STRONG-MOTION RECORDS
RECOVERED FROM THE
WESTMORLAND, CALIFORNIA EARTHQUAKE
OF
26 APRIL 1981

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CALIFORNIA DIVISION OF MINES AND GEOLOGY

OFFICE OF STRONG MOTION STUDIES

REPORT 81-5.1

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8 May 1981

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California Division of Mines and Geology

PRELIMINARY DATA

(Subject to Rivision)

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INTRODUCTION

A moderate-magnitude earthquake [M_L=5.6, California Institute of Technology, (CIT) Seismological Laboratory] occurred at 0509 PDT on 26 April 1981 approximately 8 km north-northwest of Westmorland, Imperial County, California (figure 1). The earthquake epicenter is located by CIT Seismological Laboratory at approximately 33.102°N and 115.637°W.

The main shock of 26 April was preceeded by several days of micro- to small-magnitude events. Low-level activity started on 20 April and increased on 21 April in the vicinity of the main shock (Carl Johnson, CIT Seismological Laboratory, personal communication, 1981). From the evening of 24 April until the main shock, a total of 33 events of magnitude ≥3.0 occurred in this region (CIT Seismological Laboratory).

Damage from the main shock, estimated to exceed $1.5 million, was most pronounced in Westmorland, California, the closest community to epicenter. A large percentage of the buildings in Westmorland sustained some nonstructural damage from the main event. Several unreinforced adobe buildings partially collapsed and many mobile homes were jolted from their supports. City water was temporarily cut off because of damage to filtration tanks at the processing plant. In addition, the agricultural community also sustained costly losses. Much of the damage was to irrigation canals and levees, many of which partially or totally collapsed from seismic shaking.

GROUND EFFECTS

Post-earthquake investigations by the California Division of Mines and Geology (CDMG) in the epicentral area indicate that seismically-induced ground cracks were common. All cracking observed in this region is attributed to lurching, slumping, seismic shaking and possibly lateral spreading (Richard Greenwood and James Kahle, CDMG Los Angeles, personal communication, 1981). No surface faulting was observed by CDMG or U.S. Geological Survey (USGS) investigators in the epicentral region which is devoid of mapped surface faults (Jennings, 1967, 1975). However, this area is on a northerly projection of the Imperial fault beyond limits of its mapped surface trace. Investigators did observe surface rupture along segments of the Superstition Hills and Imperial faults. The Imperial fault is probably the most active fault in the Salton Trough and has experienced several episodes of displacement in the last half century (see, for example, Richter, 1958; Sharp, 1976; Goulty and others, 1978; Real and others, 1979; Leivas and others, 1980).

Sympathetic ground rupture on the Superstition Hills fault (figure 1) occurred along approximately two-thirds of its mapped trace with the maximum offset 14 mm in a right-lateral sense coupled with a very slight (≤1 mm) vertical component (Robert Sharp, USGS Menlo Park, personal communication, 1981). Sympatietic right-lateral oblique-slip rupture on the Imperial fault (figure 1) was concentrated along 8 km to 9 km of the northernmost limit of its mapped trace. In this region, cracking occurred from just south of Wilsons Corner

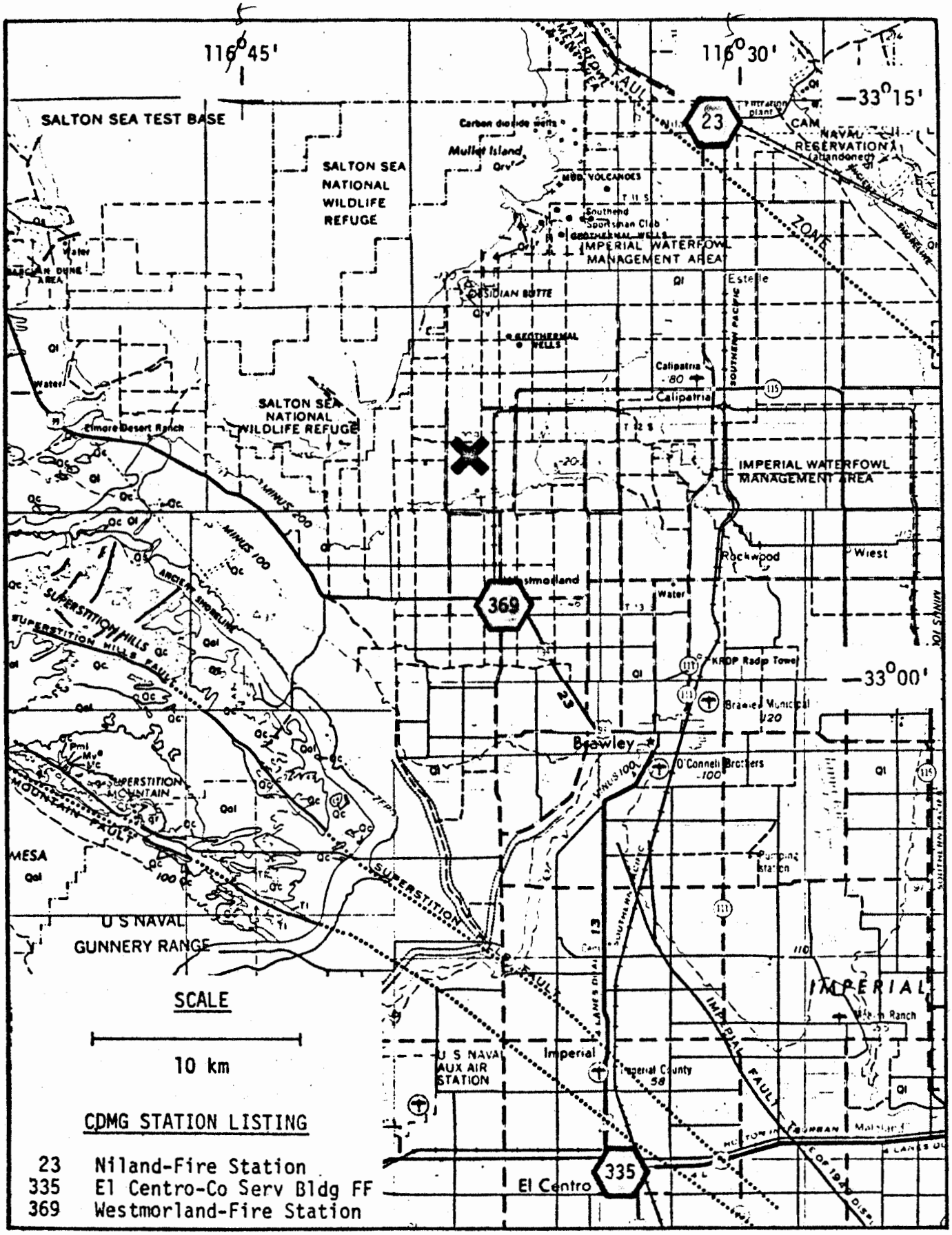

Figure 1. Locations of CDMG strong-motion stations that recorded the M_L=5.6 Westmorland earthquake of 26 April 1981. The main shock epicenter, after CIT Seismological Laboratory, is noted by cross symbol. Map base and data after Strand (1962) and Jennings (1967).

to an area between Harris and Keystone Roads on the north with maximum displacements of 5 mm vertically (west side up) and very slight (≤1 mm) right-slip indicated by left-stepping en echelon creacks (James Kahle, personal communication 1981).

Sympathetic movement of several faults in the Salton Trough during local earthquakes is not unique to this event. This phenomenon has occurred several times in the recent past (see, for example, Allen and others, 1972; Johnson and Hadley, 1976; Sharp, 1976; Real and others, 1979).

STRONG-MOTION DATA

Instruments at three CDMG Strong Motion Instrumentation Program (SMIP) stations were triggered by the 26 April 1981 Westmorland earthquake (table 1). The CDMG-SMIP station at Westmorland was closest to epicenter of the main event (7 km) and recorded the highest accelerations (table 2). This station recorded a peak vertical acceleration (spike) of 0.80 g and peak horizontal accelerations of 0.49 g and 0.39 g. In addition, numerous foreshocks and aftershocks were also recorded at the Westmorland station, however, most of these earthquakes generated accelerations less than 0.05 g; only one aftershock at this station generated accelerations (horizontal) in excess of 0.05 g.

The strong-motion accelerograph at Niland, the second closest CDMG-SMIP station to the earthquake (19 km), recorded peak horizontal accelerations of 0.19 g and 0.11 g and a peak vertical component of 0.13 g. The other CDMG station at El Centro, recorded accelerations that were less than 0.05 g.

TABLE 1

Alphabetical list of CDMG strong-motion accelerograph stations that were triggered and recorded the 26 April 1981 Westmorland earthquake.

No.	Station Name	Coordinates	Site Geology	Structure Type/Size	Instrument Location(s)
335	El Centro (Co Serv Bldg FF)	32.793°N 115.564°W	alluvium >1000 m	T-hut	ground level
23	Niland (Fire Station)	33.239°N 115.512°W	alluvium >1000 m	1-story bldg	ground level
369	Westmorland (Fire Station)	33.037°N 115.623°W	alluvium >1000 m	1-story bldg	ground level

TABLE 2

Alphabetical listing of CDMG accelerograph stations that were triggered and recorded the 26 April 1981 M_L=5.6 Westmorland earthquake. Acceleration data are for ground motion at these stations. An asterisk (*) indicates that ground acceleration was less than significant ($\leq$0.05 g).

Station (Instrument; Serial No.)	Acceleration Data Azimuth[1]	Peak Acc. (g)
El Centro	92	*
Co Serv Bldg FF	UP	*
(SMA-1T; #2761)	2	*
Niland	90	0.19
Fire Station	UP	0.13
(SMA-1T; #2550)	360	0.11
Westmorland	180	0.49
Fire Station	UP	0.80
(SMA-1T; #2588)	90	0.39

[1]Azimuthal direction for upward (positive) trace deflection on accelerogram.

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EARTHQUAKE RECORDS

Westmorland CDMG #369 3 Chs
Station 33.037N-115.623W SMA-T/2588
EQ 4/26/81 (0509 PDT) EQ 33.10N-115.64W Mag 5.6 CIT

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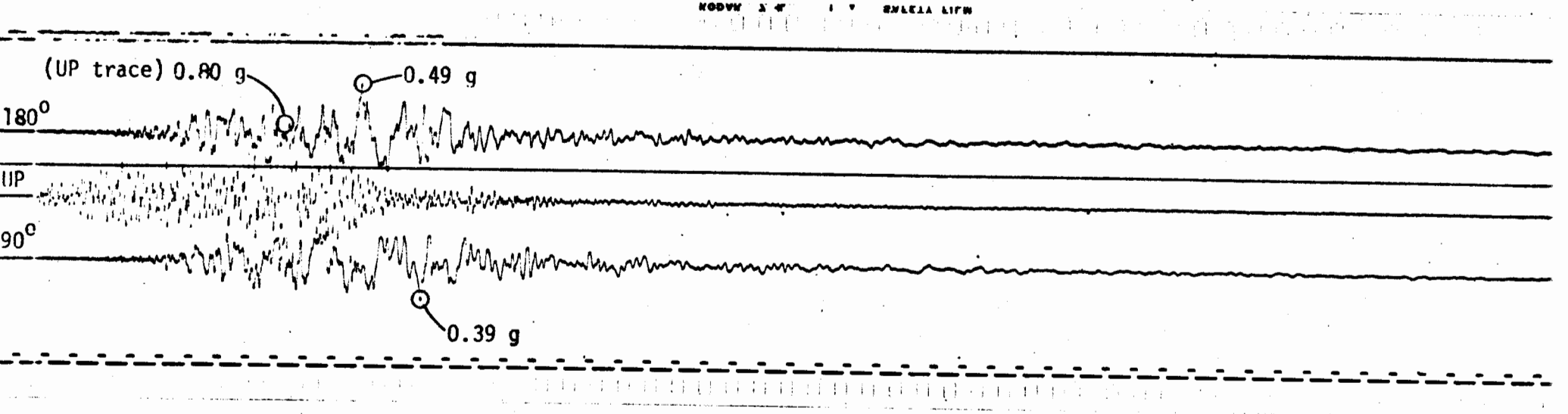
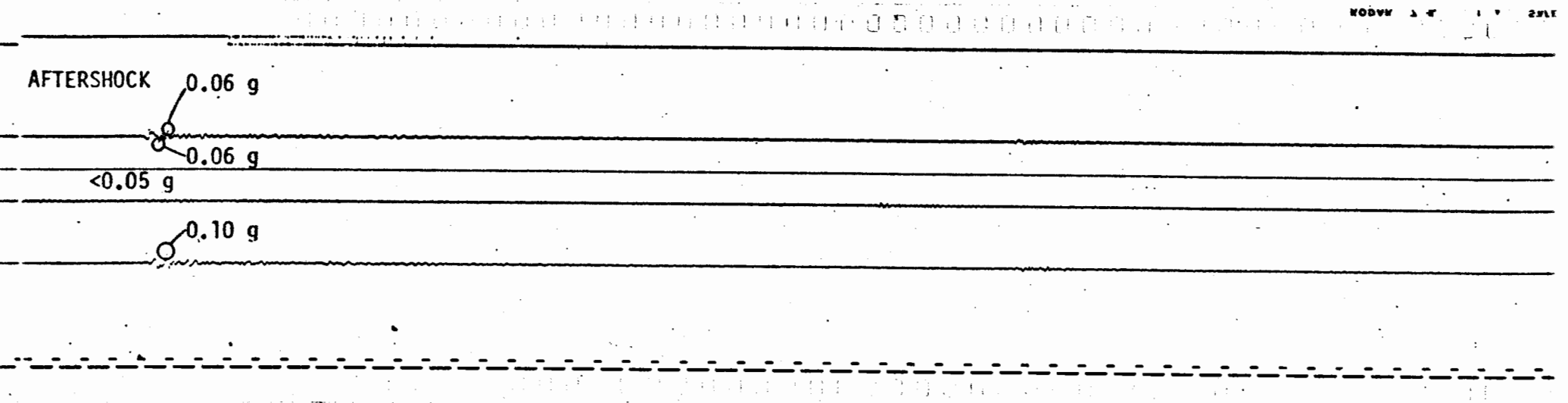


Westmorland CDMG #369
SMA-T (#2588)



Niland-Fire Station CDMG #23
Station 33.239N-115.512W
EQ 4/26/81 (0509 PDT) EQ 33.10N-115.64W

3 Chs
SMA-T/2550
Mag 5.6 CIT

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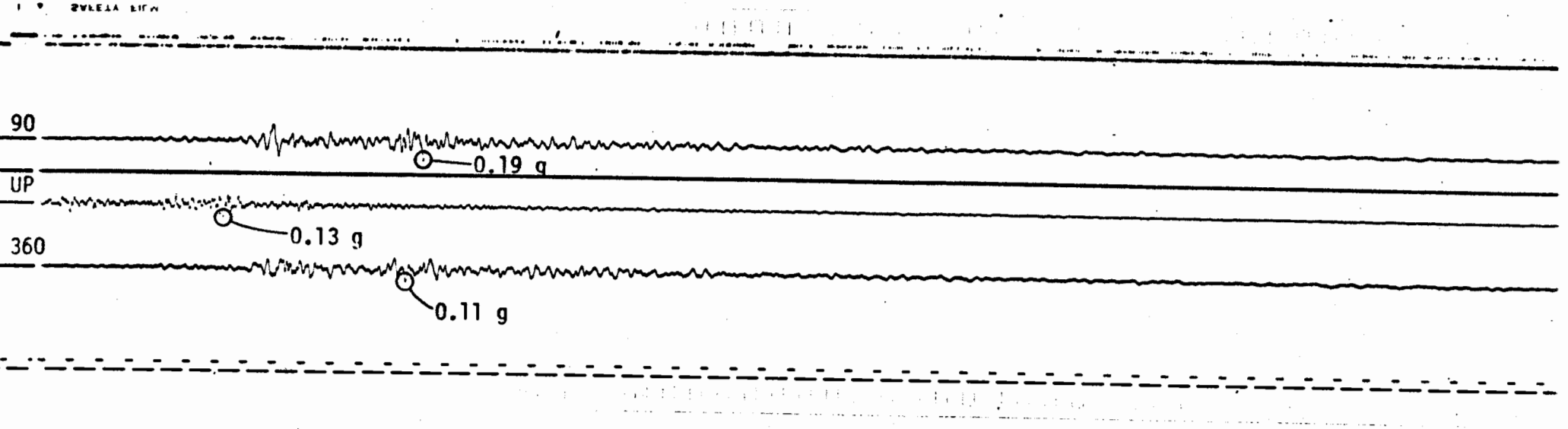

El Centro-Co Serv Bldg FF CDMG #335
SMA-T (#2761)