UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Local Multi-Station Digital Recordings of Aftershocks of the January 9th, 1982 New Brunswick Earthquake

by

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Open-File Report 82-777

This report is preliminary and has not been reviewed for conformity with U. S. Geological Survey editorial standards (and stratigraphic nomenclature).

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INTRODUCTION

On January 9, 1982, at 12:53:51.8 GMT, there occurred a magnitude 5.7 m_b earthquake in New Brunswick, Canada, which has been given a preliminary location by NEIS of 46.98° North Latitude, 66.66° West Longitude and a depth of 10 kilometers. The earthquake caused light damage in New Brunswick and was felt as far away as southern Connecticut U.S.A. (Schlesinger-Miller, et al., 1982). The largest aftershocks have been a magnitude 5.1 m_b aftershock at 16:36 GMT on January 9, and a magnitude 5.4 m_b aftershock on January 13.

Responding to a request for instruments from the Earth Physics Branch (EPB) of the Canadian Department of Energy, Mines, and Resources, Ottawa, the U. S. Geological Survey, Menlo Park, California, dispatched nine three-component digital seismographs and two staff members to New Brunswick on January 13, 1982. The American equipment and personnel arrived at Newcastle, New Brunswick on the evening of January 14. The digital instruments were deployed in the eipicentral region in cooperation with the Canadian seismological field party commencing on January 15.

This report is a summary of the digital seismograph aftershock survey conducted in the epicentral region from January 15 to January 22, 1982. It includes a brief description of the geographical setting of the seismic activity. There is a general description of the field operations with particular emphasis on those aspects which control the reliability of the parameters - station location, transducer orientation, etc. - that define the data collected. The raw results are summarized with the intent of providing other investigators sufficient information to use the digital data for further study. Appendix A is a set of figures that display the contents of the raw data digital tape files. Appendix B consists of figures that display the data after it has been processed digitally in a fashion similar to the standard

digital processing that has traditionally been applied to strong motion (SMA) film records. The preface to Appendix B describes the processing done to the New Brunswick digital records. Appendix C is addressed primarily to the engineering seismologists, and it consists of whole record acceleration spectra of some representative events.

GEOGRAPHICAL SETTING

The epicentral region is located in the northern central section of New Brunswick. Figure 1 shows a simplified geologic map of the area adapted from a geological map of New Brunswick (Potter, et al., 1979). The epicenter of the January 9 mainshock is plotted as an eight-pointed star to the immediate northwest of Tuadook Lake. The two nearest population centers are Newcastle and Chatham to the east and Plaster Rock to the west. The region has a low population density, and the principal land uses are logging and recreation.

The geologic map shows a pronounced overall northeast-southwest structural trend. East-northeast to west-southwest trending faults are prominent in the north of the map. The major structural unit depicted is the body of granitic intrusives of Devonian age which outcrop in the immediate epicentral region. Other outcrops of the same material can be seen to the northeast, and the same unit continues off the map to the southwest. The area of study which is delineated by the rectangle in Fig. 1 is underlain by granite in the west and the center, and by metamorphosed Ordovician sediments in the east. These crystalline rocks were glaciated in the Pleistocene, and thus they are fresh and unweathered at the surface. The seismological consequence of this is that the source region is probably relatively free of any heterogeneities and velocity gradients that would be introduced by lithologic boundaries and near surface mineral alteration (Moos, 1982).

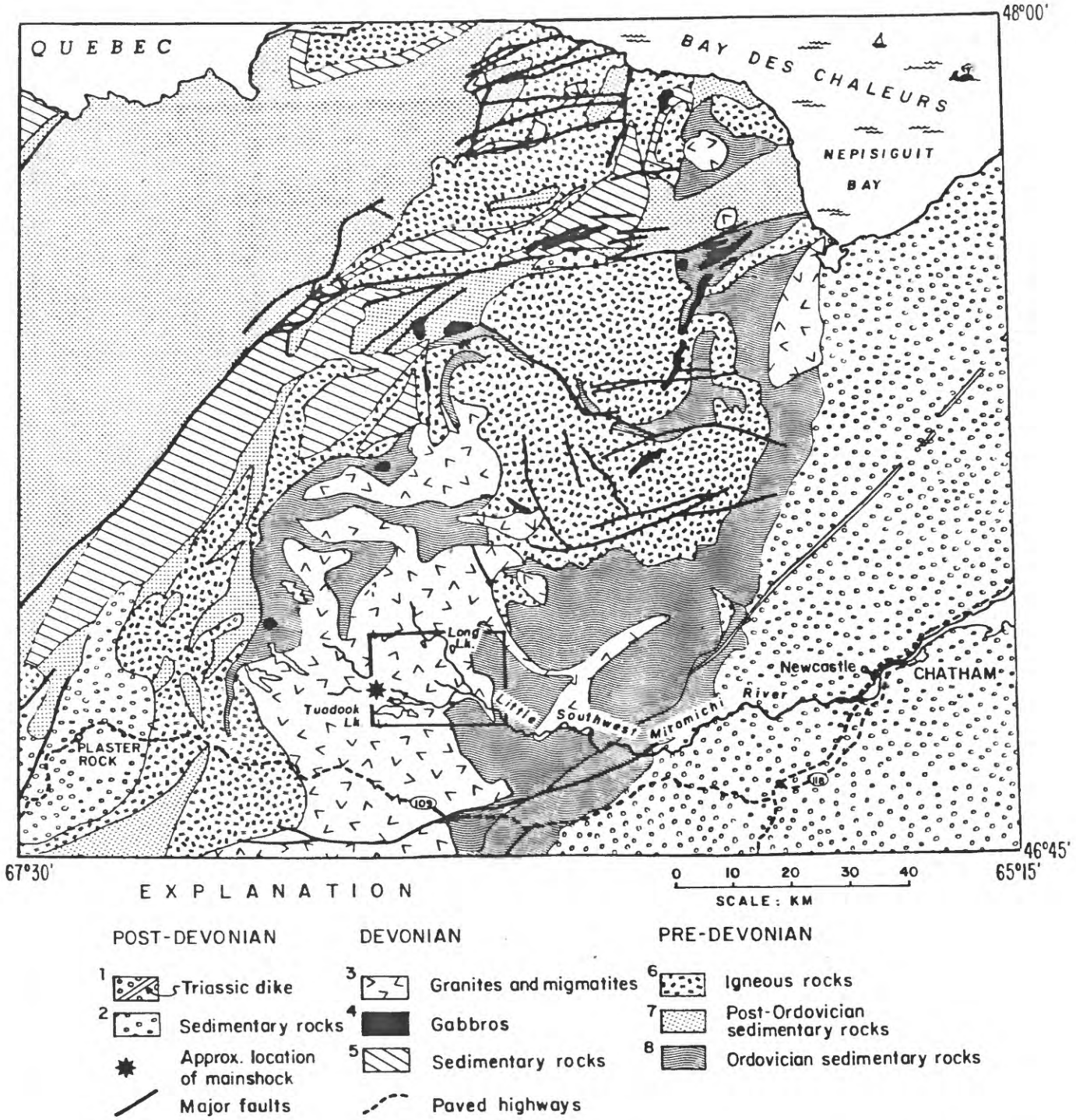


Figure 1. Geological Map of Northern Central New Brunswick: (1) Triassic dike; (2) Pennsylvanian to Mississippian-sandstone, conglomerate, siltstone, shale, limestone; (3) Devonian-granite, quartz monzonite, granodiorite, cataclastic and migmatitic granitic to granodioritic rocks locally containing inclusions of older strata; (4) Devonian-gabbros, diabase, diorite--maybe older; (5) Devonian-shale, limestone, sandstone, minor greywacke; (6) Silurian to Ordovician-silicic and mafic volcanics, tuffs, flows, dikes, and sills; (7) Silurian and Devonian-greyewacke, slates, calcareous and argillaceous sediments; (8) Ordovician-argillaceous sedimentary rocks, greywacke, quartz, conglomerate.

Adapted from Potter et al., 1979

The study area rectangle in Fig. 1 is shown at larger scale in Fig. 2. The four digital seismograph stations that were established are shown as large black triangles, and the epicenters of the forty aftershocks digitally recorded are indicated by stars. The area can be seen to have moderate relief, with the greatest difference in elevation equal to about 250 meters. There is some suggestion of a northwest-southeast topographic grain which is principally defined by the river valleys. This lineament trend is in contrast to the overall northeast-southwest structural grain of the region previously described, and it may reflect preferential erosion along fractures in the homogeneous granite that is otherwise devoid of structure. These hypothetical fractures would possibly be related to states of stress, such as those responsible for the offsets of the Triassic dike on the east side of Fig. 1, that post-date the Paleozoic states of stress that produced the regional structures.

LOGISTICS

The primary impediments to field operations were the extreme winter weather conditions and the limited access to the epicentral region. The only paved road in the region is Route 109 which runs between Newcastle and Plaster Rock shown in Fig. 1. Unpaved logging roads and private roads normally only used in summer are the only means of reaching the study area from Route 109. On several days, heavy snowfalls and winds up to 70 kph necessitated repeated snowplowing of more than twenty kilometers of unpaved roads just in order to change records at the stations. One station was installed by transporting both equipment and personnel to the site by snowmobile.

During the study period, temperatures fell to -30^{o} Celsius on at least two occasions. Since this is 15^{o}C below the manufacturer's rated minimum operating temperature of the digital recorders, heated shelter was required

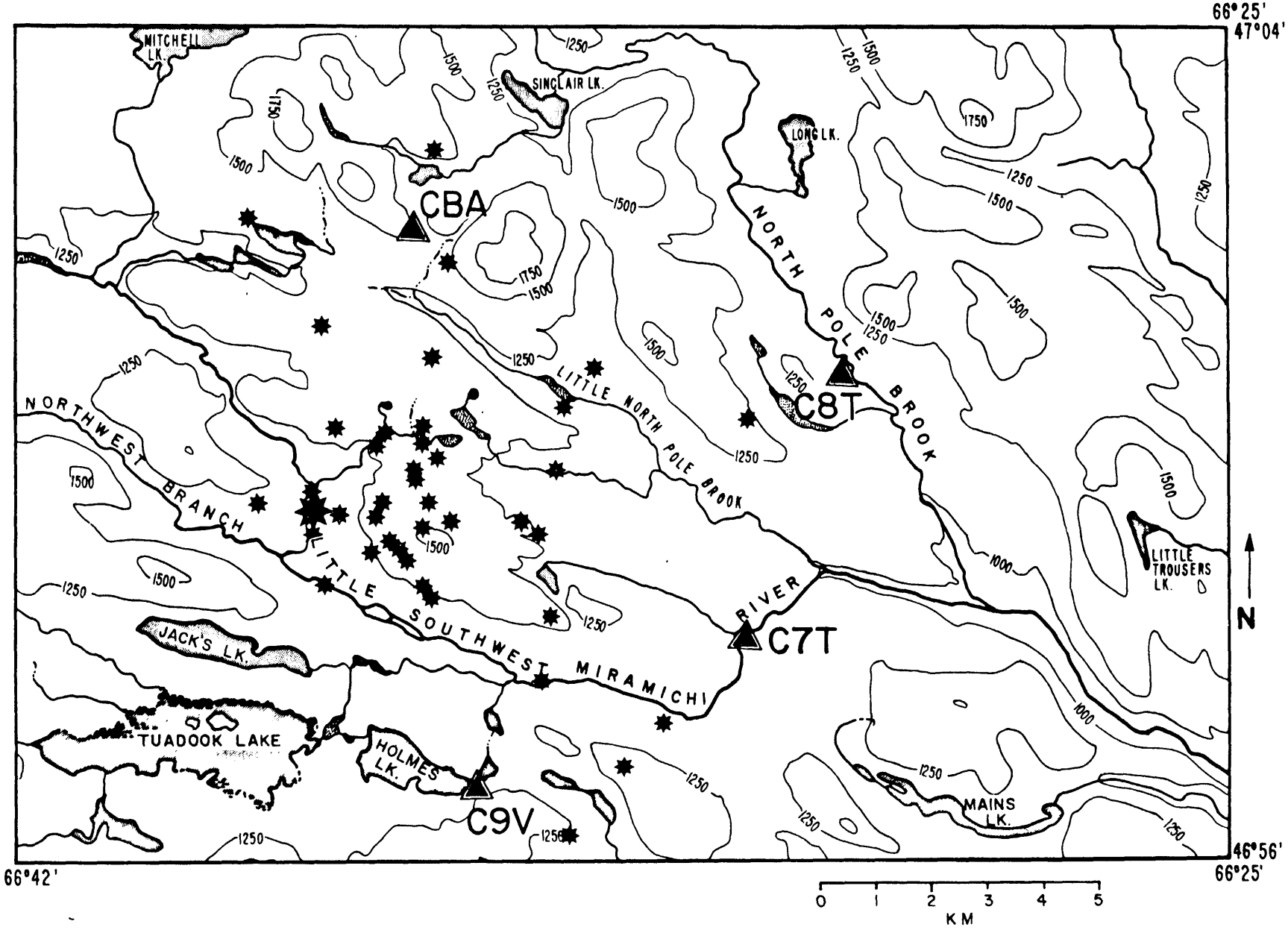


Figure 2: Topographic map of study area showing aftershock epicenters and digital station locations. Topographic contours are in feet above sea level.

for the instruments. The difficulties of limited access were therefore compounded by the necessity of finding buildings both near to the aftershock epicenters and well-distributed in azimuth from them. One station was placed in a private summer camp and two other stations in one-room huts. The seismographs of the fourth station were placed in a van that was left parked at the site for the duration of the station's operation. All four stations were heated by kerosene fueled space heaters. Since the heaters contained a fuel supply sufficient to operate them for a maximum of twenty-four hours, each station had to be visited once a day just to replenish the kerosene.

STATION DESCRIPTIONS

The study period described in this report began when the first U.S.G.S. digital seismograph station started recording on January 15, and ended on January 22 when the U.S.G.S. digital recorders were removed from the four stations established. The Canadian smoked-drum recorders which were first deployed in the epicentral region several days prior to January 15 were also removed from the field on January 22. Of the nine U.S.G.S. digital seismographs sent to New Brunswick, six were successfully deployed. Because of the relative abundance of digital seismographs compared to the paucity of appropriate station sites, two of the stations were equipped with two separate instrument systems apiece. At the dual instrument stations, one of the digital recorders was connected to a velocity transducer and the other was connected to an acceleration transducer (force balance accelerometer or FBA). The two single instrument stations were equipped with a velocity instrument and an acceleration instrument respectively. Because of the dual instrument stations, and the format requirements of the computer software used to process the digital data, the following station name/instrument code nomenclature has been used. All codes referring to the provenance of digital

records consist of three characters; the first character being the letter 'C'. The second character is the station number or letter. The third character denotes the order of motion that is recorded: 'A' for acceleration and 'V' for velocity. If the three-character code refers to a dual instrument station, the third character is 'T' denoting that both acceleration and velocity are recorded there. If the three-character code refers to a specific instrument at a dual-instrument station, it is either 'A' or 'V'. Over the course of the study period, the Canadian party co-located vertical component velocity-transducer smoked-drum recorders at the four digital stations. In order to distinguish instruments, a two letter station code refers to Canadian records:

Digital	Smoked Drum
C7T	LC
C8T	PC
C9V	HL
CBA	MR

The locations of the digital stations, except for station CBA, were established by the stations' proximity to a building marked on a topographic sheet. Station CBA was located in the field by Brunton compass bearings and topography. Its location has not yet been confirmed more rigorously. The station descriptions and histories are summarized in Table 1, and the locations of the stations are plotted in Fig. 2.

At all stations, the transducers themselves were placed outside whatever structure housed the recorder. None of the transducers were sited directly on bedrock outcrop. All transducers were sited on or several centimeters below frozen ground surface which had roughly .5 meters of snow cover. The thickness of the Pleistocene alluvial layer separating the transducers from

TABLE 1

INSTR.	SENSOR TYPE	OPERATING PERIOD	DIRECTION OF POSITIVE MOTION Ch1	Ch2	Ch3	LATITUDE DEG	MIN	LONGITUDE DEG	MIN	ALT. (m)
C7A	FBA	015 - 022	Up	356	086	46	58.22	-66	31.79	323
C7V	VEL	015 - 022	Up	000	090					
C8A	FBA	016 - 022	Up	000	090	47	00.50	-66	30.03	312
C8V	VEL	016 - 022	Up	000	090					
C9V	VEL	016 - 022	Up	142	232	46	56.72	-66	35.67	352
CBA	FBA	019 - 022	Up	000	090	47	02.00	-66	36.44	457

TABLE 2

INSTR.	SYSTEM SERIAL NUMBERS REC.	AMPL.	SENSOR	DR100 INTERNAL SWITCHES STA(s)	LTA(s)	DUR(s)	STA/LTA	SAMPLE RATE (sps)
C7A	217	122	106	0.2	20	5	6dB	200
C7V	203	127	6724	0.2	20	5	6dB	200
C8A	219	126	101	0.2	20	5	6dB	200
C8V	223	124	6723	0.2	20	5	6dB	200
C9V	222	125	6725	0.2	20	5	6dB	200*
CBA	216	114	105	0.2	20	5	6dB	200

* C9V sampled only channel 1 at 600 sps from 016 2145 to 017 1721.

TABLE 3

INSTRUMENT C7A

FBA: Natural frequency = 85 Hz
Damping = 0.55 critical
Coil constant = 0.0068
Anti-alias filter: 50 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
015 1952	24	24	24	-0.0024
016 1803	18	18	18	-0.0133
017 1611	18	18	18	-0.0177
018 1904	18	18	18	-0.0142
019 2025	18	18	18	-0.0135
020 1635	18	18	18	-0.0116
021 1611	18	18	18	-0.0081
022 1735				-0.0001

INSTRUMENT C7V

VEL: Natural frequency = 2 Hz
Damping = 0.60 critical
Coil constant = 0.5
Anti-alias filter: 50 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
015 1953	18	18	18	-0.0024
016 1804	24	24	24	-0.0093
017 1609	24	24	24	-0.0136
018 1904	24	24	24	-0.0192
018 1905	24	24	24	-0.0172
019 2152	30	30	30	-0.0146
020 1643	30	30	30	-0.0123
021 1608	36	36	36	-0.0109
022 1735				-0.0095

INSTRUMENT C8A

FBA: Natural frequency = 85 Hz
Damping = 0.55 critical
Coil constant = 0.0068
Anti-alias filter: 50 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
016 1917	18	18	18	-0.0072
017 1636	18	18	18	+0.0349
018 1831	18	18	18	+0.0717
019 1950	18	18	18	+0.1957
020 1659	18	18	18	+0.2673
021 1817	18	18	18	+0.3455
022 1715				+0.4232

INSTRUMENT C8V

VEL: Natural frequency = 2 Hz
Damping = 0.60 critical
Coil constant = 0.5
Anti-alias filter: 50 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
016 1917	24	24	24	-0.0072
017 1637	24	24	24	-0.0051
019 1953	30	30	30	+0.0117
020 1702	30	30	30	+0.0232
021 1815	36	36	36	+0.0372
022 1715				+0.0507

INSTRUMENT C9V

VEL: Natural frequency = 2 Hz
Damping = 0.60 critical
Coil constant = 0.5
Anti-alias filter: 70 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
016 2045	24	00	00	-0.0077
017 1721	30	30	30	+0.0033
018 1932	30	30	30	-0.0119
018 2105	30	30	30	-0.0123
019 1756	30	30	30	-0.0073
020 1558	30	30	30	+0.0004
021 1544	30	30	30	+0.0097
022 2008				+0.0150

INSTRUMENT CBA

FBA: Natural frequency = 85 Hz
Damping = 0.55 critical
Coil constant = 0.0068
Anti-alias filter: 50 Hz, 30 dB/octave

TIME	GAIN(dB)			CLOCK CORR.(sec)
	Ch1	Ch2	Ch3	
019 2110	24	24	24	-0.0227
020 1725	24	24	24	-0.0364
021 1720	18	18	18	-0.0447
022 1610				-0.0532

bedrock at the four stations is estimated to range from less than one meter up to a maximum of several tens of meters. These estimates are based on observations in the field and on bedrock outcrop geologic maps. At the time of this writing there has been no verification of site alluvial-layer thickness. Once installed, the transducers tended to become literally frozen into place. With the exception of the C8A transcducer, the transducers became so rigidly frozen to the ground surface that they had to be forcibly pried loose with a shovel in order to be removed.

The digital recorders (described in the next section) were generally operated in the mode of recording three orthogonal components of motion. The three individual component-transducers are packaged together as one unit. The vertical orientations of the transducers were established by means of a bubble level. The azimuths of the horizontal directions were set with a Brunton compass assuming a local magnetic declination of 23^{o} west of North. At the time of station removal, these orientations were rechecked. Vertical orientations appeared to have changed little if at all and are believed to be correct within the radius of error defined by the bull's eye circle of the bubble level. Horizontal azimuths are believed to be true to within less than 5^{o} error of their recorded values. The peculiar azimuth given for transducer C9V is a result of oversight during the haste of installation.

INSTRUMENT DESCRIPTION

The digital seismographs used in this study were Sprengnether DR-100 self-triggering three channel digital recorders connected to Sprengnether S-6000 velocity transducers and Sprengnether SA-3000 FBA's. Generally the instruments were operated in the mode of serially sampling three components of motion at a sample rate of 200.32 samples/second/component. For one day, January 16-17, the instrument C9V was accidentally operated in the mode of

sampling only the vertical component at 600.96 samples/second. Five of the instruments deployed had 5 pole anti-aliasing filters with corner frequencies at 50 Hz. By chance, instrument C9V had a 5 pole anti-aliasing filter with a corner frequency at 70 Hz. The velocity transducers had a natural period of 2 Hz and a damping coefficient of .6 critical. The FBA's had a natural period of 85 Hz and a damping coefficient of .55 critical. The dynamic range of the recorders is ± 2048 digital counts. The internal trigger used an short term average/long term average algorithm to detect events. The instruments had .74 seconds of pre-event memory and were set to record for 5 seconds after trigger. The records produced were generally of about 6 seconds duration. See Table 2 and Table 3 for summaries of the instrument constants. The instruments were powered by a 12 volt car battery. See Fletcher (1982) for futher description of the instruments.

Because of the cold operating conditions, and the jolting that accompanied transport to the field area, there was the possibility that the actual instrument constants during the study period differed from their rated values. As a test of the fidelity of the overall system response, the following comparison was made. Since there were two separate instruments at stations C7T and C8T, it was possible to compare separate records of ground motion recorded in the same place at the same time. The top trace in Fig. 3 is the N-S (transverse in terms of source-receiver) component of horizontal acceleration recorded by instrument C7A of the S-arrival of the event at 13:32:59, January 17. The middle trace is the top trace integrated to velocity, and the bottom trace is the direct velocity recording made by instrument C7V during the same time period as the traces above. All three traces have been high passed through a zero-phase-shift filter with a corner at 1.6 Hz and have had their sampling augmented in the frequency domain

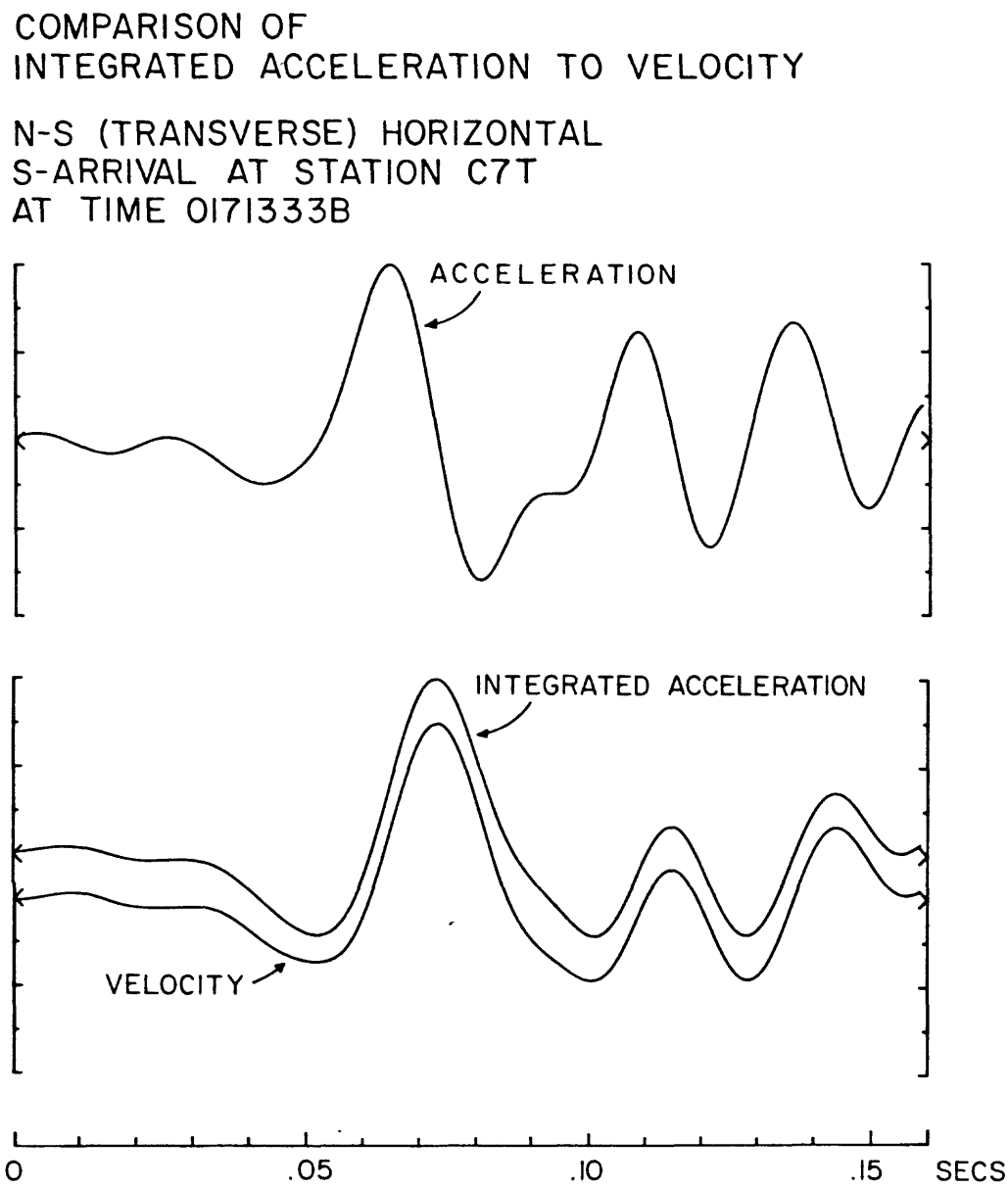


Figure 3: Test of instrument reliability as evidenced by similarity of ground motion recorded by different instrument systems at the same place and the same time. Vertical scales are normalized to maximum trace amplitudes.

(Cranswick and Spudich, 1982) to produce an apparent sample rate of 1600 samples/second. The middle and the bottom trace are plotted to amplitude normalized scales to facilitate waveform comparison. It can be seen that whereas the two lower traces are not identical in detail, the overall similarity of the waveforms is striking. The corresponding absolute amplitudes for the total six seconds of record of the integrated acceleration and velocity agree to within 10%. This congruence of recorded signals suggests that the overall system response can be trusted to accurately reflect ground motion in a predictable fashion. See the preface to the Processed Seismogram appendix for further discussion of instrument response.

The instruments were subject to two known malfunctions: one analog and one digital. At trigger time, the tape drive motor is turned on, which places a high transient current drain on the system power supply. This in turn introduces a transient bias into the analog electronics which manifests itself as a decaying step in the signal baseline beginning .74 seconds into the resulting record. The initial amplitude of this step is about 2 digital counts and is not generally apparent in the raw recorded time-series. See the appendix for further details. The data also suffered from intermittent tape drop out problems which varied in degree and frequency of occurrence from instrument to instrument, and which were exacerbated by the very cold ambient environment that developed when kerosene space heaters exhausted their fuel. The approximately five records which have the worst drop outs have yet to be fully processed, pending further developments in computer software.

Timing Considerations

The internal clocks of the DR-100 recorders were initially set and subsequently checked against a portable master clock. The master clock had an ovenheated crystal, a nominal precision of .1 milliseconds, and was calibrated to CHU radio time and the Canadian field master clock each day. Following the conclusion of the study, a least squares line was fit to the daily clock corrections to the masterclock. This line had a slope, the masterclock drift, of 5.001 milliseconds/day with a standard deviation of 1.01 milliseconds.

With the exception of instrument C8A, the drift rate of the internal clocks of the DR-100 recorders was on the order of 10 milliseconds/day. Individual recorder clocks settled down to a constant drift rate after transient behavior lasting about 1 to 2 days, which is presumably related to the time constant of thermal equilibration of the clock crystals with the ambient temperature.

Final clock corrections to the event trigger times were made by first correcting the individual recorder clock corrections for master clock drift. The appropriate instrument clock correction was then derived by linear interpolation between the immediate prior and post calibration points. This procedure is believed to yield corrected event trigger times that are in general accurate to within ± 5 milliseconds of absolute time. Clock corrections are listed in Table 3. Spot comparisons of the two arrival times calculated for events recorded at dual instrument stations show this agreement, though there is some discrepancy, not yet resolved, between the times of instrument LC and those of the digital instruments of C7T.

Field Operations Strategy

The usual procedures followed in an aftershock survey were complicated by the logistics problems described above. Because it was never certain that the

instruments could be re-visited within the next 24 hours, a conservative approach was taken to setting instrument gains, trigger sensitivities, etc. The instruments recorded on digital cassettes, each of which had a capacity of twenty-five to thirty events at the five second post-trigger duration setting. In order to ensure that there would always be tape available to record large events even if cassettes were not changed each day, and to ensure that the passing of the thirty-six ton snowplow used to clear the access roads did not cause too many false triggers, trigger sensititities were set low. In addition, gains were set relatively low on the FBA instruments to prevent them from clipping the signals of any large events.

On the first two days of the study, instruments were deployed as near to the teleseismically determined epicenter as was logistically possible. The first records made by these instruments were played back in the field on an analog strip chart recorder, and the arrival times of aftershocks were picked. The arrival times were transmitted orally by telephone to U.S.G.S., Menlo Park, Californa, where a computer program was used to calculate approximate aftershock locations. These locations made it clear that the seismic activity lay to the west of the established stations. Examination of maps of the study area revealed that there was only one road that had any westerly component and was at the same time passable to the snow-plow. Since there were no buildings at all along this route, a rented van equipped with a kerosene space heater was left at the site to house the instruments.

In the last two days of the study, after weather conditions had relented somewhat and a routine of field operations had become established, the gains were raised on the velocity transducer equipped digital instruments in an attempt to record some of the aftershocks of the smaller magnitudes that were previously missed. The daily gain settings are listed in Table 3.

Results

In the one week period of study, a total of forty aftershocks were recorded by at least one digital instrument. These recordings probably include all aftershocks greater than local magnitude 1 m_{bLg}. At this time, the Canadian EPB has not officially assigned magnitudes to any of these aftershocks with the single exception of the largest event which occurred at 13:33:56.2 GMT, January 17. This aftershock was recorded by at least four regional Canadian seismograph stations, the furthest one away being SCH at a range of 870 km. This event has been assigned a magnitude of 3.5 m_{bLg}.

The forty recorded events have been located by the Canadian EPB using an in-house computer program written by R. Wetmiller. The velocity model assumed was a homogeneous half-space with a 6.2 km/s P-wave velocity, a 3.57 km/S S-wave velocity, and corrections made for station elevation. Arrival times at the digital stations have been supplemented with these taken from Canadian EPB smoked-drum recorders in the epicentral region. Figure 4 shows the locations of what have been referred to as the Canadian smoked-drum instruments. These include smoked-drum recorders operated by Massachusetts Institute of Technology and by Lamont-Doherty Geological Observatory whose records have been included in the Canadian EPB data analysis. The locations of the recorded events can be seen in Fig. 2, with the epicenter of the magnitude 3.5 event plotted as a star twice the size of the stars representing other aftershocks. The origin times, epicenters, and depths are listed in Table 4 and the epicenters are plotted by their listed number on a large scale map in Fig. 5. These locations are preliminary pending the release of the final locations by the Canadian EPB in September, 1982. The depths listed in Table 4 are in km. below sea level. The headings "NS" and "NP" refer to the number of stations and the number of phases respectively used in locating the

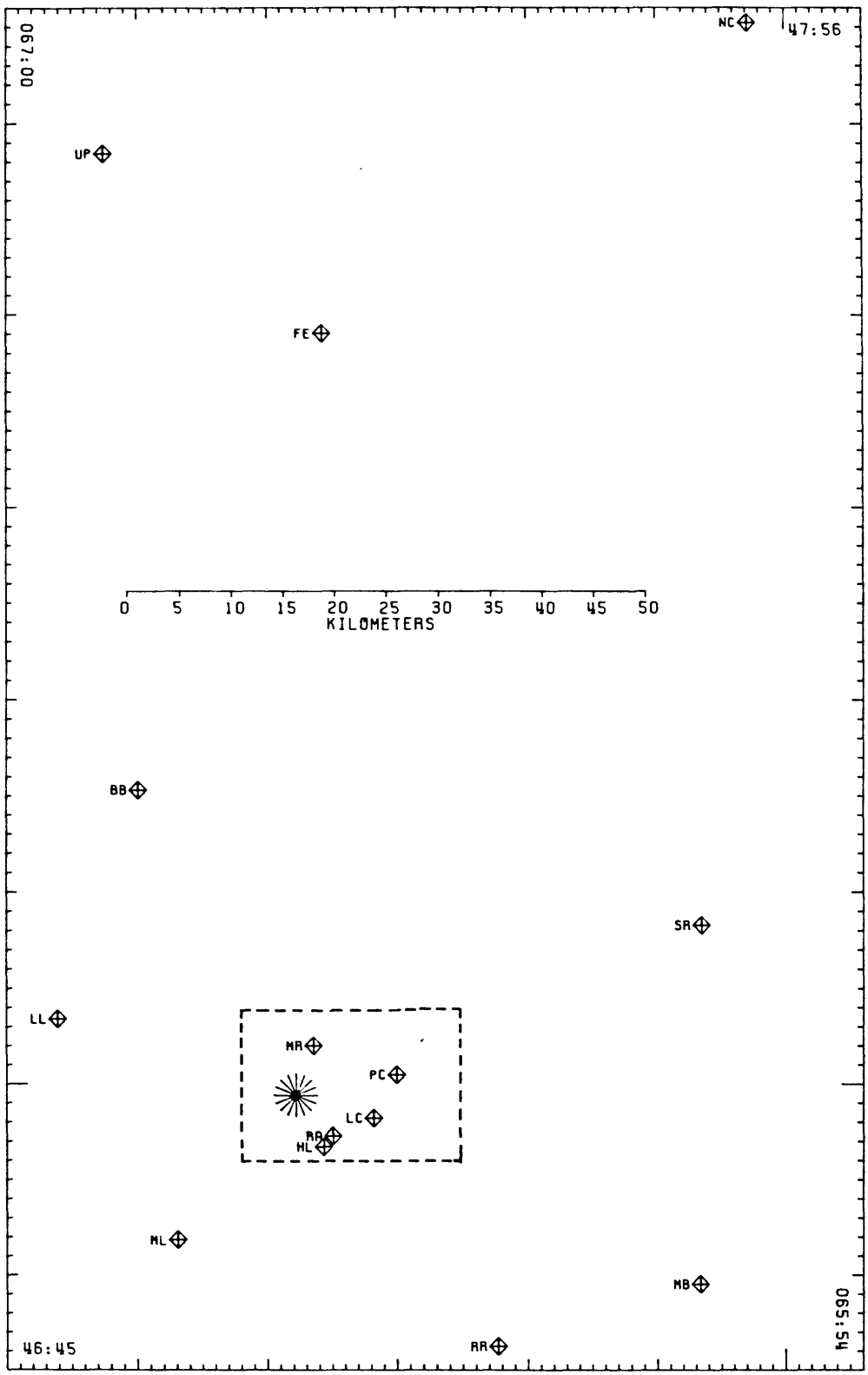


Figure 4. Sketch map of the epicentral region showing the smoked-drum recorder stations whose records have been used to locate the events shown in Fig. 5. The epicenter of the magnitude 3.5 aftershock is plotted as a star for the purposes of reference. The study area shown at larger scale in Fig. 2 is delineated by the rectangle.

different events. Because of the preliminary nature of the locations, the estimates of spatial location error are not included. It is sufficient to say that with the exception of the first event, the spatial errors are significantly less than 1 kilometer. The root mean square (RMS) values of the travel time residuals have been included as an approximate indication of the accuracy of the locations given the small number of stations used.

During the study period, there were many small events that did not trigger any of the digital instruments. These small events were visible on the smoked-drum recorders co-located with the digital instruments. Most of the larger events, i.e., those that triggered the digital instruments, had S-P times approximately equal to one second. The smaller events seen on the smoked-drum records were an order of magnitude more numerous than the larger events and had S-P times that ranged down to less than .1 seconds. This implies that the locations of the smaller events were distributed throughout the source volume as a whole. They might be visualized as being the response of an isotropic solid, the source volume, to the strain relaxation caused by the stress release of the mainshock and major aftershocks. Conversely, the 4 to 6 kilometer depth of the larger events and their relative areal concentration suggests that the larger events are related to the mainshock fault plane in particular.

Peak accelerations of approximately .08 g were recorded by instrument C7A for both the P-wave arrival on the vertical component and the S-wave arrival on the N-S horizontal component of the magnitude 3.5 aftershock (Event no. 8 in Table 4). Instrument C7V recorded a peak velocity of 1.25 cm/s on the N-S horizontal component for the S-wave arrival of the same event. All the digital records made of the magnitude 3.5 aftershock are shown in Figures 6a-6f. A small foreshock (Event no. 7 in Table 4) that occurred 57 seconds prior

TABLE 4

NO.	ORIGIN TIME DAY	HRMN	SEC	LATITUDE DEG	MIN	LONGITUDE DEG	MIN	DEPTH (km)	NS	NP	RMS (sec)
1	015	2037	27.2	46	57.78	-66	34.62	4.84	3	6	0.01
2	016	0610	18.1	46	59.46	-66	36.24	4.48	3	5	0.00
3	016	0813	07.5	47	01.14	-66	37.74	2.26	4	5	0.01
4	016	1554	15.0	47	01.74	-66	35.94	4.81	4	5	0.01
5	017	0739	34.5	46	59.76	-66	36.42	5.49	3	4	0.00
6	017	1224	47.8	46	59.34	-66	37.50	5.95	3	5	0.00
7	017	1332	59.9	46	59.52	-66	37.86	2.60	3	6	0.01
8	017	1333	56.2	46	59.40	-66	37.80	3.61	3	6	0.01
9	017	1408	46.8	46	58.98	-66	37.02	3.32	3	5	0.02
10	017	1756	58.4	46	56.28	-66	34.26	6.14	5	7	0.03
11	018	0259	19.2	47	02.82	-66	36.12	2.99	5	5	0.00
12	018	1144	26.8	46	59.34	-66	36.96	4.44	3	5	0.01
13	018	1547	15.5	47	00.00	-66	36.96	3.07	3	5	0.01
14	018	1831	51.7	47	00.06	-66	36.30	4.84	4	5	0.02
15	018	1934	49.2	47	00.18	-66	36.30	5.31	3	6	0.01
16	019	0712	23.7	47	00.72	-66	33.90	3.58	4	5	0.03
17	019	1018	51.4	46	59.46	-66	36.90	5.36	3	4	0.00
18	019	1159	24.0	46	59.16	-66	37.86	2.64	4	5	0.00
19	019	1436	35.5	46	59.22	-66	36.30	3.42	3	5	0.01
20	019	2025	09.2	46	59.28	-66	35.94	6.34	4	5	0.00
21	020	0630	48.1	47	00.18	-66	37.56	5.51	4	7	0.02
22	020	0821	52.4	46	59.76	-66	34.44	0.43	3	5	0.00
23	020	1000	10.0	47	00.12	-66	36.84	5.92	4	8	0.01
24	020	2340	16.5	46	59.10	-66	36.78	4.60	4	7	0.00
25	020	2340	41.5	46	58.56	-66	36.18	5.79	4	7	0.01
26	020	2340	43.5	46	58.92	-66	36.54	5.00	4	7	0.01
27	021	0039	55.7	46	59.04	-66	36.66	4.85	3	6	0.00
28	021	0229	03.5	47	00.24	-66	31.74	1.00	3	6	0.00
29	021	0635	44.5	47	00.36	-66	34.32	3.97	3	6	0.01
30	021	1040	40.4	46	59.16	-66	34.68	2.10	3	5	0.01
31	021	1123	31.0	46	59.70	-66	36.42	5.23	3	6	0.00
32	021	1134	28.4	46	59.88	-66	36.12	5.41	3	6	0.02
33	021	1328	58.2	46	59.28	-66	34.92	6.09	3	5	0.01
34	021	2034	49.5	46	58.68	-66	37.68	2.17	3	6	0.02
35	022	0328	11.5	46	59.46	-66	38.64	3.02	4	6	0.01
36	022	0542	23.5	46	56.94	-66	33.48	4.65	4	6	0.02
37	022	0713	51.1	47	00.84	-66	36.18	5.74	3	5	0.02
38	022	0937	19.0	46	58.68	-66	36.30	7.46	4	7	0.03
39	022	1040	38.0	47	02.16	-66	38.76	1.71	3	5	0.00
40	022	1208	41.8	46	58.38	-66	34.50	1.00	4	8	0.02

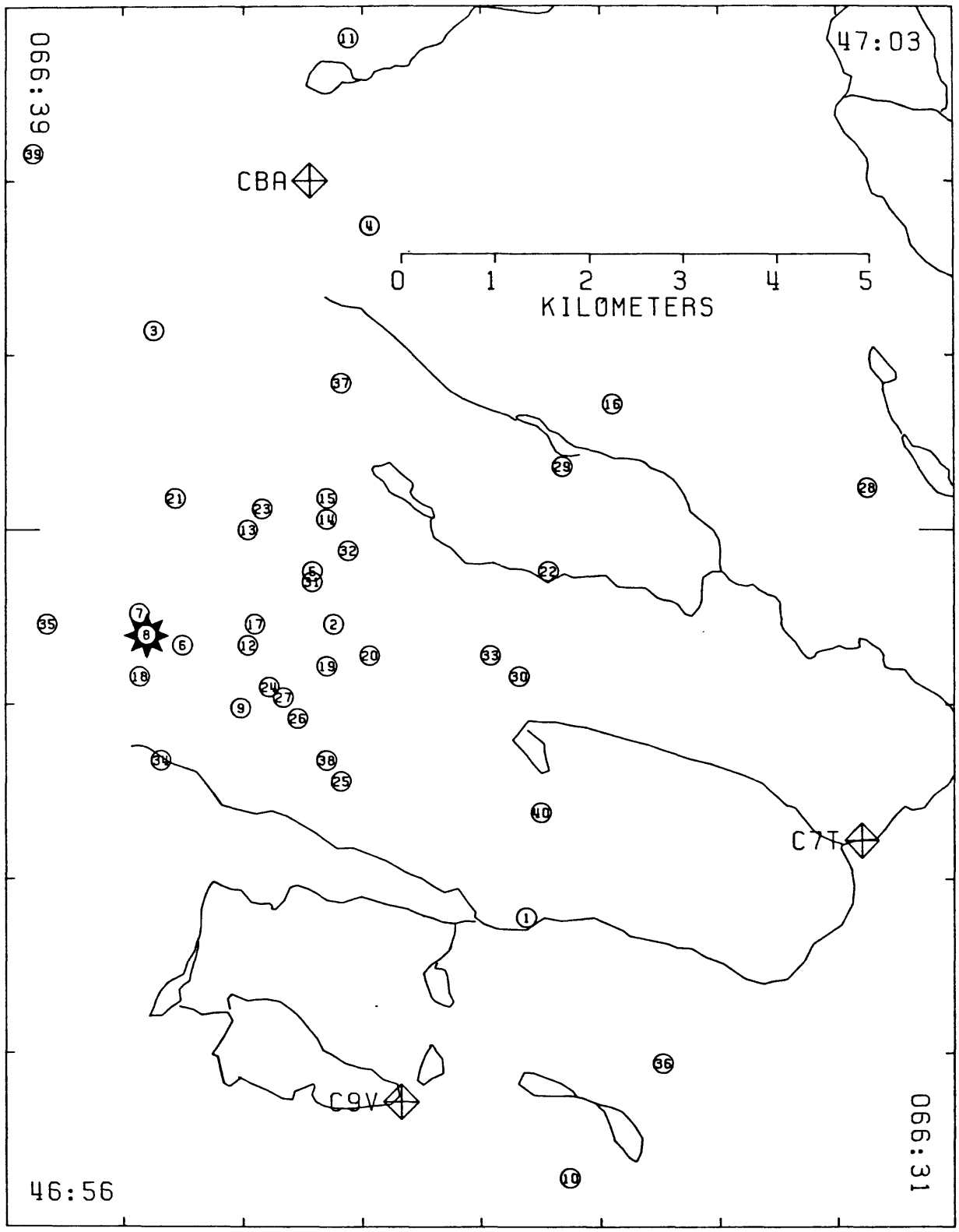


Figure 5. Sketch map of the western portion of the study area showing the locations of the forty aftershocks recorded. The numbers in the circles correspond to the chronological list of aftershocks in Table 4. Starred-circle no. 8 is the epicenter of the magnitude 3.5 aftershock. Three digital stations are plotted while station C8T is omitted because it lies outside the eastern map boundary.

to the magnitude 3.5 event and which had roughly the same location and which was recorded by the same instruments is also included in these figures for comparison. The epicenters of the events are plotted as numbered stars, and the corresponding recorded traces are plotted to the right and just above and below the respective stations. The numeral "1" refers to the magnitude 3.5 event and the numeral "2" refers to the foreshock. The time scale and the amplitude scale are indicated by the time-amplitude axis plotted in the upper left hand corner of each figure. Only the vertical component of velocity at Station C9V appears in these figures because that the only component recorded at that station at the time of these earthquakes. The horizontal components of the other stations have been rotated into the radial and transverse directions (in terms of source-receiver).

The most striking feature of these figures is the contrast of the recordings of the main 3.5 event made at Station C7T with those made at Station C8T. The differences in waveforms are most evident in the transverse components of the respective stations; the traces at C7T are far more impulsive and more compact in nature than those at C8T. Both of these stations are approximately the same distance from the epicenter, and the radial directions at the two stations are within 30^{o} of each other. However, examination of Figure 2 will show that station C7T is sited in an area of low relief while Station C8T is sited in an area of high relief. The observed differences in waveforms could be caused by differences in surface scattering at the two statiions (Boore et al., 1981).

Comparison of the recordings of the two events shows that the finite dimension of the source influences the waveforms of the larger earthquake. The P-wave arrivals of the foreshock on the vertical components are much simpler and consist of fewer cycles than the P-wave arrival of the magnitude

Figure 6a.

VERTICAL VELOCITY

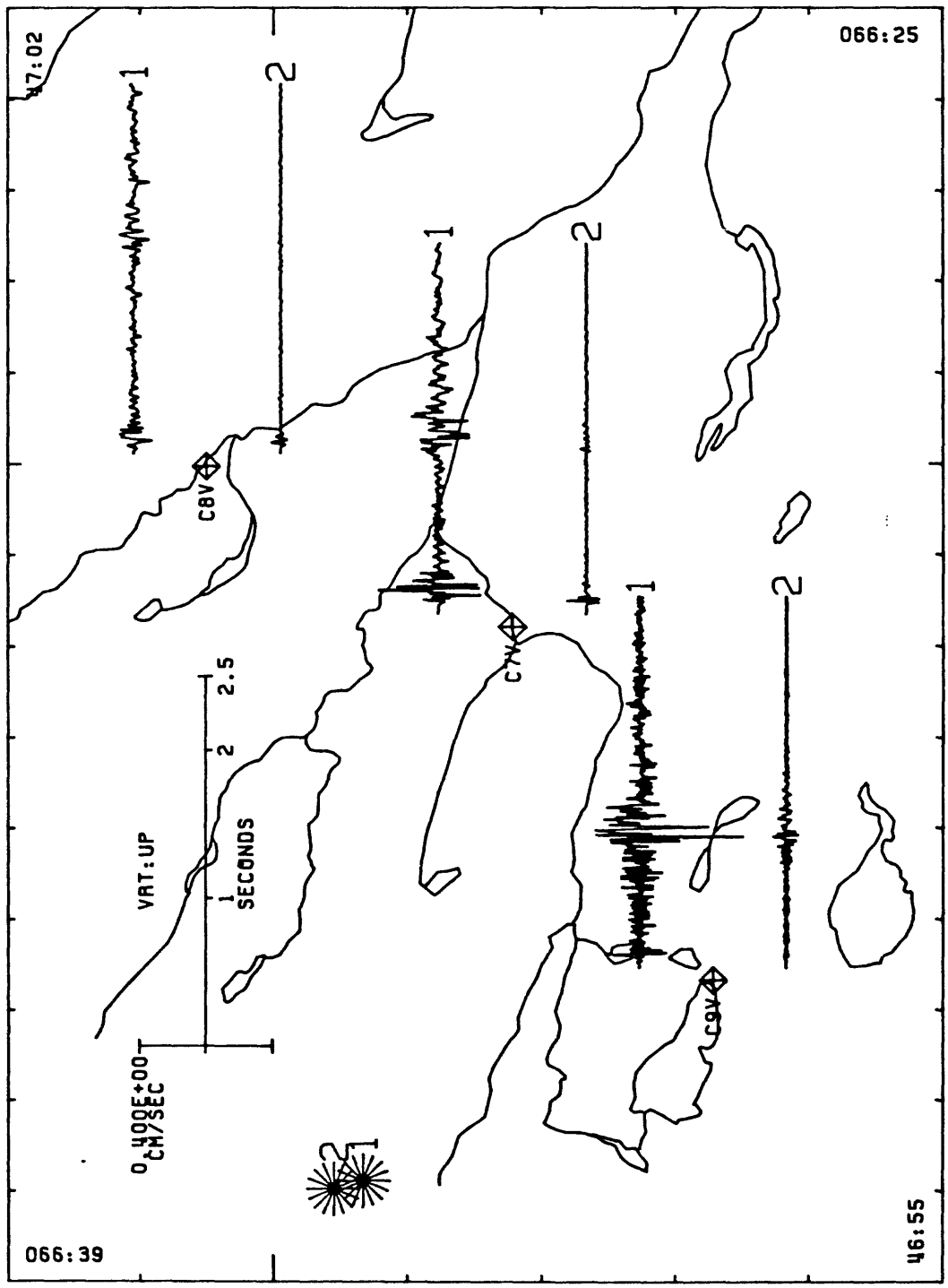


Figure 6b.

RADIAL VELOCITY

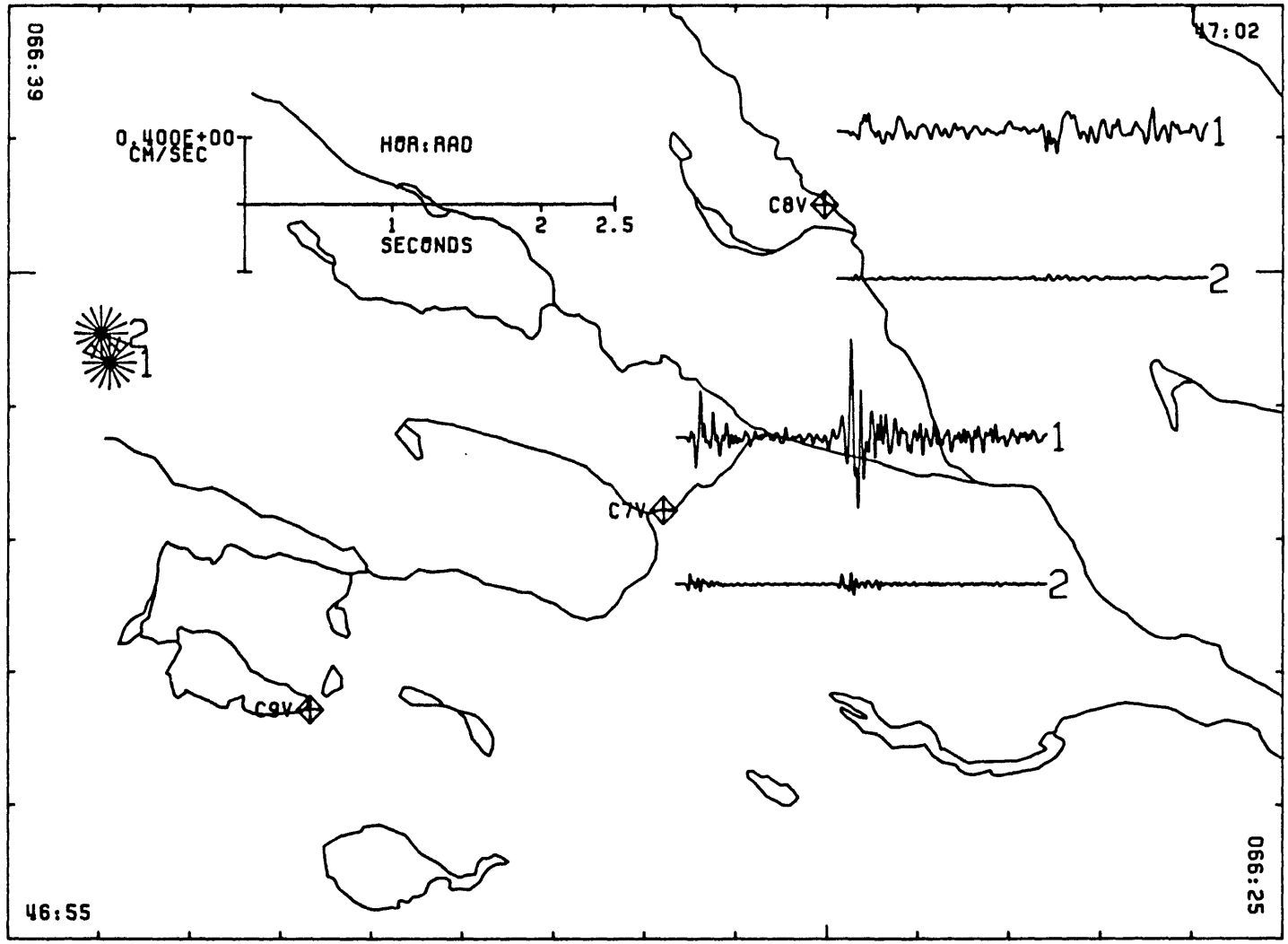


Figure 6c. TRANSVERSE VELOCITY

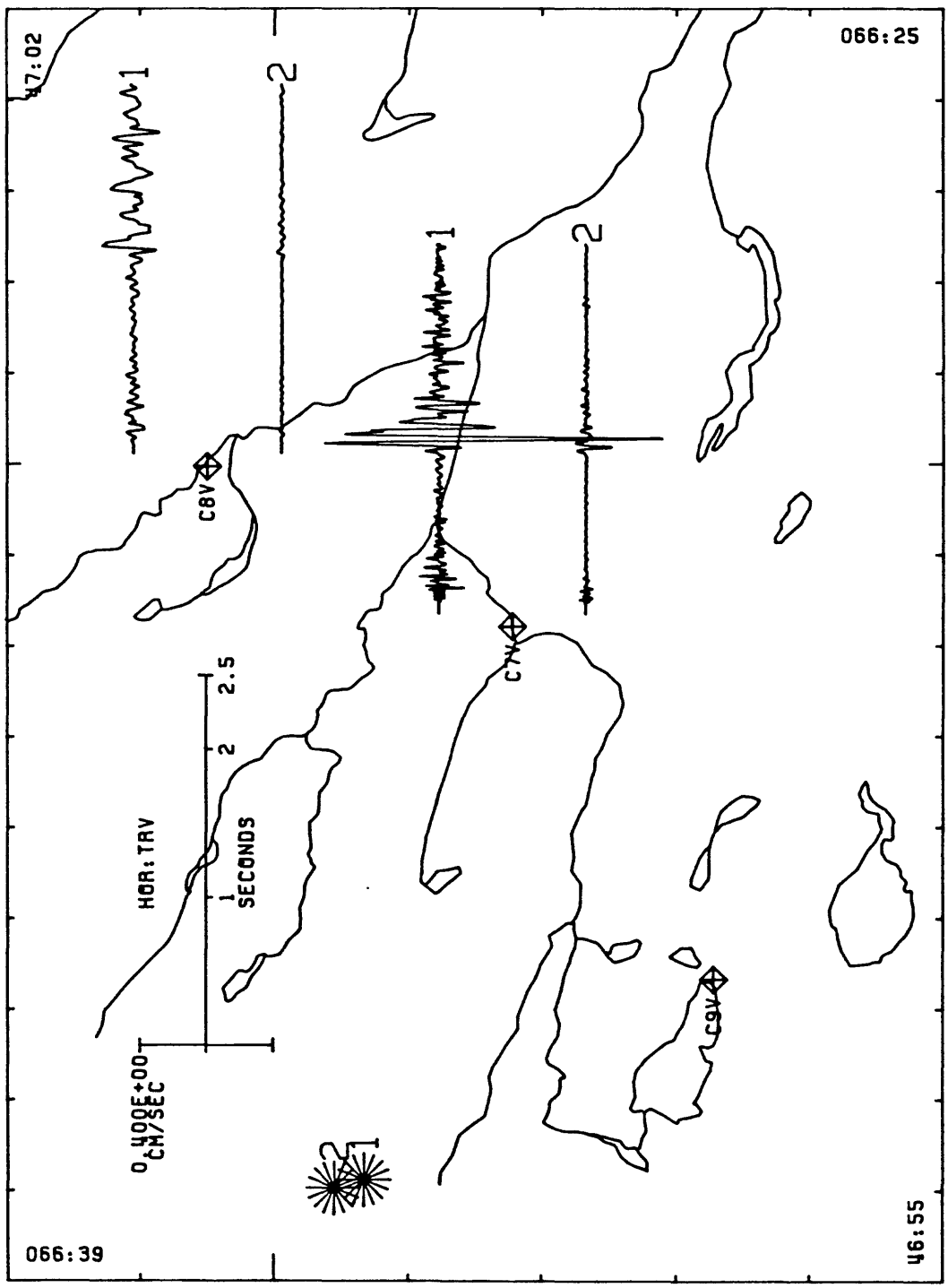


Figure 6d.

VERTICAL ACCELERATION

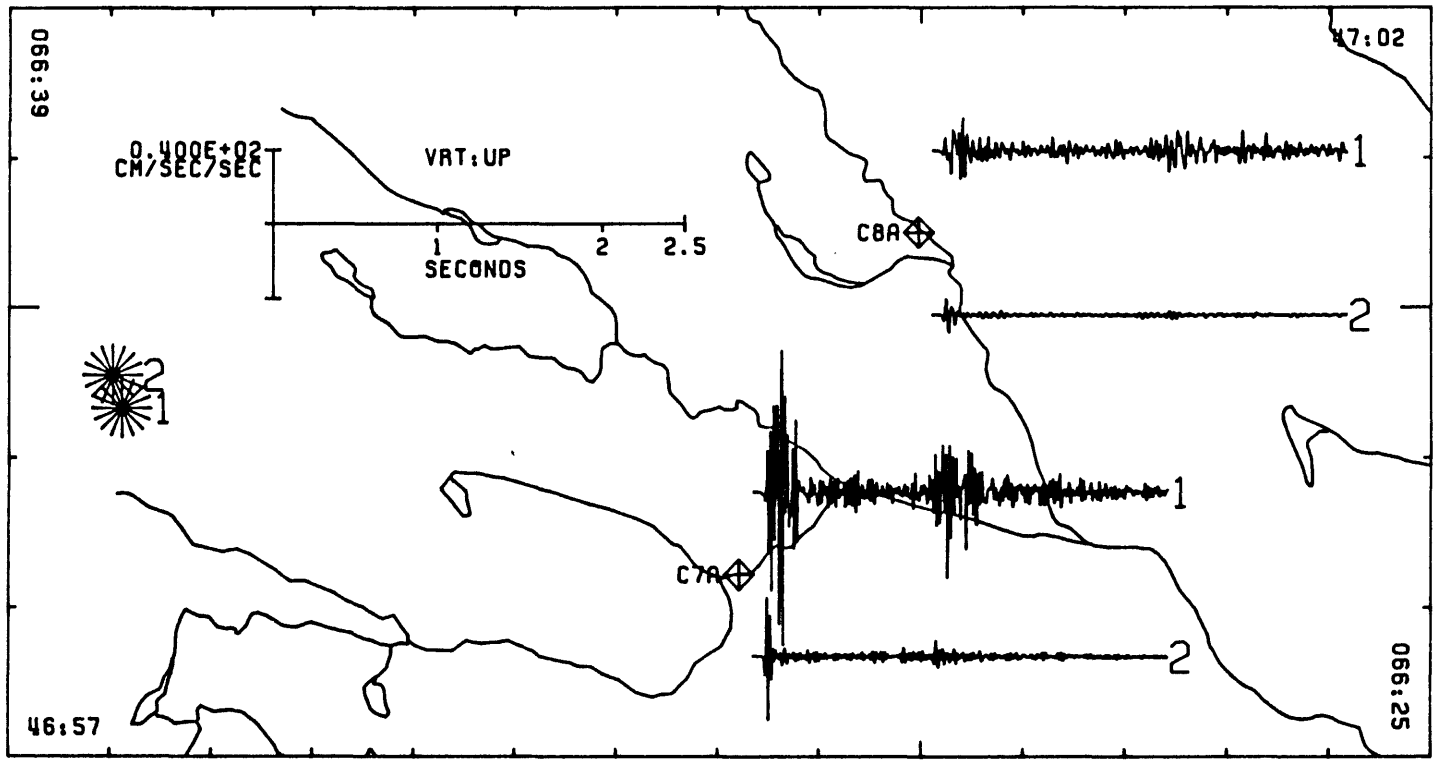


Figure 6e. RADIAL ACCELERATION

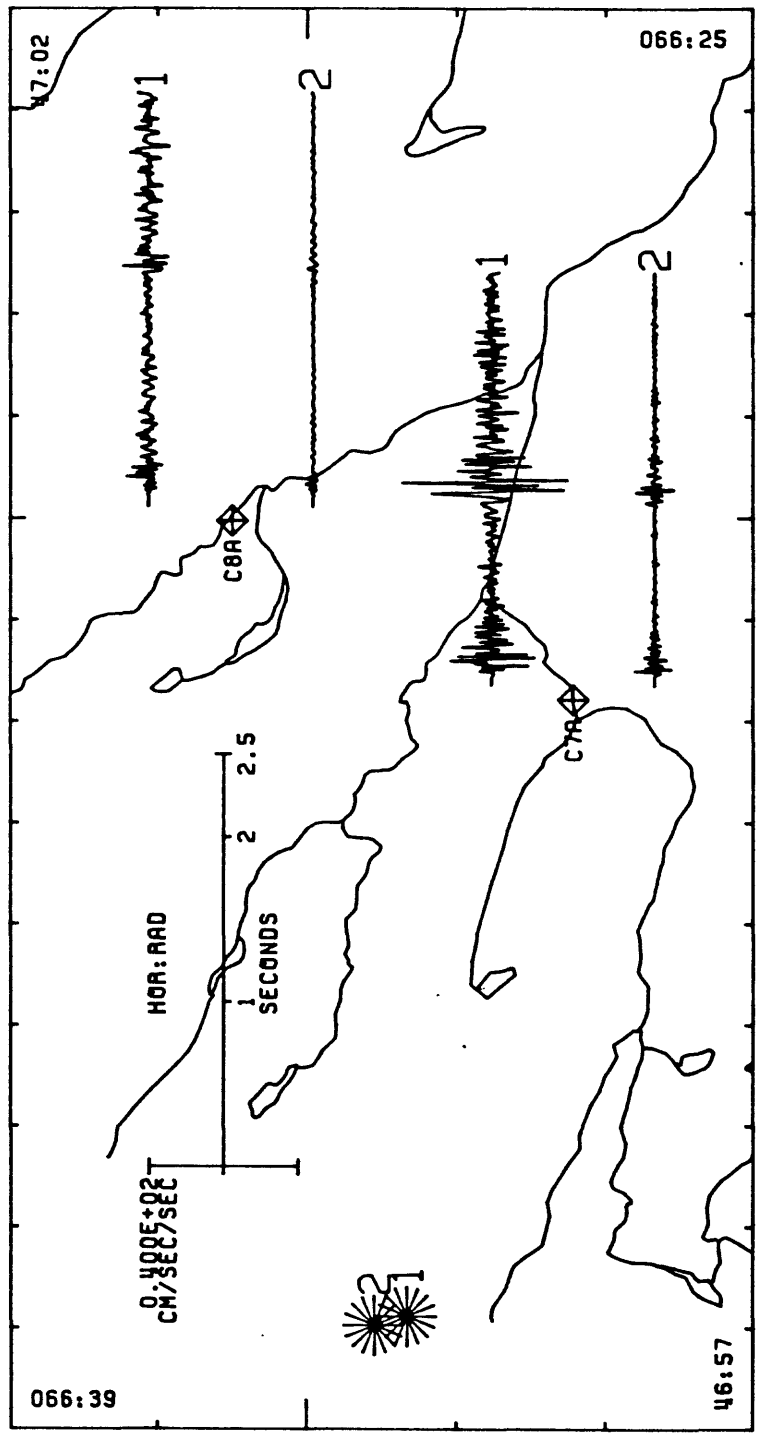
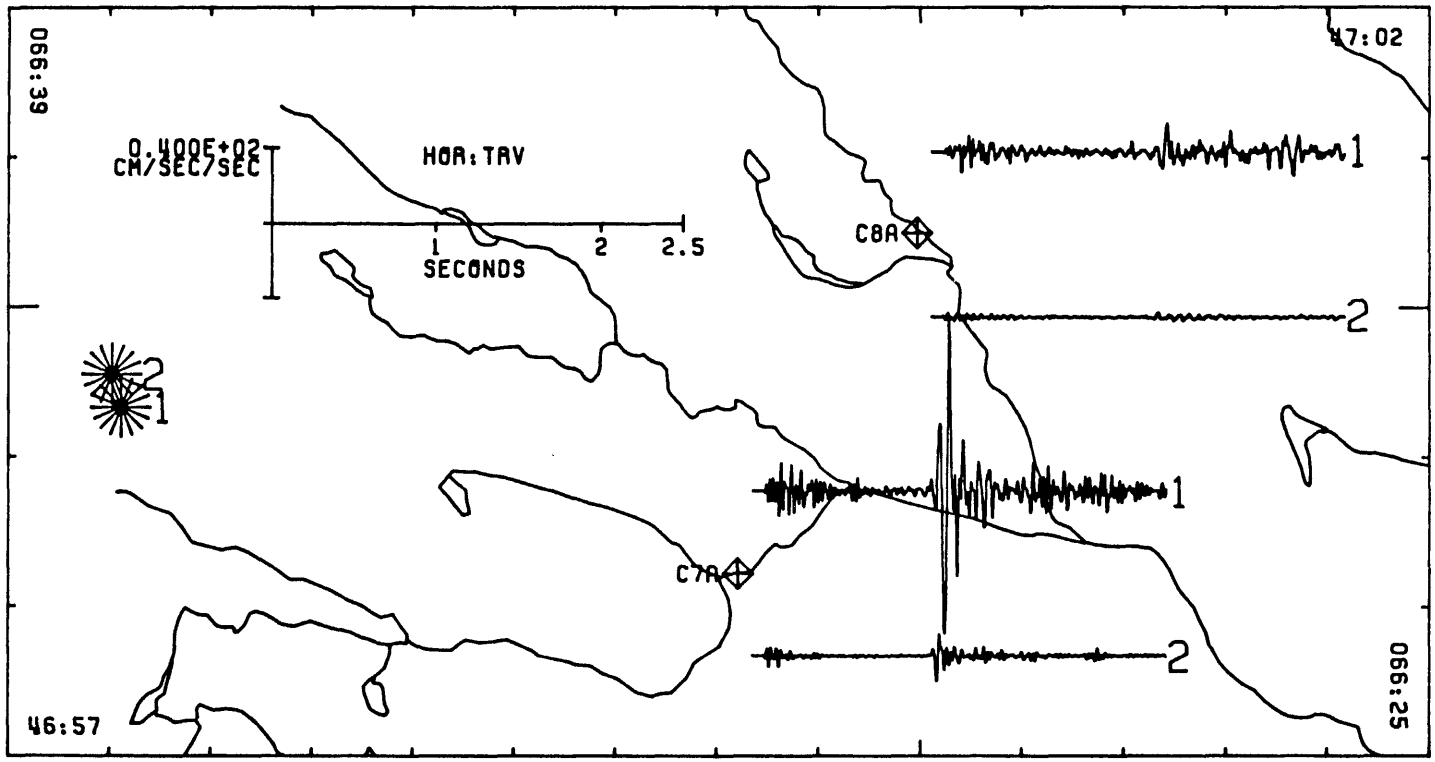


Figure 6f. TRANSVERSE ACCELERATION



3.5 event on the same components. Homogeneity of the propagation medium is evident in the absence of phases after P and before S. This is particularly true of the foreshock waveforms recorded on instrument C7V which resemble the impulse response of a homogeneous half space.

Preliminary source paramenter calculations using a Brune model (Brune 1970, 1971) have been made for twenty-five of the digitally recorded aftershocks. Calculated moments ranged from 10^{20} to less than 10^{17} dyne-cm (Cranswick and Mueller, 1982). A complete study of the source parameters of all the digitally recorded events is currently in progress (Mueller and Cranswick, 1982).

Table 5 is a key to the digital recordings made of the aftershocks listed in Table 4. The raw data files of all the digital records indicated in Table 5 are included on the digital data tape and plotted in Appendix A as a reference. The figures in Appendix A are whole record plots, and so each has a time scale that corresponds to the record duration. The amplitude scales are normalized to the peak amplitude which permits the reader to ascertain the peak value of a record by inspecting the amplitude-scale units label. Some of the figures, reflecting the state of the digital data, still have time-marks in the traces which remain in the time-series because of processing difficulties caused by instrument malfunction due to the low temperature recording conditions.

This is a valuable data set because it vastly increases the number of digital strong motion records of Eastern North American seismicity. It includes, to the best of our knowledge, the largest event in the Northeast ever recorded by digital instruments.

TABLE 5

No.	Aftershock	C7A	C7V	C8A	C8V	C9V	CBA
1	015 2037	*					
2	016 0610		*				
3	016 0813		*				
4	016 1554		*				
5	017 0739	*		*		*	
6	017 1224	*	*	*	*	*	
7	017 1332	*	*	*	*	*	
8	017 1333	*	*	*	*	*	
9	017 1408	*	*	*	*	*	
10	017 1756	*	*				
11	018 0259	*		*			
12	018 1144	*		*		*	
13	018 1547			*			
14	018 1831				*	*	
15	018 1934	*		*	*	*	
16	019 0712	*				*	
17	019 1018					*	
18	019 1159	*				*	
19	019 1436			*		*	
20	019 2025			*	*	*	
21	020 0630					*	
22	020 0821	*			*		
23	020 1000			*	*	*	*
24	020 2340	*	*	*	*	*	
25	020 2340	*	*	*	*	*	*
26	020 2340	*	*	*	*	*	*
27	021 0039	*	*	*	*	*	
28	021 0229	*	*	*	*		
29	021 0635		*				
30	021 1040		*		*		
31	021 1123	*	*	*	*	*	
32	021 1134		*			*	
33	021 1328			*	*		
34	021 2034		*				
35	022 0328		*				
36	022 0542		*			*	
37	022 0713		*	*	*		
38	022 0937		*		*		
39	022 1040		*	*	*		
40	022 1208		*			*	

ACKNOWLEDGMENTS

We wish to thank the officials of Provincial Government of New Brunswick for giving us their full cooperation in the field program. We wish to thank the people of Newcastle for providing us a place to which we could return from the cold. Two organizations were absolutely essential for field operations: the Department of Highways and the Department of Natural Resources of New Brunswick. Without the snow-plow crew from the Newcastle office of the Highway Department, we could have never reached the study area in the first place, and without the officers of the McGraw Brook Ranger Station, we would have never returned from it. Ralph Hudson, both as a representative of the New Brunswick Emergency Measures Organization, and as a very enthusiastic and interested private citizen, left no stone unturned in responding to whatever challenge befell our logistics. We would like to thank the Northeastern Seismic Network groups at both MIT and Lamont-Doherty for providing us with their data. The American authors of this report wish to thank the authorities of the Canadian Federal Government for their assistance, and the Earth Physics Branch in particular for their invitation to us to participate in this aftershock study. Edward Cranswick wishes to thank his wife, Sandra, for providing the beautiful figures that served as the carrot before the horse of this report. This report was promptly and carefully reviewed by Joe Andrews, and we are grateful to him.

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APPENDIX A

Raw Data Whole Record Seismograms

Each figure is a plot of one of the raw digital data files. All components of each record are plotted. The absence of the traces of components 2 and 3 signifies that only the vertical component was recorded by the instrument at that time.

The upper right hand corner label in large letters is the computer file specification. The three characters to the right of the period are the three-character instrument code. The first 8 characters of the specification are time of instrument trigger starting with Julian day. Because of the limit to the number of characters used in a computer filename, the time in seconds of the arrival is abbreviated to a letter representing one of the twenty 3-second intervals into which 60 seconds is divided. The 8th character is a letter denoting the 3 second interval: "A" = 0 - 2 seconds; "B" = 3-5 seconds, etc. The 9th character (character immediately to the left of the period) specifies motion/component information. Components 1-3 are the three components of acceleration, components 4-6 are the three components of velocity, etc. Where the three components of an arrival are referred collectively, the component/motion number will either be the first or last component of that motion, i.e., three components of velocity will be "4" or "6". The labels of the heading information refer to the following parameters.

Time = The time of the first sample of the record.

EVN = The instrument count of the current event since last reset.

DUR = The duration of the record in seconds

S.R. = The sampling rate in samples per second

SER = The serial number of the instrument

LAT = Station Latitude in degrees and decimal minutes

LON = Station Longitude in degrees and decimal minutes

ELV = Station elevation in meters

DIREC = The orientations of the three orthogonal components measured in degrees. The number to the left of the "/" denotes the angle of orientation of the component measured from the zenith, and the number to the right of the "/" denotes the horizontal azimuth measured clockwise from North.

TRNDUC = The transducer type either "VEL" or "FBA"

COIL = The coil or motor constant of the transducer in volts per unit of motion.

FO = The natural frequency of the transducer in hertz.

DAMP = The damping coefficient of the transducer.

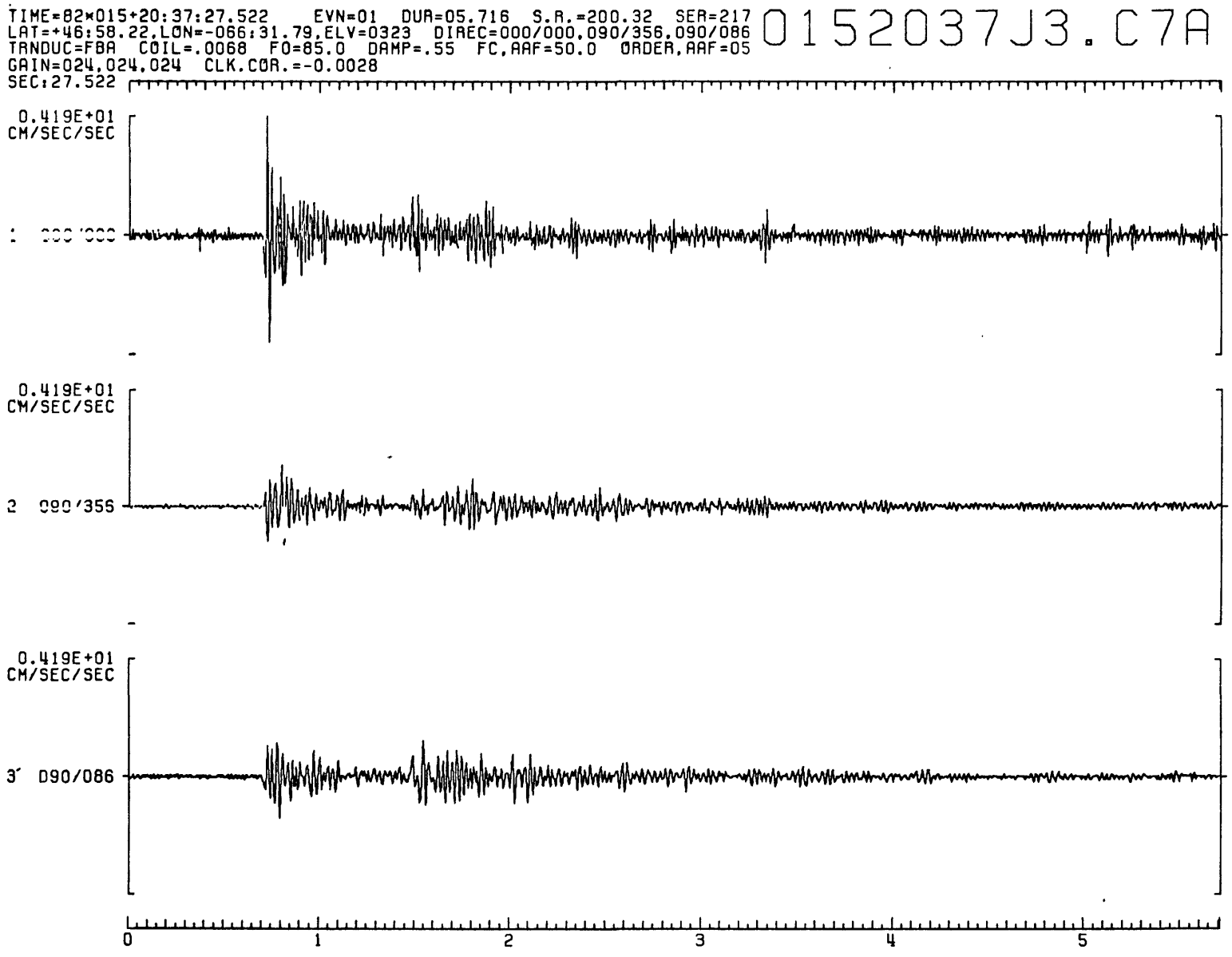
FC, AAF = The corner frequency of the instrument anti-aliasing low-pass filter. The instrument C9V has a corner of 70 hz and is labeled 50 hz in error.

ORDER, AAF = The order of the Butterworth anti-aliasing filter. Order = 5 is equal to 30 db per octave roll-off above the corner frequency.

SEC: = The time in seconds of the origin of the time-axis as plotted. This time may be greater than the seconds value indicated in the heading of the first recorded sample if several of the initial samples have been skipped for plotting convenience.

CLK. CORR. = The clock corrections in seconds to be subtracted from the times indicated on the plot to yield true time.

True Time = Record (Labeled) time - Clock correction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CM/SEC/SEC
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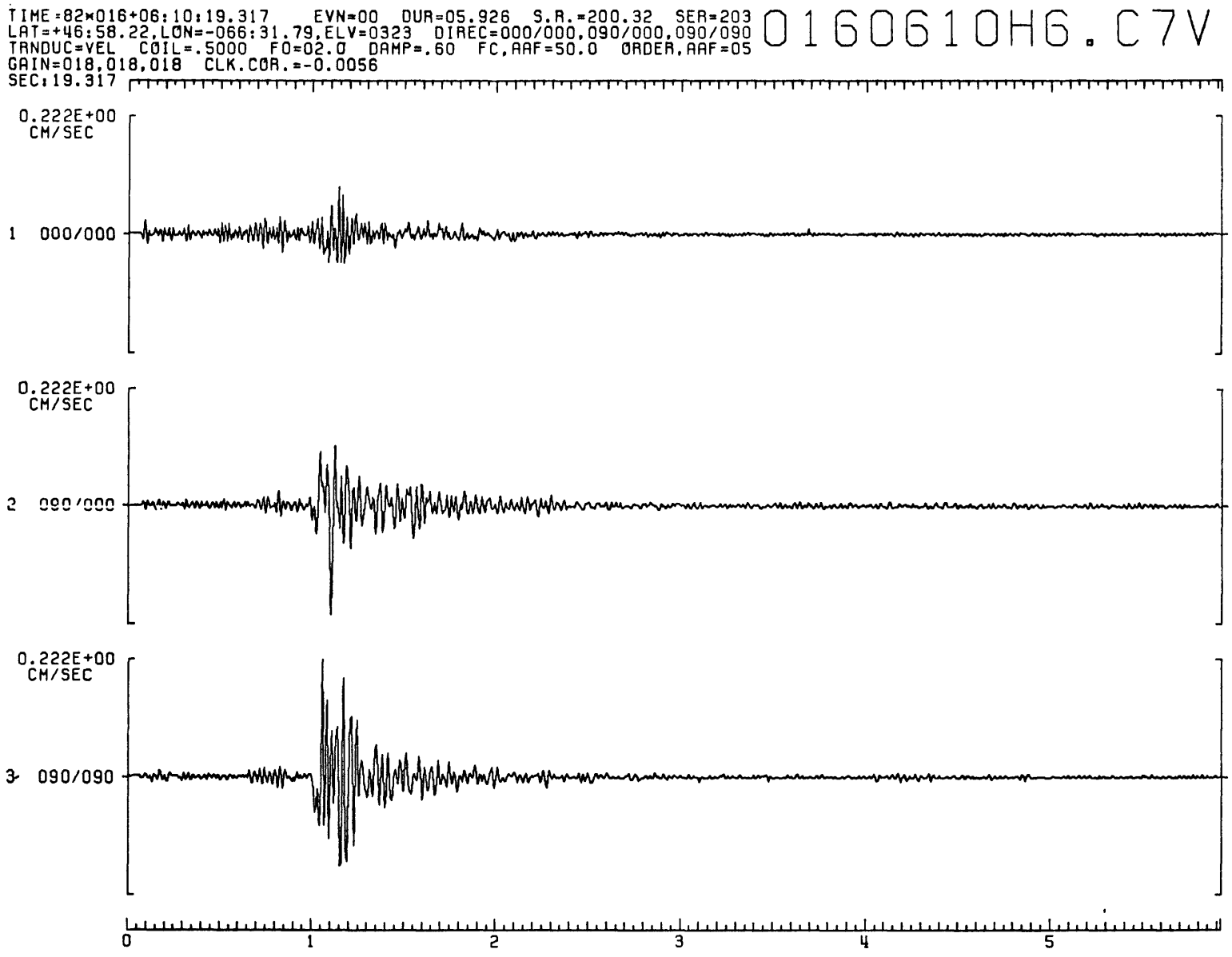
0.419E+01
CM/SEC/SEC
2 090/356
0.419E+01
CM/SEC/SEC
3 090/086
0
1
2
3
4
5

A4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0.222E+00
CM/SEC
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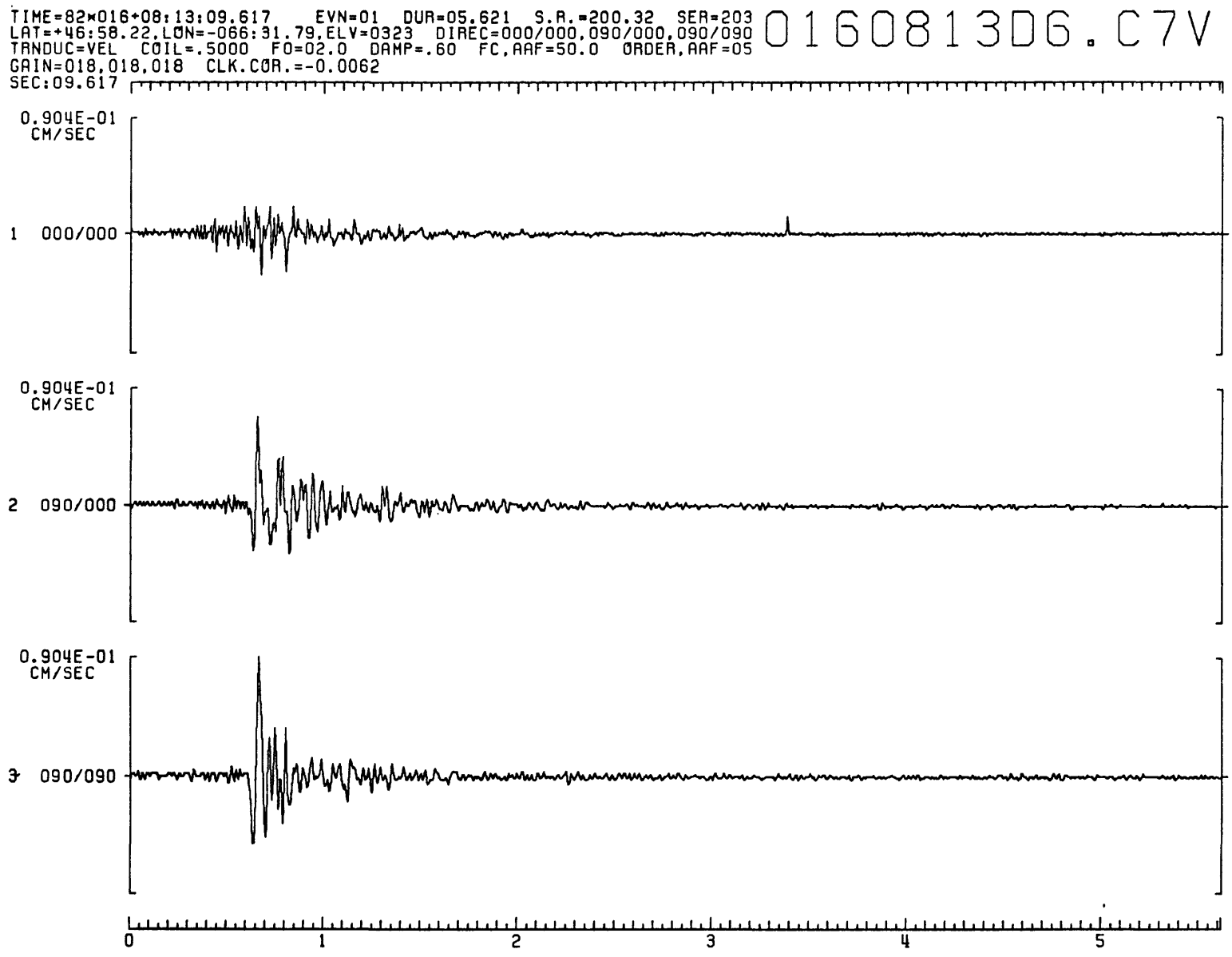
CM/SEC
3 090/090
0
1
2
3
4
5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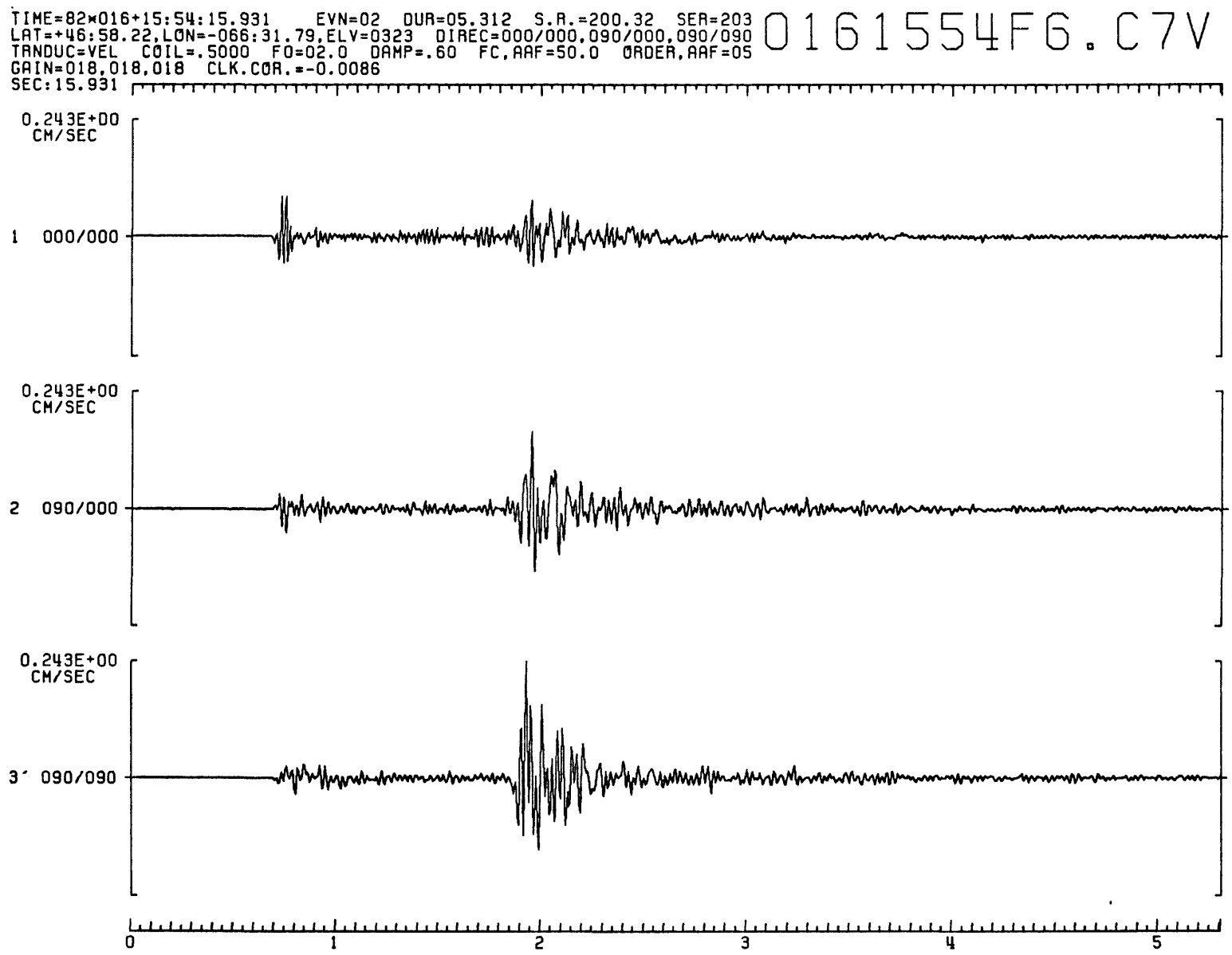
CM/SEC
1 000/000
0.904E-01
CM/SEC
2 090/000
0.904E-01
CM/SEC
3 090/090
0
1
2
3
4
5

A 6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2
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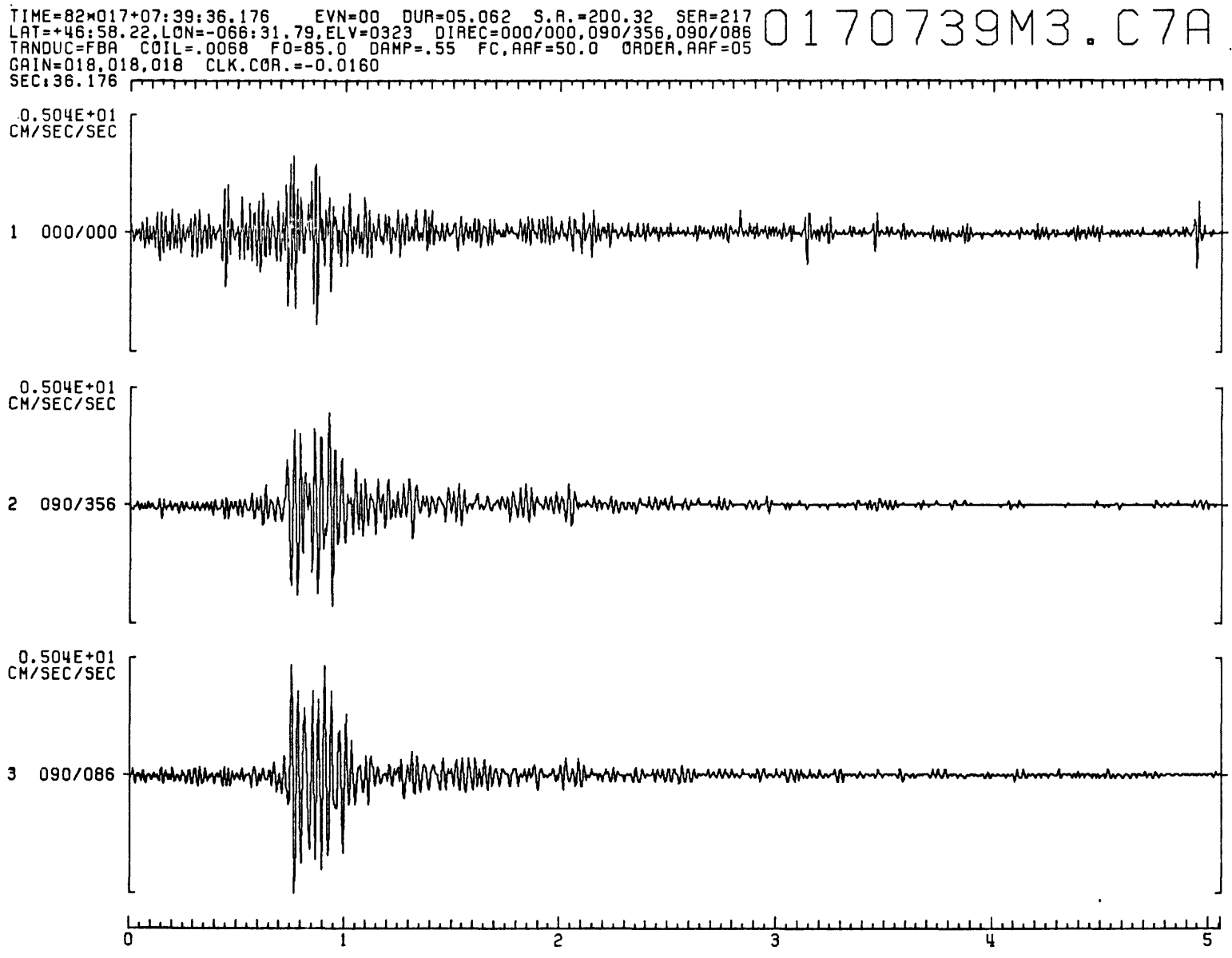
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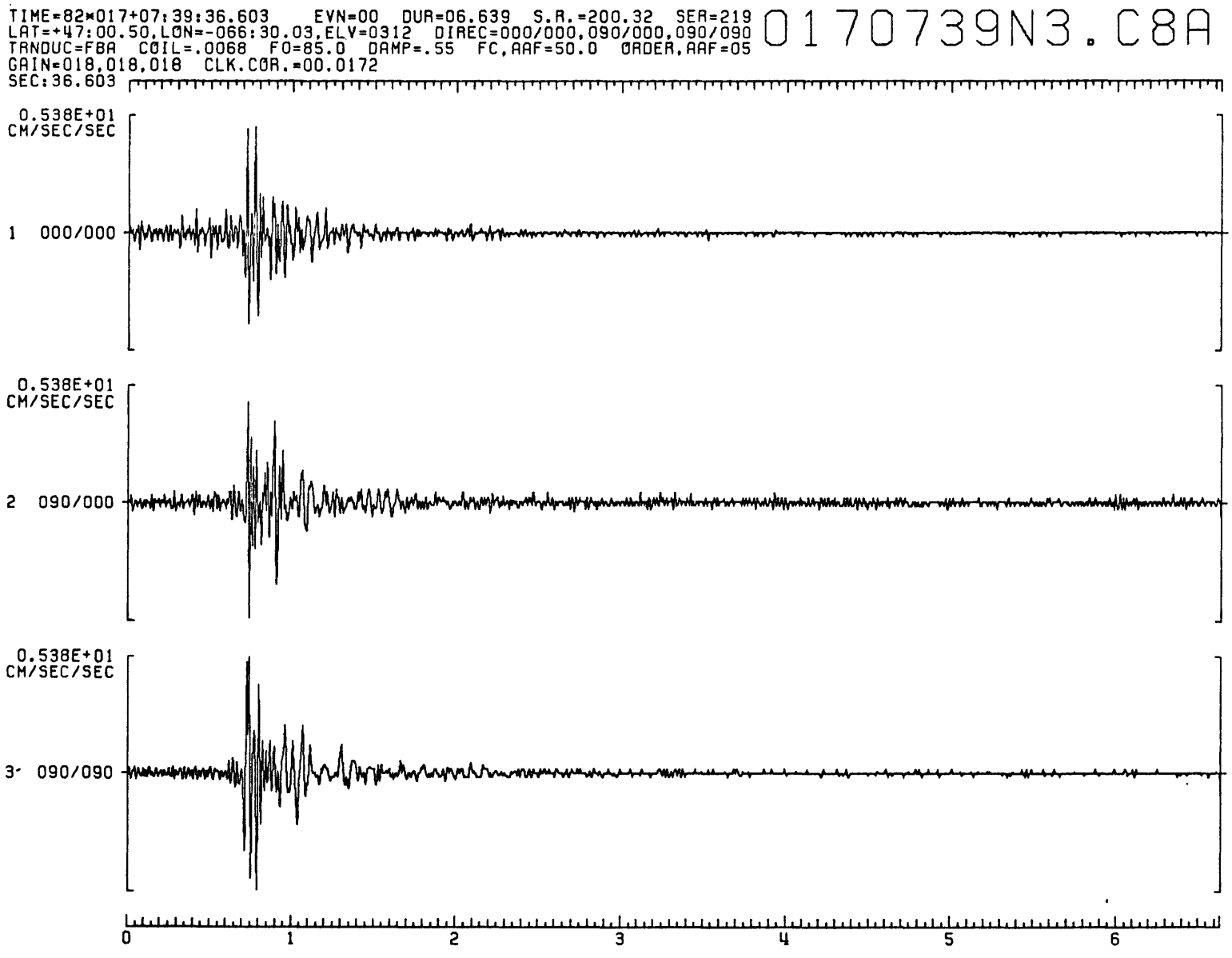
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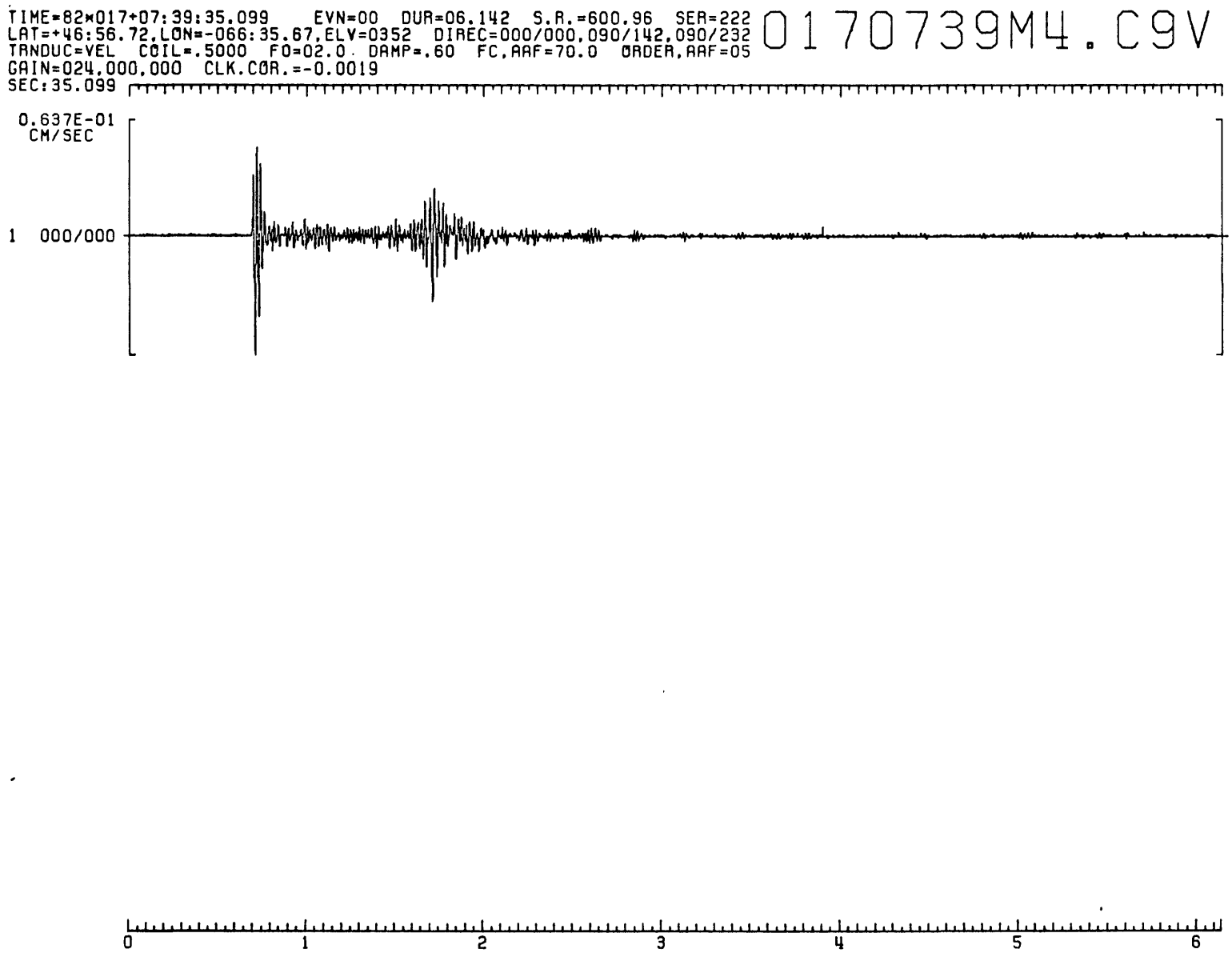
6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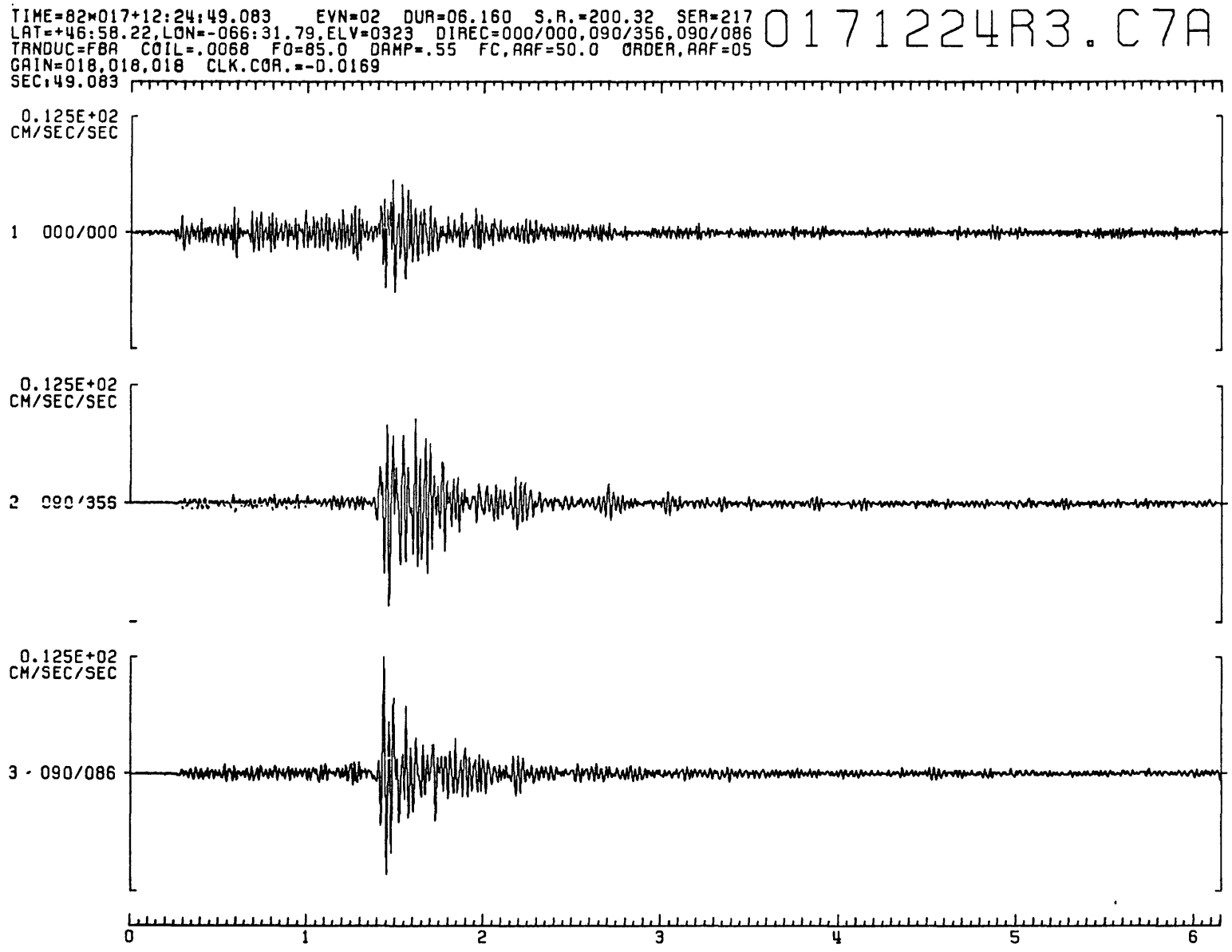
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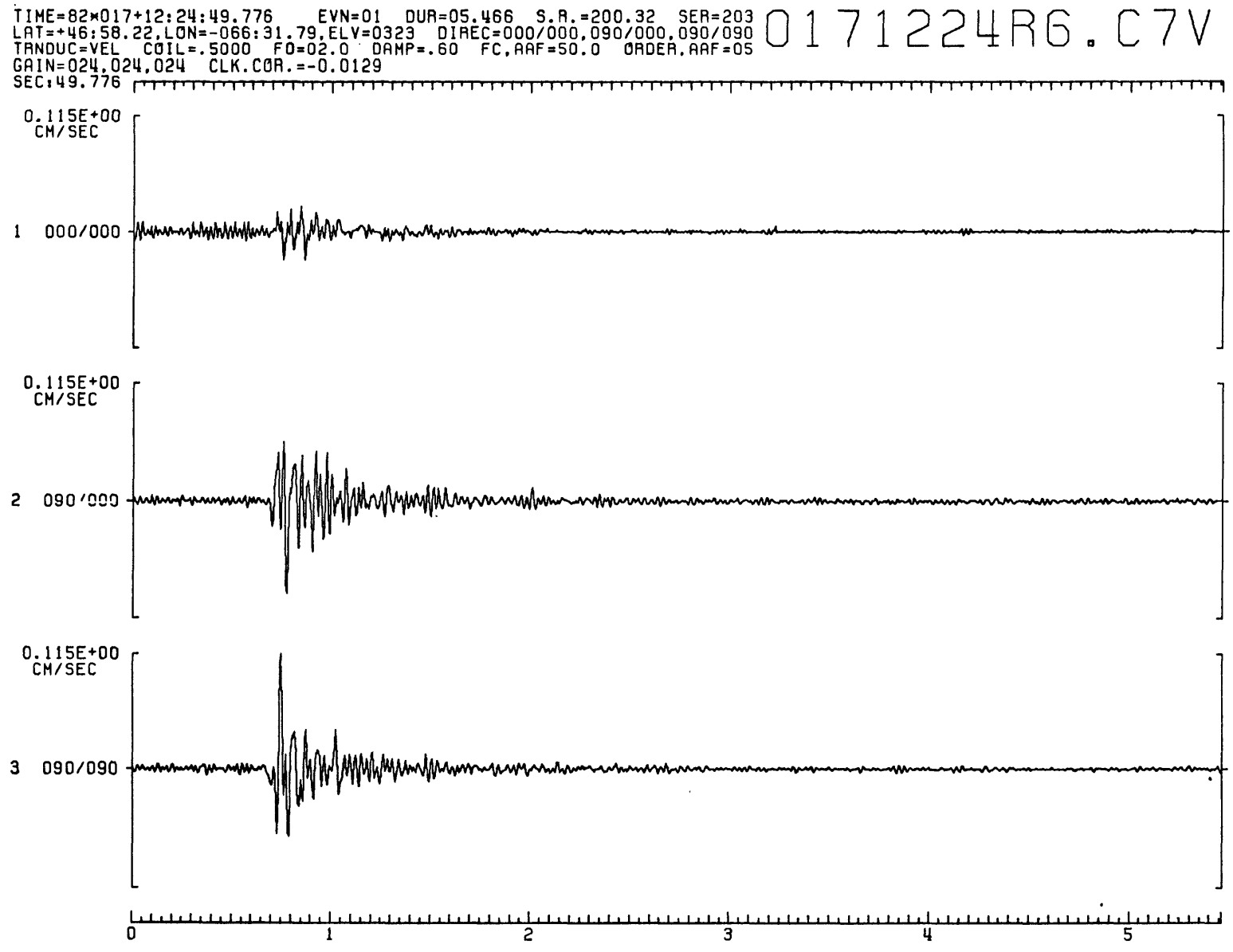
4
5
6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0
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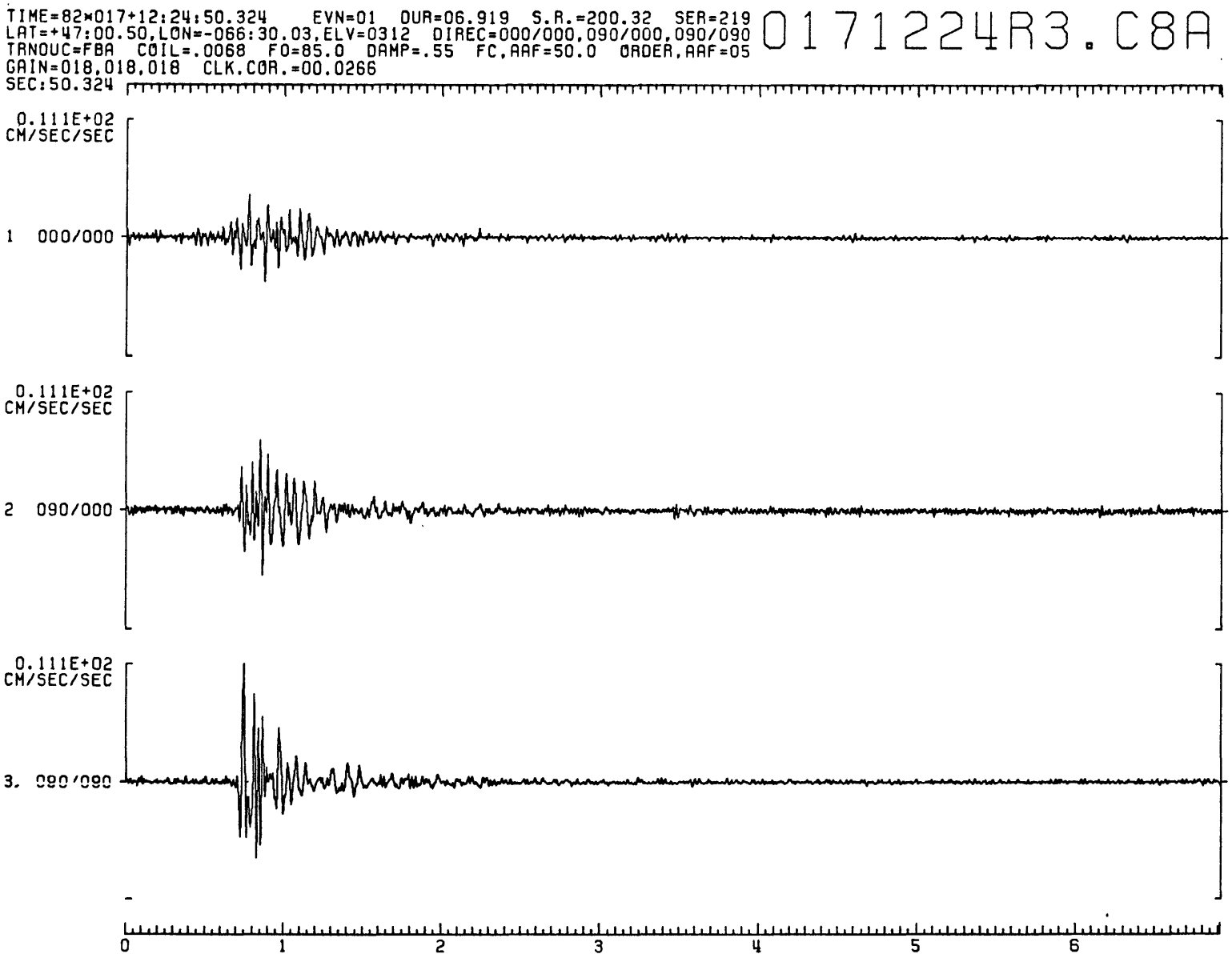
3
4
5

A/02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0
1
2
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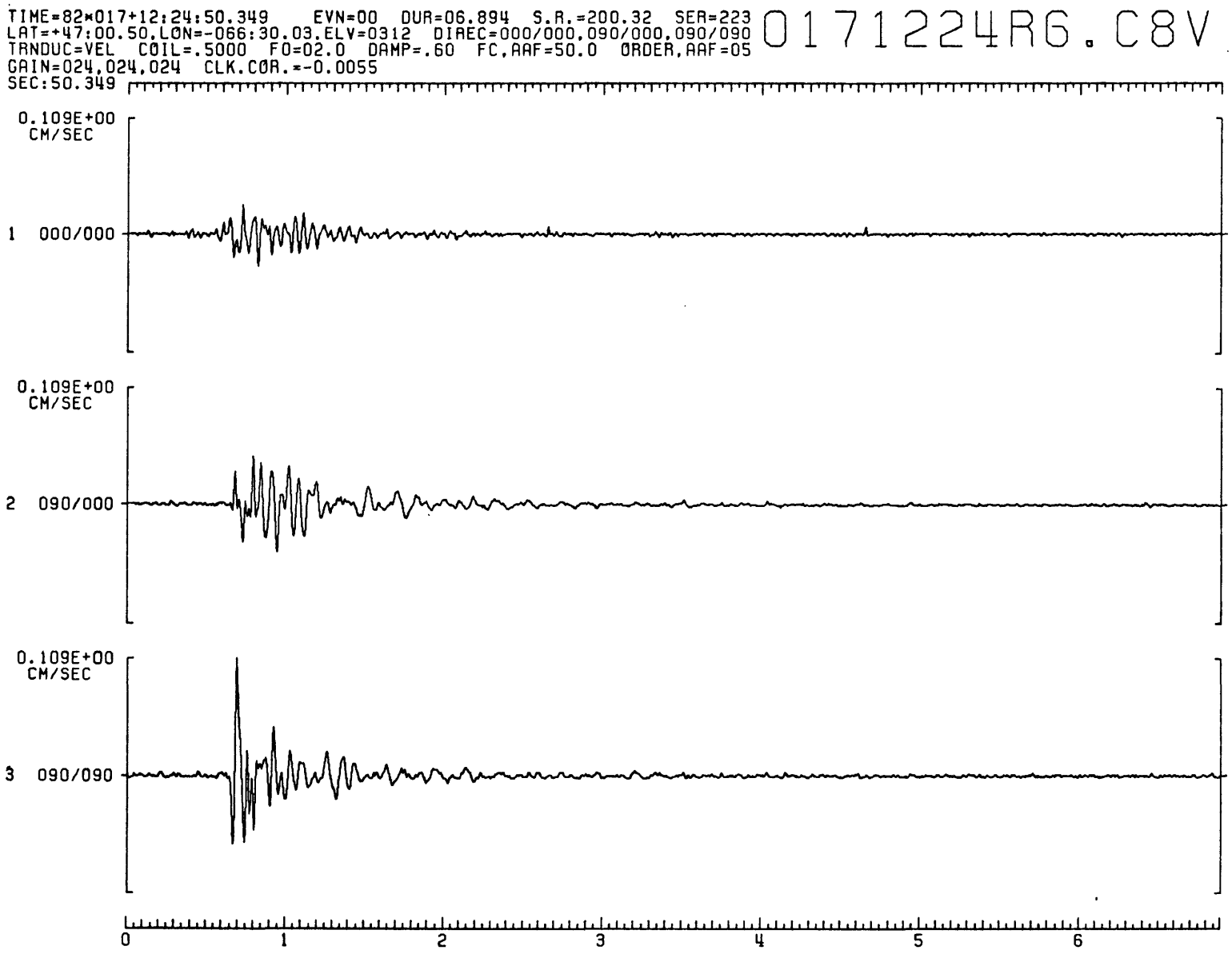
TIME=82*017+12:24:50.349 EVN=00 DUR=06.894 S.R.=200.32 SER=223
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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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0171224R6.C8V
SEC:50.349
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2 090/000
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CM/SEC
3 090/090
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1
2
3
4
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TIME=82×017+12:24:48.402 EVN=01 DUR=06.841 S.R.=600.96 SER=222 0171224R4.C9V
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
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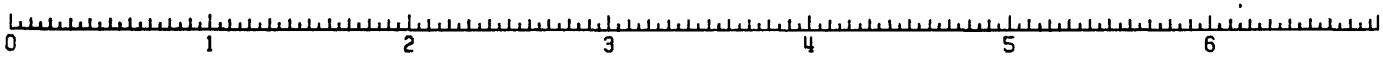
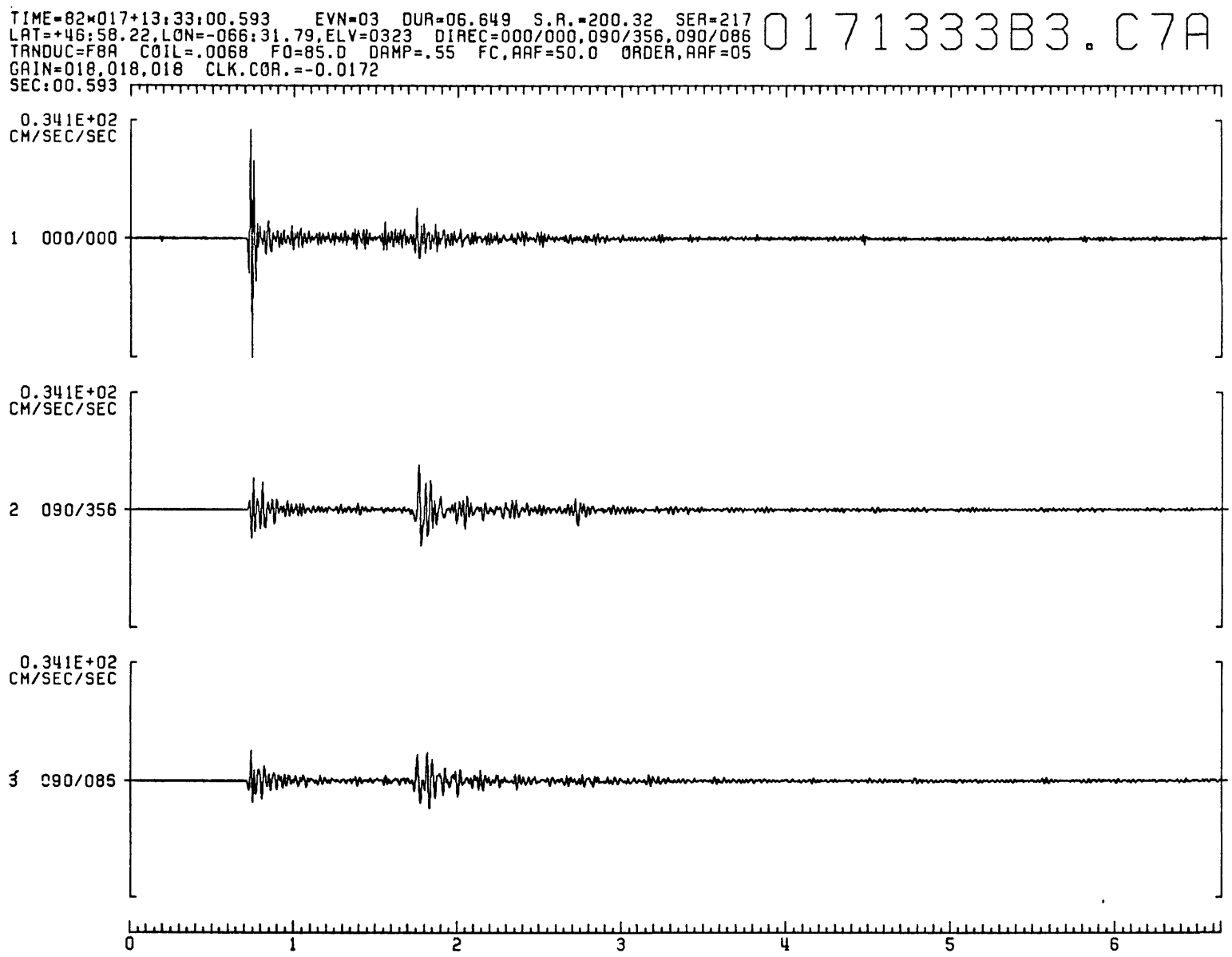
SEC:48.402




TIME=82×017+13:33:00.593 EVN=03 DUR=06.649 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=F8A COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0172
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SEC:00.593
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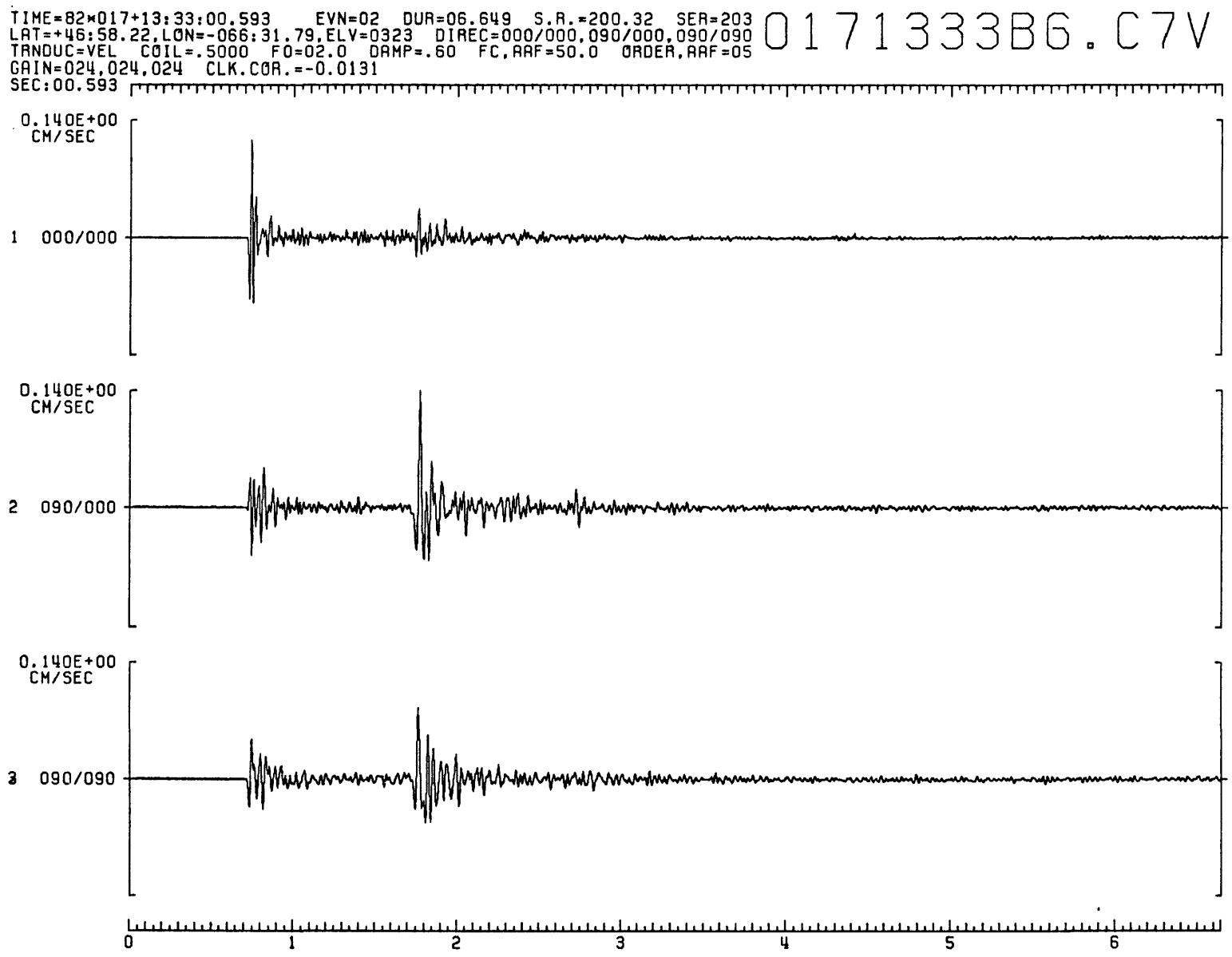
TIME=82*017+13:33:00.593 EVN=02 DUR=06.649 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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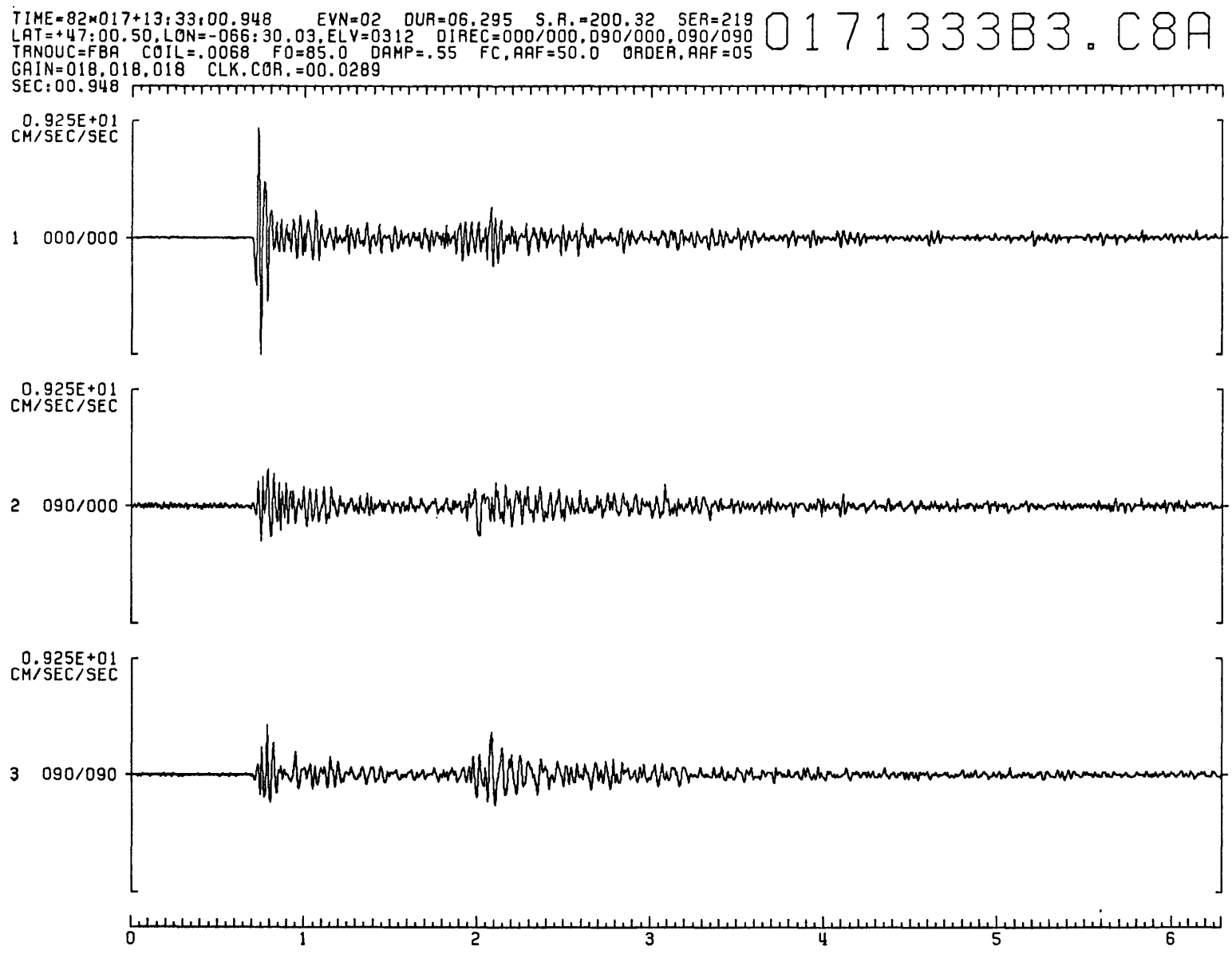
6

A 17


TIME=82*017+13:33:00.948 EVN=02 DUR=06.295 S.R.=200.32 SER=219
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TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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0171333B3.C8A
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3 090/090
0
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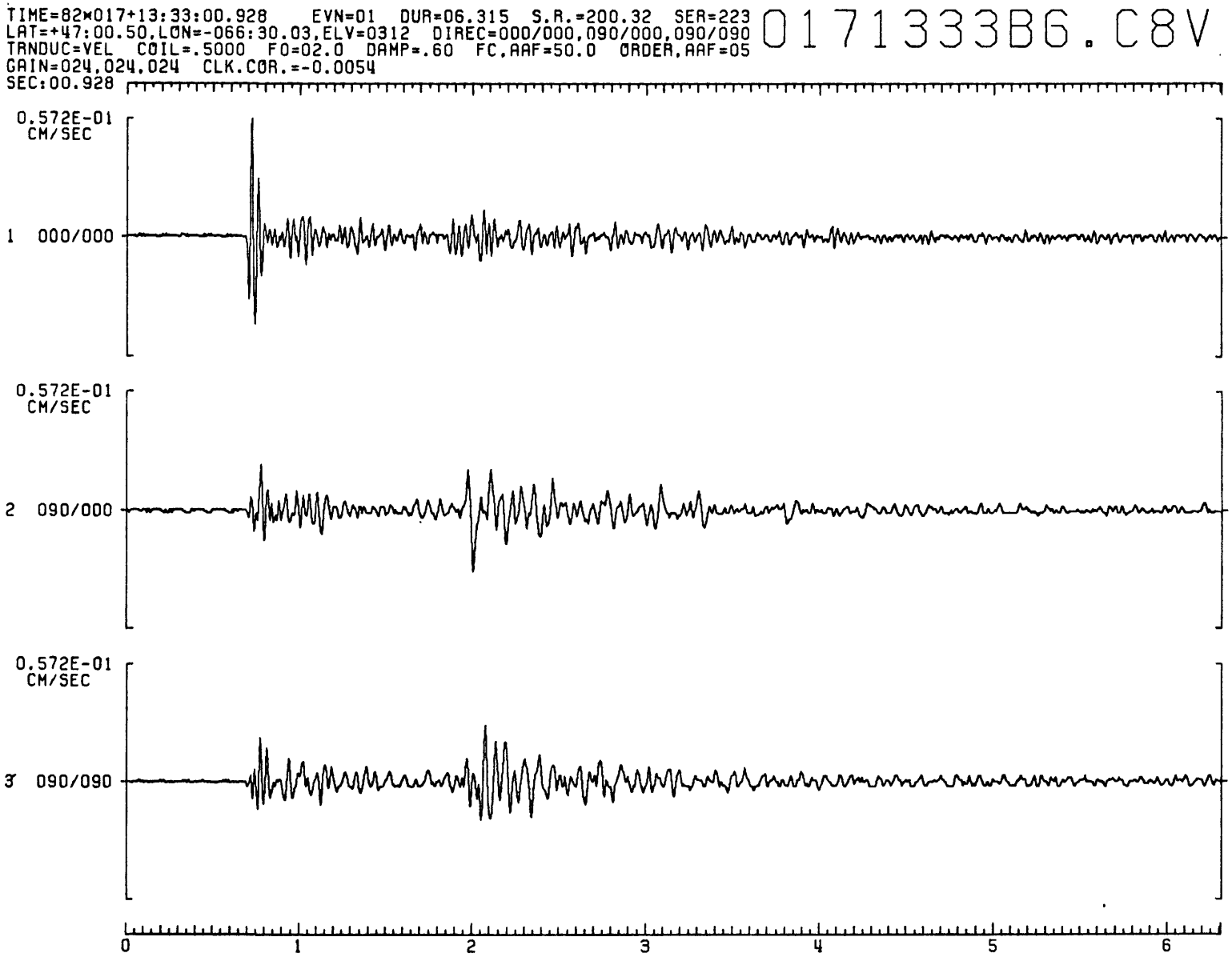
A 18


TIME=82*017+13:33:00.928 EVN=01 DUR=06.315 S.R.=200.32 SER=223
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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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2 090/000
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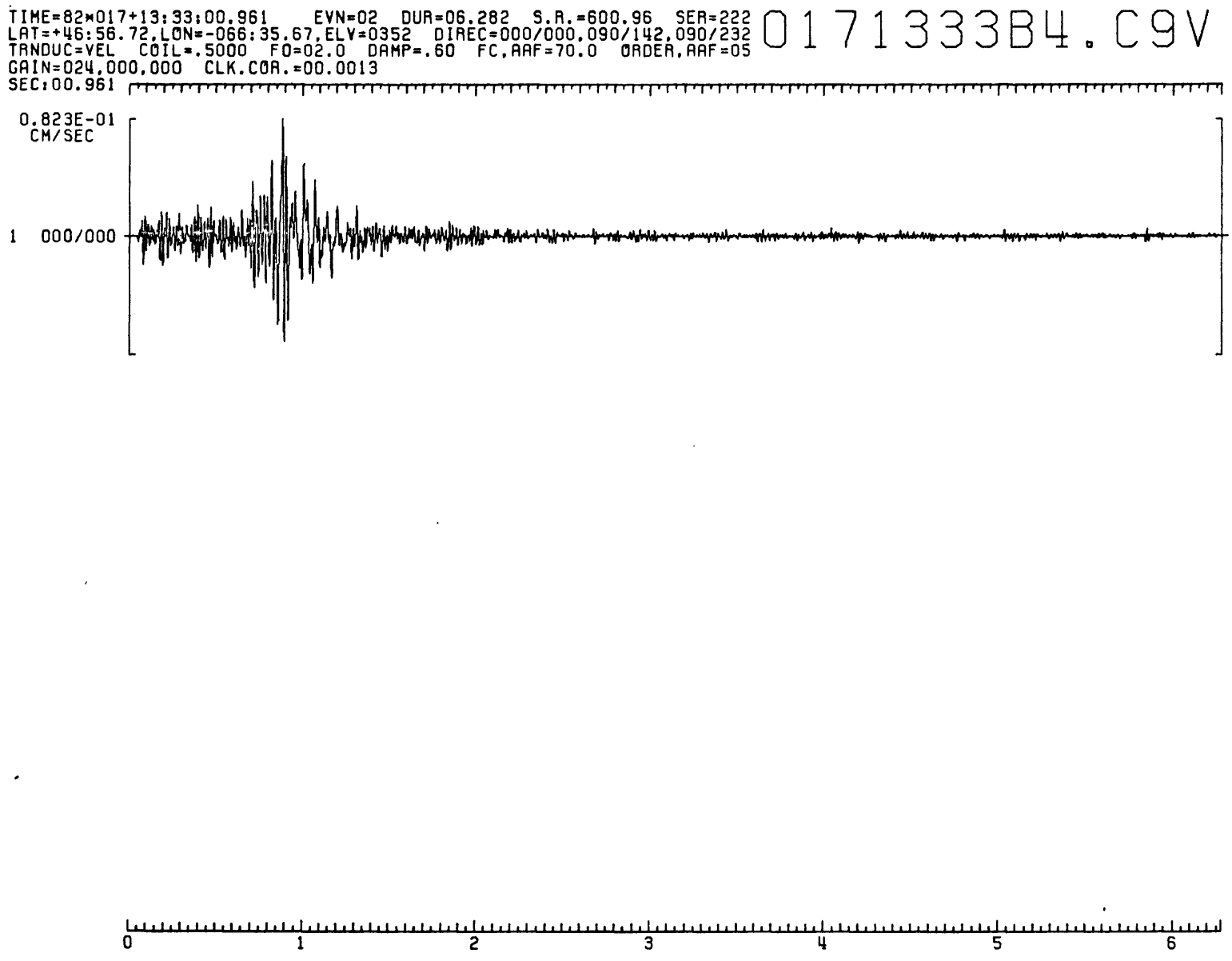
TIME=82*017+13:33:00.961 EVN=02 DUR=06.282 S.R.=600.96 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=024,000,000 CLK.COR.=00.0013
0171333B4.C9V
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CM/SEC
1 000/000
0
1
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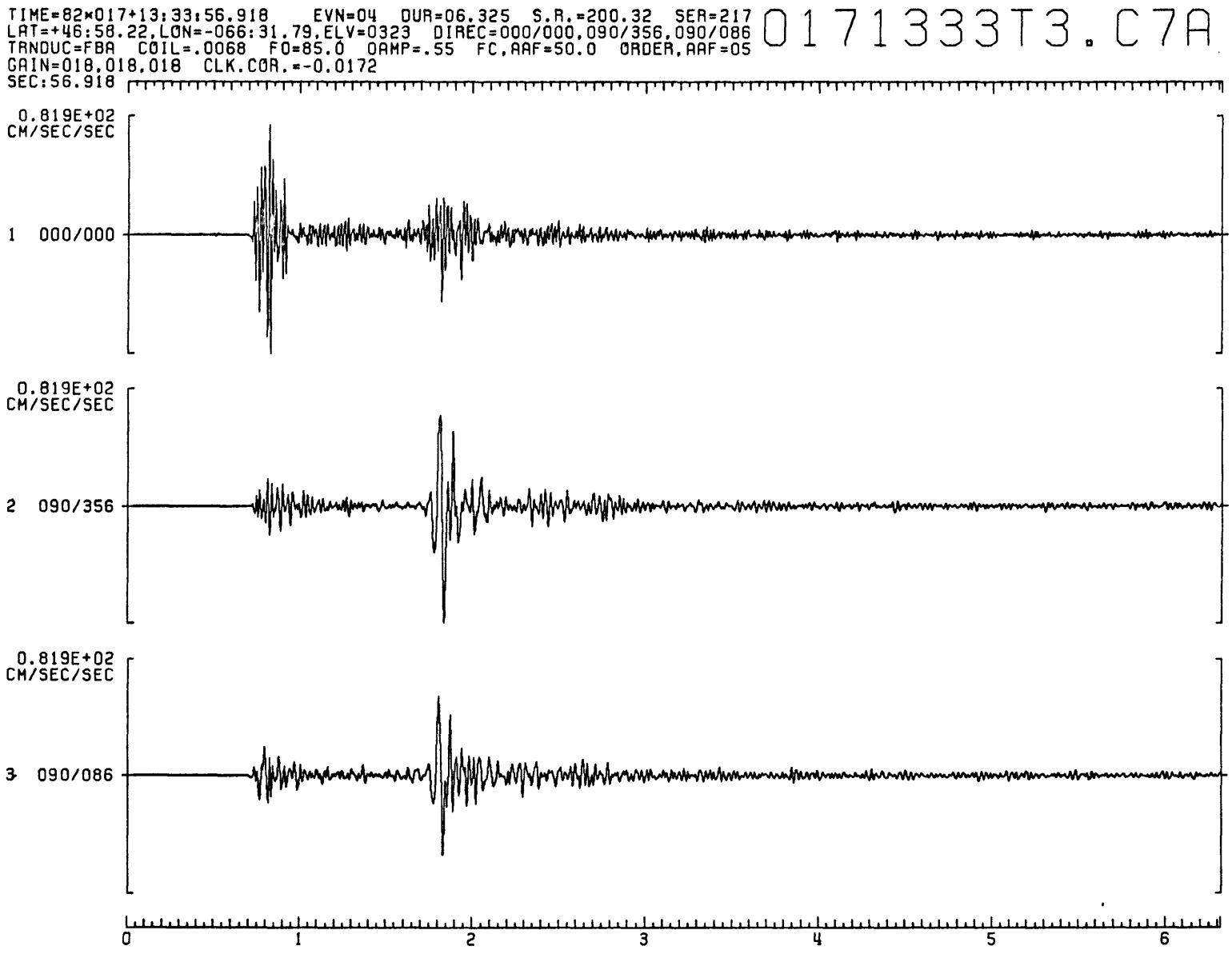
A 20


TIME=82*017*13:33:56.918 EVN=04 DUR=06.325 S.R.=200.32 SER=217
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TRNDUC=FBA COIL=.0068 FO=85.0 OAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0172
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CM/SEC/SEC
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CM/SEC/SEC
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0.819E+02
CM/SEC/SEC
3 090/086
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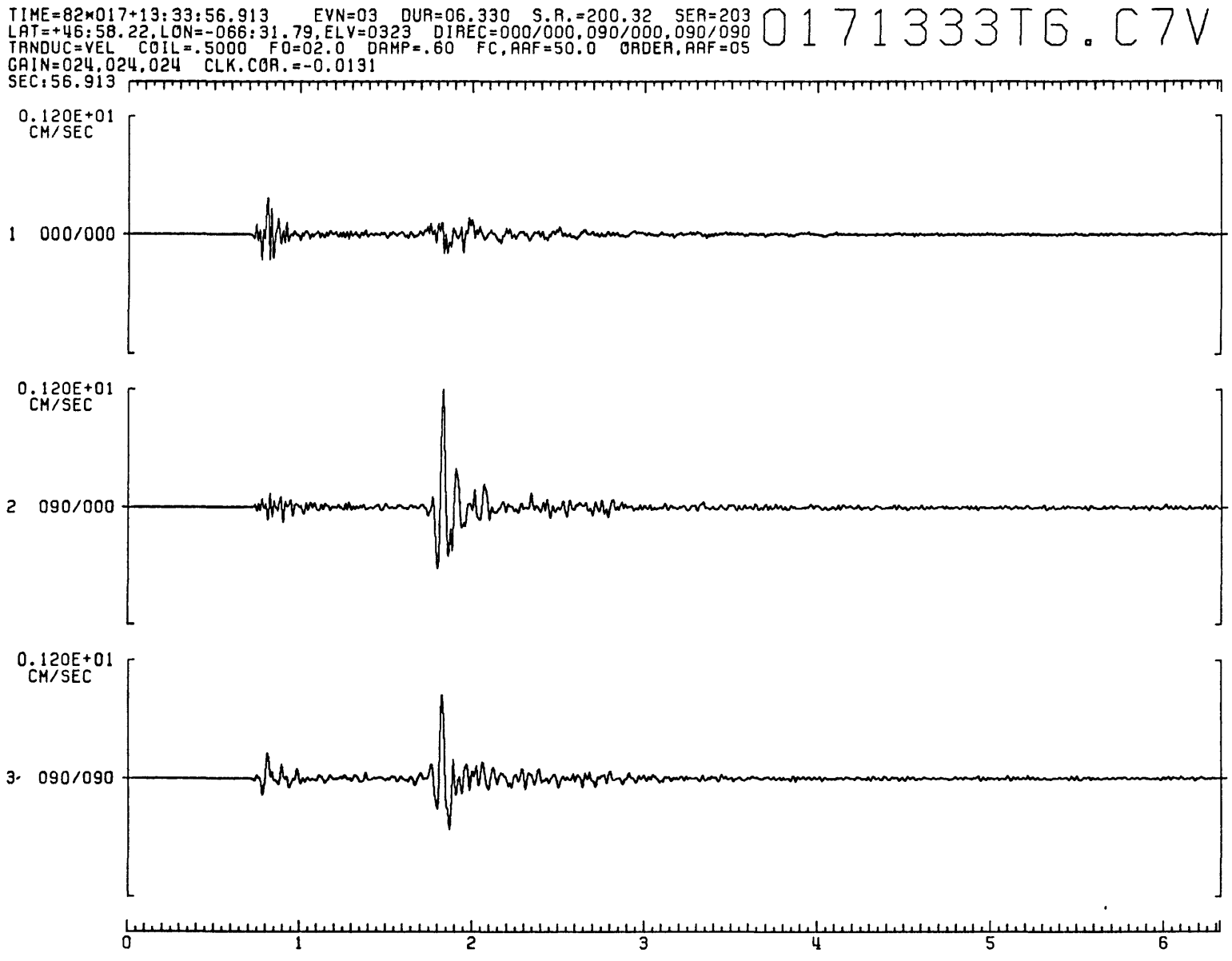
TIME=82*017+13:33:56.913 EVN=03 DUR=06.330 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0131
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1 000/000
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CM/SEC
3 090/090
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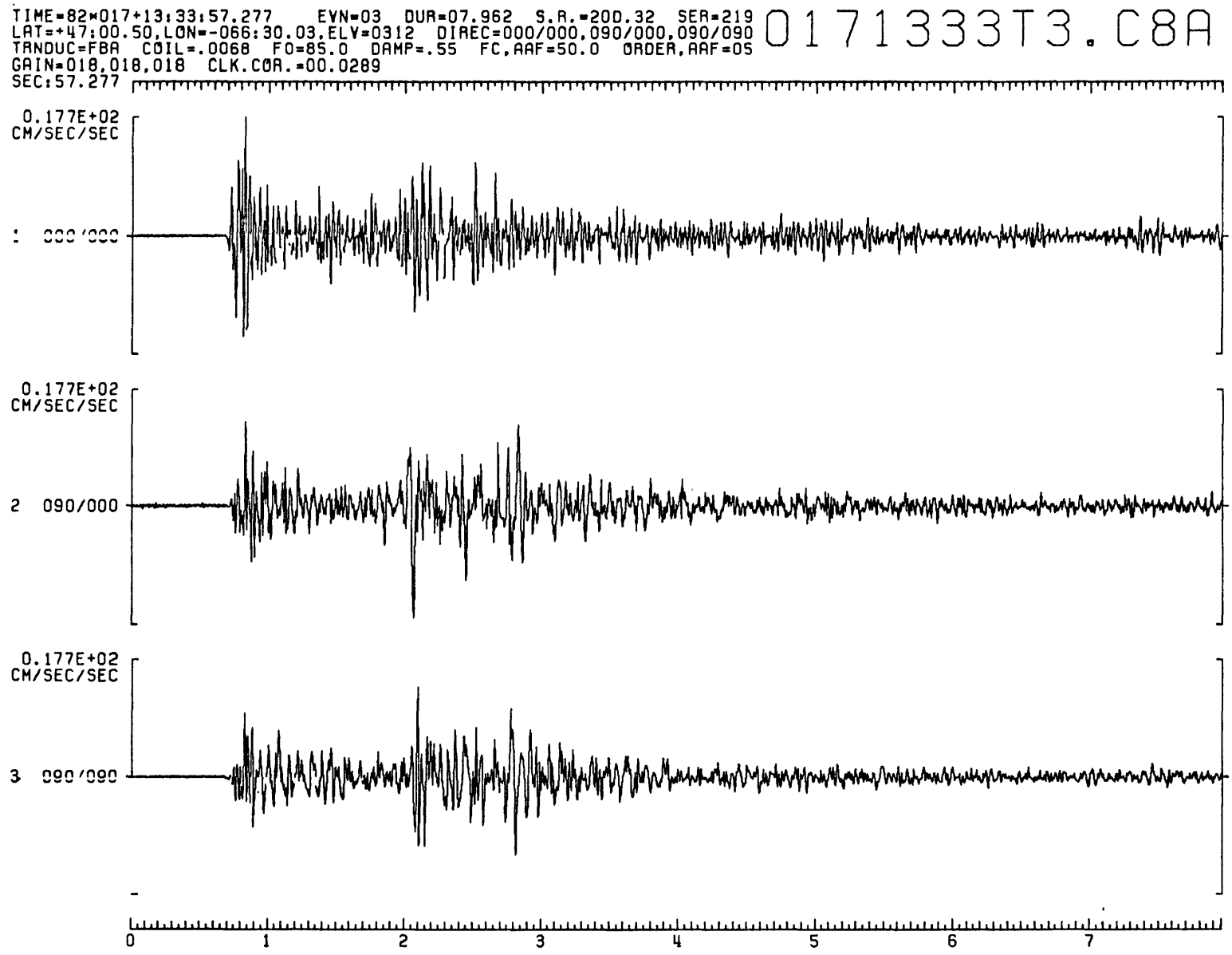
A22


TIME=82*017+13:33:57.277 EVN=03 DUR=07.962 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.0289
0171333T3.C8A
SEC:57.277
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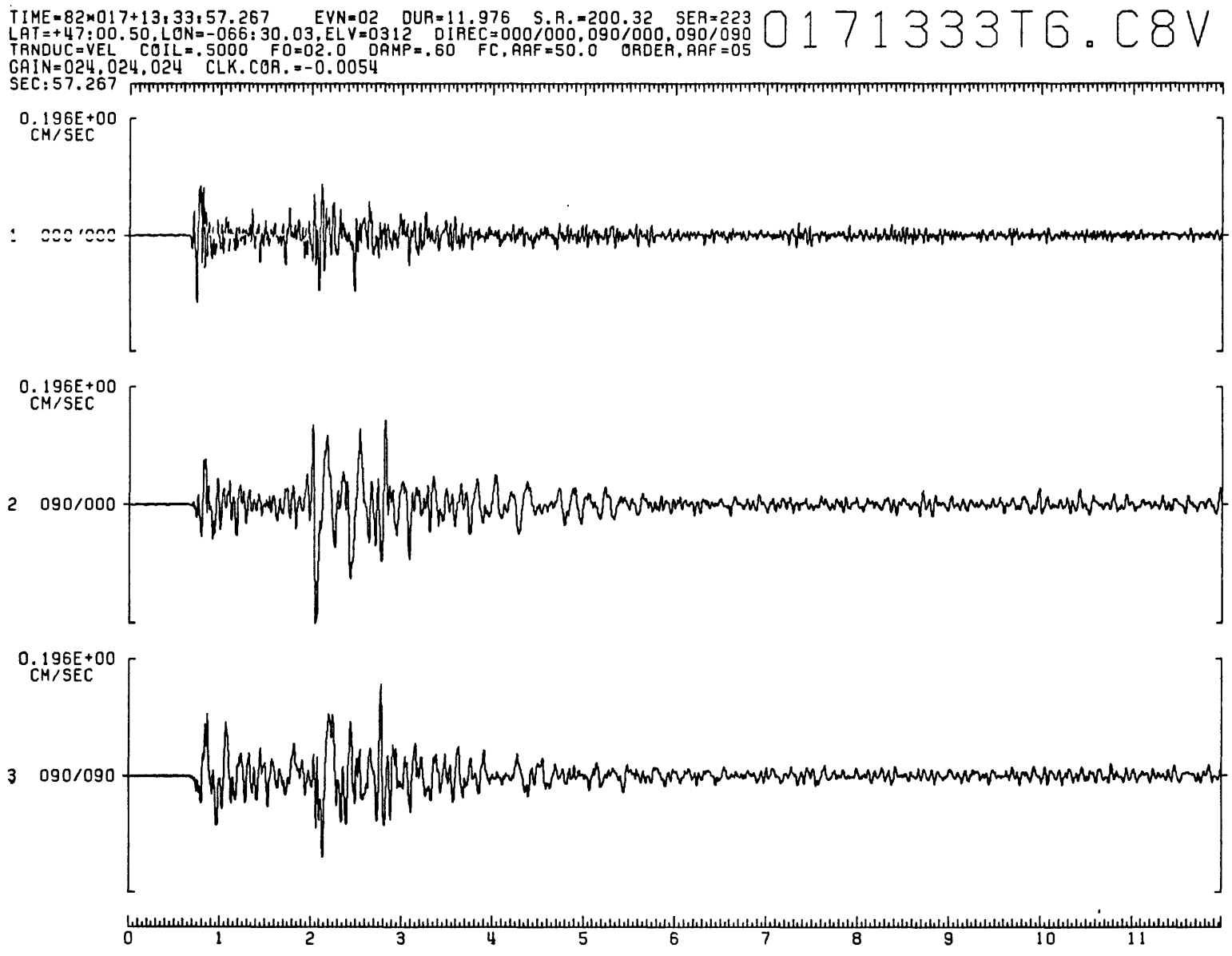
TIME=82*017+13:33:57.267 EVN=02 DUR=11.976 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0054
0171333T6.C8V
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CM/SEC
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3 090/090
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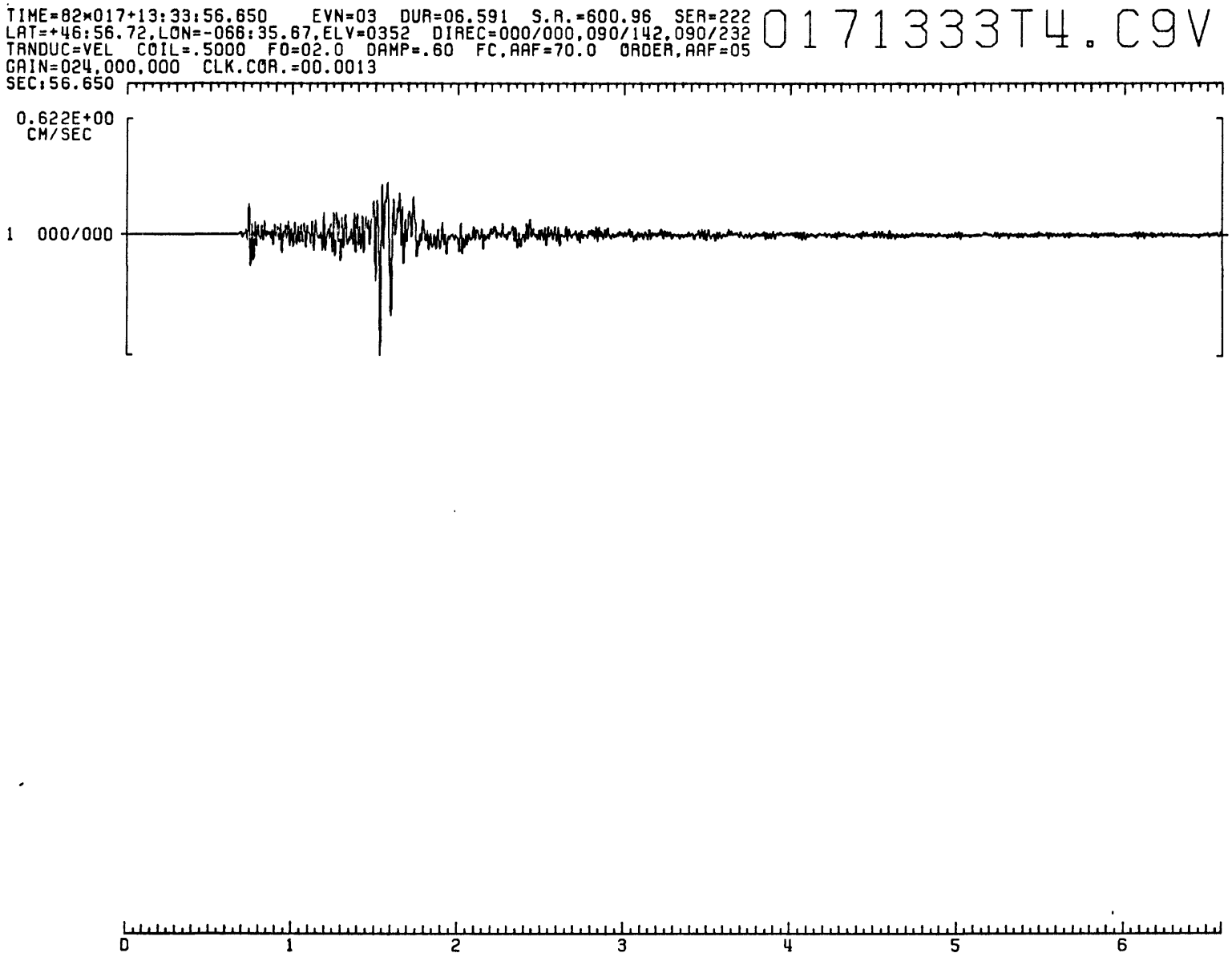
TIME=82*017+13:33:56.650 EVN=03 DUR=06.591 S.R.=600.96 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=024,000,000 CLK.COR.=00.0013
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CM/SEC
1 000/000
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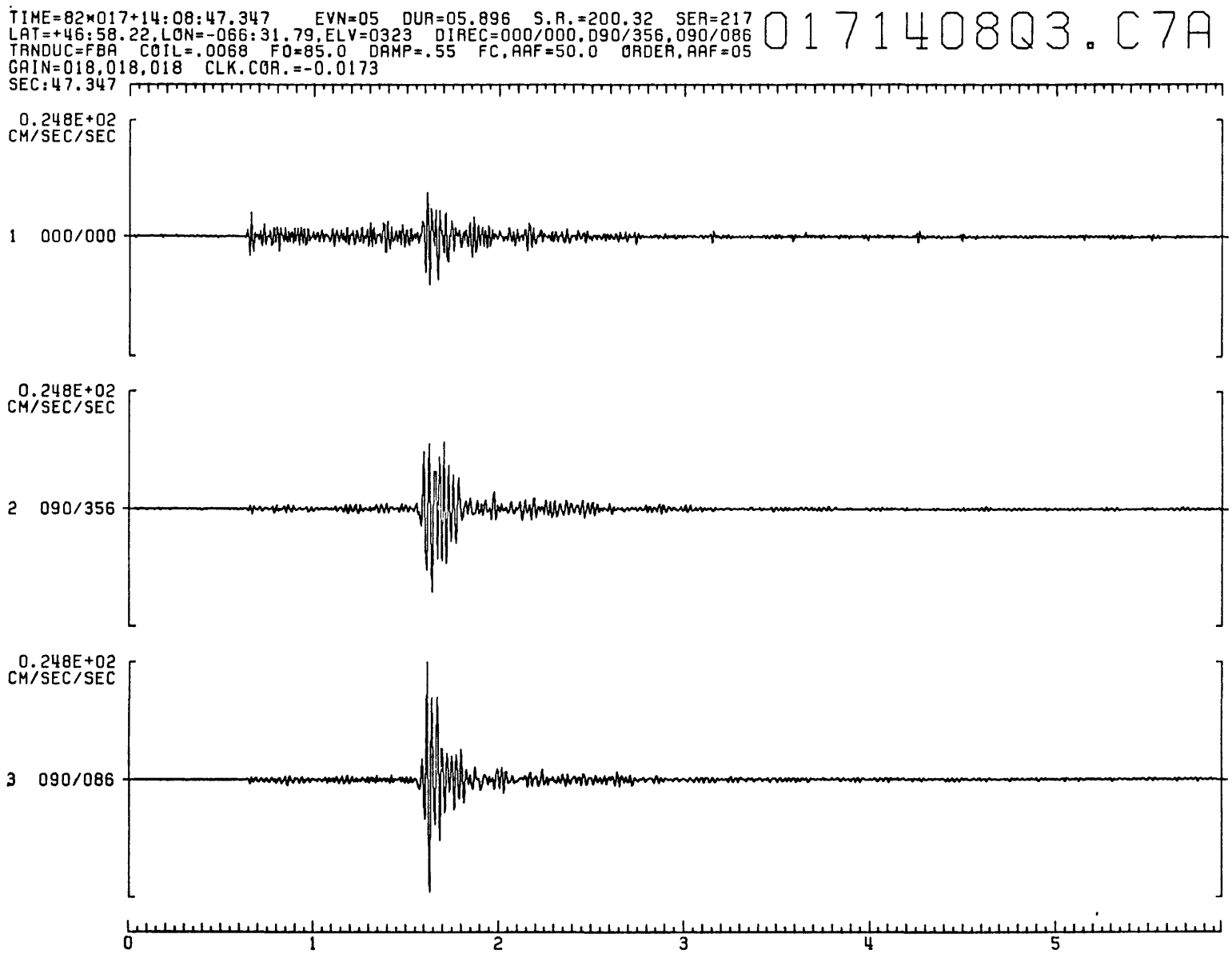
A25


TIME=82*017+14:08:47.347 EVN=05 DUR=05.896 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0173
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0.248E+02
CM/SEC/SEC
3 090/086
0
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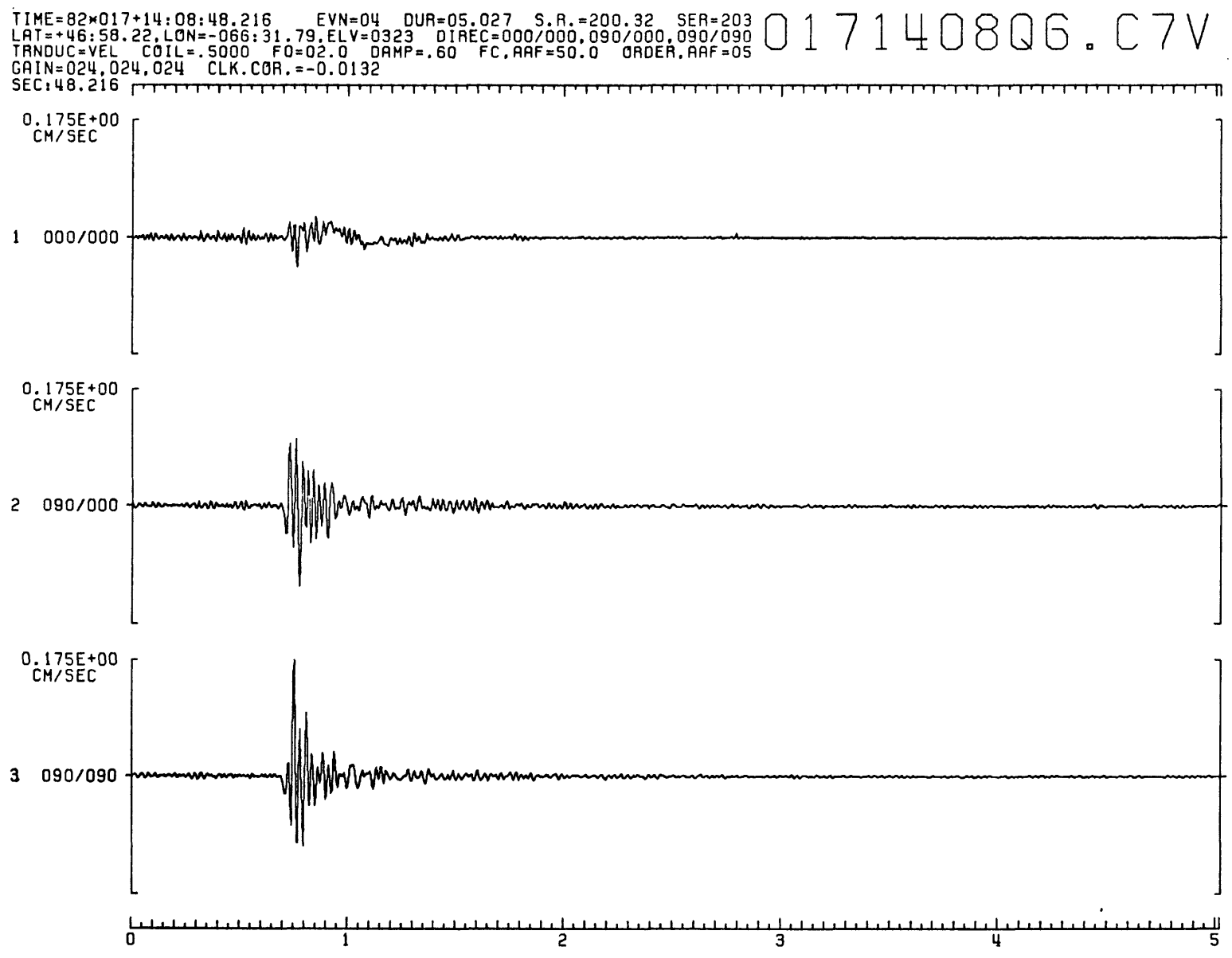
A26


TIME=82*017+14:08:48.216 EVN=04 DUR=05.027 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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2 090/000
0.175E+00
CM/SEC
3 090/090
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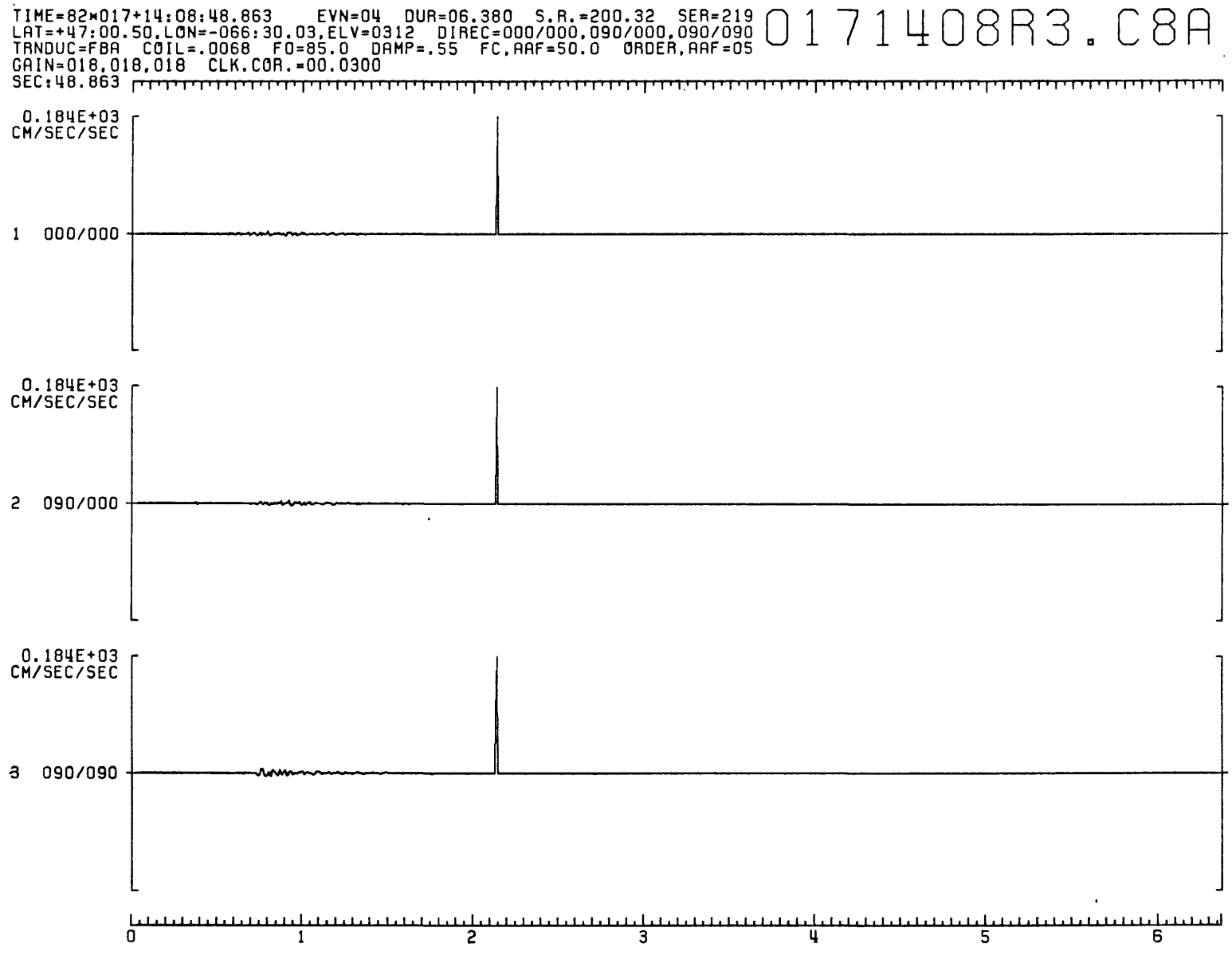
A 27


TIME=82*017+14:08:48.863 EVN=04 DUR=06.380 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.0300
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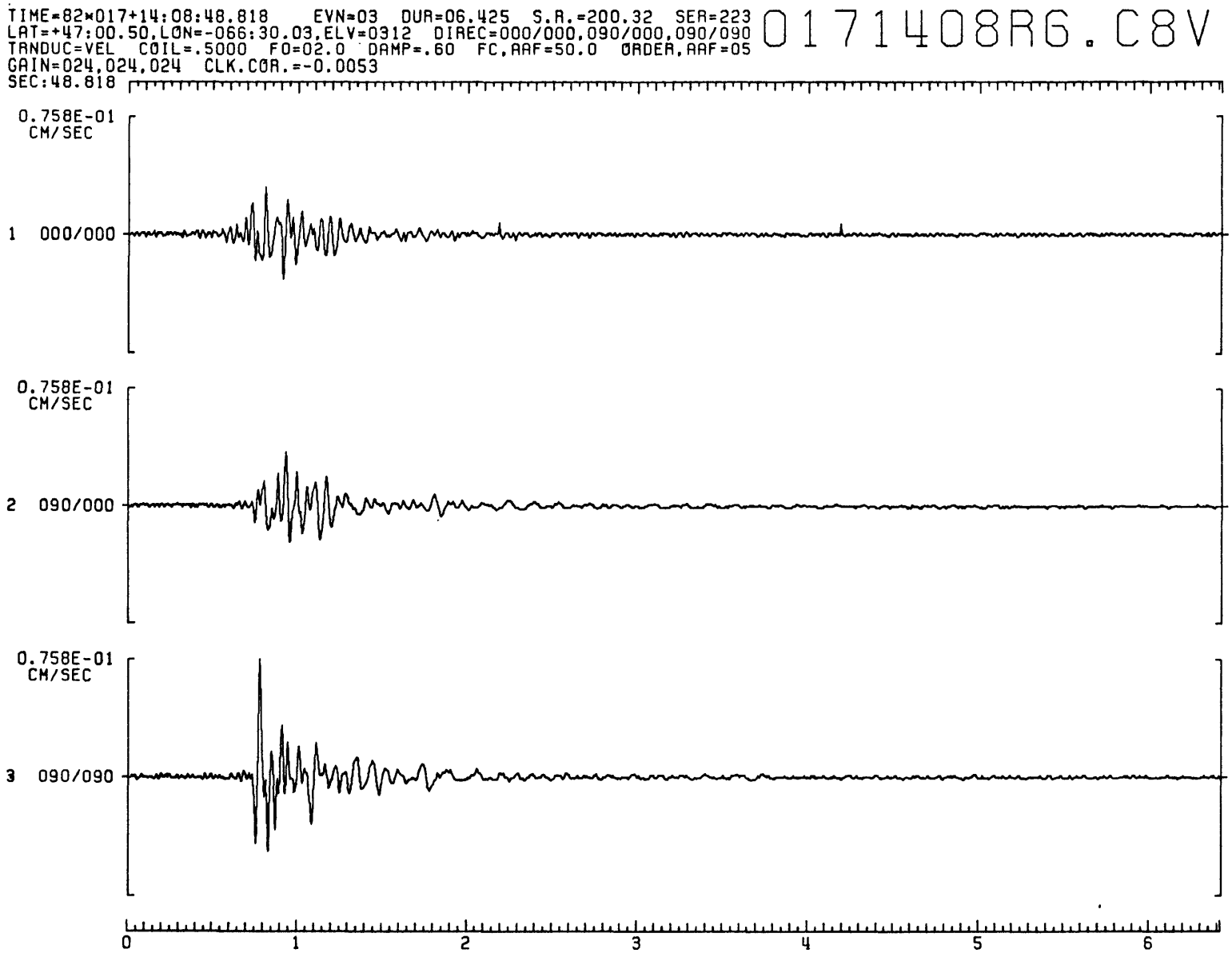
TIME=82*017+14:08:48.818 EVN=03 DUR=06.425 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0053
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2 090/000
0.758E-01
CM/SEC
3 090/090
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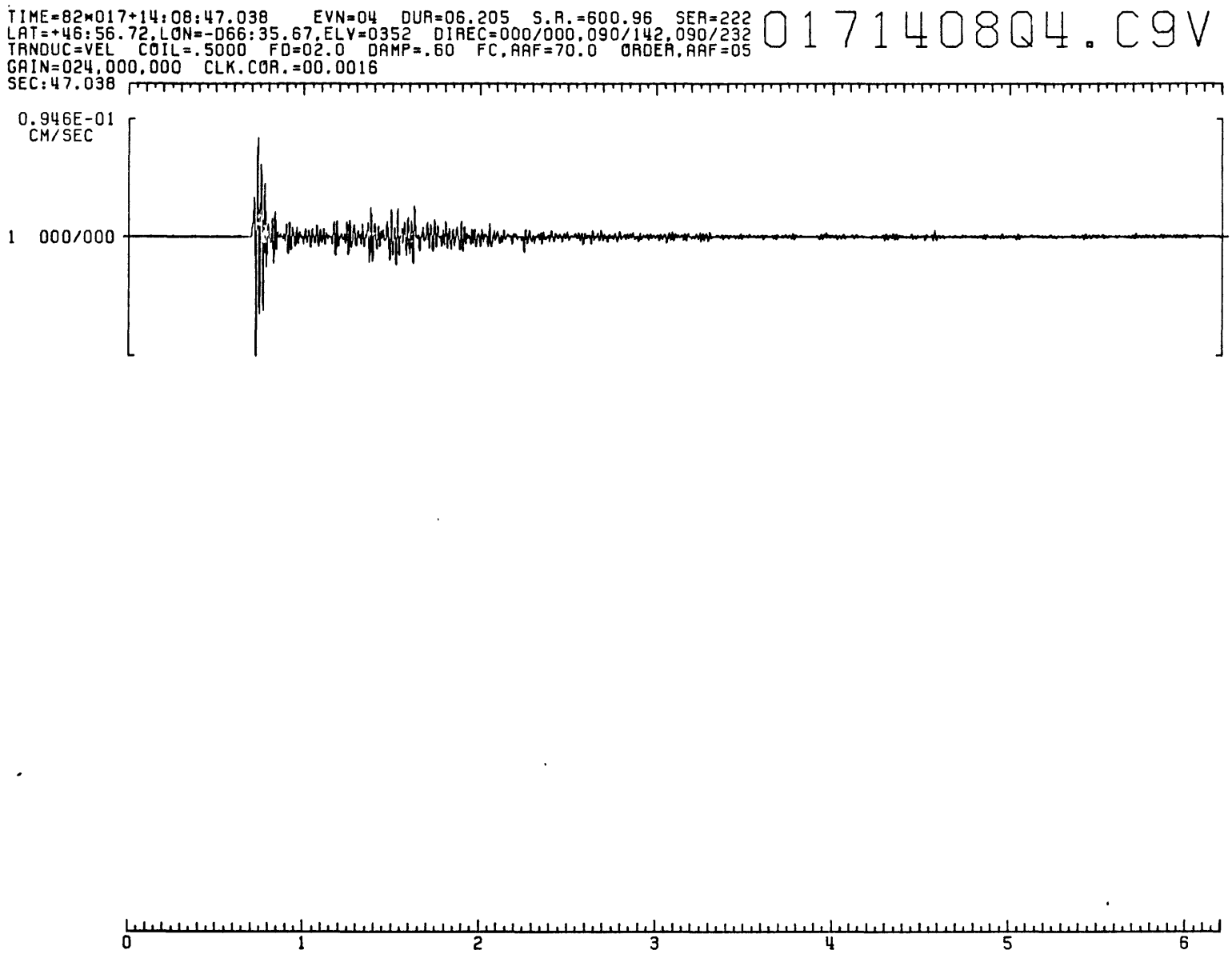
TIME=82*017+14:08:47.038 EVN=04 DUR=06.205 S.R.=600.96 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FD=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=024,000,000 CLK.COR.=00.0016
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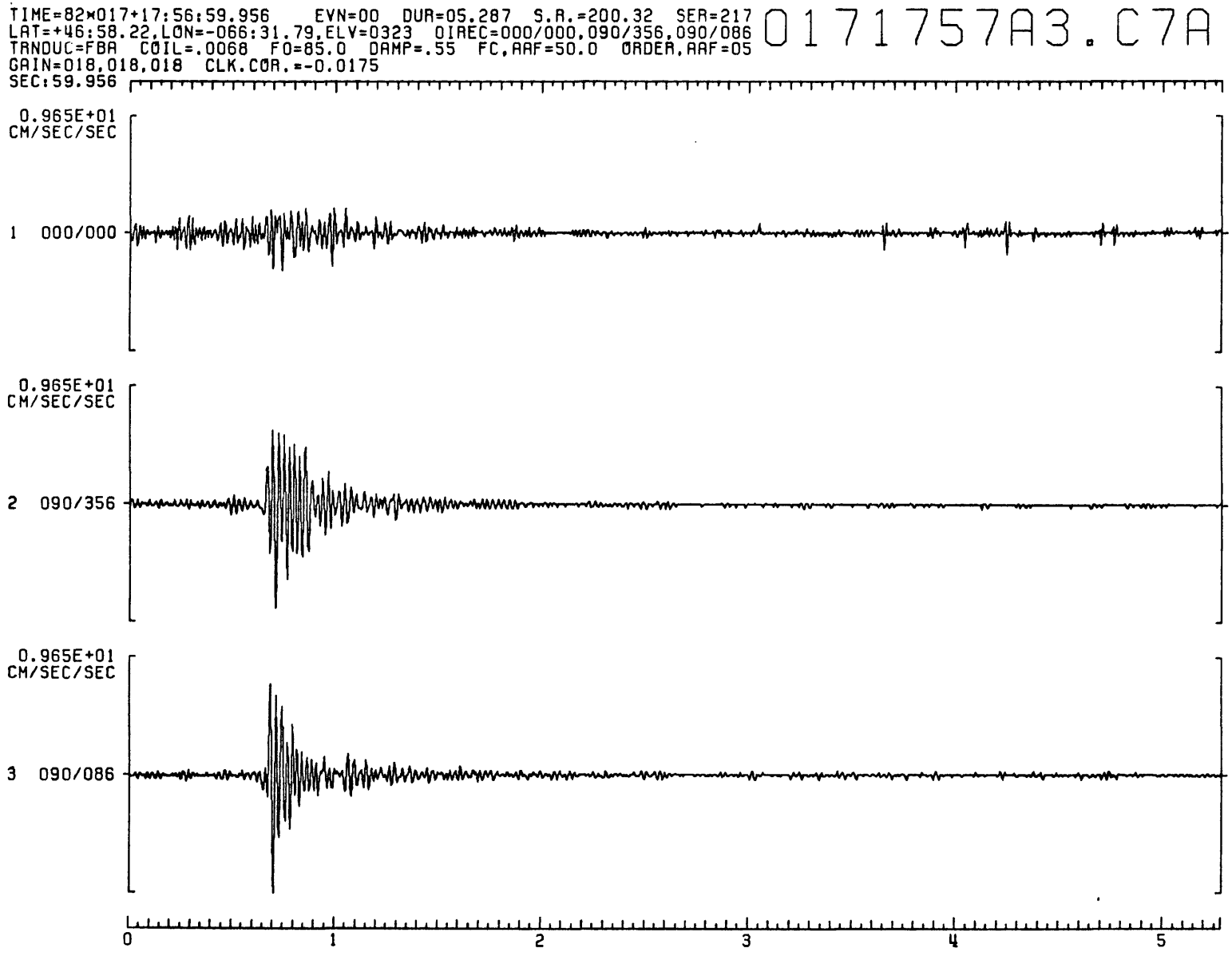
6


TIME=82*017+17:56:59.956 EVN=00 DUR=05.287 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0175
SEC:59.956
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CM/SEC/SEC
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CM/SEC/SEC
3 090/086
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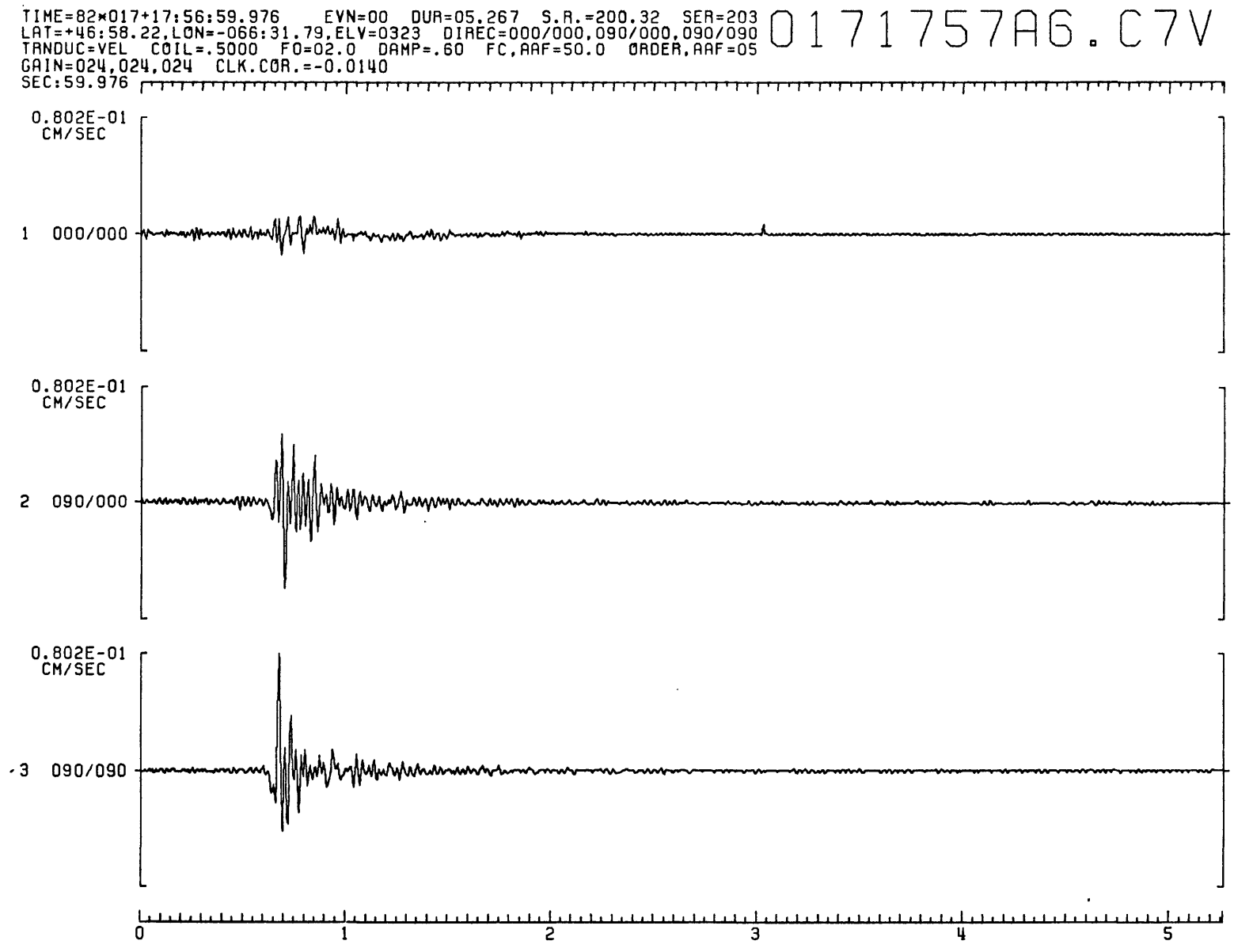
TIME=82*017+17:56:59.976 EVN=00 DUR=05.267 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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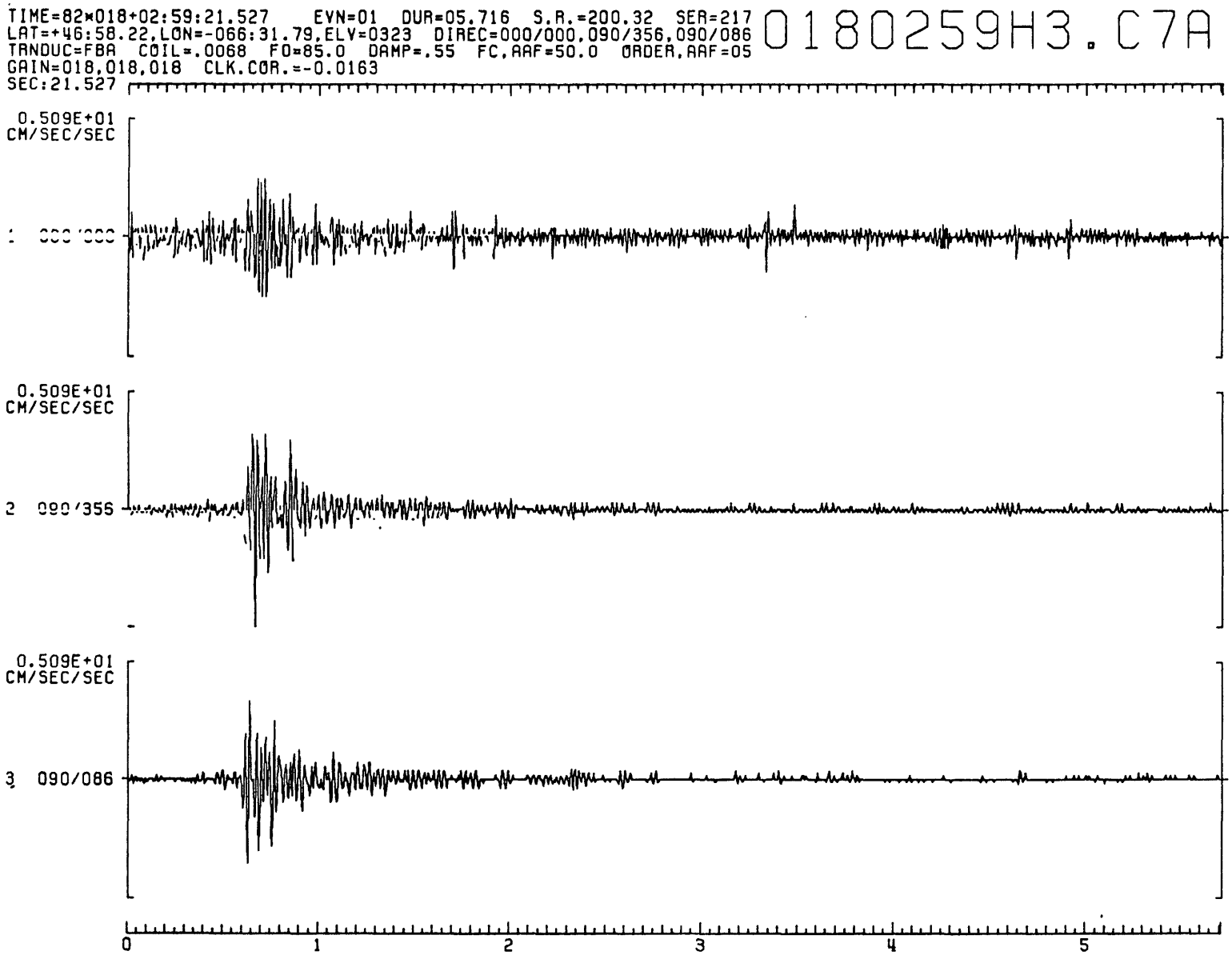
A32


TIME=82*018+02:59:21.527 EVN=01 DUR=05.716 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0163
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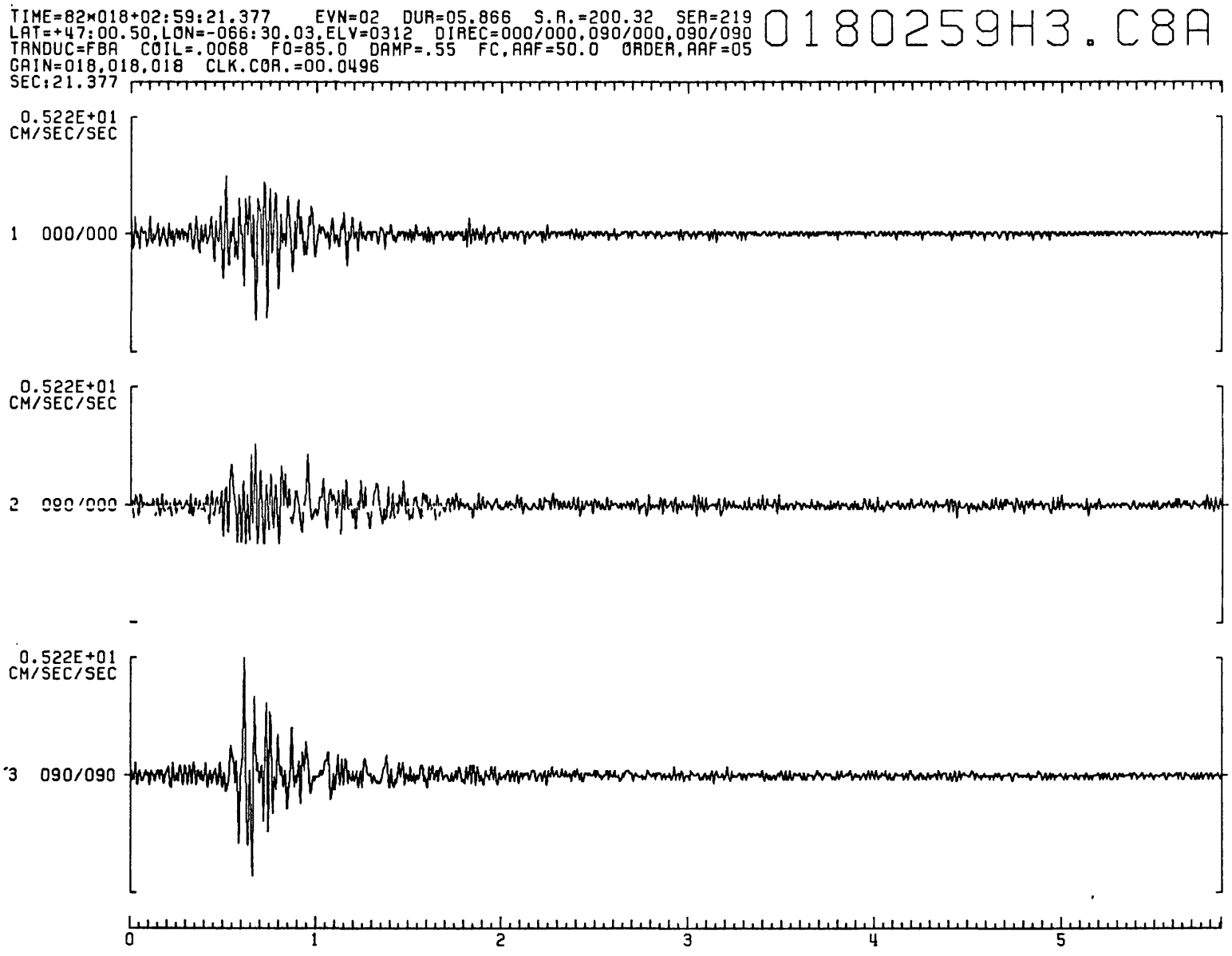
TIME=82×018÷02:59:21.377 EVN=02 DUR=05.866 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.0496
0180259H3.C8A
SEC:21.377
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CM/SEC/SEC
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3 090/090
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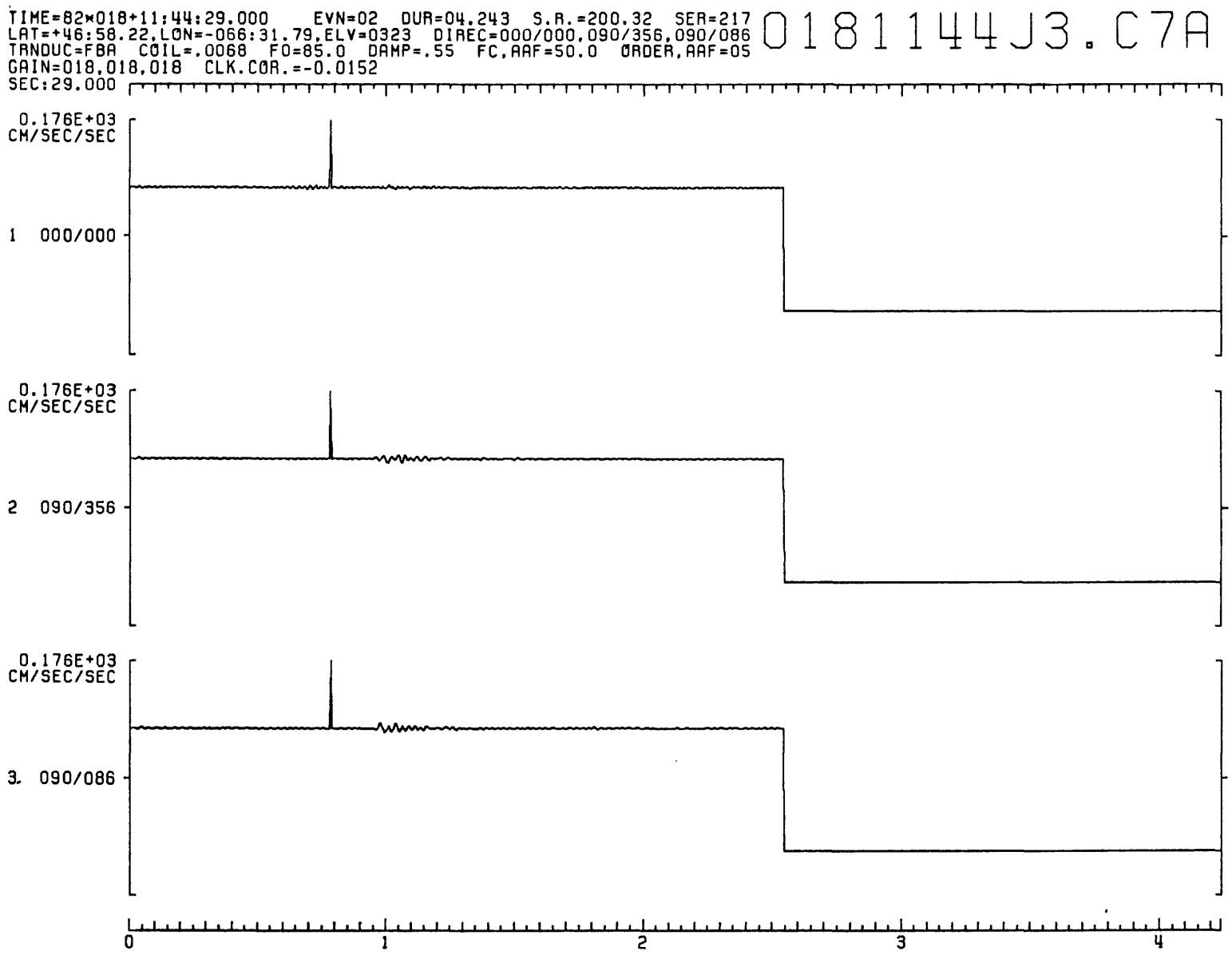
TIME=82*018+11:44:29.000 EVN=02 DUR=04.243 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0152
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SEC:29.000
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3 090/086
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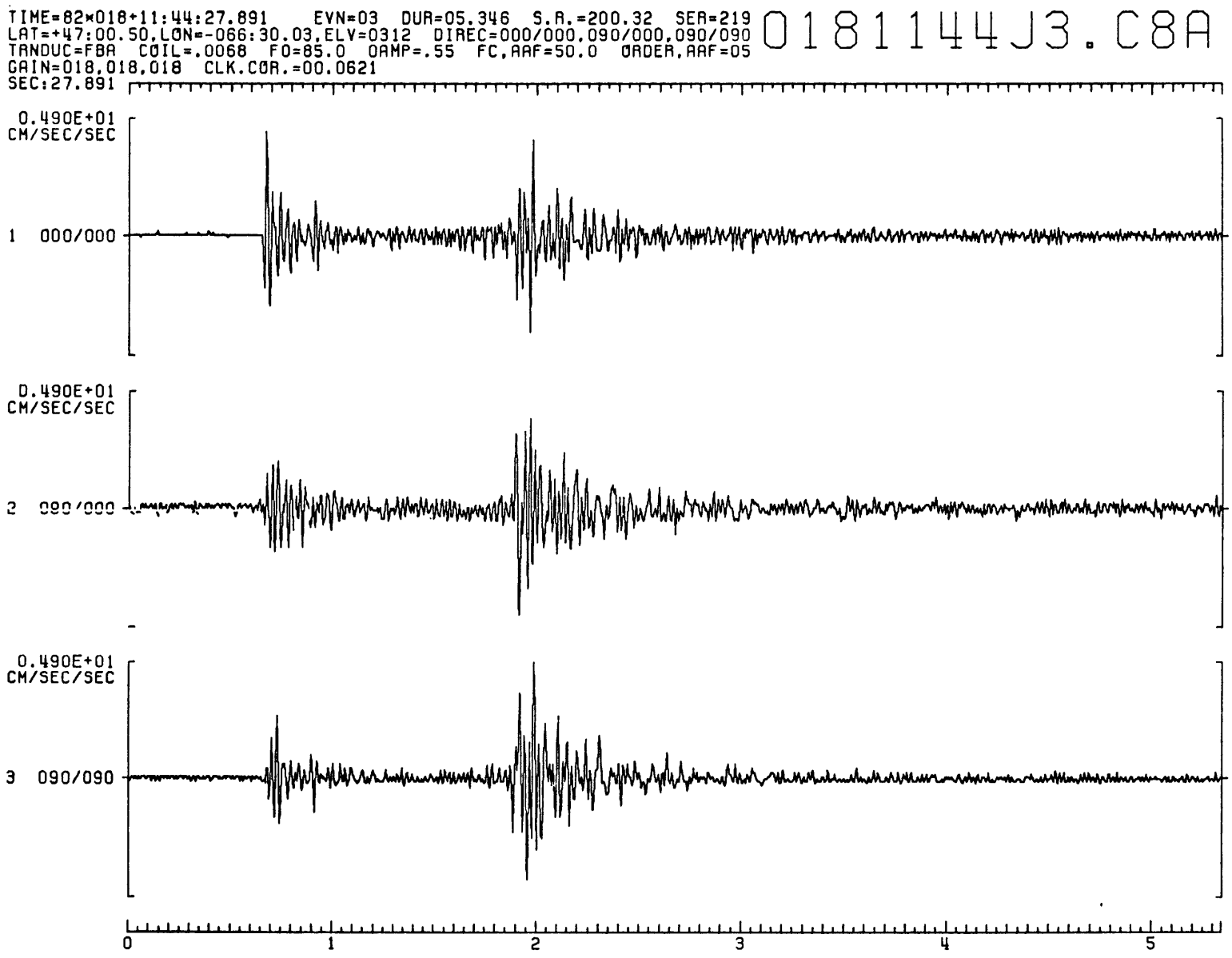
TIME=82*018+11:44:27.891 EVN=03 DUR=05.346 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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0.490E+01
CM/SEC/SEC
2 090/000
0.490E+01
CM/SEC/SEC
3 090/090
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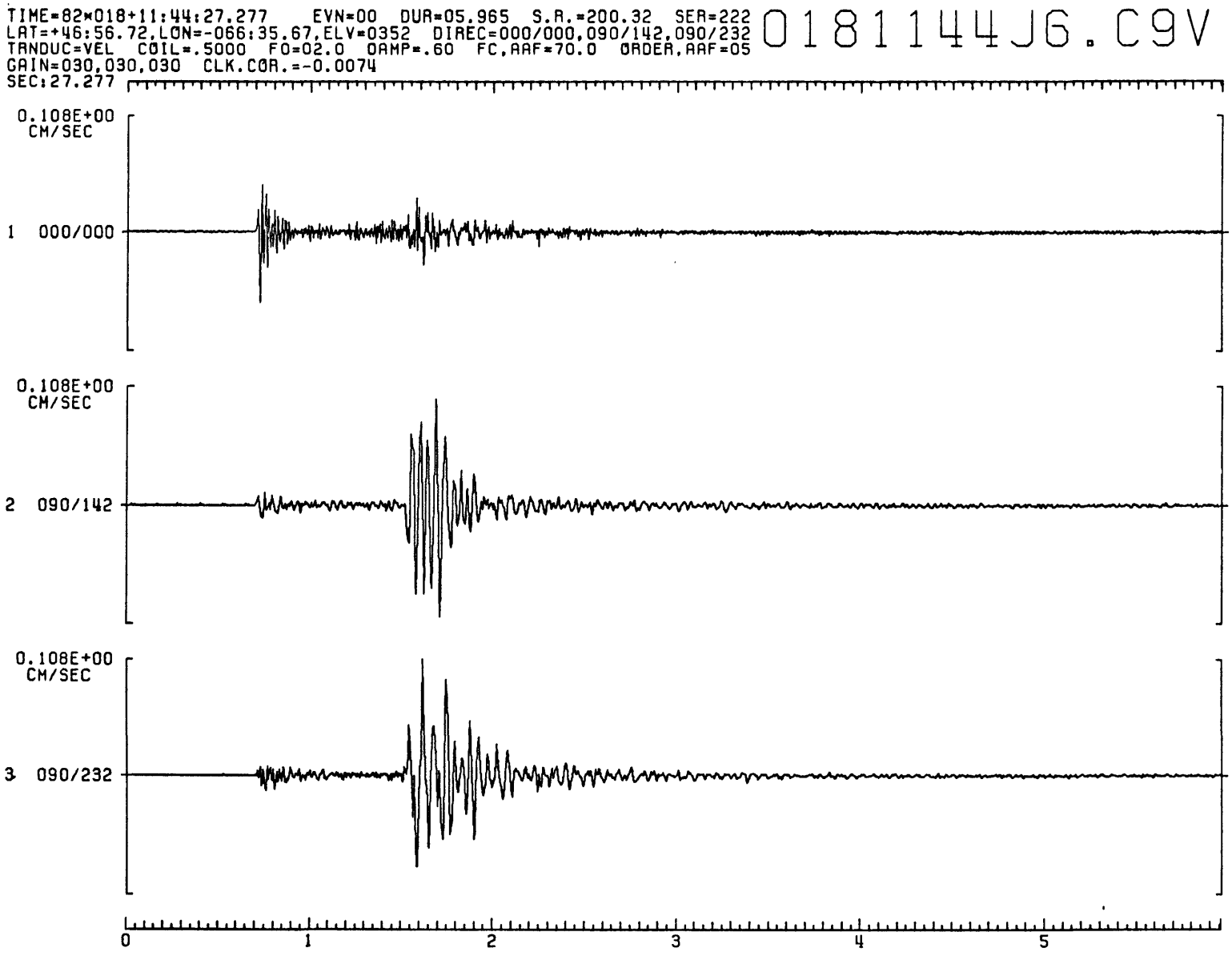
A 34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CM/SEC
3 090/232
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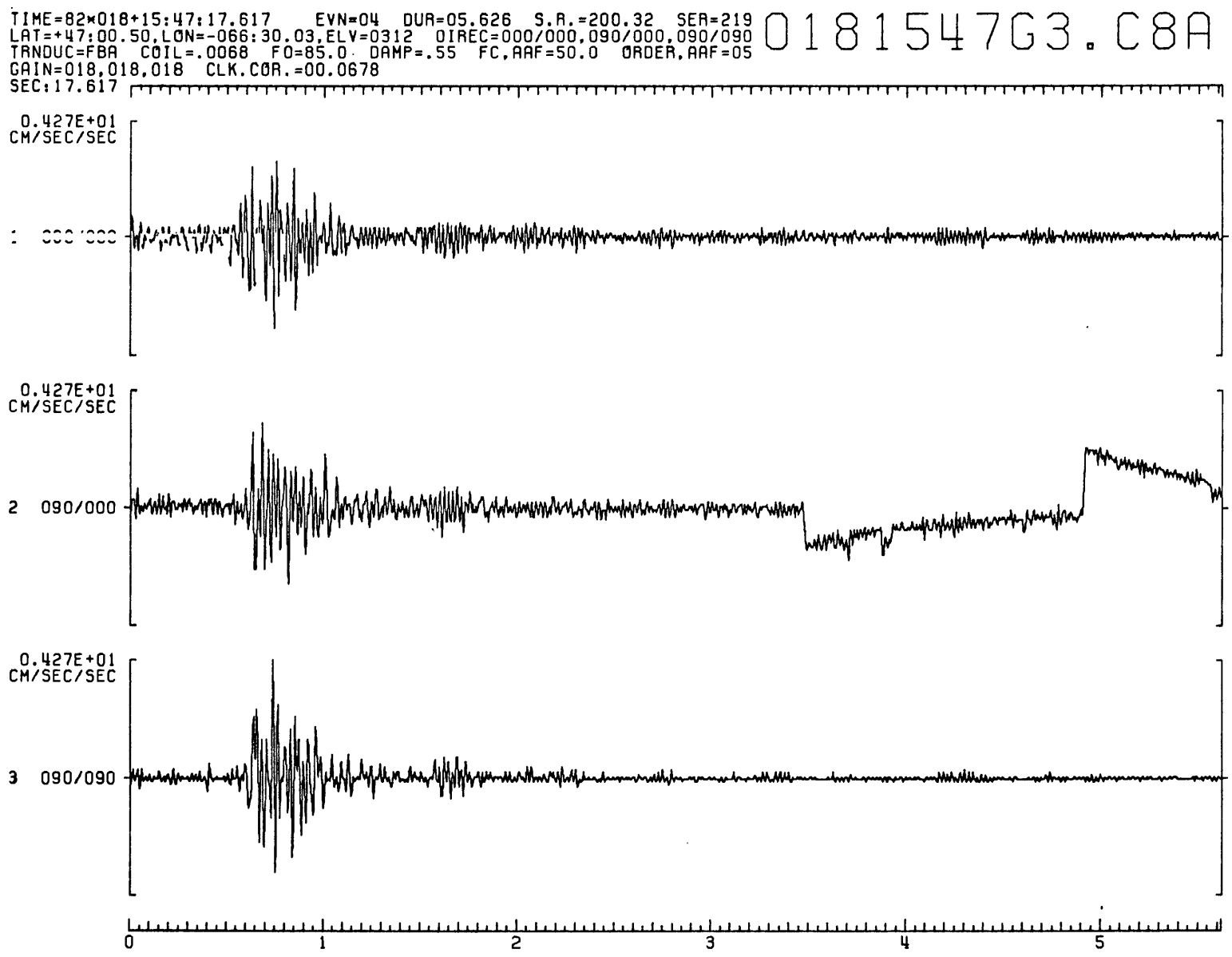
TIME=82*018+15:47:17.617 EVN=04 DUR=05.626 S.R.=200.32 SER=219
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TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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01815476 3.C8A
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3 090/090
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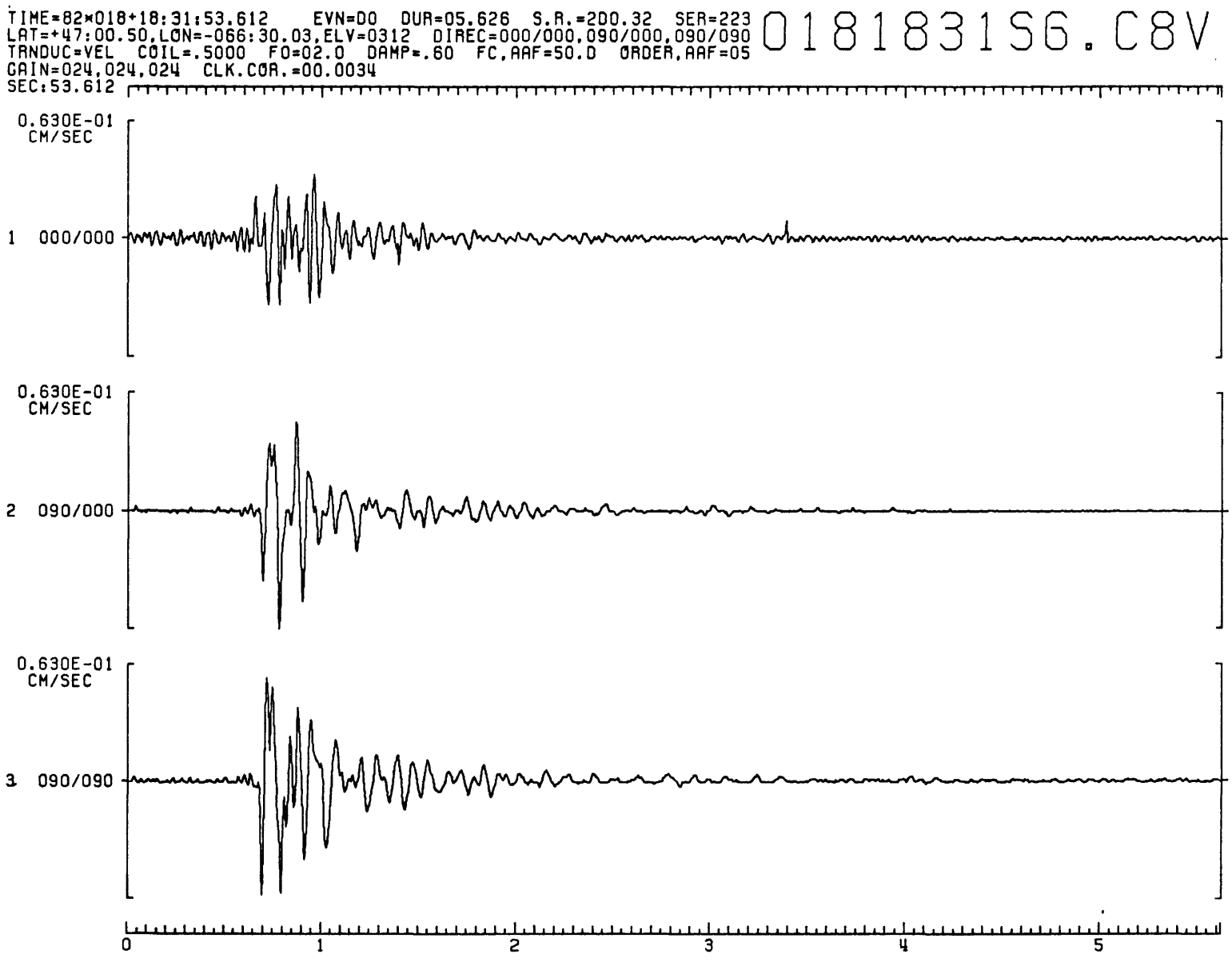
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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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CM/SEC
3 090/090
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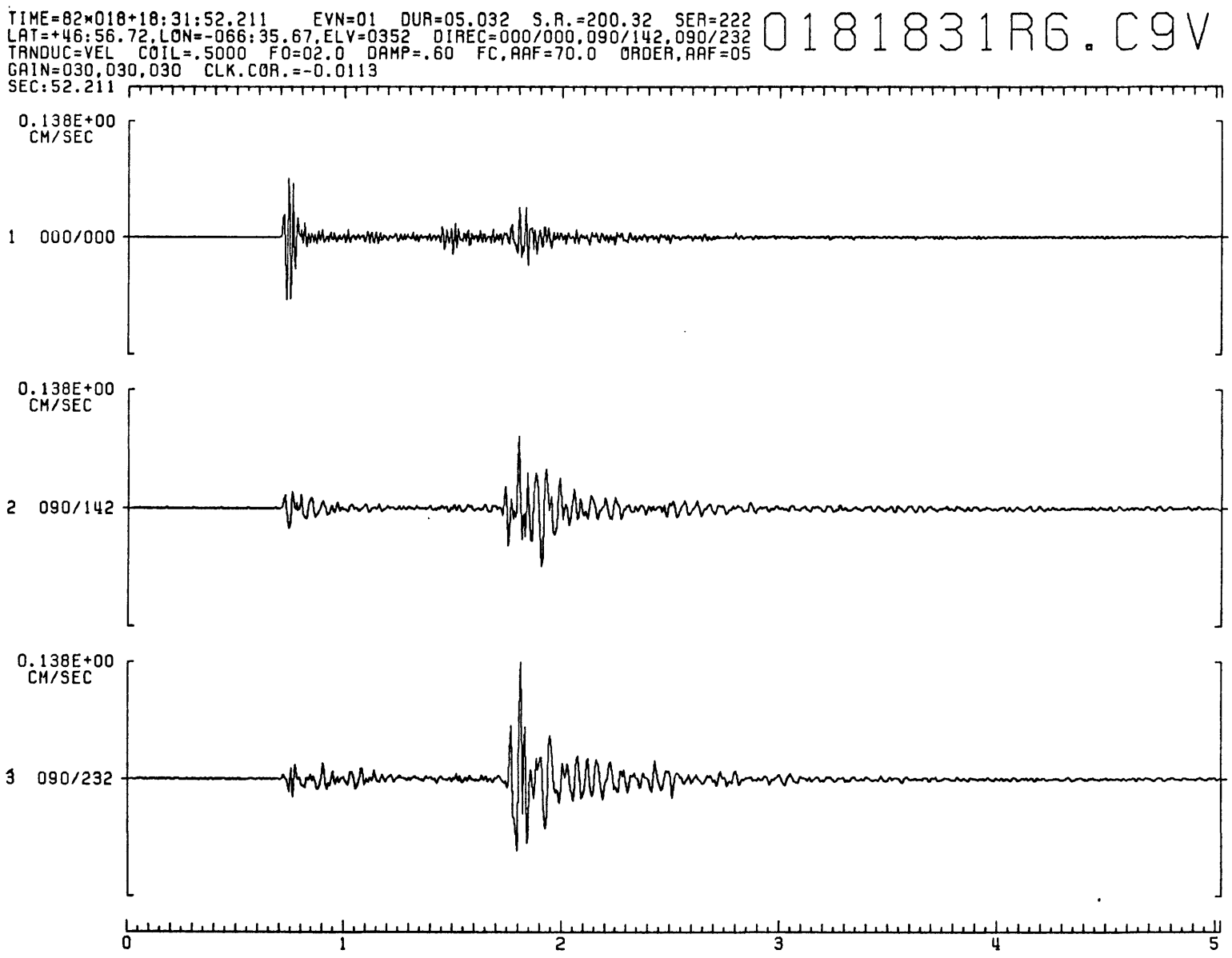
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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
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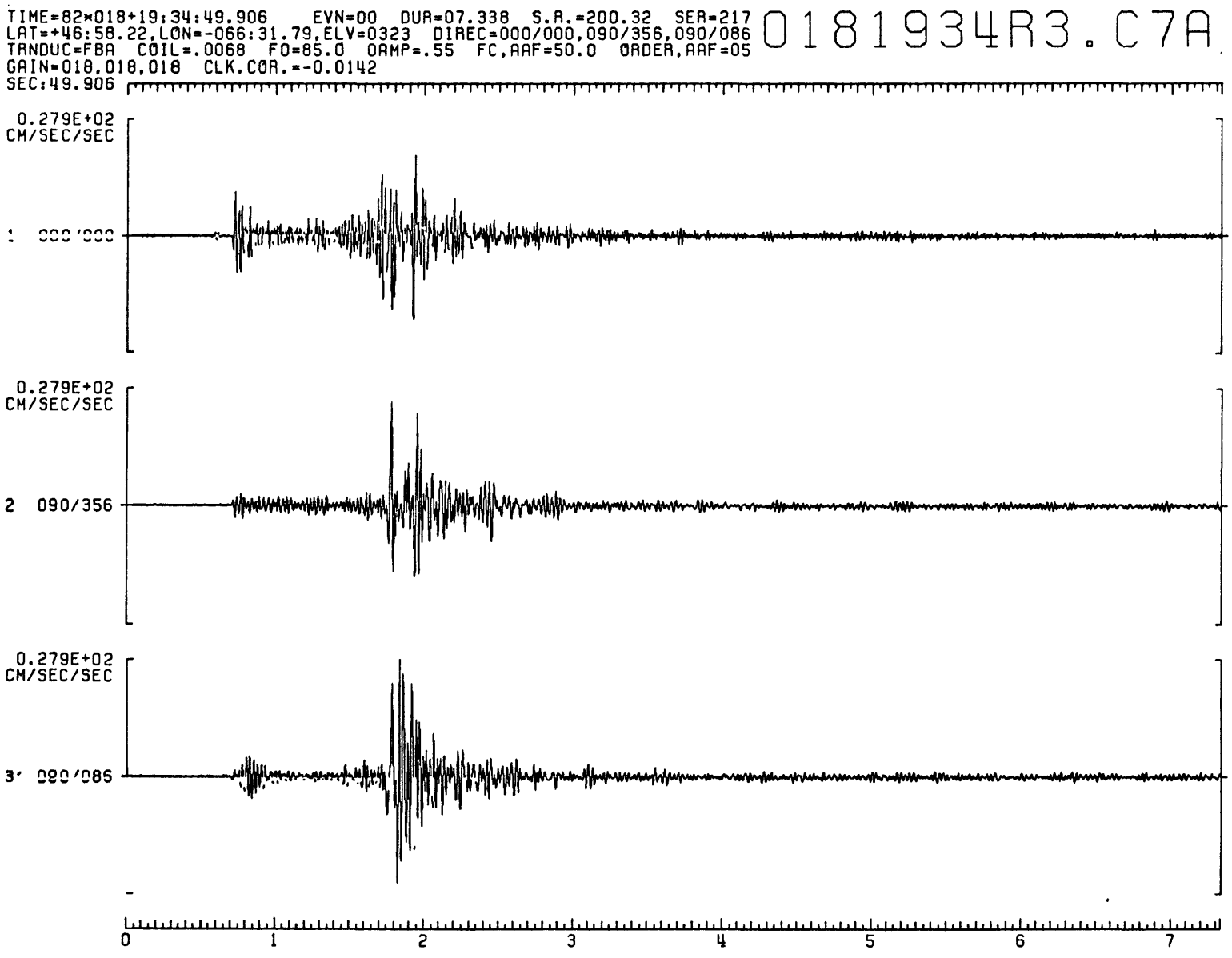
A 40


TIME=82*018+19:34:49.906 EVN=00 DUR=07.338 S.R.=200.32 SER=217
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TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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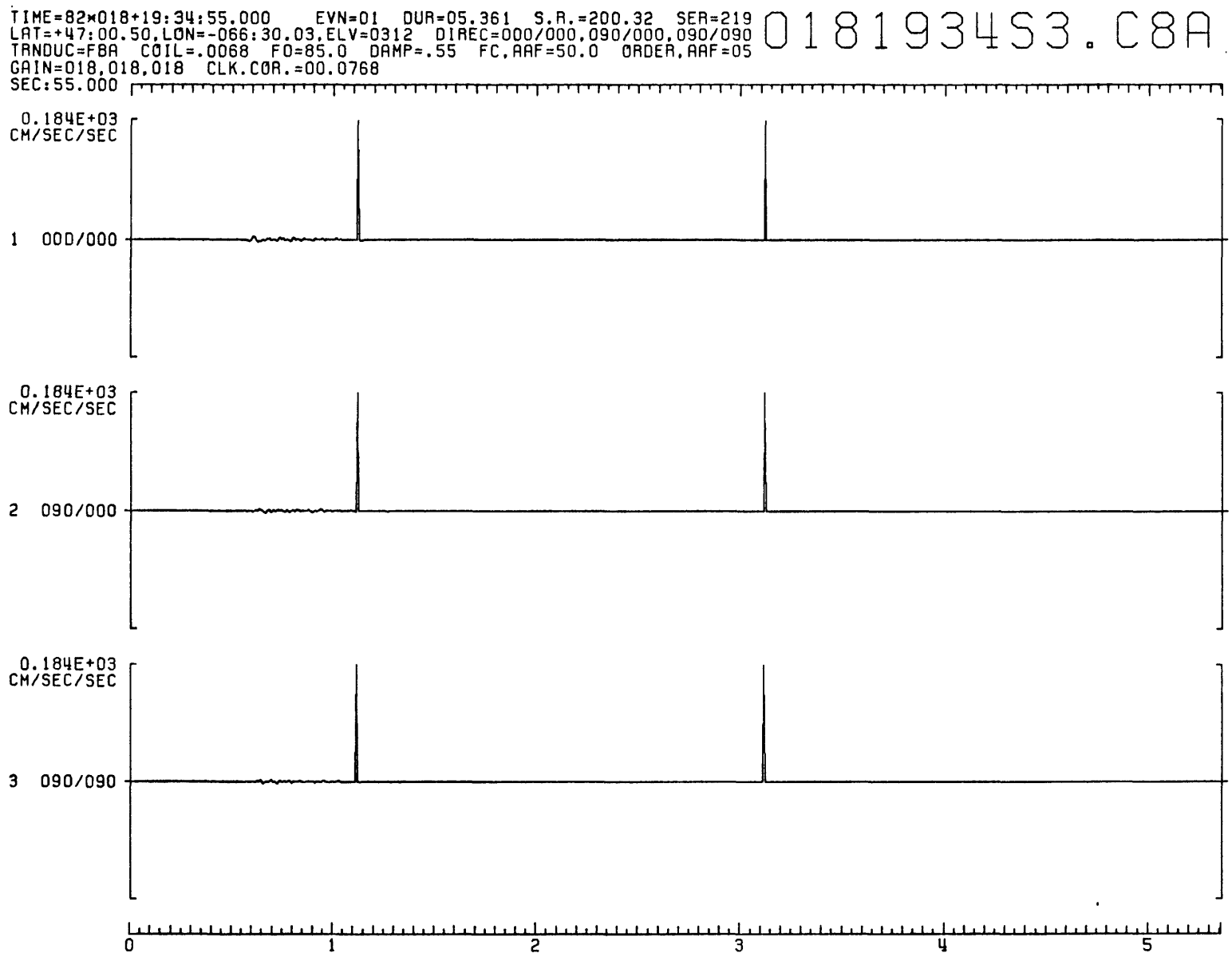
7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TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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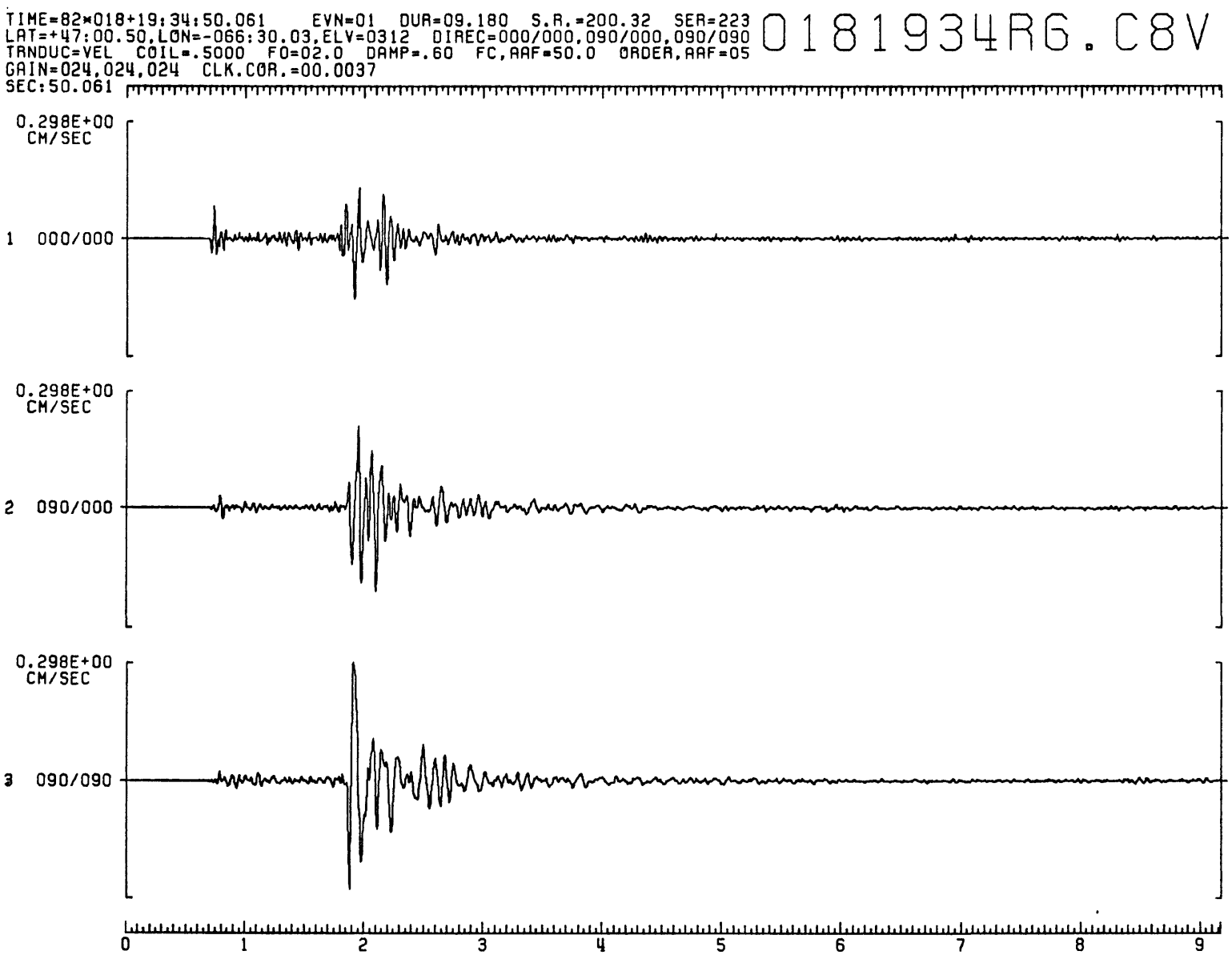
TIME=82*018+19:34:50.061 EVN=01 DUR=09.180 S.R.=200.32 SER=223
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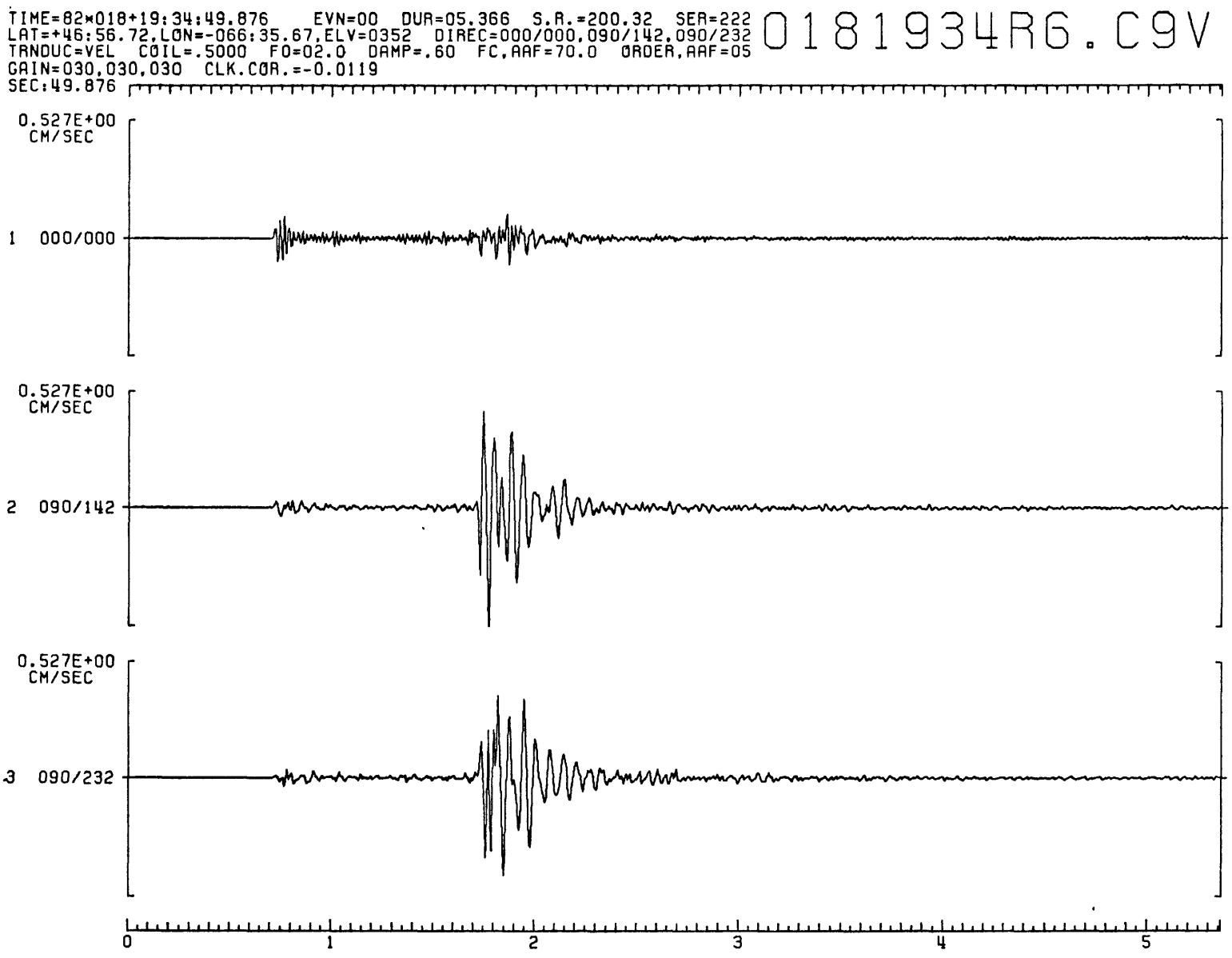
TIME=82*018+19:34:49.876 EVN=00 DUR=05.366 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0119
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3 090/232
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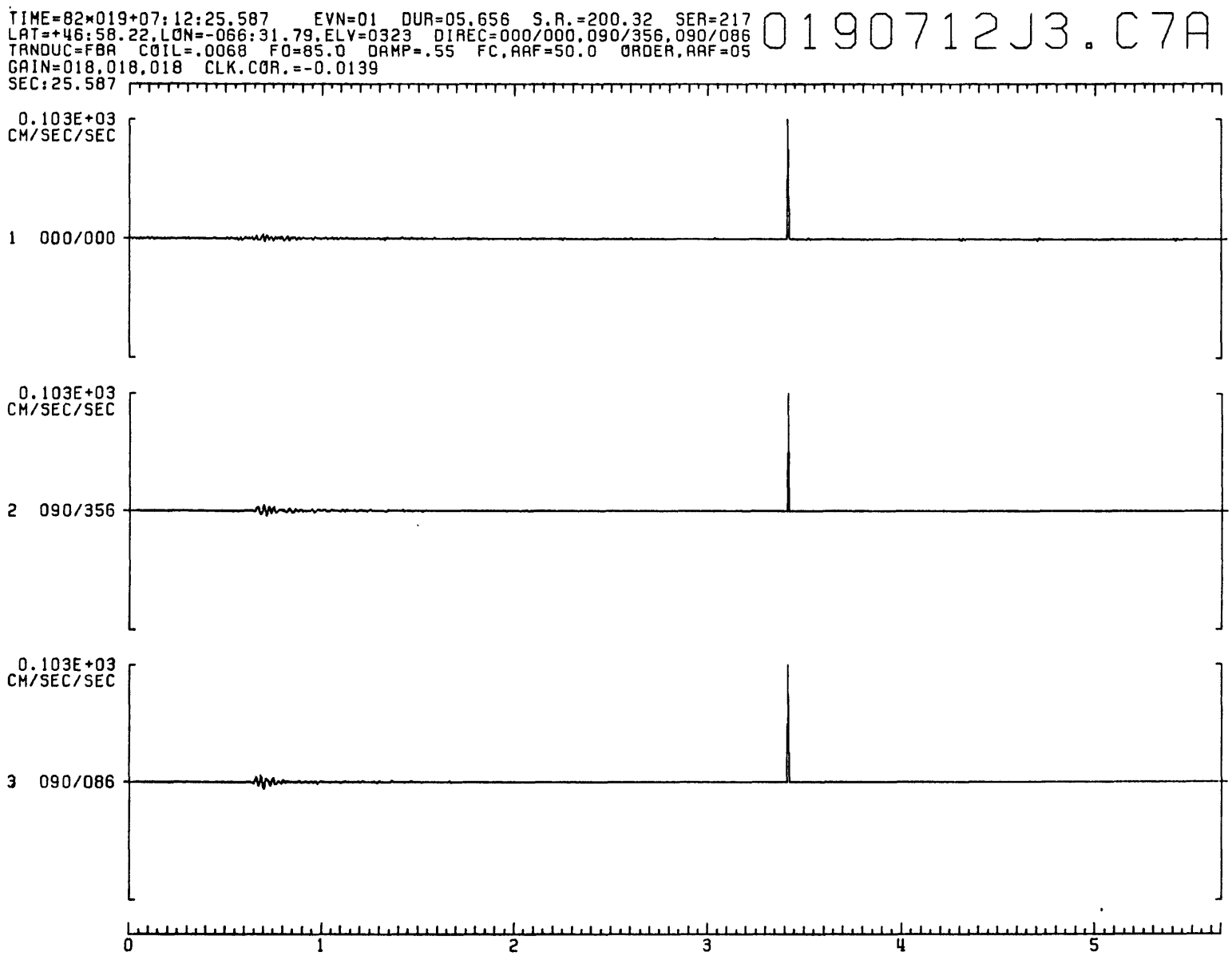
TIME=82*019+07:12:25.587 EVN=01 DUR=05.656 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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3 090/086
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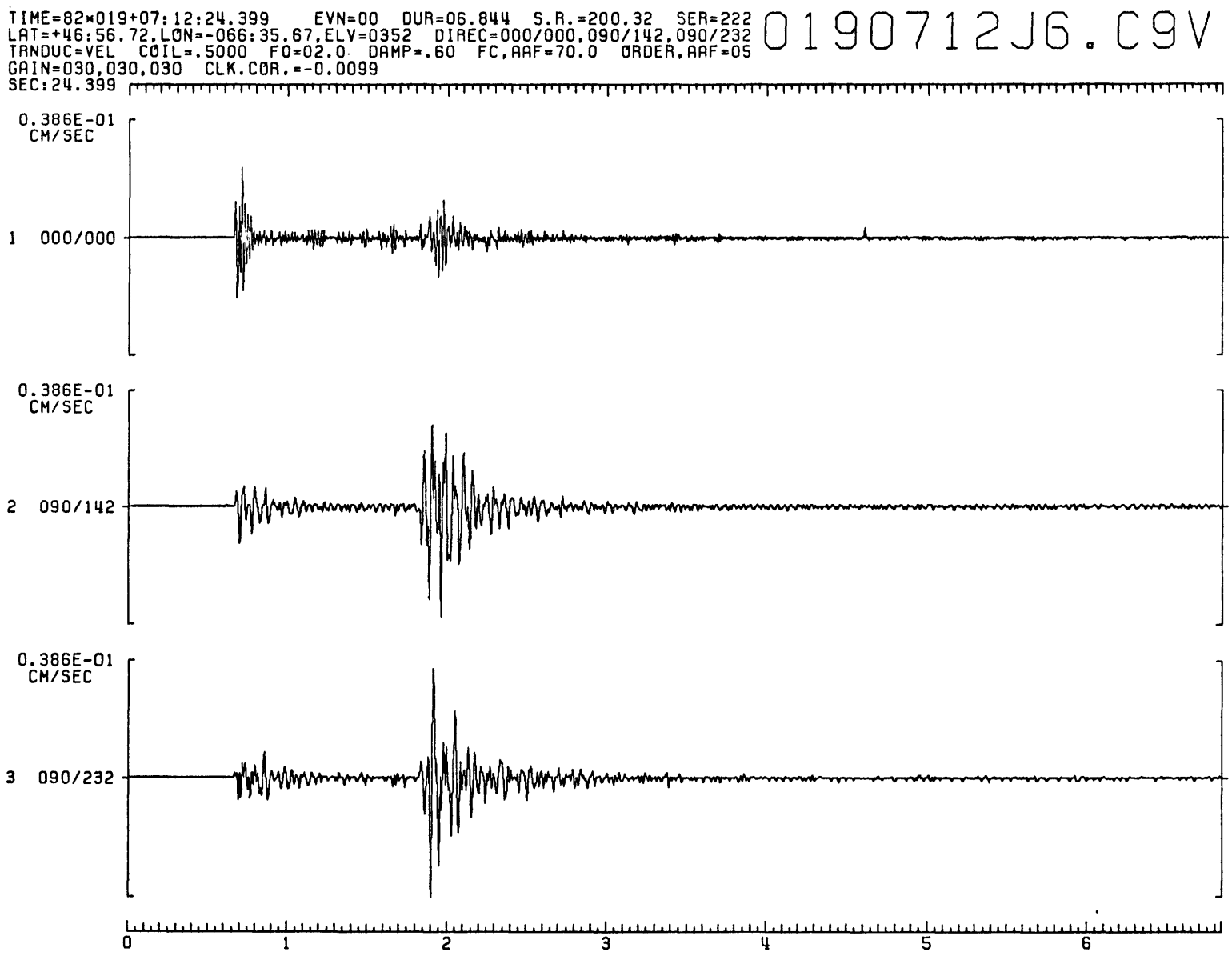
4 of 5


TIME=82*019+07:12:24.399 EVN=00 DUR=06.844 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0099
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SEC:24.399
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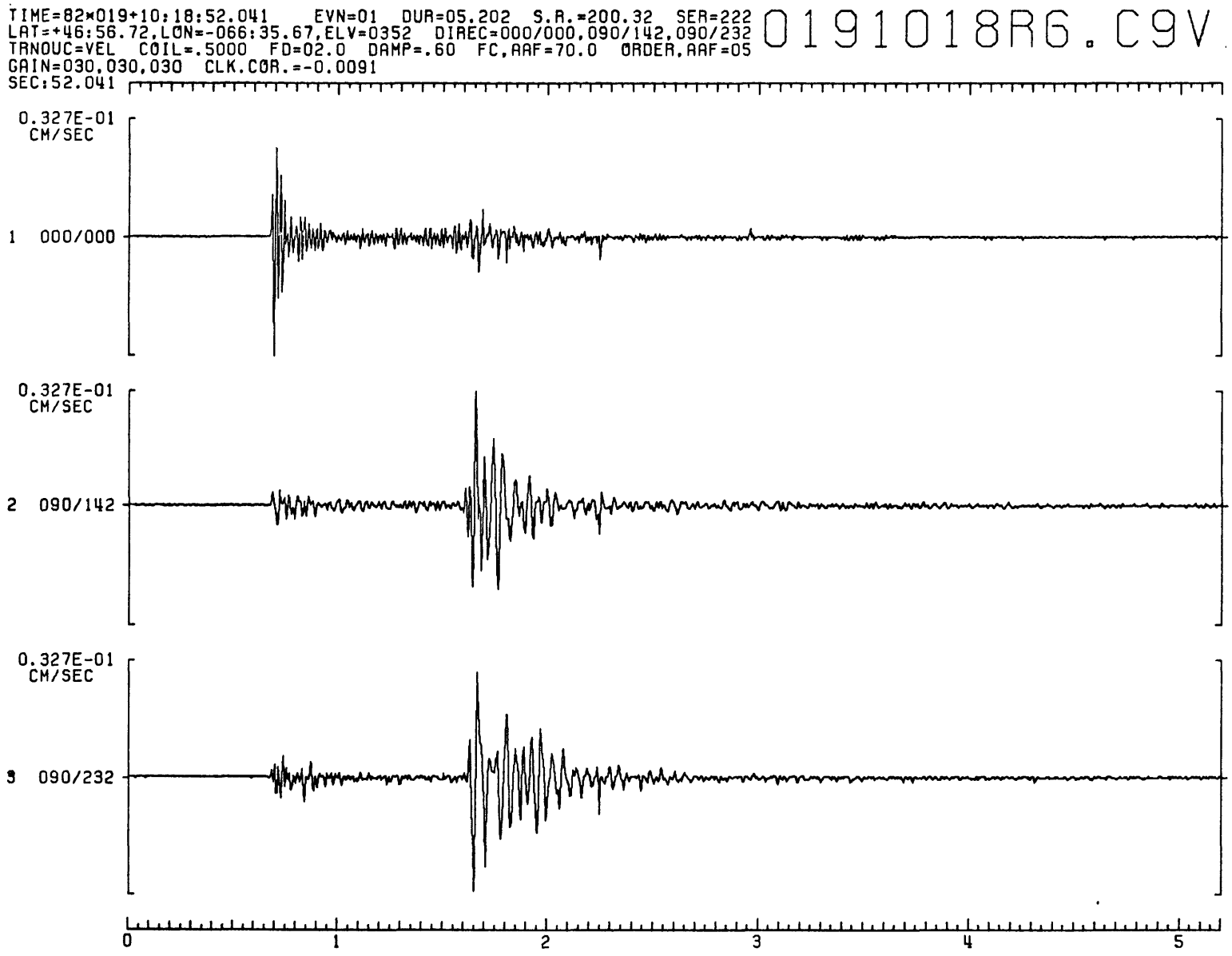
A4.6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LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FD=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0091
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SEC:52.041
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CM/SEC
1 000/000
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CM/SEC
2 090/142
0.327E-01
CM/SEC
3 090/232
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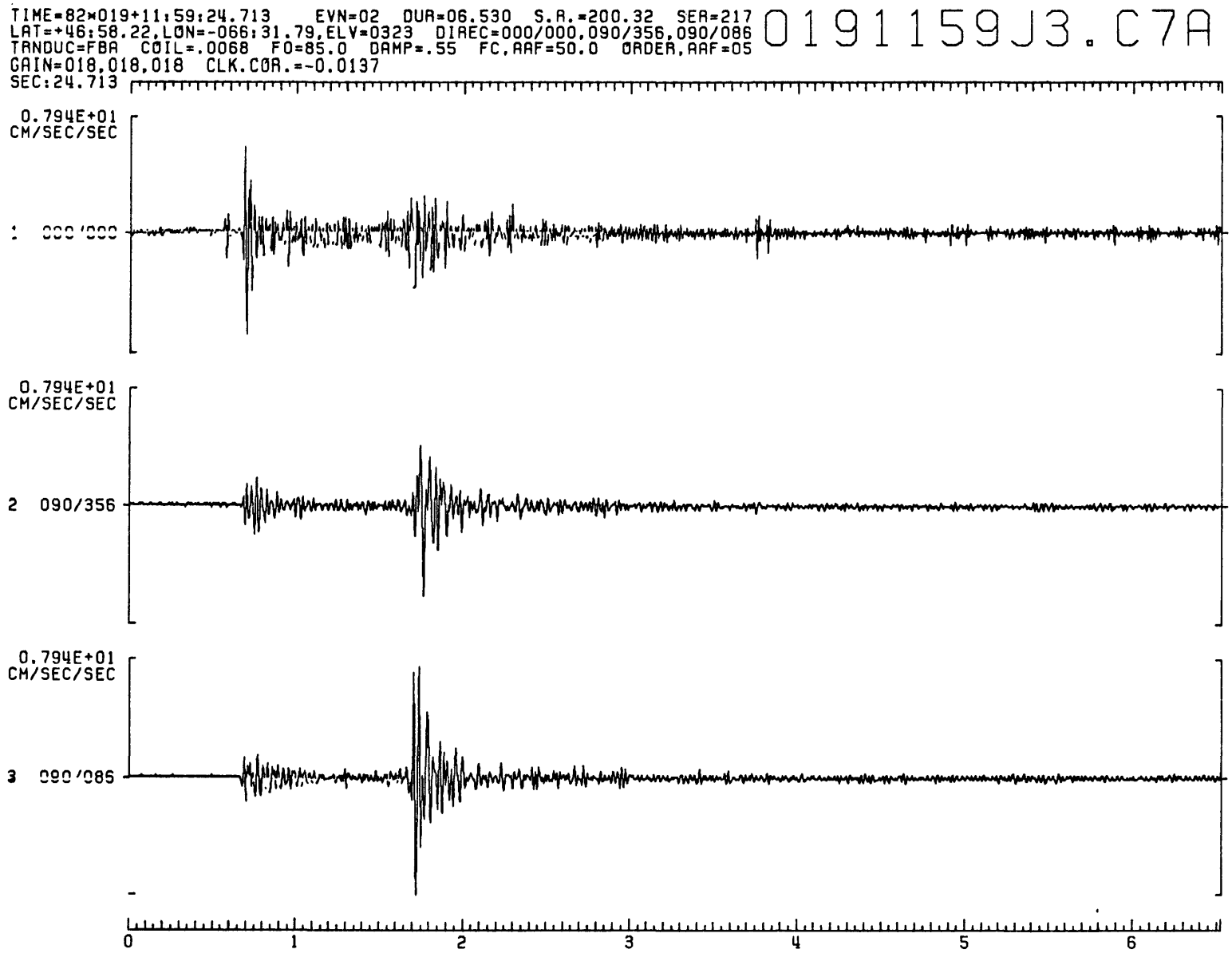
TIME=82×019+11:59:24.713 EVN=02 DUR=06.530 S.R.=200.32 SEA=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0137
0191159J3.C7A
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CM/SEC/SEC
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CM/SEC/SEC
3 090/086
0
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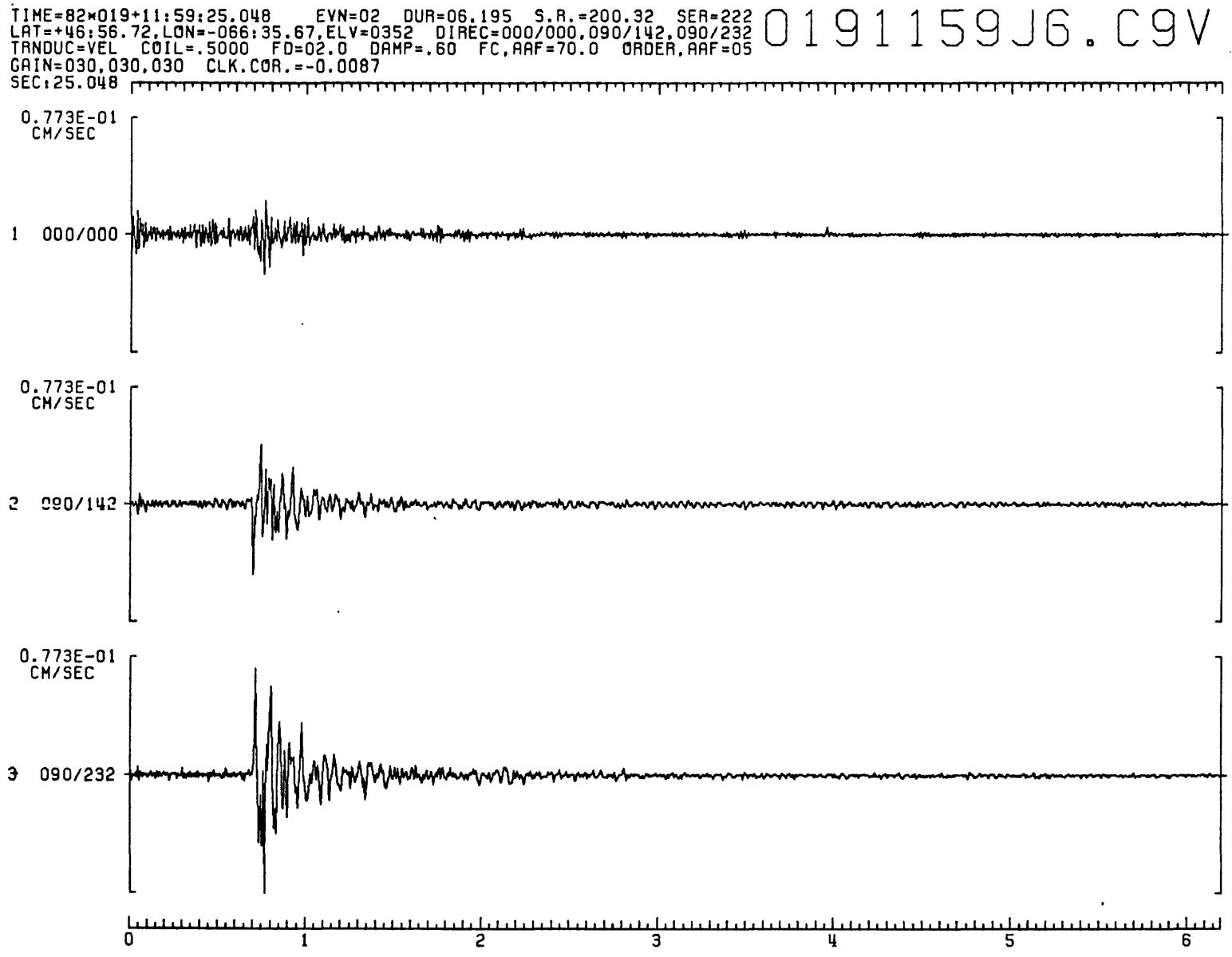
6


TIME=82*019*11:59:25.048 EVN=02 DUR=06.195 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FD=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0087
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1 000/000
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0.773E-01 CM/SEC
3 090/232
0
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4
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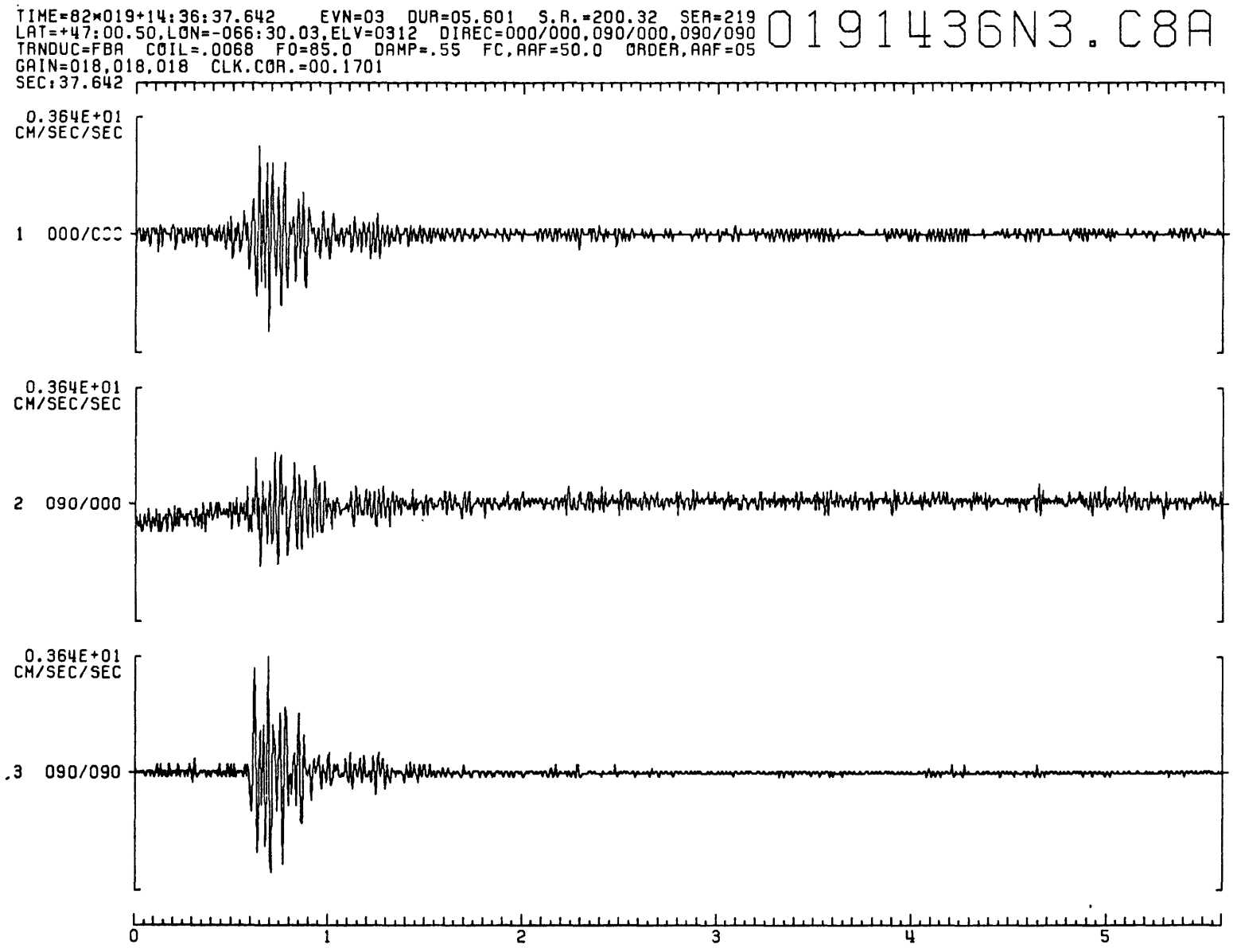
A 49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LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
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CM/SEC/SEC
3 090/090
0
1
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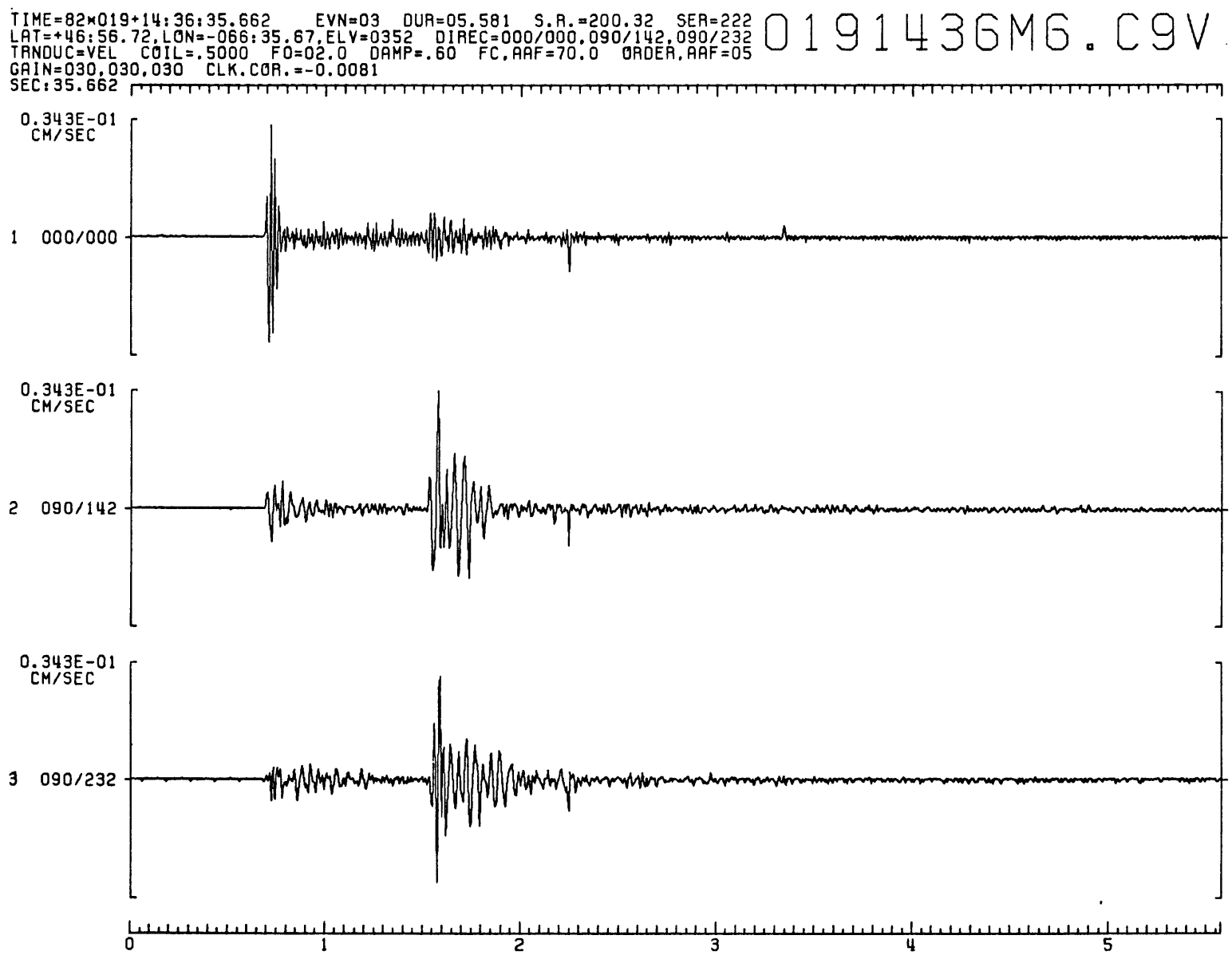
A 50


TIME=82*019+14:36:35.662 EVN=03 DUR=05.581 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0081
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CM/SEC
3 090/232
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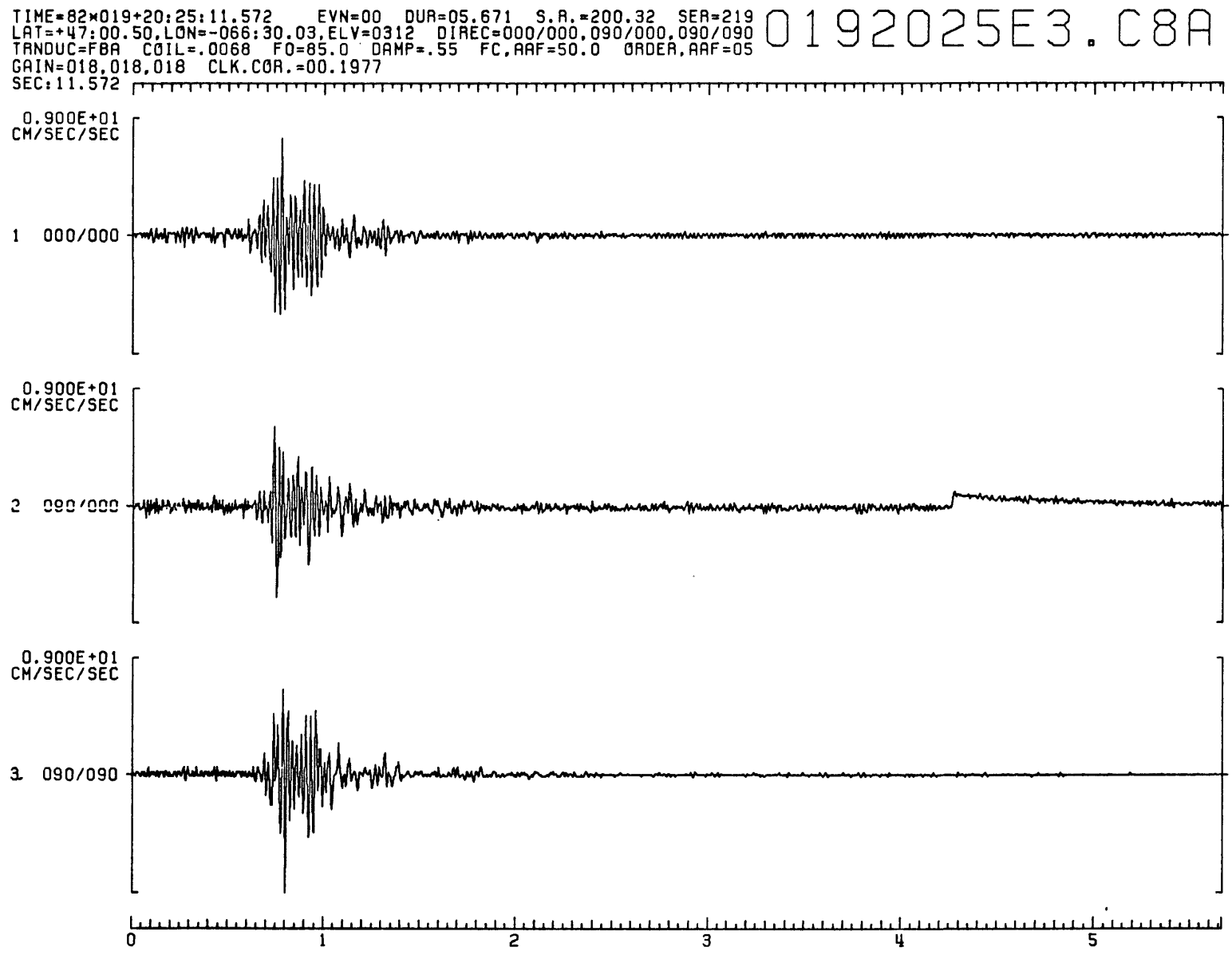
TIME=82*019+20:25:11.572 EVN=00 DUR=05.671 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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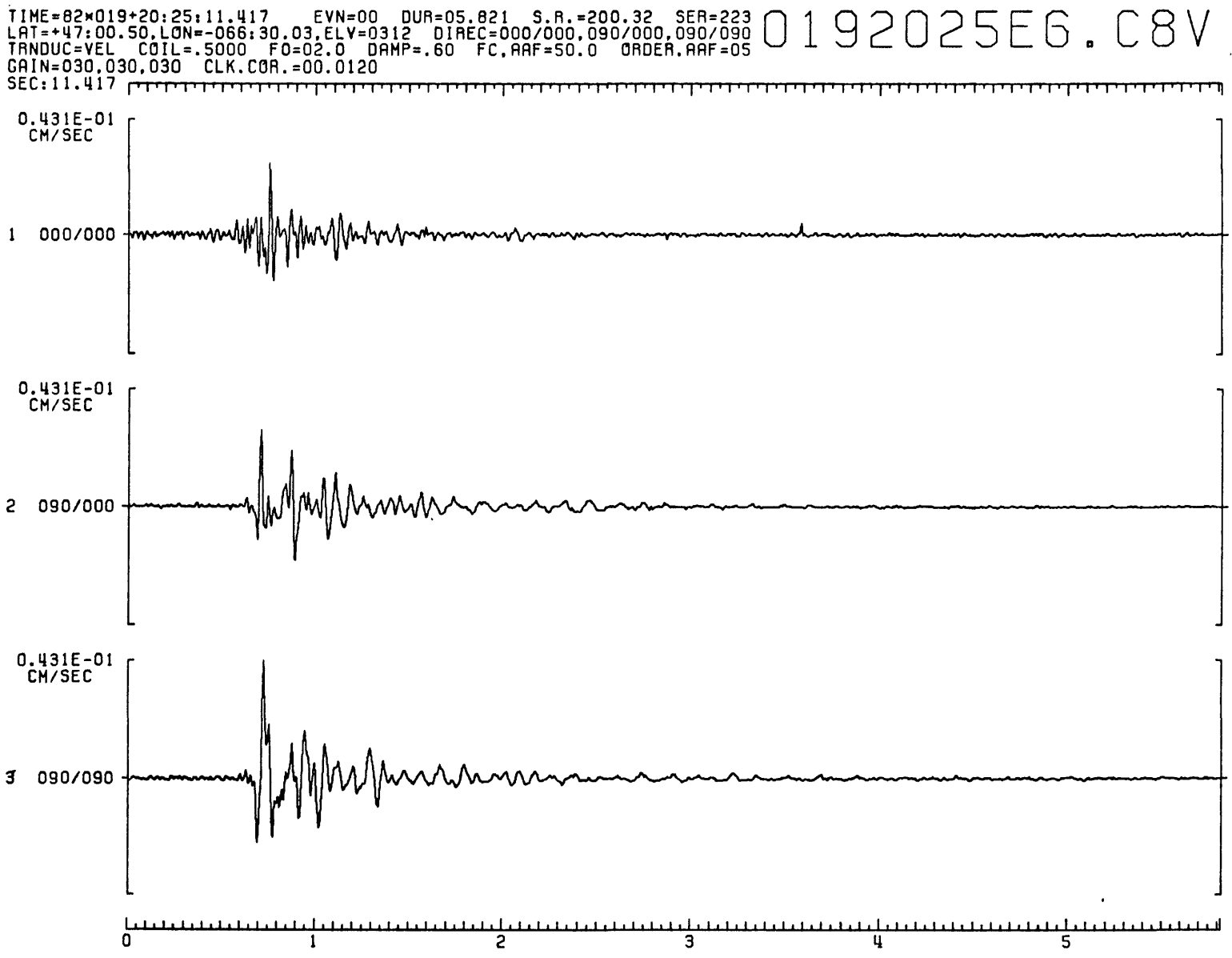
A 52


TIME=82*019+20:25:11.417 EVN=00 DUR=05.821 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0120
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SEC:11.417
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CM/SEC
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CM/SEC
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3 090/090
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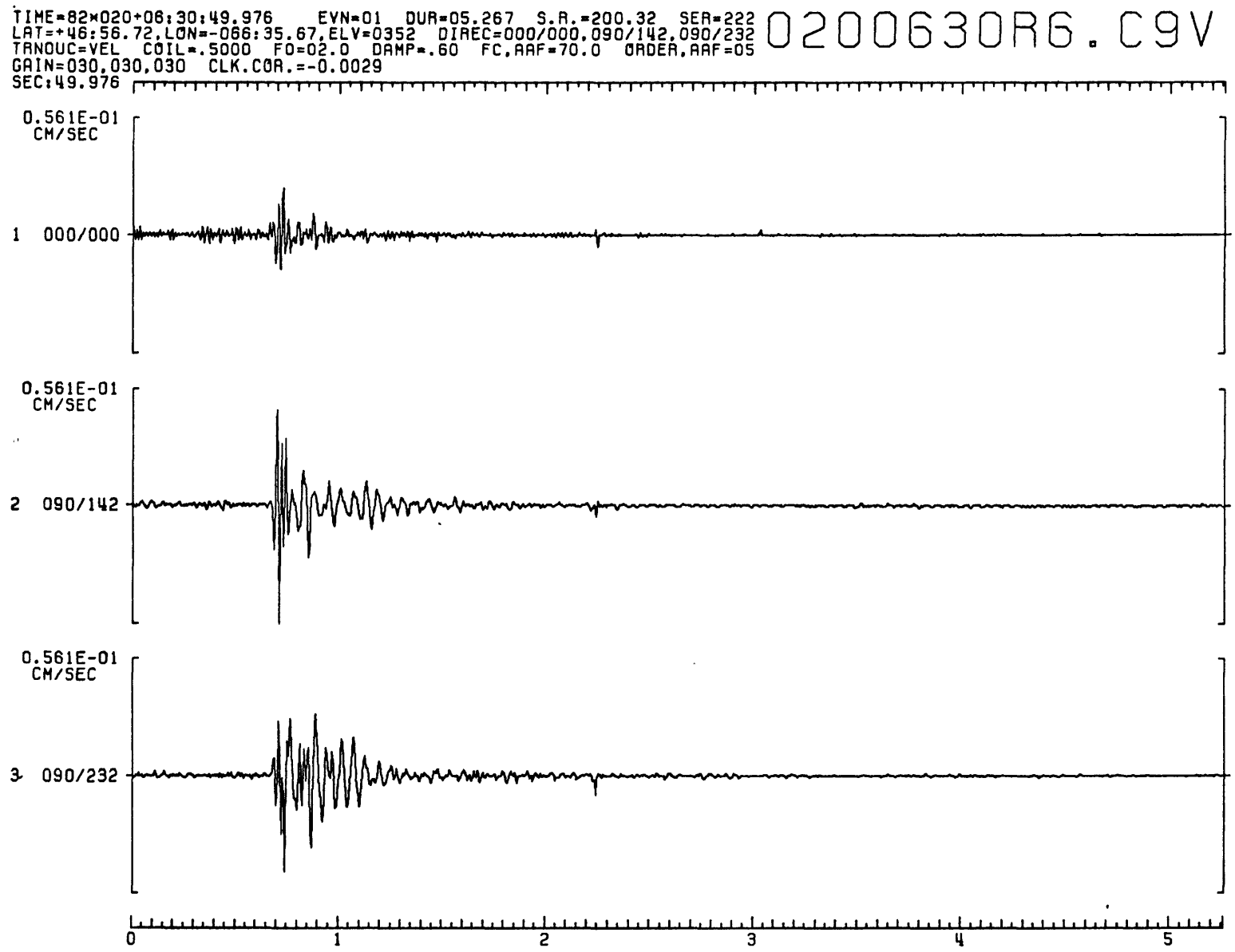
TIME=82*020+06:30:49.976 EVN=01 DUR=05.267 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0029
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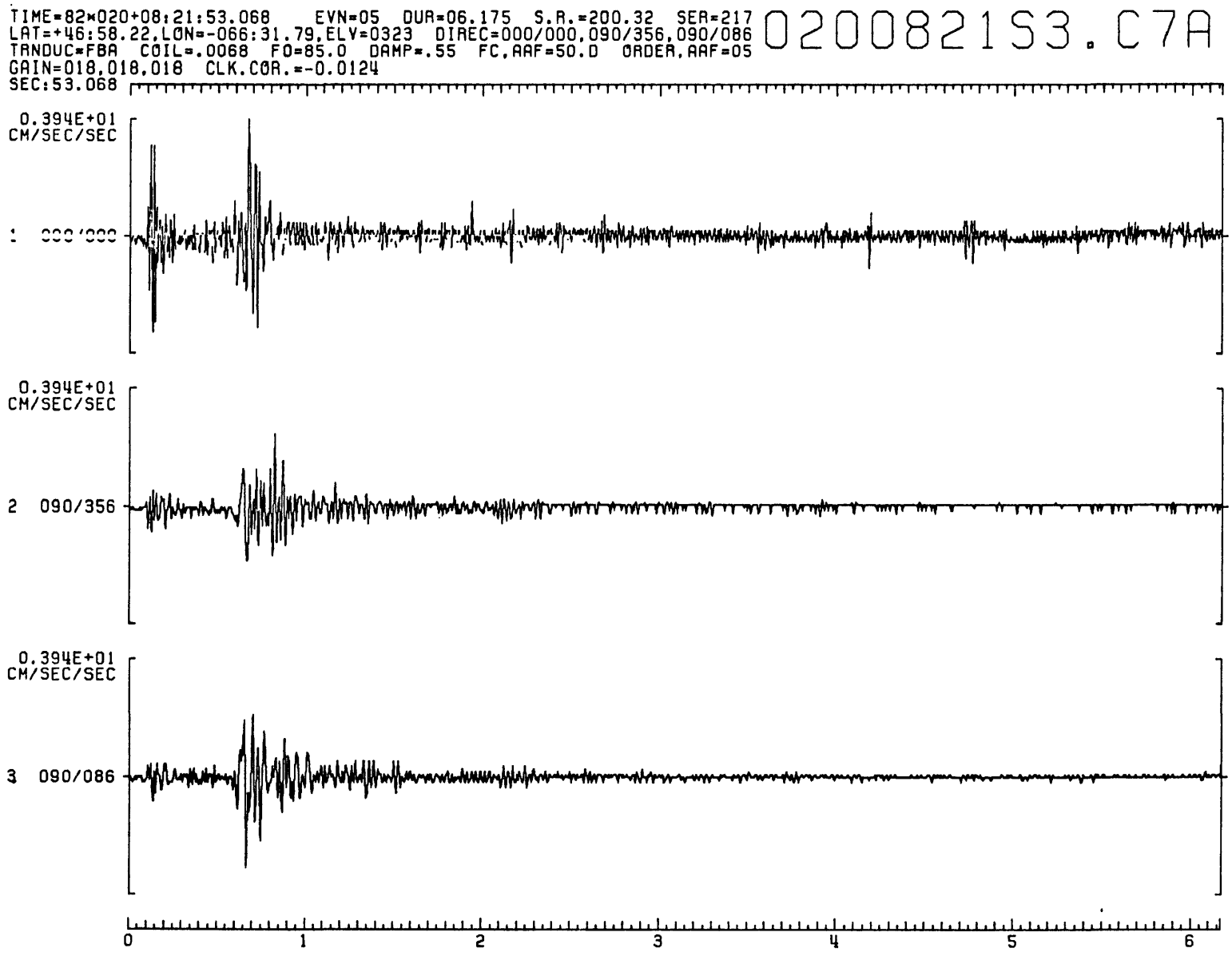
TIME=82*020+08:21:53.068 EVN=05 DUR=06.175 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0124
SEC:53.068
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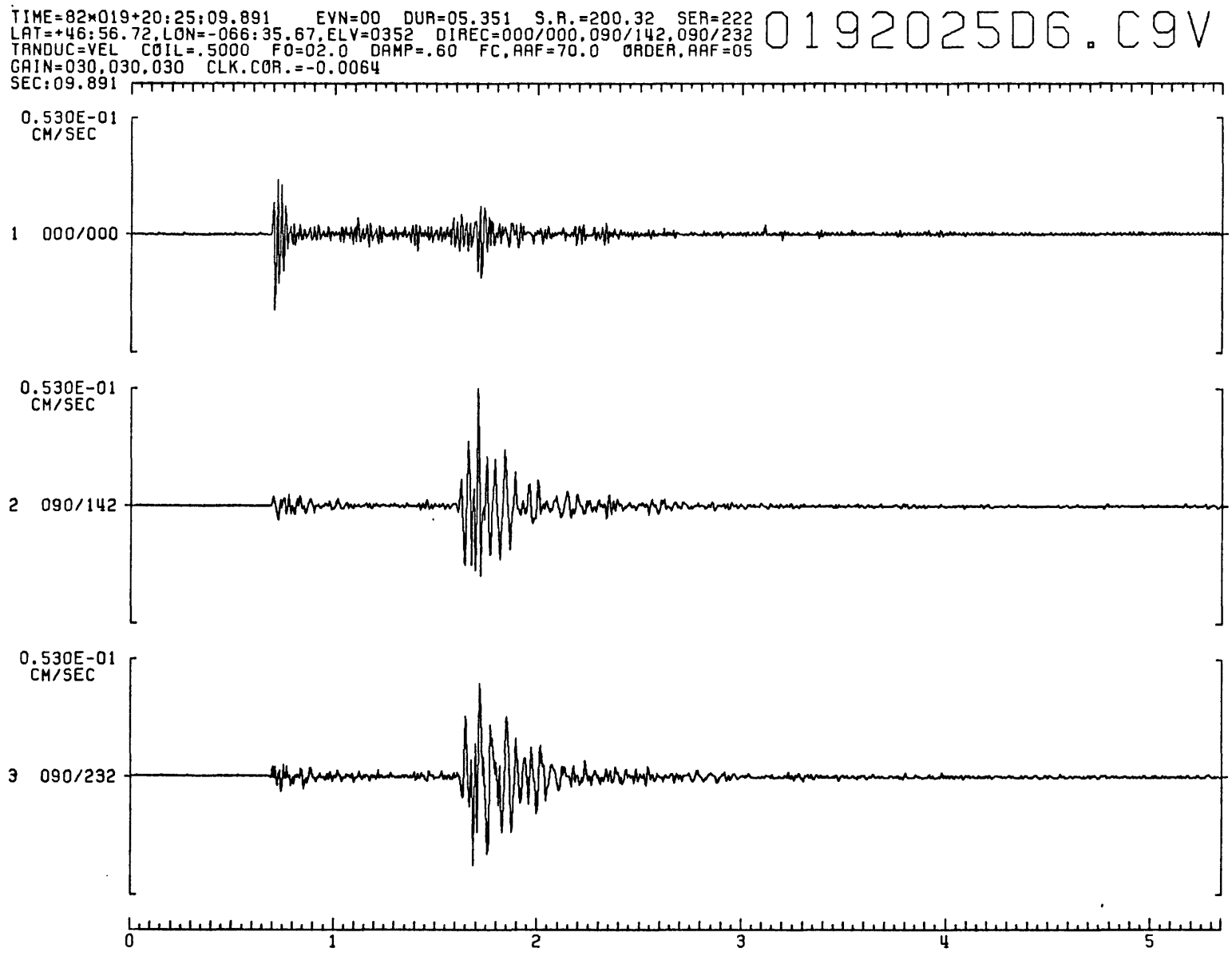
TIME=82*019*20:25:09.891 EVN=00 DUR=05.351 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0064
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CM/SEC
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CM/SEC
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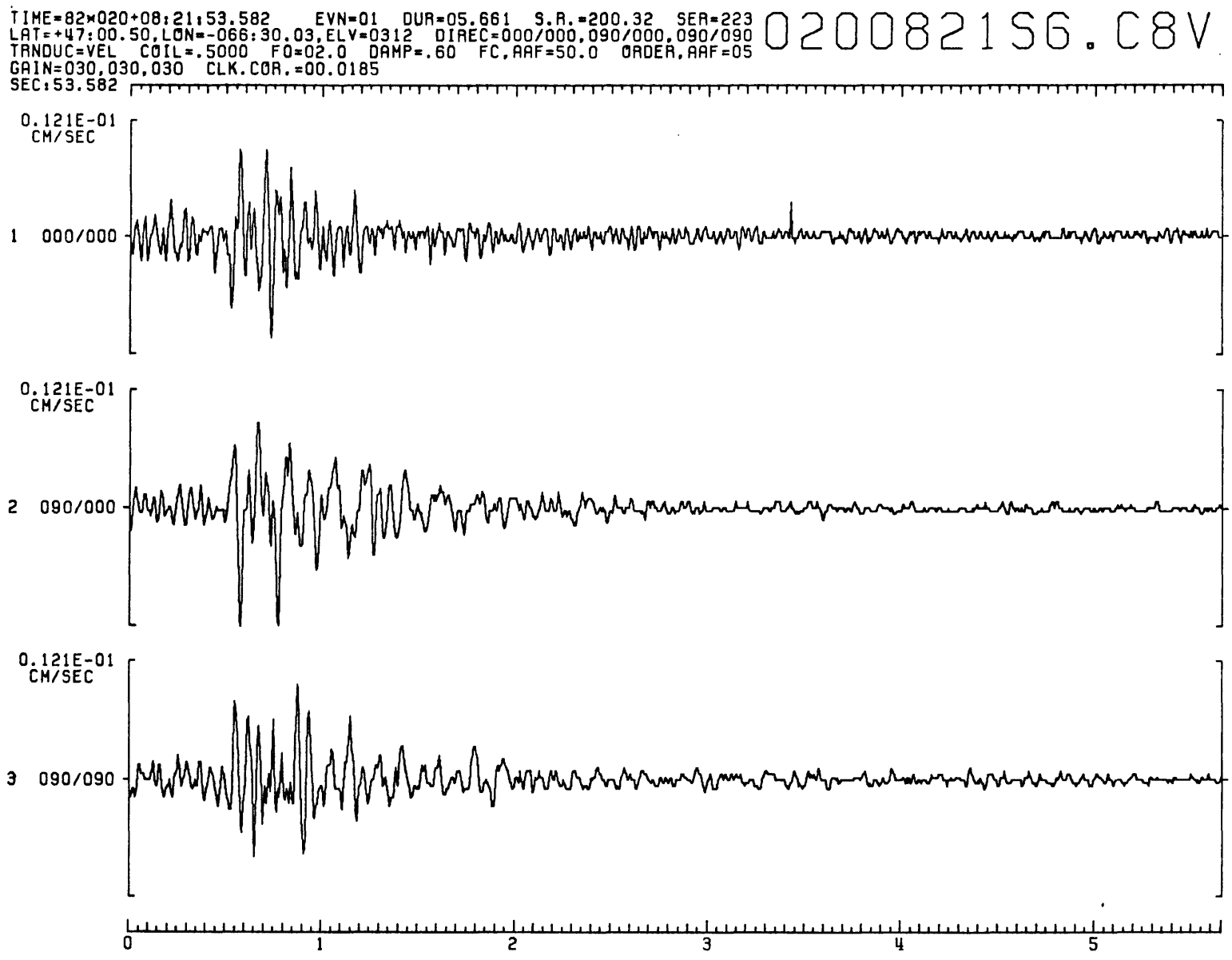
A 56


TIME=82*020+08:21:53.582 EVN=01 DUR=05.661 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0185
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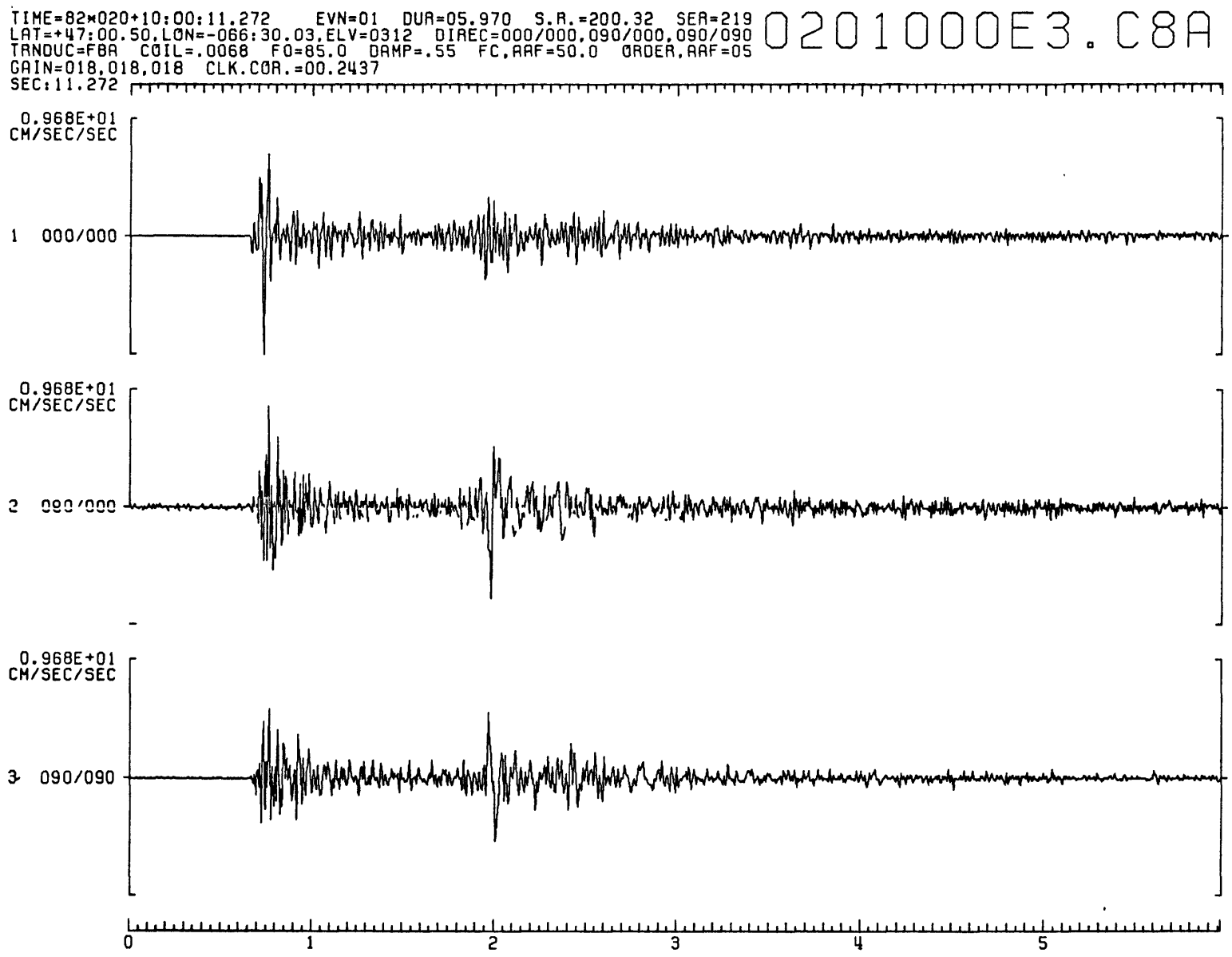
TIME=82*020+10:00:11.272 EVN=01 DUR=05.970 S.R.=200.32 SER=219
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TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
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CM/SEC/SEC
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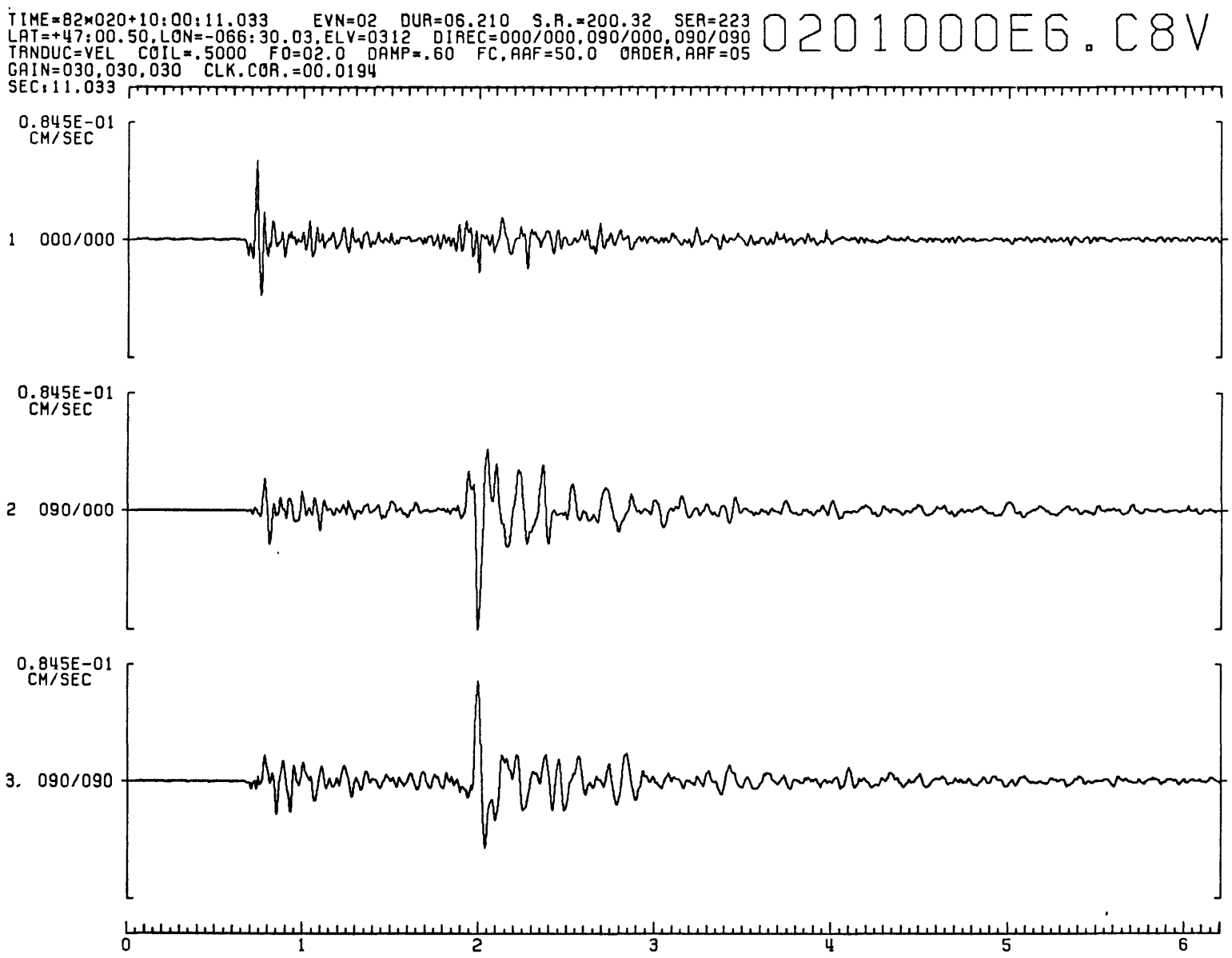
A 58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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
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CM/SEC
1 000/000
0.845E-01
CM/SEC
2 090/000
0.845E-01
CM/SEC
3. 090/090
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1
2
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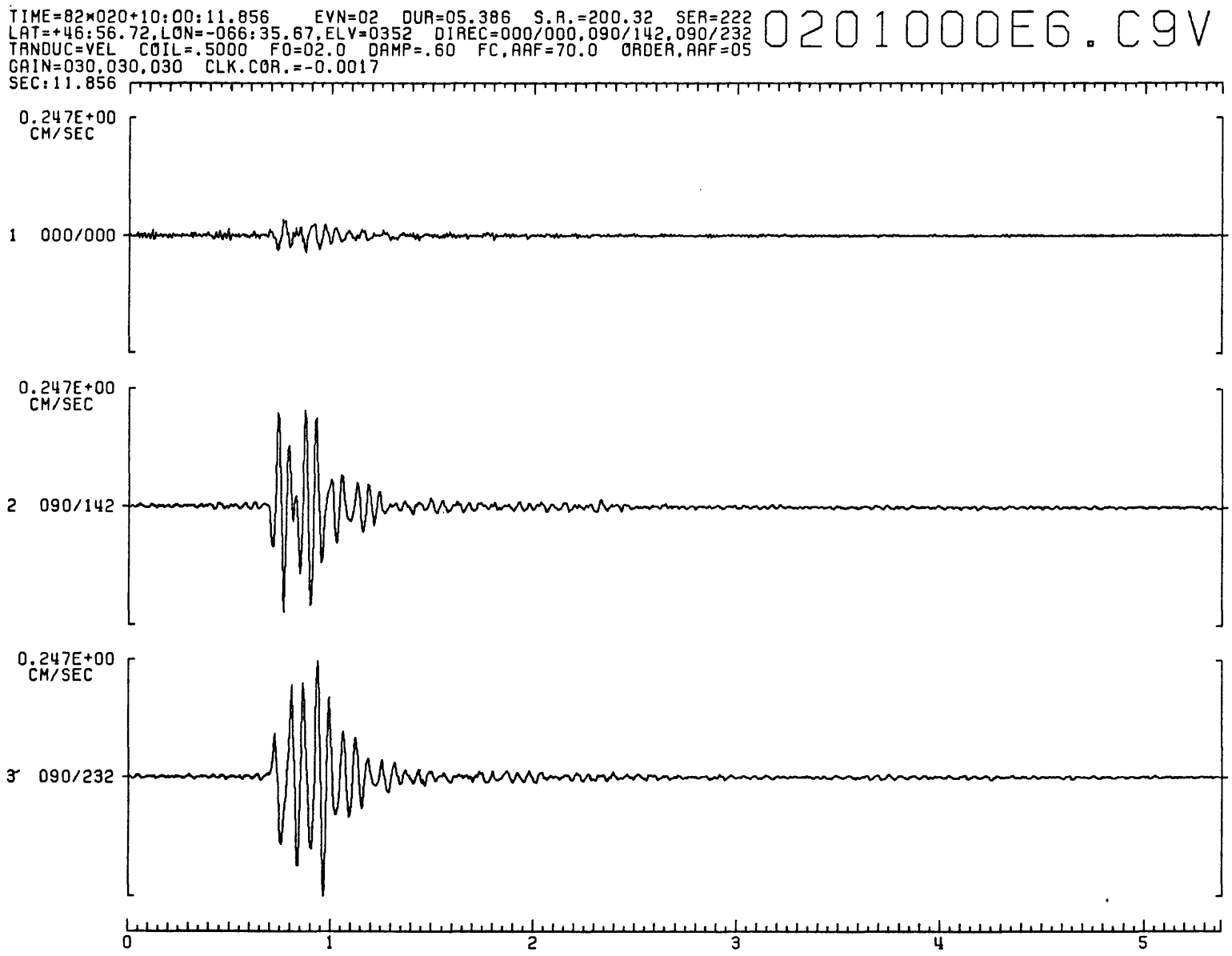
6


TIME=82*020+10:00:11.856 EVN=02 DUR=05.386 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0017
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3 090/232
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1
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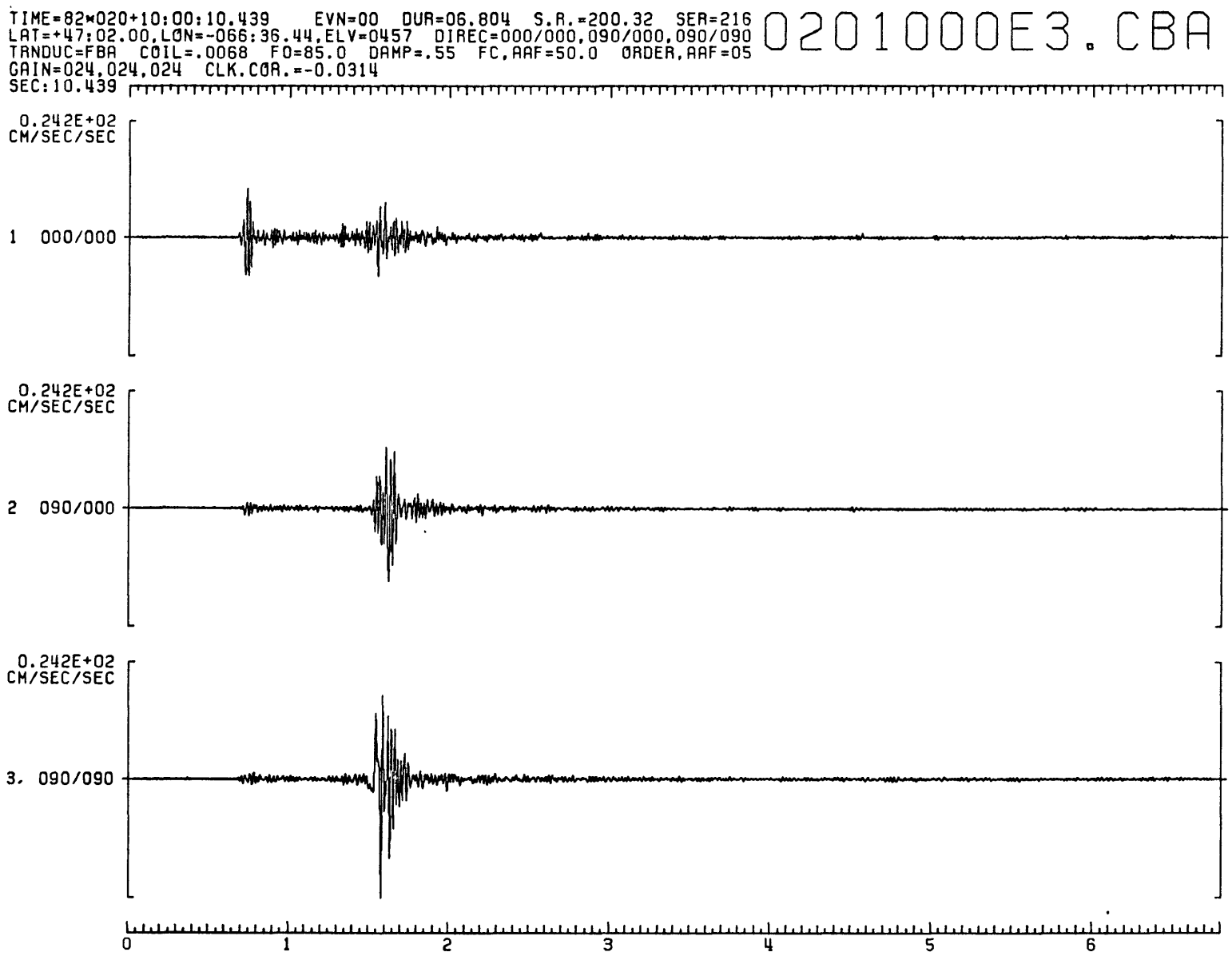
A 60


TIME=82*020+10:00:10.439 EVN=00 DUR=06.804 S.R.=200.32 SER=216
LAT=+47:02.00,LON=-066:36.44,ELV=0457 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0314
0201000E3.CBA
SEC:10.439
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0.242E+02
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0
1
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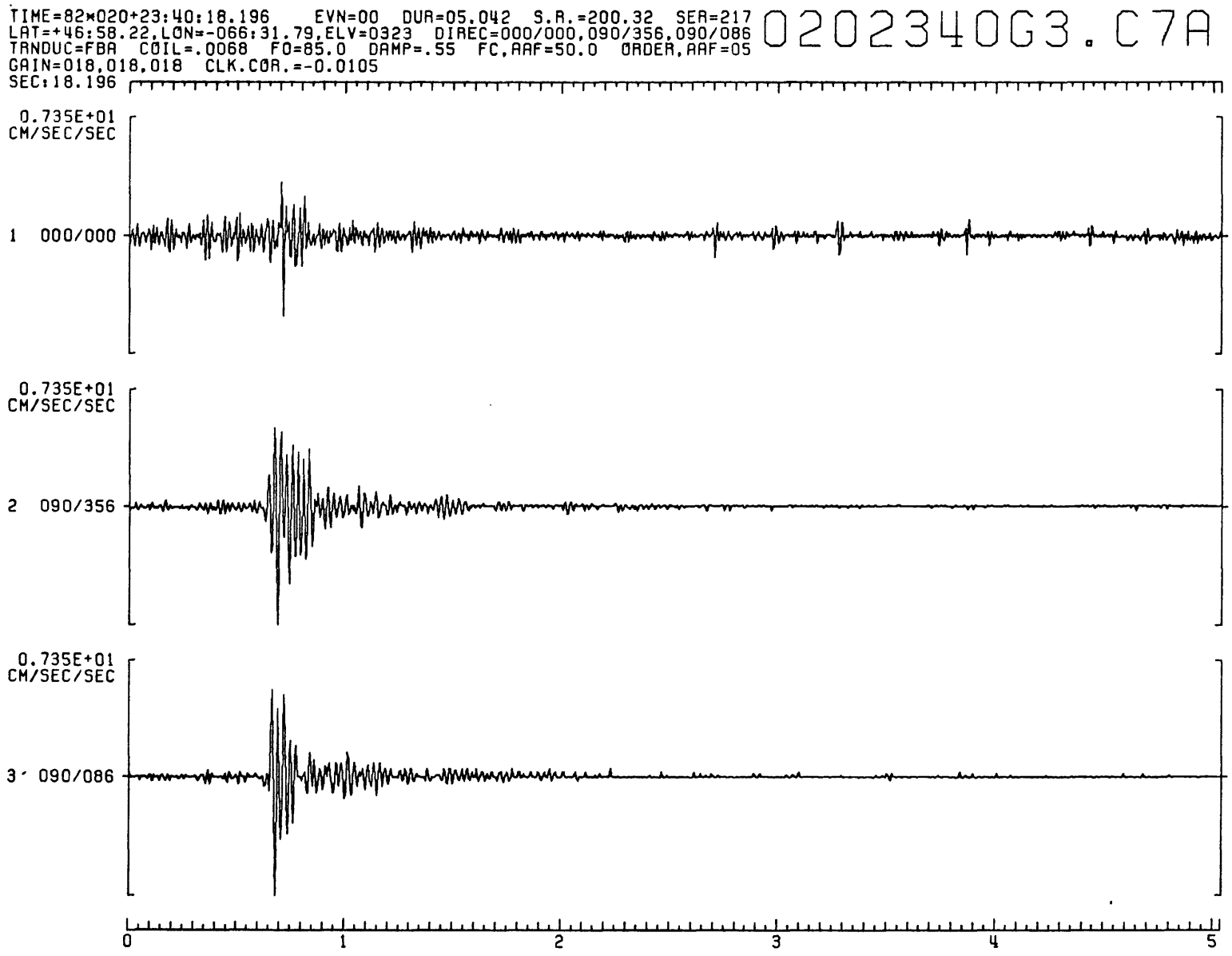
A 61


TIME=82*020+23:40:18.196 EVN=00 DUR=05.042 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0105
02023400G3.C7A
SEC:18.196
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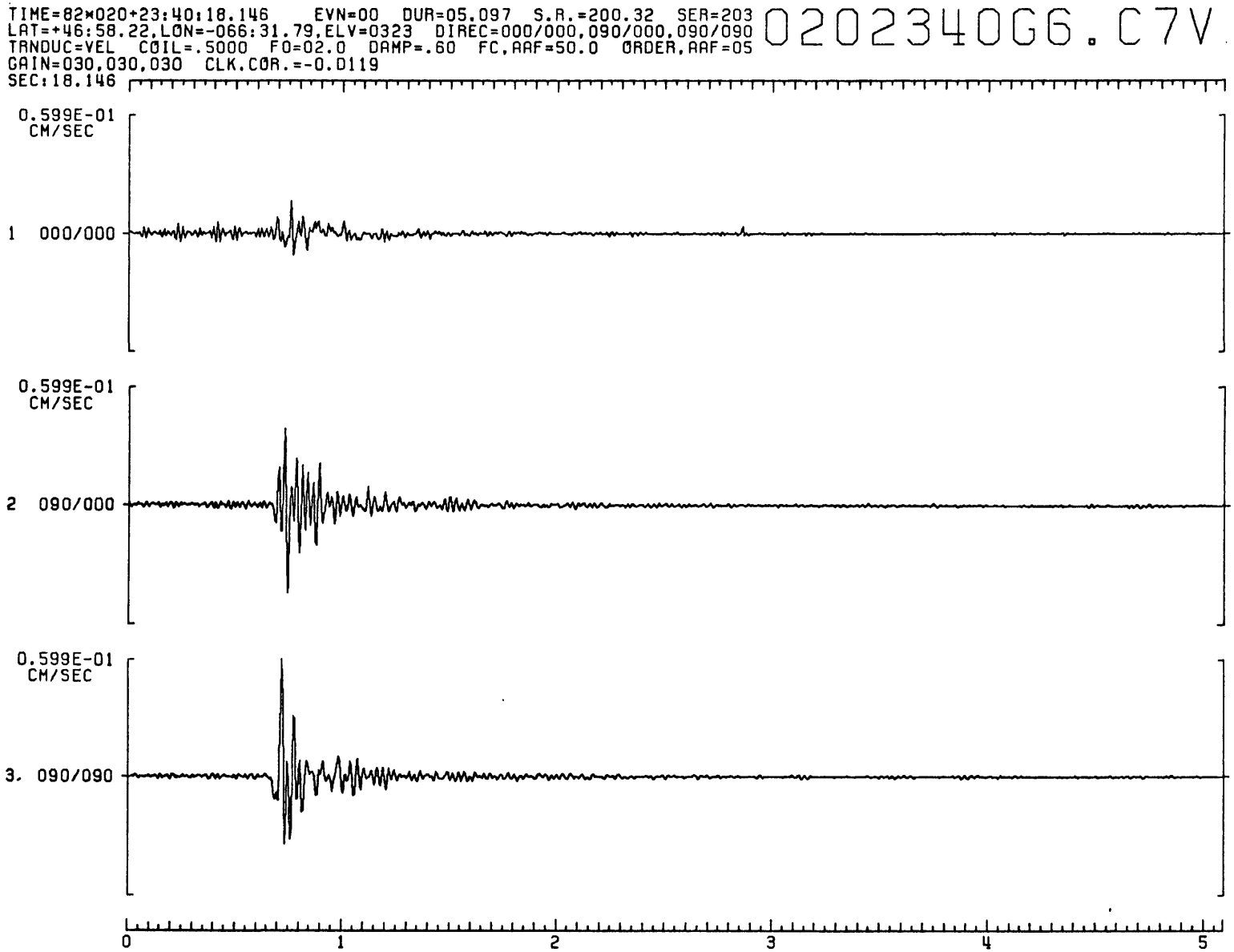
0.735E+01
CM/SEC/SEC
3 090/086
0
1
2
3
4
5

A62


TIME=82*020+23:40:18.146 EVN=00 DUR=05.097 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0119
02023400G6.C7V
SEC:18.146
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CM/SEC
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CM/SEC
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0.599E-01
CM/SEC
3. 090/090
0
1
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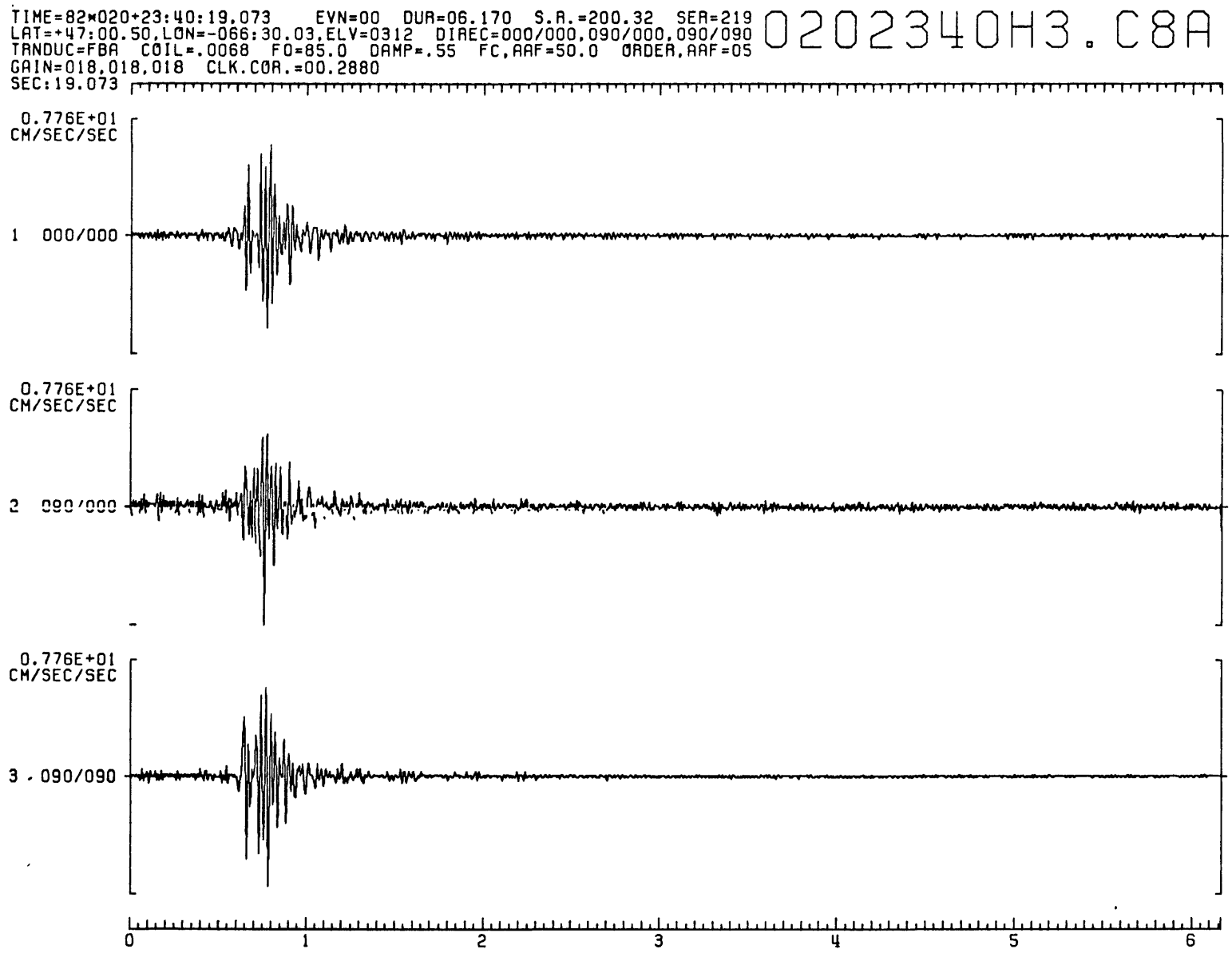
5

A63


TIME=82*020+23:40:19.073 EVN=00 DUR=06.170 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.2880
0202340H3.C8A
SEC:19.073
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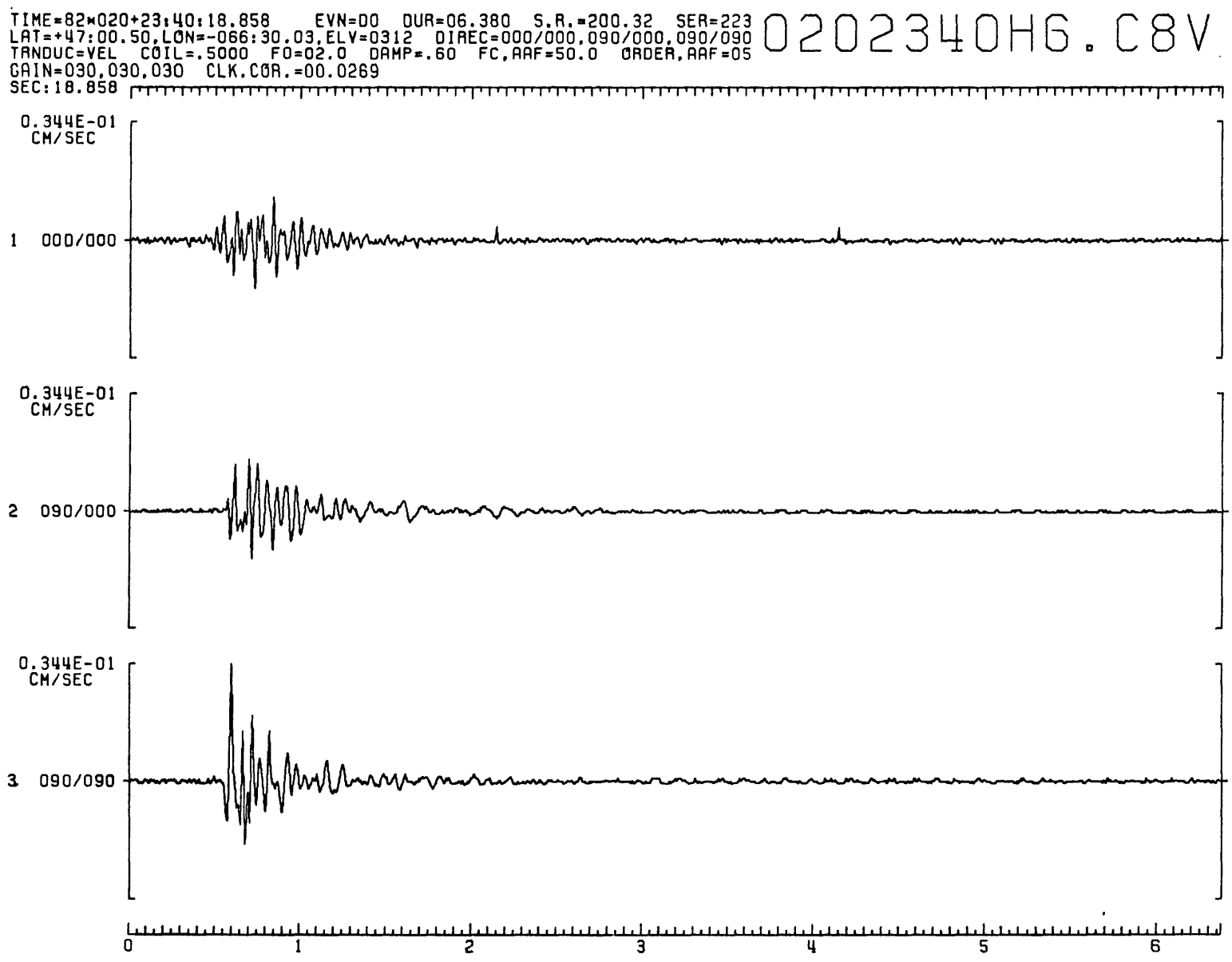
A 64


TIME=82*020+23:40:18.858 EVN=00 DUR=06.380 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0269
0202340H6.C8V
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1 000/000
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2 090/000
0.344E-01 CM/SEC
3 090/090
0
1
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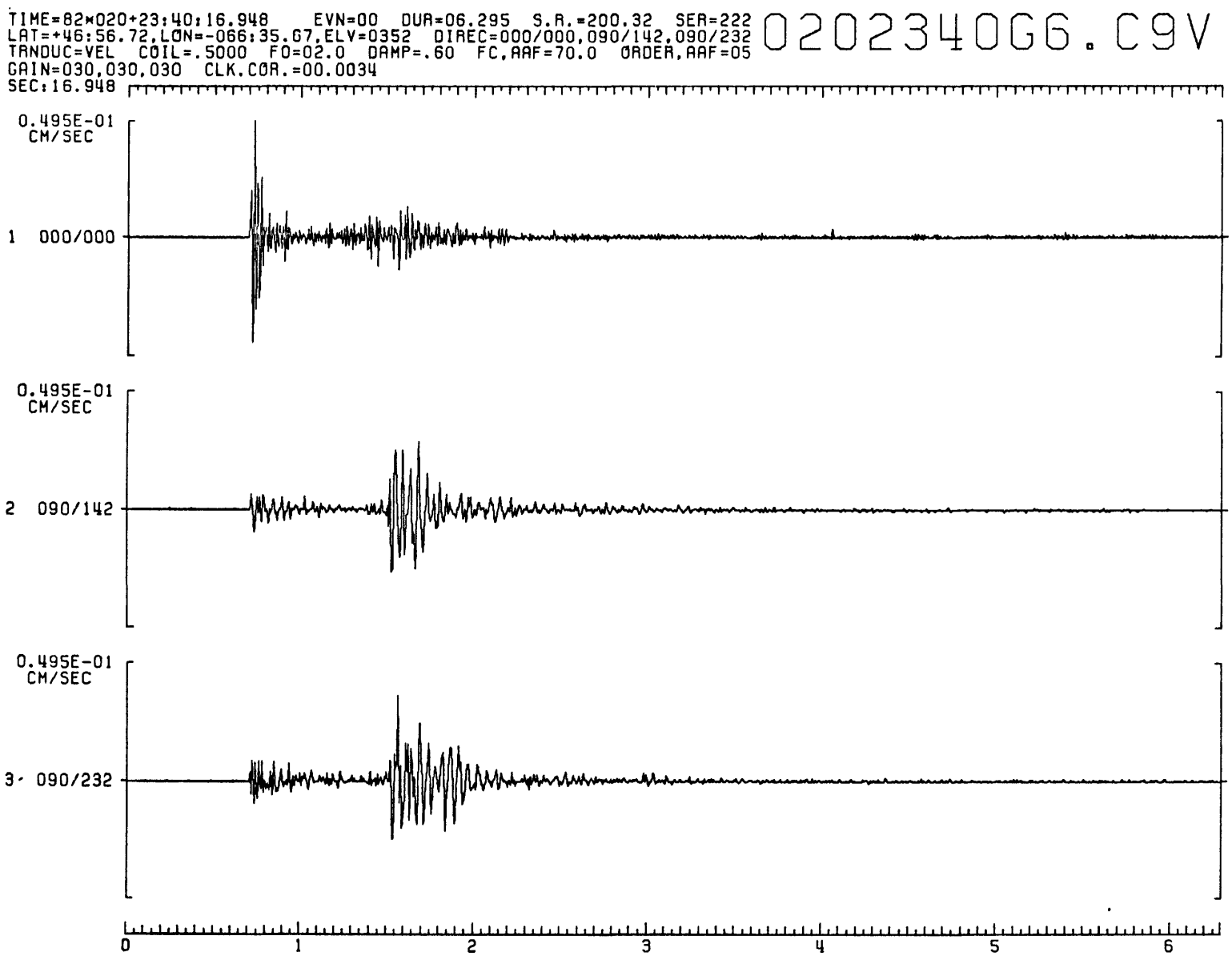
A65


TIME=82*020+23:40:16.948 EVN=00 DUR=06.295 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0034
02023406G.C9V
SEC:16.948
0.495E-01
CM/SEC
1 000/000
0.495E-01
CM/SEC
2 090/142
0.495E-01
CM/SEC
3 090/232
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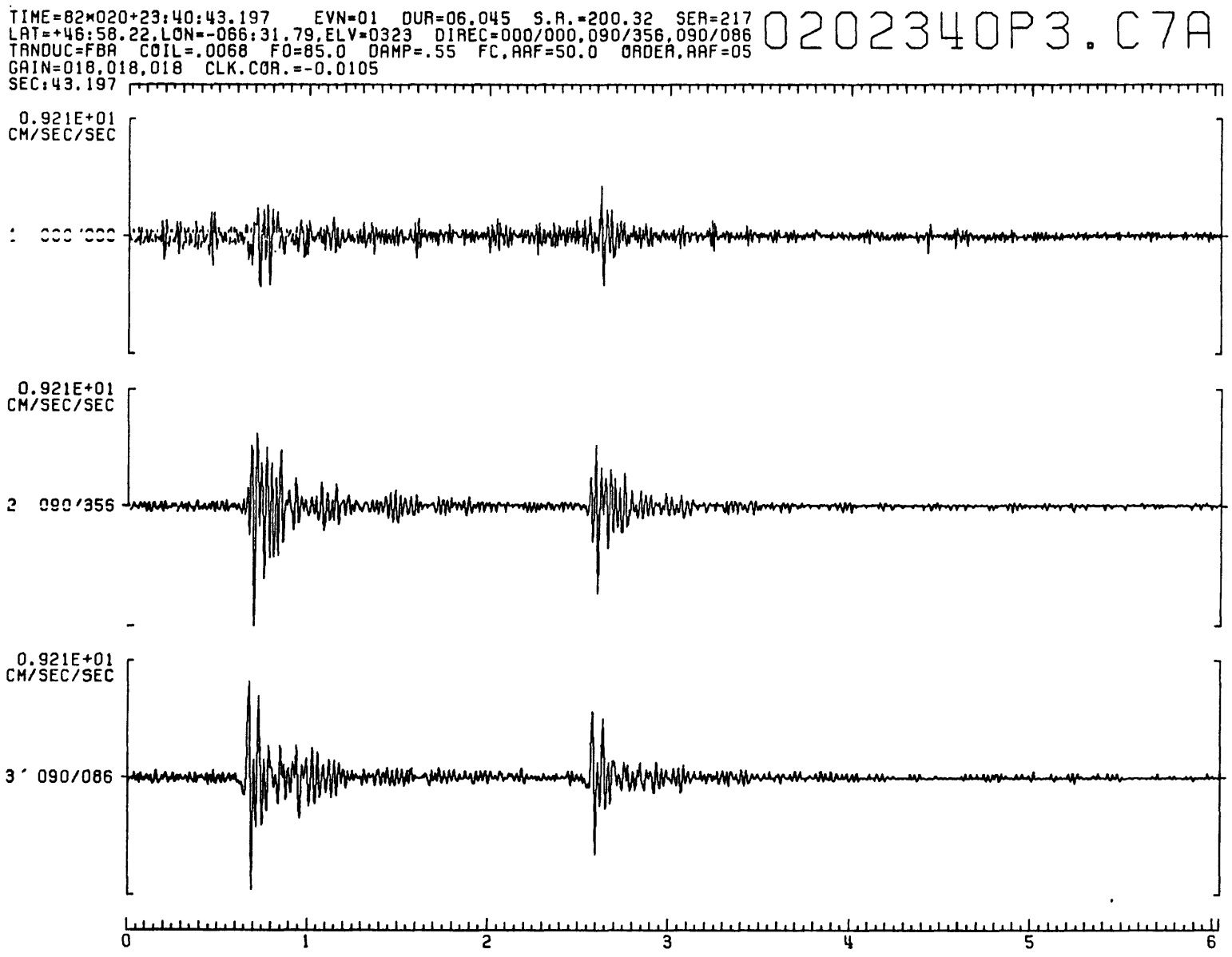
A 6 6


TIME=82*020+23:40:43.197 EVN=01 DUR=06.045 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0105
0202340P3.C7A
SEC:43.197
0.921E+01
CM/SEC/SEC
1 000/000
0.921E+01
CM/SEC/SEC
2 090/356
0.921E+01
CM/SEC/SEC
3 090/086
0
1
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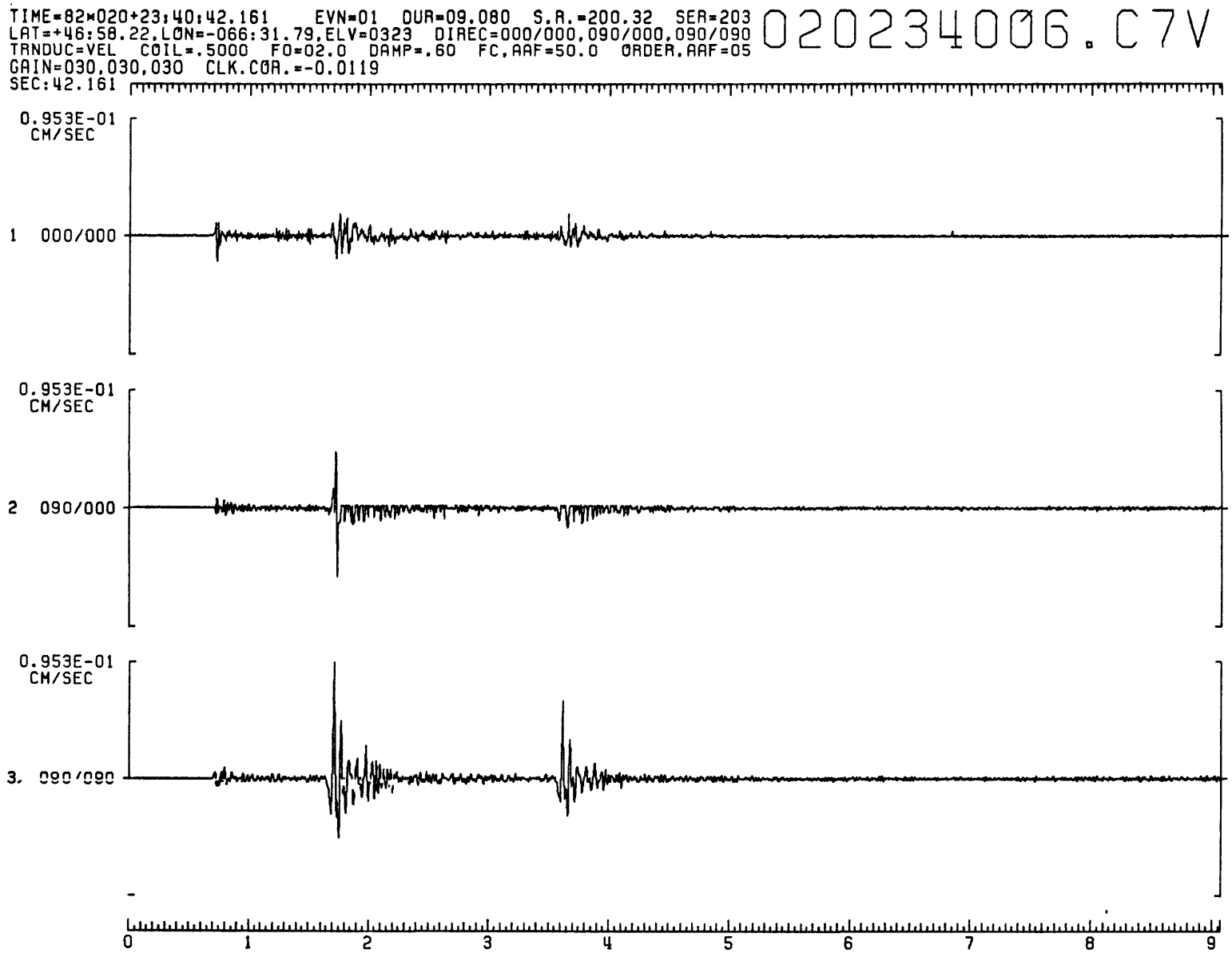
A67


TIME=82*020*23:40:42.161 EVN=01 DUR=09.080 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0119
020234006.C7V
SEC:42.161
0.953E-01
CM/SEC
1 000/000
0.953E-01
CM/SEC
2 090/000
0.953E-01
CM/SEC
3. 090/090
0
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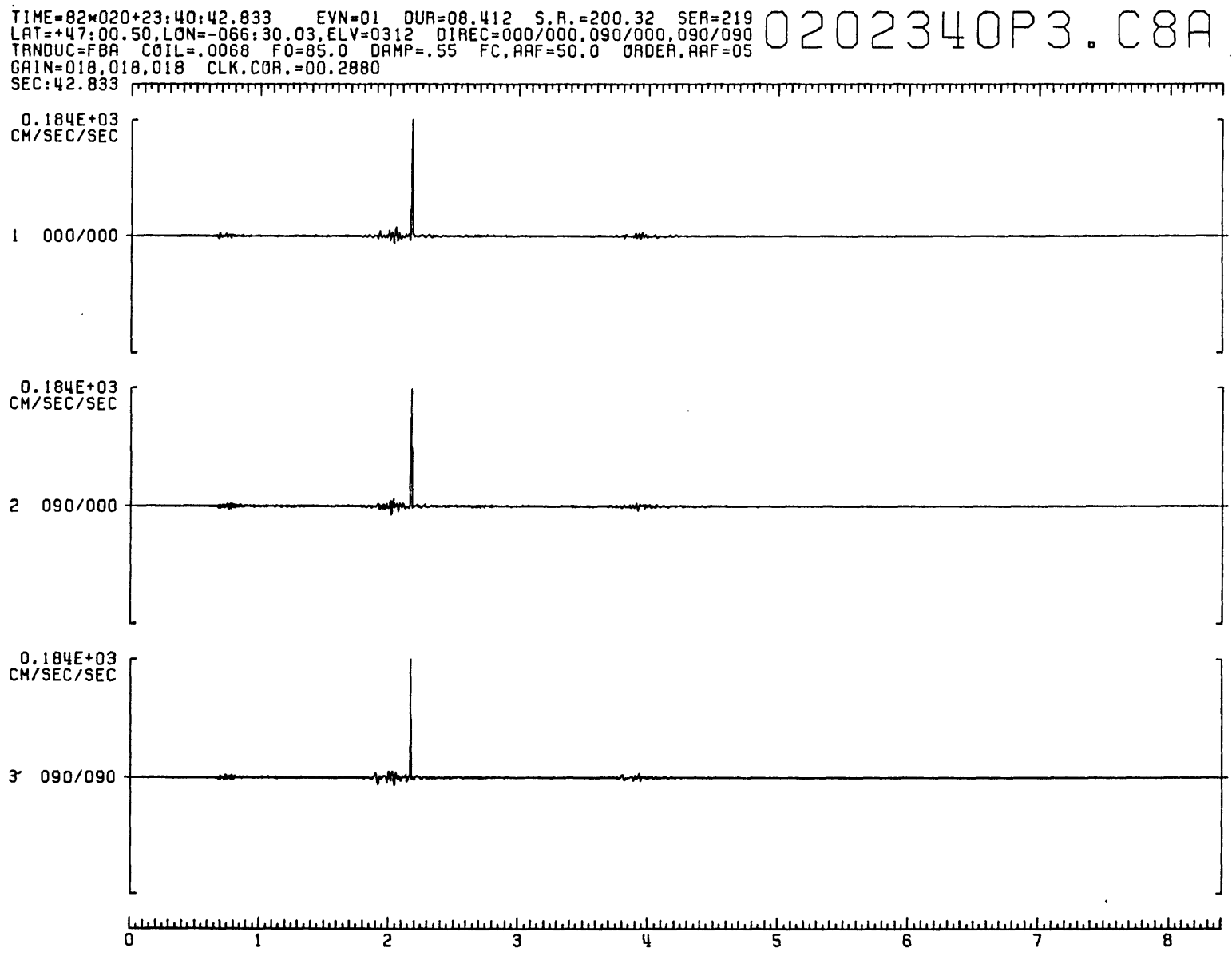
148


TIME=82*020+23:40:42.833 EVN=01 DUR=08.412 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.2880
0202340P3.C8A
SEC:42.833
0.184E+03
CM/SEC/SEC
1 000/000
0.184E+03
CM/SEC/SEC
2 090/000
0.184E+03
CM/SEC/SEC
3 090/090
0
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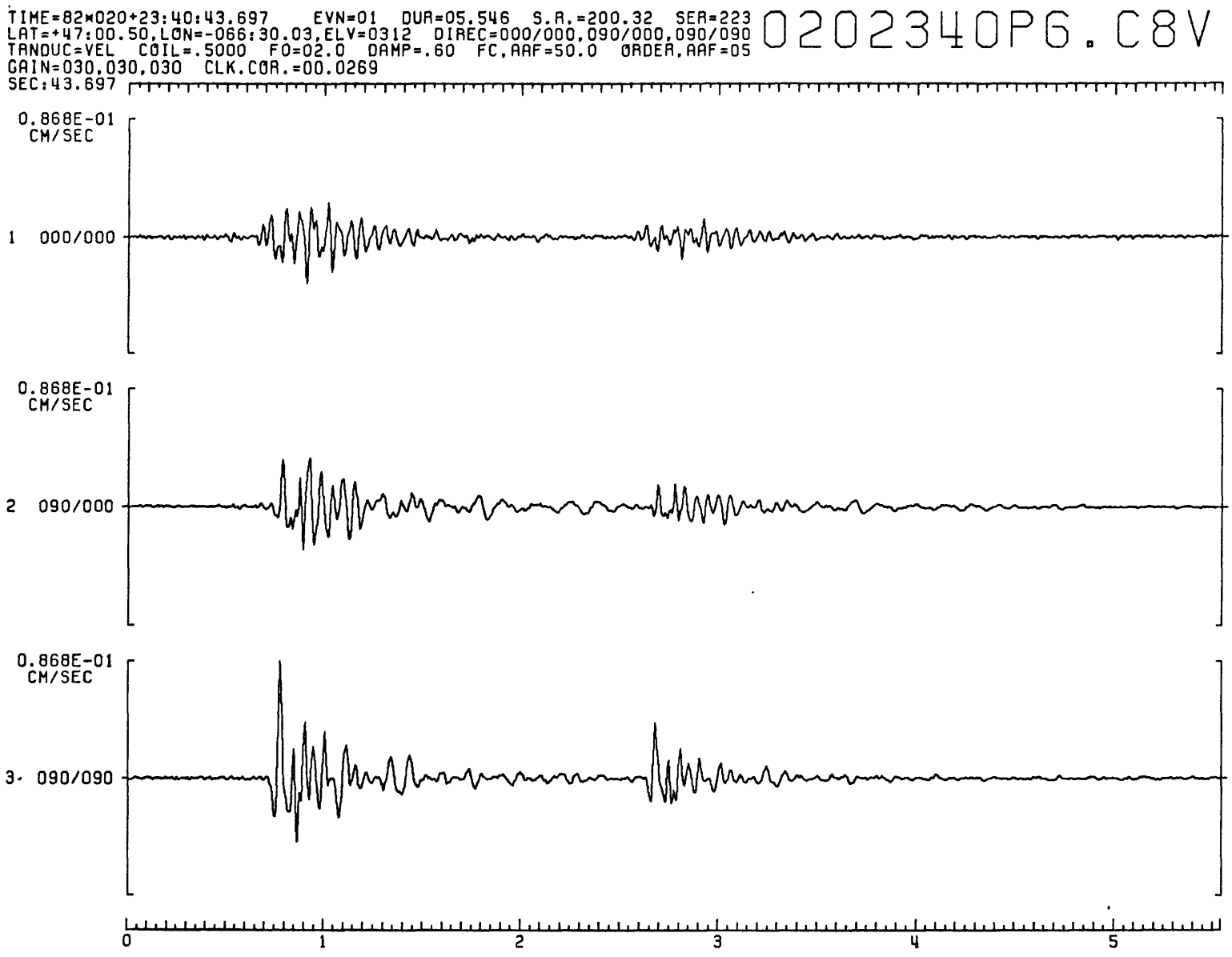
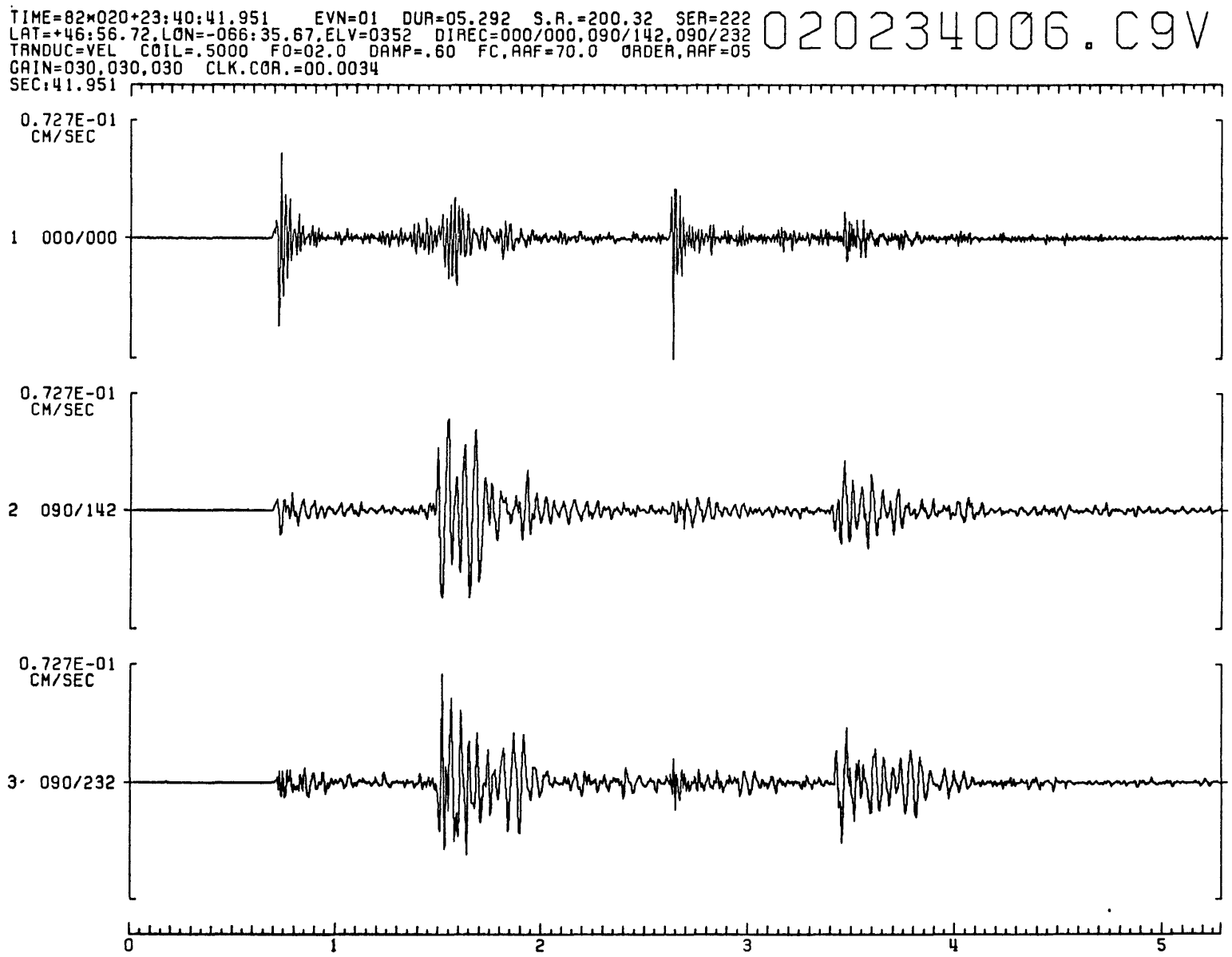
A69


TIME=82*020*23:40:43.697 EVN=01 DUR=05.546 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0269
0202340P6.C8V
SEC:43.697
0.868E-01
CM/SEC
1 000/000
0.868E-01
CM/SEC
2 090/000
0.868E-01
CM/SEC
3 090/090
0
1
2
3
4
5

A70


TIME=82*020+23:40:41.951 EVN=01 DUR=05.292 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0034
020234006.C9V
SEC:41.951
0.727E-01
CM/SEC
1 000/000
0.727E-01
CM/SEC
2 090/142
0.727E-01
CM/SEC
3 090/232
0
1
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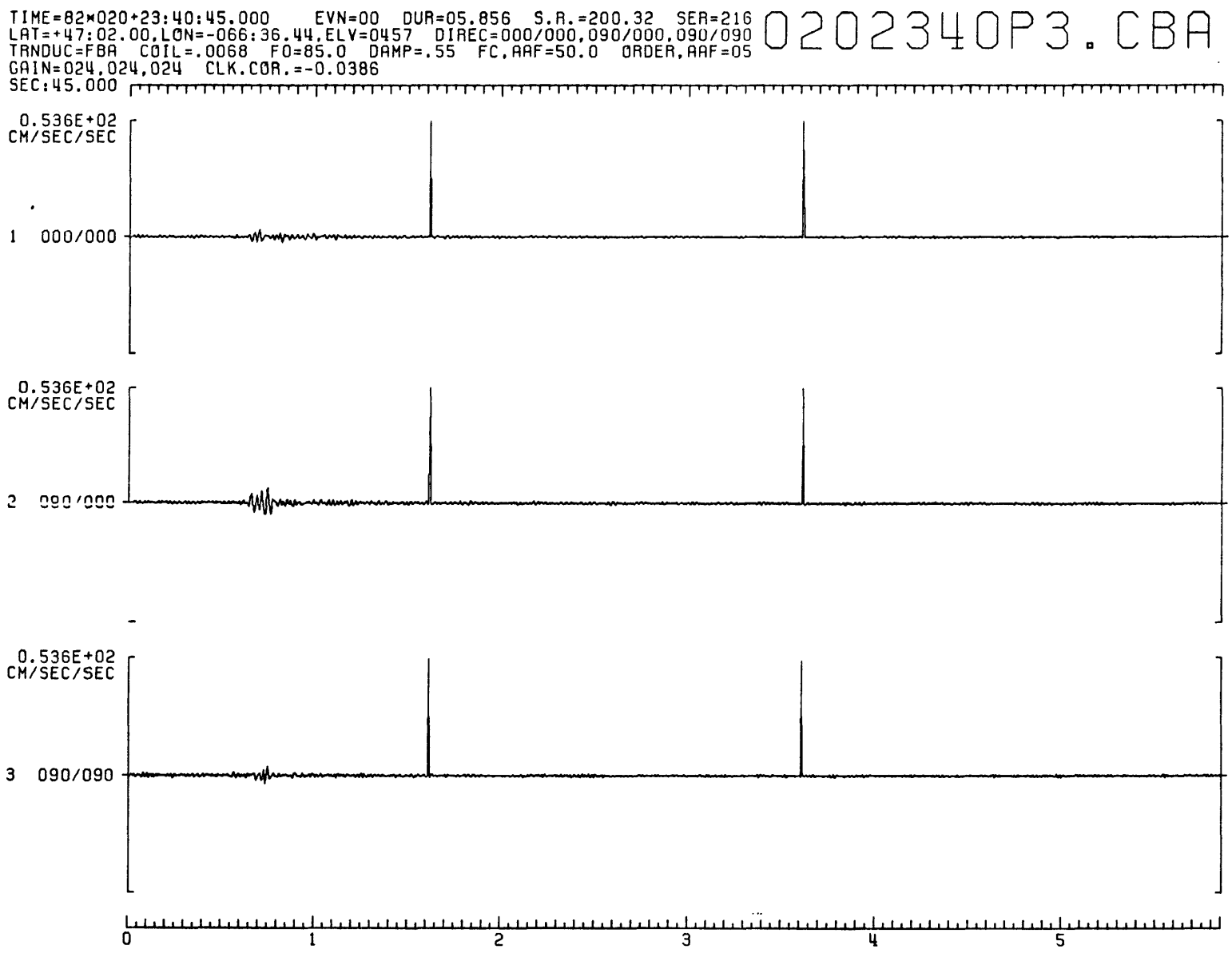
3
4
5


TIME=82*020*23:40:45.000 EVN=00 DUR=05.856 S.R.=200.32 SER=216
LAT=+47:02.00,LON=-066:36.44,ELV=0457 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0386
0202340P3.CBA
SEC:45.000
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CM/SEC/SEC
1 000/000
0.536E+02
CM/SEC/SEC
2 090/000
0.536E+02
CM/SEC/SEC
3 090/090
0
1
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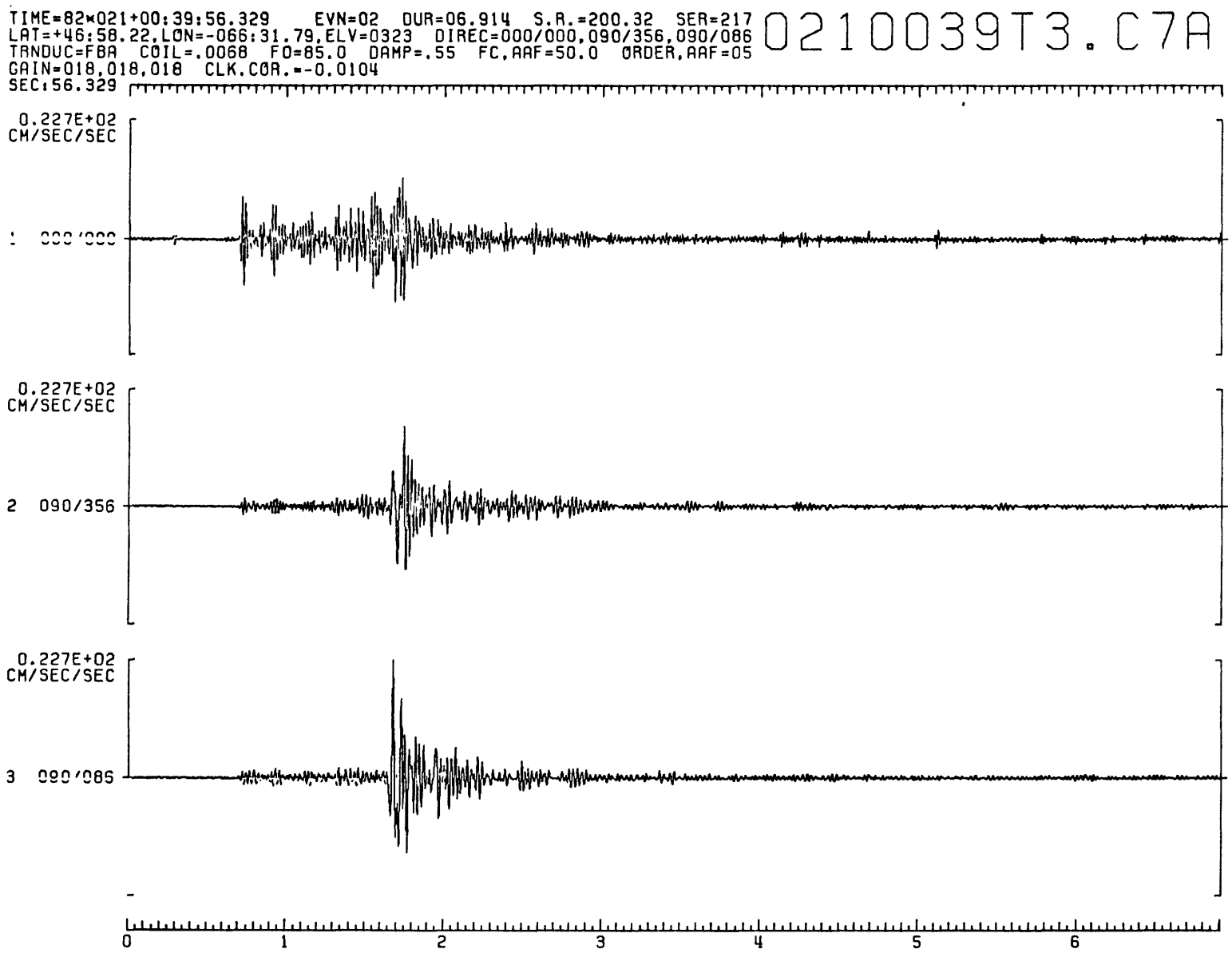
TIME=82×021+00:39:56.329 EVN=02 DUR=06.914 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0104
02100039T3.C7A
SEC:56.329
0.227E+02
CM/SEC/SEC
1 000/000
0.227E+02
CM/SEC/SEC
2 090/356
0.227E+02
CM/SEC/SEC
3 090/086
0
1
2
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4
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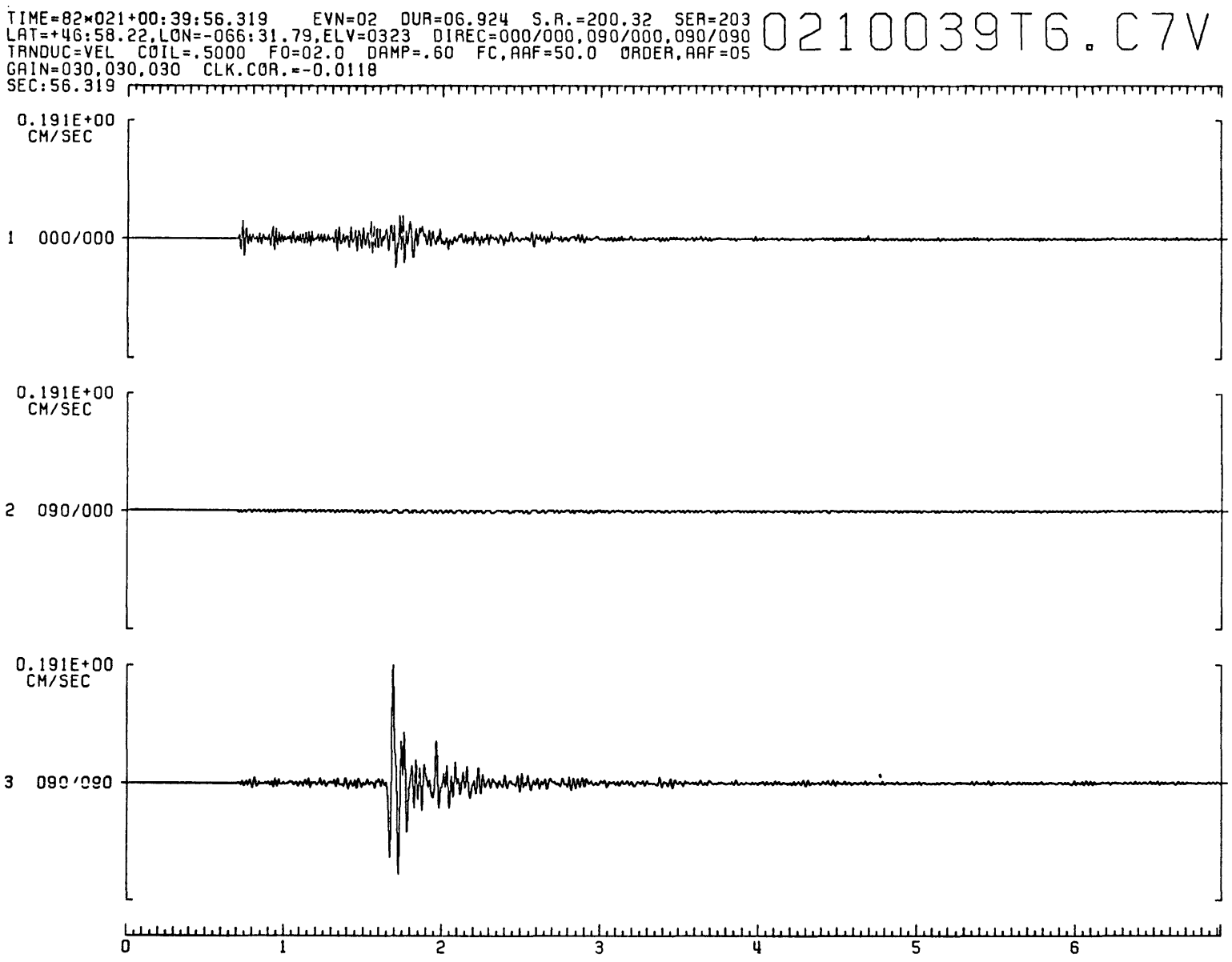
TIME=82*021+00:39:56.319 EVN=02 DUR=06.924 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0118
02100039T6.C7V
SEC:56.319
0.191E+00
CM/SEC
1 000/000
0.191E+00
CM/SEC
2 090/000
0.191E+00
CM/SEC
3 090/090
0
1
2
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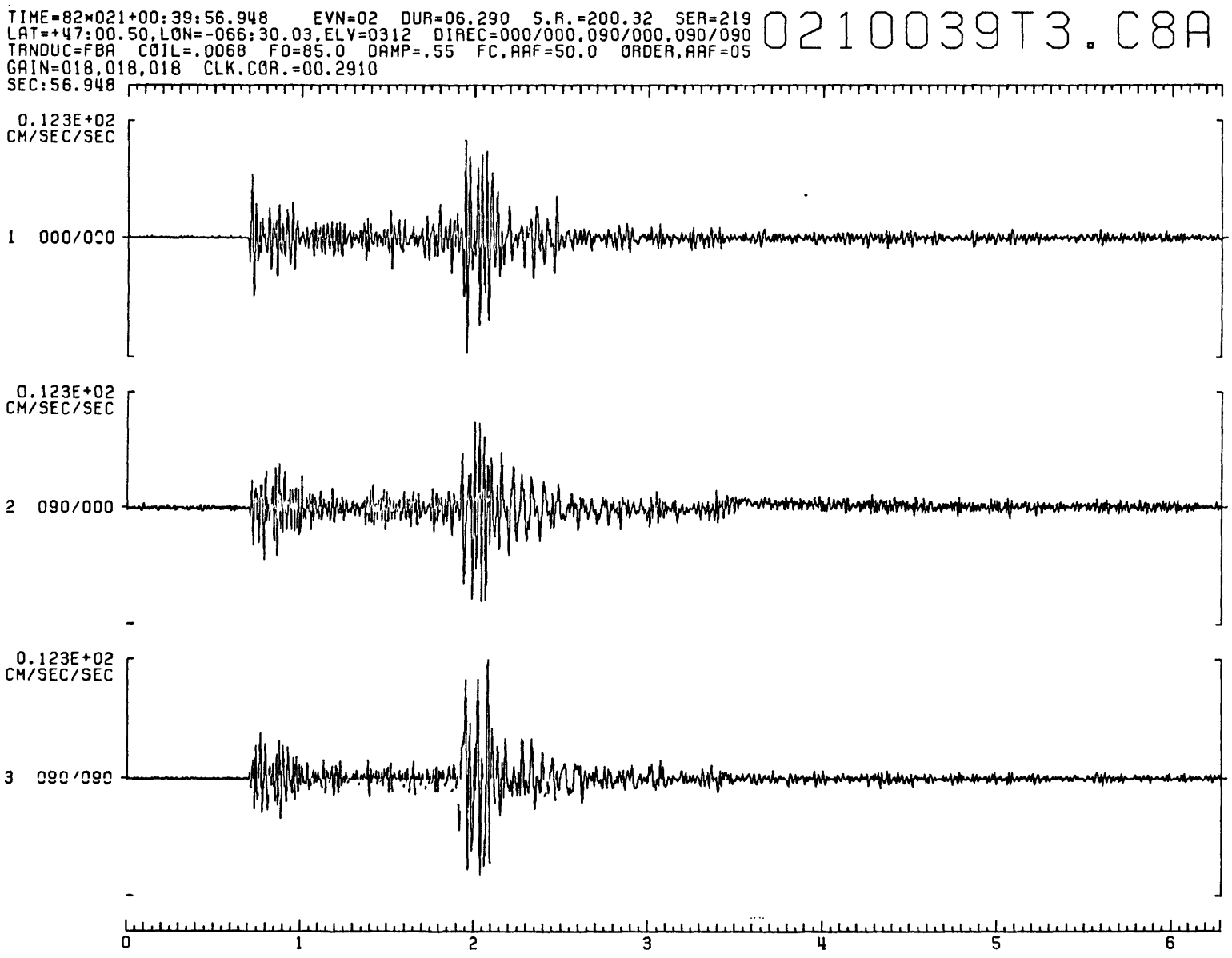
4
5
6


TIME=82*021+00:39:56.948 EVN=02 DUR=06.290 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.2910
02100039T3.C8A
SEC:56.948
0.123E+02
CM/SEC/SEC
1 000/000
0.123E+02
CM/SEC/SEC
2 090/000
0.123E+02
CM/SEC/SEC
3 090/090
0
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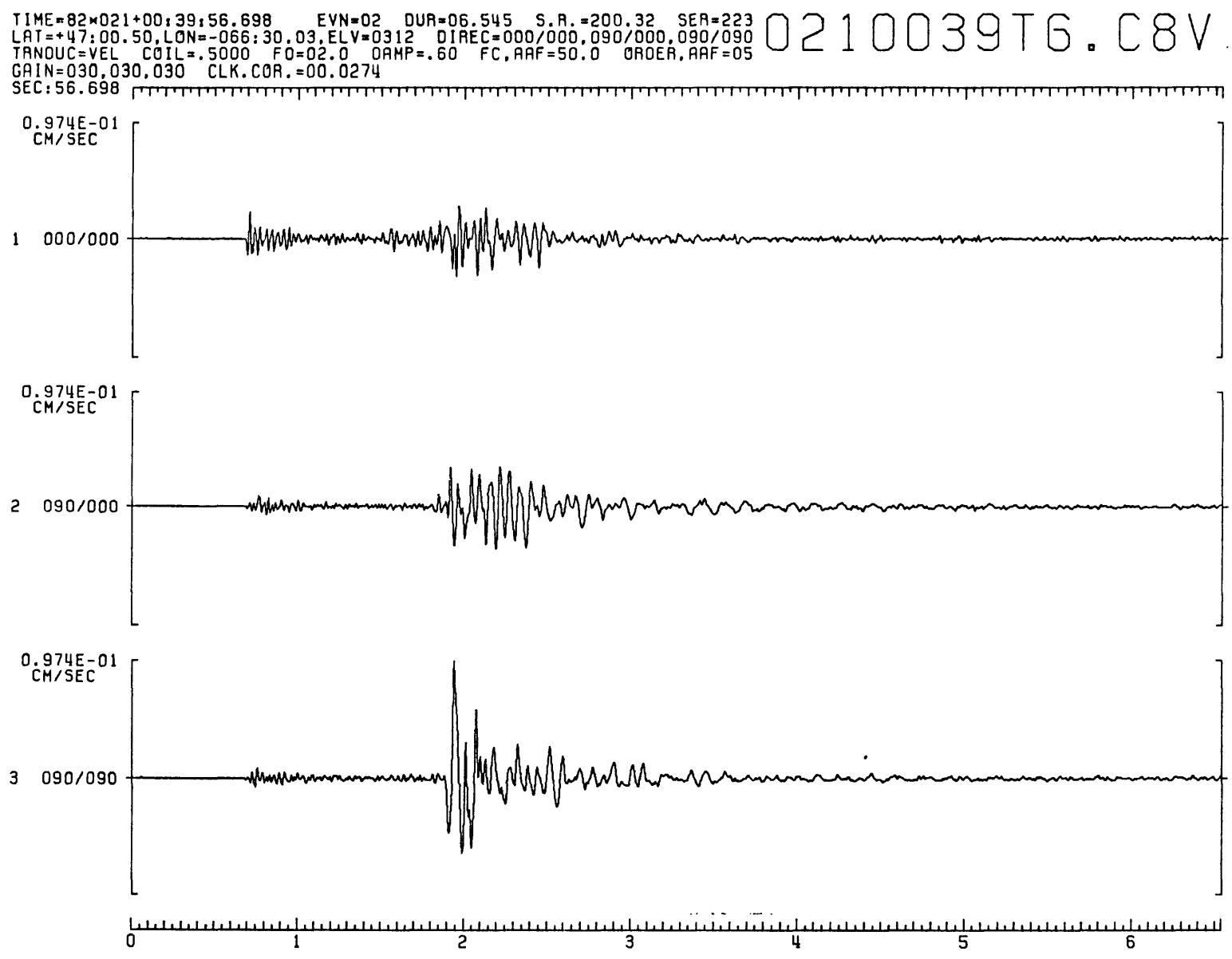
TIME=82*021+00:39:56.698 EVN=02 DUR=06.545 S.R.=200.32 SEA=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0274
02100039T6.C8V
SEC:56.698
0.974E-01
CM/SEC
1 000/000
0.974E-01
CM/SEC
2 090/000
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CM/SEC
3 090/090
0
1
2
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4
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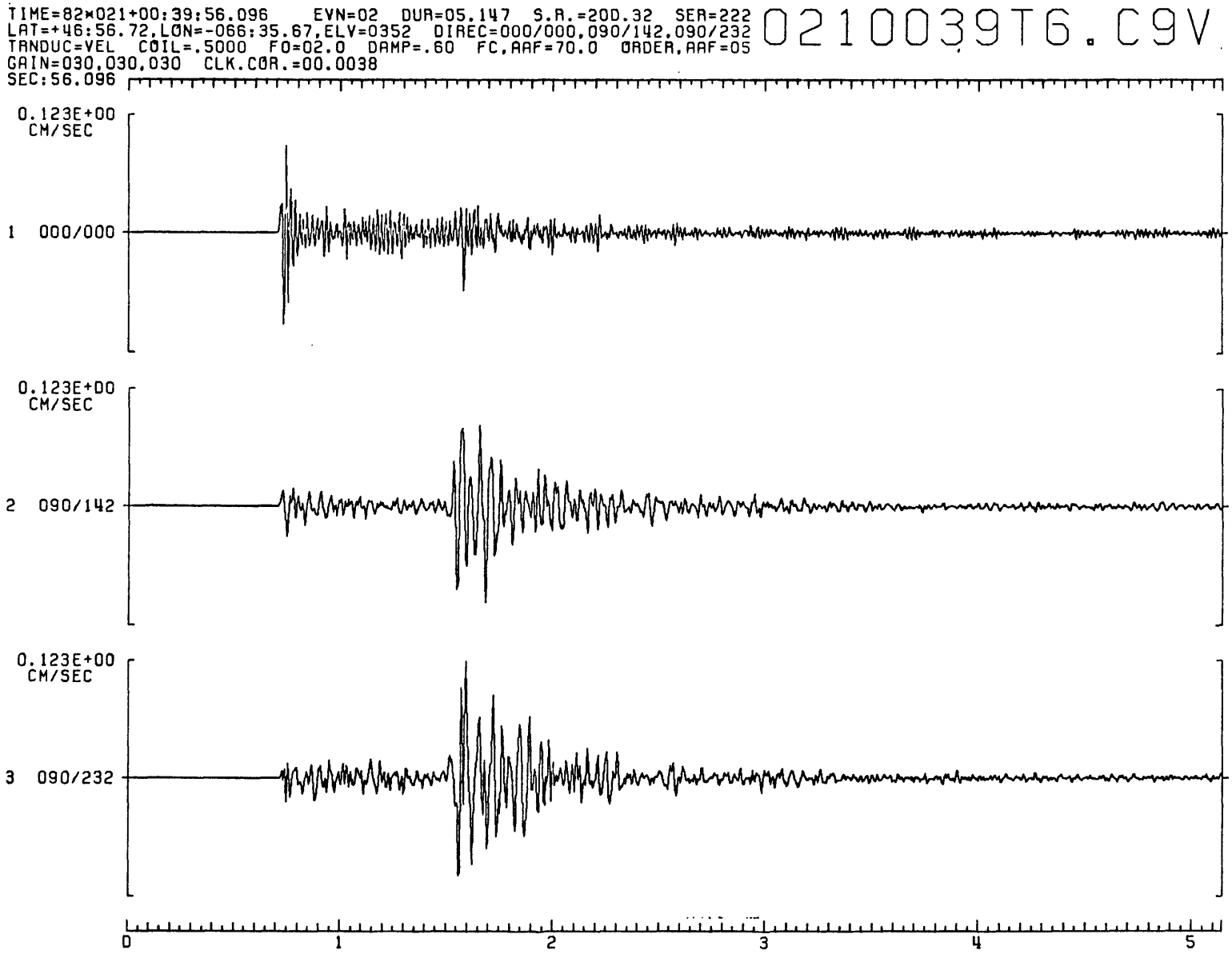
6

A 76


TIME=82*021+00:39:56.096 EVN=02 DUR=05.147 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0038
02100039T6.C9V
SEC:56.096
0.123E+00
CM/SEC
1 000/000
0.123E+00
CM/SEC
2 090/142
0.123E+00
CM/SEC
3 090/232
0
1
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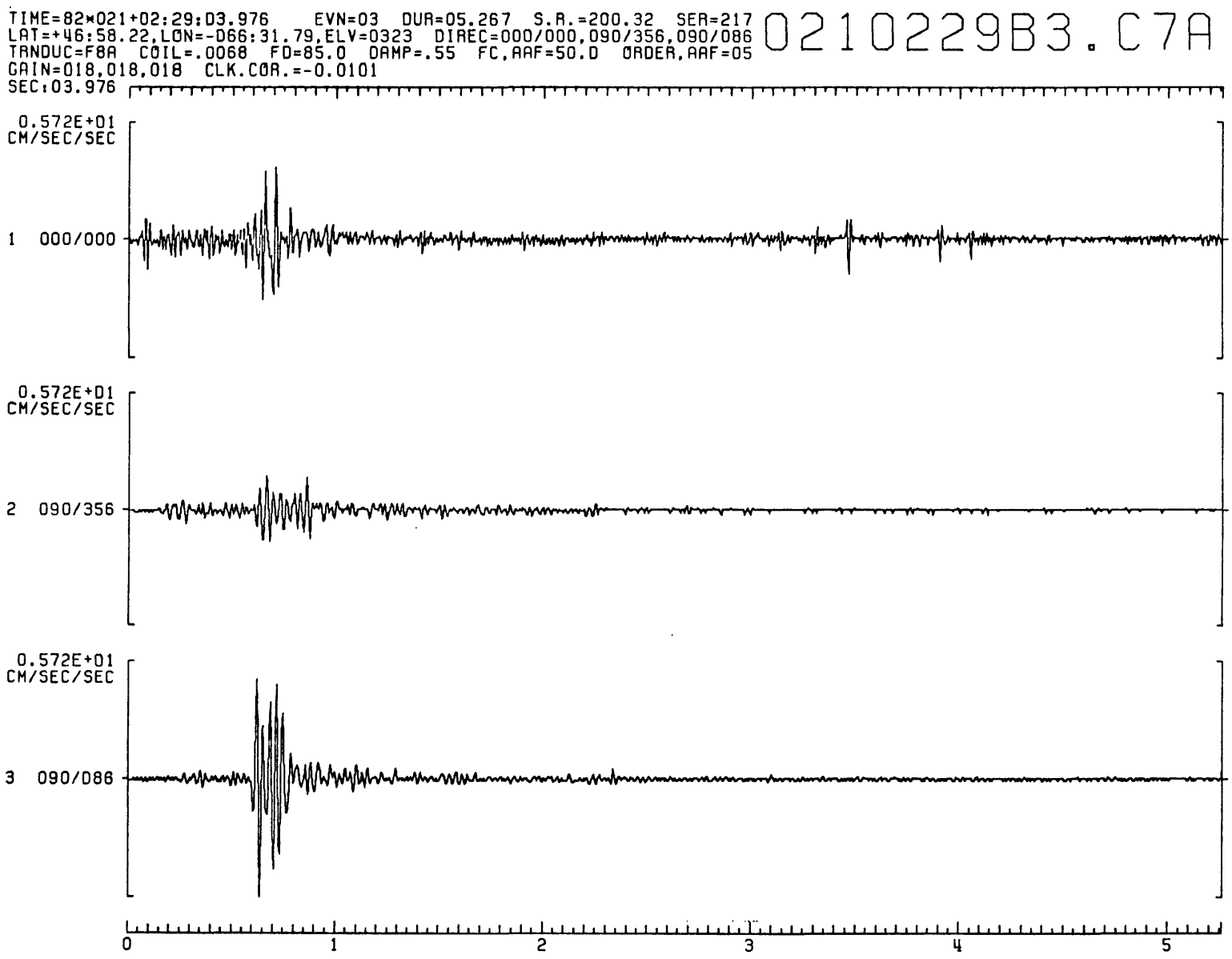
TIME=82*021+02:29:03.976 EVN=03 DUR=05.267 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=F8A COIL=.0068 FD=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0101
0210229B3.C7A
SEC:03.976
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CM/SEC/SEC
1 000/000
0.572E+01
CM/SEC/SEC
2 090/356
0.572E+01
CM/SEC/SEC
3 090/086
0
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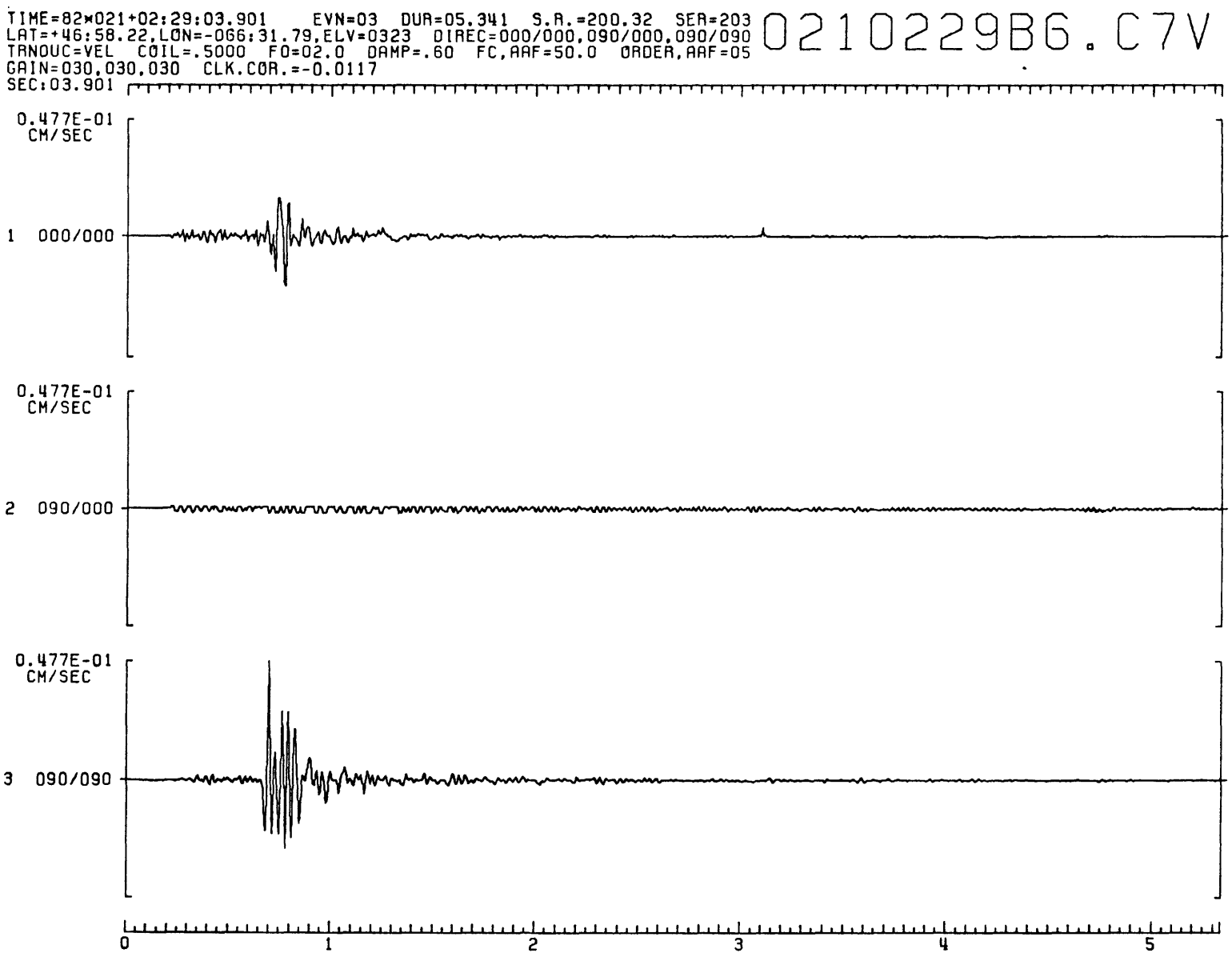
TIME=82*021+02:29:03.901 EVN=03 DUR=05.341 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0117
0210229B6.C7V
SEC:03.901
0.477E-01
CM/SEC
1 000/000
0.477E-01
CM/SEC
2 090/000
0.477E-01
CM/SEC
3 090/090
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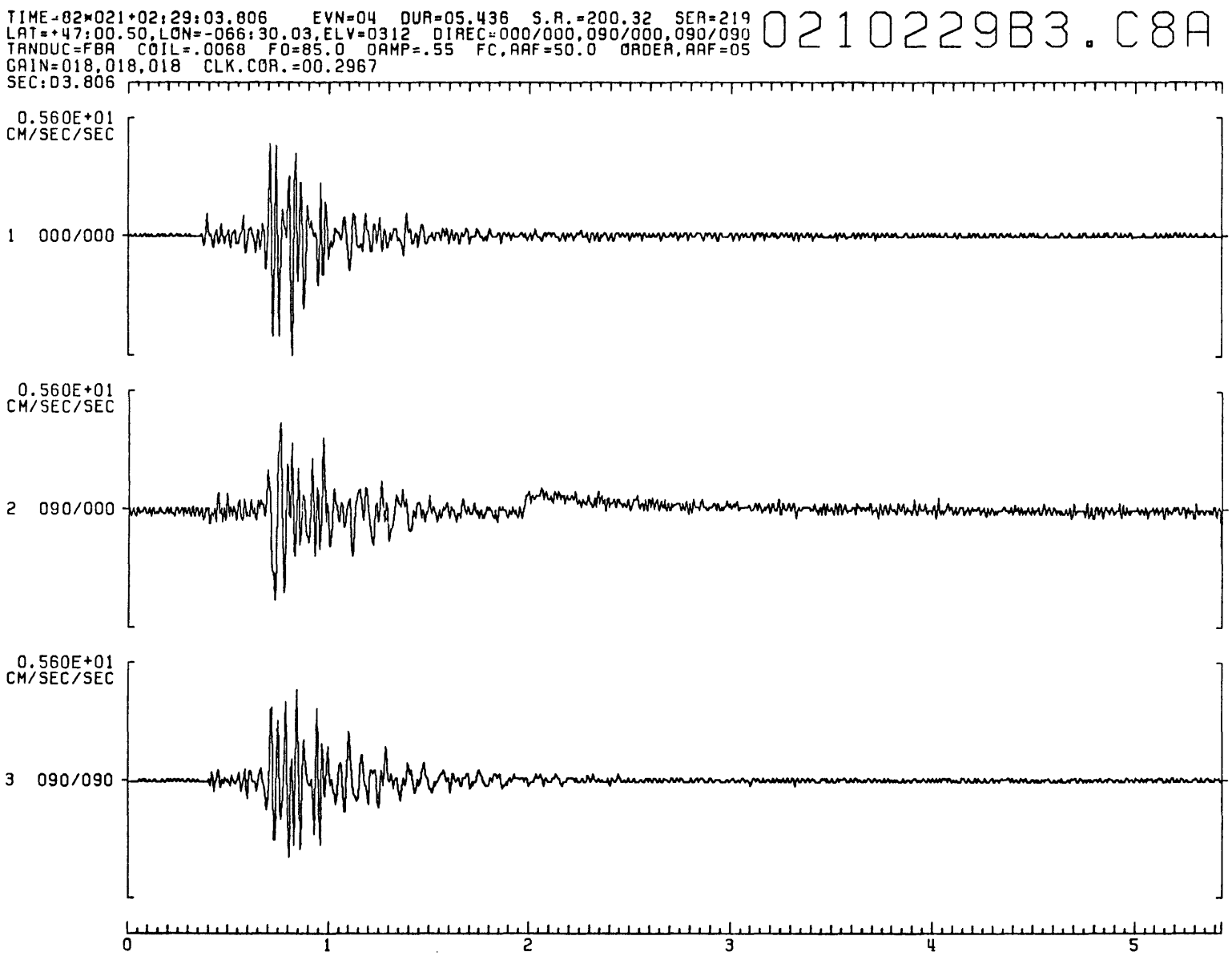
TIME=82*021+02:29:03.806 EVN=04 DUR=05.436 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.2967
0210229B3.C8A
SEC:03.806
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CM/SEC/SEC
1 000/000
0.560E+01
CM/SEC/SEC
2 090/000
0.560E+01
CM/SEC/SEC
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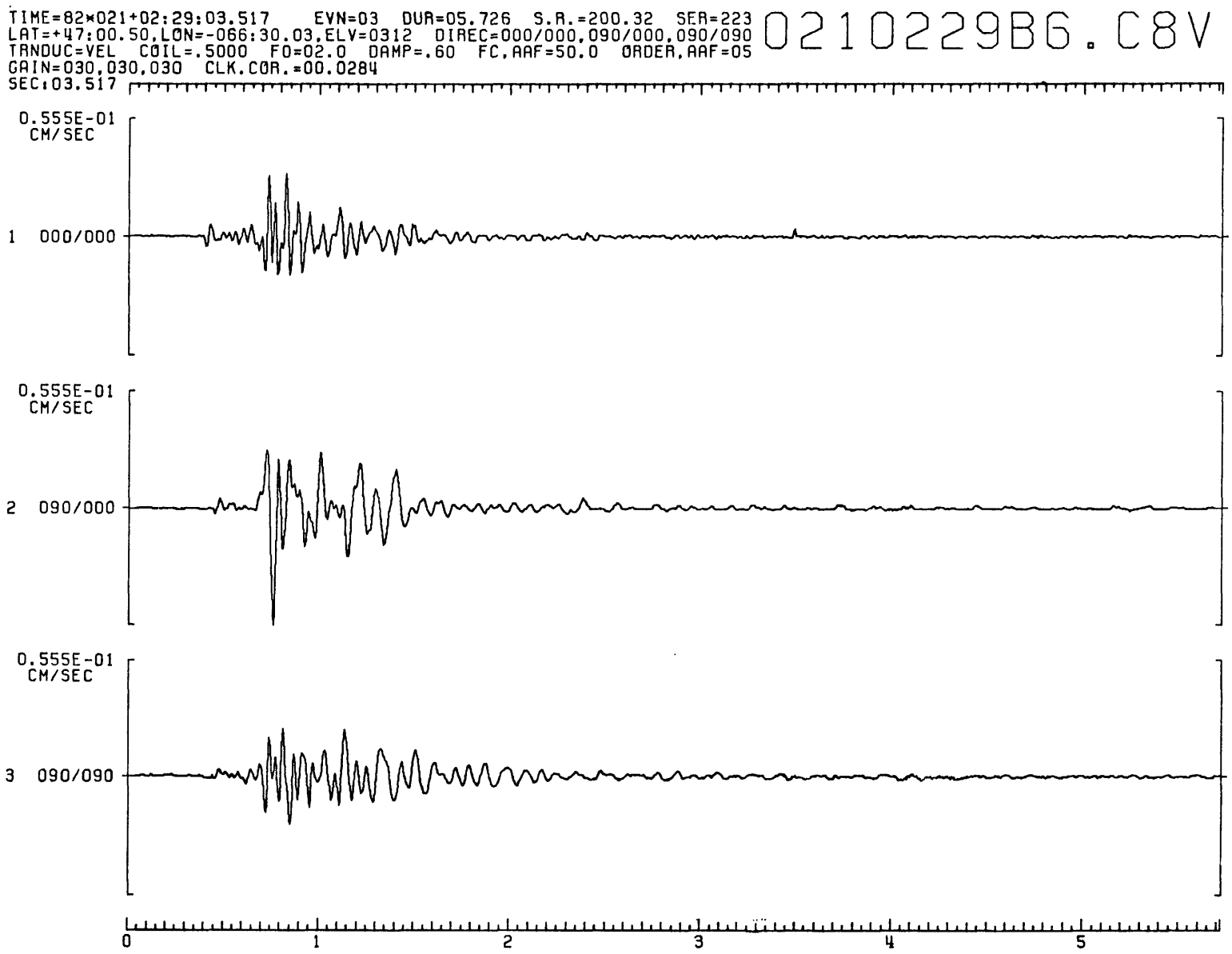
TIME=82*021+02:29:03.517 EVN=03 DUR=05.726 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0284
0210229B6.C8V
SEC:03.517
0.555E-01
CM/SEC
1 000/000
0.555E-01
CM/SEC
2 090/000
0.555E-01
CM/SEC
3 090/090
0
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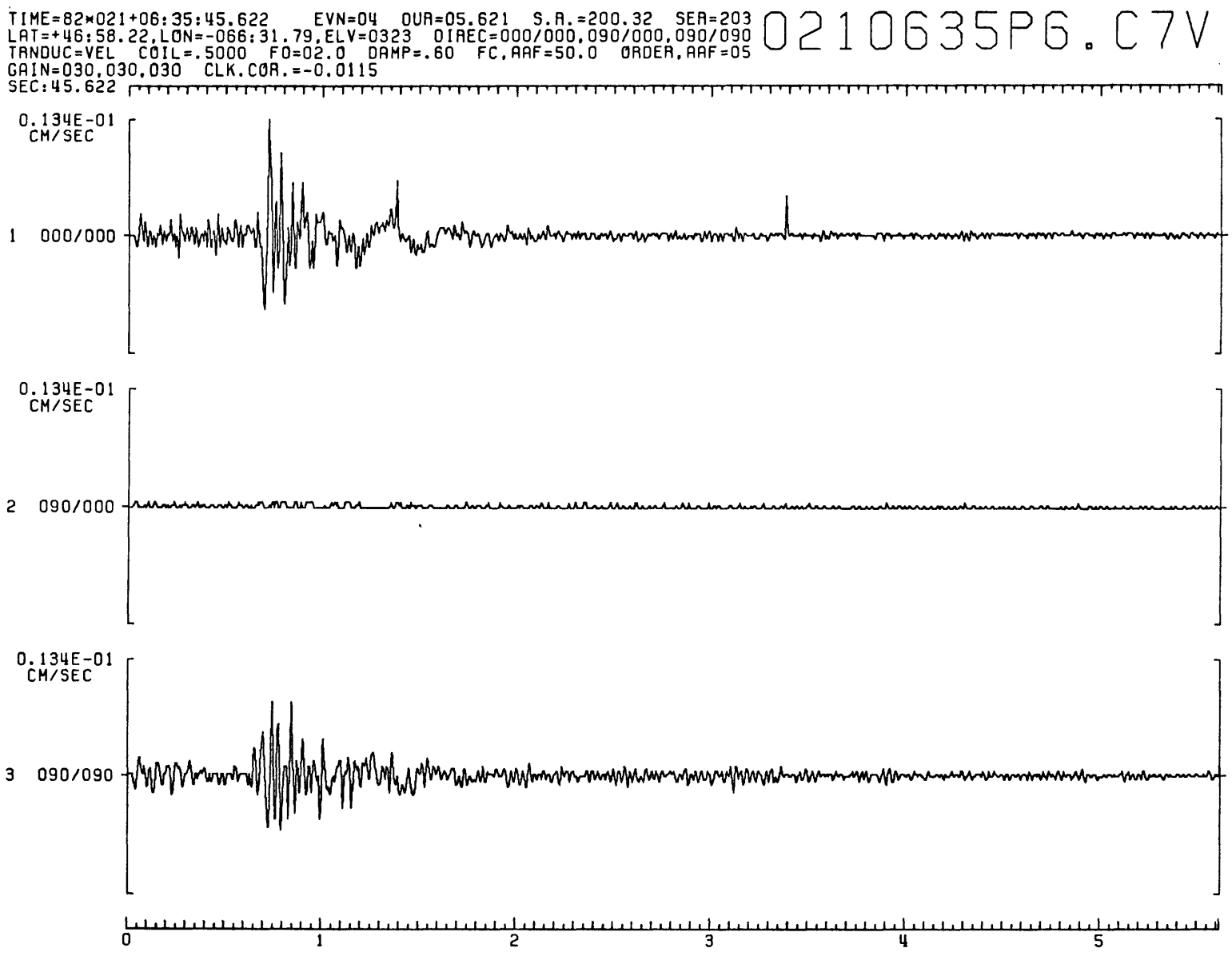
TIME=82*021+06:35:45.622 EVN=04 OVR=05.621 S.R.=200.32 SEN=203
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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0115
02106635P6.C7V
SEC:45.622
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3 090/090
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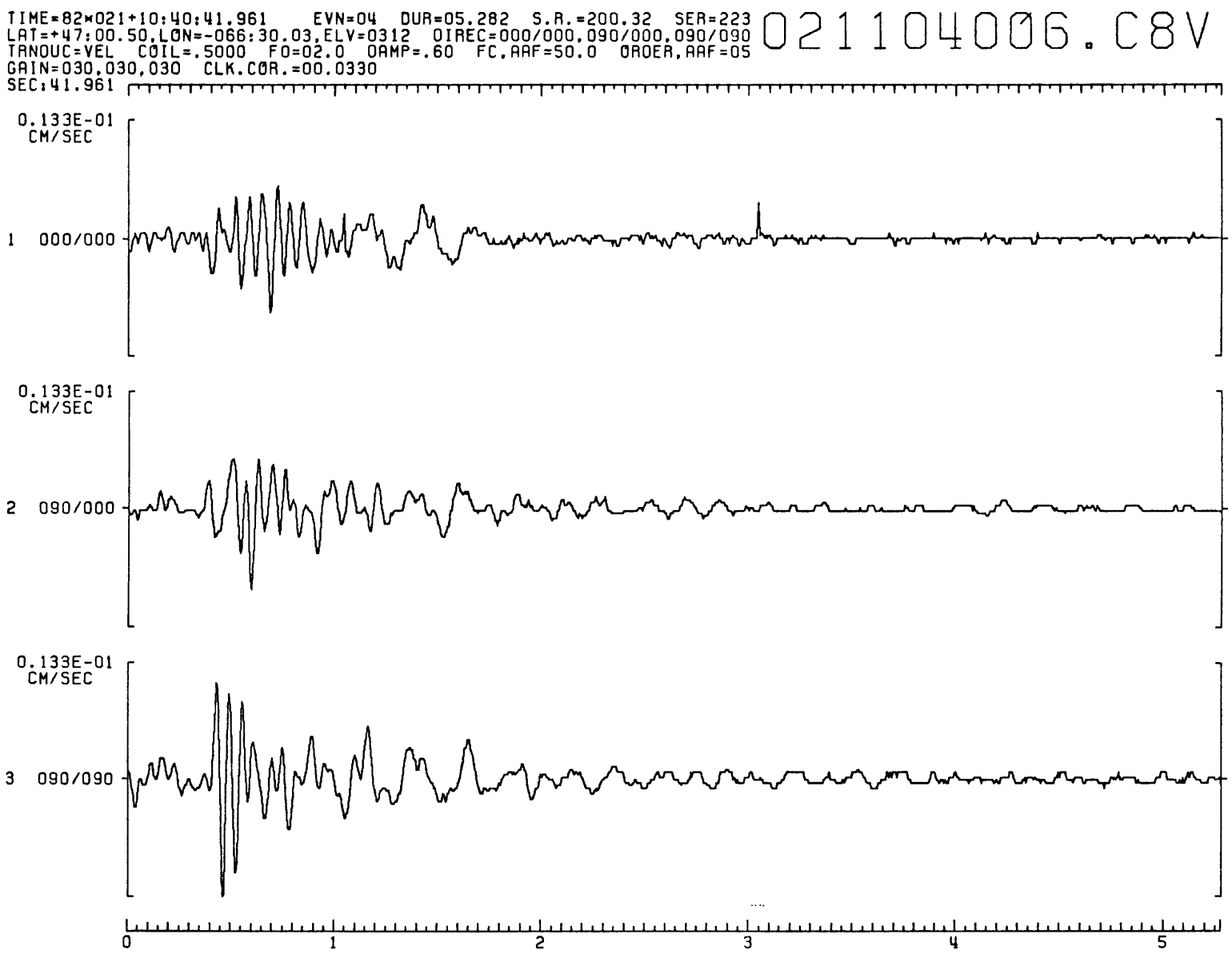
2
3
4
5


TIME=82*021*10:40:41.961 EVN=04 DUR=05.282 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0330
021104006.C8V
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CM/SEC
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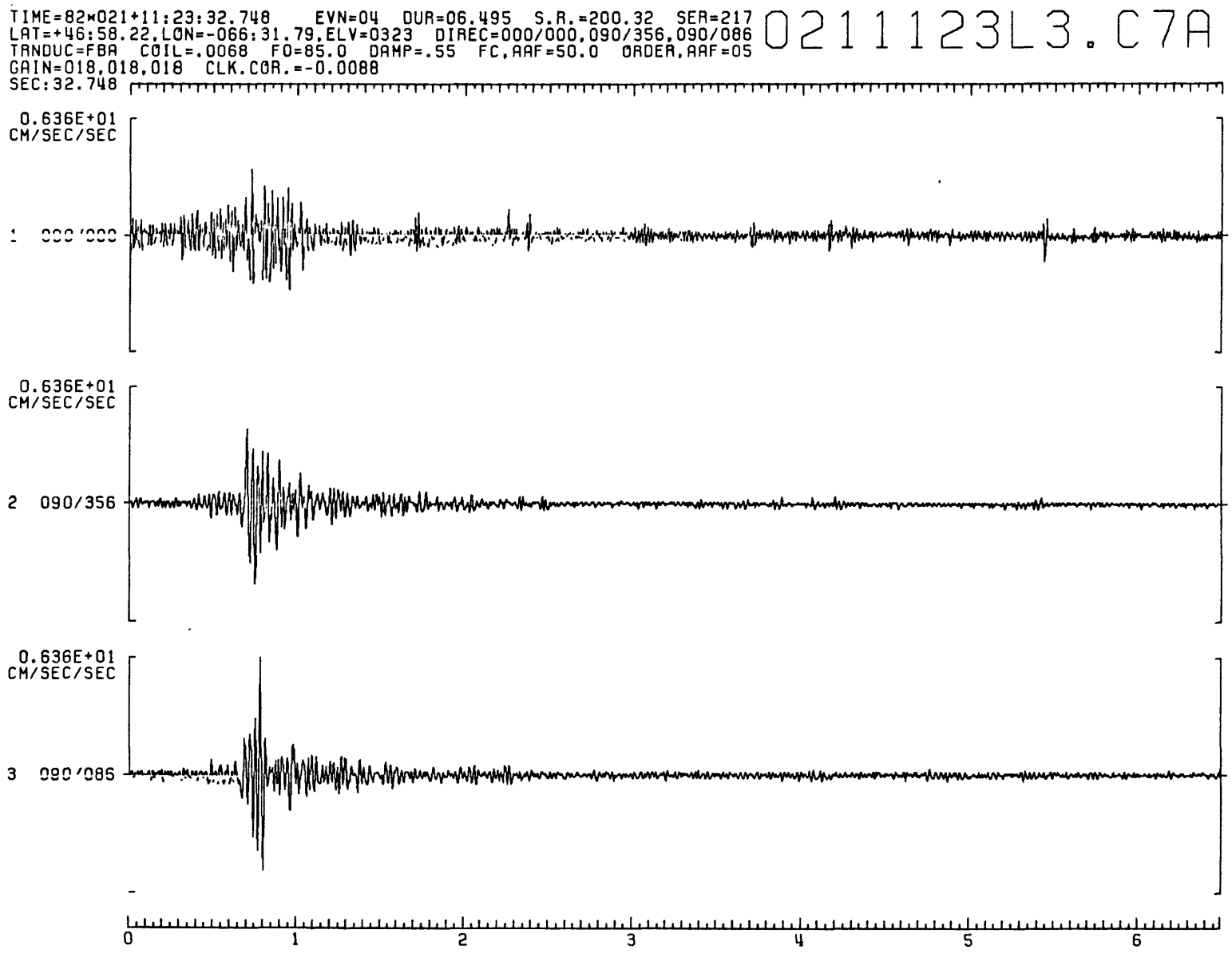
1
2
3
4
5

A 83


TIME=82*021+11:23:32.748 EVN=04 DUR=06.495 S.R.=200.32 SER=217
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/356,090/086
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=-0.0088
0211123L3.C7A
SEC:32.748
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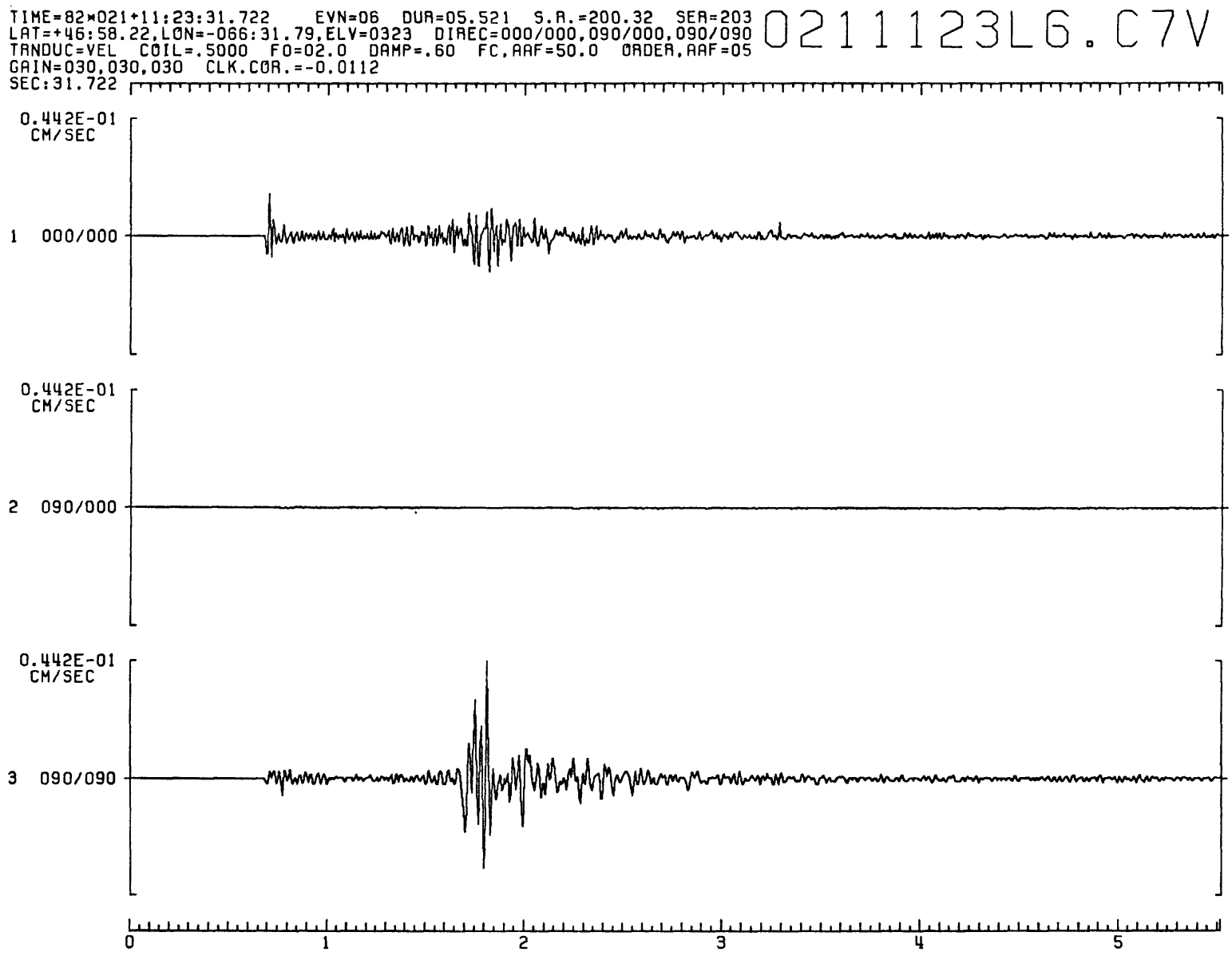
1
2
3
4
5
6

484


TIME=82*021+11:23:31.722 EVN=06 DUR=05.521 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0112
0211123L6.C7V
SEC:31.722
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CM/SEC
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CM/SEC
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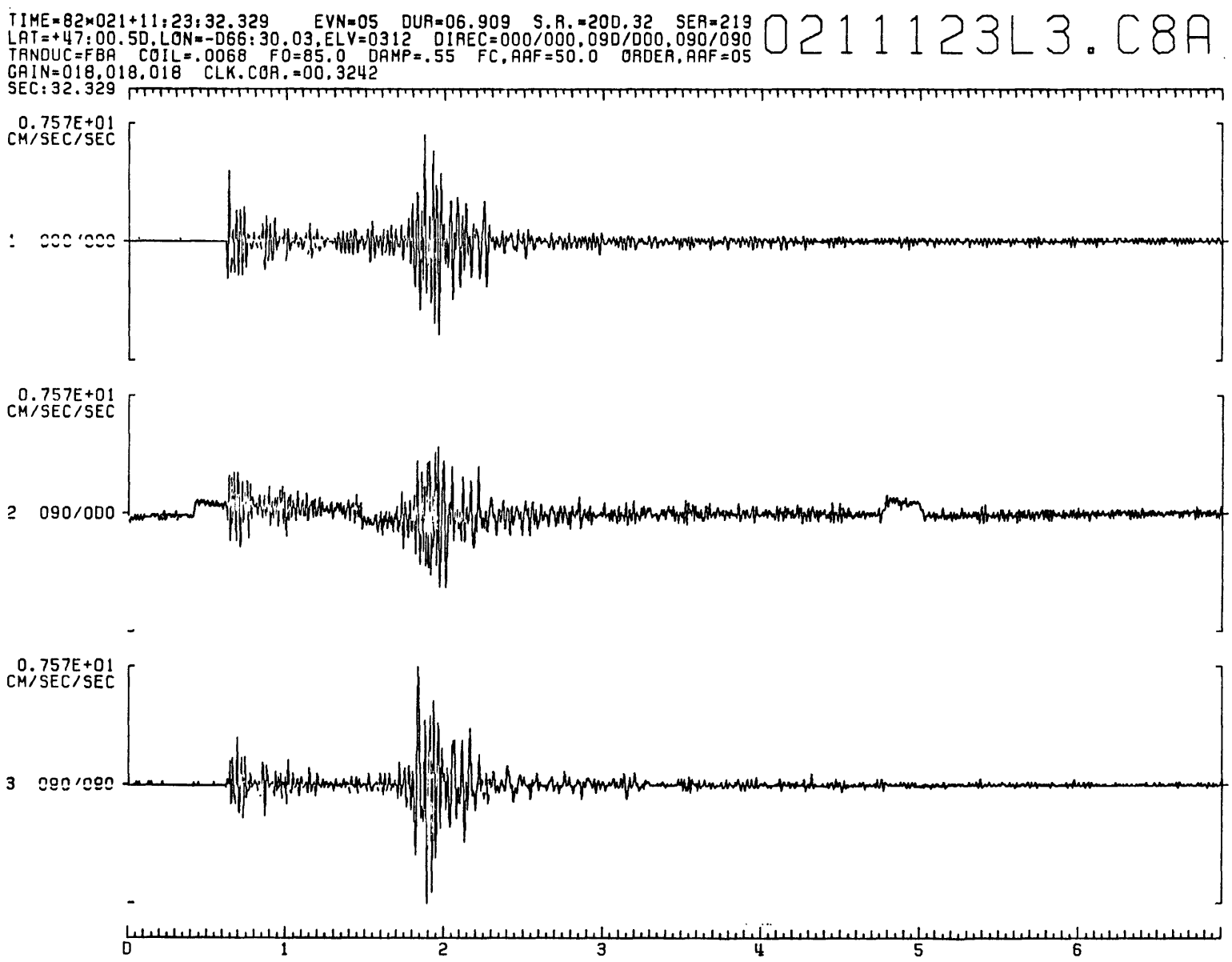
2
3
4
5

A PS


TIME=82×021+11:23:32.329 EVN=05 DUR=06.909 S.R.=200.32 SER=219
LAT=+47:00.5D,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.3242
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SEC:32.329
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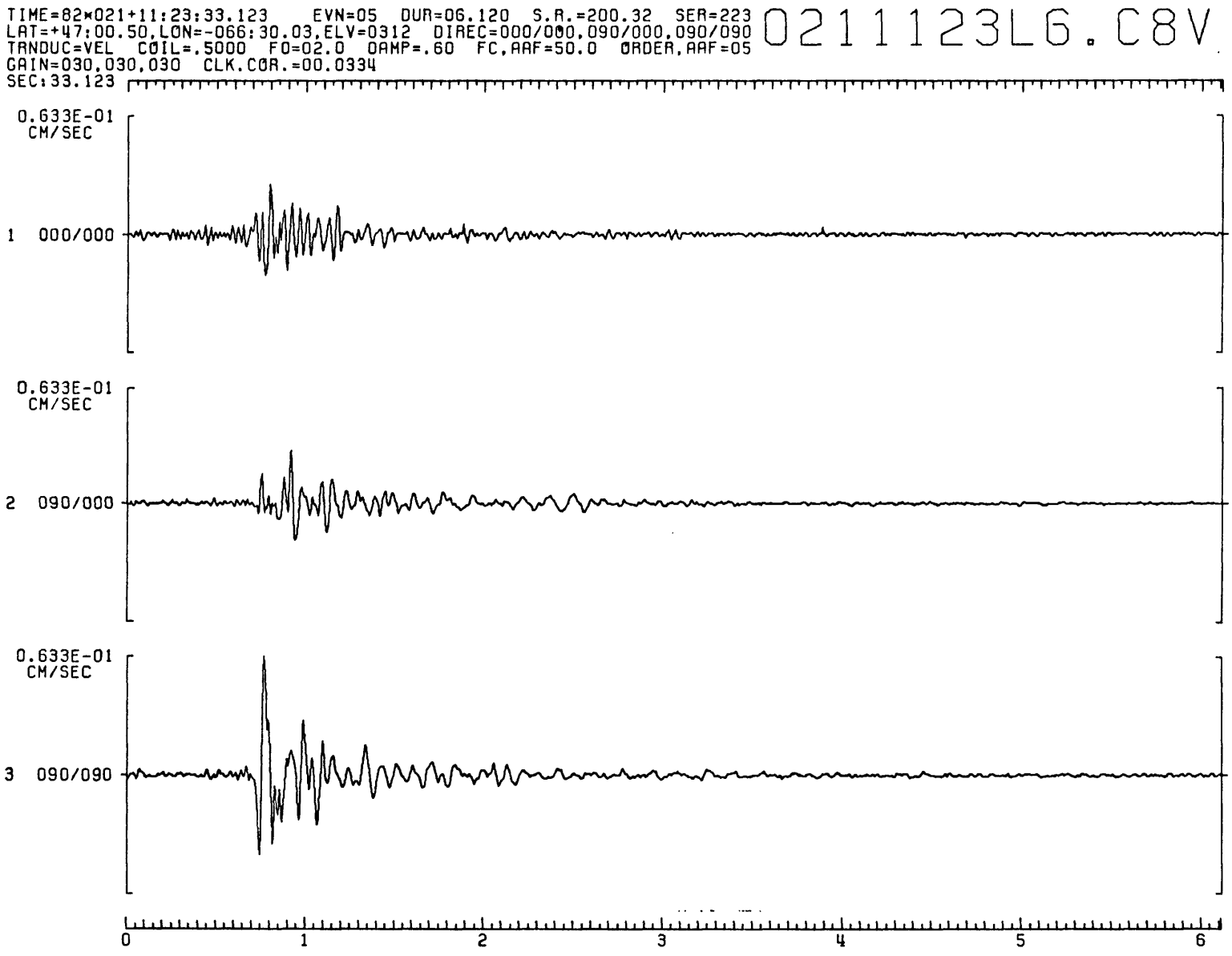
1
2
3
4
5
6

A86


TIME=82*021+11:23:33.123 EVN=05 DUR=06.120 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0334
0211123LG.C8V
SEC:33.123
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CM/SEC
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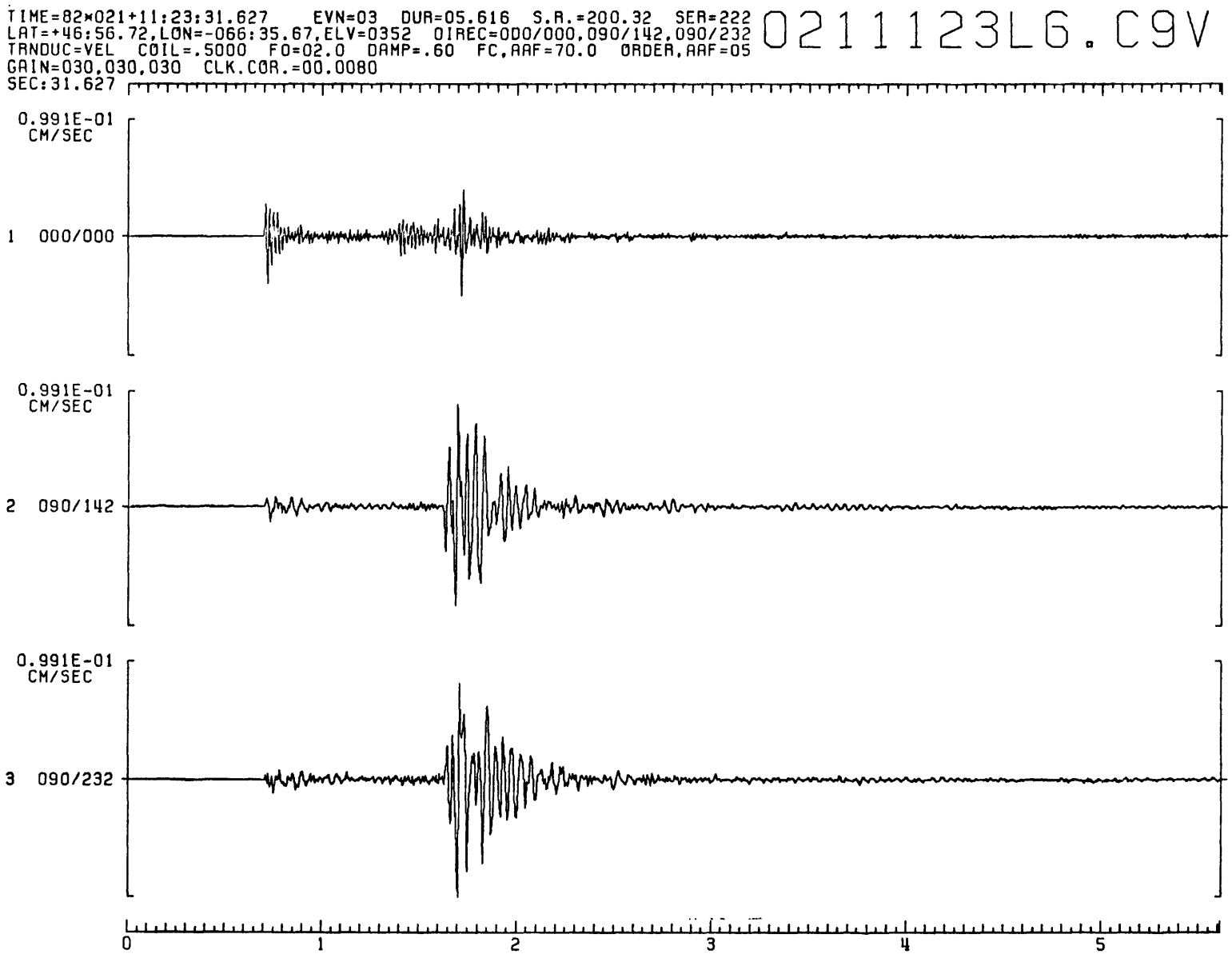
2
3
4
5
6

487


TIME=82*021+11:23:31.627 EVN=03 DUR=05.616 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0080
0211123L6.C9V
SEC:31.627
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CM/SEC
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CM/SEC
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CM/SEC
3 090/232
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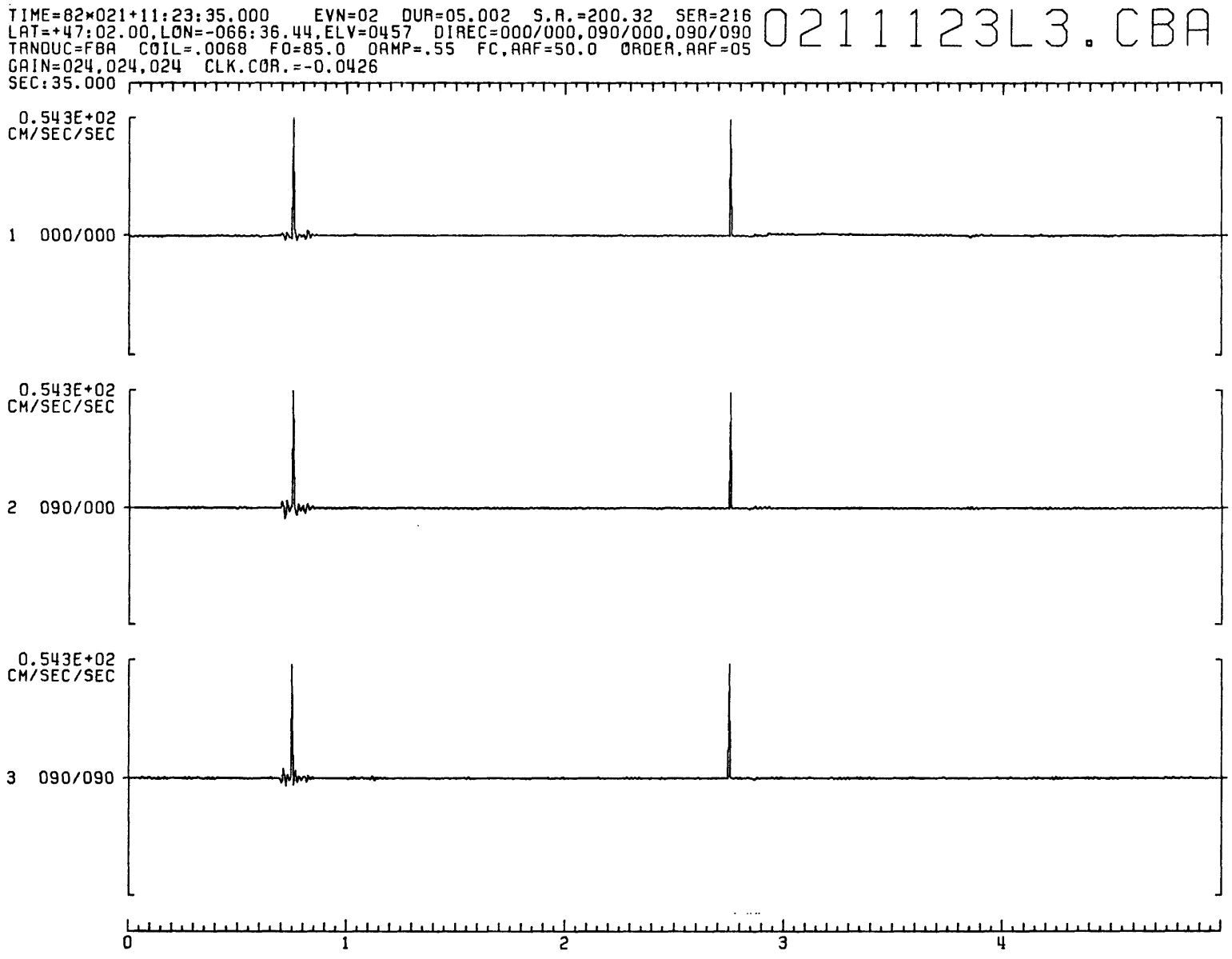
1
2
3
4
5


TIME=82*021+11:23:35.000 EVN=02 DUR=05.002 S.R.=200.32 SER=216
LAT=+47:02.00,LON=-066:36.44,ELV=0457 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=024,024,024 CLK.COR.=-0.0426
0211123L3.CBA
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3 090/090
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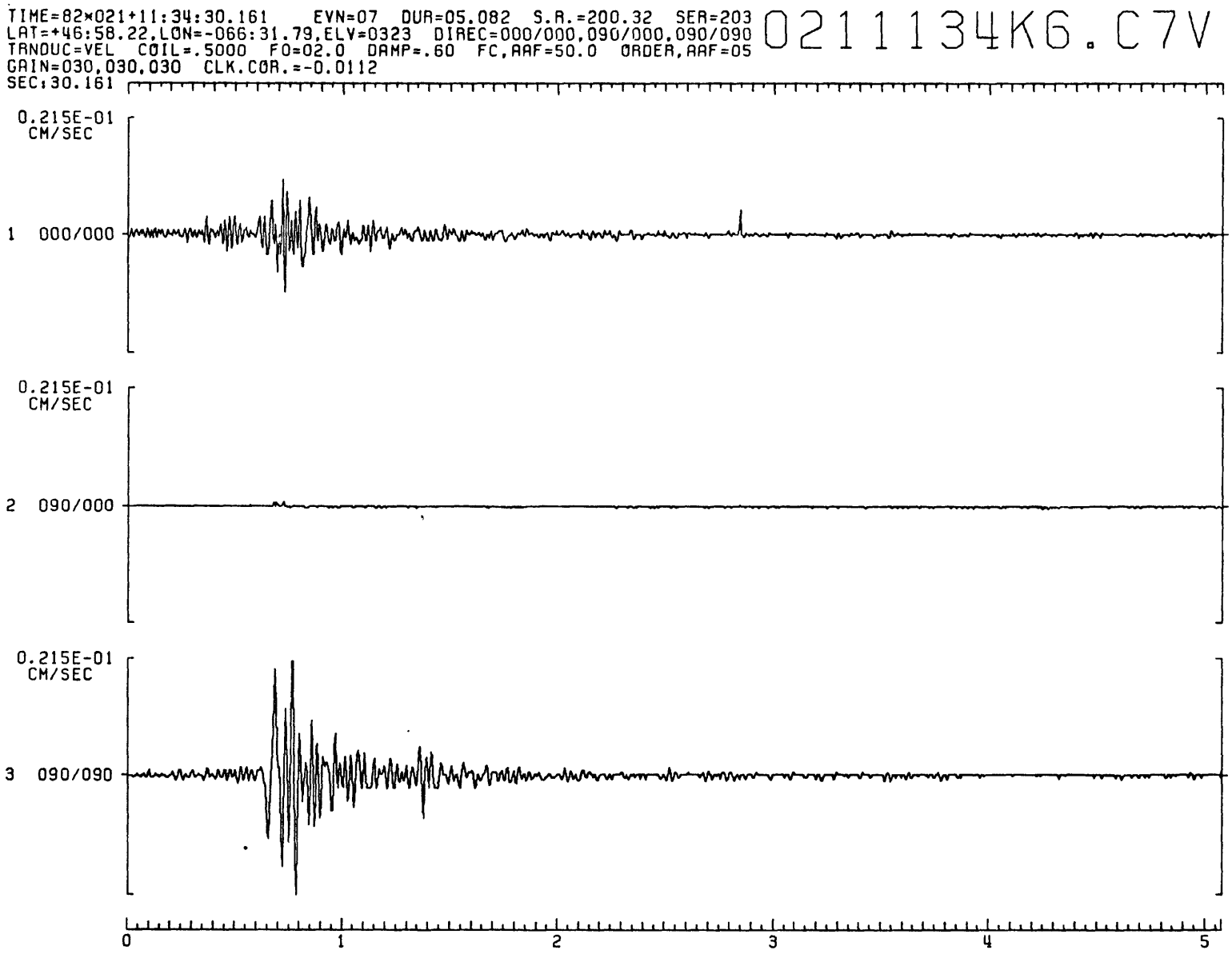
1
2
3
4


TIME=82×021÷11:34:30.161 EVN=07 DUR=05.082 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=-0.0112
0211134K6.C7V
SEC:30.161
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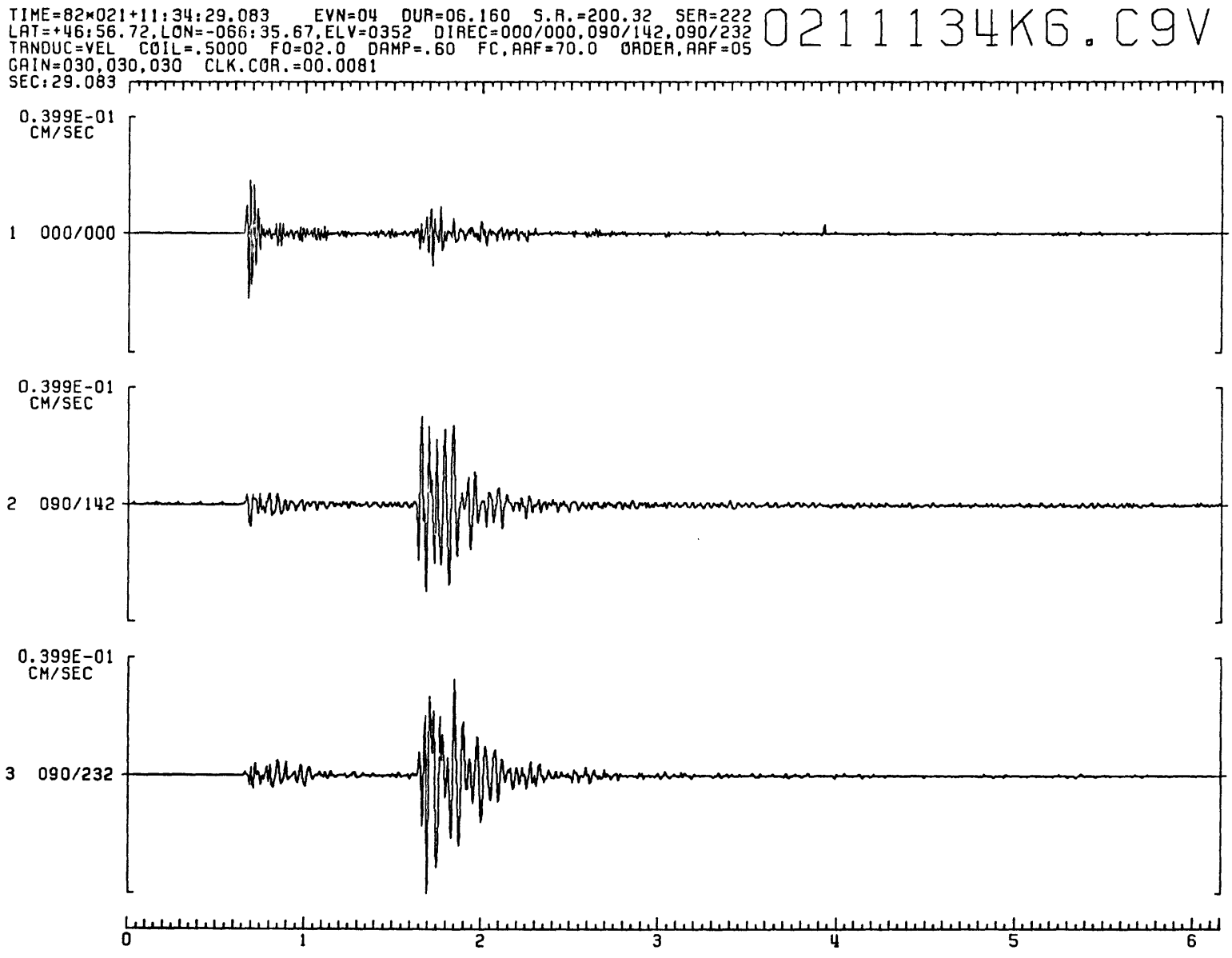
2 090/000
0.215E-01 CM/SEC
3 090/090
0
1
2
3
4
5

A90


TIME=82*021+11:34:29.083 EVN=04 DUR=06.160 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0081
0211134K6.C9V
SEC:29.083
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CM/SEC
1 000/000
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CM/SEC
2 090/142
0.399E-01
CM/SEC
3 090/232
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1
2
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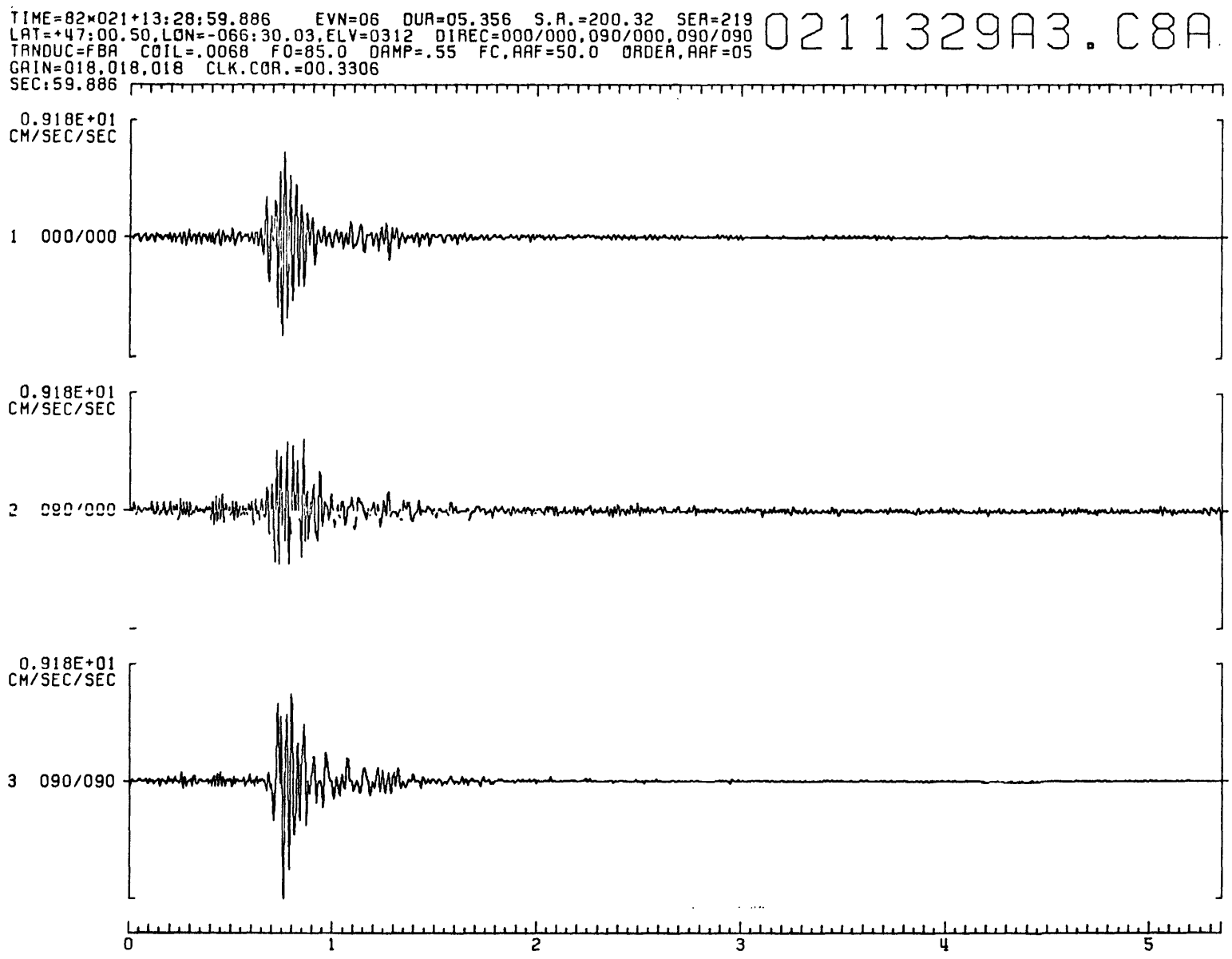
6


TIME=82*021+13:28:59.886 EVN=06 DUR=05.356 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.3306
0211329A3.C8A
SEC:59.886
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CM/SEC/SEC
3 090/090
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1
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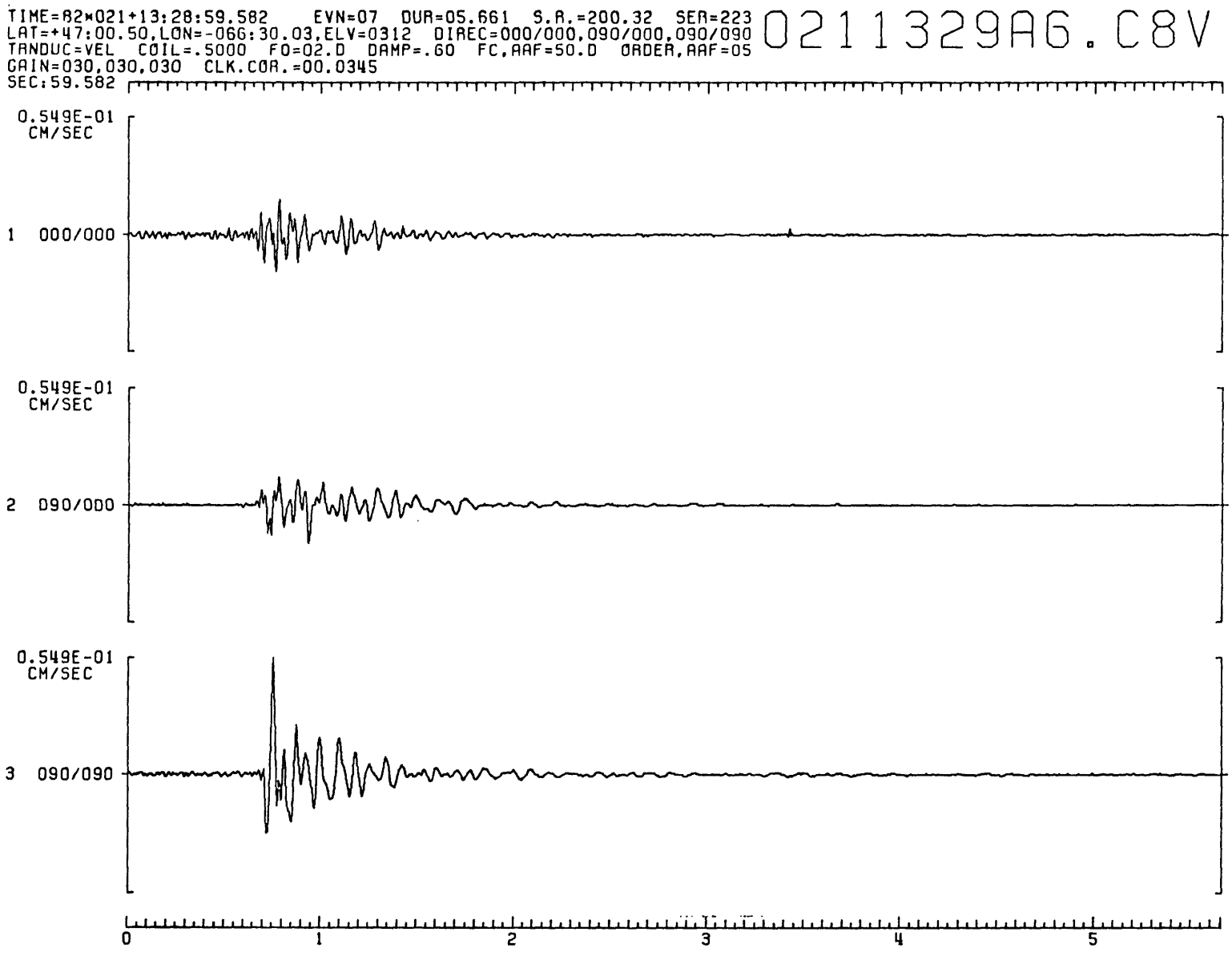
4
5


TIME=82*021+13:28:59.582 EVN=07 DUR=05.661 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0345
0211329A6.C8V
SEC:59.582
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CM/SEC
1 000/000
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CM/SEC
2 090/000
0.549E-01
CM/SEC
3 090/090
0
1
2
3
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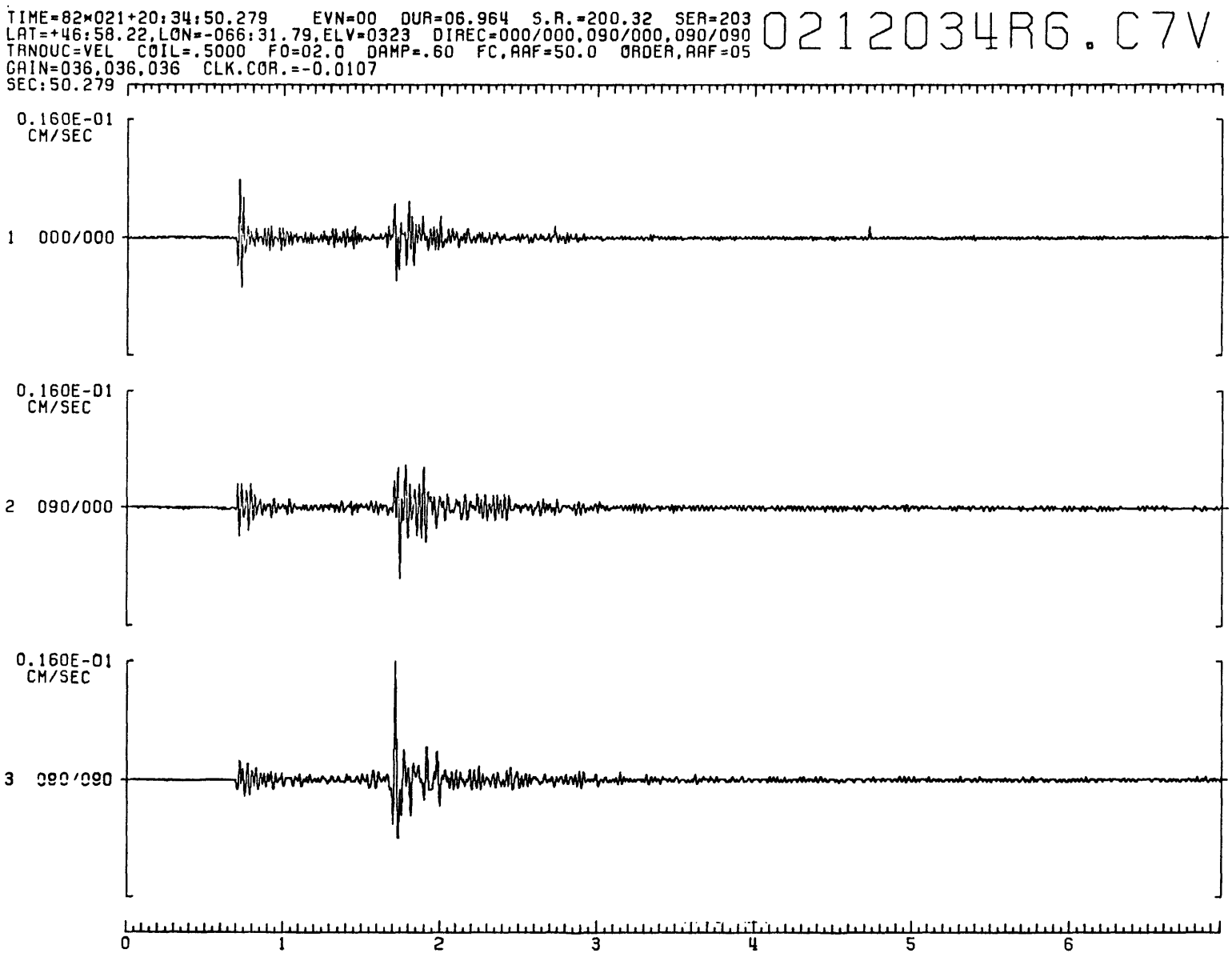
5


TIME=82*021+20:34:50.279 EVN=00 DUR=06.964 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0107
0212034R6.C7V
SEC:50.279
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CM/SEC
1 000/000
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CM/SEC
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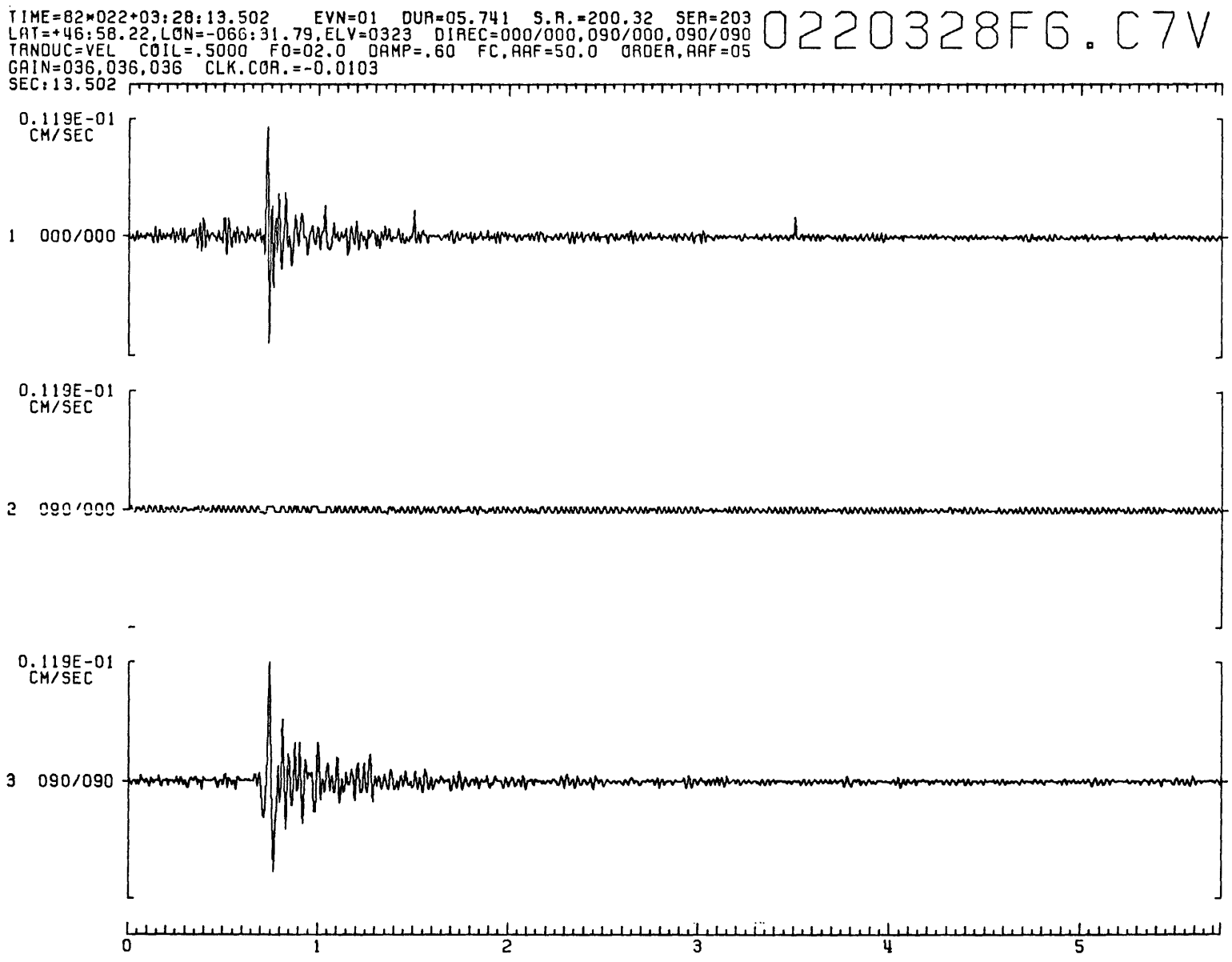
0.160E-01
CM/SEC
3 090/090
0
1
2
3
4
5
6

494


TIME=82*022+03:28:13.502 EVN=01 DUR=05.741 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0103
02203 28F6.C7V
SEC:13.502
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CM/SEC
1 000/000
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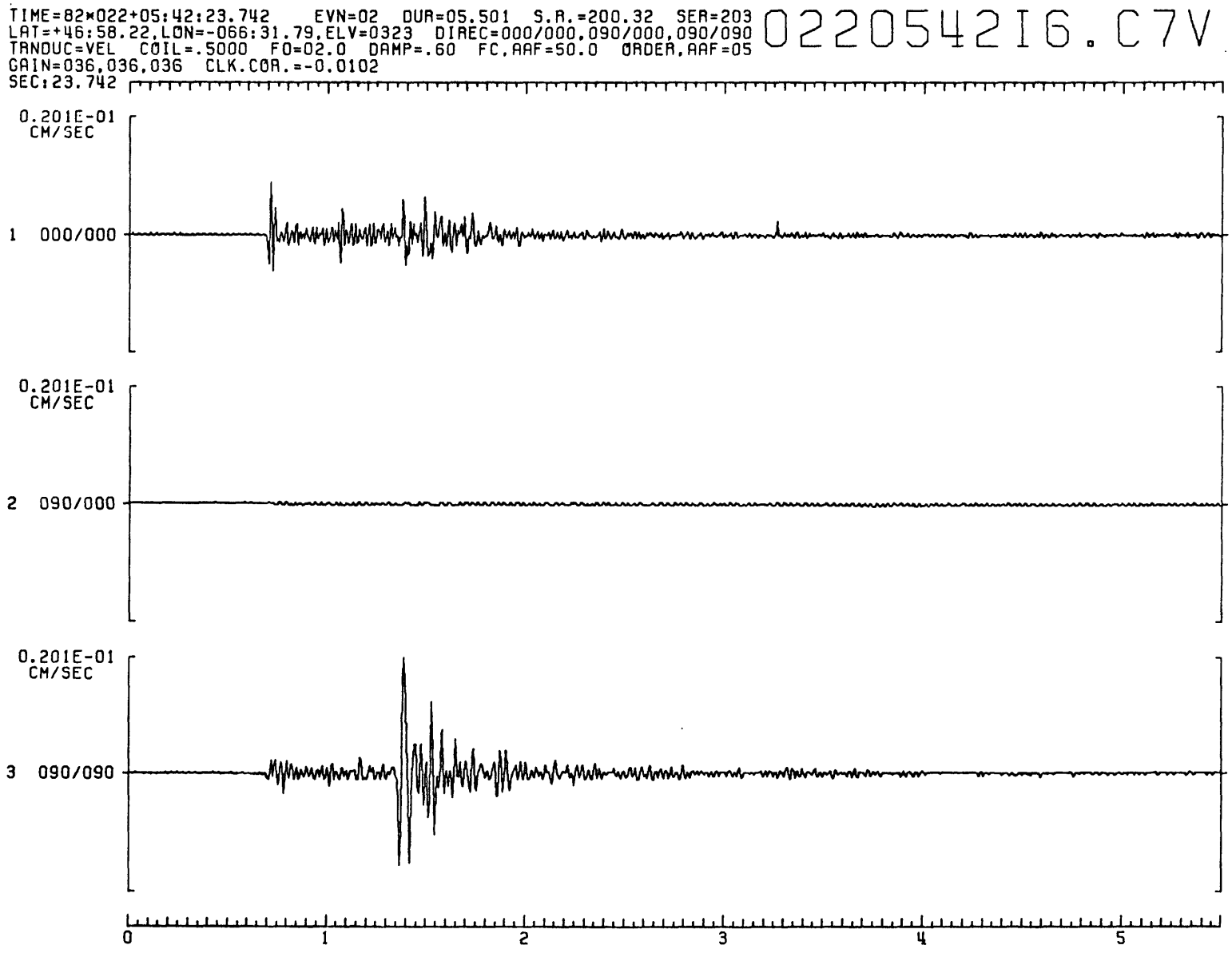
CM/SEC
2 090/000
0.119E-01
CM/SEC
3 090/090
0
1
2
3
4
5

A 95


TIME=82*022+05:42:23.742 EVN=02 DUR=05.501 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0102
022054216.C7V
SEC:23.742
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CM/SEC
1 000/000
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CM/SEC
2 090/000
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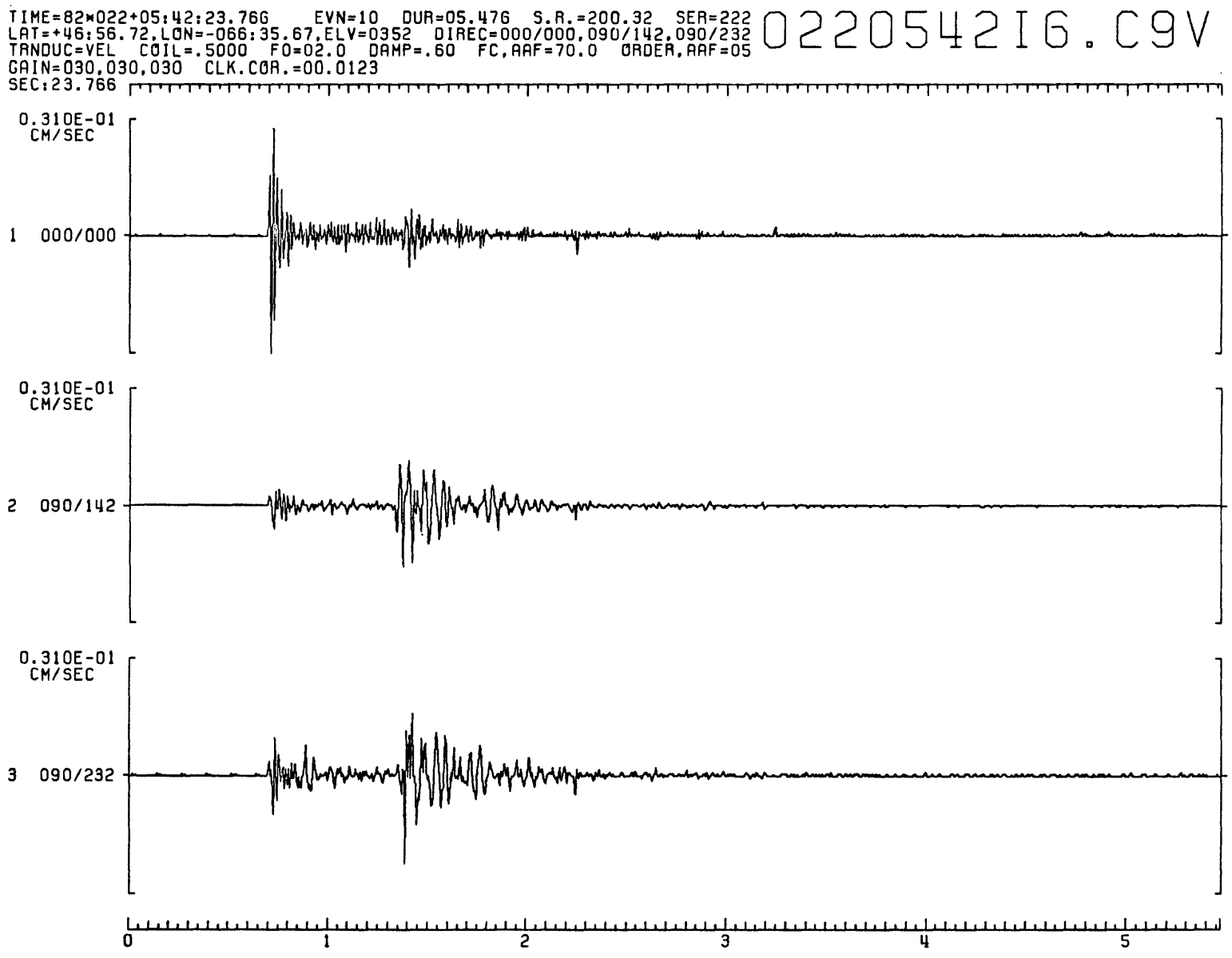
CM/SEC
3 090/090
0
1
2
3
4
5


TIME=82*022+05:42:23.766 EVN=10 DUR=05.476 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0123
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1 000/000
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CM/SEC
2 090/142
0.310E-01
CM/SEC
3 090/232
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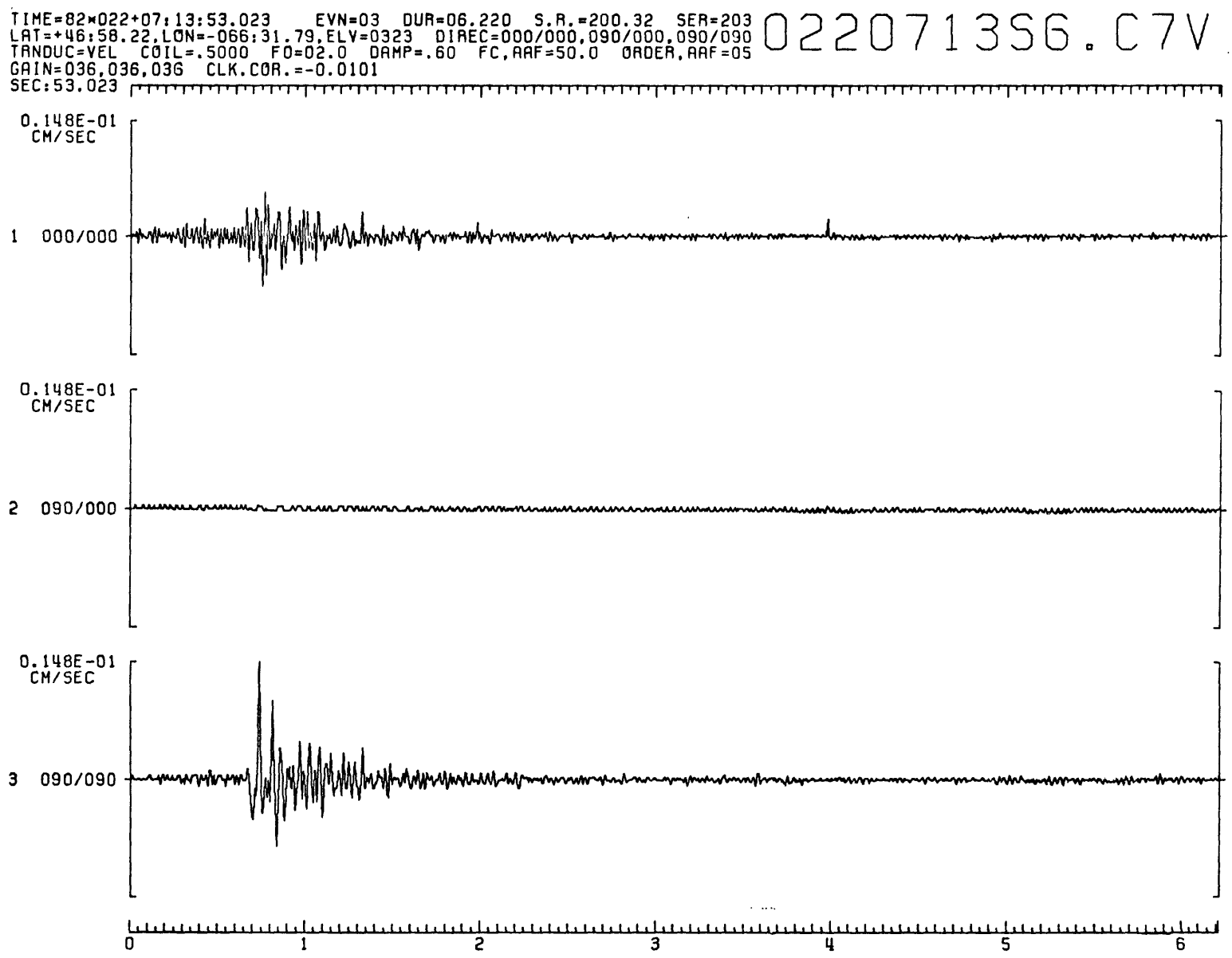
1
2
3
4
5


TIME=82*022+07:13:53.023 EVN=03 DUR=06.220 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0101
0220713SG.C7V
SEC:53.023
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1 000/000
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3 090/090
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1
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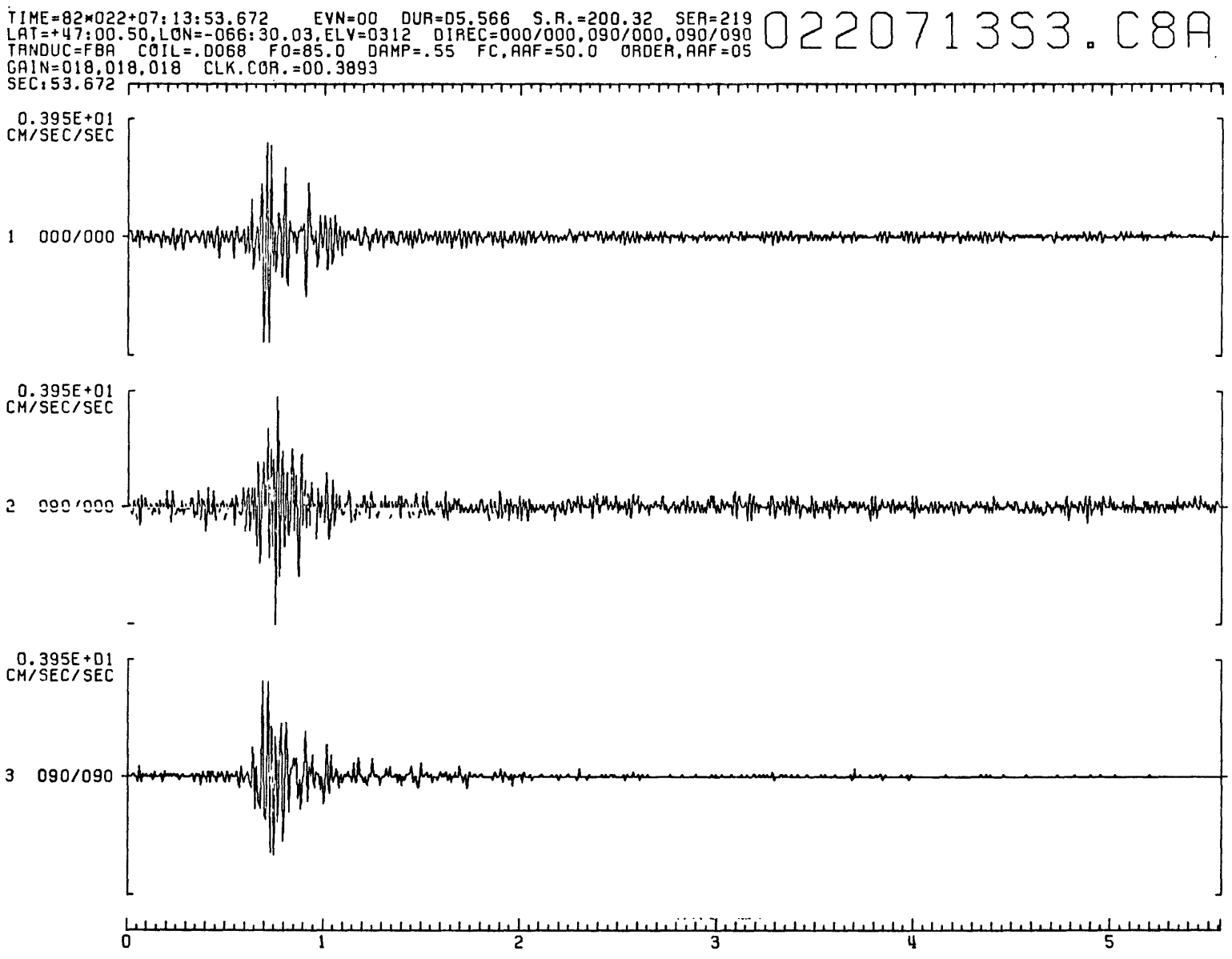
4
5
6


TIME=82*022+07:13:53.672 EVN=00 DUR=05.566 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=FBA COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.3893
0220713S3.C8A
SEC:53.672
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CM/SEC/SEC
3 090/090
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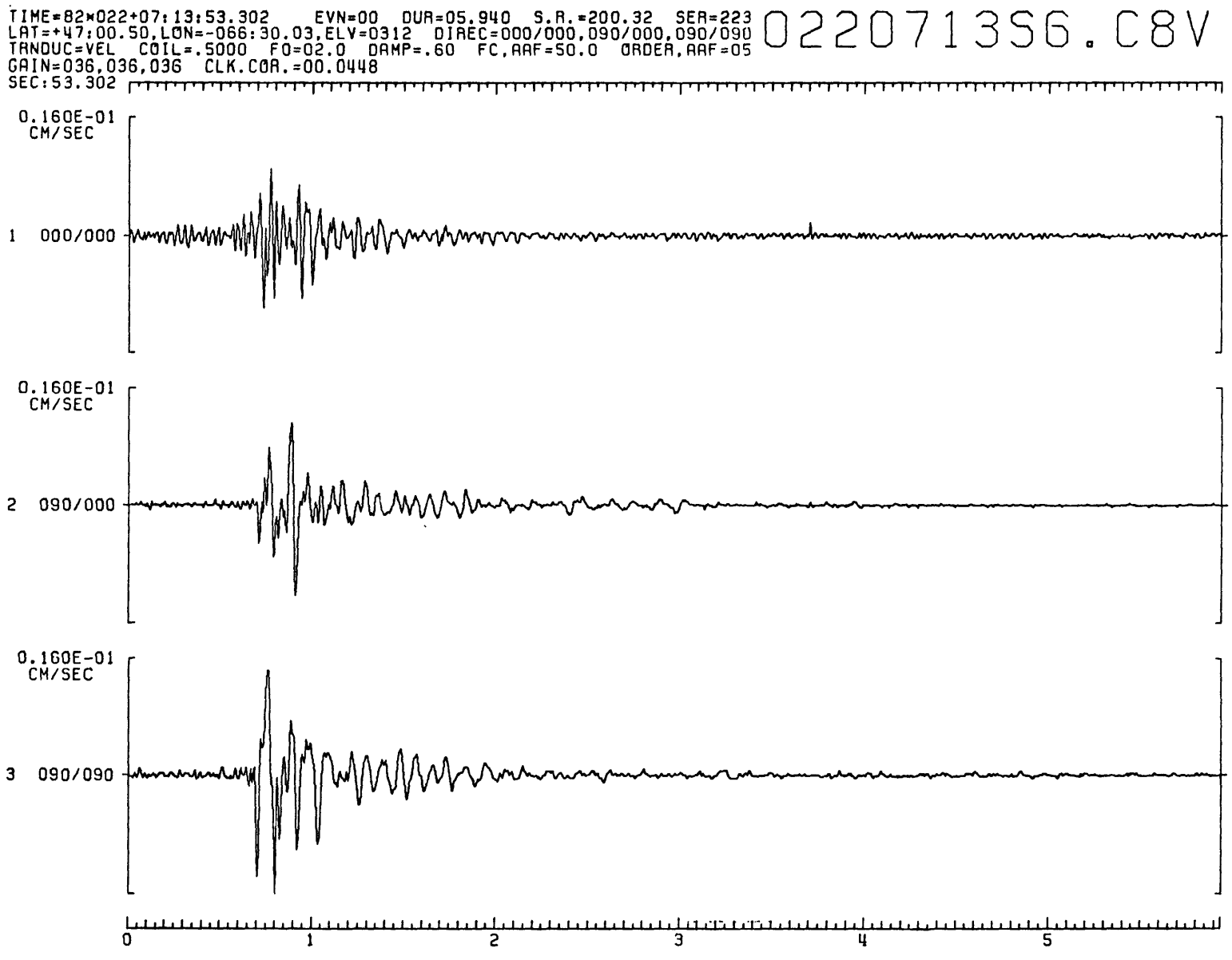
4
5


TIME=82*022+07:13:53.302 EVN=00 DUR=05.940 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=00.0448
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CM/SEC
1 000/000
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CM/SEC
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2
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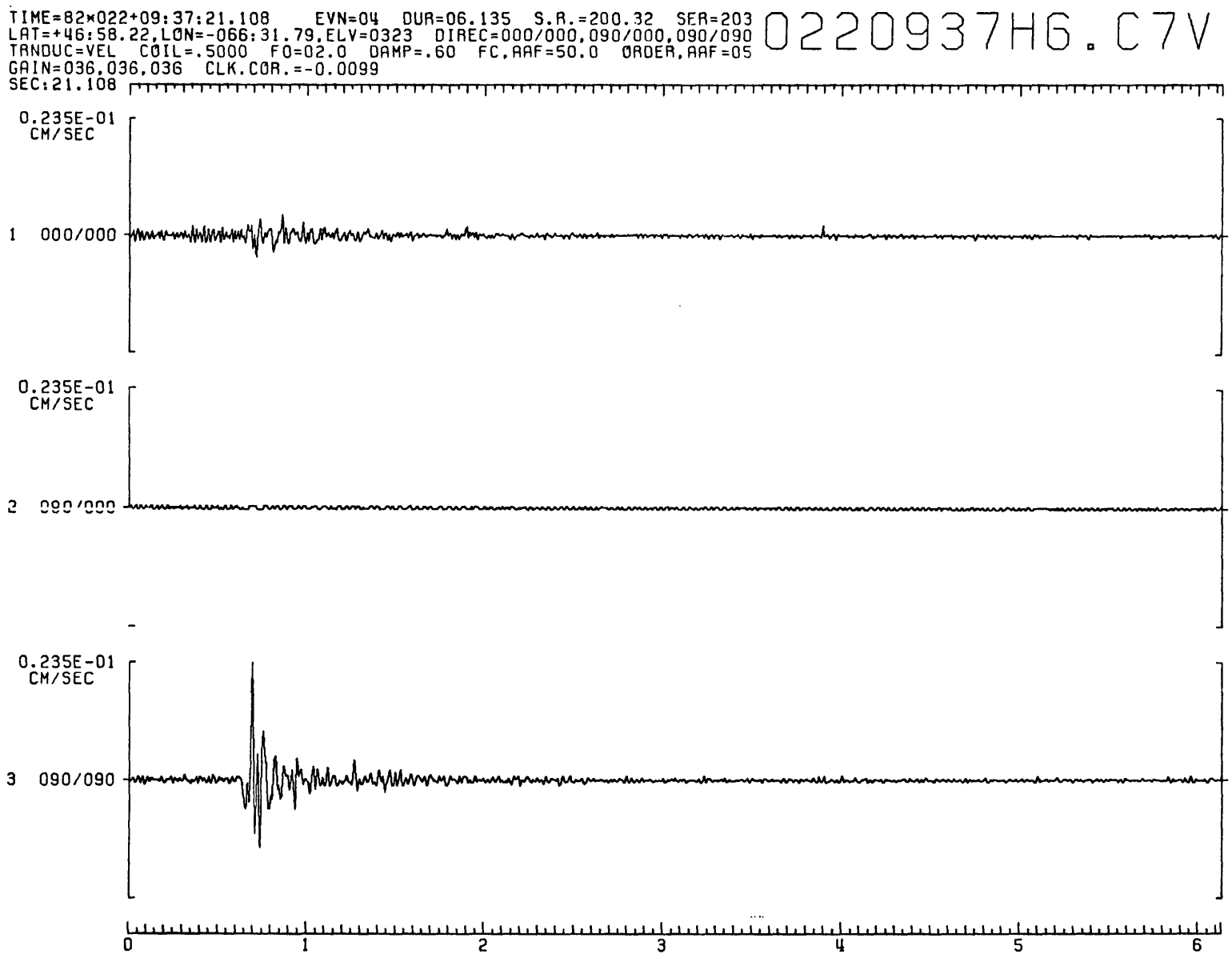
A 100


TIME=82×022+09:37:21.108 EVN=04 DUR=06.135 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0099
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CM/SEC
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CM/SEC
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1
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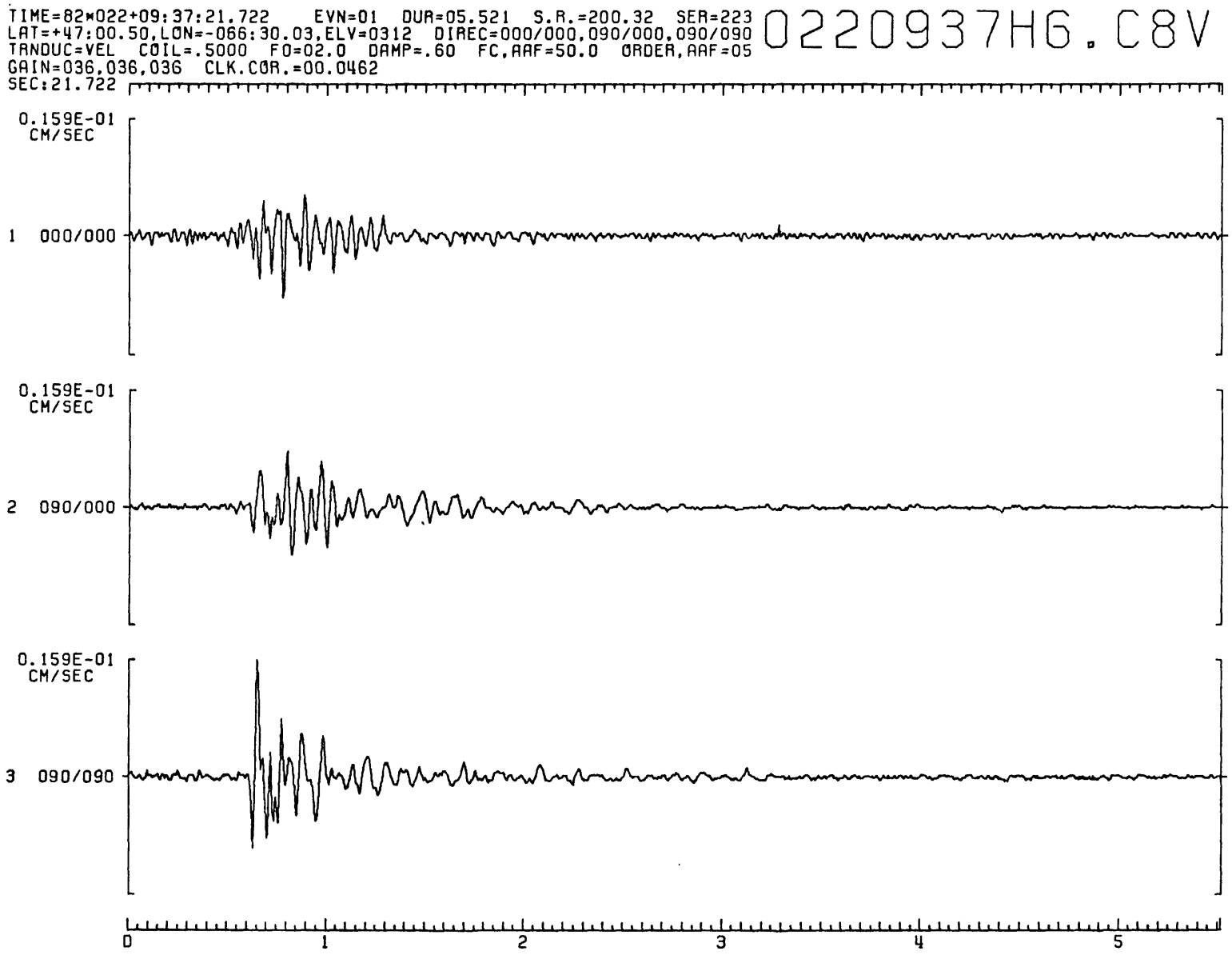
5
6

A 101


TIME=82*022+09:37:21.722 EVN=01 DUR=05.521 S.R.=200.32 SER=223
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=00.0462
0220937H6.C8V
SEC:21.722
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CM/SEC
1 000/000
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CM/SEC
2 090/000
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CM/SEC
3 090/090
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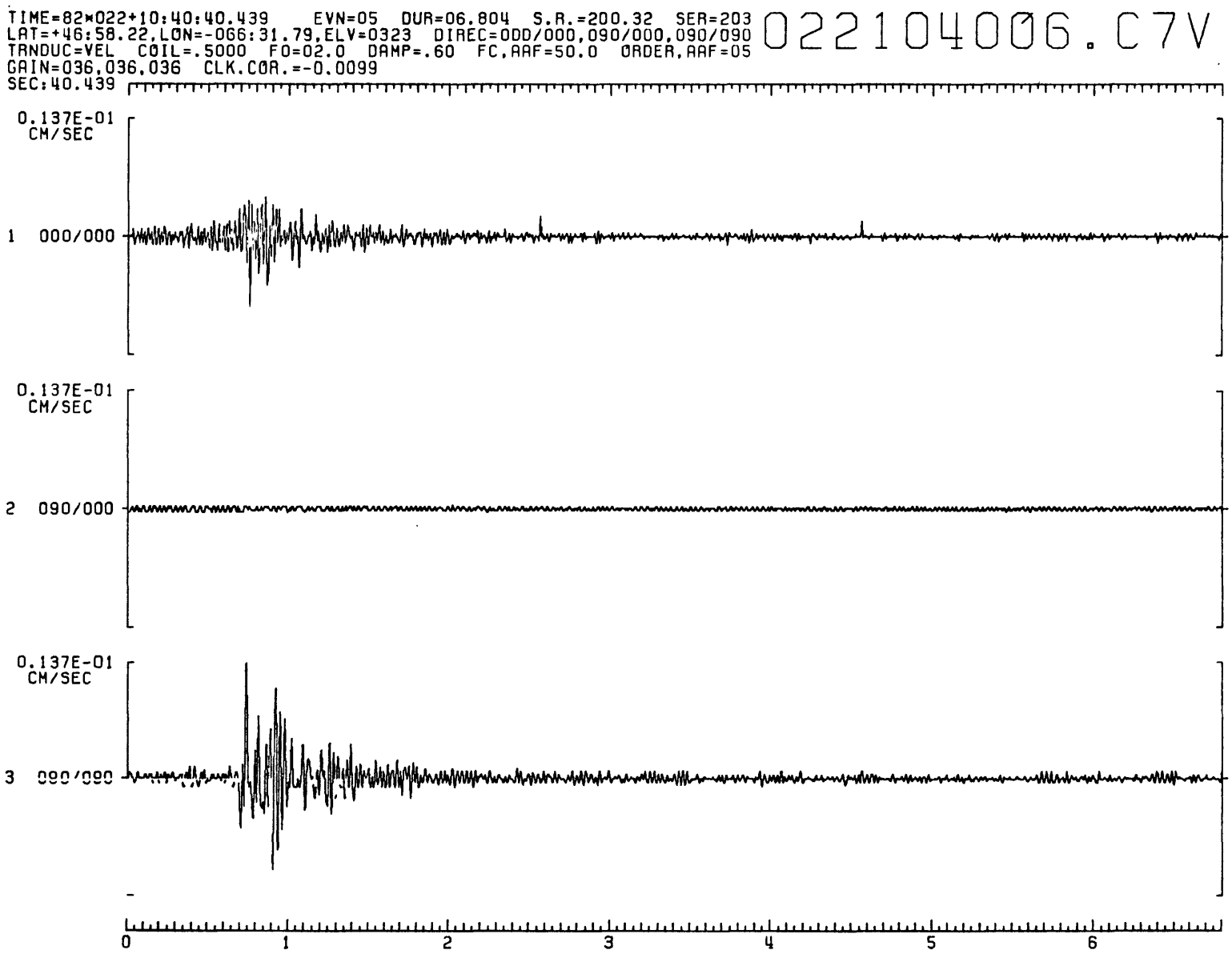
TIME=82*022+10:40:40.439 EVN=05 DUR=06.804 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=ODD/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0099
022104006.C7V
SEC:40.439
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CM/SEC
1 000/000
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2 090/000
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CM/SEC
3 090/090
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1
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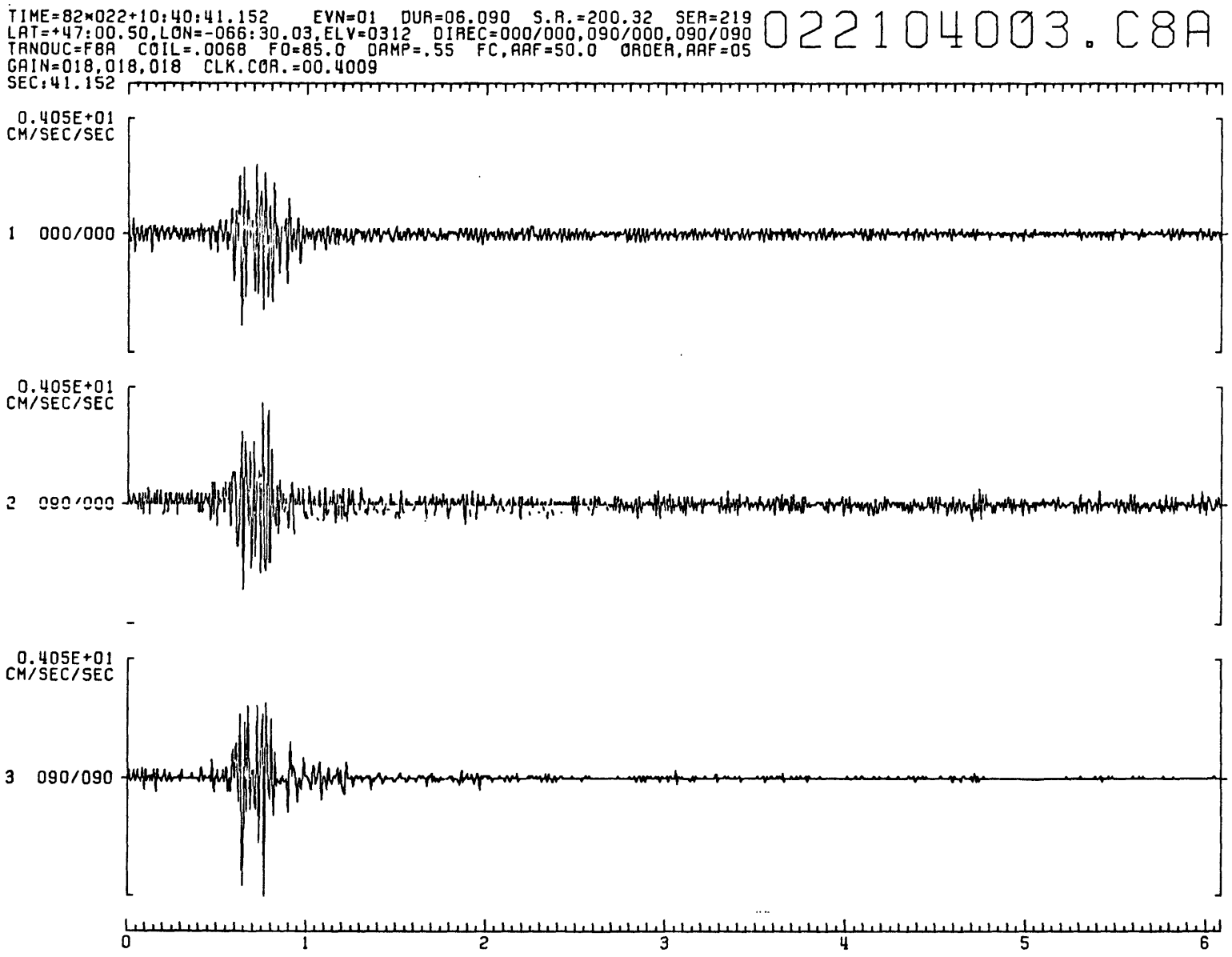
TIME=82*022+10:40:41.152 EVN=01 DUR=06.090 S.R.=200.32 SER=219
LAT=+47:00.50,LON=-066:30.03,ELV=0312 DIREC=000/000,090/000,090/090
TRNDUC=F8A COIL=.0068 FO=85.0 DAMP=.55 FC,AAF=50.0 ORDER,AAF=05
GAIN=018,018,018 CLK.COR.=00.4009
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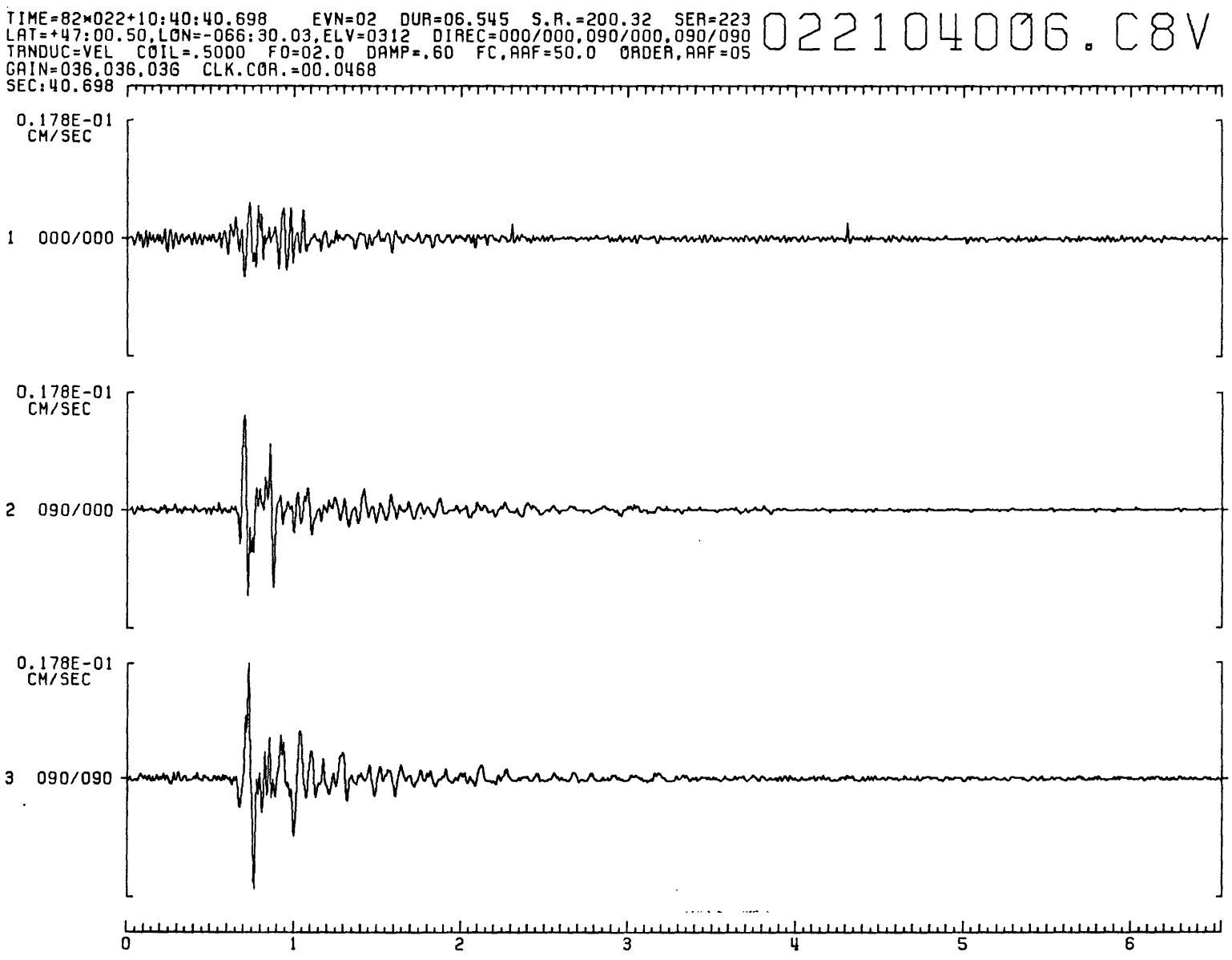
CM/SEC/SEC
1 000/000
0.405E+01
CM/SEC/SEC
2 090/000
0.405E+01
CM/SEC/SEC
3 090/090
0
1
2
3
4
5
6

A 104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TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=00.0468
022104006.C8V
SEC:40.698
0.178E-01
CM/SEC
1 000/000
0.178E-01
CM/SEC
2 090/000
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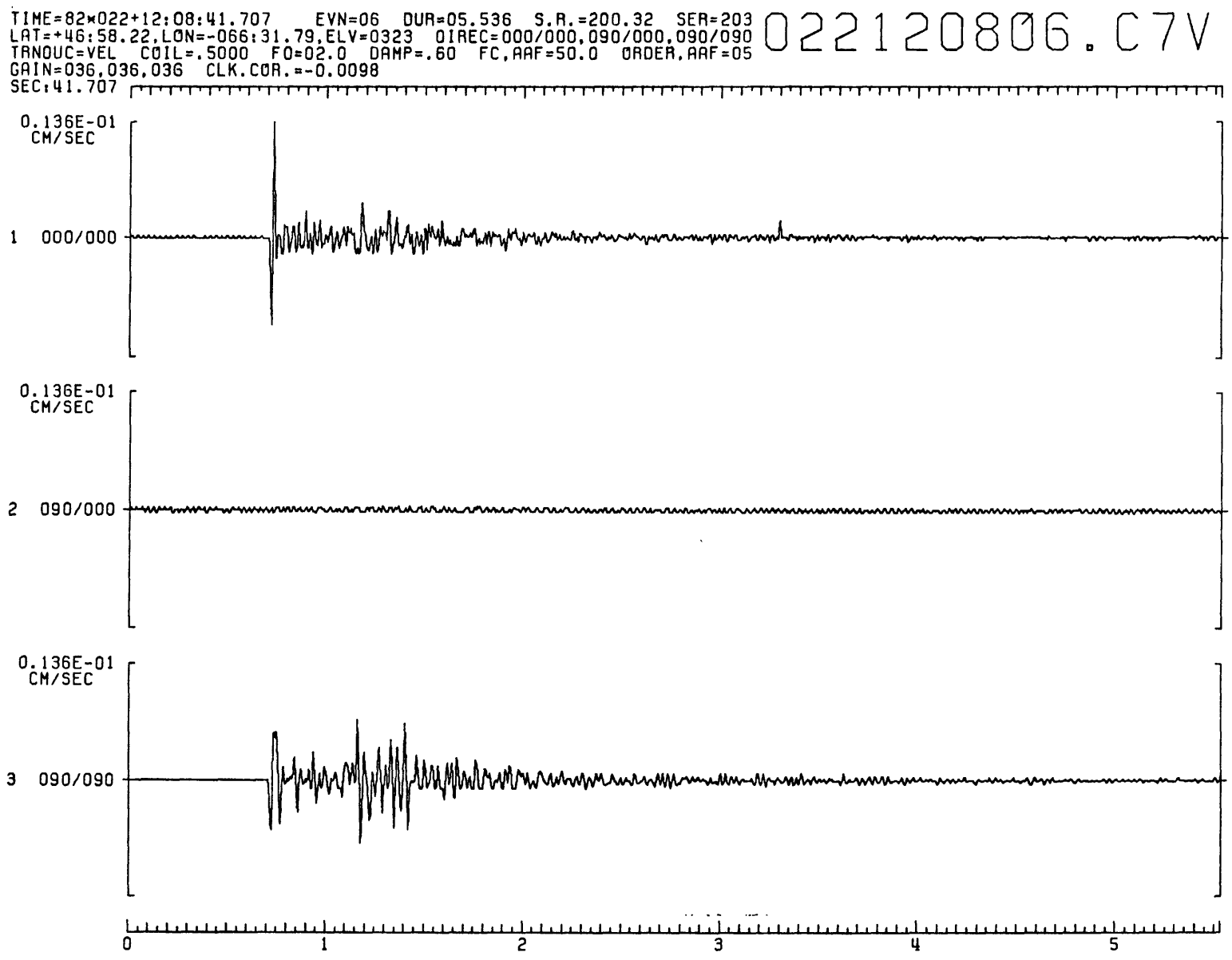
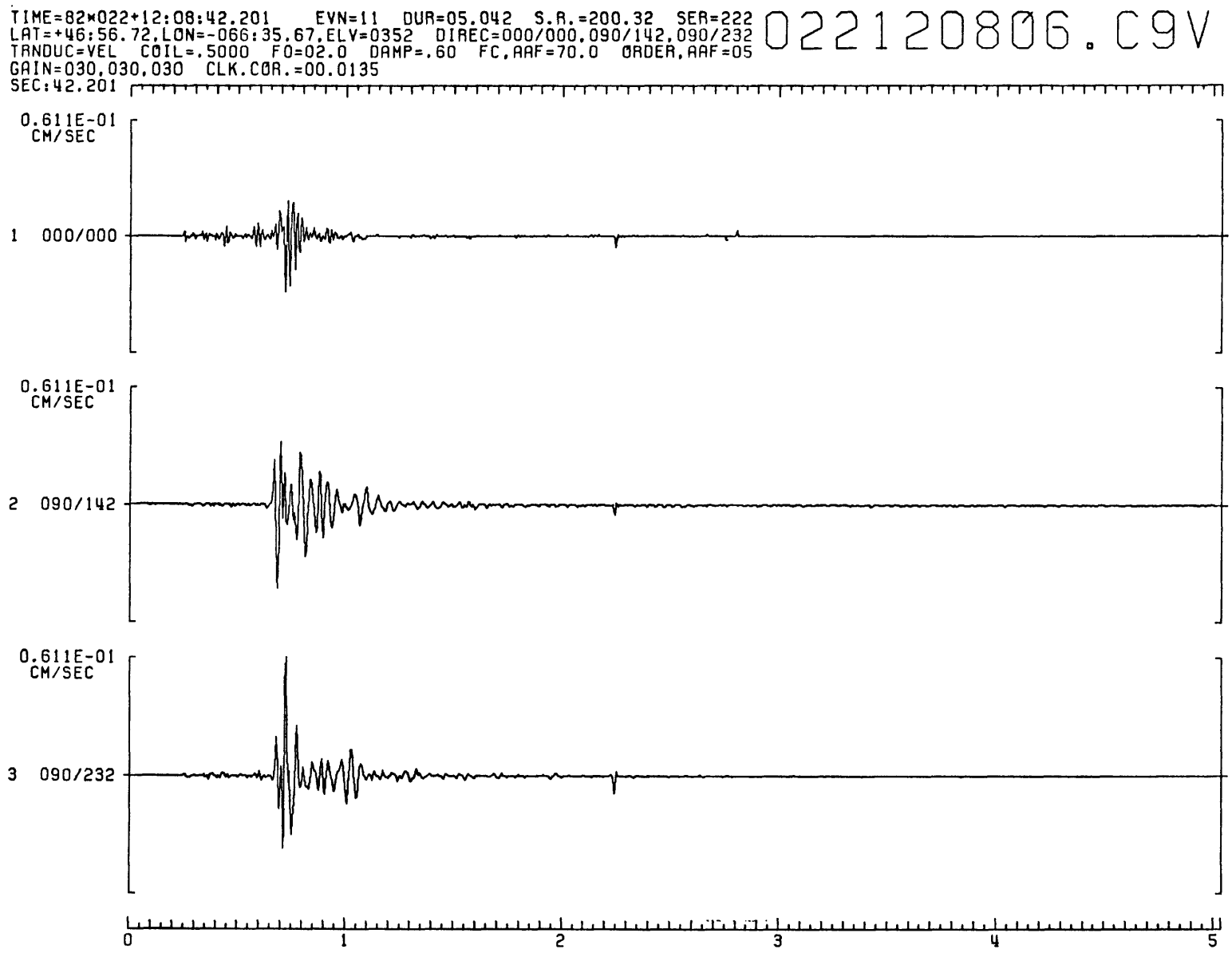
CM/SEC
3 090/090
0
1
2
3
4
5
6

A 105


TIME=82*022+12:08:41.707 EVN=06 DUR=05.536 S.R.=200.32 SER=203
LAT=+46:58.22,LON=-066:31.79,ELV=0323 DIREC=000/000,090/000,090/090
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=50.0 ORDER,AAF=05
GAIN=036,036,036 CLK.COR.=-0.0098
022120806.C7V
SEC:41.707
0.136E-01
CM/SEC
1 000/000
0.136E-01
CM/SEC
2 090/000
0.136E-01
CM/SEC
3 090/090
0
1
2
3
4
5

A106


TIME=82*022+12:08:42.201 EVN=11 DUR=05.042 S.R.=200.32 SER=222
LAT=+46:56.72,LON=-066:35.67,ELV=0352 DIREC=000/000,090/142,090/232
TRNDUC=VEL COIL=.5000 FO=02.0 DAMP=.60 FC,AAF=70.0 ORDER,AAF=05
GAIN=030,030,030 CLK.COR.=00.0135
022120806.C9V
SEC:42.201
0.611E-01
CM/SEC
1 000/000
0.611E-01
CM/SEC
2 090/142
0.611E-01
CM/SEC
3 090/232
0
1
2
3
4
5

A107

APPENDIX B

Seismogram Processing

All acceleration records have been integrated to velocity and displacement and all velocity records have been integrated to displacement. In processing the records we had two main goals in mind: consistency and discrimination between signal and noise. To satisfy the goal of consistency, we applied the same processing to all records, and the integrated records for each earthquake have the same scaling to facilitate comparison. Since signal-to-noise ratios are amplitude-dependent, transducer-dependent, and frequency-dependent, any consistent processing scheme must be a compromise. Useful signal must be sacrificed on some records, while noise will be allowed to contaminate others. After studying Fourier amplitude spectra of signal and noise and doing some trial-and-error processing, we have arrived at the following processing schemes:

Acceleration Processing

1. Integrate original acceleration (trapezoidal rule).
2. Hi-pass filter (2 Hz, 24 dB/octave) the resulting velocity trace to get processed velocity.
3. Hi-pass filter (2 Hz, 24 dB/octave) the original acceleration trace to get processed acceleration.
4. Integrate processed velocity to get processed displacement.

Velocity Processing

1. Hi-pass filter (2 Hz, 24 dB/octave) the original velocity trace to get processed velocity.
2. Integrate processed velocity to get processed displacement.

There is no baseline fitting or removal during the processing. The hi-pass filter is a recursive Butterworth (2 Hz, 12 dB/octave) which is run forward

and backward over the trace to give a zero-phase-shift filter with 24 dB/octave rolloff. Only the processed traces are shown in Appendix B. The first 0.3 seconds of integrated traces are not plotted, eliminating possible large-amplitude tails introduced by the processing.

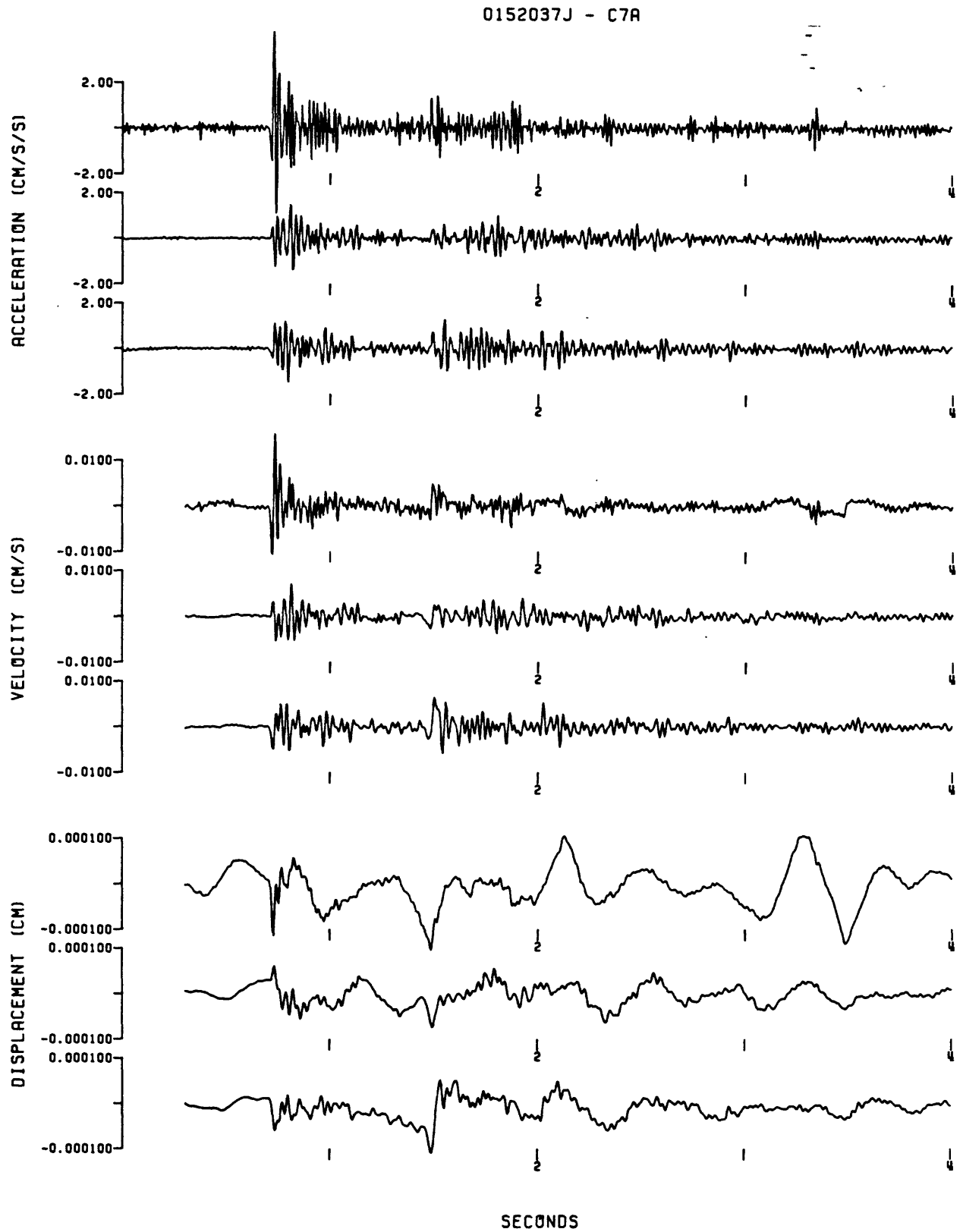
Time marks are superimposed on the data during recording and are subsequently removed during the initial DR100 processing. Two records; 0171408R - C8A and 0202340P - C8A failed the automatic time mark removal process. In each case a time mark near 2.1-2.2 seconds has been partially removed "manually" to allow integration and plotting of the traces. Part of the time mark was intentionally left to remind the reader that these records have been processed differently; the resulting integrated traces are unreliable near 2.1-2.2 seconds. Some steps and spikes in other integrated records may be due to the inability of the software to perfectly remove the time marks.

The co-located velocity and acceleration instruments provided a unique opportunity to compare the responses of both instruments at high frequencies, which are especially important in the New Brunswick data set. Spectral ratio tests from the two instruments indicate that they respond as expected up to 50 Hz but deviate above 50 Hz. Lacking detailed knowledge of instrument response, we propose, as a general rule, that the New Brunswick data are reliable up to 50 Hz. The anti-alias filter serves as a low-pass filter at 50 Hz (70 Hz for C9V) and there has been no attempt to deconvolve it during the processing.

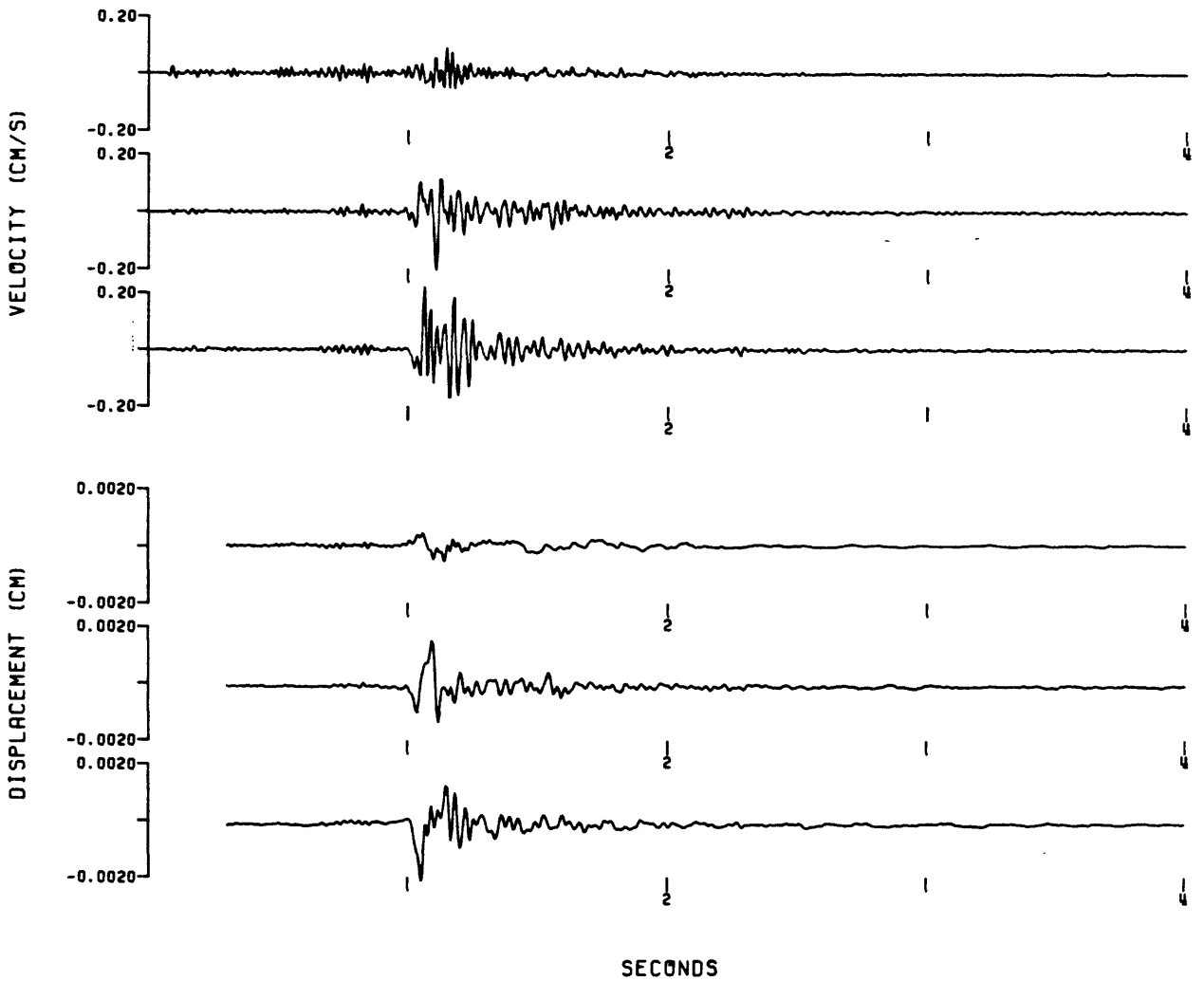
The choice of 2 Hz as a lowest reliable frequency is a compromise based on signal and noise spectra and trial-and-error processing. Some of the low amplitude accelerograms cannot be reliably integrated since they are contaminated by noise at frequencies greater than 2 Hz. Higher-amplitude

accelerograms do not suffer this problem (see, for example, 0171333T - C7A). Choosing a higher frequency corner for the high-pass filter would have discriminated against the velocity records which can be realiably integrated using 2 Hz.

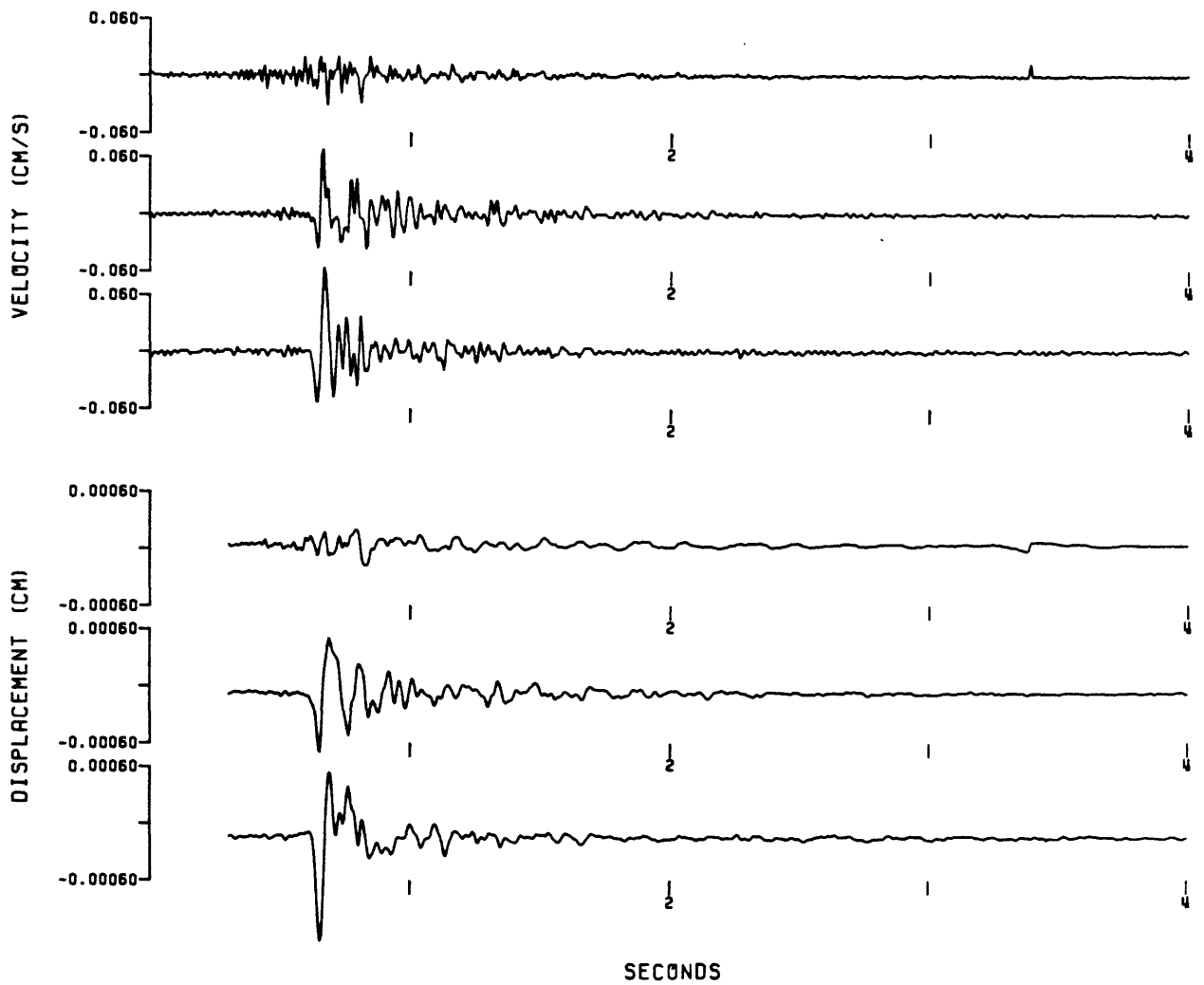
In summary, we feel that the processed New Brunswick data are reliable between 2 Hz and 50 Hz, except when low-amplitude accelerograms are contaminated by noise at frequencies above 2 Hz and except for possible contamination of low-amplitude records by imperfect time-mark removal. Since the velocity transducer and FBA are each flat from 2 Hz to 50 Hz, the instrument response has not been deconvolved from the records although gain factors have been removed so that the seismograms in the appendix are in units of ground motion. Each seismogram is named for the time and instrument. For example, record 0152037J - C7A was recorded at C7A on day 015, hour 20, minute 37, between 27 and 30 seconds.


0152037J - C7A
ACCELERATION (CM/S/S)
2.00
-2.00
2.00
-2.00
2.00
-2.00
VELOCITY (CM/S)
0.0100
-0.0100
0.0100
-0.0100
0.0100
-0.0100
DISPLACEMENT (CM)
0.000100
-0.000100
0.000100
-0.000100
0.000100
-0.000100
1
1/2
1
1/2
1
1/2
SECONDS

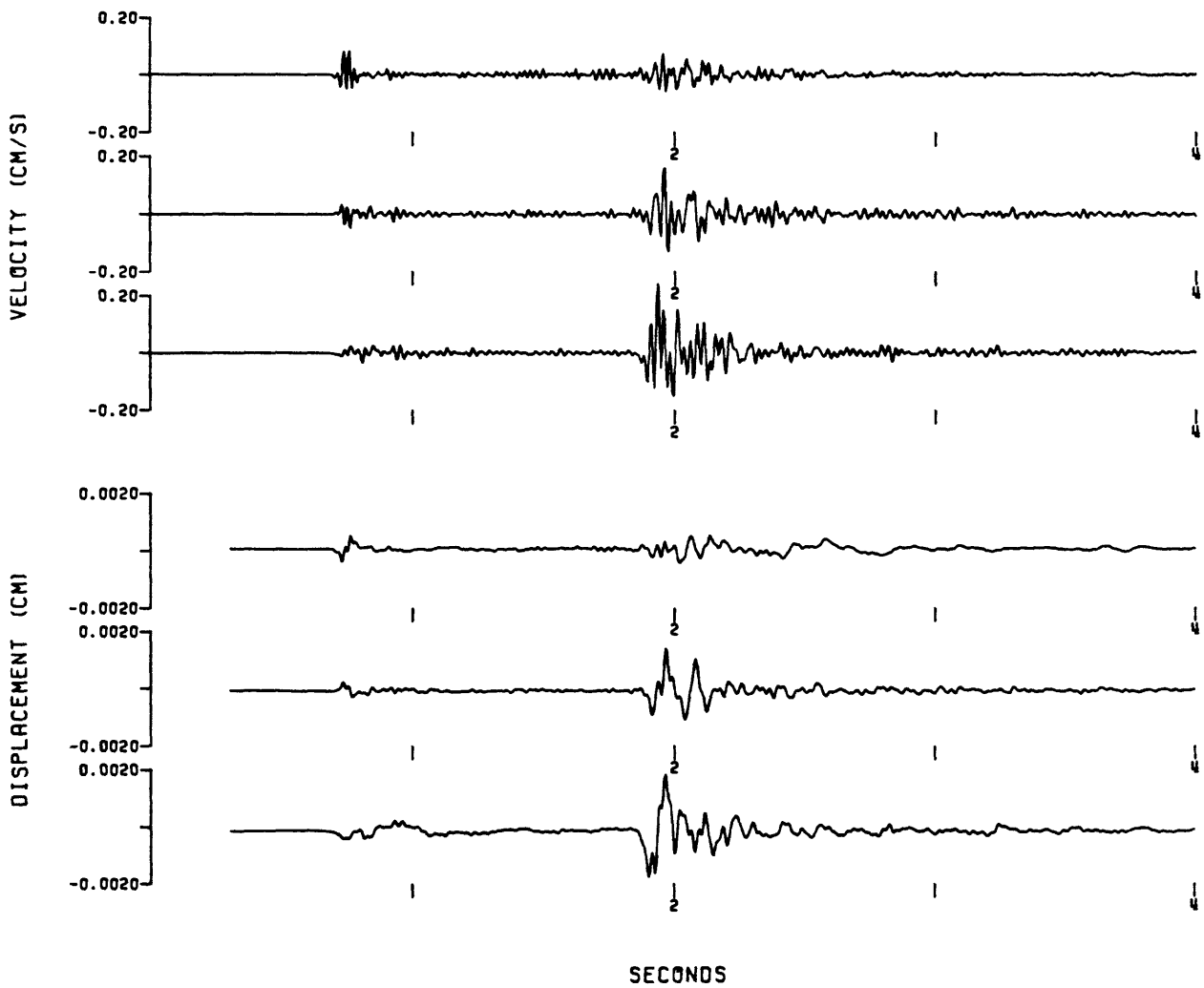
0160610H - C7V

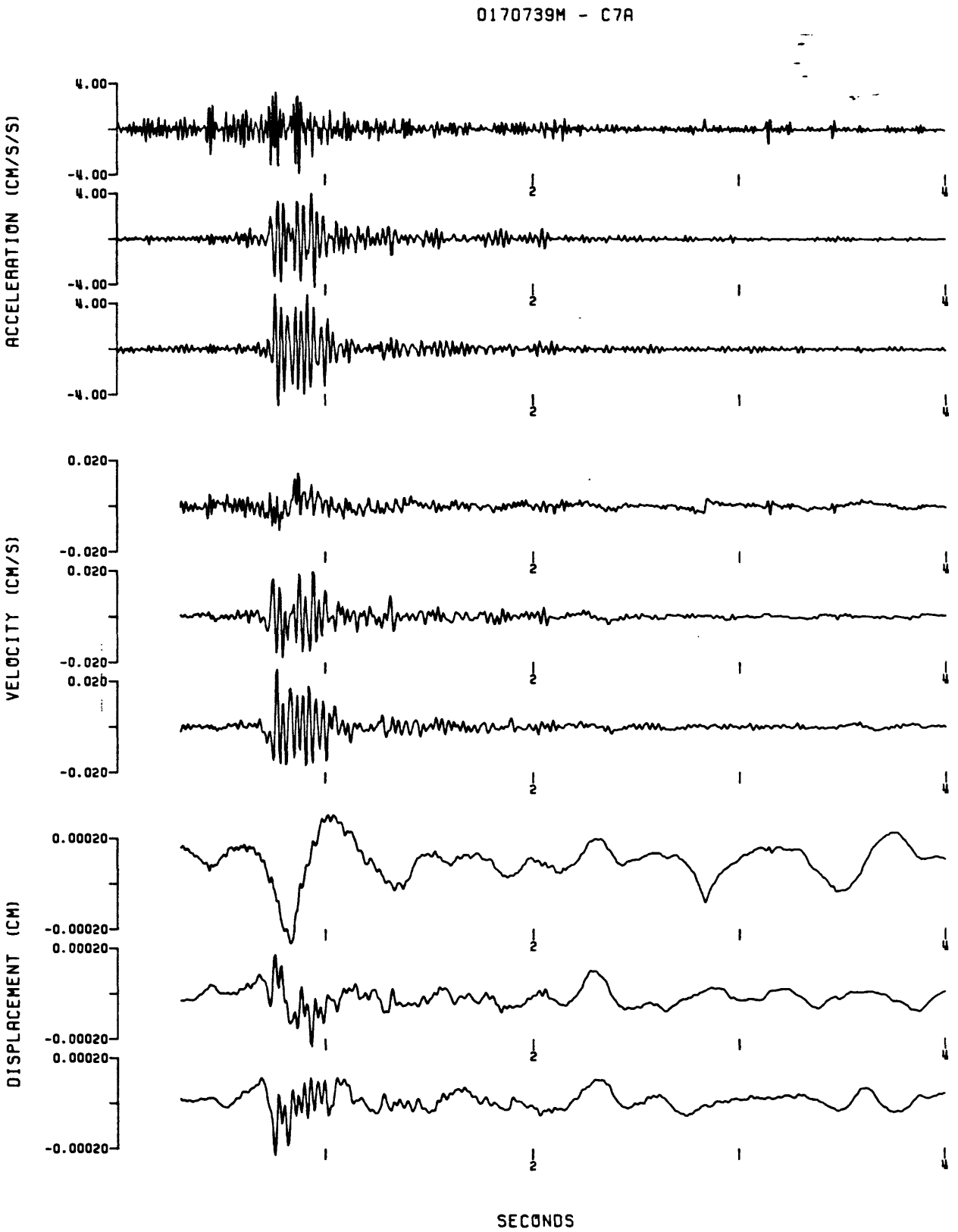


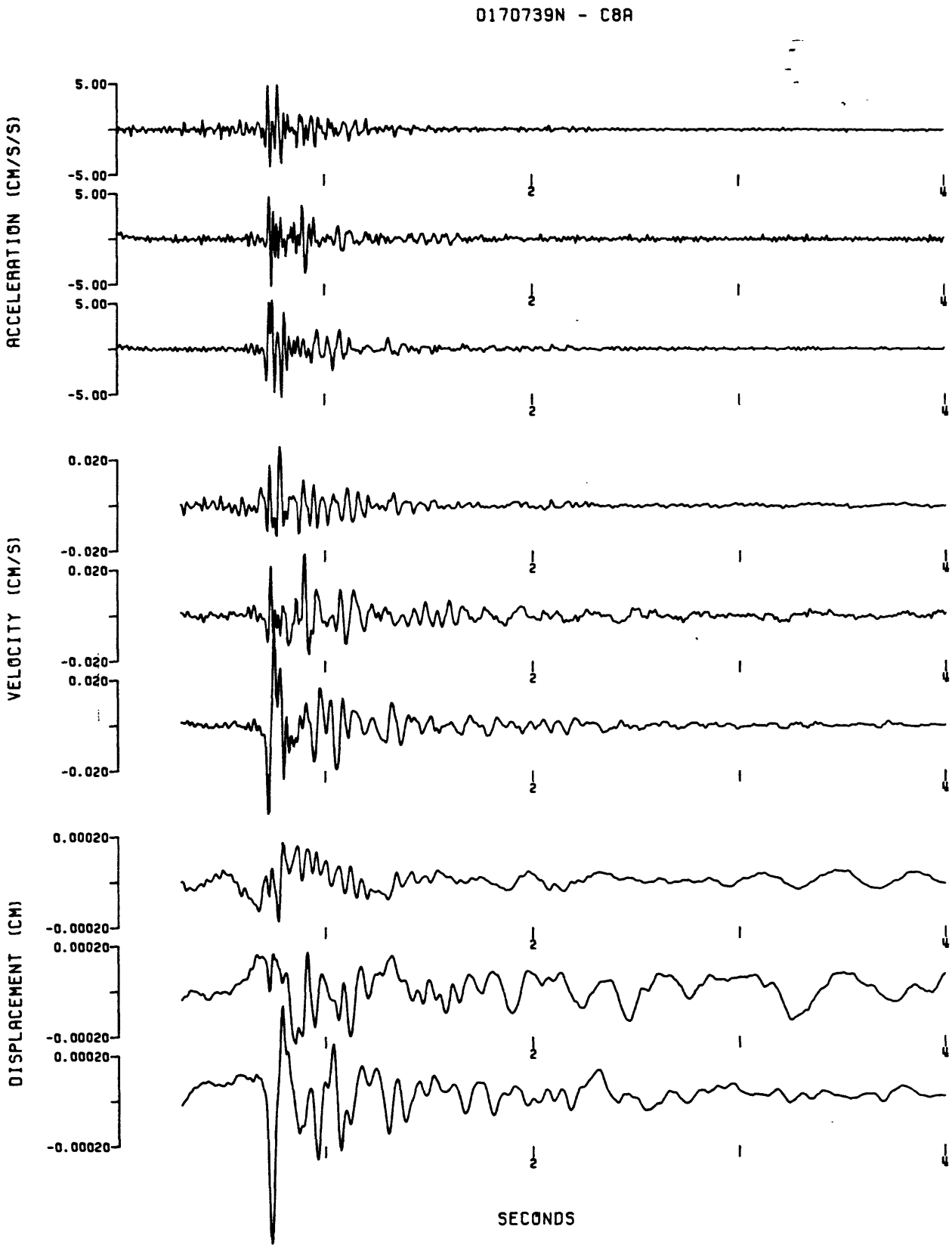
0160813D - C7V



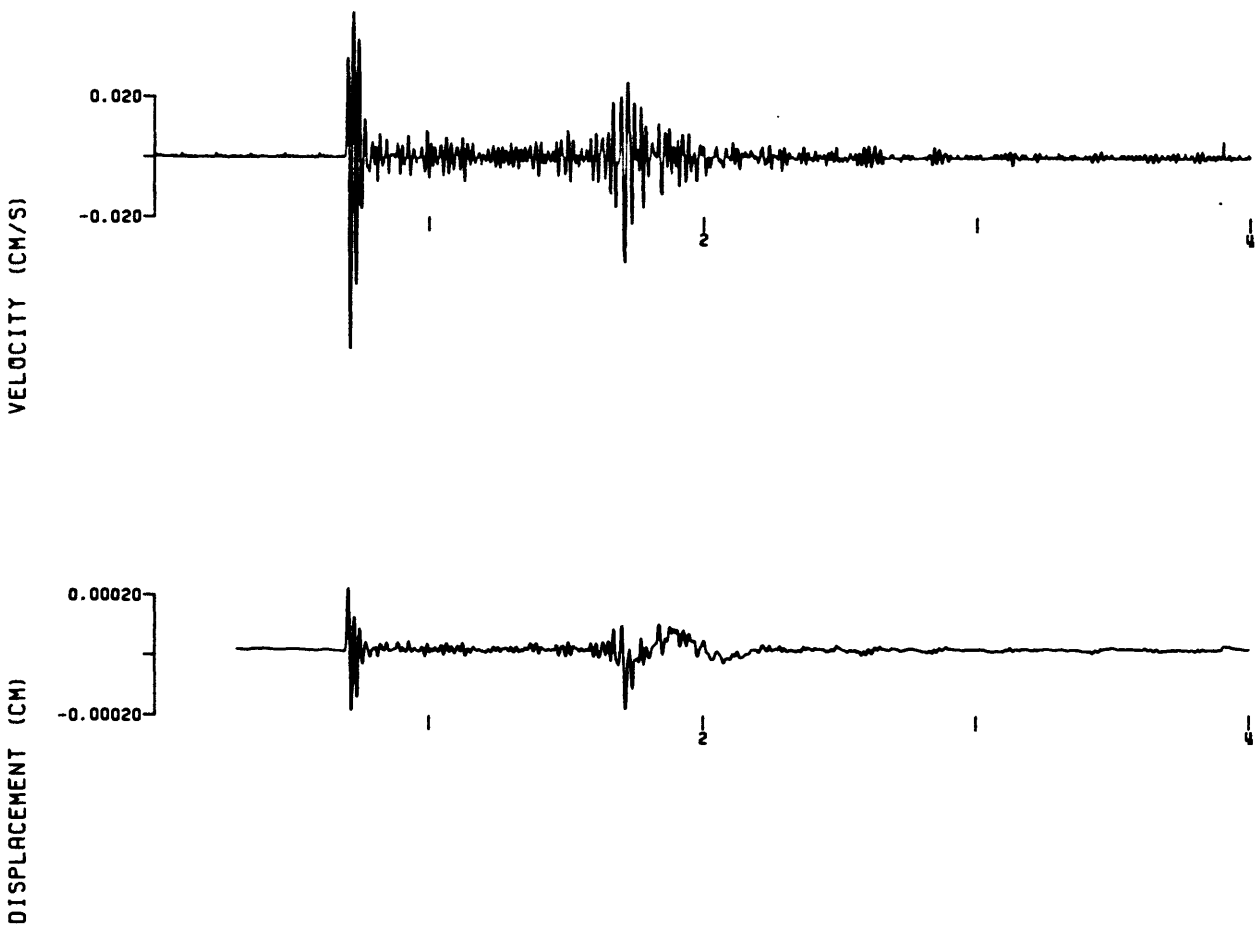
0161554F - C7V



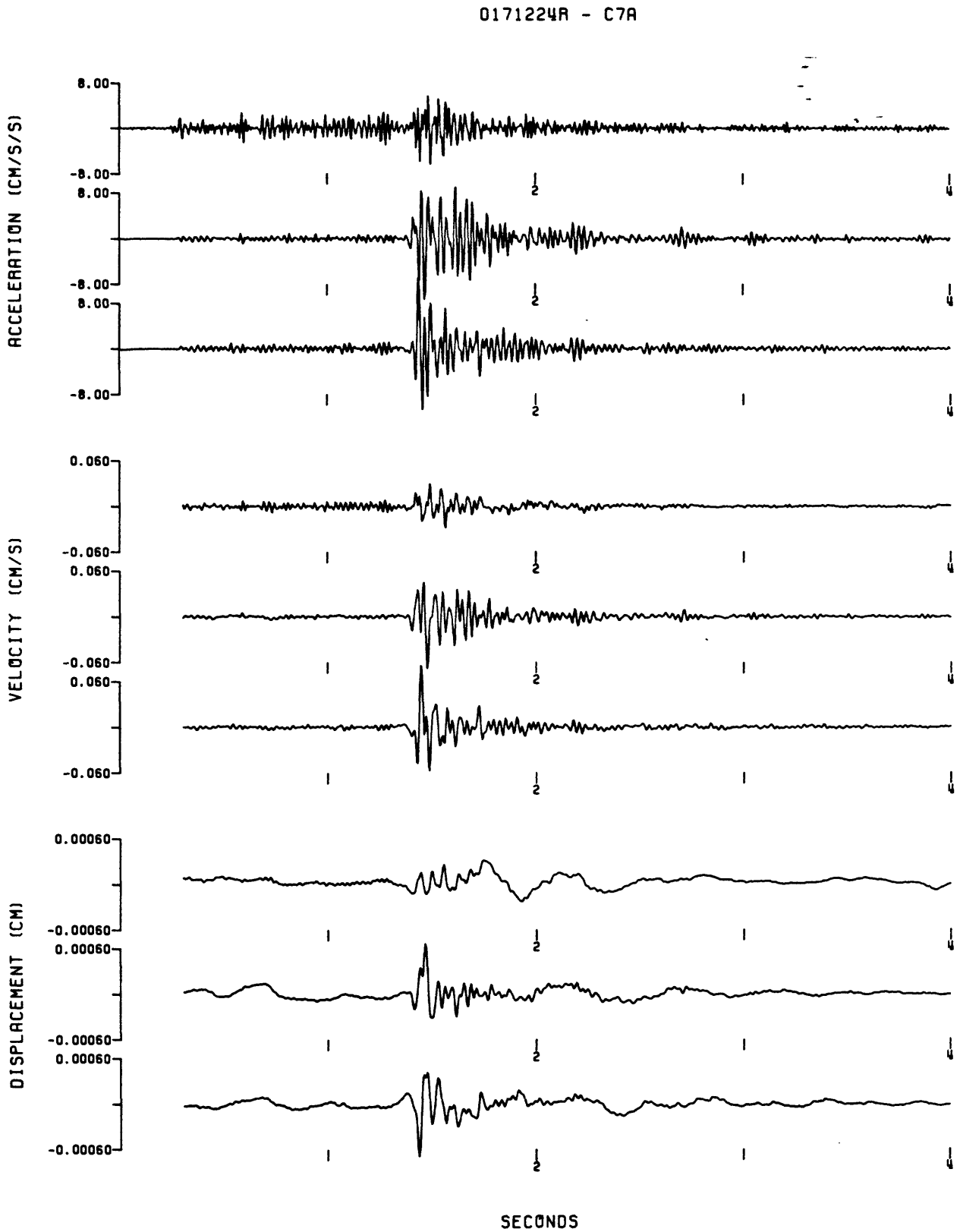

0170739M - C7A
ACCELERATION (CM/S/S)
4.00
-4.00
4.00
-4.00
4.00
-4.00
VELOCITY (CM/S)
0.020
-0.020
0.020
-0.020
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
0.00020
-0.00020
0.00020
-0.00020
1
1/2
1
1/4
SECONDS


0170739N - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

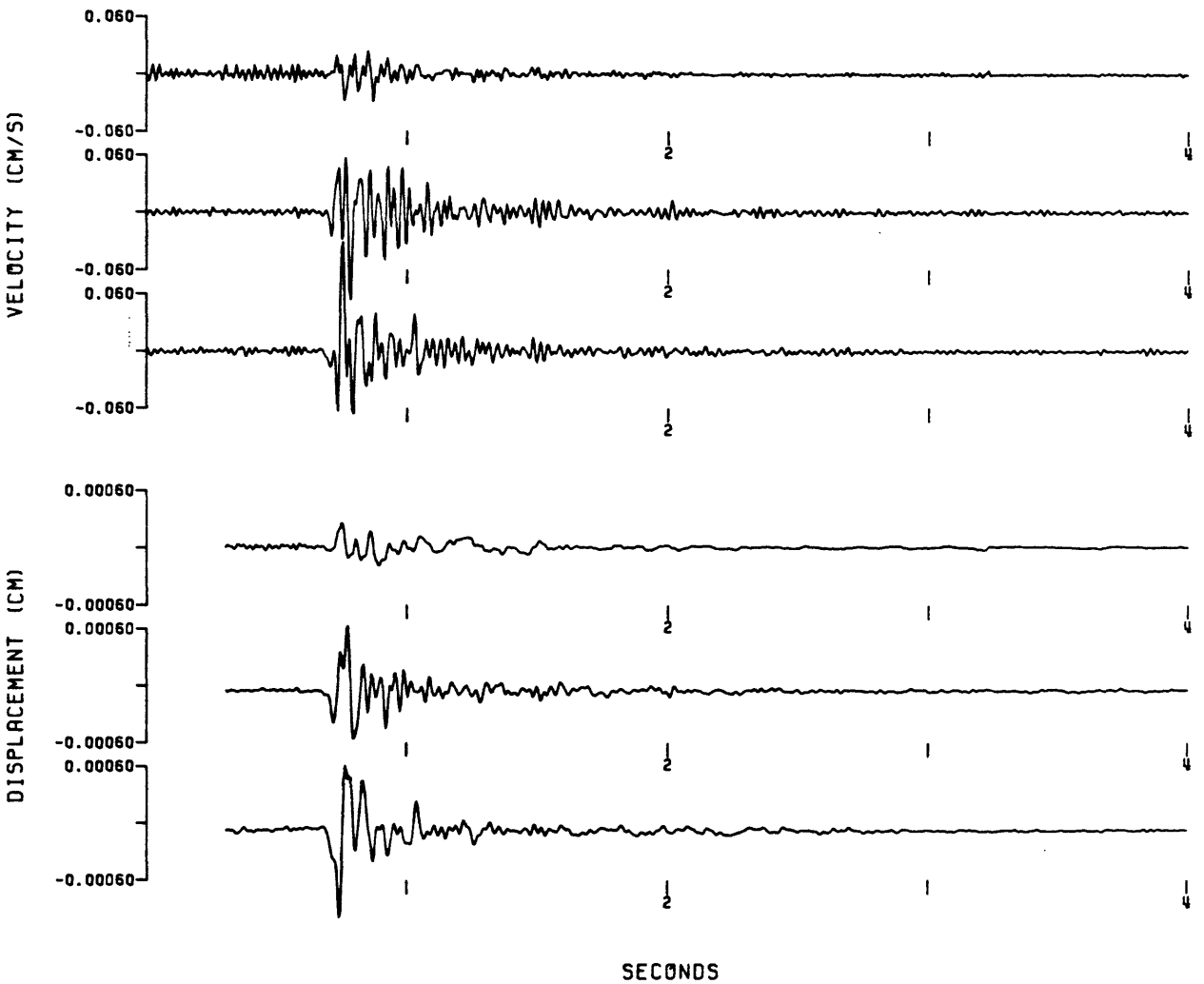
0170739M - C9V

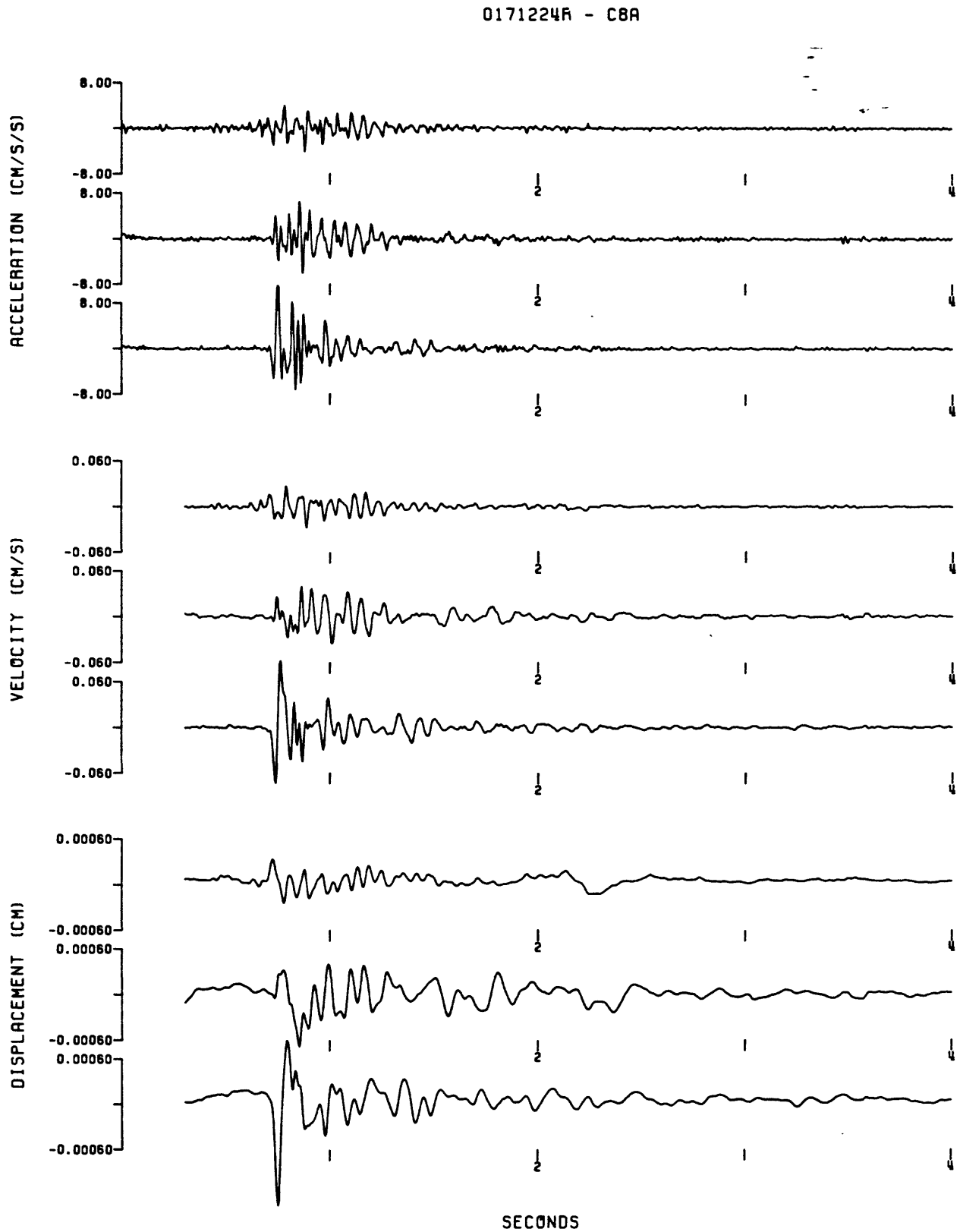


SECONDS

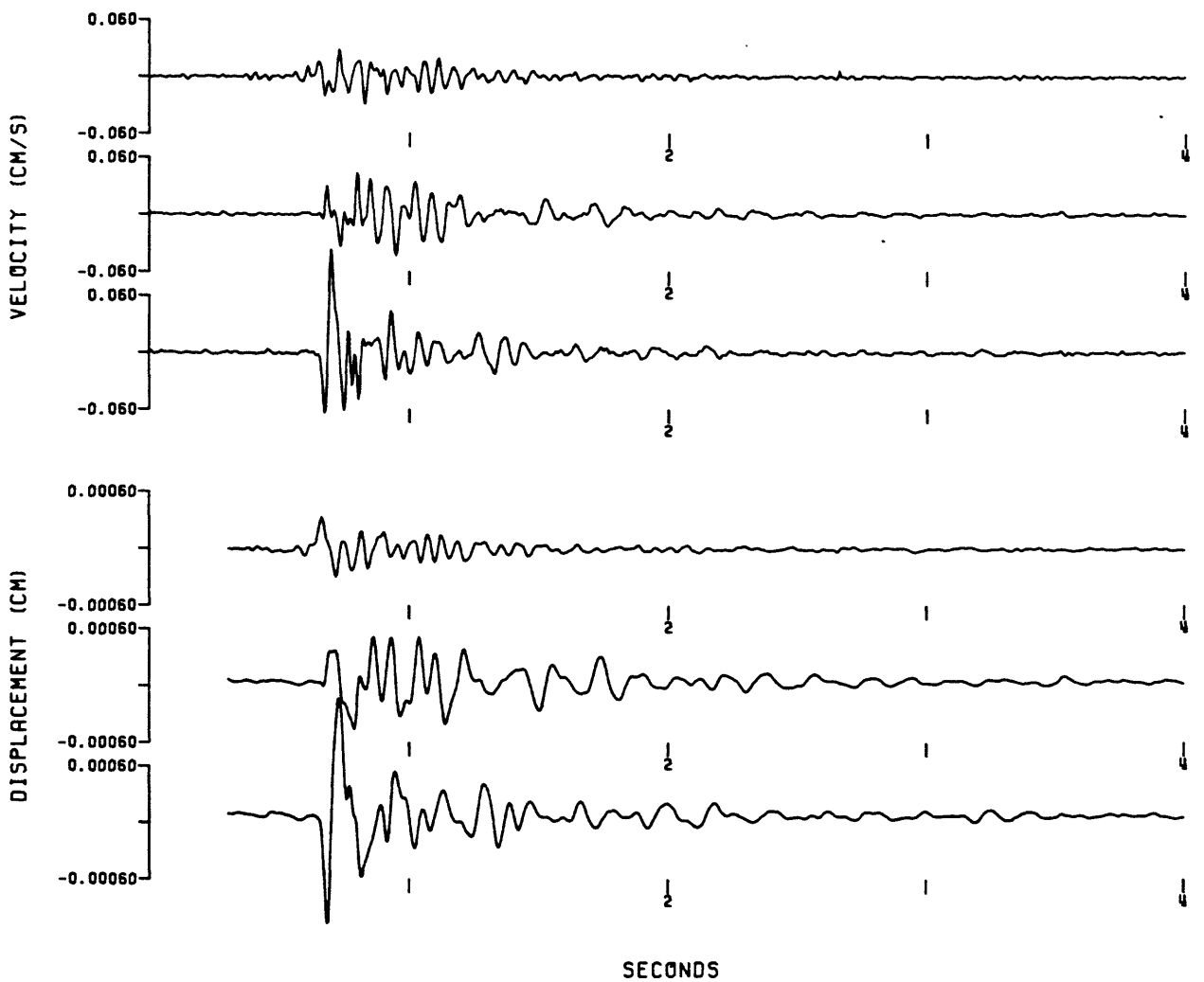

0171224R - C7A
ACCELERATION (CM/S/S)
8.00
-8.00
VELOCITY (CM/S)
0.060
-0.060
DISPLACEMENT (CM)
0.00060
-0.00060
SECONDS

0171224R - C7V

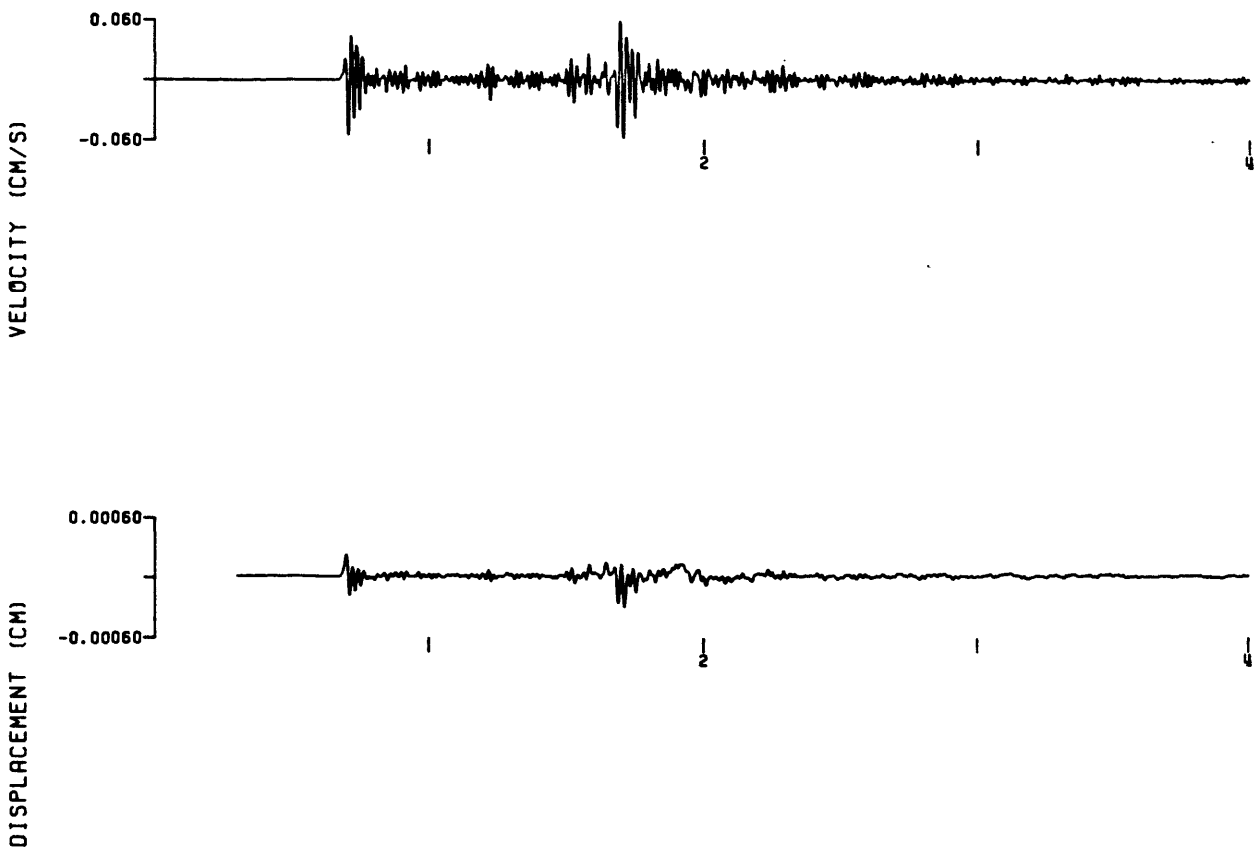


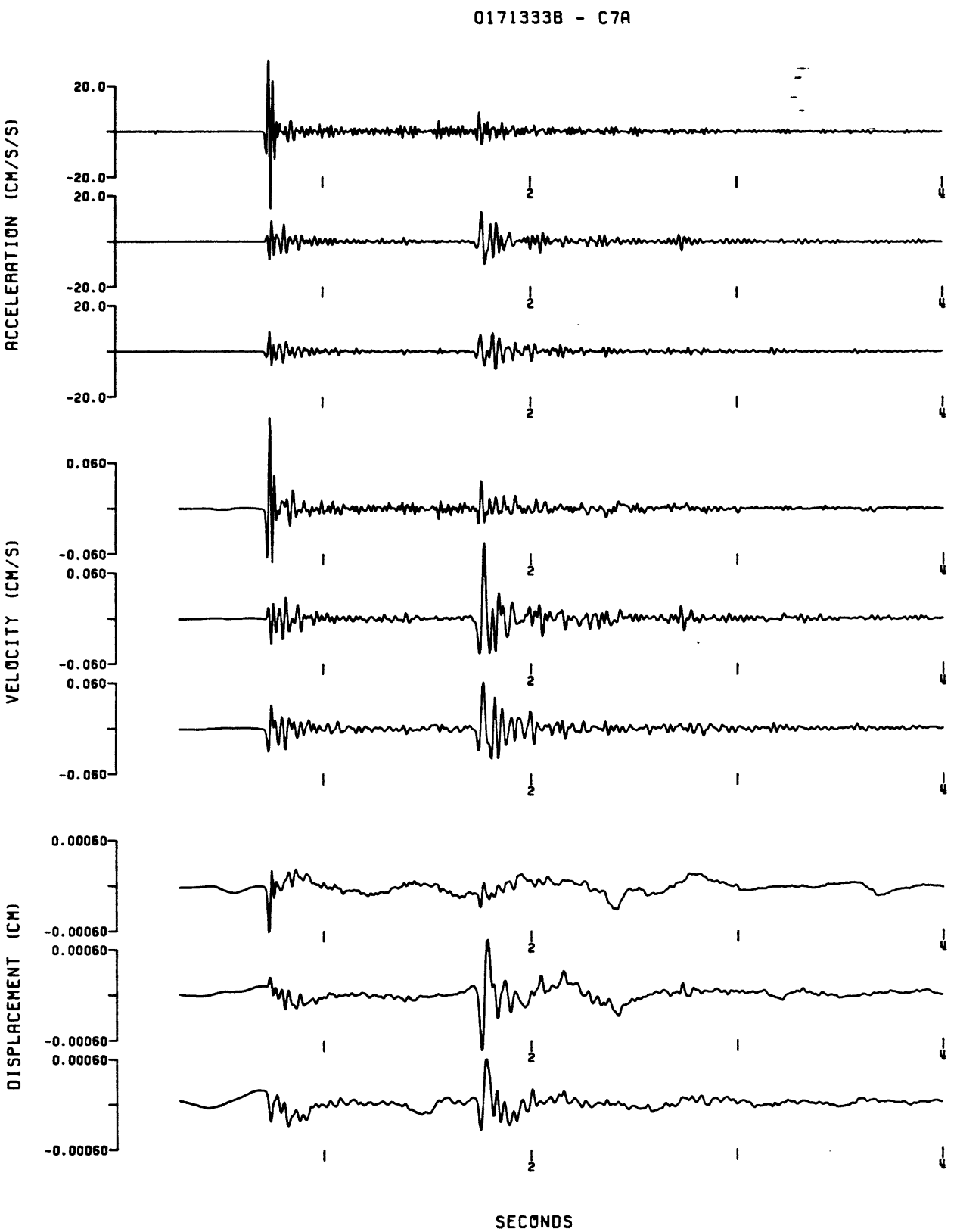

0171224R - C8A
ACCELERATION (CM/S/S)
8.00
-8.00
VELOCITY (CM/S)
0.060
-0.060
DISPLACEMENT (CM)
0.00060
-0.00060
SECONDS

0171224R - C8V

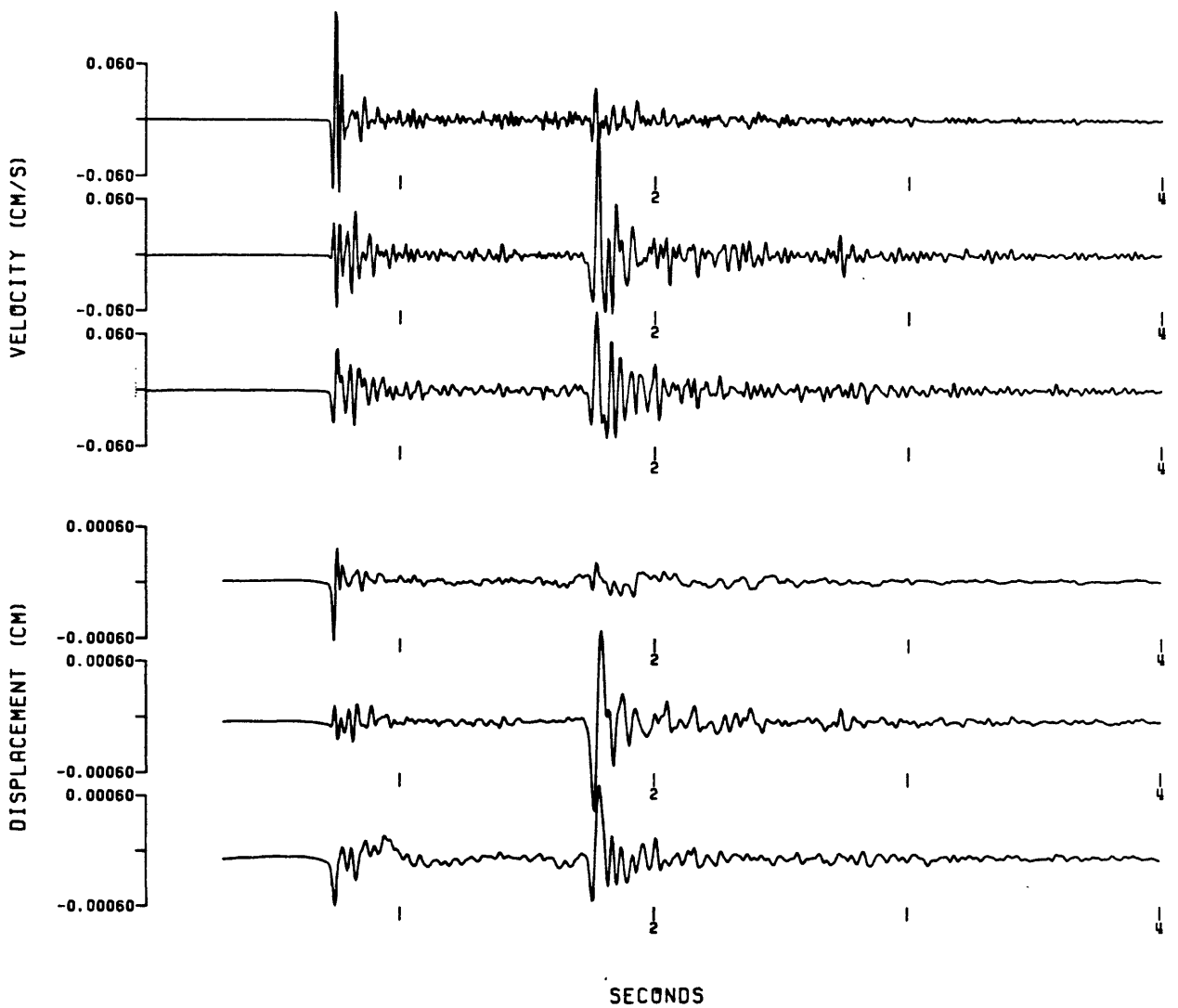


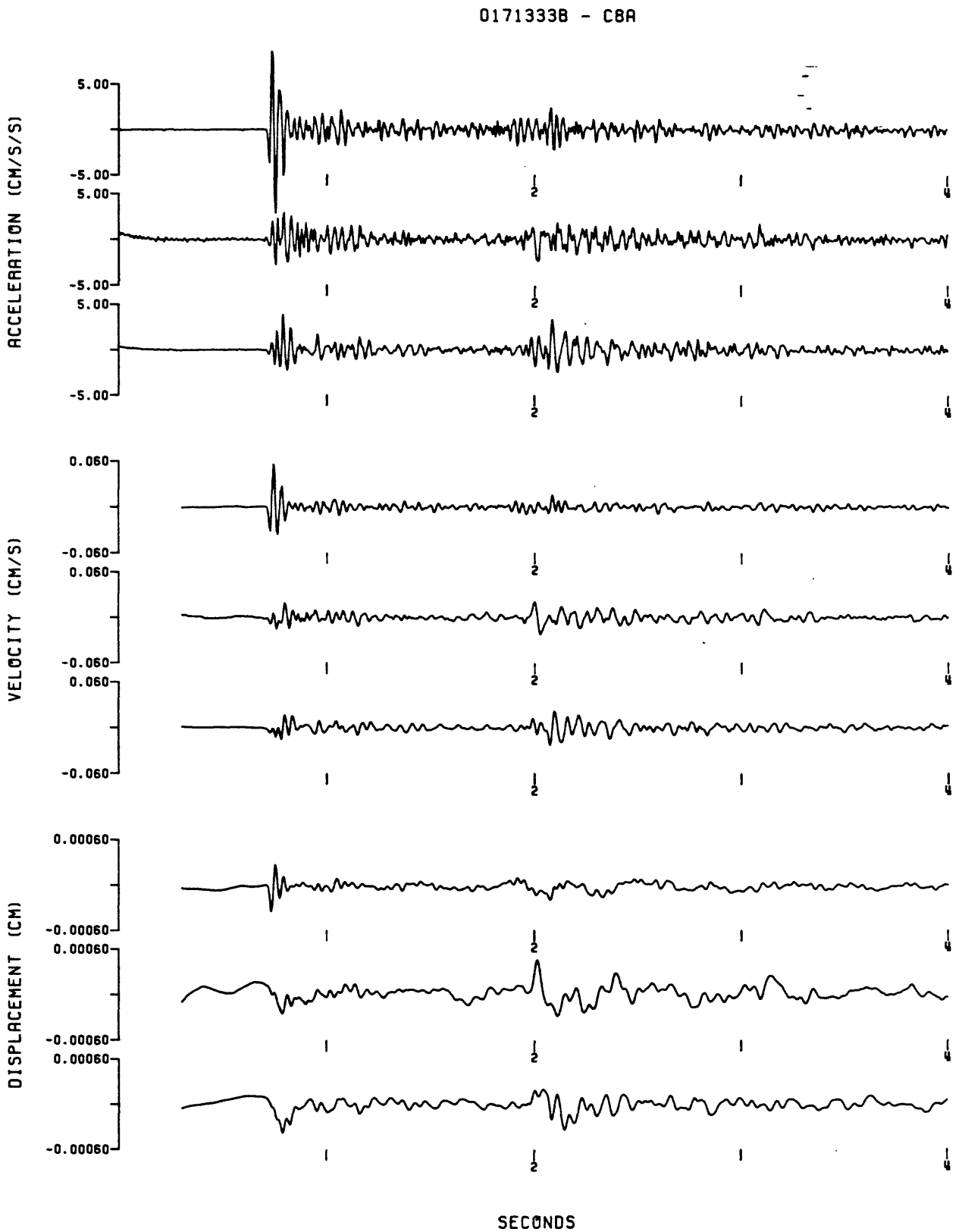
0171224R - C9V



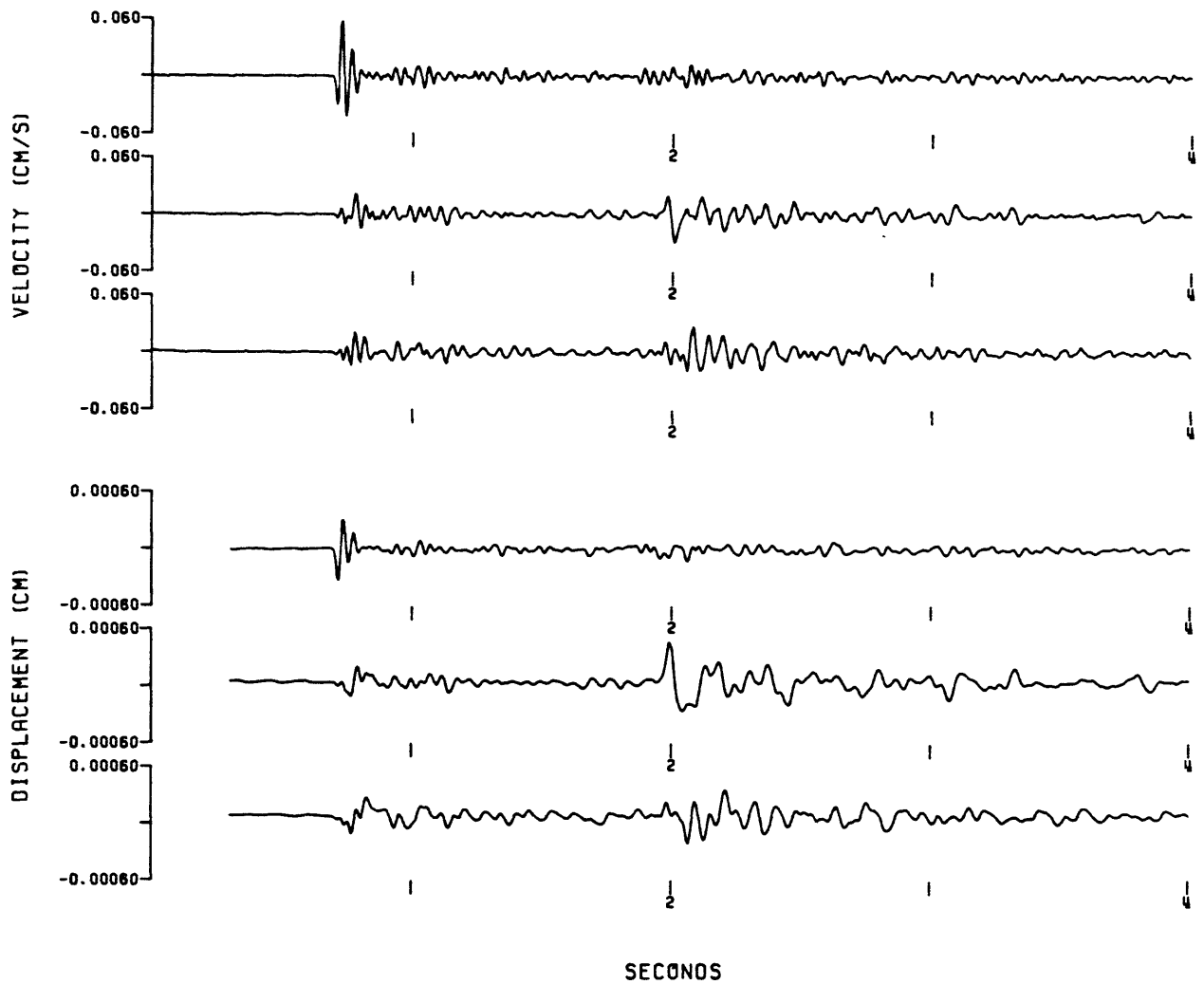

0171333B - C7A
ACCELERATION (CM/S/S)
20.0
-20.0
20.0
-20.0
20.0
-20.0
VELOCITY (CM/S)
0.060
-0.060
0.060
-0.060
0.060
-0.060
DISPLACEMENT (CM)
0.00060
-0.00060
0.00060
-0.00060
0.00060
-0.00060
1
1/2
1
1/4
SECONDS

0171333B - C7V

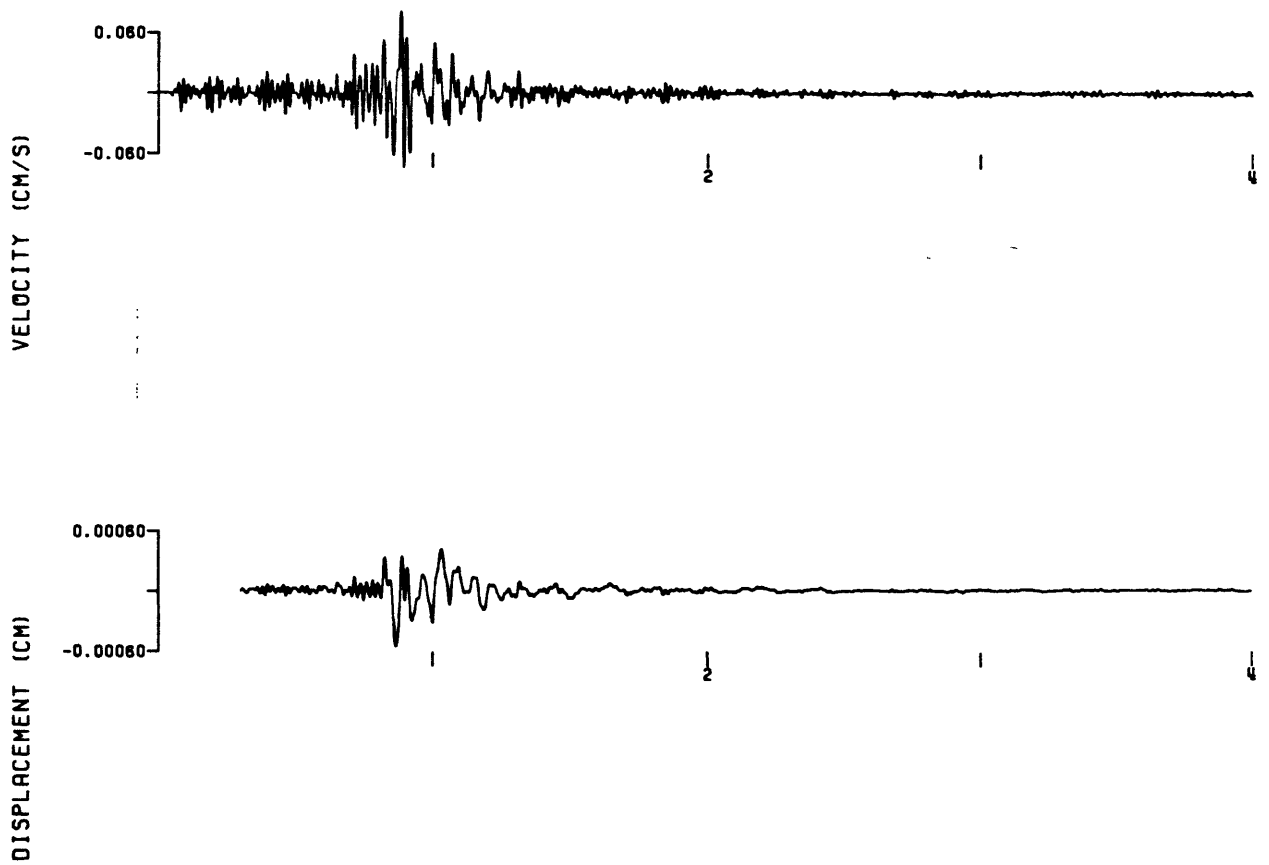


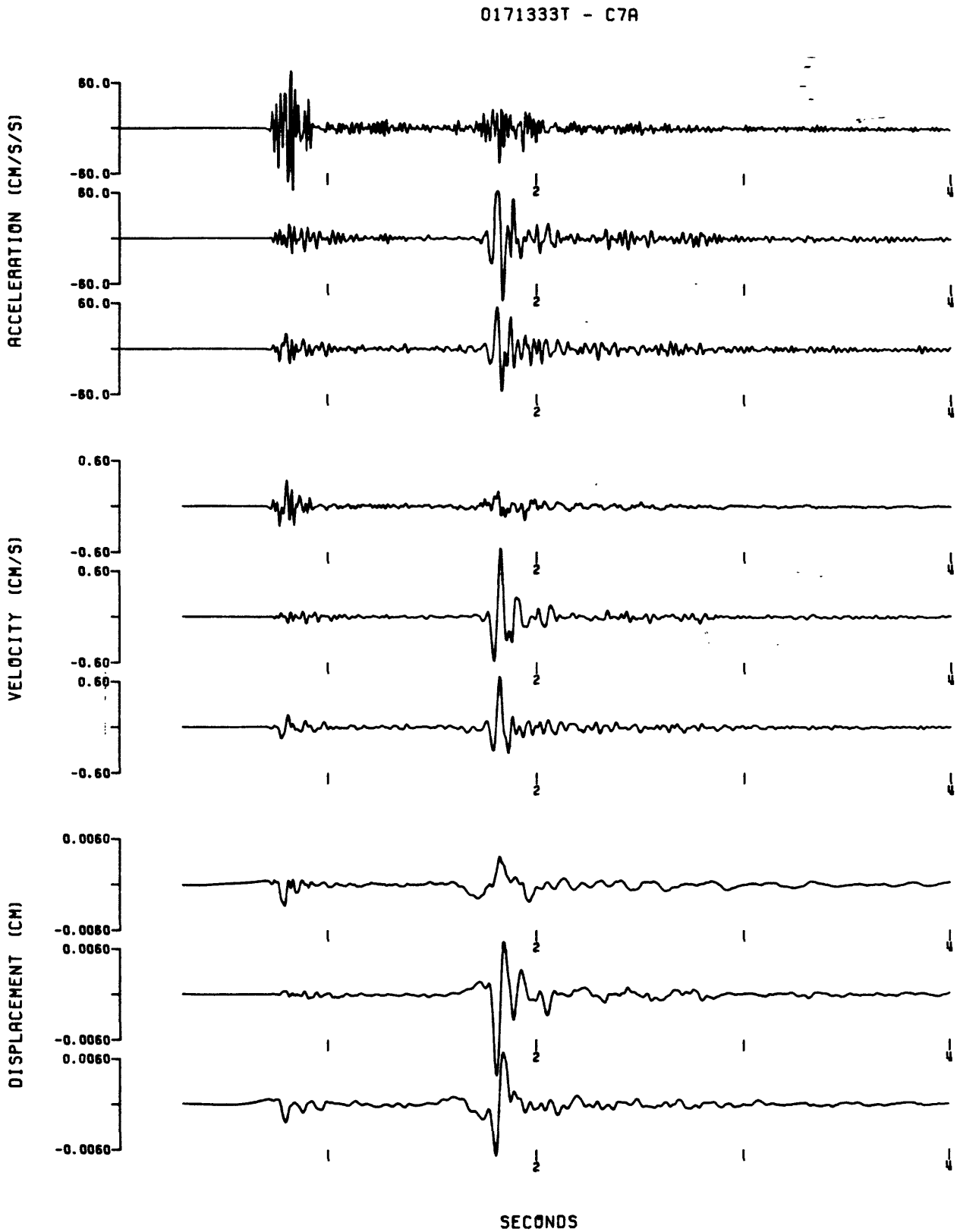

0171333B - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
5.00
-5.00
5.00
-5.00
VELOCITY (CM/S)
0.060
-0.060
0.060
-0.060
0.060
-0.060
DISPLACEMENT (CM)
0.00060
-0.00060
0.00060
-0.00060
0.00060
-0.00060
1
1/2
1
1/4
SECONDS

0171333B - C8V

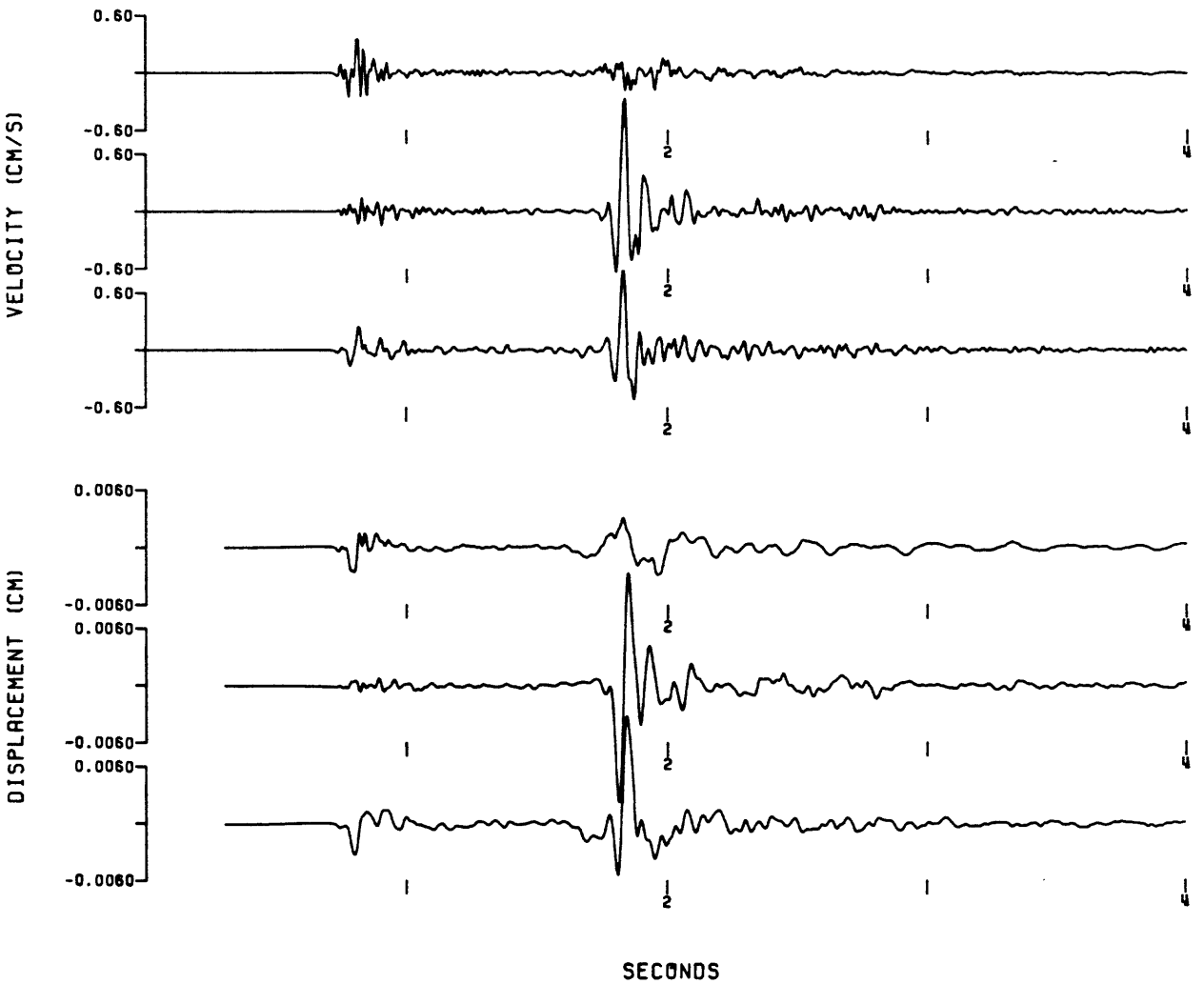


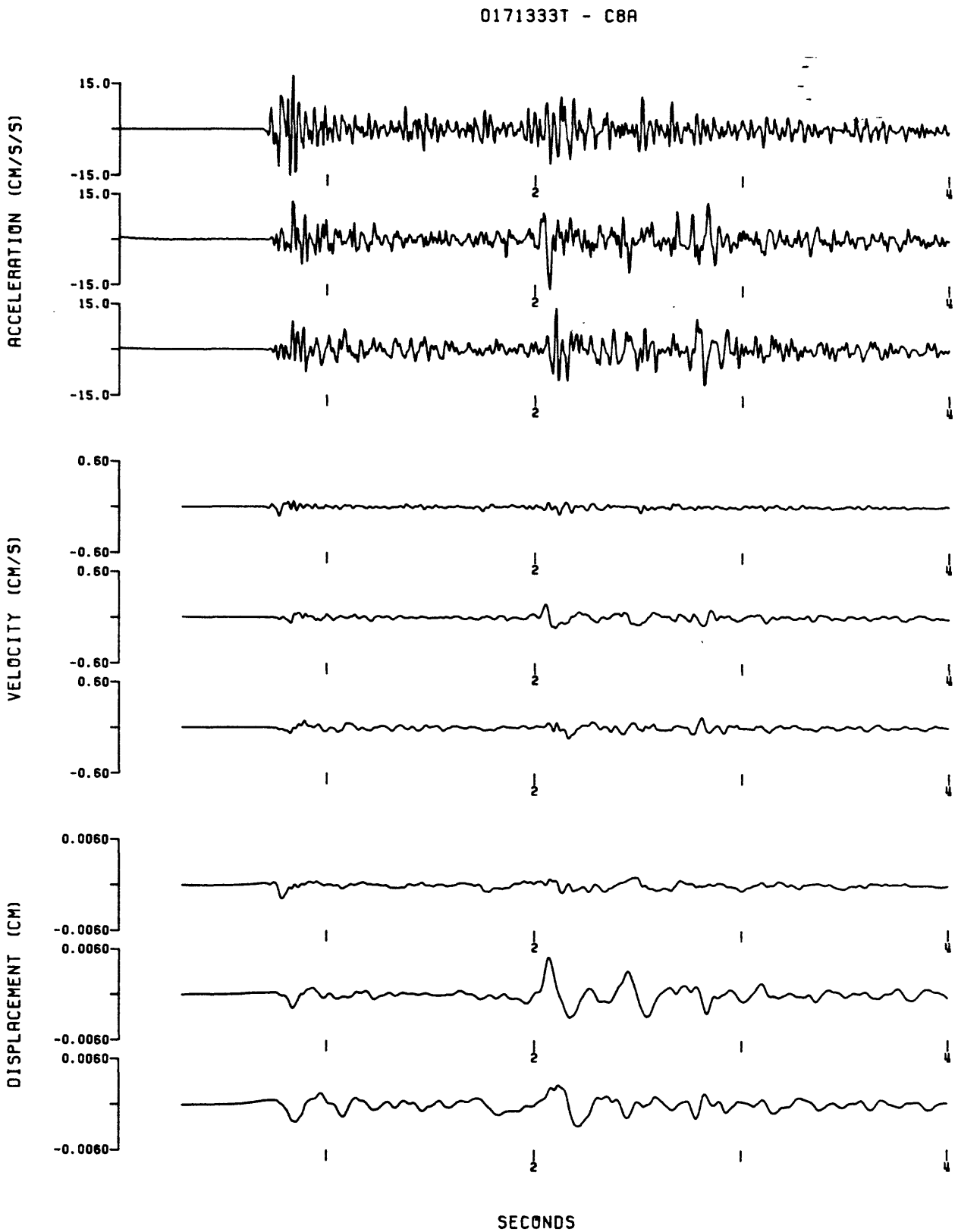
01713338 - C9V



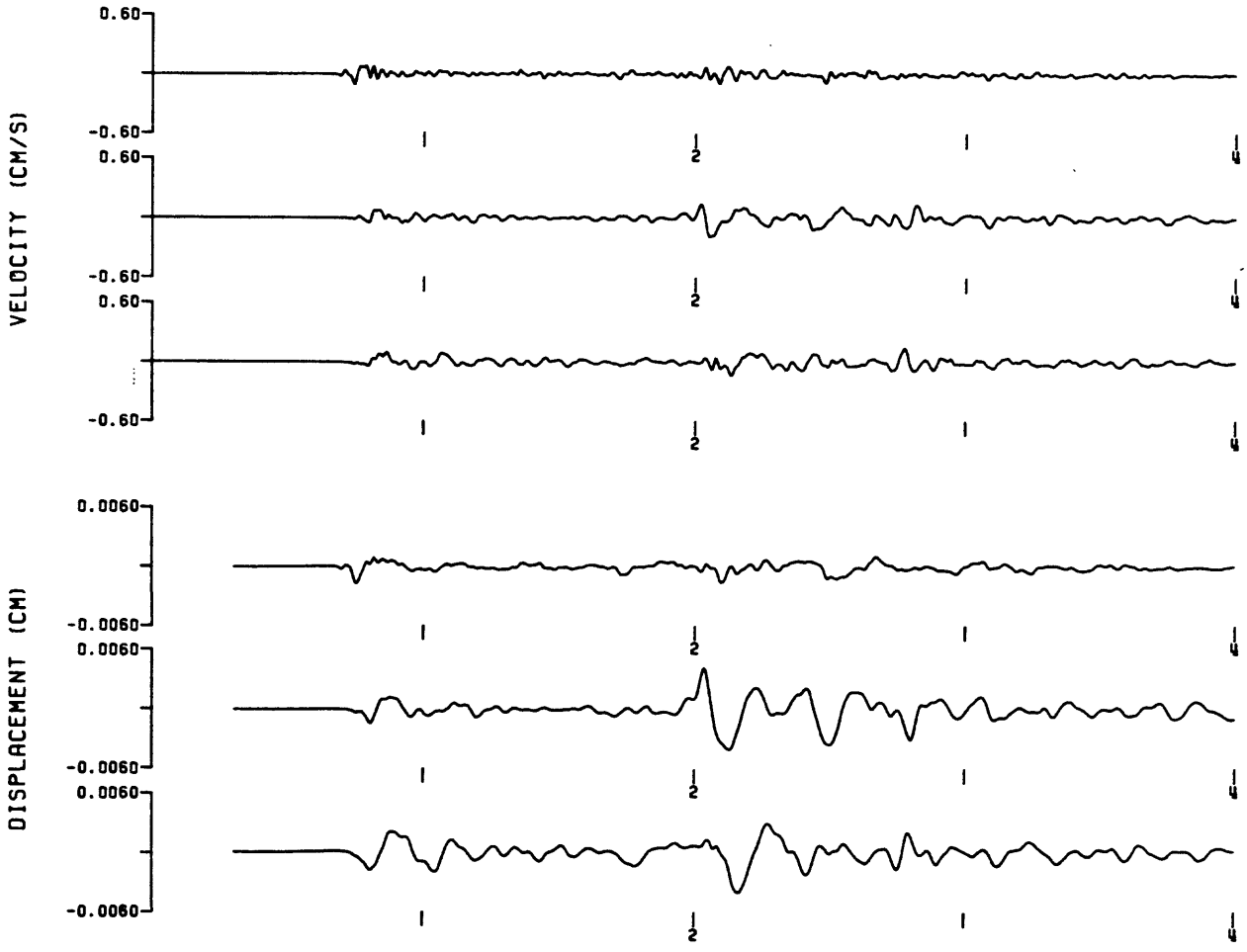

0171333T - C7A
ACCELERATION (CM/S/S)
60.0
-60.0
60.0
-60.0
60.0
-60.0
VELOCITY (CM/S)
0.60
-0.60
0.60
-0.60
0.60
-0.60
DISPLACEMENT (CM)
0.0060
-0.0060
0.0060
-0.0060
0.0060
-0.0060
1
1/2
1
1/2
SECONDS

0171333T - C7V

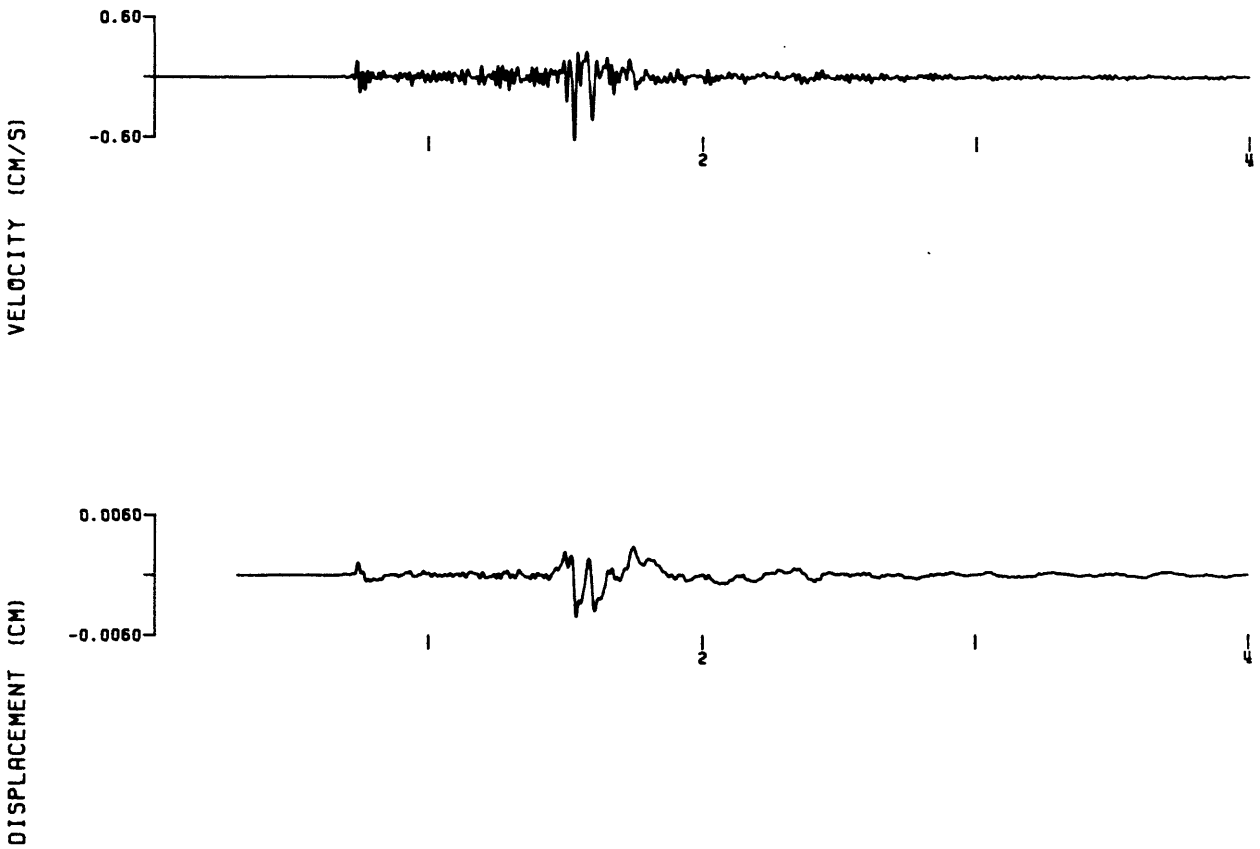


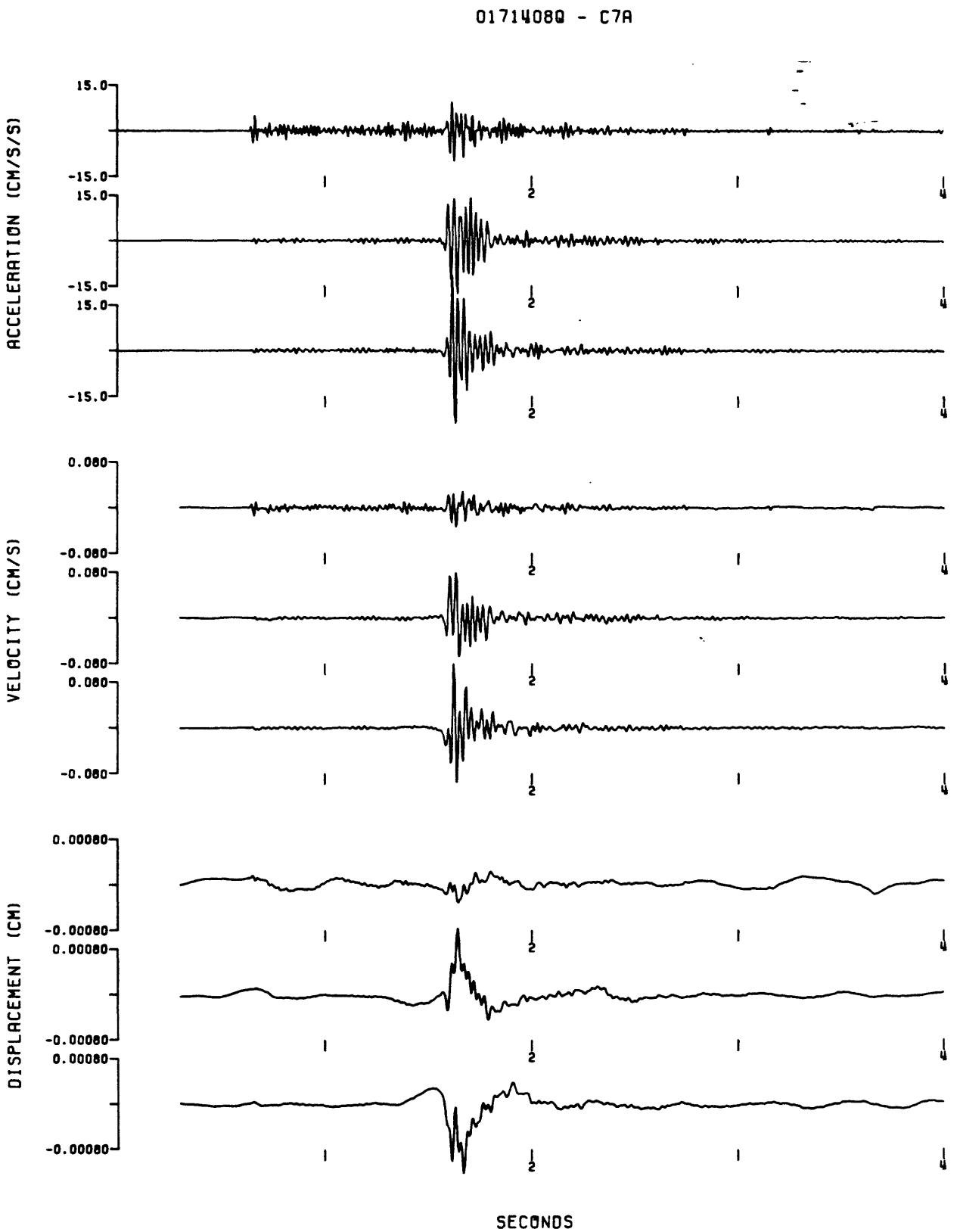

0171333T - C8A
ACCELERATION (CM/S/S)
15.0
-15.0
VELOCITY (CM/S)
0.60
-0.60
DISPLACEMENT (CM)
0.0060
-0.0060
SECONDS

0171333T - C8V

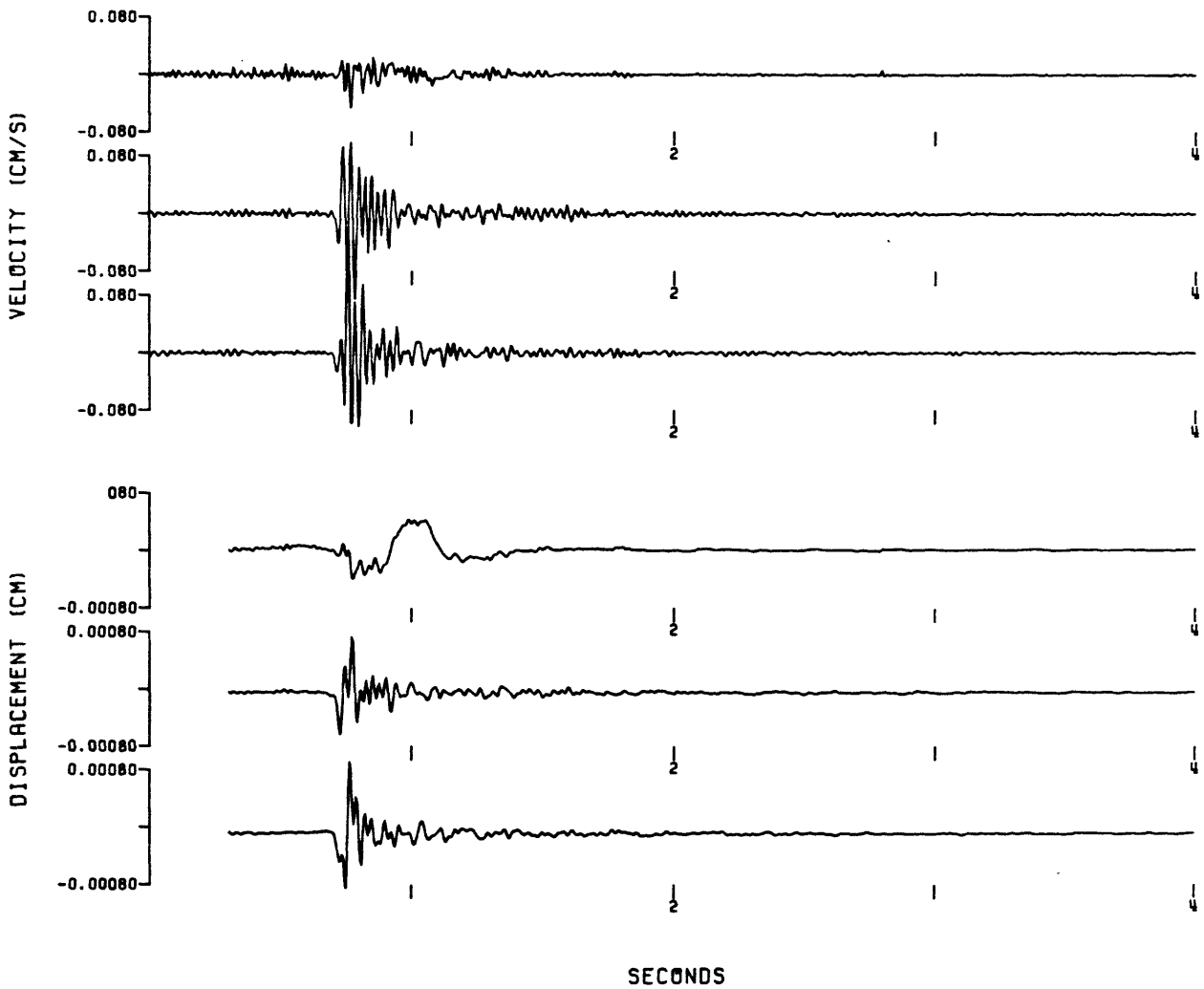


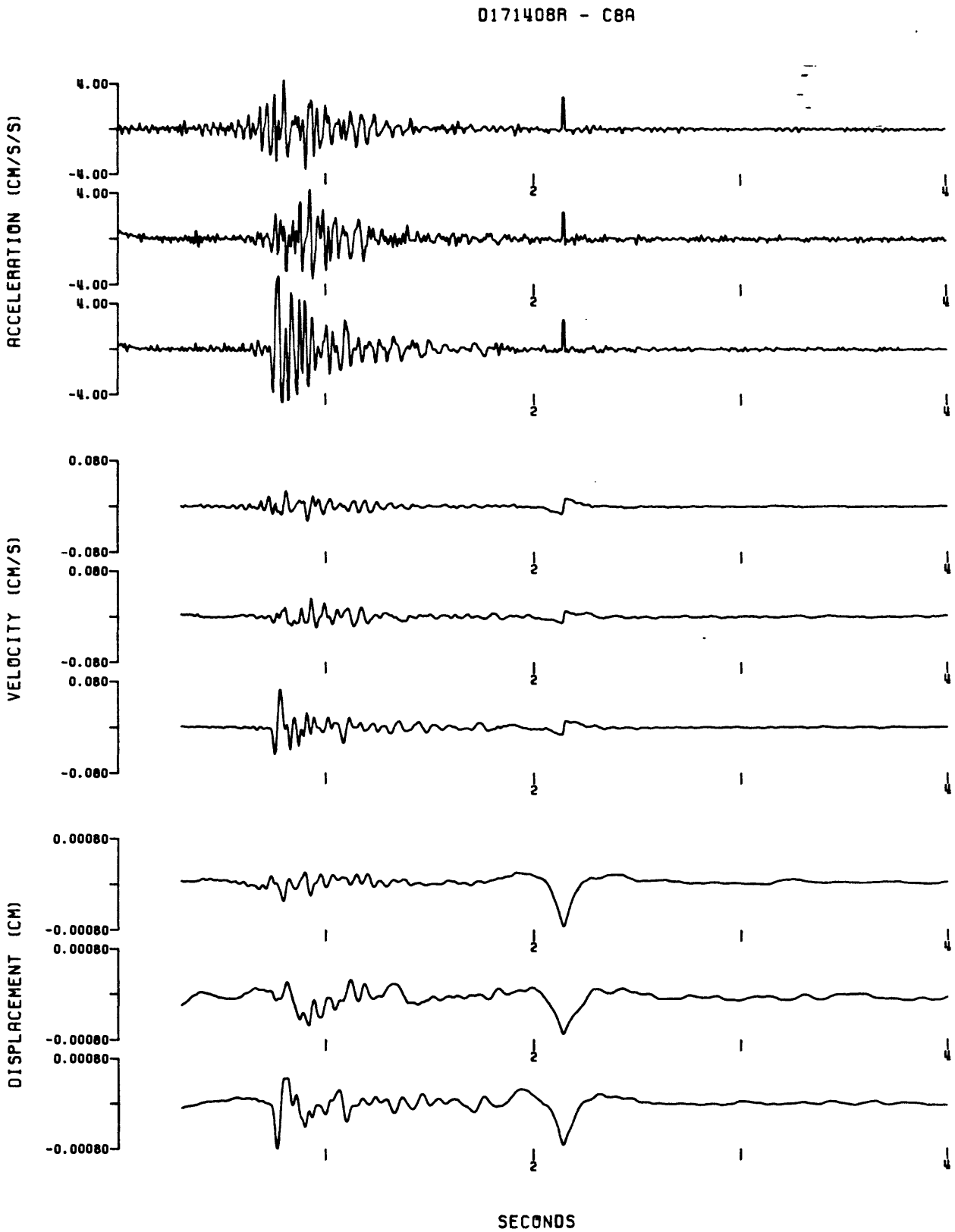
0171333T - C9V



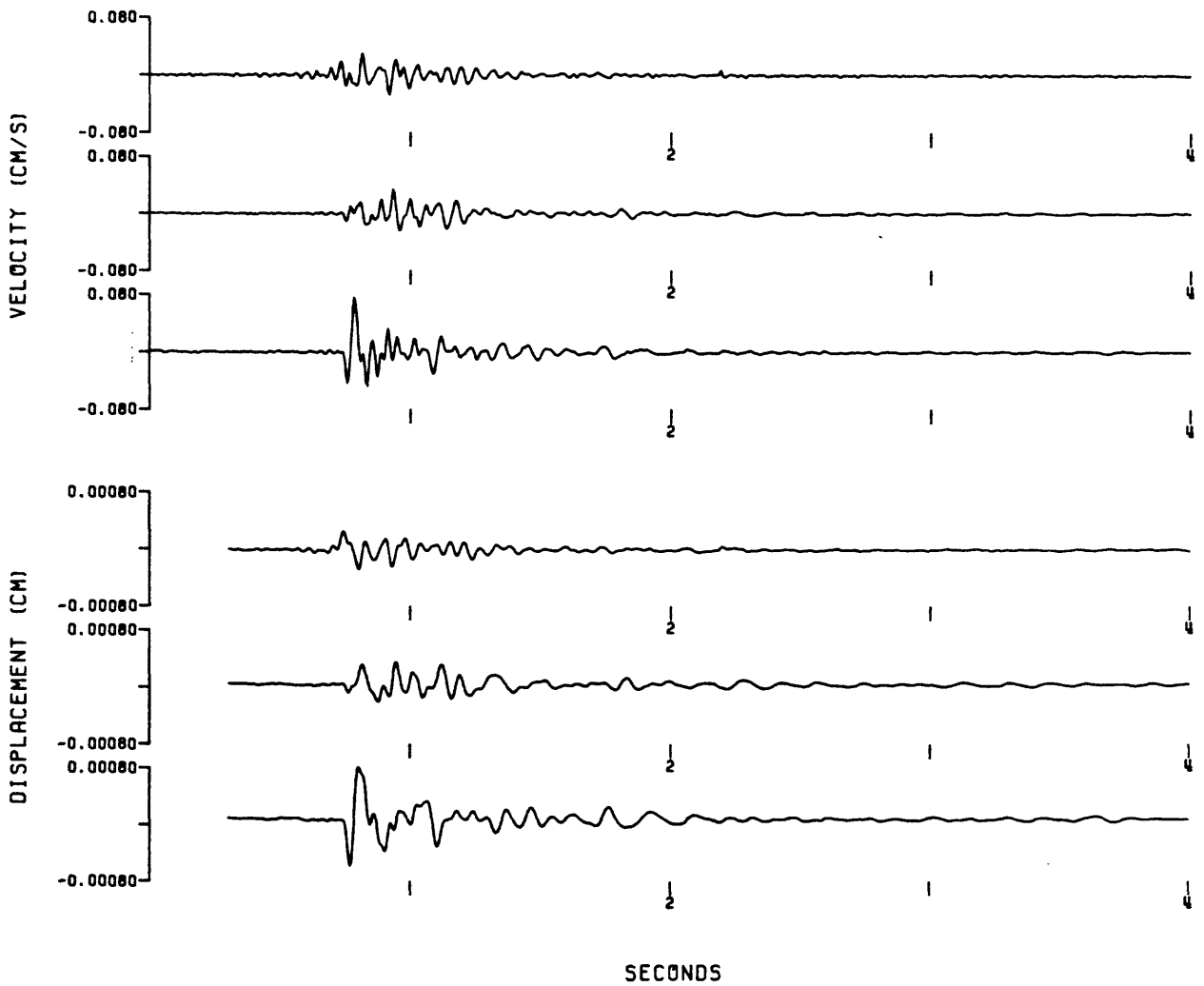

01714080 - C7A
ACCELERATION (CM/S/S)
15.0
-15.0
15.0
-15.0
15.0
-15.0
VELOCITY (CM/S)
0.080
-0.080
0.080
-0.080
0.080
-0.080
DISPLACEMENT (CM)
0.00080
-0.00080
0.00080
-0.00080
0.00080
-0.00080
1
2
4
SECONDS

01714080 - C7V

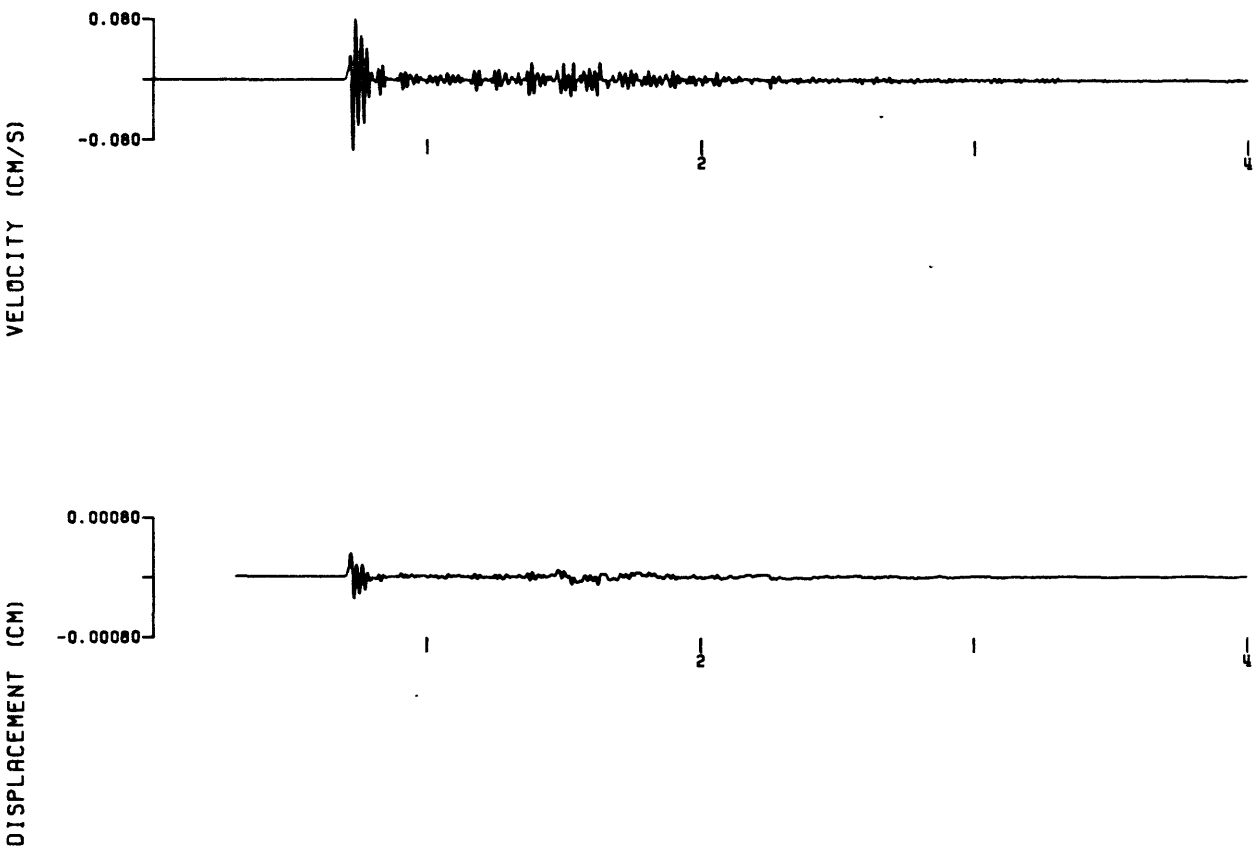


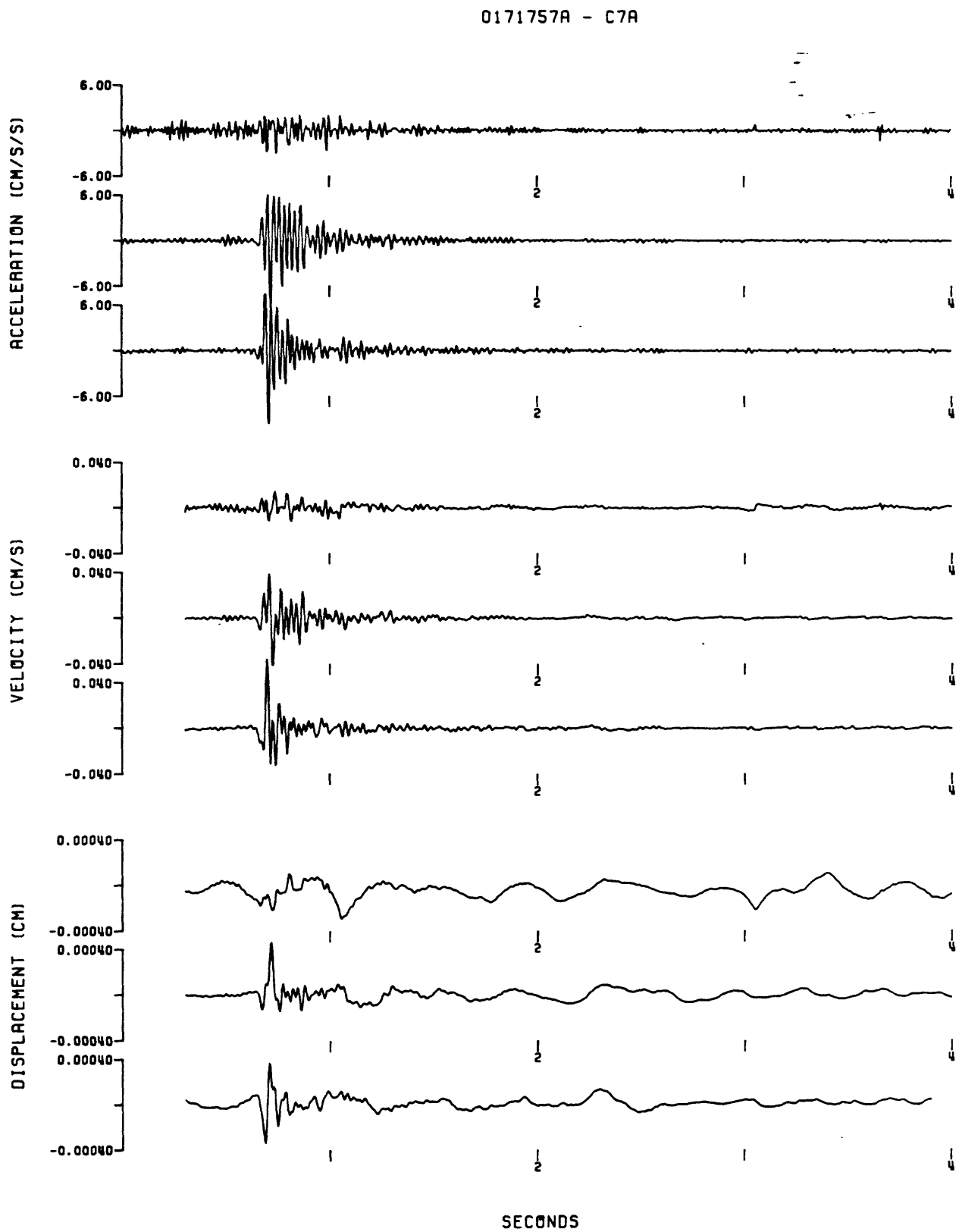

D171408R - C8A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.080
-0.080
DISPLACEMENT (CM)
0.00080
-0.00080
SECONDS

0171408R - C8V

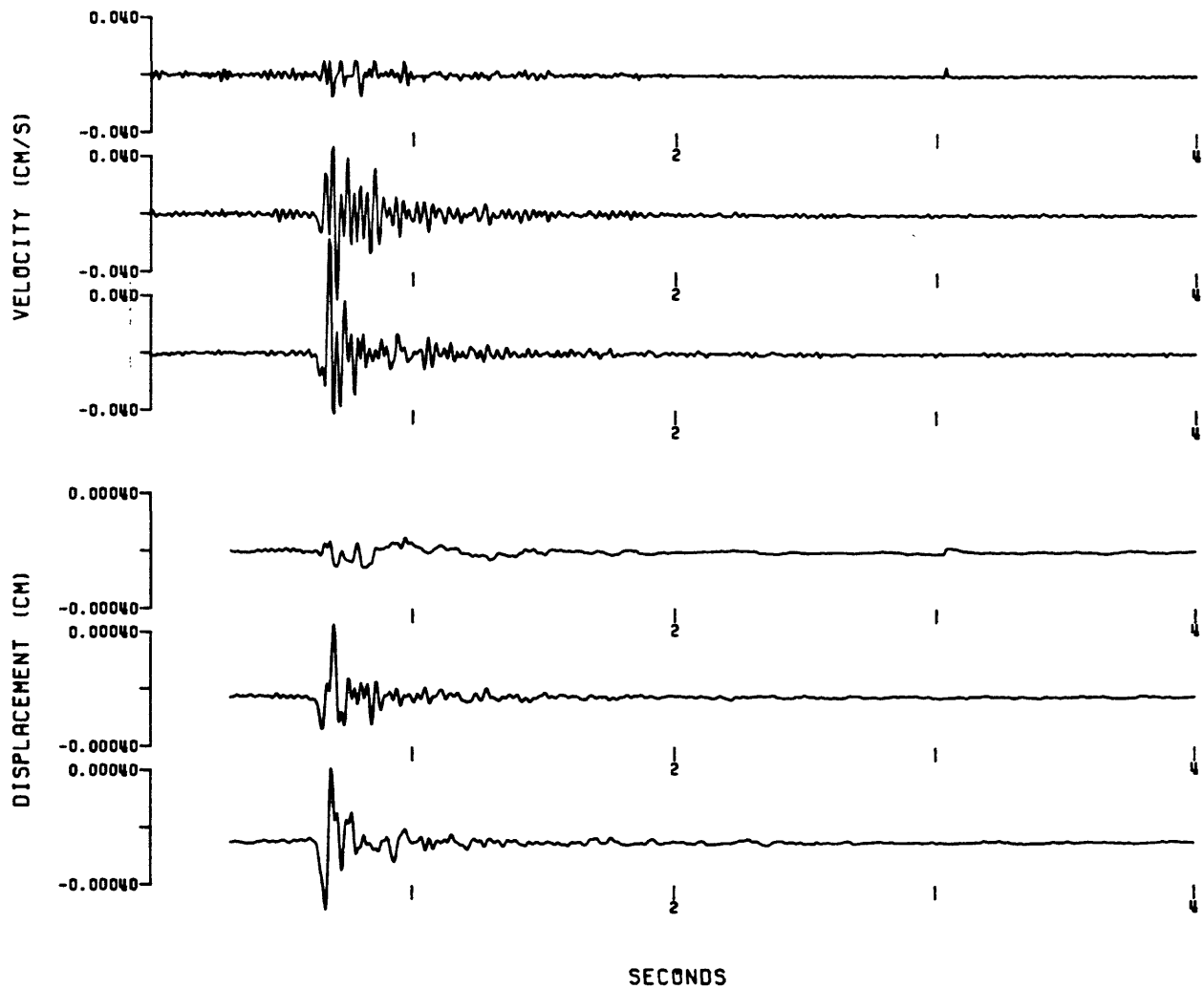


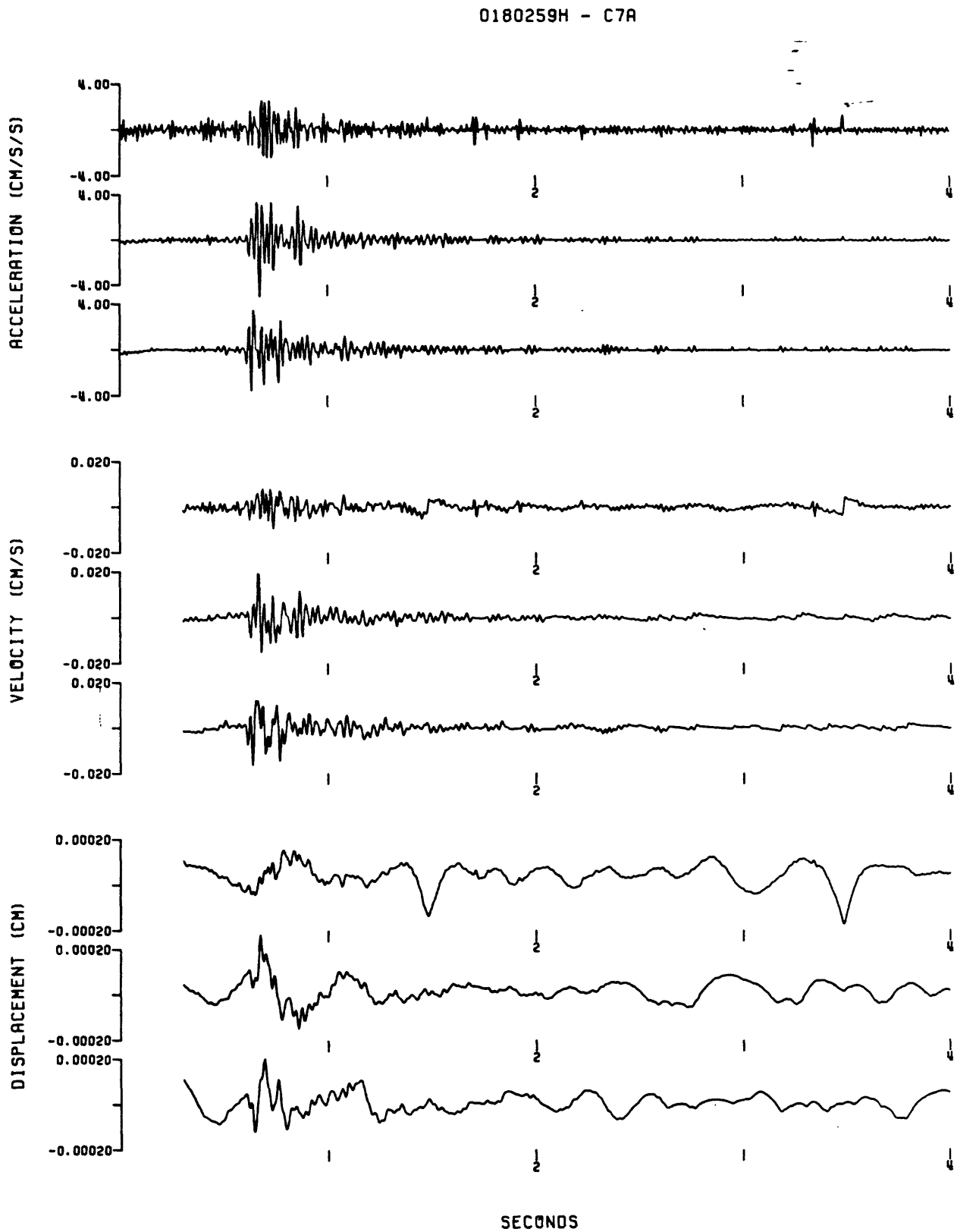
01714080 - C9V

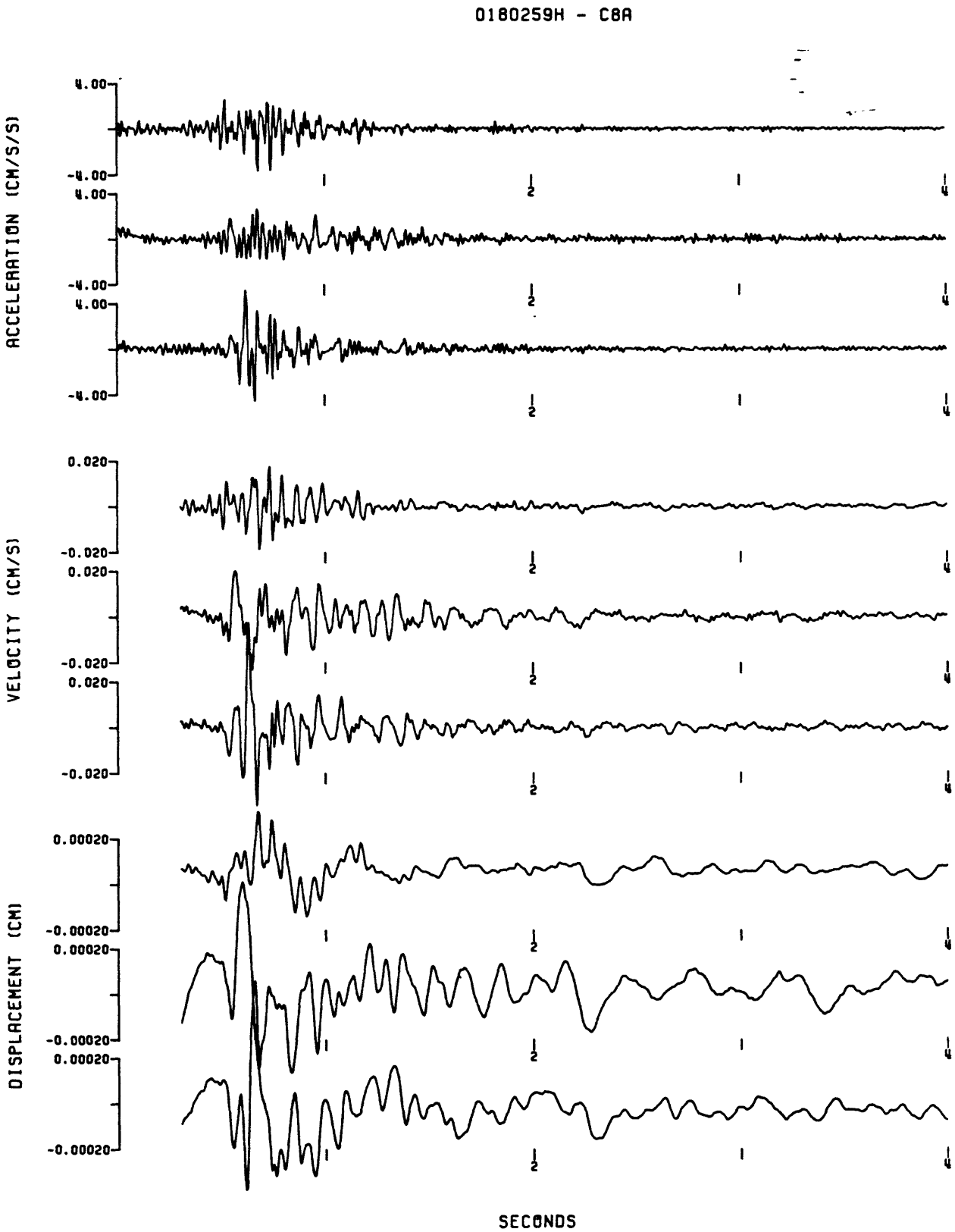


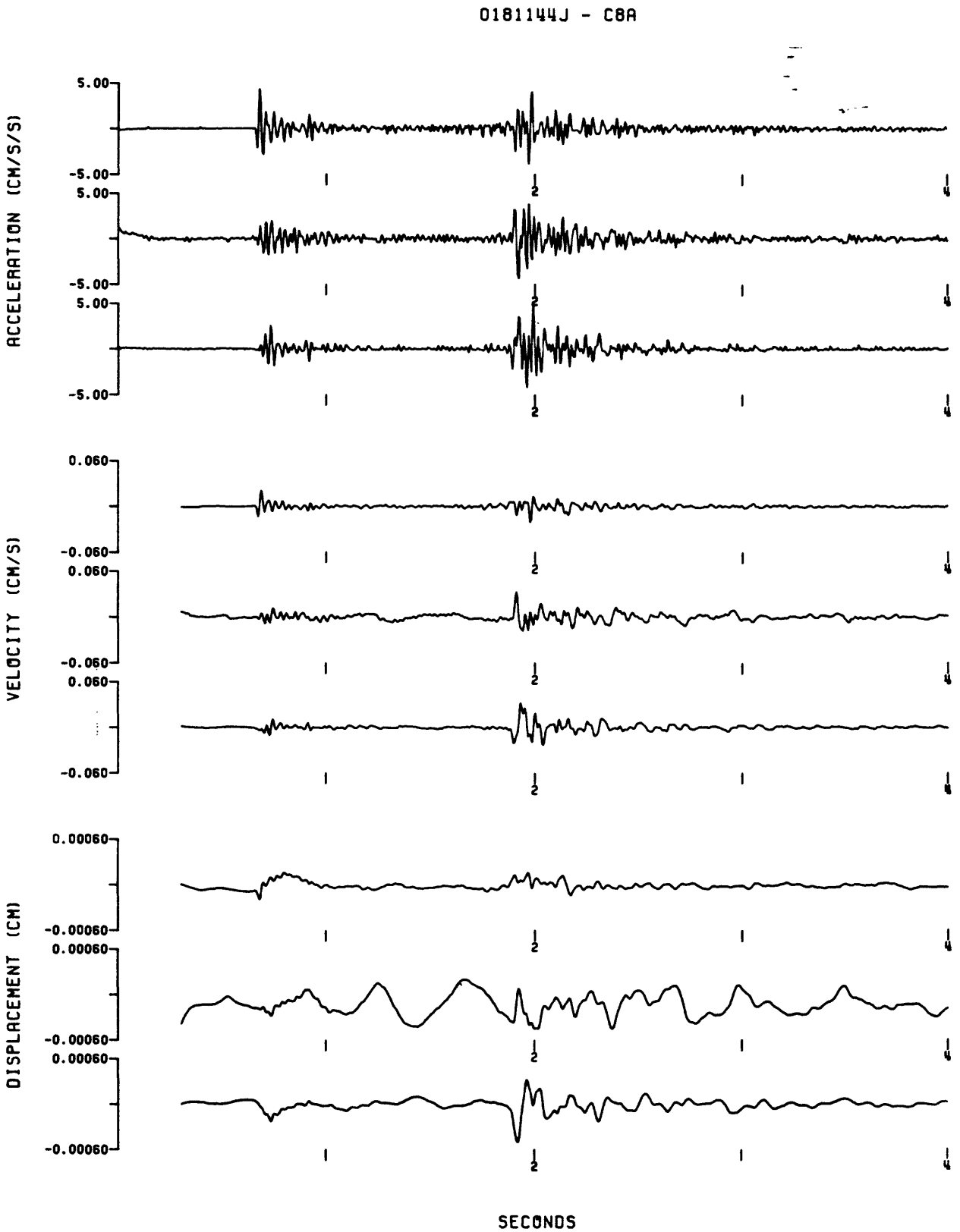

0171757A - C7A
ACCELERATION (CM/S/S)
6.00
-6.00
6.00
-6.00
6.00
-6.00
VELOCITY (CM/S)
0.040
-0.040
0.040
-0.040
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
0.00040
-0.00040
0.00040
-0.00040
SECONDS

0171757A - C7V

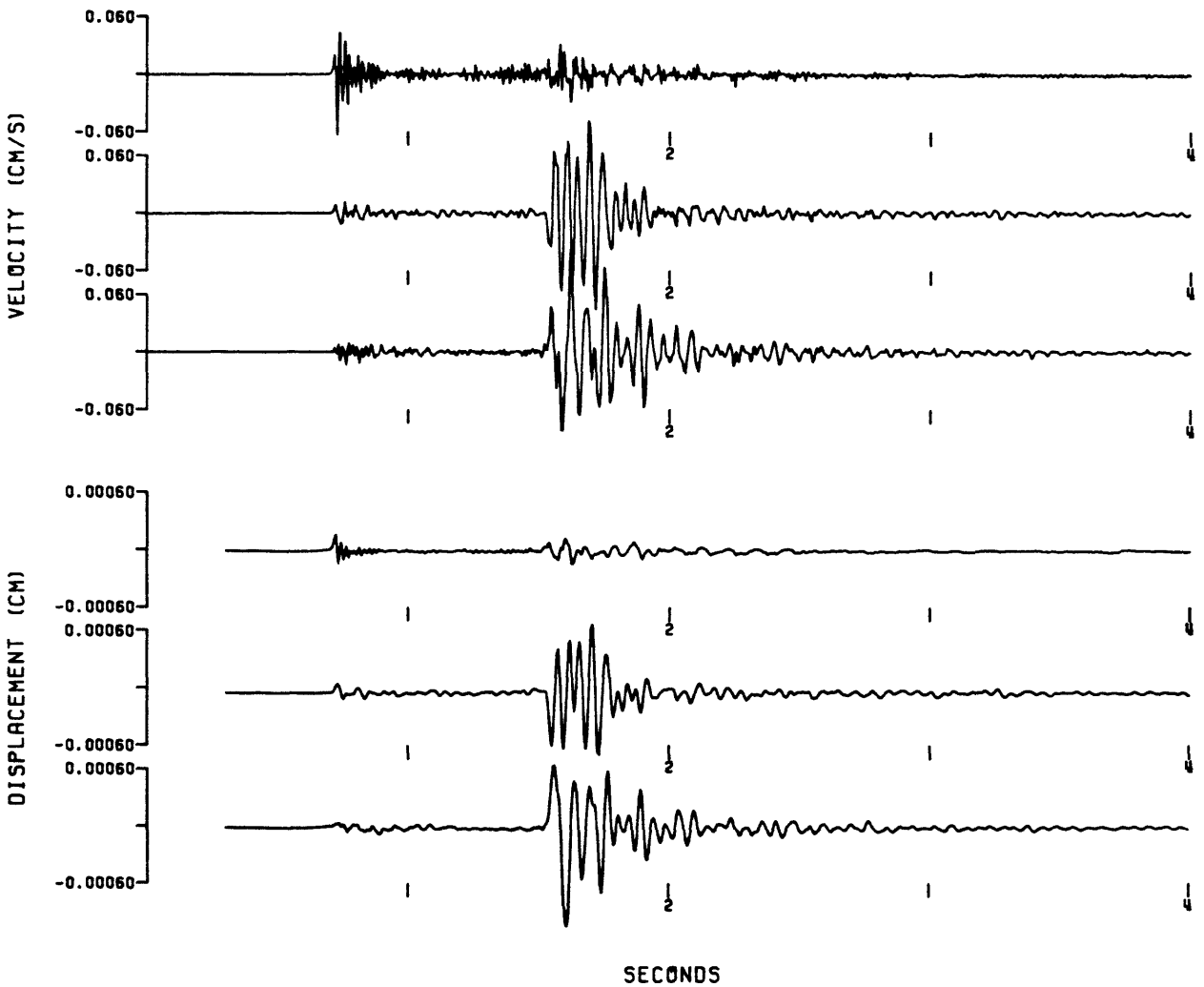


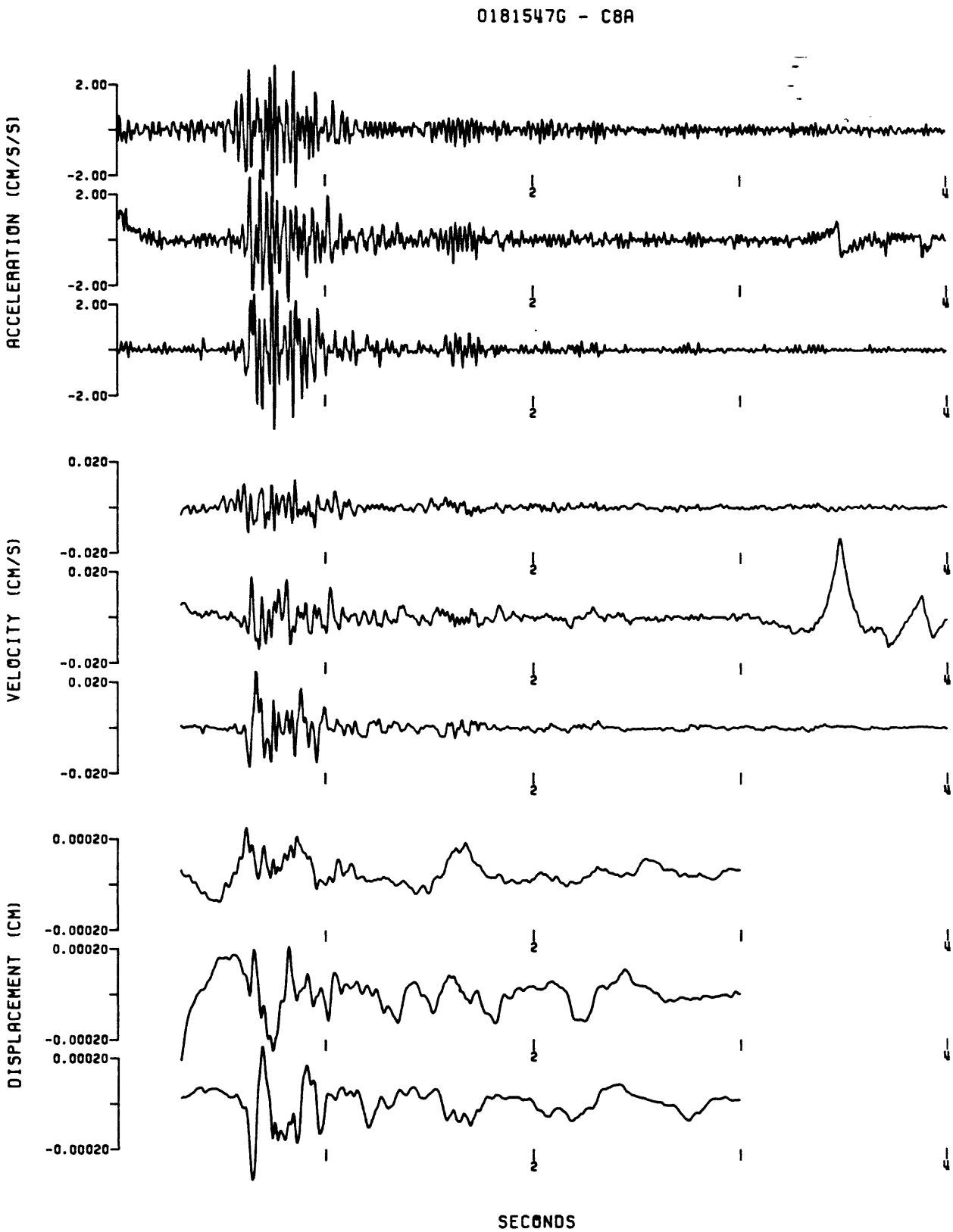

0180259H - C7A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS


0180259H - C8A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

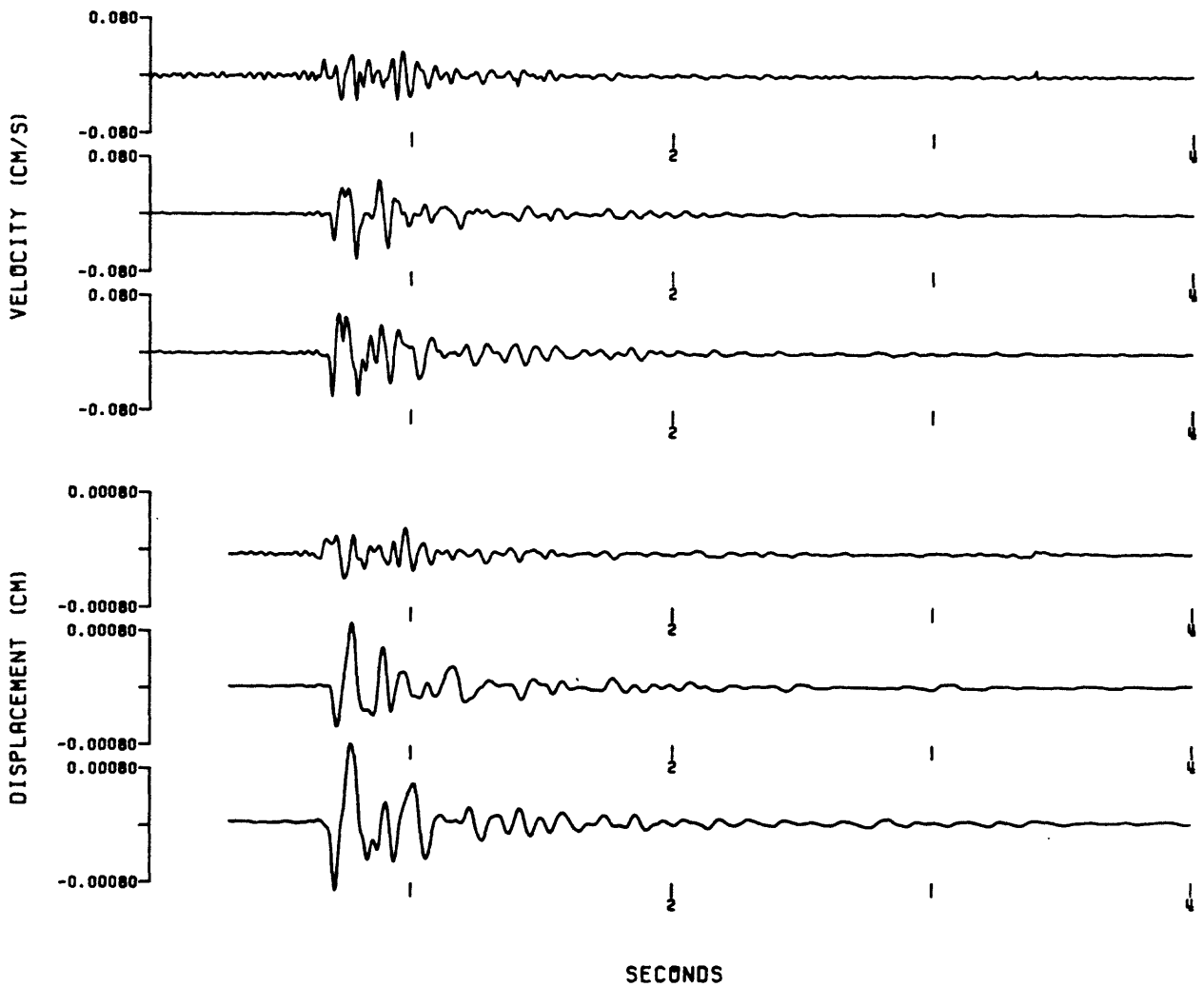

0181144J - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.060
-0.060
DISPLACEMENT (CM)
0.00060
-0.00060
SECONDS

0181144J - C9V

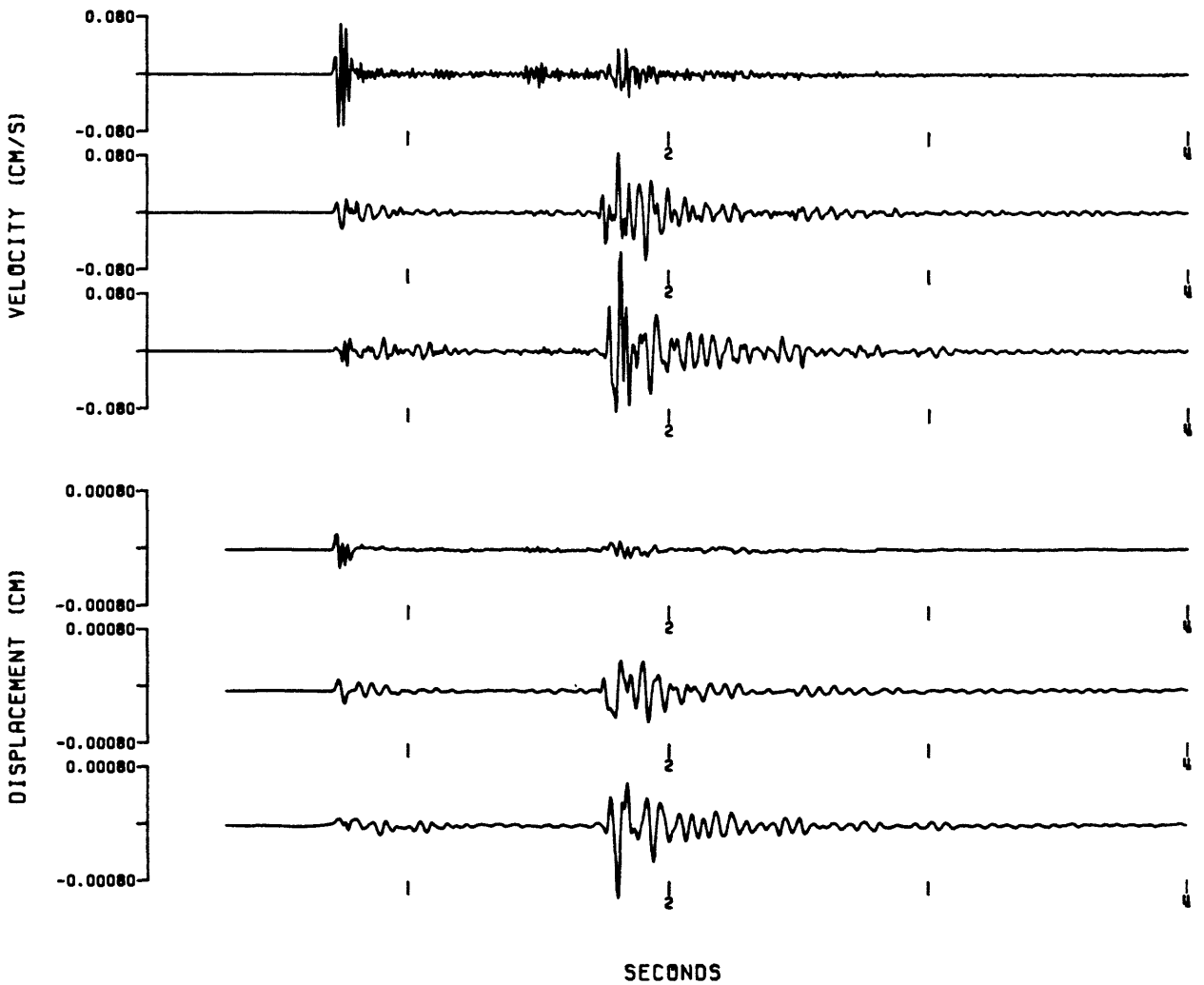


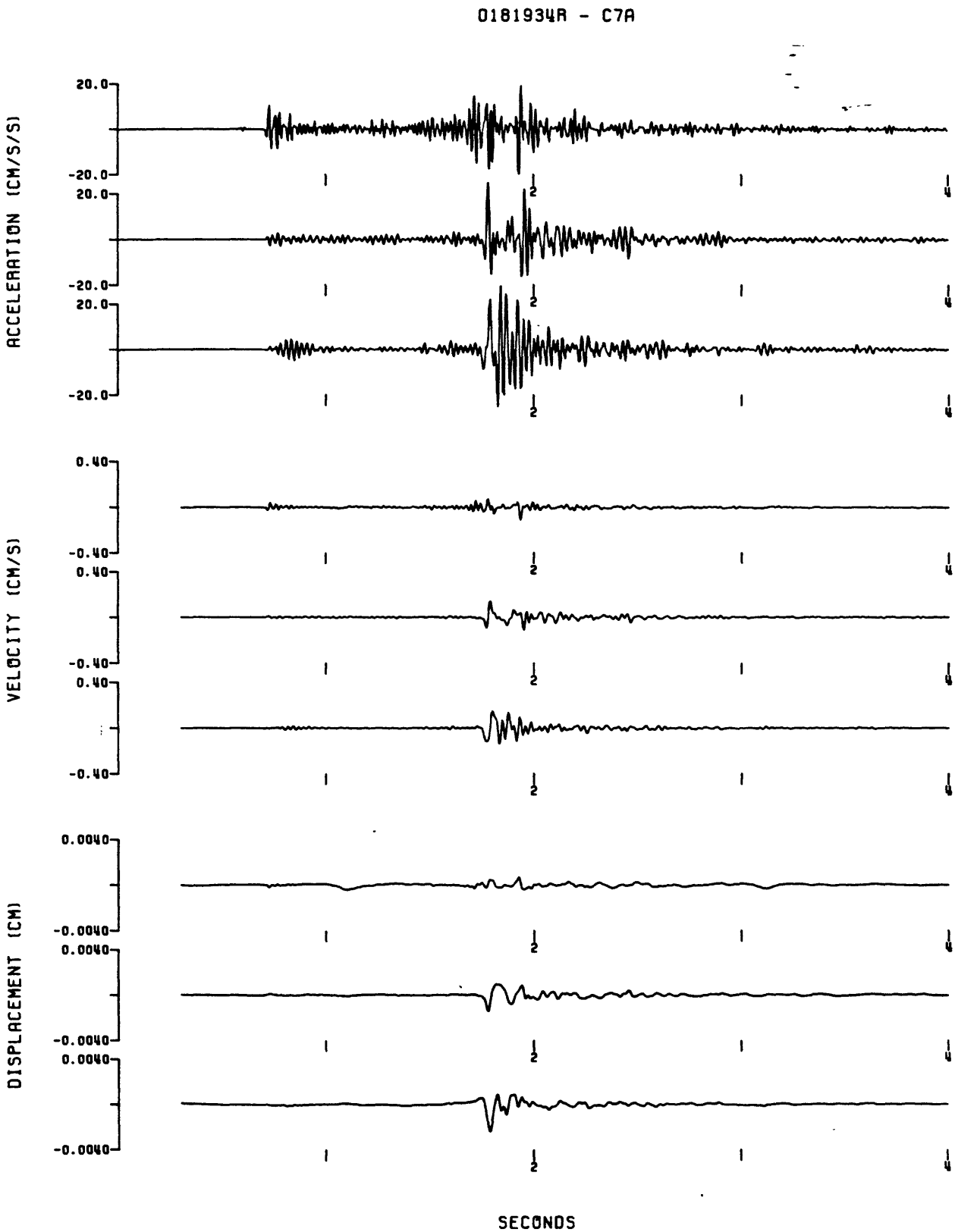

0181547G - C8A
ACCELERATION (CM/S/S)
2.00
-2.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

D181831S - C8V

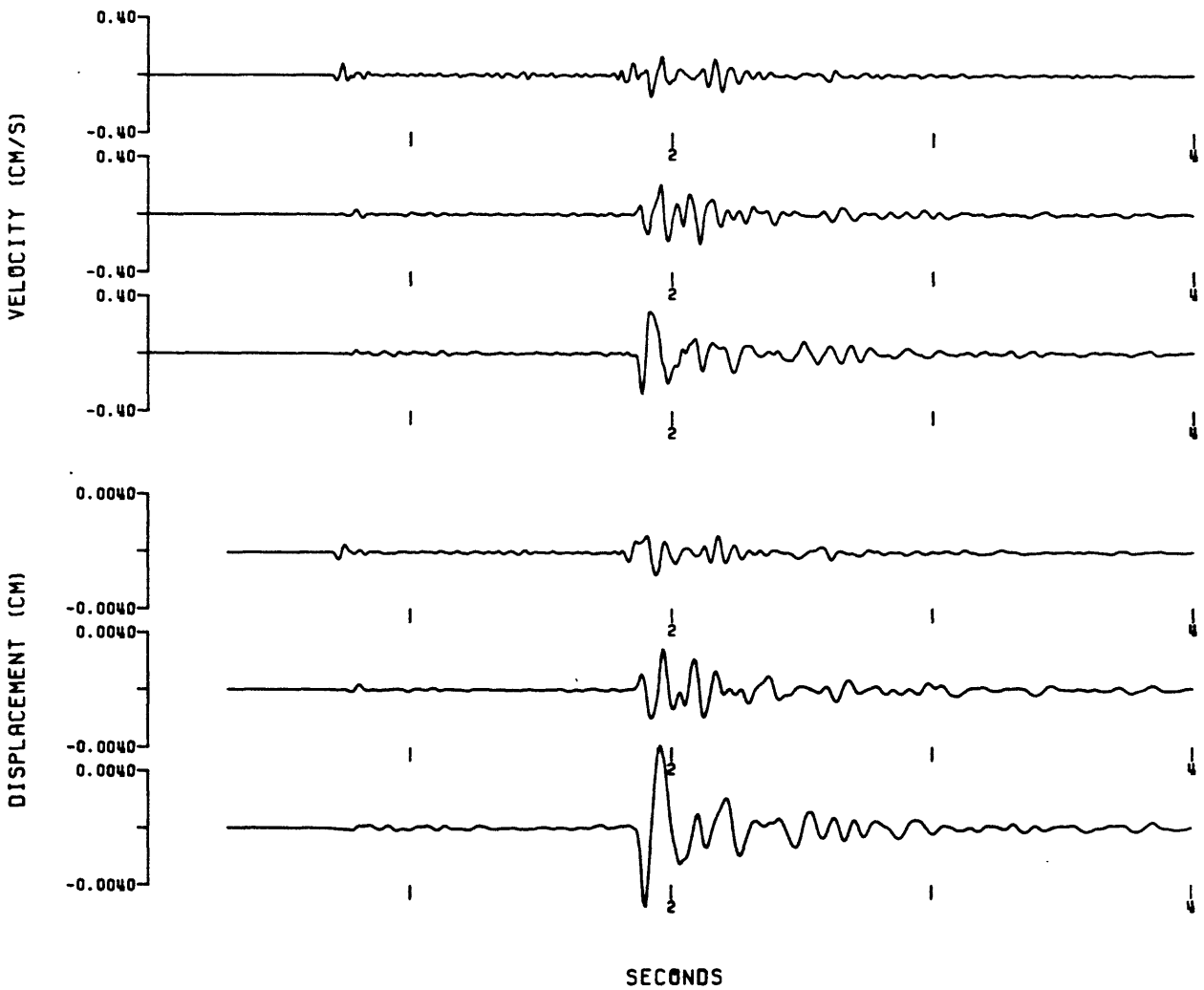


D181831R - C9V

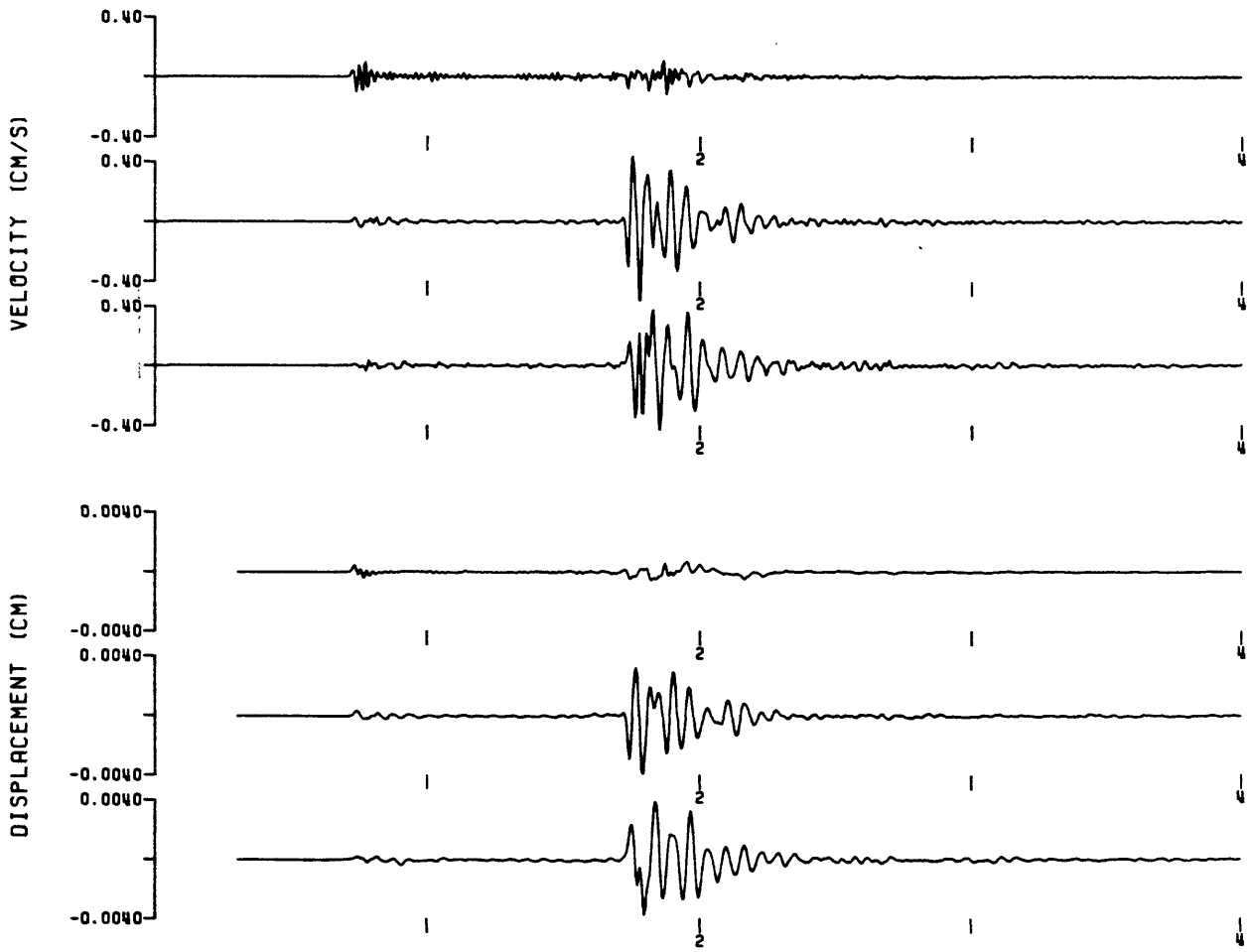


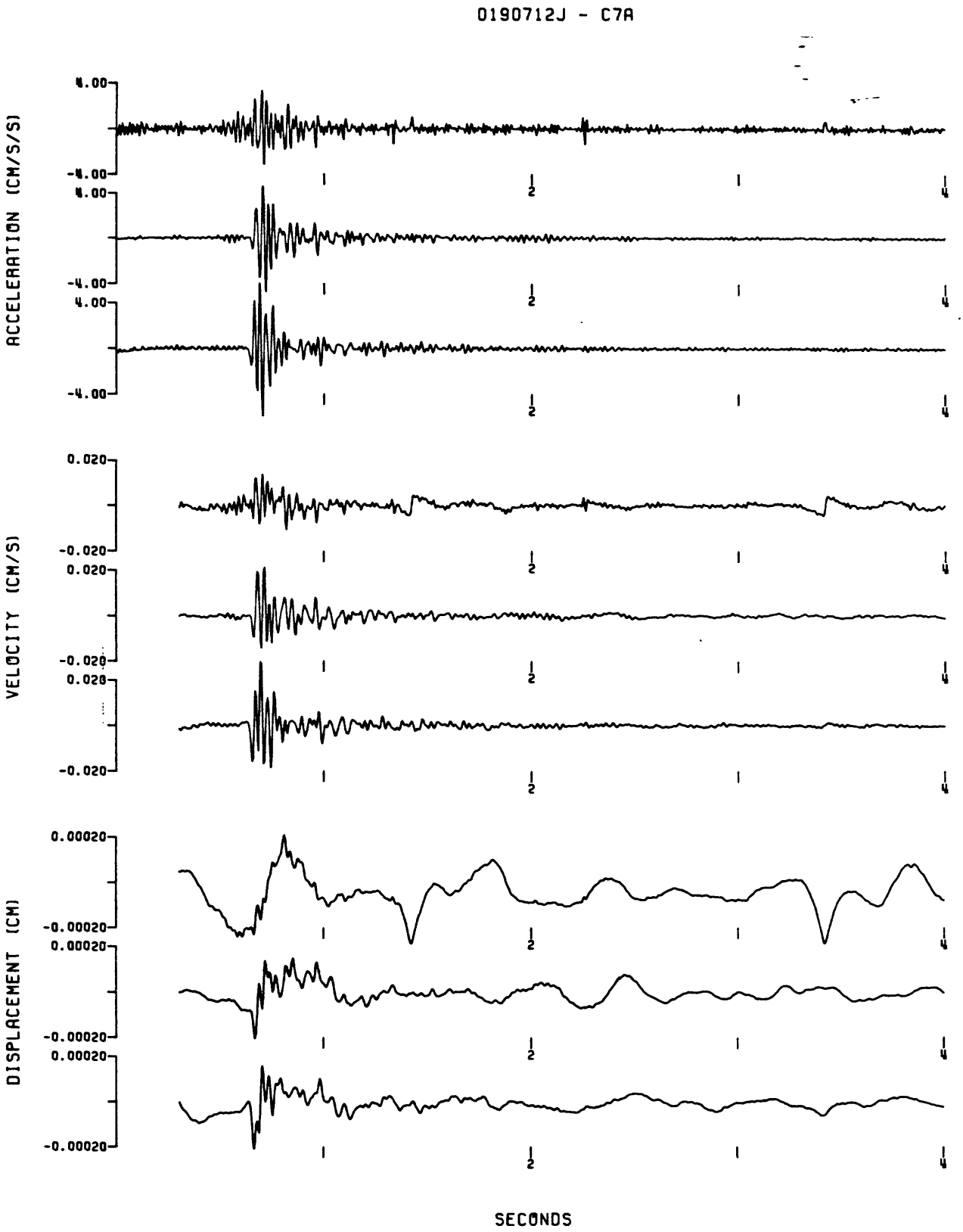

0181934R - C7A
ACCELERATION (CM/S/S)
20.0
-20.0
VELOCITY (CM/S)
0.40
-0.40
DISPLACEMENT (CM)
0.0040
-0.0040
1
1/2
1
1/4
SECONDS

0181934R - C8V

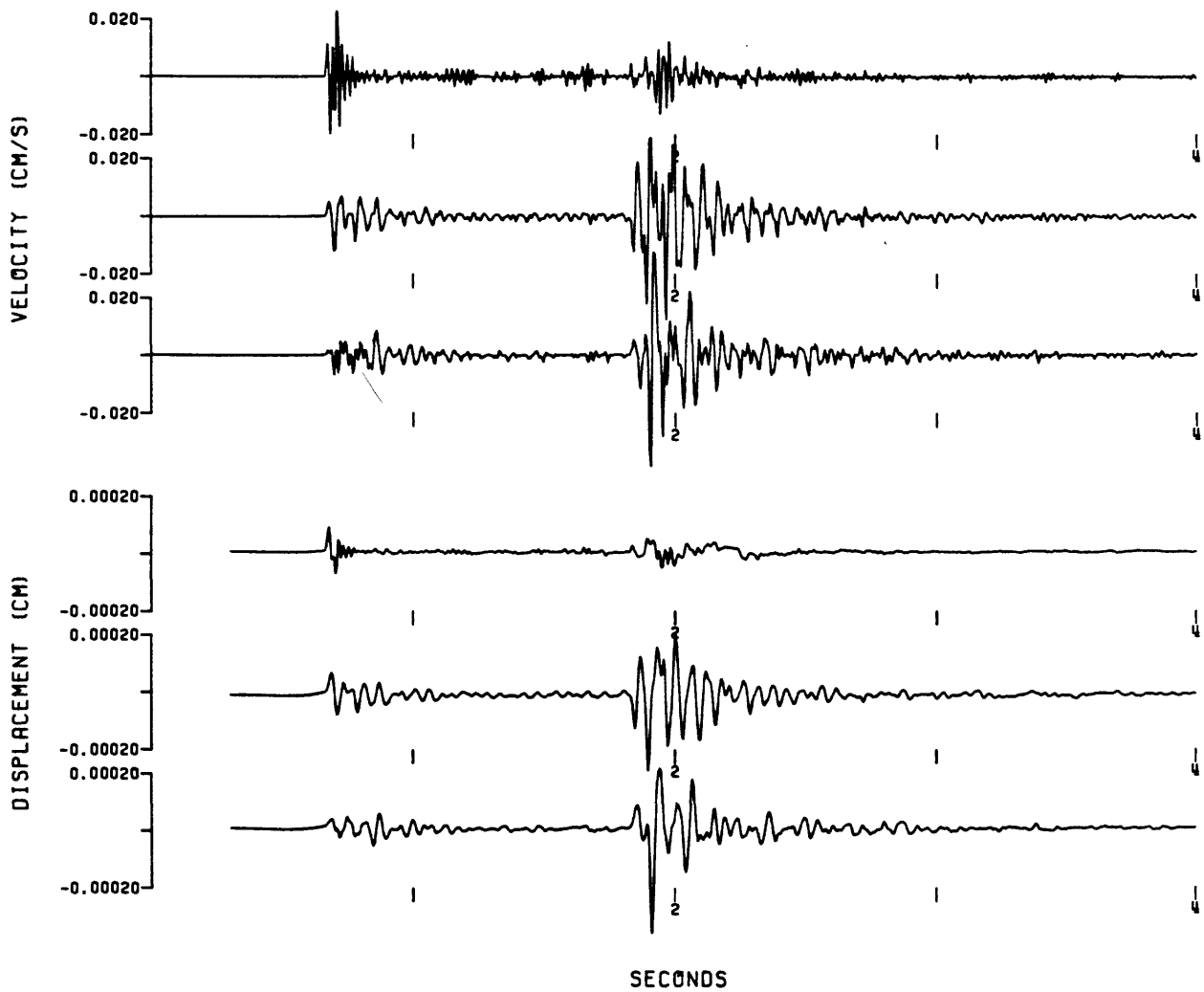


0181934R - C9V

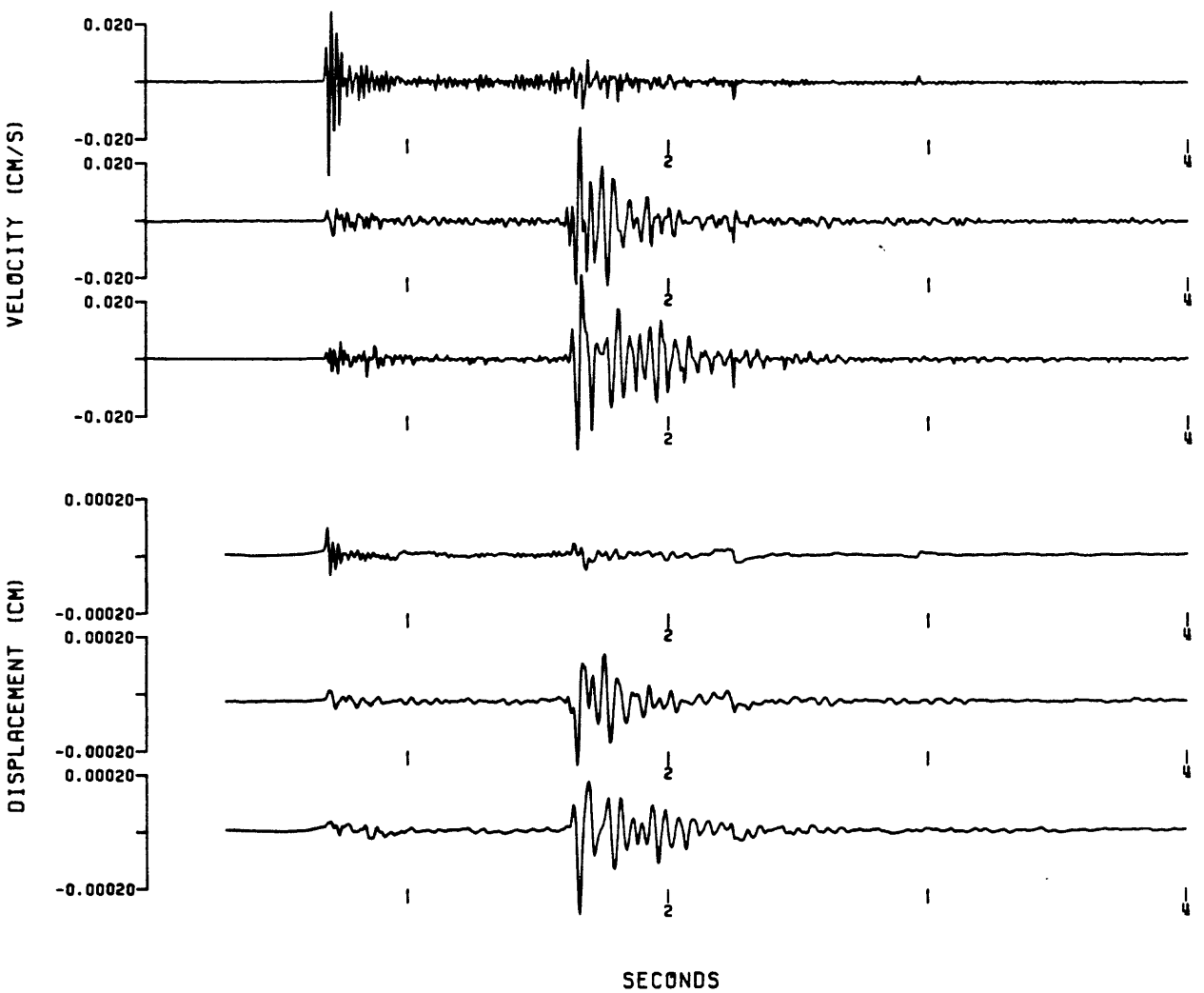


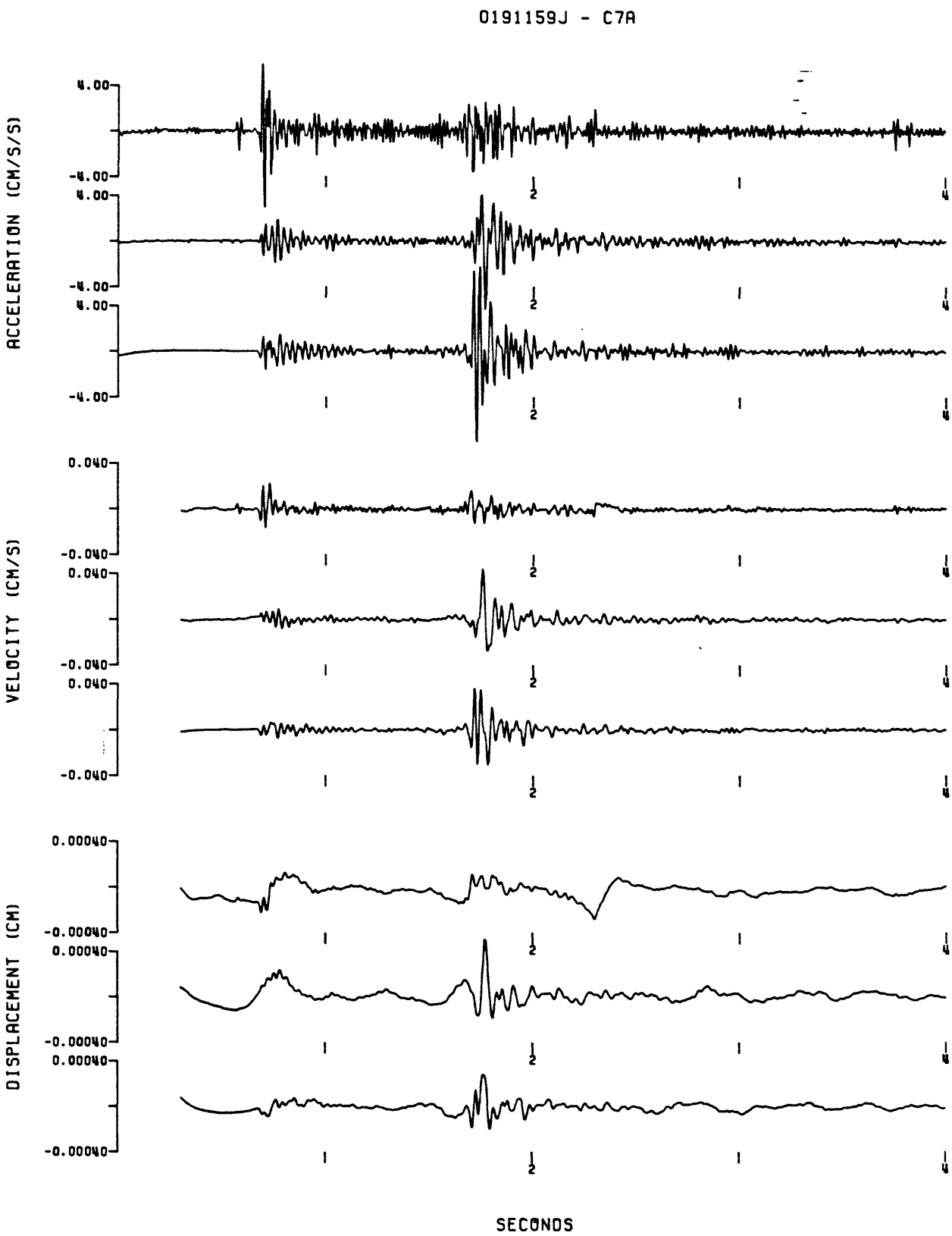

0190712J - C7A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

0190712J - C9V

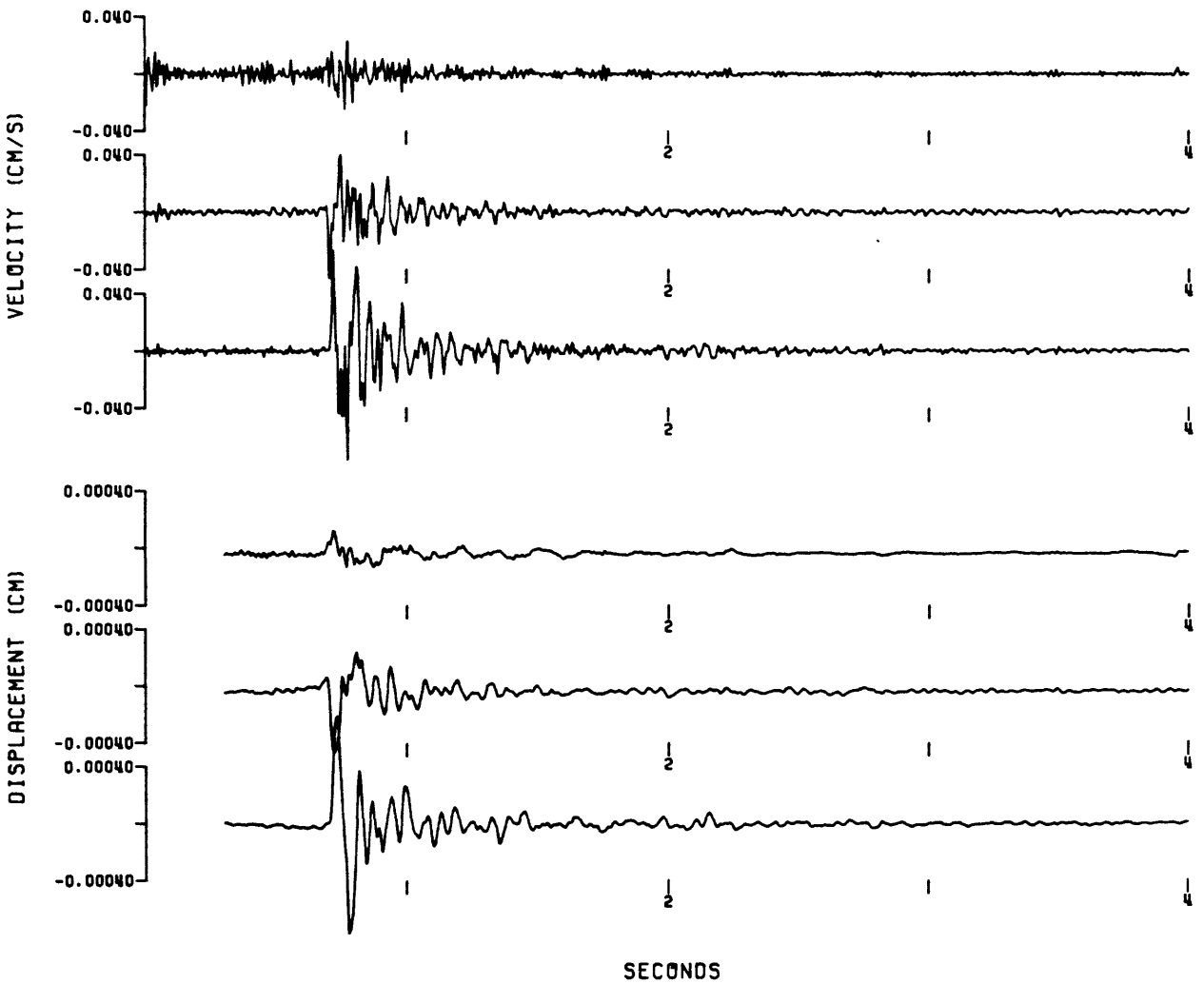


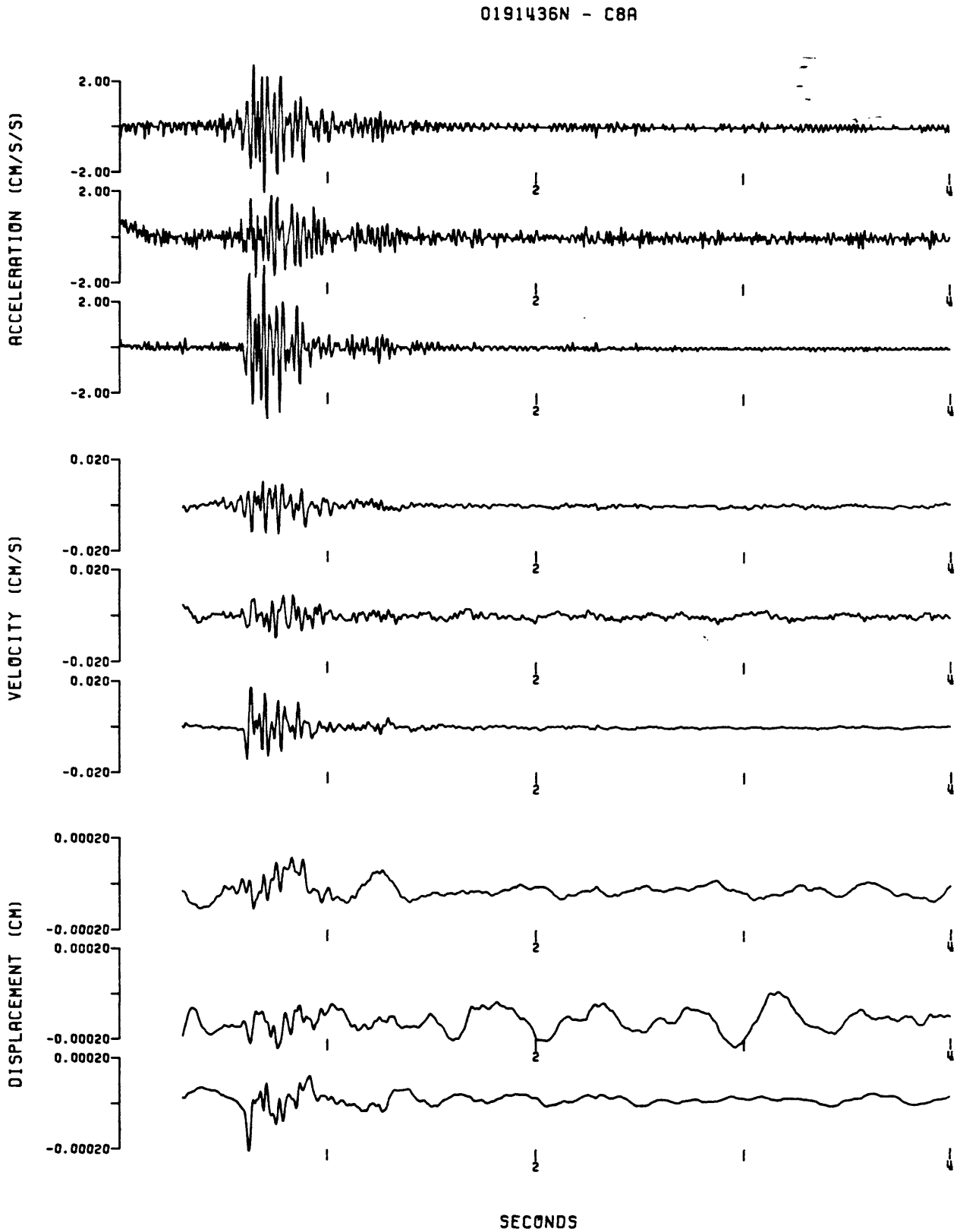
D191018R - C9V



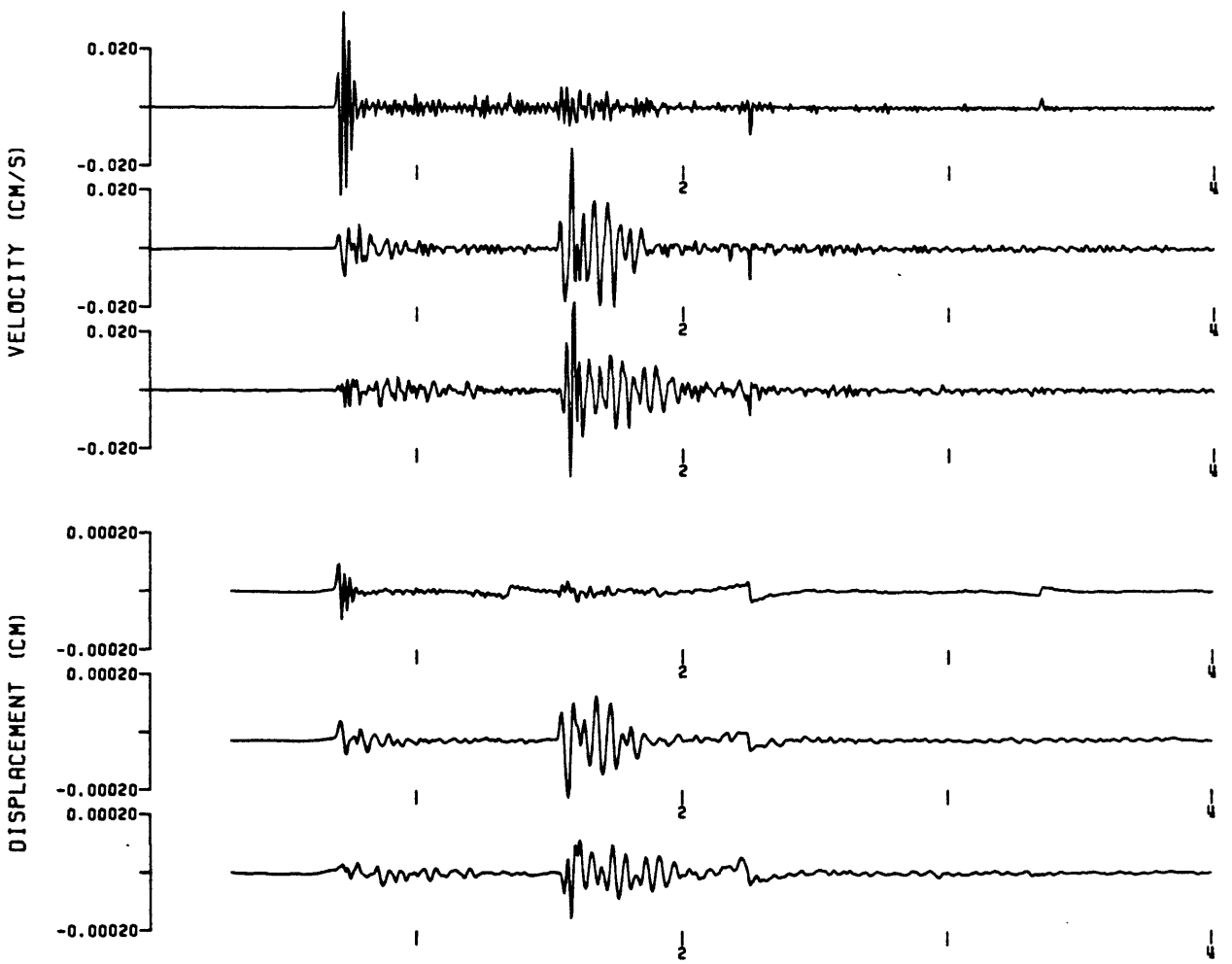

0191159J - C7A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

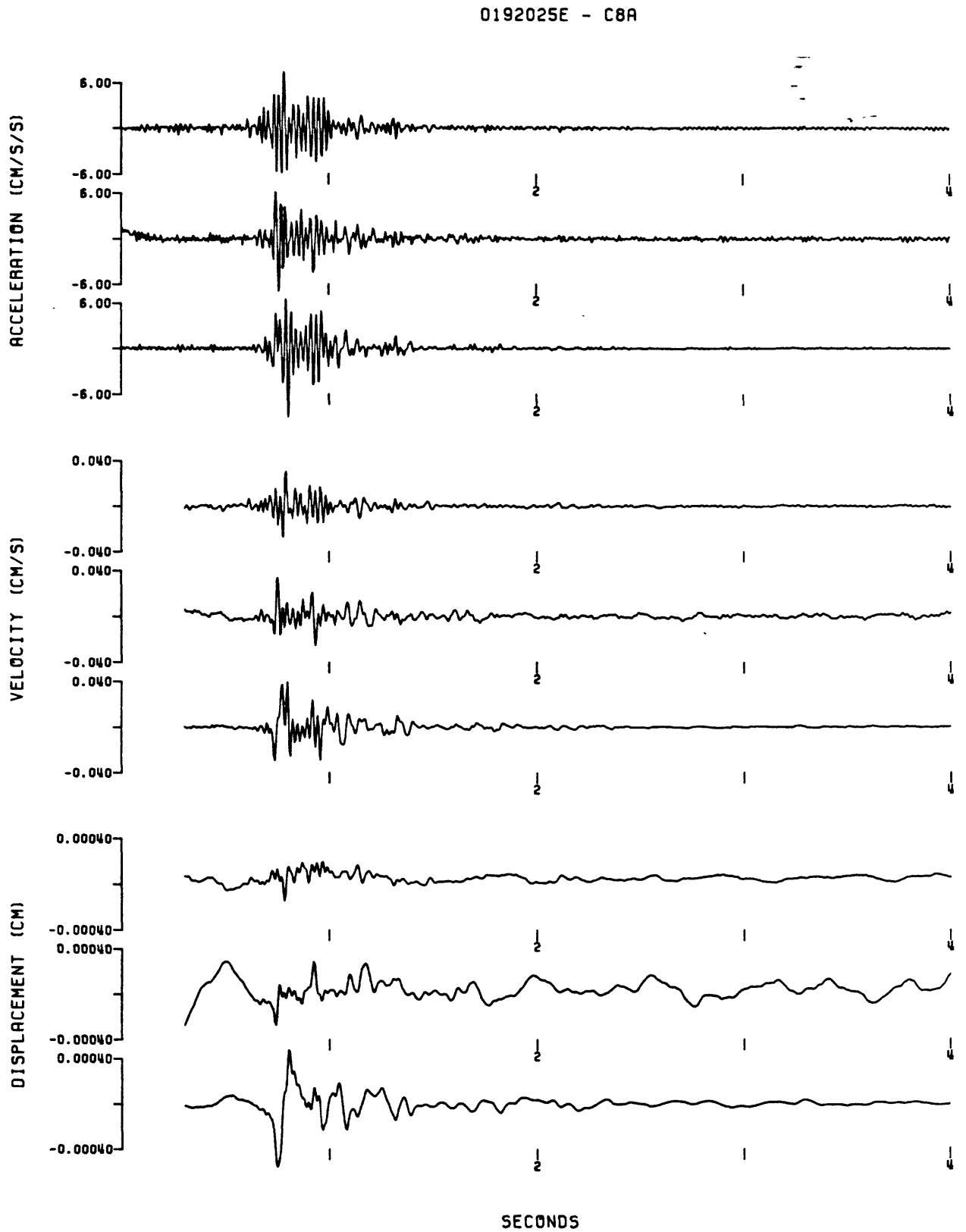
0191159J - C9V



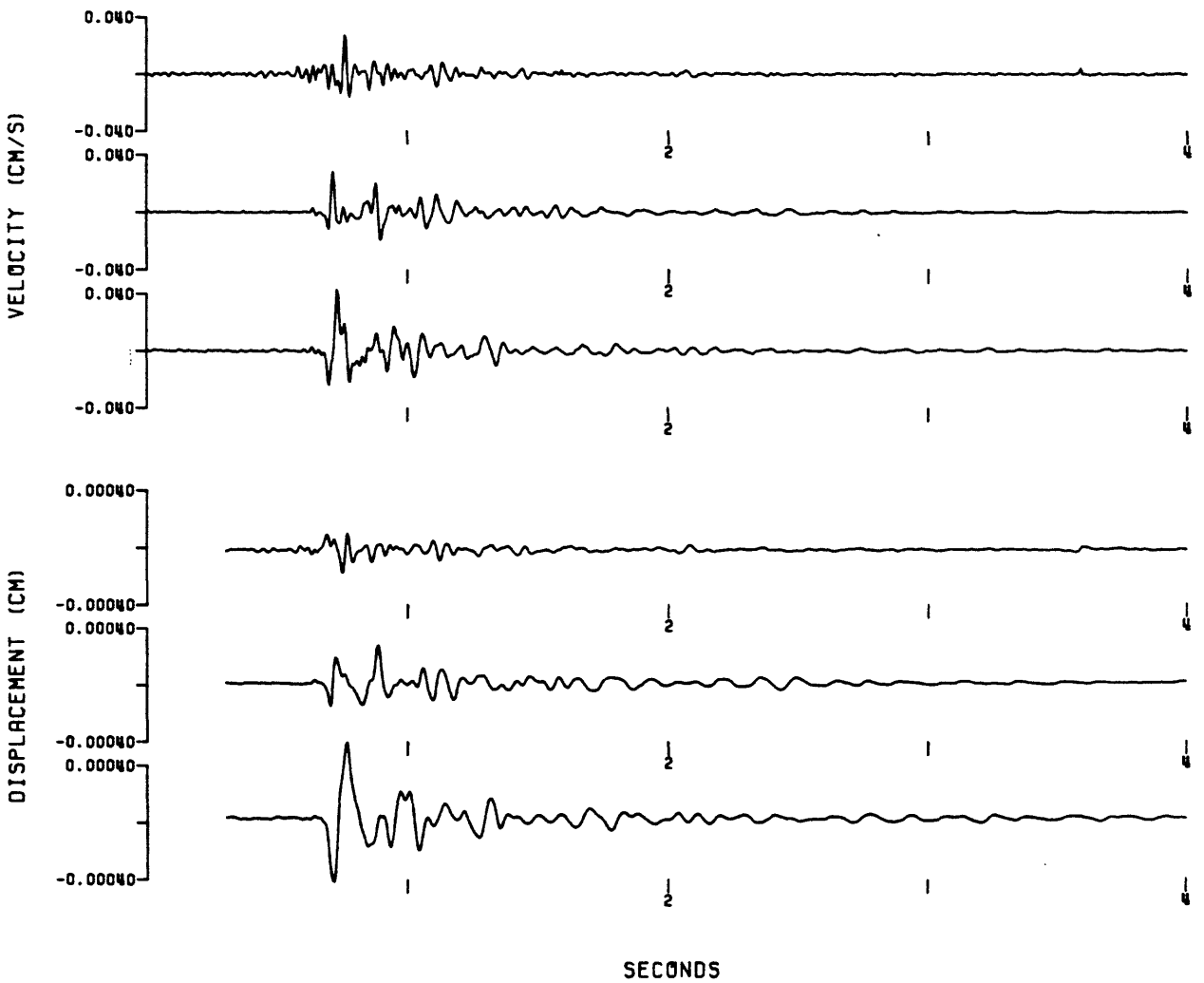

0191436N - C8A
ACCELERATION (CM/S/S)
2.00
-2.00
2.00
-2.00
2.00
-2.00
VELOCITY (CM/S)
0.020
-0.020
0.020
-0.020
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
0.00020
-0.00020
0.00020
-0.00020
1
2
1
2
SECONDS

0191436M - C9V

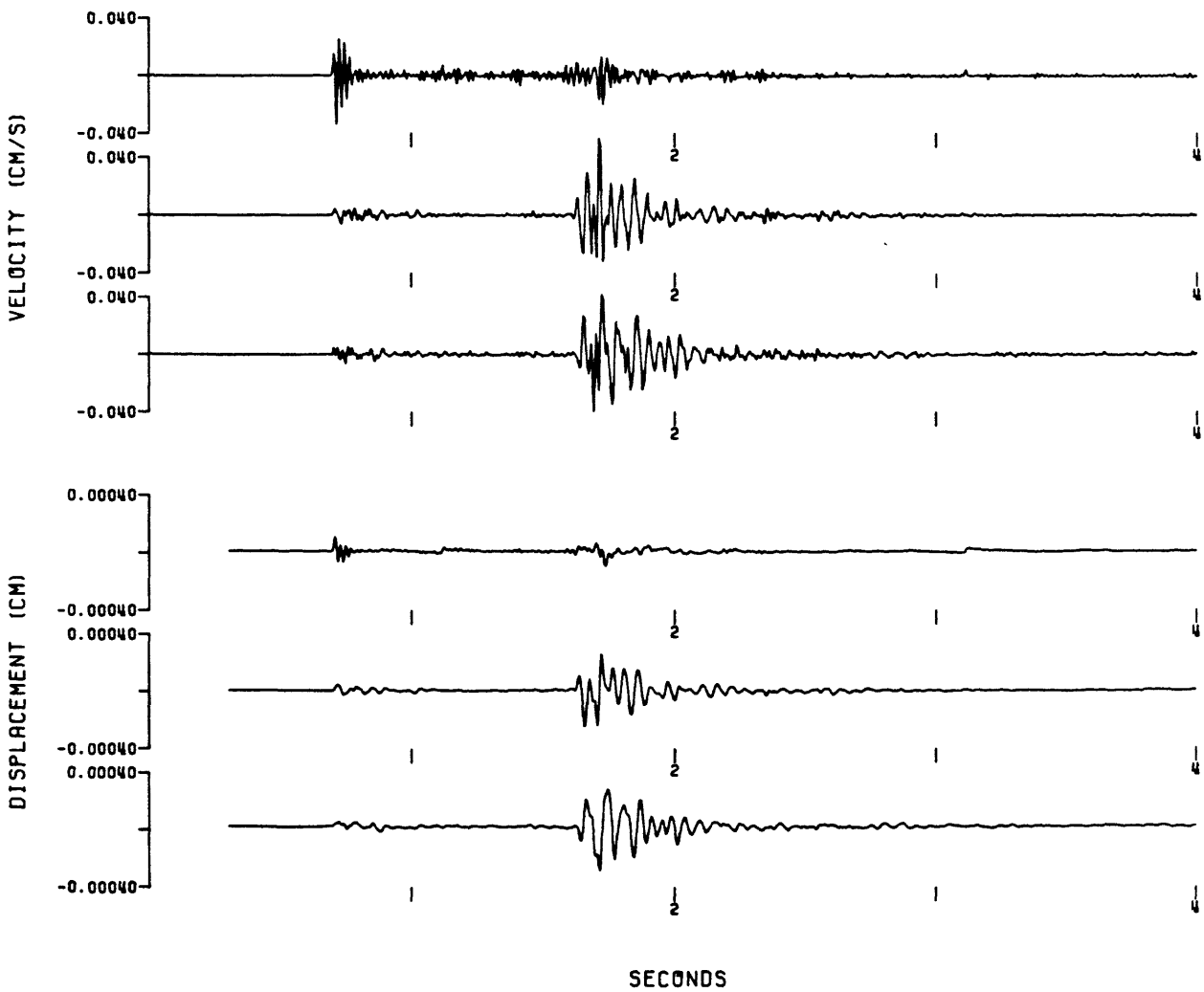



0192025E - C8A
ACCELERATION (CM/S/S)
6.00
-6.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

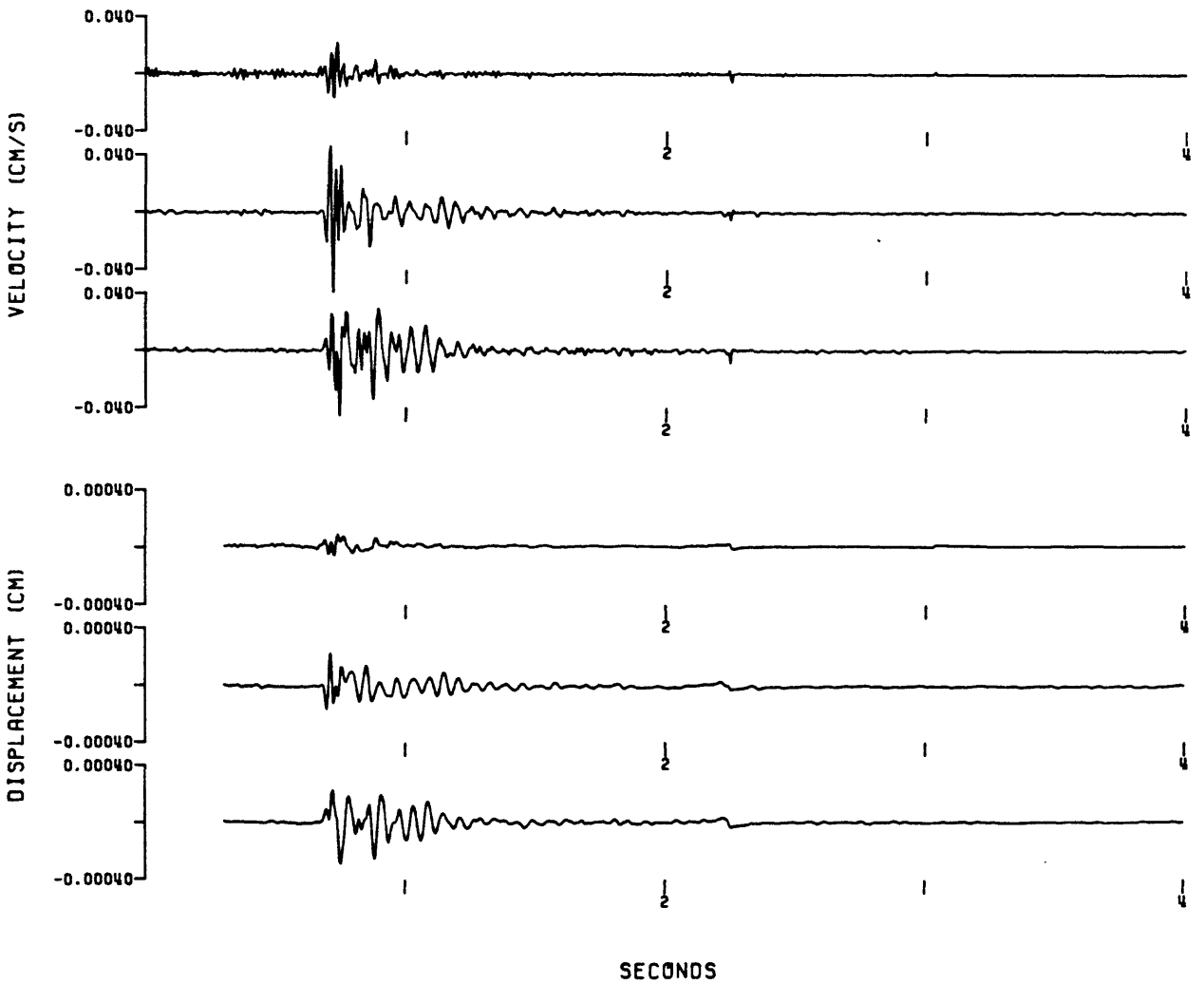
0192025E - C8V

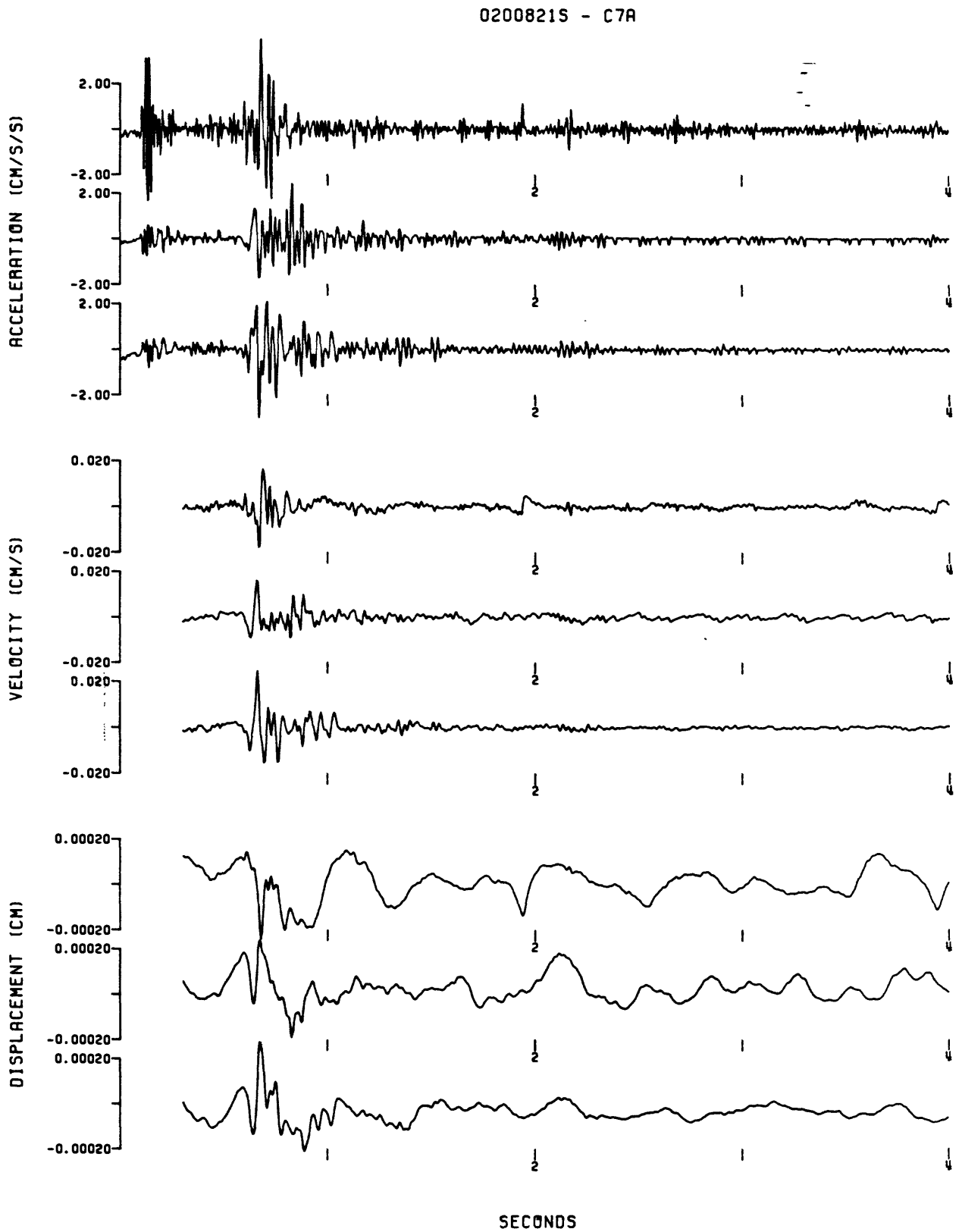


0192025D - C9V

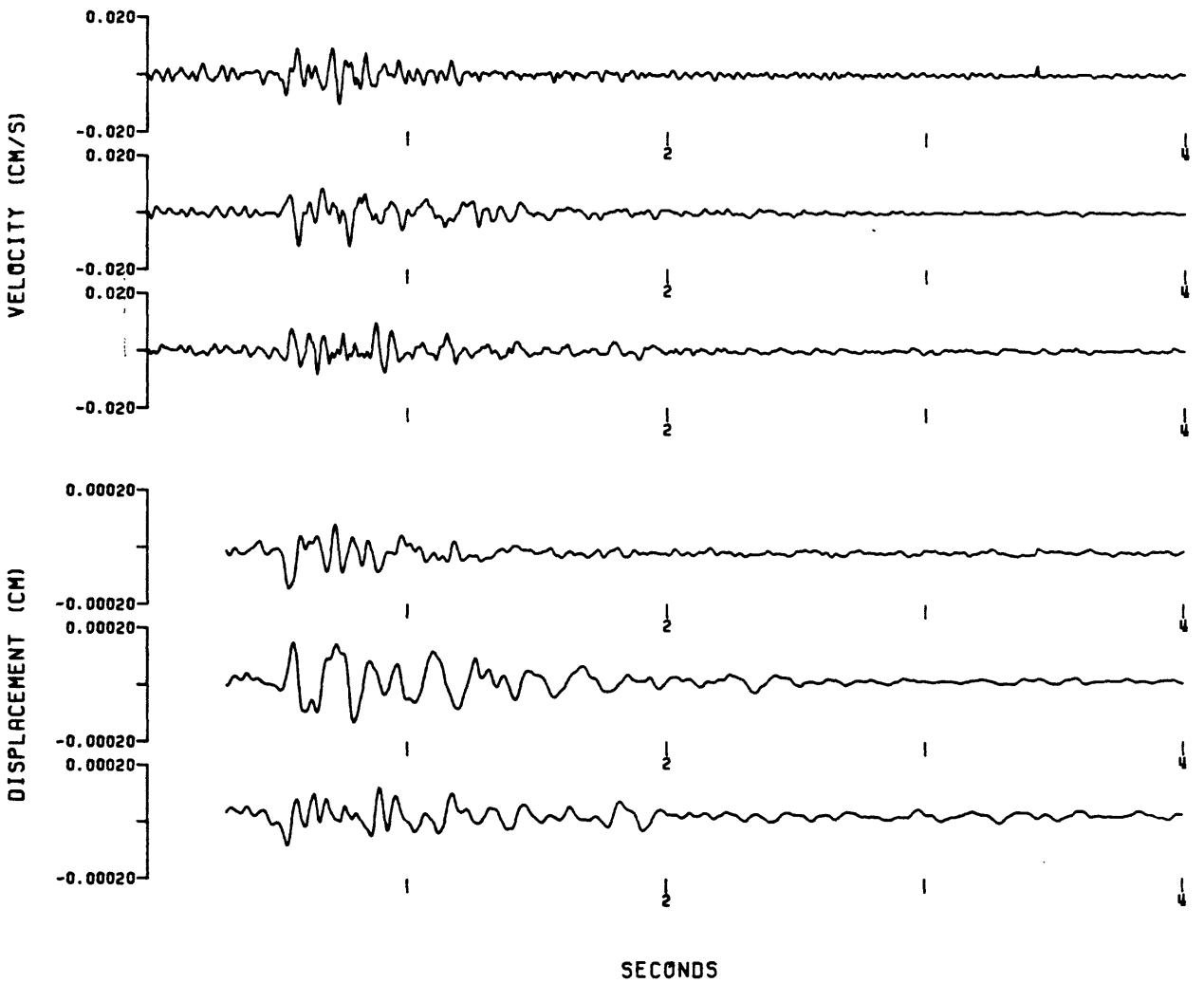


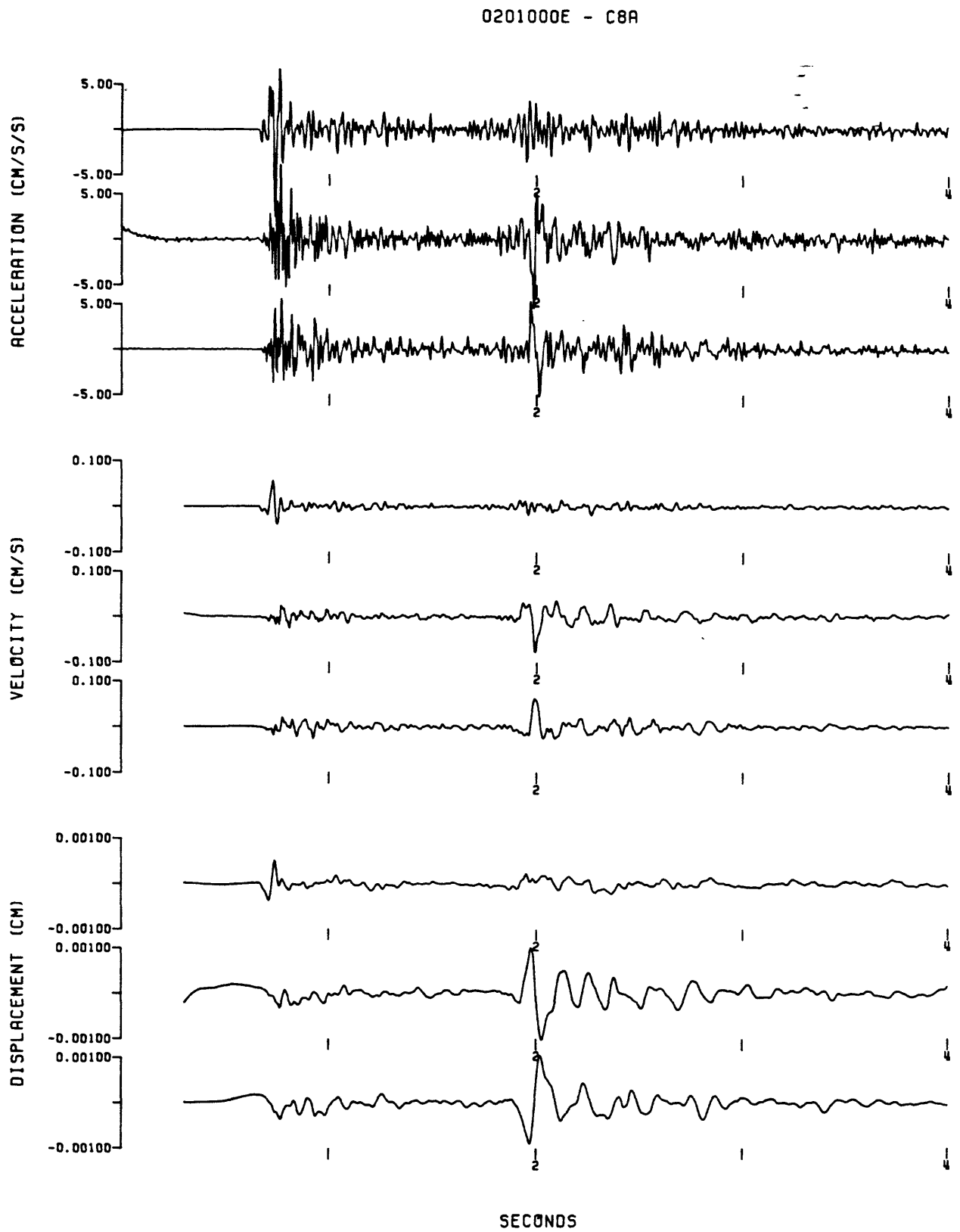
0200630R - C9V



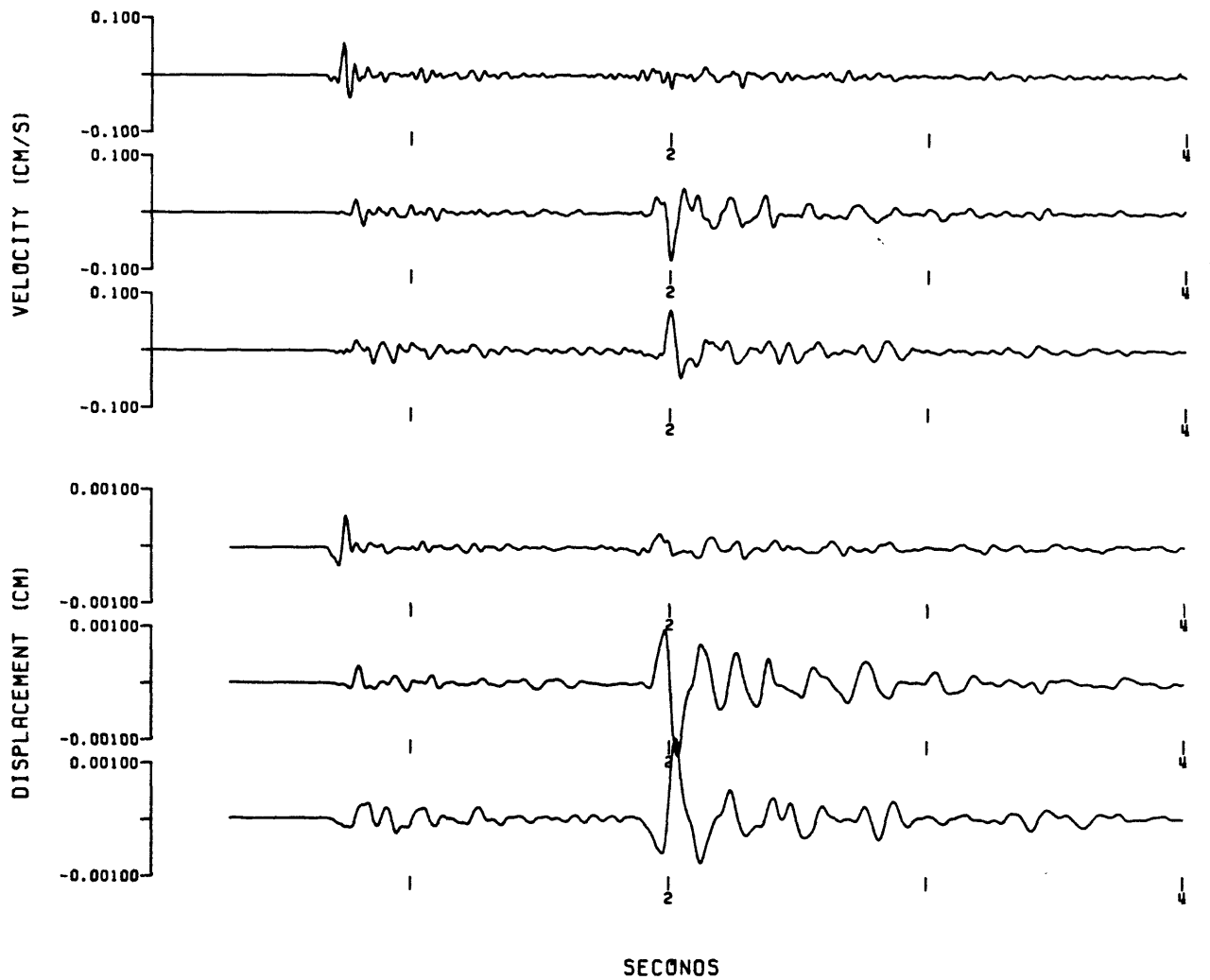

0200821S - C7A
ACCELERATION (CM/S/S)
2.00
-2.00
2.00
-2.00
2.00
-2.00
VELOCITY (CM/S)
0.020
-0.020
0.020
-0.020
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
0.00020
-0.00020
0.00020
-0.00020
1
1/2
1
1
SECONDS

0200821S - C8V

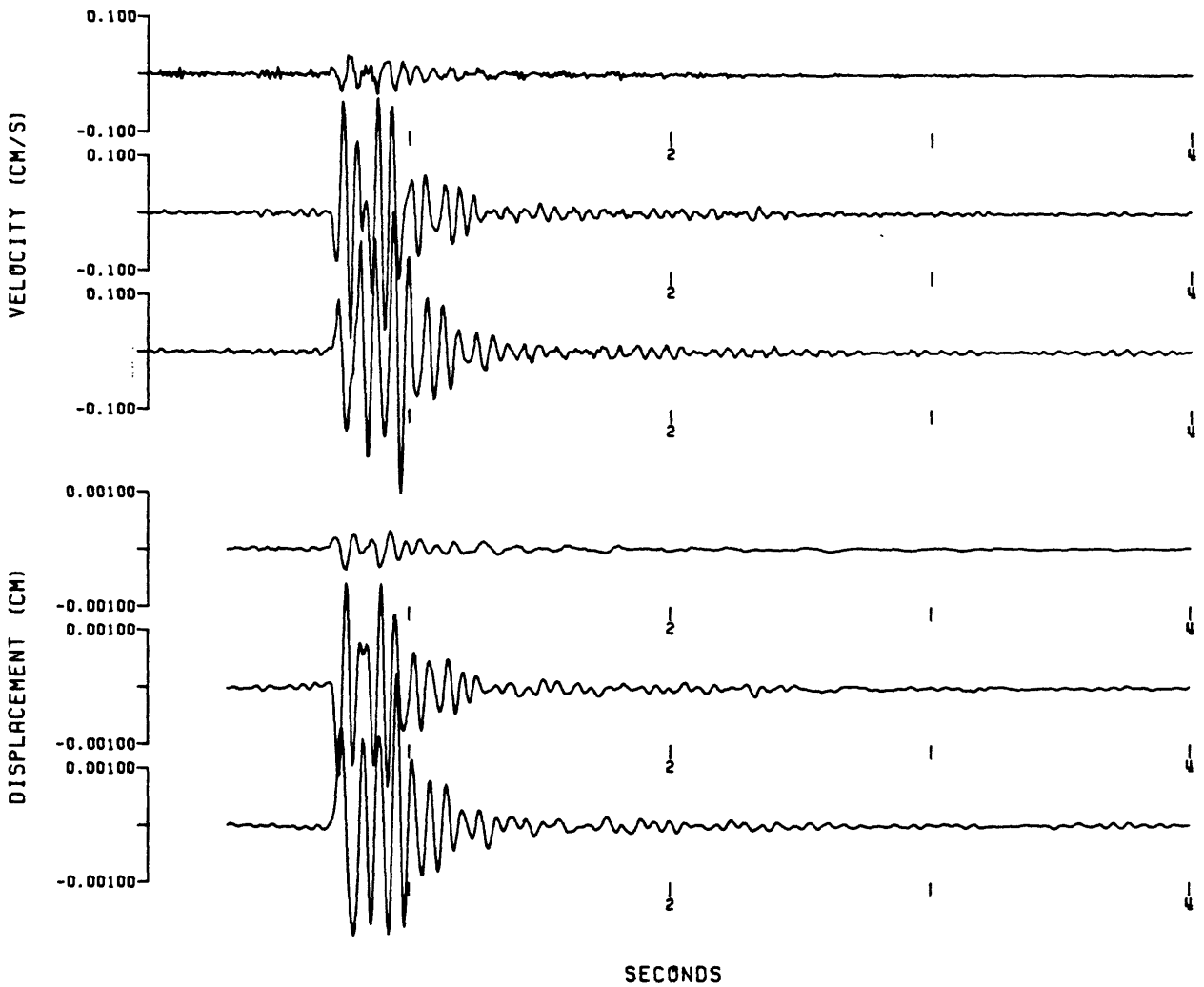


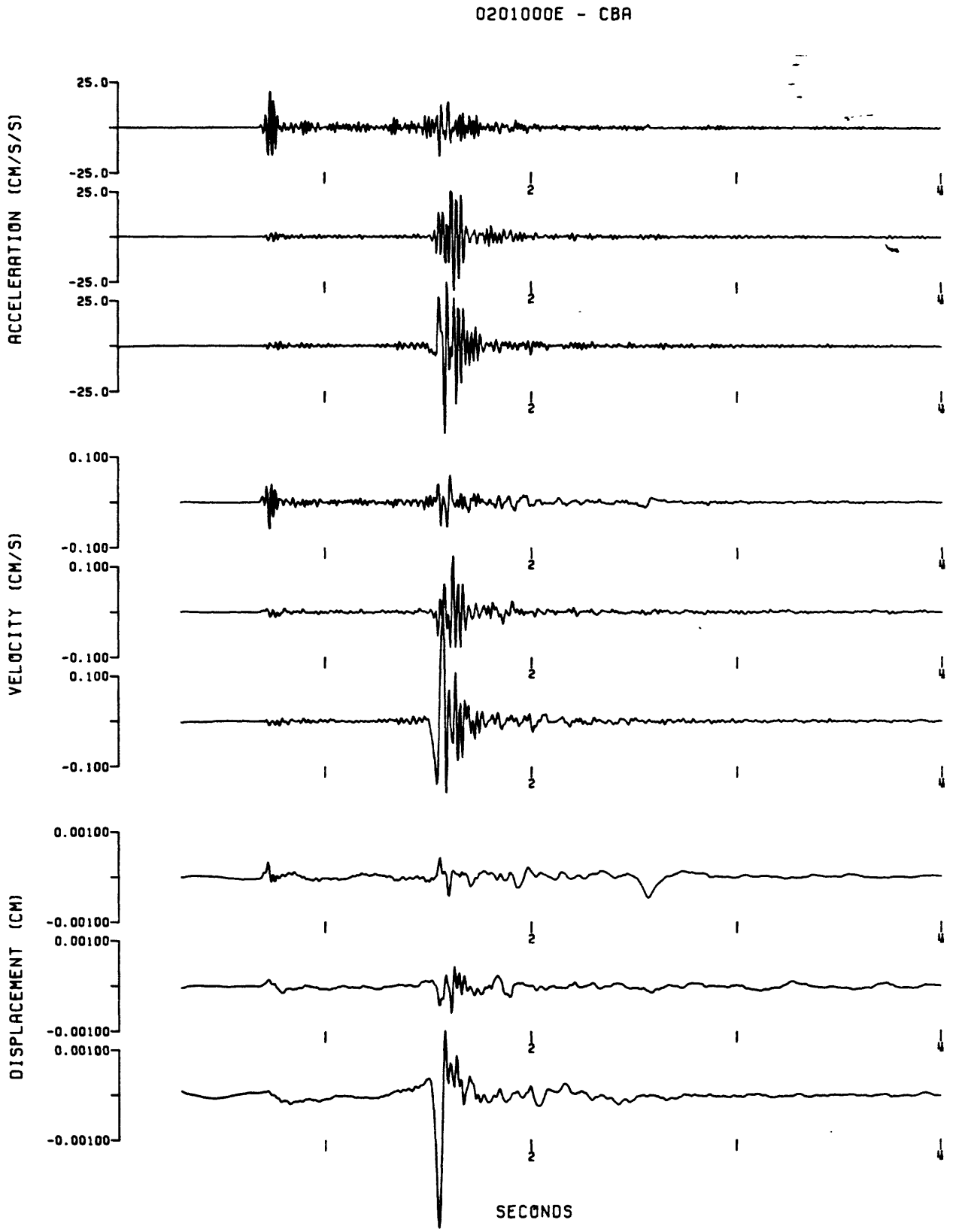

0201000E - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
5.00
-5.00
5.00
-5.00
VELOCITY (CM/S)
0.100
-0.100
0.100
-0.100
0.100
-0.100
DISPLACEMENT (CM)
0.00100
-0.00100
0.00100
-0.00100
0.00100
-0.00100
1
2
4
SECONDS

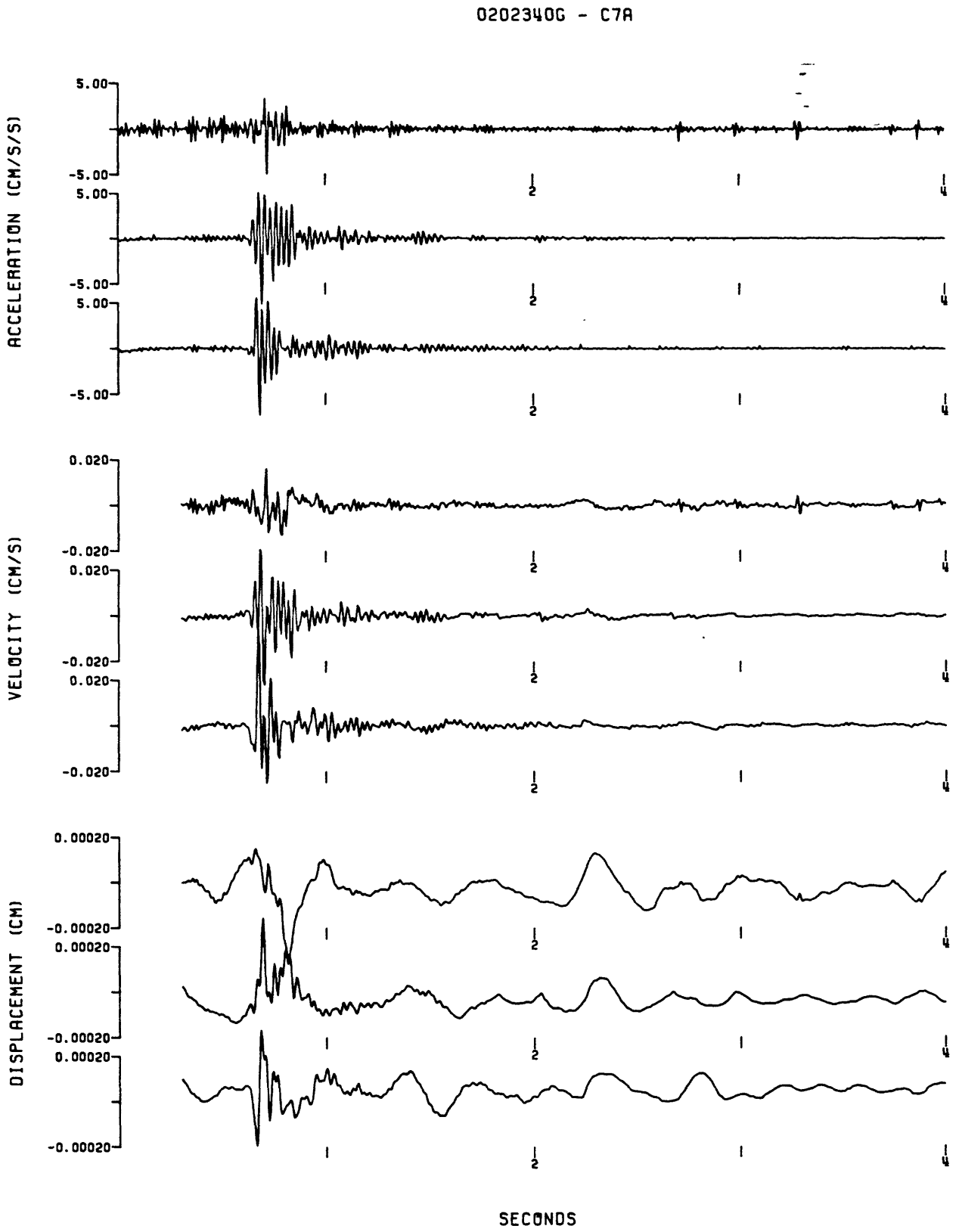
0201000E - C8V



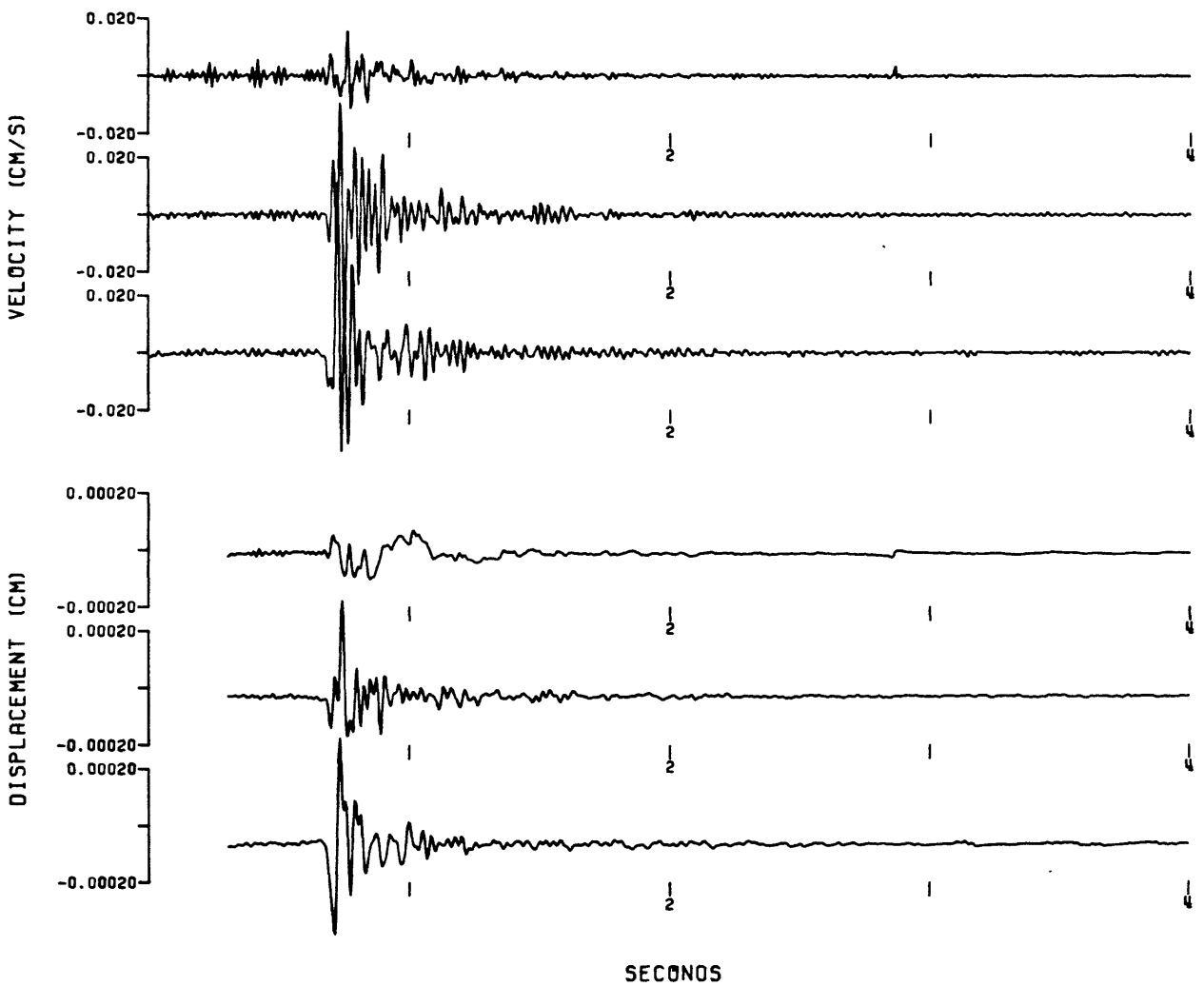
0201000E - C9V

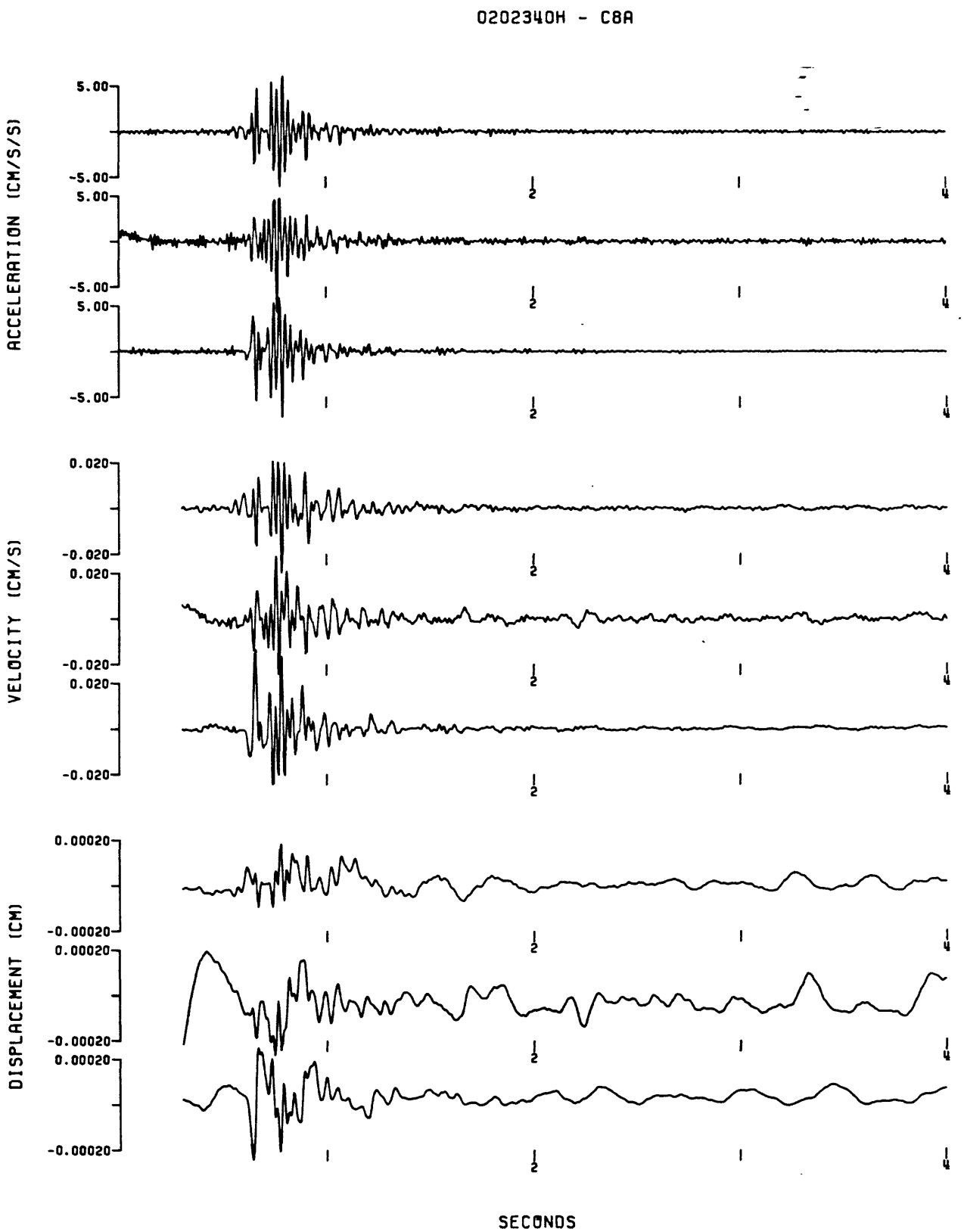



0201000E - CBA
ACCELERATION (CM/S/S)
25.0
-25.0
VELOCITY (CM/S)
0.100
-0.100
DISPLACEMENT (CM)
0.00100
-0.00100
SECONDS

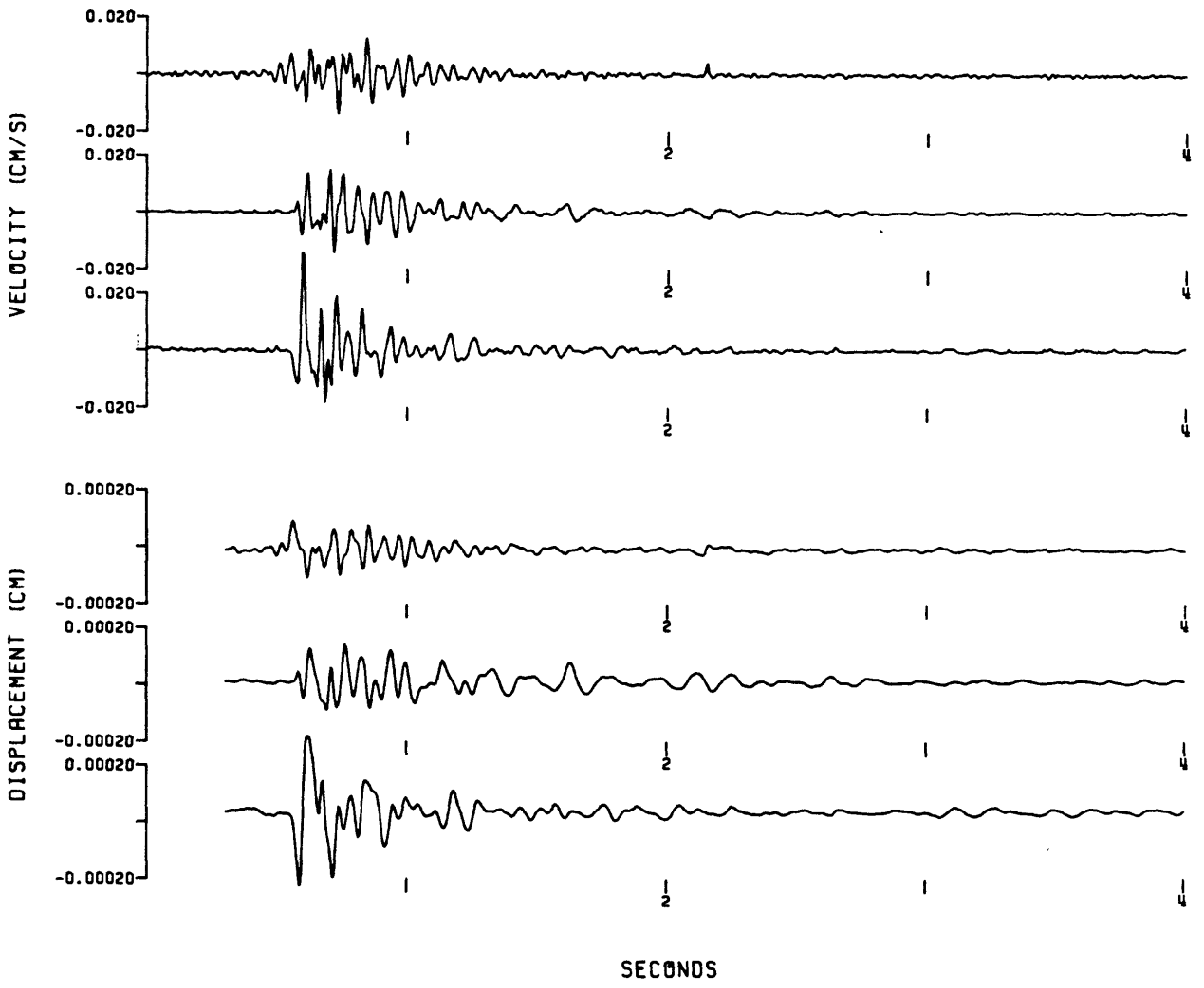

0202340G - C7A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

0202340G - C7V

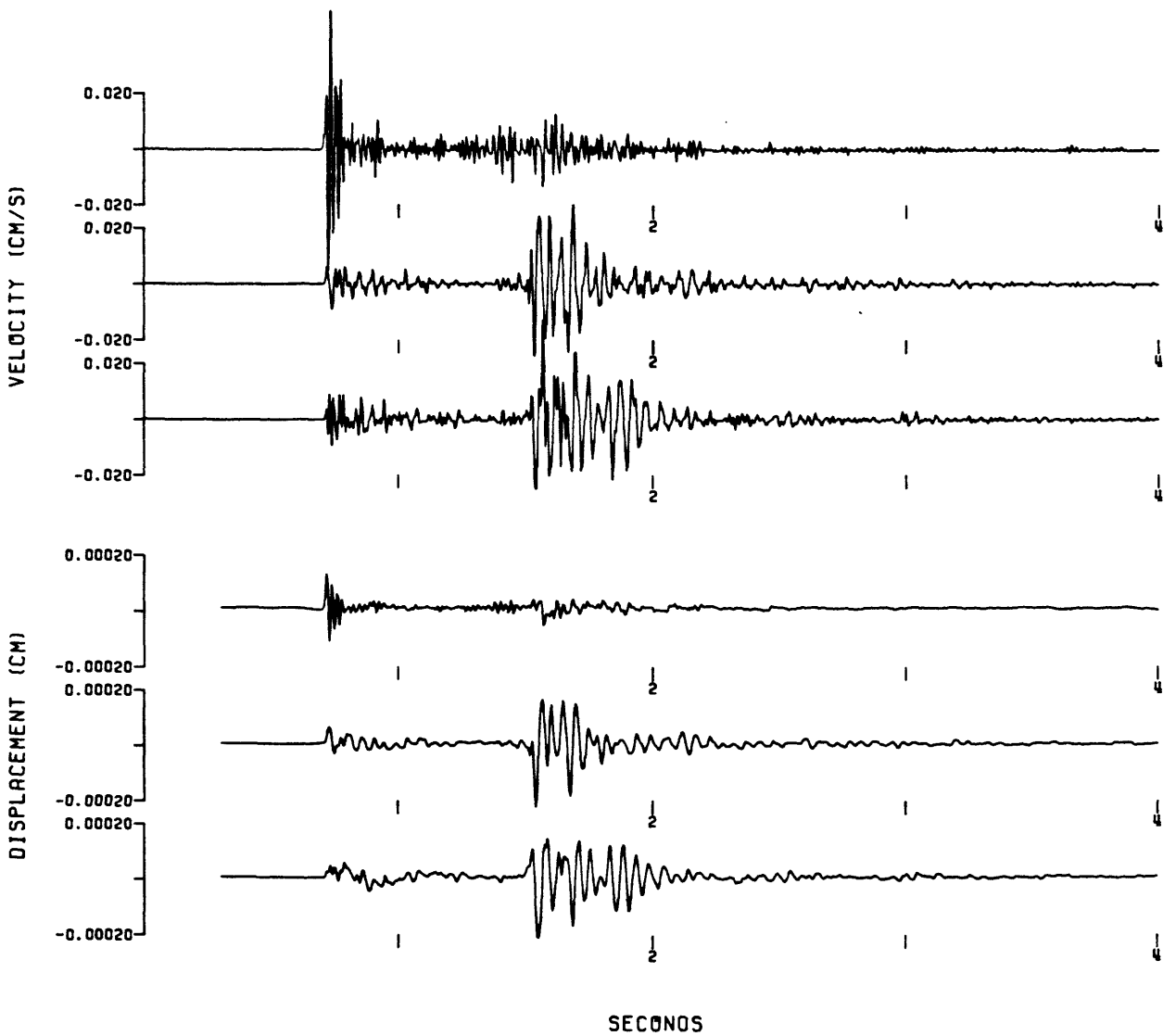


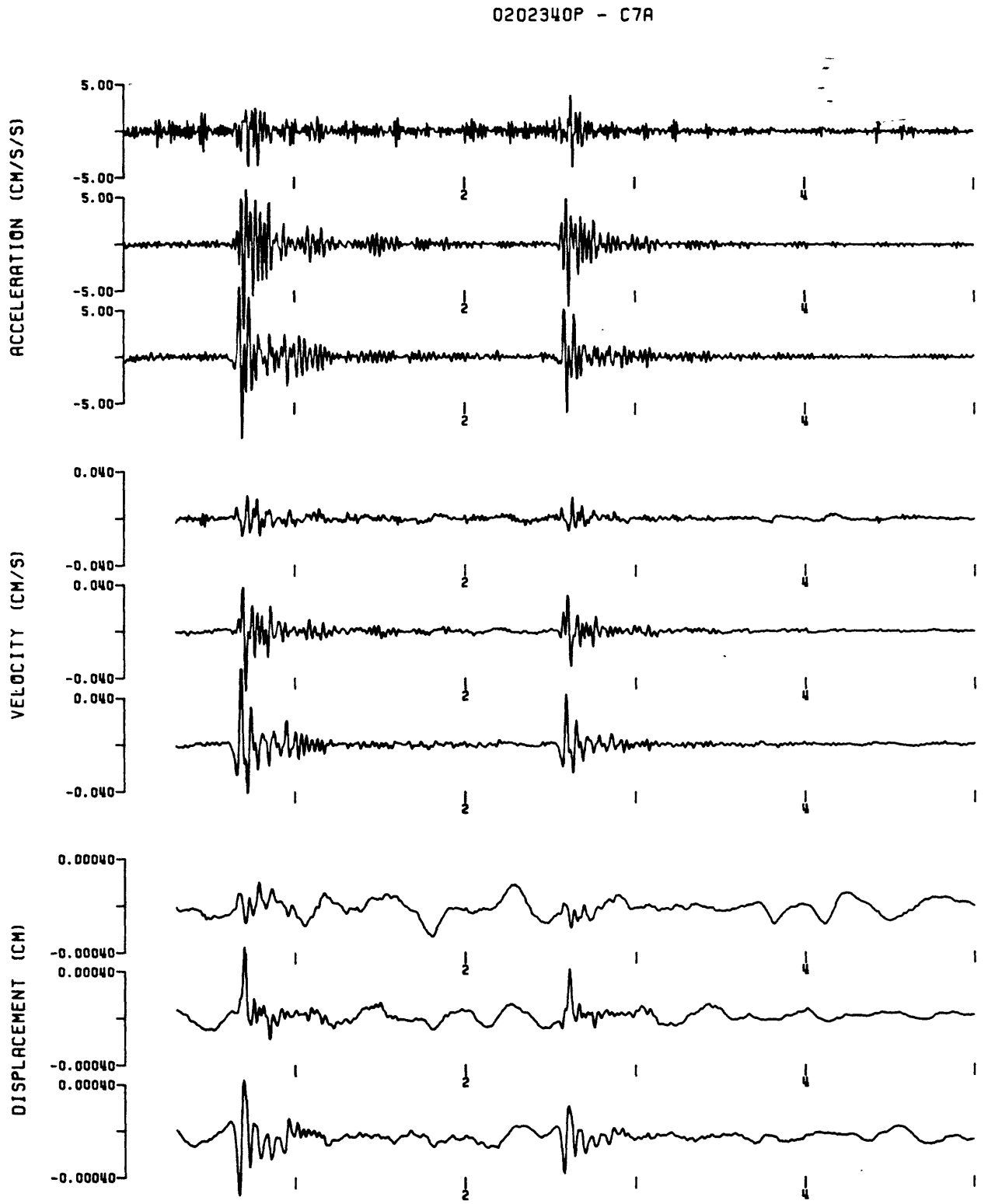

0202340H - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

0202340H - C8V

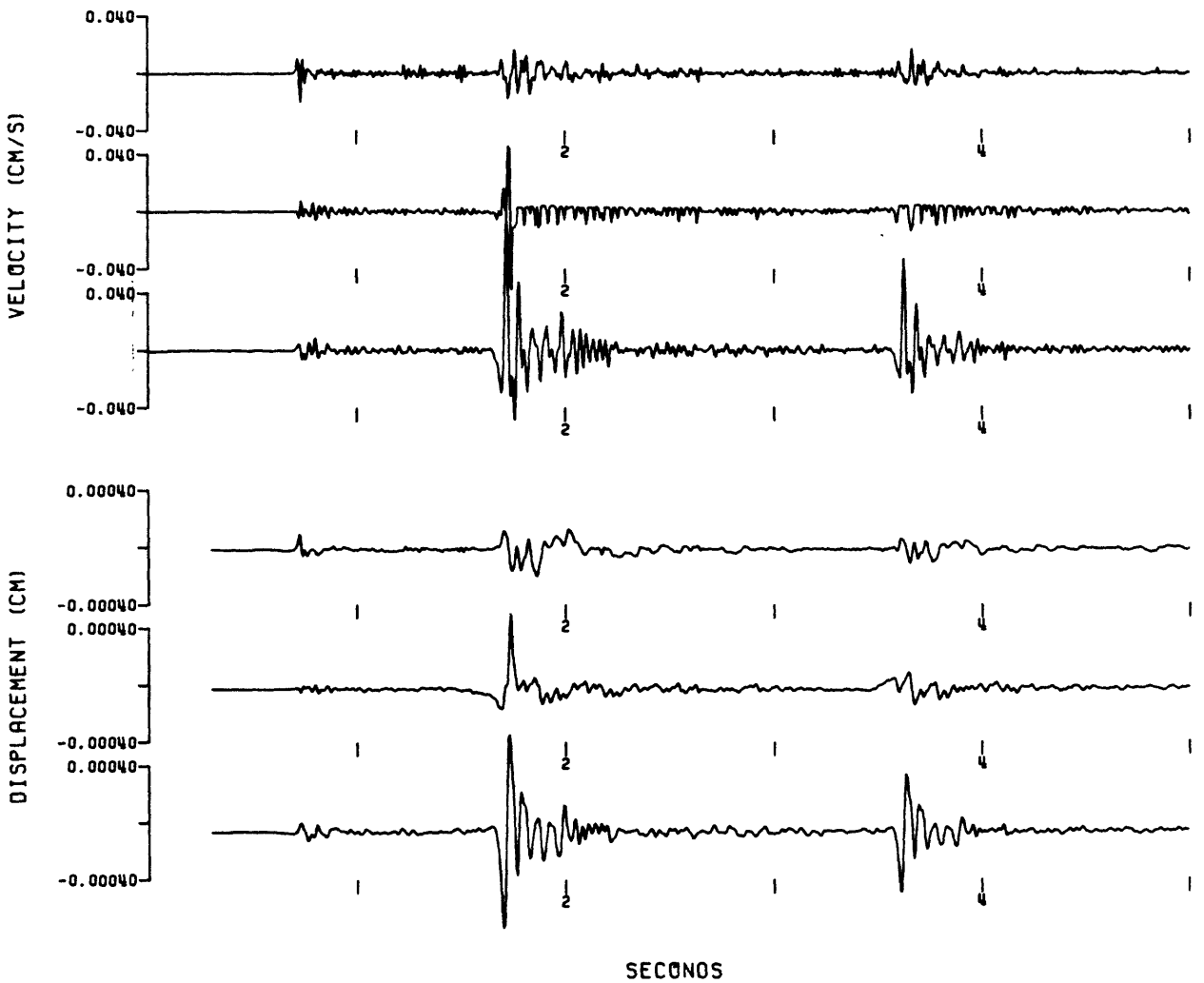


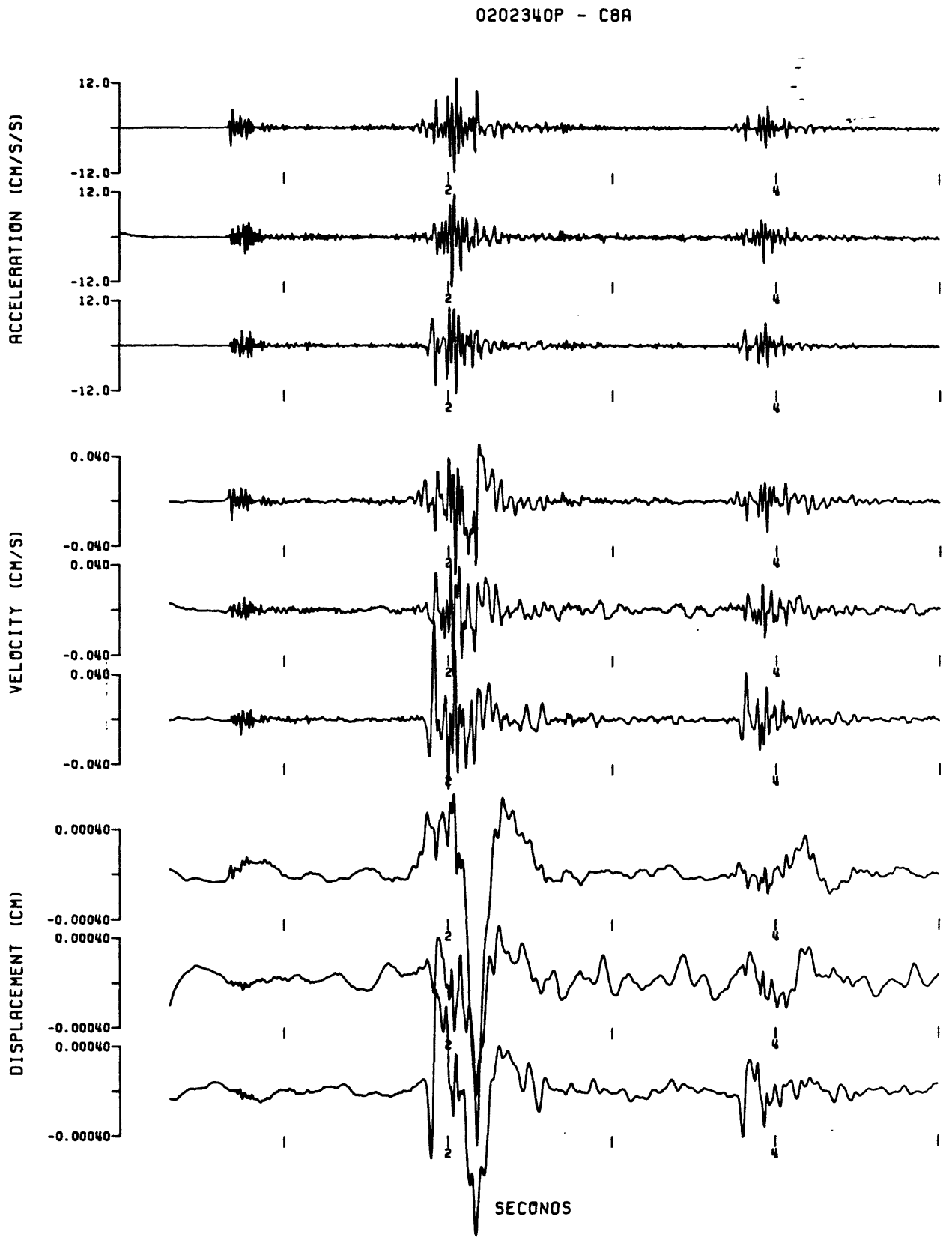
0202340G - C9V



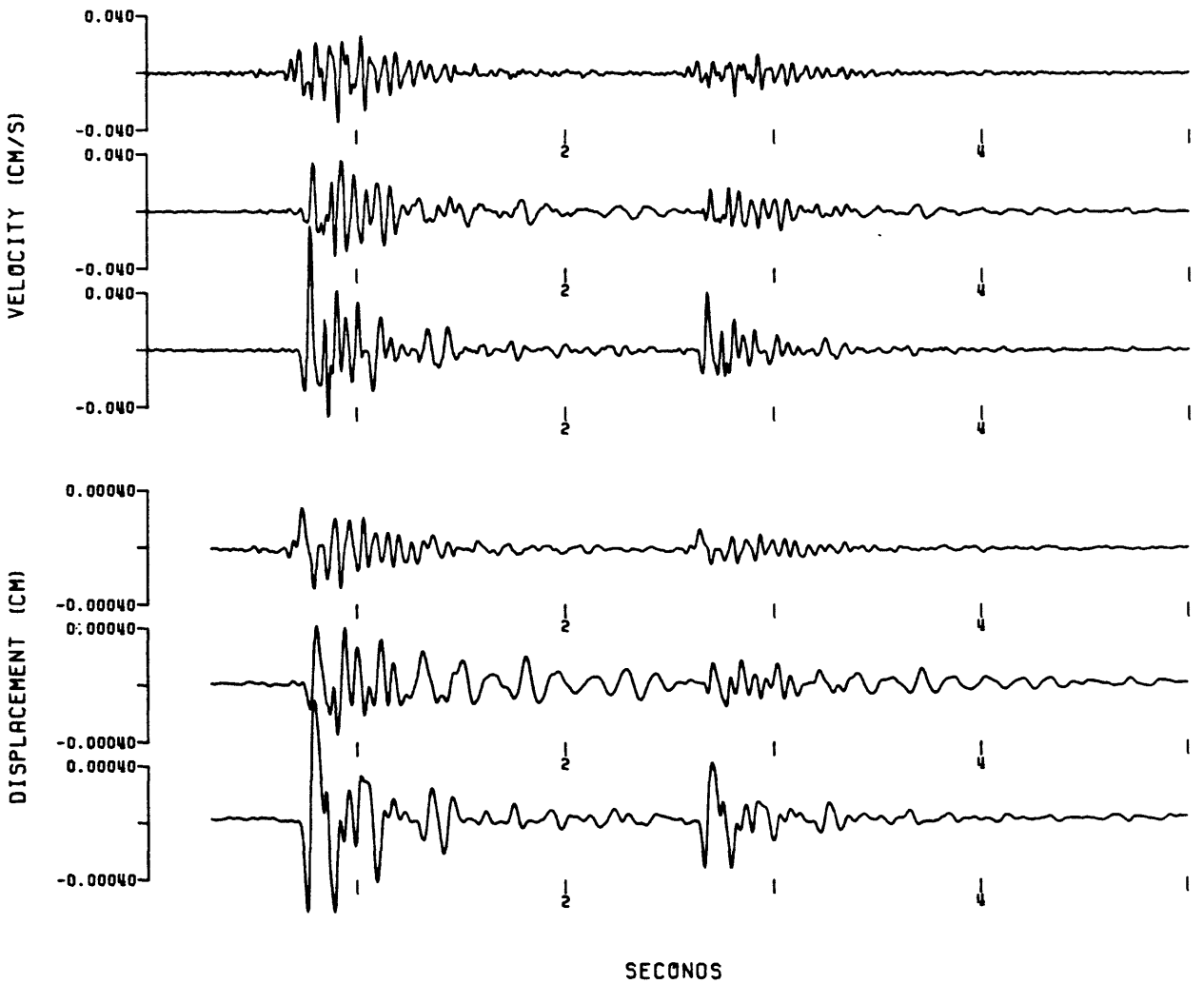

0202340P - C7A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

02023400 - C7V

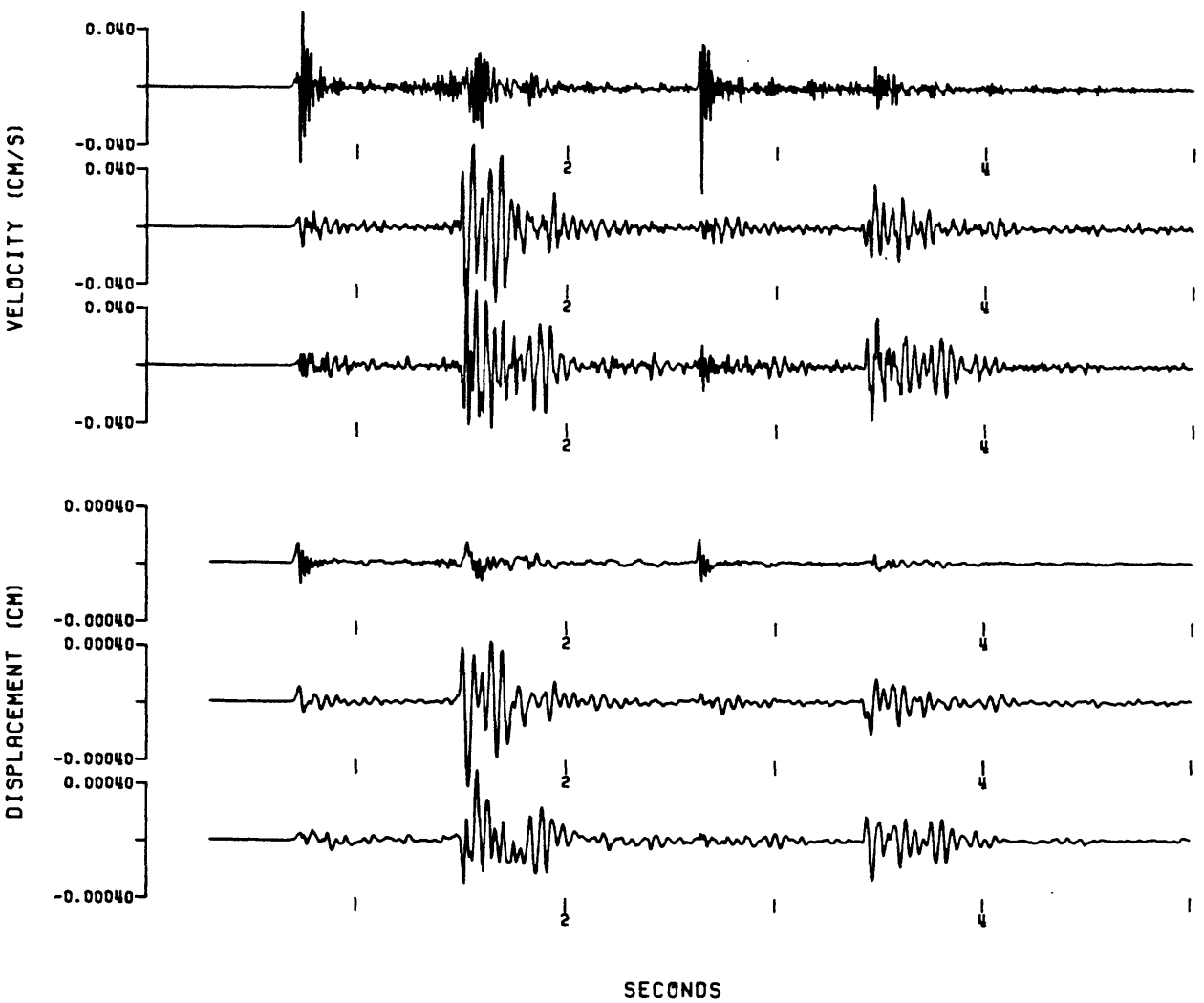


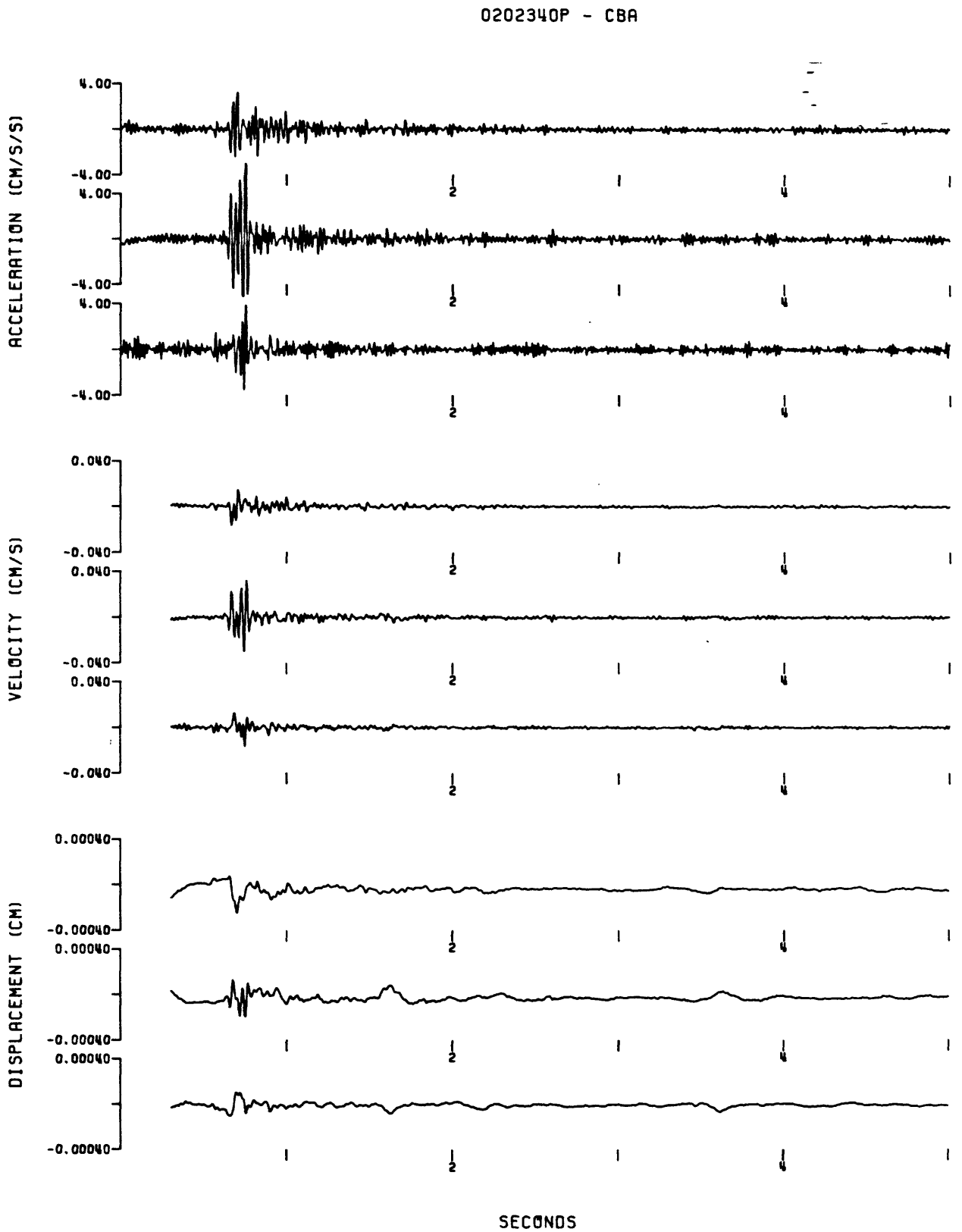

0202340P - C8A
ACCELERATION (CM/S/S)
12.0
-12.0
12.0
-12.0
12.0
-12.0
VELOCITY (CM/S)
0.040
-0.040
0.040
-0.040
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
0.00040
-0.00040
0.00040
-0.00040
1
2
4
SECONDS

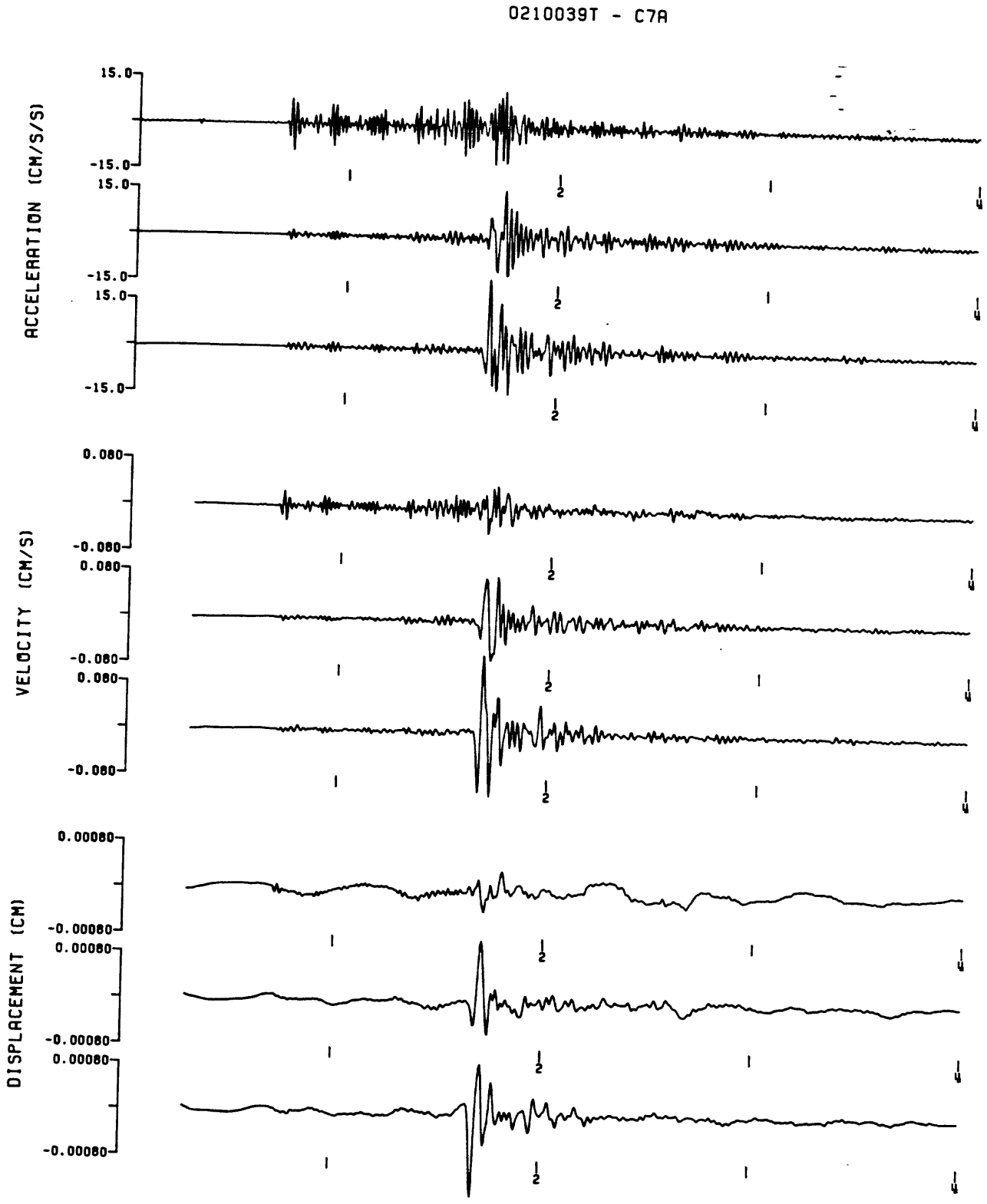
0202340P - C8V



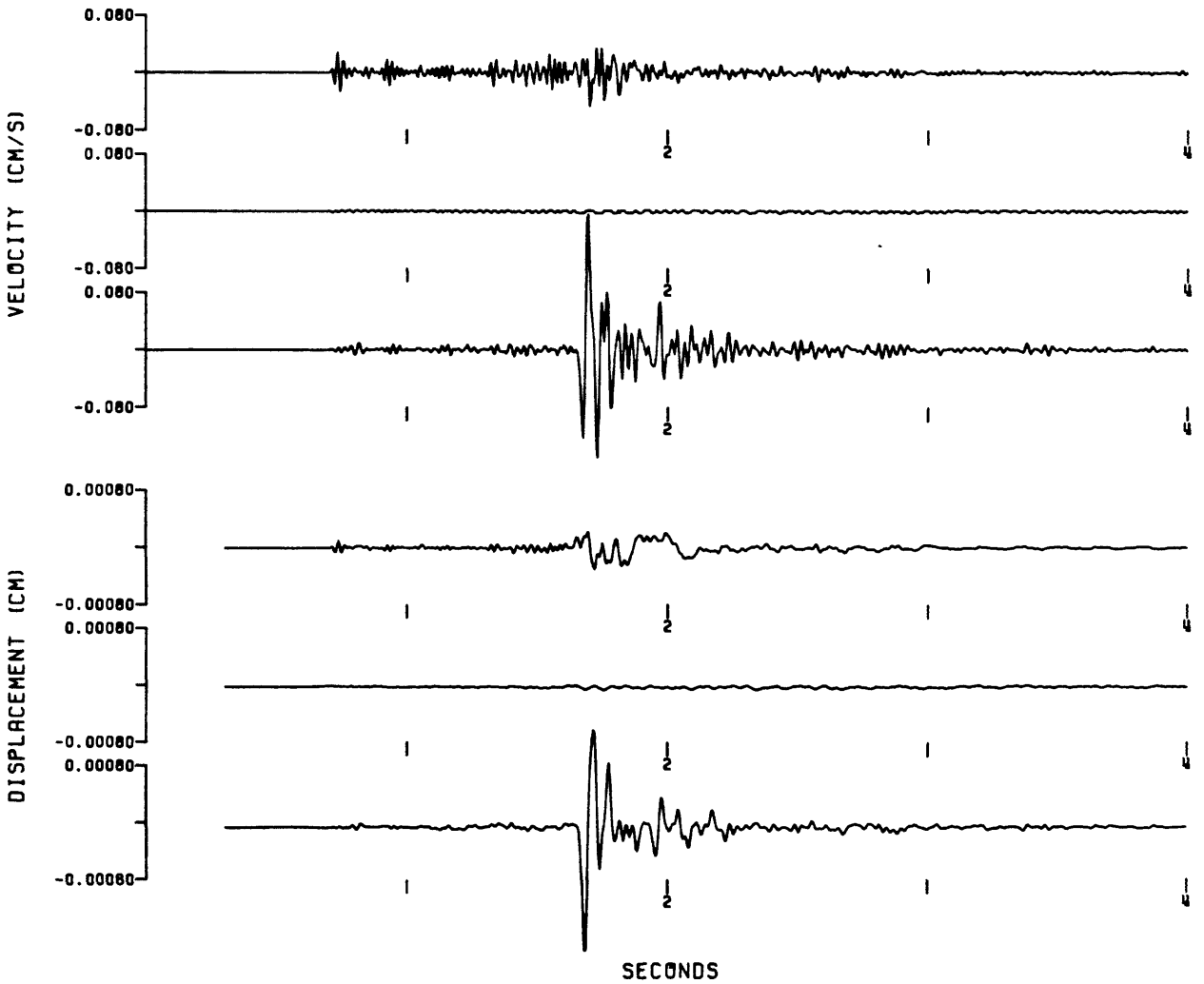
02023400 - C9V

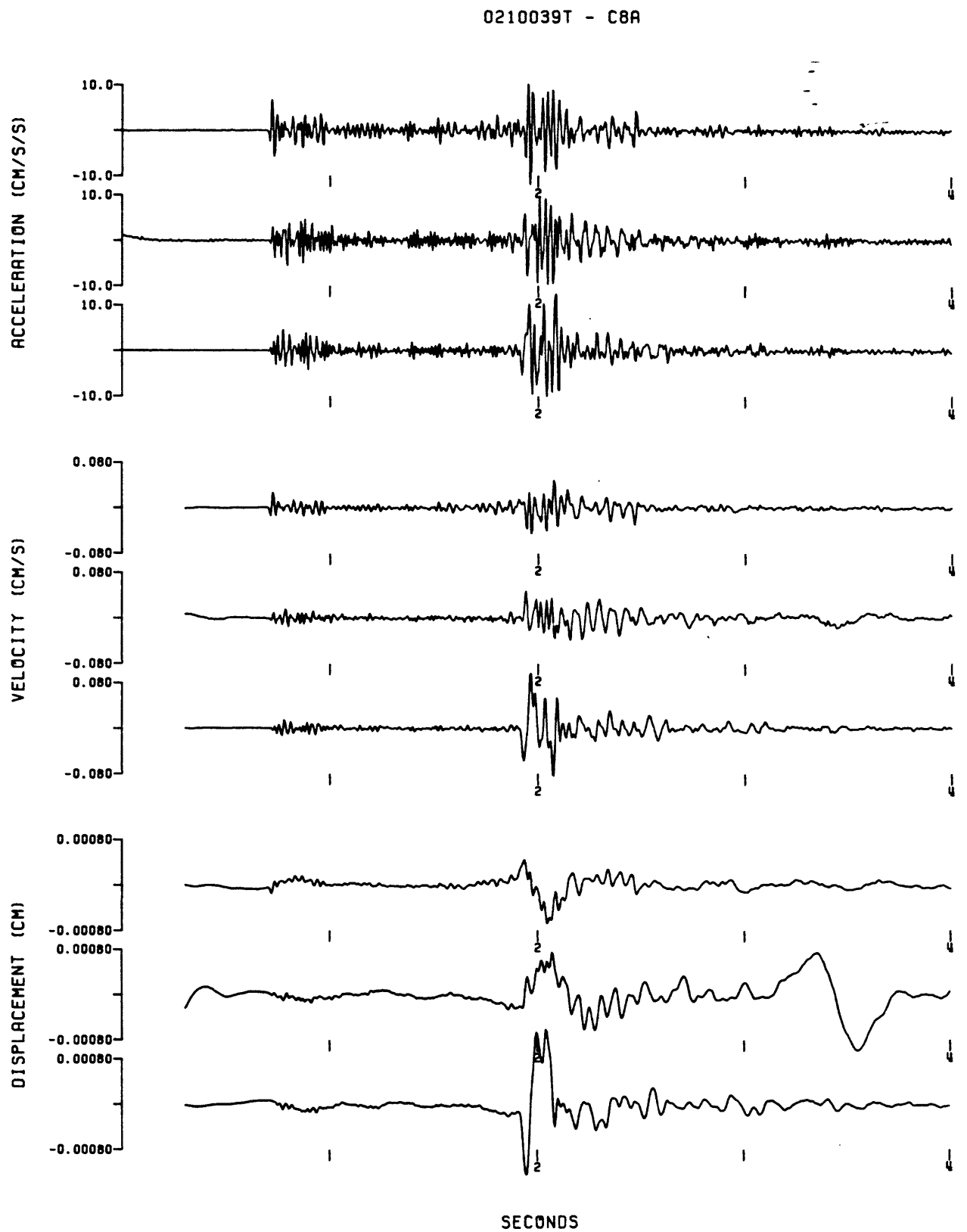



0202340P - CBA
ACCELERATION (CM/S/S)
4.00
-4.00
4.00
-4.00
4.00
-4.00
VELOCITY (CM/S)
0.040
-0.040
0.040
-0.040
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
0.00040
-0.00040
0.00040
-0.00040
1
1/2
1
1/4
1
SECONDS

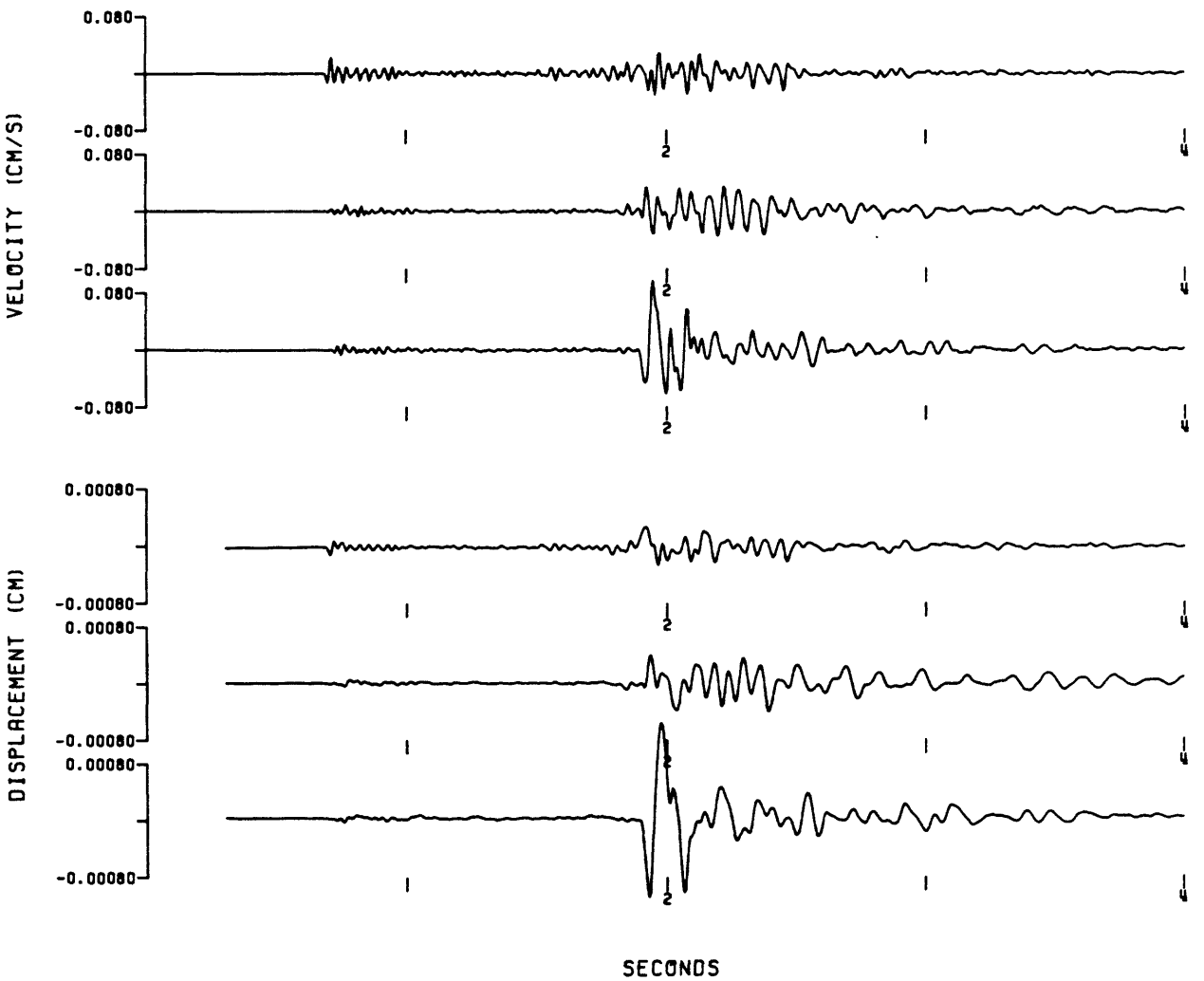

0210039T - C7A
ACCELERATION (CM/S/S)
15.0
-15.0
15.0
-15.0
15.0
-15.0
VELOCITY (CM/S)
0.080
-0.080
0.080
-0.080
0.080
-0.080
DISPLACEMENT (CM)
0.00080
-0.00080
0.00080
-0.00080
0.00080
-0.00080
SECONDS

0210039T - C7V

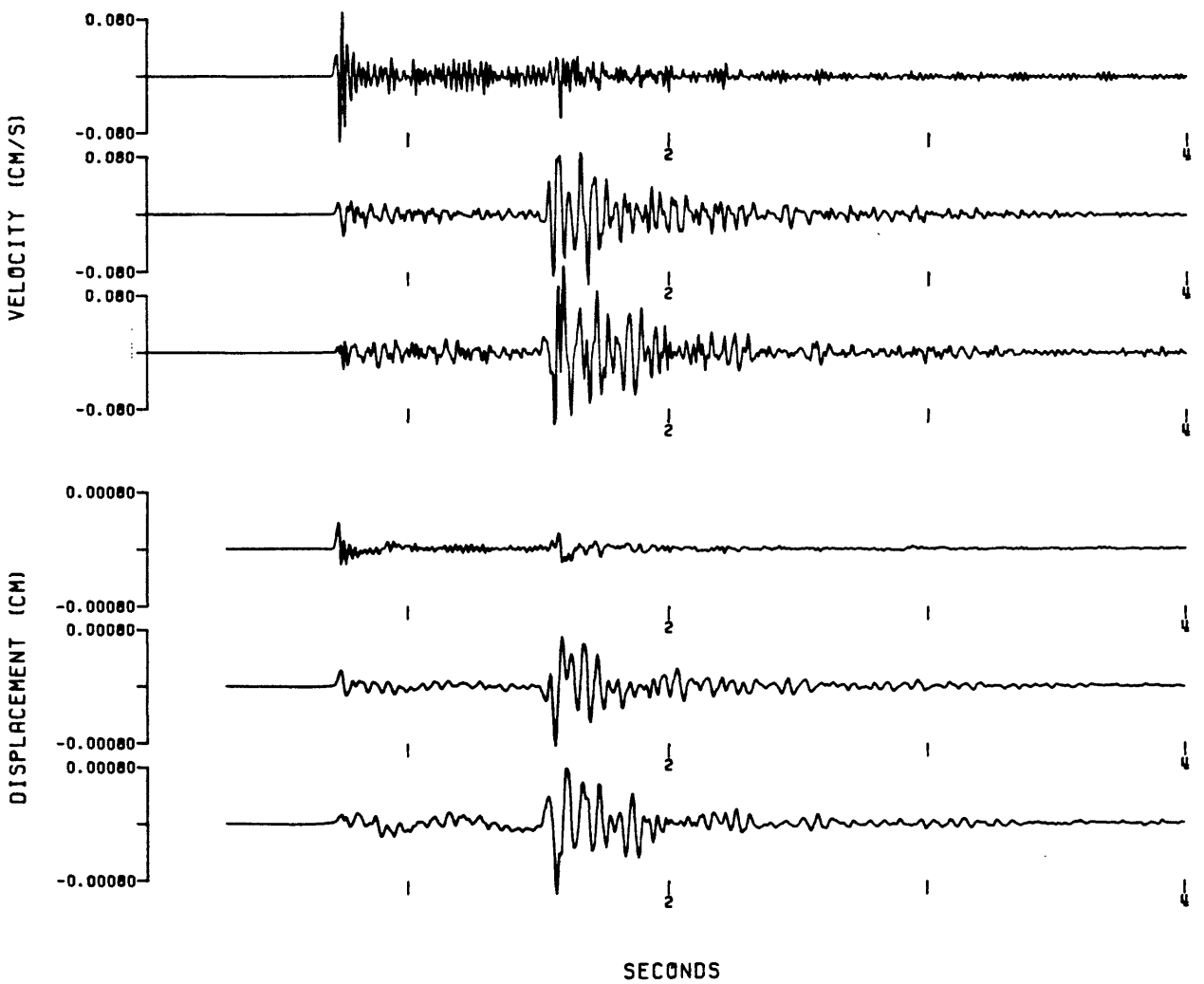


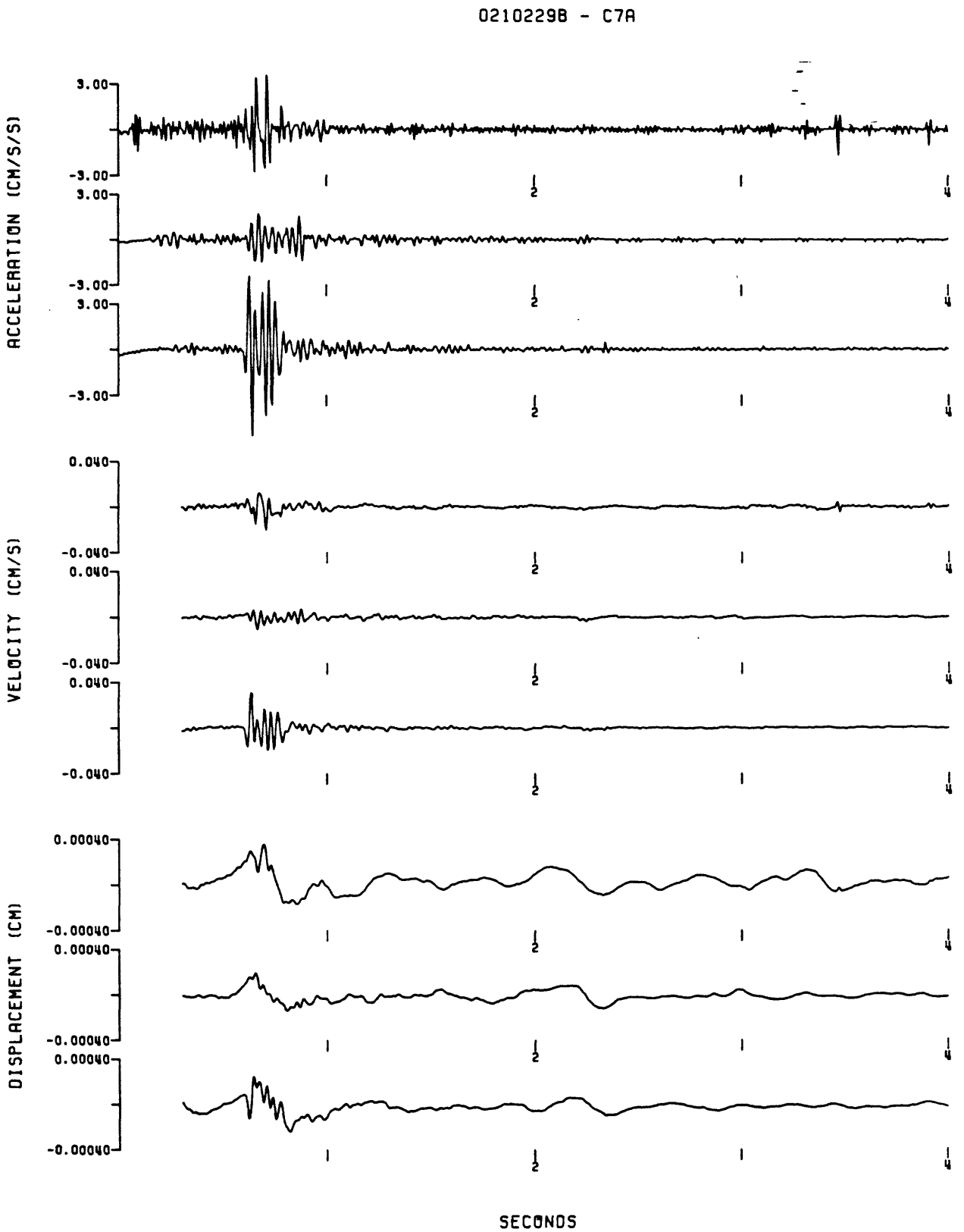

0210039T - C8A
ACCELERATION (CM/S/S)
10.0
-10.0
VELOCITY (CM/S)
0.080
-0.080
DISPLACEMENT (CM)
0.00080
-0.00080
SECONDS

0210039T - C8V

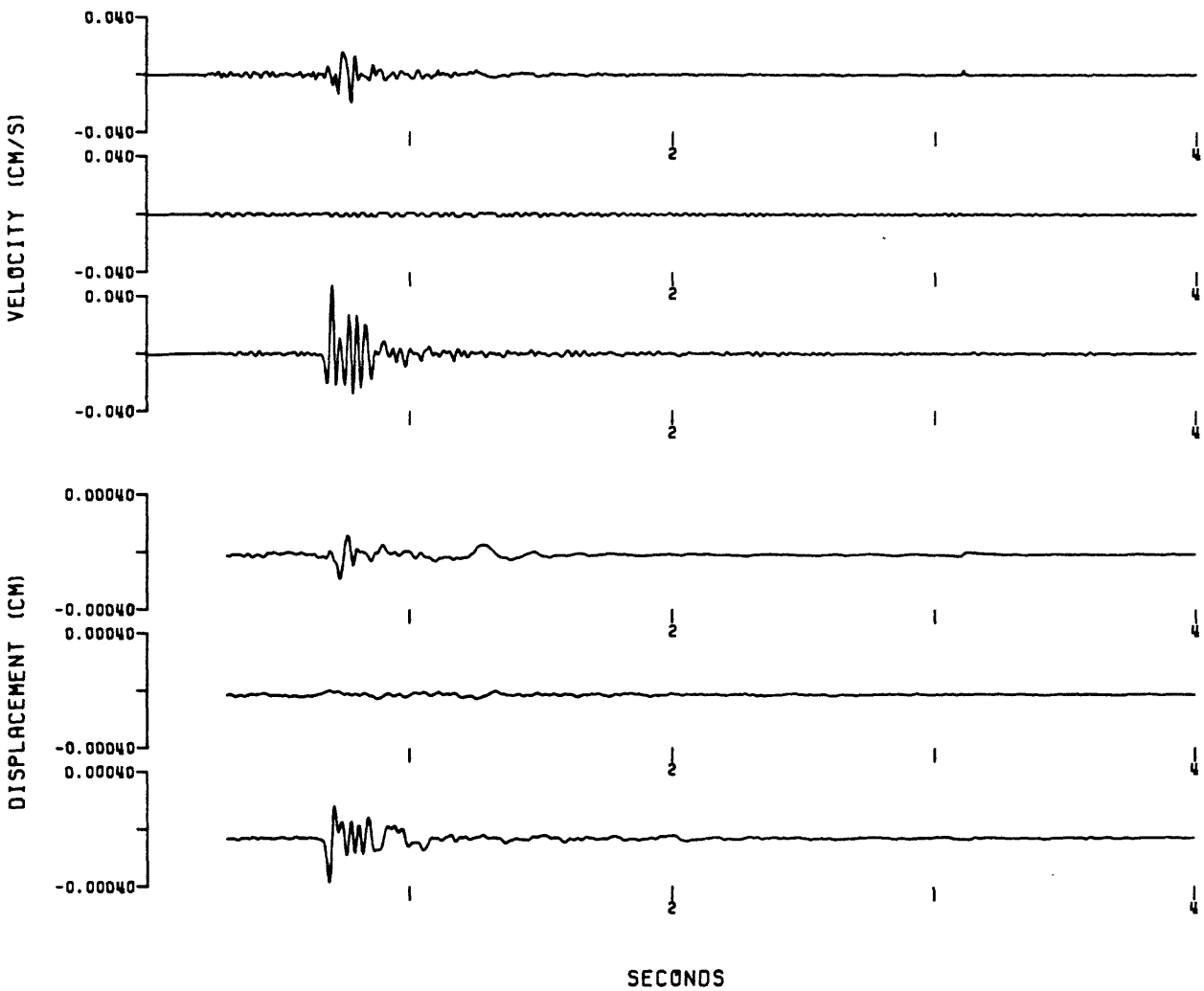


0210039T - C9V

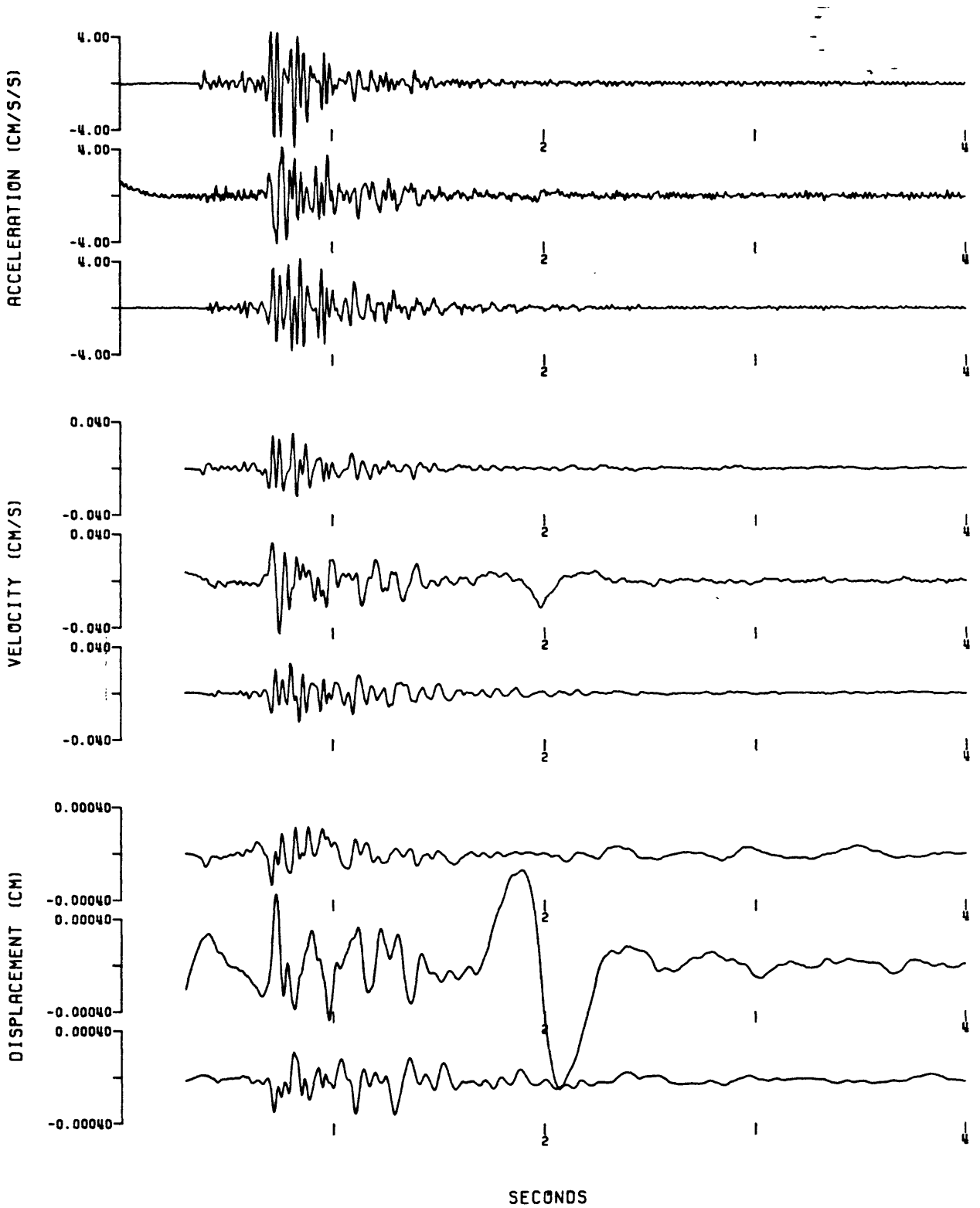



0210229B - C7A
ACCELERATION (CM/S/S)
3.00
-3.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

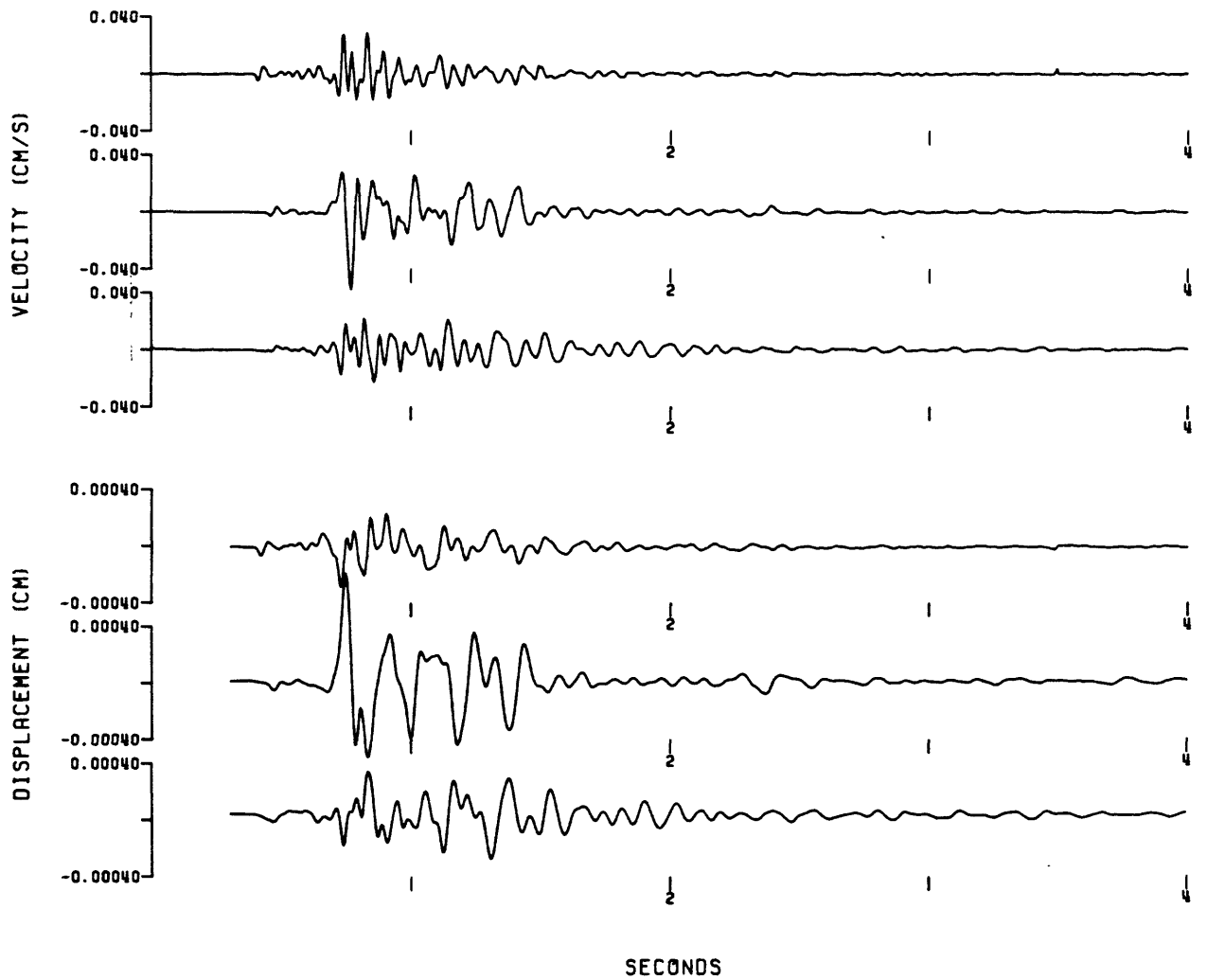
02102298 - C7V



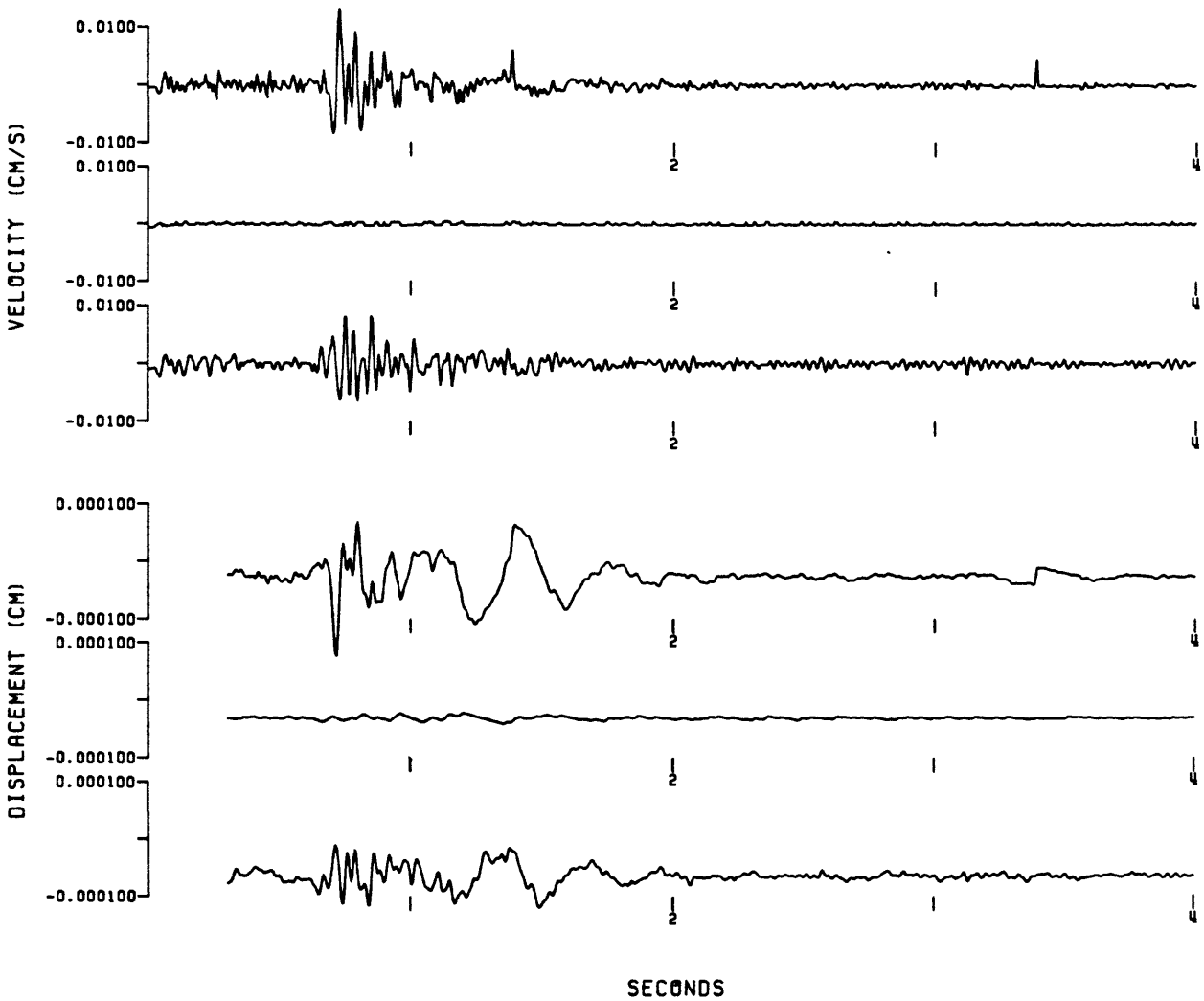
0210#298 - C8A


ACCELERATION (CM/S/S)
4.00
-4.00
4.00
-4.00
4.00
-4.00
VELOCITY (CM/S)
0.040
-0.040
0.040
-0.040
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
0.00040
-0.00040
0.00040
-0.00040
1
1/2
1
1/4
SECONDS

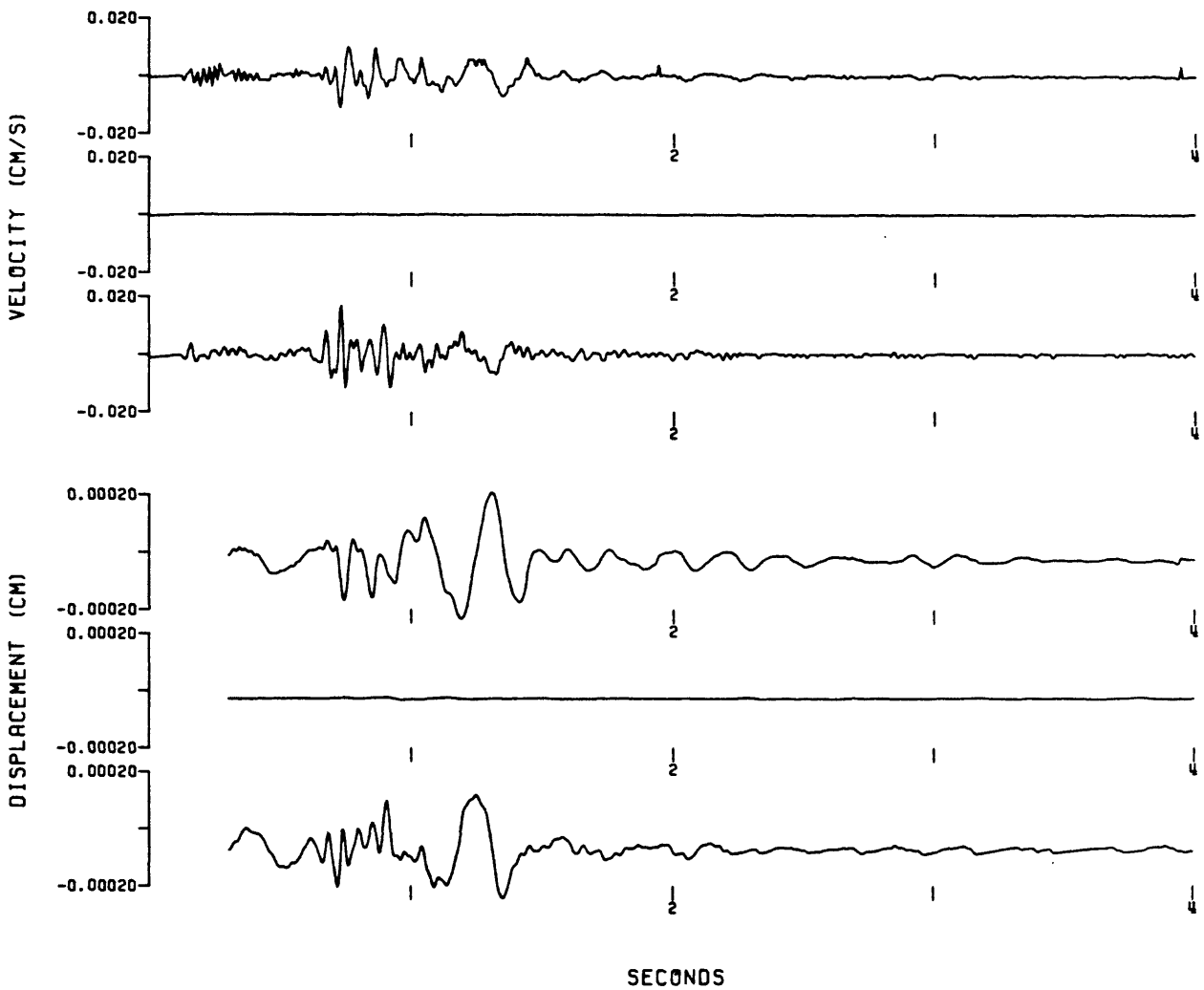
02102298 - C8V



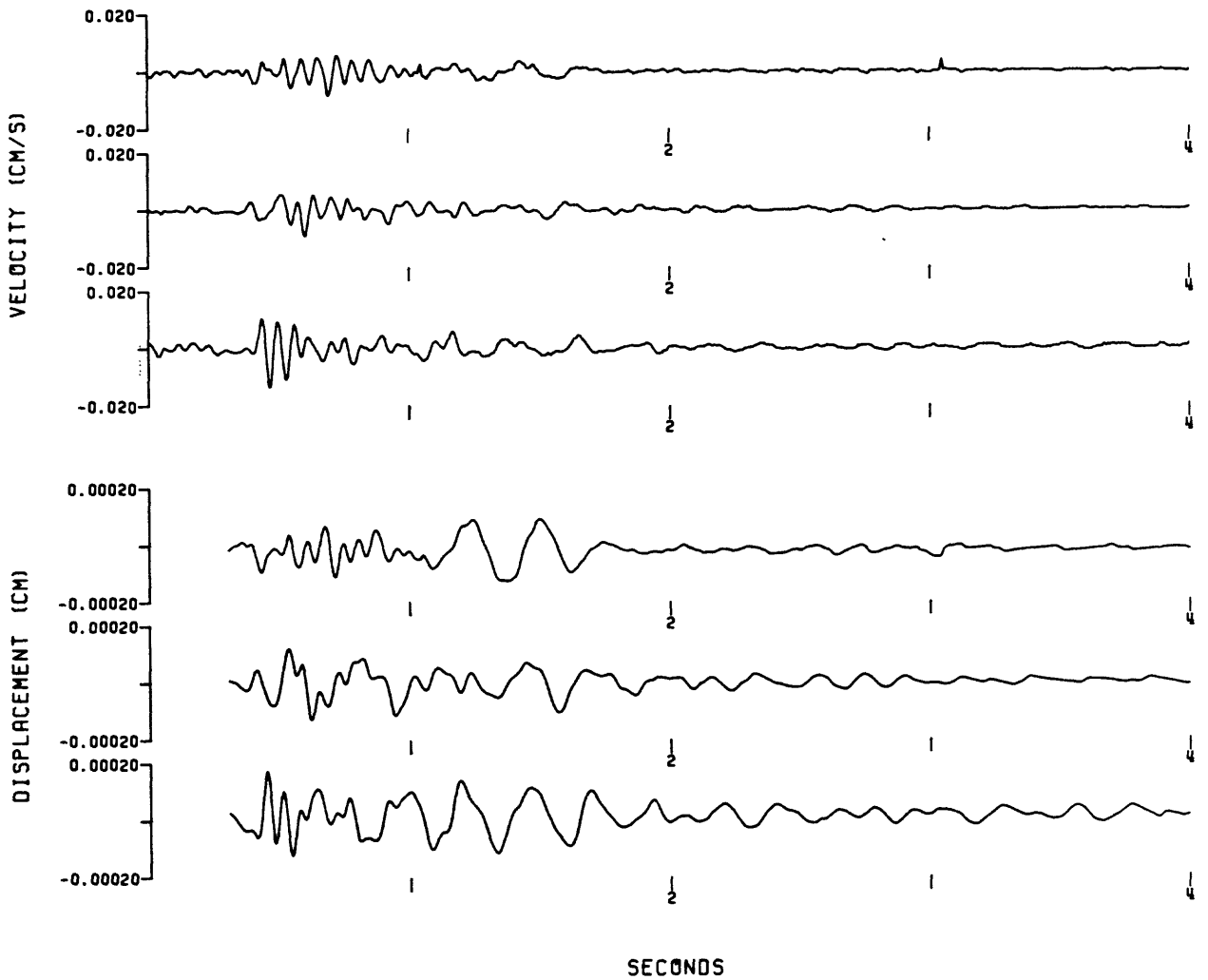
0210635P - C7V

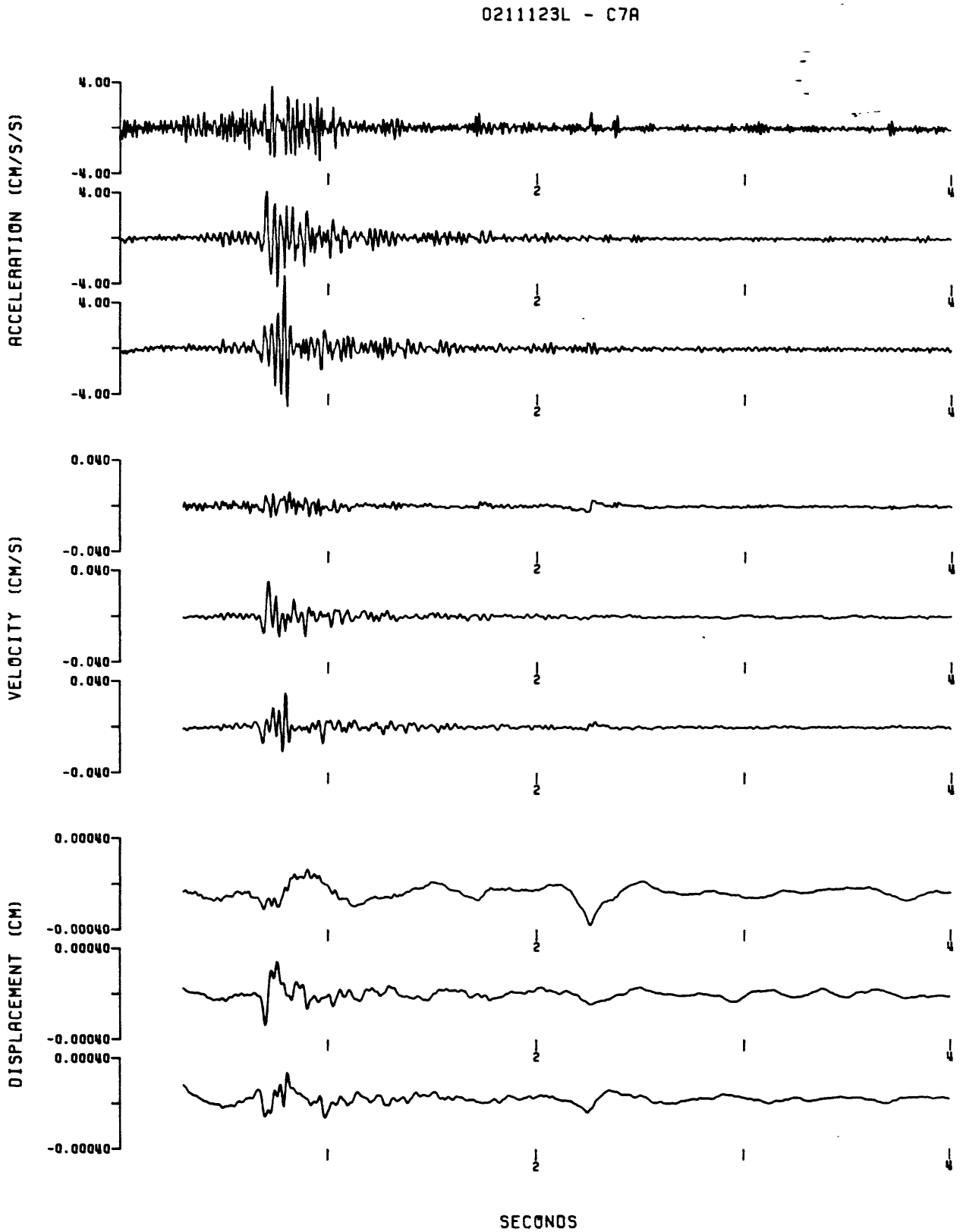


02110400 - C7V

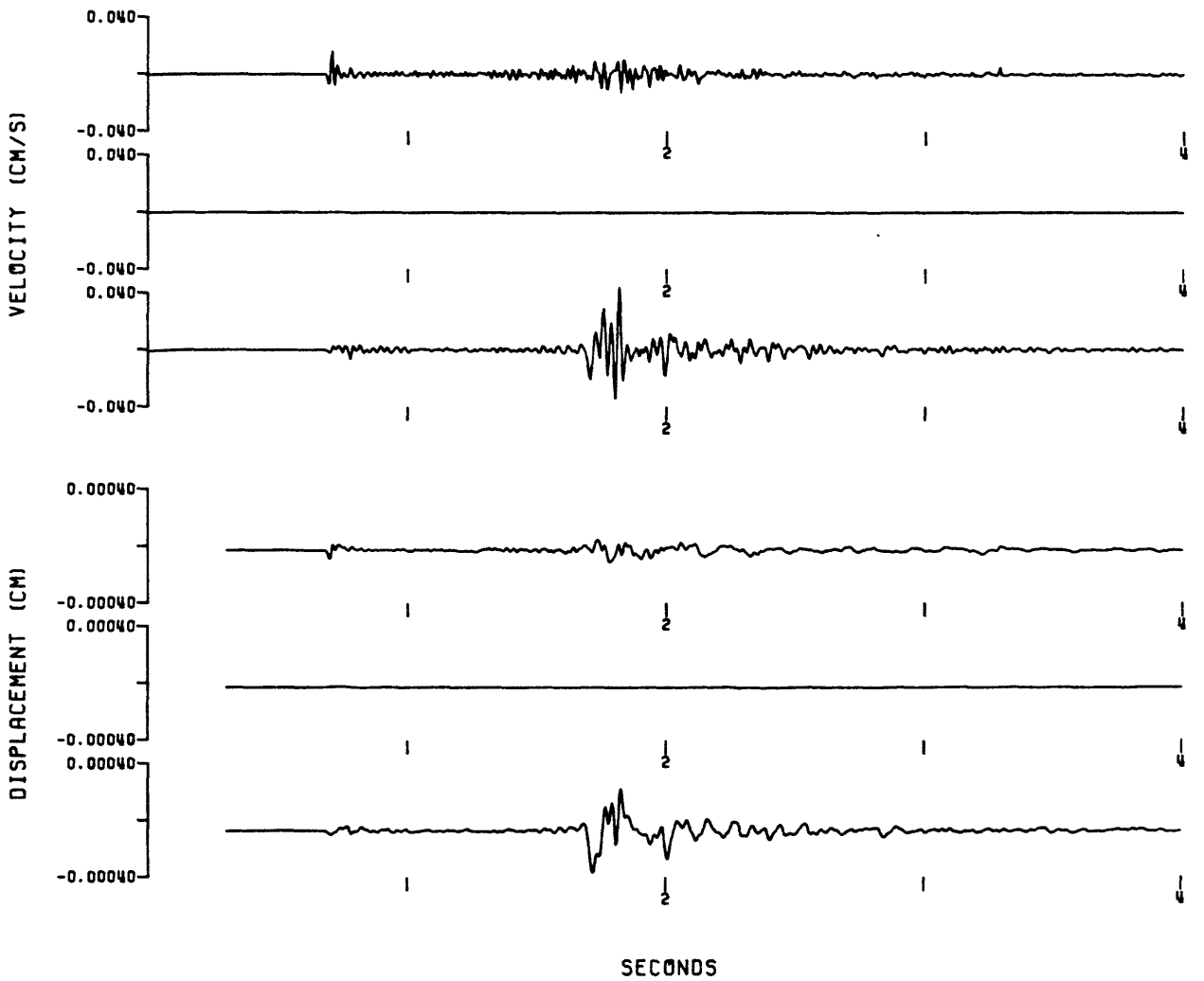


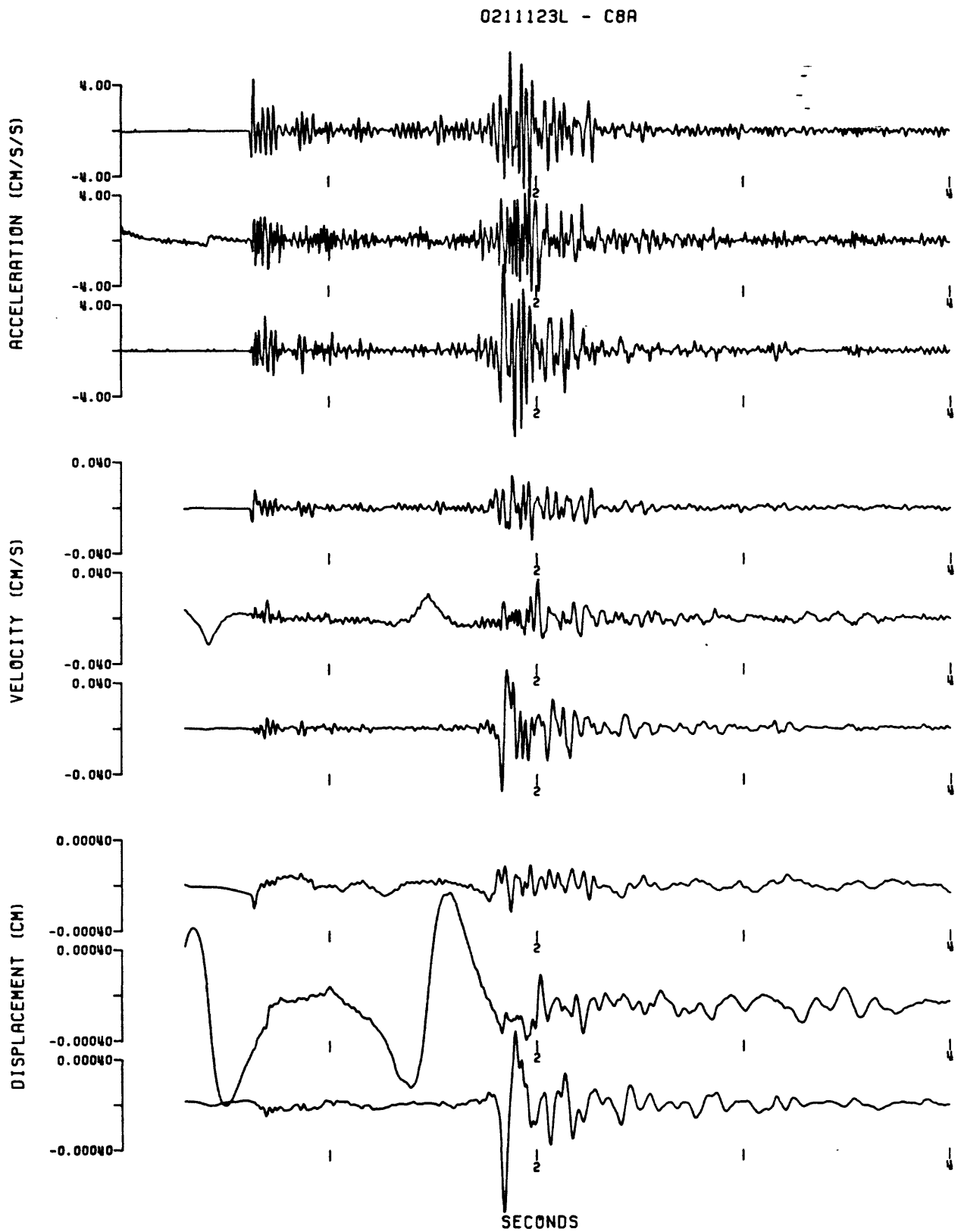
02110400 - C8V



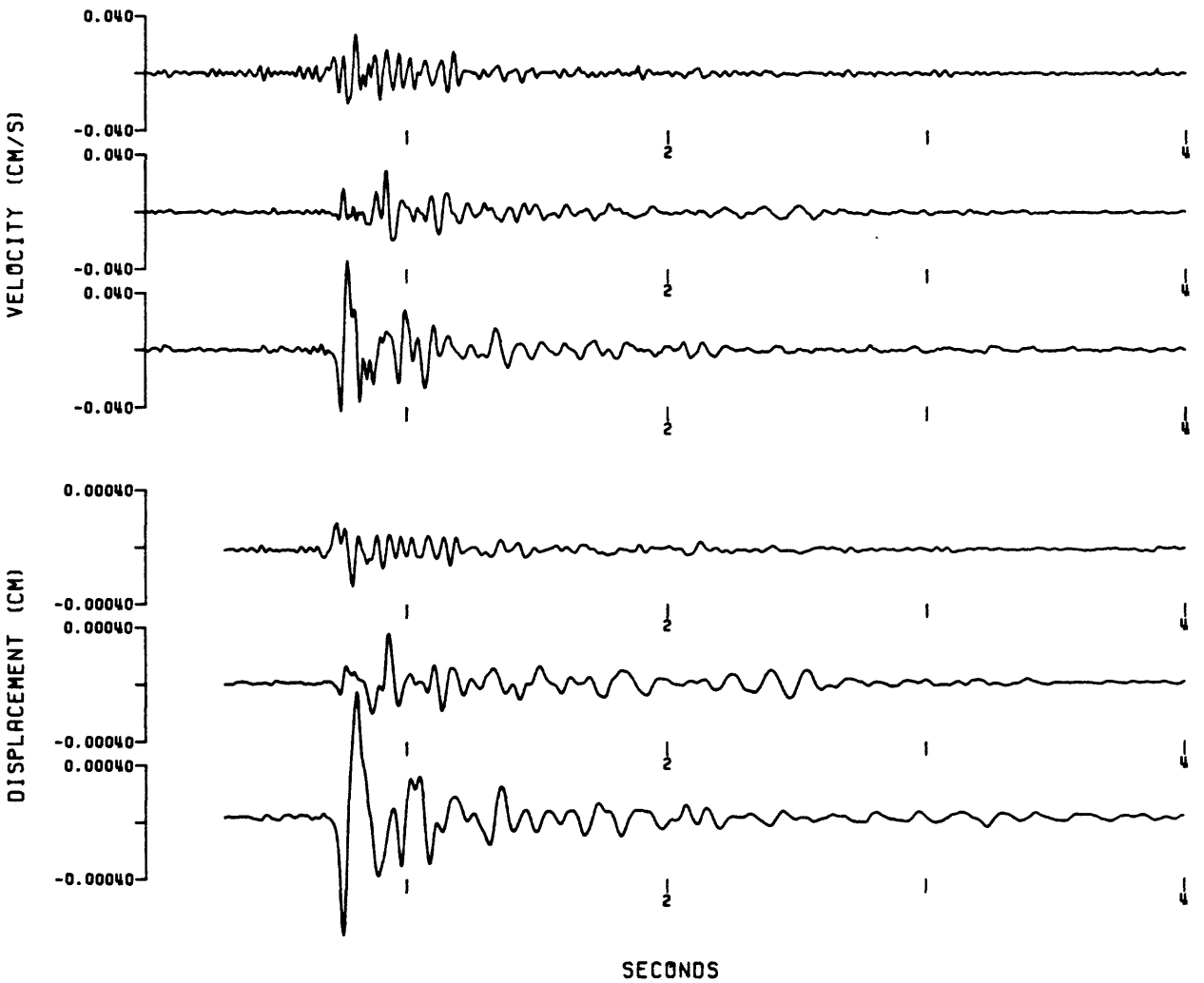

0211123L - C7A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

0211123L - C7V

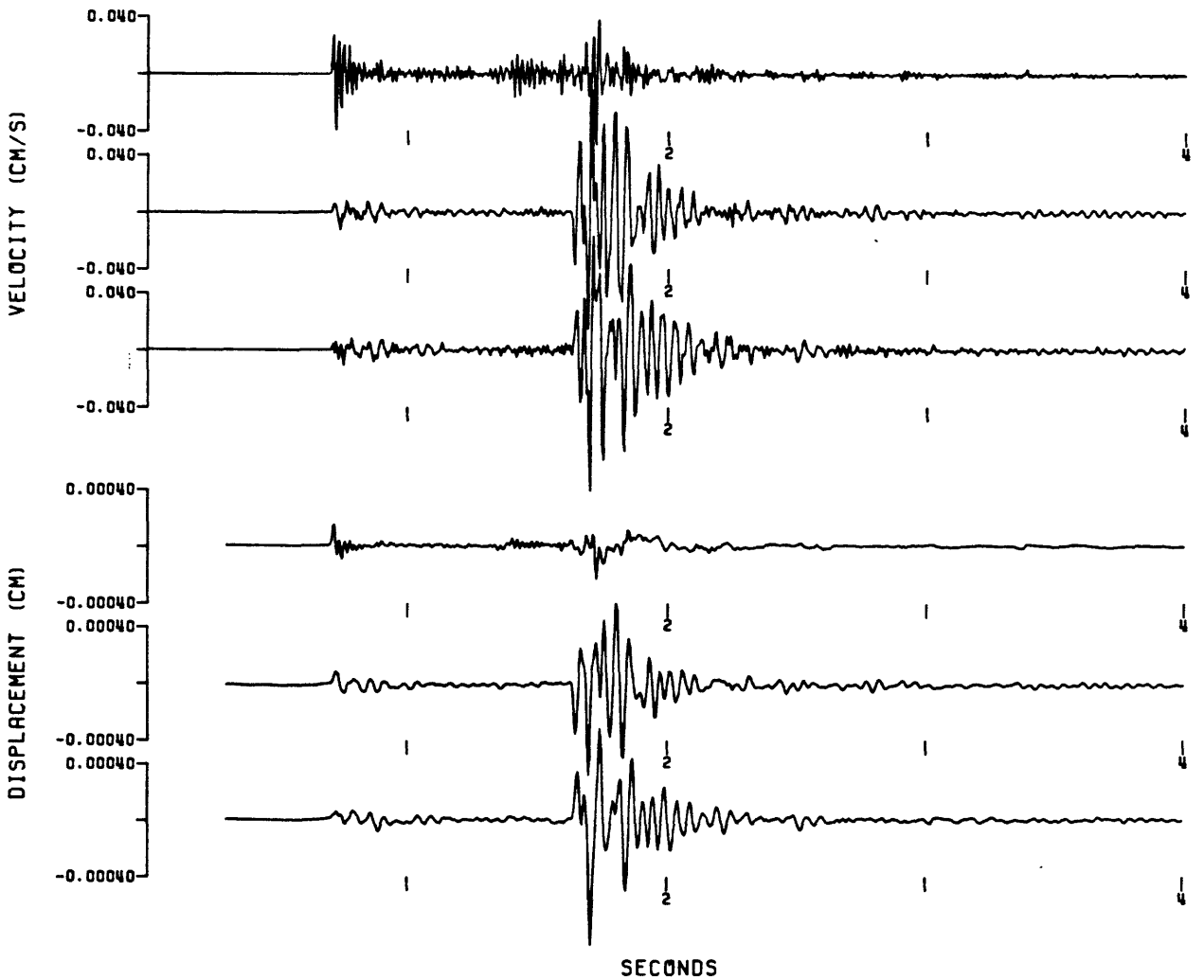



0211123L - C8A
ACCELERATION (CM/S/S)
4.00
-4.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

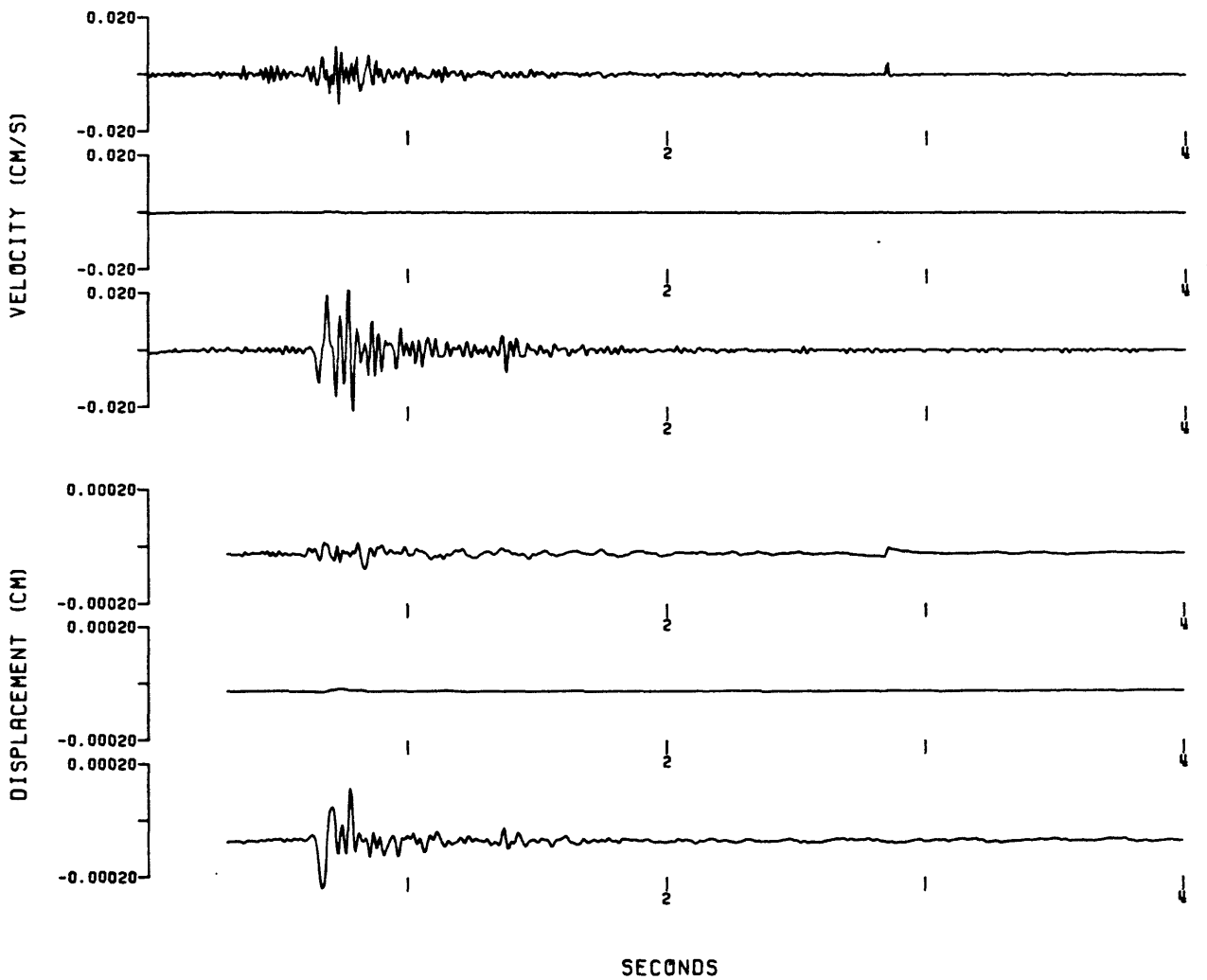
0211123L - C8V



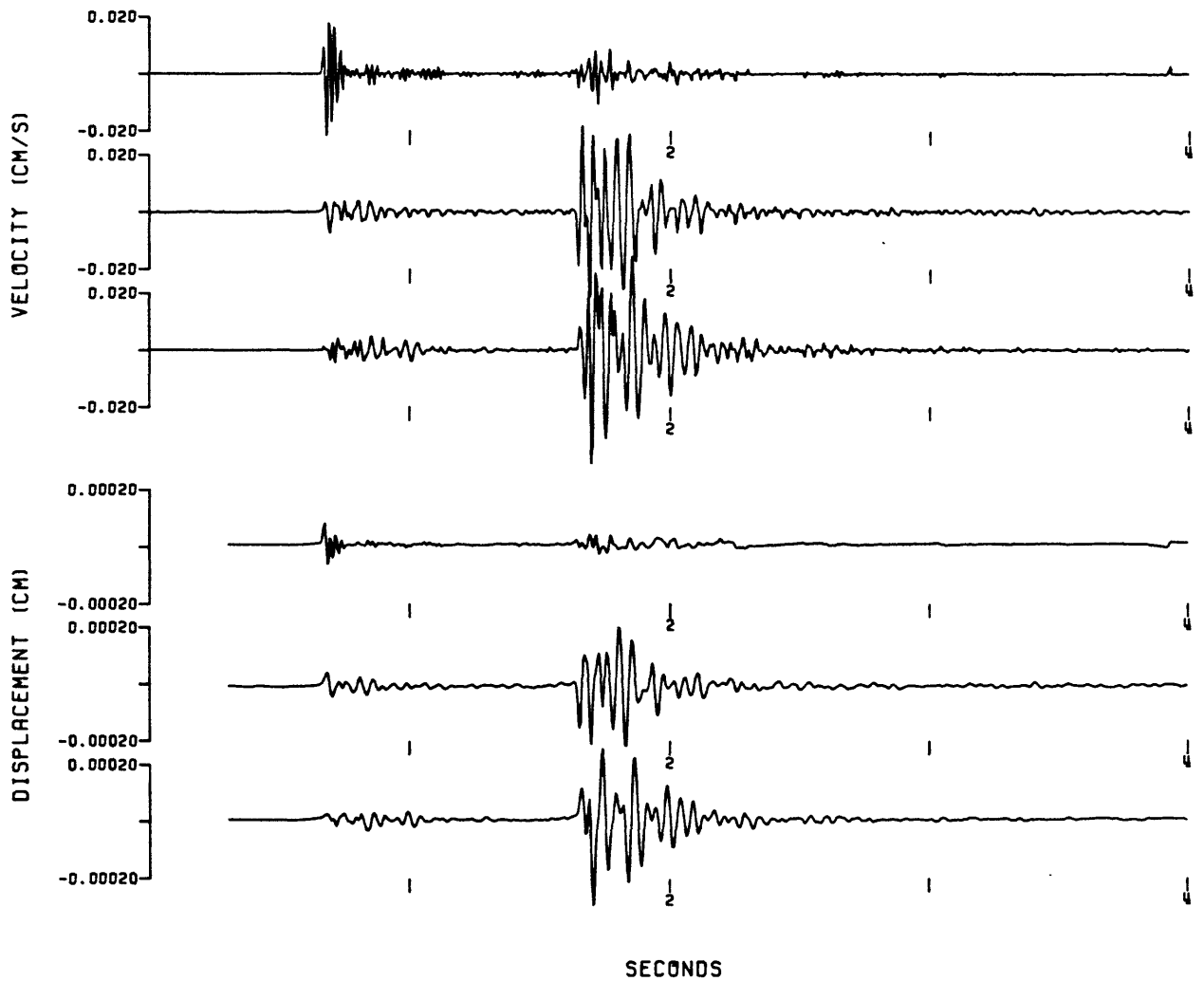
0211123L - C9V

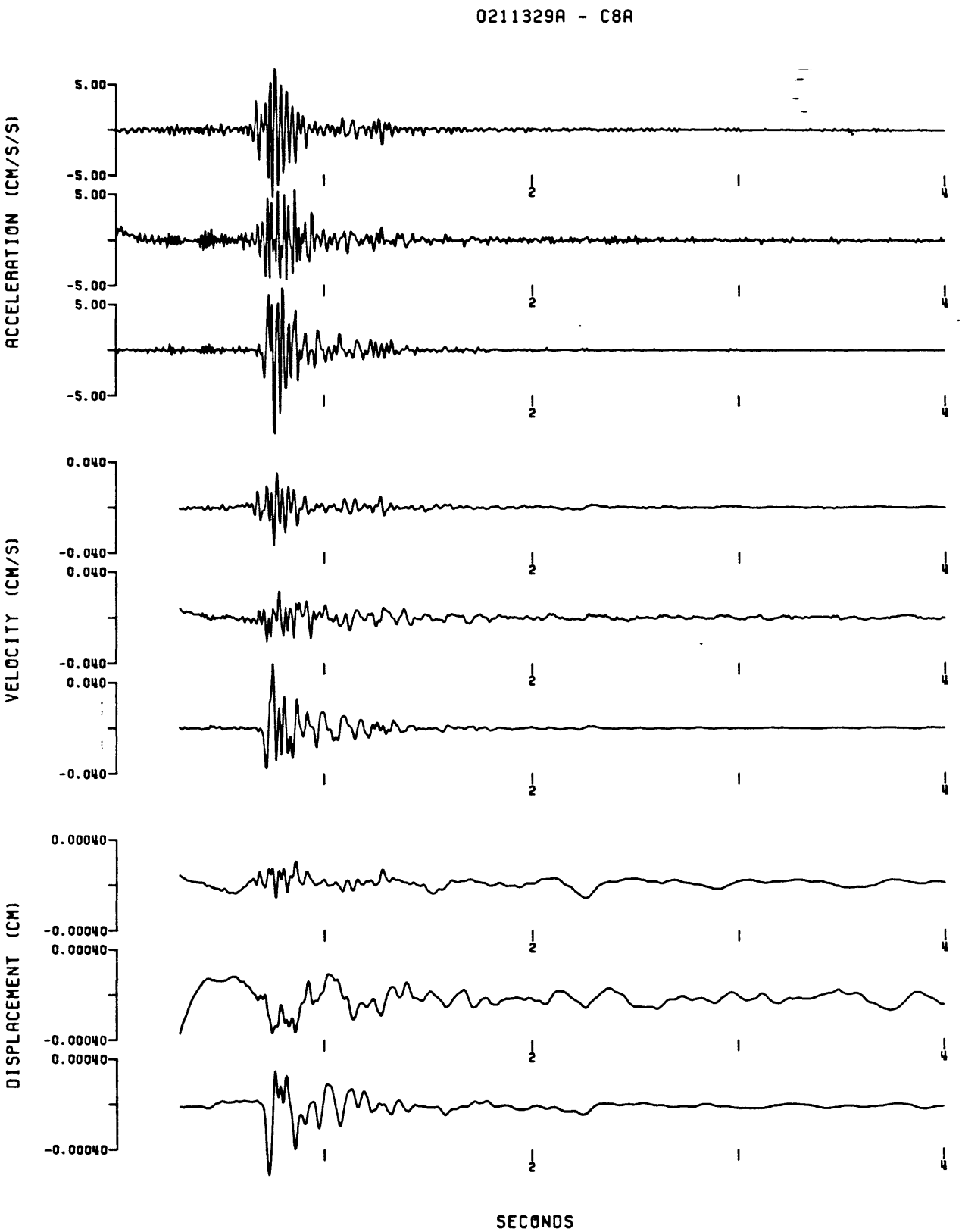


0211134K - C7V

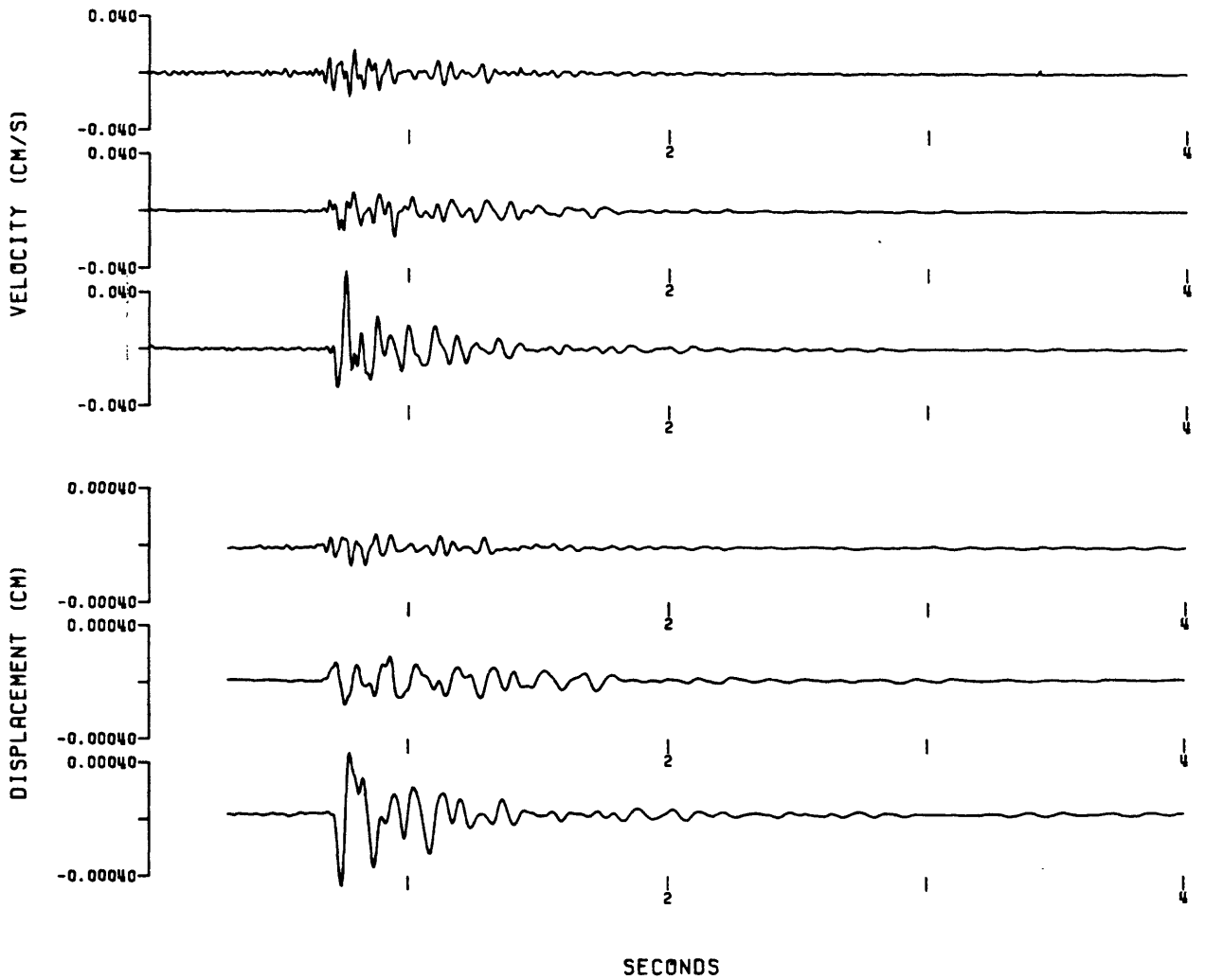


0211134K - C9V

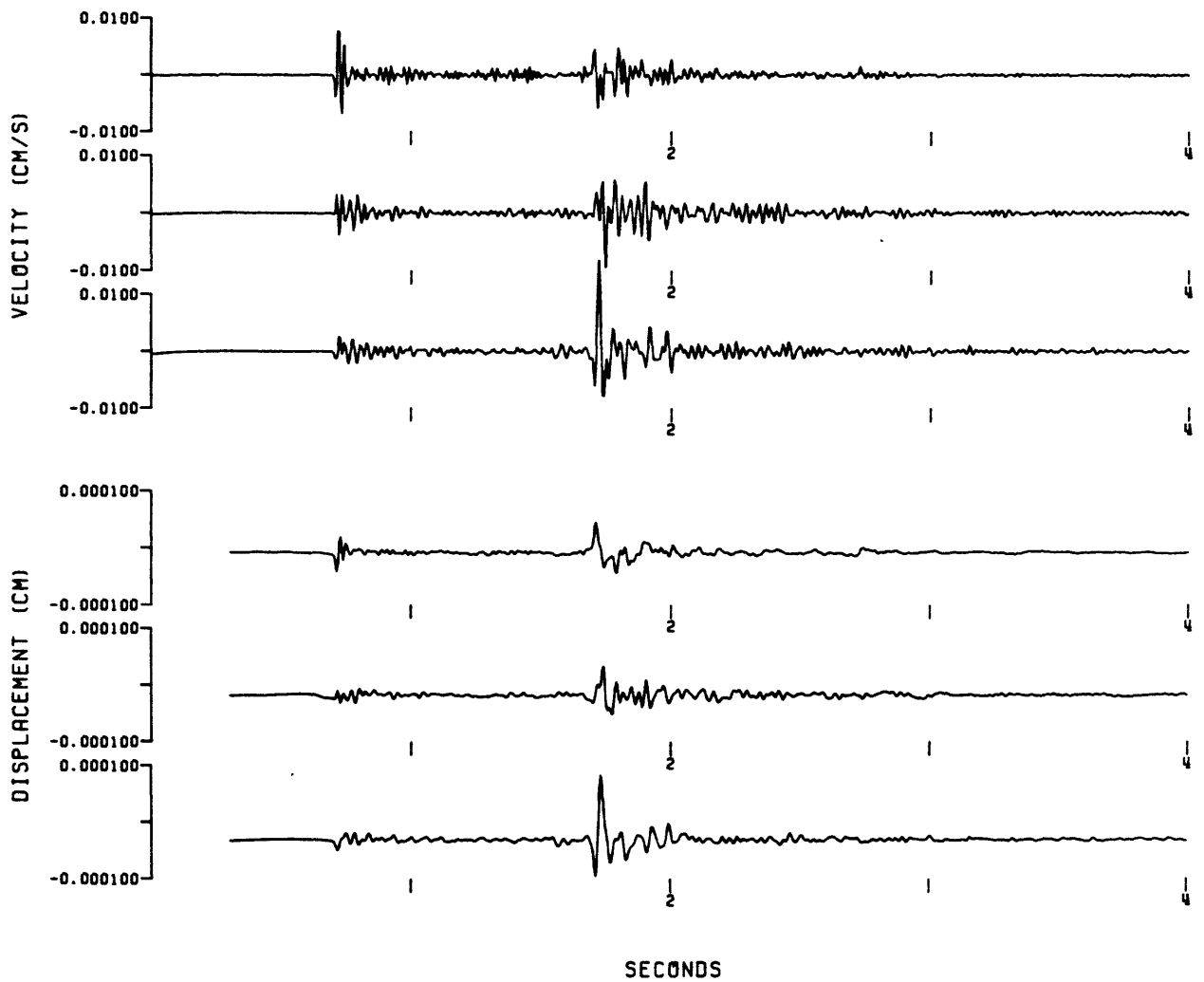



0211329A - C8A
ACCELERATION (CM/S/S)
5.00
-5.00
VELOCITY (CM/S)
0.040
-0.040
DISPLACEMENT (CM)
0.00040
-0.00040
SECONDS

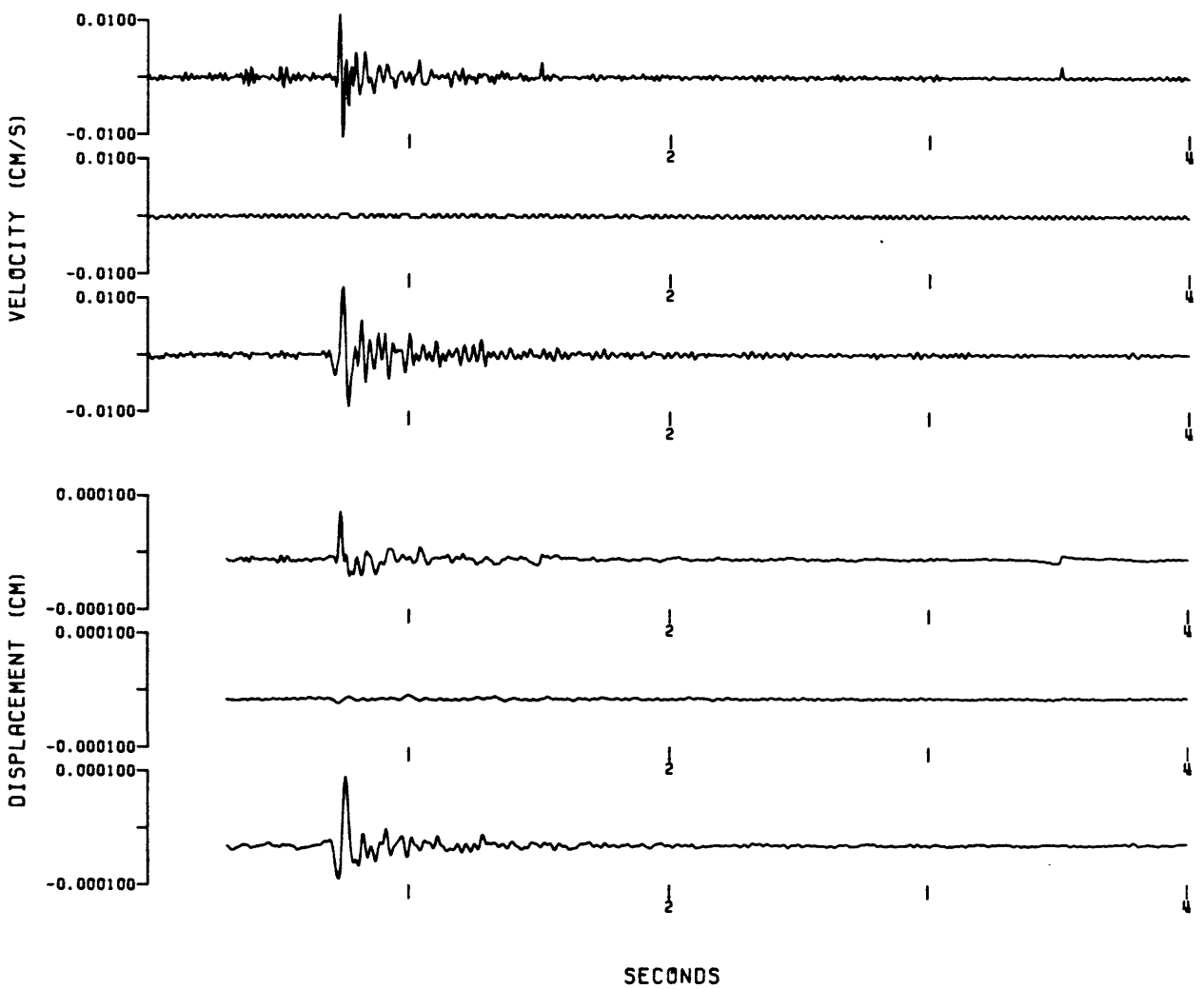
0211329A - C8V



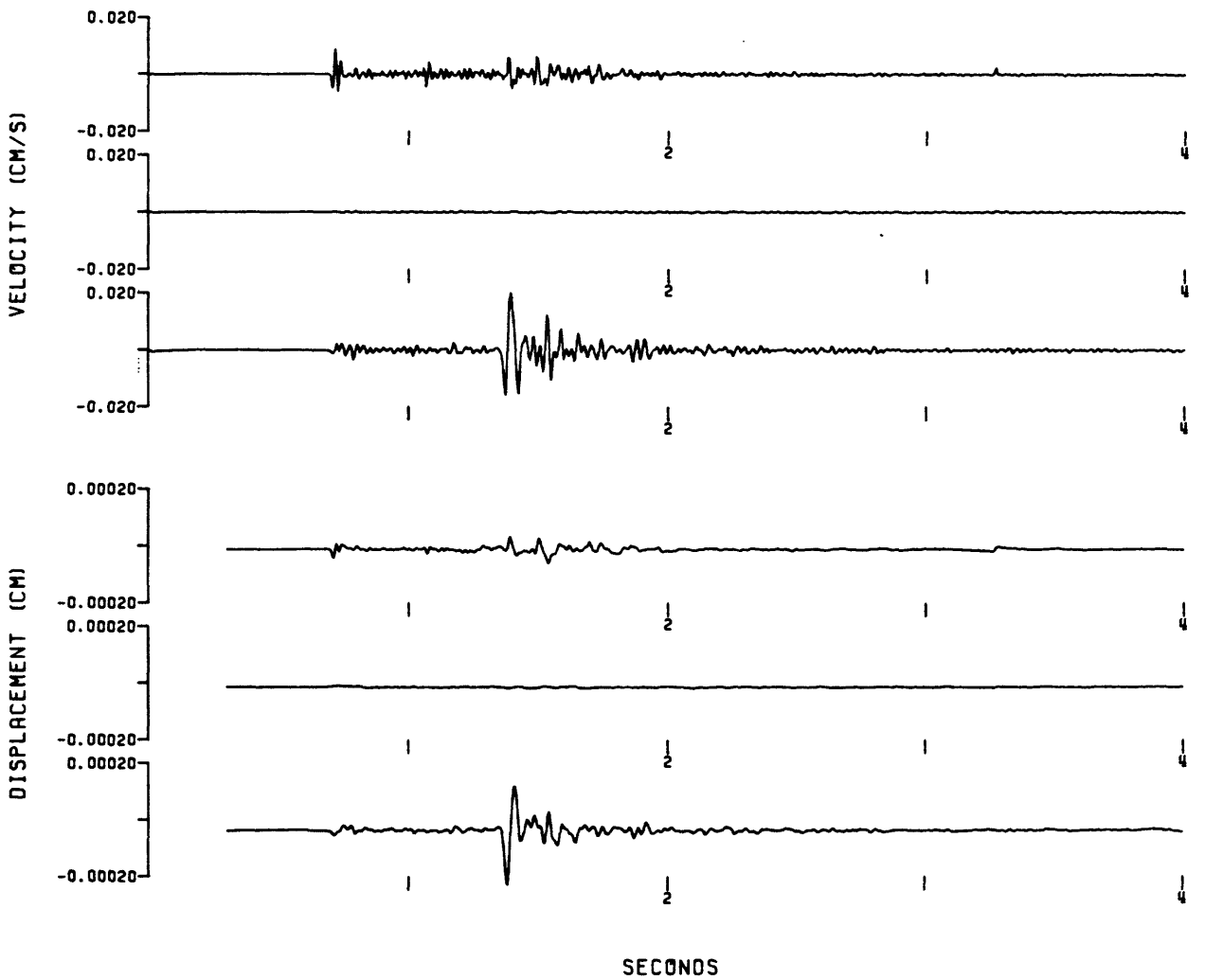
0212034R - C7V



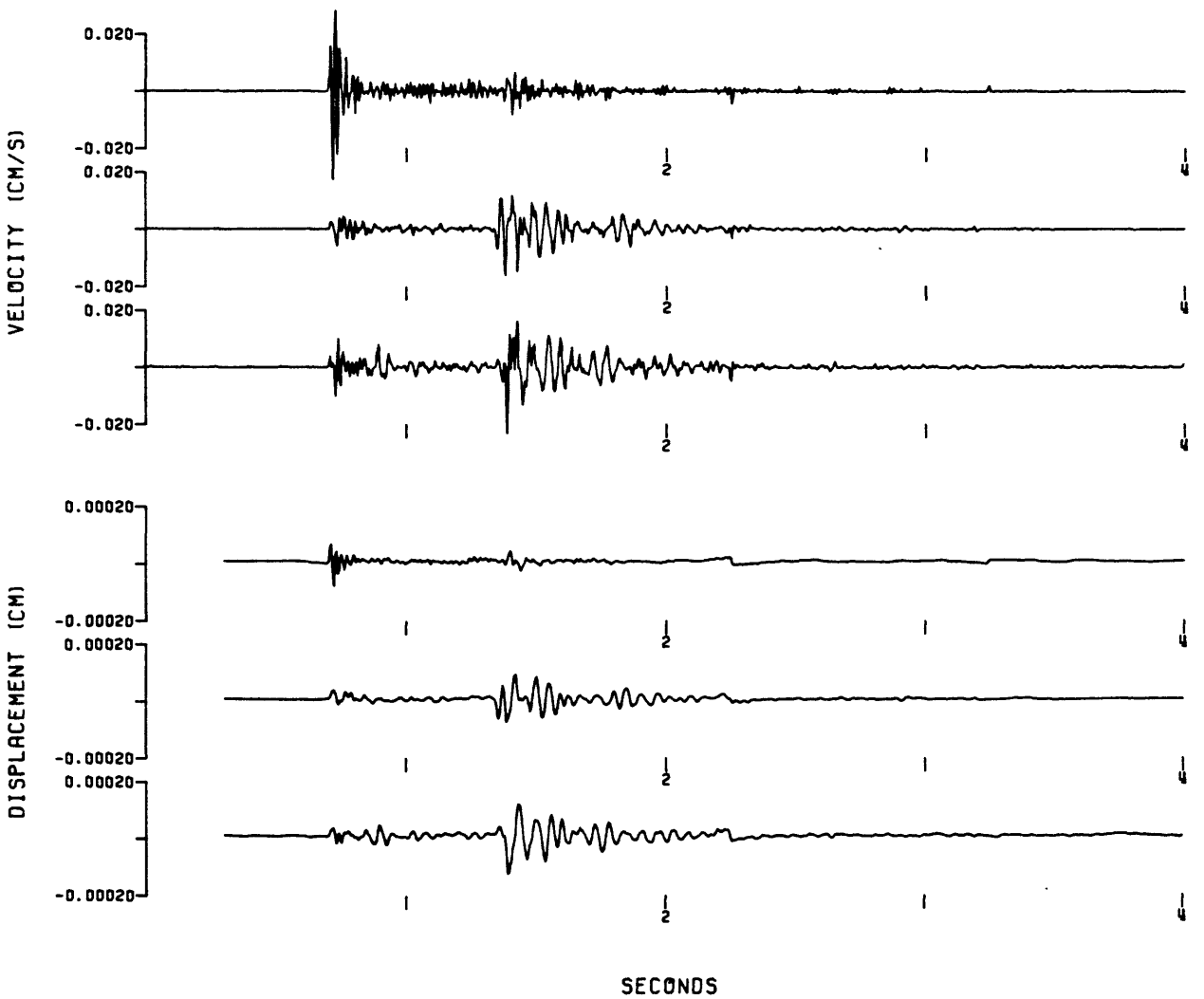
0220328F - C7V



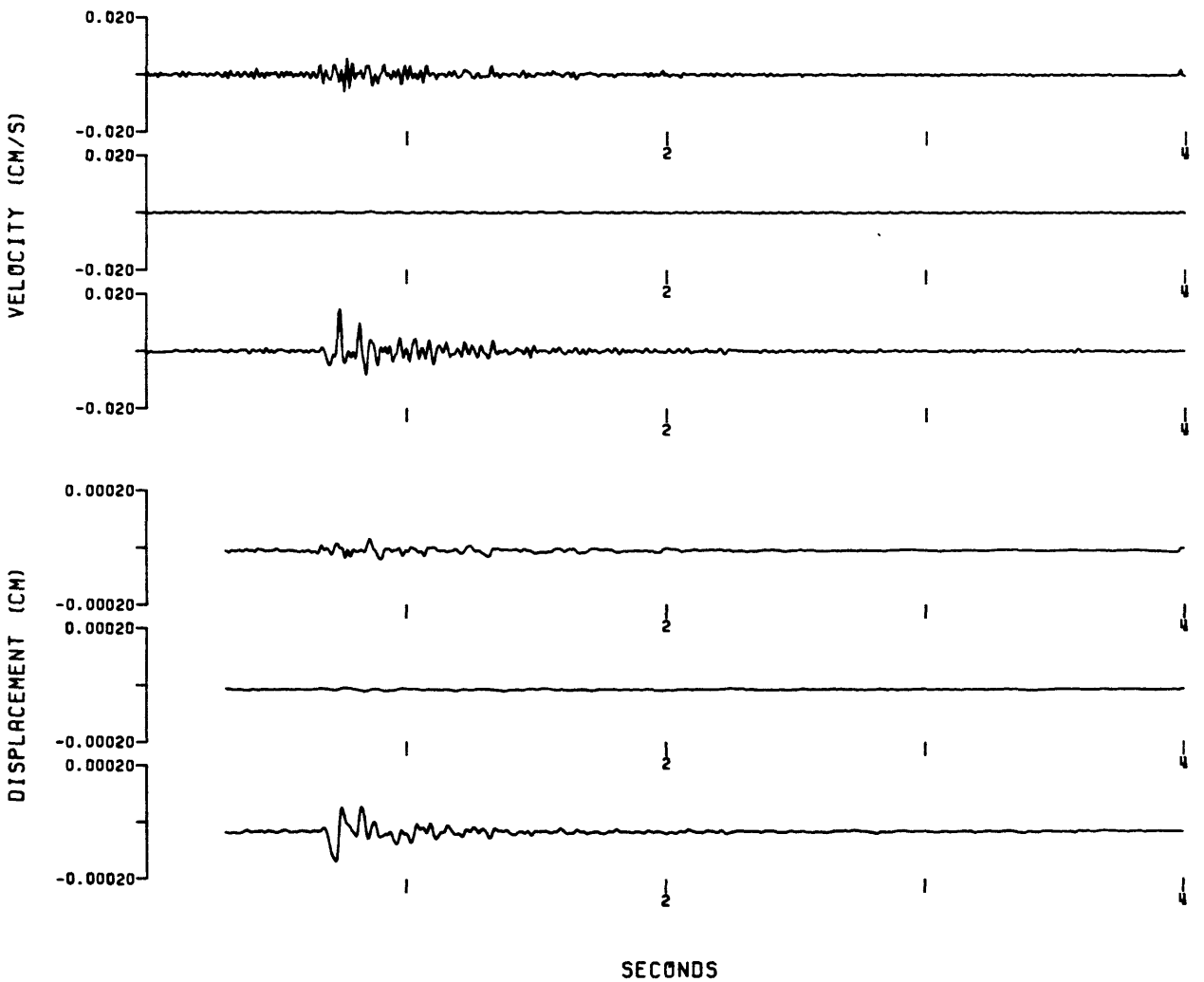
02205421 - C7V

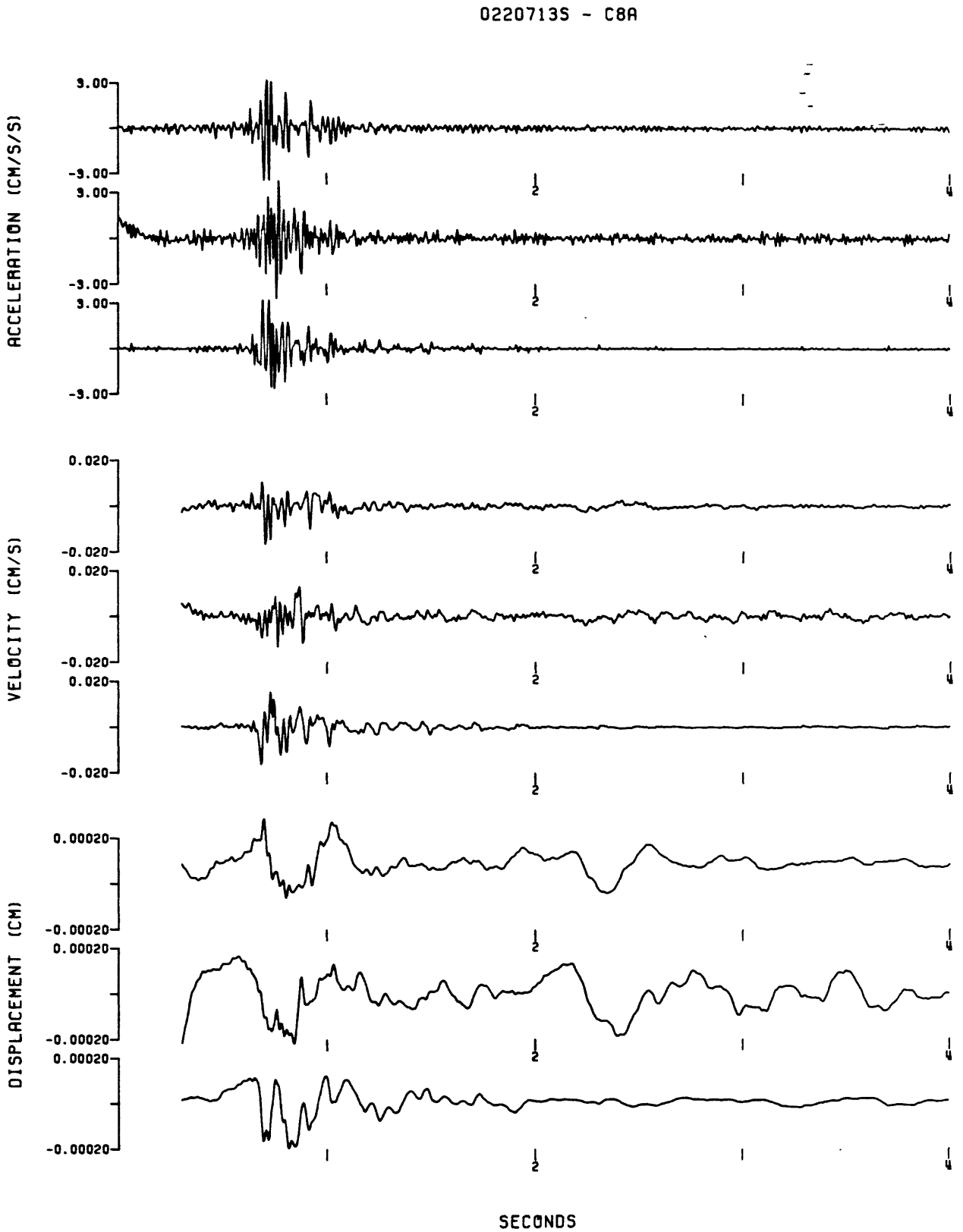


02205421 - C9V

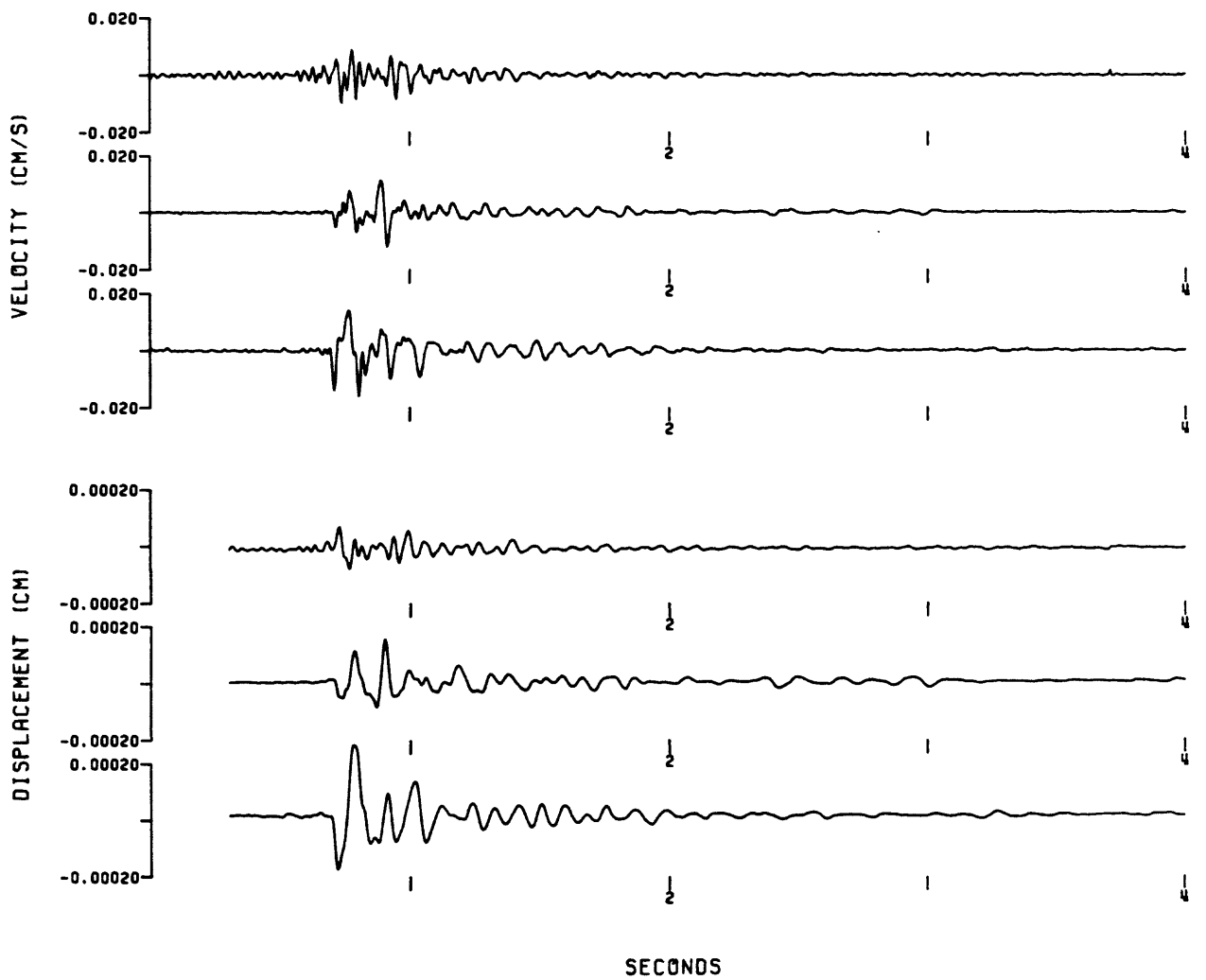


0220713S - C7V

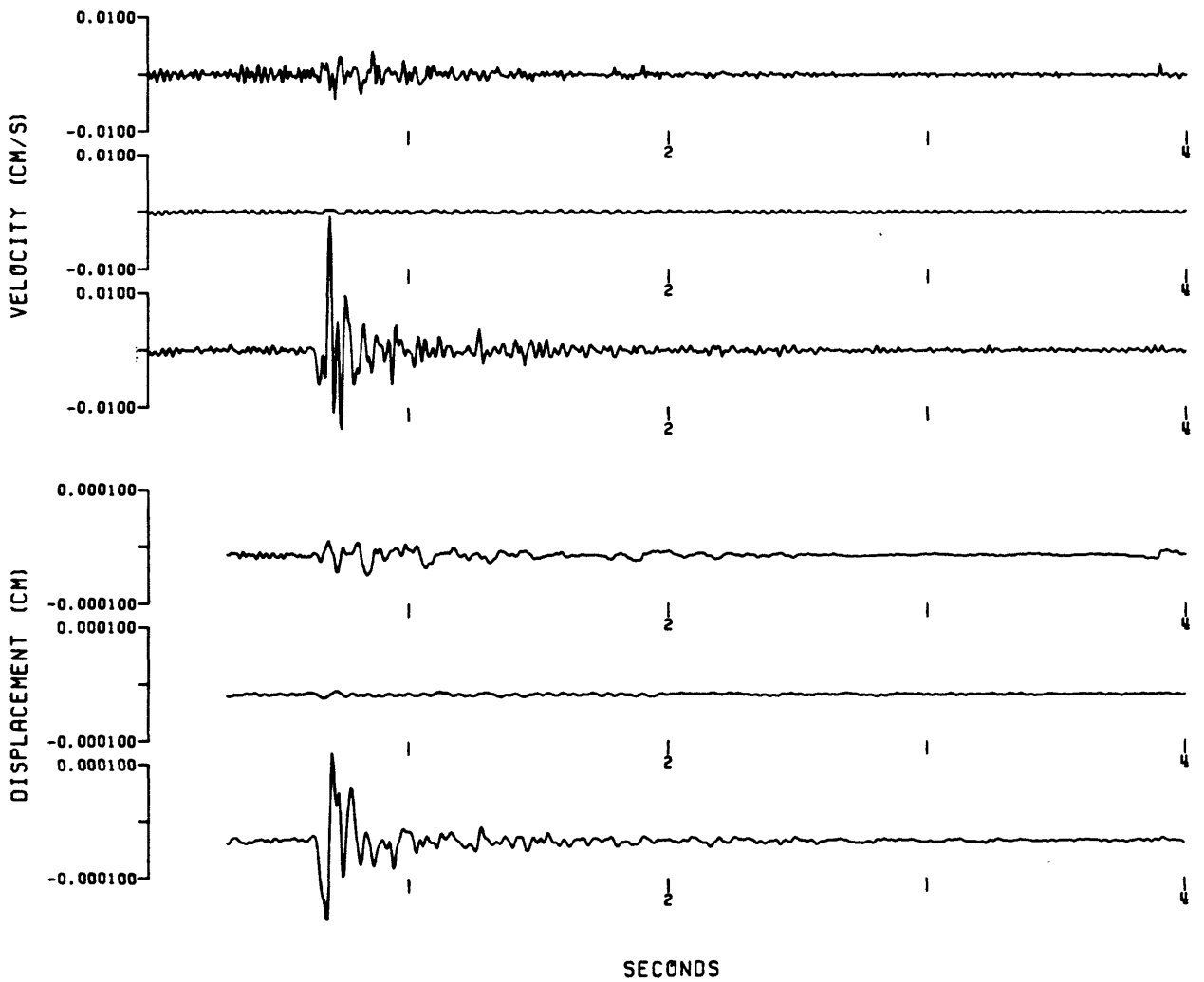



0220713S - C8A
ACCELERATION (CM/S/S)
9.00
-9.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

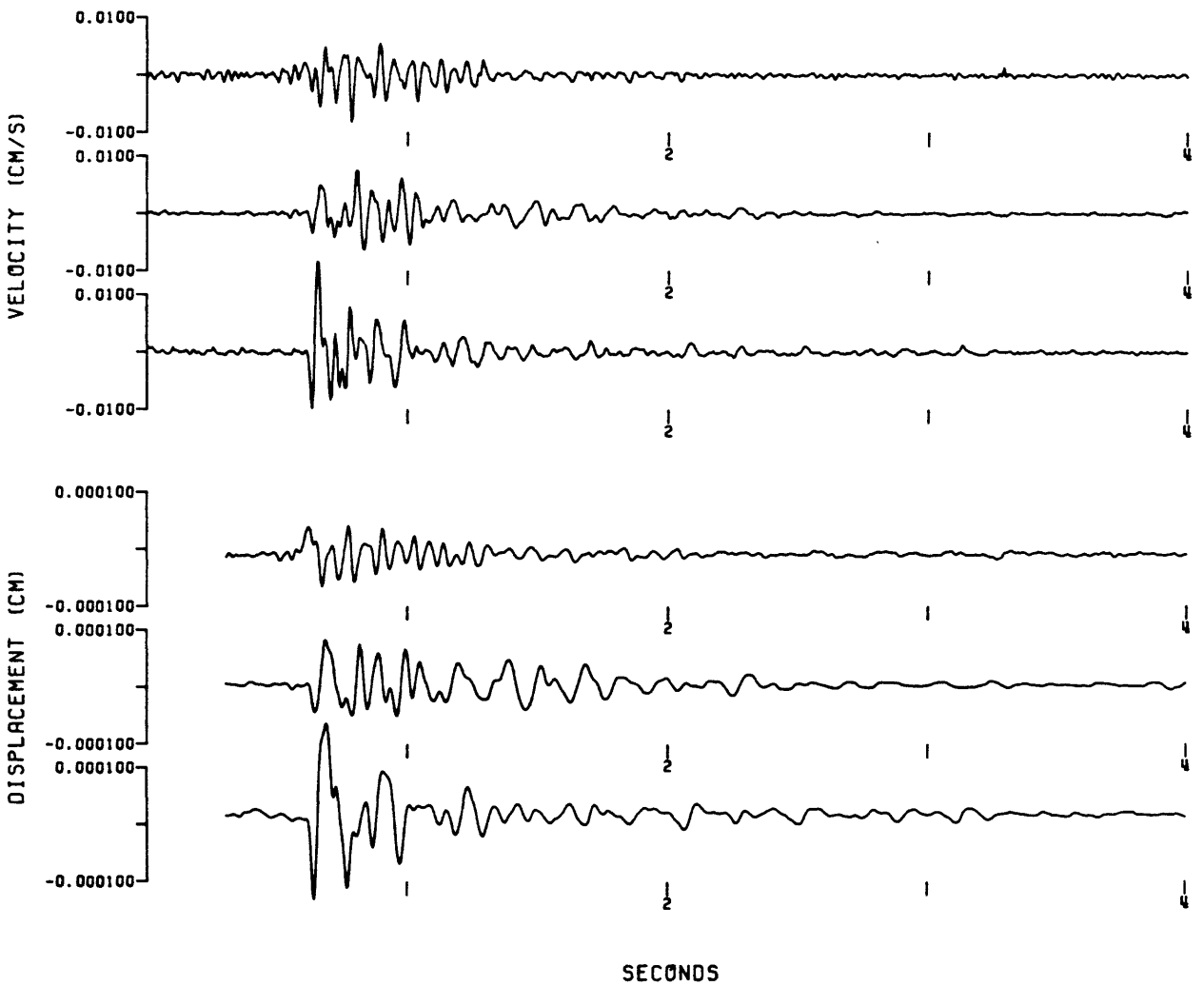
0220713S - C8V



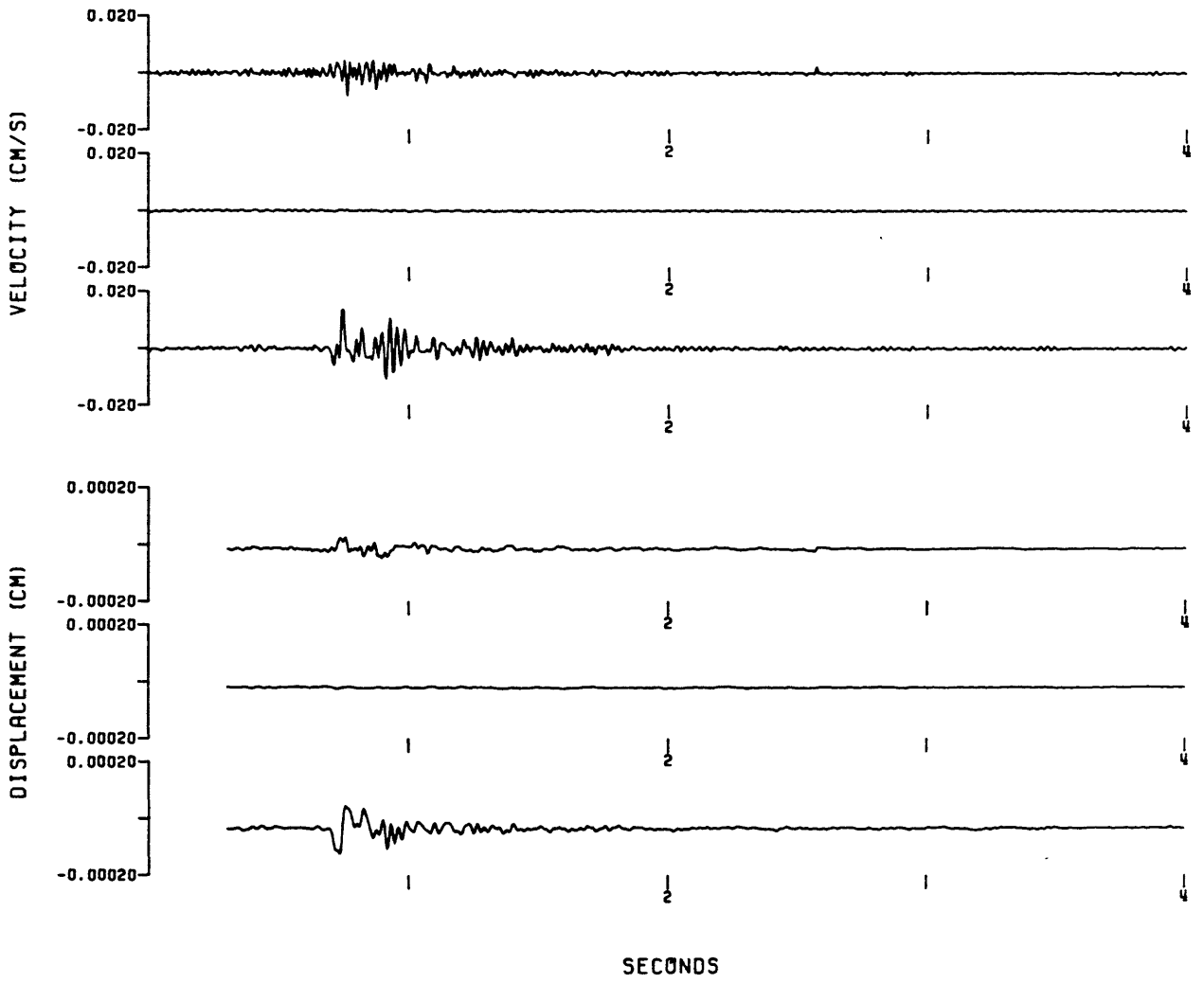
0220937H - C7V

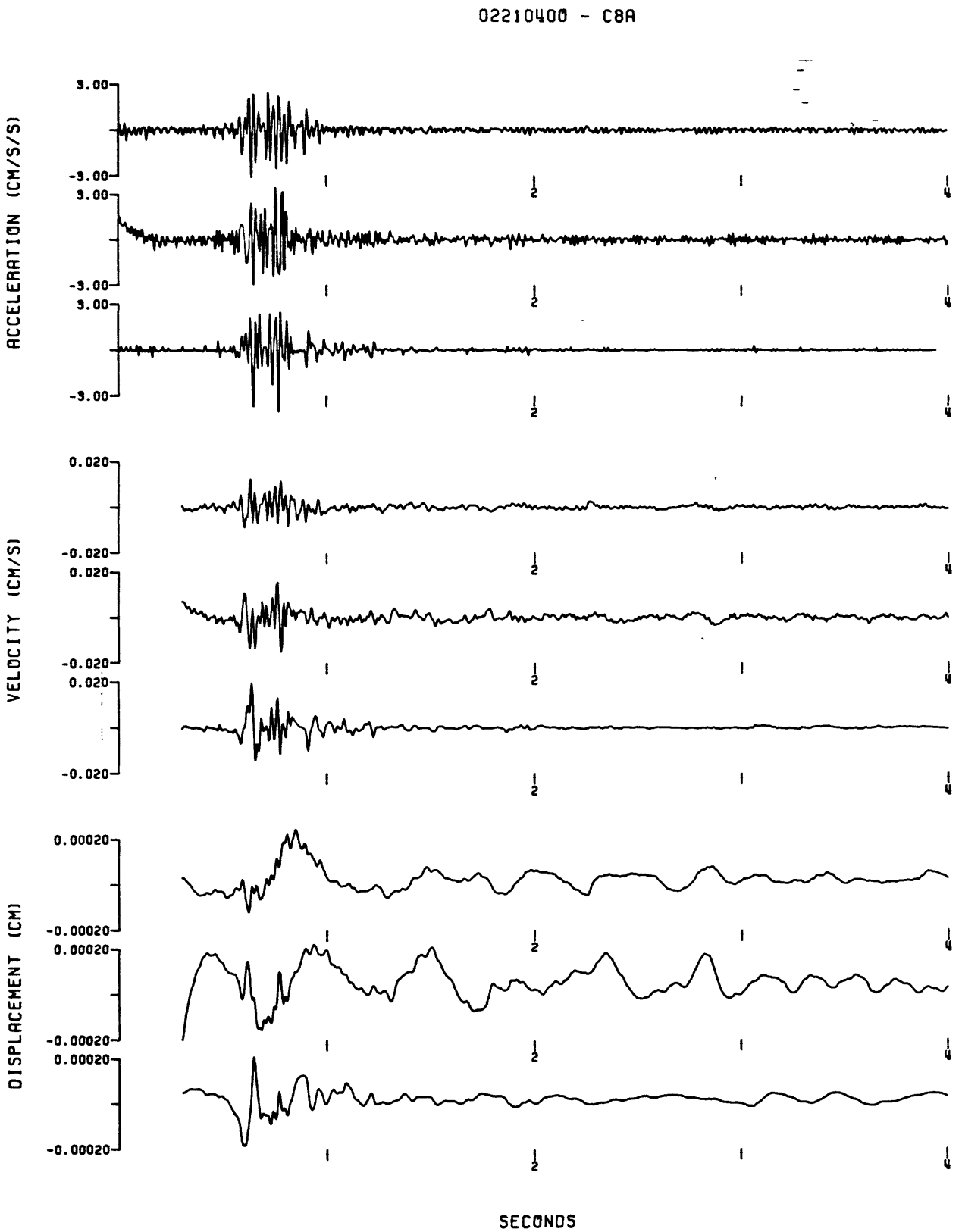


0220937H - C8V

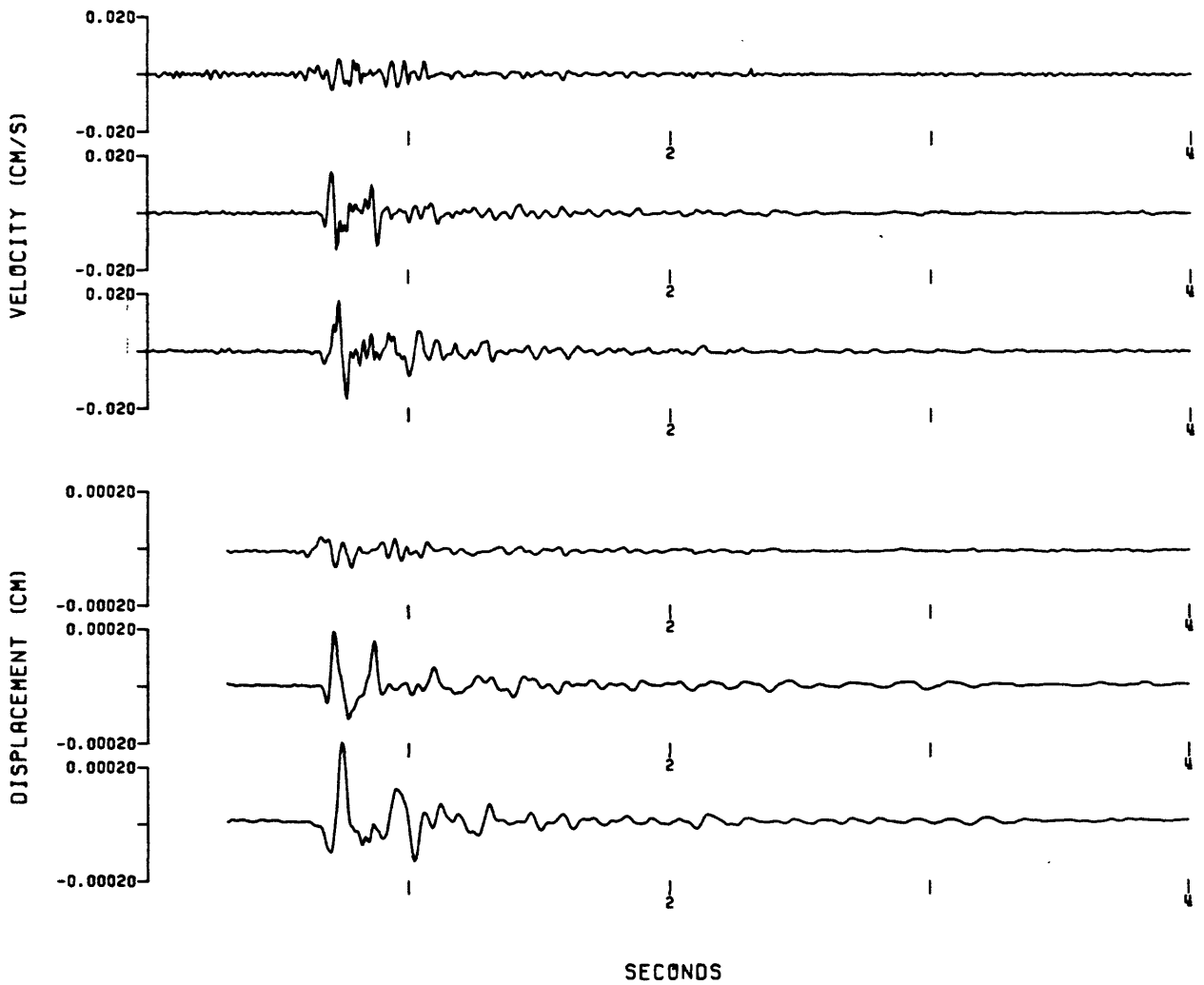


02210400 - C7V

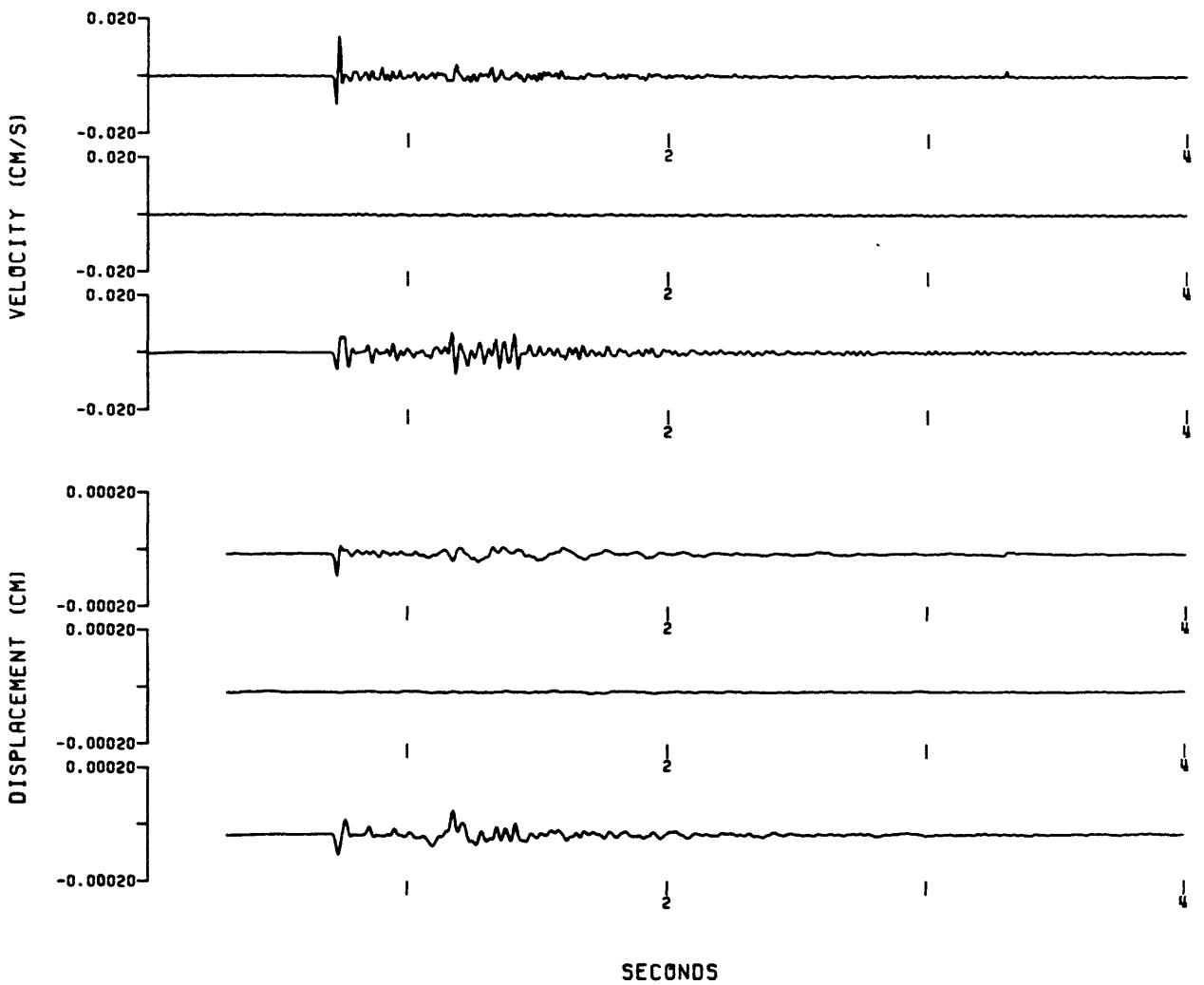



02210400 - C8A
ACCELERATION (CM/S/S)
9.00
-9.00
VELOCITY (CM/S)
0.020
-0.020
DISPLACEMENT (CM)
0.00020
-0.00020
SECONDS

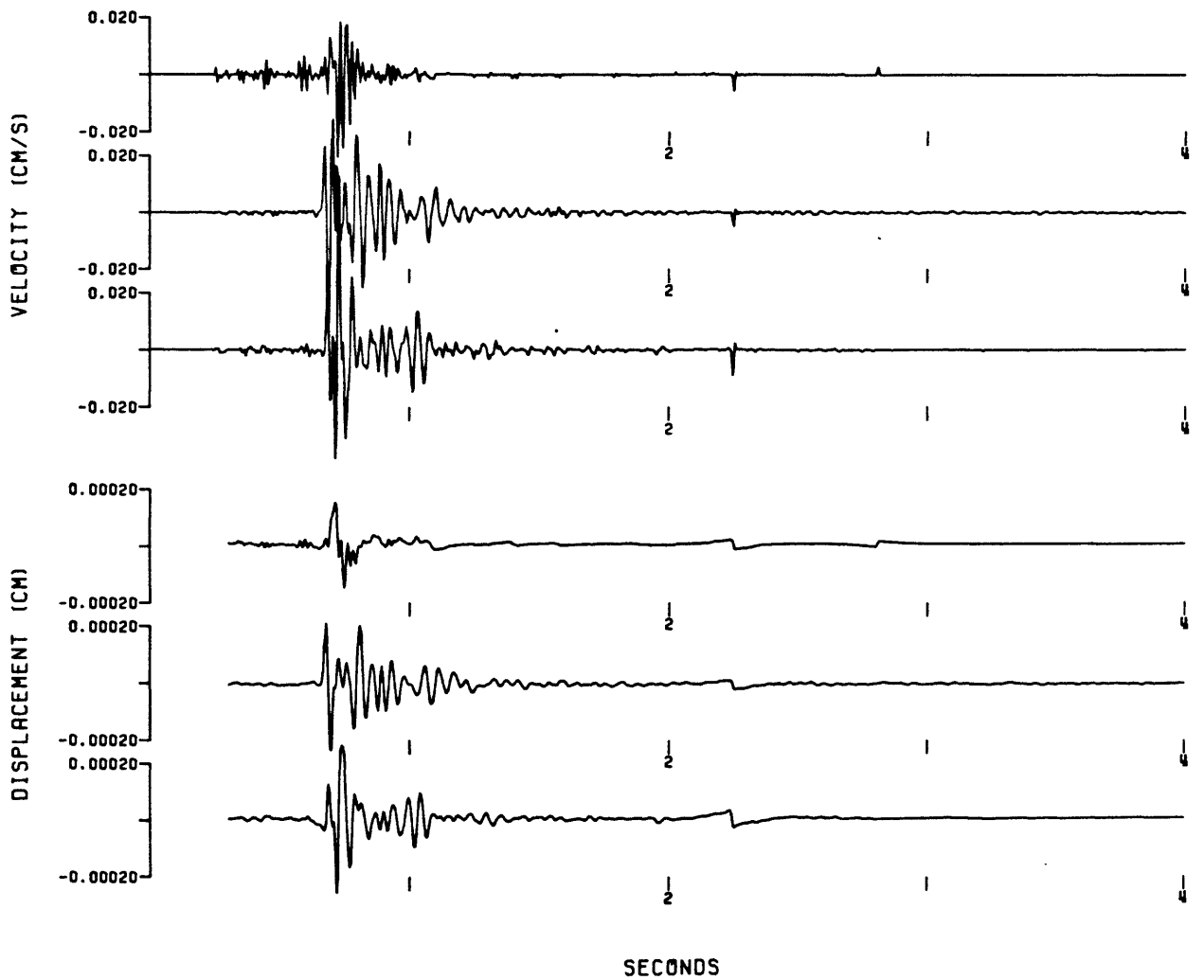
02210400 - C8V



02212080 - C7V



02212080 - C9V



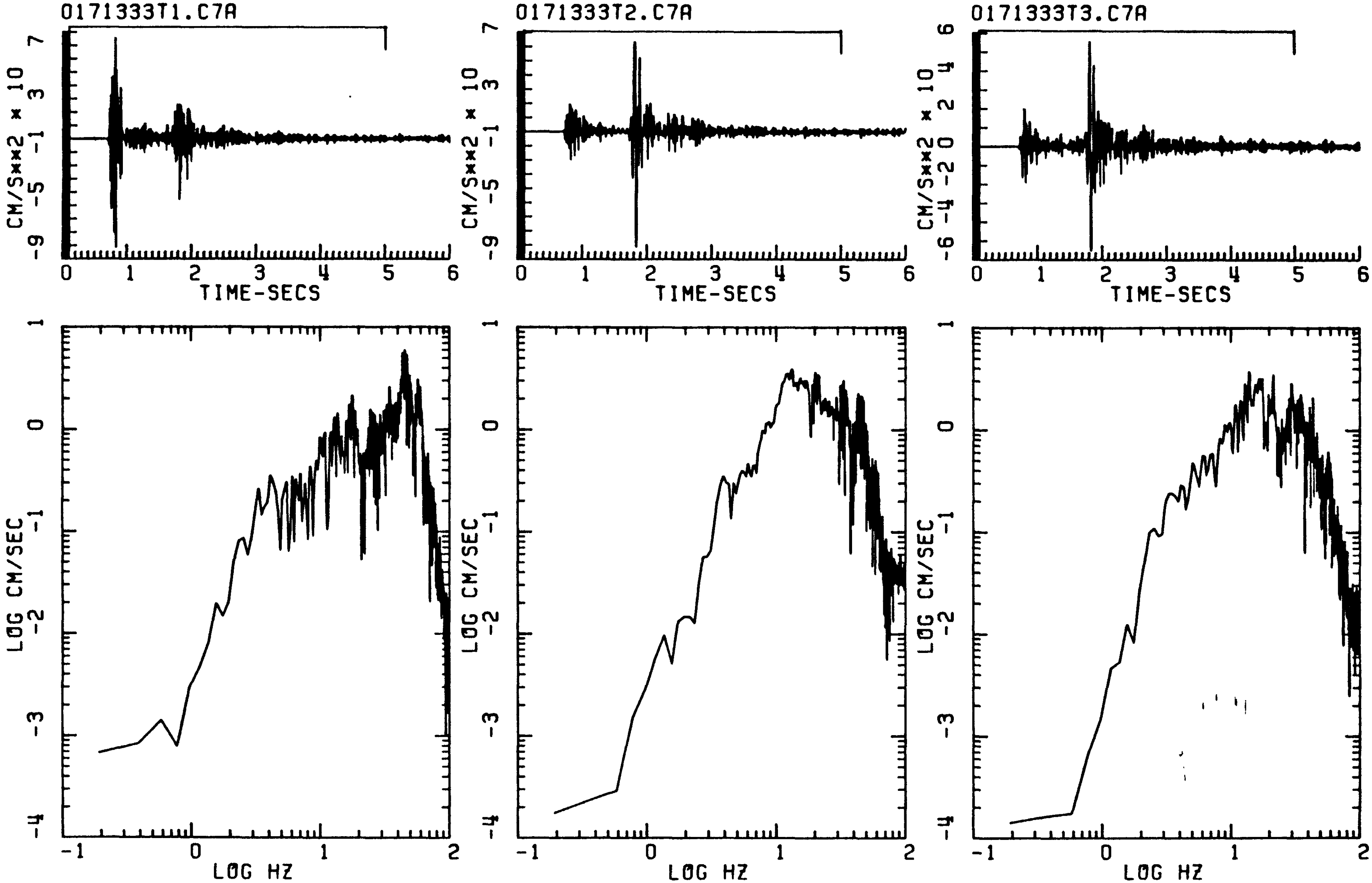
B 105

APPENDIX C

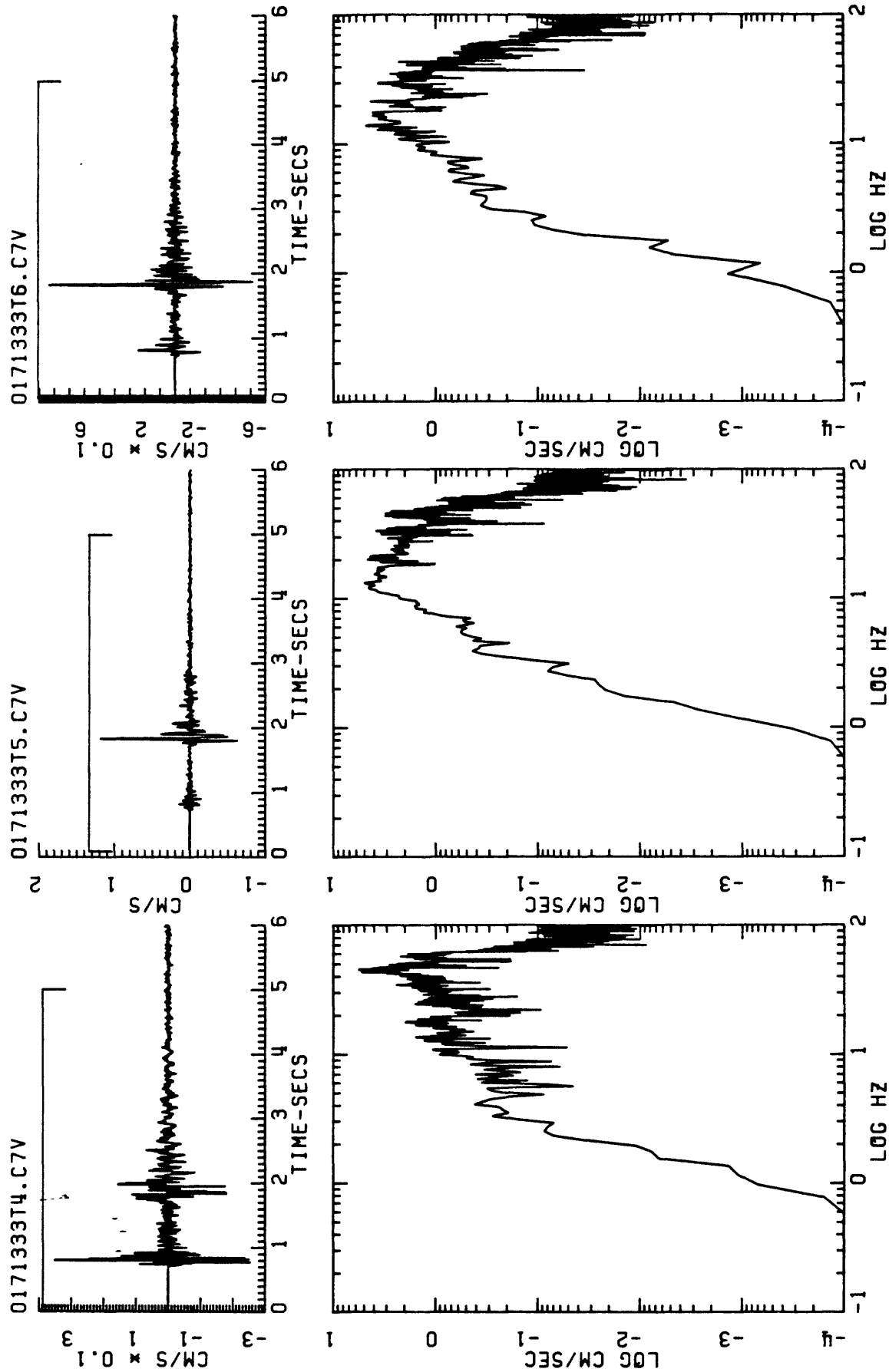
Fourier Spectra

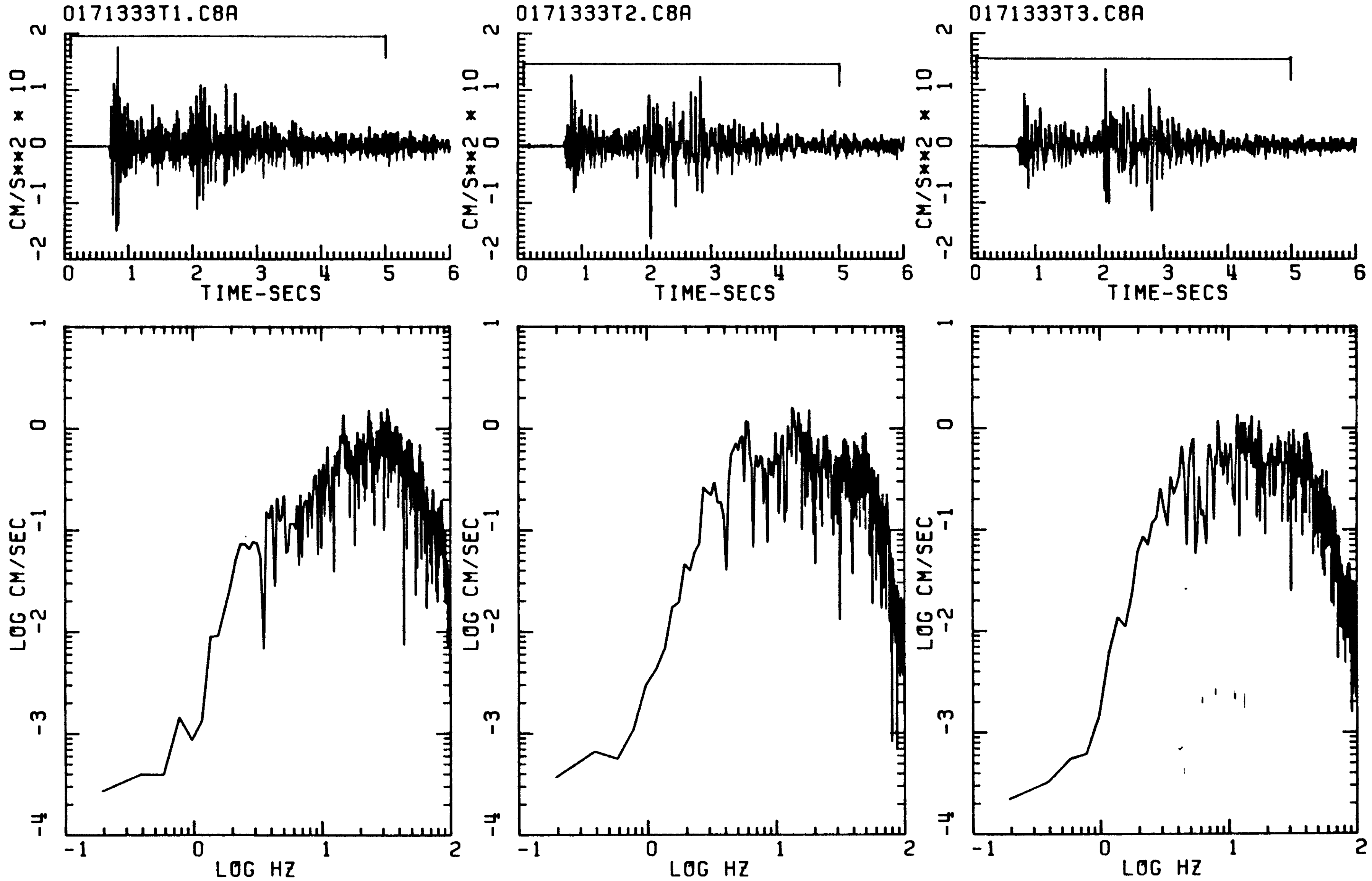
Appendix C contains Fourier acceleration spectra from selected aftershocks. First, spectra from all seismograms recorded during the largest event - 0171333T - are shown. Second, for comparison of a range of aftershocks, spectra are shown from C9V seismograms for all earthquakes whose P-arrival triggered C9V. C9V was our best instrument in terms of number of triggers and proximity to the hypocenters.

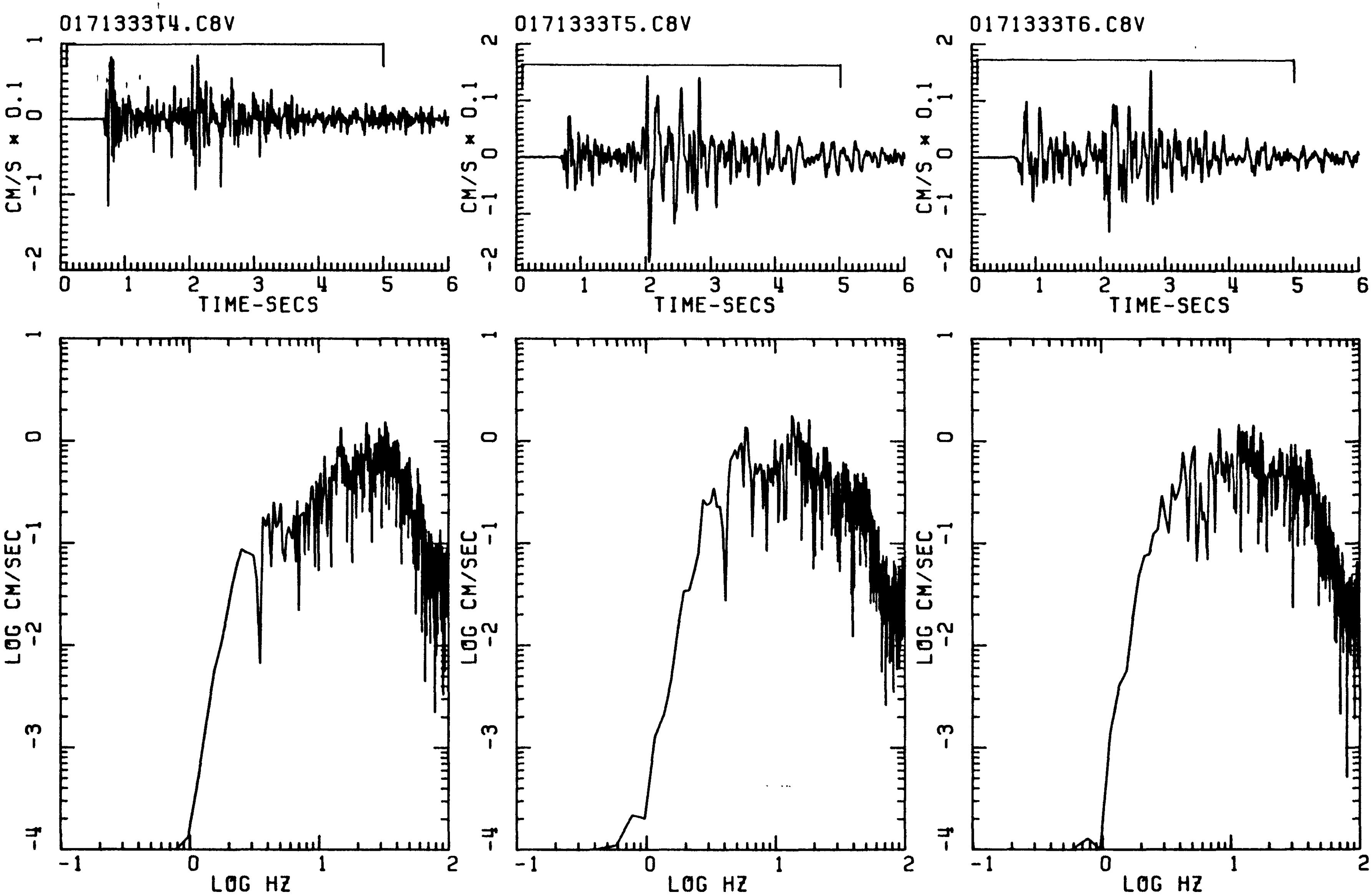
Each seismogram was hi-pass filtered at 2 Hz prior to analysis (see Appendix B). Five seconds of each seismogram were analyzed and a cosine taper was applied to the first and last 10 percent prior to the FFT. Velocity spectra were multiplied by frequency to obtain acceleration. There was no correction for attenuation, instrument, or anti-alias filter. Scaling within each group of spectral plots is similar to facilitate comparison.

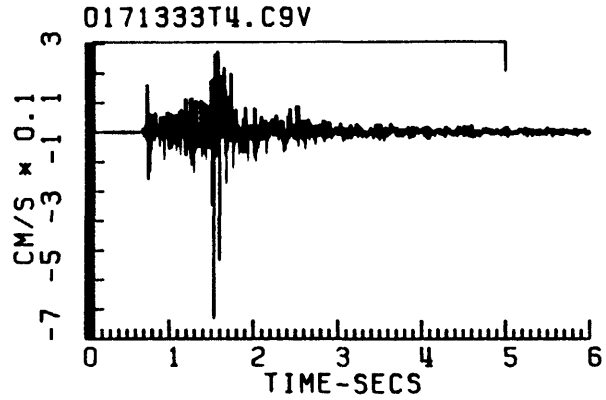


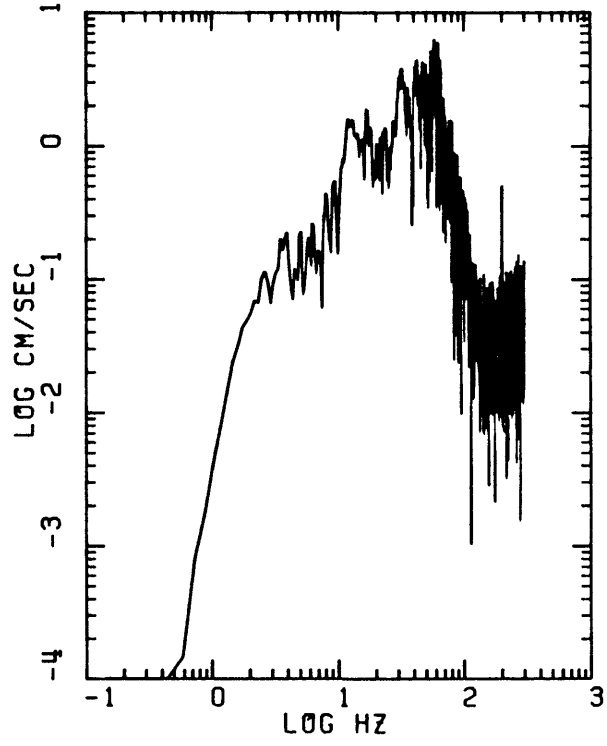
0171333T1.C7A
CM/S**2 x 10
TIME-SECS
LOG CM/SEC
LOG HZ
0171333T2.C7A
CM/S**2 x 10
TIME-SECS
LOG CM/SEC
LOG HZ
0171333T3.C7A
CM/S**2 x 10
TIME-SECS
LOG CM/SEC
LOG HZ

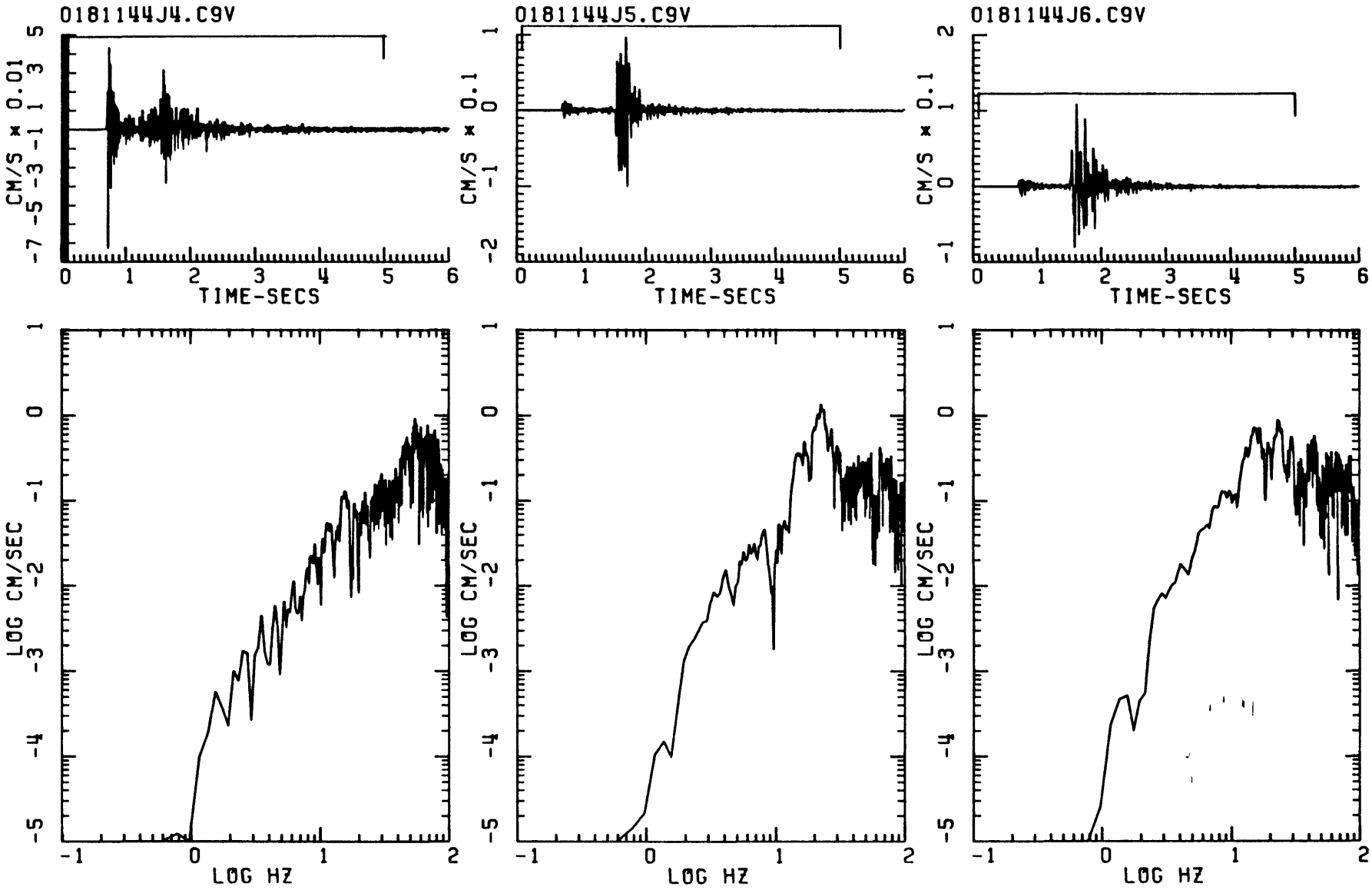

017133T6.C7V
CM/S * 0.1
TIME-SECS
LOG CM/SEC
LOG HZ
017133T5.C7V
CM/S
TIME-SECS
LOG CM/SEC
LOG HZ
017133T4.C7V
CM/S * 0.1
TIME-SECS
LOG CM/SEC
LOG HZ


0171333T1.C8A
0171333T2.C8A
0171333T3.C8A
CM/S**2 * 10
TIME-SECS
LOG CM/SEC
LOG HZ

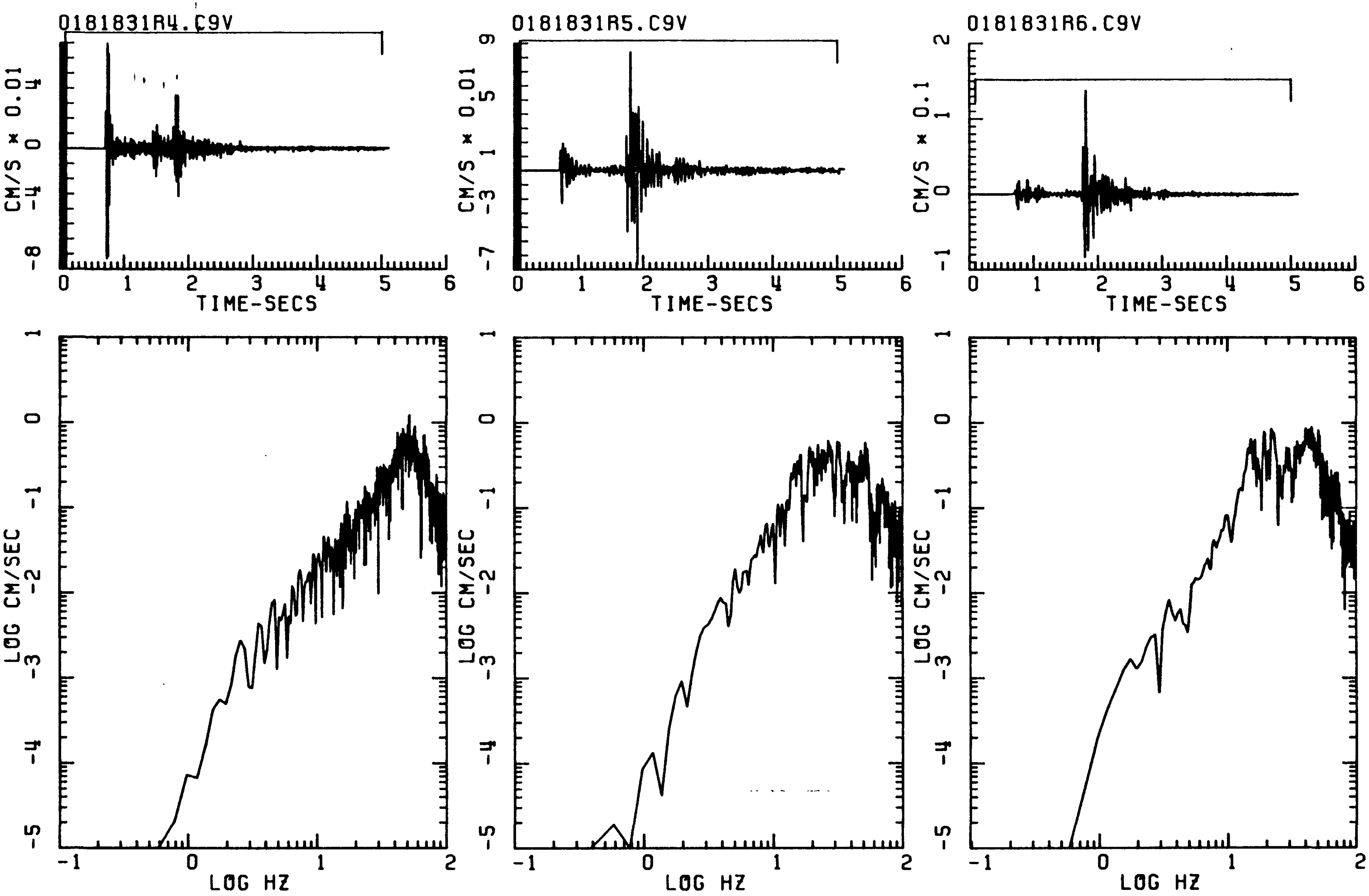

0171333T4.C8V
0171333T5.C8V
0171333T6.C8V
CM/S * 0.1
TIME-SECS
LOG CM/SEC
LOG HZ

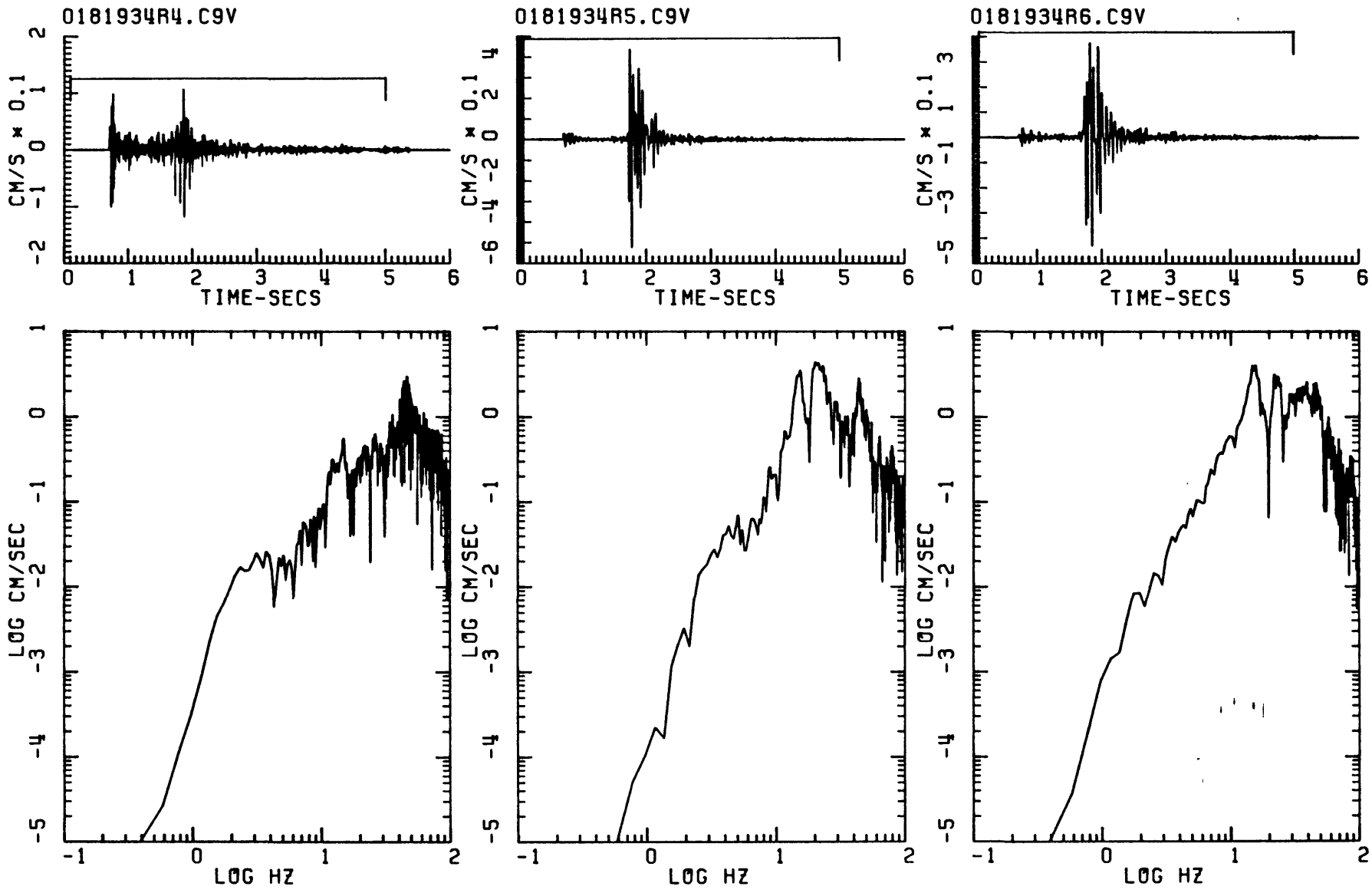

0171333T4.C9V
CM/S * 0.1
3
1
-1
-3
-5
-7
0
1
2
3
4
5
6
TIME-SECS


LOG CM/SEC
1
0
-1
-2
-3
-4
-1
0
1
2
3
LOG HZ

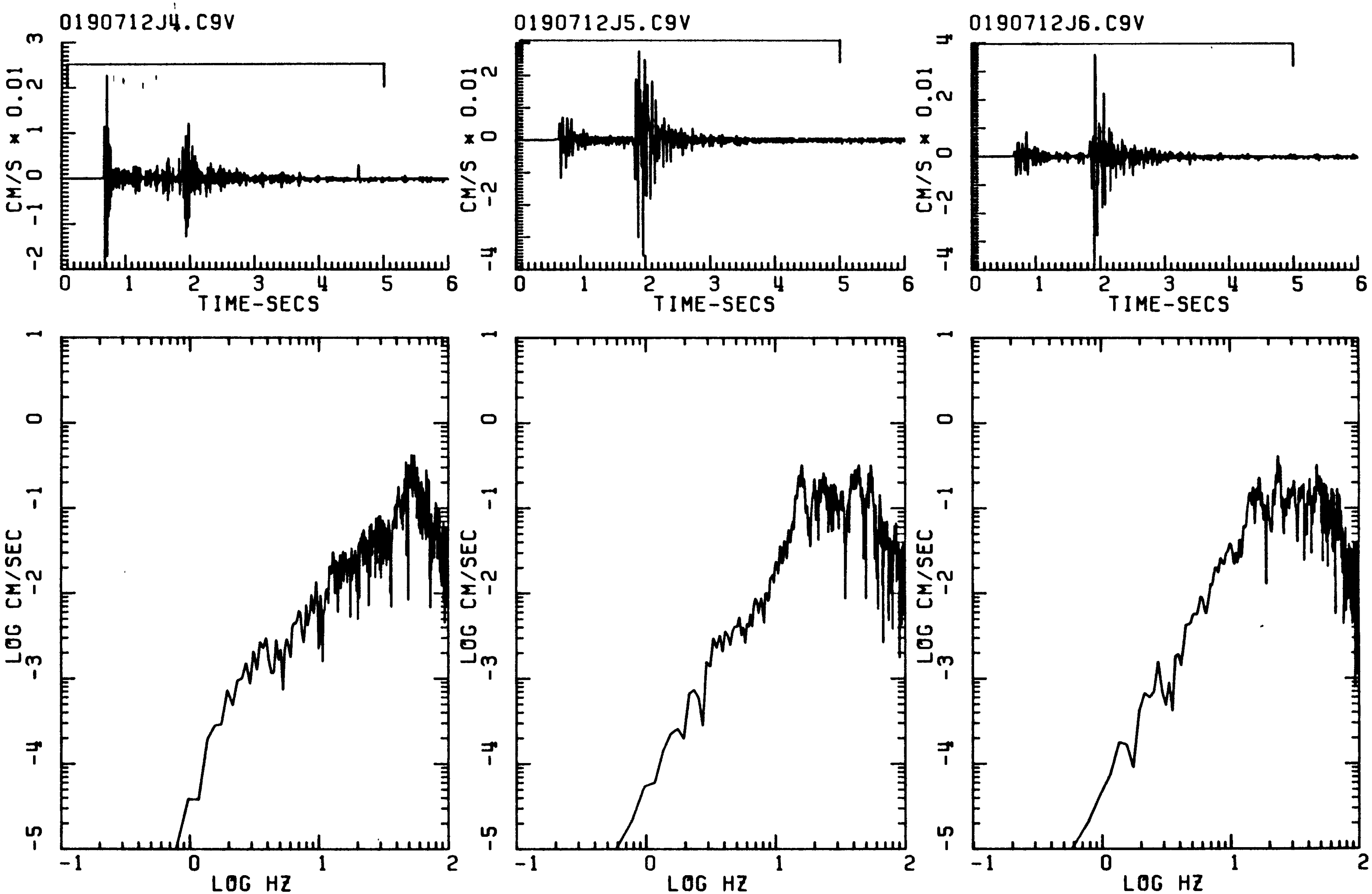

0181144J4.C9V
CM/S * 0.01
TIME-SECS
0181144J5.C9V
CM/S * 0.1
TIME-SECS
0181144J6.C9V
CM/S * 0.1
TIME-SECS
LOG CM/SEC
LOG HZ
LOG CM/SEC
LOG HZ
LOG CM/SEC
LOG HZ

C 7

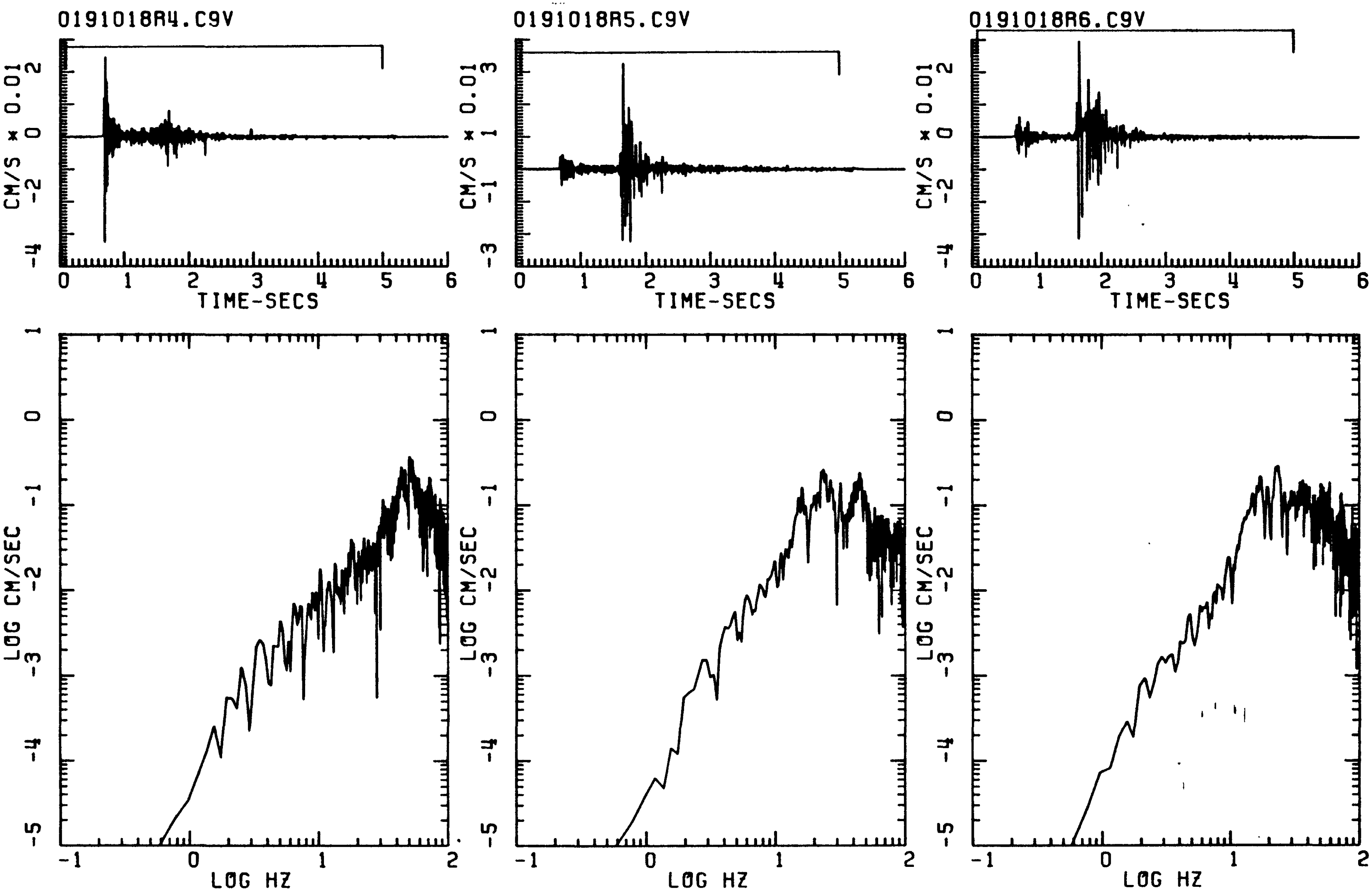

0181831R4.C9V
0181831R5.C9V
0181831R6.C9V
CM/S × 0.01
CM/S × 0.01
CM/S × 0.1
TIME-SECS
TIME-SECS
TIME-SECS
LOG CM/SEC
LOG CM/SEC
LOG CM/SEC
LOG HZ
LOG HZ
LOG HZ


0181934R4.C9V
0181934R5.C9V
0181934R6.C9V
CM/S x 0.1
TIME-SECS
LOG CM/SEC
LOG HZ

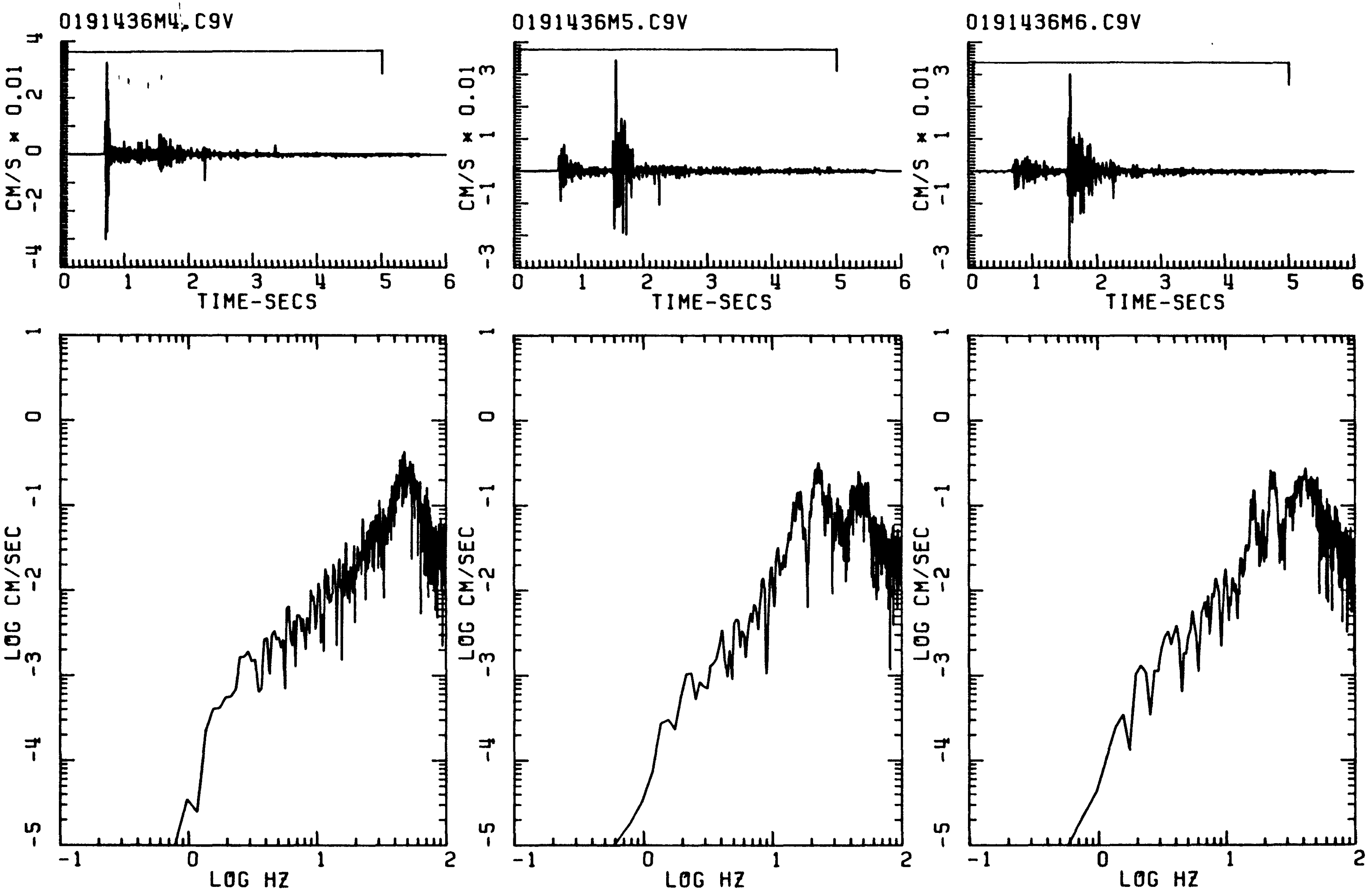
69



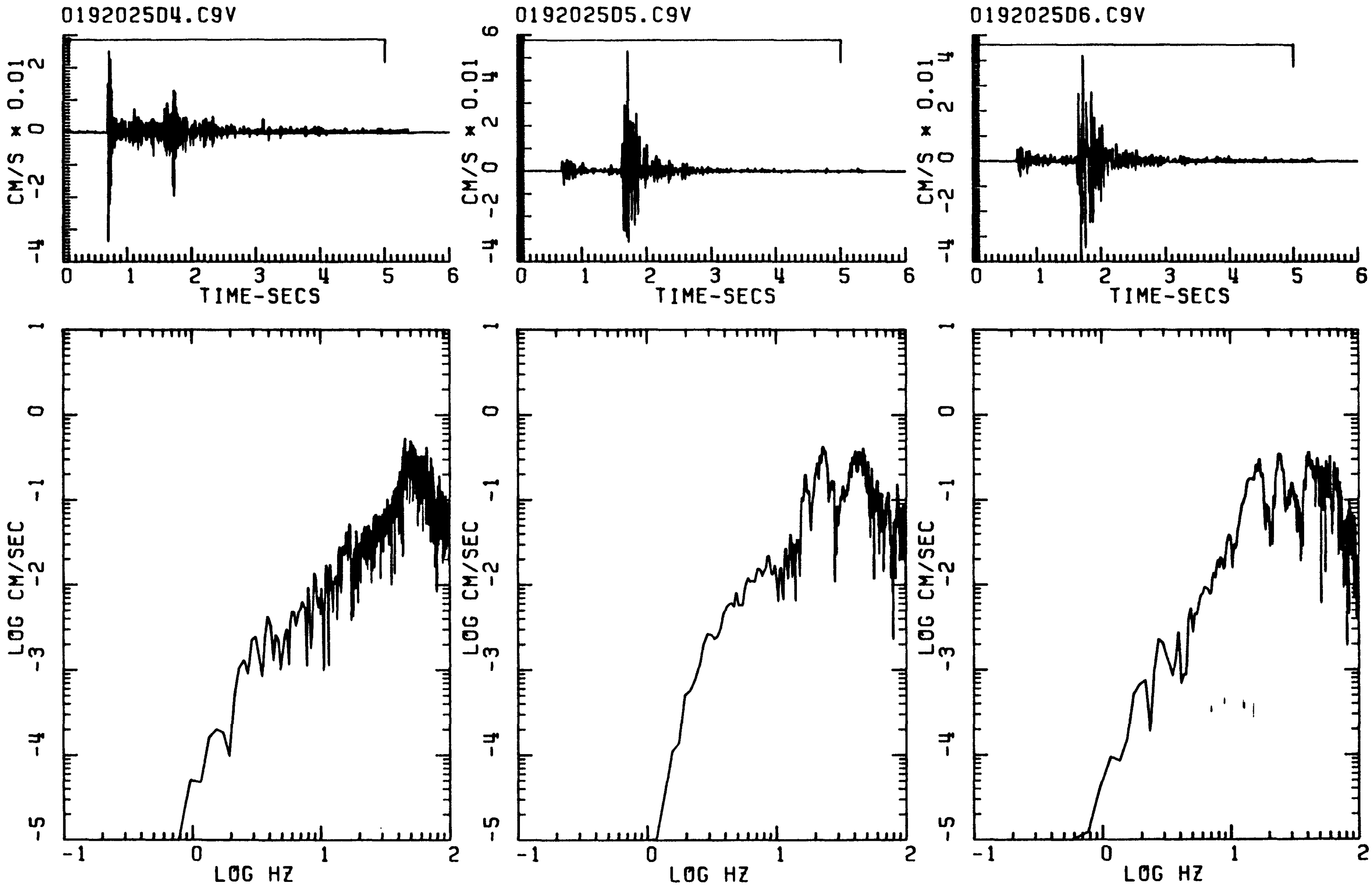
0190712J4.C9V
0190712J5.C9V
0190712J6.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ



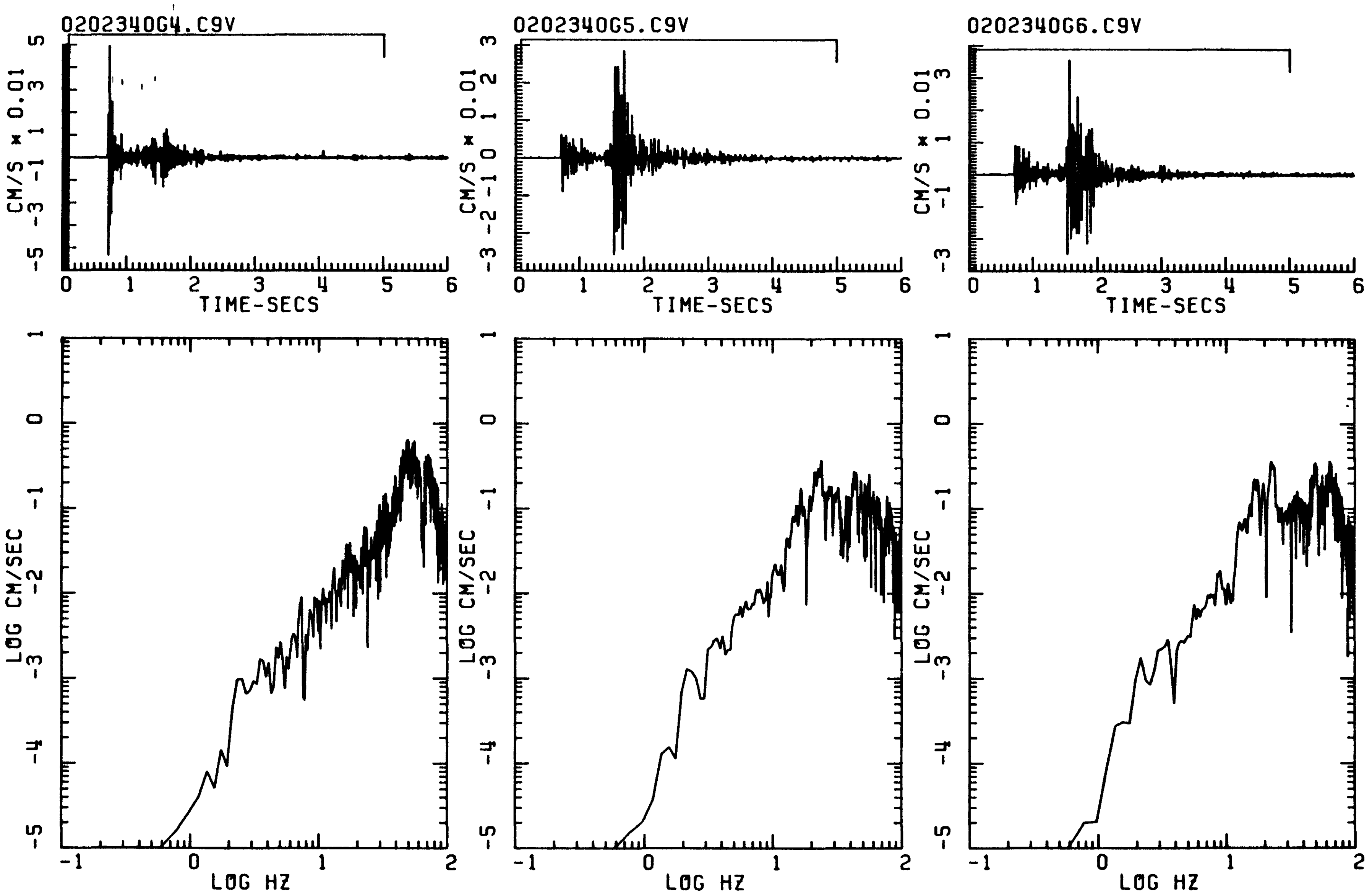
0191018R4.C9V
0191018R5.C9V
0191018R6.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ

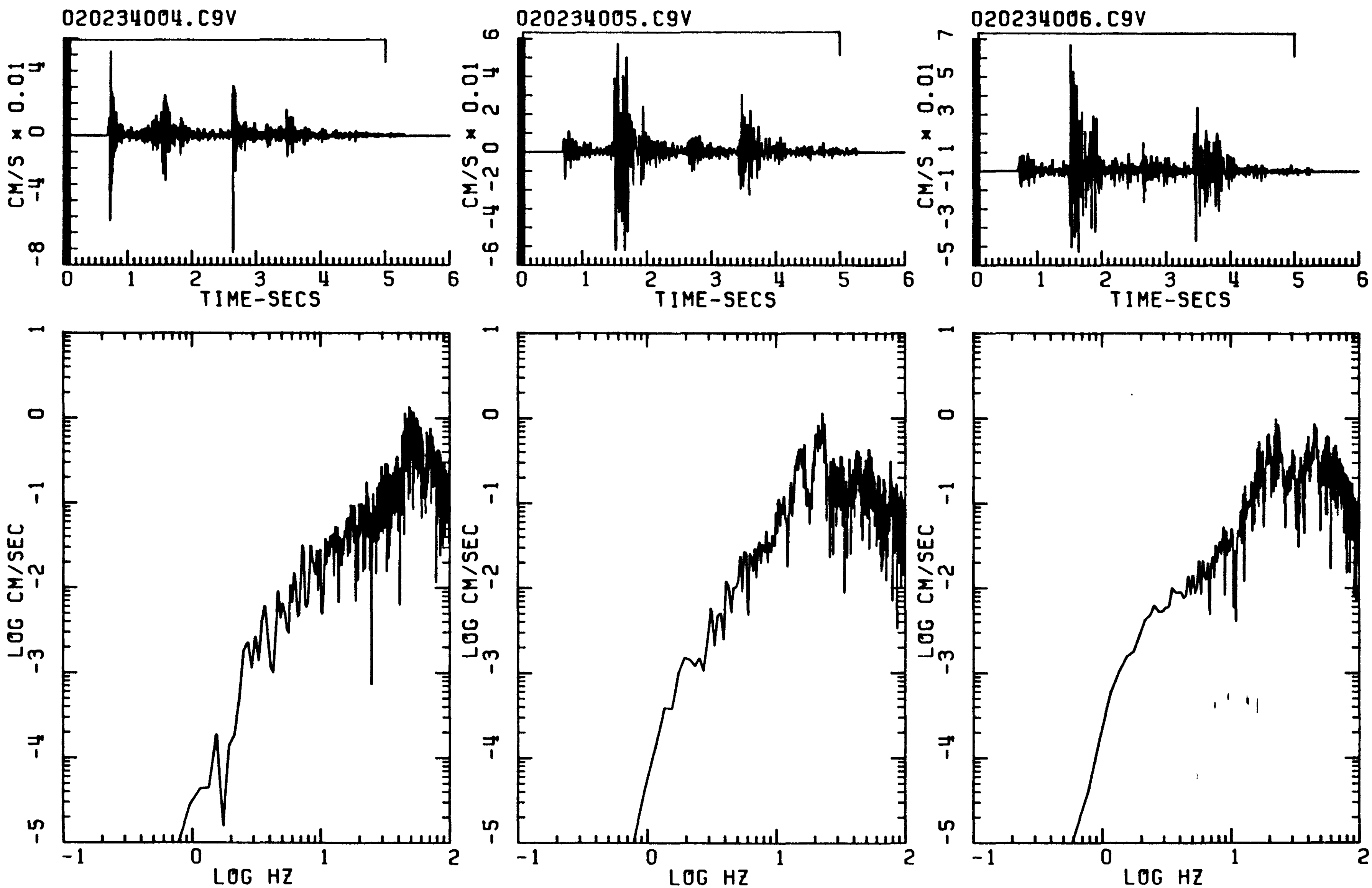


0191436M4.C9V
0191436M5.C9V
0191436M6.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ

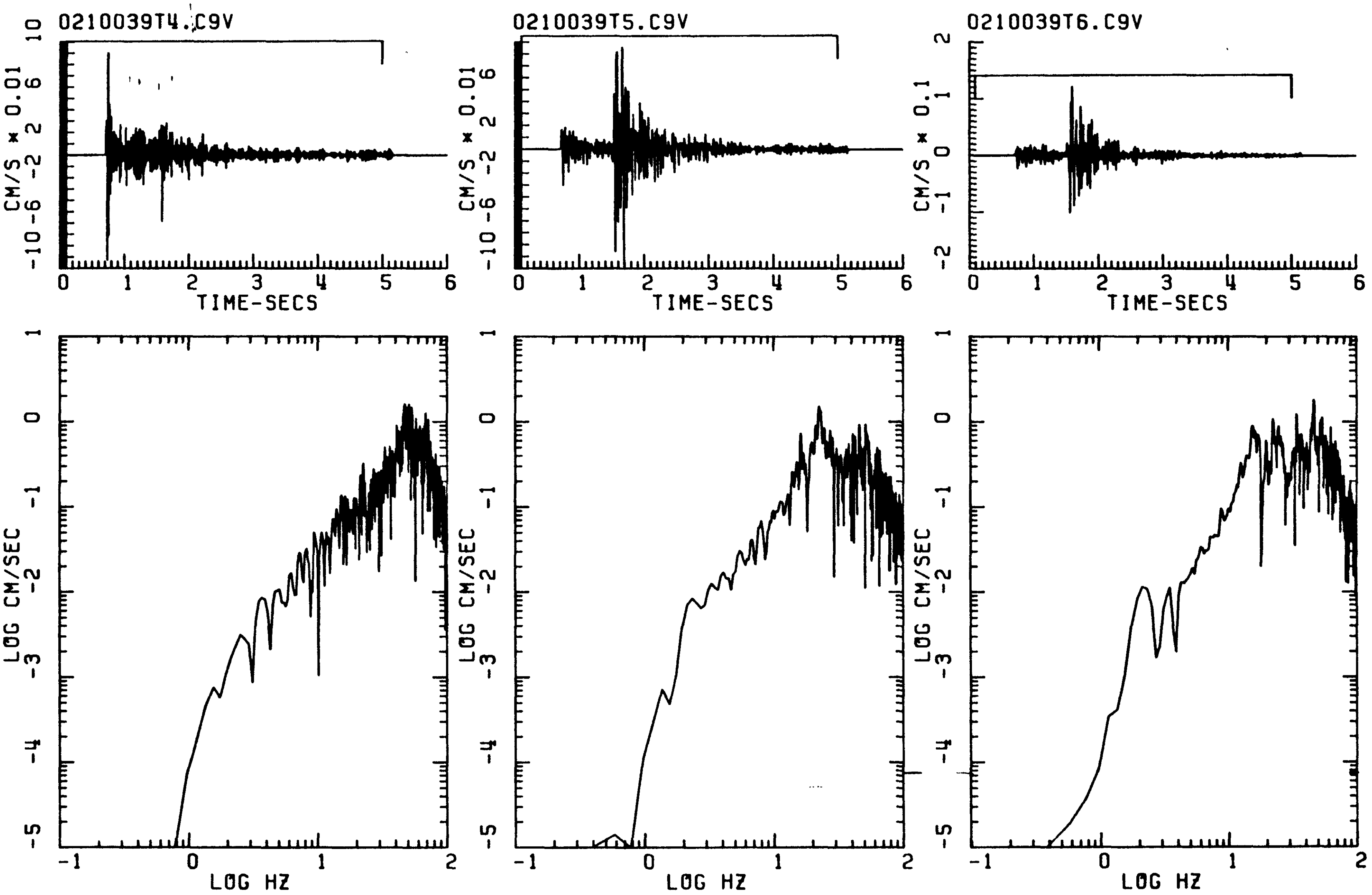


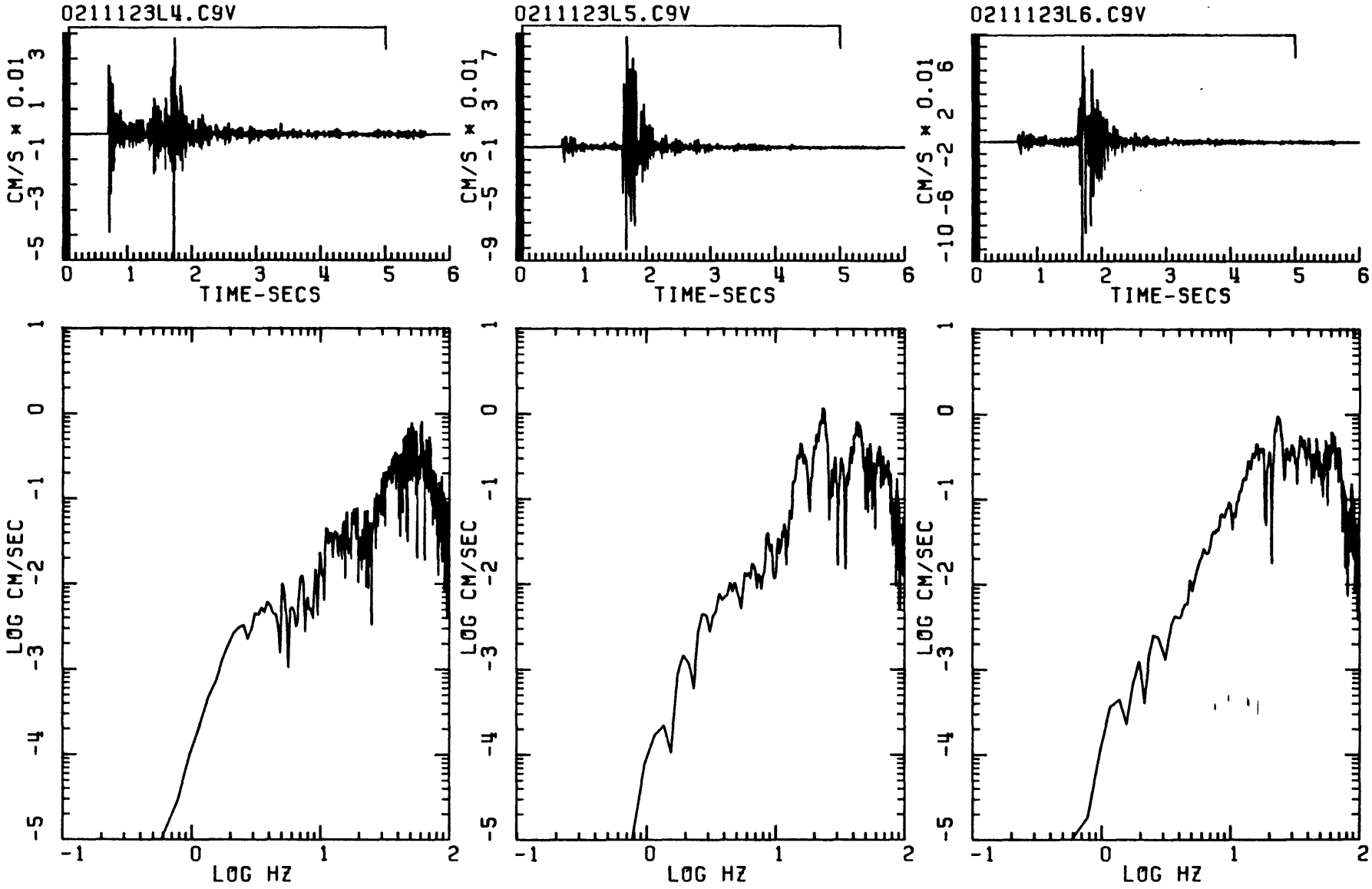
0192025D4.C9V
0192025D5.C9V
0192025D6.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ

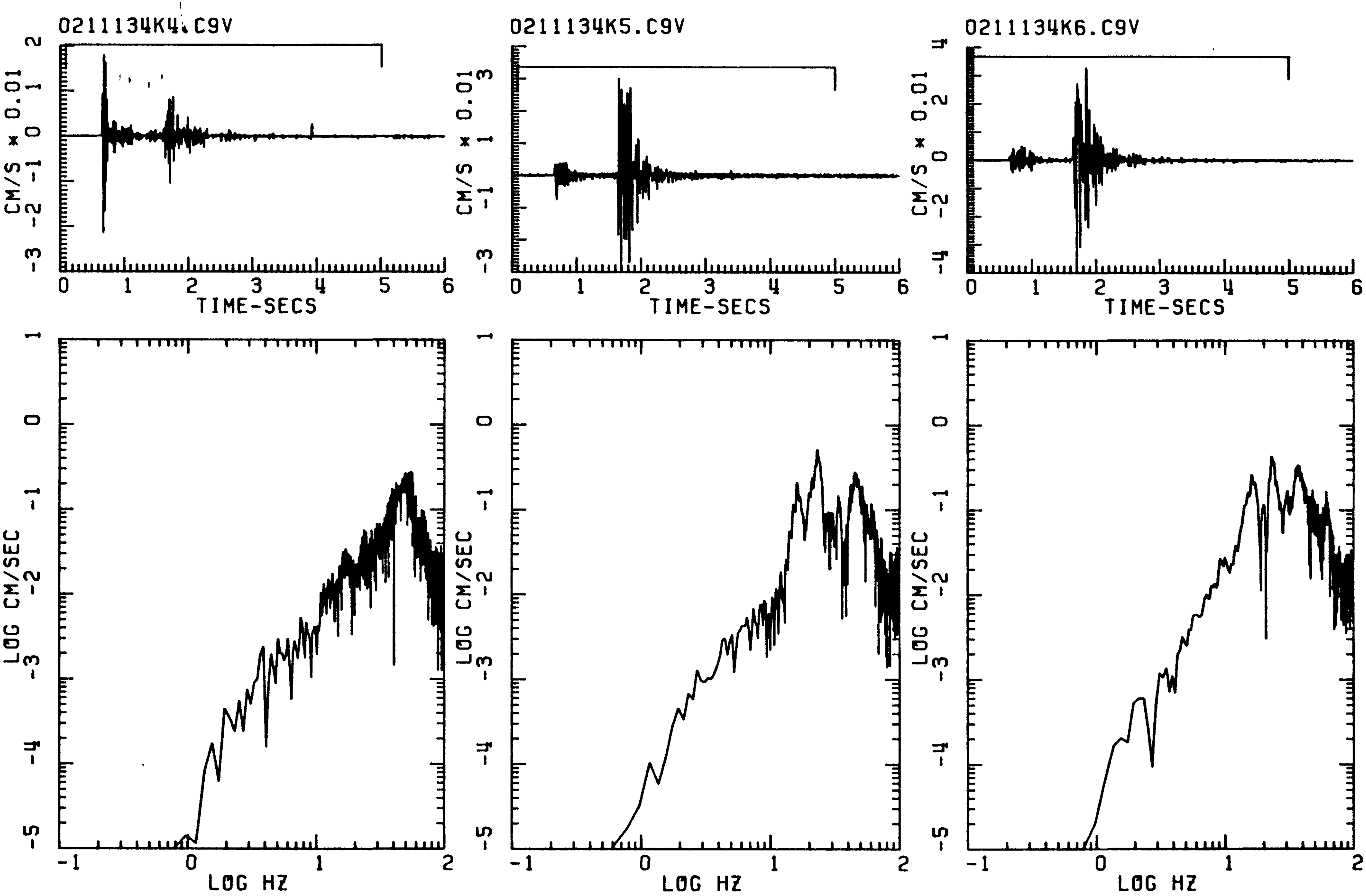

02023400G4.C9V
02023400G5.C9V
02023400G6.C9V
CM/S * 0.01
TIME-SECS
LOG CM/SEC
LOG HZ



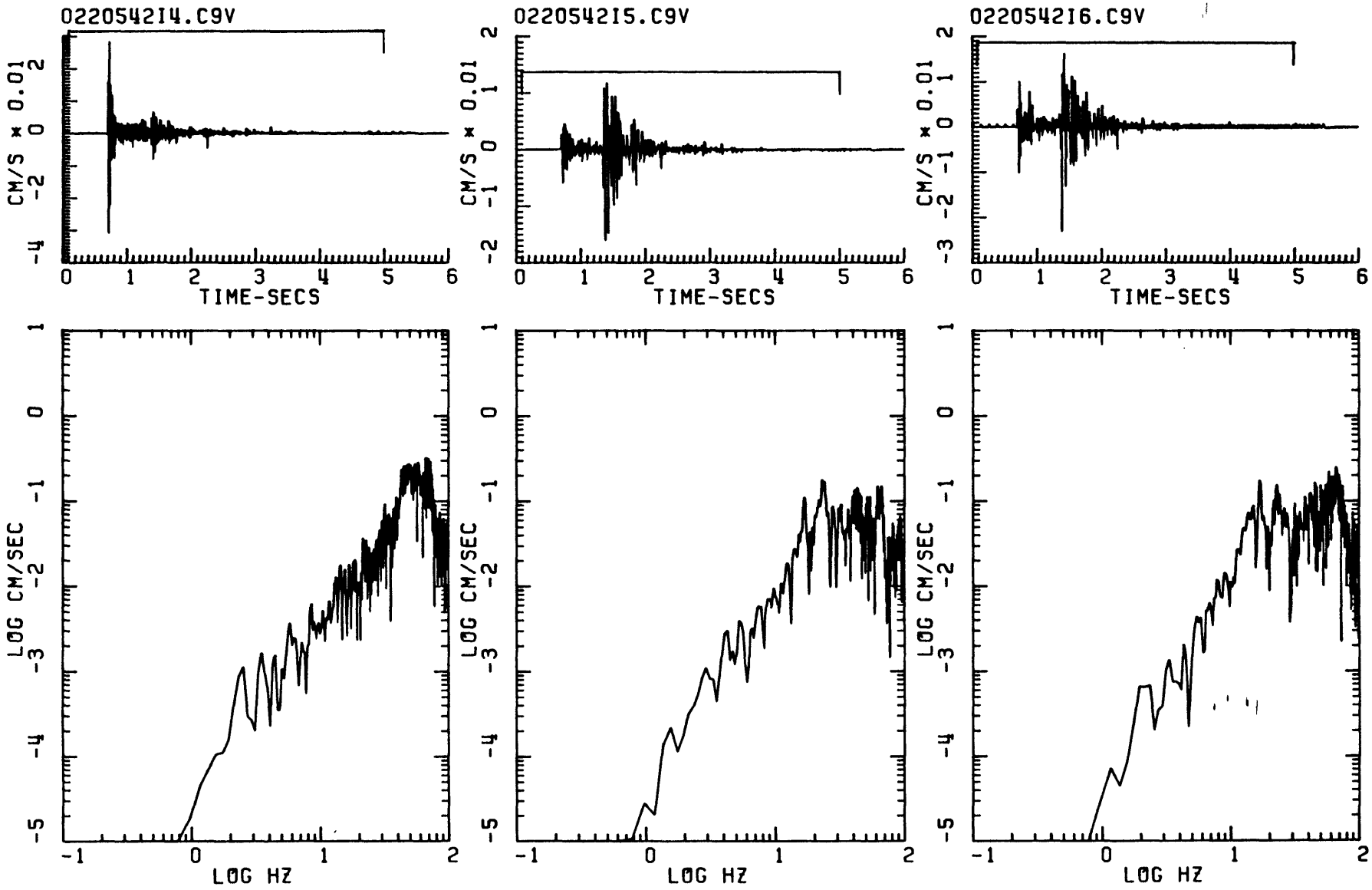
020234004.C9V
020234005.C9V
020234006.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ


0210039T4.C9V
0210039T5.C9V
0210039T6.C9V
CM/S * 0.01
CM/S * 0.01
CM/S * 0.1
TIME-SECS
TIME-SECS
TIME-SECS
LOG CM/SEC
LOG CM/SEC
LOG CM/SEC
LOG HZ
LOG HZ
LOG HZ


0211123L4.C9V
0211123L5.C9V
0211123L6.C9V
CM/S * 0.01
TIME-SECS
LOG CM/SEC
LOG HZ



0211134K4.C9V
0211134K5.C9V
0211134K6.C9V
CM/S × 0.01
TIME-SECS
LOG CM/SEC
LOG HZ


022054214.C9V
022054215.C9V
022054216.C9V
CM/S * 0.01
TIME-SECS
LOG CM/SEC
LOG HZ

C/9