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PRELIMINARY CATALOG OF EARTHQUAKES
IN NORTHERN IMPERIAL VALLEY, CALIFORNIA
APRIL 1978 - JUNE 1978

by

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INTRODUCTION

The northern section of the Imperial Valley region in southern California is an area of known geothermal resources and an area of high seismicity. To study in detail the relationship between geothermal areas and earthquakes, the U.S. Geological Survey has been monitoring seismicity in the Imperial Valley with a 16-station network since 1973. Six new stations were added to the network in November 1976. This catalog contains a description of the network and a list of preliminary data on earthquakes recorded by the network from April 1978 through June 1978.

AREA COVERED AND INSTRUMENTATION

Earthquakes reported in this catalog are located in the area indicated in Figure 1. Major faults are shown. Locations of most of the seismographic stations used in locating earthquakes reported here are shown in Figure 8 and are listed in Table 1.

The telemetered seismographic network in the Imperial Valley employs the same type of instrumentation developed by the U.S. Geological Survey for use in the central California network. Seismometers are vertical-component Mark Products ^{1/} seismometers ($T_{\text{seis}} = 1 \text{ sec}$), Model L - 4C. Signals from these instruments are high-pass filtered in the field ($T_{\text{filter}} = 0.1 \text{ sec}$) and telemetered to the California Institute of Technology in Pasadena, California, where they, (along with a WWVB time code) are recorded on 16mm films using Develocorders ^{1/} ($T_{\text{galvo}} = 0.06 \text{ sec}$). Peak magnification

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ranges from 10^5 to about 10^6 and occurs at $T_{\text{peak}} = 0.06$ sec (or 14 hz). (Refer to Wesson and others, 1974, or Hill and others, 1975, for a somewhat more detailed description of this instrumentation.) In addition to film recordings, digital recordings are made by the Caltech Earthquake Detection and Recording System (CEDAR) (Johnson, 1978). An earthquake detection algorithm is used in CEDAR, and only "detected" earthquakes are saved. CEDAR is described more fully below.

DATA ANALYSIS

During this quarter, all analysis has been based on digital recordings by CEDAR. The data reduction procedure used is as follows:

- 1) On-line processing. "On-line" processing refers to computer manipulation of signals at the time they are received. Signals from all stations are digitized continuously at 50 bits per second. The signal amplitude at each station is averaged in a 40-second interval of time which moves continuously keeping its leading edge at the present time. In addition, an average of amplitudes in the leading 5 seconds of this interval is made. Whenever the 5-second average exceeds the 40-second average by 50 percent for a given station, that station is considered to be triggered. Whenever 4 stations in a subarray of stations are simultaneously triggered, a "detection" is considered to be made. When a detection is made, digitized signals from all stations in southern California are transferred from a magnetic disc, which is being continuously erased, to a magnetic tape, from which they can be played back and examined by a data analyst at a later time. The subarrays of stations used for the detection of earthquakes in the Imperial Valley are indicated in Figures 2 - 5.

2) Off-line processing. "Off-line" processing refers to interactive computer-human manipulation of signals from detected events at some time after they have been saved and stored on magnetic tape by the on-line system (Separate computers are used for on-line processing [Data General Eclipse S/230 with 32K core] and off-line processing [Data General Nova 820 with 32K core]; but their roles can be interchanged.) All events detected in a day by the on-line system are played back the following day on the off-line system; hard copies of the seismograms from each triggered station are made for each event. A data analyst reviews these seismograms to determine which events are noise events and which are earthquakes. Earthquakes are then played back a second time onto a cathode ray tube viewer (CRT) equipped with movable vertical and horizontal cross-hairs. The data are played back in 2 stages. First, seismograms from all stations in southern California are displayed on the screen, 32 at a time. During this stage the data analyst selects stations to be reviewed for timing during the second stage. During the second stage, seismograms from individual stations are played back onto the CRT, and P and S wave arrivals are timed. During this stage it is possible to amplify or attenuate the signals for visual inspection so that optimum picks can be made.

3) At the completion of timing of a day's worth of earthquakes, arrival-time data are processed using a version of the computer program HYP071 (Lee and Lahr, 1975) that has been abbreviated and modified to be accommodated by the off-line computer. During this step, a simple velocity structure is used in the location of all events in southern California (see Discussion); no station delays are used.

4) Richter magnitudes are routinely calculated for all earthquakes of $M_L \gtrsim 3.0$ and some earthquakes with smaller magnitudes. These magnitudes are

listed here. The final catalog will include magnitudes for all earthquakes.

5) The preliminary location parameters for all earthquakes in northern Imperial Valley are listed in this catalog in Table 2; and the epicenters are plotted in Figure 6.

DISCUSSION

The velocity model used for the earthquake locations in this catalog is taken from Kanamori and Hadley, (1975):

VELOCITY (km/sec)	DEPTH TO TOP OF LAYER (km)
5.5	0.0
6.3	5.5
6.7	16.0
7.8	37.0

This model was obtained from refraction studies in the western Mojave Desert, Transverse Ranges, and Peninsular Ranges of southern California. For a discussion of the differences in earthquake location that result from using this model rather than a more appropriate model for Imperial Valley (Biehler and others, 1964), refer to Fuis and others (1978).

The hypocentral parameters listed in Table 2 are the following:

1) Y, year of occurrence	} Coordinated Universal Time
2) M, month of occurrence	
3) D, day of occurrence	
4) H, hour of occurrence	
5) M, minute of occurrence	
6) SEC, second of occurrence	

- 7) LAT, north latitude of epicenter, in degrees and minutes
- 8) LONG, west longitude of epicenter, in degrees and minutes
- 9) DEP, depth of hypocenter, in kilometers
- 10) MAG, Magnitude
- 11) N, 99 (ignore)
- 12) GAP, maximum azimuthal gap, in degrees, between stations
contributing P-arrivals
- 13) DM, distance from epicenter to nearest stations used in
locating the earthquake
- 14) RMS, root mean square of travel-time residuals, R_i , in seconds

$$RMS = \sqrt{\sum_{i=1}^N R_i^2 / N}$$

- 15) ERH, standard error of the epicenter, in kilometers
- 16) ERZ, standard error of the focal depth, in kilometers

Note: ERH and ERZ are blank when data is considered insufficient
for a good location: generally 4 impulsive arrivals are
required for a good location

- 17) Q, solution quality of the hypocenter
- 18) M, 0 (ignore)

A filter is applied to the events in this catalog to eliminate very bad hypocenter solutions. A solution was not listed or plotted unless $RMS \leq 0.50$ seconds. No events have been reread to improve preliminary locations and preliminary RMS's.

REFERENCES CITED

- Biehler, S., R. L. Kovach, and C. R. Allen, 1964, Geophysical framework of the northern end of the Gulf of California structural province, in Marine Geology of the Gulf of California (T. J. van Andel and G. G. Shor, Jr., eds.): Am. Assoc. Pet. Geol. Memoir, 3, p. 126-156.
- Fuis, G. S., C. E. Johnson, and D. J. Jenkins, 1978, Preliminary catalog of earthquakes in northern Imperial Valley, California, October 1977 - December 1977: U.S. Geol. Survey, Open-file Rept. (in review), 44 p.
- Hill, D. P., P. Mowinckel, and K. M. Lahr, 1975, Catalog of earthquakes in the Imperial Valley, California, June 1973 - May 1974: U.S. Geol. Survey, Open-file Rept. 75-401, 25 p.
- Johnson, C. E., 1978, CEDAR - an approach to the computer automation of short-period, local seismic networks: EOS, v. 59, p. 316.
- Kanamori, H., and D. M. Hadley, 1975, Crustal structure and temporal velocity change in southern California: Pure Appl. Geophys., v. 113, pp. 257-280.
- Lee, W. H. K. and J. C. Lahr, 1975, HYP071 (Revised): A computer program for determining hypocenter, magnitude, and first-motion pattern of local earthquakes: U.S. Geol. Survey, Open-file Rept. 75-311, 113 p.
- Wesson, R. L., F. W. Lester, and K. M. Meagher, 1974, Catalog of earthquakes along the San Andreas fault system in central California, October - December 1972: U.S. Geol. Survey, Open-file Rept., 46 p.

Figure 1. Base map of southern California region with major faults.

Figures 2 - 5. CEDAR subarrays for the Imperial Valley area.

Contours enclose regions in which the given CEDAR subarray detects 90% of earthquakes with magnitudes equal to or greater than the number on the contour (Johnson, 1978).

Figure 2.

Figure 4.

Figure 3.

Figure 5.

Figure 6. Locations of earthquake epicenters (X's) in the Imperial Valley with respect to major faults for the period April 1, 1978 through June 30, 1978. Solid triangles are seismograph stations in the Imperial Valley installed in 1973; solid circles are the seismograph stations installed in November 1976.

Table 1. STATION DATA

<u>STATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>ELEV.</u>
AMS	33° 8.48'N	115°15.25'W	140 m
BC2	33°39.42'N	115°27.67'W	1185 m
BLU	34°24.40'N	117°43.61'W	1880 m
BON	32°41.67'N	115°16.11'W	14 m
BSC	32°43.49'N	115° 2.64'W	43 m
CH2	33°17.77'N	115°20.17'W	347 m
CLI	33° 8.45'N	115°31.64'W	-59 m
COA	32°51.81'N	115° 7.36'W	34 m
COK	32°50.95'N	115°43.61'W	-15 m
COY	33°21.63'N	116°18.56'W	232 m
CO2	33°50.83'N	115°20.68'W	276 m
CPE	32°52.80'N	117° 6.00'W	213 m
CPM	34° 9.24'N	116°11.80'W	937 m
CRR	32°53.18'N	115°58.10'W	98 m
ELR	33° 8.84'N	115°49.95'W	-63 m
FNK	33°22.98'N	115°38.26'W	12 m
FTM	32°33.29'N	114°20.01'W	263 m
GLA	33° 3.10'N	114°49.60'W	627 m
HOT	33°18.85'N	116°34.90'W	1963 m
IKP	32°38.93'N	116° 6.48'W	957 m
ING	32°59.30'N	115°18.61'W	2 m
INS	33°56.14'N	116°11.66'W	1700 m
KEE	33°38.30'N	116°39.19'W	1366 m
LTC	33°29.34'N	115° 4.20'W	458 m
LTM	33°54.90'N	114°55.10'W	744 m
NW2	33° 5.43'N	115°41.54'W	-68 m
OB	33°10.04'N	115°38.20'W	-69 m
PIC	32°54.85'N	114°38.59'W	263 m
PLM	33°21.20'N	116°51.70'W	1692 m
PLT	32°43.87'N	114°43.76'W	61 m
PNM	33°58.64'N	115°48.05'W	1146 m
RUN	32°58.33'N	114°58.63'W	152 m
SGL	32°38.95'N	115°43.52'W	110 m
SHH	34°11.26'N	115°39.27'W	1122 m
SLU	32°30.10'N	114°46.64'W	41 m
SMO	33°32.15'N	116°27.70'W	2437 m
SNR	32°51.71'N	115°26.21'W	-30 m
SUP	32°57.31'N	115°49.43'W	219 m
TPC	34° 6.35'N	116° 2.92'W	761 m
VG2	33°49.91'N	116°48.55'W	1484 m
WIS	33°16.56'N	115°35.58'W	-68 m
WLK	33° 3.08'N	115°29.44'W	-48 m
WML	33° 0.91'N	115°37.35'W	-44 m
WWR	33°59.51'N	116°39.36'W	702 m
YMD	32°33.28'N	114°32.68'W	76 m

Table 2.

Preliminary hypocenter solution
for earthquakes
April 1, 1978 through June 30, 1978

N	Y	M	D	H	M	SFC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERH	ERZ	Q	M
1	78	4	1	3	0	49.78	33-15.94	115-59.38	5.00	0.0	99	99	0.0	0.13	1.0	17.1	C	0
2	78	4	1	6	5	9.46	33- 0.28	115-31.68	11.16	0.0	99	200	0.0	0.06	2.1	2.2	B	0
3	78	4	1	8	50	43.56	33- 4.50	115-31.45	6.33	0.0	99	140	0.0	0.14	7.0	9.5	D	0
4	78	4	2	9	22	46.03	32-53.60	115-31.34	11.52	1.70	99	86	0.0	0.18	1.3	2.8	B	0
5	78	4	2	9	53	47.55	32-53.13	115-31.20	5.04	1.50	99	110	0.0	0.07	7.1	16.3	D	0
6	78	4	2	10	0	53.60	32-52.57	115-32.11	6.10	1.60	99	164	0.0	0.06	2.7	12.3	C	0
7	78	4	2	17	8	4.41	32-54.43	115-37.85	12.84	0.0	99	101	0.0	0.12	1.2	2.4	B	0
8	78	4	3	4	5+	17.53	32-52.93	115-30.29	6.02	0.0	99	109	0.0	0.24	6.0	7.0	D	0
9	78	4	3	6	45	15.72	32-51.93	115-30.32	11.55	0.0	99	120	0.0	0.20	1.5	3.0	B	0
10	78	4	3	23	42	17.11	32-54.66	115-47.34	6.67	2.10	99	85	0.0	0.16	1.0	1.9	B	0
11	78	4	4	2	7	52.85	32-58.05	115-52.80	5.52	0.0	99	78	0.0	0.29	1.9	99.0	C	0
12	78	4	4	6	27	48.90	33-14.07	115-40.88	9.13	0.0	99	90	0.0	0.07	0.5	1.1	A	0
13	78	4	5	23	30	13.15	33- 0.28	115-42.15	4.76	2.00	99	79	0.0	0.13	0.8	0.8	A	0
14	78	4	6	1	9	22.34	33- 0.77	115-49.46	4.81	2.10	99	78	0.0	0.17	1.2	0.9	B	0
15	78	4	6	1	16	44.02	33- 0.89	115-49.10	5.88	2.10	99	68	0.0	0.20	1.2	1.1	B	0
16	78	4	6	6	25	35.84	33- 0.34	115-49.00	4.46	0.0	99	184	0.0	0.18	3.0	2.4	C	0
17	78	4	6	7	35	59.78	32-47.42	115-27.41	14.56	0.0	99	117	0.0	0.22	1.2	2.3	B	0
18	78	4	6	13	30	26.70	33- 8.21	115-35.33	7.71	0.0	99	106	0.0	0.26	2.7	3.6	C	0
19	78	4	6	19	3	26.06	32-59.33	115-46.08	9.49	0.0	99	96	0.0	0.21	3.4	3.8	C	0
20	78	4	8	9	31	0.56	32-56.28	115-34.06	7.45	0.0	99	104	0.0	0.07	0.8	2.4	B	0
21	78	4	8	14	53	54.41	32-47.41	115-27.00	16.21	0.0	99	117	0.0	0.21	1.5	1.1	B	0
22	78	4	8	14	54	27.26	32-51.32	115-18.03	5.00	0.0	99	136	0.0	0.03			D	0
23	78	4	8	22	33	8.79	32-57.98	115-32.15	14.23	0.0	99	66	0.0	0.17	0.5	1.6	B	0
24	78	4	11	11	39	42.42	32-52.56	115-30.93	18.23	3.10	99	87	0.0	0.23	0.9	2.1	B	0
25	78	4	11	11	49	3.10	32-51.81	115-29.74	15.72	2.30	99	91	0.0	0.22	1.2	1.3	B	0
26	78	4	11	18	31	36.69	32-51.96	115-29.55	12.73	0.0	99	127	0.0	0.12	1.3	2.3	B	0
27	78	4	13	0	4	12.59	32-48.50	115-28.60	5.00	0.0	99	154	0.0	0.03			D	0
28	78	4	13	14	21	6.47	32-50.80	115-27.74	8.96	0.0	99	142	0.0	0.06	1.5	1.0	A	0
29	78	4	13	16	19	27.90	32-49.00	115-28.04	4.99	0.0	99	107	0.0	0.17	3.7	27.9	C	0
30	78	4	13	21	14	3.69	33- 2.77	115-33.16	9.70	0.0	99	83	0.0	0.18	0.9	1.7	B	0
31	78	4	14	2	26	0.26	32-47.75	115-27.31	15.91	0.0	99	114	0.0	0.19	1.0	1.6	B	0
32	78	4	14	2	26	57.03	32-52.53	115-25.41	6.05	0.0	99	127	0.0	0.17			D	0
33	78	4	14	2	34	25.61	32-47.41	115-26.99	12.14	0.0	99	117	0.0	0.23	2.8	3.3	C	0
34	78	4	14	2	34	34.06	32-49.17	115-26.99	8.50	0.0	99	172	0.0	0.10			D	0
35	78	4	14	2	42	8.06	32-47.42	115-26.22	13.25	0.0	99	145	0.0	0.06	1.5	1.5	A	0
36	78	4	14	2	46	1.64	32-47.03	115-26.87	12.29	0.0	99	183	0.0	0.24	2.9	3.7	C	0
37	78	4	14	2	46	41.24	32-48.31	115-26.73	17.00	0.0	99	178	0.0	0.26	4.0	5.9	C	0
38	78	4	14	2	52	20.13	32-47.83	115-26.86	15.08	0.0	99	136	0.0	0.19	1.9	2.3	B	0
39	78	4	14	2	57	22.86	32-47.74	115-26.88	15.55	0.0	99	114	0.0	0.18	1.4	1.3	B	0
40	78	4	14	3	10	18.82	32-47.78	115-26.70	15.14	0.0	99	114	0.0	0.18	1.5	1.5	B	0
41	78	4	14	3	13	18.73	32-48.18	115-27.05	1.60	0.0	99	112	0.0	0.33	5.3	11.2	D	0
42	78	4	14	3	16	24.56	32-47.08	115-26.45	15.10	0.0	99	119	0.0	0.19			D	0
43	78	4	14	3	30	7.76	32-52.27	115-29.92	13.87	0.0	99	89	0.0	0.25	1.5	2.6	B	0
44	78	4	14	3	43	6.33	32-47.53	115-23.29	8.73	0.0	99	116	0.0	0.05	0.4	1.1	A	0
45	78	4	14	3	43	29.06	32-47.91	115-27.99	11.06	0.0	99	114	0.0	0.12	0.8	1.8	A	0
46	78	4	14	3	47	39.40	32-46.86	115-26.47	13.14	0.0	99	146	0.0	0.14	2.3	4.9	B	0
47	78	4	14	4	2	43.21	32-51.22	115-29.56	14.07	0.0	99	144	0.0	0.16	1.4	2.3	B	0
48	78	4	14	4	8	44.76	32-46.07	115-23.57	14.33	0.0	99	241	0.0	0.03			D	0
49	78	4	14	4	13	27.97	32-49.10	115-27.06	5.06	0.0	99	105	0.0	0.26	1.3	5.5	C	0
50	78	4	14	4	16	17.19	32-48.04	115-27.36	15.43	0.0	99	112	0.0	0.21	1.3	1.4	B	0

N	Y	M	D	H	M	SEC	LAT	LONG	DEP	MAG	N	GAP	DM	RMS	ERF	ERZ	Q	M
51	78	4	14	4	36	48.41	32-49.12	115-28.68	11.33	0.0	99	106	0.0	0.16	1.9	2.8	B	0
52	78	4	14	4	46	2.13	32-47.38	115-26.43	13.04	0.0	99	133	0.0	0.04	0.5	0.8	A	0
53	78	4	14	4	49	49.66	32-52.84	115-24.10	5.00	0.0	99	133	0.0	0.01			D	0
54	78	4	14	4	59	48.47	32-50.56	115-31.25	5.09	0.0	99	147	0.0	0.21			D	0
55	78	4	14	5	2	59.84	32-48.13	115-27.40	15.13	0.0	99	112	0.0	0.15	2.6	2.7	C	0
56	78	4	14	5	24	35.11	32-47.55	115-26.84	15.78	0.0	99	116	0.0	0.20	1.7	1.4	B	0
57	78	4	14	9	53	22.55	32-47.38	115-26.20	5.04	0.0	99	145	0.0	0.09	4.7	15.0	C	0
58	78	4	14	12	46	51.01	32-46.35	115-25.96	13.99	0.0	99	150	0.0	0.23	2.9	5.9	C	0
59	78	4	14	13	8	25.74	32-53.85	115-30.83	7.62	0.0	99	97	0.0	0.20	1.9	4.9	B	0
60	78	4	14	15	27	56.70	32-46.12	115-26.33	5.72	0.0	99	127	0.0	0.24	3.6	21.4	C	0
61	78	4	15	8	45	34.23	32-47.66	115-26.66	13.79	0.0	99	143	0.0	0.04	0.6	0.6	A	0
62	78	4	16	16	52	9.71	32-55.77	115-52.50	5.54	0.0	99	273	0.0	0.01			D	0
63	78	4	18	4	17	5.82	32-55.14	115-35.00	5.02	0.0	99	223	0.0	0.02			D	0
64	78	4	18	10	19	40.69	32-56.60	115-32.50	14.38	0.0	99	94	0.0	0.07	1.0	2.0	B	0
65	78	4	18	21	45	39.24	32-51.96	115-29.85	5.00	0.0	99	132	0.0	0.15	2.9	20.9	C	0
66	78	4	20	12	52	40.98	33-14.53	115-38.20	3.27	0.0	99	198	0.0	0.15	3.5	1.9	C	0
67	78	4	20	22	40	42.82	32-49.34	115-28.15	12.56	0.0	99	104	0.0	0.21	1.9	2.6	B	0
68	78	4	22	7	46	51.72	33-14.34	115-38.07	4.12	0.0	99	272	0.0	0.01	0.5	0.1	A	0
69	78	4	23	17	4	45.31	33- 4.66	115-35.03	10.75	0.0	99	87	0.0	0.17	1.3	2.0	B	0
70	78	4	24	12	5	18.15	33- 3.29	115-32.70	8.55	0.0	99	83	0.0	0.21	1.1	1.9	B	0
71	78	4	24	17	47	13.12	32-49.57	115-23.09	5.00	0.0	99	103	0.0	0.24	1.7	17.1	C	0
72	78	4	24	22	49	13.62	32-58.26	115-34.28	6.70	0.0	99	145	0.0	0.12	2.9	3.6	C	0
73	78	4	24	22	53	19.82	32-59.29	115-34.71	6.76	0.0	99	92	0.0	0.17	1.2	2.2	B	0
74	78	4	25	4	58	38.15	33- 0.11	115-34.97	10.46	0.0	99	60	0.0	0.22	0.9	1.7	B	0
75	78	4	25	5	13	25.30	33- 0.0	115-34.88	8.93	0.0	99	60	0.0	0.21	1.2	1.7	B	0
76	78	4	25	7	11	14.18	32-59.84	115-35.66	7.30	0.0	99	140	0.0	0.01	0.4	0.6	A	0
77	78	4	25	10	50	0.79	33- 0.87	115-35.68	9.69	0.0	99	130	0.0	0.13	4.9	3.1	C	0
78	78	4	25	18	44	50.51	33- 1.65	115-36.05	8.44	0.0	99	160	0.0	0.10	2.3	1.4	B	0
79	78	4	26	6	25	27.91	32-59.50	115-34.53	13.32	0.0	99	139	0.0	0.12	1.7	2.2	B	0
80	78	4	26	8	17	7.89	33- 3.44	115-36.58	6.41	0.0	99	163	0.0	0.14	23.8	12.5	D	0
81	78	4	27	8	28	13.18	33- 0.29	115-34.97	11.19	0.0	99	60	0.0	0.22	0.8	1.2	B	0
82	78	4	27	12	40	7.24	32-58.86	115-34.59	7.90	0.0	99	142	0.0	0.16	3.2	3.6	C	0
83	78	4	28	5	36	19.14	33- 5.30	115-35.15	7.30	0.0	99	121	0.0	0.21	2.1	4.7	B	0
84	78	4	30	4	35	28.45	33-16.01	115-51.48	4.94	0.0	99	252	0.0	0.14			D	0
85	78	4	30	18	57	15.04	32-59.65	115-34.52	12.19	1.90	99	61	0.0	0.19	1.0	1.6	B	0
86	78	5	1	5	51	29.67	32-58.59	115-34.69	6.40	0.0	99	140	0.0	0.18	1.8	3.0	B	0
87	78	5	1	23	56	43.37	32-49.53	115-24.81	4.36	2.40	99	97	0.0	0.30	2.0	1.5	C	0
88	78	5	2	1	58	35.52	32-50.88	115-25.05	4.43	2.40	99	92	0.0	0.28	1.8	1.3	B	0
89	78	5	2	4	23	6.55	32-50.97	115-23.87	4.90	0.0	99	132	0.0	0.07	1.0	0.5	A	0
90	78	5	2	6	17	29.39	32-50.95	115-25.19	4.42	3.20	99	92	0.0	0.32	1.1	1.2	C	0
91	78	5	2	6	23	5.17	32-51.67	115-25.63	5.00	2.20	99	39	0.0	0.31	0.9	0.9	C	0
92	78	5	2	7	25	4.23	32-51.54	115-25.76	5.00	2.10	99	90	0.0	0.22	0.8	0.8	B	0
93	78	5	2	8	33	37.08	32-51.48	115-25.27	4.79	2.90	99	89	0.0	0.32	1.1	1.1	C	0
94	78	5	2	9	24	53.99	33-15.04	115-37.30	4.75	1.90	99	138	0.0	0.13	1.2	0.8	A	0
95	78	5	2	10	21	24.38	32-50.72	115-25.44	4.39	2.20	99	131	0.0	0.20	1.8	1.2	B	0
96	78	5	2	10	37	4.76	32-51.49	115-24.89	4.86	3.10	99	89	0.0	0.35	1.1	1.2	C	0
97	78	5	2	12	12	50.41	32-51.02	115-25.10	4.96	2.40	99	91	0.0	0.28	1.3	1.4	B	0
98	78	5	2	12	18	10.97	32-51.64	115-26.21	4.44	0.0	99	140	0.0	0.13	2.5	1.1	C	0
99	78	5	2	12	59	49.22	32-51.26	115-25.68	4.22	2.20	99	91	0.0	0.27	1.6	1.1	B	0
100	78	5	2	18	50	6.24	32-50.39	115-25.62	4.24	2.50	99	133	0.0	0.24	1.9	1.3	B	0