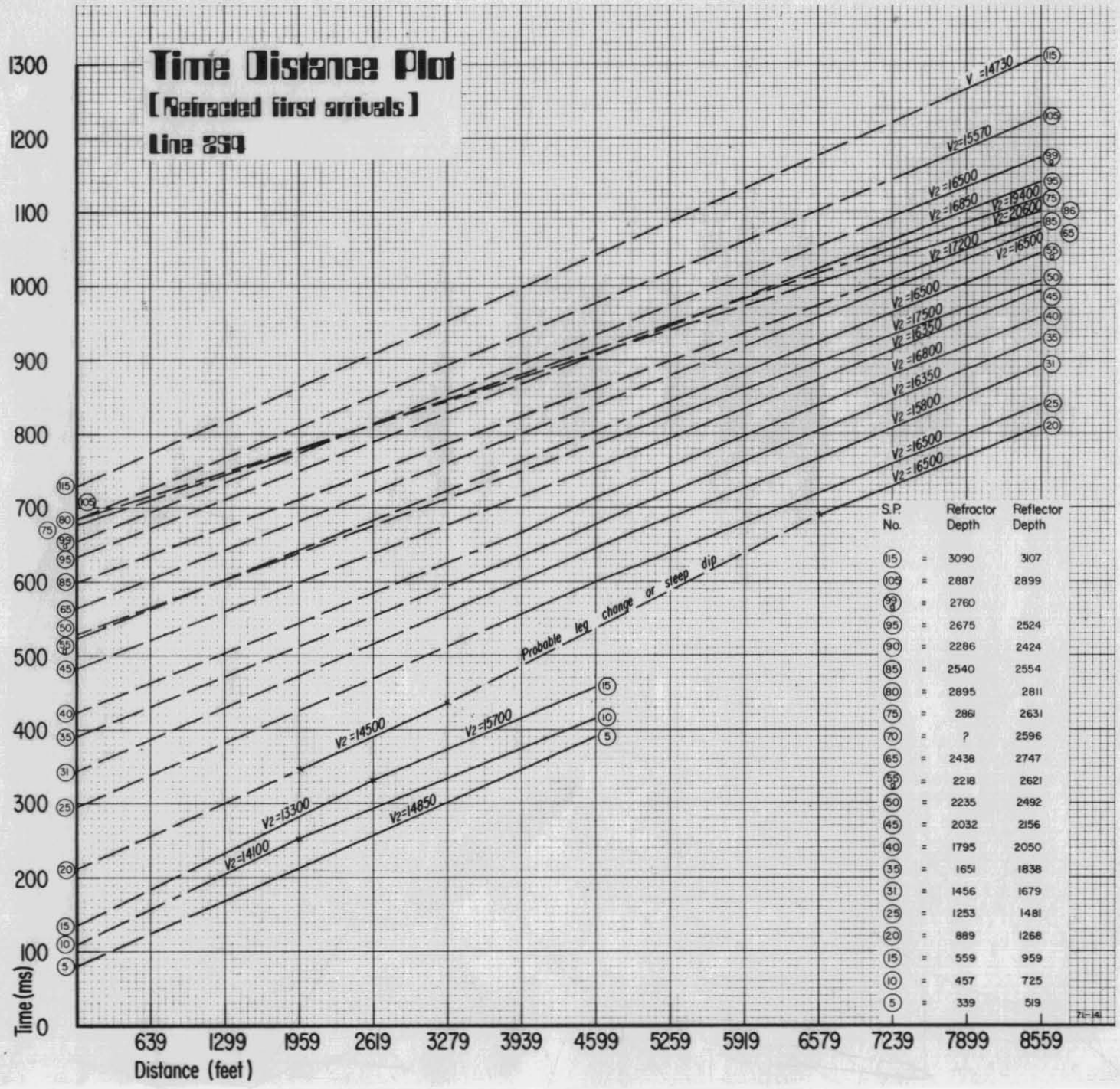
Time Distance Plot
[Refracted first arrivals]
Line 254
Time (ms)
Distance (feet)
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
639
1299
1959
2619
3279
3939
4599
5259
5919
6579
7239
7899
8559
V =14730
V2=15570
V2=16500
V2=16850
V2=19400
V2=20800
V2=17200
V2=16500
V2=16500
V2=17500
V2=16350
V2=16800
V2=16350
V2=15800
V2=16500
V2=16500
V2=14500
V2=15700
V2=13300
V2=14850
V2=14100
Probable leg change or steep dip
S.P. No.
Refractor Depth
Reflector Depth
115 = 3090 3107
105 = 2887 2899
99 = 2760
95 = 2675 2524
90 = 2286 2424
85 = 2540 2554
80 = 2895 2811
75 = 2861 2631
70 = ? 2596
65 = 2438 2747
55 = 2218 2621
50 = 2235 2492
45 = 2032 2156
40 = 1795 2050
35 = 1651 1838
31 = 1456 1679
25 = 1253 1481
20 = 889 1268
15 = 559 959
10 = 457 725
5 = 339 519
5 cm

fig. 3

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APPENDIX A

STATEMENT OF EXPENDITURES

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STATEMENT OF EXPENDITURES

Item or Service	Cost (A$)
Basic field recording and positioning (610.75 miles @ $258/mile)	157,573.50
Extra field recording and positioning (misc.)	860.70
Geophysical data processing (609.25 miles @ $71.11/mile plus 168 velocity analyses @ $66.67 each)	54,524.33
Purchase of magnetic tapes (228 reels @ $17.78/reel)	4,126.22
Reprocessing of geophysical data	149.33
Storage of magnetic tapes ($50.66/month June 1970 - Feb 1971)	456.00
Shipping costs to date (mainly for tapes)	2,240.85
Printing and reproduction of data (approx.)	1,000.00
	$220,930.93

Conversion of funds at $1A = $1.125 U.S.

Amoco overhead and personnel costs not included.

T/11P part-II*

APPENDIX B

FIELD OPERATIONS REPORT

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FINAL OPERATIONS REPORT

AUSTRALIA MARINE SEISMIC SURVEY

CAPE PILLAR AREA

TASMANIA T/11P

FOR

AMOCO AUSTRALIA EXPLORATION COMPANY

BY

WESTERN GEOPHYSICAL COMPANY OF AMERICA

PARTY 80

DECEMBER 1969 - JANUARY 1970

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PLATES

I. Location Map
II. Cable Diagram

APPENDIX

I General Description and Specification DFR-300 Binary Gain Seismic System

II Accuracy of Navigation Control

I. SUMMARY

A continuous reflection seismic survey using the AQUAPULSE* system was conducted in the Cape Pillar area offshore Tasmania, Tenement T/11P. Operations commenced on December 22, 1969 and were completed on January 6, 1970. Refer to Plate I for location of survey area.

II. GENERAL INFORMATION

A. Contractors

The survey was conducted by Western Geophysical Company of America, 8100 Westpark Drive, Houston, Texas, and 514 Miller Street, Cammeray, New South Wales, Australia. Positioning control was provided by Offshore Navigation, Incorporated, 5728 Jefferson Highway, New Orleans, Louisiana, and 202 Roma Arcade, 413-417 New South Head Road, Double Bay, New South Wales, Australia.

B. Base of Operations

Headquarters were set up in Hobart, Tasmania. Good port facilities and a daily air service for supplies were available. Radio communications were established with the "Marchart 3" from Hobart.

* Western Geophysical Company of America registered trademark and servicemark.

C. Weather

Changeable weather conditions persisted throughout most of the survey. Seas varied from calm to very rough and two full days were lost when the vessel had to seek shelter.

D. Surveying Technique

The Shoran XR Extended Range system was employed for positioning control. The mobile equipment used included a track plotter, digital print-out system and dual directional antennae. Four Shoran base stations were employed and had to be moved from site to site in order to overcome problems of blockage and bad angle due to the terrain and certain line positions. A complete description of the Shoran system and the fixed base station sites is included in a separate report to be submitted by Offshore Navigation, Incorporated.

E. Chronology

December 21, 1969:	"Marchart 3" at Orford taking on supplies. Departed for prospect.
December 22, 1969:	Recorded line TW-230 complete. Recording on lines TW-810, 819.

December 23, 1969:	Recorded lines TW-231, 234 complete.
December 24, 1969:	Recording on line TW-810.
December 25, 1969:	Boat anchored at Orford due to rough seas.
December 26, 1969:	Completed line TW-819.
December 27, 1969:	Recorded lines TW-314, 242 complete. Recording on line TW-802.
December 28, 1969:	Recorded lines TW-246, 250, 254 complete.
December 29, 1969:	Recorded line TW-258 complete.
December 30, 1969:	Recorded line TW-302 complete. Recording on line TW-306.
December 31, 1969:	Completed lines TW-306, 310. Recording on lines TW-802, 810.
January 1, 1970:	Completed lines TW-810, 330. Recording on line 326.
January 2, 1970:	Completed lines TW-326, 322.
January 3, 1970:	Boat at Port Arthur sheltering from rough seas.
January 4, 1970:	Recorded line TW-746 complete.
January 5, 1970:	Recorded lines TW-754, 318 complete. Recording on line TW-802.
January 6, 1970:	Completed lines TW-802, 334. Survey completed, boat underway to Hobart.

III. RECORDING OPERATIONS

A. Survey Vessel

M.V. "Marchart 3" - 101 foot, steel hull, twin-screw vessel of Australian registry, powered by two Caterpillar D343, 365 h.p. marine diesel engines, capable of 11 knots cruising speed. Equipped with a Decca 202 Radar, Elac fathometer and Mariner ship-to-shore radio.

B. Instrumentation

Digital Recorder -SDS 1010, 30 channel, 9 track, IBM compatible ½ inch tape, E.P.R.Co. preferred format, with binary gain controlled amplifiers.

On-board Display - Raytheon Precision Depth Recorder, driven by output of trace 23, through a playback amplifier.

Fathometer - Elac Model DENEB, 2200 fathom range.

Sonar Forward Scanner - Honywell Model S-1600-A3.

Tape Transport - Potter dual tape deck.

Monitor Records - Read-after-write wiggle trace recorded on direct write paper every 30 files.

C. Detector Cable

A 7590 feet neutrally buoyant, oil-filled streamer cable equipped with four depth detectors, three special water break detectors and 24 seismic detector groups was used. Each seismic detector group was 230 feet long and consisted of 32 geophones in a tapered, noise cancelling array. 100 foot "dead" sections separated each "live" group so as to give a group centre spacing of 330 feet.

The buoyancy of the cable was adjusted so that it ran at an average depth of 45 feet, the depth being maintained by eight pressure type depth controllers.

Refer to Plate II for a detailed diagram of the streamer cable, AQUAPULSE* gun array and navigation antennae - gun array - cable relationship.

D. Recording Technique

With the AQUAPULSE* system, four "guns" in a rectangular array were trailed at a depth of 20-25 feet. The gun pulse monitoring system was used in conjunction with Geospace MP8 phones. Under continuous tow operations, a metered, oxygen, air and propane mixture was fired electrically at intervals such that a minimum of 4 pops per 330 feet or 64 per mile were recorded.

Gas pressures used - oxygen 60 lb/sq.in., air 45 lb/sq.in., propane 18 lb/sq.in. - fill time 1.3 seconds.

Shot point locations were preplotted with a 660 foot interval.

IV. DATA PRESENTATION

A. Field

A variable density section was made by recording the output of group 23 on the Raytheon Precision Depth Recorder. Wiggle trace, read-after-write monitors were produced by a Dri-Write camera every 5 shot points. This monitor displayed data from the 24 seismic data channels, time break and individual gun pulse signatures.

B. Processing

The digital tapes were shipped to Amoco who arranged processing of the data.

C. Post Plotting

The post plotting was carried out by Engineering Computer Services Limited, of 48 Chandos Street, St. Leonards, Sydney. Maps were produced using the Gerber 522 plotting system on the Australian Map Grid (based on the U.T.M. Projection) at a scale of 1:100,000.

V. KEY FIELD PARTY PERSONNEL

A. Amoco Australian Exploration Company

Name	Position
H. Evans	Client Representative

B. Western Geophysical Company of America

Name	Position
V. Smith	Supervisor
B. Kolozs	Operations Manager
R. Stansbury	Coordinator
J. Goodin	Assistant Coordinator
A. Shirley	Instrument Supervisor
J. Hammond	Gun Captain

C. Offshore Navigation, Incorporated

Name	Position
I. Easterbrook	Party Chief
G. Owen	Mobile Operator
D. Woody	Mobile Operator

VI. STATISTICAL SUMMARY

Centre of AQUAPULSE* gun array to centre of group 24 - 969 feet.

Sampling rate - .004 seconds.

Record length - 6 seconds.

1 Profile = 1 Shoran interval = 660 feet = 0.125 miles.

Line	S.P. - S.P.	Chargeable Profiles	Statute Miles
TW 230	109 - 1	109	13.625
TW 231	90 - 1	90	11.250
TW 234	159 - 18	142	17.750
TW 242	98 - 1	98	12.250
TW 246	173 - 1	173	21.625
TW 250	18 - 181	164	20.500
TW 254	144 - 94 99A - 94A 93 - 55 60A - 55A 54 - 1	144	18.000
TW 258	22 - 134	113	14.125
TW 302	160 - 5	156	19.500
TW 306	16 - 55 46A - 55A 56 - 148	133	16.625
TW 310	141 - 5	137	17.125
TW 314	132 - 1	132	16.500
TW 318	1 - 149 149A 150 - 176	176	22.000
TW 322	387 - 5	383	47.875
TW 326	1 - 208	208	26.000
TW 330	153 - 1	153	19.125
TW 334	528 - 115 120A - 115A 114 - 1	528	66.000
TW 746	1 - 135	135	16.875
TW 754	219 - 7	213	26.625

Line	S.P. - S.P.	Chargeable Profiles	Statute Miles
TW 802	190 - 5		
	179A - 190A		
	191 - 260		
	225A - 260A		
	261 - 296		
	284A - 296A		
	297 - 330		
	325A - 330A		
	331 - 451		
	446A - 451A		
	452 - 467	463	57.875
TW 810	1 - 85		
	76A - 85A		
	86 - 127		
	115A - 127A		
	128 - 381		
	376A - 381A		
	382 - 465		
	460A - 465A		
	466 - 601	601	75.125
TW 819	100 - 66		
	71A - 66A		
	65 - 1		
	97A - 100A		
	101 - 306		
	301A - 306A		
	307 - 435	435	54.375
	TOTALS:	4886	610.750

089033

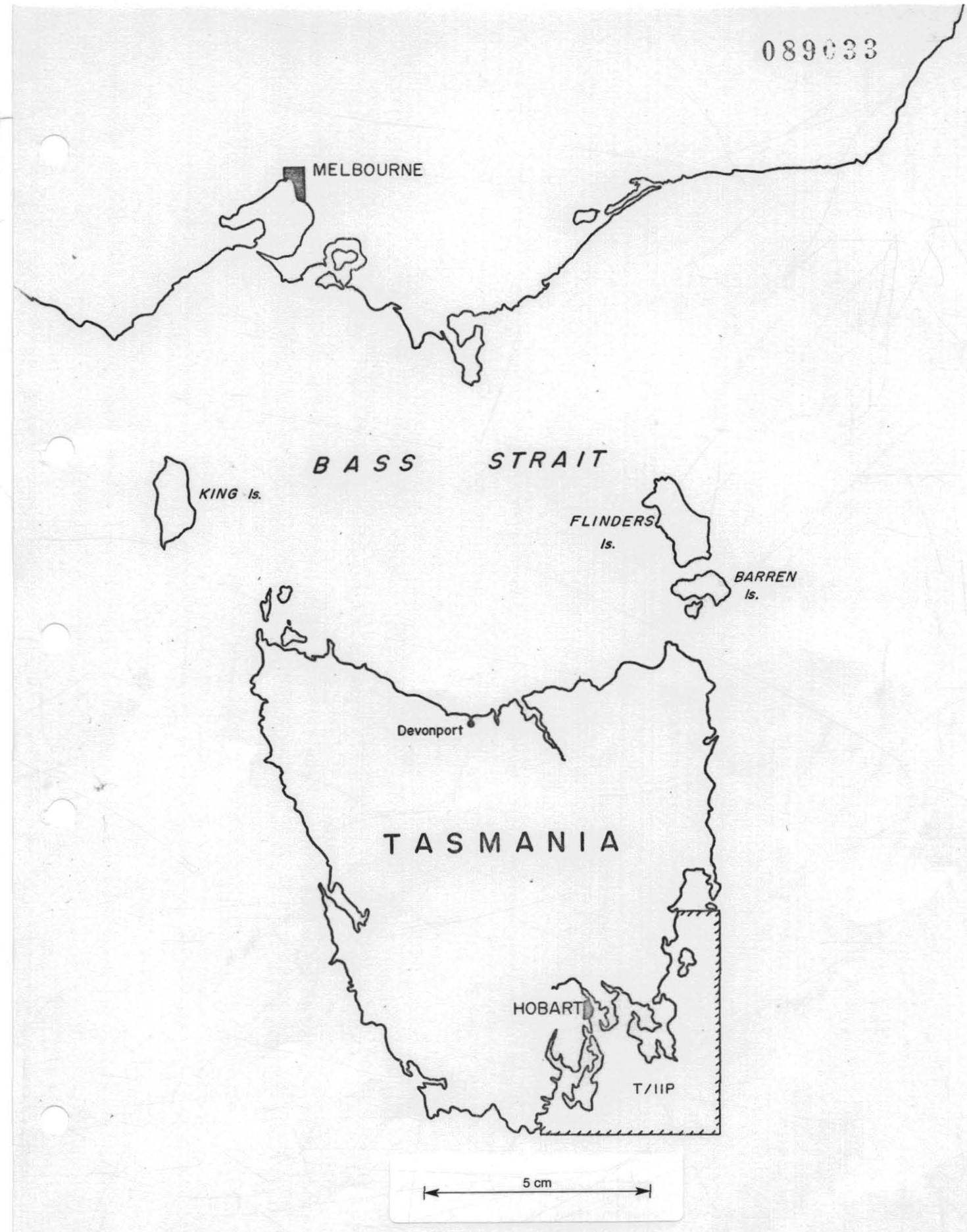
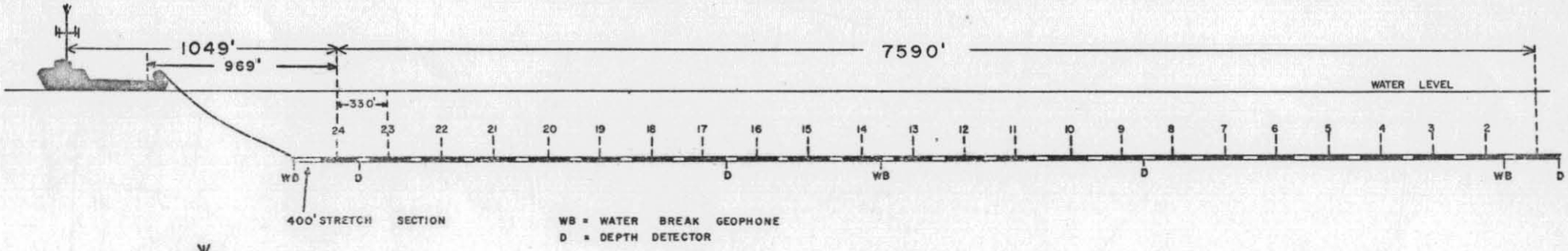


PLATE I

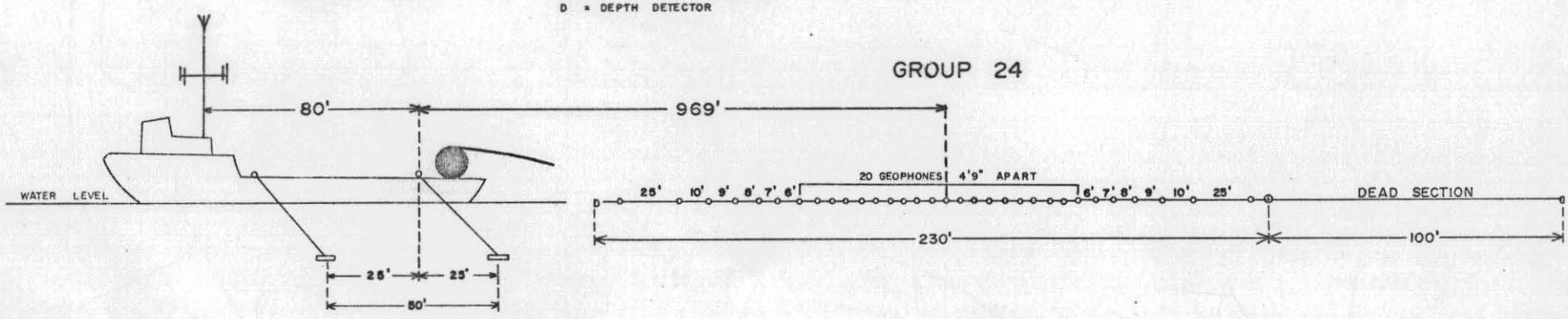
AMOCO AUSTRALIA EXPLORATION COMPANY
SEISMIC SURVEY
1969 - 1970

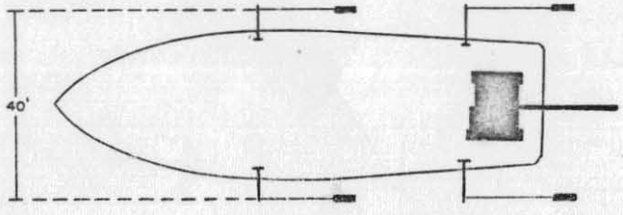
089034

DIAGRAM OF 7590 Ft. STREAMER CABLE



GROUP 24





THE AQUAPULSE SYSTEM

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

5 cm

PLATE II

Appendix I

089035

GENERAL DESCRIPTION and SPECIFICATIONS

DFR-300 BINARY GAIN SEISMIC SYSTEM (HIGH GAIN)

1. General Information

1.0 Function

1.0.0 The DFR-300 Binary Gain Seismic System accepts data directly from the seismic sensors, conditions the data, and causes the conditioned data to be recorded on digital tape. At the option of the operator, either an analog oscillograph monitor record can be recorded in the read-after-write mode concurrently with the digital recording, output from the amplifiers can be monitored directly, or else selected files can be played back at some later time.

1.0.1 The basic 9-track format is described in Savit, "A proposed standard format for nine-track digital tape", published in Geophysics, v 31, n 4, 1966.

1.1 Physical Description

1.1.1 The recording system consists of seven sections as follows:

1. Input and Test Panel
2. Binary-Gain Input Amplifiers
3. Master Control Panel
4. Magnetic Tape Unit
5. Playback Amplifiers
6. Camera
7. Power Converter

1.2 Input and Test Panel

1.2.1 Included with the input and test panels are bridling switches, cable leakage and continuity tester, precision oscillator and attenuator, group selector switch, and voltage test meter. Test panels include means to terminate the amplifier inputs with a 500 ohm load, a feature used in certain test procedures.

1.3 Binary-Gain Amplifiers

1.3.1 For each amplifier there is provided a hum balance circuit, adjustable high-cut, low-cut, and alias filters, and preamplifier-gain and D.C. offset trim pots.

1.3.2 Amplifier gain is adjusted automatically in 6 db steps; the system always attempts to maintain the signal level between one-fourth and one-half of full scale. To prevent signal clipping and distortion, it is urgent to reduce gain if the signal bursts out above half scale so downward gain-ranging may take place on every alternate scan. At a 1 ms sample rate, the attack rate is 3000 db/sec. On the other hand, in the case of a varying data signal which is crossing zero many times per second, it is apparent that some of the sample values of the signal would fall below the one-quarter scale set-point which triggers the gain increase, yet the signal peaks would be above the trigger level and the existing gain level should be continued. A means is provided to delay the gain increase until all samples fall below the trigger level. This operation is accomplished by examining all samples of a given channel for a time period which is set by a 3-position release-rate switch, having the positions, fast, medium, and slow (30, 40, 60 ms, nominal or 200, 150, 100 db/second). The release rate is an expression of the speed, in decibels per second, at which an amplifier is capable of increasing gain to follow a declining seismic signal. As soon as all samples are below the lower set point for an examination period, the gain is increased by 6 db at the next scan. Thus, with a 30 ms examination period, the gain could be increased 6 db every 30 ms or at a rate of 200 db/sec. Provision of three release rates permits the operator to select the one best suited to the data being received.

1.3.3 Each amplifier unit includes one preamplifier and two paralleled post-amplifiers. The preamplifier has a gain of 40 for systems 105 and all systems with serial number 108 and later. The output of the post-amplifiers is applied to the system multiplexer and also to the analog camera when switched to the noise monitor mode. Of the two post-amplifiers, post-amplifier 1 has selectable gains of 1 and 256; post-amplifier 2 has selectable gains of 16 and 4096. The choice of one of the two gains and one of the two post-amplifiers is a function of the gain-control unit selecting the particular amplifier. In the noise monitor mode, the amplifier gain is forced to X163,840.

1.4 Logic Control Chassis

1.4.1 The Logic Control chassis contains the master control panel multiplexer, buffer amplifier, gain control unit, A/D and D/A converters, and control logic. Early gain controls for the amplifiers are mounted on the master control panel. The tape drive is included in this chassis unless a 10" tape drive is specified, in which case the tape is mounted in a third rack. An optional dual drive is available for continuous operations.

1.4.2 The analog outputs of the amplifier units are time-multiplexed by the amplifier multiplexer, whence each analog signal is fed to the buffer amplifier. The buffer amplifier serves both as

an impedance matcher between the multiplexer and the A/D converter and as an element of the binary gain amplification scheme. Binary signals from the control unit select any one of four buffer-amplifier gains of 1, 2, 4, or 8. The selected buffer-amplifier gain, combined with one of the four gains in the post-amplifiers, result in 15 binary gain steps from 1 to 32,768.

1.4.3 The Gain Control Unit originates a 4-bit gain code to select the gain of one of the two post amplifiers and to control the gain of the buffer amplifier. In general, when the analog value being digitized falls below one-quarter scale, the gain control unit increases the gain code by 1. When the value exceeds one-half scale, the gain control unit decrements the gain code by 1. These values are acquired by decoding the digital outputs of the A/D converter.

1.4.4 The Input Control Unit controls flow of data from the A/D converter, gain control unit, file counter, time counter and other sources to the input bus. This unit sequences and formats the data words into two 8-bit bytes, generates the parity bit, and writes the data on tape via the tape write unit.

1.4.5 The A/D converter is a 14-bit-plus-sign binary converter with complement output for negative numbers. It is controlled by a single start line originating in the input control unit. A trigger pulse on this line for each seismic channel starts the entire conversion sequence. The bit circuits continuously track the analog signal; then, after a particular analog signal has settled, the start signal initiates the sequential clamping of the bit circuits. In this way the precise digital value is achieved very rapidly by successive approximation. The digital output levels are applied to the input bus and are also used to control the gain control units.

1.4.6 The D/A converter accepts the magnitude bits furnished by the A/D converter as well as the 4-bit gain code from the gain control unit. It uses both of these--as mantissa and exponent--in a floating point representation to generate an analog signal with three significant features: (1) The analog output contains the full dynamic range of the system in a form capable of representation on a recording oscillograph. (2) The gain steps that would ordinarily be visible when the system moves from one gain code to another are removed. (3) The average value of the analog signal is normalized by digital and analog AGC, around a manually set playback level, so that rapid changes such as burst-outs are readily visible. The final result is a camera record on which both the average signal value and the reflections are clearly visible for the entire length of the file. On high-gain models, the gain change blips can be displayed at the operator's option.

1.5 Magnetic Tape Unit

1.5.1 The Magnetic Tape Unit is a field tape transport accommodating 9-track tape, ½-inch wide, on 8-½ or 10 inch reels. Direction of tape motion, startup and shutdown are controlled by the system control unit on the basis of the mode selected; tape speed depends upon the sampling rate selected.

1.5.2 A beginning-of-tape sensor determines when first recording may commence, and the end-of-tape sensor warns of the approach of the tape end. If the EOT marker is sensed while a file is being recorded, recording will continue past the EOT mark until the file is completed but no further recording can be done on that reel. It should be noted that this capability is possible because the EOT marker is located 65 feet from the actual end of tape. The tape transport is interlocked with a number of system and transport conditions so that it can operate only when all conditions are ready.

1.5.3 Use of the seismic recording system may involve interlaced recording or playback operations; therefore, a special type of file protection system is provided. This over-write protection uses the electronic detection of data on the tape to inhibit writing. An advance-to-end-of-data control allows the system operator to automatically reposition the tape at the end of the previously recorded data. As a result, it is possible to record a file, replay it or another file, and go ahead with more recording with no chance of inadvertently over-writing data.

1.5.4 In addition to the electronic data-detector-write-inhibitor, conventional write-ring protection is provided. This feature assures the operator that previously recorded data cannot possibly be damaged. If desired, the erase head and electronic file protector can be disabled when recording in the continuous forward mode and, in this case, file protection is available only via the write-ring file protect.

1.5.5 The write logic generates IBM-compatible odd vertical parity which is recorded on tape along with the data. Parity errors are displayed by means of indicator-lights; whenever an excess of parity errors occurs, an audible and visible alarm is activated. The usual EOF characters are generated automatically after the recording has been completed; a manual EOF switch is also available.

1.5.6 A special switch is provided to write a block of all 1's. This block, of indefinite length, is used to check skew.

1.6 Playback Amplifiers

1.6.1 Camera displays can be made in playback mode, either read-after-write during a recording or read only at a later time, or in noise monitor mode.

1.6.2 When the noise-monitor mode is entered, signals are taken from the output of post-amplifier 2 and are fed to the camera. In this mode, the gain is forced to X163,840.

1.6.3 In the direct playback mode only the mantissa is displayed with no reference to the gain code. In this mode the transients due to gain changes are readily visible.

1.6.4 Playback AGC capability is partly analog and partly digital. The digital part removes the transients due to gain changes by bit-shifting and applies gain control to all channels so that the maximum average signal is at a preset level. Differences of amplitude level between channels are then removed by analog AGC applied to individual channels. Burstouts are preserved in their true relationship to the signal envelope level at the point where they occurred. The rate at which the average envelope level is followed in the reconstruction of the signal is adjusted by a three-position AGC rate switch. In addition to the AGC rate, the level at which the average envelope is controlled can also be adjusted. If, for example, the level is reduced, a relatively large burstout capability is provided. To prevent the AGC action from forcing the amplifier to maximum gain when no data signal is present, the AGC preset control is provided to limit the amount of gain control before trip.

1.6.5 Fixed-gain playbacks can be made by locking out the AGC action so that the effective gain is set by the preset switch. It should be noted that if the Preset gain, as set for playback, is greater than the Early gain, as set for record, all signals will be automatically bit-shifted by the amount of the difference, but if the settings are the same, no bit-shifting will occur. For certain test purposes it is desirable to make specified bit-shifts without regard to the early gain setting used at recording time. To accomplish this end, Unit 105, 108 and later models have been equipped with a special function switch providing the option of normal AGC preset, or the capability of shifting the data bits, on playback, by specified fixed amounts regardless of the Early gain setting used during recording.

1.6.6 On playback, the data can be filtered at the option of the operator. Three-position, high- and low-cut filters are provided, with provision to switch the filters out if desired.

1.6.7 Many units have a time accumulator. To monitor its functioning, the least significant bits of the time word are selected and displayed on trace 25 of the camera recording. The signal will appear as a saw-tooth wave with a period of 2048 ms. The time-word display appears on an auxiliary trace.

1.6.8 In addition to the time accumulator display, the time break event is shown as follows. At the beginning of the recording, a DC offset is applied to trace 25. At the moment that the time

break is sensed, the offset is removed and the trace returns to normal in the form of a step function. The amplitude of the time-break signal must exceed 1/4 scale for this feature to function.

1.7 Camera

1.7.1 A multi-trace, direct-writing camera is a permanent part of the system. Ordinarily, camera input is fed from the read-after-write heads on the magnetic tape recorder unless the system is in the noise monitor or tape bypass mode. Camera start may be set to coincide with either the recording or playback cycles. For test purposes, the tape can be bypassed so that incoming signals can be played directly into the camera.

1.8 Power Converter Unit

1.8.1 The Power Converter Unit converts 12-volt battery power to thirteen, DC output voltages to operate the units of the 1010 system. Five shielded outputs are used where the maintenance of analog accuracy is critically important. Seven regulated voltages are used principally for digital purposes. An unregulated voltage is used for indicators and relays, and the battery voltage is used directly for motors and heaters.

1.9 Block Diagram

1.9.1 A simplified block diagram is illustrated in Figure 1.

2. Specifications

2.1 System

Number of inputs	24 data channels plus 6 auxiliary channels
Sample rate	1, 2, or 4 ms per scan, switch-selectable
Sample rate accuracy	0.01%
System resolution (A-D)	15 bits including sign
System resolution (D-A)	10 bits including sign manually left shiftable to 84 db
Data code	15 bits in 2 bytes, 1's complement
Redundancy check	Odd vertical parity
Search capability	Forward and reverse for three-digit file identification
Playback AGC control	3 positions: fast, medium, slow
Voltage required	12 v DC

2.2 Amplifier

Maximum input signal	250 mv zero to peak
Input impedance	500 ohms nominal
Minimum gain	32 db
Noise	Less than 0.2 μvp RTI r.m.s.
Cross talk	Greater than 66 db down from full scale
Harmonic distortion	0.1% from 10 Hz to 250 Hz
Automatic gain range, binary gain amplifiers	90 db
Attack rate (@ 1 ms sample rate)	3000 db/sec.
Release rate	200, 150, 100 db/sec. (30, 40, 60 ms delay, nominal)

2.3 Multiplexer, A/D converter

Input	±10 v from seismic amplifier
Number of inputs	30
Noise	±0.6 mv peak referred to ±10 v peak at input to A-D
Coding error	±½ least significant bit
Nagative numbers	1's complement
Linearity	Better than 0.01%
Slope error	Better than 0.01%
Zero error	Better than 0.01%
Conversion time	12 μs

2.4 D/A Converter

Code input	Binary, 1's complement
Number of bits	10 bits, including sign
Accuracy	±0.2%

2.5 Magnetic Tape Unit

Speeds	20, 40, 80 ips
Speed tolerance	±2% long term
Direction	bi-directional
Tape width	½" (0.498 ±0.002)
Recording	IBM compatible
Packing density	800 bpi
Tracks	9
Track spacing	ASI standard
Tape sensing	Photo-reflective IBM compatible; both BOT and EOT

Read direction	3 speeds forward, 1 speed reverse
File protection	Electronic and/or write-ring file protection
Erase head	
Reels	8½" or 10" compatible with IBM hubs and snap-off locks

2.6 Filter Amplitude Response Curves

2.6.1 Refer to Figures 2 and 3.

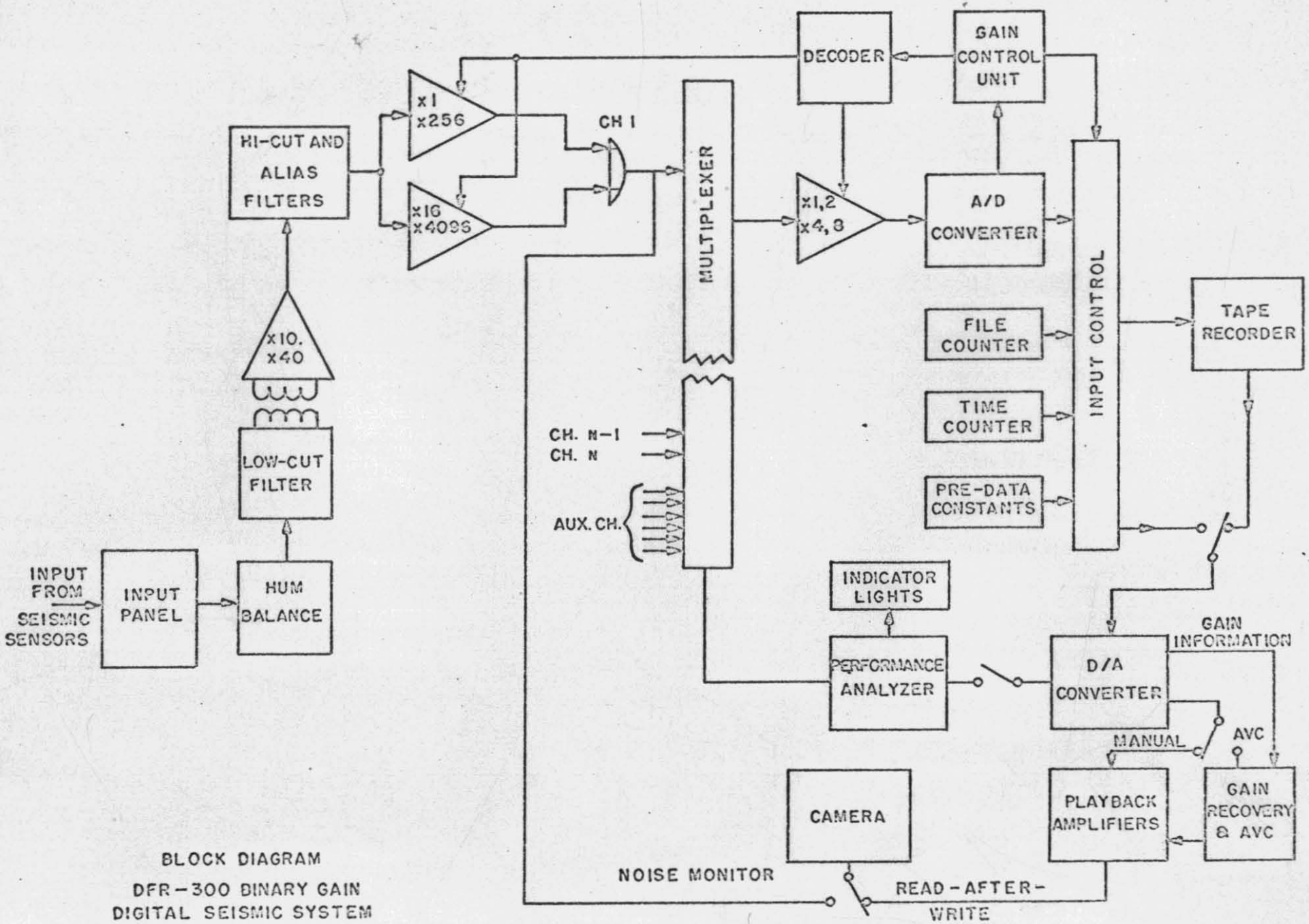


Figure 1

BLOCK DIAGRAM
DFR-300 BINARY GAIN
DIGITAL SEISMIC SYSTEM

WESTERN GEOPHYSICAL

089044

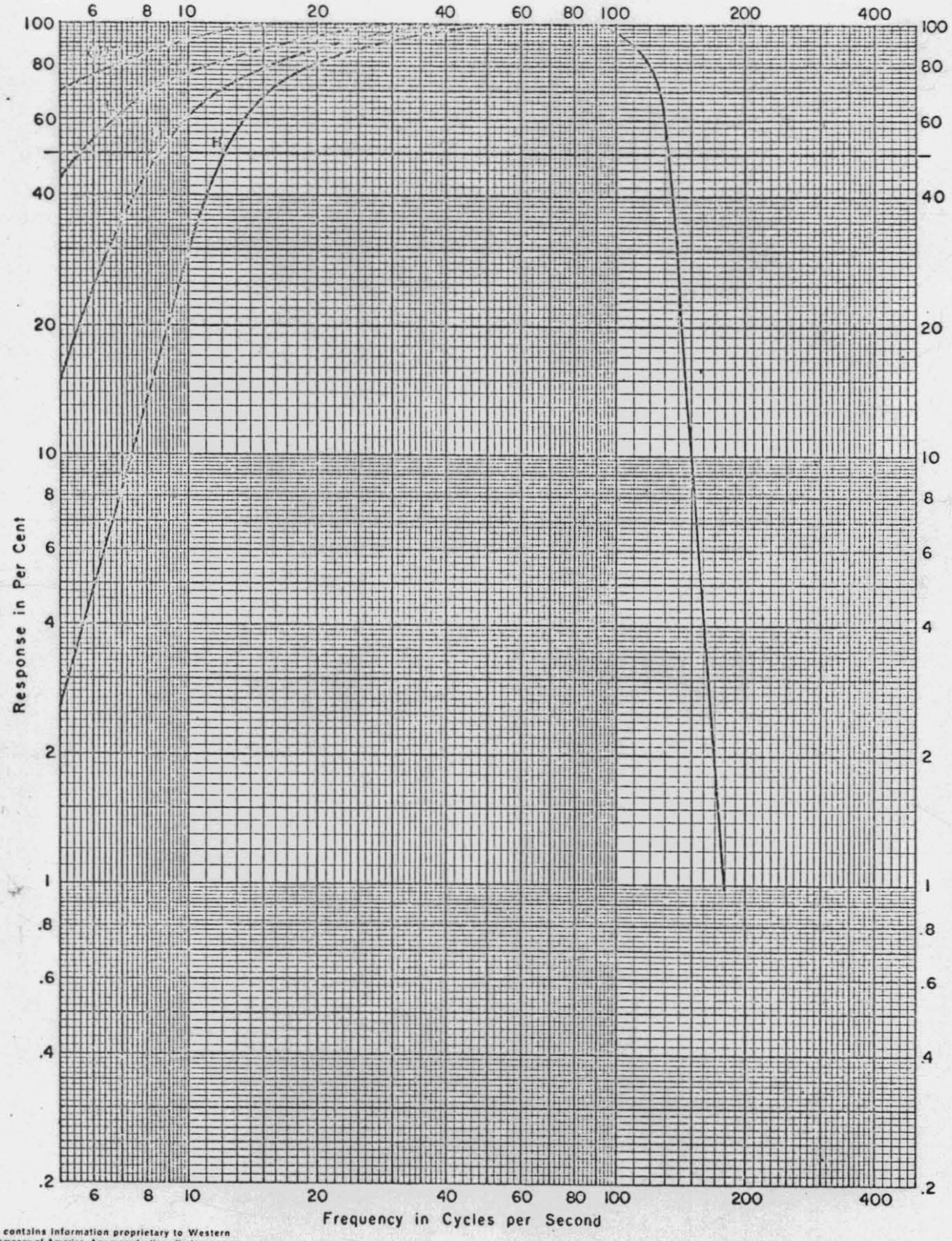
5 cm

AMPLITUDE RESPONSE

089045

SDS BINARY GAIN AMPLIFIER
SERIES DFR-300
LOW CUT FILTERS

AMPLIFIER ONLY
HIGH CUT FILTERS-OUT
ALIAS FILTER -2MS



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WESTERN GEOPHYSICAL

FIGURE 2.

5 cm

AMPLITUDE RESPONSE

089046

SDS BINARY GAIN AMPLIFIER

SERIES DFR-300

HIGH CUT FILTERS

AMPLIFIER ONLY

LOW CUT FILTER – OUT

ALIAS FILTER – 2MS

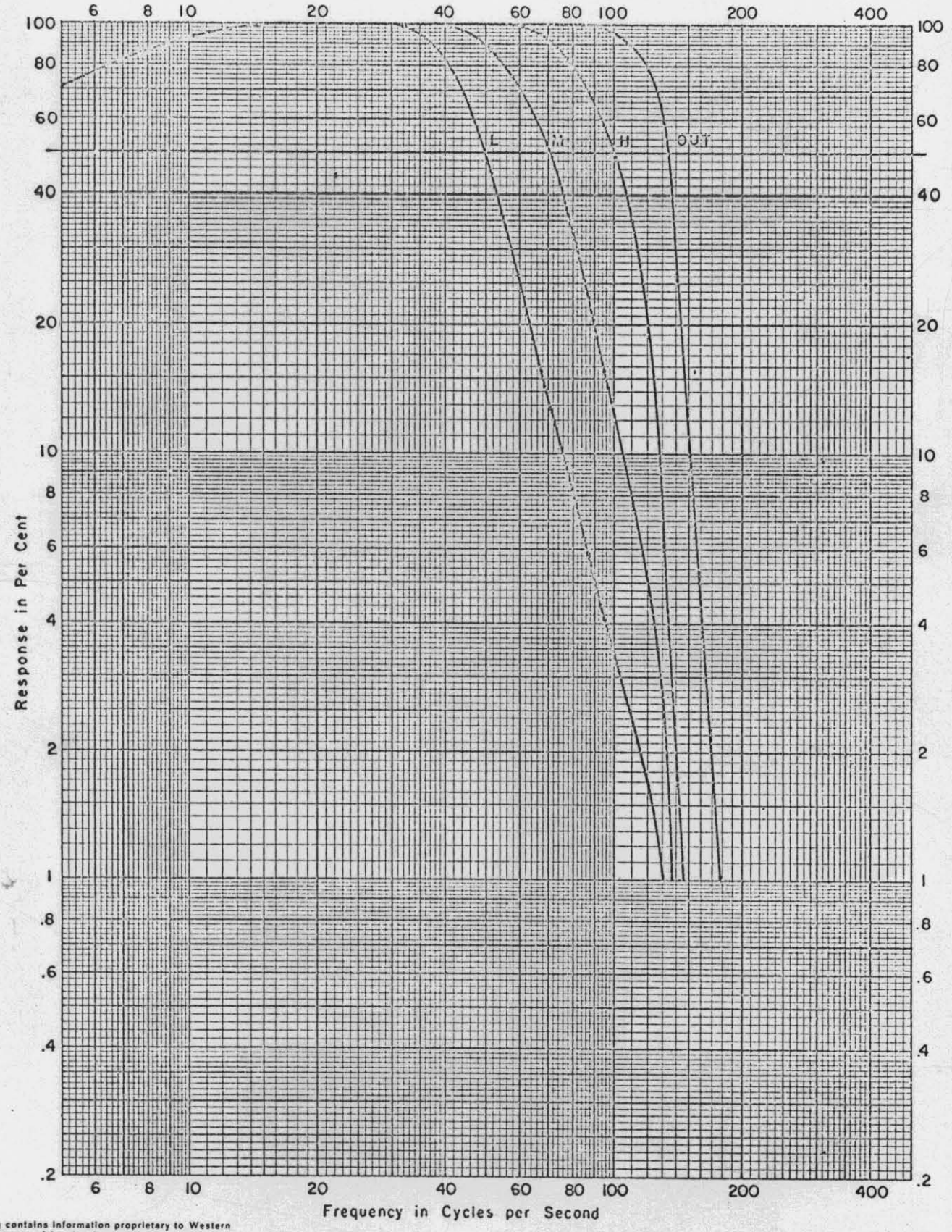

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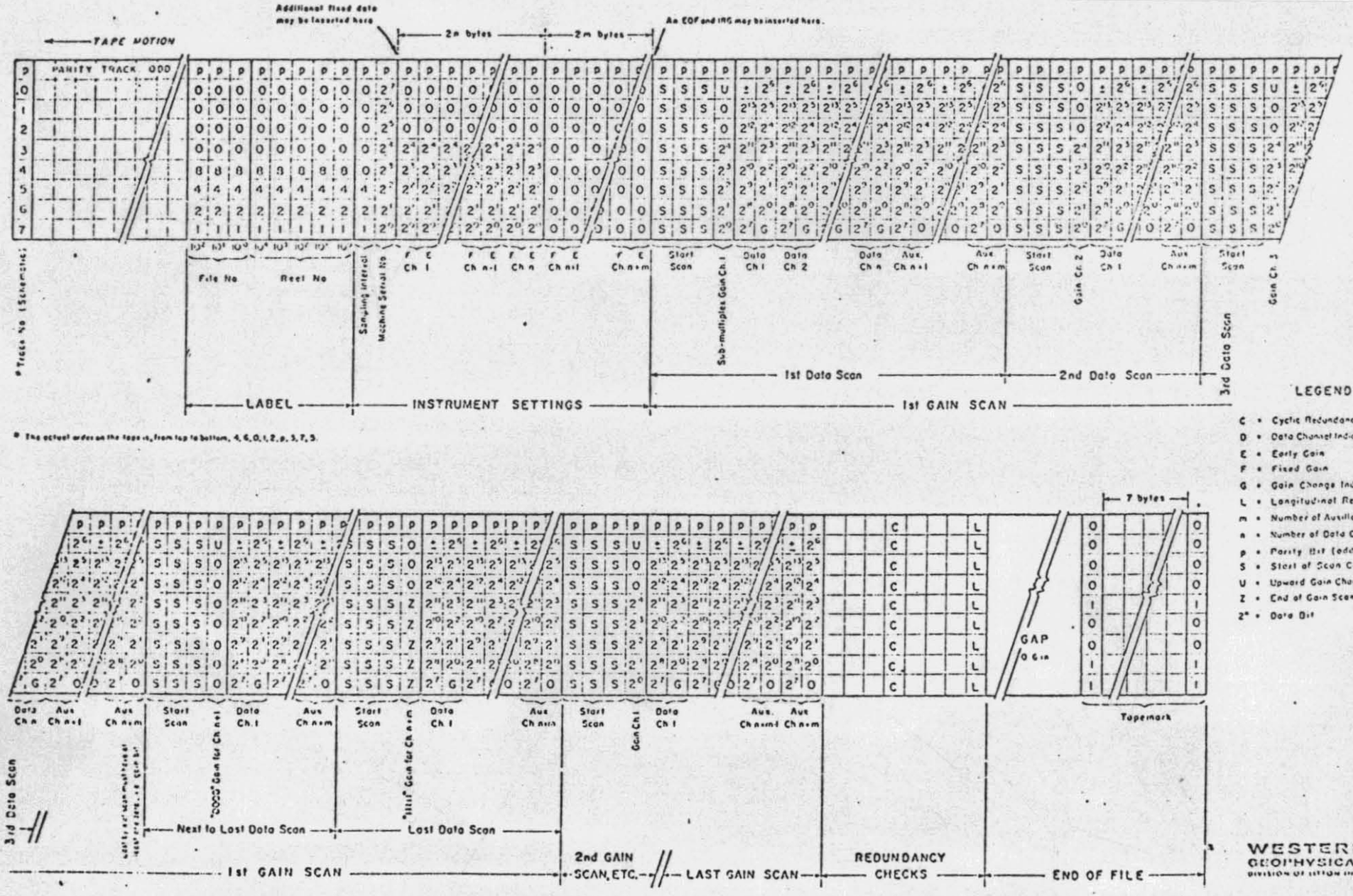
FIGURE 3.

WESTERN GEOPHYSICAL

089047

9-TRACK DIGITAL RECORDING FORMAT

5 cm



LEGEND

- C = Cyclic Redundancy Check
- D = Data Channel Indicator
- E = Early Gain
- F = Fixed Gain
- G = Gain Change Indication
- L = Longitudinal Redundancy Check
- m = Number of Auxiliary Channels
- n = Number of Data Channels
- p = Parity Bit (odd)
- S = Start of Scan Code
- U = Upward Gain Change Indicator
- Z = End of Gain Scan
- 2^x = Data Bit

WESTERN GEOPHYSICAL
DIVISION OF LITTON INDUSTRIES

APPENDIX II

ACCURACY OF NAVIGATION CONTROL

All the Shoran base stations used were located adjacent to 1st or 2nd order Land and Survey trig points, except Cape Pillar which had to be placed specially for the survey. There was no indication from the results of the 3-way fixes that any of the stations were wrongly sited.

Two 3-way fixes and one 4-way fix were taken during the survey with the boat stationary, but not anchored. The coordinates indicating the position of the boat when the fixes were taken were computed by pairing range values from each of the stations used.

FIX 1

Station	Range (miles)
Buxton Point	47.120
Cape Frederick Hendrik	21.733
Cape Pillar	31.220
Ragged Tier	29.821

Computed coordinates in metres on AMG zone 55.

Buxton - Hendrik	614192 E	5250697 N
Buxton - Pillar	614246 E	5250720 N
Buxton - Ragged Tier	614247 E	5250720 N
Hendrik - Pillar	614197 E	5250768 N
Hendrik - Ragged Tier	614174 E	5250436 N
Pillar - Ragged Tier	614248 E	5250720 N

FIX 11

Station	Range (miles)
Ragged Tier	30.770
Cape Pillar	26.995
Cape Frederick Hendrik	21.928

Computed coordinates in metres on AMG zone 55.

Ragged Tier - Pillar	612846 E	5242180 N
Ragged Tier - Hendrik	612962 E	5242438 N
Pillar - Hendrik	612874 E	5242151 N

FIX 111

Station	Range (miles)
Cape Pillar	20.235
Eaglehawk Neck	21.076
Cape Frederick Hendrik	23.392

Computed coordinates in metres on AMG zone 55.

Pillar - Eaglehawk	608376 E	5229111 N
Pillar - Hendrik	608381 E	5229102 N
Eaglehawk - Hendrik	608370 E	5229086 N

COMMENTS

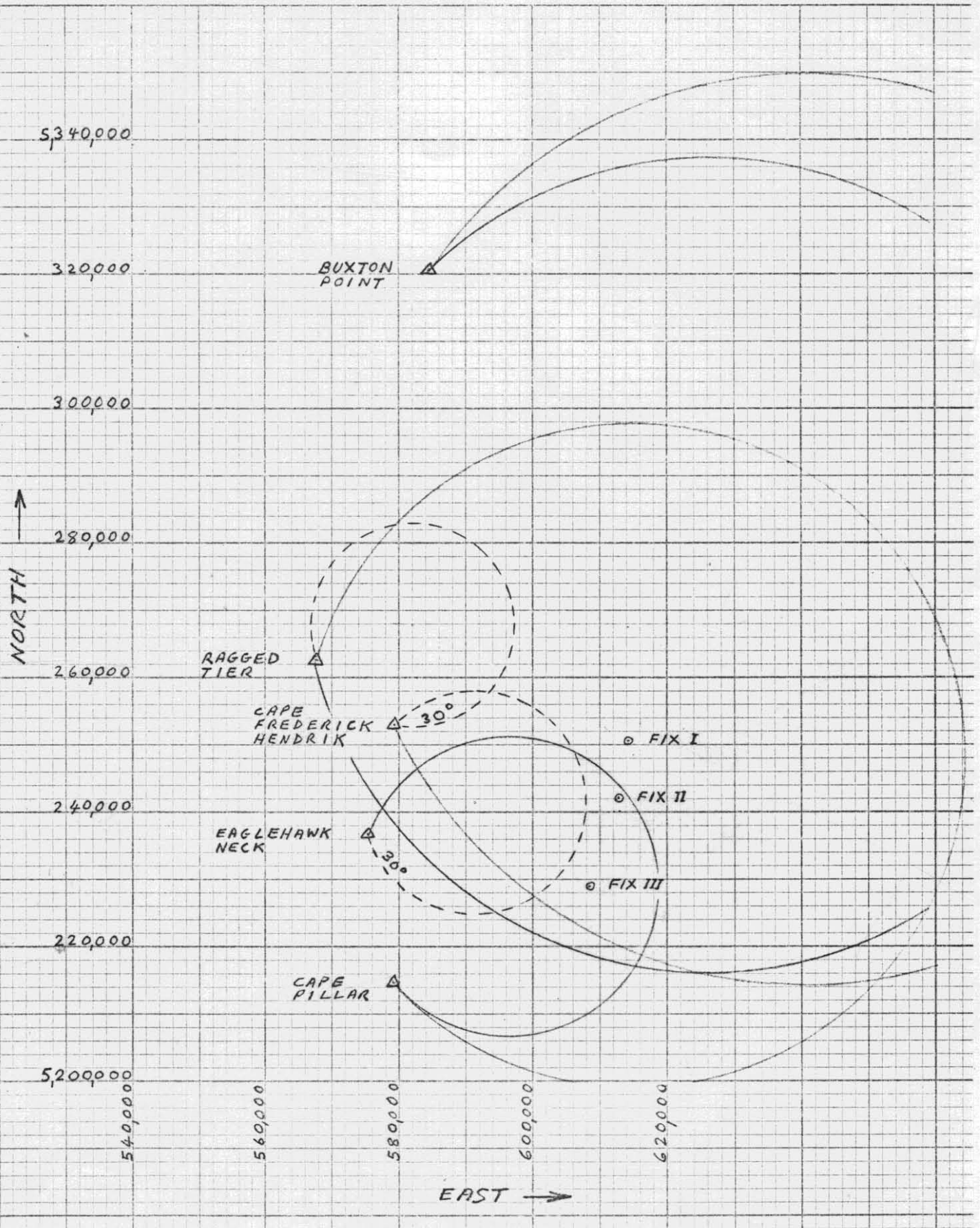
The fix 1 coordinates computed using paired ranges Buxton - Pillar, Buxton-Ragged Tier, and Pillar-Ragged Tier, differed by only 1 metre in the Easting value. This is an extremely close plot to be obtained from this type of fix but could be

accounted for by the fact that the range readings were close to the normal calibration range of 30-35 miles at which little or no system error should be evident.

Statistical error-range curves for the Shoran XR system show that for ranges shorter than the calibration distance, the system will normally read short. For ranges greater than this distance, the system normally reads long. Applying this rule would conveniently explain why Cape Frederick Hendrik station appeared to be reading about 50 metres short for this fix. However, it was noted that in the other two fixes, taken at almost the same range from Hendrik, the system was probably reading slightly long compared with the other stations. Since atmospheric conditions effect the magnetude of the range errors and may not have been similar on the days that the fixes were taken, the validity or otherwise of the Hendrik Fix 1 reading cannot be proved.

The results of the three separate fixes are considered sufficient proof that the navigation control was reasonably within the accepted limits of accuracy for the system. It should be noted that for a certain station combination in each fix, the boat was in a bad angle position. The effect of this is that a small error in range readings from one or both stations could displace the boats position by a considerable distance. These coordinates must therefore be considered invalid for the purpose of accessing accuracy.

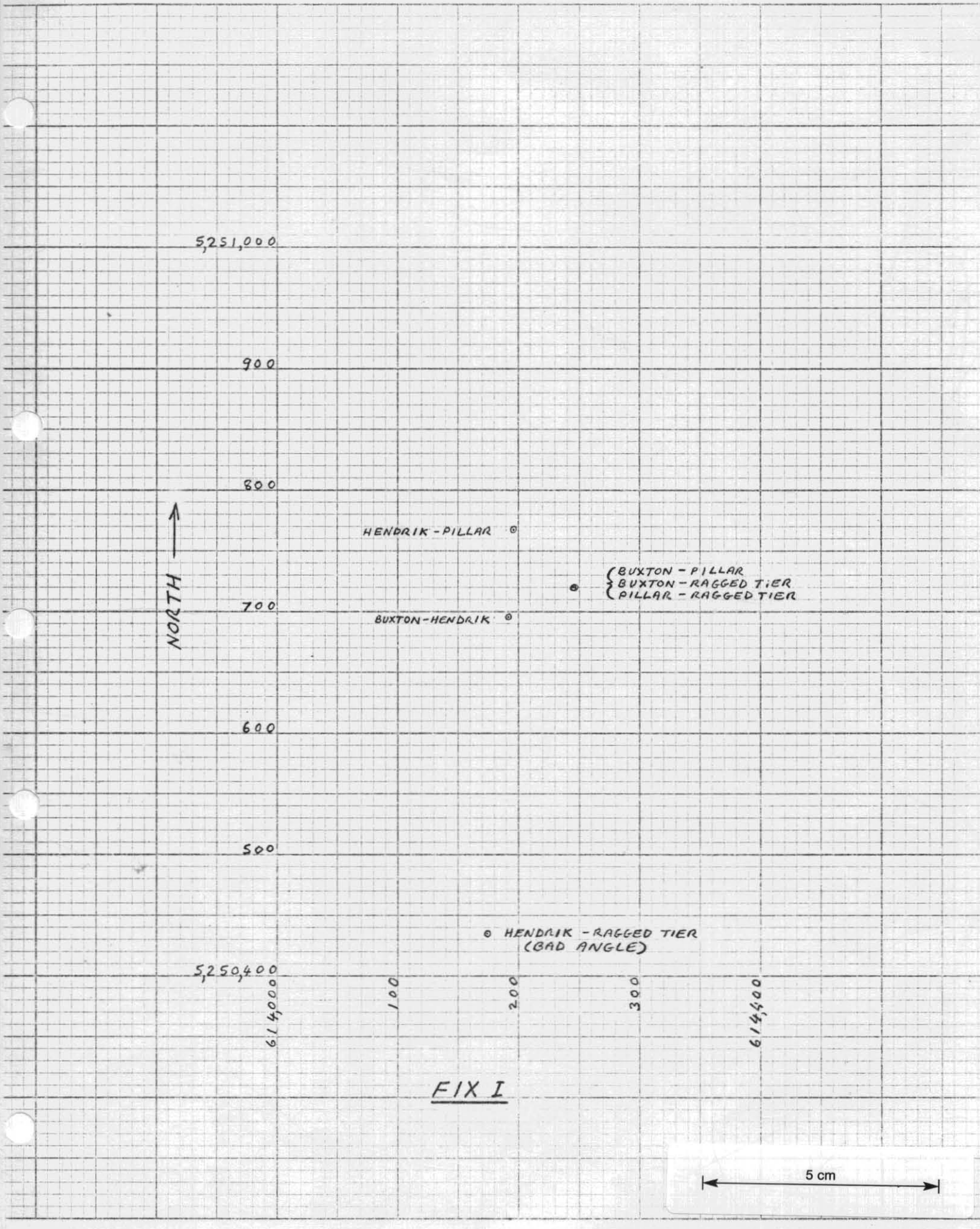
089051



3-WAY FIX LOCATIONS

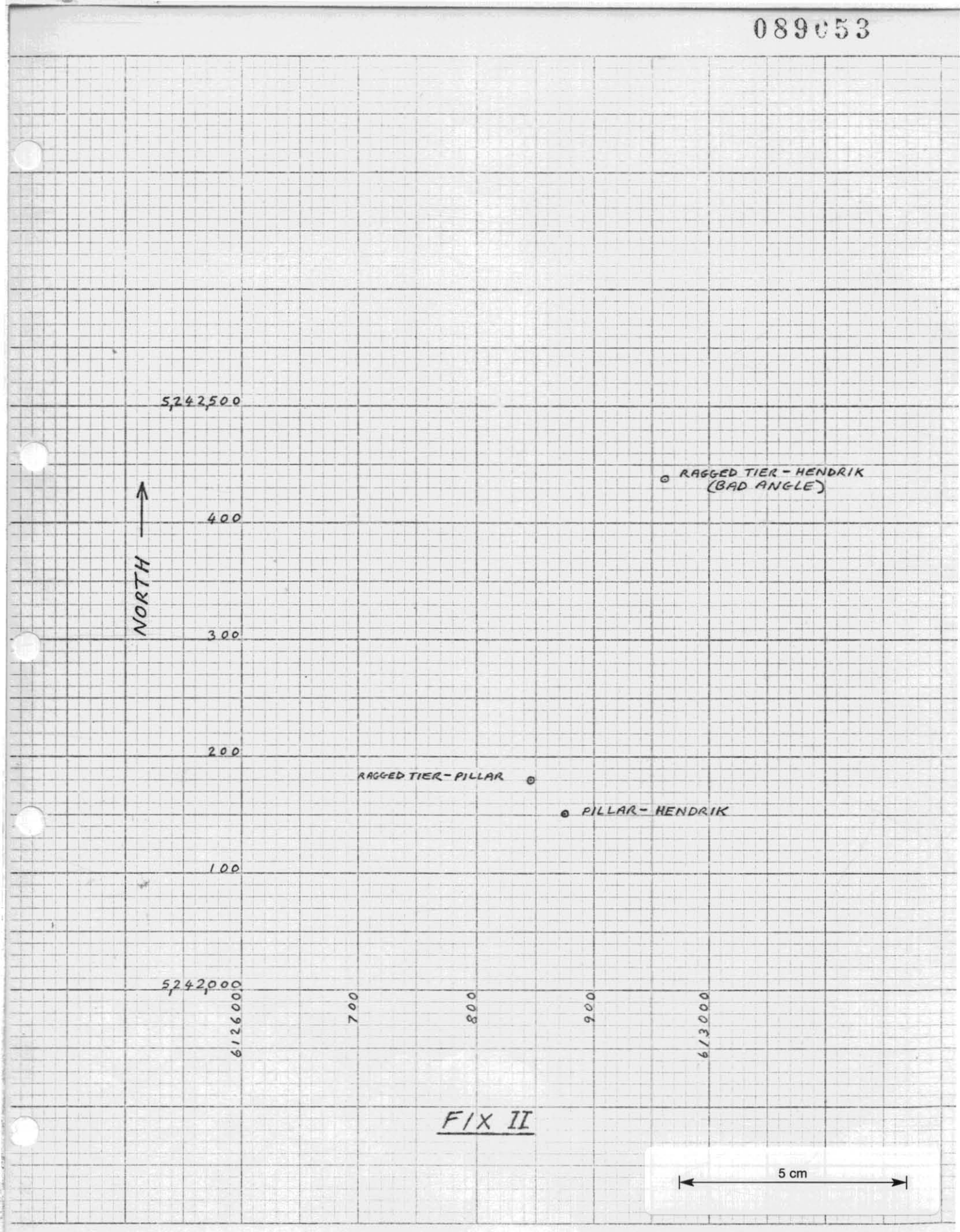
5 cm

089052

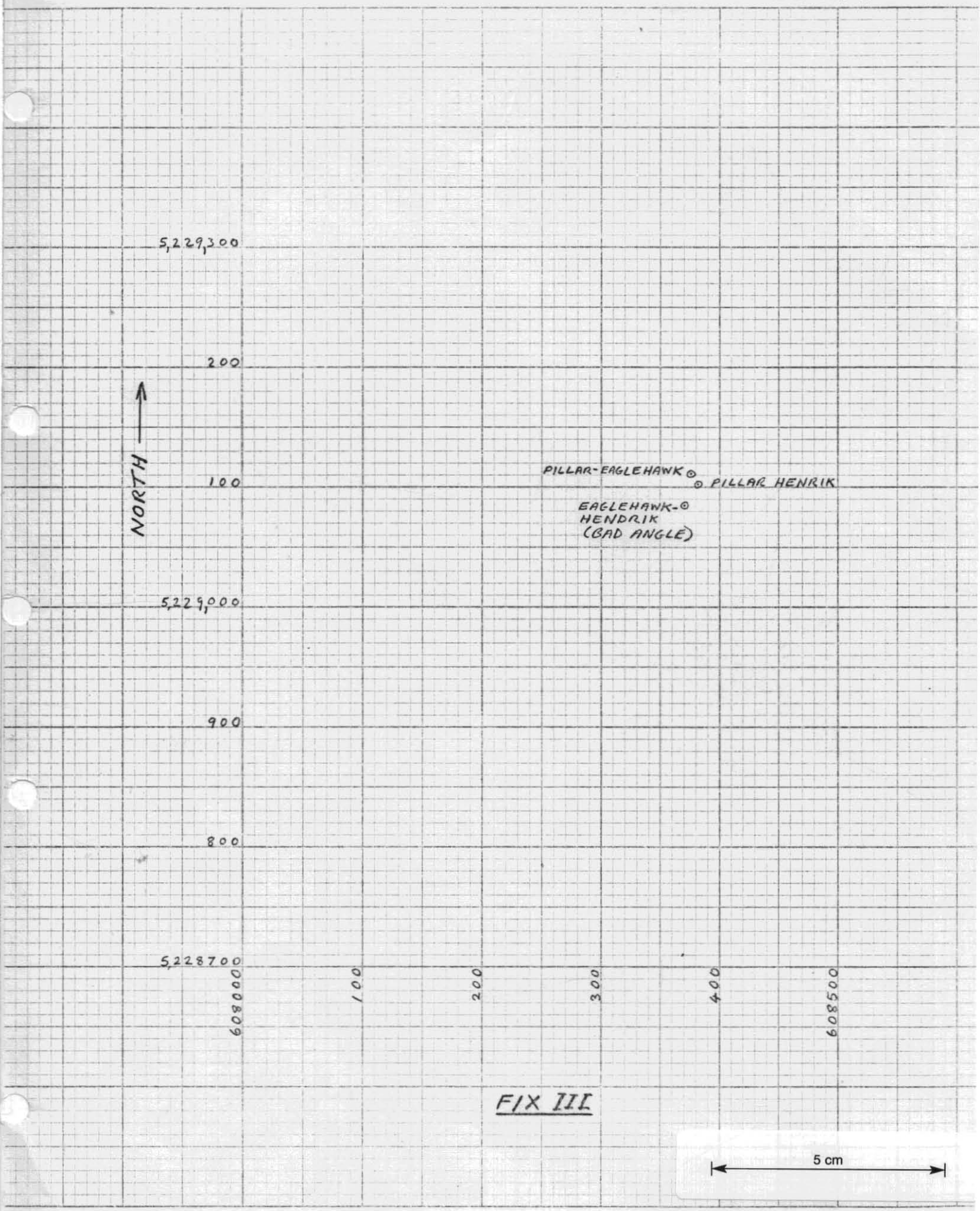

5,251,000
900
800
NORTH
HENDRIK - PILLAR
BUXTON - PILLAR
BUXTON - RAGGED TIER
PILLAR - RAGGED TIER
700
BUXTON - HENDRIK
600
500
HENDRIK - RAGGED TIER
(BAD ANGLE)
5,250,400
614,000
100
200
300
614,400
5 cm

FIX I

089053


5,242,500
400
300
200
100
5,242,000
NORTH
RAGGED TIER - HENDRIK
(BAD ANGLE)
RAGGED TIER - PILLAR
PILLAR - HENDRIK
612600
700
800
900
613000
FIX II
5 cm

089054


5,229,300
200
NORTH
100
PILLAR-EAGLEHAWK
PILLAR HENRIK
EAGLEHAWK-
HENDRIK
(BAD ANGLE)
5,229,000
900
800
5,228700
608000
100
200
300
400
608500
FIX III
5 cm

APPENDIX C

DIGITAL PROCESSING SUMMARY

CAPE PILLAR AUSTRALIA

SEISCOM
Seismic Computing Corp.

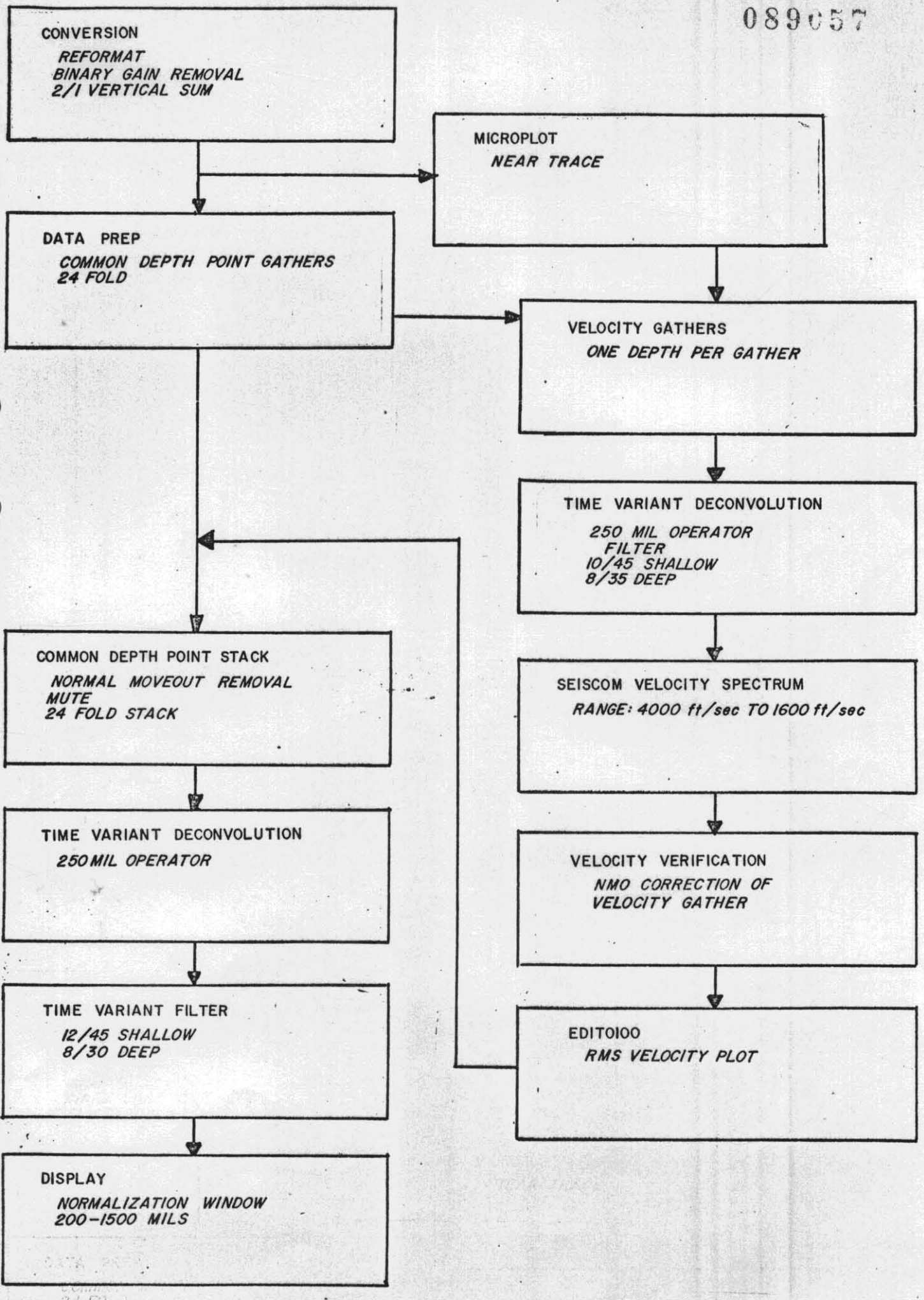
The Cape Pillar prospect acquisition was done by Western Geophysical and the field tapes shipped to Seiscom-Houston for processing. Mr. Harold Evans of Amoco visited the Seiscom office concerning the decision on the type of processing to be used on the data.

Many different processing routes and types of processing were done on one line for comparison. These included deconvolution before stack, deconvolution after stack, standard C.D.P. stack and post-stack enhancement known as seis-stack. The type of processing decided upon was two over one vertical sum, 2400% common-depth-point stack and deconvolution after stack.

All data was converted to Seiscom format with binary gain removal and vertical sum of two over one. The output from this process was used in the near trace plot program to produce a compressed scale variable-area plot of the data. The plot was used to locate the velocity spectra for the data. The subsequent process was data-prep, where all the data was gathered twenty-four fold, and velocity gathers were deconvolved with a time variant deconvolution operator of 250 mils, and filtered on output describing the velocities required to stack the data. The velocity spectra were interpreted, and the interpretation used to correct the velocity gathers. Additionally, the velocity data as it would be used at stack time was displayed by the Edit 0100 program as an R.M.S. velocity curve. After analysis of the corrected velocity gathers and R.M.S. plot, the data-prep output was stacked twenty-four fold. The C.D.P. stack program removed N.M.O., muted the traces as requested, and output the stacked tape. A 250 mil time variant deconvolution program was used on the stack data. The deconvolved output was time variant filtered 12/45 shallow and 8/30 deep. The final display was variable-area with a normalization window from 200 to 1500 mils.

P. O. Box 36789 ■ Houston, Texas 77036 ■ Phone: (713) 781-3232 ■ Cable: SEISCOM

089057


CONVERSION
REFORMAT
BINARY GAIN REMOVAL
2/1 VERTICAL SUM
MICROPLOT
NEAR TRACE
DATA PREP
COMMON DEPTH POINT GATHERS
24 FOLD
VELOCITY GATHERS
ONE DEPTH PER GATHER
TIME VARIANT DECONVOLUTION
250 MIL OPERATOR
FILTER
10/45 SHALLOW
8/35 DEEP
COMMON DEPTH POINT STACK
NORMAL MOVEOUT REMOVAL
MUTE
24 FOLD STACK
SEISCOM VELOCITY SPECTRUM
RANGE: 4000 ft/sec TO 1600 ft/sec
TIME VARIANT DECONVOLUTION
250 MIL OPERATOR
VELOCITY VERIFICATION
NMO CORRECTION OF
VELOCITY GATHER
TIME VARIANT FILTER
12/45 SHALLOW
8/30 DEEP
EDITOIOO
RMS VELOCITY PLOT
DISPLAY
NORMALIZATION WINDOW
200-1500 MILS

SEISCOM DIGITAL TAPE FORMAT

To facilitate possible future reprocessing and to minimize data storage, only the two pop vertical sum reels were retained by Amoco. The original single pop field tapes were erased. A copy of the "Seiscom Digital Tape Format", a typical file label on the vertical sum reels and an example of the reel logs are enclosed should further processing be desired. An explanation of how this material may be cross-checked by someone at a later date to clarify questions is given below.

From the digital tape format we find the label words one through six are up to twenty-four alpha-numeric characters. An example of a label from line TW-334 is shown on page two. Label word seven is the output file number nineteen. The eighth word is the trace number twenty-four. Note that the blanks on the printout are not in the label. A piece of pertinent information in the vertical sum reel label is the sixth word. It contains the last field tape file number used in the sum for that respective output file. It is also the file number as contained on the observer sheets. This file number has also been preserved on the reel logs as noted on page three.

Hopefully with the above explanation and enclosure any future questions can easily be resolved without any serious delays or problems.

089059

February 1, 1967

SEISCOM DIGITAL TAPE FORMAT

TYPICAL TAPE

	SEQ.#1 trace #1	IRG	SEQ.#1 trace #2	IRG	- - - - - - - - - -	IRG	SEQ.#2 trace #24	IRG	SEQ.#2 trace #1	IRG	SEQ.#2 trace #2	IRG	- -

LOAD POINT MARKER

TYPICAL TRACE

Word 1					Word 6				Word 7				Word 8				Word 9					Nth Word				
P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P
B	B	B	B		B	B	B	B	2^{23}	2^{17}	2^{11}	2^{5}	2^{23}	2^{17}	2^{11}	2^{5}	2^{23}	2^{17}	2^{11}	2^{5}		2^{23}	2^{17}	2^{11}	2^{5}	L
A	A	A	A		A	A	A	A	2^{22}	2^{16}	2^{10}	2^{4}	2^{22}	2^{16}	2^{10}	2^{4}	2^{22}	2^{16}	2^{10}	2^{4}		2^{22}	2^{16}	2^{10}	2^{4}	L
8	8	8	8		8	8	8	8	2^{21}	2^{15}	2^{9}	2^{3}	2^{21}	2^{15}	2^{9}	2^{3}	2^{21}	2^{15}	2^{9}	2^{3}		2^{21}	2^{15}	2^{9}	2^{3}	L
4	4	4	4		4	4	4	4	2^{20}	2^{14}	2^{8}	2^{2}	2^{20}	2^{14}	2^{8}	2^{2}	2^{20}	2^{14}	2^{8}	2^{2}		2^{20}	2^{14}	2^{8}	2^{2}	L
2	2	2	2		2	2	2	2	2^{19}	2^{13}	2^{7}	2^{1}	2^{19}	2^{13}	2^{7}	2^{1}	2^{19}	2^{13}	2^{7}	2^{1}		2^{19}	2^{13}	2^{7}	2^{1}	L
1	1	1	1		1	1	1	1	2^{18}	2^{12}	2^{6}	2^{0}	2^{18}	2^{12}	2^{6}	2^{0}	2^{18}	2^{12}	2^{6}	2^{0}		2^{18}	2^{12}	2^{6}	2^{0}	L

LONGITUDINAL CHECK CHARACTER

Word 1 - 6: 24 characters of alpha-numeric label identification
7: shot point sequence number
8: trace number (1 - 24)
9: first sample point
Nth: last sample point

Notes:

1). Seiscom reels are always binary mode.
2). The sequence number begins at "1" for each reel.
3). If the trace number is negative in word #8, then the trace is all zero.
4). Values of N
   (a) 4 second data, N=2008
   (b) 5 second data, N=2508
   (c) 6 second data, N=3008
5). Western Converted reels
   Word 1 : file number
   Word 2 : Western reel number

089c60

FILE 50 SC

FIELD TAPE LAB 051 05

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 1

INFORMATION ON ATYPICAL LABEL OUTPUT ON SUMMED REELS

FILE 51 SC

OUT AMO/23348/TW334E 0001 0051 19 24(2)

CLIENT
CAL. NO.
LINE No.
OUTPUT REEL SEQ
LAST FT FILE NO. INPUT TO SUM
OUTPUT FILE NO.

FIELD TAPE LAB 052 05

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 1

FILE 52 SC

NOTE LAST FT FILE NO. INPUT TO SUM IS USED ON STACK CHART

FIELD TAPE LAB 053 05

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 1

FILE 53 SC

OUT AMO/23348/TW334E 0001 0053 20 24(2)

FIELD TAPE LAB 054 051

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10

FILE 54 SC

FIELD TAPE LAB 055 051

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10

FILE 55 SC

OUT AMO/23348/TW334E 0001 0055 21 24(2)

FIELD TAPE LAB 056 051

FIXED GAIN 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EARLY GAIN 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10

FILE 56 SC

INPUT REEL = OUTPUT OF SUM PROCESS

INPUT FILE = OUTPUT FILE ON SUM TAPE

9598	0	70	19	19	51	LAST			123456789ABCDEFGHIJKLMNO * I
9598	0	71	20	20	53	FT FILE			123456789ABCDEFGHIJKLMNO * I
9598	0	72	21	21	55	INPUT			123456789ABCDEFGHIJKLMNO * I
9598	0	73	22	22	57	TO SUM			123456789ABCDEFGHIJKLMNO *I
9598	0	74	23	23	59	I			123456789ABCDEFGHIJKLMNO *
9598	0	75	24	24	61	I			123456789ABCDEFGHIJKLMNOI*
9598	0	76	1	25	63	I	(27) RPS	(FILE 1)	(50) RPS ↑123456789ABCDEFGHIJKLMNO *
9598	0	77	2	26	65	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	78	3	27	67	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	79	4	28	69	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	80	5	29	71	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	81	6	30	73	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	82	7	31	75	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	83	8	32	77	I	ACTUAL		I 123456789ABCDEFGHIJKLMNO *
9598	0	(84) RPS	9	33	79	(520)	SP NO.		I 123456789ABCDEFGHIJKLMNO (*) SP 520
9598	0	85	10	34	81	I	(PHYSICAL BOAT POSITION)		123456789ABCDEFGHIJKLMNO * AS ON
9598	0	86	11	35	83	I			I 123456789ABCDEFGHIJKLMNO * STACK
9598	0	87	12	36	85	I			I 123456789ABCDEFGHIJKLMNO * OUTPUT
9598	0	88	13	37	87	I			I 123456789ABCDEFGHIJKLMNO * NOTE
9598	0	89	14	38	89	I			I 123456789ABCDEFGHIJKLMNO *POSITION
9598	0	90	15	39	91	I			I 123456789ABCDEFGHIJKLMNO * = 84
9598	0	91	16	40	93	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	92	17	41	95	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	93	18	42	97	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	94	19	43	99	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	95	20	44	101	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	97	22	46	105	I			I 123456789ABCDEFGHIJKLMNO *
9598	0	98	23	47	107	I			I 123456789ABCDEFGHIJKLMNO
9598	0	99	24	48	109	I	RPS		I RPS 123456789ABCDEFGHIJKLMNO
9598	0	100	1	49	111	I	↑(5)	(FILE (2))	I (14) RPS ↑123456789ABCDEFGHIJKLMN
9598	0	101	2	50	113	I			I 123456789ABCDEFGHIJKLM
9598	0	102	3	51	115	I	STACK FILES		I 123456789ABCDEFGHIJKL
9598	0	103	4	52	117	I			I 123456789ABCDEFGHIJK
9598	0	104	5	53	119	515 I			I 123456789ABCDEFGHI
9598	0	105	6	55	123	I			I 123456789ABCDEFGH
9598	0	106	7	56	125	I			I 123456789ABCDEFG
9598	0	107	8	57	127	I			I 123456789ABCDEF
9598	0	108	9	58	129	I			I 123456789ABCDE
9598	0	109	10	59	131	I			I 123456789ABCD
9598	0	110	11	60	133	I			I 123456789ABC
9598	0	111	12	61	135	I			I 123456789AB
9598	0	112	13	62	137	I			I 123456789A
9598	0	113	14	63	139	I			I 123456789
9598	0	114	15	64	141	I			I 12345678
9598	0	115	16	65	143	I			I 1234567
9598	0	116	17	66	145	I			I 123456
9598	0	117	18	67	147	I			I 12345
9598	0	118	19	68	149	I			I 089061
9598	0	119	20	69	151	I			I 1234
9598	0	120	21	70	153	I			

OR-080

AMOCO

5 cm

Amoco Australia Exploration Co

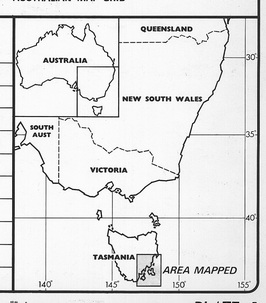
TASMANIA TENEMENT T/11P
'CAPE PILLAR MARINE SEISMIC SURVEY

089062

WATER DEPTH

Contour Interval 50', 500' Sea Level Datum
U.T.M. PROJECTION - AUSTRALIAN MAP GRID

REPORT Nº	S-33
GEOPHYSICIST	C.W. Waring
DRAFTSMAN	J. Gillis, S. Fowler
DATE	December 1970
SCALE	1:100 000
CONTRACTOR	Western Geophysical
REVISIONS	
DRAWING Nº	70-118



T/11P part-II*

PLATE 1

SCALE 1:100 000

MILES 0 1 5 10

KILOMETERS 0 1 5 10 15

520 000 540 000 560 000 580 000

15' 30' 45'

CENTRAL MERIDIAN

500 000

5 280 000

5 260 000

5 240 000

43°

5 220 000

5 200 000

5 180 000

15' 30' 45'

147° 15' 30' 45'

Triabunna
Orford
Buckland
Sorell
New Norfolk
HOBART
Huonville
Cygnet
Dover
Tasman Head
NORTH BRUNY ISLAND
SOUTH BRUNY ISLAND
FORESTIER PENINSULA
TASMAN PENINSULA
Port Arthur
Cape Raoul
Tasman Islan
Storm Bay
TASMAN

TW234 TW246 TW250 TW254 TW302 TW318 TW322 TW326 TW330 TW334 TW746 TW754

150' 200' 250' 300' 350' 400' 450'

Signals blocked by islands. Points plotted from rate station only.

T-11P AMOCO

T-8P ESSO

Oyster Bay

Schouten Island

T-7P ESSO

Triabunna

Orford

Buckland

MARIA ISLAND

Signals unreliable. Points plotted assuming constant speed

Sorell

Cape Frederick Hendrick

FORESTIER PENINSULA

TASMAN PENINSULA

Storm Bay

Port Arthur

Cape Pillar

Tasman Island

Cape Raoul

T-11P AMOCO

S E A

*See record section, Plate 5

OR-080

AMOCO

5 cm

089063

Amoco Australia Exploration Co

TASMANIA TENEMENT T/11P

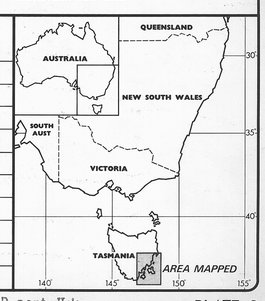
CAPE PILLAR MARINE SEISMIC SURVEY

DEPTH TO UNCONFORMITY (ECONOMIC BASEMENT ?)

Contour Interval 250' Sea Level Datum

U.T.M. PROJECTION - AUSTRALIAN MAP GRID

REPORT Nº	S-33
GEOPHYSICIST	C. W. Waring
DRAFTSMAN	J. Gillis, S. Fowler
DATE	December 1970
SCALE	1:100 000
CONTRACTOR	Western Geophysical
REVISIONS	
GEOLOGIST	G. E. Steen
DRAWING Nº	70-117



T/11P part-II*

PLATE 2

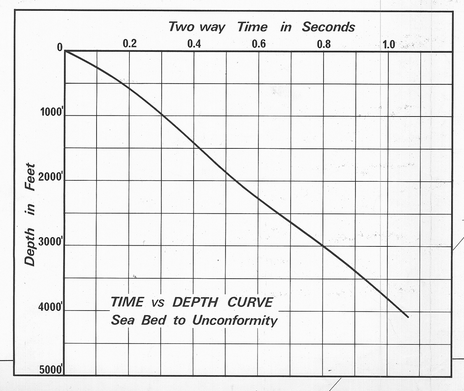
Seismic Legend

- Seismic shot point (1970 Survey) 0160
- No value at mapped horizon 0NV
- Contour (probable - reliable) —2500'—
- Contour (inferred) – –2500'– –
- Normal fault U / D
- Structural high
- Structural low

SCALE 1:100 000

MILES 0 1 5 10

KILOMETERS 0 1 5 10 15



Geological Legend

QUATERNARY	Sand	Q
TRIASSIC & PERMIAN	Shallow marine and continental clastics, carbonates, coal	TR-P
IGNEOUS ROCKS		
TERTIARY	Basalt	T
JURASSIC	Diabase	J
DEVONIAN	Granite	D

Geology from 'Geological Map of Tasmania' published 1961

500 000 — CENTRAL MERIDIAN

Intrusive diabase sheets to 1500' thick

Intrusive diabase sheets to 1500' thick

Triassic continental clastics

1050' marine sediments ex

450' marine Permian sediments exposed

Triassic continental clastics

See cross section, Plate 4

Signals blocked by islands. Points plotted from rate station only

T-11P AMOCO

T-8P ESSO

Storm Bay

TASMAN PENINSULA

FORESTIER PENINSULA

SOUTH BRUNY ISLAND

NORTH BRUNY ISLAND

HOBART

New Norfolk

Huonville

Cygnet

Dover

Tasman Head

Buckland

Sorell

Orford

Triabunna

Port Arthur

Cape Raoul

Tasman Island

Cape Fre
Hendri

100 Fathoms

5 280 000

5 260 000

5 240 000

5 220 000

5 200 000

5 180 000

5 160 000

147°

148

15'

30'

45'

Oyster Bay

Intrusive diabase sheets to 1500' thick

Triassic continental clastics

1050' marine Permian sediments exposed

450' marine Permian sediments exposed

Triassic continental clastics

Storm Bay

T-7P ESSO

T-11P AMOCO

Triabunna

Orford

Buckland

Sorell

Schouten Island

MARIA ISLAND

FORESTIER PENINSULA

TASMAN PENINSULA

Port Arthur

Cape Frederick Hendrick

Cape Pillar

Cape Raoul

Tasman Island

Signals unreliable. Points plotted assuming constant speed.

See cross section, Plate 4

See cross section, Plate 4

See cross section, Plate 4

* See record section, Plate 5

100 Fathoms

100 Fathoms

S M A N

S E A

OR-080

AMOCO

5 cm

Amoco Australia Exploration Cº

0S9064

TASMANIA TENEMENT T/11P

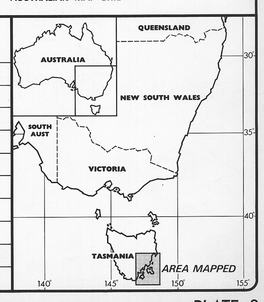
CAPE PILLAR MARINE SEISMIC SURVEY

SEA BED – UNCONFORMITY (ISOPACH)

Contour Interval 250′ Sea Level Datum

U.T.M. PROJECTION - AUSTRALIAN MAP GRID

REPORT Nº	S-33
GEOPHYSICIST	C. W. Waring
DRAFTSMAN	J. Gillis, S. Fowler
DATE	December 1970
SCALE	1:100 000
CONTRACTOR	Western Geophysical
REVISIONS	
DRAWING Nº	70-119



T/11P part-II*

PLATE 3

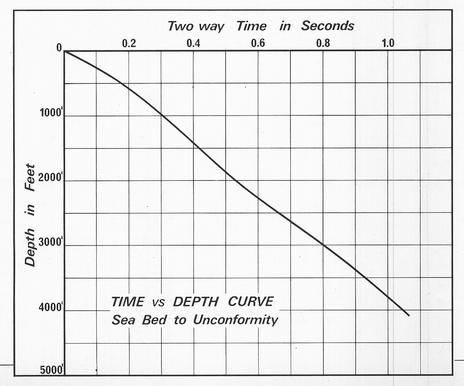
Seismic Legend

- Seismic shot point (1970 Survey) 0·160
- No value at mapped horizon 0·M.V.
- Contour (probable - reliable) —2500′—
- Contour (inferred) – –2500′– –
- Normal fault U / D
- Thickness greater than 2500′

SCALE 1:100 000

MILES 0 1 5 10

KILOMETERS 0 1 5 10 15



520 000 15′ 540 000 30′ 560 000 45′ 580 000

500 000 - CENTRAL MERIDIAN

5280 000 45′ 5260 000 5240 000 43° 5220 000 15′ 5200 000 30′ 5180 000 5160 000 45′ 147° 15′ 30′ 45′

Triabunna
Orford
TW234
Buckland
TW246
1000′
500′
250′
Sorell
New Norfolk
HOBART
TW250
Cape He
*TW254
FORESTIER PENINSULA
Huonville
TW302
TASMAN PENINSULA
Cygnet
NORTH BRUNY ISLAND
Storm Bay
Port Arthur
Cape Raoul
Tasman Islan
T-11P AMOCO
*TW318
TW754
TW746
1000′
1500′
2000′
2500′
3000′
DU
UD
Dover
TW322
SOUTH BRUNY ISLAND
TW326
TW330
Tasman Head
TW334
Signals blocked by islands. Points plotted from rate station only
100 Fathoms
TW752
T-8P ESSO
T A S M A N

T-7P ESSO

T-11P AMOCO

Oyster Bay

Schouten Island

Triabunna

Orford

Buckland

Sorell

MARIA ISLAND

FORESTIER PENINSULA

TASMAN PENINSULA

Storm Bay

Port Arthur

Cape Frederick Hendrick

Cape Pillar

Cape Raoul

Tasman Island

S M A N

S E A

TW231 TW230 TW234 TW242* TW246 TW250 TW254* TW258 TW302 TW306* TW310 TW314 TW318* TW322 TW326 TW330 TW334

TW819 TW810 TW802 TW754 TW746

1250' 2000' 1000' 500' 1750' 250' 2500' 3000' 1500' 2750' 3250'

100 Fathoms

Signals unreliable. Points plotted assuming constant speed

*See record section, Plate 5

540000 30' 560000 45' 580000 148° 600000 15' 620000 30'

43° 45' 15' 30' 45'

OR-080

5 cm

Amoco Australia Exploration Co

089005

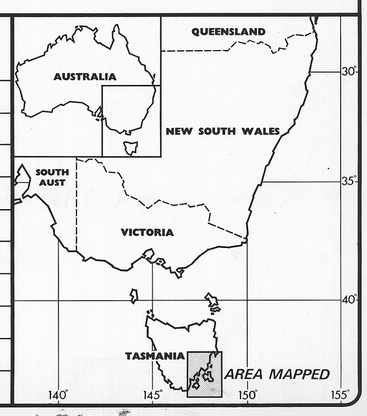
TASMANIA TENEMENT T/11P

CAPE PILLAR MARINE SEISMIC SURVEY

STRUCTURAL CROSS SECTIONS A-A′ and B-B′

Sea Level Datum

REPORT Nº	S-33
GEOPHYSICIST	C.W. Waring
DRAFTSMAN	S. Fowler
DATE	December 1970
SCALE	As Indicated
CONTRACTOR	Western Geophysical
REVISIONS	
GEOLOGIST	G.E. Steen
DRAWING Nº	71-150



T/11P part-II*

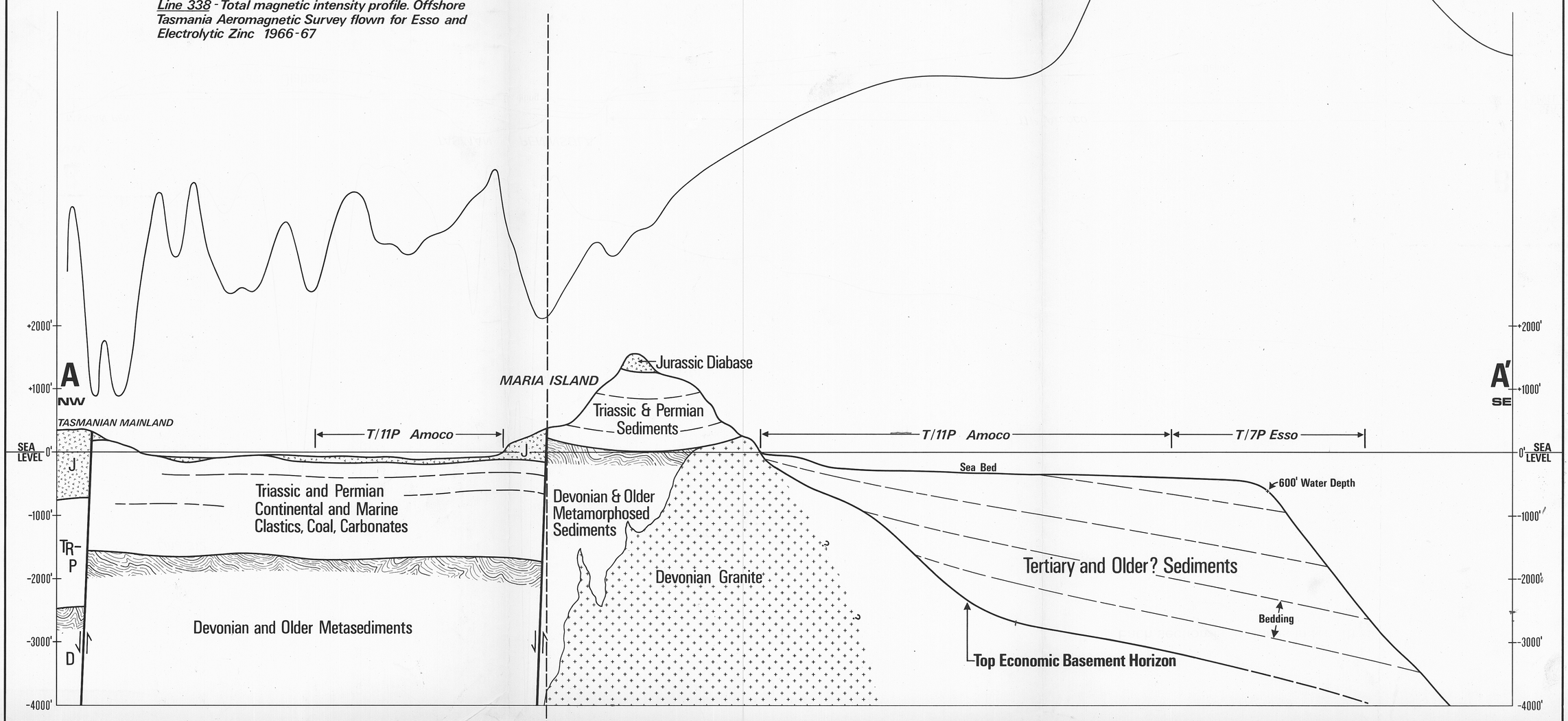
PLATE 4

SCALES

Horizontal 1:100 000
Vertical . . . 1000' to 1 inch
Vertical Exaggeration 8.3 times

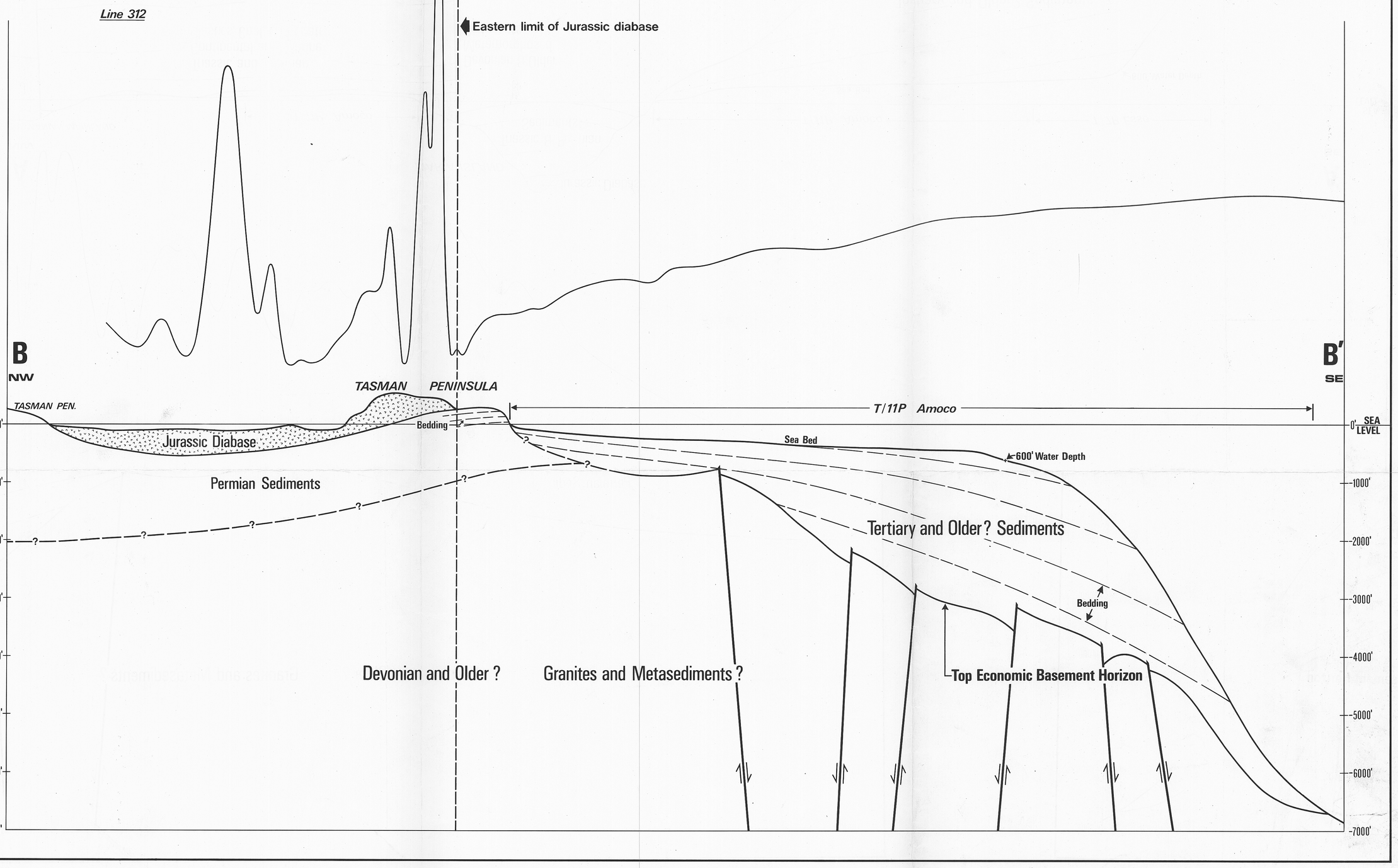
For positions of lines of section see Plate 2

Line 338 - Total magnetic intensity profile. Offshore Tasmania Aeromagnetic Survey flown for Esso and Electrolytic Zinc 1966-67



Each section is 36 miles in length

Line 312



OR-080

5 cm

Amoco Australia Exploration Co

TASMANIA TENEMENT T/11P

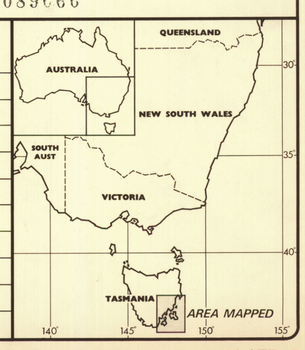
CAPE PILLAR MARINE SEISMIC SURVEY

SEISMIC DISPLAY SECTIONS

LINES TW 242, 254, 306, 318

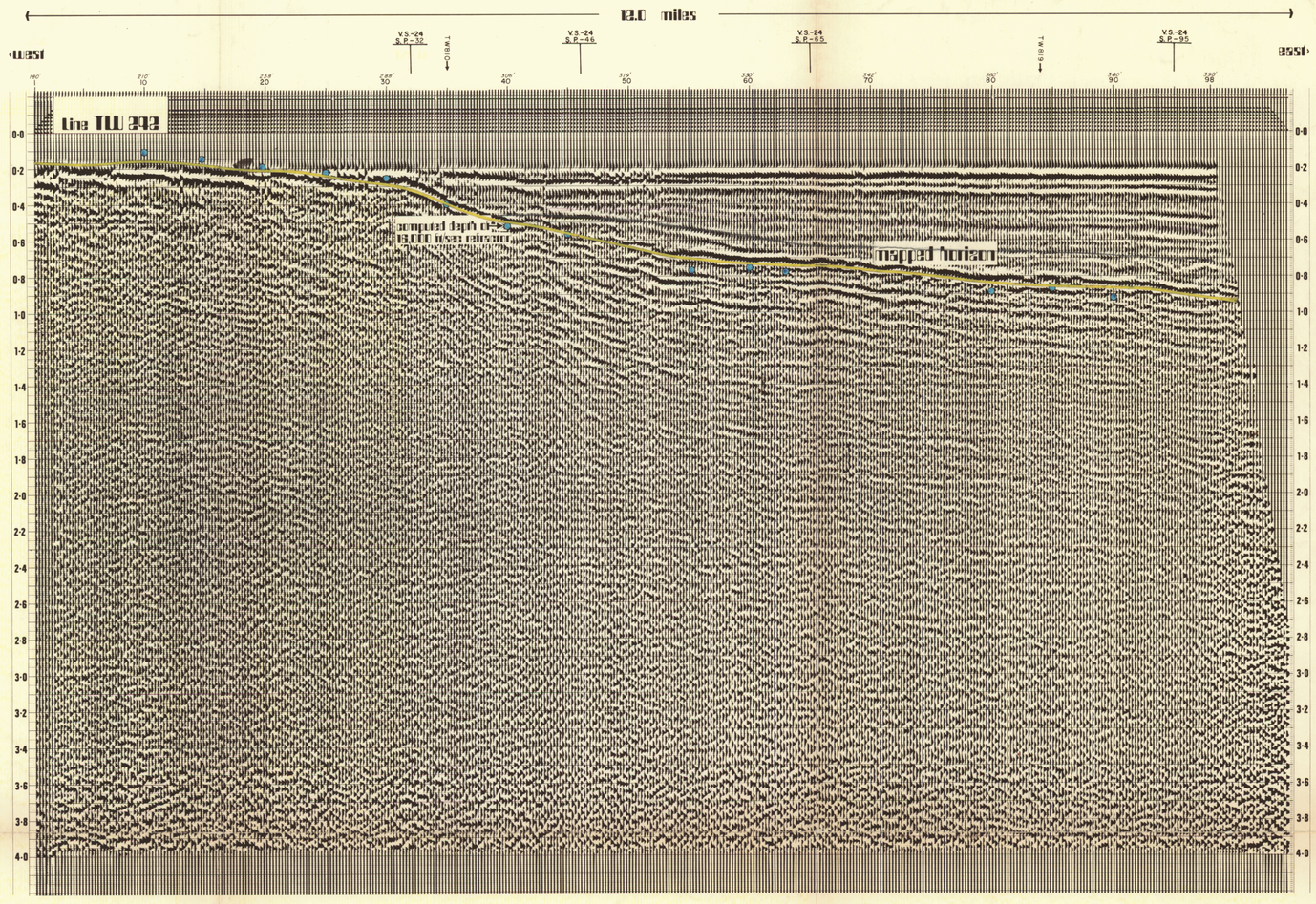
089c66

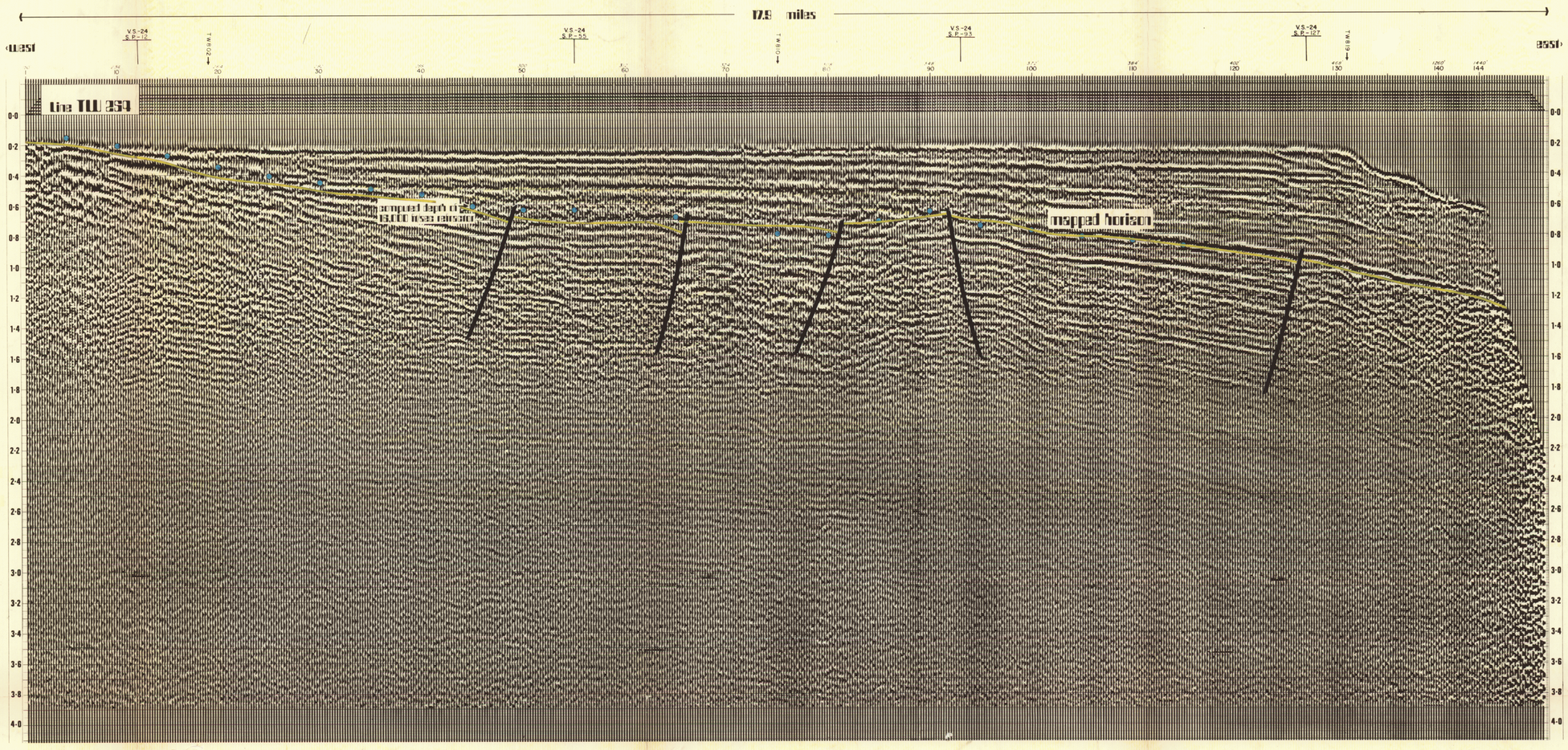
REPORT Nº	S-33
GEOPHYSICIST	C.W. Waring
DRAFTSMAN	S. Fowler
DATE	December 1970
SCALE	As Indicated
CONTRACTOR	Western Geophysical
REVISIONS	
PROCESSING	SeisCom
DRAWING Nº	71-142

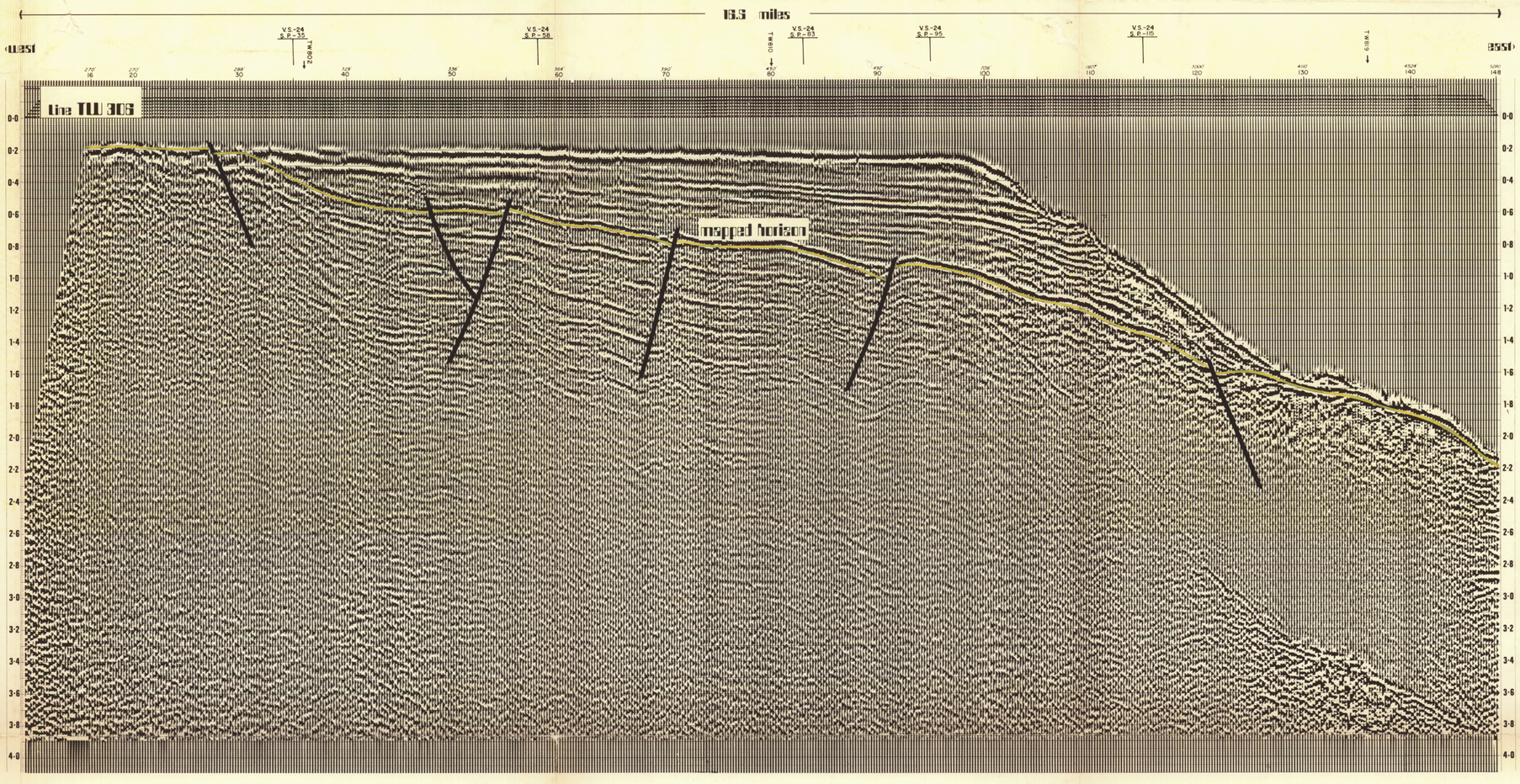


T/11P part-II*

PLATE 5

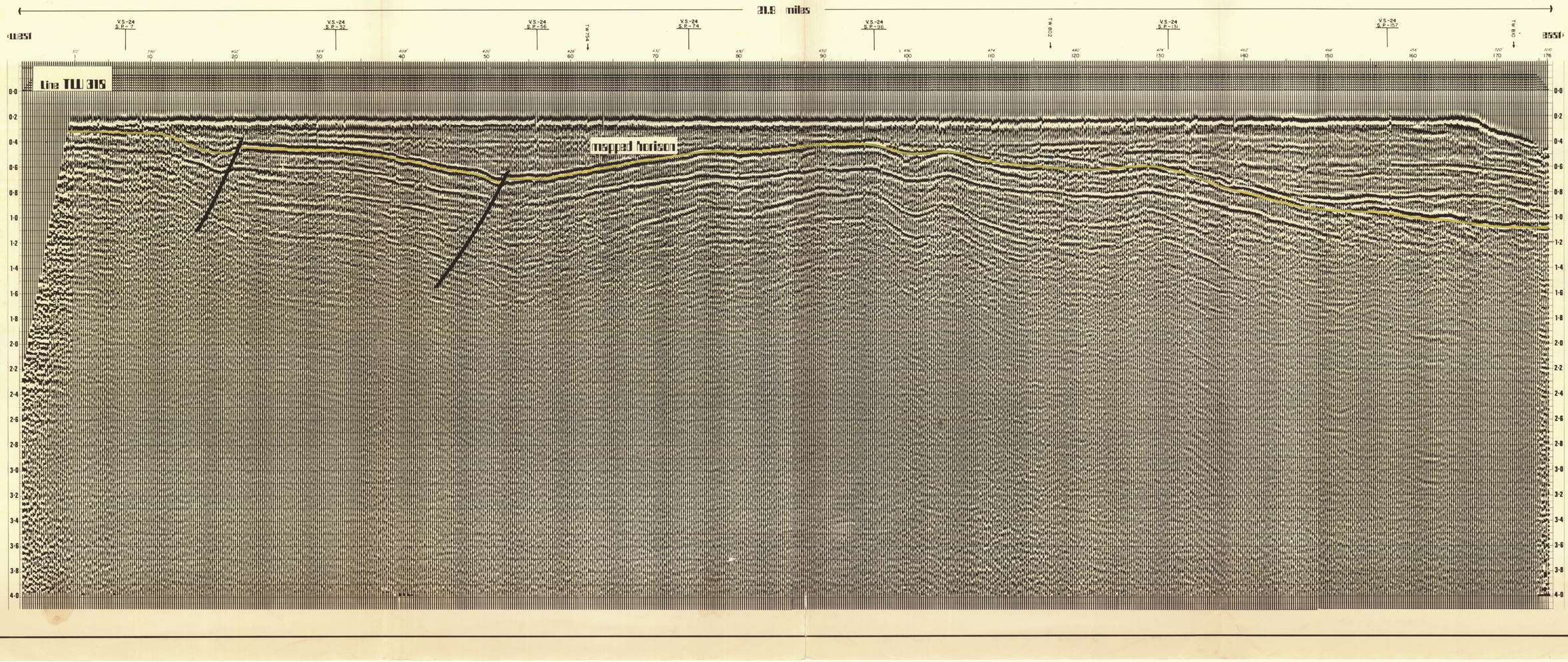






Scale: horizontal, 24 traces per inch
vertical, 2.5 inches per second, two-way time

Datum: sea level



580000E

600000E

620000E

42 20S

42 30S

42 40S

42 50S

43 00S

147 50E

148 00E

802

148 10E

210

819

148 20E

148 30E

5300000N

5280000N

5260000N

5240000N

Signals Unreliable.
Points Plotted Assuming Constant Speed.

230

231

234

242

246

250

254

258

o = RECORDING BOAT ANTENNA LOCATION STEPPED - BACK 165 METRES.

MAP INDEX

147°50'
148°30'
147°00'
43°00'
43°40'
2

5 cm

089067

WESTERN GEOPHYSICAL COMPANY

SYDNEY

FOR

AMOCO (AUST.) EXPLORATION COMPANY

EAST TASMANIA SEISMIC SURVEY

SCALE	POST-PLOT CALCULATIONS BY ENGINEERING COMPUTER SERVICES - SYDNEY.	JAN.
1:100,000	PROJECTION AUSTRALIAN MAP GRID ZONE 55 C.M. 147°E. FALSE NORTHING = 10,000,000 METRES FALSE EASTING = 500,000 METRES	1970

T/11P part-I*

T11P

OR-080

MAP 1 of 2.

Signals Blocked By Island.
Points Plotted From Rate Station Only.

** RECORDING BOAT ANTENNA LOCATION STEPPED-BACK 185 METRES.

MAP INDEX



T/11P part-1*

WESTERN GEOPHYSICAL COMPANY

SYDNEY

FOR

AMOCO (AUST.) EXPLORATION COMPANY

EAST TASMANIA SEISMIC SURVEY

SCALE	POST-PLOT CALCULATIONS BY ENGINEERING COMPUTER SERVICES - SYDNEY.	JAN.
1:100,000	PROJECTION: AUSTRALIAN MAP GRID, ZONE 55 C.M. 147° E. FALSE NORTHING = 10,000,000 METRES, FALSE EASTING = 500,000 METRES	1970

T/11P part-1*

T/11P

MAP 2 of 2.