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GIPPSLAND BASIN

AUSTRALIA

VIC P/12, T 13/P

REPORT ON THE MAGNETIC AND
SEISMIC MODELING OF INTRA-LATROBE FEATURES

March 20, 1984

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INTRODUCTION

The objectives of the combined seismic and magnetic modeling were to determine if the various small anomalies seen during the structural interpretation were of volcanic or clastic origin and to determine the fluid content of those anomalies (Figures 1 and 2).

The magnetic data acquired during the 1983 acquisition program were processed and presented by ECL in Perth, West Australia. The processed magnetic data were then modeled by AeroService in Denver, Colorado. The AeroService report covering the procedures and results of the magnetic study accompanies this report.

The seismic data were modeled over one of the defined anomalies using two distinct modeling programs, each with particular strengths and limitations. In both programs, data for the physical properties of the modeled section were derived from log data from the Sailfish, Mullet and Pisces wells, while the structural configuration was defined from line GC80-11A. This line was used because it passed through the location of the Pisces well and allowed a check of the model response through a logged section.

RESULTS AND RECOMMENDATIONS

The results of the magnetic modeling study are given in the AeroService report. Briefly, the magnetic data indicates that two of the four anomalies covered by the limited magnetic grid do not appear to be highly magnetic. This would imply that these two anomalies are not of volcanic origin. Both ECL and AeroService

caution that these results are not definitive because the wide grid spacing and the poor quality of the magnetic data leave large misties in the processed data.

The seismic modeling study was based on the anomaly seen on line GC80-11A. This seismic line was modeled because it passed through the Pisces well location and one of the defined anomalies. The filter used in the modeling study was determined by comparing the model response to the data at the Pisces location, then using the best fitting wavelet in the model. Also, this anomaly was shown to be a non-volcanic feature by the magnetic data.

The results of the seismic modeling study were ambiguous in the definition of lithology. The vesicular nature of the basalts seen in the Sailfish well cause that volcanic section to have a low velocity and bulk density. The impedance contrast between clastics seen in the nearby wells and the volcanics would be very low. For this reason, the seismic models could not confirm or refute the results of the magnetic study.

The modeling study was able to provide information about the fluid content of the modeled reservoir section. The modeling of the anomaly on line GC80-11A as a sand buildup with either water or gas in the sands showed that a gas sand would give a strong amplitude anomaly. Because there is no amplitude increase over the top of the anomaly, it is unlikely that the anomaly is a sand buildup filled with gas. The velocity and density contrasts between water filled sands and oil filled sands are so low that the different responses of a seismic wavelet would be impossible to see in the data.

The combined magnetic and seismic modeling study has shown, within the limits of the data, that at least two of the anomalies studied are not volcanic in origin, and that they are not gas bearing. These studies were not able to determine if the modeled reservoir was oil or water bearing. If the structural mapping and reservoir parameters show these small anomalies to be economically viable, a close grid of high resolution aeromagnetic data should be gathered over both the prospects and the Sailfish well prior to a drilling commitment. This additional data would allow comparison of the magnetic response over known intrusives in the Sailfish well to the response over the prospect.

METHODS

For a complete discussion of the magnetic data modeling, see the AeroServices report accompanying this report.

The seismic modeling project was undertaken in conjunction with the magnetic modeling study to determine if the seismic data could be used to define the lithology or fluid content of the small anomalies seen during the structural interpretation. Two distinct modeling programs were used, each with its own advantages. Both programs were used to model the seismic response of various lithologies, with structural information included to make the response accurate.

The first of the two programs used was the AIMS modeling program by GeoQuest. This program let the user see the effects of structural and point source interference on the seismic response of the anomaly. The drawback of this program was the limited

complexity of the model. The AIMS program uses layer models with discrete velocity/density pairs within each layer. This will not show the effect of short period interbed multiples nor the effect of thin beds within the modeled section.

A depth model for the AIMS program was derived by making a model in time from line GC80-11A and using interval velocities from the Mullet and Pisces wells for depth conversion. The velocity/density data for each model layer was derived from the Mullet, Pisces, Bluebone, and Sailfish wells. The layer model included faulting seen in the shallower section. The AIMS program took the user specified layer model and computed a two dimensional impedance contrast matrix, then propagated a wavelet through that matrix. A 12-55 Hz mixed phase wavelet was selected to most closely match the theoretical wavelet contained in the section used as the model base. The results of that program are shown as Figures 4-7. Those model sections show that structural or diffraction effects are not significant in the reflection from the Latrobe surface.

The Evergreen modeling program uses digitized sonic/density logs, but allows the user to stretch, compress, or delete log sections, insert sections from other well logs, or assign log values at any depth. A type log can be used and modified so that it has the tops and stratigraphy that the user wants to model at any point. This procedure can be used repeatedly to generate a series of impedance traces with a given structural configuration along a section. A wavelet can be convoluted with these traces and a synthetic seismic section produced that incorporates interbed multiples and interference effects from the beds. Various filters were tested at the Pisces location to determine which one gave the

best match to the seismic section. A 5/10 45/50 Hz bandpass filter gave the best response in the Oligocene to basement section and was used for the modeling.

The Evergreen program has the advantage of being able to model detailed stratigraphic sections; it also has the disadvantage of not considering any two dimensional effects or point defractors. This modeling technique will accurately show the effects of fluid content and stratigraphy, but only if the structural configuration is relatively simple. The results of this program are shown as Figures 8-10. The shale lump model used with AIMS was not included in the Evergreen models because logs with the appropriate section were not available.

These two programs were used in a complimentary fashion. The AIMS model was used to determine what effects structure had on the section. Once the AIMS models had shown negligible structure-induced seismic response, the Evergreen package was used to model the responses of the various lithologies.

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GEMINI TREND AND ANOMALOUS BUILDUPS

FIGURE 1
101008

0 5 10 km

5 cm

MORAY-1

200 METERS

GEMINI LEAD

PISCES-1

VIC P/12

MULLET-1

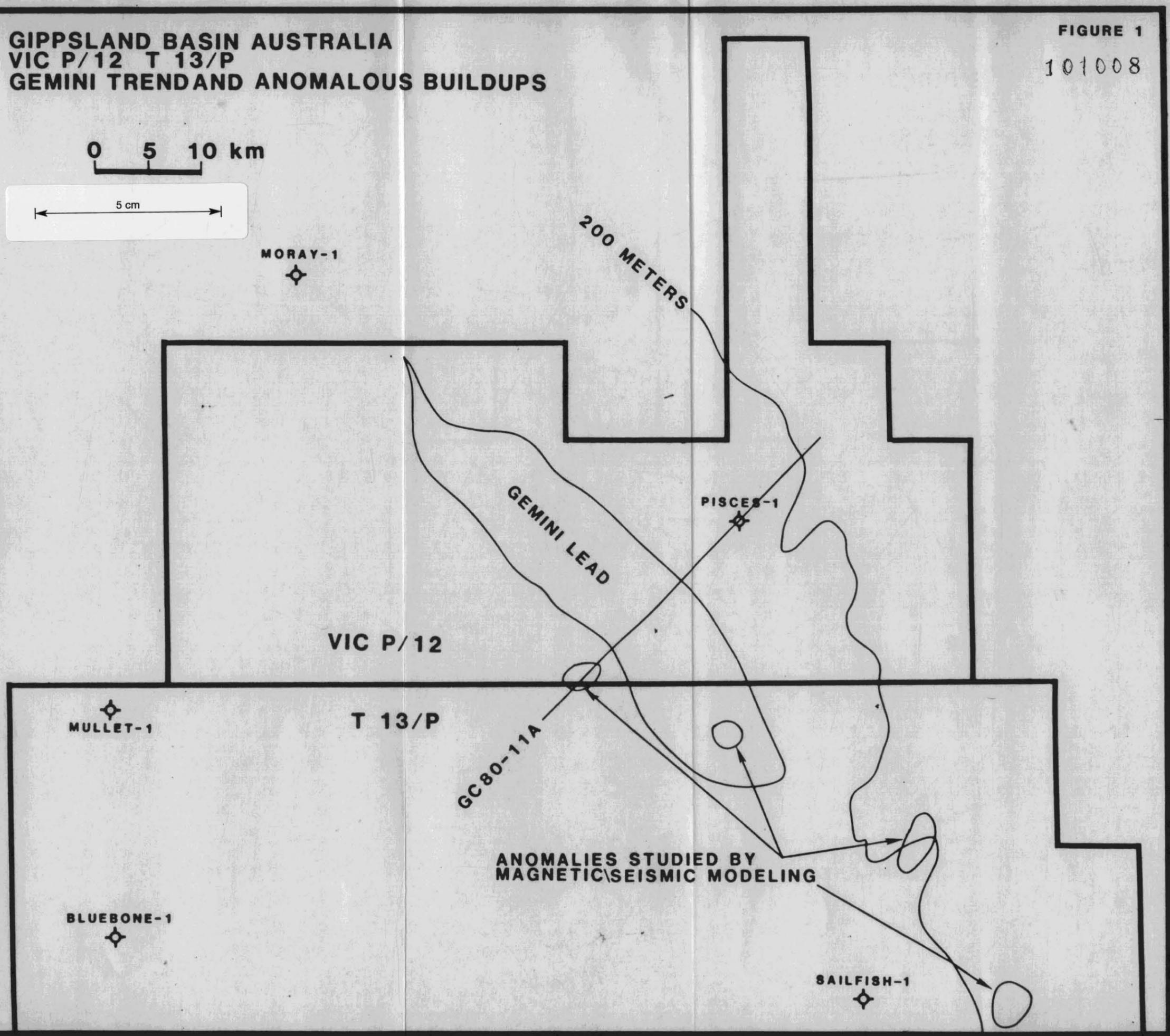
T 13/P

GC80-11A

ANOMALIES STUDIED BY
MAGNETIC/SEISMIC MODELING

BLUEBONE-1

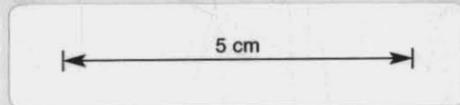
SAILFISH-1



LINE GC80-11A

FIGURE 2

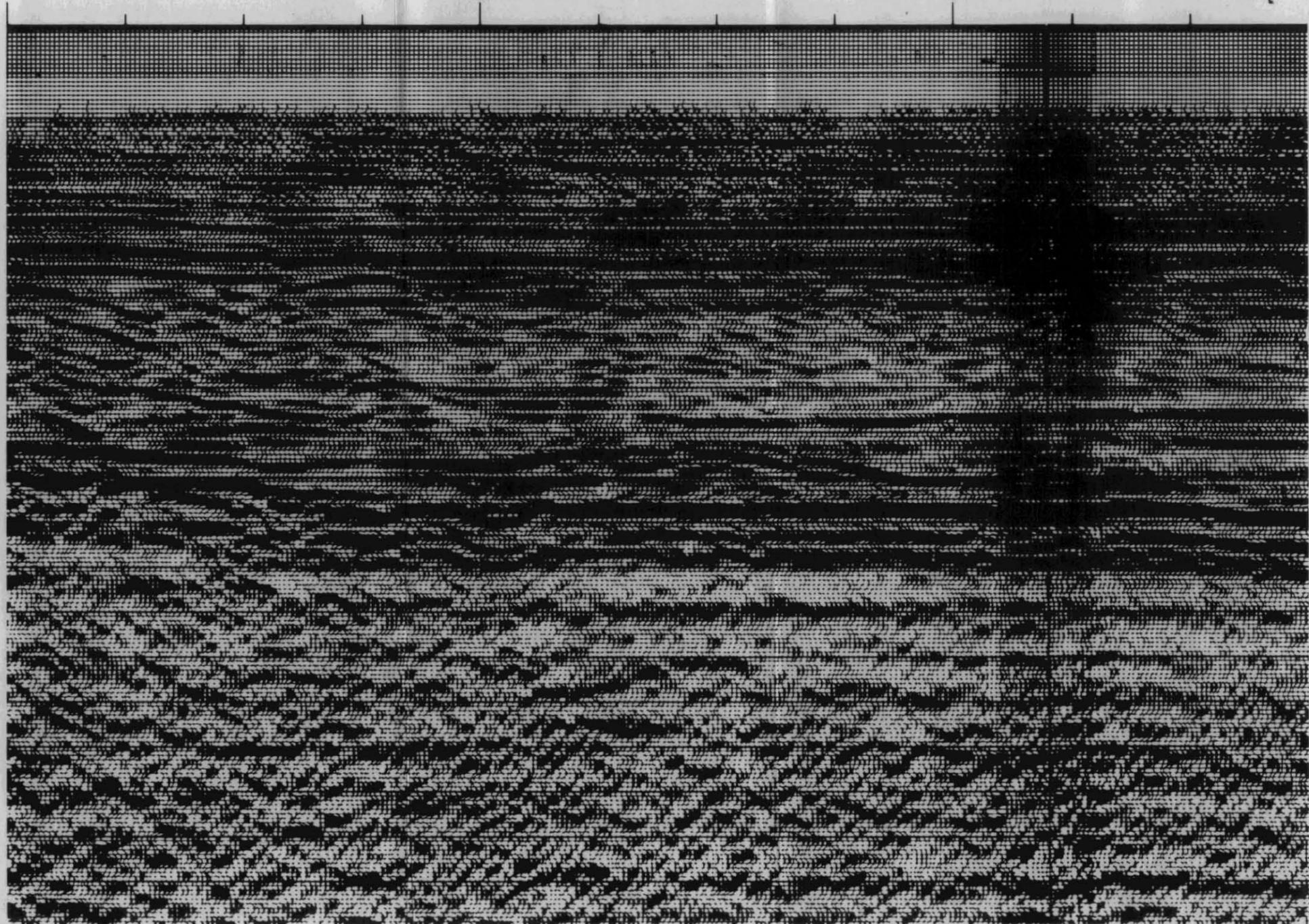
101009



MODELED ANOMALY

300
58M

400
60M



PISCES1 WAVELET COMPARISON
LINE GC80-11A

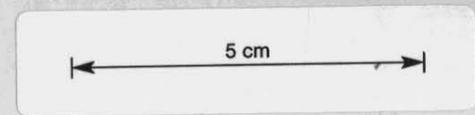
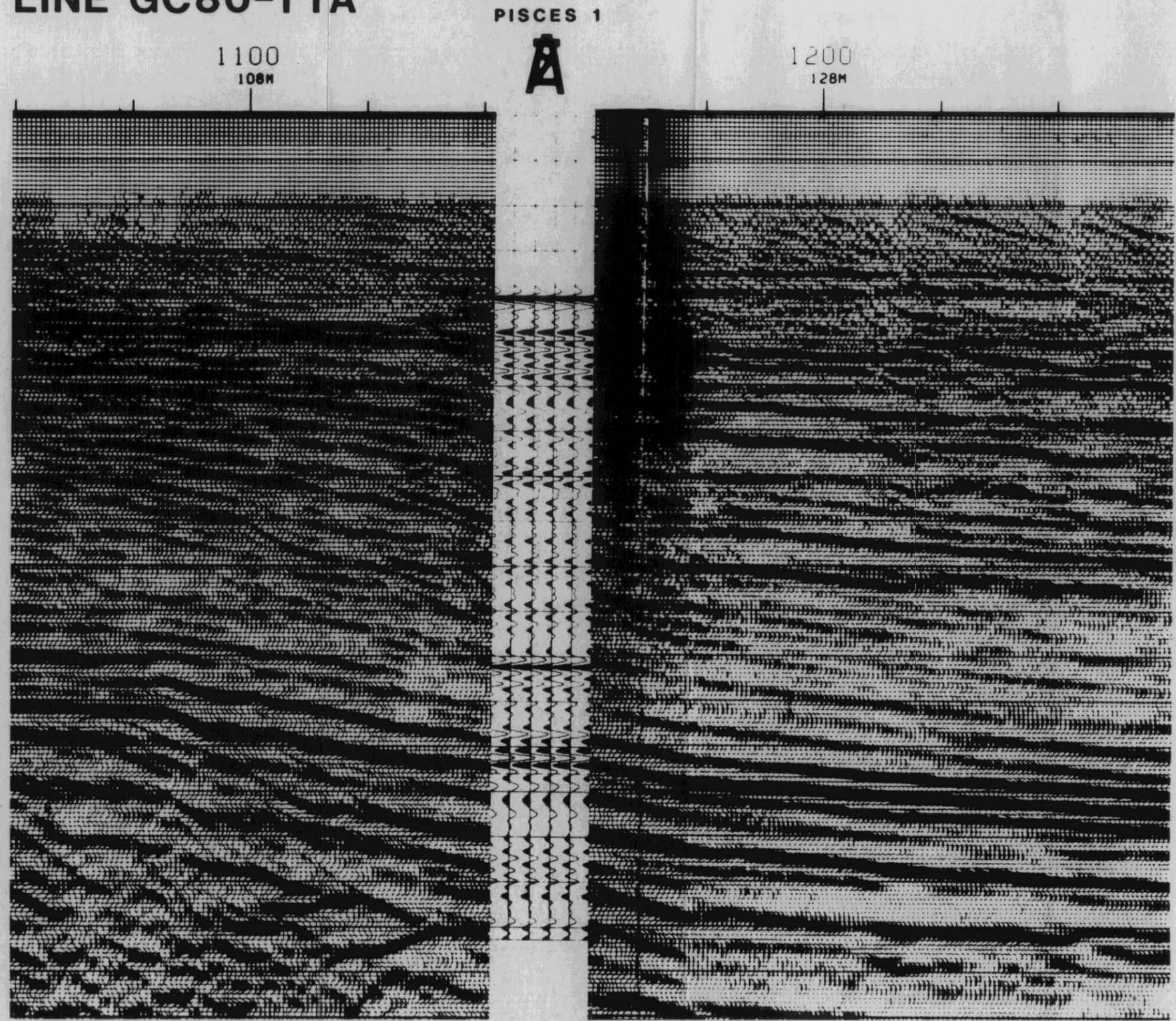


FIGURE 3
101010



5 cm

FIGURE 4
101011

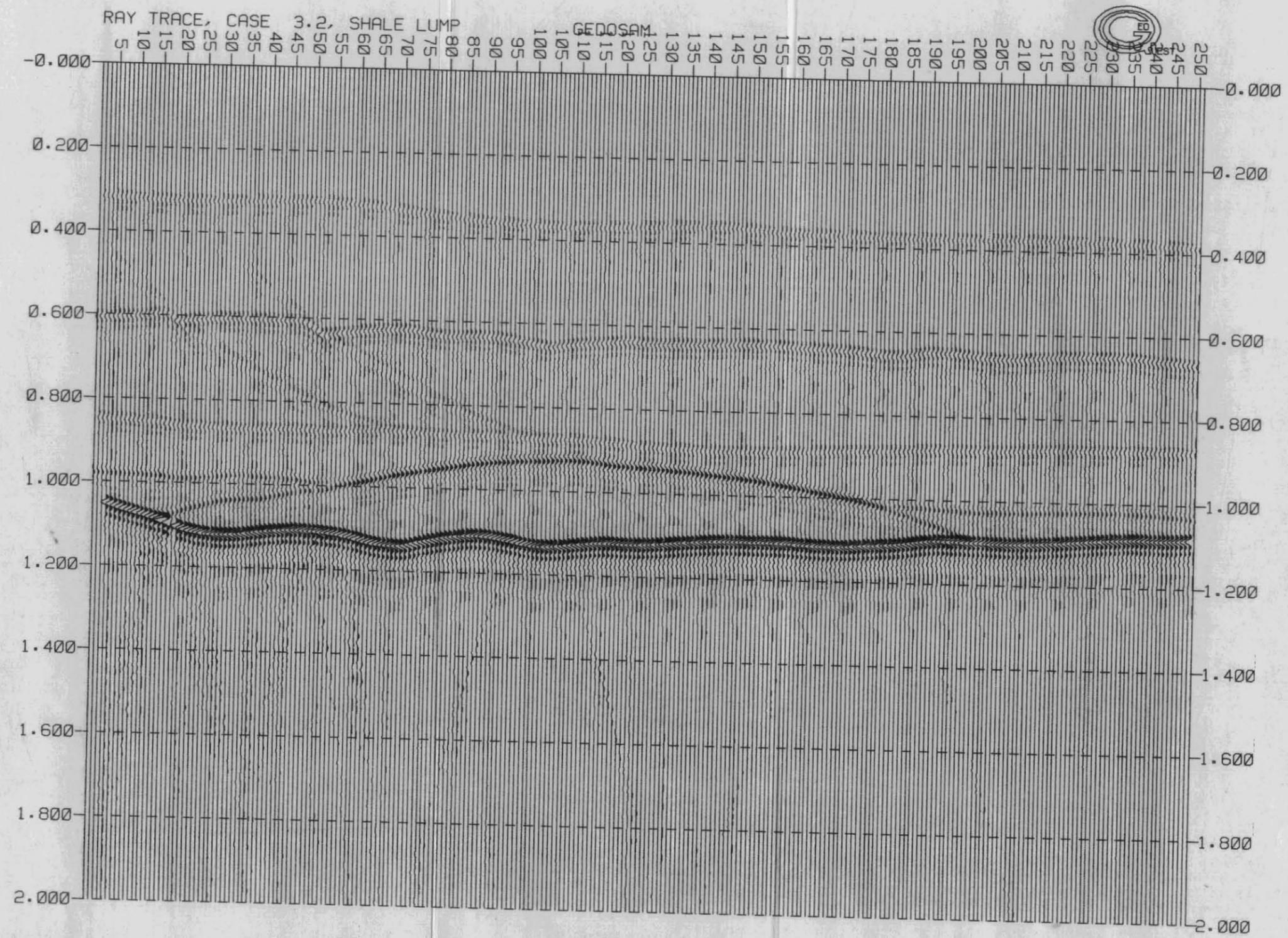
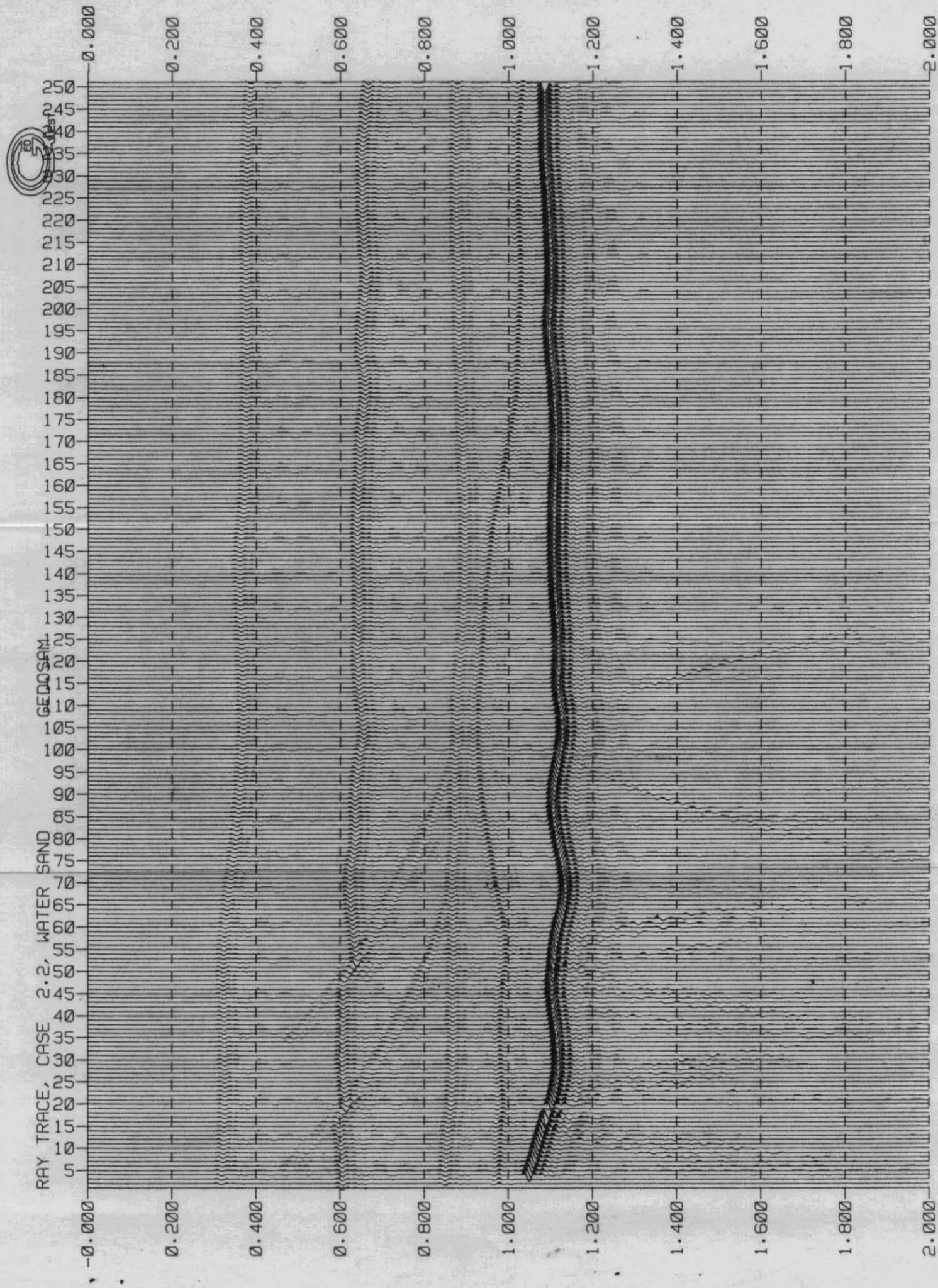


FIGURE 5

101012



RAY TRACE, CASE 2.2, WATER SAND

GEDOSAM

5 cm

5 cm

FIGURE 6
101013

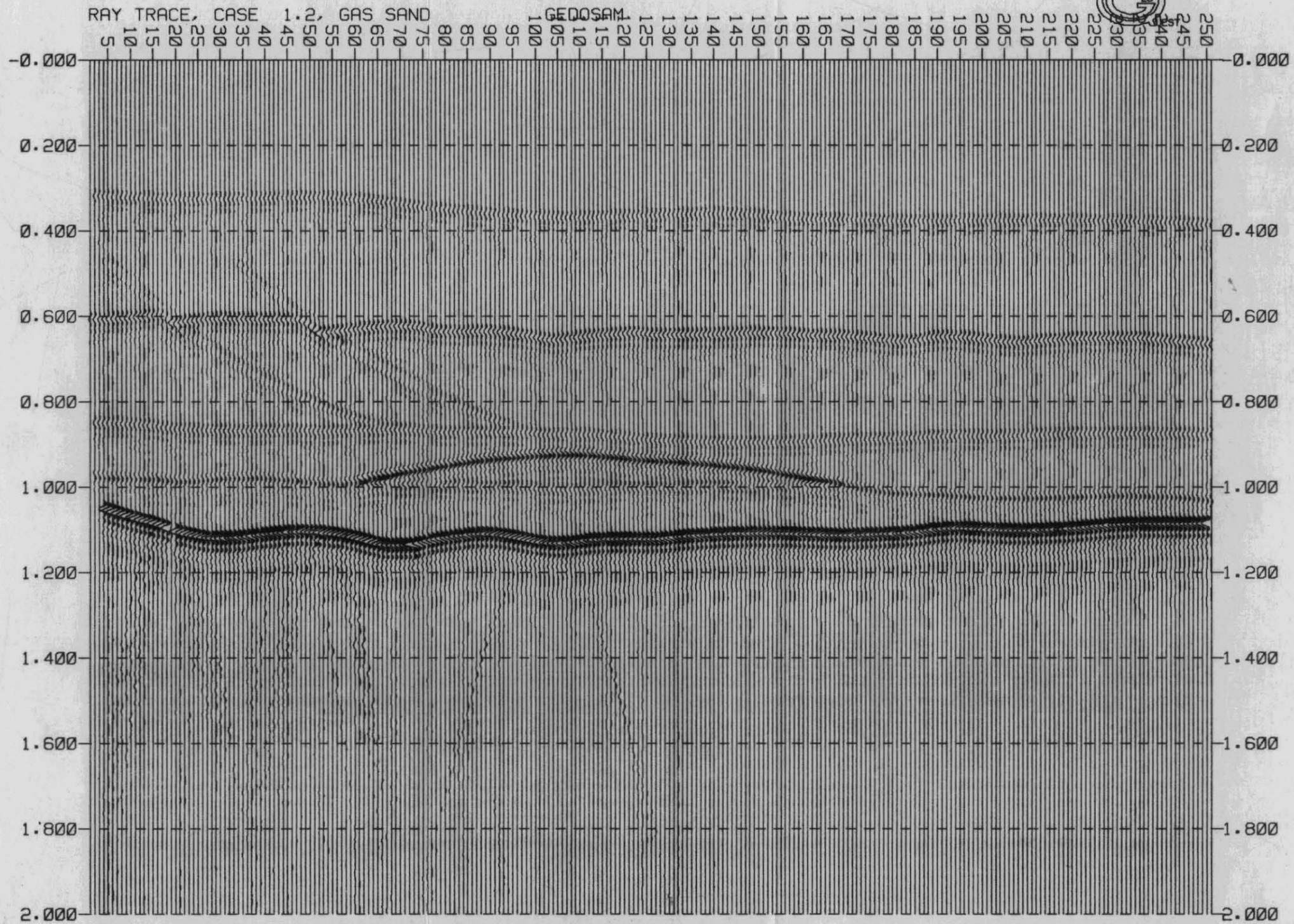


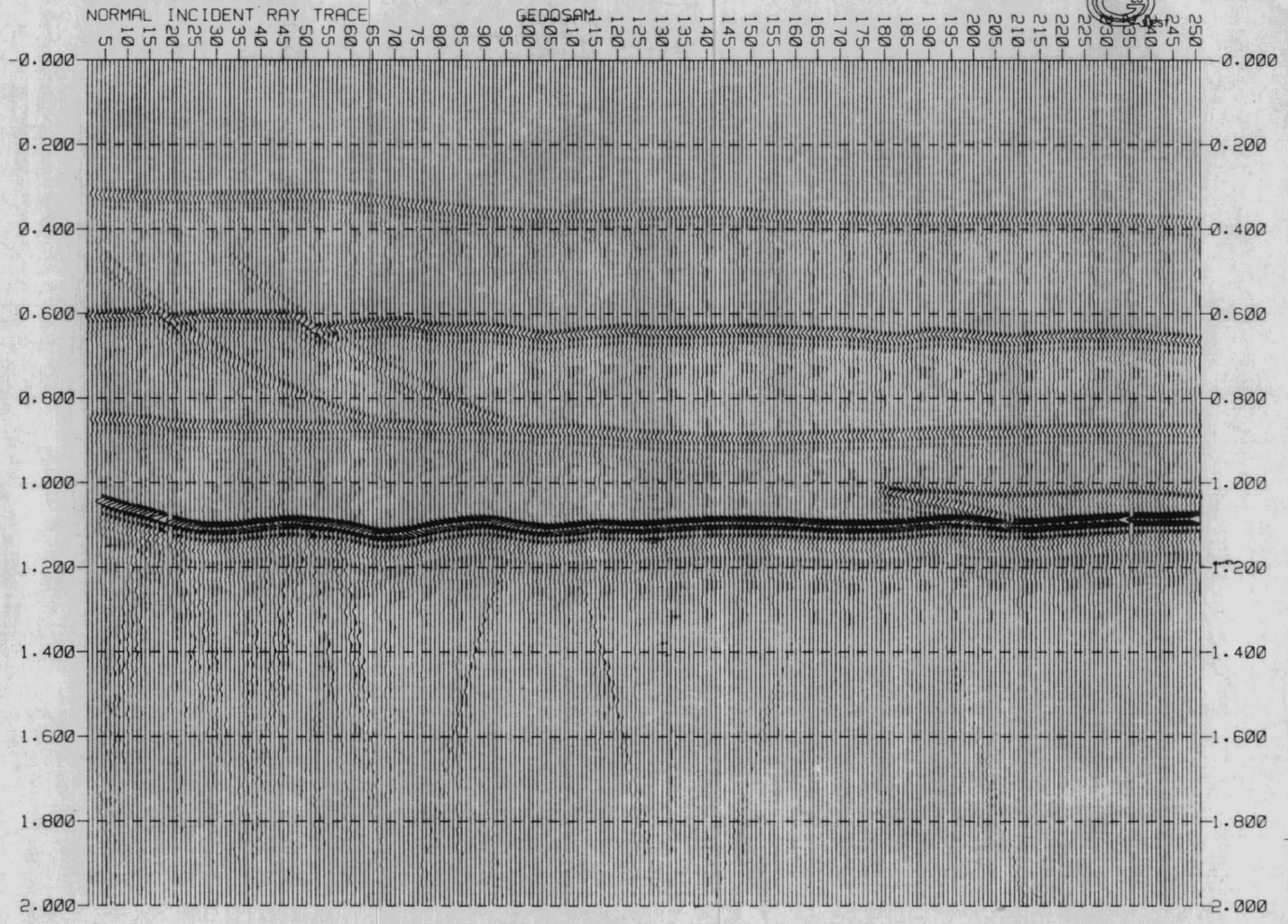
FIGURE 7
101014

5 cm

INTRUSIVE MODEL

NORMAL INCIDENT RAY TRACE

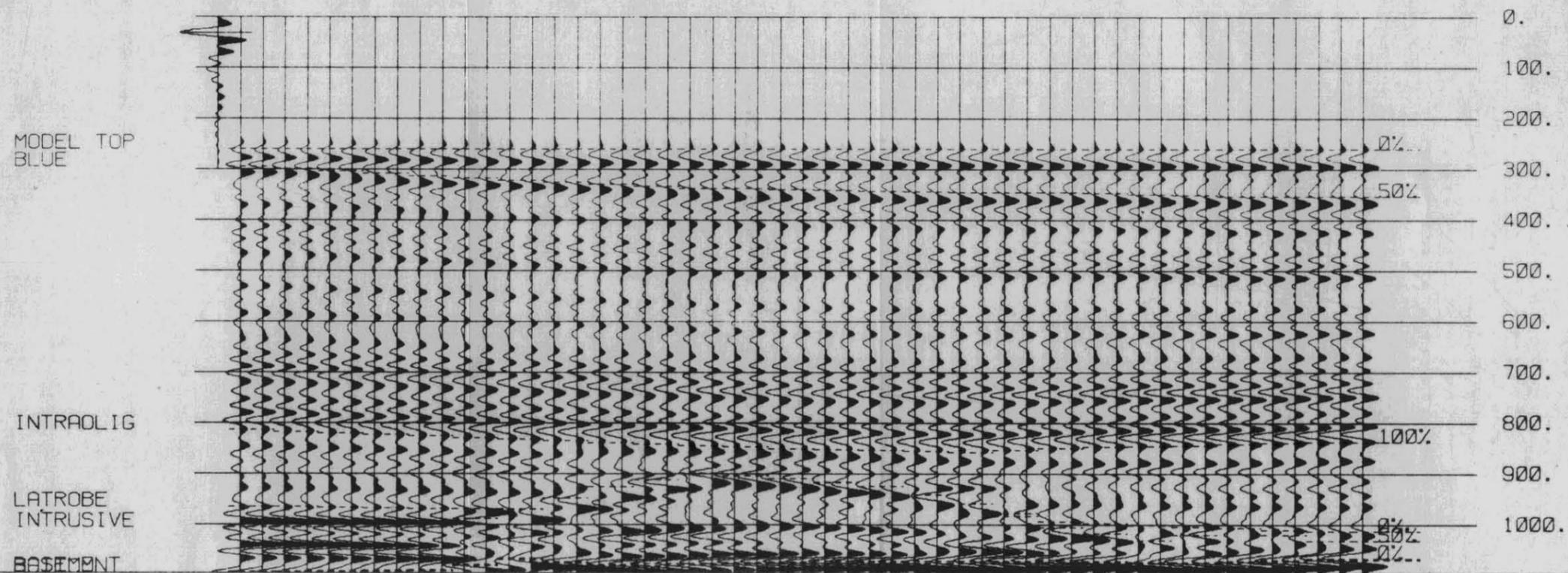
GEDOSAM



5 cm

AUSTRALIA GIPPSLAND BASIN INTRUSIVE MODEL

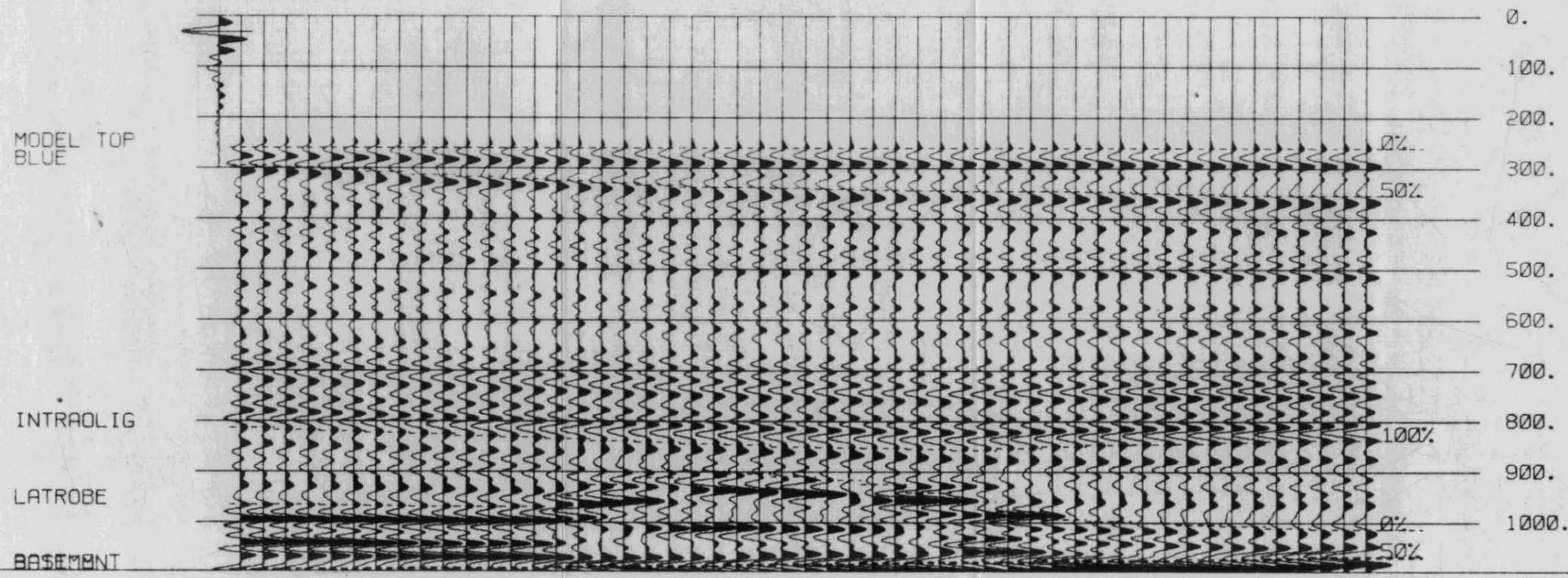
NORMAL POLARITY
5 10 45 50
WITH MULTIPLES
800 MS AGC



5 cm

AUSTRALIA GIPPSLAND BASIN SAND BUILDUP MODEL

NORMAL POLARITY
5 10 45 50
WITH MULTIPLES
800 MS AGC



101017

5 cm

AUSTRALIA GIPPSLAND BASIN GAS SAND MODEL

NORMAL POLARITY
5 10 45 50 BANDPASS
WITH MULTIPLES
800 MS AGC

MODEL TOP
BLUE

INTRAOOLIG

LATROBE

BASEMENT

