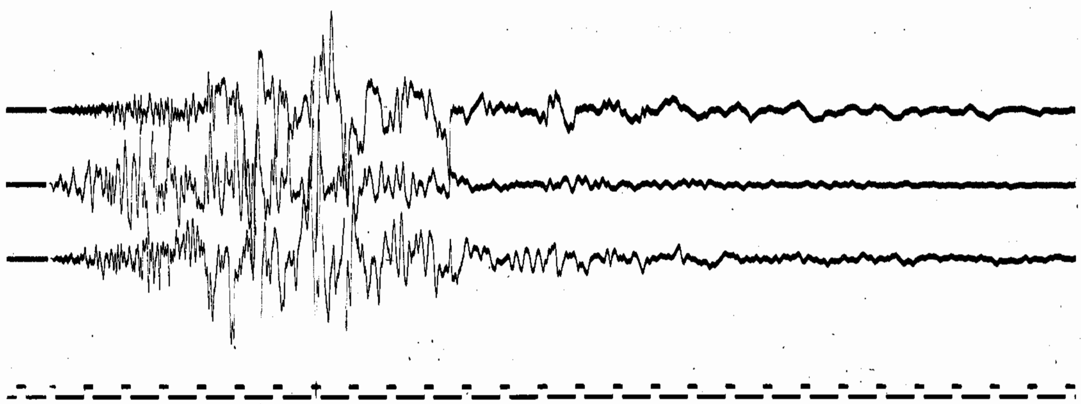
THE CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE OF FEBRUARY 6, 1987 AND PROCESSED STRONG-MOTION DATA



CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
OFFICE OF STRONG MOTION STUDIES
REPORT OSMS 87-04

1988

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THE CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE
OF FEBRUARY 6, 1987
AND
PROCESSED STRONG-MOTION DATA

Report No. OSMS 87-04
California Strong Motion Instrumentation Program

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Division of Mines and Geology
Office of Strong Motion Studies
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PREFACE

The Cerro Prieto earthquake (ML=5.4) occurred at 19:45 PST on February 6, 1987 in the Mexicali Valley, Baja California, Mexico. The earthquake epicenter was located approximately 6 km south of the Cerro Prieto volcano, approximately 34 km south of the international border. Minor damage was reported in the area. Three strong-motion records were recovered from a network maintained and operated by the Center of Scientific Investigation and Higher Education at Ensenada (CICESE) and the Institute of Geophysics and Planetary Physics (IGPP) at the University of California, San Diego (UCSD). Although the earthquake was of only moderate magnitude, a very large maximum horizontal acceleration of approximately 1.4 g was recorded at the Cerro Prieto station. Because of the unusually large horizontal accelerations and the importance of these data not only to Mexico but also to California, the California Strong Motion Instrumentation Program digitized and processed the Cerro Prieto accelerogram for distribution to engineers, seismologists, and others concerned with the seismic safety problem.

The first part of this report includes a brief overview of the earthquake characteristics, regional seismicity and strong-motion instrumentation in the area. The second part of the report presents the Cerro Prieto accelerogram and describes the accelerogram digitizing and processing procedure. In the appendix the results of the accelerogram digitization and processing are presented through a series of plots of the acceleration, velocity, and displacement, as well as the absolute acceleration and relative velocity response spectra.

CONTENTS

The CERRO PRIETO EARTHQUAKE
OF FEBRUARY 6, 1987

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INTRODUCTION

The Cerro Prieto earthquake of February 6, 1987 (ML=5.4) occurred approximately 6 km south of the Cerro Prieto volcano in northern Baja California, Mexico (see Figure 1). The mainshock was preceded by two foreshocks having magnitudes of about 3.0, and followed by many aftershocks with magnitudes as large as 3.8. The mainshock was felt strongly in the Mexicali Valley area; it was also felt at El Centro, Tijuana, Ensenada, San Diego, and Yuma, Arizona.

Three strong-motion records were recovered following the earthquake. One of the records was obtained by an analog accelerograph (SMA-1) at the Cerro Prieto station, the other two were obtained by digital accelerographs (DCA-310). An unusually large peak horizontal acceleration of approximately 1.4 g was recorded by the SMA accelerograph.

Minor damage was reported at the city of Mexicali (approximately 34 km north of the earthquake epicenter) where a few windows were cracked, local power was briefly disrupted and items fell from shelves. In the epicentral region the only engineered structure is the Cerro Prieto geothermal power plant. The plant is located about 6 km from the epicenter. Despite the high levels of acceleration recorded at the Cerro Prieto station, no damage was reported at the plant.

This section of the report briefly describes the earthquake characteristics, regional seismicity, and the strong-motion instrumentation in the area.

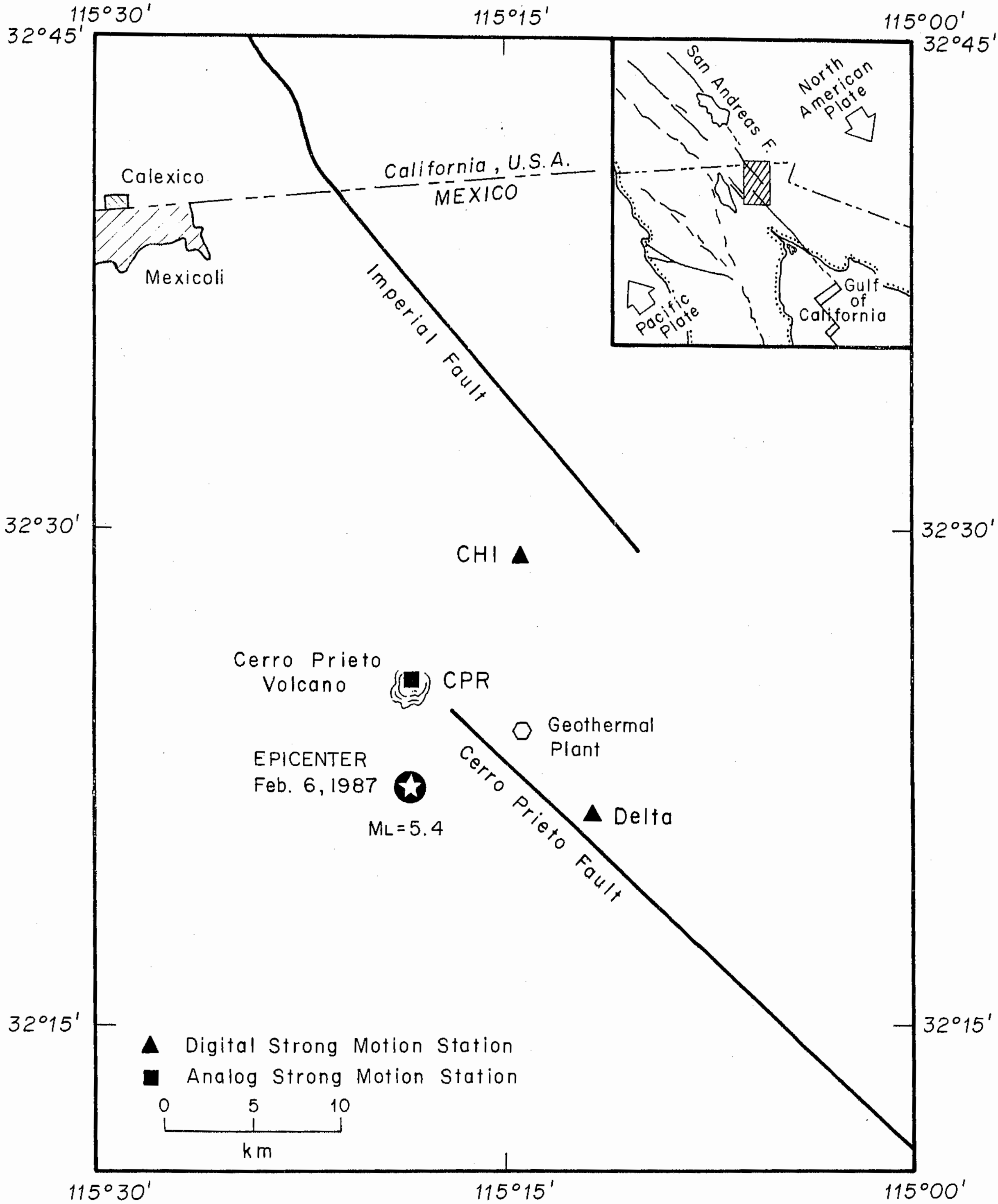

Figure 1. Map showing the locations of the three CICESE strong-motion stations that were triggered and the epicenter of the 1987 Cerro Prieto earthquake.

REGIONAL TECTONIC SETTING

The 1987 Cerro Prieto earthquake occurred near the northern end of the Cerro Prieto fault, one of the active faults in the Mexicali Valley region. In combination with the Imperial fault, this fault constitutes a right-stepping transform fault system that extends from the gulf of California onshore into the Salton Trough. The two faults are offset by a short spreading center just east of the Cerro Prieto volcano, and may be considered as the main boundary between the Pacific and North America tectonic plates. Historically, these two faults, together with the Laguna Salada-Cucapa fault system on the west side of the Mexicali Valley, have been responsible for the occurrence of at least 34 earthquakes with magnitudes larger than, or equal to, 5.0 from 1850 to 1985 (Anderson and Bodin, 1987). Twelve of these events had magnitudes between 6 and 7. Of these twelve, the February 23, 1892 and December 30, 1934 earthquakes probably occurred on the Laguna Salada-Cucapa fault system (Strand, 1980; Anderson and Bodin, 1987), the rest were associated with tectonic activity on the Cerro Prieto and Imperial faults.

HISTORICAL SEISMICITY

Instrumental detection of earthquakes in the Mexicali Valley was poor before 1970 when instrumentation of the north Baja California region began under collaborative efforts by CICESE, Universidad Nacional Autonoma de Mexico (UNAM) and UCSD. The data base that has accumulated since then indicates that the seismicity associated with the Cerro Prieto and Imperial fault systems consists primarily of swarms of small magnitude ($M_L \le 5.0$) earthquakes.

Figure 2 shows the seismicity of the Mexicali Valley region for

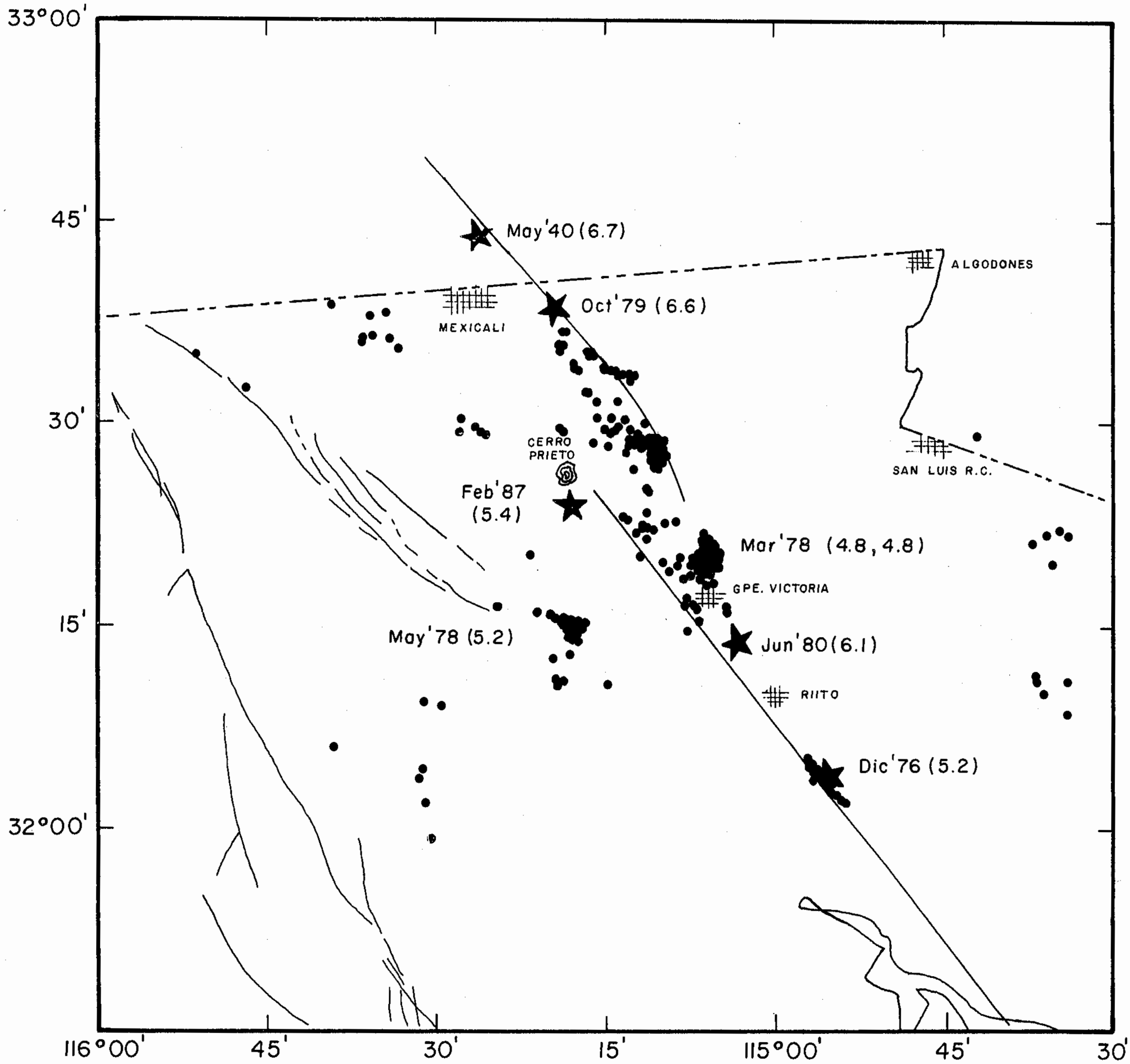

Figure 2. 1975-1980 seismicity in the Mexicali Valley region. The epicenters of the 1987 Cerro Prieto earthquake and the 1940 Imperial Valley earthquake are also shown for reference.

the period from 1975 to 1980 (Gonzalez, 1986). The most important events recorded in that period are the December 1976 Mesa de Andrade earthquake (ML=5.2, Nava and Brune, 1983; Gonzalez et al., 1984), the March 1978 Victoria swarm (ML up to 4.8, Munguia and Brune, 1984), the May 1978 Cucapa earthquake (ML=5.2), the October 1979 Imperial Valley earthquake (ML=6.6, Chavez et al., 1982), and the 1980 Victoria event (ML=6.1, Anderson and Simons, 1982).

The location of the 1987 Cerro Prieto earthquake is also indicated in Figure 2. The 1987 event was the largest earthquake that has occurred in the area since the 1980 Victoria event.

MAIN SHOCK LOCATION AND DAMAGE

The California Institute of Technology (CIT) Seismological Laboratory calculated a preliminary local magnitude of 5.4 for this earthquake (K. Hutton, CIT, personal communication). Their solution placed the hypocenter near 32.39N and 115.31W in the Mexicali Valley at a depth of 6 km. Two foreshocks of magnitude near 3.0 occurred on February 6, and several aftershocks with magnitude 3.0 or larger occurred after the mainshock. P-wave arrival times from three stations of the permanent North Baja California Seismic Network (RESNOR) and two temporary smoked paper seismographs installed by CICESE at the Cerro Prieto geothermal field prior to the main event were combined with data from the closest stations of the USGS/CIT southern California array to determine a more accurate hypocenter. The closest station was 5 km from the calculated epicenter. A velocity model composed of flat homogeneous layers was used with program HYPO71 (Lee and Lahr, 1975) to calculate the earthquake parameters. The results were:

Origin Time: 03:45:14.69 GMT 7 February 1987
Hypocenter: 32.370N, 115.300W, 5.6 km depth

CICESE began to deploy six additional portable analog seismographs in the epicentral area about 24 hours after the main event to record the aftershock activity. Many aftershocks were recorded and a detailed study is being conducted by CICESE.

The shaking of the mainshock was strongly felt in the city of Mexicali which is located at about 35 km from the earthquake epicenter. However, only minor damages, such as cracked windows, brief local power disruption, and items knocked from shelves, were reported in the urban area. The seismic shaking was also felt at Tecate and as far as Tijuana, Ensenada, and San Diego.

In the epicenter region the only important structure is the Cerro Prieto geothermal power plant which has been in operation since 1973. The plant is located about 6 km from the epicenter and 6 km from the Cerro Prieto volcano. In spite of the high level of shaking at Cerro Prieto volcano, there was no damage reported at the plant.

During a field survey in the epicenter region a few very narrow fissures and rock slides along the road to the top of the Cerro Prieto volcano were observed (Mendoza et al., 1987). Sand boils were found in some localized areas west of the geothermal plant and at Ejido Saltillo, about 17 km northeast from the epicenter (J. Gonzalez, CICESE, personal communication).

STRONG-MOTION STATIONS AND INSTRUMENTATION

The locations of the earthquake epicenter and the CICESE-UCSD strong-motion stations that recorded the earthquake are shown in Figure 1. Records from a total of three accelerographs were recovered. The closest instrument to the epicenter was the SMA-1 accelerograph at the station of Cerro Prieto. This instrument is located on the east side of Cerro Prieto volcano at an elevation of approximately 110 meters above sea level. The base of the volcano has an elevation of 30 meters and a radius of about 1 km; the peak is at an elevation of 210 meters, 180 meters above the base (see Figure 3).

Strong-motion records were also obtained at two stations, Delta and Chihuahua, located about 10 and 13 km from the epicenter, respectively. At these stations ground motion was recorded on digital accelerographs (DCA-310) with force balance accelerometers. These stations are underlain by alluvial sediments while the Cerro Prieto volcano is composed of a basalt breccia.

The Cerro Prieto accelerograph site is shown in Figure 4. The accelerograph is mounted on a concrete pedestal and housed in a protective steel enclosure. The concrete pedestal is 3.8 feet long by 2.6 feet wide, 21 inches tall above the surface, and embedded to a depth of 10 inches. This is possible because, although the volcano is entirely composed of basalt breccia, there is a very thin weathered filled layer immediately below the accelerograph pier. An excavation there revealed that the soil in the upper 10 inches is loose and can be easily removed. Below that, the soil is harder, with embedded rock fragments. The size of these solid rock fragments increases with depth to about 1 foot across at the depth of 3 feet. Concrete piers extending to a depth of approximately 3 feet into the earth have been attached to opposing corners of the

(a)

(b)

Figure 3. (a) Cerro Prieto volcano. (b) Close-up view of the Cerro Prieto volcano. The arrow indicates the location of the accelerograph.

(a)

Figure 4. (a) Photograph of the Cerro Prieto strong-motion station showing the accelerograph enclosure, concrete pedestal, and the WWVB antenna mast.
(b) Close-up view of the enclosure and concrete pedestal. Anchoring pier attached to corner of pedestal is also shown.

(b)

concrete pedestal to provide adequate anchoring (J. Prince, UNAM, personal communication, 1987). A 9-foot mast anchored to the concrete pedestal is used for mounting solar panels and WWVB antenna.

Table 1 lists geographic coordinates, site geology, epicentral distance, and peak values of motion for each of the three stations. A photographic reproduction of the Cerro Prieto accelerogram is shown in Figure 5. Peak accelerations shown on the record are 0.69 g for the vertical component and 0.93 g and 1.40 g respectively for the two horizontal components. The results of digitizing and processing the Cerro Prieto record are presented in the next section of this report.

TABLE 1. STRONG MOTION DATA FROM THE 1987 CERRO PRIETO EARTHQUAKE

Station Name	Station Coordinates N.Lat.	Station Coordinates W.Long.	Site Geology	Epicentral Distance (km)	Component Azimuth (deg.)	Peak Accel. (g)	Peak Velocity (cm/sec)	Peak Displ. (cm)
Cerro Prieto	32.42	115.30	Rock	5.6	251	-0.93#	-54.2	9.3
					Up	-0.69#	18.5	-3.1
					161	1.45#	46.3	13.1
Delta	32.36	115.19	Alluvium	10.4	352	0.14	-10.9	-2.7
					Up	-0.09	-1.7	-0.6
					262	0.17	-8.1	1.3
Chihuahua	32.48	115.24	Alluvium	13.4	12	0.31	-2.4	3.5
					Up	-0.12	-3.5	-0.6
					282	-0.33	-37.1	-4.4

Footnote:
- Volume 1 peak acceleration values.

The high recorded peak acceleration of 1.4 g is unusual for a magnitude 5.4 earthquake. However, other earthquakes in the Mexicali - Imperial Valley area have also generated high

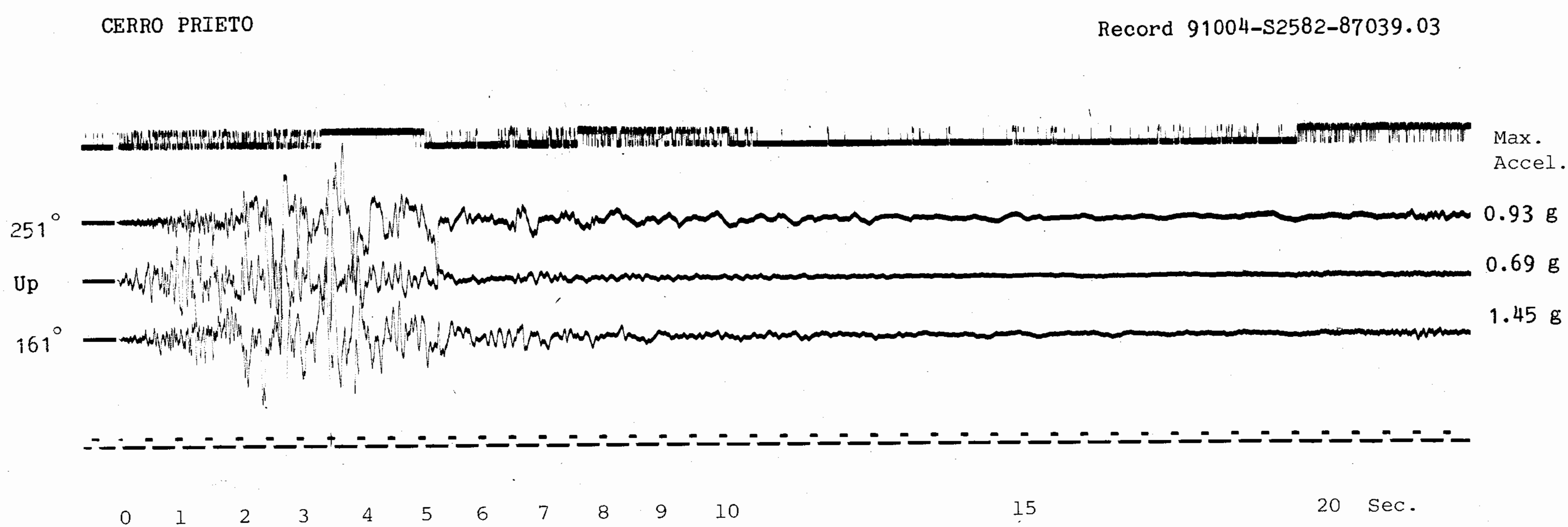

Figure 5. Accelerogram obtained from the Cerro Prieto station during the February 6, 1987 Cerro Prieto earthquake.

accelerations. For example, during the 1978 Victoria earthquake swarm a 4.8 magnitude earthquake generated ground acceleration of 0.6 g at the Victoria station which was less than 8 km from the earthquake epicenter (Munguia and Brune, 1984). Several cycles of peak vertical acceleration exceeding 1 g were recorded at Victoria station about 2 km from the 1980 Victoria earthquake of magnitude 6.1(ML) (Simons, 1982). For comparison, a peak of 1.74 g was recorded in the vertical direction at the El Centro Array station 6, on soil, during the 1979 Imperial Valley earthquake (Porcella et al., 1982). The Cerro Prieto strong-motion station recorded a peak horizontal acceleration of 0.56 g and vertical acceleration of 0.28 g during the 1980 Victoria earthquake (epicentral distance about 30 km) (Simons, 1982; Munguia and Brune, 1984).

The strong-motion data recorded by the digital recorders at Delta and Chihuahua show peak acceleration values which are considerably lower than the ones recorded at the Cerro Prieto station (see Table 1).

ACKNOWLEDGMENTS

We wish to thank Oscar Galvez and Luis Orozco from CICESE, and Paul Bodin from UCSD for their contribution in the maintenance of the North Baja California Strong Motion Array. Javier Gonzalez from CICESE provided the epicenter location. Appreciation is extended to CICESE and NSF for providing the financial support necessary to maintain and operate the array. Pictures in Figures 3 and 4 were taken by Tony Shakal of CSMIP when the tilt test of the instrument was done after the earthquake.

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PROCESSED STRONG-MOTION DATA FROM
CERRO PRIETO STATION

by

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INTRODUCTION

Following the ML 5.4 Cerro Prieto earthquake of February 6, 1987 three strong-motion records were recovered from a network maintained and operated by the Center of Scientific Investigation and Higher Education at Ensenada (CICESE) and the Institute of Geophysics and Planetary Physics (IGPP) at the University of California, San Diego. A large horizontal acceleration of approximately 1.4 g was recorded at the Cerro Prieto station. Because of the unusually large horizontal acceleration and the importance of these data not only to Mexico but also to California, the California Strong Motion Instrumentation Program (CSMIP) digitized and processed the Cerro Prieto accelerogram for distribution to engineers, seismologists, and others concerned with the seismic safety problem.

This section of the report is focused on the digitization and processing of the analog accelerogram recovered from the Cerro Prieto strong-motion station. In the appendix the results of digitization and processing are presented through a series of plots of the acceleration, velocity, and displacement, and of the absolute acceleration and relative velocity response spectra.

PARTICULAR CHARACTERISTICS OF THE ACCELEROGRAM

A photographic reproduction of the Cerro Prieto accelerogram is shown in Figure 1. Field calibration of the instrument was performed after the earthquake to determine the sensitivity, natural frequency and damping for each channel. Because the record has large amplitudes and many trace crossings, a photographic enlargement of the high acceleration section was made and is shown in Figure 2. Peak accelerations shown on the record are 0.69 g for the vertical component, and 0.93 g and 1.45 g respectively for the two horizontal components.

The large acceleration peaks on the record stand out as pulses on a background of lower acceleration values. The results of the field calibration tests performed on the instrument in May 1987 indicate no unusual behavior of the instrument. This station has produced records containing similar spikes during previous earthquakes (see, for example, Anderson, et al., 1982). Other stations have produced spikes similar to this including the CSMIP station at Long Valley Dam and the USGS station at Bonds Corner. Co-location of CSMIP and USGS instruments of two different types at Long valley Dam indicates that the site, rather than the instrument, is the origin for the spikes in that case. The spikes in the Cerro Prieto record are very short in duration (less than 0.1 second), so their importance to the response of specific structure must be considered carefully.

The upgoing acceleration peak preceding the downgoing 1.2 g peak on channel 3 at about 2.6 seconds is not visible (see Figure 2) apparently because the excursion of light beam exceeded that allowed by the internal mirrors. A photographic enlargement (6 times the original) was made of this section, and the trace was extrapolated to the estimated peak. Assuming that the invisible upgoing pulse is similar in shape to the following large downgoing pulse, the peak acceleration was calculated to be about 1.45 g. For comparison, a simple extension of the signal traces using straight lines to their crossing yields an acceleration peak larger than 1.45 g. Processing the record with different peak values indicated that the exact value

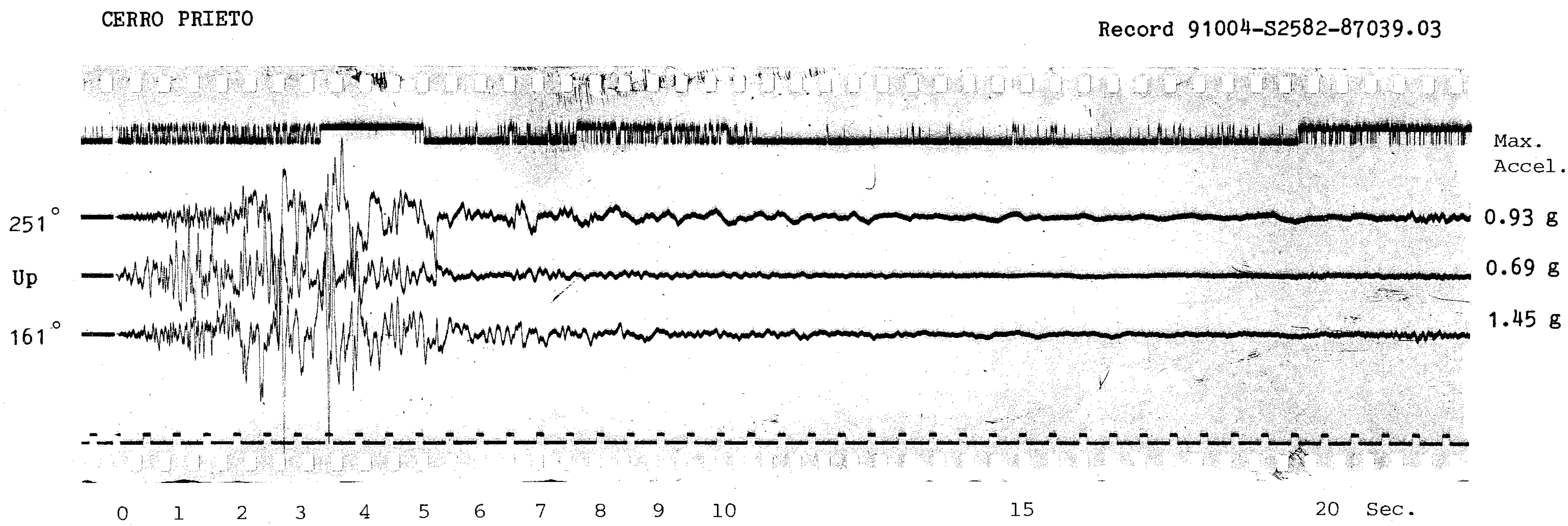

Figure 1. Accelerogram obtained from the Cerro Prieto station during the February 6, 1987 Cerro Prieto earthquake.

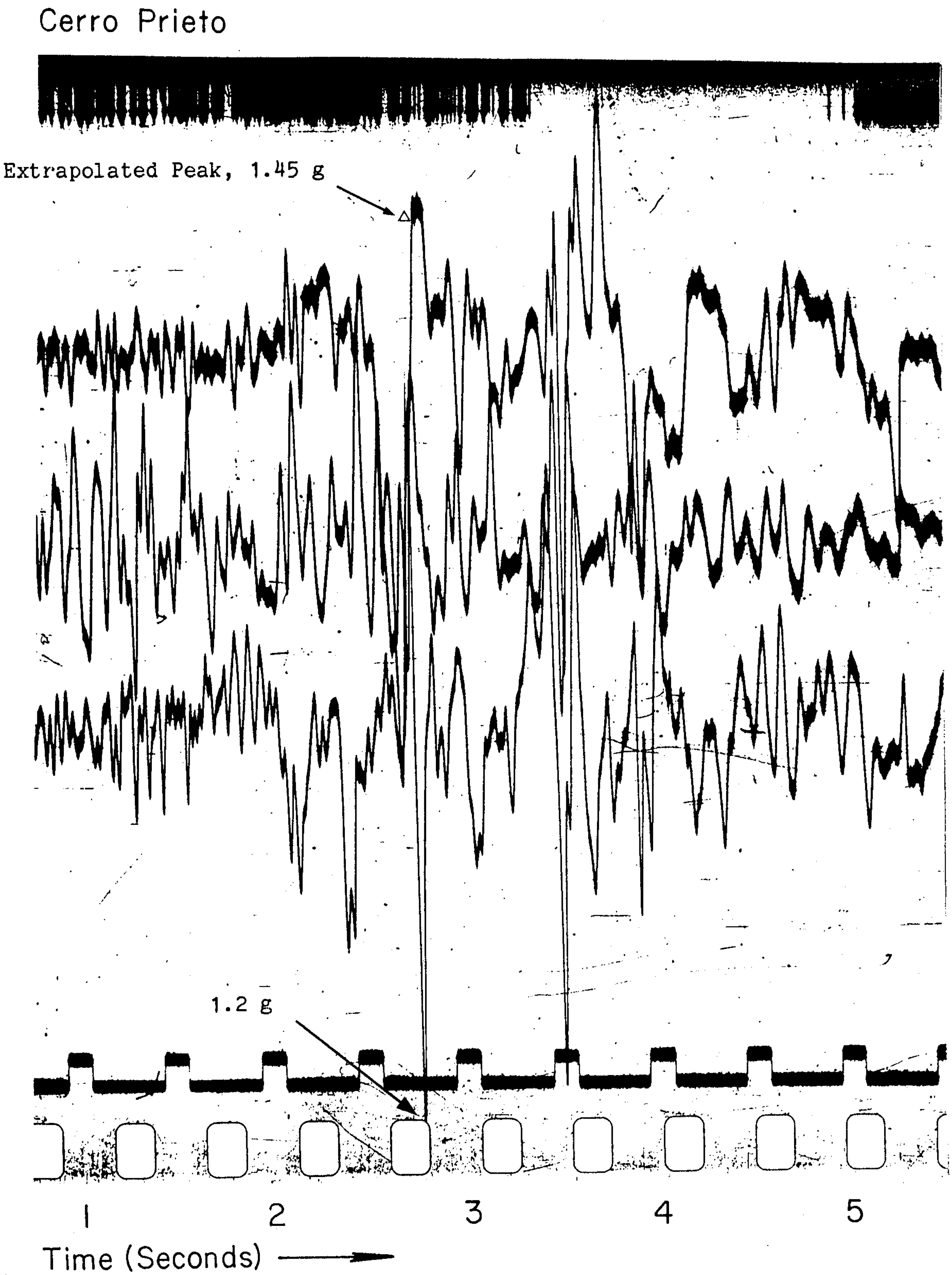

Figure 2. A photographic enlargement of the large amplitude portion of the Cerro Prieto record.

of this peak has little effect on the integrated velocity and displacement.

As evident in Figure 1, there are no fixed, or reference, traces on the film record. The low portions of the 2 pulse-per-second time trace at the bottom edge of the film were connected to form an ersatz fixed trace. This fixed trace was used in the film drift correction procedure discussed below. Although the film drift correction is expected to be less accurate as a result, no evidence of increased processing noise is apparent in the final results.

ACCELEROGRAM DIGITIZATION AND PROCESSING

The digitization results presented in this report were obtained using the CSMIP computer-driven optical scanning system. This facility is patterned after the system developed at the University of Southern California (Trifunac and Lee, 1979; Lee and Trifunac, 1979). In this system, a direct photographic negative copy of the film accelerogram is mounted on a rotating drum, which is scanned by a photodensitometer. The photodensitometer is mounted on a carriage moving perpendicular to the rotational direction of the drum. The resulting x-y array of optical density values is converted to raw time series through several trace-reconstruction steps. Baseline and other corrections are then applied to this raw data to obtain the acceleration data for further processing and spectral analysis. The subsequent post-digitization processing is similar to that first developed at the California Institute of Technology (Trifunac and Lee, 1973). As discussed in greater detail below, a change of algorithm was used to improve the instrument correction procedure at high frequencies. In addition, the results of system noise analyses are used to guide the selection of filter corner frequencies in CSMIP processing.

The sequence of steps in processing a record is summarized in the following:

1. The film record, 70 mm wide and about 60 cm (60 seconds) long, is contact-copied onto a 25 cm by 25 cm high-contrast photographic negative; three sections of the record, each approximately 22 cm (22 seconds) in length, are copied onto a single negative. To facilitate subsequent reconstruction of the original record, adjacent sections are copied so that they have an overlap of approximately 2 seconds. For further details, refer to the report by Trifunac and Lee (1979).

2. The negative containing the three sections of the accelerogram is scanned and converted into x and y coordinates by the optical scanner and computer. The scanner sampling rate used for these records is 200 samples per centimeter in x and y. This is nominally equal to a time step of 0.005 second (200 samples/sec) and an acceleration increment of 0.003 g.

3. The raw x,y data from the individual sections are concatenated to form continuous acceleration traces, straight-line reference traces and timing traces.

4. Volume I Processing. The reference trace (the modified two pulse-per-second time trace for this record) is subtracted from the acceleration traces to remove any spurious film-movement effects. The axis of zero acceleration is determined by assuming the entire record has zero mean. The time-mark traces are used to obtain an accurate time scale. The starting times of the acceleration

channels are adjusted so any time phasing error from one channel to another is less than 0.02 sec (i.e., less than one time increment in the Volume II data). The instrument sensitivities are used to scale ordinate values to accelerations. For this record, a record length of 40 seconds was processed.

5. Volume II Processing. The Volume I acceleration data are interpolated to obtain exactly 200 pts/sec sampling (100 Hz Nyquist frequency). The instrumental data are corrected to true acceleration using a simple finite-difference based instrument correction operator. A high-frequency Ormsby filter with a corner frequency of 23 Hz and a roll-off termination frequency of 25 Hz is applied. The data are then decimated to 50 pts/sec (25 Hz Nyquist). As discussed in Shakal and Ragsdale (1984), this order (instrument correction prior decimation) improves the accuracy of the instrument correction procedure at high frequencies while still using the same simple operator used in the original Caltech code (Trifunac and Lee, 1973). The acceleration data are initially corrected for long-period errors by using a low-frequency Ormsby filter with a ramp from 0.05 to 0.07 Hz. Velocity and displacement are integrated from acceleration and filtered using the same low-frequency Ormsby filter as for the acceleration. To prevent the introduction of spurious long-period energy through aliasing, an Ormsby filter rather than a running mean filter is used prior to the decimation associated with the long period filtering (Shakal, 1982; Shakal and Ragsdale, 1984).

6. Volume III Processing. The response spectra for periods from 0.04 to 15 seconds and damping values of 0, 2, 5, 10 and 20 per cent of critical are calculated from the accelerations obtained in

Step 5. The Fourier amplitude spectral values are also computed for these periods. A preliminary plot of the pseudo-velocity(PSV) response spectrum is generated for use in filter selection.

7. The Volume II Processing of Step 5 is repeated, but with a new low-frequency Ormsby filter to remove long-period noise in the record. The corner frequency of the filter used depends on the signal-to-noise ratio in the record and the noise level of the digitizing system. The long-period intersection of the PSV spectrum obtained in Step 6 and the CSMIP system average noise spectrum shown in Figure 3 (from Shakal and Ragsdale, 1984) indicates the long-period limit of useful information. An iterative procedure is used, with the filter corner being set at progressively shorter periods in order to remove the long period noise while preserving as much of the signal as possible. The final value of the filter corner used is shown on the titles of the plots. The acceleration, velocity and displacement time histories obtained using this filter are the final Volume II data written on a magnetic tape and presented in this report.

8. The final relative velocity response spectrum (SV), relative displacement response spectrum (SD), absolute acceleration response spectrum (SA), and Fourier amplitude spectrum (FS) are computed using the final filter settings. The pseudo-velocity response spectra (PSV) computed from SD are plotted on tripartite logarithmic paper and presented in this report. In addition, the SA spectra are plotted versus period with a linear scale.

As discussed above, Figure 3 shows the average noise spectrum for the CSMIP digitization system. It is also useful to consider the noise characteristics in terms of actual time-domain amplitudes.

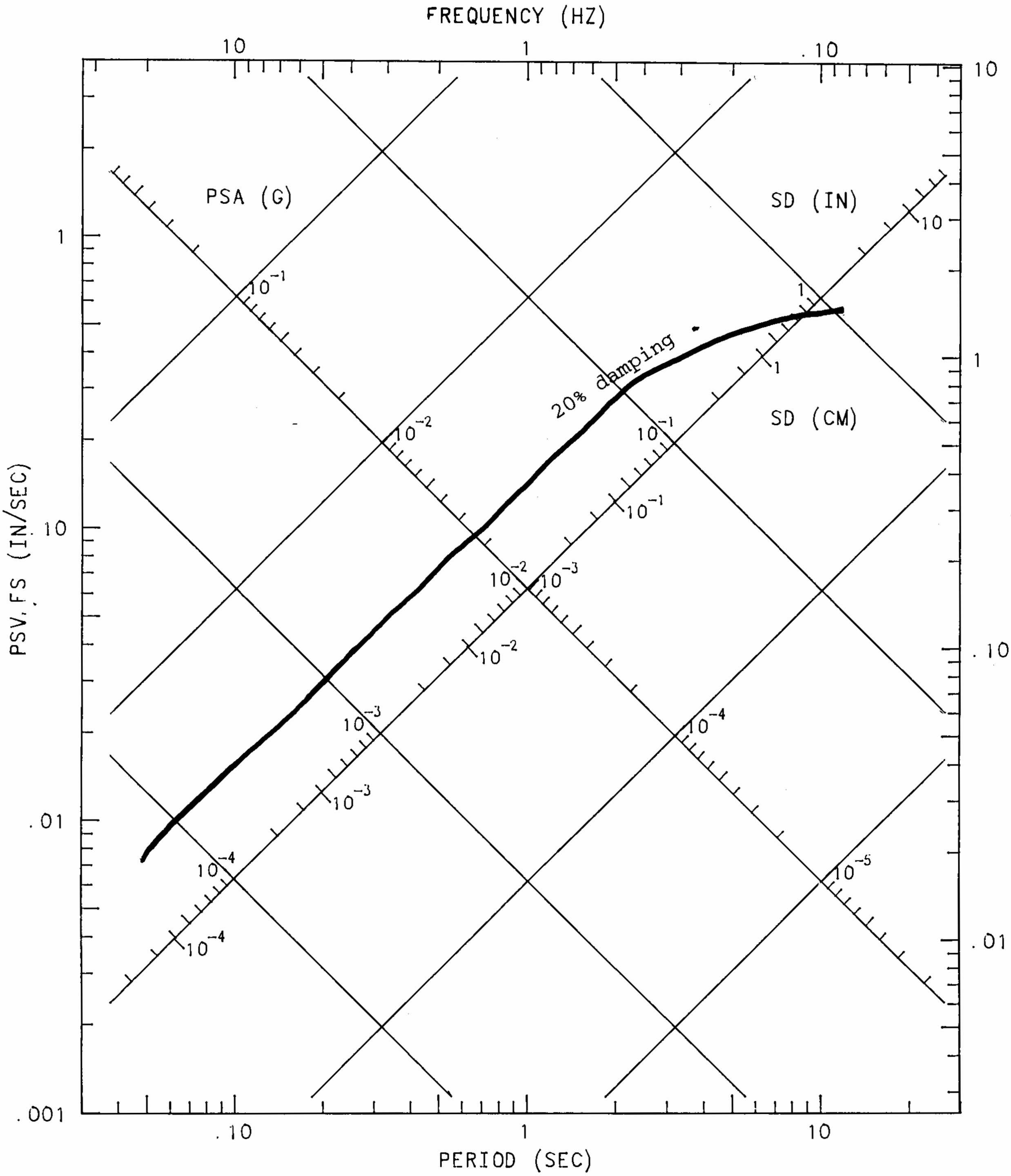

Fig. 3. Noise-level spectra (PSV, 20% damping) for the CSMIP digitization system (from Shakal and Ragsdale, 1984).

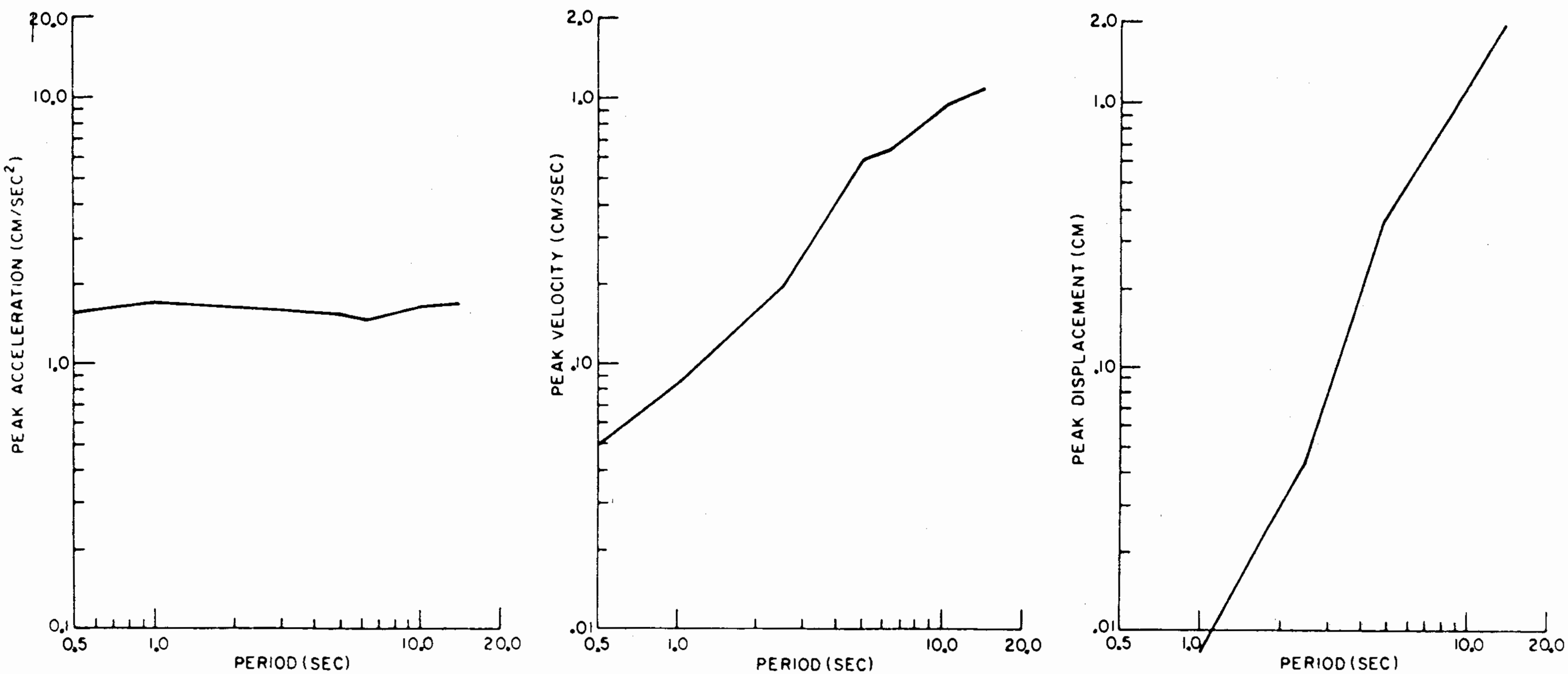

Fig. 4. Processing noise present in a typical acceleration (left), velocity (middle) and displacement (right) record processed with a long-period filter cut-off period ranging from 0.5 sec to 15 secs (from Shakal and Ragsdale, 1984).

Figure 4 shows typical noise amplitudes present in acceleration, in velocity, and in displacement time histories obtained for different long-period filter cutoff settings. For example, Figure 4 indicates that for a filter cutoff near 10 seconds, the expected noise level is near 0.002 g in acceleration, 1 cm/sec in velocity, and 1 cm in displacement.

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DATA AVAILABILITY

The processed data for the strong-motion records presented in this report are available on a magnetic tape (named CERROPRIETO87) which contains the Volume I, II and III results. The tape is written in a standard CSMIP format, similar to that of the California Institute of Technology tapes, which is documented in Shakal and Huang (1985). The tape is available in standard ASCII or EBCDIC blocked (unlabeled) coding, and can be obtained at nominal cost from either of the two institutions:

Office of Strong Motion Studies
Division of Mines and Geology
California Department of Conservation
630 Bercut Drive
Sacramento, California 95814

Centro de Investigacion Cientifica
y Educacion Superior de Ensenada
Av. Espinoza No. 843
Ensenada, Baja California
Mexico

APPENDIX

PLOTS OF PROCESSED DATA

Organization and Order of Plots

In this appendix, the processed data plots and related information for each station are presented in the following order:

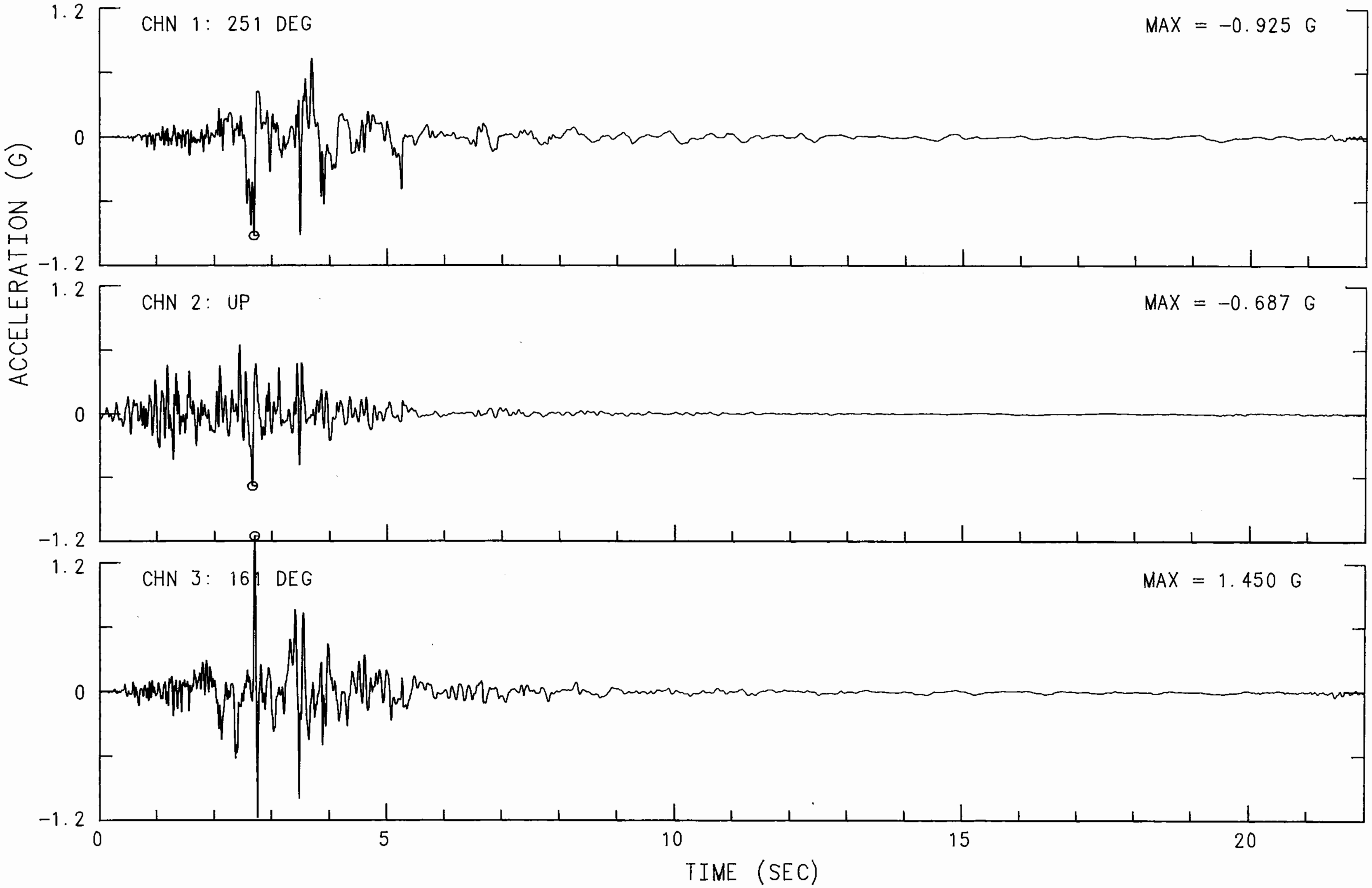
1. Uncorrected accelerograms (Vol. I data). The three components of the acceleration for the first 22 seconds are plotted with a common scaling factor and a common 22-second time axis length (which corresponds to a time scale of approximately 1 second per centimeter, like a film accelerogram). This plot is followed by another of the full digitized length with each component individually scaled.

2. Instrument and baseline-corrected acceleration, velocity and displacement (Vol. II data). The filters used are indicated on the plots. There is one 22-second plot per component; they are plotted with equal scaling for all three components.

3. Absolute acceleration response spectra (Vol. III data). The absolute acceleration (Sa) spectra for 0%, 2%, 5%, 10% and 20% dampings are plotted, all three components on a single page, with linear-linear scaling.

4. Response and Fourier amplitude spectra (Vol. III data). One spectral plot per component. The spectra are plotted for periods from 0.04 second (25 Hz) to 8.5 seconds (0.12 Hz) in these figures. This period range corresponds to the final filter used in the Vol. II processing.

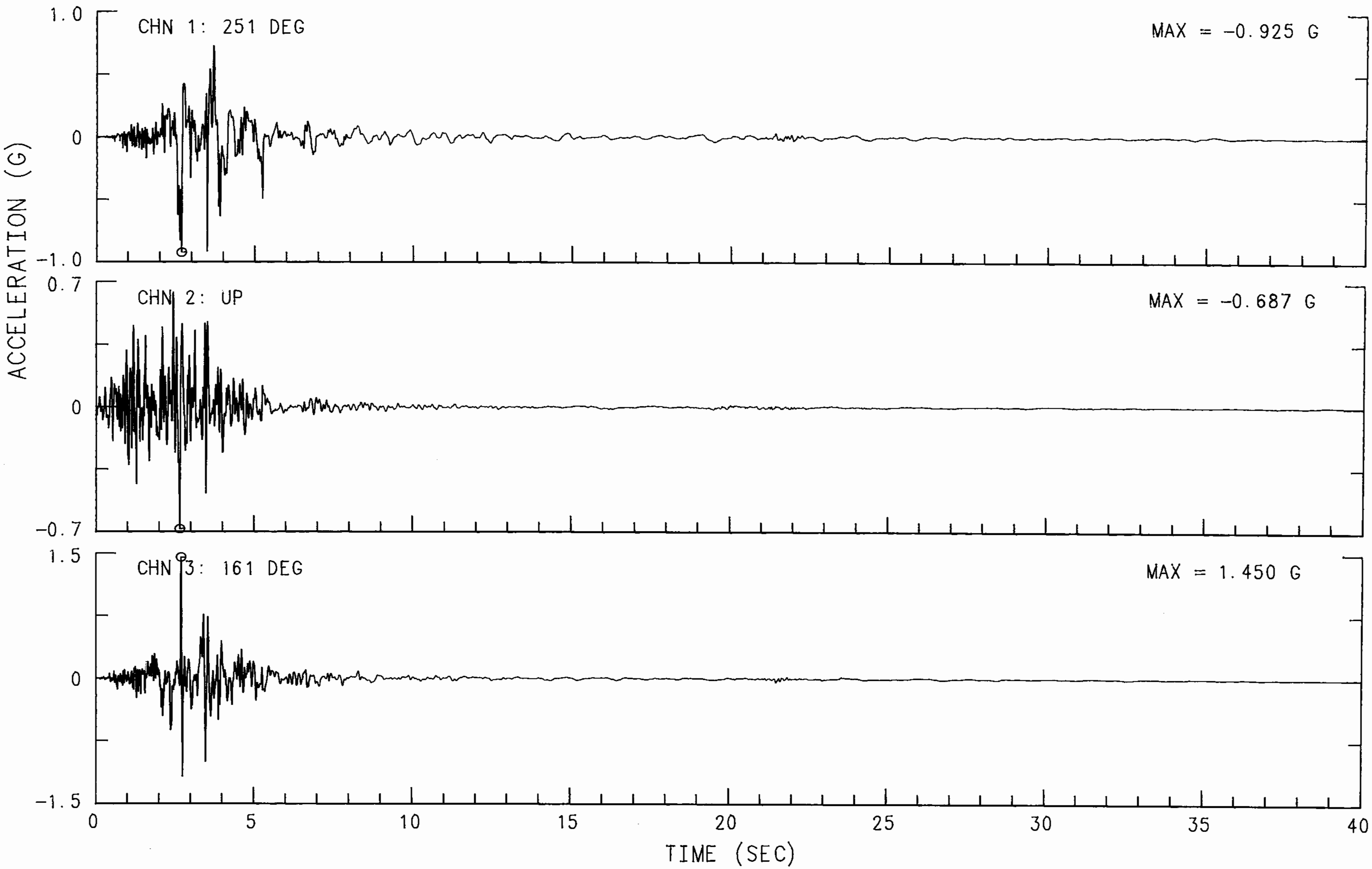
CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST
CERRO PRIETO, BAJA CALIFORNIA
UNCORRECTED ACCELEROGRAM 91004-S2582-87039.03 041488.1434-QC87A004



CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE   FEBRUARY 6, 1987 19:45 PST

CERRO PRIETO, BAJA CALIFORNIA

UNCORRECTED ACCELEROGRAM 91004-S2582-87039.03 041488.1434-QC87A004

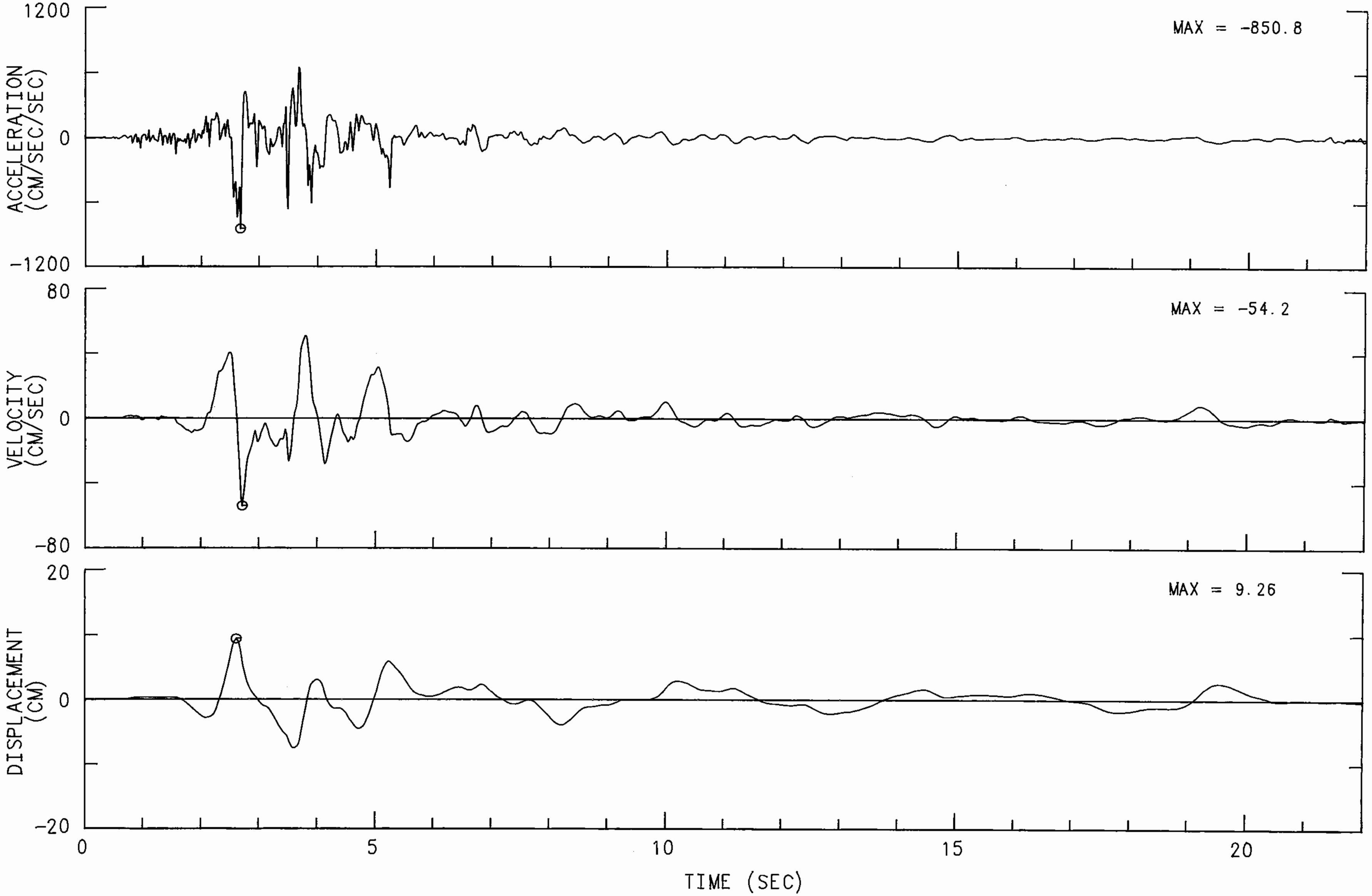


CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST

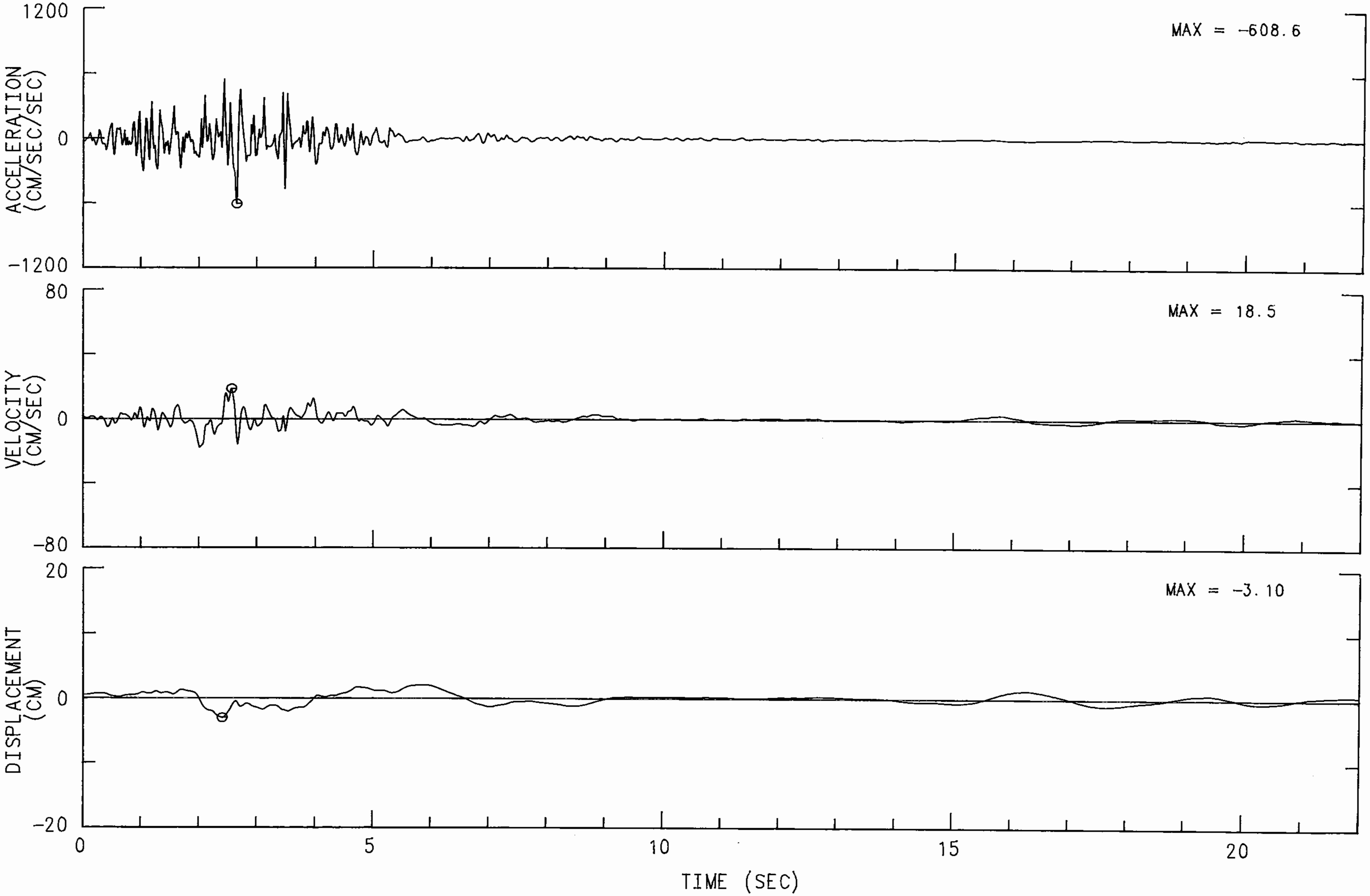
CERRO PRIETO, BAJA CALIFORNIA CHN 1: 251 DEG

INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT

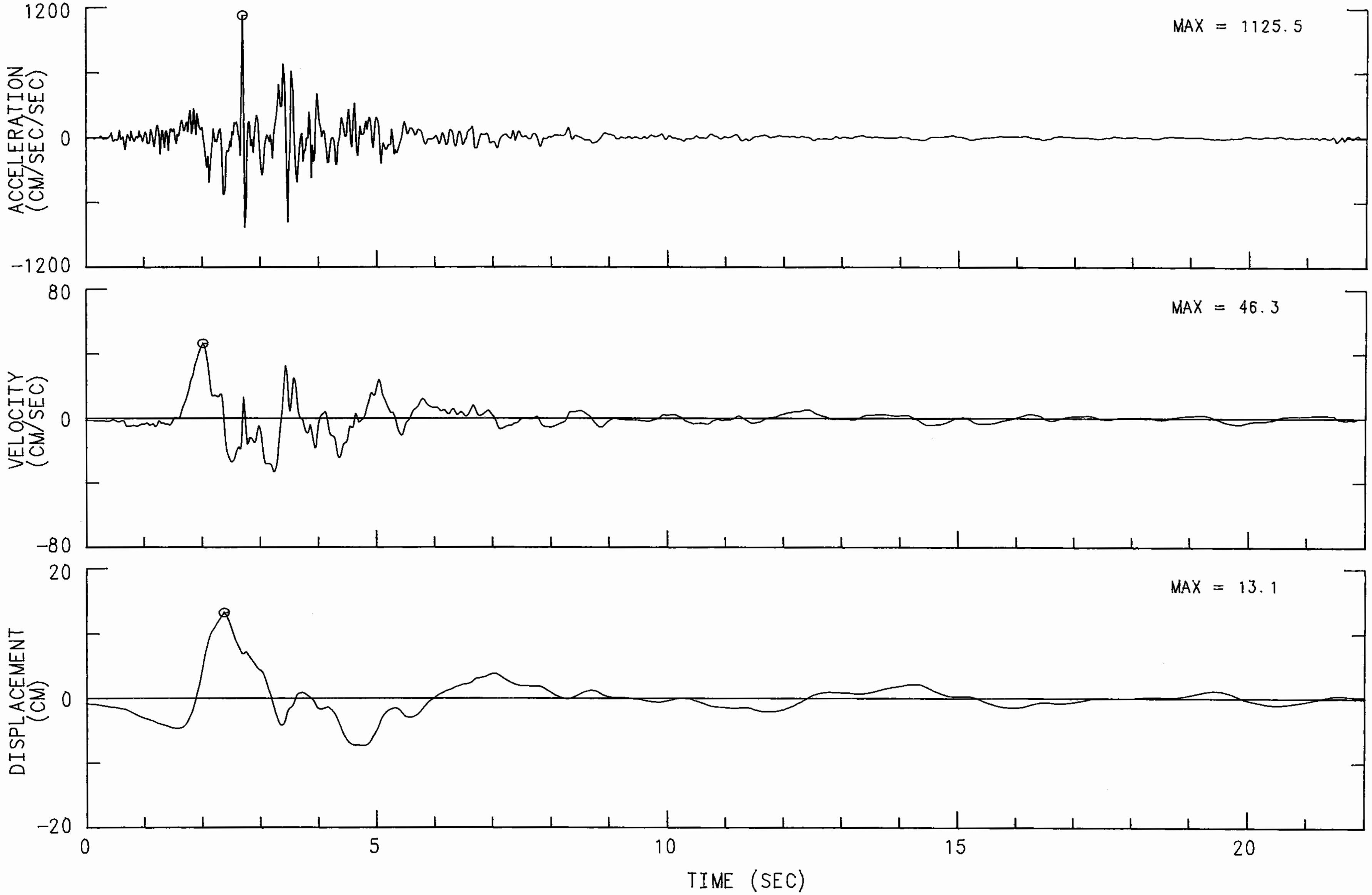
FILTER BAND: .08-.16 TO 23.0-25.0 HZ. 91004-S2582-87039.03 041488.1456-QC87A004



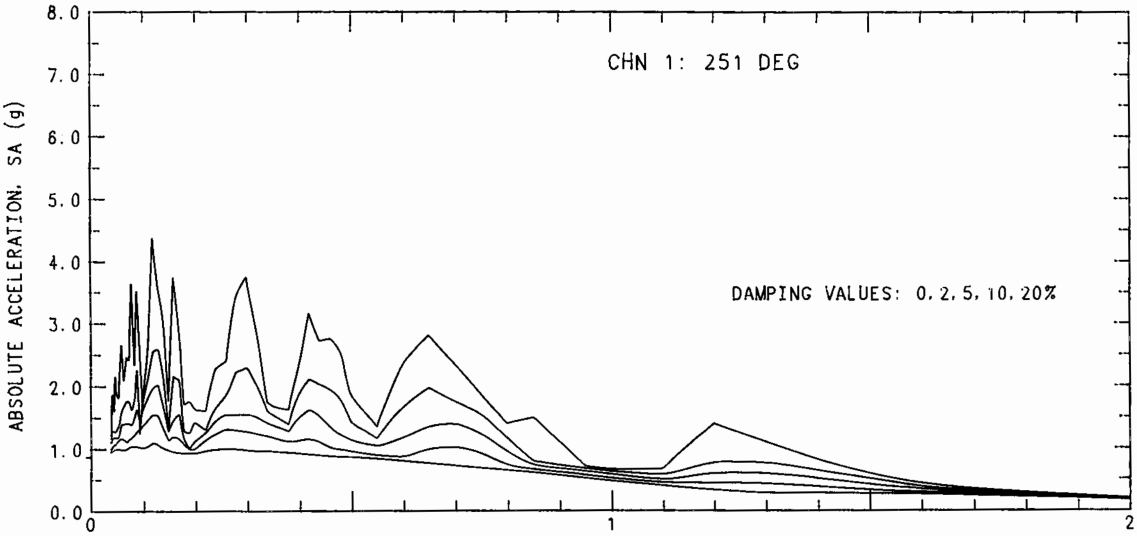
CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST
CERRO PRIETO, BAJA CALIFORNIA CHN 2: UP
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: 08-.16 TO 23.0-25.0 HZ. 91004-S2582-87039.03 041488.1456-QC87A004

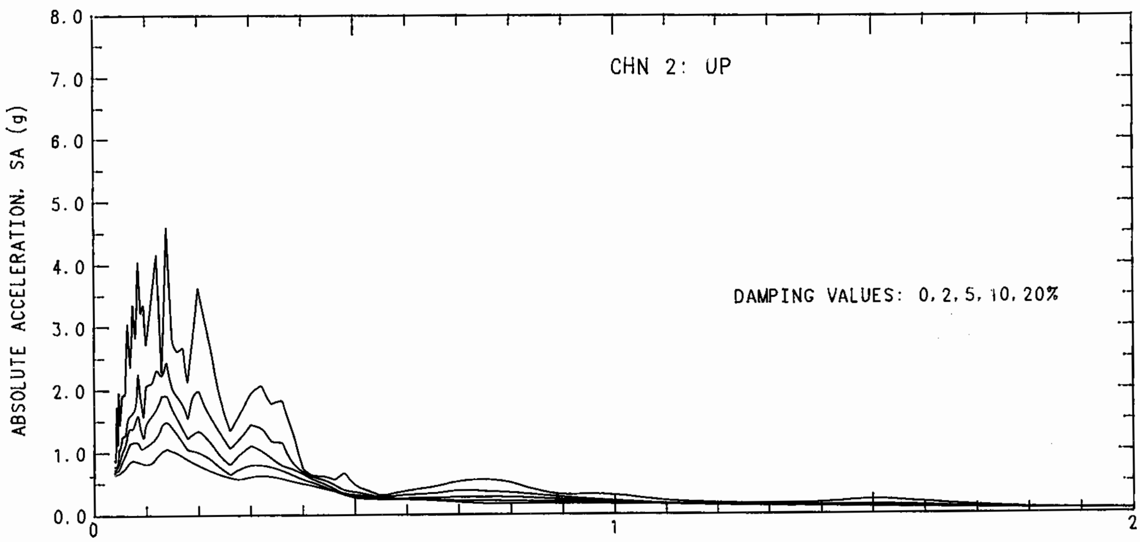


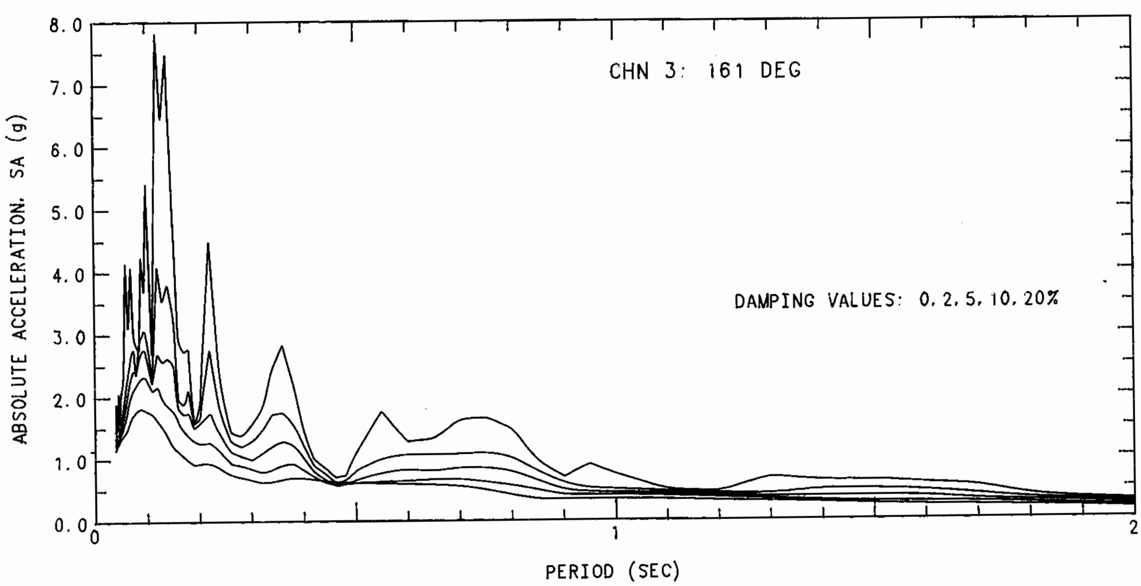
CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST
CERRO PRIETO, BAJA CALIFORNIA CHN 3: 161 DEG
INSTRUMENT-CORRECTED AND BANDPASS-FILTERED ACCELERATION, VELOCITY AND DISPLACEMENT
FILTER BAND: .08-.16 TO 23.0-25.0 HZ. 91004-S2582-87039.03 041488.1456-QC87A004



CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST
CERRO PRIETO, BAJA CALIFORNIA
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
91004-S2582-87039.03 041488.1512-QC87A004







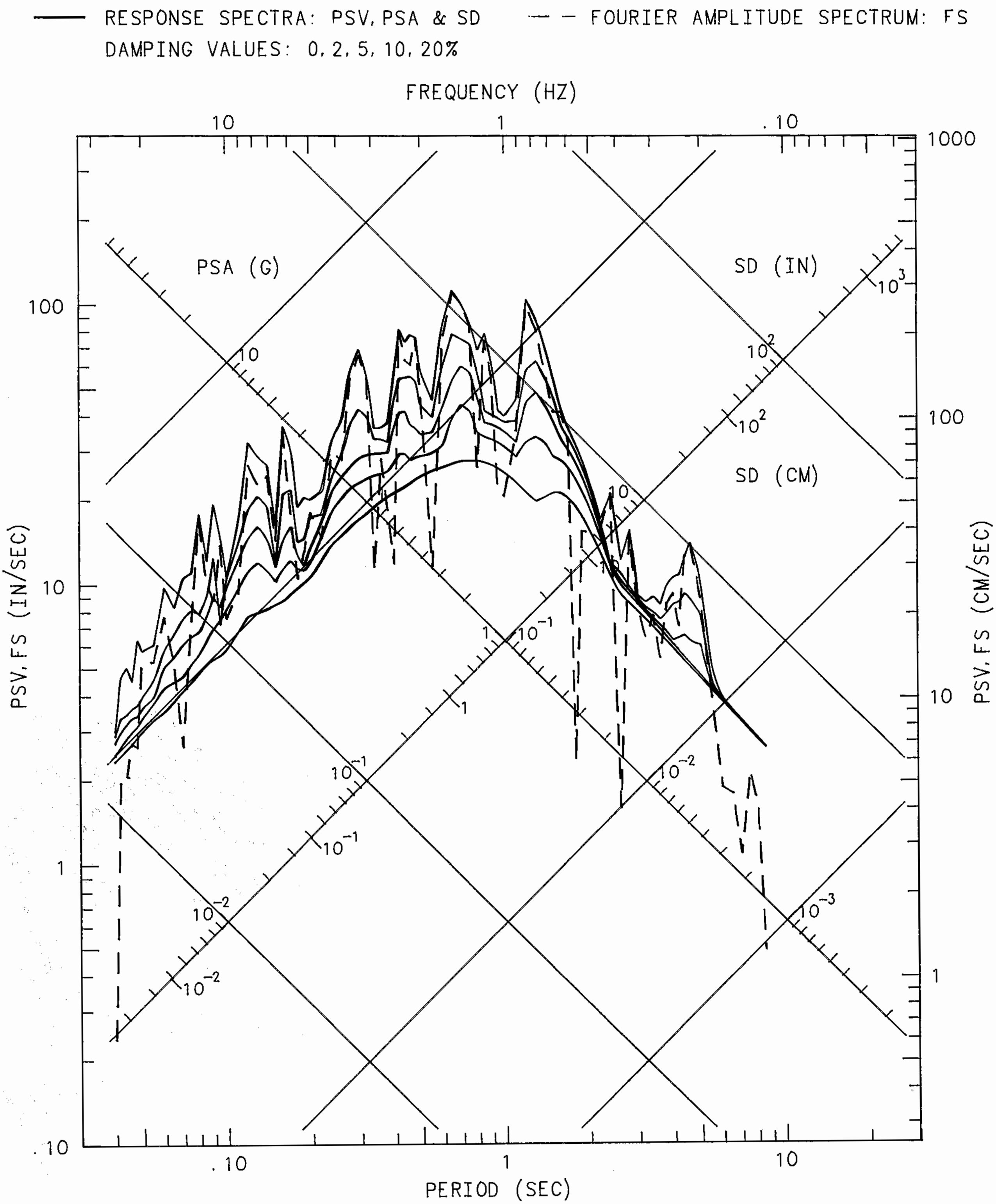
CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE   FEBRUARY 6, 1987 19:45 PST

CERRO PRIETO, BAJA CALIFORNIA

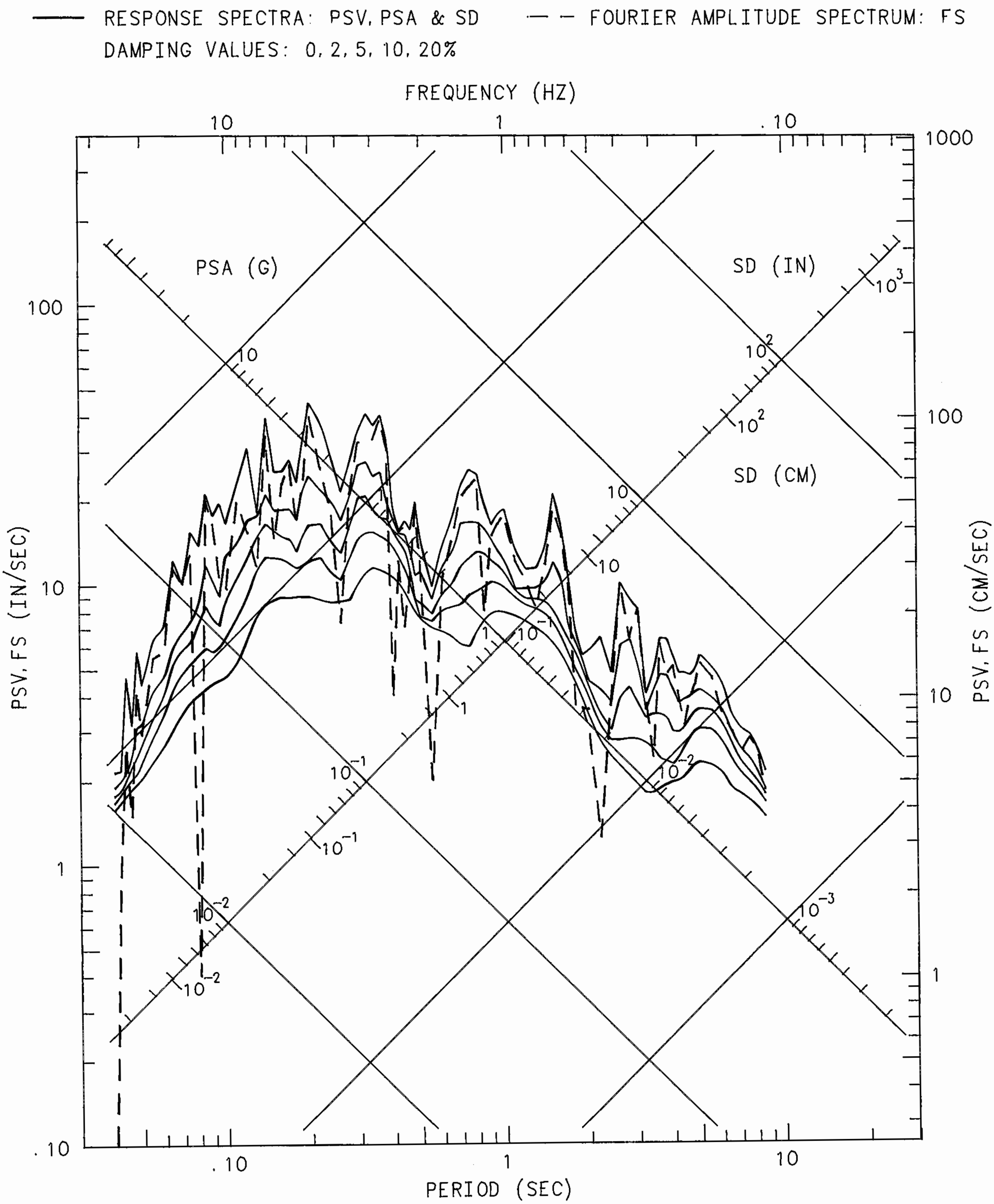
CHN 1: 251 DEG

ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.

91004-S2582-87039.03 041588.1512-QC87A004



CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE FEBRUARY 6, 1987 19:45 PST
CERRO PRIETO, BAJA CALIFORNIA
CHN 2: UP
ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.
91004-S2582-87039.03 041588.1512-QC87A004



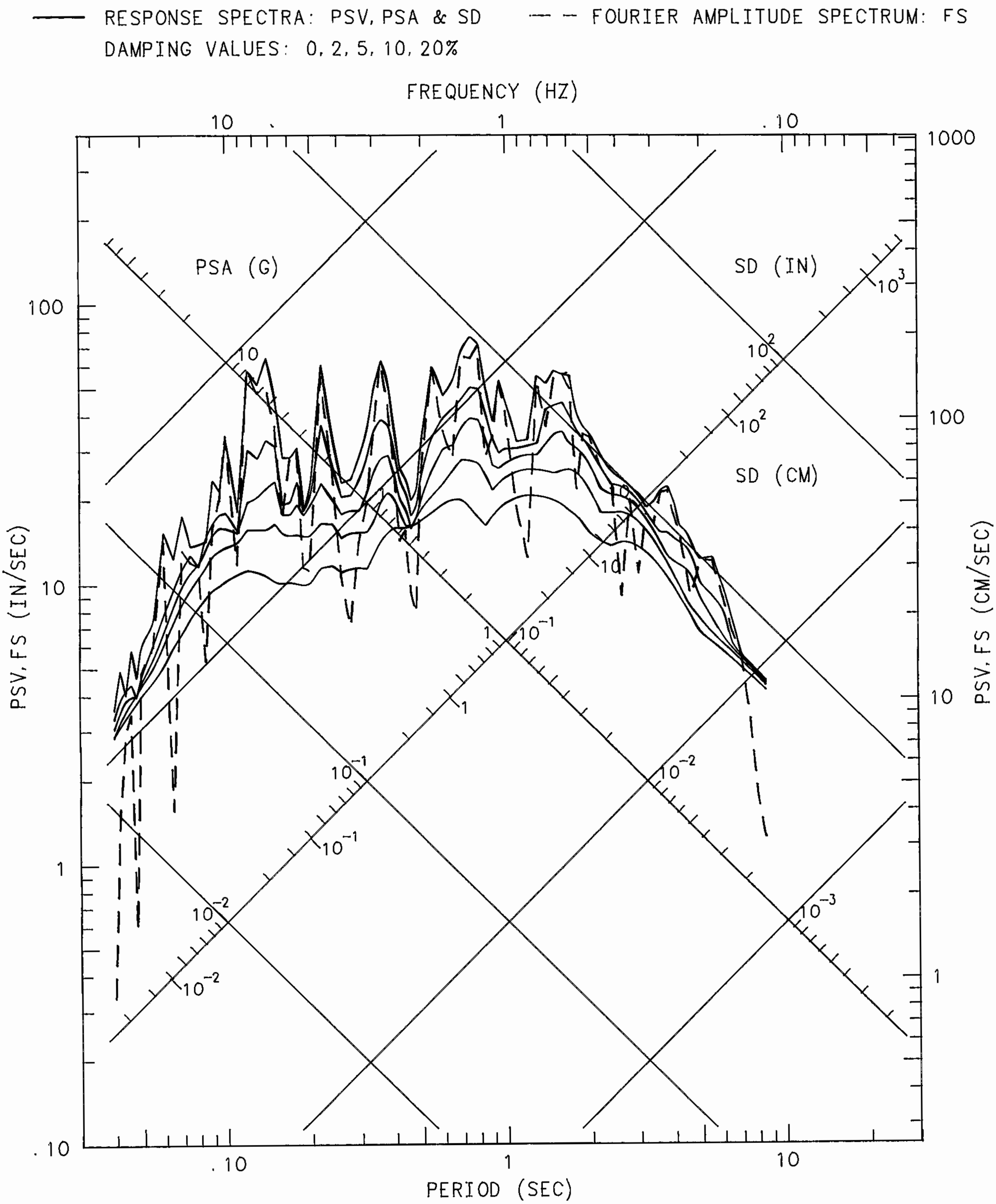
CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE   FEBRUARY 6, 1987   19:45 PST

CERRO PRIETO, BAJA CALIFORNIA

CHN 3: 161 DEG

ACCELEROGRAM BANDPASS-FILTERED WITH RAMPS AT .08-.16 TO 23.0-25.0 HZ.

91004-S2582-87039.03   041588.1512-QC87A004



LIST OF CSMIP REPORTS AND DATA TAPES

California Department of Conservation
Division of Mines and Geology
Office of Strong Motion Studies
California Strong Motion Instrumentation Program (CSMIP)

AVAILABLE REPORTS:

Title	Number
I. Earthquake Data Reports:	
CSMIP Strong-Motion Records from the Superstition Hills, Imperial County, California Earthquakes of 23 and 24 November 1987	OSMS 87-06
CSMIP Strong-Motion Records from the Whittier, California Earthquake of 1 October 1987	OSMS 87-05
CSMIP Strong-Motion Records from the Chalfant Valley, California Earthquakes of July and August 1986 (in press)	OSMS 86-06
CSMIP Strong-Motion Records from the Palm Springs, California Earthquake of 8 July 1986	OSMS 86-05
Selected Accelerograms from the Redlands, California Earthquake of October 2, 1985	OSMS 85-02
CSMIP Strong-Motion Records from the Bishop, California Earthquake of 23 November 1984	OSMS 84-12
CDMG Strong-Motion Records from the Morgan Hill, California Earthquake of 24 April 1984	OSMS 84-7
Preliminary Summary of CDMG Strong-Motion Records from the 2 May 1983 Coalinga, California Earthquake	OSMS 83-5.2
Strong-Motion Records from the Mammoth Lakes, California Earthquake of 6 January 1983	OSMS 83-1.1
Strong-Motion Records Recovered from the Mammoth Lakes, California Earthquake of 30 September 1981	OSMS 81-10.1
Strong-Motion Records Recovered from the Westmorland, California Earthquake of 25 April 1981	OSMS 81-5.1
Strong-Motion Records Recovered from the Trindad-Offshore, California Earthquake of 8 November 1980	OSMS 80-11.1
Strong-Motion Records from the Livermore Earthquakes of 24 and 26 January 1980	PR 28
Strong-Motion Records from the Mammoth Lakes Earthquakes of May 1980	PR 27
Compilation of Strong-Motion Records and Preliminary Data from the Imperial Valley Earthquake of 15 October 1979	PR 26

Title	Number
Compilation of Strong-Motion Records from the Coyote Lake Earthquake of 6 August 1979	PR 25
Compilation of Strong-Motion Records Recovered from the Bishop, California Earthquake of 4 October 1978	OSMS 78-7.1
Compilation of Strong-Motion Records Recovered from the Santa Barbara Earthquake of 13 August 1978	PR 22
Catalog of Strong Motion Accelerograph Records Recovered by Office of Strong Motion Studies before January 1, 1982	SR 154
Catalog of Strong Motion Accelerograph Records Recovered by Office of Strong Motion Studies During 1982	SR 154A

II. Processed Data Reports:

Processed Strong Motion Data from the Palm Springs Earthquake of 8 July 1986; Part I Ground-Response Records	OSMS 87-01
Processed Strong Motion Data from the San Salvador Earthquake of October 10, 1986	OSMS 86-07
Processed Data from the Strong-Motion Record Obtained at a Base-Isolated Building in Rancho Cucamonga, California during the Redlands Earthquake of 2 October 1985	OSMS 86-01
Processed Data from Strong-Motion Records of the Morgan Hill Earthquake of 24 April 1984: Part I Ground-Response Records	OSMS 85-04
Processed Data from Strong-Motion Records of the Morgan Hill Earthquake of 24 April 1984: Part II Structural-Response Records	OSMS 85-05
Processed Data from the Strong-Motion Records of the Imperial Valley Earthquake of 15 October 1979.	SP 65
Processed Data from the San Juan Bautista 101/156 Separation Bridge and the San Juan Bautista Freefield Records from the Coyote Lake Earthquake 6 August 1979	SP 64
Processed Data from the Gilroy Array and Coyote Creek Records, Coyote Lake, California, Earthquake 6 August 1979	PR 24
Processed Data from the Strong-Motion Records of the Santa Barbara Earthquake of 13 August 1978. (in three volumes)	SR 144

III. Other Reports:

Standard Tape Format of CSMIP Strong-Motion Data Tapes	OSMS 85-03

AVAILABLE STRONG-MOTION DATA TAPES:

Tape Name	Description
SANTBARB78	Santa Barbara earthquake of 13 August 1978.
IMPERIAL79	Imperial Valley earthquake of 15 October 1979 (County Services Bldg. and other CSMIP stations).
COYOTE79A	Coyote Lake earthquake of 6 August 1979, Gilroy Array stations.
COYOTE79B	Coyote Lake earthquake of 6 August 1979, San Juan Bautista overpass and nearest free-field station.
COYOTE79C	Coyote Lake earthquake of 6 August 1979, Halls Valley station.
MAMMOTH80A	Mammoth Lakes earthquakes of 25 May 1980 at 09:34 and 09:49 PDT.
MAMMOTH80B	Mammoth Lakes earthquakes of 25 May 1980 at 12:45 and 13:36 PDT.
MAMMOTH80C	Mammoth Lakes earthquakes of 26 May 1980 at 11:58 PDT and 27 May 1980 at 07:51 PDT.
WESTMOR81	Westmorland earthquake of 26 April 1981.
COALINGA83	Coalinga earthquake of 2 May 1983, 16:43 PDT; Vol. 2 and 3 data for 47 records.
COALINGA83-IA	Coalinga earthquake of 2 May 1983, Vol. 1 data for first 22 records.
COALINGA83-IB	Coalinga earthquake of 2 May 1983, Vol. 1 data for remaining 25 records.
COALINGA83AS	Vol. 2 and 3 data for eight aftershocks of the Coalinga 2 May 1983 earthquake. The aftershocks occurred between 8 May and 11 September 1983, and were of magnitude (ML) 4.3 - 6.0.
COALINGA83AS-I	Vol. 1 data for the Coalinga aftershock records included on the tape COALINGA83AS.
RIODEL8083	Processed data from the Highway 101 Overpass at Rio Dell for the earthquakes of: 8 Nov 1980 (6.9ML Trinidad-Offshore); 16 Dec 1982 (4.4ML Rio Dell) and 24 Aug 1983 (5.5ML Cape Mendicino Offshore).
MAMMOTH83	Mammoth Lakes earthquakes of 7 Jan 1983 at 01:38 and 03:24 GMT.
MORGANHILL84-IG	Morgan Hill earthquake of 24 April 1984; Vol. 1 data for 19 ground-response records.
MORGANHILL84-G	Morgan Hill earthquake of 24 April 1984; Vol. 2 and 3 data for 19 ground-response records.
MORGANHILL84-IS	Morgan Hill earthquake of 24 April 1984; Vol. 1 data for 9 structural-response records.
MORGANHILL84-S	Morgan Hill earthquake of 24 April 1984; Vol. 2 and 3 data for 9 structural-response records.

Tape Name	Description
REDLANDS85	Redlands earthquake of 2 October 1985; data from the Law & Justice Building at Rancho Cucamonga.
HOLLISTER86	Hollister earthquake of 26 January 1986.
MTLEWIS86	Mt. Lewis earthquake of 31 March 1986.
SANSALVADOR86	San Salvador earthquake of October 10, 1986.
PALMSPRINGS86-IG	Palm Springs earthquake of 8 July 1986; Vol. 1 data for 18 ground-response records.
PALMSPRINGS86-G	Palm Springs earthquake of 8 July 1986; Vol. 2 and 3 data for 18 ground-response records.
WHITTIER87-INTERIM	Whittier earthquake of 1 October 1987; data for the the 12 ground-response records processed. (interim tape)

Footnotes:

Each tape contains Vol. 1, 2 and 3 data unless otherwise specified.

Vol. 1 data - uncorrected accelerations,
Vol. 2 data - instrument and baseline-corrected acceleration, velocity, and displacement.
Vol. 3 data - Response and Fourier amplitude spectra.

The magnetic tapes are provided at cost. Included with each tape is a copy of either the processed data report (if available) or the plots of the data.

Some of the data on these tapes are also available on PC or PC-AT compatible floppy disks.

Requests for the reports and data tapes and/or for additional information should be addressed to:

Office of Strong Motion Studies
California Division of Mines and Geology
630 Bercut Drive
Sacramento, CA 95814

Phone: (916) 322-3105

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PROCESSED ACCELEROGRAMS ON CSMIP DATA TAPES:

Tape: SANTBARB78

Santa Barbara Earthquake of 13 Aug 1978, 15:54 PDT, ML=5.1(CIT)

UCSB Goleta Free Field, 3 channels
Santa Barbara - UCSB North Hall, 9 channels
Santa Barbara - Freitas Building, 9 channels
Ventura - Holiday Inn, 15 channels

Tape: IMPERIAL79

Imperial Valley Earthquake of 15 Oct 1979, 16:17 PDT, ML=6.6(CIT)

Niland, 3 channels
Westmorland, 3 channels
Westmorland, aftershock record, 3 channels
El Centro - Imperial County Services Bldg. Free Field, 3 channels
El Centro - Imperial County Services Building, 13 channels
El Centro - Highway 8/Meloland Road Overpass, 13 channels

Tape: COYOTE79A

Coyote Lake Earthquake of 6 Aug 1979, 10:05 PDT, ML=5.9(BRK)

Gilroy #1, 3 channels
Gilroy #2, 3 channels
Gilroy #3, 3 channels
Gilroy #4, 3 channels
Gilroy #6, 3 channels
Coyote Lake Dam (San Martin), 3 channels

Tape: COYOTE79B

Coyote Lake Earthquake of 6 Aug 1979, 10:05 PDT, ML=5.9(BRK)

San Juan Bautista - Fire Station, 3 channels
San Juan Bautista - Highway 101/156 Overpass, 12 channels

Tape: COYOTE79C

Coyote Lake Earthquake of 6 Aug 1979, 10:05 PDT, ML=5.9(BRK)

Halls Valley, 3 channels

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Tape: MAMMOTH80A

Mammoth Lakes Earthquake of 25 May 1980, 09:34 PDT, ML=6.1(BRK),6.4(CIT)

Convict Creek, 3 channels
Long Valley Dam, 22 channels
Mammoth Lakes - High School Gym, 10 channels

Aftershock at 25 May 1980, 09:36 PDT, ML=unknown

Mammoth Lakes - High School Gym, 10 channels

Mammoth Lakes Earthquake of 25 May 1980, 09:49 PDT, ML=6.0(BRK),5.8(CIT)

Convict Creek, 3 channels
Long Valley Dam, 3 channels
Mammoth Lakes - High School Gym, 4 channels

Tape: MAMMOTH80B

Mammoth Lakes Earthquake of 25 May 1980, 12:45 PDT, ML=6.1(BRK),6.5(CIT)

Convict Creek, 3 channels
Long Valley Dam, 19 channels

Mammoth Lakes Earthquake of 25 May 1980, 13:36 PDT, ML=5.7(BRK),5.5(CIT)

Convict Creek, 3 channels
Long Valley Dam, 19 channels

Aftershock approx 58 seconds after 25 May 1980, 13:36 Event, ML=unknown

Convict Creek, 3 channels

Tape: MAMMOTH80C

Mammoth Lakes Earthquake of 26 May 1980, 11:58 PDT, ML=5.7(BRK),4.9(CIT)

Convict Creek, 3 channels
Long Valley Dam, 9 channels

Mammoth Lakes Earthquake of 27 May 1980, 07:51 PDT, ML=6.2(BRK),6.3(CIT)

Convict Creek, 3 channels
Long Valley Dam, 22 channels
Bishop - Paradise Lodge, 3 channels
Benton, 3 channels

Tape: WESTMOR81

Westmorland Earthquake of 26 Apr 1981, 05:09 PDT, ML=5.7(CIT),6.3(BRK)

Westmorland, 3 channels
Niland, 3 channels

Tapes: COALINGA83, COLINGA83-IA, COLINGA83-IB *

Coalinga Earthquake of 2 May 1983, 16:42 PDT, ML=6.5(BRK)

Cantua Creek School, 3 channels
Slack Canyon, 3 channels
Parkfield - Vineyard Canyon 2E, 3 channels
Parkfield - Vineyard Canyon 1E, 3 channels
Parkfield - Vineyard Canyon 1W, 3 channels
Parkfield - Vineyard Canyon 2W, 3 channels
Parkfield - Vineyard Canyon 3W, 3 channels
Parkfield - Vineyard Canyon 4W, 3 channels
Parkfield - Vineyard Canyon 5W, 3 channels
Parkfield - Vineyard Canyon 6W, 3 channels
Parkfield - Gold Hill 3E, 3 channels
Parkfield - Gold Hill 2E, 3 channels
Parkfield - Gold Hill 1W, 3 channels
Parkfield - Gold Hill 2W, 3 channels
Parkfield - Gold Hill 3W, 3 channels
Parkfield - Gold Hill 4W, 3 channels
Parkfield - Gold Hill 5W, 3 channels
Parkfield - Gold Hill 6W, 3 channels
Parkfield - Stone Corral 4E, 3 channels
Parkfield - Stone Corral 3E, 3 channels
Parkfield - Stone Corral 2E, 3 channels
Parkfield - Stone Corral 1E, 3 channels
Parkfield - Cholame 3E, 3 channels
Parkfield - Cholame 2E, 3 channels
Parkfield - Cholame 1E, 3 channels
Parkfield - Cholame 2WA, 3 channels
Parkfield - Cholame 3W, 3 channels
Parkfield - Cholame 4W, 3 channels
Parkfield - Cholame 4A W, 3 channels
Parkfield - Cholame 5W, 3 channels
Parkfield - Cholame 6W, 3 channels
Parkfield - Cholame 8W, 3 channels
Parkfield - Cholame 12W, 3 channels
Parkfield - Fault Zone 16, 3 channels
Parkfield - Fault Zone 15, 3 channels
Parkfield - Fault Zone 14, 3 channels
Parkfield - Fault Zone 12, 3 channels
Parkfield - Fault Zone 11, 3 channels
Parkfield - Fault Zone 10, 3 channels
Parkfield - Fault Zone 9, 3 channels
Parkfield - Fault Zone 8, 3 channels
Parkfield - Fault Zone 7, 3 channels
Parkfield - Fault Zone 6, 3 channels
Parkfield - Fault Zone 4, 3 channels
Parkfield - Fault Zone 3, 3 channels
Parkfield - Fault Zone 2, 3 channels
Parkfield - Fault Zone 1, 3 channels

* Vol. 1 data are on tapes COALINGA83-IA and COLALINGA83-IB; Vol. 2 and 3 data are on tape on tape COALINGA83.

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Tapes: COALINGA83AS, COLINGA83AS-I **

Records from 8 aftershocks of the Coalinga Earthquake of 2 May 1983

Event #2: 8 May 1983, 19:49 PDT, ML=5.1(BRK)

Coalinga - Sulphur Baths, 3 channels
Coalinga - CHP, 3 channels
Anticline Ridge - Palmer Ave., 3 channels
Oil Fields - Skunk Hollow, 3 channels
Harris Ranch, 3 channels

Event #3: 10 June 1983, 20:10 PDT, ML=5.1(BRK)
Event #4: 9 July 1983, 00:41 PDT, ML=5.3(BRK)
Event #5: 21 July 1983, 19:40 PDT, ML=6.0(BRK)
Event #6: 21 July 1983, 20:43 PDT, ML=5.0(BRK)
Event #7: 25 July 1983, 15:31 PDT, ML=5.1(BRK)
Event #8: 9 Sept 1983, 02:16 PDT, ML=5.3(BRK)
Event #9: 11 Sept 1983, 04:48 PDT, ML=4.3(BRK)

For each of events #3 through #9:

Coalinga - Sulphur Baths, 3 channels
Coalinga - CHP, 3 channels

** Vol. 1 data are on tape COALINGA83AS-I; Vol. 2 and 3 data are on tape COALINGA83AS.

Tape: RIODEL8083

Trinidad Offshore Earthquake of 8 Nov 1980, 02:27 PST, ML=6.9(BRK)

Rio Dell - Highway 101/Painter Street Overpass, 18 channels

Rio Dell Earthquake of 15 Dec 1982, 22:53 PST, ML=4.4(BRK)

Rio Dell - Highway 101/Painter Street Overpass, 15 channels

Cape Mendocino Offshore Earthquake of 24 Aug 1983, 06:36 PDT, ML=5.5(BRK)

Rio Dell - Highway 101/Painter Street Overpass, 15 channels

Tape: MAMMOTH83

Mammoth Lakes Earthquake of 6 Jan 1983, 17:38 PST, ML=5.2(BRK)

Convict Creek, 3 channels

Mammoth Lakes Earthquake of 6 Jan 1983, 19:24 PST, ML=5.4(BRK)

Convict Creek, 3 channels

Tapes: MORGANHILL84-G, MORGANHILL84-IG ***

Ground-response records from the Morgan Hill Earthquake of
24 Apr 1984, 13:15 PST, ML=6.2(BRK)

Halls Valley, 3 channels
Coyote Lake Dam (San Martin), 3 channels
Gilroy #7 - Mantelli Ranch, 3 channels
Gilroy #6, 3 channels
Gilroy #4, 3 channels
Gilroy #3, 3 channels
Gilroy #2, 3 channels
Gilroy #1, 3 channels
Gilroy - Gavilan College, 3 channels
Corralitos, 3 channels
Capitolas, 3 channels
Santa Cruz, 3 channels
San Juan Bautista - Fire Station, 3 channels
Los Banos, 3 channels
Agnews - State Hospital, 3 channels
Redwood City - APEEL #1, 3 channels
San Francisco - International Airport, 3 channels
Fremont - Mission San Jose, 3 channels
Hayward - APEEL #1E, 3 channels

Tapes: MORGANHILL84-S, MORGANHILL84-IS ***

Structural-response records from the Morgan Hill Earthquake of
24 Apr 1984, 13:15 PST, ML=6.2(BRK)

San Jose - Town Park Apartment Towers, 13 channels
San Jose - Great Western Savings Bldg., 13 channels
San Jose - Santa Clara County Bldg., 22 channels
Saratoga - West Valley College Gym, 11 channels
Watsonville - Telephone Bldg., 13 channels
Hollister - Glorietta Warehouse, 13 channels
South San Francisco - Kaiser Medical Center, 11 channels
San Juan Bautista - Highway 101/156 Overpass, 10 channels

*** Vol. 1 data are on tapes MORGANHILL84-IG and MORGANHILL84-IS; Vol. 2 and 3 data are on tapes MORGANHILL84-G and MORGANHILL84-S.

Tape: REDLANDS85

Redlands Earthquake of 2 Oct 1985, 16:44 PDT, ML=4.8(CIT)

Rancho Cucamonga - Law & Justice Building (base-isolated),
16 channels plus 3 free field channels

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Tape: HOLLISTER86

Hollister Earthquake of 26 January 1986, 11:21 PST, ML=5.5(BRK)

SAGO South - Tunnel, 3 channels
SAGO South - Surface, 3 channels
Hollister - Glorietta Warehouse, 13 channels

Tape: MTLEWIS86

Mt. Lewis Earthquake of 31 March 1986, 03:56 PST, ML=5.8(BRK)

Halls Valley, 3 channels
San Jose - Santa Clara County Bldg., 22 channels
San Jose - Great Western Savings Bldg., 13 channels
San Jose - Town Park Apartment Towers, 13 channels

Tape: SANSALVADOR86

San Salvador Earthquake of 10 October 1986, 17:49 GMT, MS=5.4(CIG)

National Geographical Institute (IGN), 3 channels
Geotechnical Investigation Center (CIG), 3 channels
Institute Urban Construction (IVU), 2 channels
Hotel Camino Real (HCR) - Basement, 3 channels
Hotel Camino Real (HCR) - 2nd Floor, 3 channels
Hotel Camino Real (HCR) - Roof, 1 channel
Centro Americana University (UCA), 3 channels
Hotel Sheraton (HSH), 3 channels

Tapes: PALMSPRINGS86-G, PALMSPRINGS86-IG ****

Ground-response records from the Palm Springs Earthquake of
8 July 1986, 02:20 PDT, ML=5.6(CIT)

Desert Hot Springs, 3 channels
Palm Springs - Airport, 3 channels
Silent Valley - Poppet Flat, 3 channels
San Jacinto - Soboba, 3 channels
San Jacinto - Valley Cemetery, 3 channels
Hemet - Stetson Ave Fire Station, 3 channels
Winchester - Page Bros. Ranch, 3 channels
Winchester - Hidden Valley Farms, 3 channels
Winchester - Bergman Ranch, 3 channels
Murrieta Hot Springs - Collins Ranch, 3 channels
Landers - Fire Station, 3 channels
Joshua Tree - Fire Station, 3 channels
Indio - Coachella Canal, 3 channels
Temecula - CDF Fire Station, 3 channels
Puerta La Cruz, 3 channels
Riverside - Airport, 3 channels
Hesperia, 3 channels
Rancho Cucamonga - Law & Justice Center Free Field, 2 channels

**** Vol. 1 data are on tape PALMSPRINGS86-IG; Vol. 2 and 3 data are on tapes PALMSPRINGS86-G.

Tape: WHITTIER87-INTERIM

First 12 ground-response records processed from the Whittier Earthquake of 1 October 1987, 07:42 PDT, ML=5.9 (CIT)

Tarzana - Cedar Hill Nursery, 3 channels
Alhambra - Fremont School, 3 channels
San Marino - Southwestern Academy, 3 channels
Los Angeles - Obregon Park, 3 channels
Altadena - Eaton Canyon Park, 3 channels
Downey - County Maint. Bldg., 3 channels
Mt. Wilson - Caltech Seismic Station, 3 channels
Los Angeles - 116th St. School, 3 channels
Los Angeles - Hollywood Storage Bldg. FF, 3 channels
Inglewood - Union Oil Yard, 3 channels
Long Beach - Rancho Los Cerritos, 3 channels
Los Angeles - Baldwin Hills, 3 channels

4/88

THE CERRO PRIETO, BAJA CALIFORNIA EARTHQUAKE OF FEBRUARY 6, 1987 AND PROCESSED STRONG-MOTION DATA

1988