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NEAR FIELD ACCELEROMETER ARRAY

T. V. McEvilly, et al

California University

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DEPARTMENT OF GEOLOGY AND GEOPHYSICS   BERKELEY, CALIFORNIA 94720

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Short Title of Work: NEAR FIELD ACCELEROMETER ARRAY

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13. ABSTRACT

Acceleration is recorded, three components, flat response from 0.01 to 50Hz, 0.222g full scale sensitivity. Noise levels appear to be around 0.005g. Displacement is recorded, three components, flat response from about 0.01 to 1 Hz, 6.620 cm full scale sensitivity.

Instruments have been installed at 6 sites; one of these is inoperative due to unusually high rainfall and resulting flooding this season. The three remaining sites will be installed in March.

A complete listing of station parameters and response curves is presented in section II of this report.

Section III of this report outlines procedures in effect at Berkeley for informing cooperating groups of Bear Valley earthquake occurrence and data tapes saved.

Broadband signals at low sensitivities have been recorded since 1966 on two stations in our San Andreas Geophysical Observatory (SAGO) complex. An extensive library of events on tape exists for SAGO, some 30 km NW from Stone Canyon, and we have begun processing events in the magnitude range 2.5 to 5 at distances from about 5 to 40 km. Section IV presents preliminary results for a number of events.

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I. REPORT SUMMARY (as of 01 March 1973)

Station Characteristics:

Acceleration is recorded, three components, flat response from 0.01 to 50Hz, 0.222g full scale sensitivity. Noise levels appear to be around 0.005g. Displacement is recorded, three components, flat response from about 0.01 to 1 Hz, 6.620 cm full scale sensitivity.

Instruments have been installed at 6 sites; one of these is inoperative due to unusually high rainfall and resulting flooding this season. The three remaining sites will be installed in March.

A complete listing of station parameters and response curves is presented in section II of this report.

Data Reporting:

Section III of this report outlines procedures in effect at Berkeley for informing cooperating groups of Bear Valley earthquake occurrence and data tapes saved.

Data Analyzed:

Broadband signals at low sensitivities have been recorded since 1966 on two stations in our San Andreas Geophysical Observatory (SAGO) complex. An extensive library of events on tape exists for SAGO, some 30 km NW from Stone Canyon, and we have begun processing events in the magnitude range 2.5 to 5 at distances from about 5 to 40 km. Section IV presents preliminary results for a number of events.

II. STATION CHARACTERISTICS

Response:

Figures 1 and 2 give acceleration and displacement sensitivities, respectively for the field systems. Three components are recorded in both modes, horizontal orientations positive as follows; "Radial" SW, "Transverse" NW, at all stations. Figure 3 gives locations for stations as of 01 March 1973.

Recording is on 1-day FM analog magnetic tape, 0.3 ips, 270 Hz center frequency, 0-50 Hz bandwidth, for creep data (EML) and stations 1-6. Stations 7-9 will be recorded FM, 0.12 ips, 216 Hz center frequency, 0-40 Hz bandwidth on 8-day slow speed units.

Telemetry is via 100mw 72-76 MHz, ±5 KHz deviation FM radio transmission to a receiving site at station 3, for stations 5-9. These signals, plus stations 3 and 1, are sent on individual ground lines (Spiral - 4) to the central recording vans at the Stone Canyon Observatory of EML. Stations 2 and 4 are transmitted by telephone lines to the vans.

Preliminary studies of small earthquake signals indicate the threshold for useable data at several stations is at about magnitude 3. A magnitude 3.5 event should provide excellent data.

Station data are summarized in Table I.

TABLE I - STATION DATA

Sta.	Loc.	Lat. (N)	Long. (W)	Radio Freq. (MHz)	Tape Unit	Channels
1	STC-N	36°38'15"	121°14'14"	-	UC1	9-14
2	Melendy	36°35'04	121°10'37	-	UC1	2-8
3	Hilltop	36°37'25	121°10'37	-	UC2	2-8
4	J. Inn	36°36'39	121°12'33	-	UC2	9-14
5	NNE	36°39'40	121°13'56	72.240	UC3	2-8
6	NE	36°39'18	121°12'08	72.320	UC3	9-14
7				72.760		
8				72.040		
9				72.880		

Channel Assignments		Center Freqs.	Comp.		Ground Motion Sense for Positive Discriminator Output Voltage
2	9	1020 Hz	Z	Accel.	up
3	10	1360	R	"	N45E
4	11	1700	T	"	S45E
5	12	2040	Z	Displ.	up
6	13	2380	R	"	N45E
8	14	2720	T	"	S45E

1 VELA 10Hz Time Code

7 Compensation Channel

III. DATA REPORTING

The two enclosures which follow illustrate procedures followed at Berkeley in monitoring data recorded in the Bear Valley Near Field Project. Shown is the internal procedure instruction sheet and an example of the regular report (now weekly) generated. To date no suggestions for additional procedures have been received from other investigators.

IV. DATA ANALYZED

While waiting for the anticipated Bear Valley event in the Magnitude ±3.5 range, data analysis has been concentrated in two areas. First, the nature of ongoing seismicity in the region is being studied. Secondly, near field earthquake characteristics as recorded by our SAGO Observatory are being investigated. This report presents, in the subsequent series of data, the basic information derived to date.

Bear Valley Seismicity:

Table II gives hypocentral data for all Bear Valley events of magnitude ±2.0 for the 13 months 9/1/71 to 10/1/72. Figure 4 is a plot of the tabled epicentres. Figure 5 shows the long-term earthquake occurrence data, along with creep information at three pertinent sites. The regions I, II, and III in Table II refer to the epicenter groups to the south, central, and north on figure 4.

Near Field Characteristics: Figures 6-20 review with minimal discussion, the preliminaries of near field data analysis based on existing Berkeley Data.

Figure 6 shows locations of 13 earthquakes, magnitudes 2.4 to 5.1, in the Bear Valley region and northwest to San Juan Bautista(Figure 4 shows details of activity around the three southeastern earthquake locations, i.e., the region of the near field experiment). The northernmost shock is in the town of Hollister, the filled triangles show the two broadband recording sites at the SAGO Observatory (response shown in Figure 7) used in these studies. Arrows show directions of the principal compression axes (essentially horizontal in all cases) taken from the fault plane solutions shown in Figures 8-16.

Mechanisms of all shocks are explainable as right lateral transcurrent faulting on fault planes trending either NW-SE for shocks on or west of the San Andreas zone, or trending N-S for shocks NE of the

San Andreas trend. There is doubtless significance in the 45 degree rotation of fault plane and principal compression axis for the latter class of earthquakes.

Fault plane solutions are generally quite good, except for the San Juan Bautista shocks which locate some 3-5 km. off the San Andreas trace, to the southwest (see Figure 9). An attempt to infer location bias due to higher velocities southwest of the fault (see McEvilly, G.J.R.A.S. II, 13, 1966) from quality of fault plane solution is illustrated in Figure 10 where the hypocenter is arbitrarily moved onto the fault zone. The mechanism is essentially the same, with minor changes in dips, but the number of discordant points is reduced. Conclusions should be drawn carefully since lateral variations also obviate the projection method used in placing points on the focal sphere - i.e., the hypocenter could be correct but ray paths distorted. Figure 15 is a composite fault plane solution for some 93 earthquakes in the cluster (see Figure 5) near and northwest of the Melendy ranch (mainshock in Figure 14). The apparent west dip of the fault plane is doubtless affected by the presence of higher velocities (at depths to 5-10 km) on the southwestern side of the fault.

Near field spectral data are presented in the next set of figures. In Figure 17 three traces of SH ground displacement, recorded at SAGO (East vault), are shown for earthquakes of magnitudes 4.9, 4.7, and 5.1, at distances about 10, 20, and 30 km., respectively. The corresponding spectra, corrected for instrument response, are shown in Figure 18. Notable is the remarkable similiarity in both time and frequency of the three signals. High frequency slopes are about w^{-2}, the very low frequency seems to show progressively more "near field effect" in the rise to zero frequency, as expected theoretically, and the minumum at low frequencies seems fairly consistent. Corner frequencies, estimated in the "conventional" manner, are in the range 0.7 to 0.9 Hz. The rise in level at high frequencies is the effect of instrument noise becoming greater than signal.

In Figure 19 three earthquakes in the same region, about 10 km WNW from SAGO, near San Juan Bautista, of magnitudes 3.0, to 4.9, are compared. The striking observation here is the similarity, over 2 orders of magnitude, in the spectra. Corner frequencies in these displacement spectra are essentially the same, ranging from 0.55 to 0.75 Hz. Basically, source time function (or "stress drop") and dimensions are not varying much over this range of earthquakes. The low frequency minimum, around 0.1 Hz, persists.

Instrument corrected displacement spectra have been computed on the 13 events shown in Figure 6. Seismic moment, M_0, can be determined from the zero frequency intercept of the spectra. Results are shown in Figure 20, compared to the empirical relation of Wyss and Brune (1968) for San Andreas Earthquakes. Whole record spectra and the shear velocity have been used, undoubtedly with some near field effects, possibly accounting for the larger values obtained. The linearity of the observations is, however, worth noting.

Analysis of existing data on near field observations will continue, hopefully complementing the more complete data that will be obtained one day at Bear Valley.

NEAR FIELD PROJECT

UCB/EML PROCEDURES

I. TAPE DISPOSITION

Responsible: Dr. Tuneto Kurita, UCB, 642-3977

Procedure: Each Tuesday Daryl Shelton will deliver selected tapes, through the previous Sunday's data, to EML and return used tapes to STC.

Tape Selection: Daryl will select tapes as directed in one of the following ways:

1. Telephone call (each Monday) from Dr. Kurita specifying events wanted,
2. EML instruction to save particular time range
3. Suspicion on part of Daryl of instrumental problems requiring tape reading at UCB.

UCB Processing: Dr. Kurita will pick up tapes weekly at EML (Tuesday or Wednesday) and return erased tapes of previous week. Current tapes will be searched for events of interest, based on UCB Summary Sheets.

EML Processing: EML personnel, using UCB facilities, will search creepmeter tapes for events of interest.

Tape Library: For events of interest to either UCB or EML, all four one-day tapes will be saved in entirity. One-week tapes will be dubbed on alternate Fridays onto Near Field Library Tape, saving times of events of interest to either UCB or EML. Dr. Kurita will keep a summary log of events saved.

Tape Recycle: Daryl will erase tapes not selected for transfer to EML, as they are needed in routine operation. Dr. Kurita will erase tapes at UCB to be return to STC. n.b. When tape is erased, old labels will be removed and a new blank label placed on outside reel face.

II. PLAYOUT LIBRARY

For each event retained, a set of Visicorder playouts, broadband at standard gain and speed, will be made for all data channels and kept in a special log book by Dr. Kurita. Magnitude and location data will be incorporated from UCB Seismographic Station routine analyses, with additional EML, NCER data as needed, by Karen McNally.

III. INFORMATIONAL BULLETIN

A weekly letter will be sent to all participants in the project, including AFOSR. This letter will be prepared by Karen McNally and contain information on past week's operation, including:

1. Summary of earthquakes in general area of Bear Valley,
2. Summary of creepmeter activity, from EML,
3. Listing of events and time periods selected for retention in the tape library,
4. "Final" hypocenter parameters for past events retained (this list should have a lag time of about two weeks from initial reporting of the event).

IV. DATA EXCHANGE

Digital records can be provided on request for any events in the library. Cards or magnetic tape output can be furnished though cards are unwieldy if many stations and components are required. A wide range of sampling rates and lengths is available.

V. FIELD SYSTEM OPERATION

UCB has responsibility for maintaining and servicing the telemetry receivers and recording system used by both UC and EML. A series of daily checks must be performed, however, by the person changing tapes in order that we have a continuous monitoring of the operation. The daily routine should include:

1. Cleaning tape heads, guides
2. Measuring and logging DC levels of creepmeter channels
3. Inspection, using oscilloscopes, of all channels of acceleration and seismic data, with notation in log of anomalous conditions
4. Timing system check
5. Careful notation in log of abnormal conditions
6. Notification of service requirements to UCB or EML.

Other routine maintenance or monitoring procedures on daily or other time base may be specified as the operation progresses.

VI. EMERGENCIES

Problems requiring immediate consultation with UCB or EML should be handled by telephone call to the appropriate person:

UCB	Office	Home
T. McEvilly	415 642-4494	415 549-0967
L. Johnson	642-1275	933-9322
R. Sell	642-3976	792-4239
T. Kurita	642-3977	841-2760

<u>EML</u>

J. Pfluke	415 556-7710	415 346-5529
R. Nason	556-2145	386-4872
A. Langhoff	556-7710	388-5784

<u>STC</u>

D. Shelton	408 389-4596	408 637-7219
M. Harris		408 637-2643

BEAR VALLEY

NEAR FIELD PROJECT

INFORMATION BULLETIN No. 1

01 Jan - 16 Feb 1973

Karen McNally
Seismographic Stations
Dept. of Geology & Geophysics
University of California
Berkeley, CA 94720

415 642-3977

Distribution:

D. Klick - AFOSR
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1. SUMMARY OF EARTHQUAKES IN GENERAL AREA OF BEAR VALLEY, M ≥ 2.5

Date	O.T. (GMT)	M	Preliminary Location: Descriptive Location	Preliminary Location: Coordinates	h(KM)
* 15 Jan 73	09:43:29.8	4.0	STC	36°40.2'N-121°21.1'W	8
15 Jan 73	10:08:32.7	2.9	(same as 09:43)		
15 Jan 73	10:13:38.7	2.9	(")		
* 15 Jan 73	10:23:43.4	3.5	(")		
* 15 Jan 73	14:41:22.3	3.5	(")		
15 Jan 73	15:19:25.7	2.5	(")		
15 Jan 73	15:30:08.9	2.5	(")		
15 Jan 73	19:22:31.7	2.6	(")		
15 Jan 73	20:13:46.9	2.5	(")		
15 Jan 73	20:17:04.8	2.5	(")		
15 Jan 73	21:14:51.1	3.0	STC	36°39.3'N-121°19.0'W	5.1
20 Jan 73	12:30:15.8	3.0	STC	36°39.2'N-121°20.4'W	7
* 20 Jan 73	15:59:56.7	2.8	STC	36°38.5'N-121°17.7'W	7
21 Jan 73	18:23:13.9	2.9	STC	36°38.8'N-121°18.5'W	5
21 Jan 73	20:16:57	2.5	(same as 18:23)		
* 21 Jan 73	22:21:13.7	3.0	STC	36°38.9'N-121°18.3'W	7
24 Jan 73	18:26:57.0	2.7	BVL-Little Rabbit Valley	36°25.3'N-121°01.2'W	9
24 Jan 73	20:11:31.0	2.9	STC	36°38.5'N-121°18.8'W	6
26 Jan 73	00:37:22.7	2.6	STC	36°41.0'N-121°23.1'W	6
28 Jan 73	22:25:52.6	2.7	BVL	36°31.6'N-121°06.9'W	5.6
13 Feb 73	17:41:08.4	2.9	STC	36°38.5'N-121°18.8'W	4.0
13 Feb 73	17:46:48.0	2.5	STC	36°39.2'N-121°18.3W	1.0

2. SUMMARY OF CREEPMETER ACTIVITY, FROM EML

Date	Time	Instrument Location
11 Jan 73	02:58 GMT	Melindy Barn
11 Jan 73	01:08 GMT	Melindy Windmill
"	No Record	Melindy Corral
	No Record	Melindy River

3. LISTING OF EVENTS SELECTED FOR RETENTION IN THE BERKELEY TAPE LIBRARY

	Date	OT(GMT)	M	Usable Records	Max. Accel.	Tape Interval Saved
*	15 Jan 73	09:43	4.0	STC North Jungle Inn	.03 g	15 Jan, 00hrs. GMT to 16 Jan, 00hrs. GMT
*	15 Jan 73	10:23	3.5	STC North Jungle Inn	.01 g	
*	15 Jan 73	14:41	3.5	STC North Jungle Inn	.01 g	
*	20 Jan 73	15.59	2.8	STC North	.01g	20 Jan, 00 hrs. GMT to 22 Jan, 00 hrs. GMT
*	21 Jan 73	22.21	3.0	STC North	.01 g	

TABLE II. Bear Valley Seismicity, 9/1/71 - 10/1/72

Date 1971	Origin Time (G. C. T.)			Latitude North	Longitude West	Magnitude	h	Region
Sept 19	09	31	25.9	36°32.3'	121°09.6'	2.2	6.1	I
Sept 23	19	20	09.7	36°35.5'	121°11.5'	2.6	9.0	II
Sept 24	16	41	41.1	36°36.1'	121°12.9'	2.1	7.3	II
Oct 12	08	08	33.1	36°35.1'	121°11.6'	2.9	4.2	II
Oct 12	08	27	51.6	36°35.4'	121°11.8'	2.0	1.2	II
Oct 13	03	22	58.3	36°34.9'	121°11.3'	2.5	1.3	II
Oct 24	15	31	12.2	36°30.3'	121°5.3'	2.3	4.6	I
Nov 01	14	22	03.1	36°34.9'	121°11.0'	3.2	7.0	II
Nov 06	23	41	16.5	36°33.8'	121°03.4'	2.0	3.9	I
Nov 15	14	16	21.8	36°39.5'	121°17.1'	3.1	2.7	III
Nov 25	22	40	18.9	36°39.7'	121°17.3'	2.4	5.9	III
Nov 29	00	57	49.8	36°33.5'	121°10.3'	2.0	8.8	I
Nov 29	13	14	24.0	36°34.3'	121°10.0'	2.2	6.0	II
Dec 01	09	23	15.2	36°33.6'	121°06.8'	2.2	8.4	I
Dec 01	17	22	09.2	36°30.2'	121°05.6'	2.0	3.3	I
Dec 06	14	31	49.4	36°29.3'	121°02.2'	2.8	10.1	I
Dec 10	10	42	43.1	36°30.0'	121°01.8'	2.3	7.2	I
Dec 11	02	03	05.0	36°37.9'	121°06.2'	2.2	6.5	II
Dec 16	07	57	29.8	36°30.0'	121°04.1'	2.2	7.9	I
Dec 16	23	20	16.0	36°34.0'	121°10.0'	2.3	5.2	II
Dec 19	10	45	44.8	36°41.4'	121°19.7'	2.7	5.4	III
Dec 19	10	48	35.7	36°40.6'	121°21.0'	2.2	8.6	III
Dec 19	14	12	53.0	36°41.1'	121°19.9'	3.1	4.4	III
Dec 19	14	55	40.9	36°41.3'	121°19.7'	2.4	2.5	III
Dec 19	19	05	55.2	36°41.5'	121°20.0'	2.4	5.3	III
Dec 20	08	34	40.0	36°41.4'	121°20.1'	3.4	3.7	III
Dec 20	08	37	41.4	36°40.4'	121°18.5'	2.4	8.7	III
Dec 20	10	09	08.4	36°40.4'	121°21.9'	2.4	2.5	III
Dec 20	11	25	30.0	36°41.7'	121°19.9'	2.9	4.0	III
Dec 20	18	05	02.6	36°41.5'	121°20.0'	2.6	4.2	III
Dec 20	21	26	41.2	36°41.6'	121°20.0'	2.6	3.9	III
Dec 24	03	39	30.5	36°41.5'	121°19.5'	2.0	8.1	III
Dec 27	15	47	33.0	36°34.0'	121°09.0'	2.1	2.6	II
Dec 28	22	33	53.0	36°42.0'	121°20.5'	3.5	3.5	III

Date 1971	Origin Time (G. C. T.)	Latitude North	Longitude West	Magnitude	h	Region
Dec 28	22 35 16.8	36°41.8'	121°20.5'	3.4	4.5	III
Dec 28	22 38 55.4	36°41.8'	121°20.6'	3.1	4.3	III
Dec 28	22 57 04.0	36°41.3'	121°19.5'	2.7	2.3	III
Dec 29	00 25 35.7	36°41.2'	121°20.1'	4.0	3.7	III
Dec 29	00 26 45.3	36°42.3'	121°20.5'	3.2	8.3	III
Dec 29	00 32 02.6	36°41.5'	121°20.5'	2.2	3.3	III
Dec 29	00 50 26.5	36°41.3'	121°19.8'	2.0	3.6	III
Dec 29	01 06 30.7	36°41.7'	121°20.2'	2.9	4.6	III
Dec 29	01 35 36.3	36°41.7'	121°20.6'	2.7	4.1	III
Dec 29	01 37 13.7	36°41.6'	121°20.6'	3.6	4.0	III
Dec 29	01 55 47.7	36°41.4'	121°20.4'	2.4	3.6	III
Dec 30	06 46 37.3	36°41.2'	121°20.7'	2.1	2.4	III
Dec 30	07 35 27.8	36°42.1'	121°20.9'	2.7	1.9	III
1972						
Jan 01	09 51 50.1	36°41.7'	121°20.7'	2.4	3.7	III
Feb 08	19 08 23.0	36°29.4'	121°04.5'	2.3	10.5	I
Feb 18	20 58 12.5	36°39.6'	121°17.3'	2.2	6.7	III
Feb 22	05 27 12.7	36°33.1'	121°07.6'	3.2	6.0	I
Feb 22	05 41 58.4	36°32.9'	121°07.1'	3.3	5.2	I
Feb 22	15 44 09.7	36°32.1'	121°07.4'	3.1	4.8	I
Feb 24	15 56 06.5	36°35.5'	121°11.9'	2.3	7.0	II
Feb 24	15 56 16.7	36°35.7'	121°11.8'	3.0	6.8	II
Feb 24	15 56 51.3	36°35.3'	121°11.8'	5.1	6.4	II
Feb 24	16 08 39.0	36°36.1'	121°12.3'	2.8	8.3	II
Feb 24	16 36 51.9	36°35.5'	121°11.6'	2.2	7.6	II
Feb 24	16 49 25.6	36°35.4'	121°11.5'	2.9	7.8	II
Feb 24	17 06 08.8	36°35.7'	121°12.1'	2.2	6.9	II
Feb 24	17 10 03.0	36°35.9'	121°12.5'	2.3	6.8	II
Feb 24	17 12 48.8	36°35.7'	121°11.5'	2.3	9.9	II
Feb 24	17 26 38.8	36°35.9'	121°12.1'	2.4	8.0	II
Feb 24	17 40 06.8	36°37.8'	121°14.6'	2.9	6.1	II
Feb 24	17 49 55.6	36°36.2'	121°12.4'	2.6	7.8	II

Date 1972	Origin Time (G. C. T.)			Latitude North	Longitude West	Magnitude	h	Region
Feb 24	17	50	51.9	36°32.5'	121°6.7'	2.6	10.0	I
Feb 24	18	02	48.2	36°37.9'	121°14.4'	3.3	6.7	II
Feb 24	18	09	55.1	36°37.6'	121°14.6'	2.4	6.3	II
Feb 24	18	21	50.6	36°37.8'	121°14.7'	2.8	5.1	II
Feb 24	18	27	18.6	36°36.0'	121°12.4'	2.5	5.2	II
Feb 24	18	33	56.7	36°37.8'	121°14.6'	2.7	5.4	II
Feb 24	19	15	13.8	36°37.7'	121°14.4'	2.0	6.0	II
Feb 24	19	43	40.6	36°36.9'	121°13.3'	2.7	6.7	II
Feb 24	20	00	39.1	36°39.5'	121°17.1'	2.3	4.4	III
Feb 24	20	21	48.7	36°37.0'	121°13.6'	3.6	7.6	II
Feb 24	20	42	51.7	36°36.9'	121°13.1'	2.2	9.6	II
Feb 24	21	33	40.3	36°37.6'	121°14.6'	2.0	5.2	II
Feb 24	22	39	02.7	36°36.8'	121°13.5'	2.7	7.7	II
Feb 24	22	40	06.3	36°36.5'	121°13.4'	2.2	4.1	II
Feb 24	22	43	45.4	36°36.8'	121°13.6'	2.0	6.7	II
Feb 24	22	53	27.3	36°35.6'	121°11.7'	2.3	6.5	II
Feb 24	23	12	44.5	36°35.3'	121°11.7'	2.8	7.0	II
Feb 25	00	04	01.3	36°36.9'	121°13.4'	2.4	6.6	II
Feb 25	02	41	28.5	36°37.3'	121°13.4'	2.0	6.3	II
Feb 25	03	00	42.8	36°37.6'	121°14.2'	2.6	6.3	II
Feb 25	03	04	45.2	36°37.5'	121°14.1'	2.8	6.6	II
Feb 25	10	09	46.6	36°37.5'	121°14.4'	2.0	4.7	II
Feb 25	11	48	30.2	36°37.8'	121°14.7'	3.0	6.8	II
Feb 25	18	49	36.8	36°36.5'	121°13.5'	2.1	3.6	II
Feb 26	18	15	23.2	36°36.5'	121°12.9'	2.2	5.1	II
Feb 26	19	36	36.0	36°38.2'	121°14.6'	2.8	5.8	II
Feb 27	04	35	54.4	36°36.9'	121°15.2'	2.4	7.0	II
Feb 27	13	59	43.0	36°36.4'	121°13.0'	2.4	6.8	II
Feb 27	15	31	33.3	36°34.2'	121°10.3'	2.3	4.4	II
Feb 27	15	42	18.6	36°37.6'	121°14.9'	2.1	4.3	II
Feb 27	16	15	27.0	36°38.0'	121°15.1'	2.8	6.0	II
Feb 27	16	56	29.0	36°36.7'	121°12.9'	2.6	6.8	II
Feb 27	17	00	02.5	36°36.4'	121°13.2'	2.0	3.6	II

Date 1972	Origin Time (G. C. T.)			Latitude North	Longitude West	Magnitude	h	Region
Feb 27	19	52	44.9	36°38.2'	121°14.7'	3.3	6.1	II
Feb 27	21	00	18.3	36°33.3'	121°06.0'	2.8	10.7	I
Feb 27	22	13	08.6	36°33.3'	121°05.6'	4.7	10.6	I
Feb 27	22	28	52.1	36°32.6'	121°06.1'	2.2	7.9	I
Feb 28	00	23	11.4	36°34.2'	121°05.0'	2.2	10.5	II
Feb 28	02	46	26.9	36°37.4'	121°14.5'	2.1	6.3	II
Feb 28	02	54	32.5	36°33.3'	121°05.2'	2.2	9.2	I
Feb 28	03	12	42.2	36°36.7'	121°13.2'	2.4	6.0	II
Feb 28	05	14	28.7	36°33.9'	121°05.3'	2.2	9.6	I
Feb 28	06	41	43.3	36°35.4'	121°11.9'	2.2	7.4	II
Feb 28	13	04	16.4	36°32.3'	121°06.4'	2.4	9.4	I
Feb 28	15	56	33.7	36°32.2'	121°05.2'	2.0	11.4	I
Feb 29	05	30	24.4	36°33.1'	121°07.2'	2.2	8.9	I
Feb 29	19	59	08.7	36°32.8'	121°06.2'	2.4	9.3	I
Feb 29	21	32	23.4	36°32.7'	121°06.4'	2.5	8.3	I
Feb 29	22	31	58.2	36°35.9'	121°12.2'	2.5	6.9	II
Feb 29	22	34	34.9	36°35.2'	121°12.0'	2.0	3.9	II
Mar 01	05	11	24.4	36°35.2'	121°11.0'	2.3	3.8	II
Mar 01	11	39	58.7	36°33.2'	121°07.2'	3.8	10.2	I
Mar 01	11	58	12.1	36°32.9'	121°07.1'	2.0	8.5	I
Mar 01	14	09	56.6	36°36.9'	121°13.5'	2.1	6.3	II
Mar 01	16	12	23.9	36°36.3'	121°13.1'	3.5	9.3	II
Mar 01	17	34	20.1	36°33.3'	121°05.4'	2.3	7.9	I
Mar 01	19	53	01.5	36°32.6'	121°06.7'	2.5	8.9	I
Mar 02	01	46	11.3	36°32.7'	121°06.6'	2.1	8.7	I
Mar 02	10	30	39.0	36°33.1'	121°07.5'	2.6	9.7	I
Mar 02	19	04	51.6	36°35.4'	121°11.9'	2.4	5.3	II
Mar 03	12	55	20.0	36°37.1'	121°13.7'	2.7	6.9	II
Mar 04	05	57	26.6	36°32.9'	121°06.1'	3.5	10.6	I
Mar 05	04	55	02.3	36°37.4'	121°14.6'	2.0	4.7	II
Mar 05	13	53	46.7	36°37.0'	121°13.6'	2.2	7.1	II
Mar 06	18	41	02.3	36°38.0'	121°14.4'	2.2	6.4	II
Mar 13	05	36	13.0	36°40.6'	121°18.8'	3.2	5.9	III

Date 1972	Origin Time (G. C. T.)			Latitude North	Longitude West	Magnitude	h	Region
Mar 15	18	44	48.4	36°32.8'	121°06.8'	2.0	8.9	I
Mar 21	15	41	36.1	36°33.3'	121°06.1'	2.7	9.0	I
Mar 21	16	19	22.7	36°33.0'	121°06.1'	2.0	8.8	I
Mar 22	06	24	43.8	36°35.7'	121°12.3'	3.1	7.2	II
Mar 24	23	10	44.7	36°35.5'	121°11.6'	2.4	5.1	II
Mar 25	07	03	07.3	36°35.8'	121°11.8'	2.5	5.8	II
Mar 26	06	12	36.8	36°32.5'	121°05.9'	2.5	8.5	I
Mar 26	06	32	02.6	36°32.1'	121°05.9'	2.4	8.2	I
Mar 26	09	30	48.1	36°34.8'	121°10.8'	2.0	3.7	II
Apr 02	02	04	29.3	36°35.5'	121°11.7'	2.0	6.1	II
Apr 02	05	32	57.6	36°36.7'	121°13.2'	2.7	7.0	II
Apr 02	05	34	08.6	36°36.5'	121°12.9'	2.3	7.8	II
Apr 07	08	07	24.6	36°34.2'	121°10.5'	2.8	5.0	II
Apr 07	08	44	07.5	36°34.7'	121°10.4'	2.3	3.6	II
Apr 07	08	47	45.4	36°34.3'	121°10.5'	2.6	5.9	II
Apr 17	23	22	07.3	36°33.3'	121°11.8'	2.2	6.1	I
Apr 30	17	37	17.2	36°34.9'	121°12.8'	2.3	7.5	II
May 01	21	51	06.6	36°32.9'	121°06.2'	3.0	9.0	I
May 02	11	13	09.8	36°35.2'	121°11.5'	2.1	6.8	II
May 02	11	32	09.8	36°35.1'	121°11.3'	3.2	4.1	II
May 02	12	27	10.0	36°35.2'	121°11.4'	2.5	4.7	II
May 05	20	39	31.6	36°36.0'	121°12.4'	2.7	5.6	II
May 13	21	08	27.5	36°33.0'	121°04.4'	2.5	8.5	I
May 13	22	04	54.1	36°32.9'	121°04.7'	2.2	8.4	I

Date 1972	Origin Time (G. C. T.)	Latitude North	Longitude West	Magnitude	h	Region
Jun 03	08 19 53.3	36°40.3	121°16.7'	2.7	5.04	III
Jun 04	01 03 35.9	36°40.1	121°16.6'	2.8	6.00	III
Jun 06	19 03 16.77	36°28.9	121° 3.8'	2.3	5.24	I
Jun 26	07 29 21.59	36°35.1	121° 8.8'	2.2	9.3	II
Jul 03	12 38 54.22	36°33.6	121° 9.0'	2.6	9.32	I
Jul 07	10 52 43.46	36°33.6	121° 5.4'	3.0	9.69	I
Jul 07	15 27 13.21	36°33.8	121° 4.5'	2.5	8.84	I
Jul 19	23 03 41.33	36°36.3	121°13.5'	3.1	8.34	II
Jul 19	23 20 12.16	36°36.5	121°13.5'	2.5	8.44	II
Jul 23	09 27 51.21	36°31.6	121° 7.1'	2.5	6.59	I
Jul 26	04 12 53.71	36°32.6	121° 7.4'	2.4	9.53	I
Jul 30	20 21 50.12	36°32.2	121° 6.2'	3.0	9.33	I
Jul 31	01 03 47.83	36°36.4	121°13.4'	3.0	8.84	II
Aug 23	12 44 33.87	36°41.7	121°18.1'	2.0	6.33	III
Aug 23	18 03 42.38	36°39.0	121°15.3'	2.5	6.71	II
Aug 24	14 26 13.65	36°33.6	121° 3.5'	2.5	9.02	I
Aug 26	19 29 11.06	36°33.0	121°7.2'	2.5	9.21	I
Aug 30	20 26 40.16	36°31.9	121°6.8'	2.5	8.58	I
Sep 01	06 18 53.98	36°39.4	121°17.1'	2.5	3.94	III
Sep 04	03 57 39.06	36°35.0	121° 8.3'	2.3	7.53	II
Sep 04	17 55 51.22	36°38.8	121°16.1'	2.5	5.55	II
Sep 04	18 04 40.88	36°38.5	121°15.8'	4.7	5.12	II
Sep 04	18 10 18.36	36°38.7	121°16.2'	2.2	3.62	II
Sep 04	18 11 14.51	36°38.2	121°15.1'	2.2	6.39	II
Sep 04	18 11 45.38	36°38.2	121°15.1'	2.0	7.60	II
Sep 04	18 19 16.10	36°38.9	121°16.1'	2.8	6.14	II

Date 1972	Origin Time (G. C. T.)	Latitude North	Longitude West	Magnitude	h	Region
Sep 04	18 38 20.12	36°38.6	121°15.9'	3.0	5.92	II
Sep 04	19 48 01.91	36°38.0	121°15.5'	2.4	8.12	II
Sep 04	19 58 33.02	36°38.8	121°16.2'	2.8	6.44	II
Sep 05	00 37 02.45	36°38.3	121°14.0'	2.6	6.58	II
Sep 05	00 39 41.05	36°37.4	121°15.1'	2.3	3.83	II
Sep 05	01 52 54.31	36°39.0	121°16.3'	2.5	5.21	II
Sep 05	03 35 03.48	36°38.1	121°15.1'	2.0	5.68	II
Sep 05	05 03 53.15	36°38.3	121°15.3'	2.2	7.07	II
Sep 06	02 29 47.72	36°37.9	121°14.7'	2.7	6.53	II
Sep 06	15 05 59.48	36°41.7	121°22.2'	3.0	4.81	III
Sep 06	20 53 25.90	36°38.0	121°14.9'	2.1	8.05	II
Sep 06	23 02 00.69	36°37.5	121°14.4'	2.1	6.19	II
Sep 07	20 50 28.25	36°38.3	121°15.4'	2.5	7.96	II
Sep 11	09 59 23.24	36°34.9	121°11.5'	2.1	8.66	II
Sep 12	23 44 17.78	36°39.6	121°17.4'	2.4	5.86	III
Sep 14	19 33 10.41	36°36.7	121°13.2'	2.9	6.82	II
Sep 18	03 32 59.58	36°33.7	121° 9.1'	2.1	7.02	I
Sep 18	04 22 08.84	36°38.3	121°15.5'	2.2	4.76	II
Sep 18	13 36 22.84	36°37.5	121°14.5'	2.2	5.83	II
Sep 25	07 08 19.61	36°38.7	121°16.8'	2.3	4.22	II
Sep 25	07 11 55.33	36°38.9	121°16.4'	2.3	6.31	II
Sep 27	04 18 51.47	36°38.7	121°16.7'	3.0	6.00	II
Sep 27	10 51 38.94	36°38.8	121°16.6'	2.7	8.06	II

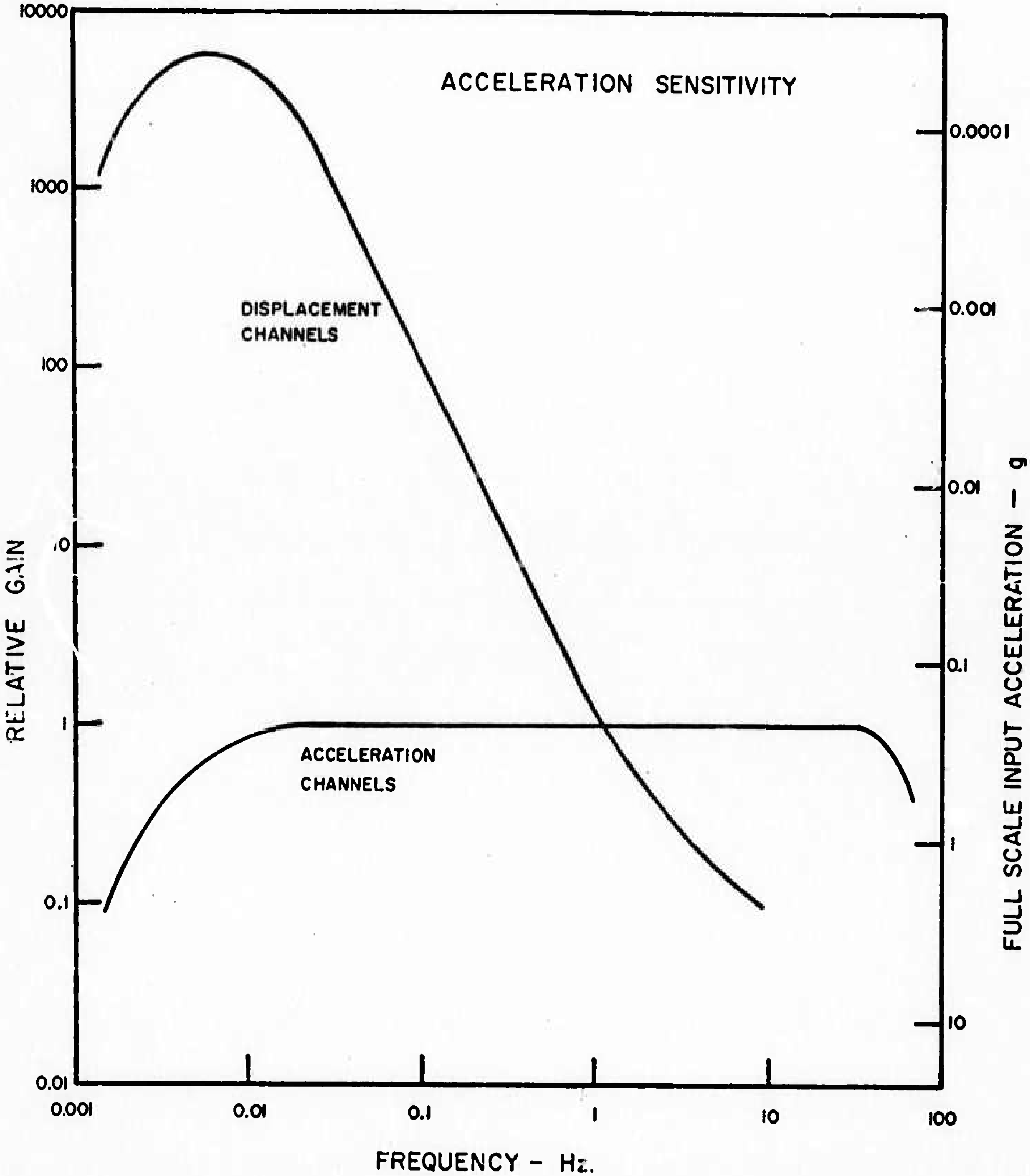
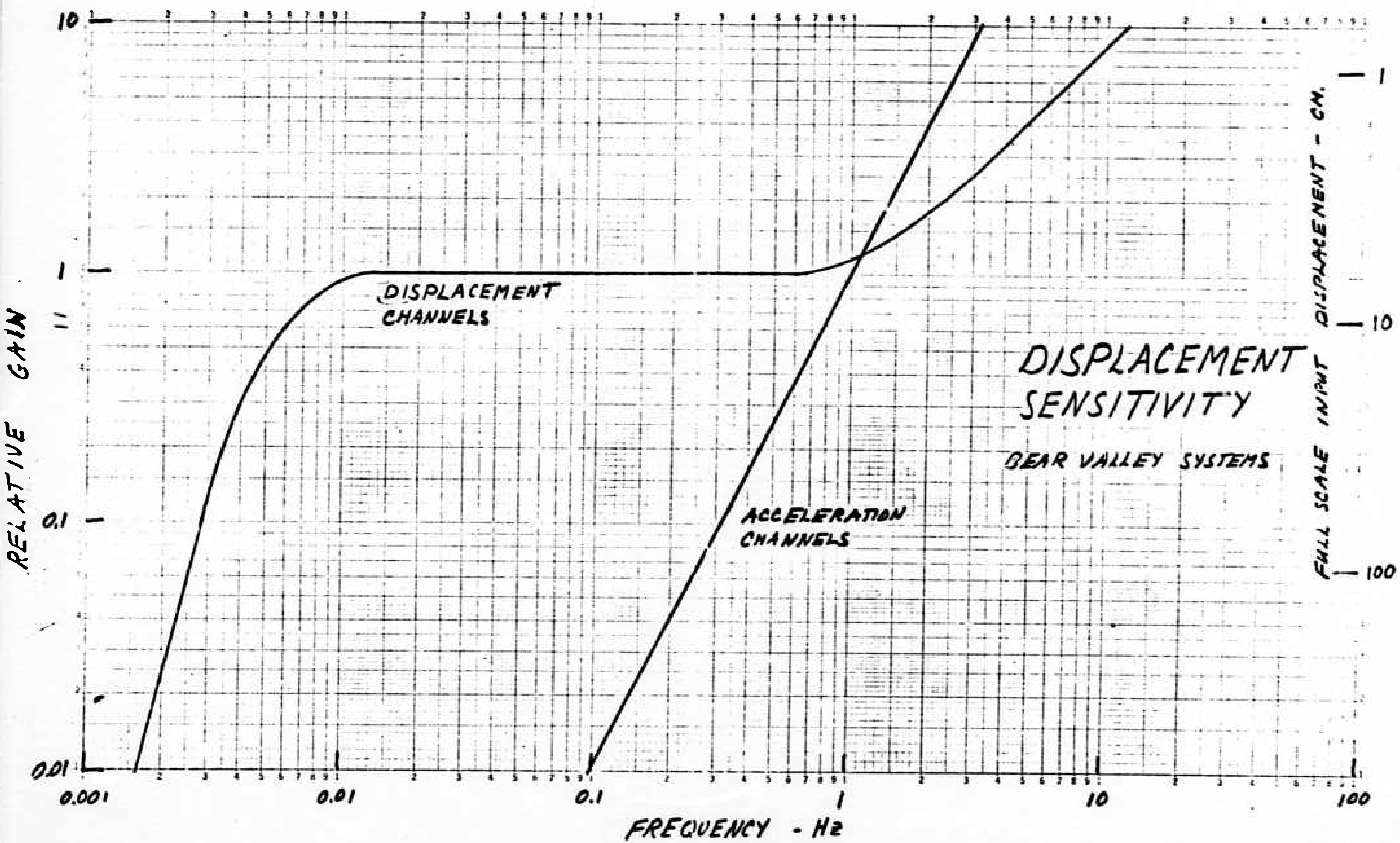


Figure 1. Acceleration sensitivity for the two recording modes.

Figure 2. Displacement sensitivity for the two recording modes.



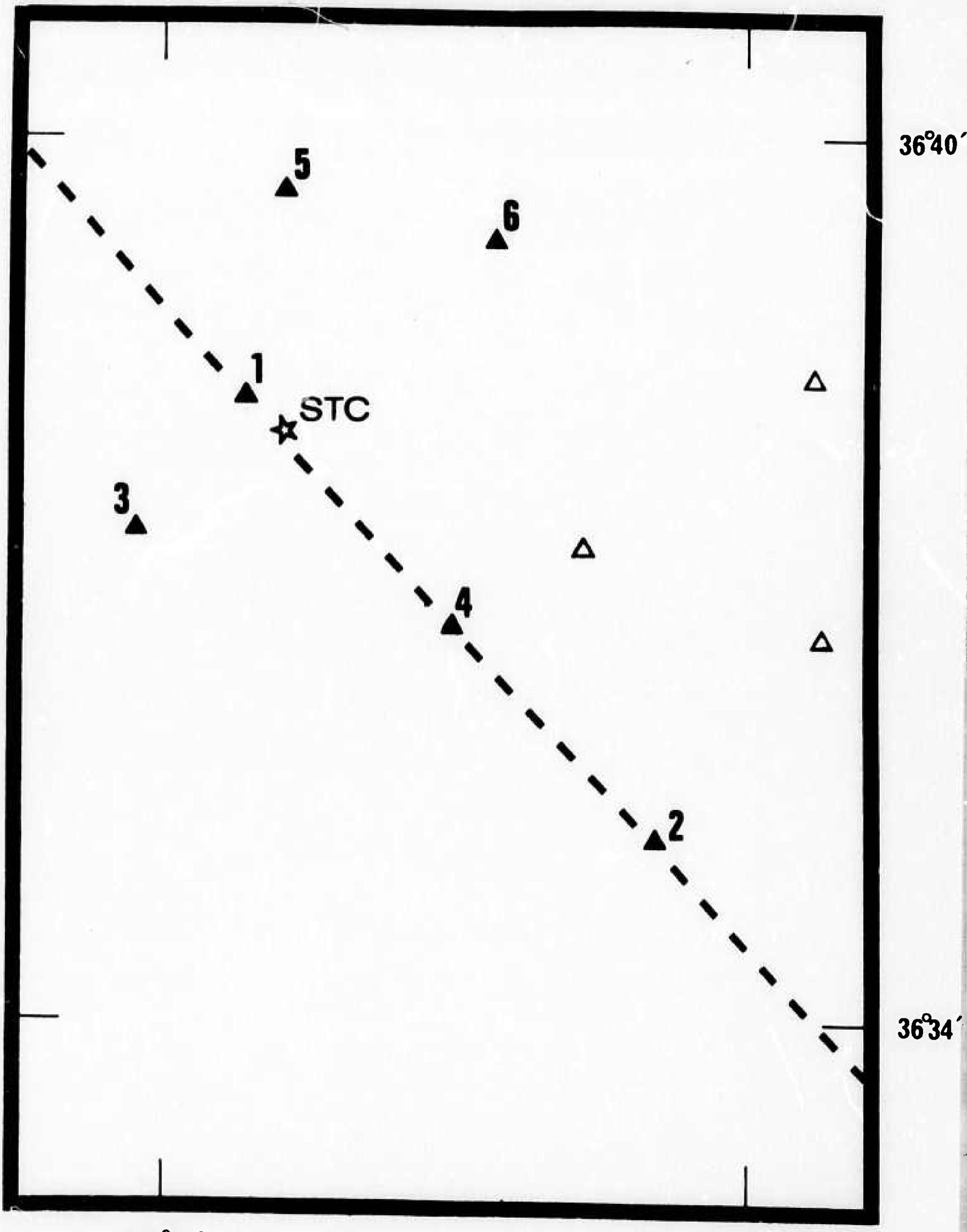


Figure 3. Station locations. Filled triangles - installed prior to 3/1/73, open triangles-to be installed.

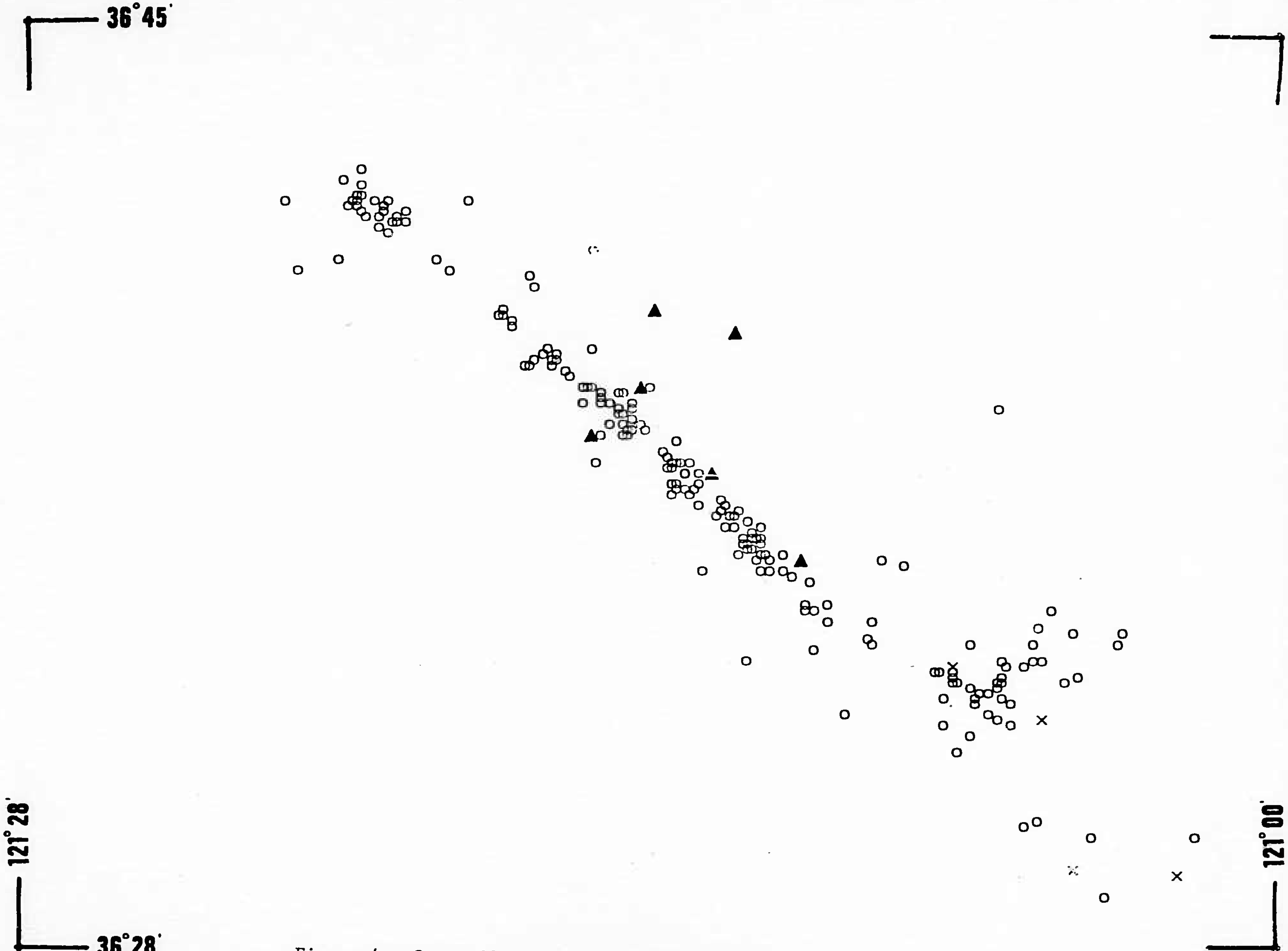


Figure 4. Sept. 1971 to Oct. 1972 Bear Valley epicenters, M $\geq$2.0
Triangles show near field stations installed.

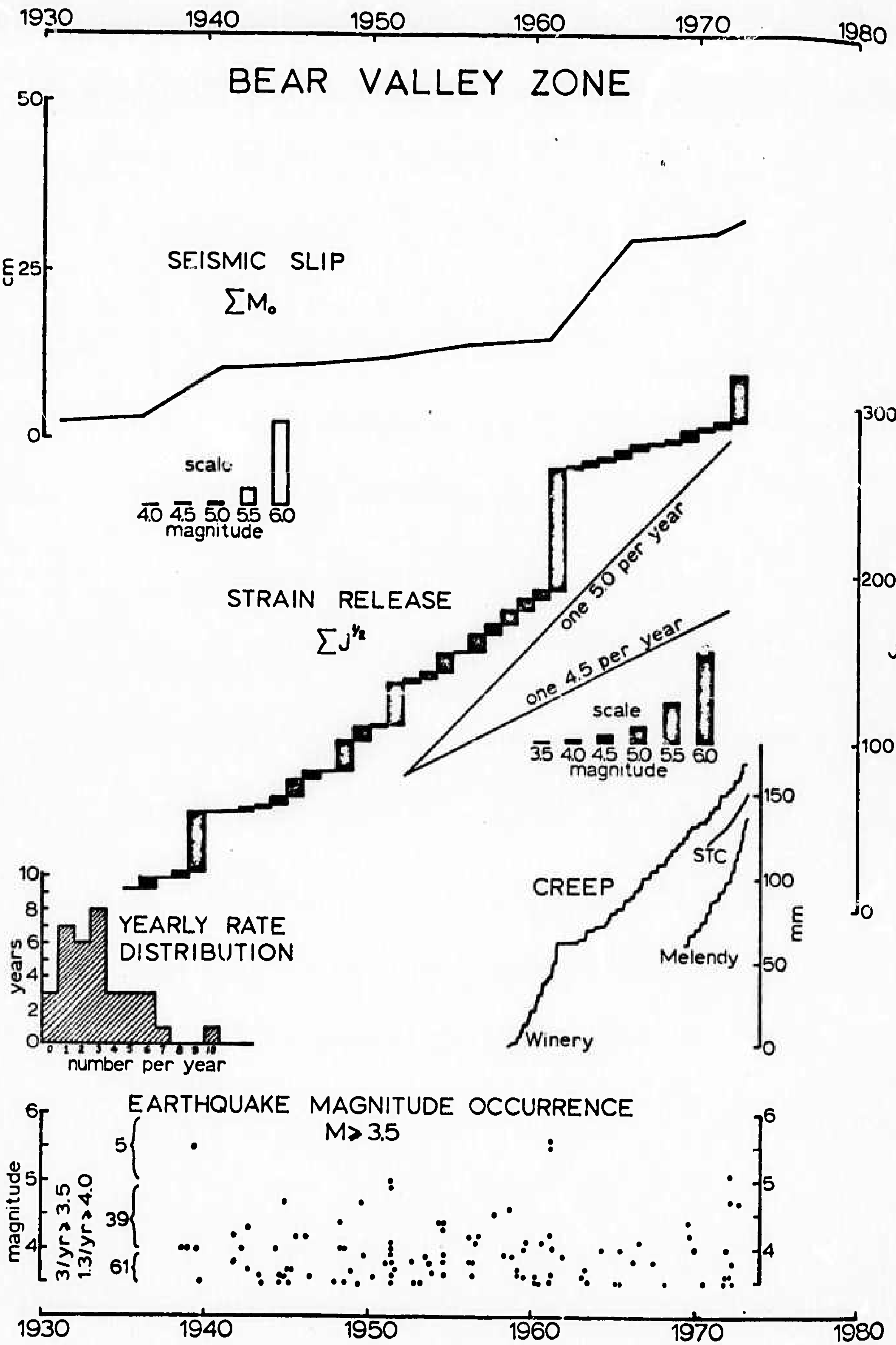


Figure 5. Long term seismic activity in Bear Valley.

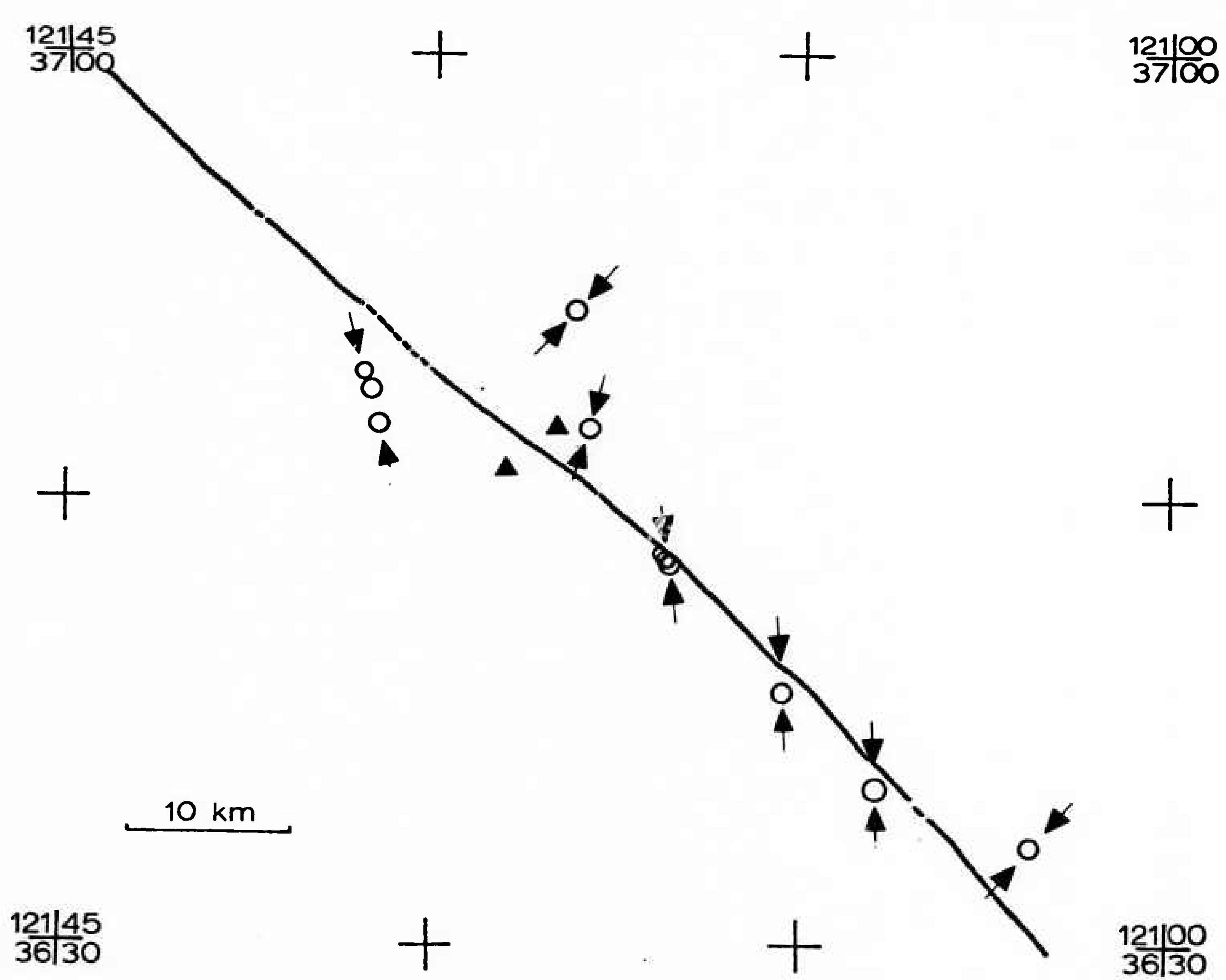


Figure 6. Earthquakes processed for near field spectra. Triangles show SAGO stations used, arrows indicate principal compression axes for earthquakes.

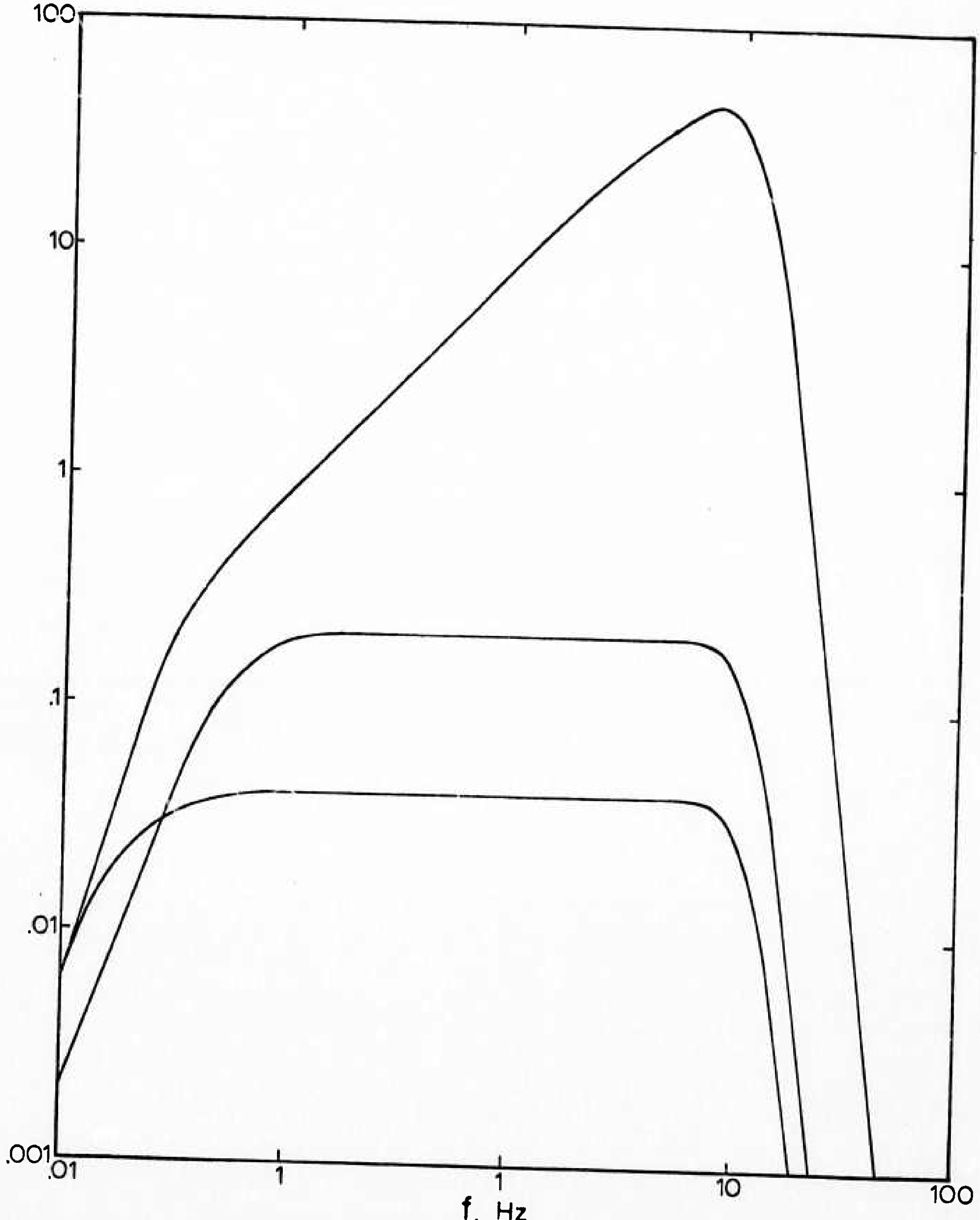
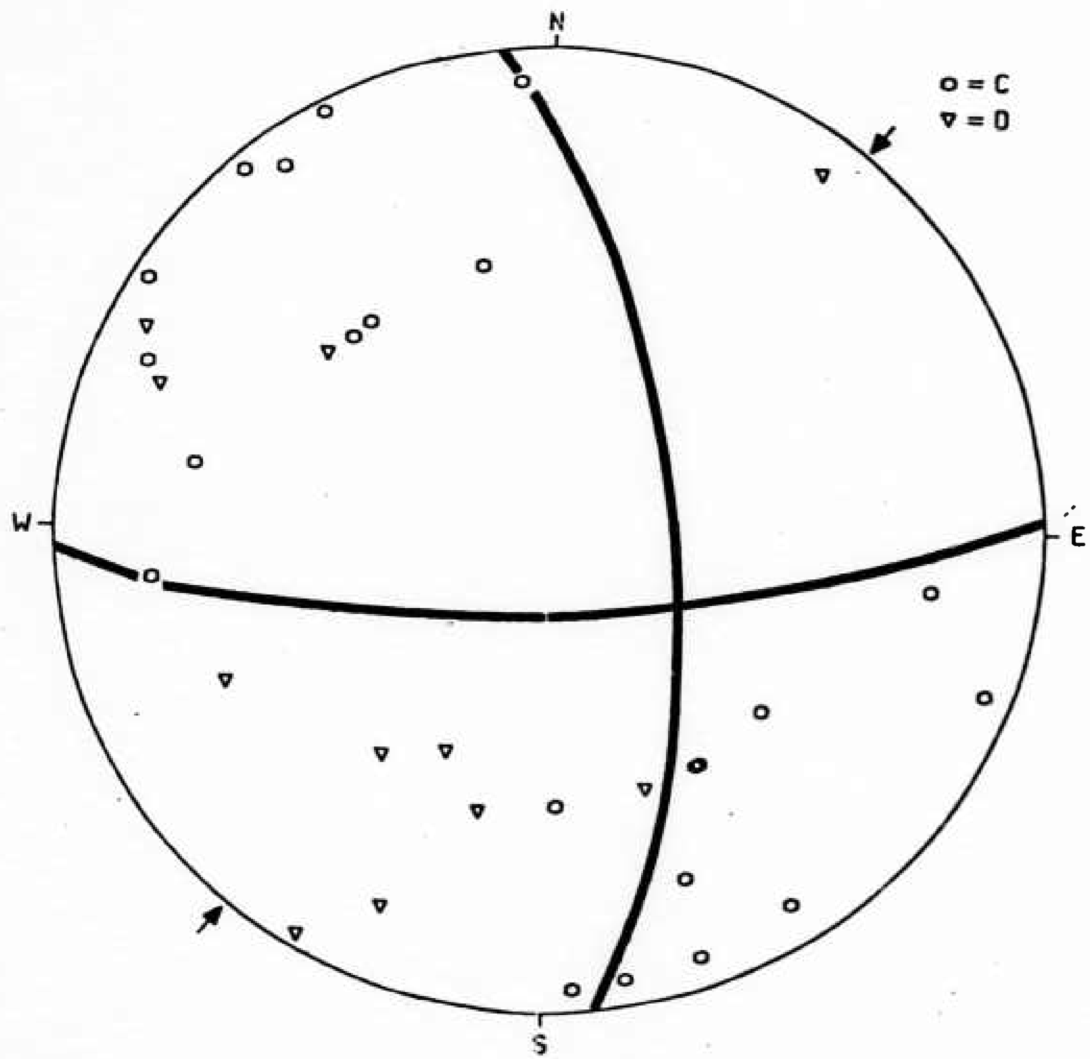


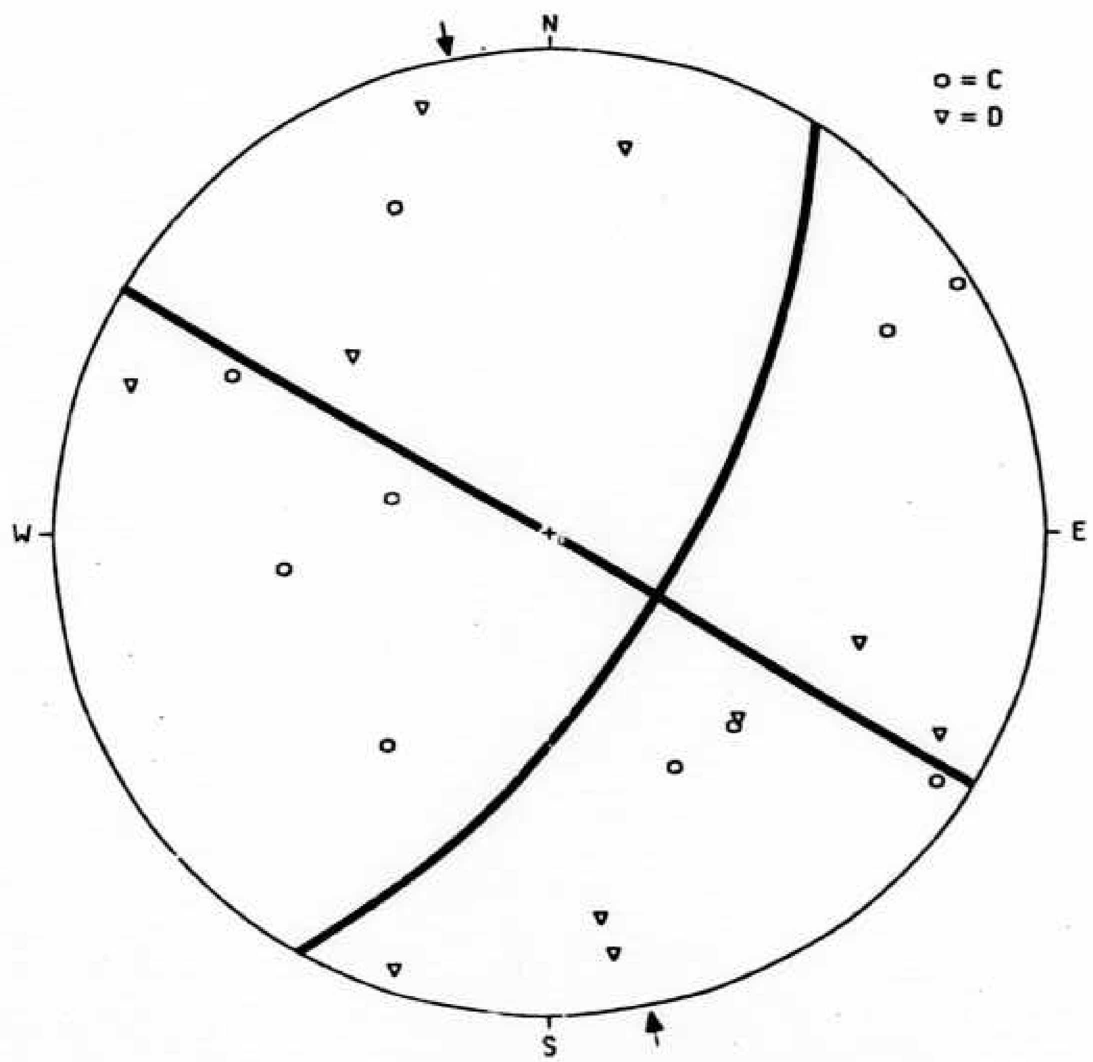
Figure 7. SAGO displacemnt sensitivity in counts per micron of ground displacement, 2048 counts maximum. Top, SAGO-Central velocity channels; middle, SAGO-East displacement channels; bottom, SAGO-Central displacement channels.



31MAR70 070228.6 M=4.7 HOLLISTER
LAT=36° 51' LONG=121° 25' DEPTH=10.2

Figure 8.

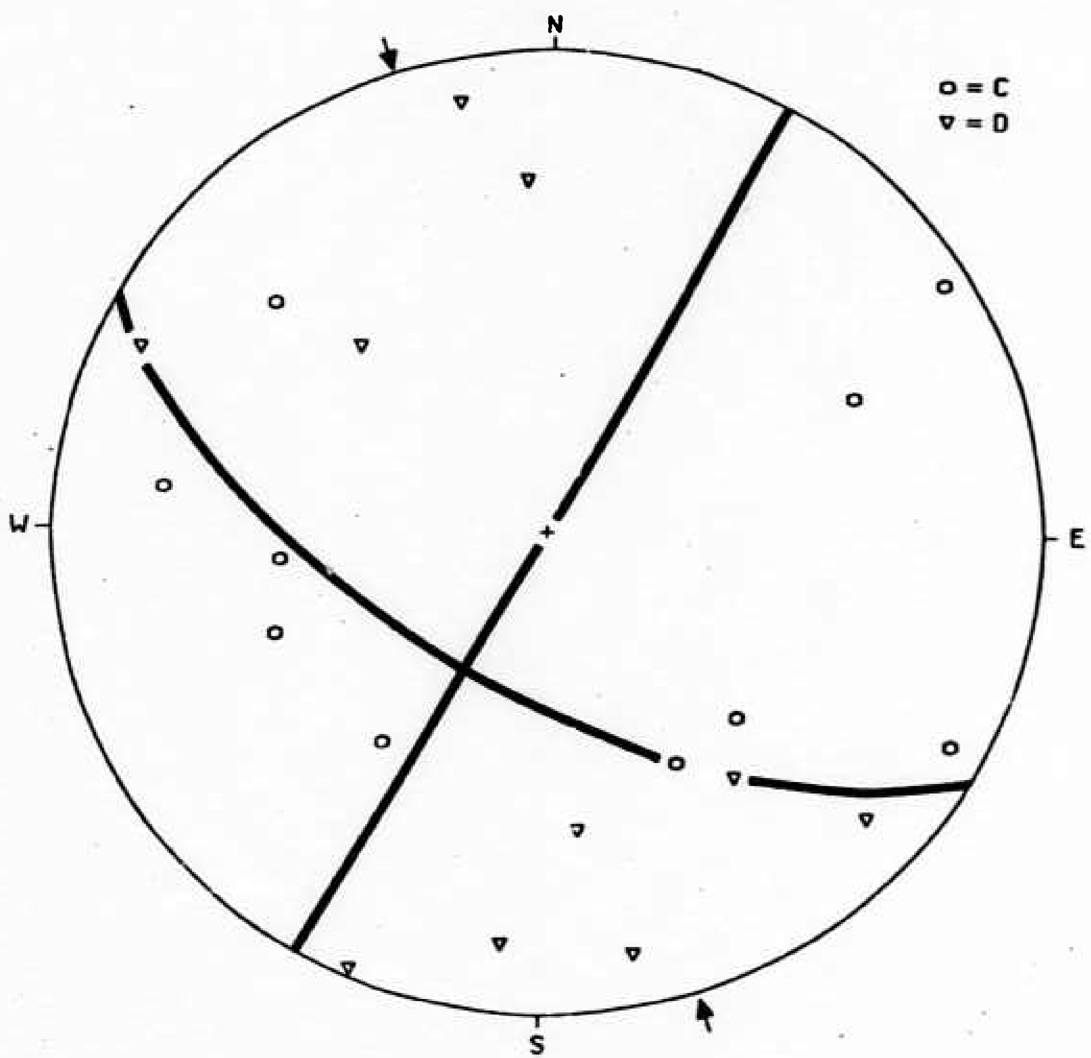
PROJECTION ON THE UPPER HEMISPHERE



030CT72 063002.2 M=4.9 S.J.BAUTISTA
LAT=36° 47' LONG=121° 32' DEPTH= 6.6

PROJECTION ON THE UPPER HEMISPHERE

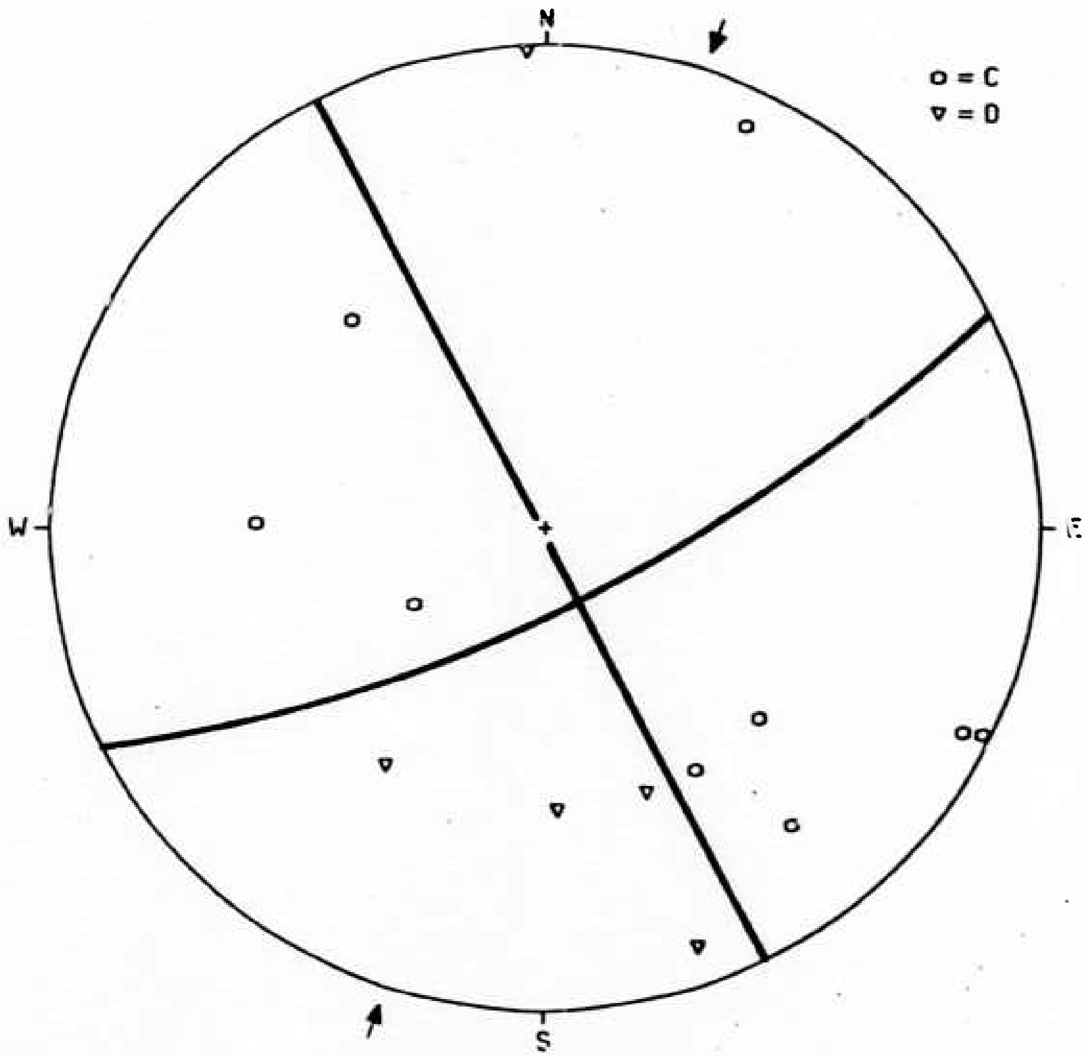
Figure 9.



030CT72 063002.2 M=4.9 S.J.BAUTISTA(C)
LAT=36° 49' LONG=121° 30' DEPTH= 6.6

Figure 10.

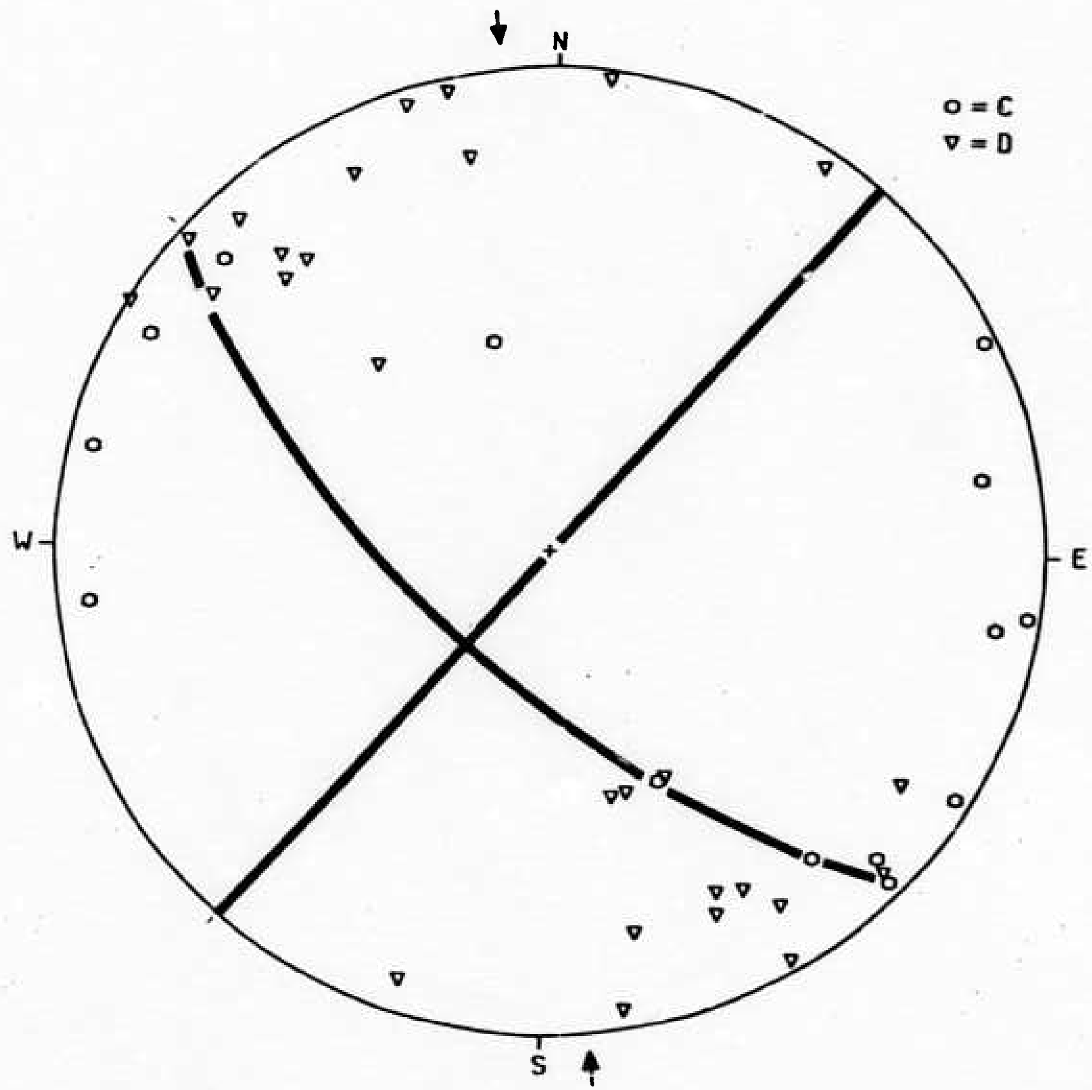
PROJECTION ON THE UPPER HEMISPHERE



270CT69. 105942.8 M=4.6 HARRIS R.
LAT=36° 47' LONG=121° 24' DEPTH=12.5

PROJECTION ON THE UPPER HEMISPHERE

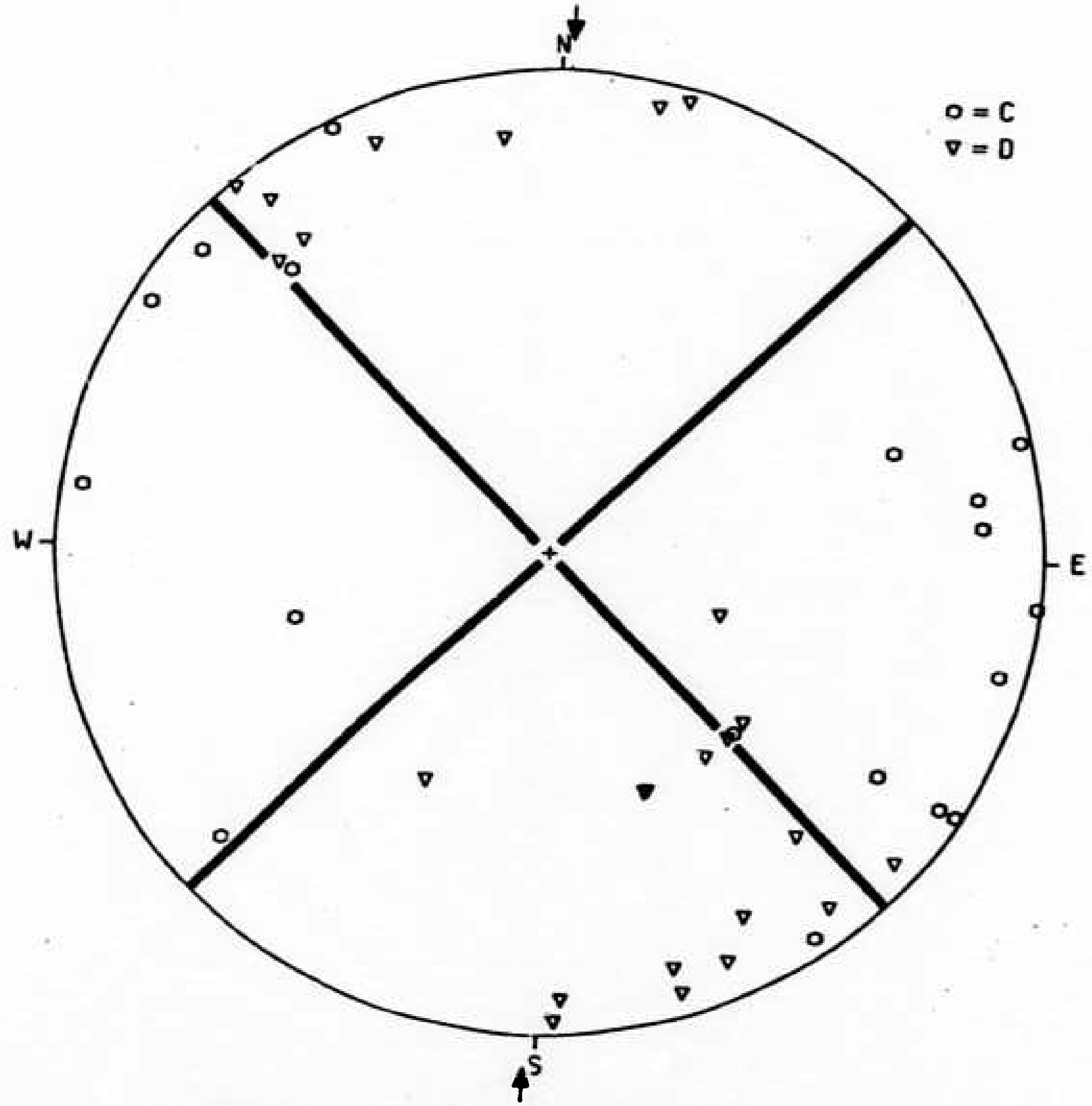
Figure 11.



29DEC71 002535.7 M=4.0 11KM N STC

PROJECTION ON THE UPPER HEMISPHERE

Figure 12.



04SEP72 1804409 M=4.7 LABOR DAY

Figure 13.

PROJECTION ON THE UPPER HEMISPHERE

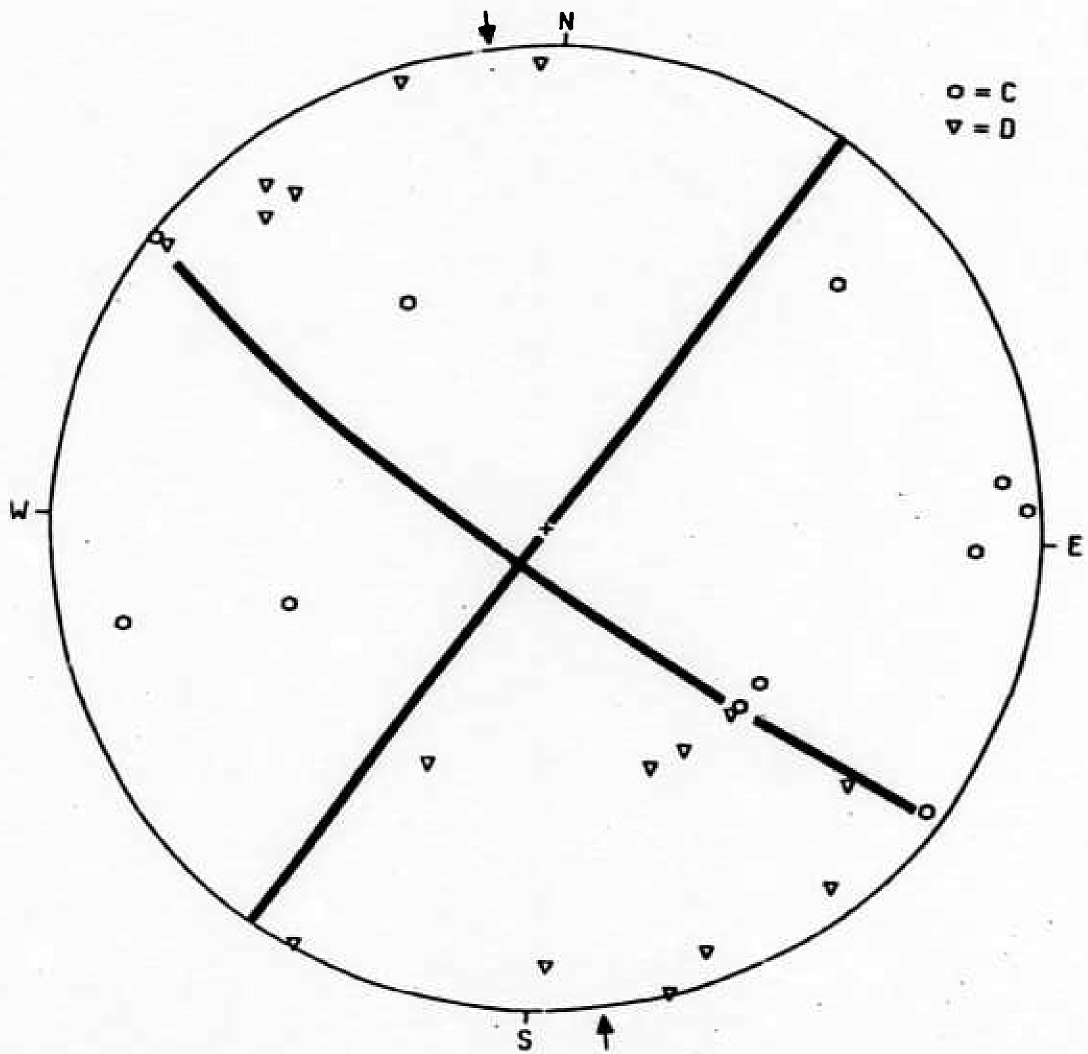


Figure 14.

24FEB72 155651.3 M=5.1 MELENDY

PROJECTION ON THE UPPER HEMISPHERE

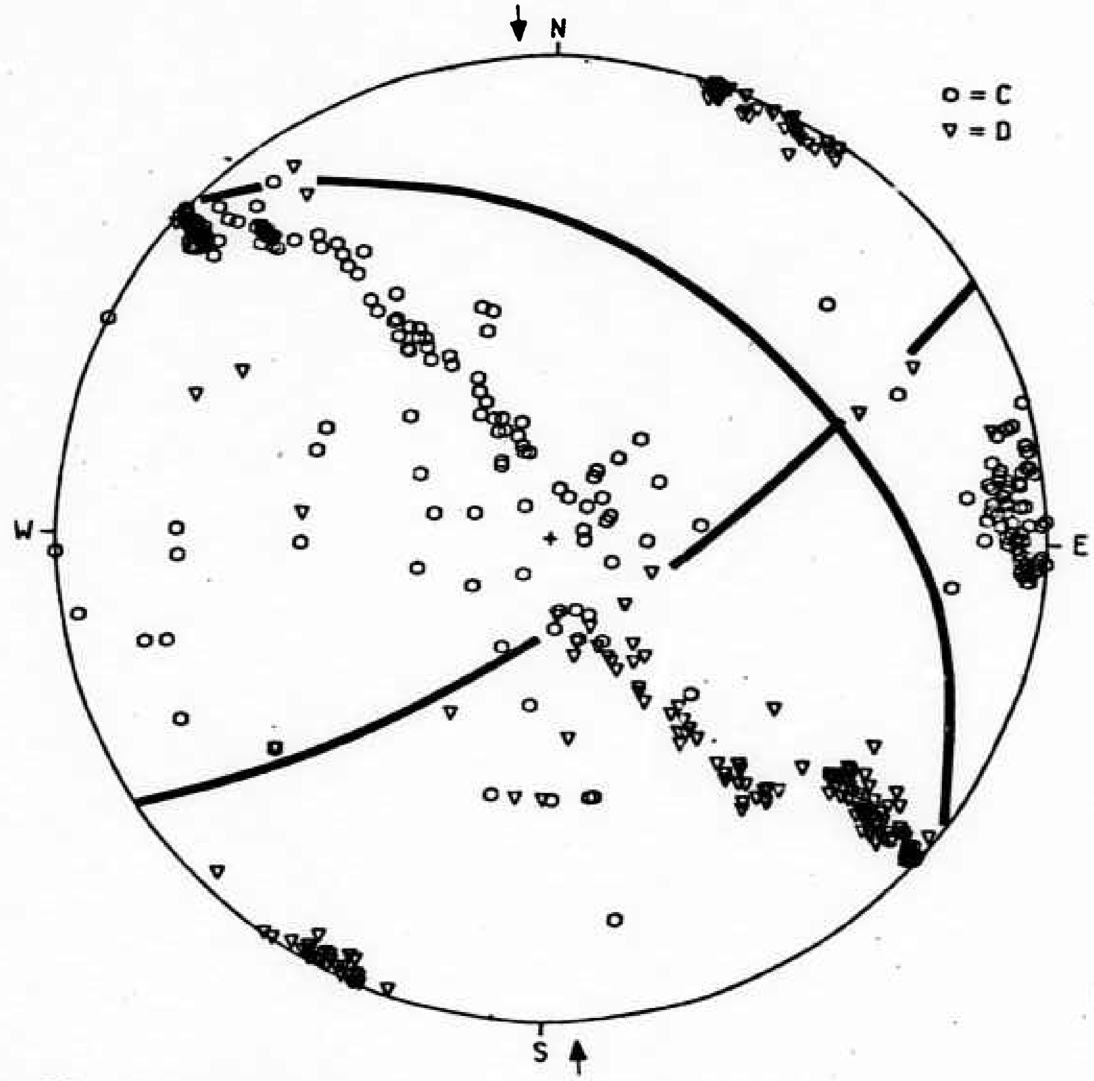
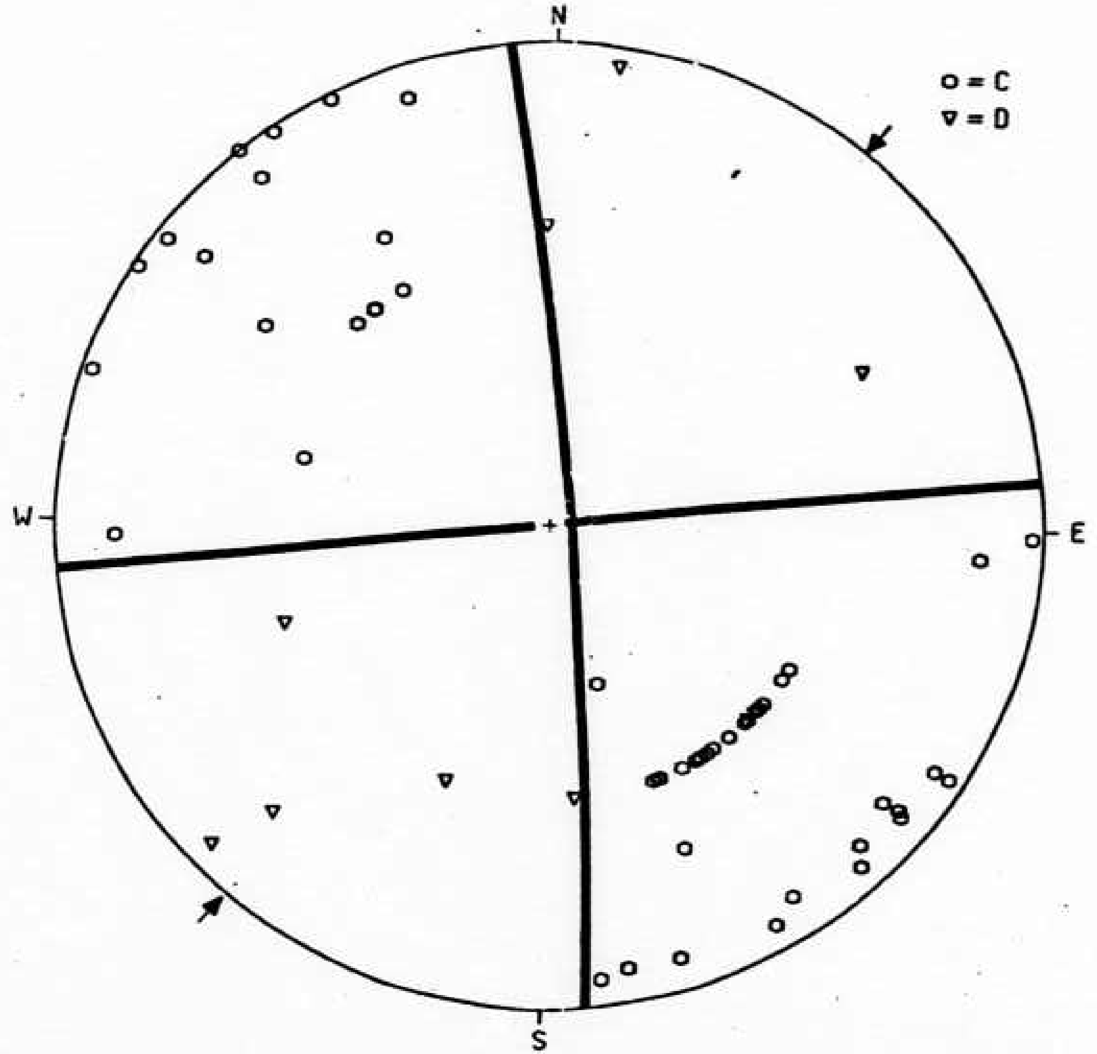


Figure 15. Composite fault plane solution for earthquakes in region II.

PROJECTION ON THE UPPER HEMISPHERE



27FEB72 21:3086 M=4.7 SAN BENITO

Figure 16.

PROJECTION ON THE UPPER HEMISPHERE

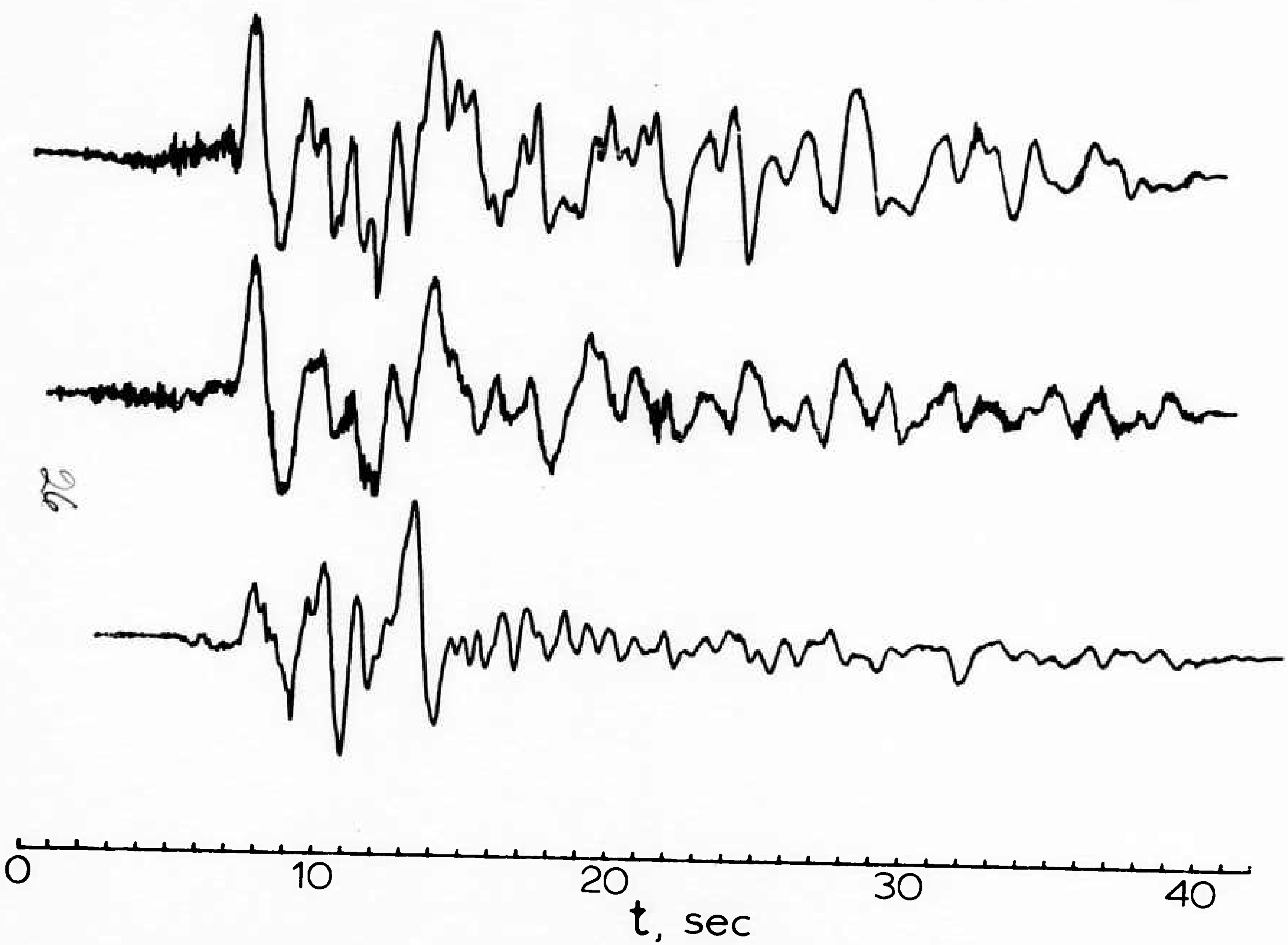


Figure 17. SH displacements at SAGO-East for 3 earthquakes: top - 2/24/72, M=5.1, Δ=30 km; center - 9/04/72, M=4.7, Δ +20 km; - lower - 10/03/72, M=4.9, Δ=10 km. Motions shown represent about 5 mm maximum ground displacements.

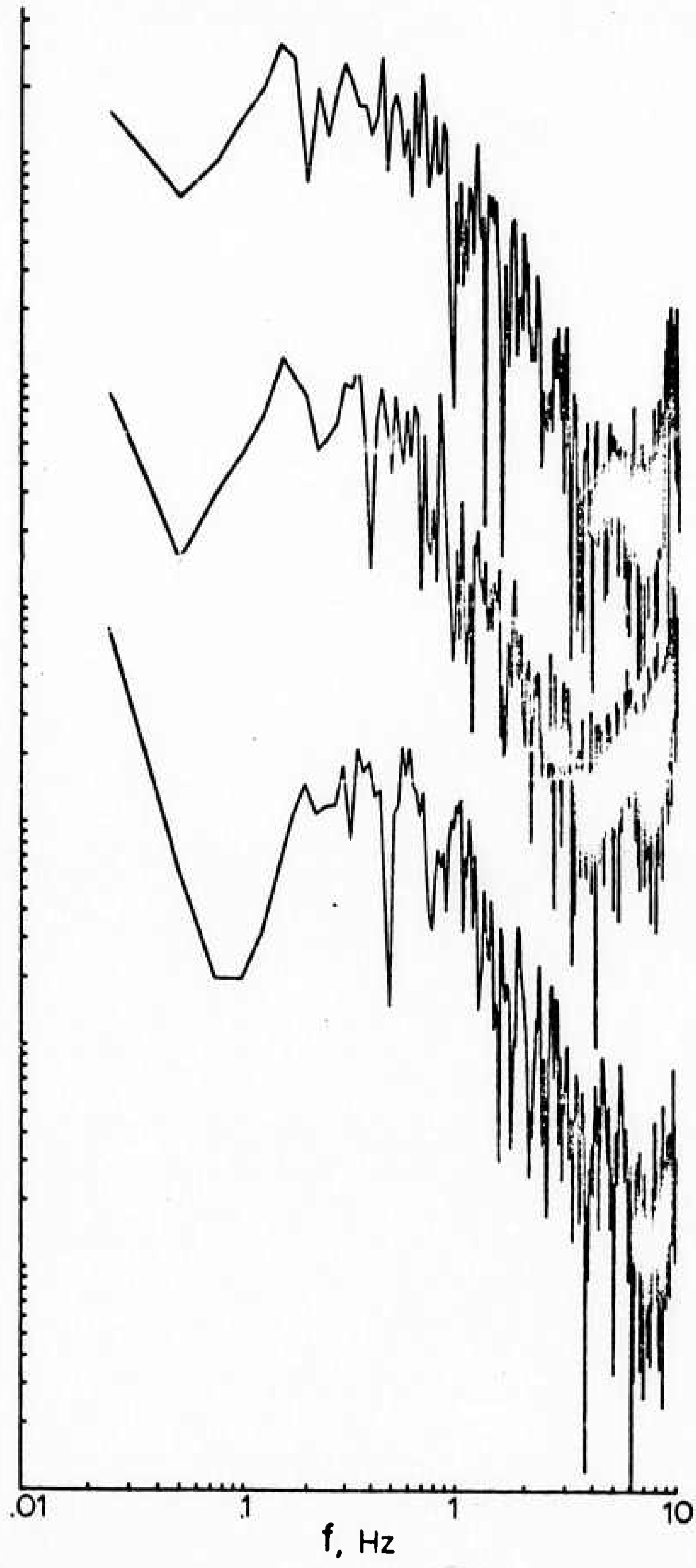


Figure 18. Displacement spectra (corrected for instrument response) for signals shown in Figure 17, events in same order. Relative vertical positions of spectra are arbitrary.

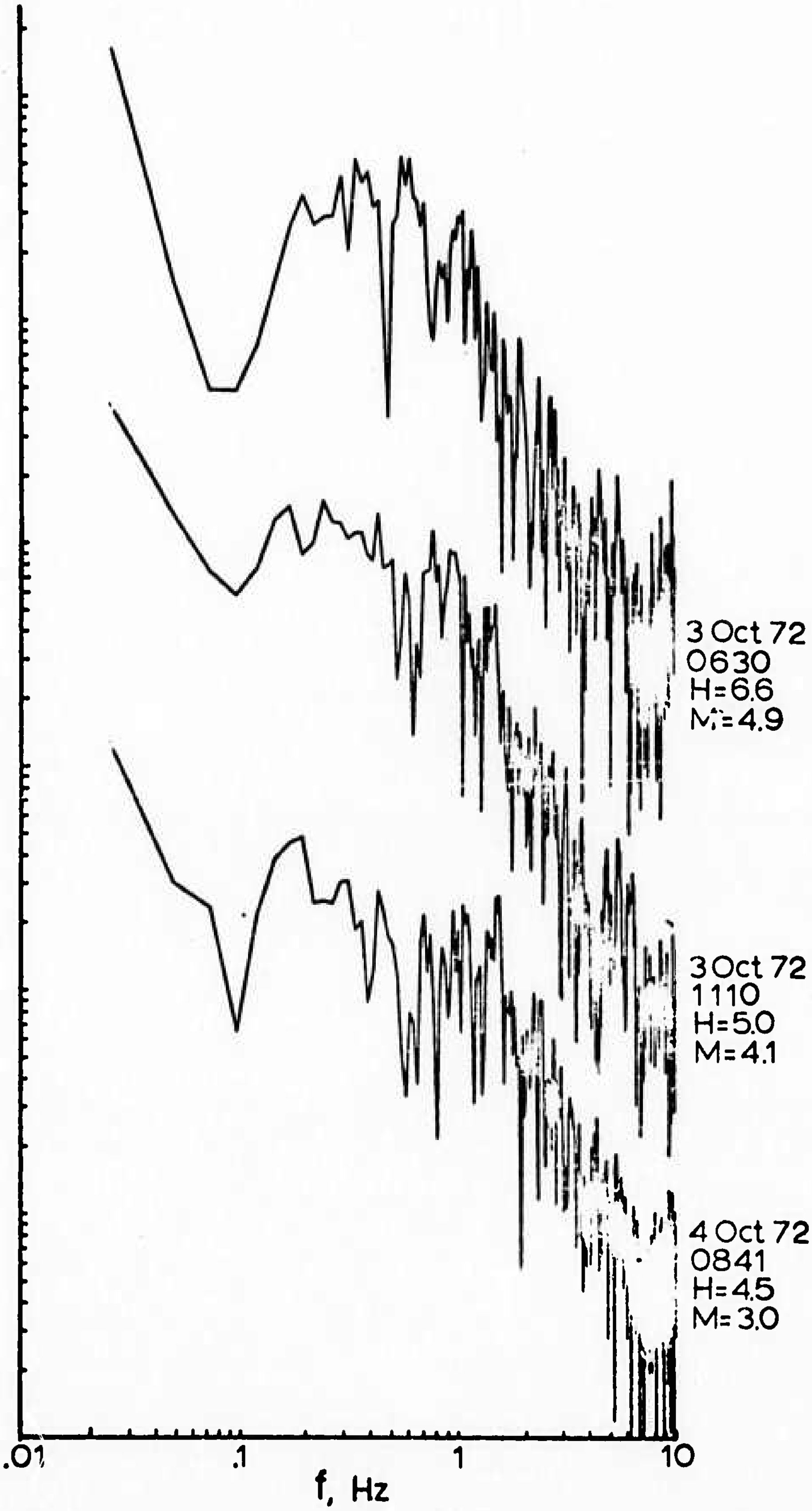


Figure 19. SH displacement spectra (corrected for instrument response) for three earthquakes from SAGO-Central. Upper spectrum from displacement channel, others from velocity outputs. Relative vertical positions of spectra are arbitrary.

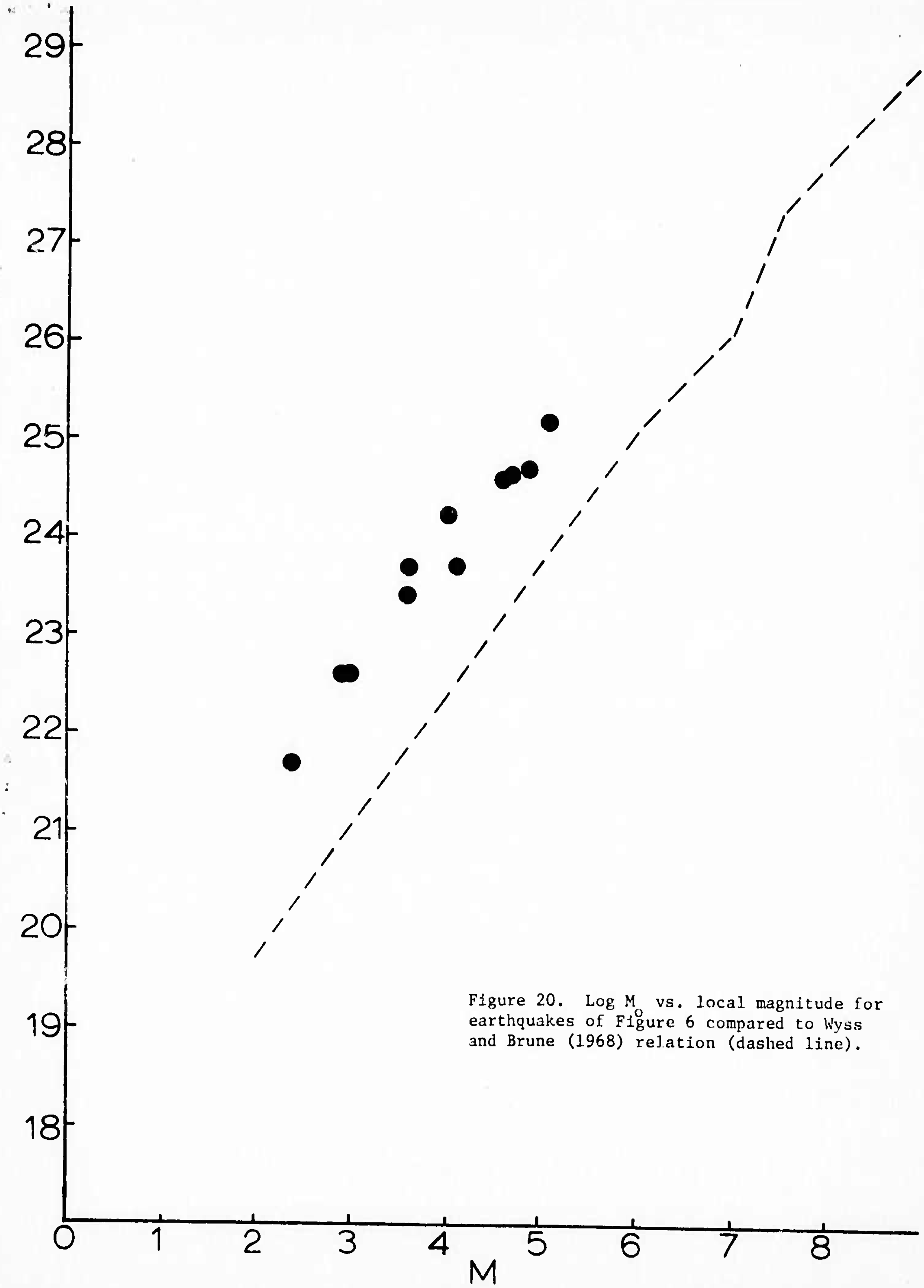


Figure 20. Log M_o vs. local magnitude for earthquakes of Figure 6 compared to Wyss and Brune (1968) relation (dashed line).