

202001

SQUID

BASS STRAIT

TASMANIA

MARINE SEISMIC SURVEY

1981

FINAL REPORT

SQUID

MARINE SEISMIC SURVEY

1981

TASMANIA

PERMIT T-15/P

for

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and

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by

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PARTY 86 M/V WESTERN ODYSSEY

Submitted by
Weaver Oil and Gas Corporation
Houston, Texas

ABSTRACT

The Squid Seismic Survey comprises 407.325 kilometers of new seismic lines on the continental shelf of Tasmania: The survey took place on Weaver Oil and Gas Corporation, Australia, Permit T-15/P between March 16th and April 2nd, 1981.

Most of the new lines surveyed were designed to further evaluate structural anomalies disclosed by earlier surveys, with the remainder devoted to gaining stratigraphic and regional control.

The report contains:

- SECTION: I) General Information
II) Data Acquisition
III) Navigation
IV) Data Processing
IV)_a Data Reprocessing
IV)_b Synthetic Seismograms
IV)_c Gravity/Magnetic Data Processing
V) Interpretation
VI) List of Plates
VII) Basic Data Submitted
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SECTION I

General Information:

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GENERAL INFORMATION

Introduction

The 1981 Squid Seismic Survey was conducted on Exploration Permit T-15/P which was awarded on February 19th, 1980 to Weaver Oil and Gas Corporation, Australia.

The M/V Western ODYSSEY, a fully equipped seismic vessel operated by Western Geophysical Company of America, was used to conduct the survey. Some 407.325 kilometers (252.1 miles) of new seismic, gravity and magnetic data were recorded.

The navigation system consisted of Western Geophysical's Western Integrated Navigation System which comprises four main subsystems; a doppler-sonar system to determine the ship's velocity continuously; a satellite system to provide the ship's position at intervals averaging two to four hours, a digital computer and a recording system to record computer data. Calculations, for all subsystems and data integration were handled by the on-board general purpose digital computer. The ship's position was continuously calculated by integrating the sonar velocity and updating with satellite fixes. The navigation data was shipped to Western Geophysical's Navigation Department in Singapore for processing.

Seismic recordings were made with a DFS "V" seismic acquisition system - manufactured by Texas Instruments - consisting of two analog modules, a controller module and four tape transports.

The digital recorded magnetic tapes were shipped to Western Geophysical Company in Houston, Texas for disposition to the nominated processing center.

AUGUST 1960

The energy source consisted of twenty high pressure Western airguns. In normal operating circumstances, ten of the airguns were combined to form a 560 cubic inches tuned array. The airguns are operated at a pressure of 5,000 pounds per square inch.

The streamer cable used by the Western ODYSSEY was composed of 48 detachable and interchangeable LRS Marine Active Cable sections. Each section is 50 meters in length and contains two 25 meter groups of twenty WM2-036 geophones.

Gravity data was acquired with a La Coste Romberg meter while magnetic data was acquired with a Geometrics G801/3 meter.

Interpretations of this data were made at Weaver Oil and Gas Corporation, Australia offices in Houston, Texas.

Field tapes and processing tapes are presently at Western Geophysical's processing center in Houston, Texas and will later be stored at Geodata Services, Inc. in Houston, Texas.

DAILY OPERATIONS

Field supervision was provided by Mr. Jack Downing, Vice President - Geophysics, Weaver Oil and Gas Corporation, Australia, and Mr. W. Sleator, Geophysical Consultant, based in Australia. The activities were coordinated through Mr. David C. Lowry, Consulting Petroleum Geologist and Manager of Weaver Oil and Gas Corporation, Australia in Perth.

<u>DATE</u>	<u>EVENT</u>
March 16	0001 hrs - M/V Western Odyssey enroute to Squid Survey Area. 1225 hrs - Vessel arrived on prospect, crew deployed equipment and streamer cable, calibrated depth indicators and conducted tap test in process. 2055 hrs - In production, completed line WB81-06.
March 17	In production, completed lines WB81-05, WB81-08, WB81-09, WB81-10 and commenced line WB81-04. The port side compressor generator's alternator blew its windings and although the vessel continued production with its starboard counterparts preparations commenced to offload the faulty alternator as soon as possible.
March 18	In production, complete lines WB81-04, WB81-07, WB81-01, WB81-02. 2310 hrs - Began taking equipment on board in order to make way to port.
March 19	0436 hrs - Streamer cable on board vessel, enroute to Portland, Victoria to remove down alternator then proceed to pre-committed survey.

April 1 0001 hrs - Vessel enroute to Squid Survey area.
0825 hrs - Vessel arrived on prospect, crew began deploying cable, changed out lead-in, calibrated depth indicators and conducted tap test in process.
1920 hrs - In production on line WB81-03.

April 2 In production, completed line WB81-03.

GEOLOGICAL SUMMARY

The Squid Marine Seismic Survey took place in the central area of the Bass Basin.

The Bass Basin is located offshore between the southern coast of Victoria and the northern coast of Tasmania. It is bounded to the west by King Island and to the east by Flinders Island and the Basin Rise. Water depth throughout the basin rarely exceeds 270 feet (82 meters). The area has been actively explored for hydrocarbons since 1963.

The oldest sedimentary rocks encountered while drilling are Early Cretaceous. However, the greatest volume of sediments accumulated during the Tertiary. Lithologies vary from continental sandstone, siltstone, shale and coal in the nonmarine Cretaceous to middle Eocene section, while the Upper Eocene to recent section consists of shale, sandstone, marl mudstone and limestone. Drilling and seismic data indicate that there was a considerable amount of volcanic activity in the basin throughout its history.

The southeastern area of the basin exhibits the earliest structural growth whereas the structural growth in the central and northwestern areas occurred later. Structural style also varies from tilted fault blocks with thousands of feet of vertical displacement in the southeastern area, to low relief small anticlinal folds and minor faults in the northwestern area. Most of the prominent structural trends are oriented in a northwestern-southeastern direction which is parallel or subparallel to the present basin axis.

Stratigraphic control for the project area is provided by nine wells, namely:

Pelican #1

Pelican #2

Pelican #3

Pelican #4

Poonboon #1

Dondu #1

Yurongi #1

Bass #2

Nangkero #1

In addition, nine wells drilled in the vicinity are considered relevant and are included in this report. These are:

Durroon #1

Narimba #1

Tarook #1A

Aroo #1

Bass #1

Cormorant #1

Toolka #1

Konkon #1

Bass #3

The Pelican #1 well was drilled in 1970 to a measured depth of 10,428 feet (3,178.45 meters) penetrating a section ranging in age from Recent to Upper Paleocene. The deep anticlinal closure was encountered as predicted. The top of the Eocene Shale or Demons Bluff was intersected at 5,365 feet and the top of the sand section at 5,760 feet. The first gas-condensate pay zone

was encountered at 8,110 feet. A total of 12 sands are interpreted to contain hydrocarbons. The sands below 9,822 feet were found to have abnormally high pressures. Reservoir qualities of the sands within the Eocene Eastern View Coal Measures section were found to be satisfactory in regards to porosities and permeabilities. These sands were found to be separated and interbedded with impermeable siltstones and shales capable of sealing the trap.

The Pelican #2 well was drilled in 1970 to a measured depth of 10,066 feet (3,068.12 meters) penetrating a section ranging in age from Recent to Eocene. The well was located 2.5 miles northwest of the Pelican #1 discovery well. The first overpressured sand was encountered at 9,779 feet. Pelican #2 intersected numerous sands which are interpreted to contain gas-condensate. Sand bodies interpreted to contain hydrocarbons above 8,700 feet in the Pelican #1 well were either not present or water bearing in Pelican #2. The first hydrocarbon bearing sand was recognized at 9,096 feet and the well eventually bottomed in a high pressure zone without drilling through the hydrocarbon column into water bearing formations.

The Pelican #3 well was drilled in 1972 to a measured depth of 9,537 feet (2,906.88 meters) penetrating a section ranging in age from Recent to Paleocene. The prognosed pay section found in the Pelican #1 and #2 wells was not encountered. However, minor gas shows were reported whilst drilling the Paleocene section. Abnormal pressure was encountered at approximately 8,432 feet and the sands below this depth were tight.

The Pelican #4 well was drilled in 1979 to a measured depth of 10,009 feet (3,050.74 meters). Significant indications of hydrocarbons were recorded from 8,950 feet to total depth.

The Poonboon #1 well was drilled in 1972 to a measured depth of 10,715 feet (3,266 meters) penetrating a section ranging in age from Recent to

Late Cretaceous. Abnormal pressure was encountered at approximately 9,300 feet. The only show recorded in the well was when the well kicked at 10,463 feet with a mud weight of 10.2 ppg. Log analysis indicated that the basal 6 feet of a sand interval from 10,416 to 10,450 feet may be hydrocarbon bearing; the well was abandoned as a dry hole due to excessive pressure imbalance.

The Dondu #1 well was drilled in 1973 to a measured depth of 9,603 feet (2927 meters) penetrating a section ranging in age from Recent to Upper Paleocene. The well results were essentially as predicted. The relatively thick Eocene coal sequence is indicative of the amount of total organic matter present, and preliminary geochemical studies indicate that the sediments are mature enough to generate hydrocarbons below a depth of about 7,000 feet. Even though there were some hydrocarbon indications reported while drilling, subsequent electric log interpretation suggest that these shows were very minor and were dispersed rather than concentrated in any of the sandstones.

The Yurongi well was drilled in 1973 to a measured depth of 8,000 feet (2,438.4 meters) penetrating a section ranging in age from Recent to Paleocene. No significant indications of hydrocarbons were recorded.

The Bass #2 well was drilled in 1966 to a measured depth of 5,910 feet (1,801.36 meters) penetrating a section ranging in age from Recent to basement. Two hundred and fifty six feet of volcanic rocks of undeterminate age were encountered between the base of the Tertiary and the top of basement. Aside from normal background gas, no hydrocarbons were recorded in the well.

The Nangkero well was drilled in 1974 to a measured depth of 9,440 feet (2,877.3 meters) penetrating a section ranging in age from Recent to Upper Paleocene. No hydrocarbon shows were encountered in the well.

The Durroon #1 was drilled in 1972 to a measured depth of 9,922 feet (3,024.22 meters) penetrating a section ranging in age from Recent to Lower

Cretaceous. There were no indications of hydrocarbons nor abnormal formation pressures recorded in the well.

The Narimba #1 well drilled in 1973 to a measured depth of 11,003 feet (3,353.7 meters) penetrating a section ranging in age from Recent to Eocene. There were no hydrocarbon shows reported nor was there abnormally pressured sections penetrated.

The Tarook #1A well was drilled in 1972 to a measured depth of 9,100 feet (2,773.68 meters) penetrating a section ranging in age from Recent to Eocene. The well was entirely devoid of hydrocarbon indications.

The Aroo #1 well was drilled in 1974 to a measured depth of 12,112 feet (3,691.74 meters) penetrating a section ranging in age from Recent to Paleocene or pre-Paleocene volcanics. Indications of hydrocarbons were observed at several levels including the top of a sand within the volcanic sequence. Formation tests recovered small amounts of gas.

The Bass #1 well was drilled in 1965 to a measured depth of 7,717 feet (2,352.14 meters) penetrating a section ranging in age from Recent to Upper Cretaceous. No commercial hydrocarbons were logged.

The Cormorant #1 well was drilled in 1970 to a measured depth of 9,846 feet (3,001 meters) penetrating a section ranging in age from Recent to Eocene. Significant indications of oil have been recorded in the Eocene.

The Toolka #1A well was drilled in 1974 to a measured depth of 8,907 feet (2,714.85 meters) penetrating a section ranging in age from Recent to Eocene. Minor oil and gas shows were encountered in the Middle Eocene while drilling; however, formation interval test results were negative.

The Konkon #1 well was drilled in 1973 to a measured depth of 5,043 feet (1,537.1 meters) penetrating a section ranging in age from Recent to

Lower Cretaceous. The well encountered the predicted sequence with no show of oil or gas and was abandoned in highly altered volcanics.

The Bass #3 well was drilled in 1967 to a measured depth of 7,978 feet (2,431.7 meters) penetrating a section ranging in age from Recent to basement. Hydrocarbon indications were recorded while drilling and a formation interval test recovered gas-condensate and water.

GEOPHYSICAL SUMMARY

Design and location of the Squid Marine Seismic Survey was based on the interpretation of seismic lines as well as magnetic and gravity data previously acquired by the State, the Commonwealth, as well as by the permit holders of the area. These surveys are:

Bass Stait and Encounter Bay aeromagnetic survey
for Hematite Exploration by Aero Services Limited
1960-1961

Anderson's Inlet aeromagnetic survey for Oil
Development by Aero Services Limited 1961

Flinders Island - Kingston seismic survey for
Hematite Exploration by Western Geophysical
1962-1963

Bass Basin seismic for Esso Australia by Western
Geophysical 1965

King Island East seismic survey for Esso Australia
by Geophysical Services International 1965

Tasmania aeromagnetic survey for the Bureau of
Mineral Resources by Aero Services Limited
1966

Eastern Bass Strait seismic survey for Esso
Australia by Geophysical Services International
1966

Bass ED-67 seismic survey for Esso Australia by
Geophysical Services International 1967

Bass EF-68 seismic survey for Esso Australia by
Western Geophysical 1968

Bass B69A seismic and magnetic survey for Esso
Australia by Western Geophysical 1968-1969

Bass B69B seismic and magnetic survey for Esso
Australia by Western Geophysical 1969

Bass B70A seismic and magnetic survey for Esso
Australia by Geophysical Services International
1970-1971

Bass B71A seismic and magnetic survey for Esso
Australia by Geophysical Services International
1971-1972

Continental Margins Geophysical - seismic,
magnetic and gravity survey - for the Bureau of
Mineral Resources by GG 1971-1972

Bass B72A seismic survey for Esso Australia
by Geophysical Services International 1972

Bass HB75A seismic survey for Hematite Petroleum
by Geophysical Services International 1975

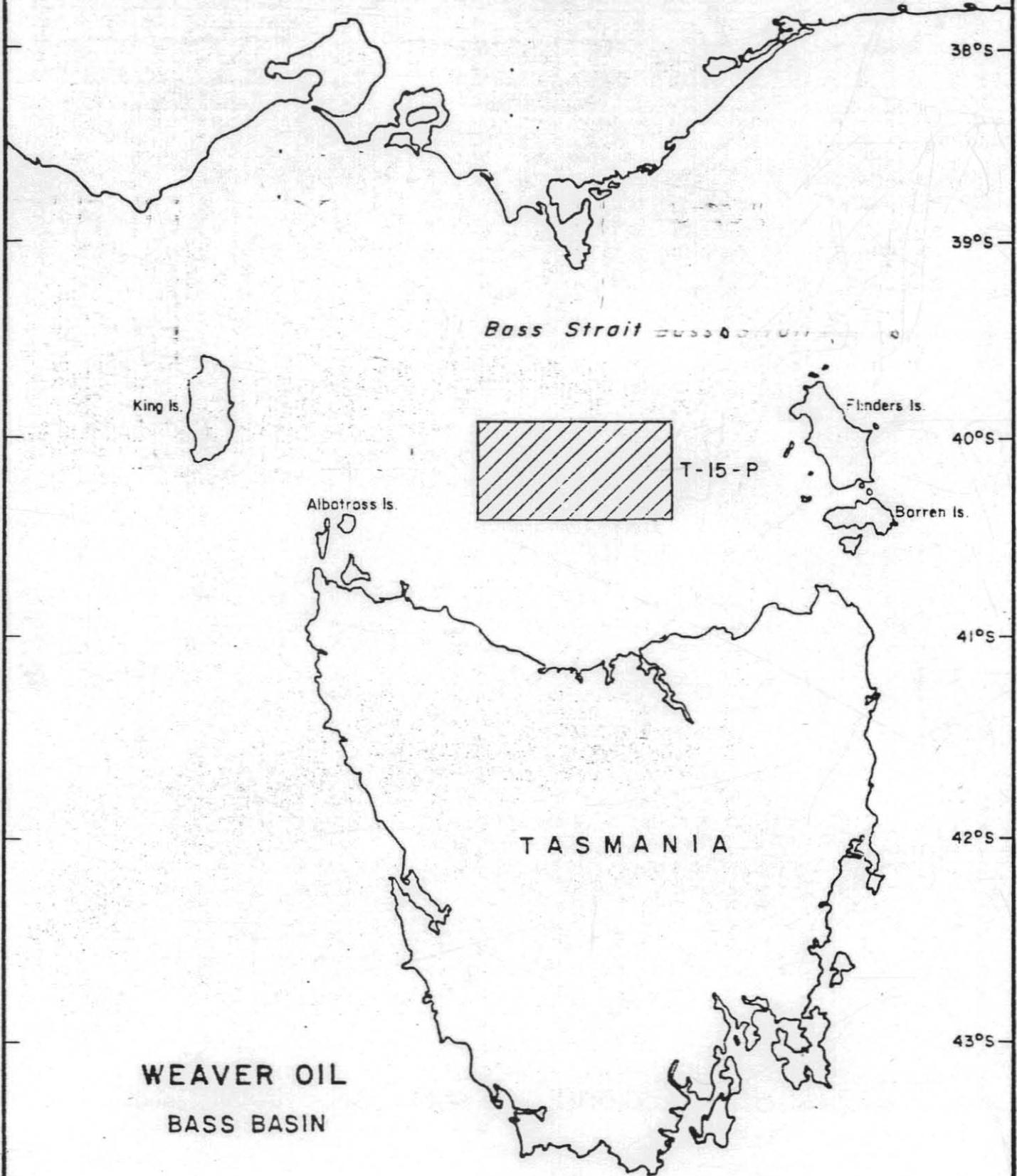
DESCRIPTION OF SURVEY AREA

The prospect was designed as T-15-P. The survey consisted of 10 lines comprising a total assigned program of 410 kilometers. The survey area is in the WEAVER's Squid Survey area in the Bass Strait off the coast of Victoria, Australia.

143°E 144°E 145°E 146°E 147°E 148°E 149°E

202024

SOUTH AUSTRALIA



WEAVER OIL
BASS BASIN

5 cm

PLATE 1

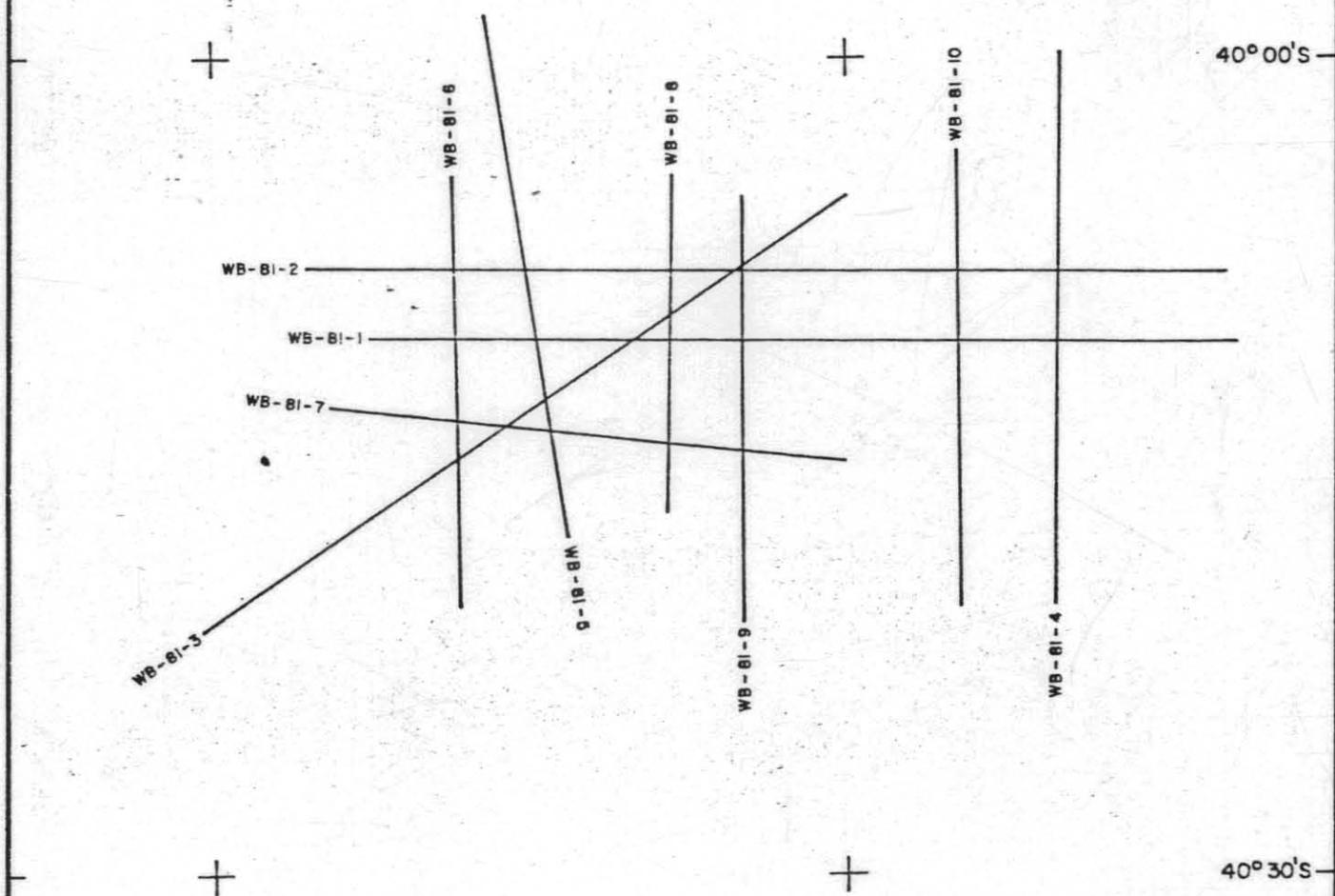


WESTERN GEOPHYSICAL

146°00'E

146°30'E

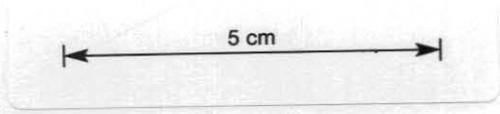
202025



WEAVER OIL

SQUID T-15-P

SCALE 1 : 500,000



WESTERN ODYSSEY
CREW ROSTER

202026

15 MARCH TO 20 MARCH

CAPTAIN:	R. WALTERS
MATE:	N. MCGOVERN
CHIEF ENGINEER:	J. DOLS
SECOND ENGINEER:	C. HEATH
ABLE SEAMEN:	W. RIVETT N. SEPAROVICH R. BAILEY G. COLLINS
COOKS:	W. LOVE B. MURPHY
STEWARDS:	J. SIEDEL R. GOLDIE
PARTY MANAGER:	P. HUGHES
COORDINATOR:	T. LEIGHTON
TECHNICIAN:	K. ROBERTS
OBSERVERS:	D. CHOW B. WISE
JR. OBSERVERS:	B. BLIZZARD M. CASEY S. VEALE A. GIBSON C. BARKER
NAVIGATORS:	I. BRAMLEY J. GREEN
GUN MECHANICS:	F. DAVIDSON V. DALBINS K. PEARSON M. WEATHERSPOON Z. POLINSKY B. DIXON

QUALITY CONTROL GEOPHYSICIST : D. ARMSTRONG

OCEANPROBE LIMITED (H.K.)

c/o A.H. FORSYTH

821 Central Building,

3 Pedder Street,

Hong Kong.

CHRONOLOGICAL NARRATIVE

15 March

- 1700 - Completed survey off Western Tasmania.
- 1730 - Cleared MacQuarie Harbor and headed for Weaver prospect located in the Bass Strait.
- 2400 - Underway to Bass Strait prospect.

16 March

- 0001 - Enroute to Bass Strait prospect.
- 1225 - Arrived in area of prospect and crew commenced laying the cable out.
- 1530 - Cable out. Heading to line WB-81-6.
- 1715 - Shortly after guns were deployed one of the hose assemblies became entangled with the lead-in of the seismic streamer. Crew had to pick up both the lead-in and the gun assembly in order to separate them.
- 1900 - Cable and guns out again. Western Odyssey returned to heading to line WB-81-06,
- 2055 - SOL WB-81-06, FSP 100, DIR 000°.
- 2352 - EOL WB-81-06, LSP 1270.
- 2400 - Changing lines. Heading to line WB-81-05.

17 March

- 0001 - Changing lines.
- 0220 - SOL WB-81-05, FSP 100, DIR 171°.
- 0549 - EOL WB-81-05, LSP 1530.
- 0727 - SOL WB-81-08, FSP 100, DIR 001°.
- 0944 - EOL WB-81-08, LSP 1030.
- 1103 - SOL WB-81-09, FSP 100, DIR 180°.
- 1355 - EOL WB-81-09, LSP 1271.
- 1607 - SOL WB-81-10, FSP 100, DIR 000°.
- 1908 - EOL WB-81-10, LSP 1272.
- 2110 - On the approach to line WB-81-04 one of the generators supplying power to drive the compressors had a mechanical breakdown. The other generator used for this purpose was being serviced at the time. Circled back for another approach on the line.
- 2234 - SOL WB-81-04, FSP 100, DIR 180°.
- 2400 - Shooting on line WB-81-04. LSP of day 650.

18 March

- 0001 - Shooting on line WB-81-04, FSP of day 651, DIR 180°.
- 0229 - EOL WB-81-04, LSP 1650. 202028
- 0500 - SOL WB-81-07, FSP 100, DIR 276°.
- 0820 - EOL WB-81-07, LSP 1472.
- 0941 - SOL WB-81-01, FSP 100, DIR 091°.
- 1522 - EOL WB-81-01, LSP 2435.
- 1700 - SOL WB-81-02, FSP 100, DIR 270°.
- 2303 - EOL WB-81-02, LSP 2572. This was the last line shot in the Bass Basin. Maxiran stations will be set up for the next survey by Friday 20 March; time needed to transit to Portland by that date.
- 2340 - Guns on board. Crew picked up the seismic streamer and checked out three bad sections. These were groups 87, 33, and group 1 in the ministreamer.
- 2400 - Working on the streamer.

19 March

- 0001 - Crew working on cable while they pick it up, repairing bad sections.
- 0436 - Repairs completed. Cable on board. Underway to Portland to offload data and generator requiring repairs.

COMMENTS

Recording instrumentation performed well. No problems experienced.

There were three bad seismic groups in the cable. Group 62 was only bad during line WB-81-08. Group 87 was dead and group 33 noisy throughout the shooting program. The cable was towed at depths between 40 and 55 feet and cable noise ranged from 2 to 5 microbars.

The air guns also performed well during this period. The misfire rate was exceptionally low. One of the generators which powers the electrically driven compressors had a mechanical failure during a line change, but the other generator was put into service while circling back on line up.

Satellite updates were received frequently, with the largest update placing the vessel approximately 1200 feet off line for a 2.5 hour period. Properly calibrated, the sonar doppler should have been able to keep a closer tolerance on drift, especially in 40 to 45 fathoms of water. There were 39 passes accepted, with a accepted miss distance mean of 504.55 feet, and a standard deviation of 272.43 feet. 8 satellite passes were accepted that had elevation angles out of standard industrial specifications: "Only satellite passes between 15 and 70 degrees shall be acceptable." The accepted miss distance mean of these bad passes was 565.80 feet, and a standard deviation of 303.78 feet. Note that these bad passes had a greater average miss distance and a higher rate of scatter. Western navigation QC, including doppler sonar miscalibration was poor. Further, there was no indication of any geoidal height calibration prior to the Weaver survey. Standard industrial specifications state: satellite geodesy is presently based on the WGS-72 reference spheroid. The satellite antenna height plus geoidal height corrections shall be maintained within 3 meters of the reported area correction, since errors in antenna height can cause relatively large errors in position. Line WB-81-08 had only one acceptable pass, yet three passes were accepted, the last having an error of over 1000 feet.

No problems were observed with the magnetometer and the data appeared to be good.

The gravimeter also seemed to be working correctly, although the calibration procedures used on board are not totally adequate. Apparently there is no record on board showing when the last gravity tie was made with a known gravity base station. Gravity readings are recorded when the vessel

is in port for short periods to determine drift, scale factor or bias. However, the vessel rarely enters the same ports which makes it difficult to even measure the long-term meter drift rate. It is recommended that a portable gravity meter be standard equipment on board enabling a base tie to be made whenever possible.

Seismic data quality overall was good.

It is recommended that for any seismic data collection task, regardless of the contractor or area, a qualified professional quality control geophysicist be engaged to supervise and control those surveys. A seismic contractor's primary goal is to make money. Be assured this goal will supercede any quality control goals in every case unless the client is represented during the survey.

SATELLITE UPDATE INFORMATION FOR PRODUCTION LINES

202031

<u>LINE NO.</u>	<u>TIME</u>	<u>ANGLE</u>	<u>INT.</u>	<u>RESID</u>	<u>DIST. OFF</u>	<u>ACCEPTED?</u>
WB-81-06	1958	37°	8	4.2	453.2'	YES
"	2116	10°	6	1.9	677.6'	NO
"	2130	43°	8	7.5	600.3'	YES
"	2218	05°	8	5.7	1757.8'	NO
"	2302	72°	5	1.0	761.6'	NO
"	2316	26°	6	2.2	1192.5'	YES
WB-81-05	0150	27°	8	3.9	438.1'	YES
"	0230	08°	7	2.9	754.1'	NO
"	0416	65°	8	1.4	503.8'	YES
"	0524	14°	6	1.4	336.9'	YES
WB-81-08	0604	21°	7	1.2	203.8'	YES
"	0710	79°	8	1.7	693.9'	YES
"	0740	01°	4	2.9	3926.9'	NO
"	0858	10°	6	5.8	1274.9'	NO
"	0918	11°	6	1.4	1179.1'	YES
WB-81-09	1020	05°	5	4.1	1483.6'	NO
"	1104	74°	8	1.7	448.6'	YES
"	1202	46°	8	1.3	299.7'	YES
"	1250	18°	7	1.3	225.8'	YES
"	1348	30°	8	1.2	111.9'	YES
WB-81-10	1432	09°	8	6.2	784.7'	YES
"	1616	65°	8	2.0	336.2'	YES
"	1724	19°	7	1.5	678.6'	YES
"	1804	21°	7	4.3	754.0'	YES
"	1908	76°	8	1.3	709.1'	NO
WB-81-04	2212	34°	8	1.5	407.8'	YES
"	2312	22°	7	1.7	131.1'	YES
"	2352	11°	6	1.8	330.4'	YES
"	0006	39°	6	1.7	542.6'	YES
"	0058	61°	8	1.3	507.8'	YES
"	0148	03°	5	2.9	1783.0'	NO
WB-81-07	0326	30°	8	1.4	938.2'	YES
"	0436	03°	5	2.7	1922.4'	NO
"	0514	45°	8	0.9	980.9'	YES
"	0620	44°	8	2.5	658.6'	YES
"	0702	05°	5	1.5	375.6'	NO
"	0808	26°	7	1.3	740.2'	YES

<u>LINE NO.</u>	<u>TIME</u>	<u>ANGLE</u>	<u>INT.</u>	<u>RESID</u>	<u>DIST. OFF</u>	<u>ACCEPTED?</u>
WB-81-01	0956	80°	7	1.5	1640.4'	NO
"	1014	34°	7	1.4	480.8'	YES
"	1110	20°	7	4.5	346.1'	YES
"	1144	12°	6	1.8	298.2'	YES
"	1200	39°	7	3.8	232.1'	YES
"	1256	68°	8	1.7	52.8'	YES
"	1352	02°	5	2.2	1139.2'	NO
"	1446	09°	7	1.2	454.6'	YES
"	1526	30°	8	1.0	513.0'	YES
WB-81-02	1638	07°	6	1.1	208.4'	NO
"	1712	45°	8	1.3	407.6'	YES
"	1820	52°	8	1.3	397.5'	YES
"	2010	28°	6	1.3	731.1'	YES
"	2058	28°	8	7.5	559.5'	YES
"	2124	15°	7	0.9	132.9'	YES
"	2220	07°	7	3.1	958.9'	NO
"	2244	41°	7	1.9	592.4'	YES

202032

NUMBER OF ACCEPTED SATELLITES 39
ACCEPTED MISS DIST. MEAN 504.55 feet
ACCEPTED MISS DIST. STANDARD DEVIATION 272.43 feet.

LINE SUMMARY

202033

<u>DATE</u>	<u>LINE NO.</u>	<u>S.P.s</u>	<u>KILOMETERS</u>	<u>ACCUMULATIVE</u>	<u>N.R.</u>	<u>P.E.</u>	<u>M.F.</u>
3/16	WB-81-06	1171	29.275	29.275	9	3	7
3/17	WB-81-05	1431	35.775	65.050	0	3	1
"	WB-81-08	931	23.275	88.325	2	6	4
"	WB-81-09	1172	29.300	117.625	4	1	18
"	WB-81-10	1173	29.325	146.950	0	10	0
"	WB-81-04	551	13.775	160.725			
3/18	WB-81-04	1000	25.000	185.725	0	5	0
"	WB-81-07	1373	34.325	220.050	0	5	0
"	WB-81-01	2336	58.400	278.450	3	8	13
"	WB-81-02	2473	61.825	340.275	2	6	7
TOTALS		13611	340.275		20	47	50

TOTAL MISFIRES 117. TOTAL MISFIRE RATE 0.86%. Excellent

OCEANPROBE
Quality
Control

CLIENT: WEAVER OIL
LOCATION: AUSTRALIA
PROSPECT: BASS BASIN
OCEANPROBE CONSULTANT:
D R ARMSTRONG

GROUPS: 96
POP. INTERVAL: 25 Meters
SPREAD LENGTH:
2375 Meters
COVERAGE: 4800%
SURVEY VESSEL:
M/V WESTERN ODYSSEY
CONTRACTOR: WESTERN
RECORDING SYS: DFS V
ENERGY SOURCE:
AIR

LINE:
WB-81-6

HEADING: 360 Degrees
FSP: 100
LSP: 1270
TOTAL SP: 1171
LENGTH: 29.275 Km
AVG. CABLE DEPTH:
47 Feet
FEATHER RANGE:
0 - 5 Degrees
SOUNDINGS:
43 - 44 Fathoms
NO. MISFIRES: 7
MISFIRE RATE: 0.6%

LINE:
WB-81-5

HEADING: 171 Degrees
FSP: 100
LSP: 1530
TOTAL SP: 1431
LENGTH: 35.775 Km
AVG. CABLE DEPTH:
48 Feet
FEATHER RANGE:
0 - 4 Degrees
SOUNDINGS:
43 - 44 Fathoms
NO. MISFIRES: 1
MISFIRE RATE: 0.1%

LINE:
WB-81-8

HEADING: 1 Degrees
FSP: 100
LSP: 1030
TOTAL SP: 931
LENGTH: 23.275 Km
AVG. CABLE DEPTH:
46 Feet
FEATHER RANGE:
0 - 3 Degrees
SOUNDINGS:
43 - 45 Fathoms
NO. MISFIRES: 4
MISFIRE RATE: 0.4%

LINE:
WB-81-9

HEADING: 180 Degrees
FSP: 100
LSP: 1271
TOTAL SP: 1172
LENGTH: 29.300 Km
AVG. CABLE DEPTH:
44 Feet
FEATHER RANGE:
0 - 4 Degrees
SOUNDINGS:
42 - 44 Fathoms
NO. MISFIRES: 18
MISFIRE RATE: 1.5%

LINE:
WB-81-10

HEADING: 360 Degrees
FSP: 100
LSP: 1272
TOTAL SP: 1173
LENGTH: 29.325 Km
AVG. CABLE DEPTH:
45 Feet
FEATHER RANGE:
0 - 3 Degrees
SOUNDINGS:
42 - 45 Fathoms
NO. MISFIRES: 0
MISFIRE RATE: 0.0%

LINE:
WB-81-4

HEADING: 180 Degrees
FSP: 100
LSP: 1650
TOTAL SP: 1551
LENGTH: 38.775 Km
AVG. CABLE DEPTH:
47 Feet
FEATHER RANGE:
0 - 3 Degrees
SOUNDINGS:
41 - 45 Fathoms
NO. MISFIRES: 0
MISFIRE RATE: 0.0%

LINE:
WB-81-7

HEADING: 276 Degrees
FSP: 100
LSP: 1472
TOTAL SP: 1373
LENGTH: 34.325 Km
AVG. CABLE DEPTH:
44 Feet
FEATHER RANGE:
0 - 4 Degrees
SOUNDINGS:
43 - 45 Fathoms
NO. MISFIRES: 0
MISFIRE RATE: 0.0%

LINE:
WB-81-1

HEADING: 91 Degrees
FSP: 100
LSP: 2435
TOTAL SP: 2336
LENGTH: 58.400 Km
AVG. CABLE DEPTH:
43 Feet
FEATHER RANGE:
0 - 3 Degrees
SOUNDINGS:
39 - 45 Fathoms
NO. MISFIRES: 13
MISFIRE RATE: 0.6%

LINE:
WB-81-2

HEADING: 270 Degrees
FSP: 100
LSP: 2572
TOTAL SP: 2473
LENGTH: 61.825 Km
AVG. CABLE DEPTH:
48 Feet
FEATHER RANGE:
0 - 4 Degrees
SOUNDINGS:
41 - 45 Fathoms
NO. MISFIRES: 7
MISFIRE RATE: 0.3%

Key to Abbreviations:

M	Meters
KM	Kilometers
2400%	24-fold C.D.P. Stack
4800%	48-fold C.D.P. Stack
SOL	Start of Line
EOL	End of Line
SP	Shot Point
SP INT	Shot Point Interval
NR	No Record (Bad or Missed Record on Tape)
PE	Record with Parity Errors
MF	Gun Misfire
NAV	Navigation
FM	Water Depth Recorded In Fathoms
CABLE ANGLE	Cable Feathering Angle
UBARS	Cable Noise Measured in Microbars Pressure
GRP	Number Label of Seismic Detector Group
VOL	Total Volume of Air Gun Array
GUN X OUT/Y IN	Gun X Taken off Firing Line, Gun Y Put on Firing Line
MAG	Magnetometer
12 TR MINICABLE	Minicable Consists of 12 Hydrophone Groups Spaced 12.5 M. Apart and Located in Stretch Sections at Head of Main Cable. Near Group Labeled 1 and Far Group Labelled 12.



LINE NO. WB81-6	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	000°
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1270	TOTAL S.P.	1171
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	16 March 1981	TIME START	20.55	TIME STOP	23.52	SEA STATE mod.
OBSERVATIONS: Avg. cable depth 47'. Cable angle range 0-5°. Soundings 43-44 fathoms. N.R.=9; P.E.=3; M.F.=7. Cable noise = 2-5 ubars. Seismic group 33 noisy, group 87 dead. Guns at SOL 1-5, 7-11 Volume = 555 in ³ . S.P. 659 Guns 10 out/ 14 in. Recorded mag. and gravity.						
LINE NO. 81-5	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	1710
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1530	TOTAL S.P.	1431
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	17 March 1981	TIME START	02.20	TIME STOP	05.49	SEA STATE mod.
OBSERVATIONS: Avg. cable depth 48'. Cable angle range 0-4°. Soundings 43-44 fathoms. N.R.=0; P.E.=3; M.F.=1. Cable noise = 2-5 ubars. Seismic group 33 noisy, group 87 dead. Guns at SOL 1-5, 7-11 Volume = 555 in ³ . Recorded mag. and gravity.						
LINE NO. 81-8	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	001°
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1030	TOTAL S.P.	931
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	17 March 1981	TIME START	07.27	TIME STOP	09.44	SEA STATE mod.
OBSERVATIONS: Avg. cable depth 46'. Cable angle range 0-3°. Soundings 43-45 fathoms. N.R.=2; P.E.=6; M.F.=4. Cable noise = 2-5 ubars. Seismic group 33 noisy, groups 62 and 87 dead. Guns at SOL 1-5, 7-11 Volume = 555 in ³ . Recorded mag. and gravity.						
LINE NO. 81-9	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	180°
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1271	TOTAL S.P.	1172
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	17 March 1981	TIME START	11.03	TIME STOP	13.55	SEA STATE slight
OBSERVATIONS: Avg. cable depth 44'. Cable angle range 0-4°. Soundings 42-44 fathoms. N.R.=4; P.E.=1; M.F.=18. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp 87 dead. Guns at SOL 6, 12-20 Volume = 555 in ³ . Recorded mag and grav. SP 435 19 out/4 in. SP 485 Gun 4 out/19 in.						
LINE NO. 81-10	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	000°
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1272	TOTAL S.P.	1173
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	17 March 1981	TIME	16.07	TIME STOP	19.08	SEA STATE slight
OBSERVATIONS: Avg. cable depth 45'. Cable angle range 0-3°. Soundings 42-45 fathoms. N.R.=0; P.E.=10; M.F.=0. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp 87 dead. Guns at SOL 6, 12-20 Volume = 555 in ³ . Recorded mag and grav. Records 010 - 034 recorded on fixed gain.						
LINE NO. 81-4	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	180°
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1650	TOTAL S.P.	1551
DETECTOR GROUPS	96	SPREAD LENGTH	2375 m.	ENERGY SOURCE	air guns	POP INTERVAL 25 m. 4800%
DATE	17-18 March '81	TIME START	2234	TIME STOP	02.29	SEA STATE slight
OBSERVATIONS: Avg. cable depth 47'. Cable angle range 0-3°. Soundings 41-45 fathoms. N.R.=0; P.E.=5; M.F.=0. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp. 87 dead. Guns at SOL 1-5, 7-11 Volume = 555 in ³ . Recorded mag and gravity.						



LINE NO. WB81-7	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	276°	
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	1472	TOTAL S.P.	1373	
DETECTOR GROUPS		96	SPREAD LENGTH		2375 m.	ENERGY SOURCE	air guns
DATE		18 March 1981	TIME START		05.00	TIME STOP	08.20
OBSERVATIONS:		Avg. cable depth 44'. Cable angle range 0-4°. Soundings 43-45 fathoms. N.R.=0; P.E.=5; M.F.=0. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp. 87 dead. Suns at SOL 1-5, 7-11 Volumn = 555 in ³ . Recorded mag and gravity.					

LINE NO. 81-1	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	091°	
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	2435	TOTAL S.P.	2336	
DETECTOR GROUPS		96	SPREAD LENGTH		2375 m.	ENERGY SOURCE	air guns
DATE		18 March 1981	TIME START		09.41	TIME STOP	15.22
OBSERVATIONS:		Avg. cable depth 43'. Cable angle range 0-3°. Soundings 39-45 fathoms. N.R.=3; P.E.=8; M.F.=13. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp. 87 dead. Guns at SOL 6, 12-20 Volumn = 555 in ³ . SP 1458 Guns 19 Out / 4 in. SP 1540 Guns 4 out/5 in. SP 1600 5 out/10.					

LINE NO. 81-2	PROSPECT	Bass Strait	COORDINATES	Aust. Nat'l Grid	SHIPHEADING	270°	
S.P. INT. 25 m.	FIRST S.P.	100	LAST S.P.	2572	TOTAL S.P.	2473	
DETECTOR GROUPS		96	SPREAD LENGTH		2375 m.	ENERGY SOURCE	air guns
DATE		18 March 1981	TIME START		17.00	TIME STOP	23.03
OBSERVATIONS:		Avg. cable depth 48'. Cable angle range 0-4°. Soundings 41-45 fathoms. N.R.=2; P.E.=6; M.F.=7. Cable noise = 2-4 ubars. Seismic group 33 noisy, grp. 87 dead. Guns at SOL 6, 12-20 Volumn = 555 in ³ . Recorded mag and gravity this and previous line.					

LINE NO.	PROSPECT	COORDINATES			SHIPHEADING
S.P. INT.	FIRST S.P.	LAST S.P.	TOTAL S.P.	STATUTE MILES	
DETECTOR GROUPS	SPREAD LENGTH		ENERGY SOURCE	POP INTERVAL SUBSURFACE COVERAGE	
DATE	TIME START		TIME STOP	SEA STATE	
OBSERVATIONS:					

LINE NO.	PROSPECT	COORDINATES			SHIPHEADING
S.P. INT.	FIRST S.P.	LAST S.P.	TOTAL S.P.	STATUTE MILES	
DETECTOR GROUPS	SPREAD LENGTH		ENERGY SOURCE	POP INTERVAL SUBSURFACE COVERAGE	
DATE	TIME		TIME STOP	SEA STATE	
OBSERVATIONS:					

LINE NO.	PROSPECT	COORDINATES			SHIPHEADING
S.P. INT.	FIRST S.P.	LAST S.P.	TOTAL S.P.	STATUTE MILES	
DETECTOR GROUPS	SPREAD LENGTH		ENERGY SOURCE	POP INTERVAL SUBSURFACE COVERAGE	
DATE	TIME START		TIME STOP	SEA STATE	
OBSERVATIONS:					

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MARINE PARAMETER AND EQUIPMENT REPORT

PARTY: 86 CLIENT: WEAVER OIL PROSPECT: BASS BASIN DATE: 10 MARCH 81

ST POINT INTERVAL: 25 met.

S PER KM: 40

FILE (ONE REPORT FOR EACH TYPE)

STREAMER BOTTOM REF STREAMER

MINIMUM DRAG

NUMBER OF GROUPS: 96

WATER ENERGY SOURCE TO CENTER NEAR GROUP: 200.7 met.

WATER NEAR GROUP TO CENTER FAR GROUP: 2375 met.

GROUP CENTER TO GROUP CENTER: 25 met.

NUMBER OF PHONES PER GROUP: 20

ATTACHED DIAGRAMS FOR CONFIGURATION

DEPTH DETECTORS AT HEAD OF GROUPS: 16 32 48 64 80 96 HEAD OF MINI

DEPTH CONTROLLERS ON GROUPS: QTY 10

2 12 26 40 54 68 82 96 SS

WATER BREAK DETECTORS AT HEAD OF GROUPS: SECTION'S 33 AND 37

STAR READING OF TAILBUOY: YES

NOBUOY: NO RECEIVER TYPE

DEPTH METER: YES

MODEL: GEOMETRICS SENSOR: SSAA

WATER REEL TO SENSOR: 193 met.

RECORDED ON DATA LOGGER: YES

CALIBRATION METER: YES S/N: 888

RECORDED ON DATA LOGGER: YES

TACH DIAGRAMS OF STILL READINGS

NAVIGATION

PRIMARY: SAT-NAV

SECONDARY:

WATER NAV: YES S/N: 16 / WINS PHASE IV

STANCE: ANTENNA TO CENTER

WATER GROUP: met.

STANCE: ANTENNA TO CENTER

WATER GROUP: met.

STANCE SAT NAV ANTENNA TO CENTER

WATER GROUP: 278.6 met.

DEPLITS PROVIDED BY:

COMPANY OPERATING PRIMARY: WESTERN

ENERGY SOURCE: AQUAPULSE: NO

NUMBER OF GUNS: FILL TIME: sec.

GUN DEPTH: met.

FIRING INTERVAL: sec.

MAXIPULSE: NO CHARGE SIZE: grms

SHOT DEPTH: met. INTERVAL: sec.

AIR GUNS: YES ARRAY VOL: 555 c.c.

NUMBER OF GUNS: 10 PRESSURE: 4500 psi.

SHOT DEPTH: 6 met. INTERVAL: 25 MTPS sec.

INSTRUMENTS: MANU: TEXAS INSTRUMENTS

MODEL: DFS V SYSTEM NO: 408

PREAMP GAIN: 36 dB. TOTAL GAIN: 120 dB.

FILTERS: LO CUT: OUT Hz. SLOPE: dB/OCT

HI CUT: 64 Hz. SLOPE: 70 dB/OCT

ALIAS: Hz. SLOPE: dB/OCT

SAMPLE RATE: 4 ms

REC. LENGTH: 6 sec.

TAPE FORMAT: SEG GAP B

NUMBER OF CHANNELS: 124

SEIS CHANNELS: 96

AUX CHANNELS: TIMEBREAK AUX CH 1

SONOBUOY: WATERBREAK AUX CH 2

HUBBLE PULSE: 50Hz/100Hz AUX CH A

GUN PHONE:

ON BOARD PLOTTER: EPC 4600 TYPE

FROM GROUP: 95

WHAT STARTS PLOTTER? TR

CAMERA TYPE: SIE MODEL ERC 100

NUMBER OF GALVOS: 64

HOW OFTEN MONITORS? 20 SP

TIMEBREAK COINCIDENT WITH DIG. START: YES

IF YES GUNBREAK TO T.B. OVERRIDE: 125 ms

IF NO DIG. START TO TIMEBREAK: ms

(NOT APPLICABLE TO MAXIPULSE)

DEPTH SOUNDER: MAKE: KRUPP MODEL: ATLAS

~~XXXXXXXXXXXX~~ X. ECHOGRAM: 600 °

DEPTH IN: FATHOMS METERS

SECTION II

Data Acquisition:

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Contractors

The survey was conducted on behalf of WEAVER OIL AND GAS CORPORATION of Houston, Texas and Perth, West Australia.

To conduct the survey, WEAVER OIL AND GAS CORPORATION contracted WESTERN GEOPHYSICAL COMPANY OF AMERICA, a Delaware Corporation and a Division of LITTON INDUSTRIES.

Location of Headquarters

The principal office of WEAVER OIL AND GAS CORPORATION is located at 5599 San Felipe Avenue, Suite 1100, Houston, Texas, U.S.A. The office in charge of Australia operations is located in Perth, West Australia and it was to this office that communications pertaining to the operation was directed.

The principal office of WESTERN GEOPHYSICAL COMPANY OF AMERICA is located at 10001 Richmond Avenue, Houston, Texas, U.S.A. The survey detailed in this report was conducted out of WESTERN GEOPHYSICAL's Southeast Asia Division office located at Unit 301, Union Building, 37 Jalan Pemimpin, Singapore 2057, Republic of Singapore.

A temporary field office was established by WESTERN GEOPHYSICAL COMPANY in order to facilitate communications and logistics involving the operation. From March 16 to 19, this office was located at Mt. Gambier, South Australia and shifted to The Entrance in New South Wales for the latter portion of the survey.

Communications

Daily production updates and vessel status reports were issued to both WEAVER OIL AND GAS CORPORATION's office in Perth and WESTERN GEOPHYSICAL's office in Singapore via telex from the field office. Periodic telephone communications were also maintained for detailed discussions of the vessel's movements.

Moderate winds and seas dominated the weather conditions during the survey operation. Although the Bass Strait is noted for its severe weather, this was fortunately not the case during the vessel's time on the prospect. At no time during the survey was it delayed or interrupted as a result of poor weather.



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Key Field PersonnelWEAVER OIL AND GAS CORPORATION

David Lowery : Exploration Manager based at Perth office, responsible for liaison between WESTERN GEOPHYSICAL and WEAVER's principal office.

WESTERN GEOPHYSICAL COMPANY

John Evans : Field Supervisor, based in Singapore, was on board vessel during first portion of operation to ensure trouble free operation.

Paul J. Hughes : Operations Manager, based at field office, responsible for client liaison and vessel logistics.

Tim N. Leighton : Marine Operations Co-ordinator, responsible for vessel's operation at sea including quality control.

Kevin Roberts : Instrument Technician

Brent Wise : Observer

Dicky Chow : Observer

Ian Bramley : Navigator

Jim Green : Navigator

Phil Knight : Airgun Mechanic

Mal Wetherspoon : Airgun Mechanic

The digital recorded magnetic tapes were shipped to WESTERN GEOPHYSICAL COMPANY in Houston, Texas for disposition to the nominated processing center. Included with the data shipments were copies of the observer's line summary sheets, streamer cable and airgun configuration prints, co-ordinator's logs, LRS-100 computer printouts, E.P.C. rolls, camera monitor rolls, fathometer rolls and parameter reports.

The navigaton and GDU data was shipped to WESTERN GEOPHYSICAL's Navigation Department in Singapore for processing.



Instrument Test

Semi-monthly and monthly instrument test were conducted on the DFS V system as per the instrument manual's instructions. The results of these test were sent to WESTERN GEOPHYSICAL's processing center in Singapore for processing and initial interpretation, then forwarded to WESTERN GEOPHYSICAL's Houston office for final analysis.

In addition to this, daily test were also conducted to ensure that the instrument's performance was consistent with specifications.

Survey Vessel

Name : M/V Western Odyssey
Length : 185 feet
Beam : 40 feet
Draft : 10 feet
Tonnage; gross/net : 830/250
Engines : 2 x Caterpillar D-399 TA
1090 HP each
Propulsion : 2 x Kamewa 50 x F/4 Control
Pitch Propellers
Generators : 2 x 550 kw - for air
compressors
2 x 175 kw - for ship's power
2 x 30 kw - for instruments
Radar : 2 x Decca Model 926, 48 mile
range
Gyro Compass : Sperry model 227 with auto
pilot
Bow Thruster : Kamewa SP 1300 with 350 HP
Electric Motor
Stabilization : Flume Type with Anti-Roll
Blige Keel
Accommodation : 36 persons
Endurance : 35 days minimum
Official Number : 8775
Call Letters : HO - 3498
Port of Registry : Panama
Helideck : 40 feet x 50 feet

Seismic Equipment and Instrumentation

Instruments : DFS V 120 Channel

Main Cable : 2400 Streamer, 96 groups
 25 m Group spacing - 96
 ch.mode
 50 m Group spacing - 48
 ch.mode

Mini Streamer* : 6 or 12 groups, 12.5 m group
 spacing incorporated into
 main cable offset sections

Compressors : 6 x Price 5000 psi electric
 drive compressors

Navigation

 Primary : SAT-NAV 16 / WINS-PHASE IV

 Secondary : LRS Phase IV Integrated
 Satellite Navigation system

Communications : Comsat 'MARISAT' Satellite
 Terminal with telex and
 telephone facilities

Sailor 800 Watt Programmable
 SSB Ship/Shore Radio

Sailor VHF Radio

UTS 10S Auxillary

SSB Radio, 150 watts

Gravity Meter : La Coste Romberg

Magnetometer : Geometrics G801/3

Ancillary Equipment : LRS Geoscience Data
 Acquisition System (Data
 Logger)

EPC Single Trace Plotter

SIE ERC 100 Monitor Camera

LRS-100 Energy Source
 Synchronizer

LRS Airgun Solenoid Controller

Kalamos M2A Cable Fault Locator

Krupp-Atlas Model 6020
Fathometer - 2000 fathom range

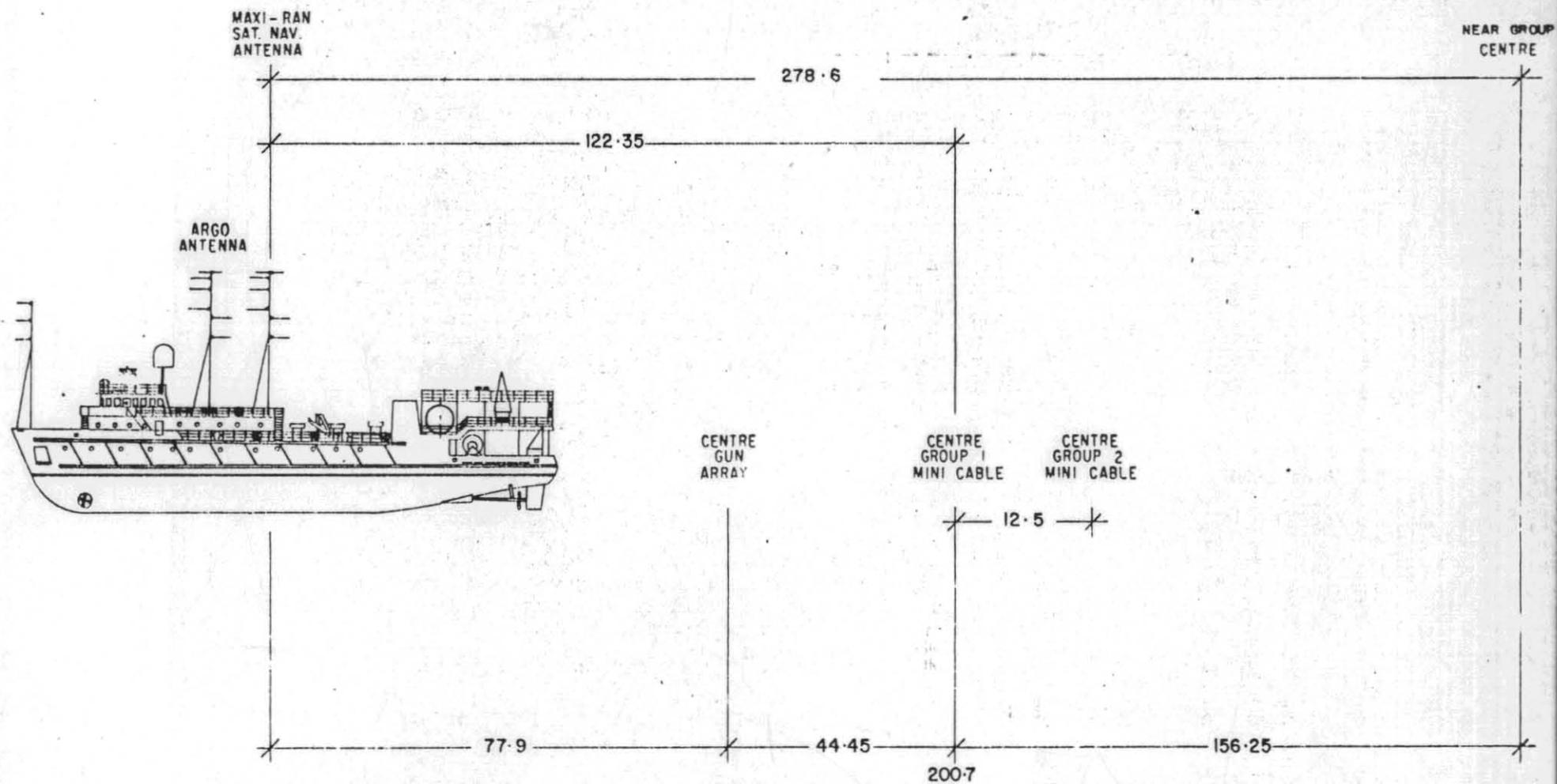
Raytheon model DE 750
Fathometer - 600 fathom range

Simrad model EX38D
Fathometer - 1000 fathom range

* Not in use during this survey.

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PLATE 3

**WESTERN ODYSSEY PARTY 86**

(DISTANCES IN METERS)

5 cm

The WESTERN ODYSSEY is equipped with a DFS V seismic acquisition system consisting of two analog modules, a controller module and four tape transports. The system accepts analog inputs signals from the streamer cable and converts these to digital form for recording on magnetic tape.

Each analog module contains 60 pairs of wires available for data acquisition. These wires come directly from the streamer cable (through a deck cable leading from the cable reel to the instrument room). Each individual channel is passed through a line filter to mitigate the effects of ambient static picked up from the seismic lines. From this filter the signal is applied to a differential pre-amplifier, then an optional lowcut filter, an alias filter and finally through an optional 50 or 60 Hz notch filter.

After the filtration process the signals are time division multiplexed to a floating point amplifier to allow for scanning of all data channels within the specified sample interval. The particular channel which is to be connected to the amplifier in any time slot is determined by an address from the controller module. The floating point amplifier adjust its gain in steps of 4:1 to bring the amplified signal to the optimum level for application to the Analog-to-Digital Converter.

The Controller Module provides a stream of commands to the Analog Module that perform the following functions:

1. Address the channels to be sampled.



2. Command the sending of status and zero offset data.
3. Control whether the gain ranging amplifier automatically selects its gain (AGC) or operates at a gain specified by the operator.
4. Control the source of input to the A/D converter.

In the normal data acquisition mode the floating point amplifier is commanded to be in it's automatic gain ranging mode, however the amplifier may be commanded to be in any of eight possible settings (particularly for test and calibration purposes). When in the normal data acquisition mode the A/D converter is commanded to derive it's input from the floating point amplifier but for various test and calibration procedures the A/D converter can derive its input from the internal test oscillator in the Analog Module, an external voltage source or ground.

The sequence of address sent out by the Controller to the Analog Module causes each individual analog channel to be sampled in sequence. Before commencement of a new sequence of addresses two time intervals occur that are reserved for specific purposes. During the first time interval, called First Start of Scan (SOS1), a special address is sent which causes the Analog Module to send back status information about the filter settings and gain constants of the Analog Module and to reset stabilize the floating point amplifier. During ensuing second interval, labeled Second Start of Scan (SOS2), the input to the amplifier in the Analog Module is commanded to be short to ground. Thus the information returned to the Controller Module as a result of this



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command contains zero offset information. The sequence of addresses is generated continuously whenever the power is on. However when a time break (start of energy source discharge) is received the sequence is interrupted and command for a Data Start and SOS1 are transmitted to commence a new sequence.

The digital data from the Analog Module comes to the Controller Module in bit serial format. After conversion to parallel format, a number which represents the dc offset of the amplifier and A/D converter in the Analog Module is subtracted from each data word (each word represents the instantaneous voltage at the moment of sampling of a channel).

The number to be subtracted is derived from the information obtained during SOS2. Since the dc offset of the amplifier may be somewhat dependent on amplifier gain, the gain is set to a different value during the successive SOS2. A separate value of dc offset is stored in a memory for each of the gain settings of the amplifier. In normal operation, the amplifier sets its own gain and the gain value that it determines is received by the controller in three bits of the data word. These bits are an address in memory from which to obtain the proper number to subtract. It is not appropriate to completely update the memory every time a new sample of the zero offset is obtained because the new value received is exaggerated by the effect of noise and thus would cause values placed in memory to be erratic. Therefore, when a new offset sample is obtained, only a fraction of the difference between the new value and the old value is added to the memory. Thus, the quantity stored in memory is a long-term average of zero offset.

The first filter removes those components of dc offset which are common to all channels but does not help the offset caused by the multiplexes of the individual channels. In order to remove the dc offset of the individual channels, it is necessary to have a memory location for each channel where a number can be stored which is to be subtracted from the data on that channel. The offset information for each channel can only be obtained from the data received from that particular channel. Thus, the number stored in memory for a particular channel is built up by adding (to the number in memory) a fraction of the difference between each new sample and the number stored in memory. Hence, the number to be subtracted is constantly changing. The net effect is the digital equivalent to a capacitor/resistor lowcut filter where the number stored in memory (which is subtracted) is analogous to the voltage across the capacitor in the analog realm. To perform this function in the analog realm would require a capacitor for each channel and switches for selecting the proper capacitors for each channel. Therefore, the digital method is much simpler. The filter time constant is 128 milliseconds.

The standard recording formats of the system are SEG-B and SEG-C. In both formats, each seismic event is recorded in a file consisting of a header block containing record constants and a data block containing seismic data values. The principal difference between the formats is the method of recording data values. Despite this difference, both header block tape formats are similar. The first 24 bytes of the header consist of record constants and processing information. The seismic channel fixed and early gain is recorded next for each channel. After

this strip, the auxiliary channel identifier code is recorded for each auxiliary channel, then any external data may be recorded at the operator's discretion.

In the SEG-B format, data is organized in 2 byte words with each byte consisting of 8 bits of information. The first of the data block comprise the sync group. Bits 0 through 5 of the sync group are recorded as "ones" for a normal time break and as "zeros" if the system is operated from an internal time break. Bit 6 indicates the number of seismic channels as designated in the following chart :

<u>CHANNELS</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
24	0	0	0	0
36	0	1	0	0
48	0	0	0	1
others	1	1	1	1

The next five words after the sync group are the auxiliary channels. The first auxiliary channel is timing word. During the remainder of the scan, seismic channels are recorded. The gain for 4 seismic channels is combined in one data word by 4 data words containing the mantissa of each of the seismic channels. The magnitude representing the channel output is expressed as a binary number with negative values in one's or two's complement code.

In the SEG-C format, data is organized in four 32 bit words, each word containing the data value for one channel. The recorded data value is the actual channel input in millivolts expressed in IBM-compatible floating point notation. In this notation, a data value is represented by a sign bit, a 7 bit

characteristic of exponent and a 24 bit fraction. The characteristic signifies a power of 16 in binary excess 64 code. The fraction is normalized to put the significant digit of the data within the uppermost 4 digits of the fraction.

The data coming from the offset filter (data in the form of a 16 bit two's complement number and a three bit gain for each sample) must be rearranged to be placed on the half inch 9 track (8 bits plus parity) tape. The logic which performs this function is called Format Logic. Only 15 of the 16 bits are actually used. The most significant bit is used to indicate overflow. The output of the Format Logic is a progression of 8 bit words arranged in accordance with either the SEG-B or SEG-C standard formats as chosen by the plug-in Format Logic board in the Controller Module. But after the words are generated, it is further necessary to encode the bits according to either the NRZI or the Phase Encoded modes of writing on the tape. The logic that performs this is called the Write Logic. The Write Logic is on the NZ board for NRZI and on the PE board for Phase Encoded. There must be a timing buffer between the Format Logic and the Write Logic. That is, the data may not be available from the Format Logic at exactly the time when it is desired to feed information to the Write Logic. The average data rate will have to be equal. The required flexibility is provided by a first in/first out memory (FIFO). This device can load a number of words into its input and later read them out of the output in the same order as they were entered. This reading out can occur at different times. The controller Write Logic translates the "ones" and "zeros" of each word into appropriate flux direction

signals to be sent to the Tape Transport for writing on tape. In the case of phase encoded signals, this requires two flux direction bits sent for each signal bit. The data is rearranged into 8-bit-plus parity bit parallel words, and these are encoded into 8-bit-plus parity flux direction words. After this 4 command bits are added to each data, word and the resulting data command words are converted to bit serial form and sent to Tape Transport. Clock and sync signals are also sent to the Tape Transport. The communication from the Tape Transport to the Controller Module is divided into 2 parts :

1. The data read from the tape is communicated to the controller by 10 wire pairs which carry all 9 tracks from the tape and a read clock for NRZI to the controller in parallel.
2. The status information (tape rewind, end of tape, etc.) is carried over a serial interface.

The Tape Transport motion control commands are sent over the serial interface with the write data. The commands are issued by the Controller Module, but the means of executing the commands are in the Tape Transport Module. Before a record is written on tape, a header is written which contains file identification and a number of constants which are introduced from the controller. Also, there are pieces of information such as gain constants and filter settings which are received from the Analog Module. All this information is arranged into a procession of 8-bit-plus parity (the same as the data) and is arranged in a specified sequence by the header logic according to SEG-B or SEG-C format. The header information or the data information is selected at the appropriate time for

feeding the FIFO. The Tape Transport Module is the means by which the digital data from the Controller Module is recorded on magnetic tape. Four transports are used in the system to facilitate dual recording where and when requested by clientele. Each of the 10 inch transports record the data on 1/2 inch tape using IBM-compatible 9-track dual gap heads. The recording can be either 800 bits per inch NRZI or 1600 BPI PE. The transports consists of the capstan drive, mechanical storage systems, supply and take up reel serve systems, record/reproduce head data electronics and tape position sensors.

Energy Source

The M/V WESTERN ODYSSEY's high pressure energy source system consists of twenty high pressure WESTERN airguns with reservoir capacities ranging from 10 to 100 cubic inches in 10 cu. in. intervals. In normal operating circumstances, 10 of the airguns are combined to form a 560 cu. in. tuned array. The airguns are operated at a pressure of 5,000 psi supplied from 4 of 6 available Price Air Gun Master Compressors.

For various reasons, most airguns have some inherent firing delay and do not fire immediately upon receipt of a "fire" command pulse. The amount of this delay tends to drift with time and naturally varies from unit to unit. To overcome this problem and to assure all airguns fire within specs required for an optimum energy pulse, the system is controlled by the LRS 100 Energy Source Synchronizer. The LRS 100 is a module microprocessor based system designed specifically to control the firing of a seismic energy source array so that all guns fire concurrently or in a pre-designated staggered time sequence. The system accomplished this by electronically sensing the individual gun delays and automatically establishing a firing sequence to compensate for the variations in delay. The basic sequence of operation is as follows :

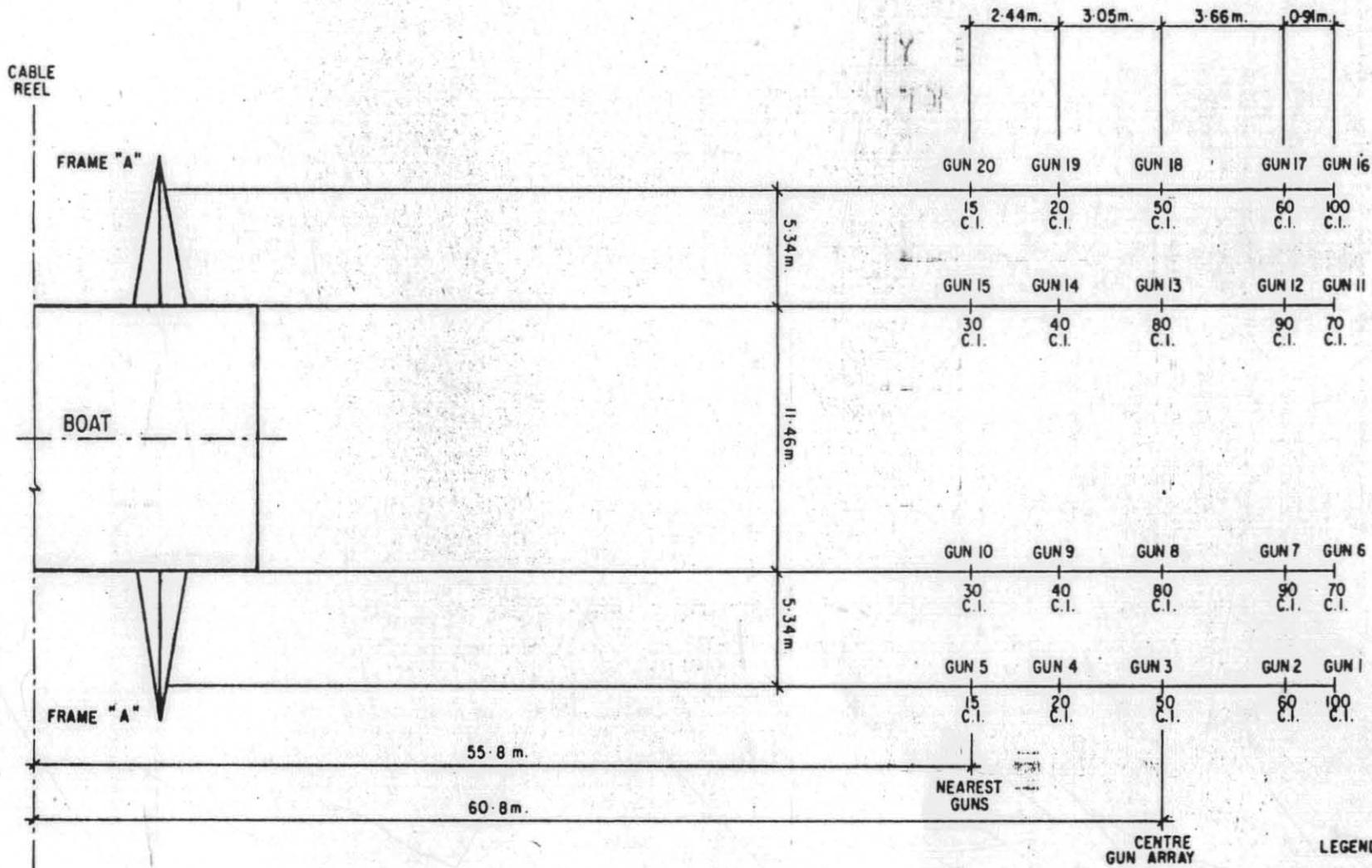
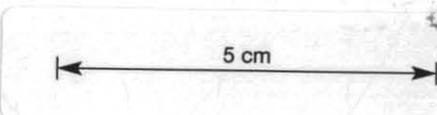
1. The Controller Module receives a fire command which signals the start of the firing cycle. The fire command signal may be issued by the seismic system or the LRS 100 Cycle Controller.
2. At some pre-calculated point after receiving the fire command, the controller will issue a fire

pulse to the solenoid power supply for each gun. The solenoid in turn triggers the release of the control pressure air. As this occurs, an imbalance is created between the control pressure reservoir and the high pressure reservoir that allows the high pressure air to force the seat and shuttle upward and expose the exhaust ports, thus releasing the pressure air.

3. Upon firing, a sensor on the guns produces a return signal which is detected by the controller. Ideally, this fire detect signal should occur at a pre-selected time referred to as the Aiming Point.
4. If the fire detect for any guns does not occur at the Aiming Point, the controller will correct the error by adjusting the time at which the next fire pulse is issued to the gun. These adjustments are computed from a filter applied to the previous error values.

Through this method of constant electronic adjustment, the energy source system delivers its optimum seismic signals.

WESTERN ODYSSEY PARTY 86 GUN ARRAY CONFIGURATION



LEGEND:
C.I. - CUBE INCH

202062

Streamer Cable

Modern seismic marine streamer cables originated from WW II anti-torpedo technology. The modern cables are 2.5 to 3 inches in diameter and, when filled with a special kerosene based fluid, are neutrally buoyant in the water column. As water density changes, the overall buoyancy of the streamer is adjusted by the addition or removal of thin lead weights taped onto the streamer at various intervals.

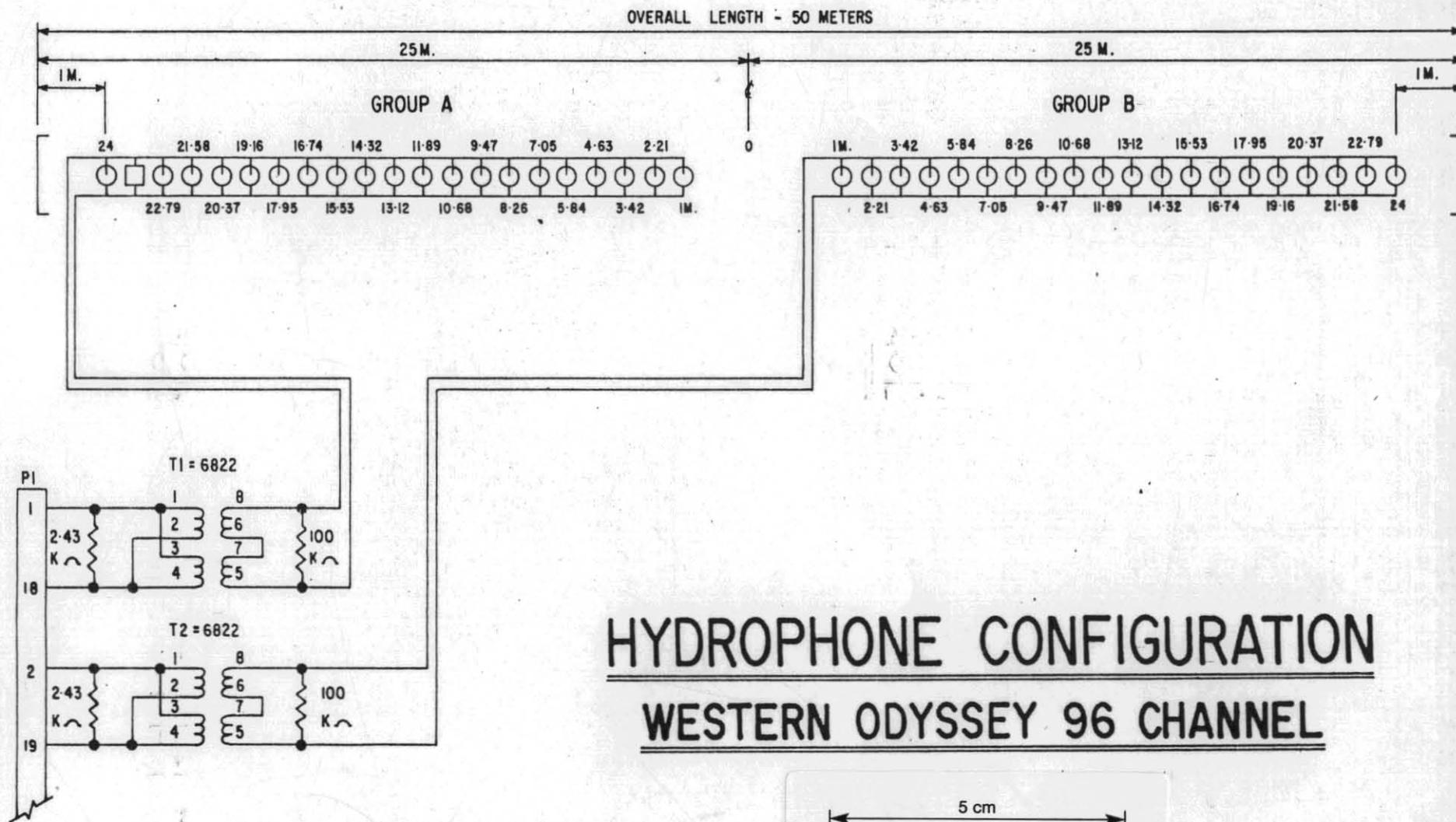
The streamer cable used by the WESTERN ODYSSEY is composed of 48 detachable and interchangeable LRS Marine Active Cable sections. Each section is 50 meters in length and contains two 25 meter groups of twenty WM2-036 hydrophones. This gives the streamer an overall length of 2400 meters excluding the lead-in and elastic sections.

The 500 foot nylon reinforced neoprene lead-in is heavily weighted in order to depress the front end of the streamer cable to the desired operating depth. It is also outfitted with neoprene florings for noise reduction. In normal operation, two 75 meter elastic sections are attached at the tail of the lead-in for additional noise reduction.

To maintain the streamer cable at the specified depth in the water column, a series of Syntron Depth Controller are employed at equal intervals along the cable. An electronic pulse controls the angle of the wings and thus controls their influence on the cable's depth. The cable depth is monitored from the readouts of pressure sensitive transducers located at regular intervals along the streamer.

A tail buoy is connected at the far end of the cable and is tracked by the vessel's radar, making it possible to observe how closely the cable is trailing the vessel along its line of motion.

In order to give a further indication of the cables physical orientation along the line of motion, 6 of the 48 active sections contain Digicouse heading sensors. Each heading sensor will give the heading in degrees of the streamer at the point of location of the heading sensor. Using the length of the streamer out from the vessel and the heading from the sensors, a simple approximation of the shape of the streamer can be made by connecting the known points with straight lines.



HYDROPHONE CONFIGURATION
WESTERN ODYSSEY 96 CHANNEL

WESTERN ODYSSEY 96 CHANNEL

Max. Input Signal	<u>Gain Constant</u>	<u>Voltage(mV RMS)</u>
Difference Mode:	24	327.68
	26	81.92
	8	20.48

Common Mode:	<u>F. Range (Hz)</u>	<u>Voltage(Peak)</u>
	0 - 60	7
	60 - 700	3.5
	700 - 1K	7
	1K - 3K	10
	3K - 10K	50

Distortion : 0.05% 3 to 256 Hz

Crossfeed Isolation : 80 dB between any 2 channels, feeding 1 channel only

Control Module Specs

Timing Accuracy : -0.005%

Data Word Rate : 64 kHz Max

Cable Parameters

Percent Coverage : 4800%

Pops per km : 40

Number of Groups : 96

Center Energy Source to
Center Near Group : 200.7 meters

Center Near Group to
Center Far Group : 2,375 meters

Group Center to Group Center: 25 meters

Number of Phones per Group : 20

Depth Detectors at Head of
Groups : 2, 16, 32, 48, 64, 80,
96, Head of Mini

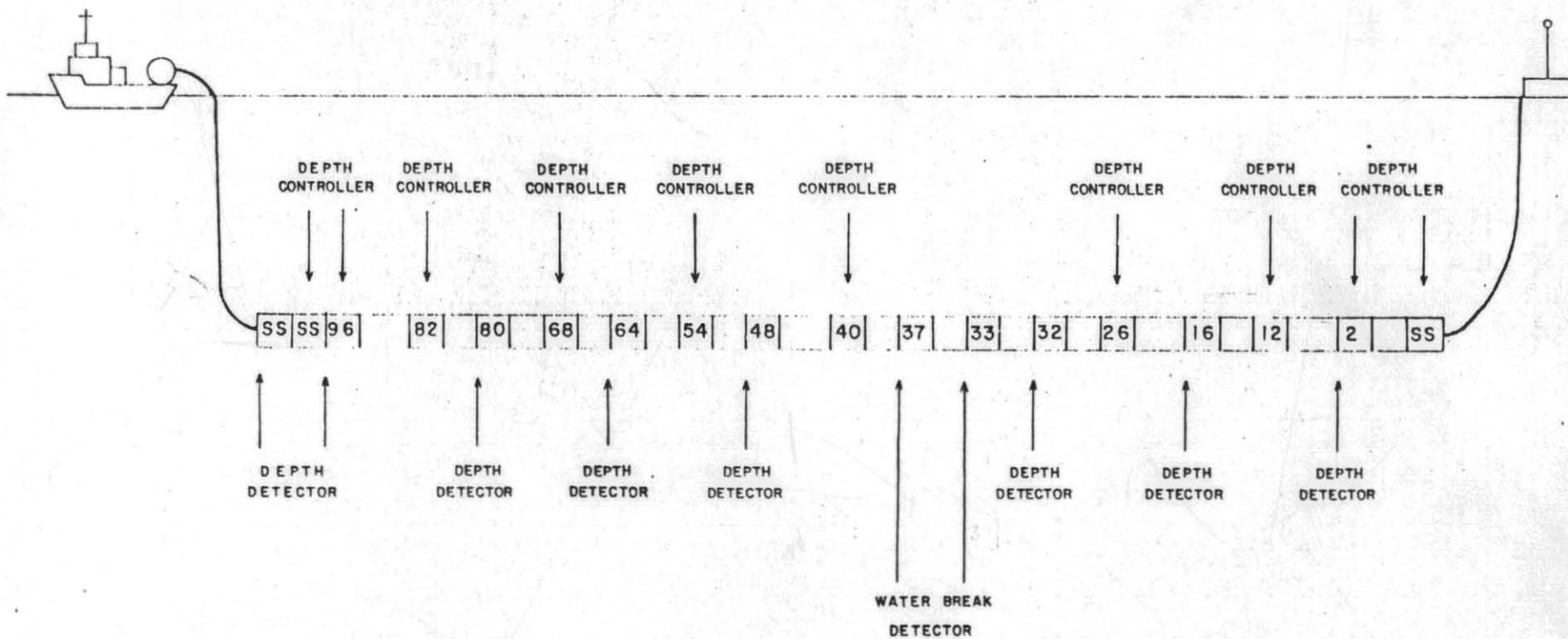
Depth Controllers on Groups : SS 2, 12, 26, 40, 54,
68, 82, 96, SS

Center Near Group to
SAT NAV Antenna : 278.6 meters

WESTERN ODYSSEY

96 GROUP CABLE CONFIGURATION

5 cm



Airgun Configuration

Array Volume : 555 cu. inches

Number of Guns : 10

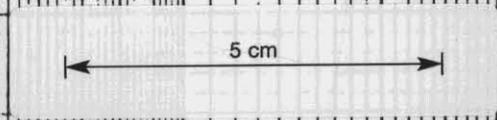
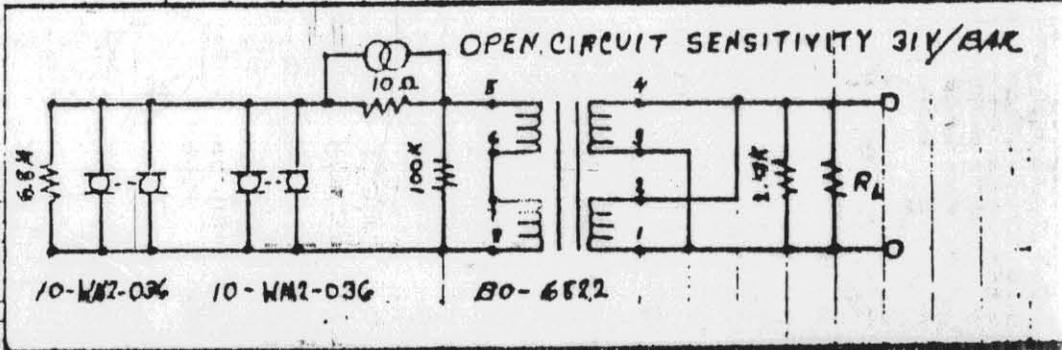
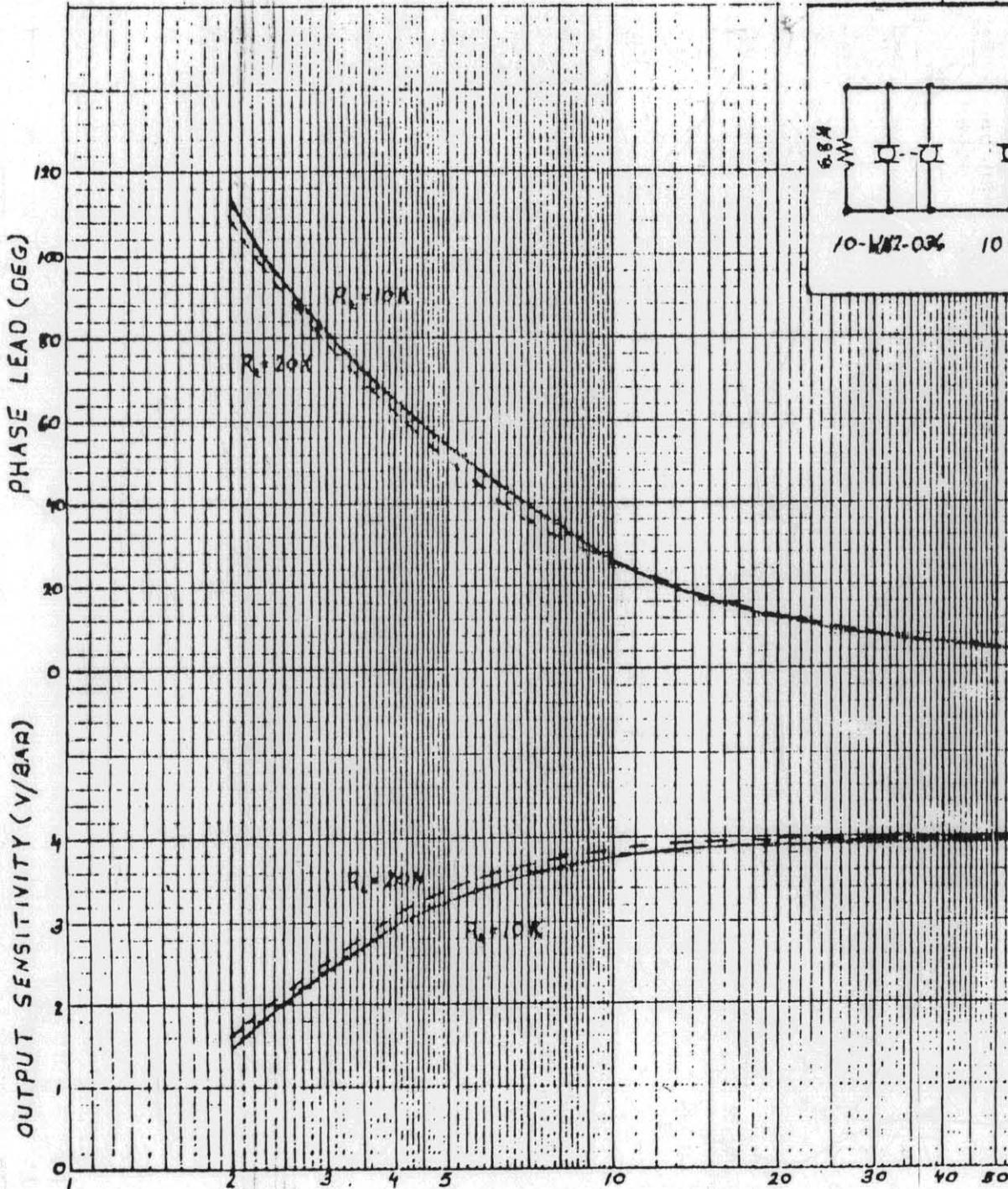
Array Pressure : 4500 psi

Shot Depth : 6 meters

Shot Interval : 25 meters

202071

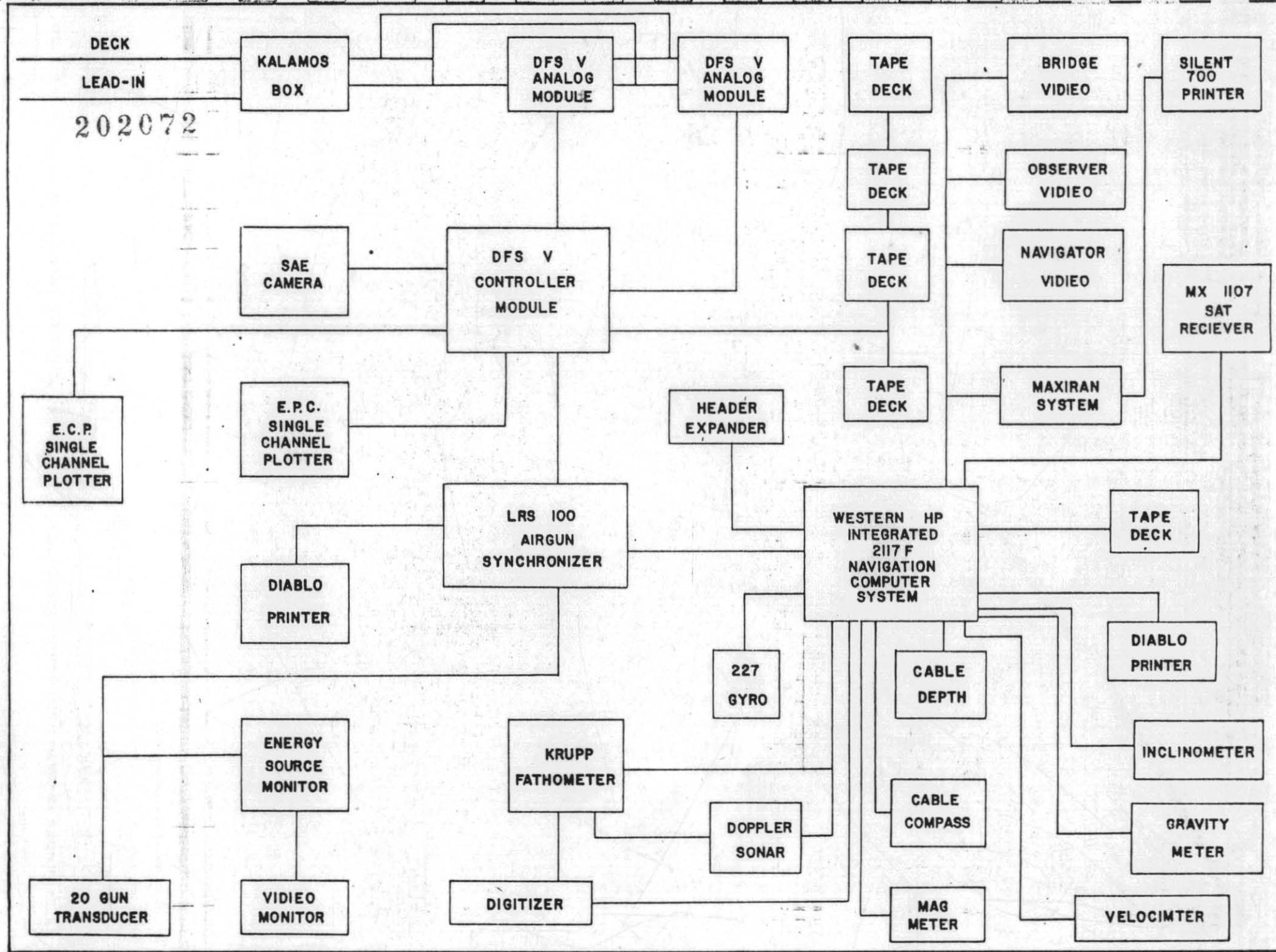
PLATE 7



DRAWN C.S.	DATE 2-4-70	MAIN CABLE	WESTERN GEOPHYSICAL SPRING TEXAS
CHECKED			
APPROVED	2-4-70	AK541152-00 WM2-036 X 20 SPREAD	

WESTERN GEOPHYSICAL

202072



DIAGRAM

STATISTICAL SUMMARY

<u>DATE</u>	<u>LINE</u>	<u>SP - SP</u>	<u>PROFILES</u>	<u>KMS</u>
March 16	WB81-06	100 - 1270	1171	29.275
March 17	WB81-05	100 - 1530	1431	35.775
	WB81-08	100 - 1030	931	23.275
	WB81-09	100 - 1271	1172	29.300
	WB81-10	100 - 1272	1173	29.325
	WB81-04	100 - 650	551	13.775
March 18	WB81-04	651 - 1650	1000	25.000
	WB81-07	100 - 1472	1373	34.325
	WB81-01	100 - 2435	2336	58.400
	WB81-02	100 - 2572	2473	61.825
April 1	WB81-03	100 - 1820	1721	43.025
April 2	WB81-03	1821 - 2781	961	24.025

Total Kilometers: 407.325

LINE SUMMARY

WB81 - 1 First shotpoint of line 100. End of
18th March line - last shotpoint 2435.

WB81 - 2 Start of line, gun array - guns 6,
18th March 12-20. Gun array volume 555 cu/in.
Change of reel number sequence
during this line. Reel 088000 ends
with SP 1569. Reel 089501 first of
new sequence - SP 1570 is first
shotpoint. First reel of line -
087987. First shotpoint of line -
100. Parity errors on SP 182. Reel
087991 - parity errors on SP 539.
Reel 087996 - parity errors on SP
1137. SP 1144 lost at reel change
087996 to 087997. Reel 087997 -
parity errors on SP 1155, 1163. SP
1463 lost at reel change 087999 to
088000. Reel 084505 - parity errors
on SP 2007. Reel 089506 - parity
errors on SP 2139. Reel 089507 -
parity errors on SP 2284. End of
line - last reel 089510, last
shotpoint 2572.

WB81 - 3 First reel of line - 089851. First
1st April/ shotpoint of line 100. Last
2nd April shotpoint of day, 1st April - 1820.
First shotpoint of day 1821, reel
089867. End of line - last reel
089876, last shotpoint 2781.

WB81 - 4
17th March

Start of line, gun array - guns 1-5, 7-11. Gun array volume 555 cu/in. Trace 87 dead at start of line. First reel of line 087935. First shotpoint of line 100. Reel 087937 - parity errors on SP 388. Reel 087940 - parity errors on SP 679. Reel 087943 - parity errors on SP 1002, 1004, 1019. Reel 087947 - excessive screw noise on records for most of this reel. Reel 087948 - SP 1480 screw noise abated. End of line - last reel 087949, last shotpoint 1650.

WB81 - 5
17th March

Start of line, gun array - guns 1-5, 7-11. Gun array volume 555 cu/in. Start of line - trace 87 dead. First reel of line 087888. First shotpoint of line 100. Parity errors on SP 113. Reel 087895 - parity errors on SP 837. Reel 087897 - parity errors on SP 1117. Last reel 087901, last shotpoint 1530.

WB81 - 6
16th March

Start of line, gun array - guns 1-5, 7-11. Gun array volume 555 cu/in. Trace 87 dead at start of line. First reel of line 087876. First shotpoint of line 100. SP 142 no timebreak. Parity errors on SP 187. Reel 087878 - parity errors on SP 304. Reel 087881 - SP 659, gun 10 out, gun 14 in, volume 565

cu/in. Reel 087885 - parity errors on SP 1060. Reel 087887 - files 1167, 1168, 1169 - dummy files. End of line - last reel 087887, last shotpoint 1270.

WB81 - 7

Start of line, gun array - guns 1-5, 7-11. Gun array volume 555 cu/in. Trace 87 dead at start of line. First reel of line 087950. First shotpoint 100. Reel 087951 - parity errors on SP 227, 228, 289. Reel 087956 - parity errors on SP 821. Reel 087957 - parity errors on SP 926. Reel 087958 - parity errors on SP 943. Reel 087960 - parity errors on SP 1211. End of line - last reel 087963, last shotpoint 1472.

WB81 - 8
17th March

Start of line, gun array - guns 1-5, 7-11. Gun array volume 555 cu/in. Start of line - traces 62 and 87 dead. First reel of line 087902. First shotpoint 100. Parity errors on SP 106, 126, 155. Reel 087904 - parity errors on SP 334. Reel 087908 - parity errors on SP 788. Reel 087909 - parity errors on SP 854. End of line - last reel 087910, last shotpoint 1030.

WB81 - 9
17th March

Start of line, gun array - guns 6, 12-20. Gun array volume 555 cu/in. Trace 87 dead at start of line. First reel of line 087911. First

shotpoint 100. Reel 087914 - SP 434
- gun 19 out, gun 4 in. Reel 087914
- SP 485 - gun 4 out, gun 19 in.
Reel change 087916 to 087917 - SP's
718, 719, lost. Reel 087917 -
parity errors on SP 786. Reel
change 087920 to 087921 - SP 1144
lost. End of line - last reel
087922, last shotpoint 1271.

WB81 - 10
17th March

Start of line, gun array - guns 6,
12-20. Gun array volume 555 cu/in.
Trace 87 dead at start of line.
First reel of line 087923. First
shotpoint 100. Files 010 thru 034
recorded on fixed gain. Reel 087924
- parity errors on SP 219, 275.
Reel 087926 - parity errors on SP
494. Reel 087928 - parity errors on
SP 625, 691. Reel 087932 - parity
errors on SP 1048, 1125. Reel
087933 - parity errors on SP 1153,
1206. End of line - last reel
087934, last shotpoint 1272.

SECTION III

Navigation:

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NAVIGATION SYSTEM - WINS^(R) PHASE IV

Western Geophysical's WINS^(R) (Western Integrated Navigation System) is comprised of four main subsystems; a doppler-sonar system to determine ships's velocity continuously, a satellite system to provide ship's position at intervals averaging two to four hours, a digital computer and a recording system to record computed data. Calculations, for all subsystems and data integration, are handled by the on-board general purpose digital computer. The ship's position is continuously calculated by integrating the sonar velocity and updating with acceptable satellite fixes.

DOPPLER SONAR SUBSYSTEMDoppler Sonar

The main unit is a Marquardt 2020A doppler sonar system. This system uses a 4-element transducer, in a single assembly, to transmit and receive pulses of 300 KHz sonic energy reflected from the sea floor.

The four elements transmit and receive energy at an angle of 30° to the vertical in the fore, aft, port and starboard directions. The associated electronics control both the pulse transmission pattern and provide independent phase-locked-loop tracking of each of the four received signals. The output from the tracker circuits are demodulated to determine the frequency shift present in the received signals. The frequency shift of each channel is pulse shaped to provide a digital pulse rate proportional to ship's velocity in that channel. Vertical velocity, heave, is derived in the computer. Pulse rates proportional to velocities in the 2 horizontal ship axes are provided to the computer.

The sonar will normally maintain lock on the sea bottom to depths greater than 600 feet. When "bottom lock" is

lost the sonar will automatically track the sonar return from the water mass. The velocities in this mode are relative to the water mass and therefore in error in the presence of ocean currents. The change in sonar mode may be controlled manually as well as automatically. The sonar mode is indicated to the computer and data logger and also visually displayed.

Velocity Resolution and Compensation

The horizontal ship-referenced velocities are resolved into North and East velocities by the computer. The necessary heading reference is provided by a gyro-compass (Sperry MK227) with electronic readout provided by a resolver. A resolver-digital converter provides a digital heading to the computer. The gyro-compass is corrected internally for latitude error. Dynamic gyro-compass errors are corrected in the computer.

Other corrections to the sonar velocities are for sound velocity in water and ship attitude.

Sound velocity in water is measured by a velocimeter (N.U.S. 1020) which provides an output frequency proportional to sonic velocity. This signal is used by the computer for sonar scale factor correction.

Ship attitude data are provided by pendulous resolver inclinometers (G.A.P. S2000) in the pitch and roll axes. The outputs of these devices are converted to digital form and passed to the computer. The computer applies corrections for pitch and roll and pitch-heave and roll-heave interaction.

SATELLITE SUBSYSTEM

The satellite receiver, Magnavox 702A-3, automatically acquires and tracks the signal from each satellite as they become available. Each satellite transmits a message on two frequencies, 400 MHz and 150 MHz, which are independently tracked by two phase-lock-loop receivers.

The doppler shift on each frequency is measured. Digital data representing the high channel doppler-shift cycle count, low channel doppler-shift cycle count and satellite message are passed to the computer.

The satellite fix program is a "short doppler" program which employs the accumulated doppler data in 23-second intervals instead of the 2 minute interval used in the earlier programs. Use of the 23-second interval allows accurate fix computation under reception and pass length conditions which would prevent a 2 minute interval program from computing a fix.

Fix accuracy is very much a function of the accuracy of the measurement of the ship's velocity during the pass. In particular one knot error in measurement of the north velocity can induce a position error of up to 1500 ft. in the satellite fix. Accurate knowledge of velocity from the sonar subsystem reduces this error to negligible proportions.

COMPUTER AND PERIPHERAL EQUIPMENT

The computer (HP 2100A) is a general purpose digital computer. The computer accepts data from all the sensor units and a manual entry keyboard. A CRT display unit is fed by the computer to provide a display of present latitude, longitude, heading, cross-course velocity and distance, and along-course velocity and distance. Several other parameters are also displayed. Initialization parameters, such as G.M.T., satellite antenna height, shotpoint interval, etc. are entered by the operator via a keyboard.

A digital line printer is used to provide a visual history by printing time and position at 10-minute intervals. The printer is also used to provide a printout of the satellite fix parameters.

The computer program is loaded from magnetic tape. Program may also be loaded with paper-mylar punched tape.

All computed navigation data, are sampled in digital form every twenty seconds. The resulting data scan is accumulated in a core memory and written onto IBM-compatible, 9-track magnetic tape at 10-minute intervals. Satellite data is accumulated for the entire satellite pass and written onto tape at the end of each pass.

The seismic system is interfaced to the computer in order to record the seismic file and reel number on the navigation tape, to allow the positive positioning of each seismic record. This interface also allows the navigation system to control the seismic recording interval on the basis of elapsed distance, instead of the more normal elapsed time method. The required distance is part of the computer initialization data.

To ensure recorded data validity, data recorded on magnetic tape is read back to the computer and compared with the data written to the tape. This data may also be printed for visual verification.

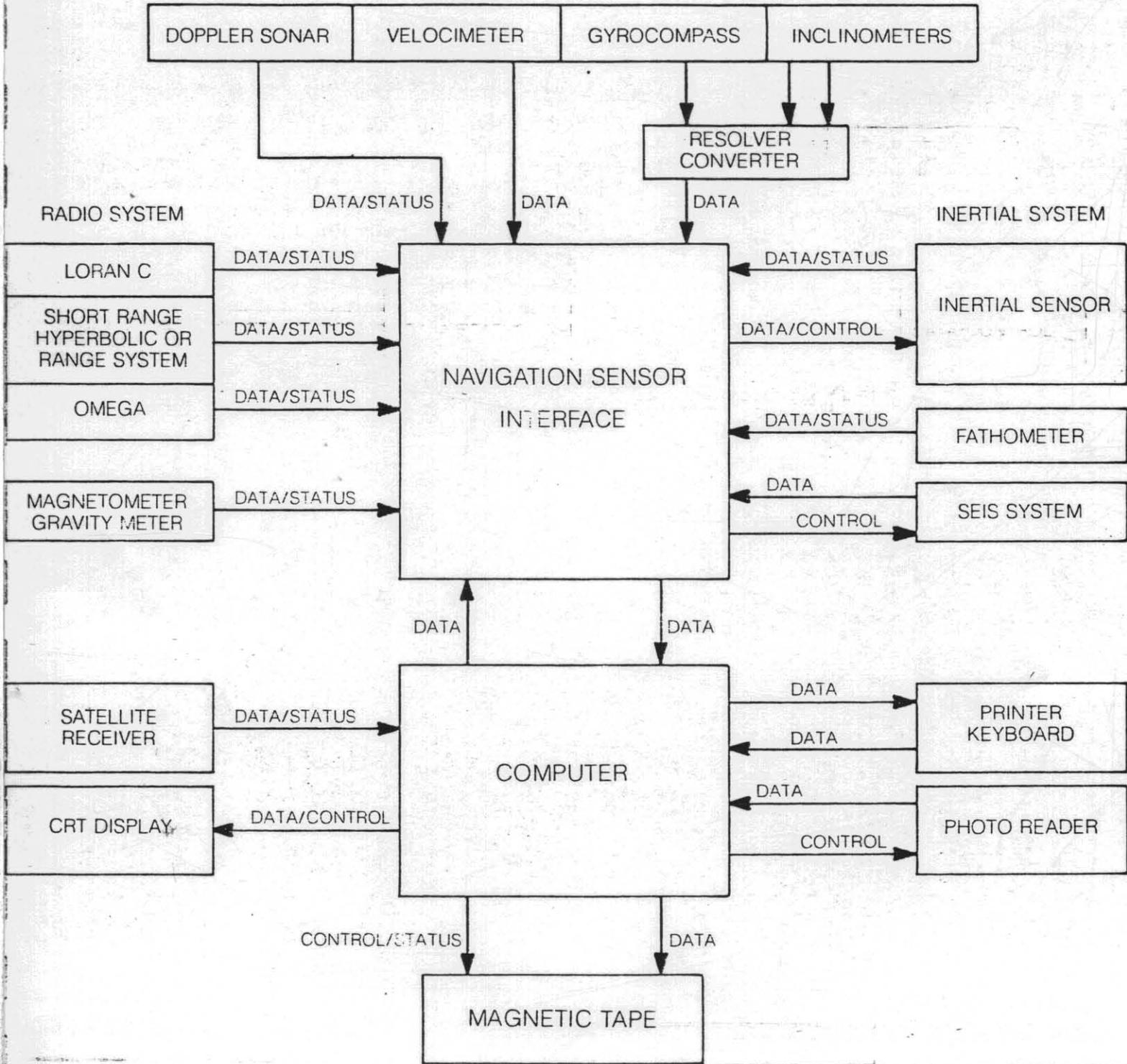
SURVEY OPERATION

The system is initialized with the Latitude/Longitude end points of the line and shotpoint control parameters; pop and shotpoint interval, initial shotpoint number and direction of count.

The system displays along-course and cross-course distance and velocity relative to the great circle line passing through the specified line end points. These displays are also available in the wheel house. The problems of bringing the vessel on line and keeping it there are thus simplified and do not require voluminous preplot tabulations or track plotter charts.

The system described above provides a reliable means of navigation to the accuracy required for geophysical survey work on the continental shelf independent of any shore base support.

SONAR SYSTEM



SECTION IV

Data Processing:

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Normal Moveout Application and CDP Stacking	70
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GENERAL

Water depths were recorded in fathoms every 40th shotpoint using an Echograph 600 S, model Atlas by Krupp.

A magnetic survey was taken with a Geometrics SSAA magnetometer. The magnetic reel to sensor was 193 meters. A data logger was used to record the survey.

A S/N S88 gravity meter was used for the gravity survey. A data logger was also used for this survey.

The following are descriptions of the programs and procedures in the order in which they were applied.

INTRODUCTION

Between March 16 and April 1, 1981, Western Geophysical Company shot ten marine seismic lines Offshore Australia, Bass Basin for Weaver Oil and Gas Corporation. This survey was recorded by Party 86 aboard the "Western Odyssey" and covered 253 miles. The digital processing for this survey was performed at the Houston Digital Center from April 16 to June 25, 1981.

The navigation system was by navigation satellite. Antenna positions were located by 16/WINS Phase IV equipment. Mapping was performed by Western Geophysical Company in Singapore at a scale of 1 to 100,000.

The seismic recording was done on a DFS V system. The DFS V recorded 124 channels in SEG-B format at a 4 ms. sampling interval for 6 seconds. The field filter settings were a low cut out and a high cut of 64 hz with a slope of 70 db/octave.

The cable used was a 96 group streamer which was pulled at an average depth of 14 meters. Each group consisted of 20 phones with a 25 meter spacing between group centers. (Hydrophone configuration diagram included.)

The energy source consisted of an array of 10 air guns. The array had a volume of 555 cubic inches with 4500 psi. A shot was made every 25 meters at a depth of 6 meters. (Air gun array diagram included.)

Test pops were taken at the start of each line, and noise file strips were made at the beginning and end of each line. Monitor records were produced every 29th shotpoint.

EDIT

The edit program demultiplexed the 96 recorded channels into a trace sequential format retaining the full-word floating point format. No summing of field pops was done.

A near trace section for each line was displayed to check the results of the editing process and to determine velocity analysis locations.

PREPROCESSOR/DECONVOLUTION

Line WB-81-1 was selected as a test line. Three types of predictive deconvolution tests were performed on the above line. After reviewing the tests with the client, it was decided that the 4 ms. predictive distance was the optimum decon to use for these data. Operator lengths were also based on autocorrelation information.

The preprocessor program generates common depth family (CDF) ordered tapes which conform to the SEG "exchange tape" specifications incorporating in reel and trace headers all basic information regarding field parameters such as spread distances and line geometry.

Prior to deconvolution a geometric spreading function was applied to compensate for spherical divergence. Deconvolution was then performed using the Weiner-Levinson least squares minimum phase algorithm. The prediction operator was constructed from an autocorrelation function in a time variant manner only in the sense that the autocorrelation start time and resultant operator for each trace was a function of the distance of the trace from the source. A new operator was calculated for each trace. Autocorrelations were computed before and after deconvolution providing a continuing check on the effectiveness of the decon.

VELOCITY ANALYSIS

Vertical velocities are automatically determined in the VELAN® (velocity analysis) program using cross-correlation techniques on deconvolved CDP gathers from the decon program. Two adjacent CDP families were used for each velocity analysis. Cross-correlations for each CDP family were obtained with the output of both families then summed to a single output, i.e., the VELAN velocity table was the average of two consecutive CDP family analyses.

The calcomp plot that was printed and sent to you is a plot of RMS velocity versus two-way time with a cross-correlation output trace at 40 millisecond intervals. Velocity increments of 250 feet per second were used. Velocity analysis locations were determined by examining near trace gathers.

NORMAL MOVEOUT APPLICATION AND CDP STACKING

Normal moveout calculations were performed independently for each trace, with the velocity function being the same for each member of a CDP family. A straight-ray iso-velocity interpolative method was used between velocity analysis locations. Muting was applied after normal moveout and the application of mute was done for each trace, the members of each CDP family were summed together to produce a stacked output trace. Each sample of time of the stacked output trace was then divided by the number of "live" samples at that time which were summed to produce that stacked sample. Effectively, this retains relative recorded time-varying amplitude of the trace.

Quality control of the applied velocity functions was performed by outputting a stack monitor section. Where deemed necessary, revised velocity functions were used to compute residual normal moveout corrections for the final stack sections.

RAP® PROCESS

A Relative Amplitude Preservation (RAP) section was produced on selected lines picked by the client.

To produce the RAP section the no-gain stack tape was run through an amplitude decay analysis in order to obtain a set of multipliers to compensate for the loss of energy at depth.

An average set of multipliers was used for the area and applied to the stack in the residual amplitude compensation program.

The data was then filtered with a 6-60 band pass for the final RAP display.

MIGRATION AFTER STACK

The finite-difference method of migration was used for this data. In this program approximations are first made to the Scalar wave equation itself rather than an integral solution, such as used in the diffraction-summation program. This method, is accomplished by propagating waves recorded at the earth's surface backward in time down into the subsurface until scatterers or reflectors are encountered. This backward propagation is accomplished by using discrete (finite-difference) approximations to a differential equation that governs wave motion and results in a migration of the data into a position closely approximating their true position in space.

TIME VARIANT FILTERING

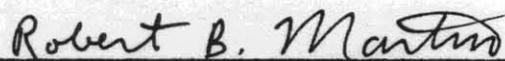
Time variant zero phase digital filter tests were run to determine the optimum filter pass-bands and times of application. Filter pass-bands at 70% response points and times of application are noted in the section headers for each line and these times are linearly variable in order to follow structural trends. The filters were designed with 18 db. slope and 36 db. slope, respectively, on the low and high frequency sides at 3 db. down on the amplitude plot.

CONCLUSION

All final sections were checked for quality and approved prior to release. All questionable data were investigated and revised where necessary prior to shipping. All sections were displayed with a vertical scale of 3.75 inches per second and a horizontal scale of 32 traces per inch.



Soule M. Mellette, Manager
Marine Processing



Robert B. Martin, Assistant
Supervisor Data Processing

SECTION IV_aData Reprocessing:

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Instantaneous Phase	77
Instantaneous Frequency	77-78
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R E P R O C E S S I N G R E P O R T

CLIENT: WEAVER OIL & GAS CORPORATION
PROSPECT: BASS BASIN; SQUID PROSPECT

Prepared by Sue Snider
SEISCOM DELTA INC.
August 26, 1981

INTRODUCTION

The following is a report summarizing the post-stack and attribute processing of line WA-81-1 for Weaver Oil and Gas Corporation, Australia.

Seiscom Delta Inc. received a tape containing the final stack data for line WA-81-1 in the Bass Basin area. This tape was reformatted to SEG Y format and the shotpoints to be processed (shotpoints 196-600) were output onto another tape.

The processing consisted of three streams:

- I. Attribute Analysis
- II. Instantaneous Velocity
- III. Datumization

Attribute Analysis

The data went into Seiscom's Attribute Analysis Program and SEISCHROME^R displays were generated. The displays are quantitative presentations of Reflection Strength, Phase, Polarity, Instantaneous Frequency, and Average Frequency. Two SEISCHROME^R prints of each attribute were generated.

Reflection Strength

Reflection strength is independent of phase.

High reflection strength is often associated with major lithologic changes between adjacent rock layers, such as across unconformities or depositional environments. High reflection strength also is often associated with gas accumulations.

Lateral variations in bed thicknesses change the interference of reflections; such changes usually occur over appreciable distance and so produce gradual lateral changes in reflection strength. Sharp local changes may indicate faulting, or hydrocarbon accumulations where trapping conditions

are favorable. Hydrocarbon accumulations, especially gas, may show as high-amplitude reflections or "bright-spots". However, such bright spots may be non-commercial and conversely some gas productive zones may not have associated bright spots.

The usual color-encoding of reflection strength is referenced to the maximum reflection strength which occurs on a seismic section or in an area, using a different color for each dB step.

Frequency is usually color-coded in 2-Hz steps. The red-orange end of the spectrum usually indicates the lower frequencies and the blue-green end, the higher frequencies. Frequencies lower than 6 Hz are usually left uncolored. . .

Weighted Average Frequency

Weighted average frequency emphasizes the frequency of the stronger reflection events and smooths irregularities caused by noise. The frequency values approximate "dominant frequency" values determined by measuring peak-to-peak times or times between other similar phase points. Like instantaneous frequency displays, weighted average frequency displays are sometimes excellent for enhancing reflection continuity. Hydrocarbon accumulations often are evidenced by low frequencies.

Apparent Polarity

While all attribute measurements depend on data quality and the quality of the recording and processing, apparent polarity measurements are especially sensitive to data quality. The analysis of apparent polarity assumes a single reflector, a zero-phase wavelet, and no ambiguity due to phase inversion.

Polarity sometimes distinguishes between different kinds of bright spots. Bright spots associated with gas accumulations in clastic sediments

usually have lower acoustic impedance than surrounding beds and hence show negative polarity for reservoir top reflections and positive polarity for reflections from gas-oil or gas-water interfaces (often called "flat spots").

Ordinarily, apparent polarity is color-coded magenta and blue for positive and negative, respectively, with the hue intensity graded in five steps according to reflection strength.

Instantaneous Phase

The Instantaneous phase emphasizes the continuity of events.

Because phase is independent of reflection strength, it often makes weak coherent events clearer. Phase displays are effective in showing discontinuities, faults, pinchouts, angularities, and events with different dip attitudes which interfere with each other.

Phase displays use the colors of the color wheel so that plus 180° and minus 180° are the same color because they are the same phase angle.

Instantaneous Frequency

Instantaneous frequency is a value associated with a point in time, like instantaneous phase. Frequency character often provides a useful correlation tool. The character of a composite reflection will change gradually as the sequence of layers gradually changes in thickness or lithology. Variations, as at pinchouts and the edges of hydrocarbon-water interfaces tend to change the instantaneous frequency more rapidly.

A shift toward lower frequencies is often observed on reflections from reflectors below gas sands, condensate and oil reservoirs. Low-frequency shadows often occur only on reflections from reflectors immediately below the petroliferous zone, reflections from deeper reflectors appearing normal. A gas sand actually filters out higher frequencies because of

frequency-dependent absorption or natural resonance, or that travel time through the gas sand is increased by lower velocity.

Fracture zones in brittle rocks are also sometimes associated with low-frequency shadows.

Instantaneous Velocity

The Instantaneous Velocity processing consisted of four steps:

- A) The data went into the XPASTA processor which estimates the seismic wavelet and the reflectivity series. The output of XPASTA is a tape containing the approximated reflectivity series.
- B) The general interval velocity field was calculated using the RMS velocities provided by the Client.
- C) The XINVEL processor was run which combined the reflectivity series output from XPASTA with the general interval velocity field to calculate velocity logs.
- D) The velocity logs output from the XINVEL processor were displayed as a function of time with calibrated colors. The seismic data were used as a background for this SEISCHROME^R display. Two SEISCHROME^R prints were generated.

Datumization

The seismic reflector with a two-way time of 1.55 seconds at shotpoint 196 and 1.48 seconds at shotpoint 600 was flattened to 1.5 seconds. This was accomplished by applying the appropriate time shifts to the stacked

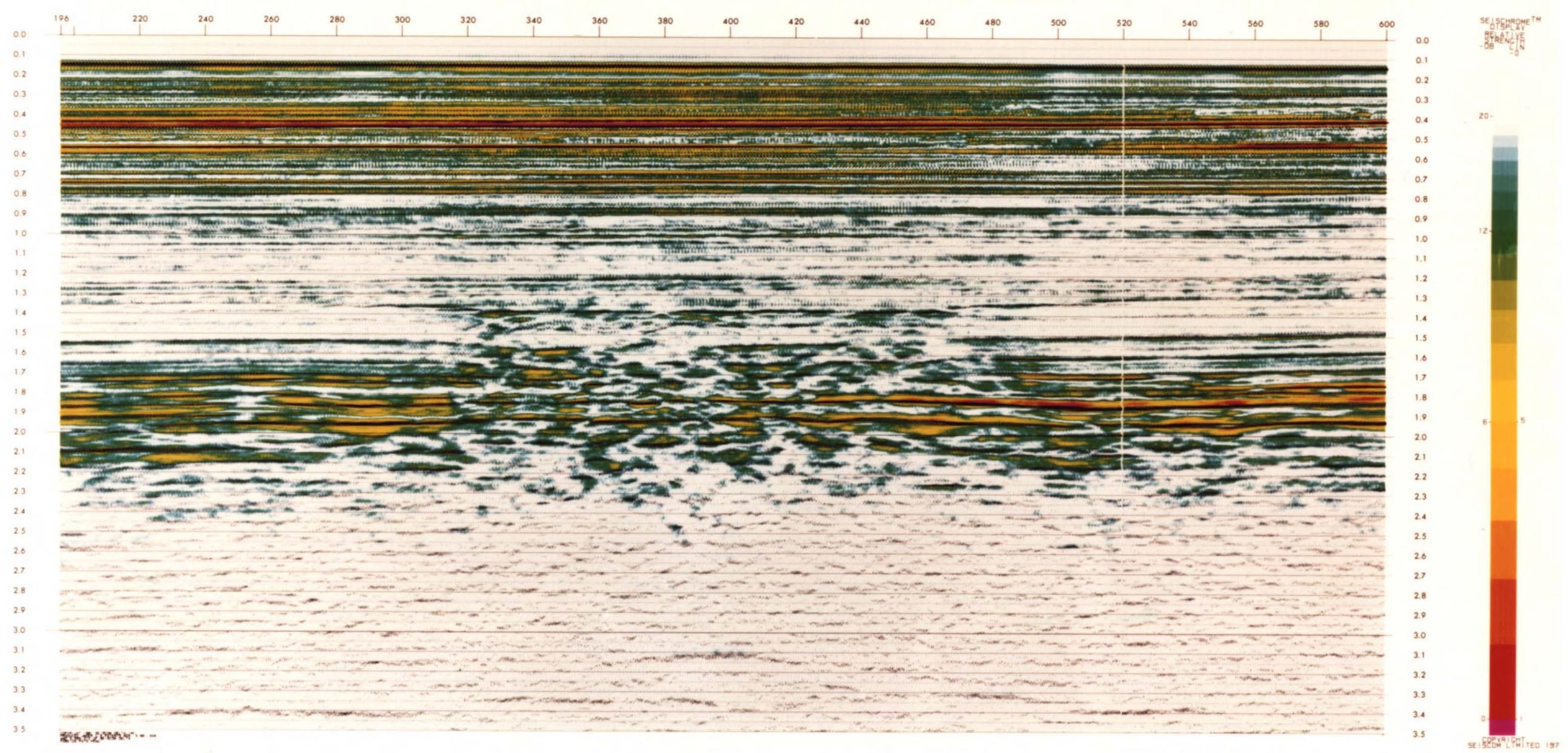
traces. The datumized data was displayed on film from 1.4 seconds to 3.5 seconds.

202102

5 cm

Seiscom Delta
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: REFLECTION STRENGTH
Client: WEAVER OIL & GAS CORP.

SQUID PROSPECT

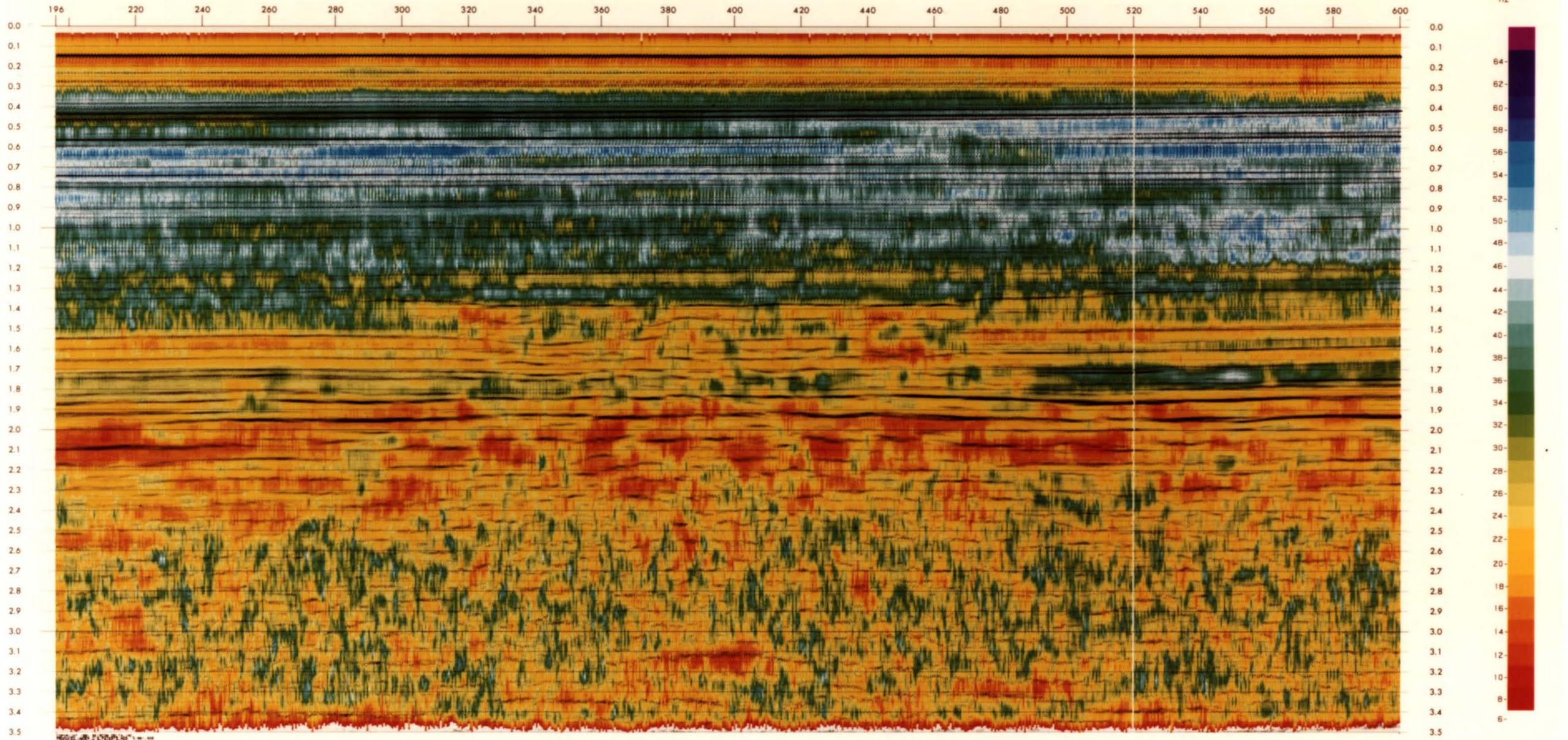


202103

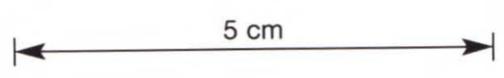
5 cm

SQUID PROSPECT

Seiscom Delta inc.
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: WEIGHTED FREQUENCY
Client: WEAVER OIL & GAS CORP.



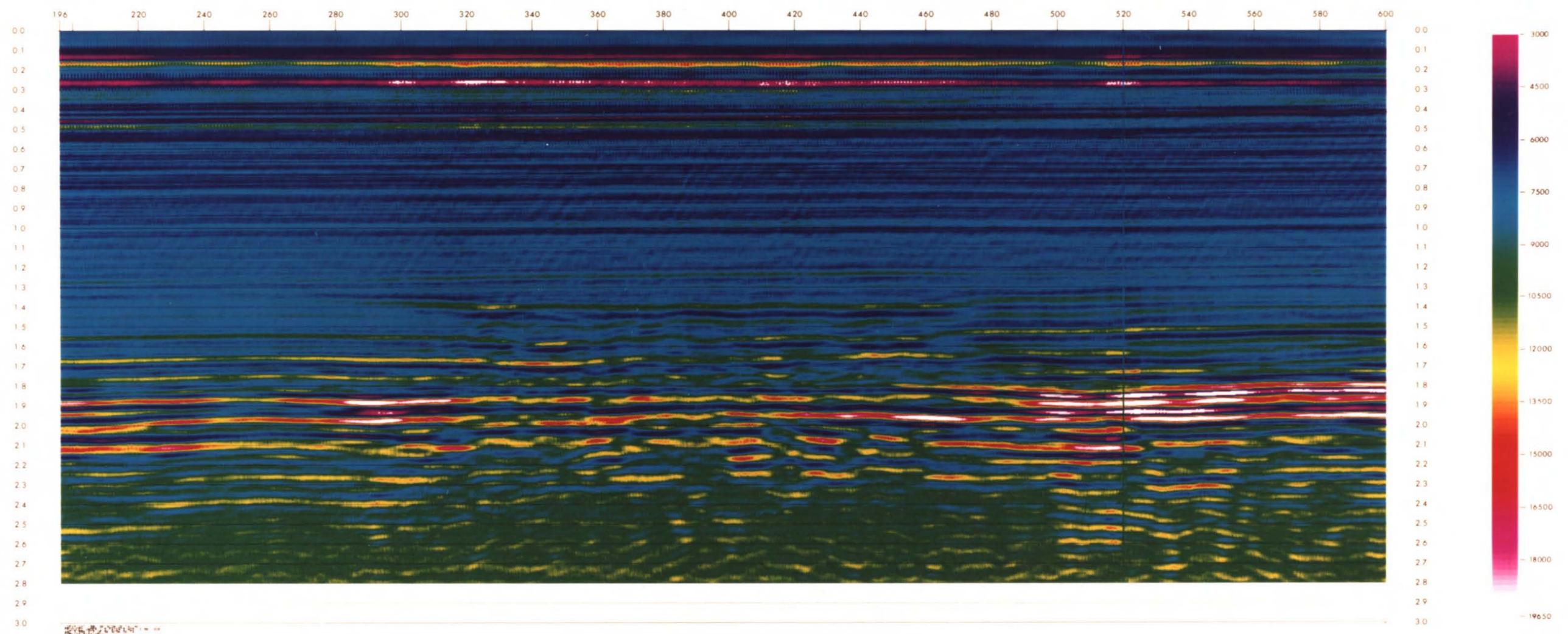
202104



Seiscom Delta
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: INSTANTANEOUS VELOCITY
Client: WEAVER OIL & GAS CORP.

SQUID PROSPECT

SEISCHROME™
DISPLAY
VELOCITY
FT. PER SEC.

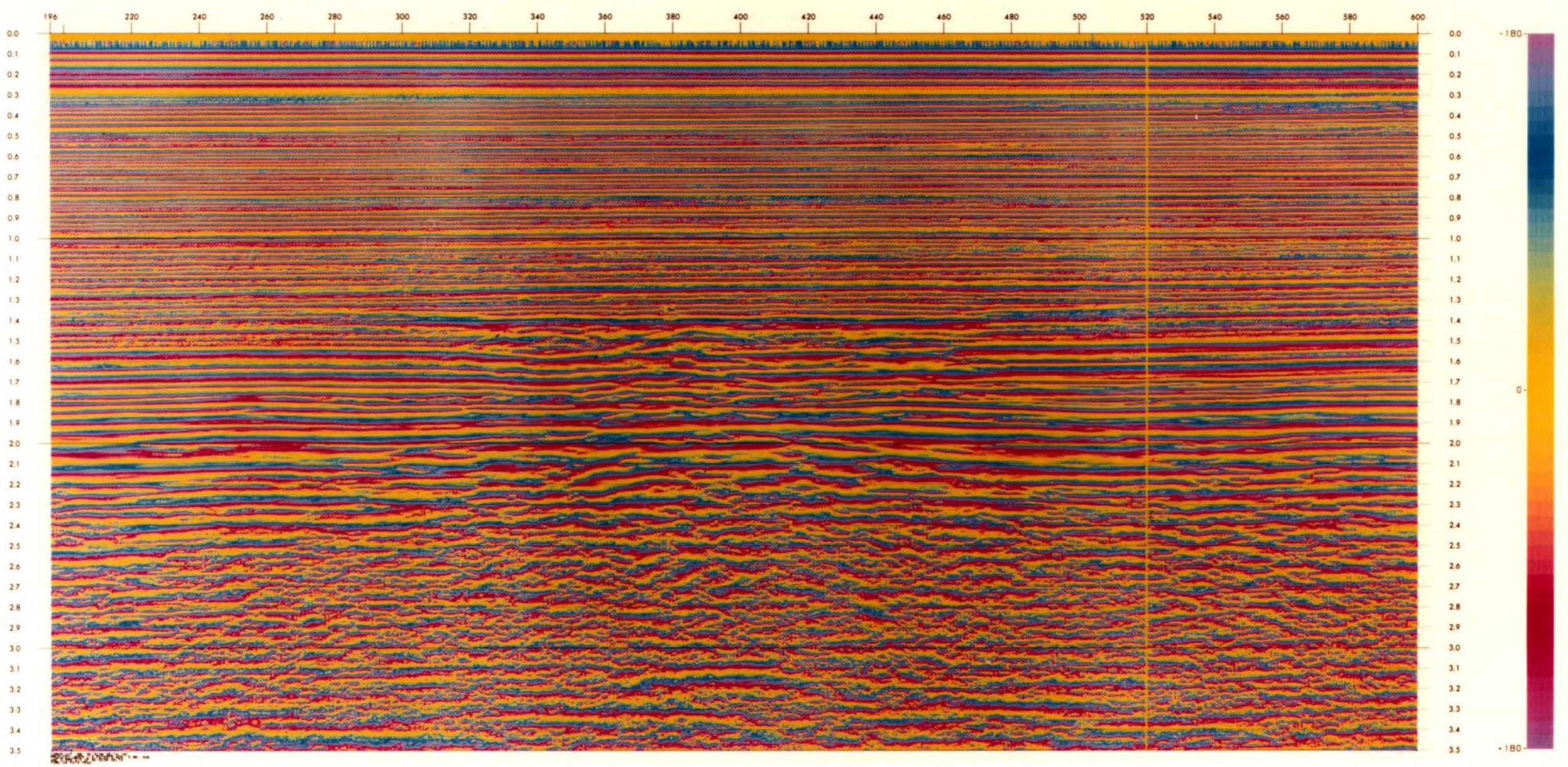


202105

5 cm

Seiscom Delta inc.
Area: BASS BASIN T-15-9
Line: WA 81-1
Display: PHASE
Client: WEAVER OIL & GAS CORP.

SEISCHROME™
DISPLAY
PHASE
DEGREES



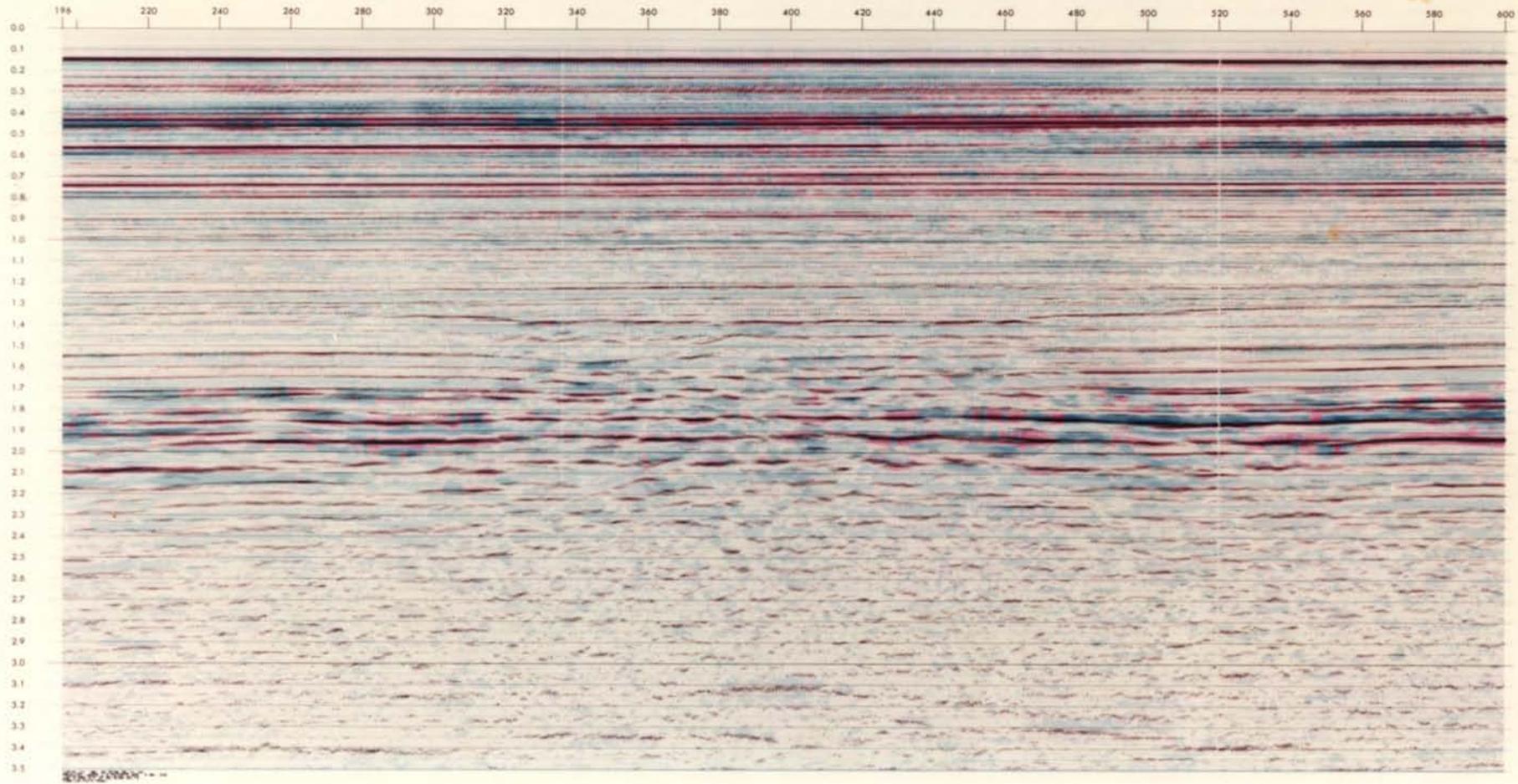
202106

5 cm

SQUID PROSPECT

Seiscom Delta INC.
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: POLARITY
Client: WEAVER OIL & GAS CORP.

DELTA
DISPLAY
POLARITY

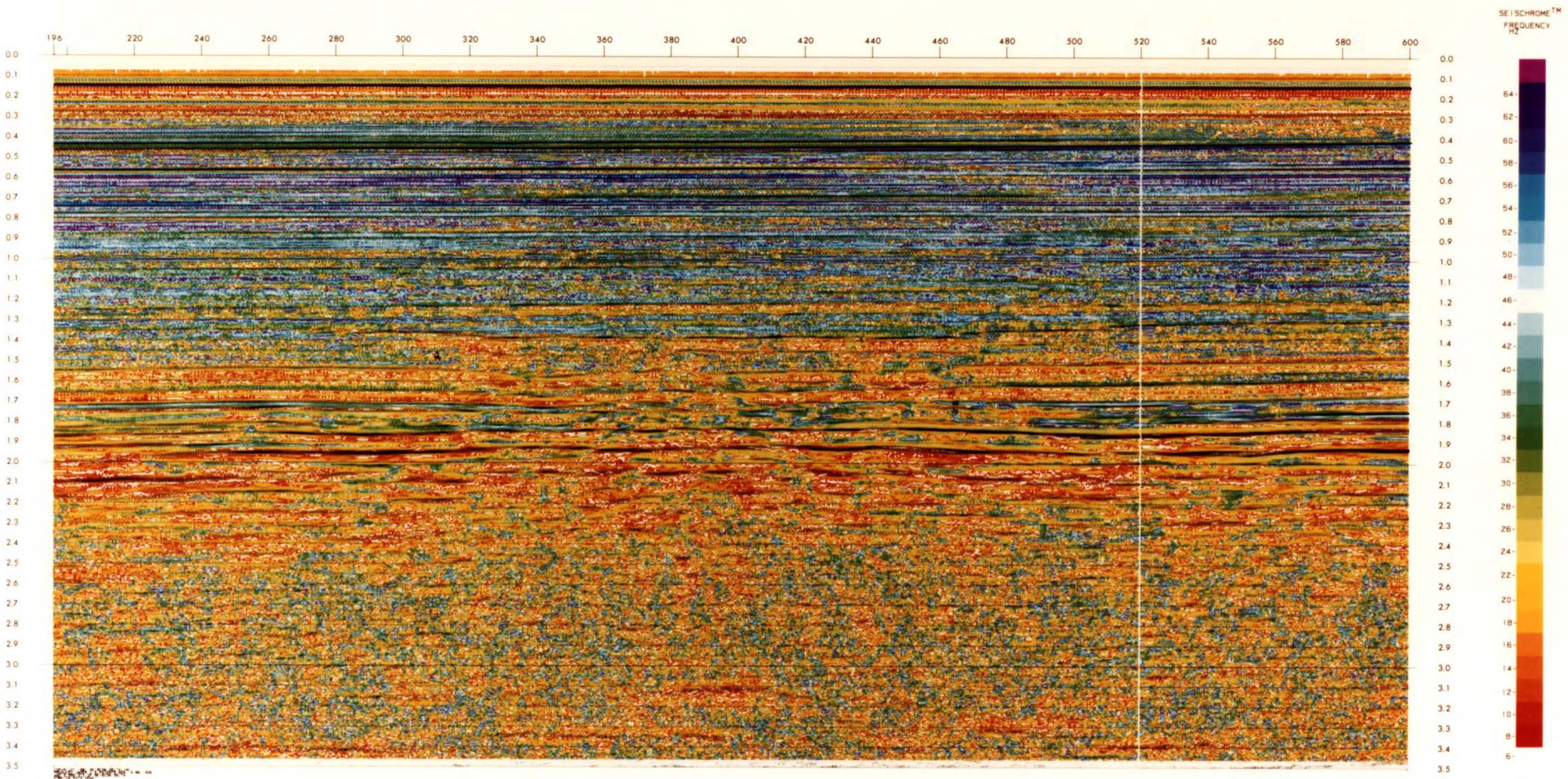


5 cm

202107

Seiscom Delta Inc.
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: INSTANTANEOUS FREQUENCY
Client: WEAVER OIL & GAS CORP.

SQUID PROSPECT



SECTION IV_bSynthetic Seismograms:

Introduction

80

- Plate 16/17/18 Synthetic Seismogram - Bass #2
- Plate 19/20/21 Synthetic Seismogram - Konkon #1
- Plate 22/23/24 Synthetic Seismogram - Durroon #1
- Plate 25/26/27 Synthetic Seismogram - Cormorant #1
- Plate 28/29/30 Synthetic Seismogram - Pelican #1

SYNTHETIC SEISMOGRAMS

Introduction

Sonic logs acquired of the Bass #2, Comorant #1, Durroon #1, Pelican #1 and Konkon #1 wells were sent to Geoscience Technology Services Corporation for editing and digitization. Within the Eastern View Coal Measures care had to be taken to edit the sharp spikes created by the individual coal beds, otherwise a high amplitude event would have been produced thereby effectively masking the immediate underlying reflectors, as the synthetic process requires a short recovery period. A series of synthetic seismograms were then produced from the calculated reflection coefficients by convolving the latter with Ricker wavelets of 20 hz, 30 hz and 40 hz respectively. Formation tops and ages were then plotted on the display for ease in reflector identifications. They were then displayed on a vertical scale of 3.75 inches/second, comparable to the seismic sections on hand. In general, the 40 hz seismogram correlated more favorably with the seismic data which intersected the individual wells.

The units most easily correlated were the Oligocene/Eocene Shale contact and the Eocene Shale/Eastern View Coal Measures contact. All of the wells except Durroon #1 correlated favorably, the Eocene Shale providing an excellent marker along with the Eastern View Coal Measures. Where igneous rocks were encountered (Bass #2, Konkon #1, Durroon #1) a seismic event corresponding to the high increase in interval velocity was produced, amplitudes varying with each type of igneous rocks, particularly at the Durroon #1 well where basalts were encountered at the top of Lower Cretaceous.

In general, Synthetic Seismograms were a great aid in correlating seismic events throughout the section. They were especially helpful in identifying reflectors beneath the Eastern View Coal Measures which produced a series of multiples which effectively mask the underlying events.

SYNTHETIC SEISMOGRAM

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXPLORATION BASS 2 WILDCAT AUSTRALIA TASMANIA

LOG DATUM = 31

SEISMIC DATUM = 0

COMMENTS

202110

W

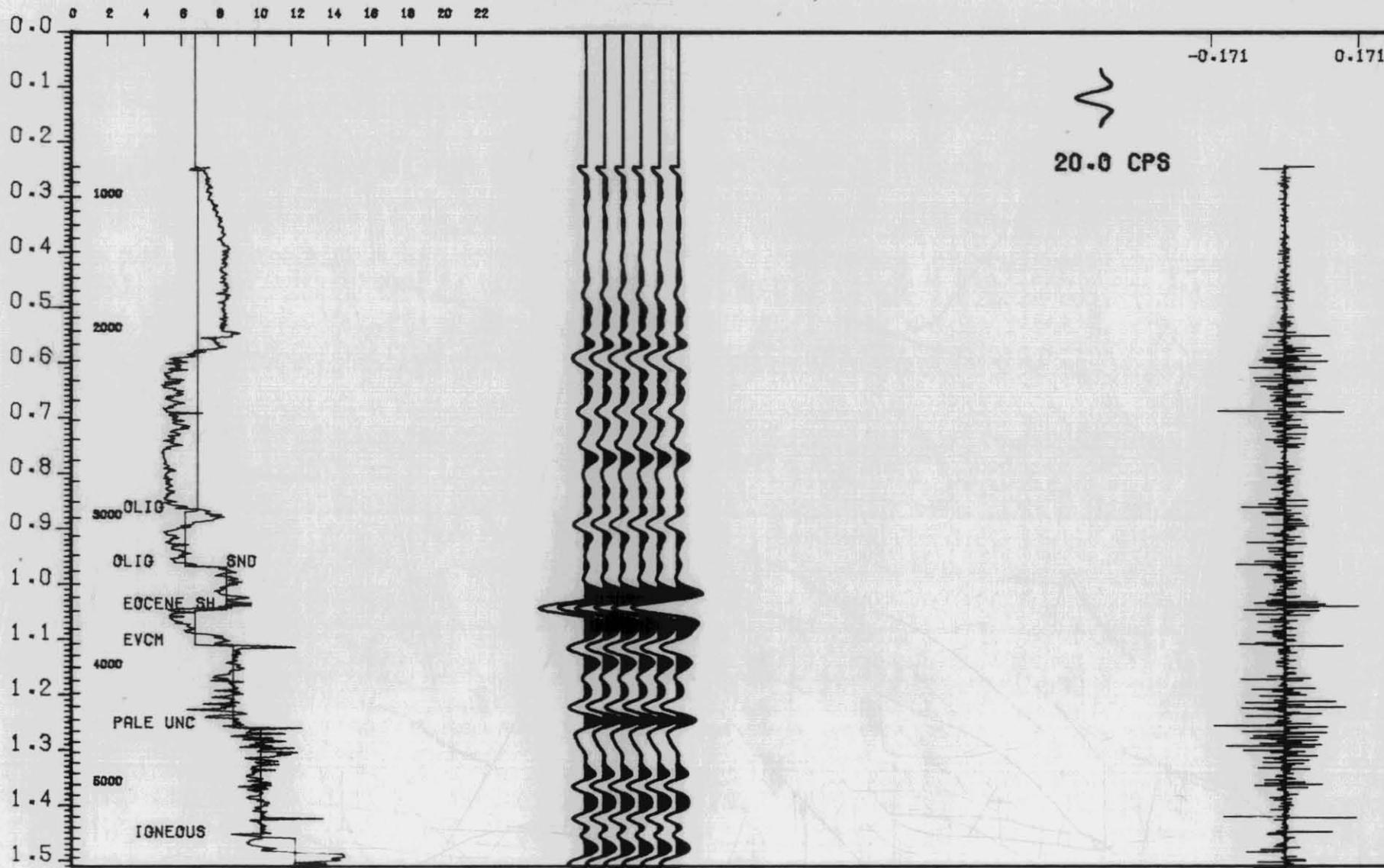
5 cm

PLATE 16

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM

GTS CORP.

HOUSTON OFFICE 3724 DACOMA, 77018

ESSO EXPLORATION BASS 2 WILDCAT AUSTRALIA TASMANIA

LOG DATUM = 31

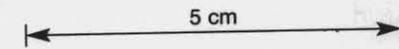
SEISMIC DATUM = 0

COMMENTS

202111

W

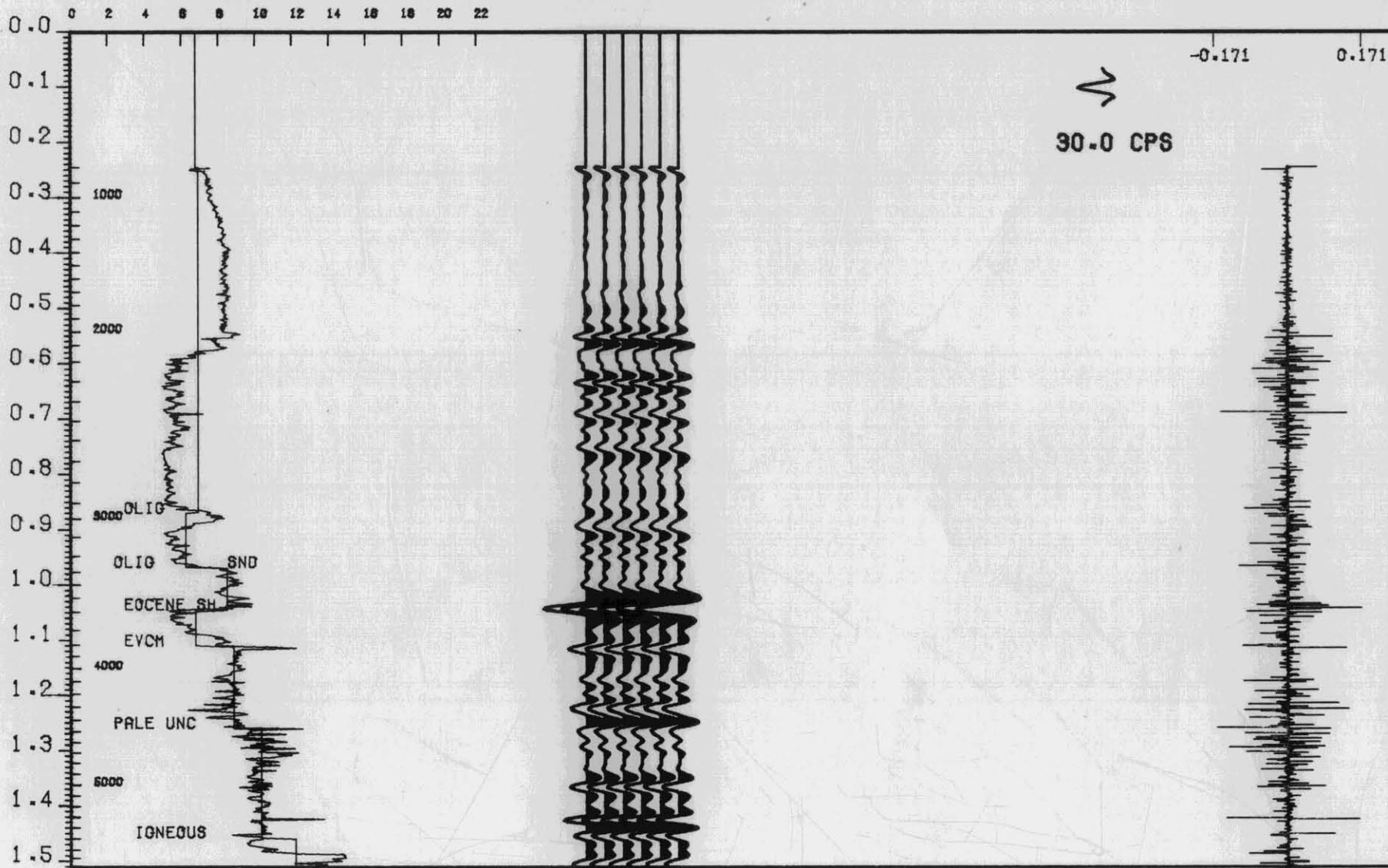
PLATE 17



INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXPLORATION BASS 2 WILDCAT AUSTRALIA TASMANIA

202112

M

LOG DATUM = 31

SEISMIC DATUM = 0

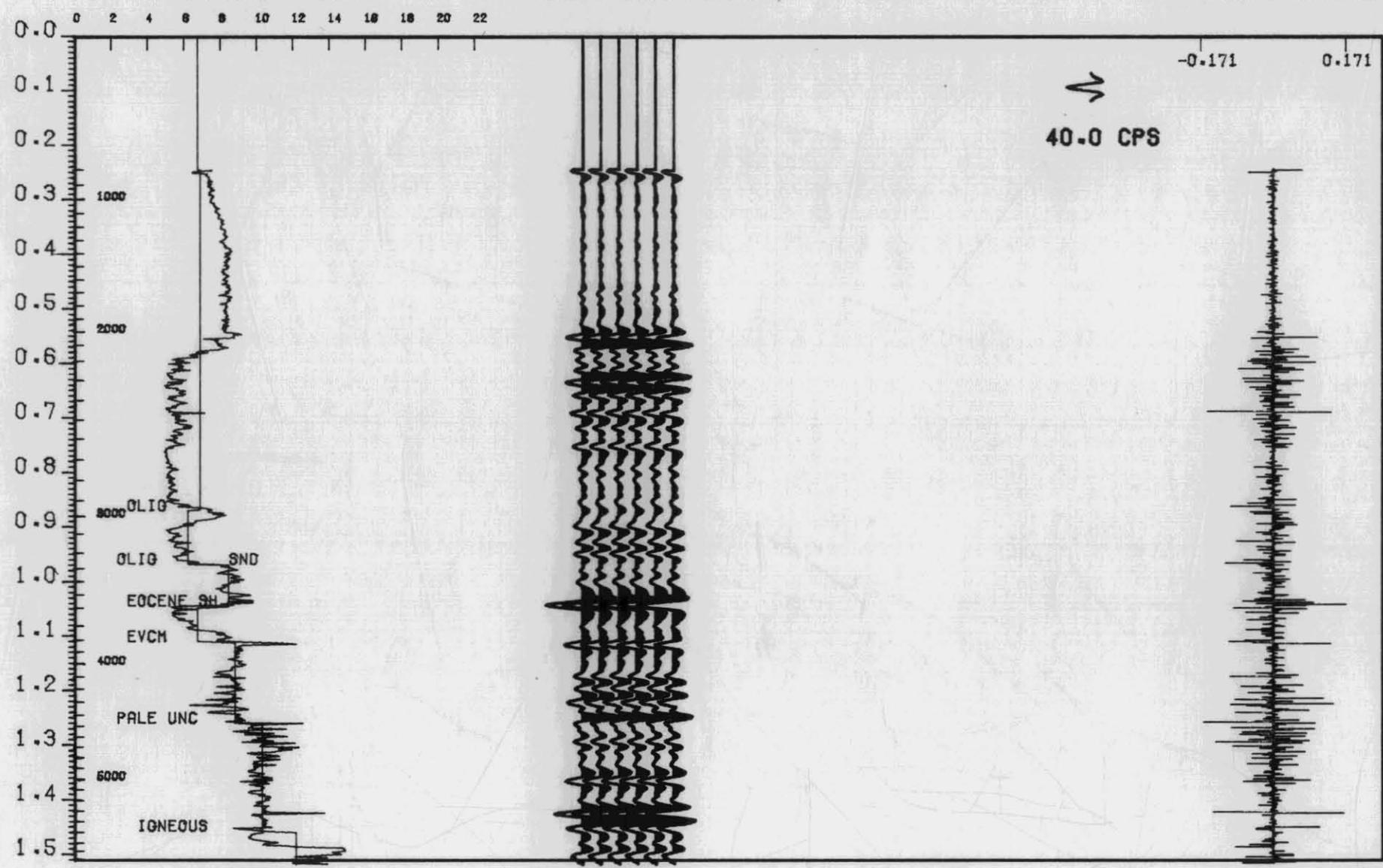
COMMENTS _____

PLATE 18

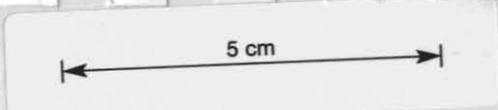
INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM



GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

PLATE 19

ESSO AUSTRALIA LTD. KONKON 1 WILDCAT AUSTRALIA TASMANIA

LOG DATUM = 32

SEISMIC DATUM = 0

COMMENTS

202113

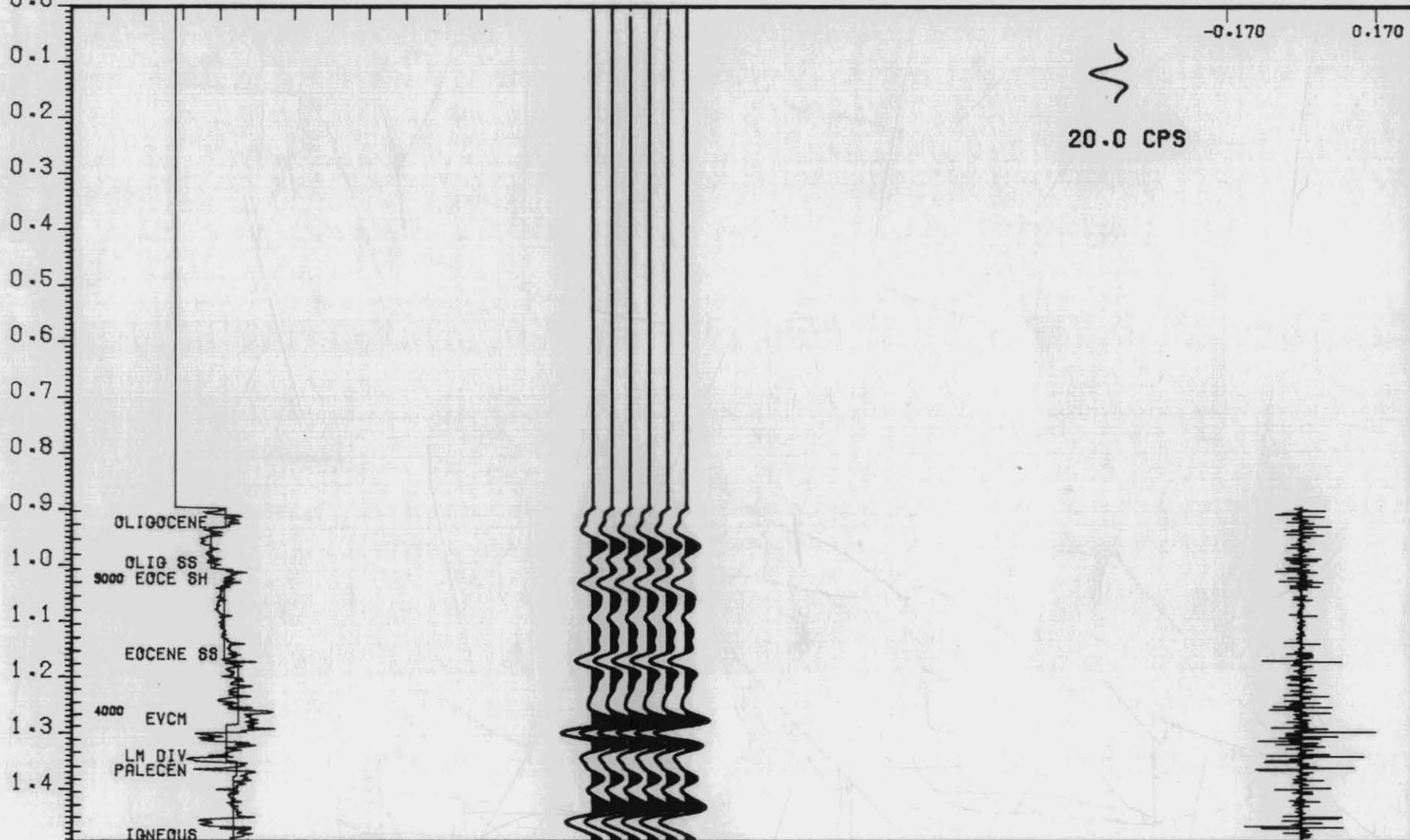
N

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS

0.0 0 2 4 6 8 10 12 14 16 18 20 22



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO AUSTRALIA LTD. KONKON 1 WILDCAT AUSTRALIA TASMANIA

202114

W

LOG DATUM = 32

SEISMIC DATUM = 0

COMMENTS

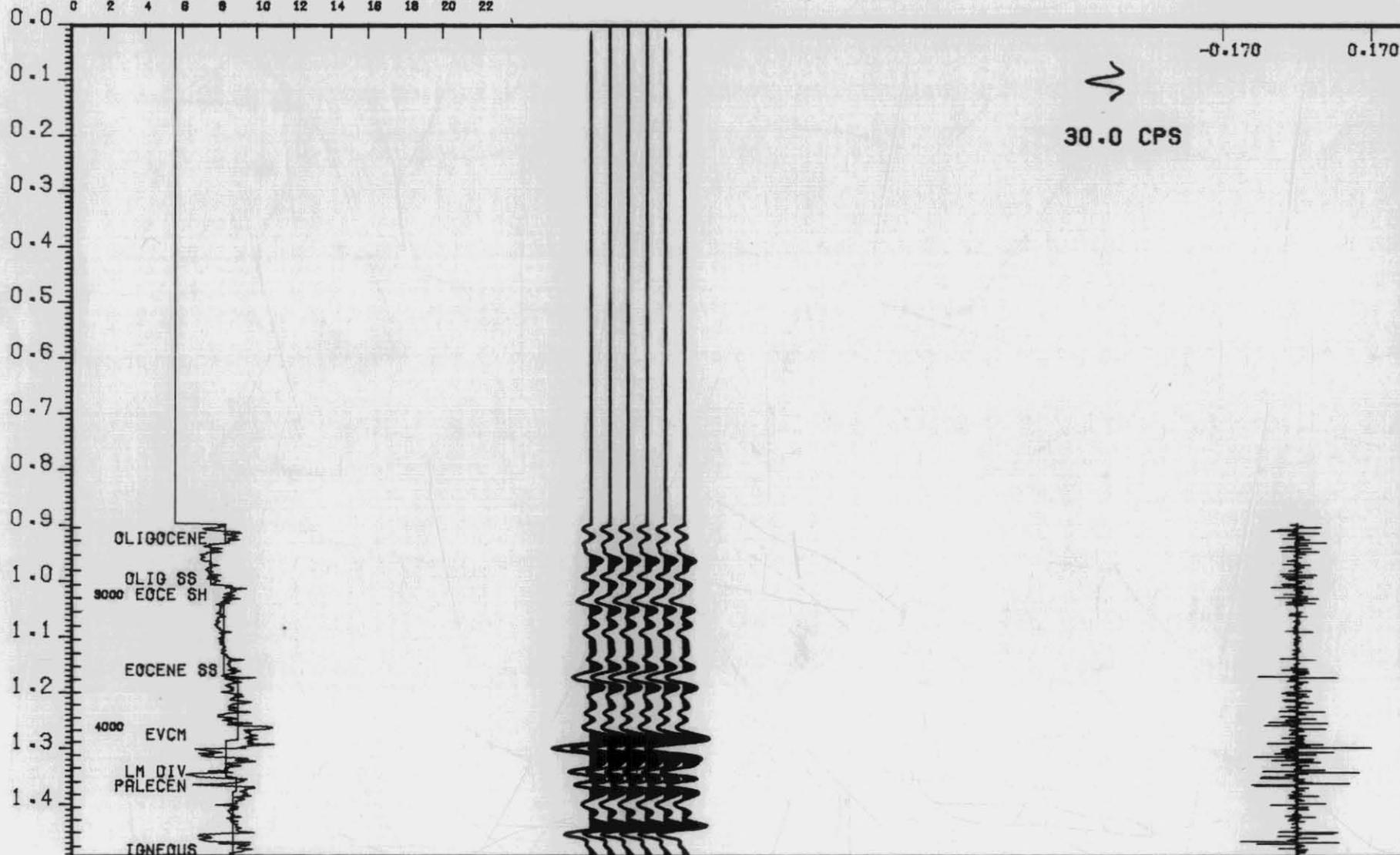
PLATE 20

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS

0 2 4 6 8 10 12 14 16 18 20 22



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO AUSTRALIA LTD. KONKON 1 WILDCAT AUSTRALIA TASMANIA

N

LOG DATUM = 32

SEISMIC DATUM = 0

COMMENTS

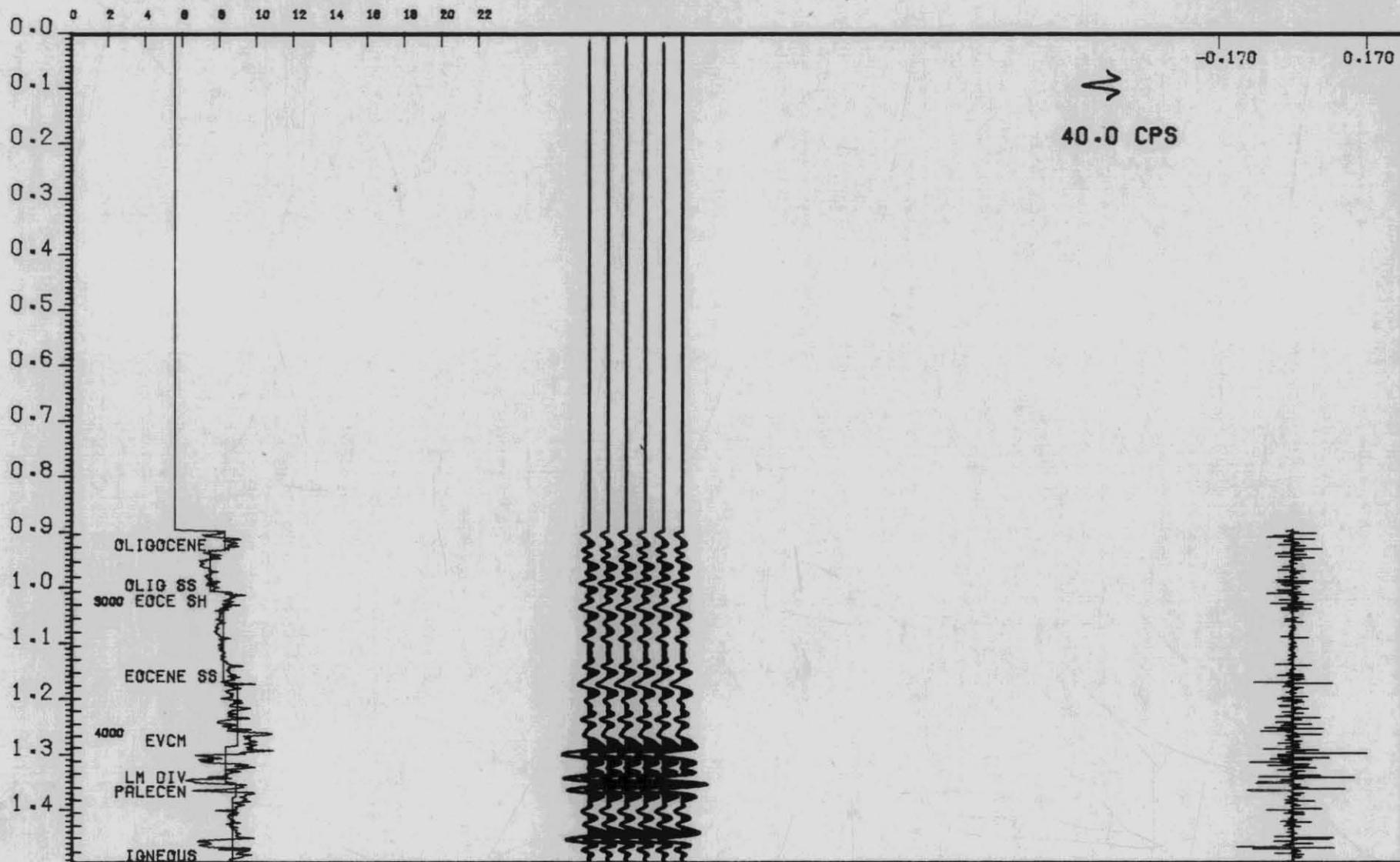
202115

PLATE 21

INTERVAL VELOCITY
FT-SEC x 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



5 cm

202116

SYNTHETIC SEISMOGRAM

GTS CORP. HOUSTON OFFICE 3724 DACOMA 77018

ESSO AUSTRALIA LTD DURROON 1 WILDCAT AUSTRALIA TASMANIA

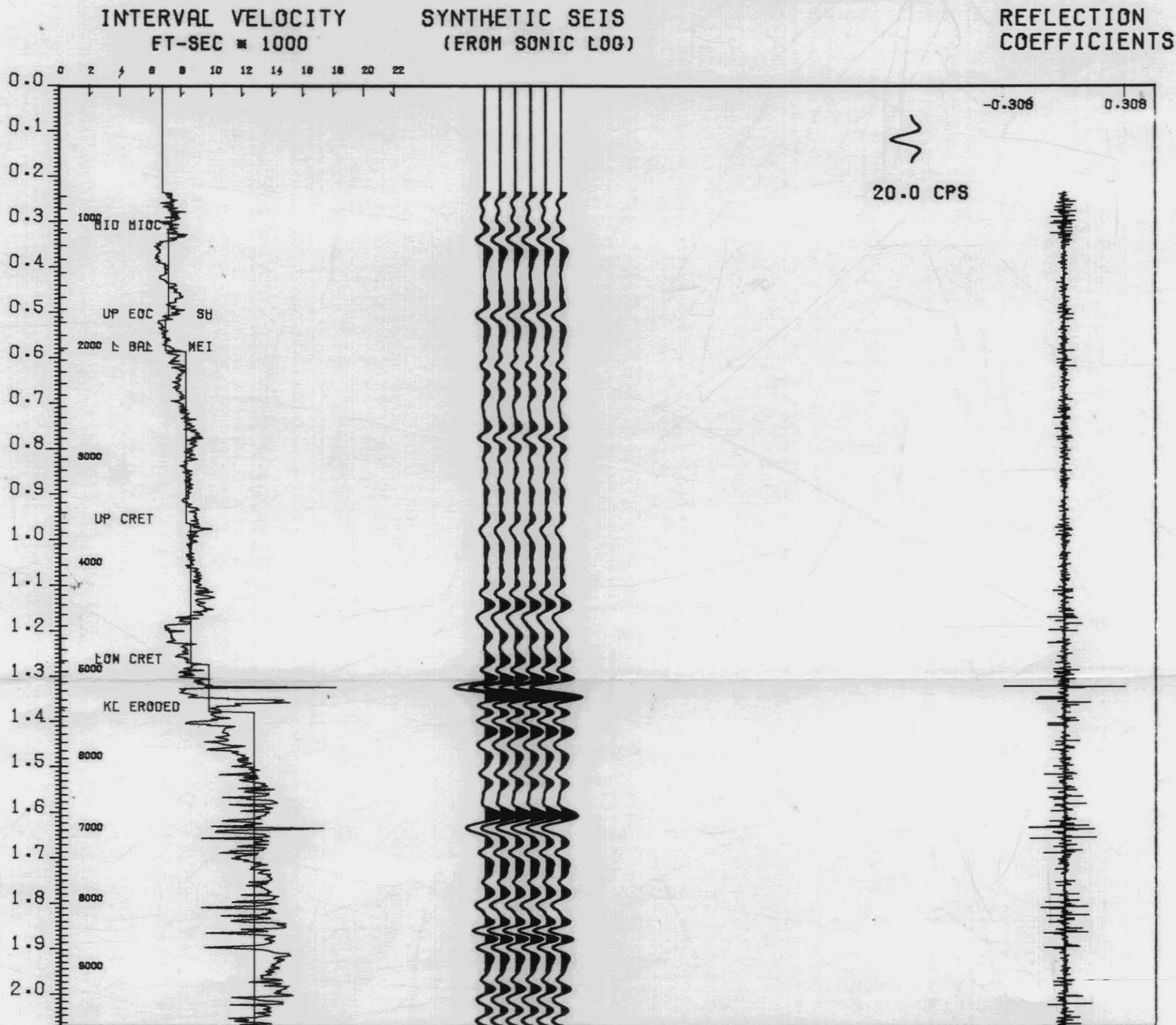
W

LOG DATUM = 32

SEISMIC DATUM = 0

COMMENTS _____

PLATE 22



5 cm

202117

SYNTHETIC SEISMOGRAM

GTS CORP. HOUSTON OFFICE 3724 DACOMA 77018

ESSO AUSTRALIA LTD DURROON 1 WILDCAT AUSTRALIA TASMANIA

W

LOG DATUM = 32

SEISMIC DATUM = 0

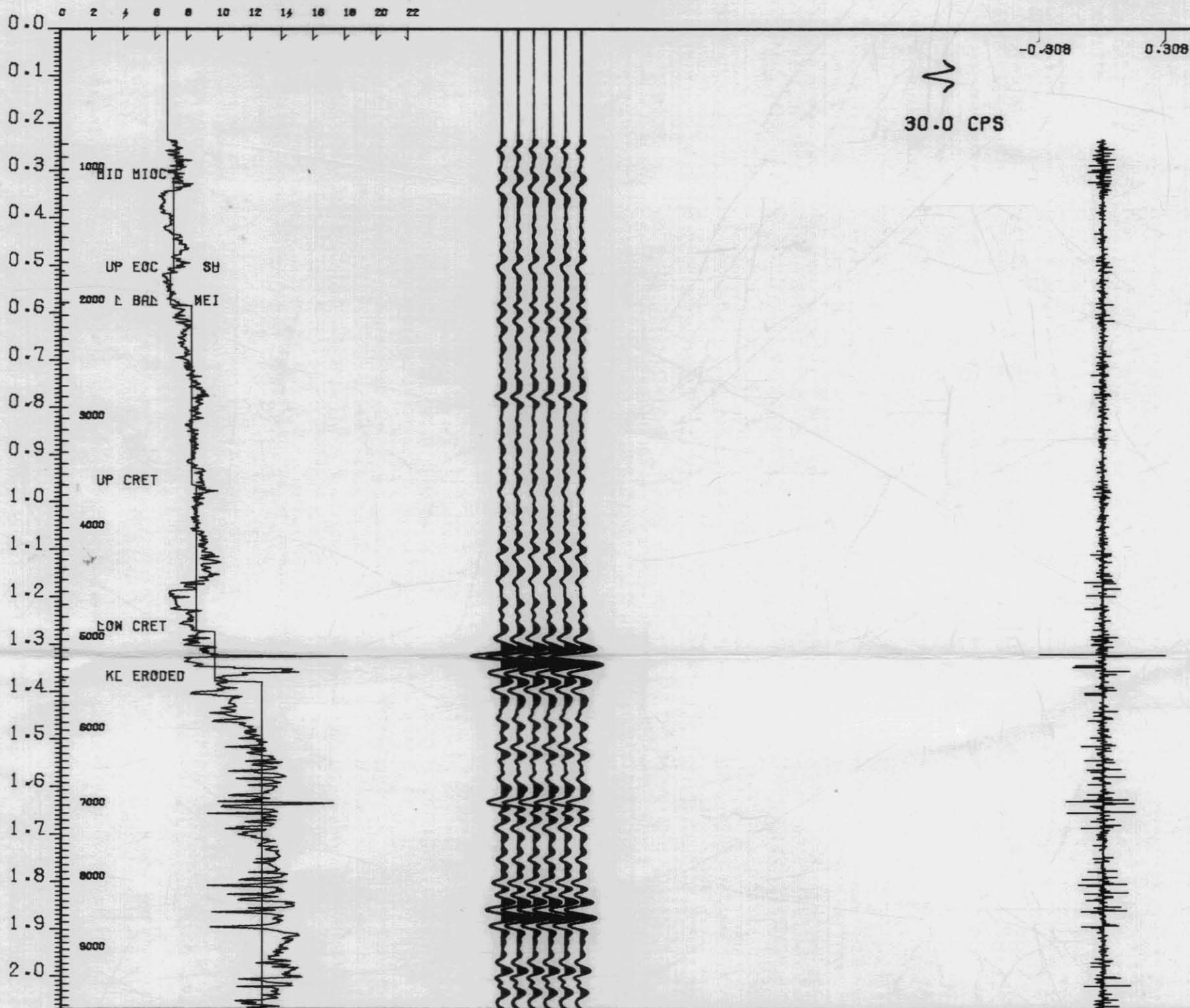
COMMENTS _____

PLATE 23

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



5 cm

202118

SYNTHETIC SEISMOGRAM

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO AUSTRALIA LTD DURROON 1 WILDCAT AUSTRALIA TASMANIA

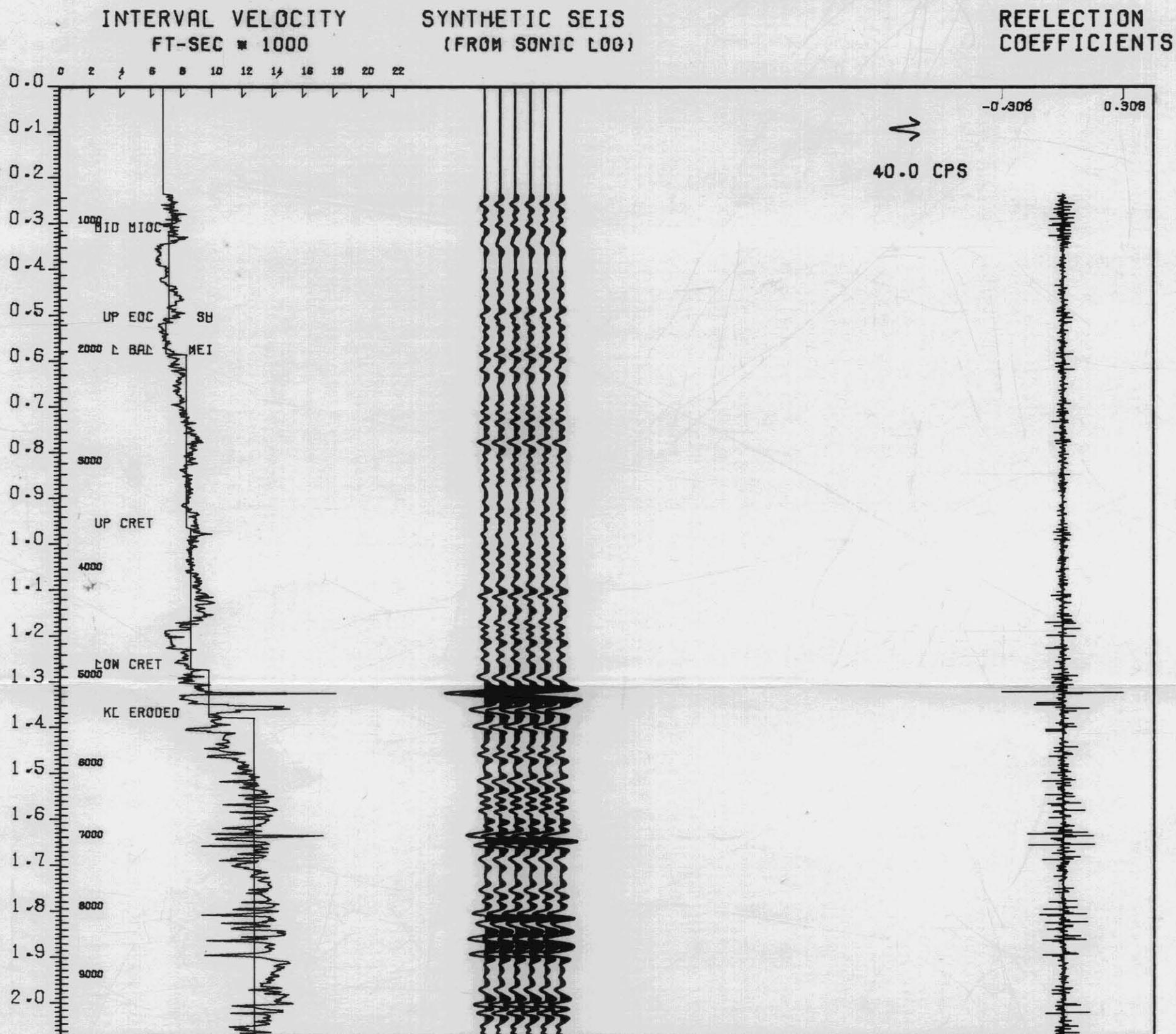
W

LOG DATUM = 32

SEISMIC DATUM = 0

COMMENTS _____

PLATE 24



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

202119 W

ESSO EXP 4 PROD AUSTRALIA INC CORMORANT 1 AUSTRALIA TASMANIA

LOG DATUM = 100

SEISMIC DATUM = 0

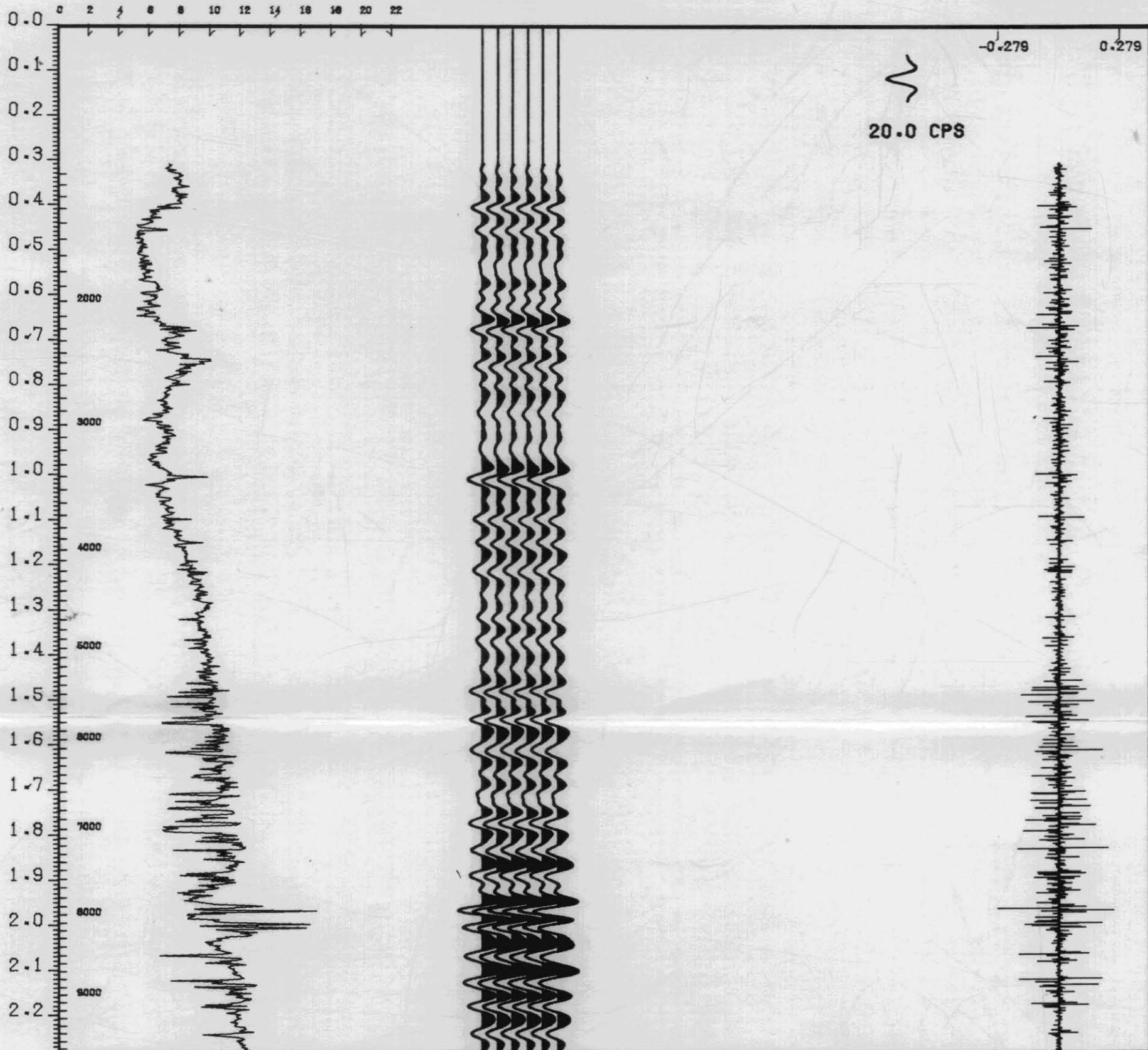
COMMENTS _____

PLATE 25

INTERVAL VELOCITY
FT-SEC $\times 1000$

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXP & PROD AUSTRALIA INC CORMORANT 1 AUSTRALIA TASMANIA

LOG DATUM = 100

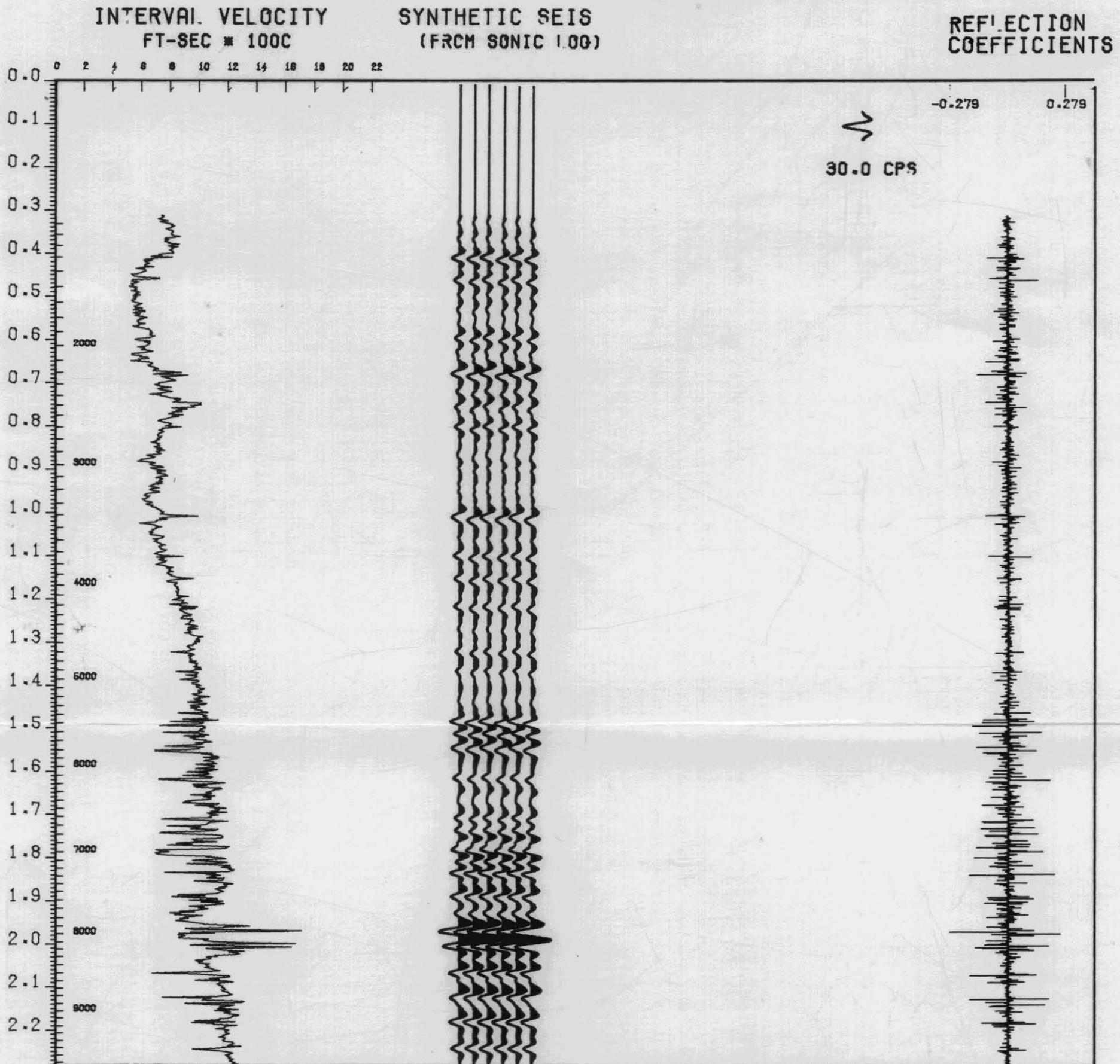
SEISMIC DATUM = 0

COMMENTS _____

202120^M

5 cm

PLATE 26



SYNTHETIC SEISMOGRAM

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXP & PROD AUSTRALIA INC CORPORANT 1 AUSTRALIA TASMANIA

202121 W

LOG DATUM = 100

SEISMIC DATUM = 0

COMMENTS _____

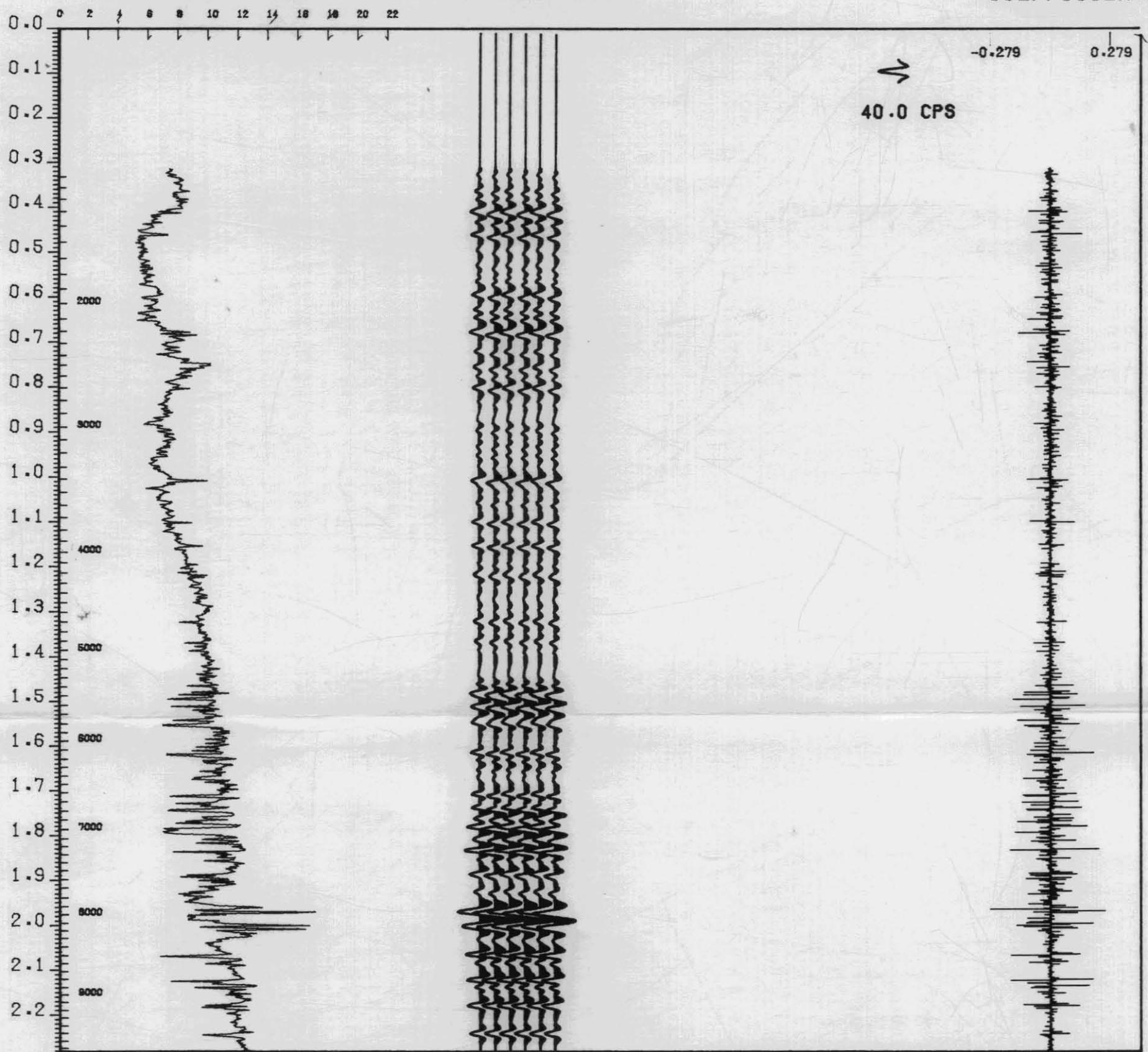
5 cm

PLATE 27

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

202122

ESSO EXPL & PROD AUSTRALIA INC PELICAN #1 WILDCAT AUSTRALIA TASMANIA

W

LOG DATUM = 100

SEISMIC DATUM = 0

COMMENTS _____

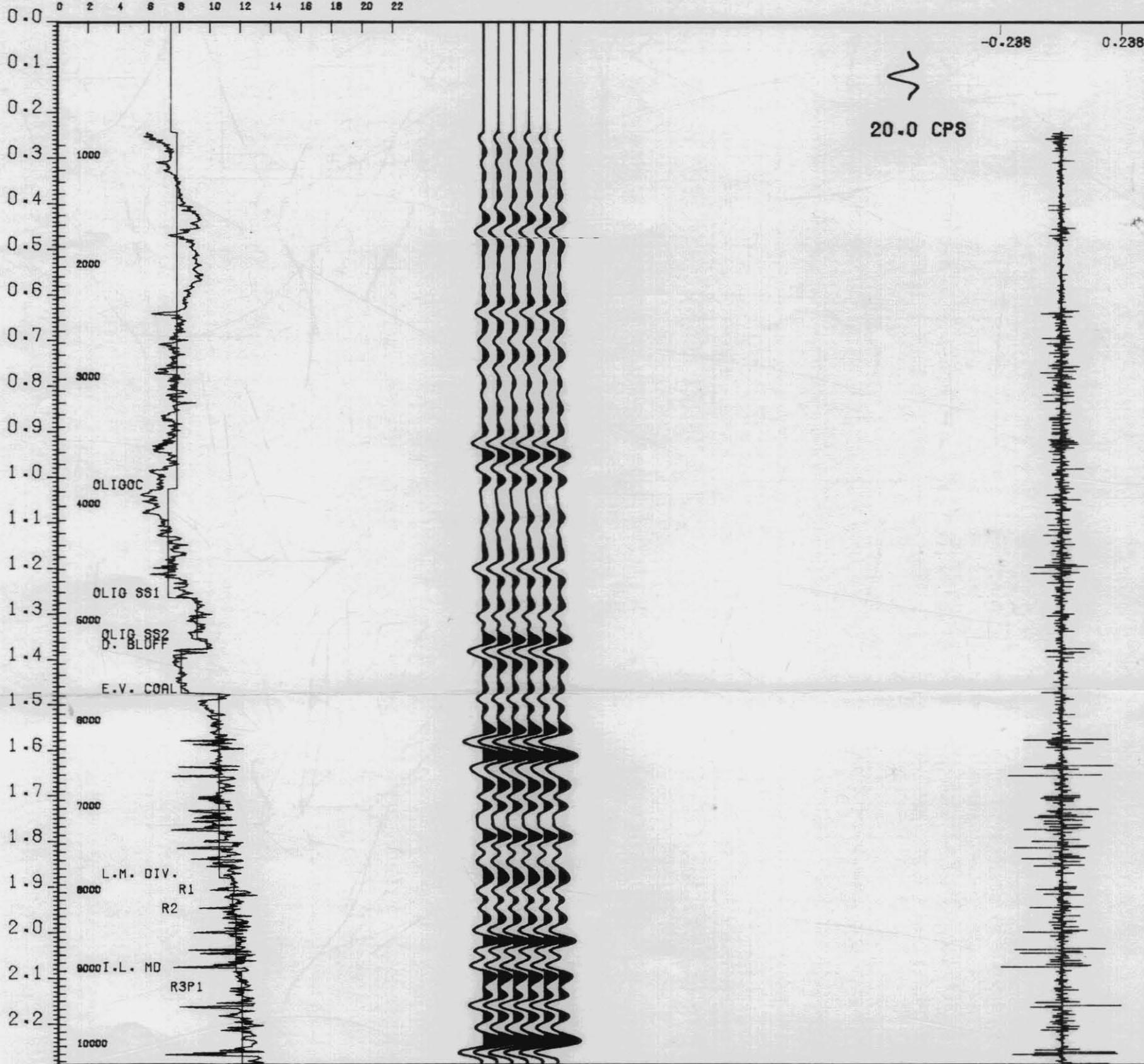
PLATE 28

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

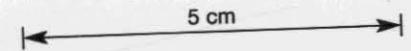
REFLECTION
COEFFICIENTS

0 2 4 6 8 10 12 14 16 18 20 22



202123

SYNTHETIC SEISMOGRAM



GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXPL & PROD AUSTRALIA INC PELICAN #1 WILDCAT AUSTRALIA TASMANIA W

LOG DATUM = 100

SEISMIC DATUM = 0

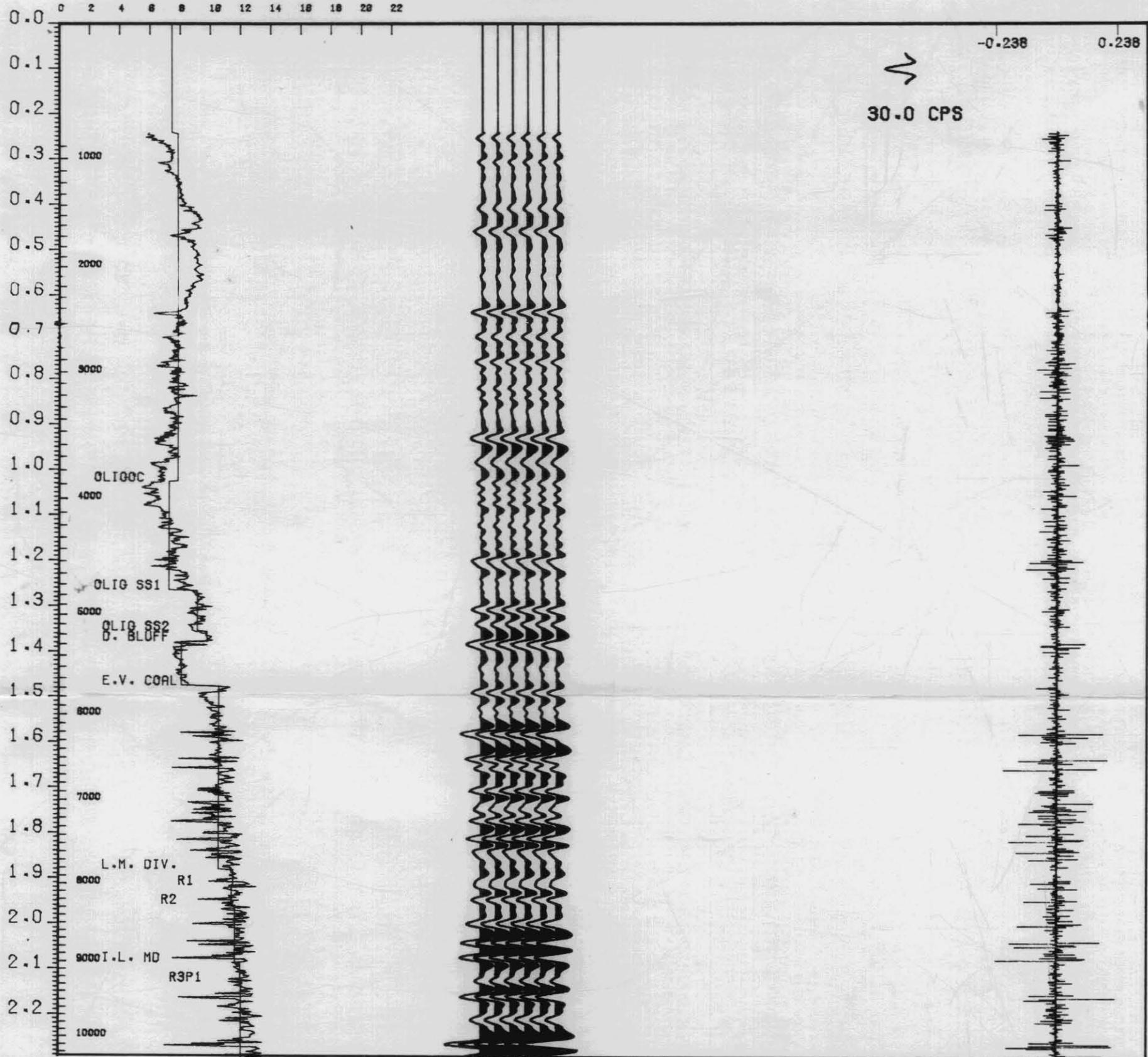
COMMENTS _____

PLATE 29

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SYNTHETIC SEISMOGRAM

5 cm

GTS CORP.

HOUSTON OFFICE 3724 DACOMA 77018

ESSO EXPL & PROD AUSTRALIA INC PELICAN #1 WILDCAT AUSTRALIA TASMANIA W

LOG DATUM = 100

SEISMIC DATUM = 0

COMMENTS

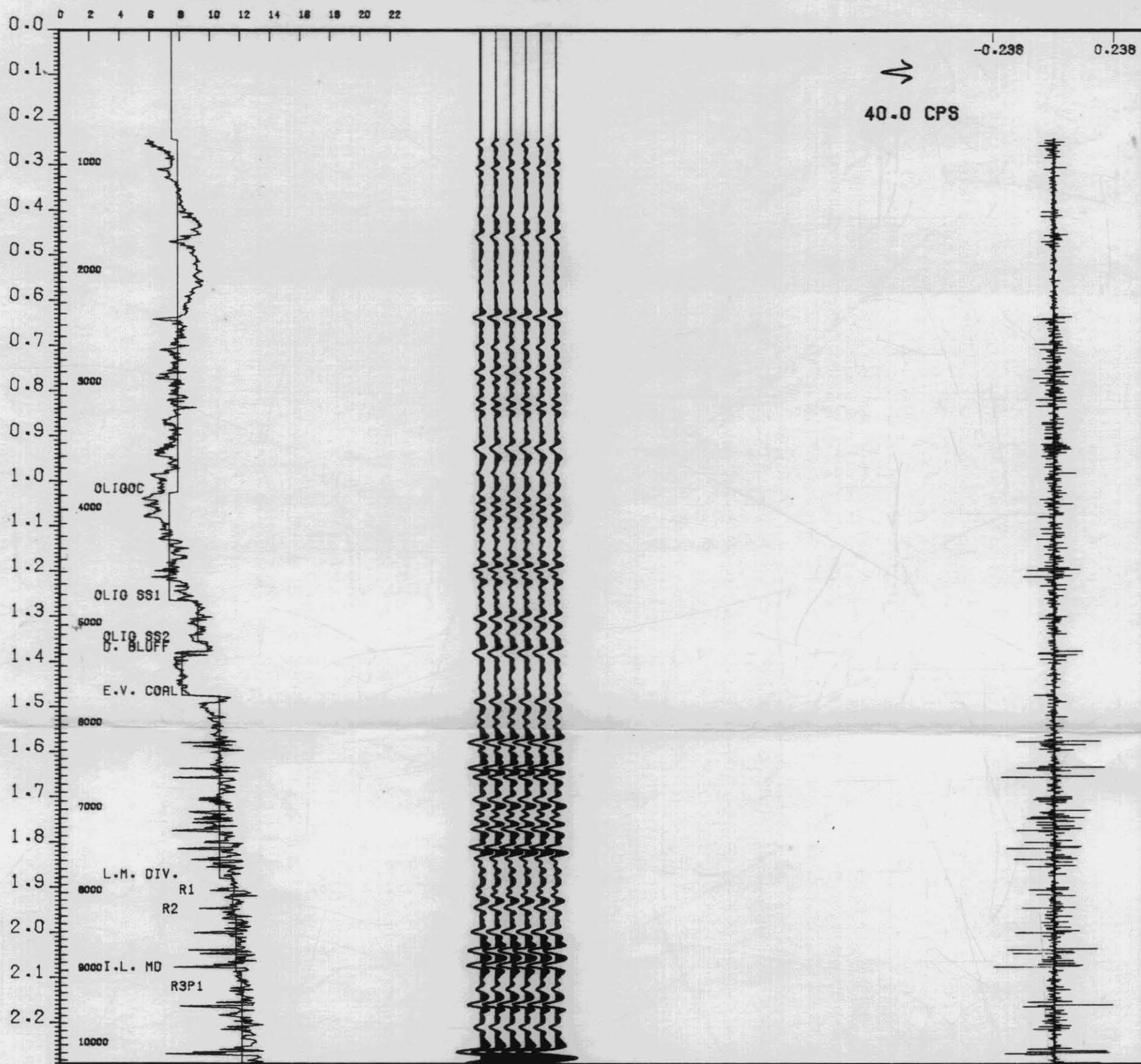
202124

PLATE 30

INTERVAL VELOCITY
FT-SEC * 1000

SYNTHETIC SEIS
(FROM SONIC LOG)

REFLECTION
COEFFICIENTS



SECTION IV_c

GRAVITY/MAGNETIC DATA PROCESSING

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Final Adjustment and Contouring of Maps	84
Final Profiles and Contour Maps	85
Gravity and Magnetic Contour Maps	85
Final Profiles	85

202126

GRAVITY/MAGNETIC DATA PROCESSING

IN

OFFSHORE TASMANIA
SQUID AREA

FOR

WEAVER OIL COMPANY

BY

AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA

AUGUST, 1981

THE GRAVITY MAGNETIC SURVEY

The gravity/magnetic field survey was performed between March 16, 1981 and April 2, 1981, in conjunction with a seismic survey by party 86 on the M.V. Western Odyssey. The gravity meter used was LaCoste and Romberg S-88, which has a constant of 0.09961 milligals per counter division. All data was simultaneously recorded on analog strip charts and magnetic tape.

The in port reading for meter S-88 was made at Portland, Australia and a base value of 980025.53 was used.

The sea bottom density used on this survey was 2.2 grams per cubic centimeter.

Latitude correction was applied as computed by the gravity formula for the geodetic reference system, 1967 (GFGRS, 1967).

Navigation was by Western Navigation using (phase 4) navigation system.

PROCESSING OF GRAVITY/MAGNETIC DATA

Aero Service uses a versatile suite of computer programs in processing, profiling, and contouring of gravity and magnetic data. These programs use the same "GMI Intermediate Tape Format" for interactive utility, and are organized logically to form a truly interrelated gravity/magnetic data base system.

Reformat of Navigation Edit Tape

The navigation reformat program is run to change the tape format of the navigation edit tape to the gravity/magnetic intermediate (GMI) format.

Gravity/Magnetic Edit

The program is designed to edit gravity/magnetic field data recorded at irregular time intervals on GMI tape. Primary edit capabilities include assigning line numbers, changing GMI word position,

step back adjustment for time lags in recording, subsampling or averaging data to one minute time interval, converting of water depth units, and flagging of discontinuities in the data.

Evaluation of Field Data

At this point the digitally recorded data is checked with the strip chart data and any difference resolved. It was noted that the gravity meter had malfunctioned on line WB-81-3.

This line was deleted from the GMI tape and not used in any adjustment.

Navigation Reformat

In this program the final navigation tapes are reformatted to the GMI format.

Navigation Merge

Final navigation data, shot points, and line names are merged with the gravity and magnetics. At the same time gravity counter units are reduced to milligals using the gravity meter constant. Latitude corrections are also made at this time and any discontinuities in navigation are flagged.

"Eotvos" Effect Removal

The GMI tape is read using latitude, longitude, and time in order to compute raw Eotvos correction. The Eotvos corrections are filtered by a running average of the sample under consideration and one sample on each side. Then a parabolic recursive filter with a frequency of 0.000700 hz is applied. At this point the Eotvos correction, $7.503 \text{ V} \cos(\text{Latitude}) \times \sin(\text{Course}) + .004154 \text{ V}^2$, is added to each free air gravity sample on the output tape.

Magnetics Reduction

This program computes and subtracts the Earth's main magnetic field (IGRF) from the observed data. Computation variables include the prospect's location and Julian date of the prospect's survey. Upon completion, the data is then output onto a GMI tape.

Gravity and Magnetics Filter

Data in the form of an evenly spaced time series is smoothed using a recursive parabolic algorithm, this algorithm is used in parallel and cascade in such a way to yield a zero phase, very flat response, low pass filter. The cut-off value used for the free air gravity data was 0.0007 Hz. and the cut-off value used for the magnetic data was .0007 Hz.

Bouguer and Terrain Correction

The water depths on tape were used to compute Bouguer and terrain correction, which were applied to the free air gravity. The terrain corrections were two-dimensional and were computed by the Talwani and Ewing method.

Intersection Calculator

Using the latitude and longitude of one minute samples on the GMI tape, the line segments are scanned to determine the location of line intersections.

Systematic Error Adjustment

Intersection mistie information is taken from the output tape of the intersection calculator program and a systematic error adjustment is computed for each line segment, such that the remaining misties are reduced substantially. These adjustments are then added to the selected GMI fields. The average mistie for the free air gravity before adjustment was 1.18 milligals. The average mistie after adjustment was 0.244. The average mistie before adjustment for the total magnetic field was 9.67 gammas; the average mistie after was 3.28 gammas.

Gravity/Magnetic Profile

The profile program is a general purpose program that produces a profile plot on a Cal-Comp drum plotter with up to eight fields displayed simultaneously with a variety of scale options. There were two sets of profiles made at this time. Gravity profiles displayed water depths, " " correction, free air, and Bouguer gravity.

Map Maker

A GMI tape is input to the map maker program and produces a value posted shot point map on any scale, using almost any type of prescribed projection or spheroid.

Final Adjustment and Contouring of Maps

The remaining misties, called random error, are then resolved by a technician comparing parallel and perpendicular profiles and distributing the misties in such a way that no legitimate anomaly is destroyed nor created; then from the corrected profiles the maps are manually contoured.

FINAL PROFILES AND CONTOUR MAPSGravity and Magnetic Contour Maps

The maps are plotted on mylar at a scale of 1:100,000. The spheroid used was Australian National with the projection being Universal Transverse Mercator. The central meridian is 147 E. The maps are bounded on the South by latitude $40^{\circ} 24'S$, on the North by latitude $39^{\circ} 55'S$ and extends eastward from longitude $145^{\circ} 45'E$ to longitude $147^{\circ} 00'E$.

The contour interval for the Bouguer gravity maps is 1 milligal and for the total magnetic intensity map is 10 gammas.

Final Profiles

Final profiles are 10 inches wide plotted on graded paper at a horizontal scale of 2540 meters per inch corresponding to contour maps. In addition, another set of profiles were produced on 10 grided paper at a horizontal scale of 400 meters per inch matching the seismic sections. The fields and vertical scales of both sets of profiles are as follows:

A. Gravity

- (a) Free air gravity, adjusted @ 5 milligals per inch
- (b) Bouguer gravity @ 5 milligals per inch
- (c) Eotvos correction @ 5 milligals per inch
- (d) Water depths @ 100 meters per inch

B. Magnetics

- (a) Raw magnetics @ 20 gammas per inch
- (b) Total magnetic intensity @ 20 gammas per inch.

GRAVITY-MAGNETICS GMI INTERMEDIATE RECORD FORMAT

WORD	FORMAT	DESCRIPTION
1	I*4	Line Number
2	I*4	Julian Date
3	I*4	Greenwich Mean Time (HHMMSS)
4	I*4	Accumulated Time (seconds)
5	R*4	Shotpoint Number
6	A*4	Re-Shot Characters or 'INT '
7	R*4	Accumulated Distance (meters)
8	R*4	Water Depth (meters) or elevation
9	R*4	Latitude (degrees)
10	R*4	Longitude (degrees)
11	R*4	Northing - Y (meters)
12	R*4	Easting - X (meters)
13	A*4	Line Name (1st 4 characters)
14	A*4	Line Name (2nd 4 characters)
15	A*4	Area Name (4 characters)
16	R*4	Magnetics, Field Master
17	R*4	Magnetics, Field Slave
18	R*4	Magnetics, Gradient
19	R*4	Magnetics, Accumulated Gradient Field
20	R*4	
21	R*4	
22	R*4	
23	I*4	
24	R*4	Instrument-Corrected Gravity (Mgals)
25	I*4	Gravity Counter Units
26	R*4	Gravity Corrected for Monitors (Mgals)
27	R*4	Eotvos Correction (Mgals)
28	R*4	Slab Bouguer Gravity (Unfiltered) (Mgals)
29	R*4	Free Air Gravity before Eotvos (Mgals)
30	R*4	System Adj. Bouguer (Mgals)
31	R*4	Final Random Adj. Bouguer (Mgals)
32	R*4	Free Air Gravity (Mgals)
33	R*4	2-D Terrain Correction (Mgals)
34	R*4	Tide Correction (Mgals)
35	I*4	Magnetics, Field Master (gammas)
36	R*4	Magnetics, Diurnal & Regional Removed (gammas)
37	R*4	Magnetics, Regional Correction (gammas)
38	R*4	Magnetics, Diurnal Correction (gammas)
39	R*4	Magnetics, Filtered (gammas)
40	R*4	Magnetics, Systematic Adjusted (gammas)
41	R*4	Magnetics, Random Adjusted (gammas)
42	R*4	Tide (meters)
43	I*4	
44	I*4	
45	R*4	Slab Bouguer Correction (Mgals)
46	R*4	2-D Bouguer Gravity (Filtered)
47	R*4	
48	R*4	
49	R*4	Adjusted Water Depths (Meters)
50	R*4	Filtered Free Air Gravity (Mgals)
51	R*4	3-D Bouguer Correction (Mgals)
52	R*4	3-D Bouguer Gravity (Unfiltered)
53	R*4	Sysfixed Free Air Gravity (Mgals)
54	R*4	3-D Bouguer Gravity (Filtered)
55	R*4	Free Air Gravity, Random Adjusted (Mgals)
56	R*4	Magnetics, Hilbert Transform
57	R*4	Magnetics, Horizontal Derivative (Gammas)
58	R*4	Magnetics, Vertical Derivative (Gammas)
59	R*4	Magnetics, Reduced to Pole (Gammas)
60	I*4	Sequence Number

60-Word Records, 100 Records (24404 Bytes) per Block, Fortran unformatted.

SECTION V

Interpretation:

General	86
Map Horizons	86
Structural Features of Interest:	86-87
Squid Anomaly	
Chat Anomaly	
Sea Eagle Anomaly	
Curlew Anomaly	
Shearwater Anomaly	

General

The Squid Marine seismic program detailed structural leads developed in preceding surveys, and furnished a fill-in of some wide reconnaissance traverses, thus permitting a more reliable definition of the principal structural and fault trends.

It will be obvious that the interpretation is still incomplete and that some faults can be aligned differently, however, it is doubtful that this incompleteness would significantly affect the evaluation of this area.

A seismic tie between the survey area and the Pelican #1 well has been established. The correlation is somewhat tenuous due to the great distance involved and the significant variations in signal character, nevertheless it does provide some valuable stratigraphic control.

Map Horizons

Semi-continuous reflector horizons have been mapped. These map horizons are within the Oligocene section, within the *M. diversus* assemblage zone of the Eocene, at the Upper Cretaceous reflector level and at an intra-Lower Cretaceous reflector level. Their exact stratigraphic position is not always well known due to the lack of nearby stratigraphic control, as well as the magnitude and relief of the uplifted areas.

Structural Features of Interest

The prominent features have been recognized, partially mapped, and assigned names at this stage of the interpretation.

An area in the northeast portion of Permit T-15/P has been mapped at an intra-Eocene *M. diversus* reflector level. It only shows regional dip interrupted by minor low amplitude anomalies.

Squid Anomaly

The Squid anomaly is a major deep-seated dormal feature well illustrated by the seismic lines of the Squid survey. It is considered prospective at the Oligocene as well as Eocene and deeper levels. The anomaly is adequately defined by existing seismic data.

Chat Anomaly

The Chat anomaly is a relatively small tilted fault block closure controlled by a down-to-the northeast fault. It is best illustrated by the seismic lines of the Squid survey. The anomaly is adequately defined by existing seismic data.

Sea Eagle Anomaly

The Sea Eagle anomaly is a tilted fault block closure controlled by a down-to-the northeast normal fault. It is located in the southeast corner of Permit T-15/P and at this stage is defined by the older seismic data only.

Curlew Anomaly

The Curlew anomaly is also a tilted fault block closure controlled by a down-to-the northeast normal fault. It is located in the southeast corner of Permit T-15/P and at this stage is defined by the older seismic data only.

Shearwater Anomaly

The Shearwater anomaly is also a tilted fault block closure controlled by a down-to-the northeast normal fault. It is located in the southeast corner of Permit T-15/P and at this stage is partially defined by the older seismic data only. Additional seismic data is needed on this anomaly.

SECTION VI

List of Plates

- 1) Location Map
 - 2) Lines Location
 - 3) Vessel and Cable Layout
 - 4) Gun Array Configuration
 - 5) Hydrophone Configuration
 - 6) Group Cable Configuration
 - 7) Main Cable Phase lead, Output
Sensitivity, Frequency Spectrum
 - 8) Recording Diagram
 - 9) Sonar System Diagram
 - 10) Reflection Strength
 - 11) Weighted Frequency
 - 12) Instantaneous Velocity
 - 13) Phase
 - 14) Polarity
 - 15) Instantaneous Frequency
- | | | | |
|-----------|----------------------|---|--------------|
| 16/17/18) | Synthetic Seismogram | - | Bass #2 |
| 19/20/21) | Synthetic Seismogram | - | Konkon #1 |
| 22/21/23) | Synthetic Seismogram | - | Durroon #1 |
| 25/26/27) | Synthetic Seismogram | - | Cormorant #1 |
| 28/29/30) | Synthetic Seismogram | - | Pelican #1 |

SECTION VII

Basic Data Submitted

Velocity Analysis VELAN^R

Time Variant Filtering

MIG, TVF

RAP

Magnetic Intensity and Bouguer

Gravity Profiles

Bouguer Gravity Profile's Showing:

Bouguer Gravity

Adjusted Free Air Gravity

Filtered Eotvos Gravity

Water Depth

Magnetic Profile's Showing:

Total Magnetic Intensity

Raw Magnetics

Bouguer Gravity Map

Depth to Magnetic Basement

Shot Point Location Map

Shot Point Location With Water Depth

Total Magnetic Anomaly Map

Velocity Analysis VELAN^R

Line WB-81-1	Sp 100 - 2435
Line WB-81-2	Sp 100 - 2572
Line WB-81-3	Sp 100 - 2781
Line WB-81-4	Sp 100 - 1650
Line WB-81-5	Sp 100 - 1530
Line WB-81-6	Sp 100 - 1270
Line WB-81-7	Sp 100 - 1472
Line WB-81-8	Sp 100 - 1030
Line WB-81-9	Sp 100 - 1271
Line WB-81-10	Sp 100 - 1272

Time Variant Filtering

Line WB-81-01	Sp 100-880, 920-1720, 1760-2435
Line WB-81-02	Sp 100-880, 920-1720, 1760-2572
Line WB-81-03	Sp 100-880, 920-1720, 1760-2781
Line WB-81-04	Sp 100-880, 920-1650
Line WB-81-05	Sp 100-880, 920-1530
Line WB-81-06	Sp 100-880, 920-1270
Line WB-81-07	Sp 100-880, 920-1472
Line WB-81-08	Sp 100-1030
Line WB-81-09	Sp 100-1271
Line WB-81-10	Sp 100-1272

MIG, TVF

Line WB-81-01 Sp 100-880, 920-1720, 1760-2435
Line WB-81-02 Sp 100-880, 920-1720, 1760-2572
Line WB-81-03 Sp 100-880, 920-1720, 1760-2781
Line WB-81-04 Sp 100-880, 920-1650
Line WB-81-05 Sp 100-880, 920-1530
Line WB-81-06 Sp 100-1270
Line WB-81-07 Sp 100-880, 920-1472
Line WB-81-08 Sp 100-1030
Line WB-81-09 Sp 100-880, 920-1271
Line WB-81-10 Sp 100-1272

RAP

Line WB-81-01 Sp 100-880, 920-1720, 1760-2435
Line WB-81-02 Sp 100-880, 920-1720, 1760-2781
Line WB-81-03 Sp 100-880, 920-1720, 1760-2781
Line WB-81-05 Sp 100-880, 920-1530
Line WB-81-06 Sp 100-1270
Line WB-81-07 Sp 100-880, 920-1472

MAGNETIC INTENSITY (GAMMAS) AND BOUGUER GRAVITY (MGALS) PROFILES

Line WB-81-1 Sp 104-2433
Line WB-81-2 Sp 104-2570
Line WB-81-3 Sp 95-2778

Line WB-81-4	Sp 100-2649
Line WB-81-5	Sp 102-1526
Line WB-81-6	Sp 101-1270
Line WB-81-7	Sp 101-1467
Line WB-81-8	Sp 98-1030
Line WB-81-9	Sp 103-1271
Line WB-81-10	Sp 102-1267

BOUGUER GRAVITY PROFILES SHOWING:

Bouguer Gravity (MGALS)
Adj. Free Air Gravity (MGALS)
Filtered Eotvos Gravity (MGALS)
Water Depth (Meters)

Line WB-81-1	Sp 104-2433
Line WB-81-2	Sp 104-2570
Line WB-81-4	Sp 100-1649
Line WB-81-5	Sp 102-1526
Line WB-81-6	Sp 101-1270
Line WB-81-7	Sp 101-1467
Line WB-81-8	Sp 98-1030
Line WB-81-9	Sp 103-1271
Line WB-81-10	Sp 102-1267

MAGNETICS PROFILE SHOWING:

Total Magnetism Intensity (GAMMAS)
Raw Magnetism (GAMMAS)

Line WB-81-1	Sp 104-2433
Line WB-81-2	Sp 104-2570
Line WB-81-3	Sp 95-2778
Line WB-81-4	Sp 100-1649
Line WB-81-5	Sp 102-1526
Line WB-81-6	Sp 101-1270
Line WB-81-7	Sp 101-1467
Line WB-81-8	Sp 98-1030
Line WB-81-9	Sp 103-1271
Line WB-81-10	Sp 102-1267

BOUGUER GRAVITY MAP - c.1. = 1 MGAL - Density = 2.2

DEPTH TO MAGNETIC BASEMENT MAP

SHOT POINT LOCATION MAP

SHOT POINT LOCATION WITH WATER DEPTH IN FEET MAP

TOTAL MAGNETIC ANOMALY MAP - c.1. = 10 GAMMAS

SECTION VIII

Interpretive Data Submitted:

- Seismic Time Structure Map
Intra-Eocene M. diversus Reflector
(northeast portion of Permit T-15/P)
- Seismic Time Structure Map - Squid Anomaly
Mid. Oligocene Reflector
- Seismic Time Structure Map - Squid Anomaly
Oligocene Reflector
- Isochron Map - Squid Anomaly
Oligocene to M. diversus Reflector
- Seismic Time Structure Map - Squid Survey Area
Lower M. diversus Reflector
- Seismic Time Structure Map - Squid and Stoney Head
Survey Areas
Upper Cretaceous Reflector
- Seismic Time Structure Map - Squid and Stoney Head
Survey Areas
Intra-Lower Cretaceous Reflector
- Seismic Time Structure Map - Chat Anomaly
Eocene M. diversus Reflector

SQUID MARINE SEISMIC SURVEY

**Bass Strait
Tasmania**

1981

Contents

Oil & Gas Journal

1. **Bass Basin T15P – Line WA81-1 Weighted Frequency**
2. **Bass Basin T15P – Line WA81-1 Instantaneous**
3. **Bass Basin T15P – Line WA81-1 Reflection Strength**
4. **Fine Grain Velocity Analysis – Squid Prospect**
5. **Squid Prospect T15P – Isochron Oligocene – Lower M.diverus**
6. **Squid Prospect T15P – Lower M.diverus Reflector**
7. **Squid Prospect T15P – M.diverus Unconformity**

TPR

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OIL & GAS JOURNAL

BASS
BASIN SET FOR
NEW EXPLORATION



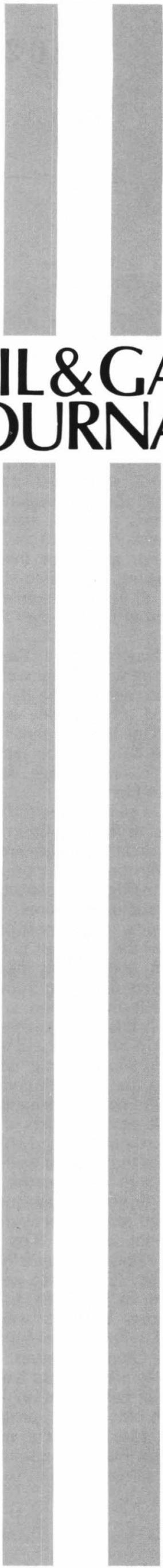
New wildcat campaign set for Australia's Bass basin, p. 154

Equipment and service firms brace for another busy year, p. 47

BLM rejects record batch of bids in Sale 59 in mid-Atlantic, p. 74

Coping with pipeline problems caused by HV power lines, pp. 83 and 88

A simpler way to calculate waterflood saturations, performance, p. 112



OIL & GAS JOURNAL

Bass basin set for new exploration

Dr. O.D. Weaver
Yvon Houde
Jack Downing
Jim Smitherman
Chris Nettels
Weaver Oil & Gas Corp.
Australia
A Kaneb company

EXPLORATION

Bass basin set for new exploration

Dr. O.D. Weaver
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Weaver Oil & Gas Corp.
Australia
A Kaneb company

Recent leasing activity in three Mesozoic-Tertiary basins of the Bass Strait—the Gippsland, Bass, and Otway basins—has focused the attention of Australian and international explorationists on this area.

The Bass Strait, separating Tasmania from the Australian mainland, is the source of over 400,000 bbl of oil daily from its eastern portion, the Gippsland basin. The initial recoverable reserves in this basin alone exceeded 3 billion bbl of oil and 8 trillion cu ft of gas.

Fig. 1 shows the location of the productive areas and the outline of the present exploration permits in the Bass and Gippsland basins. Essentially all of the permits covering the prospective areas of both basins have now been awarded.

Recent work program bidding was

heavy for the three Victoria permits, V80-1, V80-2, and V80-3, adjoining Esso-Hematite (BHP) Gippsland basin acreage. Three consortia made up of 13 companies bid \$240 million in exploration programs for these permits. Following this, Esso-Hematite announced a \$160 million exploration program of its own over the next 3 years.

The Hudbay, et al. 1 West Seahorse, a recent wildcat test well located near shore north of the Barracouta field, flowed oil at a rate of 1,900 bo/d. This is the first of a series of new test wells to be drilled on peripheral Gippsland basin acreage formerly held by Esso-Hematite.

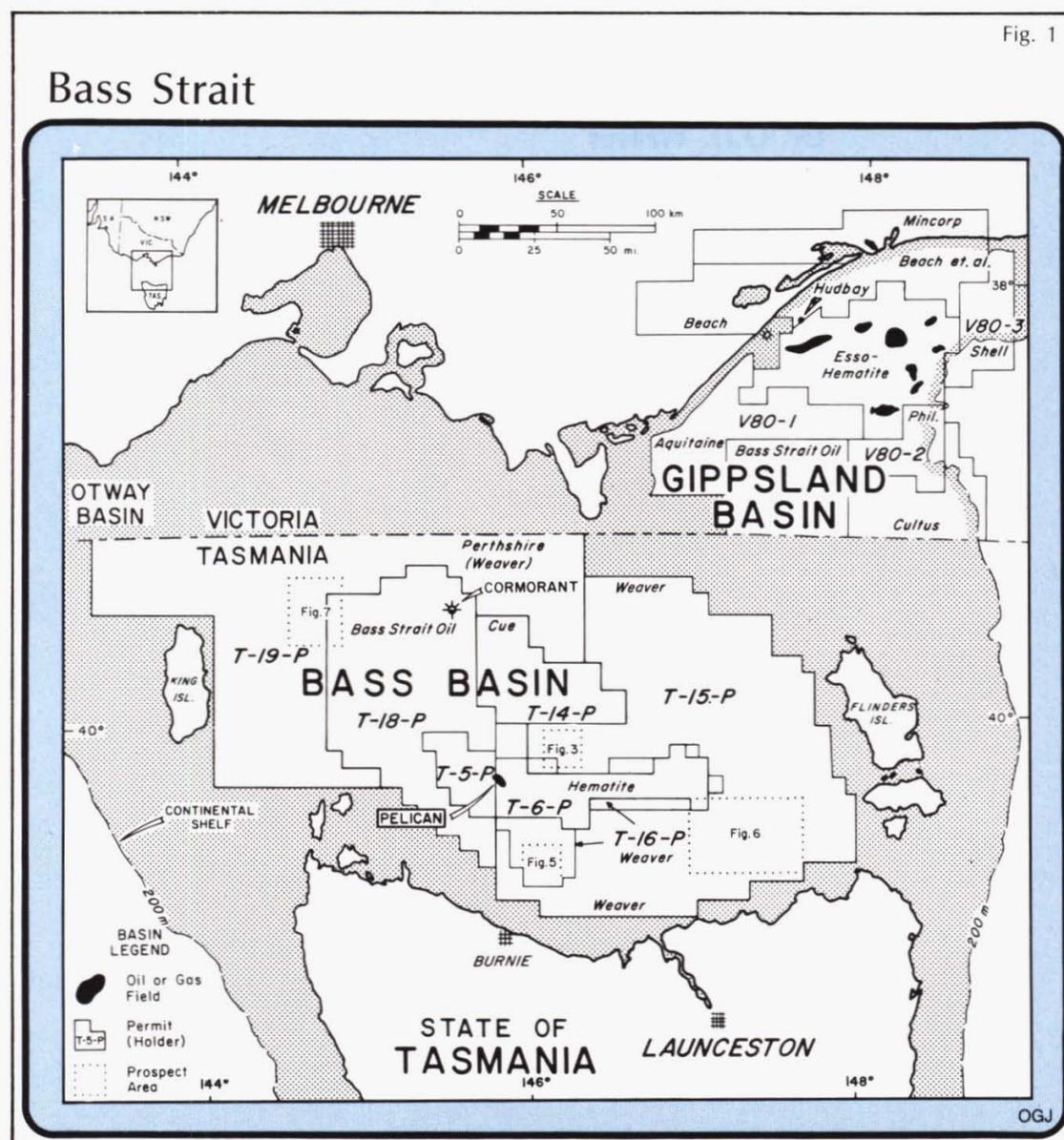
This article summarizes the oil and gas potential of the Bass basin, which contains essentially the same reservoir section as the prolific Gippsland basin, by discussing the prospectiveness of certain structural features.

Water depths in the most prospective areas of the Bass basin are less than 220 ft and drilling depths to potential reservoirs range from 3,500 ft to 10,000 ft and beyond.

The Bass basin was essentially leased in 1979 and 1980 and the bulk of the exploration drilling will take place during the 1982-84 period.

In 1964-65 Esso and Hematite were the exclusive permit holders of almost the entire offshore area shown in Fig. 1, and drilled the first test wells in the Gippsland and Bass basins. Since three of the first four Gippsland basin wells resulted in two discoveries and one confirmation, the Bass basin, with one dry hole, quickly fell behind in well activity. Only three wells had been drilled in the Bass basin by 1970, whereas over 35 wells had been drilled, with seven fields discovered, in the Gippsland basin.

The first significant Bass basin discovery was at Pelican in 1970; however, this basin with a prospective area of over 15 million acres now has had only 18 wildcat and confirmation



wells drilled. Three of these wells are located within the potentially productive areas of the Pelican gas/condensate shutin field discovery. In addition, oil was recovered in the Cormorant well in the northern part of the Bass basin.

Hematite still holds about 1,300,000 acres in the central area of the Bass basin and plans to drill two test wells by early 1982—possibly one confirmation well in the Pelican field area, and one wildcat in the east half of their block which is outlined in Fig. 1.

A complete review and integration of all the previously acquired geological and geophysical information has been completed by the authors and combined with substantial amounts of new seismic data. This study has so far delineated a number of large structural features located in different geological provinces of the basin. A selected few of these features are illustrated and discussed in this article.

The Australian Bureau of Mineral Resources, in recognition of the untested potential of the Bass basin, has committed to a 4,500 km seismic program that centers in the Bass basin and ties to the Otway and Gippsland basins. This program reflects the Australian government's interest in evaluation of the Bass basin and will stimulate exploration activities within the entire Bass Strait geological province.

Stratigraphy. The Eastern View Coal Measures constitute the principal objective section of the Bass basin. The sediments included in this

lithostratigraphic unit range from Upper Cretaceous through the basal Upper Eocene and, in a broad sense, are equivalent to the Latrobe Valley Group, which contains all of the prolific discoveries of the Gippsland basin.

Fig. 2 illustrates the most prospective portion of the stratigraphic sequence in both the Bass and Gippsland basins and compares the occurrences and distribution of the productive zones and hydrocarbon indications in each of the basins.

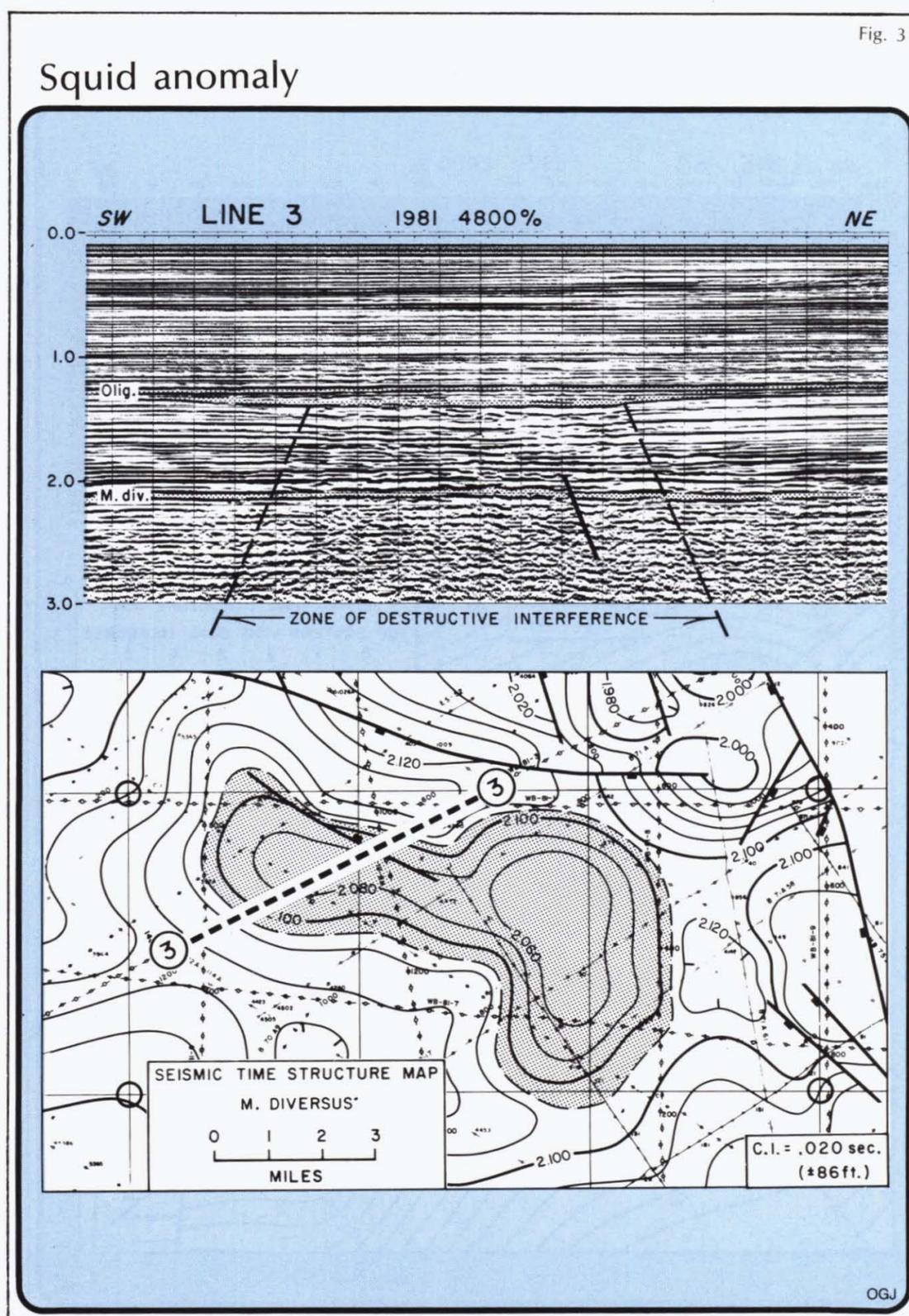
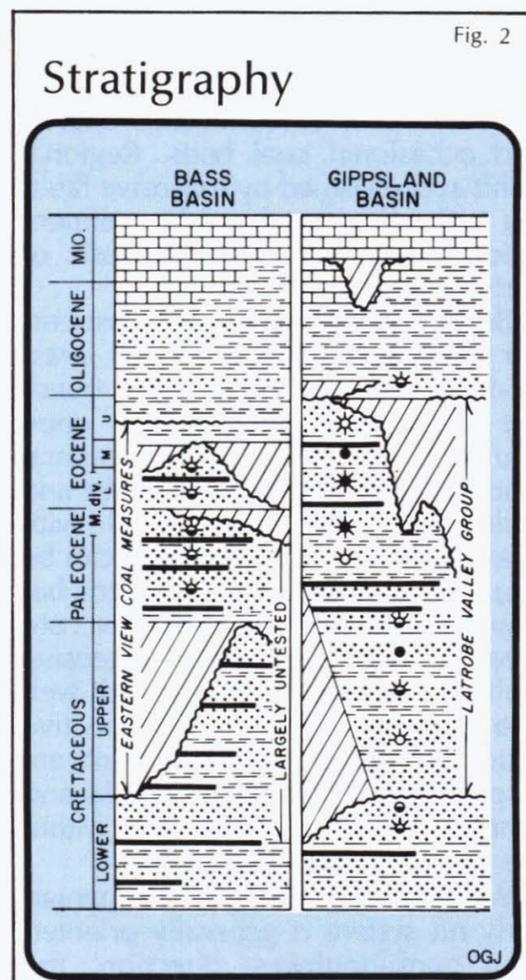
The Upper Cretaceous and Paleocene section of the Bass basin was deposited, in part, in fault controlled troughs where it reaches thicknesses of over 8,000 ft. At the basin margin, as well as in the intrabasin areas of major uplift, it rests unconformably on the Lower Cretaceous section. On the basis of limited well data the

Upper Cretaceous and Paleocene are described as containing coarse to medium grained reservoir sands interbedded with black carbonaceous shales of source rock and seal quality, along with minor coal beds.

The boundary between the Paleocene and Eocene is interpreted, at least locally, as an unconformity on the basis of seismic data as well as the drastically reduced thickness, or complete absence, of section in certain wells.

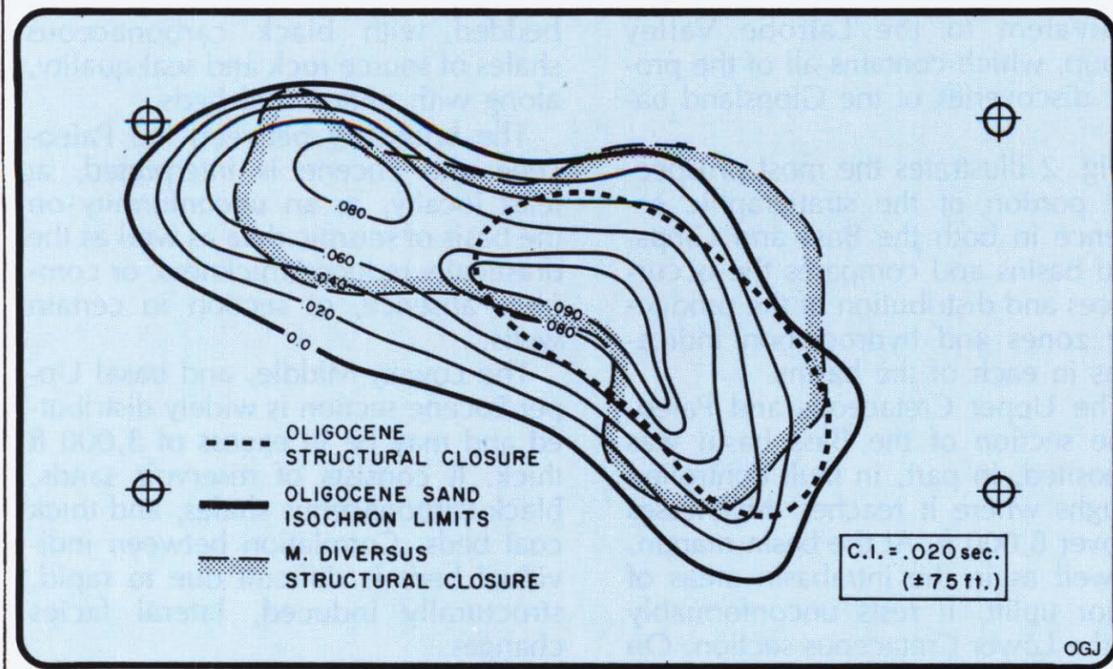
The Lower, Middle, and basal Upper Eocene section is widely distributed and may be in excess of 3,000 ft thick. It consists of reservoir sands, black carbonaceous shales, and thick coal beds. Correlation between individual beds is difficult due to rapid, structurally induced, lateral facies changes.

Regional transgression from the



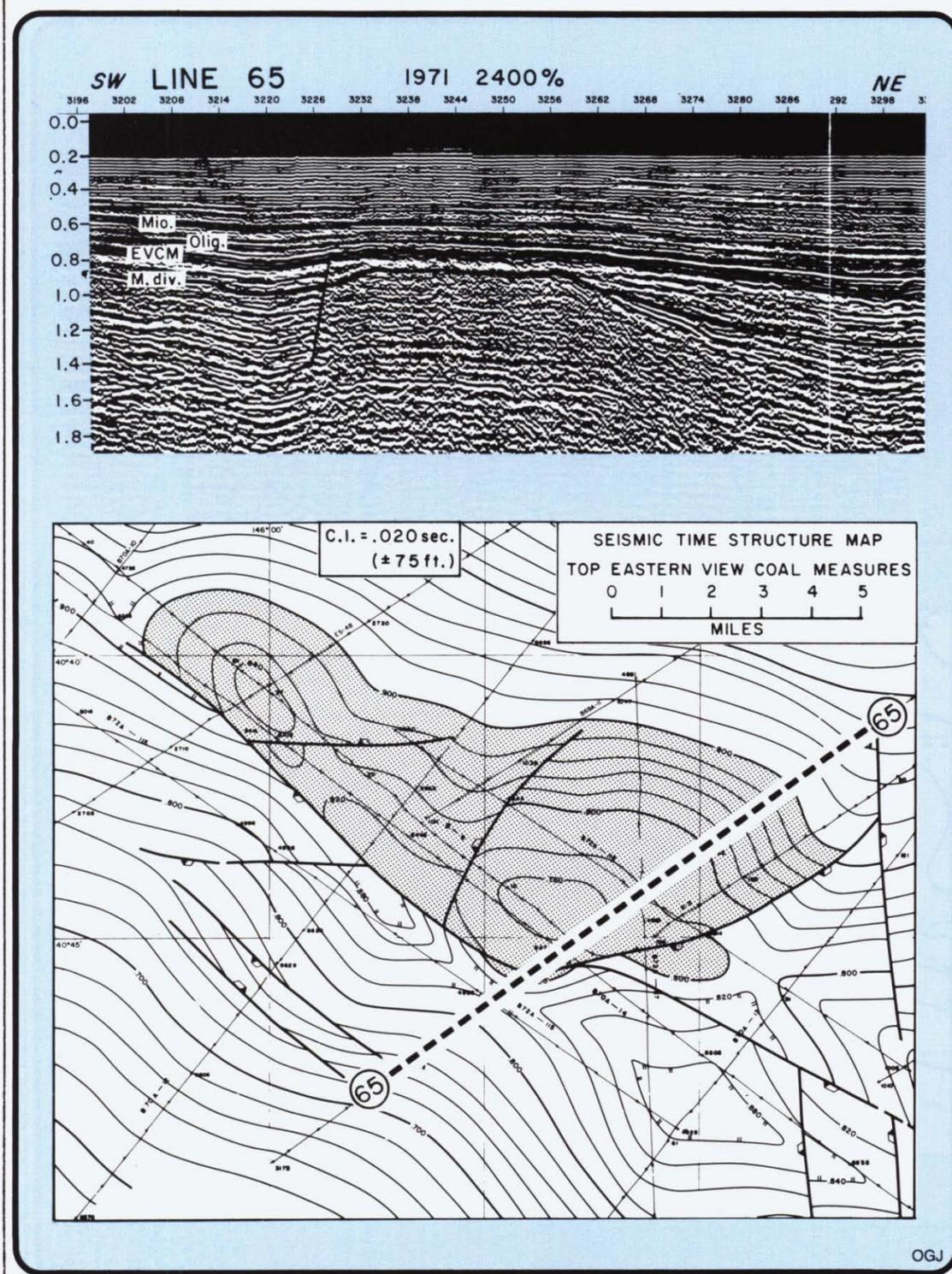
Sand isochron-structure compared

Fig. 4



Fault closure delineated

Fig. 5



northwest led to restricted marine conditions during the Late Eocene and Oligocene. This sequence consists of a predominantly shale facies overlain by marine sands in the northwest half of the basin while in the central portion of the basin it is mostly carbonaceous, pyritic, and silty shales. The late Eocene shale section constitutes the regional seal and, in part, source rock package to the underlying reservoir section.

Detailed palynological zonation of the Eastern View Coal Measures and the Latrobe Valley Group indicates that the *Malvacipollis diversus* assemblage zone ("M. diversus") is one of the most prospective portions of the section both in the Gippsland and Bass basins. The unconformity at or within this zone has been mapped seismically.

Open marine conditions prevailed during the rest of the Tertiary and sandstones and shales were deposited which offer potentially productive reservoirs.

Basin evolution. The earliest phase in the evolution of the Bass basin and other basins of the southeastern Australian continental margin is best illustrated on Tasmania where the Permian, Triassic, and Jurassic sequence occupies structural depressions in the central part of the state.

Where exposed, this sequence consists of a basal tillite overlain by marine and lacustrine carbonaceous mudstone, limestone, and fossiliferous siltstone characterized by occurrences of oil shales and cannel coal. The sequence evolves upwards towards lacustrine and fluvial clastics and coal beds, and grades finally into marginal marine to nonmarine coarse clastics, black carbonaceous shales, and occasional coal beds. Regional uplift accompanied by extensive faulting and volcanism brought sedimentation to a close in Late Triassic or Early Jurassic.

Best illustrated in the southeast corner of the Bass basin is a major Jurassic-Early Cretaceous, northwest trending rift system superimposed upon and accompanied by major structural readjustments of preexisting faults and fault angle depressions filled with coarse clastics. This rift system can be mapped seismically as it plunges basinward and forms the central or core area of the basin where extensive faulting and subsidence lasted well into the Late Cretaceous. Prospective structures along this rift system are associated with tilted fault blocks and simple fold anticlines located within the fault bounded depression.

Whereas the onshore Tasmanian early rift system is generally oriented in a north-northwest direction, the

younger offshore rift system is offset to the east and plunges in a northwest direction. Prospective structures associated with wrench fault type deformation are recognized throughout the Tertiary section of the Bass basin.

The structural evolution and sedimentary regime of the Bass Strait basins changed drastically in Late Cretaceous. The first stage in the evolution of these basins could be classified as aborted rift valley basins or failed arms associated with triple junctions and is characterized by great thicknesses of alluvial, fluviodeltaic, and organically rich lacustrine or marine sediments. The next stage is characterized by the presence of Late Cretaceous and Tertiary, the Eastern View Coal Measures, which consists of terrigenous clastics resulting from a second cycle of deposition over these deformed eugeosynclines which de-

veloped along the continental margin.

These two stage basins are further characterized by a high geothermal gradient (up to 2.5°F./100 ft) and heat flow (2.5 or more), thus promoting early and accelerated generation, expulsion, migration of hydrocarbons into favorable stratigraphic and structural traps such as have been found in the prolific Gippsland basin and are undoubtedly left to be found in the Bass basin.

The Paleocene to basal Early Eocene period was one of structural quiescence during which the still land locked basin area expanded. Structural movements intensified in later Early Eocene, and folding and faulting as well as widespread erosion of the section took place, thus forming the intra M. diversus unconformity. A more active period of stream erosion developed during the Middle

and Late Eocene, although the basin was still mostly enclosed, and a cut and fill system developed across coal swamps. The beginning of a marine influence is recognized in the north part of the basin from wells in that area.

Basinwide transgression took place in Late Eocene and was accompanied by intermittent structural readjustments throughout the remainder of the Tertiary.

Untested potential. Four structural complexes have been selected to illustrate the untested hydrocarbon potential of diverse geological provinces of the Bass basin.

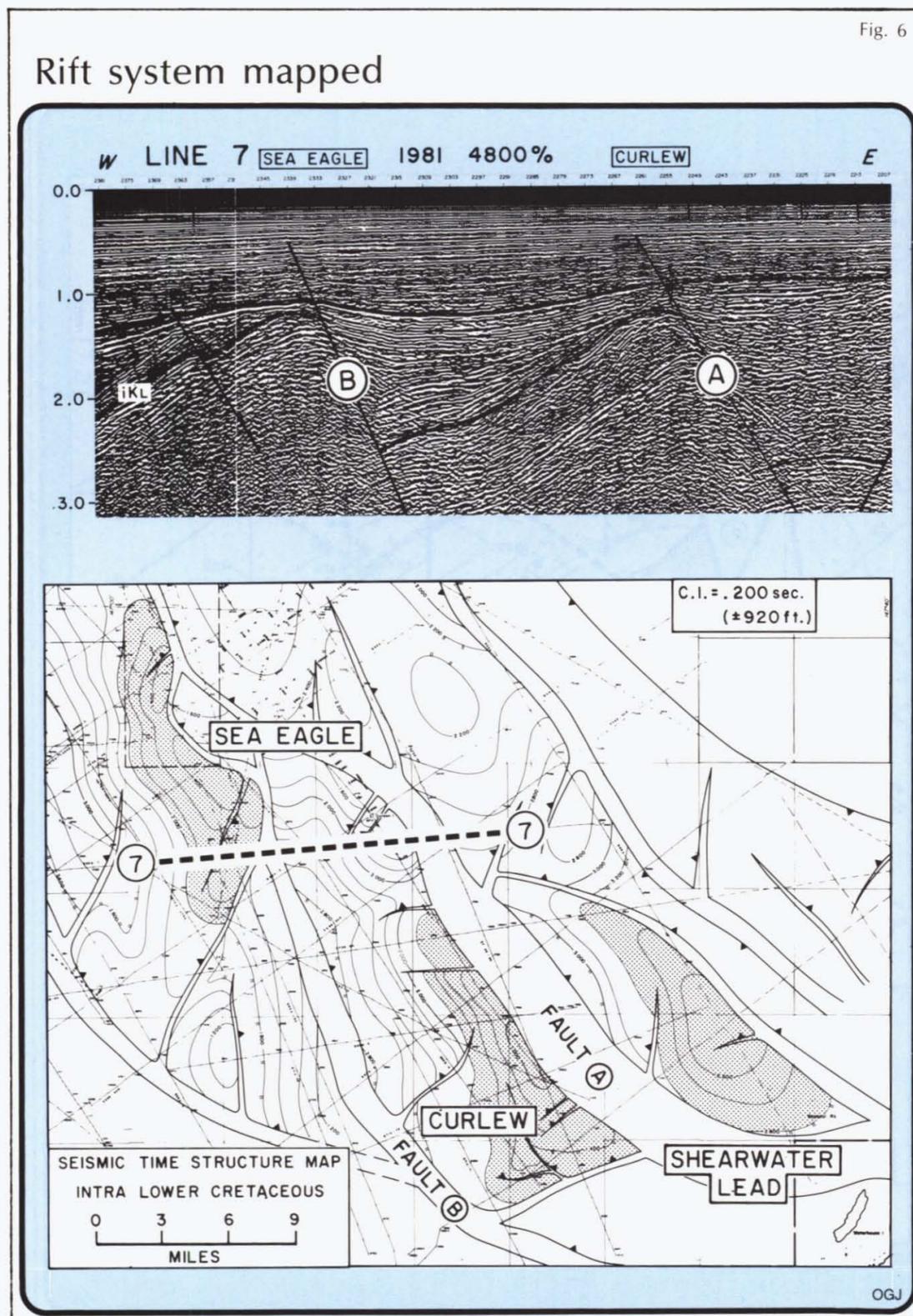
The Squid structural feature and anomaly (Fig. 3) is located in the central area of the Bass basin to the northeast by the Pelican gas/condensate field discovery in the Lower M. diversus zone of the Eocene Eastern View Coal Measures.

The feature was mapped as an anticline at the Lower M. diversus level by using both the old and new seismic data.

It is deep seated, with a demonstrated period of structural growth during deposition of its primary objective section, the Eastern View Coal Measures. A second period of growth is displayed through crestal convergence of the section between the Eastern View Coal Measures and the Oligocene reflector level. Of particular interest is the presence of an anomalous lens shaped event just below the Oligocene reflector. This anomaly is believed to be a hydrocarbon bearing sand development within the Oligocene section which is confined to the approximate area of closure of the underlying structure. Its seismic expression is characterized by polarity reversals and destructive interference, essentially within the area marked on Fig. 3. The lens and the M. diversus mapping zone have been indicated with a dot pattern for illustrative purposes.

Fig. 3 includes a 1981, 48 fold, seismic section (A-A') which trends northeast across the Squid anomaly. This section shows the lens shaped anomaly below the Oligocene horizon and the rollover at the Lower M. diversus reflector level.

Fig. 4 is an isochron of the Oligocene sand body which has an areal extent of 26,000 acres and a maximum thickness of approximately 400 ft. The outline of the closure at the M. diversus level from Fig. 3 is shown as a shaded outline on this figure. At the apex of the structure, the Oligocene objective is at a depth of 4,900 ft, and the Lower M. diversus at a depth of 7,900 ft. The area of closure for the Lower M. diversus zone is approxi-



mately 18,000 acres and the relief is 0.060 sec or about 250 ft. The Squid anomaly has two objectives: the Oligocene sand body and the Lower M. diversus, or main objective, either of which could be a great oil field. A 9,000 ft well would test these two objectives.

Located halfway between the Pelican gas/condensate field discovery and the north coast of Tasmania is the Tasmanian Devil structure (Fig. 1). This feature, as illustrated in Fig. 5, is a northwest trending, tilted fault block bounded to the southwest and southeast by a down to the coast normal fault and accompanying synclinal areas.

The structure has been mapped at the approximate top of the Eastern View Coal Measures reflector level. The northeast trending seismic section in Fig. 5 illustrates the closure at the map level and the pronounced unconformity at the Mid. M. diversus level. It is similar to the Squid structure in that it shows a major period of structural growth during deposition of the Eastern View Coal Measures section. The presence of an early structure is indicated by multiple reflectors which terminate against or onlap its basinward flank. Persistence of the structure through the shallow section, as well as the presence of an effective seal, is indicated by arching, convergence, and drape of the predominantly shale section contained within the upper Eastern View Coal Measures to Mid-Miocene reflectors level. Additional closure of the underlying section is provided by updip termination against the bounding fault.

The top of the Eastern View Coal Measures objective section is at a depth of about 3000 ft, and its area of closure is approximately 32,000 acres. Relief is in excess of 500 ft.

Sea Eagle, Curlew, and Shearwater structures are part of the rift system which occupies the southeast corner of the basin (Fig. 1 and 6). The structures are the upthrown sides of tilted fault blocks adjacent to basin forming faults, and their areas of closure have been mapped at an intra-Cretaceous reflector level. The major period of structural growth took place during the Cretaceous, as illustrated by onlap and convergence of the section on their flanks as well as erosion of the crestal areas. The magnitude and rate of dip of each tilted fault block is such that it is rooted deeply in the basin, thus making it possible for long range migration of hydrocarbons and strong water drive.

The west to east seismic section in Fig. 6 crosses the southern flank of Sea Eagle and the bounding fault of Curlew. It shows the tilted fault

blocks, the mapped intra-Cretaceous reflector level, and the down to the east faults that bound the features.

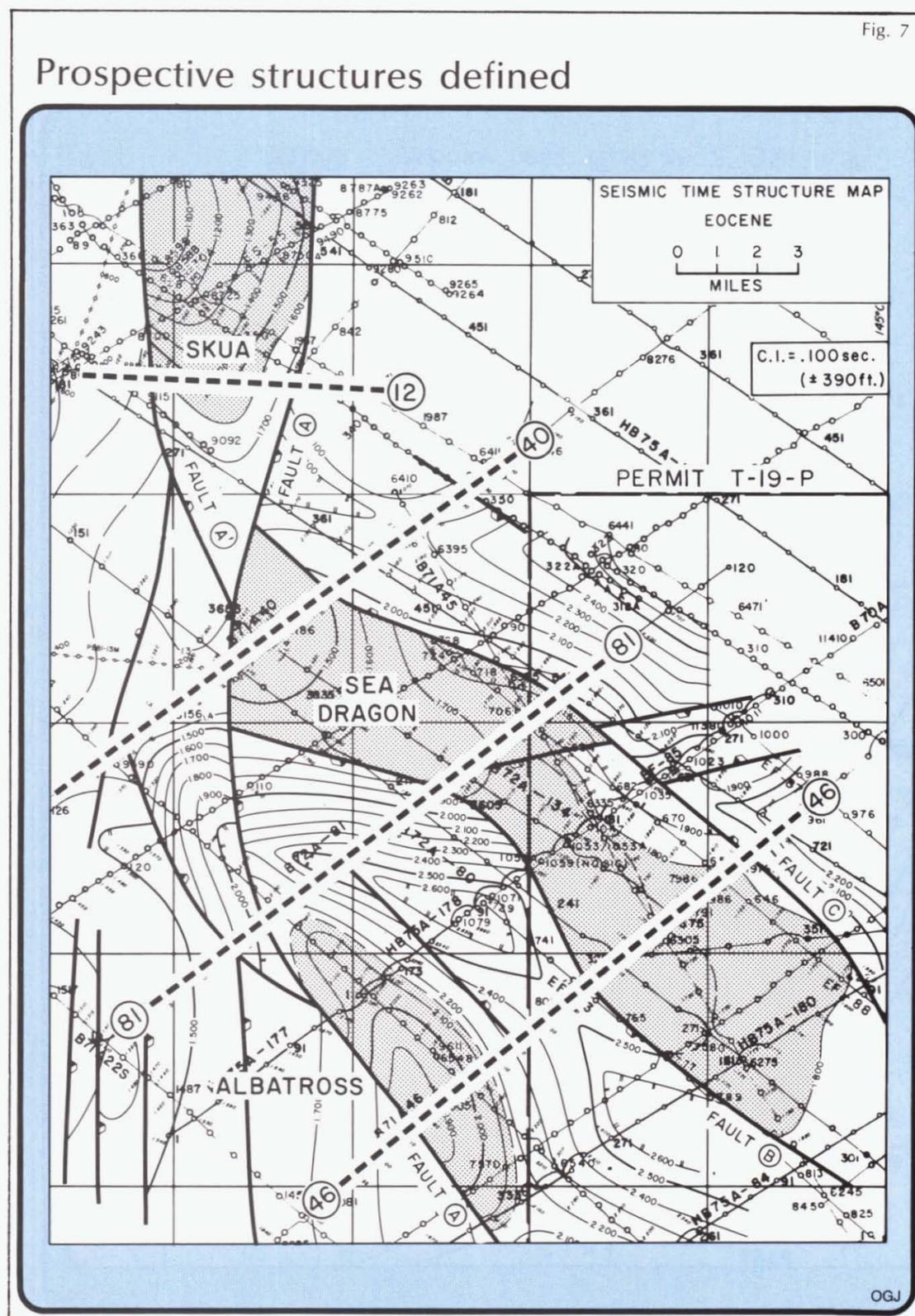
Areal closure of Sea Eagle is approximately 27,000 acres with a relief of 0.600 sec or 3,100 ft. Curlew covers approximately 20,000 acres with a relief of 0.600 sec or 2,500 ft. Shearwater is considered a structural lead at this time and additional seismic will be required for further delineation.

In the northwest portion of the basin (Fig. 1) structural mapping on pre-1974 data and recently acquired 4,800% seismic has uncovered a number of prospects and leads. Three structures have been mapped at the pre-M. diversus reflector within the Eastern View Coal Measures as shown on Fig. 7. The structural nature of the Skua, Sea Dragon, and Albatross features, their areas of closure, and the

location of seismic lines 12, 40, 81 and 46 are shown on Fig. 7. The main faults are assigned letters for ease of identification on Fig. 7 and on Fig. 8, a north-south composite of essentially east-west seismic lines across this area.

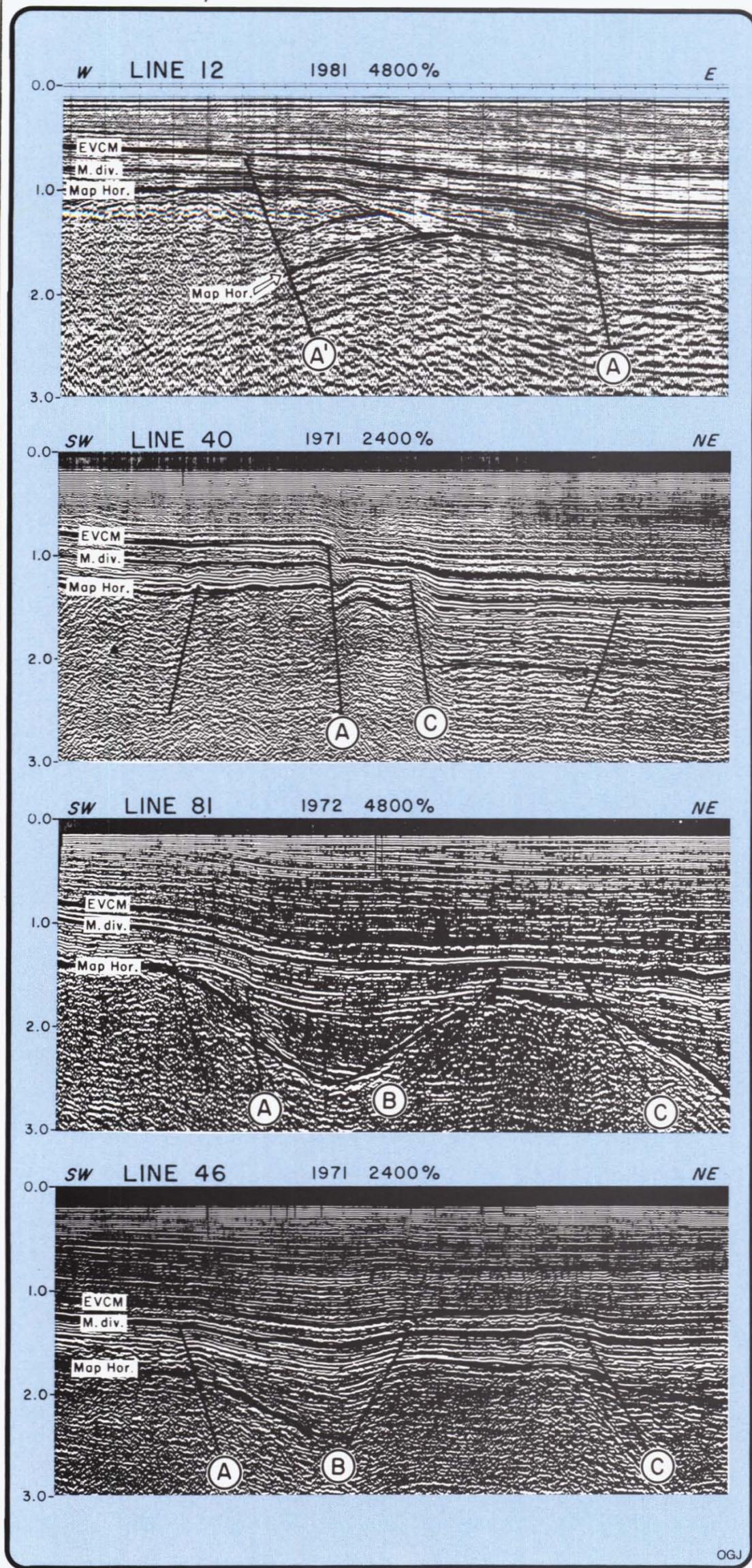
Seismic line 12 (Fig. 8), acquired in 1981, illustrates the Skua lead which is a combination anticline and erosional remnant on the upthrown side of fault "A." Above the westward tilted erosional remnant are indications of onlap at the unconformity surface. With additional seismic data to be acquired in 1982, this structural lead may develop into a prospect very similar in geometry to those found productive in the Gippsland basin.

Sea Dragon is a northwest trending horst block bounded by depositional troughs. It terminates towards the northwest against the major transverse



Structural style illustrated

Fig. 8



fault "A." Its area of closure is 41,000 acres. Seismic line 40 (Fig. 8) displays the rollover of the Sea Dragon structure into fault "A" and the position of fault "C" (on the northeast flank of the structure).

Seismic lines 81 and 46 show the Albatross structure, controlled by transverse fault "A" and separated by a synclinal area from the Sea Dragon horst block which is defined by faults "B" and "C." Its area of closure is 11,000 acres.

Summary. The Bass basin is sparsely tested, yet contains a thick, porous sedimentary section similar to the productive horizons in the nearby Gippsland basin.

A detailed seismic grid of over 14,000 km, much of it shot by Esso and Hematite during the period when these companies held exclusive permits on the entire Bass Strait area, is available to present day explorationists. A recent detailed study of this data plus new seismic has revealed numerous undrilled structural anomalies of significant size and reserve potential.

The selected structural features presented in this article illustrate the largely untested potential of the Bass basin. Exploration concepts derived in part from the Gippsland basin field studies have been utilized where applicable.

Prices of oil and gas have risen sharply in the past few years, bringing many undrilled structures within viable economic limits. The proximity of the shallow water Bass basin to markets in southeast Australia adds appreciably to its economic potential.

Long a stepchild to the Gippsland basin, the Bass basin is now fully leased and gives promise of major discoveries as the structure and stratigraphy of its over 15 million acres are unraveled.

The Australian Bureau of Mineral Resources newly commissioned seismic study of the Bass and adjoining basins will be available for all explorationists in 1982 and should contribute to the overall understanding of, and interest in, the Bass Strait basin complex.

The momentum of southeastern Australian exploration has now created in the Bass basin the interest and competition of Australian and international oil and gas companies so necessary for the discovery of world class reserves in this relatively untested basin.

Acknowledgements

Ross McDade, manager of Weaver Oil & Gas Corp.'s mapping section, illustrated the geological and geophysical data presented.



WEAVER OIL AND GAS CORPORATION

5599 SAN FELIPE, SUITE 1100, HOUSTON, TEXAS 77056

A Kaneb company



Kaneb operates a diverse fleet of mobile drilling vessels and platform rigs engaged in international contract drilling and production. The company conducts domestic and foreign exploration projects in its search for and development of oil and gas reserves. The company is also a supplier of wellhead control systems and pumping units used in the production of oil and gas.

The company provides worldwide professional engineering and management services in the areas of pipeline technology, reservoir engineering, geologic surveys, and advanced recovery methods applicable to the production of hydrocarbons. Kaneb owns and operates a 1,500-mile long common carrier pipeline and terminal system through five mid-continent states.

Kaneb produces steam grade

bituminous coal from its own mines in the Appalachian area and sells purchased and brokered coal from other sources. Kaneb's coal is marketed principally to electric power generating customers and, to a lesser extent, to industrial users.

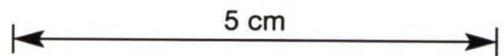
Kaneb's specialized general contracting services include the construction of locks, dams and dikes, flood control reservoirs, and highway work. Principal customers include utility companies and governmental agencies.

Kaneb designs, sells, and installs a variety of minicomputers tailored to the insurance agency and retail chain store businesses; provides data processing services to these same industries. The company also performs specialized financial and business forms printing services.


Kaneb Services, Inc.
 a concern for energy

The Kaneb Bldg. 5251 Westheimer Road Houston, Texas 77027 Phone: (713) 622-3456
 NYSE Symbol: KAB Telex: 910-881-1737

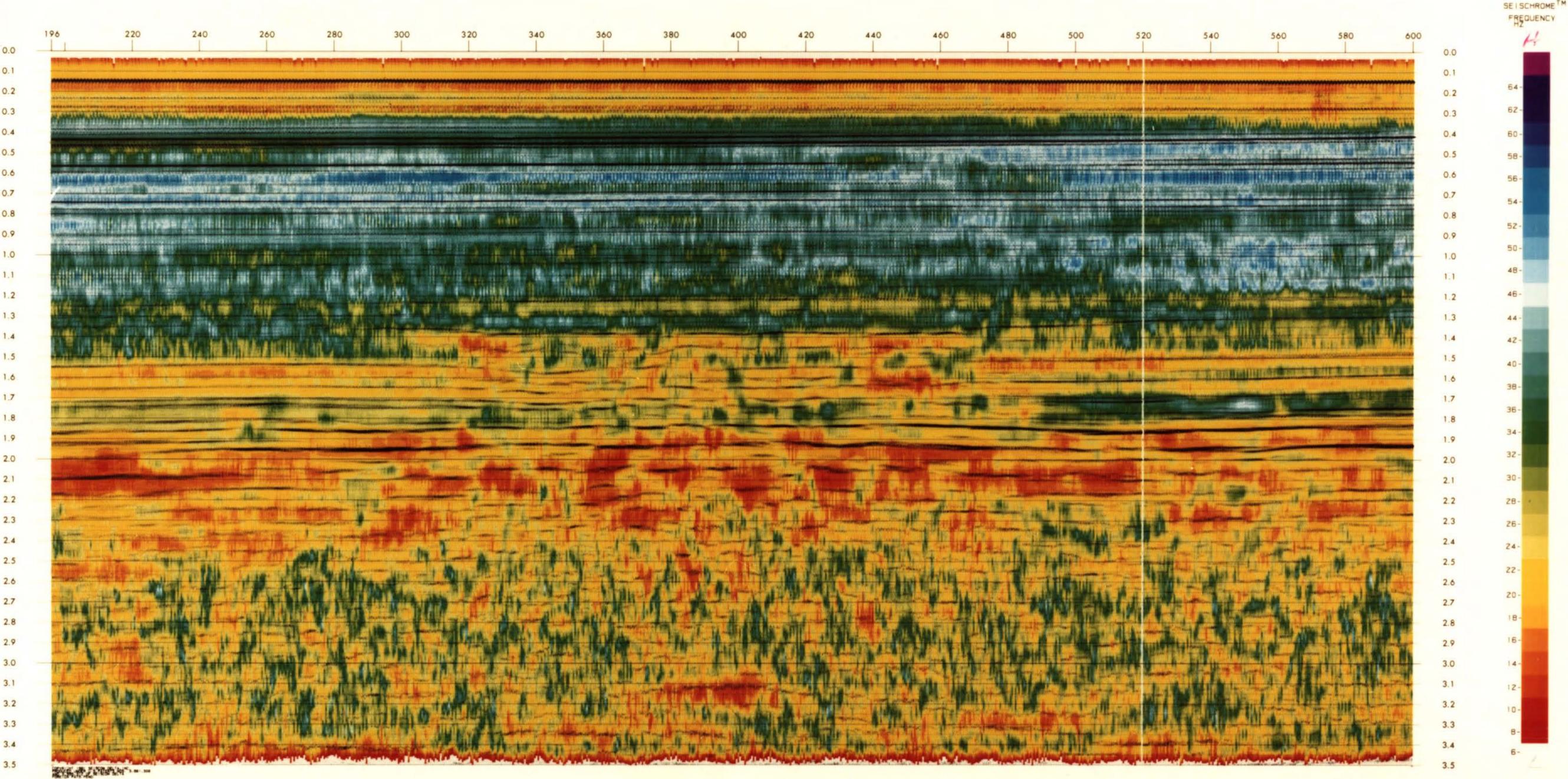
*Should get better shift
from low to low freq
(target wells)*



202153

SQUID PROSPECT

Seiscom Delta Inc.
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: WEIGHTED FREQUENCY
Client: WEAVER OIL & GAS CORP.



h

/

FREQUENCY -

202154

GAS FILTERS OUT HIGH FREQUENCIES,
ALLOWING LOWER FREQUENCIES TO PASS
THROUGH.

T/15P

IF THE LENS WERE SATURATED W/
GAS, WE WOULD EXPECT A NOTICEABLE
SHIFT FROM HIGH FREQ. (GREEN & BLUE)
TO LOWER FREQ (YELLOW, ORANGE, RED)
IMMEDIATELY BENEATH THE ANOMOLY
AND CARRYING INTO THE SHADOW ZONE.

THERE IS A SLIGHT SHIFT IN FREQUENCIES.
OBSERVE A GRADUAL, LATERAL CHANGE
BENEATH THE ANOMOLY - FROM GREEN &
BLUE TO YELLOW & ORANGE.

OR-0190 VOL II

202155

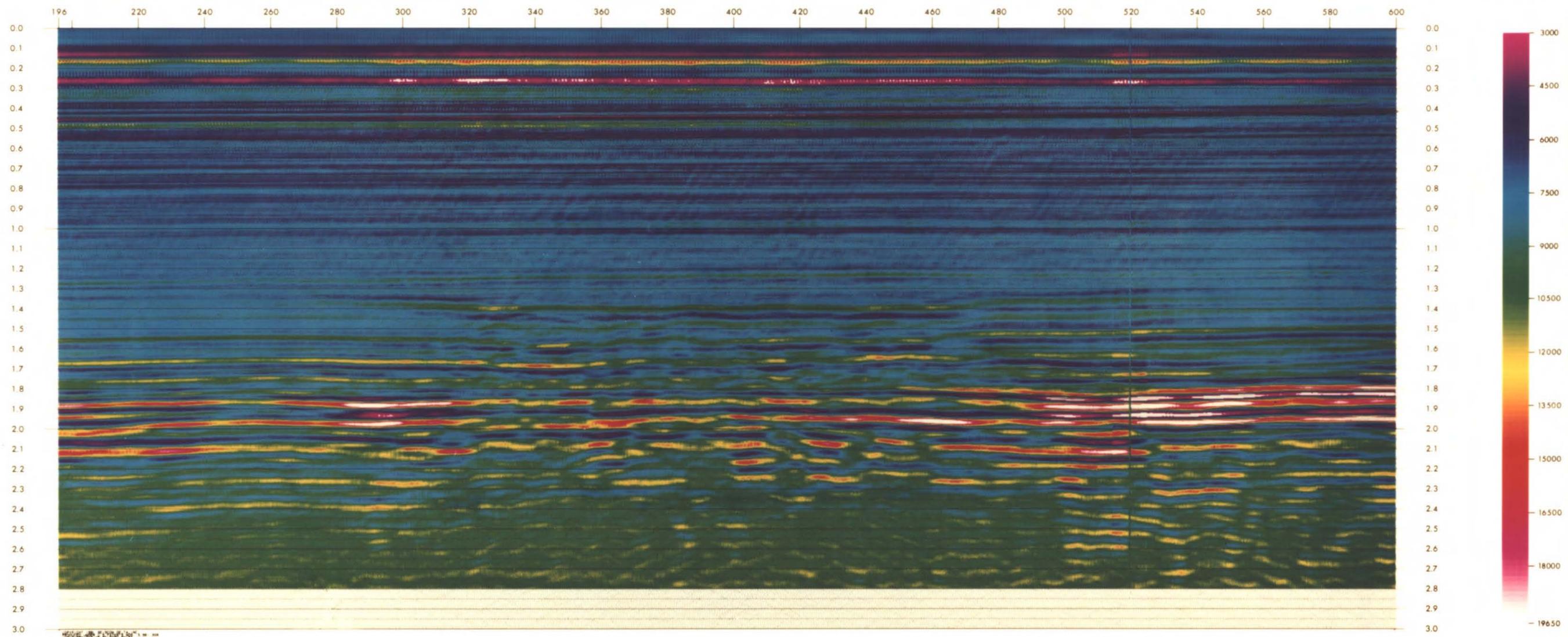
*Should get veloc.
improvement. Some shift
to dk blue beneath!
Veloc should slow
down here with more*



Seiscom Delta
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: INSTANTANEOUS VELOCITY
Client: WEAVER OIL & GAS CORP.

SQUID PROSPECT

SEISCHROME™
DISPLAY
VELOCITY
FT. PER SEC.



2.

VELOCITY PLOT

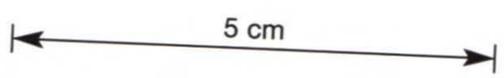
IF LENS WERE SATURATED WITH GAS,
VELOCITIES SHOULD INDICATE A DRAMATIC
INVERSION, GETTING SLOWER BENEATH ANOMOLY
WITH COLORS SHIFTING PREDOMINATELY TO
DARK BLUE & MAGENTA.

THE PLOT INDICATES A SLIGHT SHIFT FROM
GREEN TO DARK BLUE IMMEDIATELY BENEATH
THE LENS.

202156

T/15P

OR-190 VOL II

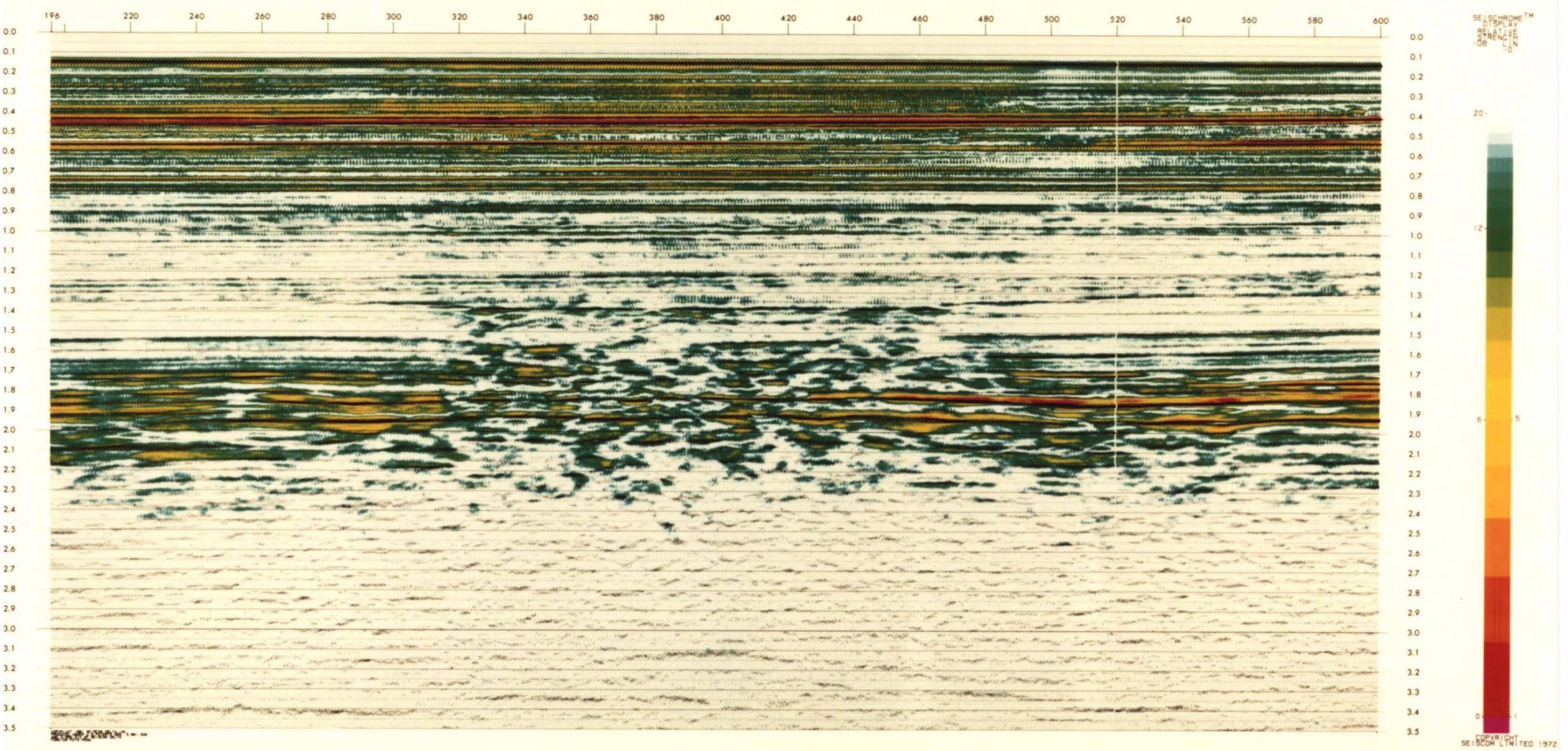


202157

*Amplitude-
(Bright Spot)
should be better shift
to higher ampl. (yellow
& orange)*

Seiscom Delta inc.
Area: BASS BASIN T-15-P
Line: WA-81-1
Display: REFLECTION STRENGTH
Client: WEAVER OIL & GAS CORP.

SQUID PROSPECT



REFLECTION STRENGTH, AMPLITUDE, "BRIGHT SPOT" INDICATOR

202158

IF GAS WAS PRESENT IN LARGE QUANTITIES
WE WOULD HAVE EXPECTED A SHIFT TO THE
HIGHER AMPLITUDES (to YELLOW, ORANGE, RED)
WITHIN THE LENS. A VERY SLIGHT SHIFT
IS NOTICEABLE WITHIN THE ANOMALY.

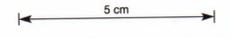
T/15P

From the desk of

JACK DOWNING

VELOCITIES WITHIN AND
BENEATH ANOMALY DO NOT
INDICATE A VELOCITY INVERSION
WHICH WOULD BE EXPECTED IF
THE LENS WERE SATURATED
WITH GASEOUS HYDROCARBONS

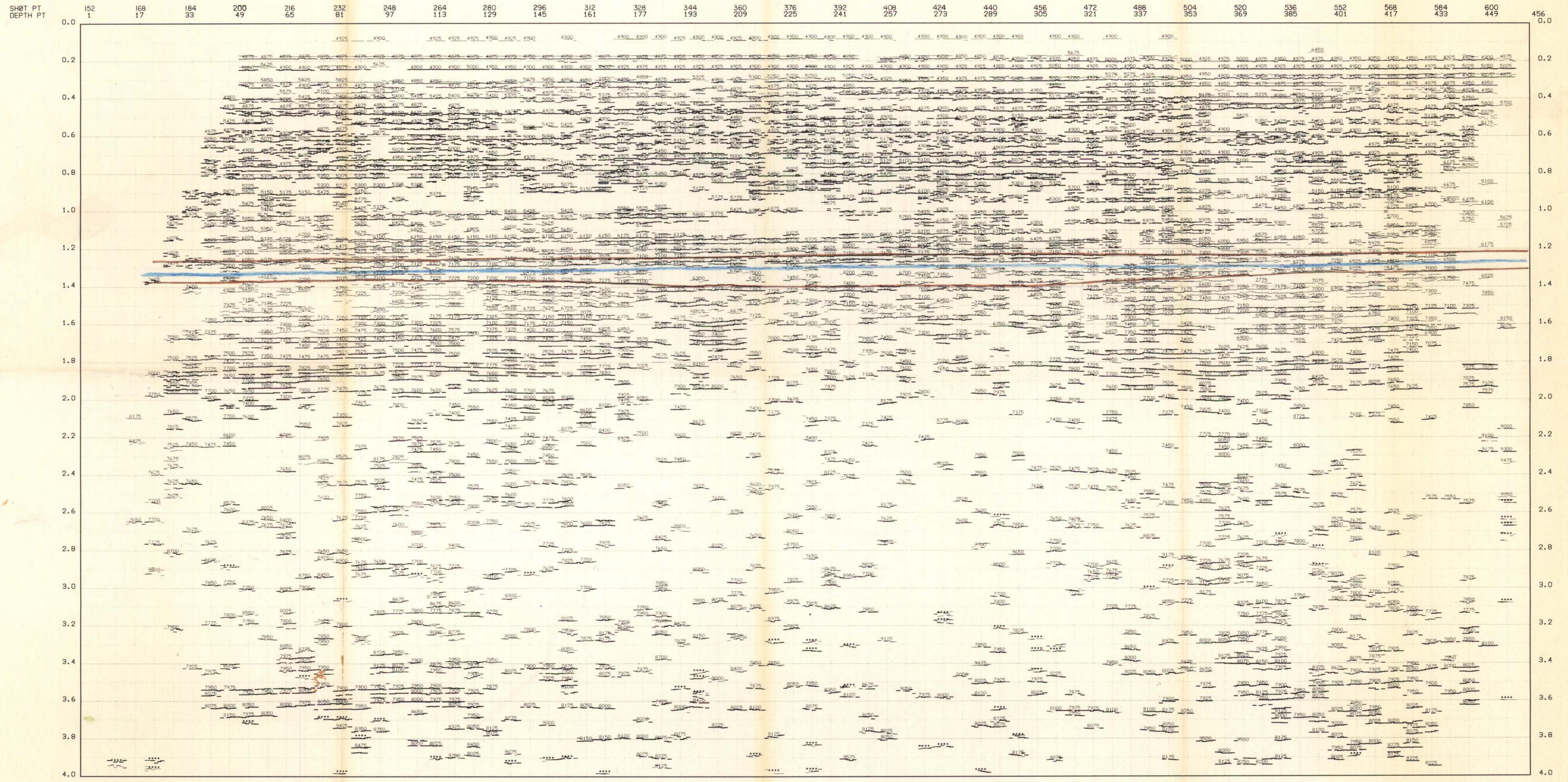
OR-190 VOL II

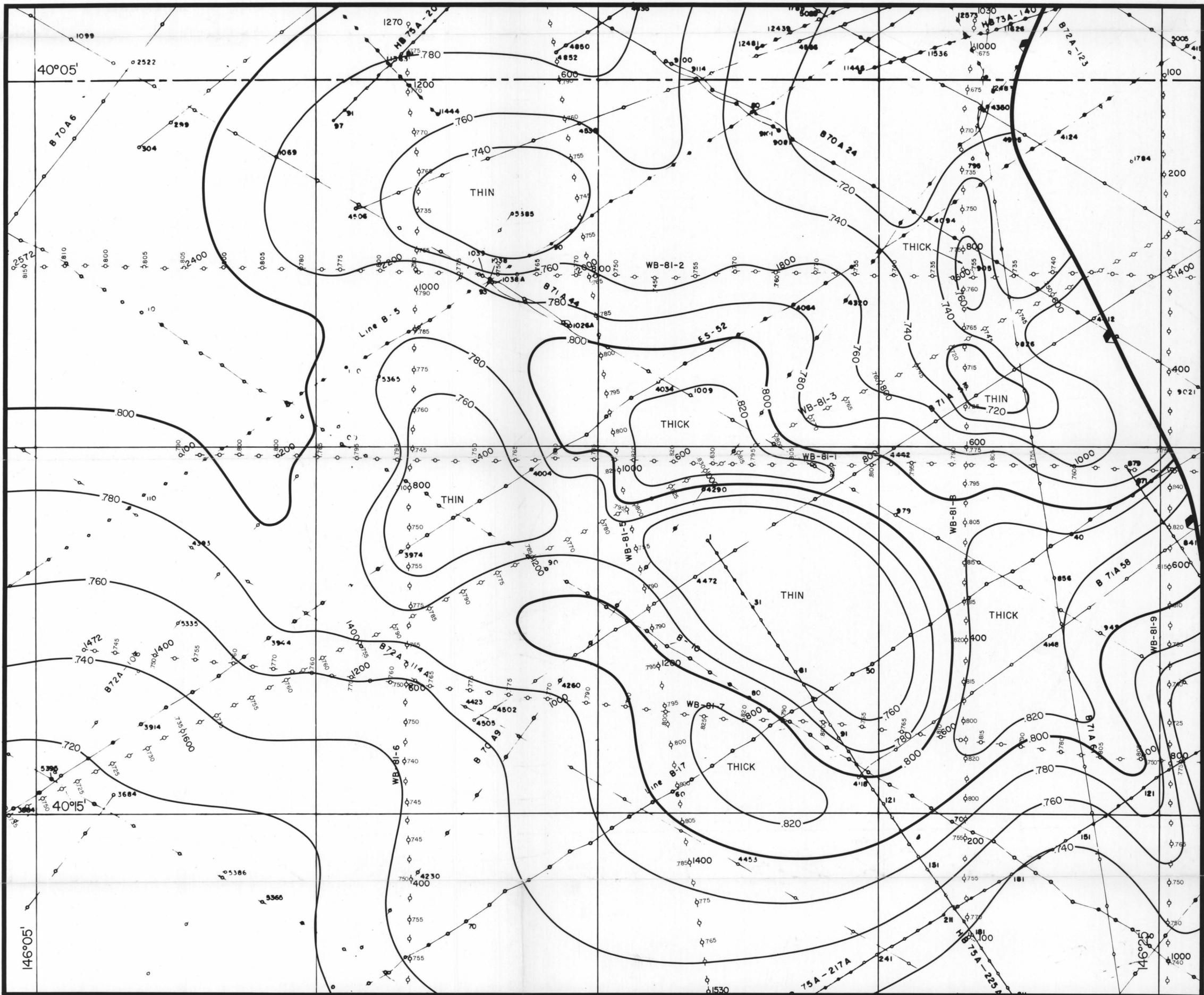


202154

FINEGRAIN VELOCITY ANALYSIS
PETTY-RAY GEOPHYSICAL DIVISION, GEOSOURCE INC.

LINE WB81-1
WEAVER OIL & GAS CO.





**WEAVER OIL AND GAS CORPORATION,
AUSTRALIA**

202160

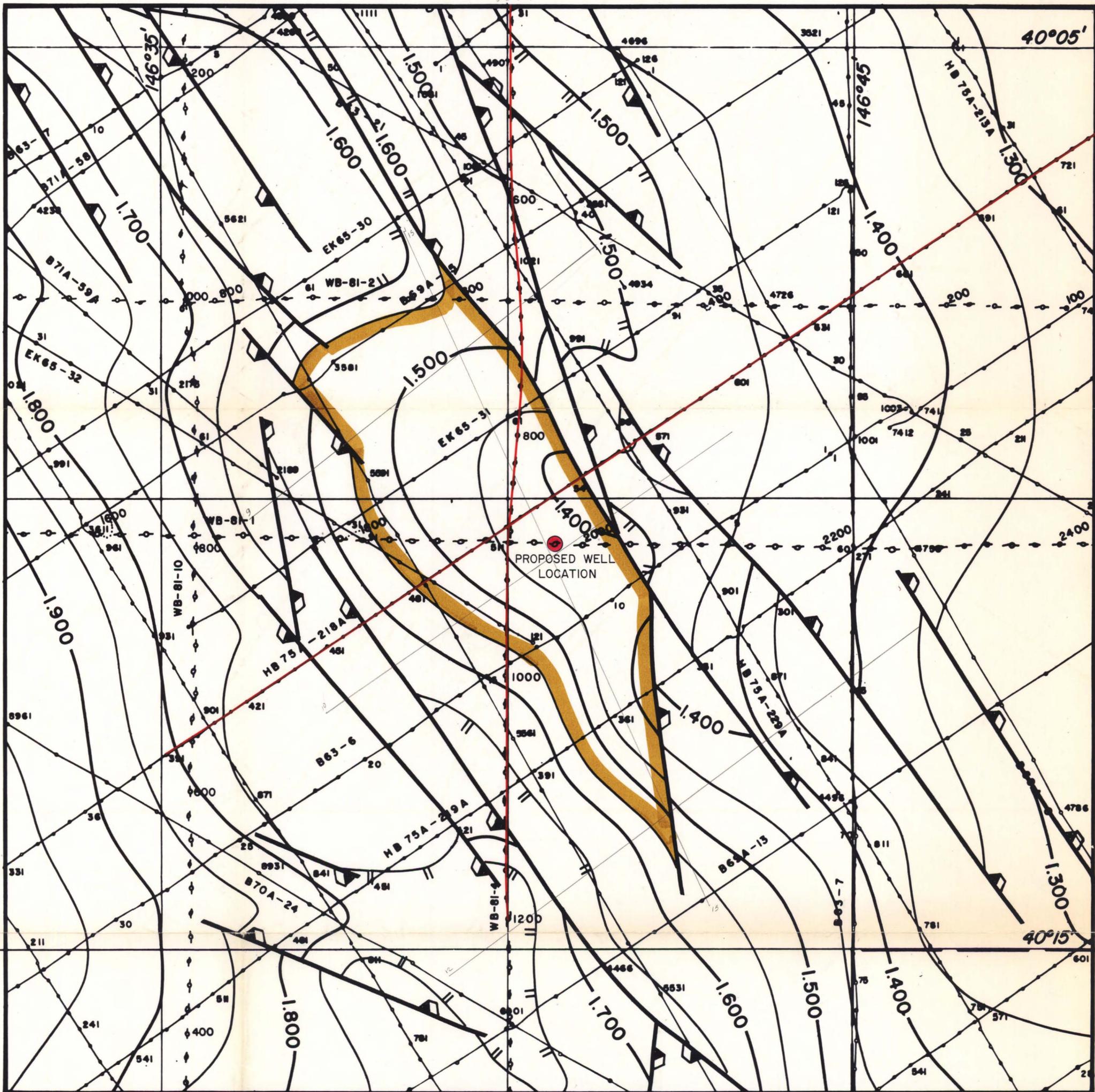
SQUID PROSPECT
PERMIT T-15-P
ISOCHRON
OLIGOCENE - LOWER M. diversus
GEOPHYSICIST: C. NETTELS

0 1 2 3 4 5
0 1 2 3 4 5
km

C.I. .020 sec. SCALE 1:50,000 OCTOBER 1981

5 cm

OR-190 VOL II
5.



WB-8104

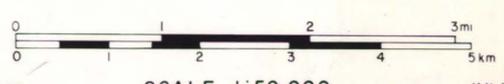
202162

PROPOSED WELL LOCATION: LINE WB-81-1, S.P. 1980
 AREA OF CLOSURE: 9600 ACRES
 WATER DEPTH: 261'

**WEAVER OIL AND GAS CORPORATION,
 AUSTRALIA**

CHAT PROSPECT
 PERMIT T-15-P
M. diversus UNCONFORMITY

GEOPHYSICIST: C. NETTLES



C.I.: .050 sec. SCALE 1:50,000 JULY 1981

5 cm OR-190 VOLT 7