Sandia National Laboratories
Albuquerque, New Mexico 87185

December 12, 1986

Mr. Charles E. Smith
Department of Interior
Minerals Management Service
EMS-Mail Stop 647
Reston, VA 22091

Dear Charles:

Enclosed is our quarterly summary of work completed on the SEMS project. If you have any questions, please feel free to call (505) 844-4831.

Sincerely,

Dennis Engi

Dennis Engi, Supervisor
Geo Systems Division 6256

DE:6256:lmc

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SEAFLOOR EARTHQUAKE MEASUREMENT SYSTEM
Quarterly Report

Performing Organization: Sandia National Laboratories
Geo Systems Division 6256

Technical Project Officer: Dennis Engi

Contracting Agency: Department of Energy

Reporting Period: July 1, 1986 - September 30, 1986

Project Description

The purpose of the SEMS project is to gather strong motion earthquake data from offshore oil and gas leasing regions that are seismically active. The principal areas of interest are offshore of southern California, in the southern Bering Sea, and near the Aleutian Islands. One SEMS unit was installed during 1985 in the Beta Field offshore of Long Beach. Given that sufficient government and industry funding can be obtained, the project will eventually emplace and monitor multiple SEMS units in Alaskan waters where the greatest seismic hazards exist.

Progress

Two significant earthquakes were recorded during July by the SEMS unit located offshore near Long Beach. On July 8, a 6.0 magnitude earthquake located near Palm Springs, approximately 95 miles east of the SEMS unit, caused significant motion on nearby Shell offshore platforms and was recorded by the SEMS unit and by accelerometers located at five different levels on a pillar of one of the Shell platforms. On July 13, a 5.8 magnitude earthquake located offshore west of Oceanside, approximately 50 miles south of the SEMS unit, was recorded by the SEMS unit and the same five accelerometers on the Shell platform. Again significant motion was observed on nearby Shell platforms. The location of these earthquakes and the position of the SEMS unit are shown in the map in Figure 1. The Shell platform on which accelerograms were obtained is located within the square marking the location of the SEMS unit.

Time history plots of the baseline corrected scaled instrument response for the Oceanside earthquake are shown in Figure 2. Noise generated by heavy rotating equipment on Shell offshore platform Elly obscures the p-wave arrival in the x-component, which is pointed directly at platform Elly located only 2,000 feet away (center trace in Figure 2). The primary frequency of this platform noise appears to be about 50 hz, well above the frequency range of interest for analysis of the earthquake data. The Fourier amplitude spectrum of this component is shown in Figure 3 and has a peak just below 50 hz which is almost certainly caused by this platform noise. Passing the signal through a high cut filter eliminates this peak resulting in the Fourier amplitude spectrum shown in Figure 4. In the corresponding time history plots, shown in Figure 5, the p-wave arrival is still not clear on the trace of the x-component. This indicates that the platform noise may have a significant low frequency content which may require more sophisticated analysis techniques for its removal.

The recording of these two earthquakes both on the seafloor and on the pillar of a nearby offshore platform provides data never before available, and should lead to better understanding of how earthquake loads are transmitted from the sediment to the pillars.

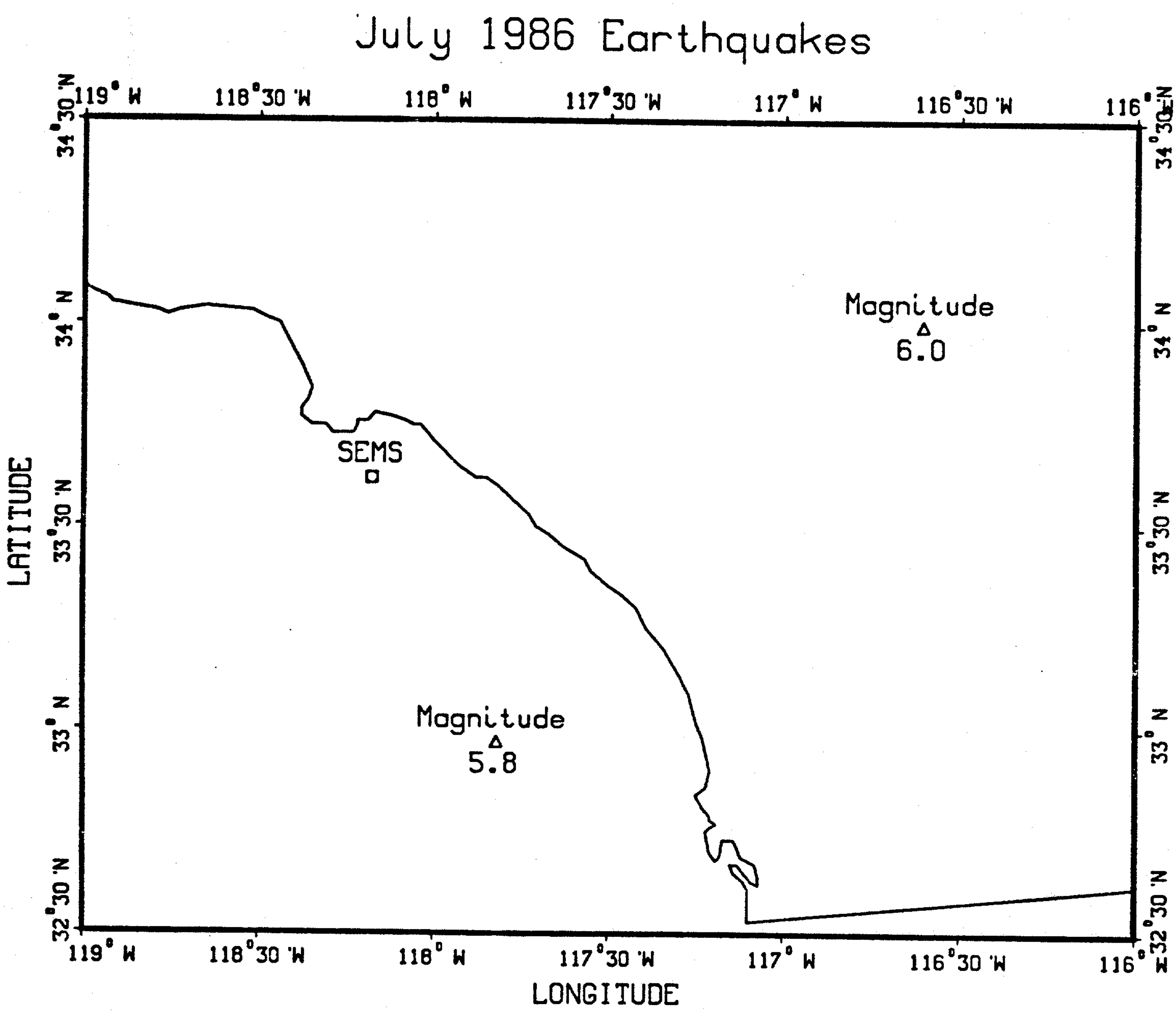

Figure 1. July 1986 Earthquake Locations.

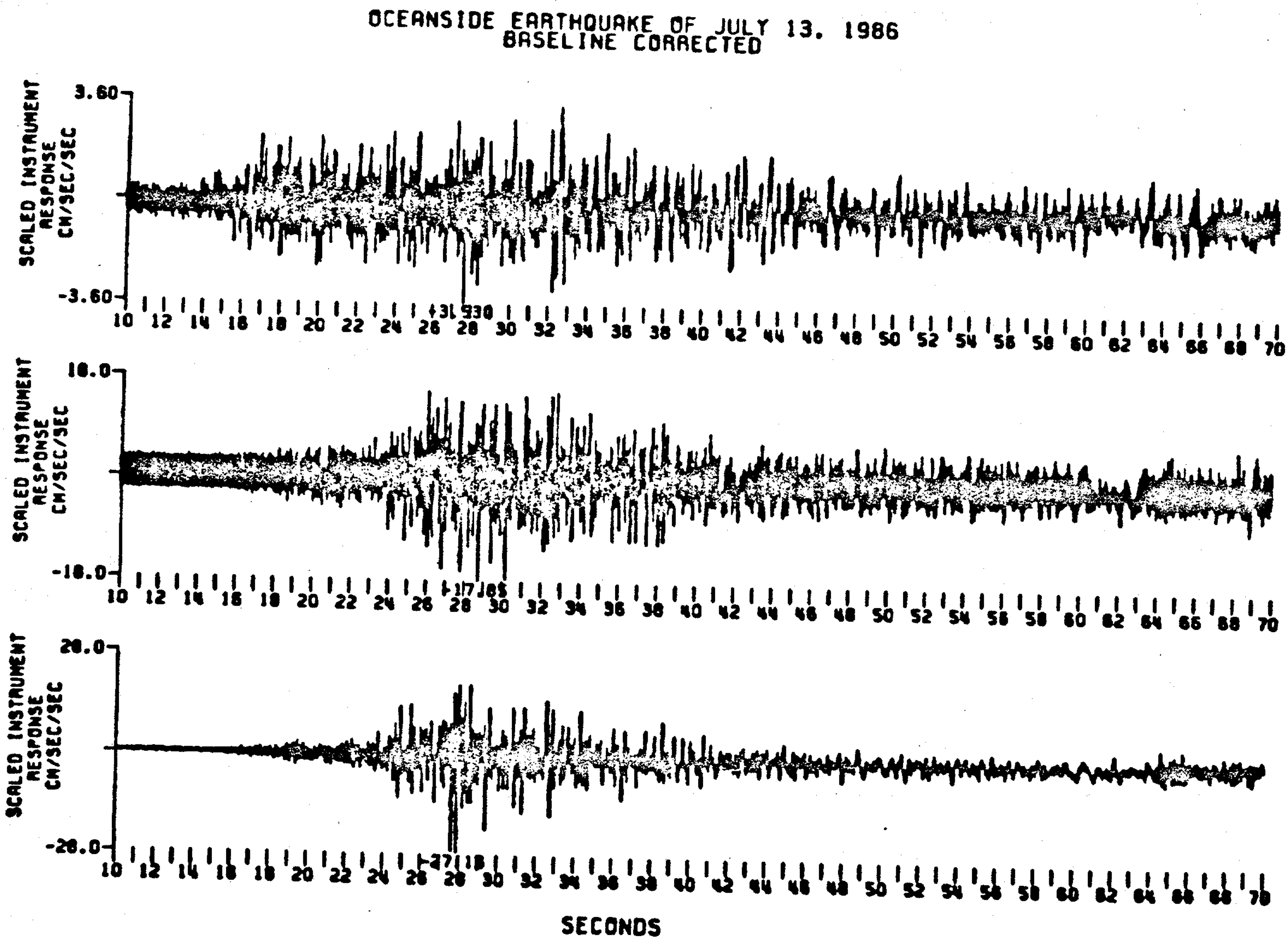

Figure 2. Oceanside Earthquake of July 13, 1986.
Baseline Corrected.

FOURIER AMPLITUDE SPECTRUM OF SCALED INSTRUMENT RESPONSE
JULY13.G02
COMPUTING OPTIONS= ZCROSS

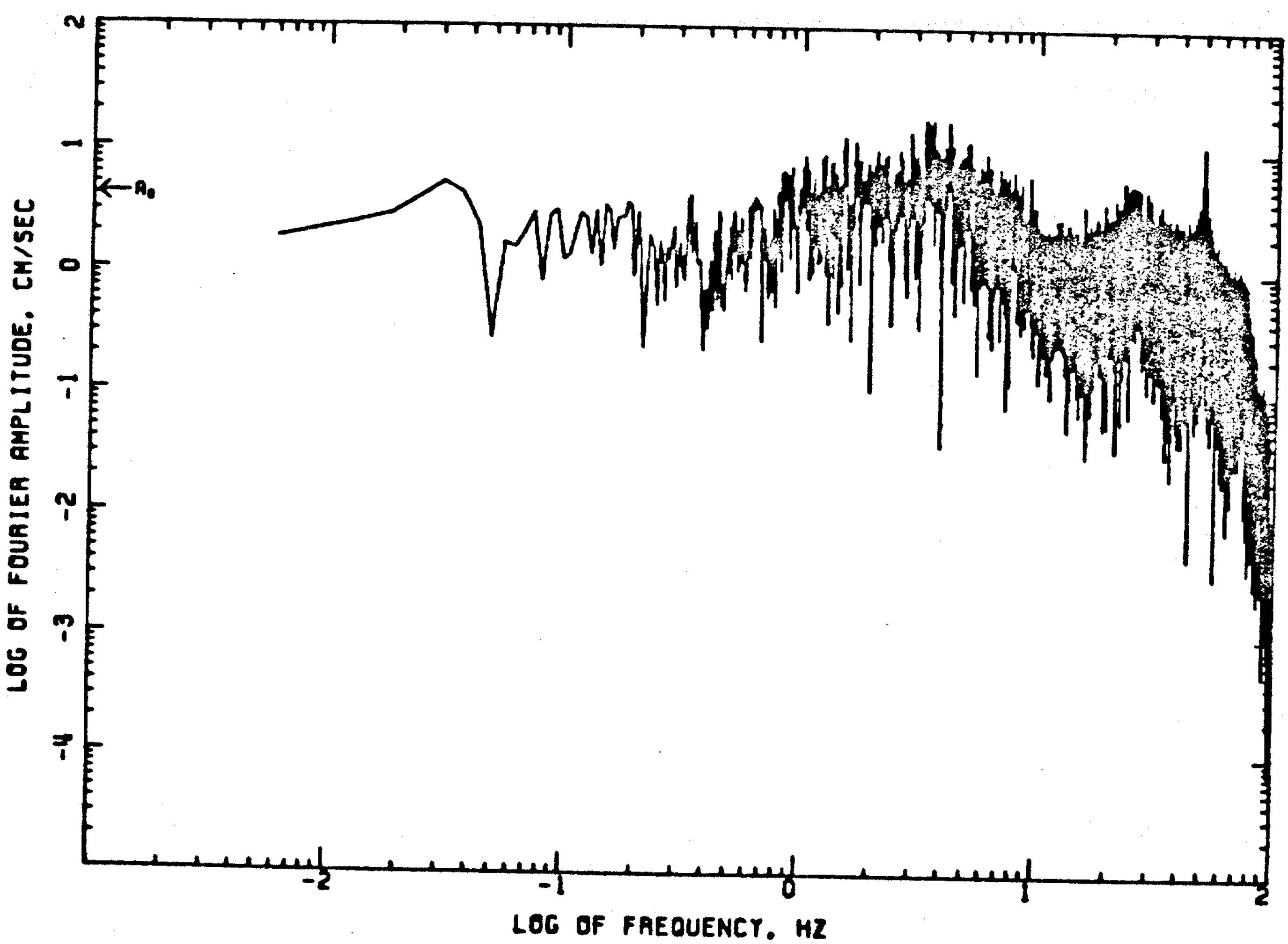

Figure 3. Fourier Amplitude Spectrum of Scaled Instrument Response.

July 13. G02
Computing Options= ZCROSS

FOURIER AMPLITUDE SPECTRUM OF INSTRUMENT CORRECTED, HIGH-CUT FILTERED ACCELERATION
JULY13.G22
COMPUTING OPTIONS= ZCROSS

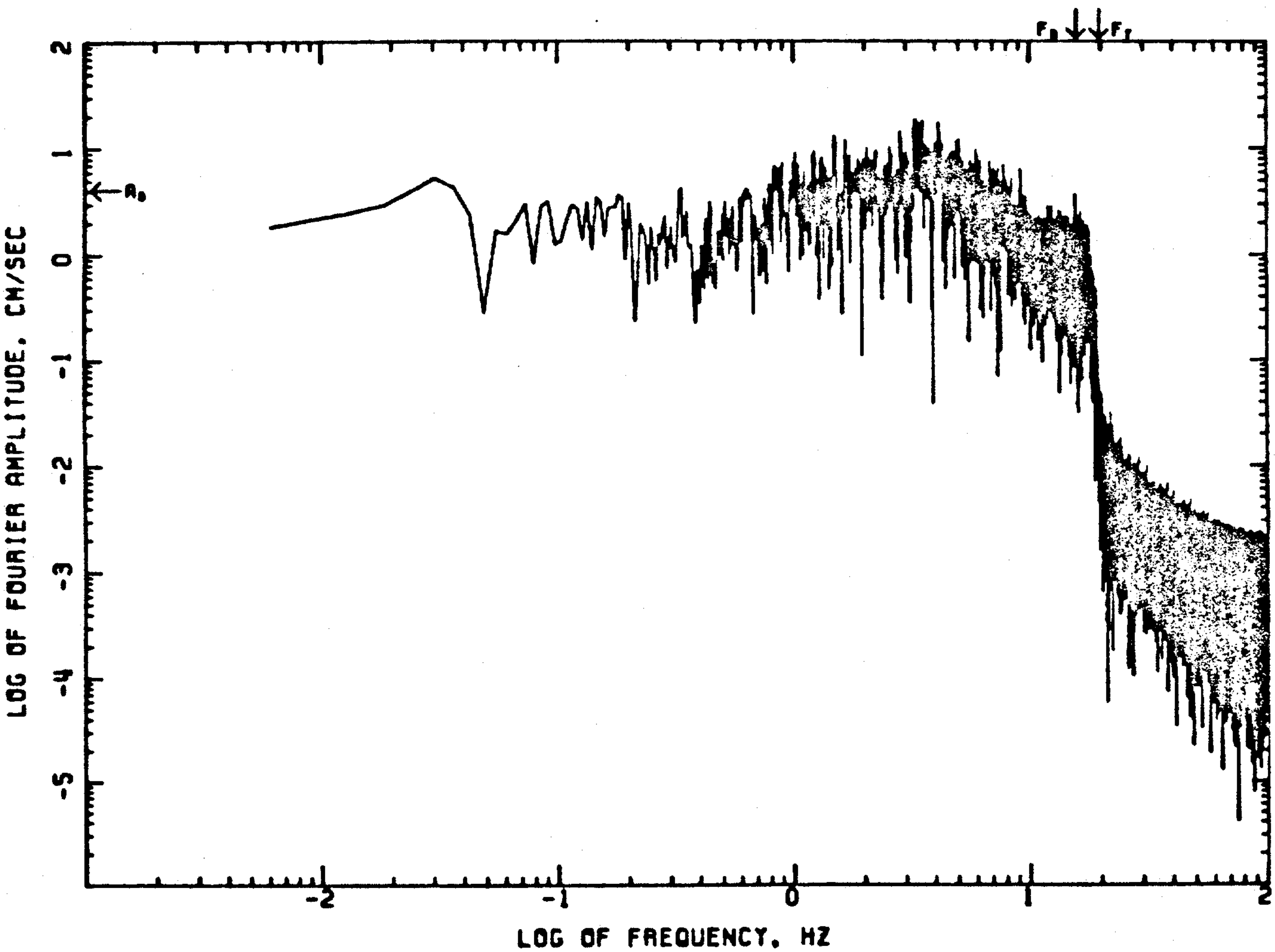

Figure 4. Fourier Amplitude Spectrum of Instrument Corrected. High-Cut Filtered Acceleration. July 13. G22 Computing Options= ZCROSS

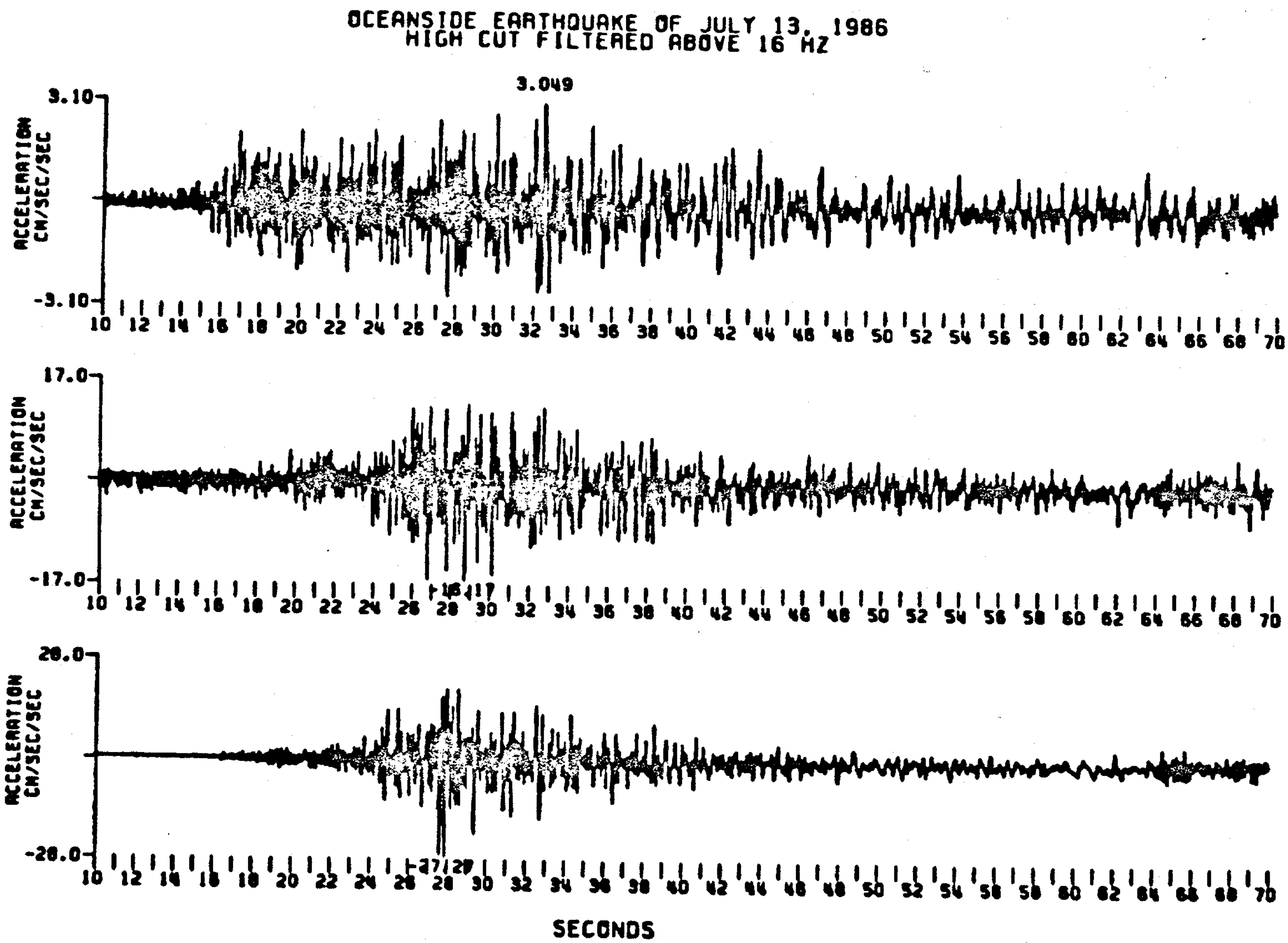

Figure 5. Oceanside Earthquake of July 13, 1986.
High Cut Filtered Above 16 Hz.