

(200)
R290
no. 79-718

X

UNITED STATES (DEPARTMENT OF THE INTERIOR)

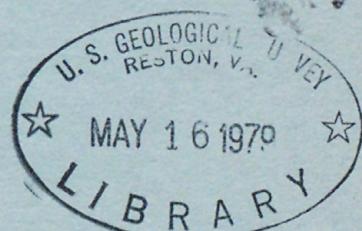
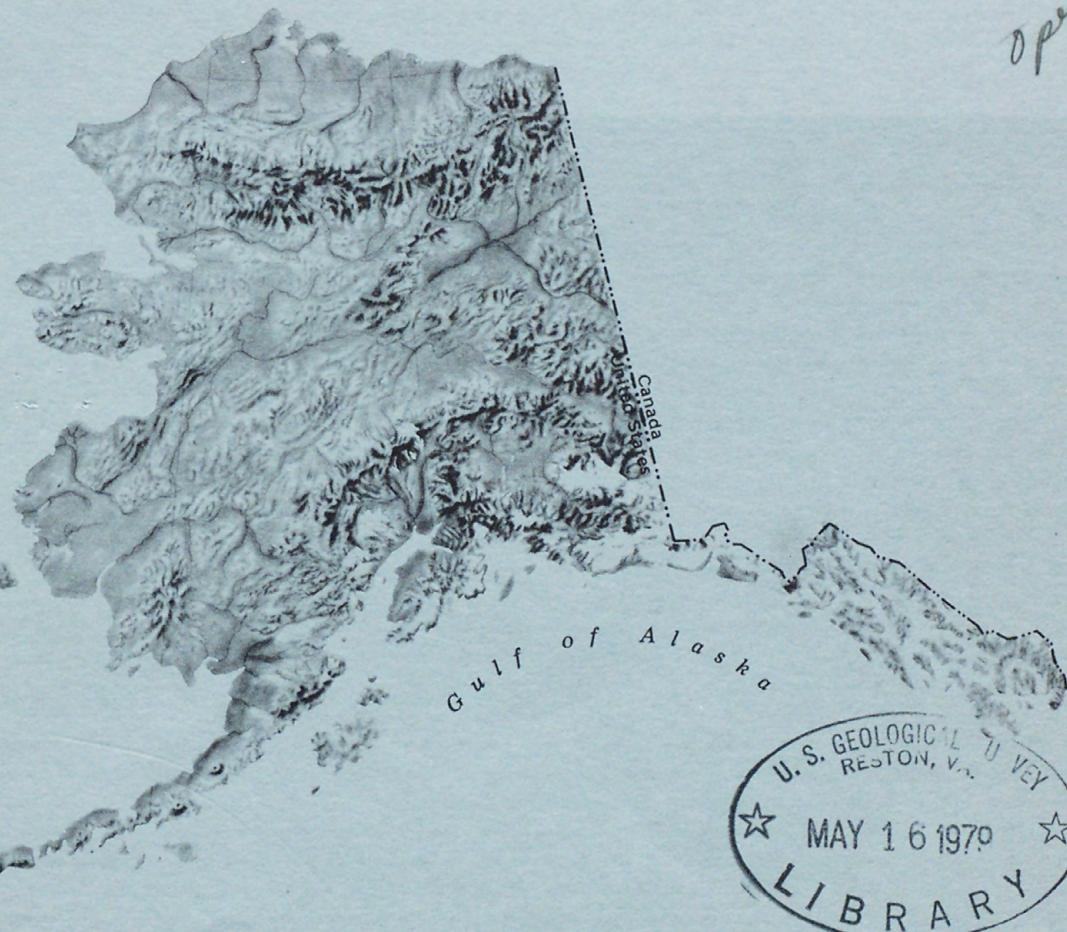
GEOLOGICAL SURVEY

[Reports - Open file series]

CATALOG OF EARTHQUAKES IN SOUTHERN ALASKA

JANUARY-MARCH 1978

100
cm
Open entry



OPEN-FILE REPORT 79-718

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

Menlo Park, California

1979

CATALOG OF EARTHQUAKES IN SOUTHERN ALASKA
JANUARY-MARCH 1978

C. D. Stephens, J. C. Lahr, K. A. Fogelman
M. A. Allan, and S. M. Helton

USGS LIBRARY-RESTON



3 1818 00073168 5

CONTENTS

	Page
Introduction	2
Instrumentation	2
Data Processing	6
Magnitude	11
Analysis of Quality	12
Discussion of Catalog	17
Acknowledgments	18
References	19

ILLUSTRATIONS

Figure 1 Map showing principal seismograph stations used in locating earthquakes	3
2 Block diagram of the USGS telemetered seismograph system	5
3 System response of a typical USGS telemetered seismograph station	7
4 Picture of a typical seismograph station installation	8
5 Map showing earthquake epicenters reported in the appendix	13
6 Map of epicenters for earthquakes with magnitudes greater than 3.5	14
7 Map showing location of cross sections	15
8 Cross section showing distribution of earthquake hypocenters listed in the appendix	16

TABLES

Table 1 Station data	4
----------------------------	---

APPENDICES

Appendix A. Southern Alaska earthquakes, first quarter 1978	20
Appendix B. List of earthquakes occurring outside of the USGS seismic network during the first quarter of 1978	31

297661

INTRODUCTION

The National Center for Earthquake Research of the U.S. Geological Survey (USGS) began a 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, to delineate seismically active faults, to assess seismic risk, to document potential premonitory earthquake phenomena, to investigate current tectonic deformation, and to 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, 7 around Cook Inlet and 3 near Valdez, was installed in 1971. Each summer since then additions or modifications to the network have been made. By the Fall of 1973, 26 stations extended from western Cook Inlet to eastern Prince William Sound, and 4 stations were located 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 (OCS) 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.

This earthquake catalog presents origin times, focal coordinates and magnitudes for 384 shocks occurring in the first quarter of 1978. Readings from a total of 62 stations were used to locate the shocks, including 11 stations operated by the NOAA Alaska Tsunami Warning Center (formerly Palmer Observatory), and 5 stations operated by the Geophysical Institute of the University of Alaska (U. of A.).

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 published in the reports "Preliminary Determination of Epicenters" (PDE). In contrast the shocks included in this catalog are as small as magnitude 1.0 and most are smaller than magnitude 3.0. Data for the larger historic earthquakes in south-central Alaska have been tabulated by Meyers (1976).

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. The USGS stations have single, vertical-component seismometers except for GLB, PNL, RDT, SKN, and VLZ which also have two horizontal seismometers.

INSTRUMENTATION

The instrumentation in the USGS seismograph network is illustrated in the block diagram in Figure 2. Data from each seismometer are telemetered to a central recording point at the NOAA Alaska Tsunami Warning Center. 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

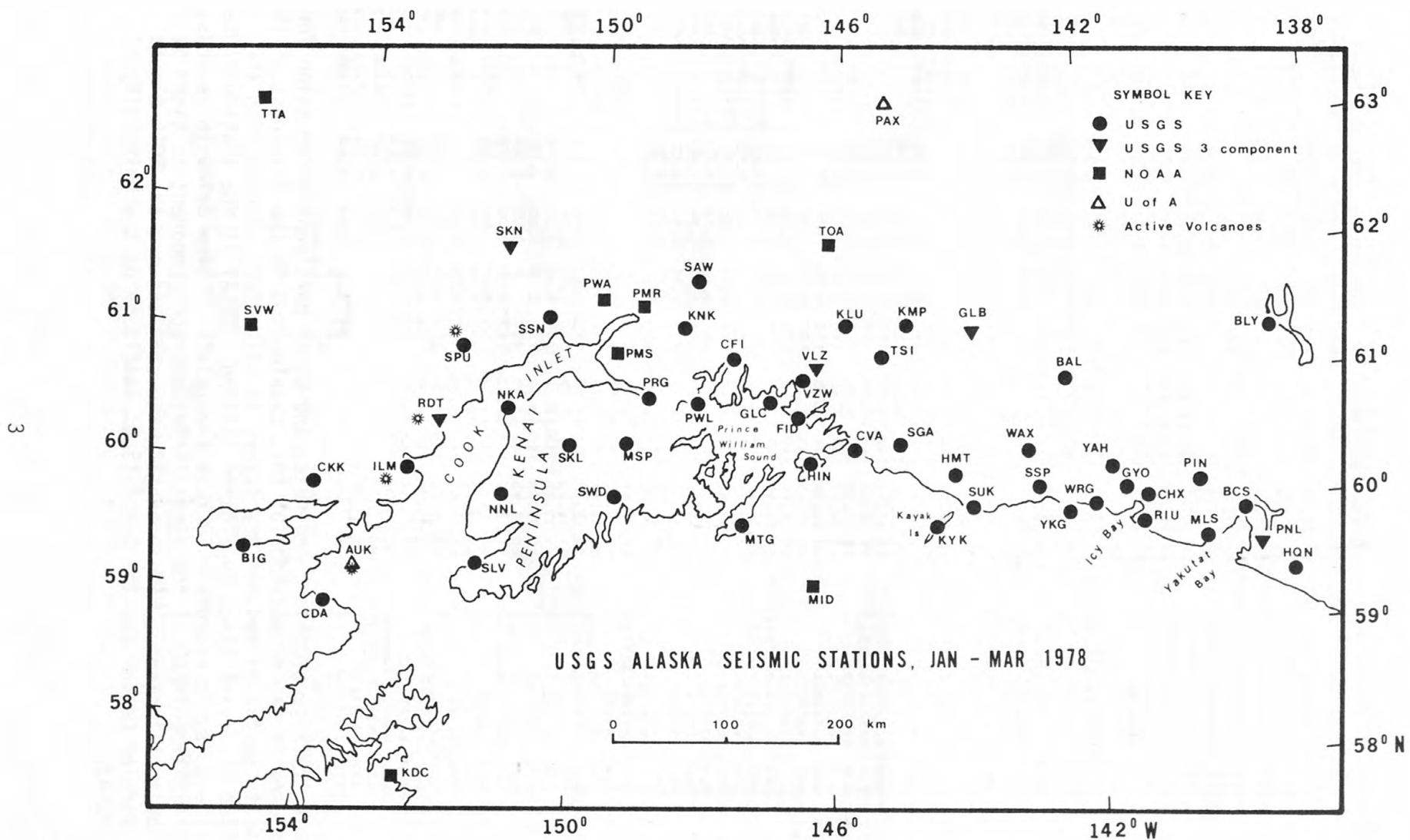


Figure 1. Map showing the USGS Alaska seismic network for the first quarter of 1978. Stations from which additional readings were obtained are also shown.

Table 1. Station Data

SEISMIC STATIONS UTILIZED DURING JANUARY - MARCH 1978

STA CODE	STATION NAME	LAT N DEG MIN	LONG W DEG MIN	ELEV M	D KM	DELAY SEC	TDLY SEC	MAG @ 1HZ	INST
AUK	AUGUSTINE IS.	59 20.10	153 25.66	293	0.01	0.00	0.00		UOFA
BAL	BALDY	61 2.17	142 20.67	1300	0.01	0.00	0.00	117000	USGS
BCS	BANCAS POINT	59 56.90	139 37.00	10	0.00	0.00	0.30	29700	USGS
P1G	BIG MOUNTAIN	59 23.34	155 13.02	567	0.01	0.00	0.00	117000	USGS
BLR	BLACK RAPIDS	63 30.10	145 50.70	809	0.01	0.00	0.00		NOAA
CDA	CAPP DOUGLAS	58 57.32	153 31.77	386	0.01	0.00	0.00		USGS
CFI	COLLEGE FIORD	61 10.96	147 45.99	2	0.01	0.00	0.00	117000	USGS
CHX	CHAIX HILLS	60 4.00	141 7.10	793	0.01	0.00	0.30	59400	USGS
CKK	CHEKOK	59 57.58	154 13.99	732	0.01	0.00	0.00	7400	USGS
COL	COLLEGE	64 54.00	147 47.60	320	0.01	0.00	0.00		USGS
CVA	CORDOVA	60 32.79	145 44.96	90	0.01	0.00	0.30	59400	USGS
FID	FIDALGO	60 43.73	146 35.79	488	0.01	0.00	0.30	234000	USGS
GIL	GILMORE	64 58.50	147 29.70	350	0.01	0.00	0.00		NOAA
GLB	GILAHINA BUTTE	61 26.51	143 48.63	845	0.01	0.00	0.00	234000	USGS
GLC	GLACIER IS.	60 53.44	147 4.35	3	0.01	0.00	0.30	117000	USGS
GLM	GILMORE DOME	64 59.23	147 23.33	820	0.01	0.00	0.00		UOFA
GYO	GUYOT HILLS	60 8.78	141 28.29	183	0.00	0.00	0.30	117000	USGS
HMT	MT. HAMILTON	60 20.19	144 15.64	620	0.01	0.00	0.30	117000	USGS
HQN	HARLEQUIN LAKE	59 27.10	138 52.62	372	0.01	0.00	0.30	117000	USGS
ILM	ILIAMNA	60 10.92	152 48.97	550	0.01	0.44	0.00	117000	USGS
IMA	INDIAN MOUNTAIN	66 4.11	153 40.72	1380	0.01	0.00	0.00		NOAA
KDC	KODIAK	57 44.87	152 29.50	13	0.01	0.00	0.00		NOAA
KLU	KLUTINA	61 29.57	145 55.21	1012	0.01	0.00	0.00	234000	USGS
KMP	KIMBALL PASS	61 30.78	145 1.09	1143	0.00	0.00	0.30	117000	USGS
KNK	KNIK	61 24.75	148 27.34	595	0.01	0.00	0.00	234000	USGS
KYK	KAYAK IS.	59 52.10	144 31.39	375	0.01	0.00	0.30	59400	USGS
LEV	LEVY	64 13.00	149 15.20	230	0.01	0.00	0.00		UOFA
MCK	MCKINLEY PARK	63 43.94	148 56.10	610	0.01	0.00	0.00		UOFA
MID	MIDDLETON IS.	59 25.67	146 20.34	37	0.01	0.00	0.30		NOAA
MLS	MALASPINA	59 45.80	140 9.00	2	0.01	0.00	0.30		USGS
MSP	MOOSE PASS	60 29.35	149 21.64	150	0.01	0.00	0.00	117000	USGS
NKA	NIKISHKA	60 44.58	151 14.28	100	4.00	1.36	0.08	7400	USGS
PAX	PAXON	62 58.25	145 28.11	1130	0.01	0.00	0.00		UOFA
PIN	FINNACLE	60 5.80	140 15.40	975	0.01	0.00	0.30	59400	USGS
PMR	PALMER OBSERVATORY	61 35.53	149 7.85	100	0.01	0.00	0.00		NOAA
PMS	ARCTIC VALLEY	61 14.68	149 33.63	716	0.01	0.00	0.00		NOAA
PNL	PENINSULA	59 40.12	139 23.82	579	0.01	0.00	0.30	59400	USGS
PRG	PORTAGE	60 51.87	149 1.42	55	0.01	0.00	0.00	117000	USGS
PWA	HOUSTON	61 39.05	149 52.72	137	0.01	0.70	0.00		NOAA
PWL	PORT WELLS	60 51.56	148 20.09	549	0.01	0.00	0.00	117000	USGS
RDT	REDOUBT	60 34.43	152 24.37	930	0.01	0.36	0.00	14700	USGS
RIU	RIOU	59 52.70	141 13.70	15	0.00	0.00	0.30	7400	USGS
SAW	SAWMILL	61 48.49	148 19.98	740	0.01	0.00	0.00	234000	USGS
SGA	SHERMAN GLACIER	60 30.07	145 12.42	424	0.00	0.00	0.30	59400	USGS
SKL	SKILAK	60 30.86	150 12.91	660	0.01	0.10	0.00	117000	USGS
SKN	SKWENTNA	61 58.82	151 31.78	564	0.01	0.00	0.00	234000	USGS
SLV	SELDOMIA	59 28.28	151 34.83	91	0.01	0.00	0.00	29700	USGS
SPU	SPURR	61 10.90	152 3.26	800	0.01	0.39	0.00	234000	USGS
SSN	SUSITNA	61 27.83	150 44.60	1297	0.01	0.67	0.00	234000	USGS
SSP	SUNSHINE POINT	60 10.80	142 50.30	732	0.01	0.00	0.30	117000	USGS
SUK	SUCKLING HILLS	60 4.60	143 47.00	427	0.01	0.00	0.30	117000	USGS
SVW	SPARREVOHN	61 6.49	155 37.30	762	0.01	0.00	0.00		NOAA
SWD	SEWARD	60 6.22	149 26.96	55	0.01	0.00	0.00	29700	USGS
TOA	TOLSONA	62 6.29	146 10.34	909	0.01	0.00	0.00		NOAA
TSI	TSINA	61 13.57	145 20.24	1113	0.00	0.00	0.30	117000	USGS
TTA	TATALINA	62 55.80	156 1.32	914	0.01	0.00	0.00		NOAA
VLZ	VALDEZ	61 7.89	146 19.92	10	0.01	0.00	0.30	7400	USGS
VZW	VALDEZ WEST	61 3.54	146 33.24	796	0.01	0.00	0.30	234000	USGS
WAX	WAXELL RIDGE	60 27.00	142 51.10	975	0.01	0.00	0.30		USGS
WRG	WHITE RIVER GLCR	60 2.27	142 1.90	550	0.01	0.00	0.30	29700	USGS
YAH	YAHKTSE	60 21.80	141 44.70	2135	0.01	0.00	0.30	59400	USGS
YKG	YAKATAGA	60 4.20	142 25.33	60	0.01	0.00	0.30	7400	USGS

This table lists geographic coordinates and other pertinent information for stations used in the preparation of this catalog. D is the thickness of the low-velocity surficial sedimentary layer, in kilometers, assigned in the calculation of travel-times to a given station. DELAY is the station P-phase travel-time delay 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 are the NOAA Alaska Tsunami Warning Center and the Geophysical Institute os the University of Alaska (UOFA).

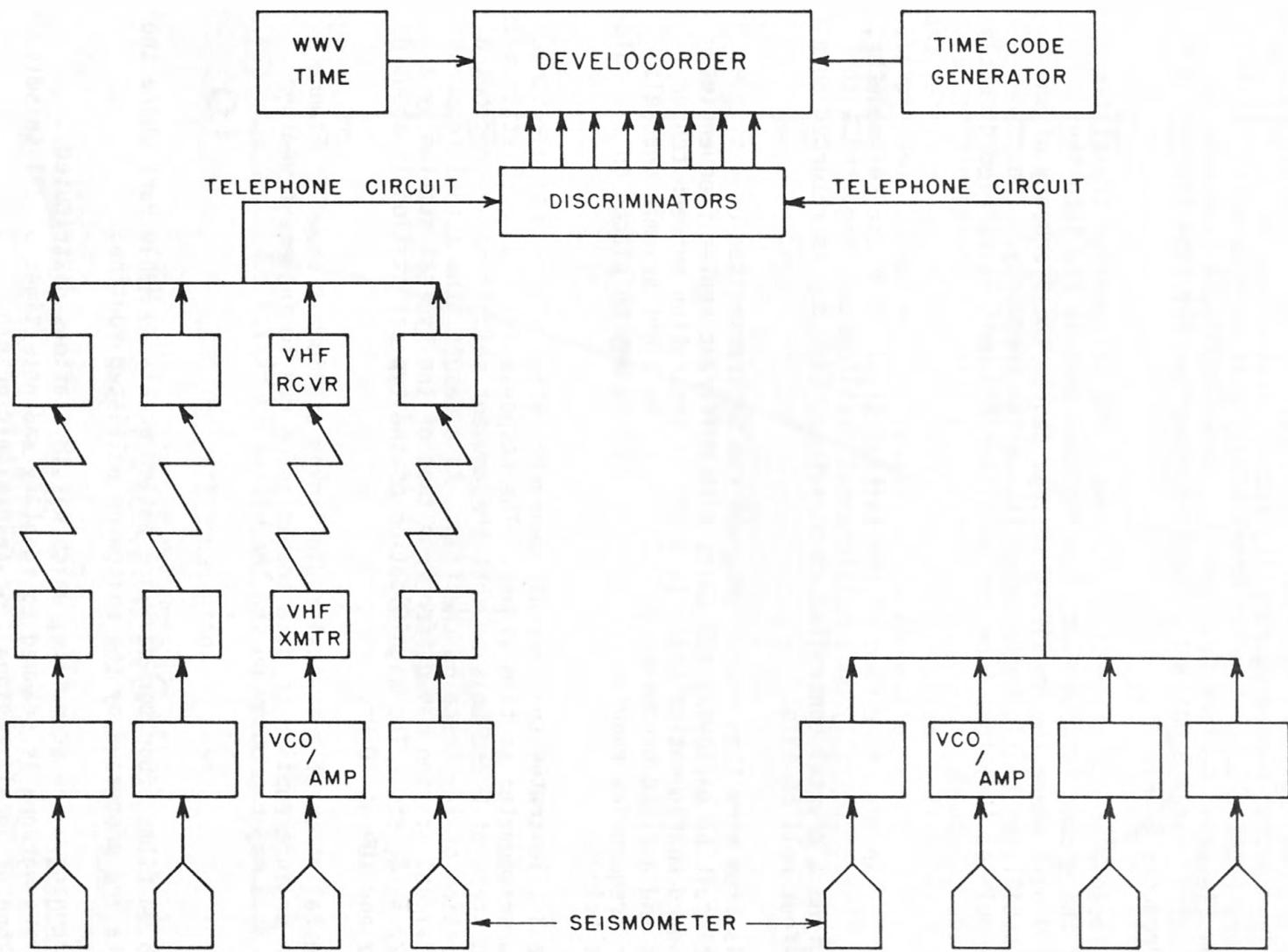


Figure 2. Block diagram of telemetered seismograph system in the USGS network.

of a pre-amplifier and a voltage-controlled oscillator (VCO model NCER 202) and air-cell storage batteries (McGraw-Edison, Model ST-2-1000). Data are telemetered via a leased telephone circuit or a VHF (162-174 MHz) radio link feeding a telephone circuit. The radio link is provided by a low-power transmitter (100 mw) and receiver adapted from a HT-200 Motorola handie-talkie transceiver and two Yagi antennae with 9 db directional gain (Scala, Model CAS-150). The central recording facility incorporates a bank of discriminators (NCER J101 or Develco Model 6203), a 16 mm-film multi-channel oscillograph (Teledyne Geotech Develocorder, Model 4000D), a time-code generator (Datum, Model 9100) and a radio receiver for WWV time signals (Specific Products SR7R).

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. Each day is recorded on a single 142-foot roll of 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 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.

DATA PROCESSING

The 16 mm films (four per day) are mailed weekly to Menlo Park where the seismic data are processed by the following multistep 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

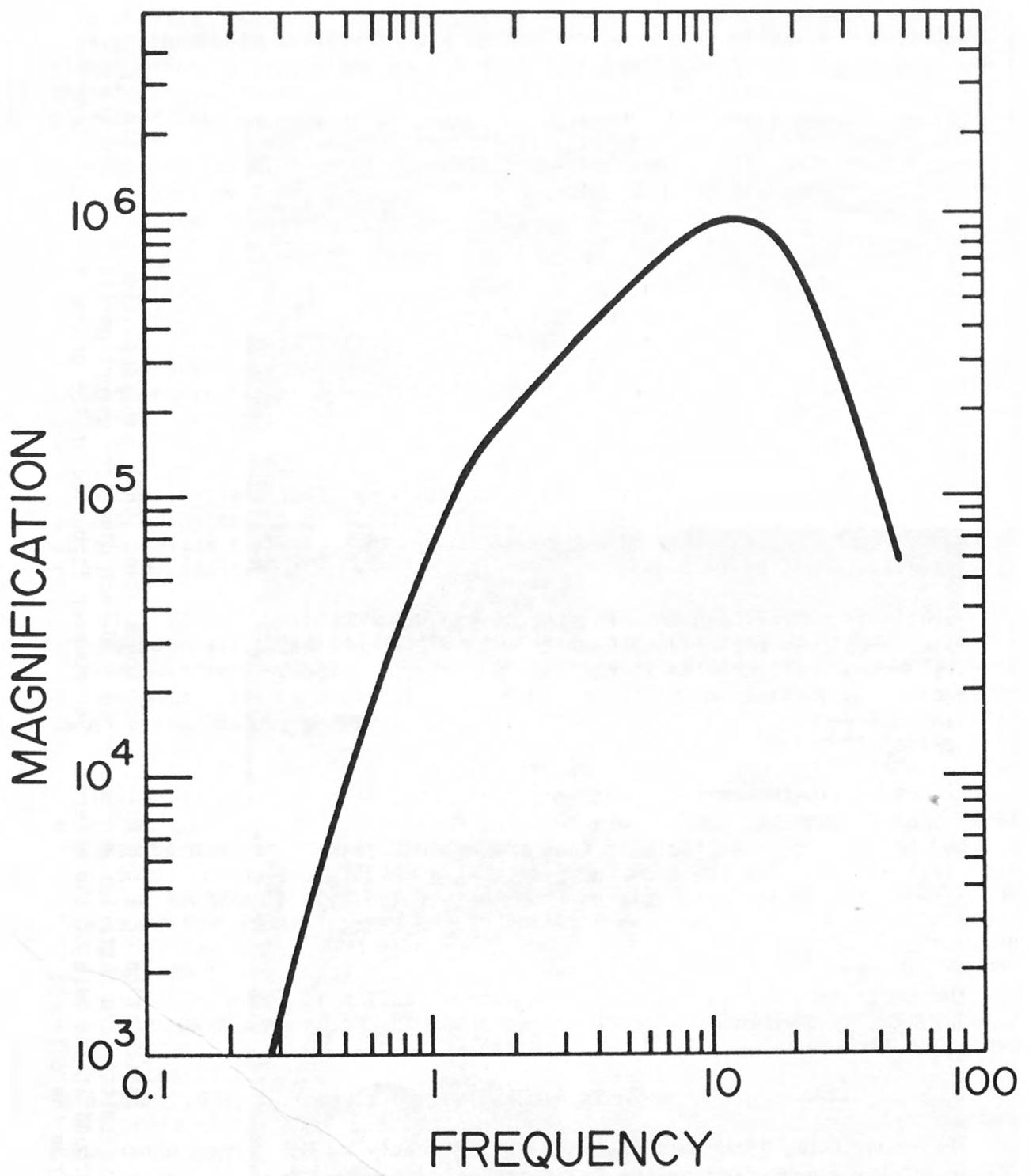


Figure 3. Response curve for a typical USGS seismograph system.

∞

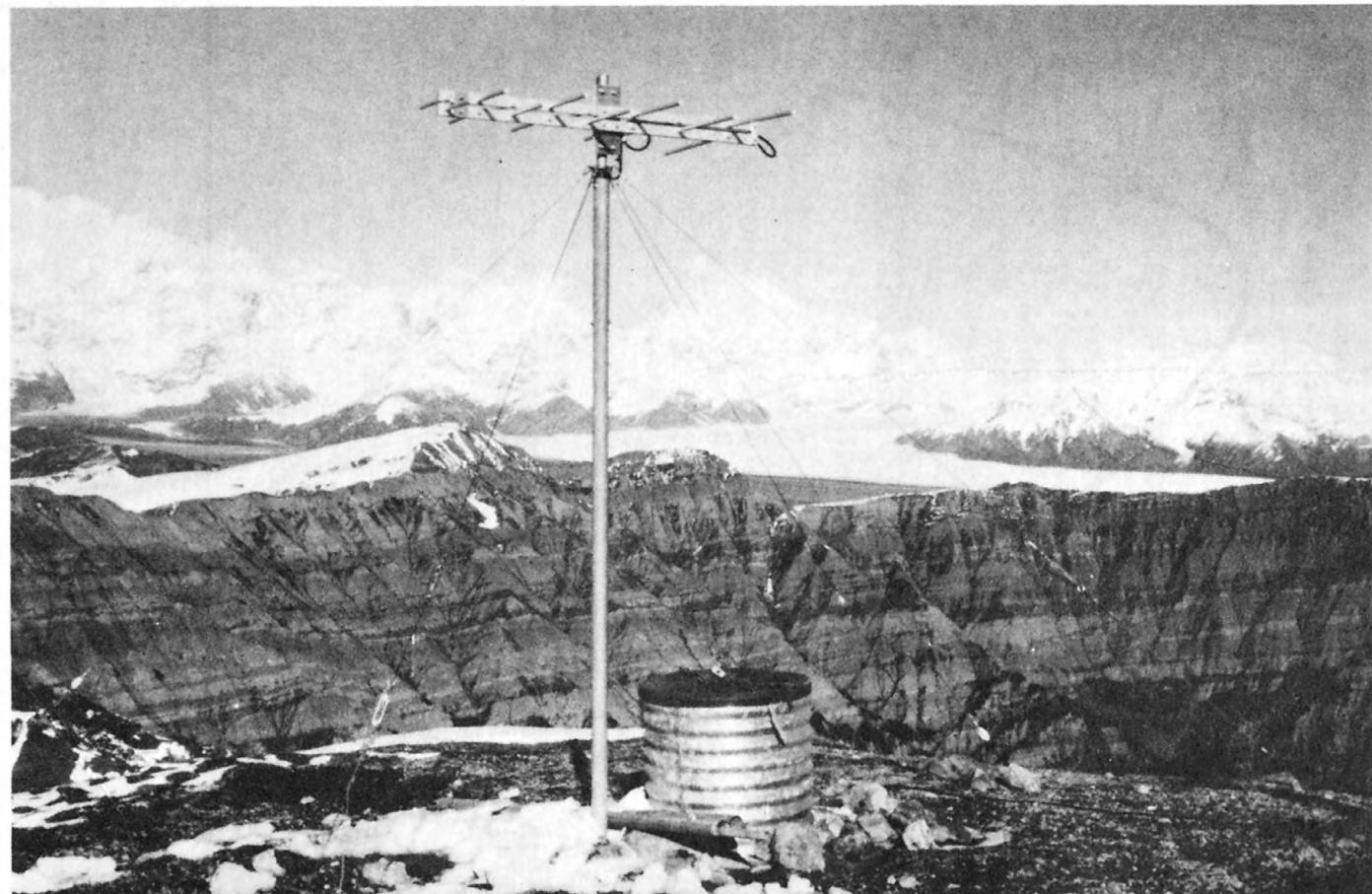


Figure 4. Installation of a typical seismograph station (CHX). VCO/amplifier unit, radio transmitter and batteries are housed in a 30-inch diameter culvert partially set in the ground at the base of the antenna. Seismometer is buried in the ground about 30 meters from the culvert.

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 156° to 150° W, 150° to 145° W and 145° to 138° W, respectively. In the western and central regions, only events with signal durations longer than 80 sec and 20 sec, 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 facilitate processing the large number of earthquakes which are recorded by the network while taking into account a relative decrease from west to east in the total number of earthquakes that have magnitudes within a given range.

The actual timing is done on a digitizing table. The output from the digitizer, in the form of x-y data pairs on punched computer cards, is converted into phase data by computer using the program DIGIT3 (written by P. Ward for use within the U.S. Geological Survey).

3. Initial computer processing. The phase data from the films is batch processed by computer using the program HYPOELLIPE (Lahr, in preparation) to obtain origin times, hypocenters, magnitudes and, if desired, first-motion plots for fault-plane solutions.

4. Analysis of initial computer results. Each hypocentral solution is checked for large travel-time residuals and for a poor spatial distribution of stations. Arrival times identified with large residuals are re-read. For shocks with a poor distribution of stations, readings from additional stations outside the USGS network are sought.

5. Final computer processing. The poor hypocentral solutions are rerun with corrections and the new solutions are checked for large residuals that might be due to remaining errors. Corrections are made as required before the final computer run is made.

The earthquake locations are based on P and S arrivals. S arrivals are important for determining depths of events in the Benioff zone beneath 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 HYPOELLIPE computer program determines hypocenters by minimizing differences between observed and computed travel-times through an iterative least-squares scheme. In many respects the program is similar to HYP071 (Lee and Lahr, 1972), which has been used in the preparation of catalogs of central California earthquakes from January 1969 through December 1973. An important new feature available in HYPOELLIPE is the calculation of confidence ellipsoids for each hypocenter. The ellipsoids provide valuable insight into the effect of network geometry on possible hypocentral errors.

All earthquakes are located using a horizontally-layered velocity model. It is recognized that any model comprised of uniform horizontal layers is a poor representation of the actual velocity structure 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 travel-times.

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 in the flat-layered model.

Two different P-wave velocity models are used to locate the earthquakes. West of 149°W the velocity model used is based on Model A of Matumoto and Page (1969) derived for the eastern Kenai Peninsula-Prince William Sound region. The velocity model is specified as follows:

<u>Layer</u>	<u>Depth (km)</u>	<u>P velocity (km/sec)</u>
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 64	8.3

The thickness 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. For earthquakes that occurred east of 149° , the velocity model used to locate the events is one that was developed by minimizing the travel-time residuals for a group of earthquakes near Valdez. The model is specified by:

<u>Layer</u>	<u>Depth (km)</u>	<u>P velocity (km/sec)</u>
1	0	2.75
2	0.01	6.0
3	20	7.0
4	below 32	8.2

A value of 1.78 for the velocity ratio between P and S is assumed for both models. The initial trial depth for earthquakes which occur west of 149°W is 75 km. East of 149°W this value is 15 km because the seismicity in this part of the net occurs at shallow depths.

Travel-time delays were applied to stations in the network that had consistent and large residuals for the locations of a large group of earthquakes. Additional delays were applied at several stations to correct for a satellite link in the relay of the signal. The P-phase delays are listed in Table 1 and are added to the calculated P-phase travel-times at each station. For S-phases the delay is multiplied by 1.78, the P to S velocity ratio.

MAGNITUDE

Magnitudes are determined from either the signal duration or the maximum trace amplitude. Eaton and others (1970) approximate the Richter local magnitude, whose definition is tied to 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)

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

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 ; however, it is assumed 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 local earthquakes in central California, $B_1 = 3.38$ and $B_2 = 1.50$ for $\Delta = 200$ to 600 km.

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

$$FMAG = -0.87 + 2.00 \log_{10} \tau + 0.0035 \Delta \quad (2)$$

where τ 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 Δ 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:

$$FMAG = -1.15 + 2.00 \log_{10} \tau + 0.007z + 0.0035 \Delta \quad (3)$$

where z is the focal depth in kilometers.

For earthquakes larger than magnitude 3.0, FMAG values may be compared to m_b magnitudes listed in the PDE reports. The average and standard deviations for 47 events in the magnitude range 3.0 to 5.5 are 0.02 and 0.44 respectively; hence the two measures are compatible.

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 sec. for the most impulsive arrivals and as large as 0.10 to 0.20 for emergent arrivals. The confidence ellipsoids are computed for a standard deviation of 0.16 sec. and therefore likely overestimate the 68% 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 betray the incompatibility; alternatively, the RMS residuals could be small and not reflect the error in a bad hypocenter. Where the velocity model is compatible, however, a large RMS residual would indicate probable misreadings of phases.

Other parameters provided by HYPOELLIPSE that are useful in evaluating the quality of a hypocentral solution are: GAP, the largest azimuthal separation between stations measured from the epicenter; D3, the epicentral distance of the third closest station; NP, the number of P arrivals used in the solution; and NS, the number of S arrivals used in the solution. If GAP exceeds 180°, the earthquake lies outside the network of available stations and the solution is generally less reliable than for events occurring inside the network.

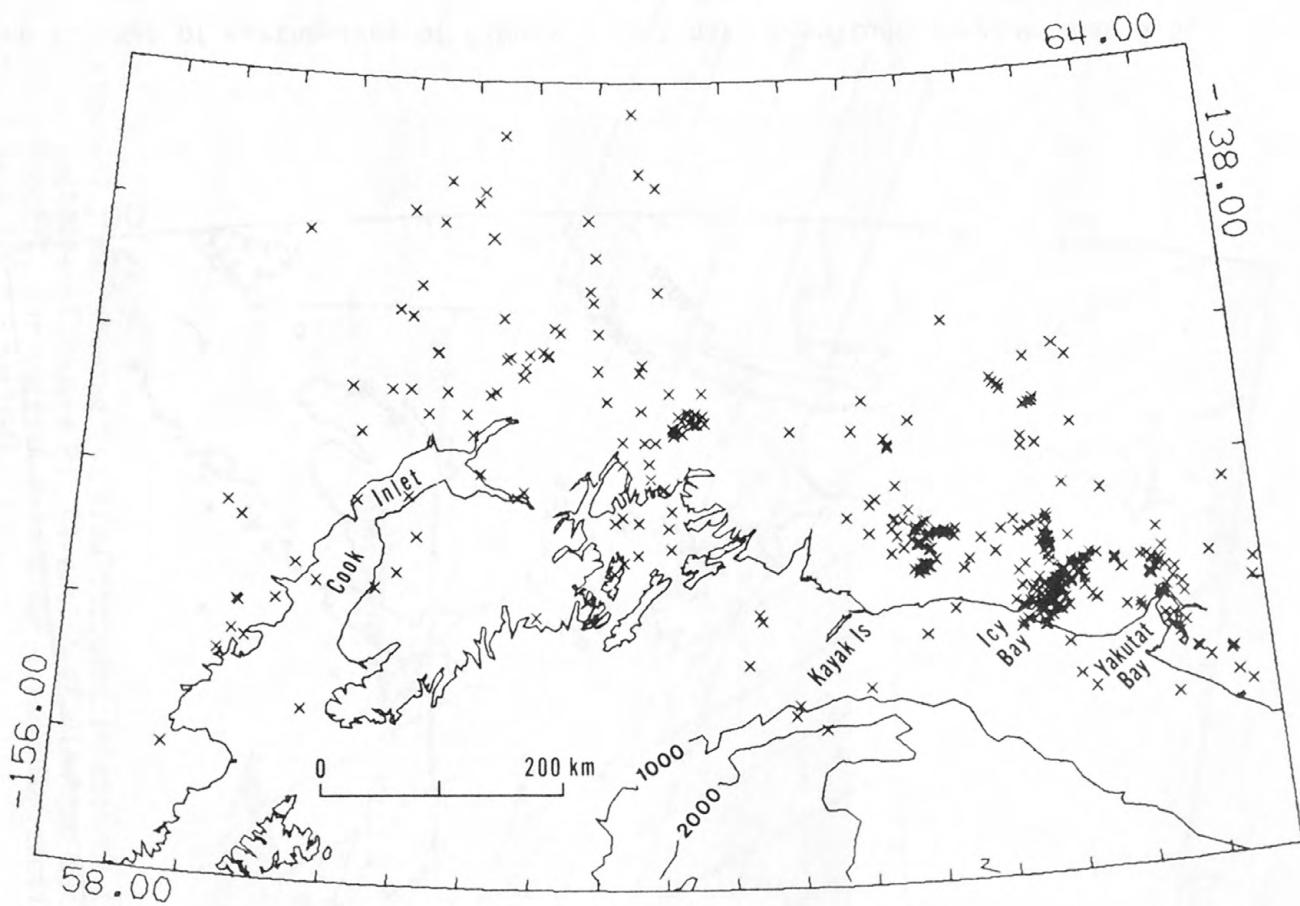


Figure 5. Map of earthquake epicenters for the period January - March 1978. Earthquake parameters are listed in Appendix A. Depth contours are in fathoms.

14

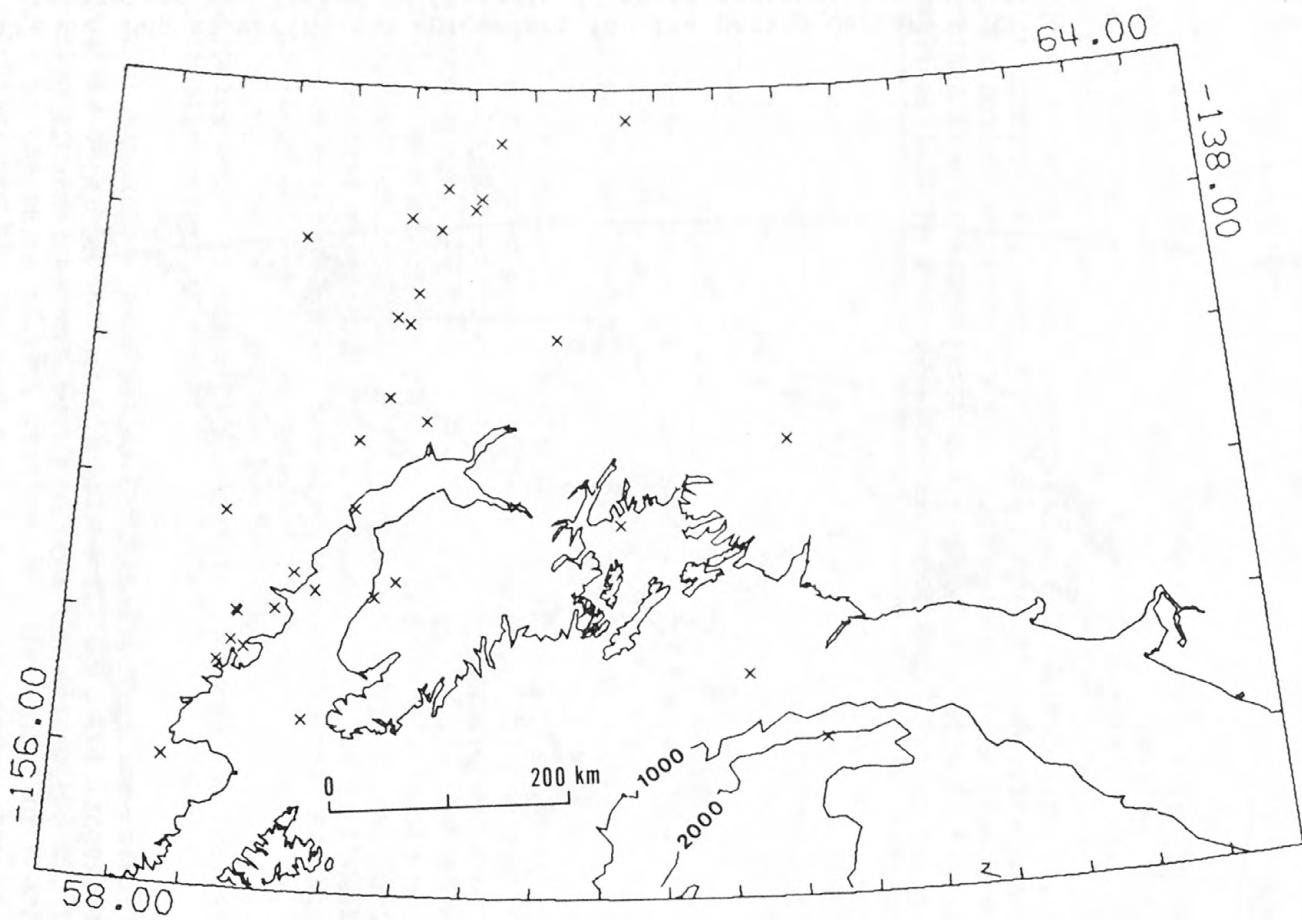


Figure 6. Map of earthquakes of Figure 5 that have magnitude greater than 3.5.

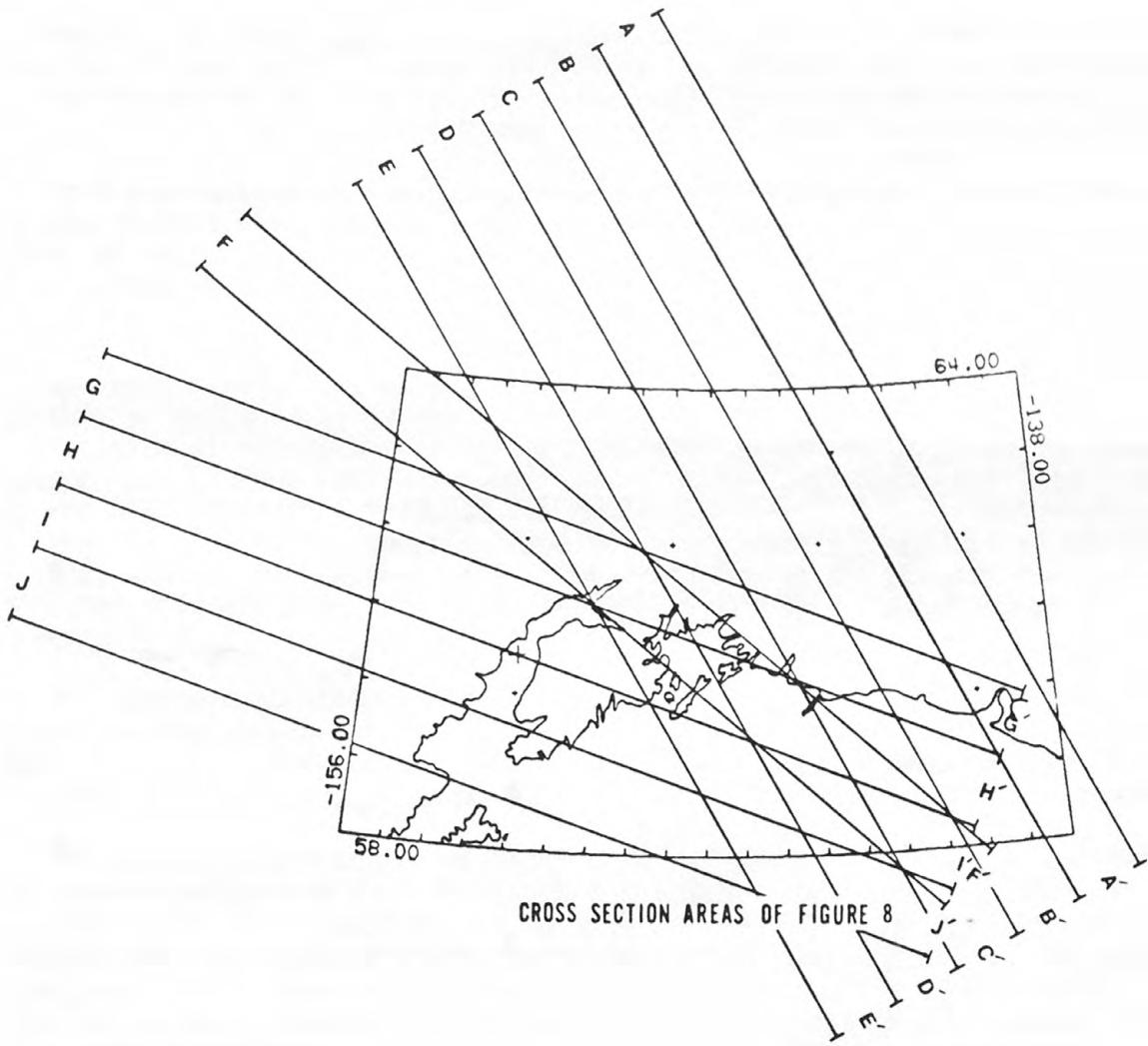


Figure 7. Map showing the area included in each of the cross sections of Figure 8. Direction of view for sections A-E is N 60° E, for section F is N 40° E, and for sections G-J is N 20° E.

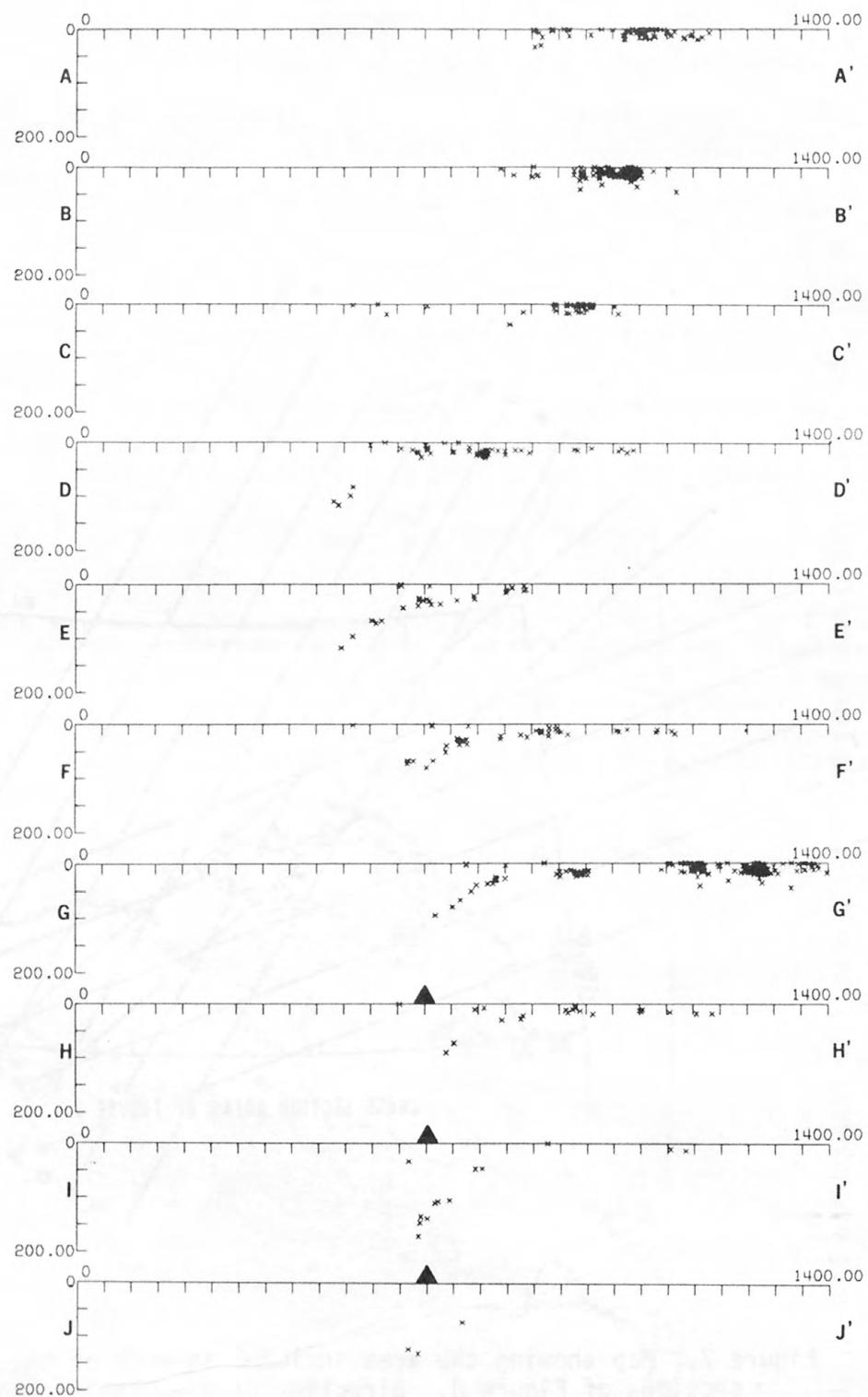


Figure 8. Vertical sections of hypocenters for the areas indicated in Figure 7. Active volcanoes are plotted as triangles at zero depth. all distances and depths are in kilometers.

DISCUSSION OF CATALOG

In Appendix A are listed origin times, focal coordinates, magnitudes and related parameters for 372 earthquakes from January-March 1978. Epicenters for these shocks are plotted in Figure 5. In Figure 6, only the earthquakes with magnitudes greater than 3.5 are plotted. Vertical sections showing the depth distribution of all of the shocks are presented in Figures 7 and 8.

Appendix B contains a list of parameters for 12 earthquakes which were located well outside of the area covered by the network (outlined in Figure 5). No attempt was made to obtain reliable solutions for these events. The events are listed solely for the purpose of noting their occurrence.

We estimate that this catalog is reasonably complete for shocks larger than magnitude 3.5 in the western, 2.5 in the central, and 2.0 in the eastern regions of the area covered by the network. The minimum magnitude of the listed earthquakes ranges from 0.6 for shallow shocks to 2.6 for the deeper shocks.

The precision of the hypocenters or the relative accuracy of the locations of neighboring events is represented by the confidence ellipsoids. The precision of epicenters, expressed in terms of the maximum axes of the projected one-standard-deviation confidence ellipsoids (ERH), averages 5.6, 2.7, and 3.4 km, respectively, in the eastern, central, and western parts of the network. Similarly, the precision of focal depth (ERZ) averages about 5.7, 3.2, and 6.1 km, respectively. The variation in the precision of hypocenter determination across the network is strongly influenced by differences in the station coverage in the different regions.

The absolute accuracy of the earthquake locations is difficult to evaluate in the absence of known explosions. Hypocenter biases equal to and larger than the dimensions of the confidence ellipsoids are not unlikely from the oversimplified velocity model assumed in the preparation of this catalog.

The general distribution of seismic activity for this quarter does not vary significantly from that described for previous quarters (Fogleman, et al., 1978; Lahr, et al., 1974). A well-defined Benioff zone dips to the northwest beneath the Cook Inlet region (Figure 8, sections G-J). The depth to the top of this zone varies from about 50 km beneath the western Kenai peninsula to about 115 beneath the active volcanoes west of Cook Inlet. The dip of the Benioff zone appears to increase from northeast to southwest, but the depth to the seismic zone beneath the active volcanoes--Augustine, Iliamna, Redoubt and Spurr--is nearly constant at about 115 km.

All of the seismic activity east of 146°W occurs at depths less than about 50 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 6). Most of the seismic activity in the eastern part of the network appears to be concentrated beneath Icy Bay and northeast of Kayak Island.

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

ACKNOWLEDGEMENTS

We thank Robert Eppley, Wayne Jorgensen and the entire staff of the NOAA Tsunami Warning Center for their assistance in maintaining our recording equipment in Palmer, Alaska, as well as making their seismic data available to us.

We also wish to thank Jurgen Kienle of the Geophysical Institute of the University of Alaska for a cooperative operation of southern Cook Inlet seismograph stations.

We are indebted to all of those who have spent time fabricating, installing, and maintaining the seismograph network in Alaska, particularly John Roger, Marion Salsman, Tom Walker and Tom Cleese.

Betty McIntire and the staff of the USGS Anchorage office has been of great assistance in solving logistic problems, both in the field and in the office.

This catalog is patterned after those prepared for central California and we gratefully acknowledge Drs. W. H. K. Lee and R. L. Wesson for development of many of the procedures and techniques used herein.

This study was supported jointly by the U.S. Geological Survey and by the National Oceanic and Atmospheric Administration, under which a multi-year program responding to needs of petroleum development of the Alaskan continental shelf is managed by the Outer Continental Shelf Environmental Assessment Program (OCSEAP) Office.

REFERENCES

- Eaton, J. P., M. E. O'Neill, and J. N. Murdock (1970). Aftershocks of the 1966 Parkfield-Cholame, California, earthquake: a detailed study, Bull. Seism. Soc. Am. 60, 1151-1197.
- Fogleman, K., C. Stephens, J. C. Lahr, M. Allan, and S. Helton (1978). Catalog of earthquakes in southern Alaska, October-December 1977, U.S. Geological Survey, Open-File Report 78-1097, 28 p.
- Jacob, K. H. (1972). Global tectonic implications of anomalous seismic P traveltimes from the nuclear explosion Longshot, J. Geophys. Res. 77, 2556-2573.
- Lahr, J. C. (1975). Detailed seismic investigation of Pacific-North American plate interaction in southern Alaska, Ph.D. dissertation, Columbia University, 141 p.
- Lahr, J. C., E. R. Engdahl, and R. A. Page (1974). Locations and focal mechanisms of intermediate depth earthquakes below Cook Inlet, Alaska, EOS 55, 349.
- Lahr, J. C., (unpublished computer program). HYPOLLIPSE: A computer program for determining local earthquake hypocentral parameters, magnitude, and first motion pattern.
- Lahr, J. C., R. A. Page, and J. A. Thomas (1974). Catalog of earthquakes in south central Alaska, April-June 1972, U.S. Geological Survey, Open-File Report, 35 p.
- Lee, W. H. K., and J. C. Lahr (1972). HYP071: a computer program for determining hypocenter, magnitude, and first motion pattern of local earthquakes, U.S. Geological Survey, Open-File Report, 100 p.
- Lee, W. H. K., R. E. Bennett, and K. L. Meagher (1972). A method of estimating magnitude of local earthquakes from signal duration, U.S. Geological Survey, Open-File Report, 28 p.
- Matumoto, T., and R. A. Page (1969). Microaftershocks following the Alaska earthquake of 28 March 1964: "Determination of hypocenters and crustal velocities in the Kenai Peninsula-Prince William Sound area", The Prince William Sound, Alaska, Earthquake of 1964 and Aftershocks, vol. 2B & C, U. S. Coast and Geodetic Survey Publication 10-3, U.S. Govt. Printing Office, Washington, 157-173.
- Meyers, H. (1976). A historical summary of earthquake epicenters in and near Alaska, NOAA Technical Memorandum EDS NGSDC-1.
- Mitronovas, W., and B. L. Isacks (1971). Seismic velocity anomalies in the upper mantle beneath the Tonga-Kermadec island arc. J. Geophys. Res. 76, 7154-7180.
- Richter, C. F. (1958). Elementary Seismology, W. H. Freeman and Co., 768 pp.

APPENDIX A

Catalog of Earthquakes

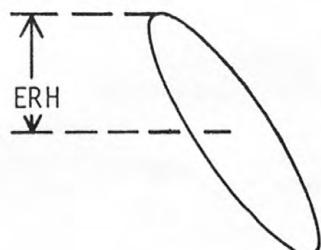
Earthquakes from southern Alaska are listed in chronological order. The following data are given for each event:

- (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. "*" next to the depth indicates that the depth control in the determination of the hypocenter was poor. "&" next to the depth indicates that the geophysicist constrained the initial trial location for the earthquake.
- (4) MAG, duration magnitude (FMAG) of the earthquake, if available, otherwise amplitude magnitude (XMAG).
- (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 traveltimes residuals:

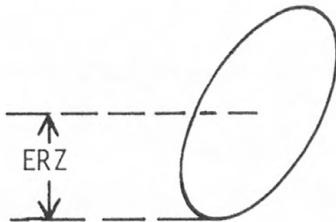
$$\text{RMS} = \sqrt{\sum_i [(R_{Pi} + R_{Si}) / (N_p + N_s)]}$$

where R_{Pi} and R_{Si} 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.
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.
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:

<u>Q</u>	<u>A</u>	<u>\leq</u>	<u>$\frac{ERH}{2.5}$</u>	<u>\leq</u>	<u>$\frac{ERZ}{2.5}$</u>
	B	<u>\leq</u>	5.0	<u>\leq</u>	5.0
	C	<u>\leq</u>	10.0	<u>\leq</u>	10.0
	D	<u>\geq</u>	10.0	<u>\geq</u>	10.0

SOUTHERN ALASKA EARTHQUAKE CATALOG

1978	ORIGIN HR MN SEC	TIME LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D'S KM	RMS SEC	ERH KM	REMARKS		
JAN 1	8 9	21.8	61 29.2	146 42.5	19.3	2.2	20	15	90	48	0.45	0.9	1.2	A
1 9 30	8.4	60 10.0	139 18.3	1.2	2.9	17	5	223	56	0.40	2.9	2.8	B	
1 16 16	4.1	59 21.0	145 0.6	15.1	2.8	22	18	204	106	0.36	2.8	1.6	B	
2 4 23	12.9	60 50.9	151 42.3	72.6	3.6	28	8	54	49	0.36	1.5	2.5	B	
2 13 14	55.2	59 52.4	141 37.2	17.7	2.0	15	12	163	35	0.43	1.9	1.1	A	
2 14 34	8.2	59 50.9	141 38.9	17.0	1.7	12	9	165	38	0.42	1.7	1.1	A	
2 16 49	1.8	60 5.9	139 21.0	1.3	1.7	6	3	241	50	0.58	4.7	17.4	D	
2 20 44	19.9	61 53.8	147 19.0	17.6	2.9	24	16	157	81	0.54	1.6	1.9	A	
2 21 12	48.0	60 58.0	147 0.1	22.5	2.8	31	19	65	34	0.43	1.0	1.1	A	
2 23 42	59.4	59 21.0	140 38.6	45.8	2.4	12	9	211	84	0.25	3.3	8.1	C	
3 4 11	25.2	60 35.1	142 41.2	15.0	1.2	5	6	101	57	0.27	2.0	2.2	A	
3 8 8	34.1	59 50.5	143 4.5	17.7	1.3	8	8	192	81	0.32	2.4	1.7	A	
3 9 47	53.8	60 8.8	139 41.4	16.1	1.0	4	3	249	56	0.09	6.6	2.5	C	
3 12 47	32.4	59 33.1	139 4.6	15.9*	1.1	3	2	182	90	0.02	25.0	25.0	D	
3 15 56	11.0	62 27.0	148 8.7	13.8	2.7	17	15	217	109	0.50	2.8	2.0	B	
3 17 28	7.3	60 18.7	140 38.9	17.7	1.6	10	8	174	49	0.36	2.4	1.6	A	
3 23 35	21.0	60 6.4	140 40.4	17.8	1.7	9	6	157	40	0.39	3.0	1.5	B	
4 18 31	26.3	60 26.5	141 10.6	14.7	1.3	9	8	171	42	0.39	2.1	1.6	A	
4 18 36	39.3	61 30.1	141 16.0	0.8	2.0	7	5	251	136	0.32	2.5	3.2	B	
5 10 26	40.4	59 27.9	143 57.6	17.8	3.4	26	10	178	99	0.54	2.5	1.8	A	
5 12 20	25.0	61 23.2	146 41.8	20.0	2.8	28	15	81	43	0.43	0.8	1.9	A	
5 15 4	4.4	60 17.5	140 39.7	20.1	1.1	5	4	229	99	0.09	5.0	3.9	C	
5 19 56	12.2	61 21.8	151 41.3	90.0	4.1	29	3	65	69	0.36	2.0	3.5	B	
5 20 41	25.3	60 7.8	139 39.7	0.7	1.6	10	7	205	53	0.44	3.8	3.3	B	
5 23 0	24.9	60 10.4	139 35.4	2.2	1.6	10	7	211	55	0.35	3.3	4.2	B	
6 0 58	42.0	60 31.8	146 53.4	19.0	2.8	27	16	132	62	0.53	1.2	1.1	A	
6 4 41	44.1	61 18.2	143 34.5	0.1	2.5	24	8	171	103	0.72	1.8	1.9	A	
6 6 39	55.7	60 27.6	142 57.8	11.2	1.3	5	2	161	62	0.31	4.4	3.4	B	
6 11 32	12.9	61 27.2	146 28.2	13.1	2.4	24	14	80	44	0.65	0.8	1.0	A	
6 14 18	34.2	60 48.8	140 17.4	0.4	2.2	6	4	229	137	0.63	4.8	2.8	B	
6 21 59	2.0	60 54.5	149 14.6	27.9	4.1	33	3	52	69	0.40	1.0	2.2	A	FELT (IV) IN ANCHORAGE, (III) AT ELMENDORF AFB AND IN PALMER
6 23 32	18.1	60 13.4	140 59.3	16.7	1.1	8	6	148	28	0.33	2.8	2.5	B	
7 2 18	5.0	60 18.4	140 35.6	12.5	1.4	12	9	176	52	0.31	2.7	1.5	B	
7 19 28	7.2	60 11.1	141 4.2	12.6	2.2	20	5	139	35	0.62	1.5	1.2	A	
7 22 39	50.9	60 7.5	140 58.2	1.3	1.5	13	4	131	31	0.44	1.4	2.9	B	
8 18 0	39.9	61 50.9	147 21.9	17.0	2.4	19	13	152	76	0.57	1.7	1.9	A	
8 23 12	12.3	61 4.8	149 49.3	29.9	2.5	23	13	40	64	0.36	0.9	2.9	B	
9 7 6	6.8	61 58.1	148 48.3	9.2	3.4	22	3	173	65	0.56	2.1	1.5	A	
9 13 31	20.0	59 49.3	139 23.8	6.2	1.6	9	4	186	51	0.36	2.3	1.8	A	
10 2 32	43.1	60 28.7	140 51.5	1.6	1.7	8	10	188	51	0.44	1.1	2.3	A	
10 11 21	8.4	61 58.7	150 32.4	1.1	2.8	21	3	176	58	0.50	2.1	1.2	A	
10 12 5	33.9	60 36.7	141 17.5	10.7	1.3	5	6	222	61	0.25	2.5	10.6	D	
10 20 49	19.2	60 43.5	144 12.0	11.9	1.8	4	3	200	106	0.15	2.2	2.0	A	
10 22 40	32.9	60 2.0	140 58.4	23.5	1.0	3	3	214	40	0.20	17.0	4.4	D	
11 12 46	19.4	61 41.6	150 57.2	67.7	3.1	13	6	184	82	0.24	3.1	2.3	B	

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME DEG MIN	LAT N LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
JAN 11	17 33	10.4	60 34.7	141 51.3	0.1*	0.9	3	3	193	58	0.21	1.9	25.0 D
12	3 37	40.0	61 58.2	148 47.8	8.6	2.7	21	4	201	65	0.52	2.3	1.5 A
12	5 16	9.1	60 36.7	142 32.9	19.2	1.4	5	4	109	51	0.49	1.2	1.2 A
12	13 43	56.3	60 11.6	141 19.3	18.1	1.2	3	3	223	60	0.17	6.1	4.5 C
12	19 32	25.0	61 32.7	146 37.6	20.1	2.1	6	5	166	77	0.40	1.3	6.8 C
12	21 35	44.0	60 15.4	139 38.6	15.9	1.2	3	1	337	99	0.07	25.0	13.3 D
13	1 54	44.1	60 12.6	140 5.5	7.2	1.4	6	4	194	77	0.16	4.7	3.2 B
13	8 46	55.2	60 21.1	147 45.2	10.2	2.8	25	8	147	90	0.44	1.8	1.4 A
13	15 11	58.8	60 12.4	139 32.1	1.0	1.9	9	5	215	60	0.36	2.4	2.6 B
13	23 14	55.9	59 54.2	141 10.4	8.6	1.3	5	5	192	60	0.20	3.4	2.7 B
15	0 41	17.3	60 1.6	141 27.1	15.0	1.1	7	5	199	41	0.33	2.7	2.0 B
15	9 0	47.2	60 32.7	143 13.9	15.0*	1.5	3	2	249	73	0.63	8.3	13.7 D
15	9 43	7.7	60 30.8	143 8.5	15.0*	1.7	4	3	185	73	0.37	7.9	8.8 C
15	21 9	0.3	59 10.0	144 38.3	13.0	4.4	29	1	202	112	0.25	3.7	2.7 B
16	5 10	2.8	61 58.1	150 32.9	3.0	2.5	18	4	175	57	0.41	1.5	2.2 A
16	10 38	32.4	61 9.7	147 13.0	11.9	2.2	15	8	72	48	0.50	1.1	0.9 A
16	11 39	14.2	59 29.0	138 55.4	12.0	1.4	3	2	192	101	0.05	25.0	9.5 D
16	15 41	11.2	60 4.7	141 9.7	11.0	1.4	5	2	175	50	0.15	4.3	1.4 B
17	12 13	37.1	60 3.0	139 13.1	0.0	1.4	6	4	221	58	0.28	2.2	2.7 B
18	5 28	42.8	61 28.1	146 34.6	19.9	2.2	19	10	85	71	0.60	0.9	1.4 A
18	7 6	6.4	60 1.0	142 37.7	4.9	1.4	5	5	264	50	0.25	3.2	2.3 B
18	7 19	25.9	60 41.6	143 20.8	17.2	1.3	4	3	180	87	0.26	13.8	18.9 D
18	7 51	36.9	59 58.8	141 5.0	15.0*	1.0	3	1	200	101	0.41	25.0	10.1 D
18	10 24	33.6	60 32.7	141 36.3	15.0	1.5	8	6	160	60	0.34	1.5	2.6 B
18	11 52	26.2	60 35.0	142 51.3	0.9	1.1	3	2	210	58	0.24	12.0	25.0 D
18	13 16	31.5	60 35.3	142 57.5	25.48	1.4	3	2	175	106	0.45	17.8	18.1 D
18	14 39	30.1	60 13.8	139 30.2	2.9	1.6	6	5	218	63	0.37	3.2	2.7 B
19	16 24	49.6	63 10.5	149 52.1	98.4	4.6	25	1	123	172	0.33	4.0	22.8 D
19	20 5	14.0	61 41.2	146 23.3	22.8	2.6	27	9	96	62	0.61	1.0	1.9 A
20	1 16	5.2	61 31.8	146 29.6	23.1	2.2	15	9	87	66	0.51	0.8	1.5 A
20	4 25	44.0	60 8.1	140 51.7	16.7	2.0	13	6	136	34	0.41	1.3	1.1 A
20	5 0	59.2	61 15.5	143 30.9	16.5	1.2	4	4	170	85	0.32	25.0	16.1 D
20	10 39	20.5	60 31.0	143 5.3	3.9	1.8	9	4	146	71	0.33	1.6	1.9 A
21	1 49	51.9	60 15.6	141 38.1	17.8	1.4	6	4	143	36	0.25	2.5	1.0 B
21	7 52	28.2	60 5.0	141 1.7	4.6	1.0	5	3	188	128	0.59	4.4	3.1 B
21	11 11	22.3	60 11.2	140 59.5	17.0	1.7	12	6	142	42	0.41	1.7	1.2 A
21	19 12	17.9	59 55.9	140 4.2	0.2	1.7	6	3	157	60	0.37	5.1	3.7 C
22	2 2	56.0	60 14.2	152 16.0	105.3	4.1	27	3	51	94	0.24	1.8	3.9 B
22	13 54	16.4	62 8.0	148 0.9	19.8	2.5	19	11	208	84	0.44	2.1	1.4 A
22	21 1	34.4	61 24.7	146 46.1	19.9	2.6	27	6	84	46	0.46	0.8	1.2 A
23	0 6	50.7	60 8.3	139 39.5	16.2	1.4	8	3	206	50	0.38	4.9	2.2 B
23	9 12	12.1	60 57.0	143 25.8	7.5	0.4	3	3	189	64	0.17	2.1	25.0 D
23	9 33	49.6	60 43.5	147 22.5	6.7	3.0	30	7	135	55	0.51	1.1	1.2 A
23	18 39	32.2	60 0.1	139 33.7	0.4	2.1	8	0	201	40	0.15	5.1	12.4 D
23	21 7	49.7	59 59.2	139 32.4	13.4	0.5	4	2	221	42	0.04	8.7	3.1 C

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

		ORIGIN 1978	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 Q KM	REMARKS
JAN	24	7 54	14.7	61 59.4	148 52.9	5.0	2.6	18	6	175	68	0.57	2.7	2.1 B	
	25	9 0	25.5	60 38.7	141 39.4	15.1	2.0	14	6	169	57	0.28	1.7	1.5 A	
	25	11 32	9.0	60 46.0	147 38.0	15.7	3.6	33	6	79	47	0.49	1.1	1.0 A	
	25	19 51	32.7	60 9.1	141 10.3	11.5	1.0	4	2	167	51	0.19	4.9	3.4 B	
	25	22 19	33.9	60 3.7	141 12.0	0.4	1.0	5	3	118	21	0.13	3.0	25.0 D	
26	3 9	5.5	61 51.5	148 0.7	0.4	2.3	19	7	177	66	0.63	1.8	2.3 A		
	26	5 45	54.4	60 43.5	147 44.4	11.5	2.7	26	11	116	62	0.48	1.2	1.2 A	
	26	8 49	32.1	61 30.9	146 45.3	19.1	2.7	26	12	94	52	0.44	0.8	1.2 A	
	26	11 49	37.5	60 18.4	141 10.3	16.4	1.3	9	7	153	32	0.18	2.2	1.4 A	
	26	16 43	45.6	60 42.3	143 28.7	15.9	1.5	4	3	188	84	0.36	10.0	14.4 D	
27	9 41	3.6	60 7.1	141 26.5	14.5	1.5	8	6	137	32	0.28	3.0	2.2 B		
	27	18 4	13.8	61 27.4	146 31.1	20.0	2.2	23	13	82	68	0.49	0.9	1.6 A	
	27	18 53	0.3	60 19.5	151 3.5	46.8	4.4	30	2	85	79	0.38	1.7	2.3 A	
	28	2 25	3.6	63 1.3	151 0.3	118.1	5.0	24	2	129	187	0.21	3.8	20.8 D	
	28	8 47	18.3	61 11.6	141 13.5	12.6	1.3	4	4	235	133	0.14	5.9	3.8 C	
28	18 53	10.0	60 12.3	151 22.1	46.9	4.2	28	2	97	72	0.33	1.6	2.3 A	FELT (III) AT KENAI AND NIKISHKA,	
	29	3 56	11.6	62 26.4	147 3.6	3.1	2.7	11	7	244	144	0.60	5.4	2.2 C	
	29	4 20	21.4	60 25.0	141 57.8	32.88	1.1	4	0	202	49	0.14	20.3	25.0 D	
	29	7 58	57.3	61 32.2	146 29.2	20.6	2.3	26	11	87	65	0.49	0.8	1.8 A	
	29	12 58	50.8	62 56.5	150 31.1	96.8	4.3	26	3	122	167	0.25	3.6	15.9 D	
29	21 29	22.1	59 41.8	140 57.9	7.6	0.9	4	3	206	121	0.09	10.6	8.4 D		
30	7 31	27.6	60 38.0	143 31.7	0.6	1.9	14	8	65	64	0.29	1.0	2.6 B		
30	16 6	13.3	61 57.0	149 24.3	29.1	1.6	10	8	206	59	0.30	3.1	3.9 B		
30	17 1	15.9	61 22.2	149 57.0	36.7	2.7	17	4	102	50	0.22	1.6	3.2 B		
30	18 37	20.5	62 58.6	148 11.1	0.5	3.2	19	4	262	162	0.26	7.5	4.4 C		
30	18 46	22.8	59 53.7	141 14.8	12.0	0.7	3	3	187	31	0.12	3.2	4.7 B		
31	7 0	8.3	60 33.5	142 34.1	20.7	1.2	9	4	114	65	0.26	3.8	5.8 C		
31	15 2	26.2	60 35.4	142 47.8	12.7	1.7	9	6	85	56	0.41	1.5	1.4 A		
31	15 54	30.0	59 56.1	139 52.5	15.2	1.2	4	3	172	40	0.48	8.8	8.6 C		
31	17 28	40.0	61 27.8	146 21.0	22.3	2.5	26	12	77	46	0.54	1.0	1.5 A		
31	21 9	58.2	60 8.1	141 7.3	0.2	2.2	18	8	129	29	0.50	1.2	2.2 A		
31	22 34	58.0	60 9.2	140 39.5	19.4	1.4	9	6	149	45	0.19	4.2	1.2 B		
FEB	1 4	34	17.7	59 50.3	153 29.1	135.5	4.2	20	7	84	56	0.38	2.5	3.1 B	
	1 5 44	6.6	60 40.7	143 2.6	15.0	1.6	4	3	166	57	0.40	10.3	13.5 D		
	1 19 42	1.8	60 1.9	141 11.9	12.9	1.6	10	7	112	48	0.38	1.5	1.1 A		
1	21 8	18.4	60 4.9	141 7.2	27.0	1.4	4	3	145	126	0.58	3.4	2.8 B		
2	21 49	4.0	61 58.2	149 5.9	30.1	3.2	8	2	221	71	0.22	4.1	7.6 C		
3	12 12	51.9	59 57.7	141 5.2	12.7	1.4	4	2	227	58	0.10	7.3	4.1 C		
4	5 0	36.1	62 14.0	150 58.3	68.5	3.7	24	1	101	87	0.27	3.6	5.1 C		
4	7 30	12.1	61 37.0	141 42.1	30.58*	2.2	4	1	299	144	0.05	25.0	25.0 D		
4	8 14	41.4	60 4.3	141 13.8	0.1	1.4	5	4	208	54	0.31	8.3	7.3 C		
4	8 53	51.2	59 33.9	139 6.2	17.8	1.4	3	1	182	88	0.03	25.0	8.9 D		
4	9 25	27.7	60 12.2	140 42.2	19.0	2.1	9	2	160	60	0.28	3.5	1.4 B		
4	9 55	29.8	60 37.8	141 9.1	8.3	2.1	12	2	187	79	0.23	2.5	2.9 B		
5	14 19	19.5	61 42.5	141 50.0	1.8	2.3	5	4	251	175	0.38	5.6	4.6 C		

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS DEG	GAP KM	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
FEB 5 23 47	10.1	61 25.5	146 51.5	17.8	2.4	19	6	87	51	0.48	1.1	1.3 A	
7 14 0	32.5	60 25.5	147 36.6	3.3	2.8	22	6	103	97	0.49	1.1	1.4 A	
7 16 36	34.2	59 50.5	141 18.3	14.8	1.7	9	5	186	63	0.39	2.5	1.3 B	
7 18 39	12.9	59 58.1	140 55.3	10.6	1.3	5	3	180	120	0.16	5.1	3.6 C	
7 18 39	57.8	60 56.9	149 8.8	22.3	2.2	14	5	87	52	0.44	1.1	2.1 A	
8 3 17	55.1	61 40.9	150 21.9	40.1	3.0	23	3	139	65	0.24	1.6	3.0 B	
8 12 31	20.3	60 0.5	141 10.4	11.2	2.6	18	4	108	48	0.48	1.6	1.3 A	
8 13 59	36.6	60 0.4	141 9.0	12.6	2.1	13	5	108	49	0.53	1.4	1.1 A	
8 14 11	48.4	60 0.7	141 10.0	8.9	1.3	10	4	109	48	0.43	2.5	2.3 B	
9 6 26	46.4	60 45.9	143 14.6	0.0	1.4	4	3	241	127	0.19	4.9	6.5 C	
9 19 33	53.9	63 35.5	149 34.2	109.7	4.2	18	4	237	217	0.21	17.6	25.0 D	
9 20 36	13.1	59 59.2	141 19.5	10.7	0.9	4	2	223	61	0.20	17.4	23.5 D	
9 21 18	22.5	60 27.4	141 16.5	5.5	0.9	6	3	168	69	0.22	3.3	12.0 D	
9 21 59	9.3	60 34.1	142 58.1	12.9	1.2	5	1	132	62	0.13	11.0	9.5 D	
9 22 11	5.5	60 29.6	141 13.3	2.1	1.9	10	6	175	68	0.37	1.5	3.0 B	
10 0 56	4.7	60 6.5	141 26.6	9.9	1.1	9	2	137	33	0.24	3.4	2.8 B	
10 5 8	46.6	61 48.5	149 11.0	3.3	2.5	23	7	159	45	0.70	1.3	1.2 A	
10 5 33	13.0	60 19.0	143 3.5	0.9	1.5	9	6	142	73	0.44	1.7	2.8 B	
10 13 18	44.9	62 8.3	148 37.3	27.5	3.5	26	6	104	81	0.32	2.4	1.9 A	
11 5 36	7.5	60 17.4	139 42.0	2.3	1.7	8	2	214	71	0.25	12.5	15.1 D	
11 13 39	35.8	63 5.8	149 57.6	82.2	3.8	23	4	213	166	0.35	7.0	13.3 D	
11 19 57	50.4	60 15.3	138 45.2	18.3	1.8	4	1	251	90	0.15	14.4	25.0 D	
11 20 22	27.6	60 37.5	143 10.8	0.5	1.3	8	3	144	65	0.45	1.1	3.2 B	
11 22 54	25.2	60 36.3	143 10.1	11.68	1.4	5	2	156	66	0.19	13.6	18.7 D	
12 0 2	45.8	60 19.2	143 7.0	0.9	2.1	10	5	175	68	0.52	2.0	2.4 A	
12 8 56	39.8	59 16.6	152 22.8	71.8	4.5	21	0	95	129	0.24	2.6	6.5 C	FELT (II) AT HOMER, KODIAK, KING SALMON, AND ENGLISH BAY
12 12 21	35.6	60 5.9	141 8.8	6.1	1.9	9	5	156	50	0.70	2.4	1.8 A	
12 12 54	43.1	59 45.6	139 13.4	10.2	1.7	5	1	197	40	0.08	3.7	4.4 B	
12 13 38	55.7	59 14.6	139 26.2	19.5	2.2	8	4	245	79	0.17	8.2	7.8 C	
13 1 16	55.3	59 41.2	153 40.7	130.2	4.9	19	1	81	82	0.25	2.7	5.2 C	
13 8 36	0.9	61 39.1	141 43.0	6.8	2.1	6	1	250	144	0.27	10.4	7.3 D	
13 12 14	1.1	59 47.2	139 28.2	8.8	2.1	10	6	163	50	0.41	3.9	1.9 B	
13 17 59	9.2	59 43.9	139 26.3	12.3	0.7	3	2	176	45	0.00	18.8	10.4 D	
13 19 57	28.1	60 5.9	141 1.2	19.2	1.2	5	5	154	103	0.27	5.8	3.0 C	
13 22 28	12.8	60 21.1	141 10.7	14.5	1.5	7	5	159	59	0.31	2.0	1.6 A	
14 4 41	19.0	60 14.6	140 40.1	18.7	1.3	6	5	172	61	0.13	4.8	1.9 B	
14 9 35	4.7	60 26.2	141 10.6	17.5	0.9	3	2	170	92	0.22	25.0	25.0 D	
14 9 42	12.2	60 29.5	141 9.5	0.2	1.0	6	4	178	66	0.19	1.3	6.8 C	
14 9 54	9.4	60 28.9	141 9.2	1.6	1.4	9	5	177	66	0.30	1.6	3.6 B	
14 12 53	6.2	60 28.1	141 10.4	14.4	1.2	6	3	174	65	0.19	2.5	3.9 B	
14 14 30	39.5	63 19.3	147 22.0	0.1	3.3	21	5	264	213	0.34	25.0	25.0 D	
14 15 10	4.0	60 0.1	141 36.9	13.8	2.1	11	4	163	41	0.46	1.9	1.2 A	
14 22 22	48.0	59 58.5	141 18.8	11.5	0.9	6	1	145	60	0.23	4.8	4.2 B	
15 10 19	30.1	60 40.9	146 55.3	14.1	2.7	24	11	141	59	0.50	1.1	1.1 A	
15 14 42	5.2	60 1.6	138 9.7	10.3	2.2	7	3	276	82	0.41	6.6	3.7 C	

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN TIME			LAT N	LONG W	DEPTH	MAG	NP	NS	GAP	D3	RMS	FRH	ERZ Q	REMARKS
	HR	MN	SEC	DEG MIN	DEG MIN	KM			DEG	KM	SEC	KM	KM		
FEB 16	6 33	21.0	59 40.9	139 20.0	5.4	1.4	5	1	163	36	0.11	3.4	2.6	B	
16 14 25	27.3	60 22.0	143 5.2	4.9	2.0	10	8	150	74	0.41	1.4	1.6	A		
16 14 35	53.0	60 17.7	143 8.8	0.2	1.4	5	4	196	94	0.19	2.1	6.5	C		
16 14 52	44.6	59 39.5	145 45.1	10.1	3.8	29	2	148	99	0.47	1.5	1.6	A		
16 20 53	51.7	61 23.2	145 1.6	38.2	3.5	32	1	83	65	0.28	1.4	3.3	B		
16 22 19	21.6	60 8.2	141 9.0	15.5	1.7	7	5	153	50	0.36	2.8	1.3	B		
17 2 38	4.8	59 58.4	141 21.9	7.1	1.2	5	3	225	63	0.10	4.1	4.8	B		
17 10 43	2.0	61 14.2	143 30.8	15.0	1.1	5	4	145	86	0.29	25.0	13.7	D		
17 10 57	57.0	59 30.8	138 36.3	10.5	1.8	4	3	296	75	0.22	4.9	2.2	B		
17 12 9	20.6	59 31.6	138 34.7	9.3	2.0	6	2	295	75	0.13	4.7	2.1	B		
17 18 6	53.7	60 43.5	147 23.2	7.1	2.4	24	12	135	55	0.49	0.9	0.9	A		
17 21 48	2.9	60 2.2	141 11.0	11.8	1.2	4	2	191	128	0.16	4.6	1.7	B		
18 14 27	24.4	60 29.2	143 20.9	0.2	1.7	9	6	181	82	0.28	1.4	2.1	A		
18 15 53	10.8	59 21.1	138 32.2	15.5	1.6	5	1	341	90	0.10	25.0	3.6	D		
18 17 58	57.9	60 0.5	141 20.2	5.3	1.5	7	4	186	61	0.24	2.6	2.1	B		
18 23 33	41.6	60 51.6	143 45.3	0.9	2.1	7	5	132	79	0.59	1.3	2.5	A		
19 3 32	57.2	60 28.8	139 30.9	2.6	2.7	7	2	228	114	0.47	6.4	5.6	C		
19 5 24	48.2	60 53.9	150 54.8	10.6	2.7	21	3	55	64	0.55	0.9	2.4	A		
19 6 4	0.2	60 21.7	143 2.1	1.0	2.1	6	4	208	84	0.43	3.1	3.8	B		
19 20 11	32.4	61 19.4	140 38.6	0.5	2.5	5	1	285	154	0.50	8.1	3.3	C		
21 4 36	46.3	60 41.8	143 29.3	0.2	1.6	7	6	156	73	0.31	1.3	2.9	B		
21 5 31	25.0	62 50.8	152 43.6	1.4	3.9	14	1	133	199	0.64	5.4	4.0	C		
21 6 8	22.2	60 20.2	142 57.8	5.4	1.5	6	3	150	85	0.51	2.1	1.8	A		
21 14 57	15.7	61 35.8	143 53.2	15.2	1.4	3	2	320	140	0.11	7.9	2.6	C		
22 6 8	12.1	60 10.2	141 6.6	11.7	1.4	9	2	140	87	0.33	5.6	3.8	C		
22 8 35	18.6	60 19.7	143 12.5	1.5	1.7	8	4	183	81	0.38	2.1	4.0	B		
22 11 29	8.8	60 35.4	142 48.4	14.8	1.8	8	4	112	56	0.27	1.7	1.6	A		
22 17 2	44.2	60 26.9	143 32.9	0.2	1.6	7	6	185	93	0.32	2.1	3.3	B		
22 20 44	55.9	59 52.4	141 18.2	7.3	1.7	9	5	197	63	0.44	2.7	2.7	B		
22 22 34	54.9	59 59.7	141 34.7	8.8	1.6	8	5	194	75	0.25	2.8	2.1	B		
22 22 40	59.3	60 0.0	141 12.4	12.8	2.6	14	3	107	50	0.37	1.9	1.2	A		
22 23 23	38.9	59 50.6	141 17.0	6.8	1.5	6	1	244	64	0.26	11.3	5.2	D		
23 2 22	38.8	60 20.7	143 0.3	4.4	1.4	7	2	156	85	0.23	2.7	3.5	B		
23 6 35	41.0	59 57.1	141 18.1	0.1	1.2	7	2	212	60	0.40	4.6	5.8	C		
23 6 47	11.5	60 12.2	141 3.2	11.1	1.4	8	4	142	46	0.30	3.3	2.6	B		
23 8 1	2.5	60 12.0	140 45.6	17.2	1.6	8	3	155	57	0.32	4.4	2.3	B		
23 8 43	44.8	61 32.0	141 11.2	0.7	1.7	4	3	257	151	0.26	5.1	3.5	C		
23 9 56	28.8	61 30.3	141 12.3	0.3	1.6	4	3	255	147	0.08	5.7	7.3	C		
23 15 3	1.3	59 27.5	140 50.3	1.6*	2.2	4	1	245	85	0.49	5.6	25.0	D		
23 23 29	15.7	60 20.1	140 27.3	3.28	1.0	4	2	210	129	0.41	3.9	7.0	C		
24 2 35	50.3	60 47.5	138 24.7	1.08	2.6	9	3	266	136	0.28	5.9	3.9	C		
24 6 55	13.2	61 40.3	141 47.8	3.58	1.7	3	3	306	148	0.05	2.9	6.2	C		
24 7 45	13.5	60 35.7	150 46.4	7.2	2.6	21	5	73	79	0.58	1.1	1.5	A		
24 17 52	39.7	60 30.7	143 6.5	2.7	1.5	6	5	148	72	0.22	1.5	3.0	B		
24 18 45	28.4	60 39.5	141 9.3	7.0	1.0	7	4	194	77	0.27	3.7	6.2	C		

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME DEG MIN	LAT N LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
FEB 24	19 31	55.2	60 9.3	140 51.3	17.3	0.9	4	2	143	128	0.09	8.4	3.5 C
	20 17	17.0	60 17.0	140 43.5	16.9	1.1	5	3	175	119	0.18	7.4	3.8 C
25	7 20	49.9	60 18.2	141 31.7	5.98	2.0	11	6	137	50	0.56	1.0	2.1 A
25	15 27	47.9	60 14.8	139 31.4	0.0	1.6	8	5	218	96	0.29	4.1	3.7 B
26	4 17	34.5	60 1.8	140 33.8	13.8	1.4	5	3	166	115	0.15	3.0	1.8 B
	10 52	39.9	60 5.3	152 51.5	110.8	3.8	22	3	72	90	0.23	1.9	4.8 B
26	11 9	28.5	61 33.6	147 20.4	15.6	2.8	26	8	108	62	0.56	1.1	1.1 A
26	13 27	54.2	60 0.3	141 14.6	14.3	1.2	6	3	122	49	0.31	1.9	1.3 A
26	14 49	54.2	59 50.1	139 30.8	0.9	1.3	5	2	165	56	0.10	3.8	5.0 C
26	15 53	39.7	60 23.3	141 13.5	13.4	1.0	5	4	207	63	0.08	3.4	2.5 B
	16 14	50.2	60 8.2	141 17.2	17.0	1.9	9	4	125	36	0.41	1.8	1.1 A
26	21 16	46.0	61 9.4	147 37.7	24.5	2.5	25	9	90	70	0.61	1.3	1.3 A
27	11 37	18.0	60 30.2	143 8.6	2.3	1.4	5	3	186	74	0.30	1.9	3.2 B
27	19 9	48.3	60 2.1	141 30.7	15.6	1.5	9	3	144	39	0.40	2.1	1.9 A
27	19 10	35.3	59 59.8	141 13.4	11.5	1.5	10	7	106	50	0.53	1.6	1.7 A
	19 33	23.7	60 52.7	140 52.2	10.28*	1.3	3	2	236	93	0.00	10.1	25.0 D
27	20 32	22.2	59 59.4	141 24.8	21.0	1.1	3	3	209	66	0.03	5.4	5.2 C
28	7 32	8.9	60 14.4	140 57.8	15.9	1.9	7	3	153	45	0.33	2.1	1.6 A
28	11 47	2.8	60 9.0	141 4.6	20.2	1.6	5	4	147	46	0.16	11.0	9.4 D
28	14 6	35.9	60 11.2	141 7.7	14.9	1.4	5	4	155	49	0.26	3.0	2.3 B
MAR 1	8 44	4.6	61 19.4	147 37.8	20.3	2.3	25	12	76	66	0.54	1.1	1.5 A
	18 50	25.8	60 36.0	142 43.4	9.4	2.2	15	10	89	60	0.69	1.3	1.8 A
28	20 40	47.2	60 34.6	142 44.5	15.4	1.4	4	3	164	56	0.11	5.1	4.0 C
	8 51	7.4	60 23.4	142 52.2	6.4	2.0	13	9	90	62	0.36	0.8	1.2 A
	12 45	44.9	61 24.5	146 50.0	24.5	2.5	22	9	85	77	0.45	1.1	1.4 A
	12 50	31.7	61 41.5	149 36.0	30.3	2.6	21	6	148	50	0.41	1.3	1.8 A
1	13 3	45.5	60 9.0	141 36.8	5.3	1.1	7	3	178	68	0.20	1.2	2.7 B
1	16 17	26.2	60 38.5	143 9.8	0.5	1.6	5	4	178	63	0.35	1.2	7.3 C
1	22 52	4.7	61 50.6	141 17.1	0.5	2.2	6	5	263	177	0.19	2.8	2.4 B
2	4 14	31.5	61 10.9	141 26.6	1.5	2.3	8	7	229	112	0.39	2.1	6.0 C
	13 34	38.6	60 1.3	148 56.1	0.0	2.7	21	8	154	90	0.40	2.0	1.4 A
3	3 20	43.4	61 15.0	141 25.8	0.0	2.7	11	5	228	118	0.51	3.1	2.1 B
3	3 52	11.1	61 29.3	141 20.6	3.0	2.2	6	4	251	132	0.38	3.1	2.6 B
3	5 52	59.8	60 10.7	141 4.8	1.6	1.7	9	5	157	98	0.28	1.4	3.5 B
4	4 23	12.0	63 15.0	150 25.3	116.3	4.5	11	3	218	193	0.31	13.6	25.0 D
	12 29	10.0	60 13.7	140 57.2	11.1	2.3	10	3	162	46	0.61	2.0	1.5 A
4	16 38	20.3	60 31.0	141 13.4	12.9	1.2	6	4	227	90	0.22	2.9	2.8 B
4	18 6	4.8	62 41.7	148 3.3	11.7	2.5	7	5	251	150	0.31	7.9	5.7 C
5	6 1	37.8	59 57.3	141 9.3	36.9	1.0	3	3	134	53	0.11	3.9	4.5 B
5	13 51	24.4	60 2.8	153 24.6	147.1	3.9	21	5	71	81	0.29	2.3	3.0 B
	20 19	24.0	61 55.3	140 48.3	33.7*	1.4	4	2	280	197	0.04	16.2	25.0 D
5	23 43	28.3	61 25.8	143 10.5	19.68	0.5	3	2	222	146	0.11	10.2	8.3 D
6	0 49	5.7	60 31.7	142 10.4	5.5	2.3	9	2	124	57	0.52	1.2	2.0 A
6	1 57	19.2	60 8.8	141 36.0	13.8	2.5	14	5	117	69	0.38	1.6	1.3 A
6	4 52	57.5	60 17.3	139 47.3	1.5	1.3	5	5	235	106	0.19	4.1	4.5 B

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME DEG MIN	LAT N LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
MAR 6 11 21	42.9	60 4.9	141 6.3	5.8	1.3	3	3	264	97	0.07	5.2	12.0 D	
6 20 47	27.9	58 57.3	154 22.7	122.1	3.8	12	3	175	69	0.22	2.9	4.0 B	
7 6 1	59.4	61 32.2	146 35.1	20.0	2.6	22	9	91	67	0.50	1.1	1.4 A	
7 13 25	36.9	61 41.2	146 53.8	8.7	2.4	21	8	119	69	0.57	0.9	1.1 A	
8 1 55	40.6	59 16.5	145 4.8	10.6	1.9	10	7	281	147	0.38	5.4	2.2 C	
8 9 13	52.5	60 4.7	141 3.8	16.8	1.1	5	2	169	107	0.09	13.2	5.9 D	
8 21 47	40.3	60 20.9	140 34.0	12.1	1.3	8	8	188	65	0.31	2.7	1.5 B	
9 2 15	47.7	60 13.7	140 47.9	17.8	1.4	10	6	159	55	0.30	2.1	1.1 A	
10 2 34	33.3	60 47.2	153 41.6	0.68	3.7	20	1	80	176	0.56	1.6	8.8 C	
10 2 34	38.9	60 41.1	153 28.3	33.0	#	6	0	247	255	0.13	25.0	25.0 D	
10 5 50	36.3	60 5.0	141 23.8	9.6	1.7	11	8	115	37	0.53	1.3	1.2 A	
10 12 9	34.3	60 24.8	141 8.3	13.4	1.3	8	6	170	60	0.35	3.0	1.7 B	
10 12 21	59.9	60 24.3	141 9.1	8.6	1.2	6	3	181	94	0.18	5.9	6.6 C	
10 13 10	59.5	60 26.1	141 8.8	7.2	1.4	7	2	172	62	0.27	1.8	5.8 C	
10 17 29	18.0	59 58.5	139 12.0	0.7	1.1	5	3	238	61	0.17	4.0	5.3 C	
10 20 22	2.5	61 57.5	148 48.8	13.7	2.7	18	8	172	64	0.44	1.8	1.1 A	
10 22 6	57.2	59 53.9	139 51.8	2.0	1.1	4	1	177	177	0.10	13.4	4.5 D	
11 21 32	57.7	60 34.6	141 26.5	17.7	2.6	22	10	169	78	0.41	1.3	1.5 A	
11 22 4	25.3	61 19.2	147 6.8	12.9	2.2	23	13	80	67	0.48	1.0	0.8 A	
12 3 15	19.9	61 31.3	150 39.4	51.7	3.6	22	3	132	81	0.34	2.4	4.7 B	
12 10 46	0.6	60 35.3	142 44.5	16.1	1.3	4	4	163	54	0.12	4.7	3.7 B	
12 10 47	2.3	60 5.2	141 3.7	22.78	1.0	4	2	198	107	0.14	16.6	5.6 D	
12 11 44	22.3	60 8.8	141 15.9	15.8	1.6	6	3	150	94	0.11	3.7	1.9 B	
12 15 31	31.8	60 17.6	140 45.3	16.2	1.1	4	2	210	117	0.09	11.7	7.8 D	
12 16 3	31.3	60 2.5	139 27.0	12.1	0.5	3	3	236	73	0.11	12.1	10.9 D	
12 16 54	9.5	61 3.2	147 11.7	15.0*	2.4	24	12	104	84	0.48	1.2	1.1 A	
12 19 27	44.3	60 17.6	140 11.2	7.8	1.4	8	1	197	86	0.31	9.3	6.2 C	
12 20 49	7.3	60 16.2	140 11.4	0.0	1.3	7	3	198	87	0.21	5.3	5.9 C	
12 21 10	0.4	59 58.2	139 31.0	0.4	1.6	8	1	201	44	0.31	3.8	4.5 B	
13 4 45	38.0	61 37.7	147 52.4	0.1	2.1	17	9	110	67	0.54	1.3	2.1 A	
13 5 35	35.0	61 30.9	146 22.4	27.38	2.8	19	8	84	52	0.50	1.0	1.3 A	
14 0 29	47.4	60 4.0	141 19.3	1.0	1.5	6	2	210	59	0.12	9.0	15.9 D	
14 7 26	51.3	61 52.5	149 9.0	28.6	2.6	21	10	165	46	0.31	1.6	2.2 A	
14 20 27	51.4	60 8.9	141 15.3	14.4	1.1	6	2	149	56	0.10	3.1	1.8 B	
15 3 22	58.2	60 16.3	140 51.3	17.2	1.7	6	3	164	110	0.37	2.5	1.5 B	
15 3 26	25.9	61 40.3	149 41.5	31.2	2.4	17	10	146	48	0.38	1.4	1.6 A	
15 20 40	42.6	61 22.3	144 4.2	15.3	1.8	5	4	143	100	0.33	2.0	1.1 A	
16 13 59	50.4	61 19.3	147 17.0	15.1	2.3	23	11	80	63	0.45	1.3	1.0 A	
16 18 47	46.3	61 31.2	150 3.2	37.8	2.7	20	6	89	40	0.37	1.2	2.8 B	
16 20 20	44.2	60 1.7	145 34.5	12.0	2.6	21	10	189	127	0.49	2.0	1.4 A	
16 22 7	25.8	60 37.1	141 10.6	10.4	1.9	8	6	191	77	0.39	1.1	1.7 A	
17 1 5	38.8	60 49.2	143 50.2	0.5	2.1	6	7	161	85	0.51	1.0	3.1 B	
17 3 32	40.9	60 34.9	141 27.2	20.7	1.2	7	6	173	70	0.20	1.6	4.6 B	
17 9 8	23.9	60 40.7	142 59.2	7.2	1.5	5	3	128	56	0.41	1.6	10.3 D	
17 17 40	32.5	60 32.8	142 59.9	0.1	1.6	6	1	136	65	0.30	2.3	4.0 B	

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
MAR 18	4 22	32.2	60 11.6	141 20.3	13.0	1.3	4	2	134	88	0.24	5.5	4.0 C
18	21 26	39.8	62 27.9	150 50.8	67.6	3.7	22	3	143	112	0.33	3.0	6.9 C
19	3 37	5.6	63 46.3	147 29.1	1.68	3.8	18	3	108	127	0.71	1.8	3.8 B
19	18 14	52.7	60 18.8	140 49.5	17.8	1.9	9	7	173	53	0.30	1.6	1.4 A
19	20 42	18.0	60 58.6	146 58.8	16.0	2.5	19	12	102	82	0.40	1.1	1.3 A
19	20 44	22.2	60 37.2	143 5.4	3.78	1.2	4	2	125	72	0.29	4.2	25.0 D
20	3 33	27.3	59 15.8	138 21.0	7.3	2.0	5	2	341	142	0.16	19.8	4.2 D
20	3 59	4.9	60 3.8	153 26.9	172.38	5.1	20	0	81	123	0.33	2.6	8.5 C
20	7 46	10.7	60 36.4	142 50.6	41.8	1.6	3	3	151	91	0.38	6.3	16.6 D
20	8 15	38.6	59 47.7	153 17.3	139.1	4.6	18	1	71	100	0.24	2.4	6.8 C
													FEELT (II) IN HOMER, AND (I) IN ANCHORAGE
													FEELT (III) AT SOLDOTNA, AND (II) AT HOMER AND KENAI
20	23 14	51.8	60 20.6	141 10.0	17.6	2.5	13	7	157	52	0.44	1.2	1.0 A
21	7 6	22.0	60 9.8	140 59.6	10.6	1.7	6	1	166	102	0.11	4.7	3.4 B
21	7 13	45.2	60 34.6	143 26.9	1.58	1.7	5	2	165	79	0.19	4.0	17.2 D
21	7 15	47.2	60 5.7	141 4.0	11.4	1.5	4	2	186	106	0.37	20.4	24.0 D
22	4 45	16.5	61 49.6	140 37.2	15.08*	1.7	3	2	324	283	0.26	25.0	25.0 D
22	8 35	59.2	60 9.2	141 1.3	14.1	1.2	7	5	145	46	0.31	6.4	2.9 C
22	13 31	49.7	60 9.5	139 40.4	13.9	0.8	4	2	252	57	0.13	12.7	4.9 D
22	20 19	21.1	60 17.7	140 51.1	11.8	1.8	13	6	168	50	0.50	2.1	1.4 A
23	0 53	20.9	62 21.9	148 5.3	16.9	2.8	22	13	210	104	0.47	2.2	1.6 A
23	8 0	4.7	60 2.1	141 11.3	11.4	1.2	6	4	164	52	0.14	7.7	3.8 C
23	8 56	22.8	60 5.2	141 8.0	11.1	1.5	10	7	150	49	0.44	2.7	1.7 B
23	12 5	33.5	59 59.0	145 32.1	13.3	2.5	17	9	194	64	0.36	2.2	1.1 A
23	13 7	32.2	59 53.8	141 33.5	14.4	1.7	12	7	161	53	0.49	1.9	1.4 A
23	16 52	35.4	60 22.8	142 21.9	5.5	2.1	19	8	92	34	0.46	1.0	1.3 A
23	20 0	0.4	60 2.3	141 43.1	17.6	1.4	6	6	161	36	0.34	2.1	1.5 A
23	23 39	36.0	62 14.4	149 31.0	43.9	3.0	21	9	200	79	0.35	2.5	3.7 B
24	2 47	42.5	62 10.3	148 42.3	19.6	2.6	20	15	191	85	0.49	1.6	1.4 A
24	4 39	43.3	60 36.2	143 52.1	3.5	1.5	9	5	108	74	0.48	2.2	2.8 B
24	6 31	53.5	60 0.2	140 30.5	20.0	1.3	6	2	143	56	0.26	5.2	8.4 C
24	8 32	46.3	60 8.6	141 24.8	11.5	1.7	13	4	122	31	0.41	1.5	1.4 A
24	10 32	43.3	60 33.1	141 10.8	10.2	1.8	8	6	184	72	0.25	1.9	3.0 B
24	17 28	41.1	60 14.2	141 2.1	10.9	1.5	9	7	149	42	0.37	1.8	2.5 B
24	17 32	13.8	60 14.2	140 59.3	12.1	1.9	9	5	151	44	0.41	1.5	1.5 A
24	18 42	12.6	60 22.8	142 21.8	7.2	1.9	19	5	92	34	0.49	1.0	1.4 A
25	2 39	19.4	60 13.7	141 0.0	13.8	1.6	11	6	149	44	0.58	1.7	1.7 A
25	18 13	55.2	60 27.7	142 58.8	0.8	1.5	9	5	80	53	0.64	1.7	3.3 B
25	20 51	53.7	60 11.4	140 54.3	8.5	1.5	7	3	146	39	0.19	2.4	6.3 C
26	0 30	2.3	60 28.2	142 55.9	0.2	1.6	8	4	79	53	0.64	1.3	2.7 B
26	15 35	29.6	60 29.2	147 23.3	13.3	2.5	21	5	96	92	0.38	1.9	2.2 A
26	19 23	4.2	62 9.5	142 32.5	3.88	1.6	3	3	288	193	0.44	4.3	4.1 B
26	19 24	1.5	60 19.9	139 27.7	3.1	1.9	9	4	224	103	0.44	5.9	4.4 C
26	19 29	38.3	60 14.5	139 37.9	3.4	1.2	5	1	237	103	0.07	15.2	9.8 D
26	20 22	6.7	59 57.1	141 7.1	10.08	0.8	3	2	204	138	0.14	13.9	18.0 D
27	9 7	23.7	61 22.1	146 49.9	16.5	1.9	13	7	81	82	0.45	1.8	1.5 A
27	10 18	19.2	62 50.1	149 42.7	5.4	2.9	12	3	202	135	0.37	6.4	6.9 C

SOUTHERN ALASKA EARTHQUAKE CATALOG (CONTINUED)

1978	ORIGIN HR MN SEC	TIME	LAT N DEG MIN	LONG W DEG MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D3 KM	RMS SEC	ERH KM	ERZ Q KM	REMARKS
MAR 28	4 23	8.1	60 9.9	138 7.2	0.3	2.1	4	0	291	90	0.11	25.0	25.0 D	
28	17 5	11.7	61 41.7	151 52.3	96.1	3.2	13	6	138	106	0.31	3.6	3.4 B	
29	19 3	11.7	60 11.3	139 26.7	7.5	1.9	6	3	218	129	0.13	10.1	7.8 D	
29	20 16	11.6	60 18.4	142 27.4	1.7	1.2	6	4	104	27	0.38	1.2	6.1 C	
30	7 29	55.7	63 12.9	147 6.0	18.9	3.1	10	2	297	201	0.30	22.0	20.6 D	
30	7 38	60.0	62 16.6	151 10.1	72.6	3.6	22	7	168	97	0.41	2.6	4.1 B	
30	15 23	7.2	60 48.5	146 52.1	13.5	2.7	14	10	126	136	0.40	1.6	1.8 A	
31	0 19	8.5	60 21.9	152 35.9	107.4	3.9	22	2	63	96	0.24	2.0	3.9 B	
31	0 38	14.8	61 41.4	151 14.6	80.3	4.7	27	3	105	71	0.27	2.3	3.5 B	FELT (IV) IN TALKEETNA AND
31	7 36	38.2	60 18.0	141 3.1	12.9	1.1	4	2	197	101	0.07	9.5	8.9 C	ANCHORAGE, (III) IN PALMER AND KENAI, AND (II) IN HOMER
31	9 28	15.2	61 56.2	149 27.6	26.3	2.8	19	7	171	61	0.42	2.0	4.8 B	
31	22 15	32.0	59 56.6	141 2.3	2.9	1.3	5	3	185	47	0.06	5.6	11.7 D	

THE MAGNITUDE OF THIS EARTHQUAKE COULD NOT BE DETERMINED BECAUSE THE CODAS OVERLAPPED WITH THOSE OF THE PREVIOUS EVENT.

ADDITIONAL SOUTHERN ALASKA EARTHQUAKES, JAN-MAR 1978

1978	ORIGIN	TIME	LAT N	LONG W	DEPTH	MAG	NP	NS	GAP	D3	RMS	ERH	ERZ	Q
		HR MN SEC	DEG MIN	DEG MIN	KM			DEG	KM	SEC	KM	KM	KM	
JAN	3 18 50	10.4	59° 0.4'	136 53.8	17.2	2.4	4	3	349	186	0.27	67.7	72.5	D
	11 23 27	18.7	59 39.1	137 42.8	0.4	2.9	6	2	322	151	0.20	14.6	7.5	D
	14 18 26	57.0	58 2.0	136 49.8	15.0	3.8	4	0	349	302	0.12	99.0	99.0	D
	17 21 15	13.6	58 16.8	136 37.3	14.5	3.0	4	3	357	253	1.05	99.0	72.7	D
FEB	12 12 47	13.1	58 42.6	136 28.1	18.4	2.9	4	3	353	226	0.34	67.6	72.4	D
MAR	17 15 8	32.9	58 49.9	137 44.2	5.4	2.4	3	2	358	201	0.17	98.9	5.0	D
	2 14 41	38.2	55 55.6	158 24.3	101.8	5.4	21	1	308	447	0.32	14.3	89.8	D
	4 10 23	11.6	56 43.1	152 26.8	48.5	4.9	21	1	273	297	0.47	28.4	12.0	D
	4 20 21	4.4	59 12.9	137 12.9	8.0	2.9	9	3	345	158	0.30	28.8	7.6	D
	8 20 51	52.1	58 52.2	137 37.1	4.3	2.3	3	1	359	202	0.02	99.0	2.9	D
	22 17 11	54.0	58 50.9	136 51.1	33.0	2.8	4	3	352	199	0.26	36.1	98.9	D
	23 3 18	6.5	58 57.1	136 29.4	31.8	3.0	4	3	350	209	0.28	52.3	84.9	D

USGS LIBRARY-RESTON



3 1818 00073168 5

