

**GEOLOGICAL SURVEY OF CANADA/
COMMISSION GÉOLOGIQUE DU CANADA**

OPEN FILE/DOSSIER PUBLIC 1996

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PROCESSED STRONG MOTION RECORDS**

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LE 25 NOVEMBRE 1988
ENREGISTREMENTS TRAITÉS DES SECOUSSES FORTES**

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Canada

1989

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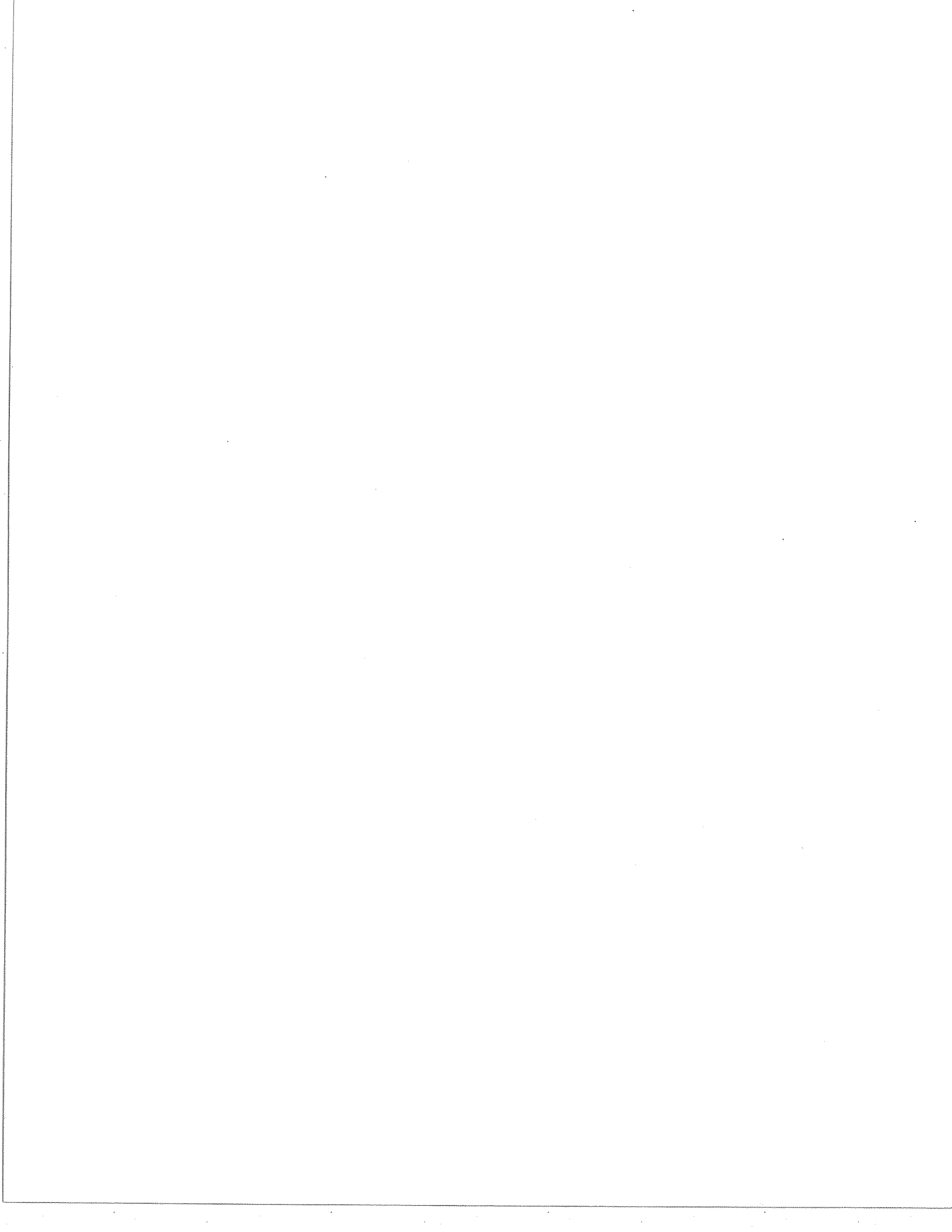
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**Open File Report Number 1996
February 1989
Dossier public numéro 1996
Février 1989**



The Saguenay Earthquake of November 25, 1988

Processed Strong Motion Records

Introduction

The most significant earthquake in over fifty years in eastern North America took place on November 25, 1988. The event was centered north of Quebec City in the Province of Quebec. The purpose of this open file report is to present the results of processing the strong motion data recorded from this event by the Eastern Canada Strong Motion Seismograph Network.

Earthquake Description

On Friday November 25, 1988, at 18:46 Eastern Standard Time (EST) an earthquake of magnitude 5.7 (M_S) occurred close to the northern border of the Laurentides Provincial Park in the province of Quebec. The epicenter was 36 kilometres south of the towns of Chicoutimi and Jonquière on the southern shore of the Saguenay River and was located at 48.117°N and 71.184°W at a depth of 29 kilometres. The earthquake was felt over a very wide area, from Goose Bay, Labrador, in the east to Thunder Bay, Ontario, in the west and from Kuujjuarapik on Hudson's Bay, in the north to Washington, D.C., in the south; the felt area was in excess of 3.5 million km^2 .

The event was preceded by a foreshock of magnitude 4.8 (m_{bLg}) at a similar depth on November 23 at 04:11 EST. An aftershock of magnitude 4.1 (m_{bLg}) occurred on November 25 at 22:38 EST and, up to January 31, 1989, there has been only one other aftershock of magnitude greater than three (January 19, $m_{bLg}=3.6$). The aftershock activity for this event has been unusually low.

Thrust faulting is indicated from the focal mechanisms for the foreshock, the main shock and the largest aftershock. Nearly all of the aftershock activity is located above the main shock, suggesting that the rupture propagated upwards (North et al., 1989).

Copies of the original uncorrected accelerograms can be found in Munro and North (1988).

Data and Data Processing

The Eastern Canada Strong Motion Seismograph Network is described in detail in Munro et al. (1986) and Weichert and Munro (1987). The sites are shown in Figure 1 and listed in Table 1. Twelve accelerographs were triggered by the main shock of November 25. Nine units produced accelerograms starting at the P-wave while two units were triggered by the S-phase and one unit jammed. There were no triggers for any other events. For those

units that did produce accelerograms, the following notes apply:

5. Tadoussac – The transverse sensor was dead.
7. Baie-St-Paul – The unit appears to have shut off early.
13. St-Éleuthère – The unit triggered but jammed and did not record.
20. Les Éboulements – The vertical sensor appears to be completely undamped, although damping appeared normal during the calibrations in October and December.

Original accelerograms, recorded on 70 mm film, were digitized commercially by LS Associates (formerly IOM/TOWILL), Santa Clara, CA, using a computer-controlled trace-following laser scanner. The resolution is $\pm 1 \mu\text{m}$ while the RMS error is in the order of $\pm 10 \mu\text{m}$ (Fletcher et al, 1980 and Converse, 1984) and corresponds to an RMS error of $\pm 0.056 \%$ g. Traces were digitized in windows of approximately 9.5 to 9.6 seconds duration, with some shorter ones at the end of some films. Horizontal reference traces, with an overlap of approximately 1.25 cm at each end of a window, and vertical butting lines were also digitized and these were used to realign adjacent windows using a least-squares fitting procedure. The reference traces also served to correct for any possible transverse slipping of the film transport mechanism while digitized time marks served to correct for inconsistencies in the film speed. All films had 80 to 100 % of the length digitized with the exception of La Malbaie (74%), where the last frame indicated no appreciable acceleration, and Les Éboulements (55%), where the unit jammed on for 70 seconds.

The digitized data were processed using the AGRAM software package developed by the U.S. Geological Survey (Converse, 1984). The data were interpolated to an even sampling rate of 600 samples per second, corrected for instrument response, filtered using a cosine taper which reduces the frequency response from 100% to zero between 50 and 100 Hz and then decimated to 200 samples per second. The resultant acceleration time series file was integrated to produce a velocity time series file. Both time series were high-pass filtered with a bi-directional (zero phase shift) 4-pole Butterworth high-pass filter. The displacement time series file was subsequently produced with an initial condition of zero displacement. The Fourier amplitude spectrum of acceleration was calculated next and plotted on log-log axes. Finally the pseudo-velocity response spectrum was calculated and plotted with tripartite log-log axes.

Preliminary calculations were done for all sites using a high-pass Butterworth filter with a corner frequency of 0.1 Hz (10 seconds). The displacement traces indicated many cases of non-seismic long-period interference and these were clearly borne out by the response spectra (spectra converged and decreased towards longer periods, then started to increase again and diverge). The source of the increase is clearly processing noise, as described below, but did not appear to be related to the digitization window length of approximately 9.6 seconds. No correlation of this interference's period or amplitude with distance or azimuth to the epicenter was noted.

In order to better quantify the overall errors of the recording, digitizing and processing routines, the transverse acceleration trace was replaced by the fixed reference trace (a straight line on the film produced by a mechanically fixed mirror) and this was reprocessed as a "dead" acceleration trace. It was noted that the response spectra reprocessed for

the longitudinal and vertical components were virtually identical (indicating that processing with only one reference trace is acceptable). The response spectrum for the fixed trace indicated noise that is more or less flat to acceleration (velocity response increases towards longer periods). The range of noise is shown in the plots for Site 2, Québec, (maximum) and for Site 14, Ste-Lucie (minimum), found at the end of Appendix "A". It was decided to reprocess the data for each site with a filter chosen to terminate the plots in the vicinity of the crossover of the decreasing response spectrum and the increasing noise spectrum.

The peak vertical and horizontal accelerations are listed in Table 2 along with the distance of the station from the epicentre and the azimuth to the epicentre. Data from the states of Maine and New York, USA, were recorded on Kinematics SSA-1 digitally recording accelerographs and are included with the kind permission of the authors (see Friberg et al, 1988). Figure 2 shows peak vertical and horizontal accelerations as a function of epicentral distance. Peak horizontal acceleration, as predicted by Hasegawa et al (1981), is also shown. It is worthwhile noting that differences (sometimes large) occur between the peak accelerations as reported in the first open file report (Munro and North, 1988) and the peak accelerations as reported in this report; the difference is that the AGRAM package uses the maximum zero-to-peak value while the former document reported one-half of the maximum peak-to-peak acceleration recorded.

Appendix "A" includes, in numerical order by station number, the plots of corrected and filtered acceleration, velocity and displacement for each component, the Fourier amplitude spectrum for each component and the pseudo-velocity response spectrum for each component.

A tape of the digitized data may be obtained separately, at the user's expense, upon request to the Director, Geophysics Division, Geological Survey of Canada, 1 Observatory Crescent, Ottawa, Ontario, Canada, K1A 0Y3.

Acknowledgements

We gratefully acknowledge the enthusiastic participation of our colleagues at the two offices of the Geological Survey of Canada, in particular, R.E. Baldwin, R.G. North, P.W. Basham and M. Lamontagne.

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Le tremblement de terre du Saguenay: le 25 novembre 1988

Enregistrements traités des secousses fortes

Introduction

Le tremblement de terre le plus important à s'être produit dans l'Est de l'Amérique du Nord au cours des cinquante dernières années, a eu lieu le 25 novembre 1988 au nord de Québec. Ce dossier présente les résultats du traitement des enregistrements des secousses fortes de cet événement, telles qu'enregistrées par le Réseau des secousses fortes de l'Est du Canada.

Description du tremblement de terre

Le tremblement de terre de magnitude 5,7 (M_S) a eu lieu à 18:46 Heure normale de l'Est (HNE) vendredi le 25 novembre 1988. L'épicentre se situait dans le nord de la Réserve faunique des Laurentides à une distance de 36 kilomètres au sud des villes de Chicoutimi et Jonquière. Ses coordonnées sont 48,117°N et 71,184°O et la profondeur du foyer est de 29 kilomètres. Les vibrations furent ressenties de Goose Bay, Labrador à l'est, jusqu'à Thunder Bay, Ontario à l'ouest, et de Kuujjuarapik sur la baie d'Hudson au nord, jusqu'à Washington, D.C. au sud; ce séisme a donc été senti sur plus de 3,5 million km².

Il y a eu un précurseur de magnitude 4,8 (m_{bLg}) et de profondeur semblable le 23 novembre à 04:11 HNE. Une réplique de magnitude 4,1 (m_{bLg}) a eu lieu le 25 novembre à 22:38 HNE. Jusqu'au 31 janvier 1989, il n'y a eu qu'une réplique de magnitude supérieure à trois (19 janvier; $m_{bLg}=3,6$). Le nombre de répliques pour ce tremblement de terre est exceptionnellement faible.

Le tremblement de terre principal, son précurseur et sa réplique indiquent un mécanisme de chevauchement. La presque totalité des répliques sont localisées au-dessus de choc principal, ce qui suggère que la rupture s'est propagée vers le haut (North et al., 1989).

Les copies des accélérogrammes originaux enregistrées peuvent être trouvées dans Munro et North (1988).

Traitement des données

Le Réseau d'enregistrement des secousses fortes de l'Est du Canada est décrit par Munro et al. (1986) et Weichert et Munro (1987). Les emplacements des sites sont montrés à la Figure 1 et décrits dans le Tableau 1. Le tremblement de terre principal du 25 novembre a déclenché douze unités; neuf par l'onde P, deux par l'onde S et un n'a pas fonctionné. Aucun des autres séismes n'a causé de déclenchement. Les remarques qui suivent réfèrent aux

unités qui ont déclenché.

5. Tadoussac – L'accéléromètre transversal n'a pas opéré.
7. Baie-St-Paul – L'unité s'est arrêté d'opérer trop tôt.
13. St-Éleuthère – L'unité a déclenché mais s'est bloqué et n'a rien enregistré.
20. Les Éboulements – L'amortissement de l'accéléromètre vertical a semblé nul pendant l'enregistrement du tremblement de terre quoiqu'il était satisfaisant lors des étalonnages d'octobre et de décembre.

Les accélérogrammes originaux, produites sur pellicule de 70 mm, ont été chiffrés par la compagnie LS Associates (autrefois IOM/TOWILL), de Santa Clara, CA, en utilisant un explorateur en rayon laser, contrôlé par ordinateur, qui suit la trace. La définition est de $\pm 1 \mu\text{m}$ (Fletcher et al, 1980 and Converse, 1984). Le processus a une erreur efficace de $\pm 10 \mu\text{m}$ qui égale $\pm 0.056 \%$ g. Les traces ont été chiffrées par segments de durée de 9,5 à 9,6 secondes, sauf pour le dernier segment de chaque film. Les traces de référence horizontales, ainsi que des lignes d'alignement verticales ajoutées à la main, ont été chiffrées aussi et ont été utilisées afin d'aligner, par méthode de moindres-carrés, les segments qui se touchent. De plus, ces traces de référence ont été utilisées pour corriger les effets mécanique de l'enregistreur. La trace du temps a été utilisée pour corriger pour les variations de vitesse d'enregistrement. On a chiffré de 80% à 100% de chaque accélérogramme sauf pour La Malbaie (74%), où le dernier segment ne montrait aucune accélération, et Les Éboulements (55%), où l'instrument s'est enrayé pendant 70 secondes.

Les données ont été traitées par la méthode du U.S. Geological Survey en utilisant le logiciel AGRAM (voir Converse, 1984). Les données ont été interpolées à un taux non-variable de 600 échantillons par seconde, ont été corrigées pour les effets d'instrumentation, ont été filtrées par un filtre de décroissance de type cosinusoidal qui réduit la sensibilité en fréquence de 100% à 0% entre 50 et 100 Hz et, finalement ont été échantillonnées à un taux de 200 par seconde. Le fichier d'accélération a été intégré afin de produire un fichier de vitesse et les deux ont été filtrés par un filtre passe-haut de type Butterworth (bi-directionnel, 4-pôles, déphasage nul). Le fichier de déplacement a été produit avec la condition initiale de déplacement nul. Les spectres d'amplitude Fourier et les spectres de réponse pseudo-vélocité ont été calculés et tracés sur les graphiques log-log.

Les essais préliminaires ont été faits pour chaque site en utilisant un filtre passe-haut Butterworth à 0,1 Hz de fréquence de coin (10 secondes). Les traces de déplacement ont montré plusieurs cas d'interférence non-séismique de période-longue. Les spectres, convergent et décroissant, ont commencé de s'accroître et de s'écarter vers les périodes-longues. L'interférence ne semblait pas être liée à la durée des segments chiffrés (9,5 à 9,6 secondes) ni ne semblait pas dépendre de la distance ou de l'azimut à l'épicentre.

Afin de mieux comprendre le bruit interne du processus de traitement des accélérogrammes, on a refait l'analyse de données en remplaçant la composante transverse de l'accéléromètre par une trace de référence (une ligne droite, produit par un miroir fixe) qui servait comme trace d'accélération stable. Il a été noté que les spectres retraités pour les composantes longitudinale et verticale restaient très semblables alors que le spectre pour la composante

transversale indiquait le bruit de système à un niveau d'accélération presque constant. Les variations peuvent être observées à la fin de l'Annexe "A" où on présente les spectres pour le Site 2, Québec (plus bruyant) et pour le Site 14, Ste-Lucie (plus tranquille). On a décidé de traiter de nouveau chaque site en utilisant un filtre qui terminait chaque spectre dans la région du point de rencontre des spectres de réponse (qui décroît) et du bruit (qui s'accroît).

Les accélérations maximales verticales et horizontales sont présentées au Tableau 2 avec les distances et azimuts à l'épicentre. Les données du Maine et de l'état de New York ont été enregistrées par des accéléromètres numériques de type SSA-1 de Kinematics et sont présentées avec permission des auteurs (voir Friberg et al, 1988). La Figure 2 montre les accélérations maximales verticales et horizontales en fonction de la distance à l'épicentre. Les accélérations maximales horizontales, prédites par Hasegawa et al (1981), sont aussi montrées. On verra que les accélérations maximales sont plus grandes dans ce rapport-ci. Le dernier rapport indiquait les accélérations calculées comme une-demie de la valeur maximale crête-à-crête, et maintenant le logiciel AGRAM indique la valeur maximale de ligne zéro-à-crête.

L'annexe "A" contient, dans l'ordre numérique de station, les graphiques d'accélération, de vitesse et de déplacement pour chaque composante, un graphique du spectre d'amplitude Fourier pour chaque composante et un graphique du spectre de réponse pseudo-vitesse pour chaque composante.

On peut obtenir un ruban magnétique contenant les données en faisant une demande spéciale au Directeur, Division de la géophysique, Commission géologique du Canada, 1 place de l'Observatoire, Ottawa, Ontario, Canada, K1A 0Y3.

Remerciements

C'est avec plaisir que nous remercions nos collègues aux deux bureaux de la Commission géologique du Canada pour leur assistance généreuse, en particulier R.E. Baldwin, R.G. North, P.W. Basham et M. Lamontagne.

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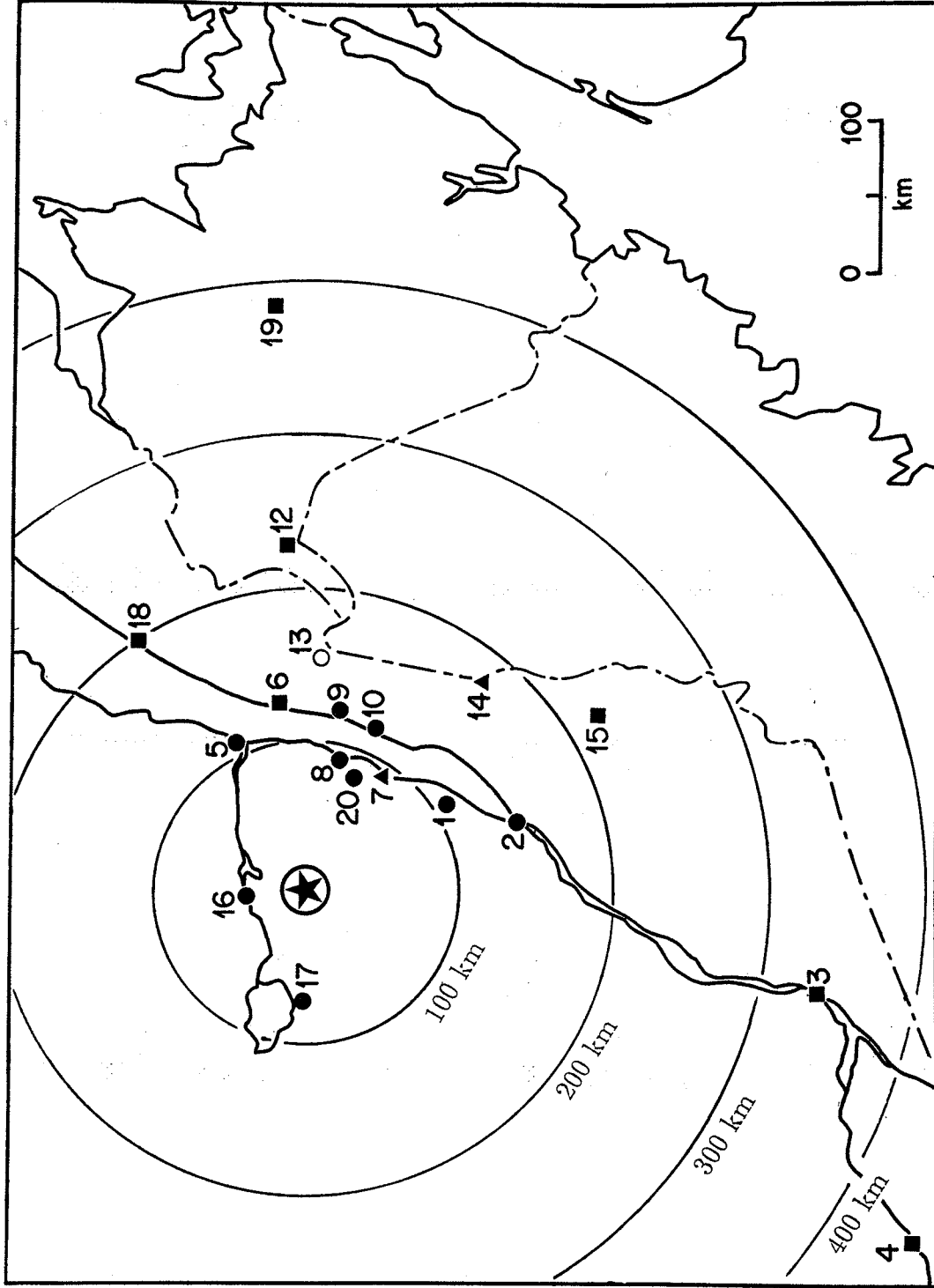
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Figure 1: Eastern Canada Strong Motion Seismograph Network; October 1988.
 Figure 1: Réseau d'enregistrement des secousses fortes de l'Est du Canada: octobre 1988.



- Key**
- P-wave trigger / déclenchement par l'onde P
 - No record / pas d'enregistrement
 - ▲ S-wave trigger / déclenchement par l'onde S
 - Untriggered / non-déclenché

Table 1: Eastern Canada Strong Motion Seismograph Network; October 1988.

No.	Location	Date	Coord	Instr.	Sens.	Trigger	Building	Foundation
1.	St-Ferréol, Qué.	1/66	47.1256 70.8282	SMA-1 TCG-1B	1 g	0.0072 g	Underground seismic vault. Instrument on concrete pier.	bedrock
2.	Québec, Qué.	6/67	46.7782 71.2749	SMA-1 TCG-1A	1 g	0.0065 g	3-storey, reinforced concrete. Instrument on concrete pier on basement floor slab.	bedrock
3.	Montréal, Qué.	12/73	45.5025 73.6230	SMA-1 TCG-1A	1 g	0.0049 g	4-storey steel frame, curtain wall, poured concrete. Instru- ment in basement seismic vault.	bedrock
4.	Ottawa, Ont.	8/84	45.3942 75.7167	SMA-1 TCG-1A	1 g	0.0105 g	Underground seismic vault. Instrument on concrete pier.	bedrock
5.	Tadoussac, Qué.	5/79	48.1432 69.7189	SMA-1 TCG-1B	1 g	0.0101 g	Concrete pier to bedrock in crawl space of 1-storey bldg.	bedrock
6.	Rivière-du-Loup, Qué.	6/80	47.8356 69.5379	SMA-1 TCG-1B	1 g	0.0108 g	Two-storey reinforced concrete. Instrument on basement slab.	bedrock
7.	Baie-St-Paul, Qué.	10/82	47.4423 70.5069	SMA-1 TCG-1B	1 g	0.0090 g	Two-storey brick building. Instrument on basement slab.	alluvium valley
8.	La Malbaie, Qué.	9/67	47.6553 70.1527	SMA-1 TCG-1B	1 g	0.0112 g	1-storey steel frame, masonry walls. Instrument on concrete pier on basement floor slab.	bedrock
9.	St-Pascal, Qué.	10/69	47.5257 69.8045	SMA-1 TCG-1B	1 g	0.0050 g	1-storey reinforced concrete and masonry. Instrument on concrete basement floor slab.	bedrock
10.	Rivière-Ouelle,	8/84	47.4757 69.9961	SMA-1 TCG-1B	1 g	0.0108 g	Above ground seismic vault	bedrock
12.	Edmundston, N.B.	8/84	47.4614 68.2411	SMA-1 TCG-1B	1 g	0.0103 g	Above ground seismic vault	bedrock
13.	St-Eleuthère, Qué.	8/84	47.4950 69.3628	SMA-1 TCG-1B	1 g	0.0059 g	Above ground seismic vault	bedrock
14.	Ste-Lucie-de- Beaugard, Qué.	8/84	46.7414 70.0172	SMA-1 TCG-1B	1 g	0.0105 g	Above ground seismic vault	bedrock
15.	St-Georges, Qué.	8/84	46.1399 70.5799	SMA-1 TCG-1A	1 g	0.0132 g	Above ground seismic vault	bedrock
16.	Chicoutimi-Nord, Qué.	9/84	48.4902 71.0123	SMA-1 TCG-1A	1 g	0.0054 g	Outcrop in basement of two-storey wood frame house.	bedrock
17.	St-André-du-Lac- St-Jean, Qué.	9/84	48.3248 71.9917	SMA-1 TCG-1A	1 g	0.0054 g	Above ground seismic vault	bedrock
18.	Rimouski, Qué.	9/84	48.4452 68.4822	SMA-1 TCG-1B	1 g	0.0035 g	Above ground seismic vault	bedrock
19.	Miramichi, N.B. 'Loggie Lodge II'	10/86	46.9729 66.5293	SMA-1 TCG-1A	1 g	0.0105 g	Above ground seismic vault	bedrock
20.	Les Éboulements, Qué.	6/85	47.5496 70.3273	SMA-1 TCG-1B	1 g	0.0075 g	Above ground seismic vault	bedrock

Tableau 1: Réseau d'enregistrement des secousses fortes de l'Est du Canada; octobre 1988.

No.	Emplacement	Date	Coord	App.	Sens.	Décl.	Bâtiment	Fondation
1.	St-Ferréol, Qué.	1/66	47,1256 70,8282	SMA-1 TCG-1B	1 g	0,0072 g	Cave sismique souterraine. Appareil sur pilier en béton.	roche dure
2.	Québec, Qué.	6/67	46,7782 71,2749	SMA-1 TCG-1A	1 g	0,0065 g	Béton armé, 3 étages. Appareil sur pilier en béton reposant sur dalle (plancher du sous-sol).	roche dure
3.	Montréal, Qué.	12/73	45,5025 73,6230	SMA-1 TCG-1A	1 g	0,0049 g	Mur de façade à charpente métal- lique, 4 étages; béton coulé. Appareil dans une cave sismique au sous-sol.	roche dure
4.	Ottawa, Ont.	8/84	45,3942 75,7167	SMA-1 TCG-1A	1 g	0,0105 g	Voûte sismique souterraine. Appareil sur pilier en béton.	roche dure
5.	Tadoussac, Qué.	5/79	48,1432 69,7189	SMA-1 TCG-1B	1 g	0,0101 g	Pilier de béton jusqu'à la roche en place de l'espace sanitaire d'un immeuble d'un étage.	roche dure
6.	Rivière-du-Loup, Qué.	6/80	47,8356 69,5379	SMA-1 TCG-1B	1 g	0,0108 g	Béton armé, deux étages. Appareil sur dalle (plancher du sous-sol).	roche dure
7.	Baie-St-Paul, Qué.	10/82	47,4423 70,5069	SMA-1 TCG-1B	1 g	0,0090 g	Bâtiment en briques, deux étages. Appareil sur dalle en béton (plancher du sous-sol).	vallée alluvionnaire
8.	La Malbaie, Qué.	9/67	47,6553 70,1527	SMA-1 TCG-1B	1 g	0,0112 g	Murs en maçonnerie, charpente métallique, un étage. Appareil sur pilier en béton reposant sur dalle (plancher du sous-sol).	roche dure
9.	St-Pascal, Qué.	10/69	47,5257 69,8045	SMA-1 TCG-1B	1 g	0,0050 g	Maçonnerie en béton armé, un étage. Appareil sur dalle en béton (plancher du sous-sol).	roche dure
10.	Rivière-Ouelle, Qué.	8/84	47,4757 69,9961	SMA-1 TCG-1B	1 g	0,0108 g	Voûte sismique au-dessus de terre.	roche dure
12.	Edmundston, N.B.	8/84	47,4614 68,2411	SMA-1 TCG-1B	1 g	0,0103 g	Voûte sismique au-dessus de terre.	roche dure
13.	St-Eléuthère, Qué.	8/84	47,4950 69,3628	SMA-1 TCG-1B	1 g	0,0059 g	Voûte sismique au-dessus de terre.	roche dure
14.	Ste-Lucie-de- Beaugard, Qué.	8/84	46,7414 70,0172	SMA-1 TCG-1B	1 g	0,0105 g	Voûte sismique au-dessus de terre.	roche dure
15.	St-Georges, Qué.	8/84	46,1399 70,5799	SMA-1 TCG-1A	1 g	0,0132 g	Voûte sismique au-dessus de terre.	roche dure
16.	Chicoutimi-Nord, Qué.	9/84	48,4902 71,0123	SMA-1 TCG-1A	1 g	0,0054 g	Charpente en bois, deux étages. Appareil sur un affleurement au sous-sol.	roche dure
17.	St-André-du-Lac- St-Jean, Qué.	9/84	48,3248 71,9917	SMA-1 TCG-1A	1 g	0,0054 g	Voûte sismique au-dessus de terre.	roche dure
18.	Rimouski, Qué.	9/84	48,4452 68,4822	SMA-1 TCG-1B	1 g	0,0035 g	Voûte sismique au-dessus de terre.	roche dure
19.	Miramichi, N.B. 'Loggie Lodge II'	10/86	46,9729 66,5293	SMA-1 TCG-1A	1 g	0,0105 g	Voûte sismique au-dessus de terre.	roche dure
20.	Les Éboulements, Qué.	6/85	47,5496 70,3273	SMA-1 TCG-1B	1 g	0,0075 g	Voûte sismique au-dessus de terre.	roche dure

Figure 2: Peak vertical and horizontal acceleration vs epicentral distance.

Figure 2: Accélération verticale et horizontale maximale en fonction de la distance à l'épicentre.

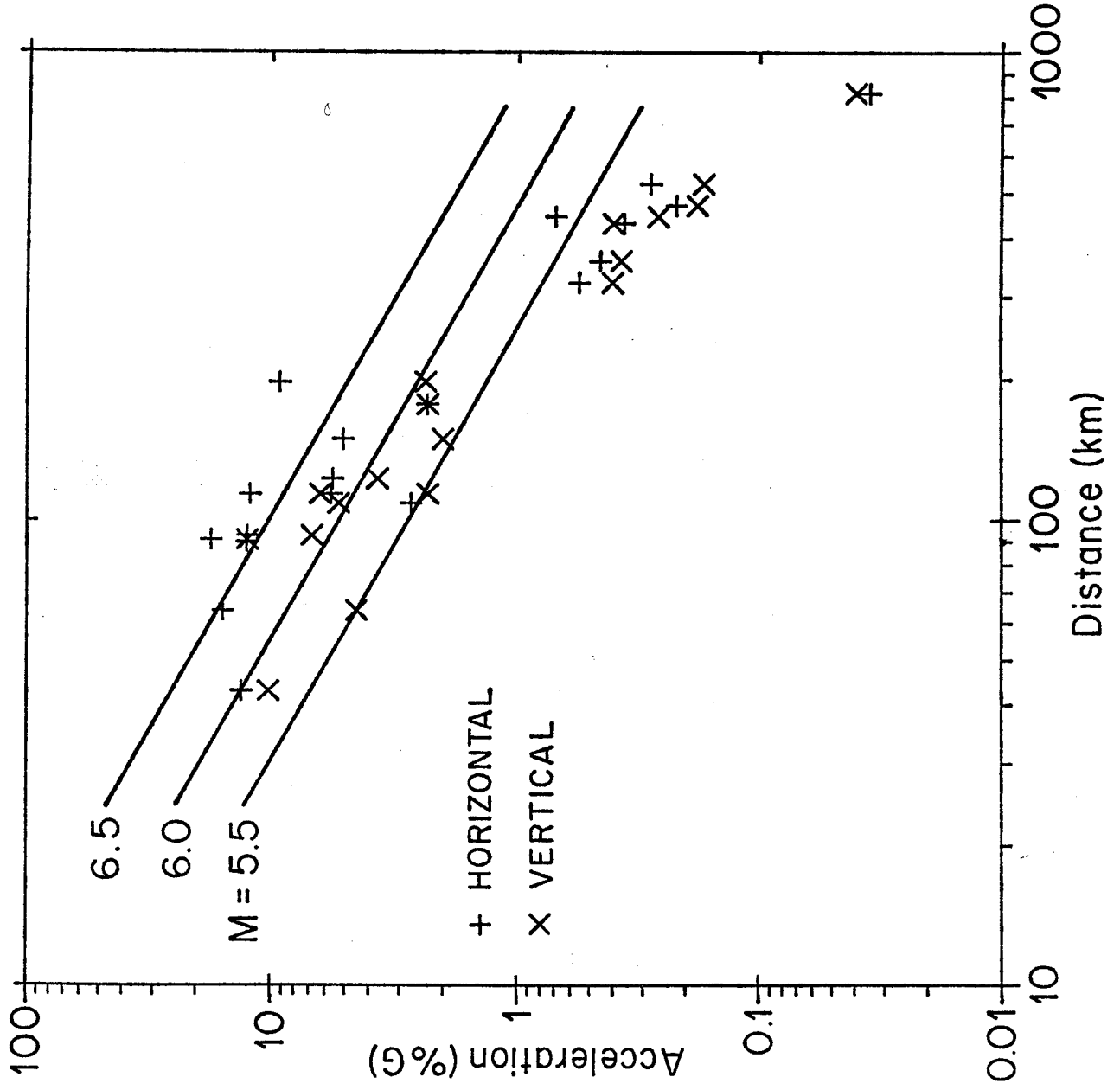


Table 2: Peak Vertical and Horizontal Acceleration (from AGRAM).
 Tableau 2: Accélération maximale verticale et horizontale (de AGRAM).

Station	Distance (km)	Azimuth (°)	Vert. (% g)	Horiz. (% g)
16 Chicoutimi-Nord, Qué.	43.2	17.6	10.2	13.1
17 St-André, Qué.	63.6	291.3	4.5	15.6
20 Les Éboulements, Qué.	90.4	134.2		12.5
7 Baie-St-Paul, Qué.	91.0	145.6	12.4	17.4
8 La Malbaie, Qué.	93.0	123.4	6.8	12.4
5 Tadoussac, Qué.	109.2	88.1	5.3	2.7
1 St-Ferréol, Qué.	113.8	166.1	6.3	12.1
10 Rivière-Ouelle, Qué.	114.4	128.3	2.3	5.7
9 St-Pascal, Qué.	122.7	122.1	3.7	5.6
2 Québec, Qué.	149.3	182.5	2.0	5.1
14 Ste-Lucie-de-Beauregard, Qué.	176.8	149.6	2.3	2.3
Dickey, Me.	198.3	125.3	2.35	9.10
Island Falls, Me.	322.5	135.7	0.40	0.55
Milo, Me.	359.2	152.1	0.37	0.45
Lyon Mt., N.Y.	431.1	209.9	0.40	0.36
Massena, N.Y.	445.6	220.2	0.26	0.69
Machias, Me.	470.8	141.6	0.18	0.22
Newcomb, N.Y.	524.2	209.5	0.17	0.28
Palisades, N.Y.	819.9	196.2	0.04	0.035

* largest of the two horizontal components

* plus grandes des deux composantes horizontales

Appendix "A"

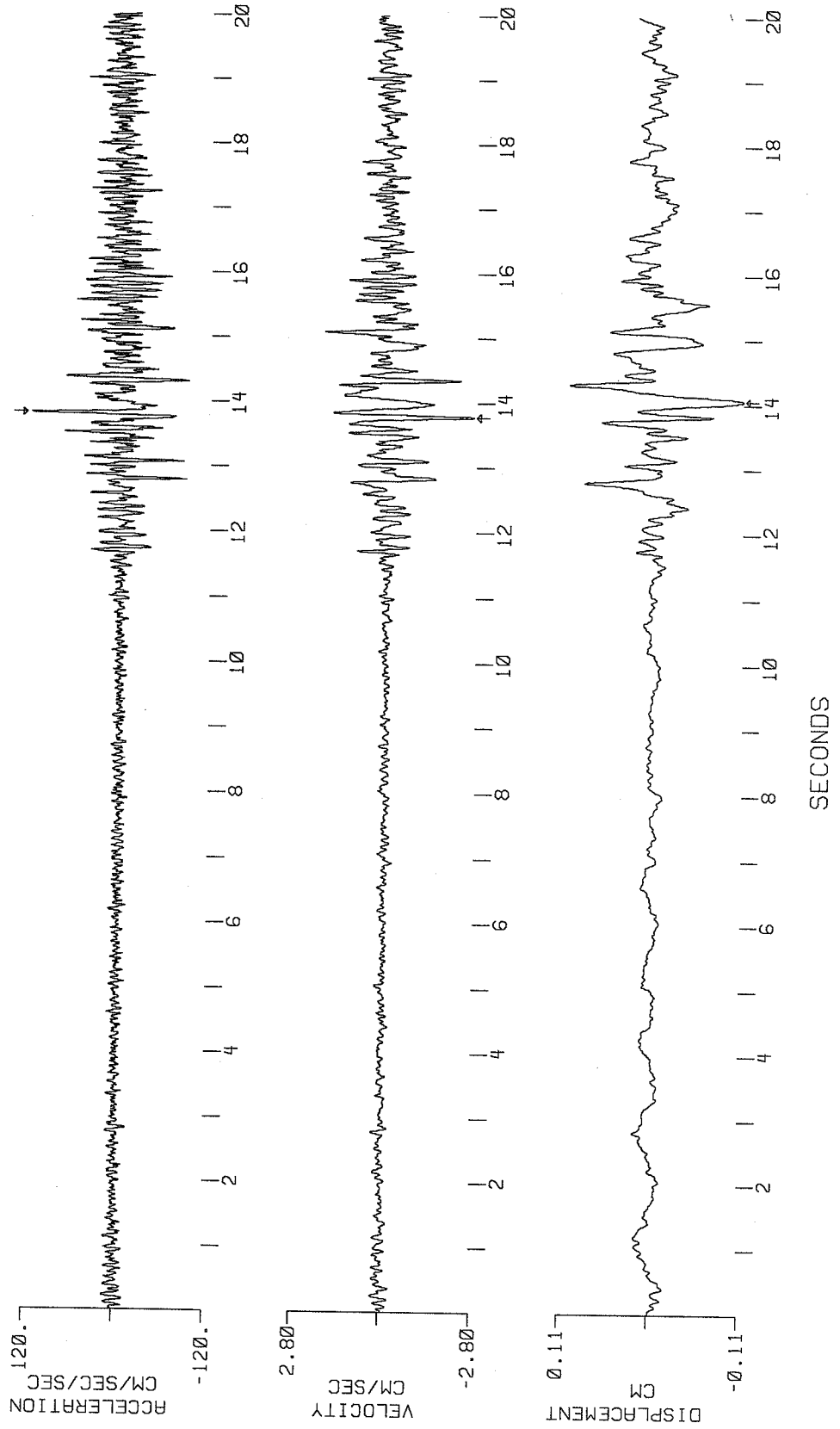
Annexe "A"

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL, QUEBEC

+L = 0 DEGREES; AZ. = 166 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL=118.79 CM/SEC/SEC, VELOCITY=-2.71 CM/SEC, DISPL=-0.11 CM

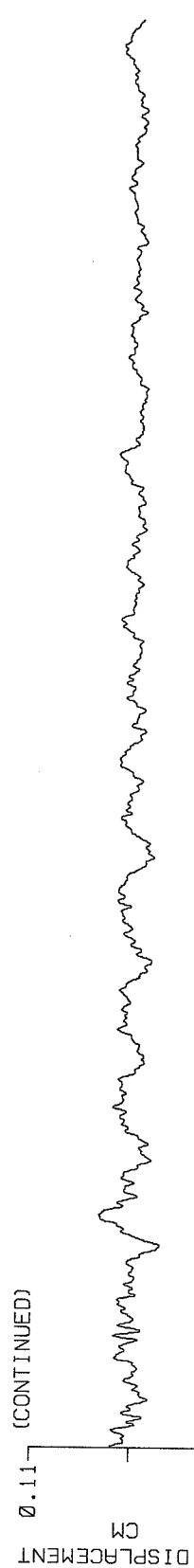
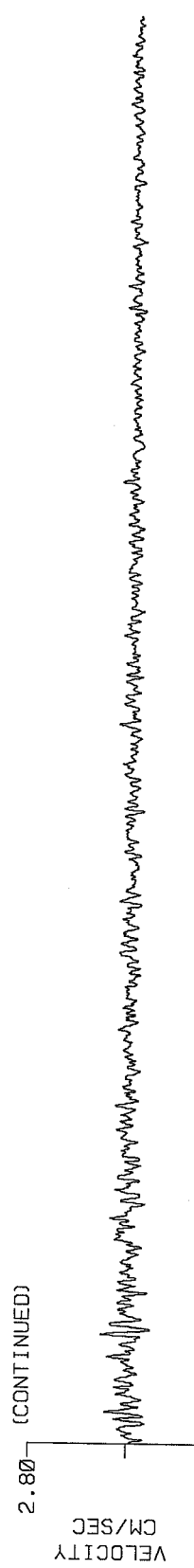
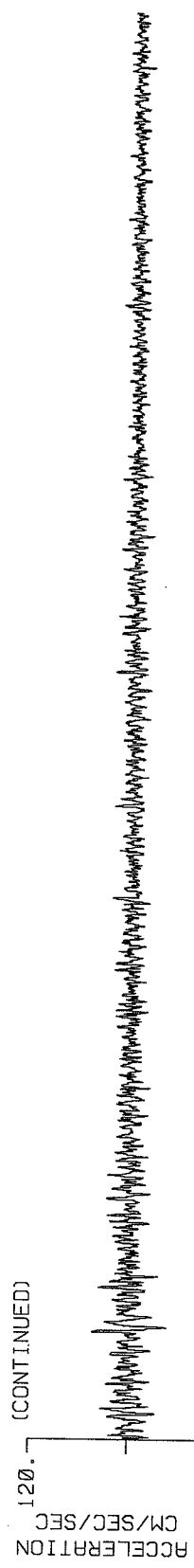


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL QUEBEC

+L = 0 DEGREES; AZ. = 166 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL=118.79 CM/SEC/SEC, VELOCITY=-2.71 CM/SEC, DISPL=-0.11 CM

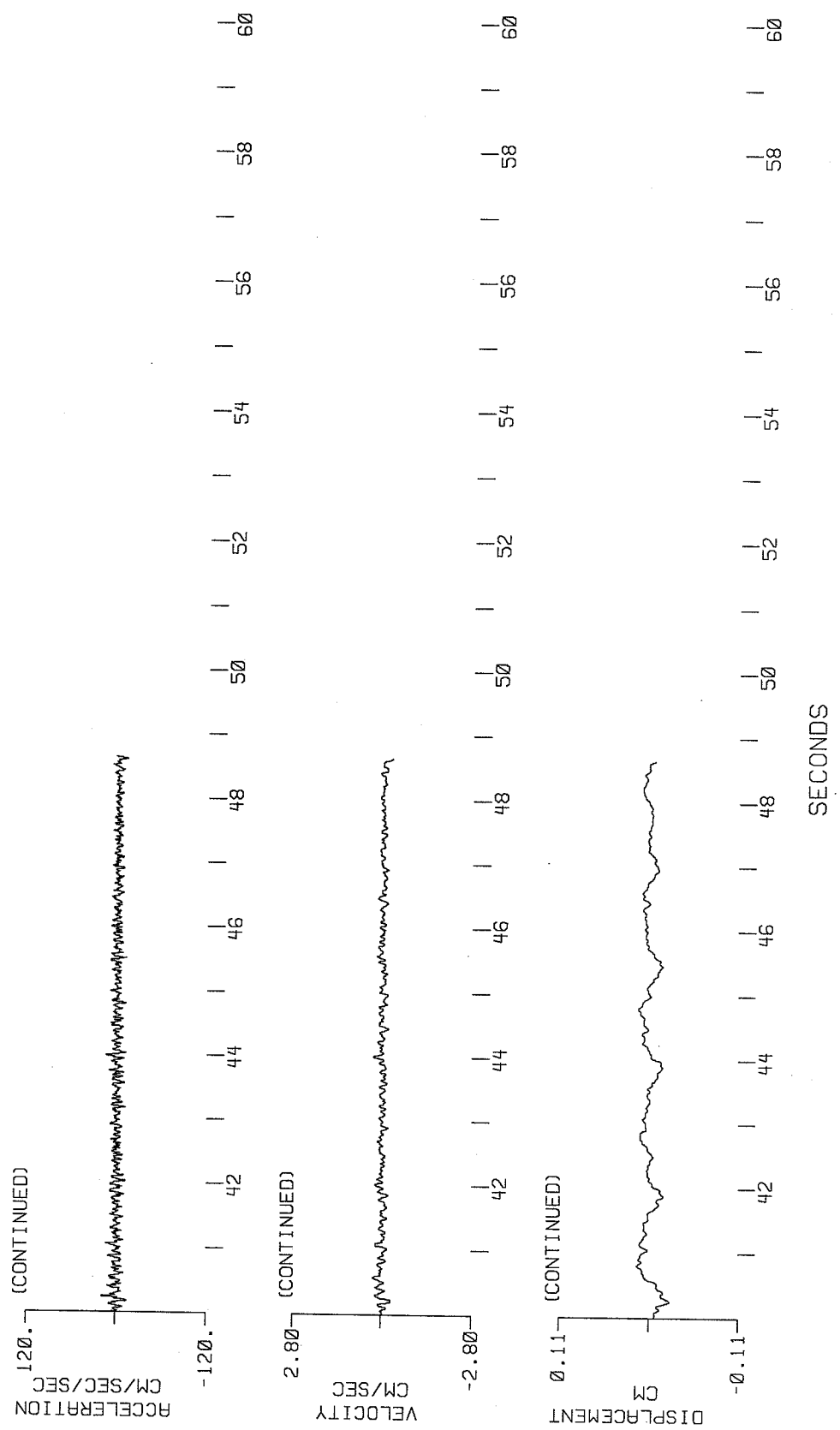


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 1: ST-FERREOL QUEBEC

+L = 0 DEGREES; AZ. = 166 DEG.; DIST. = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL=118.79 CM/SEC/SEC, VELOCITY=-2.71 CM/SEC, DISPL=-0.11 CM

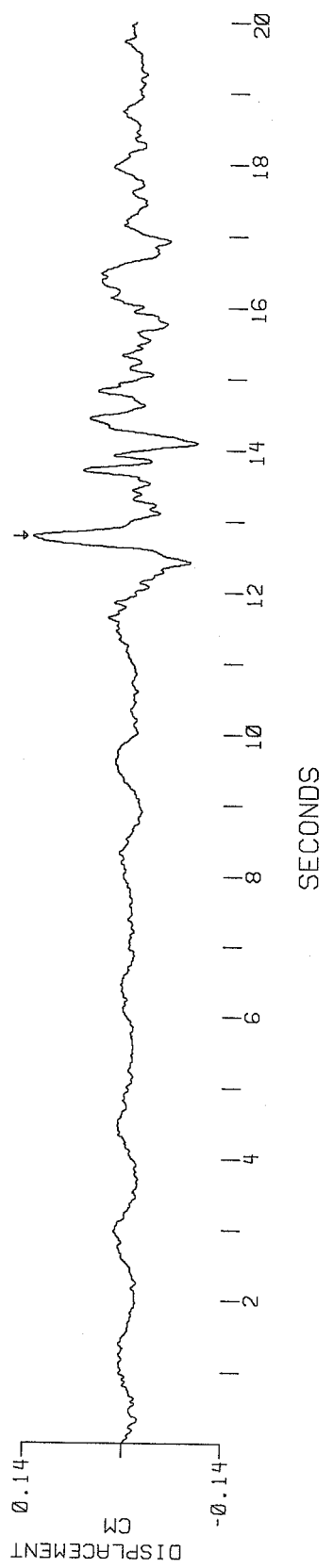
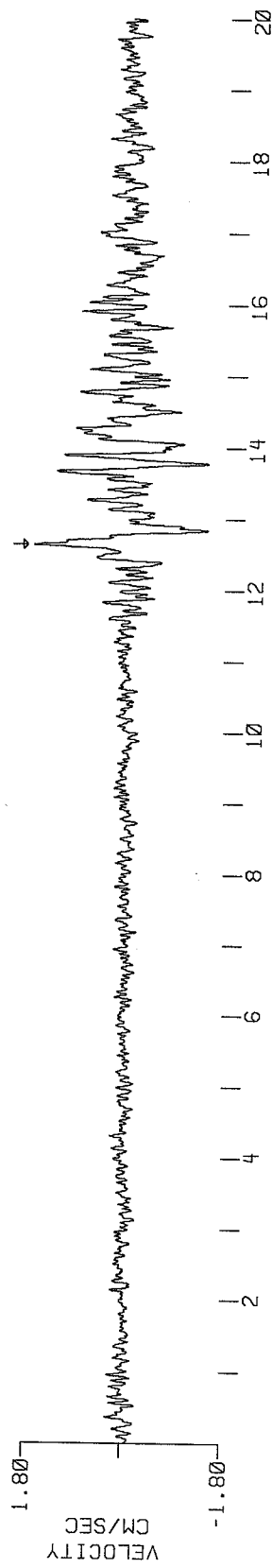
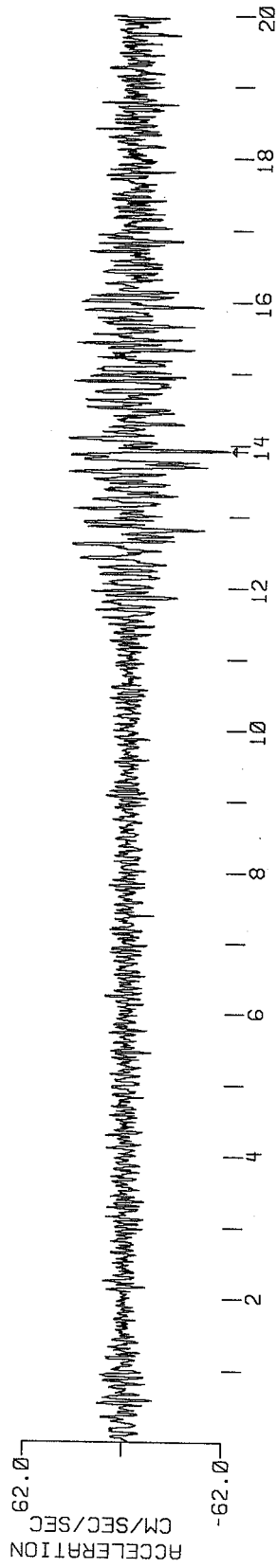


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

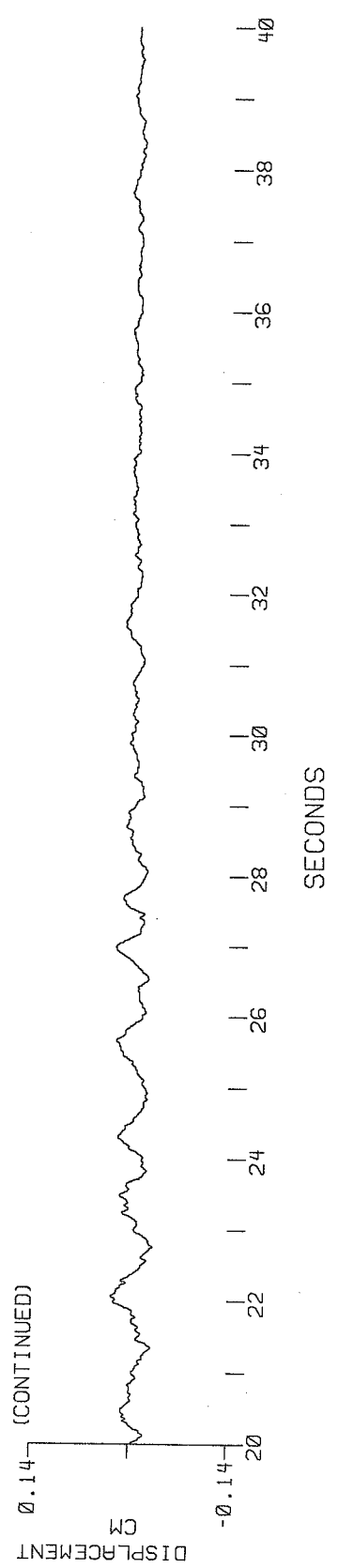
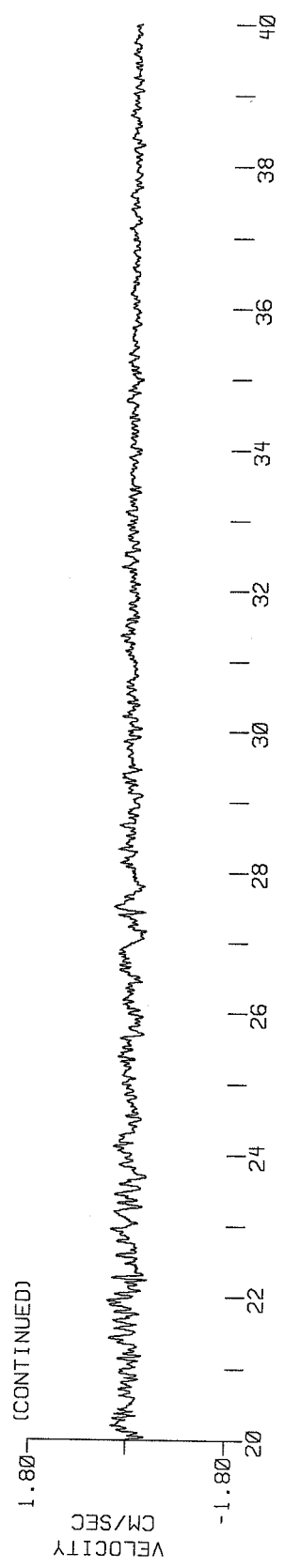
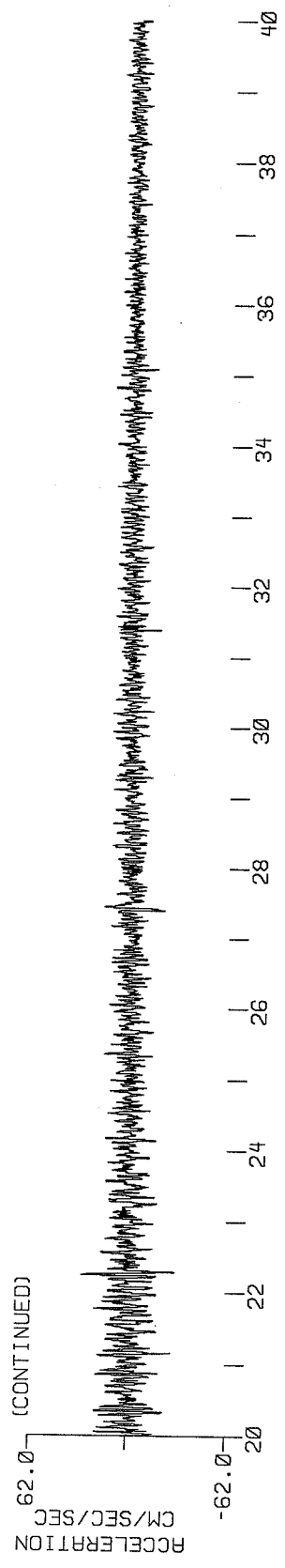
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 1: ST-FERREOL, QUEBEC
VERTICAL: AZ. = 166 DEG.; DIST. = 114 KM

4TH-ORDER BUTTERWORTH AT 0.500 HZ
PEAK VALUES: ACCEL = -61.21 CM/SEC/SEC. VELOCITY = 1.71 CM/SEC. DISPL = 0.13 CM

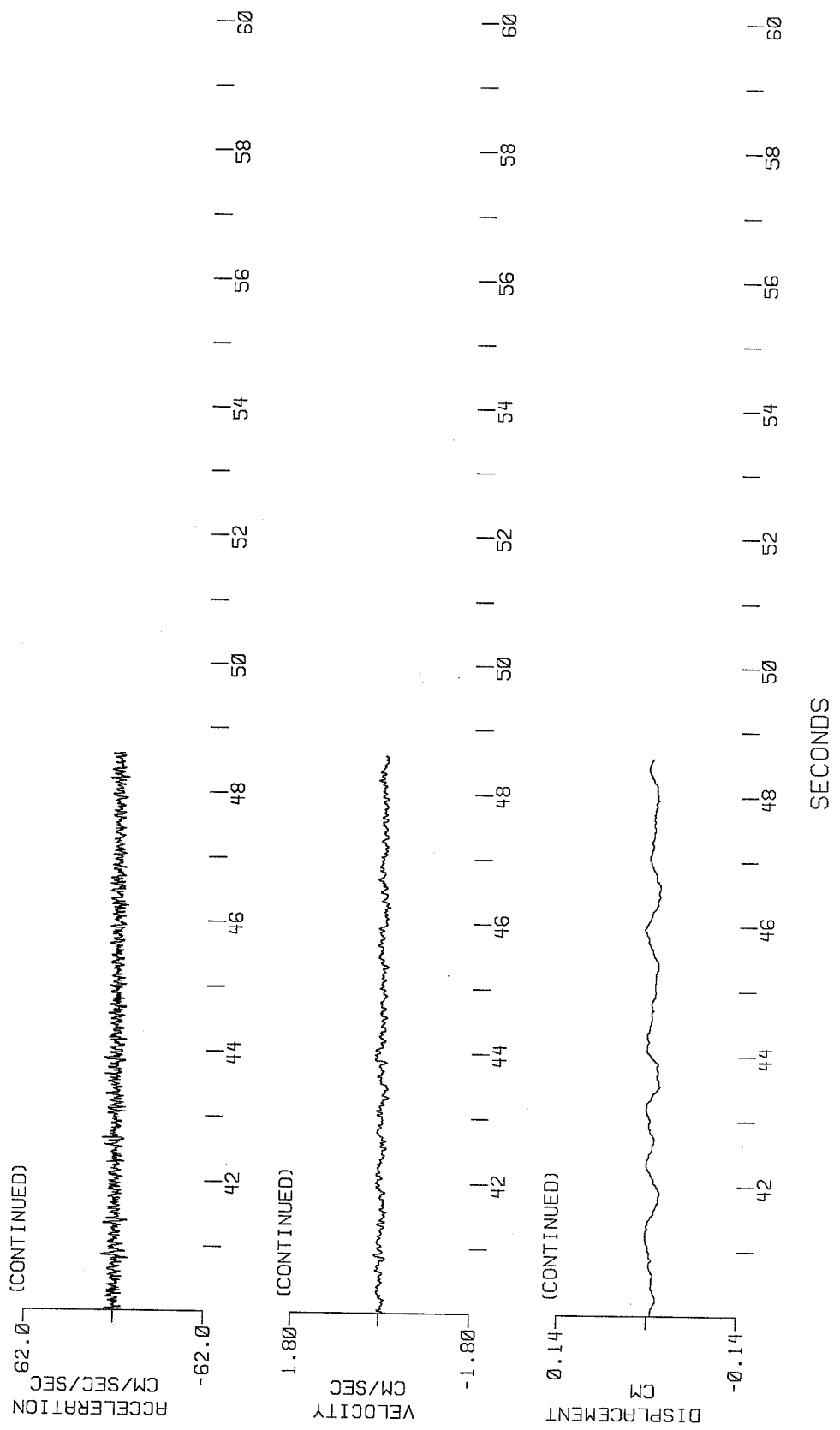


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 1: ST-FERREOL, QUEBEC
 VERTICAL: AZ = 166 DEG.; DIST = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.500 HZ
 PEAK VALUES: ACCEL = -61.21 CM/SEC/SEC, VELOCITY = 1.71 CM/SEC, DISPL = 0.13 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 1: ST-FERREOL, QUEBEC
 VERTICAL: AZ. = 166 DEG.; DIST. = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.500 HZ

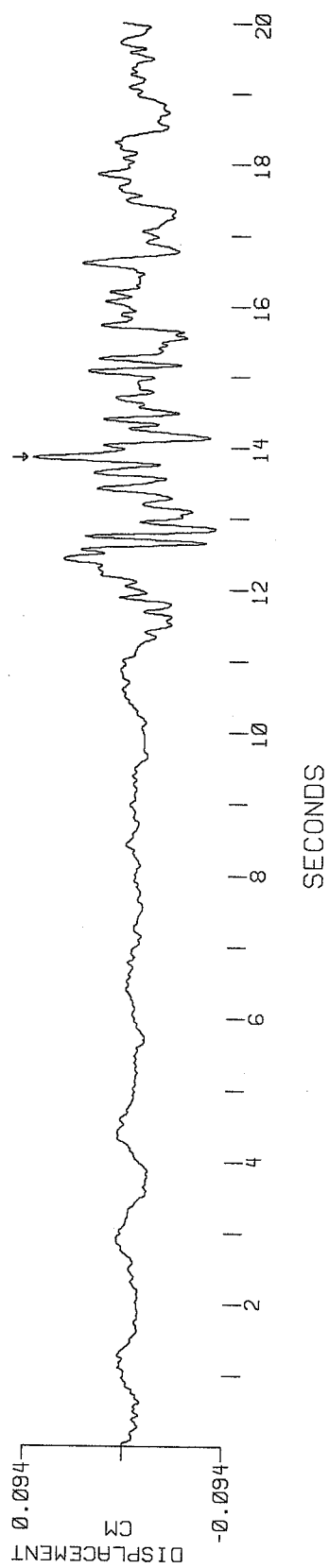
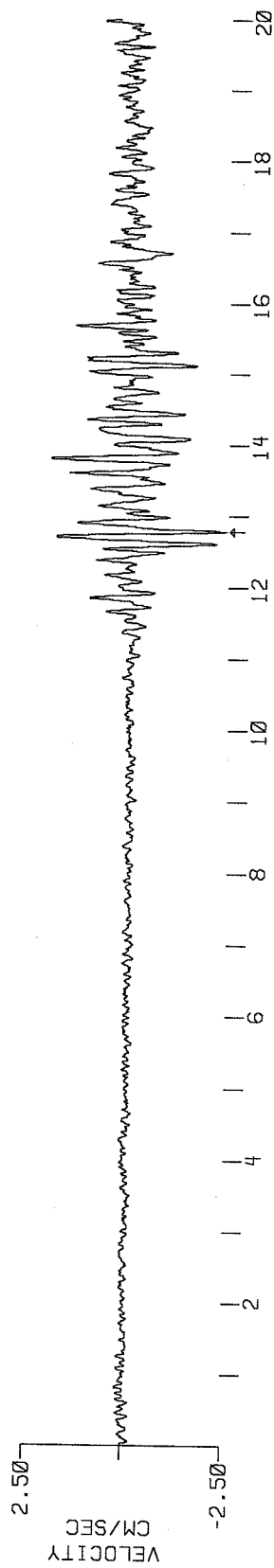
PEAK VALUES: ACCEL = -61.21 CM/SEC/SEC, VELOCITY = 1.71 CM/SEC, DISPL = 0.13 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL QUEBEC
+T = 270 DEGREES: AZ.= 166 DEG.: DIST.= 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

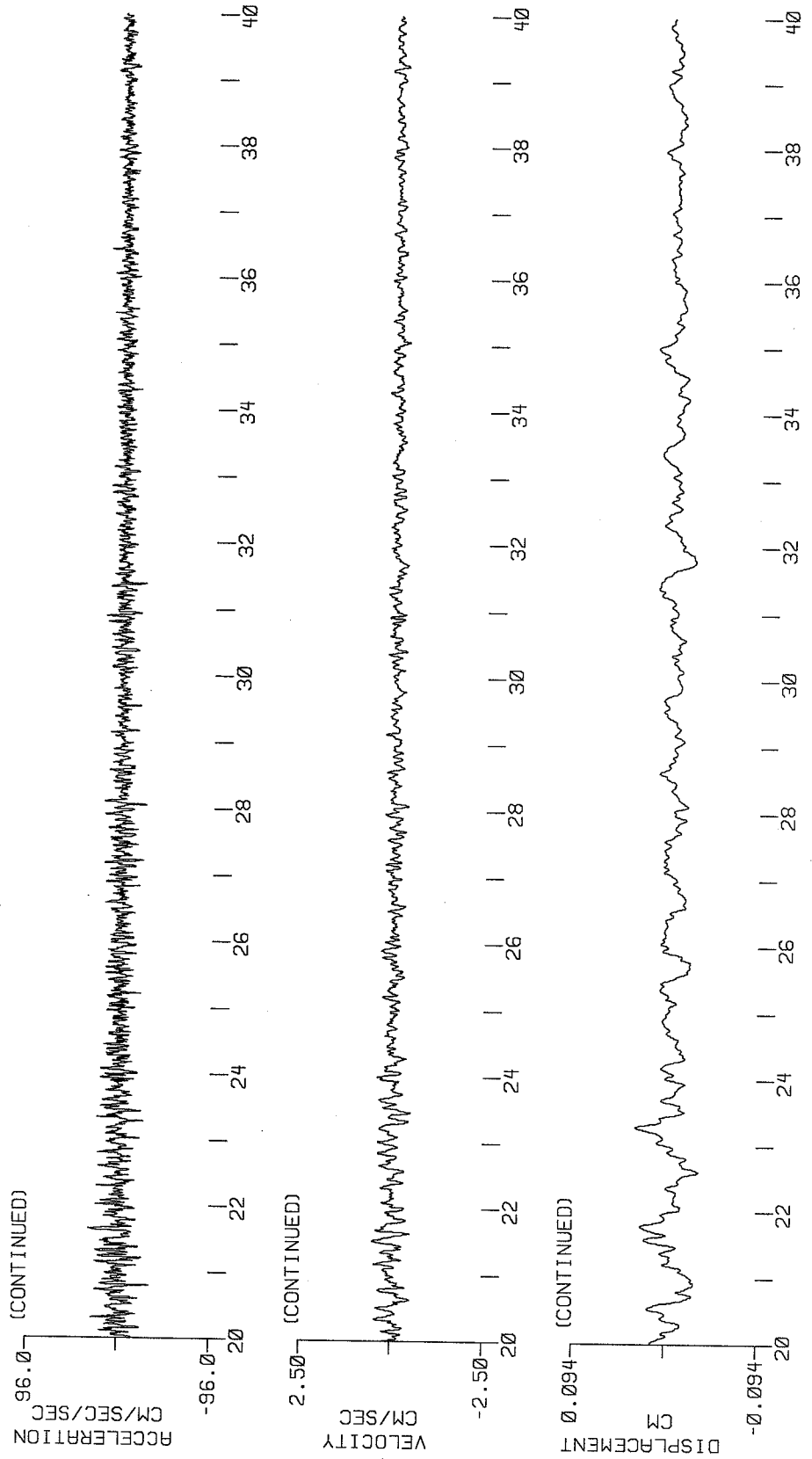
PEAK VALUES: ACCEL=-95.44 CM/SEC/SEC. VELOCITY=-2.45 CM/SEC. DISPL=-0.09 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

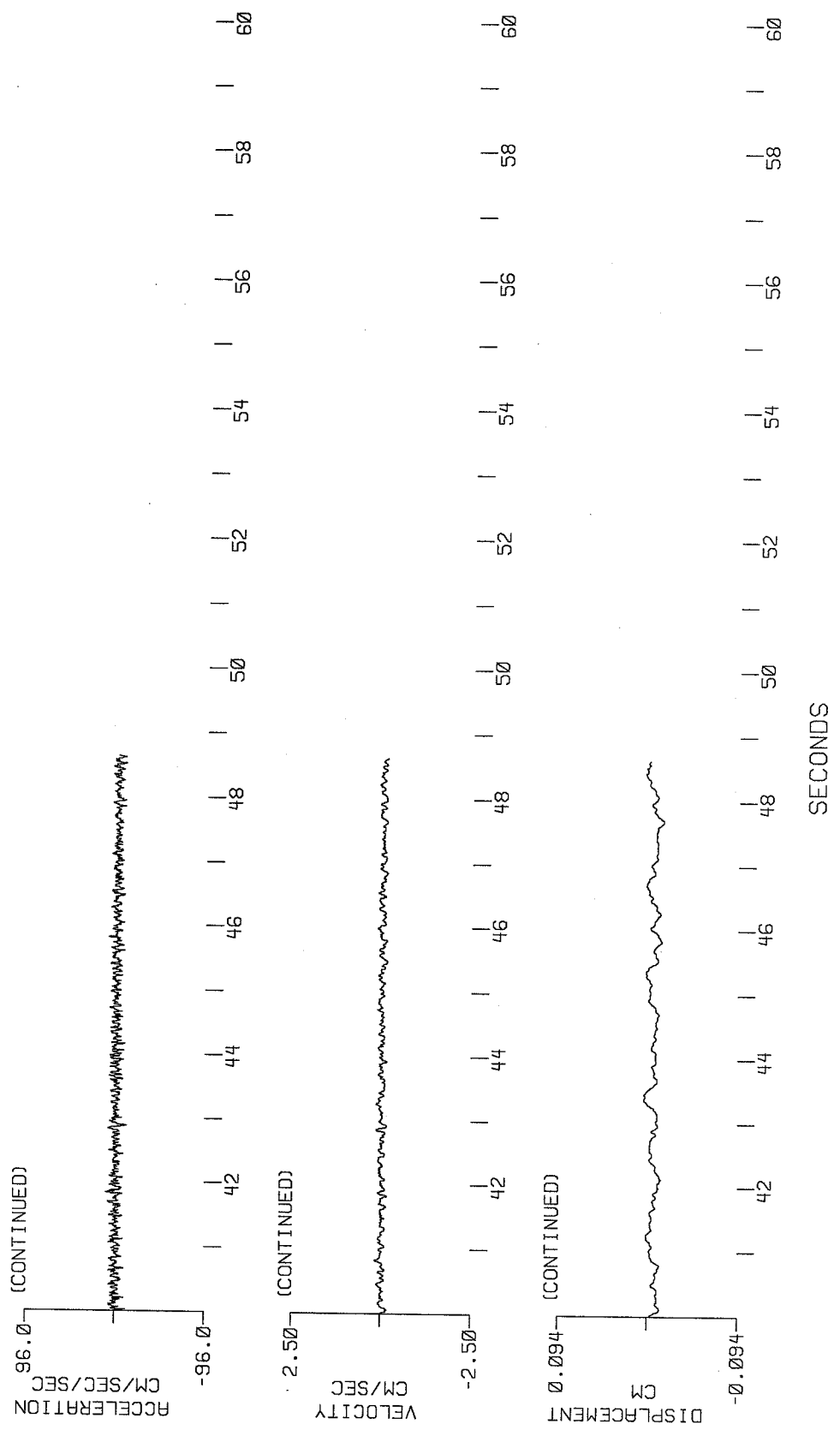
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL QUEBEC
+T = 270 DEGREES: AZ. = 168 DEG.: DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL = -95.44 CM/SEC/SEC. VELOCITY = -2.45 CM/SEC. DISPL = 0.09 CM

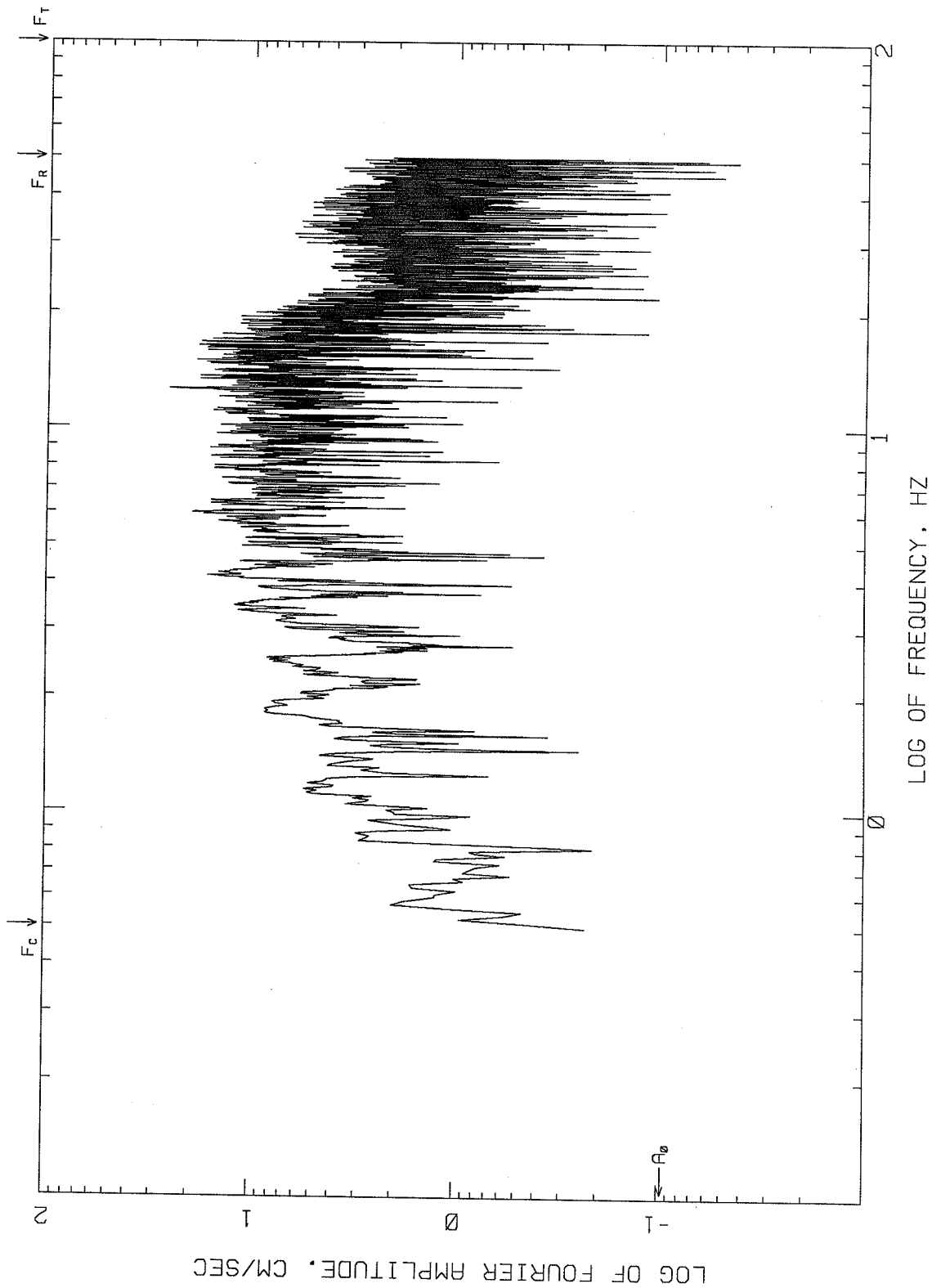


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 1: ST-FERREOL, QUEBEC
 +T = 270 DEGREES: AZ. = 166 DEG.: DIST. = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.500 HZ

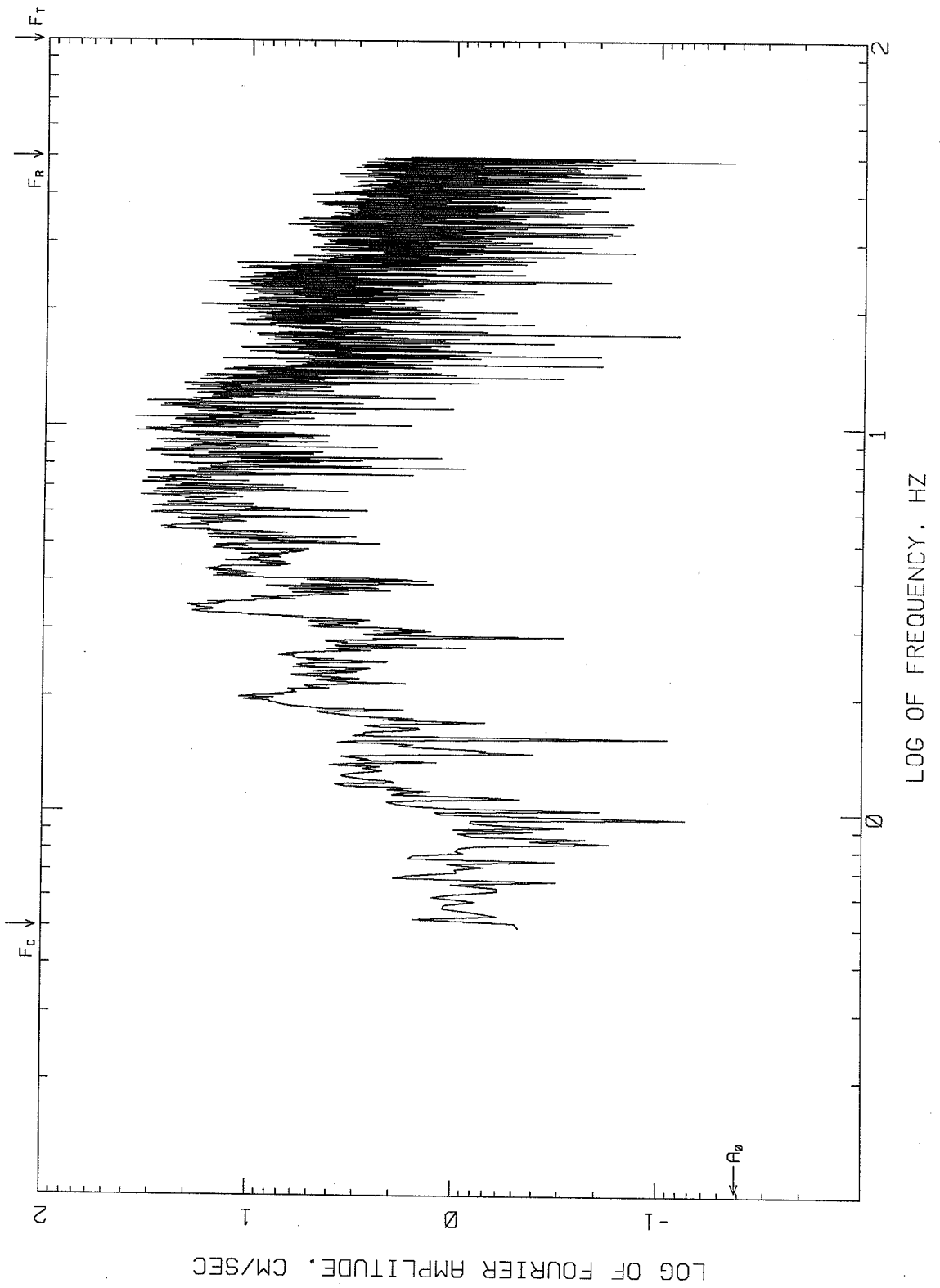
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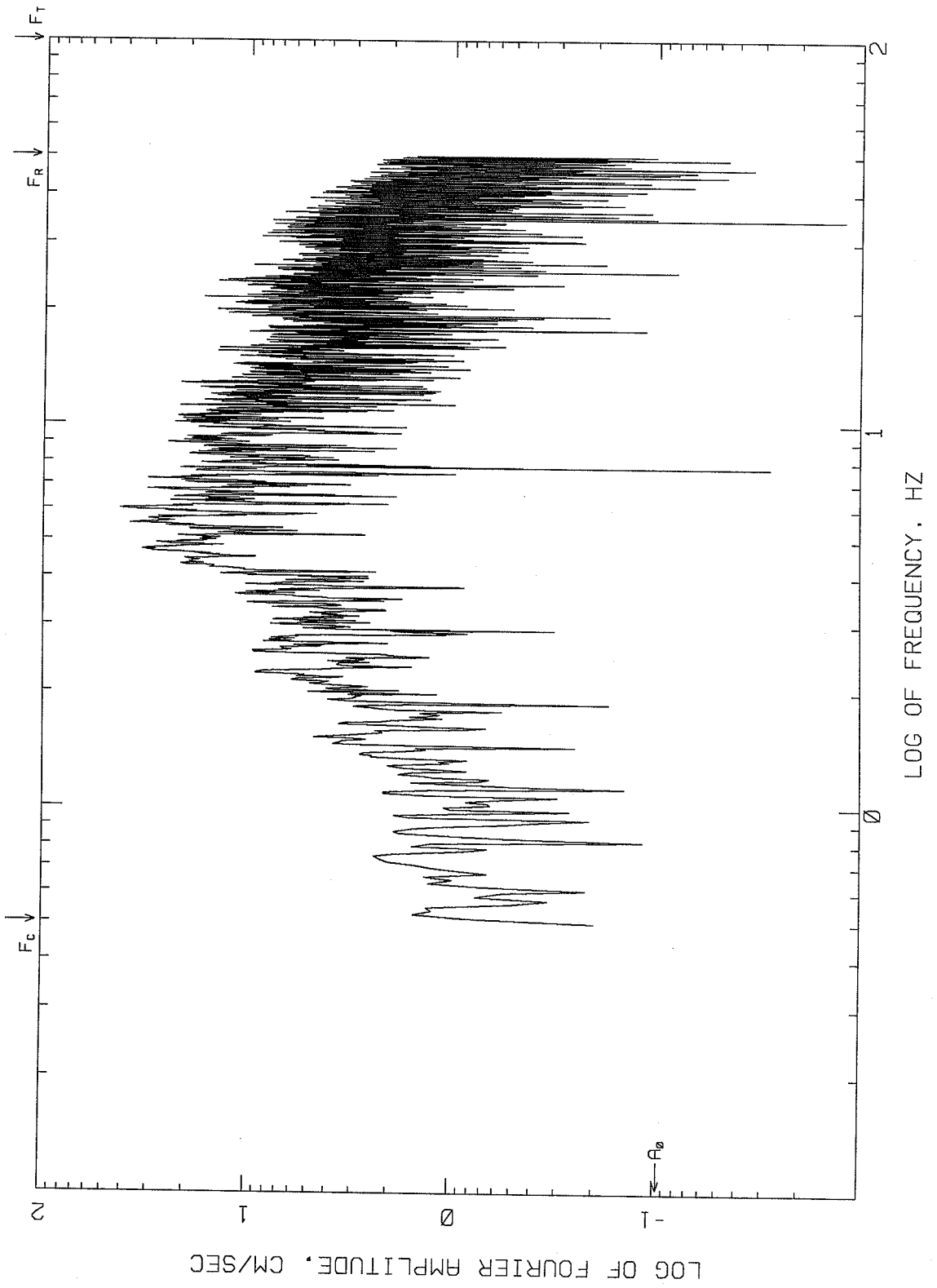
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL, QUEBEC
VERTICAL: AZ = 166 DEG.; DIST = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



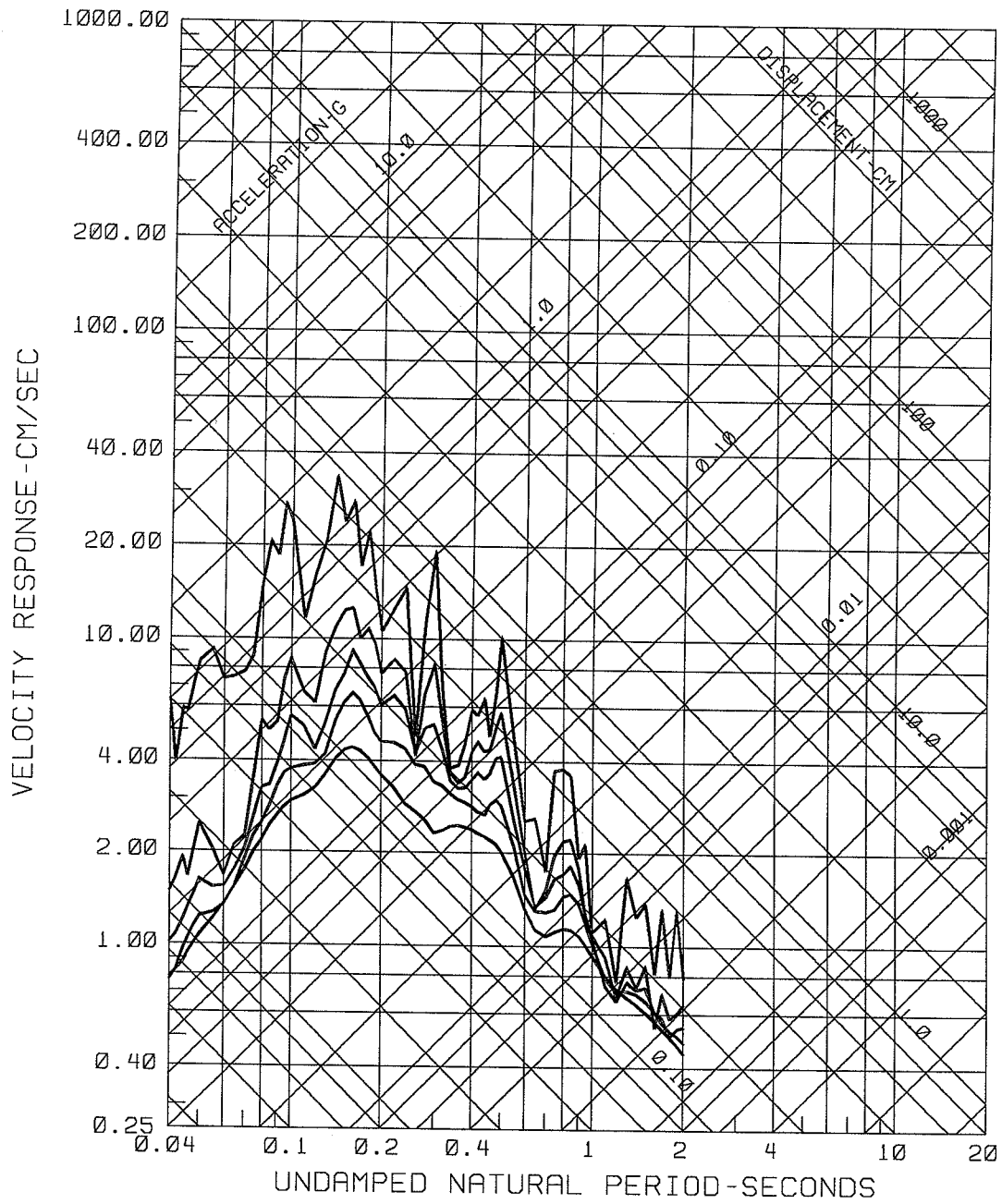
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL, QUEBEC
+L = 0 DEGREES; AZ. = 166 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ
COMPUTING OPTIONS= ZCROSS, NONOISE



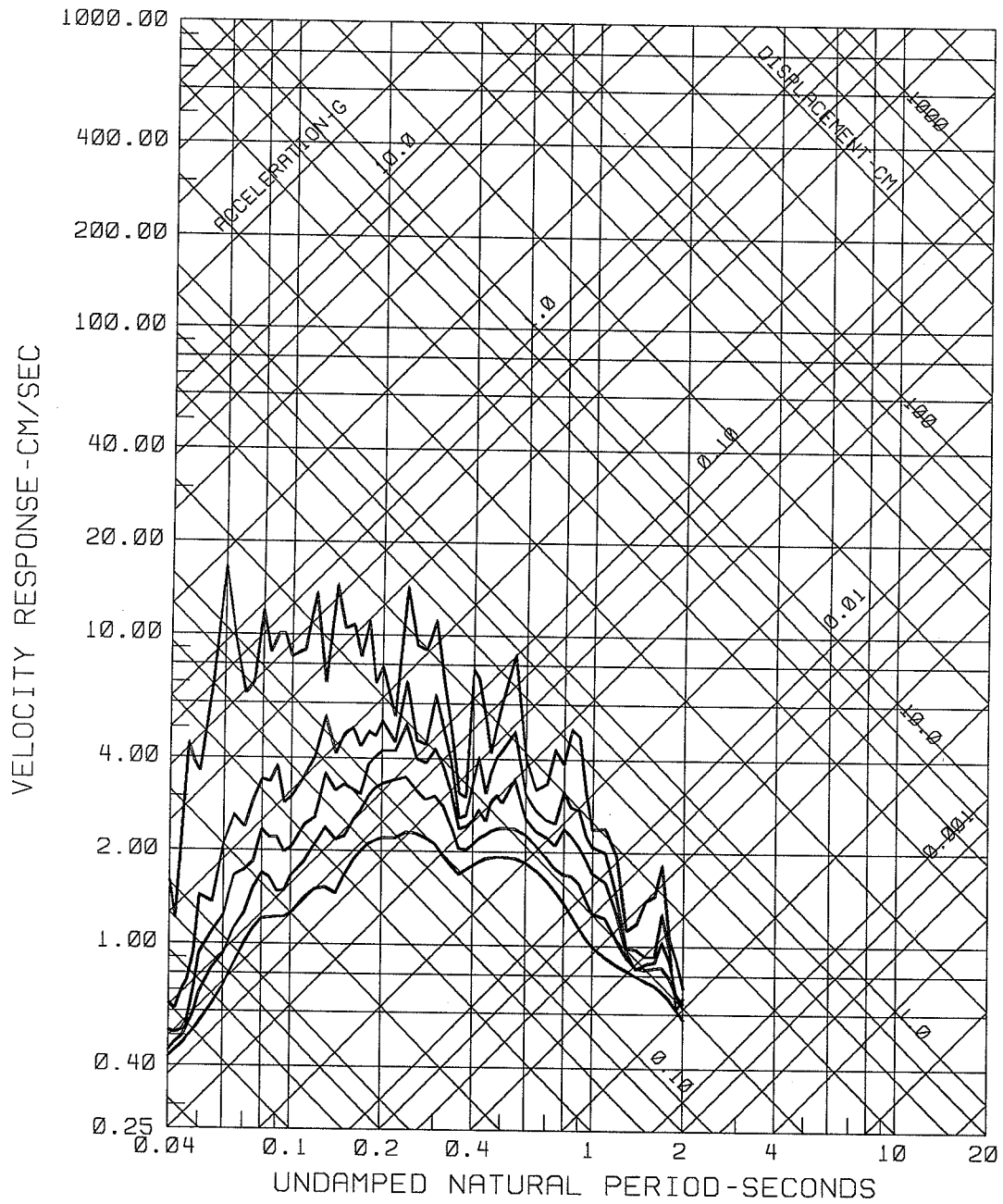
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 1: ST-FERREOL, QUEBEC
+T = 270 DEGREES; AZ. = 166 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ
COMPUTING OPTIONS = ZCROSS:NOISE



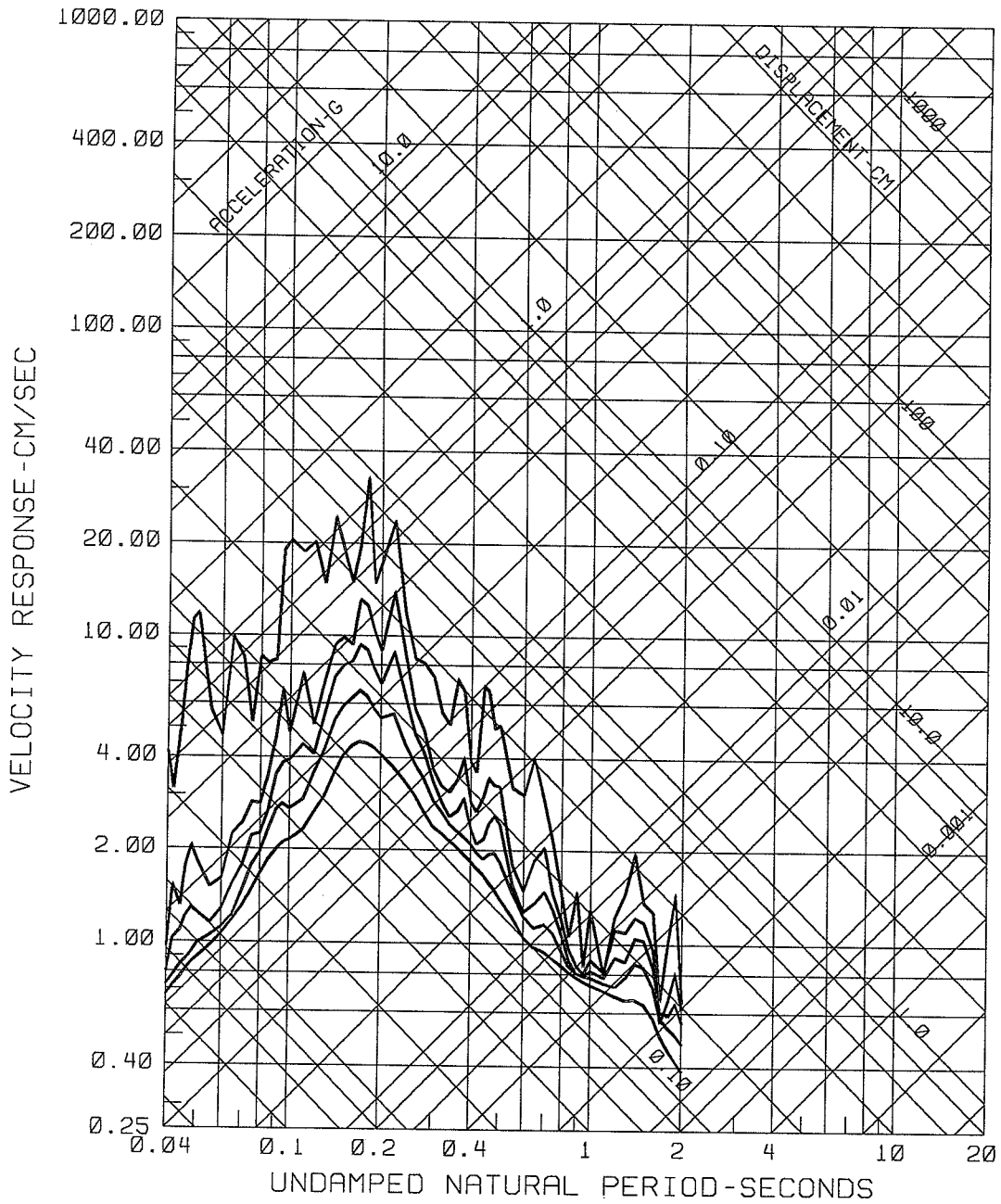
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 1: ST-FERREOL (LONGITUDINAL)
0.2,5,10,20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ: ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 1: ST-FERREOL (VERTICAL)
0.2,5,10,20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ: ANTIALIAS 50 - 100 HZ



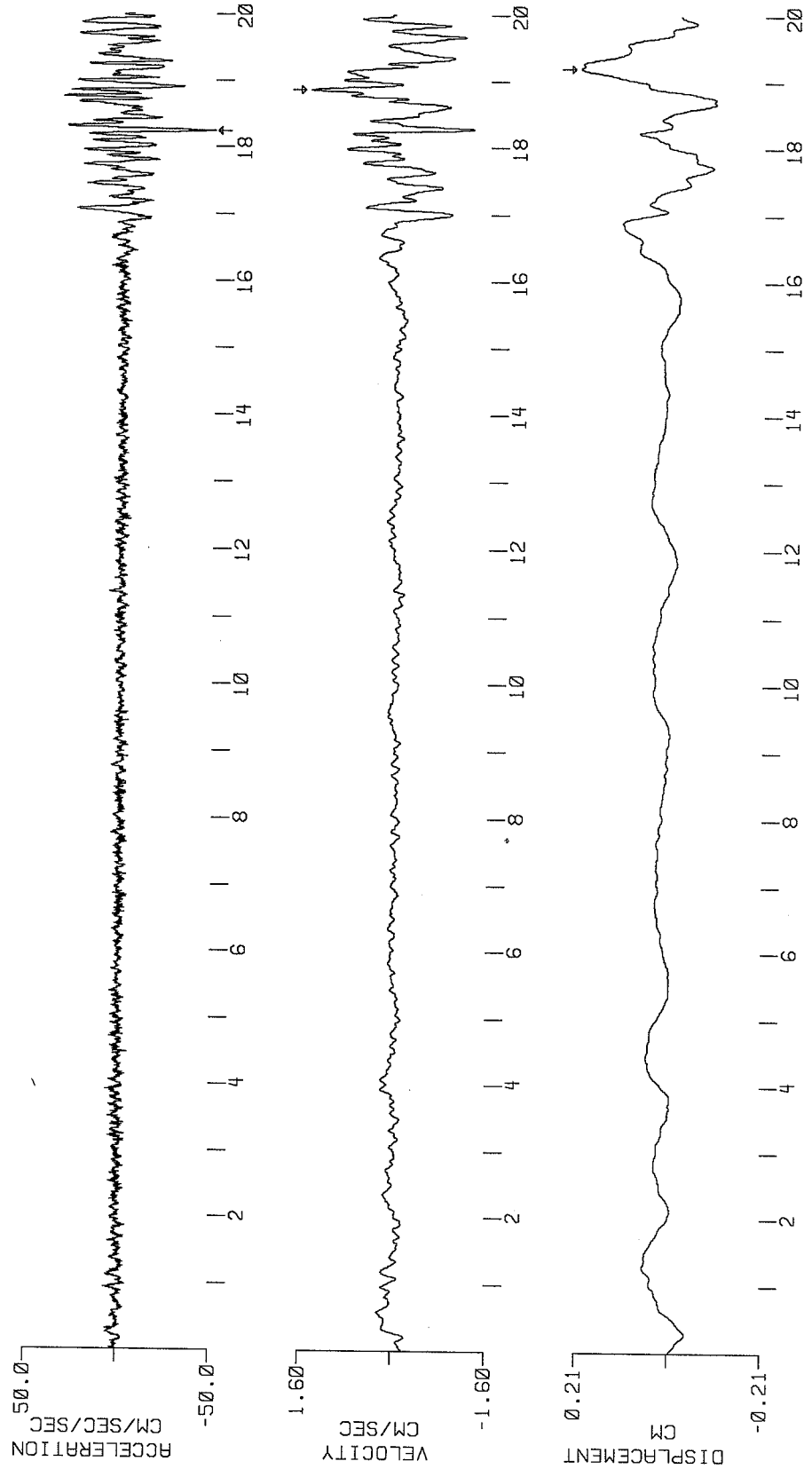
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 1: ST-FERREOL (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC

+L = 51 DEGREES; AZ = 182 DEG.; DIST. = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

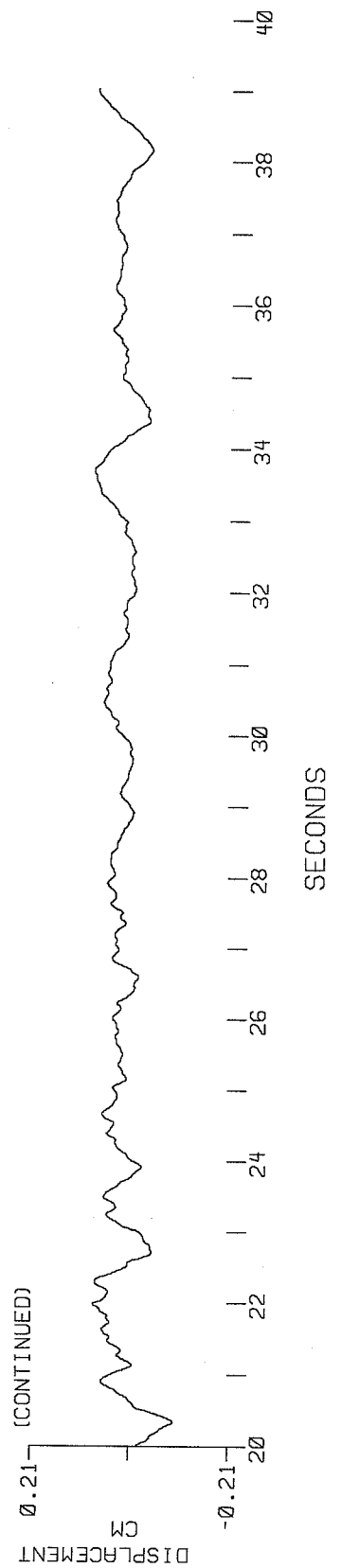
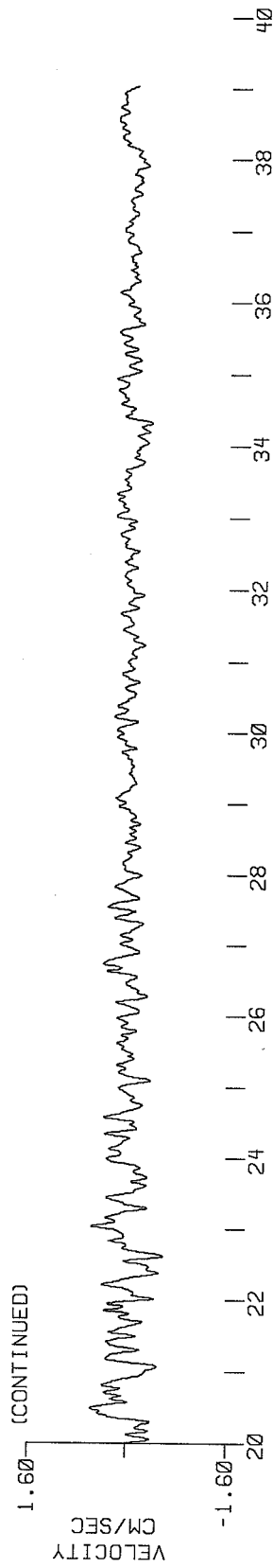
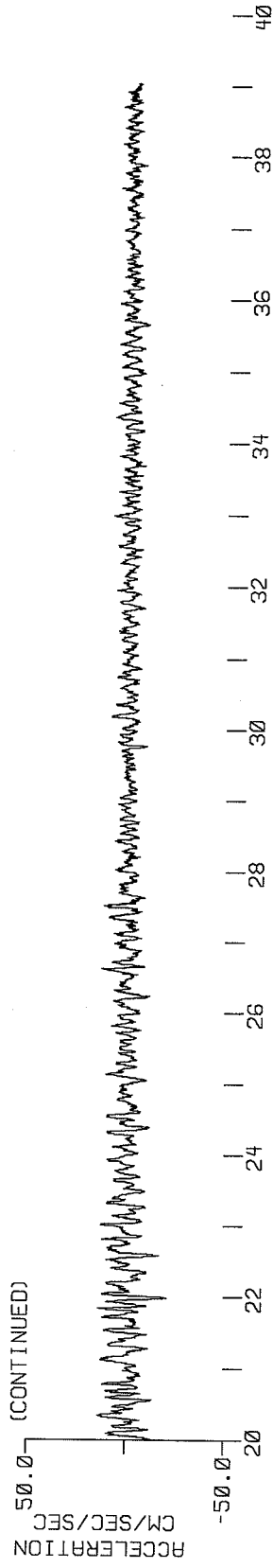
PEAK VALUES: ACCEL=-49.61 CM/SEC/SEC. VELOCITY=1.50 CM/SEC. DISPL=0.21 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC

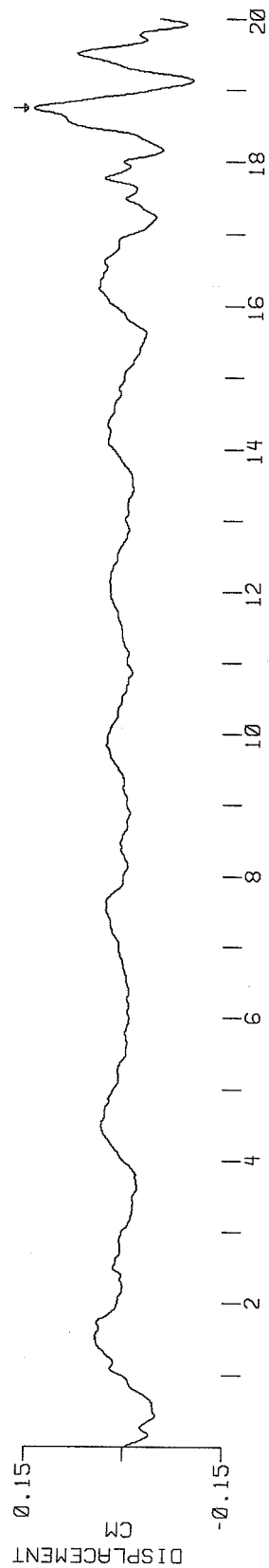
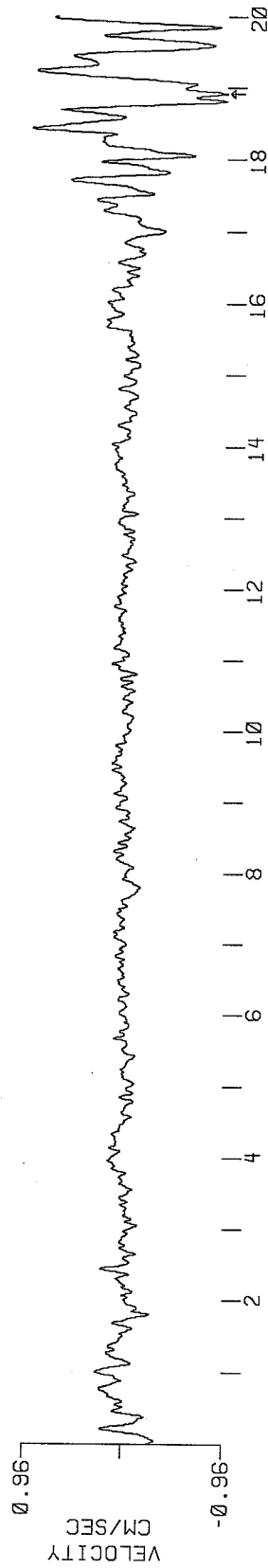
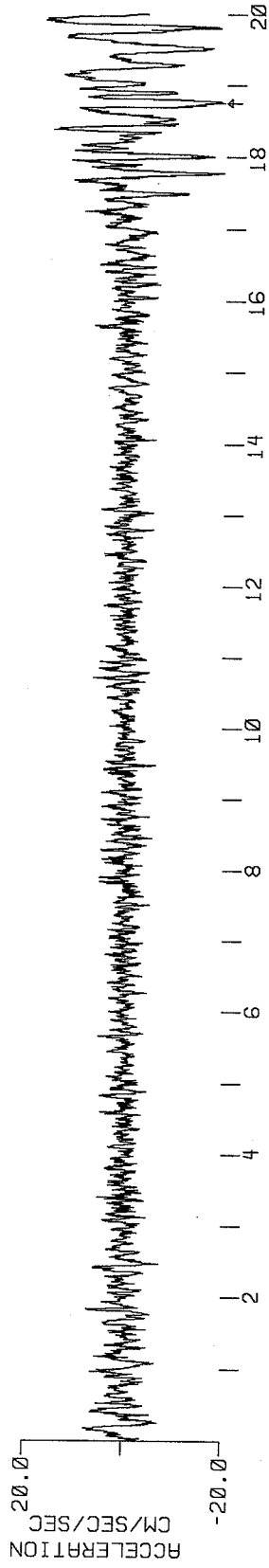
+L = 51 DEGREES; AZ. = 182 DEG.; DIST. = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL = -49.61 CM/SEC/SEC, VELOCITY = 1.50 CM/SEC, DISPL = 0.21 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC
VERTICAL: AZ.= 182 DEG.; DIST.= 149 KM

PEAK VALUES: ACCEL=-19.49 CM/SEC/SEC, VELOCITY=-0.96 CM/SEC, DISPL=0.14 CM



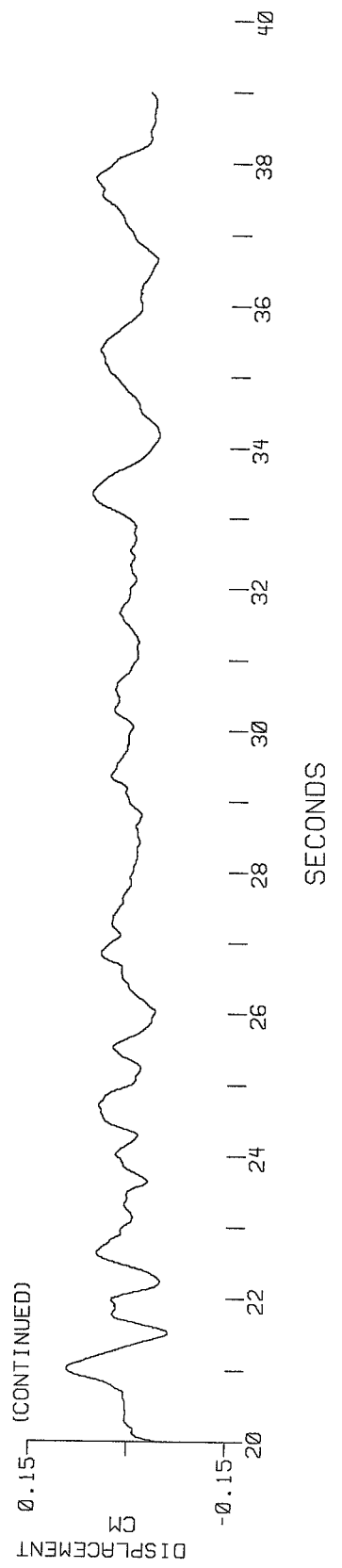
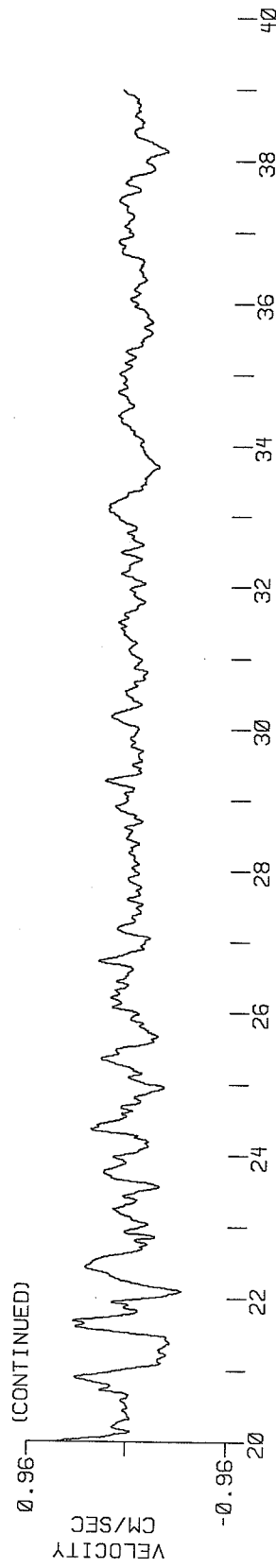
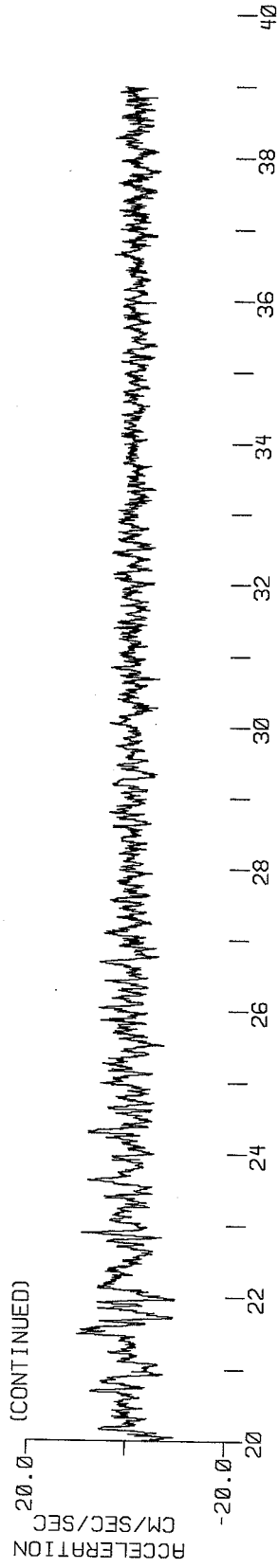
SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 2: QUEBEC, QUEBEC
VERTICAL: AZ. = 182 DEG.; DIST. = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

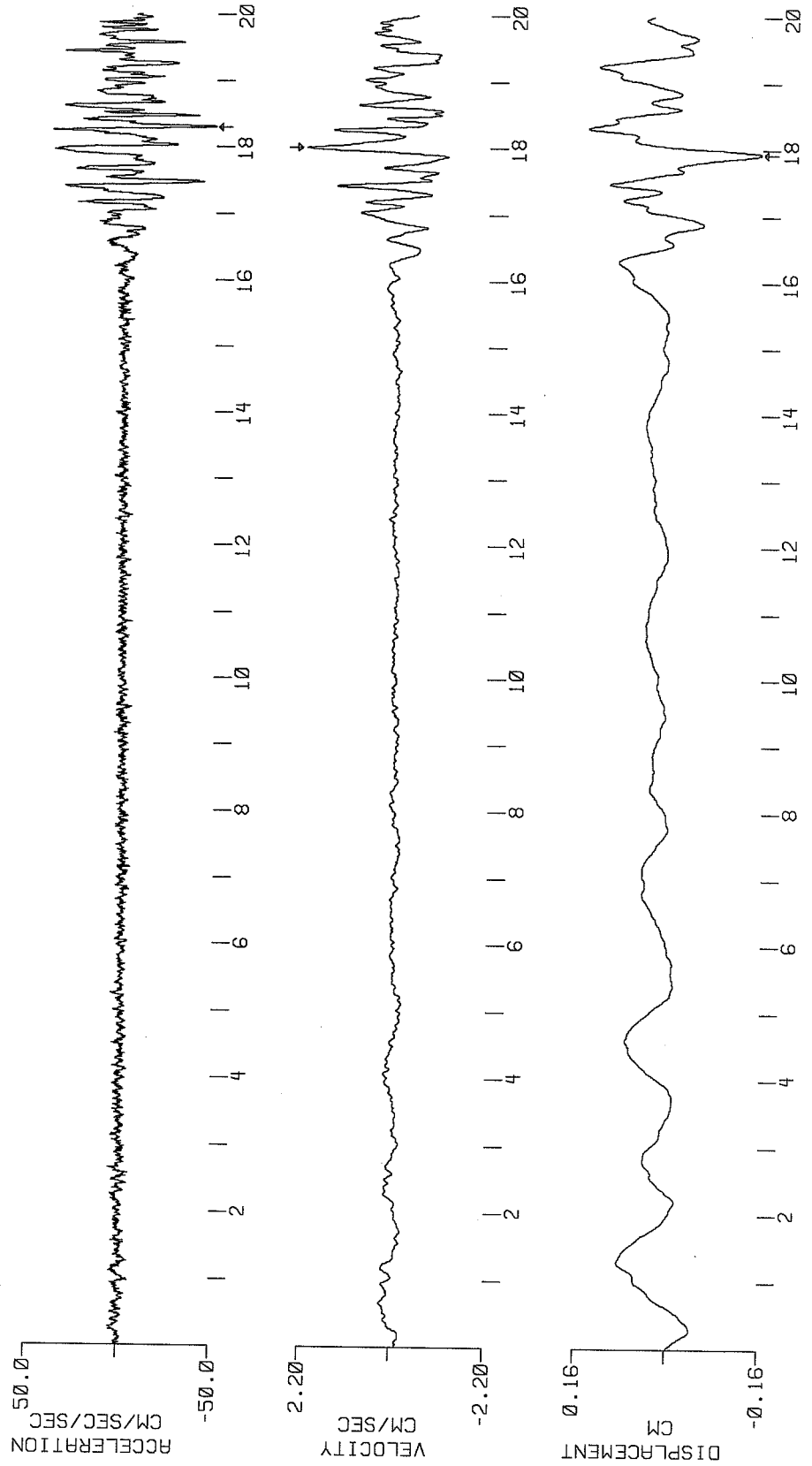
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CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC

+T = 321 DEGREES: AZ. = 182 DEG.: DIST. = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

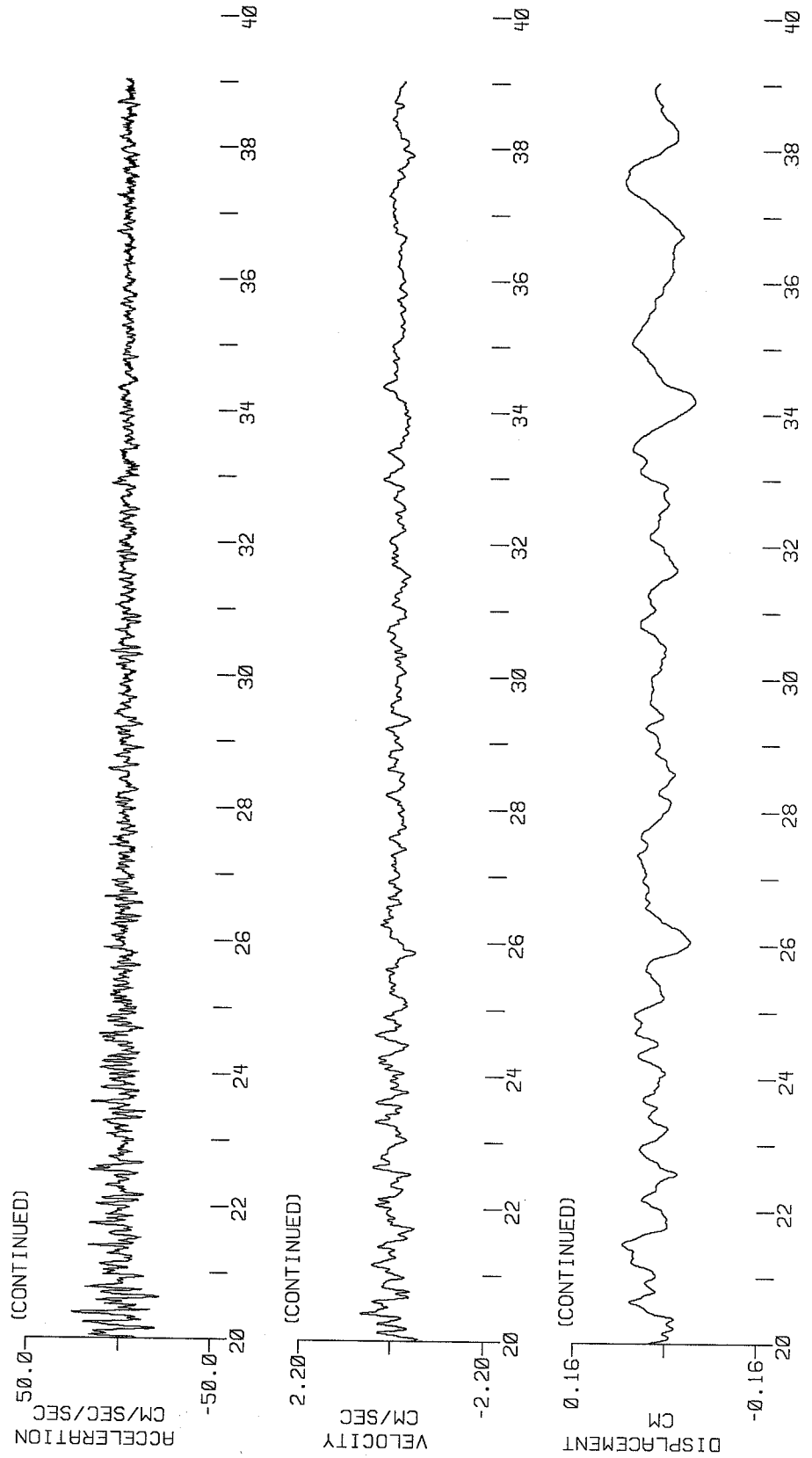
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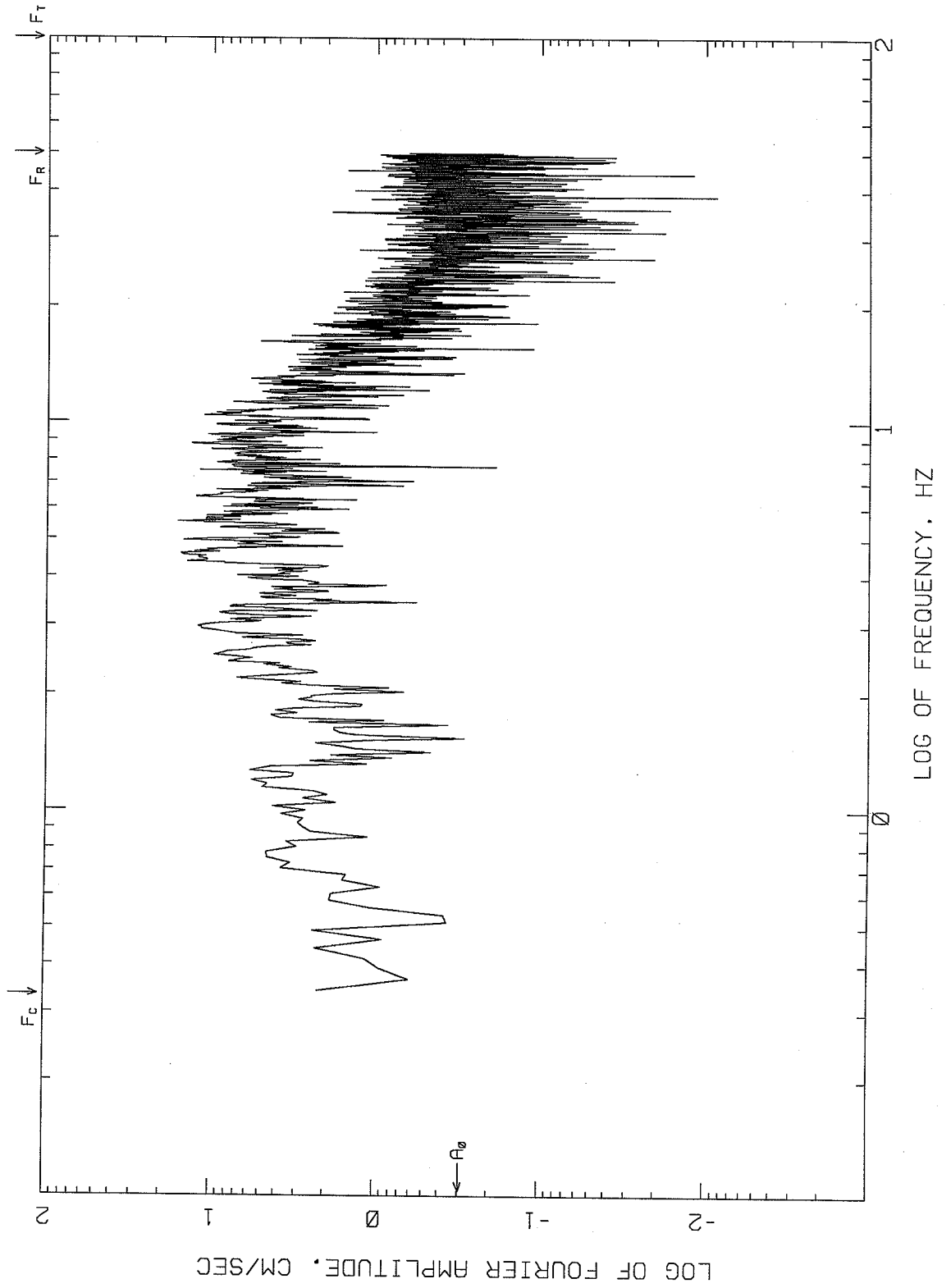
CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 2: QUEBEC, QUEBEC

+T = 321 DEGREES: AZ. = 182 DEG.: DIST. = 149 KM
 4TH-ORDER BUTTERWORTH AT 0.333 HZ

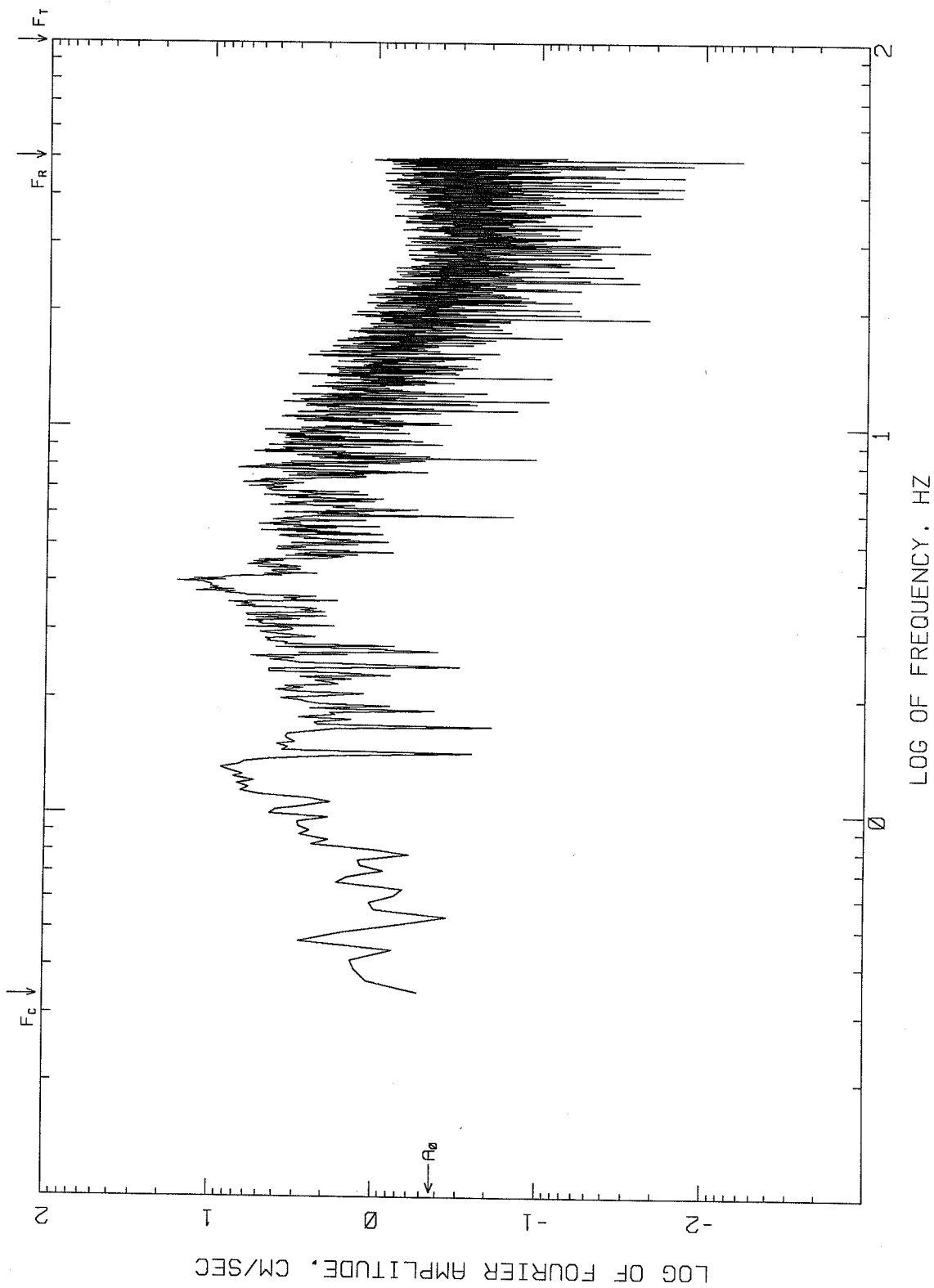
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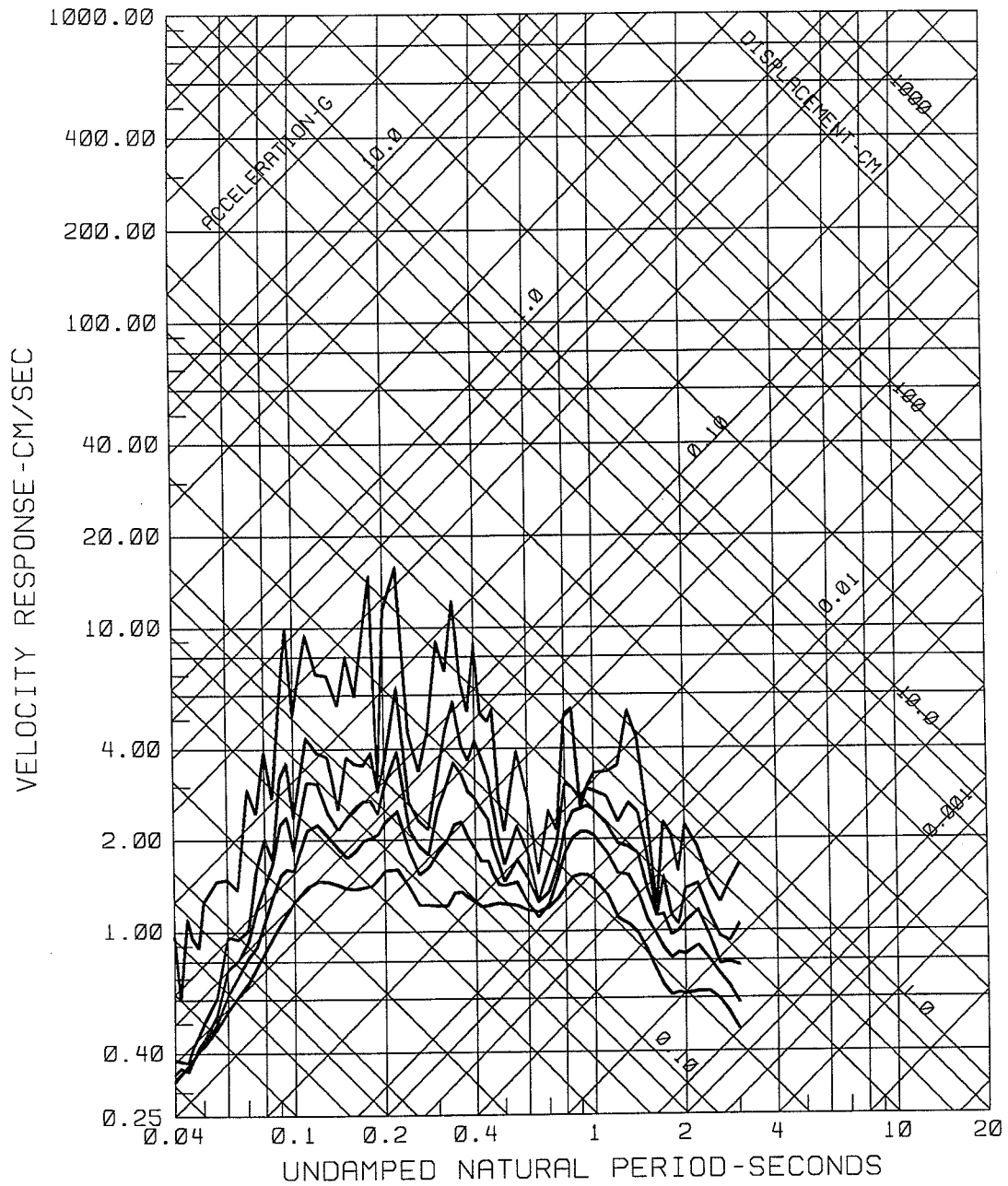
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC
+L = 51 DEGREES; AZ = 182 DEG.; DIST. = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS= ZCROSS, NONOISE



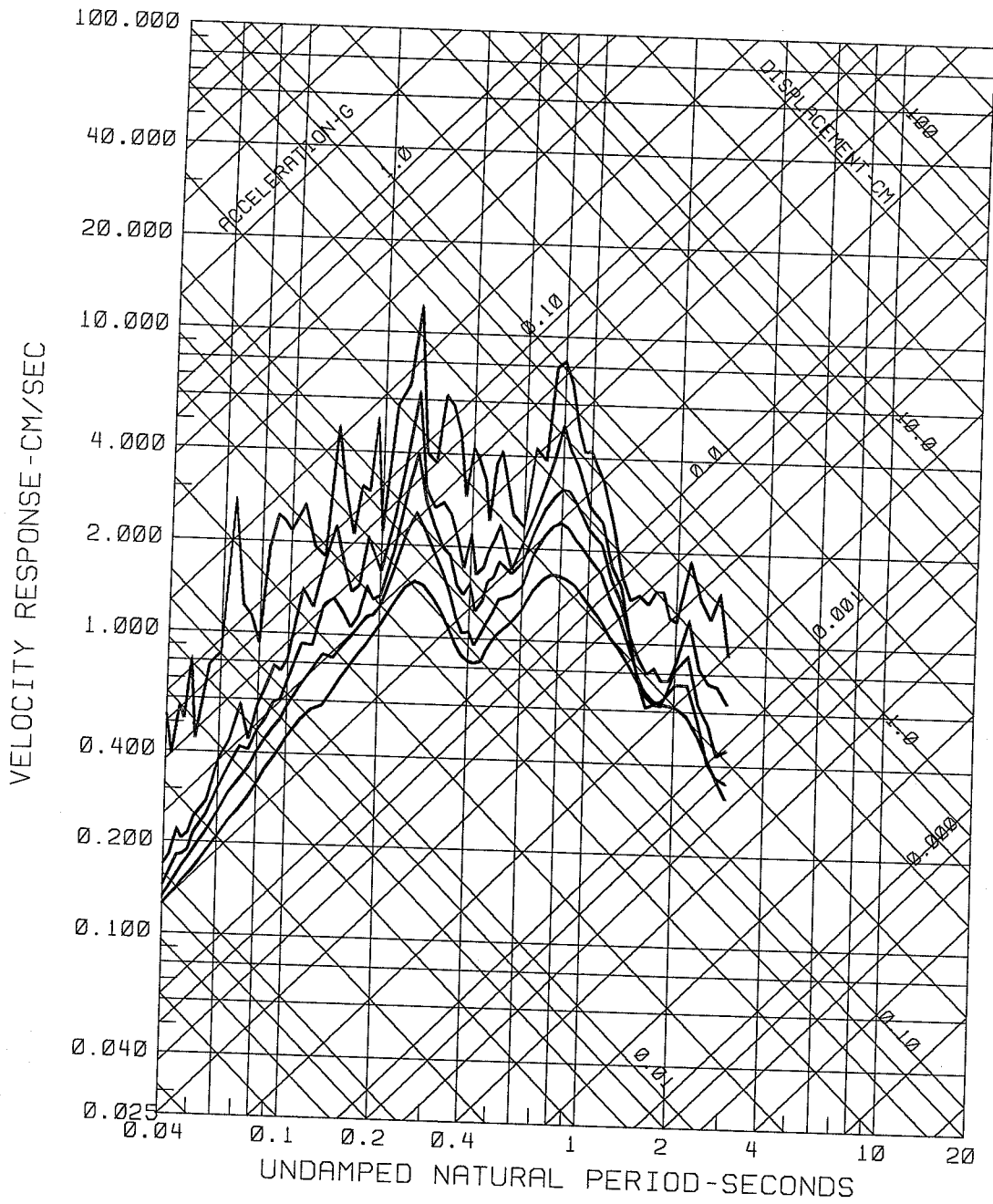
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 2: QUEBEC, QUEBEC
VERTICAL: AZ = 182 DEG.; DIST = 149 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



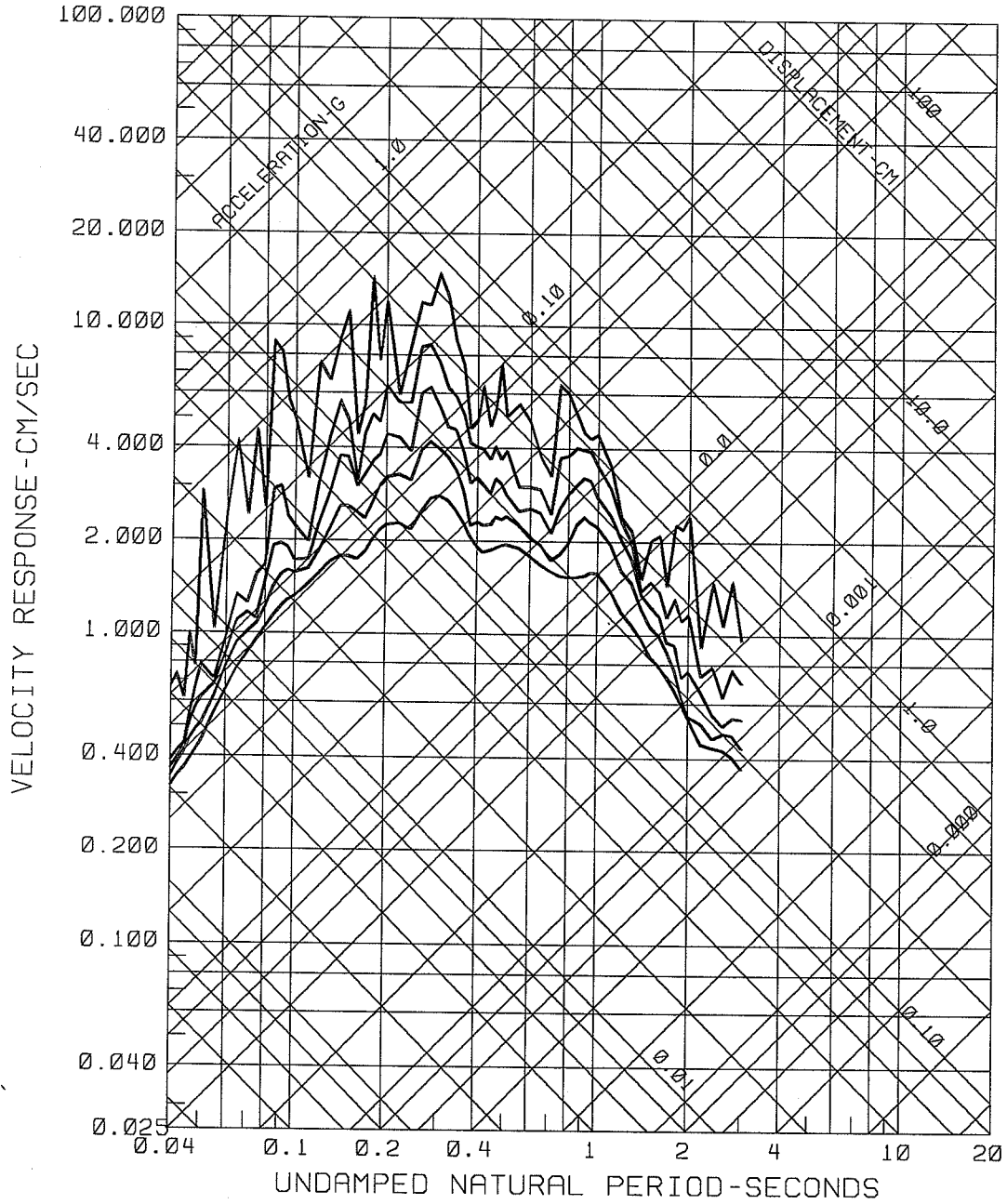
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 2: QUEBEC (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



1988 11 25 2346 UT: SITE 2: QUEBEC (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 2: QUEBEC (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ

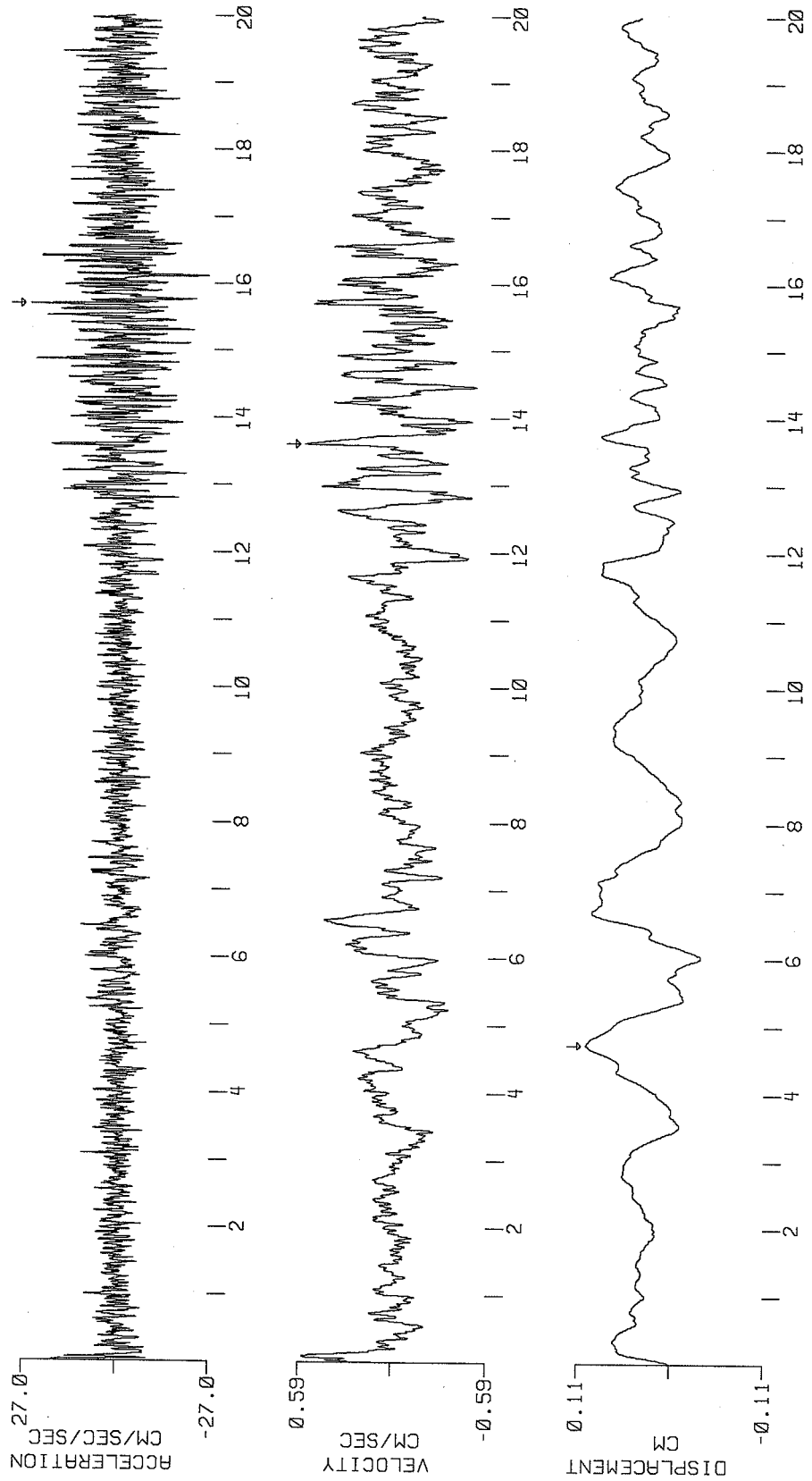


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE S: TADOUSSAC, QUEBEC

+L = 97 DEGREES; AZ. = 88 DEG.; DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=26.37 CM/SEC/SEC. VELOCITY=0.58 CM/SEC. DISPL=0.10 CM

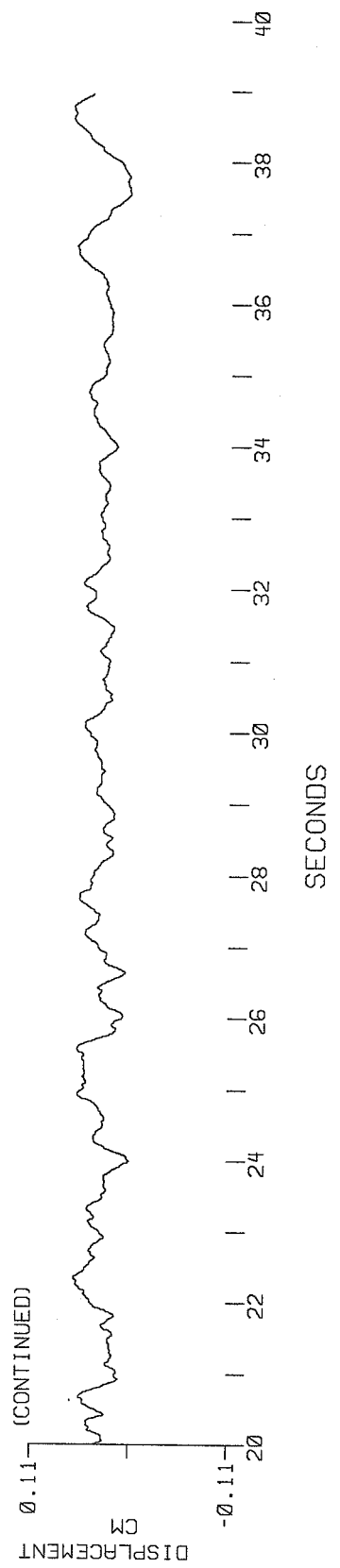
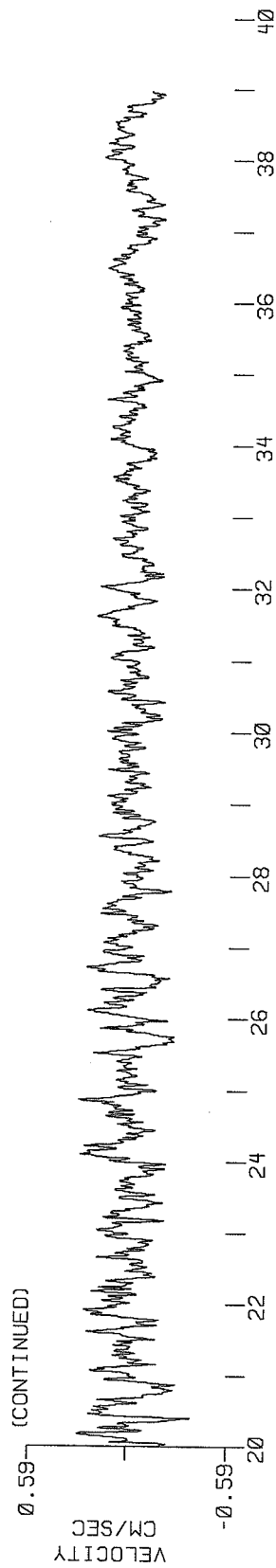
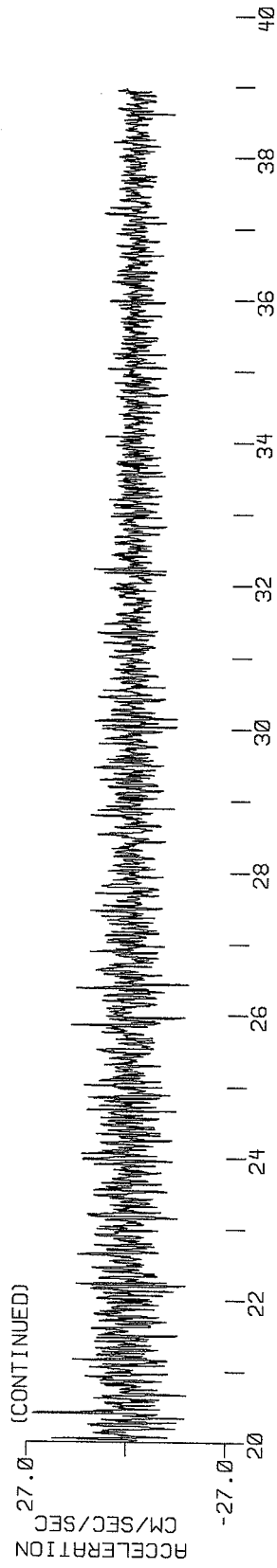


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 5: TADOUSSAC, QUEBEC

+L = 97 DEGREES; AZ. = 88 DEG.; DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=26.37 CM/SEC/SEC. VELOCITY=0.58 CM/SEC. DISPL=0.10 CM

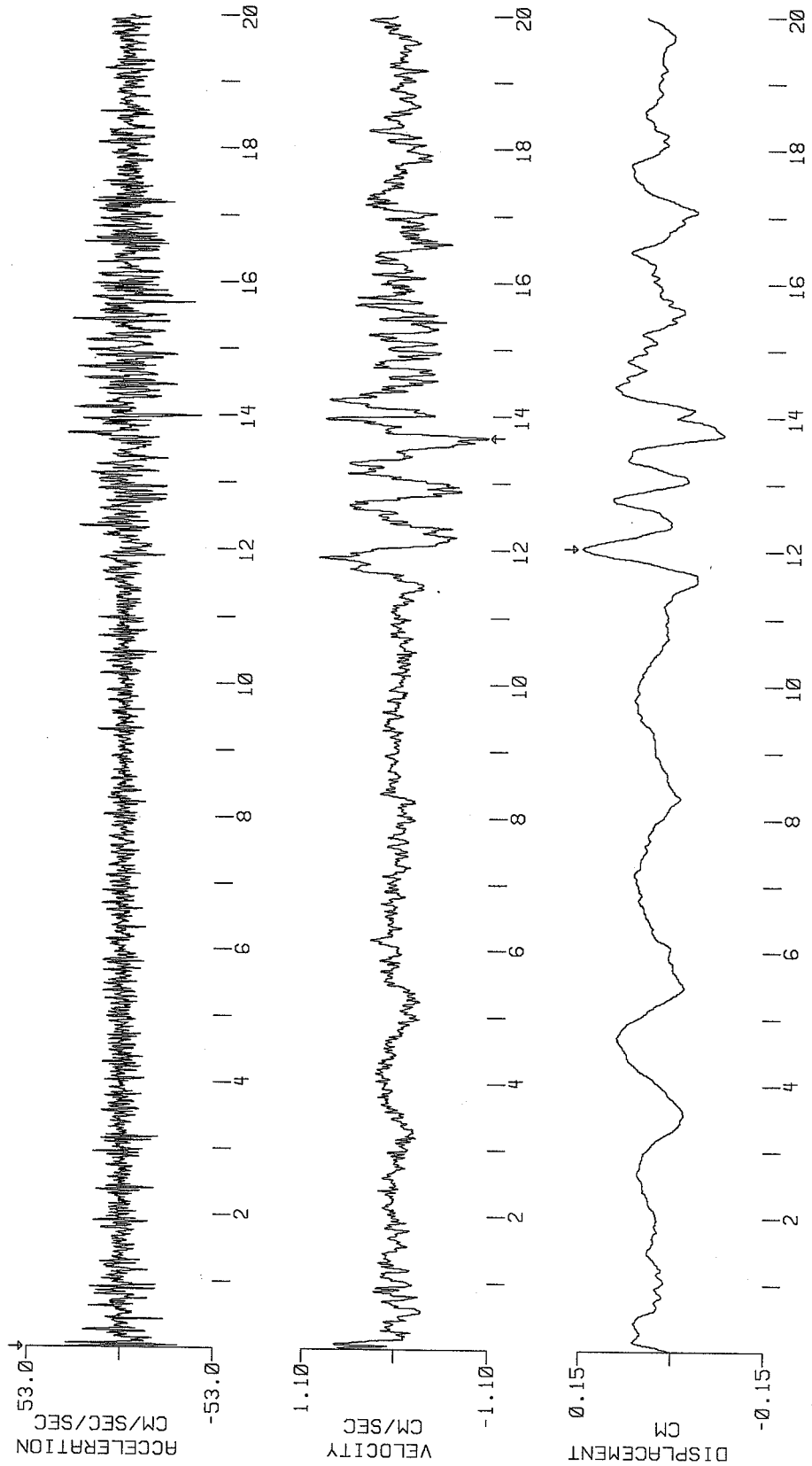


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 5: TADOUSSAC, QUEBEC
VERTICAL: AZ = 88 DEG; DIST = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=52.27 CM/SEC/SEC, VELOCITY=-1.05 CM/SEC, DISPL=0.15 CM



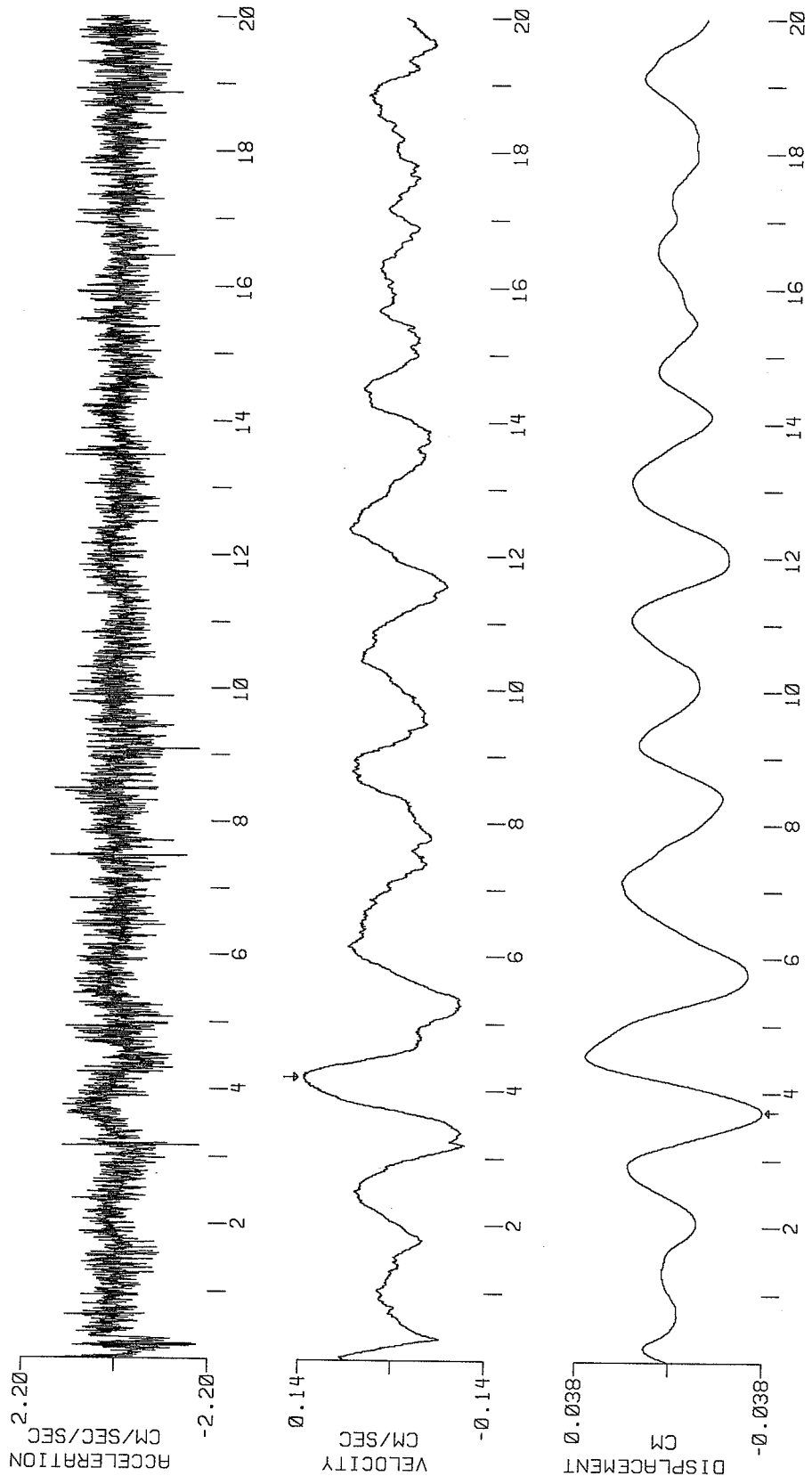
SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 5: TADOUSSAC, QUEBEC

+T = 7 DEGREES: AZ. = 88 DEG.: DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=-2.14 CM/SEC/SEC, VELOCITY=0.14 CM/SEC, DISPL=-0.04 CM



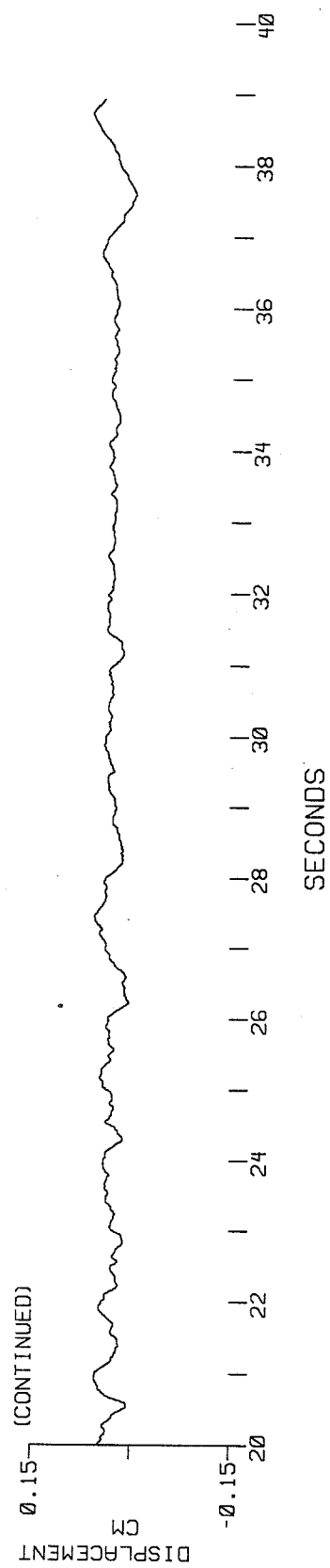
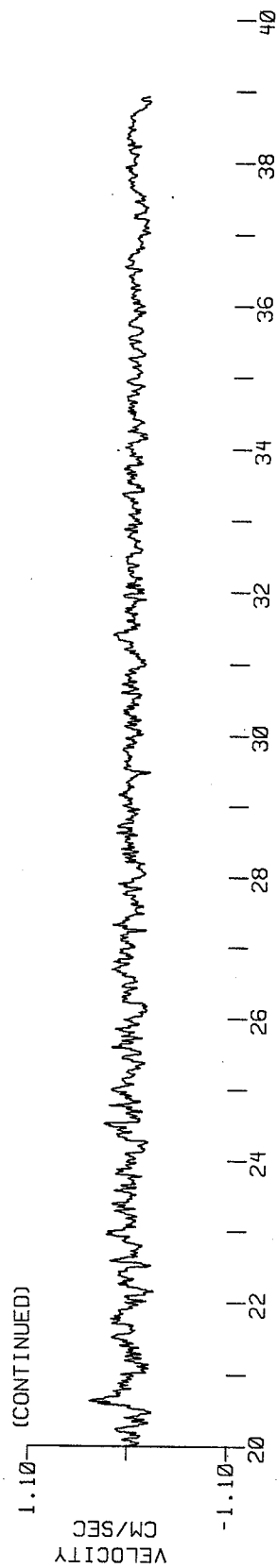
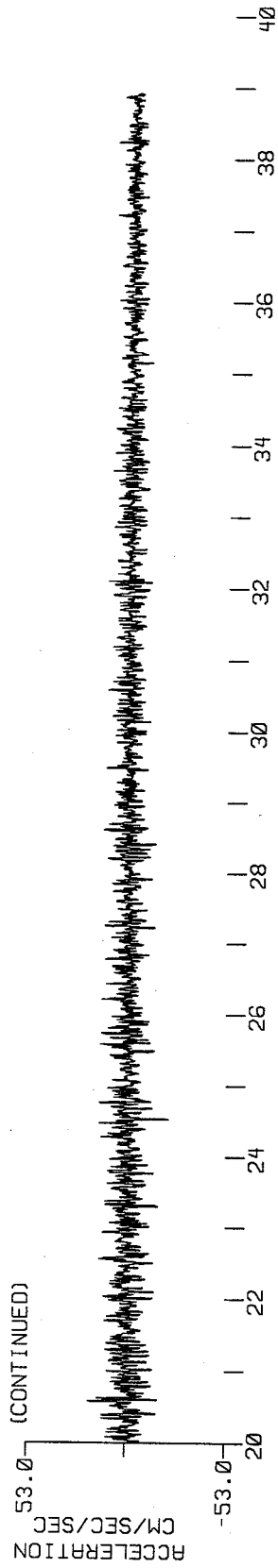
SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 5: TADOUSSAC, QUEBEC
VERTICAL: AZ. = 88 DEG.; DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=52.27 CM/SEC/SEC, VELOCITY=-1.05 CM/SEC, DISPL=0.15 CM

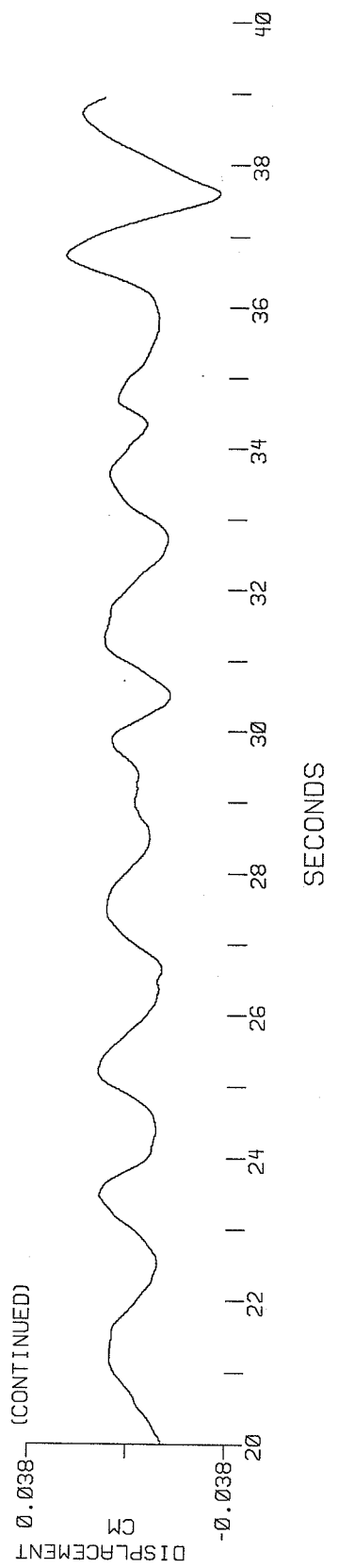
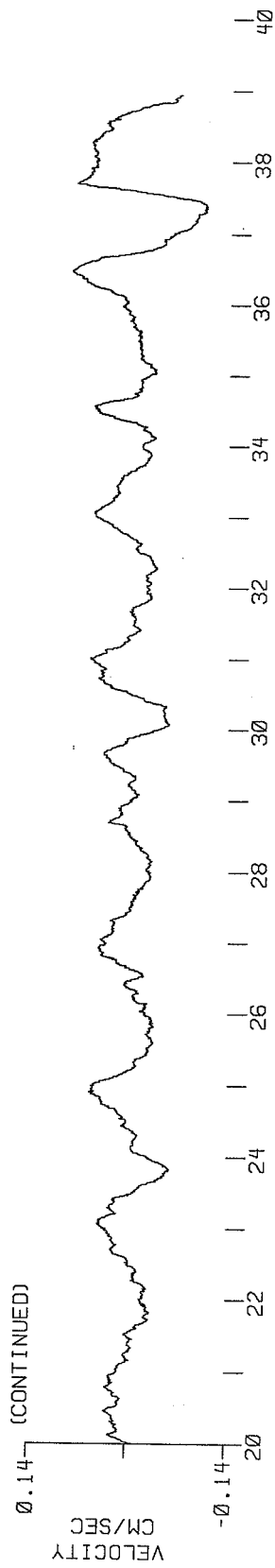
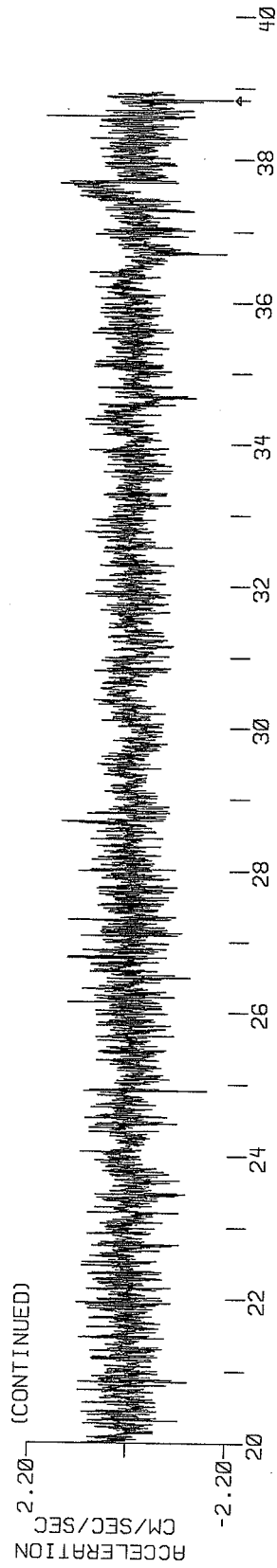


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

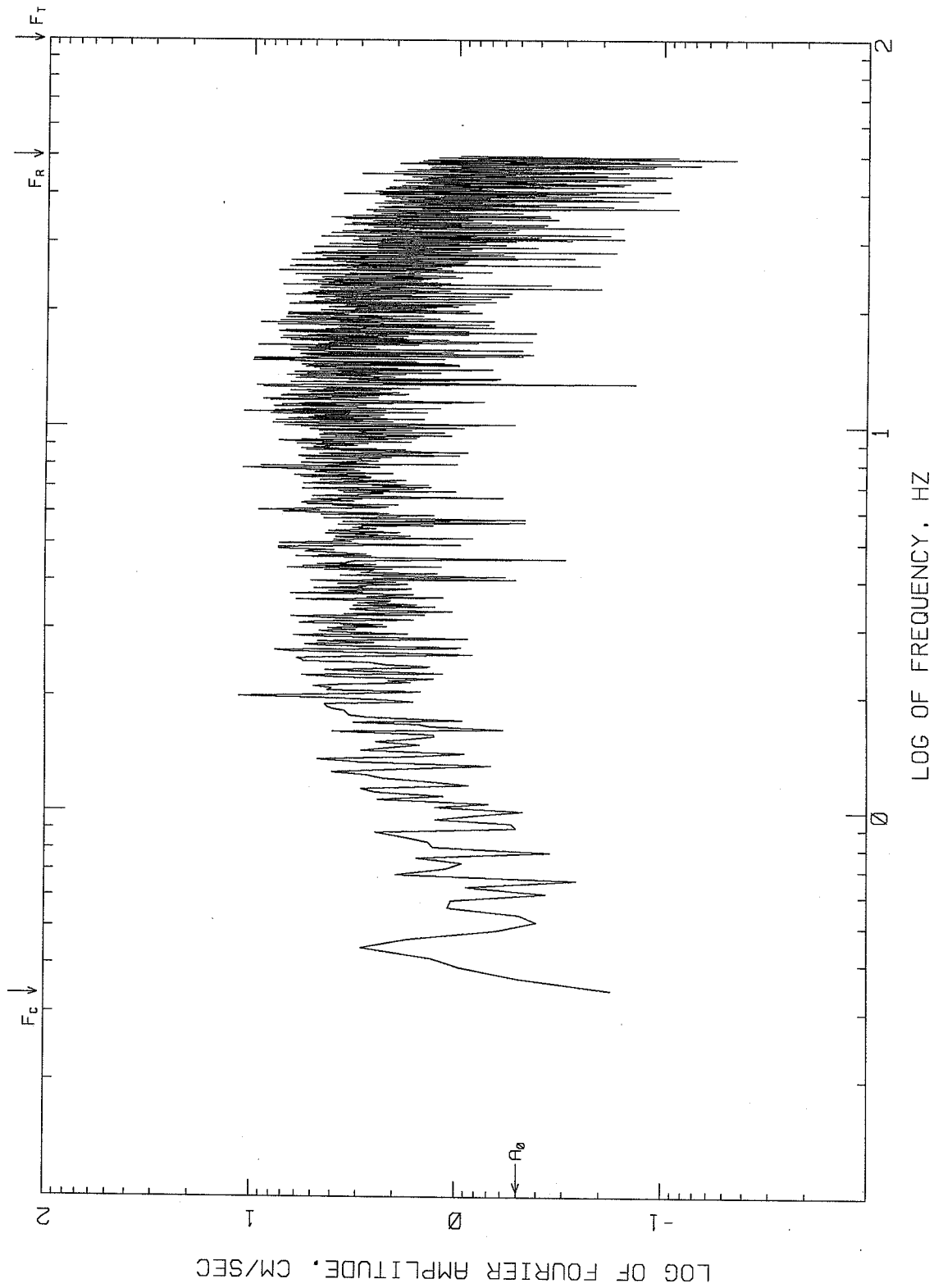
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 5: TADOUSSAC, QUEBEC

+T = 7 DEGREES: AZ. = 88 DEG.: DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

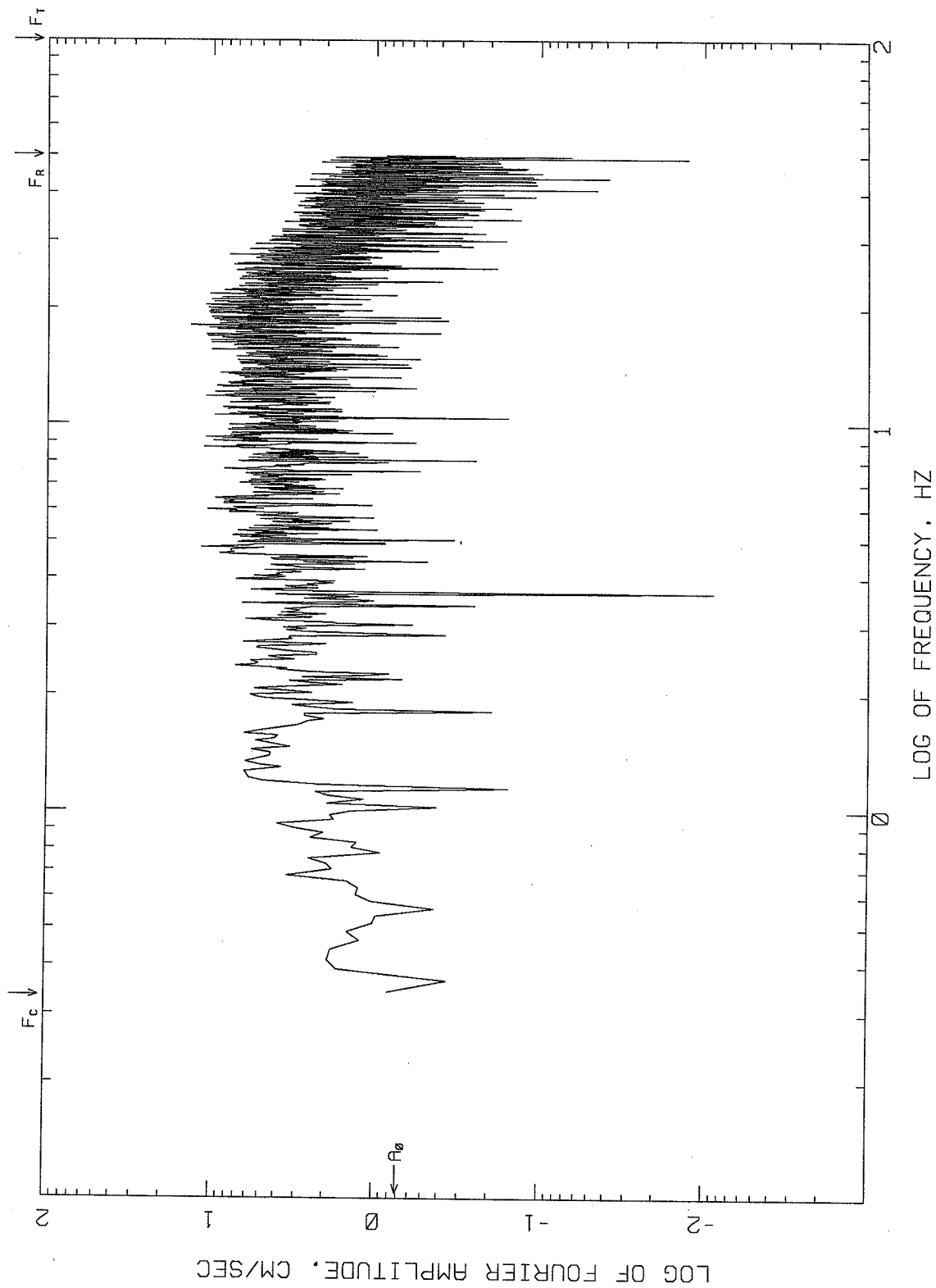
PEAK VALUES: ACCEL=-2.14 CM/SEC/SEC. VELOCITY=0.14 CM/SEC. DISPL=-0.04 CM



FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 5: TADOUSSAC, QUEBEC
+L = 97 DEGREES; AZ. = 88 DEG.; DIST. = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE S: TADOUSSAC, QUEBEC
VERTICAL: AZ = 88 DEG; DIST = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS.NONNOISE

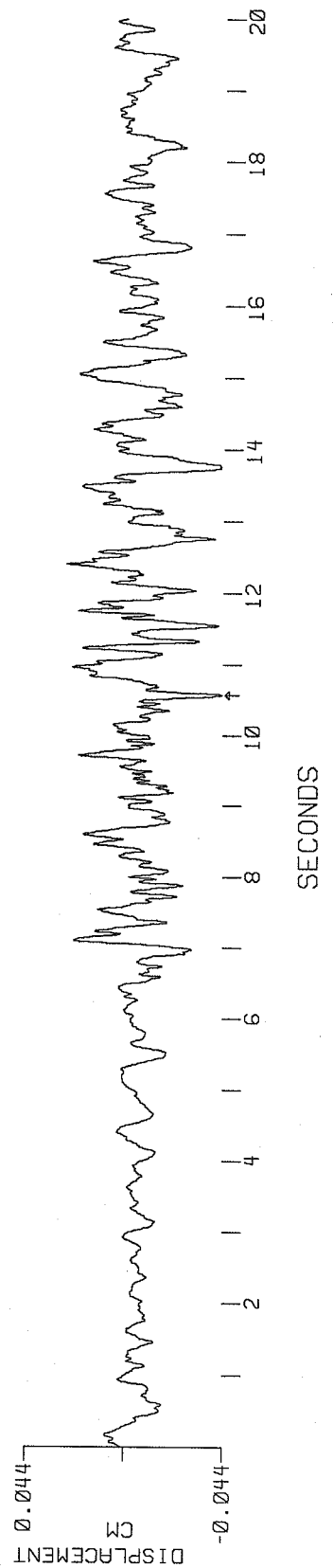
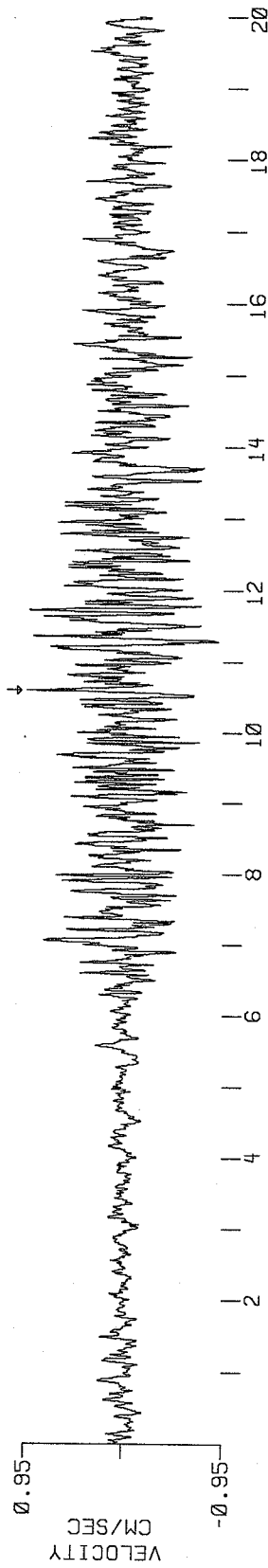
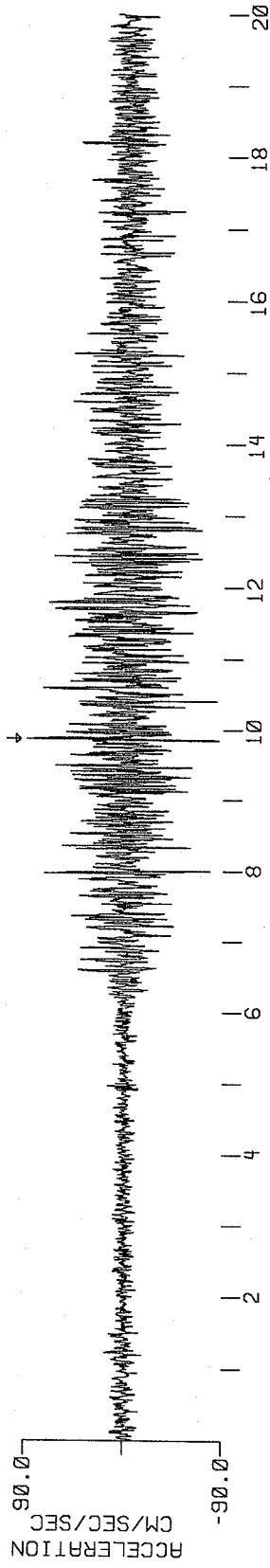


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

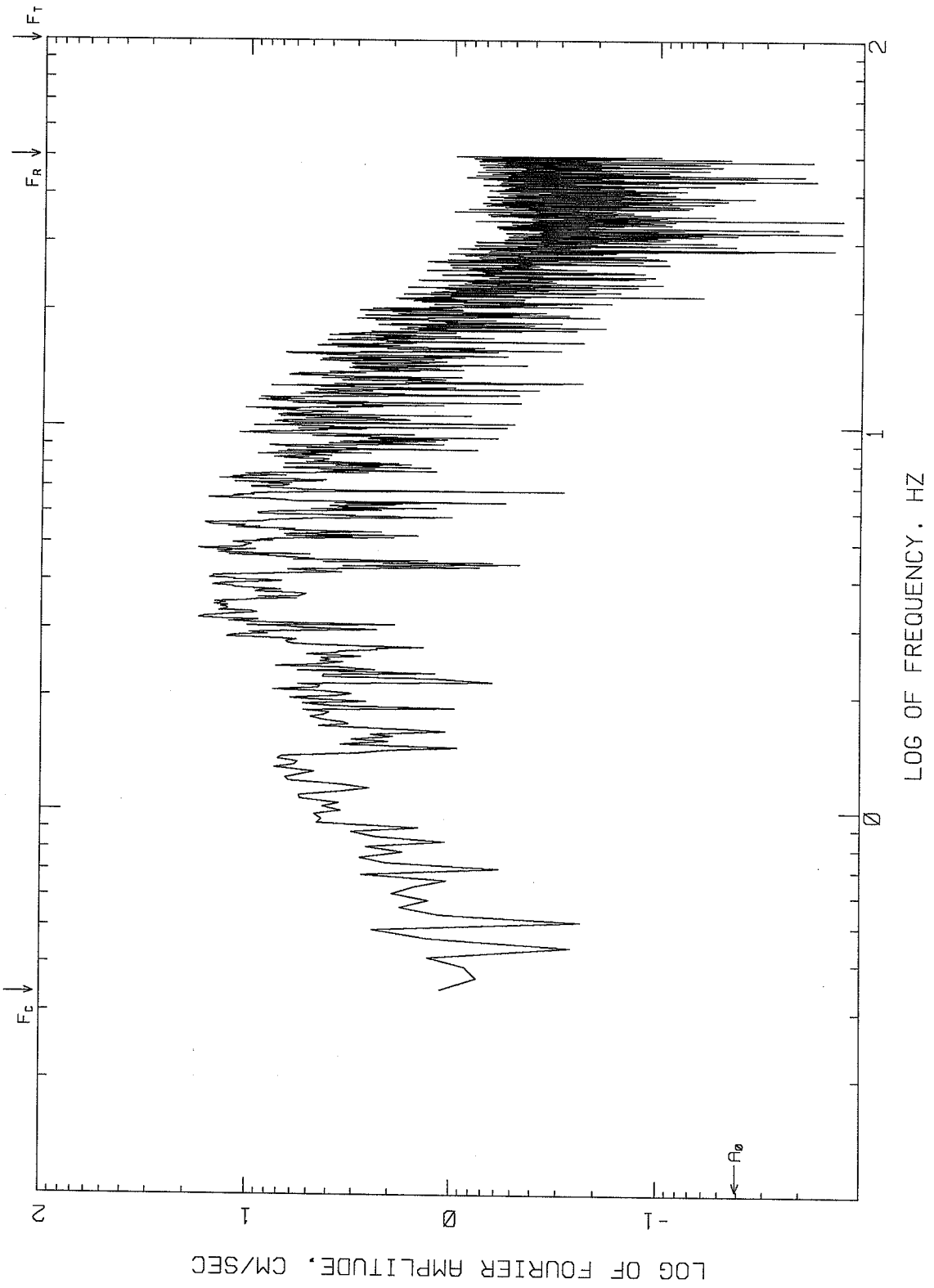
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE, QUEBEC

+T = 270 DEGREES: AZ. = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ

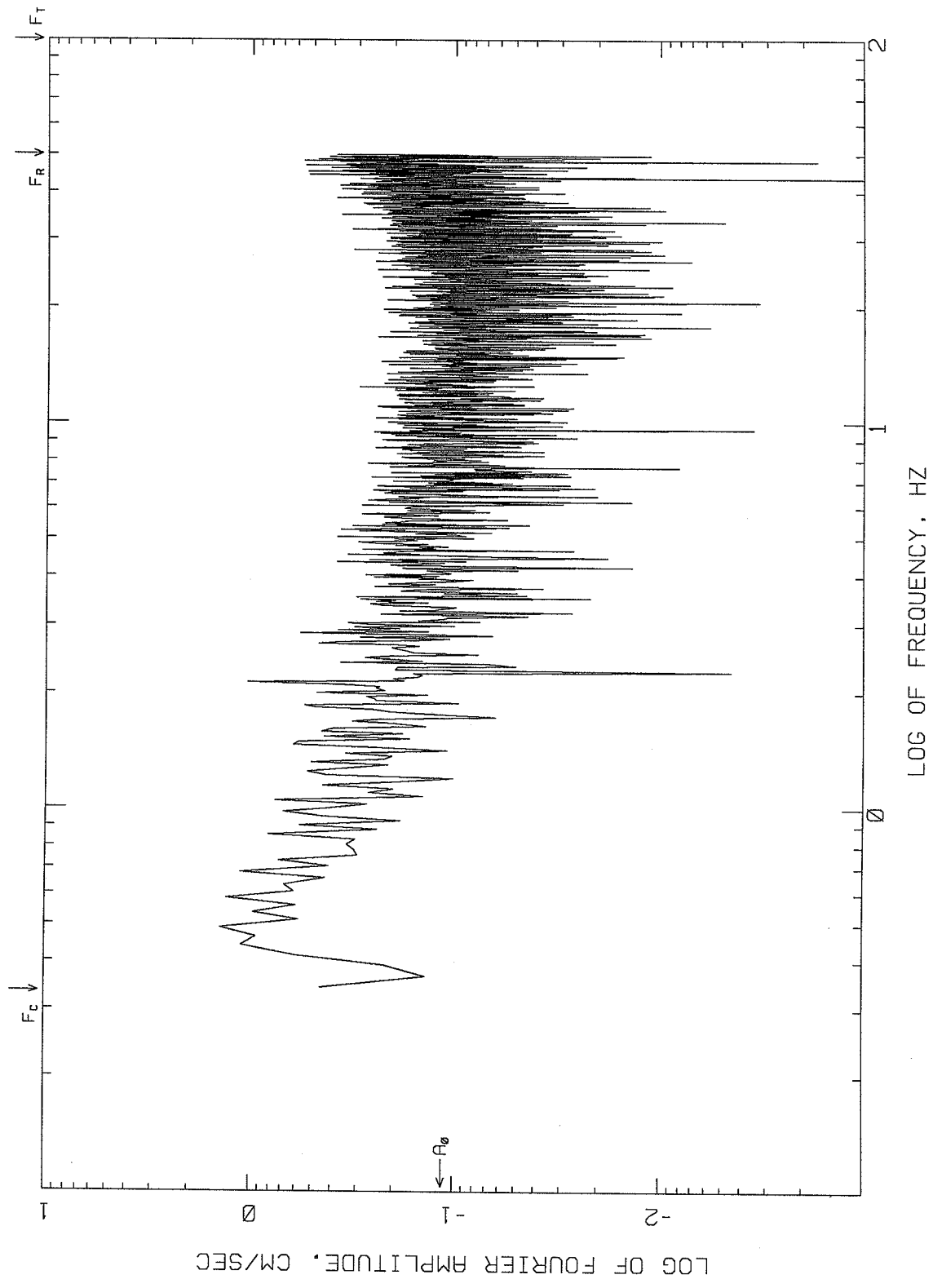
PEAK VALUES: ACCEL=89.36 CM/SEC/SEC. VELOCITY=0.94 CM/SEC. DISPL=-0.04 CM



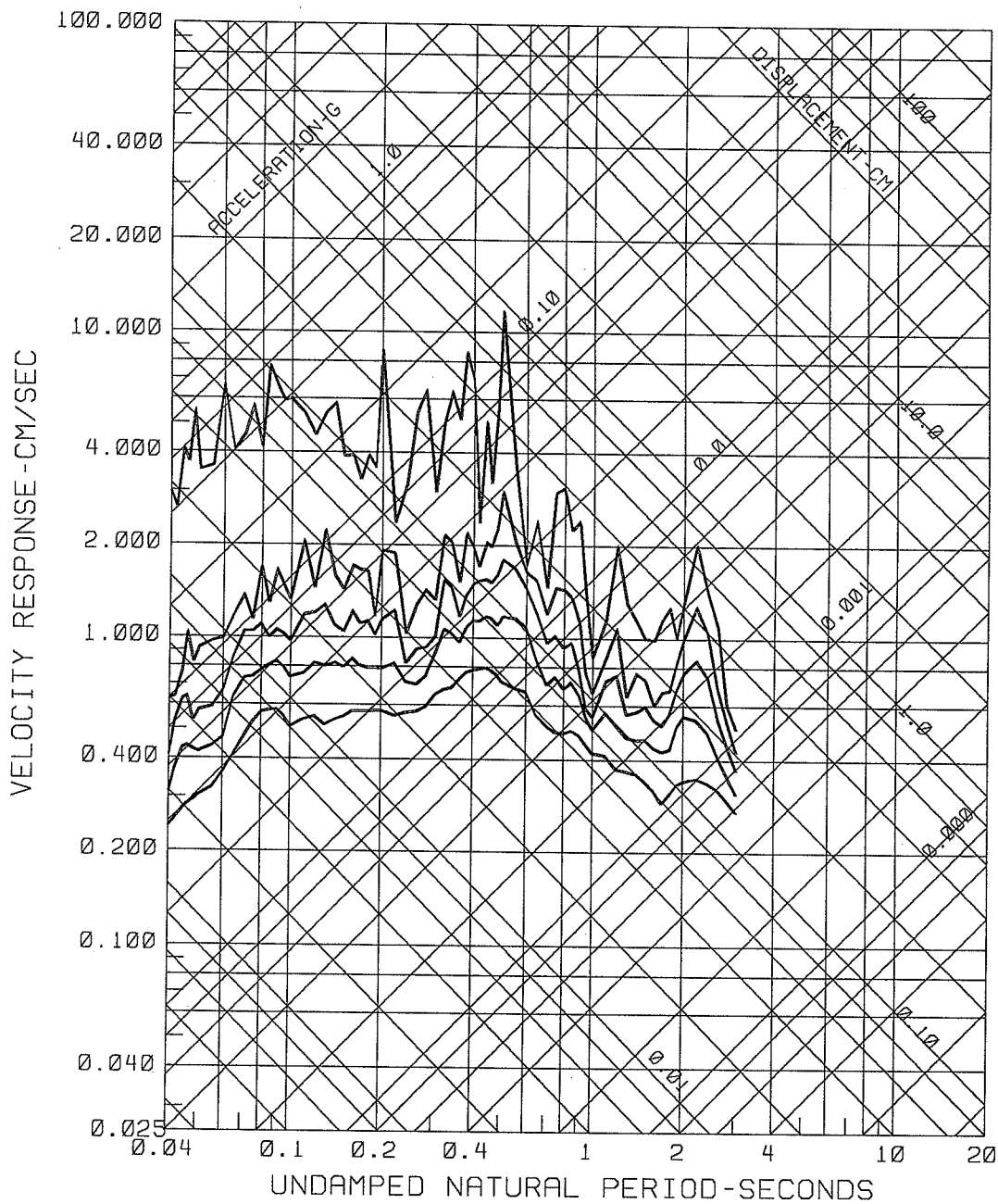
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 2: QUEBEC, QUEBEC
 +T = 32.1 DEGREES; AZ. = 182 DEG.; DIST. = 149 KM
 4TH-ORDER BUTTERWORTH AT 0.333 HZ
 COMPUTING OPTIONS = ZCROSS.NONNOISE



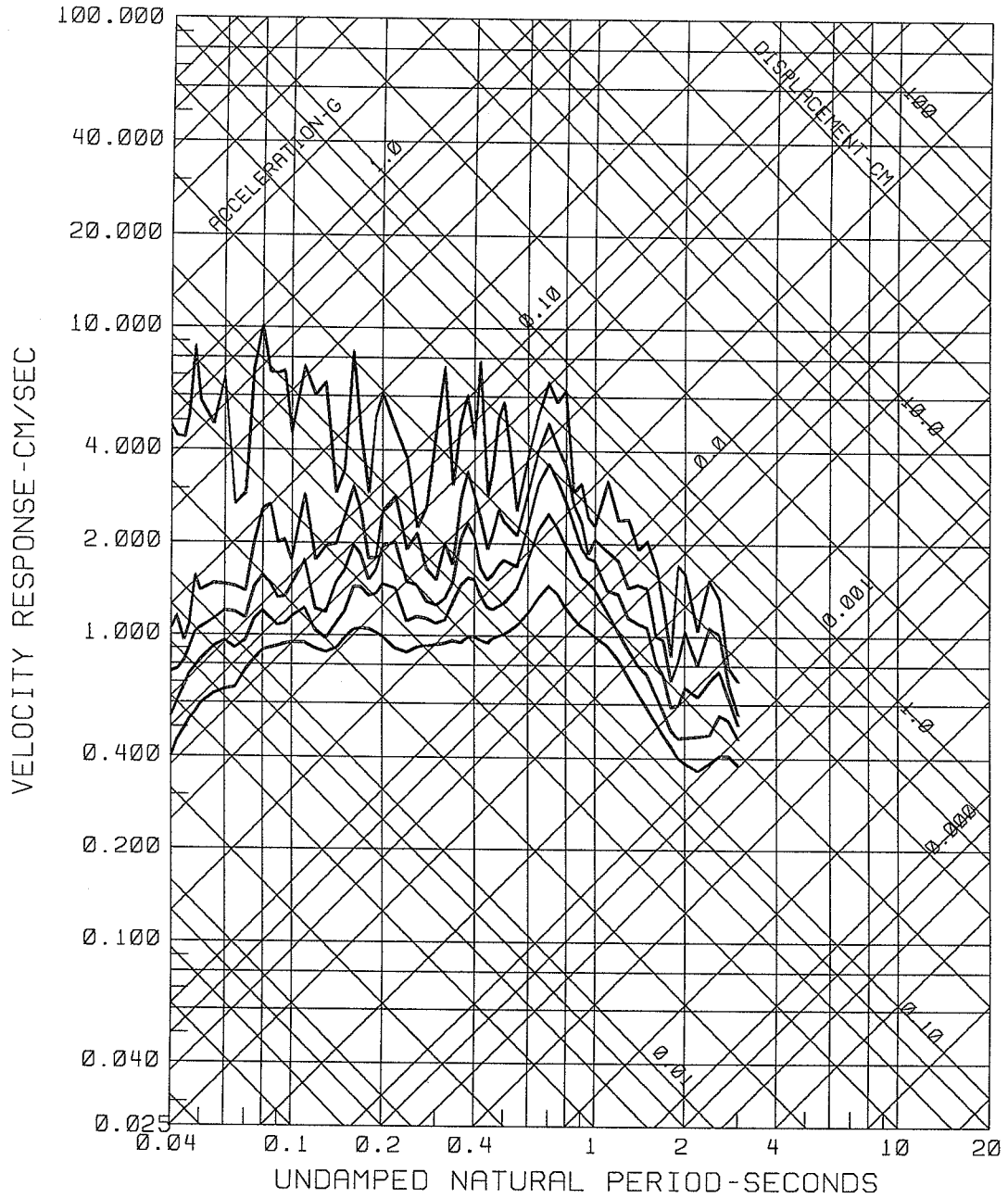
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 5: TADOUSSAC, QUEBEC
+T = 7 DEGREES; AZ = 88 DEG; DIST = 109 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONNOISE



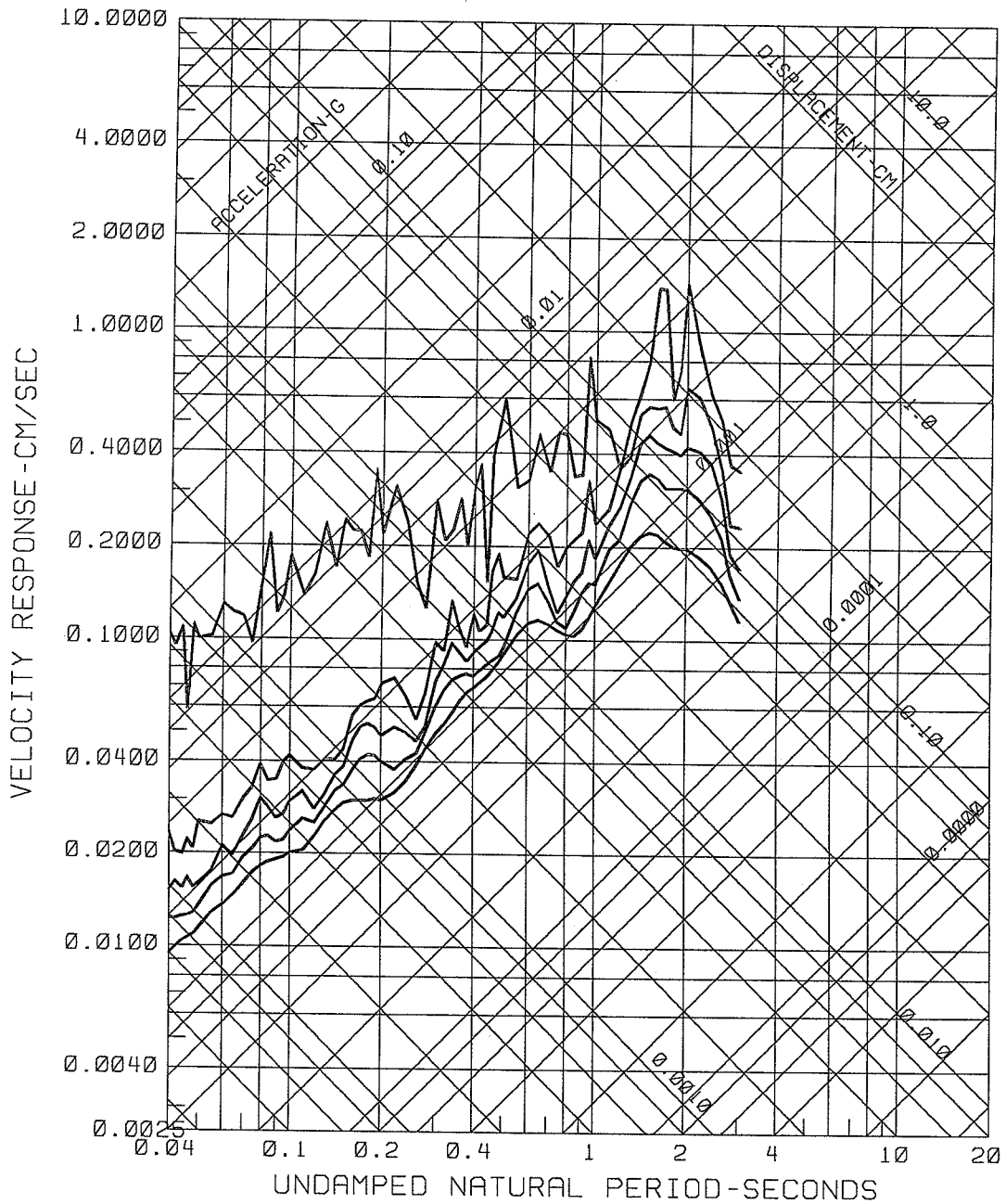
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 5: TADOUSSAC (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
 1988 11 25 2346 UT: SITE 5: TADOUSSAC (VERTICAL)
 0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
 FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 5: TADOUSSAC (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ

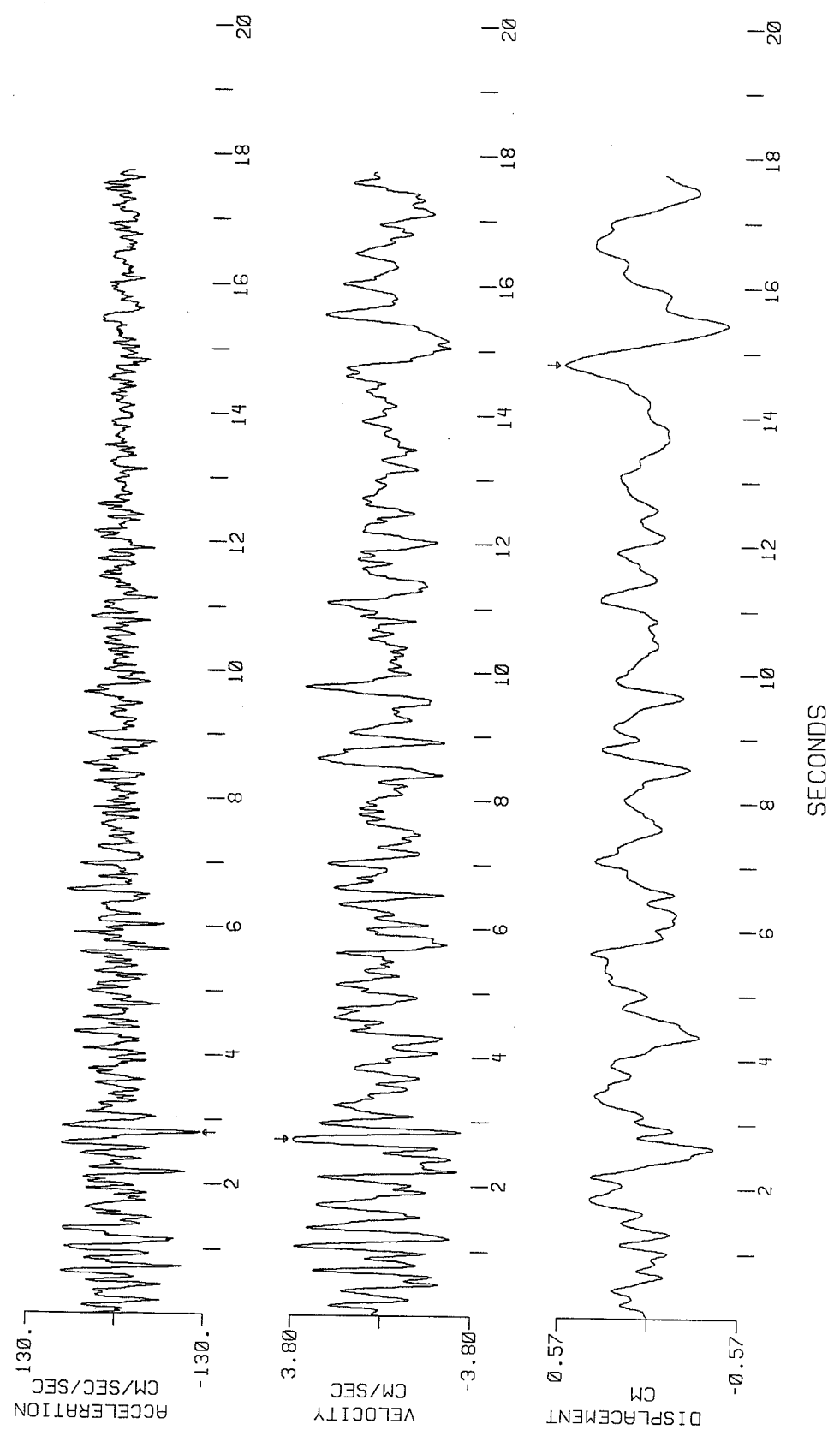


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SLIT 7: BAIE-ST-PAUL, QUEBEC
+L = 175 DEGREES; AZ. = 146 DEG.; DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=-122.84 CM/SEC/SEC. VELOCITY=3.76 CM/SEC. DISPL=0.56 CM



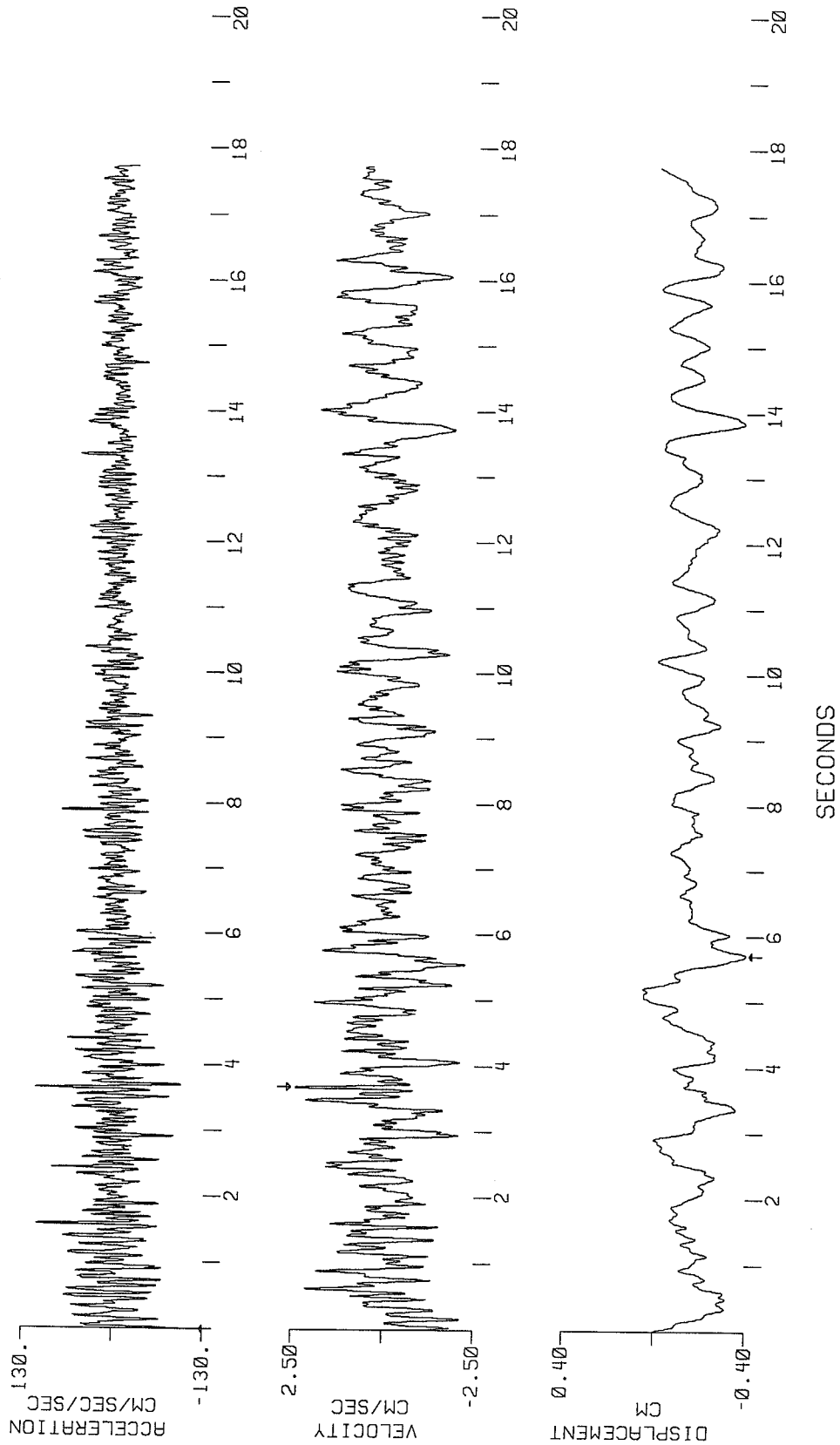
CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 7: BAIE-ST-PAUL, QUEBEC

VERTICAL: AZ. = 146 DEG.; DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL = -121.31 CM/SEC/SEC, VELOCITY = 2.43 CM/SEC, DISPL = -0.40 CM

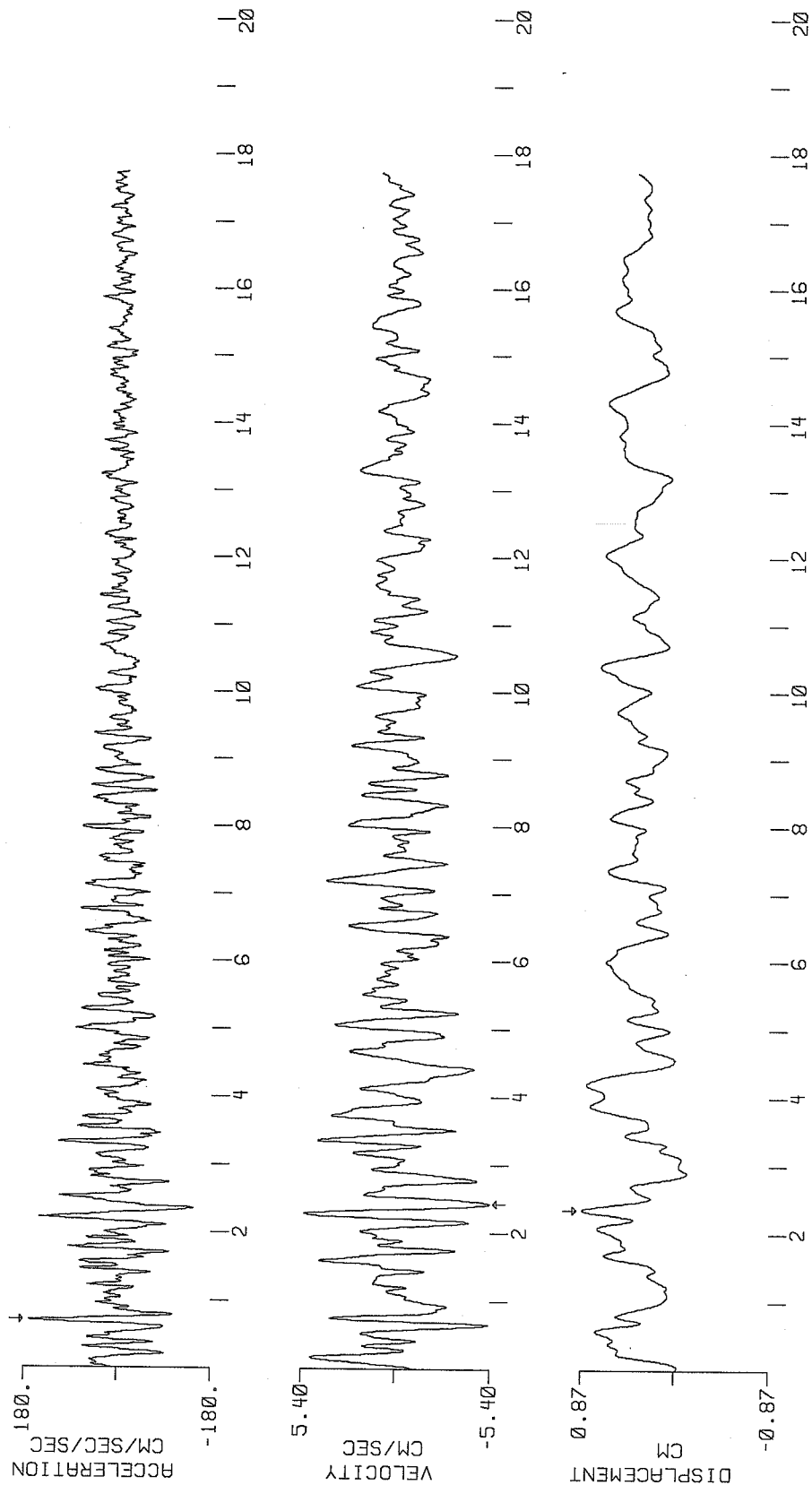


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

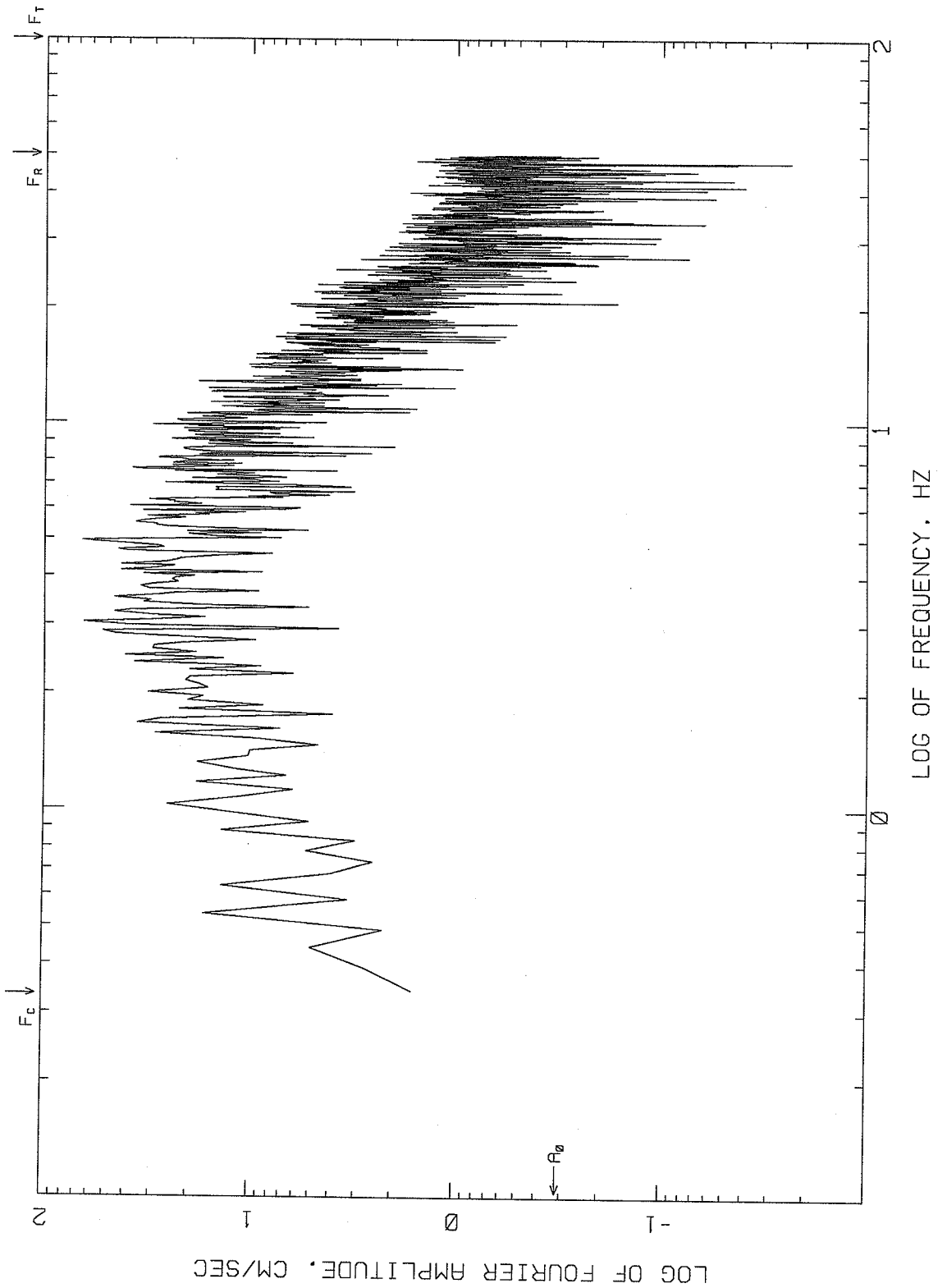
SITE 7: BAIE-ST-PAUL, QUEBEC
+T = 85 DEGREES: AZ = 146 DEG.: DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=170.62 CM/SEC/SEC, VELOCITY=-5.34 CM/SEC, DISPL=0.87 CM

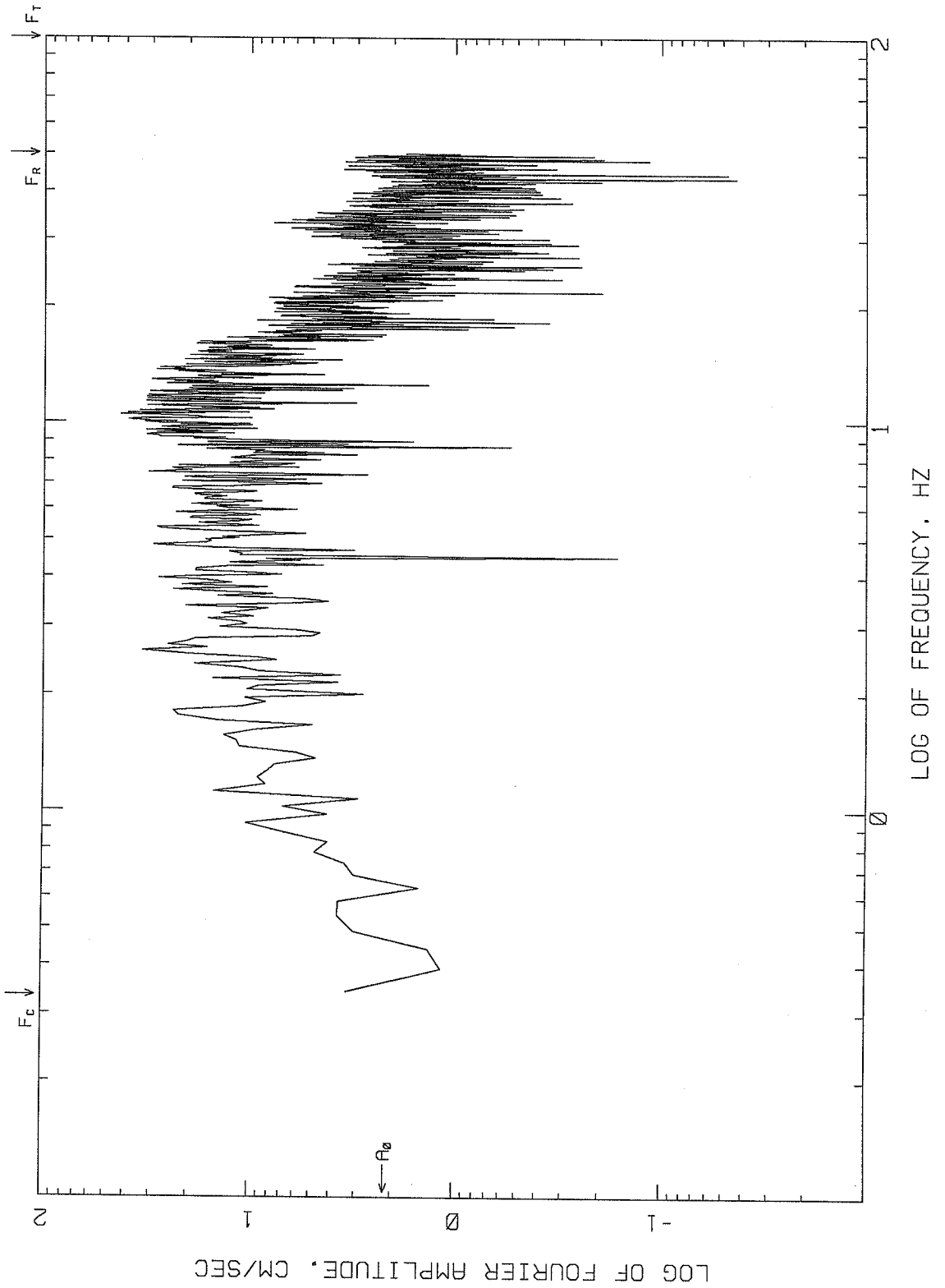


SECONDS

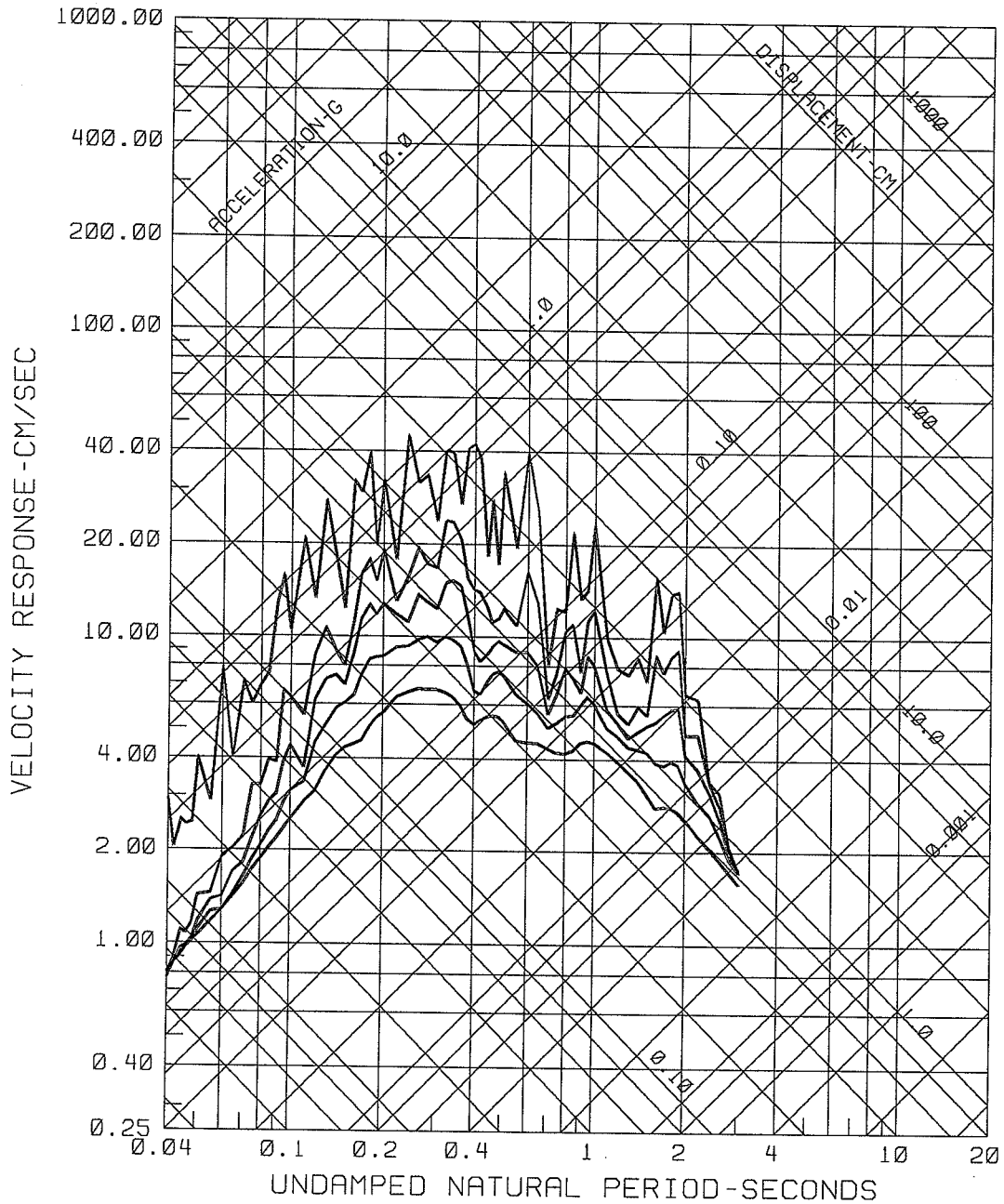
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 7: BAIE-ST-PAUL, QUEBEC
+L = 175 DEGREES; AZ. = 146 DEG.; DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



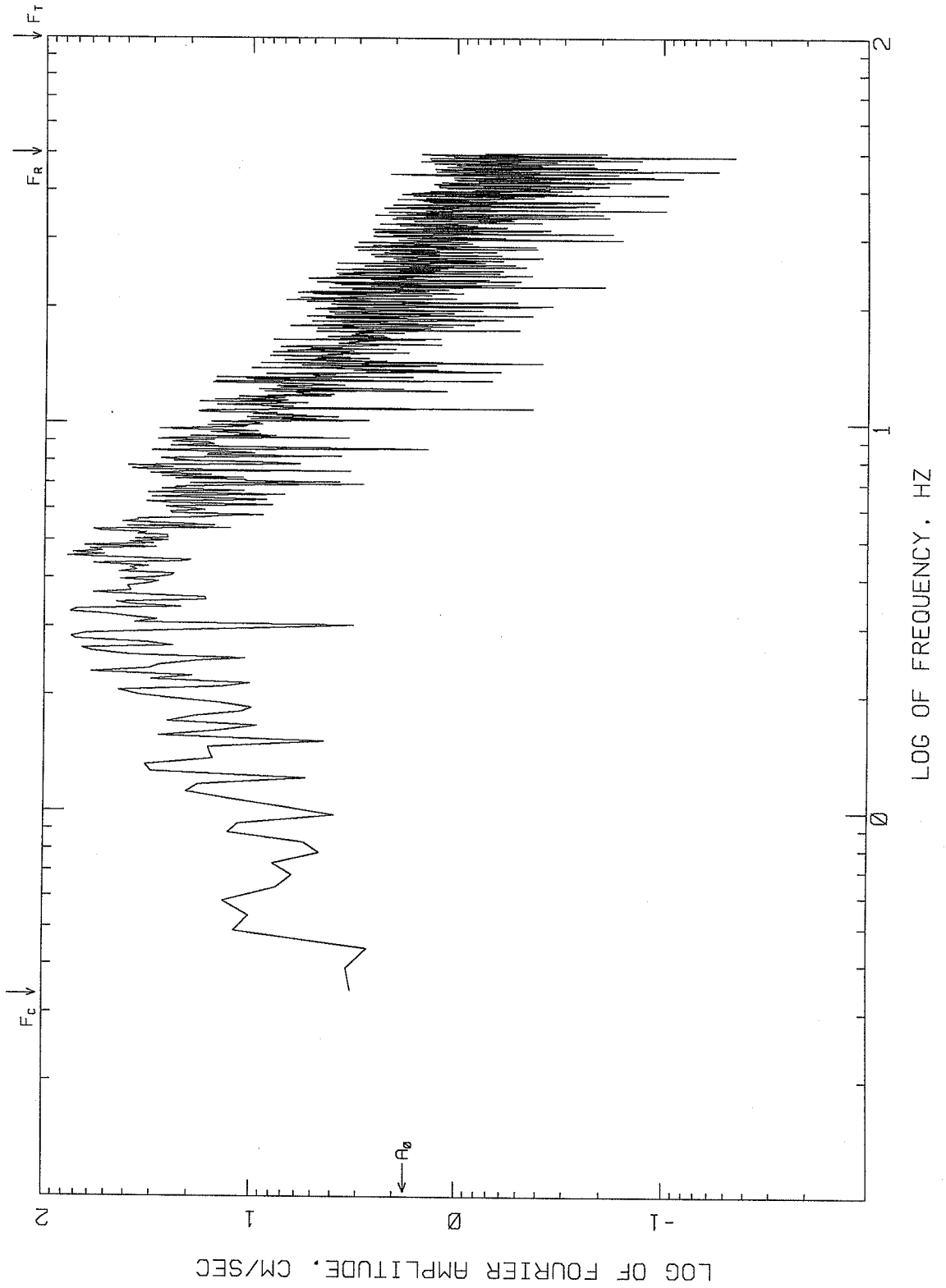
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 7: BAIE-ST-PAUL, QUEBEC
VERTICAL; AZ. = 146 DEG.; DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



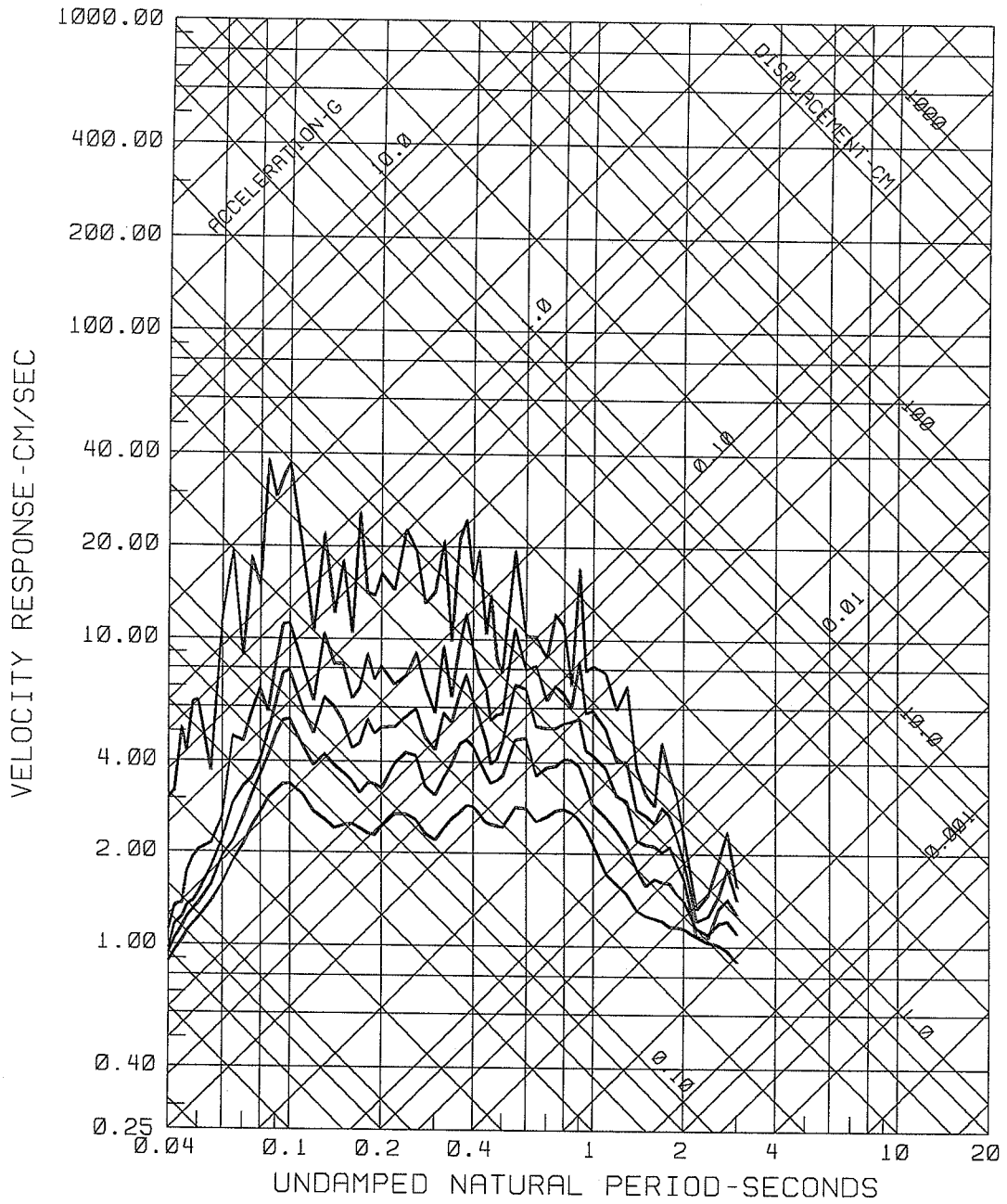
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 7: BAIE-ST-PAUL (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



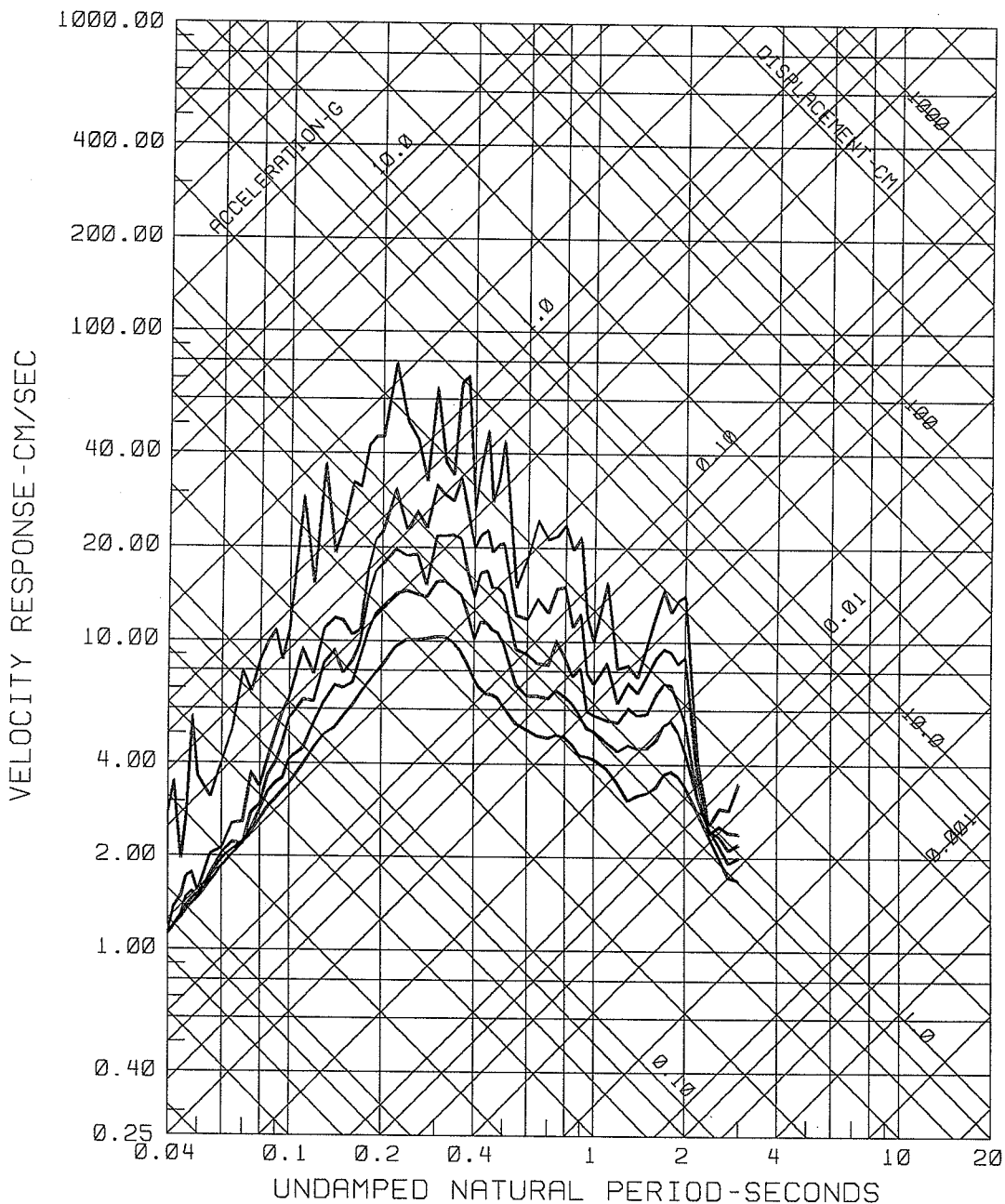
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 7: BAIE-ST-PAUL, QUEBEC
+T = 85 DEGREES: AZ. = 146 DEG.; DIST. = 91 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 7: BAIE-ST-PAUL (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



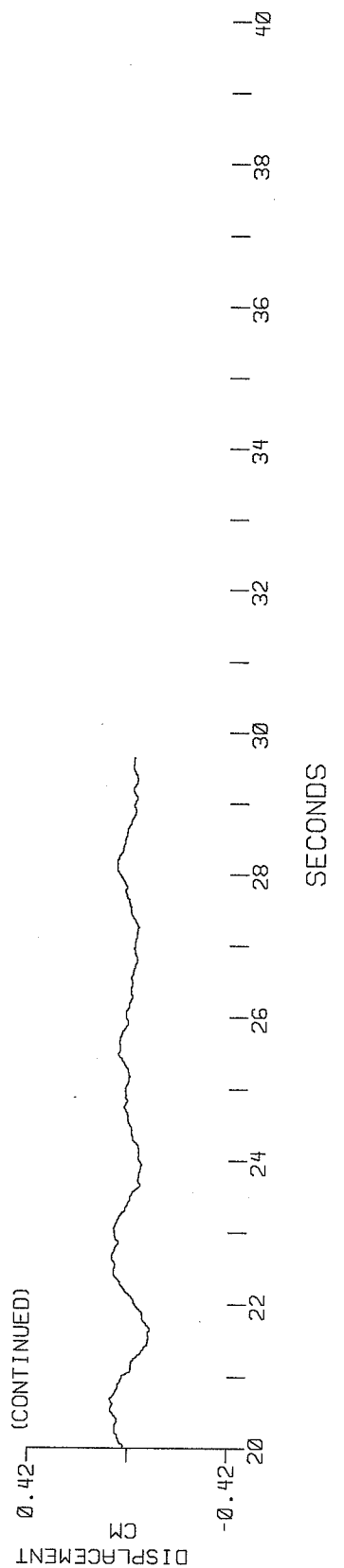
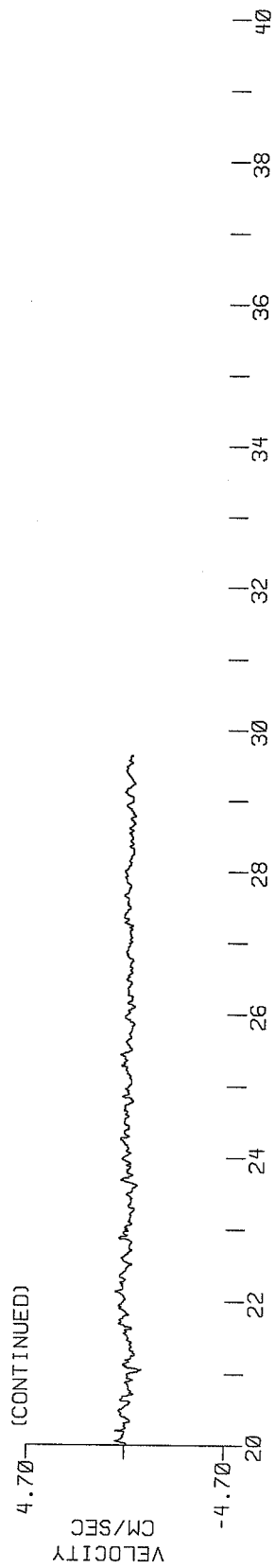
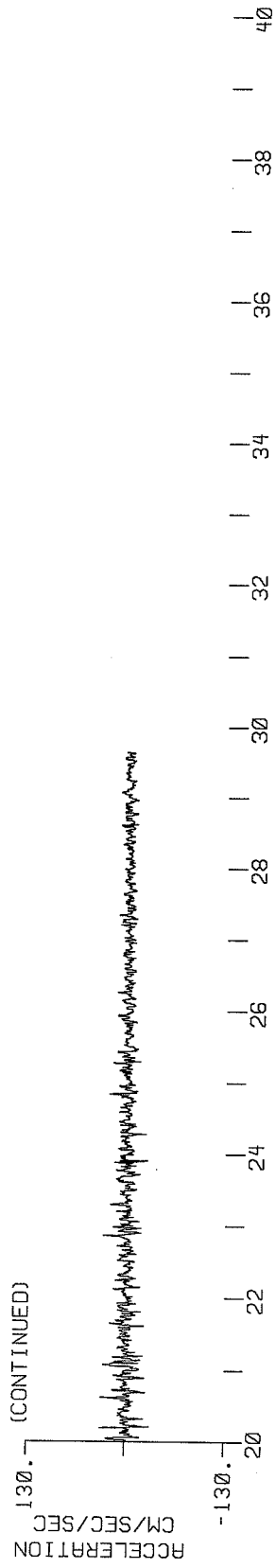
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 7: BAIE-ST-PAUL (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC
+L = 63 DEGREES; AZ. = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=-121.82 CM/SEC/SEC. VELOCITY=-4.65 CM/SEC. DISPL=-0.41 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

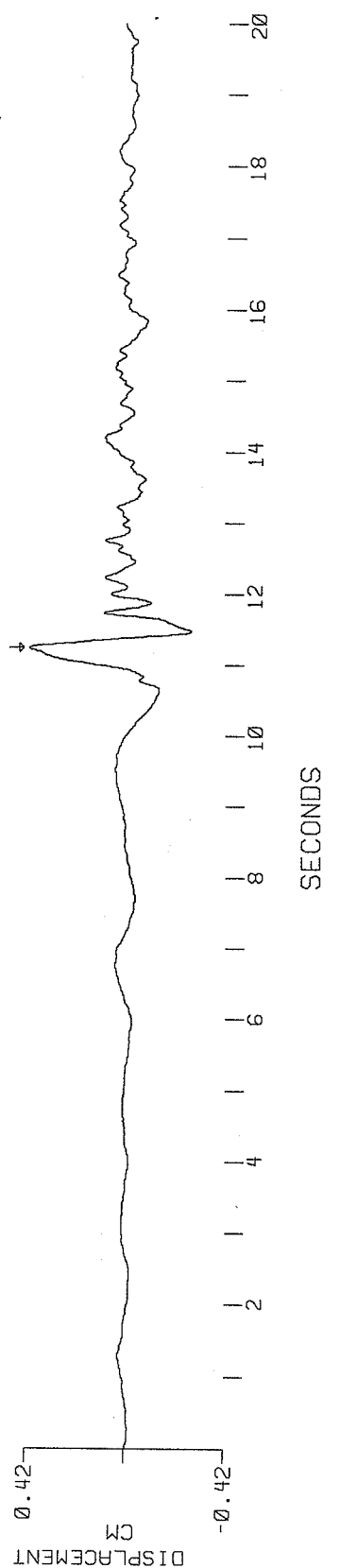
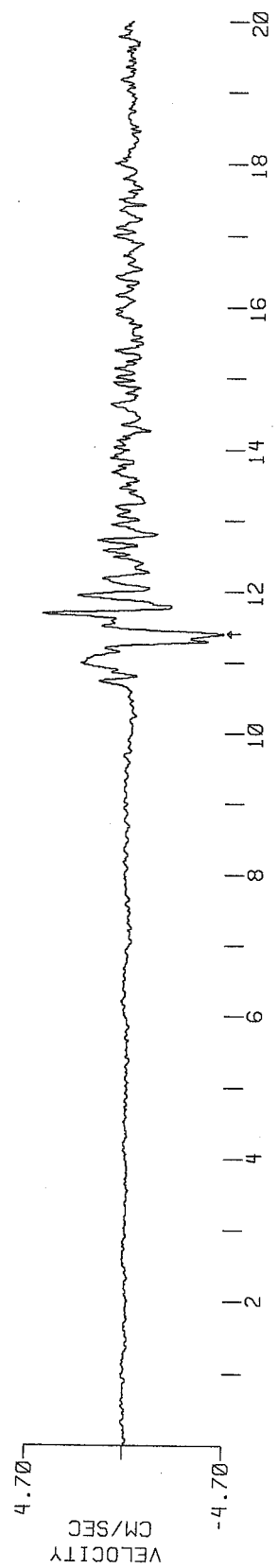
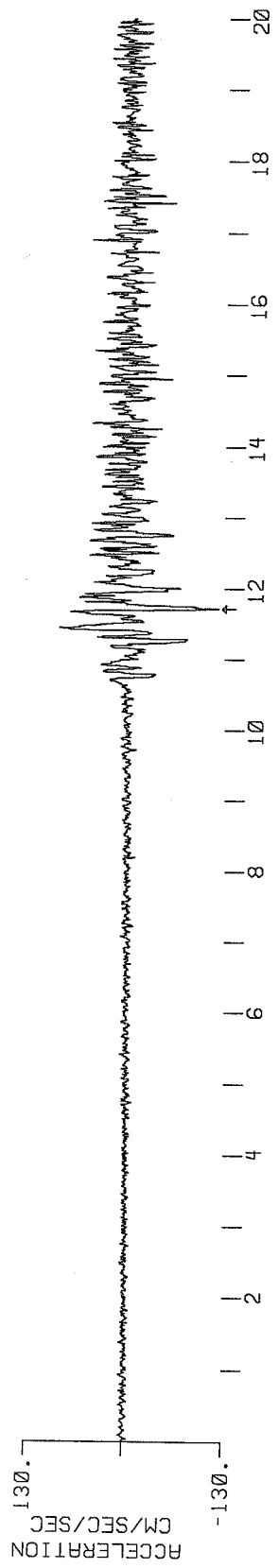
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 8: LA MALBAIE QUEBEC

+L = 63 DEGREES: AZ. = 123 DEG.: DIST. = 93 KM

4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=-121.82 CM/SEC/SEC. VELOCITY=-4.65 CM/SEC. DISPL=0.41 CM

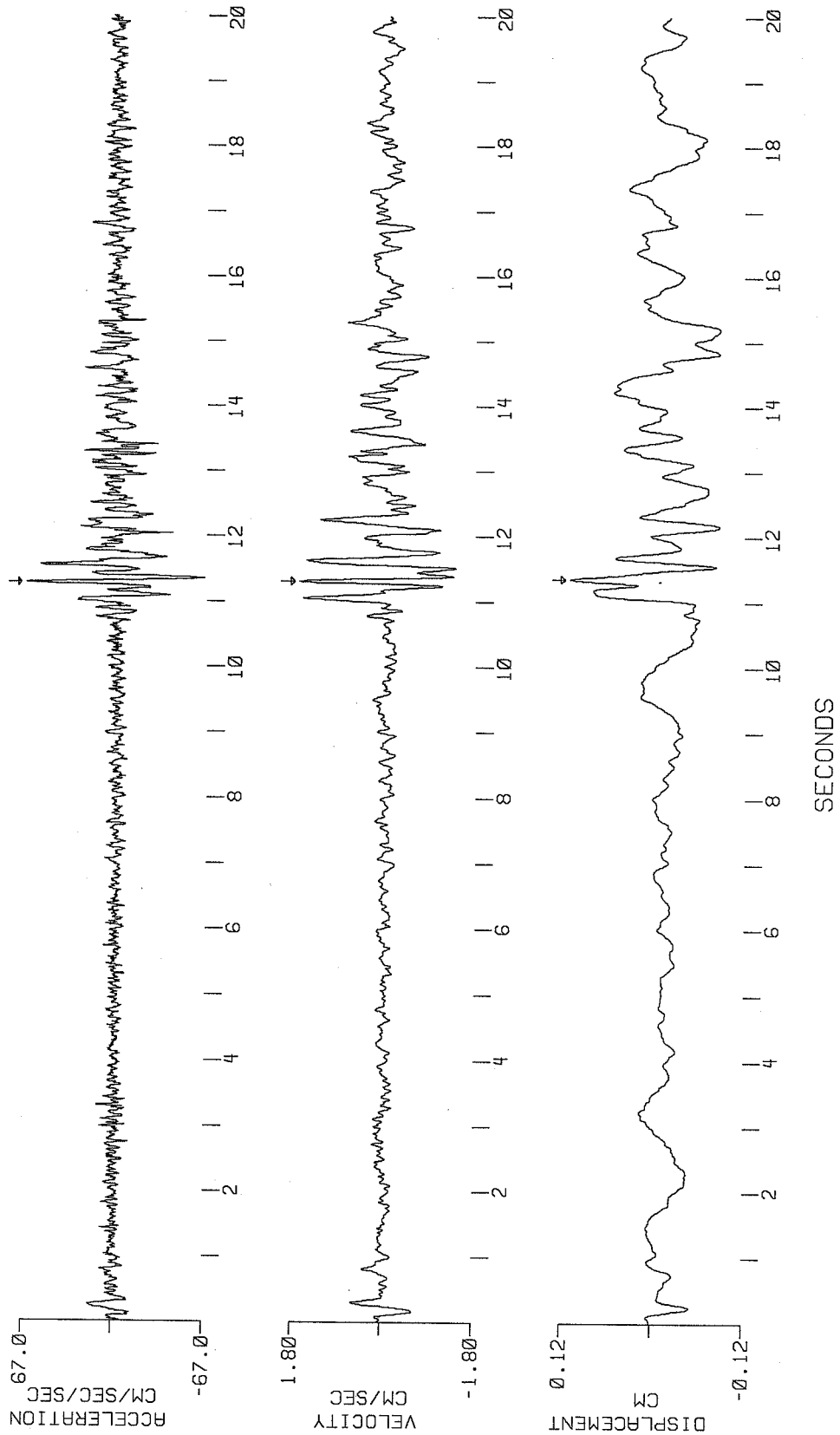


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 8: LA MALBAIE, QUEBEC
VERTICAL: AZ. = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=66.51 CM/SEC/SEC, VELOCITY=1.72 CM/SEC, DISPL=0.11 CM

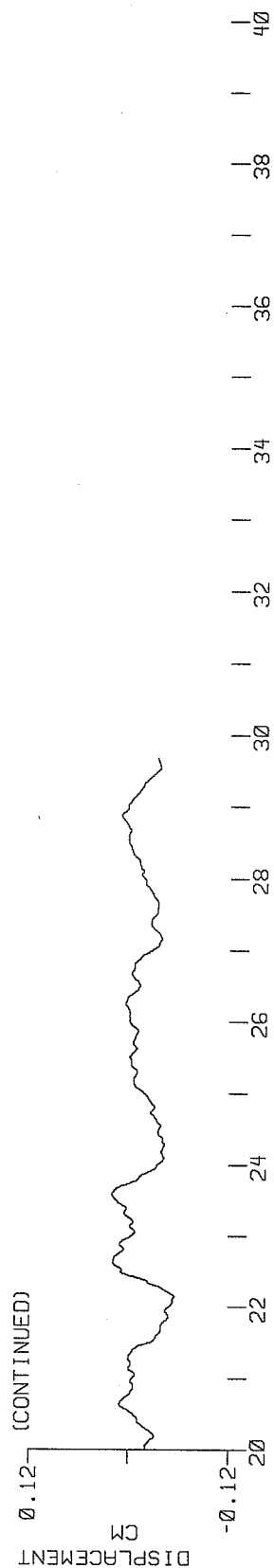
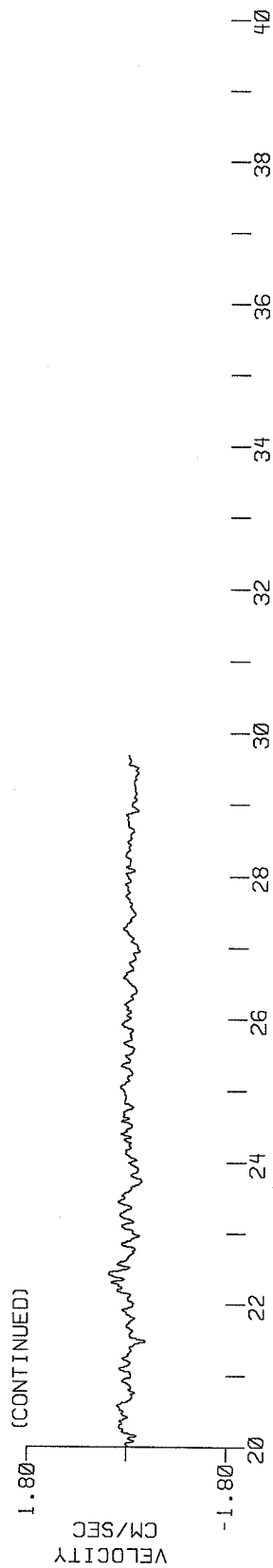
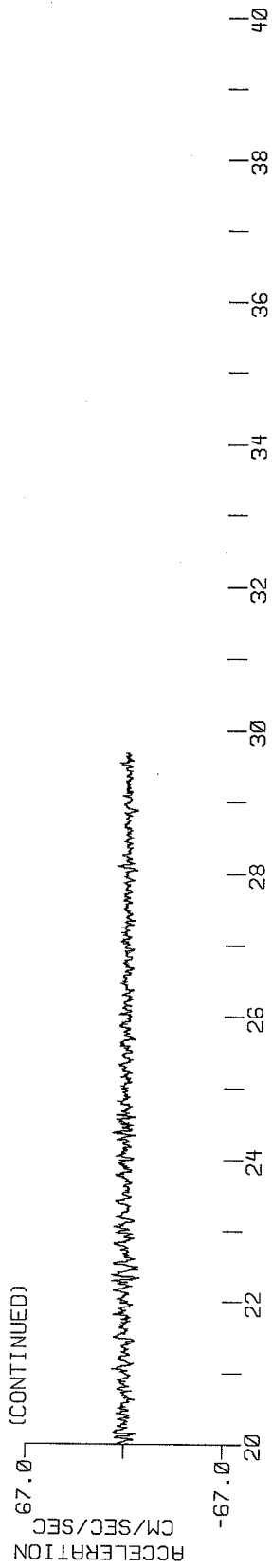


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC

VERTICAL: AZ. = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=66.51 CM/SEC/SEC. VELOCITY=1.72 CM/SEC. DISPL=0.11 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

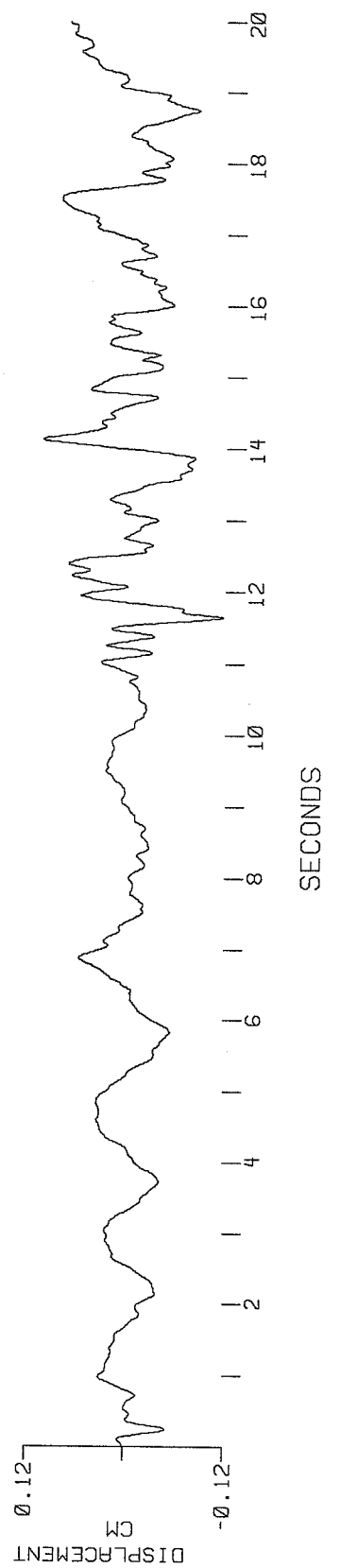
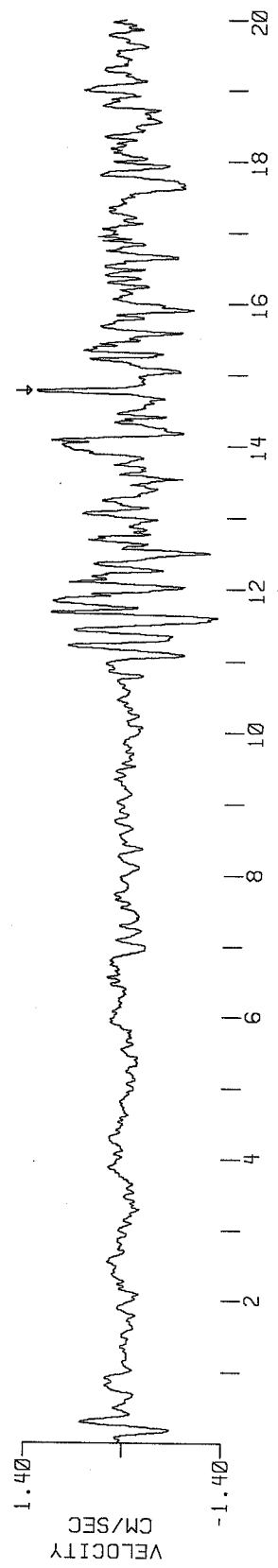
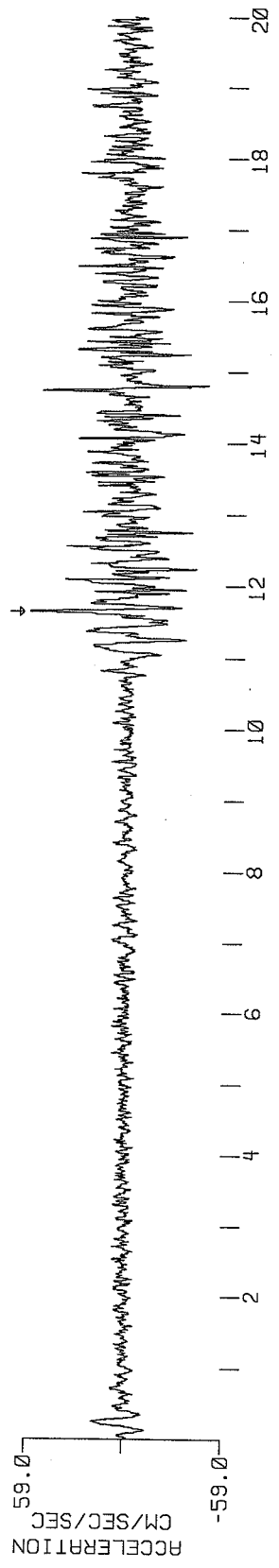
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 8: LA MALBAIE, QUEBEC

+T = 333 DEGREES: AZ. = 123 DEG.: DIST. = 93 KM

4TH-ORDER BUTTERWORTH AT 0.333 HZ

PEAK VALUES: ACCEL=58.73 CM/SEC/SEC, VELOCITY=1.33 CM/SEC, DISPL=-0.12 CM

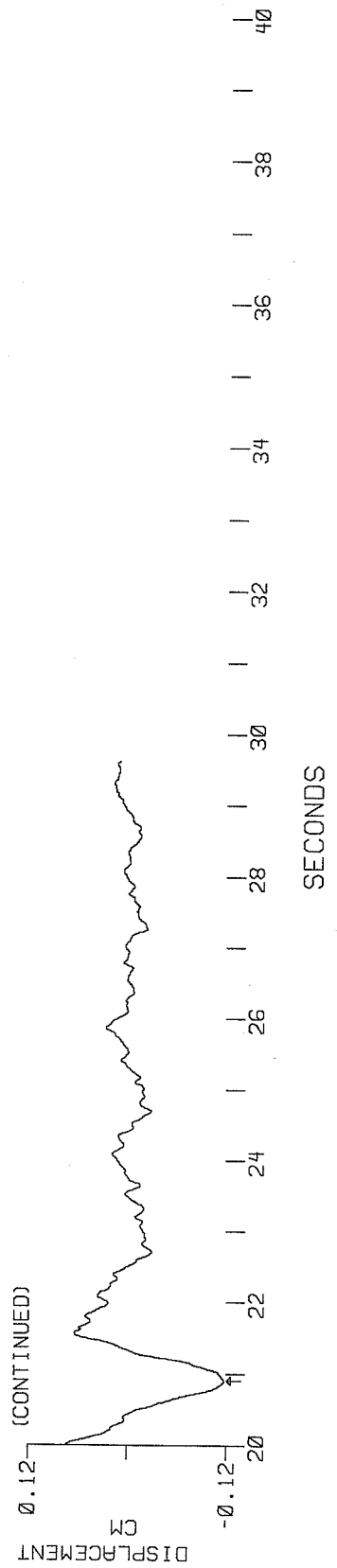
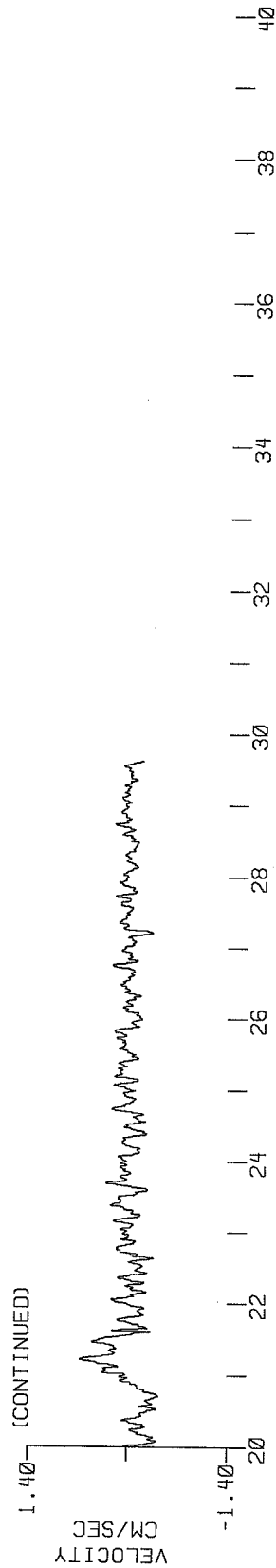
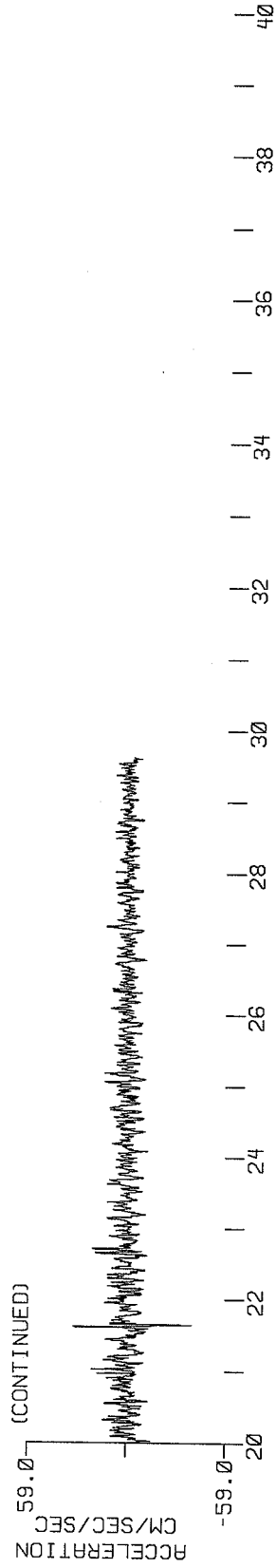


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

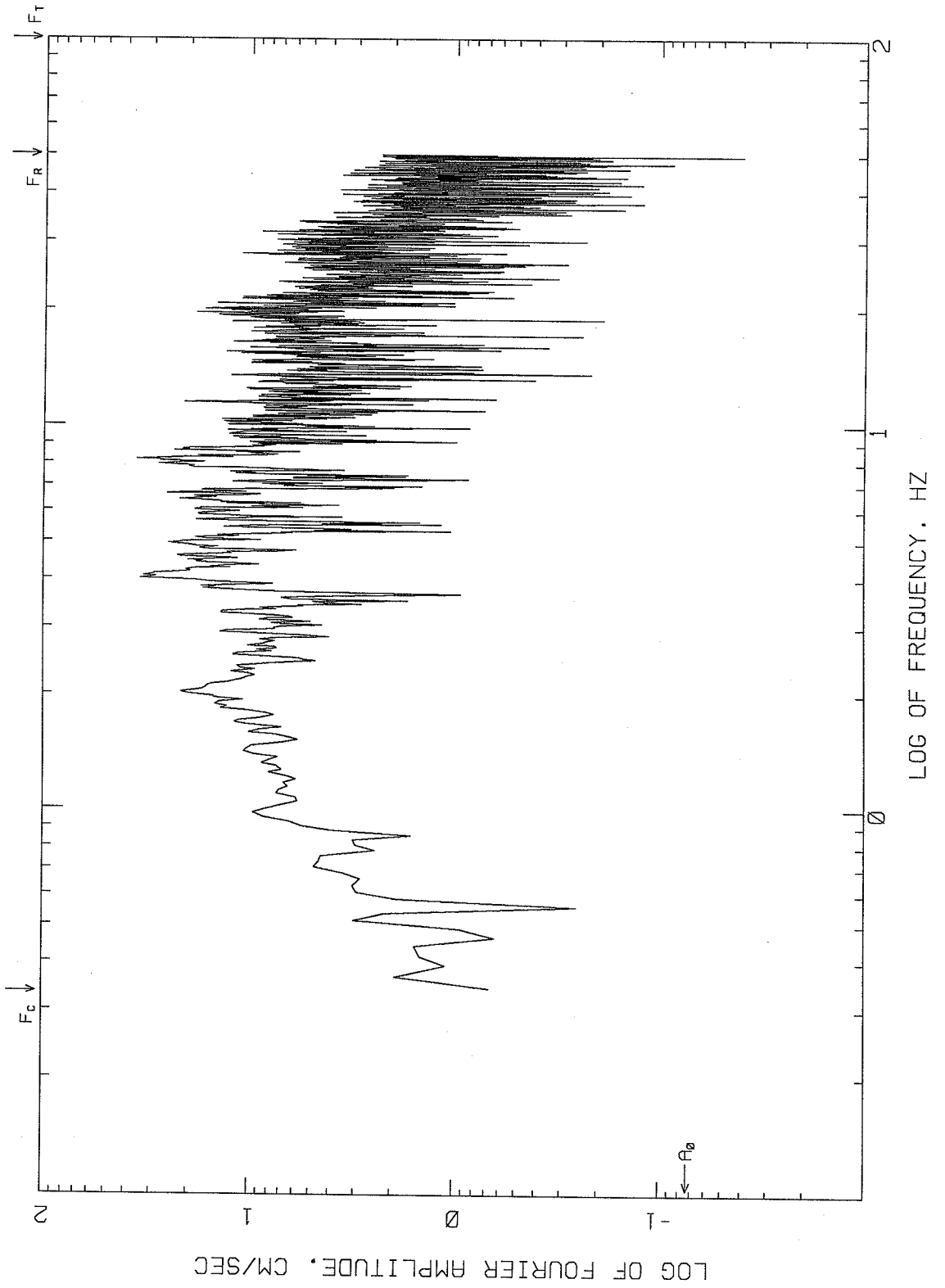
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC

+T = 333 DEGREES: AZ. = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ

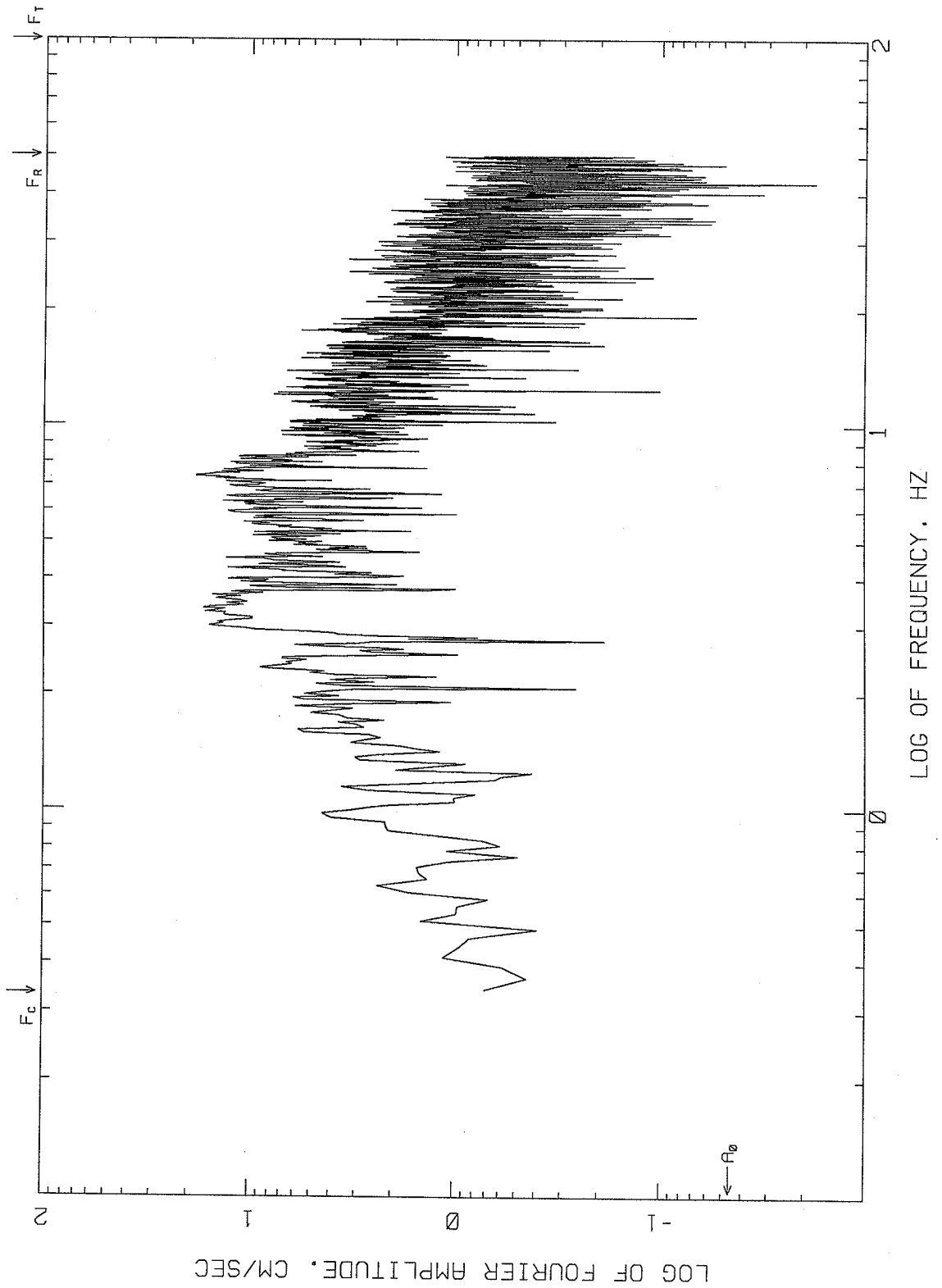
PEAK VALUES: ACCEL=58.73 CM/SEC/SEC, VELOCITY=1.33 CM/SEC, DISPL=-0.12 CM



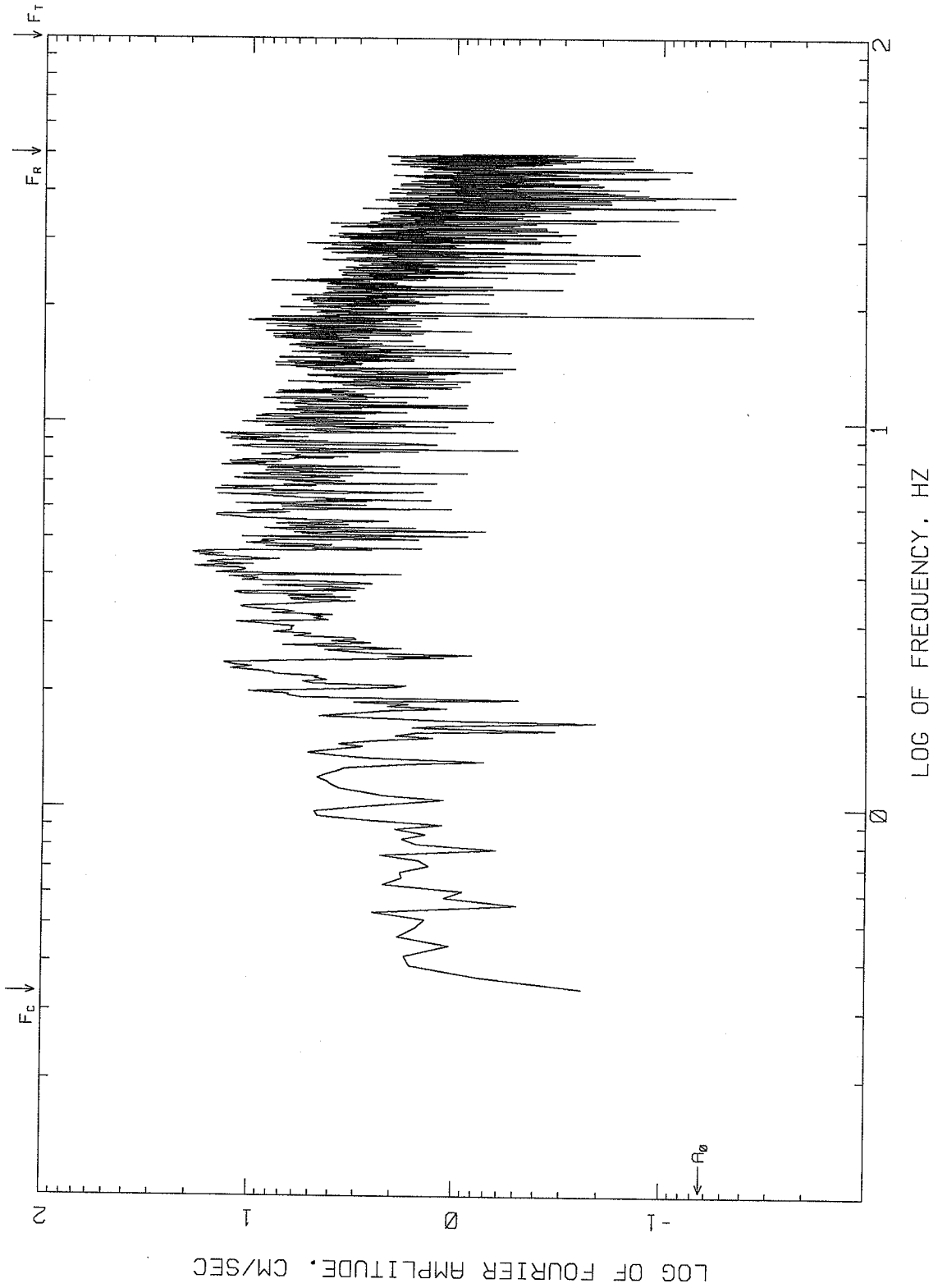
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC
+L = 63 DEGREES; AZ. = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



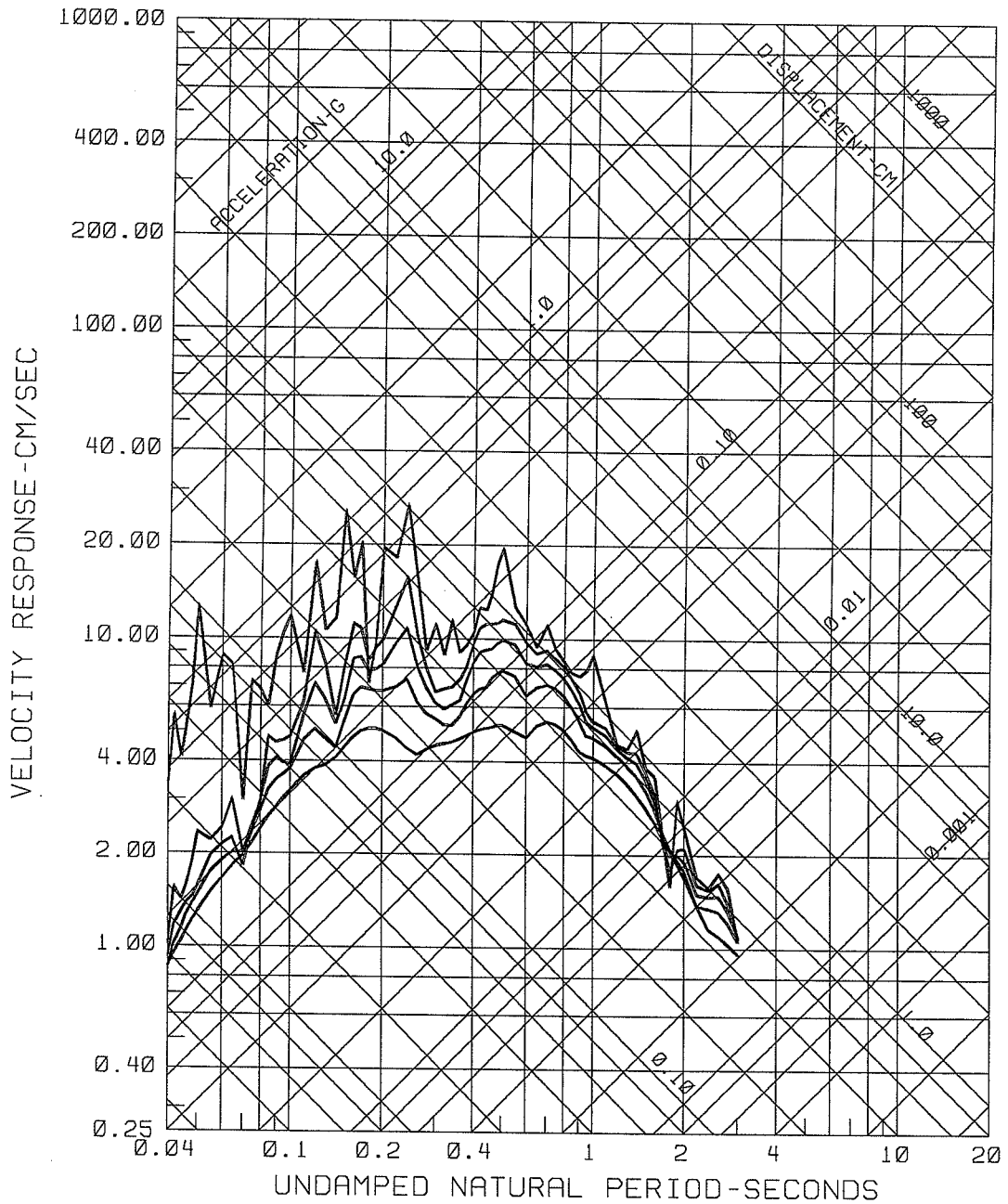
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC
VERTICAL: AZ = 123 DEG.; DIST = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



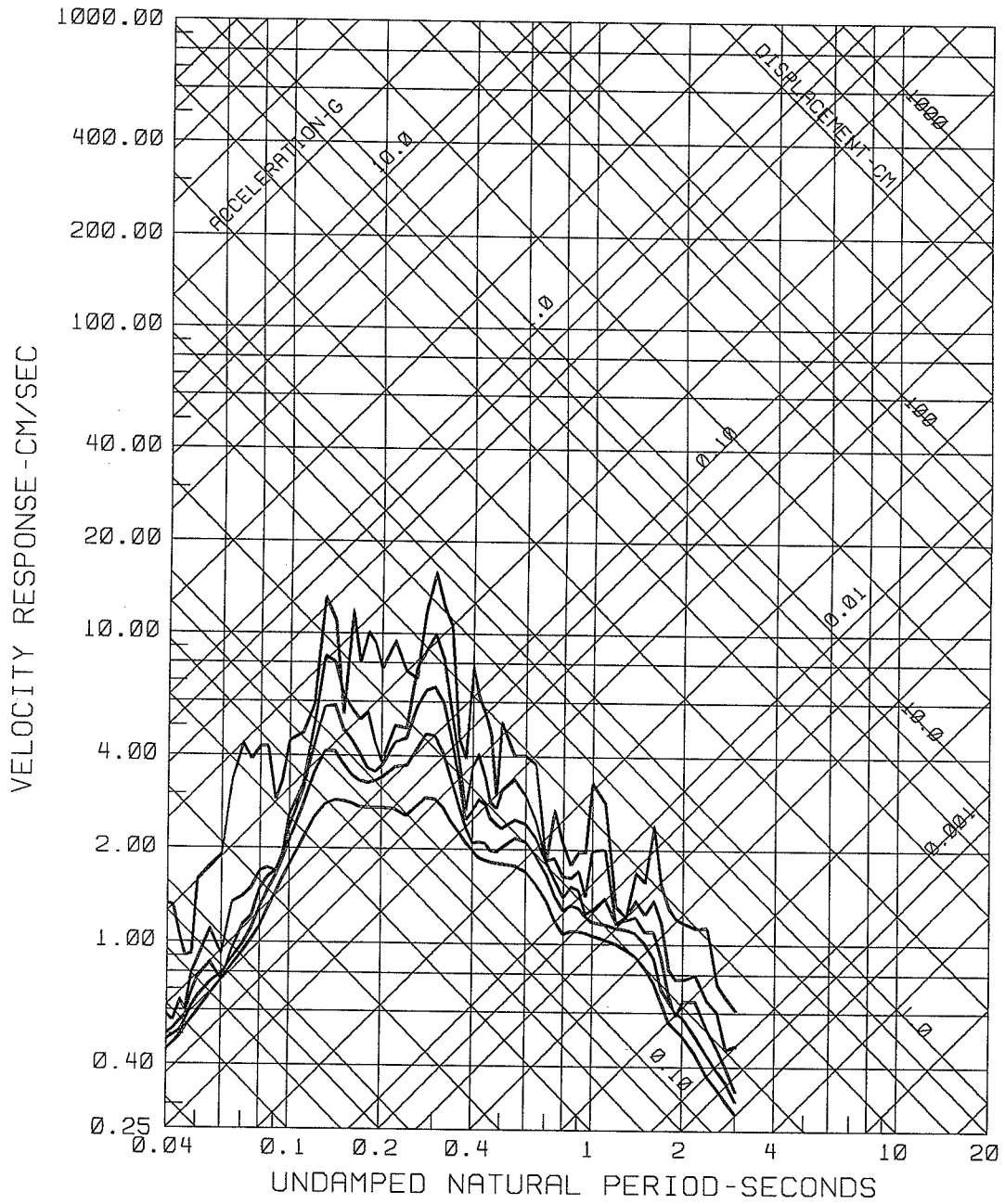
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 8: LA MALBAIE, QUEBEC
+T = 333 DEGREES; AZ = 123 DEG.; DIST. = 93 KM
4TH-ORDER BUTTERWORTH AT 0.333 HZ
COMPUTING OPTIONS= ZCROSS, NONOISE



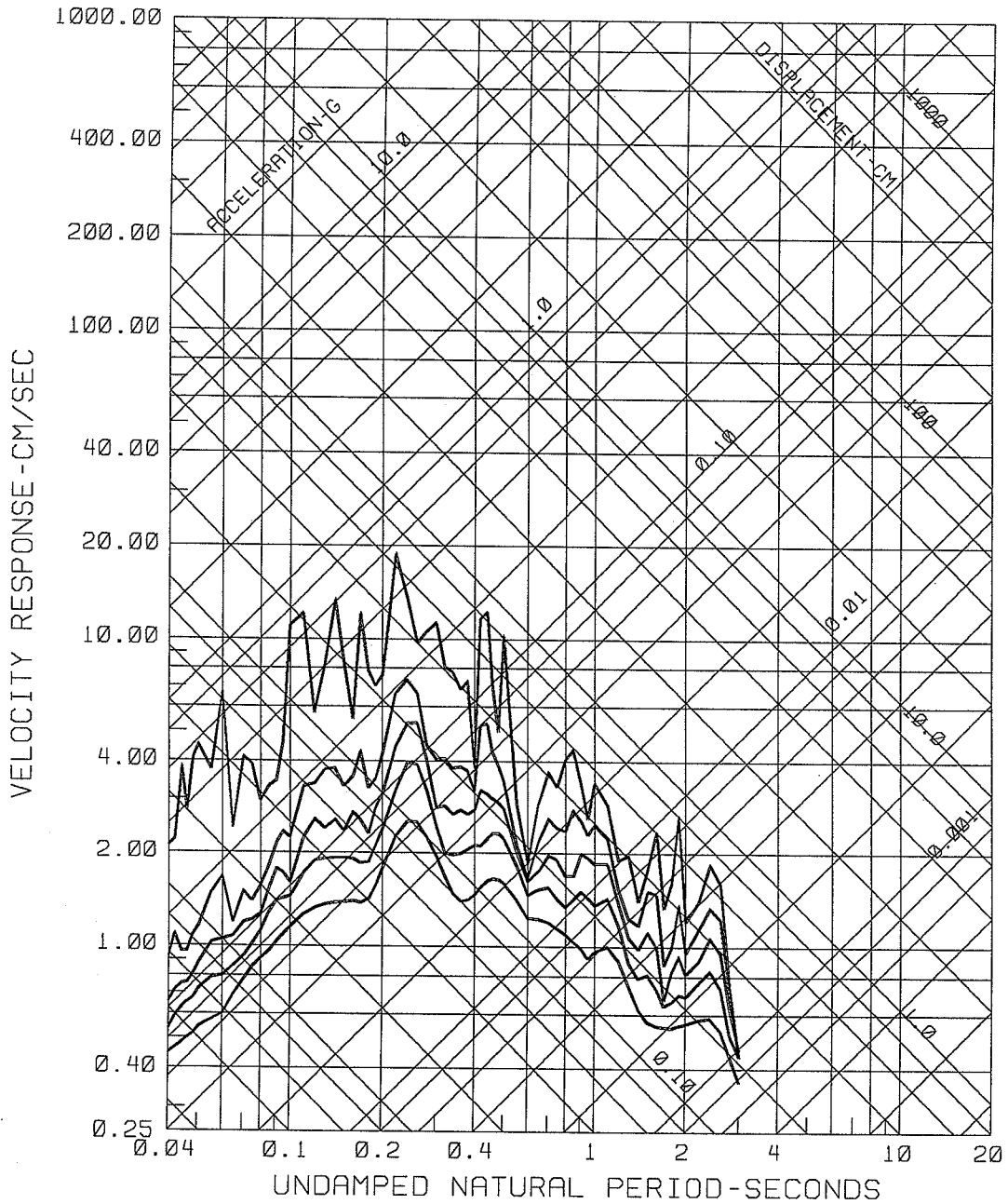
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 8: LA MALBAIE (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 8: LA MALBAIE (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



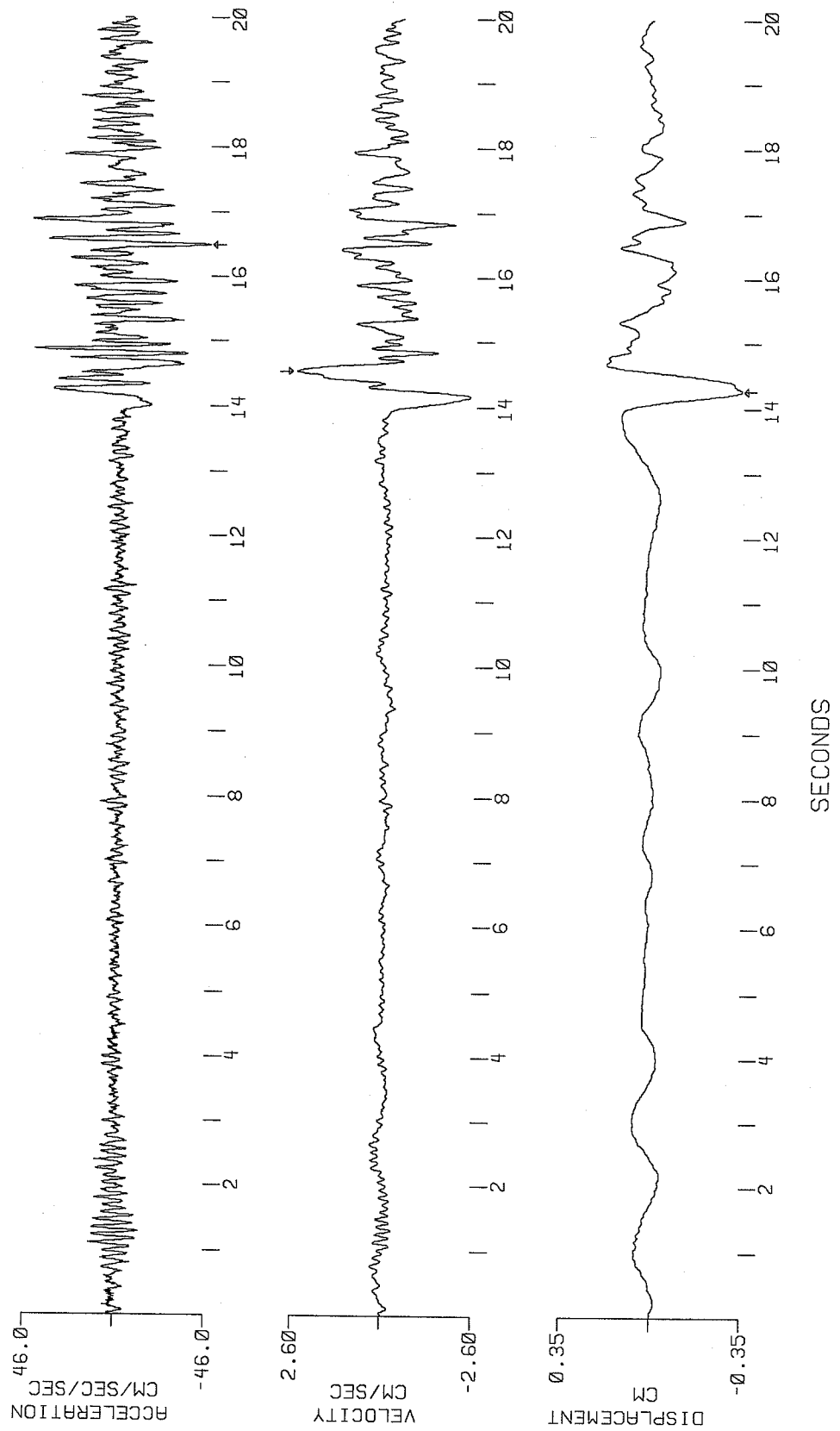
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 8: LA MALBAIE (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.333 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC

+L = 0 DEGREES: AZ. = 122 DEG.: DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

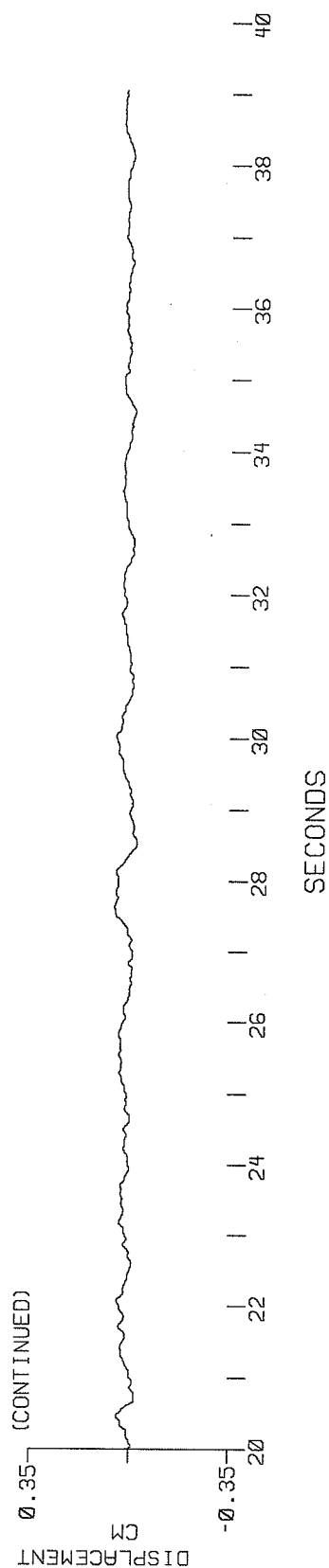
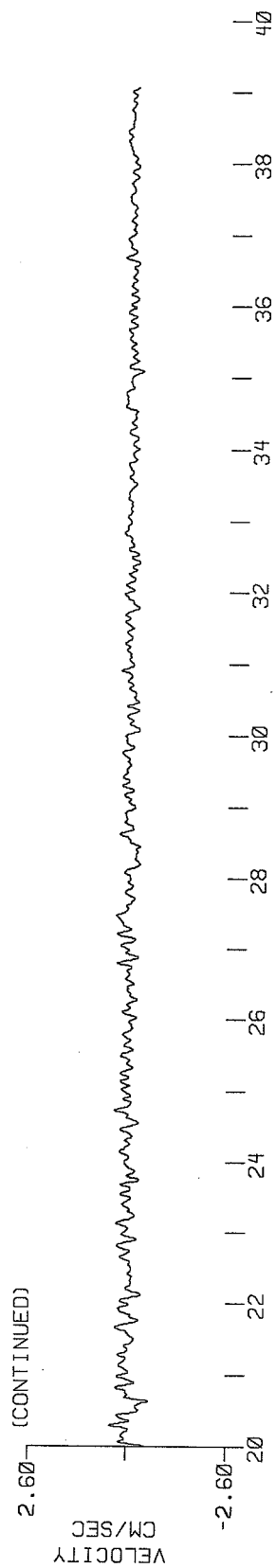
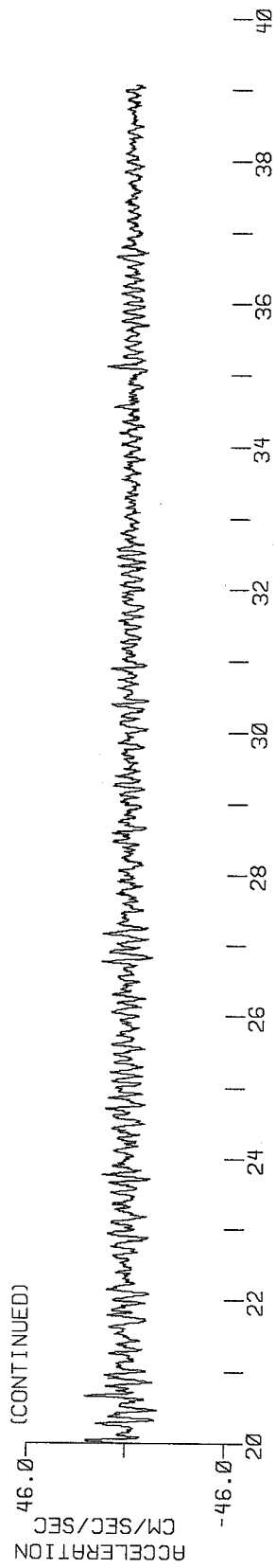
PEAK VALUES: ACCEL = -45.46 CM/SEC/SEC. VELOCITY = 2.60 CM/SEC. DISPL = -0.34 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC

+L = 0 DEGREES: AZ. = 122 DEG.: DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

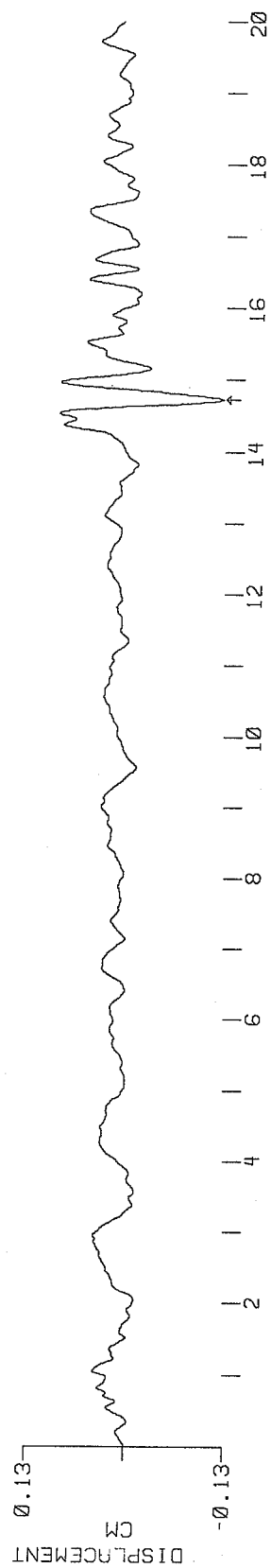
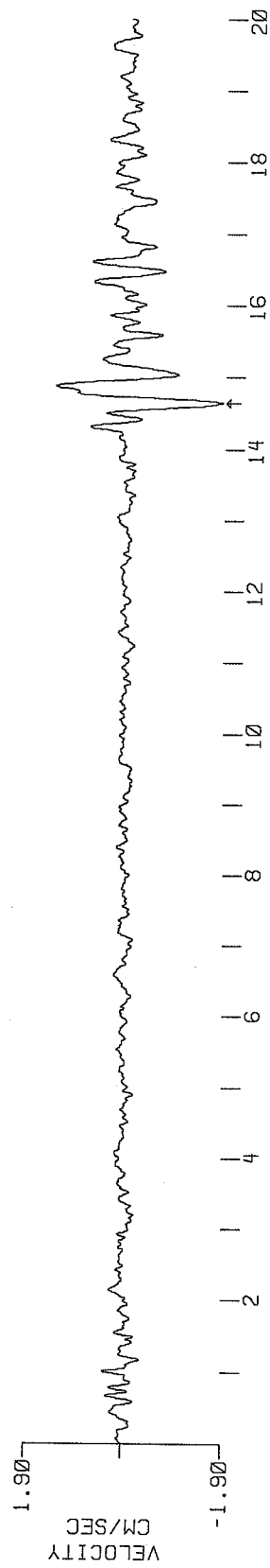
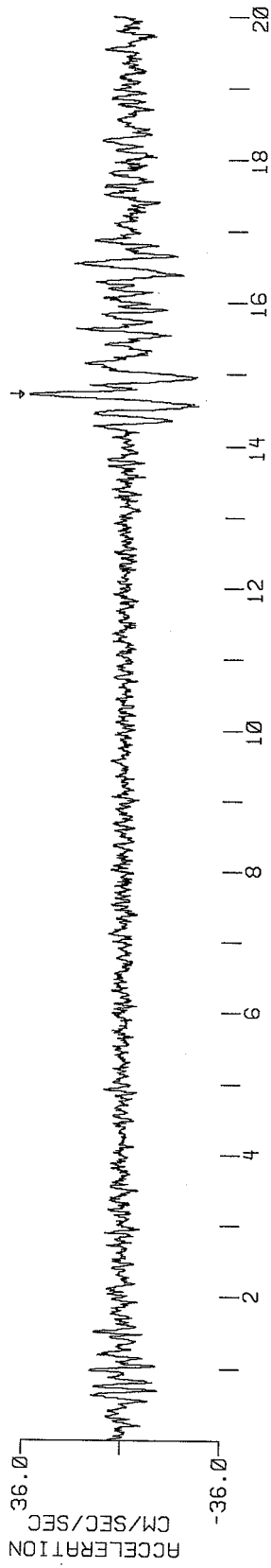
PEAK VALUES: ACCEL = -45.46 CM/SEC/SEC, VELOCITY = 2.60 CM/SEC, DISPL = -0.34 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC

VERTICAL: AZ. = 122 DEG.; DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=35.91 CM/SEC/SEC. VELOCITY=-1.85 CM/SEC. DISPL=-0.13 CM

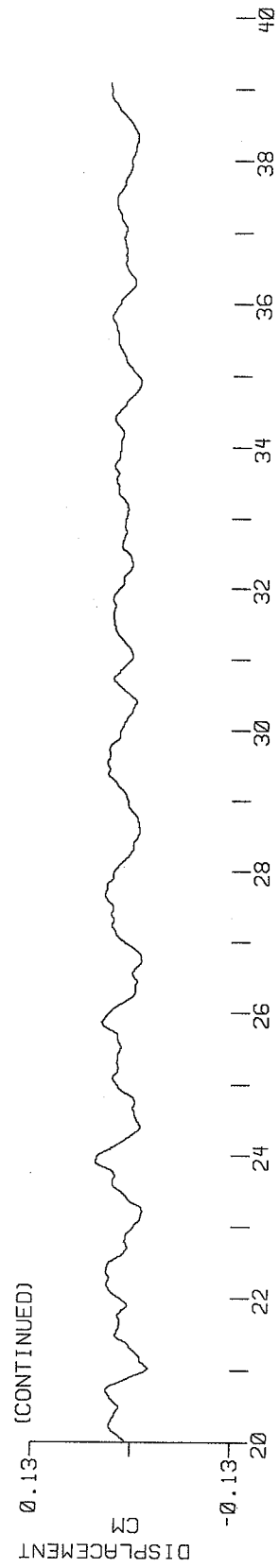
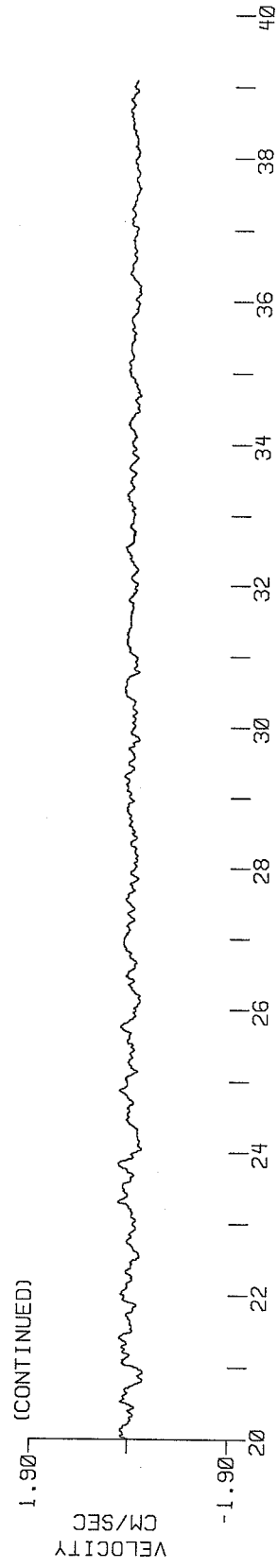
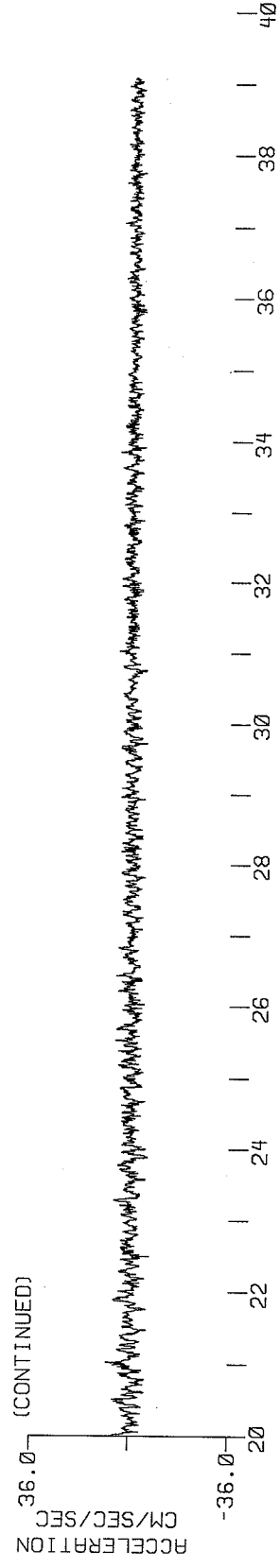


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 9: ST-PASCAL, QUEBEC

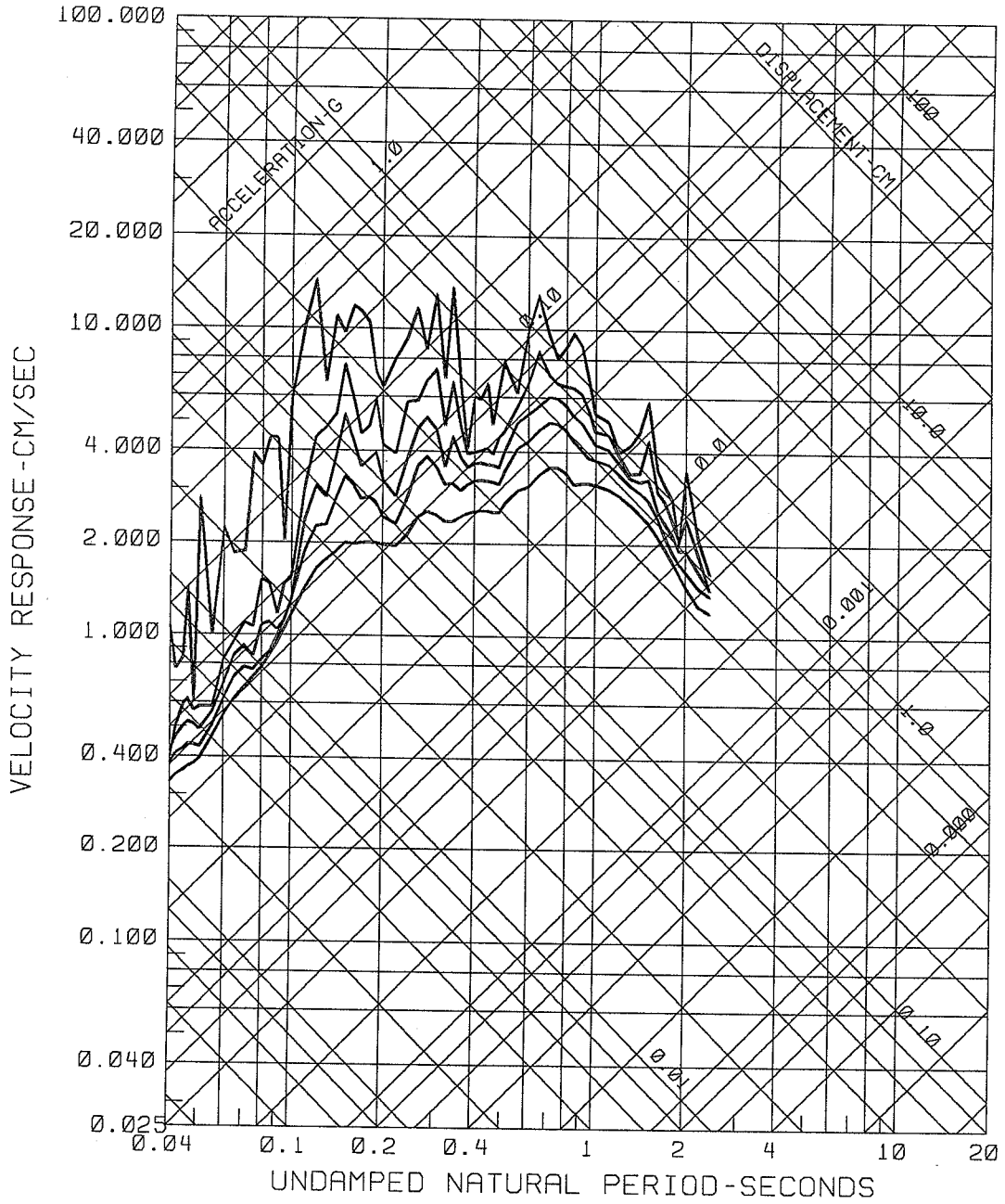
VERTICAL: AZ. = 122 DEG.; DIST. = 123 KM
 4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=35.91 CM/SEC/SEC. VELOCITY=-1.85 CM/SEC. DISPL=-0.13 CM

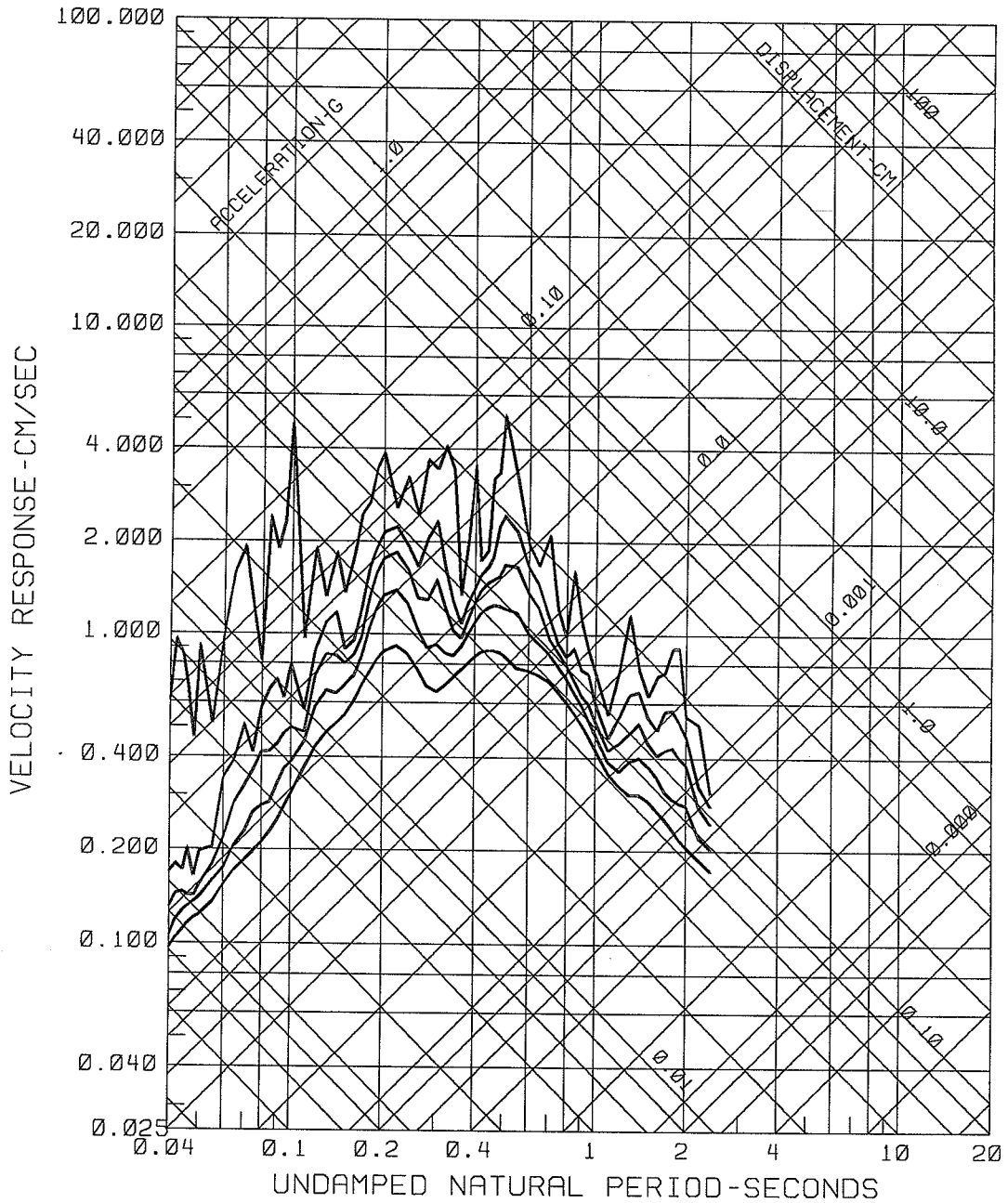


SECONDS

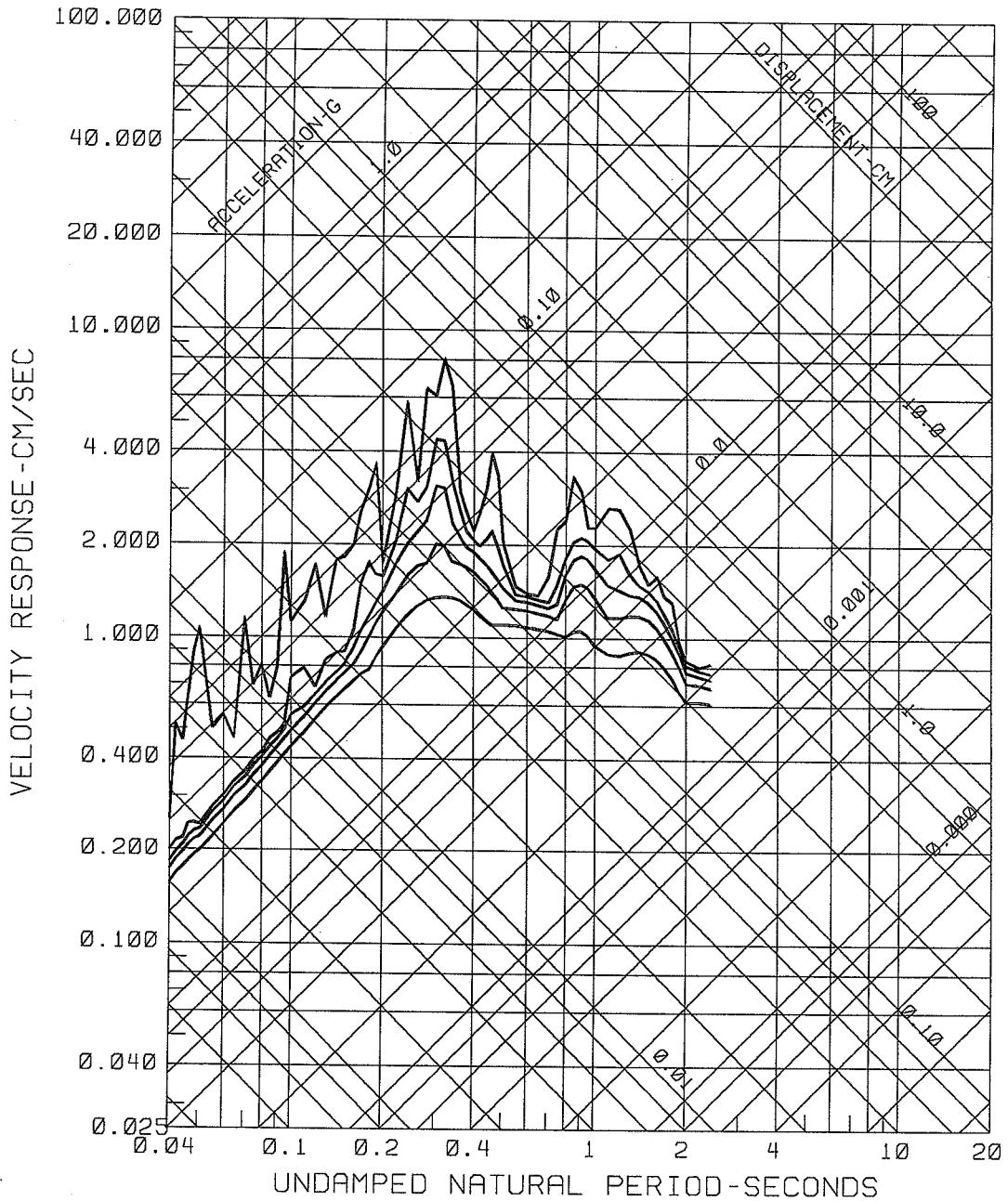
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 9: ST-PASCAL (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



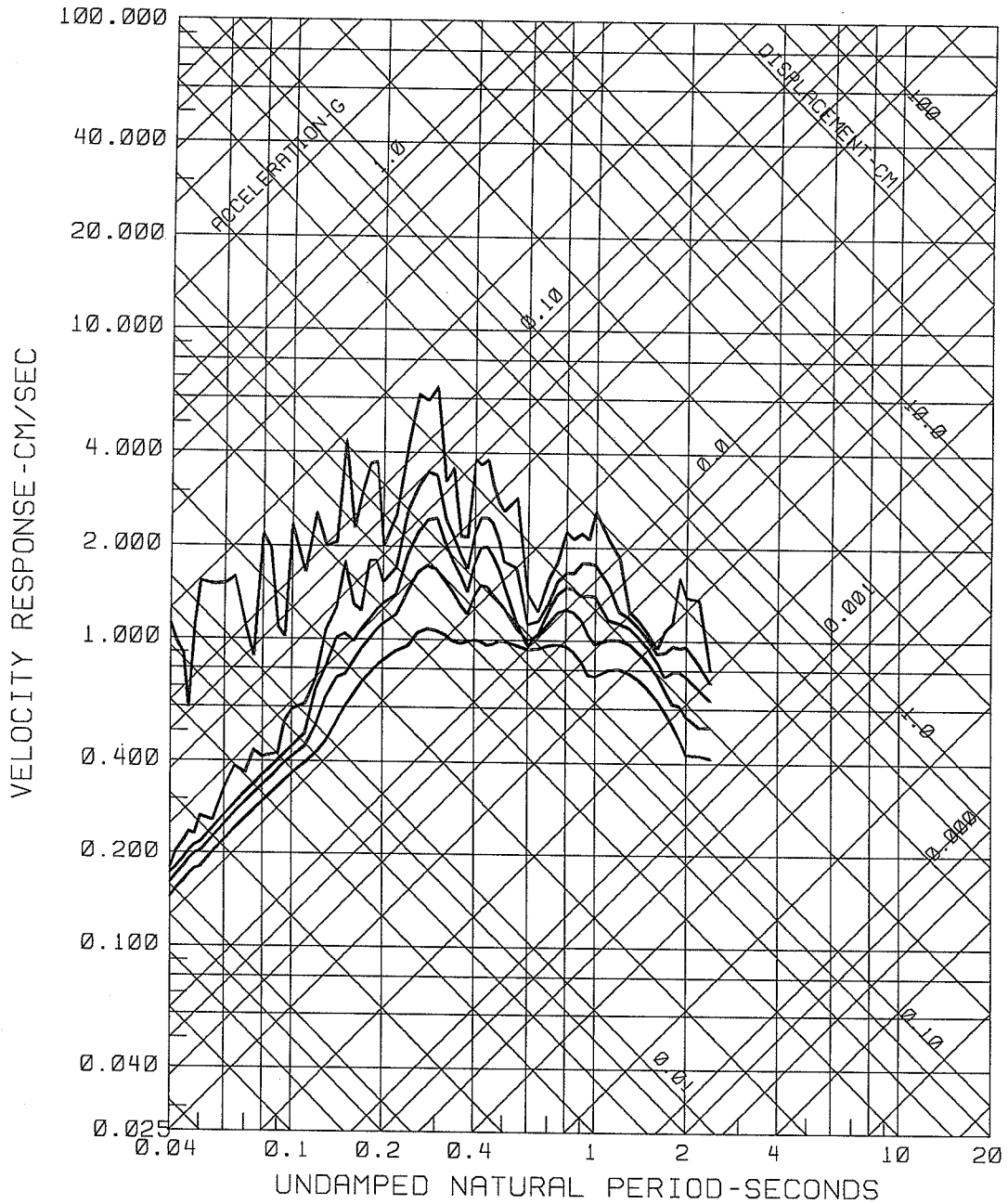
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 14: STE-LUCIE (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 14: STE-LUCIE (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 14: STE-LUCIE (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

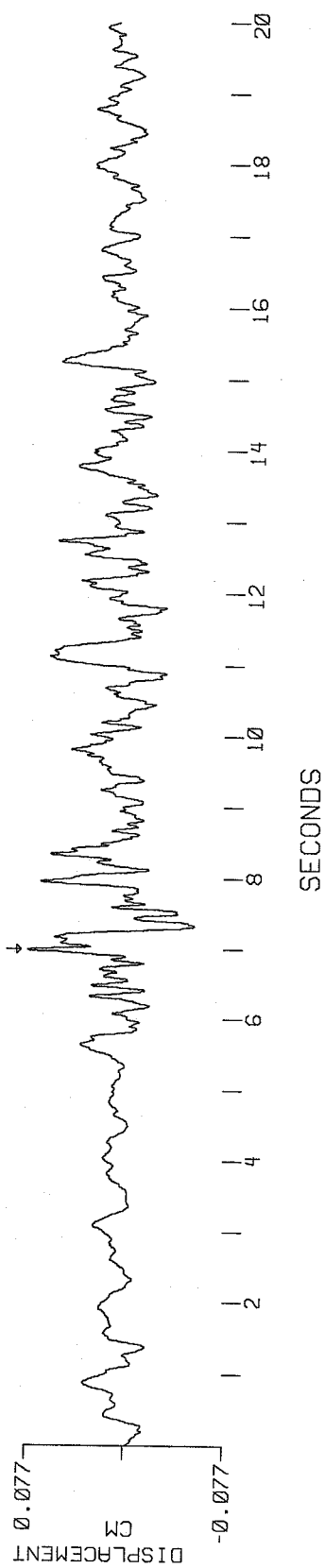
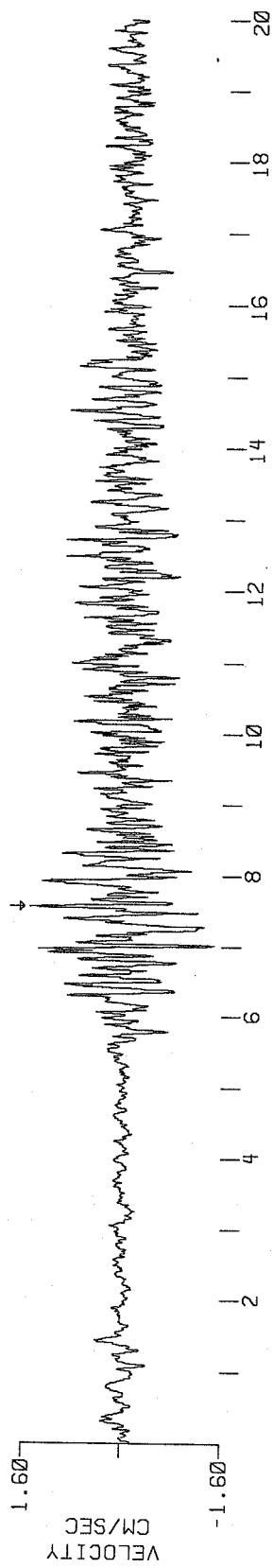
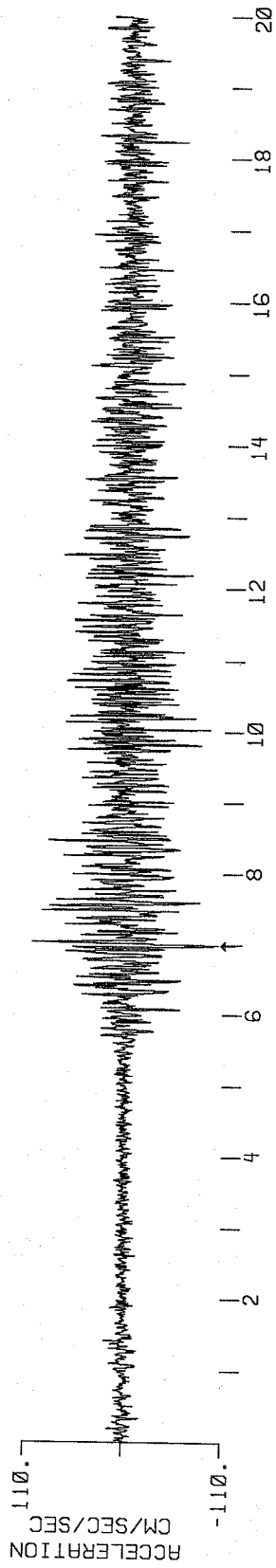
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 16: CHICOUTIMI-NORD; QUEBEC

+L = 214 DEGREES; AZ. = 18 DEG.; DIST. = 43 KM

4TH-ORDER BUTTERWORTH AT 0.667 HZ

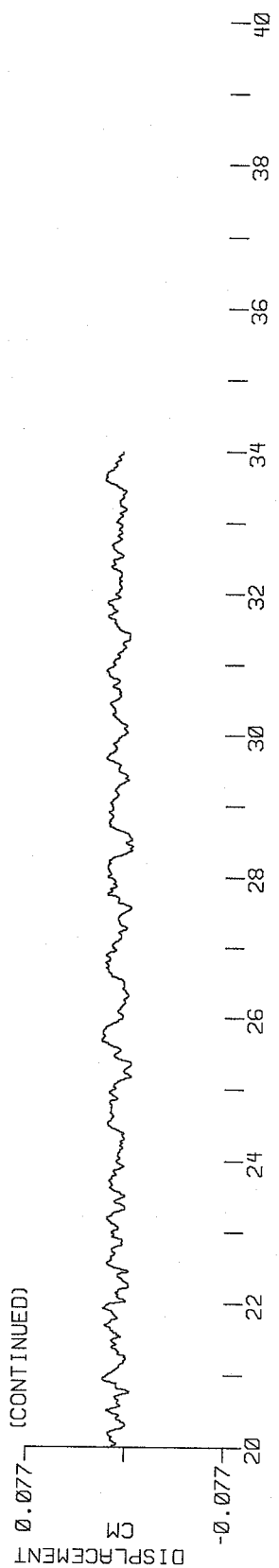
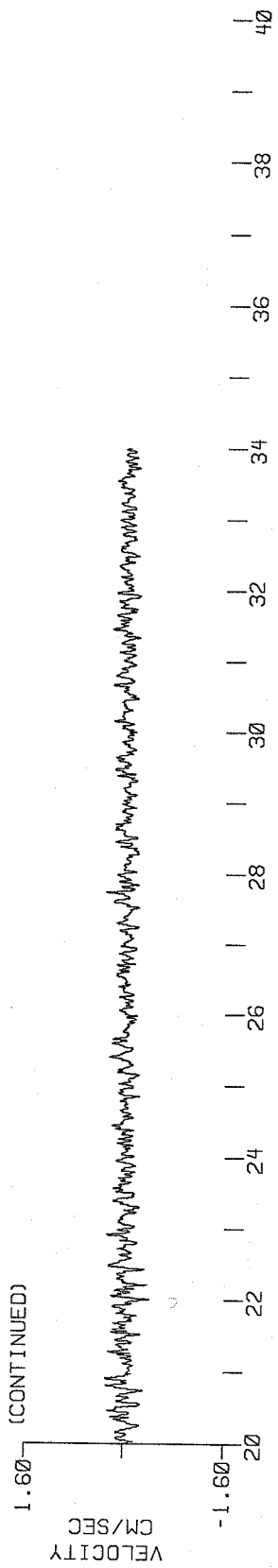
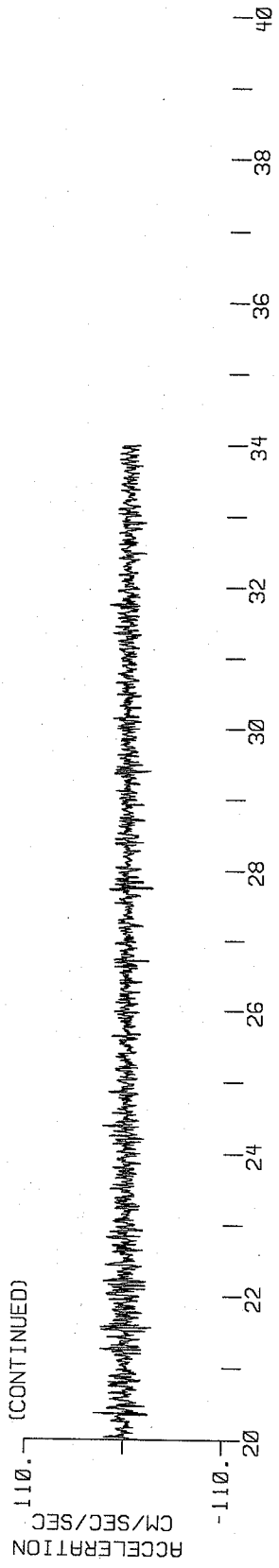
PEAK VALUES: ACCEL = -104.48 CM/SEC/SEC. VELOCITY = 1.51 CM/SEC. DISPL = 0.08 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 23:46 UT
SITE 16: CHICOUTIMI-NORD; QUEBEC
+L = 214 DEGREES; AZ. = 18 DEG.; DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ

PEAK VALUES: ACCEL=-104.48 CM/SEC/SEC. VELOCITY=1.51 CM/SEC. DISPL=0.08 CM

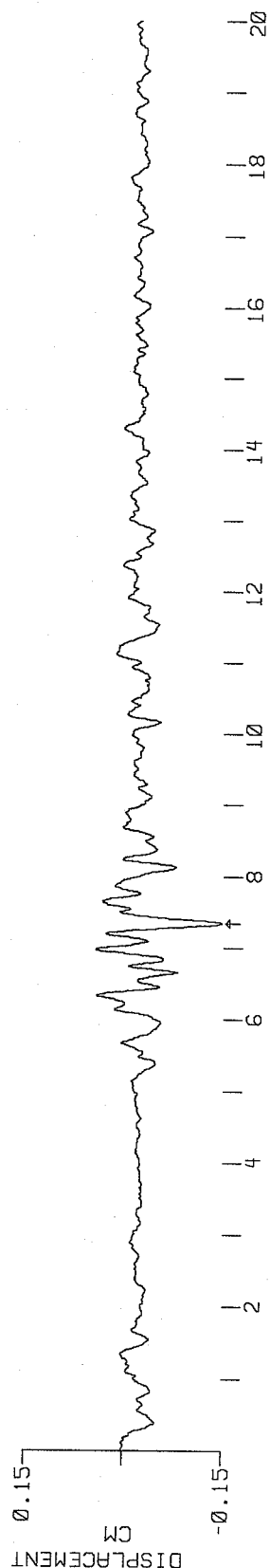
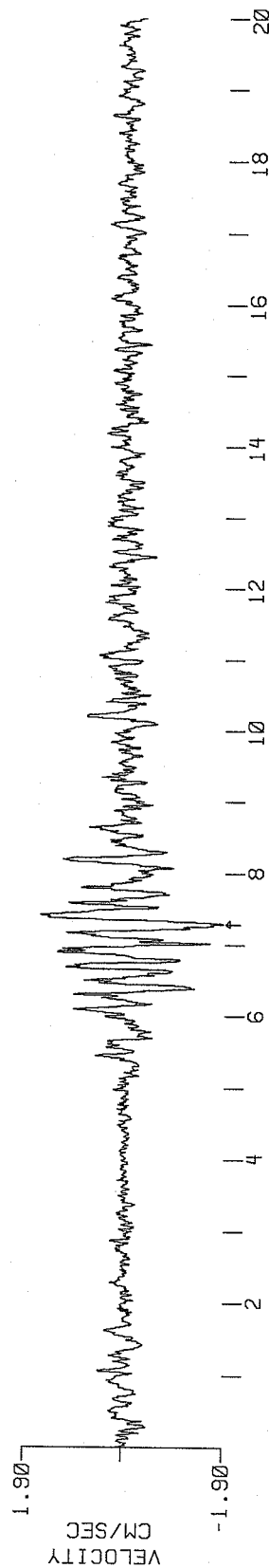
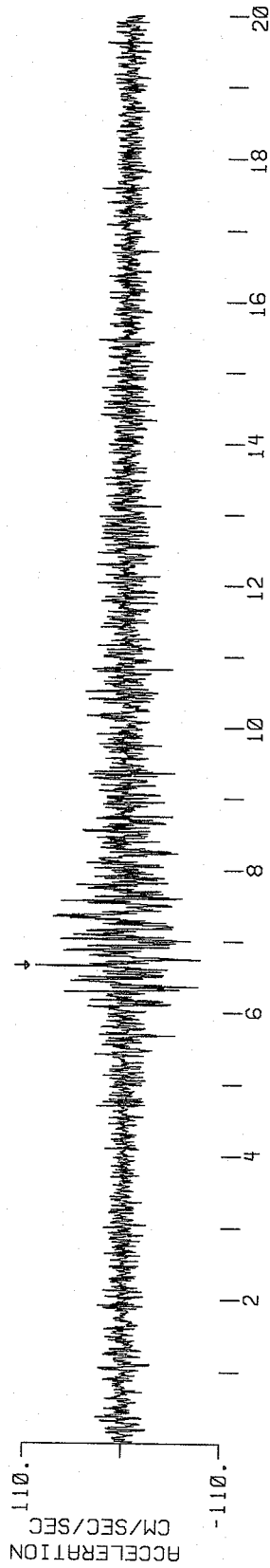


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 23:46 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
VERTICAL: AZ. = 18 DEG.; DIST. = 43 KM

4TH-ORDER BUTTERWORTH AT 0.667 HZ
PEAK VALUES: ACCEL=100.50 CM/SEC/SEC, VELOCITY=-1.85 CM/SEC, DISPL=-0.15 CM

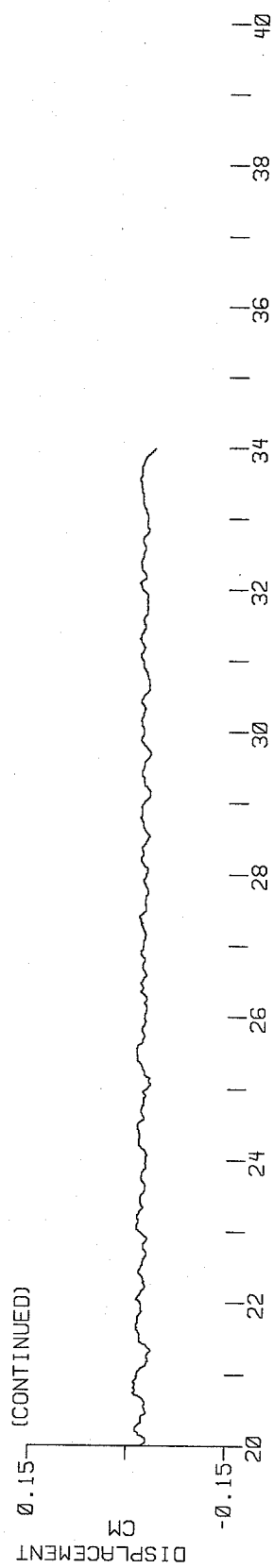
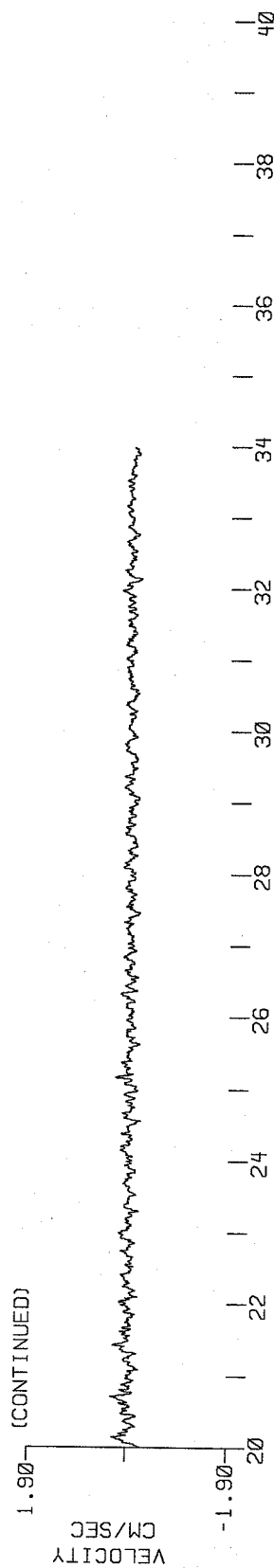
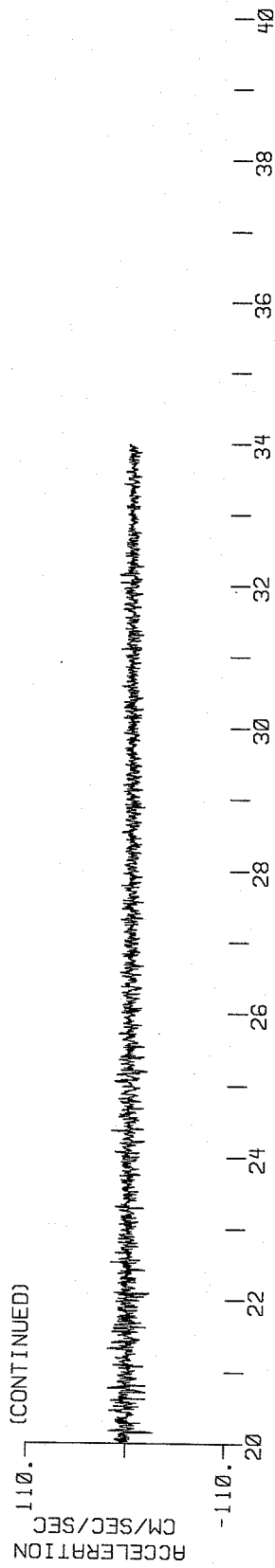


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
VERTICAL: AZ. = 18 DEG.; DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ

PEAK VALUES: ACCEL=100.50 CM/SEC/SEC., VELOCITY=-1.85 CM/SEC, DISPL=-0.15 CM

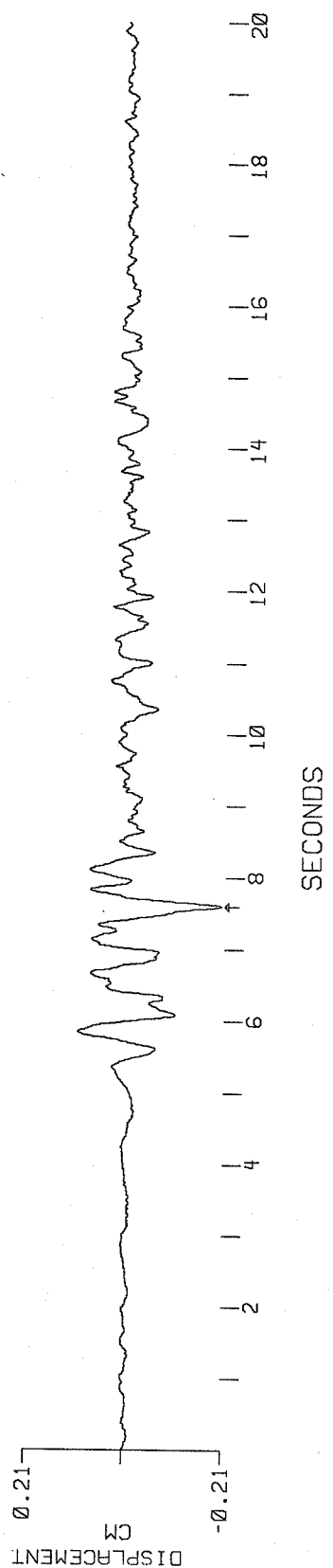
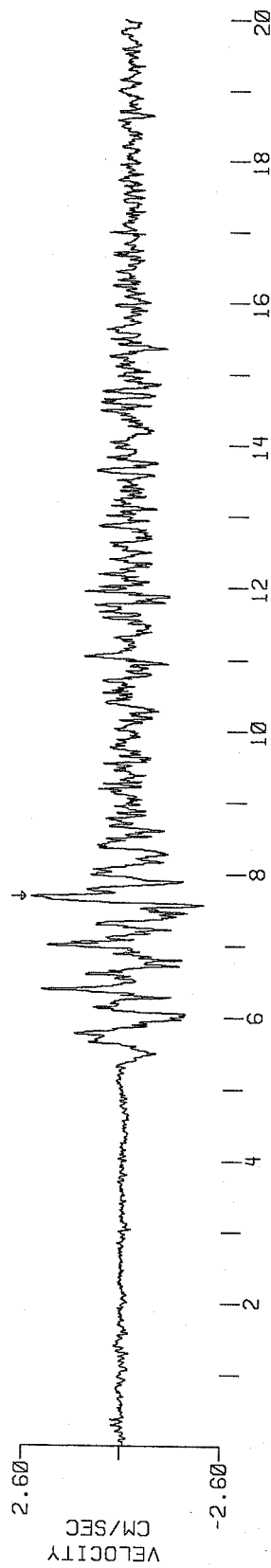
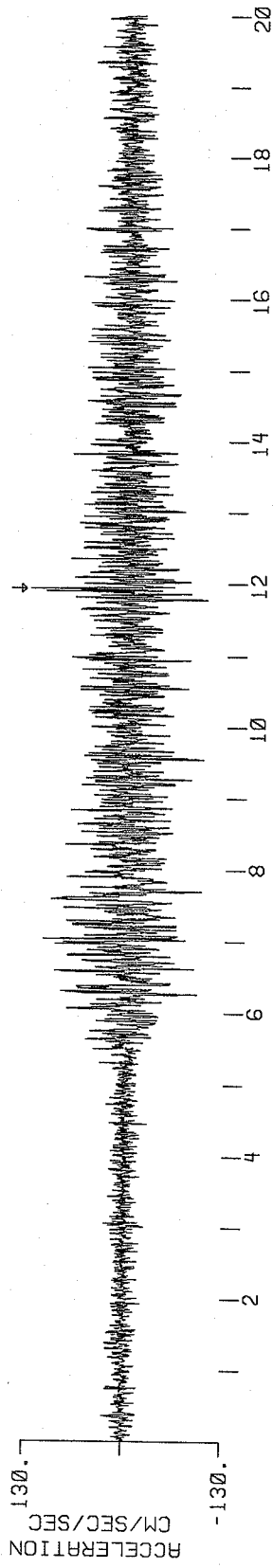


SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
+T = 124 DEGREES: AZ. = 18 DEG.: DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ

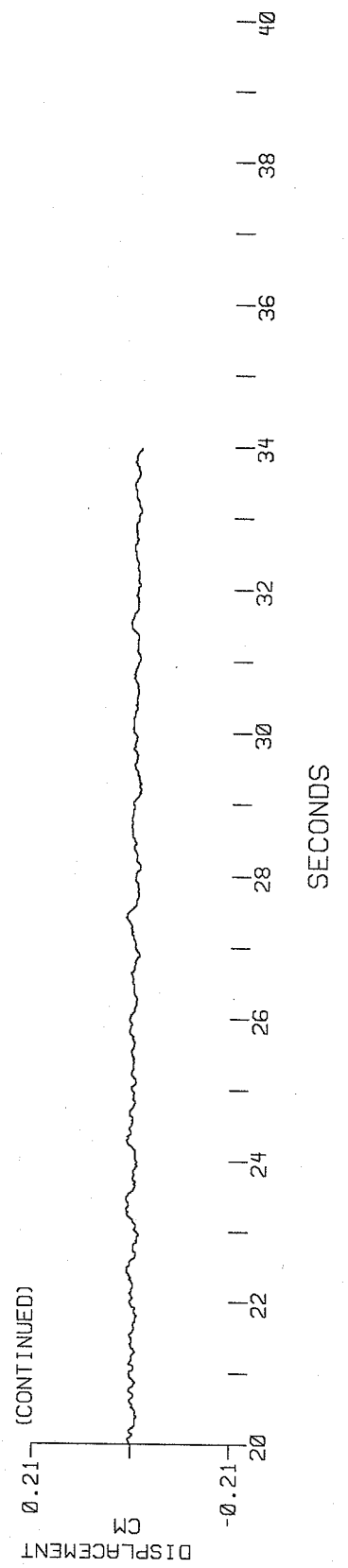
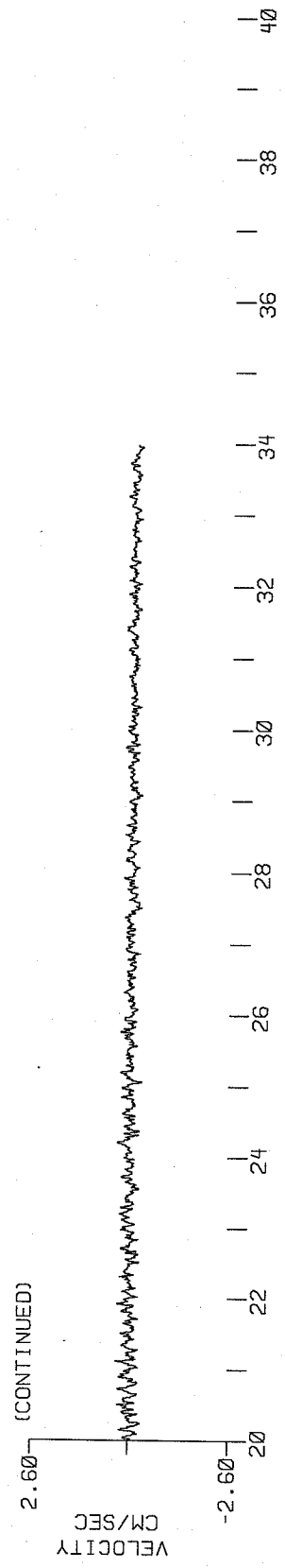
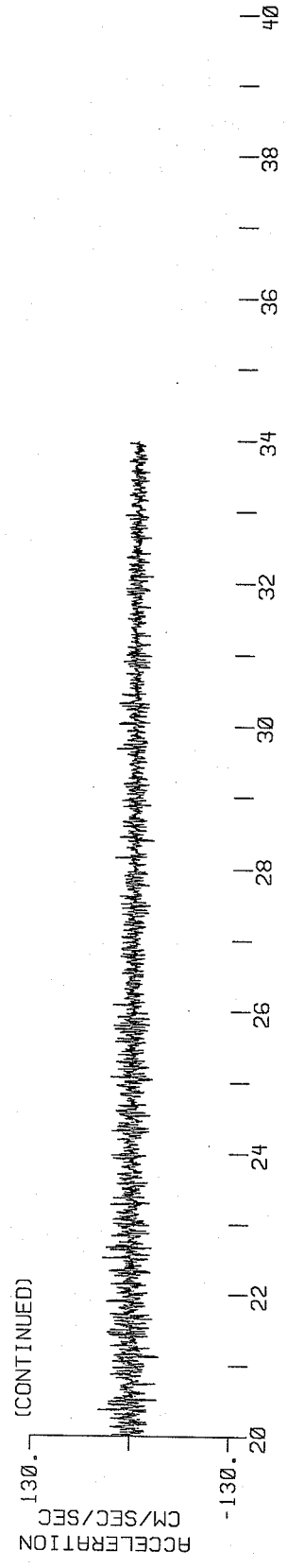
PEAK VALUES: ACCEL=128.66 CM/SEC/SEC. VELOCITY=2.52 CM/SEC. DISPL=-0.20 CM



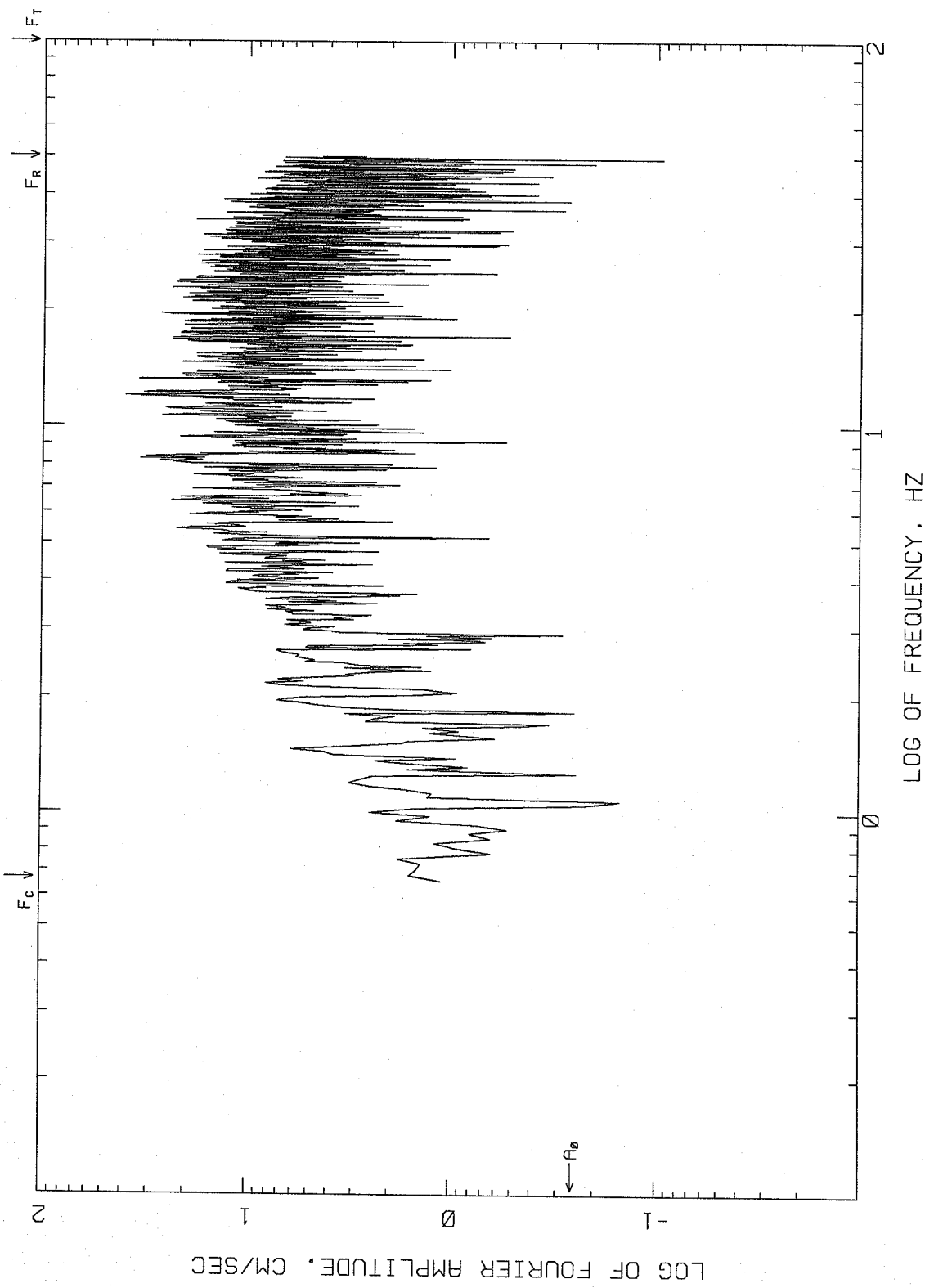
CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
+T = 124 DEGREES: AZ. = 18 DEG.: DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ

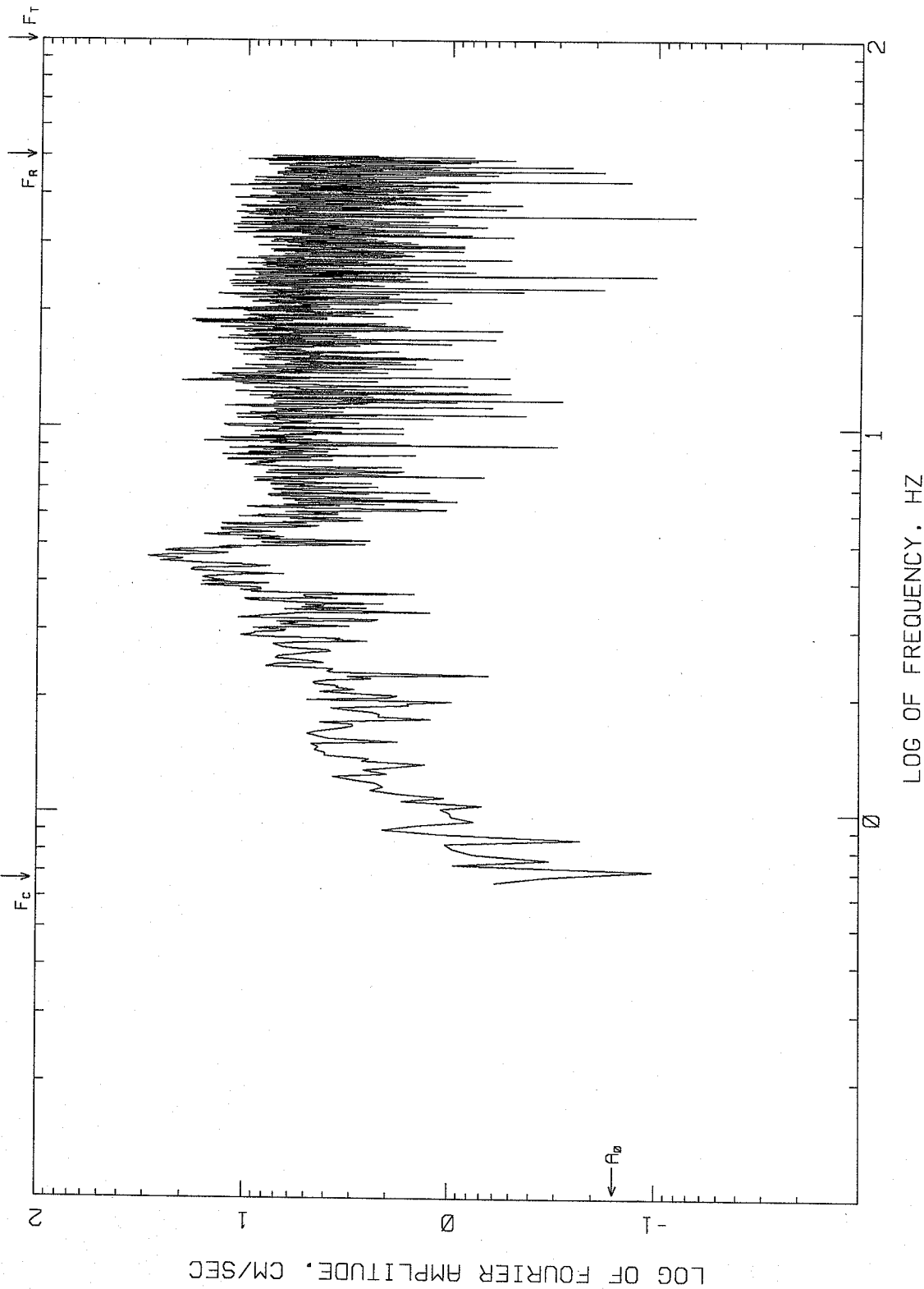
PEAK VALUES: ACCEL=128.66 CM/SEC/SEC. VELOCITY=2.52 CM/SEC. DISPL=-0.20 CM



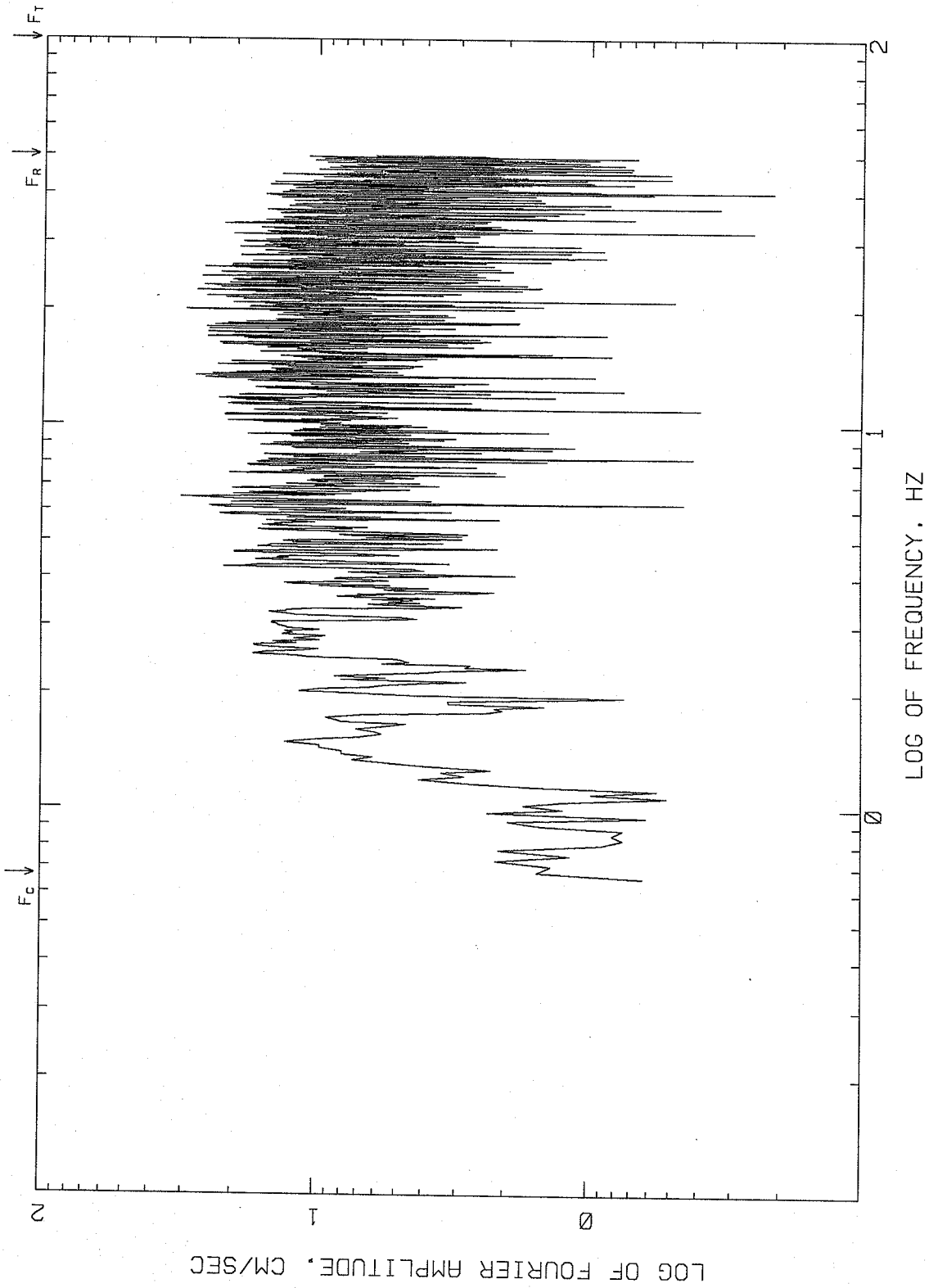
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
+L = 214 DEGREES; AZ = 18 DEG.; DIST = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



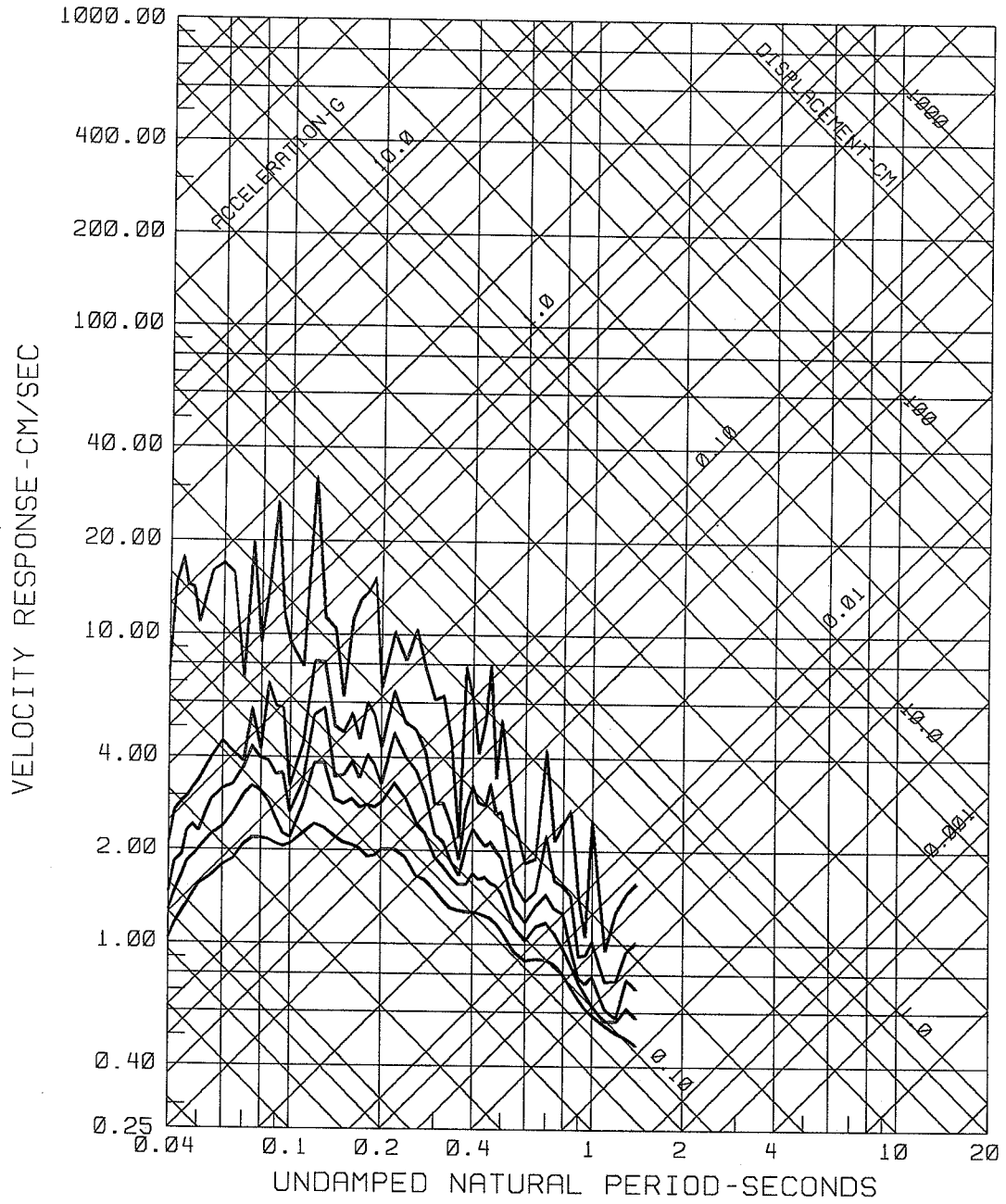
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD, QUEBEC
VERTICAL: AZ. = 18 DEG.; DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



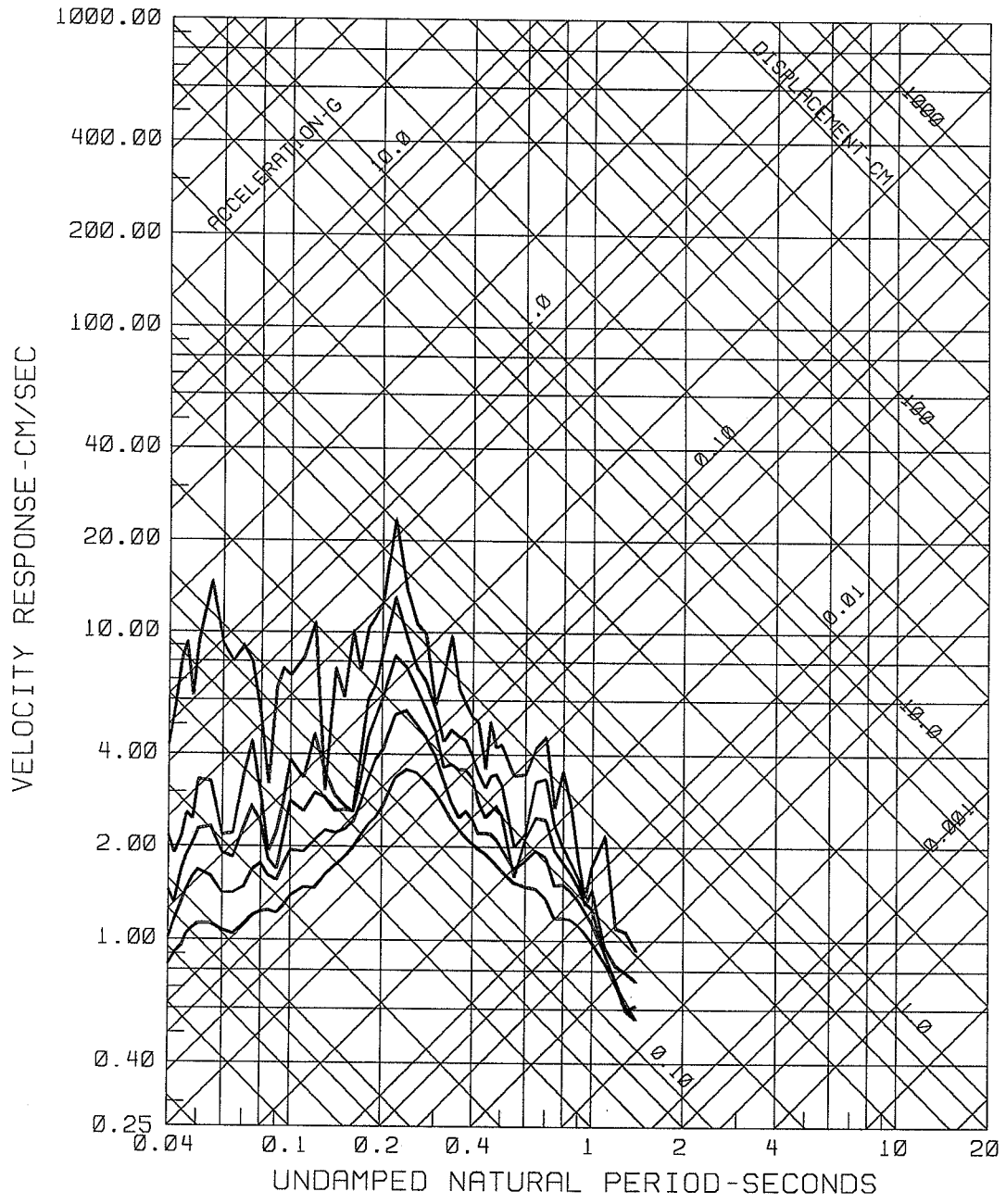
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 16: CHICOUTIMI-NORD; QUEBEC
+T = 124 DEGREES; AZ. = 18 DEG.; DIST. = 43 KM
4TH-ORDER BUTTERWORTH AT 0.667 HZ
COMPUTING OPTIONS= ZCROSS, NONNOISE



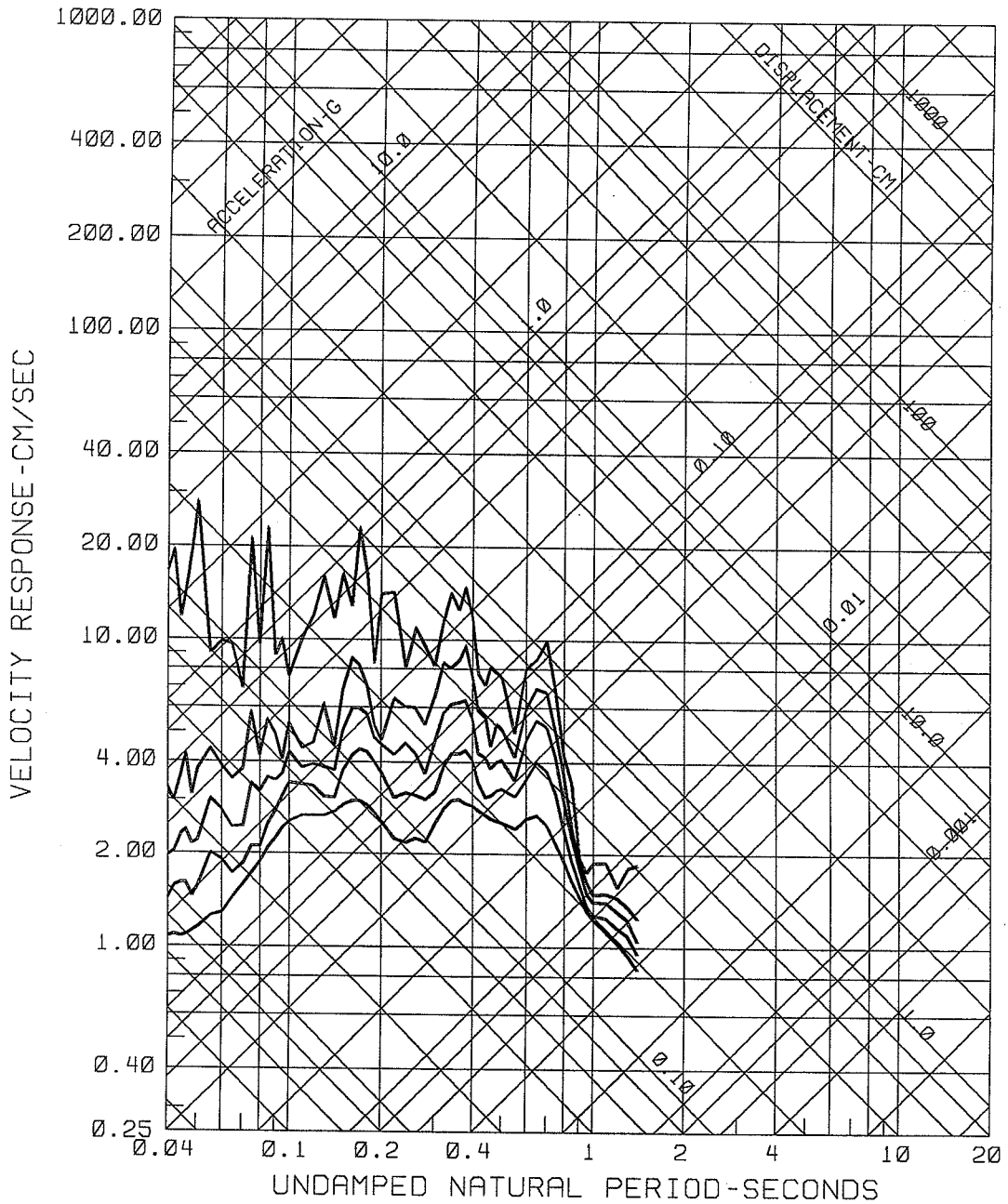
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 16: CHICOUTIMI-NORD (LONGITUDINAL
0.2,5,10,20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.667 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
 1988 11 25 2346 UT: SITE 16: CHICOUTIMI-NORD (VERTICAL)
 0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
 FILTERS: BUTTERWORTH, ORDER 4, 0.667 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 16: CHICOUTIMI-NORD (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.667 HZ; ANTIALIAS 50 - 100 HZ

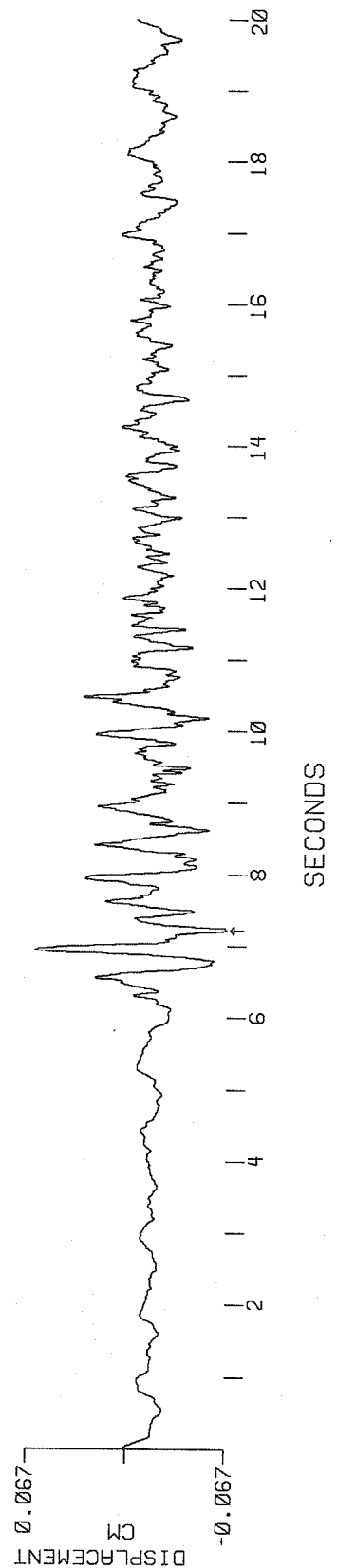
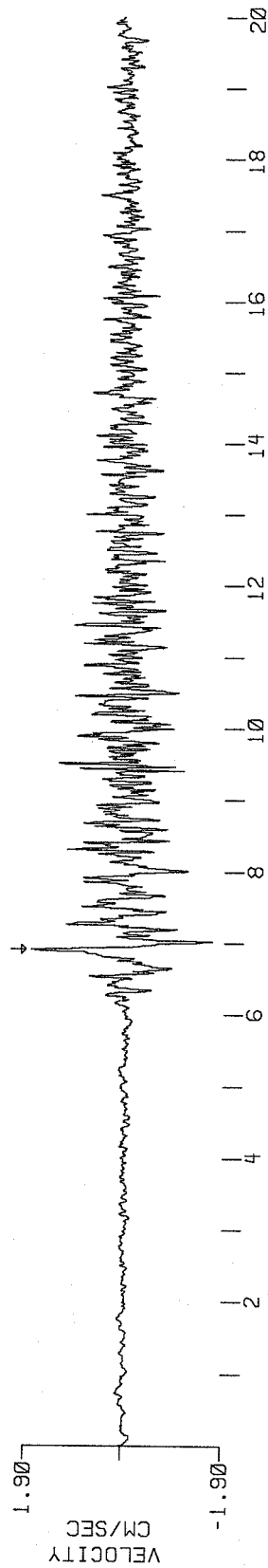
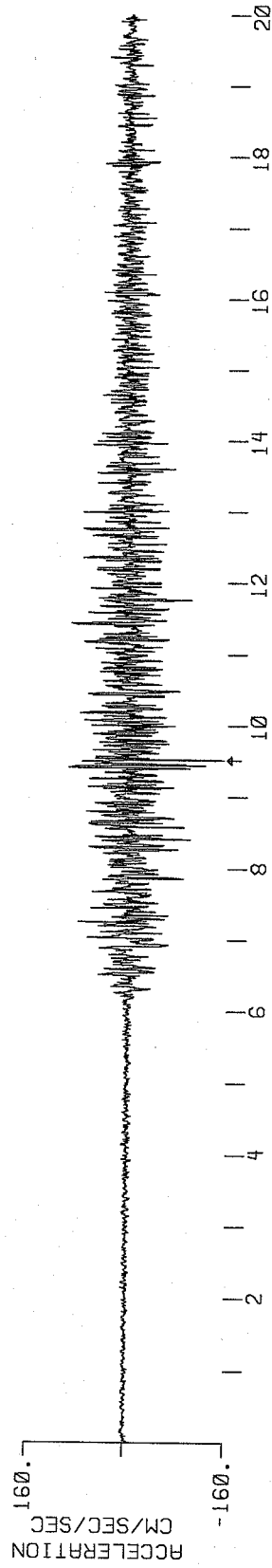


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE QUEBEC

+L = 0 DEGREES: AZ. = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ

PEAK VALUES: ACCEL = -152.92 CM/SEC/SEC. VELOCITY = 1.83 CM/SEC. DISPL = -0.07 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

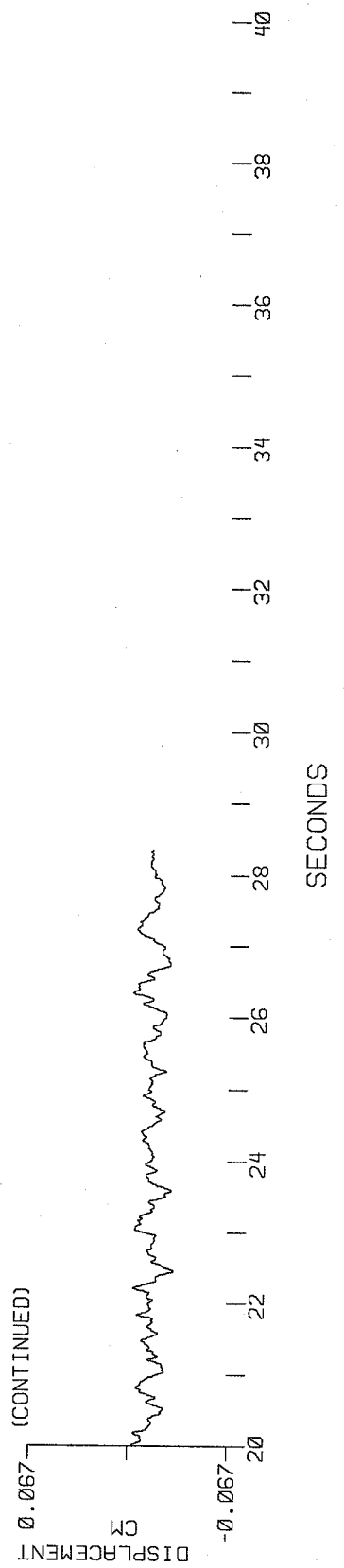
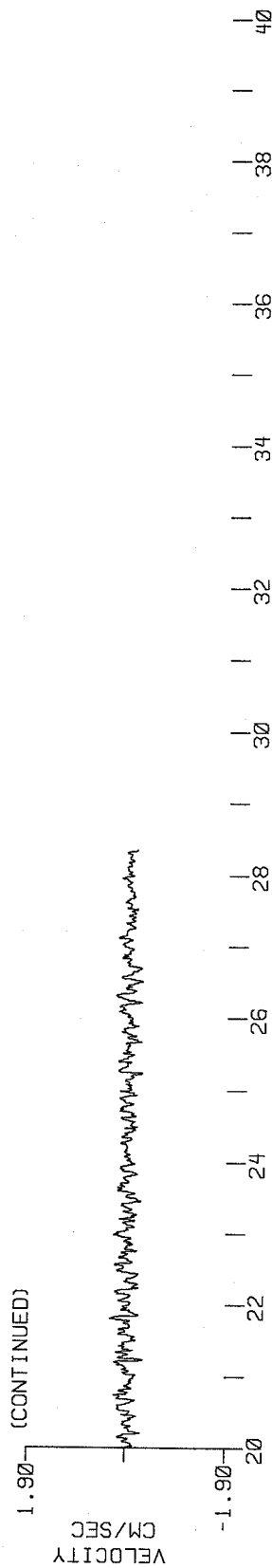
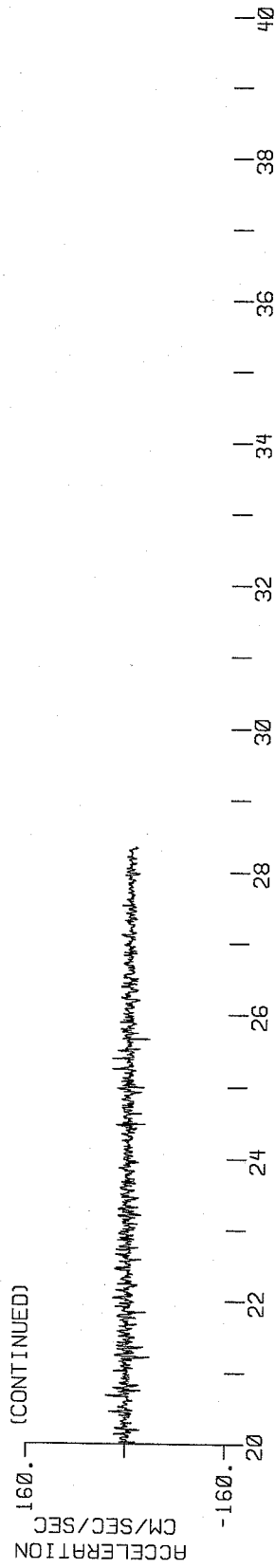
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 17: ST-ANDRE, QUEBEC

+L = 0 DEGREES: AZ = 291 DEG.: DIST. = 64 KM

4TH-ORDER BUTTERWORTH AT 0.800 HZ

PEAK VALUES: ACCEL = -152.92 CM/SEC/SEC. VELOCITY = 1.83 CM/SEC. DISPL = -0.07 CM

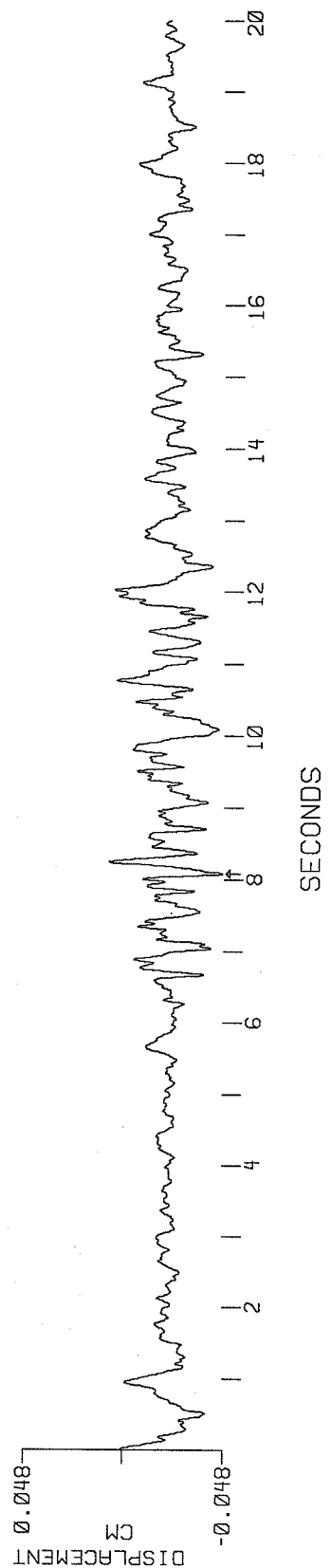
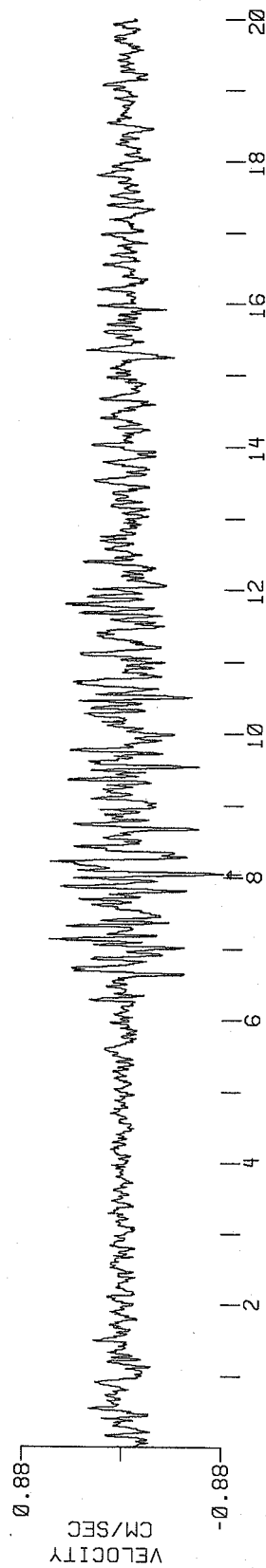
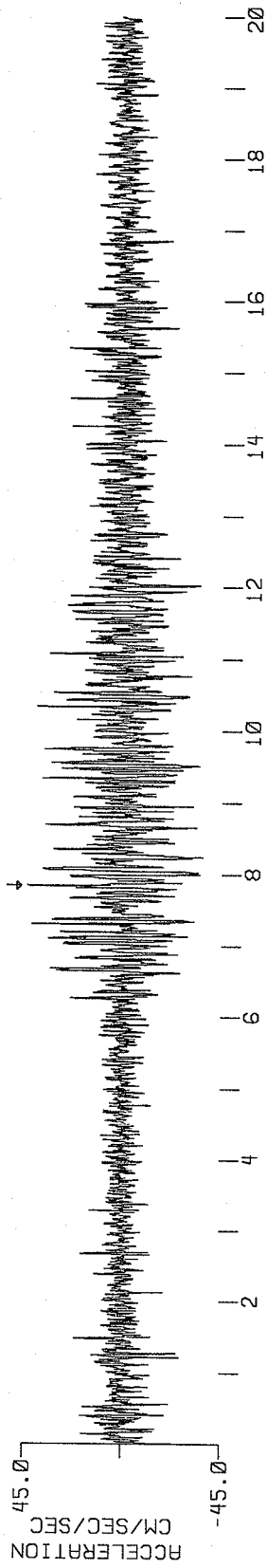


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE: QUEBEC

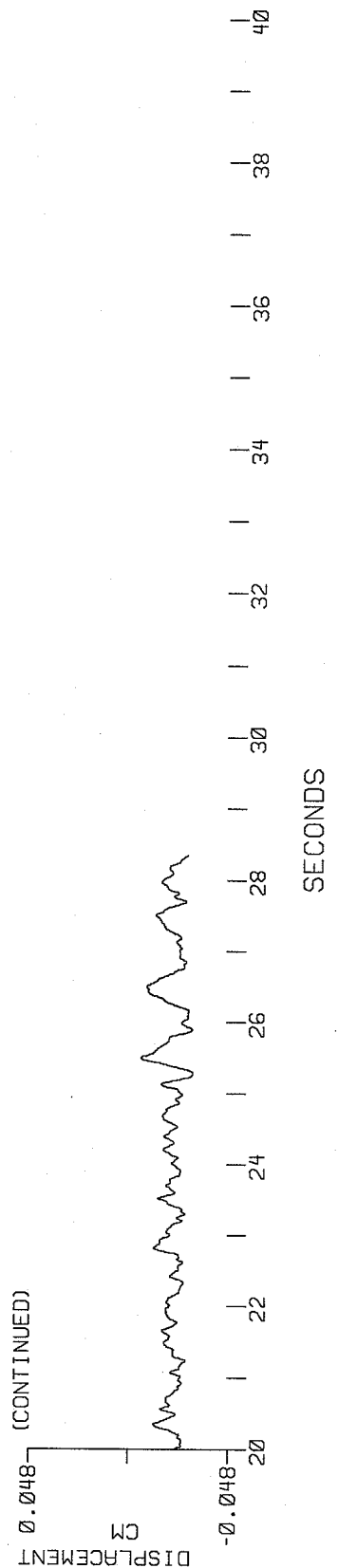
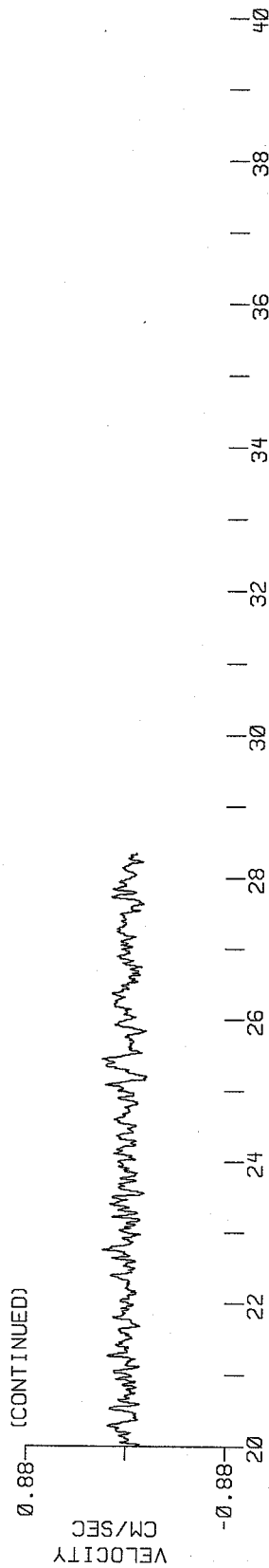
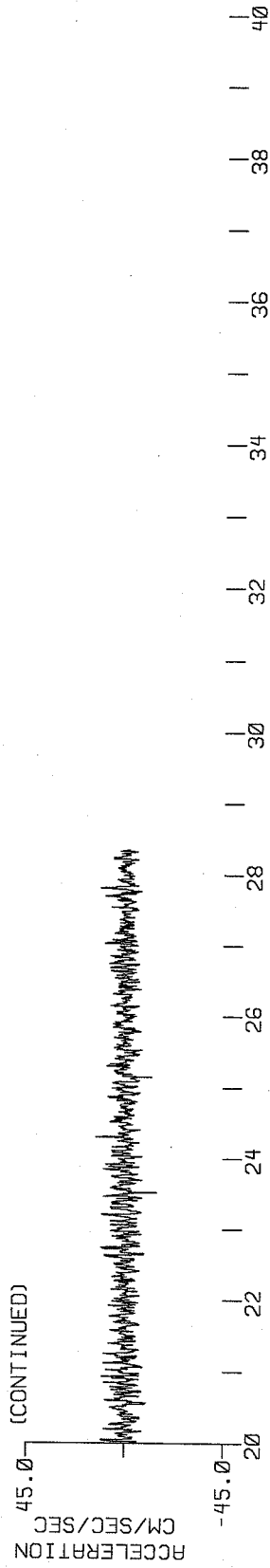
VERTICAL: AZ. = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ

PEAK VALUES: ACCEL=44.36 CM/SEC/SEC. VELOCITY=-0.88 CM/SEC. DISPL=-0.05 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 17: ST-ANDRE: QUEBEC
 VERTICAL: AZ. = 291 DEG.: DIST. = 64 KM
 4TH-ORDER BUTTERWORTH AT 0.800 HZ

PEAK VALUES: ACCEL=44.36 CM/SEC/SEC. VELOCITY=-0.88 CM/SEC. DISPL=-0.05 CM

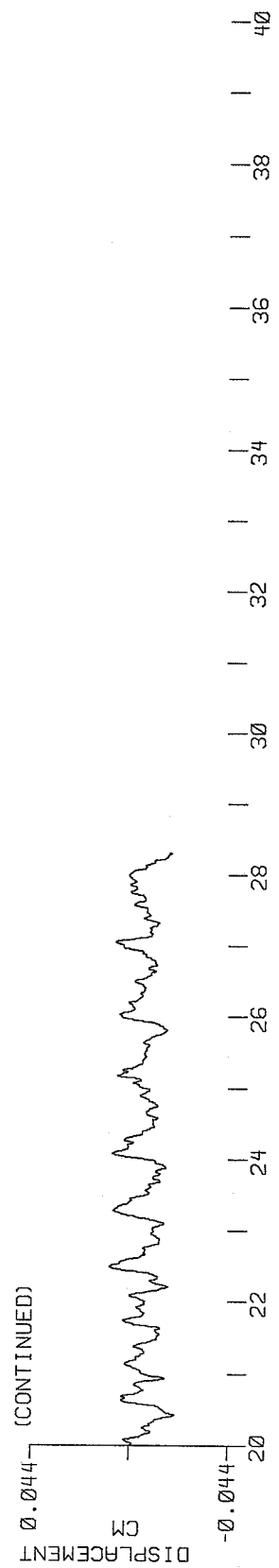
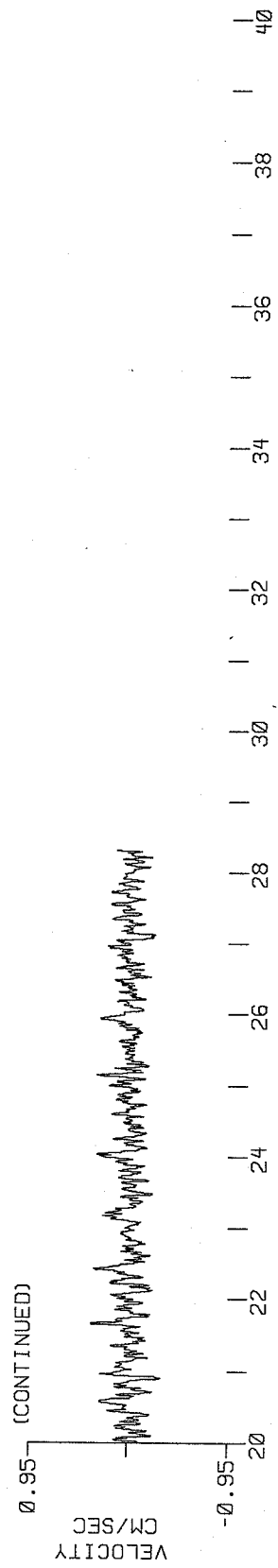
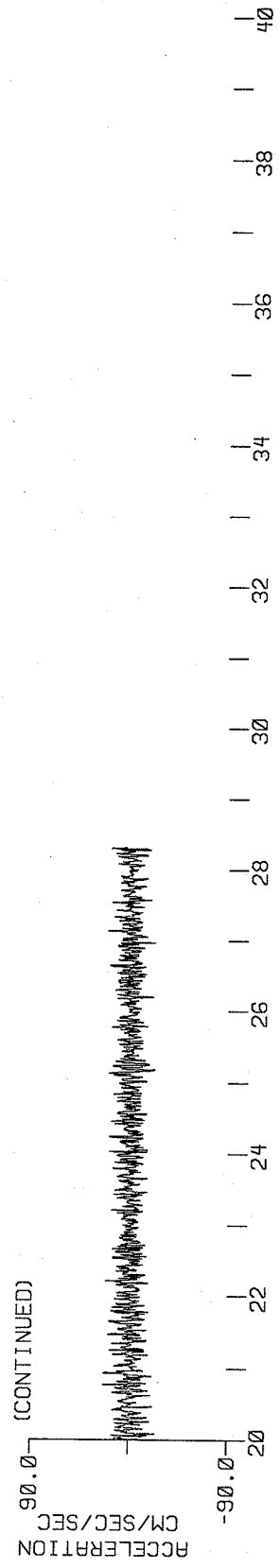


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE, QUEBEC

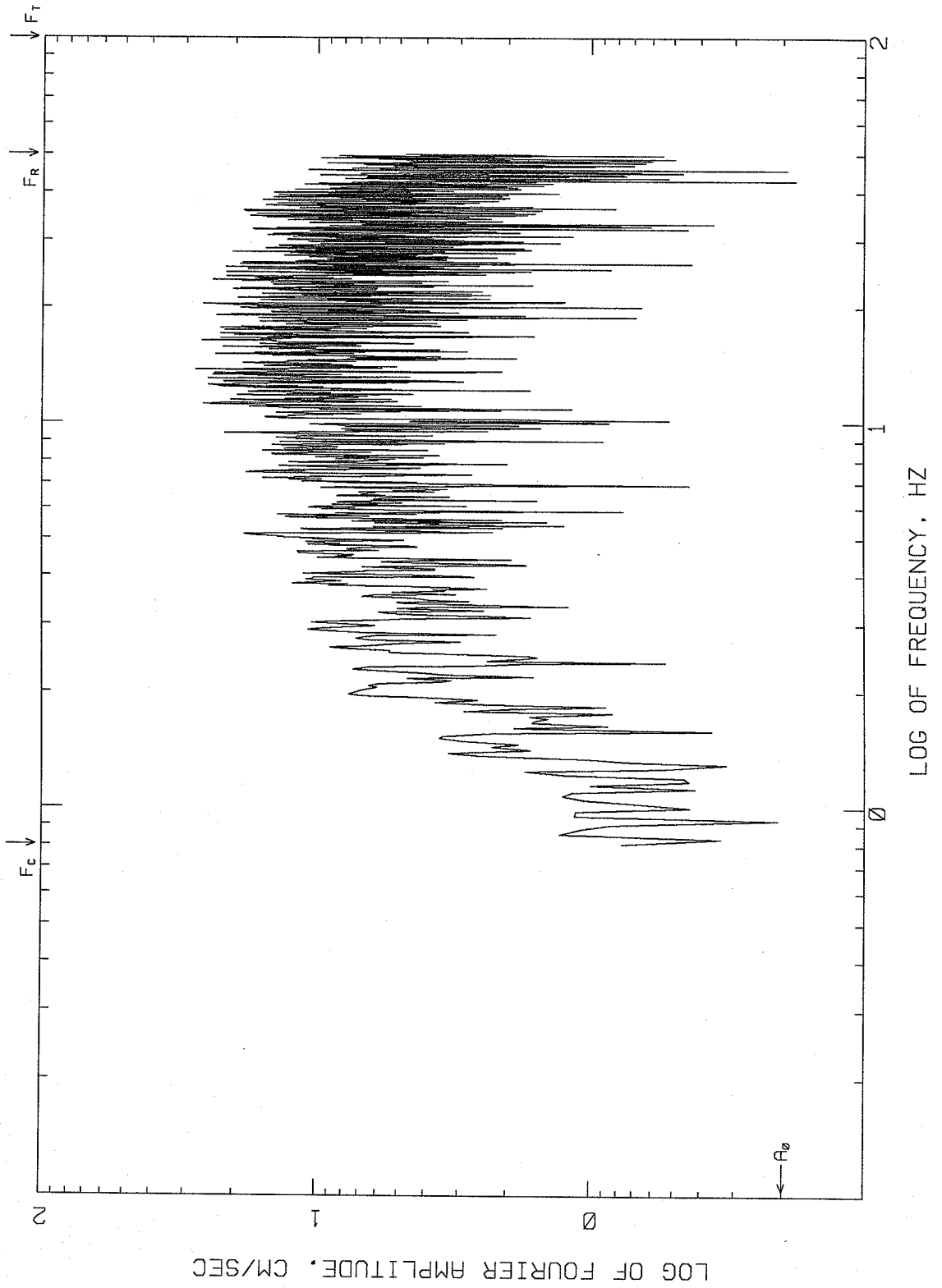
+T = 270 DEGREES: AZ. = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ

PEAK VALUES: ACCEL=89.36 CM/SEC/SEC. VELOCITY=0.94 CM/SEC. DISPL=-0.04 CM

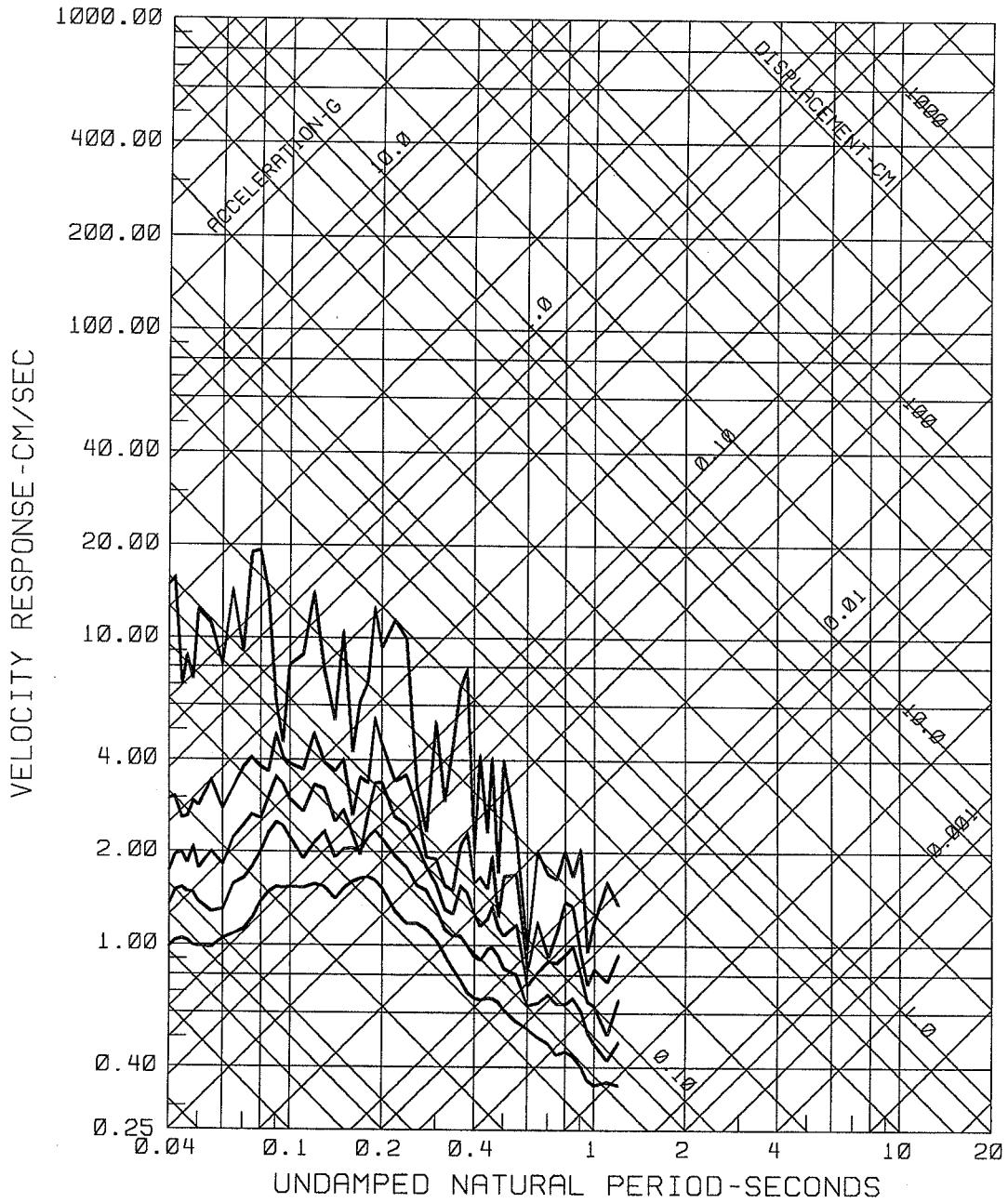


SECONDS

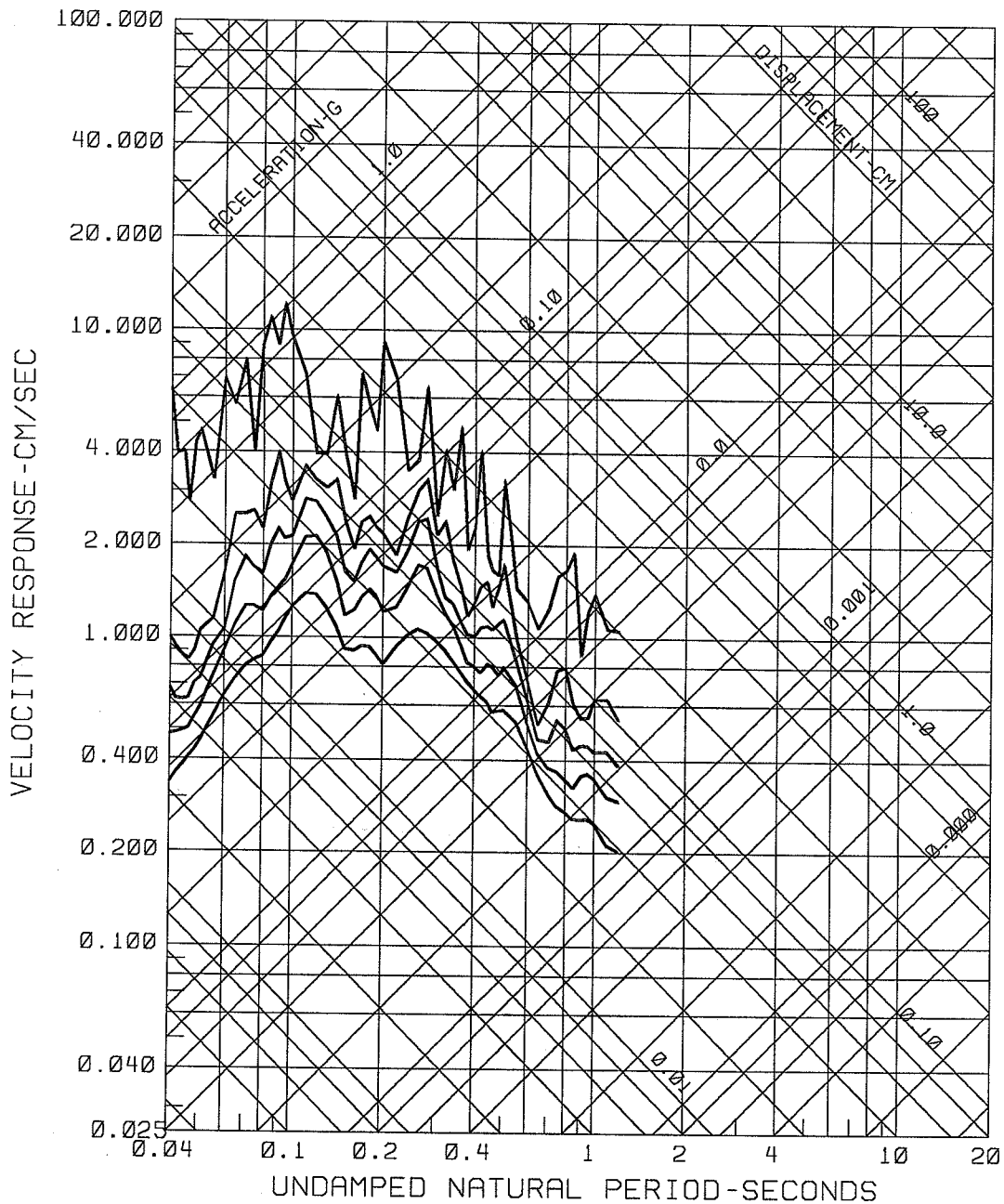
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE, QUEBEC
+L = 0 DEGREES: AZ. = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



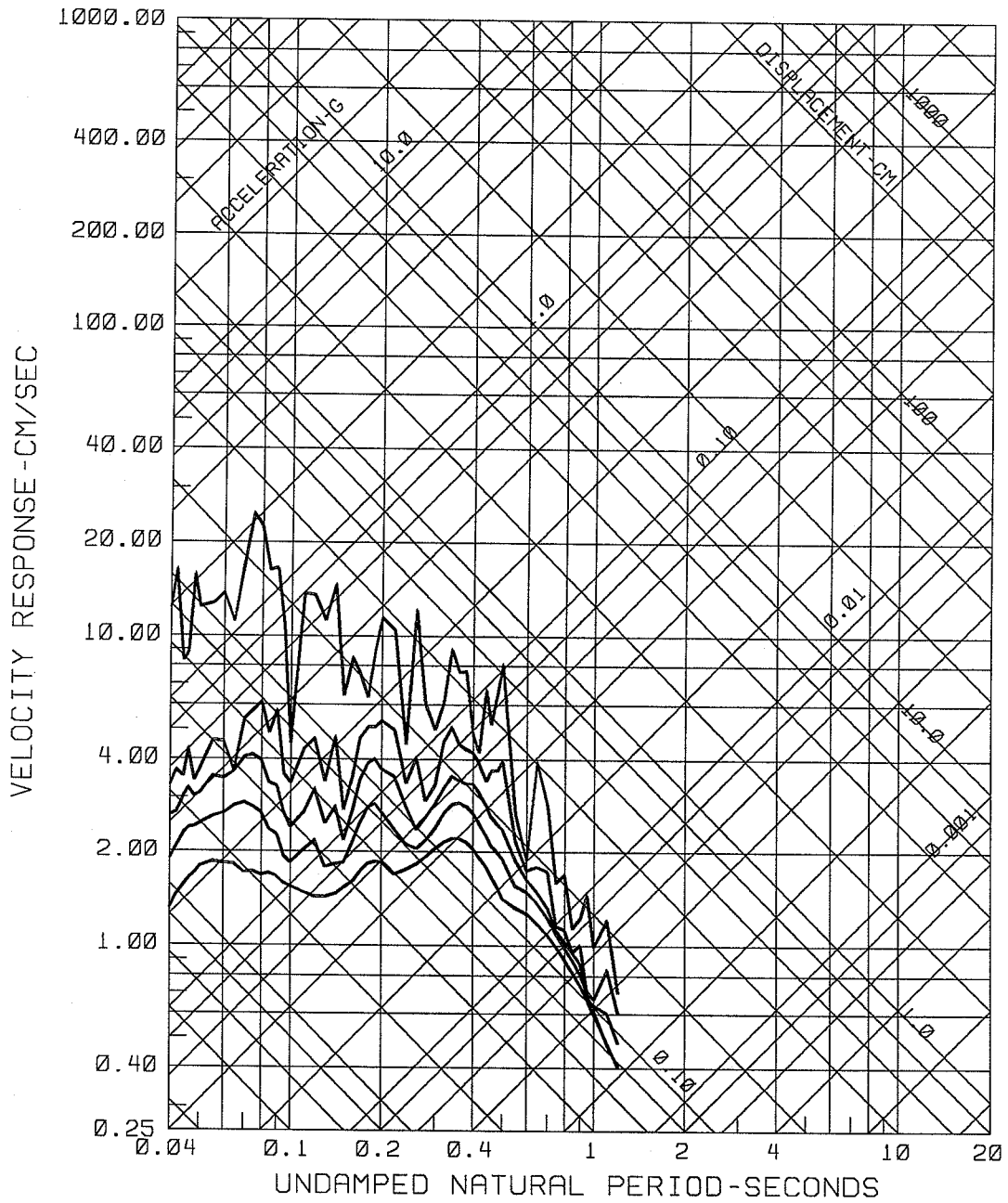
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 17: ST-ANDRE (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.800 HZ; ANTIALIAS 50 - 100 HZ



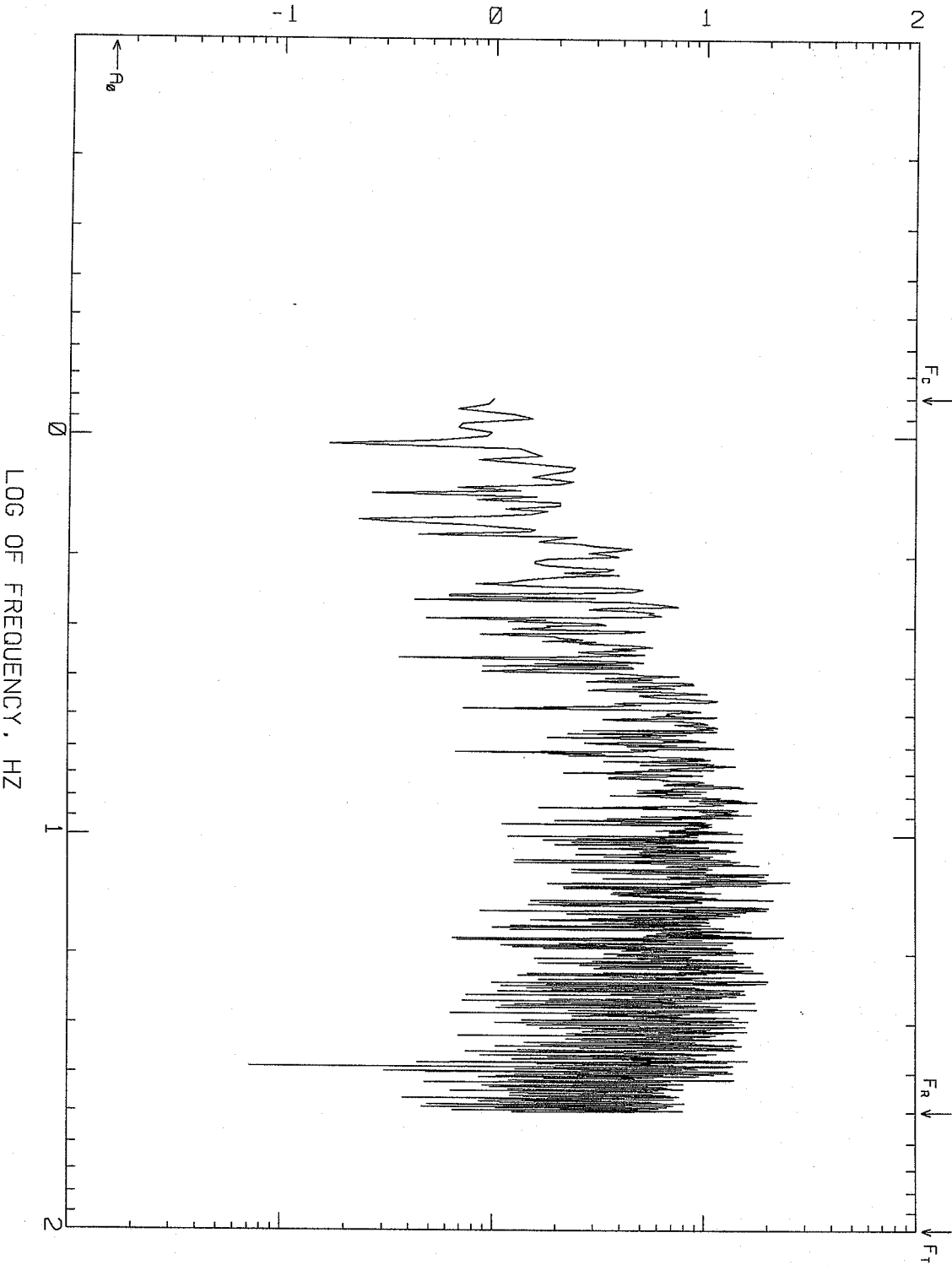
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 17: ST-ANDRE (VERTICAL)
0.2.5.10.20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.800 HZ: ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 17: ST-ANDRE (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.800 HZ; ANTIALIAS 50 - 100 HZ

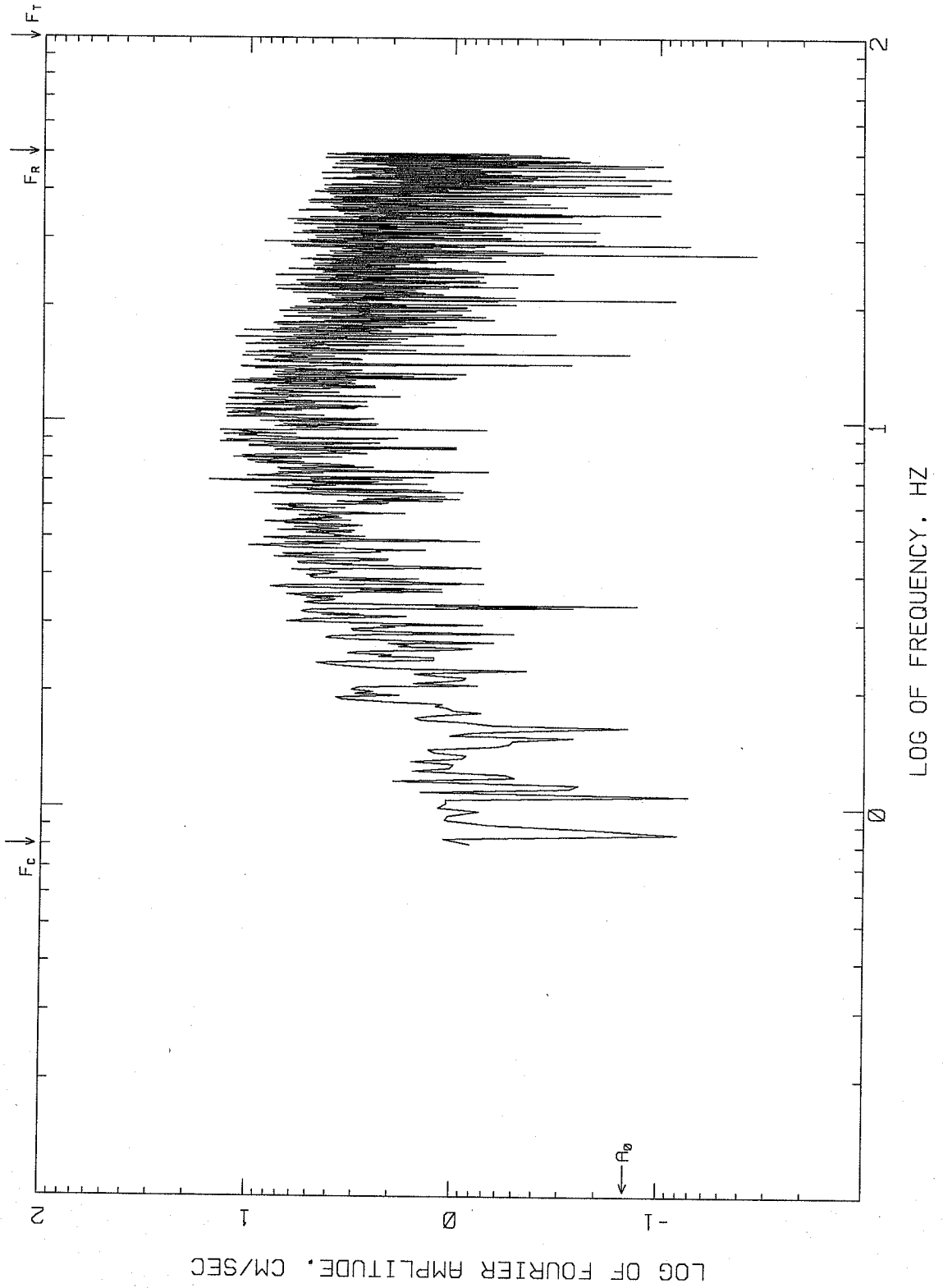


LOG OF FOURIER AMPLITUDE. CM/SEC



FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE, QUEBEC
+T = 270 DEGREES: AZ = 291 DEG.: DIST. = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ
COMPUTING OPTIONS = ZCROSS.NONNOISE

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 17: ST-ANDRE: QUEBEC
VERTICAL: AZ = 291 DEG: DIST = 64 KM
4TH-ORDER BUTTERWORTH AT 0.800 HZ
COMPUTING OPTIONS= ZCROSS.NONNOISE



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

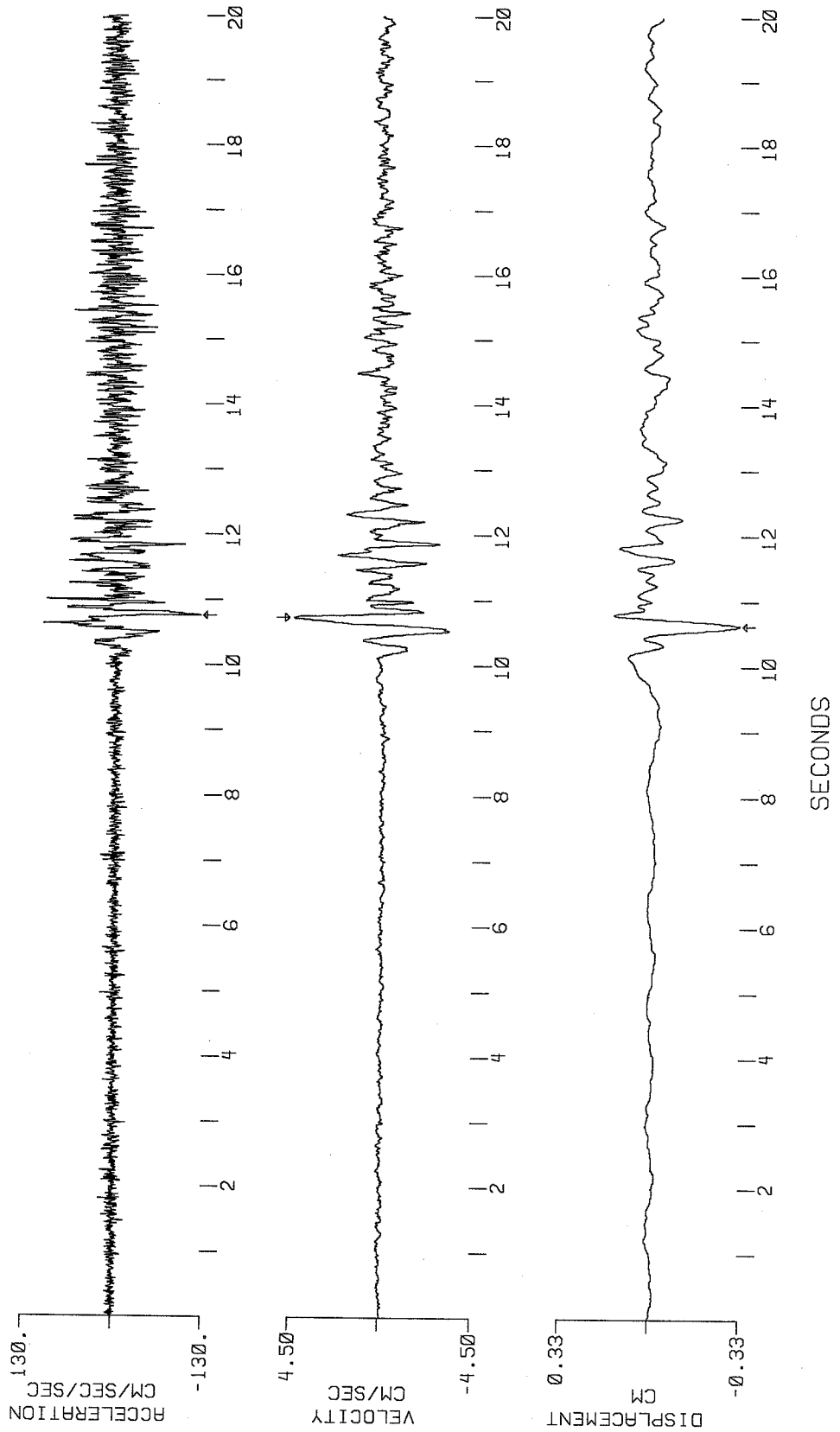
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 20: LES EBOULEMENTS, QUEBEC

+L = 0 DEGREES; AZ. = 134 DEG.; DIST. = 90 KM

4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL=-123.07 CM/SEC/SEC. VELOCITY=4.40 CM/SEC. DISPL=-0.32 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.000 SPS

GEOLOGICAL SURVEY OF CANADA

SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

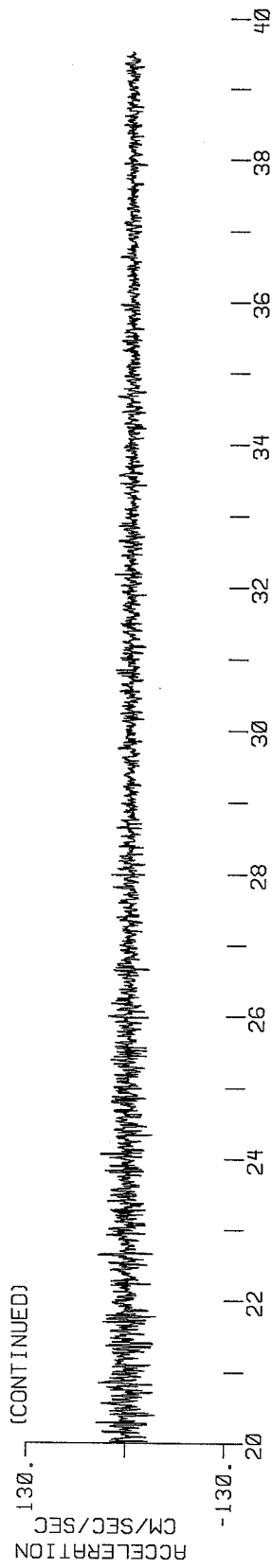
SITE 20: LES EBOULEMENTS, QUEBEC

+L = 0 DEGREES: AZ = 134 DEG.: DIST. = 90 KM

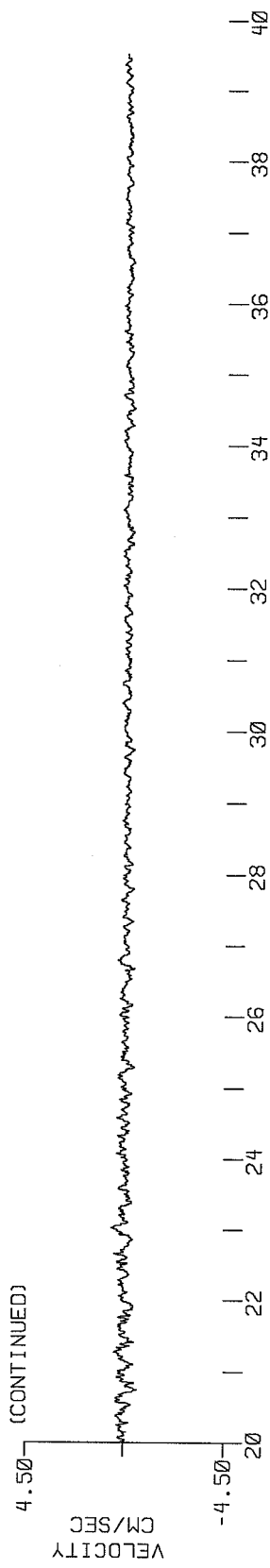
4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL = -123.07 CM/SEC/SEC; VELOCITY = 4.40 CM/SEC; DISPL = -0.32 CM

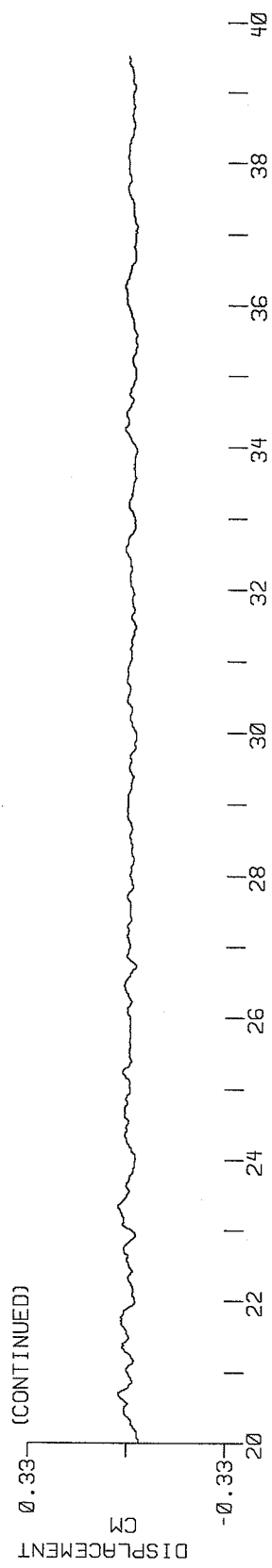
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(CONTINUED)



(CONTINUED)



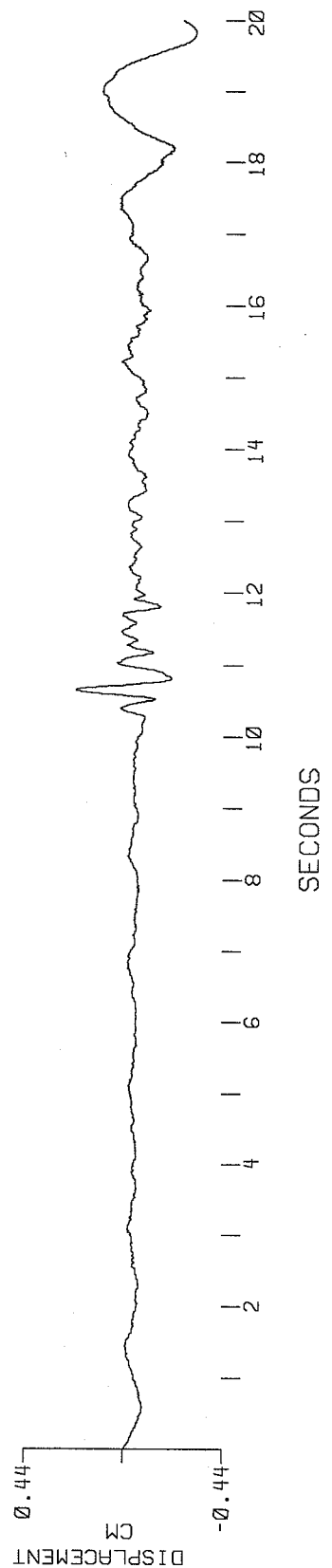
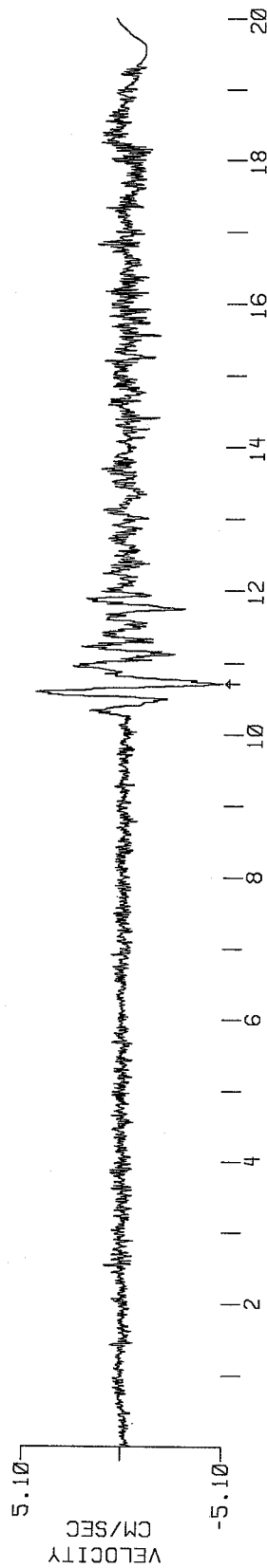
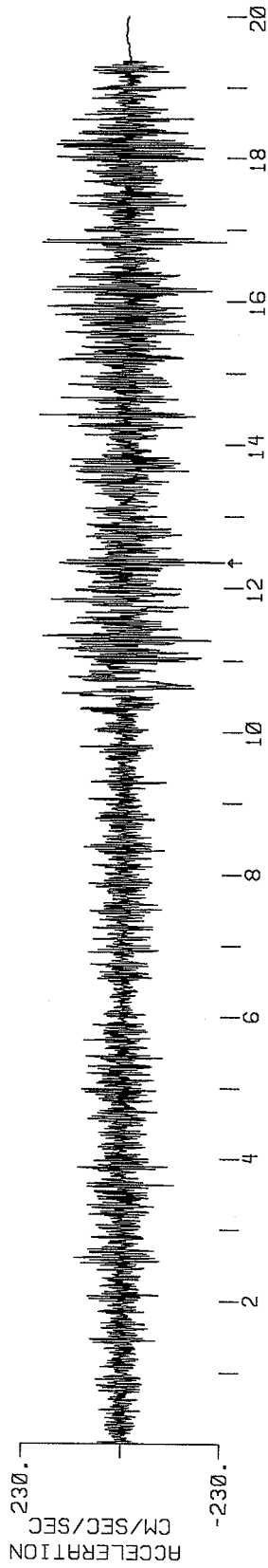
SECONDS

CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 20: LES BOULEMENTS, QUEBEC

VERTICAL: AZ. = 134 DEG.; DIST. = 90 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

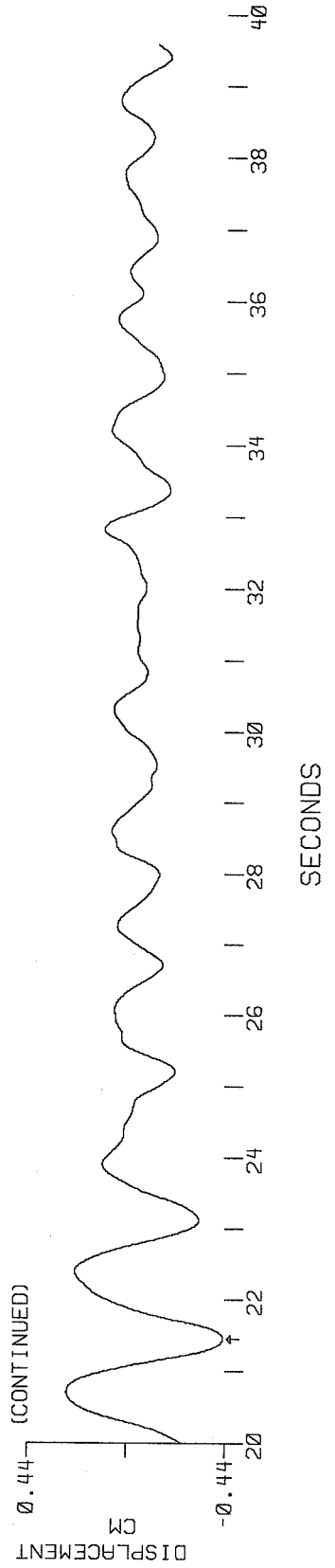
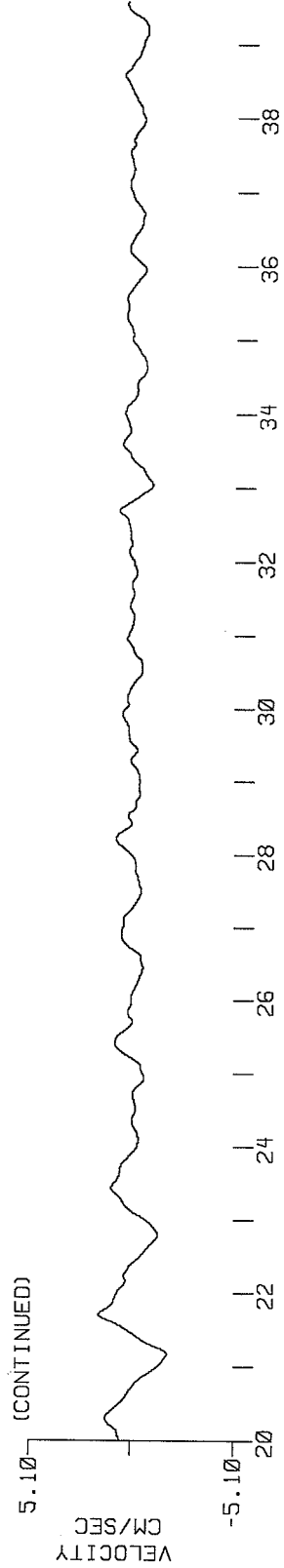
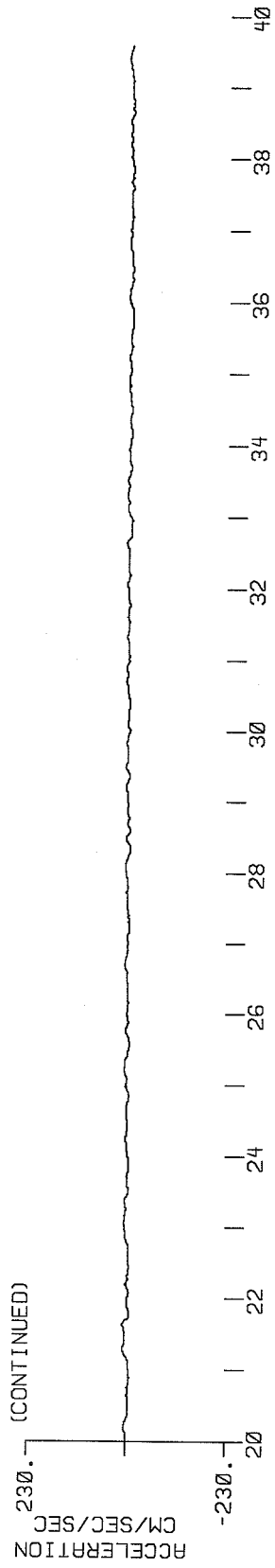
PEAK VALUES: ACCEL = -229.89 CM/SEC/SEC. VELOCITY = -5.01 CM/SEC. DISPL = -0.43 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 20: LES BOULEMENTS, QUEBEC
VERTICAL: AZ. = 134 DEG.; DIST. = 90 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

PEAK VALUES: ACCEL = -229.89 CM/SEC/SEC. VELOCITY = -5.01 CM/SEC. DISPL = -0.43 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

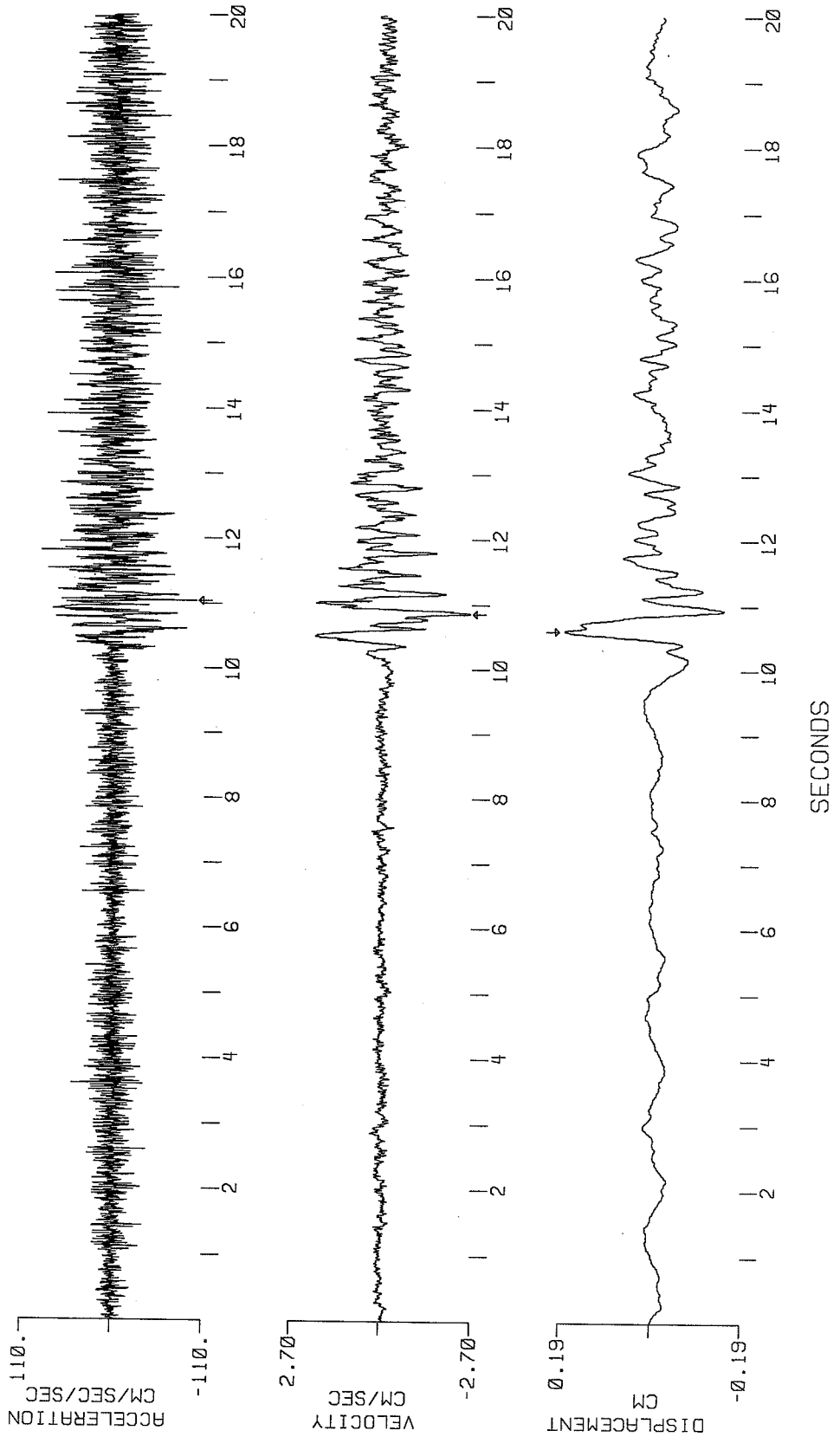
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 20: LES EBOULEMENTS, QUEBEC

+T = 270 DEGREES: AZ. = 134 DEG.: DIST. = 90 KM

4TH-ORDER BUTTERWORTH AT 0.500 HZ

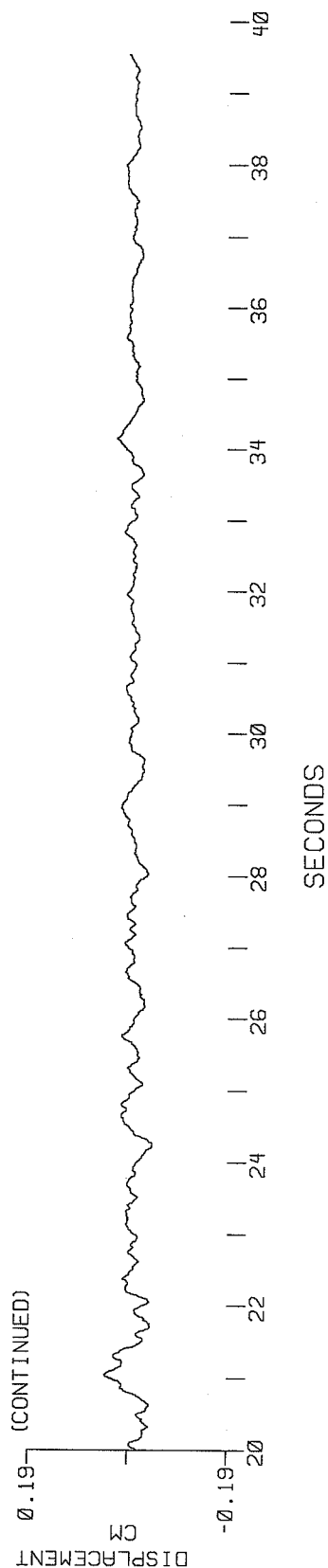
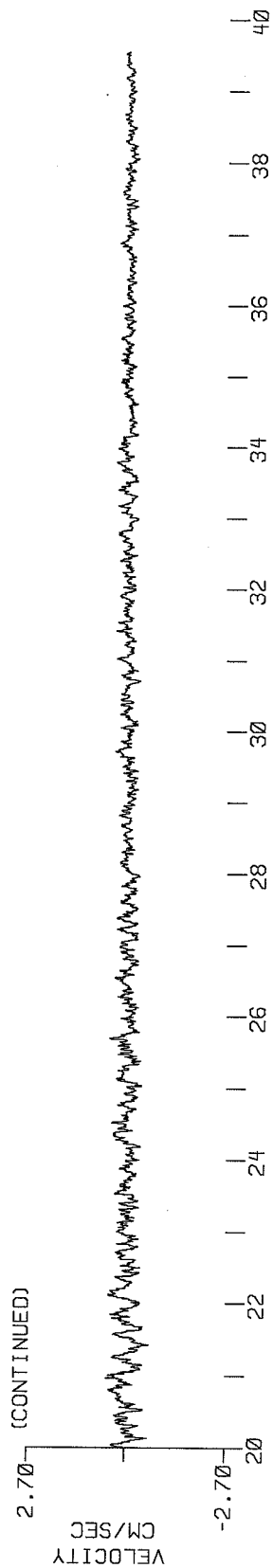
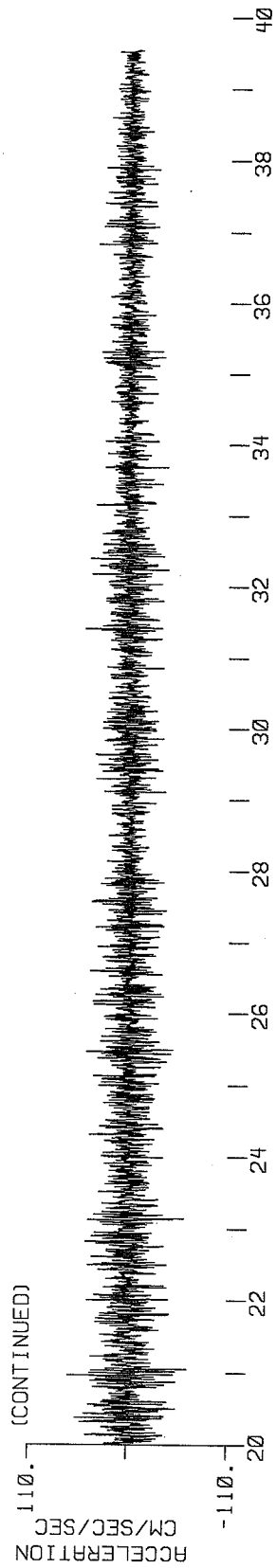
PEAK VALUES: ACCEL=-100.27 CM/SEC/SEC. VELOCITY=-2.65 CM/SEC. DISPL=-0.18 CM



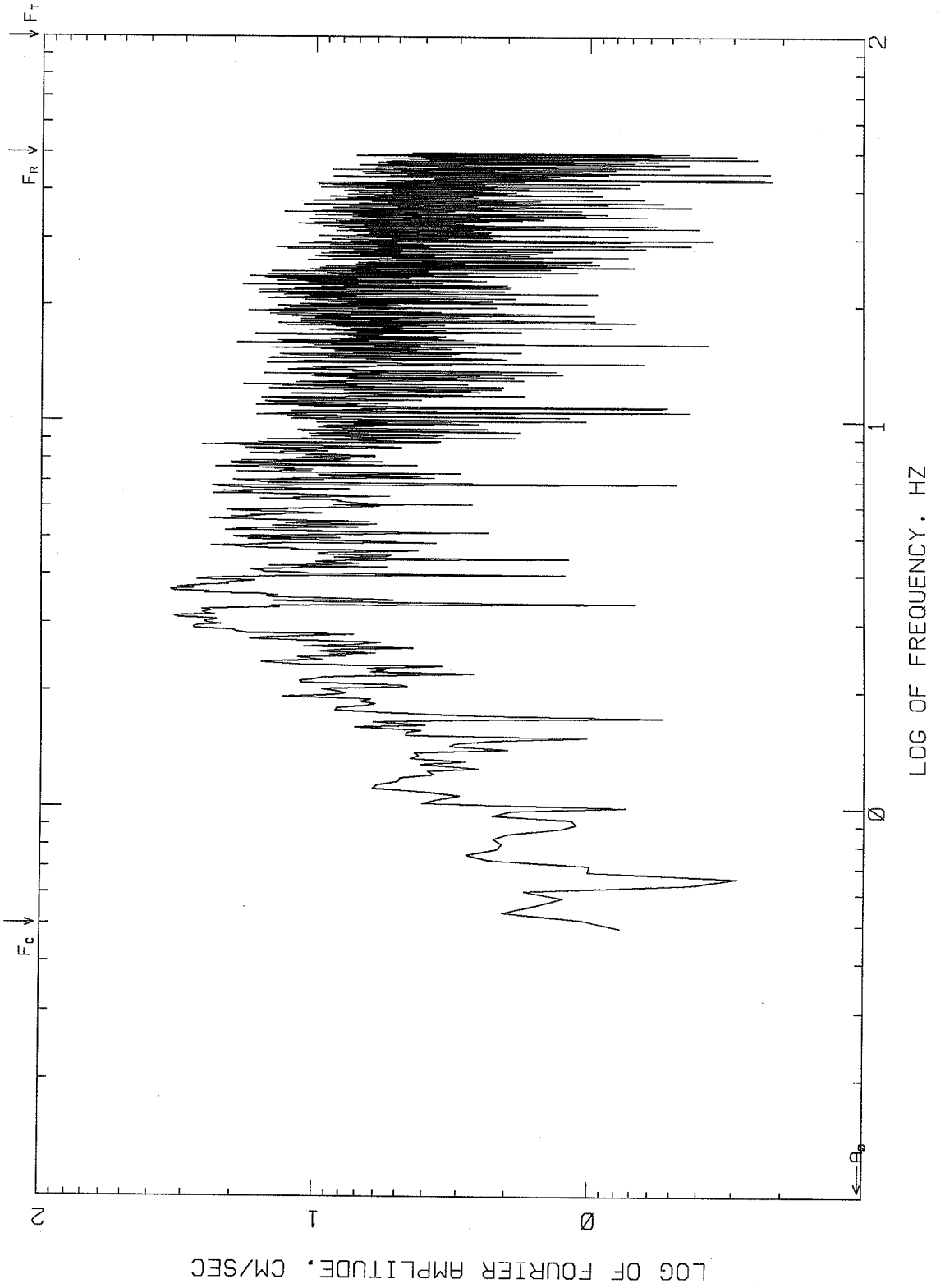
CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 23:46 UT
SITE 20: LES EBOULEMENTS, QUEBEC
+T = 270 DEGREES: AZ. = 134 DEG.: DIST. = 90 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ

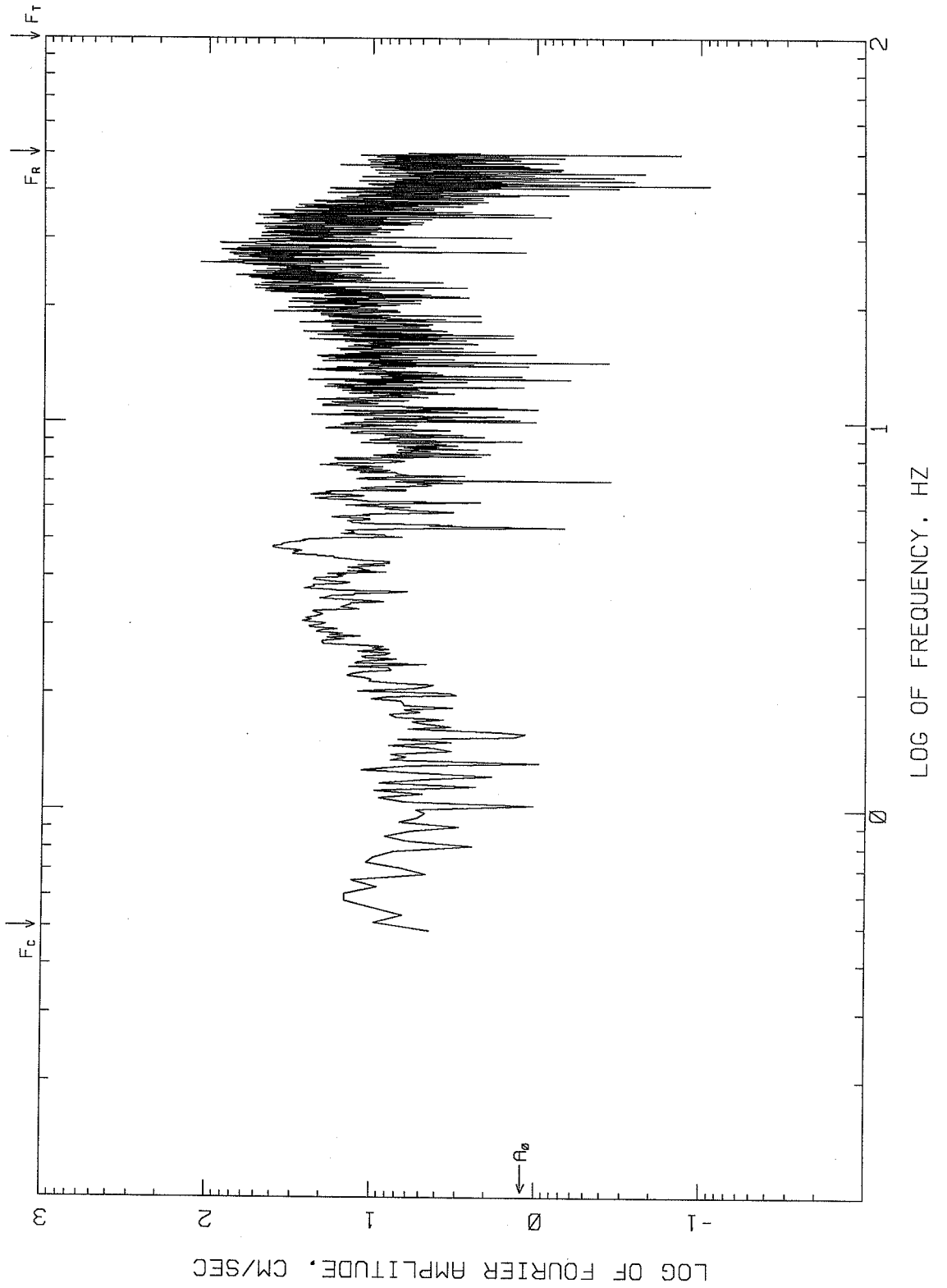
PEAK VALUES: ACCEL = -100.27 CM/SEC/SEC. VELOCITY = -2.65 CM/SEC. DISPL = 0.18 CM



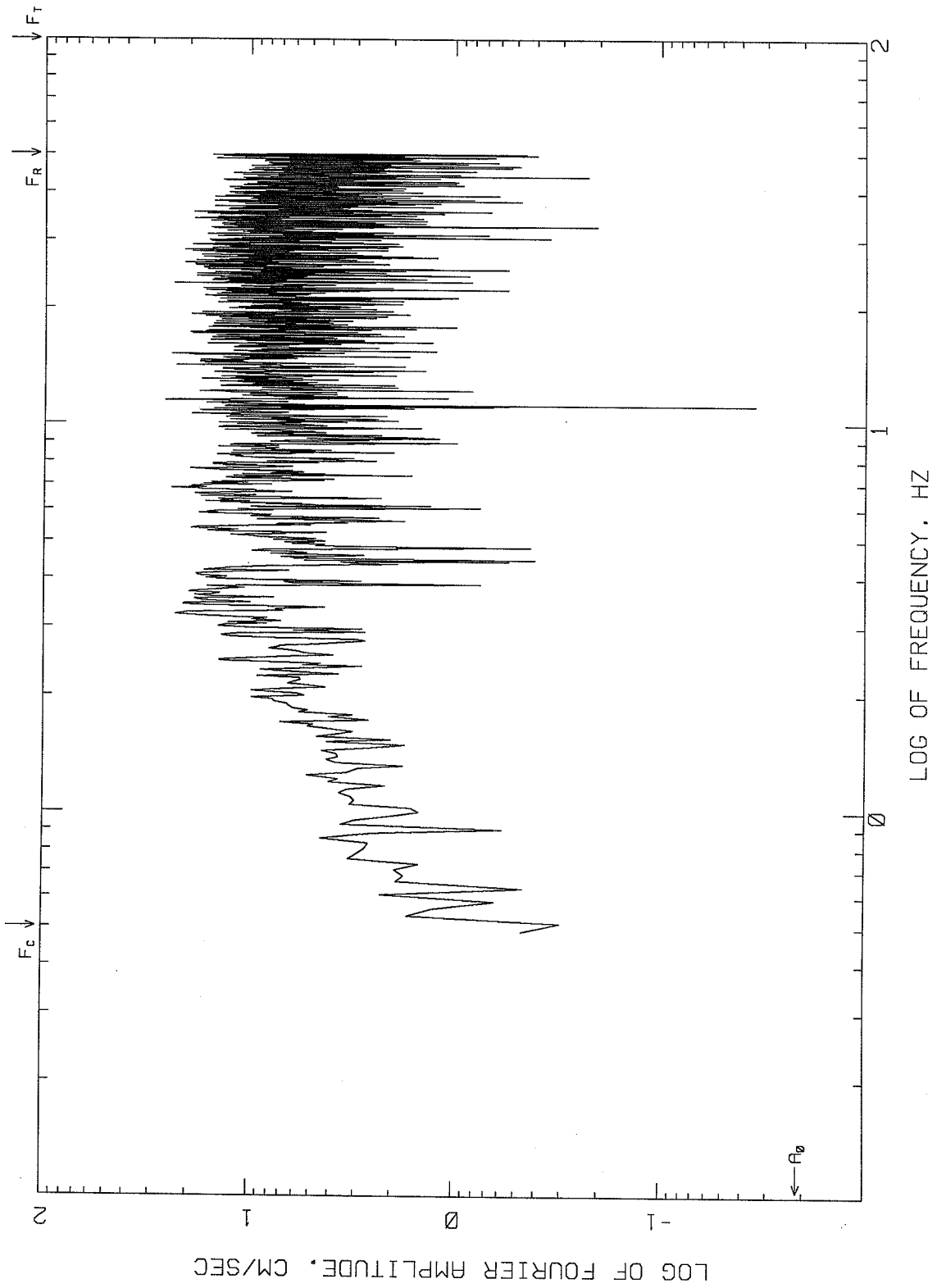
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 20: LES EBOULEMENTS, QUEBEC
+L = 0 DEGREES; AZ = 134 DEG.; DIST. = 90 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



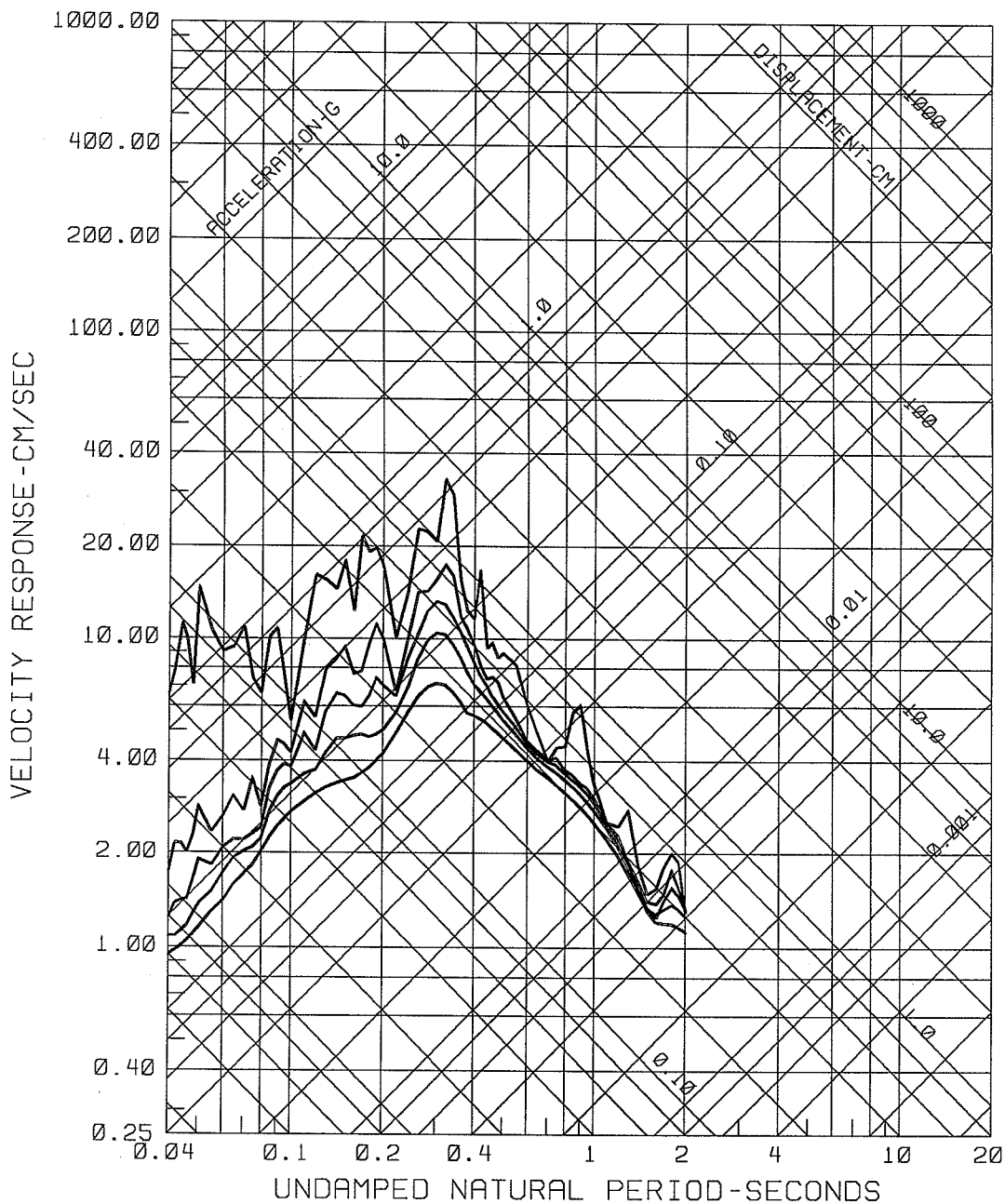
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 20: LES EBOULEMENTS, QUEBEC
VERTICAL: AZ = 134 DEG.; DIST = 90 KM
4TH-ORDER BUTTERWORTH AT 0.500 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



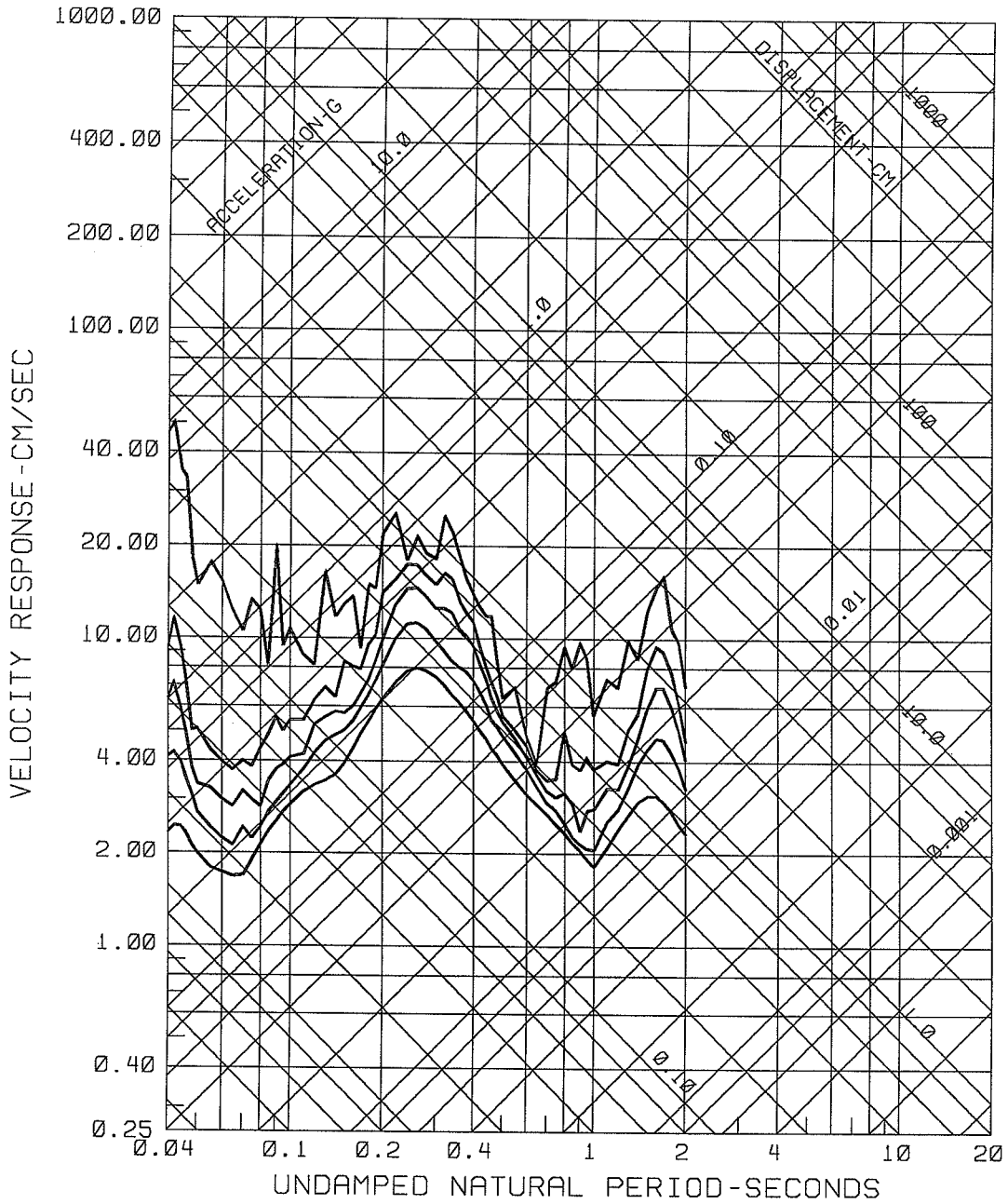
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 20: LES EBOULEMENTS, QUEBEC
 +T = 270 DEGREES: AZ = 134 DEG.: DIST. = 90 KM
 4TH-ORDER BUTTERWORTH AT 0.500 HZ
 COMPUTING OPTIONS = ZCROSS, NONOISE



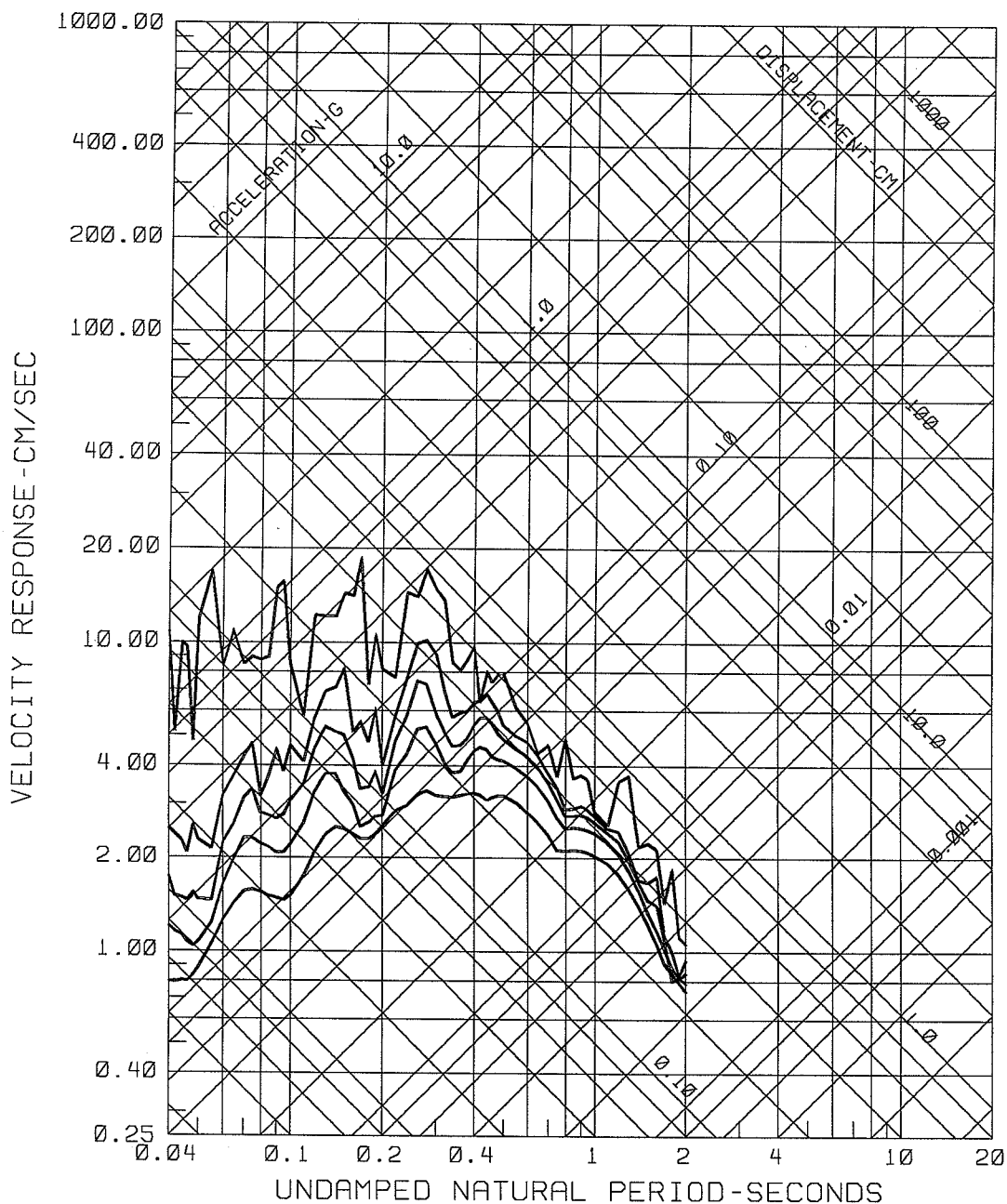
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 20: LES EBOULEMENTS (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ; ANTIALIAS 50 - 100 HZ



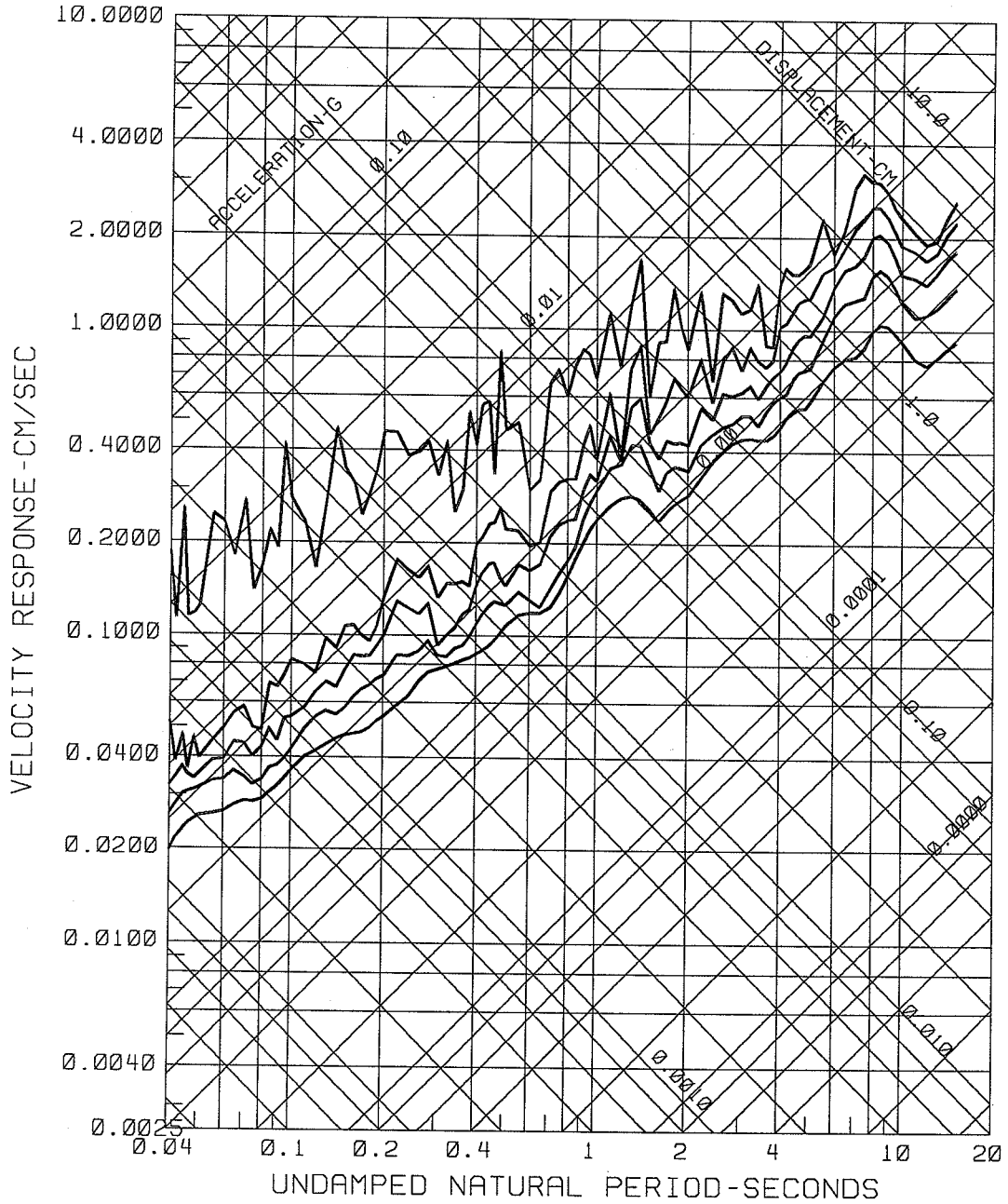
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 20: LES EBOULEMENTS (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ; ANTIALIAS 50 - 100 HZ



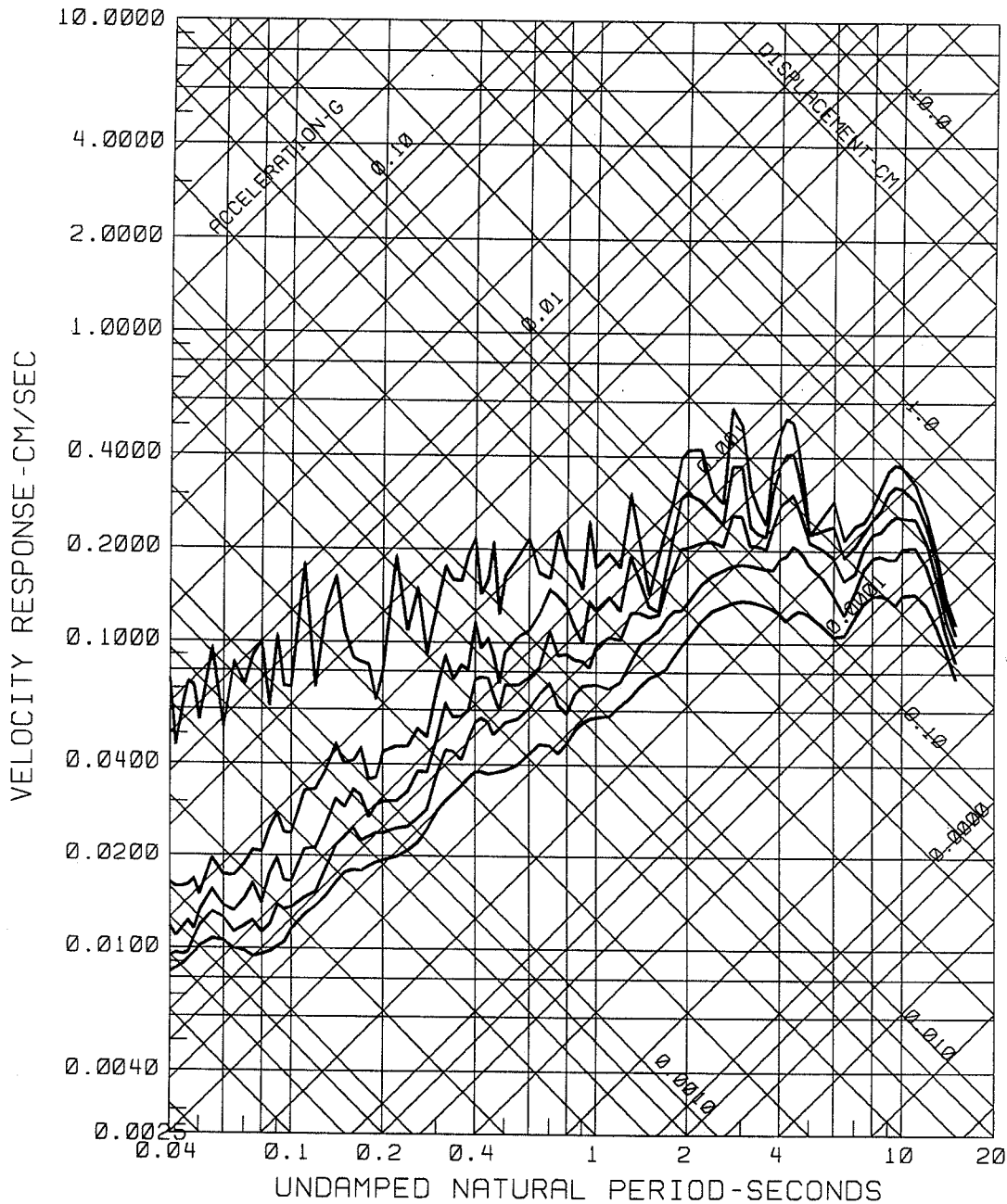
RESPONSE SPECTRA
 1988 11 25 2346 UT: SITE 20: LES EBOULEMENTS (TRANSVERSE)
 0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
 FILTERS: BUTTERWORTH, ORDER 4, 0.500 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 2: QUEBEC (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.050 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 14: STE-LUCIE (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.050 HZ; ANTIALIAS 50 - 100 HZ

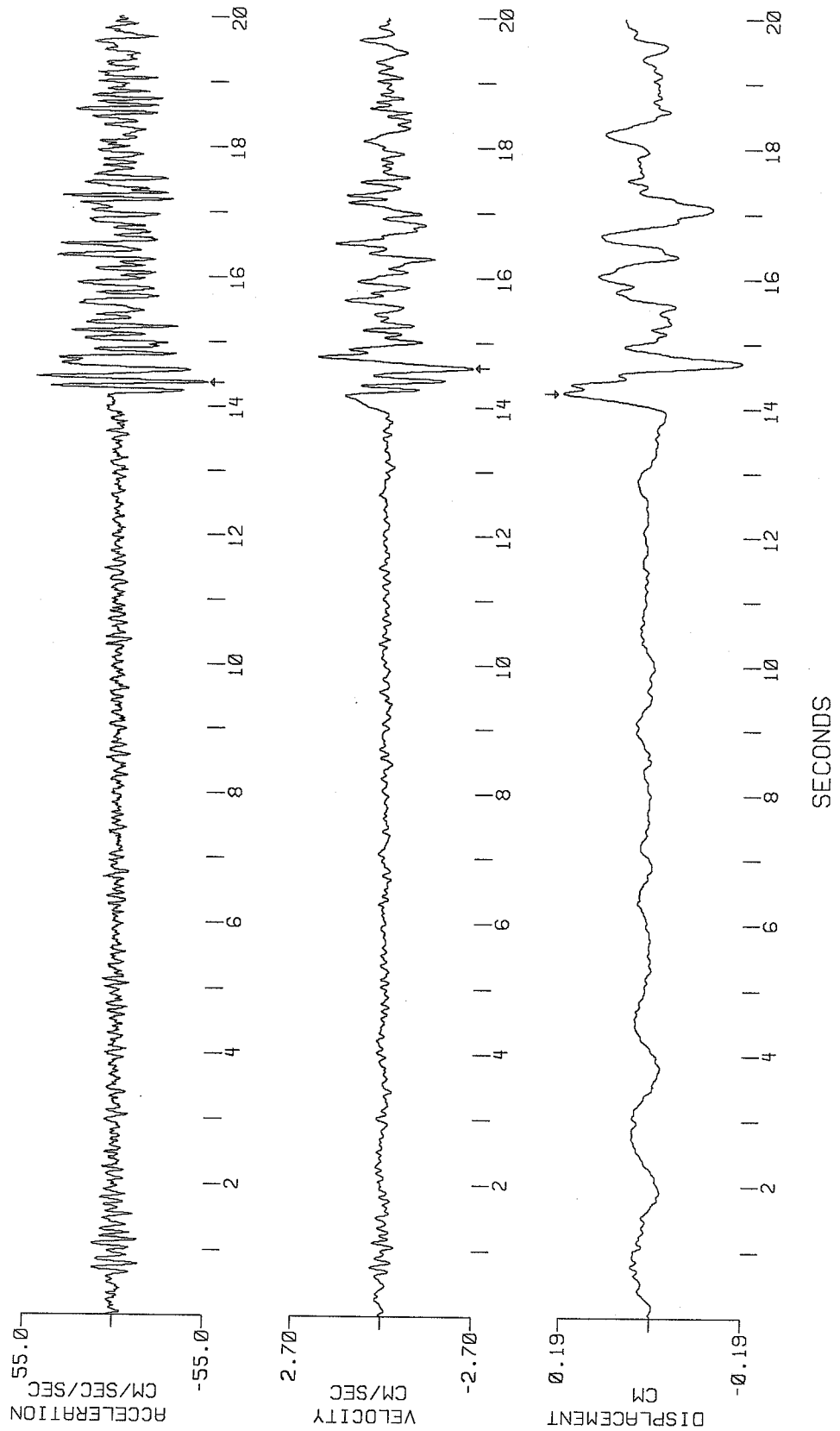


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC

+T = 270 DEGREES: AZ. = 122 DEG.: DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

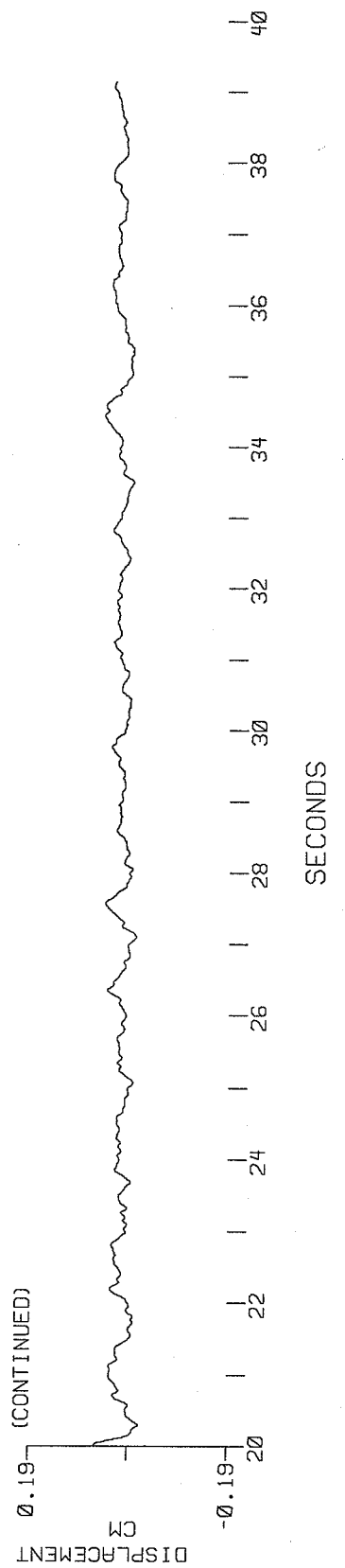
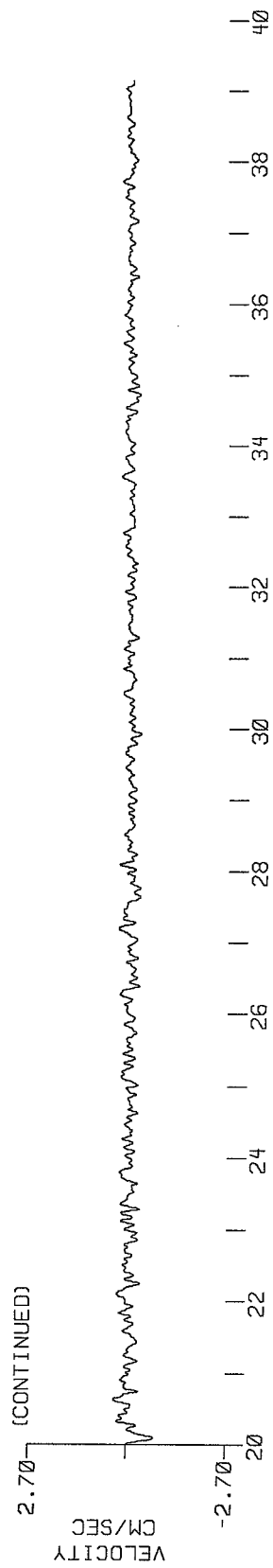
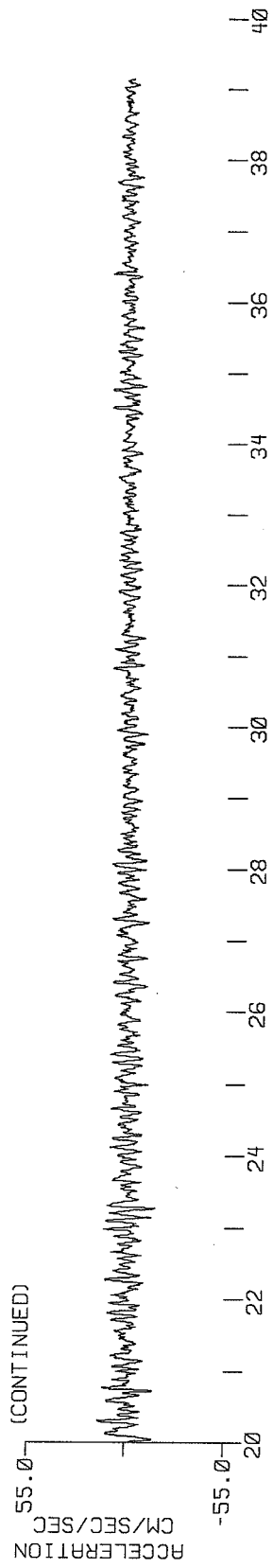
PEAK VALUES: ACCEL = -54.70 CM/SEC/SEC, VELOCITY = -2.62 CM/SEC, DISPL = 0.19 CM



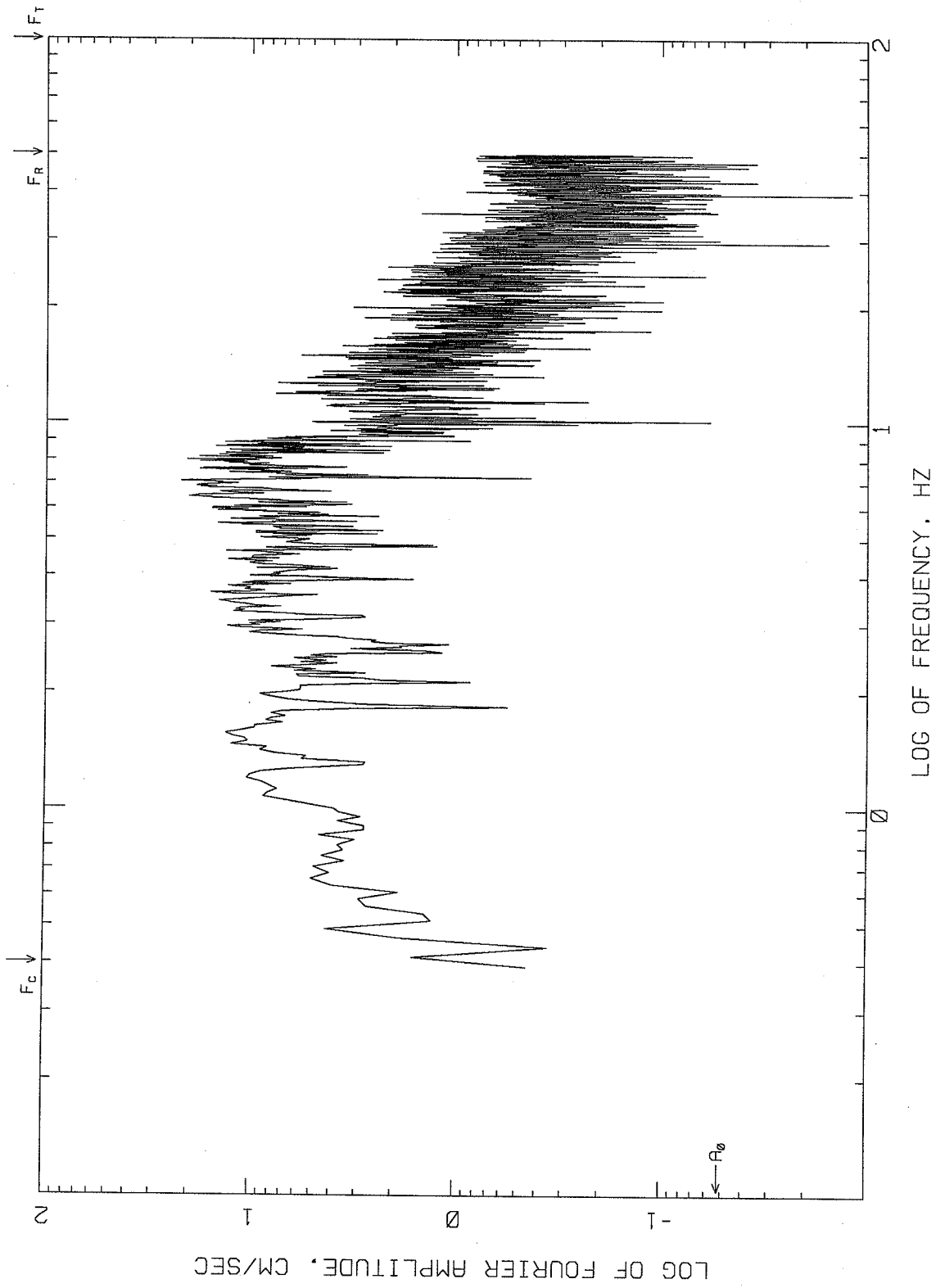
CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC

+T = 270 DEGREES: AZ. = 122 DEG.: DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

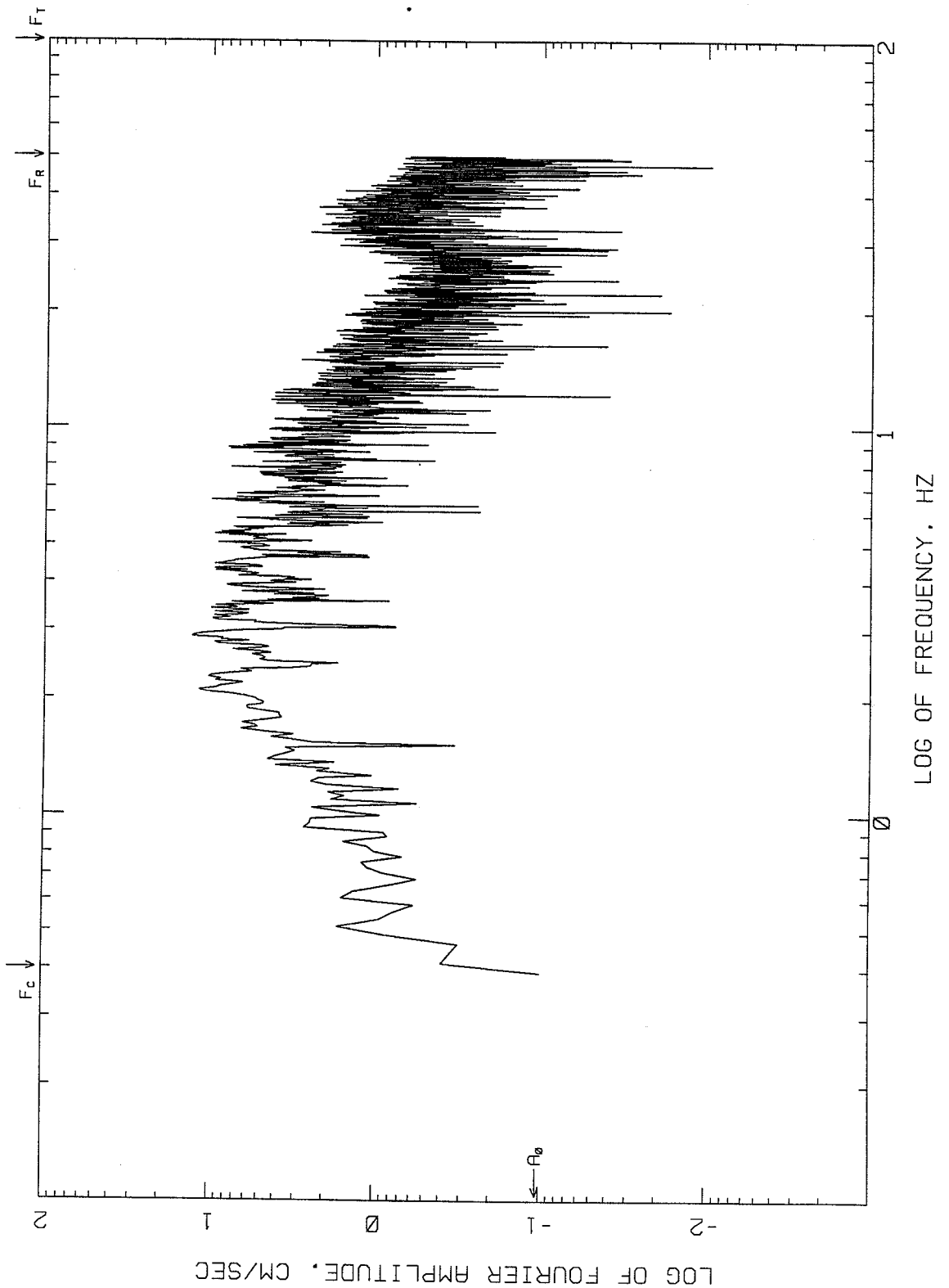
PEAK VALUES: ACCEL = -54.70 CM/SEC/SEC. VELOCITY = -2.62 CM/SEC. DISPL = 0.19 CM



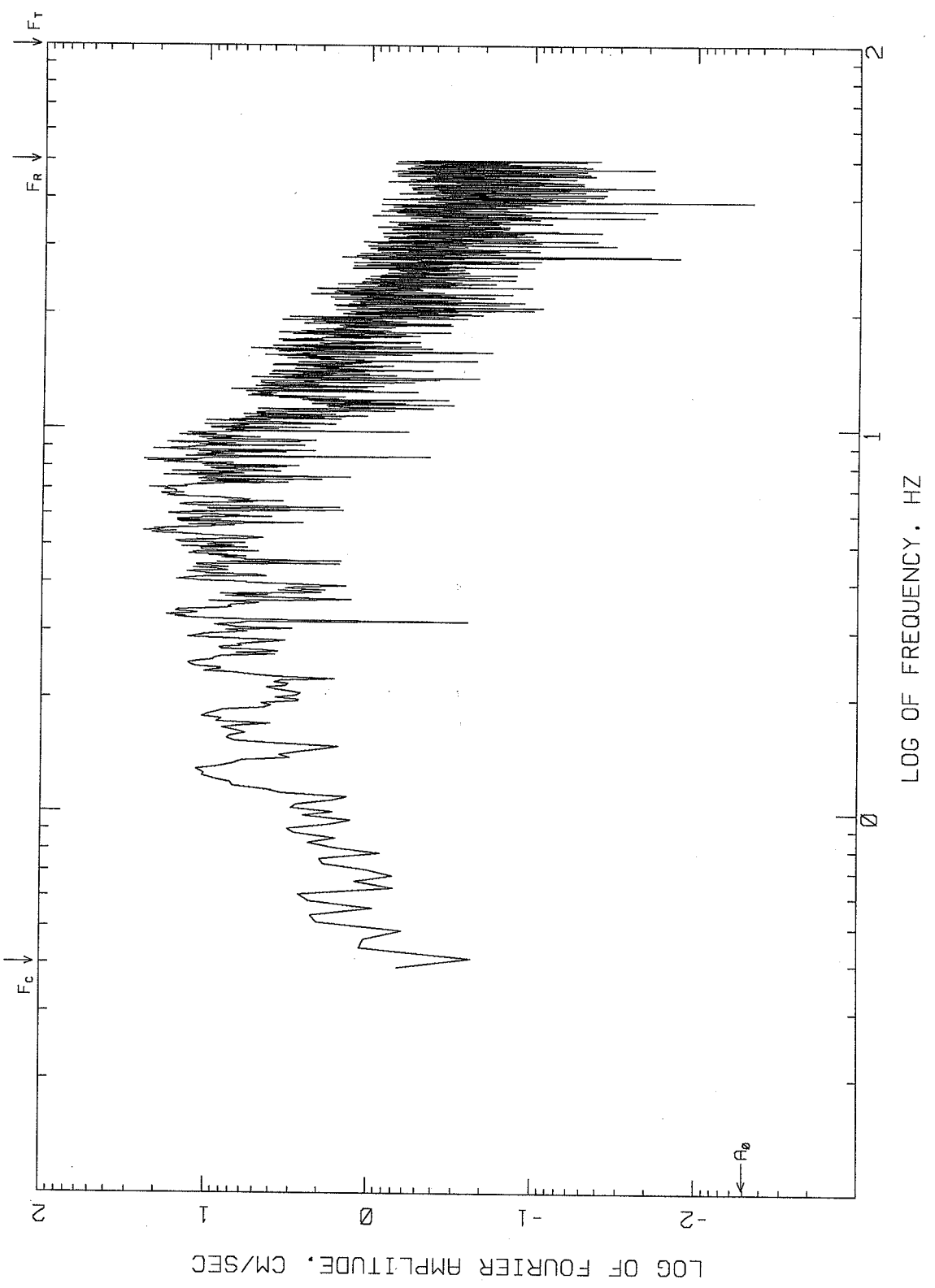
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC
+L = 0 DEGREES; AZ. = 122 DEG.; DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



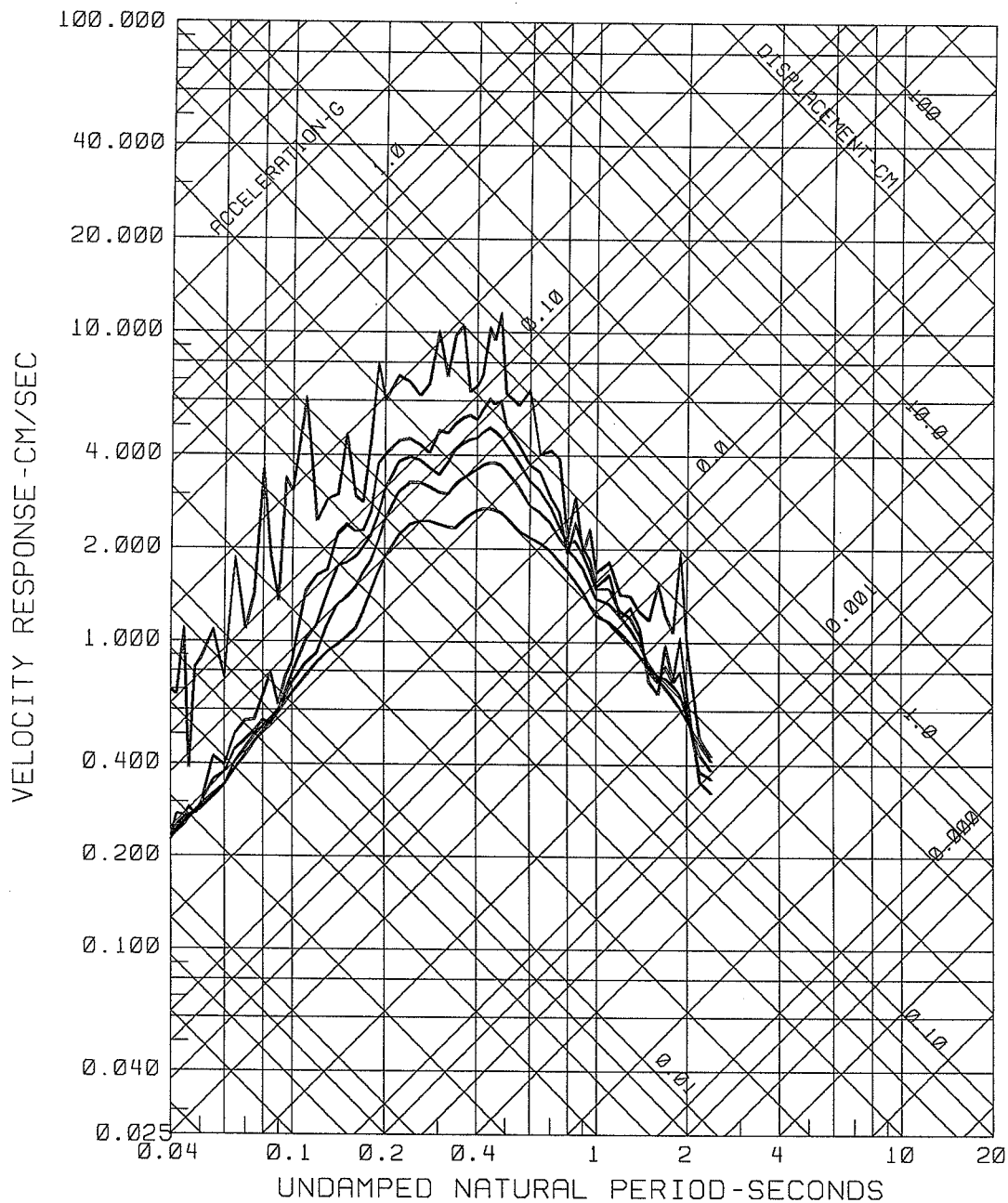
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC
VERTICAL: AZ = 122 DEG.; DIST = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS.NONNOISE



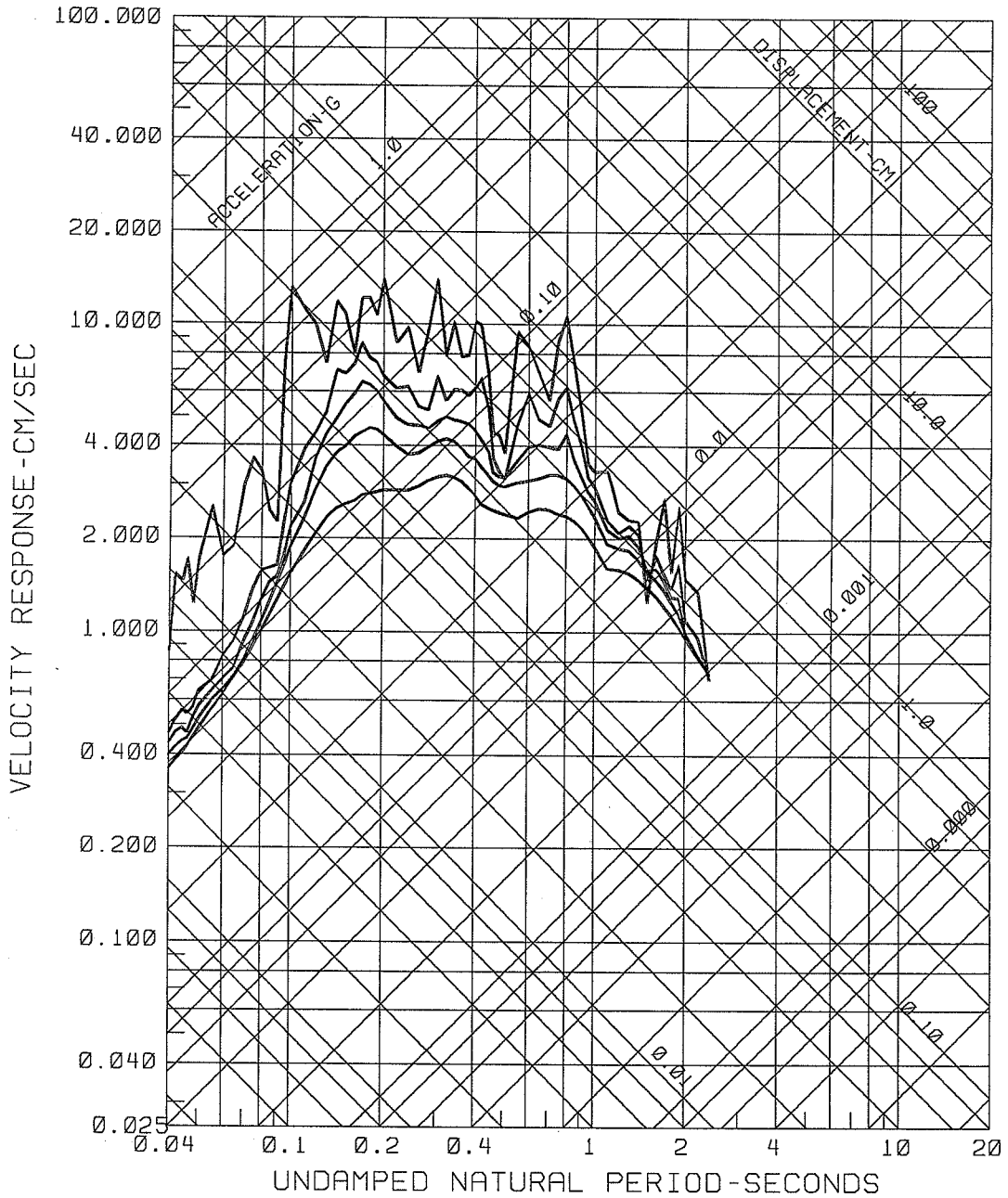
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 9: ST-PASCAL, QUEBEC
+T = 270 DEGREES; AZ. = 122 DEG.; DIST. = 123 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS:NONOISE



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 9: ST-PASCAL (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



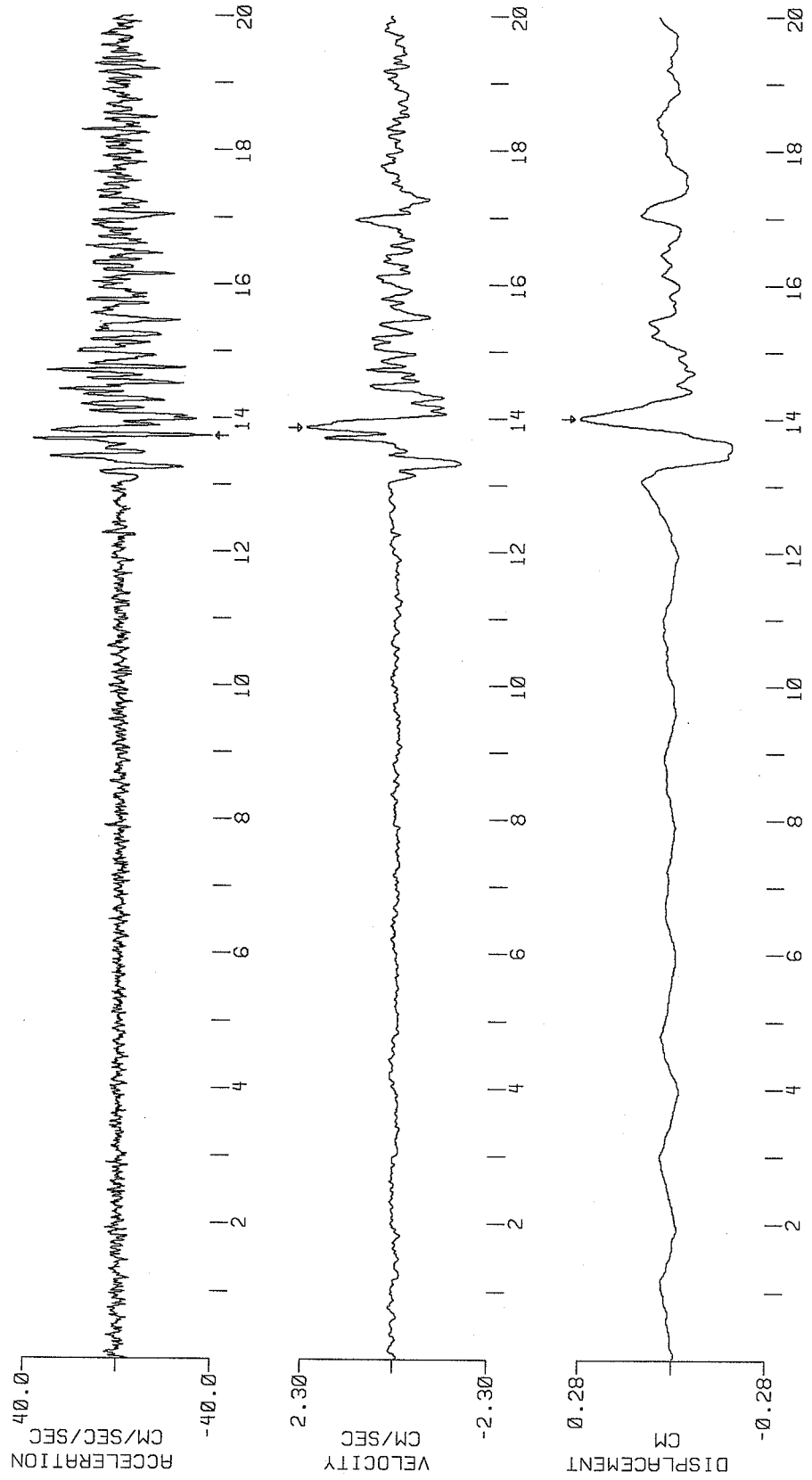
RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 9: ST-PASCAL (TRANSVERSE)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-QUELLE, QUEBEC
+L = 0 DEGREES: AZ. = 128 DEG.: DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL = -39.59 CM/SEC/SEC. VELOCITY = 2.21 CM/SEC. DISPL = 0.28 CM

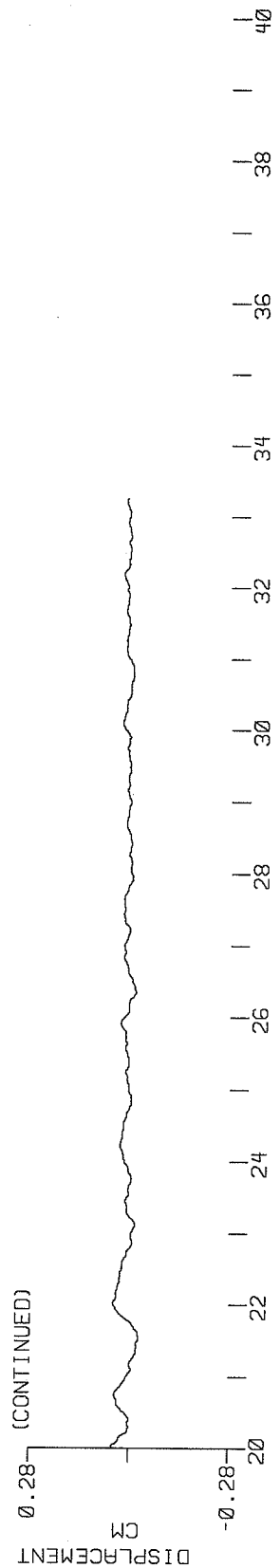
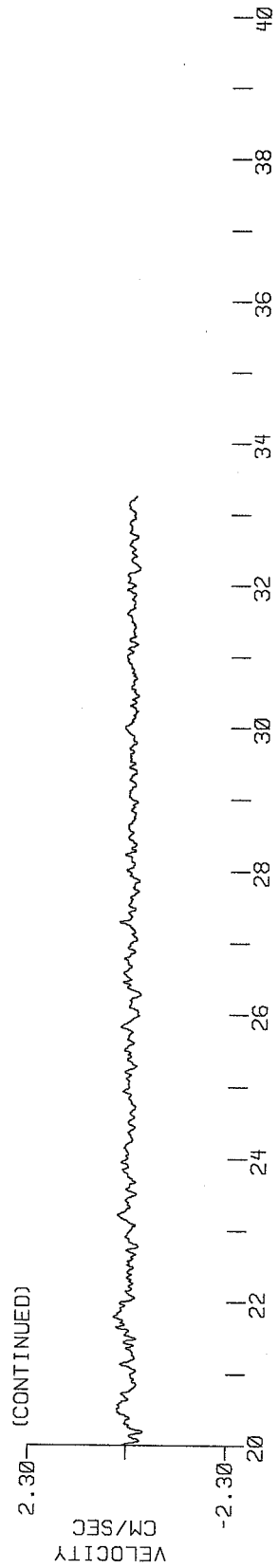
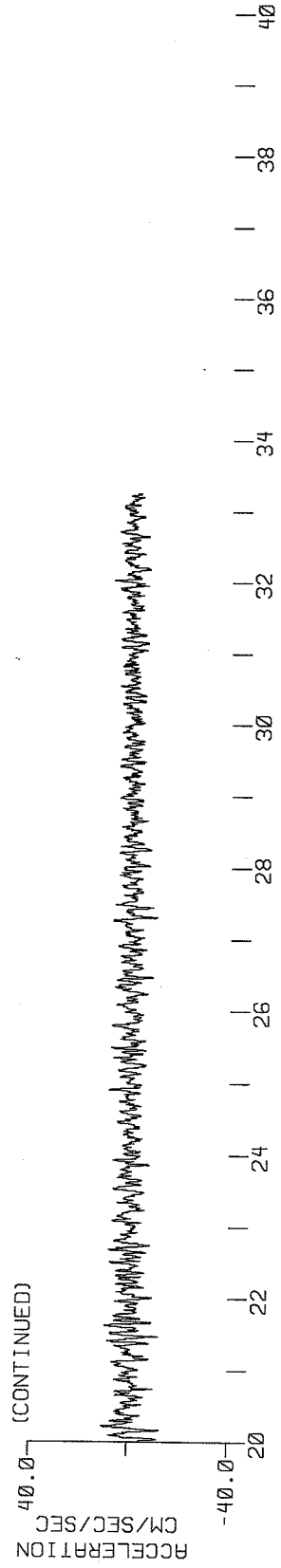


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-OUELLE, QUEBEC

+L = 0 DEGREES: AZ. = 128 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL = -39.59 CM/SEC/SEC, VELOCITY = 2.21 CM/SEC, DISPL = 0.28 CM

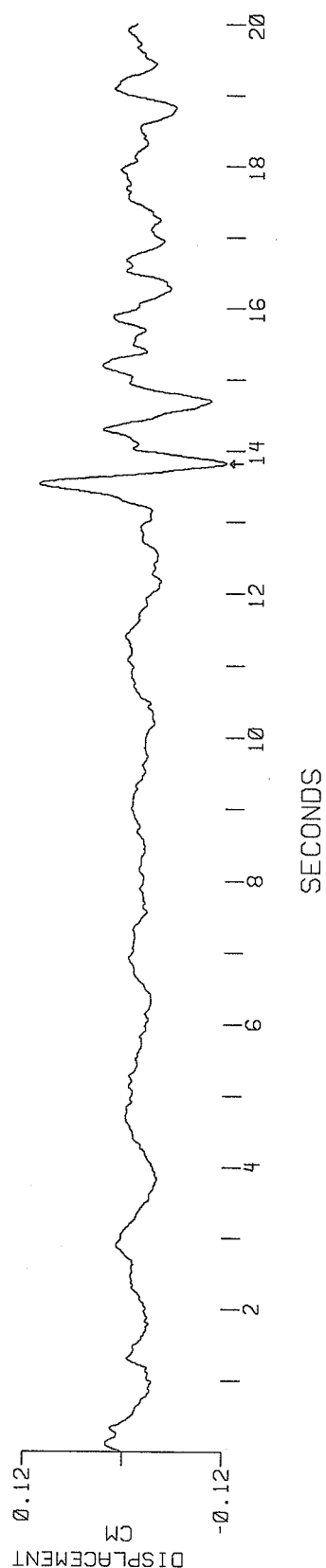
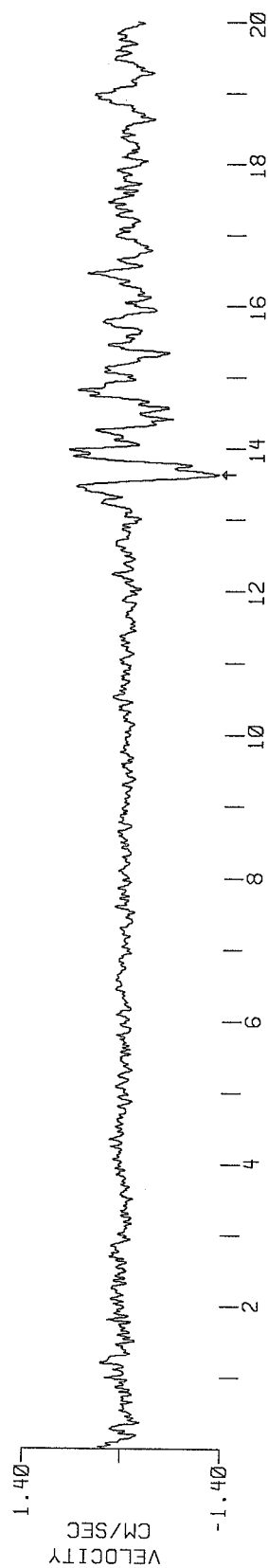
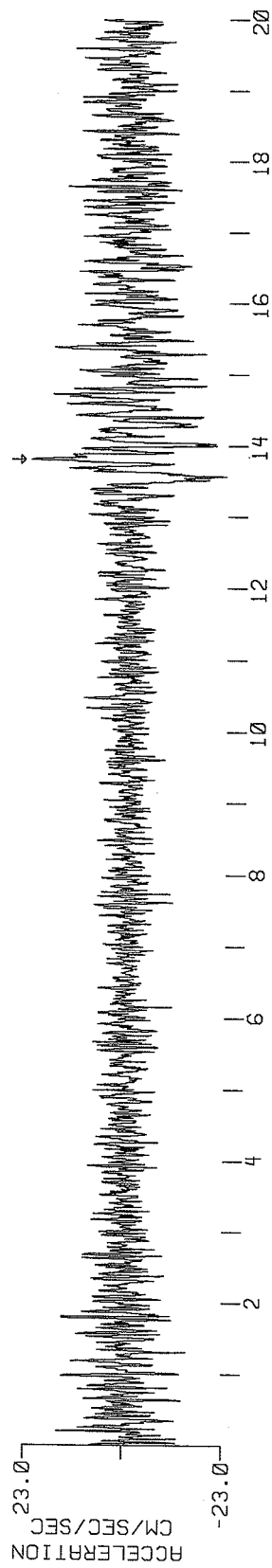


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-QUELLE, QUEBEC

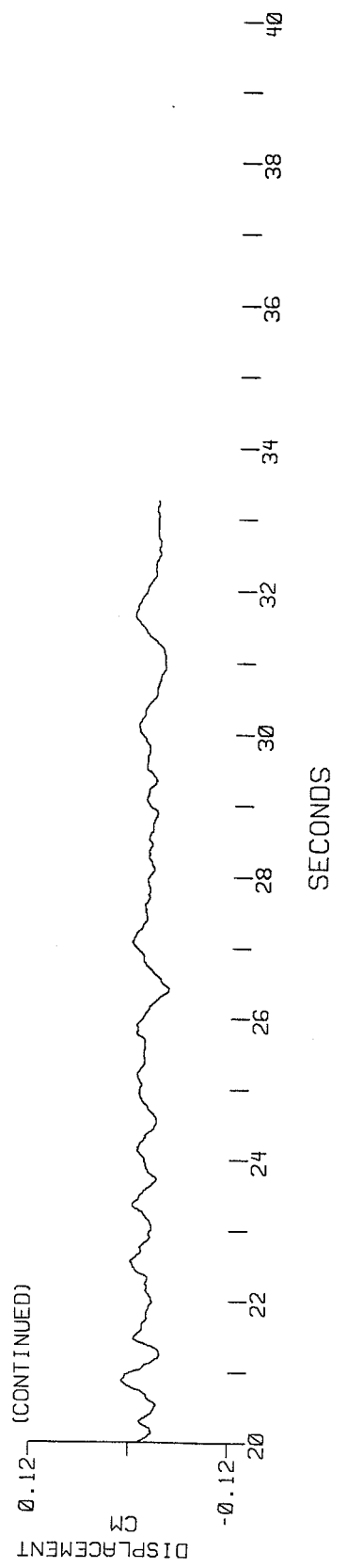
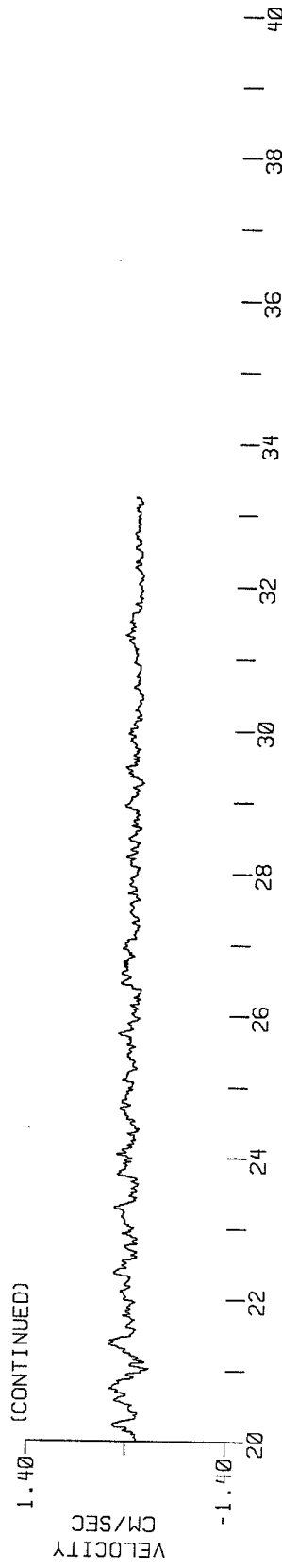
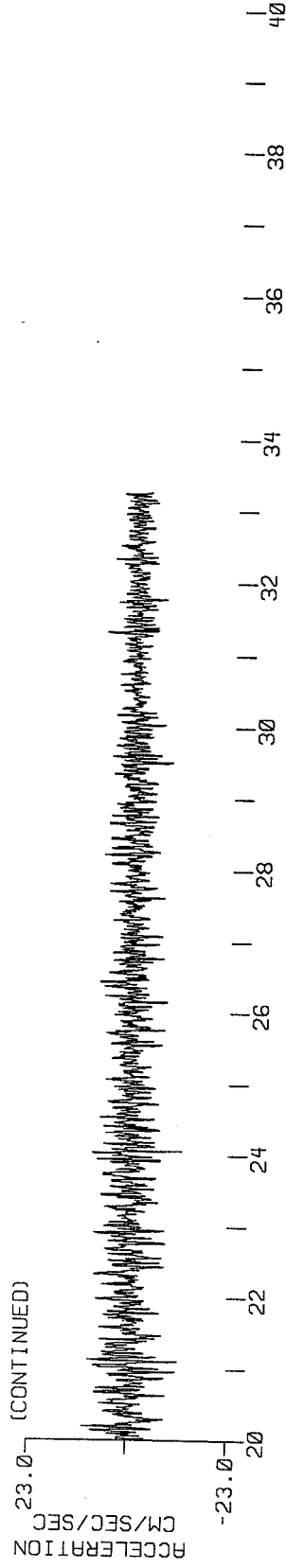
VERTICAL: AZ. = 128 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=22.85 CM/SEC/SEC. VELOCITY=-1.30 CM/SEC. DISPL=-0.12 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 10: RIVIERE-QUELLE, QUEBEC
 VERTICAL: AZ. = 128 DEG.; DIST. = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=22.85 CM/SEC/SEC. VELOCITY=-1.30 CM/SEC. DISPL=-0.12 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA

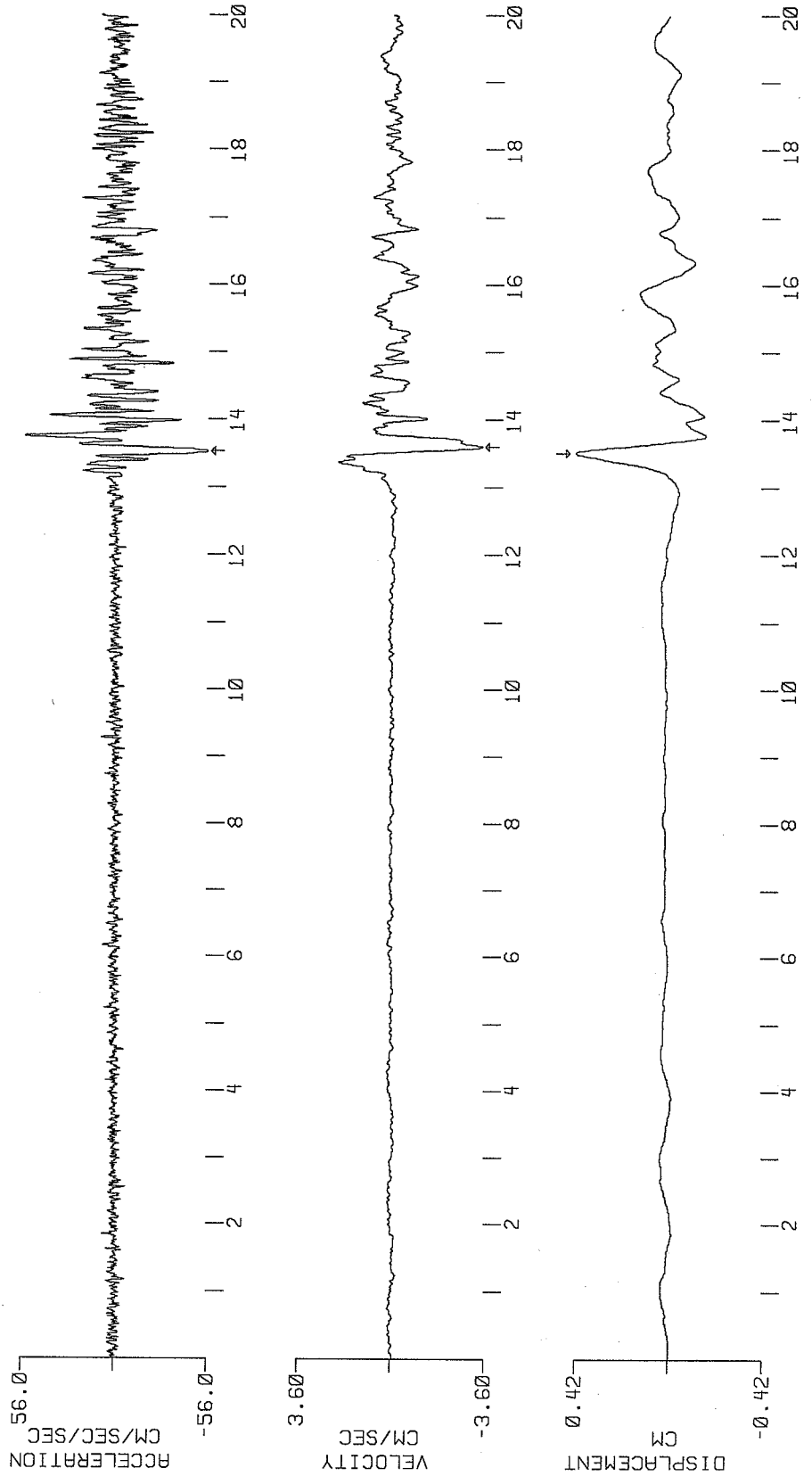
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT

SITE 10: RIVIERE-QUELLE, QUEBEC

+T = 270 DEGREES: AZ. = 128 DEG.: DIST. = 114 KM

4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL = -55.92 CM/SEC/SEC., VELOCITY = -3.52 CM/SEC., DISPL = 0.42 CM

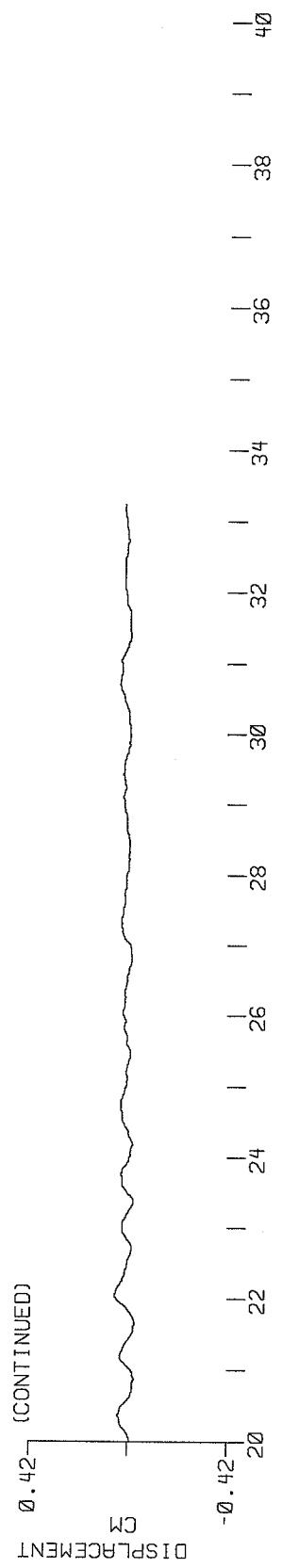
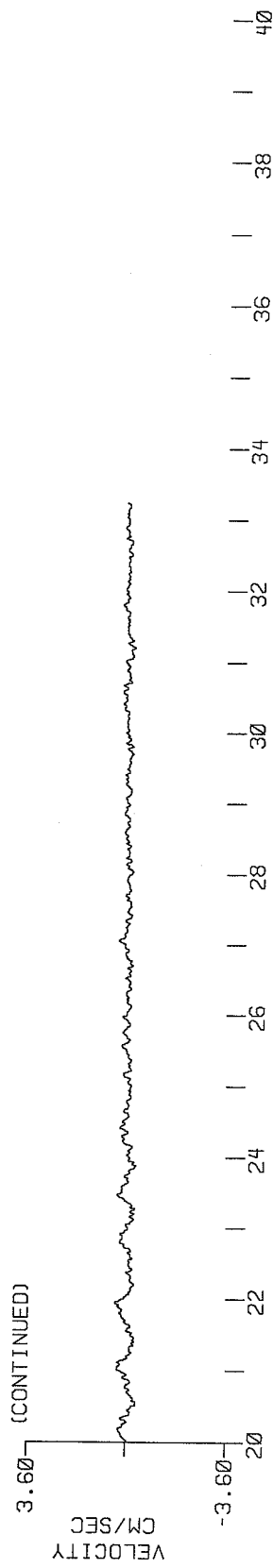
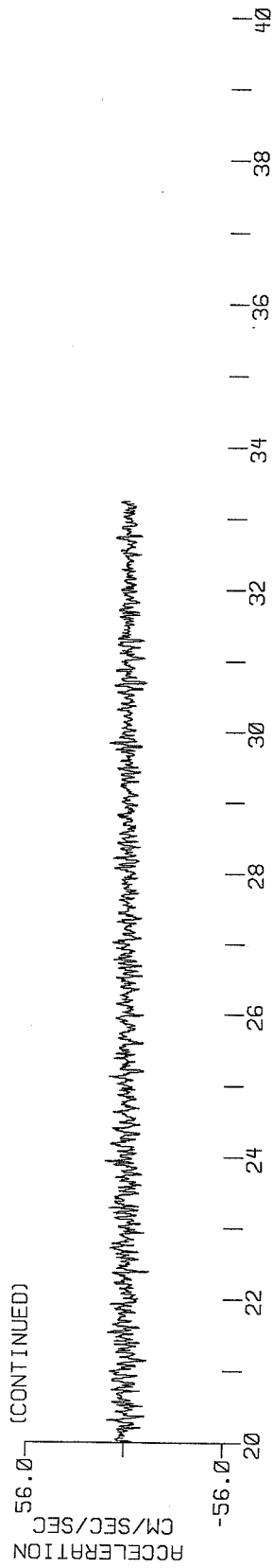


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

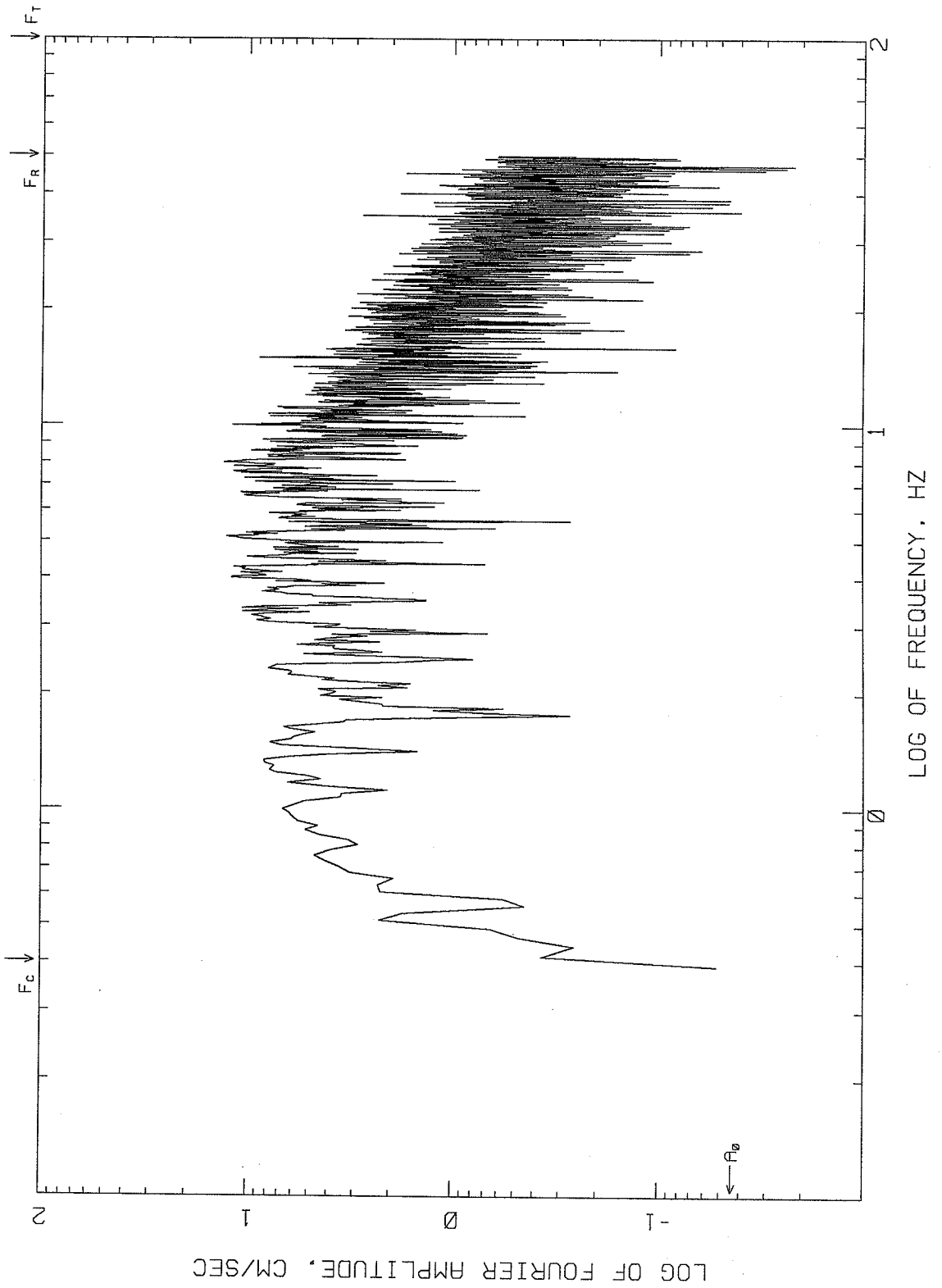
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-QUELLE, QUEBEC

+T = 270 DEGREES; AZ. = 128 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

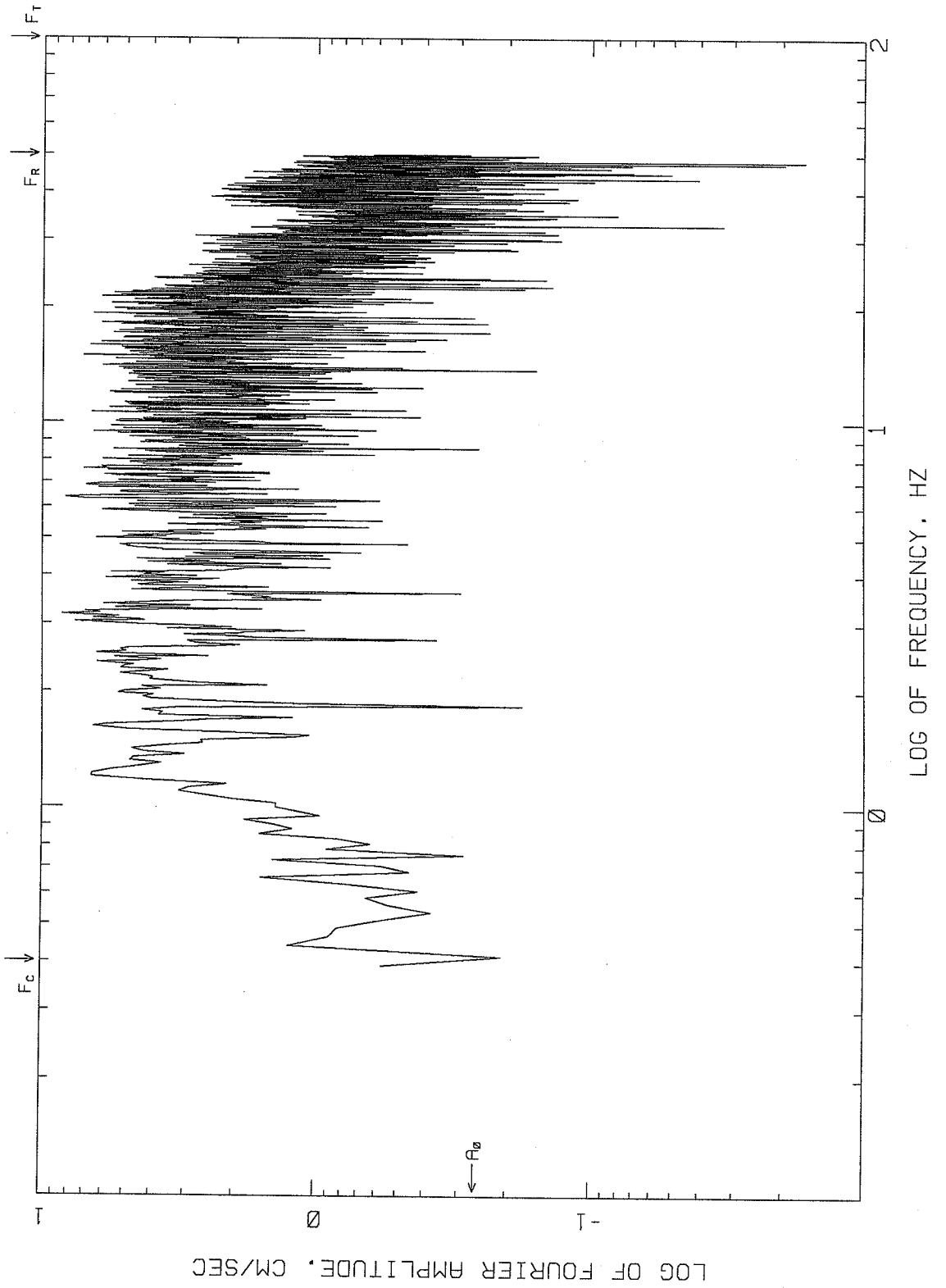
PEAK VALUES: ACCEL = -55.92 CM/SEC/SEC, VELOCITY = -3.52 CM/SEC, DISPL = 0.42 CM



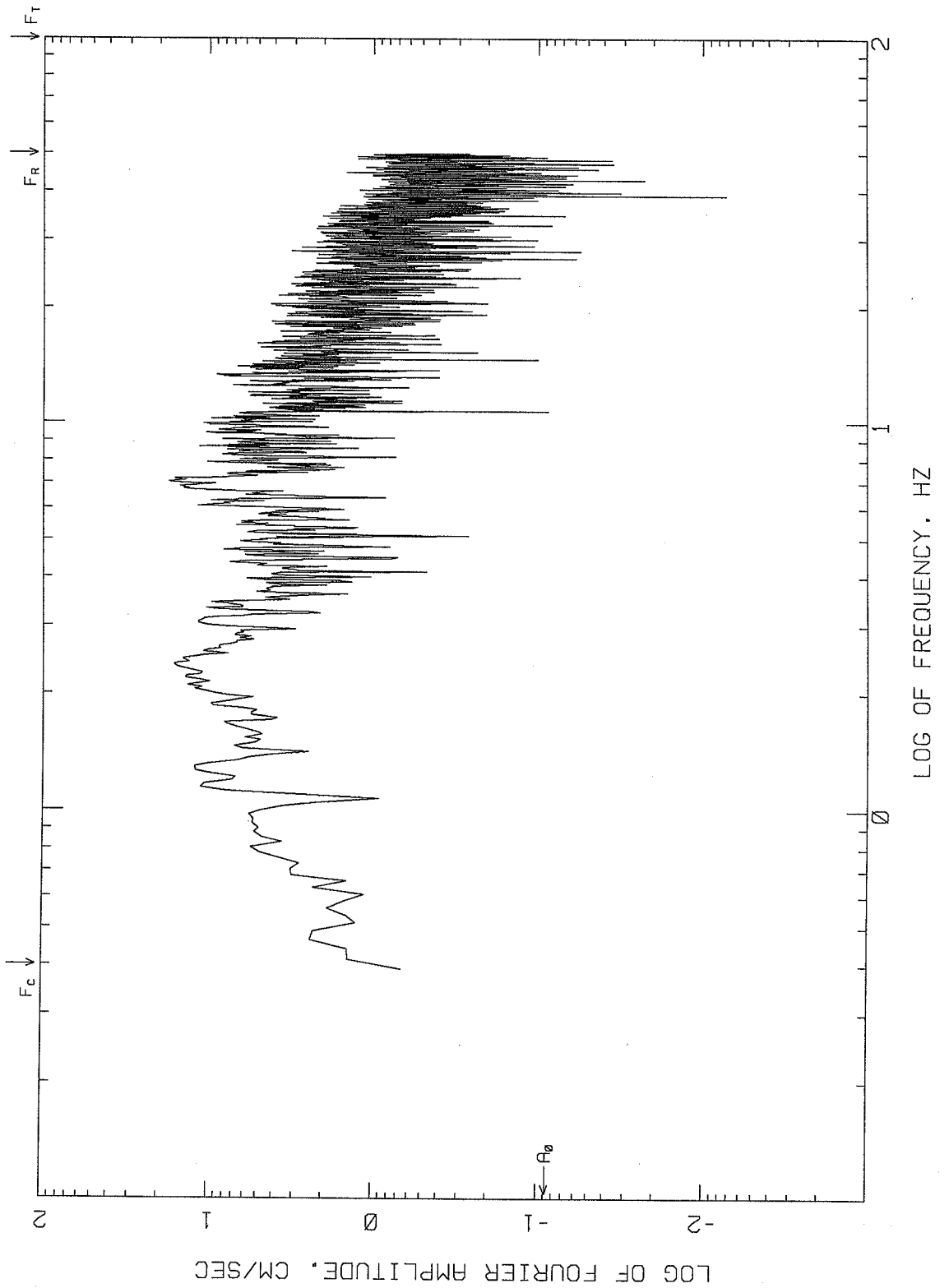
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
 GEOLOGICAL SURVEY OF CANADA
 SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
 SITE 10: RIVIERE-OUELLE, QUEBEC
 +L = 0 DEGREES; AZ. = 128 DEG.; DIST. = 114 KM
 4TH-ORDER BUTTERWORTH AT 0.400 HZ
 COMPUTING OPTIONS = ZCROSS, NONOISE



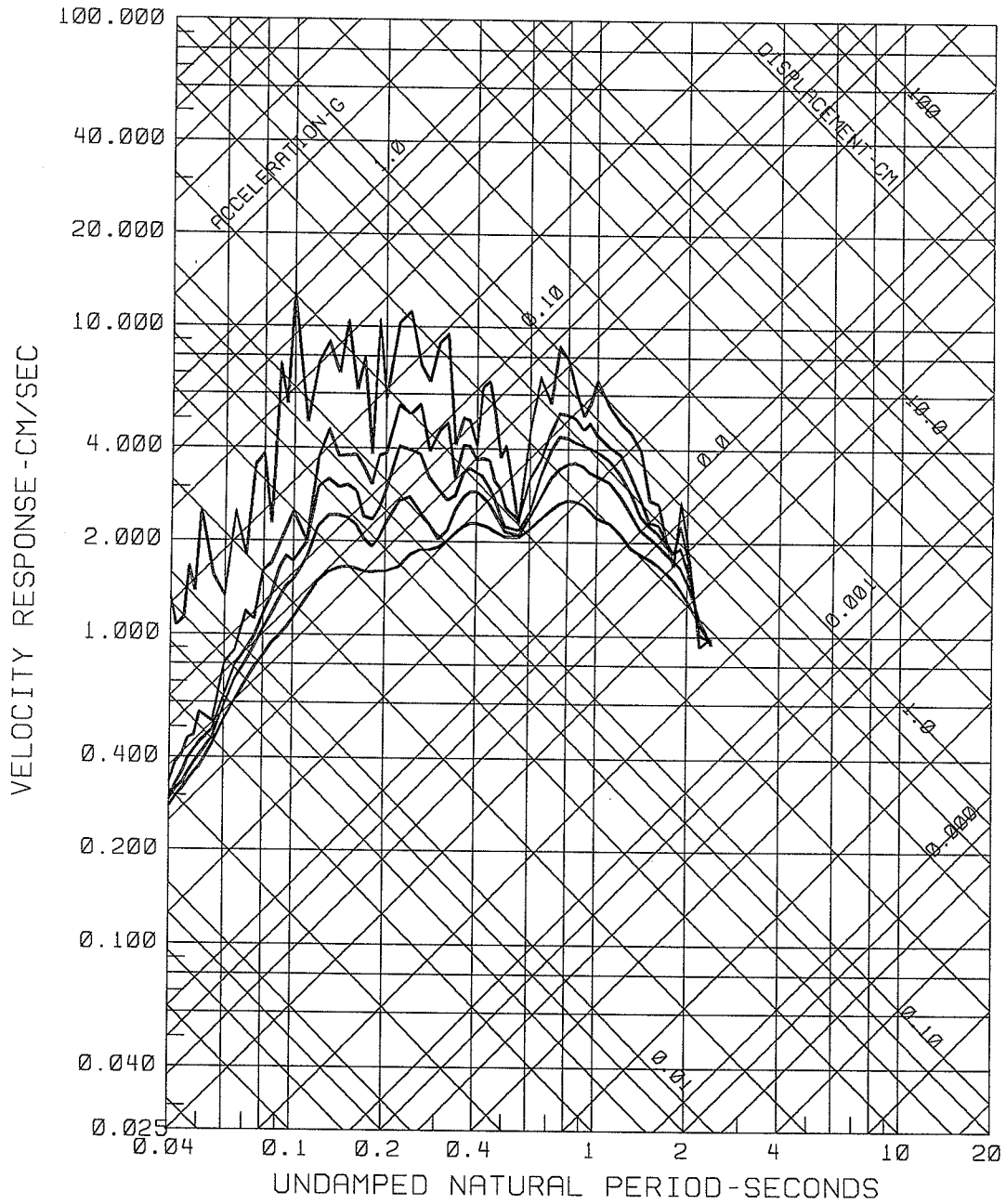
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-OUELLE, QUEBEC
VERTICAL; AZ = 128 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS.NONNOISE



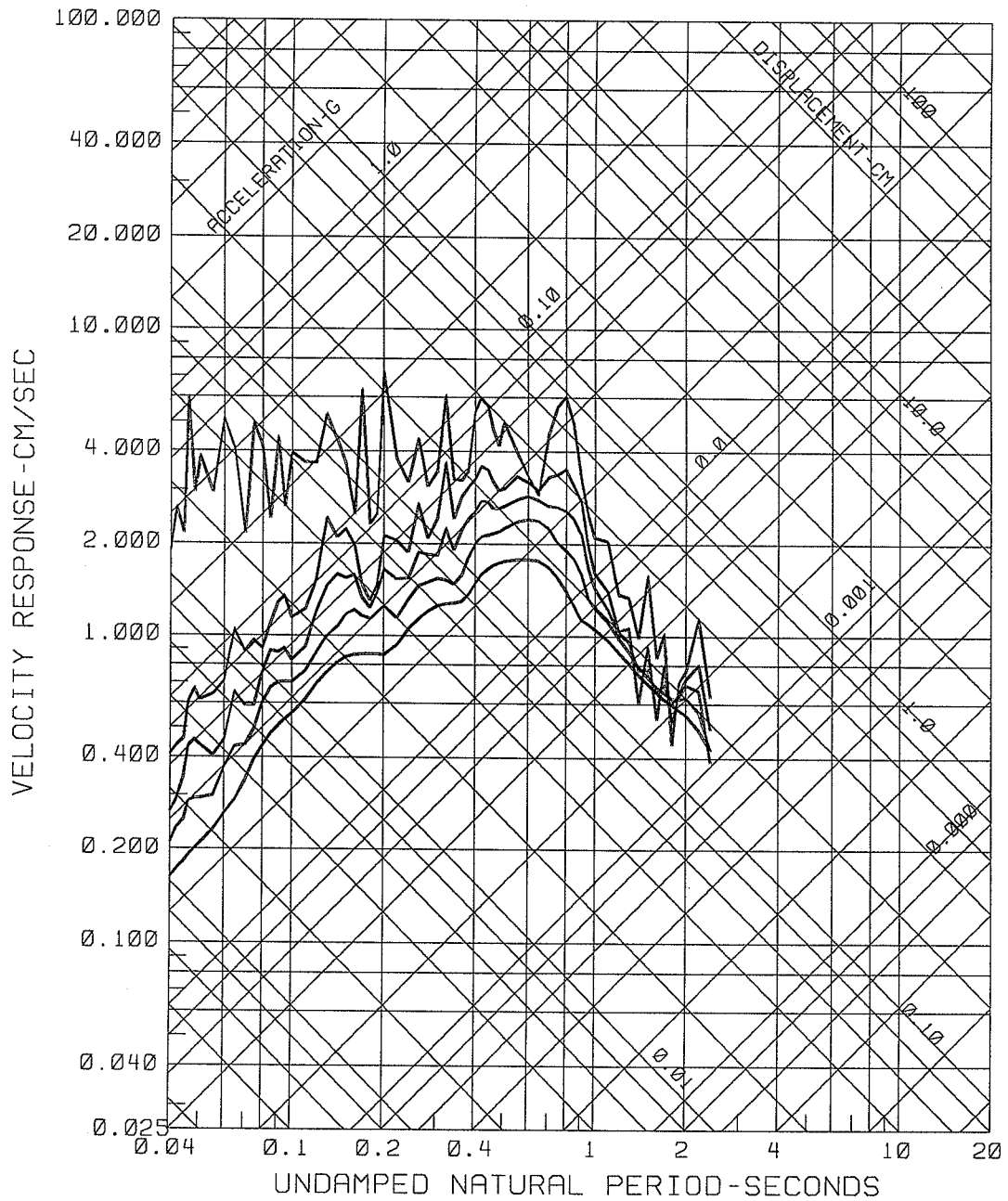
FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 10: RIVIERE-OUELLE, QUEBEC
+T = 270 DEGREES; AZ. = 128 DEG.; DIST. = 114 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS, NONOISE



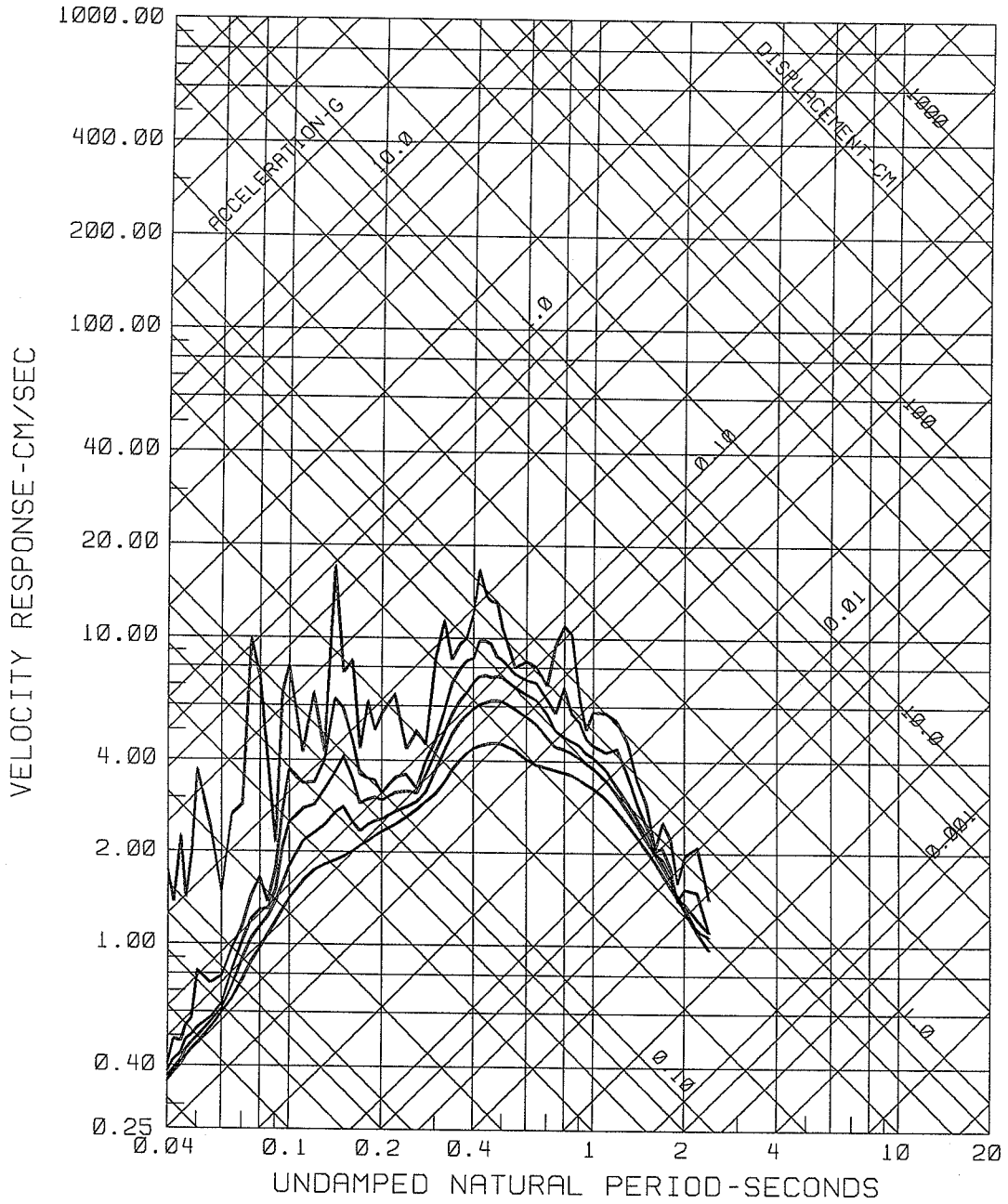
RESPONSE SPECTRA
1988 11 25 2346 UT; SITE 10: RIVIERE-OUELLE (LONGITUDINAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



RESPONSE SPECTRA
1988 11 25 2346 UT: SITE 10: RIVIERE-OUELLE (VERTICAL)
0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



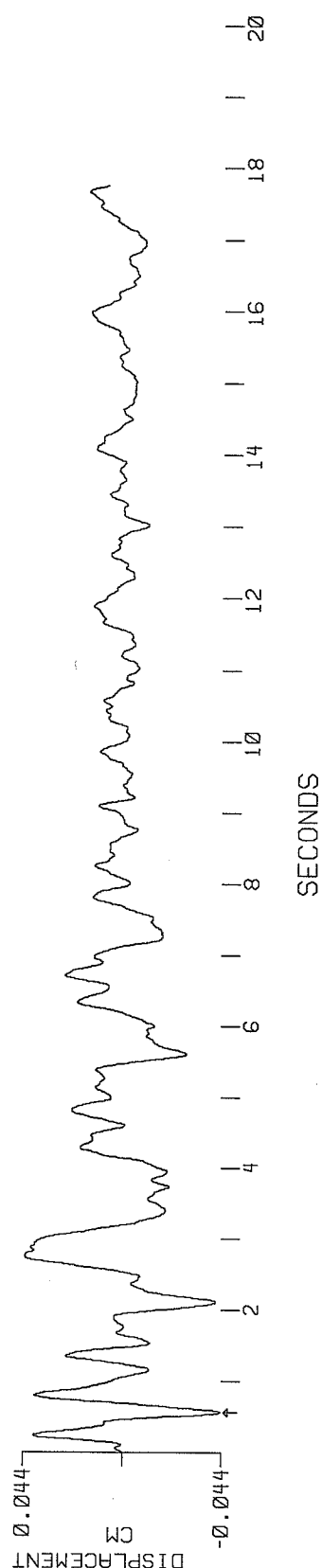
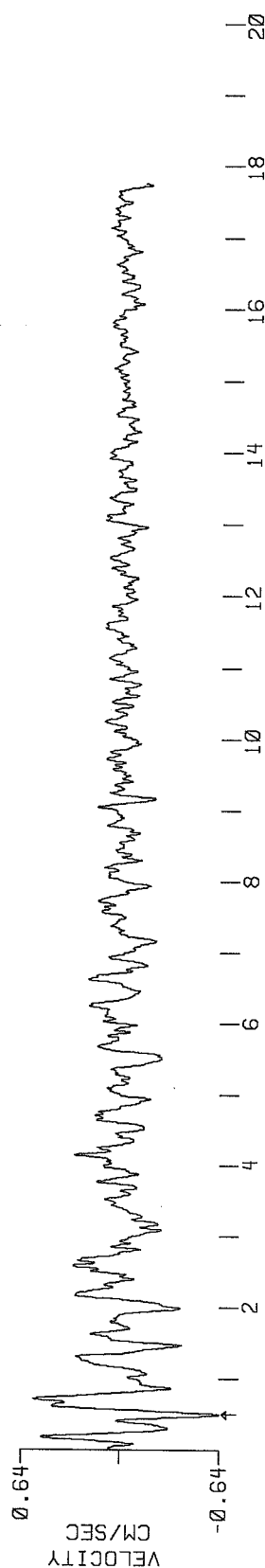
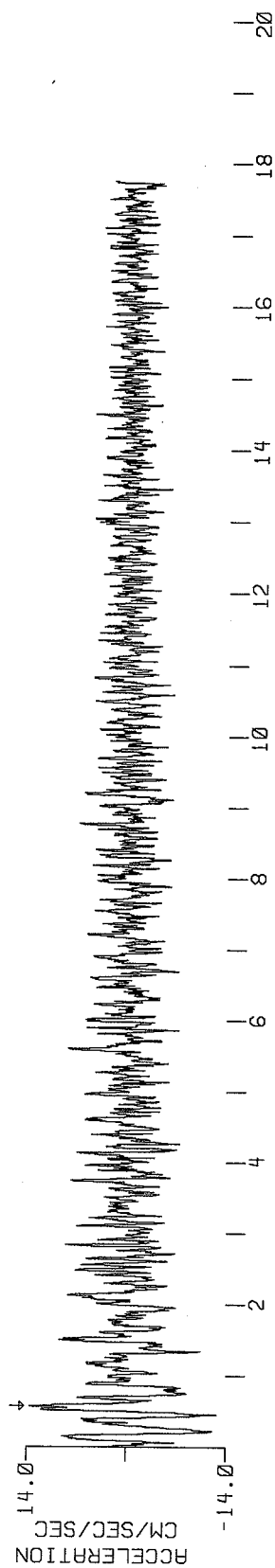
RESPONSE SPECTRA
 1988 11 25 2346 UT: SITE 10: RIVIERE-OUELLE (TRANSVERSE)
 0.2, 5, 10, 20 PERCENT CRITICAL DAMPING
 FILTERS: BUTTERWORTH, ORDER 4, 0.400 HZ; ANTIALIAS 50 - 100 HZ



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11.25 2346 UT
SITE 14: STE-LUCIE, QUEBEC

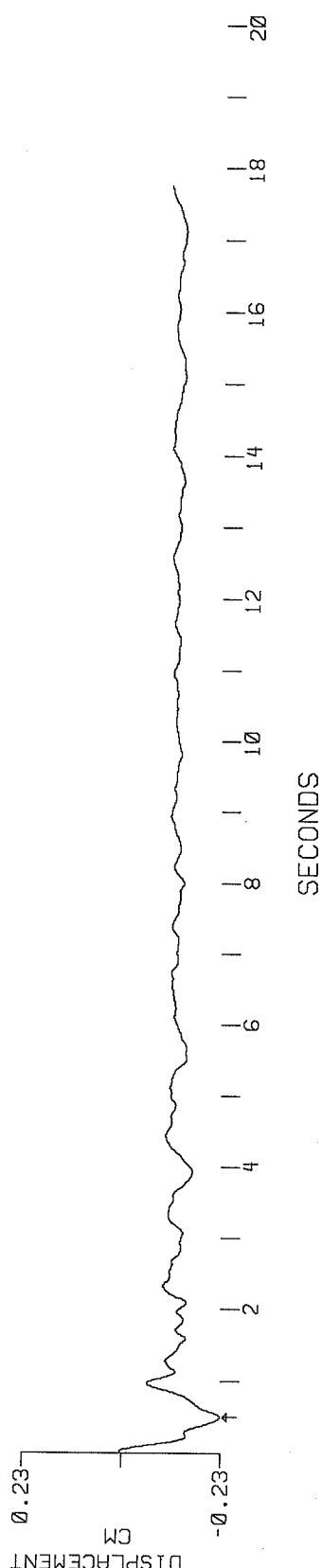
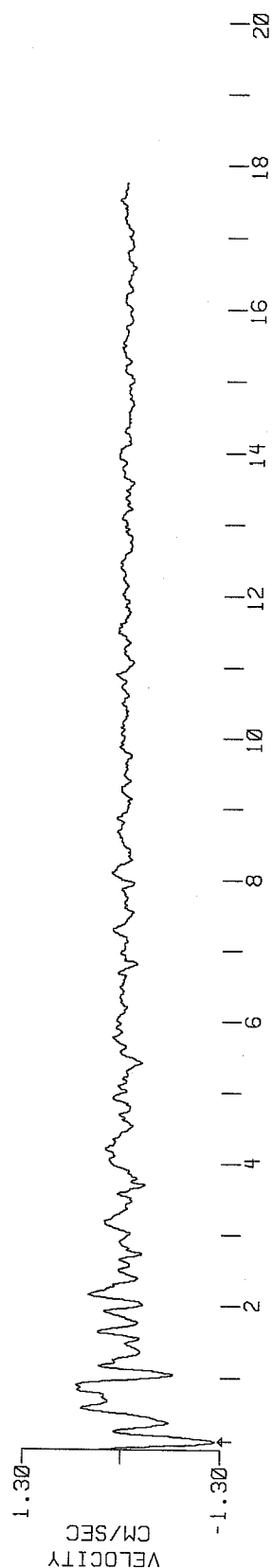
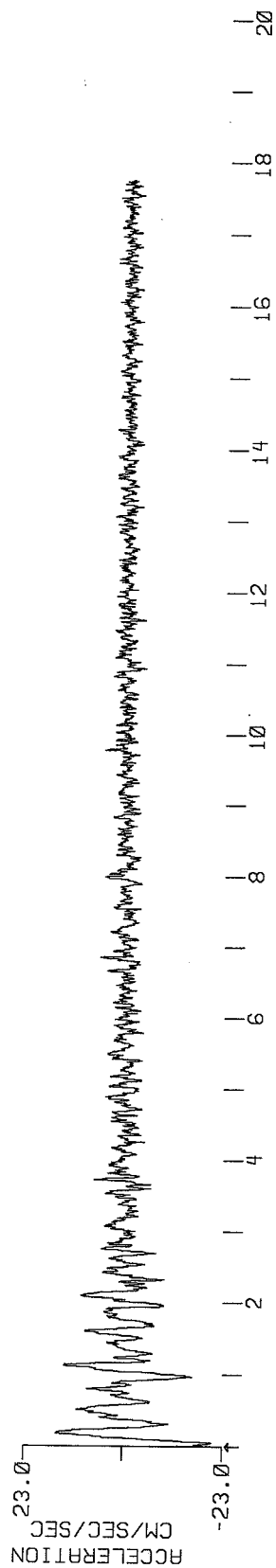
+L = 0 DEGREES: AZ. = 150 DEG.; DIST. = 177 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=13.58 CM/SEC/SEC. VELOCITY=-0.64 CM/SEC. DISPL=-0.04 CM



CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 14: STE-LUCIE, QUEBEC
VERTICAL: AZ. = 150 DEG.; DIST. = 177 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL = -22.91 CM/SEC/SEC, VELOCITY = -1.23 CM/SEC, DISPL = -0.23 CM

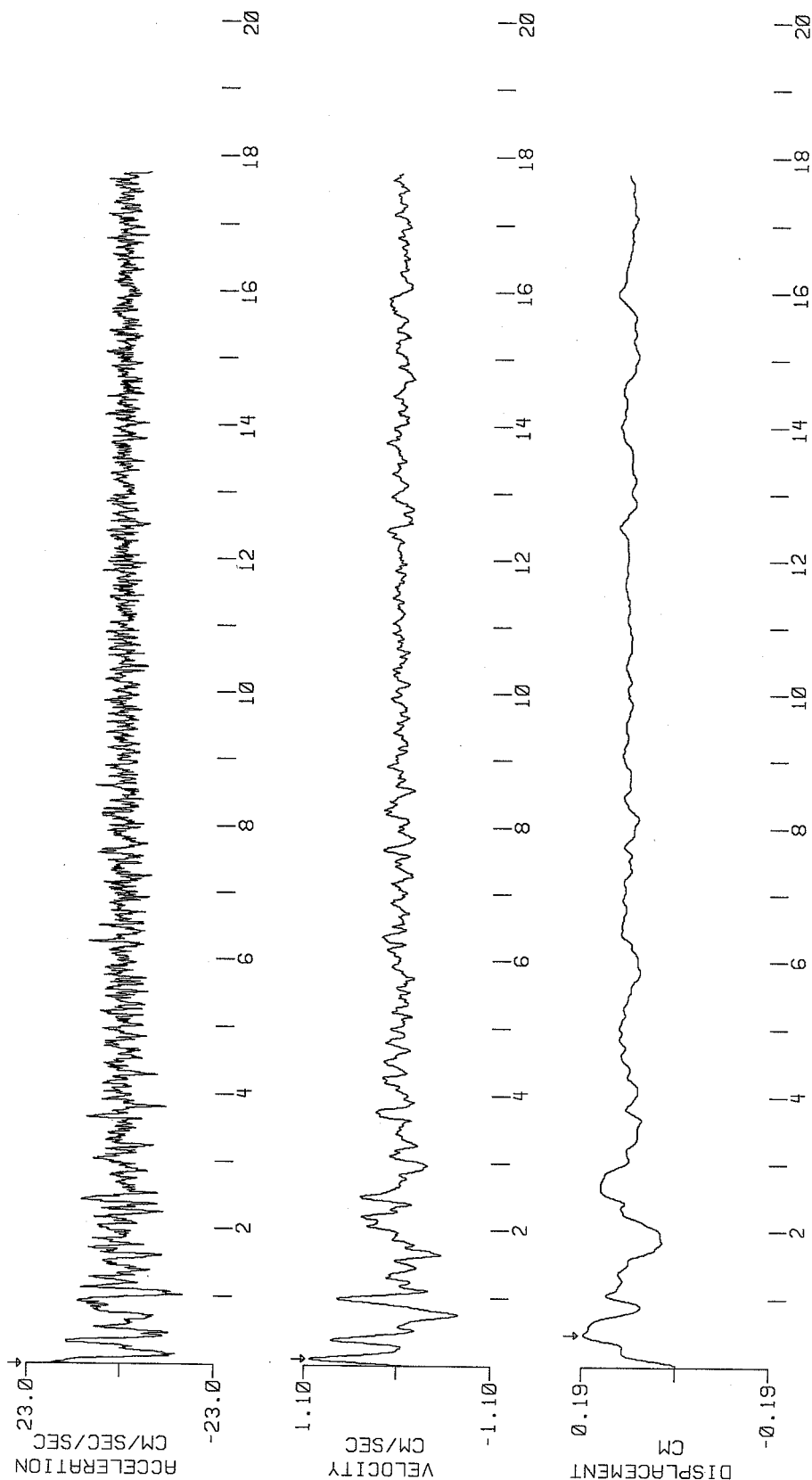


CORRECTED ACCELERATION, VELOCITY, AND DISPLACEMENT 200.00 SPS

GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 14: STE-LUCIE, QUEBEC

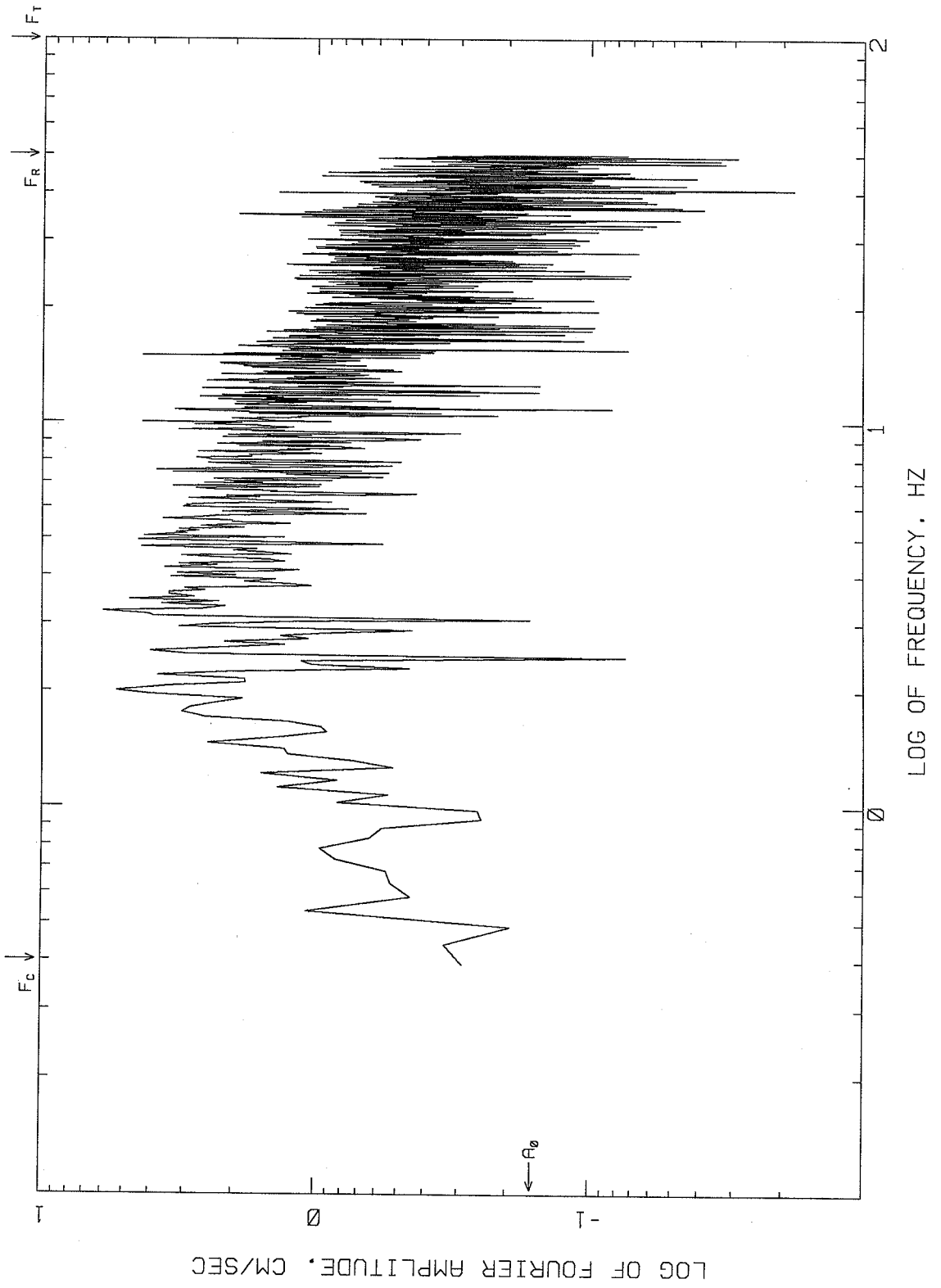
+T = 270 DEGREES; AZ. = 150 DEG.; DIST. = 177 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ

PEAK VALUES: ACCEL=22.84 CM/SEC/SEC, VELOCITY=1.03 CM/SEC, DISPL=0.19 CM

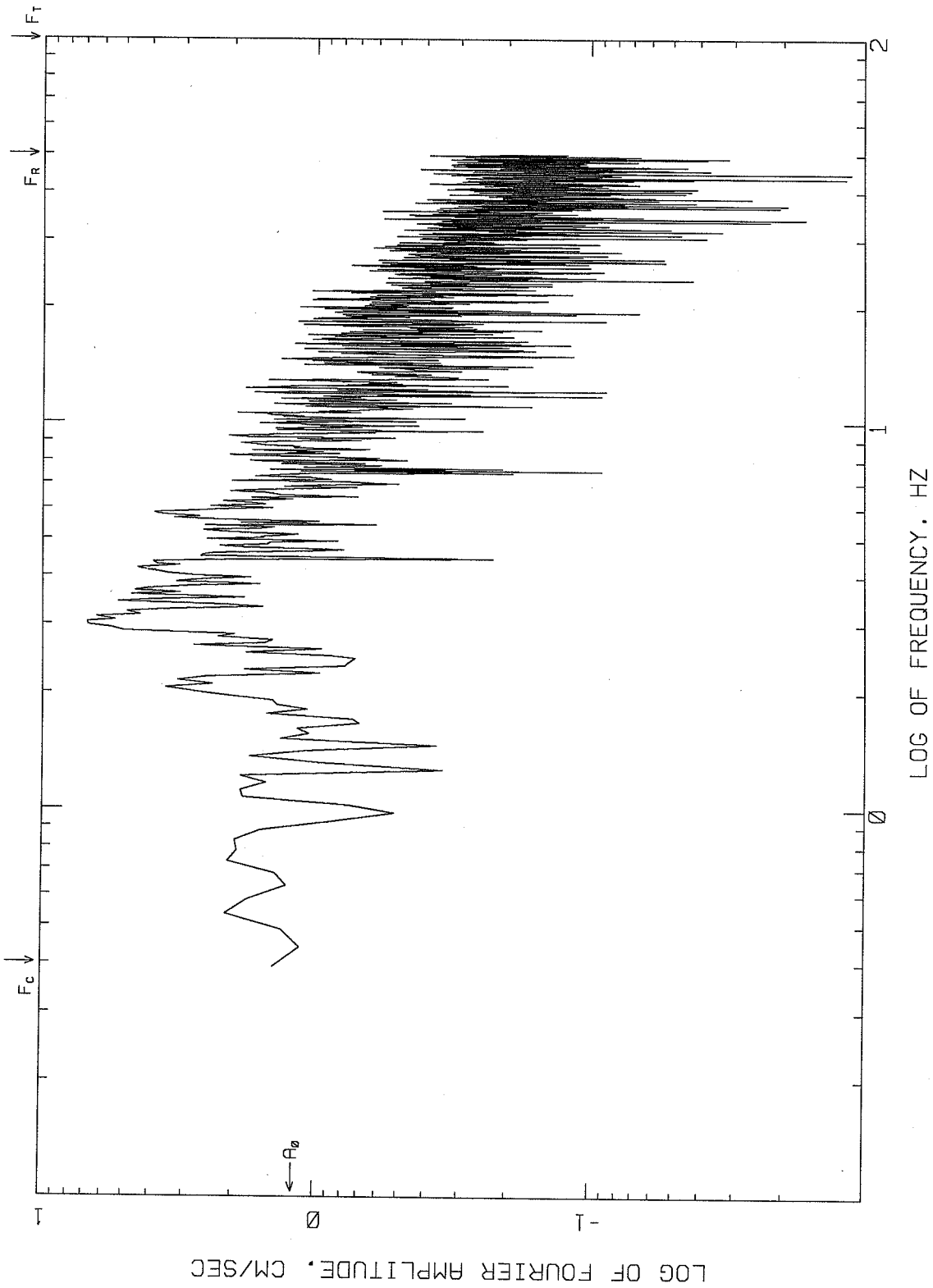


SECONDS

FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 14: STE-LUCIE, QUEBEC
+L = 0 DEGREES; AZ. = 150 DEG.; DIST. = 177 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS, NONNOISE



FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 14: STE-LUCIE, QUEBEC
VERTICAL; AZ = 150 DEG.; DIST = 177 KM
4TH-ORDER BUTTERWORTH AT 0.400 HZ
COMPUTING OPTIONS = ZCROSS.NONNOISE



FOURIER AMPLITUDE SPECTRUM OF ACCELERATION
GEOLOGICAL SURVEY OF CANADA
SAGUENAY EARTHQUAKE OF 1988 11 25 2346 UT
SITE 14: STE-LUCIE, QUEBEC
+T = 270 DEGREES; AZ. = 150 DEG.; DIST. = 177 KM
4TH-ORDER BUTTERWORTH AT 0.4000 HZ
COMPUTING OPTIONS= ZCROSS, NONOISE

