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CATALOG OF EARTHQUAKES IN SOUTHERN ALASKA

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CATALOG OF EARTHQUAKES IN SOUTHERN ALASKA
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INTRODUCTION

The U.S. Geological Survey (USGS) began a regional program of telemetered seismic recording in south-central Alaska in 1971. The principal objectives of this program have been to use data recorded by this network to precisely locate earthquakes in the active seismic zones of southern Alaska, delineate seismically active faults, assess seismic risk, document potential premonitory earthquake phenomena, investigate current tectonic deformation, and study the structure and physical properties of the crust and upper mantle. A task fundamental to all of these goals is the routine cataloging of earthquake parameters for earthquakes located within and adjacent to the seismograph network.

The initial network of 10 stations, seven around Cook Inlet and three near Valdez, was installed in 1971. In subsequent summers additions or modifications to the network were made. By the fall of 1973, 26 stations extended from western Cook Inlet to eastern Prince William Sound, and four stations were located to the east between Cordova and Yakutat. A year later 20 additional stations were installed. Thirteen of these were placed along the eastern Gulf of Alaska with support from the National Oceanic and Atmospheric Administration (NOAA) under the Outer Continental Shelf Environmental Program to investigate the seismicity of the outer continental shelf, a region of interest for oil exploration. During the subsequent years the region covered by the network has remained relatively fixed while effort has been made to improve the instrumentation and installation of the stations in order to make them more reliable.

The locations of the stations of the USGS seismograph network are plotted in Figure 1 and listed in Table 1 along with the additional stations from which readings were obtained. Each USGS station has a single, vertical-component seismometer. The stations GLB, PNL, RDT, SKN, and VLZ also have north-south- and east-west-oriented horizontal seismometers.

This earthquake catalog presents origin times, focal coordinates, and magnitudes for 356 shocks occurring in the second quarter of 1978. Readings from a total of 71 stations were used to locate the shocks, including 12 stations operated by the NOAA Alaska Tsunami Warning Center (formerly Palmer Observatory), 14 stations operated by the Geophysical Institute of the University of Alaska (U. of A.), one station operated by the National Earthquake Information Service of the U.S. Geological Survey, and two stations operated in southwest Yukon Territory by the Department of Energy, Mines and Resources, Canada.

Earthquakes in south-central Alaska as small as magnitude 3.0 have been routinely located by the National Earthquake Information Service of the USGS and its predecessor since the great Alaska earthquake of 1964 and are published in the reports "Preliminary Determination of Epicenters" (PDE). In contrast, the shocks included in this catalog are as small as magnitude 0.5 and most are smaller than magnitude 3.0. Data for the larger historic earthquakes that occurred in south-central Alaska through 1975 have been tabulated by Meyers (1976).

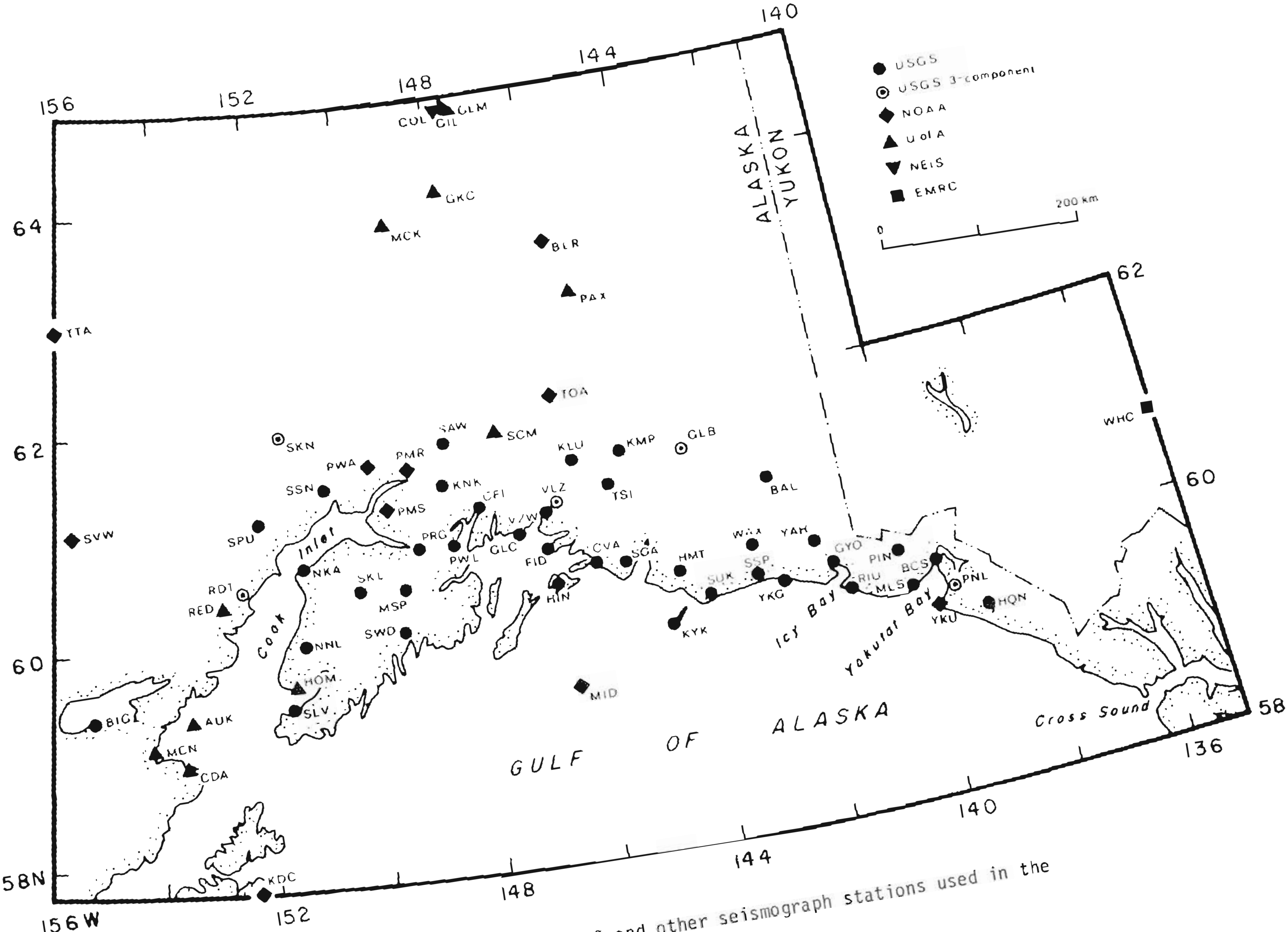

Figure 1. Map showing locations of USGS and other seismograph stations used in the preparation of this catalog.

Table 1. Station Data

STA CODE	STATION NAME	LATITUDE N	LONGITUDE W	ELEV M	P MOD	D KM	DLY1 SEC	DLY2 SEC	DLY3 SEC	TDLY SEC	MAG AT 1 HZ	INST
AUK	AUGUSTINE ISLAND	59 20.10	153 25.66	293	1	0.01	0.0	0.0	0.0	0.0		UOFA
AUM	AUGUSTINE MOUND	59 22.26	153 21.17	106	1	0.01	0.0	0.0	0.0	0.0		UOFA
BAL	BALDY	61 2.17	142 20.67	1300	3	0.01	0.0	0.0	-0.15	0.0	240000	USGS
BCS	DANCAS POINT	59 56.60	139 37.00	10	3	0.01	0.0	0.0	-0.65	-0.27	30000	USGS
BIG	BIG MOUNTAIN	59 23.34	155 13.02	667	1	0.01	0.0	0.0	0.0	0.0	120000	USGS
BLR	BLACK RAPIDS	63 30.10	145 50.70	609	2	0.01	0.0	0.0	0.0	0.0		NOAA
CDA	CAPE DOUGLAS	58 57.32	153 31.77	386	1	0.01	0.0	0.0	0.0	0.0		UOFA
CFI	COLLEGE FIORD	61 10.96	147 45.59	3	2	0.01	0.0	0.0	0.0	0.0	120000	USGS
COL	COLLEGE OUTPOST	64 54.00	147 47.60	320	2	0.01	0.0	0.0	0.0	0.0		NEIS
CVA	CORDOVA	60 32.79	145 44.96	50	2	0.01	0.0	0.0	0.0	-0.27		USGS
FID	FIDALGO	60 43.73	146 35.79	488	2	0.01	0.0	0.0	0.0	-0.27	240000	USGS
FYU	FORT YUKON	66 33.63	145 12.60	137	1	0.0	0.0	0.0	0.0	0.0		UOFA
GIL	GILMORE CREEK	64 58.50	147 29.70	350	1	0.01	0.0	0.0	0.0	0.0		NOAA
GKC	GOLD KING CREEK	64 10.72	147 56.08	490	1	0.0	0.0	0.0	0.0	0.0		UOFA
GLB	GILAHINA BUTTE	61 26.51	143 48.63	845	3	0.01	0.0	0.0	1.60	0.0	378000	USGS
GLC	GLACIER ISLAND	60 53.44	147 4.38	3	2	0.01	0.0	0.0	0.0	-0.27	171000	USGS
GLM	GILMORE DOME	64 59.23	147 23.33	620	2	0.01	0.0	0.0	0.0	0.0		UOFA
GYO	GUYOT HILLS	60 8.78	141 26.29	163	3	0.01	0.0	0.0	-0.06	-0.27	120000	USGS
HIN	HINCHINBROCK ISLAND	60 23.81	146 30.10	211	2	0.01	0.0	0.0	2.09	-0.27	240000	USGS
HMT	HAMILTON	60 20.19	144 15.64	620	3	0.01	0.0	0.0	-0.55	-0.27	120000	USGS
HOM	HOMER	59 39.60	151 38.60	198	1	0.01	0.0	0.0	0.0	0.0		UOFA
HON	HARLEQUIN	59 27.10	138 52.62	372	3	0.01	0.0	0.0	0.0	-0.27	120000	USGS
IMA	INDIAN MOUNTAIN	66 4.11	153 40.72	1380	1	0.01	0.0	0.0	0.0	0.0		NOAA
KDC	KODIAK	57 44.87	152 29.50	13	1	0.01	0.0	0.0	0.0	0.0		NOAA
KLU	KLUTINA	61 29.57	145 55.21	1021	2	0.01	0.0	0.0	0.0	0.0	216000	USGS
KMP	KIMBALL PASS	61 30.78	145 1.09	1143	2	0.01	0.0	0.0	0.0	-0.27	171000	USGS
KNK	KNIK GLACIER	61 24.75	148 27.14	595	2	0.01	0.0	0.0	0.0	0.0	60000	USGS
KYK	KAYAK ISLAND	59 52.10	144 31.39	375	2	0.01	0.0	0.0	1.97	-0.27	60000	USGS
MCK	MCKINLEY PARK	63 43.54	148 56.10	610	1	0.01	0.0	0.0	0.0	0.0		UOFA
MCN	MCNEIL RIVER	59 6.06	154 11.59	272	1	0.01	0.0	0.0	0.0	0.0		UOFA
MID	MIDDLETON ISLAND	59 25.67	146 20.34	37	2	0.01	0.0	0.0	0.0	-0.27		NOAA
MLS	MALASPINA GLACIER	59 46.00	140 9.60	30	3	0.01	0.0	0.0	0.09	-0.27	15000	USGS
MSP	MOOSE PASS	60 29.35	149 21.64	150	1	0.01	0.0	0.0	0.0	0.0	120000	USGS
NKA	NIKISHKA	60 44.58	151 14.26	150	1	4.00	1.36	0.0	0.0	0.0	9000	USGS
NNL	NINILCHIK	60 2.53	151 17.78	366	1	4.00	0.67	0.0	0.0	0.0	120000	USGS
PAX	PAXSON	62 58.75	145 28.11	1130	2	0.01	0.0	0.0	0.0	0.0		UOFA
PIN	PINNACLE	60 5.80	140 15.40	975	3	0.01	0.0	0.0	-0.01	-0.27	60000	USGS
PMR	PALMER OBSERVATORY	61 35.53	149 7.85	100	1	0.01	0.0	0.0	0.0	0.0		NOAA
PMS	ARCTIC VALLEY	61 14.68	149 33.63	716	1	0.01	0.0	0.0	0.0	0.0		NOAA
PNL	PENINSULA	59 40.06	139 23.82	685	3	0.01	0.0	0.0	-1.10	-0.27	60000	USGS
PRG	PORTAGE	60 51.87	149 1.21	35	1	0.01	0.0	0.0	0.0	0.0	198000	USGS
PWA	HOUSTON	61 39.65	149 52.72	137	1	0.01	0.70	0.0	0.0	0.0		NOAA
PWL	PORT WELLS	60 51.50	148 20.09	545	2	0.01	0.0	0.0	0.0	0.0	120000	USGS
RDT	REDOUBT	60 34.43	152 24.37	930	1	0.01	0.36	0.0	0.0	0.0	120000	USGS
RED	REDOUBT VOLCANO	60 25.14	152 46.32	1067	1	0.01	0.0	0.0	0.0	0.0		UOFA
RIU	RIOU	59 52.65	141 13.80	15	3	0.01	0.0	0.0	1.09	-0.27	7800	USGS
SAW	SAWMILL	61 48.49	148 19.96	740	2	0.01	0.0	0.0	0.0	0.0	240000	USGS
SCM	SHEEP MOUNTAIN	61 50.00	147 19.66	1020	2	0.01	0.0	0.0	0.0	0.0		UOFA
SGA	SHERMAN GLACIER	60 32.04	145 12.42	424	2	0.01	0.0	0.0	2.17	-0.27	60000	USGS
SKD	SITKALIDAK ISLAND	57 9.85	153 4.82	135	1	0.01	0.0	0.0	0.0	0.0		UOFA
SKL	SKILAK	60 30.80	150 12.66	690	1	0.01	0.10	0.0	0.0	0.0	120000	USGS
SKN	SKWENTNA	61 58.82	151 31.78	564	1	0.01	0.0	0.0	0.0	0.0	240000	USGS
SLV	SELDOVIA	59 28.25	151 34.83	91	1	0.01	0.0	0.0	0.0	0.0	30000	USGS
SPU	SPURR	61 17.90	152 3.26	830	1	0.01	0.39	0.0	0.0	0.0	240000	USGS
SSN	SUSITNA	61 27.63	150 44.60	1297	1	0.01	0.67	0.0	0.0	0.0	30000	USGS
SSP	SUNSHINE POINT	60 12.30	142 45.80	305	3	0.01	0.0	0.0	0.79	-0.27	120000	USGS
SUK	SUCKLING HILLS	60 3.32	143 47.31	295	3	0.01	0.0	0.0	2.14	-0.27	120000	USGS
SVW	SPARREVOHN	61 6.49	155 37.30	762	1	0.01	0.0	0.0	0.0	0.0		NOAA
SWD	SEWARD	60 6.22	149 26.96	91	1	0.01	0.0	0.0	0.0	0.0	30000	USGS
TNN	TANANA	65 15.40	151 54.70	304	1	0.01	0.0	0.0	0.0	0.0		UOFA
TOA	TOLSONA	62 6.25	146 10.34	905	2	0.01	0.0	0.0	0.0	0.0		NOAA
TSI	TSINA	61 13.57	145 20.24	1113	2	0.01	0.0	0.0	0.0	-0.27	120000	USGS
TTA	TATALINA	62 55.80	156 1.32	514	1	0.01	0.0	0.0	0.0	0.0		NOAA
VLZ	VALDEZ	61 7.89	146 19.92	10	2	0.01	0.0	0.10	0.0	-0.27	60000	USGS
VZW	VALDEZ WEST	61 3.54	146 32.24	796	2	0.01	0.0	0.0	0.0	-0.27	120000	USGS
WAX	WAXELL RIDGE	60 26.50	142 51.10	975	3	0.01	0.0	0.0	0.61	-0.27	30000	USGS
WHC	WHITEHORSE	60 44.20	135 5.50	732	3	0.01	0.0	0.0	2.55	0.0		EMRC
YAH	YAHTSE	60 21.51	141 44.70	2135	3	0.01	0.0	0.0	0.17	-0.27	60000	USGS
YKC	YELLOWKNIFE	62 28.70	114 28.70	198	3	0.01	0.0	0.0	0.0	0.0		EMRC
YKG	YAKATAGA	60 4.20	142 25.23	46	3	0.01	0.0	0.0	0.0	-0.27	7800	USGS
YKU	YAKUTAT	59 32.72	139 43.73	15	3	0.01	0.0	0.0	0.35	-0.27		NOAA

This table lists geographic coordinates and other pertinent information for stations used in the preparation of this catalog. P-MOD is the number of the P-wave velocity model assigned to the station (see text), where the numbers 1, 2, and 3 correspond to the western, central and eastern models. D is the thickness of the low-velocity surficial sedimentary layer in kilometers assigned in the calculation of traveltime delays to a given station. DLY1-3 are the station P-phase traveltime delays in seconds. TDLY is the telephone line delay in seconds. The magnification (MAG) of the vertical seismograph component is given at 1 Hz. The institutions (INST) operating the stations other than the USGS Office of Earthquake Studies are the NOAA Alaska Tsunami Warning Center, the Geophysical Institute of the University of Alaska (UOFA), the National Earthquake Information Service (NEIS), and the Department of Energy, Mines and Resources, Canada (EMRC).

INSTRUMENTATION

The instrumentation in the USGS seismograph network is illustrated in the block diagram in Figure 2. Data from each seismometer are telemetered to the NOAA Alaska Tsunami Warning Center in Palmer. The standard equipment at each field station includes a vertical seismometer with a natural frequency of 1.0 Hz (Mark Products, Model L-4), a package consisting of an amplifier and a voltage-controlled oscillator (VCO model NCER 202, or AlVCO, see Rogers and others, 1980), and "air-cell" storage batteries (McGraw-Edison, Model ST-2-1000). The AlVCO crystal-referenced units have an automatic gain-ranging capability and provide daily information on the gain setting, geophone response, battery voltage, station identification, and temperature. Data are telemetered via a combination of leased telephone circuits (some of which are relayed by satellite and have a -0.27 sec delay) and VHF (162-174 MHz) radio links. The radio equipment consists of low-power transmitters (100 mW) and receivers adapted from HT-200 Motorola handie-talkie transceivers. Yagi antennae with 9 db directional gain (Scala, Model CAS-150) are used. At some sites where AC power is available, base-station radio receivers (G.E. Model R46AP66B) with greater sensitivity and reliability are used. The central recording facility incorporates a bank of discriminators (NCER J101 or Develco Model 6203), four 16 mm-film multi-channel oscillographs (Teledyne Geotech Develocorder, Model 4000D), a 14-channel analog tape recorder (Bell and Howell Model VR3700B), and a time-code generator (Datum, Model 9100).

The principle of operation is as follows: The seismometer translates movement of the ground into an electrical voltage that is fed into the amplifier/VCO unit where the amplified voltage causes the frequency of an audio-band oscillator to fluctuate about its center frequency. The frequency-modulated (FM) tone from the amplifier/VCO unit is carried directly by voice-grade telephone circuit to the recording site or alternately is fed through a VHF radio link onto a telephone circuit. At the recording site the FM seismic signal is demodulated by a discriminator. The demodulated signal, which is simply an amplified form of the initial signal from the seismometer, is recorded photographically on a multichannel oscillograph, together with time marks from a crystal-controlled chronometer. Twenty-four hours of data for 18 stations can be recorded on a single 43-m-long roll of 16-mm film.

Signals from more than one seismograph can be transmitted on a single telephone circuit by employing VCO units with different center frequencies. In the standard configuration there is a 340 Hz separation between center frequencies and a fixed bandwidth of 250 Hz. Up to eight seismic channels with center frequencies ranging from 680 to 3060 Hz may be placed on a single voice-grade telephone circuit.

Figure 3 illustrates the response characteristics of the entire seismic system from seismometer to film viewer. The response level at each station is adjusted in steps of 6 decibels so that the ambient seismic noise produces a small deflection of the trace on the film. As a result, the actual response for an individual station may differ from that of the typical station by a factor of 2, 4, 8, etc. The magnification of the typical station is about 6×10^4 at 1 Hz and 10^6 at 10 Hz. The gain of a station that has an AlVCO

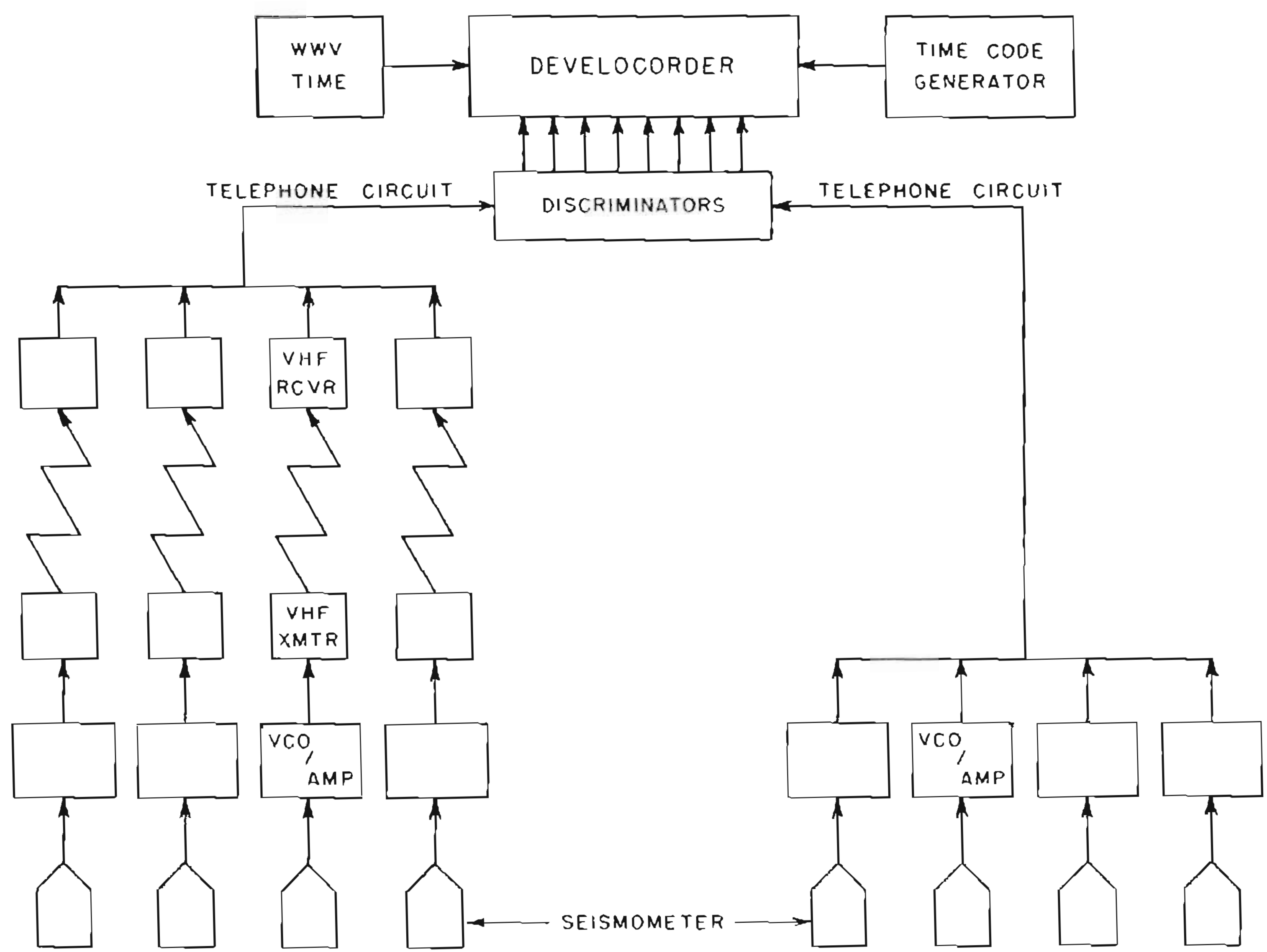

Figure 2. Block diagram of telemetered seismograph system in the USGS Alaska seismic network.

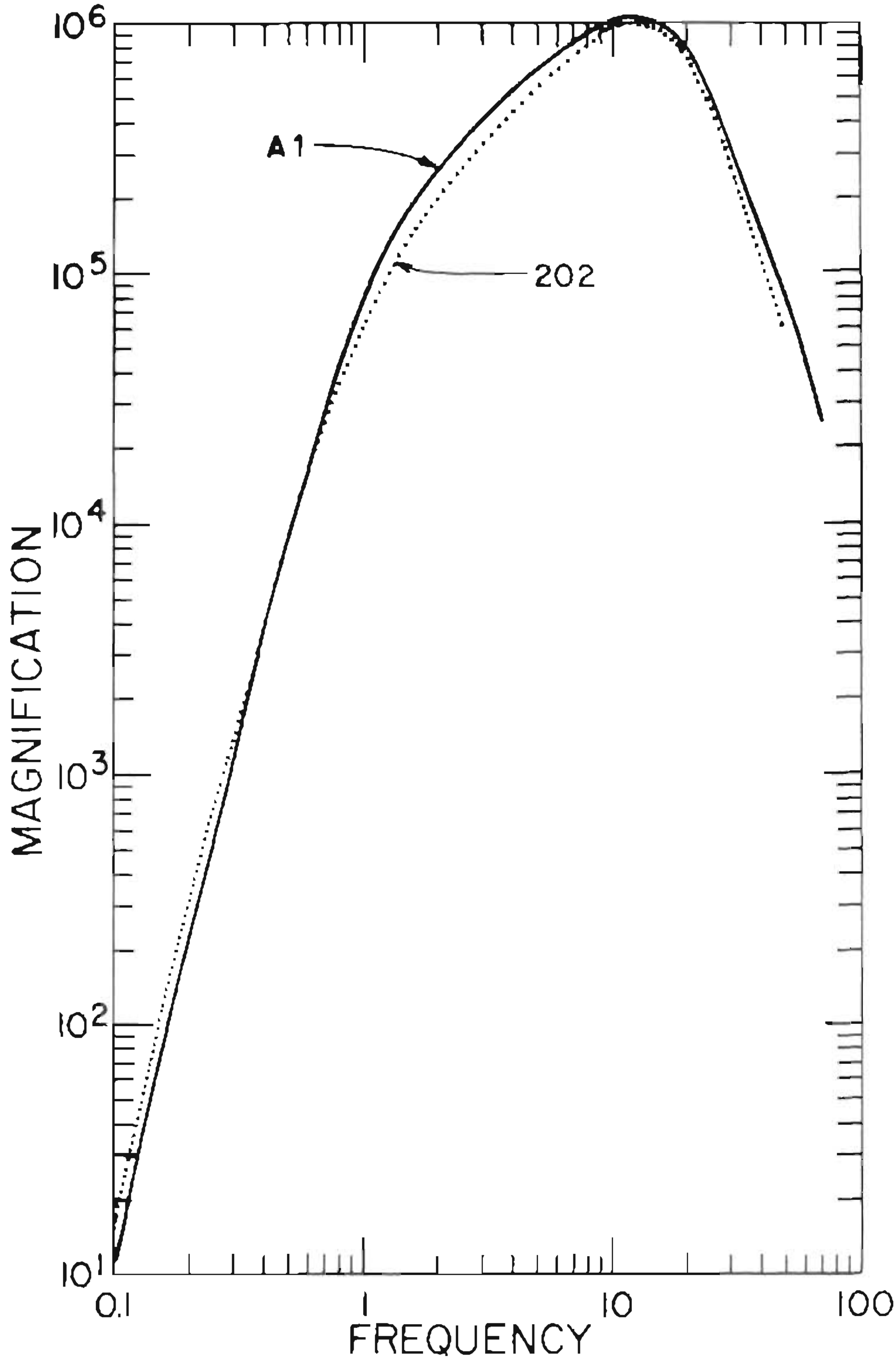

Figure 3. System response curves for typical USGS Alaska seismographs that incorporate the A1VCO unit (solid curve) and the older VCO model NCER 202 unit (dotted curve).

unit is automatically reduced by a factor of 10 when the fluctuations of the FM signal exceed a preset threshold.

The installation of a typical radio-linked station is shown in Figure 4. Degradation or interruption of data transmission due to inclement weather conditions is a major problem during the winter months. Some indication of the operational reliability of the USGS stations can be inferred from the plot of station use in Figure 5.

DATA PROCESSING

The 16-mm films (four per day) are mailed weekly from Palmer to Menlo Park where the seismic data are processed by the following multi-step routine:

1. Scanning. The scan film, which has 18 stations distributed throughout the network, is scanned to identify and note times of all seismic events whether of local, regional, or teleseismic origin.

2. Timing. For the "well-recorded" local earthquakes identified in the scanning process, the following data are read from each station: P- and S-wave arrival times, direction of first motion, duration of signal in excess of a given threshold amplitude, and period and amplitude of maximum recorded signal. The criterion for choosing earthquakes to be timed is the duration of the signal, which is related to the magnitude. The network is divided into three regions--western, central, and eastern--bounded approximately by longitudes 156° and 150° W, 150° and 145° W, and 145° and 138° W, respectively. In the western and central regions, only events with signal durations longer than 80 s and 20 s, respectively, are timed. In the eastern region, all earthquakes which are recorded by at least three stations and for which at least four clear arrivals can be read are timed. This criterion was established to select from the large number of earthquakes recorded by the network those shocks that are of greatest interest to current research objectives.

For this catalog, timing the seismic phases and measuring the waveform amplitude was accomplished by utilizing a newly-developed system consisting of a computer-based sonic digitizing table with interactive data processing capabilities (Pelton and others, 1982). The system has four main components including (1) an optical film transport unit that can display portions of up to four 16-mm Develocorder films concurrently, (2) a sonic digitizing unit activated by a hand-controlled cursor, (3) a microcomputer that controls the data organization and processing tasks, reduces the digitized data, computes a preliminary hypocenter location and magnitude, and provides an interface with a larger computer for final processing, and (4) a video display for easy monitoring of the current processing sequence, and a printer for permanent recording of each data analysis session. The system is designed to process one earthquake at a time and allow selective remeasurement of any digitized datum. This method is a significant improvement over the standard multi-step processing routine (for example, Lahr and others, 1974) where only one film at a time is viewed and digitized on a non-interactive basis and nearly all subsequent processing is done in a batch mode.

Figure 4. Installation of a typical seismograph station (ILM). VCO/amplifier unit, radio transmitter, and batteries are housed in a 30-inch diameter culvert partially set in the ground at the base of the antenna. Seismometer is buried in the ground about 30 meters from the culvert.

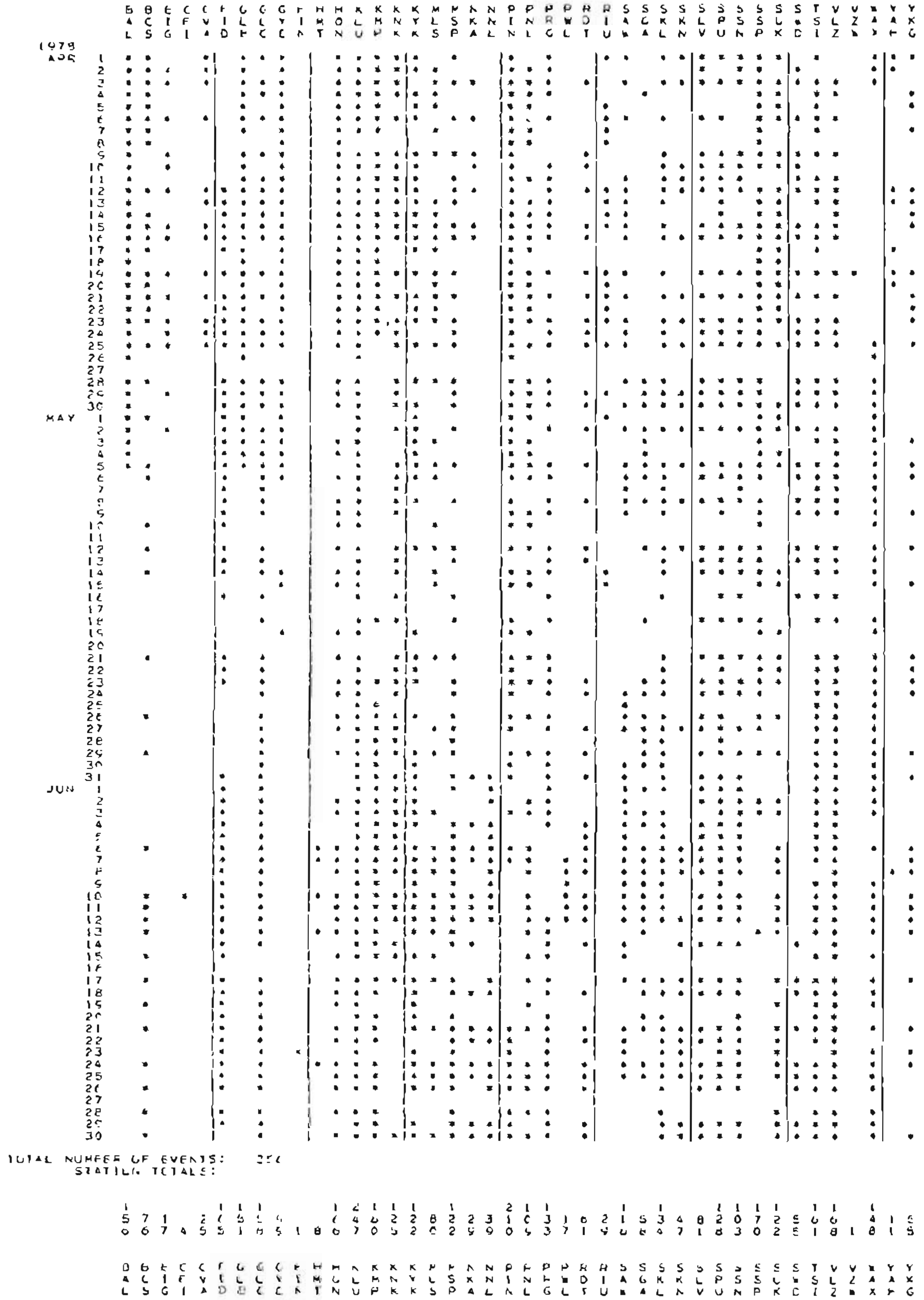

Figure 5a. Record of station operation for USGS stations during the second quarter of 1978. The figure indicated the days on which arrival times were obtained for locating earthquakes. The totals at the bottom indicate the number of events for which each was used.

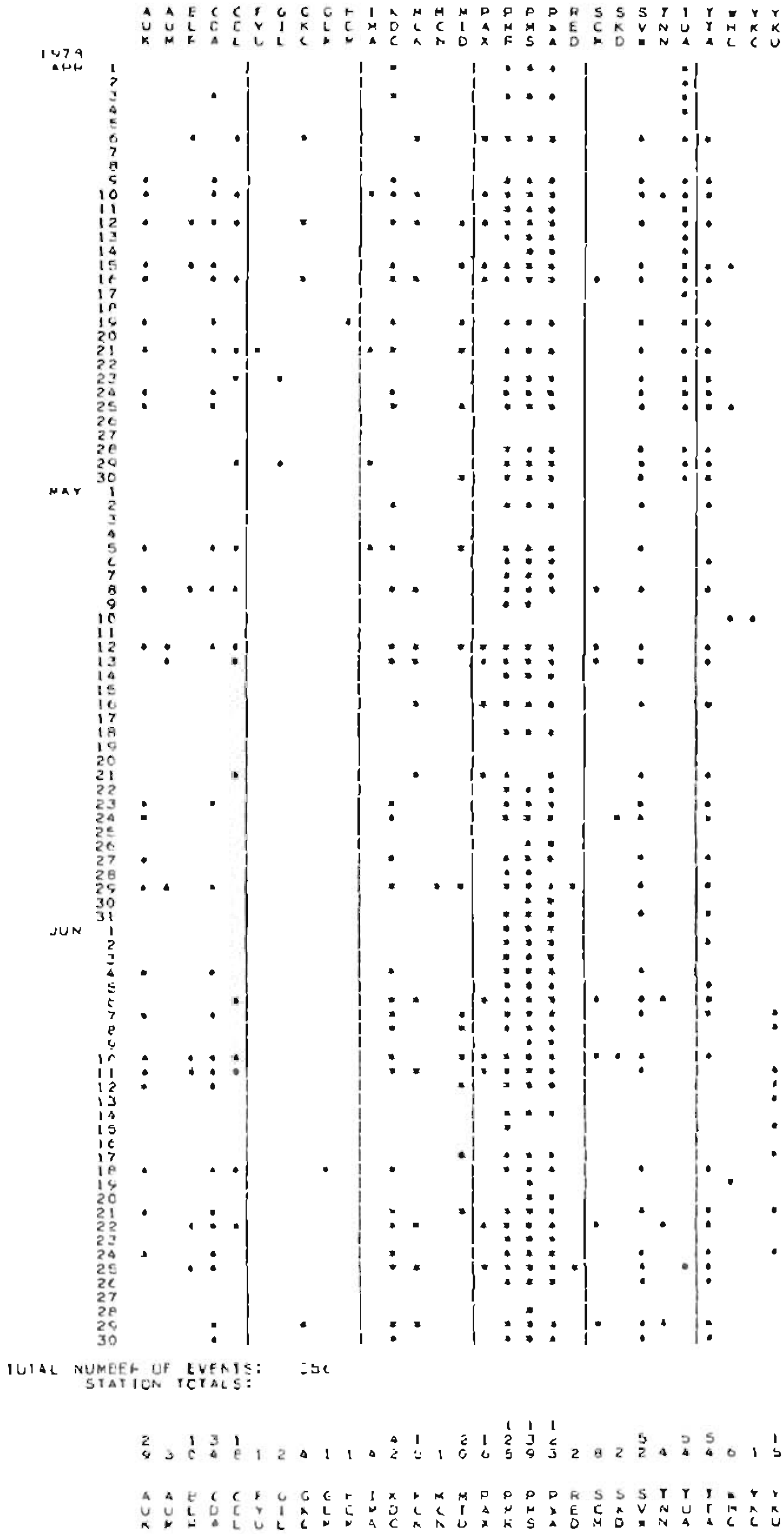

Figure 5b. This information is similar to Figure 5a, but represents the frequency with which readings from each of the non-USGS stations were used.

Final computer processing is done utilizing the computing facilities at the Stanford Linear Accelerator Center and the computer program HYPOELLIPSE (Lahr, 1980). For shocks with a poor distribution of reporting stations, readings from additional stations outside the USGS network are sought and added.

The earthquake locations are based on P and S arrivals. S arrivals are important for determining epicenters of shocks outside the network and depths of events in the Benioff zone beneath the network in Cook Inlet. Unfortunately for some large events, S cannot be read at any station because the traces on the film overlap each other or are too faint to follow.

The HYPOELLIPSE computer program determines hypocenters by minimizing differences between observed and computed traveltimes through an iterative least-squares scheme. In many respects the program is similar to HYPO71 (Lee and Lahr, 1972), which has been used in the preparation of catalogs of central California earthquakes since January 1969. An important feature available in HYPOELLIPSE is the calculation of confidence ellipsoids for each hypocenter. The ellipsoids provide valuable insight into the effect of network geometry on possible hypocentral errors.

VELOCITY MODELS

Our experience with locating earthquakes in southern Alaska suggests that significant lateral variations are present in the velocity structure across the network. Such variations might be expected from the complicated geology and tectonics of the region (e.g., Plafker, 1967). Very little information in the form of direct measurement is available for the velocity structure in southern Alaska. In previous catalogs, only two P-wave velocity models consisting of horizontal layers of constant velocity were used to locate the earthquakes (e.g., Stephens, and others, 1979). These velocity models were derived by minimizing the traveltime residuals for selected sets of earthquakes in the Cook Inlet region (Model A of Matumoto and Page, 1969) and near Valdez. The models proved adequate for locating earthquakes as far east as Kayak Island, but earthquakes located farther to the east often had large traveltime residuals at nearby stations. An improved velocity model for the region east of Kayak Island was developed by minimizing the traveltime residuals for a selected set of aftershocks from the 1979 St. Elias earthquake that occurred north of Icy Bay (Stephens, and others, 1980b). A significant difference between this model and the earlier ones is that the new model consists of a single layer of linearly increasing velocity over a half-space of constant velocity, whereas the earlier models consist of several horizontal layers of constant velocity.

In the preparation of this catalog, the method of assigning velocity models to calculate theoretical traveltimes to various stations is different from that used in some earlier catalogs. Previously, the velocity model used was determined by the region in which the earthquake occurred and would then be the same for all stations for that event. In the revised procedure, each station always uses the same velocity model, and the model used is determined by the region in which the station is located. Thus, a station in the eastern region will use the eastern velocity model to calculate traveltimes from events that occur in the western, central and eastern parts of the network.

West of longitude 148° 45' W the velocity model used is as follows:

Layer	Depth (km)	P velocity (km/s)
1	0 - D	2.75
2	D - 4	5.3
3	4 - 10	5.6
4	10 - 15	6.2
5	15 - 20	6.9
6	20 - 25	7.4
7	25 - 33	7.7
8	33 - 47	7.9
9	47 - 65	8.1
10	below 65	8.3

The thickness, D, of the first layer is allowed to vary between stations to account for the presence of thick sections of low-velocity sediments beneath the stations NKA and NNL, which are located in the Cook Inlet basin. For these stations D is 4 km. For all other stations D is 0.01 km. It is recognized that a model comprised of uniform horizontal layers may be a poor representation of the actual velocity structure, particularly in the vicinity of a subduction zone (Mitronovas and Isacks, 1971; Jacob, 1972), although such a model does have the advantage of simplifying the computation of traveltimes. In order to determine any bias that might result from this approximation, a set of events in the Benioff zone below Cook Inlet was relocated using a ray-tracing program of E. R. Engdahl that incorporates a more realistic, three-dimensional velocity model (Lahr, 1975). Hypocenter shifts, apparently due to the oversimplified flat-layer model, ranged from near zero at a depth of 60 km to as great as 25 km at the 160 km depth. The offsets were oriented in such a way that the dip of the Benioff zone would appear to be too great for locations based on a flat-layered model.

For earthquakes that occur between longitudes 148° 45' W and 144° 30' W, the velocity model used to locate the events is:

Layer	Depth (km)	P velocity (km/s)
1	0.0	2.75
2	0.01	6.4
3	below 39	8.0

East of longitude 144° 30' W the P-wave velocity of the first layer increases linearly from 5.0 km/s at the surface to 7.8 km/s at 32 km depth, while the half-space has a velocity of 8.2 km/s.

P-phase traveltime delays are applied to stations in the network that have consistent and large residuals for the locations of large groups of earthquakes. Each station has three delays (DLY1, DLY2, and DLY3 of Table 1) assigned to it that correspond to the western, central, and eastern regions covered by the network. The particular delay that is used to locate an earthquake is determined by the region in which the earthquake occurs. For example, a station near Icy Bay that is used to locate an earthquake beneath Cook Inlet (western region) will be assigned a delay DLY1, but the same station will use DLY3 to locate an earthquake that occurs beneath Icy Bay (eastern region). Additional delays are applied at several stations to correct for a satellite link in the relay of the signal. S-phase delays are determined by multiplying the P-delay by 1.78, the P to S velocity ratio.

The initial trial depths for earthquakes which occur in the western, central, and eastern parts of the network are 75, 30, and 15 km, respectively, and reflect a progressive decrease in the range of depths of earthquakes from west to east.

MAGNITUDE

Magnitudes are determined from either the signal duration or the maximum trace amplitude. Eaton and others (1970) approximate the Richter local magnitude, which depends on maximum trace amplitudes recorded on standard horizontal Wood-Anderson torsion seismographs, by an amplitude magnitude based on maximum trace amplitudes recorded on high-gain, high-frequency vertical seismographs such as those operated in the Alaskan network. The amplitude magnitude XMAG used in this catalog is based on the work of Eaton and his co-workers and is given by the expression (Lee and Lahr, 1972)

$$XMAG = \log_{10} A - B_1 + B_2 \log_{10} D^2 \qquad (1)$$

where A is the equivalent maximum trace amplitude in millimeters on a standard Wood-Anderson seismograph, D is the hypocentral distance in kilometers, and B_1 and B_2 are constants. Differences in the frequency response of the two seismograph systems are accounted for in A. It is assumed, however, that there is no systematic difference between the maximum horizontal ground motion and the maximum vertical motion. The terms $-B_1 + B_2 \log_{10} D^2$ approximate Richter's $-\log_{10} A_0$ function (Richter, 1958, p. 342), which expresses the trace amplitude for an earthquake of magnitude zero as a function of epicentral distance.

For small, shallow earthquakes in central California, Lee and others (1972) express the duration magnitude FMAG at a given station by the relation

$$FMAG = -0.87 + 2.00 \log_{10} T + 0.0035\, DEL \qquad (2)$$

where T is the signal duration in seconds from the P-wave onset to the point where the peak-to-peak trace amplitude on the Geotech Model 6585 film viewer falls below 1 cm and DEL is the epicentral distance in kilometers.

Comparison of XMAG and FMAG estimates from equations (1) and (2) for 77 Alaskan shocks in the depth range 0 to 150 km and in the magnitude range 1.5 to 3.5 reveals a systematic linear decrease of FMAG relative to XMAG with increasing focal depth. To remove this discrepancy, a linear dependence on depth is added to the expression for FMAG as follows:

$$FMAG = -1.15 + 2.00 \log_{10} T + 0.007 Z + 0.0035 DEL \quad (3)$$

where Z is the focal depth in kilometers.

The magnitude preferentially assigned to each earthquake in this catalog is the FMAG estimate. The XMAG value is used only where no FMAG can be determined.

ANALYSIS OF QUALITY

Two types of errors enter into the determination of hypocenters: systematic errors limiting the accuracy of hypocenters and random errors limiting the precision. Systematic errors arise from an incorrect velocity model, misidentification of phases, or systematic timing errors and can be evaluated through controlled experiments such as locating the coordinates of a known explosion. Random errors result from random timing errors and are estimated for each earthquake through the use of standard statistical techniques.

For each earthquake, HYPOELLIPSE calculates the lengths and orientations of the principal axes of the joint confidence ellipsoid. The one-standard-deviation confidence ellipsoid describes the region of space within which one is 68 percent confident that the hypocenter lies, assuming that the only source of error is random reading error. The ellipsoid is a function of the station geometry for each individual event, the velocity model assumed and the standard deviation of the random reading error. The standard deviation determined from repeated readings of the same phases by four seismologists is as small as 0.01 to 0.02 s for the most impulsive arrivals and as large as 0.10 to 0.20 s for emergent arrivals. The confidence ellipsoids are computed for a standard deviation of 0.16 s and therefore likely overestimate the 68 percent confidence regions. The standard deviation of the residuals for an individual solution is not used to calculate the confidence ellipsoid because it contains information not only about random reading errors but also about the incompatibility of the velocity model to the data. Thus, the confidence ellipsoid is a measure of the precision of the hypocentral solution. In a few extreme cases the value calculated for one of the ellipsoid axes becomes very large corresponding to a spatial direction with very great uncertainty. In these cases an upperbound length of 25 km is tabulated.

To fully evaluate the quality of a hypocenter one must consider both the confidence ellipsoid and the root mean square (RMS) residual for the solution. The RMS residual reflects both systematic and random errors, but the random errors are typically much smaller. Hence the RMS residual is primarily a measure of the incompatibility of the velocity model, misinterpretation of phases, and systematic timing errors. Interpretation of the RMS residual may depend upon the location of the earthquake. In areas where the velocity model is incompatible with the real earth, RMS residuals could be large and reflect the incompatibility; alternatively, the RMS residuals could be small and not reflect the error in a bad hypocenter. Where

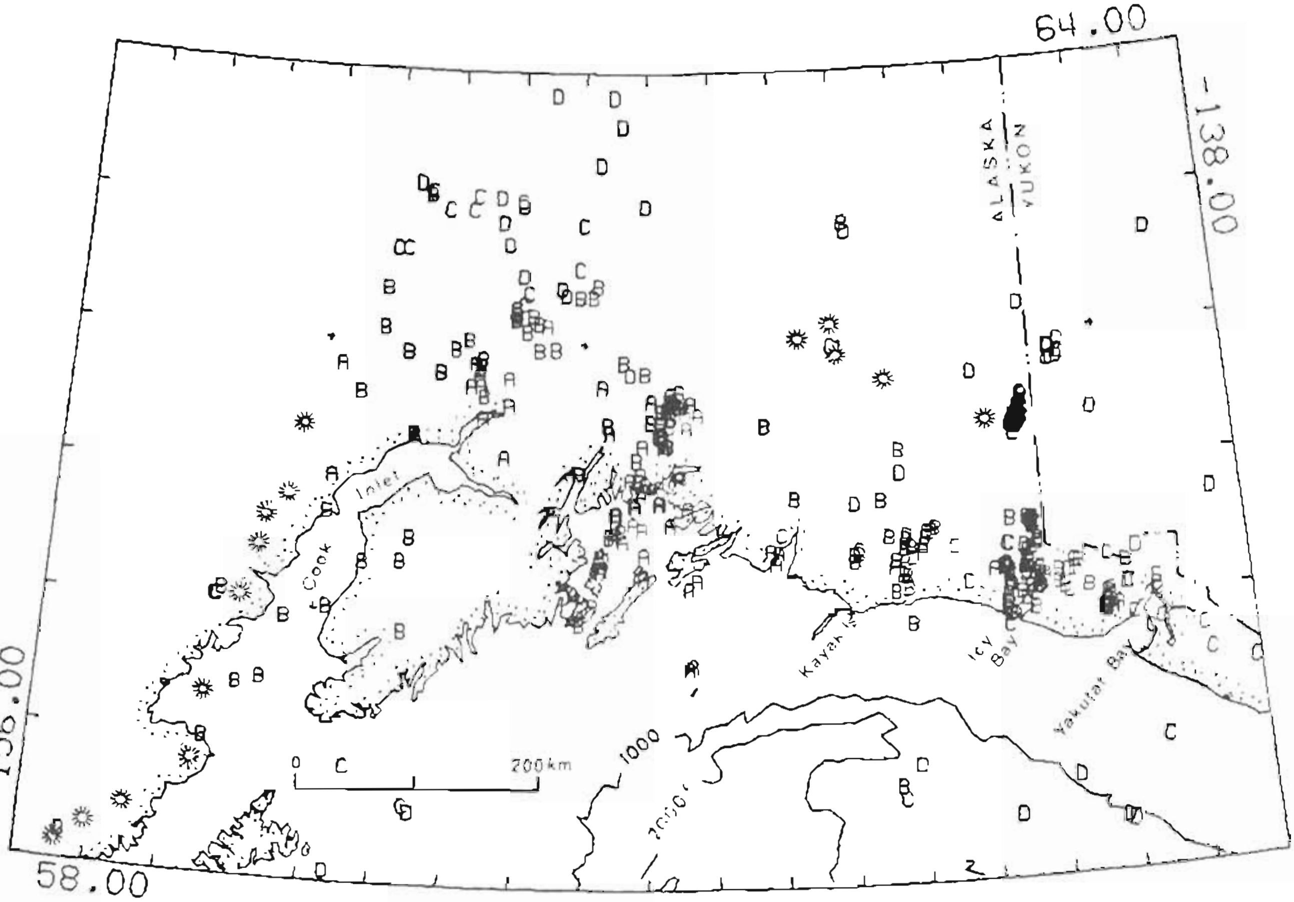

Figure 6. Map of earthquake epicenters for the period April - June, 1978. Earthquakes are plotted with a symbol that represents the quality of the location (see Appendix), with A and B representing better quality. Quaternary volcanoes (after King, 1969) are indicated by stars.

All of the seismic activity in the southern part of the network east of longitude 146° W occurs at depths less than about 35 km. The number of larger magnitude earthquakes which occur in the east is considerably smaller than that in the western part of the network (Figure 7). Most of the seismic activity in the eastern part of the network appears to be concentrated beneath Icy Bay and near Waxell Ridge northeast of Kayak Island.

One notable feature in the seismicity during this quarter is a prominent cluster of events centered near 61° 20' N, 141° 15' W, immediately south of the junction between the Totshunda and Duke River faults. A second, less prominent cluster is located about 60 km northeast of the first near the Denali fault. Poor station distribution and uncertainty in the velocity structure contribute to poor locations for these events and preclude making a clear association of the seismicity with particular faults; the apparent SSW-NNE trend of the main cluster also may be a result of mislocation errors. Although earthquakes continually occur in these areas, the interesting aspect of the clusters is that they occurred during relatively short periods of time in April (Figure 10). Only one of the located earthquakes in each group did not occur during April. Both of these later events, which were among the largest magnitude events in each cluster, did not occur until June. Within the swarm-like character of the main cluster are what appear to be several minor mainshock-aftershock sequences.

Nineteen earthquakes listed in the catalog are located outside of the map area of Figure 6. Of these events, the largest one had a coda-duration magnitude of 6.7 (6.0 m_b, 6.6 M_s) and occurred at 03:42 on April 12 southeast of Kodiak Island. Although this earthquake had a prominent aftershock sequence with many events recorded by the USGS network, only the location of the mainshock is presented in the catalog (see Gedney, 1978, for a more complete listing of the aftershocks). Nine earthquakes with coda-duration magnitudes ranging from 2.3 to 3.9 were located southeast of the network in the vicinity of Cross Sound and Glacier Bay.

The contents of the Appendix may be obtained in forms amenable to computer input (punched cards or magnetic tape) by contacting the authors.

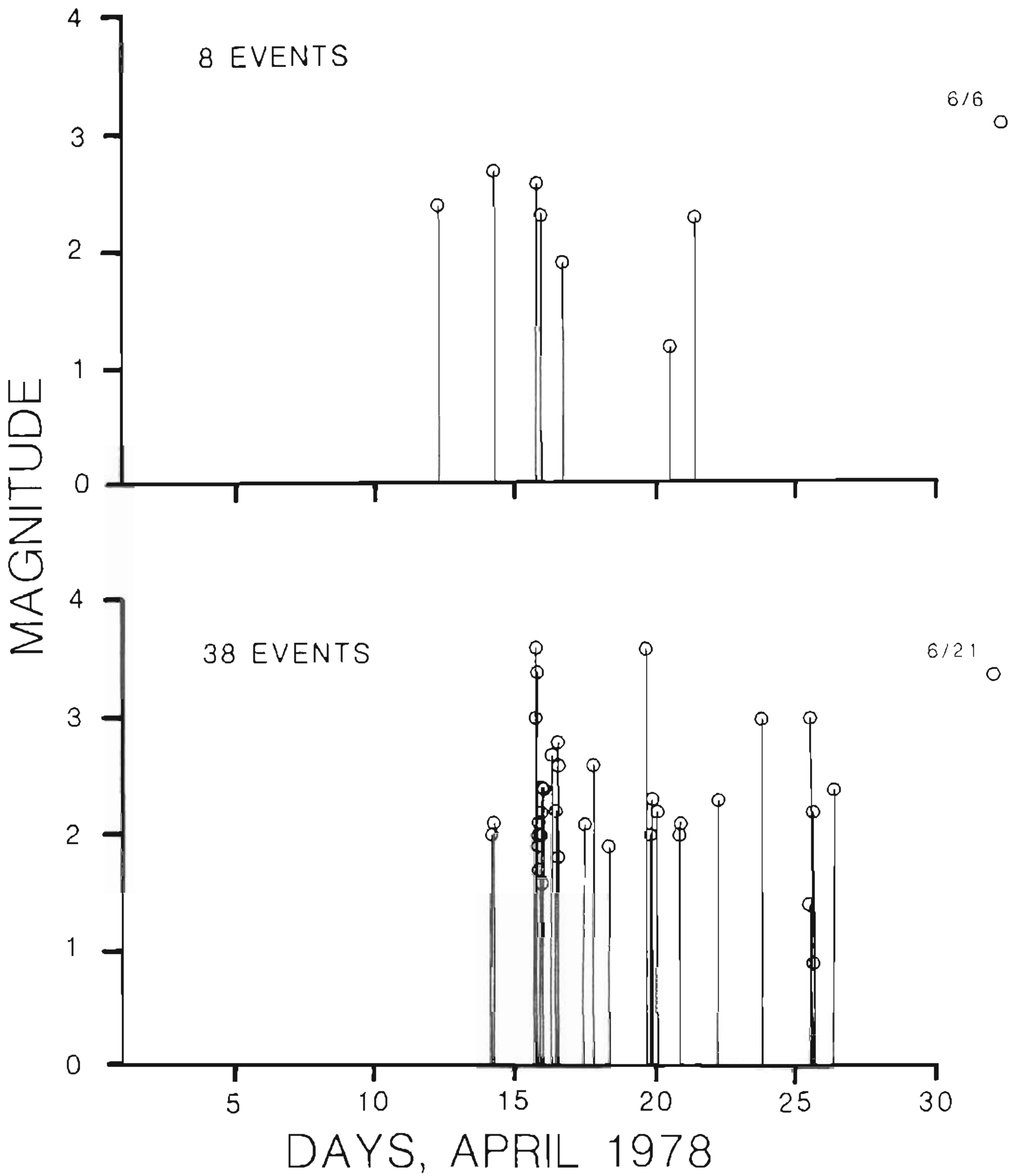

Figure 10. Magnitude versus time distribution of earthquakes for two clusters north of eastern portion of network (see text). The main cluster is plotted in the lower part of the figure. Dates and magnitudes for two events that occurred in June are indicated at right.

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APPENDIX

Catalog of Earthquakes

Earthquakes from southern Alaska are listed in chronological order. The following data are given for each event:

(1) Origin time in Universal Time (UT): date, hour (HR), minute (MN), and second (SEC). To convert to Alaska Standard Time (AST) subtract ten hours.

(2) Epicenter in degrees and minutes of north latitude (LAT N) and west longitude (LONG W).

(3) DEPTH, depth of focus in kilometers.

(4) MAG, duration magnitude (FMAG) of the earthquake, if available, otherwise amplitude magnitude (XMAG, indicated by "a").

(5) NP, number of P arrivals used in locating earthquake.

(6) NS, number of S arrivals used in locating earthquake.

(7) GAP, largest azimuthal separation in degrees between stations.

(8) D3, epicentral distance in kilometers to the third closest station to the epicenter.

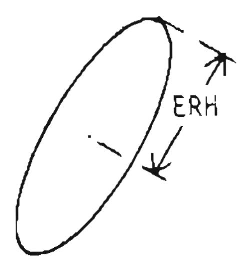
(9) RMS, root-mean-square error in seconds of the traveltime residuals:

$$RMS = \sqrt{\sum_i (R_{P_i}^2 + R_{S_i}^2) \ / \ (NP + NS)}$$

where R_{P_i} and R_{S_i} are the observed minus the computed arrival times of P- and S-waves respectively at the i-th station.

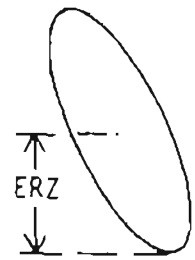
(10) ERH, largest horizontal deviation in kilometers from the hypocenter within the one-standard-deviation confidence ellipsoid. This quantity is a measure of the epicentral precision for an event. Values of ERH that exceed 25 km are tabulated as 25 km.

Projection of ellipsoid
onto horizontal plane:



(11) ERZ, largest vertical deviation in kilometers from the hypocenter within the one-standard-deviation confidence ellipsoid. This quantity is a measure of the depth precision for an event. Values of ERZ that exceed 25 km are tabulated as 25 km.

Projection of ellipsoid onto vertical plane:



(12) Q, quality of the hypocenter. This index is a measure of the precision of the hypocenter (see section Analysis of Quality) and is calculated from ERH and ERZ as follows:

Q	ERH	ERZ
A	≤ 2.5	≤ 2.5
B	≤ 5.0	≤ 5.0
C	≤ 10.0	≤ 10.0
D	> 10.0	> 10.0

(13) AZ1, DIP1, and SE1 are the azimuth in degrees (clockwise from north), dip in degrees, and standard error in kilometers of the most nearly horizontal of the three principal axes of the one-standard-deviation error ellipsoid. Values of SE1 that exceed 25 km are tabulated as 25 km.

(14) AZ2, DIP2, and SE2 are defined as above, but correspond to the principal axis of intermediate dip.

(15) AZ3, DIP3, and SE3 are defined as above, but correspond to the most nearly vertical principal axis.

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1978	ORIGIN TIME HR MN SEC	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
APR 1	0 50 43.8	60 27.3	141 36.0	13.6	1.4	4	3	200	69	0.16	6.8	3.9	C	327	12	1.8	261	27	6.5	82	53	2.5
1	4 11 41.4	61 33.5	146 40.1	7.0	2.2	17	3	96	78	0.78	1.2	1.5	A	174	13	1.1	269	21	0.6	54	65	1.6
1	4 27 7.4	59 45.1	139 34.6	0.9	3.8	18	1	142	54	0.65	3.8	5.6	C	172	20	1.6	272	24	1.7	47	58	6.5
1	9 20 50.6	61 44.6	149 10.8	31.0	2.4	17	3	154	45	0.60	1.7	1.2	A	179	17	1.8	82	22	0.8	304	62	1.1
2	3 33 53.9	60 6.1	139 51.6	26.3	1.3	4	2	233	55	0.32	10.7	2.2	D	207	2	10.7	116	27	1.3	301	63	2.3
2	8 0 49.3	60 6.4	140 25.3	16.3	1.7	9	2	142	59	0.39	3.4	1.9	B	35	18	3.5	297	25	0.9	157	59	1.7
2	9 4 14.4	60 34.8	142 48.7	22.8	1.3	5	5	130	110	0.64	1.7	2.5	A	6	10	0.7	272	20	1.5	121	67	2.6
2	10 25 16.9	61 15.5	147 5.5	8.5	2.2	10	2	110	106	0.67	2.3	2.2	A	261	8	1.0	355	44	2.8	163	45	1.5
2	16 46 12.7	62 30.2	148 59.4	39.0	3.7	13	0	248	153	0.47	9.4	26.3	D	261	0	2.5	152	5	8.6	351	70	25.0
2	21 12 16.3	59 56.0	140 5.6	5.3	1.6	8	2	113	27	0.64	2.3	2.1	A	306	13	0.9	47	41	2.8	202	46	1.5
2	21 16 45.8	59 56.4	140 13.0	27.6	1.8	4	2	184	93	0.26	6.1	6.6	C	81	27	4.5	137	38	1.2	311	36	6.2
2	22 22 40.0	60 7.3	141 9.0	13.5	1.2A	4	4	[illegible]	148	0.13	20.7	11.0	D	357	27	23.1	104	31	1.1	234	47	5.0
3	0 41 10.4	59 55.1	140 14.0	20.4	1.5	6	5	[illegible]	35	0.76	2.8	2.4	B	263	31	2.5	146	37	1.1	21	38	3.1
3	2 28 20.1	59 55.3	140 4.9	12.9	1.5	7	5	110	26	0.90	1.6	1.6	A	141	14	0.7	261	35	1.3	36	43	1.7
3	16 8 54.7	62 8.1	148 36.3	38.9	3.4	29	5	188	81	0.56	2.4	1.5	A	348	3	2.4	81	31	0.8	253	59	1.6
		3.5 ML PMR																				
4	3 53 18.2	60 23.6	141 18.3	17.3	1.8	11	1	156	87	0.46	2.8	3.0	B	97	4	1.1	3	42	1.9	191	48	3.6
4	4 1 44.3	60 25.1	141 11.6	6.5	0.9	4	3	167	169	0.04	9.6	6.3	C	81	18	1.6	168	25	10.0	315	59	5.7
4	4 47 17.0	60 4.9	141 37.9	18.8	2.0	11	4	147	68	0.59	1.9	1.4	A	174	10	1.9	268	23	0.9	62	65	1.4
4	9 16 34.1	60 35.5	144 59.8	32.9	2.1	5	4	172	153	0.26	5.3	7.1	C	207	3	2.9	299	36	1.7	113	54	8.8
4	21 43 39.8	61 34.0	146 21.1	19.0	2.0	11	2	108	61	0.97	1.4	1.8	A	20	2	1.3	110	14	1.4	282	76	1.8
5	1 7 50.3	60 2.7	141 21.6	15.4	1.2	5	3	155	84	0.15	21.7	12.6	D	11	30	25.0	261	31	2.9	135	44	1.3
5	9 40 2.8	60 16.6	141 48.3	5.6	2.0	15	11	122	55	0.56	1.3	2.2	A	294	5	0.7	26	18	1.2	189	71	2.3
5	12 53 15.0	60 10.2	141 35.9	10.3	1.9	15	8	119	47	0.40	1.6	1.3	A	293	9	0.7	198	25	1.7	41	63	1.1
6	2 16 49.5	60 14.3	141 20.6	16.9	1.3A	4	1	197	62	0.03	4.1	2.6	B	290	16	1.5	194	17	4.2	60	66	2.5
6	4 44 4.7	64 8.5	140 30.8	130.7	4.6	24	1	132	91	0.61	3.6	5.8	C	89	10	3.2	184	26	1.3	340	62	6.5
	3.6 MB																					
6	14 39 28.7	60 25.9	141 20.4	15.0	1.2	5	2	287	110	0.45	20.3	16.7	D	316	24	8.7	81	35	2.3	205	38	25.0
6	19 33 46.5	61 30.3	146 25.9	12.2	1.9	19	2	83	66	0.79	1.0	1.5	A	182	5	1.0	273	16	0.8	75	73	1.6
7	1 53 47.4	60 7.1	141 11.5	9.7	1.5	8	5	124	120	0.20	3.2	2.1	B	104	15	0.9	200	22	3.4	342	63	1.9
7	2 46 50.0	60 16.5	141 21.4	16.6	2.0	8	2	141	82	0.44	3.5	2.7	B	102	4	1.4	195	34	4.1	6	56	1.6
7	3 10 20.6	60 18.1	141 17.6	12.6	1.9	9	1	147	86	0.25	4.3	4.2	B	328	26	1.7	81	33	1.6	210	44	5.8
7	3 18 59.4	60 18.8	141 17.3	11.0	2.0	11	2	149	62	0.17	2.4	2.8	B	288	5	1.0	23	39	1.4	192	50	3.4
7	11 59 23.7	60 11.5	141 7.3	12.5	1.5	5	2	138	151	0.06	8.5	5.0	C	185	12	8.7	91	17	1.2	308	69	4.9
7	14 44 19.9	60 11.3	141 8.3	11.2	1.1	5	3	137	100	0.02	17.3	9.7	D	182	9	17.4	90	16	1.3	300	72	9.8
7	18 8 25.1	60 38.0	141 31.2	9.4	2.3	9	3	176	92	0.70	2.3	4.2	B	127	6	1.1	219	17	2.0	18	72	4.4
8	15 16 2.7	60 8.9	141 4.7	3.3	1.6	8	1	132	97	0.18	5.1	2.7	C	6	0	5.1	96	1	0.9	276	89	2.7
9	6 54 53.1	61 1.0	143 9.7	9.2	1.6	4	2	203	157	2.33	12.4	21.8	D	295	4	0.8	27	29	2.4	198	61	25.0
9	16 34 38.0	60 14.0	141 34.7	8.8	1.4A	4	2	147	100	0.07	5.2	9.4	C	42	9	1.9	309	24	2.9	151	64	10.4
9	17 13 1.5	60 43.4	151 53.7	83.6	4.2	27	0	56	52	0.63	1.9	3.2	B	261	0	1.1	143	11	1.5	351	60	2.9
	4.5 MB						FELT (III) AT KENAI AND (II) AT HOMER															
10	10 47 3.8	63 5.0	150 31.5	134.4	4.7	28	3	69	163	0.43	1.9	5.0	B	359	3	1.3	269	6	1.9	116	83	5.0
	4.2 MB																					
10	18 12 55.7	58 4.8	151 37.1	77.0	4.1	18	3	170	155	0.24	5.7	12.7	D	301	12	3.6	36	18	1.8	179	68	13.6
	3.8 MB																					
11	0 54 34.1	61 41.0	147 43.8	28.9	2.3	18	2	127	75	0.57	1.3	1.5	A	92	4	0.7	182	13	1.3	345	76	1.5
11	10 2 29.9	61 39.1	146 31.1	28.7	2.4	15	3	100	59	0.57	1.1	2.7	B	21	5	1.0	291	7	0.8	146	81	2.7
11	13 17 5.9	60 21.2	139 40.6	4.6	1.5	5	3	218	110	0.26	6.8	11.5	D	356	12	6.2	90	18	2.7	234	68	12.3
11	13 31 29.4	58 28.7	136 36.3	15.0	2.6	3	2	359	100	0.22	25.0	20.6	D	40	0	25.0	310	40	11.6	130	50	25.0
11	13 31 59.9	61 23.6	140 9.0	15.0	1.0A	3	2	271	196	1.00	21.1	18.5	D	138	10	5.7	261	42	9.8	40	38	25.0

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1978	ORIGIN TIME HR MN SEC	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
APR 12	1 56 30.1	63 5.3	149 44.9	81.1	3.6	28	11	119	154	0.56	2.7	8.5	C	328	2	2.4	81	4	1.2	217	67	7.9
12	3 42 6.1	56 23.3	152 16.1	38.2	6.7	11	0	286	335	0.33	24.9	18.1	D	355	9	25.0	91	31	25.0	251	57	14.3
	6.0 MB 4.2 MS					FELT (V) AT SITKINAK, (IV) AT OLD HARBOR, (III) AT KODIAK,																
						AND (II) AT OLGA BAY AND ZECHAR BAY																
						6.5 MS (BRK), 6.3 MS, 6.6 MB (PAS)																
12	9 55 4.4	61 51.6	140 42.4	9.2	2.4	4	3	322	100	0.08	18.2	17.6	D	155	6	6.3	59	44	25.0	251	45	3.9
12	22 7 5.4	61 35.7	146 37.7	15.7	3.0	33	3	98	62	0.64	1.1	1.6	A	11	1	1.1	281	12	0.7	106	78	1.6
			3.5 ML PMR																			
12	22 9 29.9	61 37.7	146 39.5	8.7	2.1	21	14	175	84	0.67	1.2	1.7	A	209	15	0.8	23	15	1.2	156	69	1.8
13	5 27 35.0	60 49.4	143 28.6	12.4	1.5	6	6	121	78	1.58	1.8	4.0	B	150	5	0.9	81	10	1.5	269	66	3.8
13	5 34 32.6	60 16.9	141 37.1	1.8	1.9	13	3	131	68	0.40	1.9	2.6	B	272	15	0.7	30	29	1.2	178	57	3.0
13	12 30 39.0	61 14.5	146 46.1	17.4	2.0	19	2	71	53	0.49	1.1	1.6	A	7	6	1.1	275	13	0.7	128	75	1.6
13	16 14 13.4	60 13.5	140 42.1	15.3	1.1	6	4	165	60	0.13	11.4	12.5	D	287	14	1.6	27	36	8.8	179	51	14.8
14	1 55 10.1	61 47.1	140 41.6	15.0	2.7	15	7	242	187	2.22	7.3	9.2	C	292	12	1.6	194	34	3.9	39	53	11.2
14	1 56 27.6	61 30.5	141 11.2	9.2	2.0	10	6	252	152	2.01	2.6	2.4	B	127	1	1.3	36	35	2.9	218	55	2.0
14	2 14 29.5	61 26.6	141 16.6	9.2	2.1	7	4	248	145	1.42	2.9	4.1	B	30	0	2.9	120	2	1.7	300	88	4.1
14	6 45 56.1	60 15.8	141 7.5	5.9	2.4	7	2	149	78	0.21	2.2	4.0	B	18	13	2.0	284	15	0.8	147	70	4.2
14	14 42 49.1	63 36.7	147 24.2	44.7	3.5	12	4	292	240	1.06	7.8	24.7	D	39	2	3.5	309	9	6.8	141	81	25.0
14	18 47 3.7	56 57.8	140 36.0	15.0	3.6	12	3	305	313	0.96	19.2	21.5	D	82	5	7.2	348	38	14.5	178	52	25.0
15	8 8 45.9	60 22.1	151 18.9	62.2	3.7	33	1	78	64	0.68	1.4	3.2	B	81	1	0.9	151	6	1.2	342	69	3.0
	3.5 MB																					
15	11 39 12.3	58 12.6	136 39.1	15.0	3.0	5	3	349	258	0.58	25.0	25.0	D	47	0	25.0	317	40	25.0	137	50	25.0
15	12 44 28.5	60 22.7	143 54.1	17.4	2.1	14	5	69	67	0.81	1.9	2.9	B	127	7	0.8	33	30	1.1	229	59	3.3
15	17 9 45.7	59 55.9	141 36.3	5.5	1.9	7	6	185	77	0.20	3.0	3.6	B	283	2	1.0	191	38	1.7	16	52	4.4
15	17 33 11.9	61 31.6	141 12.8	0.8	3.6	30	3	152	154	1.67	2.9	2.5	B	123	12	1.3	26	29	3.1	233	58	2.4
	3.3 MB		3.8 ML PMR	4.1 ML EMRC																		
15	17 37 58.6	61 25.4	141 16.4	0.8	2.0	5	4	249	143	0.97	5.0	4.1	B	208	6	5.0	299	12	2.3	92	77	4.2
15	17 39 59.3	61 54.6	140 33.4	15.0	2.6	8	7	275	203	2.33	11.2	14.3	D	292	12	2.7	193	35	3.2	38	52	17.9
15	17 49 0.4	61 26.1	141 12.9	0.4	3.4	30	2	149	144	1.41	3.3	1.7	B	297	1	1.2	27	6	3.3	198	84	1.6
			3.8 ML PMR	3.4 ML EMRC																		
15	18 0 34.4	61 22.1	141 12.0	0.2	1.9	5	3	247	140	1.15	6.1	4.3	C	215	4	6.1	306	11	2.2	105	78	4.3
15	18 9 46.9	61 24.2	141 14.8	0.3	3.0	23	3	148	155	1.45	3.2	1.8	B	29	3	3.3	298	12	1.3	133	78	1.8
			3.5 ML PMR	3.1 ML EMRC																		
15	18 15 6.0	61 17.9	141 19.2	3.8	2.0	5	3	240	146	0.99	6.4	5.5	C	296	19	2.5	191	38	7.4	47	46	4.2
15	18 24 9.3	61 19.1	141 24.8	2.0	2.0	5	4	239	146	0.81	6.6	4.3	C	302	15	2.4	204	28	7.4	57	58	3.0
15	18 35 57.0	61 20.4	141 14.8	0.3	2.1	7	5	243	149	0.85	4.9	4.1	B	232	11	4.0	134	37	5.6	336	51	2.8
15	18 46 56.8	61 23.8	141 10.2	5.0	1.7	6	3	247	153	1.03	3.5	4.7	B	280	13	1.4	17	29	2.3	169	58	5.4
15	21 30 34.2	61 17.9	141 23.1	0.4	2.1	5	2	229	147	0.94	5.8	3.8	C	304	11	2.3	212	11	5.9	78	74	3.7
15	21 40 14.9	59 54.7	140 10.3	14.4	1.8	8	1	107	31	0.68	2.6	2.7	B	137	13	1.2	261	29	2.0	31	45	2.9
15	21 58 49.8	61 19.4	141 18.5	0.1	2.4	10	2	231	148	0.90	3.9	1.7	B	209	3	3.9	117	36	2.0	303	54	1.6
15	22 2 44.0	61 49.8	140 36.1	12.0	2.3	11	4	258	193	2.43	13.5	13.1	D	305	7	3.1	42	44	18.4	208	45	4.0
15	22 21 53.2	61 19.5	141 23.4	0.2	2.4	7	2	230	150	0.79	5.1	2.4	C	303	13	1.4	209	15	5.3	72	70	2.1
15	22 27 59.8	61 18.7	141 18.8	0.4	2.2	7	4	240	147	1.12	5.2	2.0	C	123	6	1.4	214	9	5.3	0	79	1.9
15	23 40 45.0	61 26.5	141 16.7	0.2	1.6	5	2	250	160	0.99	8.1	8.0	C	275	5	3.6	181	44	9.3	10	46	6.6
16	5 24 0.5	61 20.9	141 22.1	0.4	2.7	8	3	241	150	1.57	5.3	3.5	C	305	22	2.4	205	23	5.6	74	57	3.1
16	8 49 19.5	59 28.2	152 43.2	74.1	3.6	29	7	86	74	0.66	1.7	3.5	B	310	1	1.7	40	10	1.1	214	80	3.5
	3.9 MB																					
16	9 11 30.1	61 21.8	141 20.6	1.6	2.2	5	3	243	152	1.08	5.4	3.9	C	189	32	6.2	74	34	3.3	310	40	1.8
16	11 53 23.6	61 23.5	141 14.4	2.0	2.6	8	3	235	154	1.44	5.4	3.0	C	113	4	1.8	204	11	5.5	3	78	2.9
16	11 59 35.9	61 23.1	141 15.8	5.0	2.8	12	4	235	154	1.33	4.1	3.3	B	220	20	4.3	121	23	1.6	347	59	3.4
16	12 6 41.0	61 14.7	141 22.5	9.2	1.8	5	3	235	132	0.08	9.7	5.8	C	300	13	2.5	203	28	10.8	52	59	3.3
16	15 30 53.2	61 52.4	140 43.9	9.2	1.9	5	2	279	197	1.26	17.8	18.2	D	285	25	3.4	177	34	5.4	43	46	25.0
16	20 36 19.1	62 52.9	143 52.4	1.9	3.4	27	3	189	160	0.86	4.2	1.4	B	261	15	4.1	347	38	1.8	152	49	1.0
			3.0 ML PMP																			
17	3 42 32.7	58 44.8	137 11.0	15.0	2.9	9	3	333	230	0.88	25.0	19.6	D	36	3	25.0	304	40	6.1	130	50	25.0

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1978	ORIGIN TIME HR	MN	SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
APR 17	0	22	8.0	60	26.0	143	50.3	21.4	2.1	10	4	71	74	0.26	1.7	3.0	B	80	17	1.1	352	20	0.9	216	63	3.3
17	0	39	43.2	60	25.6	143	54.6	21.9	1.3A	5	2	147	107	0.45	6.0	12.5	D	69	10	1.8	350	23	1.2	196	65	13.0
17	10	11	12.1	61	25.2	141	16.4	0.4	2.1	4	3	248	157	0.98	2.7	3.0	C	19	3	2.6	109	4	1.6	252	85	3.0
17	14	58	19.3	61	19.6	141	16.0	5.9	2.6	16	4	219	132	1.53	3.4	1.9	B	122	7	1.0	213	9	3.4	355	79	1.0
17	19	50	3.3	60	10.3	143	6.9	16.3	0.9	6	2	158	105	0.04	4.6	2.5	B	157	22	5.0	261	28	1.0	35	53	2.0
18	2	52	16.9	60	35.7	141	9.6	15.9	1.8A	4	4	191	81	0.15	2.0	5.1	C	225	1	2.0	315	3	1.1	117	87	5.1
18	2	52	38.2	60	34.1	141	12.1	10.6	1.8	7	6	184	81	0.46	1.8	4.2	B	34	3	1.8	303	9	1.1	142	80	4.2
18	2	53	57.8	60	35.0	141	11.4	12.7	1.9	5	6	191	80	0.79	2.9	6.9	C	334	0	1.1	81	10	1.8	219	67	7.0
18	2	57	8.1	60	36.1	141	11.4	15.9	2.2	6	3	187	79	0.25	1.4	3.0	B	215	3	1.4	305	7	1.0	102	82	3.0
18	7	58	5.9	61	29.3	141	22.0	0.9	1.9	6	5	241	133	1.03	4.9	3.0	B	217	18	5.1	120	19	1.9	347	63	2.8
18	21	4	40.1	60	23.6	143	2.0	20.9	0.5A	4	4	124	81	0.31	19.6	22.1	D	261	6	2.9	332	33	1.5	162	52	25.0
19	0	7	5.6	62	9.3	148	43.7	36.0	2.6	12	2	214	83	0.29	2.8	1.9	B	170	22	2.9	81	38	1.3	294	46	2.1
19	1	49	2.3	60	3.5	153	29.2	191.9	5.2	29	0	82	112	0.43	2.3	6.7	C	134	2	2.3	44	10	1.6	235	88	6.8
			4.6 MB							FELT (II) AT ANCHORAGE																
19	14	52	18.6	61	1.3	146	30.3	10.5	3.2	28	2	49	33	0.55	0.9	1.0	A	261	9	0.7	157	11	0.9	24	70	1.0
					3.3 ML PMR					FELT (IV) AT VALDEZ																
19	17	4	39.7	61	21.8	141	12.9	11.3	3.6	11	2	237	151	1.09	4.9	4.4	B	306	21	1.9	198	39	5.4	57	49	3.9
19	19	31	19.9	61	19.5	141	24.2	0.1	2.0	8	5	239	129	1.46	3.8	2.4	B	214	8	3.8	120	25	1.6	320	64	2.5
19	21	44	10.9	61	19.4	141	16.6	1.8	2.3	11	2	219	136	0.88	2.6	2.3	B	135	32	2.1	23	32	2.8	259	41	2.1
19	22	43	1.3	61	1.2	146	32.4	0.8	2.1	19	2	58	33	0.58	1.1	1.4	A	[illegible]	6	0.9	261	19	0.7	45	61	1.4
20	0	15	35.1	61	10.7	141	20.3	7.9	2.2	7	1	230	148	0.45	6.9	3.7	C	218	11	7.0	122	30	2.6	326	59	3.8
20	6	57	41.0	59	58.7	141	39.6	7.6	1.5	7	5	176	70	0.20	2.7	3.6	B	303	14	1.0	205	28	2.0	57	58	4.7
20	12	1	42.2	61	46.5	140	45.0	15.0	1.2A	5	3	275	186	1.00	17.4	19.0	D	289	26	4.8	178	31	7.0	47	48	25.0
20	20	27	29.4	61	22.5	141	15.2	0.5	2.0	5	2	246	137	0.86	5.9	3.3	C	148	6	2.2	81	9	5.4	278	65	3.0
20	21	23	52.6	61	25.2	141	11.5	1.9	2.1	6	2	250	140	1.01	6.2	4.7	C	140	6	2.2	81	30	5.9	240	48	3.3
20	23	27	8.8	58	7.3	136	28.7	15.0	3.7	8	5	344	272	0.62	25.0	20.5	D	43	1	25.0	312	40	11.5	134	50	25.0
20	23	37	1.6	59	8.5	137	6.9	15.0	2.3	4	3	347	100	0.22	25.1	25.0	D	207	3	25.0	300	40	25.0	113	50	25.0
21	5	25	29.5	61	10.9	143	9.8	0.3	1.5	9	3	160	106	0.24	2.4	2.6	B	117	10	0.8	215	38	2.1	15	50	2.8
21	7	31	35.4	60	35.7	141	18.2	15.0	2.5	9	6	187	81	0.62	3.7	6.1	C	309	5	1.5	39	8	3.6	187	81	6.1
21	10	1	18.7	60	1.2	151	49.2	74.6	3.8	31	0	65	104	0.62	1.8	4.4	B	320	1	1.4	51	4	0.9	219	59	3.8
			4.1 MB																							
21	10	19	15.4	61	47.1	160	36.2	4.5	2.3	9	5	271	189	2.05	15.8	11.7	D	163	39	4.2	282	36	3.4	44	36	19.3
21	20	40	39.1	64	34.2	147	57.0	27.4	4.2	19	0	145	315	0.16	11.0	13.5	D	280	12	7.4	181	36	1.7	25	51	17.1
					3.7 ML PMR					FELT AT COLLEGE																
21	21	24	24.9	58	51.6	143	4.2	9.2	2.6	8	7	249	150	1.58	11.5	7.6	D	114	30	1.7	224	32	13.3	351	44	4.1
21	21	40	43.5	59	38.0	146	21.4	8.5	3.0	25	4	109	107	0.63	1.6	1.5	A	30	8	1.6	127	41	1.1	291	48	1.7
21	21	51	44.9	59	36.7	146	24.3	11.2	3.1	26	2	118	110	0.72	1.5	1.5	A	341	23	1.1	93	40	1.3	229	41	1.8
21	23	20	45.2	60	16.3	143	11.2	6.9	1.8	10	4	116	48	0.98	1.3	2.7	B	88	4	0.9	357	8	1.3	204	81	2.7
22	4	3	50.0	61	19.8	141	22.4	0.4	2.3	12	5	231	132	1.28	4.5	2.6	B	210	8	4.5	118	13	1.7	331	75	2.6
22	13	13	6.0	60	5.9	141	34.3	10.4	1.2	6	4	158	73	0.12	11.5	4.4	D	190	11	11.7	92	35	5.6	295	53	2.4
22	14	50	46.3	60	15.6	143	7.6	13.2	1.7	6	6	126	97	0.95	3.2	4.2	B	275	23	1.0	17	27	1.2	150	53	5.2
22	15	39	40.9	60	18.3	141	37.3	1.5	1.2	6	2	133	79	0.16	3.7	0.2	C	46	9	1.8	312	21	1.0	158	67	8.9
22	16	14	36.6	60	38.0	141	16.1	15.9	2.7	14	2	183	82	0.45	1.7	3.6	B	305	1	1.0	35	5	1.7	204	85	3.6
23	0	32	40.0	60	27.3	142	23.6	7.4	1.0	5	2	112	100	0.24	5.7	9.8	C	118	4	5.7	28	6	1.2	242	83	9.9
23	0	47	25.9	60	8.9	140	52.1	7.1	2.3	8	3	139	58	0.35	2.6	2.2	B	289	0	0.9	199	28	2.8	19	62	1.9
23	1	2	29.2	60	6.5	140	47.1	19.8	1.5	5	3	176	52	0.17	4.4	3.0	B	104	8	0.9	9	30	5.0	207	59	1.9
23	7	6	17.8	60	16.8	141	38.3	4.5	2.3	17	3	147	50	0.72	2.7	3.3	B	294	7	0.8	29	37	1.4	195	52	4.0
23	8	24	51.7	62	23.3	151	8.5	84.2	3.6	27	10	107	105	0.70	2.2	4.2	B	86	2	1.5	356	6	2.2	194	84	4.2
23	18	8	55.9	58	57.1	137	9.7	15.0	2.7	6	4	350	178	0.48	29.7	23.8	D	261	6	25.0	315	39	0.9	165	39	25.0

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1978	ORIGIN TIME HR	MN	SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
APR 23	19	17	44.5	60	13.8	140	51.2	17.7	2.3	8	3	157	65	0.31	4.3	4.5	B	309	5	1.5	44	43	2.5	214	47	5.7
23	20	25	3.5	63	1.2	147	2.8	44.9	3.1	13	6	284	180	0.80	6.9	16.7	D	175	5	6.6	245	13	3.5	64	76	19.2
23	21	9	21.1	61	32.5	141	13.1	0.4	3.0	13	4	242	169	1.57	5.5	3.9	C	300	10	2.2	34	18	5.7	182	69	3.7
24	1	8	48.6	61	9.4	149	13.9	36.9	2.5	17	6	52	49	0.39	1.1	1.3	A	63	21	0.8	181	21	0.9	312	60	1.4
24	3	2	32.4	60	33.6	143	6.3	26.5	1.4	4	3	145	106	0.84	11.1	22.5	D	2	15	1.0	267	21	1.8	125	64	25.0
24	7	36	37.4	60	33.1	143	22.3	13.0	1.4	4	3	204	102	0.69	2.8	3.7	B	261	1	2.6	329	8	1.1	164	67	3.4
24	10	5	2.9	60	22.8	150	45.3	71.9	3.3	29	3	86	79	0.62	1.3	2.8	B	348	0	1.3	81	5	0.6	258	84	2.8
25	0	21	29.7	58	12.3	155	22.2	4.6	3.4	10	1	251	169	0.50	9.2	25.0	D	315	0	3.2	45	2	9.2	225	88	25.0
			3.7 MB																							
25	7	36	6.6	60	3.0	153	26.8	182.0	4.7	28	1	81	122	0.35	2.2	6.2	C	125	4	2.2	34	6	1.6	248	83	6.3
			4.5 MB																							
25	9	21	12.9	60	5.5	141	25.4	10.1	1.9	8	5	123	65	0.37	2.8	1.4	B	27	9	2.8	120	19	1.0	273	69	1.4
25	11	14	10.1	61	26.1	141	17.3	0.4	3.0	19	5	177	159	1.51	4.0	2.8	B	115	5	1.5	207	17	4.1	9	72	2.6
								3.3 ML EMRC																		
25	11	40	52.9	61	21.1	141	17.2	0.2	1.4A	4	3	244	135	0.65	6.3	4.9	C	81	14	4.6	170	39	7.1	334	49	2.8
25	12	53	9.9	61	22.3	141	20.5	9.2	2.2	5	4	244	137	1.31	3.2	3.1	B	117	17	1.6	222	41	3.3	10	44	3.0
25	14	19	40.7	61	19.5	141	19.1	0.0	0.9A	4	2	241	134	0.76	8.1	5.6	C	302	29	2.5	198	20	8.9	66	52	4.6
26	5	3	1.4	61	20.8	141	20.0	1.8	2.4	5	3	243	133	0.67	4.6	3.7	B	310	15	2.3	210	32	5.1	61	54	3.1
28	0	54	10.5	61	21.2	147	36.4	17.5	3.0	25	4	79	64	0.42	1.0	1.7	A	179	13	1.0	272	14	0.6	48	71	1.8
28	3	2	28.3	60	48.1	143	52.9	20.4	1.3A	4	3	238	87	0.78	10.3	26.5	D	143	3	1.5	81	19	3.3	241	56	25.0
28	5	37	29.1	60	13.1	141	20.3	21.9	1.5	4	2	134	88	0.23	20.6	10.7	D	209	14	2.3	192	27	23.1	44	59	2.9
28	8	31	9.6	62	1.2	149	49.4	31.7	2.6	18	4	160	82	0.47	2.8	2.0	B	83	6	1.3	176	23	3.0	339	66	1.8
28	12	59	38.8	60	2.4	140	9.3	12.0	1.9	8	5	151	32	0.68	3.7	2.1	B	38	16	3.9	135	23	1.5	276	61	2.0
28	15	9	7.9	60	17.5	140	32.7	10.1	1.5	7	3	185	127	0.47	3.6	3.1	B	290	21	1.1	183	38	4.1	42	45	2.5
28	16	6	35.1	60	32.3	142	49.8	1.4	1.8	3	3	223	151	0.63	4.0	4.1	B	136	6	1.3	81	43	4.3	232	37	2.6
28	21	32	6.4	63	4.8	149	23.3	75.0	3.7	16	3	215	166	0.82	7.3	20.1	D	61	1	2.4	341	13	5.5	175	79	20.3
29	5	55	42.0	60	27.9	143	50.0	22.4	1.9	5	4	198	103	0.82	4.9	5.2	C	323	17	0.9	81	31	3.1	213	46	6.3
29	12	27	42.3	59	55.8	141	33.0	1.8	2.0	10	2	184	74	0.38	2.5	2.0	A	130	5	1.1	38	29	2.6	229	61	1.7
29	17	12	53.6	61	20.0	146	46.3	25.9	3.2	23	3	97	68	0.45	1.2	1.8	A	276	10	0.7	8	10	1.1	142	76	1.8
29	17	30	32.5	63	50.2	148	29.8	40.4	3.7	26	11	114	226	0.78	7.3	24.2	D	186	3	1.3	277	14	4.1	84	76	25.0
						3.4 ML PMR																				
29	18	43	12.4	61	34.8	146	57.2	17.7	2.2	14	3	122	72	0.37	1.2	2.0	A	270	9	0.8	1	9	1.2	135	77	2.0
30	1	2	59.2	60	12.5	141	4.1	11.4	1.5	4	4	196	98	0.07	23.7	8.6	D	274	0	1.2	184	19	25.0	4	71	3.0
30	3	41	21.0	60	33.3	147	23.6	17.8	2.4	17	4	153	86	0.44	1.9	1.9	A	261	17	0.6	152	36	1.5	10	47	2.3
30	9	1	56.8	60	10.4	141	3.3	11.5	1.7	5	4	139	104	0.09	8.7	5.5	C	280	3	0.9	188	31	10.1	15	59	2.0
30	9	30	0.1	60	4.1	141	12.2	3.0	2.1	6	3	162	92	0.16	4.8	2.2	B	19	1	4.8	109	12	1.3	284	78	2.3
30	9	34	40.8	60	5.0	141	15.5	10.9	1.6	7	4	161	89	0.84	6.1	2.7	C	14	0	6.1	284	4	1.1	109	86	2.7
30	11	1	22.1	60	26.7	141	8.3	6.7	1.5	5	5	179	93	0.40	3.0	7.2	C	81	5	1.5	348	18	1.9	186	71	7.6
30	11	3	30.8	60	26.9	141	8.8	10.8	1.4	6	5	173	93	0.27	3.1	5.8	C	317	10	1.0	81	15	1.1	205	52	5.6
30	11	7	14.2	60	28.4	141	7.7	6.8	2.2	9	3	177	91	0.48	2.5	3.6	B	316	10	0.9	51	27	1.7	207	61	4.1
30	11	14	48.0	60	28.2	141	8.1	8.8	1.5	6	5	177	94	0.37	3.7	5.0	B	311	8	0.8	49	16	3.6	195	72	5.1
30	11	47	52.7	60	21.9	147	44.6	10.4	2.9	30	6	102	89	0.53	1.0	1.6	A	172	8	1.0	265	21	0.6	62	67	1.8
MAY 1	23	47	5.5	60	7.7	141	7.5	1.9	2.3	11	2	128	48	0.17	2.8	2.9	B	109	5	0.9	14	44	1.8	204	46	3.6
2	2	44	56.9	61	57.8	148	27.5	34.2	2.8	19	4	193	61	0.56	4.3	1.5	B	0	2	4.3	267	43	1.8	92	47	1.1
2	2	47	8.7	60	50.1	146	51.8	17.8	2.3	28	3	111	44	0.41	1.2	1.2	A	261	23	0.6	159	25	1.1	26	53	1.4
2	6	57	46.1	61	36.8	151	28.5	94.5	4.2	24	3	87	57	0.63	1.8	3.2	B	83	6	1.2	174	9	1.7	320	79	3.2
2	7	11	57.1	60	19.5	143	18.7	1.2	1.3	7	5	105	40	0.60	1.6	2.0	A	116	2	1.0	25	23	1.5	211	67	2.1
2	14	21	56.4	60	35.1	147	32.8	10.2	2.6	21	3	127	86	0.32	1.9	2.5	A	261	20	0.8	157	24	1.4	25	56	2.8
3	7	53	30.1	60	32.2	143	8.5	1.0	1.7	5	3	185	71	0.65	2.6	3.8	B	265	8	2.5	357	14	1.0	146	74	3.9

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1978	ORIGIN TIME HR	MN	SEC	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
MAY 3	15	8	17.0	60 43.1	130 27.7	2.4	2.1	6	2	270	143	0.75	16.0	10.7	D	316	13	2.7	01	20	16.1	205	49	6.2
3	22	9	59.1	60 20.4	145 9.8	14.2	2.0	10	9	138	83	0.49	1.9	1.7	A	356	29	1.2	108	34	0.8	236	42	2.3
3	22	55	43.6	60 36.2	141 13.6	12.5	3.0	12	6	187	78	0.57	2.1	3.7	B	315	9	0.9	47	13	2.0	191	74	3.8
3	23	1	55.9	60 37.9	141 11.4	18.0	2.2	8	5	190	94	0.84	3.3	5.3	C	304	10	1.1	210	21	2.6	58	67	5.7
3	23	3	32.4	60 36.8	141 11.9	5.9	2.4	11	3	188	93	0.53	4.2	3.3	B	304	3	1.1	214	17	4.3	44	73	3.2
4	5	5	9.4	60 22.8	145 5.8	32.6	2.2	10	6	145	81	0.69	1.5	1.9	A	291	10	0.9	26	27	1.3	102	61	2.0
4	10	7	11.7	58 12.2	136 26.3	15.0	3.4	6	3	347	100	0.68	25.0	20.9	D	40	0	25.0	310	40	13.0	130	50	25.0
5	5	32	47.3	63 10.1	150 41.3	153.4	5.5	26	0	108	193	0.52	3.0	10.2	D	201	0	3.0	11	1	2.2	191	89	10.2
		5.2 MB						FELT (IV)																
5	9	23	52.2	60 38.8	147 6.9	16.2	2.3	21	10	121	69	0.55	1.2	1.5	A	261	17	0.6	155	25	0.9	19	56	1.7
5	12	5	42.5	62 44.1	149 14.2	42.3	3.0	22	6	235	127	0.56	5.3	11.8	D	84	4	1.7	353	8	5.1	200	81	11.9
6	5	45	54.8	60 36.0	142 40.6	7.4	2.5	11	3	173	61	0.37	3.8	6.3	B	136	18	0.8	81	30	1.3	260	42	5.6
6	7	31	48.9	61 15.7	146 43.3	12.8	2.2	14	3	114	50	0.41	1.1	1.7	A	185	5	1.1	277	17	0.7	79	72	1.8
6	22	16	40.9	60 17.7	140 37.1	0.4	1.7	7	4	207	64	0.40	6.7	6.1	C	229	18	1.1	193	40	8.1	48	44	4.4
6	22	43	54.1	62 26.1	147 48.1	28.8	3.0	16	2	212	119	0.46	4.0	3.3	B	321	30	2.6	01	36	1.5	205	37	4.8
7	7	45	17.8	62 22.5	148 54.2	30.0	3.0	13	2	250	96	0.37	5.6	4.5	C	298	10	3.0	200	37	6.8	41	51	2.2
8	4	38	55.5	60 59.2	151 50.8	87.8	3.3	25	6	60	80	0.64	1.5	2.5	A	150	5	1.3	81	15	0.9	259	64	2.4
8	14	5	25.7	62 59.2	149 49.4	86.3	4.1	27	5	116	149	0.50	2.2	8.8	C	207	1	1.5	297	1	2.2	72	89	8.8
		3.2 MB																						
8	15	35	2.8	59 54.2	143 4.8	13.3	2.4	6	3	165	81	0.47	3.1	3.4	B	93	2	2.1	185	38	2.6	0	52	3.8
9	3	4	24.1	60 39.9	147 30.9	20.0	2.2	14	6	144	83	0.41	2.3	3.7	B	275	13	0.9	179	24	1.6	31	62	4.1
9	12	57	53.7	60 34.6	141 11.3	5.8	2.9	9	4	202	93	0.60	3.3	6.2	C	282	8	1.3	190	14	3.0	41	74	6.4
10	12	50	17.1	58 53.9	136 18.2	24.1	3.9	8	2	273	216	0.62	21.8	23.2	D	81	2	2.9	333	37	18.4	173	49	25.0
						4.2 ML EMRC																		
12	12	16	5.4	62 13.4	149 5.7	48.6	4.6	30	0	104	96	0.31	2.2	5.5	C	89	2	1.2	359	6	2.1	197	84	5.6
		5.1 MB						FELT (IV) AT GOLD CREEK, TALKEETNA, PALMER, WASILLA, AND ANCHORAGE, (III) AT FAIRBANKS AND HOMER																
12	13	43	33.4	60 17.6	141 39.9	13.9	2.3	11	3	166	68	0.31	3.0	6.2	C	92	12	1.5	359	13	2.6	223	72	6.5
12	14	59	49.4	62 13.0	149 5.2	41.4	2.9	27	3	80	96	0.90	1.7	5.2	B	325	1	1.3	01	7	1.1	228	63	4.8
12	21	3	12.1	62 15.6	149 5.3	39.6	3.0	14	4	245	100	0.32	3.6	9.6	C	352	4	3.6	83	6	1.4	229	83	9.7
13	3	9	52.2	61 55.1	150 45.8	50.8	3.3	19	3	168	93	0.77	2.4	3.2	B	81	4	1.4	346	4	2.4	214	82	3.2
13	13	43	55.3	62 11.2	149 5.4	46.6	3.6	25	3	80	93	0.51	1.7	3.6	B	81	4	1.1	329	8	1.4	192	66	3.4
14	3	5	42.0	62 21.7	148 18.5	39.0	2.9	14	4	251	114	0.69	3.2	17.2	D	176	2	3.2	85	4	1.6	292	85	17.3
14	11	5	1.6	59 58.1	140 10.4	4.2	1.8	7	3	112	31	0.65	1.4	1.8	A	300	13	0.8	204	23	1.2	57	63	1.9
14	11	6	53.9	59 58.8	140 10.7	8.0	1.4	7	4	115	32	0.37	3.3	5.6	C	261	2	2.8	145	16	1.3	357	60	5.4
14	15	57	26.3	62 49.1	143 50.0	56.4	2.9	7	5	292	229	0.72	8.2	26.3	D	331	4	7.0	01	5	4.1	210	69	25.0
14	23	26	46.1	60 0.6	141 37.4	10.1	2.0	7	2	149	71	0.39	2.8	3.5	B	207	20	0.8	108	24	2.3	53	58	3.9
15	11	11	55.5	60 7.9	141 17.0	4.5	1.7	6	4	162	86	0.22	2.8	3.8	B	282	7	0.8	15	26	2.4	178	63	4.1
15	12	7	26.8	60 16.4	141 35.5	8.2	2.2	11	4	165	51	0.39	2.4	2.4	A	290	8	0.8	28	44	1.8	192	45	2.9
16	1	11	36.9	61 56.9	150 1.8	42.5	3.4	16	2	86	66	0.42	2.4	4.6	B	324	0	1.9	01	15	1.3	234	59	4.3
					2.8 ML PMR																			
16	16	11	28.9	61 0.4	147 9.1	18.6	2.1	13	4	108	83	0.26	1.5	3.1	B	163	2	1.4	261	19	0.8	67	69	3.3
18	15	3	1.5	61 30.7	146 48.1	22.2	2.6	18	2	175	71	0.47	2.1	2.9	B	279	12	0.8	13	17	2.0	156	69	3.0
19	13	31	1.9	60 26.6	142 53.0	1.2	1.4	5	4	132	150	0.11	2.2	2.5	A	292	12	2.2	197	24	1.1	47	63	2.7
19	20	43	18.3	59 58.2	141 14.2	0.2	1.3	8	4	153	104	0.64	4.2	3.2	B	92	1	1.0	182	10	4.2	356	80	3.1
21	0	42	42.6	63 3.4	149 2.5	91.2	3.8	20	3	96	163	0.54	2.6	7.5	C	91	3	2.5	182	8	1.4	301	81	7.6
21	8	10	33.5	62 12.4	148 49.5	28.9	2.8	11	6	247	131	0.42	3.3	2.4	B	188	29	3.6	[illegible]	31	1.1	313	46	2.2
21	10	28	36.6	59 32.9	138 42.2	5.4	1.6	6	2	271	68	0.58	7.3	4.8	C	261	0	7.3	349	35	1.3	171	55	5.8
21	11	59	15.3	60 3.6	148 6.7	14.5	1.5	6	5	177	33	0.83	1.8	1.8	A	230	18	1.7	128	32	0.8	345	52	2.1
21	14	25	32.6	58 56.5	139 28.7	9.2	2.9	9	4	257	100	0.80	7.4	6.9	C	261	22	1.5	146	41	8.7	10	39	5.7
22	9	10	12.0	61 0.4	147 17.9	18.6	2.0	13	4	113	53	0.40	1.3	1.9	A	12	8	1.3	279	20	0.6	123	68	2.0

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1978	ORIGIN TIME HR MN SEC	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
MAY 22	11 40 23.2	60 27.1	141 33.9	6.0	1.9	5	2	182	83	0.34	8.2	9.1	C	276	0	1.1	186	41	4.4	6	49	11.4
22	16 34 59.6	60 27.6	143 9.0	0.9	2.4	8	3	147	57	0.81	2.0	3.4	B	91	1	1.1	182	22	1.6	359	68	3.6
23	2 25 7.2	57 46.1	156 16.3	127.2	5.5	8	4	275	240	0.17	18.9	26.1	D	330	4	5.5	261	17	16.7	73	63	25.0
	3.9 MB																					
23	10 34 56.2	59 56.7	148 3.0	12.1	2.7	14	4	163	162	0.65	2.5	2.6	B	261	17	1.8	144	32	1.6	11	46	2.9
23	21 46 27.8	61 23.6	145 12.1	11.1	1.0	4	4	165	40	0.19	1.4	5.3	B	330	4	1.3	261	7	1.0	94	68	4.9
23	22 34 15.1	60 8.9	143 18.8	8.6	1.6	8	7	145	42	0.55	1.7	3.6	B	81	5	0.6	169	6	1.6	310	82	3.6
24	0 3 47.8	62 53.7	149 20.4	41.4	3.1	12	6	272	172	0.47	5.3	21.6	D	320	3	3.2	81	4	3.3	205	59	18.7
24	8 30 2.2	58 31.8	150 27.6	54.9	3.4	19	6	159	193	0.60	5.6	21.4	D	27	1	1.5	117	11	3.8	292	79	21.8
			3.5 ML PMP																			
24	13 35 16.3	60 50.6	146 49.6	18.4	3.0	23	4	112	87	0.43	1.5	1.7	A	261	22	0.7	155	25	1.3	25	54	1.9
			3.4 ML PMR																			
24	19 49 56.3	61 45.2	149 38.6	40.9	2.4	13	4	201	57	0.36	2.4	2.3	A	355	6	2.4	86	9	1.0	232	79	2.3
25	0 52 32.4	61 23.3	145 13.4	2.4	1.0	4	3	161	39	0.16	2.7	24.1	D	220	1	0.9	310	5	1.7	119	85	24.2
25	18 15 47.0	61 58.1	144 8.5	10.9	2.1	6	2	252	108	0.25	7.1	4.4	C	81	14	3.4	173	32	8.1	330	55	1.9
26	2 45 18.3	60 35.6	147 36.4	23.1	2.5	18	2	125	97	0.40	2.3	3.3	B	261	14	0.8	157	24	1.6	17	57	3.7
26	8 48 29.4	60 34.8	142 43.9	10.9	1.6	5	3	171	127	0.21	2.9	2.8	B	104	28	1.5	354	33	1.3	[illegible]	44	3.8
26	22 17 18.3	60 13.9	140 37.0	15.8	1.9	4	4	206	126	0.29	25.0	2.7	D	29	2	25.0	297	41	1.6	121	49	3.0
26	22 57 47.8	59 52.3	139 47.6	6.1	1.3	5	3	155	36	0.59	4.3	7.2	C	313	3	0.8	221	29	1.7	48	61	8.2
27	1 45 30.0	60 49.7	147 14.3	29.9	2.1	15	5	146	93	0.42	2.1	2.0	A	261	16	0.7	151	41	2.1	7	43	2.1
27	14 50 9.9	60 33.2	150 37.8	41.0	2.9	21	2	98	95	0.47	1.4	3.3	B	261	0	0.9	336	6	1.2	171	74	3.2
			3.5 ML PMR																			
27	17 52 0.9	60 10.1	141 8.7	11.3	2.1	5	3	171	94	0.17	6.2	4.5	C	283	5	0.9	16	31	7.0	185	57	3.3
27	18 21 6.1	61 25.7	146 48.8	15.8	1.9	13	4	144	62	0.61	1.1	1.9	A	6	3	1.1	275	19	0.5	105	71	2.0
28	21 29 18.1	60 48.8	147 12.5	21.0	2.1	13	4	147	95	0.24	1.9	2.4	A	264	18	0.8	166	23	1.7	28	60	2.6
29	6 24 45.3	60 6.3	153 23.1	162.0	4.4	25	3	110	82	0.43	2.2	3.5	B	30	5	1.5	121	6	2.2	261	82	3.5
	4.1 MB																					
29	7 20 47.8	60 3.5	139 26.1	17.6	1.5	4	2	240	46	0.34	8.9	4.9	C	229	25	9.7	123	31	1.5	351	48	3.4
29	11 27 12.5	60 11.6	142 12.8	12.4	1.7	6	4	147	109	0.88	4.0	8.2	C	10	9	3.1	104	22	1.1	259	66	8.9
29	21 12 11.7	59 56.9	140 0.5	13.6	1.3	6	2	130	84	0.58	2.2	2.1	A	132	15	1.0	234	39	2.4	25	47	1.9
29	22 19 29.4	58 27.2	141 41.2	32.1	2.9	9	4	259	188	0.91	8.5	10.6	D	286	6	2.3	192	33	6.4	25	56	12.0
30	1 54 17.4	60 27.3	145 3.1	18.5	2.3	14	3	116	87	0.35	1.9	1.9	A	137	11	0.9	261	39	2.0	37	39	1.7
31	7 52 37.1	61 52.2	147 22.9	0.5	2.1	8	7	216	99	0.60	3.7	2.5	B	281	9	0.8	15	24	4.0	172	64	2.1
31	12 15 22.4	60 22.6	143 16.8	1.3	2.3	9	3	108	89	0.30	2.1	3.4	B	199	13	1.9	105	16	0.9	326	69	3.6
31	18 29 26.2	61 26.8	149 34.1	42.2	3.2	23	2	91	28	0.35	1.6	2.4	A	261	1	0.9	159	17	1.5	354	69	2.5
								FELT (II) AT PALMER														
31	21 17 12.2	60 27.3	147 4.5	30.5	2.4	15	3	169	86	0.47	2.1	1.5	A	154	6	2.1	261	20	0.9	50	63	1.5
JUN 1	6 20 8.2	61 32.3	146 31.5	26.9	2.8	20	3	165	72	0.72	1.4	2.0	A	194	1	1.4	284	11	0.7	99	79	2.0
1	10 52 23.3	60 56.8	146 56.9	21.3	2.2	15	2	86	39	0.42	1.3	1.8	A	261	15	0.7	354	15	1.2	128	69	1.9
2	1 13 18.9	59 51.3	141 38.1	7.8	2.3	7	3	164	127	0.33	6.3	6.1	C	112	16	1.3	7	42	9.0	218	44	7.9
2	19 10 53.7	63 19.7	147 45.5	39.0	3.4	19	2	237	217	0.60	12.3	7.3	D	340	23	13.1	89	37	3.2	226	44	6.9
3	3 14 12.3	58 42.6	140 48.3	13.7	2.6	7	4	258	158	1.49	16.3	17.2	D	81	16	2.6	332	37	4.3	189	47	23.2
3	21 10 53.4	61 9.3	147 11.1	15.2	2.0	10	2	101	57	0.51	1.4	3.1	B	192	8	1.3	284	14	0.8	73	74	3.2
3	22 15 24.9	61 32.1	146 35.3	20.4	2.2	16	3	163	75	0.82	1.4	2.0	A	13	2	1.4	282	9	0.7	115	81	2.1
3	22 56 27.9	62 21.0	148 4.7	28.5	2.6	16	4	242	106	0.53	4.0	2.8	B	197	26	4.2	308	35	3.2	80	43	1.3
4	9 49 1.2	61 3.1	147 7.3	19.0	2.2	16	4	90	46	0.29	1.1	1.6	A	185	9	1.1	277	13	0.6	61	74	1.6
4	11 32 29.7	58 60.0	153 29.8	0.9	3.1	20	6	125	121	0.64	3.7	1.6	B	283	19	3.9	30	42	0.8	175	42	1.3
			3.2 ML PMR																			
5	13 19 12.2	62 33.5	148 5.7	34.7	3.0	18	3	210	129	0.39	5.2	2.7	C	192	14	5.3	90	40	1.5	297	47	3.1
6	10 9 32.7	61 20.8	146 48.1	33.8	2.3	10	3	129	53	0.35	1.4	2.8	B	282	9	0.7	15	16	1.2	164	71	2.9
6	11 39 40.2	62 59.0	150 12.9	117.8	4.4	32	2	73	149	0.55	1.9	7.7	C	359	1	1.5	269	1	1.9	134	89	7.7
	3.6 MB																					
6	16 0 31.0	60 6.7	139 24.3	16.4	1.1	5	2	250	49	0.30	11.7	6.2	D	128	4	1.7	220	24	12.7	29	66	3.8

SOUTHERN ALASKA EARTHQUAKES, APRIL - JUNE 1978

1978	ORIGIN TIME HR MN SEC	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
JUN 6	21 14 29.2	61 49.0	140 32.9	4.8	3.1	10	4	258	220	0.83	19.4	16.4	D	137	30	2.9	251	36	5.4	18	40	25.0
7	5 40 46.5	58 37.0	143 19.2	11.6	2.9	19	5	228	222	0.65	8.2	3.6	C	20	3	8.2	112	22	1.8	283	68	3.8
7	12 37 49.1	59 55.7	152 26.0	89.3	3.6	29	7	87	72	0.58	1.8	3.1	B	10	3	1.4	100	4	1.8	243	85	3.1
7	20 54 32.4	59 43.9	138 46.6	10.1	1.7	5	2	254	77	0.12	5.0	5.7	C	330	23	1.3	81	24	3.8	206	52	6.7
8	2 49 4.8	60 12.2	146 24.3	13.5	3.8	30	3	68	85	0.66	1.1	1.6	A	297	12	0.8	202	22	0.9	54	65	1.7
	3.9 MB																					
9	3 23 34.1	60 48.1	146 24.8	20.2	2.2	17	2	96	37	0.71	1.4	1.8	A	146	3	1.1	261	14	0.9	46	61	1.7
10	2 27 28.9	60 59.1	147 3.0	20.5	2.0	12	3	84	42	0.26	1.1	2.3	A	275	4	0.7	5	4	1.1	140	84	2.3
10	8 24 0.9	57 57.8	156 44.0	0.4	4.8	11	0	258	246	0.26	17.7	9.5	D	81	2	17.7	348	3	4.3	204	85	9.5
	4.5 MB 3.9 MS 4.6 ML PMR							FELT (II) AT EGEGIK, (I) AT KING SALMON														
10	9 40 51.3	60 41.1	147 15.1	29.2	2.6	19	2	131	62	0.42	1.3	1.2	A	264	5	0.7	358	34	1.4	167	55	1.1
10	13 2 4.9	63 1.1	149 1.7	70.3	4.0	30	3	100	159	0.53	2.3	12.6	D	204	1	1.6	294	5	2.1	103	85	12.6
10	17 30 5.1	60 20.2	147 43.2	26.6	3.0	26	3	103	76	0.49	1.5	1.7	A	261	4	0.9	163	29	1.4	358	60	1.8
10	17 45 4.4	61 28.0	146 38.2	20.3	1.7	11	2	153	75	0.30	2.0	4.7	B	283	4	1.0	16	15	1.4	163	72	4.9
10	19 35 11.7	60 15.9	146 17.2	15.7	4.2	33	1	68	82	0.50	1.1	1.5	A	303	1	0.8	213	20	1.0	36	70	1.6
	4.8 MB	4.7 ML PMR						FELT (IV) AT CORDOVA, (III) AT ANCHORAGE AND VALDEZ														
10	22 5 22.8	60 17.1	147 4.7	21.1	2.6	20	12	107	94	0.67	1.0	1.4	A	83	1	0.8	173	13	1.0	349	77	1.4
11	5 1 16.8	62 5.5	148 55.0	44.8	3.9	27	2	121	70	0.33	1.3	2.8	B	304	2	1.3	34	13	1.0	205	77	2.8
11	7 53 21.8	58 50.7	151 24.8	58.0	3.7	25	3	135	128	0.48	3.8	6.5	C	159	3	3.7	81	10	2.5	266	74	6.4
11	12 13 6.7	61 33.8	146 20.2	31.3	2.2	18	3	170	65	0.58	1.4	1.4	A	280	13	0.9	22	41	1.2	176	45	1.6
11	19 12 32.9	60 4.2	140 43.6	19.3	2.5	12	3	158	81	0.31	5.2	5.4	C	289	11	0.9	28	40	4.1	187	48	6.3
11	19 17 27.3	60 50.6	146 50.6	16.8	2.7	23	3	117	42	0.53	1.1	1.4	A	178	9	1.1	270	17	0.7	61	71	1.5
11	20 51 30.5	60 50.4	146 50.3	21.0	2.6	21	2	117	42	0.51	1.3	1.7	A	349	1	1.3	261	14	0.7	83	76	1.7
11	23 21 1.6	60 28.5	142 52.0	13.1	1.6A	5	4	197	114	0.52	2.8	4.0	B	325	0	1.1	261	18	2.3	55	59	3.8
12	0 26 44.8	58 42.9	143 21.8	15.0	3.8	24	4	208	160	1.00	3.4	3.0	B	3	15	3.4	97	16	1.5	232	68	3.1
		3.4 ML PMR																				
12	7 30 40.2	59 51.5	150 40.6	41.1	3.8	26	1	140	77	0.63	2.0	5.0	B	81	5	0.9	147	5	1.8	294	65	4.6
	4.0 MB							FELT (III) AT HOMER														
12	15 28 41.0	61 3.2	148 4.8	27.9	3.2	24	2	89	57	0.32	1.0	1.5	A	188	3	1.0	278	4	0.7	61	85	1.5
12	22 59 33.3	60 53.3	147 8.0	32.0	2.2	14	3	128	51	0.19	1.9	1.5	A	261	22	0.8	154	23	1.9	26	55	1.4
13	5 21 50.8	60 24.7	141 14.5	25.0	2.5	8	5	224	104	0.84	5.7	6.4	C	95	1	1.1	5	16	5.6	188	74	6.5
13	14 53 22.9	59 26.6	138 5.0	1.2	2.3	6	2	328	103	0.71	9.3	6.9	C	270	32	5.8	156	32	10.7	33	41	3.4
13	18 27 33.3	60 28.4	143 3.1	0.4	3.1	19	2	147	62	0.49	2.1	2.7	B	116	12	0.9	211	25	1.9	2	62	2.9
14	11 27 1.8	61 40.7	149 46.1	1.3	3.0	19	4	149	50	0.71	1.7	1.2	A	358	15	1.7	263	18	0.7	125	66	1.2
		3.6 ML PMR																				
15	2 4 39.3	64 38.5	147 18.3	40.6	3.9	9	5	326	358	1.11	21.5	24.8	D	187	2	16.4	278	13	21.3	88	77	25.0
15	15 20 33.7	56 53.1	142 10.2	15.0	3.9	7	5	303	345	1.50	19.7	21.4	D	100	1	11.5	9	40	15.0	191	50	25.0
17	2 18 11.3	64 5.1	147 49.6	15.0	3.8	9	3	322	301	1.08	16.5	20.2	D	102	15	11.1	202	34	6.0	352	52	25.0
17	4 22 36.7	60 5.2	147 51.9	24.6	2.9	19	5	121	100	0.49	2.1	2.2	A	261	5	1.1	345	24	2.0	160	65	2.2
17	10 57 21.6	60 15.2	141 9.4	14.0	2.8	11	4	168	92	0.51	5.5	6.4	C	278	2	1.3	8	13	5.4	179	77	6.4
17	14 8 2.8	60 45.7	147 31.7	22.8	2.3	14	2	132	77	0.56	2.2	2.1	A	261	18	0.8	348	20	2.2	128	63	2.2
17	16 59 9.9	61 41.1	149 37.0	34.4	2.7	10	6	168	49	0.42	1.9	1.5	A	114	10	0.9	207	18	2.0	356	69	1.5
17	17 51 46.4	61 36.5	149 33.8	36.2	2.8	13	5	161	41	0.42	2.7	1.7	B	6	8	2.7	100	29	0.9	262	60	1.8
17	18 7 0.3	61 15.7	146 41.3	41.8	2.1	6	3	167	48	0.25	4.7	4.0	B	261	1	1.4	142	35	5.3	352	46	1.9
17	19 15 52.9	61 57.2	148 43.3	9.8	2.4	13	5	193	91	0.68	2.5	4.9	B	3	0	2.5	273	26	0.8	93	64	4.9
18	0 22 17.3	61 50.9	149 42.8	6.6	2.3	11	11	182	68	0.79	1.4	1.2	A	17	18	1.5	278	25	0.7	139	58	1.2
18	6 55 39.4	60 26.9	147 45.2	31.2	2.2	5	2	209	88	0.22	4.3	2.8	B	81	9	1.2	174	24	4.6	332	64	2.4
18	15 14 25.9	60 57.5	146 50.3	27.1	2.9	20	3	100	33	0.47	1.3	1.5	A	167	11	1.3	261	17	0.8	46	69	1.6
18	19 31 4.8	62 41.1	151 1.5	87.4	4.1	27	5	117	137	0.59	2.0	7.4	C	292	2	1.9	22	3	1.4	168	86	7.4
19	17 34 19.1	62 40.4	138 59.6	25.0	4.1	12	6	246	322	0.87	15.2	18.3	D	301	3	5.7	209	37	9.6	35	53	21.8
				3.8 ML EMRC																		
20	7 6 47.2	61 23.0	146 24.9	35.2	2.2	12	3	153	60	0.37	2.4	2.5	A	261	20	1.0	358	38	1.8	147	47	3.0

SOUTHERN ALASKA EARTHQUAKES, APRIL - JUNE 1978

ORIGIN TIME 1978	HR	MI	SEC	LAT N DEG	LAT N MIN	LONG W DEG	LONG W MIN	DEPTH KM	MAG	NP	NS	GAP DEG	DS KM	RMS SEC	ERH KM	ERZ KM	Q	AZ1 DEG	DIP1 DEG	SE1 KM	AZ2 DEG	DIP2 DEG	SE2 KM	AZ3 DEG	DIP3 DEG	SE3 KM
JUN 20	11	26	34.3	61	28.6	146	14.0	34.4	1.8	7	3	198	55	0.38	2.3	2.1	A	134	32	2.6	261	34	1.4	19	34	1.6
20	12	43	5.1	62	24.7	148	23.0	41.6	2.8	9	5	259	165	0.29	3.9	18.7	D	0	2	3.9	90	3	2.0	236	86	18.7
21	0	33	29.2	62	12.4	141	8.4	15.0	3.4	16	5	266	248	0.78	17.9	18.8	D	293	8	4.5	105	42	7.1	32	47	25.0
21	2	6	50.8	60	19.1	140	7.8	8.0	2.3	13	3	207	83	0.43	4.6	5.7	C	301	11	1.9	36	24	4.2	188	63	6.1
21	21	9	3.6	62	17.9	148	58.2	28.2	2.8	13	6	224	122	0.58	3.3	5.2	C	348	3	3.1	81	29	1.4	253	61	5.9
21	22	58	49.0	59	25.1	153	3.7	112.9	4.1	26	3	50	84	0.33	2.4	4.3	B	116	4	2.3	25	15	1.4	221	74	4.5
22	2	22	8.0	61	32.6	169	10.6	32.0	3.2	23	3	71	39	0.62	1.8	1.4	A	81	12	0.8	261	44	1.1	351	0	1.5
					2.7 ML PMR																					
22	5	14	4.9	63	6.9	150	29.5	134.7	4.6	25	3	78	166	0.52	2.7	7.8	C	185	3	1.5	275	4	2.7	50	85	7.8
22	5	35	19.1	61	49.5	149	37.4	41.9	2.6	14	3	172	65	0.21	2.4	3.4	B	90	7	1.0	359	7	2.4	225	80	3.4
23	6	9	28.6	61	53.0	149	35.9	36.6	2.8	13	3	218	67	0.19	4.4	1.8	B	327	21	3.6	261	38	2.2	86	42	1.3
23	6	19	46.8	60	18.4	143	10.3	0.9	2.1	6	3	108	49	0.52	2.7	5.5	C	214	5	2.7	123	16	1.2	321	73	5.7
23	21	56	31.3	61	46.5	150	14.9	45.1	2.9	12	4	159	63	0.18	3.4	4.4	B	168	16	3.3	81	19	1.3	299	65	4.7
24	6	1	3.7	60	40.8	146	41.0	26.8	2.5	19	2	127	54	0.46	1.8	1.8	A	261	18	1.0	137	40	1.6	6	37	1.9
24	6	13	16.1	58	55.6	136	42.9	10.3	3.0	6	2	347	186	0.68	25.0	20.0	D	27	1	25.0	296	44	12.6	118	46	25.0
24	7	43	18.0	61	24.5	146	40.2	43.0	2.3	11	3	140	62	0.44	2.3	4.4	B	261	8	1.4	343	14	2.1	140	72	4.4
24	10	26	52.3	60	51.3	144	47.2	2.2	2.4	18	6	118	65	0.95	2.2	2.9	B	42	5	2.2	134	17	0.9	296	72	3.0
24	11	33	44.4	58	23.1	140	10.9	32.1	2.9	8	4	280	150	0.44	6.7	25.0	D	297	0	4.6	27	0	6.7	0	90	25.0
24	13	24	53.5	61	20.6	147	38.1	24.5	2.5	20	3	124	76	0.33	1.8	4.7	B	186	5	1.6	277	18	0.8	81	71	5.0
24	23	18	0.7	58	34.3	150	32.7	59.6	4.1	26	0	177	169	0.30	3.9	7.7	C	35	5	1.7	125	8	3.8	273	81	7.8
		4.2 MB																								
25	1	11	31.3	62	5.5	151	9.5	84.8	3.5	30	1	101	83	0.50	2.0	3.3	B	349	2	2.0	81	5	1.3	238	84	3.3
		3.8 MB																								
25	5	24	53.6	60	4.7	136	57.8	15.0	2.4	3	3	326	183	0.37	17.4	21.0	D	331	9	8.0	261	39	4.5	72	46	25.0
25	5	40	59.3	61	46.9	147	16.9	39.9	2.2	7	4	201	80	0.38	5.8	25.0	D	81	2	3.4	172	3	5.6	318	86	25.0
25	5	58	1.2	58	21.4	140	6.2	15.0	2.6	5	4	296	157	0.48	16.2	19.7	D	281	0	6.4	12	39	4.8	191	51	25.0
25	9	52	53.9	61	19.9	146	50.6	15.3	1.4	7	5	126	95	0.15	4.9	9.0	C	355	10	2.2	261	26	1.0	104	62	10.1
25	10	55	27.1	61	47.3	147	3.1	10.5	2.9	21	3	144	83	0.45	2.3	3.1	B	193	5	2.3	285	25	0.9	92	64	3.4
25	17	0	4.2	61	31.9	146	42.5	10.7	2.0	13	4	162	74	0.56	1.5	2.2	A	187	10	1.4	281	25	0.8	77	63	2.5
25	20	4	44.3	61	25.8	146	57.7	10.4	1.8	8	3	143	60	0.29	1.7	3.2	B	184	4	1.6	276	24	0.9	85	66	3.5
26	17	40	8.2	60	45.9	147	29.9	27.8	2.5	18	4	114	75	0.38	1.9	2.3	A	261	10	0.7	347	27	1.8	152	61	2.5
26	17	57	30.7	62	52.9	148	2.6	36.4	3.5	17	6	266	190	0.63	9.4	8.9	C	202	24	7 7	93	36	2.1	318	44	11.7
26	18	26	23.6	60	38.2	147	25.9	25.[illegible]	2.4	15	5	135	81	0.48	3.2	3.1	B	261	11	0.9	145	43	2.4	1	40	3.6
26	21	10	23.3	60	15.4	139	51.6	0.1	1.8	7	3	216	57	0.62	2.9	3.8	B	310	5	1.1	43	30	2.3	211	59	4.2
28	16	40	59.0	61	33.5	146	34.1	4.6	1.8	12	4	196	76	0.66	2.8	2.9	B	13	28	1.7	265	30	0.9	137	47	3.8
28	22	37	5.5	60	6.0	139	49.1	24.6	1.3	4	3	235	54	0.45	9.5	2.1	C	208	4	9.5	116	26	1.3	306	64	2.1
29	6	44	26.1	61	18.7	150	36.9	55.4	3.1	22	6	68	79	0.66	1.2	3.3	B	90	3	0.9	180	9	1.1	342	81	3.4
29	8	52	32.9	62	41.1	150	51.7	107.1	4.2	26	4	76	136	1.19	2.7	6.9	C	11	2	1.4	101	3	2.7	267	86	6.9
29	10	45	20.8	61	43.5	141	57.8	4.0	2.7	9	3	250	188	0.57	18.2	18.2	D	102	29	2.4	211	31	7.8	338	45	25.0
30	11	38	14.8	62	21.2	147	52.4	23.1	2.7	18	9	224	131	0.54	3.0	2.8	B	93	18	1.5	199	40	3.5	344	44	2.2
30	12	34	22.4	63	49.4	147	32.4	104.2	4.3	16	3	282	306	0.67	21.0	24.4	D	298	9	16.4	31	18	20.5	183	70	25.0
30	18	13	25.5	61	48.8	151	48.1	109.0	3.6	24	13	98	72	0.67	1.7	2.3	A	86	2	1.2	177	16	1.6	349	74	2.4
30	20	48	24.2	60	1.3	139	25.1	2[illegible].3	0.9A	4	2	234	47	0.31	10.3	3.9	D	130	2	1.9	221	17	10.8	33	73	2.4
30	23	22	57.9	59	48.9	139	23.7	27.0	1.6	5	4	184	50	0.23	6.8	2.8	C	317	9	0.9	261	9	5.6	109	56	2.3

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