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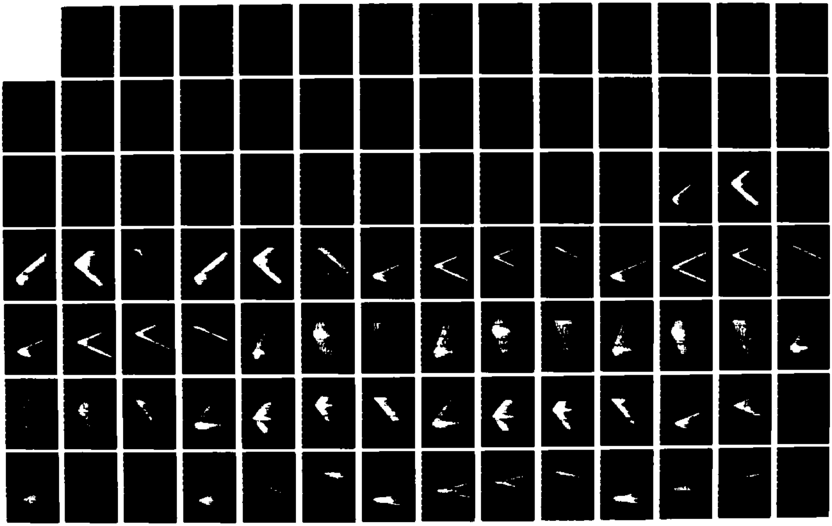

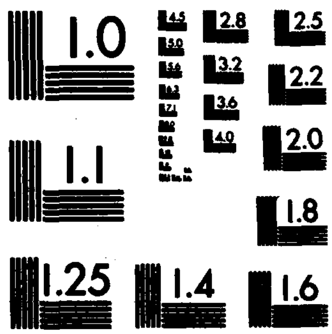
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OF THE CENTRAL MEDITERRANEAN SEA
USING OCEAN BOTTOM SEISMOMETERS

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TABLE OF CONTENTS

ABSTRACT

Ocean bottom seismometers (OBS) were deployed in the Mediterranean for two refraction surveys shot with underwater sound signal (SUS) charges. The digital data were analyzed to determine: (1) the attenuation features, signal/noise (S/N) characteristics and frequency content of water waves and body waves; and (2) the crustal structure of the test areas. The attenuation of water-wave signals was fairly uniform within the passband of the OBS (10-31 HZ) and was greater in deep water than in shallower water, and body waves were much more strongly attenuated than water waves. The S/N ratios were much larger for the SUS shots detonated at 91 m depth than for those detonated at 244 m depth. The body-wave data indicated the presence of a layer with P-wave velocity of 3.8 km/sec about 0.8 km below mean sea level in one test area. Probably this is a Miocene evaporite sequence.

INTRODUCTION

Two seismic refraction lines were shot with explosives in the central Mediterranean in the fall of 1981 using Ocean Bottom Seismometers (OBS) to study acoustic and seismic wave propagation in the test areas. These were the final field operations in a long-term collaborative project between the University of Texas Institute for Geophysics (UTIG - formerly the Marine Science Institute) and the Office of Naval Research for the design, development and testing of a light-weight, self-contained, easily deployed and recovered electronic system for detecting and recording seismic data on the ocean floor. The two lines, denoted Line 21 and Line 22 (Figs. 1 and 2), were located in the Mediterranean Sea between Sicily and northern Africa. They comprised part of a Mediterranean acoustic survey conducted from the USNS Wilkes (Survey 3306-81).

The OBS experiments were included in the program to address several objectives: 1) to gather water-borne and earth-borne acoustic data for analysis and comparison with sonobouy data recorded simultaneously on shipboard, 2) to record refracted arrivals to find layer velocities and depths for modeling the geological structure of the region, and 3) to field test the OBS, a new technological tool, for future applications in studying signal propagation.

The analysis of the data recorded by the OBS units is the sole subject of this report since we had no access to the sonobouy data.

DESCRIPTION OF THE EXPERIMENTS

Ocean Bottom Seismometers

The OBS used in these experiments (Latham et al., 1978; Steinmetz et al., 1979) consisted of a 10 Hz triaxial geophone system with recording and control electronics housed in a glass sphere 43 cm in diameter that was secured firmly in a heavy square spiked metal frame about 1.2 m on each side (Fig. 3). The sampling rate of the instrument was approximately 136 samples/sec (sample interval = 7.344 ms), and the dynamic range was about 96 dB.

At deployment, an OBS in its frame was released from the sea surface and allowed to fall to the sea bottom, where upon impact the spiked frame firmly lodged in the sea floor providing good coupling between ground motion and the OBS geophones. Each unit contained electronic clocks and three microprocessors programmed to activate the instrument at the beginning of the line and to detect and record 60-second segments of multiplexed 3-component digital data for each shot. All OBS units possessed an externally-mounted compass, whose needle locked into place several hours after the OBS reached bottom, allowing us to determine the orientation of the two horizontal geophones. Each OBS was programmed so that at the appropriate time an electric current caused the electrochemical dissolution of the stainless steel wire holding the instrument sphere in the heavy frame, allowing the sphere to float to the surface for recovery.

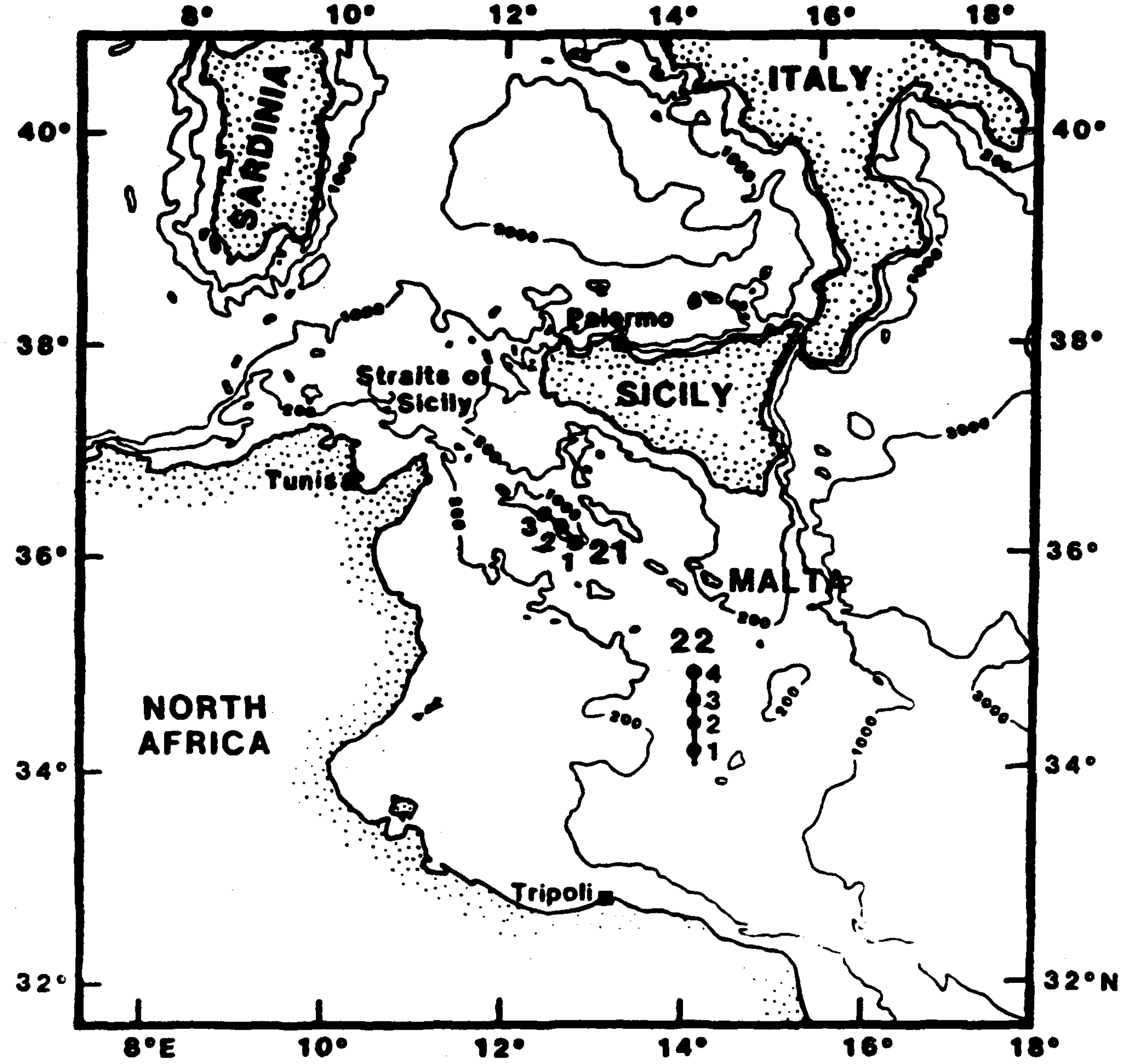


Fig. 1. Location of Line 21 and Line 22; circles denote the OBS locations; depths in meters.

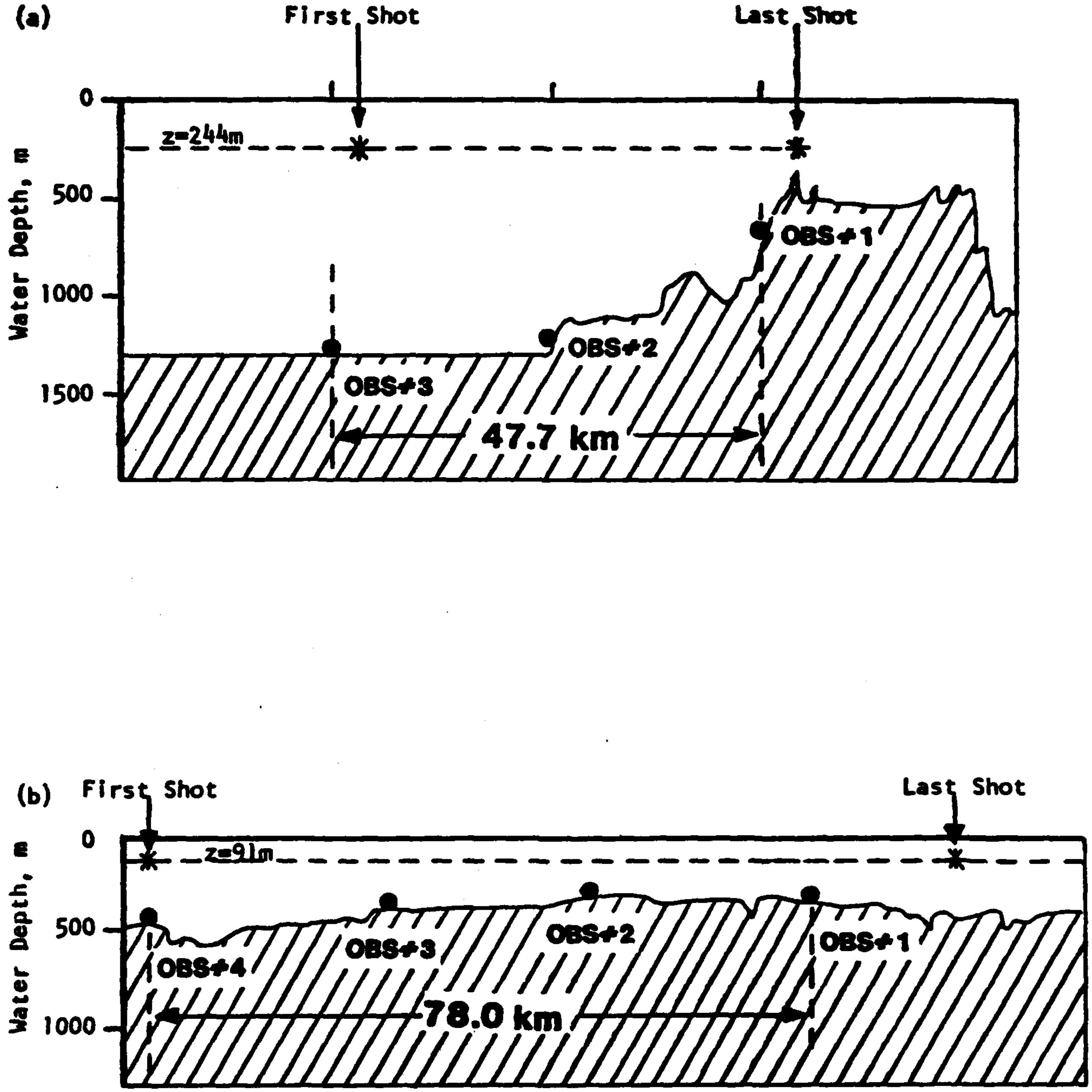


Fig. 2. Bathymetry with OBS locations, end-point shot locations and depths for a) Line 21 and b) Line 22.

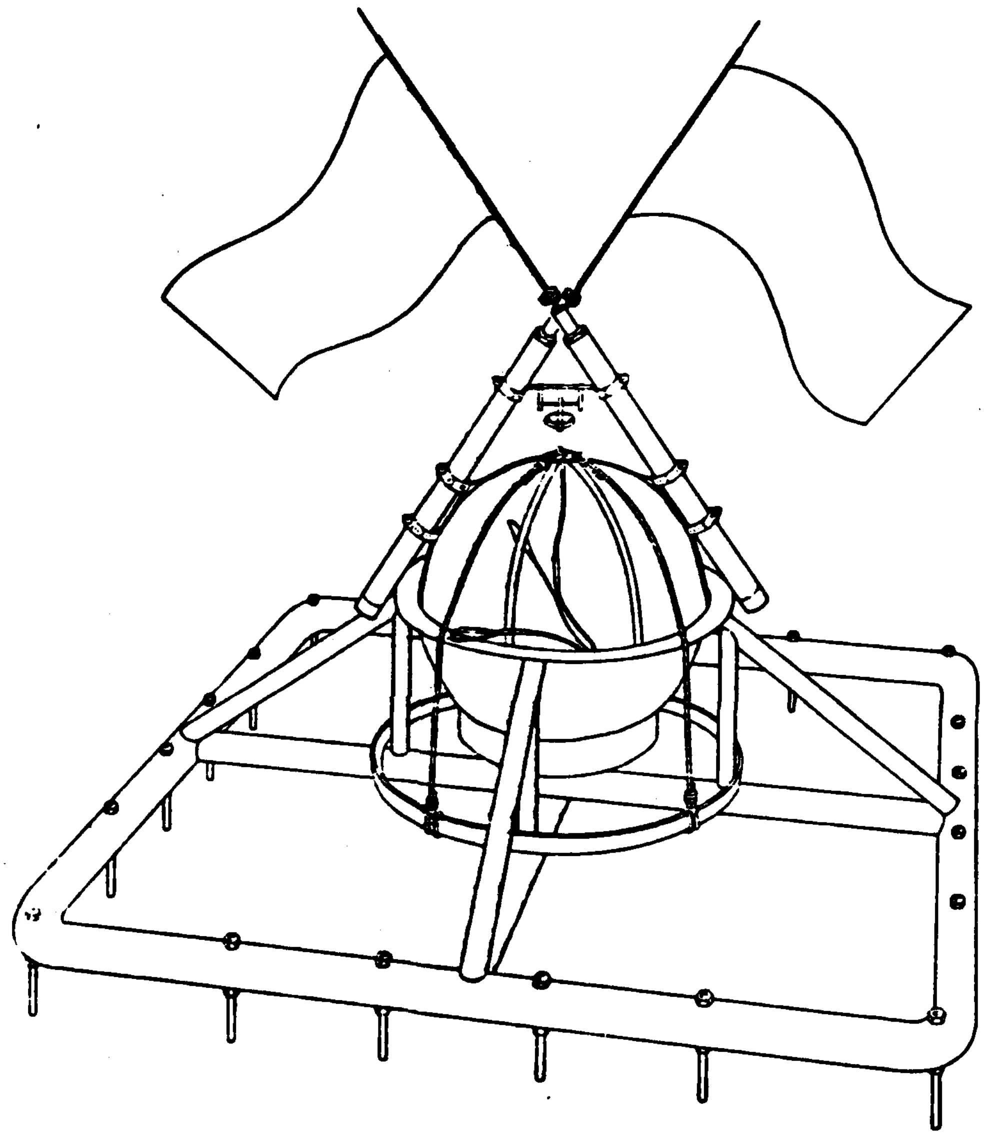


Fig. 3. The UTIG digital OBS used in these experiments, mounted in its spiked frame.

The instrumental response of the OBS depends on at least four separate factors: the geophone response, the electronic alias filter in the preamplifier, the structure of the OBS frame and the degree of coupling of the frame to the ocean bottom. The output EMF of the geophones used in these experiments was directly proportional to the velocity of ground motion for frequencies above the geophone frequency of 10 Hz. The EMF generated at frequencies below 10 Hz fell off exponentially with a rolloff of -12 dB/octave. The low-pass alias filter had a corner frequency of about 31 Hz and a rolloff of -24 dB/octave at frequencies above 31 Hz. No resonance tests were made on the frames used in these experiments although a prototype frame was tested extensively (Steinmetz et al., 1979) and found to have its fundamental resonance at 24 Hz. Presumably the frame we used had its resonance frequency above 24 Hz because it was built more rigidly than the prototype frame. The coupling of an OBS frame to the ocean floor is a classic unresolved problem (Sutton et al., 1981).

The unknown coupling factor and the fact that the geophones and electronics were not bench calibrated made it impossible to determine an absolute instrumental response for the OBS. We did, however, determine the relative instrumental response of the OBS by considering only effect of the geophone and electronic filter (Fig. 4). Note that the passband ranges from 10 to 31 Hz, a broad band which contains most of the signals of interest in this experiment.

Sound Sources

The sound sources used (Fig. 5) were standard underwater sound signal (SUS) charges (Gaspin and Shuler, 1971). The original plan also called for a towed acoustic projector source on each OBS line, but the projector malfunctioned and was not used on either line. For Line 21 we used Mark 61 SUS charges detonated by pressure at a depth of 244 m (800 ft), and for Line 22 we used Mark 82 SUS charges detonated by pressure at a depth of 91 m (300 ft). Each of these SUS charges contained 0.82 kg (1.8 lb) of TNT. For Line 21, using shots detonated at 244 m depth, the peak of the source energy spectrum was near 60 Hz; for Line 22, using shots detonated at 91 m depth, the peak was near 28 Hz.

Field Operations

The general procedure for an OBS seismic refraction survey is to deploy several OBS units from shipboard along a straight line, then to steam the line while dropping explosive charges, and finally to recover the surfaced instruments. This procedure was followed for the OBS surveys described in this report.

The USNS Wilkes departed Palermo, Sicily, on the afternoon of 3 November 1981, and arrived at Station 21 for the first OBS line (Line 21) on 6 November 1981. Three OBS units were deployed along the 48 km line (Fig. 6; Appendix A). Then a sonobouy was deployed, and as the ship steamed the line at about 10 knots, SUS charges (detonation depth ≈ 244 m) were dropped at 3-minute intervals (Appendix A). All three OBS units were then recovered. The shot spacing along this line was about 0.9 km, and the water depths along this line ranged from about 1300 m to about 400 m (Fig. 2a).

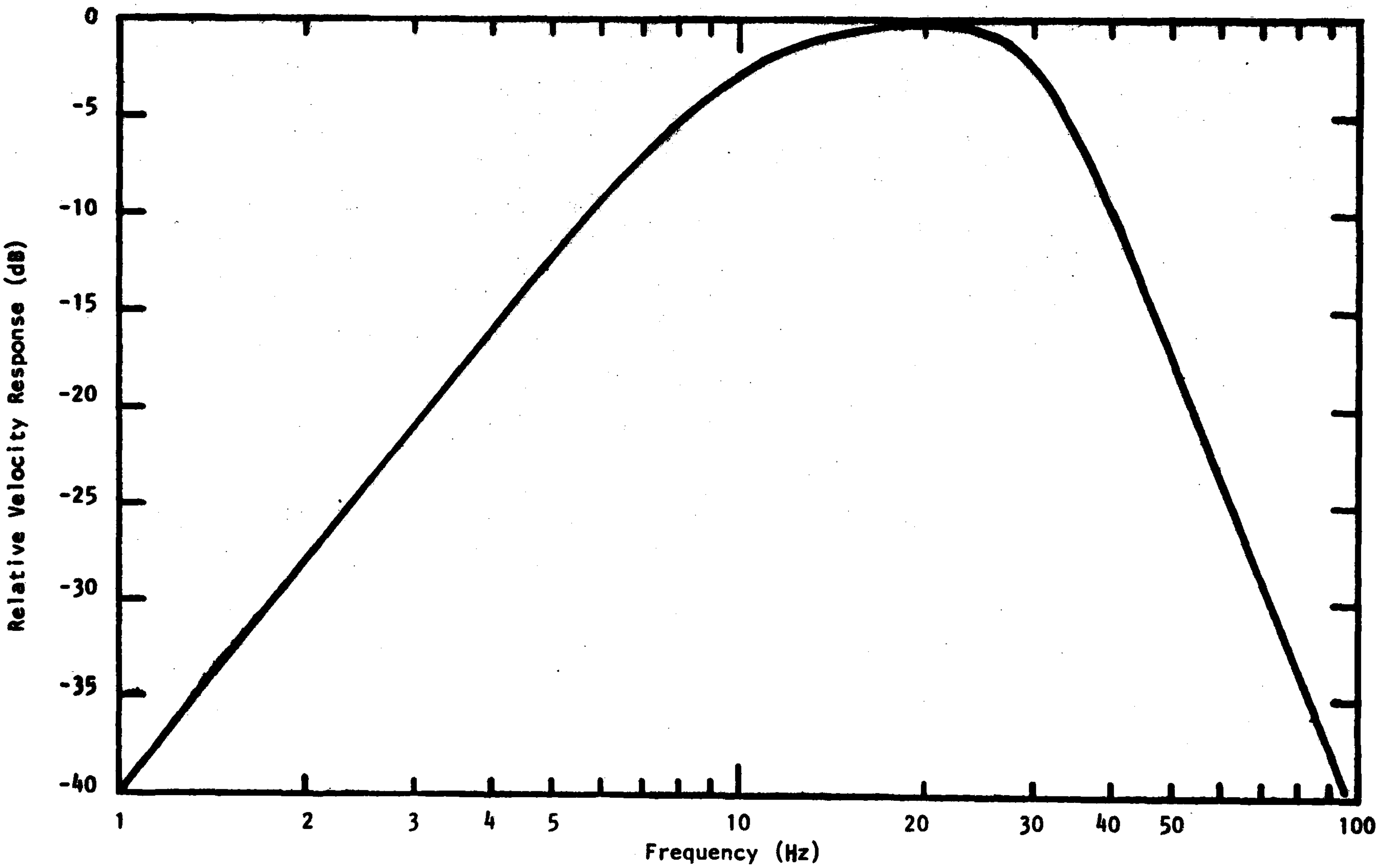
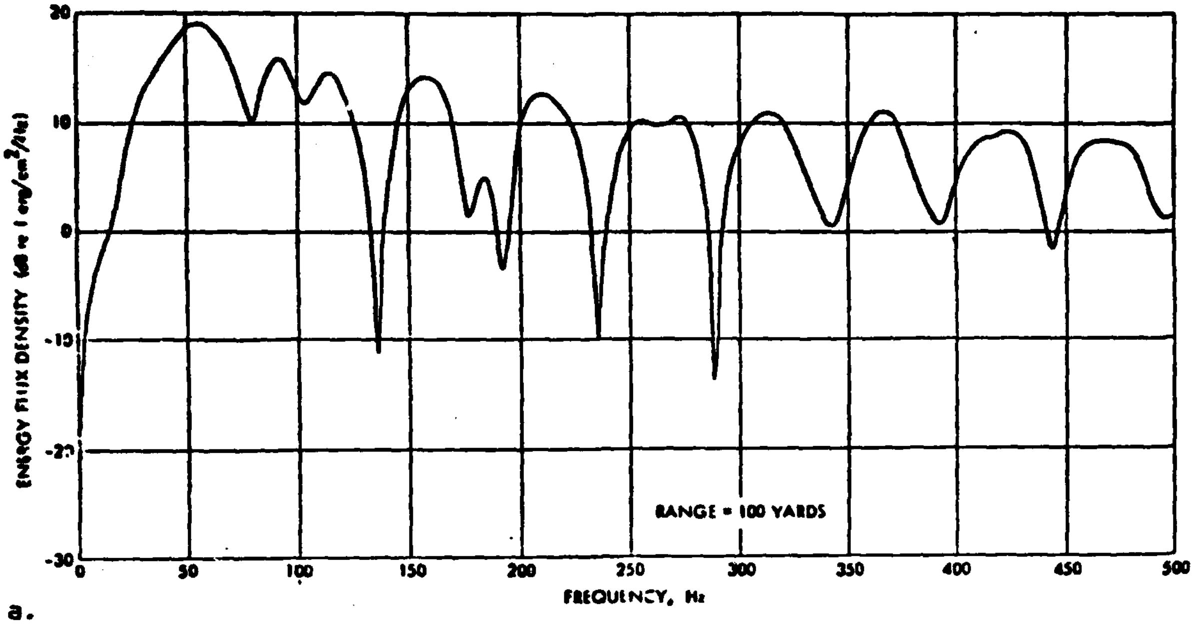
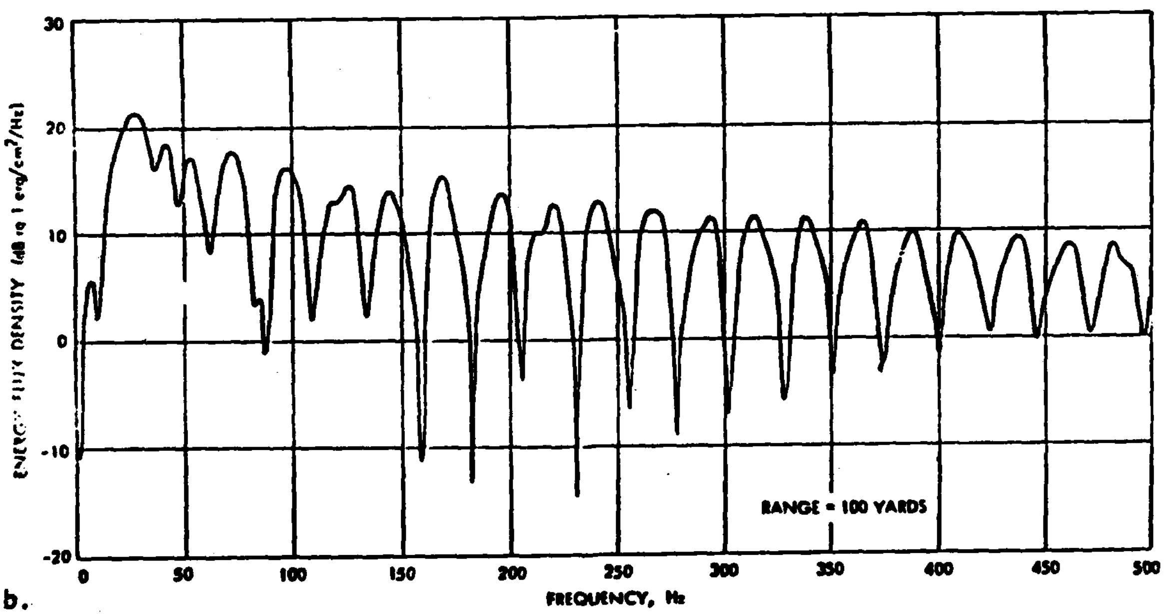


Fig. 4. Relative instrumental response to ground velocity of the UTIG OBS. This curve takes into account the properties of the geophones and the alias filter.



a.



b.

Fig. 5. Source frequency spectra for a) Mark 61 SUS charges detonated at 244 m (800 ft) on Line 21, and b) Mark 82 SUS charges detonated at 91 m (300 ft) on Line 22. All charges contained 0.82 kg (1.8 lb) of TNT (from Gaspin and Schuler, 1971).

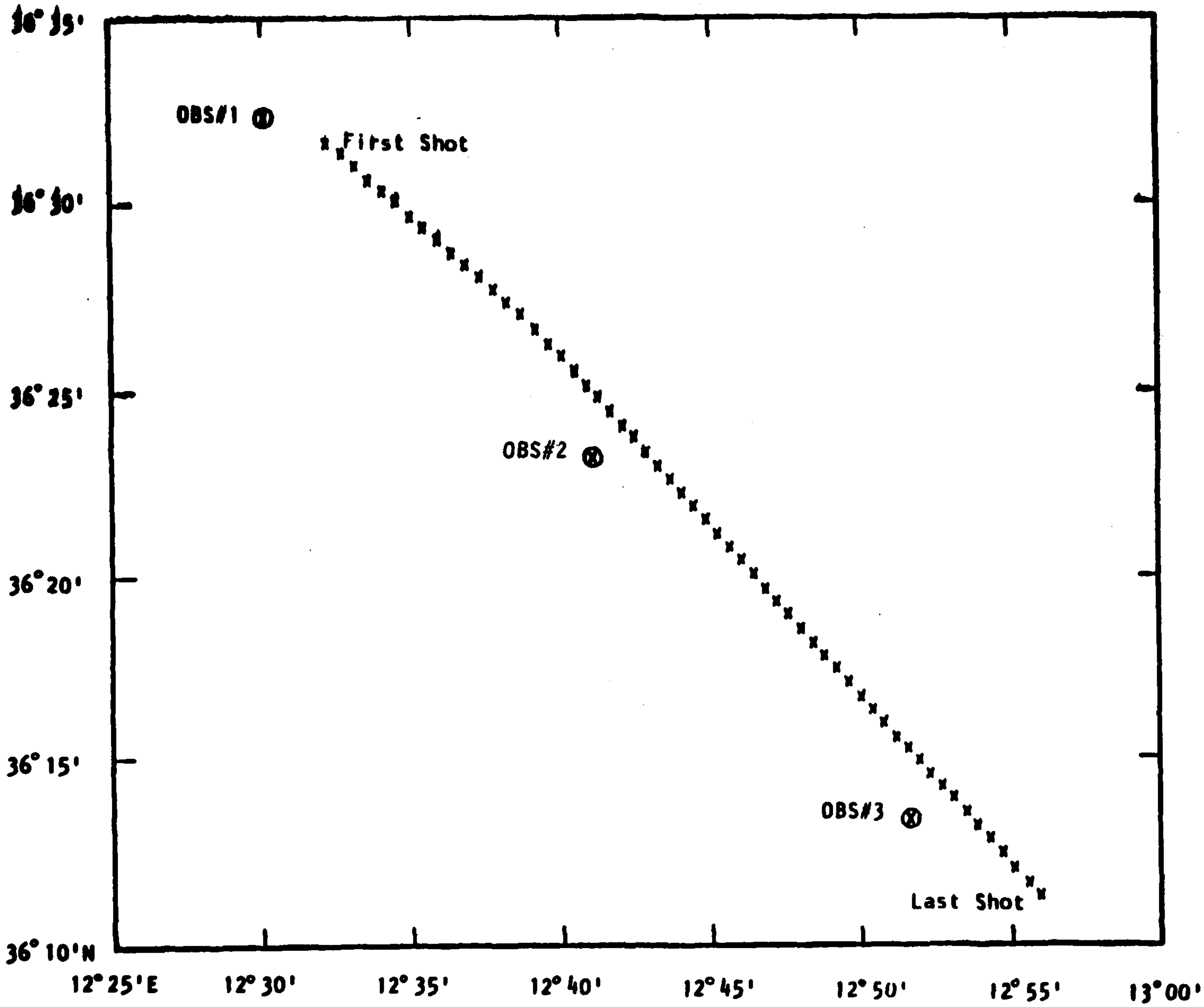


Fig. 6 OBS and shot location details for Line 21.

The ship arrived at Station 22 to begin Line 22 on the morning of 9 November 1981. Four OBS units were deployed along the 78 km line (Fig. 7; Appendix A). Then a sonobouy was deployed, and as the ship steamed the line at about 10 knots, SUS charges (detonation depth = 91 m) were again dropped at 3-minute intervals. The sonobouys again transmitted data to the ship from each shot, but the OBS units on the line were programmed to record only every other shot in order to use most effectively the limited data recording capability of the OBS units on this longer line. All four OBS units were then recovered. The shot spacing along this line was about 1.7 km, and the water depths along this shallower line ranged from about 280 m to about 580 m (Fig. 2b).

The OBS and shot coordinates listed in Appendix .. are based on the best navigational information available to us. These data came from the onboard SATNAV system which gave the latitude and longitude of points to the nearest 0.1 minute of arc, which translates to a relative location uncertainty of about 200 m (0.1 nautical mile). Roger Merrifield (personal communication) estimated the uncertainty in the SATNAV system as a whole to be about 500 m (0.25 nautical mile) for absolute locations. The shot-to-OBS distances and other quantities derived from the navigation data are subject to these uncertainty considerations.

The Chief Scientist for the cruise was Roger Merrifield of NAVOCEANO of Bay St. Louis, Mississippi. Personnel from NORDA/NAVOCEANO and from the Institute for Acoustic Research of Miami, Florida, conducted the sonobouy and sound source operations of the experiments.

The UTIG team aboard the USNS Wilkes in charge of conducting these OBS experiments consisted of William P. O'Brien, Jr. and Paul M. McPherson. Paul L. Donoho, the designer of the OBS, was not aboard the Wilkes but was present in Sicily for several days prior to departure to direct the final checkout of the hardware and software.

DATA

Each of the 58 recording windows programmed into the three OBS units on Line 21 was 60 seconds long as were the 55 windows programmed into the four OBS units on Line 22. No charges were detonated for shots 1, 11 and 52 of Line 21 or for shots 1, 2, 14 and 35 of Line 22 (see Appendix A). The shot times were determined by comparing the recorded signals from a towed hydrophone with a recorded time from a calibrated electronic master clock, taking into account the elapsed time between the actual shot and the detection of the shot by the towed hydrophone. This elapsed time was calculated using the mean value of the sound velocities determined by XBT casts over the depth range of interest; the sound velocities used were 1.52 and 1.53 km/sec for Lines 21 and 22, respectively. The master clock also was used to determine the drift of each OBS clock during deployment. The digital data recorded on each 4-track OBS cassette tape were transferred to 9-track tape in standard SEG-Y format (Barry et al., 1980). This format incorporated the firing time, clock drift and travel time corrections so that the first sample on each trace (at t = 0 sec) corresponded to the actual shot time. Further processing utilized the VAX 11/780 computer at UTIG.

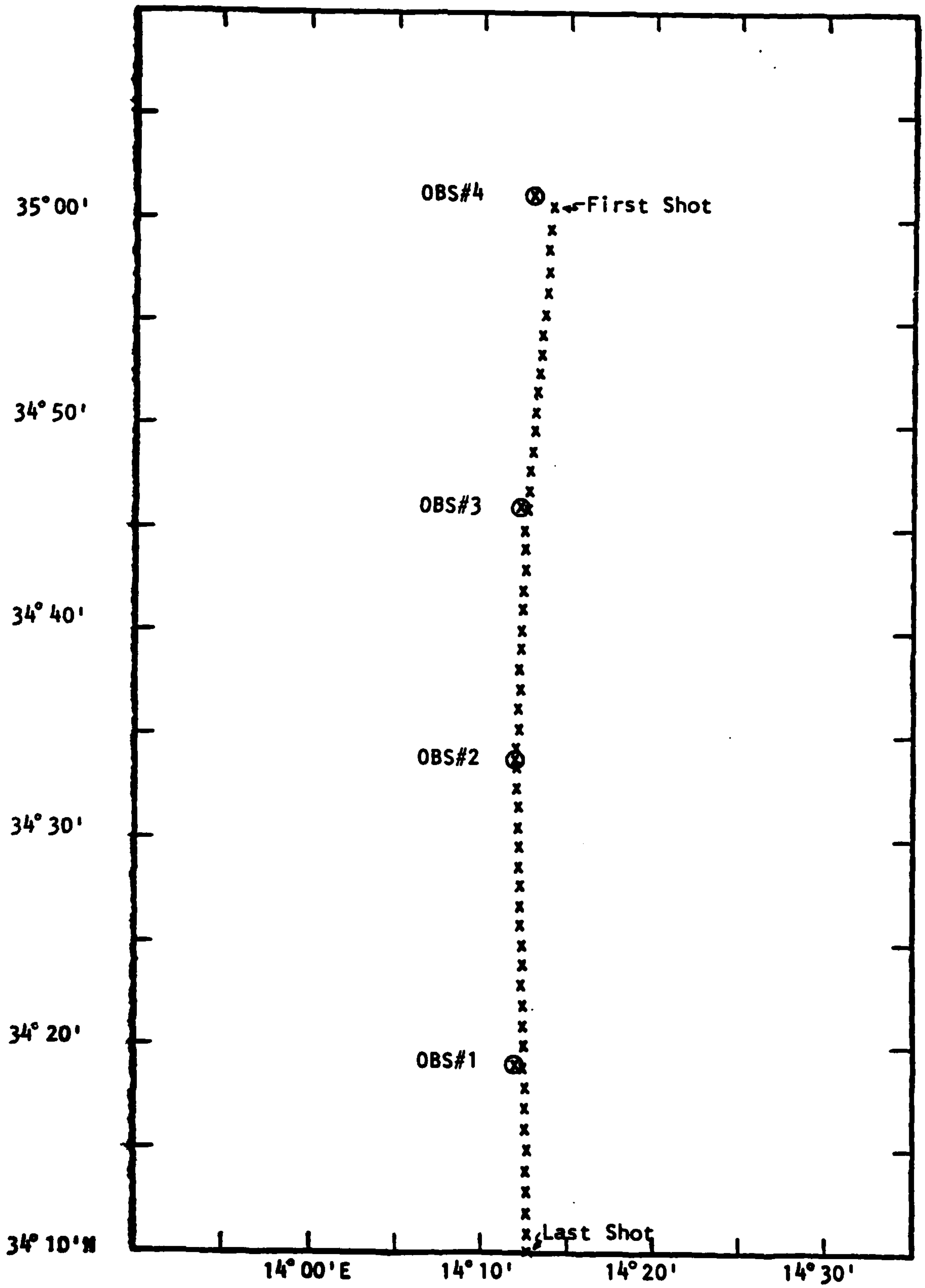


Fig. 7. OBS and shot location details for Line 22.

For Line 22 the horizontal data were transformed using a rotation matrix that took into account the orientation of the OBS and the azimuth of the shot relative to the OBS. This transformation yielded the radial (R) component of motion (along the line connecting the shot to the OBS) and the transverse (T) component (perpendicular to the line connecting the shot to the OBS).

A DC bias was found to be superimposed on the data from several OBS units, so all the data were filtered with a broad bandpass filter (passband from 1 to 65 Hz) before further analyses. The instrument used as OBS#3 on Line 21 was the same instrument used as OBS#4 on Line 22; the quality of data recorded by this unit was poor because an electronic malfunction added about 25 dB of instrumental noise to the data.

Seismic record sections of 1) all the raw OBS data, and 2) rotated data plotted with using reducing velocities of 1.7 and 4.5 km/sec are given in Appendix B. The high-frequency large-amplitude water wave arrival was the most pronounced feature on each trace.

DATA ANALYSIS

The acoustic energy released into the water by each shot travels to each OBS along many different paths. For our purposes the waves are designated either as water waves, which travel directly or indirectly through the water column, or as body waves, which refract into the sea bottom and propagate through the bottom and sub-bottom materials to the OBS.

We first determined relative energy levels for the water waves and body waves by integrating the power over the first 1.0-second interval of the wavetrain under consideration. We then studied the variation of these energy levels with distance. Energy levels for noise signals taken prior to the arrivals were calculated similarly, and these were used to calculate the overall signal/noise (S/N) ratios for arrivals recorded by the OBS units. We next calculated the spectral composition of the various types of signals and determined the frequency dependence of the attenuation factor k and the S/N ratio. Finally we analyzed the body-wave arrivals and deduced a model for the ocean crust in the test area.

The data were not corrected for the instrumental response of the various OBS units; therefore the results mainly apply to signals in the passband of 10 to 31 Hz. Furthermore, since the OBS units were not calibrated before deployment, there was no meaningful comparison of signal levels that could be made from one OBS to another. However, it was possible to compare, from one shot to another, the signal level of a particular phase of an arrival recorded by a single OBS.

Variation of Energy Levels with Distance

For a wave incident on the ocean bottom the fraction of energy that is transmitted into the earth depends on the wavelength, the surface geometry and the composition and thickness of the sediment layers. These factors determine the "bottom loss" (Vidmar, 1980) by governing the degree of compressional wave and shear wave excitation and absorption. The variation of the energy levels E of a wave with distance r is most clearly revealed by plotting log E vs. log r. If we let k denote the slope of a least-squares straight line fit to this plot, then we can easily model the total attenuation of the energy by

$$E = a\,r^{k}$$

Figures 8 and 9 present the results of this type of analysis for the water waves detected by the vertical-component geophones in the two good OBS units on Line 21 and by the four OBS units on Line 22. For the data from Line 22 (shallow water) the slopes ranged from -1.40 to -2.18. This suggests wavefront propagation in a geometric regime intermediate between cylindrical and spherical divergence. This result for the shallow water propagation is probably due to the effects of surfaces and waveguide phenomena. For the data from Line 21 (deep water) the slopes were -2.29 and -2.36. These suggest that the observed energy attenuation was due to a combination of spherical-wavefront spreading, for which energy varies inversely with the square of distance, and a term that decreased exponentially with distance. Therefore, we modeled the energy E for this line as

$$E = a\,r^{-2}\,e^{-br}$$

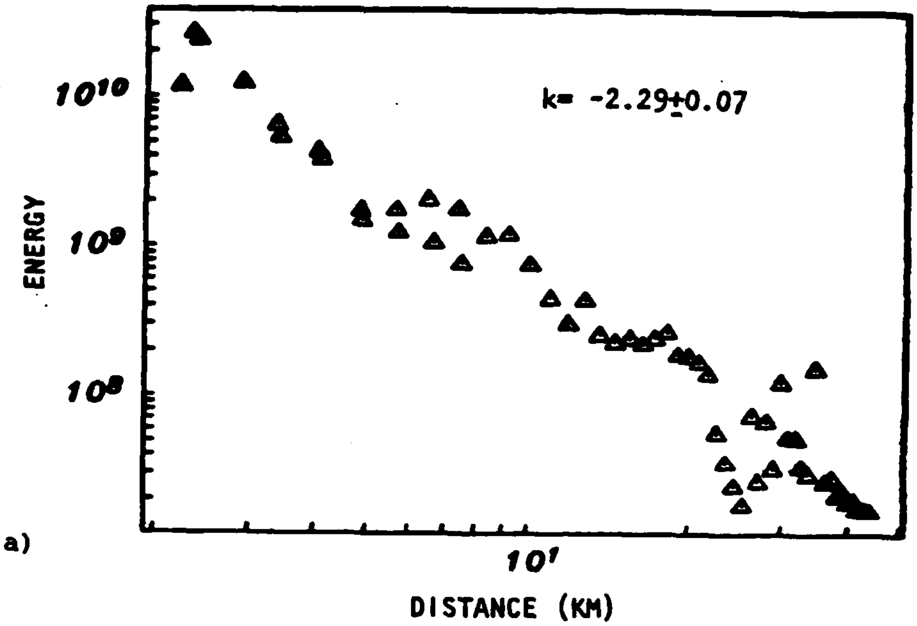
The resulting values for the attenuation coefficient b were $-0.0069 \pm 0.0024\ (\mathrm{km})^{-1}$ for OBS#1 and $-0.0143 \pm 0.0031\ (\mathrm{km})^{-1}$ for OBS#2.

Body waves were clearly discernible only in the horizontal radial geophone data from three OBS units on Line 22. The refracted body waves chosen for calculating the body-wave energy levels (Fig. 10) were those that were the most pronounced in the data, and all had an apparent group velocity of about 3.8 km/sec. For these data the slope k ranged from -2.51 to -4.80, indicating a much higher degree of attenuation for the refracted signals than for the water waves. In the limit of two isotropic layers separated by a plane boundary, the refracted energy (headwaves) would be expected to decrease inversely with the fourth power of the distance.

Signal/Noise Ratios

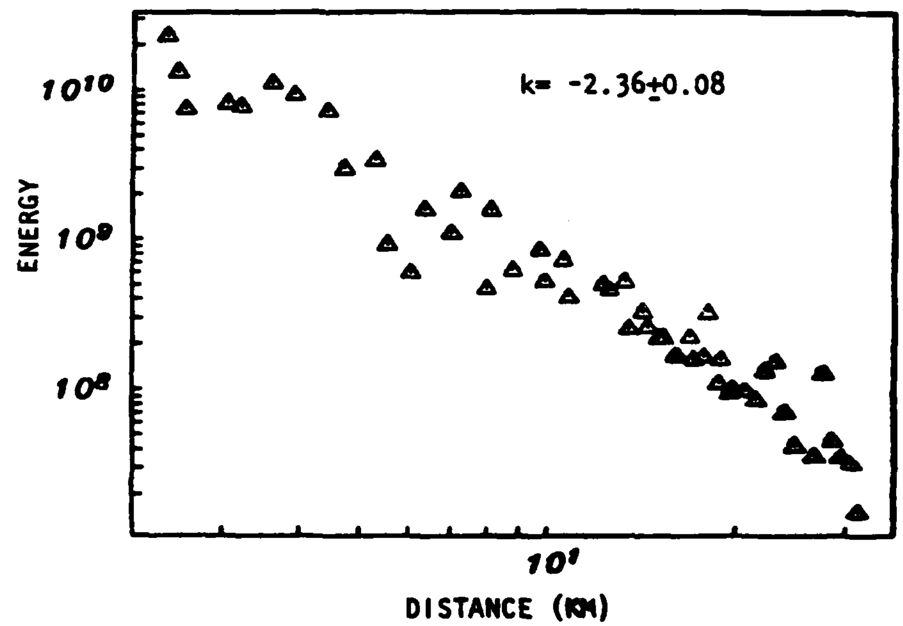
To determine the S/N ratio for a water wave or body wave detected by an OBS at a given distance, we first averaged the 1.0-second noise energy levels of all traces analyzed from that particular OBS to determine the mean 1.0-second noise energy level characteristic of that unit. We then calculated the interpolated value of the signal energy level at the desired distance from the data in Figs. 8-10 and divided this interpolated signal value by the mean noise value to get the desired S/N ratio. These S/N ratios (in dB) are given in Table 1 for distance values of 2 km, 10 km and 20 km along with the estimated distance values for which the signal and noise levels would be equal (S/N = 0 dB).

LINE 21 OBS 1V WATER WAVE



a)

LINE 21 OBS 2V WATER WAVE



b)

Fig. 8. Log E vs. log r for the water-wave data from a) OBS#1 and b) OBS#2 of Line 21. The slope of the least-squares straight line through these points is the corresponding value for the attenuation coefficient k. Energy values are in an arbitrary unit. The error term for the k values represents one standard deviation.

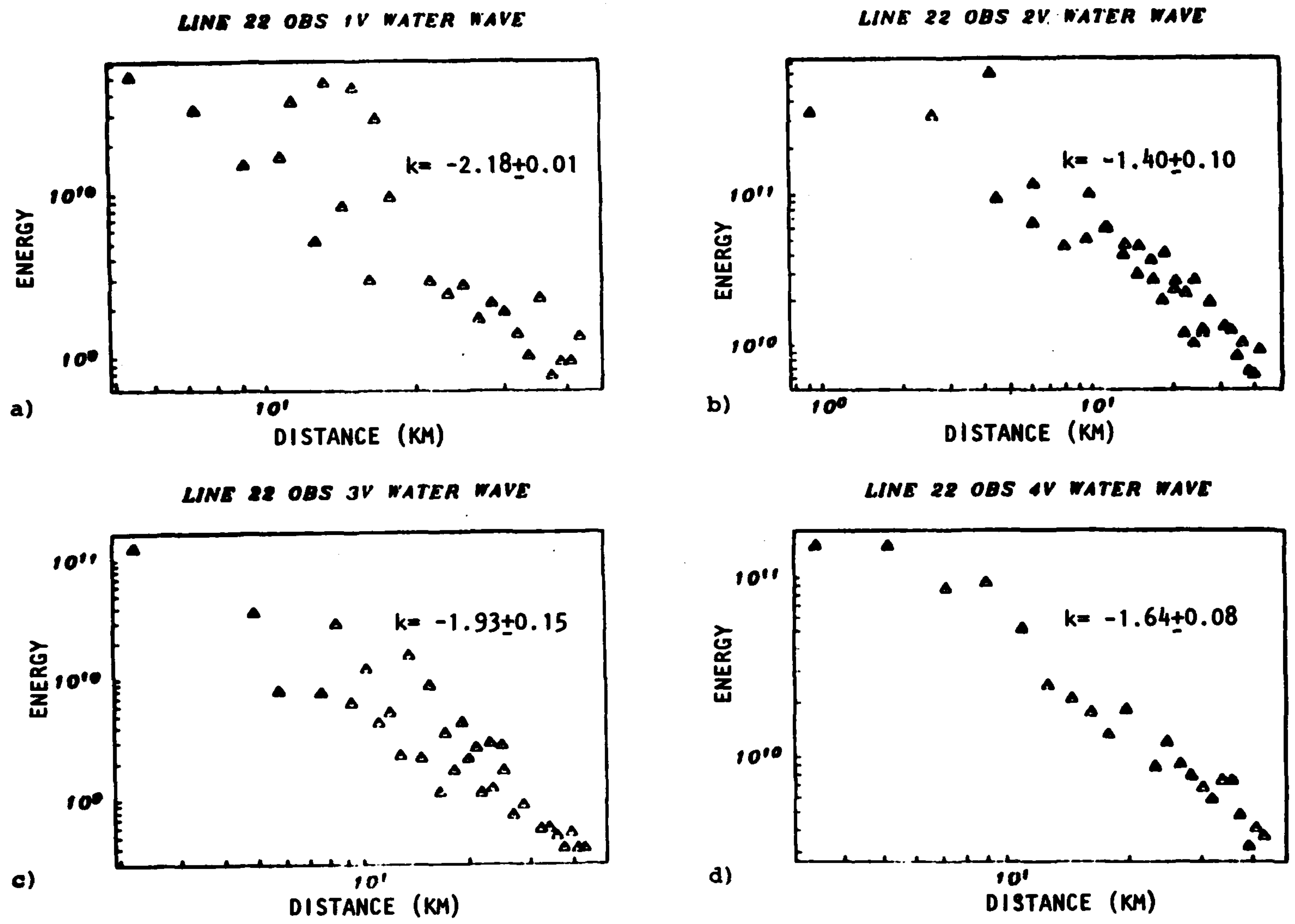


Fig. 9. Log E vs. log r for the water-wave data from a) OBS#1, b) OBS#2, c) OBS#3 and d) OBS #4 of Line 22. The slope of the least-squares straight line through these points is the corresponding value for the attenuation coefficient k.

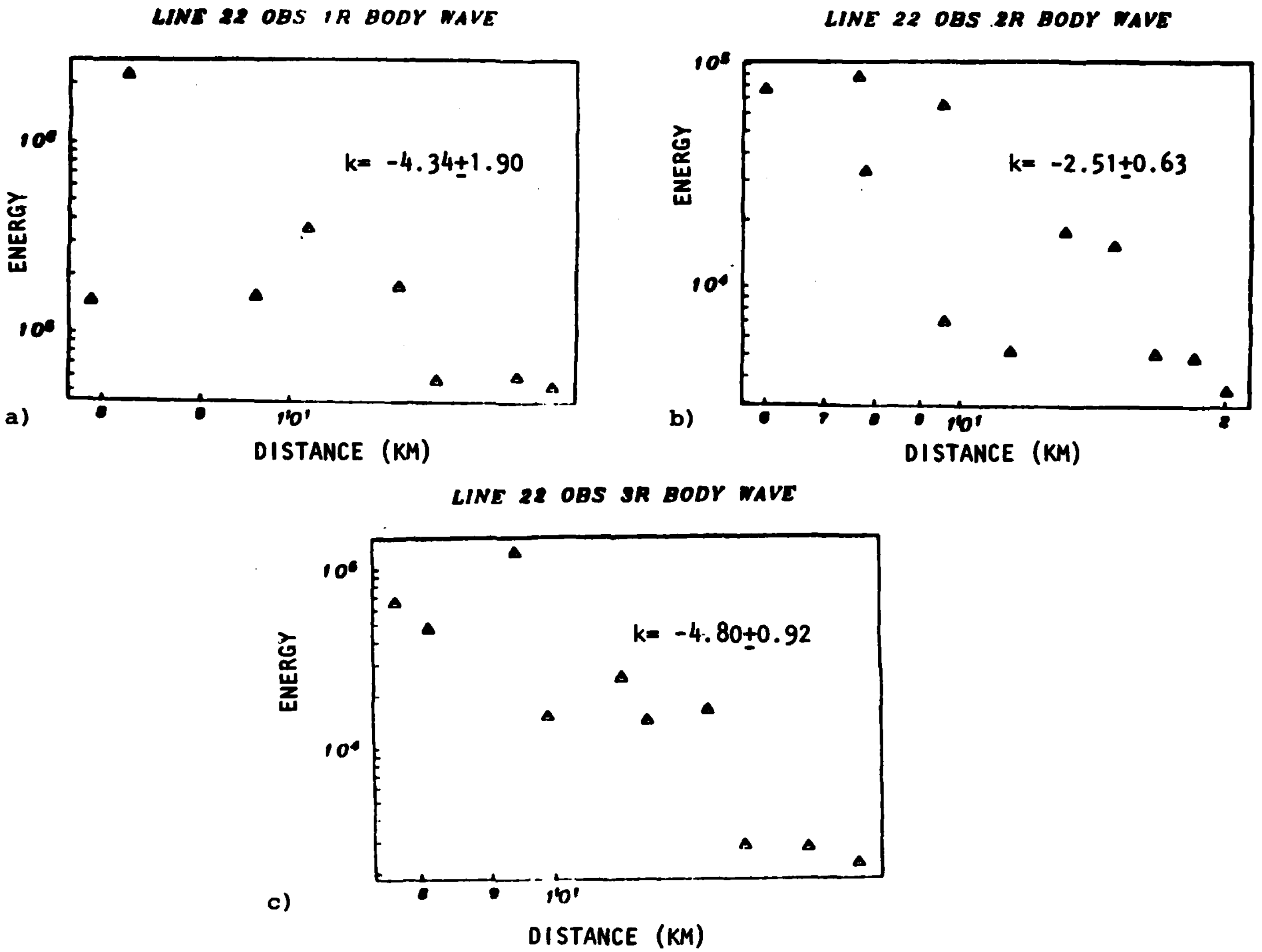


Fig. 10. Log E vs. log r for the body-wave data from a) OBS#1, b) OBS#2 and c) OBS#3 of Line 22. The slope of the least-squares straight line through these points is the corresponding value for the attenuation coefficient k.

Table 1. Estimated S/N ratios (dB) at shot-to OBS distances of 2 km, 5 km, 10 km and 20 km for water waves and body waves for the OBS units on Line 21 and Line 22. The estimated distances for which the signal levels equal the noise level are given in the last column.

LINE	OBS	S/N RATIOS(dB)				R(km)
		r=2 km	r=5 km	r=10 km	r=20 km	For S/N=1
			WATER WAVES			
21	1V	45.3	36.2	29.3	22.4	190
	2V	47.1	37.7	30.6	23.5	197
22	1V	58.9	50.2	43.7	37.1	1010
	2V	57.4	51.8	47.6	43.4	25200
	3V	53.8	46.1	40.3	34.4	1210
	4V	33.1	26.5	21.6	16.6	205
			BODY WAVES			
22	1R	61.6	44.3	31.2	18.2	52
	2R	38.5	28.5	21.0	13.4	69
	3R	56.2	37.1	22.7	8.2	30

On Line 22 the OBS units detected water-wave signals out to the maximum shot-to-OBS distance of about 75 km. The average S/N ratio measured at this range was 27.8 dB for the three good units on Line 22; for the two OBS units of Line 21 (which was actually only 48 km long), the extrapolated value at 75 km was 9.6 dB. The low S/N ratio value for OBS#4 of Line 22 was not included in the average for this line since the instrumental noise was abnormally high for that unit. The cause for the large difference between the S/N ratios for the two lines is that much more source energy was within the 10 to 31 Hz passband of the OBS for Line 22 than for Line 21. In addition the rate of the amplitude decrease with distance was less in the shallow water. Note from Fig. 5 that the energy peak is at 60 Hz for Line 21 (shot depth = 244 m) whereas it is at 28 Hz for Line 22 (shot depth = 91 m).

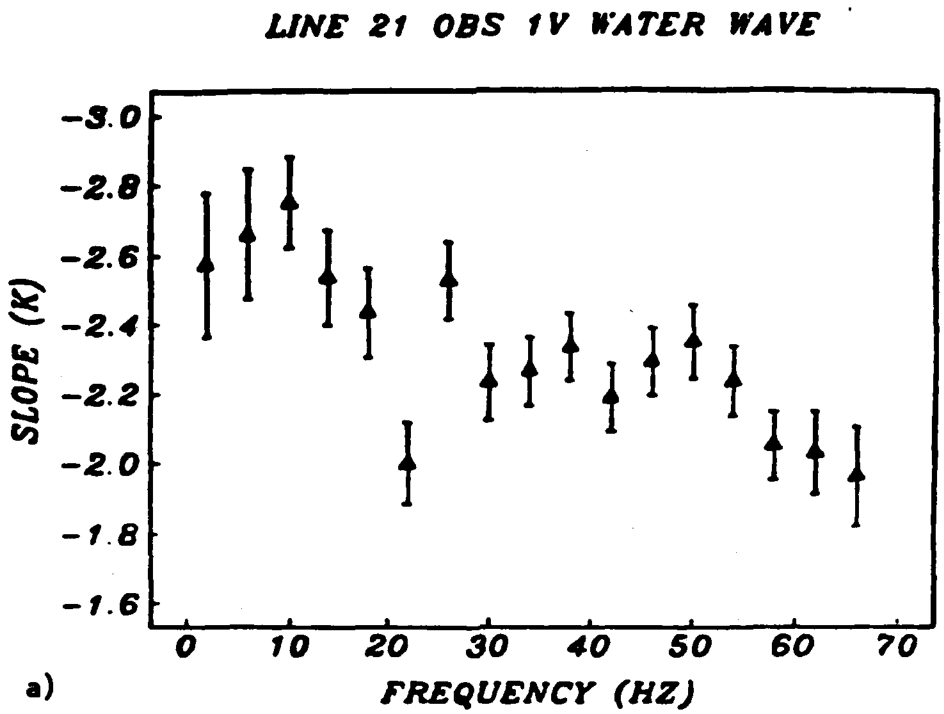
On Line 22, OBS#1, OBS#2 and OBS#3 detected body-wave signals out to distances of 14 km, 20 km and 17 km, respectively. The average S/N ratio for the three units at a distance of 15 km was 18.1 dB.

The distances listed in the last column in Table 1 are the extrapolated range values where the water-wave signal becomes as weak as the noise; the average values for these distances are about 200 km for Line 21 (deep SUS shots) and about 1100 km for OBS#1 and OBS#3 of Line 22 (shallower SUS shots). The large range predicted for OBS#2 of Line 22 is suspect since the attenuation factor k for that unit was markedly less than those of the other two good OBS units on the line, presumably because of instrumental noise. The corresponding distance for the body waves from Line 22 is about 50 km.

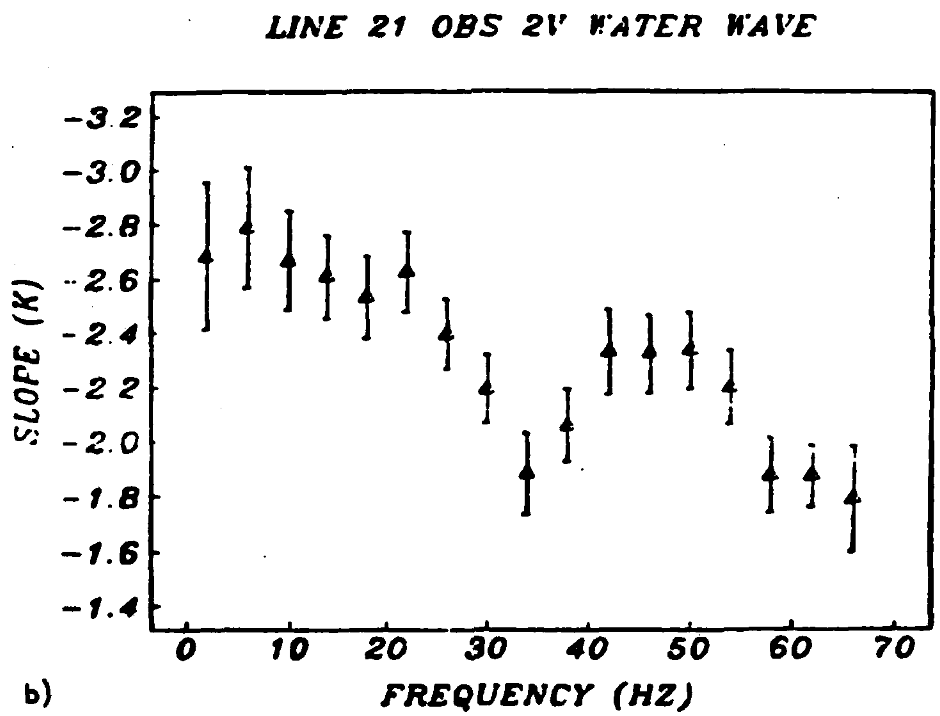
Frequency Spectra

All previous calculations concerning the signal and noise energy levels for various portions of the data traces have made use of the total energy at all frequencies. However, the various types of signals and noise had different spectral characteristics.

To evaluate the frequency dependence of the energy attenuation factor k, we analyzed the power spectra of the first 1.0-second of the water-wave and body-wave arrivals from both Line 21 and Line 22. We partitioned the frequencies from 0 to 68 Hz (the Nyquist frequency) into 17 4-Hz bands and determined the total integrated energy for each of these 4-Hz bands for each OBS. For each frequency band of each data record considered, log E was plotted vs. log r and the data fitted by least squares to find the slope k (attenuation factor). The values of k were plotted as functions of the frequency for the water-wave and body-wave data (Figs. 11-13). The apparent decrease in the absolute value of k for frequencies greater than about 30 Hz is probably an artifact of the instrumental response: the signal level was reduced by the alias filter while the instrumental noise continued to contaminate the data. The data in the passband of 10 to 31 Hz showed no consistent relationship between the attenuation coefficients k and the frequency.



a)



b)

Fig. 11. Frequency dependence of the water-wave attenuation factor k for a) OBS#1 and b) OBS#2 of Line 21. Vertical bars indicate ranges of one standard deviation.

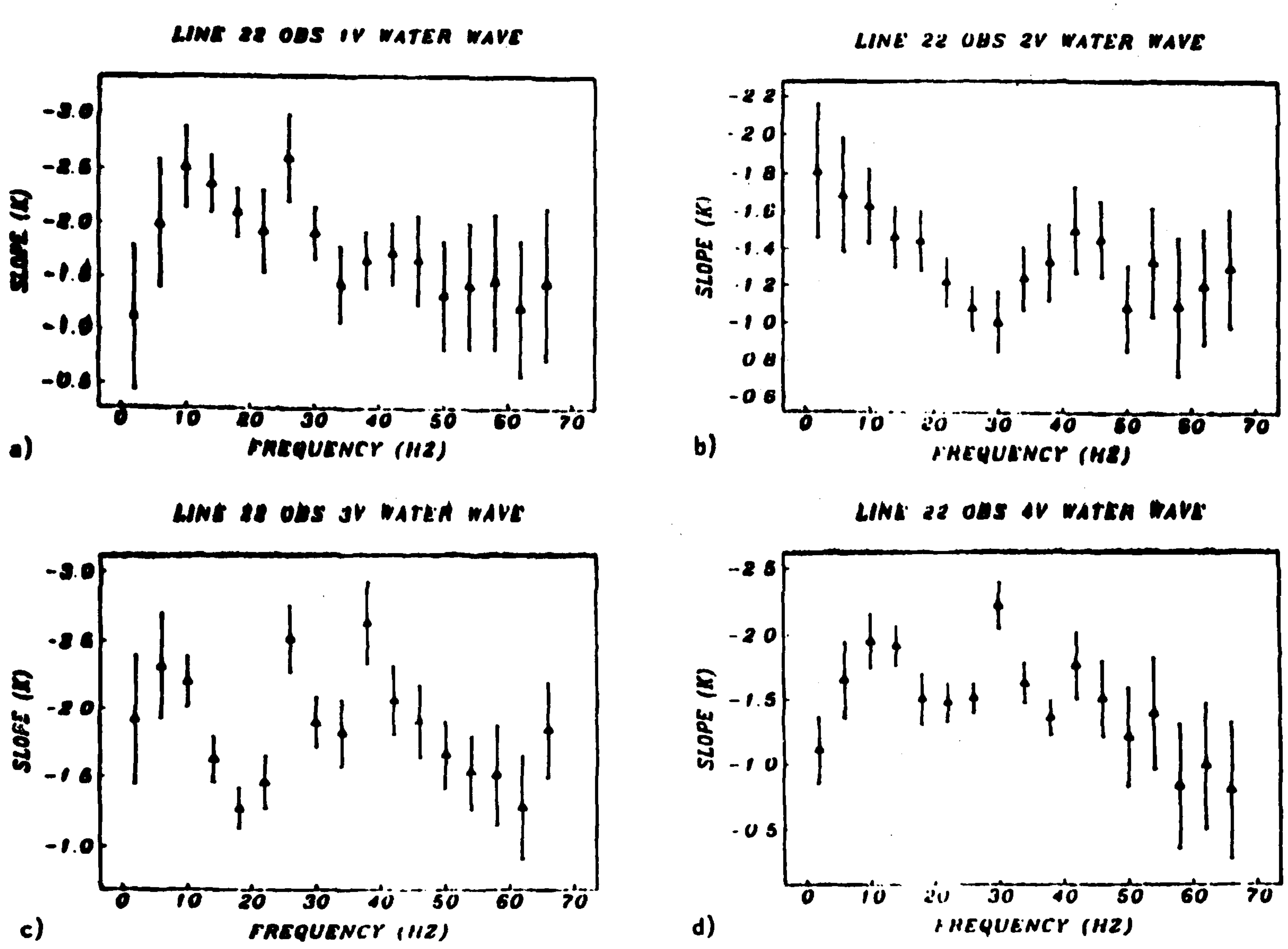


Fig. 12. Frequency dependence of the water-wave attenuation factor k for a) OBS#1, b) OBS#2, c) OBS#3 and d) OBS#4 of Line 22. Vertical bars indicate ranges of one standard deviation.

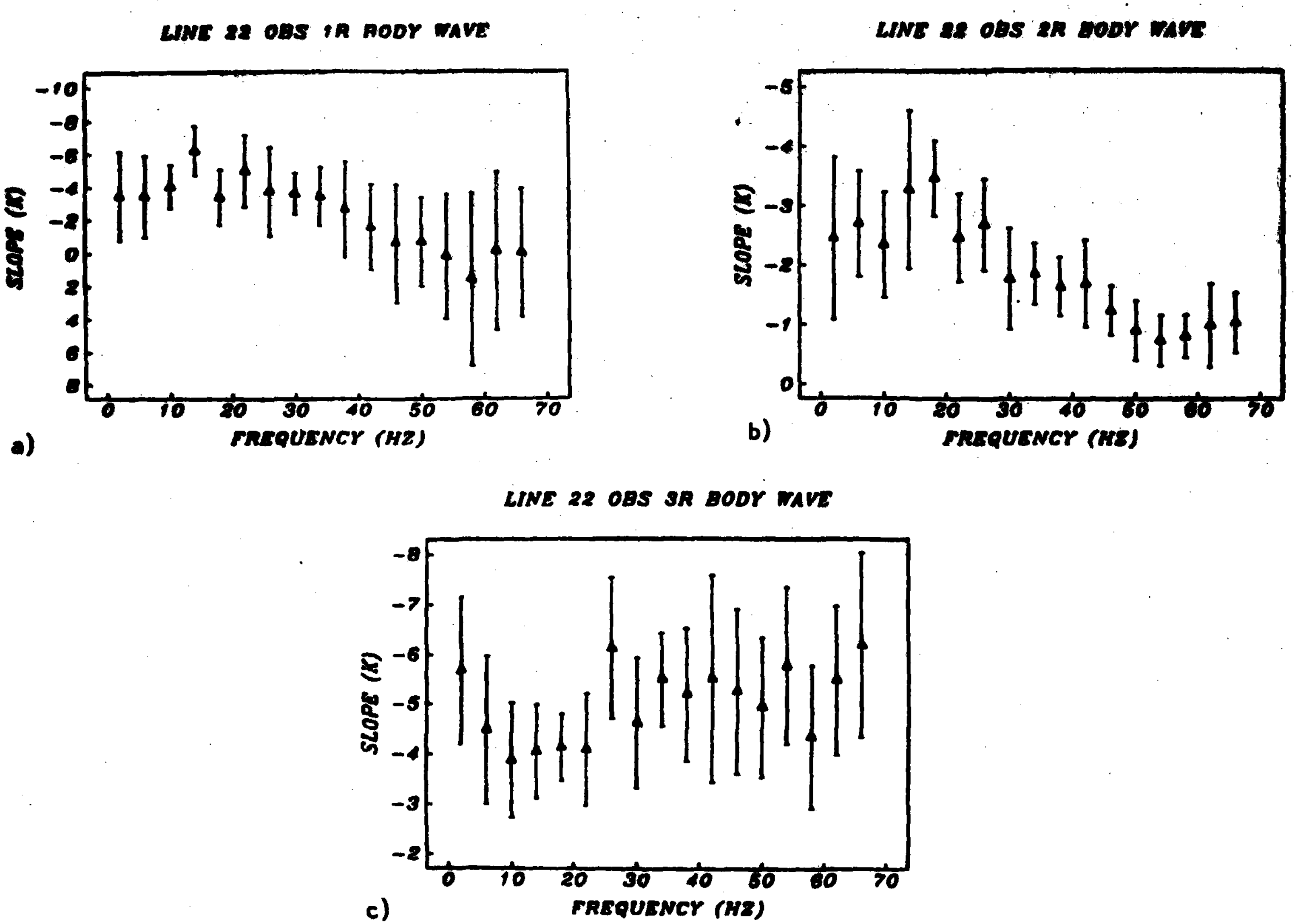


Fig. 13. Frequency dependence of the body-wave attenuation factor k for a) OBS#1, b) OBS#2 and c) OBS#3 of Line 22. Vertical bars indicate ranges of one standard deviation.

To evaluate the frequency dependence of the S/N ratios, we calculated the energy levels of the water-wave, body-wave and noise signals for shots in the 8 to 13 km distance range for each of the 17 frequency intervals defined above. There were between 6 and 11 traces in this range for the various OBS units. We then averaged the signal and noise power values in this range for each frequency interval and calculated S/N ratios for the signal of interest (Figs. 14-16). For both the water waves and body waves, these data generally had the largest S/N levels in the 10 to 30 Hz passband. For most of the water-wave signals, substantial S/N values persisted out to about 60 Hz in spite of the -24 dB/octave rolloff of the instrumental response above 31 Hz. The S/N ratios for body waves were generally smaller than the water-wave S/N ratios by several orders of magnitude (20 to 30 dB) for all frequencies, an effect due to the low energy output of the SUS charges at low frequencies and the strong attenuation within the earth of the higher-frequency components.

Generally, the noise spectra (Figs. 14-16) were nearly white despite the limited instrumental passband. Only OBS#2 on Line 21 showed a significant spectral peak corresponding to the instrumental response. Background noise on the ocean bottom in general increases with decreasing frequency (Asada and Shimamura, 1976; Latham and Sutton, 1966); therefore the observed noise below 10 Hz is likely to be due to true increases of ground noise. On the other hand, the noise above about 31 Hz is most likely to be due to inherent instrumental noise whose level is unaffected by the alias filter. It is this noise component which becomes an increasingly-dominant aspect of the S/N ratio for signals above 31 Hz and causes the apparant decrease in the absolute value of k in this band (Figs. 11-13). On Line 21 an additional peak in the S/N ratio (Fig. 14) is observed at about 40 Hz; this peak is due to the very strong high-frequency content of the water waves for the deep SUS shots.

We found that even though the body waves and water waves had somewhat characteristic spectra, there was nonetheless enough similarity in the 15 to 30 Hz range to make it impossible to design frequency filters that would significantly improve the detectability of the body waves on the seismic sections.

Geological Interpretation

Very little geological information is available for the areas around Line 21 and Line 22. Surrounding areas in the Mediterranean show (Stanley, 1977) the persistent presence of a refracting layer at 0.25 to 1.0 km depth with an average P-wave velocity around 3.5 km/sec, overlain by a group of acoustic refractors (generally stratified at the top and acoustically transparent at the bottom) with P-wave velocities varying from 1.7 to 2.8 km/sec. The 3.5 km/sec refracting layer is probably interbedded marine sediments and evaporites of late Miocene age, and the overlying material is probably clay and silty clay deposited from Pliocene to Recent times.

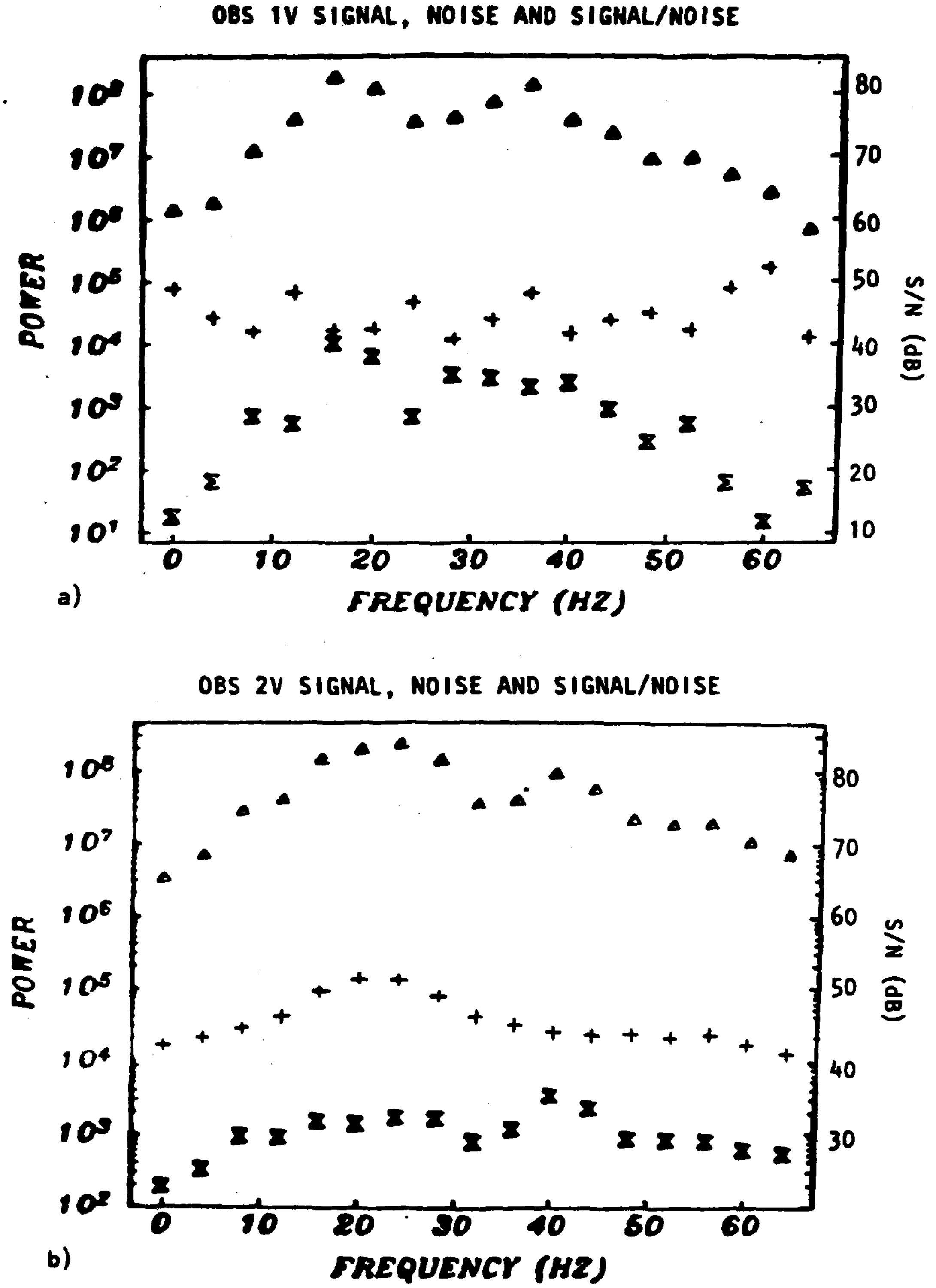


Fig. 14. Frequency dependence of the water-wave signal (▲) and noise (+) energy levels (left scale, arbitary units) and the S/N ratios (⧗) in dB for a) OBS#1 and b) OBS#2 of Line 21.

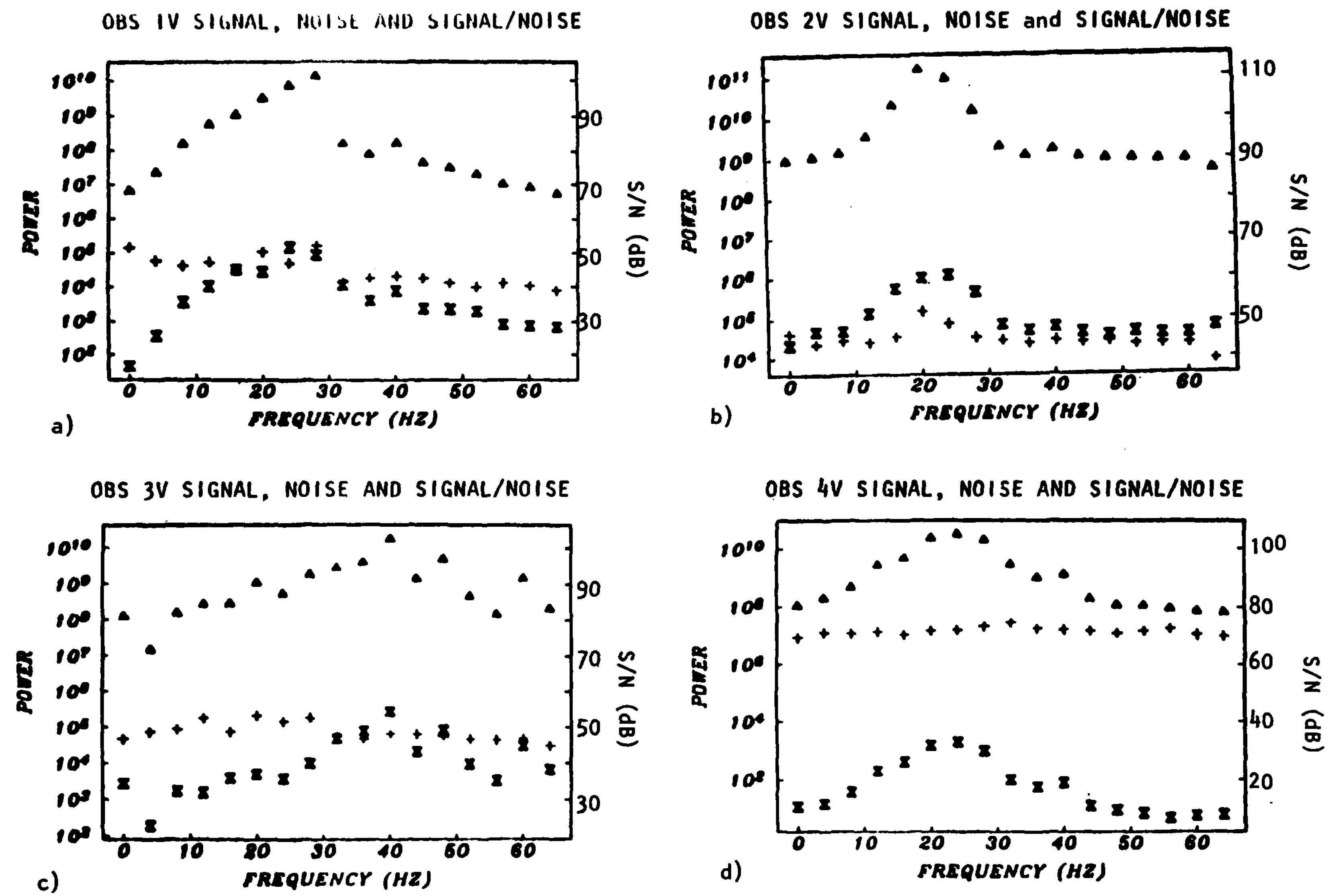


Fig. 15. Frequency dependence of the water-wave signal (▲) and noise (+) energy levels (left scale, arbitary units) and the S/N ratios (x) in dB for a) OBS#1, b) OBS#2, c) OBS#3 and d) OBS#4 of Line 22.

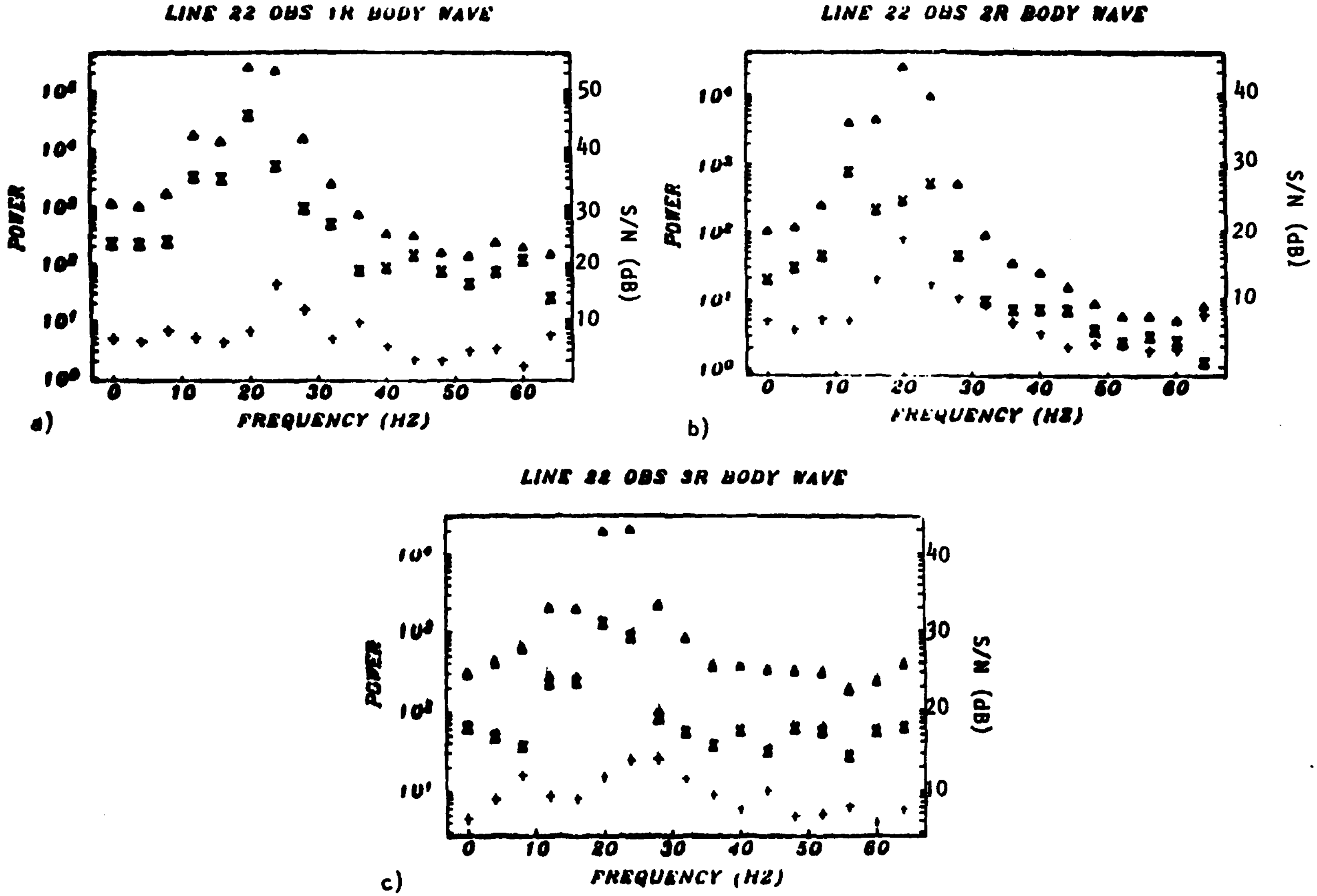


Fig. 16. Frequency dependence of the body-wave signal (▲) and noise (+) energy levels (left scale, arbitary units) and the S/N ratios (x) in dB for a) OBS#1, b) OBS#2 and c) OBS#3 of Line 22.

No body waves were detected in any OBS data from Line 21, while on Line 22 the data showed two groups of refracted waves with apparent group velocities around 3.8 km/sec and 2.5 km/sec. The travel-time data for all the body-wave arrivals are plotted versus distance in Fig. 17. Note that the 3.8 km/sec layer was seen in three of the OBS units but that the 2.5 km/sec layer was clearly present only in OBS#3.

We inverted the apparent velocities and intercepts that were determined from the body-wave travel-time curves for OBS#1 and OBS#3 of Line 22 using the assumption that the layers were homogeneous and flat, and we derived a model for the upper crustal structure that is shown in Fig. 18. These refractors correlate well with those layers discussed above.

CONCLUSIONS

This experiment involved the use of low-frequency ground-motion transducers (the velocity-sensitive geophones inside each OBS with a 10 to 31 Hz passband) mounted on the ocean floor to detect water-borne and earth-borne signals from two distinct high-frequency sound sources (SUS Mark 61 at 244m and SUS Mark 82 at 91 m). The primary conclusions are summarized below:

1. There was sufficient low-frequency energy released by the SUS charges to generate detectable water waves and body waves within the 10 to 31 Hz passband of the OBS units. Water waves were detected by all three geophones on all OBS units for both types of SUS. However body waves were detected only on the horizontal-geophone data and only for the SUS Mark 82 detonated at 91m. In particular:

   a. Acoustic signals were transmitted through the water column and detected by the OBS units to distances of over 75 km.

   b. At 75 km distance the average water-wave S/N ratio was 10 dB (estimated) for deep SUS shots and was 28 dB (observed) for shallower SUS shots.

   c. The maximum distance for detecting refracted body waves for Line 22 ranged from 14 to 20 km.

   d. The average S/N ratio at 15 km for the body wave signals was 18 dB for Line 22.

2. The attenuation of the water waves and body waves detected by the OBS units varied in a regular (but different) fashion with distance for the two water depth regimes. In particular:

   a. For water waves, the values for the energy attenuation factor k indicated that in deep water the loss was due primarily to spherical divergence and that in shallower water the loss was due to a combination of cylindrical and spherical divergence.

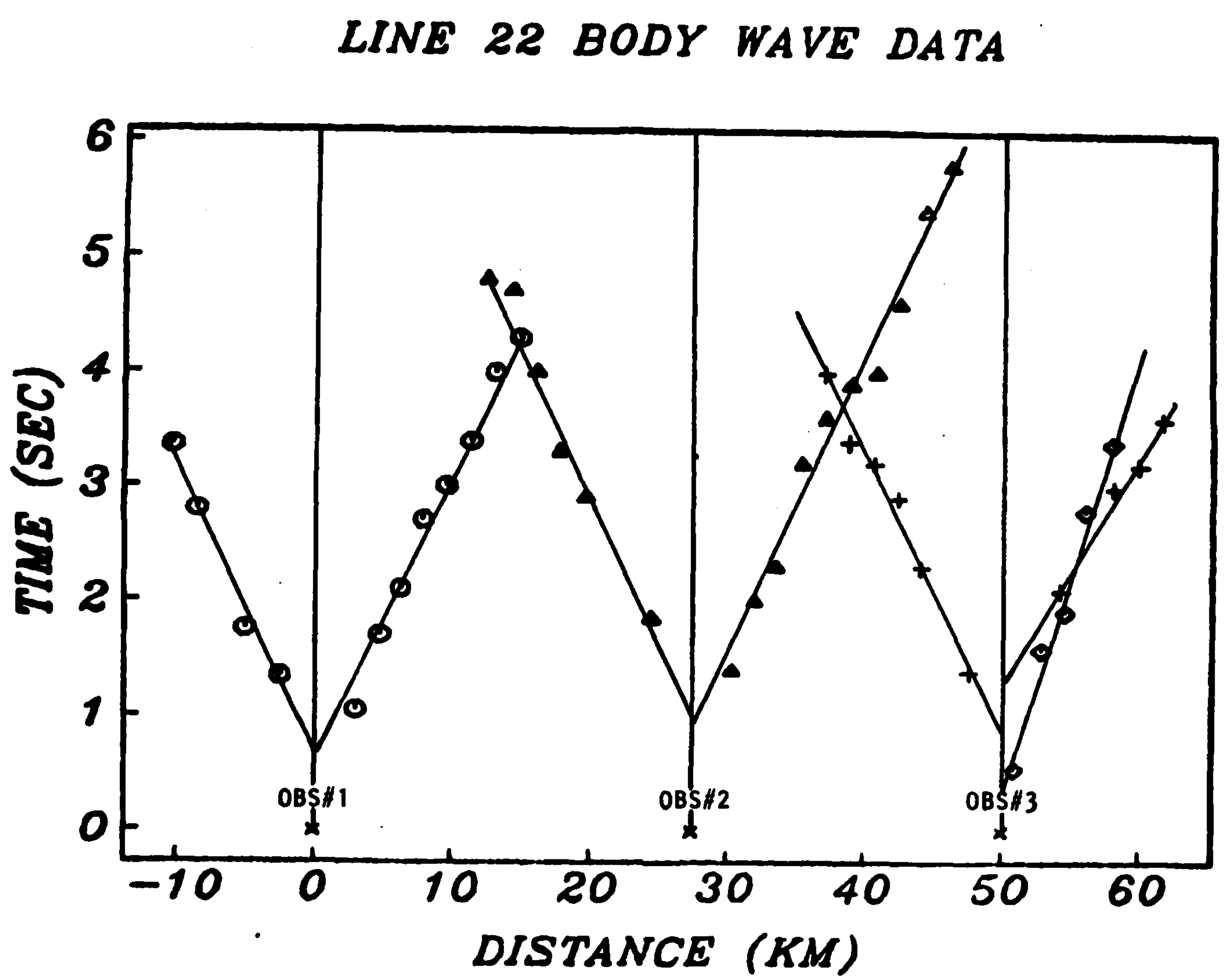


Fig. 17. Travel-time data for the body-wave arrivals from Line 22.

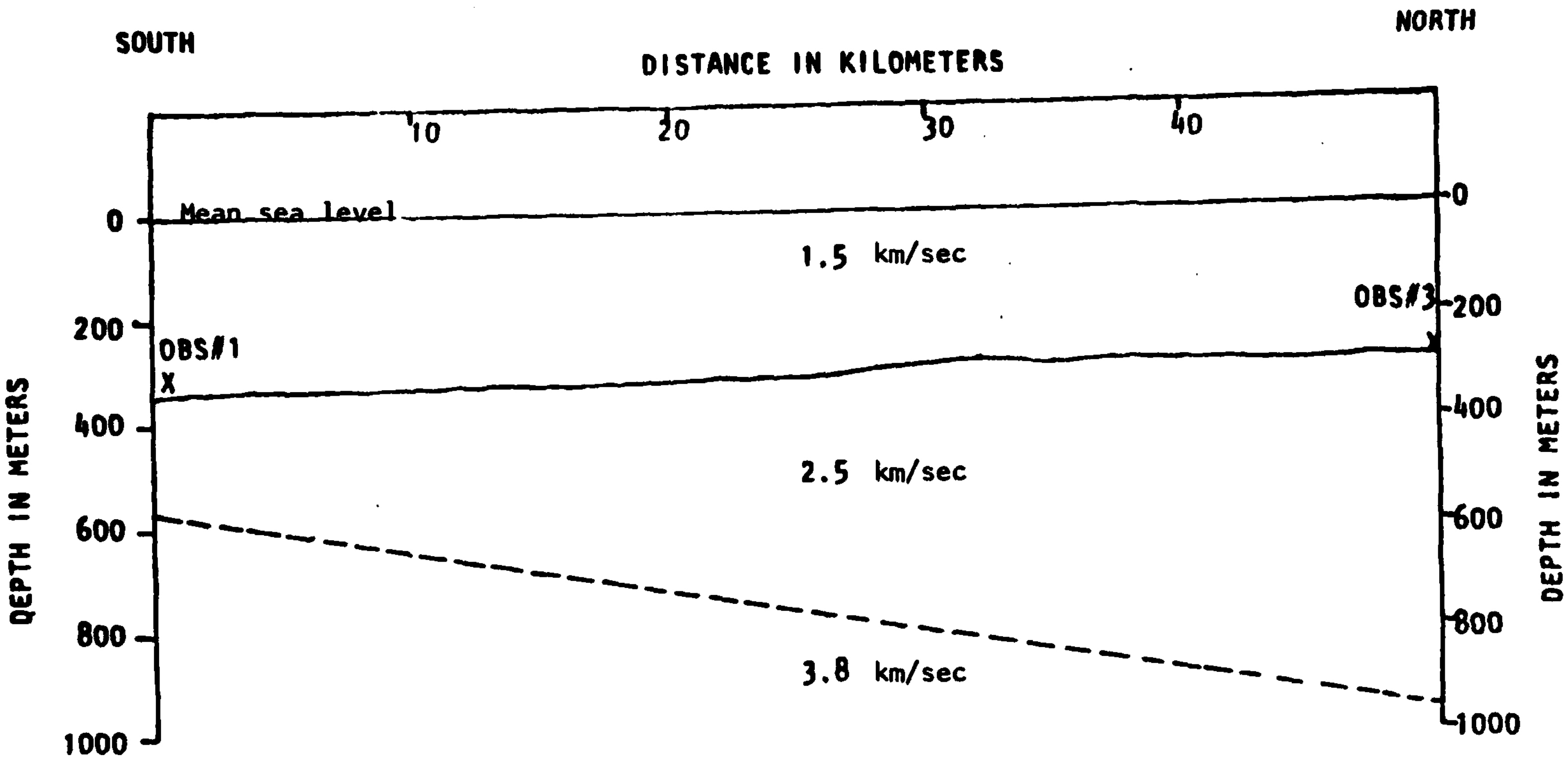


Fig. 18. Crustal model for Line 22 derived from OBS#1 and OBS#3 body-wave data.

b. The attenuation factors k were much larger for the body waves than for the water waves, an effect due to the greater diversity of signal-loss mechanisms in the solid and semisolid earth.

3. For water waves the variation of the attenuation factor k with frequency displayed no consistent pattern. In particular, there was no evidence for an increase in k with increasing frequency between 0 and 68 Hz.

4. The geological interpretation of the refraction data for the region near Line 21 suggests the presence of a layer with P-wave velocity of 3.8 km/sec at 0.6 km depth at OBS#1 and at 1.0 km depth at OBS#3. Data from OBS#3 indicate that the 3.8 km/sec layer is overlain by a layer with P-wave velocity of 2.5 km/sec.

RECOMMENDATIONS

In light of the finding that OBS units detected water waves and body waves from high-frequency SUS charges, it is important that future investigators using these types of equipment carefully specify their objectives and modify the equipment and field procedures accordingly. In this experiment the instrumental response of the OBS was not designed to take advantage of the spectral characteristics of the sound source, and the sound sources generated very little energy at the 3 to 15 Hz frequencies that travel substantial distances through the earth. Therefore the following factors should be considered:

1. If the objective is to study high-frequency propagation, then the sampling rate of the OBS should be increased so that the Nyquist frequency is well above the frequency range of interest. In this case deep SUS shots should be used, and they should be fired as densely as possible. Waterguns might be considered as possible sound sources.

2. If the objective is to study low-frequency propagation, then either the SUS shots should be detonated much closer to the sea surface and as densely as possible, or else a more appropriate source should be used. We have had considerable success using large explosives detonated at a depth of one-fourth the wavelength of the bubble frequency and have recorded strong body-wave signals with the OBS at ranges up to 100 km. Airguns are an alternate source; we have used the large low-frequency twin 2000 PSI (13.8 MPa) 2000 cubic inch (33 liter) airguns on the UTIG vessel R/V Fred Moore and have recorded body-wave arrivals on the OBS units to distances of over 65 km. The use of airguns permits shot spacings of less than 100 m (in contrast to the 0.9 km and 1.7 km spacing of these experiments) which makes it possible to use tau-P and other slant-stacking procedures in processing the data. We have found that the closely-spaced airgun shots enable us to resolve the structure of the near-surface sediment layer in greater detail than was possible using explosives.

Acknowledgments

We would like to recognize the captain and crew of the USNS Wilkes for their efficient and cordial handling of all ship-related details and to give credit to Roger Merrifield for skillfully coordinating the many scientific phases of the survey. Paul L. Donoho designed the OBS, and he and Paul M. McPherson were responsible for the successful operation of the units. We thank Yosio Nakamura for his many helpful suggestions in preparing this report and also thank Cliff Frohlich and Dale Sawyer for reading the manuscript and offering constructive comments.

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APPENDIX A

OBS LOCATIONS AND DEPTHS

LINE 21

	LATITUDE	LONGITUDE	WATER DEPTH(m)
OBS #1	36°13.4'N	12°51.6'E	910
OBS #2	36°23.2'N	12°41.0'E	1275
OBS #3	36°32.4'N	12°30.0'E	1300

LINE 22

	LATITUDE	LONGITUDE	WATER DEPTH(m)
OBS #1	34°19.0'N	14°12.0'E	337
OBS #2	34°33.8'N	14°12.0'E	305
OBS #3	34°46.0'N	14°12.3'E	390
OBS #4	35°01.1'N	14°13.0'E	465

Line 21 Shot Coordinates and Distances to OBS Units

SHOT NO.	LATITUDE north	LONGITUDE east	DISTANCE, km, TO OBS #1	OBS #2	OBS #3
1	(none)				
2	36 31.35	12 32.60	43.70	19.61	4.34
3	36 31.05	12 33.05	42.84	18.76	5.19
4	36 30.65	12 33.50	41.84	17.76	6.15
5	36 30.35	12 34.00	40.94	16.86	7.07
6	36 30.05	12 34.45	40.08	16.01	7.94
7	36 29.65	12 34.90	39.08	15.01	8.91
8	36 29.35	12 35.35	38.22	14.17	9.78
9	36 29.05	12 35.85	37.32	13.28	10.71
10	36 28.65	12 36.30	36.32	12.29	11.69
11	36 28.35	12 36.75	35.47	11.45	12.56
12	36 28.05	12 37.25	34.57	10.58	13.49
13	36 27.70	12 37.70	33.64	9.67	14.41
14	36 27.35	12 38.15	32.72	8.78	15.34
15	36 27.05	12 38.60	31.87	7.97	16.21
16	36 26.65	12 39.10	30.83	6.98	17.26
17	36 26.25	12 39.55	29.83	6.04	18.24
18	36 25.95	12 40.00	28.98	5.30	19.11
19	36 25.55	12 40.40	28.03	4.44	20.04
20	36 25.15	12 40.80	27.08	3.62	20.98
21	36 24.85	12 41.15	26.33	3.06	21.73
22	36 24.45	12 41.55	25.38	2.45	22.67
23	36 24.05	12 41.95	24.43	2.12	23.60
24	36 23.75	12 42.35	23.62	2.26	24.42
25	36 23.35	12 42.75	22.67	2.63	25.36
26	36 23.00	12 43.15	21.80	3.24	26.23
27	36 22.65	12 43.55	20.93	3.95	27.11
28	36 22.25	12 43.95	19.98	4.75	28.05
29	36 21.90	12 44.35	19.10	5.56	28.93
30	36 21.55	12 44.75	18.23	6.39	29.81
31	36 21.15	12 45.15	17.28	7.27	30.75
32	36 20.80	12 45.55	16.41	8.12	31.63
33	36 20.45	12 45.95	15.54	8.98	32.50
34	36 20.05	12 46.35	14.60	9.90	33.45
35	36 19.65	12 46.75	13.65	10.82	34.39
36	36 19.30	12 47.15	12.79	11.69	35.27
37	36 18.95	12 47.55	11.92	12.56	36.15
38	36 18.55	12 47.95	10.98	13.49	37.09
39	36 18.15	12 48.35	10.04	14.43	38.04
40	36 17.80	12 48.75	9.19	15.30	38.92
41	36 17.45	12 49.15	8.34	16.18	39.80
42	36 17.05	12 49.55	7.42	17.12	40.74
43	36 16.65	12 49.95	6.50	18.06	41.69
44	36 16.30	12 50.35	5.68	18.94	42.57
45	36 15.95	12 50.75	4.89	19.82	43.45
46	36 15.55	12 51.15	4.03	20.76	44.40
47	36 15.25	12 51.55	3.42	21.57	45.21
48	36 14.95	12 51.90	2.90	22.34	45.98
49	36 14.55	12 52.25	2.34	23.23	46.87
50	36 14.25	12 52.65	2.22	24.04	47.68
51	36 13.95	12 53.05	2.40	24.86	48.50
52	36 13.55	12 53.45	2.79	25.80	49.45
53	36 13.20	12 53.85	3.39	26.68	50.33
54	36 12.85	12 54.25	4.10	27.56	51.21
55	36 12.45	12 54.65	4.90	28.51	52.16
56	36 12.05	12 55.05	5.74	29.46	53.11
57	36 11.65	12 55.50	6.68	30.46	54.11
58	36 11.30	12 55.90	7.52	31.34	54.99

Line 22 Shot Coordinates and Distances to OBS Units

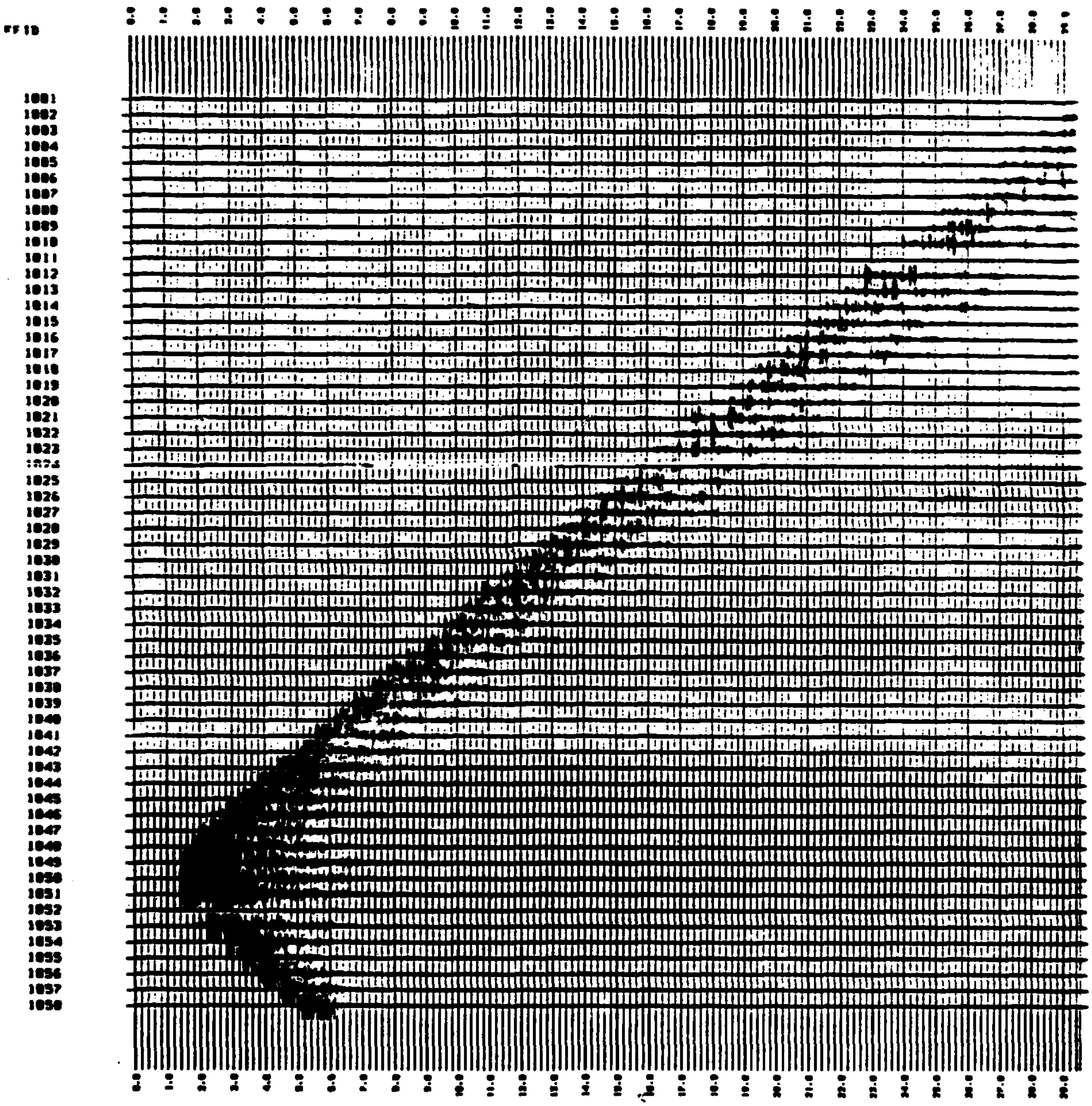
SHOT NO.	LATITUDE north	LONGITUDE east	DISTANCE, km, TO OBS #1	OBS #2	OBS #3	OBS #4
1	(none)					
2	(none)					
3	35 0.50	14 14.00	76.79	49.46	26.94	1.88
4	34 59.40	14 13.90	74.75	47.42	24.90	3.43
5	34 58.40	14 13.80	72.90	45.57	23.04	5.14
6	34 57.30	14 13.80	70.87	43.54	21.02	7.13
7	34 56.30	14 13.70	69.01	41.68	19.16	8.94
8	34 55.20	14 13.60	66.97	39.64	17.13	10.95
9	34 54.30	14 13.50	65.31	37.97	15.45	12.60
10	34 53.30	14 13.40	63.45	36.12	13.60	14.43
11	34 52.40	14 13.30	61.78	34.45	11.93	16.09
12	34 51.50	14 13.20	60.12	32.78	10.26	17.75
13	34 50.50	14 13.10	58.26	30.92	8.41	19.60
14	34 49.60	14 13.00	56.60	29.25	6.74	21.26
15	34 48.60	14 12.90	54.74	27.40	4.89	23.11
16	34 47.70	14 12.80	53.08	25.73	3.23	24.78
17	34 46.70	14 12.70	51.22	23.87	1.43	26.63
18	34 45.80	14 12.60	49.56	22.21	0.59	28.30
19	34 44.80	14 12.50	47.71	20.35	2.24	30.15
20	34 43.90	14 12.50	46.04	18.69	3.89	31.81
21	34 42.90	14 12.50	44.19	16.84	5.74	33.66
22	34 41.90	14 12.40	42.34	14.99	7.58	35.51
23	34 41.00	14 12.40	40.68	13.33	9.25	37.18
24	34 40.00	14 12.30	38.83	11.47	11.09	39.03
25	34 39.10	14 12.30	37.16	9.81	12.76	40.69
26	34 38.10	14 12.20	35.31	7.96	14.61	42.54
27	34 37.10	14 12.20	33.47	6.11	16.46	44.39
28	34 36.20	14 12.10	31.80	4.44	18.12	46.06
29	34 35.20	14 12.10	29.95	2.59	19.97	47.91
30	34 34.30	14 12.00	28.29	0.92	21.64	49.58
31	34 33.40	14 12.00	26.62	0.74	23.30	51.24
32	34 32.40	14 12.00	24.77	2.59	25.15	53.09
33	34 31.50	14 12.10	23.11	4.25	26.81	54.75
34	34 30.50	14 12.10	21.26	6.10	28.66	56.59
35	34 29.60	14 12.10	19.60	7.77	30.32	58.26
36	34 28.60	14 12.10	17.75	9.62	32.17	60.11
37	34 27.70	14 12.20	16.09	11.28	33.84	61.77
38	34 26.70	14 12.20	14.24	13.13	35.68	63.61
39	34 25.80	14 12.20	12.58	14.79	37.35	65.28
40	34 24.80	14 12.30	10.73	16.63	39.20	67.12
41	34 23.90	14 12.30	9.07	18.31	40.86	68.79
42	34 22.90	14 12.30	7.22	20.16	42.71	70.64
43	34 21.90	14 12.40	5.40	22.01	44.56	72.48
44	34 20.90	14 12.40	3.57	23.86	46.41	74.33
45	34 19.90	14 12.40	1.77	25.71	48.26	76.18
46	34 18.90	14 12.40	0.64	27.53	50.10	78.03
47	34 17.90	14 12.50	2.17	29.41	51.95	79.88
48	34 16.90	14 12.50	3.96	31.25	53.80	81.73
49	34 15.90	14 12.50	5.78	33.10	55.65	83.57
50	34 14.90	14 12.60	7.64	34.95	57.50	85.42
51	34 13.90	14 12.60	9.47	36.80	59.35	87.27
52	34 12.90	14 12.60	11.32	38.65	61.20	89.12
53	34 11.90	14 12.60	13.16	40.50	63.05	90.97
54	34 10.90	14 12.70	15.01	42.35	64.90	92.81
55	34 10.00	14 12.70	16.67	44.01	66.56	94.48

APPENDIX B Seismic Record Sections

This appendix contains a complete set of seismic record sections in three parts:

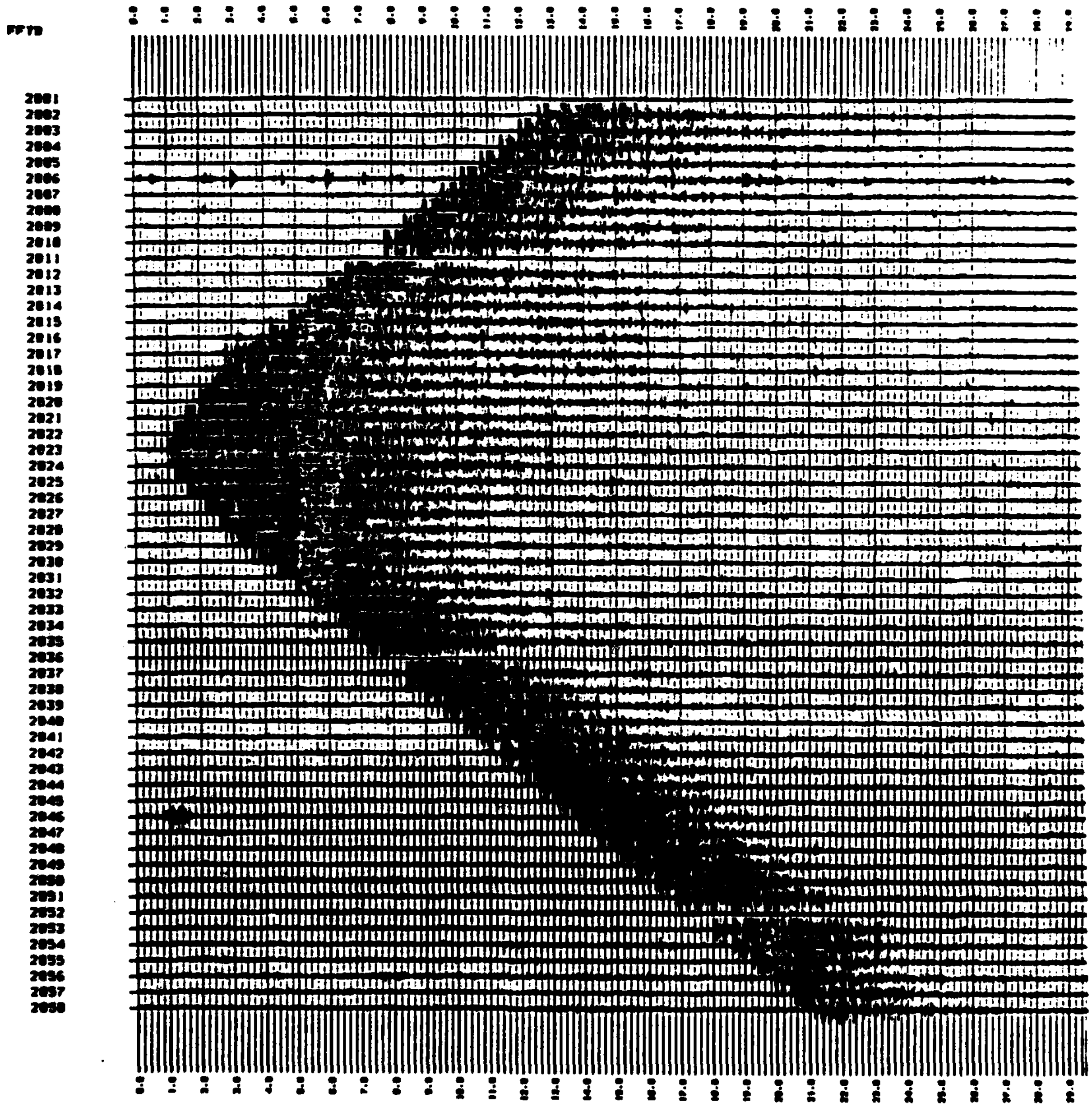
On each figure, the boxes on top and bottom contain the line number (21 or 22), OBS number, and component (vertical, horizontal-1, horizontal-2, radial or transverse). The last two digits of the four digit numbers on the left margin represent the shot number as listed in Appendix A. The time, given at the top and the bottom in seconds, increases from left to right.

PROJECT : SICILY	SICILY 21 OBS# 1 VERTICAL (RAW DATA)	LINE	1
	22-APR-1983 18:15:23.17	JOB NO.	7962
POLARITY NORMAL - POSITIVE	DATA(49997 MILLS 07.344)	PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. =	0.3142E+03



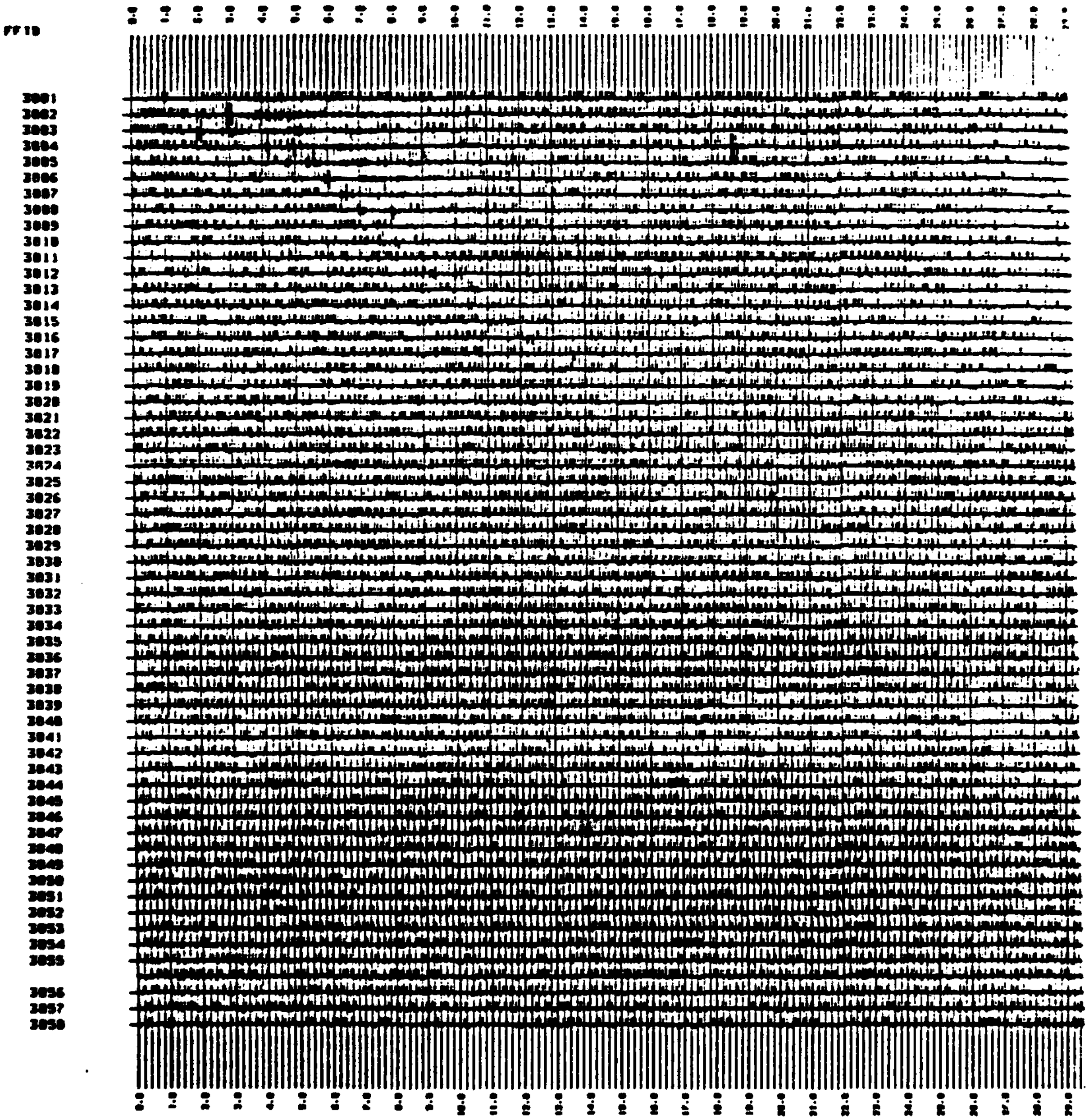
PROJECT : SICILY SICILY 21 OBS# 1 VERTICAL (RAW DATA) LINE 1
22-APR-1983 18:15:23.17 JOB NO. 7962
POLARITY NORMAL - POSITIVE DATA(49997 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.3142E+03

PROJECT : SICILY	SICILY 2) OBS# 2 VERTICAL (RAW DATA)	LINE 1
	27-APR-1983 10:10:16.27	JOB NO. 7964
POLARITY NORMAL - POSITIVE	DATA(49997 MILLS 07.344)	PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. = 0.0920E+02



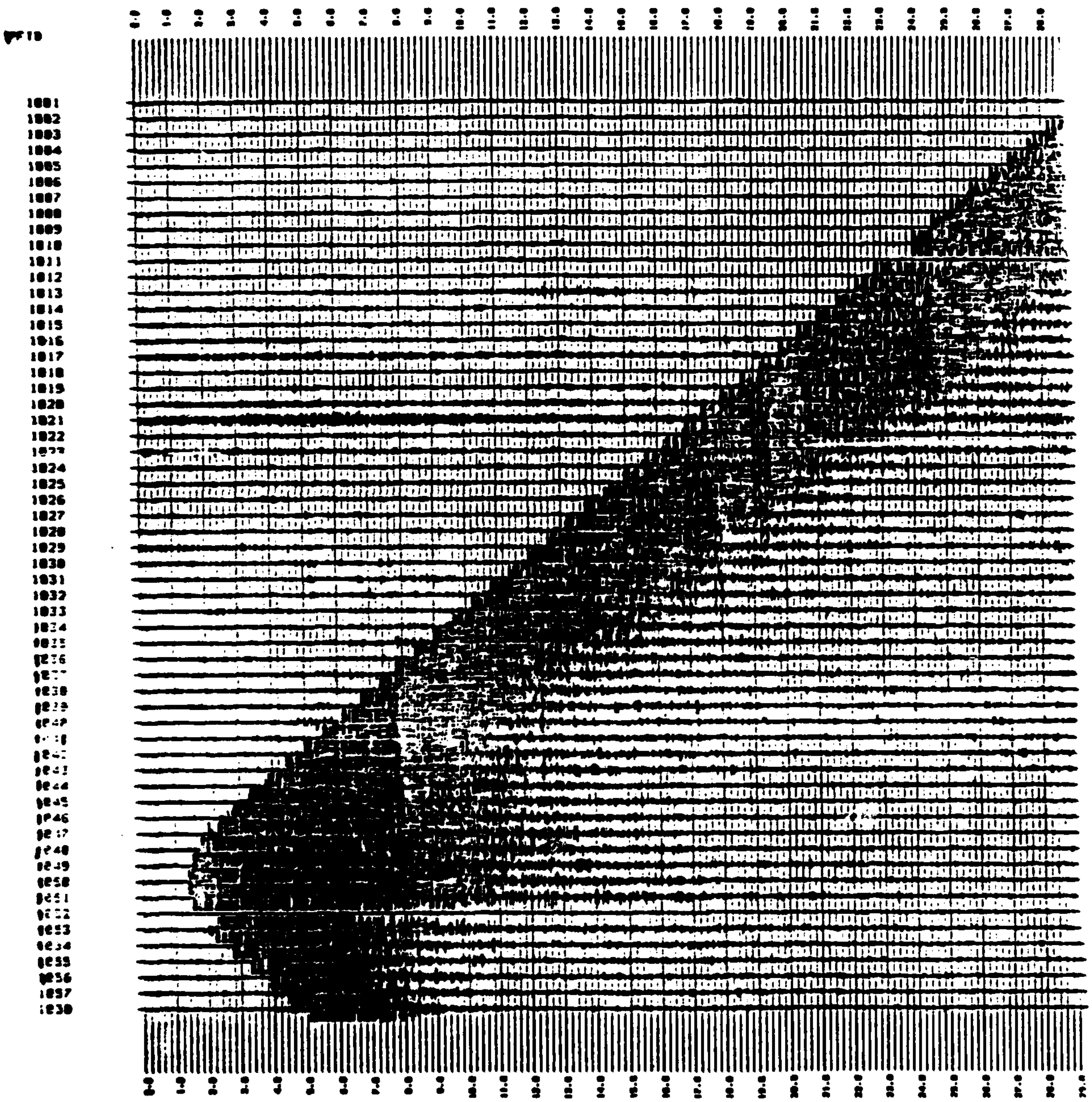
PROJECT : SICILY SICILY 2) OBS# 2 VERTICAL (RAW DATA) LINE 1
27-APR-1983 10:10:16.27 JOB NO. 7964
POLARITY NORMAL - POSITIVE DATA(49997 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.0920E+02

PROJECT : SICILY   SICILY 21 OBS# 3 VERTICAL (RAW DATA).   LINE 1
22-APR-1983 10:21:05.60   JOB NO. 7968
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.1150E+04



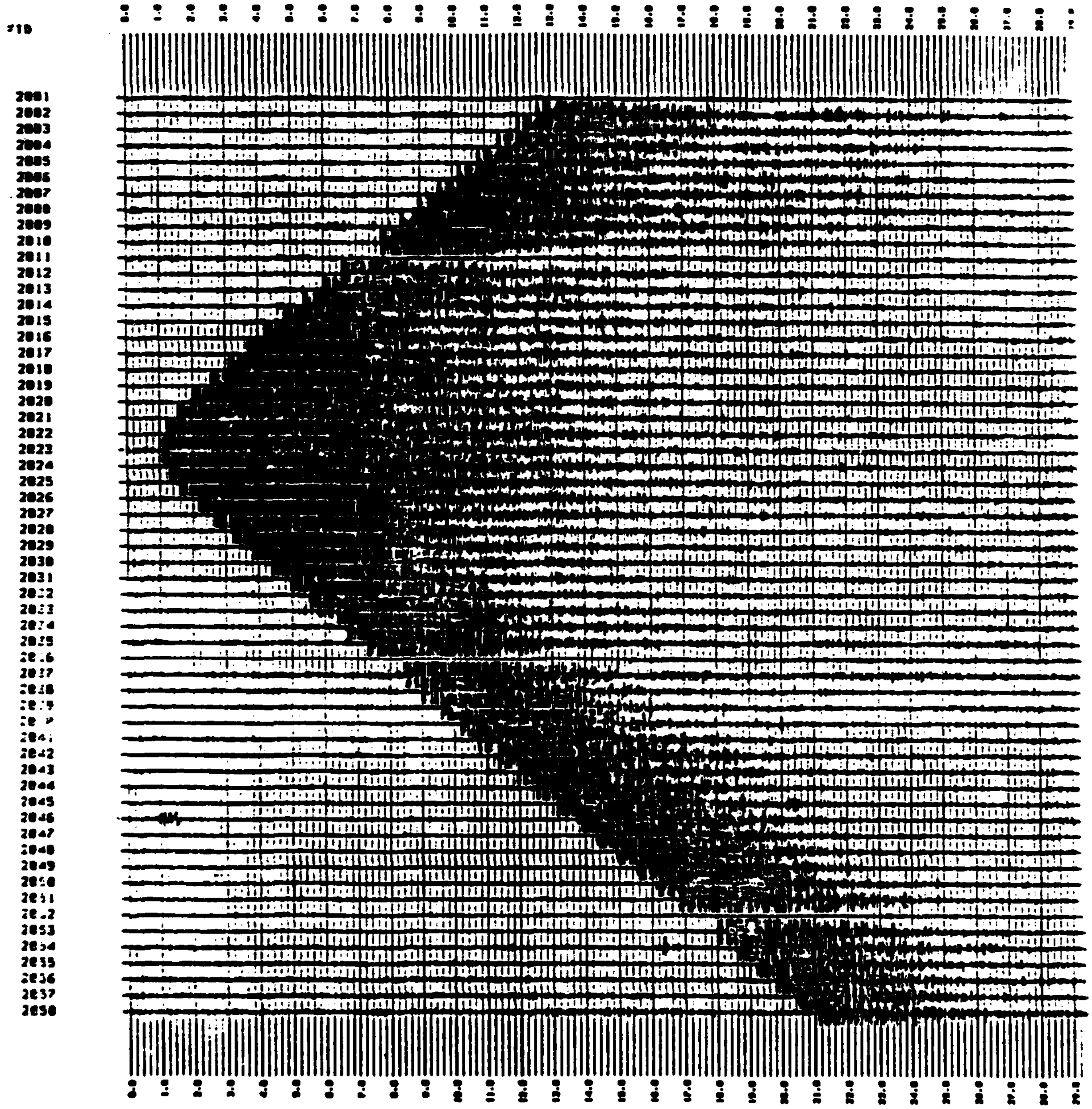
PROJECT : SICILY   SICILY 21 OBS# 3 VERTICAL (RAW DATA)   LINE 1
22-APR-1983 10:21:05.60   JOB NO. 7968
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.1150E+04

PROJECT : SICILY   SICILY 21 OBS# 1   H1   (RAW DATA)   LINE 1
22-APR-1983 14:44:00.39   JOB NO. 0037
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1350E+03



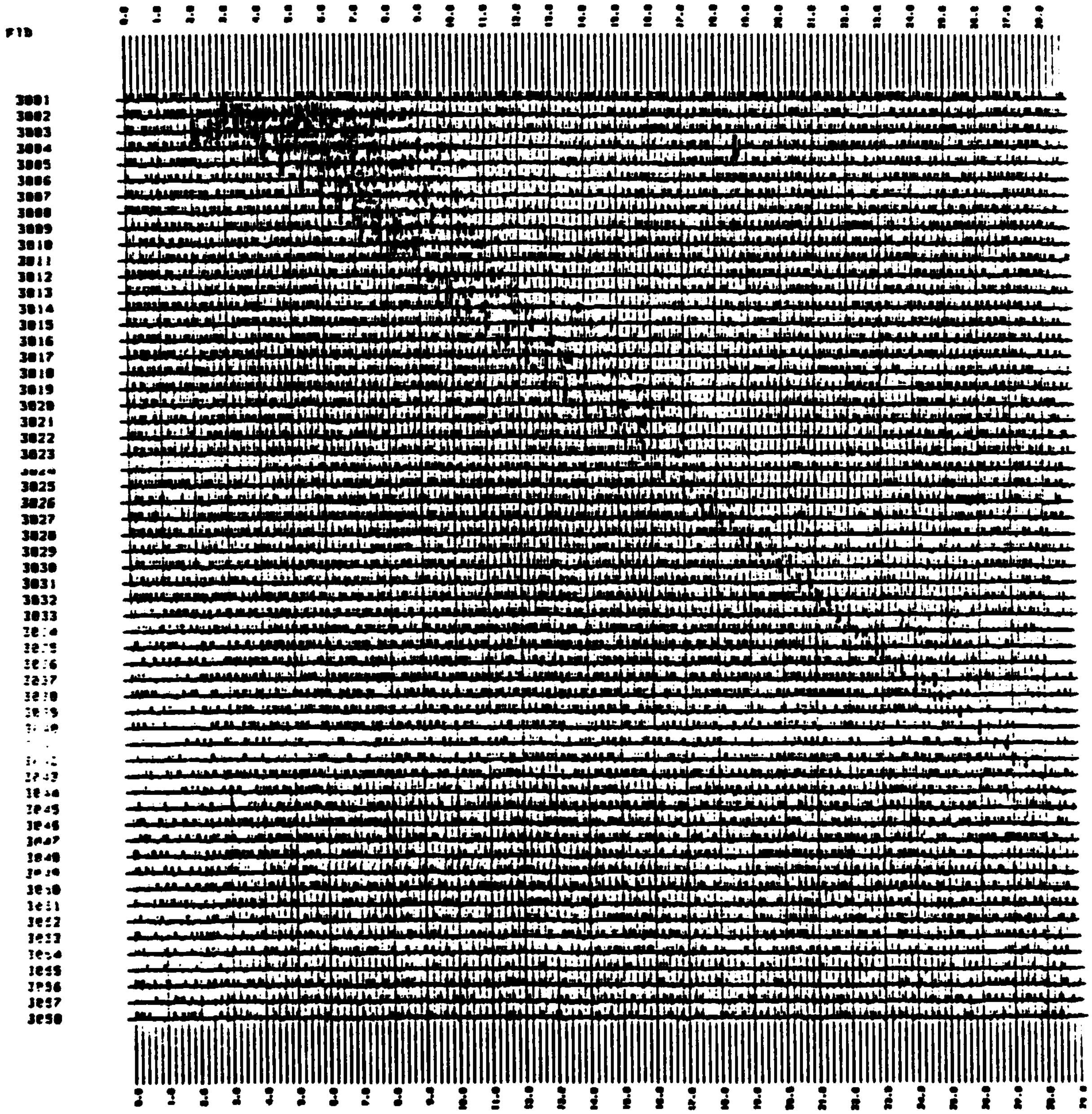
PROJECT : SICILY   SICILY 21 OBS# 1   H1   (RAW DATA)   LINE 1
22-APR-1983 14:44:00.39   JOB NO. 0037
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1350E+03

PROJECT : SICILY   SICILY 21 OBS# 2 H1   (RAW DATA)   LINE 1
22-APR-1983 14:46:58.28   JOB NO. 0038
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1782E+03



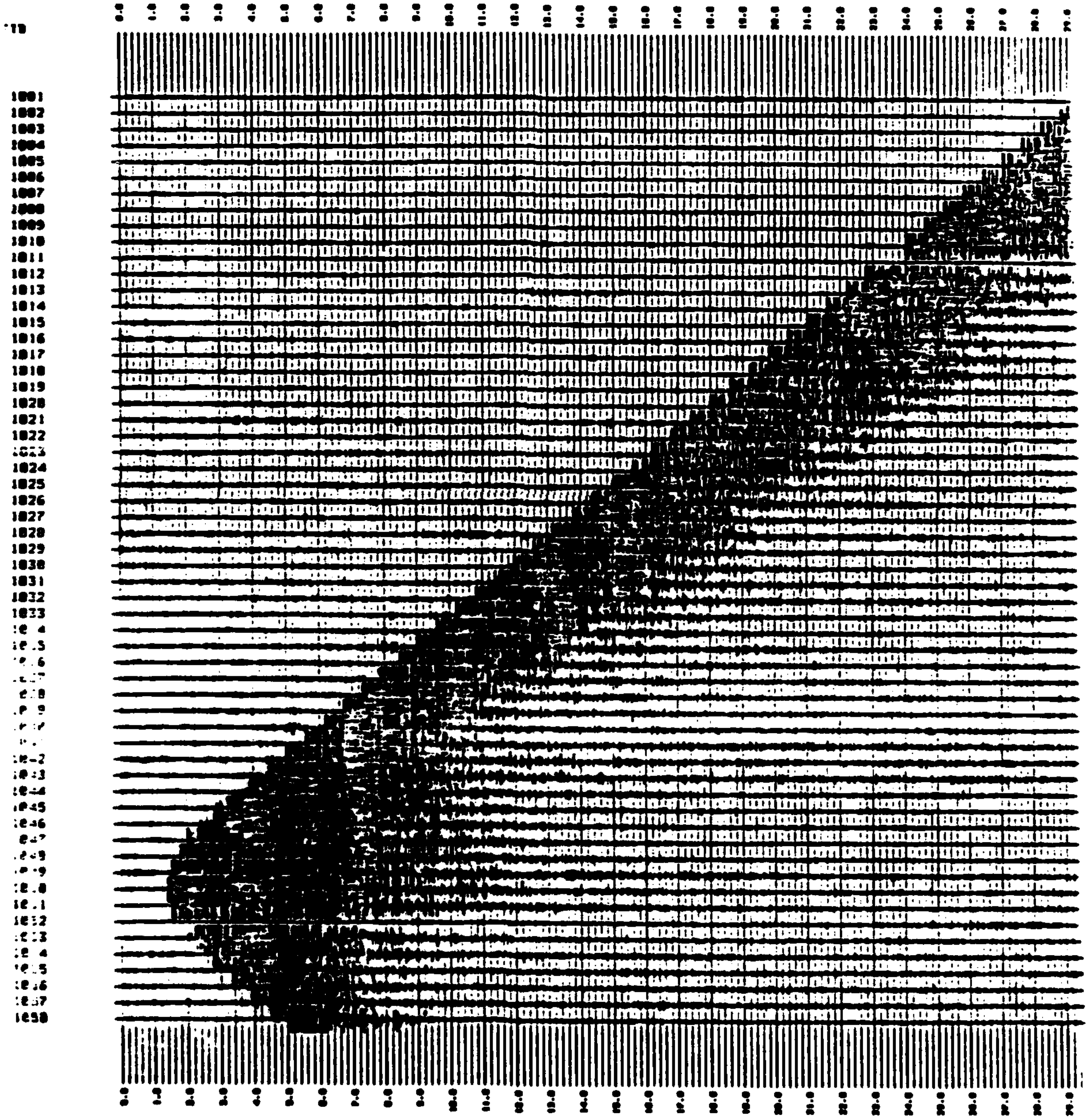
PROJECT : SICILY   SICILY 21 OBS# 2 H1   (RAW DATA)   LINE 1
22-APR-1983 14:46:58.28   JOB NO. 0038
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1782E+03

PROJECT : SICILY   SICILY 21 OBS# 3 H1 (RAW DATA)   LINE 1
22-APR-1983 14:49:52.14   JOB NO. 0040
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1256E+04



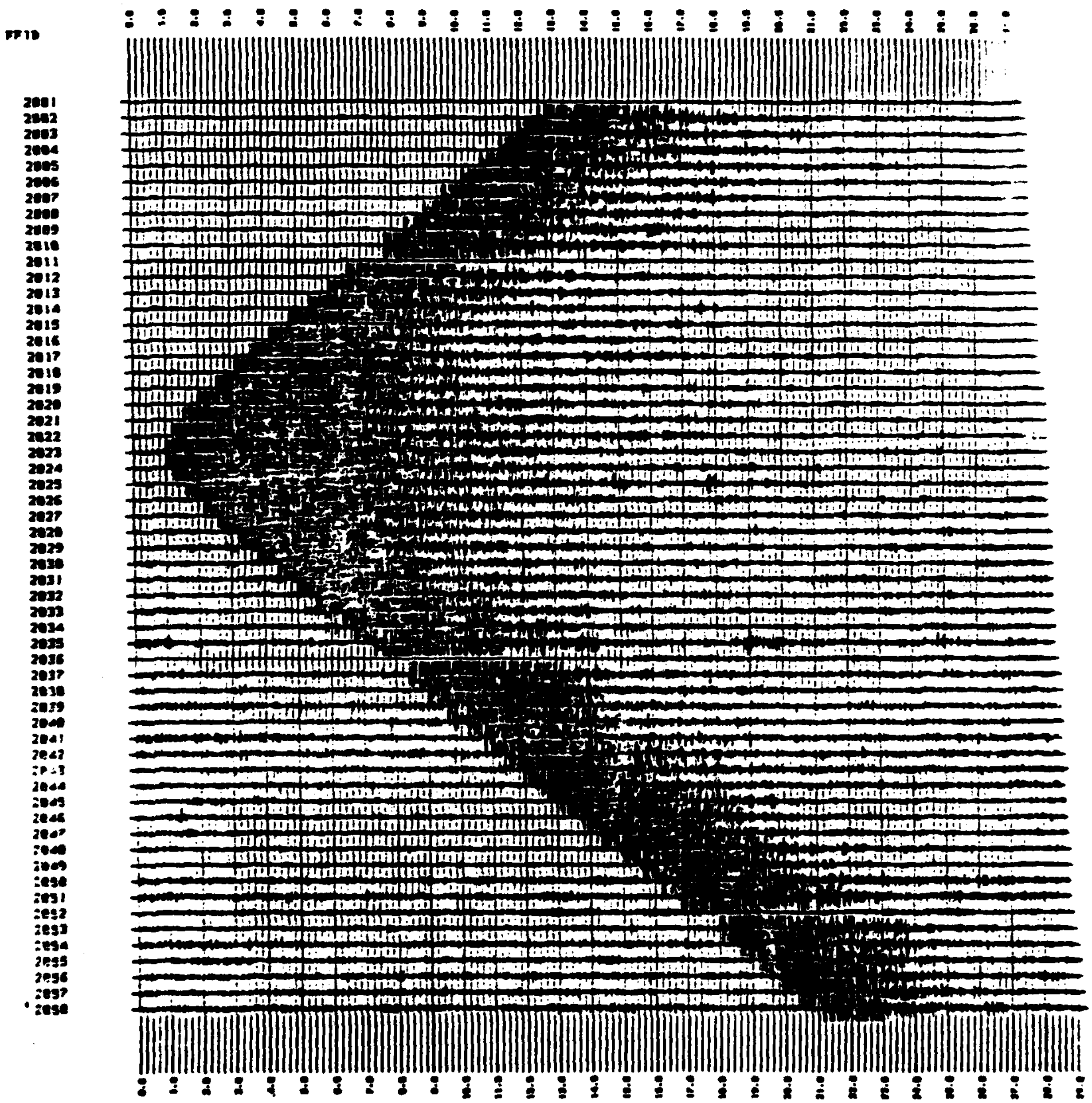
PROJECT : SICILY   SICILY 21 OBS# 3 H1 (RAW DATA)   LINE 1
22-APR-1983 14:49:52.14   JOB NO. 0040
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1256E+04

PROJECT : SICILY   SICILY 21 OBS# 1   H2   (RAW DATA)   LINE 1
22-APR-1983 14:53:01.95   JOB NO. 0041
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1077E+03



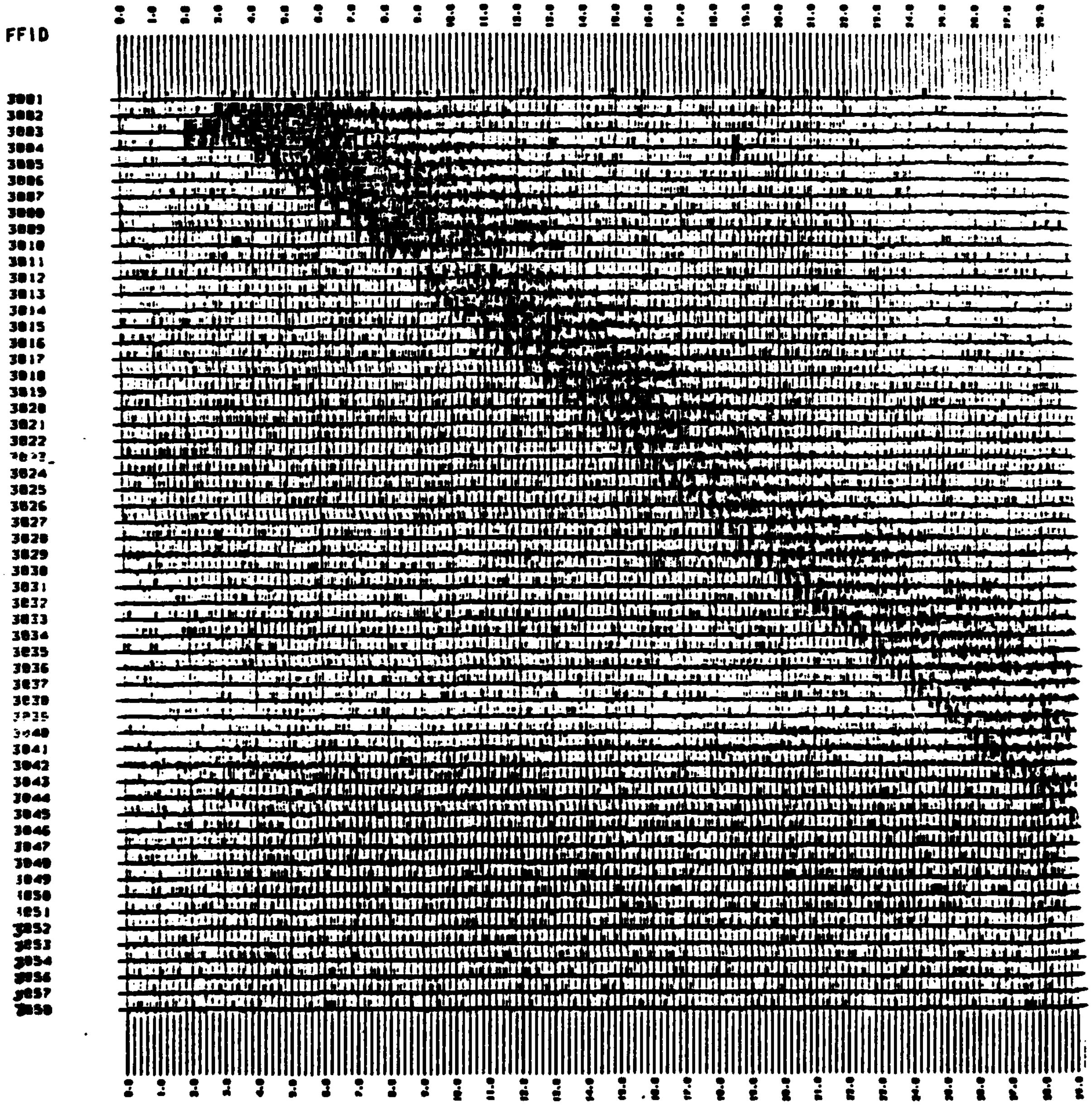
PROJECT : SICILY   SICILY 21 OBS# 1   H2   (RAW DATA)   LINE 1
22-APR-1983 14:53:01.95   JOB NO. 0041
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1077E+03

PROJECT : SICILY	SICILY 21 OBS# 2 H2 (RAW DATA)	LINE	1
	22-APR-1983 14:55:36.98	JOB NO.	0042
POLARITY NORMAL - POSITIVE	DATA(49997 MILLS 07.344)	PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. =	0.3831E+03



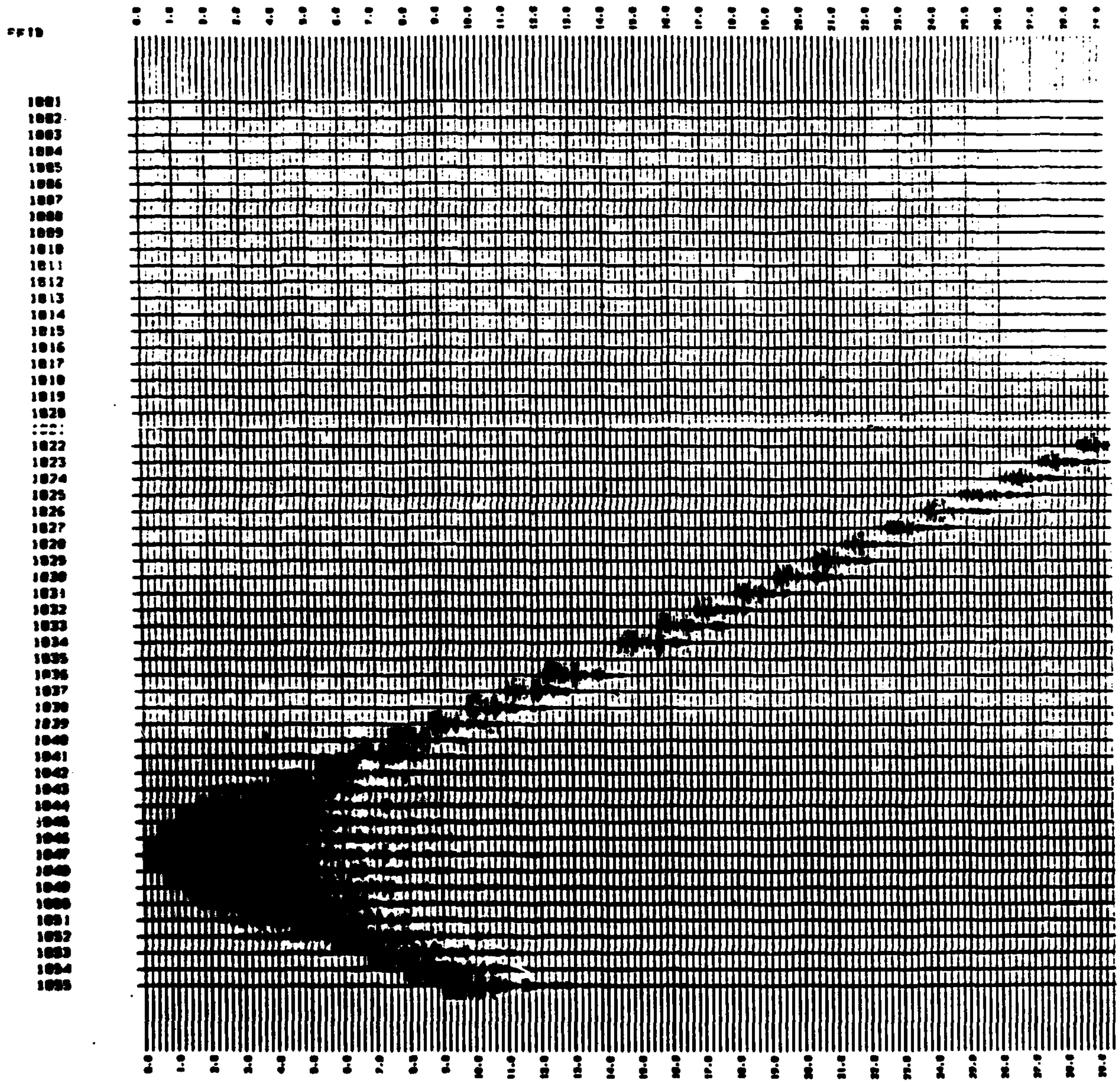
PROJECT : SICILY	SICILY 21 OBS# 2 H2 (RAW DATA)	LINE	1
	22-APR-1983 14:55:36.98	JOB NO.	0042
POLARITY NORMAL - POSITIVE	DATA(49997 MILLS 07.344)	PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. =	0.3831E+03

PROJECT : SICILY   SICILY 21 OBS= 3   HZ   (RAW DATA)   LINE 1
22-APR-1983 14:57:58.27   JOB NO. 3843
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.9848E+03



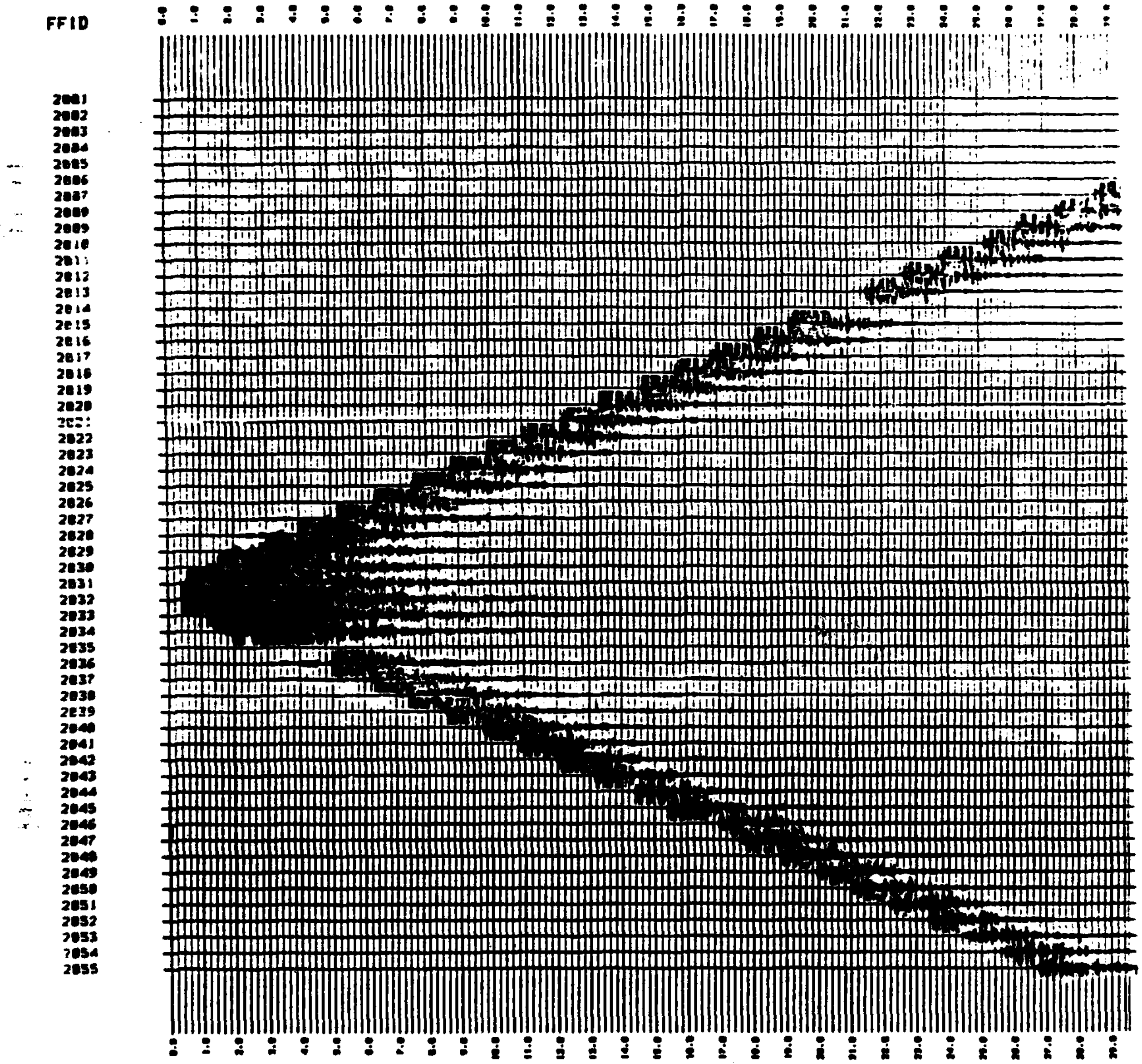
PROJECT : SICILY   SICILY 21 OBS= 3   HZ   (RAW DATA)   LINE 1
22-APR-1983 14:57:58.27   JOB NO. 3843
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.9848E+03

PROJECT : SICILY   SICILY 22 OBS# 1 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:02:41.39   JOB NO. 7928
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1815E+04



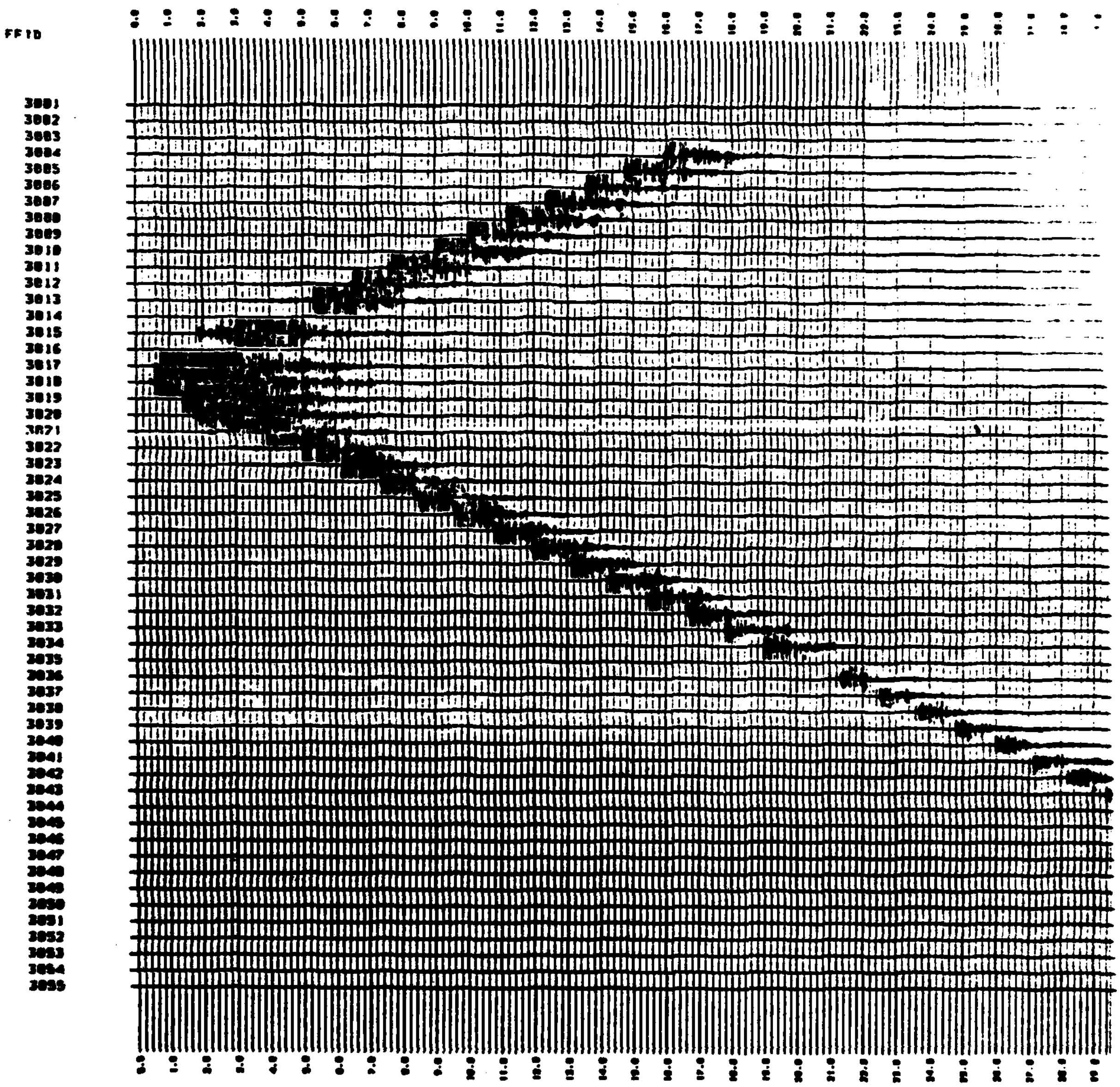
PROJECT : SICILY   SICILY 22 OBS# 1 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:02:41.39   JOB NO. 7928
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1815E+04

PROJECT : SICILY	SICILY 22 OBS* 2 VERTICAL (RAW DATA)	LINE	2
	27-APR-1983 09:05:58.94	JOB NO.	7930
POLARITY NORMAL - POSITIVE	DATA(59993 MILLS 07.344)	PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. =	0.1310E+04



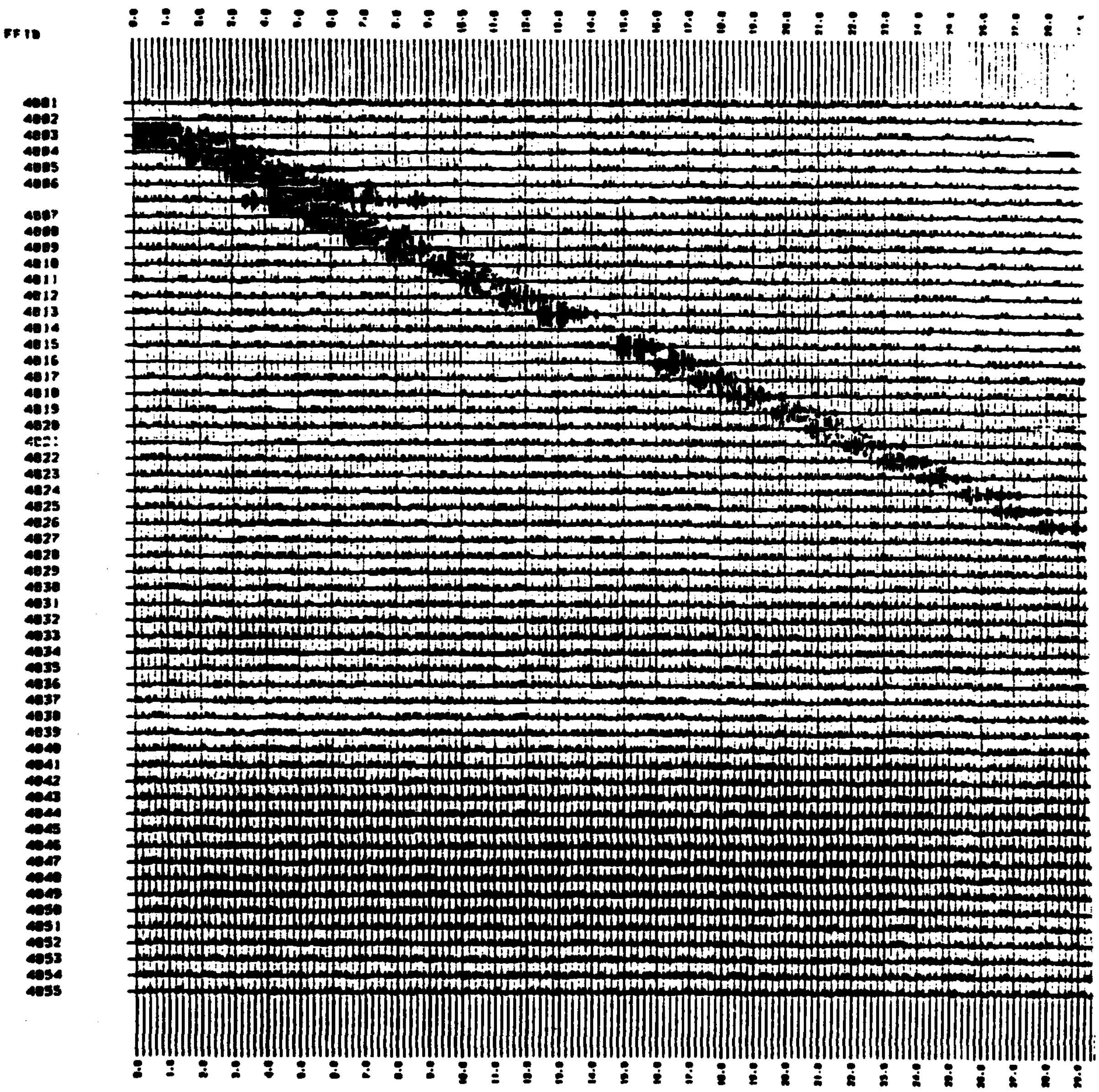
PROJECT : SICILY SICILY 22 OBS* 2 VERTICAL (RAW DATA) LINE 2
27-APR-1983 09:05:58.94 JOB NO. 7930
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.1310E+04

PROJECT : SICILY   SICILY 22 OBS* 3 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:00:39.40   JOB NO. 7932
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5551E+03



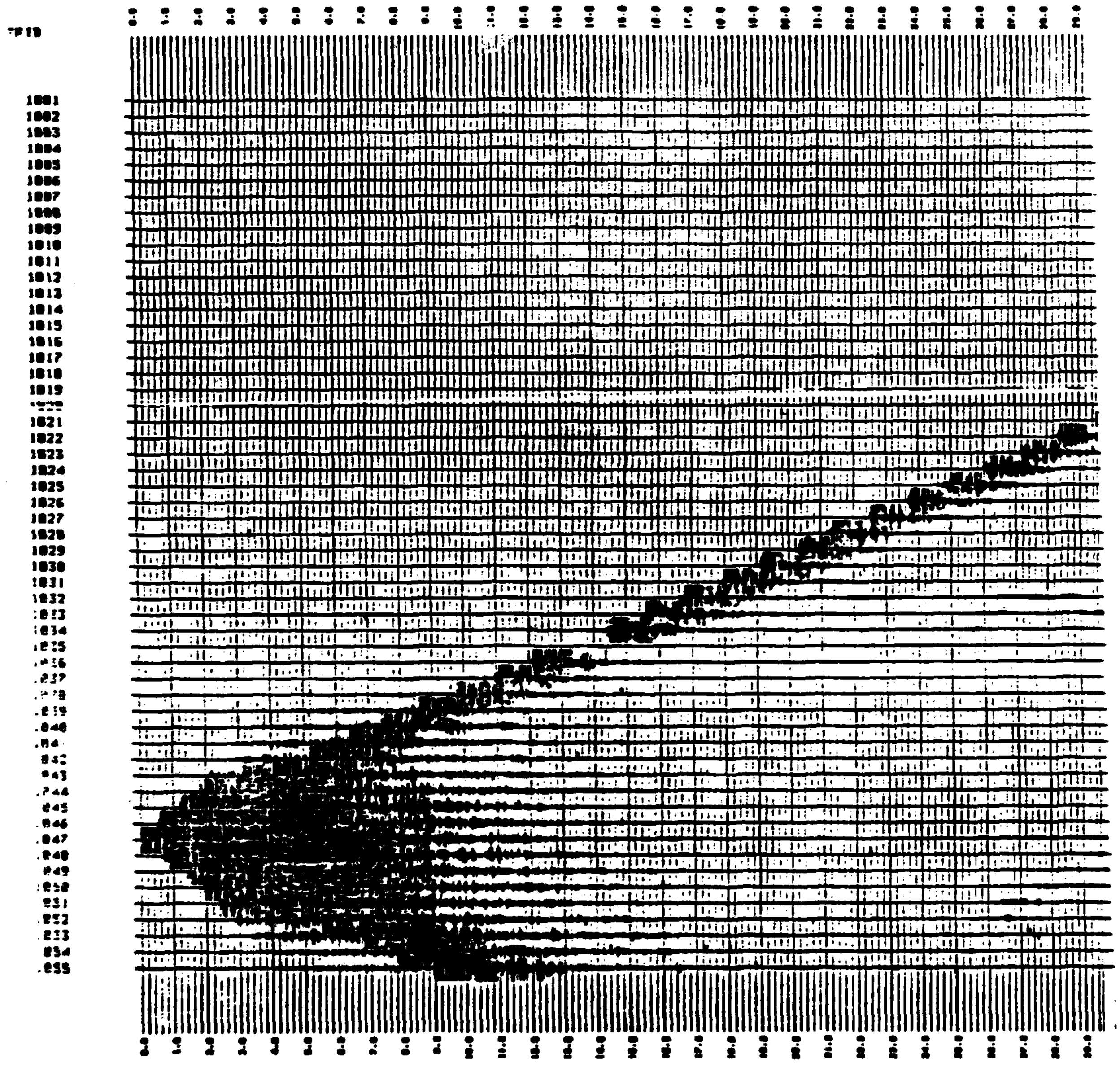
PROJECT : SICILY   SICILY 22 OBS* 3 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:00:39.40   JOB NO. 7932
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5551E+03

PROJECT : SICILY   SICILY 22 OBS# 4 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:12:09.66   JOB NO. 7933
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1604E+04



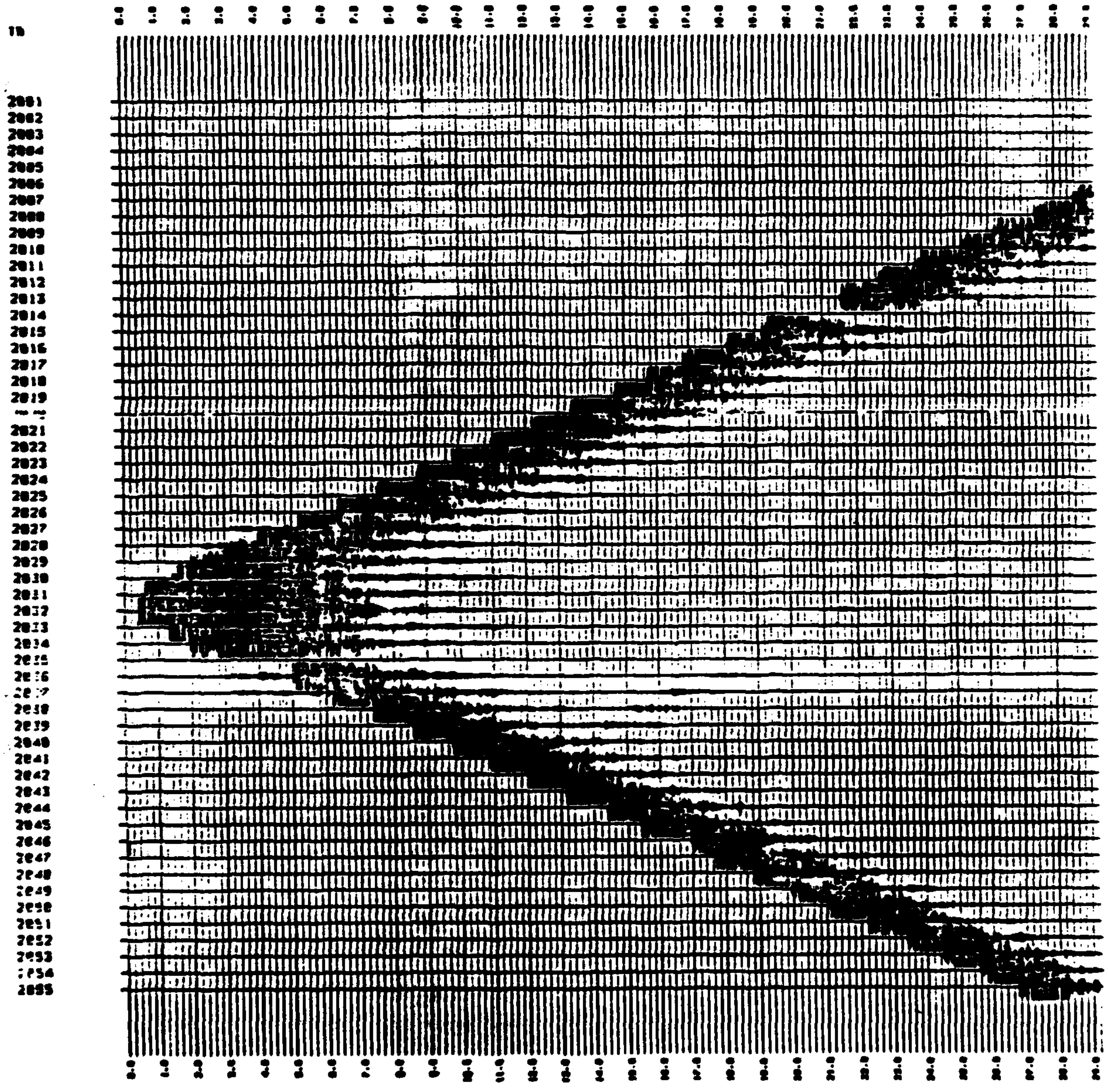
PROJECT : SICILY   SICILY 22 OBS# 4 VERTICAL (RAW DATA)   LINE 2
22-APR-1983 09:12:09.66   JOB NO. 7933
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1604E+04

PROJECT : SICILY　SICILY 22 OBS* 1　H1　(RAW DATA)　LINE 2
22-APR-1983 09:15:46.72　JOB NO. 7934
POLARITY NORMAL - POSITIVE　DATA(59993 MILLS 07.344)　PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE　REF. - 0.1592E+04



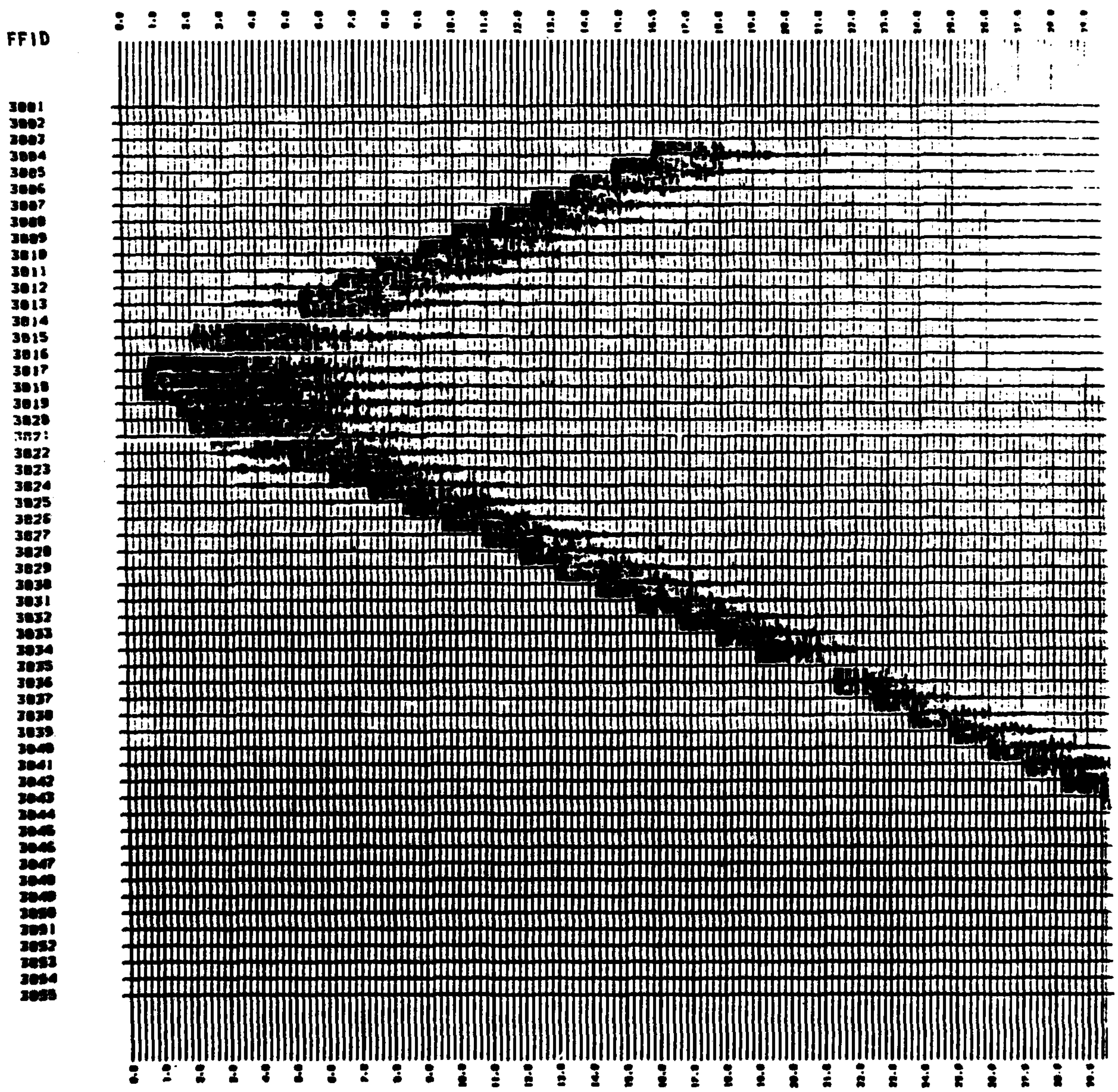
PROJECT : SICILY　SICILY 22 OBS* 1　H1　(RAW DATA)　LINE 2
22-APR-1983 09:15:46.72　JOB NO. 7934
POLARITY NORMAL - POSITIVE　DATA(59993 MILLS 07.344)　PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE　REF. - 0.1592E+04

PROJECT : SICILY   SICILY 22 OBS# 2   H1   (RAW DATA)   LINE 2
22-APR-1987 09:10:17.16   JOB NO. 7935
POLARITY NORMAL - POSITIVE   DATA(39993 MILLS 0P.340)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3991E+04



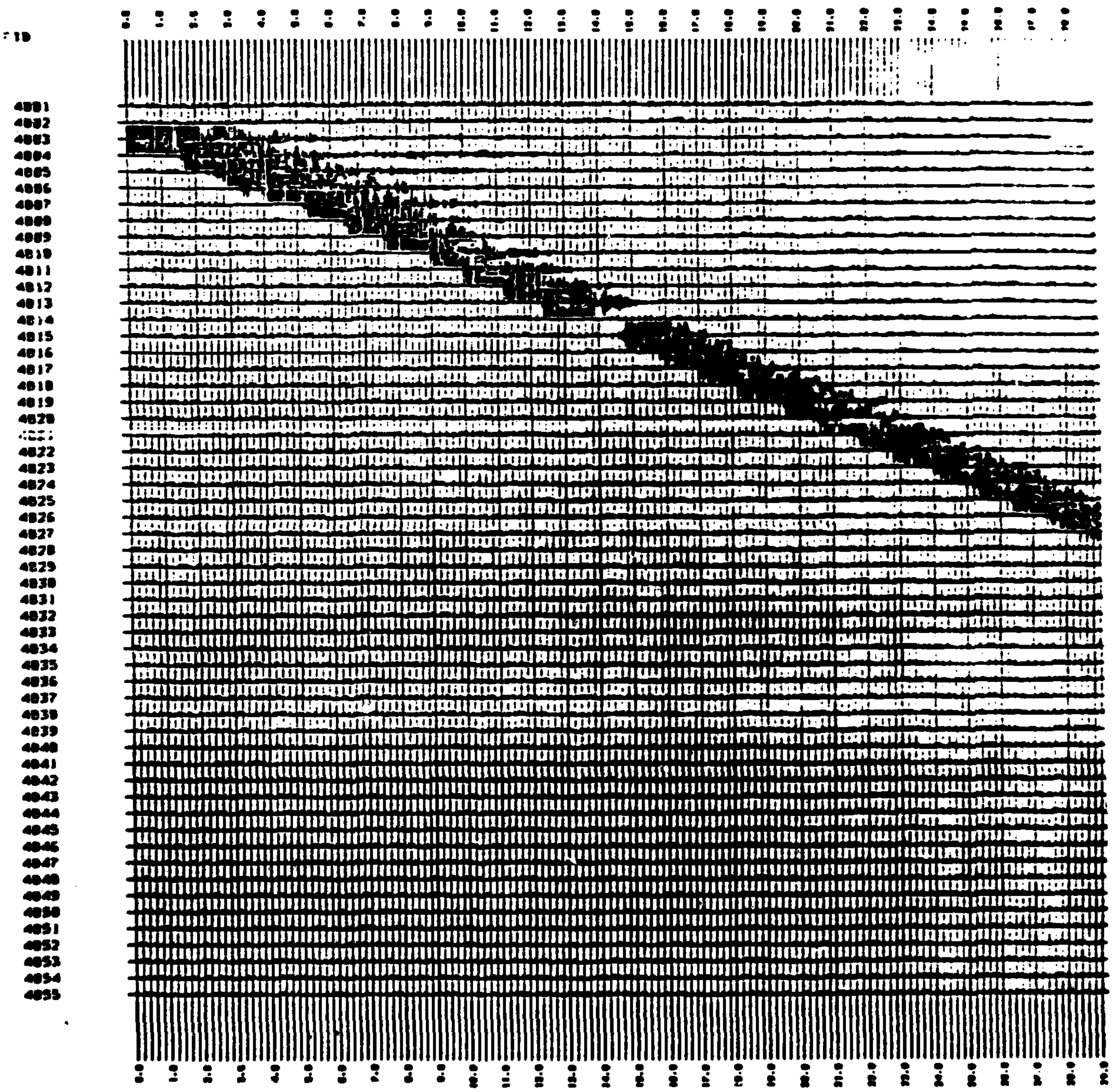
PROJECT : SICILY   SICILY 22 OBS# 2   H1   (RAW DATA)   LINE 2
22-APR-1987 09:10:17.16   JOB NO. 7935
POLARITY NORMAL - POSITIVE   DATA(39993 MILLS 0P.340)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3991E+04

PROJECT : SICILY SICILY 22 OBS# 3 H1 (RAW DATA) LINE 2
22-APR-1983 09:28:51.02 JOB NO. 7936
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.2006E+04



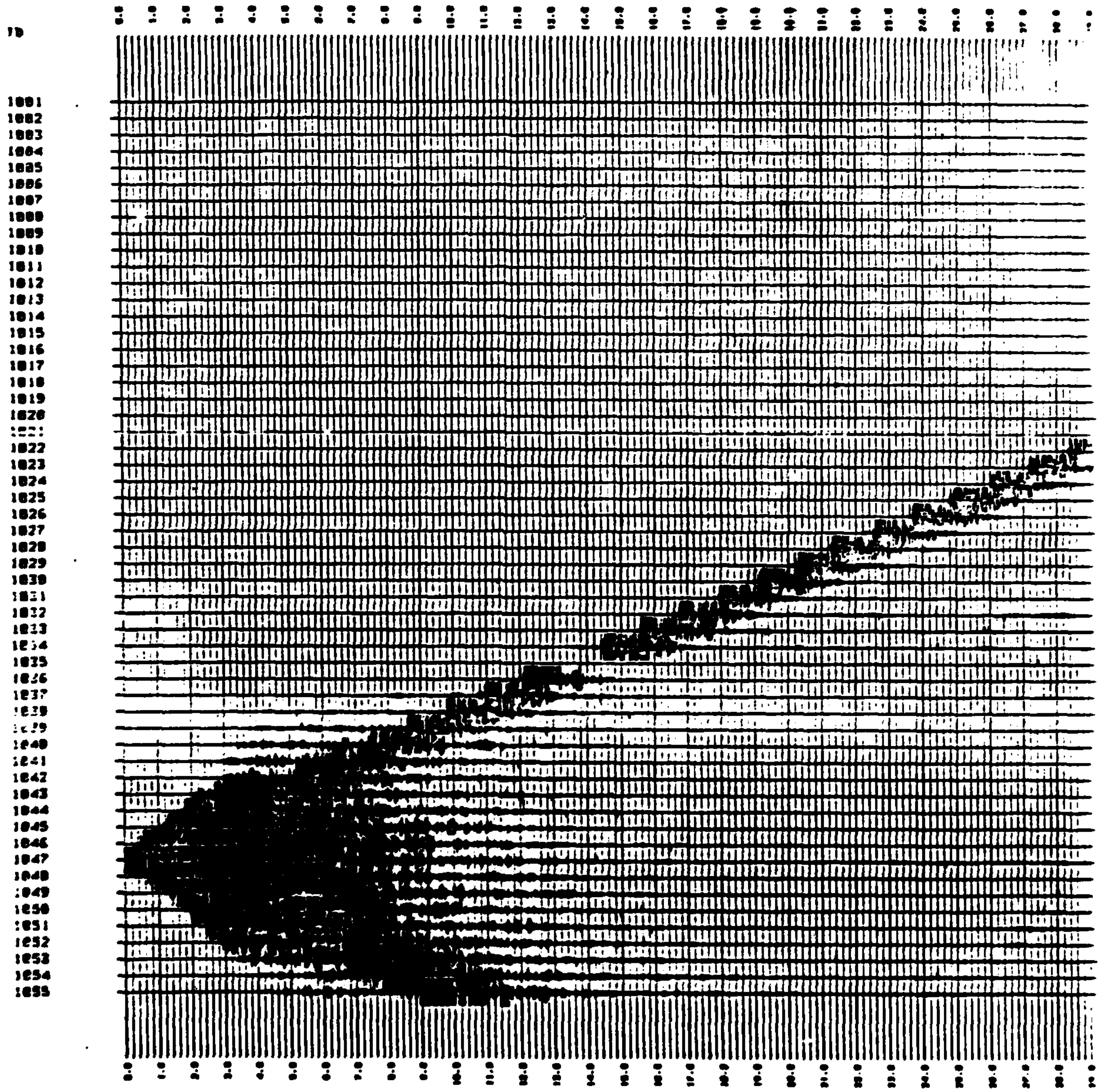
PROJECT : SICILY SICILY 22 OBS# 3 H1 (RAW DATA) LINE 2
22-APR-1983 09:28:51.02 JOB NO. 7936
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.2006E+04

PROJECT : SICILY	SICILY 22 OBS# 4 H1 (RAW DATA)	LINE 2
	27-APR-1983 09:23:47.05	JOB NO. 7938
POLARITY NORMAL - POSITIVE	DATA(59993 MILLS 07.344)	PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. = 0.2873E+04



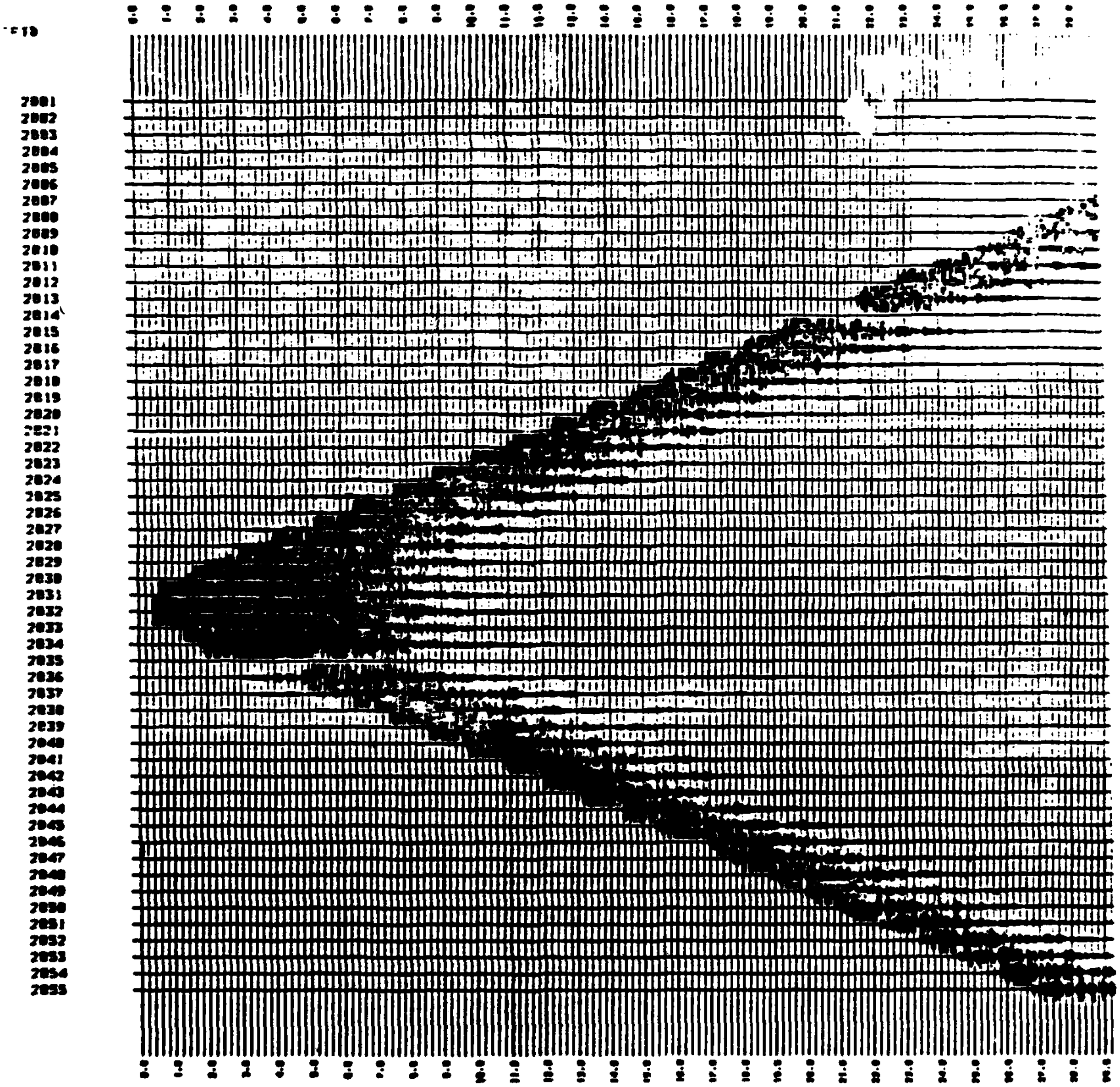
PROJECT : SICILY	SICILY 22 OBS# 4 H1 (RAW DATA)	LINE 2
	27-APR-1983 09:23:47.05	JOB NO. 7938
POLARITY NORMAL - POSITIVE	DATA(59993 MILLS 07.344)	PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE		REF. = 0.2873E+04

PROJECT : SICILY   SICILY 22 OBS+ 1 . . H2 . (RAW DATA)   LINE 2
22-APR-1983 09:27:18.50   JOB NO. 7940
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.1814E+04



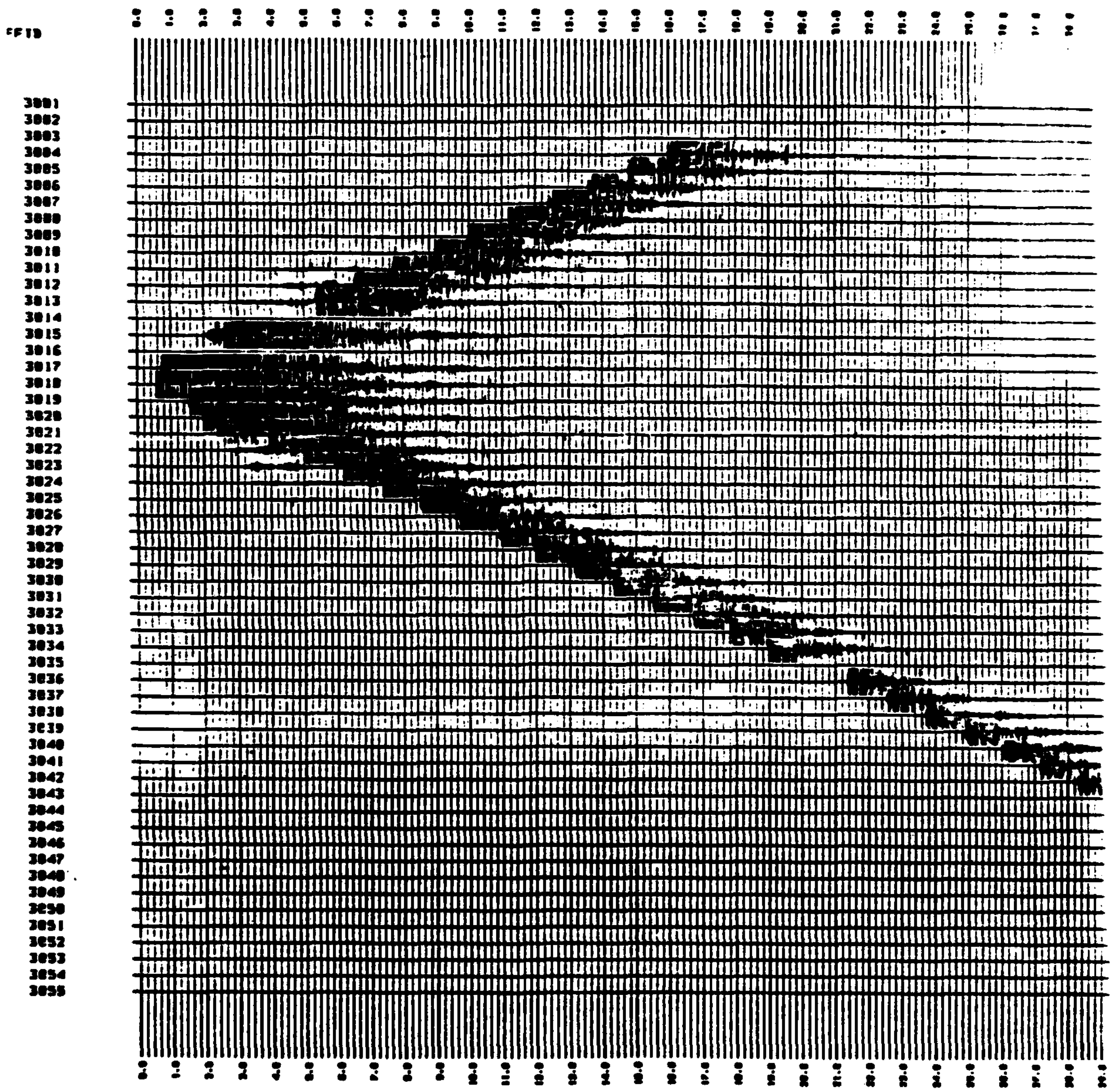
PROJECT : SICILY   SICILY 22 OBS+ 1 . H2 . (RAW DATA)   LINE 2
22-APR-1983 09:27:18.50   JOB NO. 7940
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.1814E+04

PROJECT : SICILY   SICILY 22 OBS# 2   H2   (RAW DATA)   LINE 2
22-APR-1983 09:29:38.54   JOB NO. 7941
POLARITY NORMAL - POSITIVE   DATA(55993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2474E+04



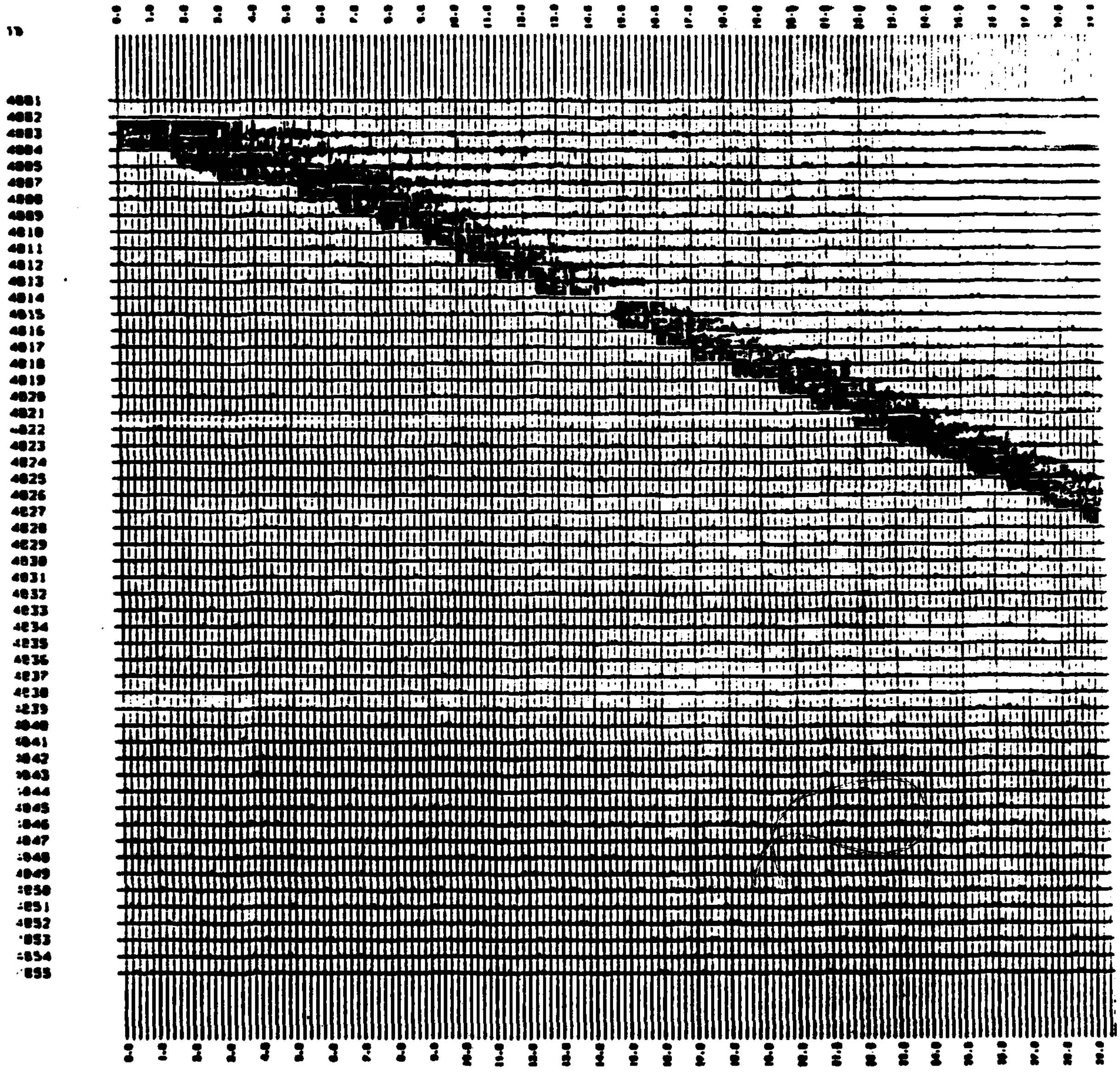
PROJECT : SICILY   SICILY 22 OBS# 2   H2   (RAW DATA)   LINE 2
22-APR-1983 09:29:38.54   JOB NO. 7941
POLARITY NORMAL - POSITIVE   DATA(55993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2474E+04

PROJECT : SICILY   SICILY 22 OBS# 3   H2   (RAW DATA)   LINE 2
22-APR-1983 09:32:19.96   JOB NO. 7943
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1663E+04



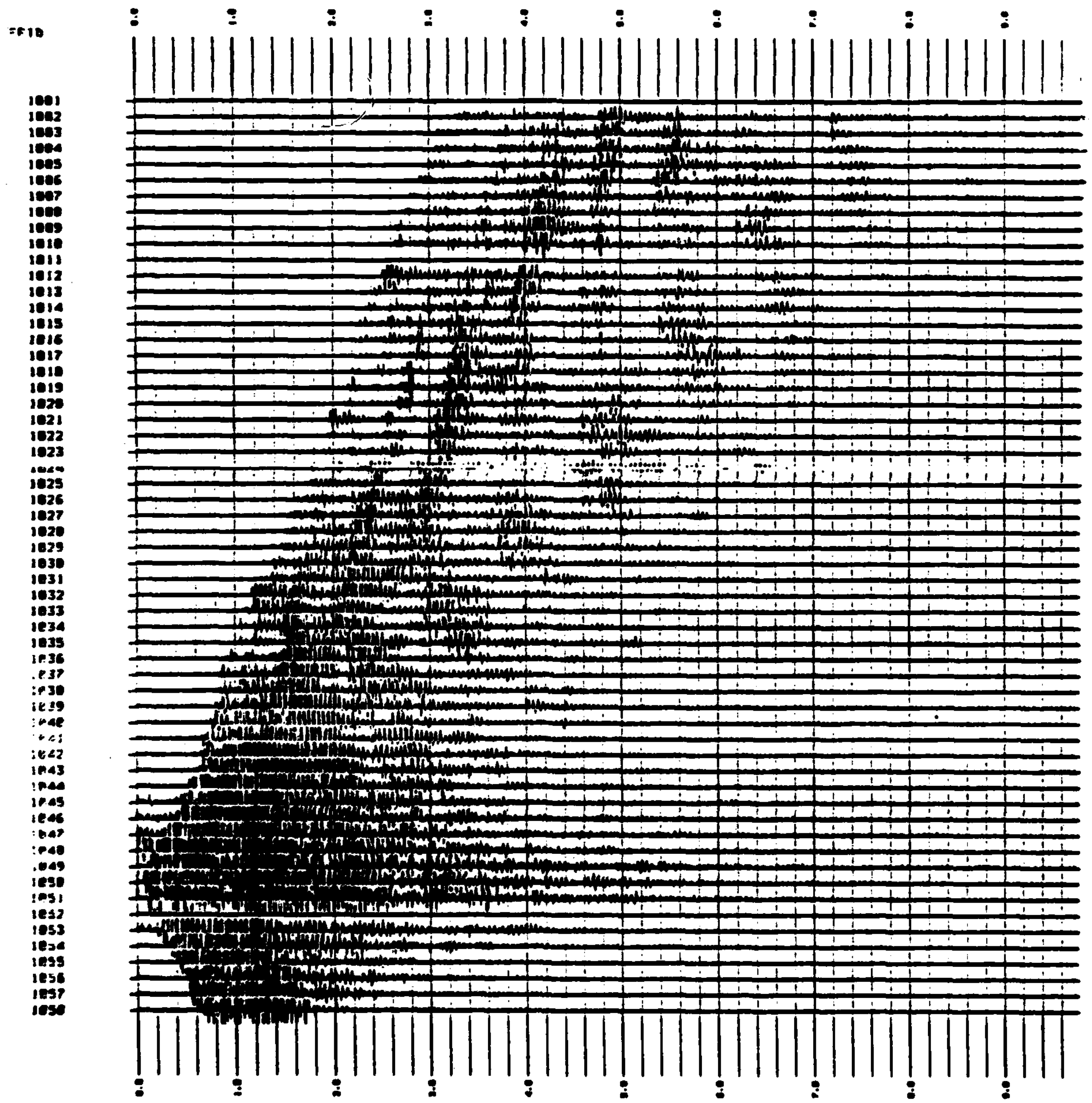
PROJECT : SICILY   SICILY 22 OBS# 3   H2   (RAW DATA)   LINE 2
22-APR-1983 09:32:19.96   JOB NO. 7943
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1663E+04

PROJECT : SICILY	SICILY 22 OBS# 4	H2 (RAW DATA)	LINE 2
	22-APR-1983 09:35:19.00		JOB NO. 7500
POLARITY NORMAL	- POSITIVE	DATA(59993 MILLS 07.344)	PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE			REF. = 0.2[illegible]E+04



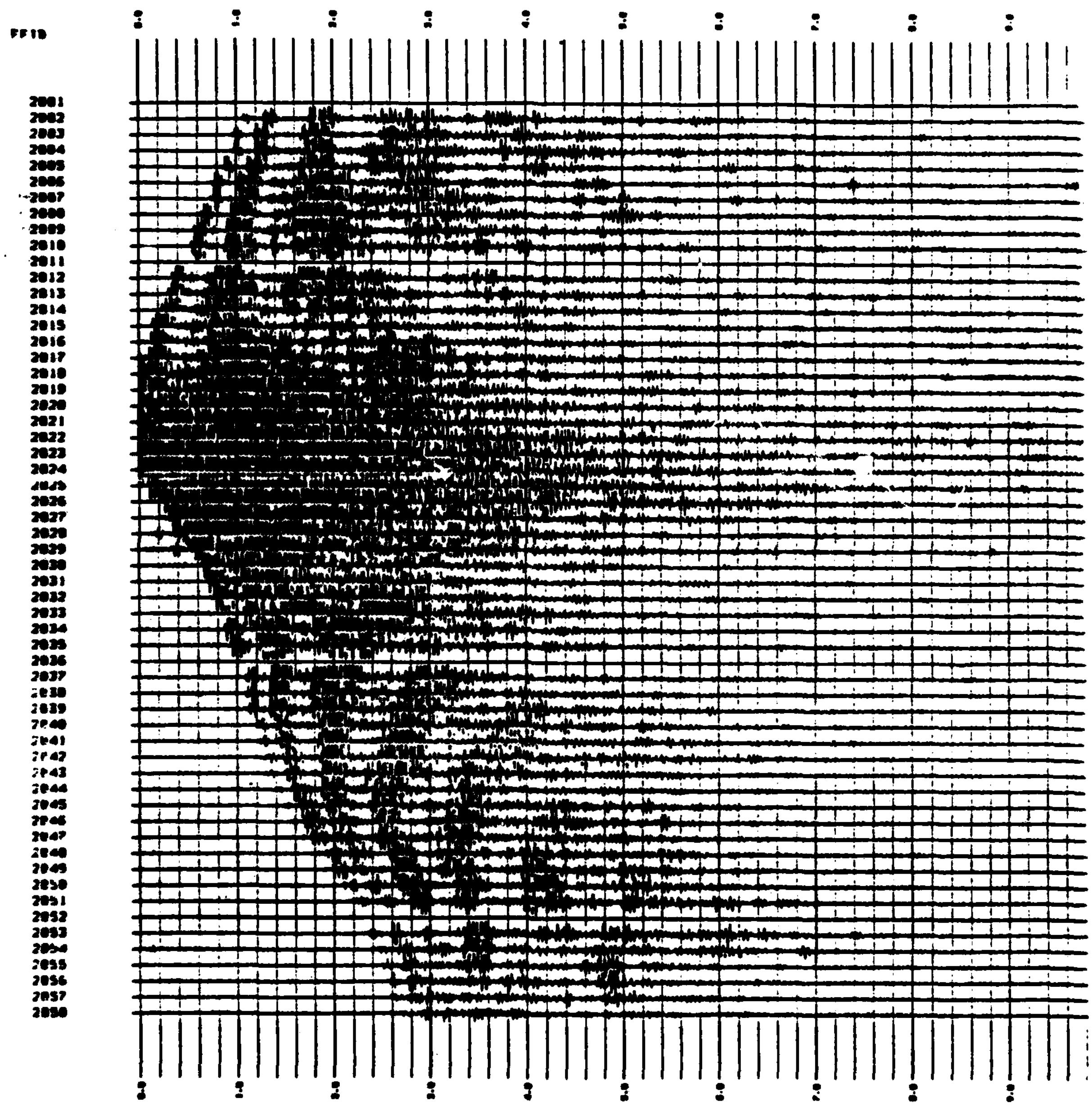
PROJECT : SICILY SICILY 22 OBS# 4 H2 (RAW DATA) LINE 2
22-APR-1983 09:35:19.00 JOB NO. 7544
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = -0.2899E+04

PROJECT : SICILY	SICILY 21 OBS=1 VER(UNFILT.RDT @1.7 KM/SEC) LINE	1
	20-APR-1983 16:32:51.74 JOB NO.	7770
POLARITY NORMAL - POSITIVE	DATA(49997 MILLS 07.344) PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE	REF. =	0.2355E+03



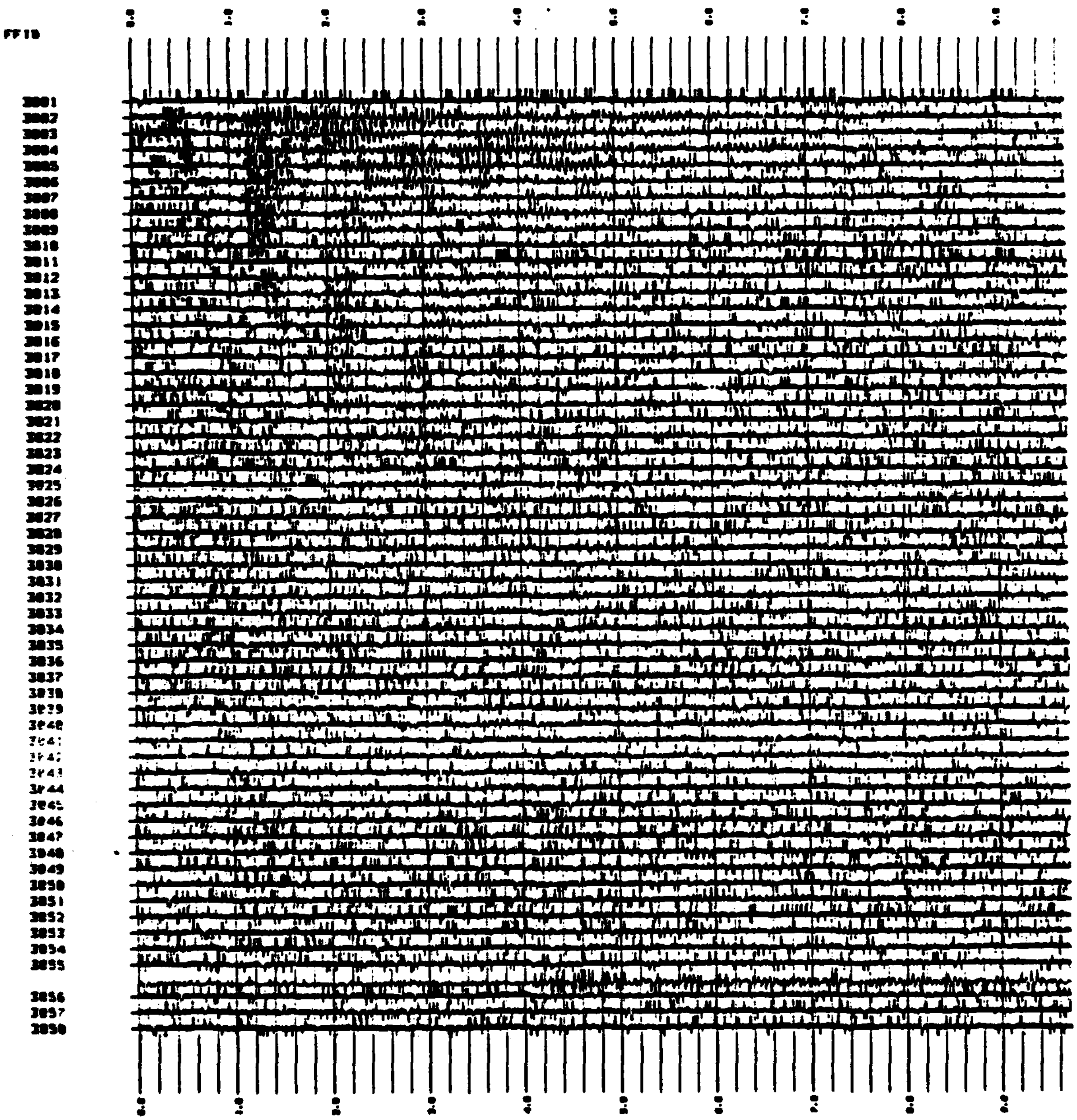
PROJECT : SICILY SICILY 21 OBS=1 VER(UNFILT.RDT @1.7 KM/SEC) LINE 1
20-APR-1983 16:32:51.74 JOB NO. 7770
POLARITY NORMAL - POSITIVE DATA(49997 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.2355E+03

PROJECT : SICILY   SICILY 2) OBS#2 VER(UNFILT.ROT @1.7 KM/SEC) LINE 1
20-APR-1983 16:35:38.46   JOB NO. 7771
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1923E+03



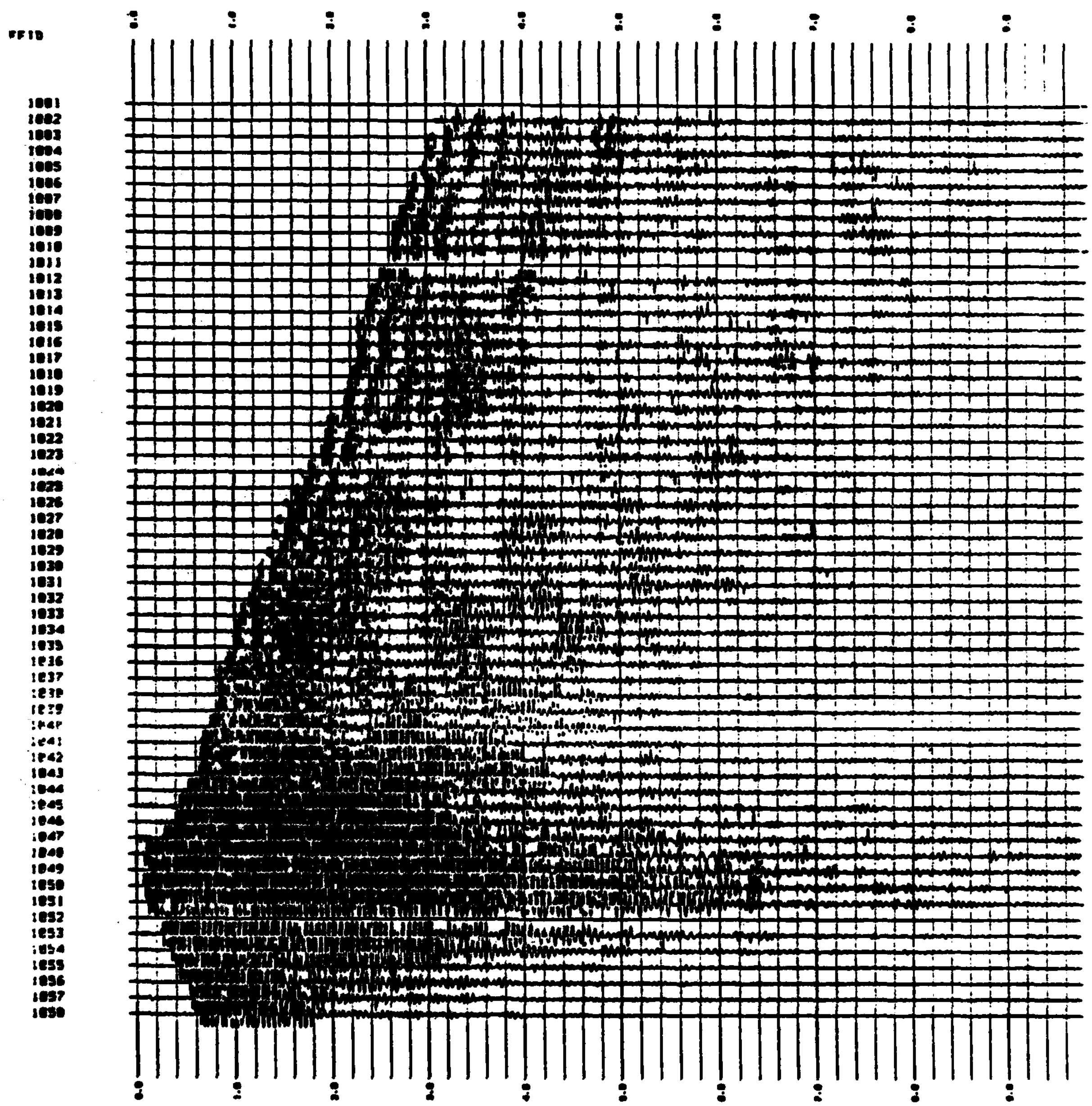
PROJECT : SICILY   SICILY 2) OBS#2 VER(UNFILT.ROT @1.7 KM/SEC) LINE 1
20-APR-1983 16:35:38.46   JOB NO. 7771
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1923E+03

PROJECT : SICILY   SICILY 21 OBS03 VER(UNFILT.ROT 01.7 KM/SEC) LINE 1
20-APR-1983 16:38:53.80   JOB NO. 7773
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.4838E+03



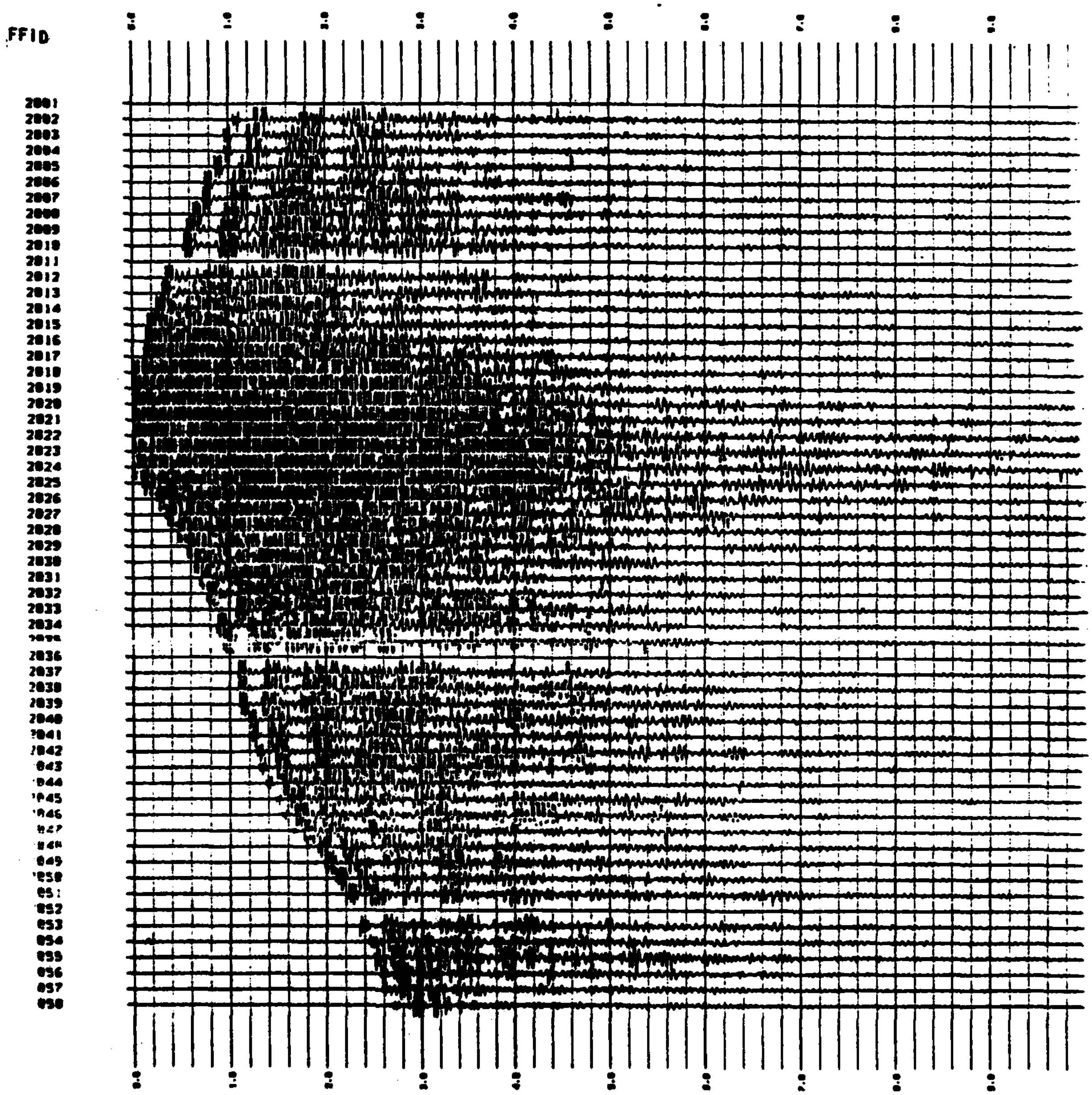
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.4838E+03
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
20-APR-1983 16:38:53.80   JOB NO. 7773
PROJECT : SICILY   SICILY 21 OBS03 VER(UNFILT.ROT 01.7 KM/SEC) LINE 1

PROJECT : SICILY   SICILY 21 OBS#1 Rad (UNFILT.ROT @1.7 KM/SEC) LINE 1
20-APR-1983 16:50:40.91   JOB NO. 7778
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.4977E+03



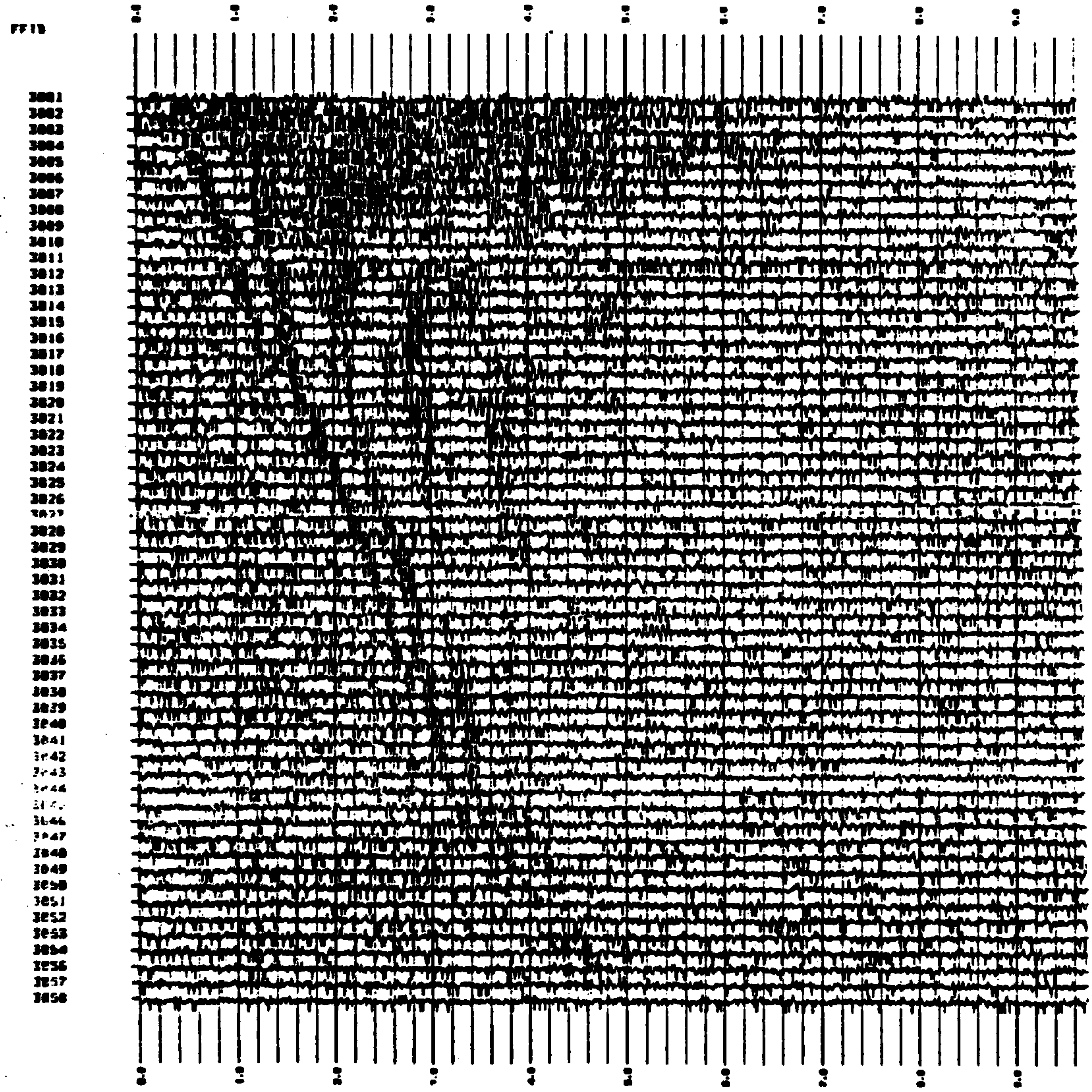
PROJECT : SICILY   SICILY 21 OBS#1 Rad (UNFILT.ROT @1.7 KM/SEC) LINE 1
20-APR-1983 16:50:40.91   JOB NO. 7778
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.4977E+03

PROJECT : SICILY SICILY 21 CBS+2 Rad (UNFILT.ROT @1.7 KM&SEC) LINE 1
28-APR-1983 16:53:12.12 JOB NO. 7779
POLARITY NORMAL - POSITIVE DATA(49997 MILLS @7.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.6124E+03



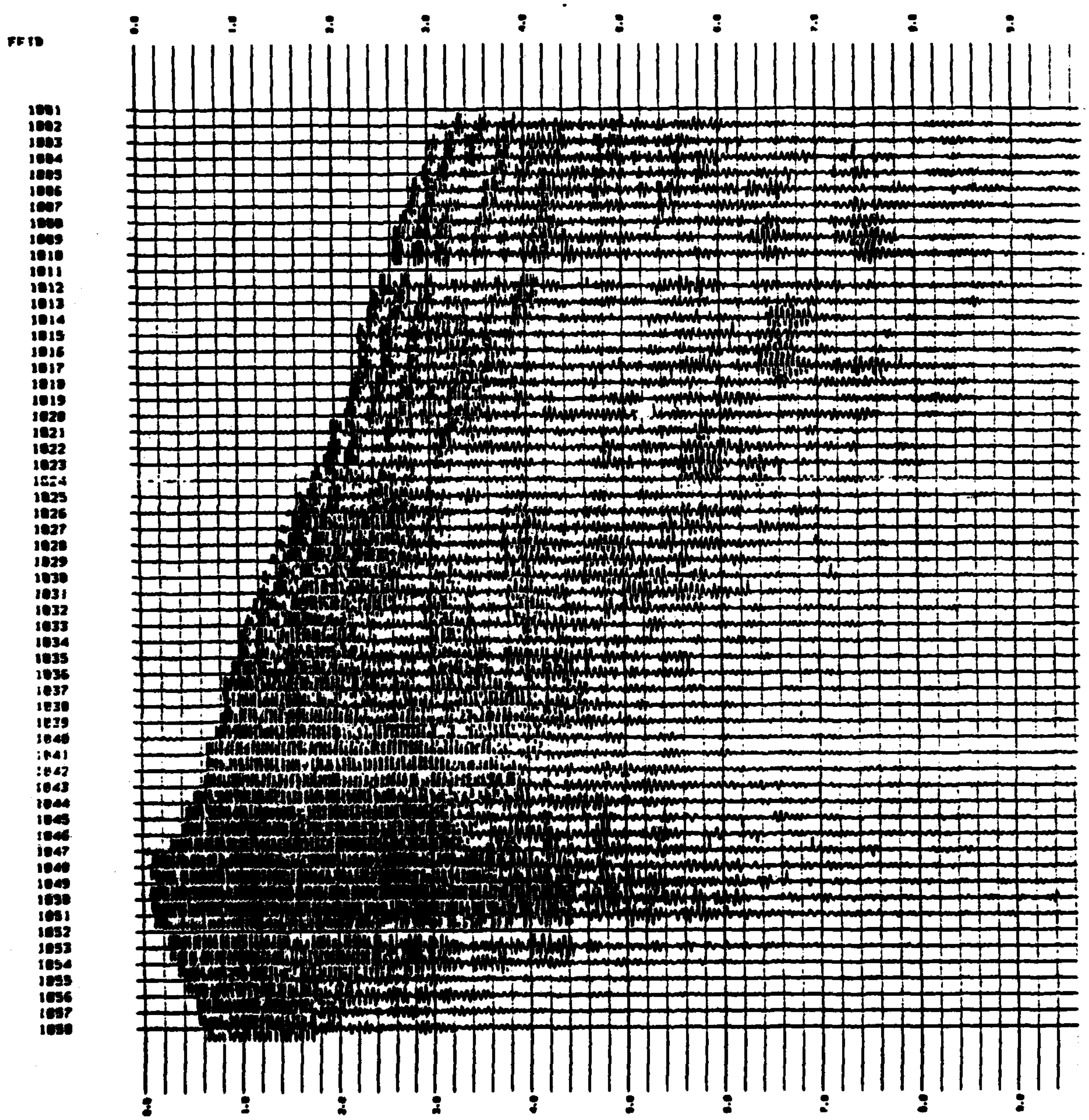
PROJECT : SICILY SICILY 21 CBS+2 Rad (UNFILT.ROT @1.7 KM&SEC) LINE 1
28-APR-1983 16:53:12.12 JOB NO. 7779
POLARITY NORMAL - POSITIVE DATA(49997 MILLS @7.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.6124E+03

PROJECT : SICILY   SICILY 21 OBS#3 Rad (UNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:55:45.14   JOB NO. 7788
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5945E+03



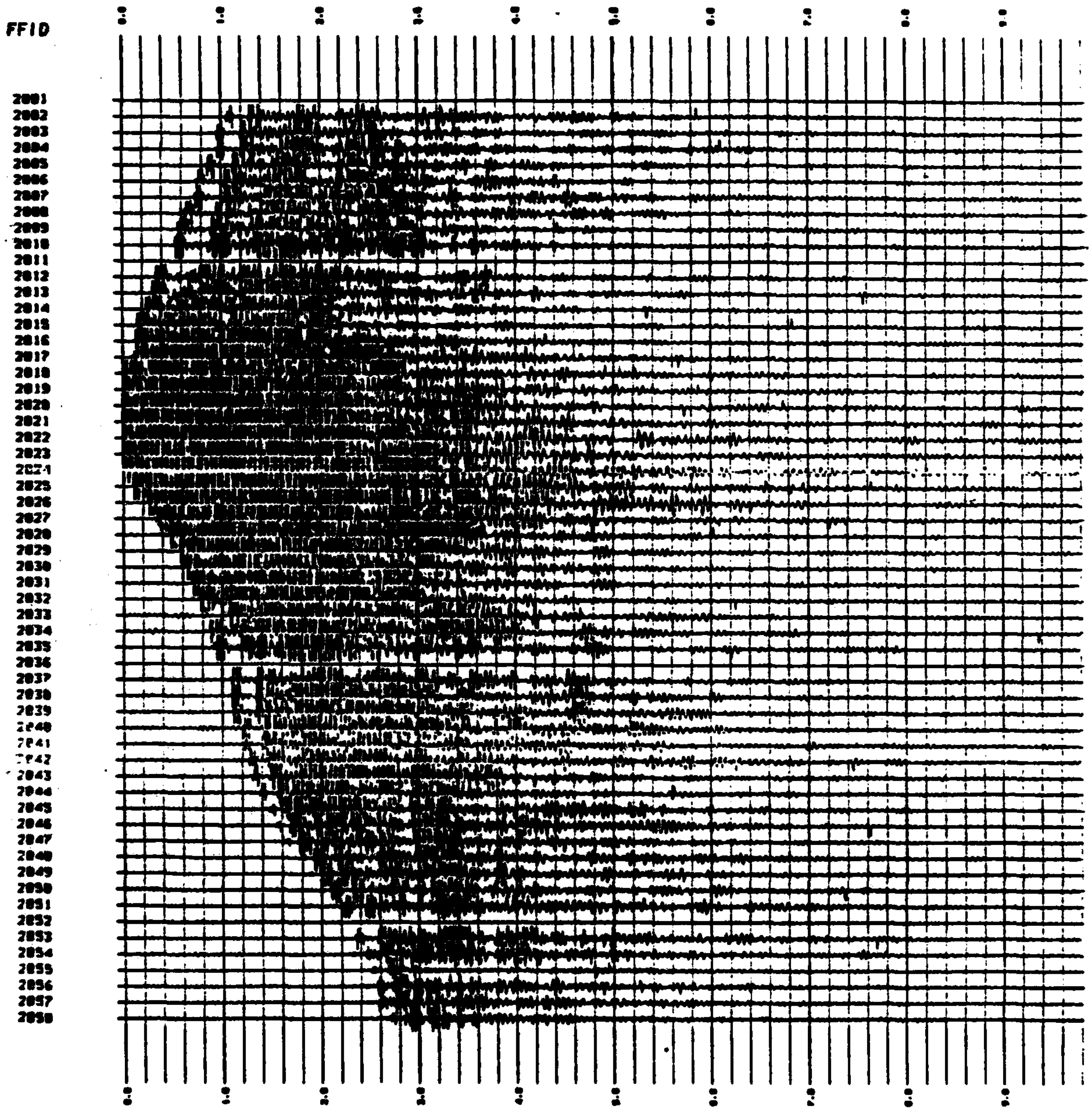
PROJECT : SICILY   SICILY 21 OBS#3 Rad (UNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:55:45.14   JOB NO. 7788
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5945E+03

PROJECT : SICILY   SICILY 21 OBS#1 Tra (UNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:47:06.89   JOB NO. 7775
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 9.6437E+03



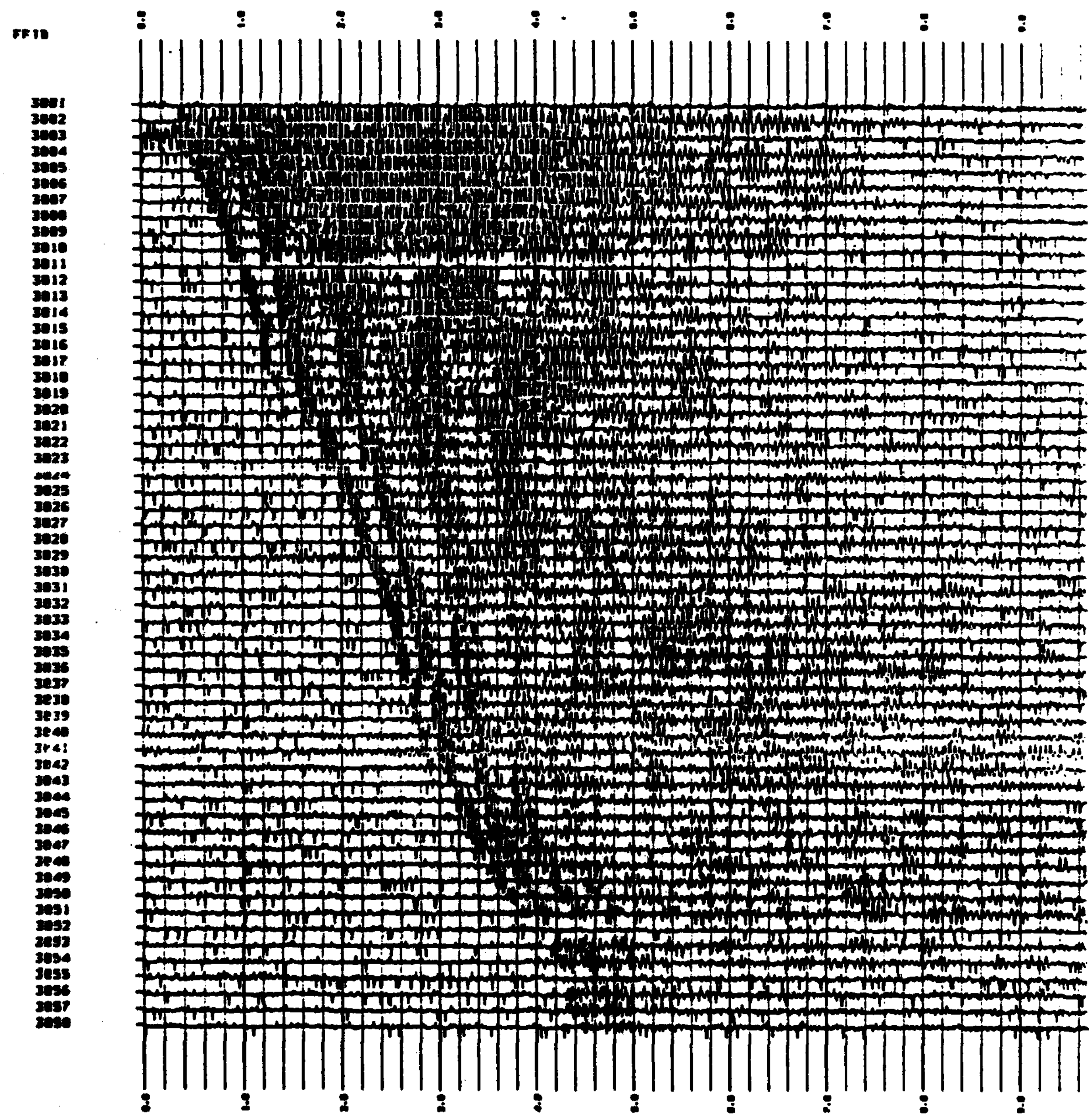
PROJECT : SICILY   SICILY 21 OBS#1 Tra (UNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:47:06.89   JOB NO. 7775
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 9.6437E+03

PROJECT : SICILY SICILY 21 OBS#2 TranUNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:44:43.95 JOB NO. 7776
POLARITY NORMAL - POSITIVE DATA(4999? MILLS @7.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.9459E+03



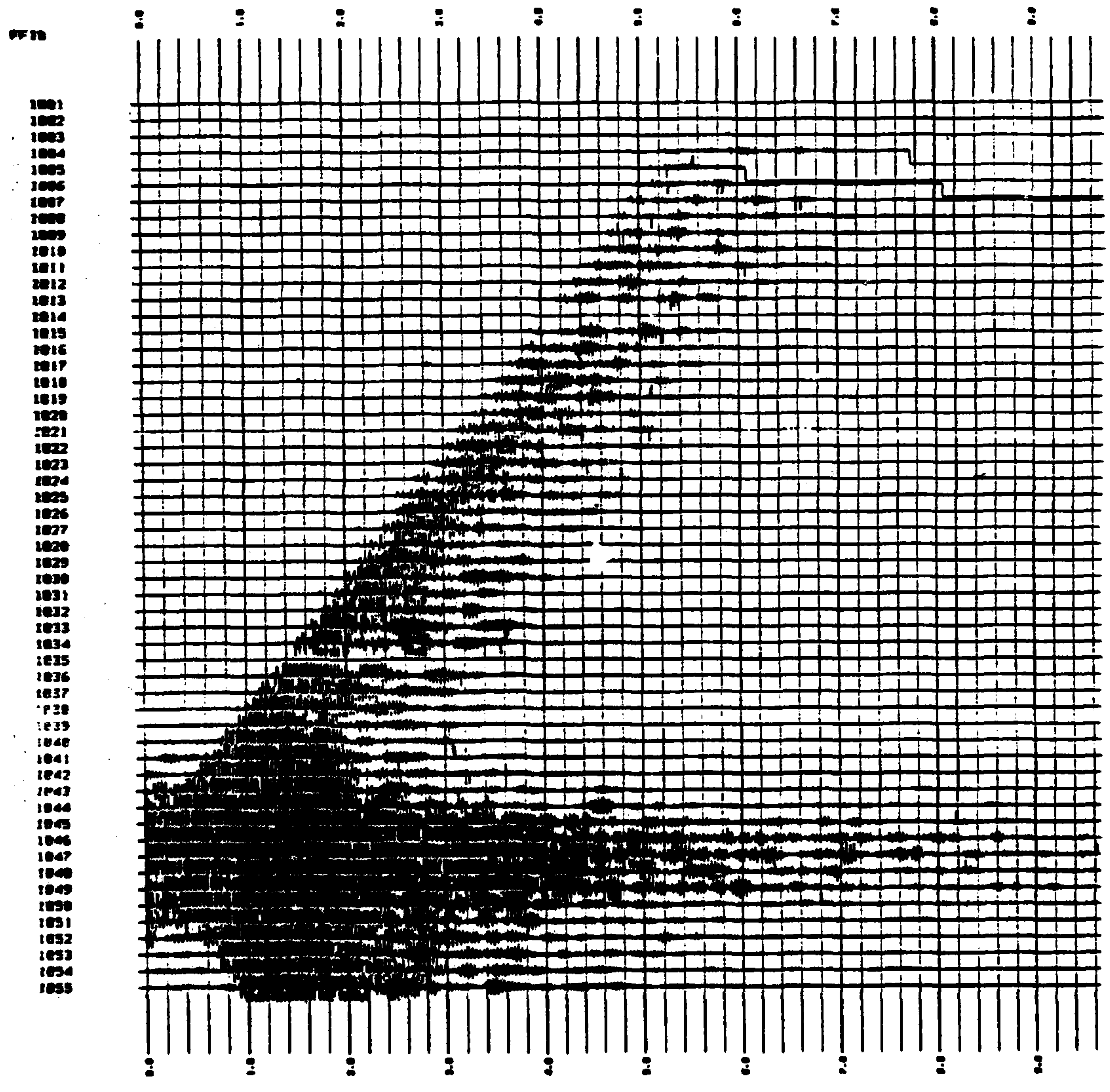
PROJECT : SICILY SICILY 21 OBS#2 (UNFILT.ROT @1.7 KM/SEC) LINE 1
28-APR-1983 16:44:43.95 JOB NO. 7776
POLARITY NORMAL - POSITIVE DATA(4999? MILLS @7.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.9459E+03

PROJECT : SICILY   SICILY 21 OBS#3 Tra UNFILT.ROT 01.7 KM/SEC) LINE 1
20-APR-1983 16:47:20.58   JOB NO. 7777
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6806E+03



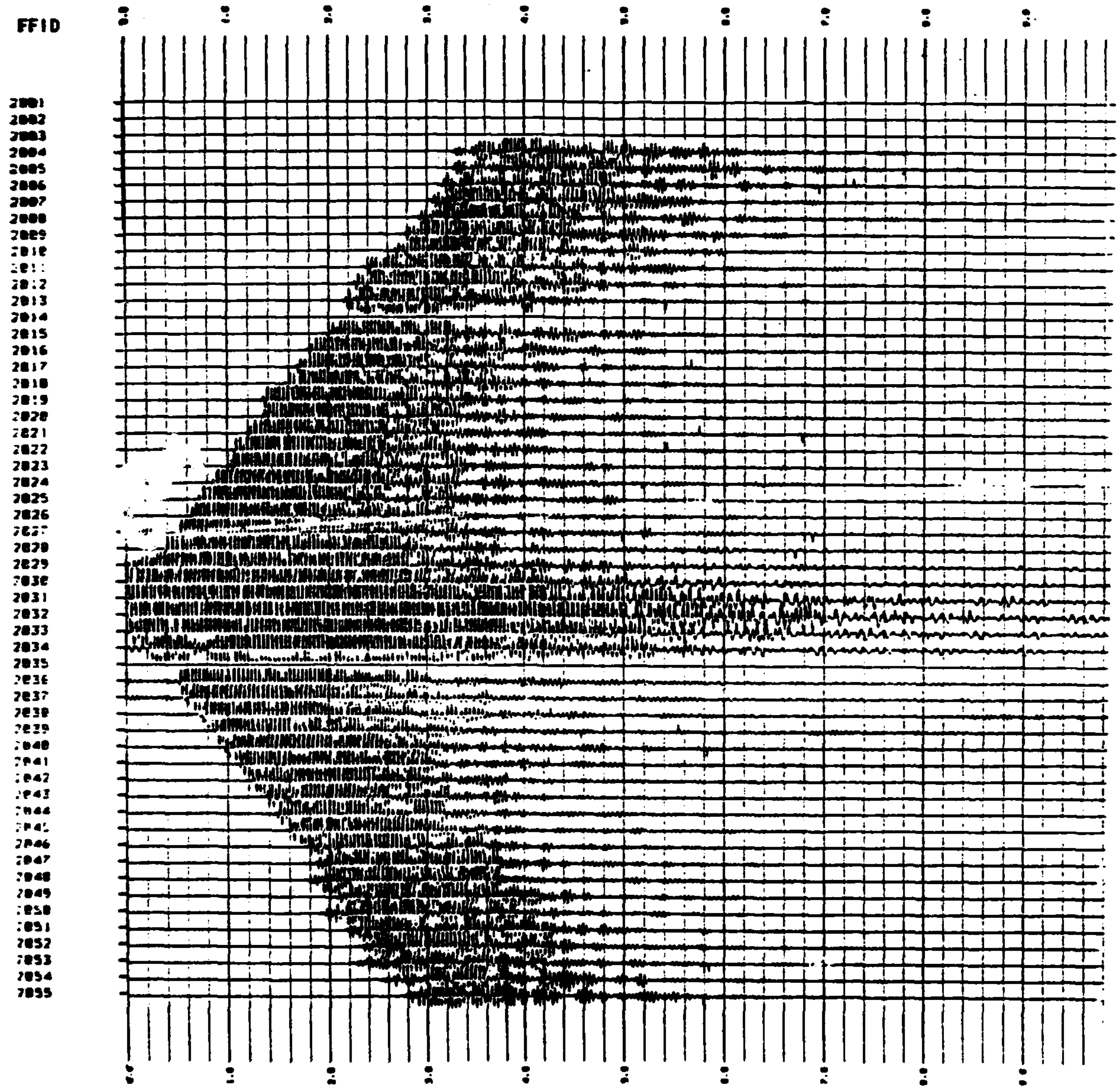
PROJECT : SICILY   SICILY 21 OBS#3 Tra UNFILT.ROT 01.7 KM/SEC) LINE 1
20-APR-1983 16:47:20.58   JOB NO. 7777
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6806E+03

PROJECT : SICILY   SICILY 22 OBS#1 VERT (UNFILT.RDT @1.7 KM/SEC) LINE 2
21-APR-1983 14:26:22.83   JOB NO. 7842
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.7942E+03



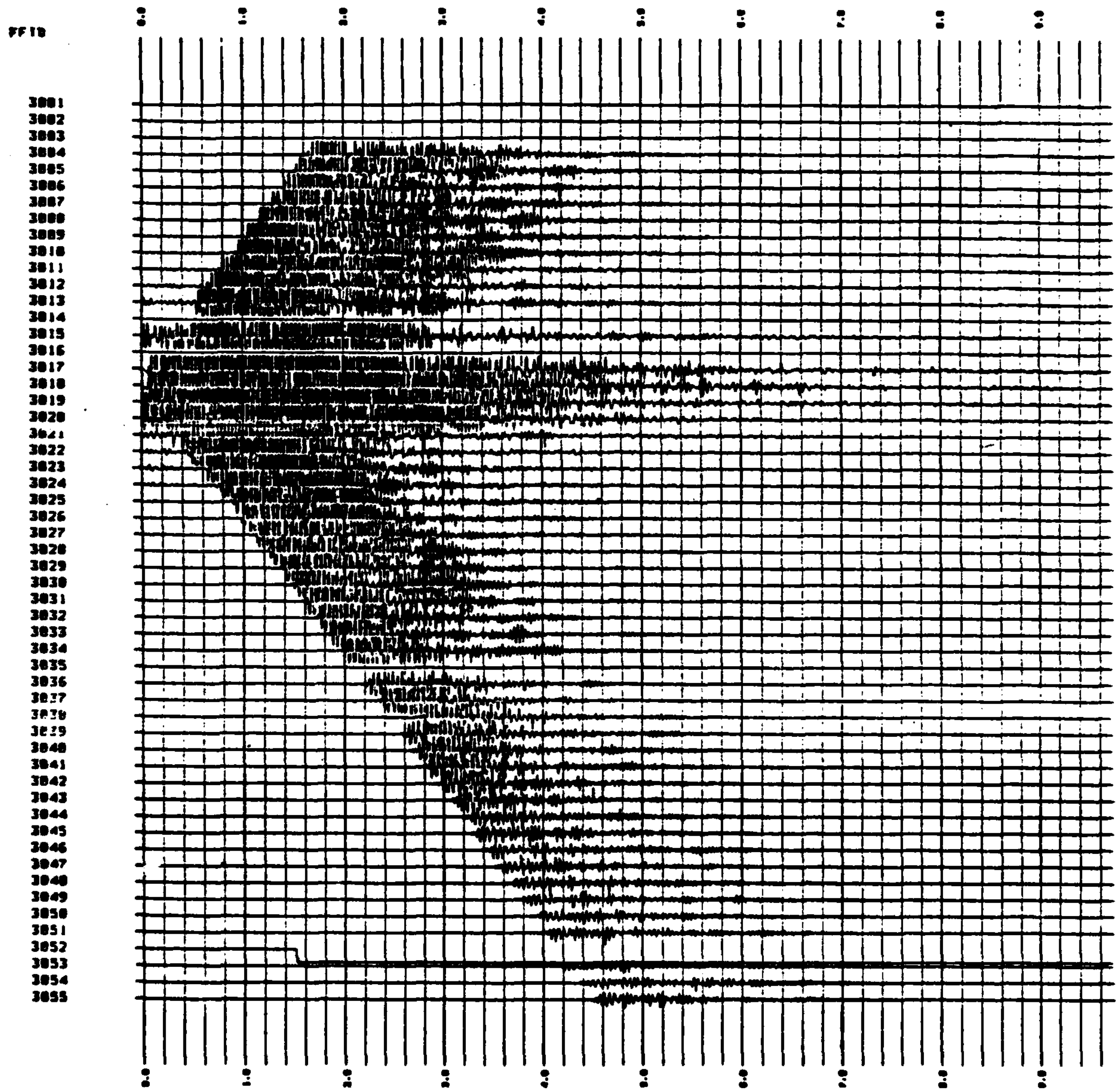
PROJECT : SICILY   SICILY 22 OBS#1 VERT (UNFILT.RDT @1.7 KM/SEC) LINE 2
21-APR-1983 14:26:22.83   JOB NO. 7842
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.7942E+03

PROJECT : SICILY   SICILY 22 OBS#2 VERT (UNFILT.ROT @1.7 KM/SEC) LINE 2
21-APR-1983 14:29:14.19   JOB NO. 7843
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1133E+04



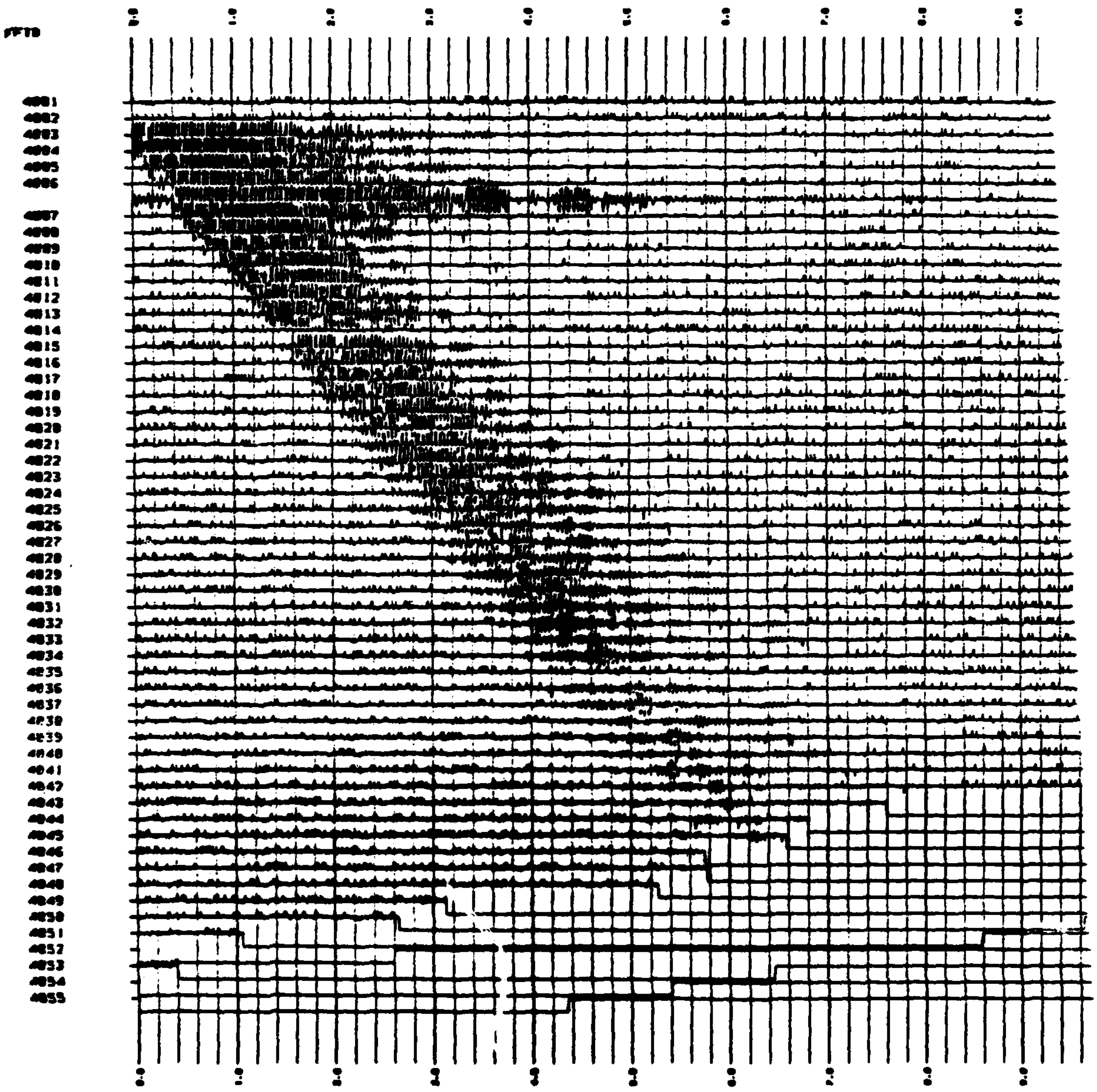
PROJECT : SICILY   SICILY 22 OBS#2 VERT (UNFILT.ROT @1.7 KM/SEC) LINE 2
21-APR-1983 14:29:14.19   JOB NO. 7843
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1133E+04

PROJECT : SICILY   SICILY 22 OBS#3 VERT (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 14:32:38.38   JOB NO. 7846
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3950E+03



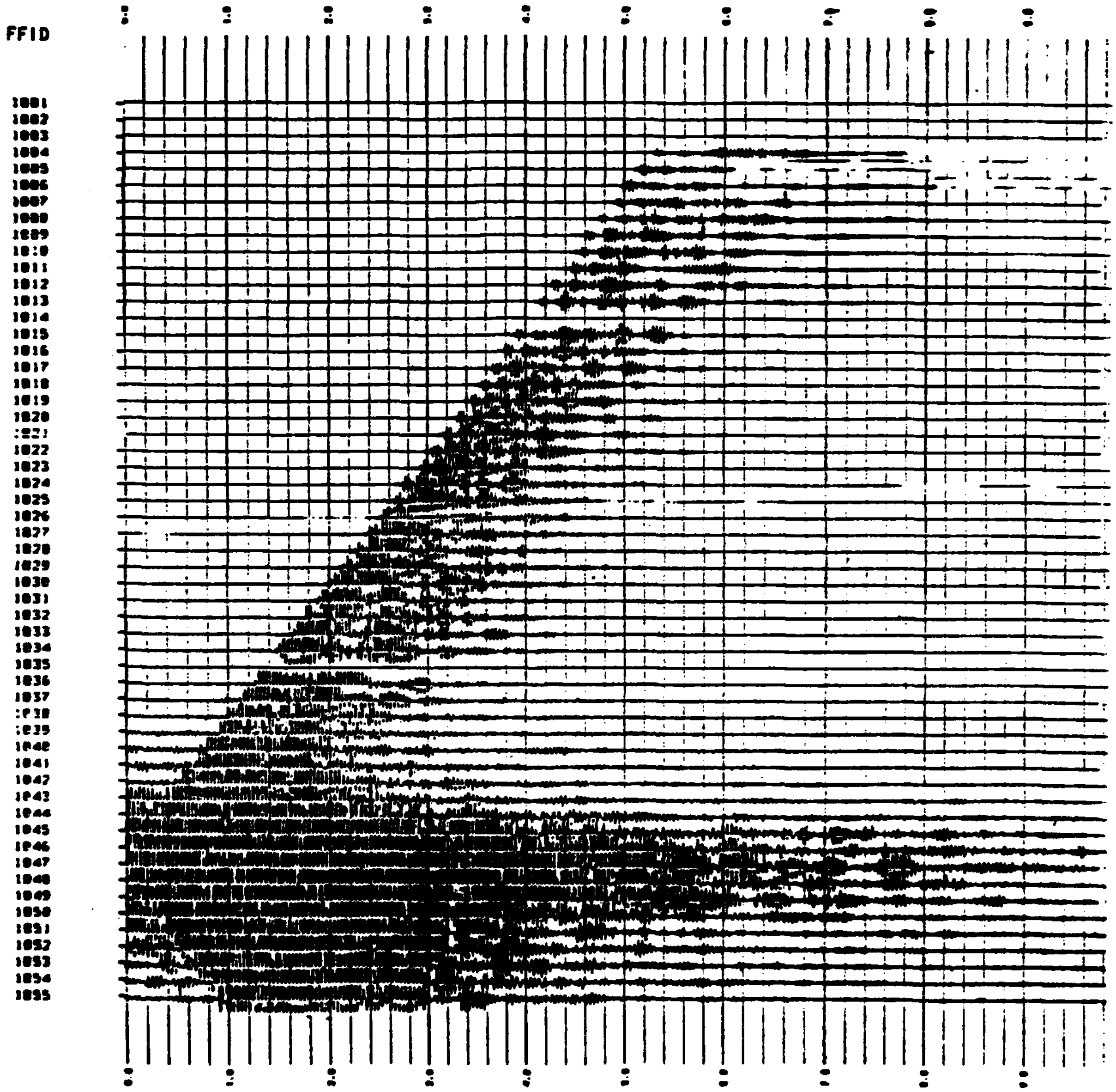
PROJECT : SICILY   SICILY 22 OBS#3 VERT (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 14:32:38.38   JOB NO. 7846
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3950E+03

PROJECT : SICILY   SICILY 22 OBS#4 VERT (UNFILT.ROT @1.7 KM/SEC) LINE 2
21-APR-1983 14:35:44.78   JOB NO. 7847
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1344E+04



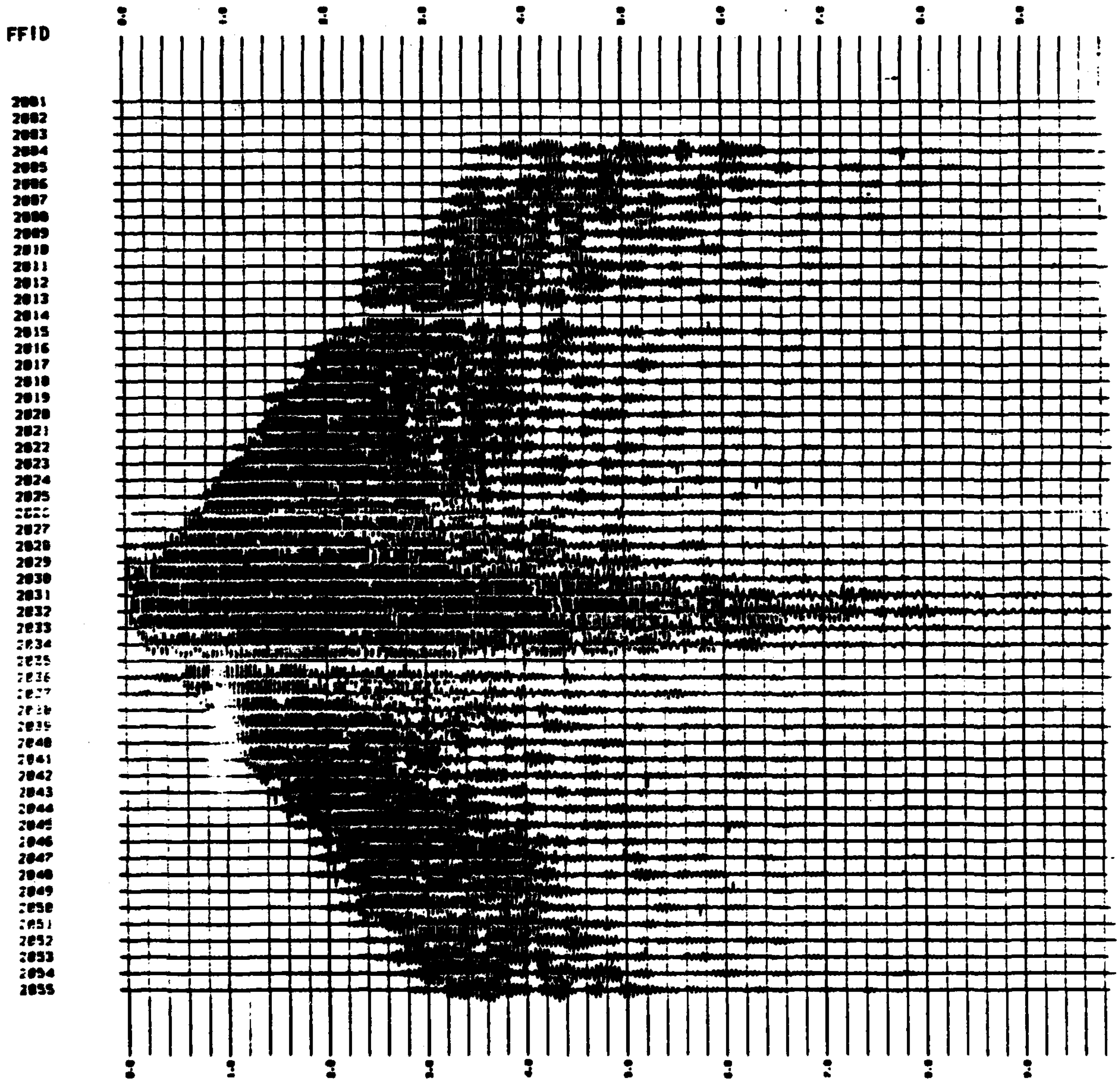
PROJECT : SICILY   SICILY 22 OBS#4 VERT (UNFILT.ROT @1.7 KM/SEC) LINE 2
21-APR-1983 14:35:44.78   JOB NO. 7847
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1344E+04

PROJECT : SICILY   SICILY 22 OBS#1 Rad (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 14:52:35.95   JOB NO. 7887
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.344) . PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2573E+04



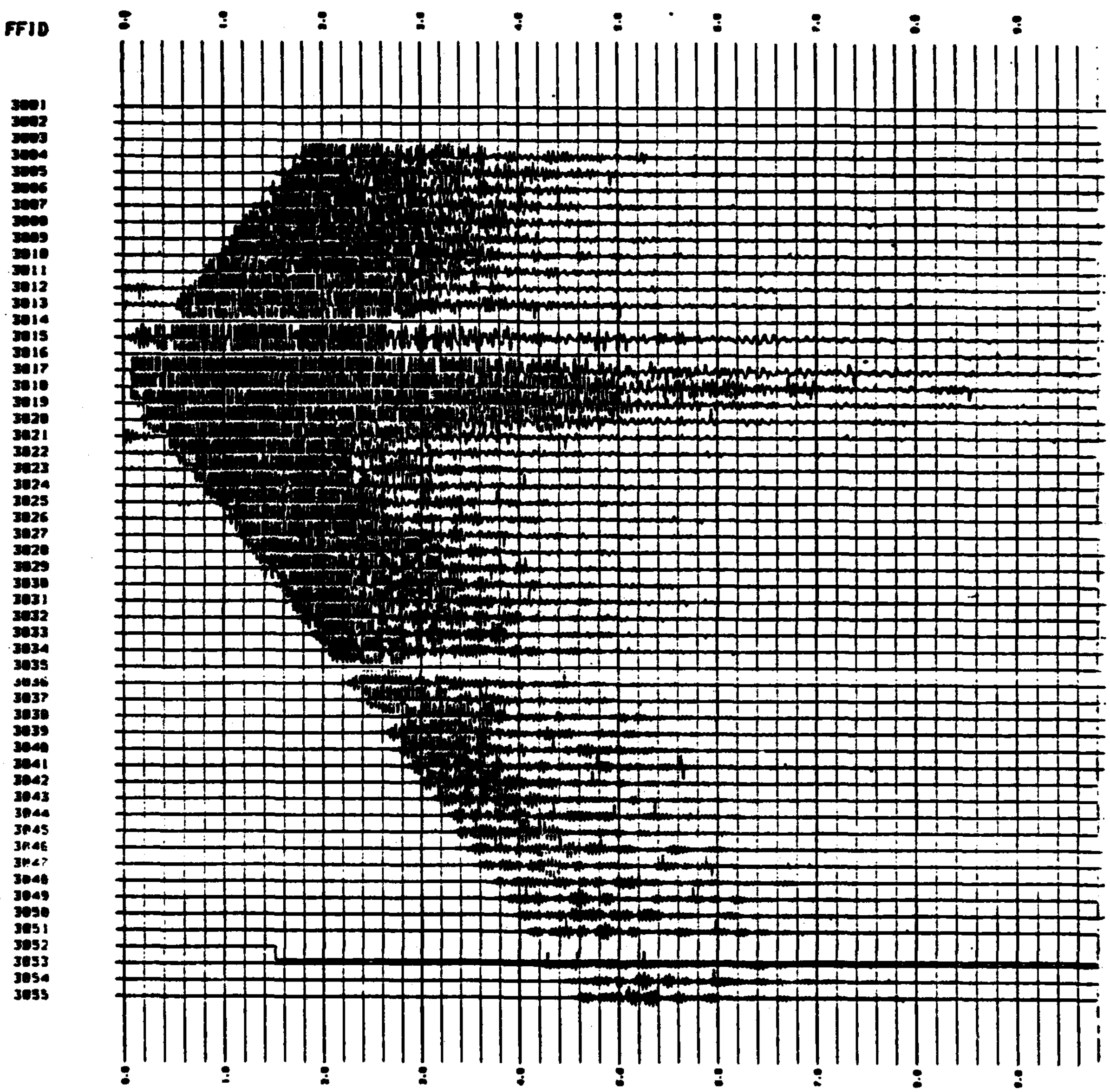
SICILY 22 OBS#1 Rad (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 14:52:35.95   JOB NO. 7887
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2573E+04

PROJECT : SICILY   SICILY 22 OBS•2 Radial (UNFILT.ROT 01.7 KM/SEC) LINE   2
21-APR-1983 14:56:10.64   JOB NO.   7859
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3629E+04



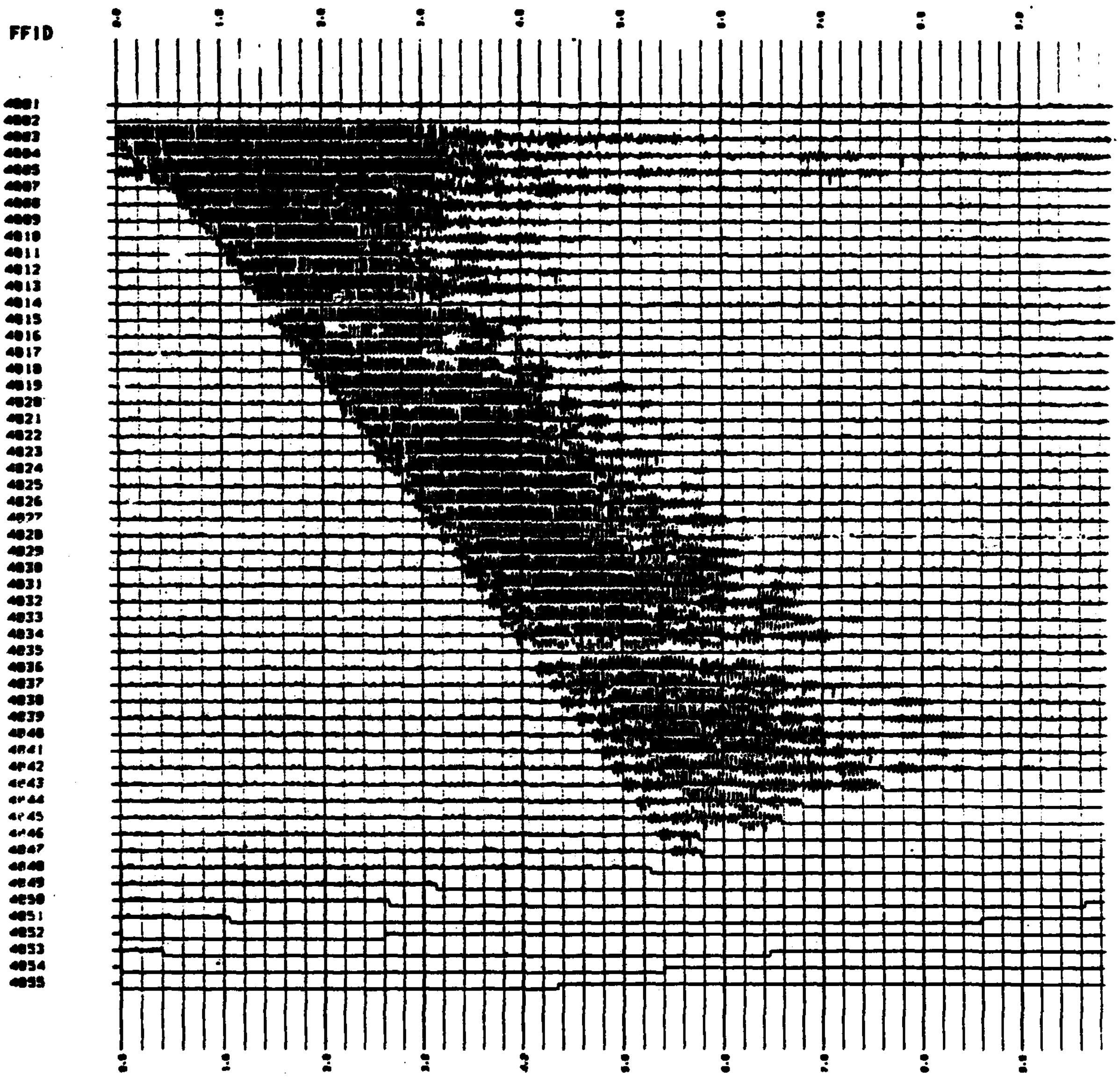
PROJECT : SICILY   SICILY 22 OBS•2 Rad (UNFILT.ROT 01.7 KM/SEC) LINE   2
21-APR-1983 14:56:10.64   JOB NO.   7859
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.3629E+04

PROJECT : SICILY   SICILY 22 OBS#3 Rad (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 15:01:19.00   JOB NO. 7061
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2362E+04



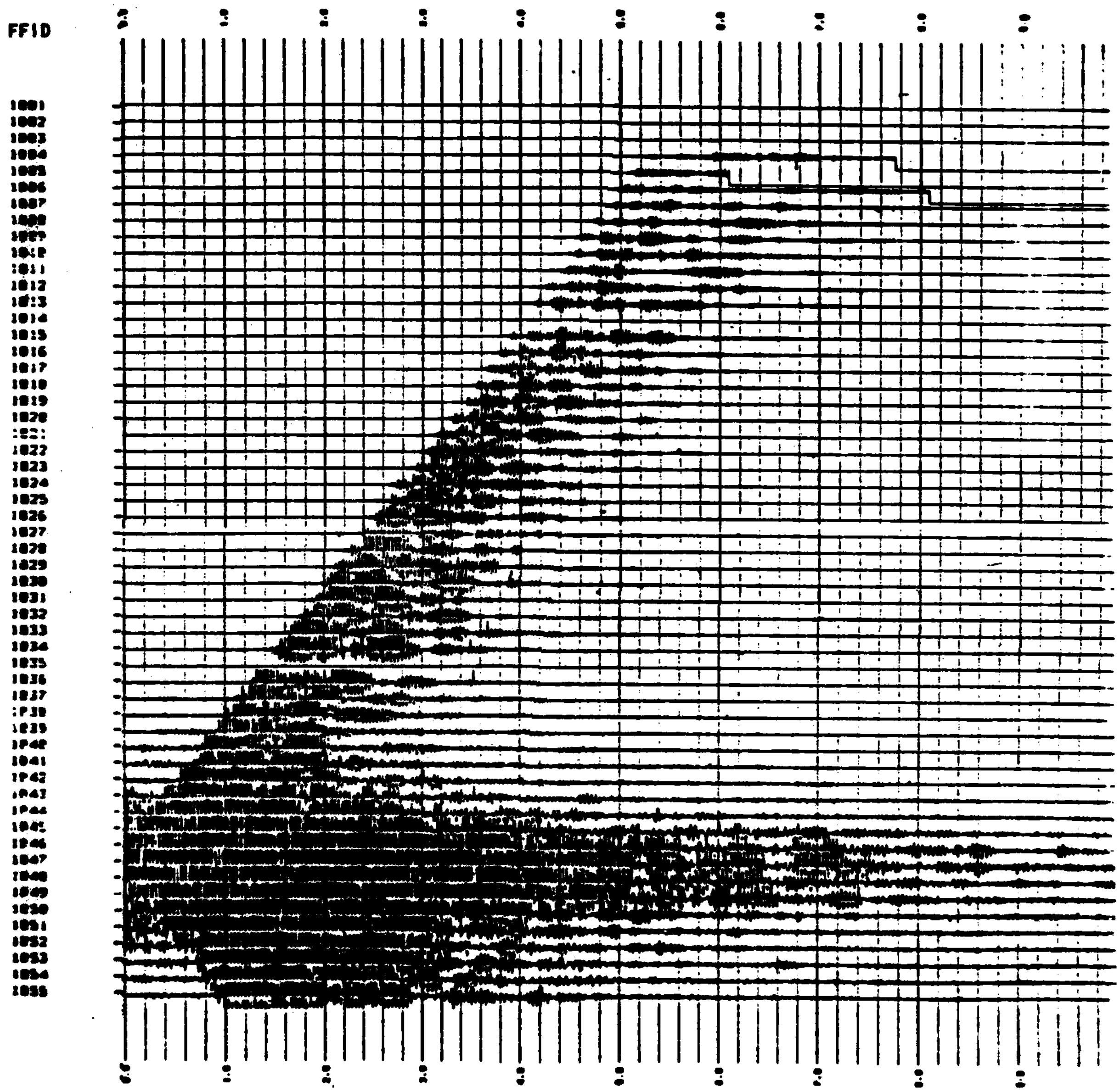
PROJECT : SICILY   SICILY 22 OBS#3 Rad (UNFILT.ROT 01.7 KM/SEC) LINE 2
21-APR-1983 15:01:19.00   JOB NO. 7061
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2362E+04

PROJECT : SICILY   SICILY 22 DBS=4 Rad (UNFILT.RDT 01.7 KM&D) LINE 2
21-APR-1983 15:04:25.60   JOB NO. 7062
POLARITY NORMAL - POSITIVE   DATA(39993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.2519E+04



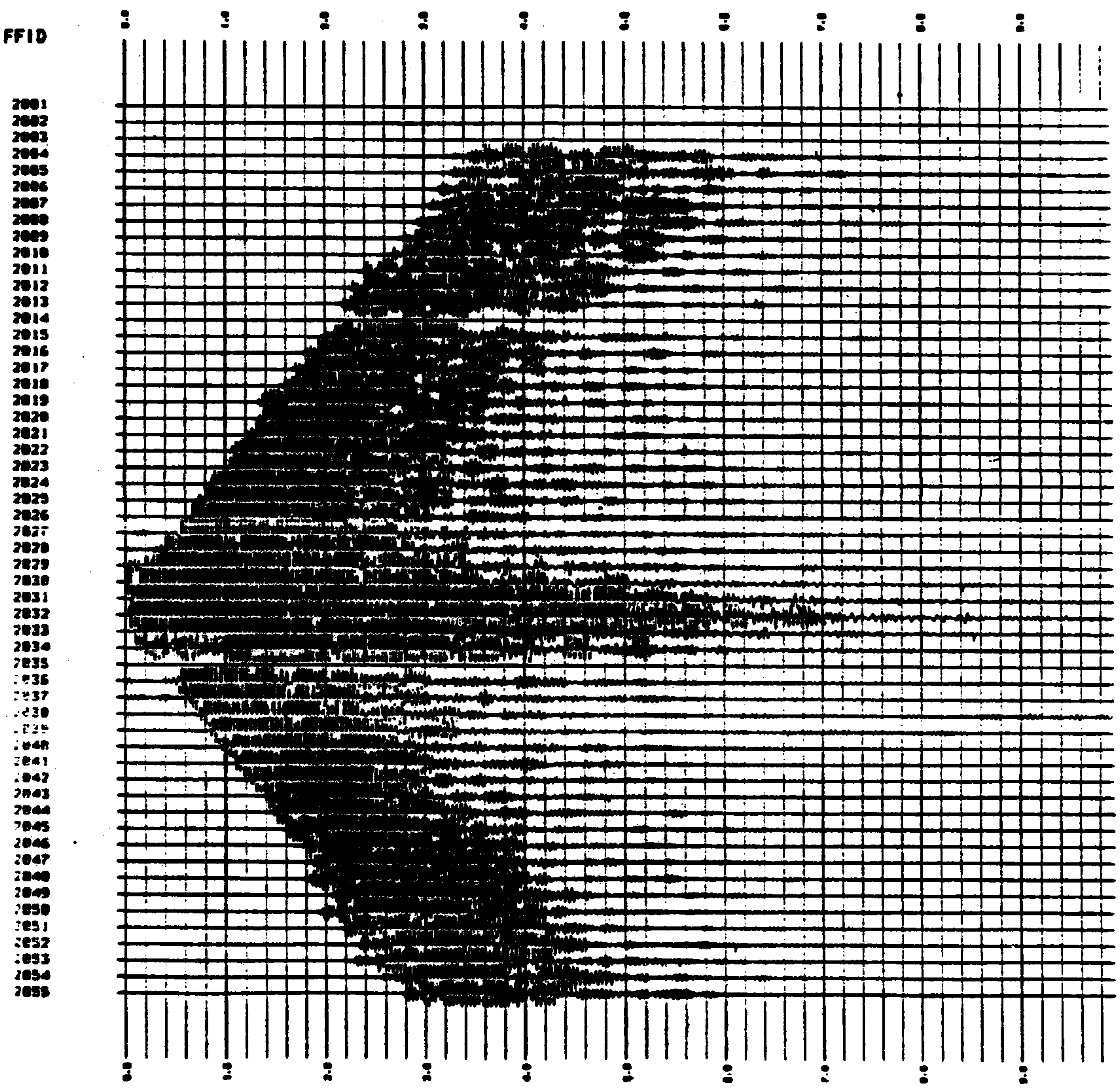
PROJECT : SICILY   SICILY 22 DBS=4 Rad (UNFILT.RDT 01.7 KM&D) LINE 2
21-APR-1983 15:04:25.60   JOB NO. 7062
POLARITY NORMAL - POSITIVE   DATA(39993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.2519E+04

PROJECT : SICILY   SICILY 22 OBS# ITran(UNFILT.OBT 01.7 ENVEQ) LINE 2
21-APR-1983 14:39:17.99   JOB NO. 7849
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2413E+04



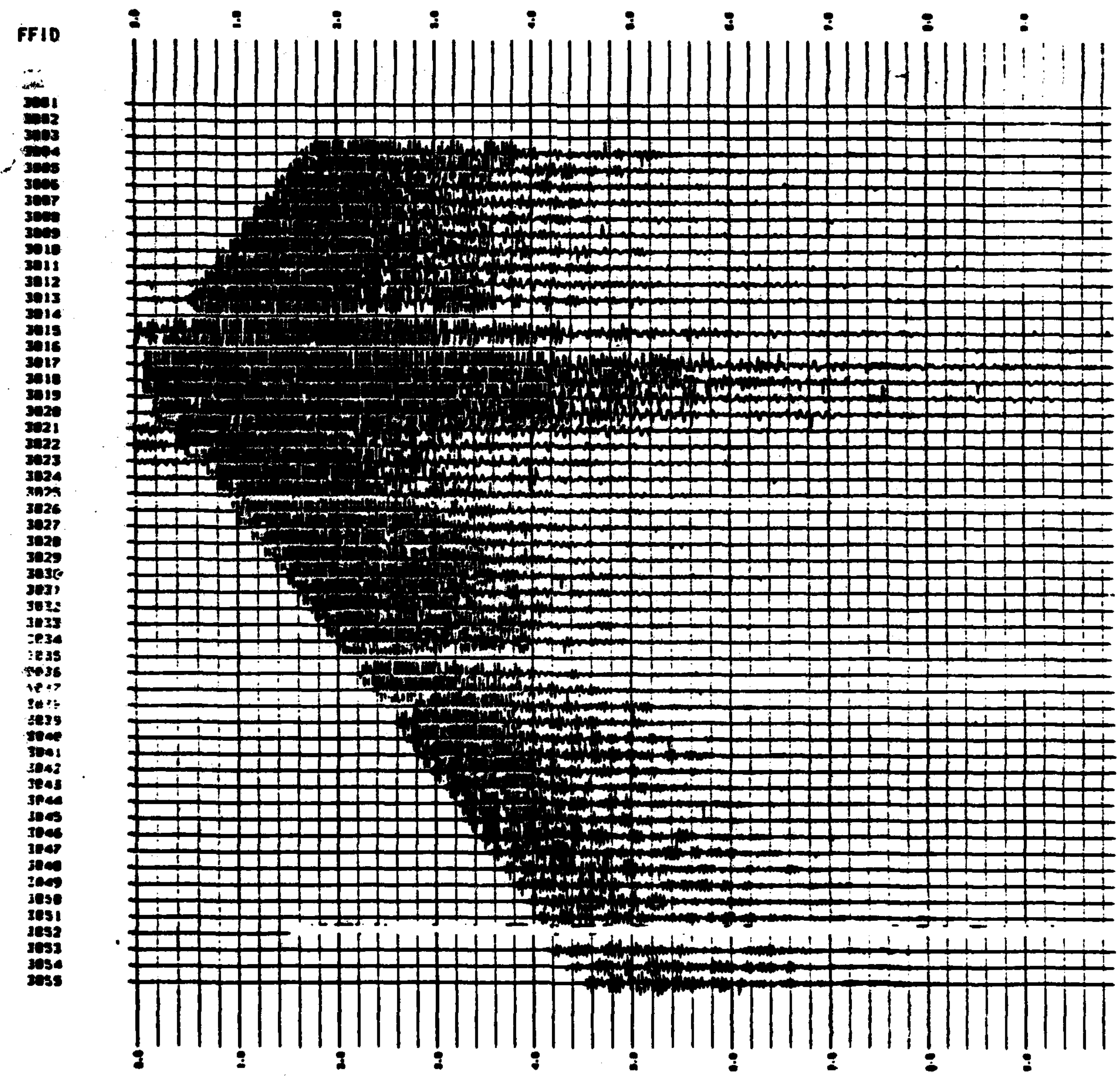
PROJECT : SICILY   SICILY 22 OBS# ITran(UNFILT.OBT 01.7 ENVEQ) LINE 2
21-APR-1983 14:39:17.99   JOB NO. 7849
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2413E+04

PROJECT : SICILY SICILY 22 SUB+ 2 Tra (UNFILT.ROT 01.7 KMSEC) LINE 2
21-APR-1983 14:42:27.35 JOB NO. 7851
POLARITY NORMAL - POSITIVE DATA(55993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. - 0.5389E+04

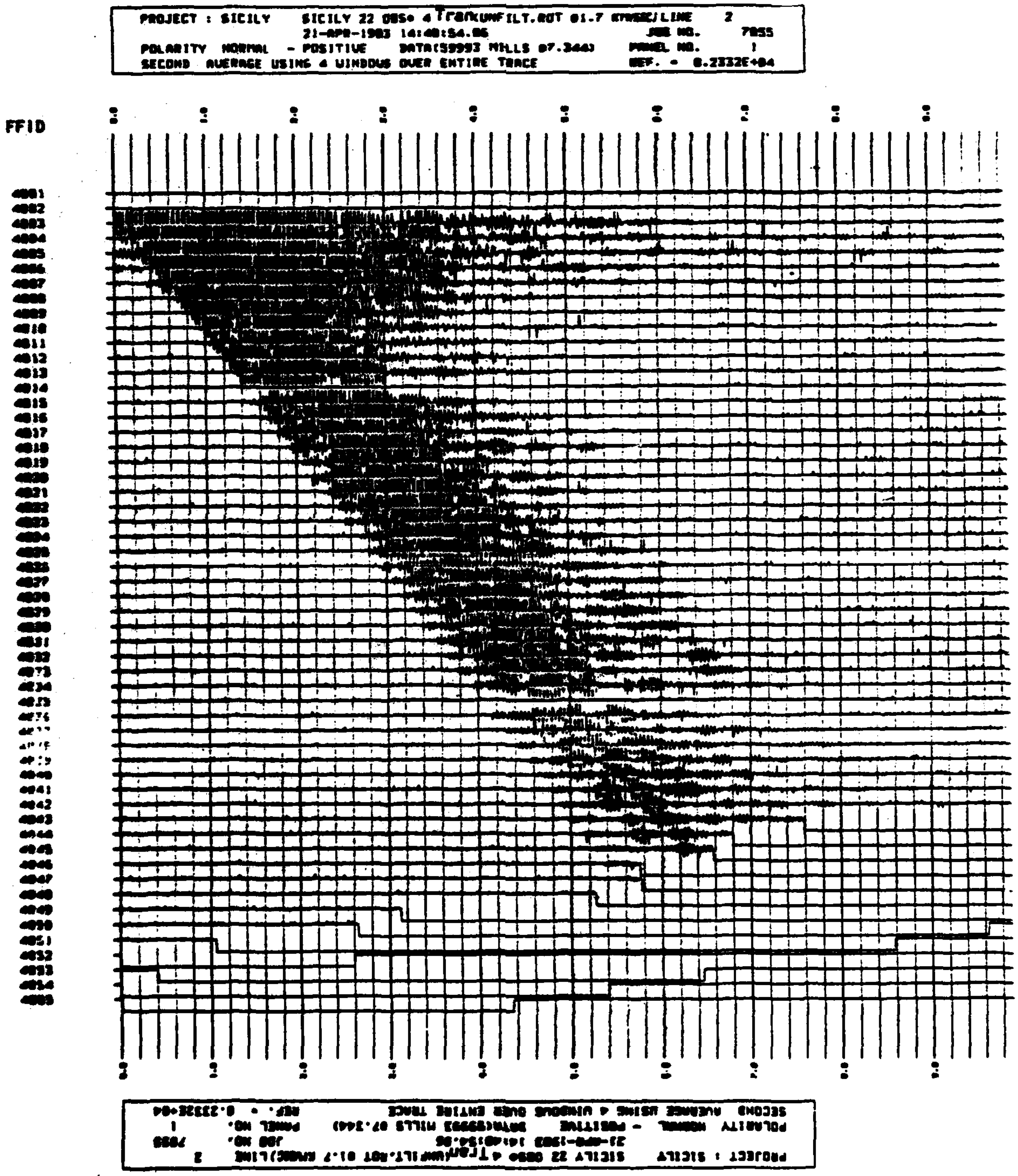


PROJECT : SICILY SICILY 22 SUB+ 2 Tra (UNFILT.ROT 01.7 KMSEC) LINE 2
21-APR-1983 14:42:27.35 JOB NO. 7851
POLARITY NORMAL - POSITIVE DATA(55993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. - 0.5389E+04

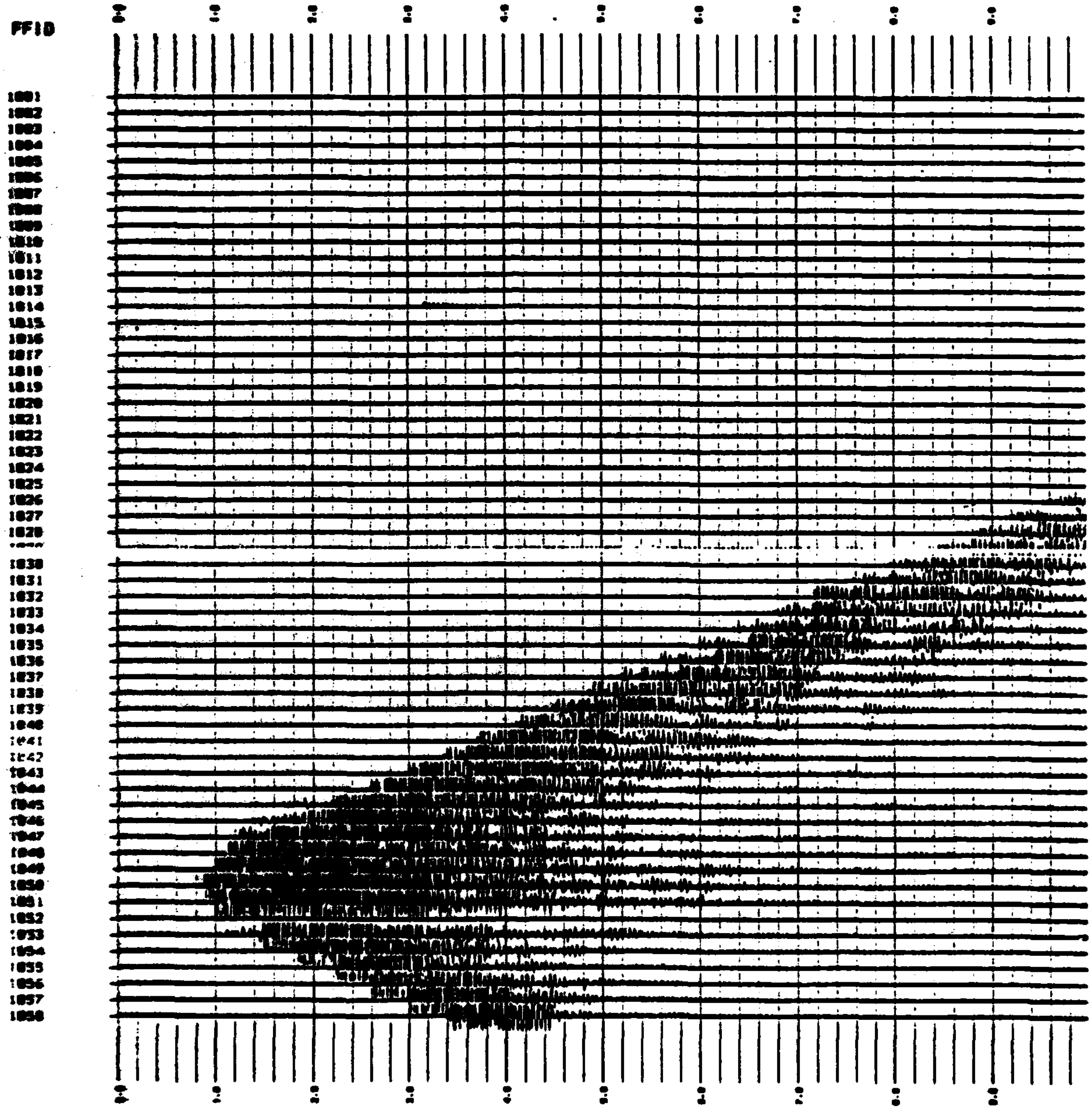
PROJECT : SICILY   SICILY 22 OBS# 3 Tran(UNFILT.ROT 01.7 KMGD) LINE 2
21-APR-1983 14:45:22.86   JOB NO. 7883
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2381E+00



PROJECT : SICILY   SICILY 22 OBS# 3 Tran(UNFILT.ROT 01.7 KMGD) LINE 2
21-APR-1983 14:45:22.86   JOB NO. 7883
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2381E+00

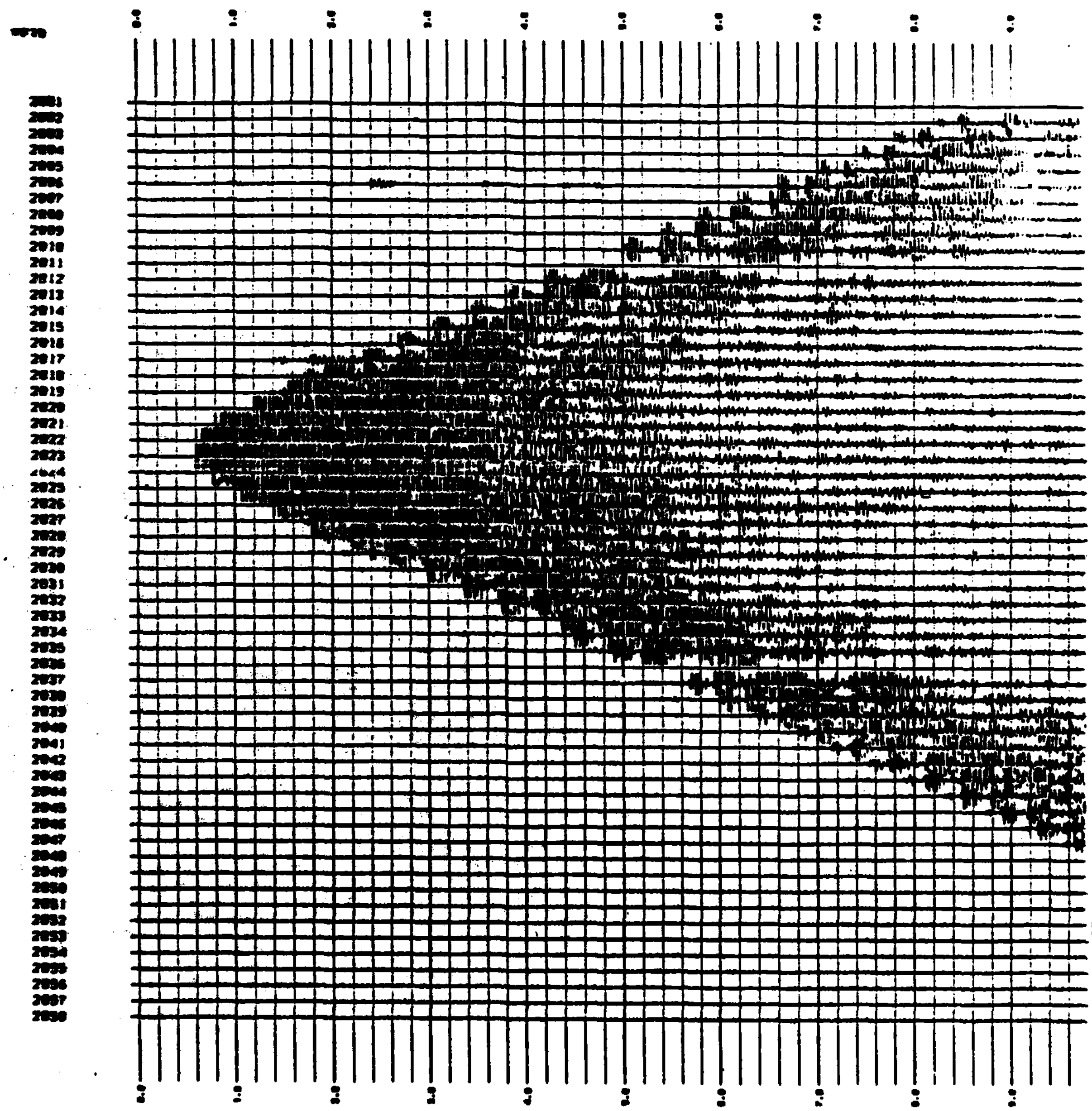

PROJECT : SICILY
SICILY 22 OBS# 4 Tran(UNFILT.ROT 01.7 KM/SEC)/LINE 2
21-APR-1983 14:40:54.06
JOB NO. 7855
POLARITY NORMAL - POSITIVE
DATA(59993 MILLS 07.344)
PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE
REF. = 0.2332E+04
FFID

PROJECT : SICILY   SICILY 21 OBS#1 VERT(UNFILT.ROT 04.5 KM/SEC) LINE 1
28-APR-1983 08:25:23.40   JOB NO. 7665
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2191E+03



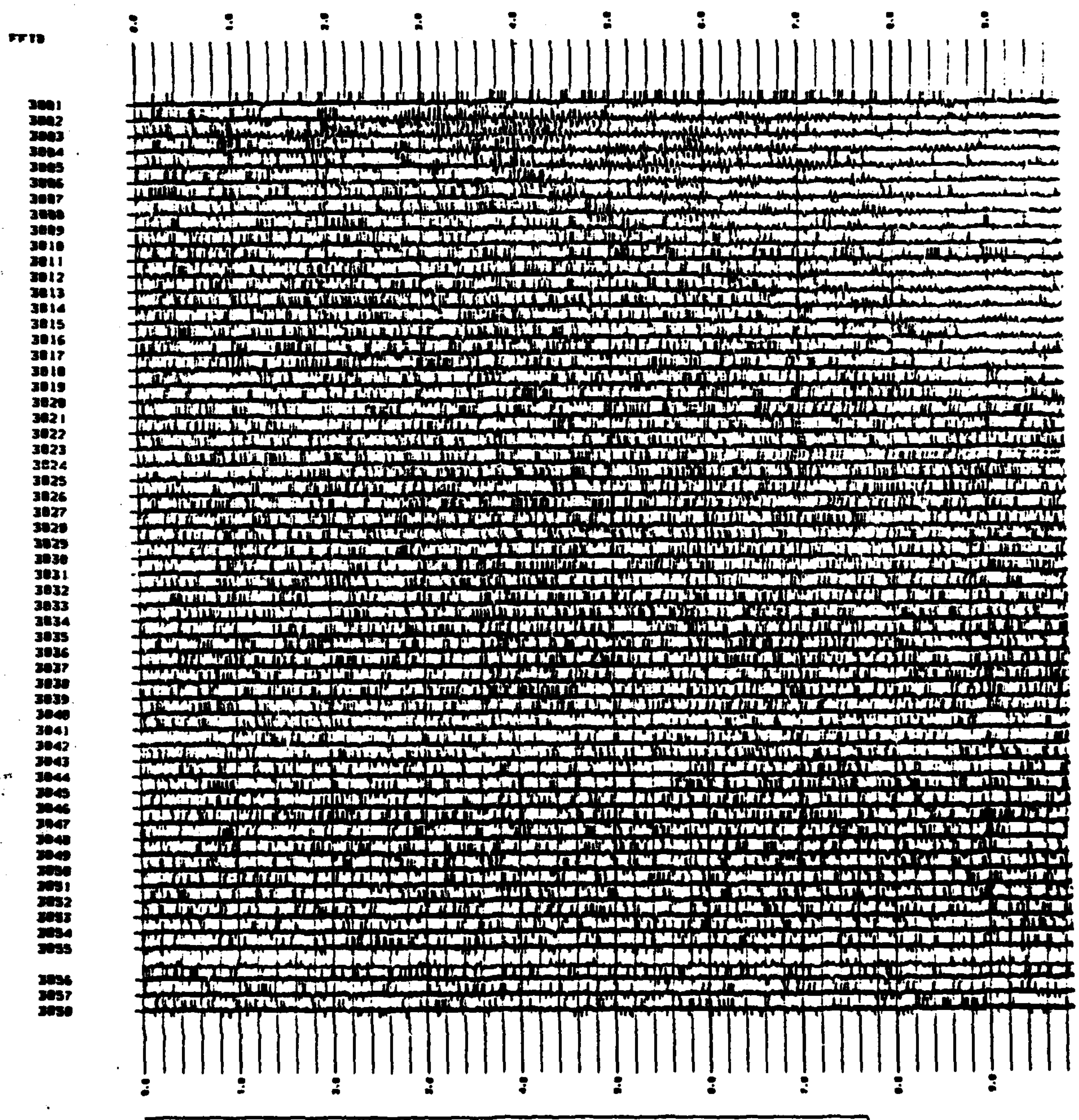
PROJECT : SICILY   SICILY 21 OBS#1 VERT(UNFILT.ROT 04.5 KM/SEC) LINE 1
28-APR-1983 08:25:23.40   JOB NO. 7665
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2191E+03

PROJECT : SICILY   SICILY 21 OBS42 VERT(UNFILT.ROT 04.5 KM/SEC) LINE 1
29-APR-1983 09:28:57.82   JOB NO. 7666
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1780E+03



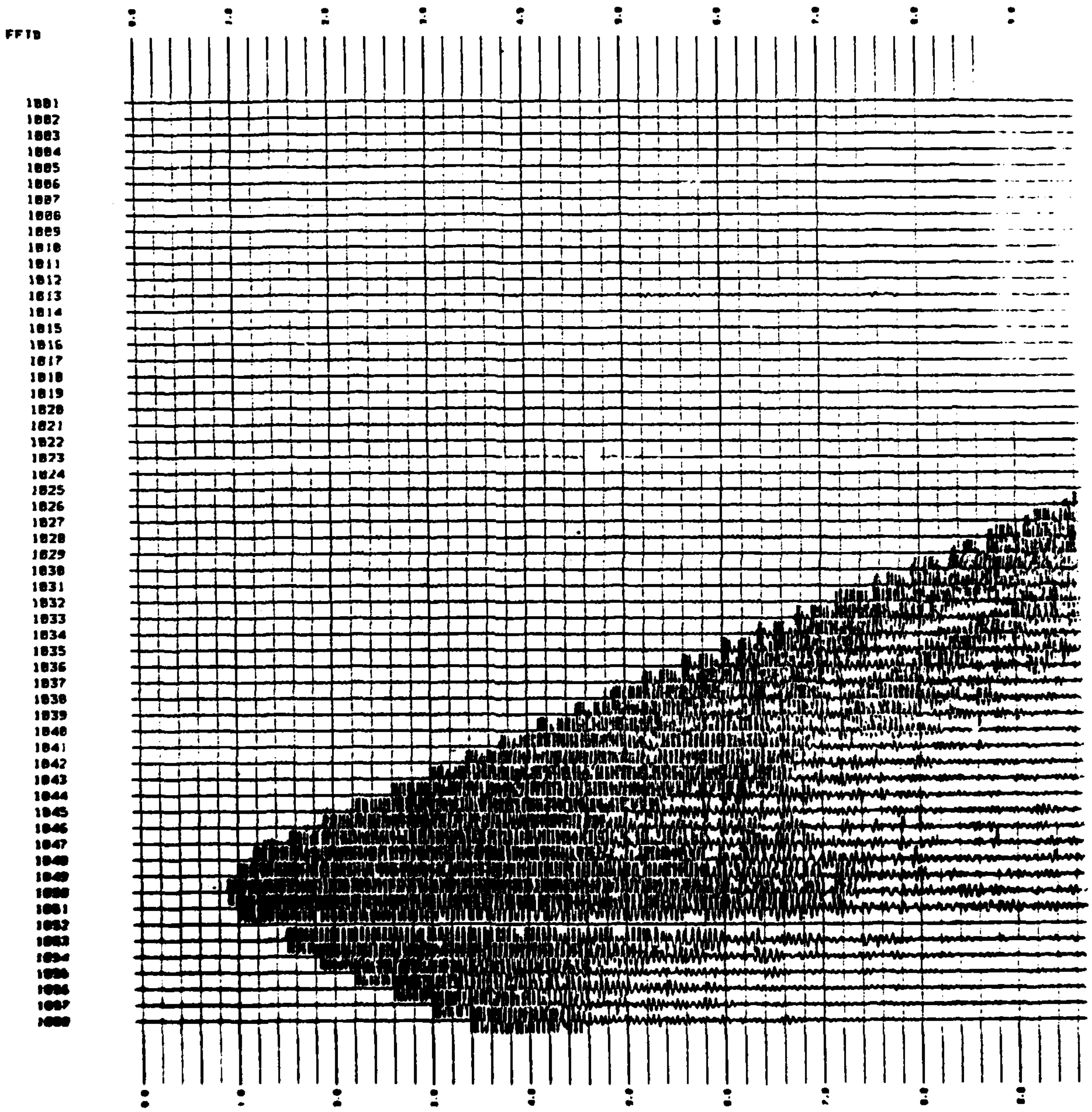
PROJECT : SICILY   SICILY 21 OBS42 VERT(UNFILT.ROT 04.5 KM/SEC) LINE 1
29-APR-1983 09:28:57.82   JOB NO. 7666
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1780E+03

PROJECT : SICILY   SICILY 21 OBS03 VERT(UNFILT.RDT 04.5 KM/SEC) LINE   1
20-APR-1983 09:32:36.19   JOB NO.   7669
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5489E+03



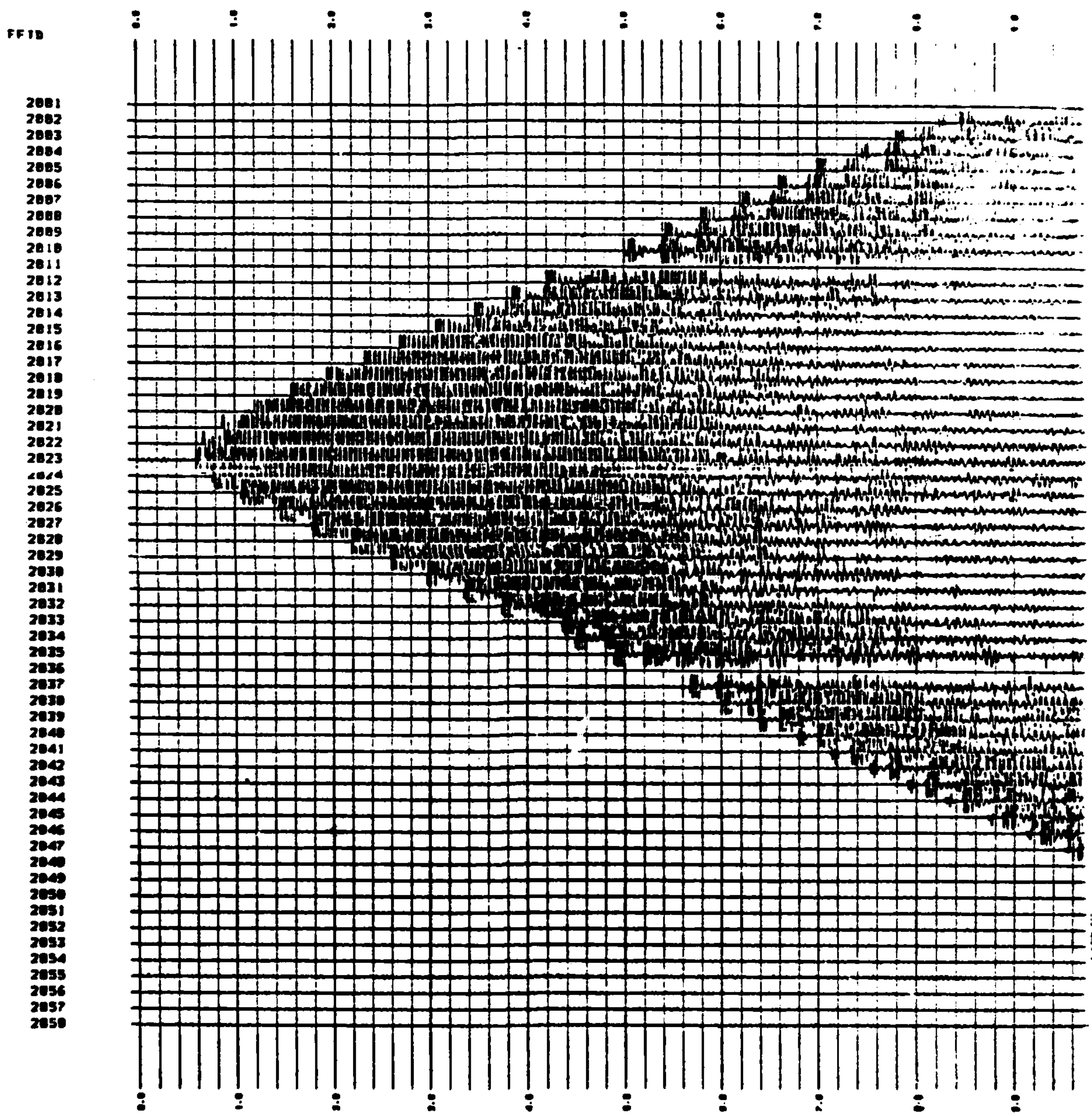
PROJECT : SICILY   SICILY 21 OBS03 VERT(UNFILT.RDT 04.5 KM/SEC) LINE   1
20-APR-1983 09:32:36.19   JOB NO.   7669
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5489E+03

PROJECT : SICILY   SICILY 21 OBS*1Rad (UNFILT.RDT @4.5 KM/SEC) LINE 1
20-APR-1983 09:44:55.89   JOB NO. 7675
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.3979E+03



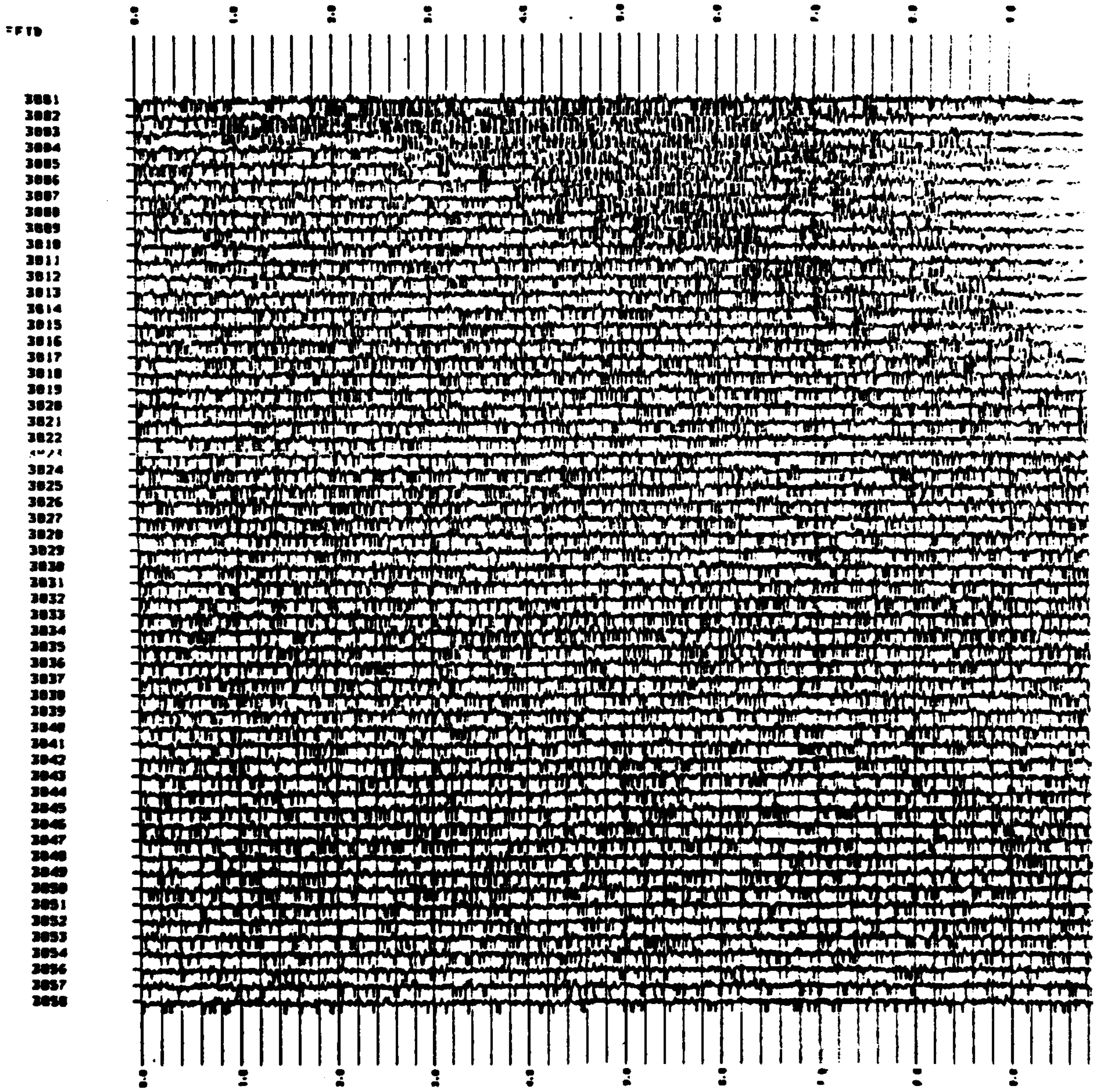
PROJECT : SICILY   SICILY 21 OBS*1Rad (UNFILT.RDT @4.5 KM/SEC) LINE 1
20-APR-1983 09:44:55.89   JOB NO. 7675
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 8.3979E+03

PROJECT : SICILY   SICILY 21 OBS•2 Rad (UNFILT.RDT 04.5 KM/SEC) LINE 1
28-APR-1983 09:47:48.70   JOB NO. 7676
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5440E+03



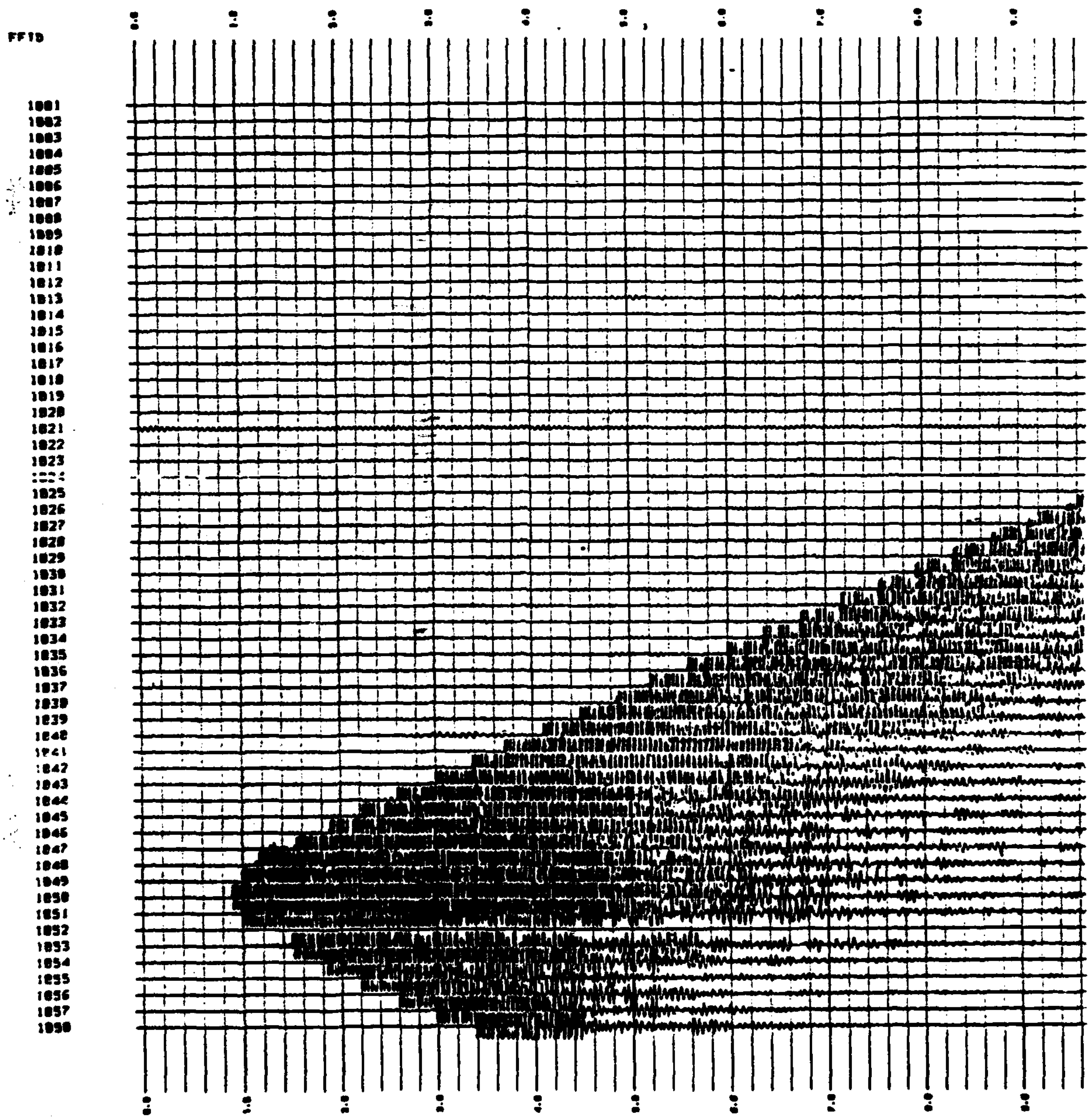
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.5440E+03
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
28-APR-1983 09:47:48.70   JOB NO. 7676
PROJECT : SICILY   SICILY 21 OBS•2 Rad (UNFILT.RDT 04.5 KM/SEC) LINE 1

PROJECT : SICILY SICILY 2: OBS=3 Rad (UNFILT.ROT 04.5 KM/SEC) LINE 1
20-APR-1983 09:50:17.64 JOB NO. 7677
POLARITY NORMAL - POSITIVE DATA(49997 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 8.6368E+03



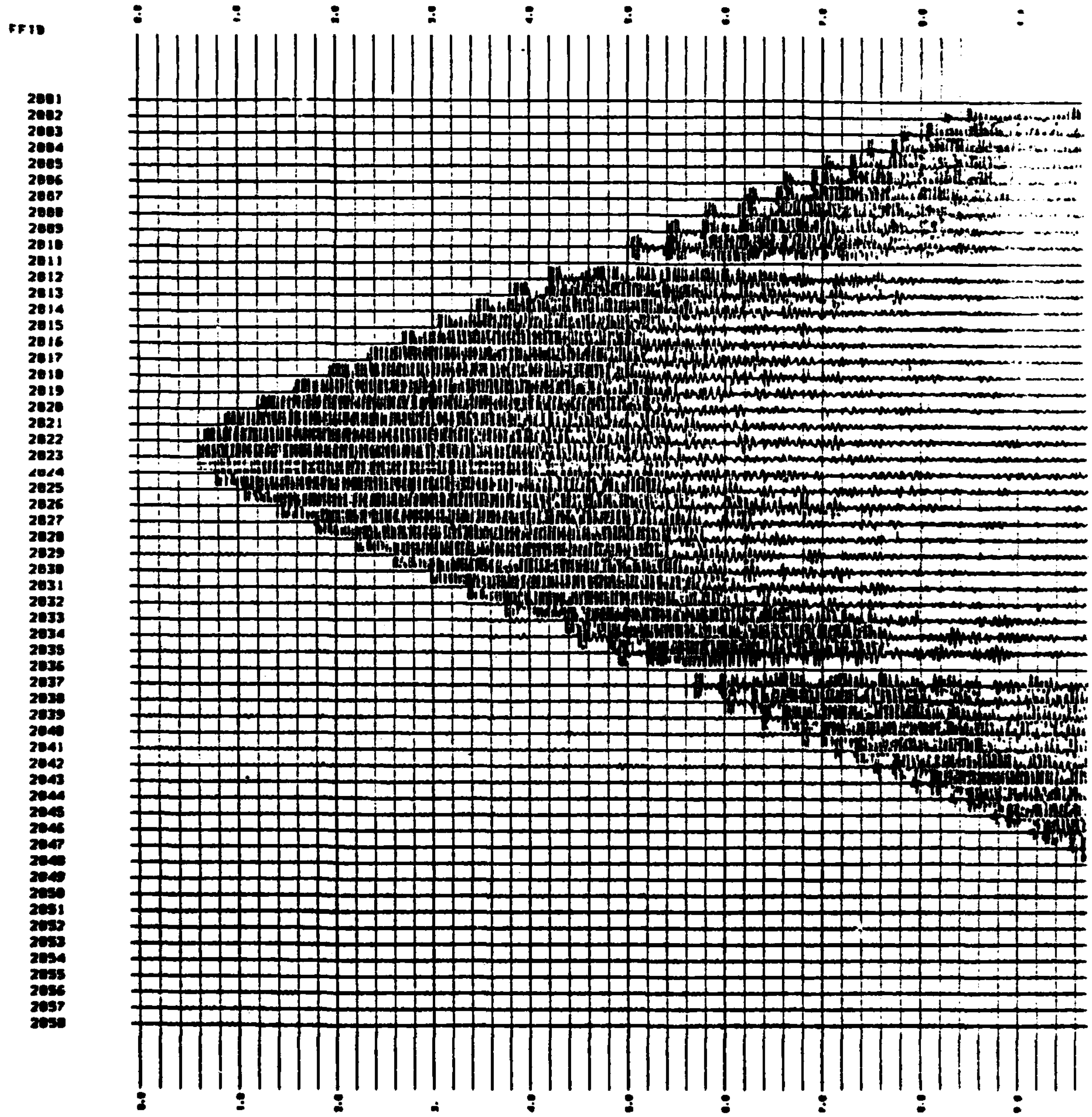
PROJECT : SICILY SICILY 2: OBS=3 Rad (UNFILT.ROT 04.5 KM/SEC) LINE 1
20-APR-1983 09:50:17.64 JOB NO. 7677
POLARITY NORMAL - POSITIVE DATA(49997 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 8.6368E+03

PROJECT : SICILY   SICILY 21 OBS#1 Tra(UNFILT.ROT @4.5 KM/SEC) LINE 1
20-APR-1983 09:36:31.20   JOB NO. 7672
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.4921E+03



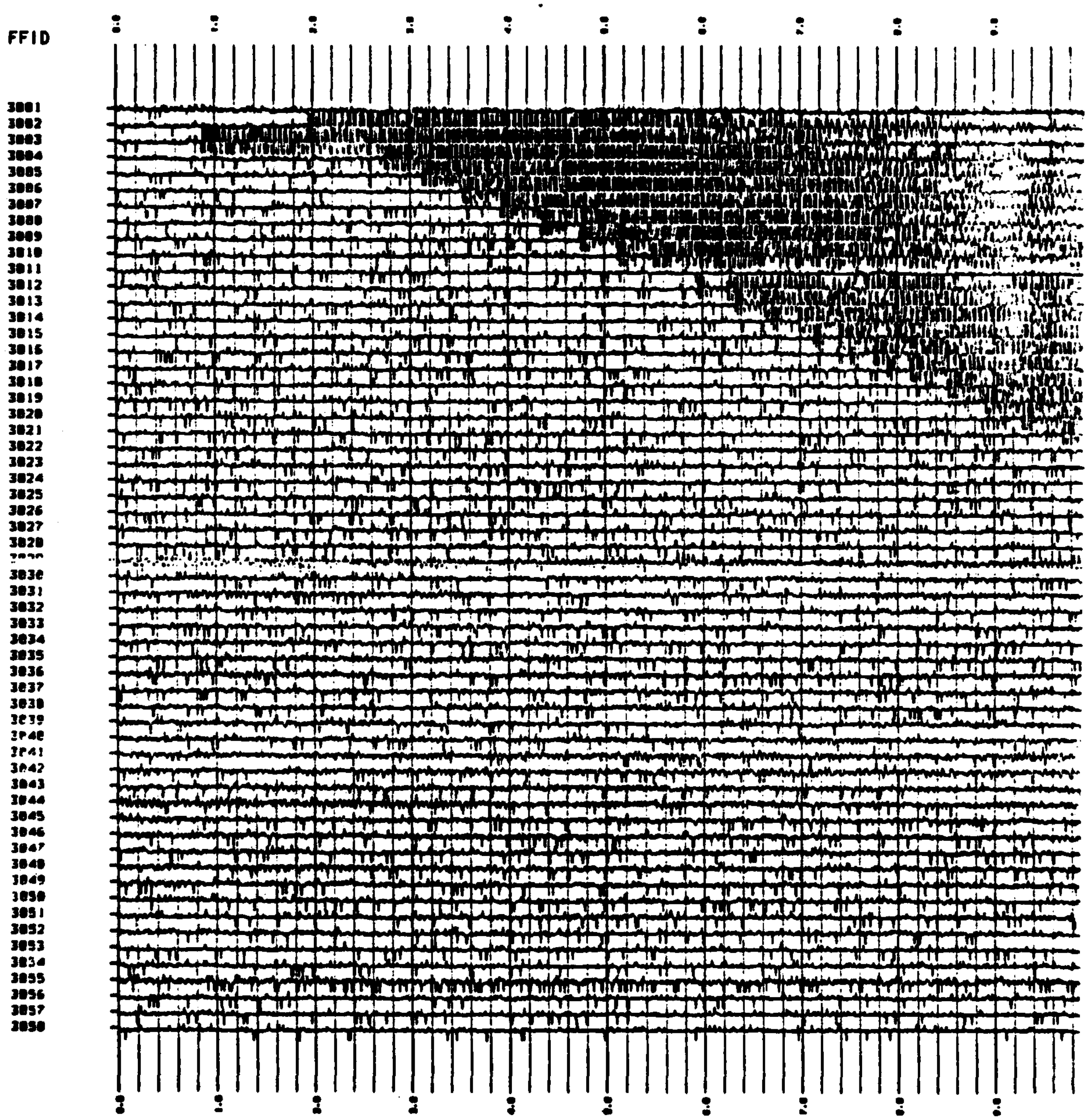
PROJECT : SICILY   SICILY 21 OBS#1 Tra(UNFILT.ROT @4.5 KM/SEC) LINE 1
20-APR-1983 09:36:31.20   JOB NO. 7672
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.4921E+03

PROJECT : SICILY   SICILY 2) OBS#2 Tra (UNFILT.ROT 04.5 KM/SEC) LINE 1
28-APR-1983 09:39:22.04   JOB NO. 7673
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.8466E+03



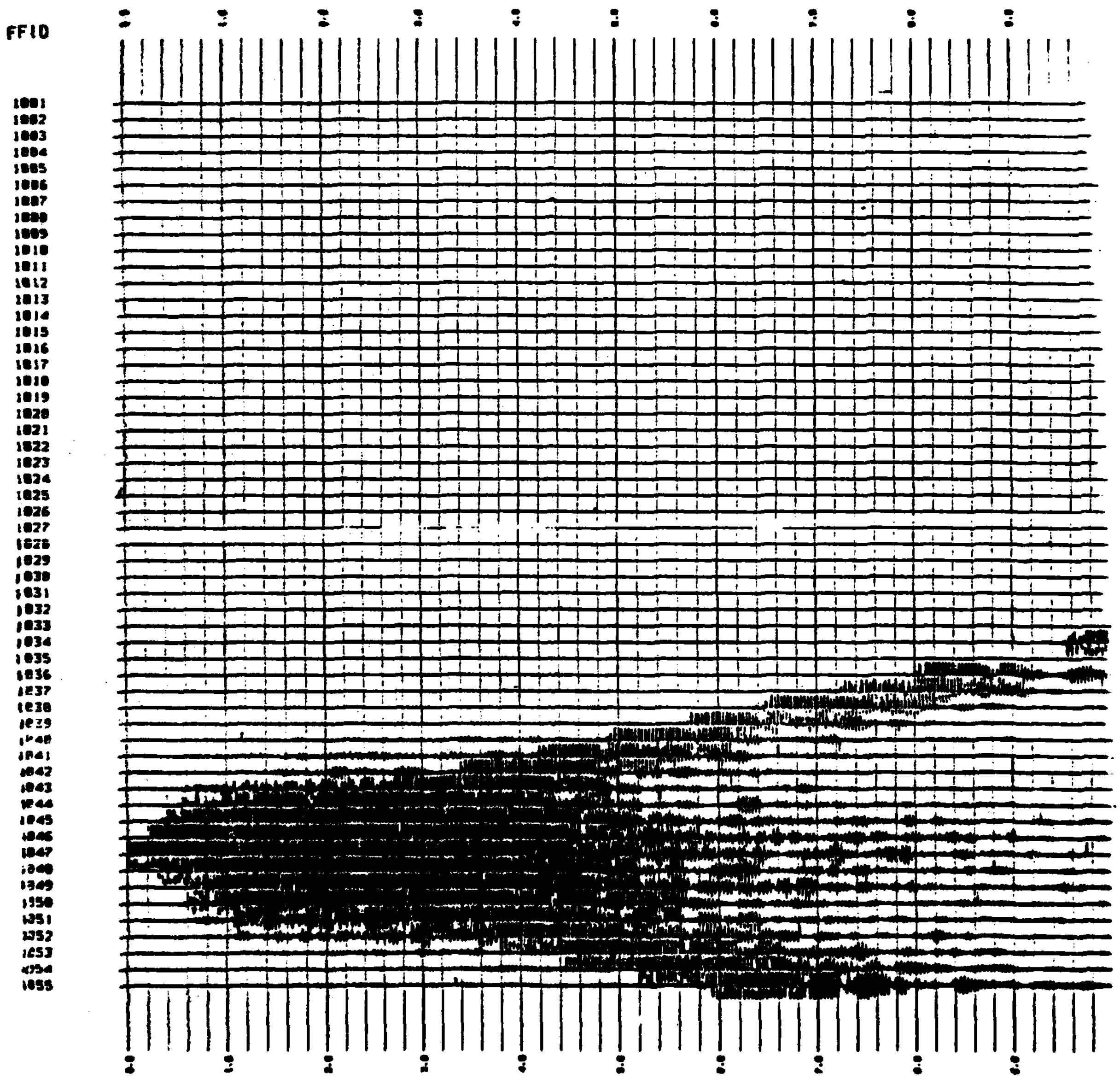
PROJECT : SICILY   SICILY 2) OBS#2 Tra (UNFILT.ROT 04.5 KM/SEC) LINE 1
28-APR-1983 09:39:22.04   JOB NO. 7673
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.8466E+03

PROJECT : SICILY   SICILY 21 OBS•3TrA (UNFILT.RDT @4.5 KM/SEC) LINE 1
28-APR-1983 09:41:59.09   JOB NO. 7674
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.5874E+03



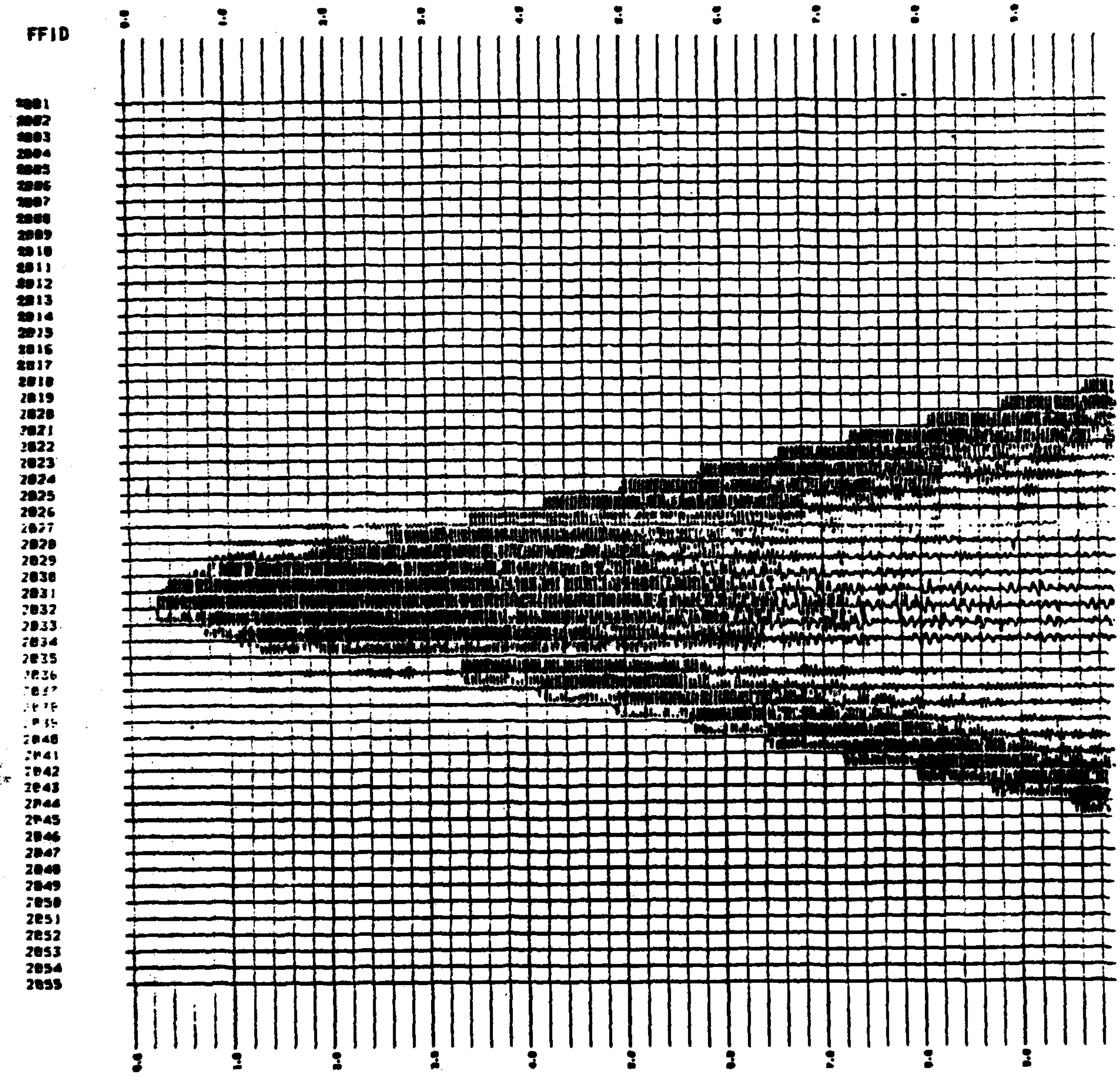
PROJECT : SICILY   SICILY 21 OBS•3TrA (UNFILT.RDT @4.5 KM/SEC) LINE 1
28-APR-1983 09:41:59.09   JOB NO. 7674
POLARITY NORMAL - POSITIVE   DATA(49997 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. - 0.5874E+03

PROJECT : SICILY   SICILY 22 OBS#1 VERT(UNFILT.RDT @4.5 KM/SEC) LINE 2
28-APR-1983 18:42:48.93   JOB NO. 7683
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6922E+03



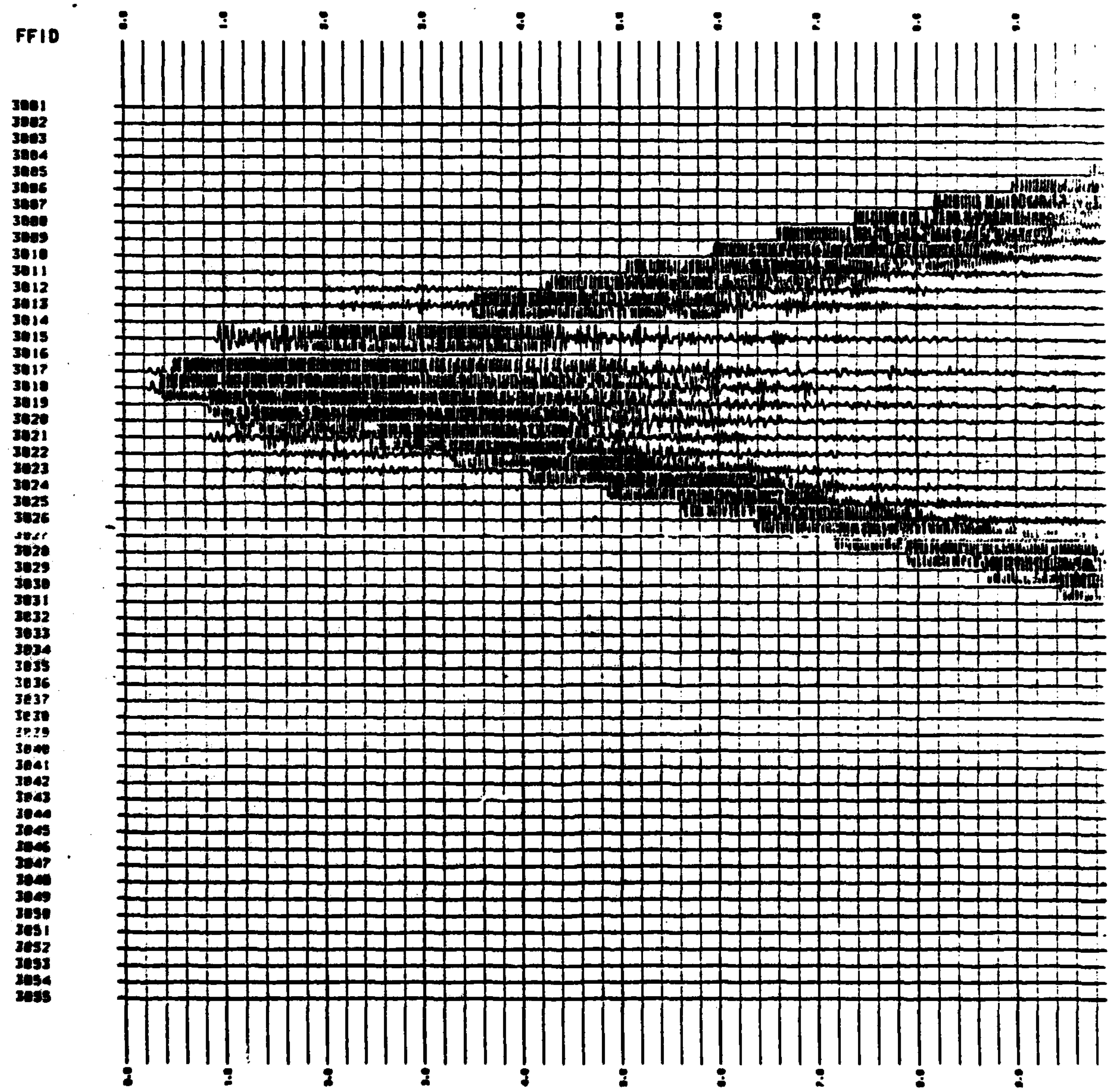
PROJECT : SICILY   SICILY 22 OBS#1 VERT(UNFILT.RDT @4.5 KM/SEC) LINE 2
28-APR-1983 18:42:48.93   JOB NO. 7683
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6922E+03

PROJECT : SICILY   SICILY 22 OBS02 VERT(UNFILT.RDT 04.5 KM/SEC) LINE 2
20-APR-1983 10:45:34.44   JOB NO. 7684
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.8793E+03



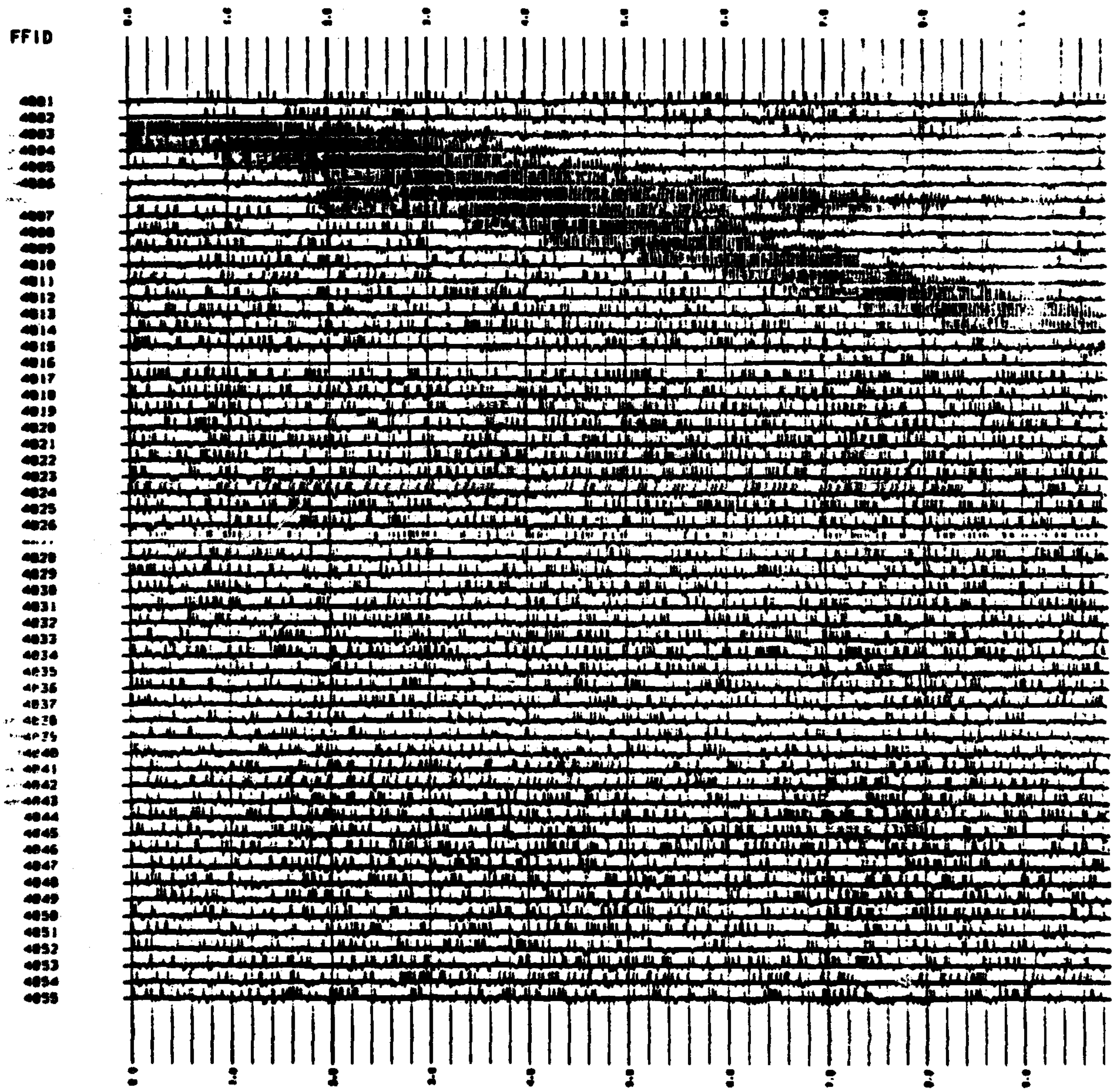
PROJECT : SICILY   SICILY 22 OBS02 VERT(UNFILT.RDT 04.5 KM/SEC) LINE 2
20-APR-1983 10:45:34.44   JOB NO. 7684
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.8793E+03

PROJECT : SICILY	SICILY 22 OBS#3 VERT(UNFILT.RDT @4.5 KM/SEC) LINE	2
	28-APR-1983 10:48:18.28 JOB NO.	7685
POLARITY NORMAL - POSITIVE	DATA(59993 MILLS @7.344) PANEL NO.	1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE	REF. = 0.2600E+03	



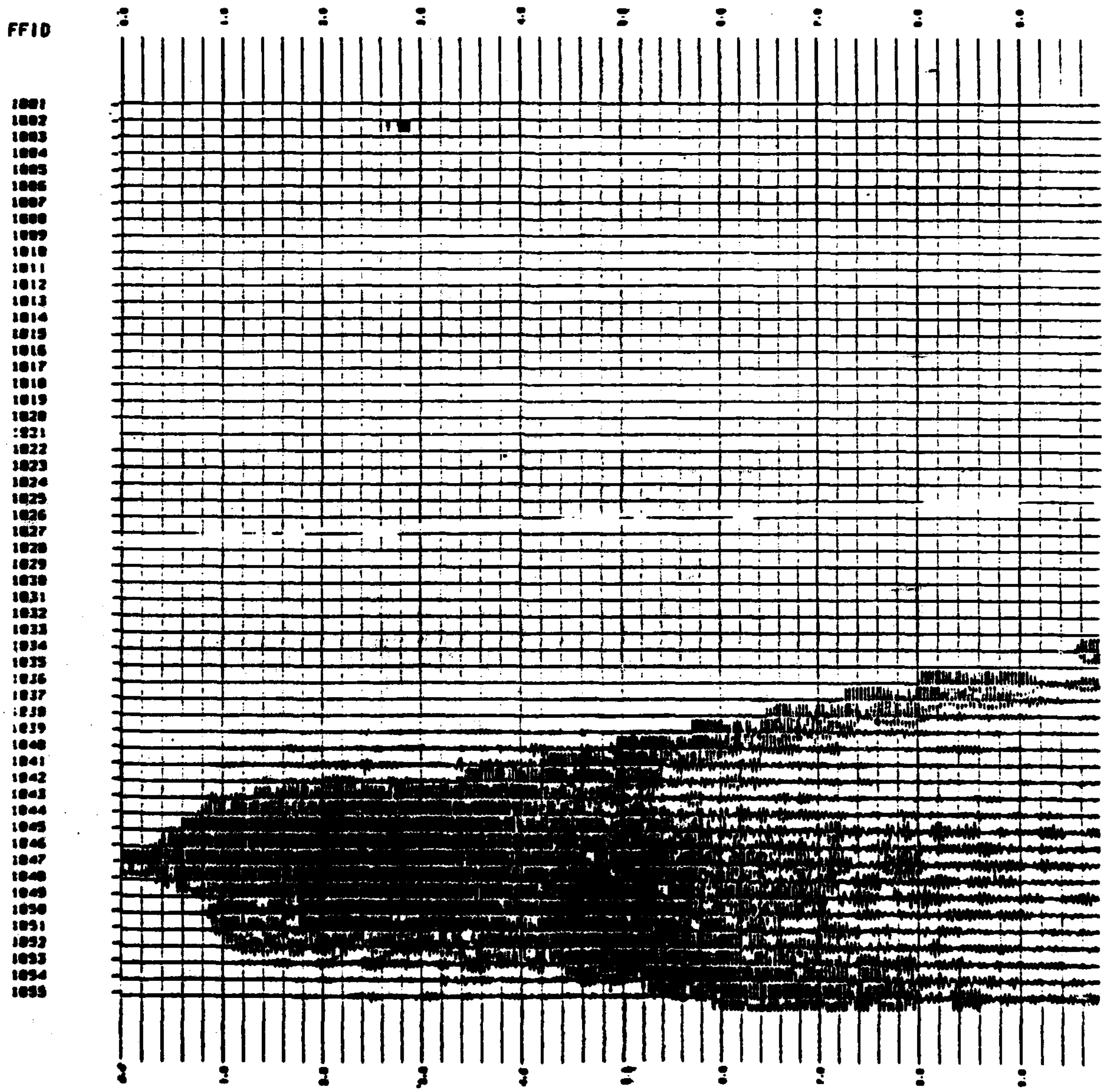
PROJECT : SICILY SICILY 22 OBS#3 VERT(UNFILT.RDT @4.5 KM/SEC) LINE 2
28-APR-1983 10:48:18.28 JOB NO. 7685
POLARITY NORMAL - POSITIVE DATA(59993 MILLS @7.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. = 0.2600E+03

PROJECT : SICILY   SICILY 22 OBS#4 VERT(UNFILT.ROT @4.5 KM/SEC) LINE 2
20-APR-1983 10:50:52.89   JOB NO. 7606
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6871E+03



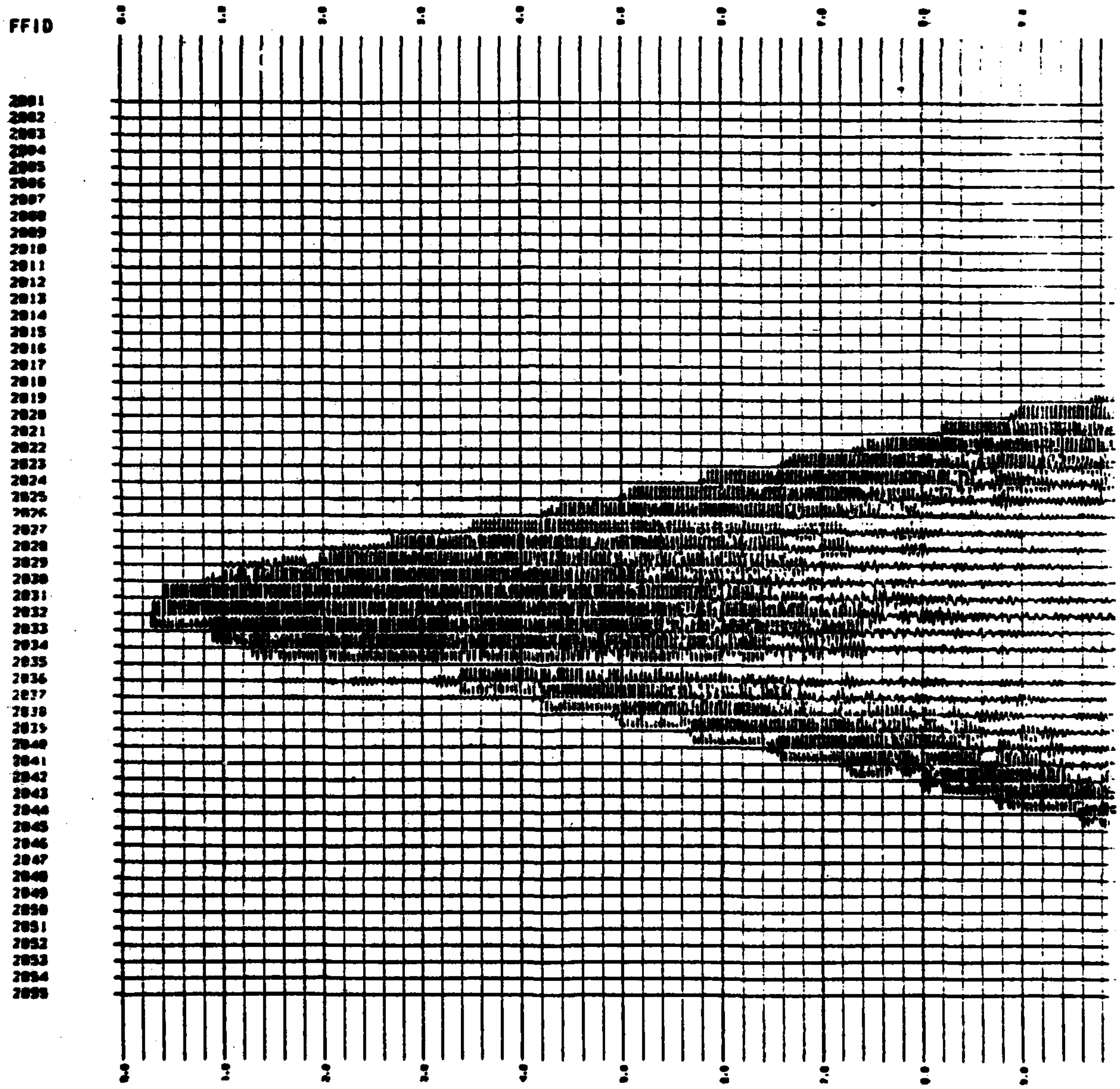
PROJECT : SICILY   SICILY 22 OBS#4 VERT(UNFILT.ROT @4.5 KM/SEC) LINE 2
20-APR-1983 10:50:52.89   JOB NO. 7606
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.6871E+03

PROJECT : SICILY   SICILY 22 OBS#1 Rad (UNFILT.RDT 04.5 KM/SEC) LINE 2
28-APR-1983 14:43:54.83   JOB NO. 7750
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.3443)   PANEL NO. 1
USER SUPPLIED REFERENCE VALUE   REF. = 0.2400E+04



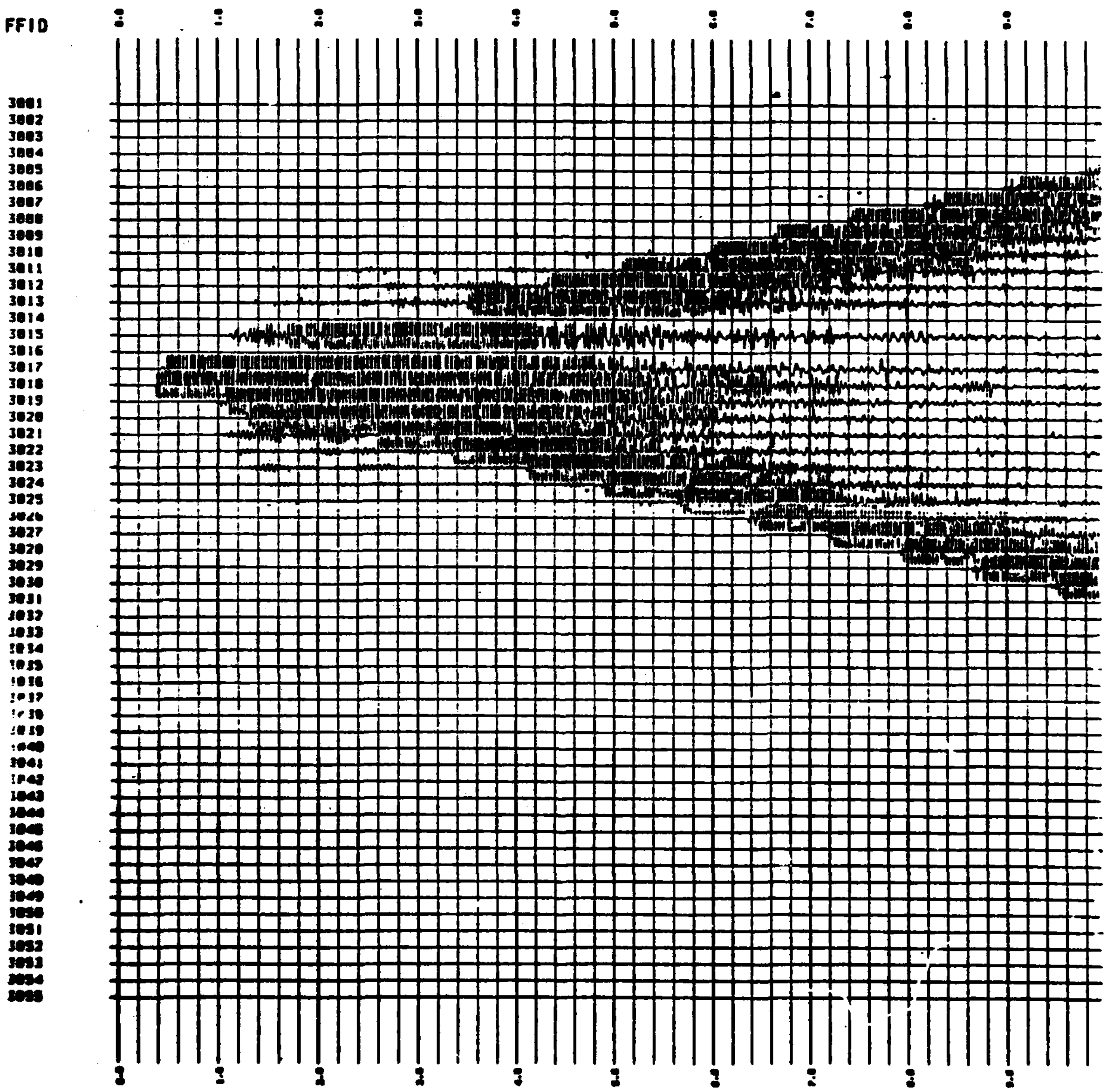
PROJECT : SICILY   SICILY 22 OBS#1 Rad (UNFILT.RDT 04.5 KM/SEC) LINE 2
28-APR-1983 14:43:54.83   JOB NO. 7750
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.3443)   PANEL NO. 1
USER SUPPLIED REFERENCE VALUE   REF. = 0.2400E+04

PROJECT : SICILY   SICILY 22 OBS#2 Rad (UNFILT.ROT 04.5 KMSEC) LINE 2
28-APR-1983 11:07:49.68   JOB NO. 7692
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2744E+04



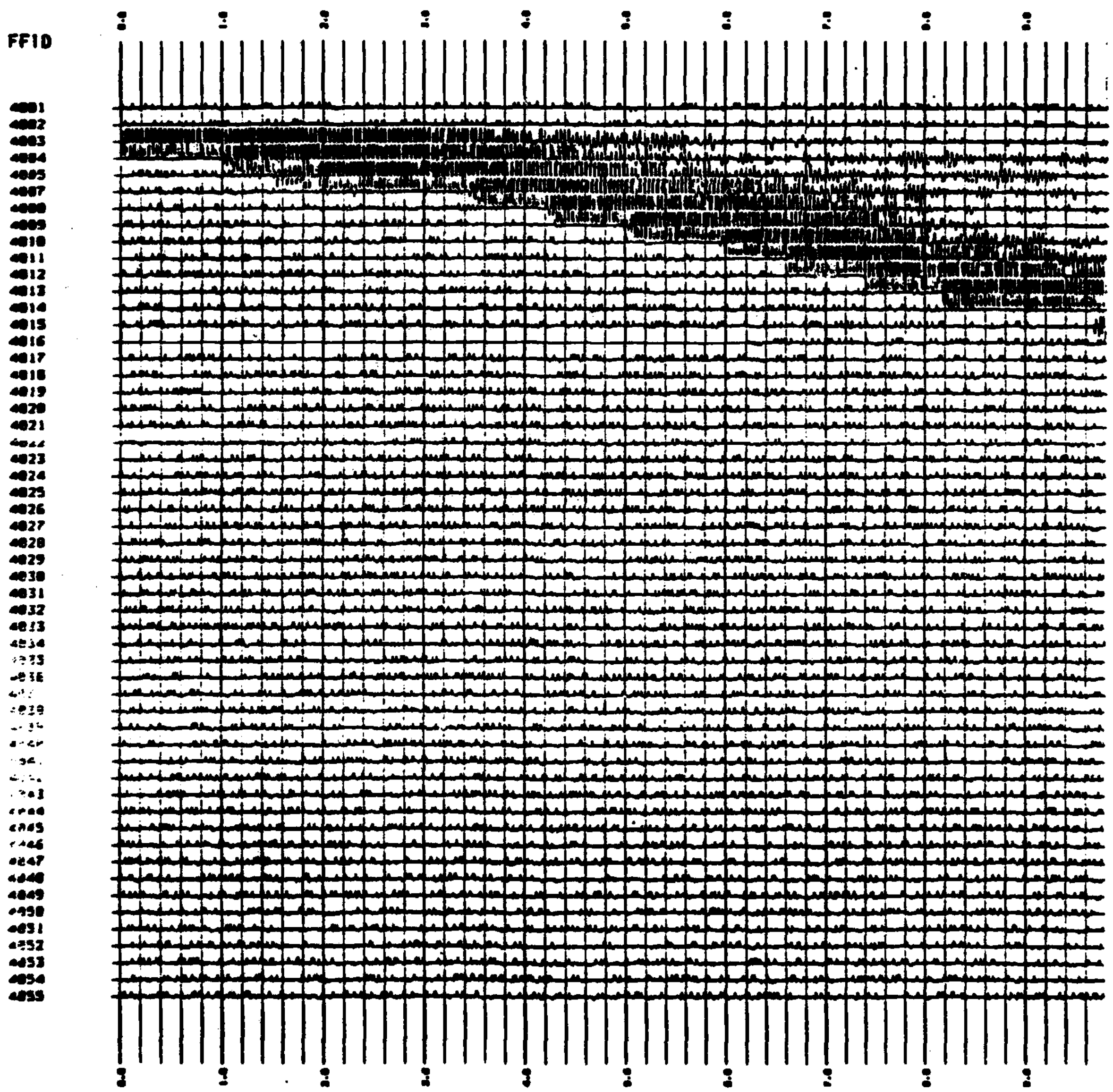
PROJECT : SICILY   SICILY 22 OBS#2 Rad (UNFILT.ROT 04.5 KMSEC) LINE 2
28-APR-1983 11:07:49.68   JOB NO. 7692
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.2744E+04

PROJECT : SICILY   SICILY 22 OBS=3 Rad (UNFILT.ROT 04.5 KM/SEC) LINE   2
28-APR-1983 11:10:22.03   JOB NO.   7693
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1929E+04



PROJECT : SICILY   SICILY 22 OBS=3 Rad (UNFILT.ROT 04.5 KM/SEC) LINE   2
28-APR-1983 11:10:22.03   JOB NO.   7693
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1929E+04

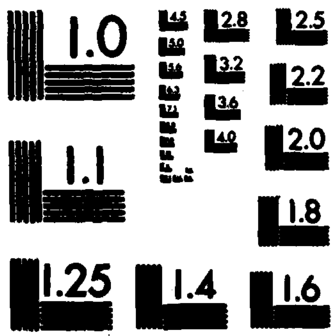
PROJECT : SICILY   SICILY 22 OBS#4 Rad (UNFILT.RDT @4.5 KM/SEC) LINE 2
28-APR-1983 11:12:56.63   JOB NO. 7694
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1458E+04



PROJECT : SICILY   SICILY 22 OBS#4 Rad (UNFILT.RDT @4.5 KM/SEC) LINE 2
28-APR-1983 11:12:56.63   JOB NO. 7694
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS @7.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1458E+04

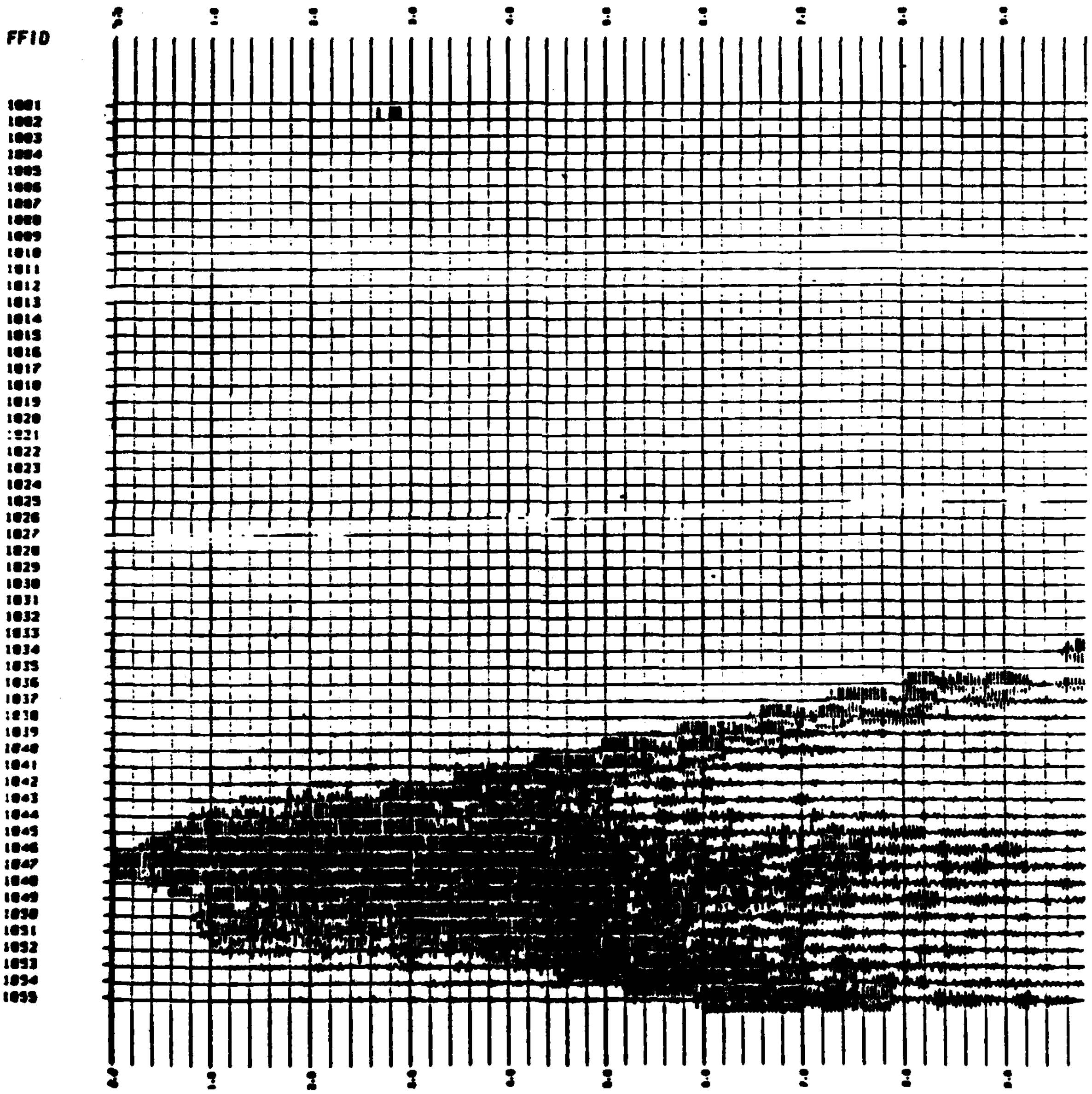
AD-A135 484 WAVE PROPAGATION STUDY OF THE CENTRAL MEDITERRANEAN SEA USING OCEAN BOTTO..(U) TEXAS UNIV AT AUSTIN INST FOR GEOPHYSICS W P O'BRIEN ET AL. 01 NOV 83 CONTRIB-575 2/2

UNCLASSIFIED N00014-77-C-0606 F/G 8/11 NL



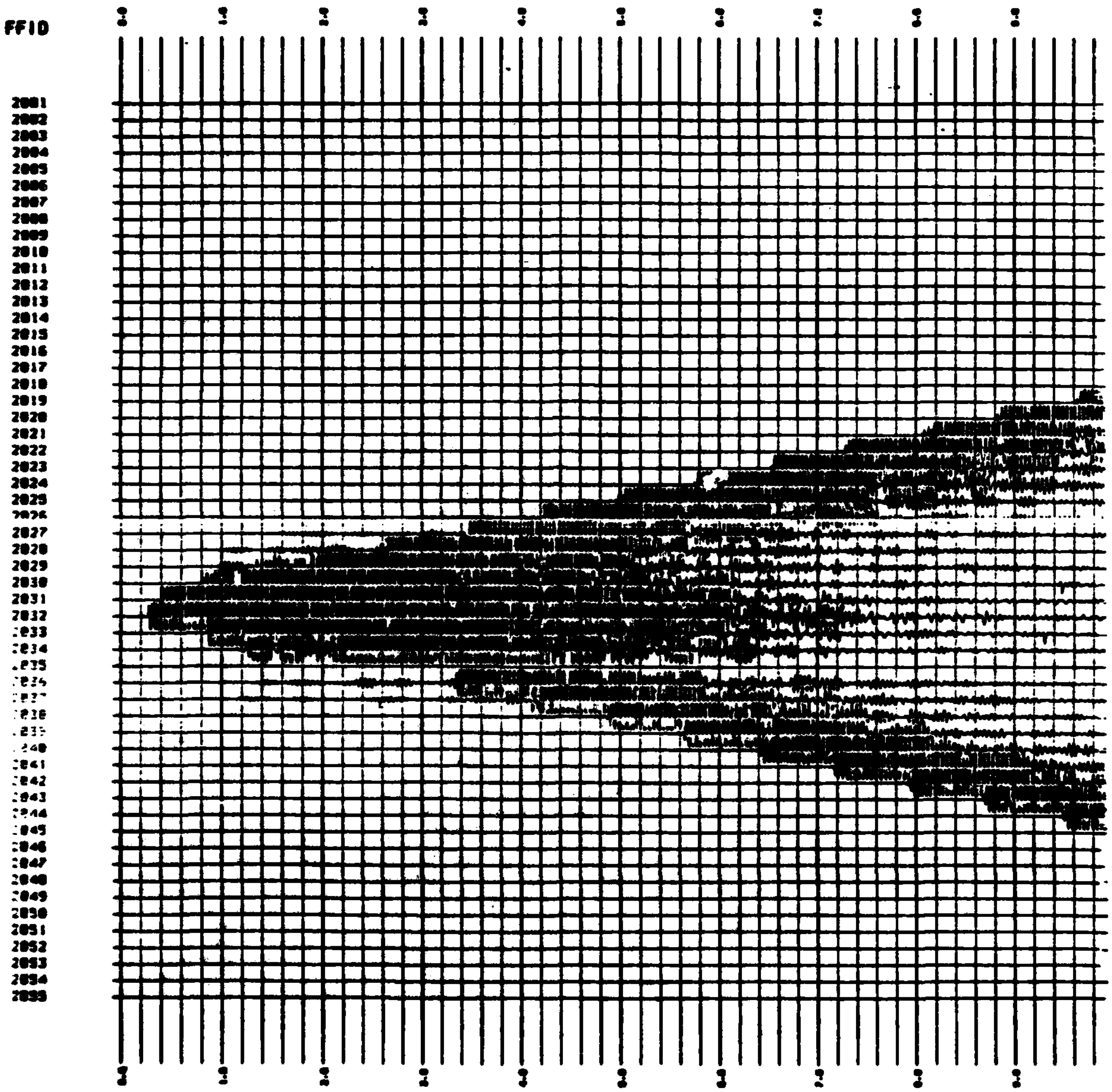
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PROJECT : SICILY   SICILY 22 OBS#1 Tra(UNFILT.ROT @4.5 KM/SEC) LINE 2
20-APR-1983 14:46:51.89   JOB NO. 7751
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
USER SUPPLIED REFERENCE VALUE REF. = 0.2400E+04



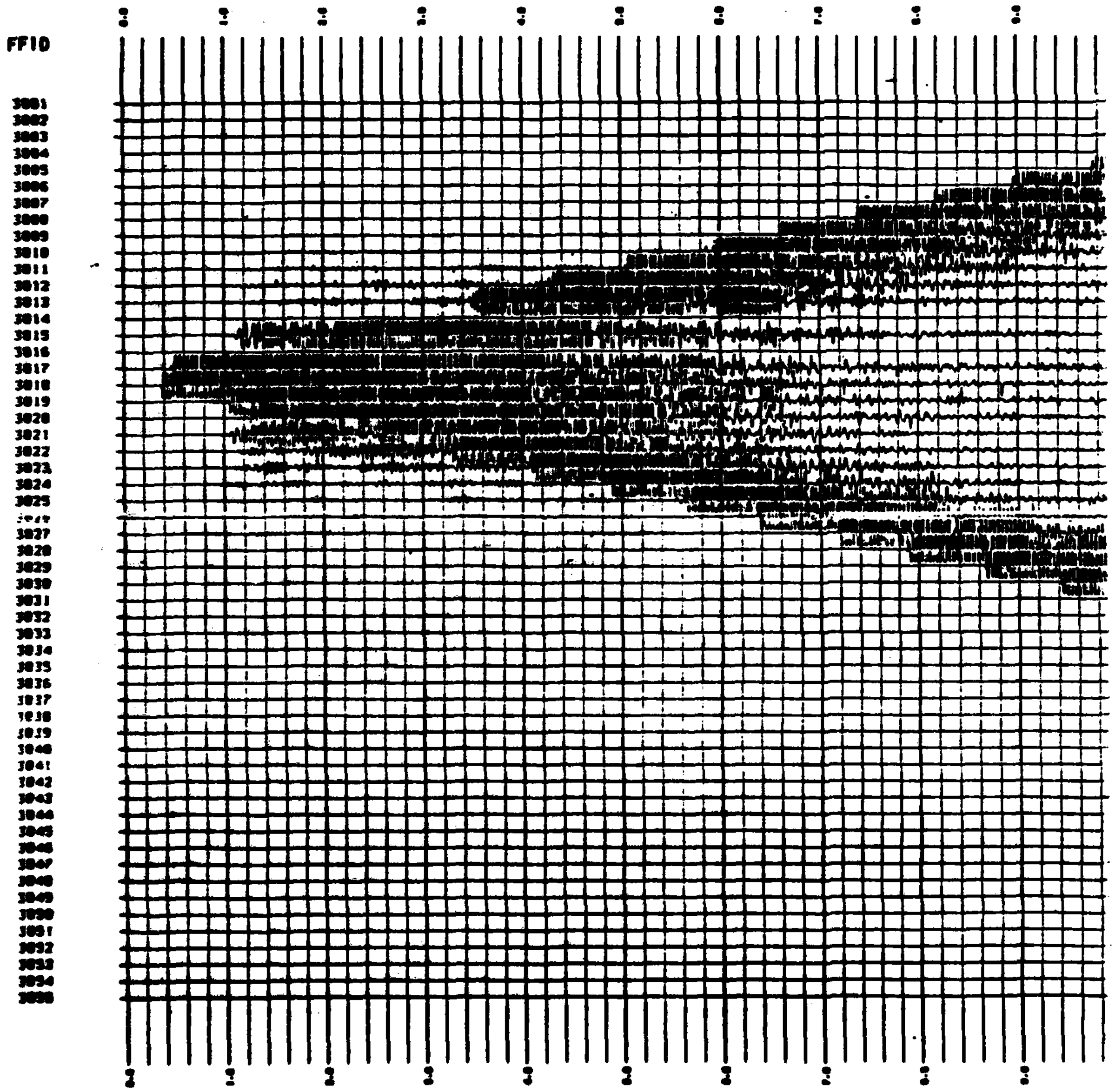
PROJECT : SICILY   SICILY 22 OBS#1 Tra(UNFILT.ROT @4.5 KM/SEC) LINE 2
20-APR-1983 14:46:51.89   JOB NO. 7751
POLARITY NORMAL - POSITIVE DATA(59993 MILLS 07.344) PANEL NO. 1
USER SUPPLIED REFERENCE VALUE REF. = 0.2400E+04

PROJECT : SICILY SICILY 22 08S02 Tra(UNFILT.ROT 04.5 KM/SEC) LINE 2
20-APR-1983 10:56:31.72 JOB NO. 7680
POLARITY NORMAL - POSITIVE DATA(S9993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. - 0.3830E+04



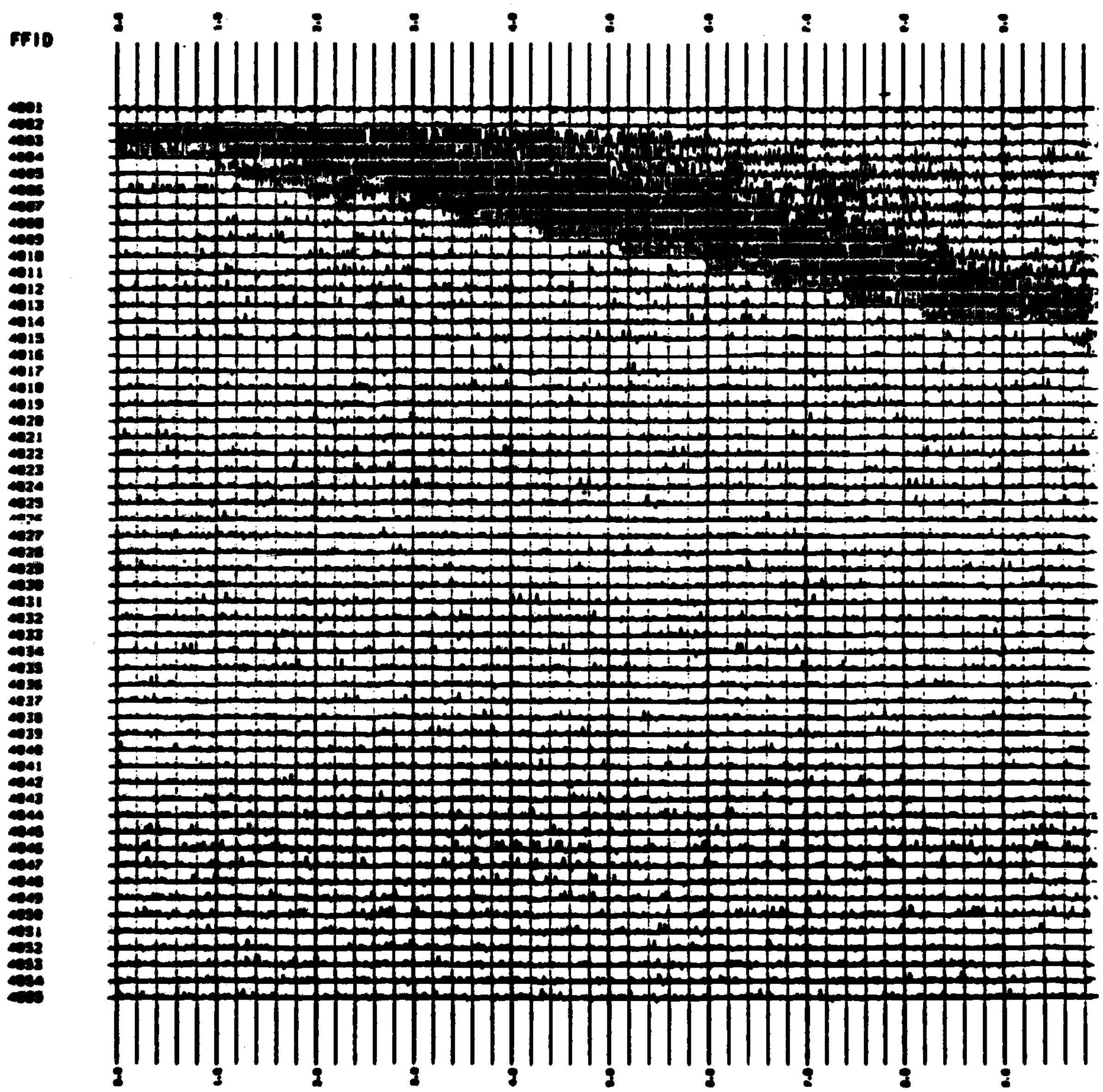
PROJECT : SICILY SICILY 22 08S02 Tra(UNFILT.ROT 04.5 KM/SEC) LINE 2
20-APR-1983 10:56:31.72 JOB NO. 7680
POLARITY NORMAL - POSITIVE DATA(S9993 MILLS 07.344) PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE REF. - 0.3830E+04

PROJECT : SICILY   SICILY 22 08S03 TFS (UNFILT.RGT 04.5 KM/SEC)   LINE 2
28-APR-1983 18:59:06.36   JOB NO. 7609
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1847E+04



PROJECT : SICILY   SICILY 22 08S03 TFS (UNFILT.RGT 04.5 KM/SEC)   LINE 2
28-APR-1983 18:59:06.36   JOB NO. 7609
POLARITY NORMAL - POSITIVE   DATA(S9993 MILLS 07.344)   PANEL NO. 1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1847E+04

PROJECT : SICILY   SICILY 22 OBS#4 Tra(UNFILT.ROT @4.5 KM/SEC) LINE   2
20-APR-1983 11:01:35.50   JOB NO.   7698
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1123E+04



PROJECT : SICILY   SICILY 22 OBS#4 Tra(UNFILT.ROT @4.5 KM/SEC) LINE   2
20-APR-1983 11:01:35.50   JOB NO.   7698
POLARITY NORMAL - POSITIVE   DATA(59993 MILLS 07.344)   PANEL NO.   1
SECOND AVERAGE USING 4 WINDOWS OVER ENTIRE TRACE   REF. = 0.1123E+04

END

FILMED

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