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SUMMARY DATA REPORT

of

DOWNHOLE VELOCITY SURVEYS

at the

Proposed Waste Handling Building

(ATTACHMENT B) emj 6/27/01

to accompany

SCIENTIFIC NOTEBOOK: SN-M&O-SCI-030-V1

Date Completed: 10/17/01 emj 10/22/01

Yucca Mountain Project

REDPATH GEOPHYSICS

ENGINEERING GEOPHYSICS ▫ BLAST DESIGN & PHENOMENOLOGY

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Downhole Seismic Velocity Surveys
at the
Waste Handling Building Site
Yucca Mountain Project, Nevada

Introduction

This report presents shear- and compression-wave velocities obtained in 15 boreholes at the site of the proposed Waste Handling Building (WHB) at the Yucca Mountain Project (YMP), located on the Nevada Test Site (NTS). The report also describes the procedures and equipment used to acquire the raw data by means of the standard downhole technique. The downhole velocities, supplemented by corresponding information from Spectral Analysis of Surface Waves and from surveys using the OYO P-S Suspension Logger, are intended to be used in an earthquake-hazard analysis of the WHB site

All procedures and relevant calibration information are completely documented in **Scientific Notebook SN-M&O-SCI-030-V1** which was compiled as the field work progressed and as the data were interpreted.

The field work for these investigations was performed in two phases because the drilling had not progressed far enough to complete all the planned velocity surveys during the first mobilization to the site. I was assisted by Mr. Mark Dober of URS Corp. (Oakland) during the first phase in October 2000, and by Mr. Chris Goetz, also of URS Corp. (Santa Ana), during the second phase of field work in November 2000.

The scope of work was as follows:

Borehole Number	Depth of Survey
RF-13	345 ft
RF-14	520
RF-15	200
RF-16	445
RF-18	485
RF-19	640
RF-20	155
RF-21	185
RF-22	505
RF-23	155
RF-24	260
RF-25	155
RF-26	260
RF-28	96
RF-29	405

All of the holes were cased with 4-inch PVC pipe grouted in place. The water inside the casing in each hole, with the exception of RF-13, was pumped out prior to performing the downhole velocity surveys; RF-13 had about 160 ft of water in it at the time of the survey. Although the downhole geophone package is designed to operate under water, the holes were pumped dry to avoid any chance of tubes waves interfering with the shear-wave signals. A tube wave is a pressure pulse that propagates nearly unattenuated down the fluid in a borehole at a velocity close to that of the shear wave in the surrounding material.

Procedures and Equipment

We used the conventional downhole survey method in which travel times of signals from an impulsive source of energy at the surface are measured to progressively greater depths in the borehole. The corresponding plot of travel time *vs.* depth is then converted to velocity *vs.* depth by computing slopes of the interpreted major straight-line segments of the plotted data.

A vehicle-on-a-beam traction source located close (≈10 ft) to the collar of the hole was used to generate shear waves. The source consists of a 7-ft-long 6x6 wood beam with cleats on the bottom and steel end caps, the beam being held in firm contact with the ground by driving the front wheels of a vehicle on to it. Horizontal blows to the ends of the beam with a sledge hammer generate shear-wave pulses. Shear-wave signals with 'positive' and 'negative' polarities are generated by striking each end of the beam in sequence. The 'positive' and 'negative' shear waves are, ideally, mirror images of each other and, viewed as a pair, greatly assist in identifying the shear wave. The sledge hammer has an impact sensor attached to the handle near the head that starts the timing process in the recording instrument upon impact with the beam. Where site conditions permitted, the beam was aligned at an azimuth of 340° [true], which I understand is the approximate strike of the bedding.

Compression-wave signals were generated by vertical hammer blows to a steel striker plate on the ground, also located close to the collar of the hole.

The downhole sensor for the velocity surveys was a Model BHG-3 geophone manufactured by Geostuff of Saratoga, California. The sensor package contains an orthogonal array of three geophones, mounted on a gearhead-motor assembly, and a fluxgate compass. A manually-activated servo circuit links the compass to the motor for the geophone array so that the horizontal geophones maintain a constant, pre-determined azimuth at each measurement point. This allows one of the two horizontal geophone elements to stay aligned with the shear-wave source as the sensor package is raised or lowered in the hole. This capability ensures that the detected shear-wave signal is always the optimum. The BHG-3 is mechanically locked in the hole casing with a motor-actuated clamping spring operated from the control box at the surface.

All signals were recorded with a Geometrics R24 'Strataview' digital seismograph. The R24 was configured to record 24 1024-sample channels of data, sampling at a rate of 125 or 250 microseconds, depending on the hole depth.

In a downhole survey the data are collected channel-by-channel until 24 channels have been recorded or until the survey is complete, at which time the signals are transferred to a hard disk drive and printed in the R24's internal printer for field examination. The raw signals on disk can be filtered and processed on playback and prior to printing. The data are ultimately stored in SEG-2 binary format on 3-1/2-inch disks.

Our procedure was to lower the BHG-3 to the bottom of the hole and expand the clamping spring so that the BHG-3 could be pulled up the hole but would still hold its position. Travel times were then measured from the bottom up at 5-ft intervals to a depth of 100 ft, and at 3-ft intervals from there to the surface. Exceptions to this procedure were holes 14 and 19, in which measurements were made at 10-ft intervals below 480 and 490 ft, respectively. In some of the deep holes data were acquired in two phases, first from 400 ft up to the surface and then from 400 ft downwards. Because of the weight of the cable attached to the BHG-3, it is difficult for one person to pull more than 400 ft of cable up the hole between each measurement point.

Careful attention was given to the polarity of the shear-wave signals. Prior to beginning a survey, one of the two horizontal geophones inside the BHG-3 was aligned with the shear-wave beam. The system was always configured so that at each measurement point the first blow to the beam would produce a shear wave for which the initial deflection of the trace on the seismograph record was upwards, *i.e.*, towards the top of the paper record. At each measurement point the same end of the beam (*e.g.*, on the passenger side of the vehicle) was always struck first and the resulting signal recorded on an odd-numbered channel. The signal from the blow to the other end of the beam was then recorded on the adjacent even-numbered channel. A compression-wave signal was recorded next (while still at the same depth) and a switch box directed that signal to a separate block of channels allocated to compression waves. Because each measurement point consists of two shear-wave signals and one compression-wave signal, a total of 8 measurement points comprise a 24-channel record; channels 1 through 16 are shear waves and channels 17 through 24 are compression waves. The ability to keep careful track of the polarity of the shear-wave signals proved to be extraordinarily important in the interpretation of the data acquired in these surveys.

It should be noted that the R24 seismograph has the capability of 'stacking' or linearly adding multiple signals. More than one hammer blow for each signal is almost always required at the deeper measurement points in order to increase the signal-to-noise ratio or to clearly develop the shear wave amidst interfering arrivals. As many as 5 blows to each end of the plank were sometimes required.

It was initially thought that some degree of shear-wave anisotropy might be present at the WHB site, *i.e.*, that the shear-wave velocity might be a function of the direction of polarization of the signals. For this reason we performed an experiment in borehole RF-25 in which two orthogonal shear-wave sources (340° and 250°) were set up at equal distances from the collar of the hole. Prior to starting the survey the 'longitudinal' geophone in the BHG-3 was aligned with the 340°-source and, consequently, the 'transverse' geophone was aligned with the second source. The first blow to each shear-wave beam produced an initial upward deflection of the seismograph trace. At each measurement point shear waves from both

sources were recorded before the BHG-3 was raised to the next measurement point. A special switchbox was used which routed the signals from one shear-wave source to channels 1 through 8, signals from the second source were directed to channels 9 through 16, and the compression-wave signals were sent to channels 21 through 24; channels 17 through 20 were not used. Four measurement points comprised a complete record. In this manner a direct visual comparison of arrival times from the two shear-wave sources could be made at each measurement point. Significant anisotropy was not present; differences in the shear-wave travel times from the two sources at each depth were generally less than one millisecond, and no further experiments of this nature were performed.

Results and Analysis

Reduced copies of complete sets of the shear- and compression-wave signals are attached to this report. The source offset and the frequency of the low-pass filters used for playback are shown on each set of records. Although shear- and compression-wave signals are recorded on the same seismograph record in the field, they have been played back and presented here as separate paper records. It should be noted that the travel times that were plotted to obtain velocities were read from full-size copies of the recordings.

As stated previously, the horizontal geophones in the BHG-3 maintained a constant azimuth during each survey and, therefore, the polarity of the recorded shear-wave signal was always consistent with the direction of the hammer blow. A blow to the first end of the beam always resulted in an initial upward deflection of the seismograph trace. As noted on the attached copies of the records, some filtering was applied to all of the signals during playback from the hard disk. The signals acquired in the velocity surveys were transferred to the hard drive without any filtering; filtering was used only during playback to the R24's internal printer. The filtering was accomplished by using the digital filters built into the R24's operating system. The R24 filters used for processing these records were either 100-, 200- or 400-Hz low-pass.

The degree of filtering varied from hole to hole and depended upon the amount of interference present. For example, it appears that shear-wave signals arriving at the BHG-3 transducer in portions of RF-15 may have traveled by different paths, i.e., multiple and overlapping signals were present. In this specific instance the least amount of filtering was used (400 Hz) to allow me to track the 'predominant' shear wave from the top of the hole to the bottom. A contrasting example is hole RF-22 where more filtering (100 Hz) was judged necessary because of weak signals near the bottom of the hole and because of noise from nearby drilling operations. Only one filter setting was used for the shear waves in any given borehole, and 400-Hz low-pass filtering was used for all the compression-waves signals.

The time of the onset or 'first break' of the shear wave was **not** used as the travel time. The onset of the pulse may be reasonably clear at shallow depths, but soon becomes vague or completely obscured as the depth increases. For this reason I prefer to pick the time of the first peak (and of the first trough of the corresponding reverse-polarity blow) as the travel time of the shear wave. In most boreholes at the WHB, even the first peak becomes too ambiguous at depth to time accurately and reliably, and it was necessary to use the maximum

trough (which immediately follows the first peak) and its corresponding maximum peak as the travel time. The first peak was used only for holes RF-25 and -28. The times picked as travel times are indicated on the attached copies of the shear-wave signals by the small dots. In every case the average time of a peak and its corresponding trough were used. The time of the first peak of the compression wave was always used as its travel time, but no dots are shown on the attached copies.

Because the energy source, whether compression or shear, is offset horizontally from the collar of the hole, it is necessary to correct the travel times at shallow depths for this offset. The correction is intended to convert the actual travel time along the slant path from source to receiver to the equivalent time required to travel vertically from the surface down to the receiver. In the past this has always been done by simply multiplying the travel time by the cosine of the angle (Θ) between the slant path and vertical. During the analysis of the data acquired in this program it was realized that this method of correcting the shallow travel times is valid only if the **onset** of a signal is used. If this simple version of the cosine correction is applied to a later portion of the signal, such as the first peak or the maximum peak, then the times will be over-corrected and the computed near-surface velocities will be too low. It is also necessary to correct for any time shift of the signals caused by low-pass filtering before making the cosine correction. Although the R24 uses digital filters, they are not 'zero-phase' filters and will cause a small time shift. The proper method of correcting for the offset is as follows:

$$t_{vertical} = [(t_{peak} - \Delta t - \Delta t_o) \times \cos\Theta] + \Delta t + \Delta t_o$$

where $t_{vertical}$ is the time that is plotted against the depth to the measurement point, t_{peak} is the time of the selected peak, Δt is the time difference between the onset of the signal and the selected peak (and corresponding trough) for signals recorded at shallow depths, and Δt_o is the time shift of the onset of the signal due to filtering. This shift is easily measured at shallow depths by comparing the times of onset of unfiltered and filtered signals in each hole. A complete discussion of the filter-delay correction is given on page 109 of the Scientific Notebook. In practice, the value of $\cos\Theta$ is computed from the source offset, **s**, and the depth to the transducer, **d**, so that the above equation becomes:

$$t_{vertical} = [(t_{peak} - \Delta t - \Delta t_o) \times (d/(d^2 + s^2)^{1/2})] + \Delta t + \Delta t_o$$

The cosine correction is required to a depth equal to approximately 10 times the offset distance. The cosine correction shown above was applied to the travel times in these surveys until the difference between the raw and the corrected time was only 0.1 millisecond.

Small-scale plots of shear- and compression-wave times *vs.* depth are attached to this report, and a 3-1/2-inch disk with an Excel file of these data accompanies the report. It must be emphasized that the determination of the reported velocities was performed on large-scale hand-drawn plots which are attached to the Scientific Notebook describing these surveys. The data points in these were plotted at a scale of 20 ft to the inch and 10 milliseconds to the inch.

The final values of shear- and compression-wave velocities are shown in the attached tables. Careful examination and comparison of the tabulated values of shear- and compression-wave velocities will reveal that the depths to the interfaces between layers based on the respective velocities are not always coincident, *i.e.*, the shear and compression wave boundaries may not agree. This may be due to the possibility that the shear and compression signals do not always follow the same path from source to receiver.

Discussion

In general the quality of the raw data was good to excellent. It will be noted on the large-scale time *vs.* depth plots, and also on the smaller scale plots attached to this report, that there is some scatter of the data points about their respective trend lines over some portions of some boreholes. The scatter is most probably attributable to the complex geology at the WHB site. The scatter is not due to insufficient signal amplitudes, to noise from extraneous sources, nor to some systemic flaw in the recording instrumentation or procedures. In many cases an examination of the shear-wave records suggests that signals are arriving at the transducer from more than one pathway. This may also be happening in the case of compression waves, but this cannot be discerned by looking at the recorded signals. The degree of scatter is not large in absolute terms, typically a departure of only a millisecond or two from the overall trend line of the data points; in extreme cases the departure was as high as 4 msec. However, because of the relatively high velocities present at the site, even small variations in travel times can appear to be significant.

There is always some judgement involved when assigning travel-time data points to a layer. Often the change of slope of the data points is not especially pronounced when crossing the boundary between one velocity zone and the one immediately below, and the exact depth of the boundary becomes somewhat uncertain due to the inherent scatter in the data. Least squares calculations of slopes were applied in many cases, but it was also necessary to use judgement in many cases where it appeared that scatter precluded meaningful statistical calculations.

Some comments about the data acquired in specific boreholes will illustrate the above comments: The shear-wave signals at a depth of 335 ft in Hole RF-14 show a jump in arrival time of 13 msec, *i.e.*, a shear wave can be followed down to that depth but then simply fades away, and another shear wave at that depth can be seen to begin 13 msec later and to continue on to the bottom. I believe this is due to multiple travel paths that happen to coincide near 335 ft.

The best overall signal quality was observed in Hole RF-19, despite the fact that this was the deepest hole surveyed in this report. Only two hammer blows were required to produce a clear and unambiguous shear wave at a depth of 640 ft, and multiple or overlapping shear waves were not evident. The scatter in arrival times was typically less than 1 msec.

There is an apparent low-shear-wave-velocity zone in RF-22 from a depth of 175 ft to 192 ft, but there is no corresponding decrease in the compression-wave velocity over this depth

range. This anomaly suggests that the low shear-wave velocity may be an artifact of different travel paths which, in turn, is probably a manifestation of the complex geology associated with the graben in which the borehole is located.

Values of shear-wave velocity below 338 ft in RF-29 that result from a literal interpretation of the shear-wave travel times are simply not plausible. Specifically, the shear-wave velocity appears to be about 7000 ft/sec between 338 and 360 ft, but the compression-wave velocity is only 6040 ft/sec in this same zone. Despite the fact that the OYO P-S logger survey in this hole showed similar erratic behavior of the shear-wave velocity, the most reasonable approach is to use an 'eyeball' best fit through the data points from 338 ft to the bottom of the hole, which results in a continuation of the 3800 ft/sec velocity that starts at a depth of 230 ft.

Finally, the digital format of the raw data allowed some preliminary values of *in-situ* shear-wave damping to be computed from spectral ratios of the downhole signals. Although these damping calculations were not part of the original scope of work for the velocity surveys, it seemed appropriate to determine some initial values of damping for subsequent comparison with the corresponding values obtained from laboratory tests on core samples of the rocks. The damping calculations were not Quality Assured, but are completely described on pages 75 through 83 in the Scientific Notebook for these velocity surveys.

Briefly, the calculation of *in-situ* shear-wave damping is based on the spectral decay of the shear-wave signals as they propagate down through the subsurface materials. The damping calculations are concerned only with frictional losses in amplitude as the signal travels downward and not with geometric spreading, and these frictional losses are manifested by a progressive loss of the higher frequencies with increasing distance. By computing a sequence of spectral ratios between the downward traveling shear wave and a reference signal at shallow depth, low-strain ($<10^{-5}$%) *in-situ* values of the fraction of critical damping can be determined.

I believe that these calculations of damping are meaningful in the sense that they are influenced by the characteristics of the entire rock mass through which the shear wave travels, including porosity and fractures. Laboratory tests on rock cores may be biased towards relatively low values of damping; only the more durable samples of rock that were competent enough to survive the drilling process will remain sufficiently intact to be suitable for laboratory testing.

Shear-wave damping calculations were performed using data acquired in holes RF-16 and –19. Spectral ratios were calculated at 100-ft depth intervals using the signals at a depth of 40 ft as a reference . In RF-16 the computed fraction of critical damping was 6.4% from 40 ft to 290 ft, and 1.4% below that. In RF-19 the shear damping was calculated to be 5.1 % from 40 ft to 280 ft, and 2.3% from 280 ft to the bottom at 640 ft. The overall values of damping from a depth of 40 ft to the bottom of each hole, *i.e.*, ignoring any changes in the subsurface velocities, were 4.9% for RF-16 and 3.9% for RF-19. For comparison, low-strain values ($<10^{-3}$%) of shear damping obtained in laboratory tests of cores from depths of 81 and 127 ft in RF-16 were approximately 1% or less.

Yucca Mountain Project
Final Downhole Velocity Values

SHEAR WAVES

	Depth Range - ft	Velocity – ft/sec
RF-13	3 – 10	750
	10 – 25	1355
	25 – 80	2030
	80 – 230	2740
	230 - 345	5800 ±

	Depth Range - ft	Velocity – ft/sec
RF-14	3 – 15	1240
	15 – 38	1700
	38 – 114	2375
	114 – 165	3390
	165 – 305	2640
	305 - 520	5000 ±

	Depth Range - ft	Velocity – ft/sec
RF-15	3 – 38	1935
	38 – 122	2700±
	122 – 230	3380
	230 - 320	5900

	Depth Range - ft	Velocity – ft/sec
RF-16	3 – 15	655
	15 – 24	1130
	24 – 50	1640
	50 – 296	2800
	296 – 376	3540
	376 - 445	7000

	Depth Range - ft	Velocity – ft/sec
RF-18	3 – 24	1435
	24 – 48	1670
	48 – 78	2900
	78 – 220	3860
	220 – 250	2400
	250 - 480	4200

SHEAR WAVES

	Depth Range - ft	Velocity – ft/sec
RF-19	3 – 18	1285
	18 – 39	1810
	39 – 96	2305
	96 – 282	2740
	282 – 550	3780
	550 - 640	4250

	Depth Range - ft	Velocity – ft/sec
RF-20	3 – 24	1200
	24 – 70	2020
	70 - 155	2800±

	Depth Range - ft	Velocity – ft/sec
RF-21	3 – 20	1310
	20 – 84	1930
	84 - 185	2500±

	Depth Range - ft	Velocity – ft/sec
RF-22	3 – 21	1465
	21 – 83	2200
	83 – 175	3540
	175 – 192	1400
	192 - 500	3500

	Depth Range - ft	Velocity – ft/sec
RF-23	3 – 9	690
	9 – 21	1565
	21 – 72	2100
	72 – 110	2865
	110 - 155	3600

	Depth Range - ft	Velocity – ft/sec
RF-24	3 – 18	1195
	18 – 33	1535
	33 - 260	2070

	Depth Range - ft	Velocity – ft/sec
RF-25	3 –37	1645
	37 – 86	2940
	86 - 155	2100

SHEAR WAVES

	Depth Range - ft	Velocity – ft/sec
RF- 26	3 – 12	425
	12 – 46	1745
	46 – 95	2550
	95 - 260	3780

	Depth Range - ft	Velocity – ft/sec
RF-28	3 – 10	1305
	10 – 39	1980
	39 - 95	3300

	Depth Range - ft	Velocity – ft/sec
RF-29	3 – 33	1660
	33 – 75	2170
	75 – 138	2560
	138 – 230	3320
	230 – 405	3800

Note: These tables were corrected for filter delay times in October of 2001.

Yucca Mountain Project
Final Downhole Velocities

COMPRESSION WAVES

	Depth Range - ft	Velocity – ft/sec
RF-13	3 – 9	1455
	9 – 26	3405
	26 – 226	4685
	226 - 345	9335

	Depth Range - ft	Velocity – ft/sec
RF-14	6 – 12	2530
	12 – 38	3805
	38 – 110	4300
	110 – 304	5900
	304 – 420	7500
	420 - 520	11,000

	Depth Range - ft	Velocity – ft/sec
RF-15	3 – 18	3215
	18 – 39	3815
	39 - 133	4600±
	133 – 210	9850
	210 - 320	14,000±

	Depth Range - ft	Velocity – ft/sec
RF-16	3 – 15	1590
	15 – 50	3075
	50 – 280	4850
	280 – 376	6600±
	376 - 445	10,000±

	Depth Range - ft	Velocity – ft/sec
RF-18	3 – 48	3305
	48 – 78	4600
	78 – 290	5850
	290 – 390	7200
	390 - 485	8300±

COMPRESSION WAVES

	Depth Range - ft	Velocity – ft/sec
RF-19	3 – 9	1710
	9 – 39	3440
	39 – 104	3950
	104 – 294	5000
	294 - 640	6350

	Depth Range - ft	Velocity – ft/sec
RF-20	3 – 13	1935
	13 – 70	3540
	70 - 155	4320

	Depth Range - ft	Velocity – ft/sec
RF-21	3 – 57	2845
	57 – 120	3900
	120 - 185	4850

	Depth Range - ft	Velocity – ft/sec
RF-22	3 – 24	2445
	24 – 87	4185
	87 - 505	5560

	Depth Range - ft	Velocity – ft/sec
RF-23	3 – 18	2000
	18 – 72	3765
	72 – 120	4700
	120 - 155	5500

	Depth Range - ft	Velocity – ft/sec
RF-24	3 – 12	1425
	12 – 33	2785
	33 - 260	4960

	Depth Range - ft	Velocity – ft/sec
RF-25	3 – 41	2710
	41 – 86	4840
	86 – 105	3400
	105 - 155	4800±

COMPRESSION WAVES

	Depth Range - ft	Velocity – ft/sec
RF-26	3 – 10	840
	10 – 95	4115
	95 – 140	7030
	140 - 260	5750

	Depth Range – ft	Velocity – ft/sec
RF-28	3 – 39	3995
	39 - 96	5640

	Depth Range - ft	Velocity – ft/sec
RF-29	3 – 33	2875
	33 – 75	3675
	75 – 135	4500
	135 - 405	6040

Note: These tables were corrected for filter delay times in October 2001.

2

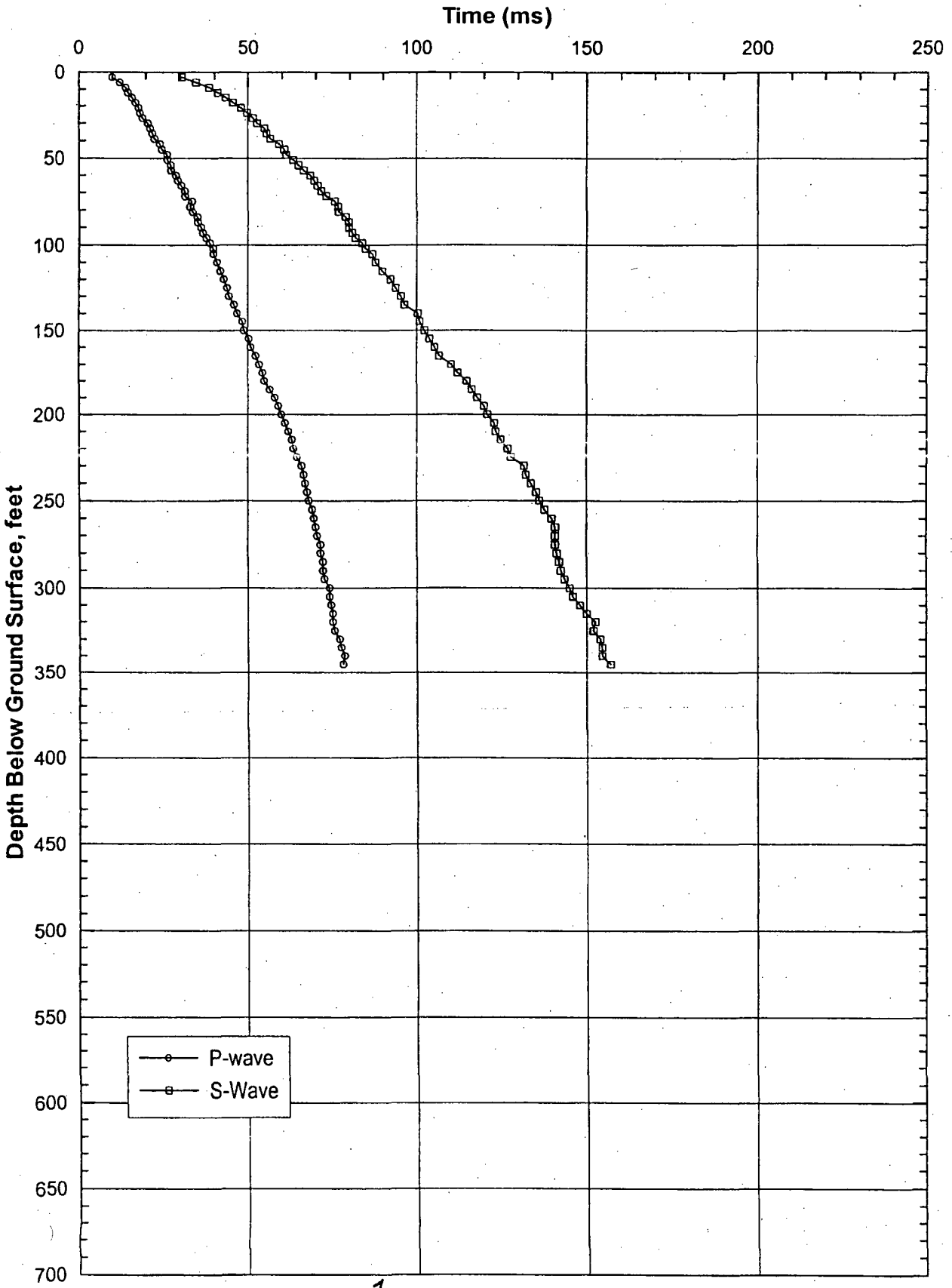

Figure 1. Downhole Travel Time RF-13

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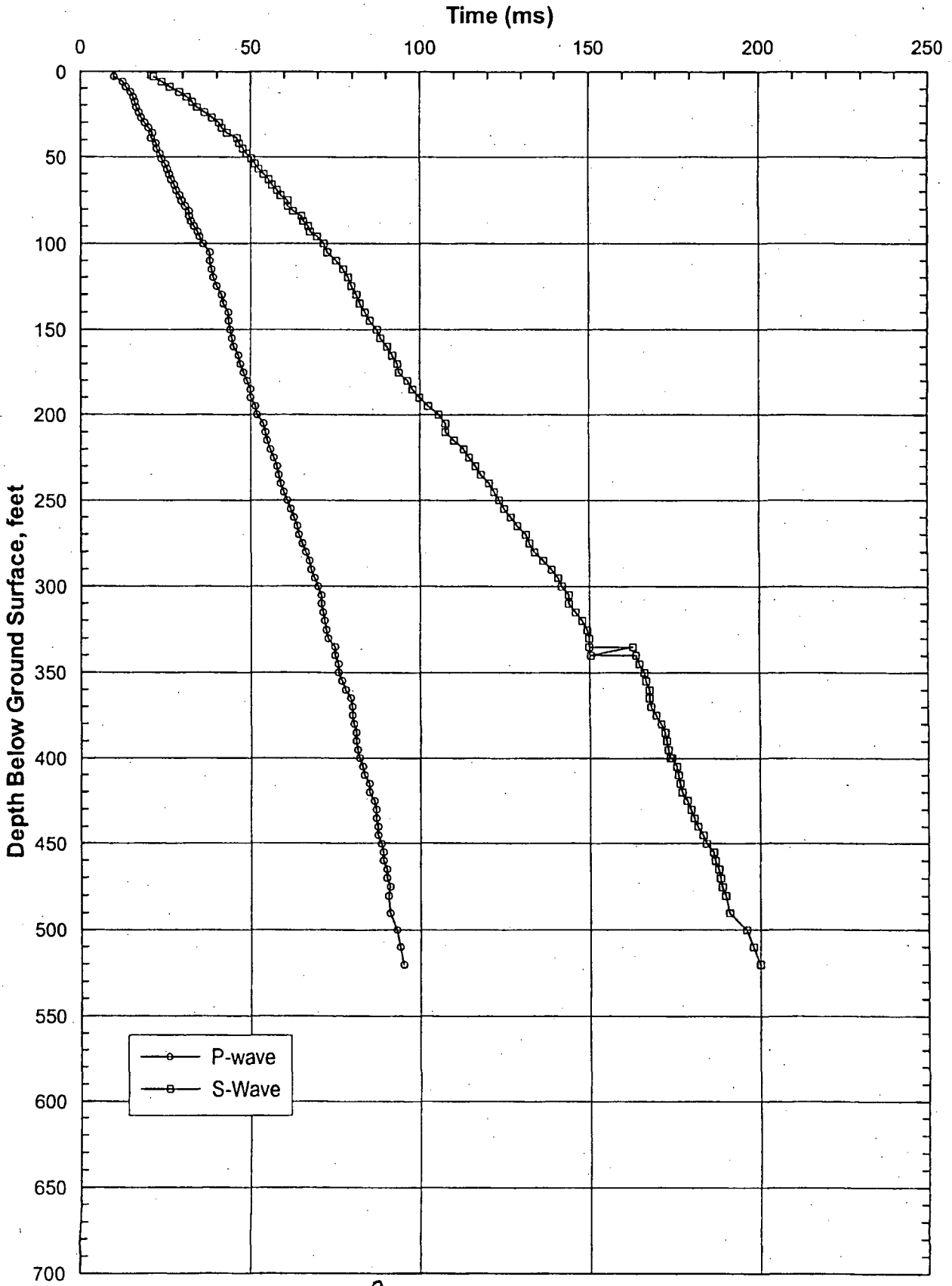

Figure 2. Downhole Travel Time RF-14

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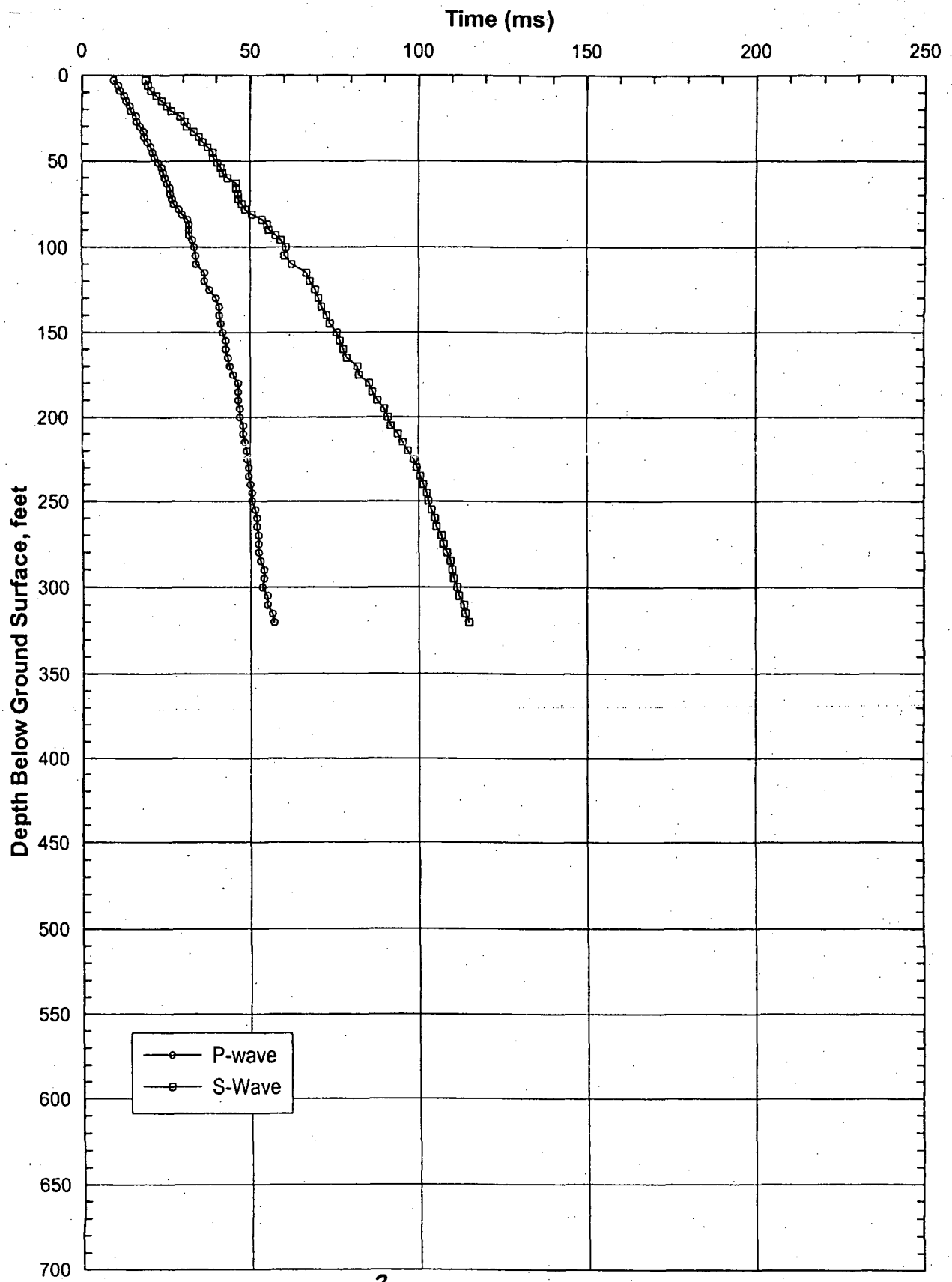

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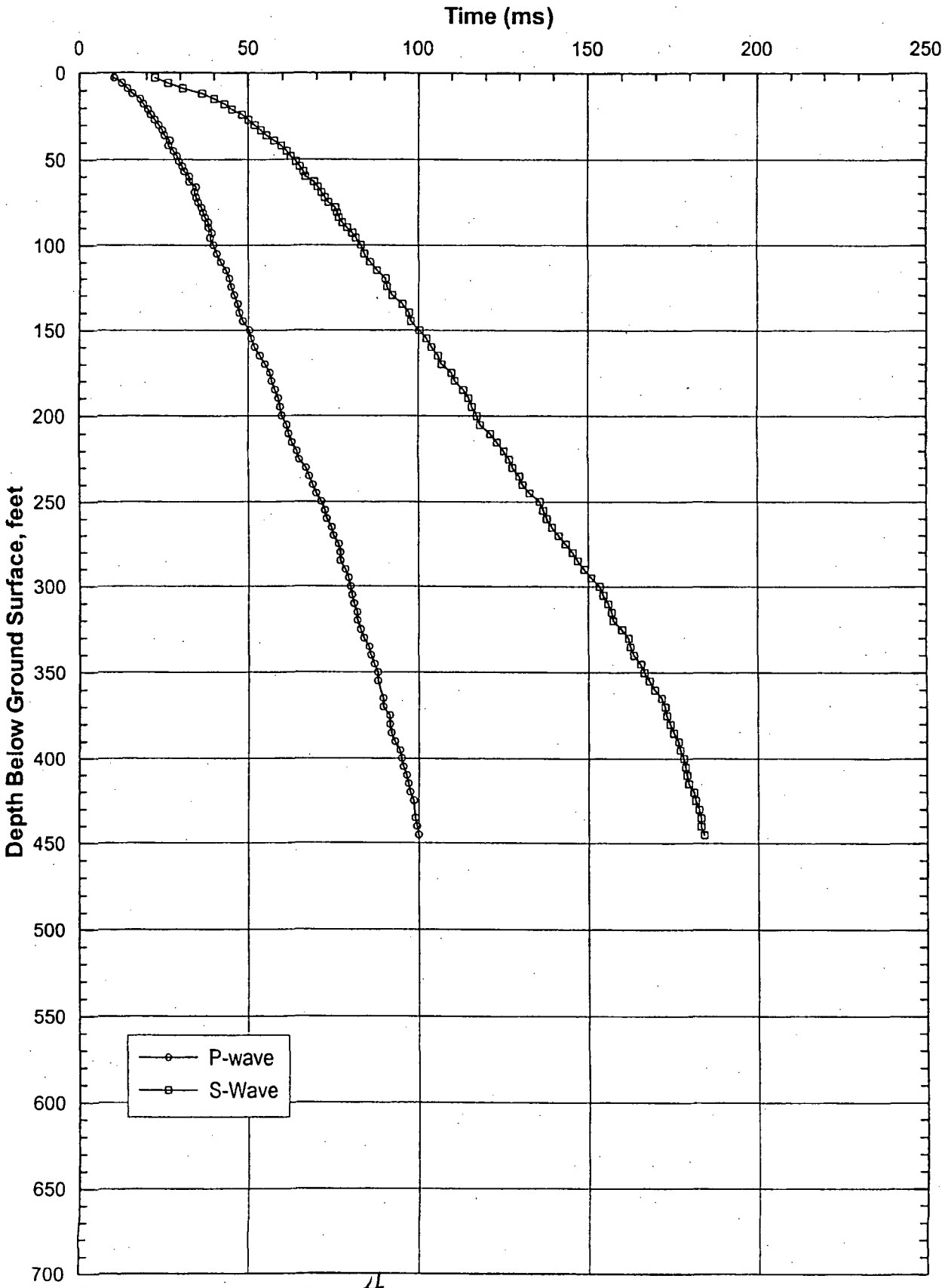

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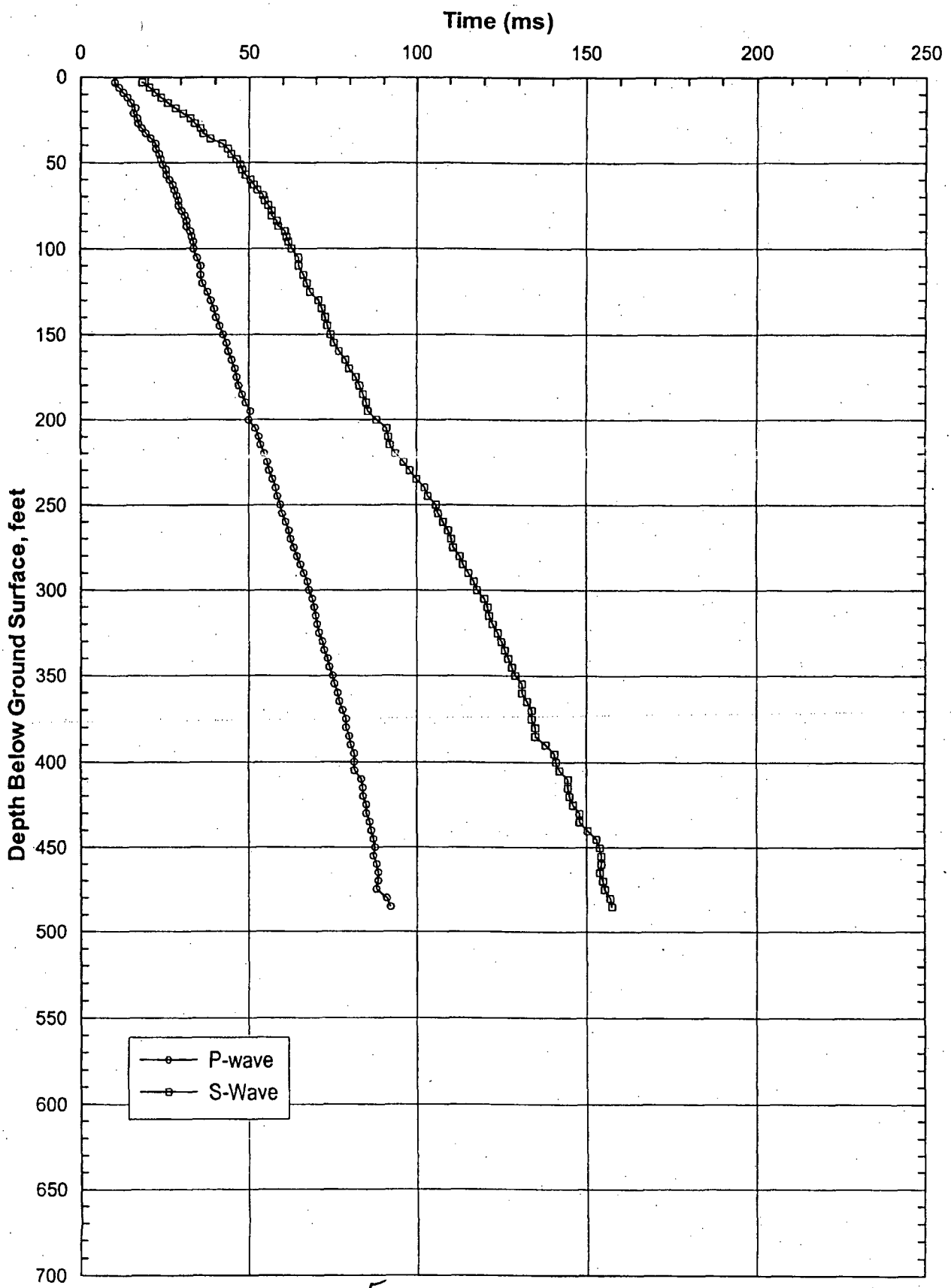

Figure 5. Downhole Travel Time RF-18

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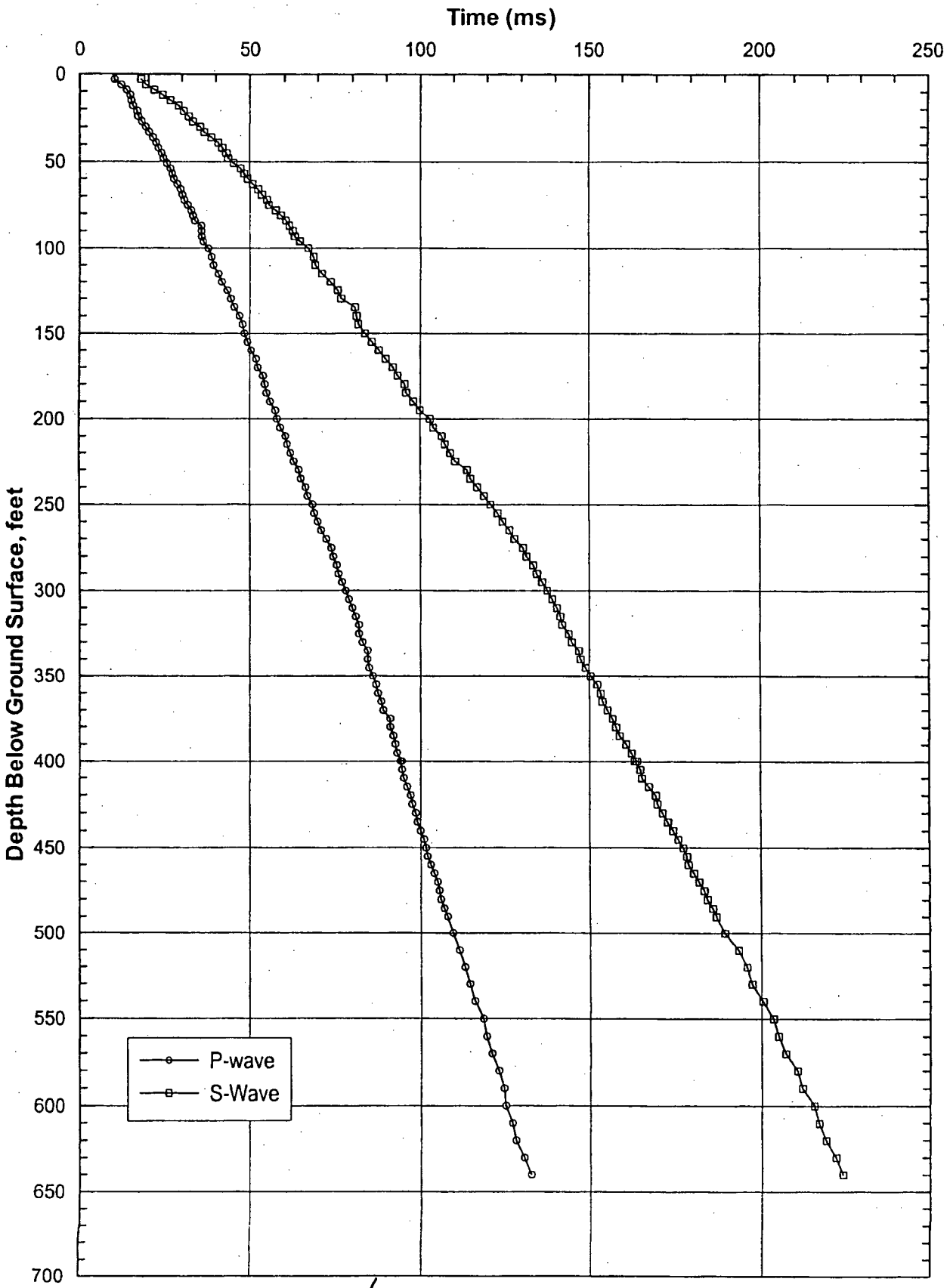

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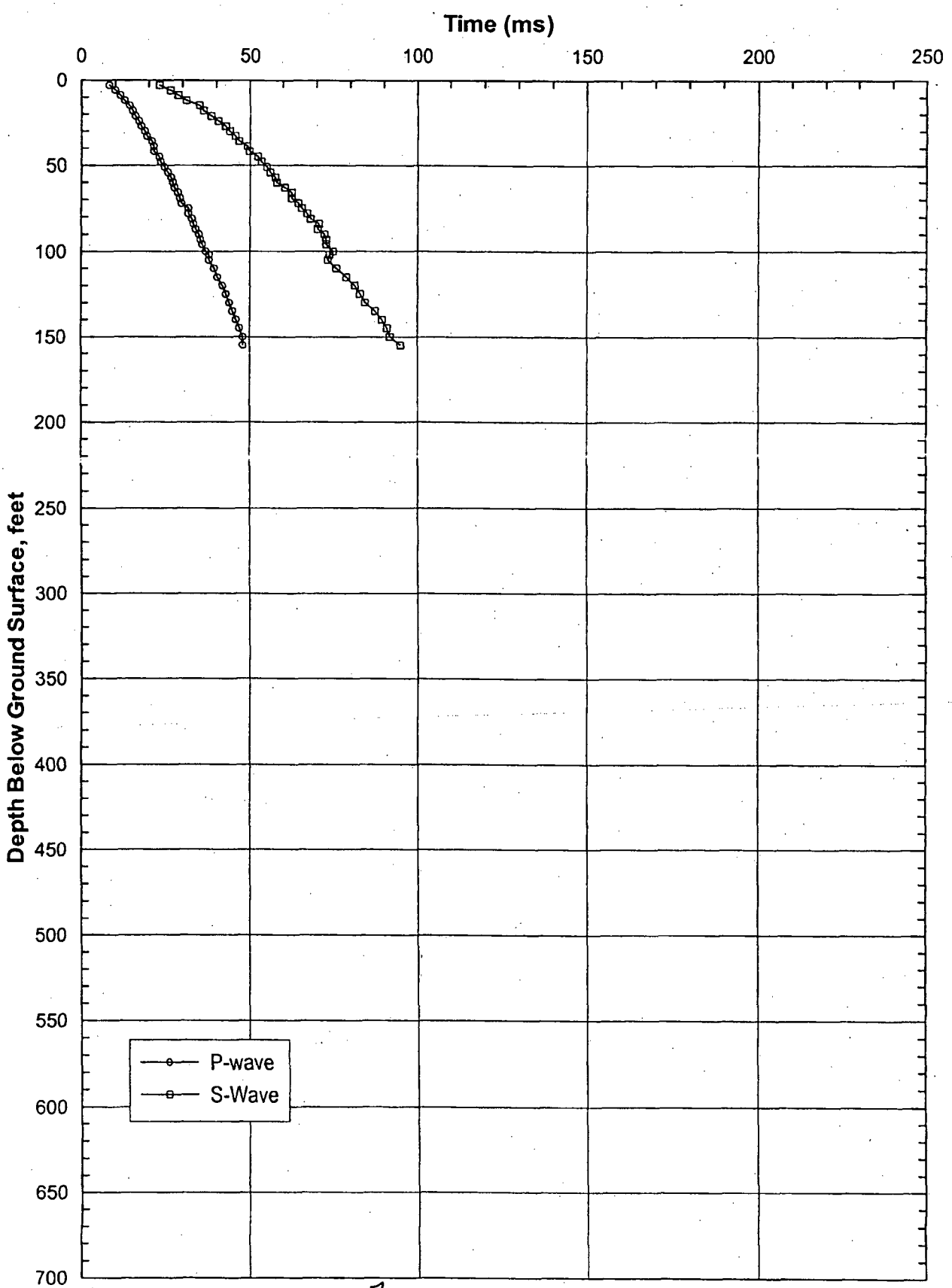

Figure 7. Downhole Travel Time RF-20

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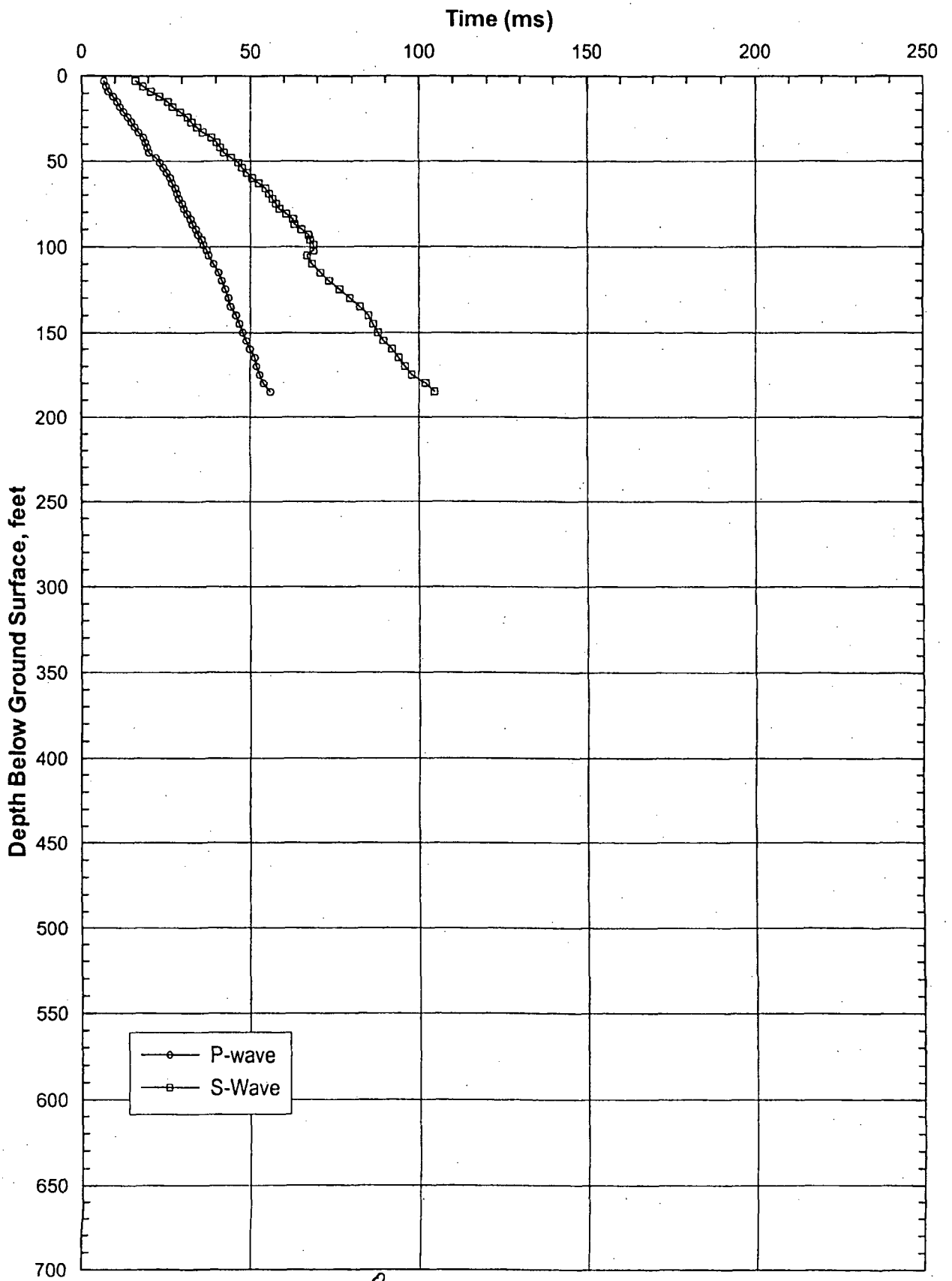


Figure 8. Downhole Travel Time RF-21

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:05 PM

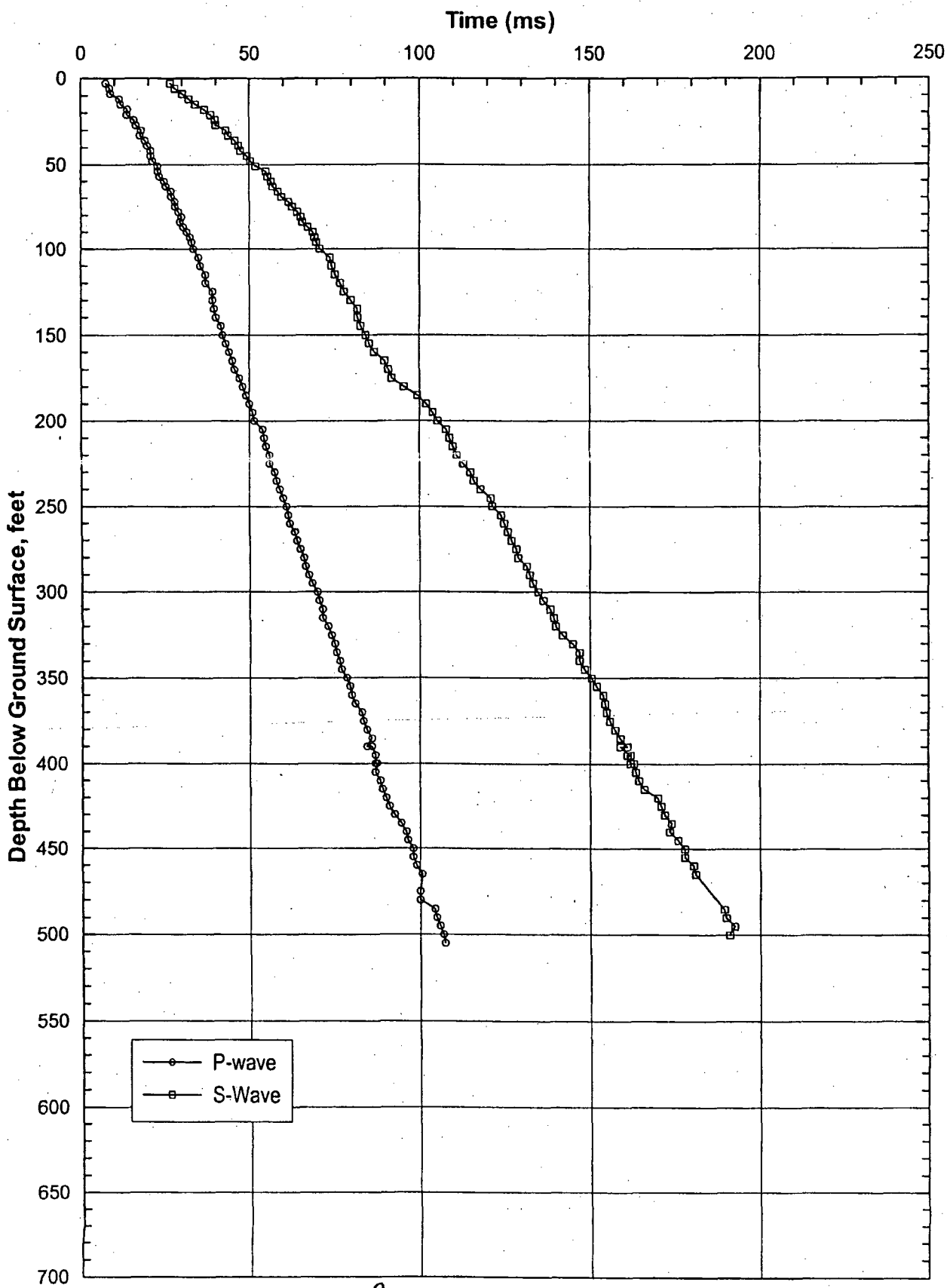


Figure 9. Downhole Travel Time RF-22

x:\x_wcfs\projects\yuccamtn\whb\fieldata\downhole\final\whb\amr\redpath-tt 10/17/01 1:05 PM

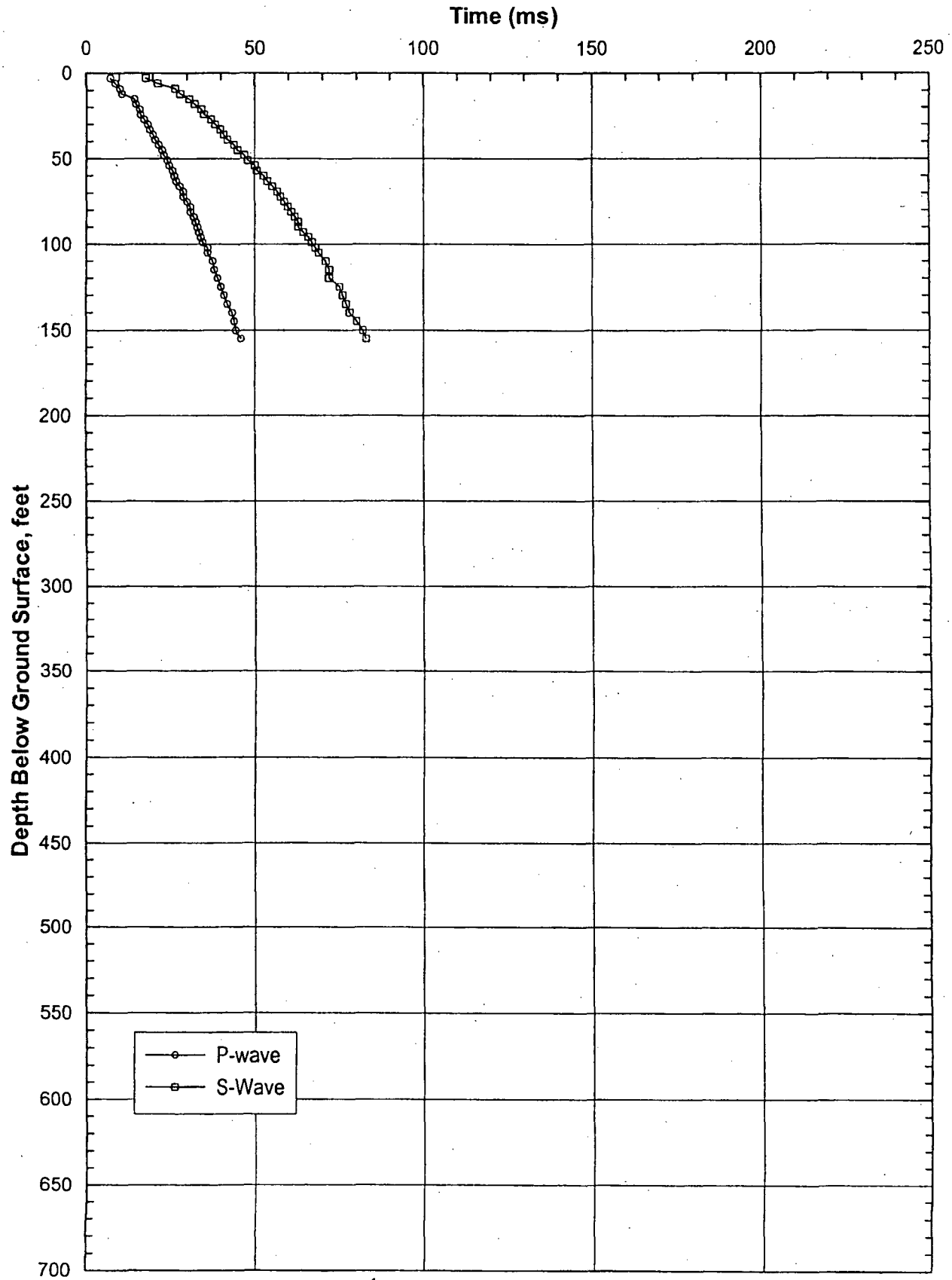


Figure 10. Downhole Travel Time RF-23

x:\x_wcfs\projects\yuccamtn\whb\fieldata\downhole\final\whb\amr\redpath-tt 10/17/01 1:05 PM

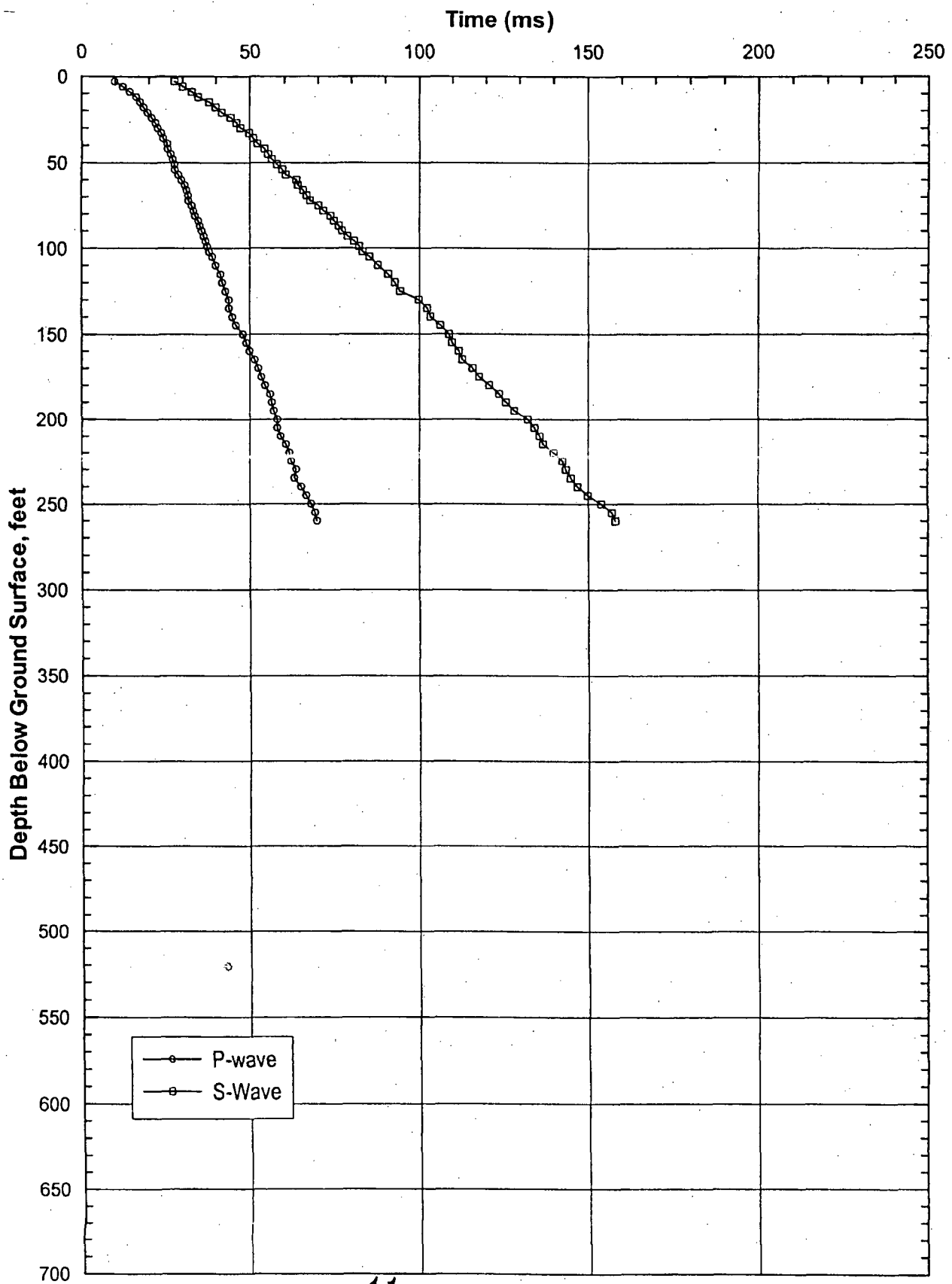


Figure 11. Downhole Travel Time RF-24

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:05 PM

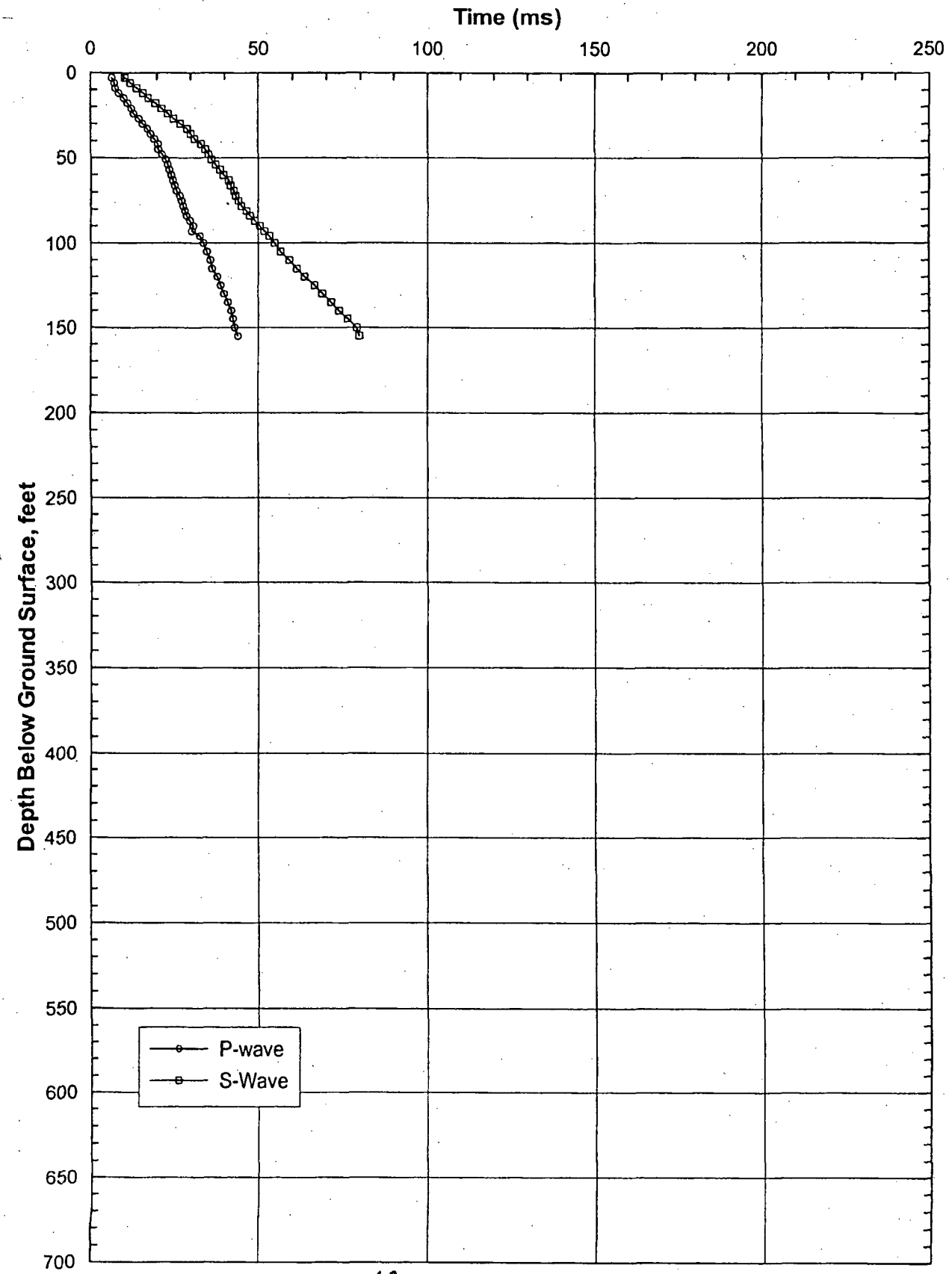


Figure 12. Downhole Travel Time RF-25

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:05 PM

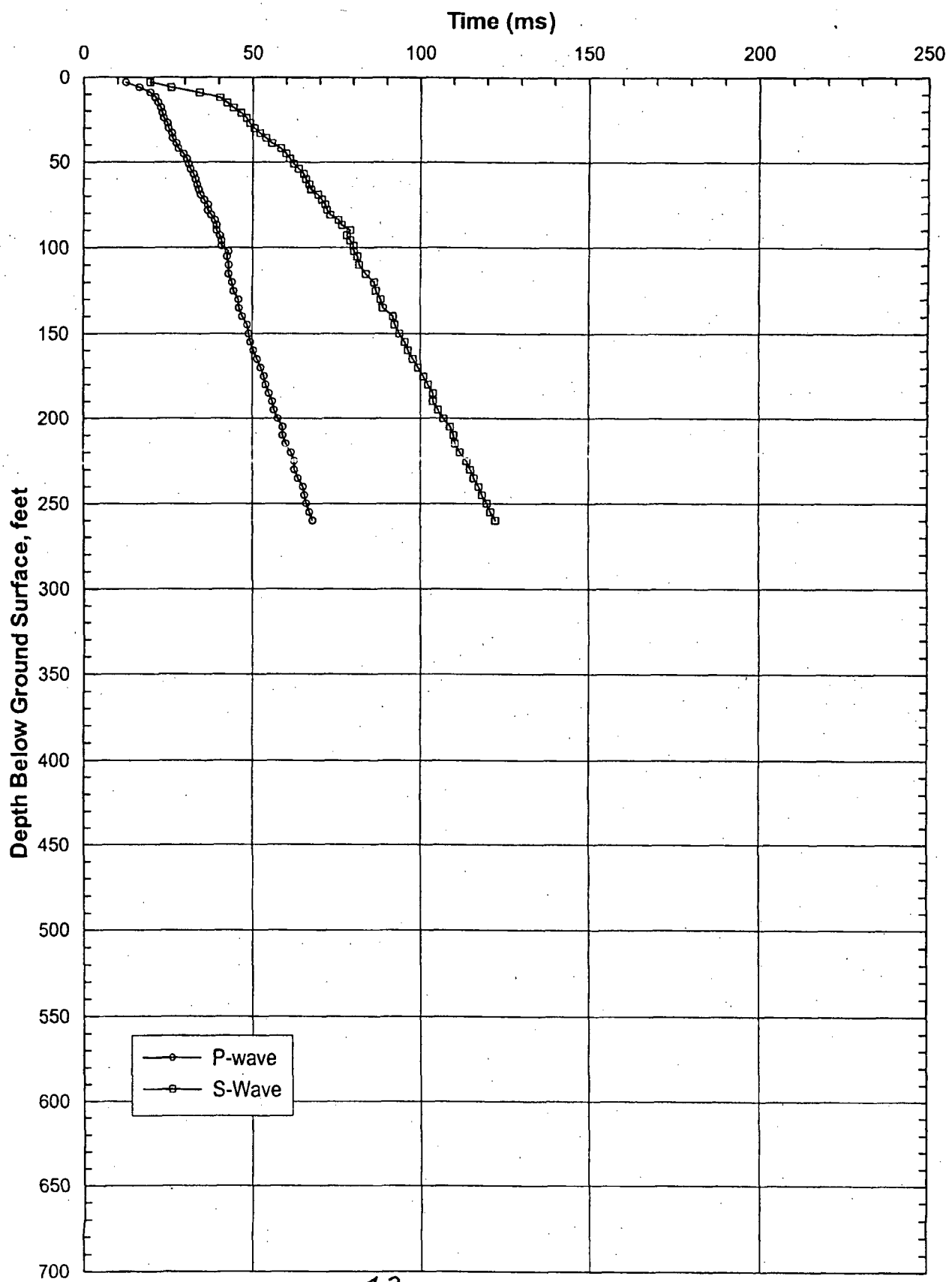


Figure 13. Downhole Travel Time RF-26

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:06 PM

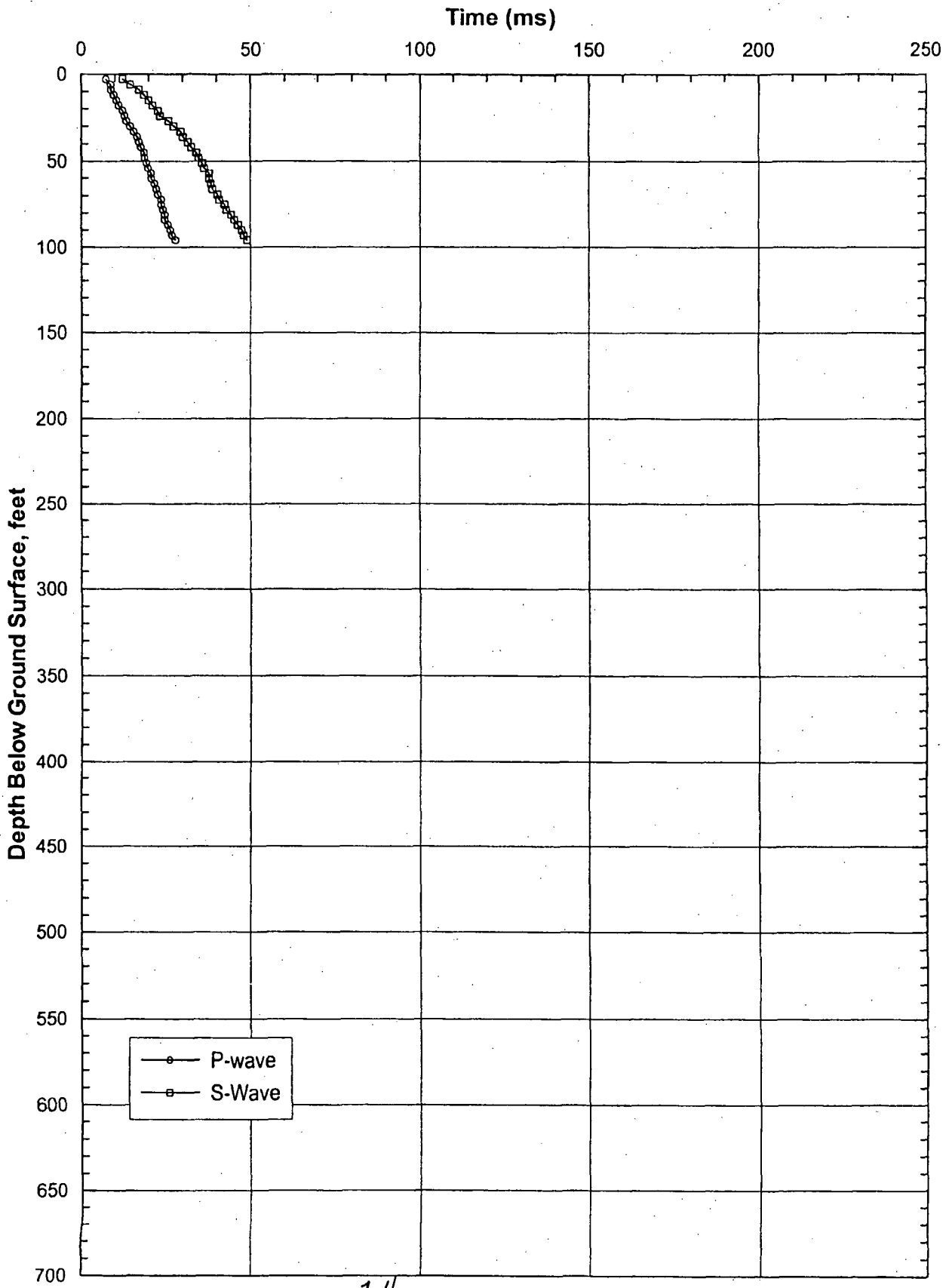


Figure 14. Downhole Travel Time RF-28

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:06 PM

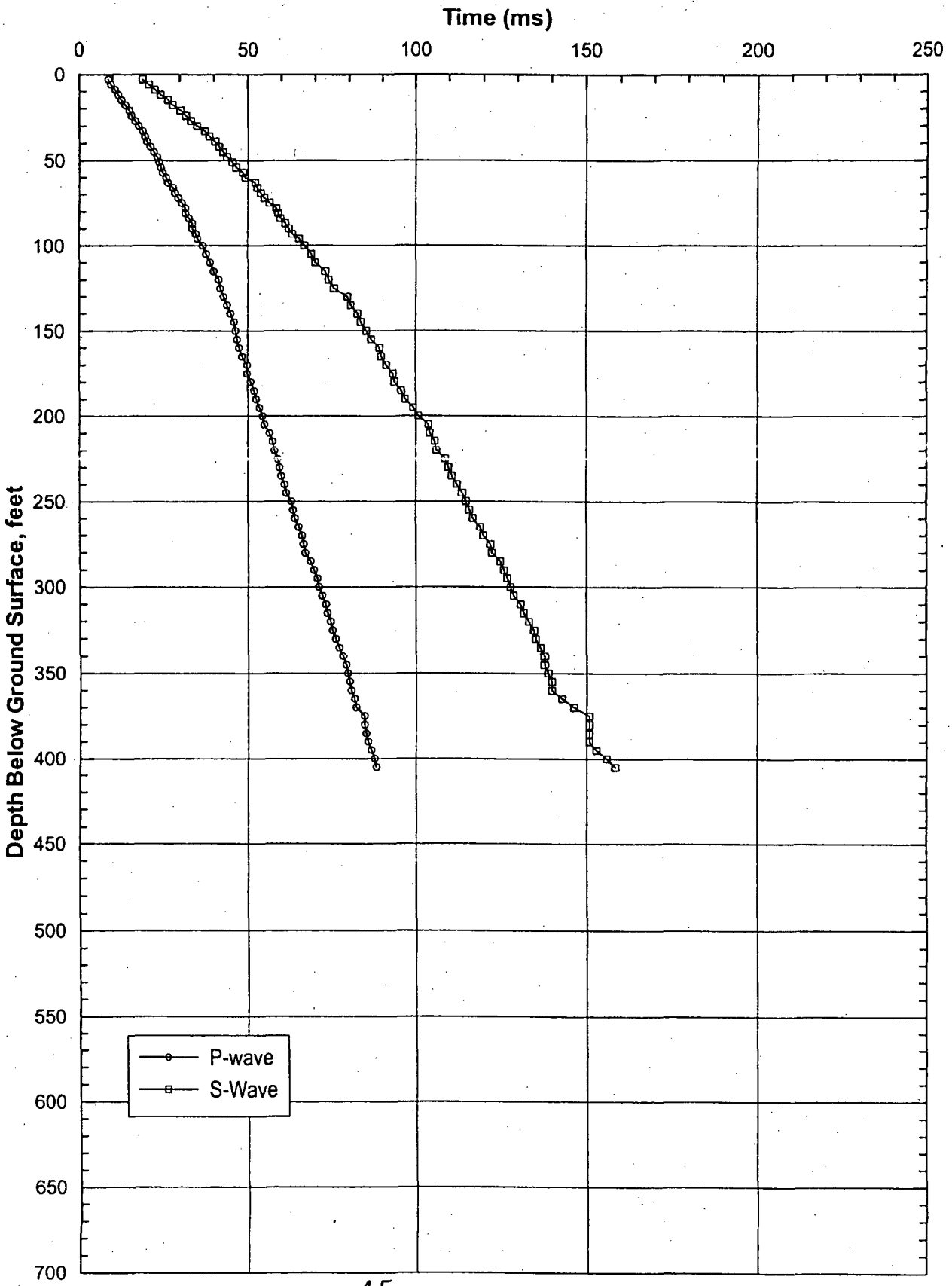


Figure 15. Downhole Travel Time RF-29

x:\x_wcfs\projects\yuccamtn\whb\fielddata\downhole\final\whb\amr\redpath-tt 10/17/01 1:06 PM

3

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

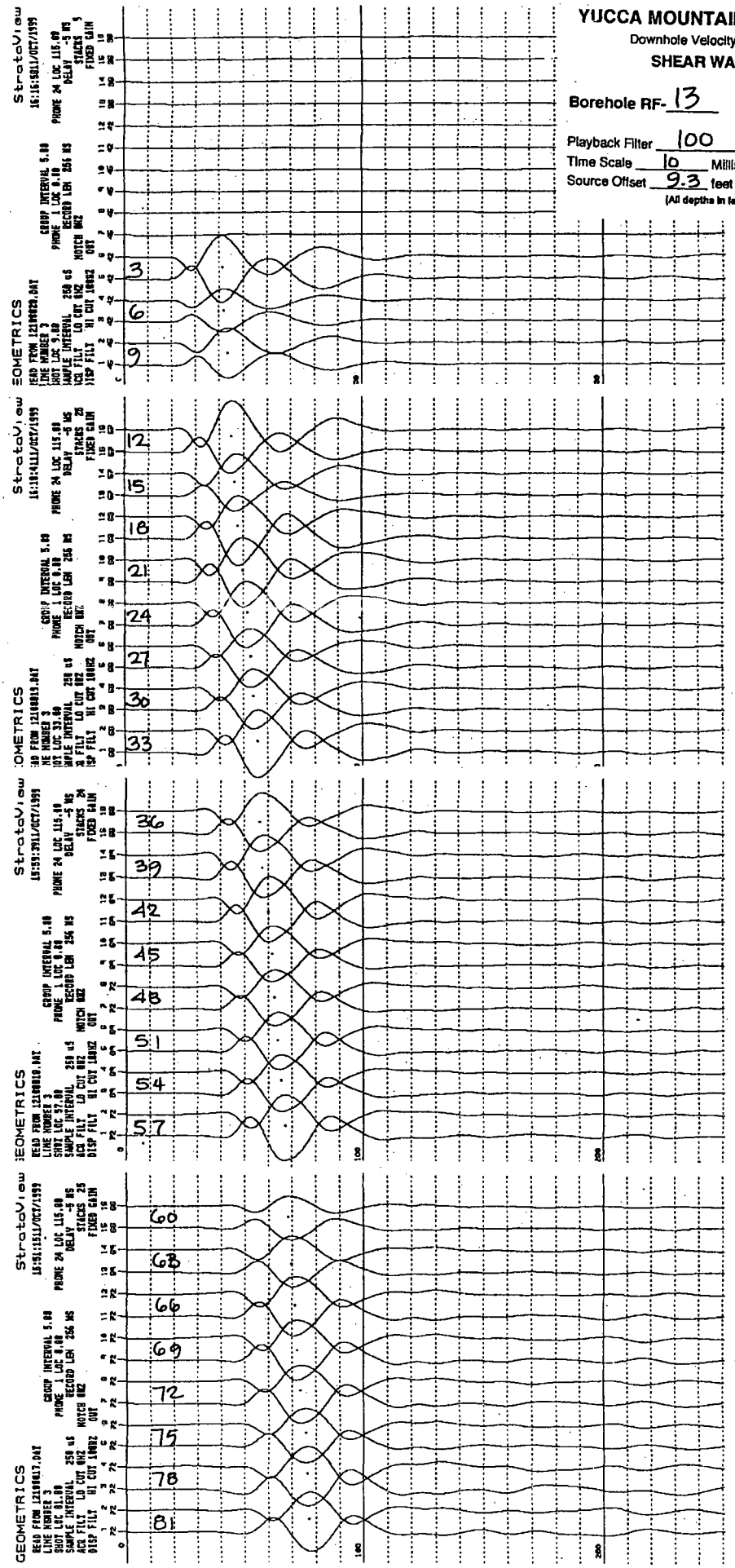
Borehole RF- 13

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 9.3 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

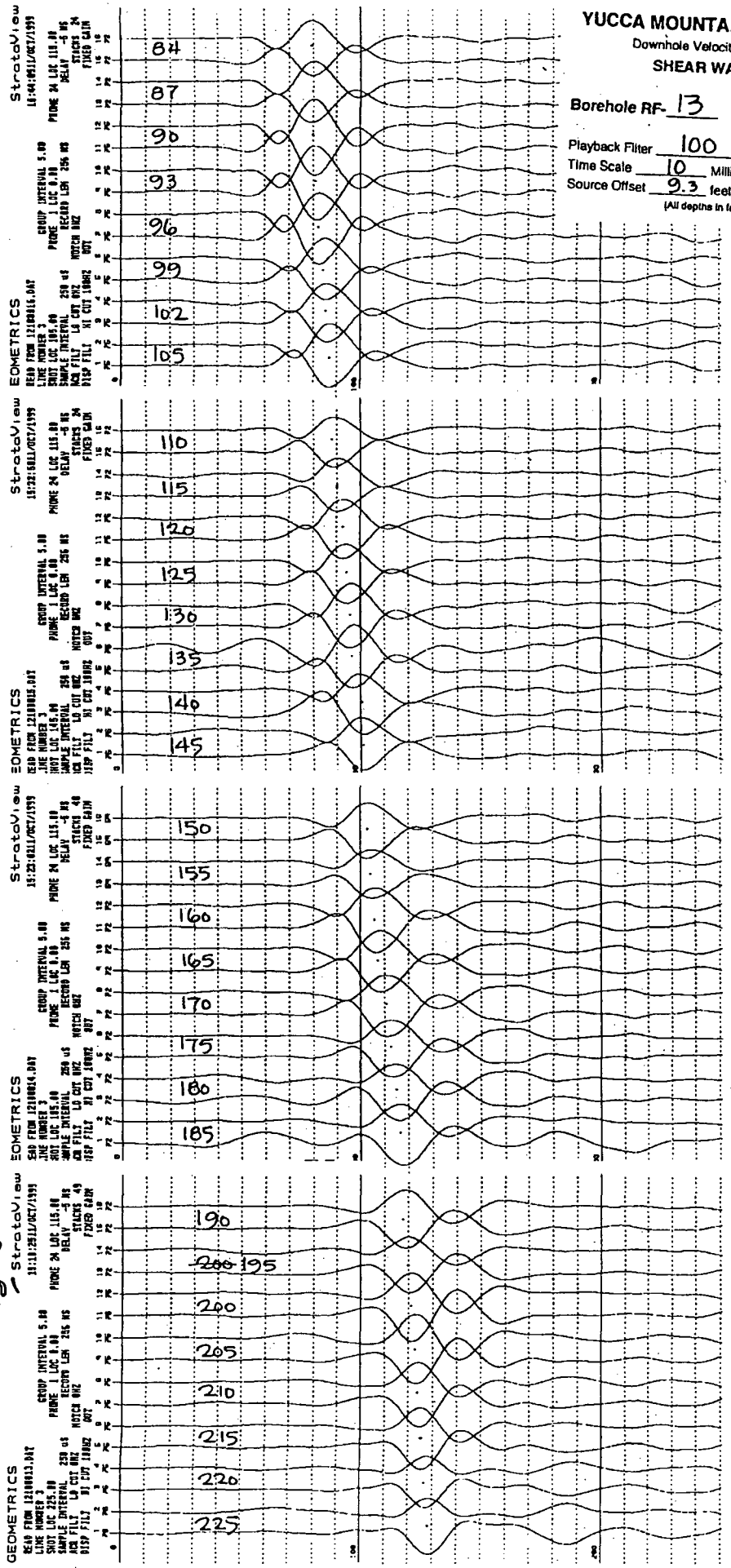
Borehole RF- 13

Playback Filter 100 Hz Low Pass

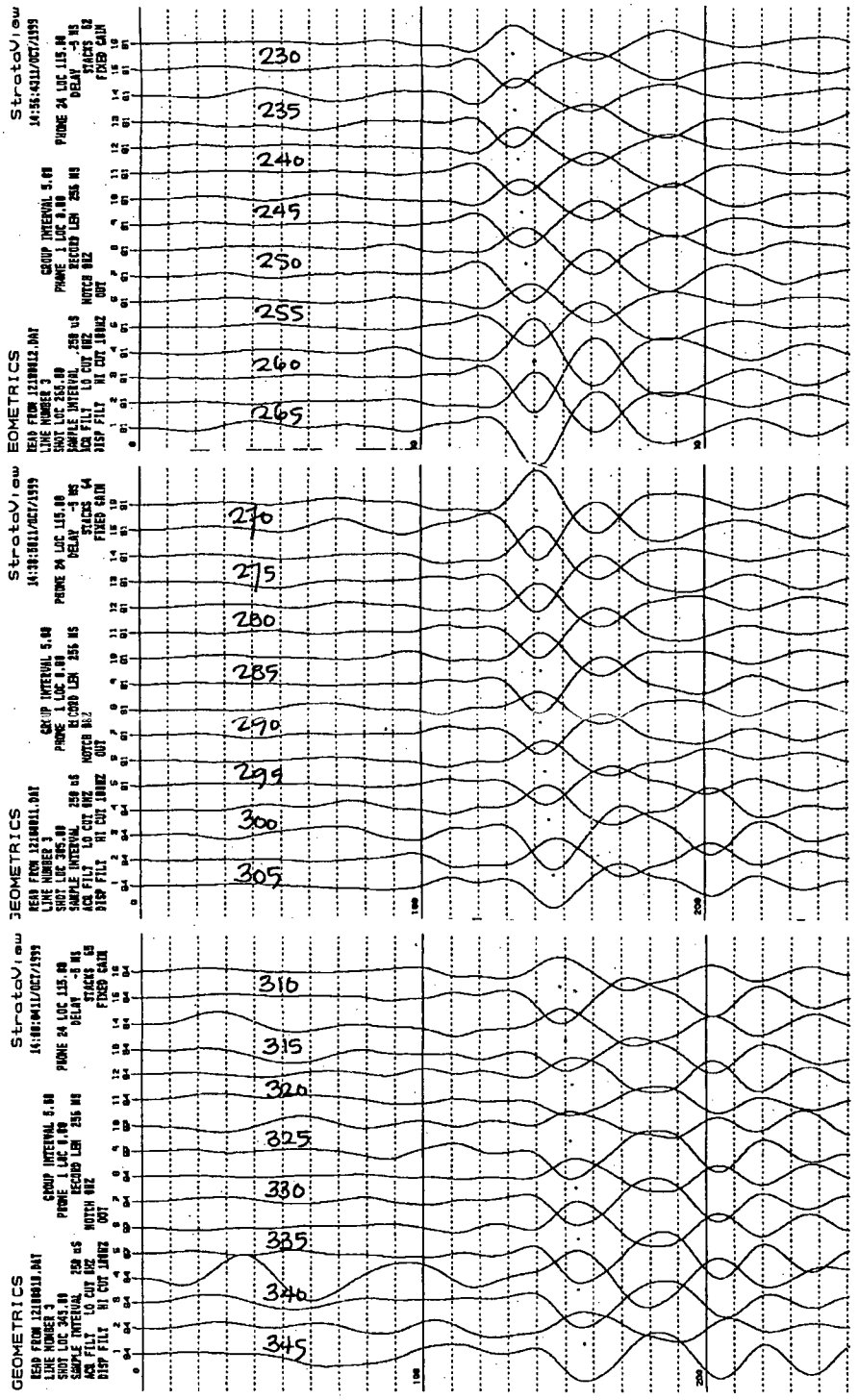
Time Scale 10 Milliseconds/Line

Source Offset 9.3 feet

(All depths in feet)



low 9/27/01



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 13

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 9.3 feet

[All depths in feet]

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

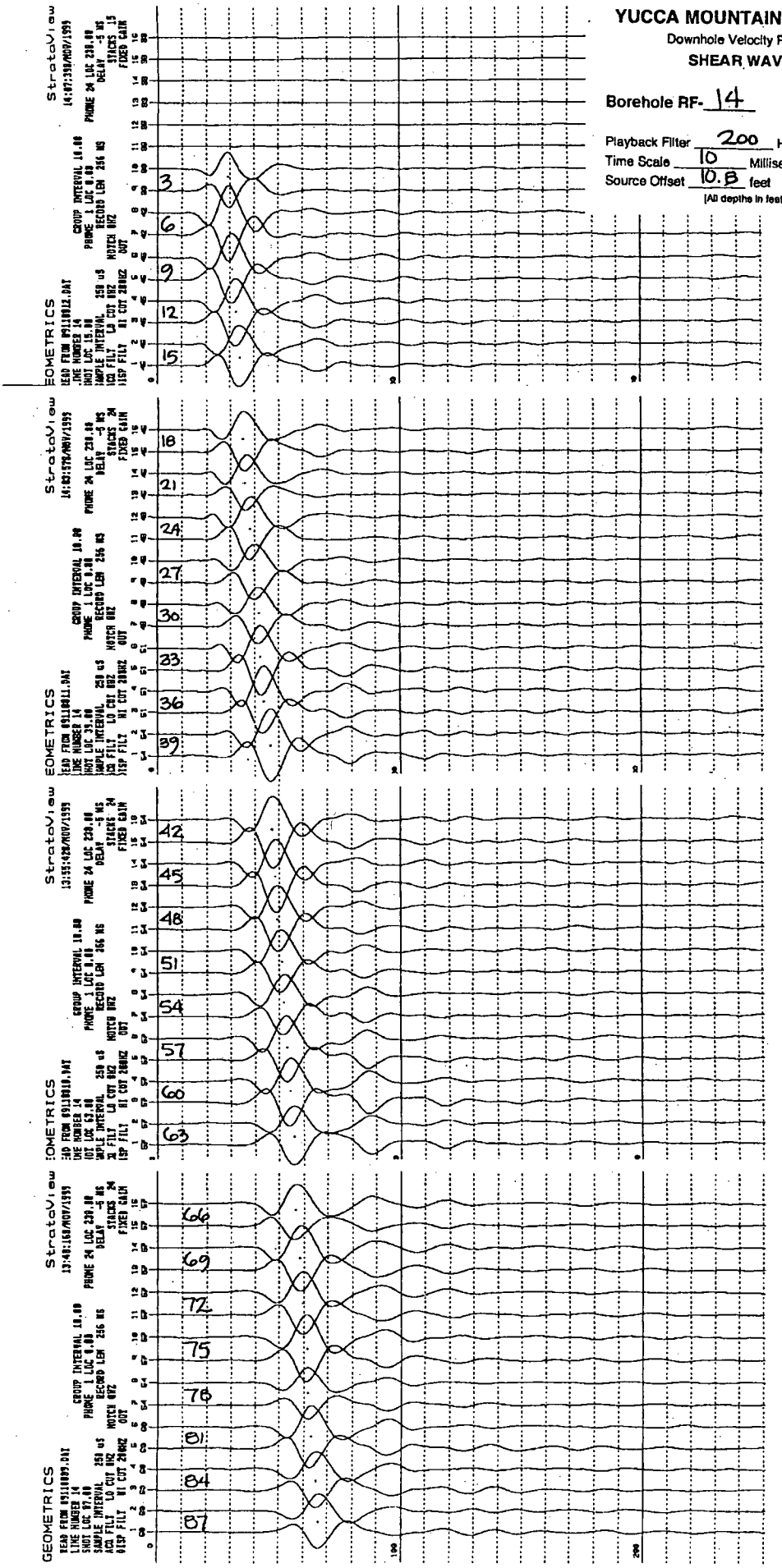
Borehole RF- 14

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

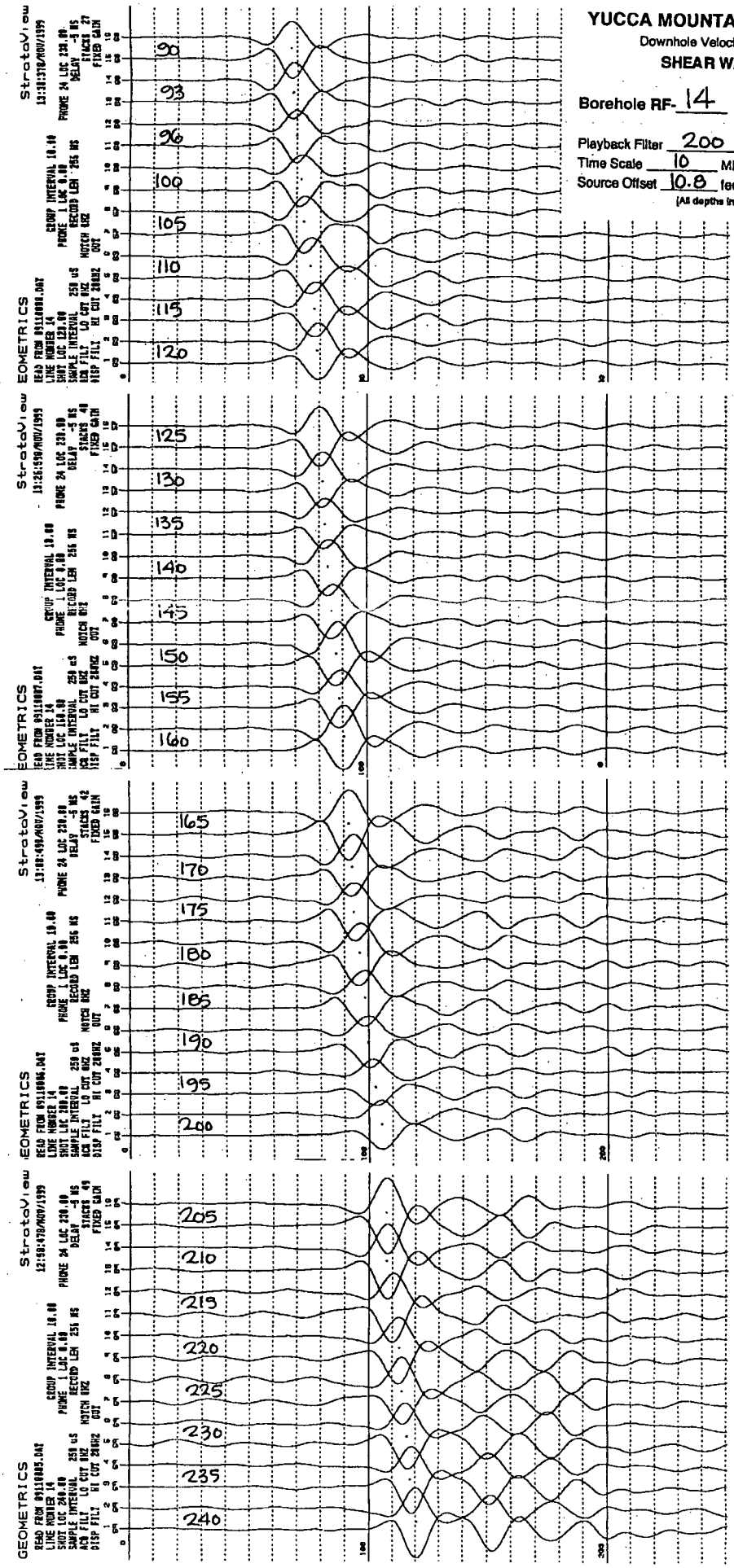
Borehole RF- 14

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.8 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

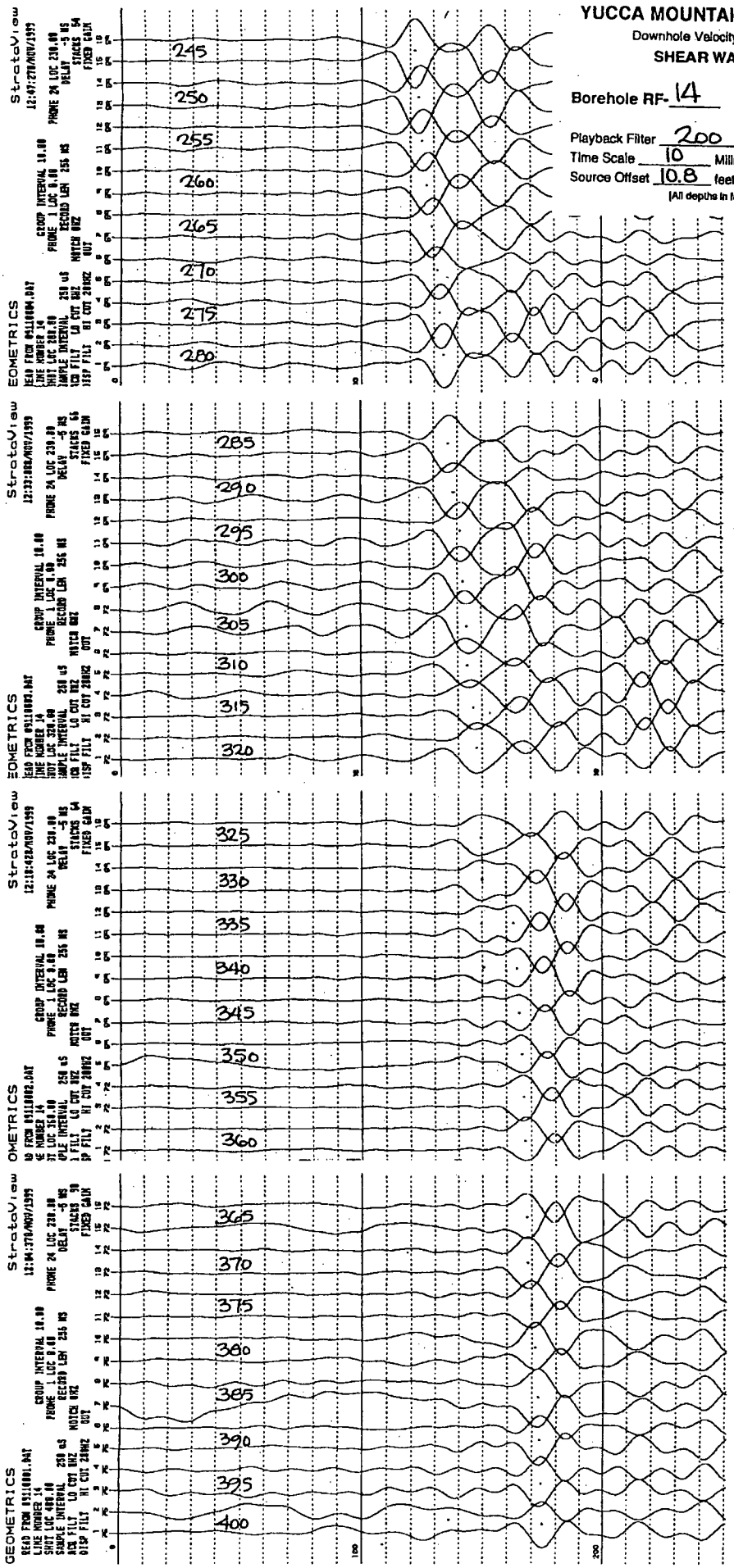
Borehole RF- 14

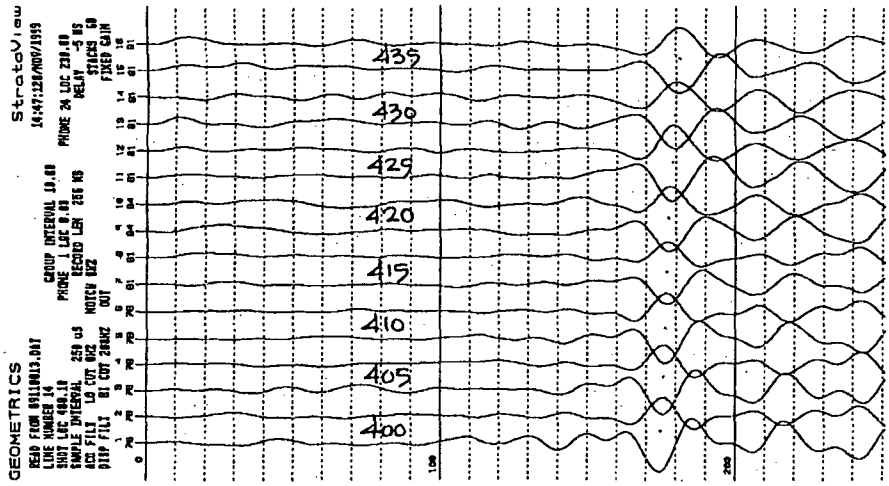
Playback Filter 200 Hz Low Pass

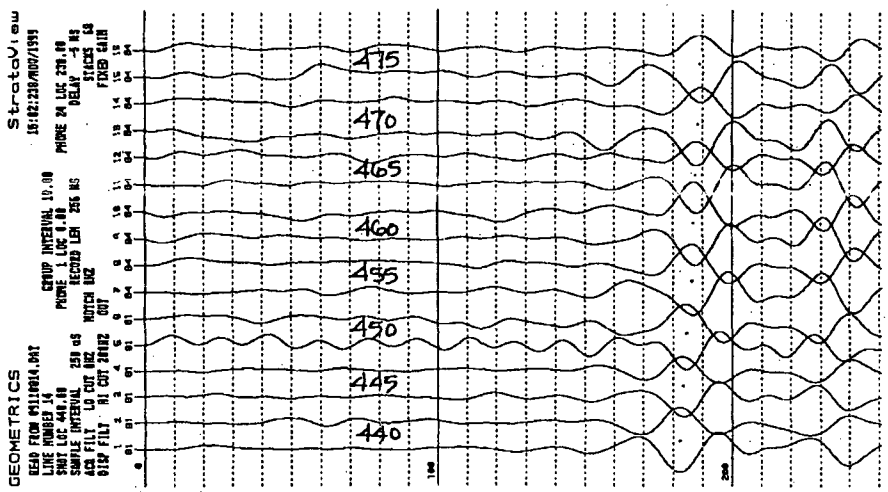
Time Scale 10 Milliseconds/Line

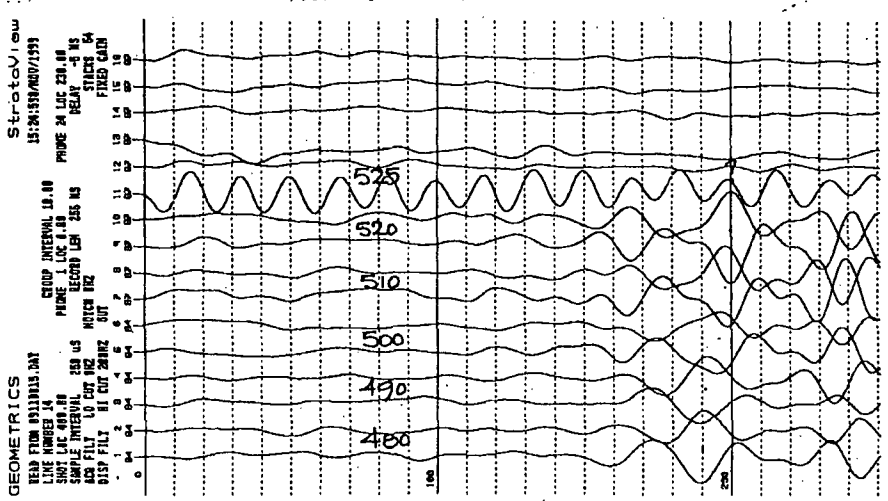
Source Offset 10.8 feet

(All depths in feet)









YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 14

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.8 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

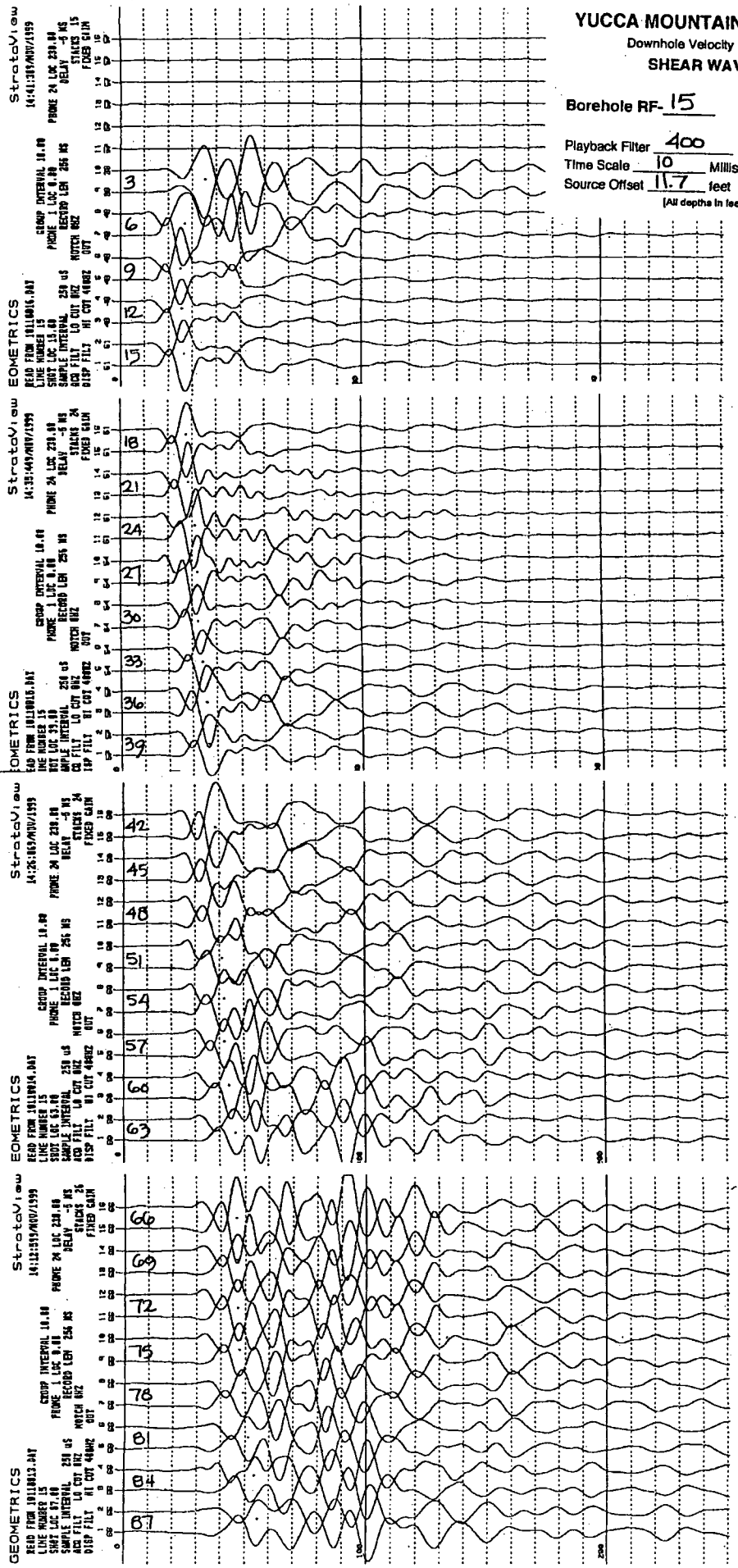
Borehole RF- 15

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

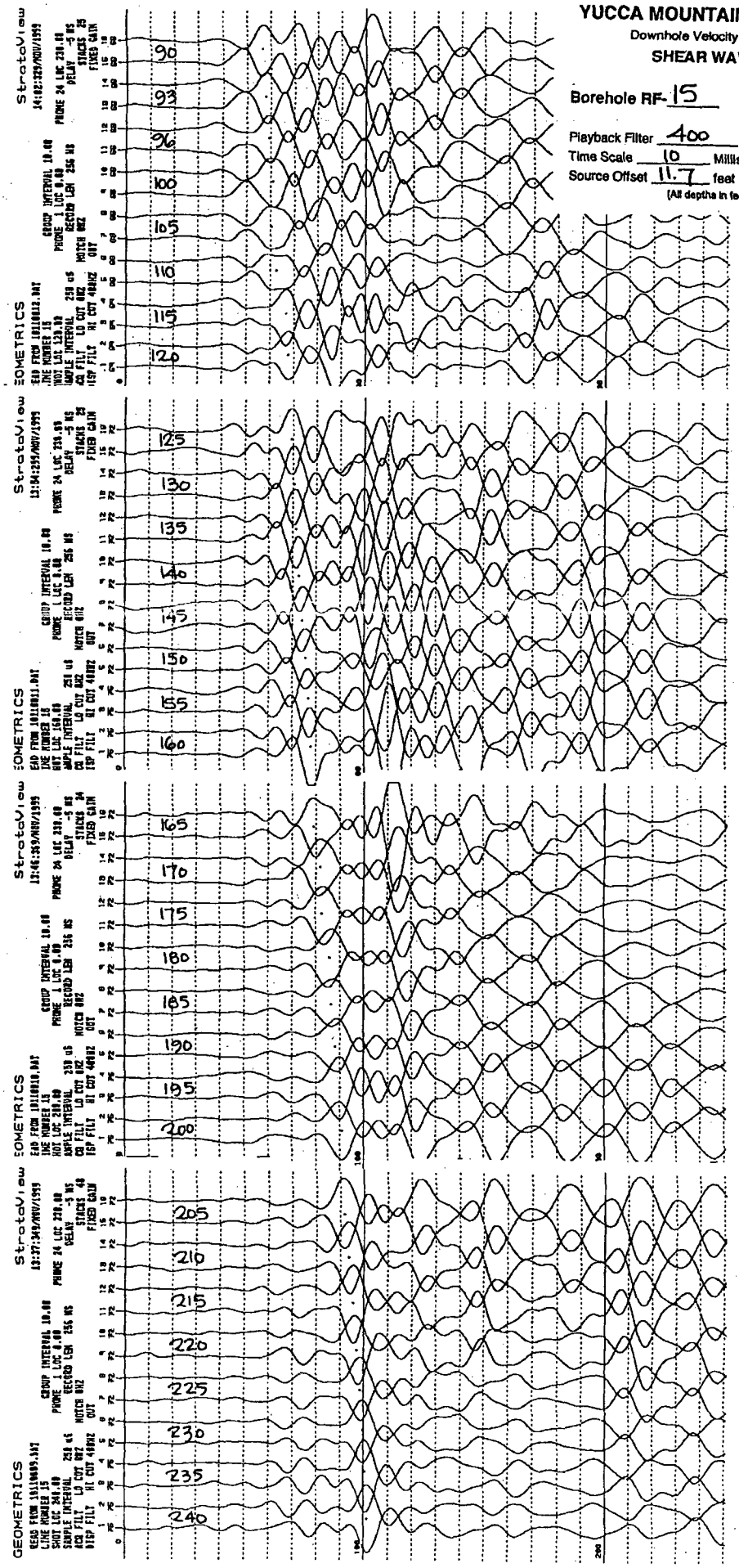
Borehole RF-15

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

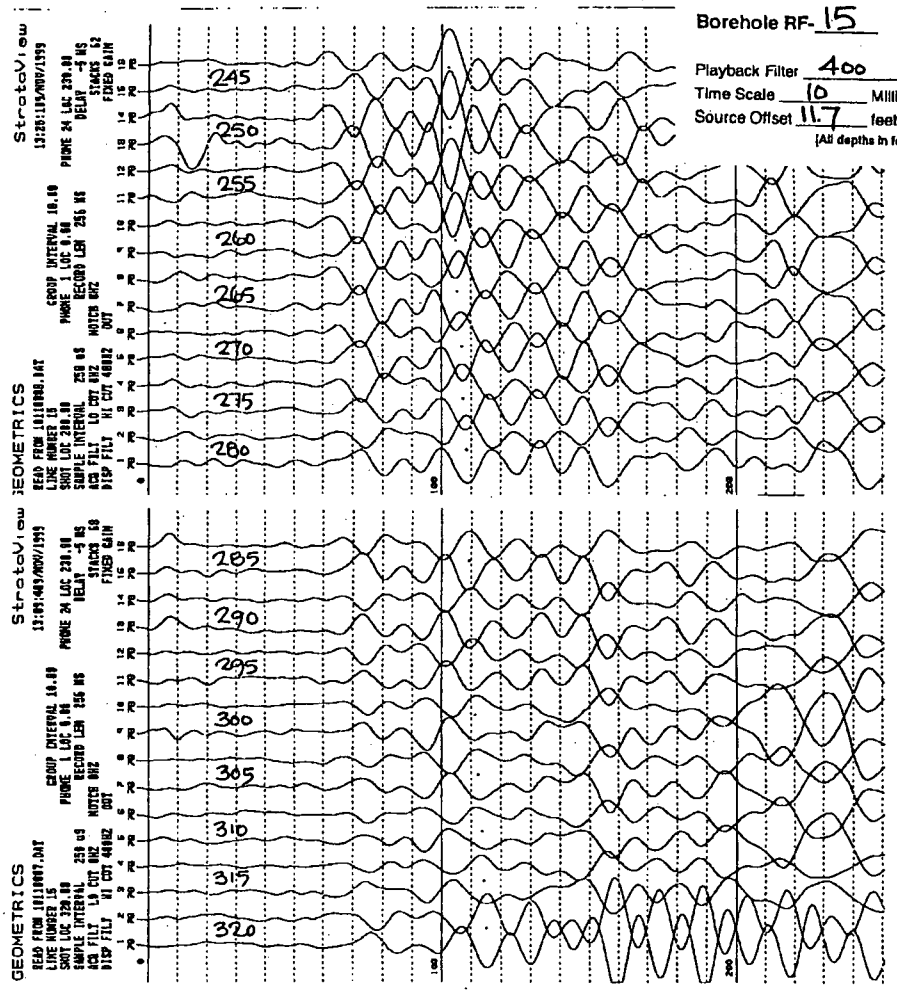
Borehole RF- 15

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

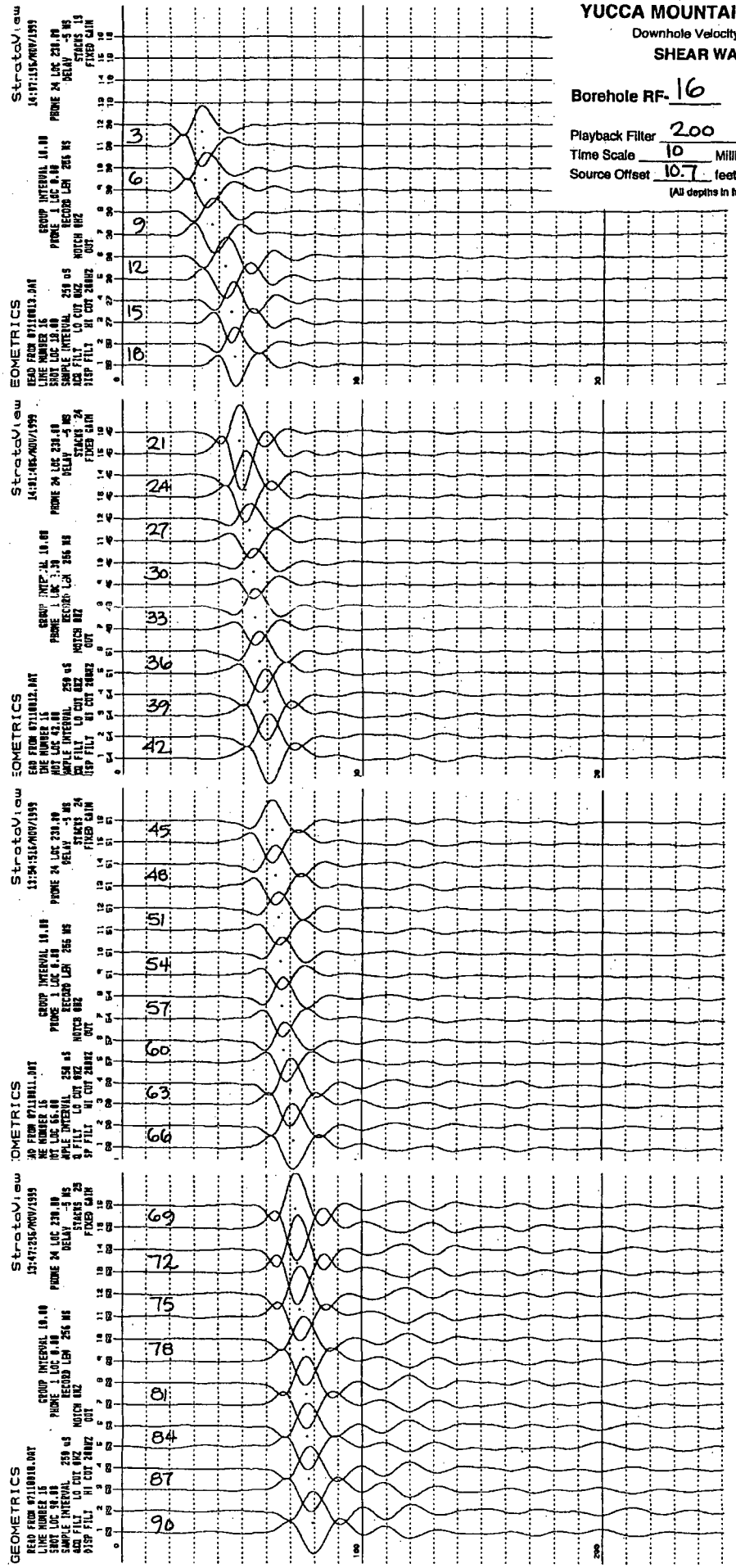
Borehole RF- 16

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

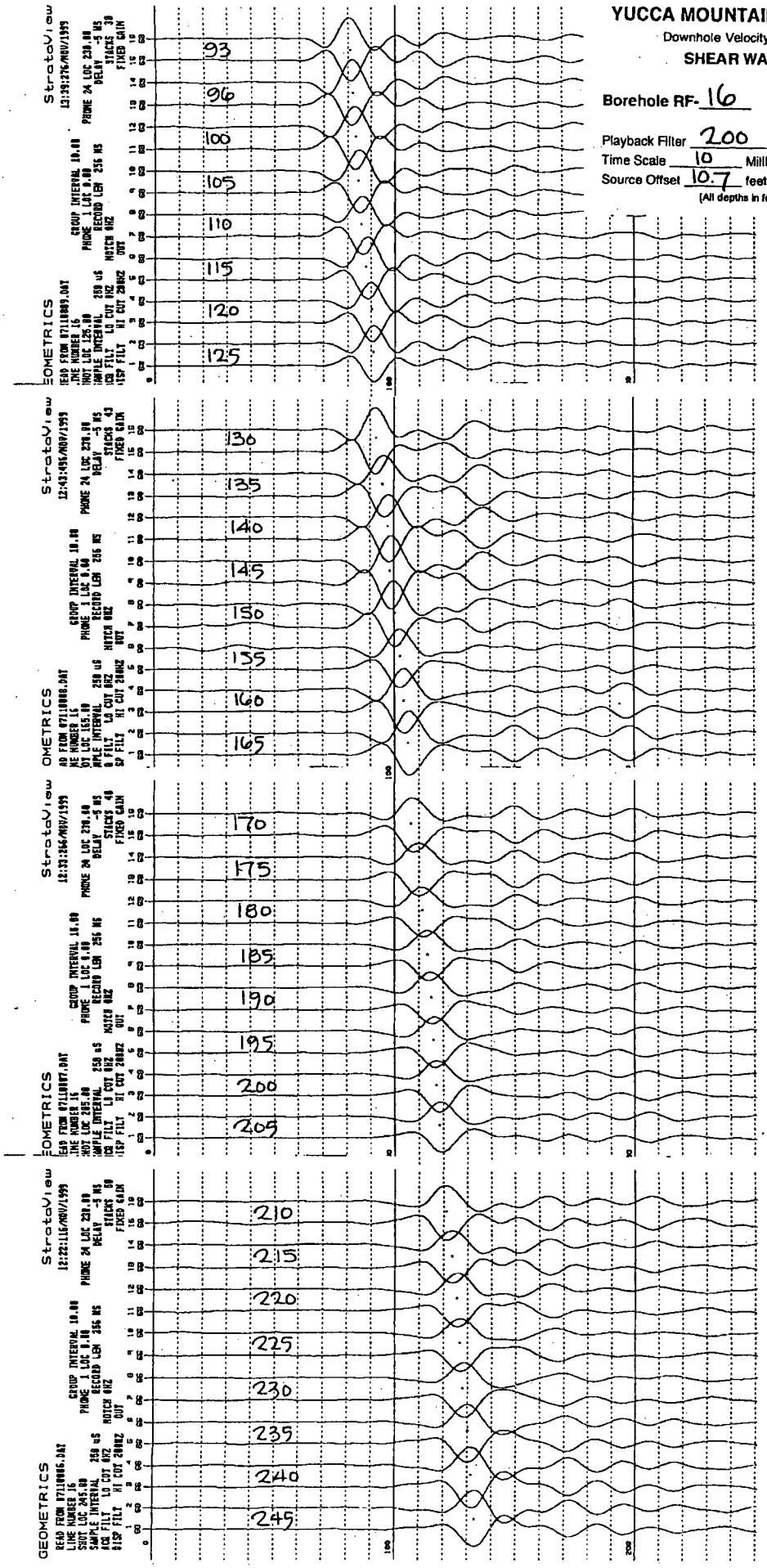
Borehole RF- 16

Playback Filter 200 Hz Low Pass

Time Scale 10 Millseconds/Line

Source Offset 10.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

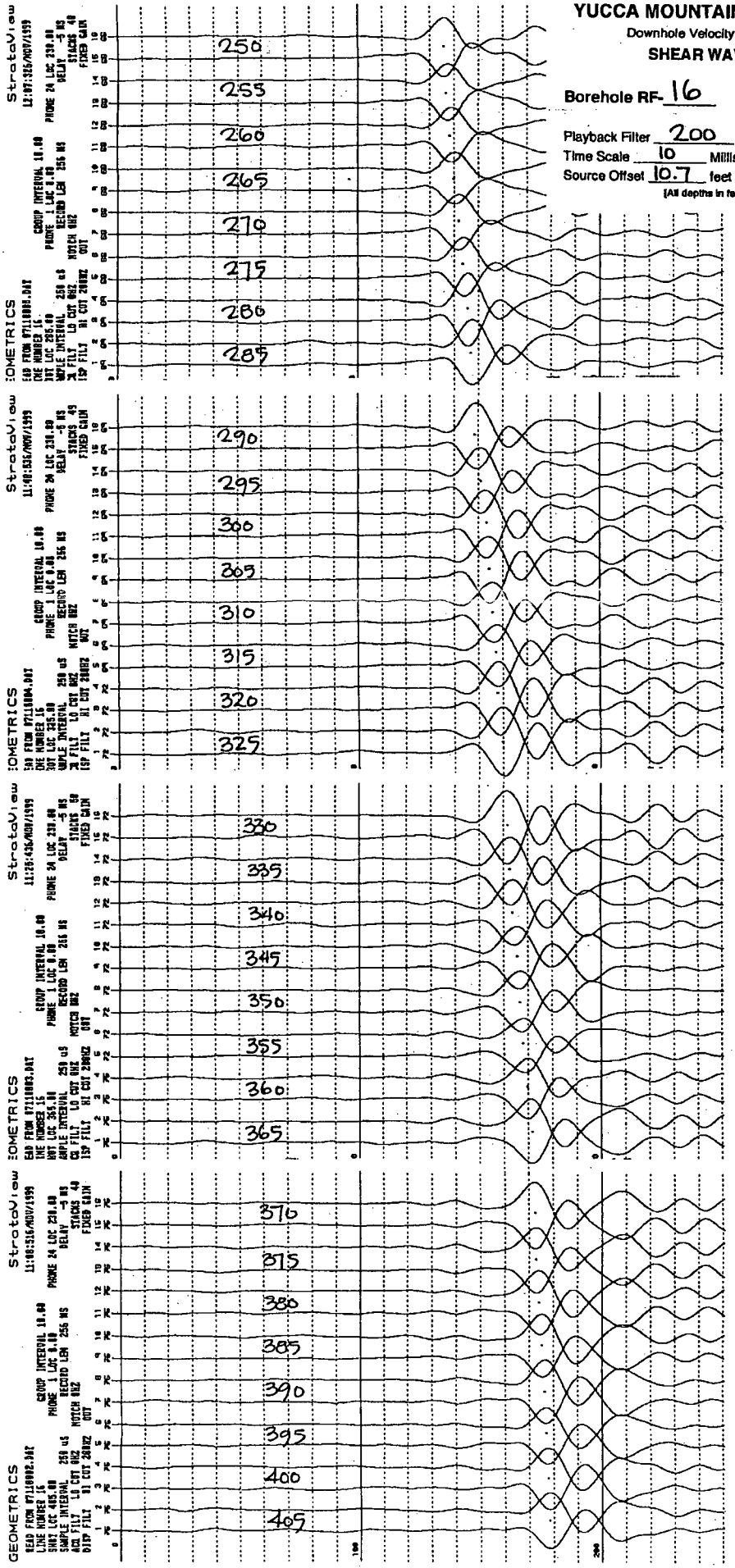
Borehole RF-16

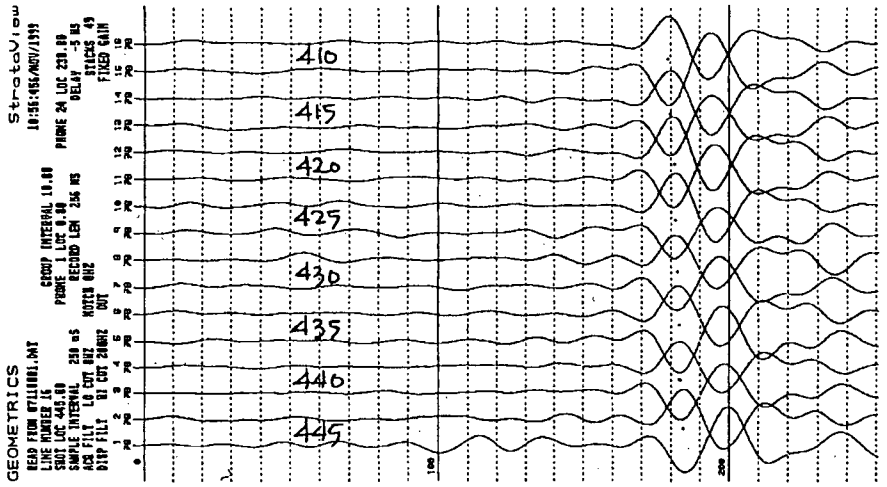
Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 16

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

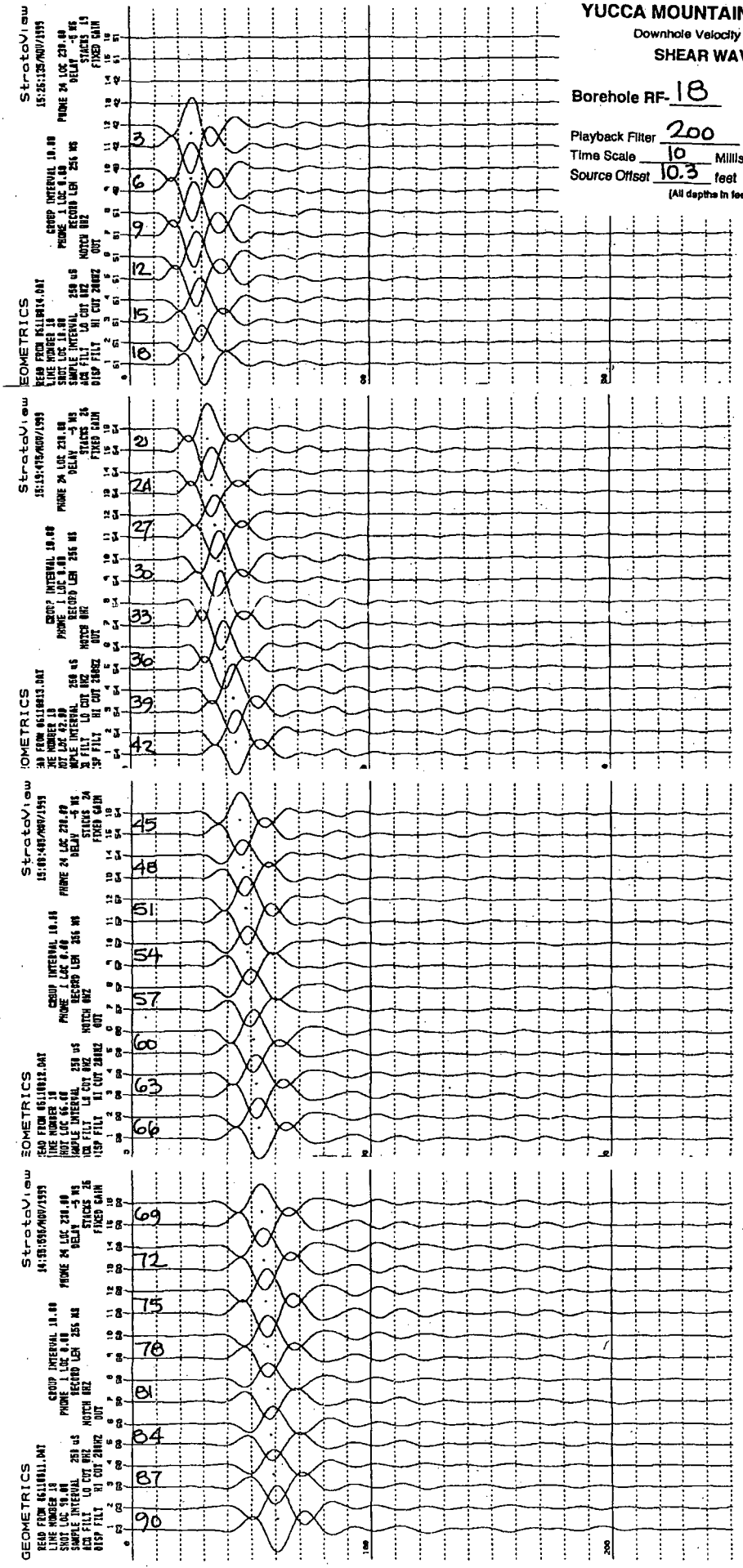
Borehole RF-18

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

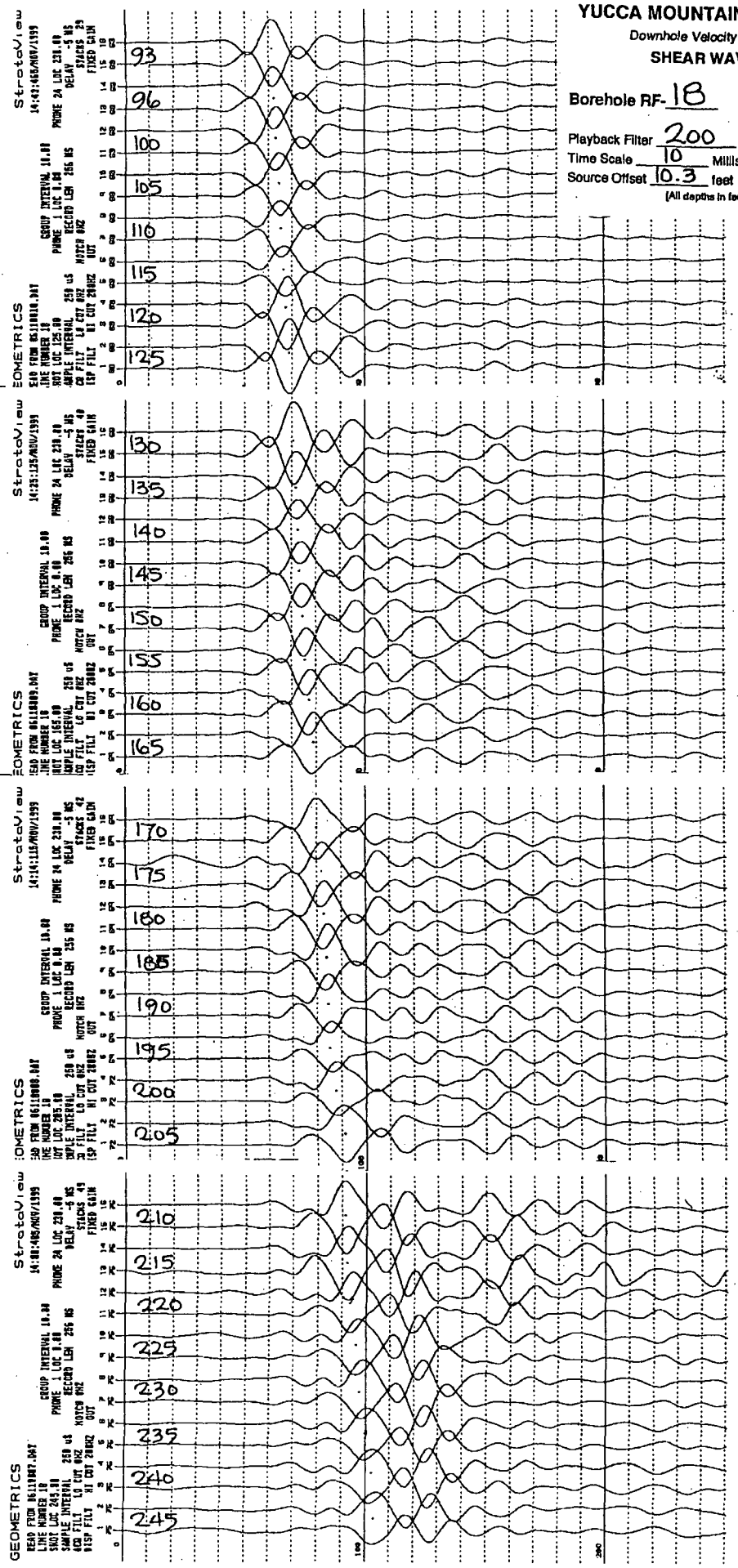
Borehole RF-18

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

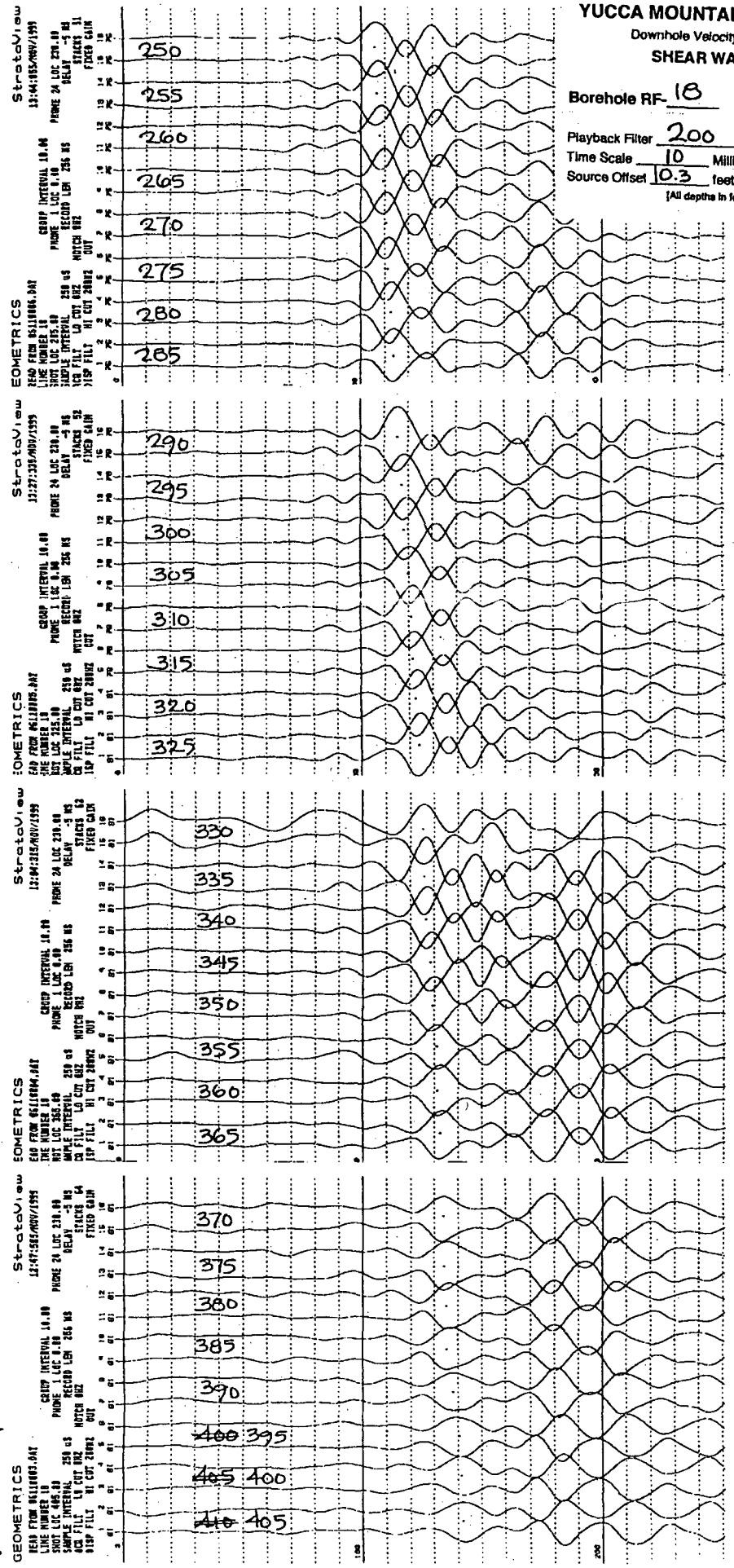
Borehole RF- 18

Playback Filter 200 Hz Low Pass

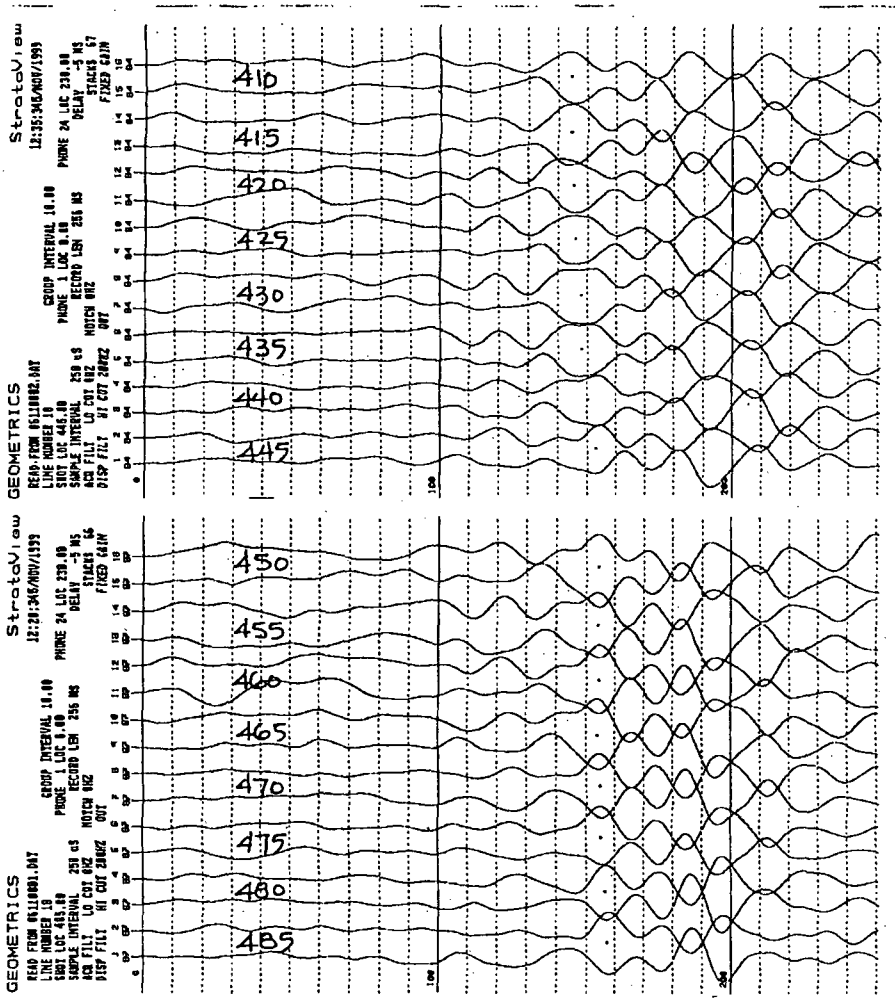
Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

[All depths in feet]



IGW
9/27/01



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 18

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

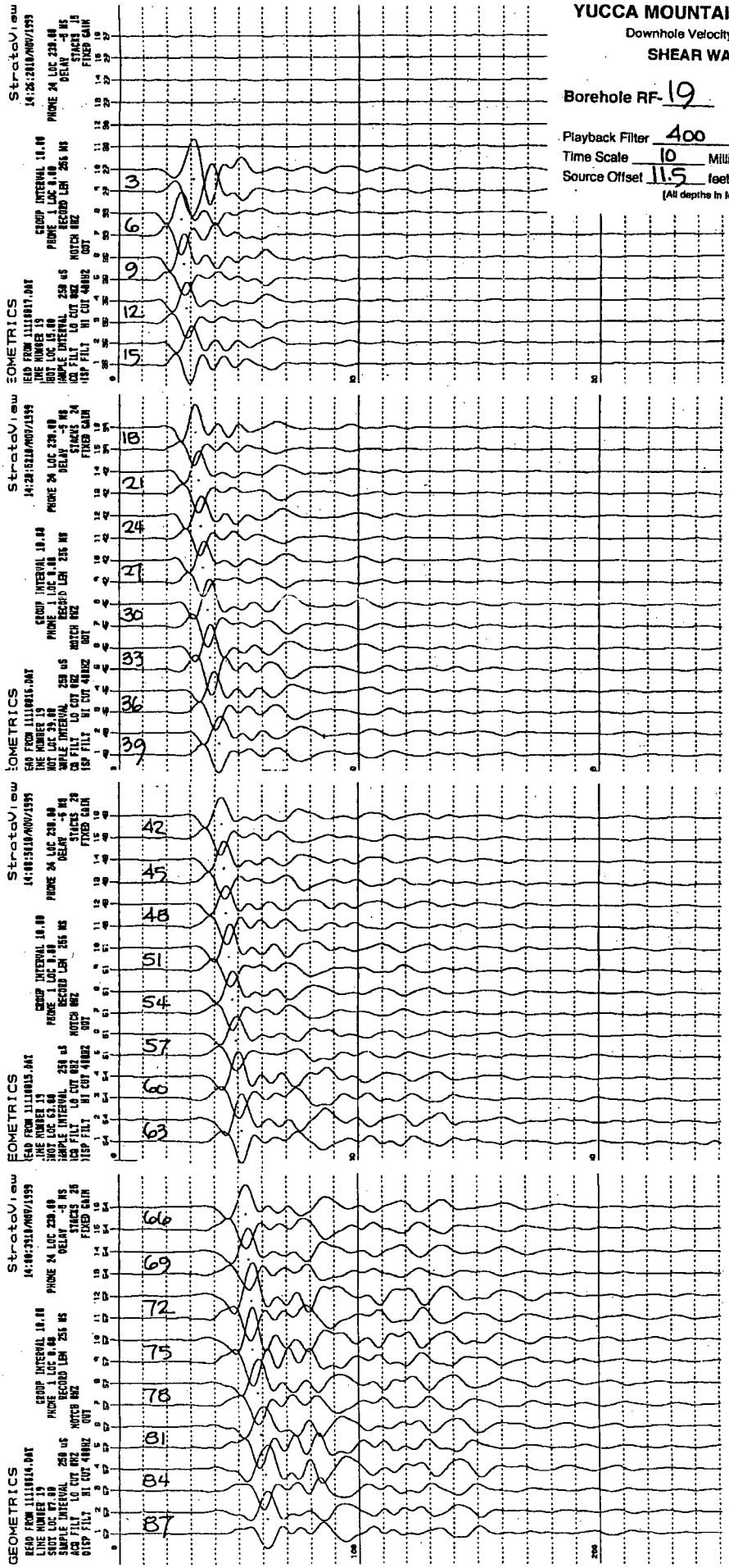
Borehole RF-19

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.5 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

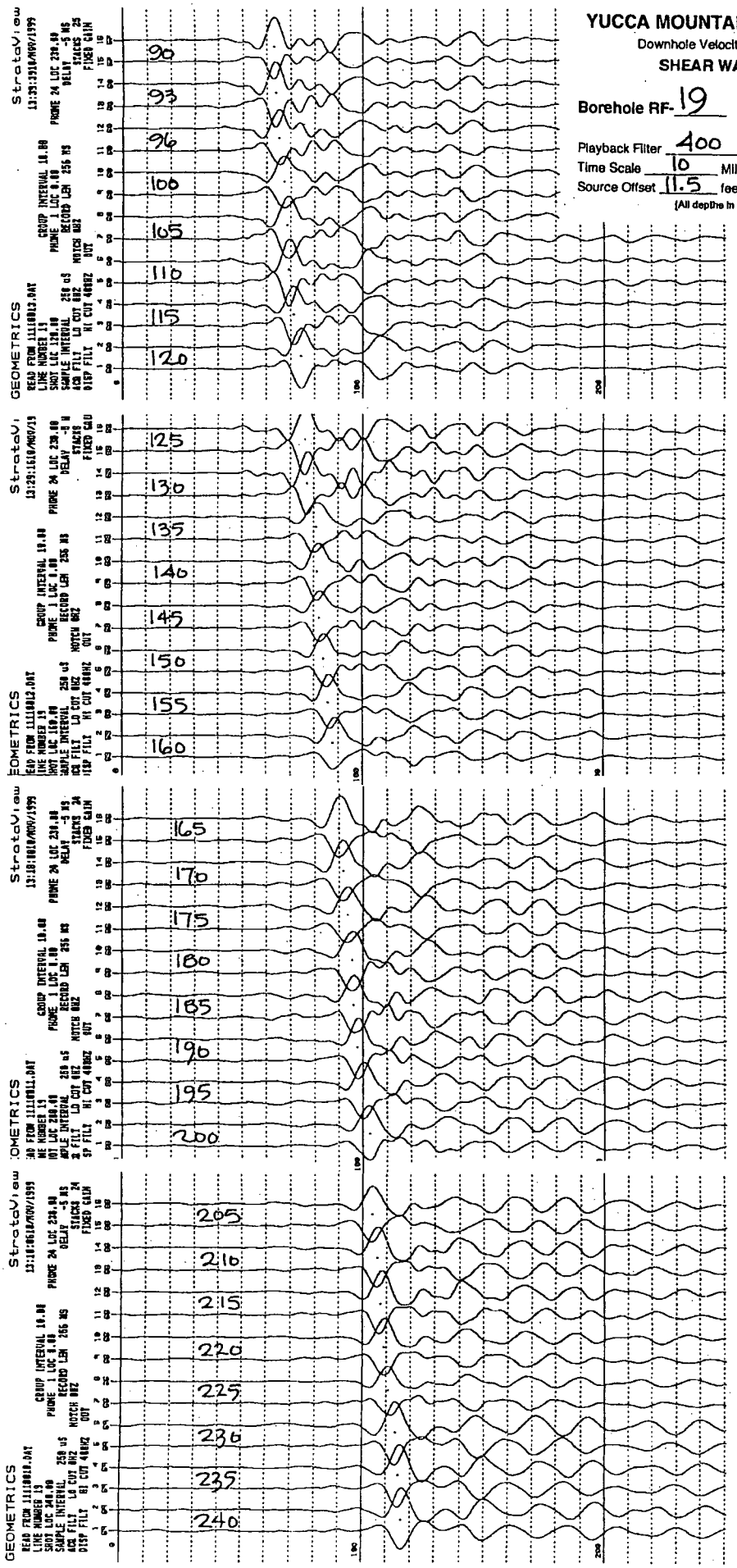
Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

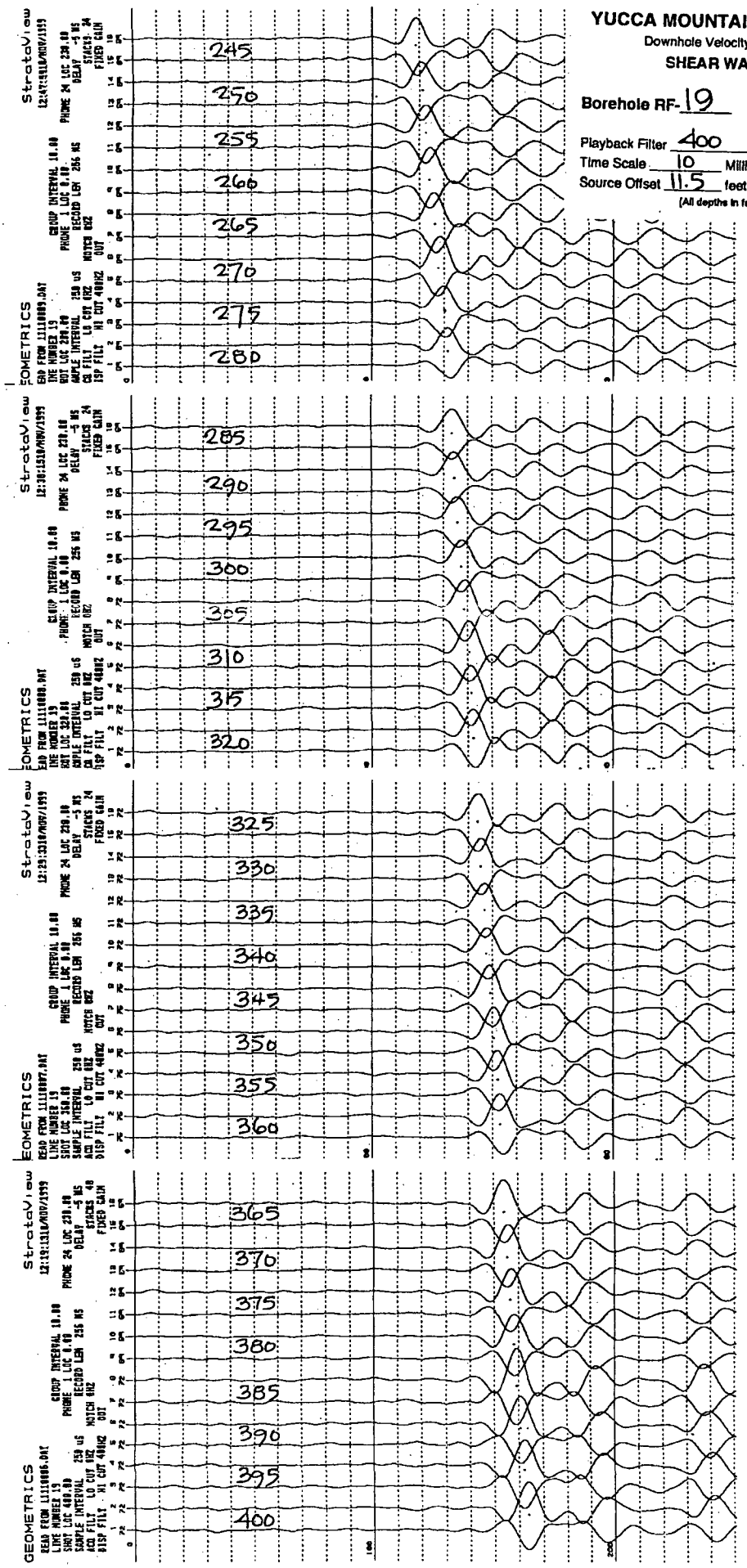
Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

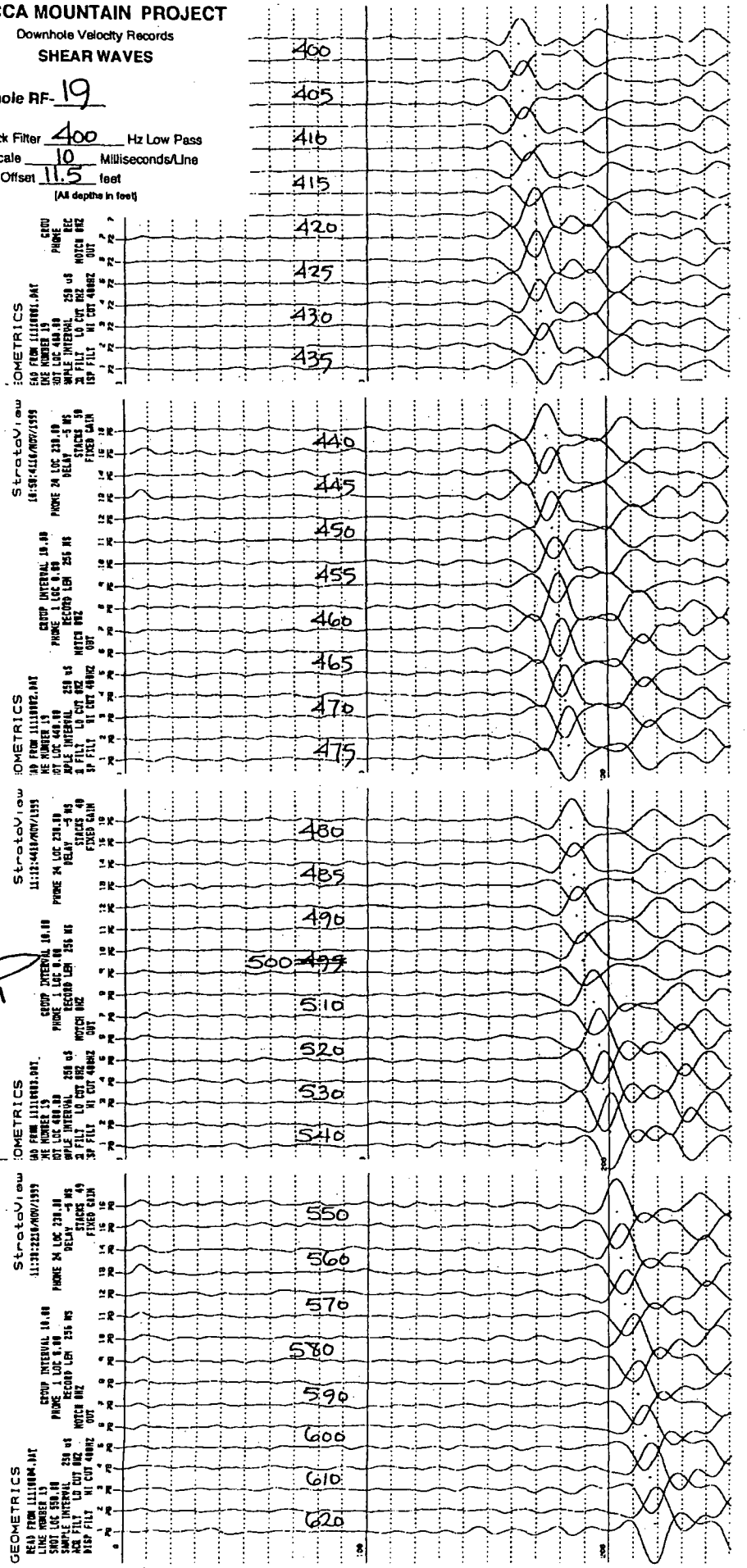
Borehole RF- 19

Playback Filter 400 Hz Low Pass

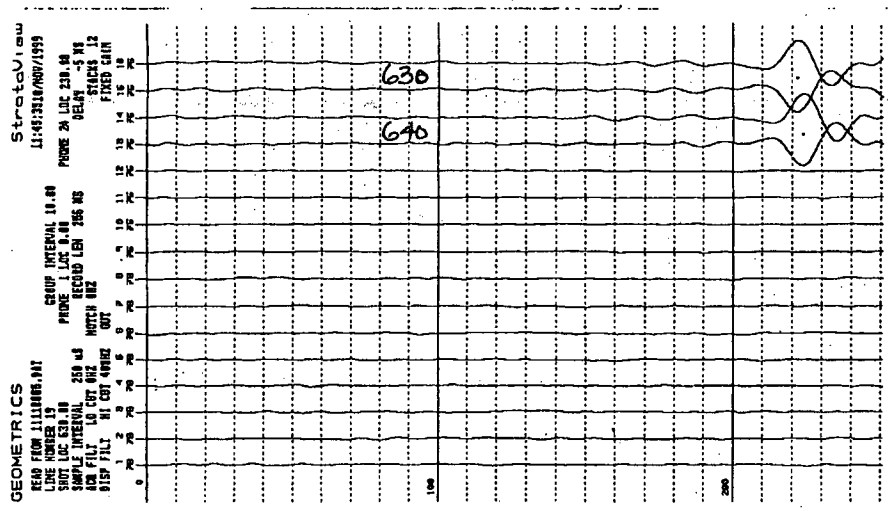
Time Scale 10 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)



IGW
9/27/01



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

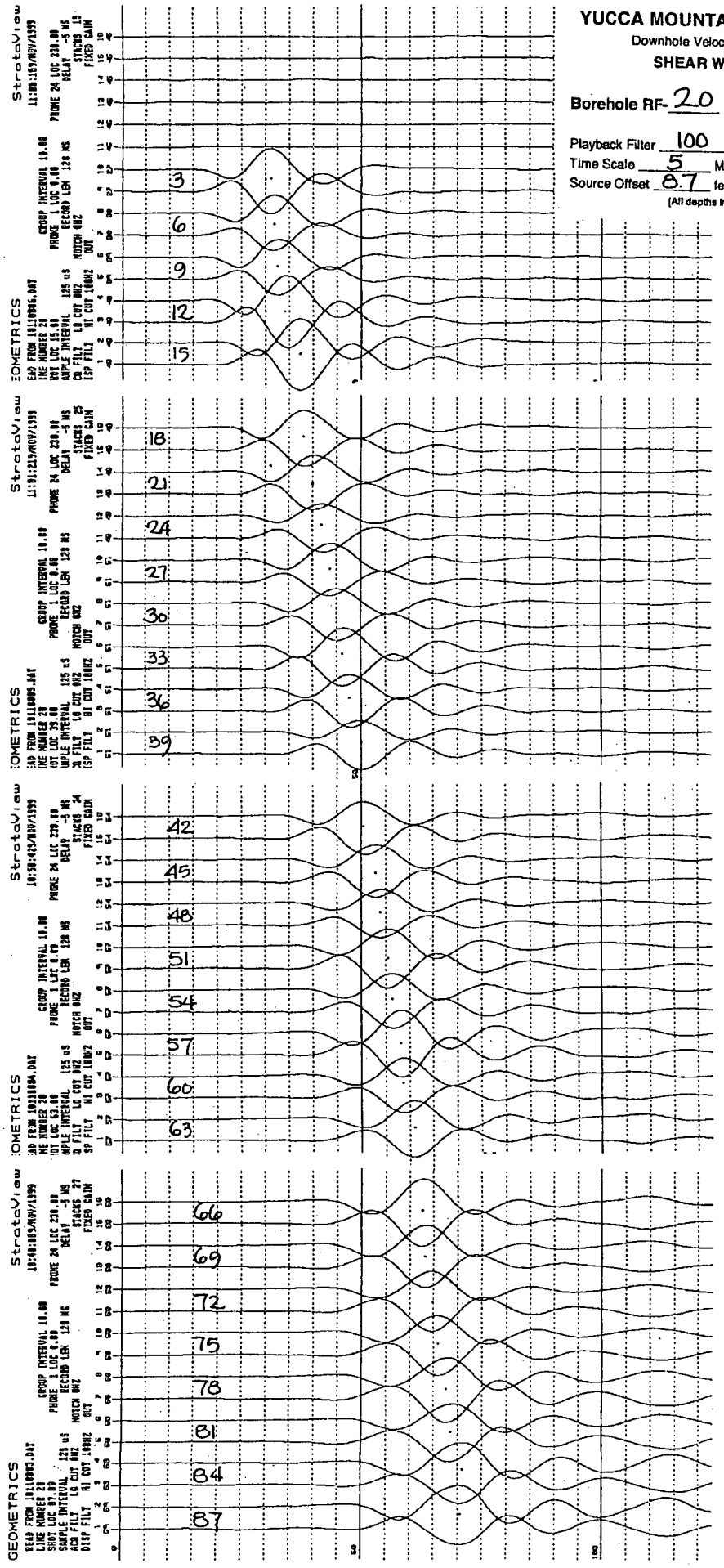
Borehole RF- 20

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 8.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

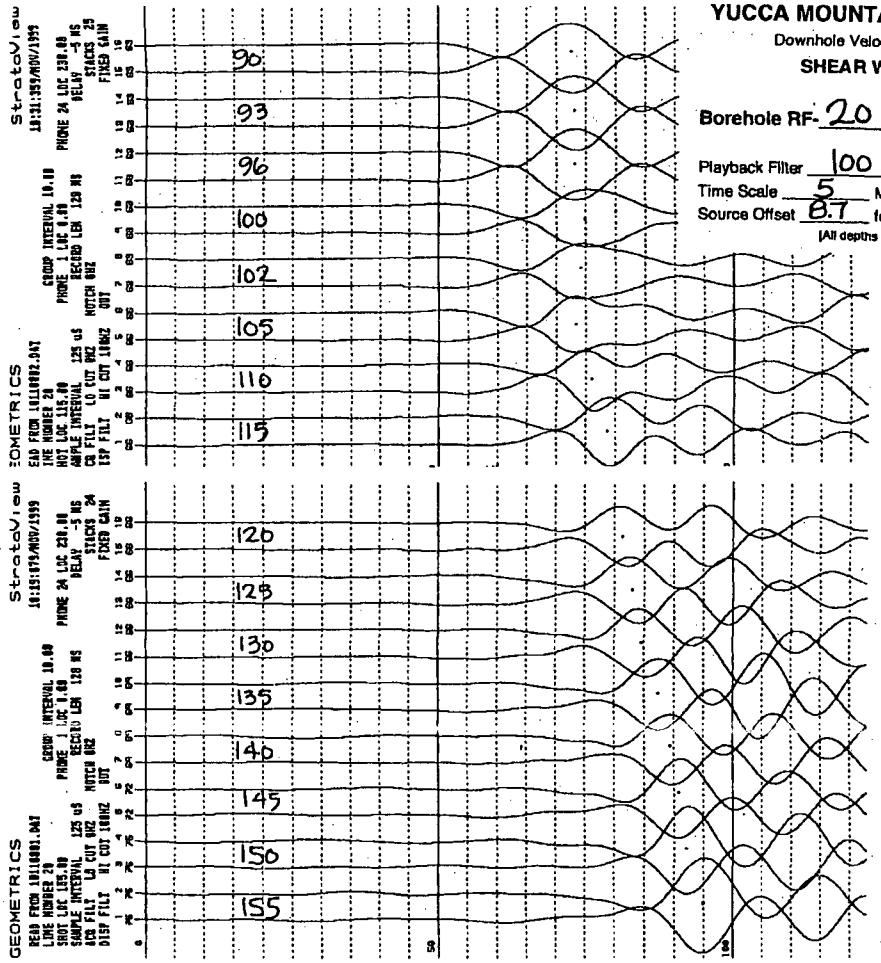
Borehole RF- 20

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 8.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

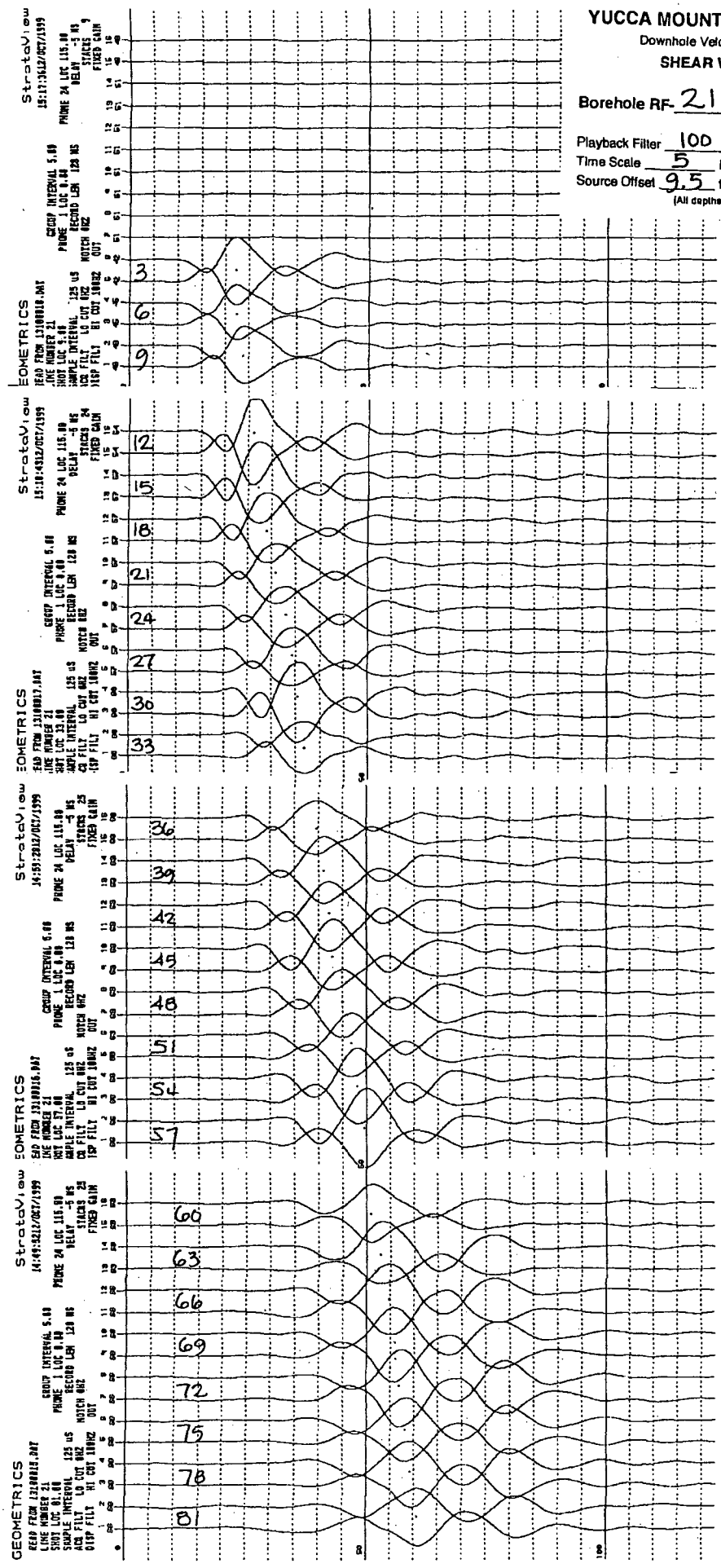
Borehole RF- 21

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

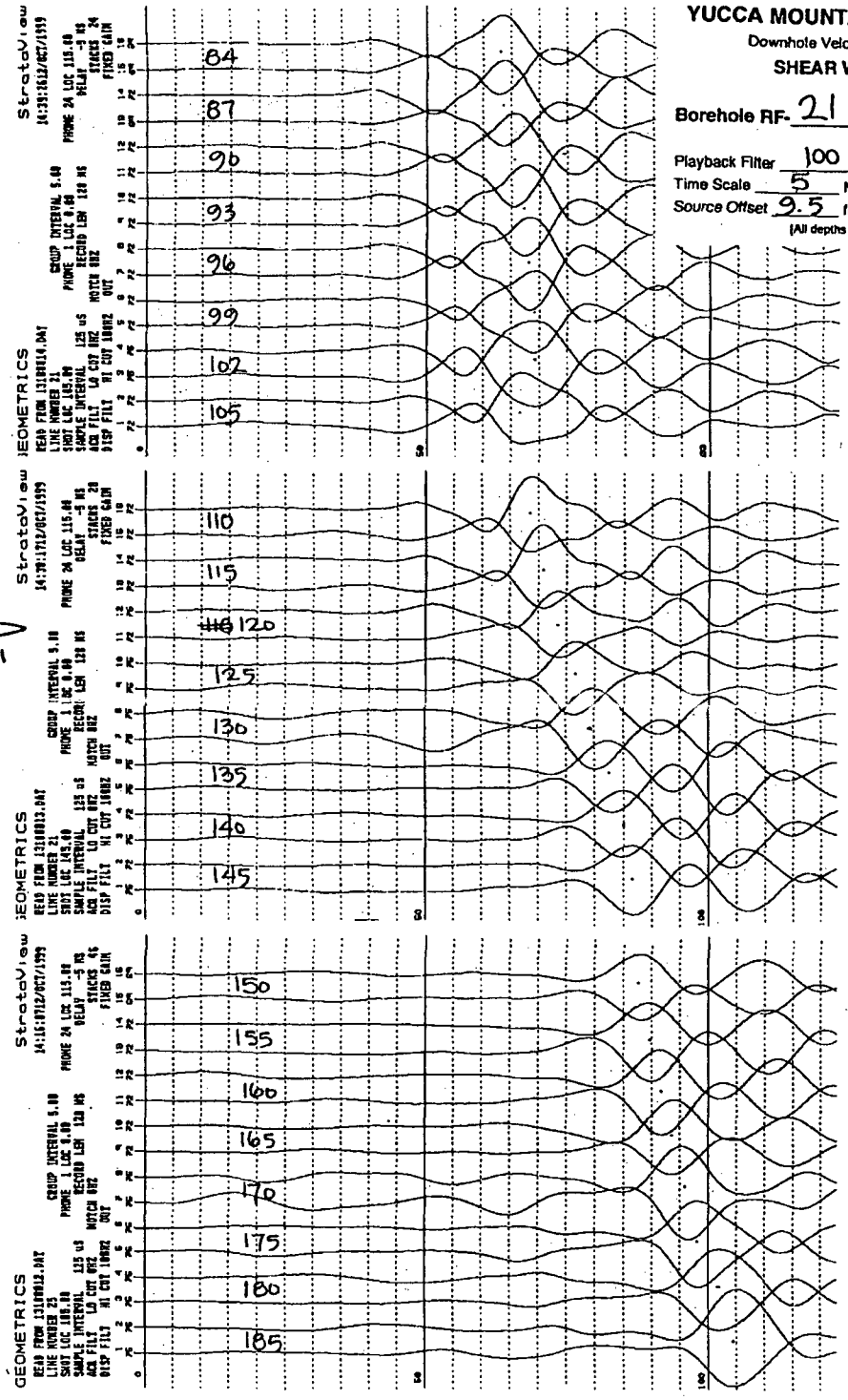
Borehole RF- 21

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.5 feet

(All depths in feet)



IGW
9/27/01

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

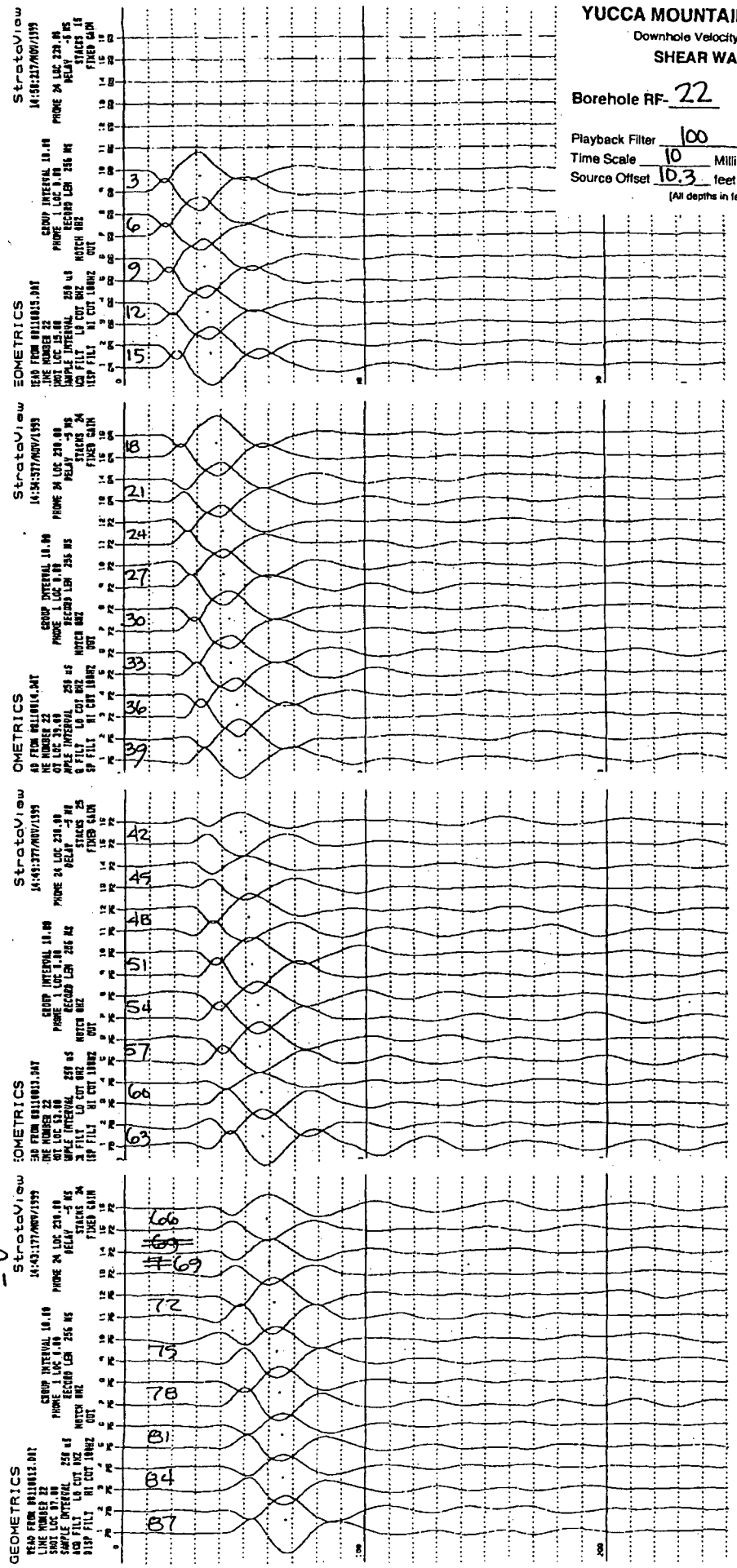
Borehole RF- 22

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)



lcw
9/27/01

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

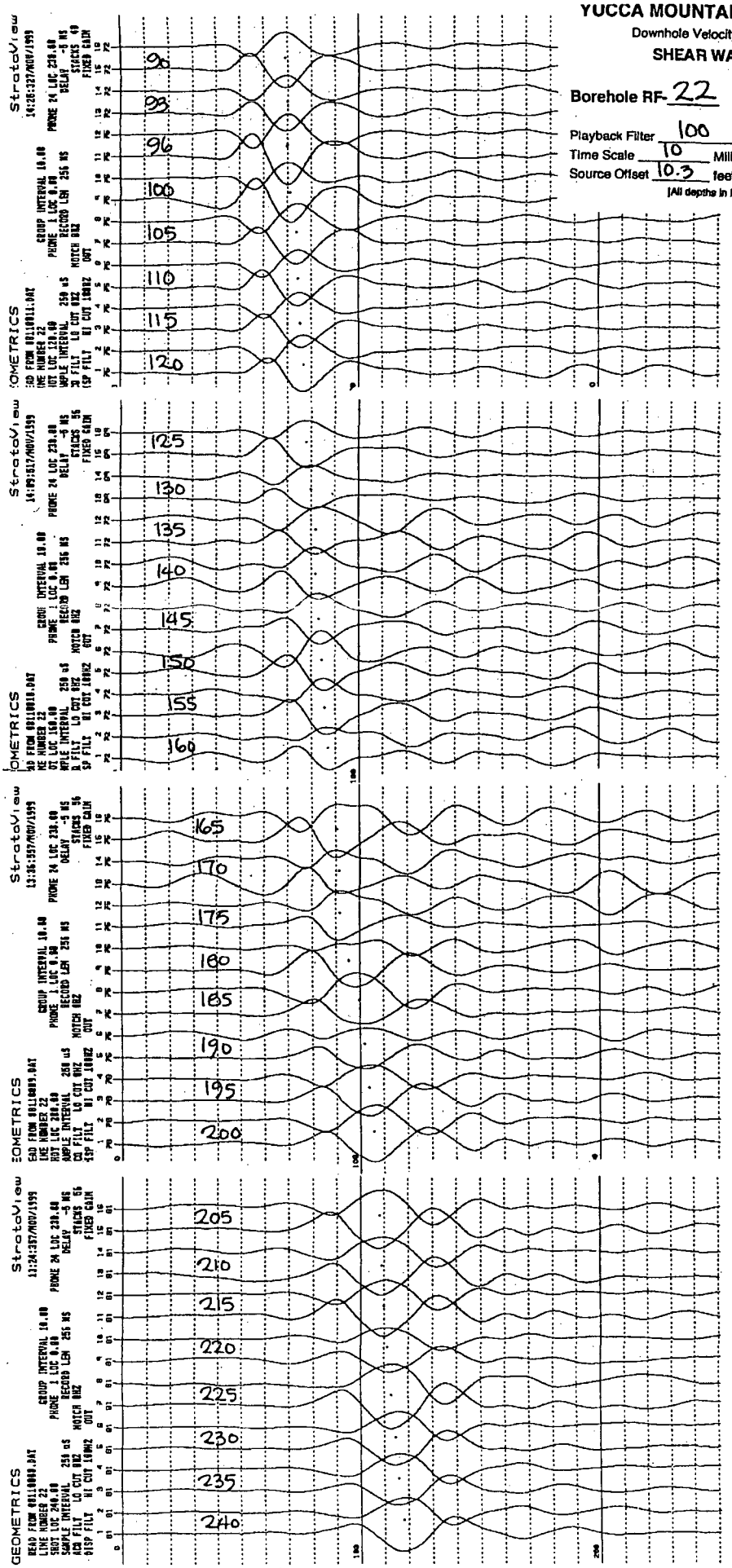
Borehole RF- 22

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

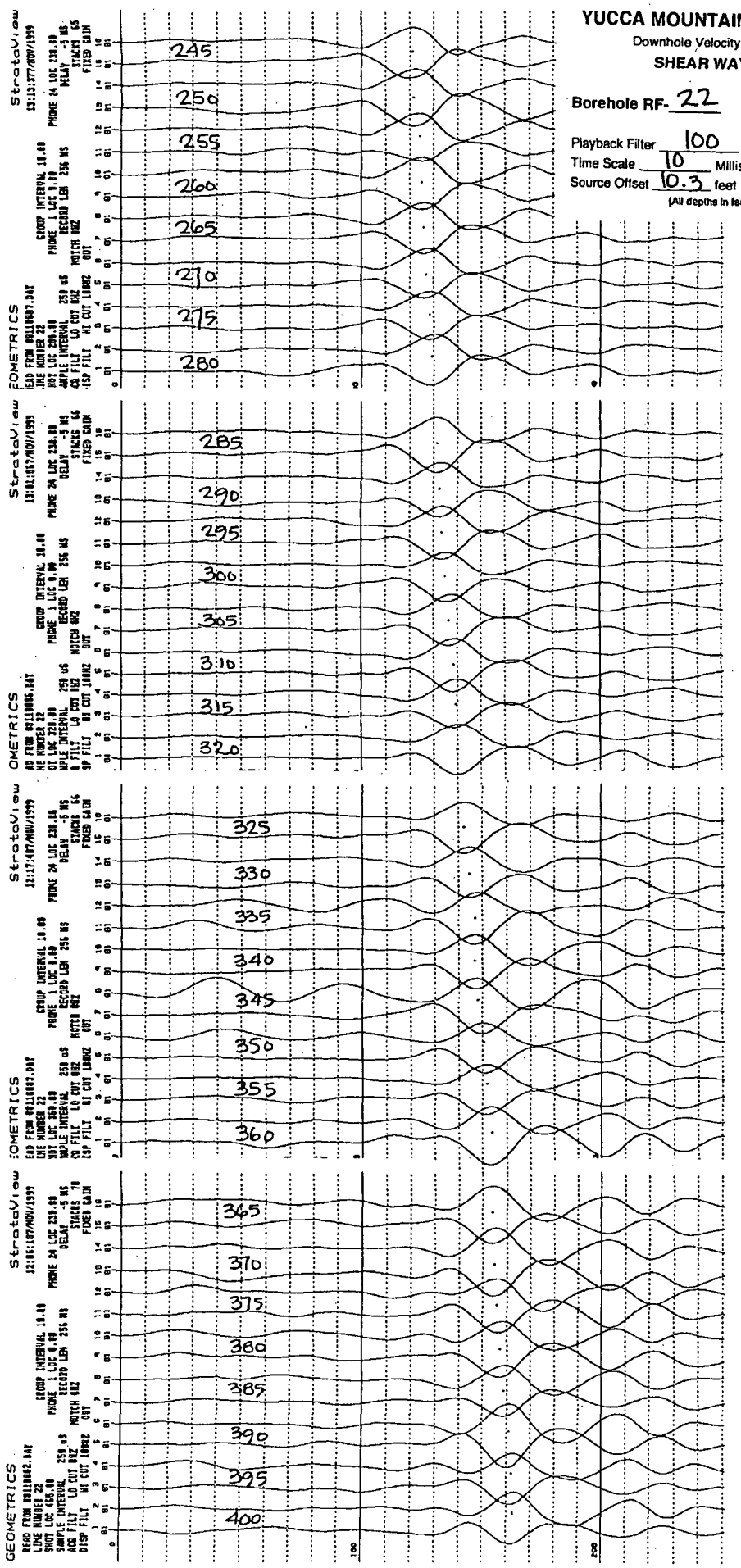
Borehole RF- 22

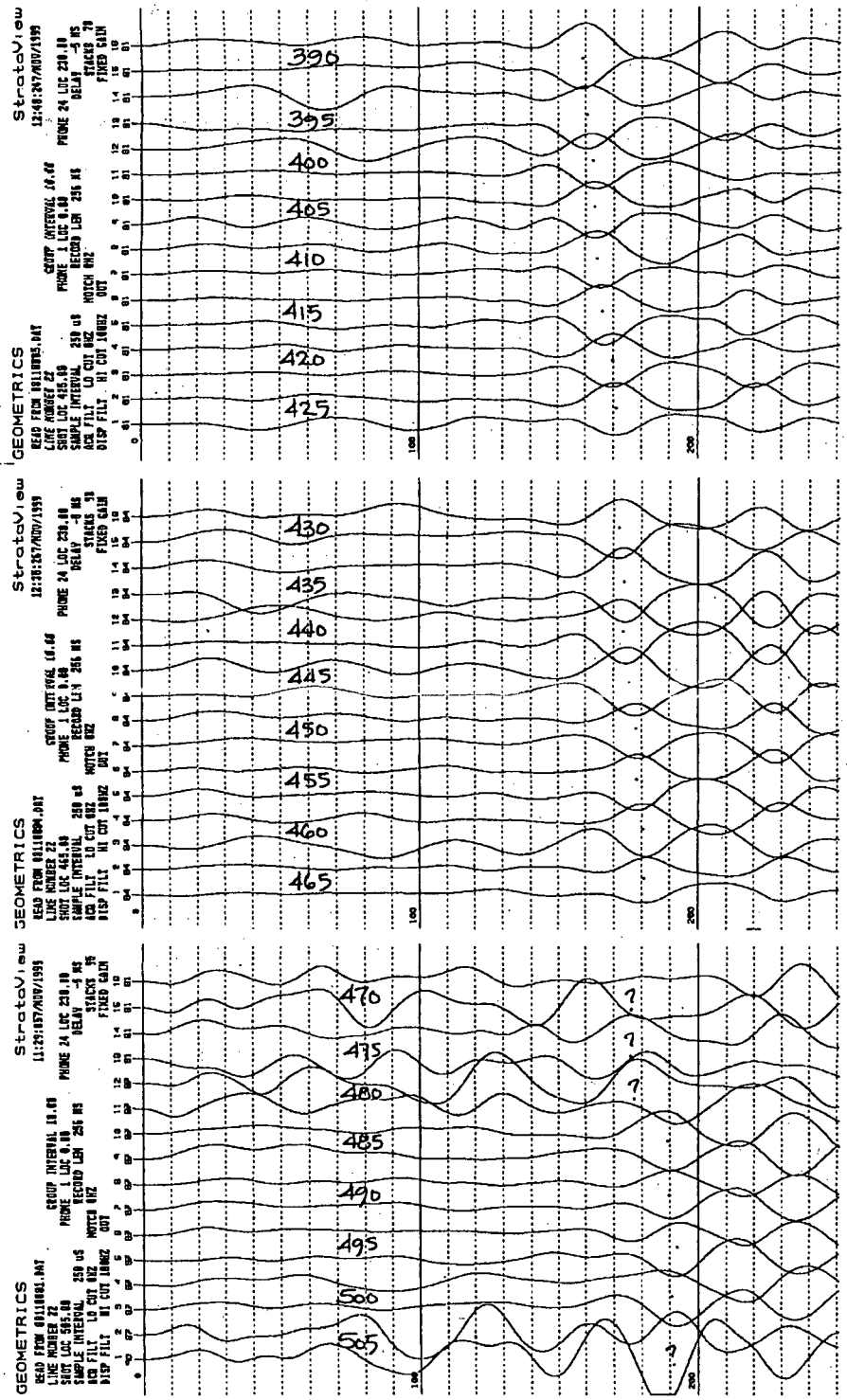
Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

Borehole RF- 22

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

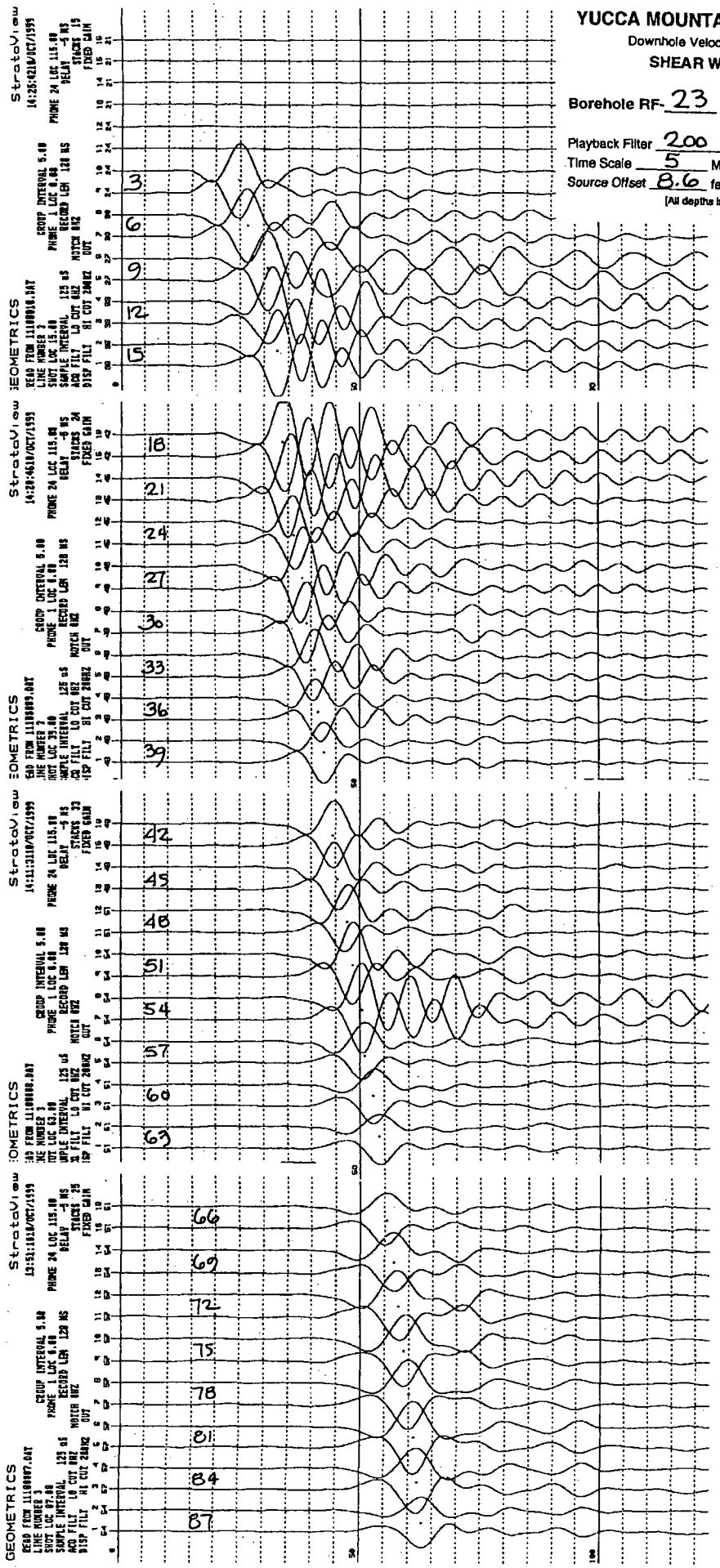
Borehole RF- 23

Playback Filter 200 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 8.6 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

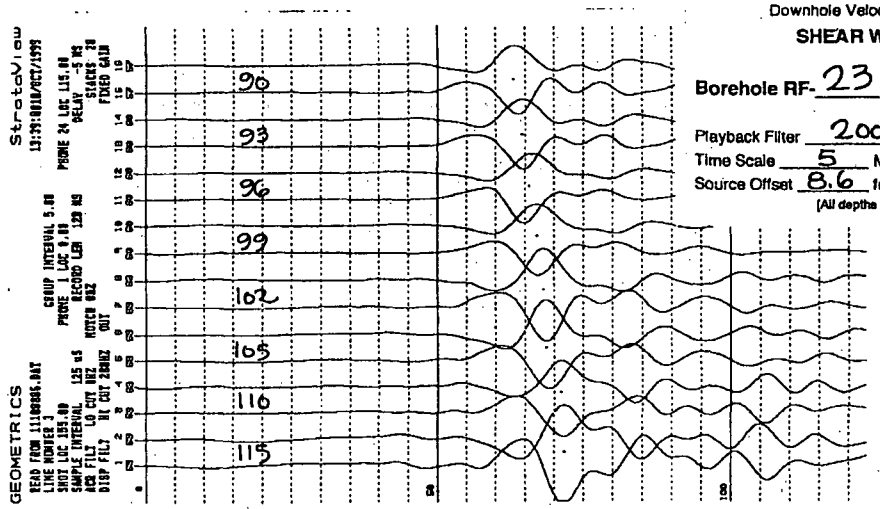
Borehole RF- 23

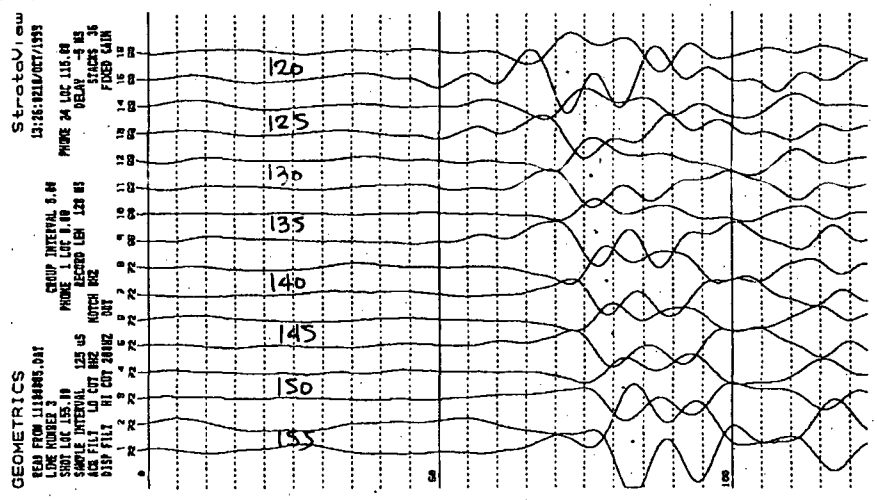
Playback Filter 200 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 8.6 feet

(All depths in feet)





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

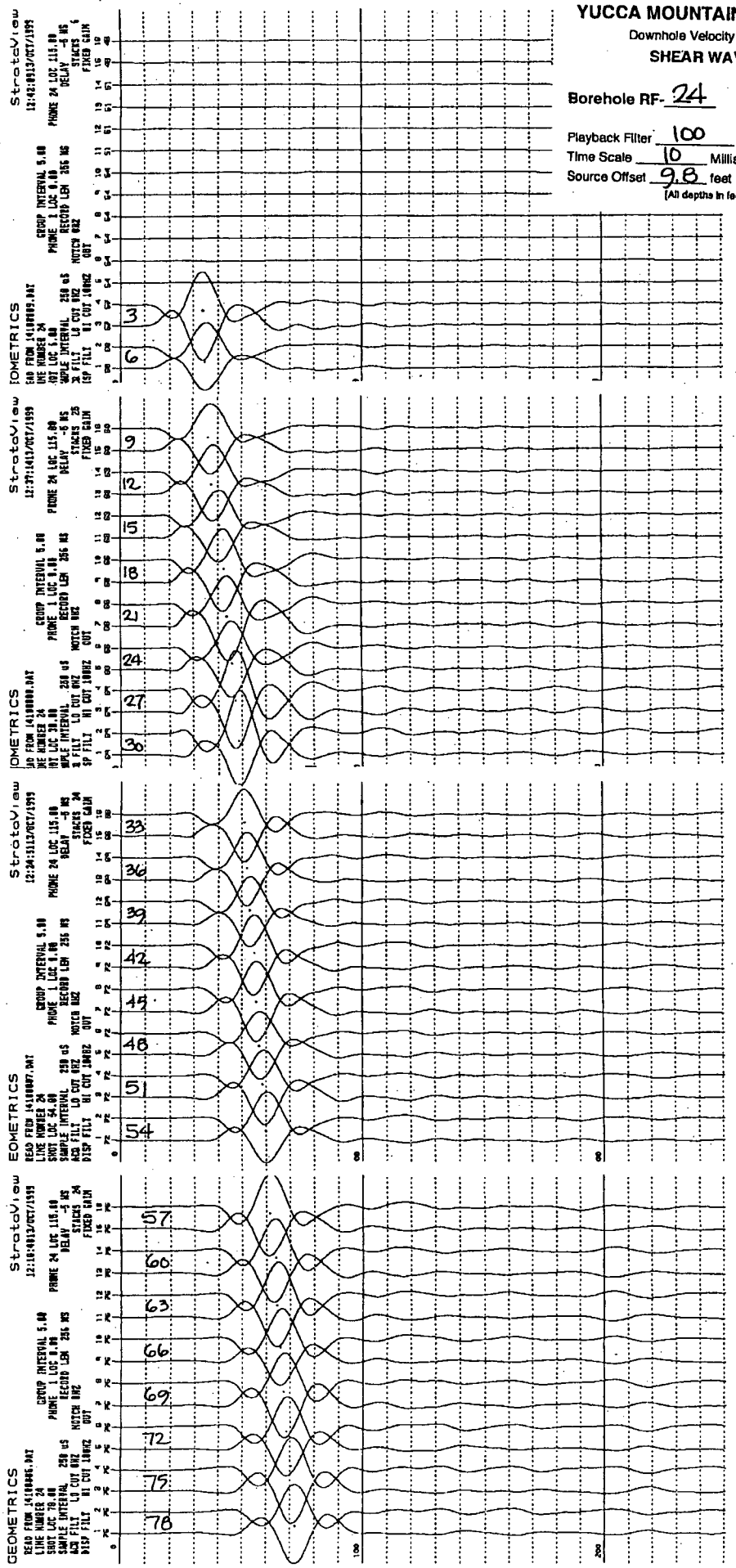
Borehole RF- 24

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

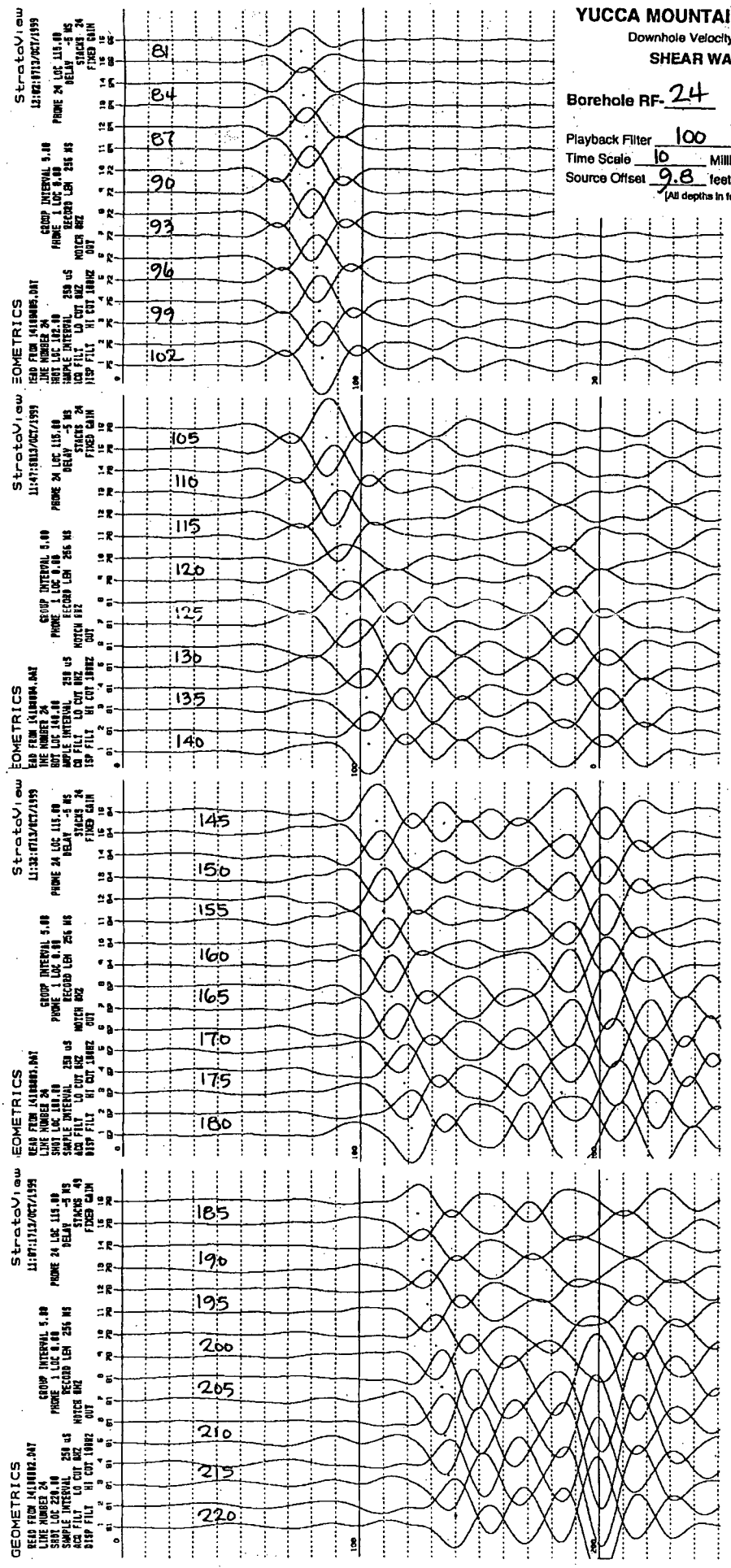
Borehole RF- 24

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

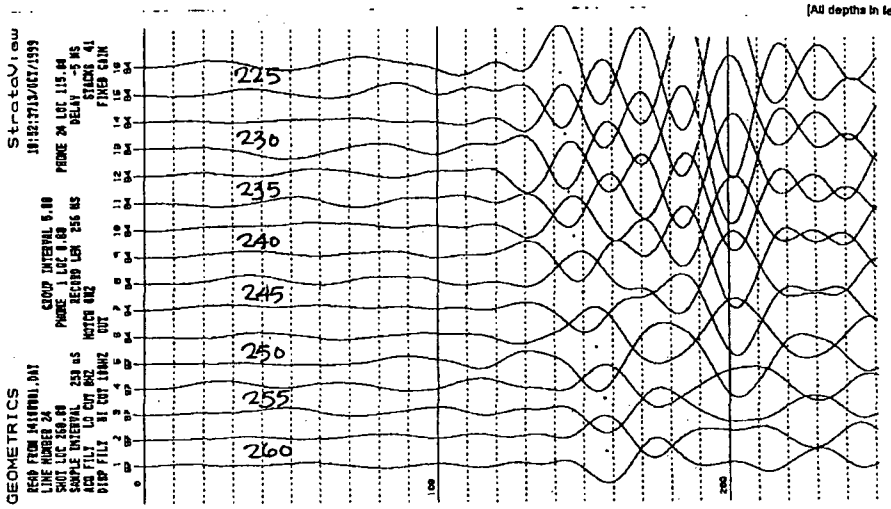
Borehole RF- 24

Playback Filter 100 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

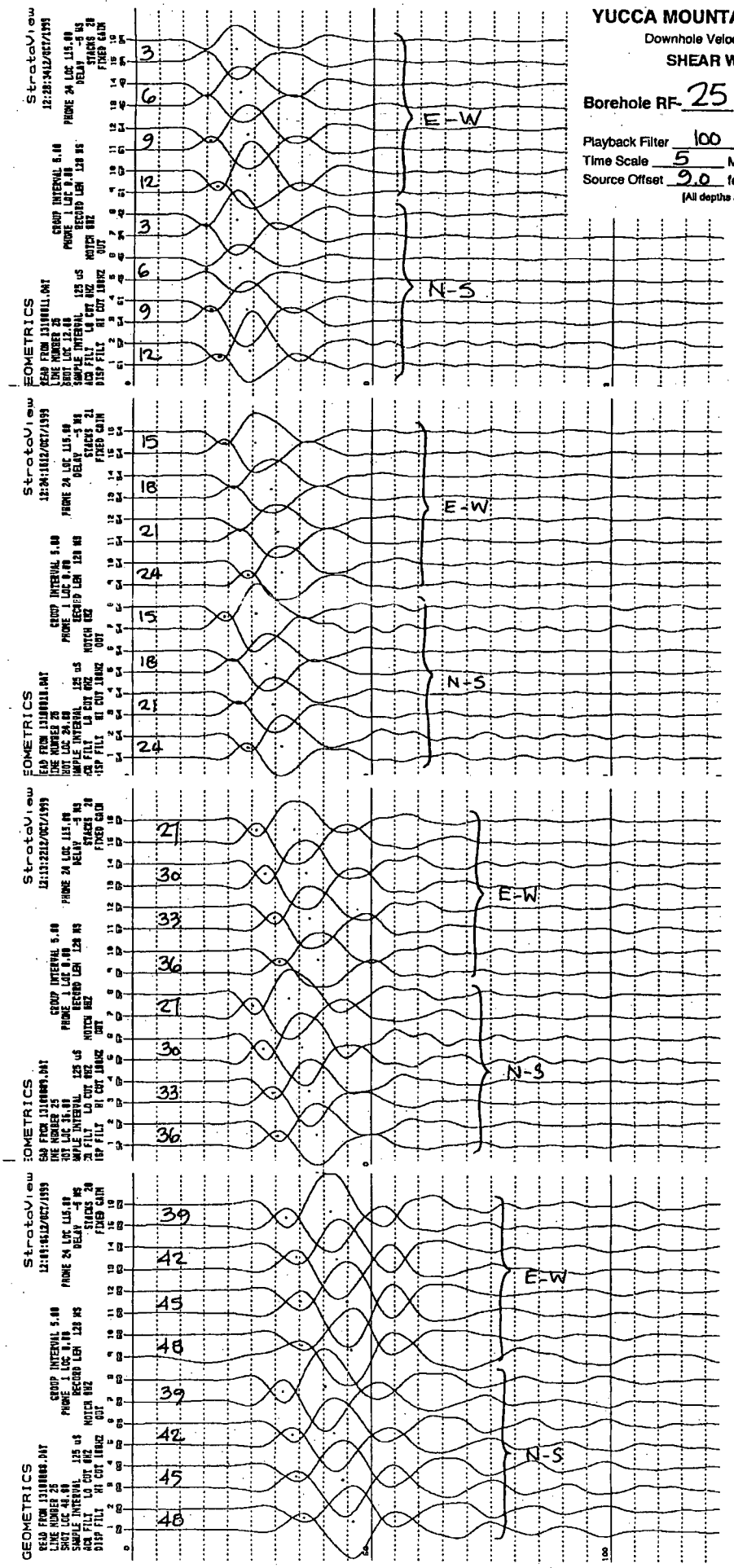
Borehole RF-25 ANISOTROPY STUDY

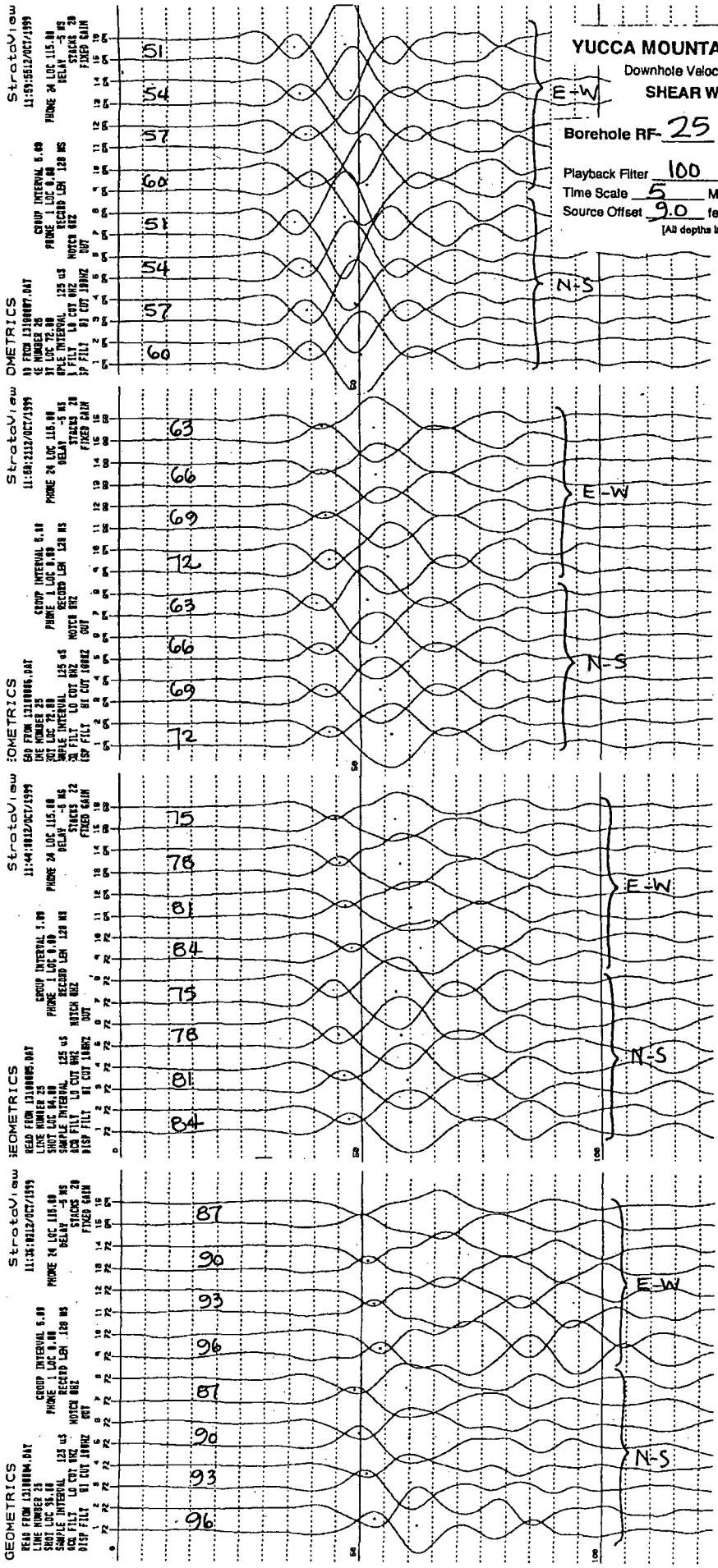
Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.0 feet

[All depths in feet]





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

ANISOTROPY STUDY

Borehole RF- 25

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.0 feet

[All depths in feet]

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

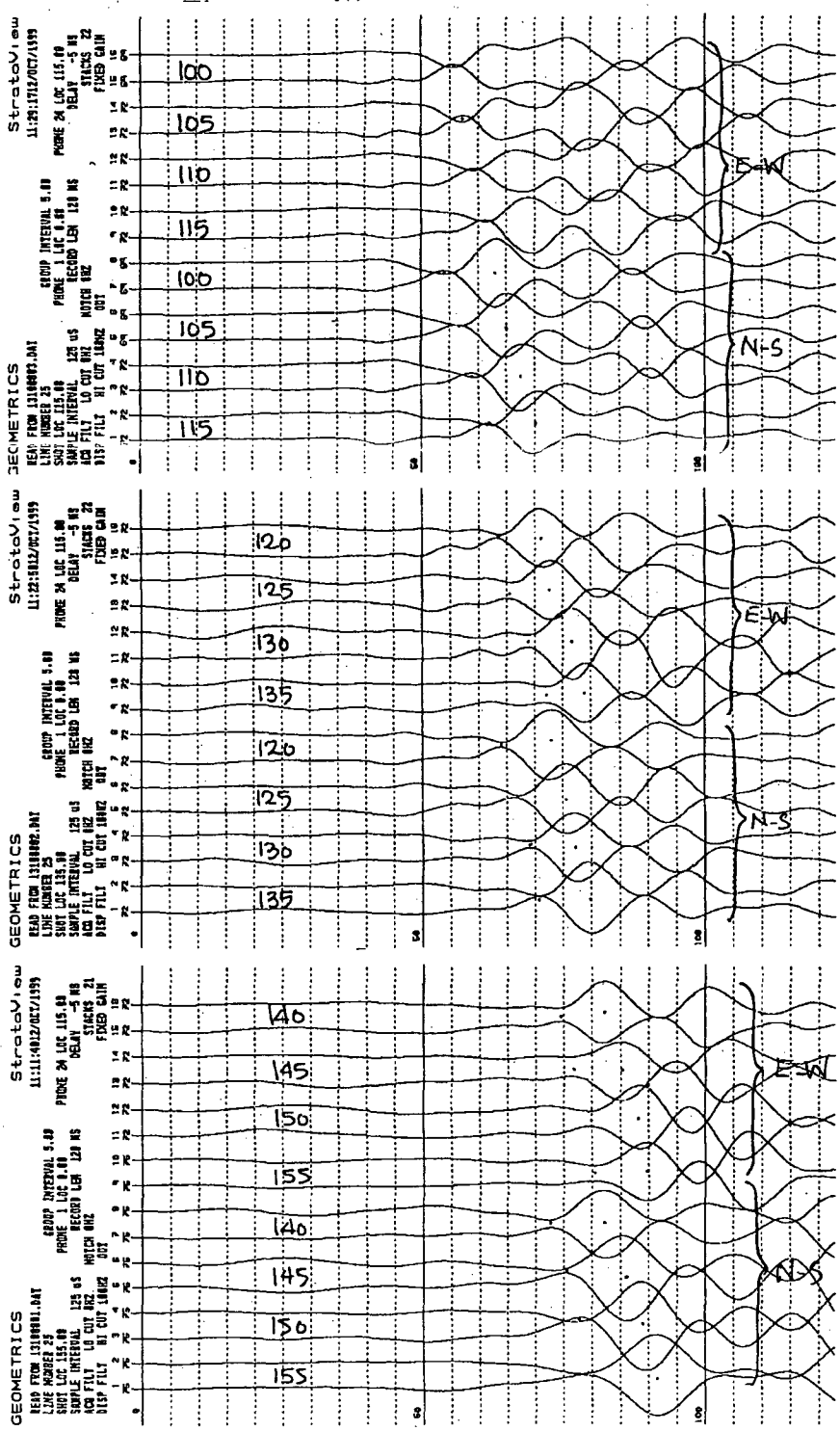
Borehole RF-25 ANISOTROPY STUDY

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

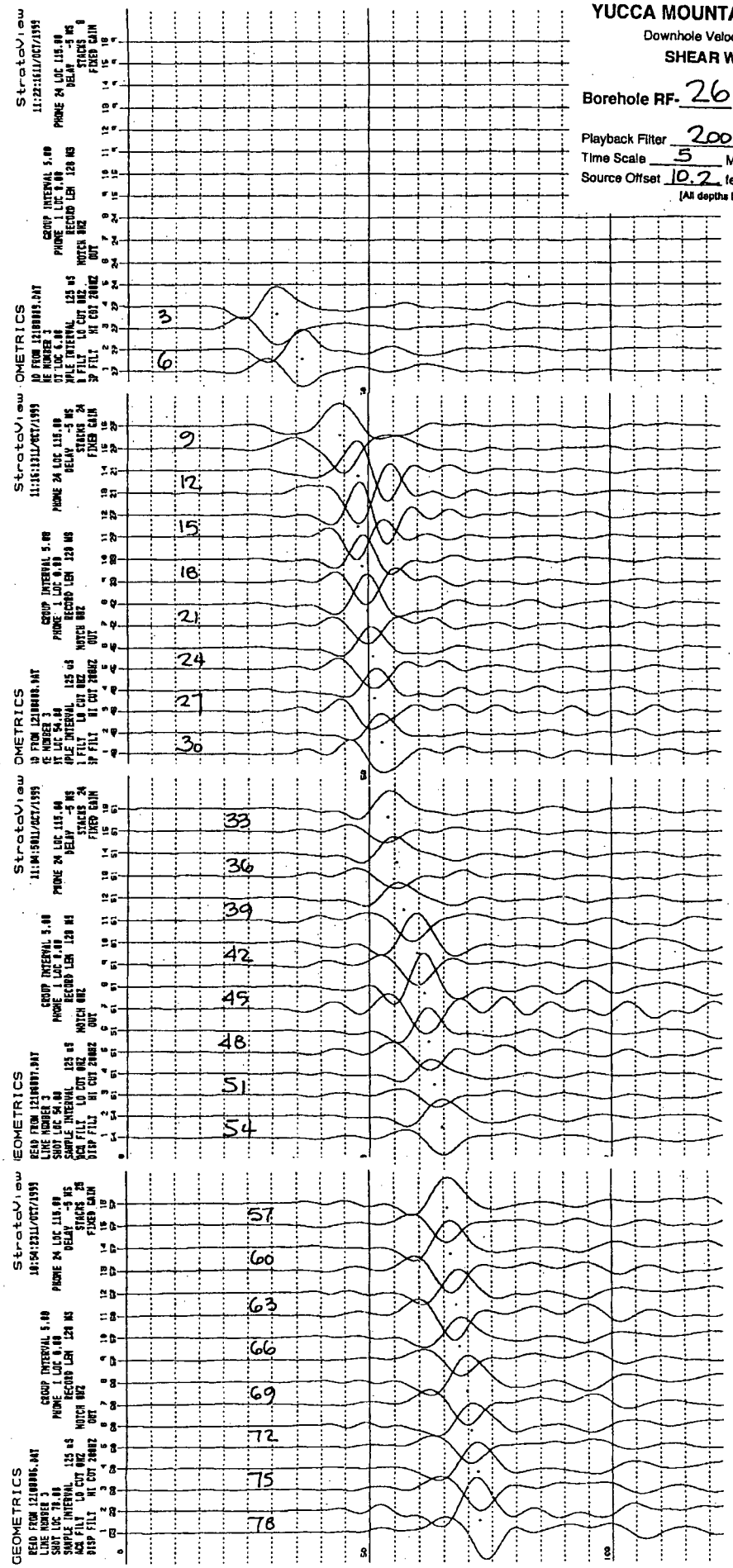
Borehole RF- 26

Playback Filter 200 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

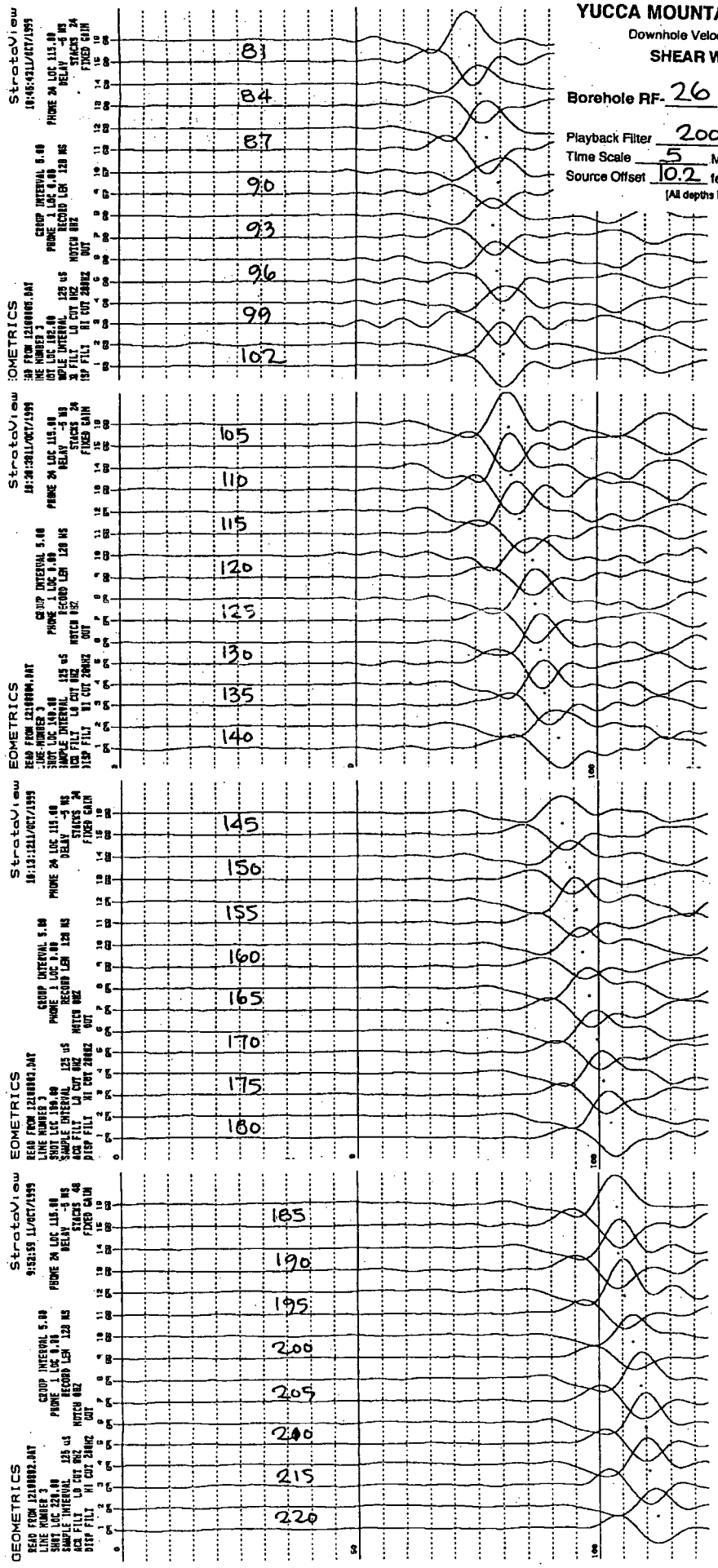
Borehole RF- 26

Playback Filter 200 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

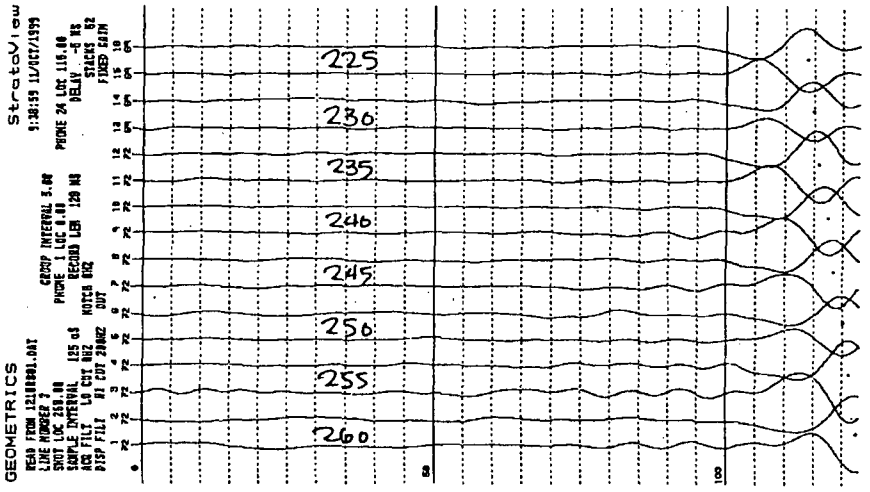
Borehole RF-26

Playback Filter 200 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

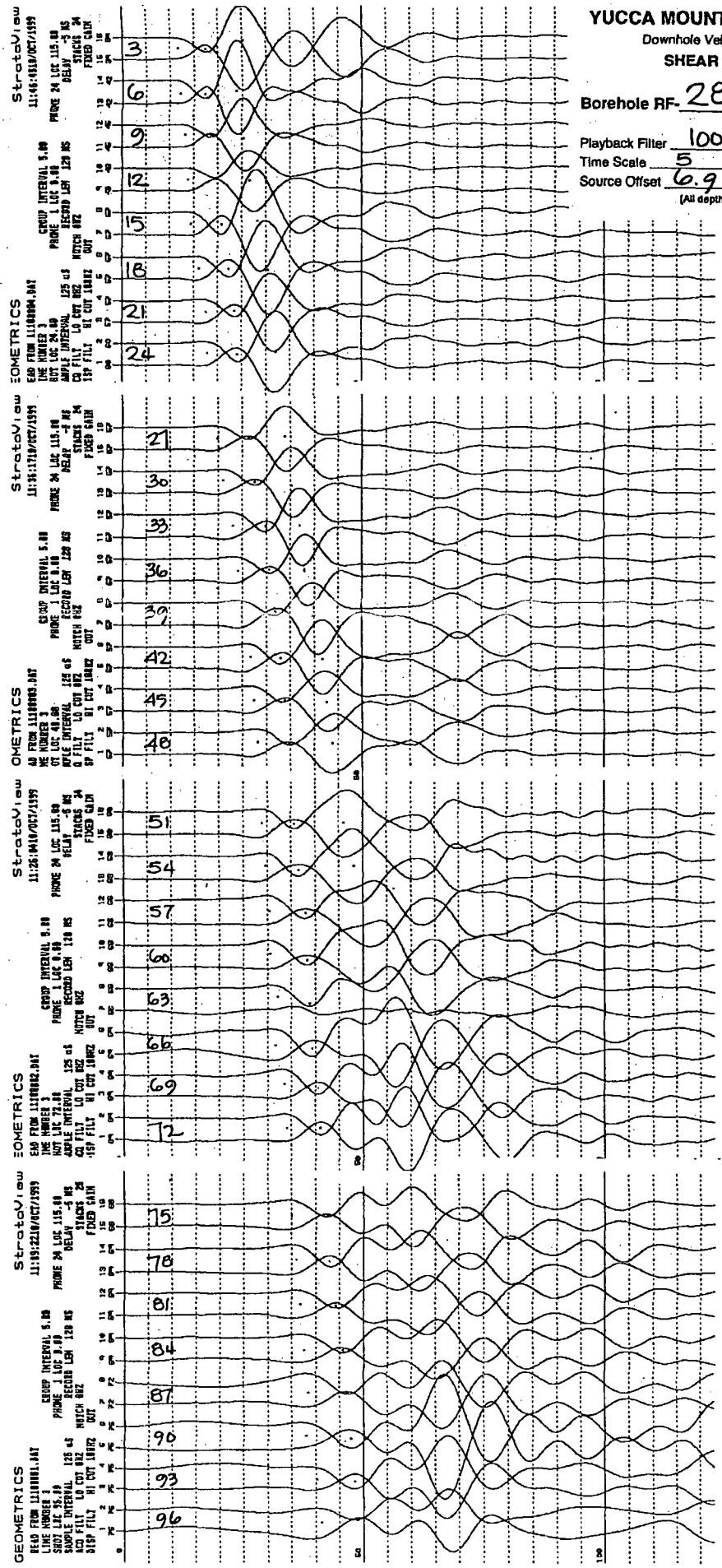
Borehole RF- 28

Playback Filter 100 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 6.9 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

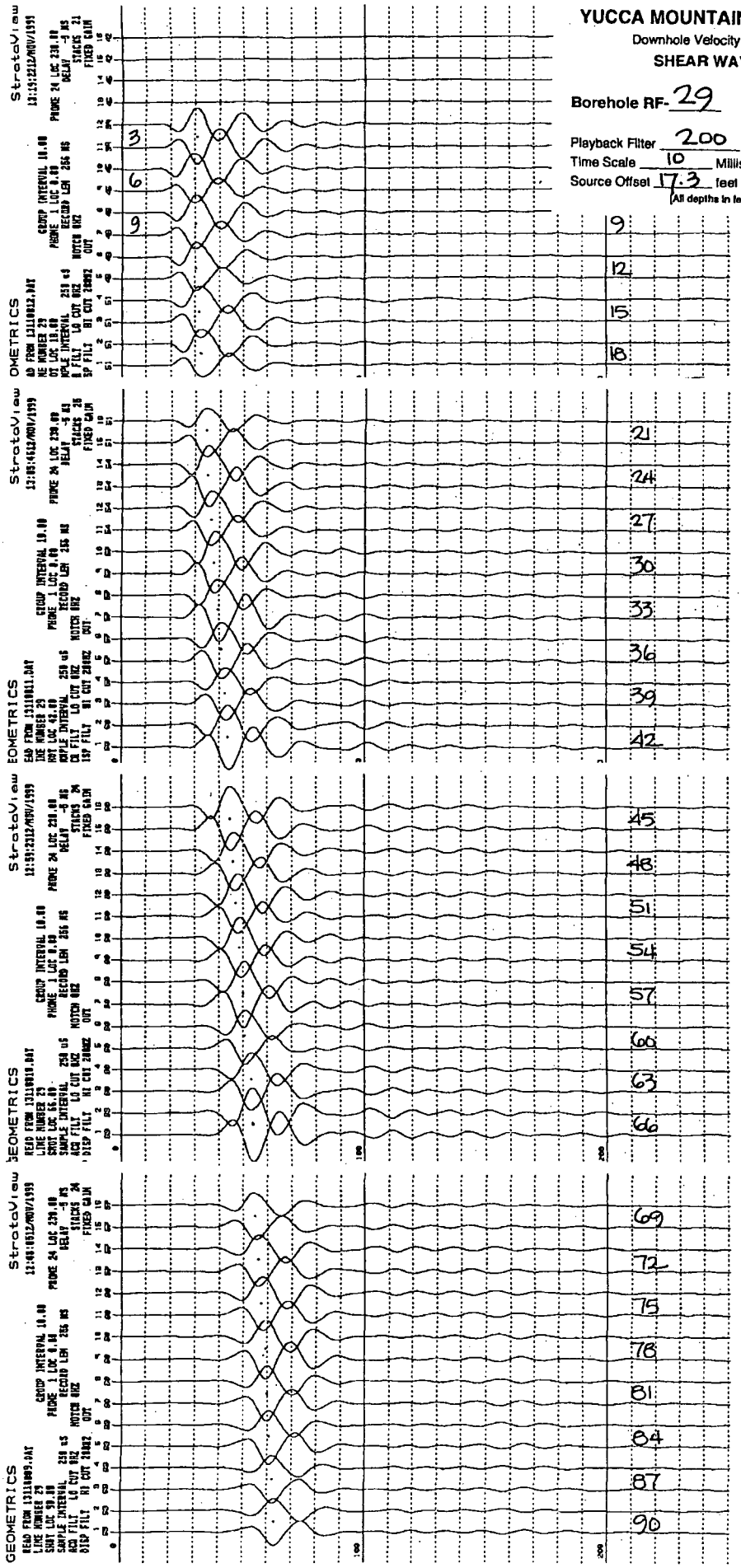
Borehole RF- 29

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 17.3 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

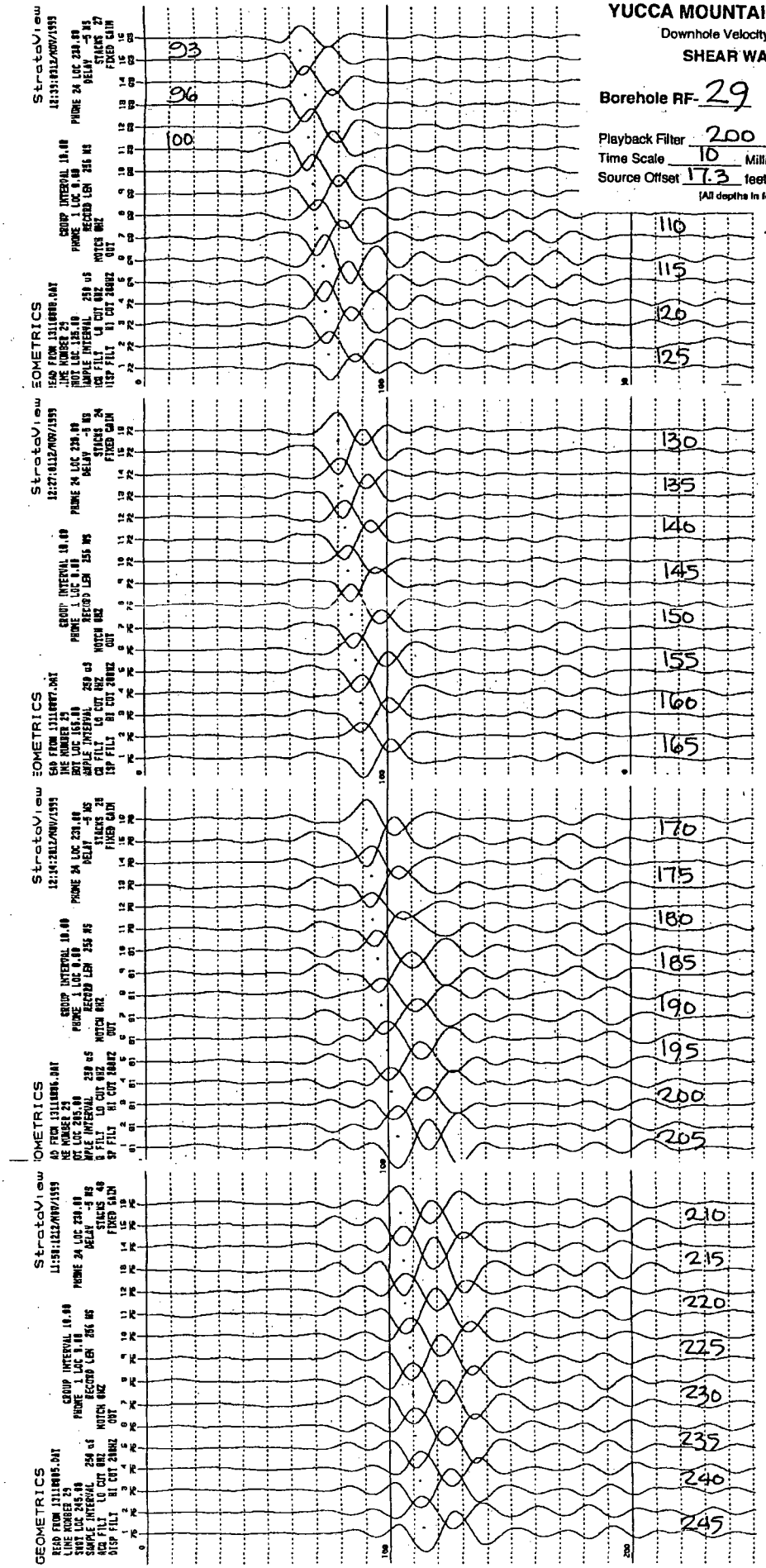
Borehole RF- 29

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 17.3 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

SHEAR WAVES

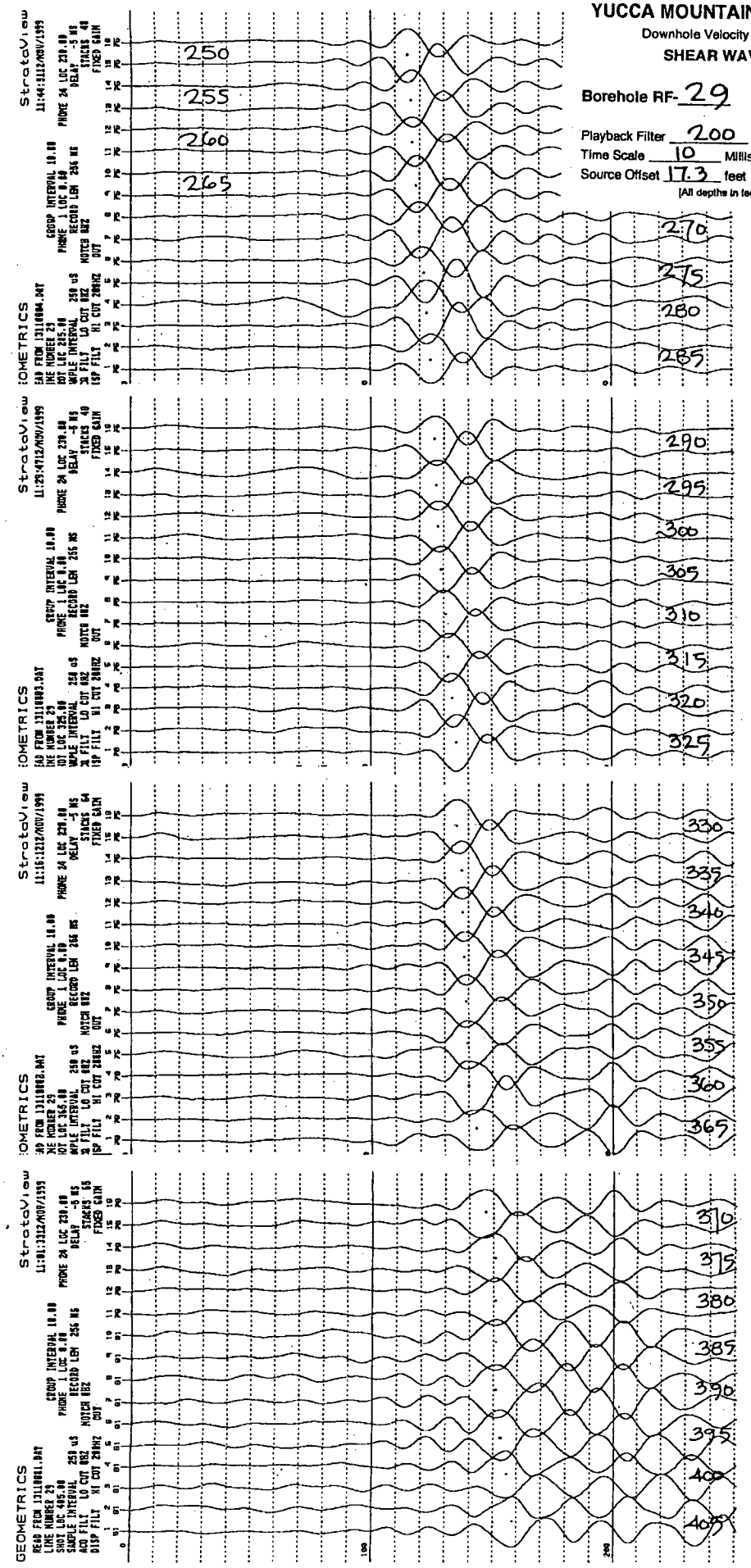
Borehole RF-29

Playback Filter 200 Hz Low Pass

Time Scale 10 Milliseconds/Line

Source Offset 17.3 feet

[All depths in feet]



4

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

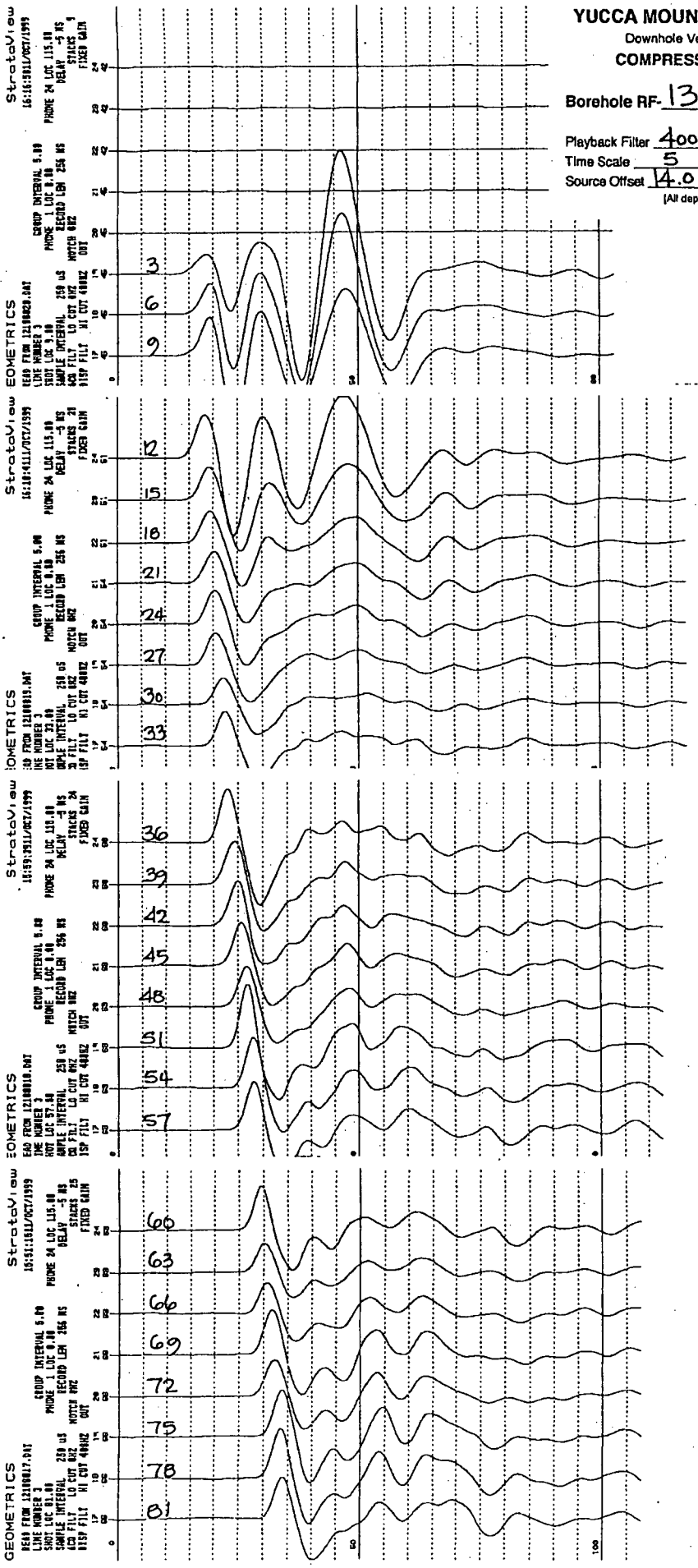
Borehole RF-13

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 4.0 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

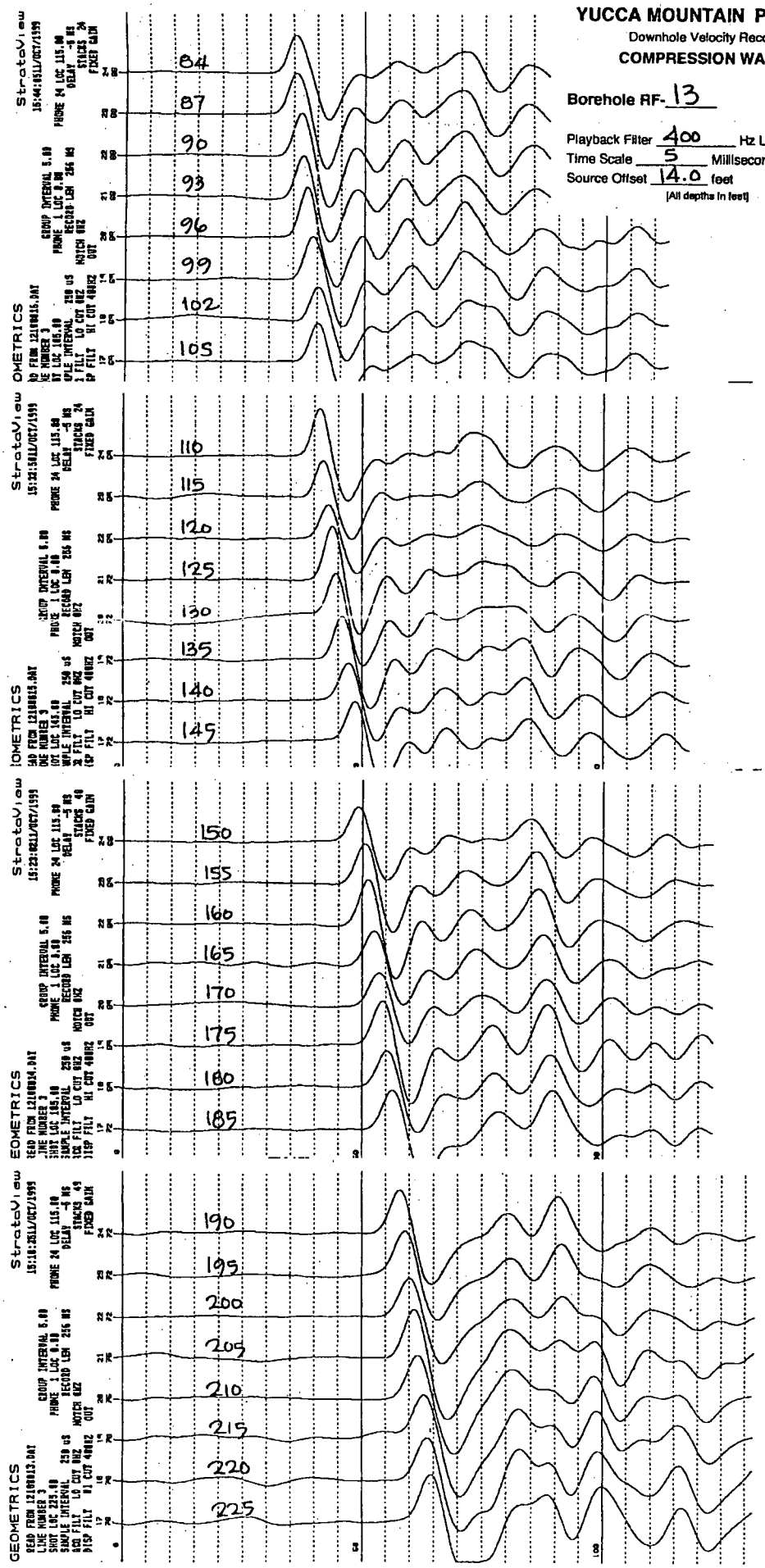
Borehole RF- 13

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 14.0 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

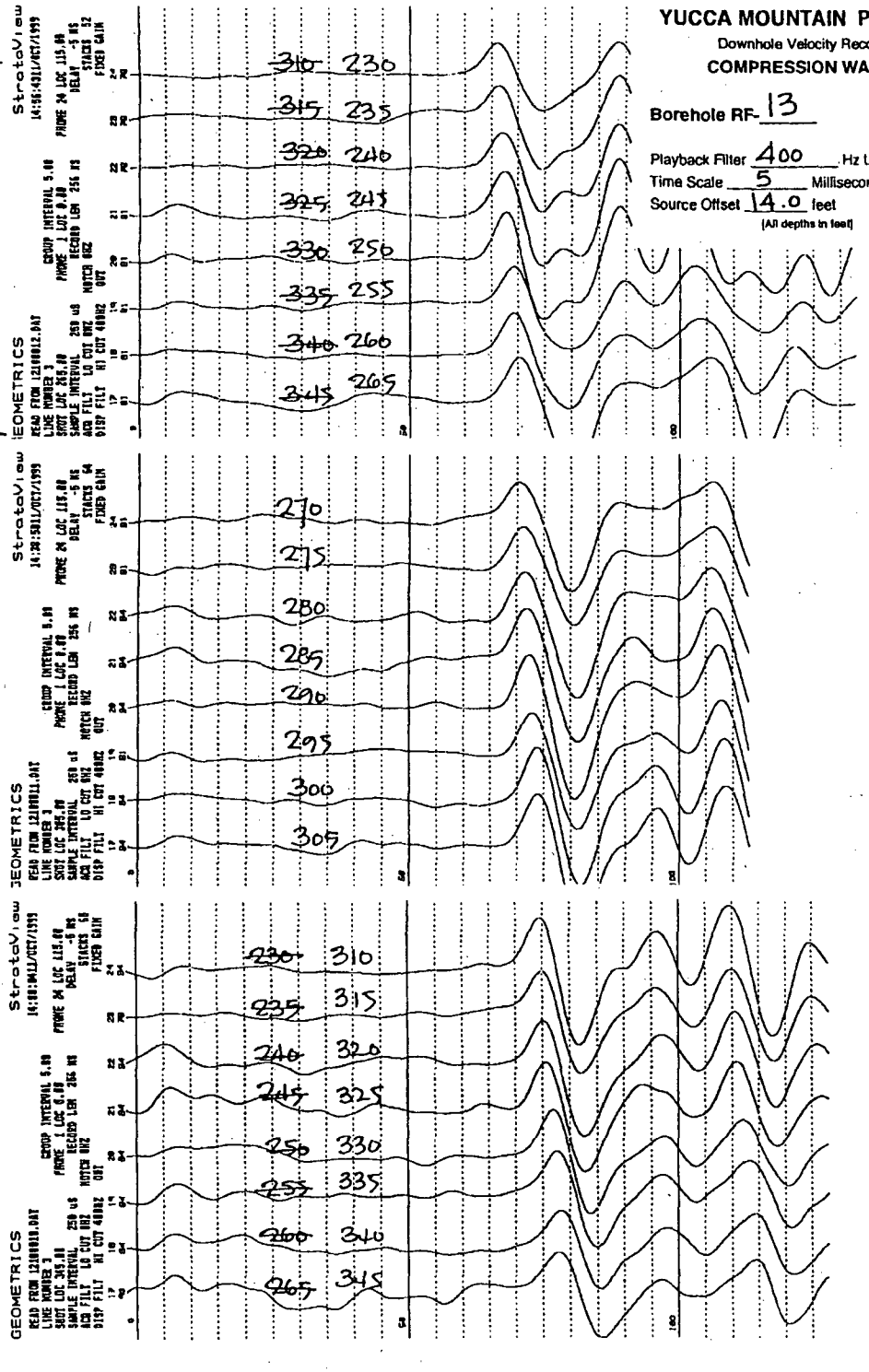
Borehole RF- 13

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 14.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

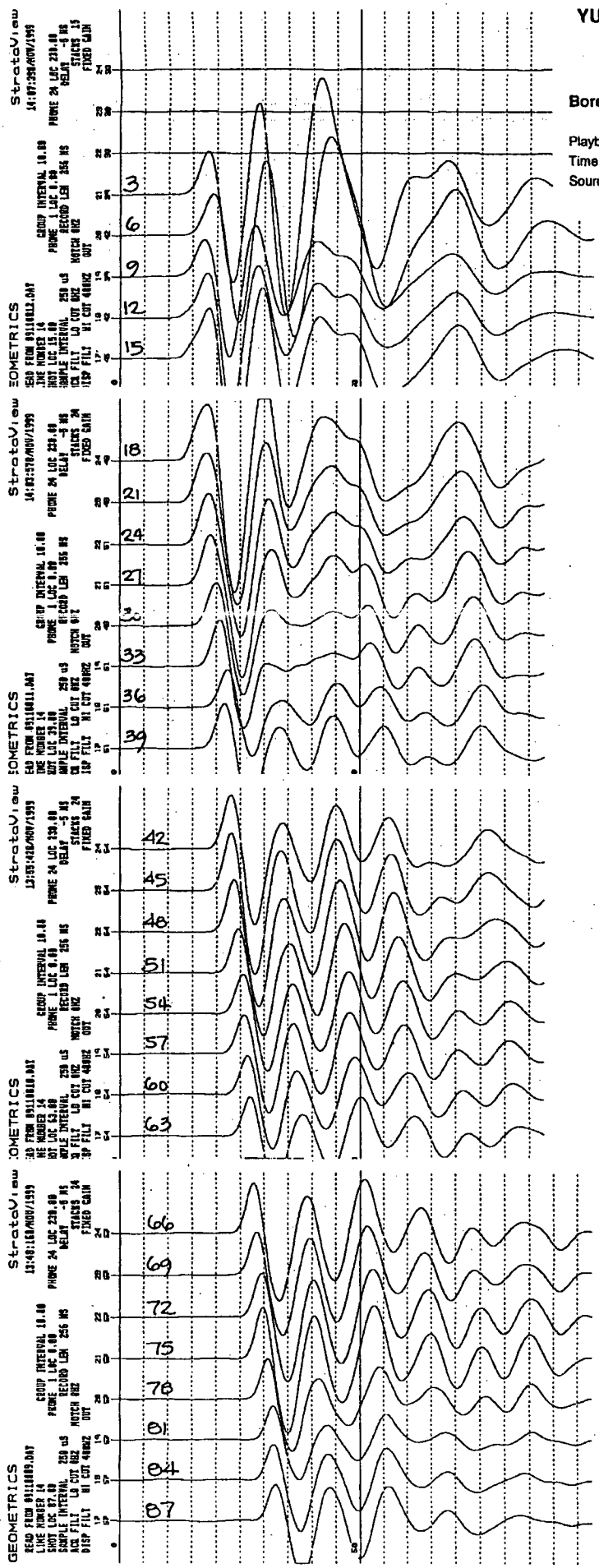
Borehole RF-14

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.2 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

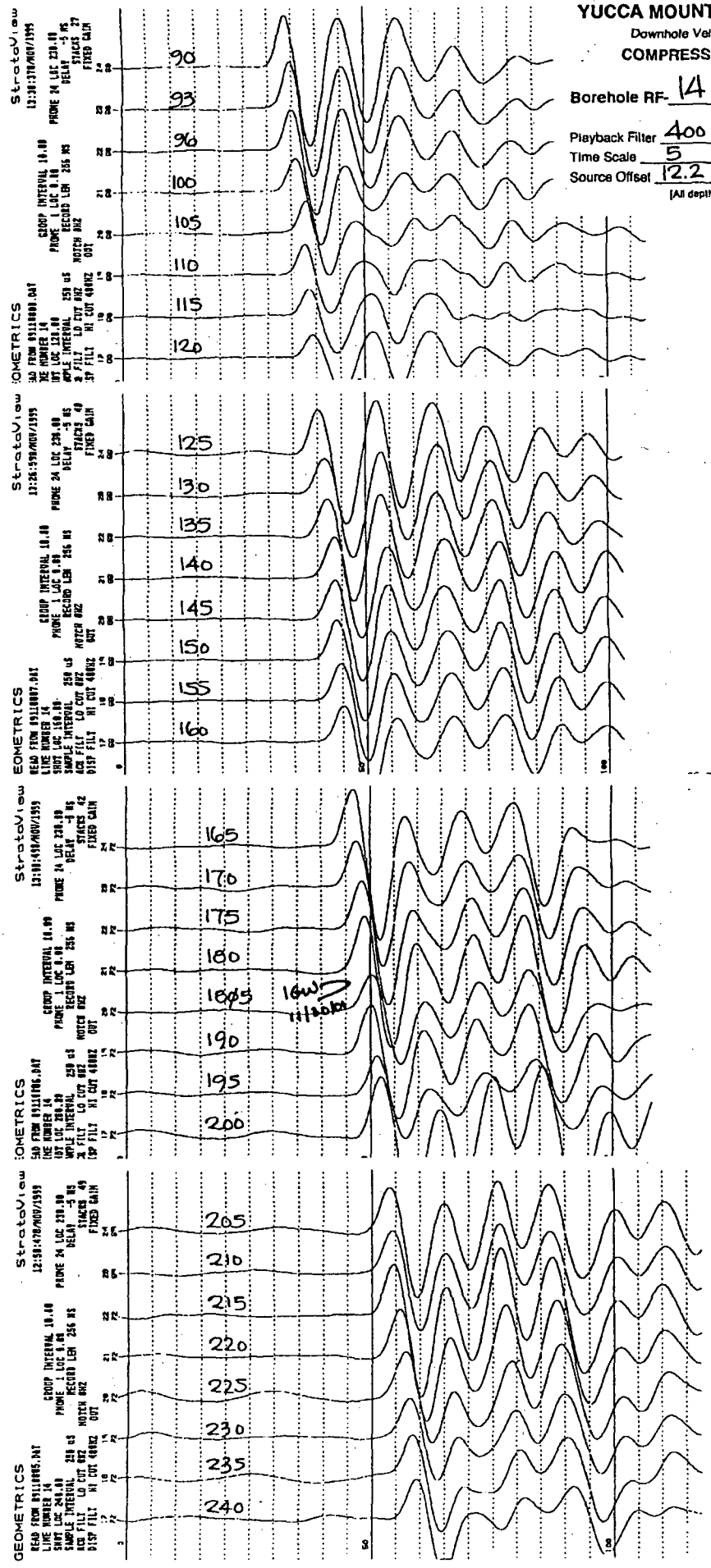
Borehole RF- 14

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

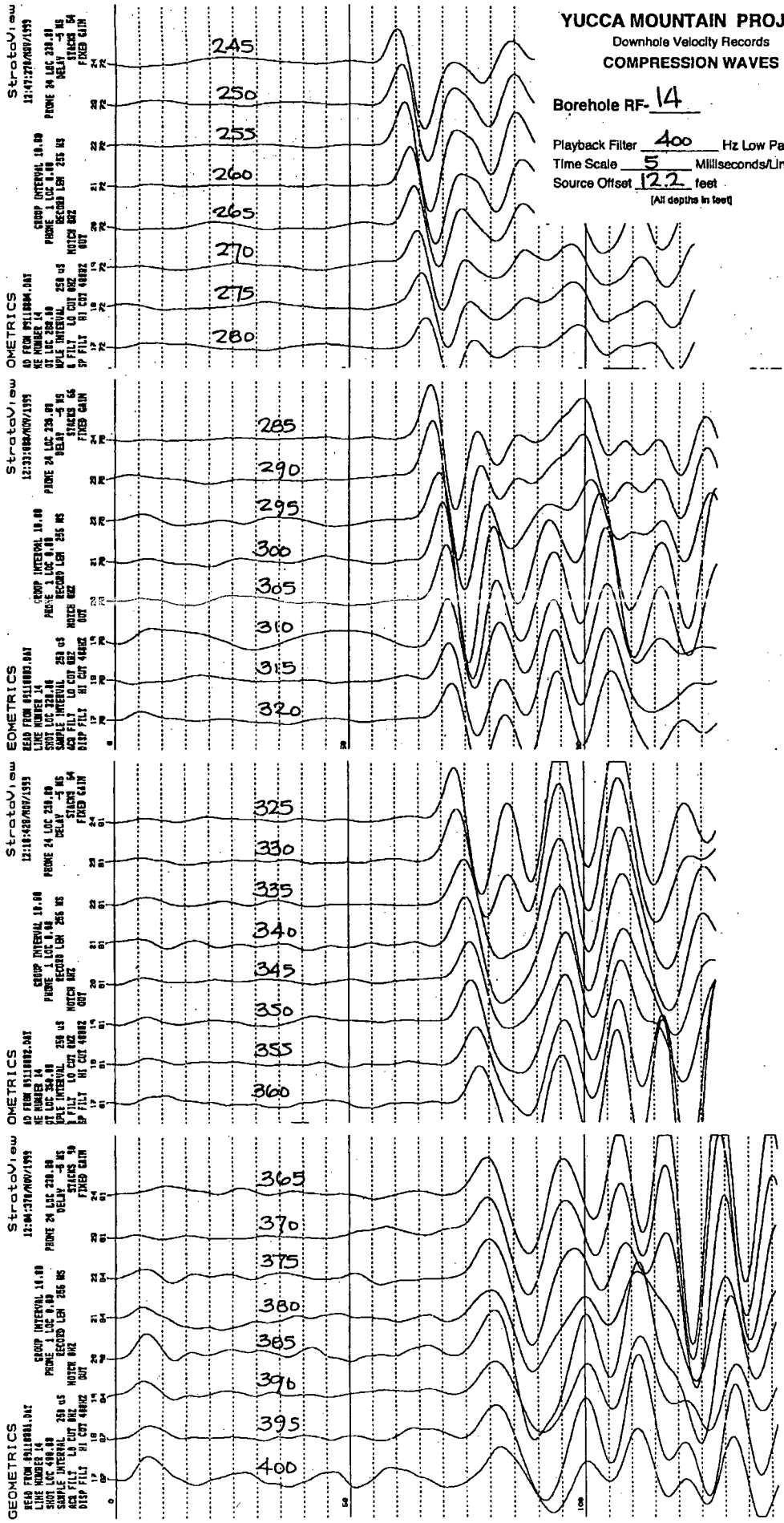
Borehole RF-14

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

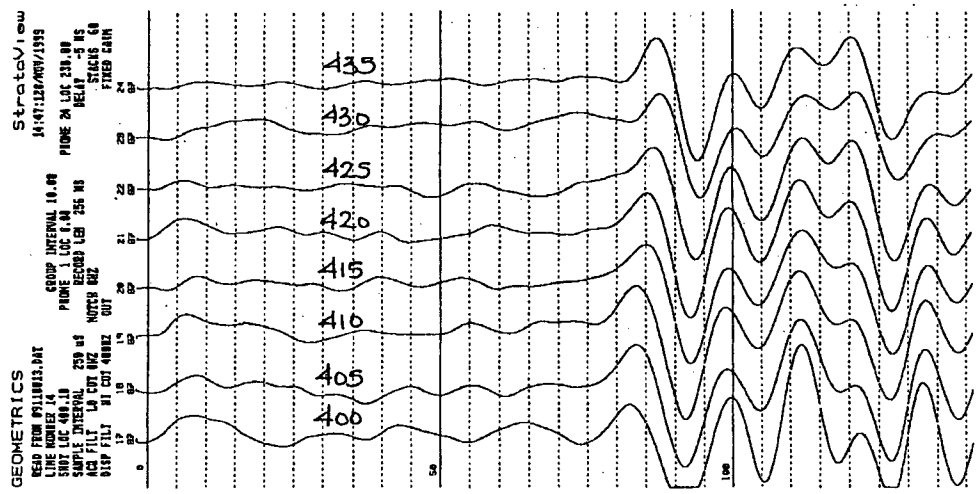
Borehole RF- 14

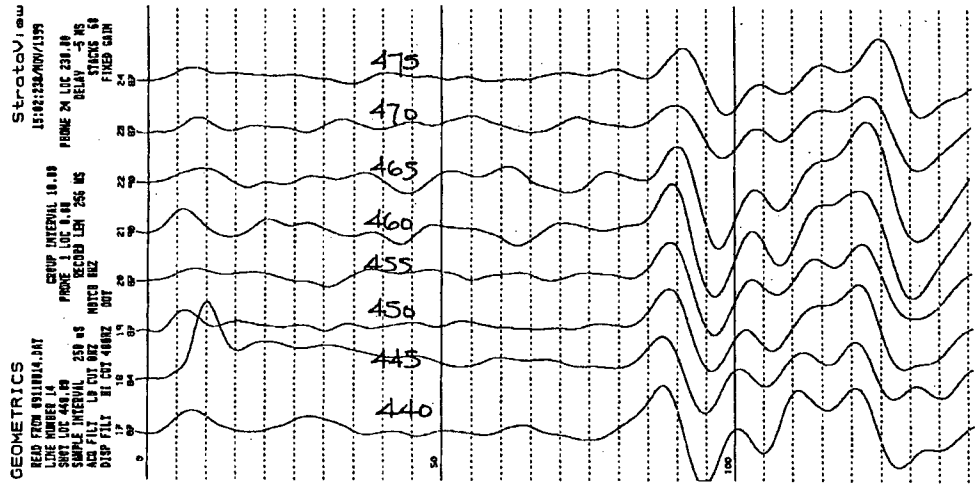
Playback Filter 400 Hz Low Pass

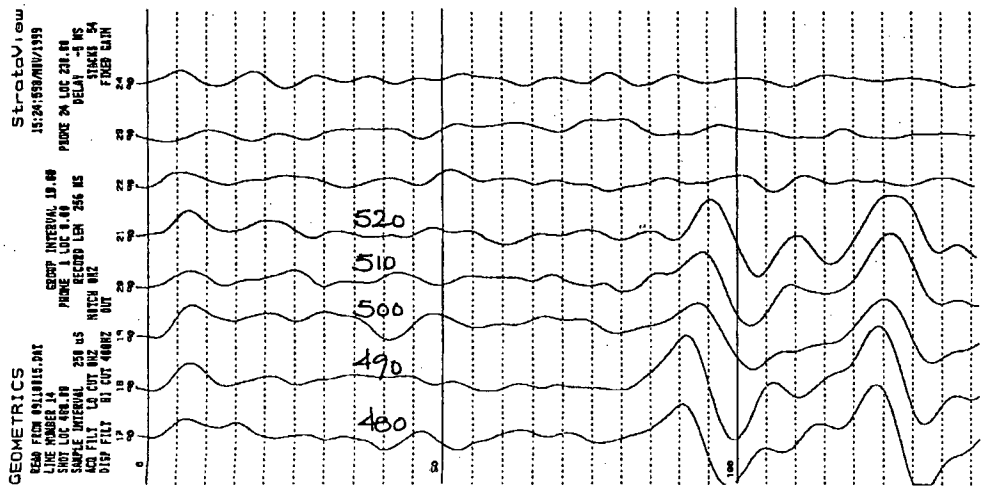
Time Scale 5 Milliseconds/Line

Source Offset 12.2 feet

(All depths in feet)







YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

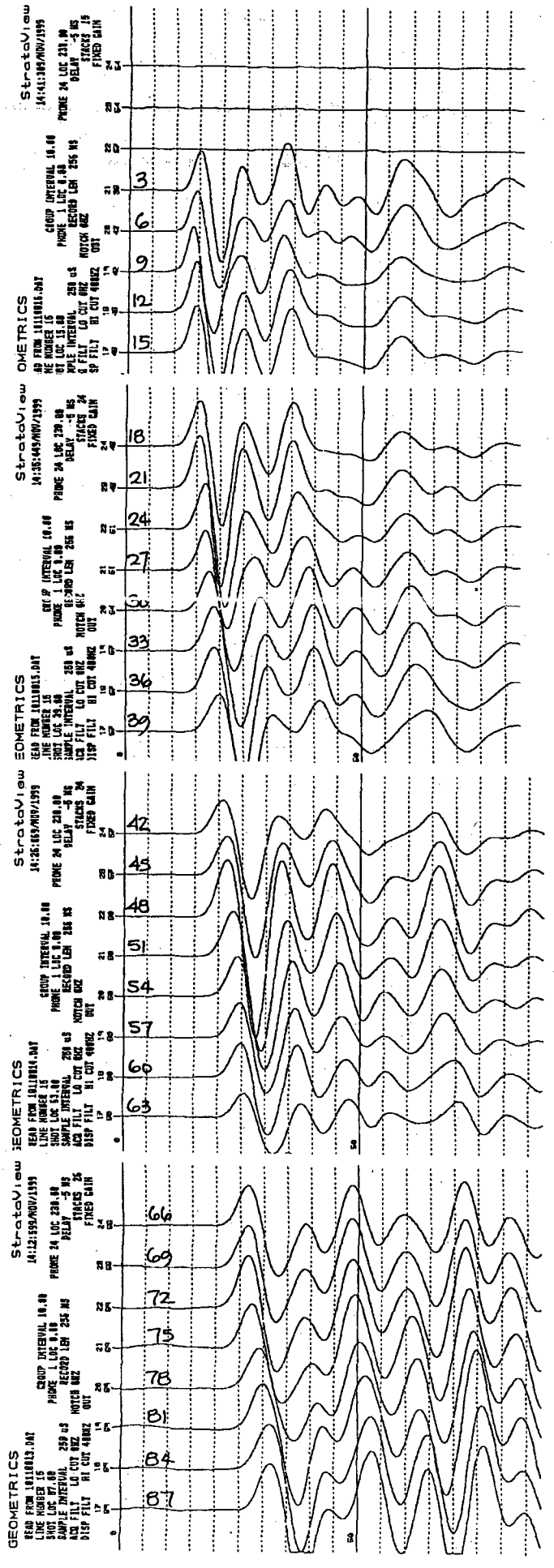
Borehole RF-15

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

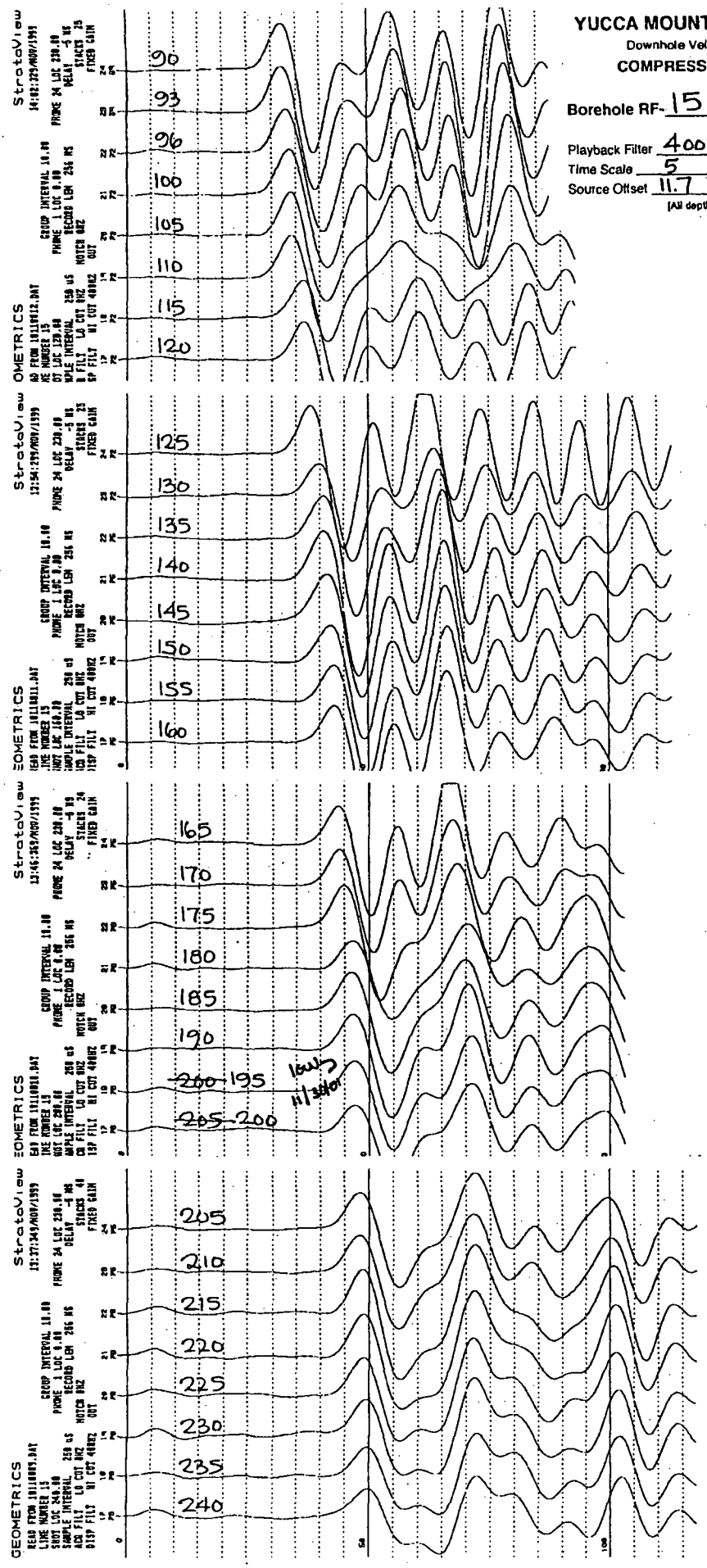
Borehole RF-15

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

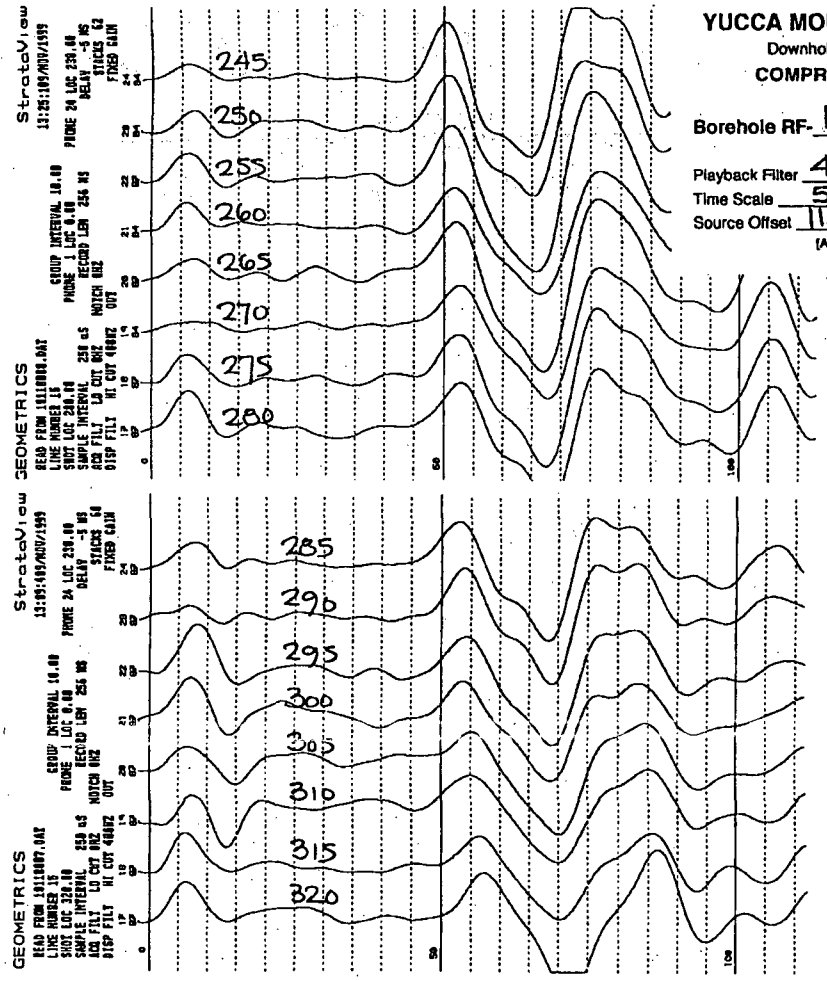
Borehole RF- 15

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

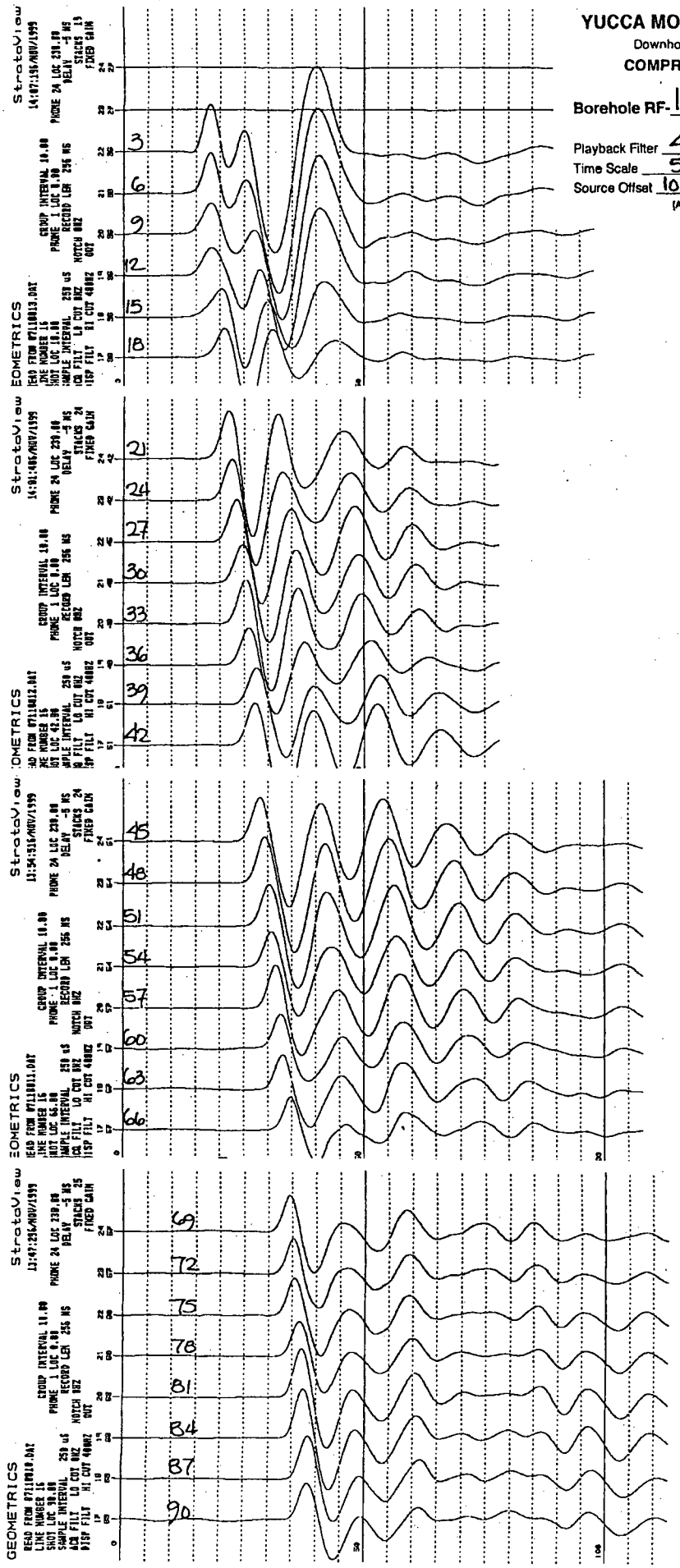
Borehole RF-16

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

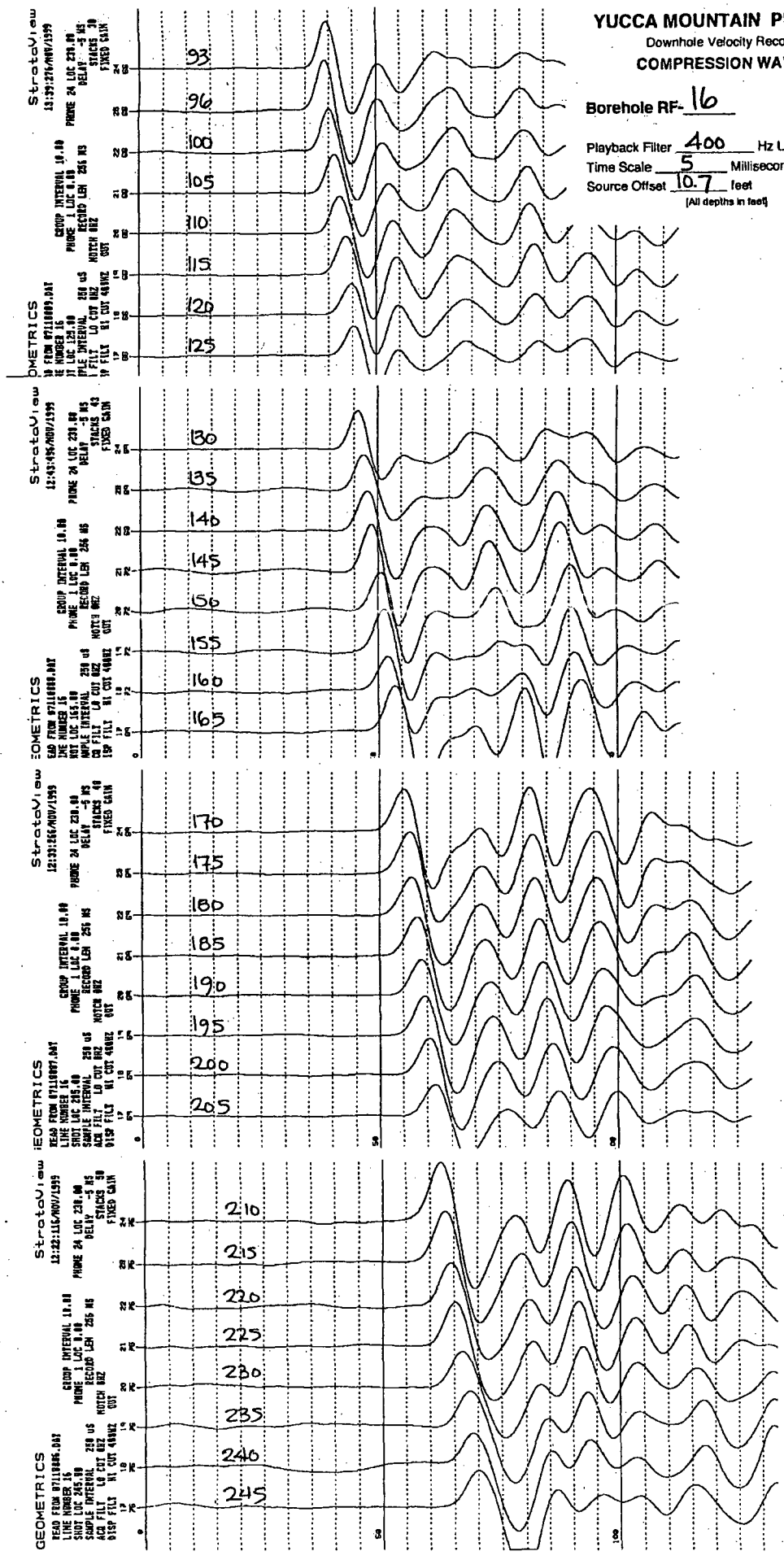
Borehole RF- 16

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

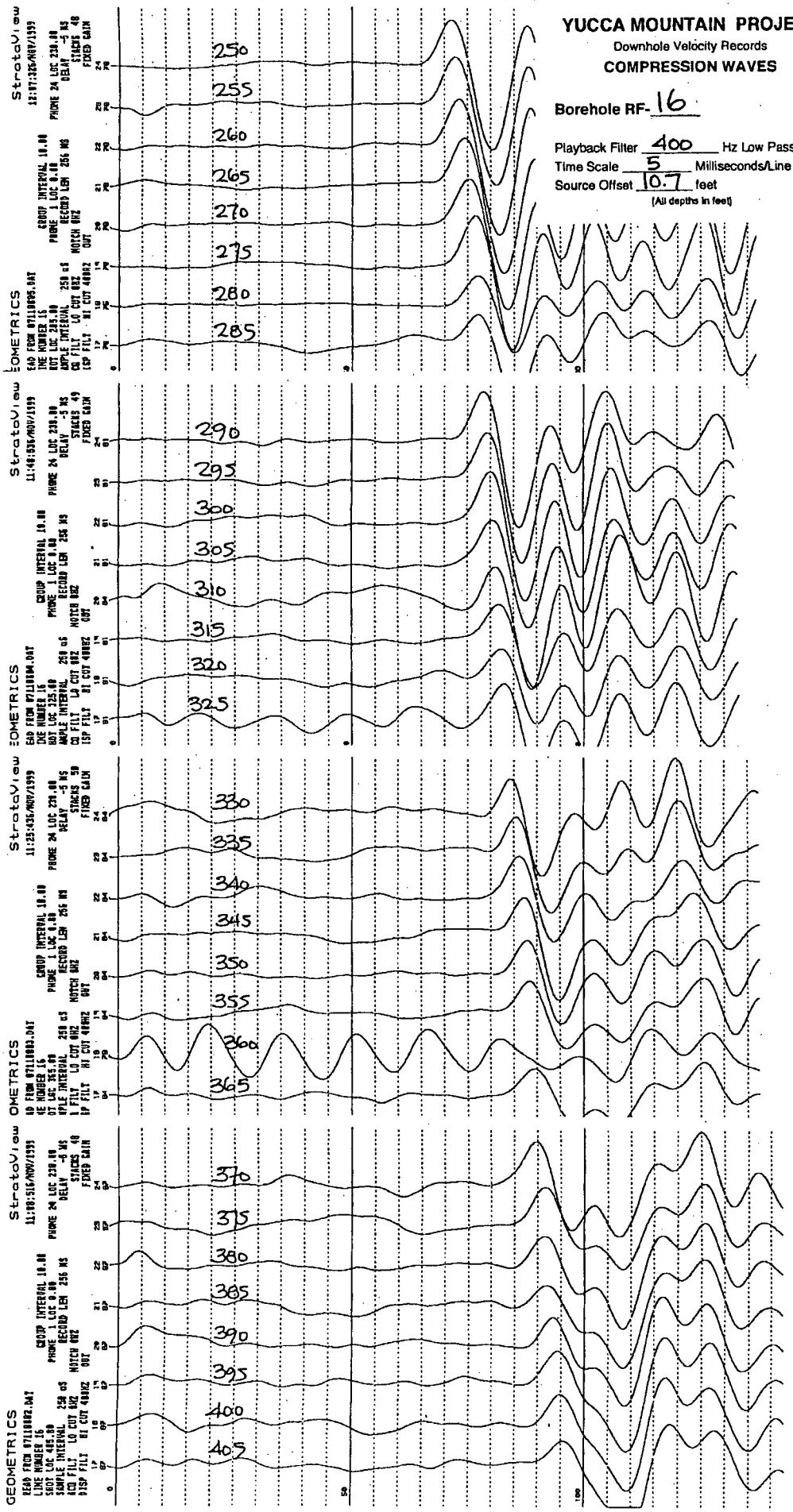
Borehole RF- 16

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

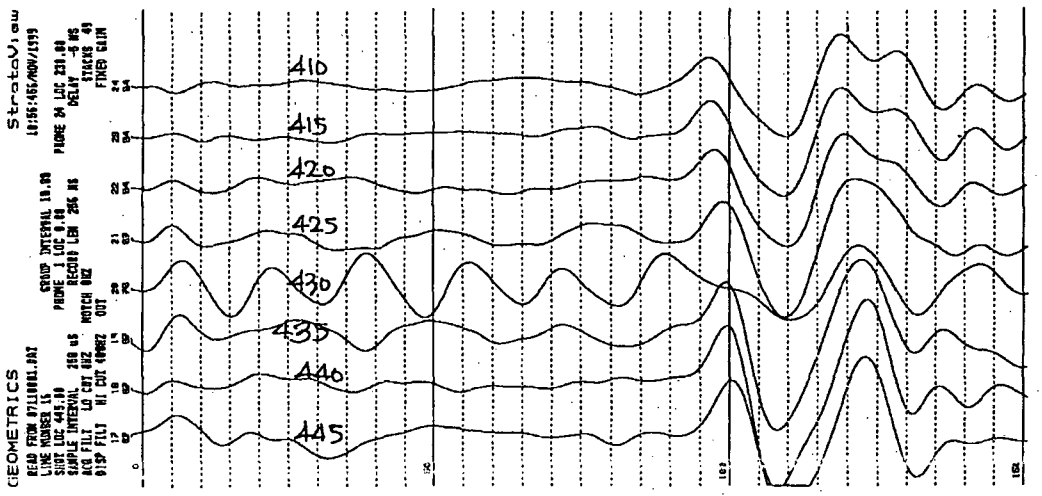
Borehole RF-16

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.7 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

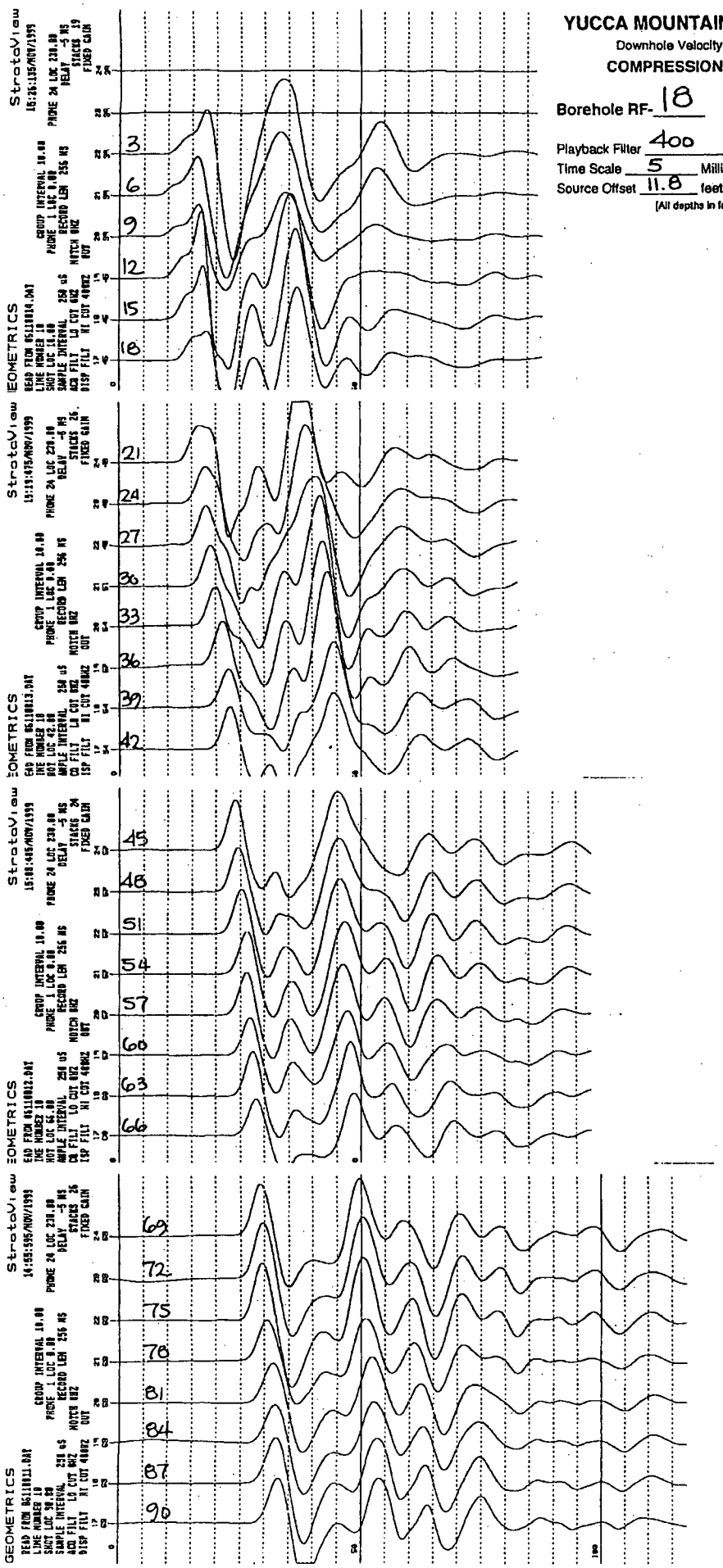
Borehole RF- 18

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

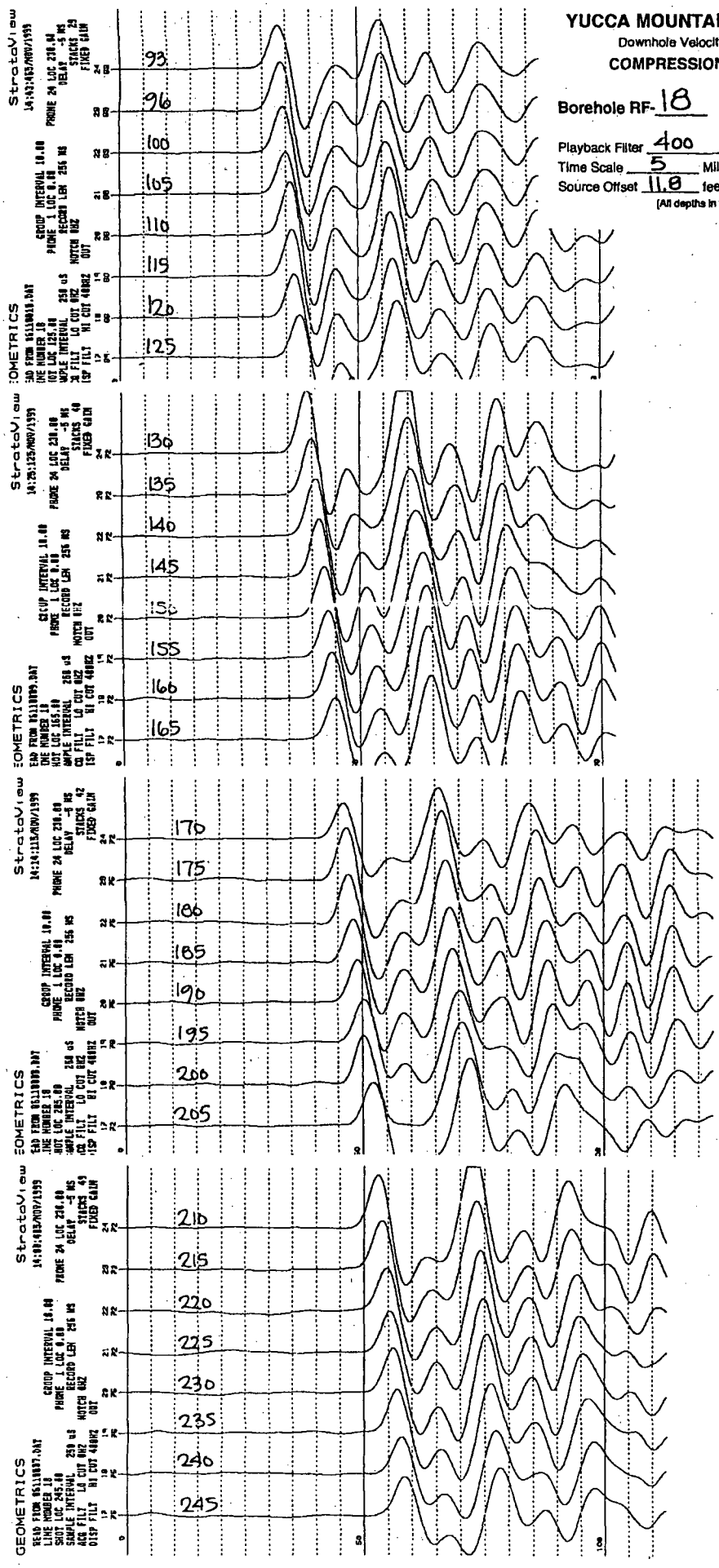
Borehole RF- 18

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.8 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

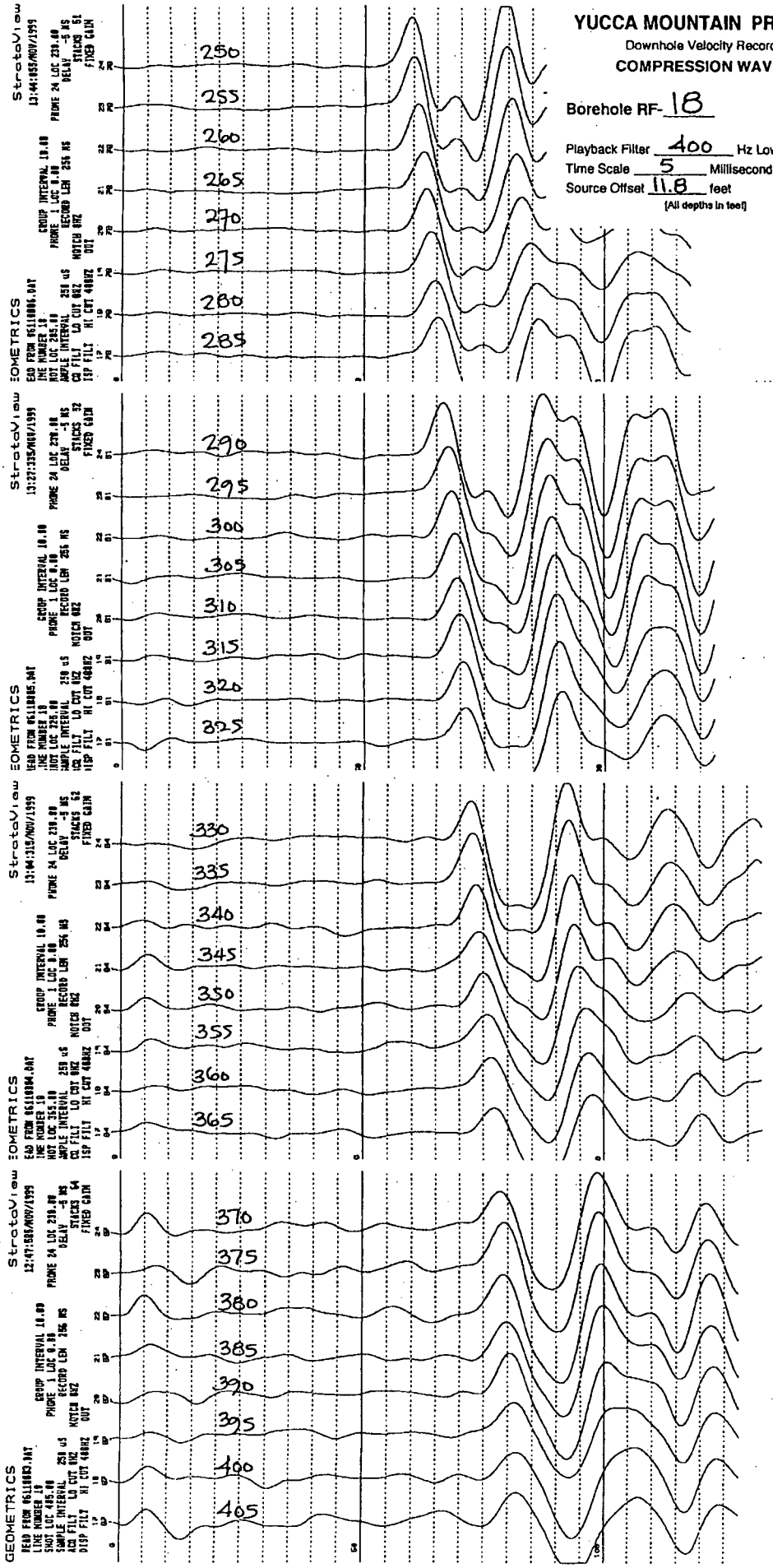
Borehole RF-18

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.8 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

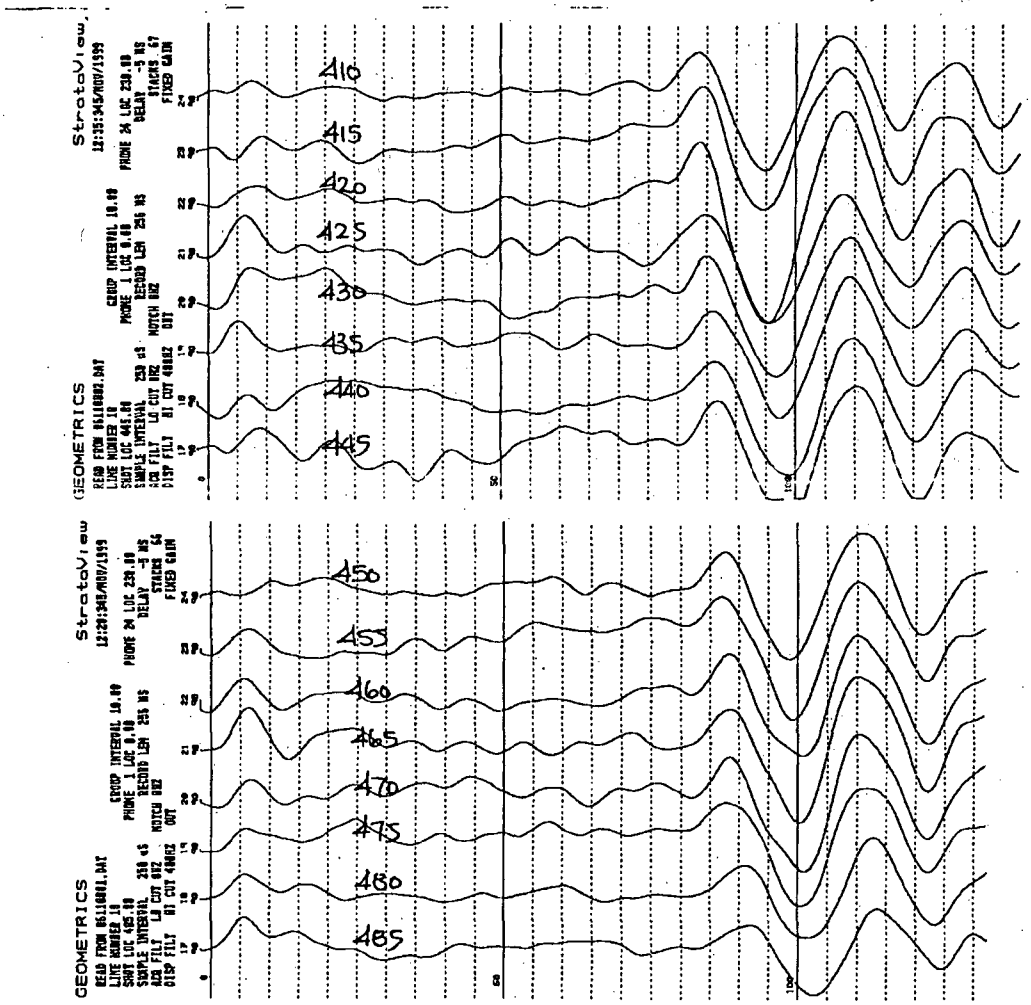
Borehole RF- 18

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.8 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

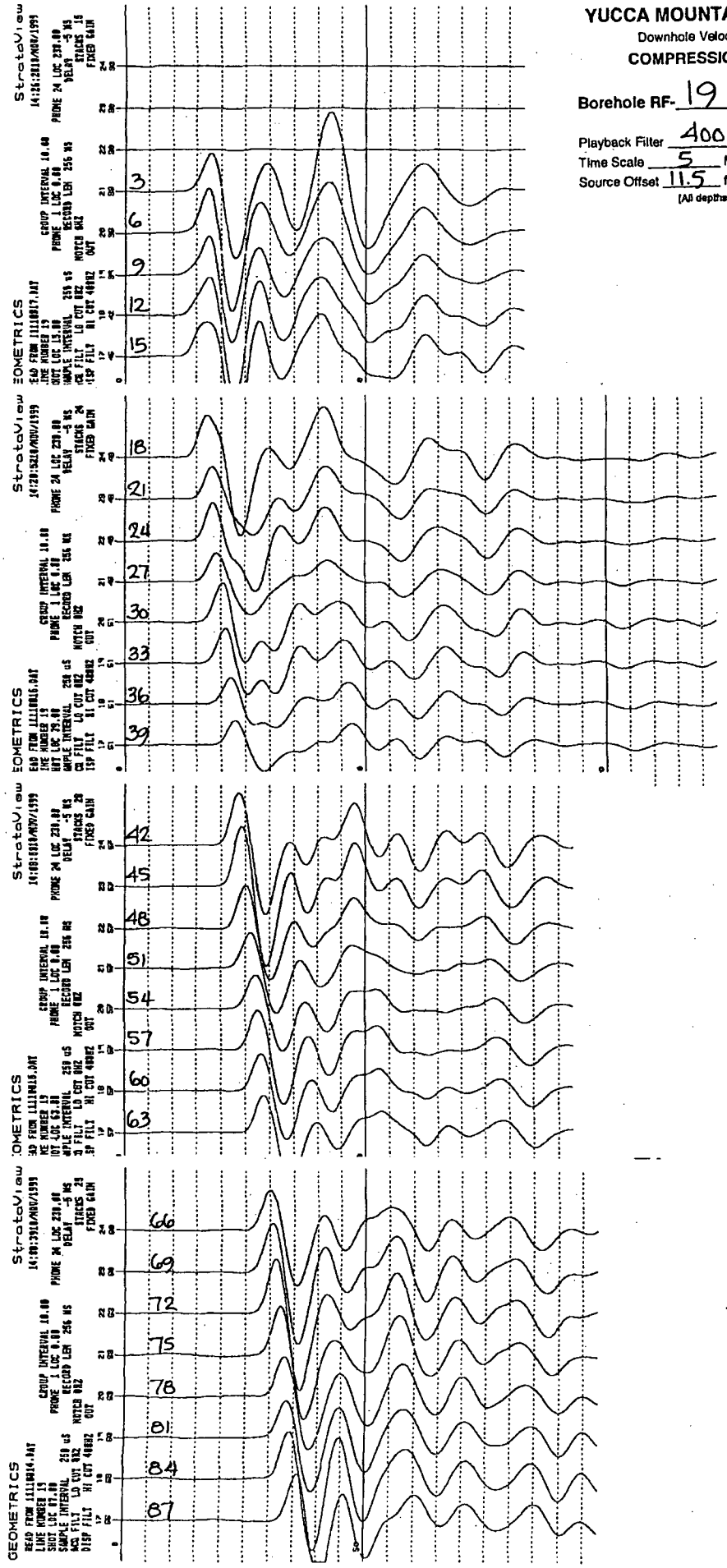
Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.5 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

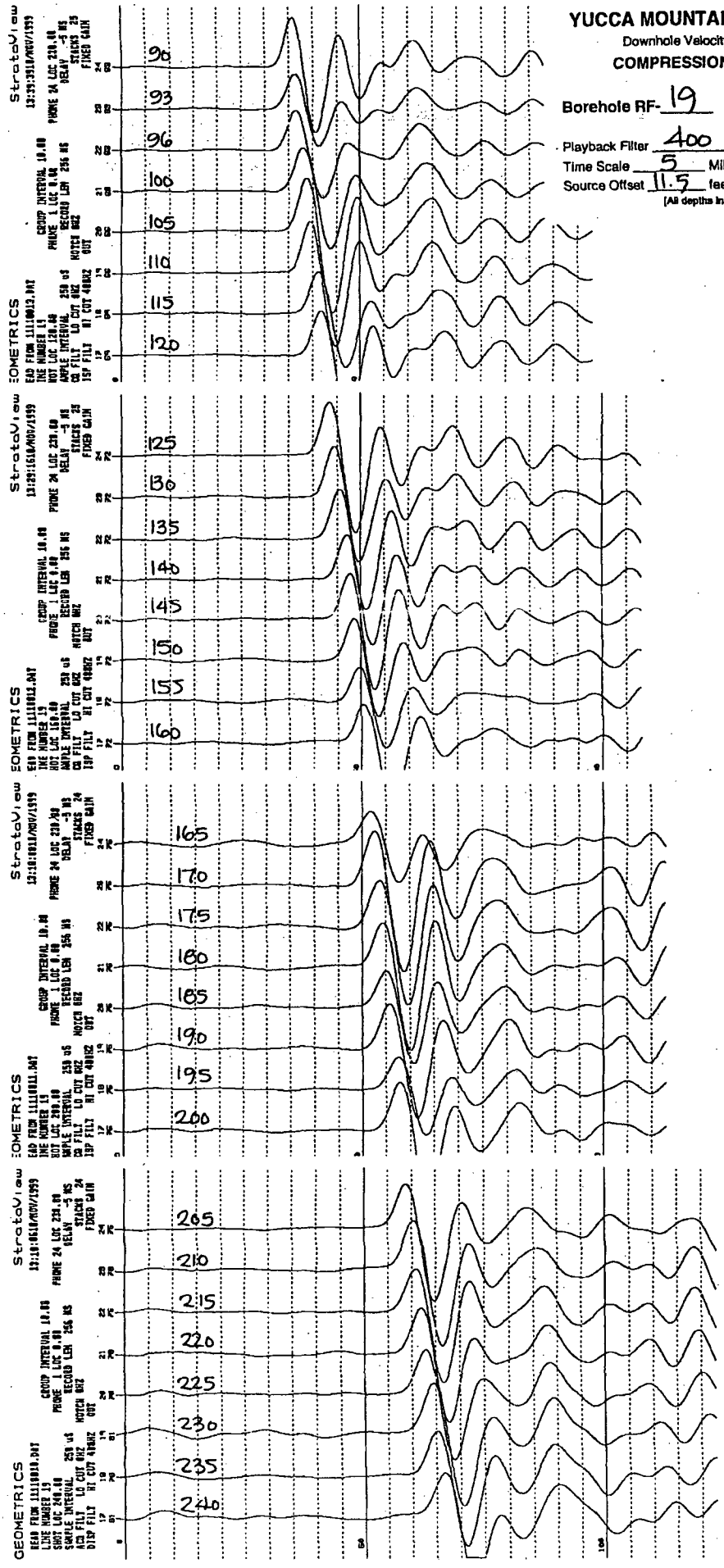
Borehole RF-19

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

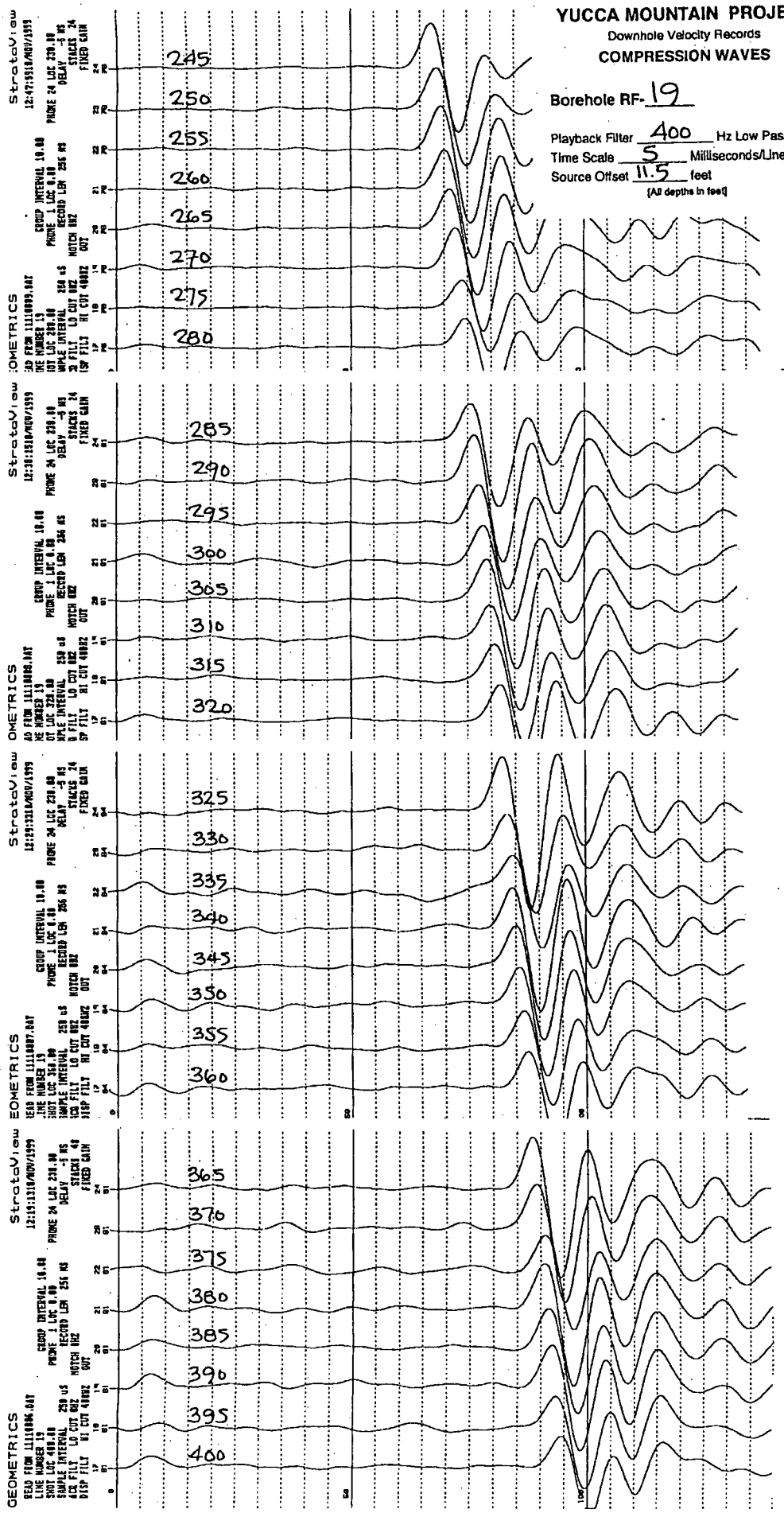
Borehole RF-19

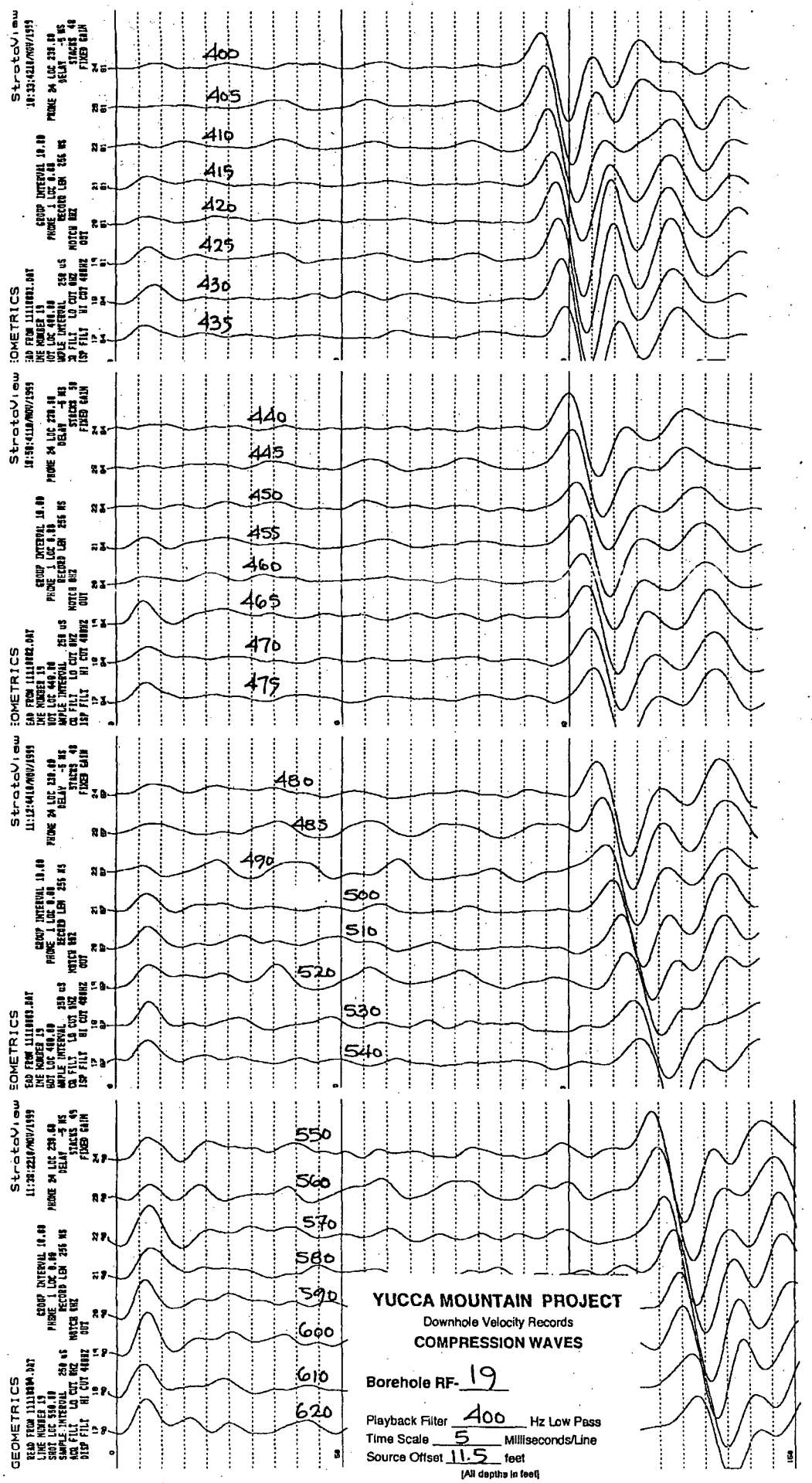
Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)

YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

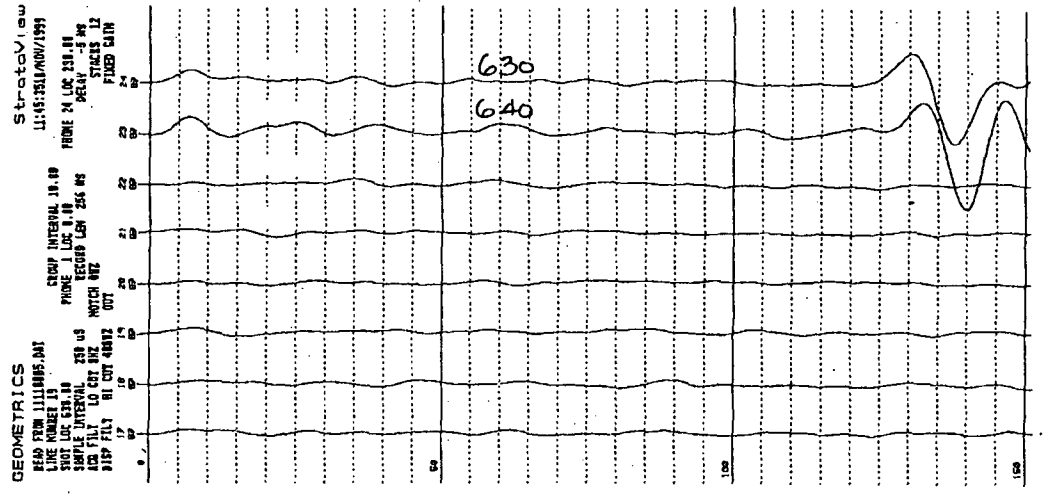
Borehole RF- 19

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 11.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

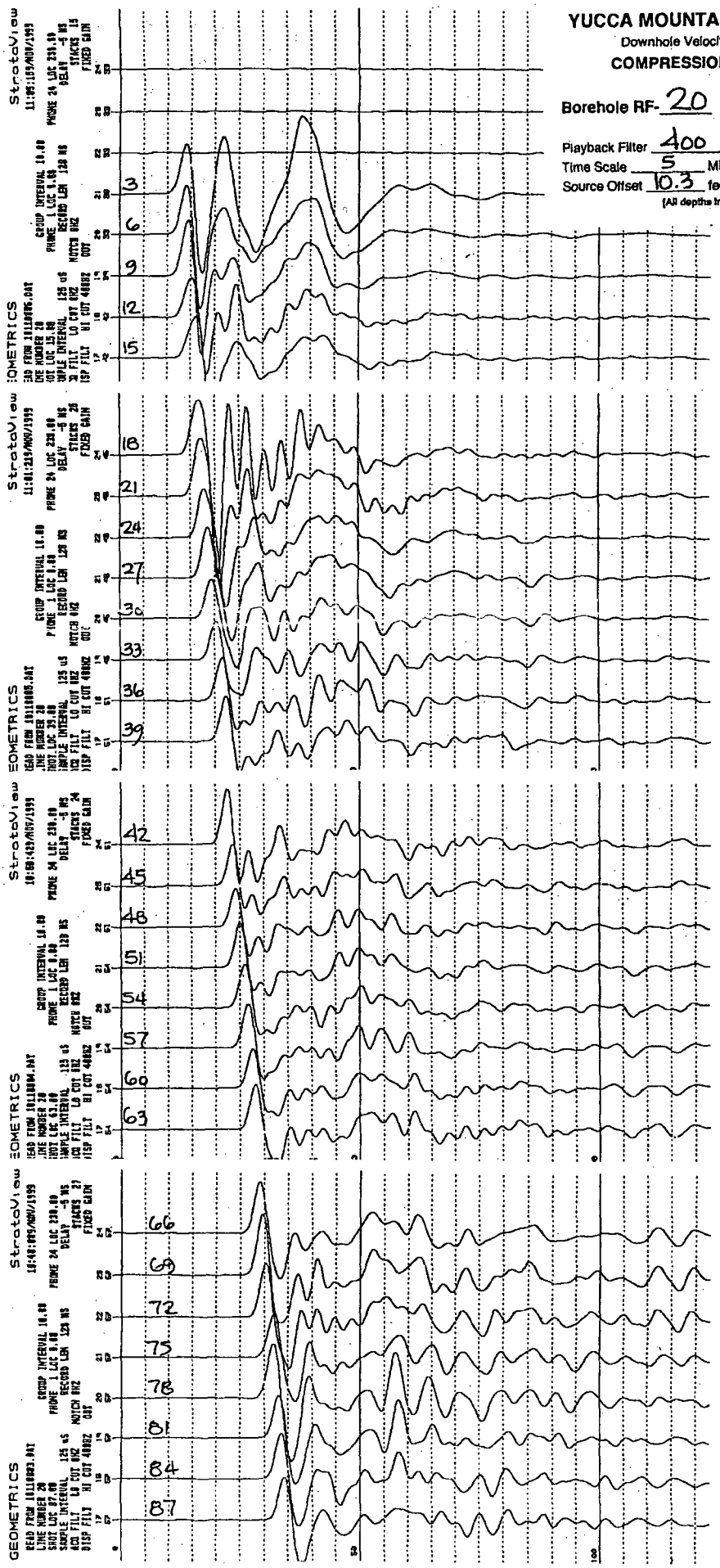
Borehole RF- 20

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.3 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

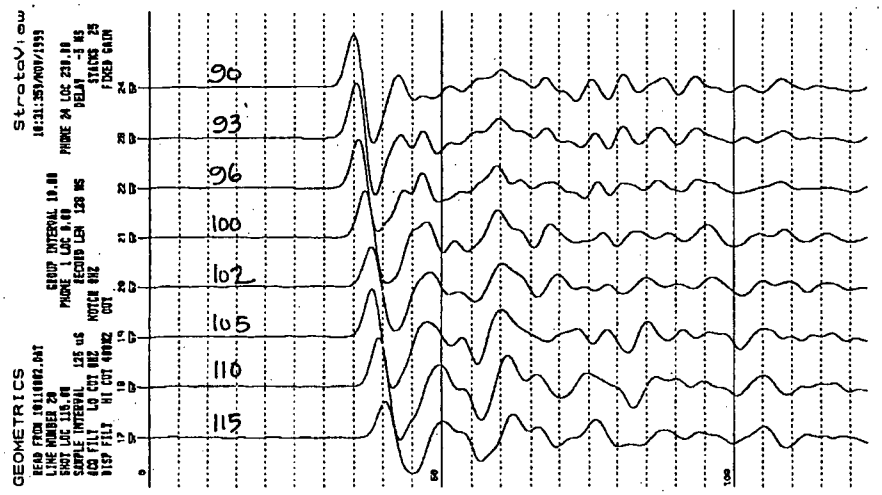
Borehole RF- 20

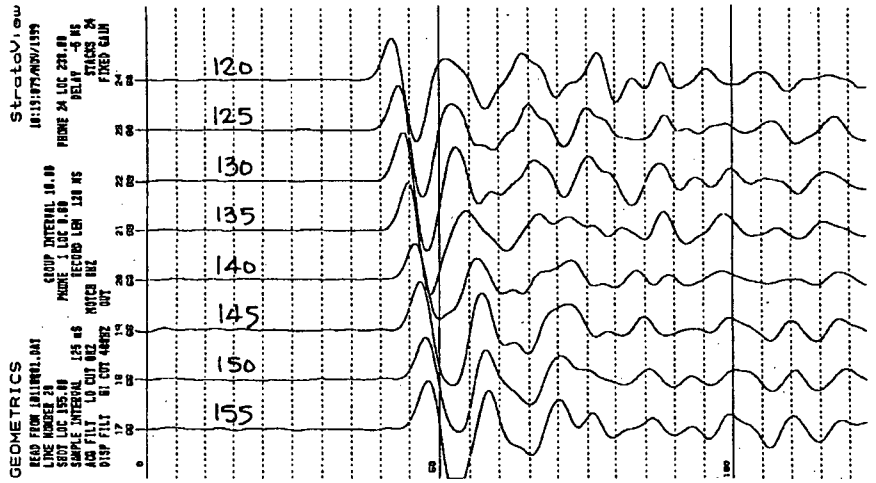
Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.3 feet

[All depths in feet]





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

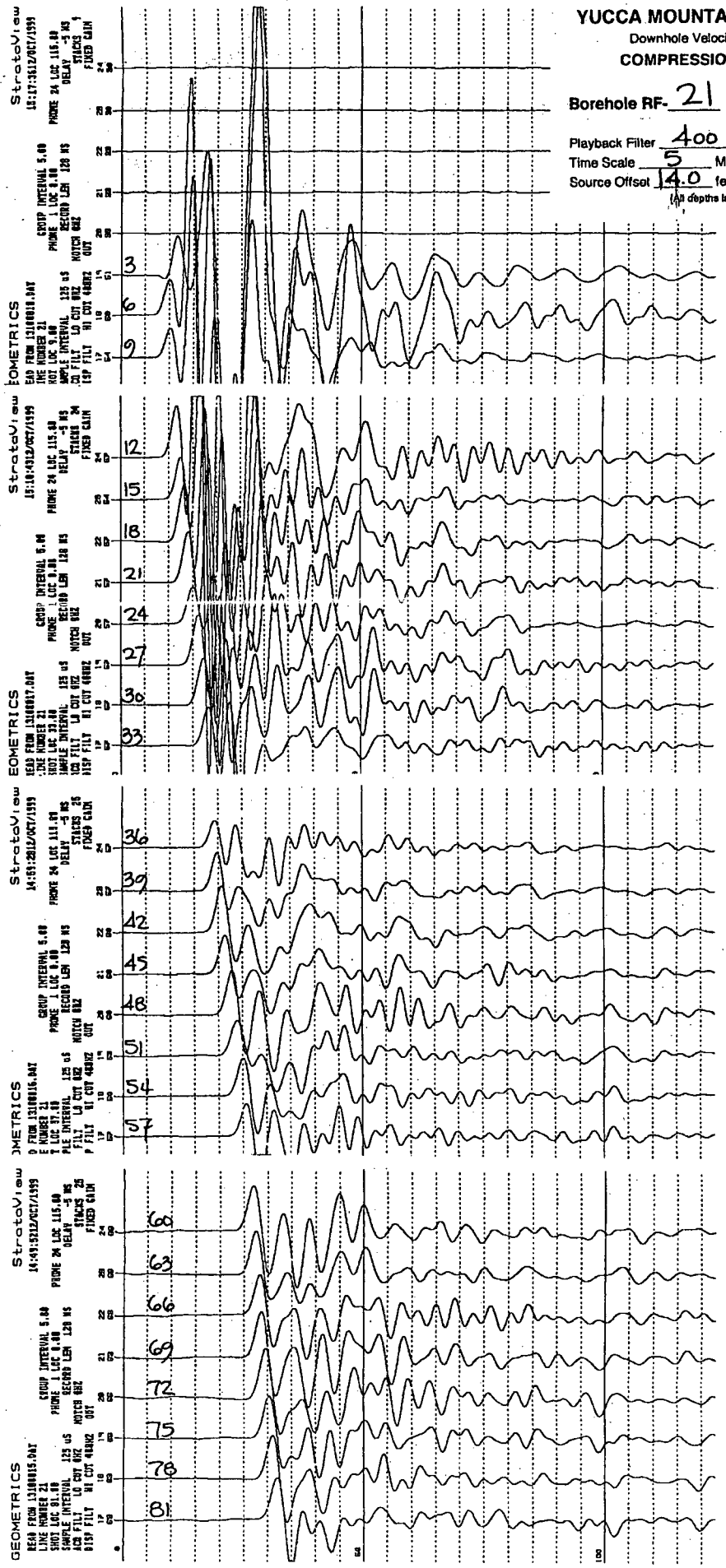
Borehole RF- 21

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 14.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

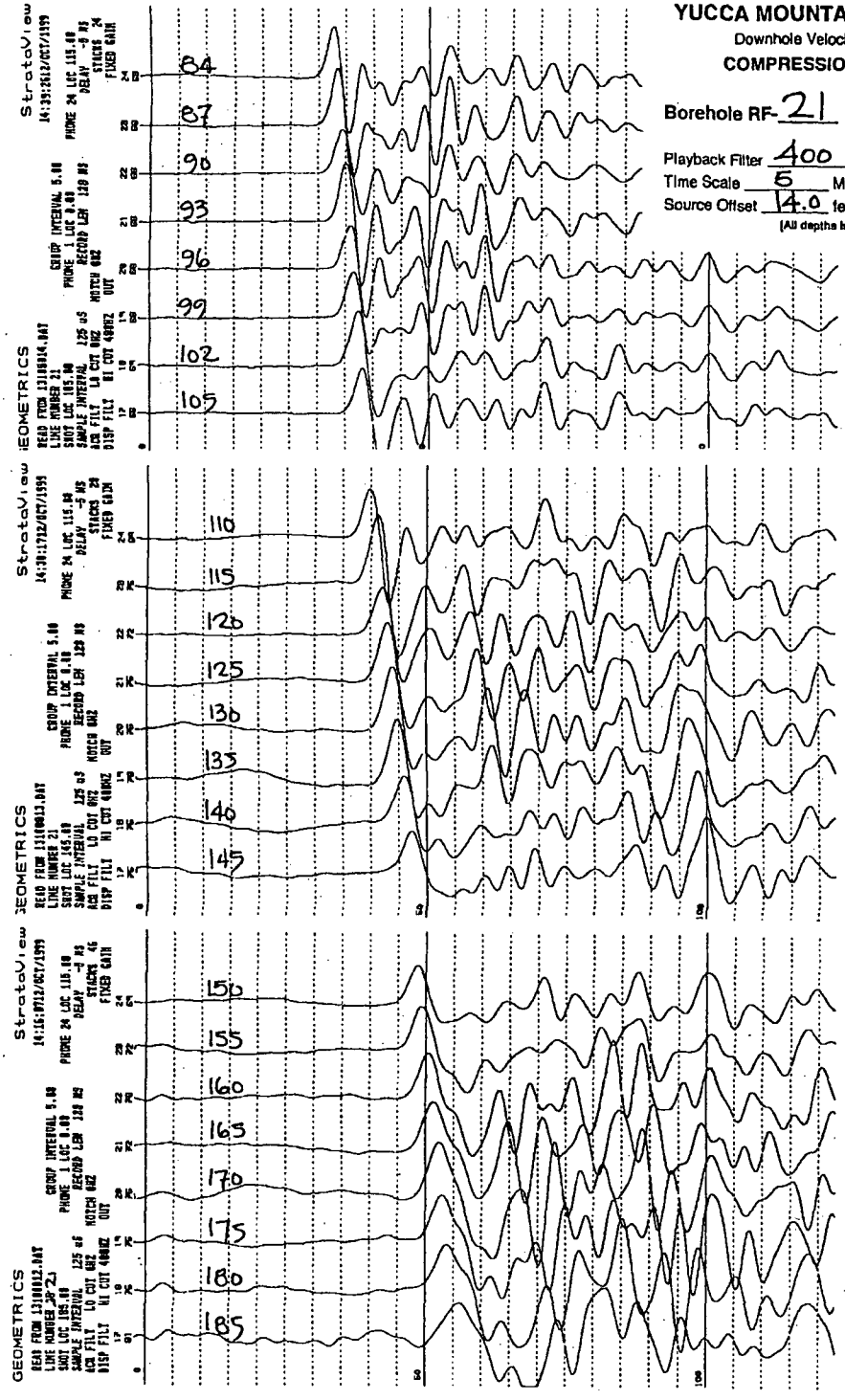
Borehole RF-21

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 14.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

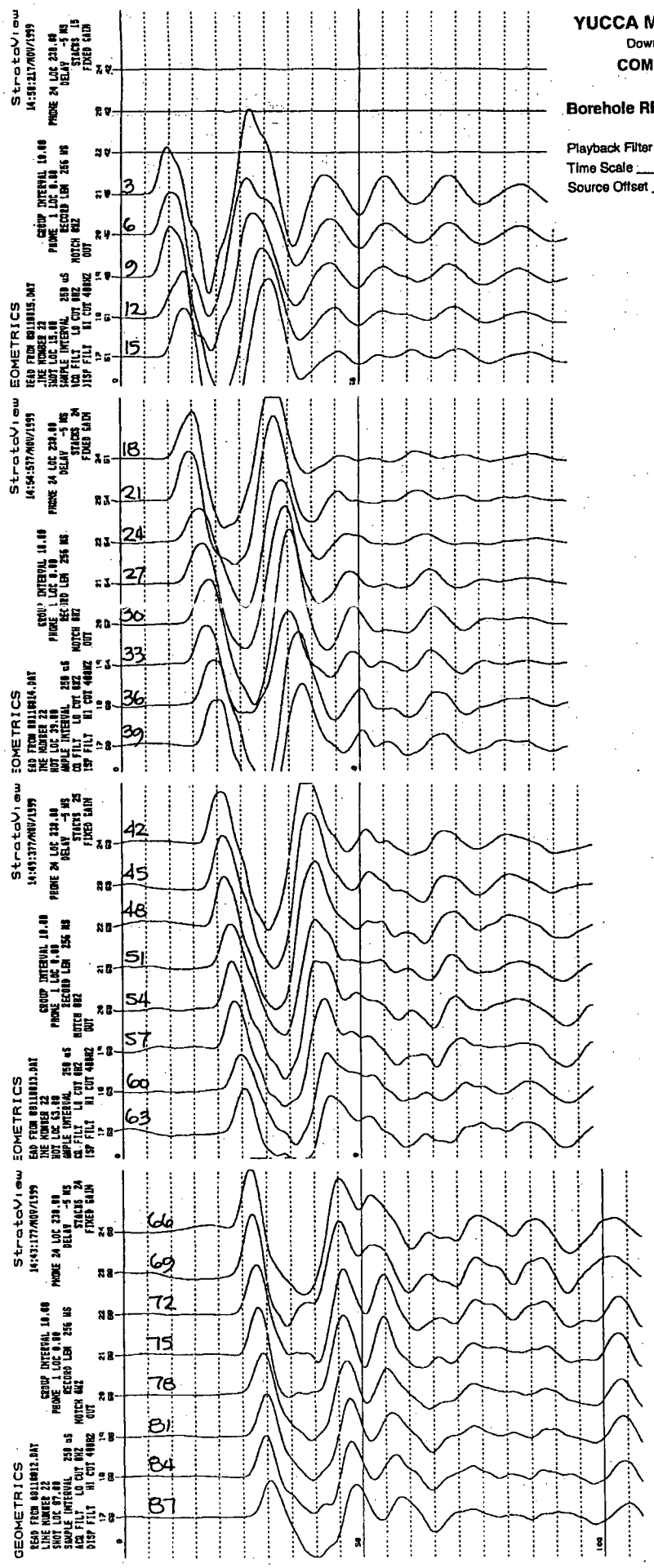
Borehole RF- 22

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.0 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

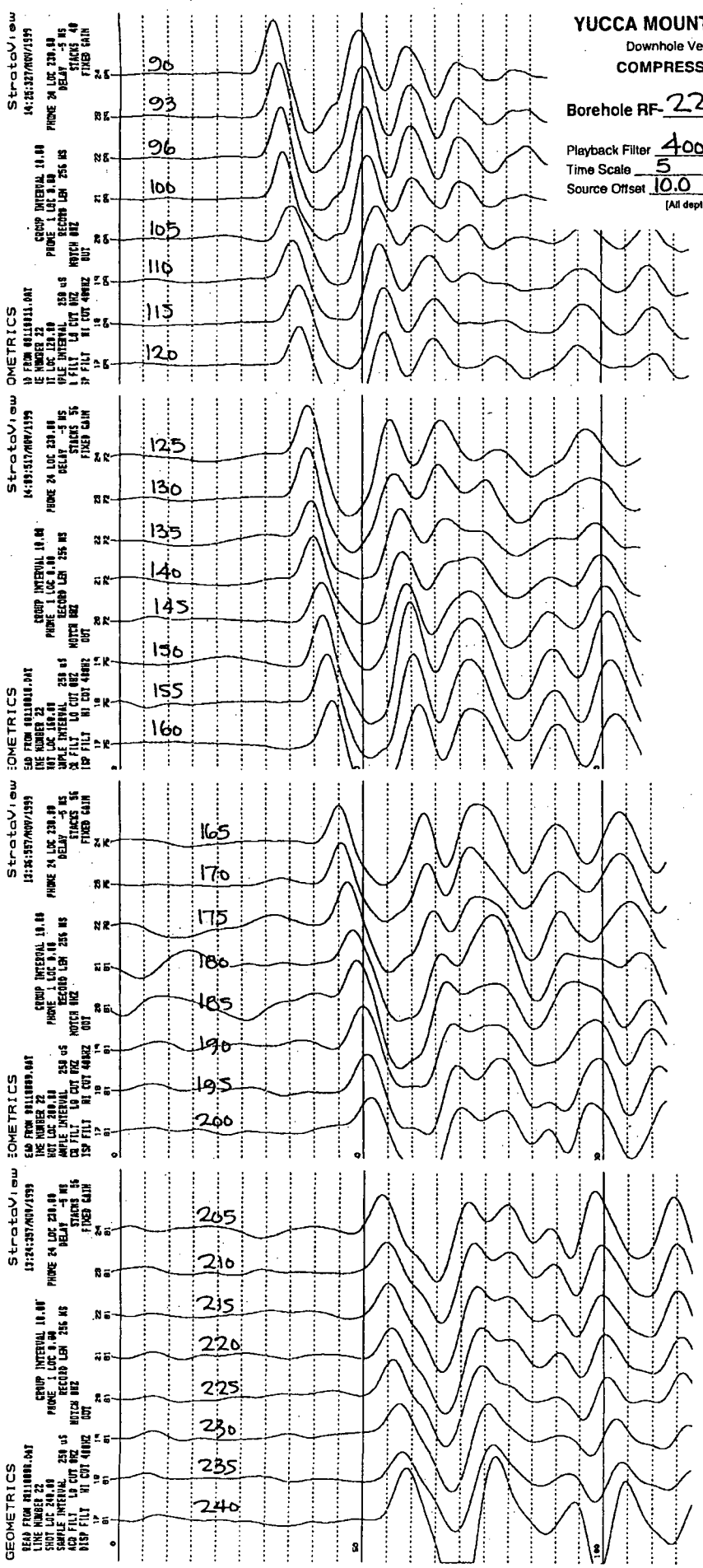
Borehole RF-22

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.0 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

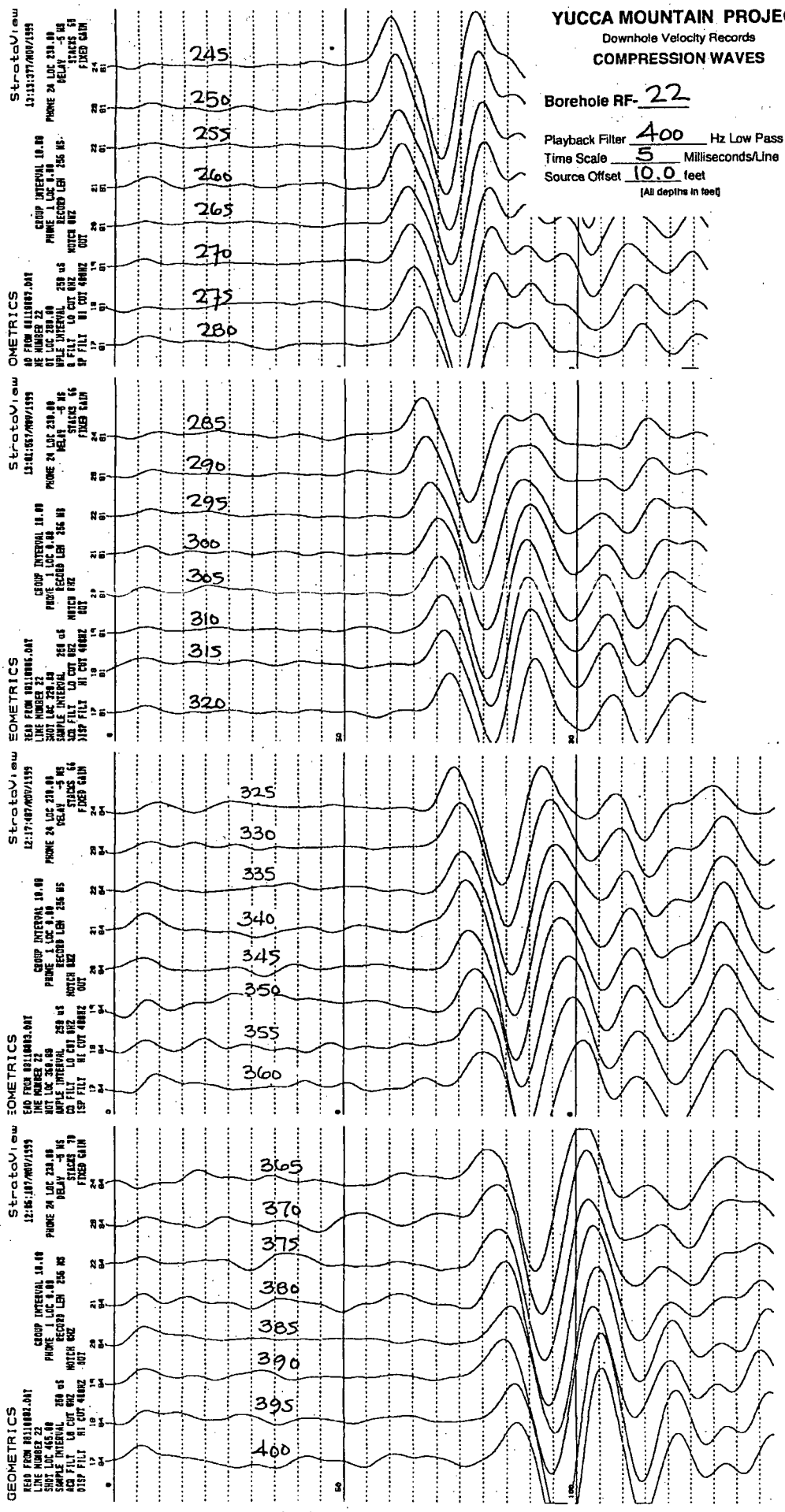
Borehole RF- 22

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.0 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

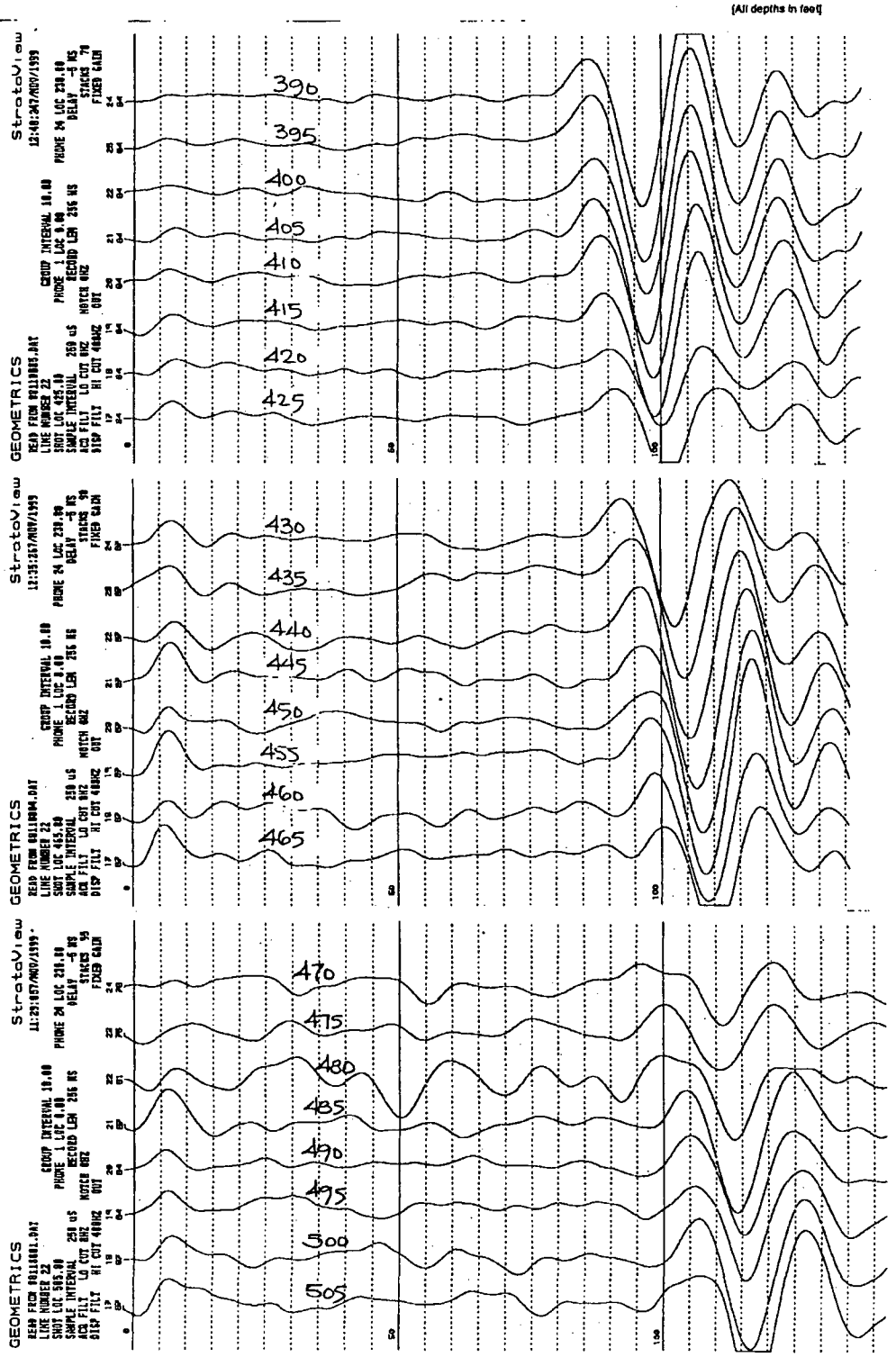
Borehole RF- 22

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

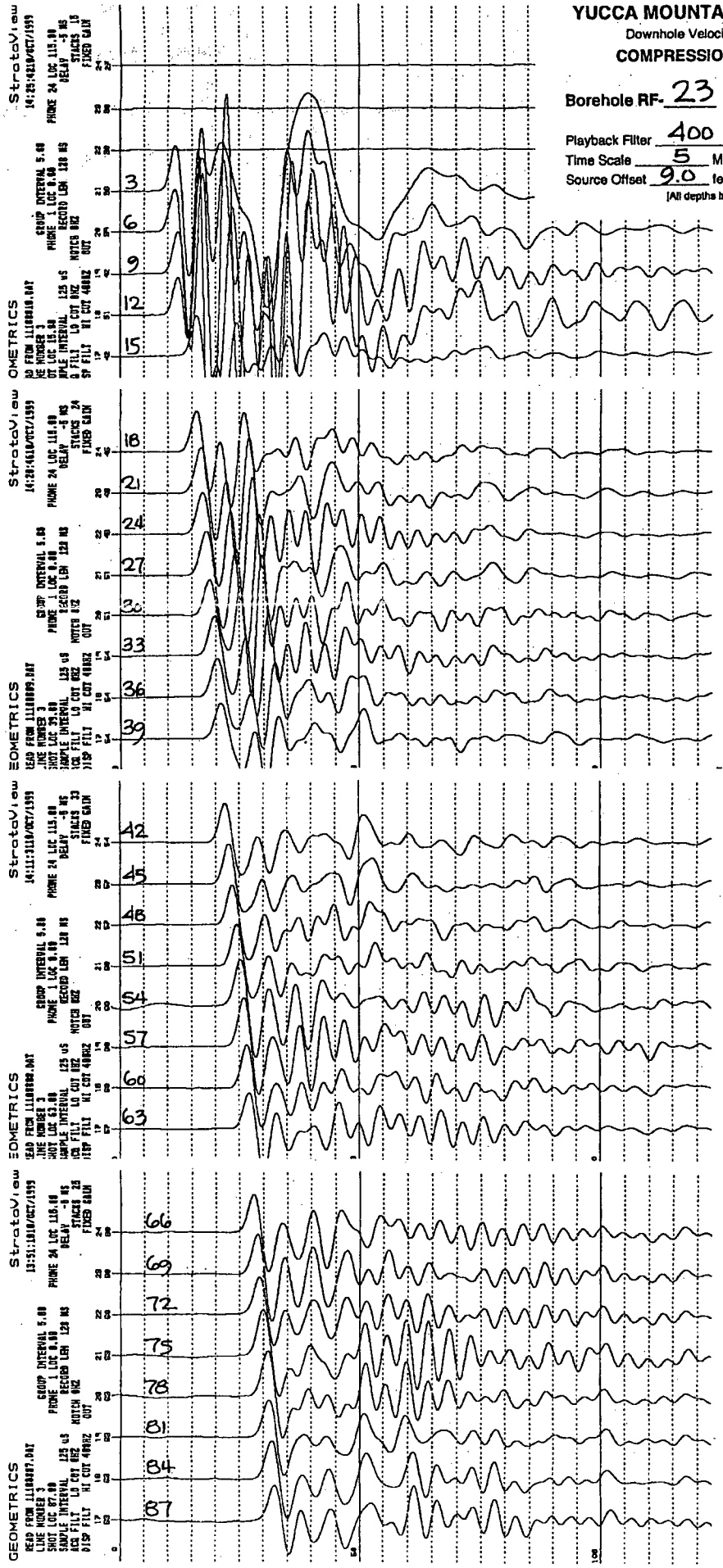
Borehole RF- 23

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.0 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

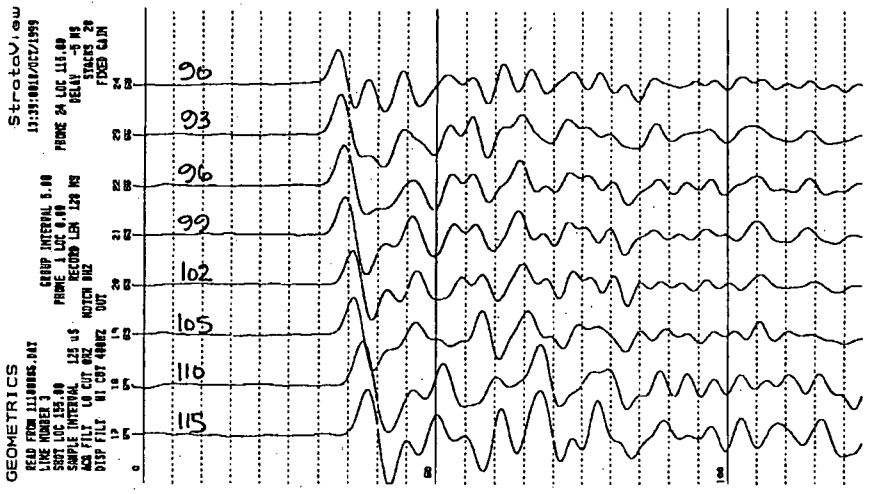
Borehole RF- 23

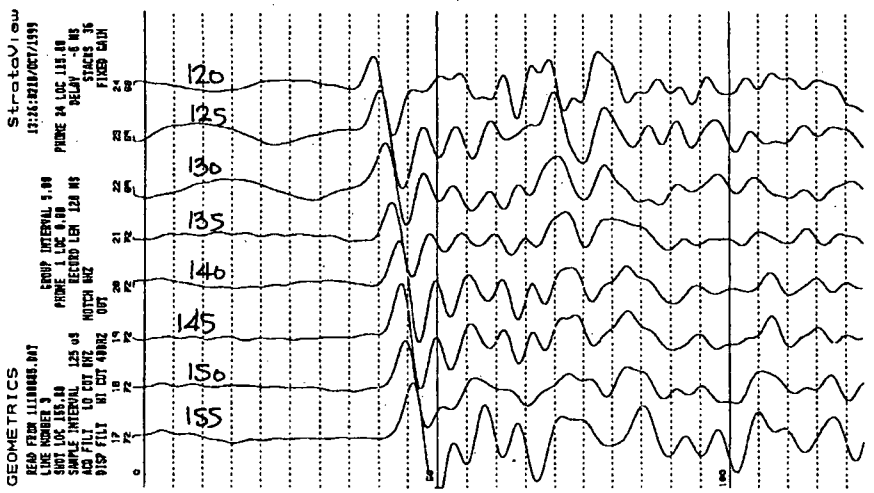
Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.0 feet

[All depths in feet]





YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

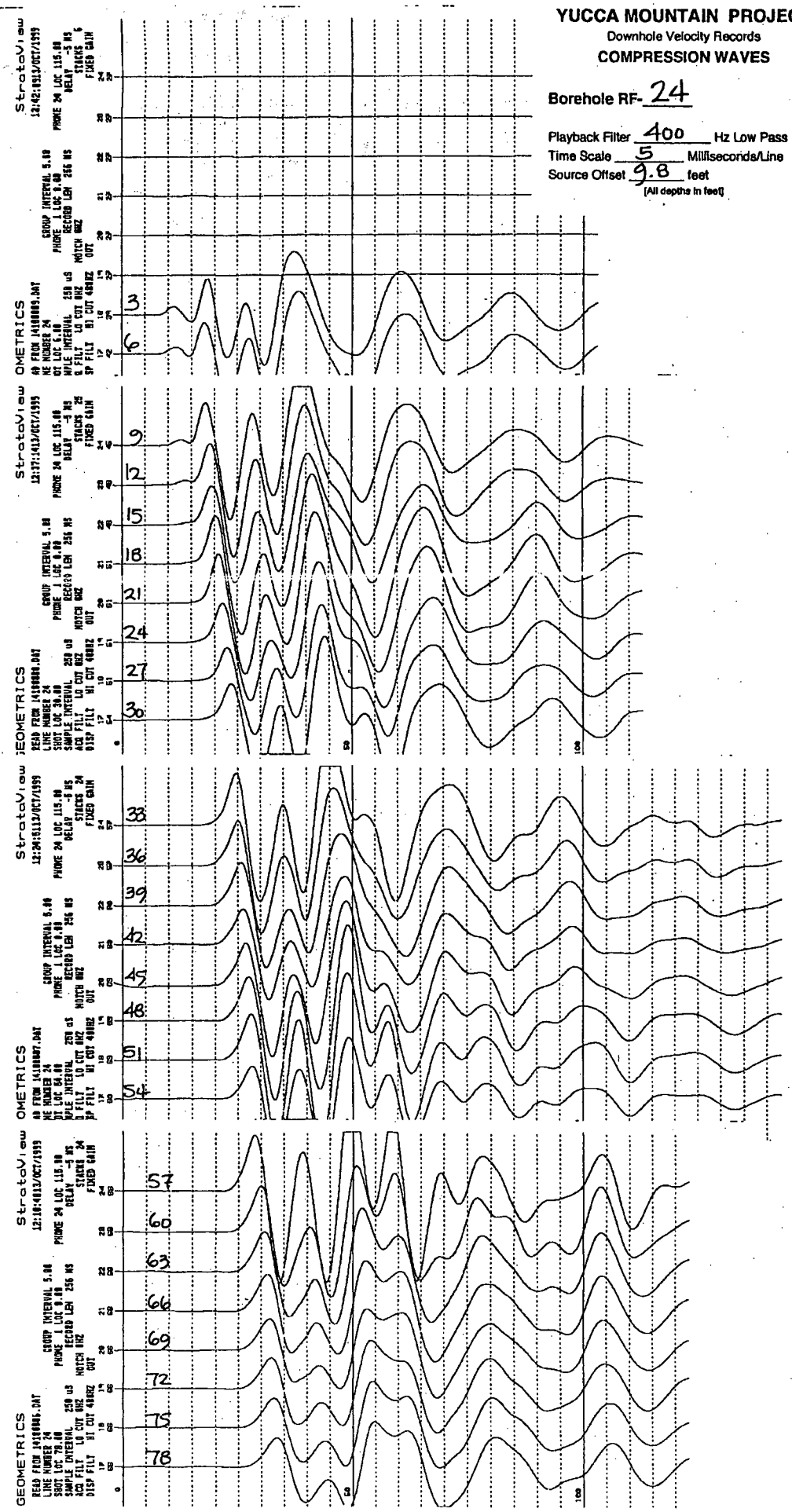
Borehole RF- 24

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

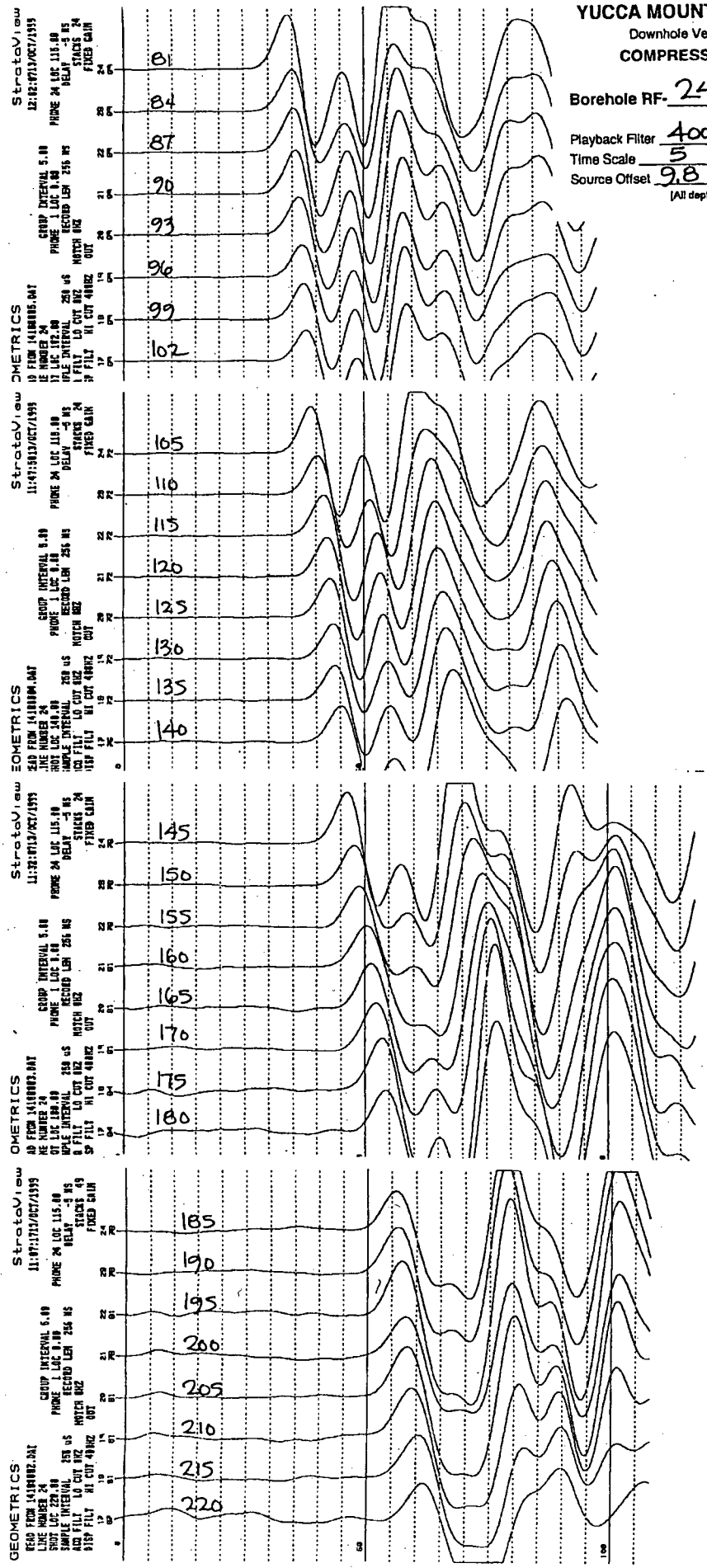
Borehole RF- 24

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

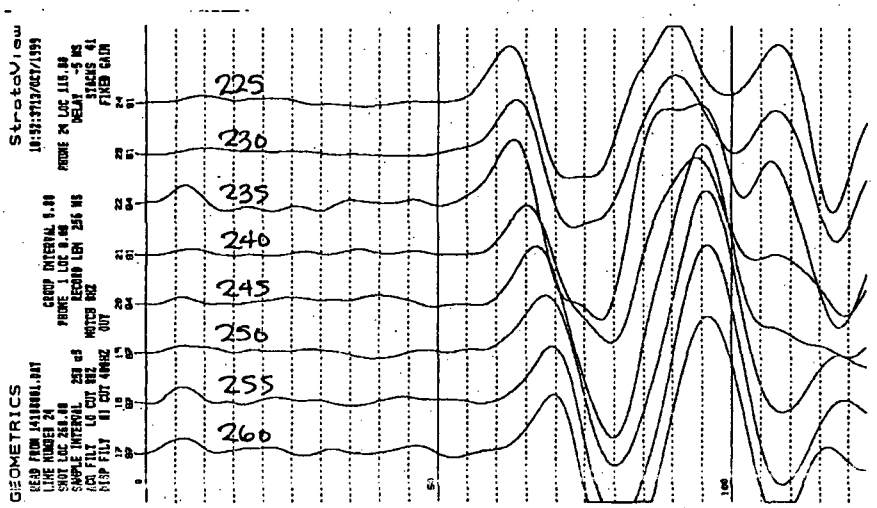
Borehole RF- 24

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 9.8 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

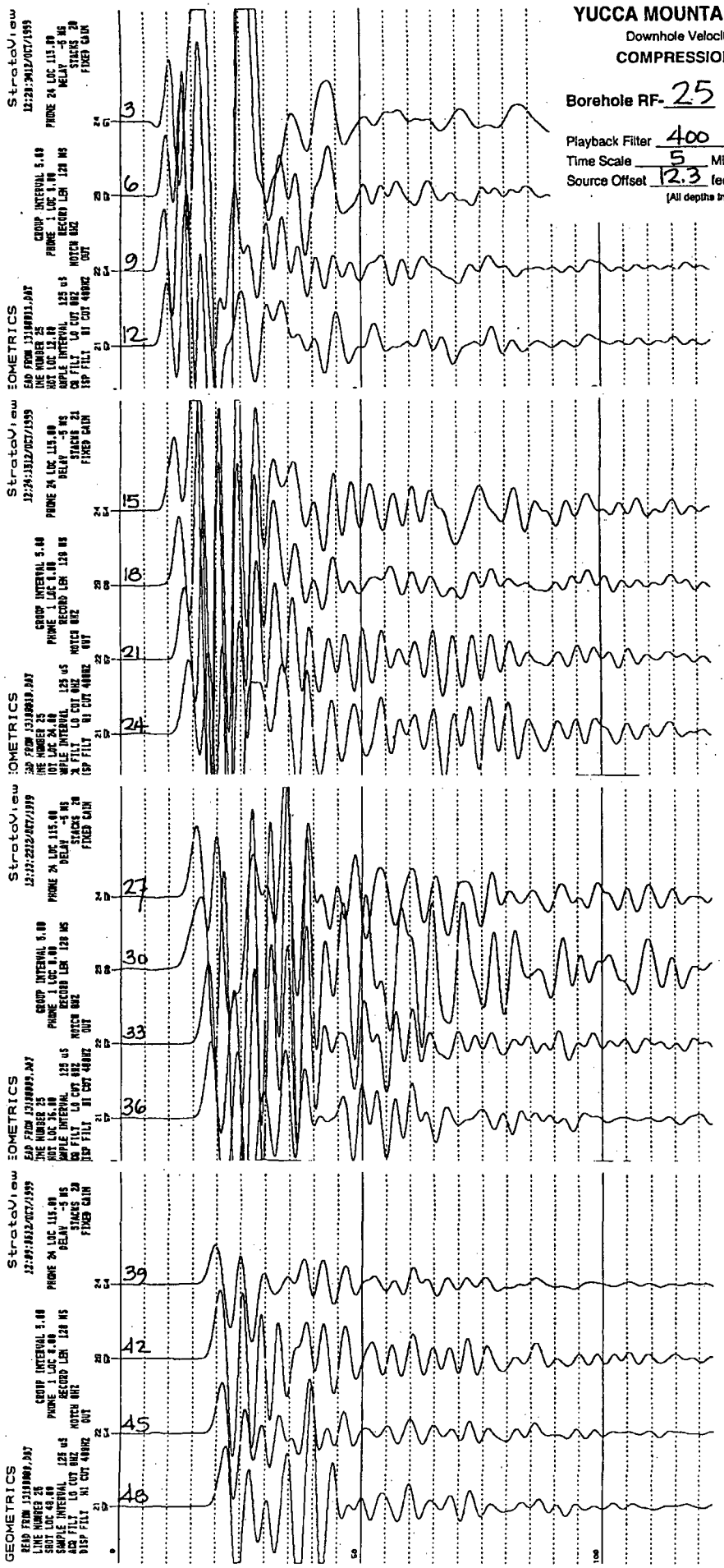
Borehole RF- 25

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.3 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

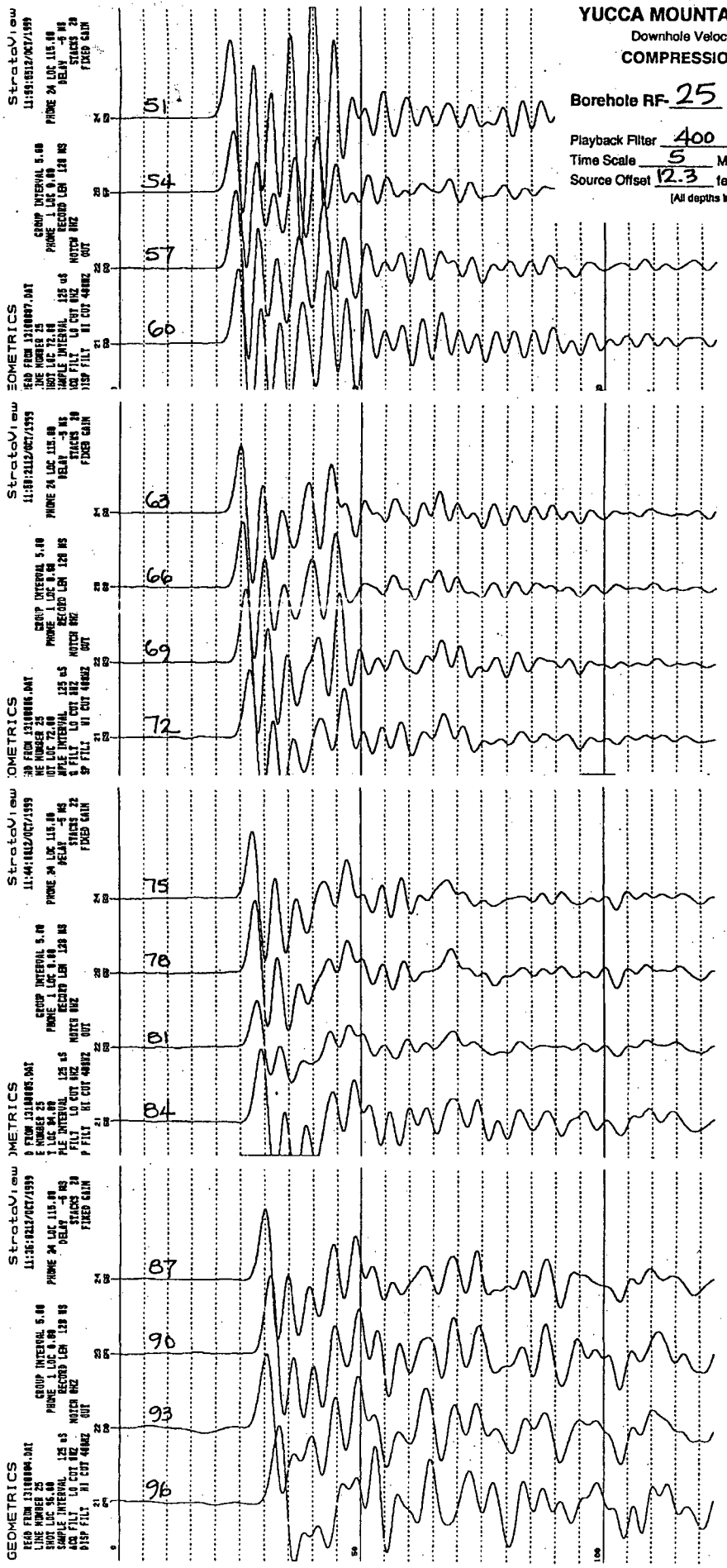
Borehole RF- 25

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.3 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

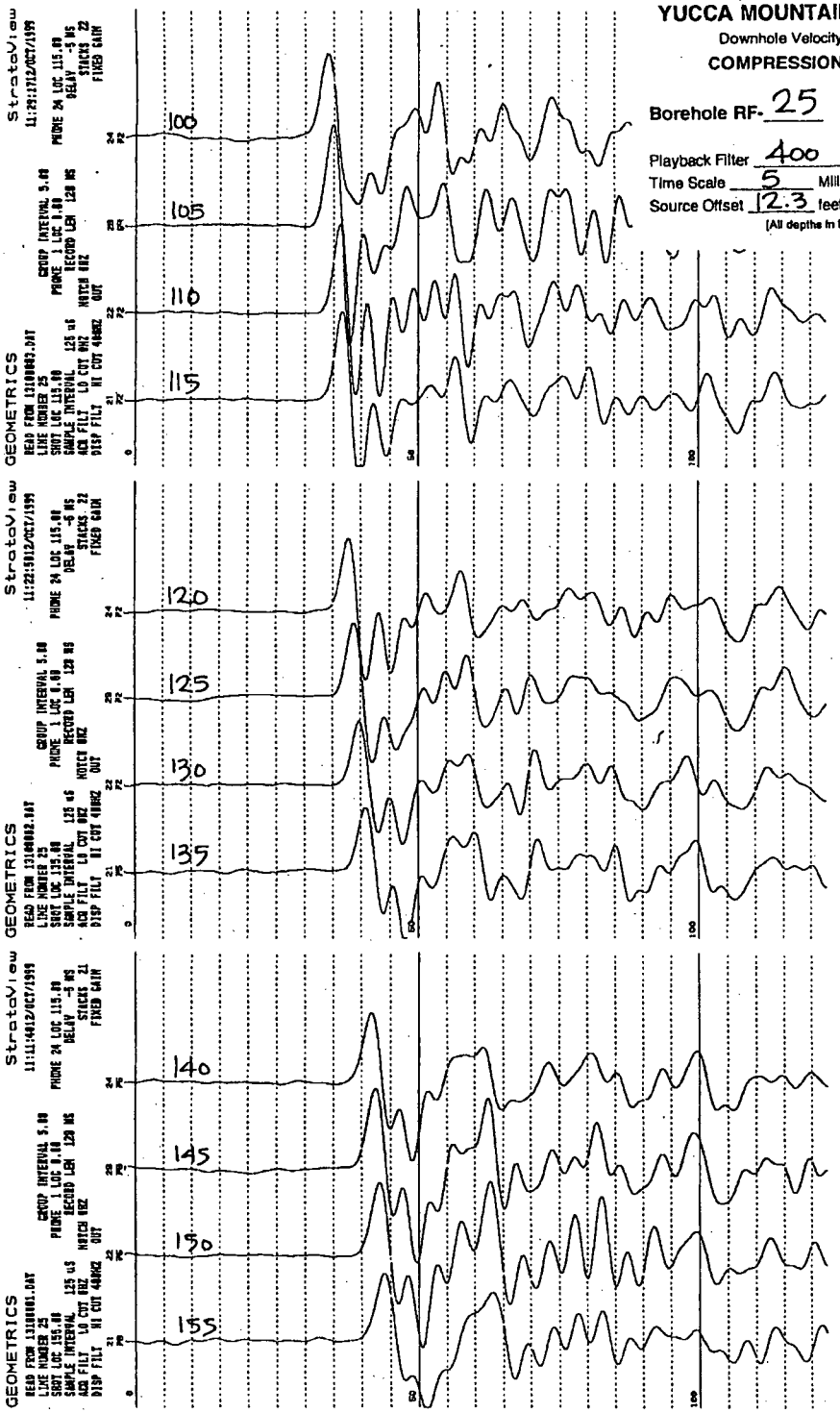
Borehole RF- 25

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 12.3 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

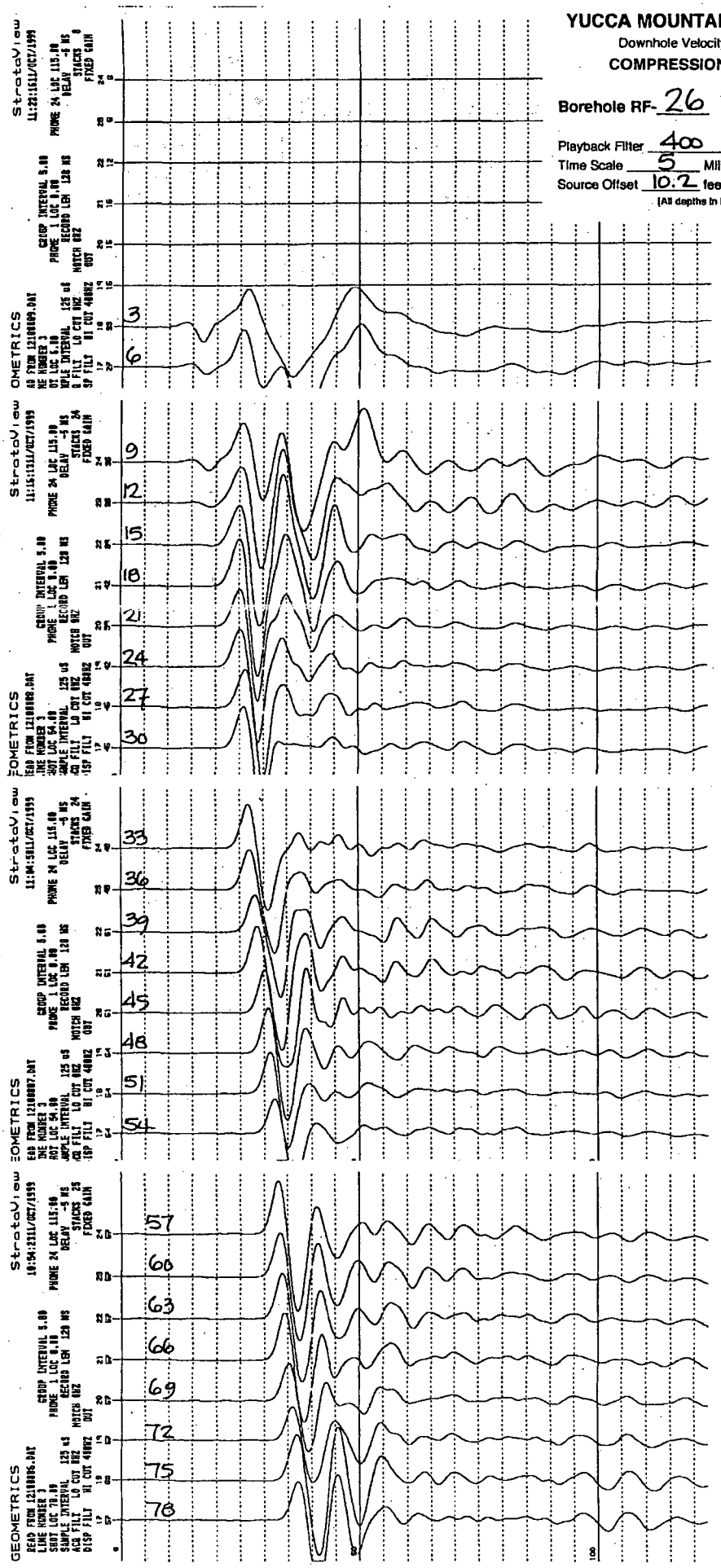
Borehole RF- 26

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

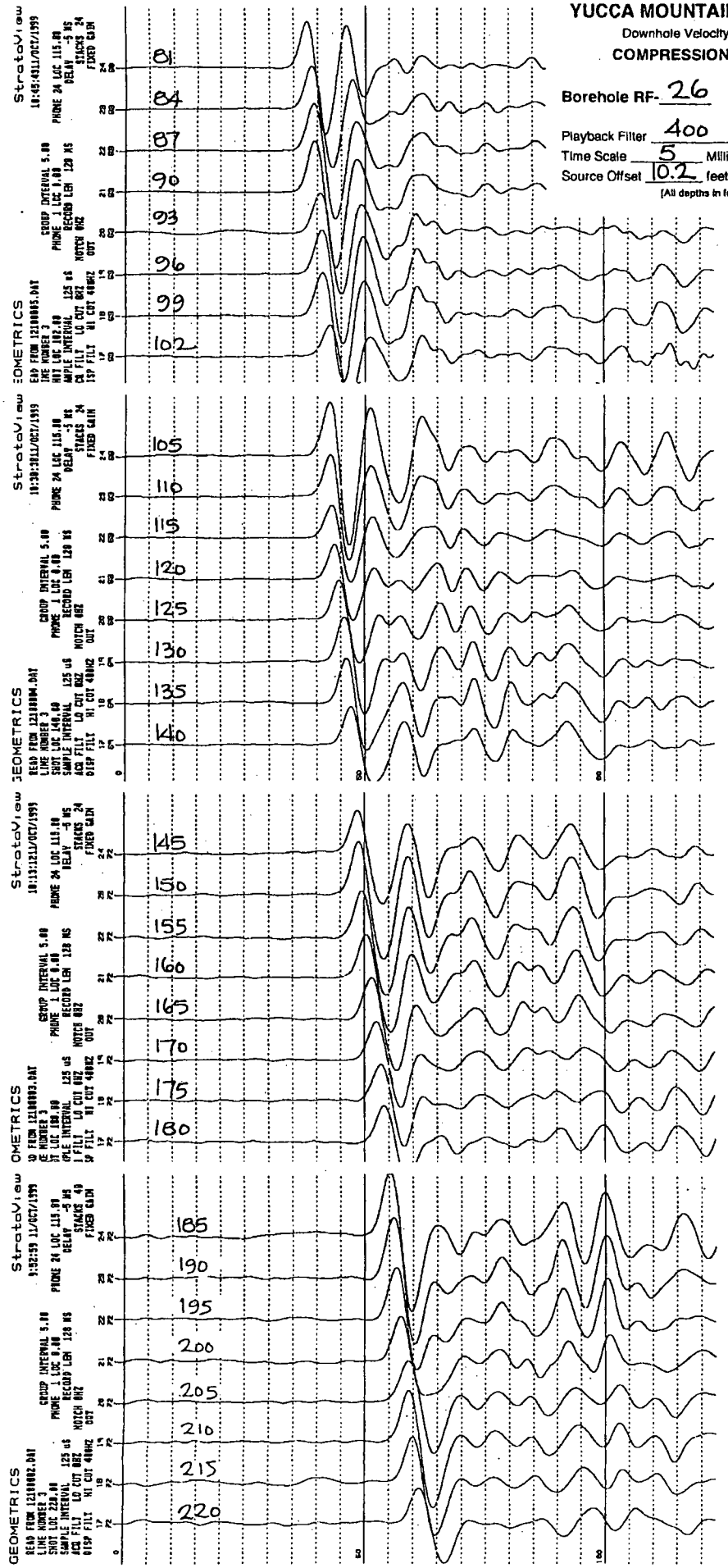
Borehole RF- 26

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

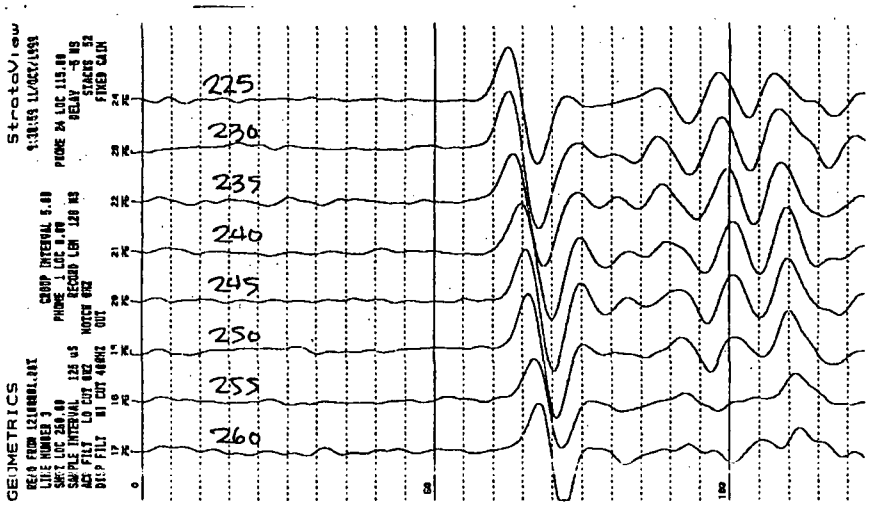
Borehole RF- 26

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.2 feet

[All depths in feet]



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

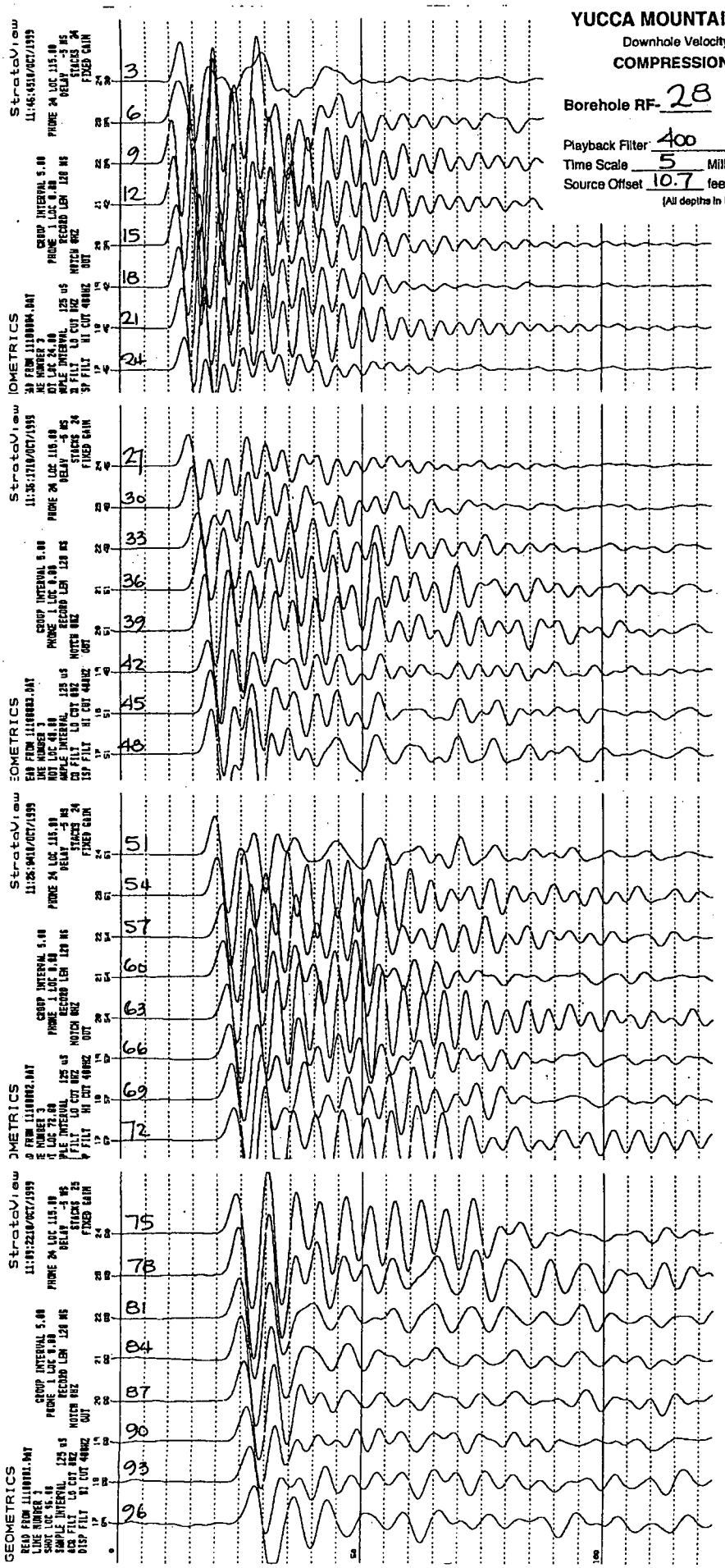
Borehole RF-28

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 10.7 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

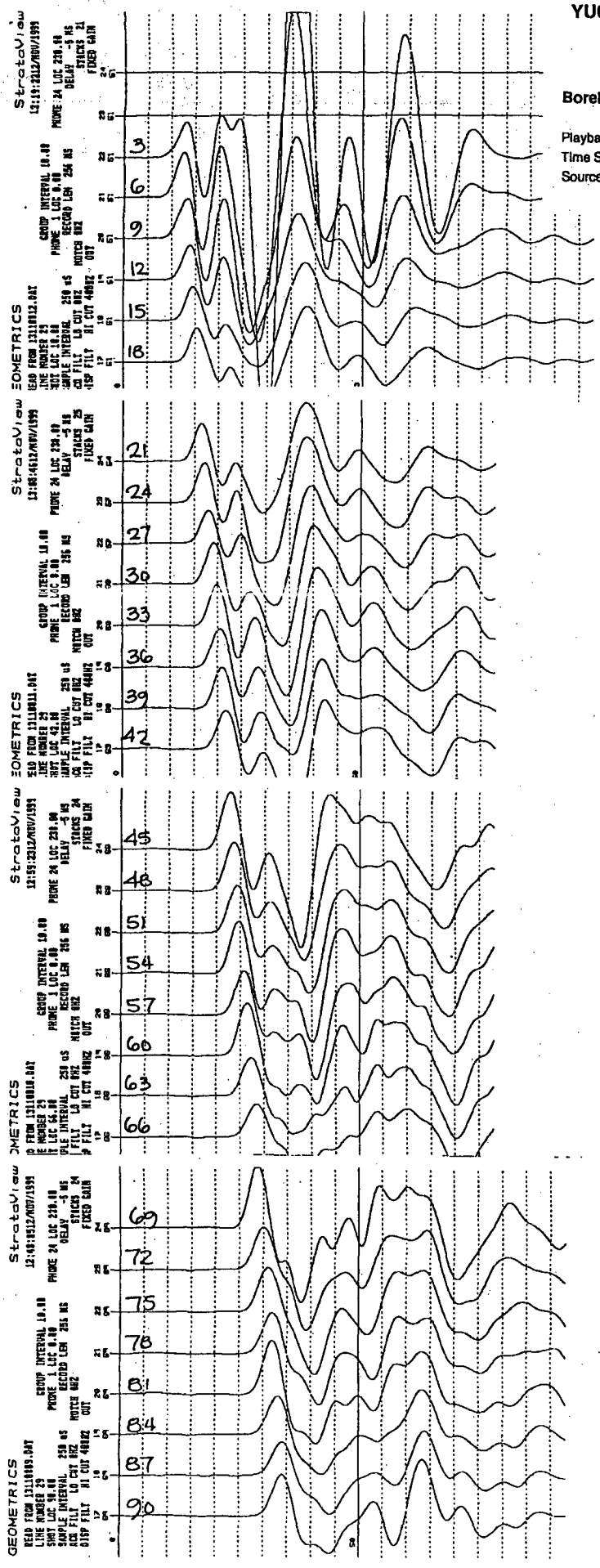
Borehole RF- 29

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 13.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

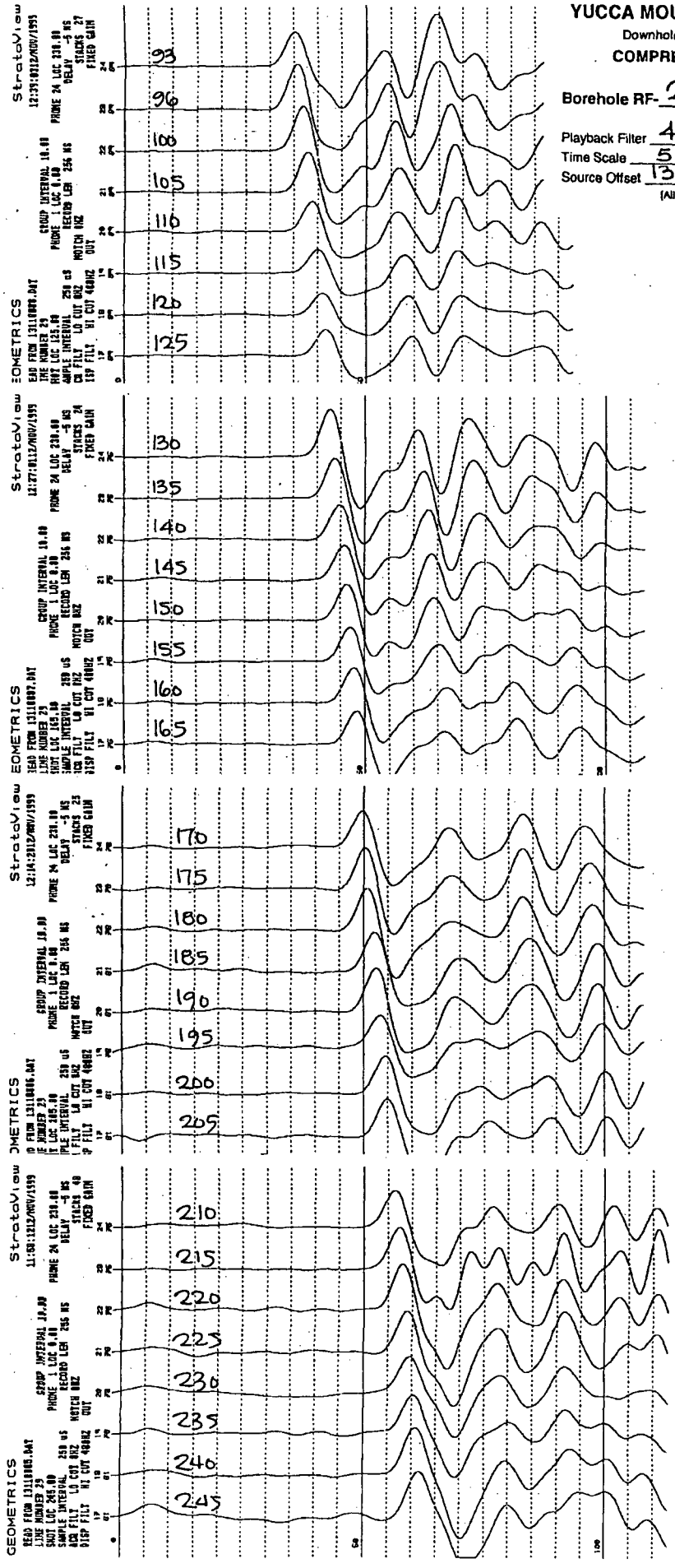
Borehole RF- 29

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 13.5 feet

(All depths in feet)



YUCCA MOUNTAIN PROJECT

Downhole Velocity Records

COMPRESSION WAVES

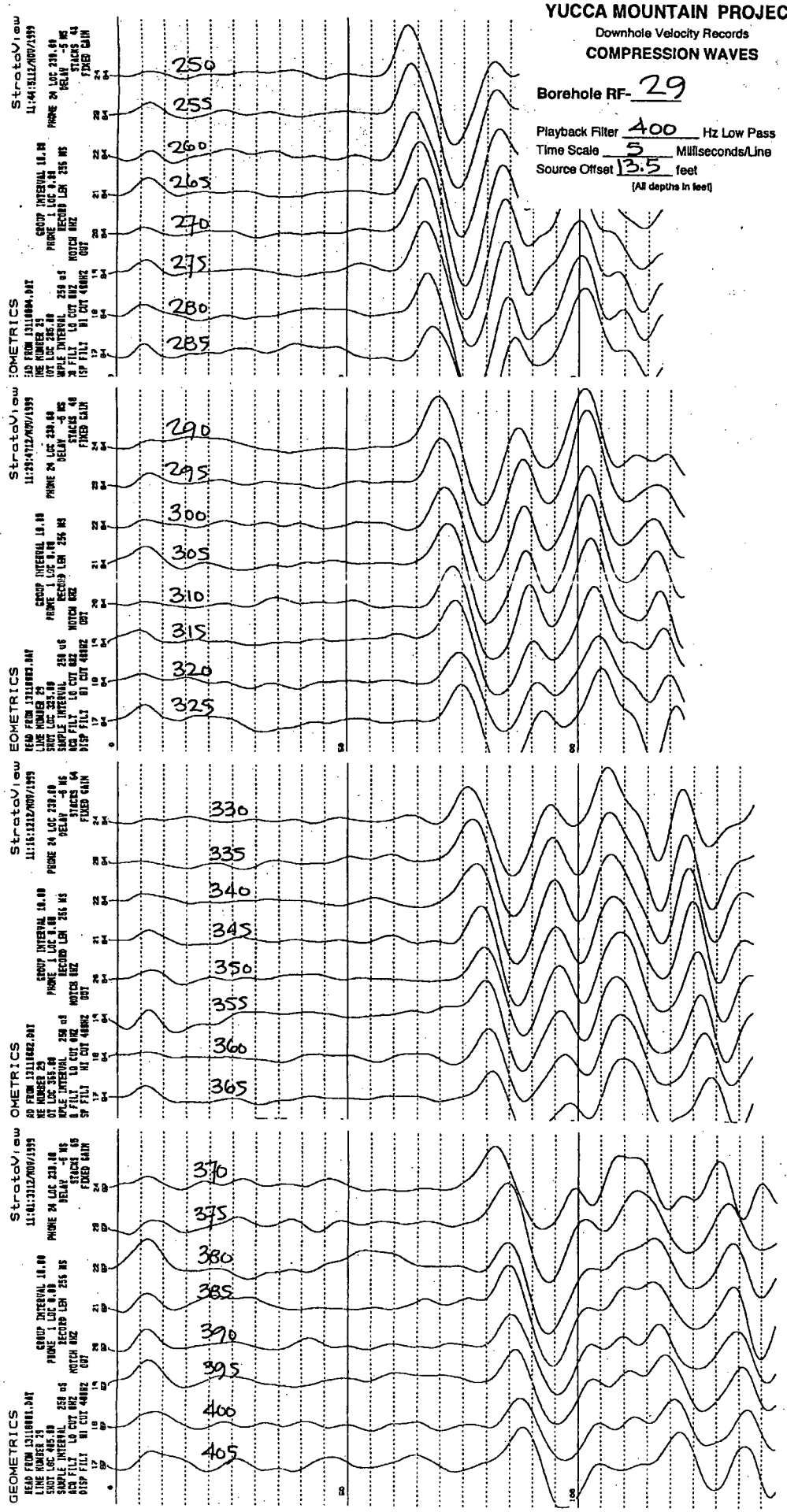
Borehole RF- 29

Playback Filter 400 Hz Low Pass

Time Scale 5 Milliseconds/Line

Source Offset 13.5 feet

(All depths in feet)



File List JL 2/27/02

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
SPECIAL INSTRUCTION SHEET

1. QA: QA

Page: 1 of: 1

Complete Only Applicable Items

This is a placeholder page for records that cannot be scanned.

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YMP DOWNHOLE DATA FOR WHB (WASTE HANDLING BUILDING) Vs & Vp TIMES VS DEPTH, EXCEL DATA FILES FOR SCIENTIFIC NOTEBOOK: SN-M&O-SCI-030-V1, REDPATH GEOPHYSICS, FINAL (REVISED OCT 2001)

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12. Traceability Designator
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13. Comments
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Downhole-Redpath_revised.zip

Software required:
WinZip
Microsoft Excel

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