211001

PERMIT T-15-P

BASS BASIN

TASMANIA AUSTRALIA

QUARTERLY REPORT

February 19 to May 19, 1984

FIRST QUARTER

Submitted by:

Weaver Oil and Gas Corporation
14141 Southwest Freeway
Sugar Land, Texas U.S.A.

SUMMARY

The following is a summary of the main events which took place during the First Quarter period, February 19, 1984 to May 19, 1984, of Permit T-15-P fifth year.

During this quarter the general Squid prospect area was completely remapped at two seismic reflector levels. These levels are the Lower Malvocipolis diversus unconformity level and the Top Oligocene level. In addition, an isochron of the Oligocene lens was constructed.

All the geological and geophysical data considered relevent to the general Squid area has been assembled and summarized. Selected portions of this data constitute this report.

The results of an aeromagnetic survey conducted in 1960-61 indicate that at the proposed Squid #1 exploration well location; the calculated depth to magnetic basement is more than 12,000 feet below sea level.

The Squid geophysical survey consisted of 407.325 kilometers of new seismic data acquisition on Permit T-15-P and adjoining Weaver Permit T-16-P. In addition, gravity and magnetic data was also acquired. A summary of the data acquisition; processing and reprocessing is enclosed.

The gravity and magnetic acquisition parameters, processing and interpretation methods and results are enclosed.

The Squid geophysical survey revealed the presence of the Squid, Chat, Sea Eagle, Curlew and Shearwater anomalies. Additional prospect definition seismic acquisition is needed on each of these anomalies. Depths to magnetic basement have been calculated.

The Unicorn geophysical survey consisted of 407.425 kilometers of new seismic data acquisition on Permit T-15-P and adjoining Weaver Permit T-16-P. In addition gravity and magnetic data was also acquired. A summary of the data acquisition and processing is enclosed. A summary of the gravity and magnetic data acquisition and processing is also enclosed.

The Unicorn geophysical survey provided a better understanding of the leads or anomalies identified by the Squid survey. These have been up graded to prospects, ie: Squid, Chat, Sea Eagle and Shearwater.

Four different approaches to seismic modeling have been tried on the Squid Oligocene lens which is recognized on all the old and the new seismic lines crossing this prospect.

A complex trace analysis was performed on Weaver's seismic line WB-81-01 in order to provide a better understanding of the nature of the Oligocene lens as well as its effects on the underlying reflectors. A recognizable and mappable response was found when measuring the following attributes: reflection strength, weighted frequency, apparent polarity, instantaneous phase and instantaneous velocity. The lens was described as a stratified area characterized by lower than regional velocity and a strongly reflecting lower surface.

A second method of investigation was applied to the same seismic line. This method consisted of measuring the relative signal amplitude in and out of the lens and calculating and comparing the instantaneous velocity. No significant vertical or horizontal change in velocity was recognized, probably because this is a rather crude measuring tool.

A third method consisted of producing a series of synthetic sonic logs by combining velocity coefficients derived from density corrected inverted seismic traces with lower frequency velocity components obtained from velocity data. Results of this method described the Oligocene lens as an erosion surface containing isolated stratigraphic units, without unusual velocity based on move-out data. It further described the lens as a structural sag related to normal faulting which localized the erosional, or lower, lens surface. The destructive interference was assumed to be related to closely spaced faults and irregularities on the erosion surface.

The fourth method consisted of collecting check-shot velocity survey data from nearby wells leading to the development of major velocity-units within which lenses of sand were included for purposes of modeling theoretical responses. The resulting synthetic seismic section was then compared with the actual seismic lines crossing the prospect. The best fit with the actual data was found to be a velocity-unit model containing a low velocity interval.

The Squid prospect area has been remapped at the top Oligocene reflector level as well as at the Lower Malvocipolis diversus unconformity reflector level. The prospect area is tied to the Dondu #1 and Pelican #1 wells.

A well prognosis has been prepared for the proposed Squid #1 exploratory well. Results of the mapping are enclosed.

A drilling program has been prepared for the proposed Squid #1 well. Details are enclosed.

The whole of the Bass Basin area has been reviewed by Petroconsultants S.A. Their conclusion is that the untested hydrocarbon potential of the basin lies within the sediments of the Lower Eastern View Coal Measures where sands and mature source rock shales are indicated to be present in structural traps.

not tested by Squid #1

PLANS

No new seismic was acquired nor well drilled during this quarter.

It is expected that the proposed Squid #1 exploratory well will be drilled sometime during the third quarter of 1984.

211005

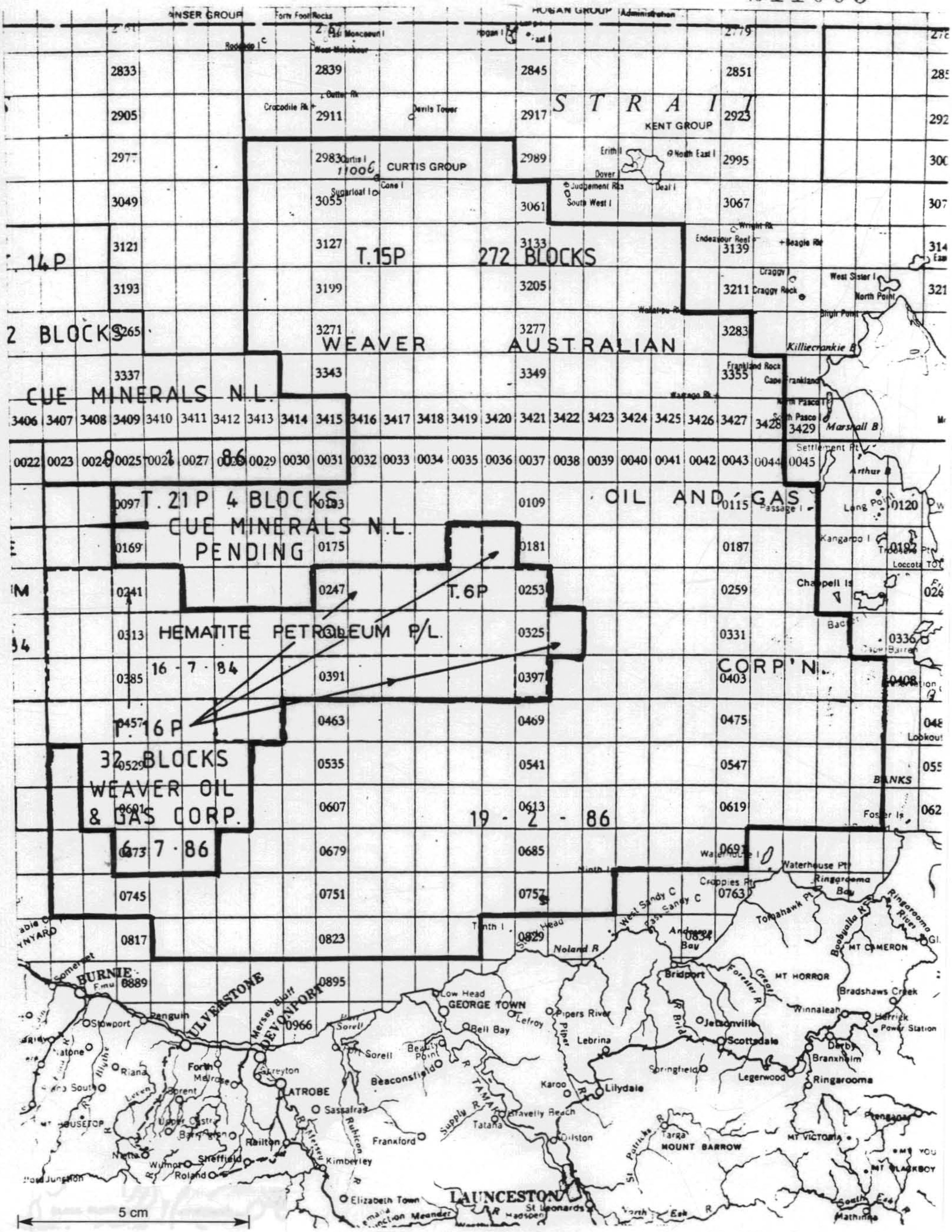


Figure 1

211006

TABLE OF CONTENTS

SECTION I

GEOPHYSICAL SURVEYS

AEROMAGNETIC SURVEY

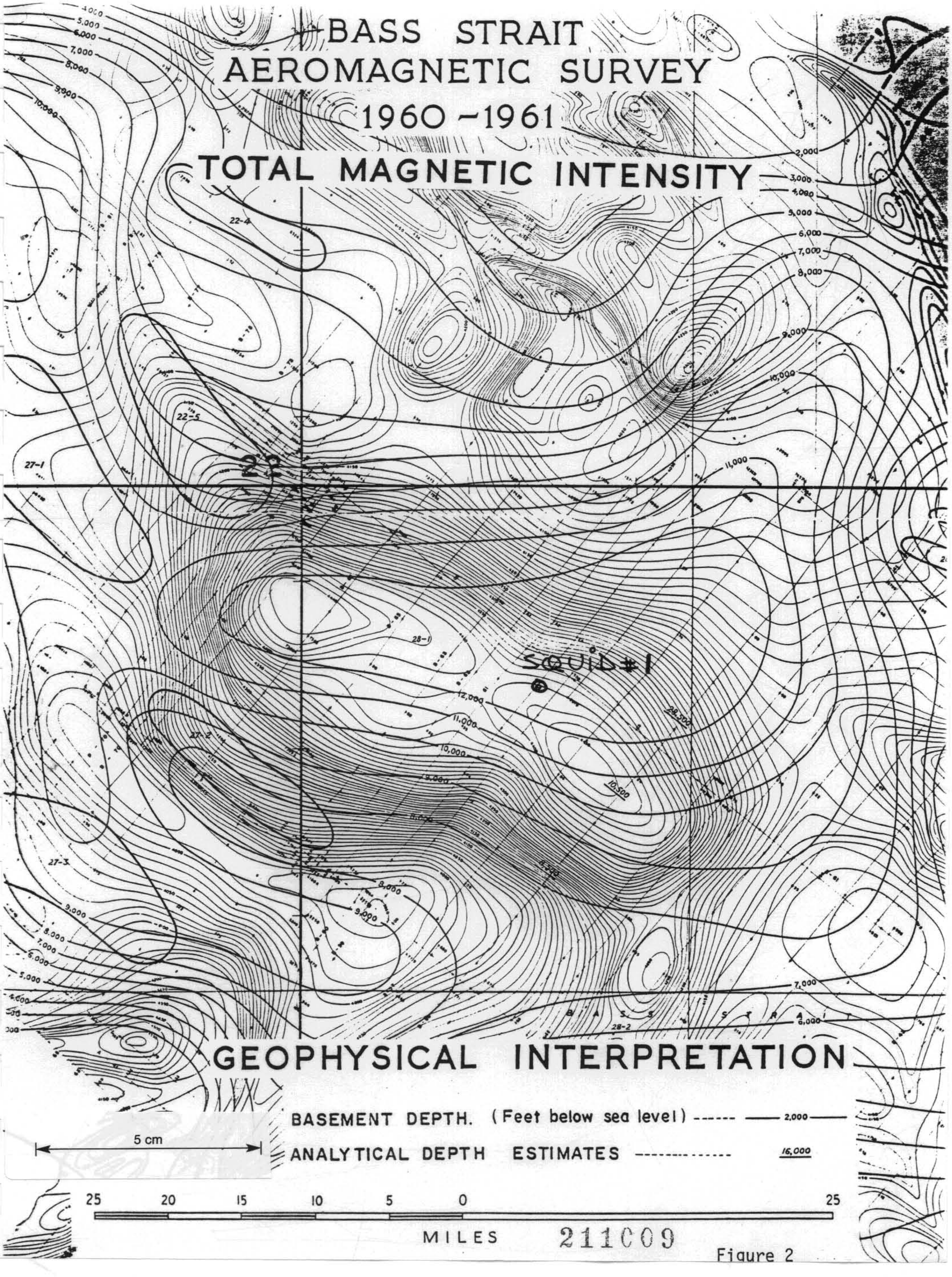
SUMMARY

A regional aeromagnetic survey of the Bass Basin was carried out for Haematite Exploration Proprietary Limited by Aero Service Limited by Aero Service Limited during 1961. A previous survey was carried out in 1960 and had indicated the presence of deep Tertiary-Mesozoic sedimentary basins. The objective of the later survey was to further delineate these basins.

Results of the operation are presented as integrated contour maps of the total magnetic field intensity and of interpreted depths to magnetic basement, Figure 2 . The location of the proposed Squid #1 exploratory well is indicated.

The general Squid area probably includes the deepest basement of the Bass Basin. It is associated with a huge northwest trending magnetic anomaly.

At the proposed Squid #1 exploratory well location the depth to magnetic basement is calculated to be more than 12,000 feet below sea level, Figure 2.



211009

Figure 2

SQUID SURVEY

211013

SQUID

MARINE SEISMIC SURVEY

1981

TASMANIA

PERMIT T-15/P

for

WEAVER OIL AND GAS CORPORATION, AUSTRALIA
5599 SAN FELIPE, SUITE 1100
HOUSTON, TEXAS 77056-2795

and

109 ST. GEORGE'S TERRACE, 16TH FLOOR
PERTH, (W.A.) AUSTRALIA 6000

by

WESTERN GEOPHYSICAL COMPANY OF AMERICA
10001 RICHMOND AVENUE
HOUSTON, TEXAS
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 &-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.

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.

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.

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 Bassian 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 prognozed 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 hydrocabon 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 Strait 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

211026

Bass B72A seismic survey for Esso Australia

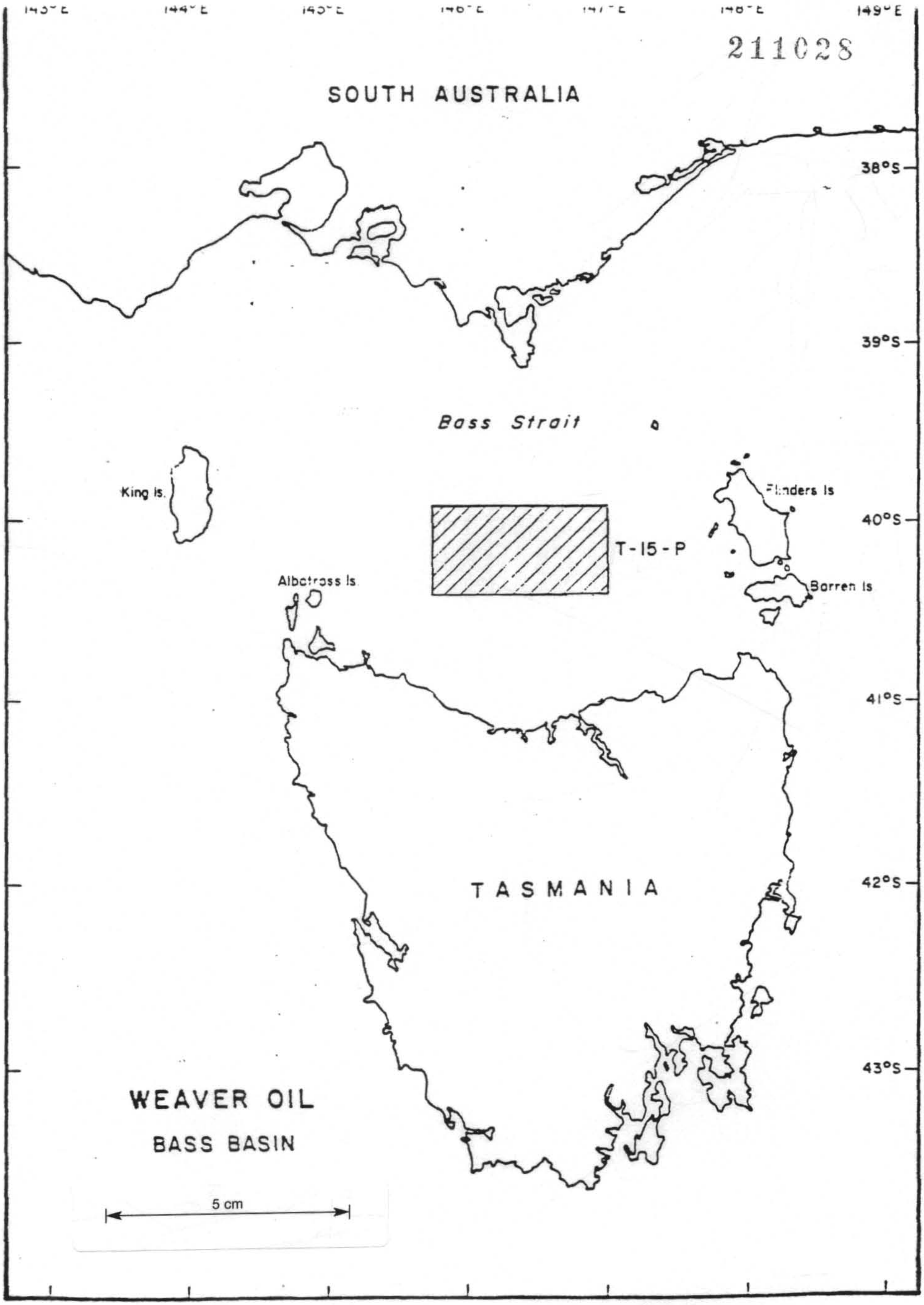
by Geophysical Services International 1972

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. Figure 3 and 4.



143°E
144°E
145°E
146°E
147°E
148°E
149°E
211028
SOUTH AUSTRALIA
38°S
39°S
Bass Strait
King Is.
Flinders Is
40°S
T-15-P
Albatross Is.
Barren Is
41°S
TASMANIA
42°S
43°S
WEAVER OIL
BASS BASIN
5 cm

Figure 3

211029

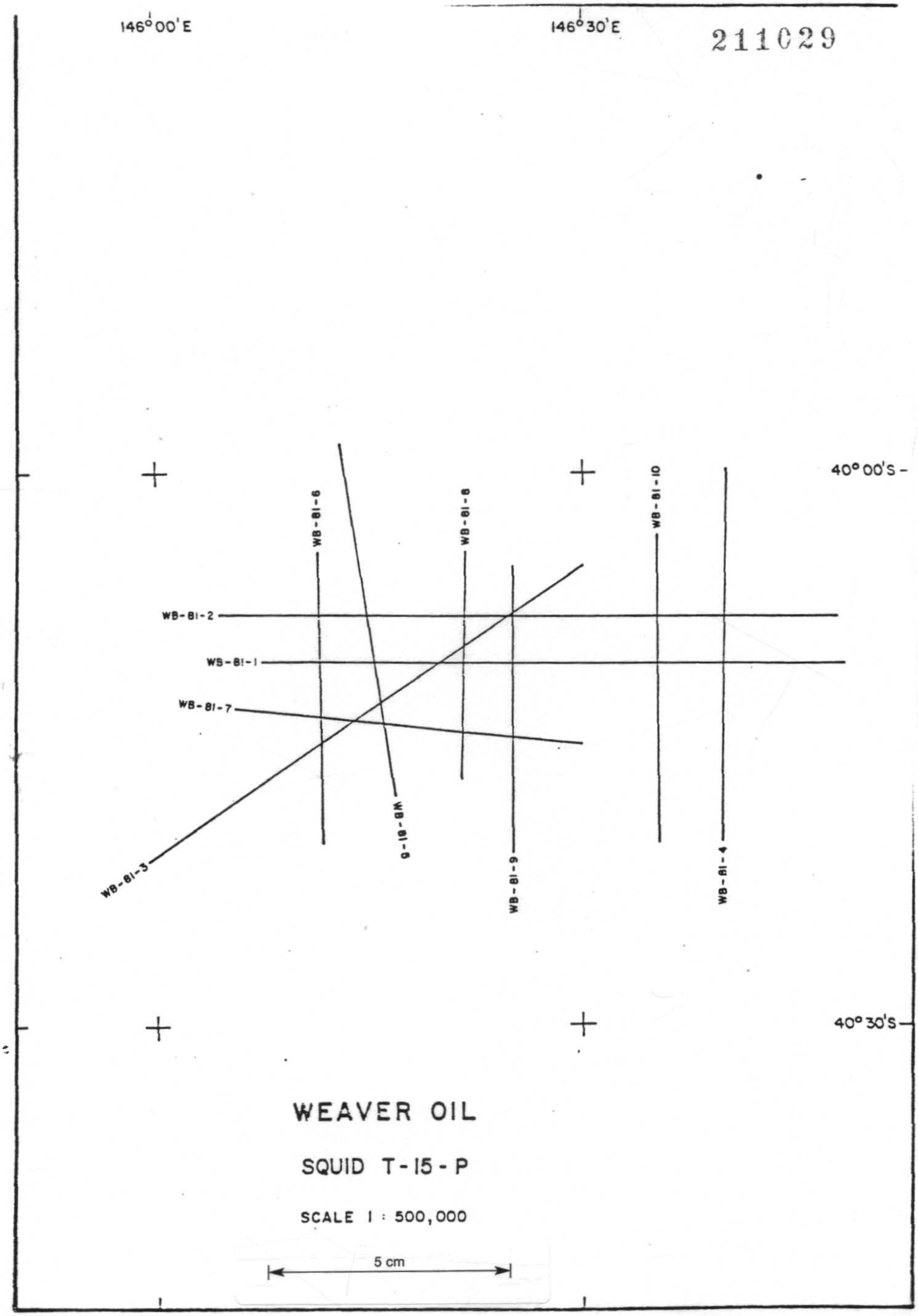


Figure 4

DATA ACQUISITION

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.

Weather

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.

Key Field Personnel

WEAVER 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

Disposition of Data

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 consistant 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 Propellors
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-Altas 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.

Instrument Settings and Specifications

Model	:	DFS V
System Number	:	408
Tape Format	:	SEG-B, 9 track
BPI Density	:	1600
Number of Channels Available	:	124
Number Seismic Channels	:	96
Auxiliary Channels	:	Timebreak - Channel 1 Waterbreak - Channel 2
Pre-Amp Gain	:	36 dB
Total Gain	:	120 dB
Lo Cut Filter	:	Out
Hi Cut Filter	:	64 Hz, Slope 70 dB/OCT
Sample Rate	:	4 milliseconds
Record Length	:	6 seconds
Analog Module Specs		
Frequency Response	:	3 to 256 Hz
Maximum Gain	:	132 dB
Minimum Gain	:	24 dB
Input Impedence		
Difference Mode	:	20,000 ohm resistive in parallel with 0.035 microfarads
Common Mode	:	500 ohms parallel with the series combination of 0.02 microfarads and induction of 6 Henries

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

Common Mode:	F. Range (Hz)	Voltage(Peak)
	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 Enery 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

Airgun Configuration

Array Volume	:	555 cu. inches
Number of Guns	:	10
Array Pressure	:	4500 psi
Shot Depth	:	6 meters
Shot Interval	:	25 meters

STATISTICAL SUMMARY

DATE	LINE	SP - SP	PROFILES	KMS
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

DATA PROCESSING

211045

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.

An 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.

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.

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

211055

REPROCESSING REPORT

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 reformated to SEGY 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 coorelation 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.

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. Latitutde 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 V COS (Latitude) X SIN (Course) + .004154 V^2, is added to each free air gravity sample on the output tape.

Magnetics Reduction

This program computes and subtracts the Earths main magnetic field (IGRF) from the observed data. Computation variables include the prospects location and Julian date of the prospects 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 prupose 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, Eötvös 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 MAPS

Gravity 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° 24'S,on the North by latitude 39° 55'S and extends eastward from longitude 145° 45'E to longitude 147° 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.

INTERPRETATION

General

The Squid Marine seismic program detailed structural leads developed in preceding surveys, and furnished a fill-in of some wide reconnaissance traverses, thus permiting 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.

BASIC DATA ACQUIRED

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 Magnetics Intensity (GAMMAS)

Raw Magnetics (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.l. = 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.l. = 10 GAMMAS

211073

DEPTH TO MAGNETIC BASEMENT
IN THE
SQUID SURVEY AREA
PERMIT T-15-P

October 1981

Aero Service Division
Western Geophysical
Company of America
Houston, Texas

Summary

The Squid survey area is located within the Bass Strait of Southeastern Australia between the Otway Basin to the west and the Gippsland Basin to the east.

Its boundaries are 146° and 146° 45' east longitude and 40° to 40° 30' south latitude.

Three different types of sources seem to be responsible for the magnetic pattern. Very broad basement anomalies suggest basement depths at approximately 4500 meters where one well depth reached 3066 meters at Pelican 2.

In certain areas, bracketed depth values from 7500 meters to 10,000 meters are denoted as intrabasement features. It is conceivable that basement could reach those depths. Questionable depth values at approximately 2500 meters are interpreted as basement, but may represent shallow weakly magnetic volcanics. The broad anomaly pattern on the total intensity map indicates that it is likely that basement is actually deeper.

211075

UNICORN

MARINE SEISMIC SURVEY

1982

TASMANIA

PERMIT T-15/P

for

WEAVER OIL AND GAS CORPORATION, AUSTRALIA
14141 SOUTHWEST FREEWAY
P.O. BOX 4562
HOUSTON, TEXAS 77210

and

109 ST. GEORGE'S TERRACE, 16TH FLOOR
PERTH, (W.A.) AUSTRALIA 6000

by

WESTERN GEOPHYSICAL COMPANY OF AMERICA
10001 RICHMOND AVENUE
HOUSTON, TEXAS
PARTY 86 M/V WESTERN ODYSSEY

Submitted by
Weaver Oil and Gas Corporation
Houston, Texas

211078

ABSTRACT

The Unicorn Seismic Survey comprises 470.425 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 February 26 and March 2, 1982.

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.

GENERAL INFORMATION

Introduction

The 1982 Unicorn Seismic Survey was conducted on Exploration Permit T-15/P which was awarded on February 19, 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 470.425 kilometers (252.1 miles) of new seismic, gravity and magnetic data were recorded between February 26 to March 2, 1982.

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.

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 GeoCenter, Inc. in Houston, Texas for processing.

The energy source consisted of twenty high pressure Western airguns. In normal operating circumstances, ten of the airguns were combined to form a 760 cubic inches tuned array. The airguns are operated at a pressure of 4,500 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.

GEOLOGICAL SUMMARY

The Unicorn Marine Seismic Survey took place in the central and southeastern areas 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 Bassian 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 prognozed 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 hydrocabon 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 Unicorn 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 Strait 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

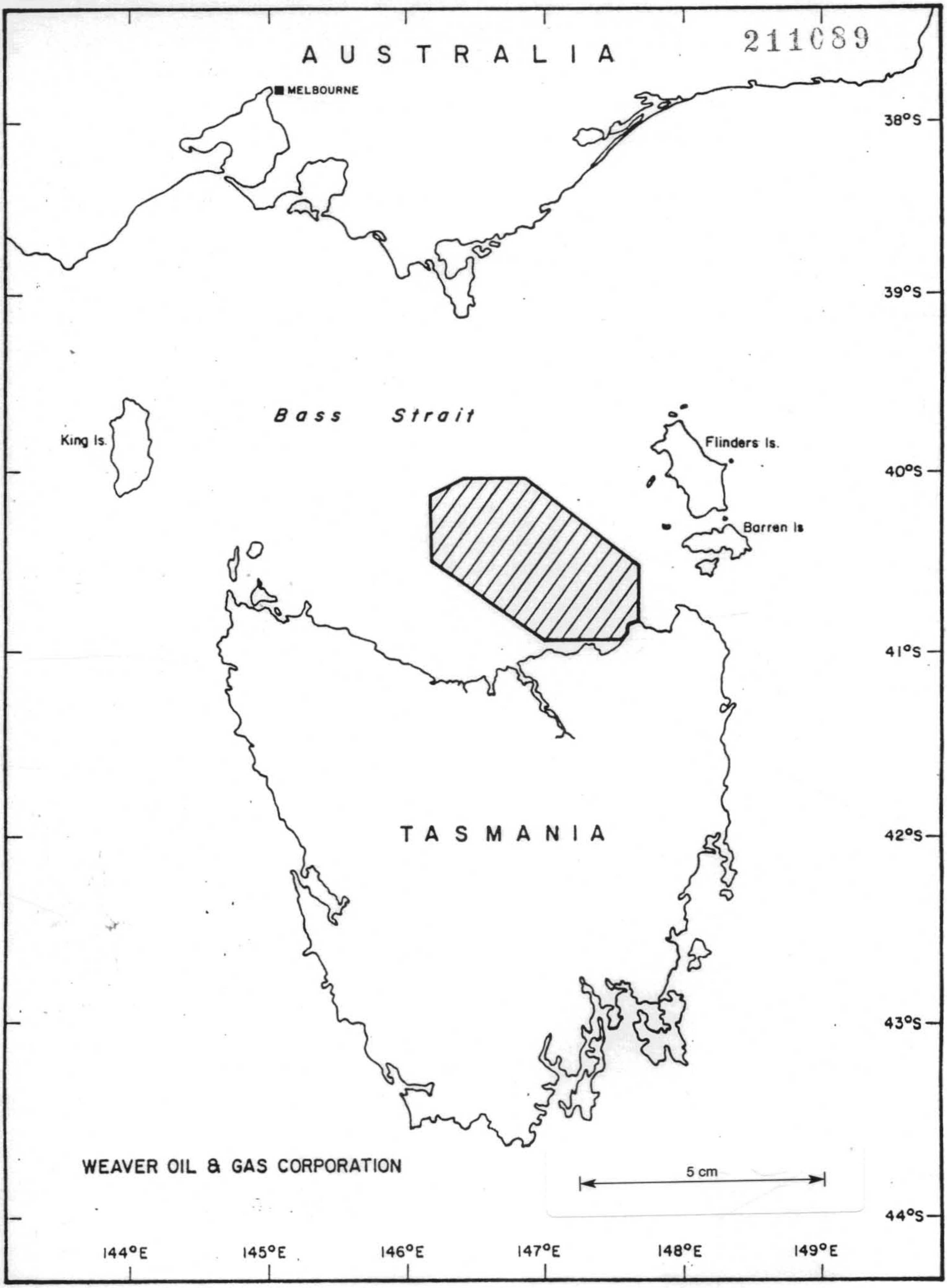
Bass HB75A Seismic Survey for Hematite Petroleum by Geophysical Services International 1975

Squid Seismic Survey for Weaver Oil and Gas Corporation, Australia by Western Geophysical 1981

Description of Survey Area

The prospect was designated as Permit area T-15/P by the Tasmanian Department of Mines. The approximate geodetic center of the prospect for T-15/P was 40° 15' South latitude by 147° East longitude.

There were no major shipping lanes passing through the prospect. Fishing activity in the area was sparse at the time of the survey as not to have an adversed effect on the operation. There were no oil rigs in the area and water depth exceeded twenty meters for the duration of the survey. Figure 5 and 6.



211089
AUSTRALIA
MELBOURNE
Bass Strait
King Is.
Flinders Is.
Barren Is
TASMANIA
WEAVER OIL & GAS CORPORATION
5 cm
38°S
39°S
40°S
41°S
42°S
43°S
44°S
144°E
145°E
146°E
147°E
148°E
149°E

Figure 5

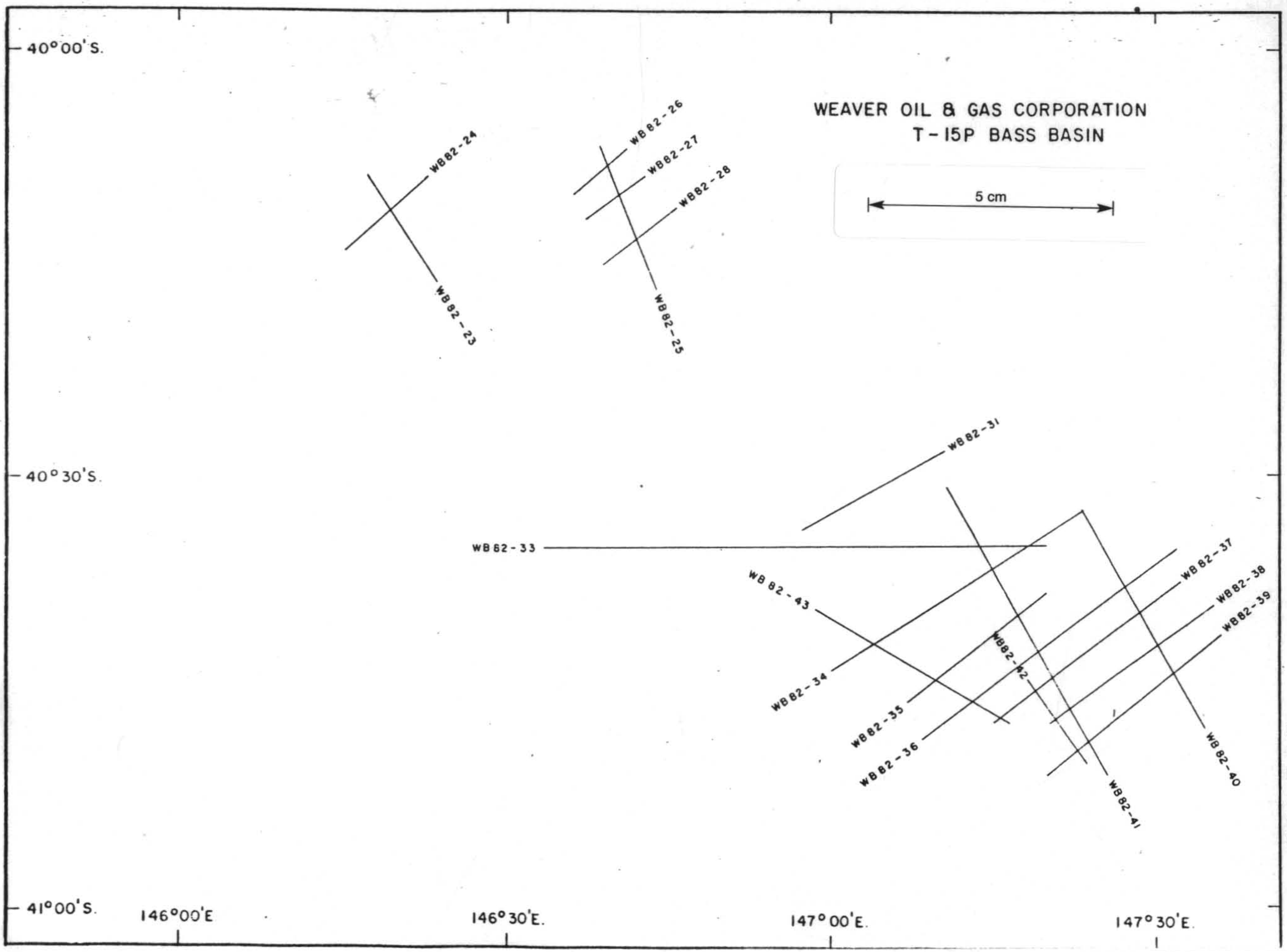


Figure 6

211090

DATA ACQUISITION

Contractors

The survey was conducted on behalf of Weaver Oil and Gas Corporation who contracted Western Geophysical Company of America, a Delaware Corporation and a division of Litton Industries to conduct the above mentioned seismic survey.

Location of Headquarters

The main office of Weaver Oil is located at 14141 Southwest Freeway, P.O. Box 4562, Houston, Texas 77210. It was to this that all correspondence pertaining to the operation were directed.

The head office of Western Geophysical is located at 10001 Richmond Avenue, Houston, Texas, U.S.A. The survey detailed in this text was conducted under the supervision of Western Geophysical's Singapore office located at Unit 301, Union Building, 37 Jalan Pemimpin, Singapore 2057, Republic of Singapore.

A temporary field office was established and maintained by Western Geophysical at Town Central Motel, 164-166 Nicholson Street, Bairnsdale, Victoria 3875, Australia in order to facilitate communications and logistics involved in the operation.

Communications

Daily production reports were issued to Weaver Oil via telex from Western ODYSSEY and Western's field office in Bairnsdale. Production updates and vessel status were periodically issued to Western Geophysical's offices in both Singapore and Houston from the same field office.

Weather

The weather for the survey was fine with slight seas and force 2 winds, however, during February 28 and March 1, winds force 6 to 8 were experienced which resulted in some production time being lost.

Key Field Personnel

David Lowry: Exploration Manager of Weaver Oil and Gas, Australia. Based at Perth office, responsible for Liaison between Western and Weaver's principle office; also, acted as onboard supervisor

Western Geophysical Company:

Boyd Kolozs:	Marine Operations Supervisor based in Singapore
Terry Leighton:	Operations Manager
Peter Rock:	Marine Operations Coordinator
Vinay Sharma:	Instrument Technician
Mike Clark:	Assistant Operations Coordinator
Dicky Chow:	Observer
Mike Casey:	Observer
Glen Batten:	Airgun Mechanic
Mal Weatherspoon:	Airgun Mechanic
Peter Durran:	Mobile Navigator
Ken Furphy:	Mobile Navigator

Disposition of Data

The recorded seismic data tapes, camera monitor records and fathometer charts were sent to GeoCenter, Inc. in Houston, Texas.

The primary navigation data along with the gravity still readings' results, magnetic data and gravity data were sent to Western Geophysical's Singapore office.

Data Processing

Data to be processed by:

Marine Seismic -	GeoCenter, Inc. - Houston, Texas
Magnetic Data -	Aero Service - Houston, Texas
Gravity Data -	Aero Service - Houston, Texas
Primary Navigation Data-	Western Geophysical - Singapore

Instrument Test

Semi-monthly and monthly instrument test were conducted on the DFS V recording system as per the instrument manual's instructions. The results of these tests 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.

EQUIPMENT AND INSTRUMENTATION

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 Propellors
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 m Streamer, 96 groups 25 m group spacing - 96 ch. mode
Energy Source	:	Western Geophysical High Pressure 4500 psi Array Airgun
Compressors	:	6 x Price 5000 psi Compressors electrically driven
Primary Navigation	:	LRS WINS Phase IV Integrated Satellite Navigation System with Doppler Sonar
Communications	:	INMARSAT Satellite Terminal with telex and telephone facilities Sailor 800 Watt Programmable SSB Ship/Shore Radio Sailor VHF Radio
Gravity Meter	:	La Coste Romberg S 88
Magnetometer	:	Geometrics G801/3.
Ancilliary Equipment	:	Litton Resources System Geoscience Data Acquisition System (Data Logger) EPC Single Trace Plotter SIE ERC 10C Monitor Camera LRS-100 Energy Source Synchronizer LRS Airgun Solenoid Controller Kalamos M4 Cable Fault Locator Krupp-Altas Model 640 Fathometer - 2000 fathom range Simrad model EX38D Fathometer - 600 fathom range

RECORDING PARAMETERS

Instrument Settings and Specifications

Model	:	DFS V
System No.	:	408
Pre-Amp Gain	:	36 dB
Total Gain	:	120 dB
Lo Cut Filter	:	OUT 3 Hz, Slope 18 dB/OCT
Hi Cut Filter	:	128 Hz, Slope 70 dB/OCT
Sample Rate	:	2 ms
Record Length	:	5 secs
Tape Format	:	SEG GAP B
BPI Density	:	1600
Number of Channels	:	124
Seismic Channels	:	96
Auxiliary Channels	:	Timebreak - Aux 1 Waterbreak - Aux 2 100 Hz - Aux 4

Analog Module Specs

Frequency Response	:	3 to 256 Hz
Maximum Gain	:	132 dB
Minimum Gain	:	24 dB

Input Impedence

Difference Mode	:	20,000 ohm resistive in parallel with 0.035 microfarads

Max. Input Signal

		Gain Constant	Voltage(mV RMS)
Difference Mode	:	24	327.68
		36	81.92
		48	20.48

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 maximum

Cable Parameters

1. Streamer:

Percent Coverage	:	4800%
Shot Point Interval	:	25 meters
Pops per km	:	40
Number of Groups	:	96
Center Enery Source to Center Near Group	:	194.45 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	:	Tail stretch, 14, 28, 42, 56, 70, 84, 96
Depth Controllers on Groups	:	Tail stretch, 12, 26, 40, 54, 68, 82, head stretch
Water Break Detectors at Head of Groups	:	94
Center Near Group to Sat-Nav Antenna	:	271.4 meters

2. Magnetometer:

Sensitivity	:	1 gamma
Chart Scale	:	0 - 99 gammas

Recorder marked every 50 shotpoints with total magnetic value and time.

Magnetometer Reel to Sensor	:	193 meters

3. Gravity Meter:

The only selectable control on the gravity meter which was used is the 2/3 minutes averaging control. During production recording, all readings were 3 minutes averaged while the still readings in port were 2 minutes averaged.

The chart pen assignments by colour are:

Green	:	Gravity
Black	:	Total Correction
Red	:	Cross Coupling
Orange	:	Spring Tension

Energy Source Configuration

Array Volume	:	760 cubic inches
Number of Guns	:	10
Array Pressure	:	4500 psi
Shot Depth	:	6 meters
Shot Interval	:	25 meters

STATISTICAL SUMMARY

DATE	LINE	SP - SP	PROFILES	KMS
February 26	WB82-23	001 - 646	646	16.150
	WB82-24	001 - 590	590	14.750
	WB82-27	001 - 388	388	9.700
	WB82-26	001 - 351	351	8.775
	WB82-25*	001 - 818	818	20.450
	WB82-28*	001 - 400	400	10.000
February 27	WB82-28*	401 - 497	97	2.425
	WB82-33*	001 - 2684	2684	67.100
	WB82-40*	001 - 1302	1302	32.550
	WB82-41*	001 - 1731	1731	43.275
February 28	WB82-31*	001 - 646	646	16.150
	WB82-43*	001 - 1191	1191	29.775
	WB82-42	001 - 529	529	13.225
	WB82-39	001 - 1159	1159	28.975
	WB82-38	001 - 1025	1025	25.625
	WB82-37	001 - 1203	1203	30.075
March 1	WB82-36	001 - 1535	1535	38.375
March 2	WB82-35	001 - 946	946	23.650
	WB82-34	001 - 1576	1576	39.400
			TOTAL KILOMETERS:	470.425

* Gravity meter not in use.

DATA PROCESSING

Introduction

In February 1982, Western Geophysical Company shot 18 lines, approximately 470 km of marine data offshore Australia, Permit T - 15 (Unicorn) for Weaver Oil And Gas Corporation. The digital processing for this survey was performed by GeoCenter, Inc. of Houston, Texas from February 1982 to April 1982.

The primary navigation system used was WINS PHASE. The secondary navigation system was SAT - NAV.

The seismic recording was done on a DFS V system. The DFS V recorded 96 channels in SEG-B format at a 2 ms sampling interval for 5 seconds. The field filter settings were a low cut out and a high cut out of 128HZ with a slope of 70 db/octave.

The cable used was a 96 group streamer which was pulled at an average depth of 12 meters. Each group consisted of 20 phones evenly spaced with a 25 meter spacing between group centers.

The energy source consisted of an array of 10 air guns with a capacity of 760 cubic inches and 4500 PSI. A shot was made every 25 meters at a depth of 6 meters.

Demultiplex

The data was demultiplexed into trace sequential SEG-Y 32-bit floating point format using our PREP program. During the demultiplex run the near trace was edited to a secondary tape and displayed to check the results of the demultiplex program and to determine velocity analysis locations. Also at this time the data was resampled from 2 ms to 4 ms. An anti-alias filter before resampling was not deemed necessary since the field filter had eliminated the problem.

Testing - Deconvolution

Testing was done on various lines. The geometry tests conducted were adjacent-trace and two-pop sum and also a combination of both. These tests revealed after client review that summing should be performed. The summing improved the signal to noise ratio. Various deconvolution before stack tests were performed. After reviewing the tests with the client, it was decided that a 32 ms predictive distance and a 160 ms operator length was the optimum prestack decon for this data. Post stack deconvolution tests were also performed and after client review it was decided that no post stack decon was necessary.

Our IGEM program then generated common depth point ordered tapes in SEG-Y format incorporating in the trace headers all the basic information regarding field parameter such as spread distances and line geometry. A 2:1 adjacent trace sum was performed at this time prior to CDP sort.

Prior to deconvolution a geometric spreading correction was applied to compensate for spherical divergence. Deconvolution was then performed using the Wiener - Levinson least squares minimum phase algorithm. The design gates for the deconvolution operators varied as a function of the distance of the trace from the source. A new operator was calculated for each trace. Auto correlations were computed before and after deconvolution, providing a check on the effectiveness of the decon.

Velocity Analysis

Velocity analyses were performed using the constant velocity stack method. Six adjacent deconvolved CDP gathers were used. These analyses were performed at the rate of 1 per 2 km. The results were displayed in a variable area, wiggle trace mode using a versatec electrostatic plotter. The stacking velocity functions were determined from these analyses.

Normal moveout corrections were applied to each trace on a fractional millisecond basis. The program used a 16 point Lagrangian operator for interpolation. The velocity functions were input at specified CDP locations along the line. Velocities were then interpolated between input points on a CDP basis. Within each velocity function, RMS velocities were linearly interpolated between control points. Traces were muted individually after normal moveout application. 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 the relative recorded time-varying amplitude of the trace.

Quality control of the applied velocity functions was performed by generating an ISO-VELOCITY plot. Where deemed necessary revised velocity functions were used to compute the normal moveout corrections.

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 were chosen after client review and the filters and times of application are noted in the section headers for each line. These filters were both space and time-variant in order to follow structural trends. Filter slopes are also noted in the side label.

Conclusion

All final sections were checked for quality and approved prior to release. All questionable data was investigated and revised where necessary. The sections were displayed at a vertical scale of 2.5 in/sec and a horizontal scale of 24 tr/in. All velocity information i.e. "knee points", line ties, and water depth were noted at the top of the section.

J. S. Hayhre
Data Processing Manager

PROCESSING GRAVITY/MAGNETIC DATA

IN

BASS BASIN

UNICORN AREA

OFFSHORE AUSTRALIA

1982 SURVEY

for

WEAVER OIL AND GAS

by

AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA

AUGUST, 1982

THE GRAVITY AND MAGNETIC SURVEY

The Gravity and Magnetic Field Survey was performed on Weaver Oil and Gas, Australia Permits T-15/P between February 22, 1982 and March 4, 1982 by Western Geophysical Company of America, Party 86 on board the M/V Western ODYSSEY. The gravity meter used was La Coste 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 the survey was made at Port Victoria, Australia and a base value of 980,038.85 milligals 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 coordinates were provided by Western Geophysical Company of America using the ARGO navigation system. There were approximately 280.4 kilometers of gravity and 475.4 kilometers of magnetics recorded with 18 line segments. All gravity and magnetic data was directly tied to the previous Bass Basin survey shot in April, 1981.

PROCESSING FLOW

Plate 10 shows the data processing flow for the gravity and magnetics processing. The following paragraphs discuss each of the steps involved in the data processing flow.

Edit - This program processes the field tapes data at 20 second intervals and outputs a gravity and magnetic sample at every minute by averaging the current sample with the samples occurring 20 seconds earlier and 20 seconds later. Before averaging, each sample is checked to see if the value falls within a reasonable accepted range for such data. If a value falls outside the acceptable range, it is not used in the average. A delta value check is made also. The values used were:

	Delta	Minimum	Maximum	
Gravity	333	55,000	70,000	Counter Units
Magnetics	666	25,000	60,000	Gammas

These numbers were based on empirical information gathered during previous data processing.

GRAVITY/MAGNETICS UPDATE - This program is used to make changes to line numbers, water depths, or to manually update sensor information when obvious errors such as one point spikes not trapped by the edit program appear on the quality control profiles.

NAVIGATION REFORMAT - This program changes the format of the navigation tapes to Aero's standard gravity/magnetics tape format to facilitate further processing.

NAVIGATION RESEQUENCE - This program records all navigation data to coincide with the gravity and magnetics data.

NAVIGATION MERGE - After the reformatting and resequencing operations have been performed, this program merges the navigation data with the gravity and magnetics data, scales gravity counter units to milligals using the gravity meter constant, scales gravity counter units to milligals using the gravity meter constant, and computes latitude corrections. Latitude corrections are computed using the algorithm for the Geodetic Reference System, 1967 (GFGRS, 1967). If any discontinuities (large distance jumps) or missing data exist, the affected samples are flagged. All subsequent processes are performed using the merged gravity magnetics formatted (GMI) tape. It was notice at this point that there were 6 line segments of gravity data where the gravity meter had malfunctioned. These lines were deleted from further processing and are listed as follows:

WB82-25 WB82-28 WB82-31 WB82-33 WB82-40 WB82-41

"EOTVOS" EFFECT REMOVAL - This program reads the GMI tape and computes a raw Eotvos correction for each sample using the following formula:

E = 7.5 * S * COS (LAT) * SIN (HEAD)

where

E = Eotvos correction

S = Ship's speed in knots

LAT = Ship's latitude

HEAD = Ship's heading

Speed and heading are computed from the time, latitude, and longitude of the tape record. These raw Eotvos numbers are smoothed in a three (3) point running average synthetic operation and then filtered using a parabolic recursive filter passing frequencies below 0.0007 Hz. This filter setting has proven to be effective in reducing high frequency noise jitter associated with ship motion and navigation resolution. The final filtered Eotvos correction is applied to each free air gravity sample and all values are written onto the output tape.

MAGNETIC REGIONAL REMOVAL AND HORIZONTAL GRADIENT CALCULATION

This program reads the GMI tape and computes the earth's normal magnetic field using the International Geomagnetic Reference, 1975 updated to 1981. Each sample's latitude, longitude, and time is used to develop a unique value for that sample. This program also calculates the magnetic horizontal gradient from the gradiometer system's master and slave sensors by subtraction and division by the distance between sensors where applicable.

FILTERING - Low pass filtering operations are performed on both the gravity and magnetics data. The magnetics filtering is used to smooth high frequency instrument noise and the gravity filter is used to smooth the effects of the sea state and wave action. Each preliminary profile is examined and a particular filter length is chosen manually to compensate for the observed "noise". A filter length of 0.0003 Hz. was used for the gravity data and 0.0008 Hz. was used for the magnetic data. After the filtering process, each line is checked by plotting profiles displaying water depth, Eotvos, free air gravity without Eotvos correction, unfiltered free air gravity with Eotvos correction, filtered free air gravity with Eotvos, and unfiltered magnetics. Any error conditions (such as direct or inverse correlation of Eotvos correction and Bouguer gravity, improper filtering, or errors in water depths) are spotted and corrected before further processing.

INTERSECTION PICKER - Latitude and longitude coordinates from the GMI tape are input to this program and an intersection algorithm calculates sample times at which lines cross one another. Subsequent processing programs use this intersection information to compute statistics for applying systematic corrections.

INTERSECTION MISTIE - By using the intersections determined in the Intersection Picker Program and the sensor data tape output by the Filter Program, this program calculates the filtered free air gravity and filtered magnetics misties at intersections. The average free air mistie is 7.67 milligals, and the average magnetics mistie is 14.18 gammas.

FREE AIR SYSFIX - The sensor data output from the Filter Program and the mistie data are used to compute a systematic adjustment bias for each line by the method of least squares. The data is then corrected by adding the applicable bias to each line. The average filtered adjusted free air gravity mistie for the survey after this process is 2.36 milligals.

MAGNETICS SYSFIX - Next the same procedure as above is used to systematically adjust the magnetics data. The average magnetics mistie for the survey for the adjusted filtered magnetics is 8.36 gammas.

BOUGUER AND TERRAIN CORRECTION - The water depths values at each sample are used to compute Bouguer and terrain corrections for application to the adjusted free air gravity. The terrain corrections are two (2) dimensional and are computed by the Talwani et al method referenced in the Journal of Geophysical Research, Vol. 64, No. 1 January, 1959, page 49. The first and last depth for each line is extended to infinity for purposes of this calculation.

INTERSECTION MISTIE - This program is run next to compute mistie in the unadjusted Bouguer gravity after the above correction have been applied. The average mistie for the unadjusted Bouguer gravity is 12.11 milligals.

BOUGUER GRAVITY SYSFIX - Using the sensor data output by the Bouguer and terrain correction program and the mistie information listed above, a systematic error correction is computed and applied using least squares to minimize the average errors across the entire survey. After applying this correction for the survey, the average mistie is 2.32 milligals.

FINAL GRAVITY/MAGNETICS PROFILE - This program creates a Calcomp drum plot tape from the sensor data contained on a GMI tape. This tape is fed to a Calcomp 1052 drum plotter and the final gravity and magnetics profiles are plotted on 10" gridded paper. The horizontal scale of the profiles for the survey is 1 inch = 2,450 meters. Vertical scales of the plotted curves are listed below:

GRAVITY:

a) Final Bouguer Gravity @ 5 milligals/inch
b) Adjusted Free Air Gravity @ 5 milligals/inch
c) Adjusted Bouguer Gravity @ 5 milligals/inch
d) Eotvos Correction @ 5 milligals/inch
e) Water Depths @ 20 meters/inch

MAGNETICS:

f) Adjusted Raw Magnetics @ 20 gammas/inch
g) Total Magnetic Intensity @ 20 gammas/inch

In addition to the above presentation, a set of gravity and magnetic profiles were produced on 10" gridded mylar with the horizontal scale of 1" = 575 meters matching the seismic sections scale. Vertical scales of the two plotted curves are as follows:

h) Final Bouguer Gravity @ 5 milligals/inch

i) Total Magnetic Intensity @ 20 gammas/inch

GRAVITY/MAGNETICS MAPMAKER - This program creates a Flatbed plot tape from the sensor data contained on a GMI tape, this data is fed to a 748 Flatbed plotter and the final mylar maps on which the contours are drafted are made. The maps are at a scale of 1:100,000. The projection used was Universal Transverse Mercator with the spheroid being Australian National. The central meridian is 147°E. The maps are bounded on the south by latitude 41°00'S, on the north by latitude 148°00'E. and extend eartward from longitude 144°00'E to longitude 146°00'E. The maps covering the entire survey area are as follows:

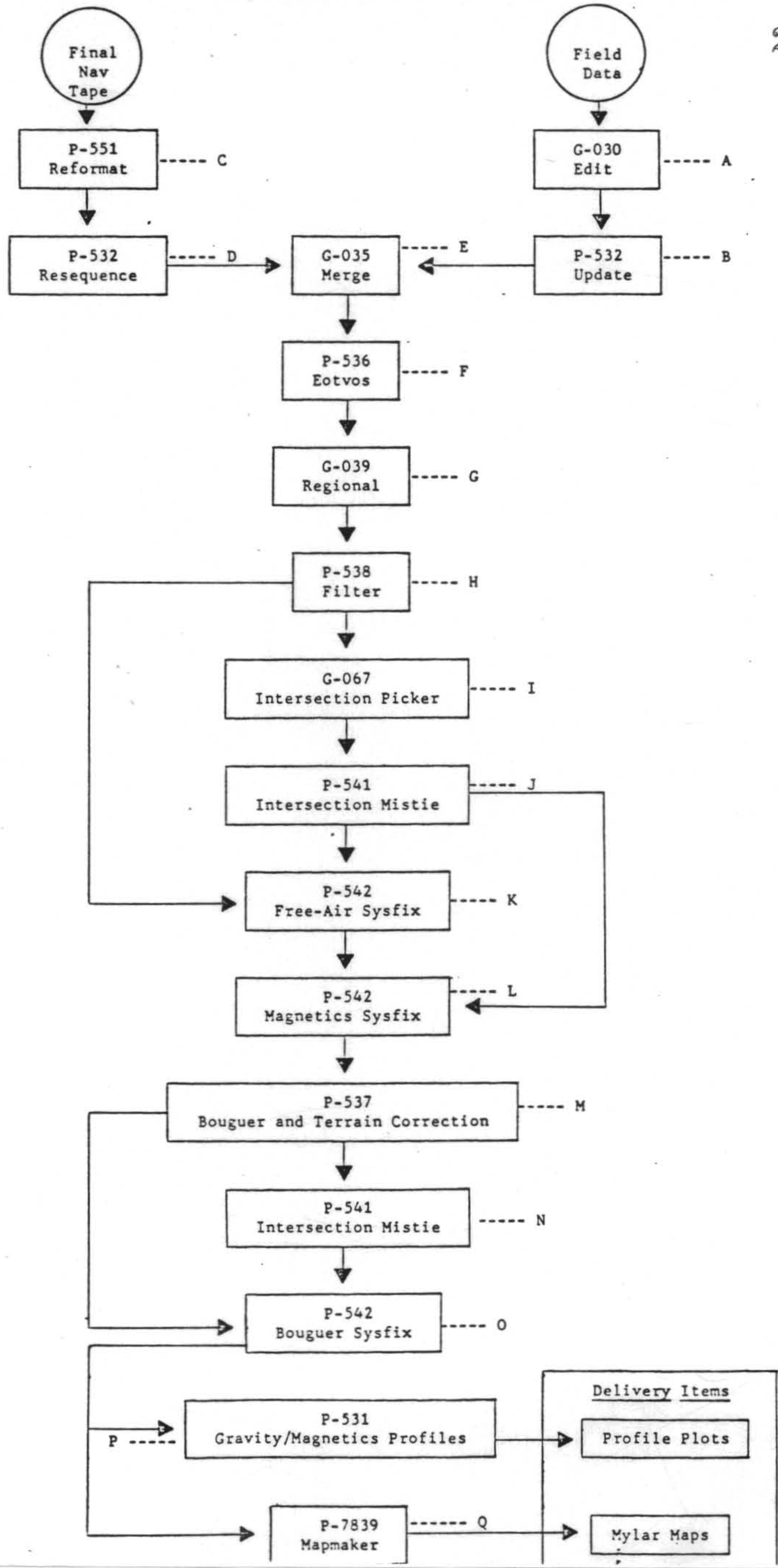
a) Six (6) Total Magnetic Anomaly Map @ contour interval = 10 gammas (MAPS 1-5) and 20 gammas (MAP 6)

b) Six (6) Bouguer Gravity Map @ contour interval = 1 milligal.

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.


Final Nav Tape
Field Data
P-551 Reformat
----- C
G-030 Edit
----- A
P-532 Resequence
----- D
G-035 Merge
----- E
P-532 Update
----- B
P-536 Eotvos
----- F
G-039 Regional
----- G
P-538 Filter
----- H
G-067 Intersection Picker
----- I
P-541 Intersection Mistie
----- J
P-542 Free-Air Sysfix
----- K
P-542 Magnetics Sysfix
----- L
P-537 Bouguer and Terrain Correction
----- M
P-541 Intersection Mistie
----- N
P-542 Bouguer Sysfix
----- O
P-531 Gravity/Magnetics Profiles
P -----
P-7839 Mapmaker
------ Q
Delivery Items
Profile Plots
Mylar Maps

INTERPRETATION

General

The Unicorn 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 certain areas of 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 was established in the Squid Seismic Survey (1981). Further ties were made to the Durroon well with 1982 data. The correlation is somewhat tenuous due to the distance involved and the significant variations in signal character, nevertheless it does provide some valuable stratigraphic control.

Map Horizons

Semi-continuous reflective 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

Prominent features have been previously noted prospects and remapped utilizing the additional seismic control gained as a result of this survey.

Squid Prospect - The Squid Anomaly is a major deep-seated domal feature illustrated by the seismic lines of the 1981 Squid Survey. Since the crest of the structure fell in a seismic void, two additional lines were acquired directly across the contoured crest to defend its validity. The prospect is considered prospective at the Oligocene as well as Eocene and deeper levels.

Chat Prospect - The Chat structure is a relatively small tilted fault block closure controlled by a down-to-the northeast fault. It is well illustrated by the seismic lines of the Squid and Unicorn surveys.

Sea Eagle Prospect - This major structure has been mapped on the Base of the Eastern View Coal Measures. It is a large anomaly on the upthrown side of a major tilted fault block.

Shearwater Prospect - Top of Lower Cretaceous. This anomaly is also a tilted fault block with closure controlled by a down-to-the northeast fault. As mapped on the Top of Lower Cretaceous, it lies within the same major fault block as the Duroon well; however, the crest of the Shearwater Prospect is 2932' above the Duroon location. The area of closure of this prospect is 17,520 acres, with approximately 14,027 acres being above the Duroon well.

A map was also constructed on a reflector in the Lower Eastern View Coal Measures. It has 8640 acres under closure and has a vertical closure of 1366'. The depth to the interpreted horizon is 2550'.

SECTION II

SEISMIC MODELS

SEISMIC MODELS

Prospect Definition

The Squid prospect is defined by fourteen seismic lines acquired through the late 60's and early 70's by the previous permit holder. In addition, the prospect is further defined by eight Weaver seismic lines acquired in 1981 and two seismic lines also acquired by Weaver in 1982.

Seismic models of the Oligocene lens and underlying section have seen constructed and analysed by Seiscom Delta, Technica Inc. and Exploration Associates International. Results are presented and summarized.

SEISMCOM DELTA TRACE ANALYSIS

A complex trace analysis have been performed by Seiscom Delta on Weaver's seismic line WB-81-01 in order to provide a better understanding of the Oligocene lens as well as its effects on the underlying seismic reflectors. Color displays have been provided previously. Enclosed are black and white copies for purpose of reference.

The Reflection Strength display, Figure 7 , of Weaver's seismic line WB-81-01 shows that the Oligocene lens is characterized by an increase in reflection strength at its upper surface. Its lower survace also displays an increase in reflection strength. Lateral fading is also observed.

The trace analysis leading to the construction of the Weighted Frequency display, Figure 8 , emphasises the stronger reflecting events and smooths out irregularities caused by noise. Improved reflector continuity is observed.

The Apparent Polarity display, Figure 9 , distinguishes a lower acoustic impedance area within the lens as well as improved continuity of the reflector.

The Instantaneous Phase display, Figure 10, effectively shows discontinuties and angularities as it is independent of reflection strength.

The Instantaneous Velocity display, Figure 11, as determined from signal amplitude, emphasises the boundaries of the Oligocene lens, as indicated by a reduction in velocity from 8,500 feet per seconds to 6,500 feet per seconds within the lens.

211124

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

SQUID PROSPECT

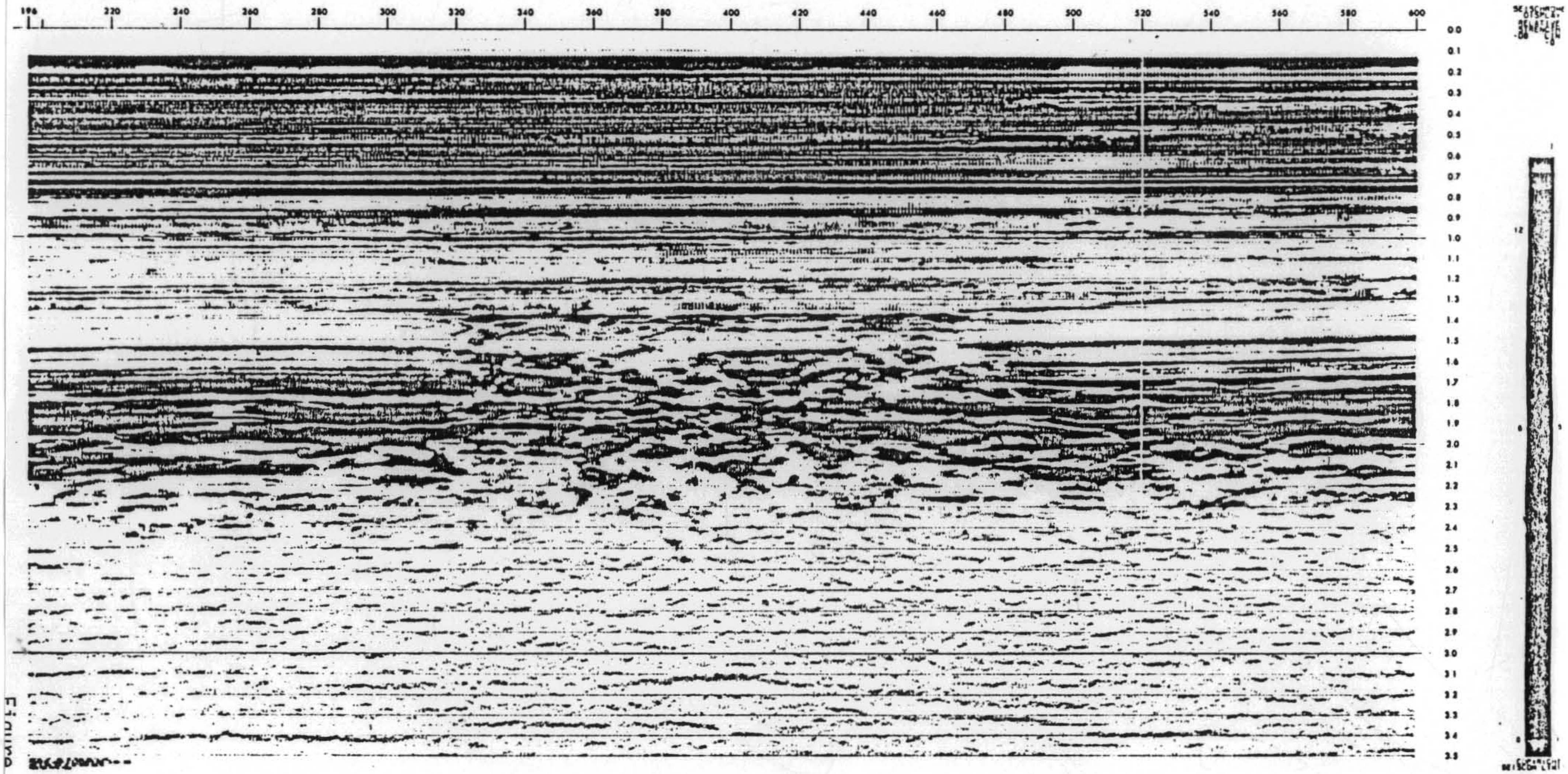


Figure 7

5 cm

FIGURE 7.

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

211125

SQUID PROSPECT

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

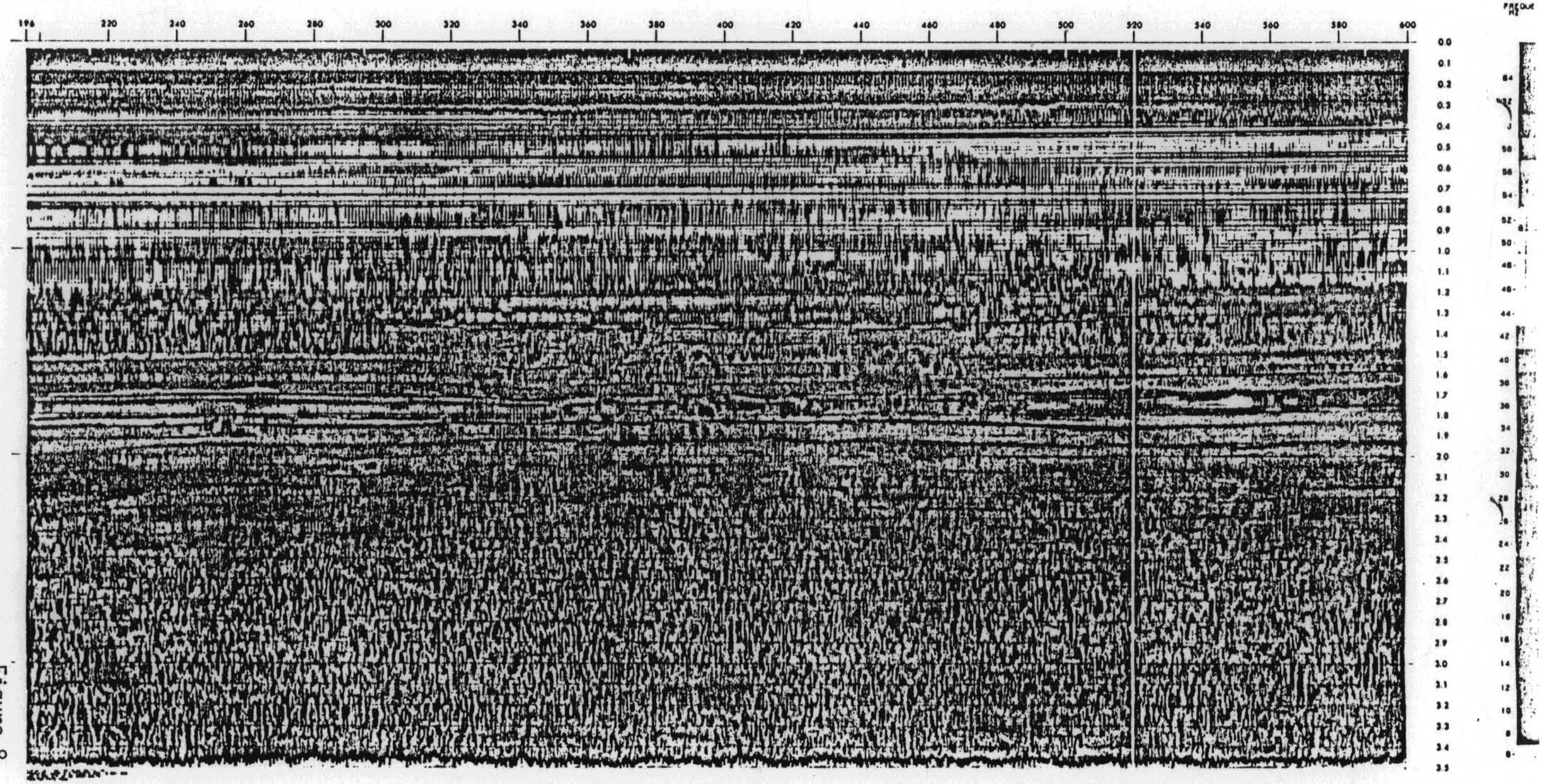


Figure 8

5 cm

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

211126

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

SQUID PROSPECT

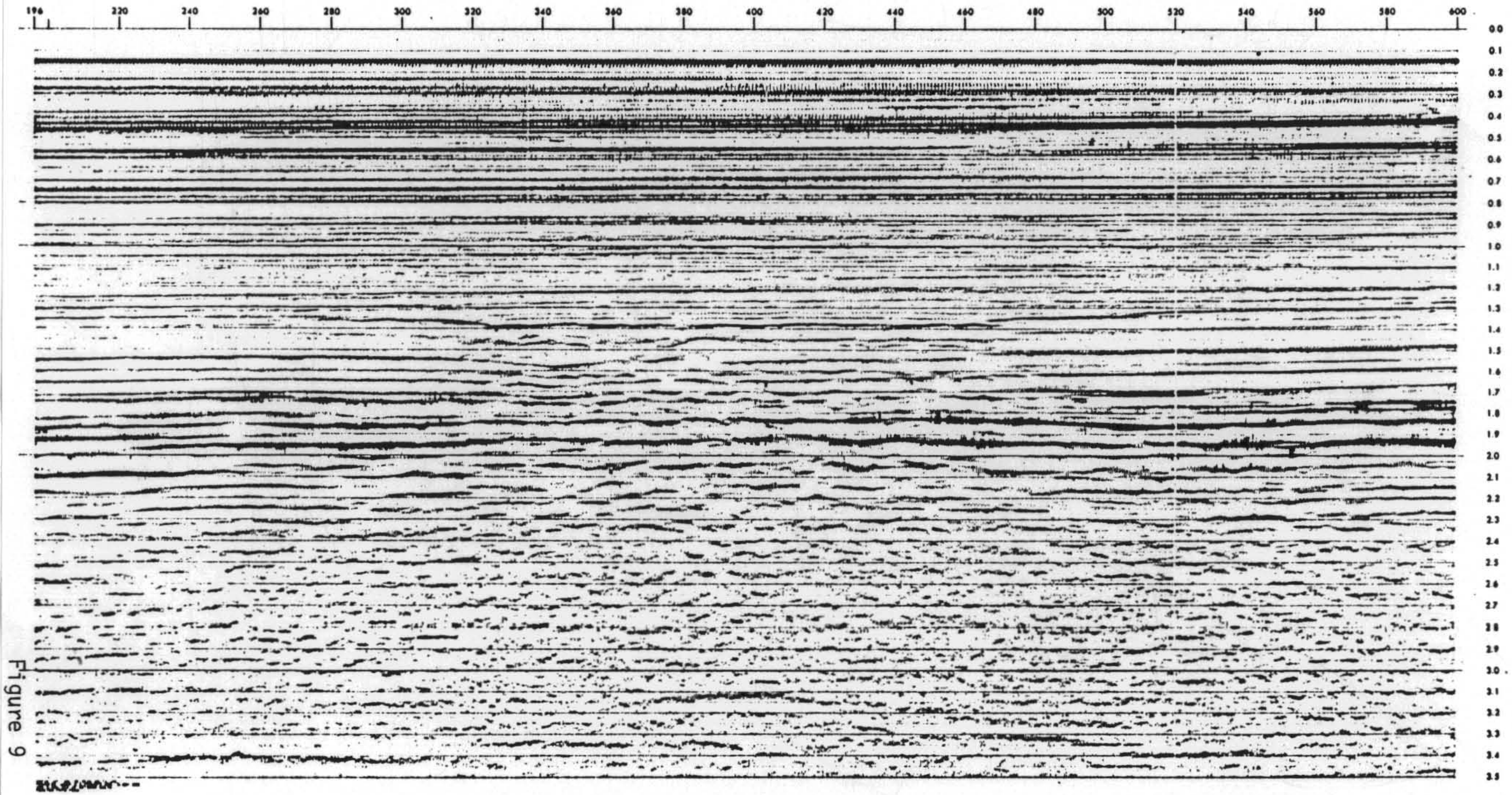


Figure 9

5 cm

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

211127

SQUID PROSPECT

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

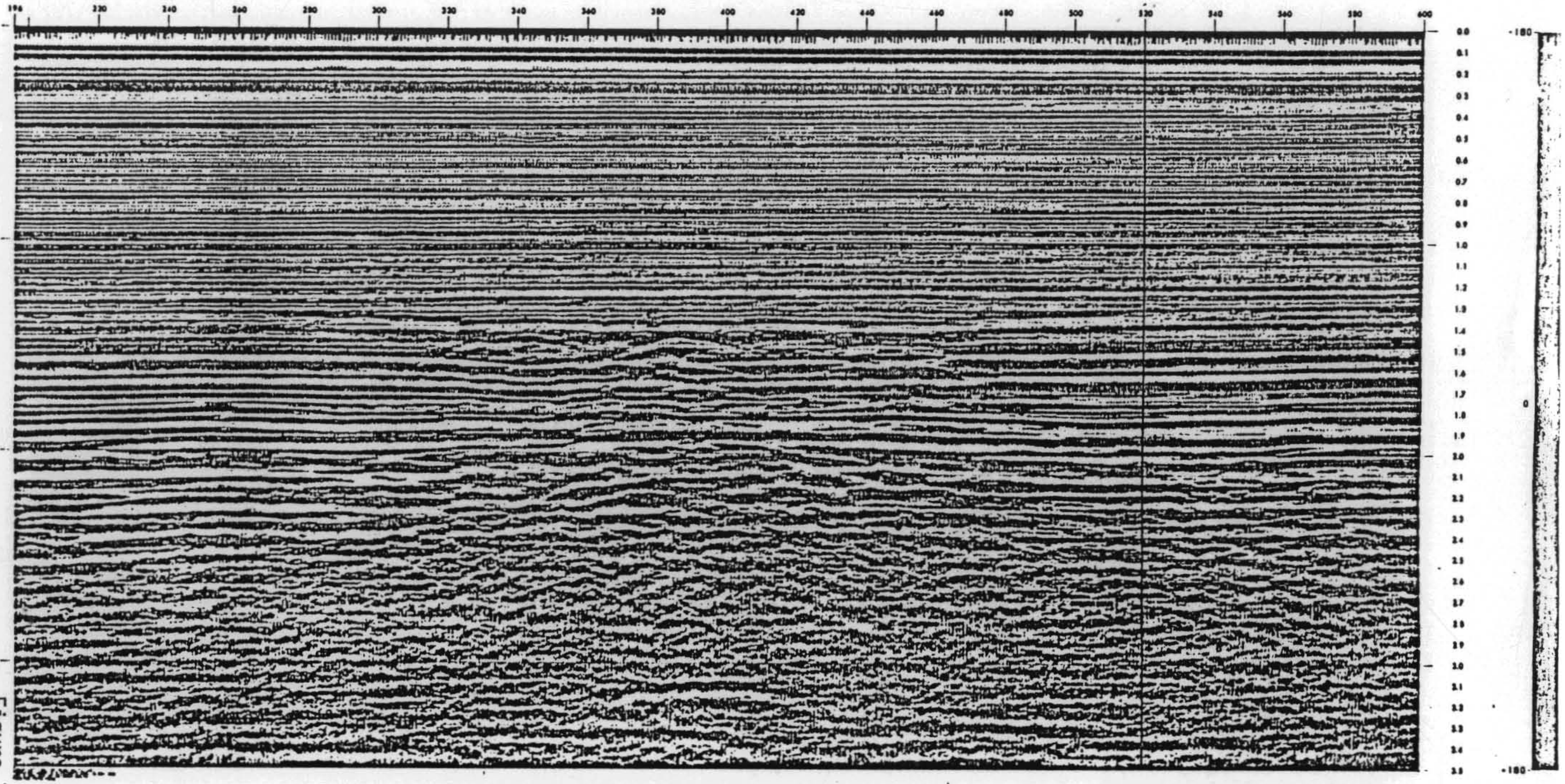


Figure 10

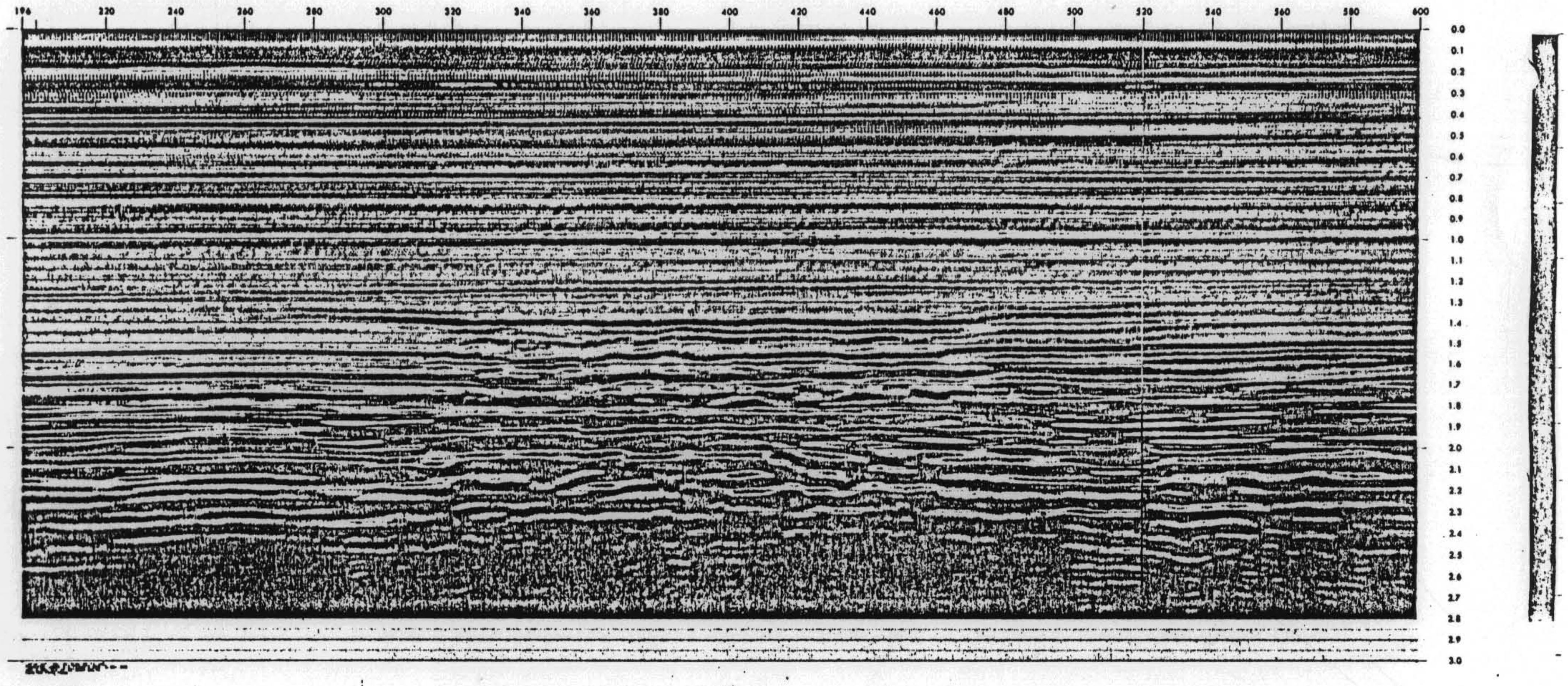
5 cm

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

211128

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

SQUID PROSPECT



5 cm

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

Figure 11

SEISLOG PROCESSING - LINE WB-81-7

INTRODUCTION

This report describes the results of Seislog^R processing and interpretation of a single seismic line in the Bass Basin. The study was designed to evaluate an amplitude anomaly in Oligiocene age strata approximately 1,000' above the Demon's Bluff shale.

The project area provides a rather severe test of the method since no direct well tie was available. Hence, it was necessary to project Esso Pelican #1 well to the line to recognize stratigraphic units and estimate the velocity of lithologic units. Seislog^R is more accurate at defining precise lithilogy when lines serve to extend data from a well location.

Geologists frequently use sonic logs as an aid to the construction of the subsurface geologic sections. A Seislog^R is a synthetic sonic log, produced by combining velocity coefficients derived from density-corrected inverted seismic traces with low frequency velocity components obtained from velocity data. The result is a synthetic sonic log which, within the limits of resolution of the seismic method and the constraints of wave propogation data, can be used for subsurface interpretation in exactly the same manner as sonic logs.

The present study is based on data of good quality although, as in most marine areas, there appears to be only about 60 hz useable data in the Oligocene strata.

Seislog^R . . . registered trademark of Teknica

The Seislog[R] results supply an abundance of geological information, adding much to the interpretive data which can be extracted from the seismic section, but even so it remains interpretive due to the extremely complex nature of the stratigraphy within the sedimentary section and the distance of projection of the only well control.

RECORDING PARAMETERS

Recording:

Recorded by	Western Geophysical Co.
Instruments	DFS V
Coverage	48 fold
Filter	0 - 64 hz

Source:

Type	Air Guns
Shot Interval	25 meters
Charge Size	10 guns at 4,500 PSI Average Depth 6 meters
Pattern	Not applicable

Detectors:

Group Interval	25 meters
Type Cable	Streamer, 96 hydrophone groups
Cable Layout	X——96——| |—200.7 meters—|—2375 meters—|
Spread	2575.7 meters

Teknica Inc.

WELL TIES

The best and simplest manner to verify the quality of the original seismic data and the validity of the inversion processing is to compare the sonic log from a nearby borehole to a Seislog synthetic sonic. A good match leads to a high degree of confidence in the results, while a poor match naturally produces the opposite effect. Even negative results have some value for inasmuch as the inversion process is fundamentally a standard processing routine applied to field seismic data. A poor match is often symptomatic of some problem inherent in the seismic data, revealing aberrations that may not be evident on the conventional seismic display section.

Borehole log signals include high frequencies, and provide great detail in the definition of the sedimentary column. Seismic data are subject to the filtering effects of the earth in their passage through it. Hence, they are frequency band-limited and the derived synthetic logs can provide less resolution than the borehole log. The effect is analagous to a borehole log produced with very long separation, say 50 feet, between the source and receiver.

To simulate this effect the borehole sonic log used for control (Esso Pelican #1) has been digitized, integrated to a vertical time scale, filtered to approximately the same range as the seismic data, and then replotted in depth to match the scales of the Seislog^R output.

Simple inversion of seismic data will produce an impedance log which also lacks low frequency components, and which is influenced by density. The Seislog^R process corrects the impedance log for density and then uses the resulting velocity coefficients to modulate low frequency velocity components derived from velocity data. Normal seismic field data has a frequency range which usually extends from about 10 to approximately 100 hz. Low frequencies from velocity data will extend over a range from 0 to a high limit which rarely exceeds 10 hz. When the highest frequency of the velocity information fails to meet the lowest frequency of the seismic information a gap will occur in the spectrum of the synthetic log.

The sonic log used for control is plotted to the same scale as the Seislog^R section. Each log curve is referenced to a 90 microseconds-per-foot base line, indicated at both the top and the base of each log curve; and each Seislog^R is referenced to a 90 microseconds-per-foot base line located at the shotpoint number designator for that particular log.

The only well available is the Esso Pelican #1 which can be projected to Line 3 over 20 kms from the project area. To overcome the projection problem the synthetic seismogram constructed by GTS Corporation was used to locate the Demon's Bluff Formation on the conventional seismic line of Line 3. This horizon was followed on the sections to the portion of Line 7 which was processed into Seislog^R. When this was done, the line was processed so that the Demon's Bluff Formation was a key horizon in phase compensation. The correlation between the projected well and the Seislog^R was based primarily on the Demon's Bluff although there is fair unit-for-unit relationship in the coal-bearing horizons.

Additional evidence for the validity of the correlation can be found in the derived depths. Due to the distance of projection the depth surface for the Seislog was constructed using the move-out function. This method is often subject to error due both to the vagaries of velocity determination from move-out data and a lag present in seismic times. Overall, however, a depth of 5,500' for the base of Oligiocene seems reasonable based on well control.

When the velocity surface was constructed from the move-out data an automatic routine is used. This routine is checked manually to determine the validity of the picks being selected. For this project, it is probably not possible to accurately measure move-out closer than ± 200 ft. per second. Errors of this magnitude are such that shales the thickness of the Demon's Bluff do not cause perturbations of the average velocity curve. It was concluded that using move-out data, it is not possible to accurately locate the Demon's Bluff as an interval velocity unit. Of course, the Demon's Bluff is recognizable on the high frequency data derived from inversion of the seismic signal.

In the zone above the Demon's Bluff our anlaysis revealed no unusual move-out velocity data. This is not surprising, since it would take a considerable gas column to perturb the move-out away from a curve whose average velocity could be determined within accuracy of only ± 200 feet/second. It was concluded that either there was no significant gas column, or that the move-out function was too coarse a measuring tool to recognize it.

SEISLOG INTERPRETATION

Introduction

The interpreter of conventional seismic data measures one basic dimension: vertical time. He augments this information by interpreting the significance of amplitude changes and variations in reflection character, but in the end the only quantity placed on the seismic map has the dimension of vertical reflection time.

An interpreter of the Seislog section also makes vertical measurements but these are in depth rather than reflection time. Time measurements are subject to severe vertical distortion where the sedimentary section has substantial variations in vertical velocity with depth. Furthermore, in a situation such as found on this study, where there is substantial change in interval across the major fault, the time distortion is different on opposite sides of the fault and a mistaken impression of the physical situation may result.

To illustrate this point, compare the seismic time section to the Seislog depth section. Seismic time reference markers have been marked lightly on the Seislog section in order to relate seismic time to Seislog depth.

The Seislog interpreter has an advantage over the seismic interpreter in that he has, in addition to the vertical depth measurements, a second measured dimension, that of formation transit-time. The transit-time measurements can be coded in color automatically by special plotting equipment to represent the variations in velocity within each geological member thick enough to be resolved by the basic data. If an assumption is made that each stratigraphic member of the subsurface has a characteristic velocity which will remain constant until the composition of the rock, or the porosity changes, then that member will have a characteristic, although not necessarily unique, color division on the section. Lateral changes in color within any unit, which may occur independently of structure, likely represent changes in lithology and/or porosity.

In general, the color scheme is grouped by convention into two major divisions. Yellow and brown tones signify high velocity material while shades of green are used for the obvious low velocities commonly associated with shales. Within these groups, colors generally become darker or more intense as the velocity of sandstones increases, but at the other end of the scale, the green colors darken for the lower velocity shales.

Contrasts in color in the section often mark boundaries of age or deposition, but in addition the character of each log can and should be used for correlation from log to log when mapping such boundaries, particularly when changing lithology or porosity of a given rock unit is believed to change laterally at the boundary contact.

A further complicating factor is the velocity increase with increased depth of burial or loading. This effect is most noticeable in areas where a fair amount of structure is present. Formations having a given velocity at one depth, will usually have a slightly higher velocity at any appreciably greater depth. This is particularly true of shales, but less noticeable for the more competent rocks.

Also included in this report is a vertical time scaled section of impedance logs from which the Seislogs were derived. It is possible to correlate events on the Seislog depth section to events of equivalent character on the impedance log time section. The vertical time measurements on the impedance log section can in turn be tied directly back to the conventional seismic time section. While this may appear to be a redundant exercise, it is nevertheless often useful to find out what in the lithologic section generates particular seismic events. Events mapped as tops on the seismic section may, and quite often do, differ significantly from the actual geologic boundary as discussed for the top of Buckner in the section on well ties. For quick reference, time reference markers are included on the Seislog section to provide a gross reference to the time sections.

The conventional seismic section has an overall "dish-shaped" anomaly SP's 875 to 631. On the Seislog section the base of the feature is outlined with wiggle tape. This taping convention is utilized when it can be demonstrated that there are unconformable relationships. Truncation of a low velocity unit is present at SP 865 at 4,700' and a deeper high velocity bed at 4,900' at SP 799. This suggests an erosional surface. The termination of high and low velocity lenses above this surface indicates a depositional sequence that was localized.

The combination of basal erosional surface and superposed isolated lenses is typical of a channel sequence, or deposition over an eroded surface. In both cases, the depositional relief created at the scour surface controlled the processes of deposition.

One method of determining whether the "channel" acted as a hydrocarbon trap is to look for velocity anomalies that would be attributed to the presence of natural gas. The first step in locating a bright spot is to search for a regional shale. Normally, shales can be recognized as low velocity units that can be carried easily across the section. Between 4,000' and 4,500' there are two good marker shales outlined in dark green color that can be traced from one end of the line to the other. Gas accumulations can then be found by searching for low velocity units which are: (1) lenticular; (2) lower velocity than the shale; (3) stratigraphically or structurally trapped. If the channel sequence is considered to be the most probable trapping mechanism, there are no Seislog units that meet criteria (1) and (2) within the channel on this line.

There are other features useful for gas recognition, but if criteria (1) thru (3) are met the probability of encountering a porous sandstone with a thick gas column is very high. The converse is also valid. There appears to be no thick gas column in this portion of the channel. There can be very complex relationships between sand velocity, shale velocity, and gas-filled sand velocity. These can often be recognized and followed during development drilling. In an exploration case, however, the only useful criteria are those listed above.

If no classic gas anomaly is recognized what generates the slight sag beneath the channel anomaly? The sag area is one of geophysical interest since the strata on either side have remarkable continuity. An explanation of the feature must account for both the structural attitude and the sudden loss of data quality. At the 1" = 100' scale of the Seislog there are some abrupt dip rate changes beneath the channel right at the margin of the decrease in data quality zone. It seems reasonable to interpret these small steps as faults with offset between 20' and 50'. Noise generated from the fault plane is probably a major contributor to the poor data quality zone. Even though data has less fidelity, units A and B can be traced from the zones of well-bedded strata marginal to anomaly through the faulted zone.

It is also speculated that the base of the erosional surface was in part localized by the faulting. In fact, the erosion surface may be highly irregular in the fault zone. This may add to the overall loss of stratigraphic continuity in this area.

CONCLUSIONS

Analysis of a dish-shaped anomaly in the Bass Basin indicated:

(1) the anomaly is an erosion surface with isolated stratigraphic units within the feature;

(2) the zone was not of unusual velocity based on move-out data; and

(3) using criteria designed to recognize low velocity gas-filled porous sands, there are no features that meet the criteria on the lines.

Below the anomaly there was a decrease in data quality and a structural sag.

(1) The structural sag is related to normal faulting which localized the erosional surface.

(2) A combination of closely spaced faults and irregular erosion surface led to a loss in data quality and stratigraphic continuity.

Respectfully submitted,

TEKNICA INC.

John A Ward

John A. Ward, Ph.D.

THE SEISLOG PROCESS

The material contained in this report represents the results of the digital computing process designed to convert seismic reflection traces into a form of acoustic impedence log. Under favorable conditions, the process yields a curve which will duplicate a borehole sonic log at a tie location with a fairly high degree of fidelity. Application of the process to each seismic trace along a conventional seismic line allows a simulated sonic log to be obtained at every point, without the need to drill a borehole.

Data interpretation is enhanced as the result of increased resolution, with a reasonable expectation of resolving beds 25 feet thick or greater, and the ability to map lateral changes in lithology and stratigraphy as indicated by changes in the velocity and character of the log.

PROCEDURE:

The basic concept is quite simple and in its simplest terms may be considered the reversal of the process used to develop a synthetic seismogram from a sonic log. Sonic logs can be converted to synthetic seismic traces by a relatively simple computer process. The log is first integrated to convert the vertical scale from depth into time. The reflection coefficient at each velocity interface over the length of the log is calculated to a first order approximation by the simple formula:

$$R_c = \frac{V_2 - V_1}{V_2 + V_1}$$

This calculation ignores the effects of density.

Seislog, registered trademark of Teknica Resource Development Ltd.

The series of reflection coefficients is then convolved with a suitable operator representing the response of the total seismic reflection system. The resulting synthetic seismic trace is normally a good match to a noise free seismic field recording made near the location from which the borehole log was taken.

An exact reversal of the series of reflection coefficients to the original integrated sonic log can be obtained by re-arranging the terms of the reflection coefficient formula and solving for velocity.

$$V_2 = V_1 \cdot \frac{1 + R_c}{1 - R_c}$$

This requires the first velocity to be known from which all others can be derived by applying the formula in succession to each reflection coefficient.

This is the fundamental basis of the procedures used to invert the seismic trace into a synthetic sonic log. Implementation of the process to conventional seismic field data requires the successful resolution of a number of other considerations, including the effects of system response, the accuracy of reflection amplitude information, the frequency bandwidth, and the effects of noise of all kinds, including multiple reflections, diffractions, random and coherent superimposed noise.

Deconvolution is a standard procedure used to remove, insofar as possible, the phase distortion and frequency attenuation caused by the system response.

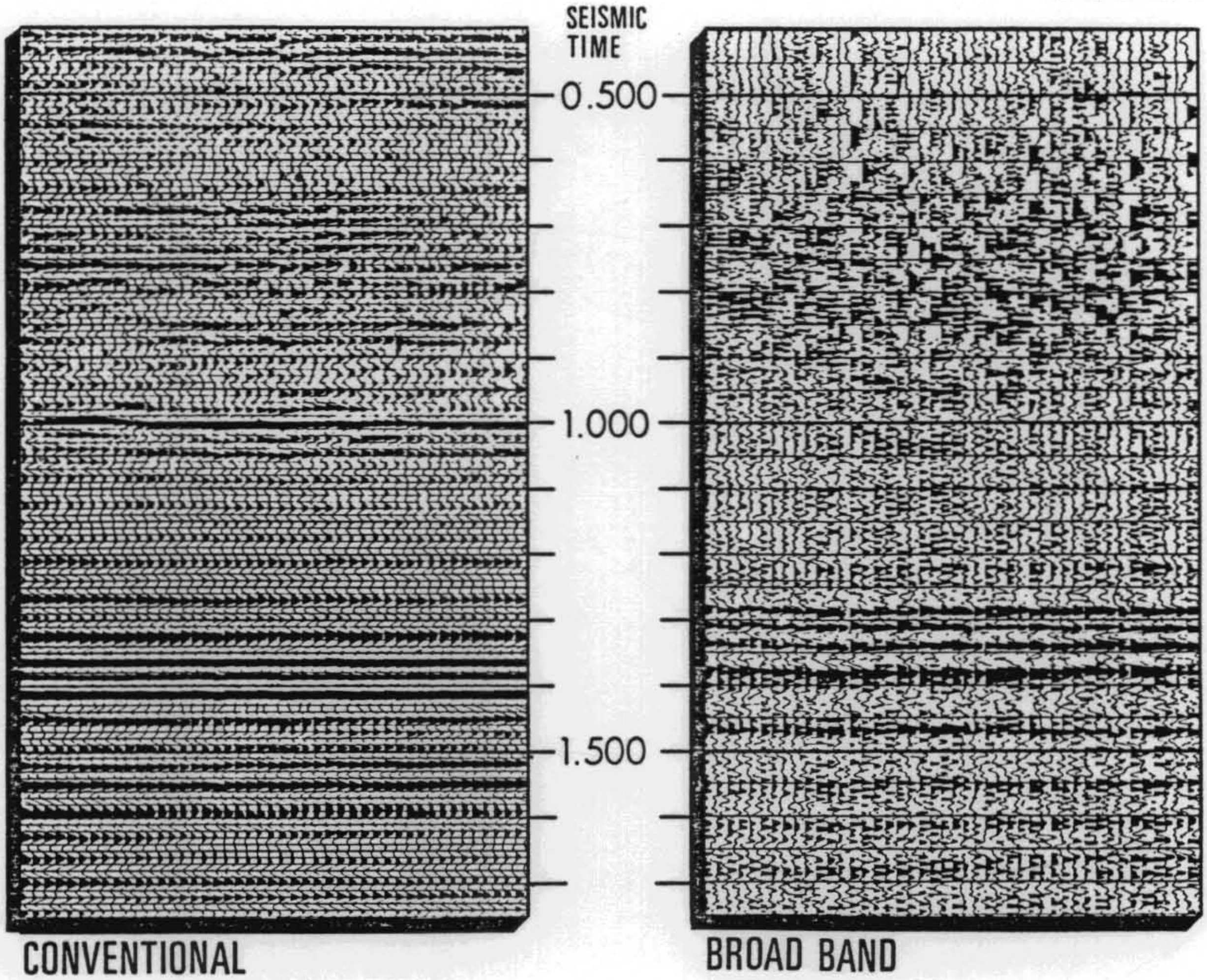
The true amplitude of the field seismic signal can be recorded with sufficient fidelity using binary gain or floating point instrumentation.

Prior to application of the Seislog process, it is necessary to compensate the signal for transmission losses and to ensure that the recorded amplitudes are not influenced by superimposed noise.

A serious constraint is the limiting of the bandwidth caused by filtering which may occur through the system. A sonic log has a very broad frequency bandwidth, extending from DC to approximately 1 kilocycle. Seismic recordings are band limited, due in part to the natural filter effect of the earth through which the signal passes, but also to limitations imposed by instrumentation. Current field practice and equipment limits the low end of the spectrum, while the natural response of the earth tends to eliminate frequencies much over 100 Hertz, depending upon the depth.

Limiting the bandwidth does not necessarily preclude application of the inversion process. A sonic log can be filtered to any desired bandwidth prior to the calculation of the reflection coefficients to demonstrate the loss of resolution caused by filtering. The effect is roughly analogous to logging with a very long tool, which will decrease the resolution of the log by smoothing out the high frequency information. A band limited seismic trace produced from that operation will have the same resolution as the log.

The low frequencies, which are also important, are most often lost by mechanical filtering through geophone response or band pass filtering circuits in the recording instruments. One reason for doing this is to eliminate low frequency noise which is often present. Better digital computer techniques exist for the purpose of removing such noise and stacking of traces can also be used to advantage.



SEISMIC DATA

5 cm

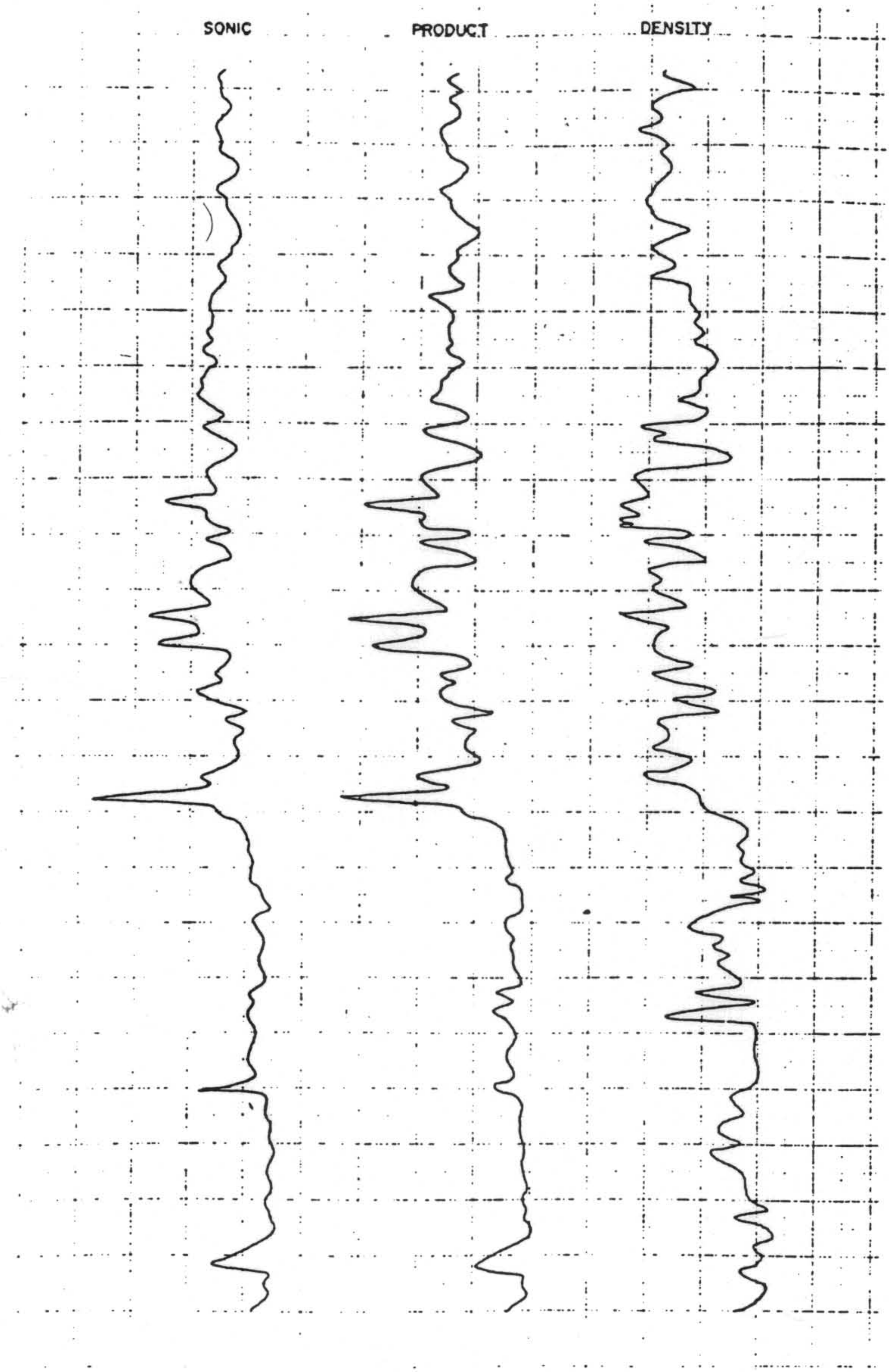
Simple Synthetic

Reflection Coefficient

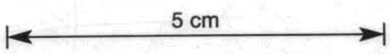
$$Rc = \frac{V_2 - V_1}{V_2 + V_1}$$

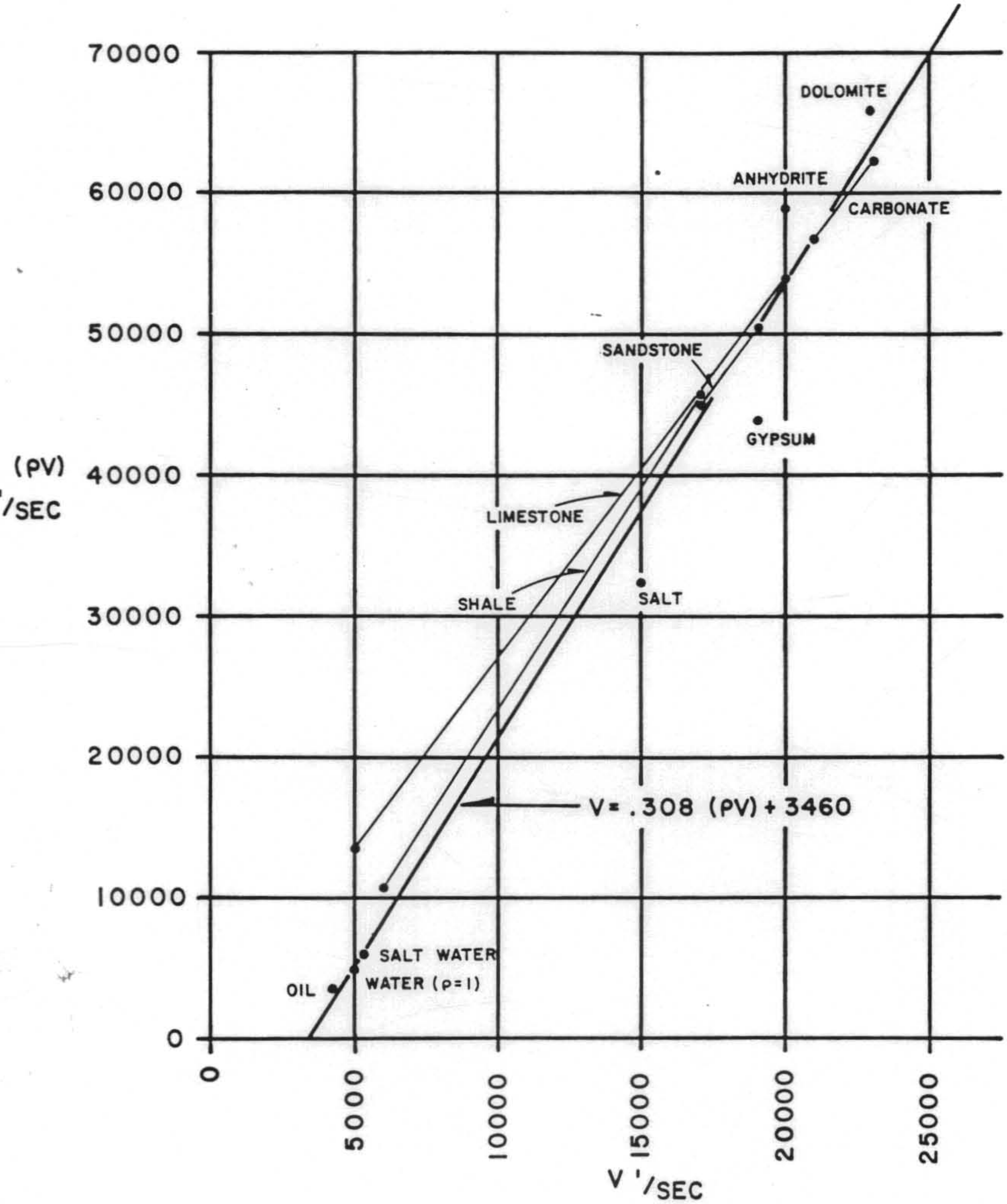
Velocity Inversion

$$V_2 = V \cdot \frac{1 + Rc}{1 - Rc}$$



SONIC - DENSITY RELATIONSHIP





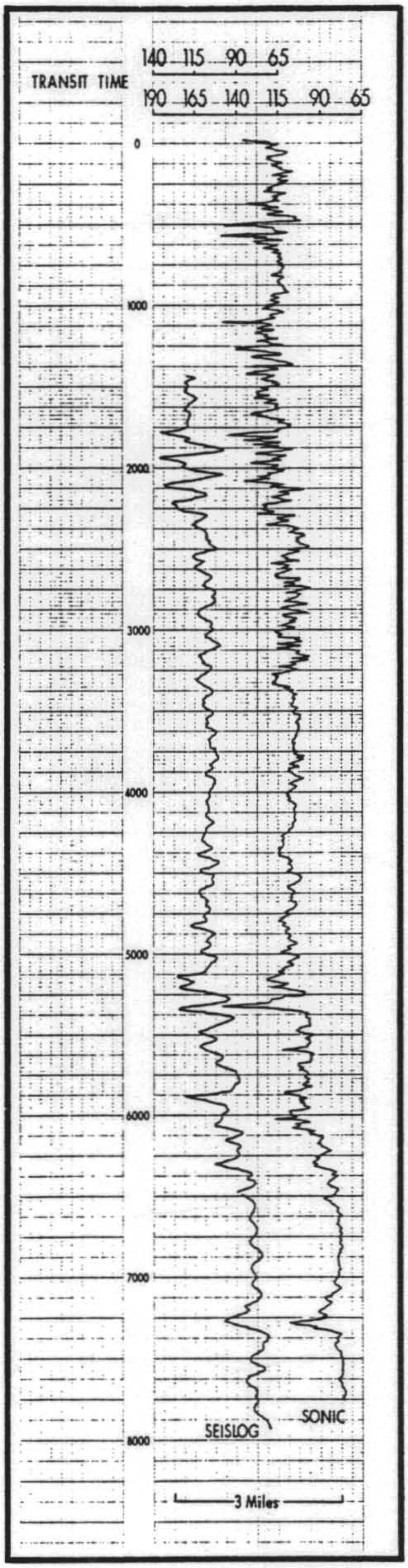
VELOCITY - DENSITY RELATION
FOR COMMON ROCK TYPES

5 cm

The success of the Seislog process is a direct function of the data quality and available bandwidth. Narrow bandwidth seismic data will produce output which is not substantially different from the seismic trace. An estimate of the probable Seislog response can be obtained by filtering a sonic log in the area to the approximate bandwidth of the seismic data, as determined by spectrum analysis. One of the principle problems of narrow band recordings is the loss of the ability to define the major geologic boundaries. These are frequently demonstrated on the sonic log by sharp lateral velocity shifts corresponding to changes in lithology. Narrow band signals are unable to hold the shift, and much of the value of the inversion process is lost.

If the synthetic log is to correlated to a real log, some compensation must be made for the effects of density. The amplitude of seismic trace reflections, and hence of reflection coefficients, is properly computed by operating with the product of velocity and density. The inverted seismic trace is more properly a sonic density product log rather than a sonic log. Density is, to some degree, a linear function of velocity and is so treated in the inversion. Effects are illustrated on the following figure, in which a sonic log and a density log in the same hole have been multiplied and normalized to the average density. The resulting product shows greatest similiarity to the sonic but has noticable differences.

Noise must be eliminated from the seismic data insofar as possible. This is done through standard seismic processing techniques. Any residual noise will tend to cancel out if it is truly random, but coherent noise, including multiples, diffractions, refractions, and others of similiar ilk will distort the output.


TRANSIT TIME
140 115 90 65
190 165 140 115 90 65
0
1000
2000
3000
4000
5000
6000
7000
8000
SEISLOG
SONIC
3 Miles

5 cm

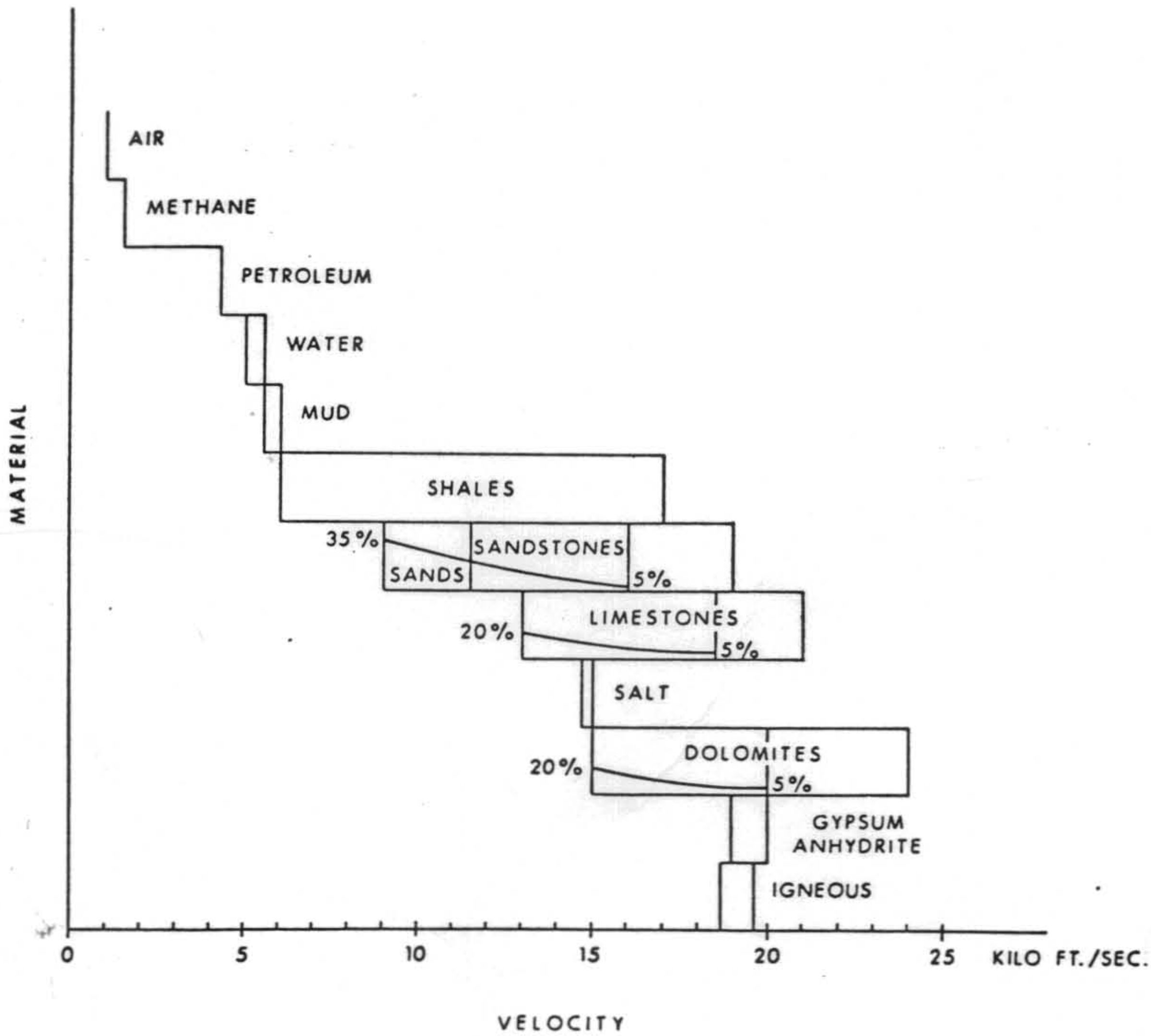
The final test of the process is to correlate an inverted seismic trace to a nearby sonic log, plotted to the same scale. The degree of correlation provides a direct estimation of the reliability of the seismic data. A poor correlation does not indicate a fault in the process, since it is merely a direct transformation of the existing seismic data, but rather may be considered an aid to interpretation, inasmuch as it highlights problems which are present in the basic seismic data and which may not be recognized otherwise.

INTERPRETATION:

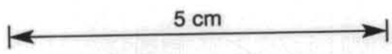
The interpretation of a Seislog section requires the development of new experience and techniques if the full potential of the system is to be utilized. Information theory allows a formal calculation of the information carrying capacity of any signal to be made. The calculation is roughly similiar to the calculation of volume of a rectangular container in which the length, (here measured in time), is multiplied by the height (or amplitude), and this product multiplied by the width, (expressed as frequency bandwidth). The broadband seismic signal input to the Seislog process, and hence to output Seislog contains a substantial increase in the amount of information over the conventional narrow band seismic trace. If the same broadband seismic input is plotted on a conventional seismic plotter, it will be found to be very difficult to interpret; the large amount of detailed information masks the basic information which is mapped on normal seismic sections.

The increased information can be utilized on the Seislog sections but it does require an increase in the amount of study and time required for the interpretation.

211151



NORMAL RANGE OF VELOCITIES

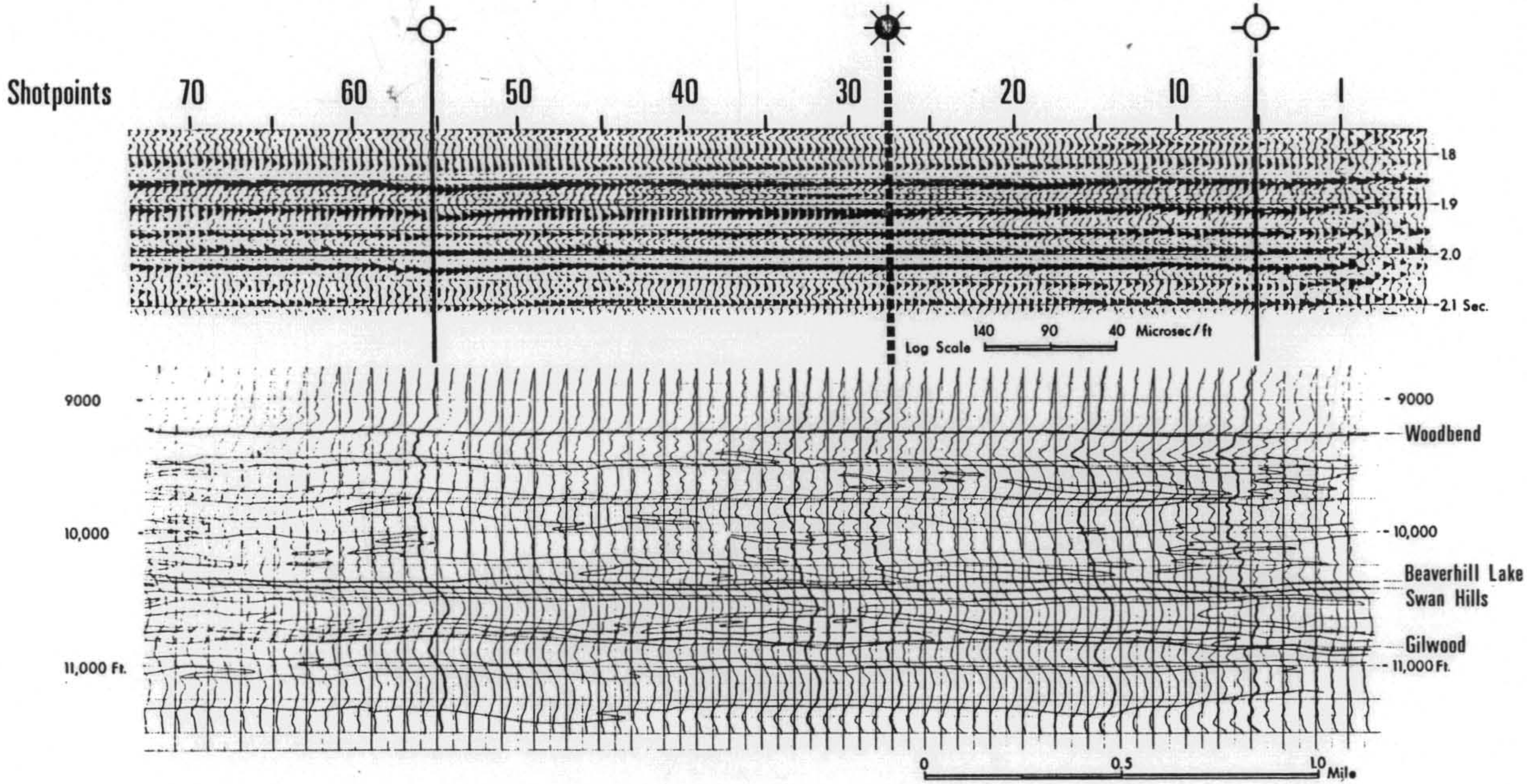


Geologists may carry out subsurface studies by correlating sonic logs. Lithologic units are mapped by character, which in turn is primarily a function of velocity changes over the length of the log. Velocity is related to lithology but the relationship is not linear nor is it unique for any given lithology. A second curve, such as the gamma, may be a valuable aid to resolve ambiguities, but it should be remembered that only a single velocity curve is produced by the Seislog process. Nevertheless, within gross divisions, an estimation of lithology can be made from velocity.

Stratigraphic relationships can be obtained from a continuous log section, under the assumption that a given lithologic unit will maintain a given velocity unless that lithology changes. Changes in thickness of a given velocity/lithology unit, and the attitude of that unit in the section, are usually directly related to the nature of deposition of that unit, and any subsequent structural deformation.

Two methods are normally used to extract the above information from the Seislog section. Correlation of equivalent units is an accepted practice for interpretation of both seismic sections and of logs. It can be applied to the Seislog sections. The close spacing of the Seislog traces generally permits detailed correlation from trace to trace with a high degree of confidence.

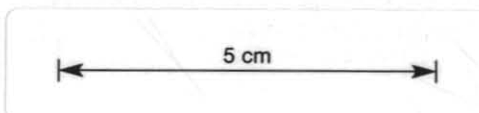
Frequently, the most valuable aid to interpretation of the Seislog sections is to contour iso-velocity lines over a zone of interest or the entire section. Each Seislog trace is plotted in terms of conventional sonic log scaling. The vertical scale is in depth, usually at 250 feet per inch, and the horizontal scale is in transit time expressed as microseconds per foot. The normal horizontal scale is 25 microseconds per foot, and the base line of the log which passes through the shotpoint location is always 90 microseconds per foot. Hence, it is possible to measure at any point on any Seislog the transit time or velocity of the geologic unit at that depth.

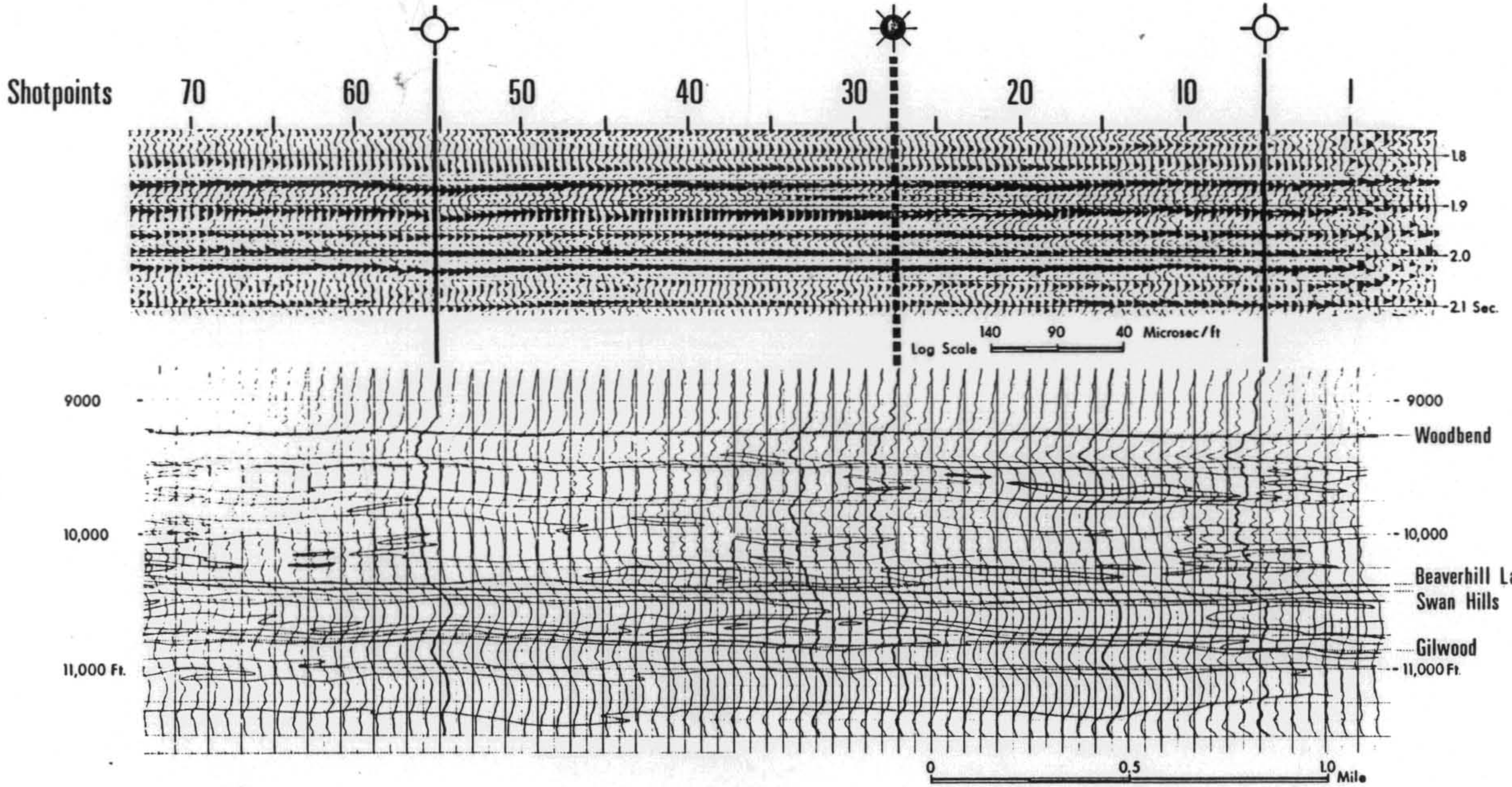


LINE 1

SEISLOG SECTION

'Sonic' logs derived from seismic traces





LINE 1

SEISLOG SECTION

'Sonic' logs derived from seismic traces

While the absolute velocities produced by Seislog may not match the recorded borehole velocity exactly, the relative velocity from trace to trace is normally quite reliable and very sensitive to change.

The procedure used for interpretation is to contour lines of constant velocity over the section. It is helpful to colour intervals of constant velocity with a code which might be related to the interpretation of lithology.

A given geologic unit may be expected to have a very uniform velocity response over a wide lateral area unless the lithology changes, of where there is substantial structural change with a corresponding change of velocity due to compaction. Sands which become shaly, and changes in porosity, are usually reflected in changes in velocity.

The application of this process will reveal details of stratigraphy which are normally not visible on any conventional seismic section.

Under ideal conditions, where a tie is made to a control well, and a lithologic strip chart is available in the well, the lithology can be superimposed on the sonic log and in turn transferred into the Seislog section. Changes in lithology then can be recognized as they occur in the Seislog section.

TIES TO THE SEISMIC SECTION:

There is not direct wiggle for wiggle tie of the Seislog section back to the seismic section. Obviously, since they are both derived from exactly the same data, there must be some correlation and events which appear on the seismic section must be present on the Seislog section.

The relation between the two, ignoring for the moment the scaling differences between time and depth, can be best visualized by considering the Seislog section to be a form of integration of the seismic section. Integration has the effect of lagging the phase 90° and tilting the slope of the amplitude spectrum. Thus, the zero crossings of a synosoid on a seismic section become peaks on the Seislog, and seismic peaks represent merely changes in slope on the Seislog trace. A study of these relationships alone, can provide the seismic interpreter with valuable insight into the nature of the seismic reflection. It can demonstrate why substantial changes in vertical lithology are not readily apparent on a seismic section. For instance, a unit which is graded from bottom to top so that the velocity changes not as a sharp discontinuity but rather as a ramp or gradation will produce a lengthy series of reflection coefficients, each having very low amplitude. These may be hardly visible on the seismic trace, but, as in integration over time, the repetitive inversion of a series of relatively small units will sum to a substantial deviation.

In order to provide a certain method of tying the Seislog section back to seismic time information, each Seislog section is plotted on a time scale as well as the conventional depth scale. The vertical time scale is adjusted to the same time scale as the conventional seismic section. This greatly compresses the vertical scale, so it becomes necessary to also compress the horizontal scale to avoid a great deal of continuous overlap and confusion. The horizontal scale on the time Seislog is normally plotted on a compressed velocity scale.

If it is desired to correlate the seismic section to the Seislog depth section, the time velocity Seislog plot can be laid over the seismic section and the Seislog events correlated to the seismic events at any given time. The character of the Seislog time plot is the same as that of the Seislog depth section but at a greatly reduced scale. It is then possible to correlate on the basis of character and signature from the time Seislog section to the depth Seislog section. Thus, when a correlation is made from a digitized well log, plotted in depth, to the Seislog depth section, the correlation is usually unambiguous. This correlation can then be transferred to the time Seislog section and in turn to the time seismic section. The results are often somewhat surprising, and illustrate the difficulty in correlating geologic information directly to seismic time sections. In a number of cases it has been found that seismic horizons which have in the past been identified with certain geologic horizons are substantially in error, mapping some feature above or below the horizon in question.

FINAL CONSIDERATIONS:

The interpretation of the Seislog section is often best handled by a geologist experienced in stratigraphy and sedimentation, and familiar with well logs. However, it is important to remember at all times that the Seislog section is seismic data and as such is subject to all of the distortion, limitations and superimposed noise that would be encountered on a seismic section.

In particular it must be remembered that the seismic trace used to compute the Seislog arrives at the ground surface at an angle normal to the angle of dip. It is then plotted vertically below the corresponding surface point. The effect is migration distortion, which is always present on the Seislog section.

The effects of multiples, diffractions and other wave phenomena are also included, and can cause erroneous information to be generated.

The important point to remember is that in any case all such distortion was present on the original seismic section; the use of the Seislog may or may not allow easier detection of such phenomena. In general, the final test is always the degree of match of the Seislog to the sonic log at a given tie point. Good correlation will increase the confidence of the data, and poor correlation will demonstrate the weakness inherent in any interpretation made from that basic field data, whether it be an ordinary seismic interpretation or the Seislog section.

SYNTHETIC SEISMOGRAMS

The seismic expression of the Oligocene section at the proposed Squid #1 exploratory well location is dominated by a lenticular anomaly which thickens from a feather edge at its boundary to a maximum of 0.110 seconds along its axis. This is equivalent to an increase in thickness of plus or minus 500 feet or approximately 153 meters.

The cross-sectional geometry of the lens resembles a channel cut and fill, with the lower surface rough and irregular and the upper surface amooth. The upper surface exhibits approximately 30 feet or 10 meters of structural closure. Continuous or near continuous reflectors are recognized within the lens. These are also arched and terminate against the rising lower boundary surface of the lens.

The boundaries of this lens anomaly correlates with the Mid-Oligocene section found in surrounding wells where minor, thin bedded sands of semi-regional extent are recognized. A Basal Oligocene sand section is also recognized in some of the near by wells. The shape of the Spontaneous Potential curve of these sands indicate that they may represent a series of stacked channel deposits. It is theorized that this lens represents a local thickening and coalescing of these Mid-Oligocene and Basal Oligocene sands associated with and overlying a structurally active area. This thickened sand/shale sequence is considered a combination structural/stratigraphic objective for drilling, Figure 12.

Check-slot velocity survey data from nearby wells have been collected and geologic models have been constructed using major interval velocity-units with the inclusion of a lens at the Mid-Oligocene and Basal Oligocene levels. Two cases have been retained for purposes of calculations. One case with an anomaleously low interval velocity-unit, the other with an anomaleously high interval velocity unit. Both cases were imputed to a computer program for normal incident ray tracing and synthetic seismogram modeling. Reflection coefficient computed along the ray paths were convolved with a 30 HZ Ricker Wavelet.

The resulting synthetic seismic sections were then compared with the seismic lines crossing the Squid prospect. The low velocity model, Figure 13, showed the best fit to the "actual" data, and it was therefore concluded that the lens is apparently filled with a lower, than regional, velocity material. The high velocity model, Figure 14, displays a reverse relationship than observed on the "actual" data.

One of the effects of this low velocity lens, on the deeper reflectors, is to delay them by as much as 0.030 seconds. As a result, the faulted anticlimal structure mapped under the Oligocene lens probably has more vertical relief has been measured in two-way time on the uncorrected seismic data.

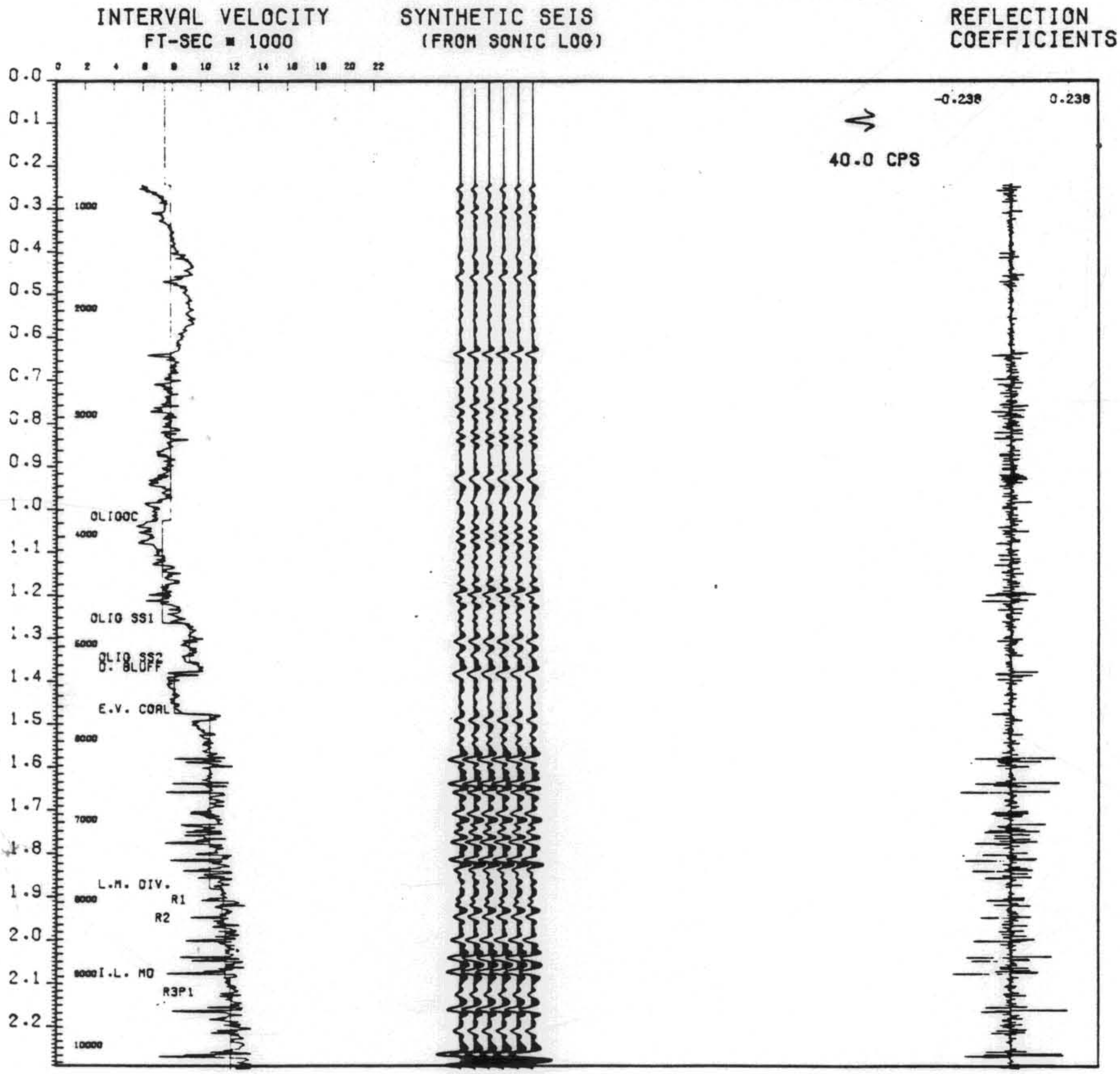
211160

SYNTHETIC SEISMOGRAM

GTS CORP. HOUSTON OFFICE 3724 OACOMA 77018

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

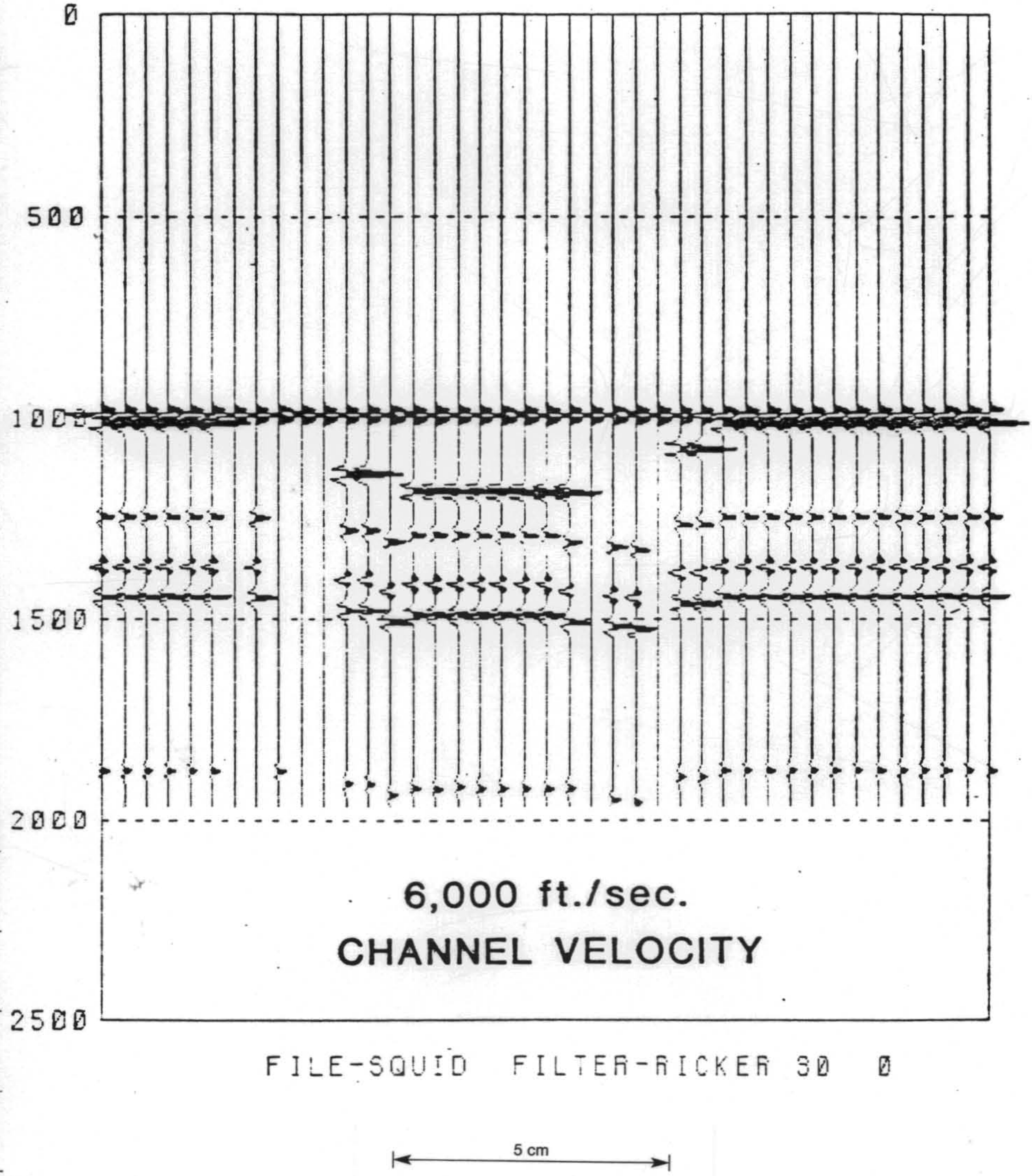
LOG DATUM = 100 SEISMIC DATUM = 0 COMMENTS



5 cm

FIG 12

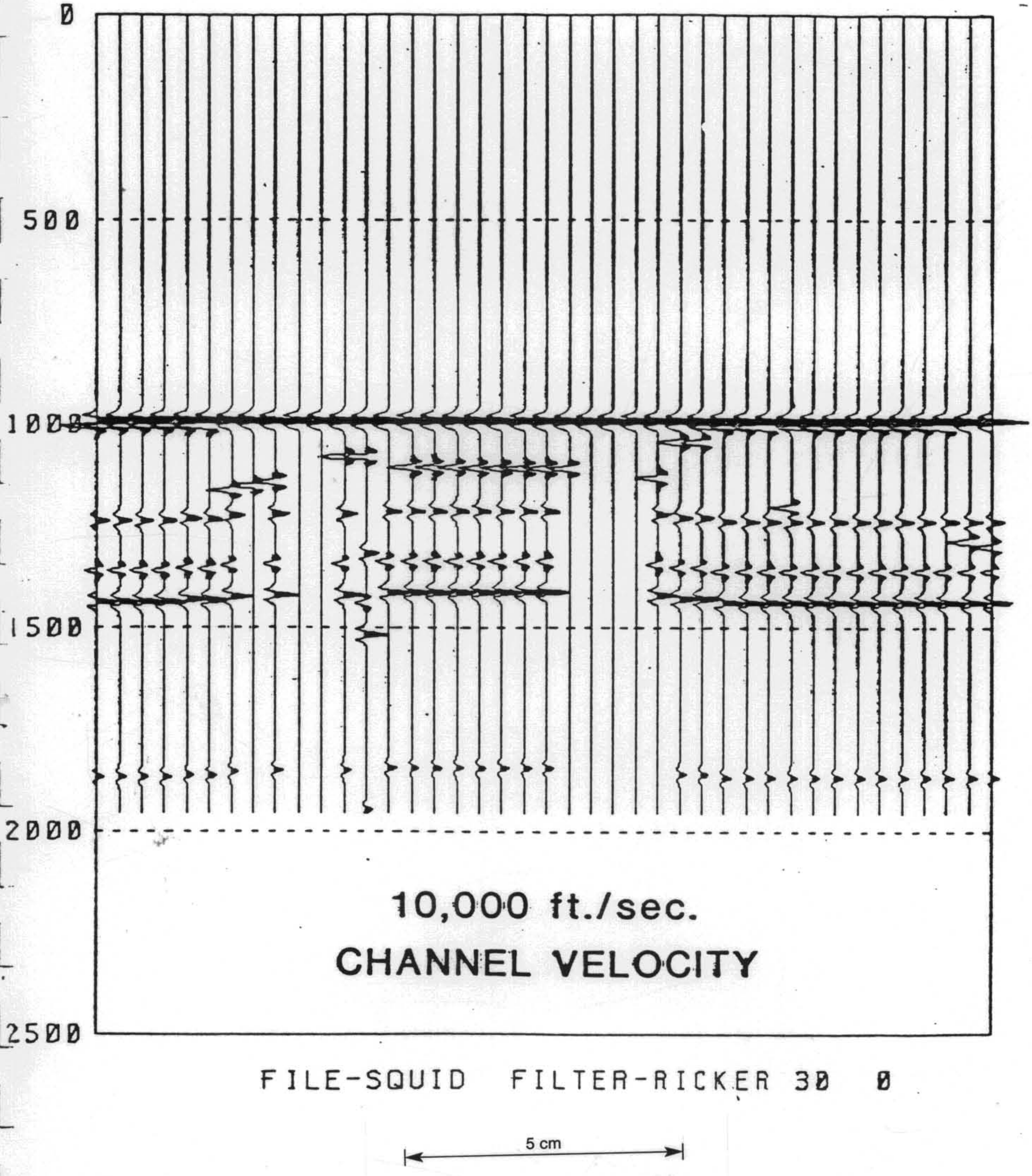
WEAVER OIL AND GAS CORPORATION, AUSTRALIA



WEAVER OIL AND GAS CORPORATION, AUSTRALIA

Figure 13

211162



WEAVER OIL AND GAS CORPORATION, AUSTRALIA

Figure 14

SECTION III

SQUID PROSPECT

SQUID PROSPECT

SEISMIC INTERPRETATION

The Squid anomaly was originally recognized on the old seismic lines ES-52 and B-70A-9 as a lens-shape anomaly at the Oligocene seismic marker level. Apparently associated with this lens is a zone of destructive interference, a major unconformity and a deeper horst block. The seismic data quality in the general Squid area of the Bass Basin is considered good.

WELL TIES

The nearest well to the Squid prospect is the Dondu #1 well located some 16 miles to the north. It is tied to the prospect through Weaver's seismic line WB-81-05, Figure 15.

The Pelican #1 well is located some 28 miles to the southwest and is also tied to the Squid prospect through Weaver's seismic line WB-81-03. A synthetic seismogram has been constructed for the Pelican #1 well. Seismic markers as well as map levels are indicated, Figure 16.

Other wells to the north, west and southwest are located at comparable or greater distances but have not been tied with new Weaver seismic lines to this prospect.

SEISMIC MAP

A seismic time structure map has been constructed at the top Oligocene reflector level, the scale is 1:50,000 and the contour interval is 0.0005 seconds. A domal feature is recognized.

The stratigraphic closure within the Oligocene interval is substantially larger than its structural closure. This is due to termination of beds against the lower surface and lateral surfaces of the lens, Figure 17.

Figure 17, is a isochron map of the seismically defined Oligocene lens. The scale is 1:50,000 and the contour interval is 0.010 seconds.

Figure 18, is a seismic time structure map at the Lower Malvocipolis diversus unco nformity reflector level. The scale is 1:50,000 and the contour interval is 0.010 seconds. At this level, the Squid prospect is a fault bounded domal feature.

5 cm

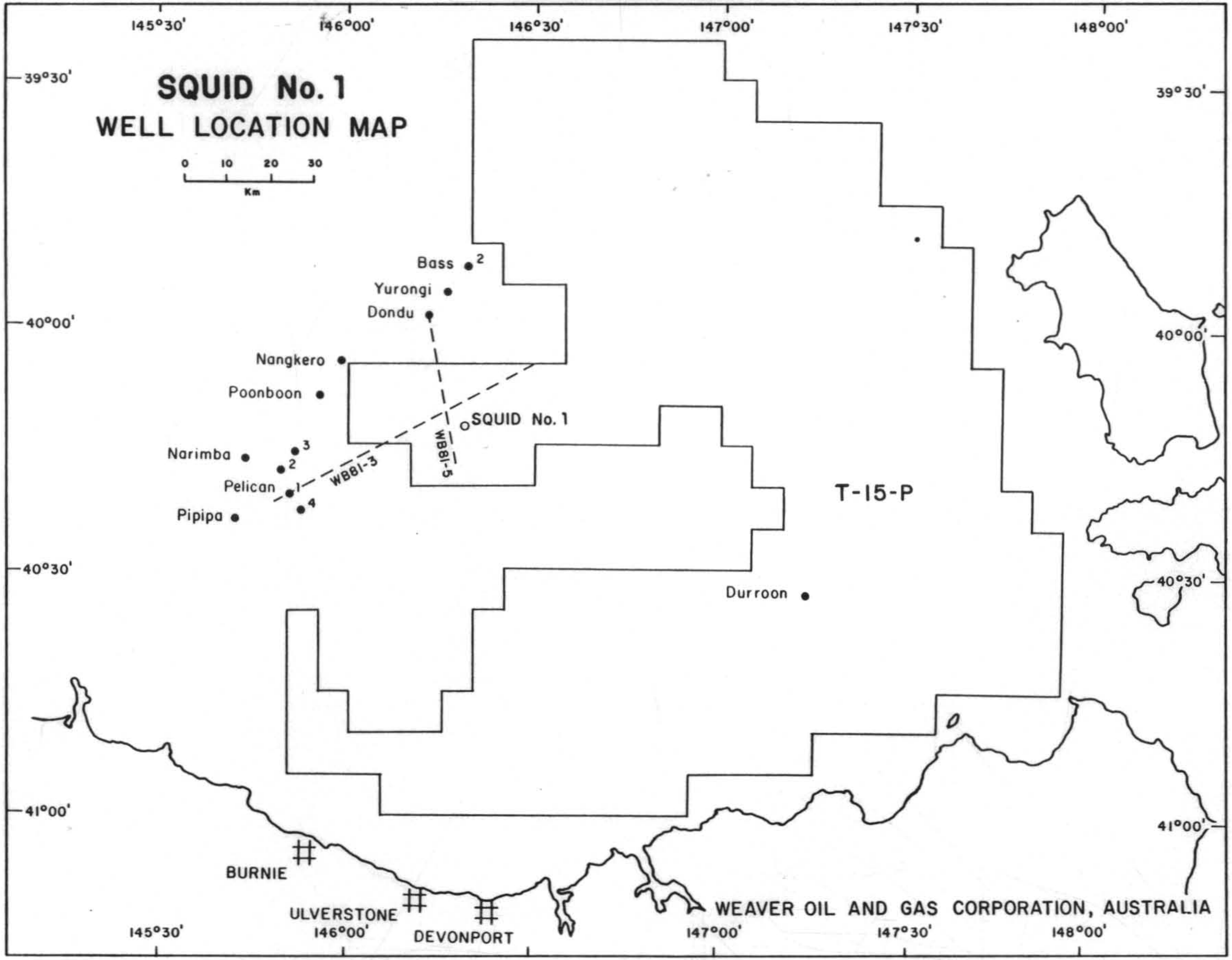


Figure 15

21168

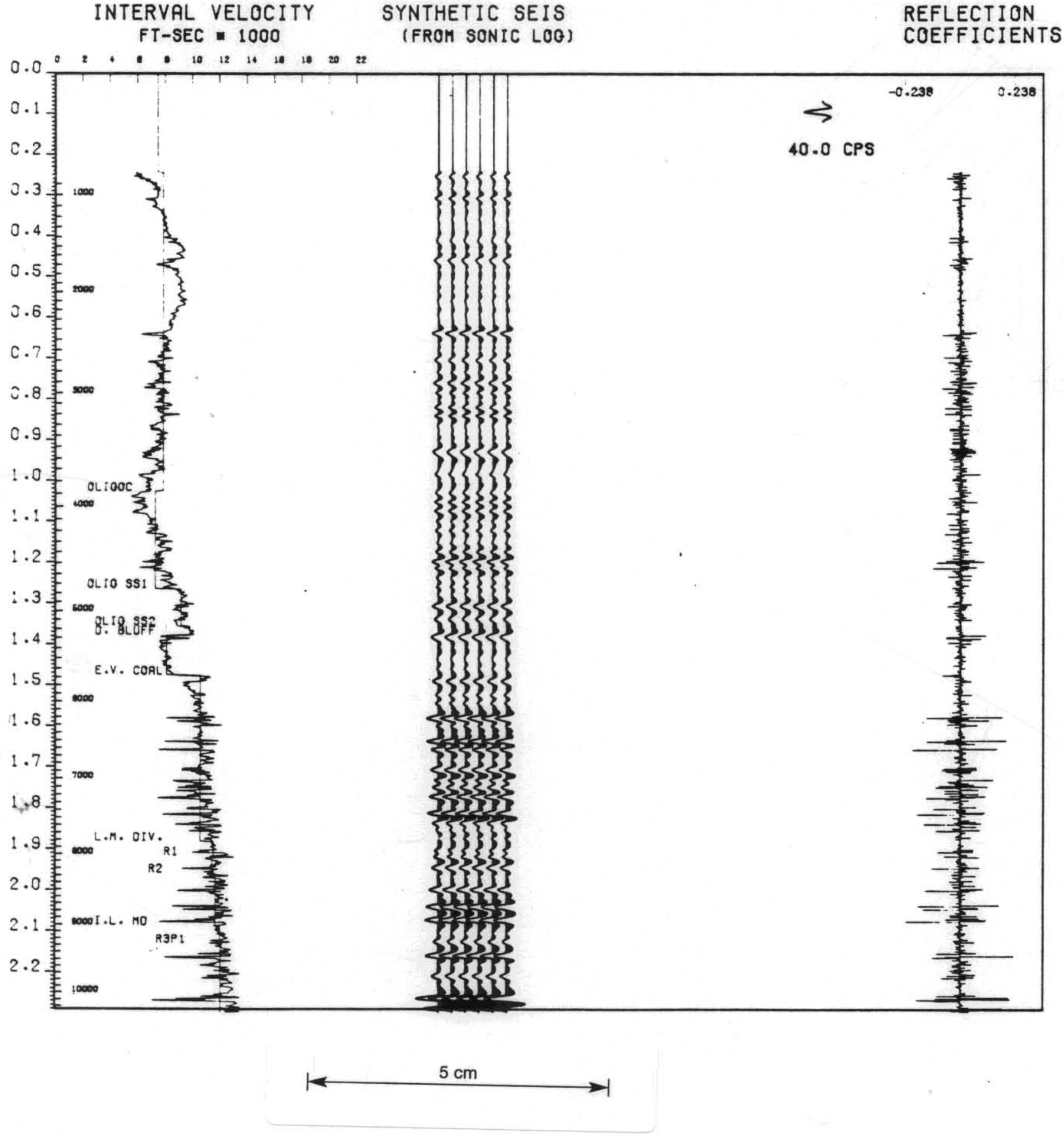
211169

SYNTHETIC SEISMOGRAM

GTS CORP. HOUSTON OFFICE 3724 OACOMA 77018

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

LOG DATUM = 100 SEISMIC DATUM = 0 COMMENTS



WEAVER OIL AND GAS CORPORATION, AUSTRALIA

Figure 16

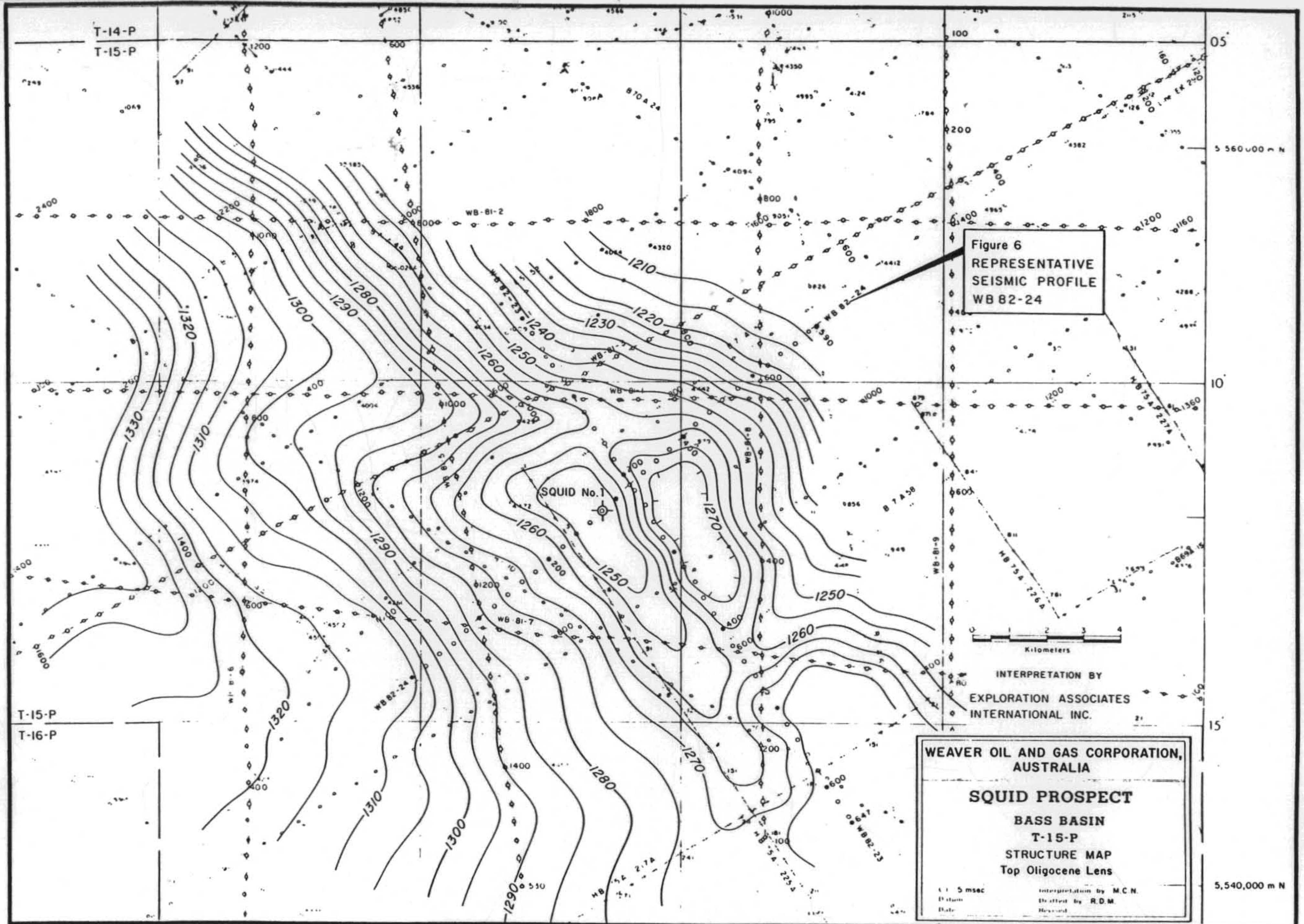


Figure 17

5 cm

21170

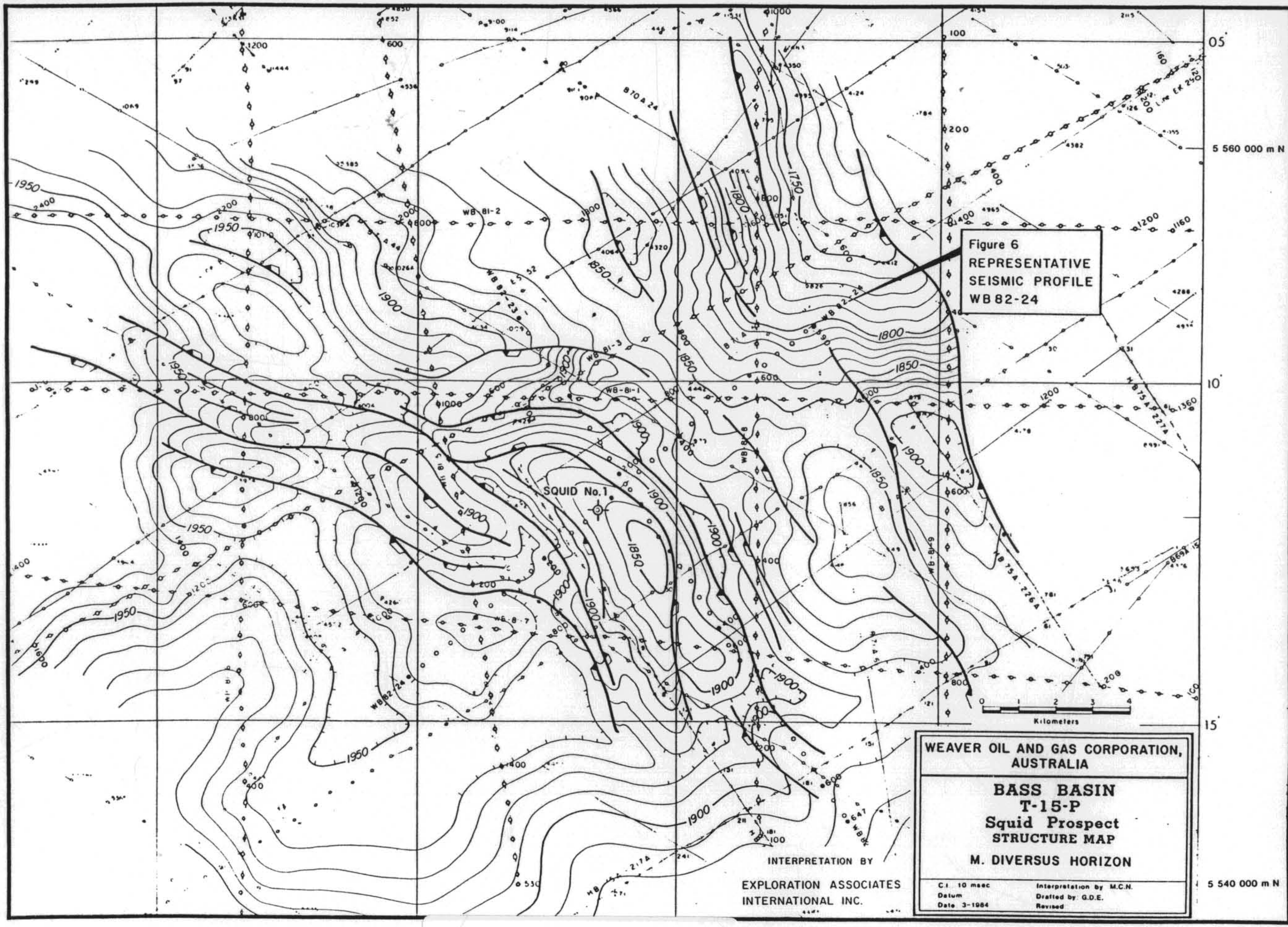


Figure 18

5 cm

OBJECTIVE SECTION

The primary objective section of the proposed Squid #1 exploratory well consist of the sand, shale and coal sequence known as the Eastern View Coal Measures of Eocene, Paleocene and Upper Cretaceous age.

The secondary objective section of this proposed well consist of the seismically defined intra-Oligocene lens which is assumed to contain an interbedded sand and shale sequence.

The tertiary objective section of this proposed well consist of the Basal Oligocene sand and shale sequence known to be present in this part of the Bass Basin, Figure 19.

211173

SQUID No. 1
ANTICIPATED STRATIGRAPHIC SECTION

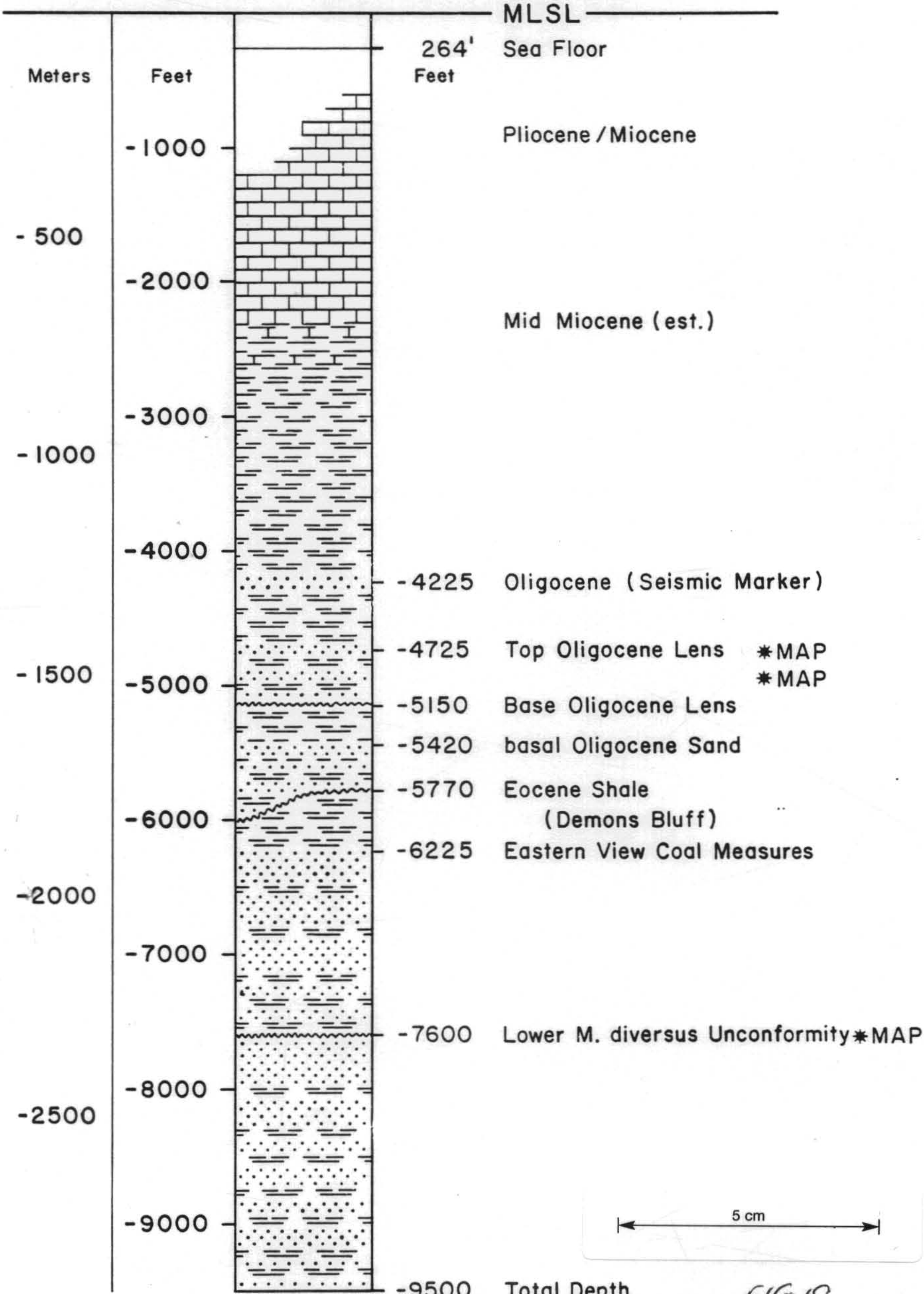


FIG 19

WEAVER OIL AND GAS CORPORATION, AUSTRALIA

Figure 19

SECTION IV

SQUID #1 WELL PROGNOSIS

211175

SQUID #1 WELL PROGNOSIS

INTRODUCTION

• The Squid # 1 well, located on Permit T/15P, will test the structural and stratigraphic hydrocarbon potential of the Oligocene and Eocene section of the central area of the Bass basin. This well will also provide valuable information as to the sand reservoir quality and intra-formational sealing capacity and maturation of the source-rock shale package of this objective sequence.

SEISMIC INTERPRETATION

The Squid prospect was originally recognized on the old seismic lines ES-52 and B70A-9 as a lens-shape anomaly associated with a band of destructive interference at the Oligocene and deeper horizon levels. The seismic data quality in this area of the Bass basin is generally good, except within this band of interference.

The nearest well is Dondu # 1, 16 miles to the north, and is tied to the prospect through seismic line WB-81-5. The Pelican # 1 well is located 28 miles to the southwest and is also tied to the prospect through seismic lines WB-81-3. A synthetic seismogram has been constructed for the Pelican # 1 well (Fig 16). Other wells to the north, west and southwest are located at comparable distances but have not been tied with new Weaver lines to the prospect.

The prospect is defined by two Weaver seismic lines acquired in 1982, in addition to eight Weaver seismic lines acquired in 1981. Fourteen lines acquired through the late 60's and early 70's by the previous permit holders have also been used in the interpretation.

Preliminary Instanteneous Velocity studies by Seiscom Delta Inc., performed on line WB-81-01, indicate a reduction in velocity of some 2000 feet per seconds within the seismically defined Oligocene lens area. This intra-Oligocene area is also characterized by Polarity reversal, Phase, as well as Reflection strength and weighted Frequency departures from the regional. The nature of this Oligocene lens has not yet been determined conclusively. This lens, or at least its lower surface, appears to be the source of destructive interference noticed in the deeper section.

Weaver's 1981 seismic lines

WB-81-01
WB-81-02
WB-81-03 (tie to Pelican #1 Well)
WB-81-05
WB-81-06
WB-81-07
WB-81-08
WB-81-09

Weaver's 1982 seismic lines

WB-82-23
WB-82-24

SEISMIC TIME STRUCTURE MAPS

The final seismic interpretation of the Squid prospect was carried out by Exploration Associates International Inc. which are consultants to Weaver Oil and Gas Corporation, Australia on the Bass basin project.

Figure 17, is a time structure map constructed at the top of the Oligocene lens reflector level. The scale is 1:50,000 and the contour interval is .005 seconds. This domal-feature has an area of closure of

1750 acres or approximately 710 hectares and a vertical relief of 30 feet or approximately 10 meters. The stratigraphic closure within the Oligocene lens is significantly larger than the structural closure.

Figure 18, is a time structure map constructed at the Lower Malvacipolis Diversus Unconformity seismic reflector level. The scale is 1:50,000 and the contour interval is 0.010 seconds. At this level the Squid prospect is a fault bounded domal feature with an area of 7100 acres or approximately 2875 hectares, and a vertical relief of 300 feet or approximately 92 meters.

REPRESENTATIVE SEISMIC LINE

The Squid # 1 well will be located on seismic line WB-82-24 at shot point # 280. This seismic line was recorded by Weaver Oil and Gas Corporation, Australia and processed in May 1982, as part of its second generation of prospect definition seismic data acquisition. This NE-SW seismic line shows the prospective fault bounded domal feature at the Lower M. diversus seismic horizon level, the Lower M. diversus unconformity seismic horizon, the convergence between the depressed Eastern View Coal Measures seismic horizon and the underlying Lower M. diversus seismic horizon, as well as the base of the Oligocene lens, its top, and finally the top Oligocene reflector horizon. The reflectors and map levels are identified.

GEOLOGICAL SETTING

In the Bass basin area, the earliest period of sediment accumulation is most likely to date back to the Early Cretaceous period when large thicknesses of coarse clastics, volcanogenic detritus and muds filled major fault bounded troughs and half graben depressions. This first step in the evolution of the basin could be classified as its aborted rift valleys stage characterized by alluvial, fluvial, fluviodeltaic and lacustrine environments of deposition.

Considerably less structural activity took place during the Late Cretaceous period, or second stage of the basin. Slower basin-wide subsidence prevailed and sediments were derived from the margin areas of the basin as well as from elevated intra-basin areas. These reworked, or second generation sediments, were deposited under alluvial, fluvial and lacustrine conditions. Minor marine ingressions may have taken place.

The Bass basin remained a barred basin throughout the Paleocene and Eocene. A time when reworked sand, shale and coal deposition was widespread within what appears to have been a swampy alluvial environment. Regional structural readjustments, in response to an accelerated late Eocene sediment loading, triggered a marine transgression from the north-west. Basal Oligocene coarse clastics were derived from the basin margin areas. These are overlain by widespread mudstones, marl and limestones deposited during the remainder of the Oligocene and Miocene periods. Marine carbonate shelf conditions prevailed thereafter.

Objective reservoir sands interbedded with shales of potential source rock quality have been identified within the Upper Cretaceous, Paleocene, Eocene and Oligocene section.

OBJECTIVE SECTION

The primary objective section of the Squid # 1 well consists of the sand, shale and coal sequence known as the Eastern View Coal Measures of Eocene, Paleocene and Upper Cretaceous age. The top of this objective section is predicted, on the basis of seismic data, to be at a depth of 6225 feet, or approximately 1898 meters below mean low seal level at the proposed well location. A similar stratigraphic sequence was tested and found to contain several gas and condensate, or light oil, bearing intervals in the Pelican # 1 well, to which the Squid prospect is tied seismically through line WB-81-03. This prospect is also tied seismically through line WB-81-05 to the Dondu well which tested an apparently barren Eastern View Coal Measures section.

The secondary objective section of the Squid # 1 well consists of a seismically defined intra-Oligocene lens assumed to contain an interbedded porous and permeable sand sequence. The top and base of this secondary objective section are predicted to be at depths of 4725 feet and 5150 feet or approximately 1440 meters and 1570 meters. Seismic ties to the Pelican # 1 well and Dondu # 1 well indicate that this lens is not present in either of the two wells.

The tertiary objective section of the Squid # 1 well consists of the basal Oligocene sand-shale sequence. The top and base of this tertiary objective section are predicted to be at depths of 5420 feet and

5770 feet, or approximatley 1652 meters and 1759 meters. Seismic ties to the Pelican # 1 well indicate a similar sequence some 110 feet thick. Ties to the Dondu # 1 well indicate a similar sequence some 375 feet thick.

The anticipated stratigraphic section is shown on figure No. 19.

OPENHOLE LOGGING AND FORMATION EVALUATION

The following suite of logs and wireline formation tests program has been specifically designed to evaluate the hydrocarbon potential of the Squid prospect.

The first run of logs will take place before the 13-3/8" surface casing is put in place.

Run # 1 Interval 850'-4100'
DIL-LSS-CAL-GR

The second run of logs will take place at total depth.

Run # 2 Interval 4100-'TD (9500')
DIL-LSS-CAL-GR

Should hydrocarbons be present, the second run of logs will be modified to include the following:

LDT-LNT-GR
DLL-MSFL-CAL

in addition:

Velocity Survey
HDT
CST (30 cores) or as required
RFT (10 pressure tests per chamber)
as required

DRILLING DATA

Mud Logging: Continuous from the 20" conductor casing shoe to total depth.

Cuttings:	Five sets of washed and dried cuttings will be caught every 30 feet from the conductor casing shoe down to a depth of 4100 feet. Sampling intervals may be varied as dictated by rapid drilling rates. Minimum sample size will have a weight of 100 grams. Sampling rate will be reduced to 10 feet over the interval 4100 feet to total depth.
Conventional Cores:	Below the surface casing shoe, conventional cores will be cut only if significant hydrocarbon indications are encountered.
Sidewall Cores:	Below the surface casing shoe, sidewall cores will be acquired only if significant hydrocarbon indications are encountered.

SECTION V

SQUID #1 WELL DRILLING PROGRAM

Squid #1 Well Drilling Program | Page

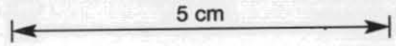
INTRODUCTION

The Squid #1 Well, located on Permit T/15P, will test the structural and stratigraphic hydrocarbon potential of the Oligocene and Eocene section of the central area of the Bass Basin.

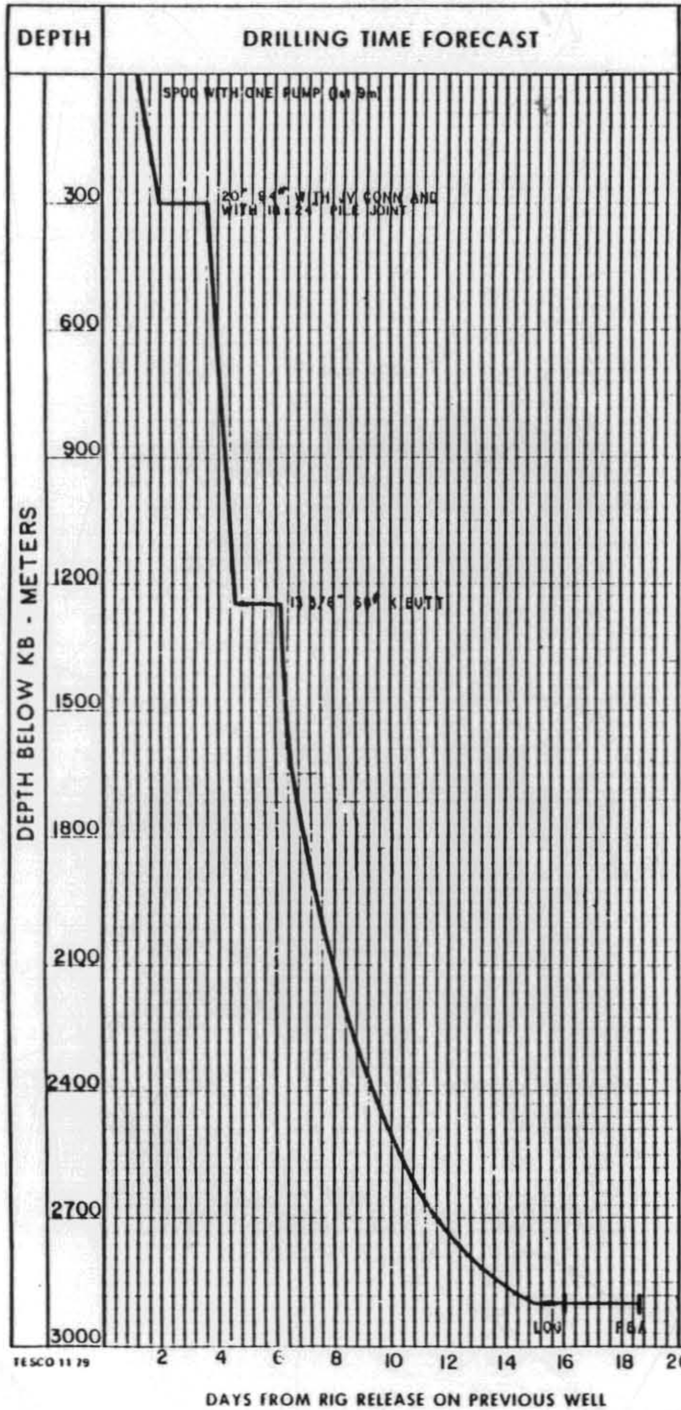
The primary objective section of the Squid #1 Well consists of the sand, shale and coal sequence known as the Eastern View Coal Measures of Eocene, Paleocene and Upper Cretaceous age. The top of this objective section is predicted, on the basis of seismic data, to be at a depth of 6225 feet, or approximately 1898 meters below mean sea level at the proposed well location.

The secondary objective section of the Squid #1 Well consists of a seismically defined intra-Oligocene lens assumed to contain an interbedded porous and permeable sand sequence. The top and base of this secondary objective section are predicted to be at depths of 4725 feet and 5150 feet, or approximately 1440 meters and 1570 meters.

The tertiary objective section of the Squid #1 Well consists of the basal Oligocene sand-shale sequence. The top and base of this tertiary objective section are predicted to be at depths of 5420 feet and 5770 feet, or approximately 1652 meters and 1759 meters.



COMPANY **WEAVER OIL & GAS AUSTRALIA** WELL **SQUID No.1**



Depth (m)	Geological Data	Casing	Bit Size	Bit Type	Bit Wt	RPM	Q	Nozzle	AV	Mud Wt	Funnel	W.L.	YP/PV	Mud Treatment and Remarks
0–300	WATER DEPTH - 80m (MAXIMUM ANGLE 2°)	20" AT 259m KBE CEMENT TO SURFACE	26"	1-1-1	0-10 8/10	80 170	600 1200 1200	3-20	25 45 45	DRILL WITH SEAWATER AND SLUG WITH VISCOUS MUD ON CONNECTIONS				MIX PREHYDRATED GEL SPUD MUD AS EARLY AS POSSIBLE USE FRESH WATER 100+ FUNNEL VISCOSITY
300–600			17 1/2"	1-1-1	25/30	170	1200	3-20	105	8.9/9.1	36	NO CONTROL	15/5	USE SEAWATER FOR MAKE-UP AND ADD PREHYDRATED GEL TO MAINTAIN VISCOSITY FLOCCULATE WITH LIME IF NECESSARY TO MAINTAIN YIELD POINT
600–900	(MAXIMUM ANGLE 4°)													ADD WATER AS REQUIRED TO MAINTAIN LOW PV
900–1200	MID MIOCENE											NO CONTROL		
1200–1500	TOP OLIGOCENE MID OLIGOCENE (OBJECTIVE 1463m-1593m)	13 3/8" AT 1250m KBE CEMENT TO SURFACE	17 1/2" 12 1/4"	1-1-1 SDGH	40/50 40/50 50/60	200 100 165 160	1200 750	3-20 3000 psi	105 150	9.1 9.1 9.3	36 36	10	15/6 20/7	RUN ONLY GAUGE PROTECTED BITS CONTROL PV WITH WATER AND MAINTAIN YP WITH PREHYDRATED
1500–1800	BASE OLIGOCENE SECONDARY OBJECTIVE 1677m-1784m			SDGH	50/60 60 60/70	160 125 125	750			9.1	36		20/7	BENTONITE USE FRESH WATER FOR MAKE-UP USE DEXTRID FOR FLUID LOSS
1800–2100	EASTERN VIEW COAL MEASURES (OBJECTIVE 1921m - T.D.) (MAXIMUM ANGLE 7°)			SDGH OR 5-1-7	70	90/110	750			9.1				CONTROL USE PACKED BHA, SHOCK SUB AND DRILLING JARS
2100–2400					75	90/110	700		135	9.1			14/7	ADD ASPHALT FOR SHALE STABILITY USE CAUSTICIZED LIGNITE TO CONTROL GELS
2400–2700				SDGH OR 5-1-7	75	90/110	650		125	9.1 9.3		8.0	15/8 15/8	MAXIMUM PH - 8.5
2700–3000	MAY ENCOUNTER NON-SEDIMENTARY ROCKS (BASEMENT) NEAR T.D.		12 1/4"				650	3000	125	9.3	36	8.0	15/9	HAVE HPHT FLUID LOSS 20-25 AT T.D.

TESCO 11 79

PREPARED BY LINDSEY I. LIPSCOMB

DATE MAY 1, 1984

Figure 20

2118

211188

OFFSHORE DRILLING PROGRAM
Miscellaneous Data Sheet

Operator: Weaver Oil and Gas Corporation Australia

Well Name: Squid No. 1 Total Depth: 2896 meters

Permit No.: T/15P Water Depth: 80 meters

Graticular Block No. 0172

Coordinates: LAT - 40° 11' 54.0161" S LONG - 146° 18' 28.4208" E

Seismic Line WB-82-24 Shot Point No. 280

CASING PROGRAM

Size	Depth	Length	Weight	Grade	Connection	Test Pressure
20"	--	12m	Pile Joint	24"OD x 18"ID	CC	
20"	259m KBE	155m	94	H	JV	500 psi
13 3/8"	1250m KBE	1143m	68.0	K	Butt	1500 psi

CEMENTING PROGRAM

Casing Size	Cement Class	Excess, %	Sacks	Yield, M^3/Sk	Water, CPS	Water Type	Additives %	Top of Cement
20"	G	200	1500	0.033	4.97	Fresh	2% CaCl	SF
13 3/8"								
Lead	G	None	900	0.057	11.3	Fresh	10% Gel	198m
Tail	G	None	500	0.033	4.97	Fresh	None	--

FORMATION EVALUATION

Electric Logging: Run No. 1, 1250m to 259m

DIL-LSS-CAL-GR

Run No. 2, TD to 1250m

DIL-LSS-CAL-GR
LDT-CNT-GR
DLL-MSFL-CAL

additionally as required:

Velocity Survey
HDT
CST (30 cores)
RFT (10 pressure tests per chamber)

Mud Logging: below 20" conductor casing to total depth.

Cuttings: washed and dried samples every 9 meters from 20" conductor to 1250 meters, and every 3 meters from 1250 meters to total depth.

Conventional Cores: below surface casing, cut only if significant hydrocarbon indications are encountered.

Sidewall Cores: below surface casing, acquired only if significant hydrocarbon indications are encountered.

Production Tests: as required for formation evaluation.

BLOWOUT PREVENTORS:

18 3/4" - 10,000 psi. Test when installed and to 5000 psi after running surface casing and weekly thereafter.

LEAK OFF TESTS:

Run a leak-off test after drilling out below the conductor and surface casing.

DRILLING PROCEDURES

Positioning the Drilling Vessel

Anchor Pattern

The general mooring pattern will be with the bow facing into the direction of maximum anticipated storm conditions, taking into account the need for the helicopter to land and take off into the prevailing wind and for the work boats to have a comfortable lee side for day-to-day operations. Everything else being equal, the heading should be designed to simplify holding station while running the first moorings.

A detailed mooring pattern should be provided by the barge master or drillship captain showing the preferable pattern for the specific water depth and environmental conditions anticipated.

Surveying and Marking Location

The location will be surveyed using a Decca transponder with three base stations.

At least two days prior to the rig move, set up onshore stations to ensure that all equipment is functional. Install the mobile station on the standby boat.

Establish the location using double triangulation from these shore base stations. Install one location buoy and one buoy at the position to drop the first anchor.

The timing will depend on availability of equipment but complete the survey 24 hours prior to the arrival of the rig at the new location. The survey vessel will standby on the well site to guide the rig as it approaches the location.

Mooring Procedures

The Drilling Supervisor will convene all parties for a mooring meeting prior to each move to review the mooring procedures and assign responsibilities for checking availability and condition of equipment.

Picking Up Anchors

1. While cutting the 30-inch casing, make preparations for retrieving anchors. Anchor handling crews should be aboard the work boats and the boats in position.

2. As soon as the 30-inch well head has cleared the seafloor, start ballasting up.

3. Whenever bolsters have cleared the water, start retrieving anchors.

4. If the drilling contractor will permit, retain the mud in the tanks while moving. If 8-inch drill collars are being used do not lay them down.

5. While underway, remove the 30-inch housing from the temporary guide base (if applicable) and slip and cut guide wires and tensioner wires.

6. Approach the location 30+ degrees to port or starboard of the prevailing wind (depending on current) and drop either number 6 or 7 at the location indicated by the buoy. This anchor will serve as a brake.

7. After approaching the location, turn the vessel into the prevailing wind.

8. Attach one boat to moorings 2 or 3. Hold the vessel position with this boat while running the other mooring. (Run about 3000 feet of chain).

9. After four anchors are set, take a position fix and start moving the vessel as required by manipulating the mooring lines.

10. While moving the vessel over the location, start ballasting down. Move the temporary guide base into the moonpool and prepare for running.

11. While moving the vessel over the location run the final four moorings.

12. When ballasted down, tension the moorings to 250 kips, take a final fix and run the temporary guide base.

13. Leave the windward anchors off the pawl until surface casing is set.

2.1.4 Testing and Pretension of Moorings

All anchors should be set and tested to 200,000 pounds prior to spudding. All anchors will be tested to 250,000 pounds prior to landing the 18 3/4-inch BOP stack.

Establishing the Well

Prior to Arrival on Location

1. Prepare a bentonite, caustic, fresh water spud mud (800 barrels with a 100 ± second funnel viscosity).

2. Prepare 400 barrels of 11.5 ppg kill mud. (See Sections 8.4 and 8.5, Triton Operations Manual)

3. Inspect all pendant wires for wear and broken strands. Inspect all buoys and pig tails.

4. Slip and cut riser tensioner wires. Finish cutting guide wires.

Upon Arrival on Location

1. Measure the length of the 20-inch conductor and pile joint. Dress the running tool and assemble the temporary guide base on the spider deck. Attach the guide lines. Prepare to run.

2. Assemble all tools needed to run the 20-inch casing, pile joint and permanent guide structure.

3. Run the temporary guide base to the ocean floor as soon as ballasted down and a final fix has been taken to ensure the vessel is on location within the accepted tolerance of 300 meters.

4. Note the distance from the rotary table to the sea bed prior to spudding. Record the water depth and air gap measurement on the tour report, noting the date and time of day.

Drilling the 26-inch Hole and Setting 20-inch Casing

Drilling the Hole

The 26-inch hole will be drilled with a 26-inch hole pilot bit. Drill to the approximate depth specified on the drilling program but to the precise depth required to run the 20-inch casing and pile joint plus 30 feet of rat hole.

Drilling Parameters

Weight - a maximum of 5,000 to 10,000 pounds of bit weight should be used to spud the well until the bit and first two drill collars are buried. After drilling 50 feet, the weight can gradually be applied to a maximum of 15,000 to 20,000 pounds. To safeguard against developing hole angle, use the lightest weight reasonable.

Rotary Speed - a maximum rotary speed of 50 RPM should be used to spud the well and until the bit and two drill collars are buried, then gradually increase the rotary not to exceed 150 RPM. Note: Release the torque in the string gradually prior to making connections to avoid a possible string back-off.

Pump Speed - the first 30 feet of hole should be made with pumps at approximately half speed. Thereafter, the maximum volume from both pumps will be necessary to clean the hole.

Hole Cleaning

The hole will be drilled using sea water. Prior to making connections, the hole should be slugged with 10 to 15 bbls. of spud mud (funnel viscosity of the mud should be at least 100 seconds). Should it become difficult to keep the hole open, increase the size of the gel slug prior to making connections.

Directional Survey

After reaching total depth, the hole will be displaced with mud and a Totco survey run on wire line prior to pulling out. A maximum of two degrees deviation is allowed.

Wiper Trip

A wiper trip should be made to check for bridges and fill. If no fill or drag is experienced, again displace the hole with mud and pull out of hole.

If drag and/or fill-up is experienced, make a second wiper trip and displace the hole with mud again. Repeat until drag and fill are eliminated. In some cases a heavier mud may need to be spotted to keep hole open.

Running 20-inch Casing, Pile Joint

1. The permanent guide structure should already be on the spider. A string of 20-inch OD, 94 lb/ft casing with Cameron JV Connectors will be run. The top joint of 20-inch casing will have a Cameron CC connector.

2. All connections on the bottom two casing joints will be thread locked to prevent back-off when drilling out.

3. Paint a white strip on the shoe joint approximately 3 feet above the shoe to aid in identifying the location of the shoe on TV while stabbing into the temporary guide base.

4. Fill the casing with water as run. Ascertain that circulation is possible through the float shoe.

5. Have a 20-inch swedge available on the rig floor while running 20-inch casing.

6. Torque the casing properly. Do not weld casing.

7. Run centralizers as follows: One centralizer 10 feet above the float shoe, on each of the bottom three joints. Stab the 20-inch casing into the temporary guide base using ropes or 1/4-inch wire and shackles. Observe the stab with television.

8. Install the 18 3/8-inch housing in the casing string. Run one joint drill pipe as a stinger inside the 20-inch casing. Land the 18 3/8-inch housing and pile joint in the permanent guide base. Pick up the assembly and remove the spider beams.

9. Lower the casing on drill pipe. Land in the temporary guide base. Observe the landing with television.

10. Do not use wiper plugs for cementing.

Cementing 20-inch Casing

1. Break circulation slowly with water. As soon as proper circulation is established start mixing cement.

2. Mix sufficient cement slurry to fill twice the theoretical annular capacity. Observe returns with TV. Pumping five sacks of Mica ahead of the cement will improve the likelihood of recognizing cement returns.

3. Displace cement to within 30 feet of the shoe with Halliburton measuring displacement and release the pressure to check the float.

4. If the float holds, release the running tool, retrieve the running string. If float does not hold, wait on cement until cement will not backflow.

Blow Out Control

Refer to section 8.4 of the Triton Operations Manual for the contingency procedure for kick control in the conductor hole.

Checklist for Materials and Equipment 26-Inch Hole

ITEM	DESCRIPTION	QUANTITY	LOCATION
1	Temporary Guide Base, Cameron P/N 698514-1 with 6-foot radius and "J" running slots	1 1	Rig Base (Standby)
2	Permanent Guide Base, Cameron P/N 676389-2 with ring for attaching to Conductor Housing	1 1	Rig Base (Standby)
3	"O" Ring for 20-inch Cameron CC Connector	1	Rig
4	Retainer Lock Ring for 20-inch Cameron CC Connector	1	Rig
5	Tool, Mechanical Release for 20-inch Cameron CC Connector	2	Rig
6	Running Tool for Temporary Guide Base, J-Type	1	Rig
7	Housing, Casing Head, 18 3/4-inch, 10,000 psi w/AX Hub top, w/adapter, external, to land in Permanent Guide Base and welded to 30 foot piece of 24" OD x 18" ID 4130 steel pile joint w/CC Connector, box down, Cameron P/N 695586-1-1	1	Rig
8	Wear Bushing, 18 3/4-inch Housing with 17 5/8-inch ID, Cameron P/N 690148-1	1	Rig
9	Casing, 20-inch OD Float Shoe Joint, Grade X-52, w/welded float shoe w/JV Connector	2	Rig
10	Casing, 20-inch OD, grade X-52, 94 lb/ft. w/JV Connector	5 extra joints	Rig
11	Casing, 20" OD, grade X-52, 94 lb/ft w/JV Connector pin by CC Connector pin	2	Rig
12	Centralizer, 20-inch Halliburton	4	Rig
13	Stop Ring, 20-inch Halliburton	1	Rig

Checklist for Materials and Equipment 26-Inch Hole

ITEM	DESCRIPTION	QUANTITY	LOCATION
14	Housing Running Tool, 18 3/4-inch, w/4 1/2-inch IF box top and bottom, Cameron P/N 689956	2	Rig
15	"O" Ring for 18 3/4-inch Housing Running Tool, Cameron P/N 40314-15-13-85	1	Rig
16	Hole Opener, 26-inch Security Type B-26	2	Rig
17	Hole Opener Cutter, spare sets, Type S	1 set	Rig
18	Bit, 17 1/2-inch, X3A (or equivalent), w/5/8-inch nozzles	2	Rig
19	Bit, 26-inch, X3A (or equivalent), w/5/8-inch nozzles	1	Rig
20	AX Gasket for 18 3/4-inch, 10,000 psi WP Connector	2	Rig

Drilling the 17 1/2-inch Hole and Running 13 3/8-Inch Casing

Installing the 18 3/4-inch BOP Stack and 21-inch riser.

Pressure Testing the BOP Stack on the Test Stump.

1. Prior to testing the stack on the stump, open all rams and check sealing elements for wear or damage. Flush the connector and ram cavities with a high pressure stream of water. Visually inspect the annular sealing element and replace bonnet seals.

2. Function test BOP's. Note gallons to function and closing time.

3. Test BOP's to at least 5000 psi. Complete the BOP test and inspection affidavits and send to shore for filing.

Running the Stack and Riser.

The pressure and function check will be completed outside the critical path. Other preparations for running the BOP will proceed simultaneously in order to have the stack ready to run as soon as possible after cementing 20-inch casing.

1. Position the BOP stack on the spider beams. Insert the guide lines in the posts of the BOP stack.

2. Install and lock the lower marine riser package onto the 18 3/4-inch BOP stack.

3. Install a new AX gasket in the wellhead connector. Clean and grease with proper lubricant.

4. Insert the guide lines in the marine riser guide frame.

5. Place the marine riser handling spider on the rotary table.

6. Pick up a joint of 21-inch marine riser using the marine riser handling sub. Lower the marine riser joint through the marine riser handling spider and make up to top of the ball joint.

7. Pick up the BOP stack, remove the spider beams and lower the marine riser joint until it can be landed on the marine riser handling spider. Continue to run the marine riser spacing out as necessary. Test the choke line as run. (Every third joint to 1000 psi.)

8. Pick up the telescopic joint (locked in the closed position) and attach to the riser assembly.

9. Lower the slip joint through the rotary table and land in the marine riser handling spider. A special landing ring is provided on the slip joint below the packing box for this purpose. Remove the pins that lock the slip joint in the closed position.

10. Stroke out the slip joint inner barrel and pick up the entire assembly. Remove the marine riser handling spider and lower the slip joint through the rotary table until the riser tensioning cables can be installed to the riser tensioning ring on the outer barrel of the slip joint. Adjust the tension on the cables to support approximately 125 percent of the weight of the marine riser.

11. Install the air operating line to the slip joint packing gland; 5 to 10 psi is normally sufficient pressure to maintain an effective seal against the hydrostatic head of the drilling fluid. Install the choke line to the terminal fitting on the slip joint. Install the diverter package.

12. Tension the guide wires for landing the BOP stack.

13. Lower the marine riser and the BOP stack until the wellhead connector of the BOP stack is landed on the wellhead housing. Observe the landing with television.

    Note: The Cameron collett connector should be open when the connector is on the rig floor and the control valve maintained in the "open" position until it is landed on the wellhead housing. Lock the BOP stack on the wellhead housing with 1500 psi. A pick-up test of 50,000 pounds above the stack weight should be performed to ensure the connector is latched.

14. Land and lock the diverter housing.

15. Reduce the tension in the guide wires to 5000 lbs.

16. Test the wellhead connector and casing against the blind/shear rams to 500 psi for 15 minutes. It will not be necessary to run a test plug.

17. Prior to drilling out cement, close the diverter bag on drill pipe and test the system to 50 psi.

Drilling the Hole

A 17 1/2-inch hole will be drilled to the setting depth of the 13 3/8-inch casing. A minimum of 40 feet of rat hole should be drilled below the proposed shoe depth.

Leak-Off Test

After drilling out cement and cleaning to bottom, drill 10 feet of new formation. Circulate and condition the mud and perform a leak-off test.

Drilling Parameters

1. Weight - drill the float shoe with a maximum of 10,000 to 15,000 pounds. Restrict the drill-out torque to the make-up torque applied to the casing when running. Gradually increase the weight on the bit but keep the neutral point below the casing until the last stabilizer has cleared the shoe. As a rule, the hevi-wate drill pipe will be run in tension.

2. Rotary Speed - when drilling 17 1/2-inch hole, a maximum of 75 RPM rotary speed should be used until bit and stabilizers have cleared the float shoe and gradually increase to optimum speed (200 ± RPM) according to the formation encountered.

3. Pump Speed - when drilling the 17 1/2-inch hole, annular velocities should be maximized.

Mud Properties

While drilling the 17 1/2-inch hole, a flocculated mud mixed by adding prehydrated gel to sea water will be used. A funnel viscosity 35 to 40 will be used to drill out and sea water additions will be made as needed. No water loss control will be maintained unless there are prospective hydrocarbon intervals in this section of the hole. All solids removal equipment should be in operation whenever circulating to effectively control solids build-up. Maintain 60 to 80 mesh screens on the shale shakers.

Reduce the PV by adding water and maintain the YP by continuous addition of prehydrated bentonite.

Prior to logging, the funnel viscosity should be increased to approximately 50-60 seconds by the addition of prehydrated gel.

Wiper Trips

After drilling the 17 1/2-inch hole, make a wiper trip to the 20-inch casing shoe. Circulate the hole clean then pull out to log. Should the logs fail to go to bottom, raise the viscosity and yield point of the mud and make a second wiper trip. If the logs still fail to go to bottom, make a trip into the hole. Do not circulate. Pull out of hole without rotating the drill string.

Deviation Control

While drilling the 17 1/2-inch hole, Totco surveys will be taken at 500 foot intervals below the 20-inch casing.

Contingency for Kick Control while drilling the Surface Hole

A kick which occurs while drilling the surface hole will be handled as any other kick, but the definite possibility of a kick broaching to the surface around the conductor casing demands added precautions.

Running 13 3/8-inch Casing

1. Prior to the start of running casing:

   a. Calculate the space-out for the running strings.

   b. Remove the casing protectors, clean and dry all threads.

   c. Drift the casing, hanger and pup joint.

   d. Make up the casing hanger, pup joint and the sub sea cementing plugs into a joint of casing. Stand in the derrick.

   e. Have the cementer on board.

   f. Mix gel and other additives in fresh water.

   g. Retrieve the nominal wear bushing.

2. The float shoe, float collar, and all casing collars (on both mill side and field side) on the bottom two joints will be thread locked.

3. As soon as float equipment is picked up, check the floats for circulation.

4. Install centralizers per the drilling program.

5. Fill the casing as run. Calculate the running speed to avoid excessive surge pressures.

6. After installing the hanger, the 13 3/8-inch casing will be run on drill pipe. Drift the HWDP to insure adequate clearance for the ball and dart.

Cementing the 13 3/8-inch casing

1. When the casing is landed and cement lines connected, break circulation slowly. If any hydrocarbon sands were encountered in the surface hole, circulate bottoms up prior to cementing.

2. While circulating, keep the annular velocity the same as used when drilling.

3. Mix cement, pump the dart and shear the wiper plug. Displace with rig pump or cementing pump.

4. Bring the cement 200 feet into the conductor casing. If a caliper log is not available, cement with the theoretical volume required.

5. Bump the plug with 2000 psi. Do not overdisplace the casing. Check the float. Do not test the casing at this time.

6. Observe returns while cementing. At completion of the cement job, back out the running tool and wash out the wellhead and BOP's thoroughly to remove any cement that might have accumulated in the wellhead, BOP's or riser.

7. If the float holds, back out the running tool and pull the running string.

8. Run the casing pack-off and test to 5000 psi.

Checklist for Materials and Equipment 17 1/2-Inch Hole

ITEM	DESCRIPTION	QUANTITY	LOCATION
1	Casing, 13 3/8-inch, K-55, 54.5 lb/ft, buttress, R-3 (two joints with loose couplings)	(8 extra)	Rig
2	Float Shoe, 13 3/8-inch buttress	2	Rig
3	Float Collar, 13 3/8-inch buttress box x pin	2	Rig
4	Casing Hanger, flow thru, 18 3/4-inch x 13 3/8-inch, Torque Set with 6-foot buttress pup joint, Cameron P/N 689410	2	Rig
5	Seal Assembly, 18 3/4-inch x 13 3/8-inch, Cameron P/N	2	Rig
6	Casing Hanger Running Tool, 18 3/4-inch x 13 3/8-inch, Cameron P/N 689432-1	2	Rig
7	Wear Bushing for 18 3/4-inch x 13 3/8-inch Housing, Cameron P/N 689701	1	Rig
8	Running and Testing Tool for 18 3/4-inch x 13 3/8-inch Torque Set Seal Assembly, Cameron P/N 689445-5	1	Rig
9	Testing Tool for 18 3/4-inch x 13 3/8-inch x 9 5/8-inch to test BOP, Cameron P/N 689460 c/w spare "O" Ring P/N 40314-14-13-85	1	Rig
10	Centralizer, 13 3/8-inch	10	Rig
11	Stop Collar, 13 3/8-inch	1	Rig

ITEM	DESCRIPTION	QUANTITY	LOCATION
12	Sub Sea Cementing Tools, Howco		
	Sub Sea Mandrel, 4-inch NU pin up	2	Rig
	Bottom Plug	2	Rig
	Top Plug	2	Rig
	Ball and Dart Launching Manifold, 4 1/2-inch I.F.	1	Rig
	Ball	2	Rig
	Dart	2	Rig
13	Thread Protectors, 13 3/8-inch Klampon	5	Rig
14	Casing Drift, 12.250-inch O.D.	1	Rig
15	Circulating Sub, 13 3/8-inch buttress pin x 4 1/2-inch I.F. box	1	Rig
16	Thread Lock Compound, equivalent to Bakerlok Product 199-50	3 cans	Rig
17	Thread Lubricant, API Modified (no teflon)	4 pails	Rig
18	Emergency Slip and Seal Assembly w/running tools	1	Base
19	Stabilizer, 17 1/2-inch, four blade, 9 1/2-inch body w/7 5/8-inch API regular box and pin	2	Rig
20	Packer, Halliburton RTTS, for 13 3/8-inch, 54.5 lb/ft casing, adapted to 4 1/2-inch I.F.	1	Howco
21	Bit, 17 1/2-inch, X3A (or equivalent)	2	Rig
22	Marine Casing Cutter, 11 3/4-inch O.D., A-Z Hydraulic C-13 w/2 sets C13-8-19 knives	1	Base

ITEM	DESCRIPTION	QUANTITY	LOCATION
23	Marine Swivel, A-Z Assembly MSA-10, 12-inch O.D. w/6 5/8-inch API regular box and pin, c/w MSA-10-16 ring to land on 13 5/8-inch Wellhead, Cameron P/N 693880-01	1	Base
24	Cutter Space Out Assembly, A-Z, 6 1/4-inch OX 10-inches long	1	Base
25	Cutter Stablizer, A-Z, w/ FWS-20 and FWS-5 blades	1	Base
26	Hole Opener, 17 1/2-inch, Security or equivalent, 6 5/8-inch API Reg. box by box	1	Rig
27	Hole Opener Cutters	1 set	Rig
28	Single Joint Elevators, 13 3/8-inch	1	Rig

Drilling the 12 1/4-Inch Hole and Running 9 5/8-Inch Casing

Testing the 18 3/4-inch BOP's and Casing

1. Test the BOP stack and choke manifold to 5000 psi, and the Hydril to 3500 psi prior to drilling out. The Drilling Supervisor will complete the test affidavit.

2. Test the casing prior to drilling out to 2000 psi.

3. Set the ball joint pressure.

4. Pump through the choke and kill line at 45 and 90 SPM to measure the circulating pressure loss. Record along with mud weight.

5. Perform a hang off drill on the upper pipe rams and post the space out information near the driller.

Drilling Out

1. Run the 12 1/4-inch wear bushing.

2. Check the cement samples prior to drilling out.

3. Restrict the torque when drilling out to the make-up torque applied to the casing while running.

4. When drilling out with stablizers in the drill string keep the neutral point in the open hole.

After drilling out cement and drilling 10 feet of new hole, perform a leakoff test.

Drilling Parameters

Drill the float collar and shoe with a maximum of 10,000 to 15,000 pounds and 75 RPM. Gradually increase the weight on the bit and the rotary speed to comply with the drilling program but maintain the neutral point below the casing until the last stabilizer has cleared the shoe.

Hydraulics

Maintain the annular velocity specified in the drilling program. However, the nozzle sizes specified in the program are approximate and should be adjusted in the field as necessary.

Mud Properties

Follow the mud properties specified in the drilling program. In general, run a flocculated prehydrated gel system until viscosity or water loss control is required, at which time chemical treatment should be initiated. Use the minimum chemical thinner required to control gel strength and reduce the water loss with bentonite and lignite. Prehydrate all bentonite in fresh water.

Well Control

1. Abnormal pressure indicators will be monitored below surface casing.

2. Conduct well control drills routinely.

3. Test the blowout preventors weekly.

4. Function test BOP's on round trips.

Formation Evaluation

The formation evaluation program is detailed in the drilling program.

FORMATION EVALUATION

Formation evaluation will be conducted as outlined in the Weaver Oil & Gas Geological Prognosis.

WELL CONTROL

Well control procedures and operating guidelines are included in the Triton Well Control Manual and Section 4.4 of the Triton Operations Manual.

CASING DESIGN FACTORS

Casing design factors, along with running and handling procedures, are included in Section 3.3.2 of the Triton Operations Manual.

CONTINGENCY PROCEDURES

Contingency procedures for emergencies which may occur can be found in the Oil Spill Contingency Plan, the Emergency Procedures Manual, and Section 8 of the Triton Operations Manual.

AUSTRALIAN GOVERNMENT REGULATIONS

The subject well will be drilled in full compliance with the Direction as to Drilling Operations (1 June 1980) by the State of Tasmania and the Commonwealth of Australia.

211219

SECTION VI

BASS BASIN REVIEW

by

PETROCONSULTANTS S.A.

SECTION V, PETROCONSULTANTS S.A. REVIEW

BASS BASIN

ABSTRACT

Area:	62,000 sq km
Location:	Bass Strait, between Tasmania and the main Australian mainland.
Age:	Early Cretaceous to Tertiary.
Structure:	Elliptic northwest-southeast trending graben controlled be normar vertical movements, The major structural units are a deep basin, basin edges and a number of structural noses.
Environments and Lithologies:	Early Cretaceous continental poorly sorted sandstones, shales (Otway Group) considered as economic basement. Late Cretaceous to basal Late Eocene delta plain, fluviatile sandstones, shales, coals with marine influences on top of the section. (Eastern View Coal Measures). Late Eocene marine shales and sands. (Demons Bluff). Oligocene to Pliocene shallow marine carbonates and clays (Torquay Group).
Thickness:	In excess of 5,000 m including up to 3,000 m of prospective Eastern Coal Measures.
Discoveries:	Non commercial gas/condensate in Pelican area. Good oil show in Cormorant 1.
Potential:	Fair.

EXPLORATION HISTORY

In 1960, the Broken Hill Proprietary Ltd (BHP) was granted an exploration licence covering the whole of the Bass Basin. The permits were later held by Hematite Petroleum a wholly owned subsidiary of BHP.

Lewis G Weeks designed the initial exploration programme to define the suspected sedimentary basin which consisted of an aeromagnetic survey flown in 1961. This was followed by a regional seismic survey in 1962-63. In 1965, Esso obtained rights to production in return for sole exploration risk.

By mid-1970 six wells had been drilled and shows were recorded at Bass 3, Pelican 1, Pelican 2 and Cormorant 3. Major regional seismic surveys in 1971 and 1972 were followed by the drilling of ten wells, all dry. The last well drilled was Pelican 4 by Esso in 1979.

In 1980-1981, various permits covering areas previously relinquished by Hematite were granted to Weaver Oil and Gas and groups headed by Bass Strait Oil & Gas. Seismic surveys were subsequently carried out but no wells have been drilled by these companies to date.

TECTONIC FRAMEWORK

The Bass Basin is an elliptic northwest-southeast trending graben produced by a NW-SE oriented tensional stress. It covers 62,000 sq km in the Bass Strait between Tasmania and the Australian mainland. The northeastern and western boundaries are defined by the King Island, Mornington High on the west, and the Bassian Rise to the northeast. The basin is entirely offshore in water depth up to 90 m.

Major structural features are a deep basin, basin edges, and a number of fault controlled structural noses: Dondu, Paipan, Konkon and Damala noses.

The predominant structural style is that of faulted basement blocks with onlap and compaction of sediments over upthrown blocks. Other characteristics are faulted anticlines and arches or folds generated by intrusive or extrusive rocks.

Predominantly vertical movements seem to have controlled structural growth throughout the basin's history, and there are no, or little evidences of compressional forces such as in the Gippsland Basin.

The oldest tectonic events (Late Cretaceous) are seen in the southern area, while the youngest activity (Late Tertiary) is observed in the northwestern area.

BASIN EVOLUTION

The Bass Basin appears to have initially developed in Late Jurassic time as the result of northeast-southwest tensional stress caused by the initial break-up of the Australian and Antarctic plates.

A thick continental sequence, the Otway Group, derived from the Tasmanian highlands, was deposited in rapidly subsiding northwest-southeast trending fault-angle depressions. The section consists of poorly sorted sandstones, argillaceous sediments and thin coals associated with lacustrine, alluvial fan and alluvial plain complexes. The Otway Group is generally considered as the economic basement.

On the basin margins, an unconformity marks the boundary between the Early and Late Cretaceous. At Durroon 1, Late Cretaceous volcanics rest unconformably on the Otway Group. At Bass 2 and 3, the Late Cretaceous is unconformable on Paleozoic basement. Relationships between the two units are unknown over a large part of the basin.

A second period of basin downwarp associated with extensive normal faulting initiated the deposition of a predominantly continental section, the Eastern View Coal Measures. The only well to have penetrated a significant thickness (595 m) of Late Cretaceous sediments is Durroon 1. On seismic sections, the sequence is seen to thicken in fault controlled troughs flanking the Durroon High and Aroo area.

Rapid subsidence during these two sedimentary stages are further characterized by high geothermal gradients (up to 2.5° F/100 ft) and heat flow (2.5 or more) (Weaver, 1982).

During the Paleocene, the Bass Basin area expanded and was structurally quiescent. The sequence exhibits a broad facies change becoming more argillaceous towards the north. The basin appears to have been landlocked and filled by arenaceous fluviatile sediments from the south with a stream drainage oriented towards the northwest, on an interpretated low energy delta plain (V.A. Robinson, 1974).

The basal Early Eocene shows similar characteristics, but fault movements became more intense. The Early Tertiary and older rocks were folded and faulted and locally intruded by basic to intermediate igneous rocks. Seismic data suggest that at least locally the top of the Lower Eastern View Coal Measures is truncated by an unconformity.

The depositional environment for the Early to Late Eocene Upper Eastern View Coal Measures is believed to be predominantly delta plain characterized by thick coal seams, with a cut-and-fill stream channel system developed across coal swamps (Brown, 1976). At the close of the Early Eocene, a marine shallow water bay spread across the coal swamps in the northern part of the basin into a southeasterly direction, and a more shaly facies was established there.

A widespread Late Eocene marine transgression deposited a predominantly argillaceous sequence, the Demons Bluff Formation. The basin thereafter continued to subside and except in a few areas where a sandy facies is present, the Oligocene-Pliocene sequence consists mainly of shallow shelf carbonates and clays.

Structural movements intermittently activated along pre-existing major fault lines produced drape structures in the overlying sediments.

Associated with tensional movements mainly concentrated in the northern part of the basin, major volcanic events occurred both subaerially and on the sea floor.

STRATIGRAPHY

PALEOZOIC

Lithologies: Only two wells, Bass 2 and 3, drilled respectively on the northeast and western flanks of the basin have penetrated Paleozoic sediments, presumably of Lower Paleozoic age, as follows:

Bass 2: altered tuffaceous mudstones recovered at 1,799 m.

Bass 3: interbedded sequence of silicified black shales, fine grained quartzites and black siltstones at 2,387 m.

------------------------- UNCONFORMITY -----------------------------

LATE JURASSIC TO EARLY CRETACEOUS

Otway Group

Environments: Continental, alluvial fan, lacustrine and alluvial plain complexes.

Lithologies: North West: 40 m of lithic sandstones with weathered volcanics in Konkon 1 at 1,487 m subsea.

South East: over 1,200 m of interbedded fine to medium grained lithic sandstones, rare thin conglomerates, dark brown to grey siltstones, carbonaceous grey shales and rare thin coal beds in Durroon 1. The sediments have been dated Late Albian and Late Aptian suggesting a stratigraphic break within the section.

Thickness: Possibly up to 3,000 m.

LATE CRETACEOUS TO EARLY EOCENE

Lower Eastern Coal Measures

Environments: Delta plain, fluviatile, lacustrine, coal swamps. Paleocene and Early Eocene deltaic with a stream drainage.

Lithologies: Late Cretaceous: Durroon 1 is the only well to have penetrated a significant thickness of Late Cretaceous sediments. A volcanic sequence comprising 100 m of olivine basalt separates the Late from the Early Cretaceous.

The Late Cretaceous section consists of 335 m of grey to brown calcareous shales succeeded by 240 m of coarse grained sandstones with interbeds of thin shales.

The section thickens in fault controlled troughs in Durroon and Aroo areas.

Paleocene: Interbedded sandstones, siltstones, shales and thin coals.

The Paleocene is subdivided into the Lower L. balmei, Upper L. balmei and lower part of the Lower M. diversus zones.

The Paleocene section exhibits a broad facies change, being dominantly arenaceous to the south and southeast, and becoming more argillaceous towards the north. Coarse Paleocene sandstones at Durroon 1 grade to an interbedded section of silty and carbonaceous dark grey to brown shales, sandstones and grey siltstones, with very thin to occasionally very coarse grained thin sandstones and thin black coals.

Bass 3 penetrated a 245 m Paleocene section comprising up to 100 m of sands. The sequence at Konkon 1 consists of shales and coals.

The thickest section of Paleocene (620 m) was penetrated in the centre of the basin at Poonboon 1.

LATE CRETACEOUS TO EARLY EOCENE Cont'd

Lower Eastern Coal Measures

Lithologies Cont'd

The section thins to 180 m on the eastern margin at Bass 2, 370 m at Bass 3 and 120 m farther north at Konkon 1.

Basal Early Eocene: There is very little difference in lithology between the basal Early Eocene and Paleocene.

The Lower M. diversus is 660 m thick at Pelican 1, 130 m thick at Pelican 3 and thins to about 30 m at Bass 2 and 3. The entire Early Eocene section is absent at Durroon 1. The percentage of interbedded sandstones, siltstones, shales and coals within this section is similar to that of the underlying L. balmei unit.

The facies change seen in the Paleocene is also well marked in the Lower M. diversus zone. Seismic data suggest that at least locally, the Lower Eastern View coal measures are truncated by un unconformity within the M. diversus Zone (Brown, 1976).

Thickness: The Lower Eastern Coal Measures are assumed to be up to 2,500 m in fault controlled.

---------------------- UNCONFORMITY ------------------------------

EARLY EOCENE TO LATE EOCENE

Upper View Coal Measures

Environments: Delta plain with stream drainaged succeeded by delta plain and marine shallow water bay.

EARLY EOCENE TO LATE EOCENE Cont'd

Upper View Coal Measures Cont'd

Lithologies:

Early Eocene: The Upper M. diversus Zone is characterized by a high percentage of coal relative to the other units wthin the Eastern View. Coal beds are usually less than 5 m thick, but coal beds up to 25 m have been penetrated in Dondu 1. The greatest thickness of the Upper M diversus Zone (450 m) has been penetrated at Cormorant 1. Individual sandstone beds are generally up to 25 m thick, but usually have a limited extent.

Late Eocene: The P. asperopolus Zone is lithologically similar to the Upper M. diversus Zone. However, the proportion of sandstones decreases towards the top of this unit. In contrast, the proportion of coal increases up the section. The thickness of individual sandstones are in excess of 40 m. The siltstones and shales interbeds rarely exceed 15 m. The maximum thickness of the P. asperopolus Zone is characterized by sandstones, with some siltstones, shales and coals interbedded in the lower part of the section. The upper part consists of shales, and no coals are present near the top of this zone. Coal beds rarely exceed 2 m in thickness.

At the close of the Early Eocene, a shallow sea starting from the northwest spread across the central part of the basin into a southeastern direction.

Thickness:

The Upper View Coal Measures are at least 900 m thick.

LATE EOCENE

Demons Bluff Formation

Environments: Restricted marine.

Lithologies: Predominantly shales overlain by marine sands in the northwest half of the basin, carbonaceous, pyritic and silty shales in the central portion and sandy facies in the southeast.

Thickness: Up to 270 m at Cormorant (140 m at Poonboon). The unit thins towards the margins of the basin.

OLIGOCENE TO PLIOCENE

Torquay Group

Environments: Shallow marine.

Lithologies: Oligocene (Jan Duc Formation equivalent): interbedded glauconitic clays and marls, sandstones.

Early Miocene (Puebla Formation equivalent): clays with interbedded calcarenites.

Middle Miocene to Pliocene: Predominantly calcarenites, sandstone member up to 150 m in Bass 2 and 30 m in Bass 1.

Thickness: Up to 760 m.

HYDROCARBON POTENTIAL

(i) RESERVOIR ROCKS AND OCCURRENCES OF HYDROCARBONS

The prospective section in the Bass Basin is mainly restricted to the sandstones of the Eastern View Coal Measures. A number of wells have recorded hydrocarbon shows, the most significant non-commercial accumulations being from the Pelican area. The only oil show was encountered in Cormorant 1.

- Pelican 1 recorded 3.9 m^3 of gas and 600 cm^3 of condensate from a FIT at 2,661 m within the Lower M diversus Zone (Early Eocene). In Pelican 2 a FIT at 2,880 m within the same zone recovered 1.05 m^3 of gas and 750 cm^3 of condensate. Pelican 3 recorded a gas show but no condensate from Paleocene sand, below 2,800 m, while in well N° 4 a FIT at 2,739 m recovered gas and condensate.
- Bass 3 recovered 0.82 m^3 of gas and 800 cm^3 of condensate from a 15 m thick Paleocene sand (Lower balmei) at 2,055 m.
- A FIT at 1,550.6 m in Cormorant 1 from a sand in the Upper Eastern View (N asperus Zone) recovered 22 litres of oil. Shows were also present in four thin sands between 1,828 and 2,347 m.

  In addition, ecouraging shows were recorded in Aroo 1, mainly in the Lower balmei Zone and also in Dondu 1 and Poonboon 1 from thin, rather tight sands below 2,740 m.

Abnormal high pressure zones and relatively fresher formation waters occur locally at depths below 2,750 m. By instance such pressures were encountered below 2,800 m in the Pelican area.

(II) SOURCE ROCKS

Geochemical analysis from 27 core samples made by Nicholas and Partners (1981) led to the following results:

The Lower Eastern View Coal Measures are rated as having a good to very good source potential and the Upper View a fair to good potential. The Early Cretaceous Otway Group in the southeastern Bass Basin has also been rated as having a fair to good source potential.

(ii) SOURCE ROCKS Cont'd

All samples taken from the Eastern View Coal Measures reached or exceeded the minimum total organic content (TOC) of 0.5% necessary for a clastic rock to have hydrocarbon source potential. Excluding coal samples, 15 had a TOC content in excess of 1.0%. The highest values are from a Paleocene carbonaceous shale (L. Balmei Zone) from Bass 3 with 20.1%, and from an Eocene carbonaceous shale (N asperus Zone) from Cormorant 1 with 10.1%, which occurs immediately below the horizon in which the oil show was recorded.

Results from Narimba 1 are also significant because its proximity to the Pelican gas/condensate discovery. Three samples from shales (L. M diversus Zone) have a TOC content ranging from 0.85% to 7.10%. Only one Late Cretaceous sample from Bass 3 has been rated as having a fair source potential.

The prevalence of vitrinitic kerogen within the Eastern View Coal Measures indicate a gas prone source. However, the exinitic kerogen content from samples in Cormorant 1 and Pelican 1 is suggestive of a gas and oil source potential.

(iii) MATURATION OF HYDROCARBONS

The lowest geothermal gradients (25° to 28° C/km) occur in the deeper parts of the basin tending to increase on the flanks (30° to 40° C/km), particularly on the northeast flank.

Vitrinite reflectance (Ro) measurements on 26 samples from the Bass Basin indicate that values of Ro in the range of 0.6% to 0.7% are frequent for samples from the Lower Eastern View, while overlying units are less mature, except one sample from the Torquay Group with Ro of 0.63%.

Ro values in excess of 0.5% (corresponding to 60° C or top of oil window) are listed below:

(iii) MATURATION OF HYDROCARBONS Cont'd

Unit/Zone	Well	Depth(m)	Ro max.
L. balmei	Aroo	2,903.8	0.65
N. asperus	Bass 1	1,197.7	0.50
Torquay Group	Bass 2	931	0.63
L. balmei	Bass 3	2,104.6	0.63
L. balmei	Bass 3	2,265.6	0.56
Lower M. diversus	Narimba 1	2,833.6	0.67
Lower M. diversus	Narimba 1	2,912.3	0.62
Lower M. diversus	Narimba 1	2,972.3	0.56
Lower M. diversus	Poonboon 1	2,472.8	0.60
L. balmei	Poonboon 1	3,034.0	0.70
L. balmei	Poonboon 1	3,258.6	0.66
Otway Group	Durroon 1	3,024.2	0.69

(After E. Nicholas and Partners, 1981, Saxby and others, 1979 & 1980).

Highest values not sampled in the above study are from deeper level in Cormorant 1 (Ro 1.16% from 2,950 m) and in Pelican 1 (Ro 1.10% from 3,150 m).

The geothermal temperature gradients indicate that generation of hydrocarbons can be expected from a depth of about 2,000 m in the deep basin and at shallower depths on the flanks. On the other hand, vitrinic reflectance data indicate immature to marginally mature source rocks at depths of approximately 3,000 m in the deep basin and 2,000 m on the flanks.

CONCLUSIONS

The prospective section in the Bass Basin lies in the Eastern View Coal Measures which are the stratigraphic equivalent of the Latrobe Coal Measures in the adjacent Gippsland Basin.

In the Gippsland basin, hydrocarbons are trapped in en echelon anticlines resulting from an east-west right lateral shear system, associated with a widespread unconformity at the top of the Latrobe Group. Such a play lacks in the Bass Basin as in contrast, predominantly vertical movements seem to have controlled structural growth throughout. In addition, the Late Eocene marine shales of the Demon's Bluff. Formation appear to be conformable on the coal measures.

However, the Lower Eastern view Coal Measures have been rated as having a good to very good source potential and the Upper Eastern View a fair to good source potential. The section is mainly gas prone with some possibilities for generation of oil. Thermal studies indicate that the deepest levels tested are within the mature zone for hydrocarbon generation.

To date eighteen wells have been drilled in the Bass Basin resulting in sub-commercial gas/condensate accumulations in the Pelican area, and encouraging shows. The lack of success has been mainly attributed to the following factors:

- The interpretation of volcanic sections from seismic sections often difficult.

- Most wells were terminated in inmmature or maginally mature source rocks sections.

- A number of wells appear not to have been located on structural closures at the top of the Eastern View Coal Measures.

Recent geophysical and geochemical surveys carried out by Bass Strait Oil & Gas NL, Weaver and the B.M.R. have contributed to a better understanding on deeply buried structures, maturation and trapping mechanisms in the Bass Basin.

Following the recent agreement between Amoco/SAOG and the Bass Strait Oil and Gas Group, a new phase of exploration is expected to include at least the drilling of two wells. Further developments are expected with the award of one block covering part of the deep basin, and a not yet specified drilling program by Weaver.

In summary, the main objectives in the Bass Basin will be to test Late Cretaceous deep structures within the zone of hydrocarbon generation, sealed by Early Paleocene shales, mainly in the Durroon and Aroo areas; structural closures at the top of the Eastern View Coal Measures sealed by shales at the Demons Bluff Formation with postulated updip migration of hydrocarbons (Bass 2 and Cormorant areas); anticlines mapped at the Late Paleocene ~~and~~ Early ~~Eocene levels below the Early Eocene unconformity~~ (northwestern and Squid areas).

WELLS DRILLED IN BASS BASIN

WELL	Operator	Year	TD(m)	Bottom Hole Formation
AROO 1	Hematite	1974	3,693	Igneous extrusive
BASS 1	Esso	1965	2,352	Eocene
BASS 2	Esso	1966	1,801	Early Paleozoic
BASS 3	Esso	1967	305	Early Paleozoic
CORMORANT 1	Esso	1970	3,000	Eocene
DONDU 1	Esso	1973	2,927	Paleocene
DURRON 1	Esso	1972	3,026	Otway Group
KONKON 1	Esso	1973	1,524	Otway Group
NANGKERO 1	Hematite	1974	2,877	Paleocene
NARIMBA 1	Esso	1973	3,356	Paleocene
PELICAN 1	Esso	1970	3,178	Paleocene
PELICAN 2	Esso	1970	3,066	Paleocene
PELICAN 3	Esso	1972	2,904	---
PELICAN 4	Hematite	1979	3,051	---
PIPITA 1	Hematite	1982	2,100	---
POONBOON	Esso	1972	3,266	Paleocene
TAROOK 1	Esso	1972	2,774	Paleocene (?)
TOOLKA 1	Esso	1972	828	---
YURONGI 1	Esso	1973	2,927	---
SQUID 1	Weaver	1984	2,925	Paleocene
TASMANIAN DEVIL L	Weaver	1984	869	Igneous

BIBLIOGRAPHY

BROWN, B.R., 1976 - Bass Basin: Some aspects of the petroleum geology. In LESLIE, R.B., EVANS, H.J., & KNIGHT, C.L. (Editors), ECONOMIC GEOLOGY OF AUSTRALIA AND PAPUA NEW GUINEA, Vol. 3 - PETROLEUM. Australasian Institute of Mining & Metallurgy, Monograph 7, 67-82.

KANTSLER, A.J., SMITH, G.C., & COOK, A.C., 1978 - Lateral and vertical rank variation: implications for hydrocarbon exploration. The APEA Journal, 18(1), 143-56.

MARTIN, A.R., & SAXBY, J.D., 1980 - Petroleum-source rocks and migration. Progress report: 1 July 1979-30 June 1980 to National Energy Research Development & Demonstration Program.

NICHOLAS, E., LOCKWOOD, K.L., MARTIN, A.R., & JACKSON, K.S., - Petroleum Potential of the Bass Basin. B.M.R. Journal of Australian Geology & Geophysics. Vol.6 N°3. September 1981, 212.

PARTRIDGE, A.D., 1979 - Revision of Bass Basin palynology and micropalaeontology data sheets. Esso Australia Ltd, Palaeontology Report, 1979/19 (unpublished).

RAPHAEL, N.M., & SAYBY, J.D., 1979 - A report to the Bureau of Mineral Resources, Canberra. CSIRO Restricted Investigation Report 1030R (unpublished).

RICHARDS, K.A., & HOPKINS, B.M., 1969 - Exploration in the Gippsland, Bass and Otway Basins, Australia. Economic Commission for Asia and the Far East: Symposium on the development of petroleum resources of Asia and the Far East, 4th Session, Canberra, Australia.

ROBERTSON, C.S., NICHOLAS, E., & LOCKWOOD, K.L., 1978 - A review of petroleum exploration and prospects in the Bass Basin. Bureau of Mineral Resources, Australia, Record 1978/91 (unpublished).

ROBINSON, V.A., 1974 - Geologic history of the Bass Basin. The APEA Journal, 14(1), 45-9.

SAXBY, J.D., BENNETT, A.J.R., & RAPHAEL, N.M., 1980 - A report to the Bureau of Mineral Resources, Canberra. CSIRO Restricted Investigation Report 1129R (unpublished).

SHIBAOKA, N., & BENNETT, A.J.R., 1977 - Patterns of diagenesis in some Australian sedimentary basins. The APEA Journal, 17(1), 58-63.

WEAVER, O.D. - Bass Basin set for new exploration. World Oil. 4 January 1981, 154-161.

WEEKS, L.G., & HOPKINS, B.M., 1967 - Geology and exploration of three Bass Strait basins, Australia. Bulletin of the American Association of Petroleum Geologists, 51(5), 742-60.

LIST OF FIGURES