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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEISMIC REFRACTION DATA FOR SHOTS RECORDED IN THE COSO RANGE, CALIFORNIA,
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By

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This report is preliminary and
has not been edited or reviewed
for conformity with Geological
Survey standards or nomenclature

Introduction

The Coso Range lies in the southwest corner of the Basin and Range province, east of the Sierra Nevada and north of the Garlock Fault. The range, circular in form, is covered by a thin sequence of late-cenozoic volcanics which overlie highly fractured crystalline basement, similar in composition to the nearby Sierra Nevada (Duffield et al., 1980).

Thirty-eight rhyolite domes of Pleistocene age were emplaced near the center of the range and are aligned approximately parallel to the direction of Basin and Range faulting (Figure 1). Bacon et al. (1980), using both age-dates and chemical analyses, inferred that the domes originated from a magma source beneath the central and largest of the rhyolite domes, Sugarloaf Mountain (Figure 1). A shallow source was inferred because active fumaroles, hydrothermally altered zones, and high heat flow values (Combs, 1980) are presently observed in this vicinity.

In an effort to collect seismic data which could be used to identify a magma body beneath Sugarloaf Mountain, a 16 station seismograph array was operated in the Coso Range from September 1975 through September 1977. During the two years of network operation, over 4000 local earthquakes were located in the vicinity of the Coso Range (Walter and Weaver, 1980a, 1980b). In October of 1976, a seismic refraction experiment was conducted in the Coso Range in order to develop a crustal velocity model for use in interpreting the earthquake data.

Refraction Experiment

Earlier refraction studies were conducted in the immediate area of the Coso Range by: Zbur (1963) in Indian Wells Valley, just south of the range, Pakiser et al. (1964) in Owens Valley, just north of the range, and by Eaton (1966), along a profile between Mono Lake, north of the range and China Lake, south of the range. The refraction experiment of October 1976 consisted of two profiles: a reversed profile, 40 km long and oriented southwest-northeast across the Coso Range, and an unreversed quarry blast profile, oriented WSW across the range. These profiles crossed four major areas of interest: the southwest front of the Coso Range, the Sugarloaf Mountain rhyolite dome, the Coso Basin fault system, and a fault zone in the northeastern corner of the range (Figure 2).

For the SW-NW profile, twenty 5-day tape-recording seismograph stations (Criley et al., 1978), seventeen of which were 3-component, were deployed at approximately 2 km intervals (Figure 2). Shots were fired at both ends and at the center of the profile. For the northeast and southwest shots, arrivals were recorded along a geophone spread extending 1.5 km from the shotpoint. Fourteen of the telemetry stations that were operating in the Coso Range at that time recorded the shots (Figure 1). All stations along the profile recorded the WWVB time standard.

Upon completion of the SW-NE profile shooting, ten of the 5-day stations were removed and the ten remaining stations were deployed in a 3-component configuration at locations between a quarry east of the Coso Range and the southwest shot point of the reversed profile (Figure 2, Table 2). The subsequent quarry blast (Table 1) provided both P- and S-wave travel-time data out to 60 km at an azimuth slightly east of the reversed profile.

Data Reduction

The shot records at each station were computer digitized. The digital data were then plotted at a scale sufficient to give a timing precision of ± 0.01 seconds. The arrival times at each station are listed by shot in Table 3. Record sections of the shot arrivals reduced by 6 km/sec are shown in Figures 3a-d. An interpretation of the seismic refraction data is presented in a separate paper by Weaver and Walter (1980).

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Table 1
Shotpoint Data

SW-NE Reversed Profile						
Shotpoint Name	LAT(N)	LONG(W)	ELEV	DAY(J)	TIME(GMT)	SIZE(#)
Northeast	36 13.52	117 34.73	1346	294	0104 00.50	1800
Center	36 04.36	45.23	1168	294	1905 00.61	1000
Southwest	35 59.41	52.97	1023	295	1705 00.54	2000
Kerr-Mcgee Quarry Profile						
Quarry	LAT(N)	LONG(W)	ELEV	DAY(J)	TIME(GMT)	SIZE(#)
Quarry	36 09.41	117 24.48	0945	300	2225 30.90	40000

Table 2
Station Data

Coso Network Telemetry Stations				
Station	Latitude (N)	Longitude (W)	Elev (m)	
NMC	35 50.57	117 54.29	0951	
MFS	36 07.03	51.30	1524	
JRW	35 59.70	49.20	1387	
SMW	36 01.17	50.72	1113	
DKN	36 03.13	48.56	1341	
RVC	36 00.47	53.42	1066	
CPT	36 04.26	51.01	1494	
HPH	36 05.82	55.52	1143	
CGS	36 11.41	37.39	1676	
RCW	35 57.04	38.89	0945	
BCH	36 03.28	43.74	1265	
HWS	36 06.30	45.67	1448	
CBH	35 59.38	45.01	0884	
VPE	35 56.98	49.02	1463	
CSS	36 01.58	46.01	1143	
CFW	36 12.50	54.23	1372	

Table 2 (continued)

Station Data

Temporary 5-day Recorder Stations deployed for SW-NE reversed profile

Station Name	Latitude (N)	Longitude (W)	Elev (M)	Time of Operation October 1976
C01	35 59.46	117 52.99	1038	293 1744 295 1751
C02	59.95	52.14	1071	293 2032 295 1836
C03	36 00.50	51.40	1085	292 2349 295 1904
C04	01.25	50.23	1158	292 2218 295 1852
C05	02.23	50.05	1243	293 2141 295 2057
C06	02.54	48.82	1274	293 0114 295 2017
C07	03.16	48.02	1323	293 2032 295 2030
C08	04.02	47.44	1548	293 1742 295 2323
C09	04.59	45.76	1219	292 2347 295 2251
C10A	05.58	44.78	1292	292 2215 296 2015
C10B	06.14	44.22	1489	293 2134 296 2015
C11	07.40	42.76	1938	291 2300 295 2216
C12	07.74	42.31	1975	291 2253 295 2226
C13	08.55	41.03	1987	292 0040 295 2332
C14	09.05	40.13	1926	292 0054 296 0007
C15	09.73	39.45	1844	292 2100 293 1920
C16	10.62	38.86	1780	292 2303 295 2338
C17	11.04	37.94	1707	292 2343 295 2258
C18	12.14	36.41	1513	293 0054 295 2227
C19	12.72	35.73	1445	292 2300 295 2155
C20	13.60	34.68	1361	294 0021 295 2300

Refraction Truck Geophones

TT11	36 13.46	117 34.82	1372	for shots only
TT12	13.32	35.03	1386	for shots only
TT13	13.12	35.27	1399	for shots only
TN	04.24	45.60	1176	for shots only
TT21	35 59.38	53.33	1025	for shots only
TT22	59.29	53.65	1014	for shots only
TT23	59.20	53.96	1007	for shots only

Kerr-McGee Revenue Canyon Quarry Profile

Temporary 5-day Recorders

QRY	36 09.41	117 24.49	0945	for shot only
MAT	08.53	29.97	1798	297 2107 304 2342
DAW	07.22	32.23	1554	297 2045 304 2330
DAS	06.27	35.13	1646	298 2055 302 2119
COF	05.28	38.26	1768	298 0200 301 1738
FLB	05.15	41.49	1585	297 0002 304 1930
CHS	02.84	46.52	1158	299 1838 304 1810
SME	01.94	48.58	1295	295 2245 304 1742
UCF	06.05	48.89	1524	295 2250 304 1930
RVN	05.42	54.96	1204	296 0120 304 2035

Table 3
SW-NE Reversed Profile October 1976

Shot name: Northeast Center Southwest

P-ARRIVAL TIMES (GMT)

Julian Day:	(294J)			(294J)			(295J)		
Station	Hr	Mn	Sec	Hr	Mn	Sec	Hr	Mn	Sec
NMC	01	04	?????	19	05	?????	17	05	03.80
MFS			05.90			02.90			03.46
JRW			?????			02.81			01.94
SMW			?????			02.67			01.72
DKN			?????			01.90			02.66
RVC			?????			03.46			01.14
CGS			01.96			04.26			06.68
RCW			06.37			04.09			04.83
BCH			05.14			01.67			03.99
HWS			04.73			01.60			03.99
CBH			06.48			02.84			03.26
VPE			?????			03.56			02.34
CSS			?????			01.87			02.97
CFW			06.20			04.62			05.14
C01			?????			?????			00.61
C02			?????			03.33			01.06
C03			?????			03.00			01.36
C04			?????			02.50			01.79
C05			06.33			02.41			02.21
C06			06.09			02.01			02.47
C07			05.78			01.66			02.78
C08			05.46			01.43			03.05
C09			05.07			00.86			03.51
C10A			04.76			01.39			04.01
C10B			04.58			01.80			04.35
C11			03.95			02.33			04.89
C12			03.76			02.48			04.99
C13			03.30			02.84			05.34
C14			02.98			03.12			05.62
C15			02.67			DEAD			DEAD
C16			02.36			03.71			06.15
C17			02.08			04.00			06.46
C18			01.47			04.47			06.86
C19			01.14			04.74			07.13
C20			00.61			05.20			07.85
T11			00.71						
T12			01.00						
T13			01.08						
TN						00.81			
T21									00.66
T22									00.91
T23									01.03

Table 3 (continued)

Quarry Blast Refractor Profile October 26 1976 (300J)

Arrival: Station	ARRIVAL TIMES (GMT)					
	P			S		
	Hr	Mn	Sec	Hr	Mn	Sec
NMC	22	25	41.02	22	25	????
MFS			38.24			????
JRW			38.39			43.9
SMW			38.49			44.2
DKN			37.83			42.9
RVC			39.22			45.3
CGS			34.75			????
RCW			36.67			40.8
BCH			36.71			40.5
HWS			37.00			????
CBH			37.59			????
VPE			38.70			44.4
CSS			37.41			42.2
CFW			39.10			????
MAT			32.59			33.7
DAW			33.32			34.9
COF			35.06			37.7
FLB			35.90			39.5
CHS			37.33			42.0
SME			37.95			43.0
RVN			39.23			45.0
UCF			37.75			43.0

REGIONAL MAP

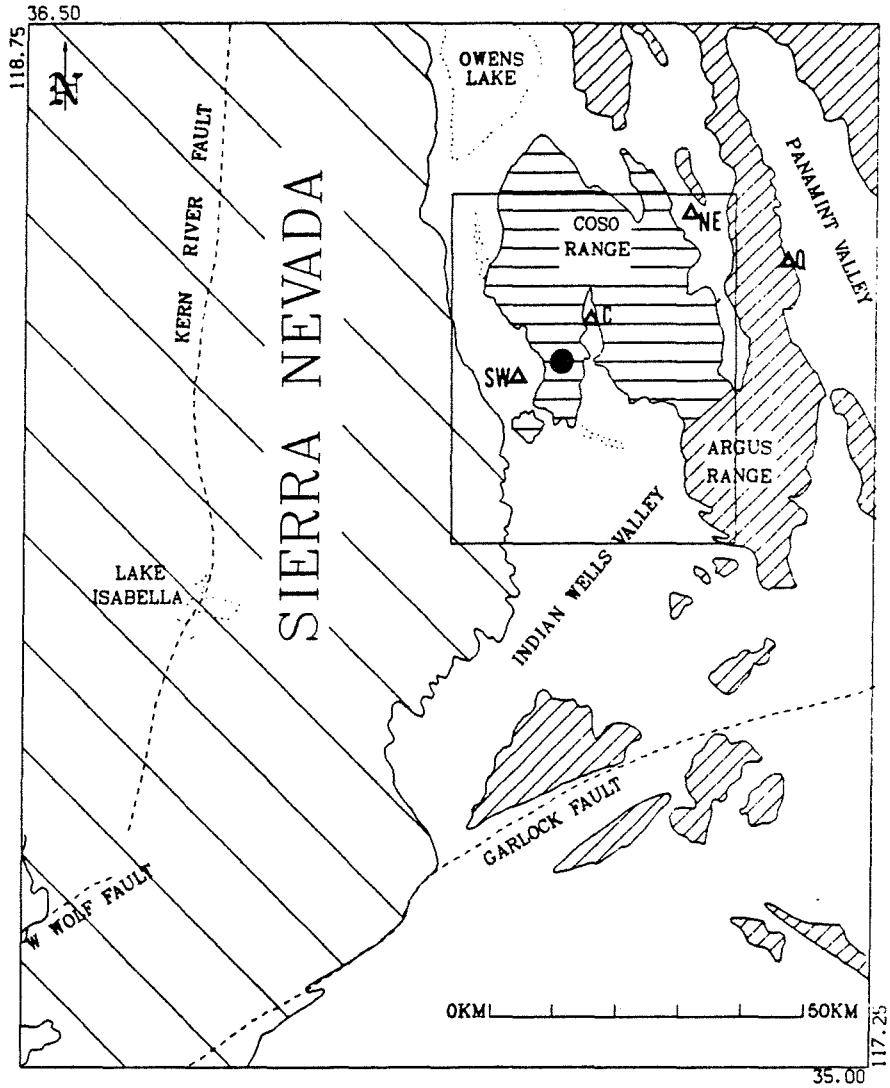


Figure 1. Regional Map showing Coso Range. Shotpoints are designated by open triangles, SW- southwest shotpoint, C- center shotpoint, NE- northeast shotpoint, Q- quarry shotpoint. Box outlines area shown in Figure 2. Dot shows location of- Sugarloaf Mountain, the largest rhyolite dome.

STATION MAP

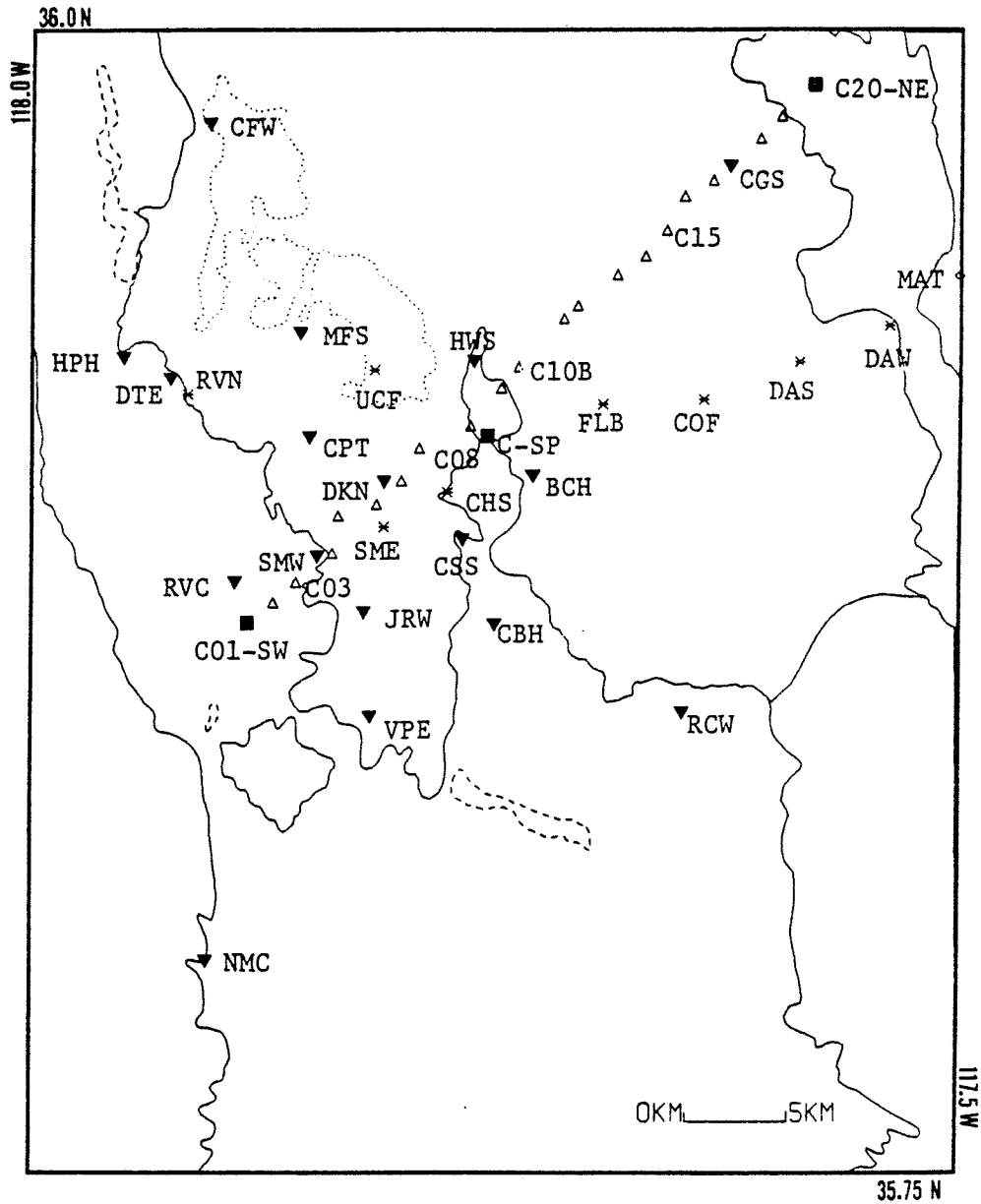


Figure 2. Station map showing stations operating in the Coso Range for the seismic refraction experiment. Shotpoints are indicated by the solid squares, ■, the telemetry stations, solid inverted triangles, ▼, the 5-day SW-NE profile stations, open triangles, △, and the 5-day quarry profile stations, labeled asteriks, *.

NORTHEAST SHOT SW PROFILE

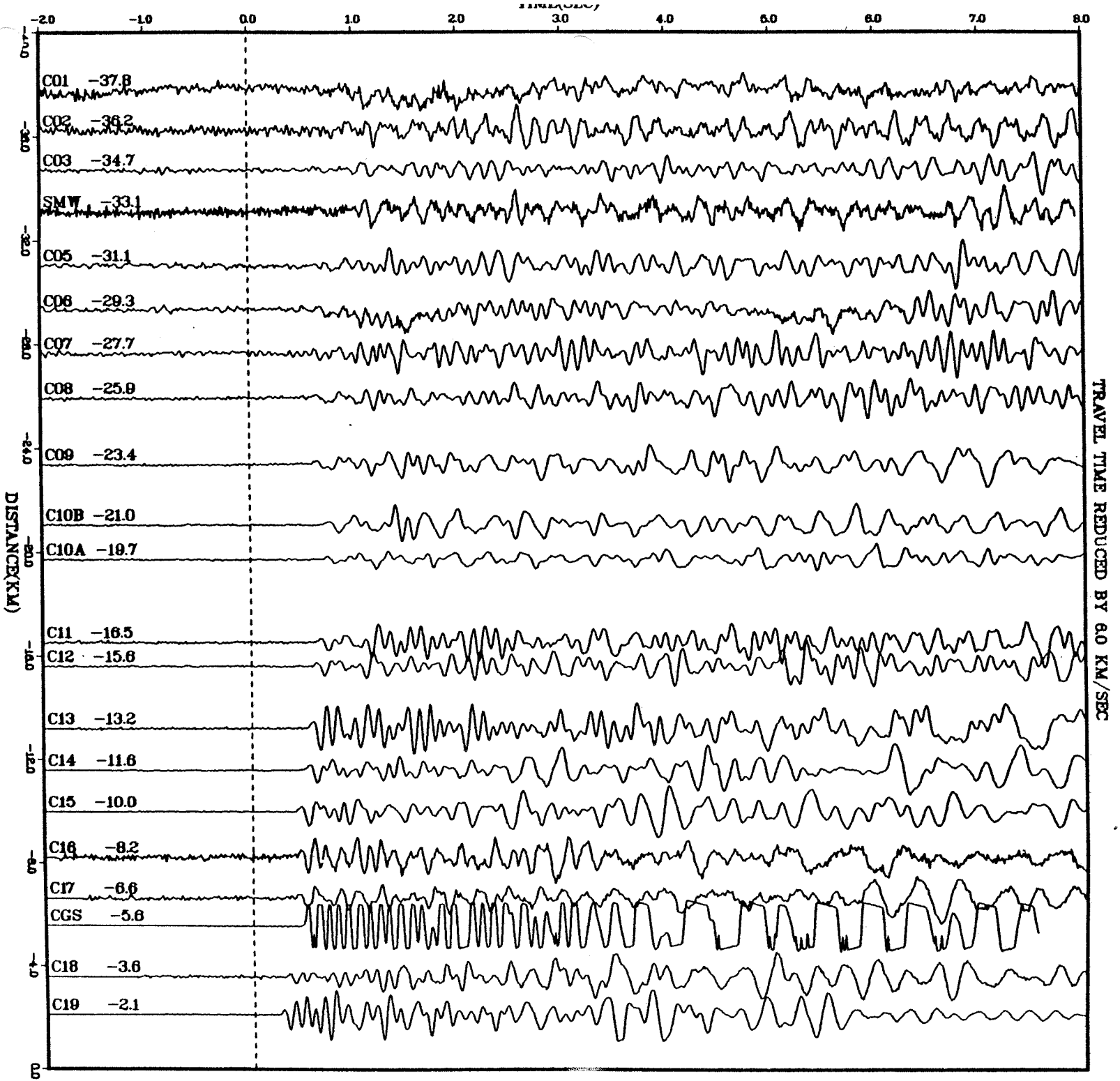


Figure 3 a

CENTER SHOT PROFILE

TRAVEL TIME REDUCED BY 6.0 KM/SEC

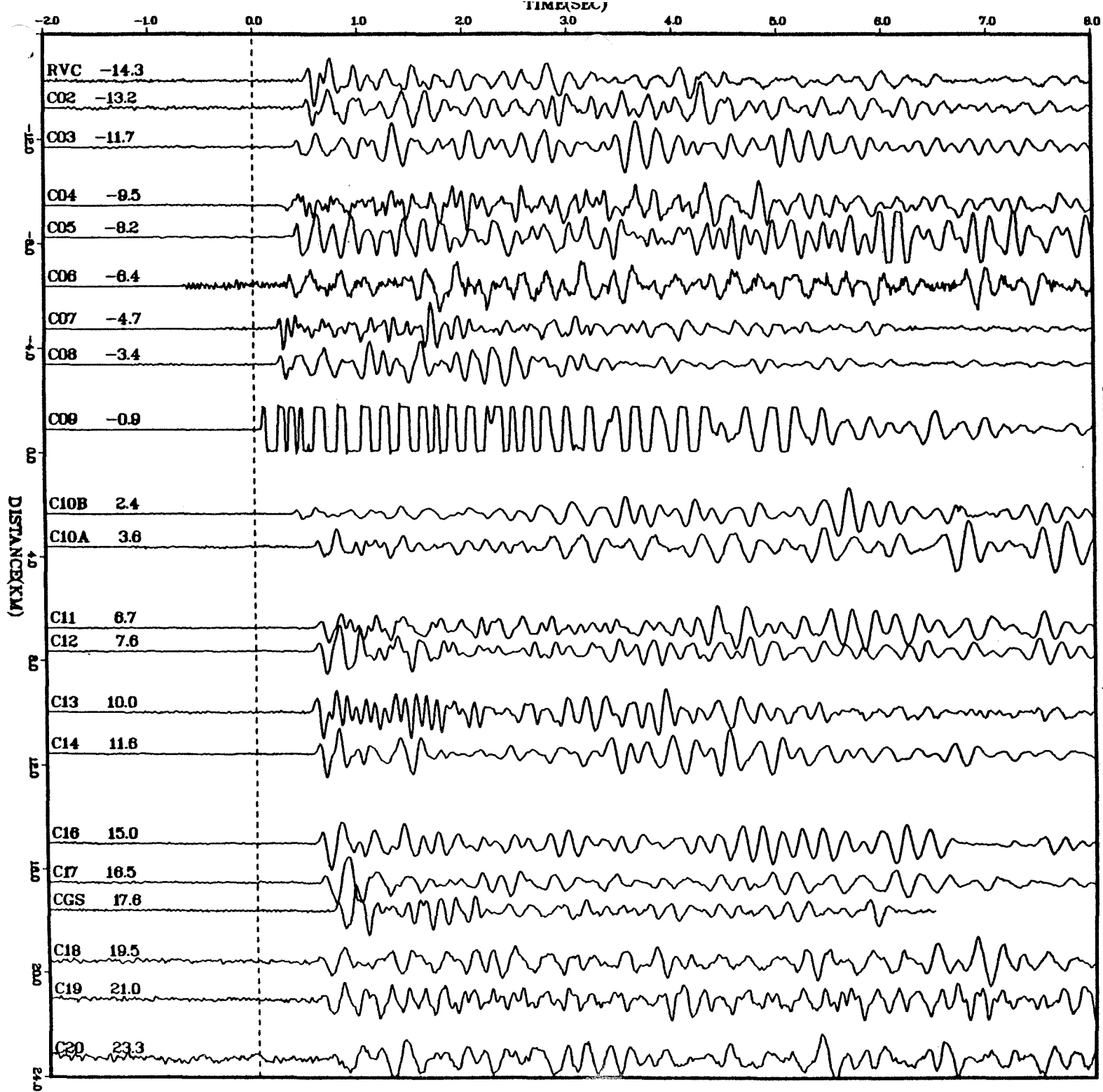


Figure 3 b

SOUTHWEST SHOT NE PROFILE

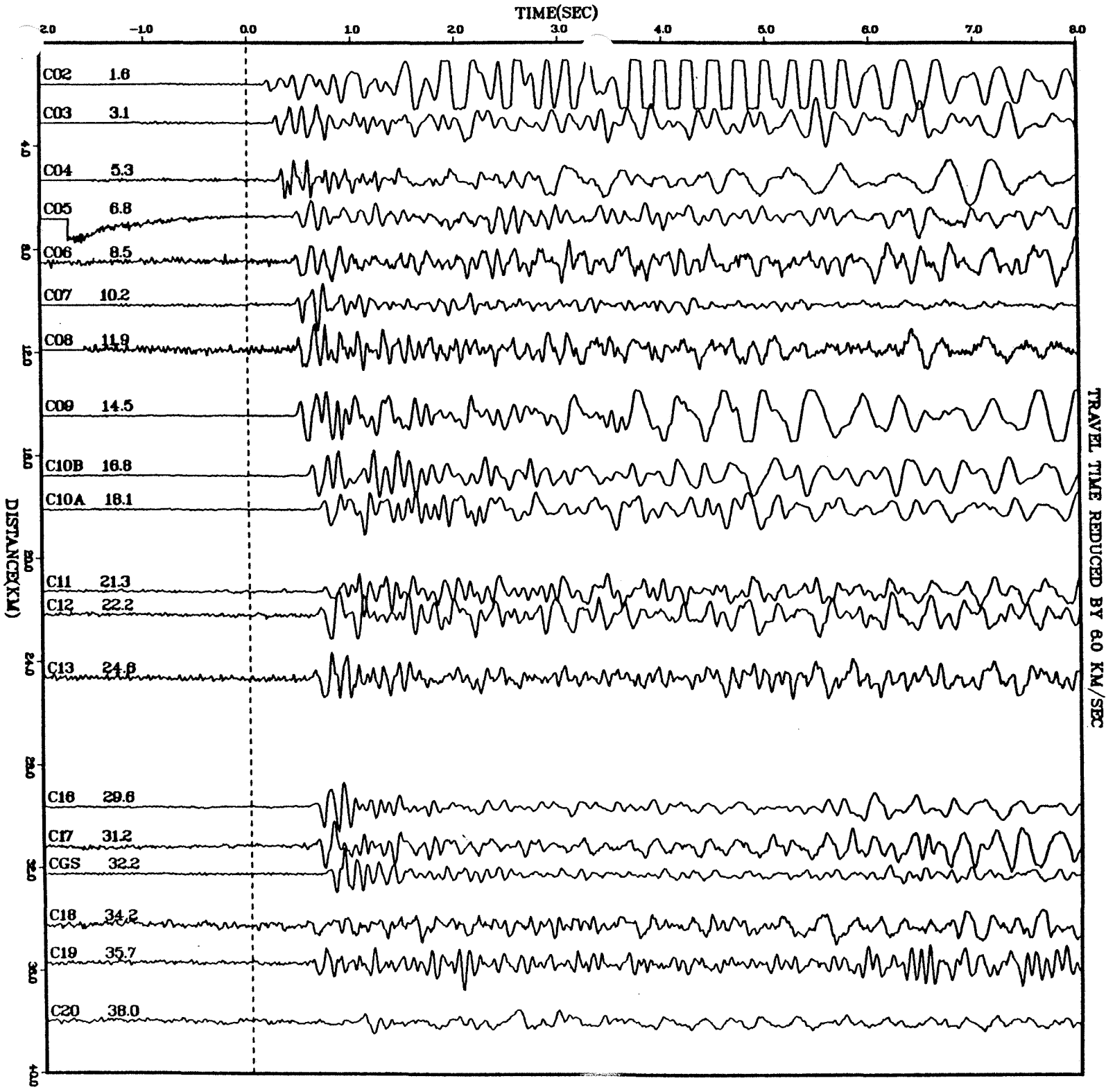


Figure 3 c

QUARRY BLAST REFRACTION PROFILE

TRAVEL TIME REDUCED BY 8.0 KM/SEC

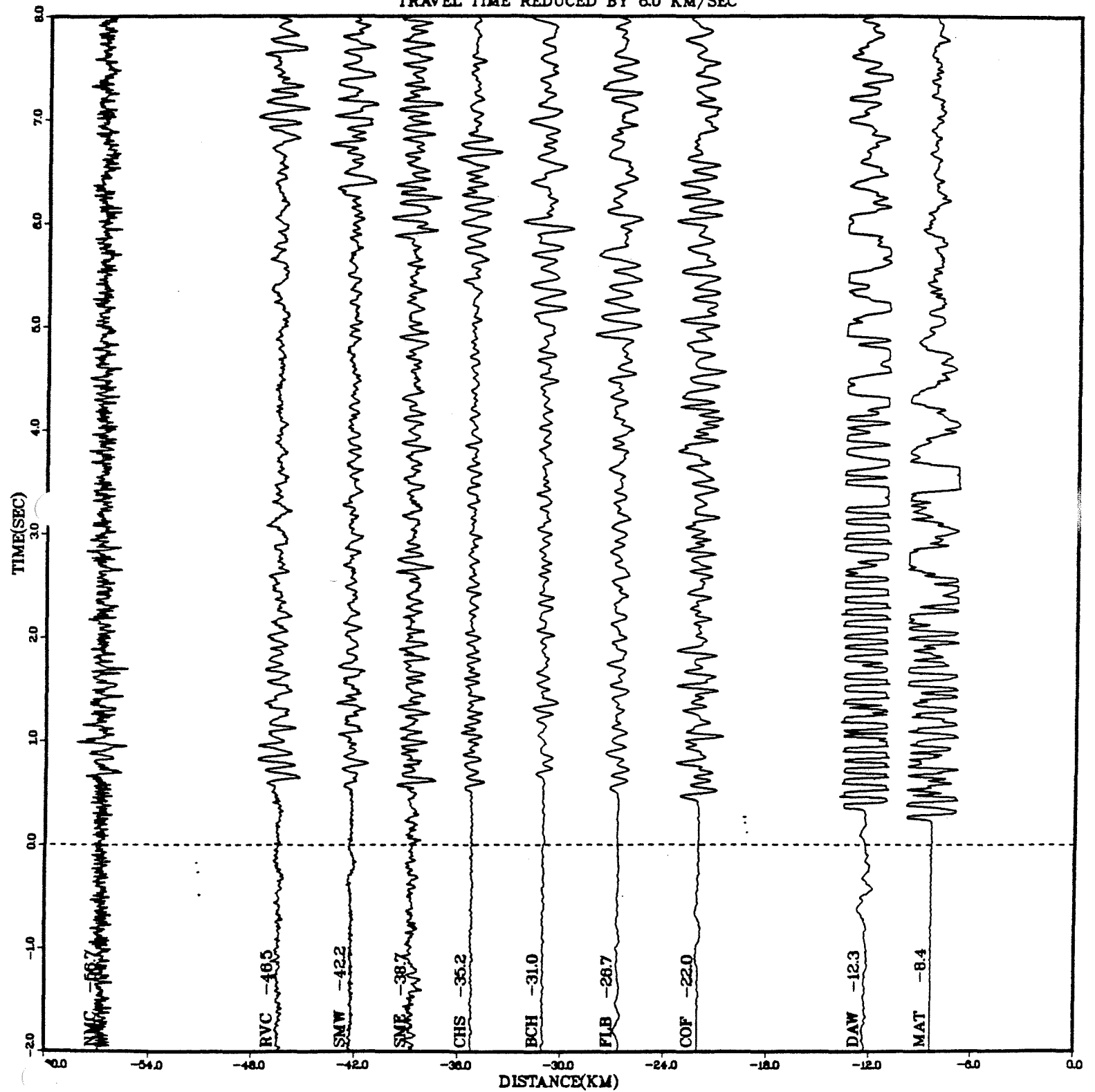


Figure 3 d