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Location Plat in Appendices A and B

SUMMARY AND CONCLUSIONS

The R/V Atlantic Seal was used in the one-boat seismic survey. Air guns were used as the energy source, and the data were recorded 48 and 24 fold on DFS III instruments. The recorded data were then shippedto Digicon's Houston Computing Center where a 9300 Series SDS computer produced the final Var wiggletrace continuous sections. The data were then shipped back to Milano for the final interpretation.

The objective of the survey was to search for and evaluate any subsurface structures found on Blocks BR-29, BR-30, BR-109, DR-20, DR-21, DR-22 and DR-23. Very good structures were found to exist in Blocks BR-30 and BR-109 (Features 1, 2 and 3) with other good structural leads in all of the blocks, but to completely evaluate these leads, additional seismic coverage and study is needed. The areas are complex geologically, they exhibit normal faulting, grabens, possible horst areas, numerous unconformities, possible reefing or barrier island type deposits and various anticlines of different geologic age.

Potential hydrocarbon reservoirs are believed to be concentrated beneath the Miocene Unconformity (Horizon A), except for Block BR-29 where there is a thick Upper Tertiary section.

RECOMMENDATIONS

It is recommended that more seismic coverage and study be obtained to further evaluate the structural leads that have been established. The same field and processing procedures should be used in future work and in areas with shallow sections 24 fold coverage would be sufficient. Areas of shallow penetration, when reinterpreted, should be processed 48 fold to eliminate the shallow effects of the two on one vertical stack. In Block BR-29, a detailed interval velocity study is recommended. In very complex areas with steep dips, it is suggested that the digi-migration dsx 200 system be employed for a more precise subsurface picture.

At this time, however, a specific drilling program should commence in Blocks BR-30 and BR-109 on Features 1, 2 and 3. These features are very large and have all of their seismic parameters satisfied to establish good trapping capability.

DISCUSSION

I. Introduction

A detail seismic survey was conducted by Digicon Inc., Party 203 in the Adriatic Sea, Italy, on Blocks BR-29, BR-30, BR-109, DR-20, DR-21, DR-22 and DR-23 from August 1, 1971 to September 1, 1971 for Mineraria Texas Italiana S.p.A. Approximately 1047.5 Kilometers of 48 and 24 fold coverage were recorded and approximately 496 kilometers of old data were incorporated to produce the final report. The objectives were to survey, process and interpret the data hoping to establish possible structures that could contain hydrocarbons on Mineraria Texas Italiana's offshore blocks.

II. Interpretation

A.) Methods

The horizons mapped were chosen by the client (Plate 1). The maps were constructed from Digicon's Var wiggletrace continuous sections (Plates 2 and 3). The maps have a 1 : 100,000 scale and all of the horizons have been mapped in depth of meters. The conversion of time to depth was obtained by plotting on a graph, the velocities from the V-Studies (new data only) for each horizon and then constructing an average Time Vs Depth Chart (Plates 4 to 9) following the highest concentration of the V-Study points. Horizon A^1 (Lower Pliocene) in BR-29 is the only velocity study that leaves some doubt as to its validity, due to the random scattering of the velocity points. The data were contoured both in time and depth (final maps) as a cross-check method.

Horizon A^1 (BR-29, Lower Pliocene) is a continuous reflector.

Horizon A (Miocene Unconformity) is a continuous reflector and is of excellent quality throughout the surveyed area except where it has been truncated by younger erosional activities or non-deposition. Horizon B is believed to be the top or very near the top of the Eocene. It is generally a good to fair reflector, but in some areas becomes a phantom level based on reliable dip segments. Horizon C is believed to be within or near the top of the Cretaceous. The quality of these data is considered good to poor and in the areas of poor data, phantom

horizons were used. Both the B and C Horizons in some areas are unconformable (BR-109, Feature 6) while in other areas (BR-109, Feature 1) they appear to be conformable.

The seismic interpretation indicates a varied and complex geological history; such as different age levels of subsidence, structural growth, extensive normal faulting, erosional features, unconformities and indications of complete lithological changes in the country rocks.

B. Discussion of maps and important structural features:

In Block BR-29, the A^1 Horizon (Lower Pliocene) indicates regional dip toward the Southwest or landward. The A Horizon (Miocene Unconformity) shows that the regional dip has shifted 90 degrees and is now toward the Northwest, plunging into the Marche-Abruzzi Basin, thus establishing the start of subsidence for this late Tertiary Basin. A very clear erosional channel is seen at this level in the northern part of Block 29. The B Horizon (Eocene) again shows regional dip to the Northwest, but the dip is not at a constant rate like that of the A Horizon. The small amount of faulting shown, has little effect as a trapping agent. It should be pointed out at this time that small segments of turnover can be seen at this level and mapping a deeper level might produce some mappable closures. The A^1 - A Isopach shows thinning toward the Northeast away from the basin. The A - B Isopach shows the significance of the changing rates of dips seen on the B Horizon. At the time of deposition of the A Horizon (Miocene Unconformity), the B Horizon (Eocene) had some very good structures as indicated by Features 1, 1a and 1b, (on A-B Isopach), but the later subsidence of the Tertiary Basin to the Northwest has removed all of their effective closure. Nevertheless, stratigraphic possibilities plus possible deeper closures, the structural trend that Features 1, 1a and 1b have established and velocity problems in the Upper Tertiary leads one to believe that further detail study is required in Block BR-29.

Blocks BR-30, BR-109 and DR-21 are located on one map just to the North and Northeast of the Gargano Peninsula.

The A, B and C Horizon exhibits regional dips seaward away from the Gargano Peninsula landmass, but they are interrupted by two large

structures (Features 1 and 3) and by the pinchout of the A (Miocene Unconformity) and B (the Upper Eocene) horizons into shallower beds. It is difficult to tell at this point as to the exact cause for the truncations, but it is believed to be caused by erosion on Feature 1 and possible non-deposition on the flanks of Features 2 and 3.

Feature 1 (Plates 2 and 3) is the prime structure of the entire surveyed area. It is a Northwest-Southeast trending asymetrical faulted anticline. It is flanked to the North by normal fault N-1 and its steepest dips are seaward and it is flanked to the South by a syncline that is plunging toward the Southeast. The anticline is well expressed on all three structure horizons and the two isopachous maps. It has probably had different times of structural movements as shown by the isopachous maps, but its latest movements indicate that it is the youngest of the structures in this area. Feature 1a is a fault closure on the North flank of Feature 1, trapped against Fault N-6 at the A, B and C levels. North of fault N-5 (B and C Horizons), the seismic reflection quality is much better with depth and it is believed that this indicates a different litholigical sequence from that of the country rocks to the South. Feature 1b has developed to the North of Fault N-5 on the B and C Horizons, but more seismic coverage is needed between lines 34 and 35 to completely establish the amount of East-West turnover on this structure.

Feature 2 in BR-109 (Plate 1) has a very weak expression at the A Horizon level, but it does indicate the start of the graben area to the Southwest and dips that will develop into closure with depth. At the B Horizon, the graben area (Feature 2a) is much better developed, but the closure is obscured on the North side of the graben area by the pinchout of the Upper Eocene level. The C Horizon shows that faults N-3 and N-4 have developed into a well defined graben area with Features 2a and 2b. To the North of fault N-3, Feature 2 has now developed into an extremely large area of closure with turnover into Fault N-3. Features 2, 2a and 2b are are further enhanced by Isopachous maps A-B and B-C showing thin areas over their structural highs. The structural history of Features 2, 2a and 2b is complex, but it was probably an ancient ridge system, with Fault N-3 acting as a growth or subsidence fault and Fault N-4 as a relief fracture.

Sediments of the Upper Eocene age were deposited on the North flank of Feature 2 and in the graben areas of Features 2a and 2b to the South, but never deposited (?) on the crest of Feature 2. The complete structural complex is very large and would only be secondary to Feature 1 in a drilling program.

Feature 3 and 3a located on the border line in the Southern part, between BR-30 and BR-109 is an ancient giant regional type structural high. It is flanked to the South by a normal regional Fault N-1 that separates it from the Gargano Platform. This fault coupled with Fault N-2 forms another graben area (Feature 4) throughout most of Block BR-30 and it possibly runs to the South of Feature 3. The feature is well defined at all three structural levels and shows thinning over the structure on the A-B and B-C Isopachous maps. The Miocene and part of the Eocene that is missing is probably due to non-deposition, rather than erosional elements. It should be a prime drilling target for the Cretaceous age and older rocks.

Feature 6 and 6a located in BR-109, between Features 1 and 2, shows its only expression at the C Horizon level and on the Isopachous maps. It is a normal faulted Cretaceous anticline. It is unconformable with the beds above it and thus is believed to be an erosional feature of Cretaceous Age. Additional seismic coverage is needed to establish a more complete structural configuration in a Northwest-Southeast direction, but Northeast-Southwest turnover has definitely been established on lines 21, 22 and 23.

BR-109 and BR-30 are by far the most interesting, they exhibit the largest structures and the most complex geologic history. The following will be a list of the important features; with each horizon showing their minimum horizonal (kilometers) and minimun vertical (meters) closures.

Feature	Horizon	Approx. Kms. East-West	Approx. Kms. North-South	Vertical Meters
1	A	16.0	5.5	200
	B	16.0	5.0	400
	C	17.5	5.5	900
1a	A	7.0	1.5	100
	B	6.5	1.5	150
	C	7.5	1.5	300
1b	A	-	-	-
	B	6.0	4.5	100
	C	12.0	5.5	400
2	A	1.3 ?	5.5 ?	+ 50 ?
	B	?	?	?
	C	2.5	17.5	150
2a	A	-	-	-
	B	1.8	6.5	+100
	C	2.5	9.5	300
2b	A	-	-	-
	B	-	-	-
	C	1.8	11.5	200
3 a & b	A	13.0	15.0	± 200 (faulted to the South)
	B	17.5	14.5	± 300
	C	22.0	14.0	600 (faulted to the South)
4	A	?	?	?
	B	?	?	?
	C	6.0	1.5	400 (faulted to the North)
6	A	-	-	-
	B	-	-	-
	C	8.0	5.0	200

Blocks DR-20, DR-22 and DR-23 are located on another map South of Block BR-109 and East of the Gargano Peninsula and the Italian coastline toward the South.

Block DR-20 on the A, B and C Horizons show regional dip seaward (to the East) and the strike generally followsthe coastline of the Gargano Peninsula. Feature 4 on the B Horizon is shown only to point out the stratigraphic possibilities of the Upper Eocene Pinchout. Feature 1 is located just to the South of Block DR-20. It is a horst or faulted ridge system. At the tie of lines 40, 38 and D436 between the A and B Horizons, without any deeper structural influence, there exist some anomalous dips. Possible explanation for this seismic phenomenon are reefing or barrier island type deposits.

Block DR-22 located to the South of the Gargano Peninsula, shows regional dips to the Northeast into a Tertiary Basin. Seismic coverage is sparse and more coverage is needed to completely evaluate the block.

Block DR-23, located to the North-Northwest of Bari, shows regional dips to the Northeast (seaward). The data are very poor in some parts of this area (line 45), but Features 2, 2a and 3 exhibit anomalous dips on the A, B and C Horizons and on the Isopachous maps. These features with their associated faulting should be further evaluated with more seismic coverage.

Respectfully submitted,
DIGICON INC.

S. F. Hough
Technical Supervisor
Milan, Italy

FINAL REPORT

ADRIATIC SEA BLOCKS BR-29, 30, 109

DR-20, 21, 22 AND 23

FOR

MINERARIA TEXAS ITALIANA

by

Digicon Inc.,
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Houston, Texas,
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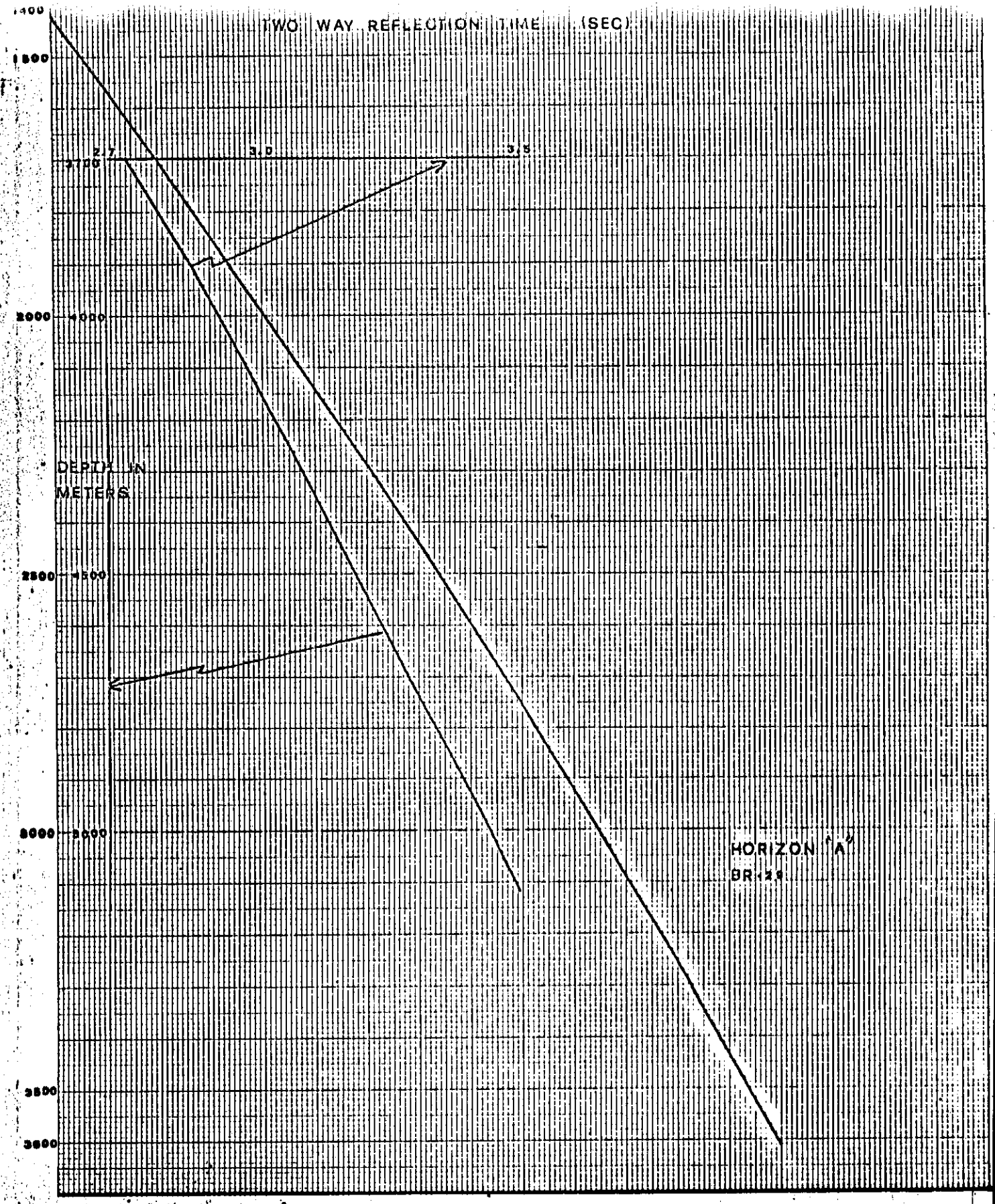
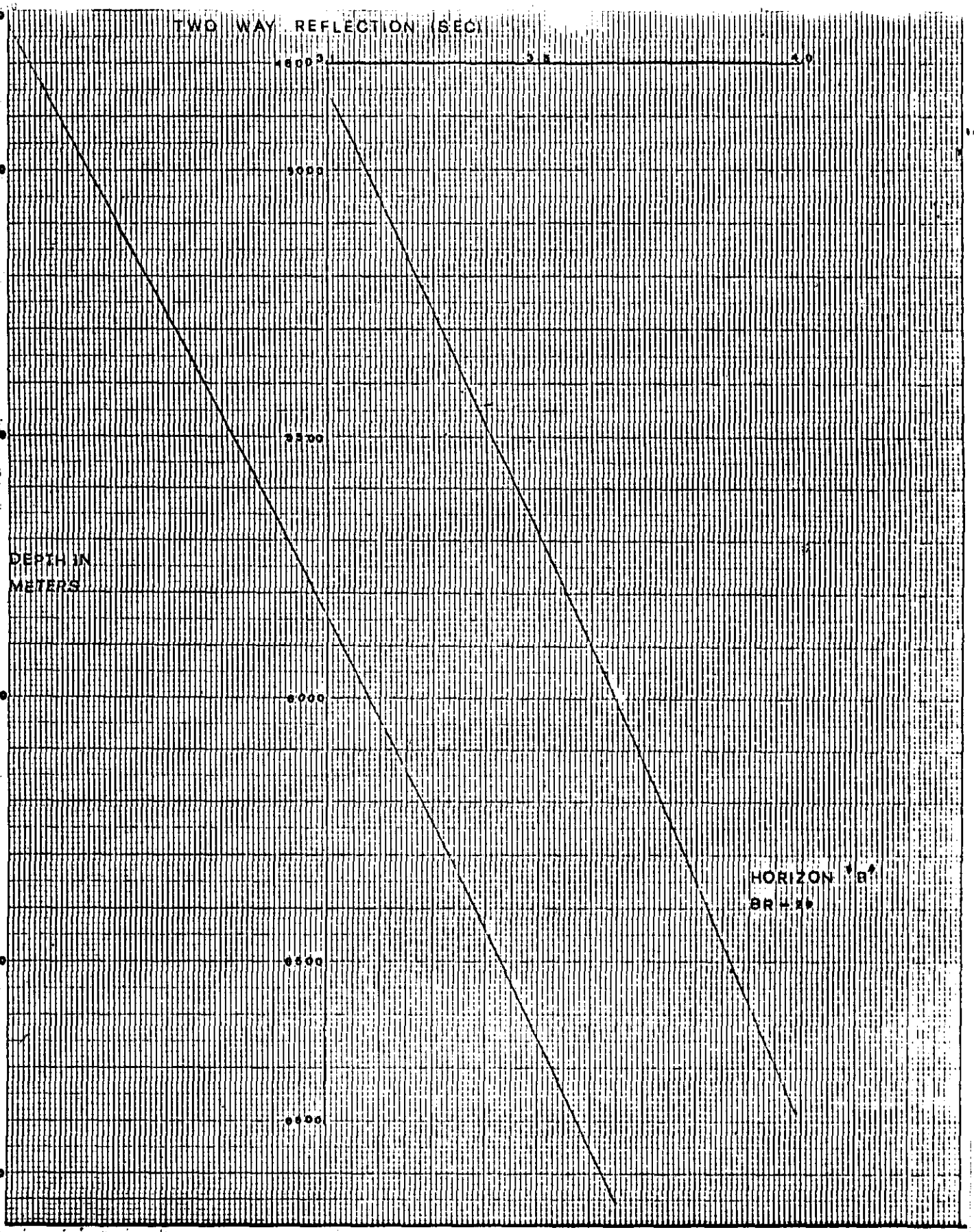


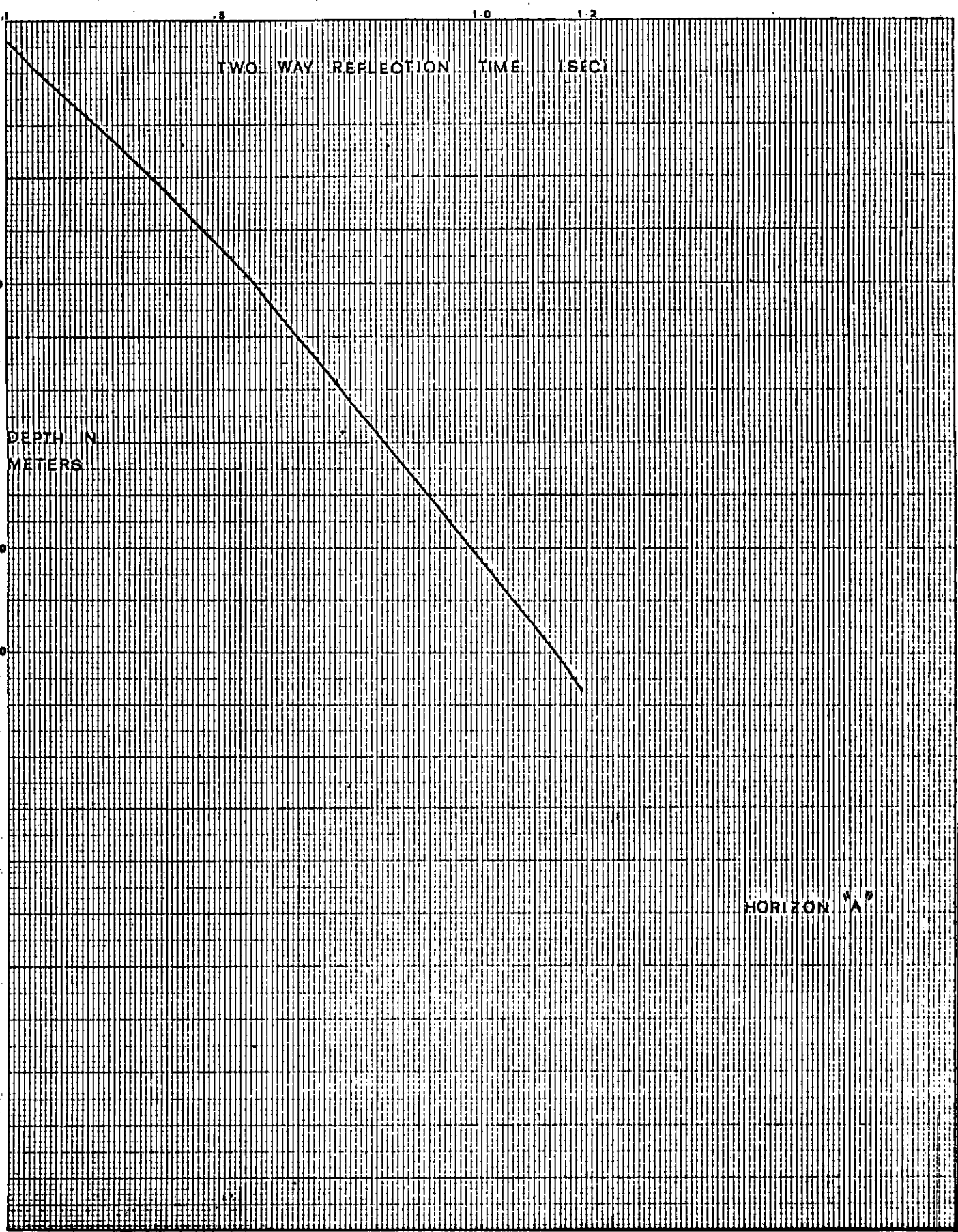
Time Vs Depth Chart

Plate 5



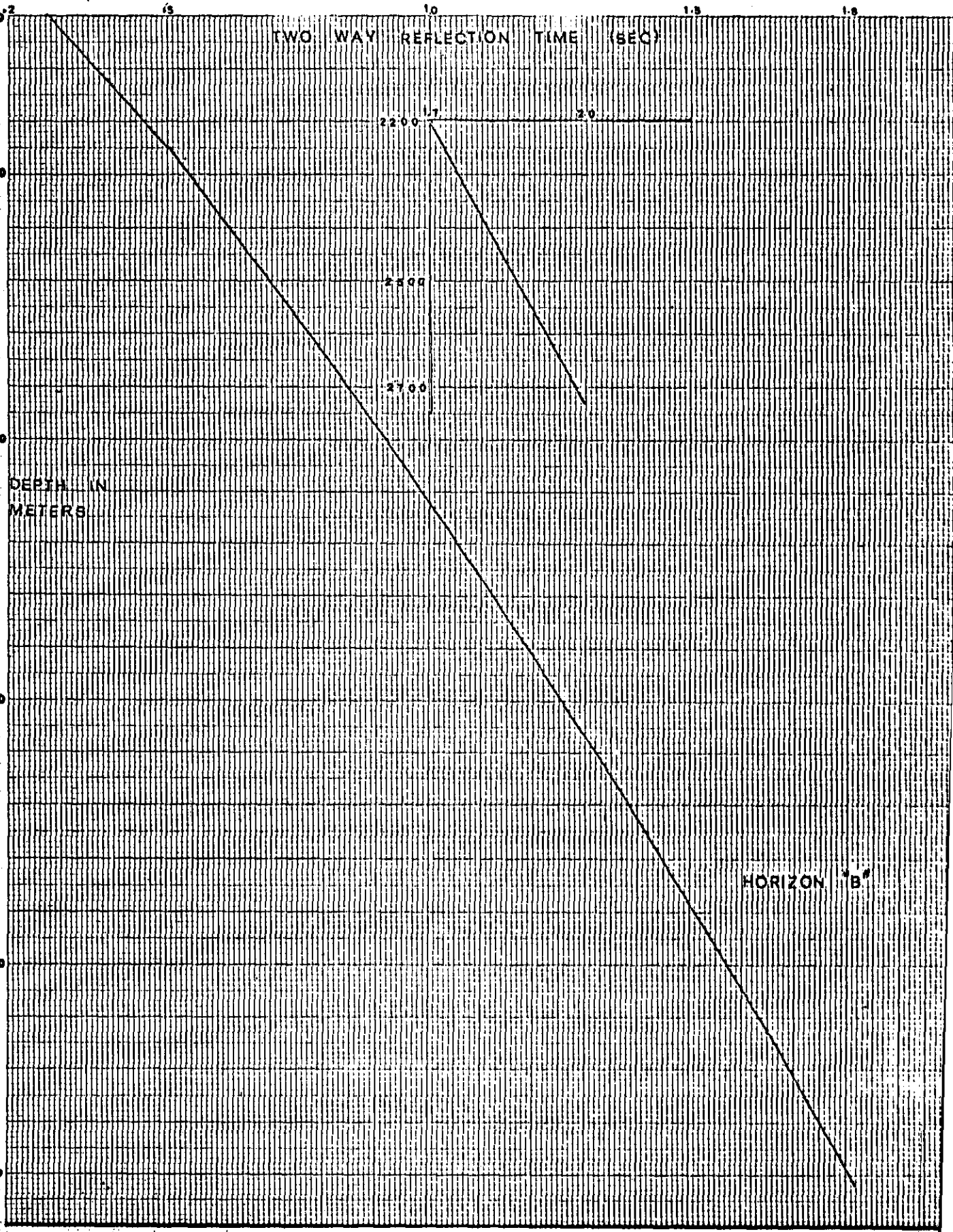
Time Vs Depth Chart

Plate 6



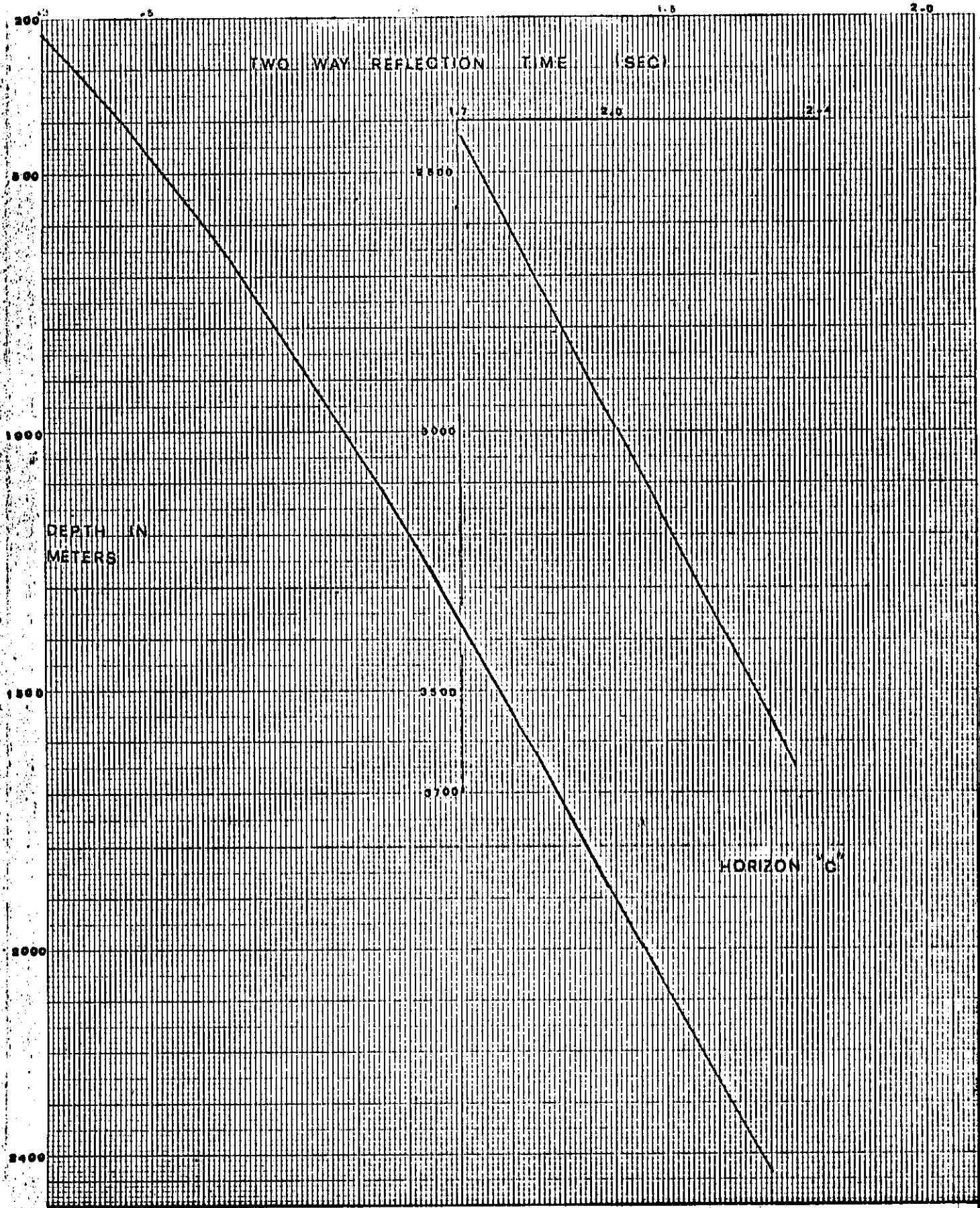
Time Vs Depth Chart

Plate 7



Time Vs Depth Chart

Plate 8



Time Vs Depth Chart

Plate 9

APPENDIX A

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ABSTRACT

A seismic survey was performed in the Adriatic Sea off the coast of Italy (Plate 1) for Mineraria Texas Italiana S.p.A. Shooting started 1 August 1971 and was completed 12 September 1971. The total prospect covered 1,047.5 Kilometers of shooting.

The prospect was shot for forty-eight (48) and twenty-four (24) fold coverage with a forty-eight trace cable, using an airgun array as the energy source. The data were processed twenty-four (24) fold using, in some cases, a two on one vertical stack. All data were recorded in the direct digital form for processing on a SDS 9300 computer.

The objective of the survey was to evaluate the prospect using digital recording and advanced data processing techniques.

INTRODUCTION

Prospect	Adriatic Sea
Location	Offshore Italy (Plate 1)
For	Mineraria Texas Italiana S.p.A.
By	Digicon Inc. Party 203
Party Headquarters	Field - Bari, Italy
	Processing - Houston, Texas
Field Operations	August 1, 1971 - September 12, 1971

PROCESSING

A. DIGITAL PROCESSING EQUIPMENT:

The digital processing equipment used in the Houston center to process the data for Mineraria Texas Italiana seismic survey was as follows:

1. SDS Model 9300 Computer

   This computer has a core memory of 32,000 twenty-four bit words, auxiliary drum storage of six million characters, a convolver filtering unit and 7-Track and 9-Track input/output.

2. SDS Model 925 Computer

   This computer has a core memory of 16,000 twenty-four bit words, auxiliary drum storage of one million characters, a convolver filtering unit and 7-Track, 9-Track, and 21-Track input/output.

3. On line with the SDS Model 925 Computer is a Geospace Model 123 Cathode ray tube cross section plotter. The plotter was used to plot the 24 fold film sections.

The data were plotted using 16 traces per inch as the horizontal scale and 3.97 inches per second as the vertical scale. All sections were displayed with wiggletrace variable area presentation.

B. PROCESSING SEQUENCE:

The data were processed to a 5 second record time using the following processing sequence: (See Plate 2)

1. Perform gain normalization
2. Vertical stack (2 on 1). Used on data shot for 48 fold coverage to obtain 2 X 24 fold common depth point sum.
   This process was not used on data shot for 24 fold coverage.
3. Gathered data into common depth point traces.
4. Computed velocity analysis (one analysis every five kilometers). Plots of analyses showing velocities used to stack data were sent to client.

5. Normal moveout correction applied using velocities derived from velocity analyses.
6. Twenty-four (24) fold common depth point sum.
7. Deconvolution after stack.
8. Filter with a suite of zero phase passband digital filters in a time variant fashion.
9. Trace amplitude equalization
10. Final draft stacked film display.

C. DESCRIPTION OF PROGRAMS:

1. Gain Normalization:

Gain normalization is necessary because the advanced processing techniques demand that their inputs are free of distortion by nonlinear operators. The gain applied in the field by the TI 11000 series amplifiers is nonlinear and time varying. Therefore, the binary gain applied in the field is removed from the data. Then a correction is applied to compensate for signal losses due to spherical decay and inelastic attenuation. In the case of spherical decay, the amplitude attenuation is considered directly proportional to the distance from the energy source, or the product of the average velocity times its respective two-way time. The correction for inelastic attenuation can be approximated by a slope in db/sec. A 4db/sec. slope from 0 to 3.000 sec. was used on the data in this area.

2. Vertical Stack:

Two input records were vertically stacked (two on one) to produce one output record. This process was bypassed on data shot for 24 fold coverage and a 1 X 24 fold common depth point sum was obtained. The purpose of the vertical stack is to help improve the signal to random noise ratio.

3. Common Depth Point Gather:

This program gathers all traces that are common to any subsurface positions. In 24 fold shooting, there will be 24 traces common to each subsurface position.

4. V-Study Velocity Analysis:

The input to the V-Study process is a collection of seismic

traces from a number of adjoining common depth points. A sequence of time gates is selected with the time increment between each gate center being in the range of 25 to 100 milliseconds. The gate width for the best results is usually selected so that the adjoining gates do not overlap. For each time gate, the data are taken through a series of residual normal moveouts. Each of the residual normal moveouts is equivalent to some root mean square (RMS) velocity. After the data are time aligned for each of these velocities, an estimate is made of the coherence between the common depth point traces. A technique is employed at this time to diminish the possible interference between the velocity of a coherent seismic event with some other RMS velocity. In the situation where a single seismic event exists in the time gate, this yields a very low coherence estimate except at RMS velocities that properly correct the seismic event. When the RMS velocities are displayed on the V-Study output, the RMS velocity of the seismic event is very clearly resolved. The maximum coherence withinthe time gate is a subsidiary display at the side of the main presentation, with a deflection of one inch corresponding to the maximum possible coherence. For the main display, the relative amplitude between the time gates is preserved. However, a single scaling factor is applied in order to yield an overall amplitude that is appropriate for visual presentation.

5. Normal Moveout Correction:

The program corrects for normal moveout using a velocity function in the form:

$$V = Vo + Ktv$$

Where,

V = Average Velocity
Vo = Initial Velocity
K = Acceleration Constant
Tv = Two-way Travel Time

The normal moveout is removed from the data by using the

above velocity in the equation:

$$T = T_x - T_o$$

where T = Amount moveout removed

$$T_x^2 = \frac{X^2}{V^2} + T_o$$

X = Offset Distance

T_o = Two-way Vertical Travel Time

The velocities in this program are continuously interpolated in both time and space to avoid any transient in the velocity.

6. Common Depth Point Sum:

This program sums the common depth point traces of the gathered records and outputs 24 trace records.

7. Decon After Stack:

The time variant deconvolution filters were applied to the data after CDPSum. The length of the operator was dependent upon the water depth and generally computed as 1.5 times the two-way travel time through the water. The design gates for the filters in turn depend on the length of the operator. The operator or filter length should not be any greater than 10 to 15 percent of the design gate. If the filter length exceeds this figure by any considerable amount, it is felt there are not enough statistics to design a reliable filter.

8. Time Variant Filtering:

The data were filtered in a time variant method. In Area BR 29 the suite of filters consisted of a 15-46, 10-40, and a 10-30 CPS zero phase passband digital filters. Times and application of filters can be determined from plate 3. The remaining areas were processed with a 15-45, 10-40, and a 10-25 CPS filters. See plate 4 for times and applications.

9. Trace Amplitude Equalization:

Trace equalization was applied using generally three gates, and on some lines four gates were used. These gates were allowed to vary in length with each line to conform to the data.

SUMMARY AND RECOMMENDATIONS

A. Summary

The shooting in the Adriatic Sea prospect consisted of forty-eight (48) production lines which covered 1047.5 Kilometers of data shot both forty-eight (48) fold and twenty-four (24) fold coverage using a forty-eight (48) trace streamer. The group interval was 50 meters with a shot taken every 25 meters. The near group (48) had an offset of 585 feet. The energy source used was an array of air guns of various chamber sizes totalling 590 cubic inches. The various sizes being used so that the frequency spectra in the passband of interest was flat.

The data were processed 24 fold to a record length of 5.000 seconds. On data shot 48 fold a two on one vertical sum was used. A velocity analysis was obtained every five (5) Kilometers using one set of four common depth point gathers for each analysis. There were no major problems encountered in processing the data. The quality of data in area BR-29 was good with good penetration and a thick section. In areas BR-30 and BR-109 the quality of data was good with good penetration through a section that is thinning to the east to approximately 1.000 second. In areas DR-20, DR-22 and DR-23 the section becomes very thin to the south and data quality as a result is only fair.

B. Recommendations

It is believed that the 24 fold processing, with a 2 on 1 vertical sum on the 48 fold shooting, is adequate for this prospect. However, we believe you do not realize full advantage of the 48 trace streamer in these areas until the depth of section reaches approximately 2.500 to 3.000 seconds. Therefore, it might be more practical to use a 24 trace streamer in areas with sections shallower than this, operational conditions permitting. In the case of this particular survey the thinner section prevailed in all areas except BR-29.

Enhancement processes considered essential to make an effective

interpretation of this data would include:

Gain Normalization

Common Depth Point Gather

Velocity Analyses

Normal Moveout

Common Depth Point Sum

Time Variant Predictive Deconvolution

Time Variant Filtering

STATISTICS

Length of Data Recorded	5 seconds
Length of Data Processed	5 seconds
Sample Period	4 ms
Fold Coverage	
Shot	24 & 48
Processed	24
Shot Interval	82 feet (line S5, 164 feet)
Shotpoint Interval	328 feet
Survey Antenna to 1st Group	735 & 695 feet
Survey Antenna to Center of Gun Array	150 & 110 feet
Group Interval	164 feet
Number of Groups	48
Cubic Inches of Guns/	570 Cu. In./40 Cu. In.
and Individual Sizes in Array	20 Cu. In.
	10 Cu. In.
Depth of Guns	Approx. 40-45 feet
Number of Kilometers Shot	1,047.5
Shotpoints Per Mile	16.1
Date of Survey	Aug. 1, 1971 to Sept. 12, 1971
Specifications of M/V	Atlantic Seal
Length	165 feet
Beam	38 feet
Tonnage	197
Quarters	26 Berths

Equipment

- Radio
- Radar
- Fathometers (Simrad and Ratheon)
- Gyrocompass
- Sperry Auto Pilot
- Two 60 Kw 3 phase 60 cycle Generators
- Twin Screw Propulsion by Two 1550 H.P., D-398A Caterpillar Engines

Recording Instruments

- T.1. 11,000 amplifiers
- DFS III
- Geospace single trace plotter

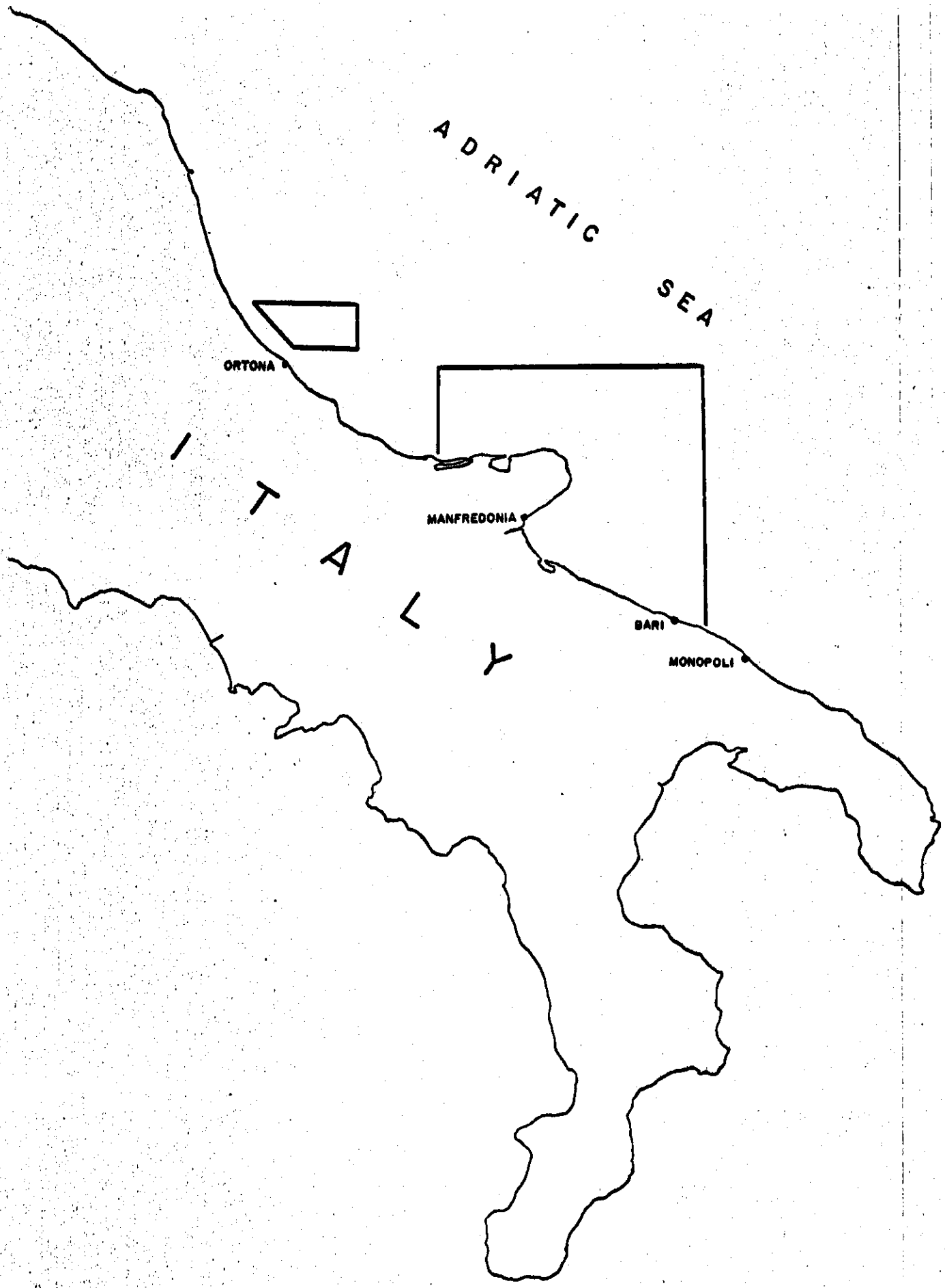
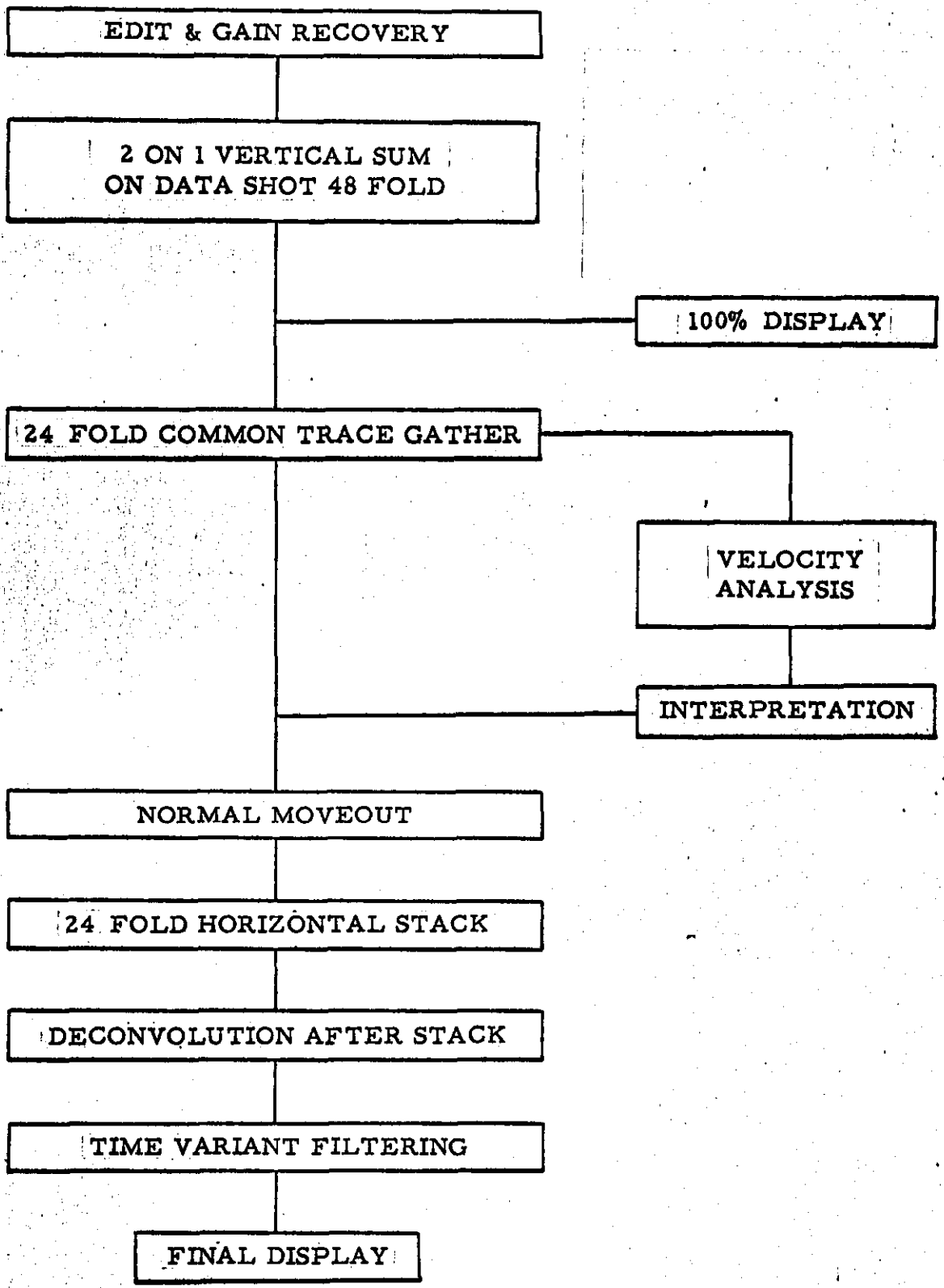
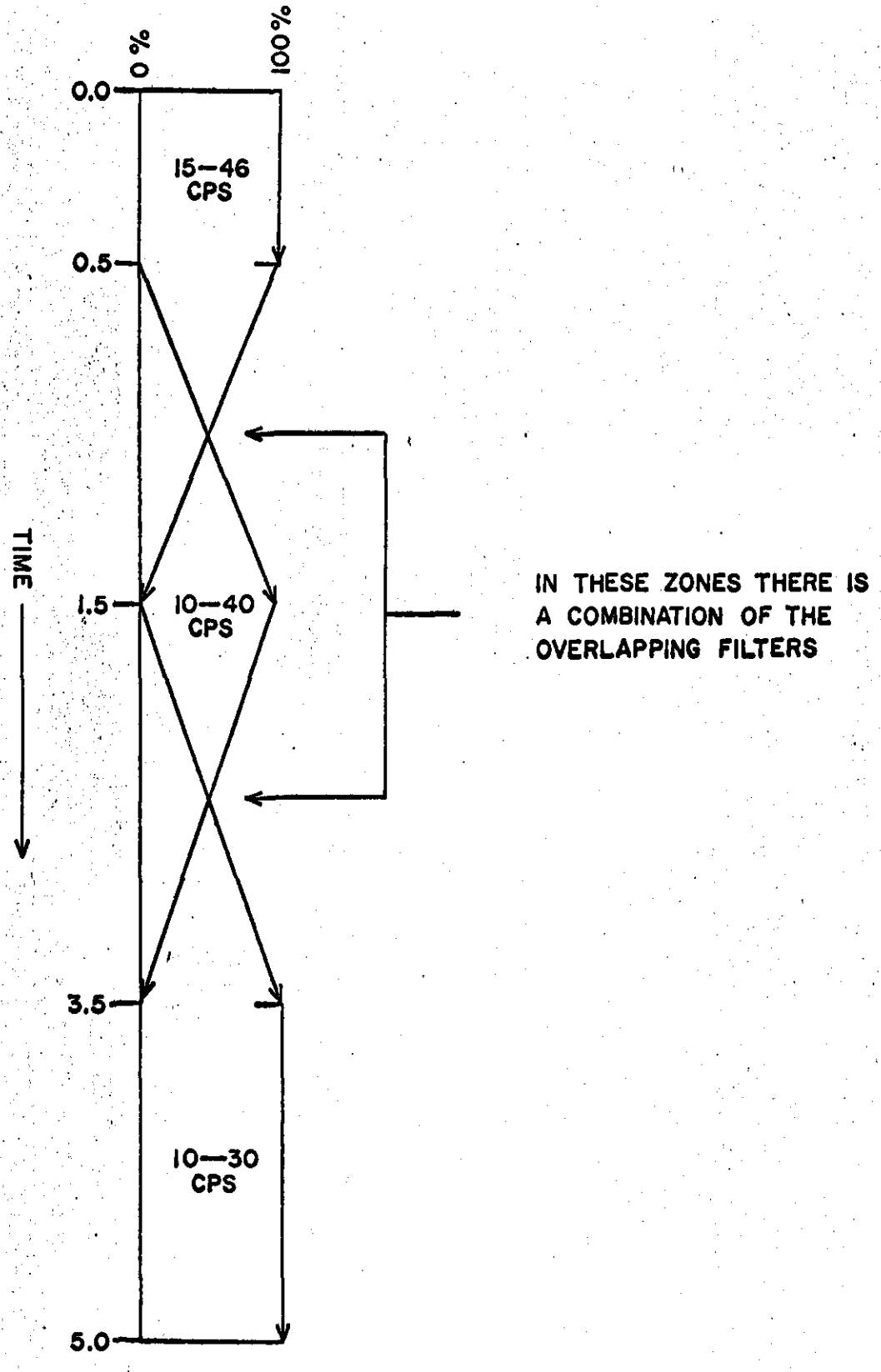


PLATE I a & b



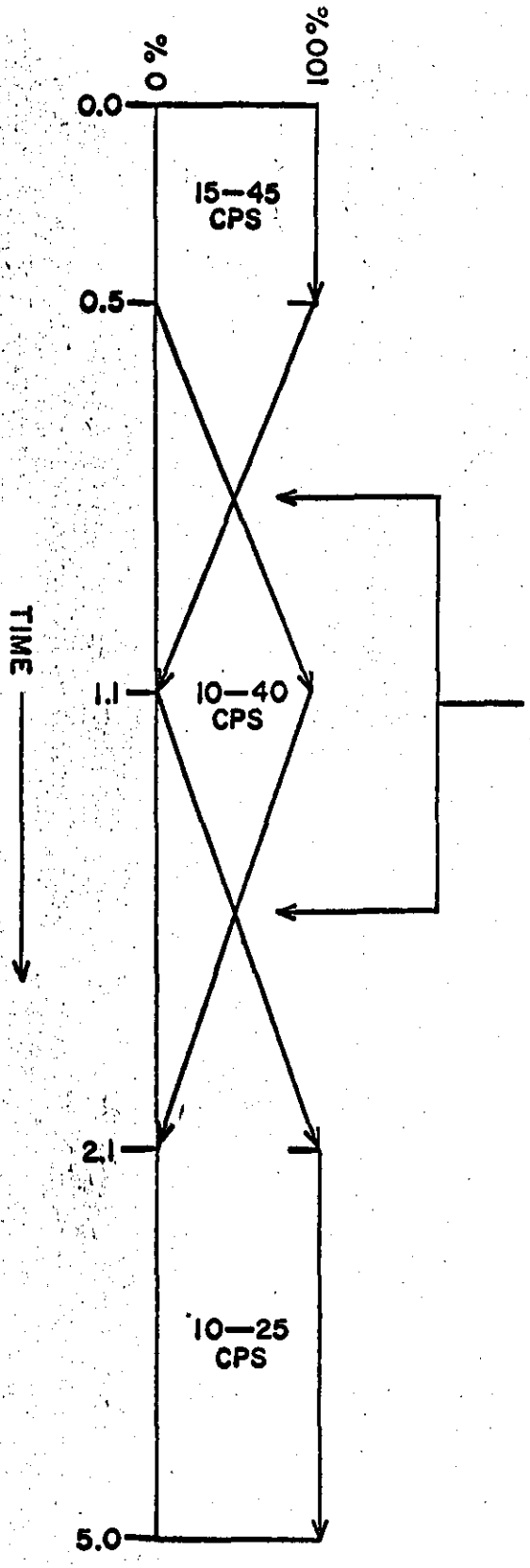
PROCESSING SEQUENCE
FOR
24 FOLD DATA

PLATE 2



APPLICATION OF DIGITAL FILTERS
SHOWING TAPER ON AND OFF

PLATE 3 a



IN THESE ZONES THERE IS A COMBINATION OF THE OVERLAPPING FILTERS

APPLICATION OF DIGITAL FILTERS
SHOWING TAPER ON AND OFF

PLATE 4a

APPENDIX B

OPERATIONS REPORT

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Respectfully submitted:

DIGICON INC.

D. L. Ford, Party Chief

Louis Hooper, Supervisor

INTRODUCTION

A marine seismic survey was conducted in the Adriatic Sea by Digicon Inc. for Mineraria Texas Italiana. The area surveyed is shown on the location map (Plate 1) in this report.

The R/V Atlantic Seal was utilized in conducting the one boat operation of shooting and recording. Air guns were used as the energy source. Necessary permits were obtained from the Government of Italy by Mineraria Texas Italiana. Production shooting was commenced on 1 August 1971 and was completed on 1 September 1971. A total of approximately 1047.5 Kilometers was recorded during the survey. Digicon's field office was located in Pescara and Bari, Italy.

PRODUCTION SHOOTING

A. Vessel

R/V Atlantic Seal

Length 165 feet

Beam 38 feet

Quarters 26 berths

Equipped as follows:

Twin screw - powered by two D398 Caterpillar engines

Two 100 KW generators

Radar - one Decca type 434M and one Decca type 202

Fathometer - Simrad (600 fathoms)

- Raytheon DE - 721-A (280 fathoms)

Sperry Gyro Compass

Radio Direction Equipment - ADF Bendix

Radio Marine Telephone - Apelco AE-176M

Sperry Auto-pilot

Loran "A" Dx Navigator

B. Key Personnel

Supervisor	Neal Wylie
Party Manager	J. M. Markham
Observer	W. J. Hays
Junior Observer	Gerald Austin
Compressor Operator	Gordon Searcy
Loran "C" Operator	Jack Black
Administrator	D. V. Player

C. Energy Source

An array of Par 600B airguns was used for the energy source (Plate II). The effective sizes of the airguns ranged from 10 cu. in. to 80 cu. in. for a total of 570 cu. in. The guns were equipped with S.V. 1200 A solenoids and fired simultaneously by a Digicon blaster which was activated by the recording instrument clocks. A Gardner-Denver compressor unit consisting of (ZEG-stage and LAOQ-stage) powered by an 8V71 and a 4031C Detroit diesel engine was used to maintain a minimum pressure of 1800 psi to the air guns.

D. INSTRUMENTATION AND RECORDING PARAMETERS

1. Streamer

The cable used for this survey was designed and manufactured by Digicon Inc. Each section of the cable is 50 meters in length and contains 20 dual crystal element hydrophones equally spaced. The cable is 2.5 inches in diameter, it is oil-filled and is equipped with quick coupling connectors. The total length of the active streamer was 2400 meters for 48 trace recording and 1200 meters for 24 trace recording (for cable details see Plates III, IV, and V.) The streamer depth was controlled by ballasting and "condep" birds.

For constant monitoring of the cable depth, eight Spartan depth transducers were installed at regular intervals in the cable and connected to direct read-out meters in the instrument room. These transducers are factory-calibrated and require only zero adjustment at water level at the time of installation in the cable: their accuracy is $\pm$ 2 feet at 100 feet.

2. Recording Instruments

Recording was with TI's DFS III 48 channels of binary gain amplifiers.

Dual nine-track $\frac{1}{2}$ inch tape transports were used.

Data were recorded in nine-track SEGA format.

An SDW 200 electrostatic camera was used to make read after write monitor records.

A Geospace single trace plotter was used for a continuous monitor of each pop and a single trace section.

3. Recording Parameters

a.	Length of data	5.0 seconds
b.	Sample rate	4 Ms.
c.	Recording filter	8 Hz - 62 Hz
d.	Cable length	2400 meters and 1200 meters
e.	Group interval	50 meters
f.	Shot interval	50 meters

E. NAVIGATION

Digicon's surveying system uses the Austron Model 5000 Loran-C Navigation System in the Rho-Rho mode and Hyperbolic mode for horizontal control in the surveyed area. Shotpoint locations were pre-plotted by Digicon's navigation personnel in Houston. After recording was accomplished, the navigation data were shipped back to Houston where a base map was made; drawn to a scale of 1 : 100,000. The first, last and every 5th occupied shotpoints were plotted on the base maps.

Loran-C is a relatively new addition to the Loran family. The master station (located in southern Italy near the town of Catanzaro) transmits pulses at a specified pulse repetition rate which is common to all stations in its net. Since all Loran-C stations transmit on a frequency of 100 KHz, the nets are identified by their respective pulse repetition rates. The repetition rate, as well as the station frequency and pulse modulation, is controlled by a very stable cesium frequency standard. These signals are received at both slave stations (SL4-Z located on the east coast of Spain and SL4-Y located on the coast of the Sea of Marmara east of Istanbul) in addition to the mobile receiver on board the R/V Atlantic Seal.

At the slave stations, the received master station pulses are used to synchronize other independently generated pulses transmitted by the slave station. Each slave station is also controlled by a Cesium frequency standard.

The signal processing at the slave station is such as to give the effect that the master station pulses are received and retransmitted by the slave stations. There is a constant timing delay built into each slave station, so that a pulse from the master station is received by the mobile station before the corresponding pulse from any slave station is received.

The system operates in the Rho-Rho (range-range) mode (or when needed in the Hyperbolic mode); the mobile station's receiver is designed to include a very stable atomic frequency standard. This atomic standard acts as a clock which is then synchronized to the

Cesium standard controlling the Loran-C net, so that at the instant the master station transmits a pulse, the mobile atomic standard starts a time interval counter which is stopped when the master station pulse is received by the mobile station. The counter then reads the one-way transmission time from the master station to the mobile station which is readily converted to range. By utilizing a second counter, which is started by the atomic standard when the master station transmits a pulse, but is stopped when the corresponding pulse from a slave station is received, the direct range to that slave station can be determined by subtracting the baseline delay (from the master to the slave station) and the coding delay in the slave station from the slave counter reading. The position of the mobile station is determined by the intersection of the two range circles from the respective stations.

DISCUSSION

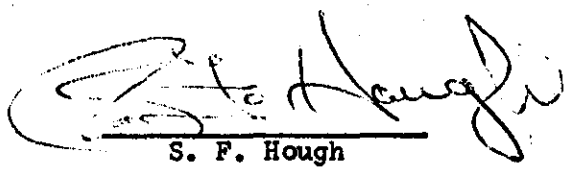
During the survey, Digicon maintained a field office in Pescara and Bari, Italy. The office was staffed by the Supervisor of Operations and the Administrator.

The field tapes containing the recorded data were shipped via air freight to Digicon's computing center in Houston, Texas for processing.

The field data were considered to be very good to fair and the results of the survey are considered satisfactory.

Respectfully submitted,

DIGICON INC.



S. F. Hough
Technical Supervisor

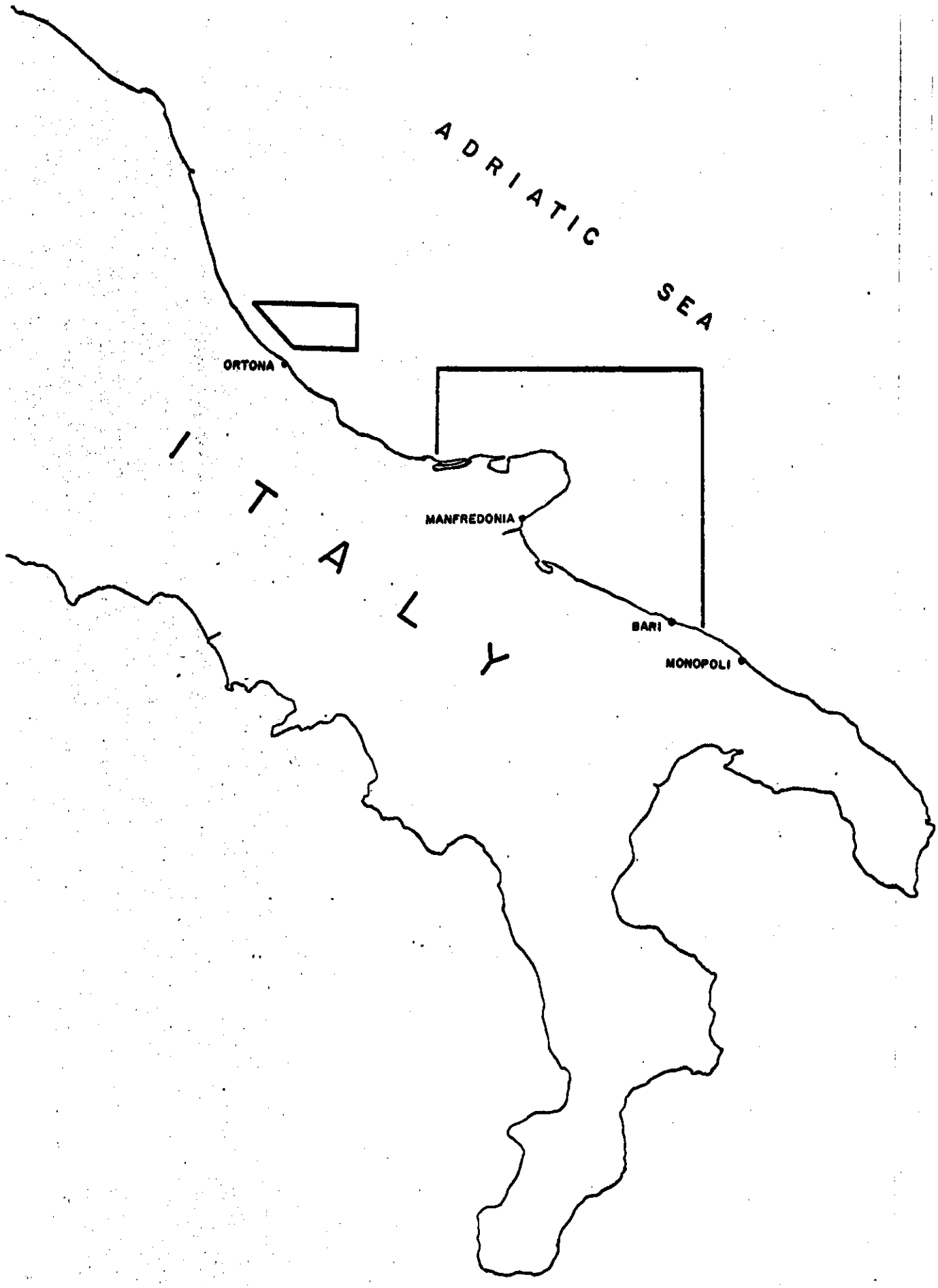
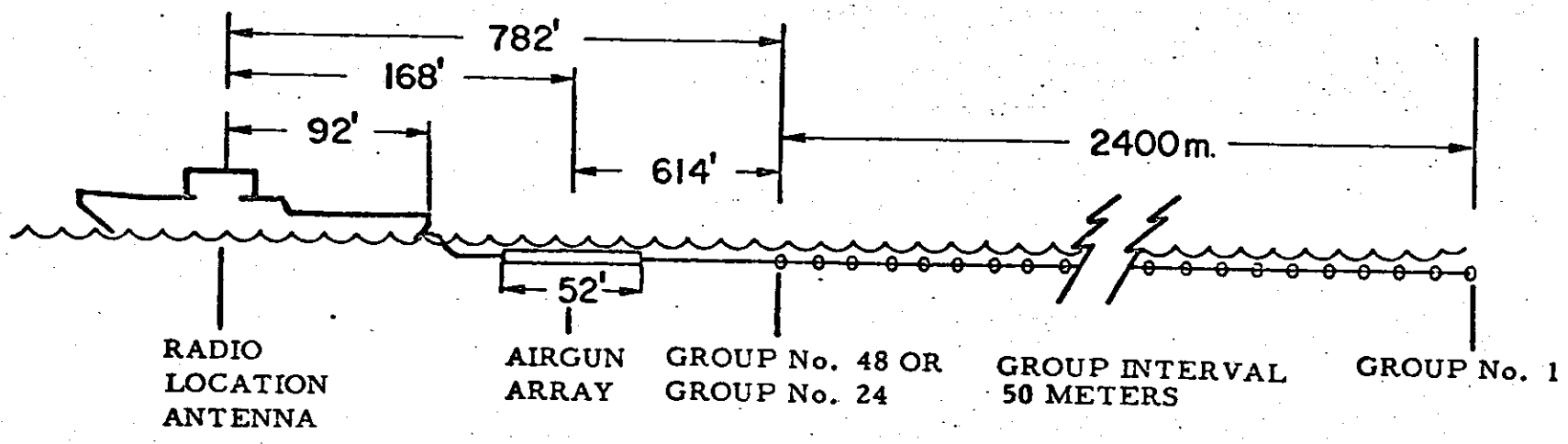
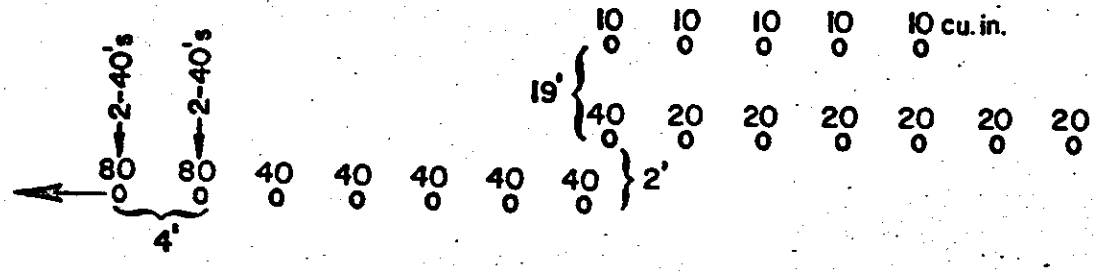


PLATE I a & b



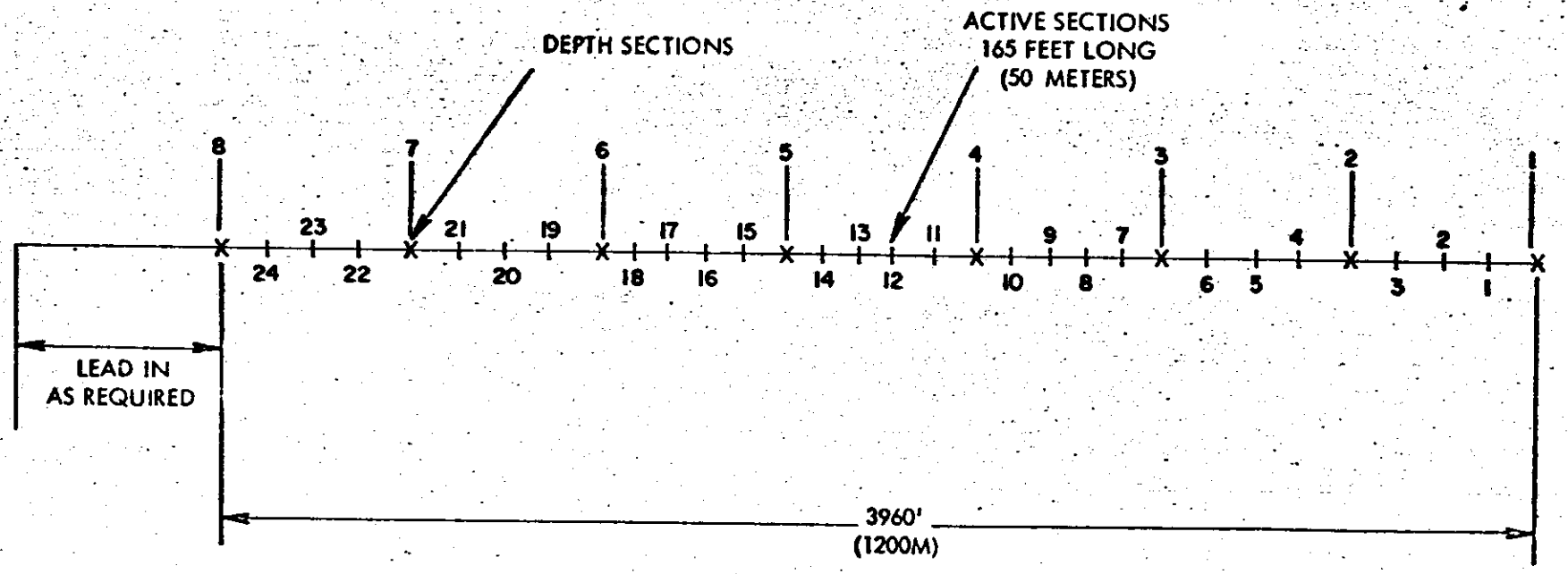
AIRGUN ARRAY SKETCH



TOTAL 570 cu. in.

digicon inc.

Plate 2b


DEPTH SECTIONS
ACTIVE SECTIONS
165 FEET LONG
(50 METERS)
8 7 6 5 4 3 2 1
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
LEAD IN
AS REQUIRED
3960'
(1200M)

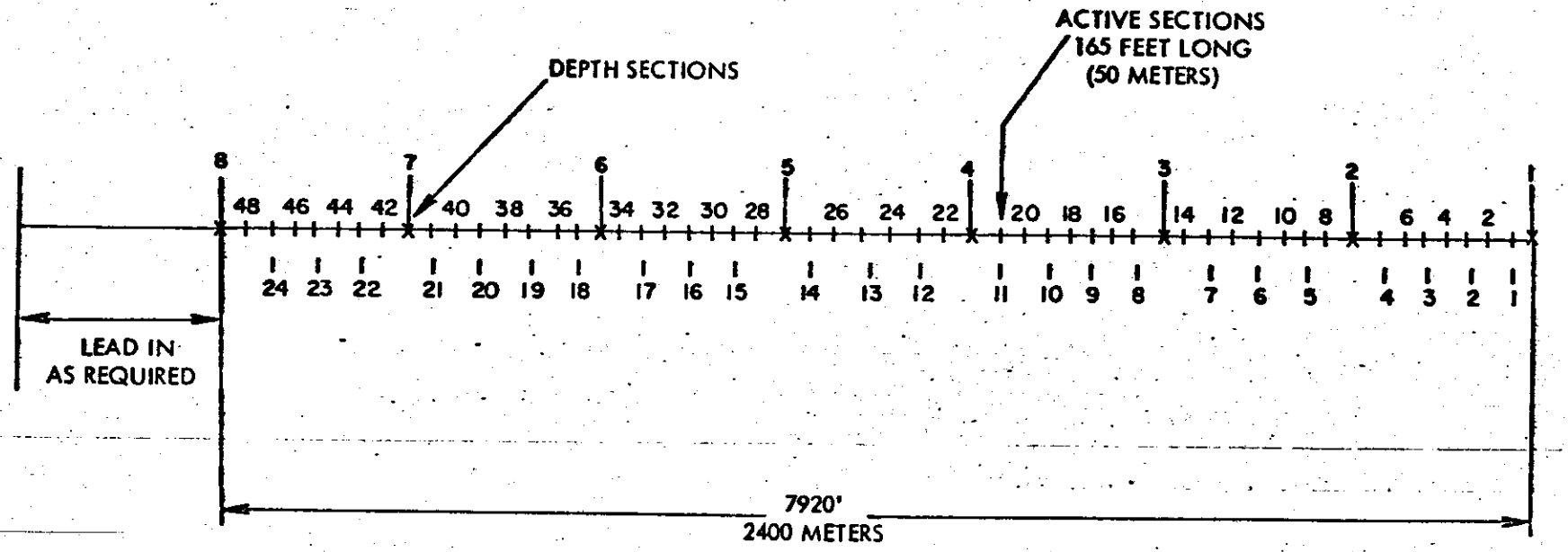

DEPTH SECTIONS
ACTIVE SECTIONS
165 FEET LONG
(50 METERS)
8 7 6 5 4 3 2
48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
LEAD IN
AS REQUIRED
7920'
2400 METERS

Plate 3b

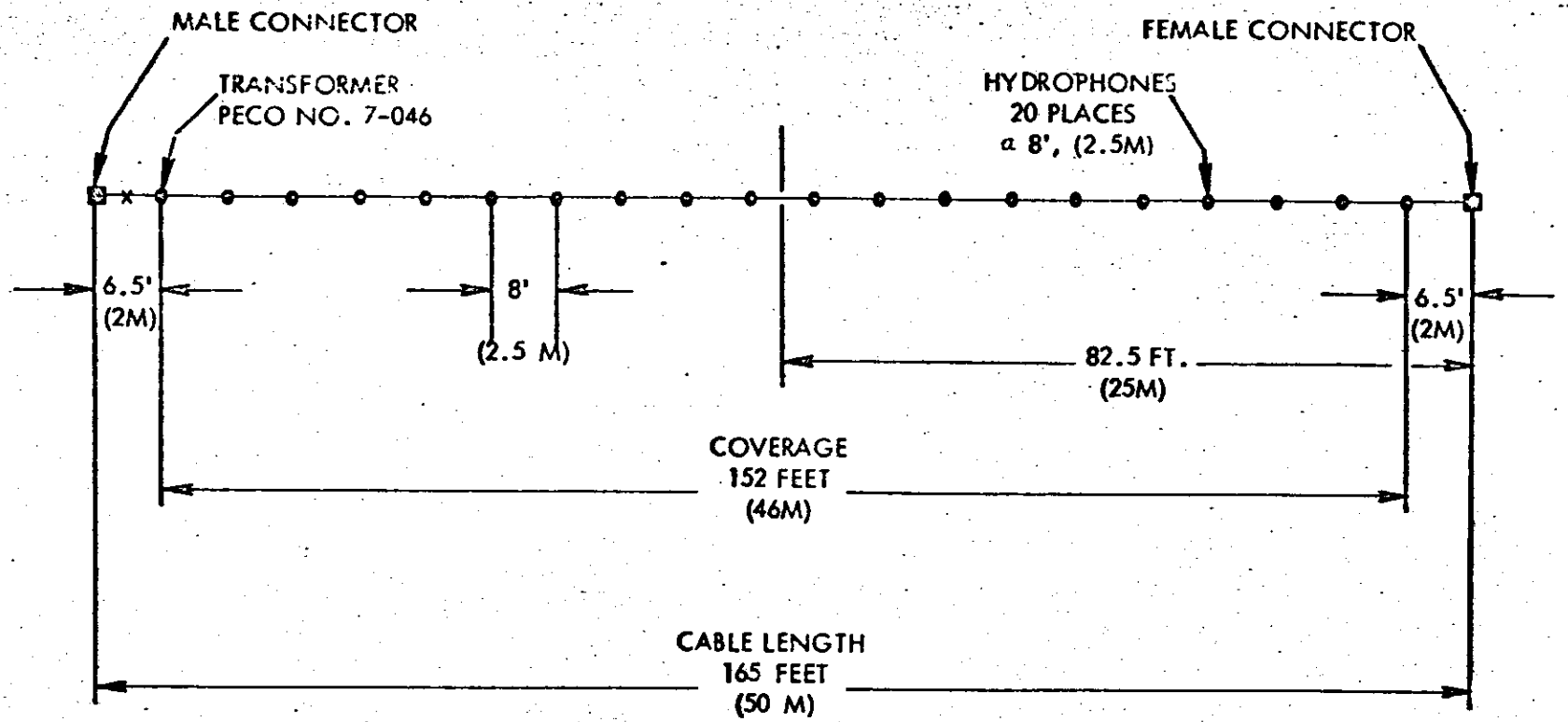

MALE CONNECTOR
TRANSFORMER
PECO NO. 7-046
HYDROPHONES
20 PLACES
@ 8', (2.5M)
FEMALE CONNECTOR
6.5'
(2M)
8'
(2.5 M)
82.5 FT.
(25M)
6.5'
(2M)
COVERAGE
152 FEET
(46M)
CABLE LENGTH
165 FEET
(50 M)

Plate 4b

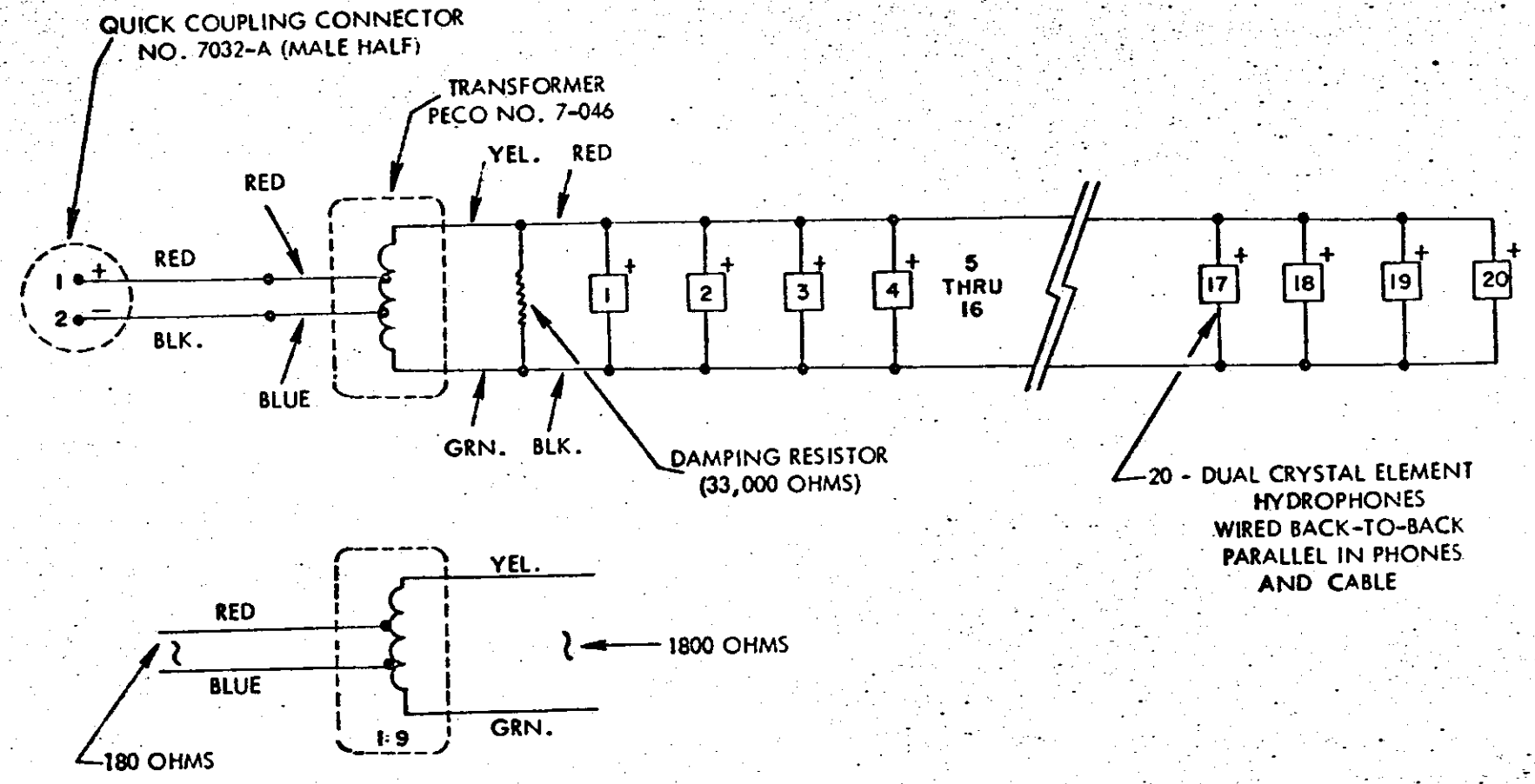
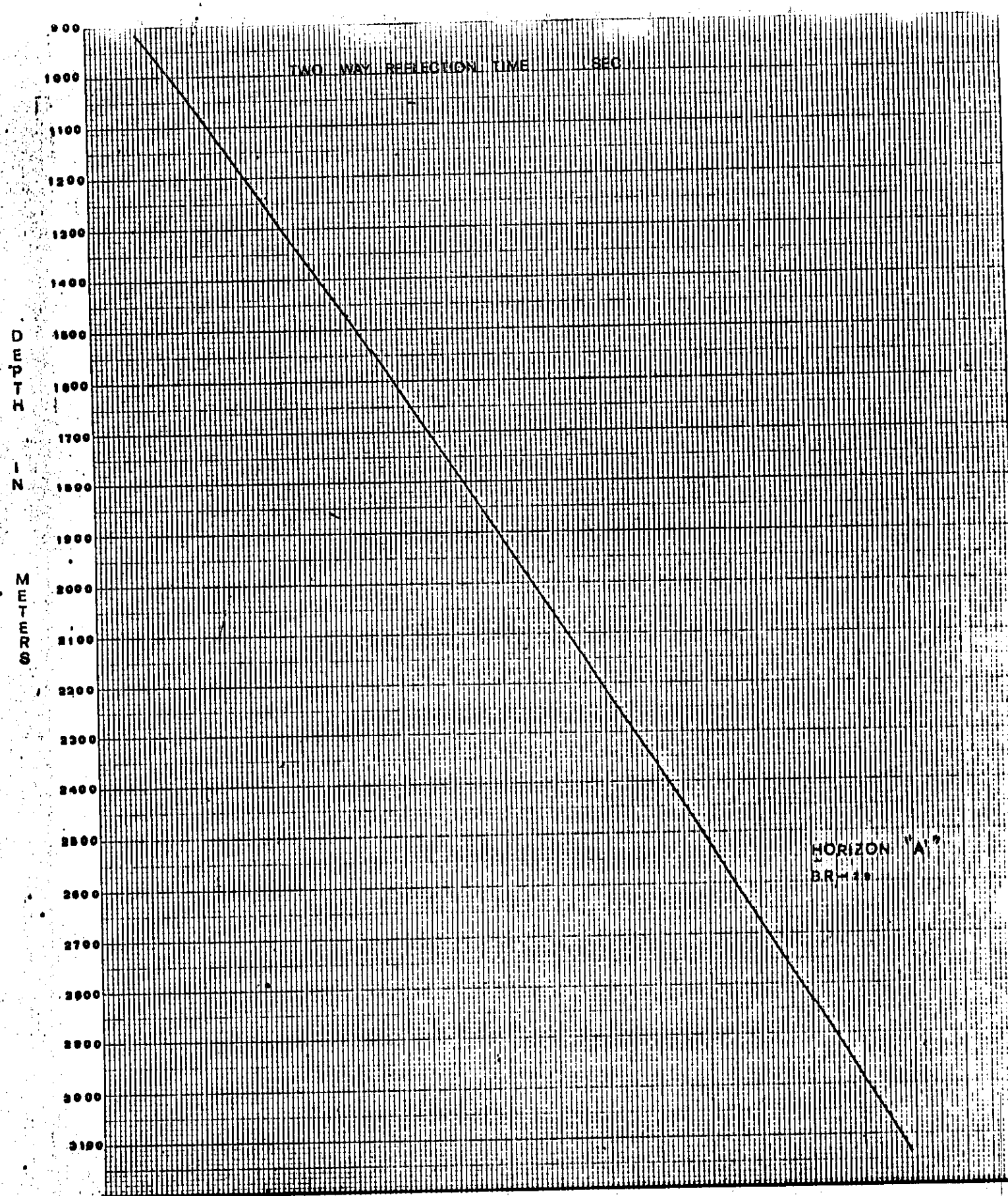

QUICK COUPLING CONNECTOR
NO. 7032-A (MALE HALF)
TRANSFORMER
PECO NO. 7-046
YEL.
RED
RED
RED
1 +
2 —
BLK.
BLUE
GRN.
BLK.
1
2
3
4
5
THRU
16
17
18
19
20
DAMPING RESISTOR
(33,000 OHMS)
20 - DUAL CRYSTAL ELEMENT
HYDROPHONES
WIRED BACK-TO-BACK
PARALLEL IN PHONES
AND CABLE
YEL.
RED
BLUE
GRN.
1800 OHMS
1:9
180 OHMS

Plate 5b



Time Vs Depth Chart

Plate 4