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**INFORMATION CIRCULAR 72**

# COMPILATION OF EARTHQUAKE HYPOCENTERS IN WESTERN WASHINGTON - 1978

By

LINDA LAWRANCE NOSON

and

ROBERT S. CROSSON

1980

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# COMPILATION OF EARTHQUAKE HYPOCENTERS IN WESTERN WASHINGTON - 1978

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## SUMMARY

The Geophysics Program at the University of Washington operates a continuously recording, telemetered seismograph network located west of the Cascade Mountains and centered along the Puget Sound Lowland. Station locations (fig. 1) have been chosen to best record earthquakes in the lower Puget Sound basin, an area of historically high seismicity. This report is the seventh in an annual series designed to provide a standardized compilation of earthquake locations, determined by using network data. Locations for 367 earthquakes recorded in 1978 are listed in Appendix I. Machine plotted maps show the distribution of epicenters by magnitude (fig. 2) and depth (fig. 4). Figure 3 shows the distribution of epicenters for events greater than magnitude 2.8.

The number of events successfully located each year depends on numerous factors: The number of stations operating, location of earthquakes relative to recording stations, earthquake magnitude, experience of personnel handling data, and of course, the number of earthquakes that occur in the area monitored. Ignoring the inherent variability of the data set may lead to incorrect interpretations. When used carefully, the data in this report may enhance evaluations of seismic hazard potential, as well as contribute to basic studies in seismology, earth structure, and tectonics.

## INTRODUCTION

The seismograph network operated by the University of Washington consists of 21 short-period telemetered seismograph stations and one on-site recording World Wide Standard Station at Longmire, Washington (LON). Stations extend from Mount St. Helens (SHW) at 46° N. latitude north to Mount Baker (MBW) at 49° N. latitude, an area approximately 300 km N-S by 150 km E-W. Each station (except LON) consists of a single component vertical short-period seismome-

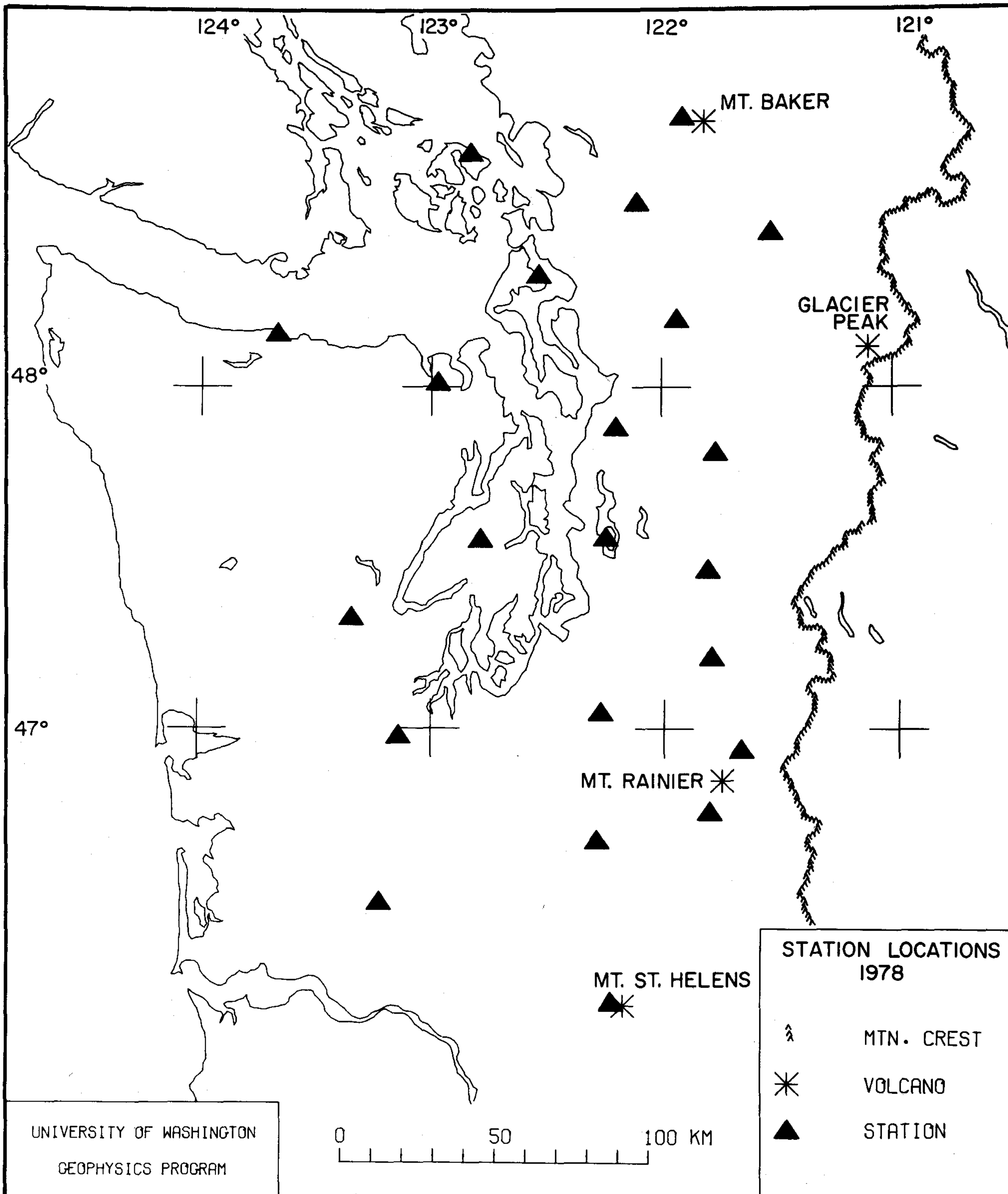


FIGURE 1.—Location map for stations operating in 1978.

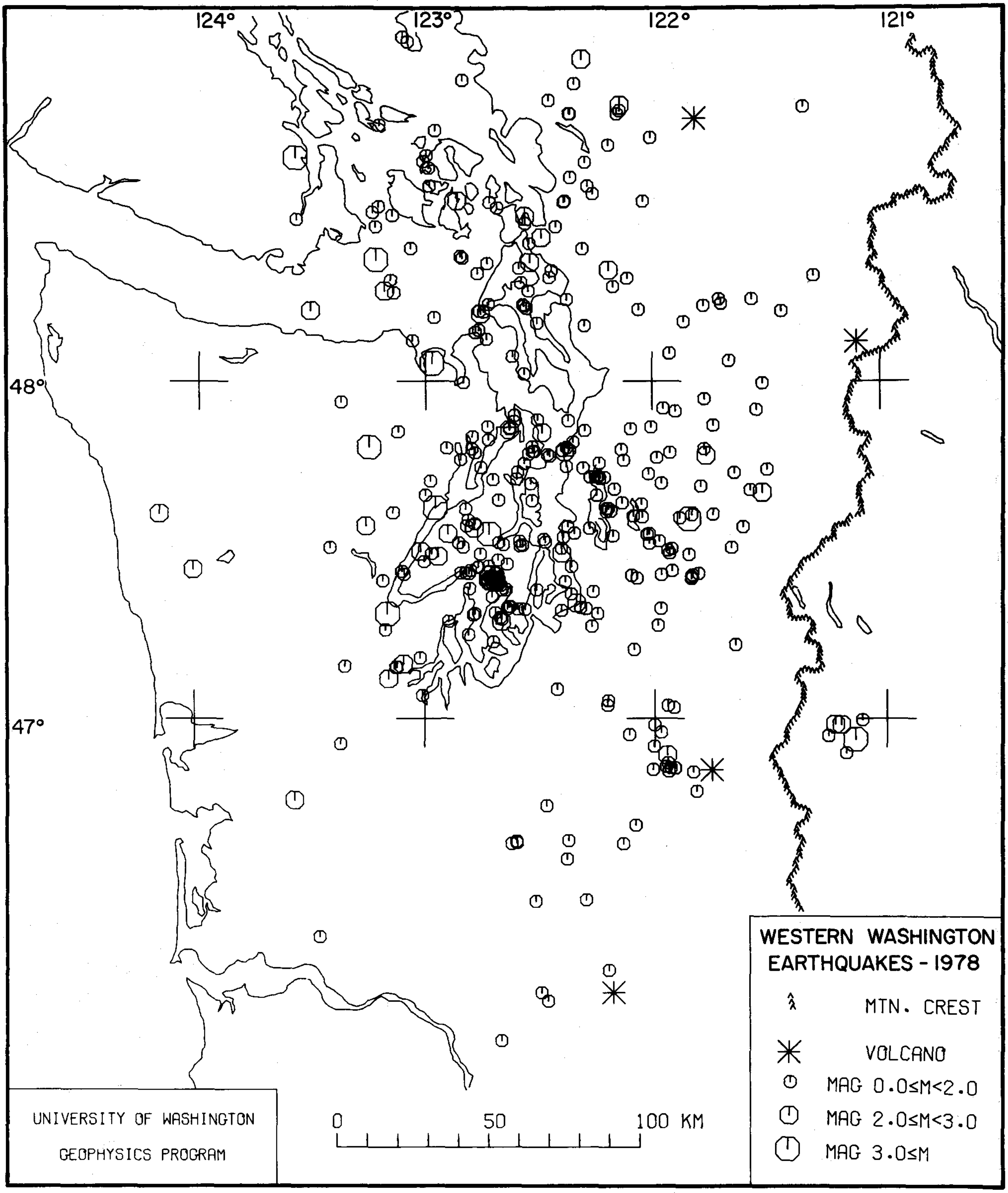


FIGURE 2.—Map showing epicenters for 1978 by magnitude.

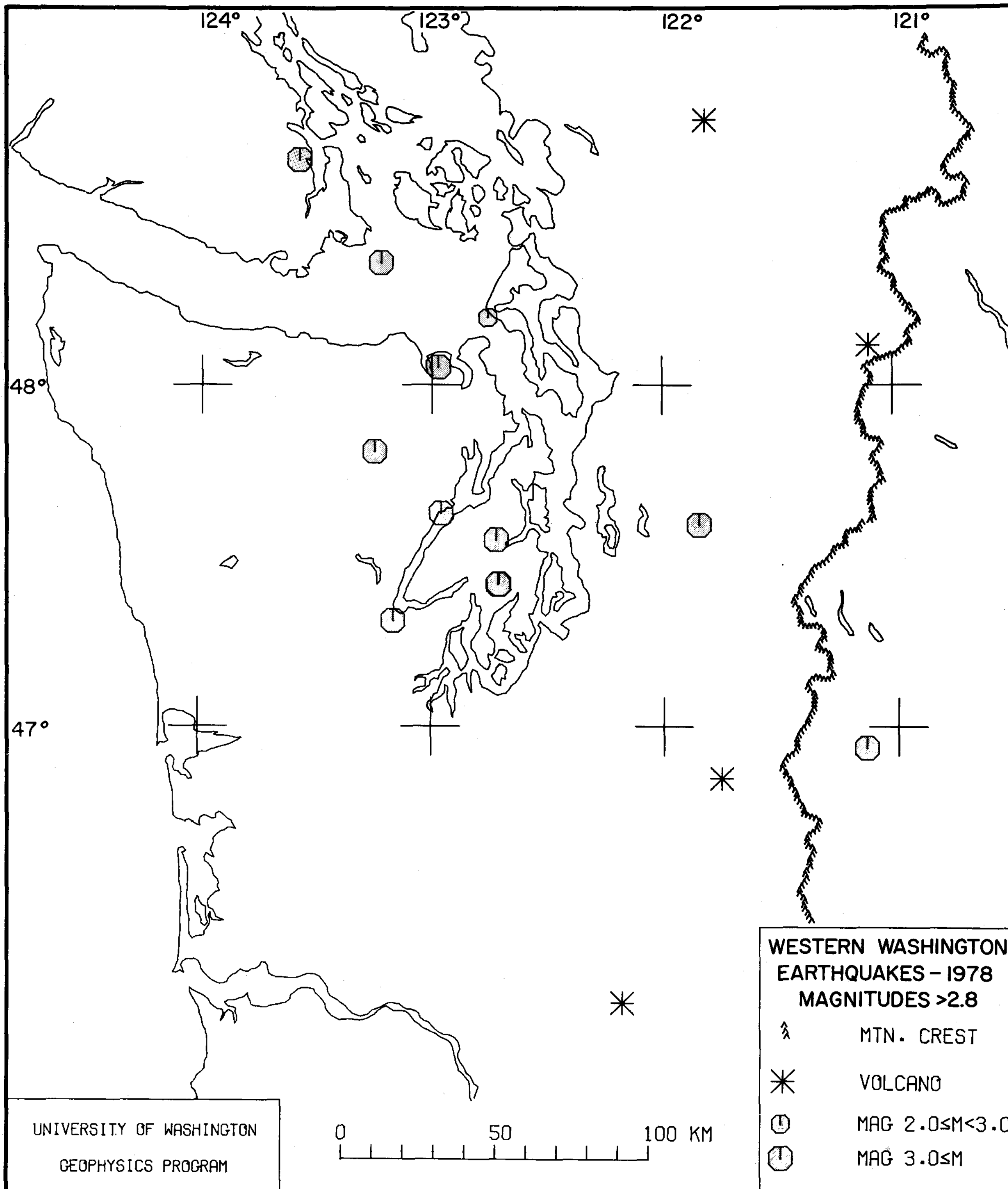


FIGURE 3.—Map showing epicenters for events greater than 2.8 magnitude.

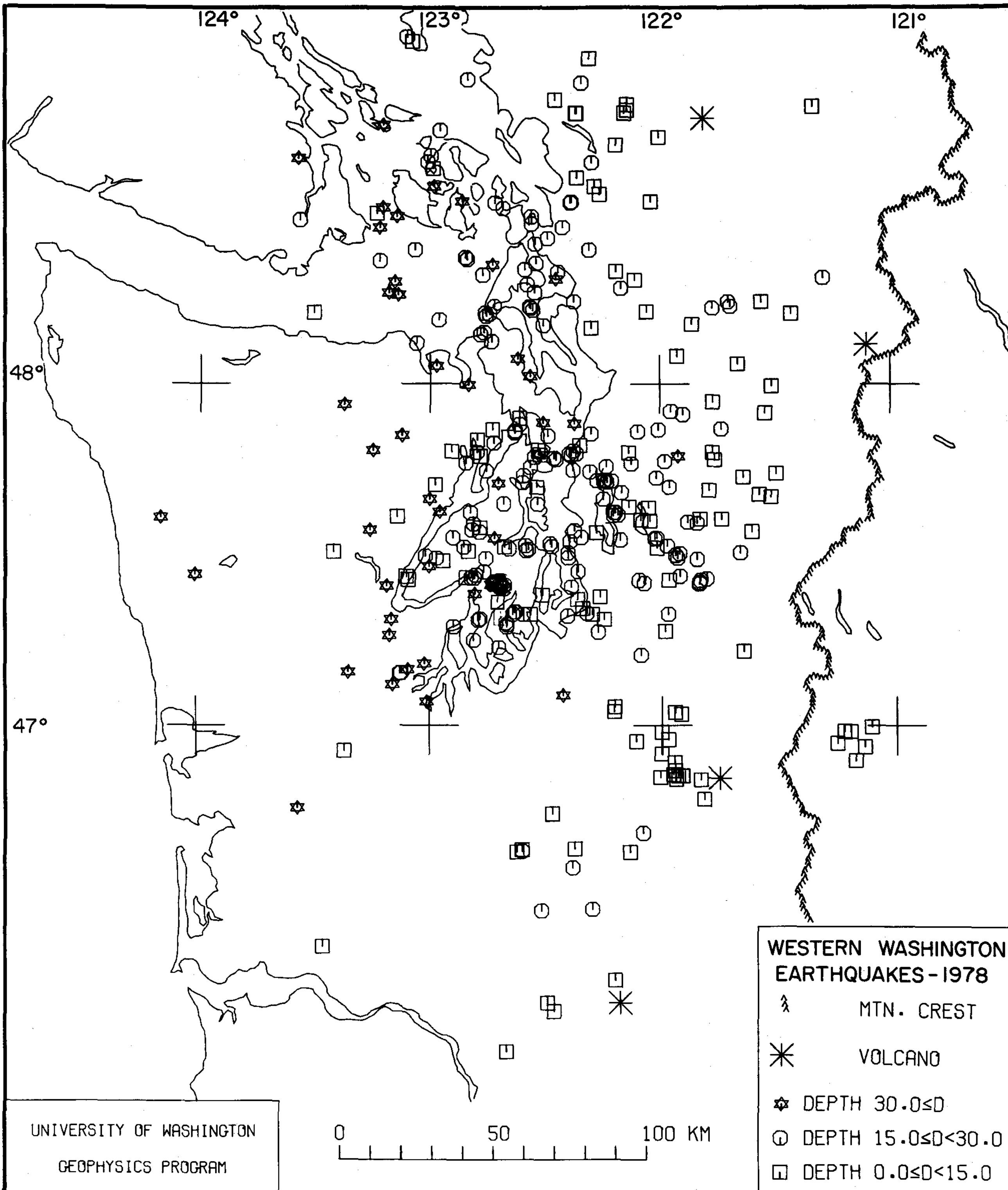


FIGURE 4.—Map showing epicenters for 1978 by depth (in kilometers).

ter, an amplifier and a voltage-controlled oscillator, which converts the output voltage from each amplifier to a frequency modulated audio tone capable of being telemetered to the central recording laboratory at the University of Washington. The first report in this series (Crosson, 1974) contains a description of network instrumentation, background information, a glossary of terms, and a compilation of earthquake data for 1970, 1971, and 1972. In this report, we provide revised and updated information on instrumentation and analysis procedures. Table 1 of the second report (Crosson, 1975) shows the revised crustal velocity structure used in the determination of earthquake locations compiled since 1973. Details of the method used to determine this velocity structure can be found in a separate publication (Crosson, 1976a, 1976b). Station delays, which are also determined with the model, are reported in the second report and repeated here in table 1. This table provides a summary of network station information, including station coordinates, elevations, P-time corrections (P-delays), and installation dates. Stations added since the second report have provisional delays. Compilations of hypocenter locations for events recorded in 1974, 1975, 1976, and 1977 may be found in Crosson and Millard (1975), Crosson and Noson (1978a), Crosson and Noson (1978b), and Crosson and Noson (1979). Information for larger historic earthquakes in Washington State from 1840 to

TABLE 1.— *Summary of network station data*

**List of NEIS abbreviated stations in western Washington**

| Sta. Name | LAT Deg | LAT Mn | LAT Sec | LON Deg | LON Mn | LON Sec | ELEV Km | P DEL Sec | INSTALL Date | MAG* 1 Hz | LOCATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPW | 047 | 33 | 13.30 | 122 | 14 | 45.10 | 0.008 | 1.029 | 9/17/69 | 65000 | SEWARD PARK |
| GMW | 047 | 32 | 52.50 | 122 | 47 | 10.80 | 0.506 | 0.100 | 2/27/70 | 145000 | GOLD MT |
| GSM | 047 | 12 | 11.40 | 121 | 47 | 40.20 | 1.305 | 0.399 | 6/11/70 | 165000 | GRASS MT |
| BLN | 048 | 00 | 26.50 | 122 | 58 | 18.64 | 0.585 | -.137 | 7/2/70 | 115000 | BLYN MT |
| CPW | 046 | 58 | 25.80 | 123 | 08 | 10.80 | 0.792 | 0.241 | 7/29/70 | 135000 | CAPITOL PEAK |
| RMW | 047 | 27 | 34.95 | 121 | 48 | 19.20 | 1.024 | 0.385 | 7/27/71 | 190000 | RATTLESNAKE MT |
| JCW | 048 | 11 | 36.60 | 121 | 55 | 46.20 | 0.616 | -.033 | 2/18/71 | 120000 | JIM CREEK |
| FMW | 046 | 55 | 54.00 | 121 | 40 | 19.20 | 1.890 | 0.246 | 9/4/72 | 100000 | MT FREMONT |
| BFW | 046 | 29 | 12.00 | 123 | 12 | 53.40 | 0.902 | 0.113 | 10/25/72 | 150000 | BAW FAW MT |
| SHW | 046 | 11 | 33.00 | 122 | 14 | 12.00 | 1.423 | 0.319 | 10/25/72 | 45000 | MT ST. HELENS |
| MCW | 048 | 40 | 46.80 | 122 | 49 | 56.40 | 0.693 | 0.125 | 11/8/72 | 70000 | MT CONSTIT |
| MBW | 048 | 47 | 02.40 | 121 | 53 | 58.80 | 1.676 | 0.433 | 11/8/72 | | MT BAKER |
| STW | 048 | 09 | 0.75 | 123 | 40 | 12.00 | 0.308 | 0.009 | 6/27/73 | | STRIPED PEAK |
| LON | 046 | 45 | 00.00 | 121 | 48 | 36.00 | 0.853 | 0.011 | | 60000 | LONGMIRE |
| HTW | 047 | 48 | 12.50 | 121 | 46 | 08.65 | 0.829 | 0.000# | 6/11/75 | | HAYSTACK |
| LMW | 046 | 40 | 04.80 | 122 | 17 | 28.80 | 1.195 | | 6/30/75 | | LADD MT |
| SMW | 047 | 19 | 10.20 | 123 | 20 | 30.00 | 0.840 | 0.200# | 3/24/75 | | SOUTH MT |
| LYW | 048 | 32 | 07.20 | 122 | 06 | 06.00 | 0.107 | | 4/18/75 | | LYMAN |
| OHW | 048 | 19 | 24.00 | 122 | 31 | 54.60 | 0.054 | -.100# | 5/27/75 | | OAK HARBOR |
| FTW | 047 | 52 | 36.00 | 122 | 12 | 05.00 | 0.147 | | 9/24/75 | | FAIRMONT |
| GHW | 047 | 02 | 30.00 | 122 | 16 | 21.00 | 0.268 | | 9/24/75 | | GARRISON HILL |
| RPW | 048 | 26 | 54.00 | 121 | 30 | 49.00 | 0.850 | | 12/1/77 | | ROCKPORT |

# Provisional station P delay
* Magnification at 1 Hz; not determined where blank

1965 was compiled by Rasmussen (1967).

Since no new stations were added to the network in 1978, the network configuration was essentially uniform throughout the year. Inevitable failure does occur in the operation of some stations, which affects the uniformity of station coverage. A station activity graph (fig. 5) shows the major gaps in station operation in order to indicate approximately where such failure may affect the data in this report.

The basic information for this series is contained in Appendix I. The Appendix listing is a direct copy of a machine listing. Appendix II lists corrected information for six earthquakes whose magnitudes were reported incorrectly in the compilation of hypocenters for 1977 (Crosson and Noson, 1979). These errors resulted from data entry. To assess the accuracy and consistency of past magnitude determinations, we are reviewing film records of earthquakes recorded from 1975 to the present.

## EARTHQUAKE ANALYSIS PROCEDURE

A Geotech Develocorder with film speed of 15 mm/min records signals received onto sixteen millimeter film. The film is then scanned on a Develocorder viewer with a magnification of X 20. Events detected are classified into the following categories: teleseisms (greater than 1000 km distant), regionals (less than 1000 km, with an S wave to P wave time generally greater than 10.0 seconds) and local events (nominally within the network perimeter). Each 300 foot reel of film represents 96 hours of recording time during which, typically, a total of 30 or more events are detected. All events are classified and entered into a master catalog.

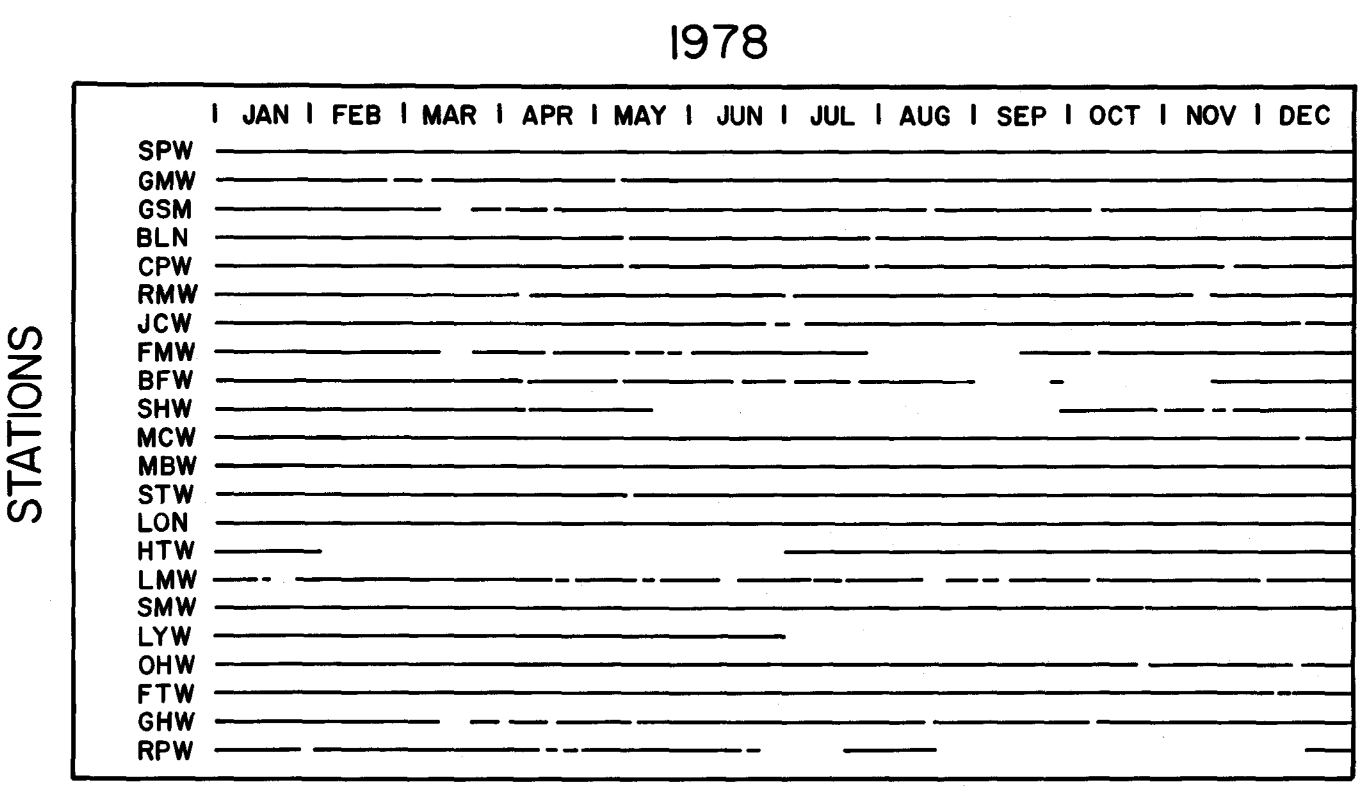


FIGURE 5.—Station activity graph.

Local earthquakes large enough to be well recorded on three or more stations are prepared for computer location runs. Usually, six or fewer local events will be successfully located during each four-day interval.

The location program, based on the standard nonlinear least squares inversion scheme of Geiger (1912), was especially written for use with data from the western Washington array. The accuracy of the locations determined with this program depends on the crustal model, station distribution and quality of the arrival time data. The main data set consists of P wave arrival times, coda lengths, and a weighting factor for each reading. S wave arrivals are used as supplementary data where necessary. Using the crustal model developed by Crosson (1976a, 1976b) and the current station distribution (fig. 1), hypocenter parameters are generated until the observed minus predicted arrival times (residuals) are a minimum. The quality of the data can then be estimated by examining the residuals for each event. Higher quality and quantity of data generally produces more reliable locations. The standard deviation (SD) of residuals for each earthquake is tabulated in the Appendix I. Although there are many possible indicators of solution quality, the standard deviation is an easily understood and useful one. An SD less than 0.1 second indicates a solution that fits the observed arrival-time data very well. A value greater than 0.5 usually indicates a poor solution. Events with an SD greater than 0.5 are usually removed from the data set. Earthquakes recorded on three or four stations theoretically always have an SD of zero. Since there is no measure of error, these events are removed unless they have very clear P-arrivals, locations within the perimeter of the network, and are recorded at stations distributed around the estimated hypocenter.

Explosions are removed from the data set wherever possible. Criteria useful in distinguishing explosions are: Shallow depths, positive P wave polarity, size, clustering, time of the day of occurrence, coda frequency, and of course, direct verification. When explosions occur in unusual locations and are nonrepetitive, positive identification is difficult. Suspected or possible explosions that are not subject to reasonable verification are indicated in the Appendix by a symbol ($). In particular, explosion contamination may be present in data recorded in the southern part of the network. All events from this area since 1970 are currently being reviewed.

Magnitudes of earthquakes are determined using a coda or signal duration technique. The method used is presented by Crosson (1972).

## SIGNIFICANT EVENTS

During 1978, a total of 367 earthquakes were successfully located. Depending upon the location with respect to population centers and the depth of origin, most events with a magnitude greater than approximately 2.8 were felt. Ten of twelve 1978 events with magnitudes greater than 2.8 caused ground motion large enough to be detected by people living near the epicenter. These events are flagged in Appendix I by an asterisk (*). No structural damage was reported to have resulted from any of these earthquakes. Three events during the year had magnitudes greater than 4.0. The largest (m = 4.6) occurred on March 11, 1978 with an epicenter 4 km southwest of Port Orchard. Figures 2 and 4 show that this was an area of high seismicity during 1978 due to aftershock activity related to the event. Sixty-five earthquakes were located within a 10 km radius of the epicenter. A more detailed study of this earthquake is in preparation. A second felt event with a magnitude of 4.0 occurred in approximately the same location on March 31. Both of these events were felt widely in the Puget Sound area. A third earthquake (m = 4.0) occurred near Fall City on December 31. During 1978, six events were located within 10 km of this epicenter.

## ACKNOWLEDGMENTS

The cooperation of many people and organizations is necessary to complete these reports. Although individual acknowledgment is impossible, we want to stress our appreciation to those involved. The contributions of the following merit special recognition. Laurens Engel provided major technical support and fulfilled the demanding task, often in adverse conditions, of network operation and maintenance. Access to lands and facilities for the purpose of station installation has been generously provided by the State Department of Natural Resources, U.S. Forest Service, State Parks Commission, Weyerhauser Company, U.S. Navy, U.S. National Park Service, and the City of Seattle Parks Department. The U.S. Geological Survey provided support for radio telemetering operations. Research support has been provided by the U.S. Geological Survey under contracts #14-08-0001-15896 and #14-08-0001-16723.

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## APPENDIX I

### CATALOG OF EARTHQUAKES (1978)

Earthquakes located with the western Washington seismograph network are listed chronologically in this Appendix. The columns are generally self-explanatory except the following features should be noted:

(a) The origin time listed is that calculated for the earthquake on the basis of multistation arrival times. It is given in Coordinated Universal Time (UTC), which is identical to Greenwich Civil Time, in hours (HR), minutes (MN), and seconds (SEC). To convert to Pacific Standard Time (PST), subtract eight hours.

(b) The epicenter location is given in north latitude (LAT N) and west longitude (LONG W) in degrees, minutes, and seconds.

(c) In most cases the depths, which are given in kilometers, are freely calculated by computer from the arrival-time data. In some instances, depths must be fixed arbitrarily to obtain epicenter solutions. Such depths are noted by an F (fixed) in the column immediately following the depth.

(d) The residual standard deviation (SD) is taken about the mean of the station first-arrival residuals. It is only meaningful as a general statistical measure of the goodness of the solution when 5 or more stations are used in the solution. Good solutions are normally characterized by SD values less than about 0.4.

(e) NO is the number of station observations used in calculating the earthquake location. Three observations at minimum are required and generally the greater the number of observations used, the better the solution quality.

(f) MAG is the local Richter magnitude as calculated using the coda length—magnitude relationship determined for western Washington. Where blank, data were insufficient or impossible to obtain for a reliable magnitude determination. Normally, the only earthquakes with undetermined magnitudes are those with very small magnitudes.

(g) SDMAG is the magnitude standard deviation. Where blank, either no magnitude was calculated or only one station observation was used to determine the magnitude.

(h) Felt earthquakes as determined by the University of Washington, various news and other agencies, are designated by a star (*) following the listing.

(i) Possible, but unverified, explosions are designated by a ($) following the listing.

## APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JAN | 2 | 10 | 49 | 28.9 | 47-59-39 | 121-30-54 | 5.9 | 0.0 | 4 | 1.1 | .2 | |
| | 2 | 14 | 22 | 21.3 | 47-38-16 | 122- 8-13 | 4.4 | .2 | 7 | 1.4 | .3 | |
| | 4 | 17 | 51 | 44.7 | 45-48-53 | 122-34- 7 | 8.1 | .3 | 5 | 1.7 | .1 | $ |
| | 5 | 15 | 9 | 4.3 | 47-34-13 | 123-15-36 | 44.5 | .1 | 15 | 2.4 | .2 | |
| | 7 | 4 | 14 | 25.4 | 47-47-35 | 122-23-47 | 21.4 | .1 | 6 | 1.4 | .5 | |
| | 9 | 16 | 38 | 16.5 | 47-32-23 | 122-10-36 | 24.2 | .1 | 7 | 1.4 | .3 | |
| | 10 | 16 | 47 | 58.4 | 48-55-59 | 122-18-23 | .7 | .2 | 7 | 2.7 | .2 | |
| | 11 | 9 | 14 | 21.4 | 47-42-24 | 122-42-14 | 53.1 | .2 | 20 | 2.0 | .4 | |
| | 13 | 1 | 42 | 17.5 | 47-44-34 | 122-45-26 | 27.8 | .0 | 5 | 1.0 | .5 | |
| | 16 | 19 | 10 | 3.3 | 46-45-29 | 123-33-44 | 39.5 | .3 | 19 | 2.6 | .4 | $ |
| | 18 | 10 | 33 | 31.4 | 47-15-30 | 121-59- 2 | 14.3 | .2 | 6 | 1.3 | .2 | |
| | 19 | 6 | 46 | 36.2 | 47-51-30 | 122- 5-52 | 22.3 | .1 | 6 | 1.7 | .1 | |
| | 22 | 16 | 47 | 13.8 | 47-29-12 | 122-45-36 | 16.5 | .1 | 9 | 1.3 | .4 | |
| | 23 | 9 | 14 | 59.9 | 47-46-37 | 122-27-13 | 15.2 | .1 | 7 | .7 | .2 | |
| | 24 | 7 | 10 | 48.5 | 48-45-22 | 123-12-47 | 53.8 | .1 | 7 | 1.3 | .4 | |
| | 24 | 8 | 9 | 14.0 | 46- 9-48 | 122-28- 6 | 7.4 | .1 | 9 | 1.5 | .2 | |
| | 25 | 12 | 52 | 53.7 | 47-30- 6 | 121-55-16 | 21.7 | .0 | 6 | .8 | .3 | |
| | 25 | 14 | 3 | 27.6 | 47-25-52 | 122-46-10 | 23.3 | .1 | 6 | 1.0 | .4 | |
| | 26 | 2 | 7 | 55.7 | 47-51-20 | 122-37-52 | 22.7 | .2 | 19 | 2.3 | .4 | |
| | 26 | 7 | 9 | 53.0 | 47- 7- 7 | 123- 9-25 | 47.6 | .2 | 12 | 2.0 | .2 | |
| | 27 | 13 | 56 | 24.4 | 47-25-27 | 121-49-55 | 18.7 | .3 | 12 | 1.5 | .4 | |
| | 29 | 13 | 14 | 38.2 | 47-25-29 | 124- 0-58 | 38.5 | .2 | 18 | 2.8 | .3 | $ |
| FEB | 1 | 11 | 39 | 24.0 | 46-37-46 | 122- 8-30 | 2.7 | .2 | 10 | 1.6 | .1 | |
| | 3 | 12 | 9 | 30.4 | 47-31- 4 | 122- 1- 7 | 12.2 | .1 | 7 | 1.3 | .1 | |
| | 3 | 19 | 30 | 41.4 | 47- 3-11 | 122-12- 8 | 5.1 | .2 | 13 | 1.6 | .3 | |
| | 5 | 16 | 37 | 45.7 | 48-41-50 | 122-11-16 | 14.7 | .2 | 9 | 1.4 | .4 | |
| | 5 | 22 | 7 | 58.4 | 47-31-28 | 121-58-28 | 19.1 | .2 | 14 | 1.9 | .4 | |
| | 9 | 11 | 14 | 37.9 | 47-33-50 | 122-47-10 | 23.3 | .2 | 17 | 2.0 | .2 | |
| | 10 | 14 | 9 | 16.1 | 47-48-15 | 123-14-49 | 43.7 | .2 | 20 | 3.1 | .3 | * |
| | 11 | 5 | 3 | 43.9 | 48-13-22 | 121-46-17 | 16.6 | .3 | 9 | 1.7 | .3 | |
| | 11 | 6 | 12 | 13.2 | 47-27- 4 | 122-43-27 | 20.9 | .1 | 5 | .6 | .5 | |
| | 12 | 10 | 16 | 11.7 | 48-21- 2 | 122-32-25 | 20.9 | .3 | 15 | 2.2 | .3 | |
| | 12 | 17 | 58 | 36.9 | 47-30-54 | 122-39-27 | 21.9 | .1 | 6 | 1.2 | .4 | |
| | 14 | 22 | 19 | 4.4 | 47-13-36 | 122-42- 6 | 17.5 | .2 | 5 | 1.2 | .1 | |
| | 15 | 10 | 42 | 6.5 | 47-39-40 | 123- 0- 5 | 47.0 | .1 | 6 | 1.0 | .3 | |
| | 22 | 18 | 52 | 40.4 | 48- 4-53 | 121-55-27 | 5.1 | .4 | 7 | 1.1 | .5 | $ |
| | 23 | 4 | 46 | 42.7 | 47-35-45 | 122- 2-52 | 6.1 | .3 | 6 | 1.0 | .2 | |
| | 24 | 21 | 38 | 2.4 | 47-25-30 | 121-58- 3 | 5.2 | .3 | 7 | 1.6 | .3 | |
| | 26 | 14 | 0 | 34.4 | 47-42-48 | 122-12-49 | 20.5 | .4 | 5 | 1.4 | .3 | |
| | 26 | 21 | 48 | 18.6 | 47-29-20 | 122-24-10 | 18.6 | .1 | 18 | 2.1 | .3 | |
| | 27 | 6 | 9 | 23.7 | 48-13-26 | 122-34-10 | 17.5 | .3 | 8 | 1.2 | .4 | |
| | 27 | 7 | 12 | 28.2 | 46-35- 4 | 122-23- 5 | 20.4 | .1 | 7 | 1.6 | .4 | |
| | 27 | 10 | 28 | 53.4 | 48-12-49 | 122-33-21 | 16.5 | .3 | 9 | 1.4 | .2 | |
| | 27 | 11 | 47 | 12.8 | 47-47-22 | 122-23-14 | 16.7 | .2 | 14 | 2.1 | .3 | |
| | 27 | 16 | 47 | 26.9 | 48-13-13 | 122-33-56 | 16.7 | .0 | 7 | 1.3 | .1 | |
| | 28 | 3 | 46 | 11.4 | 47-35-27 | 124- 9-60 | 36.4 | .2 | 7 | 2.0 | .2 | $ |
| | 28 | 10 | 10 | 21.4 | 47-54-55 | 121-32-40 | .1 | .2 | 6 | 1.6 | .3 | |
| MAR | 2 | 5 | 41 | 27.9 | 48- 1-14 | 122-33-52 | 52.1 | .0 | 6 | 1.5 | .4 | |
| | 3 | 6 | 34 | 9.2 | 46-11-17 | 122-29-45 | 1.0F | .3 | 6 | 1.8 | 0.0 | $ |
| | 3 | 8 | 58 | 53.8 | 47-51- 9 | 122-18- 0 | 20.3 | .3 | 8 | 1.6 | .3 | |
| | 3 | 10 | 42 | 25.9 | 46- 2-42 | 122-40-10 | .7 | .2 | 5 | 1.9 | .1 | $ |
| | 4 | 7 | 53 | 52.0 | 47-42-31 | 122-35-57 | 20.9 | .2 | 13 | 1.8 | .3 | |
| | 4 | 9 | 1 | 36.4 | 47-21-37 | 122-42-24 | 11.7 | .1 | 4 | .7 | .1 | |
| | 4 | 13 | 59 | 51.0 | 47-22-52 | 122-38-44 | 25.5 | .1 | 6 | 1.4 | .3 | |
| | 5 | 18 | 13 | 36.1 | 48- 3- 6 | 122-58-22 | 56.5 | .1 | 13 | 3.4 | .2 | * |
| | 6 | 16 | 20 | 49.3 | 48- 4-20 | 122-37- 5 | 58.5 | .2 | 6 | 1.5 | .4 | |
| | 7 | 14 | 14 | 1.9 | 47-42-35 | 122-14- 2 | 19.6 | .2 | 7 | 1.5 | .3 | |
| | 11 | 1 | 13 | 29.8 | 46-47- 0 | 121-49-27 | 11.5 | .2 | 7 | 1.4 | .3 | |
| | 11 | 5 | 25 | 12.2 | 47-51-33 | 122-37-54 | 19.0 | 0.0 | 4 | .9 | .2 | |
| | 11 | 15 | 52 | 11.3 | 47-25- 4 | 122-42-31 | 24.6 | .3 | 20 | 4.6 | .1 | * |

APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAR | 11 | 16 | 31 | 9.9 | 47-25-11 | 122-40-44 | 24.6 | .2 | 5 | 1.0 | .4 | |
| | 11 | 16 | 37 | 31.9 | 48-23-25 | 122-18-25 | 15.2 | .2 | 7 | 1.4 | .3 | |
| | 11 | 16 | 49 | .2 | 47-23-54 | 122-41-42 | 22.1 | .1 | 5 | .8 | .5 | |
| | 11 | 18 | 6 | 17.6 | 47-24-24 | 122-41-35 | 23.9 | .3 | 7 | 1.5 | .3 | |
| | 11 | 19 | 40 | 48.6 | 47-24-25 | 122-42-13 | 23.2 | .2 | 14 | 1.8 | .1 | |
| | 11 | 21 | 18 | 40.8 | 47-24-31 | 122-42-10 | 22.9 | .2 | 13 | 2.2 | .1 | |
| | 12 | 1 | 22 | 14.5 | 47-24-44 | 122-41-57 | 23.0 | .1 | 6 | 1.7 | .3 | |
| | 12 | 5 | 41 | 48.3 | 47-25-16 | 122-42- 2 | 25.7 | .1 | 7 | 1.5 | .1 | |
| | 12 | 13 | 35 | 55.0 | 47-23-59 | 122-41-37 | 22.7 | .1 | 9 | 1.4 | .2 | |
| | 12 | 15 | 53 | 49.2 | 47-33-44 | 122-16-47 | 1.0F | .1 | 6 | 1.2 | .4 | $ |
| | 12 | 20 | 18 | 5.6 | 47-23-58 | 122-40-36 | 21.2 | .0 | 5 | .9 | .4 | |
| | 15 | 17 | 53 | 28.3 | 47-18-46 | 122-41-34 | 7.2 | .0 | 5 | 1.2 | .3 | |
| | 17 | 11 | 38 | 47.6 | 47-26-19 | 122-48-11 | 21.7 | .1 | 6 | 1.0 | .3 | |
| | 17 | 19 | 13 | 33.7 | 47-23-49 | 122-40-41 | 21.3 | .0 | 6 | 1.0 | .2 | |
| | 19 | 5 | 50 | 45.5 | 47-30-13 | 122-24-14 | 18.4 | .3 | 8 | 1.0 | .3 | |
| | 19 | 15 | 53 | 13.3 | 47-24-16 | 122-41-39 | 22.0 | .2 | 7 | 1.2 | .3 | |
| | 20 | 13 | 21 | 8.0 | 48-34-31 | 122-59-23 | 48.7 | .1 | 5 | 1.1 | .2 | |
| | 20 | 14 | 7 | 34.1 | 47-24-33 | 122-40-33 | 24.0 | .1 | 6 | 1.2 | .2 | |
| | 20 | 23 | 58 | 12.5 | 47-23-38 | 122-40-13 | 20.5 | .0 | 6 | .9 | .3 | |
| | 22 | 11 | 7 | 49.7 | 47-24-47 | 122-42-33 | 23.9 | .2 | 10 | 1.4 | .3 | |
| | 22 | 16 | 0 | 35.1 | 47-48- 8 | 122-22-43 | 16.5 | .2 | 10 | 1.4 | .4 | |
| | 23 | 23 | 41 | 39.6 | 47-47-55 | 122-47-48 | 20.0 | .2 | 7 | 1.3 | .5 | |
| | 25 | 6 | 26 | 32.7 | 47-24-13 | 122-42-43 | 24.0 | .2 | 8 | 1.2 | .5 | |
| | 26 | 5 | 15 | 37.9 | 48-20-49 | 122-43-50 | 51.9 | .1 | 9 | 1.2 | .2 | |
| | 26 | 6 | 51 | 4.1 | 47-30-18 | 121-39-33 | 18.9 | .3 | 6 | 1.4 | .1 | |
| | 26 | 11 | 3 | 5.4 | 47-51-54 | 122-43-41 | 9.8 | 0.0 | 4 | .8 | .6 | |
| | 27 | 4 | 48 | 11.1 | 48-24-24 | 122-32-35 | 24.9 | .2 | 12 | 1.8 | .4 | |
| | 27 | 8 | 51 | 26.9 | 46-55- 2 | 122- 0-16 | 8.0 | .1 | 5 | 1.0 | .6 | |
| | 27 | 13 | 28 | 6.0 | 47- 1-57 | 121-55- 5 | 12.7 | .2 | 8 | 1.4 | .4 | |
| | 28 | 8 | 14 | 26.5 | 47-24- 1 | 122-41-21 | 20.5 | .0 | 5 | 1.1 | .3 | |
| | 28 | 22 | 1 | 13.6 | 47-40-43 | 122-10-11 | 16.9 | .2 | 6 | 1.1 | .4 | |
| | 29 | 1 | 17 | 48.7 | 47-38-42 | 122-31-58 | 21.4 | .1 | 7 | .9 | .1 | |
| | 29 | 3 | 51 | 3.1 | 48-31-56 | 122-51-56 | 57.9 | .2 | 14 | 2.1 | .3 | |
| | 29 | 12 | 16 | 38.5 | 48-11-52 | 122-45-31 | 23.6 | .3 | 20 | 2.9 | .3 | * |
| | 29 | 14 | 26 | 45.2 | 47-27-24 | 122-38-31 | 8.2 | .1 | 5 | 1.2 | .3 | |
| | 31 | 2 | 7 | 22.5 | 47-29-51 | 121-56-19 | 20.3 | .2 | 11 | 1.3 | .4 | |
| | 31 | 8 | 3 | .1 | 47-24-57 | 122-42-48 | 23.8 | .3 | 20 | 4.0 | .1 | * |
| APR | 1 | 8 | 39 | 14.1 | 47-27-52 | 123- 0-22 | 43.6 | .4 | 6 | 1.0 | .4 | |
| | 1 | 9 | 37 | 48.6 | 48-19-58 | 122-35-21 | 22.0 | .2 | 7 | 1.2 | .4 | |
| | 2 | 22 | 18 | 34.6 | 47-32-51 | 122-54- 8 | 17.8 | .3 | 20 | 2.2 | .3 | |
| | 3 | 19 | 52 | 33.8 | 47-22-52 | 122-39-43 | 21.5 | .2 | 6 | 1.2 | .2 | |
| | 4 | 11 | 12 | 53.9 | 47-43-36 | 121-38-38 | 9.1 | .2 | 9 | 1.5 | .3 | $ |
| | 6 | 6 | 8 | 32.4 | 47-25- 8 | 122-42-37 | 23.3 | .2 | 12 | 1.8 | .3 | |
| | 6 | 12 | 59 | 28.1 | 47-25-10 | 122-43-19 | 24.6 | .2 | 9 | 1.8 | .4 | |
| | 7 | 14 | 53 | 9.4 | 46-15-15 | 122-12-27 | 8.7 | .2 | 9 | 1.5 | .2 | $ |
| | 8 | 20 | 36 | 22.6 | 48-43-11 | 121-59-59 | 2.7 | .3 | 6 | 1.6 | .3 | $ |
| | 9 | 2 | 41 | 2.3 | 46-27-32 | 122-31- 9 | 20.2 | .0 | 5 | 1.1 | .3 | |
| | 9 | 15 | 46 | 35.6 | 47-40-32 | 121-34-31 | 7.4 | .2 | 9 | 1.2 | .4 | |
| | 10 | 19 | 43 | 26.7 | 46-57-31 | 121-58-30 | 6.6 | .4 | 8 | 1.8 | .3 | |
| | 14 | 11 | 59 | 56.9 | 48-47-57 | 122- 8-14 | 7.2 | .3 | 7 | 1.9 | .2 | |
| | 16 | 11 | 10 | 54.0 | 47-37-15 | 122-49-30 | 24.3 | 0.0 | 4 | .7 | .3 | |
| | 17 | 15 | 30 | 3.7 | 47-25-48 | 122-41-45 | 22.5 | .1 | 5 | .9 | .3 | |
| | 18 | 10 | 33 | 51.1 | 47-23-44 | 122-40-56 | 19.4 | .2 | 6 | 1.0 | .3 | |
| | 19 | 3 | 32 | 37.8 | 47-25- 2 | 122-41-55 | 23.7 | .1 | 6 | 1.2 | .5 | |
| | 19 | 4 | 11 | 13.3 | 47-29-19 | 121-55-49 | 20.9 | .2 | 6 | 1.1 | .5 | |
| | 19 | 10 | 51 | 39.9 | 47-25-12 | 122-42-34 | 24.3 | .2 | 10 | 1.3 | .3 | |
| | 19 | 18 | 50 | 5.9 | 47-48- 6 | 122-54-26 | 6.6 | .1 | 5 | 1.1 | .4 | |
| | 20 | 23 | 41 | 33.8 | 48-31-39 | 122-43-15 | 26.9 | .2 | 9 | 1.0 | .4 | |
| | 22 | 7 | 42 | .1 | 46-53-51 | 121-10-33 | 10.1 | .1 | 6 | 1.6 | .5 | |
| | 24 | 23 | 47 | 28.6 | 48-30-41 | 122-41- 8 | 20.3 | .3 | 8 | 1.1 | .3 | |

APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | 25 | 8 | 46 | 49.0 | 47-53- 6 | 122-30-29 | 53.0 | .2 | 13 | 1.5 | .4 | |
| | 25 | 9 | 52 | 31.7 | 47-17-13 | 122-40- 1 | 23.6 | .2 | 18 | 2.2 | .4 | |
| | 25 | 15 | 28 | 59.0 | 48-47-27 | 122-21-54 | 2.3 | .1 | 6 | 1.4 | .3 | $ |
| | 25 | 19 | 6 | 32.6 | 48-47-23 | 122-21-41 | 3.6 | .2 | 6 | 1.3 | .2 | |
| | 26 | 12 | 26 | 20.5 | 47-24-46 | 122-42-24 | 23.6 | .1 | 8 | 1.2 | .4 | |
| | 26 | 15 | 49 | 53.2 | 47-17-56 | 122-40-14 | 29.3 | .2 | 8 | 1.2 | .3 | |
| | 26 | 21 | 50 | 10.3 | 47-24-34 | 122-41-55 | 22.0 | .1 | 6 | .9 | .1 | |
| | 26 | 22 | 0 | 18.6 | 48-38-51 | 123- 1- 1 | 15.9 | .2 | 8 | 1.4 | .3 | |
| | 27 | 2 | 14 | 51.8 | 47-17-38 | 122-39-53 | 23.3 | .3 | 13 | 1.8 | .4 | |
| | 28 | 9 | 6 | 40.4 | 47-25-22 | 122-42- 3 | 23.9 | .1 | 9 | 1.1 | .2 | |
| | 30 | 0 | 57 | 50.4 | 47-22-52 | 122-30-46 | 11.1 | .4 | 6 | .7 | .3 | |
| | 30 | 19 | 16 | 9.4 | 48-31-54 | 122- 2-10 | 1.7 | .3 | 6 | 1.7 | .3 | |
| MAY | 1 | 0 | 20 | 55.4 | 47-52- 7 | 121-44- 7 | 20.9 | .1 | 5 | 1.1 | .3 | |
| | 1 | 20 | 46 | 14.1 | 47-24-50 | 122-42-22 | 22.1 | .2 | 15 | 1.7 | .2 | |
| | 2 | 13 | 28 | 27.7 | 47-24-22 | 122-41-10 | 22.2 | .1 | 6 | .5 | .4 | |
| | 2 | 16 | 34 | 7.3 | 47-25-51 | 122-49-26 | 23.3 | .3 | 16 | 1.9 | .2 | |
| | 5 | 3 | 58 | 28.5 | 47-19-29 | 122-38-24 | 26.1 | .2 | 11 | 1.6 | .3 | |
| | 5 | 5 | 29 | 47.5 | 48-29-12 | 122-33-42 | 17.4 | .4 | 19 | 2.3 | .4 | |
| | 5 | 21 | 18 | 58.7 | 47-46-42 | 121-45-60 | 4.6 | .3 | 18 | 2.3 | .3 | |
| | 6 | 2 | 1 | 2.4 | 47-43-46 | 122-35-42 | 16.3 | .1 | 5 | .5 | .4 | |
| | 6 | 9 | 44 | 50.4 | 47-32-11 | 122-23-42 | 19.3 | .1 | 6 | .6 | .4 | |
| | 6 | 11 | 18 | 45.2 | 47-24-31 | 122-41-38 | 21.7 | .1 | 5 | .6 | .4 | |
| | 7 | 5 | 23 | 44.9 | 47-19-50 | 122-37-59 | 22.3 | .2 | 8 | .7 | .3 | |
| | 9 | 8 | 32 | 52.1 | 47-13- 2 | 121-38-53 | 1.0F | .3 | 5 | 1.2 | .2 | |
| | 9 | 18 | 22 | 2.6 | 47-25-20 | 122-41-25 | 25.8 | .1 | 12 | 2.0 | .3 | |
| | 10 | 2 | 29 | 45.1 | 47- 9-42 | 123- 5-42 | 43.3 | .3 | 19 | 2.7 | .3 | |
| | 10 | 15 | 0 | 10.1 | 47-24-45 | 122-43-42 | 23.5 | .2 | 10 | 1.5 | .4 | |
| | 10 | 17 | 19 | 36.3 | 47- 2-19 | 122-12-20 | 5.5 | .2 | 5 | 1.3 | .4 | $ |
| | 11 | 18 | 50 | 20.5 | 48-27-56 | 122-33-40 | 20.6 | .3 | 10 | 1.4 | .4 | |
| | 12 | 8 | 48 | 5.5 | 47-48-18 | 122-31-48 | 3.6 | .1 | 5 | .7 | .5 | |
| | 13 | 11 | 59 | 18.5 | 47-38- 4 | 122- 3-11 | 13.8 | .3 | 18 | 1.8 | .4 | |
| | 14 | 4 | 1 | 11.1 | 47-46-19 | 121-58-57 | 27.6 | .1 | 9 | 1.1 | .2 | |
| | 15 | 19 | 21 | 50.9 | 47-24-14 | 122-41-34 | 20.5 | .2 | 6 | 1.1 | .4 | |
| | 16 | 14 | 52 | 6.0 | 47-54-36 | 121-54- 2 | 15.5 | .2 | 14 | 1.8 | .4 | |
| | 17 | 4 | 43 | 36.3 | 48-48-54 | 122- 8-11 | 4.8 | .3 | 11 | 2.5 | .2 | |
| | 18 | 18 | 50 | 19.9 | 47-53-53 | 122-36-33 | 7.4 | .2 | 11 | 1.1 | .3 | |
| | 20 | 14 | 6 | 15.0 | 48-19-39 | 122-11-25 | 7.4 | .3 | 18 | 2.5 | .3 | |
| | 21 | 9 | 41 | 53.9 | 48-53-18 | 122-50-33 | 15.8 | .1 | 6 | 1.3 | .5 | |
| | 24 | 14 | 2 | 4.7 | 48-39-56 | 123- 0- 9 | 19.1 | .0 | 5 | 1.0 | .4 | |
| | 24 | 19 | 55 | 58.5 | 48-12-11 | 122-44-42 | 21.0 | 0.0 | 4 | .8 | .2 | |
| | 24 | 22 | 38 | 30.1 | 47-35-56 | 122- 5-13 | 13.3 | 0.0 | 6 | .7 | .4 | |
| | 24 | 23 | 18 | 37.8 | 47-31-15 | 122-40-41 | 3.4 | .2 | 5 | 1.1 | .4 | $ |
| | 25 | 3 | 43 | 38.8 | 47-56-50 | 121-46-19 | 11.1 | .1 | 5 | 1.2 | .3 | |
| | 26 | 8 | 47 | 51.4 | 48- 9-42 | 122-17-55 | 12.1 | .2 | 9 | 1.0 | .4 | |
| | 26 | 10 | 54 | 38.2 | 47-30-23 | 123-25- 3 | 6.6 | 0.0 | 4 | .6 | .1 | |
| | 26 | 15 | 46 | 55.2 | 48-19- 2 | 122-46-28 | 20.2 | .4 | 11 | 1.5 | .6 | |
| | 27 | 23 | 11 | 25.4 | 47-24-40 | 122-44- 6 | 39.2 | .1 | 6 | .8 | .2 | |
| | 29 | 23 | 28 | 48.5 | 47-25-53 | 122-50-45 | 8.6 | .3 | 5 | 1.0 | .3 | |
| | 31 | 0 | 38 | 24.2 | 47-44-15 | 121-30- 2 | 11.6 | .2 | 5 | .9 | .3 | $ |
| JUN | 1 | 3 | 52 | 26.0 | 47-14-54 | 122-48-40 | 18.7 | .1 | 6 | .6 | 0.0 | |
| | 2 | 3 | 51 | 38.1 | 47-17-18 | 122-53-51 | 19.4 | .2 | 8 | 1.2 | .3 | |
| | 2 | 5 | 16 | 4.2 | 47-34-37 | 122-47- 0 | 14.7 | .1 | 5 | .8 | .5 | |
| | 3 | 8 | 52 | 13.5 | 47-34-15 | 122-49-11 | 16.5 | .2 | 6 | .9 | .5 | |
| | 3 | 12 | 12 | 37.9 | 47-32-39 | 122- 1-39 | 17.9 | .1 | 11 | 1.1 | .3 | |
| | 4 | 2 | 32 | 22.5 | 47- 4- 6 | 123- 0-42 | 39.9 | .4 | 7 | .7 | .1 | |
| | 4 | 6 | 57 | 50.1 | 48-10-12 | 122-30-31 | 28.8 | .1 | 8 | .8 | .3 | |
| | 4 | 8 | 37 | 16.9 | 47-24-44 | 122-42-31 | 23.2 | .1 | 10 | .8 | .4 | |
| | 4 | 14 | 4 | 3.7 | 47-24- 3 | 122-40-52 | 20.7 | .2 | 6 | .7 | .4 | |
| | 4 | 20 | 33 | 41.9 | 48-31-51 | 122-23- 5 | 15.3 | .1 | 7 | 1.5 | .4 | |
| | 5 | 3 | 44 | 24.9 | 48-31-44 | 122-23-21 | 16.8 | 0.0 | 4 | .8 | .1 | |

APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | 7 | 15 | 15 | 14.2 | 47-25-22 | 122- 5-50 | 15.3 | .2 | 10 | .9 | .1 | |
| | 8 | 1 | 8 | 8.3 | 47-24-53 | 122-42- 3 | 22.6 | .1 | 6 | .8 | .1 | |
| | 10 | 10 | 46 | 43.2 | 47-24-55 | 122-42-54 | 23.7 | .1 | 9 | 1.1 | .3 | |
| | 10 | 21 | 25 | 13.6 | 47-15-46 | 123-10-19 | 42.9 | .3 | 13 | 1.9 | .3 | |
| | 11 | 1 | 34 | 5.3 | 48-27-22 | 123-13-32 | 48.7 | .1 | 7 | 1.5 | .3 | |
| | 11 | 1 | 41 | 35.4 | 47-47-14 | 121-55-27 | 30.3 | .1 | 5 | 1.1 | .3 | |
| | 11 | 2 | 43 | 57.3 | 46-58-54 | 121-11-48 | 1.0F | .3 | 14 | 2.2 | .4 | |
| | 11 | 2 | 49 | 11.0 | 47-47-56 | 121-46-28 | 9.2 | .3 | 6 | 1.5 | .2 | |
| | 11 | 3 | 18 | 47.9 | 47-36-10 | 121-49-53 | 6.7 | .3 | 5 | .9 | 0.0 | |
| | 11 | 15 | 55 | 8.1 | 46-38-15 | 122-36- 6 | 2.0 | .2 | 11 | 1.5 | 0.0 | |
| | 12 | 15 | 57 | 32.9 | 46-58-60 | 121-13-22 | 1.0F | .3 | 9 | 2.2 | .3 | |
| | 14 | 5 | 54 | 44.5 | 47-23- 4 | 122-48-24 | 31.5 | 0.0 | 4 | .8 | .3 | |
| | 16 | 3 | 3 | 31.0 | 47-19-31 | 121-58-11 | 22.3 | .2 | 12 | 1.3 | .3 | |
| | 18 | 0 | 53 | 4.3 | 48-25-27 | 122-29-19 | 28.2 | .4 | 16 | 2.2 | .3 | |
| | 20 | 8 | 45 | 24.8 | 47-46-52 | 122-27-44 | 21.2 | .1 | 8 | .8 | .3 | |
| | 20 | 14 | 40 | 20.8 | 47-32-46 | 122-43-15 | 49.6 | .2 | 16 | 3.3 | .2 | |
| | 21 | 3 | 34 | 2.1 | 47-19-26 | 122-35-44 | 15.2 | .3 | 6 | .4 | .2 | |
| | 22 | 5 | 49 | 16.0 | 48- 8-34 | 122-46-57 | 27.6 | .1 | 5 | .8 | .4 | |
| | 22 | 7 | 51 | 27.1 | 47-24-43 | 122-42-19 | 22.2 | .2 | 7 | .9 | .2 | |
| | 23 | 6 | 27 | 6.5 | 47-34- 3 | 122-22-30 | 23.4 | .1 | 8 | .9 | .5 | |
| | 25 | 8 | 58 | 2.1 | 47-26-57 | 122-21-39 | 27.0 | .2 | 7 | 1.0 | .3 | |
| | 26 | 11 | 55 | 12.7 | 47-25-42 | 121-48-20 | 20.7 | .2 | 8 | 1.1 | .4 | |
| | 27 | 2 | 19 | .3 | 46-56-15 | 121- 8-13 | 3.1 | .2 | 14 | 3.4 | .3 | * |
| | 27 | 13 | 48 | 36.4 | 48-14-22 | 122-22-37 | 23.2 | .2 | 8 | 1.2 | .2 | |
| | 28 | 13 | 20 | 8.7 | 47-31-28 | 122-35-12 | 23.0 | .1 | 6 | .8 | .2 | |
| | 29 | 18 | 50 | 6.5 | 46-56-53 | 121-15-14 | 10.0F | .2 | 6 | 1.7 | .2 | $ |
| JUL | 1 | 3 | 55 | 16.6 | 48-28-41 | 123-34-43 | 16.1 | 0.0 | 4 | .9 | 0.0 | |
| | 2 | 2 | 34 | 36.7 | 46-41- 7 | 122- 5-13 | 17.7 | .2 | 9 | 1.6 | .2 | |
| | 2 | 17 | 28 | 32.5 | 47-43-24 | 122- 1-10 | 22.8 | .1 | 6 | 1.0 | .3 | |
| | 3 | 14 | 35 | 15.5 | 47-42-48 | 122-14-53 | 21.6 | .1 | 9 | 1.0 | .2 | |
| | 4 | 13 | 27 | 54.4 | 47-26-10 | 121-55-14 | 25.3 | .2 | 7 | .8 | .3 | |
| | 5 | 6 | 10 | 37.6 | 47-55- 9 | 121-57-12 | 20.0 | .4 | 13 | 1.6 | .3 | |
| | 7 | 0 | 5 | 53.0 | 48-30-55 | 123-12-44 | 32.7 | .2 | 8 | 1.5 | .4 | |
| | 8 | 3 | 47 | 46.3 | 46-51-10 | 121-54-51 | 9.6 | .3 | 10 | 1.5 | .4 | |
| | 8 | 11 | 1 | 50.5 | 47-19-52 | 122-37-41 | 22.2 | .0 | 6 | .9 | .3 | |
| | 8 | 11 | 55 | 56.4 | 46-52- 3 | 121-56-43 | 4.7 | .2 | 10 | 1.6 | .3 | |
| | 8 | 15 | 54 | 50.1 | 47-46-60 | 122-32-48 | 19.3 | .0 | 5 | .4 | .4 | |
| | 8 | 19 | 50 | .9 | 46-51- 8 | 121-54-56 | 9.5 | .4 | 10 | 1.3 | .4 | |
| | 8 | 21 | 53 | 2.5 | 47-37-18 | 122-12- 8 | 25.1 | .1 | 8 | 1.0 | .5 | |
| | 9 | 6 | 12 | 43.1 | 47-24-51 | 122- 4-28 | 18.0 | .2 | 14 | 1.4 | .3 | |
| | 9 | 17 | 20 | 8.7 | 47-45-50 | 122- 7-41 | 20.6 | .2 | 7 | 1.1 | .1 | |
| | 13 | 5 | 25 | 43.8 | 48-29-53 | 123-14-22 | 9.1 | .2 | 5 | .9 | .3 | |
| | 14 | 5 | 3 | 41.4 | 48-33-45 | 122-17-38 | 20.5 | .2 | 9 | 1.5 | .4 | |
| | 14 | 7 | 44 | 7.2 | 47-37-16 | 122-12- 7 | 27.6 | .1 | 8 | 1.1 | .4 | |
| | 15 | 2 | 57 | 1.2 | 47-37-16 | 122-11-49 | 25.2 | .0 | 7 | .9 | .4 | |
| | 15 | 17 | 38 | 56.4 | 48-12-23 | 121-25-40 | 9.5 | .2 | 5 | 1.5 | .1 | |
| | 19 | 3 | 42 | 23.7 | 47-36-49 | 122-11- 5 | 26.3 | .1 | 6 | .7 | .2 | |
| | 19 | 13 | 17 | 9.7 | 46-58-48 | 122- 0-10 | 11.4 | .4 | 8 | 1.4 | .2 | |
| | 19 | 14 | 11 | 58.3 | 48-18-11 | 122- 6-30 | 12.7 | 0.0 | 4 | .8 | .5 | |
| | 20 | 3 | 20 | 3.1 | 47-45-19 | 122-14- 9 | 20.9 | .2 | 6 | .9 | .2 | |
| | 21 | 8 | 38 | 31.0 | 47- 9- 8 | 123- 7-19 | 17.4 | .1 | 10 | 1.3 | .1 | |
| | 21 | 8 | 38 | 51.9 | 47- 9-10 | 123- 7-34 | 16.9 | .1 | 7 | 1.3 | .3 | |
| | 21 | 18 | 40 | 15.7 | 48- 3-35 | 121-39-38 | 7.3 | .2 | 5 | 1.2 | .1 | $ |
| | 22 | 0 | 1 | 18.1 | 48-44-23 | 122-57-50 | 20.5 | .1 | 6 | 1.2 | .3 | |
| | 23 | 5 | 47 | 45.7 | 48- 7-21 | 122-44- 1 | 27.7 | .2 | 14 | 1.9 | .3 | |
| | 23 | 19 | 14 | 56.1 | 46-50-53 | 122- 0-36 | 3.2 | .3 | 13 | 1.6 | .4 | |
| | 25 | 12 | 22 | 24.0 | 48-18-43 | 121-17- 5 | 16.8 | .3 | 6 | 1.4 | .4 | |
| | 28 | 4 | 56 | 54.4 | 46-21-10 | 123-26-53 | 13.3 | .0 | 5 | 1.5 | .1 | |
| | 29 | 5 | 13 | 34.3 | 47-52-47 | 122-36-39 | 17.2 | .2 | 11 | 1.5 | .3 | |
| | 29 | 6 | 42 | 41.8 | 48-49-45 | 122-27-19 | 1.5 | .3 | 7 | 1.3 | .2 | |

APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUL | 29 | 7 | 56 | 31.9 | 47-24-28 | 123-11- 8 | 40.9 | .3 | 9 | 1.2 | .3 | |
| | 30 | 6 | 12 | 1.0 | 47- 9-18 | 123-20-56 | 31.6 | 0.0 | 4 | .8 | .1 | |
| AUG | 2 | 18 | 8 | 53.9 | 47-29- 5 | 121-50-48 | 20.7 | .2 | 11 | 1.5 | .3 | |
| | 4 | 11 | 58 | 50.1 | 46-38- 0 | 122-36- 3 | 15.3 | .1 | 10 | 1.6 | .3 | |
| | 4 | 13 | 15 | 23.6 | 46-37-51 | 122-37-24 | 8.5 | .3 | 9 | .9 | .2 | |
| | 5 | 22 | 19 | 59.2 | 47-47-13 | 122-46-56 | 8.9 | .1 | 4 | .6 | .5 | |
| | 6 | 13 | 5 | 23.2 | 48-27-24 | 122-25-28 | 16.2 | .2 | 11 | 1.4 | .4 | |
| | 7 | 20 | 37 | 3.5 | 48-14-30 | 121-42- 8 | 17.1 | .4 | 7 | 1.7 | .5 | |
| | 8 | 16 | 19 | 6.1 | 48-12-36 | 122- 3-30 | 13.8 | 0.0 | 4 | 1.0 | .2 | |
| | 9 | 1 | 49 | 6.5 | 47-44-44 | 122-22-51 | 20.7 | .3 | 5 | .8 | .1 | |
| | 10 | 22 | 51 | 57.4 | 47-32-46 | 122- 1- 6 | 18.4 | .1 | 10 | 1.1 | .4 | |
| | 11 | 22 | 54 | 15.1 | 47-25-10 | 122-43- 5 | 23.3 | .2 | 11 | 1.0 | .3 | |
| | 11 | 22 | 55 | 5.9 | 47-25- 1 | 122-42-51 | 23.6 | .2 | 14 | 1.6 | .4 | |
| | 13 | 6 | 46 | 30.7 | 47-31-48 | 122-28-49 | 19.2 | .1 | 15 | 1.7 | .4 | |
| | 17 | 7 | 5 | 9.0 | 47-40- 8 | 121-31-23 | 8.7 | .3 | 15 | 2.3 | .2 | |
| | 17 | 14 | 58 | 24.8 | 47-47-46 | 122- 8-16 | 1.0F | .5 | 6 | 1.1 | .4 | |
| | 19 | 1 | 51 | 18.3 | 48-39-34 | 123-35-15 | 53.9 | .2 | 17 | 3.9 | .2 | * |
| | 19 | 11 | 25 | 8.2 | 48-37-41 | 122-59-34 | 14.6 | .2 | 7 | 1.2 | .5 | |
| | 23 | 10 | 37 | 18.5 | 48-21-29 | 123-13-24 | 20.9 | .4 | 17 | 3.6 | .2 | |
| | 24 | 0 | 20 | 15.9 | 47-47-28 | 122-31-20 | 5.2 | .1 | 5 | .8 | .2 | |
| | 26 | 10 | 11 | 59.4 | 48-48-39 | 121-19-10 | 1.3 | .2 | 8 | 1.9 | .2 | |
| | 26 | 17 | 39 | 42.9 | 48- 8-56 | 122-46- 3 | 25.5 | .2 | 10 | 1.3 | .2 | |
| | 27 | 0 | 59 | 28.6 | 47-45-15 | 122-33-53 | 21.6 | .2 | 9 | 1.2 | .3 | |
| | 28 | 2 | 17 | 11.3 | 47-37-26 | 122-57-30 | 46.9 | .3 | 17 | 3.2 | .4 | |
| | 28 | 2 | 51 | 10.8 | 48-17-21 | 122-34-44 | 23.6 | .2 | 7 | .7 | .5 | |
| | 29 | 3 | 38 | 44.8 | 47-56-18 | 123-22-24 | 38.2 | .2 | 5 | 1.2 | .3 | |
| | 29 | 14 | 20 | 40.1 | 47-25-35 | 123- 5-38 | 5.9 | .1 | 5 | .9 | .2 | |
| | 29 | 22 | 23 | 24.9 | 48-13-41 | 121-41-35 | 17.4 | .2 | 6 | 1.4 | .4 | |
| | 31 | 2 | 46 | 8.3 | 47-26- 8 | 123- 6-13 | 6.5 | .1 | 8 | 1.6 | .2 | |
| | 31 | 10 | 0 | 37.2 | 47-47-39 | 122-21-56 | 26.6 | .1 | 8 | 1.4 | .2 | |
| SEP | 3 | 5 | 45 | .4 | 47-50-48 | 122-29-16 | 22.3 | .1 | 14 | 2.1 | .4 | |
| | 5 | 9 | 16 | 25.2 | 47-29-17 | 122-58-26 | 17.0 | .2 | 6 | .8 | .3 | |
| | 5 | 13 | 17 | 46.8 | 47-35-17 | 122-48-45 | 20.3 | .2 | 5 | 1.0 | .2 | |
| | 6 | 8 | 51 | 40.7 | 47-25-10 | 122-42-47 | 23.4 | .2 | 13 | 1.9 | .4 | |
| | 8 | 5 | 57 | 32.6 | 47-41-44 | 122-32-16 | 5.9 | 0.0 | 4 | .6 | .2 | |
| | 9 | 1 | 48 | 11.1 | 48-29-22 | 123- 9- 3 | 36.8 | .4 | 5 | 1.2 | 0.0 | |
| | 9 | 8 | 36 | 56.9 | 48-13-32 | 122-43-24 | 24.0 | .2 | 9 | 1.4 | .4 | |
| | 10 | 15 | 5 | 12.8 | 48-14-29 | 121-33-26 | 2.4 | .0 | 5 | 1.2 | .4 | |
| | 11 | 20 | 53 | 34.1 | 49- 0- 2 | 123- 5-23 | 14.6 | .4 | 9 | 1.8 | .1 | |
| | 12 | 22 | 3 | 10.7 | 47-36-14 | 121-44-17 | 8.3 | .4 | 7 | 1.6 | .4 | |
| | 14 | 1 | 31 | 4.1 | 47-36-35 | 123- 8-29 | 6.0 | 0.0 | 4 | .6 | .2 | |
| | 14 | 3 | 13 | 27.1 | 46-50-26 | 121-50-13 | 5.0 | .1 | 5 | .9 | .2 | |
| | 15 | 16 | 49 | 26.8 | 47-20-29 | 122-20-19 | 14.2 | .1 | 13 | 2.2 | .2 | |
| | 16 | 15 | 11 | 23.8 | 47-19-39 | 122-19-14 | 17.3 | .1 | 6 | .8 | .1 | |
| | 17 | 2 | 32 | .6 | 48-52-41 | 122-20-26 | 21.0 | .2 | 6 | 1.4 | .4 | |
| | 18 | 15 | 52 | 11.8 | 47-25- 6 | 121-50-11 | 20.0 | .1 | 6 | 1.0 | .1 | |
| | 20 | 23 | 51 | 1.8 | 47-19-25 | 122-33-48 | 8.5 | .2 | 12 | 1.4 | .3 | |
| | 21 | 3 | 22 | 3.2 | 47-51-39 | 122-37-46 | 20.5 | .1 | 5 | .5 | .3 | |
| | 21 | 3 | 36 | 15.1 | 47-30-29 | 122-50- 8 | 11.6 | .2 | 5 | 1.0 | .1 | |
| | 23 | 23 | 2 | 47.3 | 47-24-18 | 122-41-55 | 21.8 | .1 | 6 | .7 | .2 | |
| | 24 | 19 | 57 | 32.8 | 47-42- 9 | 122-58-46 | 2.7 | .2 | 5 | .7 | .1 | $ |
| | 26 | 17 | 34 | 52.8 | 48-12-27 | 123-30-43 | 1.0F | .3 | 5 | 2.0 | .2 | |
| | 27 | 12 | 34 | 18.5 | 48-15-57 | 123-11- 1 | 42.9 | .2 | 15 | 2.2 | .2 | |
| | 28 | 0 | 34 | 9.9 | 48-10-27 | 121-51-37 | 2.2 | .1 | 4 | 1.1 | .4 | $ |
| | 29 | 9 | 27 | 55.8 | 47-42-50 | 122-16-38 | 21.3 | .2 | 11 | .7 | .5 | |
| | 29 | 18 | 48 | 29.5 | 47-18-39 | 122-46-60 | 19.9 | .2 | 7 | .4 | .2 | |
| | 29 | 18 | 52 | 14.4 | 47-18-26 | 122-47-24 | 21.8 | .2 | 7 | .7 | .5 | |
| | 30 | 5 | 27 | 47.7 | 48- 7- 4 | 123- 3-41 | 27.3 | .3 | 7 | .8 | .3 | |
| | 30 | 19 | 4 | 9.9 | 47-47-27 | 122-31-43 | 46.2 | .2 | 6 | .6 | .2 | |
| OCT | 2 | 13 | 25 | 57.7 | 47-33-48 | 122-40-46 | 23.3 | .0 | 5 | .6 | .5 | |

## APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OCT | 2 | 14 | 42 | 54.2 | 48-34-33 | 122-16-60 | 6.5 | .3 | 6 | 1.0 | .3 | |
| | 5 | 6 | 5 | 3.4 | 47-19-28 | 122-17-47 | 6.9 | .1 | 5 | .8 | .4 | |
| | 6 | 4 | 55 | 42.5 | 47-39-34 | 122-14-57 | 27.1 | .1 | 10 | 1.4 | .2 | |
| | 6 | 8 | 55 | 46.5 | 47-22-30 | 122-15-54 | 2.7 | .4 | 7 | 1.0 | .3 | |
| | 6 | 17 | 54 | 34.0 | 47-41-47 | 121-57-50 | 21.5 | .2 | 6 | 1.0 | .3 | |
| | 6 | 10 | 26 | 34.5 | 47-31-15 | 122-51-18 | 22.7 | .2 | 6 | .5 | .4 | |
| | 8 | 15 | 5 | 38.8 | 47-22- 6 | 122-21-41 | 12.1 | .1 | 4 | .7 | .1 | |
| | 8 | 16 | 15 | 43.7 | 47-52-56 | 122-22-20 | 32.5 | .3 | 12 | 1.4 | .4 | |
| | 9 | 17 | 28 | 43.8 | 46-50-32 | 121-56-34 | 7.3 | .4 | 9 | 1.6 | .3 | |
| | 13 | 13 | 14 | .9 | 48-36- 5 | 122-21-36 | 10.0F | .3 | 4 | 1.4 | .4 | |
| | 14 | 9 | 16 | 33.4 | 47-46- 1 | 122-50-45 | 22.7 | .0 | 5 | 1.3 | .2 | |
| | 14 | 14 | 48 | .7 | 47-12-13 | 122- 5-22 | 19.9 | .2 | 7 | 1.3 | .3 | |
| | 15 | 9 | 45 | .1 | 47-24-51 | 121-50-14 | 20.7 | .1 | 5 | 1.0 | .4 | |
| | 16 | 13 | 33 | 55.5 | 46-57- 6 | 122- 6-45 | 4.3 | .3 | 10 | 1.9 | .3 | |
| | 16 | 20 | 13 | 36.0 | 47-19- 9 | 122-24-14 | 22.8 | .2 | 10 | 1.6 | .4 | |
| | 16 | 20 | 22 | 35.8 | 48-19-33 | 122-26-42 | 20.2 | .2 | 8 | 1.3 | .4 | |
| | 17 | 6 | 13 | 26.3 | 48-17-50 | 123- 9-29 | 41.7 | .1 | 6 | .8 | .3 | |
| | 17 | 7 | 51 | 43.6 | 47-18-34 | 122-14-46 | 8.3 | .2 | 14 | 1.6 | .4 | |
| | 17 | 8 | 16 | 17.9 | 47-59-46 | 122-50- 2 | 50.1 | .1 | 12 | 1.3 | .3 | |
| | 17 | 19 | 24 | 51.6 | 47-50-59 | 123- 7-18 | 47.1 | .1 | 6 | 1.0 | .5 | |
| | 18 | 12 | 57 | 59.1 | 46-51-23 | 121-57-14 | 11.9 | .2 | 7 | 1.1 | .3 | |
| | 19 | 2 | 8 | 45.6 | 48-23-28 | 123- 4-14 | 20.3 | .1 | 8 | 1.1 | .3 | |
| | 19 | 13 | 1 | 7.8 | 47-34- 0 | 121-36-28 | 6.6 | .2 | 5 | .7 | .2 | |
| | 22 | 16 | 25 | 18.5 | 47-32-54 | 122-20-47 | 22.7 | .2 | 9 | 1.0 | .4 | |
| | 25 | 11 | 6 | 15.8 | 46-27-46 | 122-18-10 | 23.5 | .3 | 7 | .9 | 0.0 | |
| | 26 | 5 | 28 | 13.4 | 48-11-10 | 122-57-55 | 23.7 | .3 | 8 | 1.1 | .3 | |
| | 26 | 13 | 30 | 17.3 | 48-47-25 | 122- 8-58 | 12.2 | .2 | 5 | 1.4 | .2 | $ |
| | 27 | 12 | 39 | 50.2 | 46-51-10 | 121-55-59 | 3.6 | .3 | 10 | 1.1 | .5 | |
| | 27 | 13 | 16 | 34.5 | 47-24-16 | 122-23-20 | 17.5 | .1 | 11 | 1.2 | .1 | |
| | 28 | 15 | 25 | 18.9 | 47-51-49 | 122- 0-29 | 17.1 | .0 | 5 | 1.4 | .3 | |
| NOV | 2 | 1 | 59 | 39.1 | 47-49-33 | 122-43-22 | 22.0 | .1 | 7 | .8 | .3 | |
| | 2 | 3 | 59 | 46.3 | 48-12-21 | 122-45-50 | 25.5 | .2 | 11 | 1.9 | .4 | |
| | 2 | 21 | 31 | 18.6 | 48-16-42 | 122-10-10 | 17.6 | .1 | 6 | 1.5 | .5 | |
| | 6 | 19 | 51 | 56.4 | 46-44-27 | 122-28-23 | 8.0 | .2 | 11 | 1.9 | .1 | |
| | 8 | 18 | 52 | .9 | 47-30-37 | 122-35- 1 | 25.5 | .2 | 8 | 1.2 | .3 | |
| | 9 | 3 | 59 | 51.5 | 47-10-46 | 123- 1-24 | 31.7 | .1 | 6 | 1.1 | .2 | |
| | 12 | 0 | 27 | 56.4 | 47- 2-17 | 121-56-39 | 3.0 | 0.0 | 5 | 1.1 | 0.0 | $ |
| | 12 | 20 | 23 | 59.0 | 48-33-12 | 122-15-38 | .8 | .3 | 5 | 1.1 | .1 | $ |
| | 14 | 10 | 10 | 10.2 | 47-42-56 | 122-14-29 | 23.7 | .2 | 9 | 1.2 | .4 | |
| | 15 | 5 | 27 | 41.2 | 47-31-18 | 122-28-26 | 17.9 | .1 | 8 | 1.2 | .2 | |
| | 17 | 15 | 55 | 30.8 | 48-18-19 | 122-27-16 | 52.5 | .2 | 5 | 1.1 | .2 | |
| | 21 | 3 | 29 | 16.8 | 46-53-28 | 121-56-51 | 11.4 | .3 | 10 | 2.0 | .2 | |
| | 21 | 5 | 21 | 17.3 | 47-28-47 | 122-56-42 | 14.1 | .2 | 11 | 2.0 | .1 | |
| | 24 | 17 | 53 | 31.0 | 46-59-44 | 121- 6-19 | 3.5 | .3 | 11 | 1.9 | .1 | |
| | 25 | 6 | 18 | 28.2 | 47-24-36 | 122-41-51 | 21.9 | .2 | 6 | 1.0 | .3 | |
| | 25 | 9 | 20 | 26.1 | 47-41-13 | 121-47-31 | 7.8 | 0.0 | 5 | 1.3 | .4 | |
| | 28 | 12 | 47 | 58.6 | 47-50- 7 | 122-47-43 | 5.5 | .2 | 6 | .9 | .4 | |
| | 29 | 2 | 16 | 1.8 | 49- 0-53 | 123- 6-46 | 18.0 | .1 | 8 | 1.5 | .2 | |
| | 30 | 11 | 24 | 37.9 | 47- 5-13 | 122-25-27 | 43.7 | .4 | 9 | 1.2 | .4 | |
| DEC | 1 | 1 | 35 | 15.9 | 47-30-49 | 122-34-26 | 25.6 | .1 | 11 | 1.5 | .4 | |
| | 1 | 7 | 42 | 42.7 | 47-28- 9 | 122-40-54 | 31.0 | 0.0 | 4 | .4 | .2 | |
| | 3 | 9 | 12 | 29.1 | 47-29-40 | 123- 1-18 | 15.6 | .3 | 17 | 2.5 | .2 | |
| | 3 | 13 | 52 | 48.9 | 47-44-26 | 122-18-26 | 25.4 | .2 | 6 | 1.7 | .1 | |
| | 6 | 0 | 42 | 27.6 | 47-24-38 | 122-41-60 | 23.9 | .0 | 6 | 1.2 | .3 | |
| | 6 | 5 | 33 | 44.2 | 47-16-19 | 122-16-22 | 18.3 | .3 | 7 | .7 | .4 | |
| | 9 | 22 | 9 | 58.9 | 48-15-36 | 123- 8-34 | 48.6 | .3 | 8 | 1.6 | .2 | |
| | 13 | 4 | 5 | 27.4 | 47-49- 6 | 122-20-60 | 7.6 | .1 | 7 | 1.0 | .3 | |
| | 13 | 20 | 59 | 11.3 | 47-25-46 | 122-48-35 | 24.6 | .1 | 9 | 1.3 | .4 | |
| | 14 | 1 | 59 | 10.5 | 47-36-44 | 122-12-21 | 25.2 | 0.0 | 4 | .9 | .1 | |
| | 18 | 1 | 52 | 23.6 | 48-21-46 | 122-50-33 | 19.3 | .4 | 8 | 1.6 | .4 | |

APPENDIX I—Continued

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DEC | 18 | 12 | 19 | 38.4 | 46-55-28 | 123-21-53 | 10.0F | .4 | 4 | 1.4 | .3 | |
| | 18 | 14 | 56 | 46.4 | 48-22- 5 | 122-50-60 | 18.3 | .2 | 6 | 1.4 | .2 | |
| | 23 | 7 | 59 | 19.5 | 46-38-22 | 122-22-39 | 10.6 | .2 | 11 | 1.6 | .3 | |
| | 28 | 12 | 18 | 58.3 | 47-18-36 | 123- 9-49 | 42.0 | .3 | 19 | 3.4 | .2 | * |
| | 29 | 8 | 41 | 34.4 | 48-15-57 | 122-32-49 | 23.8 | .1 | 6 | 1.0 | .4 | |
| | 31 | 3 | 23 | 46.6 | 47-35-25 | 121-50-39 | 19.9 | .2 | 20 | 4.0 | .3 | * |
| | 31 | 3 | 30 | 34.4 | 47-35-37 | 121-53- 5 | 18.8 | .1 | 6 | 1.4 | .4 | |

## APPENDIX II

### CATALOG OF EARTHQUAKES (1977)

Corrected Values

| | DY | HR | MN | SEC | LAT N | LONG W | DEPTH | SD | NO | MAG | SDMAG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FEB | 11 | 14 | 23 | 55.6 | 46- 5-44 | 122-43-53 | 2.2 | .2 | 9 | 1.8 | .2 |
| AUG | 6 | 9 | 13 | 28.2 | 46-10-25 | 122-11-48 | 6.6 | .3 | 9 | 1.4 | .1 |
| | 27 | 16 | 3 | 12.9 | 46-18-60 | 121-57-25 | 2.5 | .2 | 6 | 1.3 | .6 |
| OCT | 7 | 6 | 22 | 57.9 | 45-56-56 | 122-15-17 | 1.0F | .4 | 7 | 1.6 | .2 |
| | 12 | 5 | 24 | 25.1 | 46-15- 4 | 122- 6-41 | 7.0 | .1 | 6 | 1.0 | .1 |
| | 15 | 4 | 24 | 7.2 | 48-14-35 | 123-47-43 | 49.3 | .2 | 13 | 3.2 | .1 |
| NOV | 13 | 14 | 58 | 39.3 | 46-45-58 | 122- 3- 5 | 2.1 | .2 | 10 | 1.6 | .3 |