UR1980-45 1/7

1980/45. A seismic reflection traverse on the Seymour coalfield.

R.G. Richardson
D.E. Leaman

Abstract

A seismic reflection survey has shown coal seams at Seymour to be cut by a number of small faults with throws between one and two metres. Problems encountered when interpreting the time section suggest that traverses in similar areas should be recorded twice if both seam structure and stratigraphic correlation are required.

INTRODUCTION

The Seymour coalfield [FP070770] is representative of those Triassic coalfields of Tasmania where the problems of difficult access and/or dolerite cover do not arise. In view of the apparent simplicity of the area, it was decided to perform a sample seismic reflection survey east along the road to Long Point. Coal and granite crop out in the area and two bores (Hills *et al.*, 1922) provide some stratigraphic control (Table 1). The two bores are approximately 1.2 km apart with Bore 1 located at Shot 3 of the seismic traverse (the western end) and Bore 4 located approximately 800 m south of Shot 87.

Table 1. SUMMARY LOGS OF SEYMOUR BORE HOLES

	Seymour Bore 1	*Seymour Bore 4*
Coal measures (no coal)	0 - 9 m	0 - 40 m
Coal measures (with coal)	9 - >50 m	40 - 100 m
Sandstone and mudstone		100 - 160 m
Limestone		160 - 240 m
Sandstone, shale and conglomerate		240 - 290 m

The traverse was recorded using 28 Hz geophones at an interval of 10 m, a shot offset from geophone 1 of 10 m, and a shot separation of 10 m. This produced a 4-fold CDP coverage. Shots consisting of 80 g of gelignite and a detonator were fired in tamped holes augered to a depth of 1.2 m and recorded through a 60 Hz to 1000 Hz bandpass filter. The shallow charge depth resulted in most shots being fired in very weathered coal measures and, combined with the large charge size necessary to overcome wind and wave noise, produced high amplitude low velocity ground roll. The ground roll is particularly apparent on the expanding velocity spread (fig. 4). Any future surveys in this area should be fired only in calm weather using 3 m deep shot holes and smaller charges.

RESULTS

The data recorded along the traverse was processed by Geophysical Service International. After displays of field records and common offset gathers (fig. 1) were made, several potential shallow reflectors could be seen. The signals had a low signal-to-noise ratio and contained large amplitude low frequency ground roll. Displays of signals made using the recording instrument's internal replay filters with a passband from 120 Hz to 280 Hz (fig. 2) were significantly better than the first stage of processed data.

A series of noise tests and filtered record analyses showed that a significant improvement in signal-to-noise ratio could be made by bandpass filtering between 96 Hz and 250 Hz for the first 250 msec of the record, and between 64 Hz and 200 Hz for the remainder. Although it appears from the noise analyses that velocity filtering would be advantageous, the use of only eight recording channels prevented the use of the available velocity filtering techniques. The final section (fig. 3) was bandpass filtered between 60 Hz and 250 Hz and dip filtered to enhance reflector continuity. No static corrections were made because of the poorly defined and very variable weathered layer velocity.

First arrival data from some shots show a thin low velocity layer, but the first arrival data from most shots shows a single layer with a velocity of approximately 2100 m/sec. An expanding spread centred on Shot 15 was fired (fig. 4) to permit an estimate of the velocity-reflection time function to be made by producing a series of constant velocity gathers. The gathers show a uniform average velocity of about 2000 m/sec down to a two-way time of 180 msec. A poor reflection at approximately 400 msec suggests an average velocity between 2500 m/sec and 3000 m/sec. The reflector at 180 msec probably corresponds to the top of the limestone encountered in Bore hole 4.

INTERPRETATION

Reflectors A, B, C and D on the processed time section (fig. 5) are interpreted as coal seams. Reflectors A and B correspond to seams reported from Seymour Bore 1 at 8.2 m and 25.9 m respectively, while reflector C correlates with an outcropping seam approximately 200 m east of Shot 88. Minor faults (F1, F2, F5, F6) break all these seams with throws of less than five metres. Faults F7 and F8 do not disrupt the upper coal seam, and appear to be contemporaneous with deposition of the coal measures. The throw on fault F7 is between one and three metres.

The zone of poor signal between Shots 35 and 48 represents a downthrown block filled with soft, highly attenuating material. Correlations cannot be made across this zone, as there is no distinctive deep reflector visible and the bore at the western end of the traverse did not reach the base of the coal measures. The absence of any granite-related reflections at the eastern end of the traverse implies that the granite outcrop to the east has a steeply dipping or faulted margin. Hints of reflectors at two-way times in excess of 150 msec are tantalising, but there is insufficient continuity to allow interpretation.

The number of small faults detected in the coal seams along this traverse shows that the seismic reflection technique is well suited to the investigation of coalfields similar to that at Seymour. It is recommended that additional traverses be performed in the Seymour area to locate any major faults and to enhance the recording of deeper reflectors for correlation purposes. It may be necessary to fire any such traverse twice to fulfil these requirements.

REFERENCE

HILLS, C.L.; REID, A.M.; NYE, P.B.; KEID, H.G.W.; REID, W.D. 1922. The coal resources of Tasmania. *Miner.Resour.geol.Surv.Tasm.* 7.

[20 November 1980]

TASMANIAN DEPT. OF MINES
SEYMOUR AREA
COMMON OFFSET GATHER
CHANNEL 7

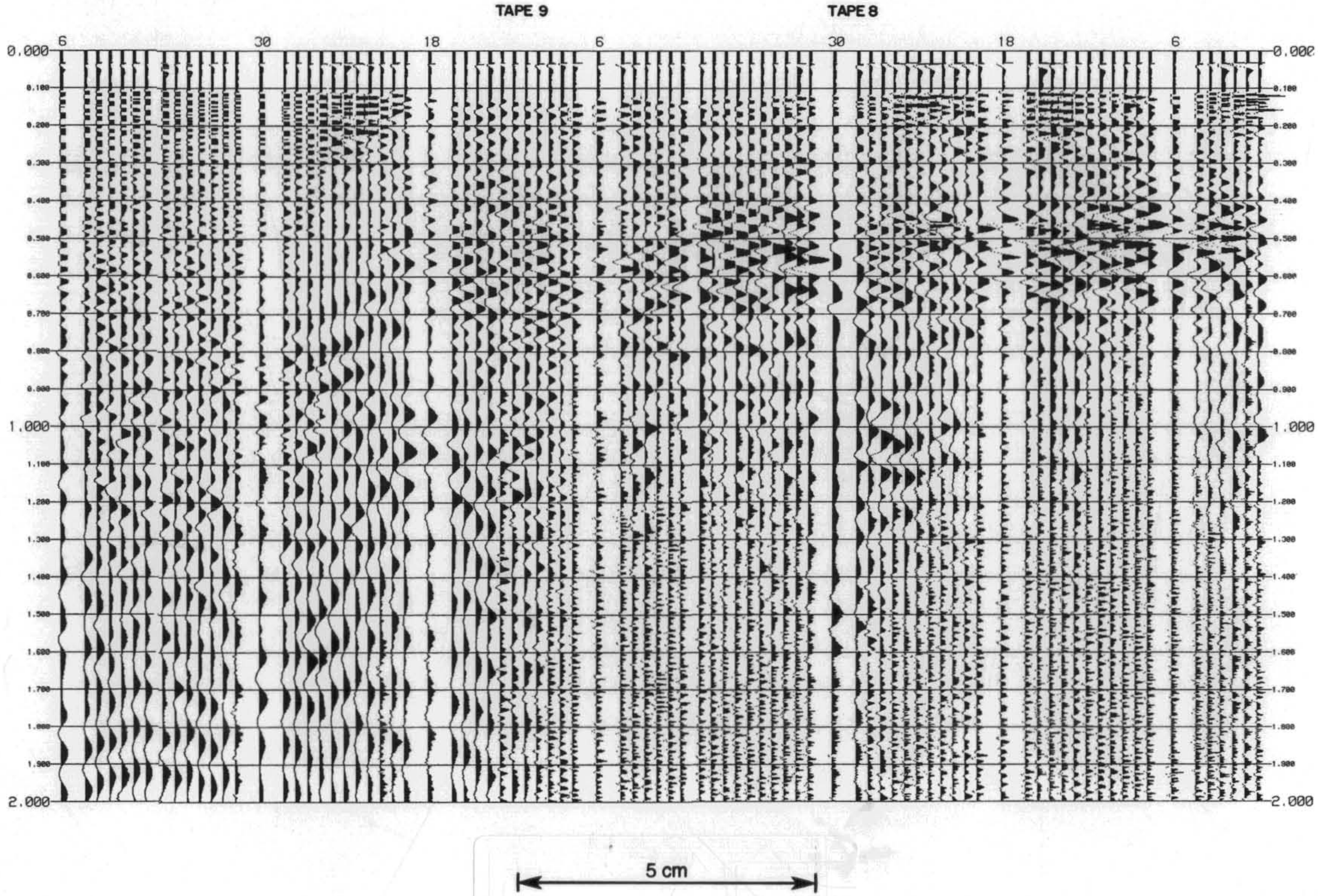


Figure 1.

3/7

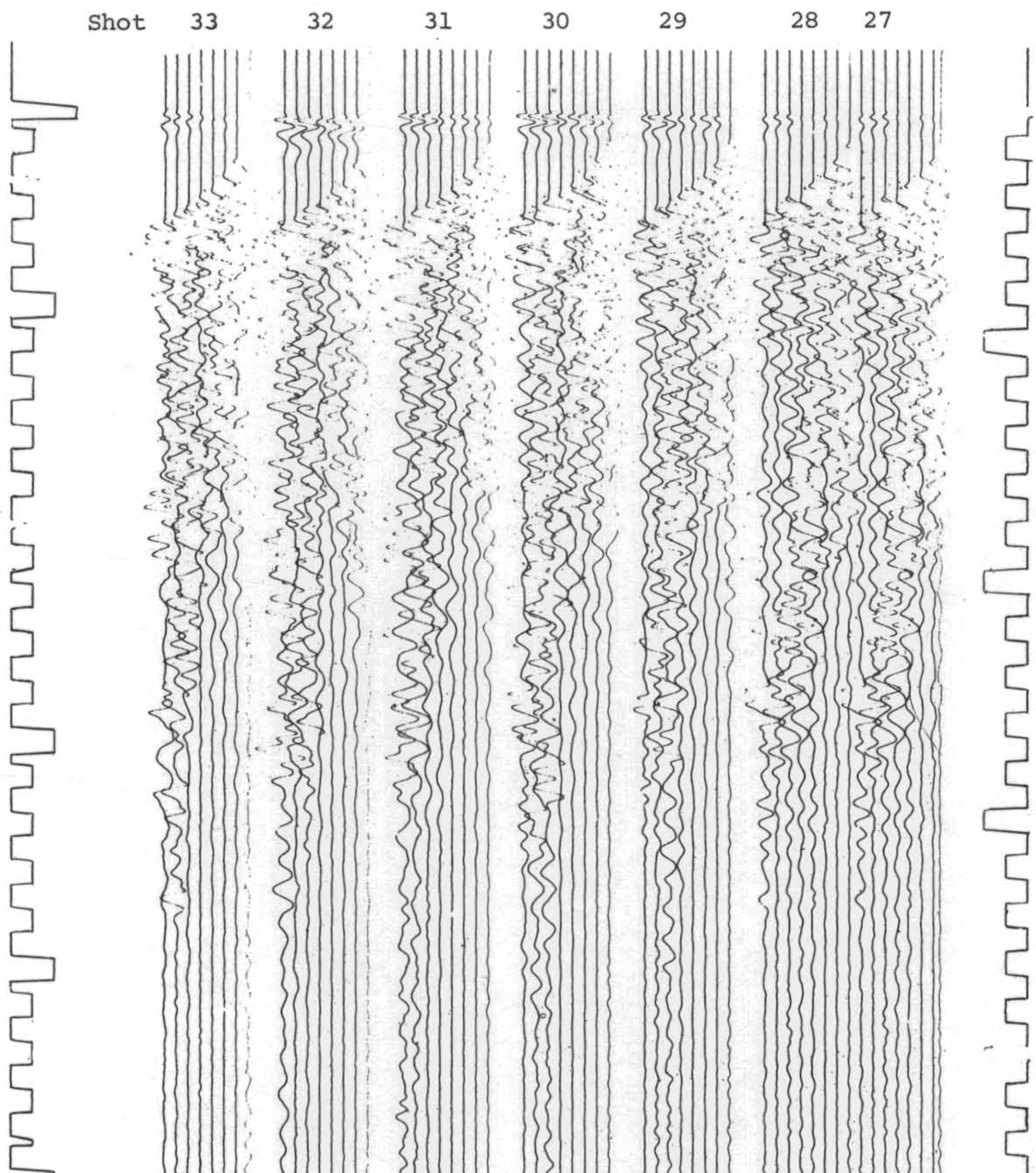
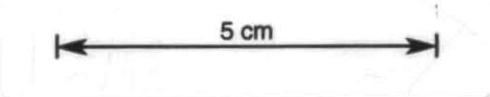
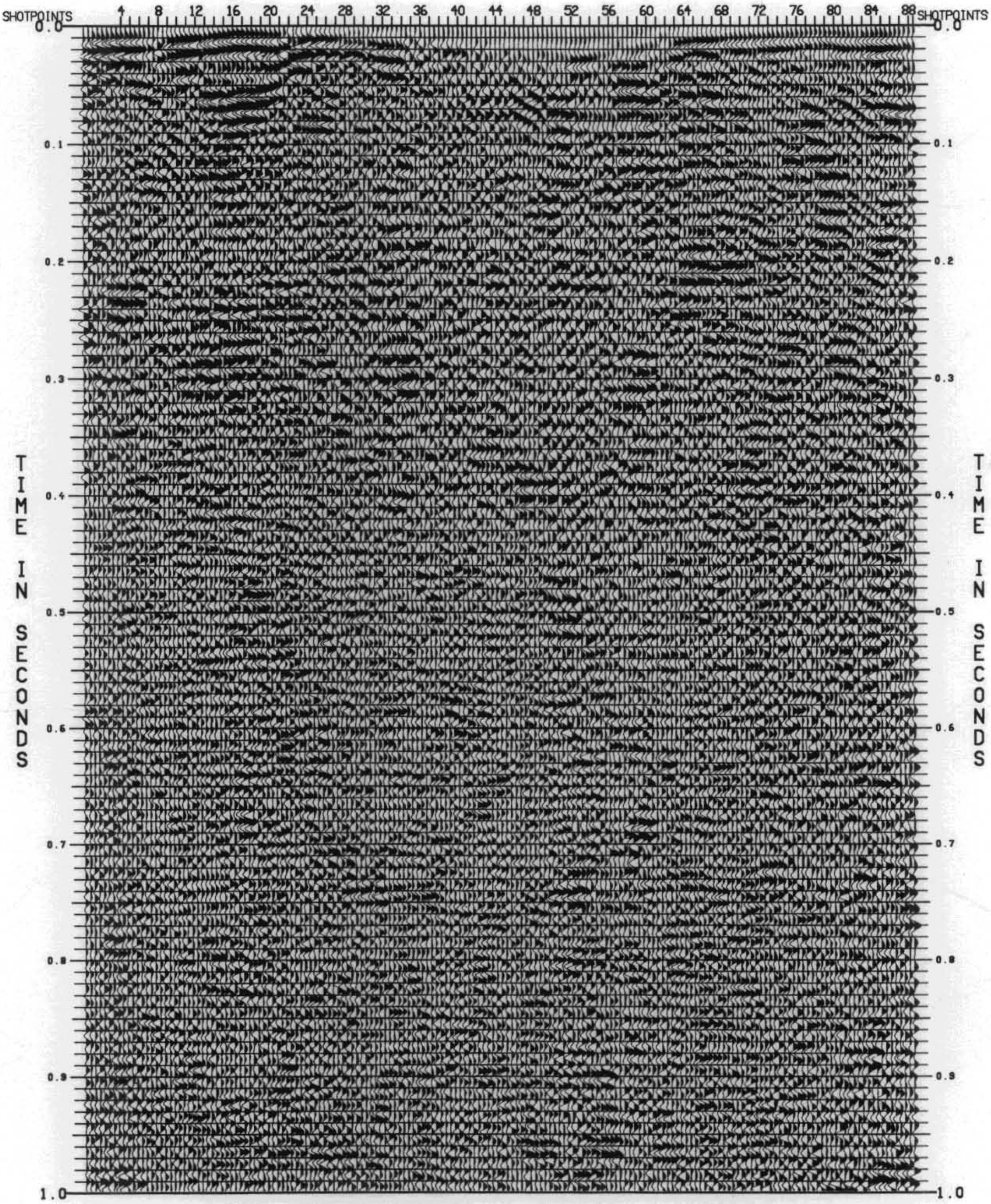


Figure 2. *DHR field plot.*





SEYMOUR SURVEY
SP.4 - SP.89
FINAL STACK

RECORDING PARAMETERS
1. INSTRUMENT - DHR 1632
2. 8 TRACE - 1 FOLD
3. SPREAD - OFF END 10M.
4. 6X28HZ PHONES-TRACE
5. GROUP INTERVAL-10M.
6. SAMPLE RATE - 0.5MSEC
7. SOURCE - DYNAMITE
8. SHOT DEPTH - 1.5M.
NOVEMBER 1979

PROCESSING PARAMETERS
1. TVS - 0.2 SEC GATES (50% OVERLAP)
2. NMO
3. TVF - 60-250HZ.BANDPASS
4. TVS - 100MSEC. GATE FROM 30MSEC (THEN 25% OVERLAP.50% INCREASE)
5. DIPFILTER
6. FILM 50CM-SEC.5TR-CM.
G.S.I. SYDNEY SEPT.1980

Figure 3.

5 cm

SEYMOUR SURVEY
SP.1 -SP.8

RECORDING PARAMETERS

1. INSTRUMENT-DHR 1632
2. 8 TRACE-1 FOLD
3. SPREAD-EXPANDED
4. 6X28HZ GEOPHONES-TRACE
5. GROUP INTERVAL-10M
6. SAMPLE RATE-0.5MSEC
7. SOURCE-DYNAMITE

NOVEMBER 1979

PROCESSING PARAMETERS

1. TVS-4MSEC GATES
2. 1FOLD STACK
3. TVF-SEE PANEL
4. TVS-10MSEC GATES
5. FILM-5TR/CM ,50CM /SEC

G.S.I. SYDNEY JUNE 1980

FILTERS APPLIED

96-280HZ AT 200
64-200HZ AT 300

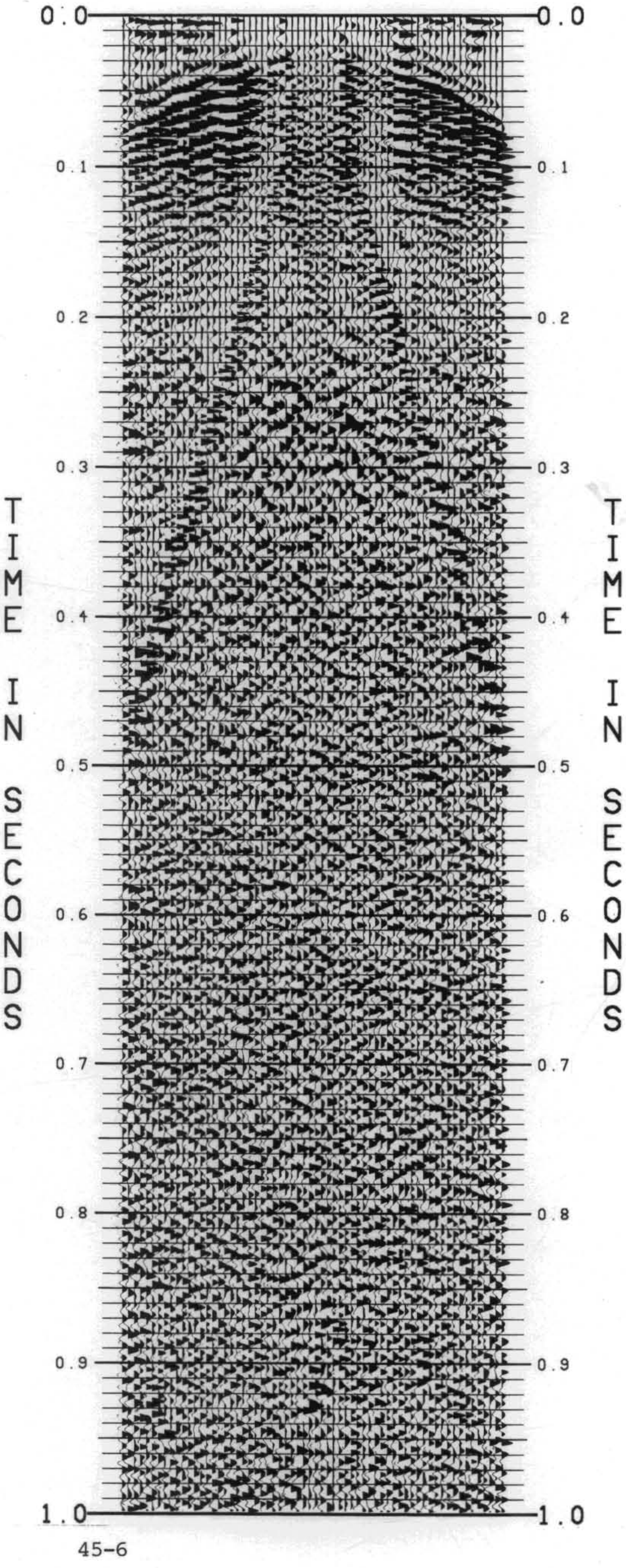


Figure 4.

5 cm

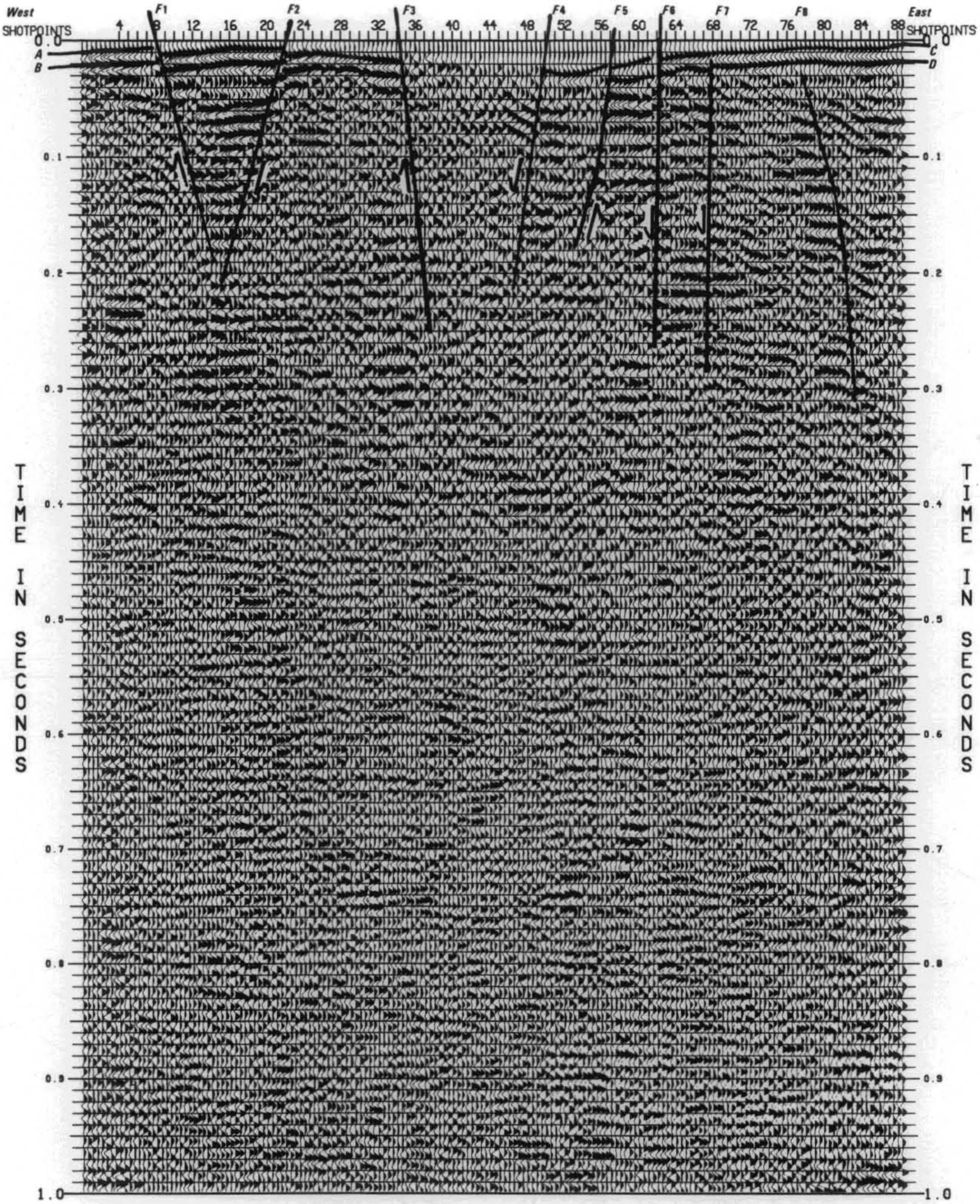


Figure 5. *Interpreted section.*