FINAL TECHNICAL REPORT

on

Earthquake Monitoring of Eastern Washington

July 1988

Geophysics Program

University of Washington

Seattle, Washington

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TASK AGREEMENT NO. 39

I - INTRODUCTION AND SUMMARY OF OPERATIONS

Introduction

This is the final report for the operations and research performed for D.O.E. by the University of Washington Geophysics Program on the seismicity and structure of eastern Washington and northeastern Oregon. This contract has supported parts of the Washington state regional seismograph network for the past thirteen years. There have been an average of 64 seismic stations operating between 1975 and 1979 and 105 stations between 1980 and 1988 whose data are telemetered to the University for recording, analysis and interpretation. The Department of Energy has supported approximately 40 stations located on the east flank of the Cascades and throughout eastern Washington and northeastern Oregon. Other parts of the network have been supported by the U.S. Geological Survey, U.S Nuclear Regulatory Commission, WPPSS, and other agencies.

Since 1976, annual technical reports have been produced that summarize network operation, analysis of data, and research results. The reports include earthquakes that have occurred since 1969. Each has been distributed widely, and all are available through the University of Washington library system. A summary of the topics covered in each report is listed in Table I-1. In addition to the annual technical reports, quarterly listings of located earthquakes have been published. Also, since 1980, comprehensive earthquake bulletins for the whole state-wide network have been published and are available through the State Department of Natural Resources as Information Circulars 82, 83, and 84 (see references). There have also been a number of special studies done from time to time, usually as part of a student's thesis work. These publications are listed in the references in Appendix V.

This is the last annual technical report on the seismicity of eastern Washington funded by direct DOE support. As of the writing of this report continued support for a scaled down eastern Washington network is being negotiated with Westinghouse

Hanford operations. This modified network is planned to be a composite of some of the stations from the U. of W. regional network and the Westinghouse local network. The number of stations and areal coverage will decrease from previous levels, but we anticipate that the sensitivity of the network in areas like the central basin will decrease only marginally. We will continue to publish quarterly technical reports and annual bulletins listing all earthquakes located by the state-wide network including events in eastern Washington.

This final report includes a section on the seismicity in eastern Washington for the past year, July 1, 1987 to June 30, 1988. It also includes a section reviewing eastern Washington seismicity for the past 19 years of instrumental data.

Table I-1 Topics covered in Annual Technical Reports 1976-87

besides discussion of annual seismicity

REPORT	TOPIC
1976	Wahluke earthquakes, 1974.
	Wooded Island seismicity, 1975 (includes resistivity monitoring).
	Implementation of HYPO71 earthquake location program.
1977	Review of Seismicity for last 7 years.
	New velocity models to locate earthquakes.
	Eastern Washington velocity structure from refraction and time-term analysis.
	Earthquake magnitude and attenuation.
	Lake Chelan seismicity.
1978	Wood Anderson vs coda-length magnitude.
	Attenuation patterns in Pacific northwest from Intensity data. 1872 earthquake.
	Lake Chelan earthquakes.
	Wooded island earthquakes and tiltmeter recording.
	Digital recording using portable seismographs
1979	Chief Joseph Dam earthquakes
	Walla Walla earthquake
	Statistics of earthquake swarms in eastern Washington.
	Wood-Anderson vs coda-length magnitude
	Surface wave velocity and attenuation
	Refraction study of North Cascades and Northeastern Washington
	Eastern Washington earthquake catalog 1969-74 (in Appendix).

Table I-1 Continued

REPORT	TOPIC
1980	Cold Creek earthquake swarm
	Effect of rock fractures in basalt on geophysical measurements
	Shear wave velocity structure from Surface wave dispersion
	Geology and Seismicity of Columbia River basalts and other plateau basalts.
	Digital Seismic processing at UW.
	Mount St Helens Seismic Report May, 1980.
1981	Ray tracing and synthetic seismograms: eastern Washington crustal structure.
	Identification of rock boundaries in well-log analysis: Walsh transform.
	Shear wave velocity in Washington: Surface wave dispersion.
1982	Velocity structure: refraction profiles and synthetic seismograms.
	Crust and upper mantle structure of the North Cascades: Teleseismic P residuals.
	Well-log characteristics of Columbia river basalts.
	Teleseismic P-wave study in Washington and northern Oregon.
1983	Eastern Washington crustal structure: refraction data from blasts.
	Effects of cracks and pores on seismic velocity
	Inversion of vertical seismic profiling data to determine seismic velocity.

Table I-1 Continued

REPORT	TOPIC
1984	Completeness of earthquake catalog vs magnitude.
	Large scale refraction experiment (USGS, Rockwell, U. Washington)
	Vertical seismic profiling: attenuation.
	Automatic digital picking of seismic phase arrival times.
1985	Crustal structure of Columbia basin from borehole seismic refraction data.
	Seismic attenuation from borehole data.
	Borehole studies at Hanford.
	Vantage earthquake swarm.
	Powder river, Oregon earthquakes.
	Precise relative location of earthquakes.
1986	Earthquakes in the sedimentary layer below basalts at Hanford.
	Earthquake magnitude determination from 1969-74.
	Relocation of earthquake swarms using cross correlation of seismograms.
1987	Seismograph calibration in UW network.
	Earthquake focal mechanisms in eastern Washington 1980-87.
	Classifying earthquake sequences.
	Hypocenter location programs: a comparison.
	Coda-Q in Washington.

II SUMMARY OF SEISMICITY 1969-1988

In 1969 the US Geological Survey installed a seismograph network in eastern Washington near the Hanford reservation. In 1975 the operation of the network was transferred to the University of Washington and since that time the areal extent of the network has been expanded to cover most of eastern Washington and northeastern Oregon. By 1987 the Department of Energy funded 43 stations east of the Cascades that, together with the stations to the west funded by other agencies, made up a network of 117 stations in Washington and Oregon.

Since 1975 the University has produced quarterly and annual reports that review the earthquake activity in eastern Washington. The earthquake lists in these reports have been complete for earthquakes as small as 1.0 to 1.2 in the Hanford region and as small as 1.7 to 2.0 in the rest of eastern Washington (see the 1984 Annual Technical Report for a discussion of completeness). Smaller earthquakes are sometimes detected and located, but not consistently. Since 1969 we have located 5,207 seismic events in eastern Washington having magnitude greater than or equal to 1.0 ($M \geq 1.0$); 3,622 of these were identified as earthquakes (Figures II-1 and II-2) and 1,585 were known or problable blasts (Figure II-3). Appendices I and II list epicenters for the larger earthquakes and blasts. Appendix I lists 330 earthquakes having $M \geq 2.5$ and Appendix II lists 136 blasts having $M \geq 2.5$.

In many cases blasts are easily identified because their calculated epicenters are at known quarries and some are confirmed by verbal communication with agencies responsible for the blasting. These blasts are identified as type X in Appendix II. When blasts occur in unusual locations and are non-repetitive, positive identification is difficult. However, seismograms may be used to identify these events. Criteria useful in distinguishing blasts are their shallow depths, positive P-wave polarity, clustering of epicenters, time of day of occurrence and spectral content of signals. Events believed to be blasts on the basis of these criteria are listed as type P in Appendix II.

In the last twenty years, earthquake epicenters in eastern Washington have been broadly scattered and many show little correlation to known structural features. However, the focal mechanisms of the earthquakes generally indicate that the region is undergoing north-south compression, in agreement with the deformation indicated by many anticlinal structures at the western edge of the Columbia river basalts. The greatest seismic activity occurs along the eastern flanks of the Cascades of southern Washington and at several locations along the course of the Columbia river. Many of the details of this activity are covered in the annual technical reports. The places where earthquake activity is prominent has changed with time as shown near the Hanford region in Figures II-4 to II-7. The east-west trending Saddle mountains, north of the Hanford region, has been a particularly persistent zone of earthquake activity, although in the last few years the activity has been most intense at the western end of this range. The many earthquakes to the northeast of Hanford appear to lie south of the axis of the Saddle Mountains anticline. Additional earthquakes occur periodically 1) in the western part of the reservation, 2) at the eastern edge of the reservation (on the Columbia river), and 3) south of the reservation near the Horse Heaven Hills.

The Hanford region is covered by Miocene flood-basalts that are from 2 to 5 km thick. Glover (1985) has shown that seismic refraction data and evidence from deep well cores indicate that the basalts are likely underlain by low-velocity Tertiary sediments. These, in turn, cover basement rocks that are found below depths of 4 to 10 km. In Figure II-8 are cross sections through the region showing earthquake depths in relation to the basalt, sediments, and basement rocks. Most of the earthquakes in the Hanford region occur in the flood basalts and the underlying sediments within 8 km of the earth's surface although depths of 0 to 4 km are most common. There are a few considerably deeper earthquakes that occur in the lower crust, 12 to 22 km below the surface. There is no evidence of earthquakes with hypocenters deeper than 25 km.

Eastern Washington earthquakes have fault plane solutions that are quite con-

sistent with one another, as reported in the 1987 Annual Technical Report. Usually, the derived axes of maximum compressive stress (P) are oriented north-south. The orientations of the axes of minimum compressive stress (T) range from vertical to east-west. Fifty three of the best quality fault plane solutions are tabulated in the 1987 Annual Technical Report. Only earthquakes in the cluster southwest of Chelan have fault plane solutions that usually differ from the solutions for the rest of eastern Washington. The maximum compressive stress direction determined in the Chelan area is oriented northwest-southeast rather than north-south.

The seismicity of eastern Washington is distinctly different than that of western Washington. Large deep earthquakes such as the 1965 Seattle earthquake or 1949 Olympia earthquake are not likely to occur in eastern Washington. However, because of the shallow nature of the seismicity in eastern Washington, damage from moderate sized earthquakes is possible close to their epicenters. Earthquakes in the magnitude range around M=5 are likely to occur in eastern Washington, but less frequently than in the west.

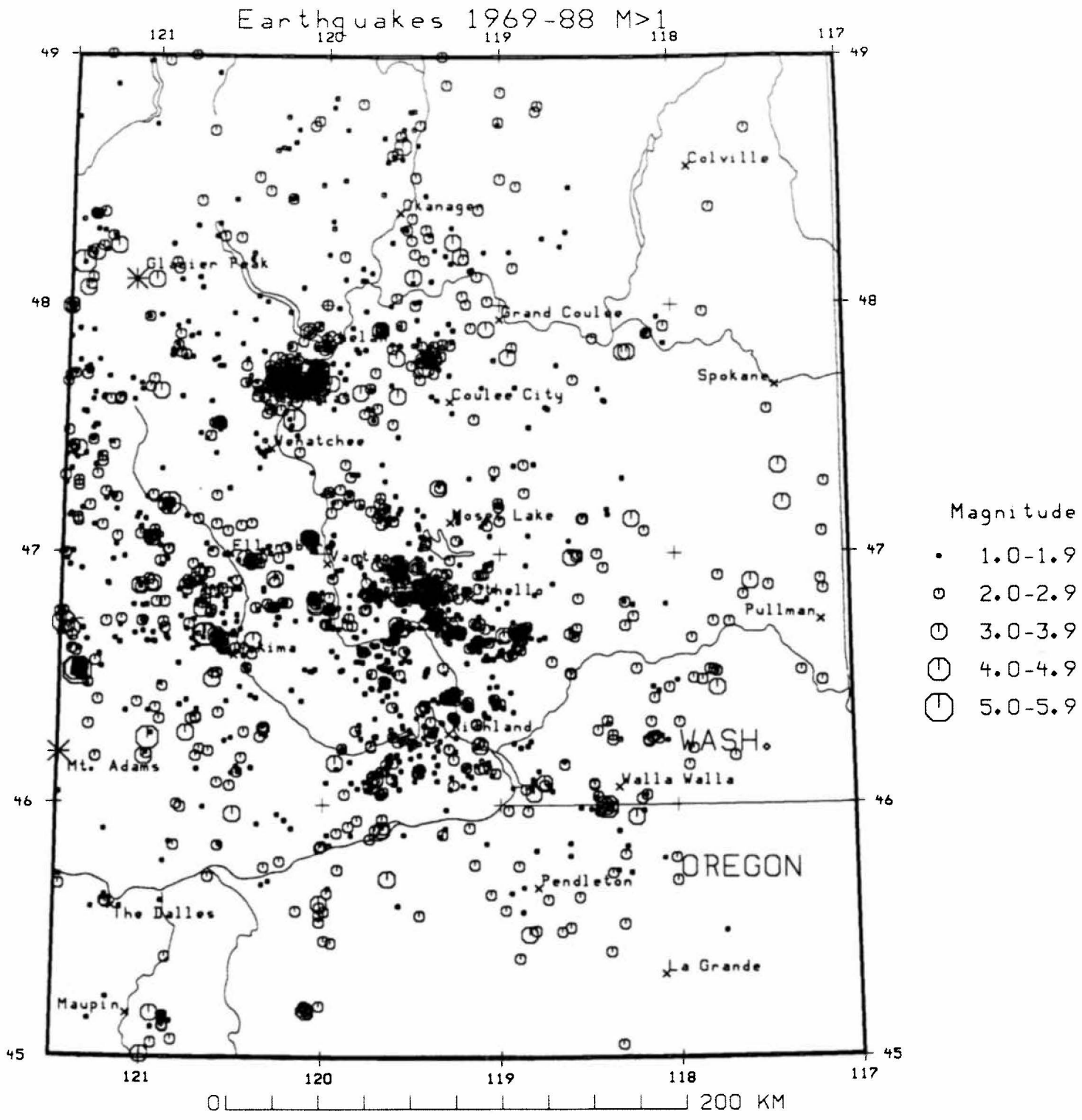


Figure II-1. Earthquakes in Eastern Washington from 1969 to April 4, 1988. Earthquakes with magnitude M $\geq$ 1.0 are shown.

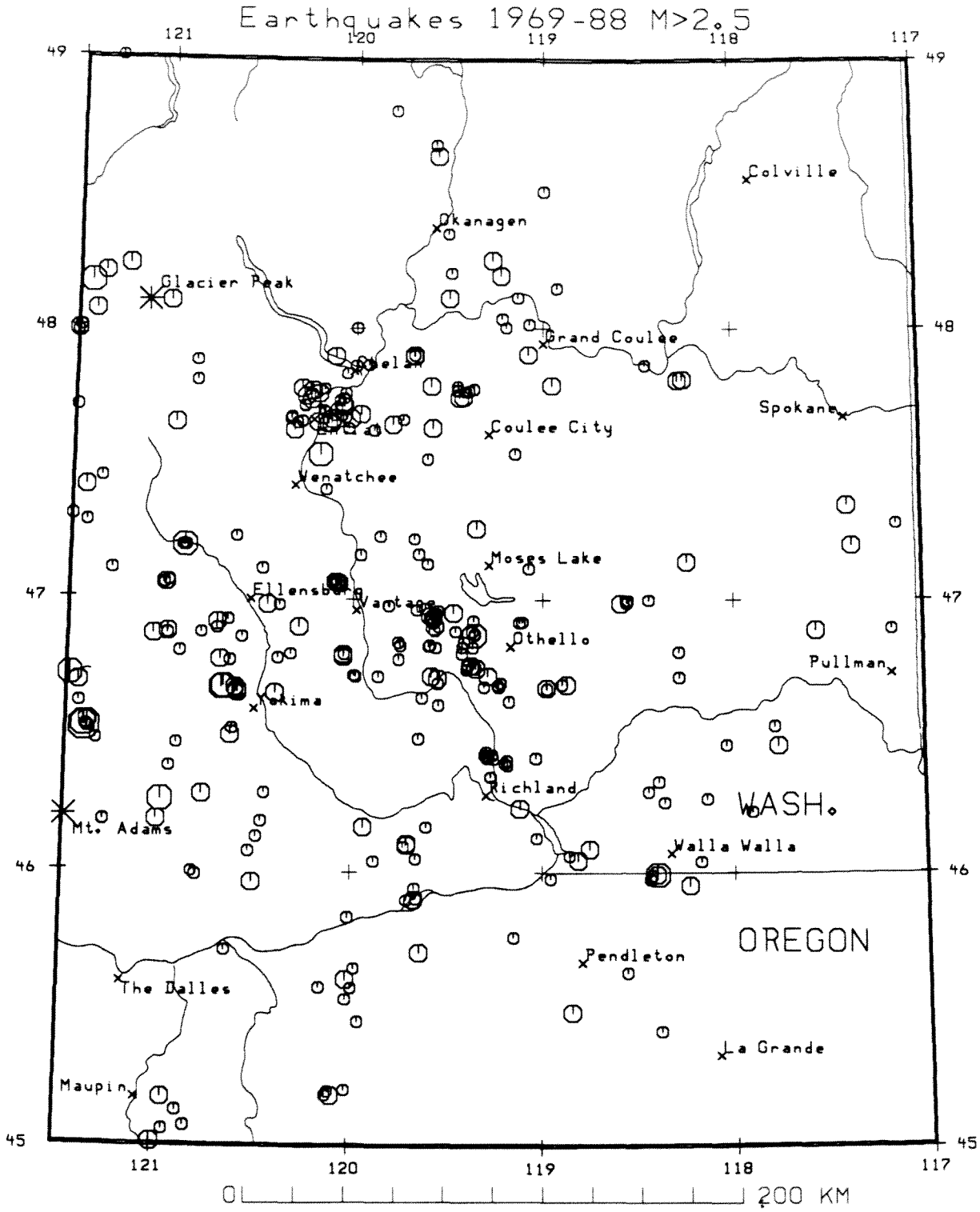


Figure II-2. Principal earthquakes in Eastern Washington from 1969 to April 4, 1988. Only earthquakes with magnitude M $\geq$ 2.5 are shown. The earthquakes shown are listed in Appendix I. The magnitude scale is the same as in Figure II-1.

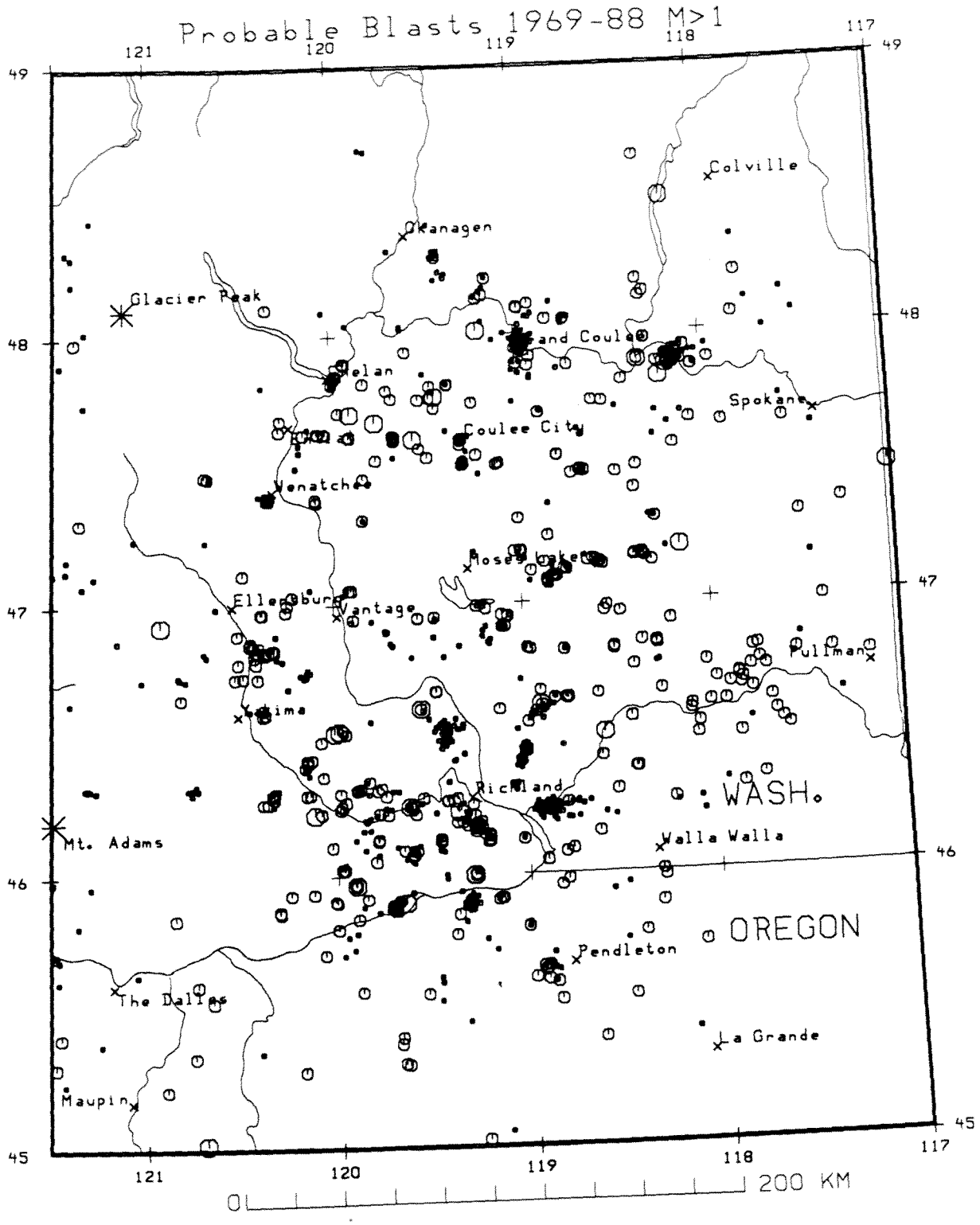


Figure II-3. Probable blasts in eastern Washington from 1969 to April 4, 1988. Only blasts with magnitude M $\geq$ 1.0 are shown. Blasts with M $\geq$ 2.5 are listed in Appendix II. The magnitude scale for this Figure is the same as for Figure II-1.

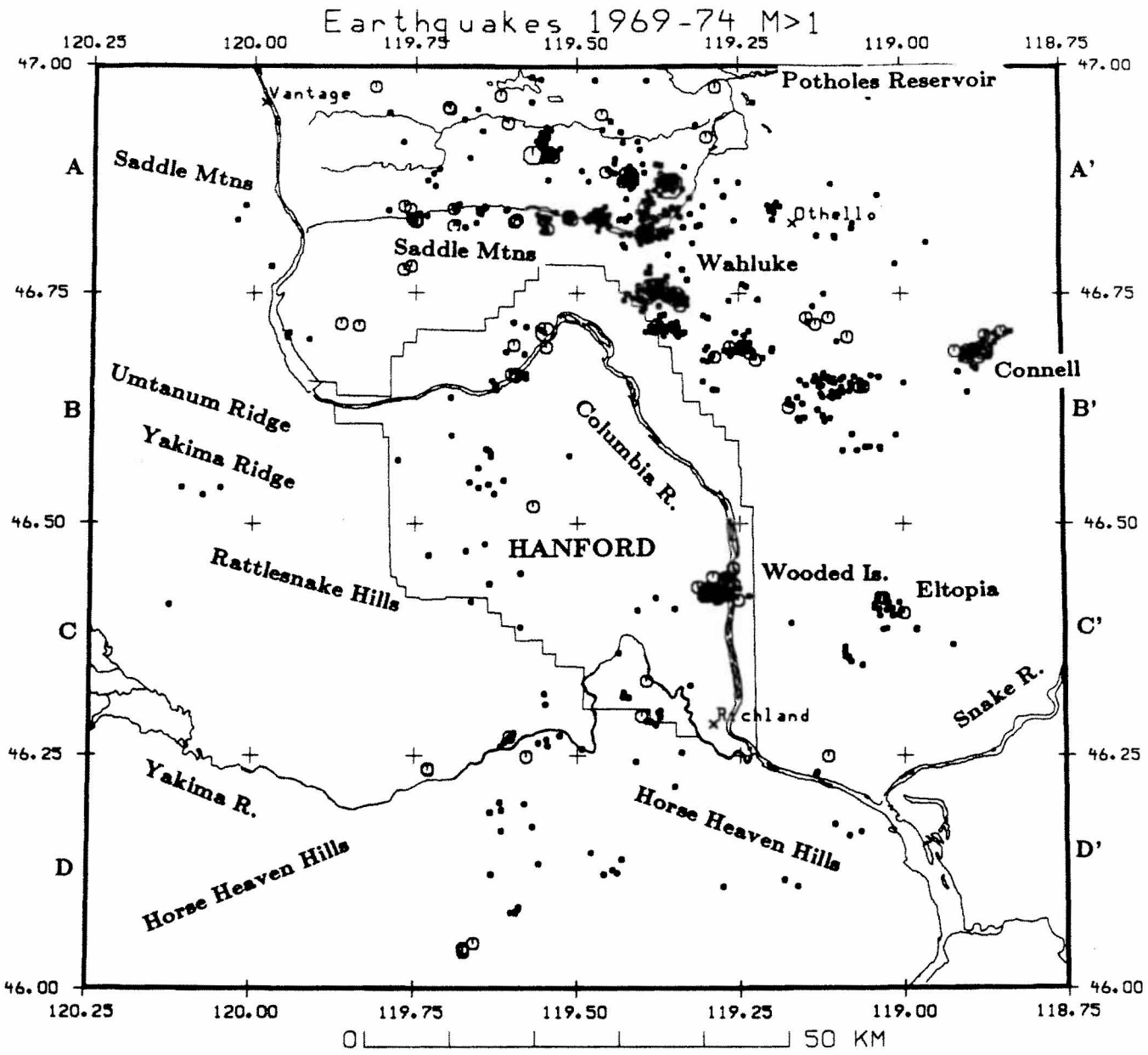


Figure II-4. Earthquakes (M $\geq$ 1.0) in the Hanford Region of Eastern Washington from 1969 to 1974 (6 years). The boundary of the Hanford reservation is shown as well as the general locations and axial trends of anticlines (Saddle Mountains, Umtanum Ridge, Yakima ridge, Rattlesnake Hills, and Horse Heaven Hills). Points A and A', B and B', etc., are end-points of cross sections shown in Figure II-8. The magnitude scale is the same as in Figure II-1.

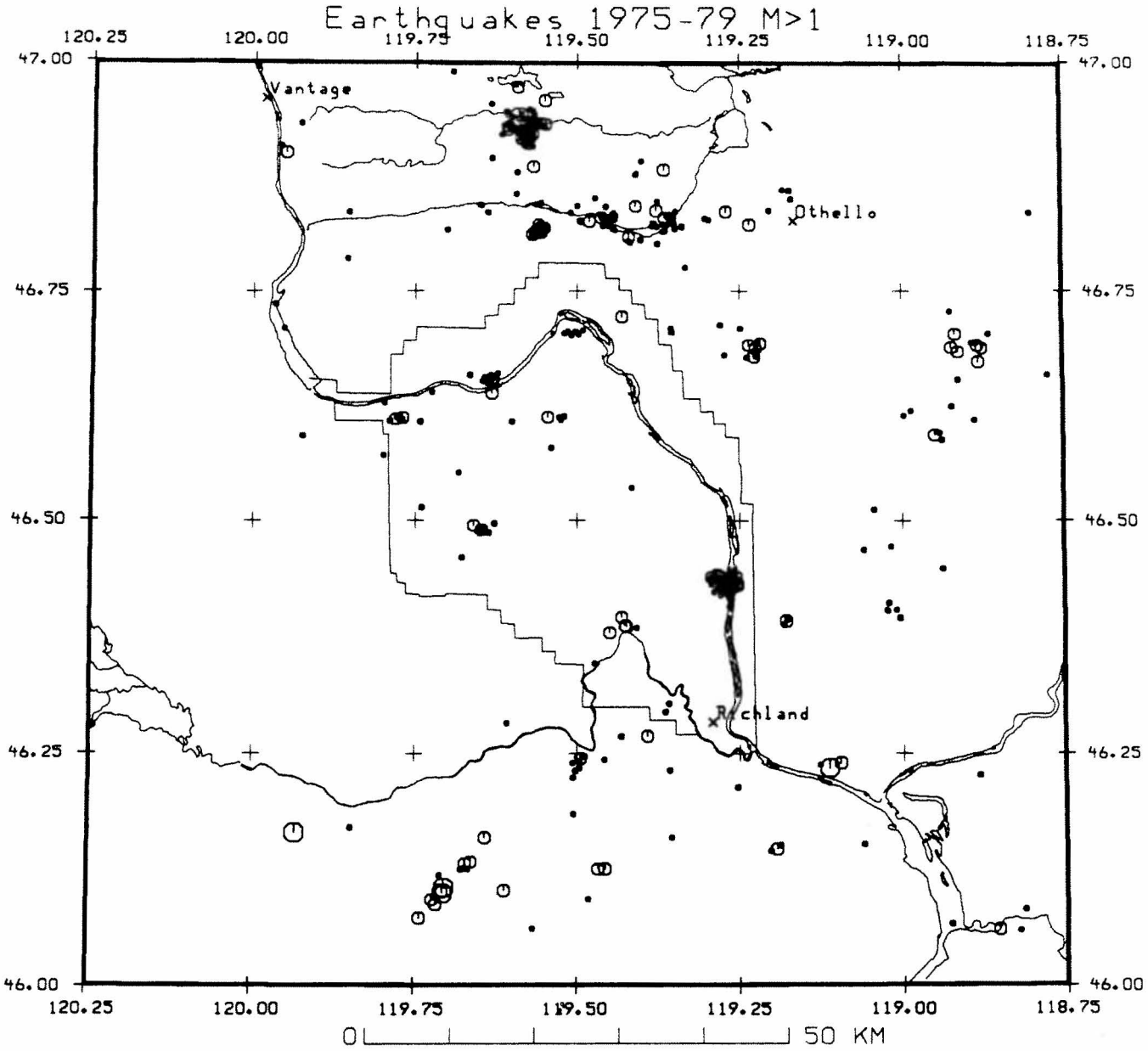


Figure II-5. Earthquakes (M $\geq$ 1.0) in the Hanford Region of Eastern Washington from 1975 to 1979 (5 years). The magnitude scale is the same as in Figure II-1.

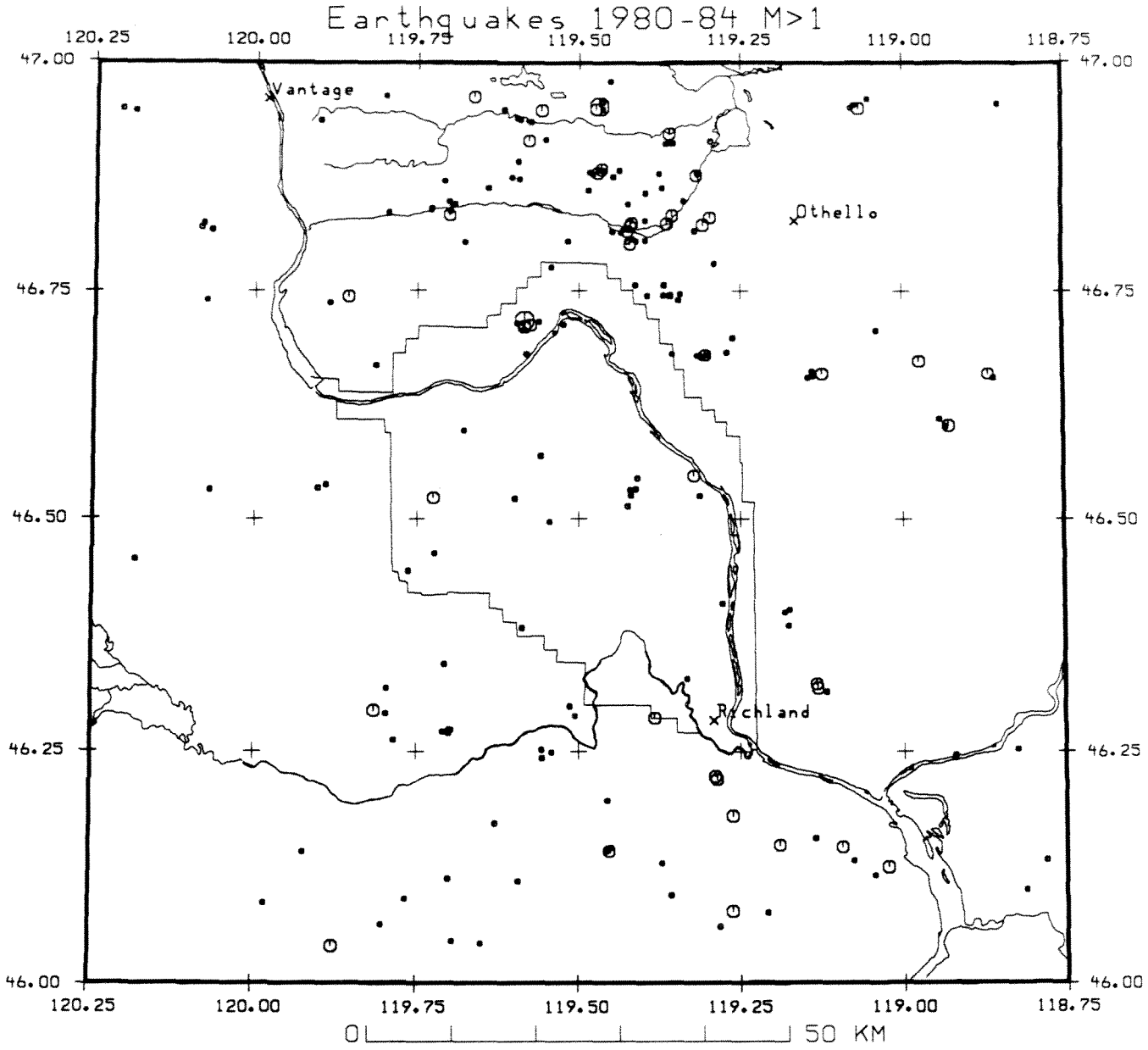


Figure II-6. Earthquakes (M $\geq$ 1.0) in the Hanford Region of Eastern Washington from 1980 to 1984 (5 years). The magnitude scale is the same as in Figure II-1.

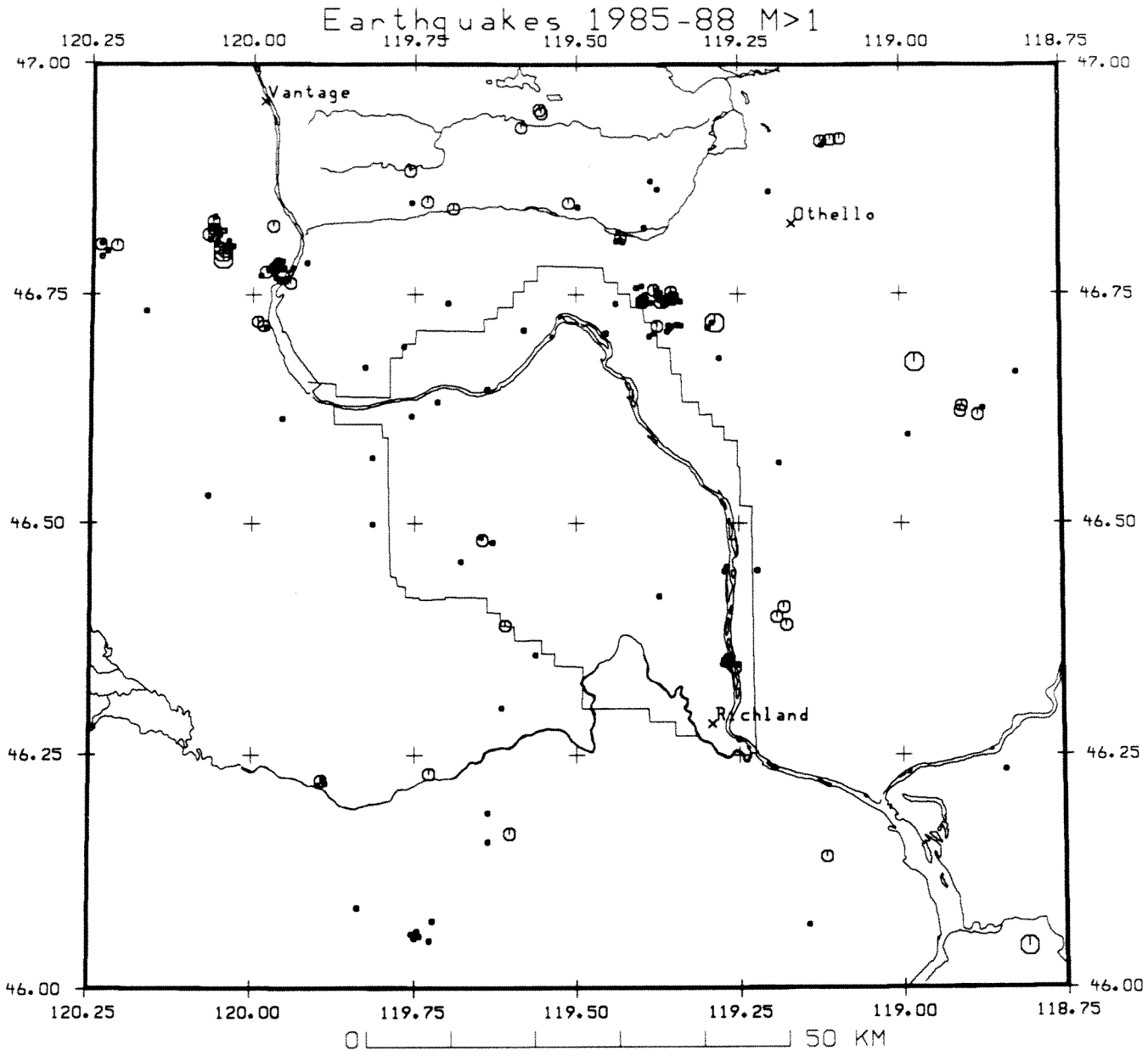


Figure II-7. Earthquakes ($M \geq 1.0$) in the Hanford Region of Eastern Washington from 1985 to April 4, 1988 (3.3 years). The magnitude scale is the same as in Figure II-1.

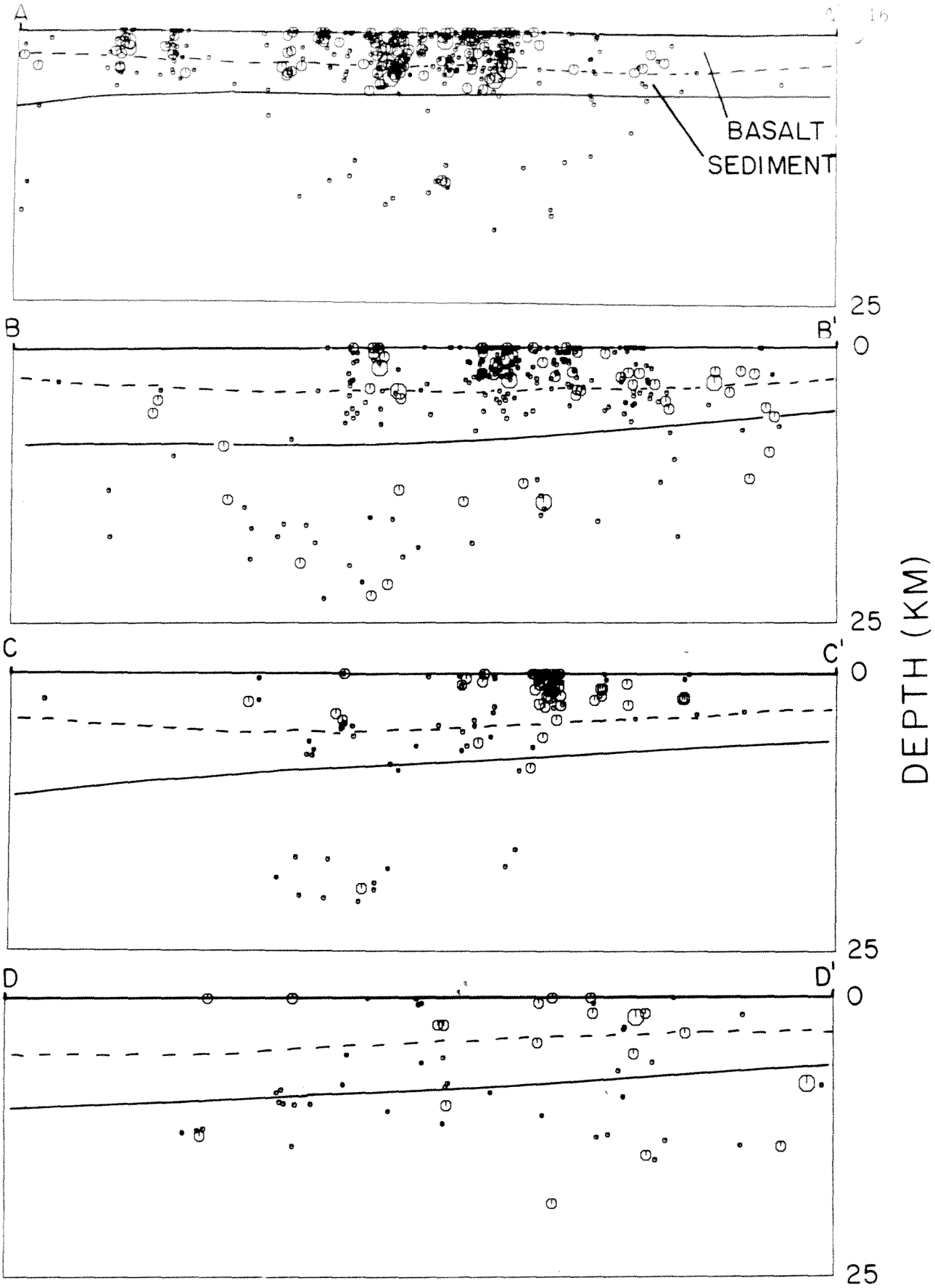


Figure II-8. Depths of earthquakes in the Hanford region along profiles AA', BB', CC', and DD' indicated in Figure II-4. Hypocenters within 13.5 km of vertical planes along each profile are projected onto the plane of the cross section. Earthquakes that occurred between 1969 and April 4, 1988 and had M $\geq$ 1.0 are shown except for any hypocenters with D quality solutions (RMS $\geq$ 0.5 sec, GAP $\geq$ 180°, DMIN $\geq$ 50 km, number of phases $\leq$ 5). The quality criteria eliminated 732 out of 1824 earthquakes in the Hanford region. Each profile is 114 km long (horizontal scale same as Figure II-4). The magnitude

III 1987-1988 SEISMICITY

Network Operations

Table III-1 lists the stations supported under this contract for the period 1987-1988 and Figure III-1 shows all the stations of the state-wide network. In general, the contract supported stations east of 121 ° W. In the third quarter of 1987 we began to expand the network into Oregon with the addition of new stations BPO, NCO, TCO, GMO, and VCR. We expect to add new stations in Oregon in the fall of 1988 via funding by the US Geological Survey.

Since the beginning of 1988, we have shut down a few of the stations in eastern Washington like WEN, HH2, and SYR because of the elimination of funding for most aspects of the Basalt Waste Isolation Project study at Hanford. On the other hand, we are now recording some of the stations operated by Westinghouse Corporation such as RCV and LOC so that our earthquake detection threshold has changed very little. We are no longer recording the USGS station NEW, which was the the most eastern station of the net, because of the termination of USGS funding for the site. We are trying to obtain a BPA microwave telemetry link to NEW so that we can continue to record seismic data from this excellent station.

During the second quarter of 1988 the on-line computer system used for recording and analyzing data for the network was changed. Since 1980, a DEC PDP-11/34 has been used for on-line recording and a DEC PDP-11/70 has been used for analysis. In April of 1988 we installed a Masscomp-5600 minicomputer, funded by the U.S. Geological Survey, to take the place of both DEC computers. By June 1, we had software running on the Masscomp computer that does both the data acquisition and analysis tasks for the network. This software is a modified version of *RAVEN*, a specialized data acquisition system from NEWT Inc. We have a software agreement with NEWT Inc. for the development of a regional network recording version of this software called *HAWK*.

As of the end of June 1988, the *HAWK* software running on the Masscomp computer had taken over all aquisition and analysis tasks and the DEC equipment was being phased out. The PDP-11/34 is still running as a backup recording system; however, all recording, processing, and archiving are now done routinely on the Masscomp.

Seismicity July 1, 1987 - June 30, 1988

Introduction

From July 1, 1987 to June 30, 1988 we processed 2107 seismic events that were recorded by the seismograph network in Washington and Oregon shown in Figure III-2. These included local earthquakes within the network, regional earthquakes just outside the network, and teleseisms (earthquakes greater than 1000 km from Washington). In eastern Washington and Oregon between 44.0-49.0 ° N and 117.0-121.5 ° W, we recorded and located 412 earthquakes (Figures III-2 and III-3) and 48 confirmed or probable blasts (Figure III-4).

The two largest earthquakes during the year both occurred on December 7, 1987 just northwest of Yakima. The two events occurred within 2 hours of one another, had magnitudes of 4.1 and 4.3, and were widely felt over a region including Naches and Yakima. The third largest earthquake (M 3.5) occurred 20 km southwest of Othello on May 28, 1988 as part of a swarm of events near Corfu.

All earthquakes and blasts located in eastern Washington or northern Oregon for the year are listed in a catalog as Appendix III of this report. Blasts are distinguished from earthquakes by telephone inquiry or by recognizing their characteristic source locations and recorded waveforms.

Seismicity

In terms of number of earthquakes, the two most active areas in eastern Washington were the region near Entiat, southwest of Chelan, and the region near Corfu, at the

northeast boundary of the Hanford reservation. As usually happens, the Entiat area was active every quarter, and two earthquakes that occurred there in 1988 were felt. The one on February 6, 1988 (M 3.0, h = 7 km) was felt in the Waterville region and the one on May 5, 1988 (M 3.3, h = 7 km) was felt in Wenatchee. These earthquakes had thrust and strike-slip fault plane solutions (Fig III-5) with northwest to west trending P axes (direction of maximum principal stress).

The Corfu earthquakes, whose epicenters are shown in detail in Figure III-3, began to occur in August of 1987 and continued until June of 1988. The epicenters shifted in a complicated pattern and clustered into several groups that were active at various times. The activity began in the northern group A, shown in Figure III-3. A few months later, the eastern portion of group C began to become active and the epicenters of the group migrated to the west. Soon after the earthquakes began in group C, activity began in the central portion of group B then migrated to the east. The eastern migration of group B events ceased fairly abruptly and intense earthquake activity resumed about 3 km away in the western portion of group B. Finally, after two months of little earthquake activity, earthquakes began occurring again in Group A. The largest (M 3.5) in the series occurred in this group on May 28, 1988. Its fault plane solution appears to define a thrust type focal mechanism with a northeast-southwest trending P axis (Fig III-6).

The largest earthquakes during the year were located west of Yakima and, as mentioned previously, they had magnitudes of 4.1 and 4.3. Their fault plane solutions (Fig. III-7) indicate thrust mechanisms with north-south trending P axes, in agreement with other earthquakes that have occurred in the region. Besides these two events, there were numerous other earthquakes in the region west of Yakima and Ellensburg. A cluster of 21 earthquakes having $M_c > 1.0$ occurred east of the Deschutes river near Maupin, Oregon between August 8 and 24, 1987. The largest had a magnitude of 2.4. In 1976, an earthquake of magnitude 4.8 occurred in this area, and 8 earthquakes with $1.0 \leq M_c \leq 2.1$ were located here in 1982.

In December, six earthquakes, the largest having magnitude M_c=2.7, occurred to the west of Banks lake, southwest of Grand Coulee. This is a region that has shown frequent earthquake activity in the past. Two other swarms occurred in southern Washington. A cluster of 5 earthquakes occurred in October and November, north of Richland; the largest had a magnitude of 2.0. A cluster of 6 smaller events occurred from January 8 to 10 in the Horse Heaven Hills south of Prosser (40 km southwest of Richland).

TABLE III-1 DOE Supported or Related Stations 1987-88

Station Designator	Latitude(N) (dg mn sec)	Longitude(W) (dg mn sec)	Elevation (km)	Station Name
BRV	46 29 07.2	119 59 29.4	0.925	Black Rock Valley
BVW	46 48 37.8	119 52 54.1	0.707	Beverly
CBS	47 48 16.7	120 02 27.6	1.073	Chelan Butte, South
CHO	45 35 27.0	118 34 45.0	1.076	Cabbage Hill, Oregon
CRF	46 49 30.6	119 23 18.0	0.260	Corfu
DPW*	47 52 14.3	118 12 10.2	0.892	Davenport
DY2	47 59 06.9	119 46 13.0	0.884	Dyer Hill 2
ELL	46 54 35.0	120 34 06.0	0.805	Ellensburg
EPH	47 21 12.8	119 35 46.2	0.628	Ephrata
ETP	46 27 53.4	119 03 32.4	0.250	Eltopia
ETW*	47 36 16.2	120 19 51.6	1.475	Entiat
FOX	48 19 50.0	119 42 29.0	0.896	Fox Mountain
GBL*	46 35 51.6	119 27 35.4	0.330	Gable Mountain
GL2*	45 57 35.0	120 49 22.5	1.000	New Goldendale
HH2	46 10 18.0	119 23 01.0	0.490	Horse Heaven Hills (moved HHW)
LOC	46 43 04.8	119 25 54.6	0.201	Rohay Station
LNO	45 52 15.8	118 17 06.0	0.768	Lincton Mt., Oregon
MDW*	46 36 48.0	119 45 39.0	0.330	Midway
MOX	46 34 38.0	120 17 35.0	0.540	Moxie City
NAC	46 44 03.8	120 49 33.2	0.738	Naches
NEL	48 04 41.8	120 20 17.7	1.490	Nelson Butte
ODS	47 18 24.0	118 44 42.0	0.523	Odessa
OTH	46 44 20.4	119 12 59.4	0.260	Othello
PAT	45 52 50.1	119 45 40.1	0.300	Paterson
PRO	46 12 45.6	119 41 09.0	0.552	Prosser
RCV	46 56 60.0	119 26 00.0	0.500	Royal City
RPK	45 45 42.0	120 13 50.0	0.330	Roosevelt Peak
RSW	46 23 28.2	119 35 19.2	1.037	Rattlesnake Mt. (East)
SAW	47 42 06.0	119 24 03.6	0.690	St. Andrews
SYR	46 51 46.8	119 37 04.2	0.267	Smyrna
TBM	47 10 10.1	120 35 54.0	1.064	Table Mt.
TWW	47 08 17.2	120 52 04.5	1.046	Teanaway
VGB	45 30 56.4	120 46 39.0	0.729	Gordon Butte, Oregon
VIP	44 30 29.4	120 37 07.8	1.731	Ingram Pt., Oregon
VTG	46 57 28.8	119 59 14.4	0.208	Vantage
VTH	45 10 52.2	120 33 40.8	0.773	The Trough, Oregon
WA2*	46 45 24.2	119 33 45.5	0.230	Wahluke Slope
WAT	47 41 55.0	119 57 15.0	0.900	Waterville
WBW	48 01 04.2	119 08 13.8	0.825	Wilson Butte
WEN	47 31 46.2	120 11 39.0	1.061	Wenatchee
WG2	46 01 50.3	118 51 20.0	0.511	Wallula Gap
WIW	46 25 48.8	119 17 13.4	0.130	Wooded Island
WNS	46 42 37.0	120 34 30.0	1.000	Wenas
WRD	46 58 11.4	119 08 36.0	0.378	Warden
YAK	46 31 15.8	120 31 45.2	0.619	Yakima

*Calibrated Station. See 1987 Annual Technical Report.

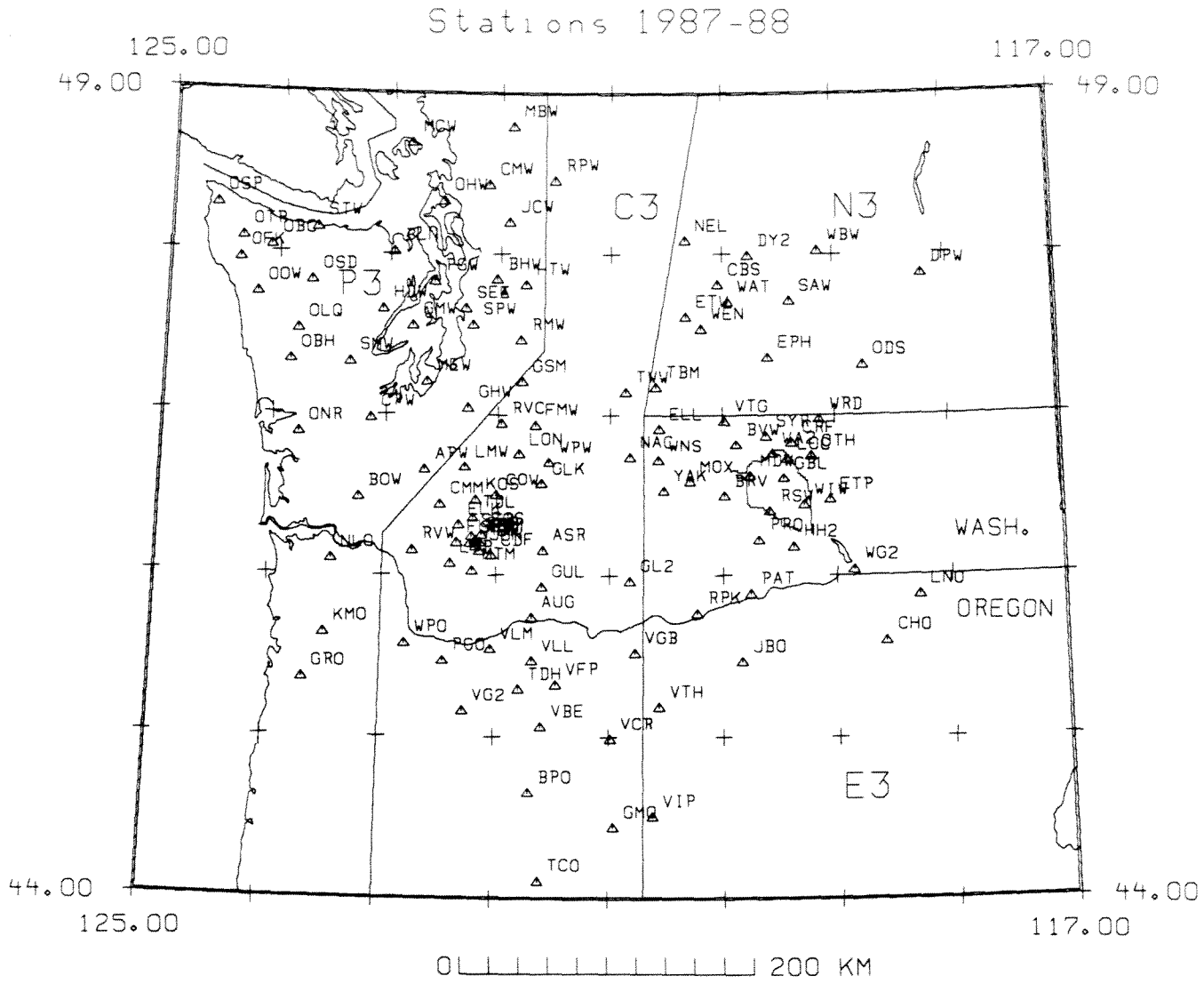


Figure III-1. Seismograph stations operating in the period July 1, 1987 to June 30, 1988. The Department of Energy supports stations east of 121.5° W. Thin, straight lines outline regions in which different velocity models are used (P3, C3, N3, E3). The outline of the Hanford reservation is also shown in southeast Washington.

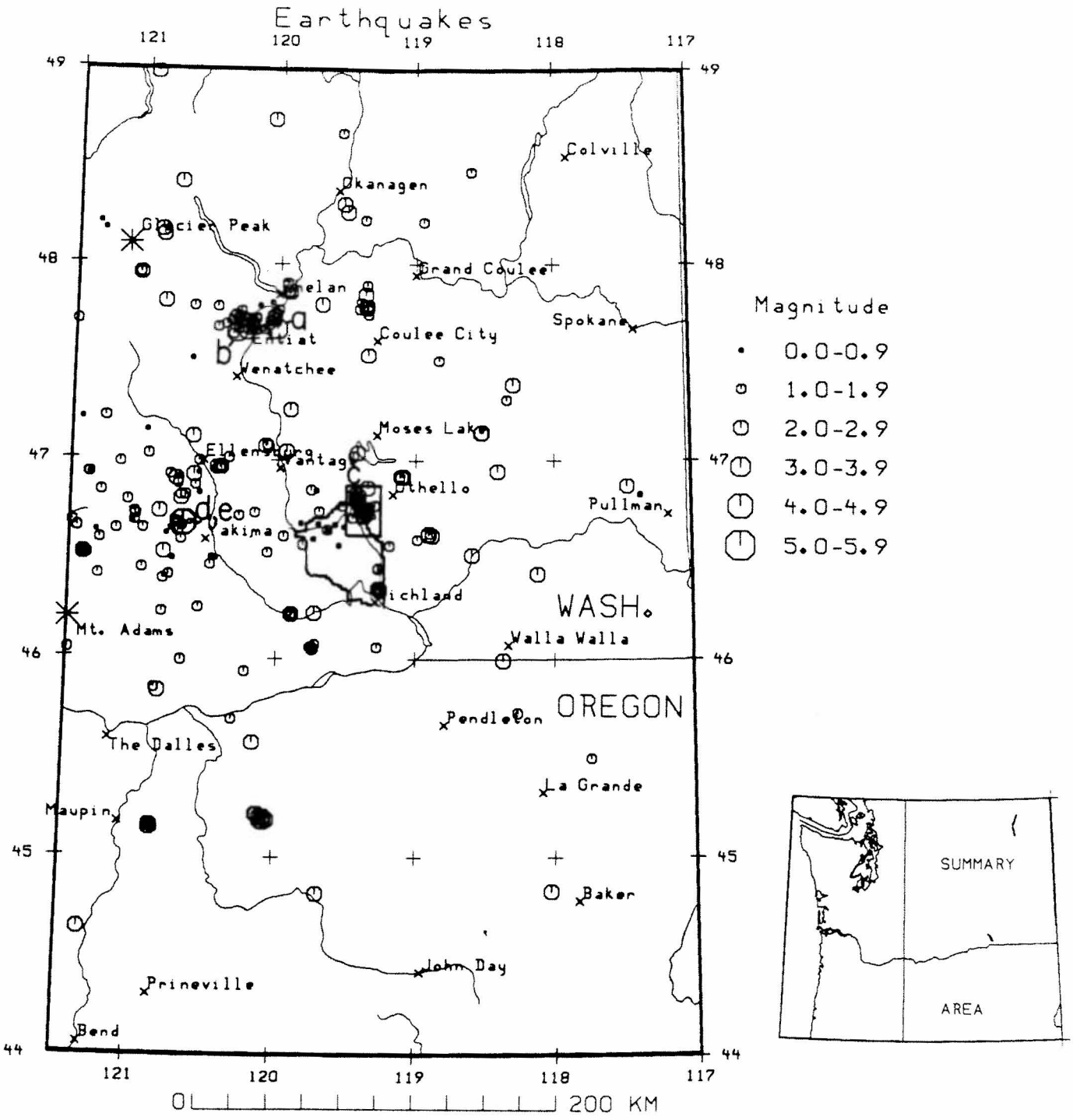


Figure III-2. Earthquakes in eastern Washington and Oregon, July 1, 1987 - June 30, 1988. The area summarized in this report is shown at lower right. The earthquakes shown are listed in Appendix III. At the center of the map is shown the outline of the Hanford reservation as well as a small box that outlines the area shown in Figure III-3.

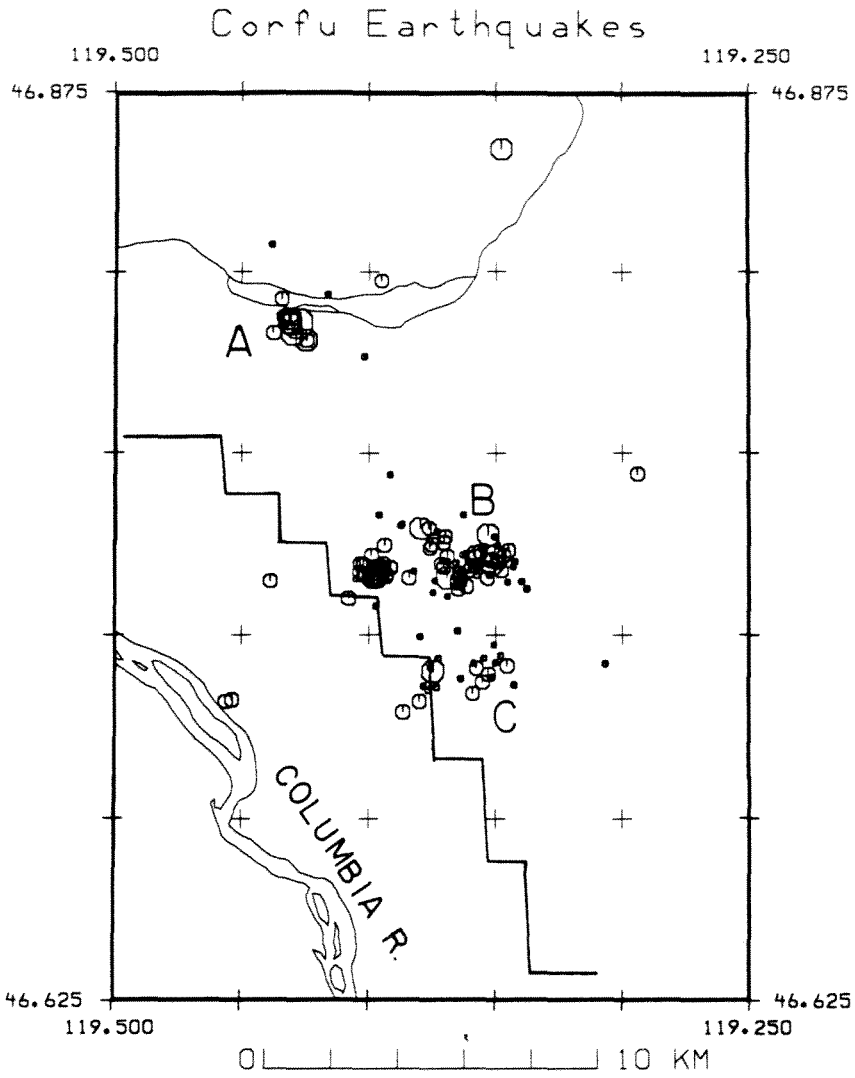


Figure III-3. Earthquakes in the area of Corfu for the period July 1, 1987 - June 30, 1988. The jagged line is the northeast boundary of the Hanford reservation seen in Figure III-2. The earthquakes are arbitrarily divided into a northern (A), central (B), and southern group (C). The earthquake sequence began and ended in group A.

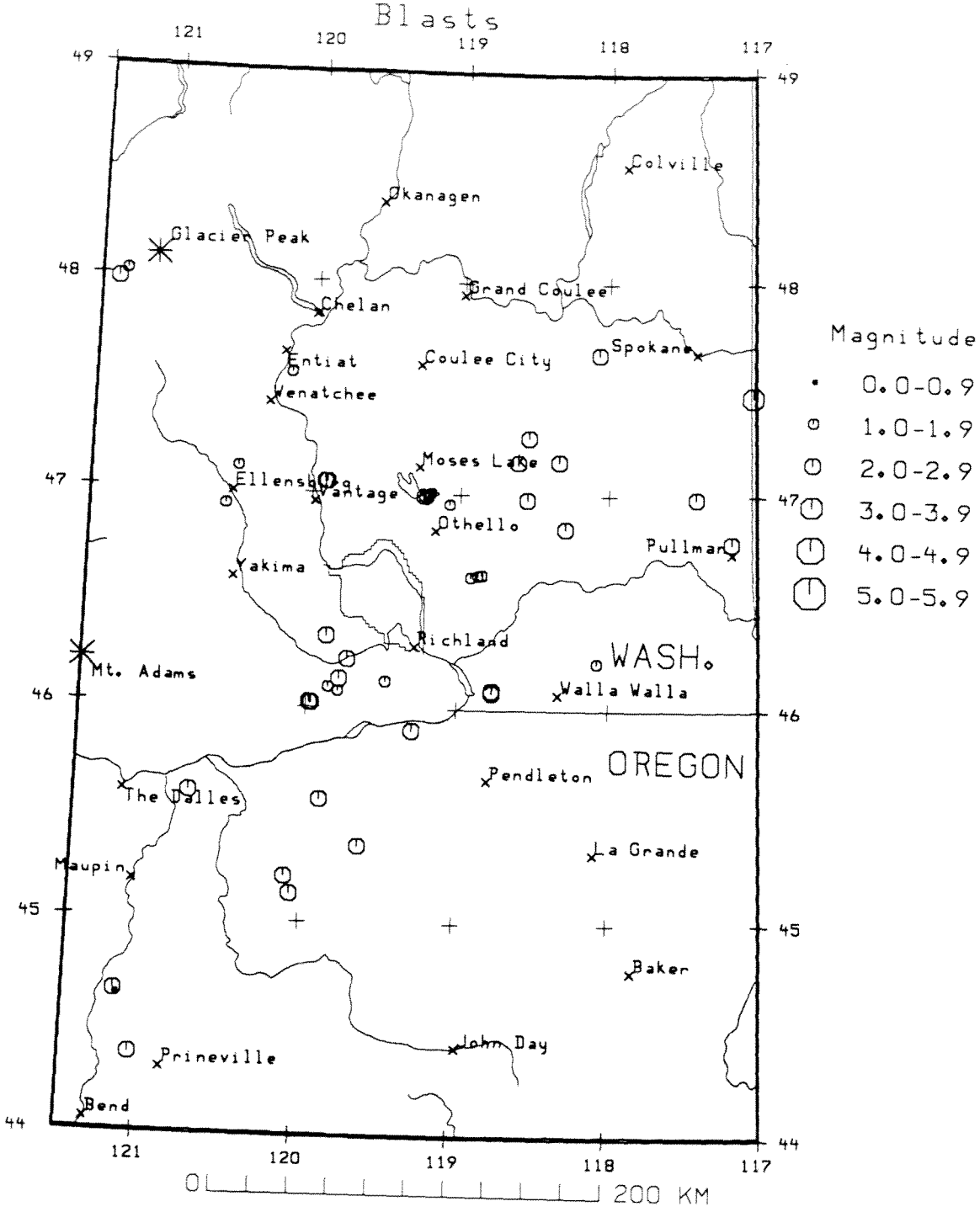
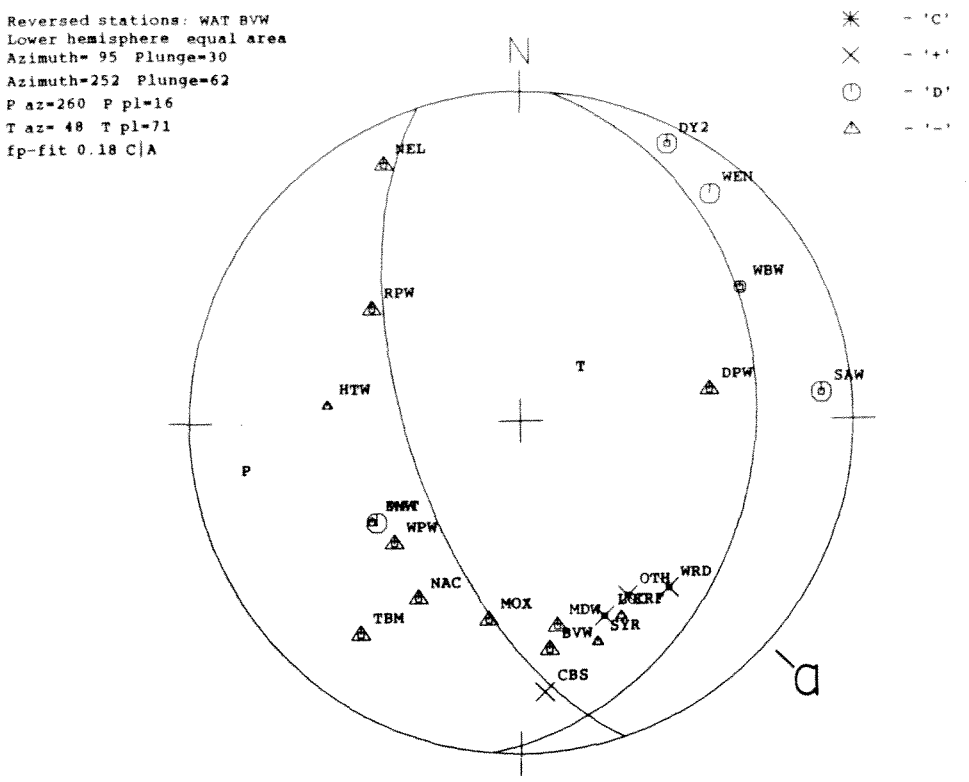


Figure III-4. Known or suspected blasts in eastern Washington and Oregon, July 1, 1987 - June 30, 1988. The blasts shown are listed in Appendix III.



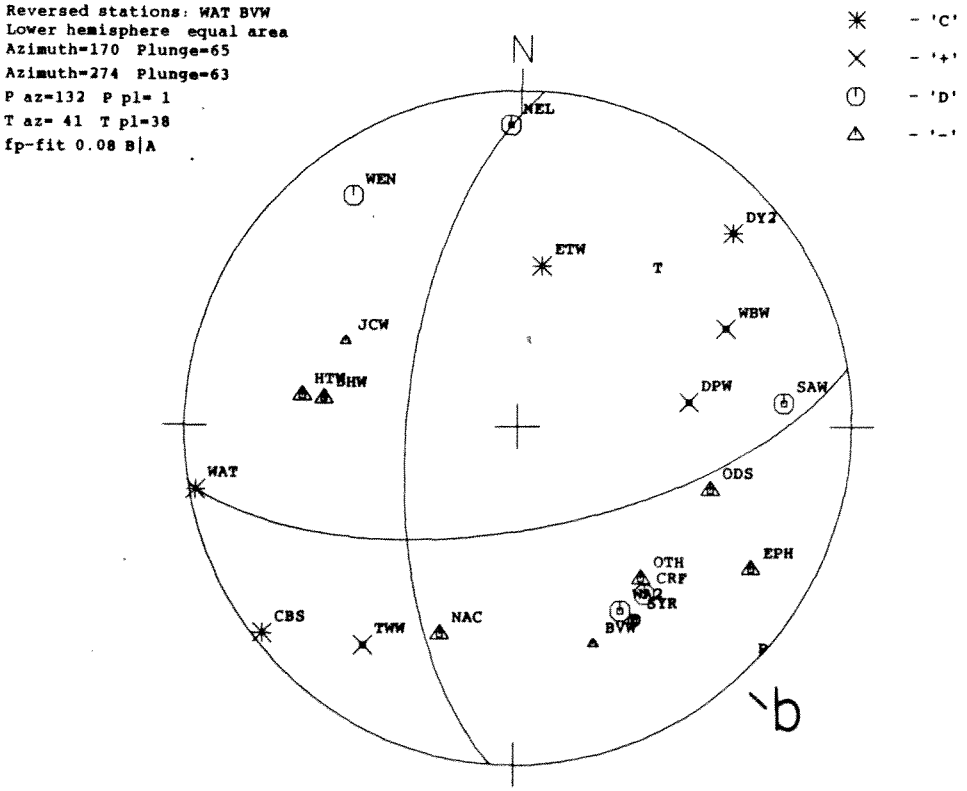


Figure III-5. Fault plane solutions for two earthquakes in the Entiat area indicated by the letters a and b in Figure III-2. Event a occurred on February 6, 1988 at 12:51 UT. It had a magnitude of 3.0 and a depth of 7.2 km. Event b occurred on May 5, 1988 at 00:18 UT.

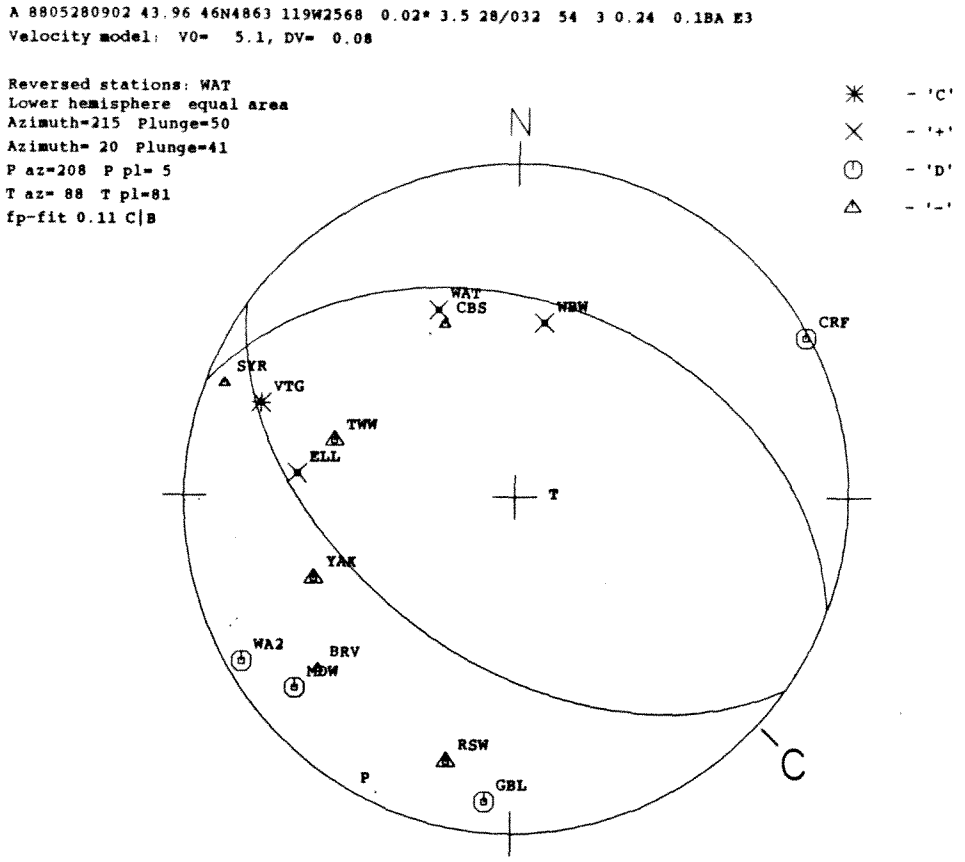
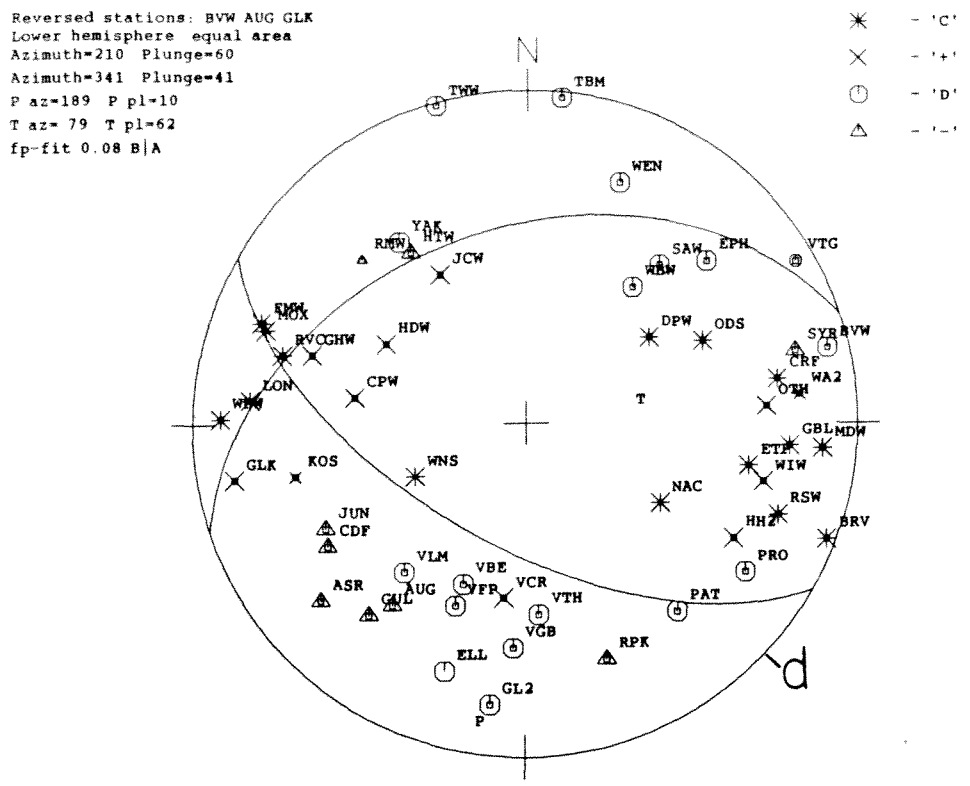


Figure III-6. Fault plane solution for the Corfu earthquake indicated by the letter c in III-2. The event occurred on May 28, 1988 at 09:02 UT. It had a magnitude of 3.5 and a very shallow depth (fixed at 0.02 km).



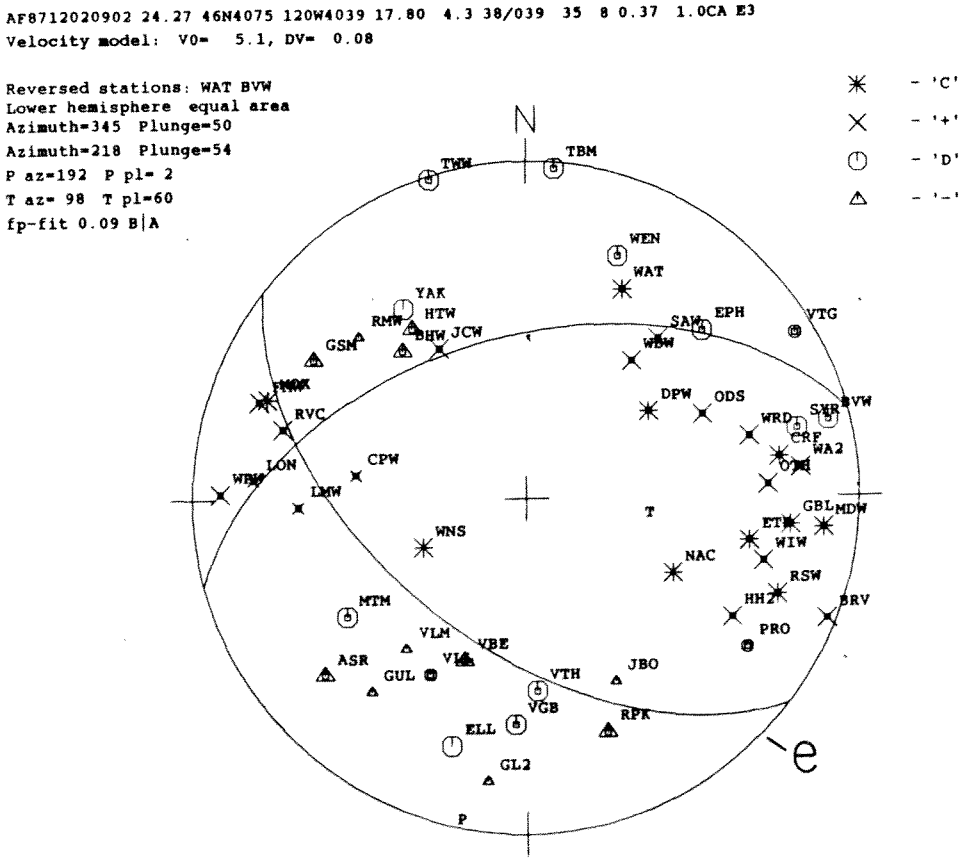


Figure III-7. Fault plane solutions for two earthquakes northwest of Yakima indicated by the letters d and e in Figure III-2. The events occurred on December 2, 1987 at 07:12 and 09:02 UT respectively. Both had depths of 18 km and had magnitudes of 4.1

Earthquakes 1969-March 1988
44.0°-49.5°N, 117.0°-121.5°W, M≥2.5

DAY	TIME	LAT	LOfi	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
69/02/28	00:37:04.00	48 00.00	120 00.00	18.00	2.6	0/00	0	0.			9
69/03/20	00:39:12.00	48 05.99	121 00.00	18.00	3.2	0/00	0	0.			9
69/03/26	22:32:07.60	47 06.77	119 04.37	3.00	2.5	0/00	0	0.			9
69/03/27	00:35:42.00	48 47.99	119 48.00	18.00	2.7	0/00	0	0.			9
69/03/27	04:03:04.70	48 00.93	119 04.40	7.08$	2.5	5/06	0	0.77	DD	N3	
69/03/27	04:03:04.80	48 00.17	119 11.81	0.	2.8	0/00	0	0.			9
69/04/01	03:11:17.11	48 08.91	118 55.44	39.00	2.5	5/06	0	0.34	DD	N3	
69/04/10	23:55:03.00	48 30.00	119 00.00	18.00	2.5	0/00	0	0.			9
69/04/19	05:46:02.98	45 53.85	119 42.21	0.02*	2.8	6/09	0	0.36	CD	E3	
69/04/20	02:19:16.49	48 06.87	119 08.05	3.59	2.9	5/08	0	0.25	DD	N3	
69/04/20	02:19:16.00	48 15.00	119 16.32	6.00	3.2	0/00	0	0.			9
69/04/21	14:16:34.80	47 13.45	119 40.83	0.04*	2.6	5/08	0	0.55	DD	N3	
69/04/21	14:16:35.50	47 07.80	119 36.42	1.00	2.8	0/00	0	0.			9
69/05/09	19:06:09.70	47 38.75	119 48.06	0.	3.3	0/00	0	0.			9
69/05/10	19:37:21.54	46 49.80	119 35.60	0.53*	2.5	6/08	0	0.08	AC	E3	
69/05/10	19:37:21.40	46 49.67	119 35.82	1.00	2.8	0/00	0	0.			9
69/05/11	03:50:13.28	48 02.16	119 13.10	2.42	2.8	5/09	0	0.35	DD	N3	
69/05/11	03:50:11.90	48 11.64	119 13.67	3.00	3.1	0/00	0	0.			9
69/05/19	18:59:26.50	47 48.47	118 17.10	3.00	3.7	0/00	0	0.			9
69/06/10	14:50:27.10	46 25.49	119 16.50	2.00	2.5	0/00	0	0.			9
69/07/18	04:31:39.97	46 47.03	120 23.51	13.00*	2.5	6/08	0	0.07	AD	E3	
69/07/18	04:31:40.60	46 47.93	120 19.49	12.00	2.8	0/00	0	0.			9
69/07/24	07:08:12.40	47 39.06	120 18.59	2.00	2.8	0/00	0	0.			9
69/07/31	06:14:22.06	46 25.11	119 17.07	5.74	2.6	6/06	0	0.22	BC	E3	
69/07/31	06:14:22.00	46 25.55	119 16.85	0.	2.9	0/00	0	0.			9
69/08/01	15:58:24.70	47 47.21	119 35.70	0.	3.1	0/00	0	0.			9
69/08/02	03:04:16.00	47 20.75	117 23.74	39.55	3.1	5/07	0	0.16	DD	N3	
69/08/02	03:04:16.30	47 11.88	117 22.50	15.00	3.4	0/00	0	0.			9
69/08/02	16:00:12.00	49 00.00	121 18.00	18.00	2.5	0/00	0	0.			9
69/08/04	15:31:09.80	47 40.97	119 58.32	5.00	3.4	0/00	0	0.			9
69/08/08	07:05:48.50	47 32.34	119 08.88	11.00	2.6	0/00	0	0.			9
69/08/08	17:04:52.20	47 44.63	119 26.64	3.00	3.1	0/00	0	0.			9
69/08/11	13:36:35.50	46 42.95	119 51.83	9.00	2.5	0/00	0	0.			9
69/08/14	16:31:46.60	47 37.97	119 35.27	1.00	3.5	0/00	0	0.			9
69/08/15	16:23:04.00	46 25.01	119 15.17	2.00	2.6	0/00	0	0.			9
69/08/31	11:18:07.76	46 25.75	119 17.50	2.73	2.5	7/08	0	0.14	AC	E3	
69/08/31	11:18:07.70	46 25.68	119 16.85	3.00	2.7	0/00	0	0.			9
69/08/31	11:19:31.20	46 25.55	119 17.40	1.00	2.5	0/00	0	0.			9
69/08/31	16:27:34.55	46 23.05	120 56.98	10.21	2.7	6/09	0	0.19	CD	C3	
69/08/31	16:27:35.00	46 17.09	120 46.56	2.00	3.0	0/00	0	0.			9
69/09/02	21:50:31.10	46 41.46	119 32.87	13.00	2.7	0/00	0	0.			9
69/09/10	12:14:58.00	46 57.95	119 37.14	3.00	2.7	0/00	0	0.			9
69/09/13	08:30:47.70	47 44.88	119 25.44	1.00	3.3	0/00	0	0.			9
69/10/19	07:30:23.78	46 15.42	118 21.70	7.30	2.6	7/11	0	0.18	CD	E3	
69/11/05	00:41:29.20	47 08.33	118 14.51	2.00	3.4	0/00	0	0.			9
69/12/03	20:18:48.60	46 46.73	119 45.42	2.00	2.5	0/00	0	0.			9
70/01/01	06:44:28.06	46 19.97	118 23.47	0.02*	2.6	6/10	0	0.15	AD	E3	
70/05/06	17:15:38.03	46 52.93	119 27.33	1.28	2.5	5/06	0	0.19	BD	E3	
70/07/11	10:24:30.86	48 12.21	121 21.32	0.05*	3.0	4/08	0	0.10	AD	C3	
70/07/29	20:42:31.21	48 12.26	119 29.56	20.78	2.7	10/14	0	0.36	DD	N3	
70/08/23	11:11:40.74	46 44.76	119 20.85	2.96	3.4	14/15	0	0.07	AB	E3	
70/09/01	13:48:43.27	46 42.81	118 17.01	10.46	2.9	13/19	0	0.24	BD	E3	
70/09/11	02:20:53.97	46 39.24	120 24.21	18.15$	3.5	14/18	0	0.32	CD	E3	
70/09/29	17:50:13.40	45 45.63	119 08.73	19.82	2.5	11/18	0	0.23	BD	E3	
70/09/29	18:51:19.32	46 45.51	119 23.27	4.36$	2.9	12/17	0	0.27	BB	E3	
70/09/29	22:47:52.25	46 58.55	119 48.76	25.05	2.7	12/13	0	0.08	AD	E3	
70/10/01	11:46:52.60	46 45.38	119 22.70	4.52*	3.0	12/14	0	0.15	BB	E3	
70/10/02	01:18:19.17	45 42.73	120 38.41	12.17	2.7	10/12	0	0.13	CD	E3	
70/10/02	15:56:24.75	46 45.39	119 22.37	4.01	3.4	12/12	0	0.12	AB	E3	
70/10/19	07:15:07.52	46 53.18	117 34.12	15.53	3.2	13/19	0	0.29	DD	E3	

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
70/11/06	18:15:16.68	46 41.24	118 52.32	2.42	3.1	11/12	0	0.15	BD	E3	
70/11/07	07:19:44.23	46 26.52	119 17.49	0.44*	2.9	12/20	0	0.40	CA	E3	
70/11/14	15:40:45.97	46 25.79	119 17.94	1.44	2.9	15/17	0	0.15	AB	E3	
70/11/29	02:15:53.06	47 24.70	121 25.26	14.94#	3.3	5/05	0	0.07	AD	C3	
70/11/30	12:48:54.74	47 10.02	119 39.23	0.04*	2.6	9/14	0	0.23	BD	N3	
71/01/22	15:07:18.00	46 53.98	119 32.82	2.55	2.8	11/12	0	0.13	AB	E3	
71/01/24	21:05:48.18	46 37.53	119 10.45	0.57	2.5	9/10	0	0.13	AC	E3	
71/01/26	10:17:05.40	46 54.06	119 34.13	4.36	3.2	11/12	0	0.24	BB	E3	
71/03/01	01:33:31.28	47 41.79	120 10.29	8.65	2.7	8/11	0	0.13	BD	N3	
71/03/17	09:57:02.31	46 41.27	118 53.76	1.15	2.8	14/15	0	0.10	AD	E3	
71/04/26	04:38:18.64	47 40.75	120 06.74	5.23	2.5	9/11	0	0.14	BD	N3	
71/05/22	15:57:10.68	47 47.42	118 57.16	35.08	3.3	13/14	0	0.21	CD	N3	
71/07/13	23:29:25.66	44 59.93	117 52.47	23.55$	3.5	10/13	0	0.40	DD	E3	
71/08/18	23:44:24.52	47 38.93	120 08.74	13.23	3.2	10/12	0	0.21	CD	N3	
71/09/21	13:16:25.79	46 41.08	119 14.02	2.23	2.7	15/15	0	0.10	AB	E3	
71/10/25	18:52:49.17	46 42.49	119 33.00	3.99	3.8	15/16	0	0.09	AB	E3	
71/11/23	02:12:17.86	48 09.98	121 25.61	24.81	4.1	6/08	0	0.17	BD	C3	
72/02/11	01:07:35.90	46 50.47	119 45.47	4.14	2.5	16/16	0	0.10	AC	E3	
72/06/05	20:17:31.39	47 18.21	121 29.44	4.73	2.5	5/08	0	0.20	BD	C3	
72/06/19	23:57:59.94	48 03.80	121 23.94	2.34	3.2	6/10	0	0.15	BD	C3	
72/08/21	11:16:55.58	45 34.51	119 59.34	7.34$	2.6	20/27	0	0.42	DD	E3	
72/08/27	08:31:00.51	45 31.97	120 00.97	0.03*	2.5	11/12	0	0.14	AD	E3	
72/12/09	19:44:07.52	46 25.13	119 01.83	2.28	2.6	18/24	0	0.18	BC	E3	
72/12/09	19:51:53.97	46 25.13	119 01.84	2.08	2.5	18/25	0	0.15	BC	E3	
73/02/06	07:17:03.51	46 53.50	120 42.84	0.24$	2.6	17/17	0	0.15	CD	E3	
73/03/27	16:01:14.50	46 52.53	120 47.82	0.02*	2.8	4/06	0	0.28	BD	E3	
73/09/04	09:02:22.72	46 49.78	119 44.93	3.76	2.6	17/17	0	0.15	AC	E3	
73/09/04	17:56:50.99	48 13.97	121 13.62	4.87	3.7	10/11	0	0.23	BD	C3	
73/09/30	20:45:46.65	46 49.73	119 44.87	0.05*	2.5	16/16	0	0.15	AC	E3	
73/12/20	01:08:28.30	46 52.03	119 21.39	3.31	4.4	21/21	0	0.11	AB	E3	
73/12/22	04:11:46.92	46 36.93	121 25.61	4.29	2.5	5/06	0	0.15	CD	C3	
73/12/29	09:38:14.14	46 02.93	119 39.48	11.06	2.8	22/25	0	0.16	BD	E3	
74/01/07	19:13:07.01	46 52.24	119 21.05	0.04#	2.7	24/25	0	0.14	AB	E3	
74/04/20	03:00:09.38	46 42.95	121 28.54	5.55	4.7	6/06	0	0.16	DD	C3	F
74/04/21	14:08:53.35	46 41.45	121 25.81	4.82	3.5	7/07	0	0.10	CD	C3	
74/09/04	01:04:28.64	46 52.37	119 21.28	2.95	2.9	21/21	0	0.11	AB	E3	
75/04/09	20:27:01.42	46 59.90	118 26.60	38.09#	2.5	4/04	0	0.03	AD	N3	
75/05/09	09:34:25.30	46 25.86	119 15.60	1.29	2.8	8/09	0	0.04	AD	E3	
75/05/09	20:52:14.30	45 37.98	118 33.36	0.02#	2.7	4/04	0	0.04	AD	E3	
75/05/22	13:31:33.59	46 23.51	119 10.74	2.03	2.8	9/09	0	0.05	AC	E3	
75/05/22	20:18:51.13	45 25.07	118 23.03	0.04*	2.8	7/07	0	0.12	BD	E3	
75/06/15	17:51:31.75	46 14.04	119 06.79	1.74	3.1	10/10	0	0.22	BC	E3	F
75/06/16	19:59:48.17	46 36.71	119 32.74	4.65	2.5	11/11	0	0.08	AB	E3	
75/06/28	16:33:43.33	46 06.32	119 42.22	9.34	3.3	10/10	0	0.08	BD	E3	
75/06/28	22:17:52.37	46 05.94	119 42.36	10.97	3.8	12/12	0	0.07	AD	E3	F
75/06/28	22:27:46.15	46 05.53	119 43.33	9.36	2.7	9/09	0	0.11	CD	E3	
75/07/01	05:28:02.71	45 36.32	120 00.97	15.32	3.6	11/11	0	0.11	CD	E3	
75/07/07	20:41:15.10	45 57.06	118 14.02	8.04$	3.2	10/10	0	0.26	DD	E3	
75/07/17	18:33:59.63	47 24.31	120 09.09	6.66	2.7	10/10	0	0.07	AC	N3	
75/07/18	22:47:01.31	47 41.45	120 09.82	3.31	2.6	8/10	0	0.07	BC	N3	
75/08/30	08:40:00.21	47 51.88	118 27.61	8.88$	2.5	5/06	0	0.33	DD	N3	
75/09/18	12:19:28.75	47 48.65	118 15.49	6.52	3.5	11/12	0	0.06	AD	N3	F
75/11/07	04:49:28.43	46 52.91	119 22.01	3.27	2.9	18/18	0	0.24	BB	E3	
75/12/31	03:23:26.13	46 41.56	119 13.07	3.95	2.7	16/16	0	0.22	BC	E3	
76/01/05	23:50:01.97	46 40.70	119 13.64	4.38	2.6	12/12	0	0.17	BC	E3	
76/03/29	12:36:20.41	45 00.78	120 59.76	44.50	3.0	10/11	0	0.19	CD	C3	R
76/05/15	13:04:53.55	47 42.64	120 03.69	8.04	3.1	9/10	0	0.11	AB	N3	F
76/06/15	01:01:45.15	46 27.87	117 45.98	0.02*	3.0	13/14	0	0.40	CD	E3	F
76/06/15	09:08:04.77	47 37.48	120 19.61	0.75	3.0	8/09	0	0.19	BD	N3	F
76/07/02	01:35:53.40	46 59.70	118 33.09	4.73*	2.7	10/11	0	0.22	BC	E3	
76/07/10	17:54:40.03	46 59.19	118 33.51	8.54$	2.9	14/17	0	0.35	CC	E3	
76/07/23	17:59:36.58	46 05.12	118 44.98	0.02*	3.1	11/11	0	0.12	AC	E3	F
76/07/26	07:21:07.47	45 38.81	119 58.43	3.95	2.9	11/13	0	0.16	BD	E3	
76/07/30	01:53:15.28	46 57.39	119 33.03	0.78	2.7	12/14	0	0.25	BC	E3	
76/08/05	01:38:16.09	46 27.99	118 02.18	0.04*	2.8	8/09	0	0.18	BD	E3	

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
76/08/25	23:12:47.33	45 03.56	120 56.25	33.09	2.7	6/10	0	0.12	BD	C3	R
76/08/30	16:34:01.57	47 39.22	120 12.01	5.50	3.1	13/14	0	0.10	AC	N3	F
76/09/04	12:05:05.27	45 07.70	120 52.27	38.46	2.9	7/11	0	0.28	BD	C3	R
76/10/10	05:41:08.10	45 10.52	120 56.77	43.06	3.6	8/09	0	0.26	DD	C3	R
76/10/31	05:59:12.57	45 59.34	120 47.98	21.76$	2.7	15/18	0	0.35	CD	C3	C
76/10/31	21:37:36.49	46 00.06	120 49.25	14.92$	2.9	12/13	0	0.32	CD	C3	C
76/11/19	07:04:36.62	44 59.91	120 57.58	84.04	3.1	9/12	0	0.57	DD	C3	R
76/12/13	08:47:29.52	47 39.03	120 07.82	5.61	3.1	10/10	0	0.12	BB	N3	F
77/01/27	07:47:29.24	46 56.31	119 35.47	1.47	3.2	14/15	0	0.26	BB	E3	F
77/03/11	22:50:11.47	45 53.95	119 39.94	0.02*	3.1	9/11	0	0.24	BC	E3	F
77/03/15	22:59:26.84	47 31.12	119 36.85	6.78	2.7	10/15	0	0.17	BC	N3	
77/03/31	22:29:04.01	45 54.11	119 39.25	0.03*	2.9	10/13	0	0.24	BC	E3	
77/04/14	19:55:08.98	45 04.36	120 49.66	38.18	2.8	10/14	0	0.40	CD	C3	R
77/06/07	08:09:52.05	47 59.96	121 28.87	0.57	2.5	13/19	0	0.31	CC	P2	
77/07/13	07:15:06.39	47 03.46	120 59.13	4.07	3.9	35/37	0	0.32	CD	P2	F
77/09/11	04:13:15.82	46 38.28	119 37.89	0.05*	2.7	13/15	0	0.32	CC	E3	
77/10/09	02:55:16.57	47 06.72	120 28.79	1.08	2.9	14/16	0	0.10	AD	N3	
77/11/18	12:31:23.53	48 20.69	119 30.57	15.68*	2.7	11/11	0	0.10	AC	N3	
78/01/25	01:09:20.84	47 53.81	120 06.71	0.56	3.3	13/13	0	0.12	AC	N3	
78/03/04	19:47:05.42	46 03.62	118 51.33	13.39	2.8	11/12	0	0.12	AA	E3	
78/03/22	03:08:59.43	48 06.67	119 30.04	13.06	3.3	10/10	0	0.07	AD	N3	
78/04/16	19:45:16.86	47 44.21	120 14.35	4.75	3.3	16/16	0	0.09	AB	N3	
78/06/11	02:43:55.29	46 52.21	120 58.46	2.41	2.6	23/27	0	0.20	BD	C3	
78/06/27	02:18:59.53	46 52.60	120 58.30	12.38	3.6	30/31	0	0.34	CD	C3	F
78/10/10	12:04:28.05	47 53.94	119 41.43	4.48	3.1	12/13	0	0.08	AB	N3	
78/10/18	04:36:07.66	46 49.31	119 33.62	4.21	2.5	9/09	0	0.11	AB	E3	
79/01/19	14:55:16.07	47 54.07	119 41.26	6.60	3.9	12/12	0	0.10	AB	N3	F
79/01/19	15:53:45.06	47 54.02	119 41.31	6.13	2.7	15/15	0	0.16	BB	N3	
79/01/21	20:40:06.24	47 53.94	119 41.22	4.86	3.0	15/15	0	0.11	AB	N3	
79/01/30	16:06:45.74	47 39.93	120 07.56	7.19	3.0	15/15	0	0.16	BB	N3	
79/02/06	04:37:58.69	47 54.11	119 41.35	5.93	2.8	11/11	0	0.07	AB	N3	
79/02/17	08:36:21.53	46 09.85	119 55.96	18.11	3.6	15/15	0	0.12	BD	E3	
79/04/07	03:47:23.10	46 58.71	120 27.07	16.89	3.0	12/13	0	0.24	CD	E3	
79/04/07	07:41:55.27	46 58.67	120 23.28	16.75$	2.5	11/12	0	0.23	BD	E3	
79/04/08	07:29:37.57	45 59.48	118 23.95	7.88	4.3	8/08	0	0.07	AD	E3	F
79/07/06	18:10:32.56	47 39.98	120 20.72	4.74	2.5	11/11	0	0.04	AC	N3	
79/07/22	15:25:55.99	46 50.54	119 24.63	2.01	2.9	13/13	0	0.14	AA	E3	
79/07/28	02:19:05.50	46 40.47	120 36.81	0.04*	3.7	16/19	0	0.36	CD	E3	F
79/09/08	06:21:59.45	46 29.38	119 38.82	4.20*	2.5	9/09	0	0.02	AC	E3	
79/11/10	04:53:29.95	47 43.45	120 04.14	4.22	3.1	18/18	0	0.18	BB	N3	
79/11/11	00:43:09.64	47 45.96	119 24.64	0.30	2.7	8/08	0	0.14	AB	N3	
79/11/12	06:08:33.35	46 55.34	119 35.19	3.19	2.7	12/12	0	0.17	BB	E3	
79/11/18	02:08:45.61	46 53.07	119 34.09	3.06	2.8	14/15	0	0.31	CA	E3	
79/11/21	02:07:06.52	46 55.18	119 34.22	1.54	2.8	17/18	0	0.19	BB	E3	
79/11/22	19:17:12.69	46 55.46	119 35.07	2.29	2.6	15/15	0	0.20	BB	E3	
79/11/24	11:48:31.70	46 55.97	119 35.68	2.19	2.5	13/14	0	0.16	BB	E3	
79/11/24	11:51:14.08	46 55.79	119 34.60	2.80	3.4	20/20	0	0.23	BB	E3	
79/12/01	15:47:55.79	46 55.89	119 33.47	0.04*	2.6	12/12	0	0.18	BC	E3	
79/12/04	21:31:24.00	47 44.45	120 03.93	6.32	2.6	10/10	0	0.08	AB	N3	
79/12/10	05:40:06.70	46 39.87	120 36.05	7.54	3.1	18/19	0	0.27	BC	E3	F
79/12/31	07:27:48.96	47 51.60	120 00.17	0.03*	2.6	11/13	0	0.09	AB	N3	
80/01/05	16:02:08.04	46 48.04	119 25.28	0.03*	2.9	17/17	0	0.18	BA	E3	H
80/01/26	20:00:40.48	49 12.84	120 06.73	6.44	2.5	11/11	0	0.94	DD	N3	
80/01/28	07:16:39.62	46 17.34	120 27.10	4.63	2.6	20/21	0	0.61	DD	E3	
80/02/18	22:09:14.42	49 19.16	120 11.28	33.85$	2.5	7/09	0	0.57	DD	C3	
80/03/02	19:50:26.94	47 42.39	121 28.97	10.02	2.7	20/24	0	0.15	BC	C3	
80/03/04	00:42:17.02	45 56.40	119 39.84	0.02*	2.6	11/11	0	0.25	BD	E3	
80/03/07	02:58:32.02	47 44.00	120 05.14	2.03*	2.5	14/16	0	0.16	BB	N3	
80/03/12	17:02:05.03	46 07.48	119 01.54	3.19	2.6	10/11	0	0.15	BC	E3	
80/06/18	11:41:27.90	48 40.21	119 34.69	11.18#	2.9	6/06	0	0.09	AD	N3	F
80/09/29	03:53:52.99	47 45.40	120 14.15	0.66	2.6	24/28	0	0.18	BC	N3	F
80/11/09	02:36:16.98	47 40.70	120 04.57	8.16	2.7	25/27	0	0.14	AB	N3	
80/11/19	21:35:24.07	46 56.98	119 28.17	0.86	3.3	26/27	0	0.10	AC	E3	
80/11/23	04:10:54.20	46 54.77	119 34.71	1.49	2.5	17/19	0	0.14	AB	E3	
80/12/03	06:58:46.86	46 55.21	119 21.66	1.22	2.6	26/27	0	0.25	BC	E3	

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
80/12/18	22:44:27.93	45 49.98	120 00.44	0.03*	2.8	16/16	0	0.28	BD	E3	
81/02/02	01:23:18.30	46 15.77	120 59.34	1.98*	4.0	54/54	0	0.31	CC	C3	F
81/02/15	08:13:13.24	47 11.83	120 54.33	5.80	2.6	29/32	0	0.44	CC	C3	
81/02/18	06:09:38.71	47 11.84	120 53.55	3.37	4.2	37/37	0	0.20	BC	C3	F
81/02/19	17:19:23.14	46 40.73	119 18.28	0.04*	2.7	16/17	0	0.14	AC	E3	
81/02/27	22:45:32.63	46 56.73	119 33.55	0.61	2.7	23/23	0	0.18	BC	E3	
81/03/02	11:34:24.59	47 11.93	120 53.45	0.03*	2.8	29/29	0	0.24	BC	C3	
81/03/06	14:19:07.26	47 11.92	120 53.19	0.02*	2.9	38/38	0	0.28	BC	C3	F
81/03/10	22:50:03.75	47 26.94	121 20.43	8.49	2.6	28/31	0	0.26	BC	C3	
81/03/15	07:24:06.85	47 59.24	121 29.58	5.35	3.6	29/29	0	0.29	BC	C3	F
81/04/01	16:45:30.37	47 40.48	120 20.44	0.50	2.7	20/22	0	0.24	BA	N3	
81/05/26	21:10:23.91	47 39.45	120 17.16	2.74$	2.6	25/25	0	0.18	BC	N3	
81/05/28	08:56:02.54	46 31.80	121 23.91	2.98	4.6	51/51	0	0.21	BC	C3	F
81/05/28	09:10:45.90	46 31.52	121 23.64	3.22	5.0	52/52	0	0.20	BC	C3	F
81/05/29	15:12:30.73	47 37.44	119 54.12	1.17*	2.5	22/27	0	0.18	BB	N3	
81/05/29	17:20:16.65	46 31.26	121 22.83	7.78	2.9	44/54	0	0.21	BC	C3	
81/06/10	16:56:01.97	47 37.82	120 02.17	0.04*	2.8	13/14	0	0.27	BB	N3	
81/06/14	13:12:56.81	45 57.70	120 30.42	13.58	3.2	28/29	0	0.31	CC	E3	
81/07/10	02:42:03.01	46 17.75	118 26.69	2.33	2.6	14/14	0	0.27	CD	E3	
81/07/22	06:05:50.38	47 46.65	120 17.28	9.53	3.0	28/28	0	0.26	BB	N3	F
81/08/06	12:32:28.51	46 28.76	121 19.98	4.01	2.8	40/43	0	0.27	BC	C3	
81/09/28	00:54:22.42	46 57.65	119 39.81	0.96	2.6	23/24	0	0.16	BC	E3	
81/10/07	12:10:56.86	46 31.27	121 22.53	4.05	2.6	39/47	0	0.28	BC	C3	
81/10/25	03:21:03.67	47 45.51	120 11.77	7.58	3.2	24/24	0	0.14	AB	N3	F
82/01/01	15:21:42.50	47 58.85	121 29.72	5.57	2.9	28/30	0	0.23	BC	C3	
82/01/04	08:43:51.98	47 13.91	120 37.30	1.09$	2.7	37/39	0	0.35	CC	C3	
82/01/23	15:31:37.16	46 32.77	121 22.67	3.33	3.2	40/40	0	0.18	BC	C3	
82/02/03	09:37:43.73	47 03.96	120 58.31	1.25$	2.5	35/37	0	0.29	CC	C3	
82/02/18	03:27:46.56	47 39.84	119 44.70	0.80	2.8	22/25	0	0.30	BC	N3	
82/03/01	00:47:00.96	47 03.30	120 59.71	5.32	2.7	38/43	0	0.36	CD	C3	
82/03/22	12:07:13.89	47 51.93	119 56.02	0.56	2.7	19/22	0	0.17	BC	N3	
82/07/18	14:05:30.69	46 31.68	121 23.07	6.48	2.9	42/44	0	0.29	BC	C3	
82/07/20	17:10:41.48	46 07.66	120 29.30	9.84	2.6	22/22	0	0.24	BC	E3	
82/08/30	02:05:35.31	46 04.51	120 31.63	2.34	2.6	18/19	0	0.31	CC	E3	
82/09/10	00:44:26.04	46 49.41	119 25.16	3.01	2.6	28/28	0	0.15	BA	E3	
82/09/26	10:09:23.58	46 52.04	121 02.86	3.25	3.4	50/53	0	0.23	BC	C3	F
82/10/12	21:43:56.25	47 06.48	121 16.34	1.13	2.6	29/30	0	0.19	BC	C3	
82/10/19	07:32:37.94	46 11.13	120 27.85	11.98$	2.7	29/29	0	0.29	BC	E3	
82/12/14	19:48:11.27	47 11.61	120 53.76	0.04*	2.8	41/44	0	0.46	CC	C3	
82/12/20	04:20:28.82	46 31.71	121 23.35	5.26	2.7	46/47	0	0.28	BC	C3	
83/01/28	06:36:09.62	47 45.52	120 03.27	0.53	2.5	19/20	0	0.18	BB	N3	
83/03/22	12:47:02.37	45 59.52	118 24.18	7.53	3.8	17/18	0	0.18	BD	E3	F
83/04/13	16:38:44.29	46 02.32	118 10.47	6.49	2.6	14/15	0	0.52	DD	E3	
83/04/24	13:20:36.98	46 31.26	121 22.80	4.97	2.7	45/47	0	0.25	BC	C3	
83/04/25	15:48:20.43	48 37.80	119 34.01	8.03*	3.0	7/10	0	0.15	BD	N3	
83/05/16	11:47:45.54	46 49.39	119 21.89	2.09	2.6	28/29	0	0.25	BA	E3	
83/05/21	01:11:14.85	47 16.94	121 24.85	11.69	2.8	44/46	0	0.27	BB	C3	
83/06/10	18:20:07.96	47 39.40	120 17.11	4.88	2.7	22/24	0	0.23	BA	N3	
83/07/24	14:20:51.79	47 42.13	120 06.22	0.81$	2.5	26/29	0	0.39	CC	N3	
83/09/14	09:03:02.81	47 42.97	120 16.30	4.48	2.5	27/29	0	0.27	BB	N3	F
83/09/14	10:51:01.29	47 42.82	120 16.38	4.69	2.6	25/28	0	0.35	CB	N3	F
83/10/05	23:02:51.36	46 31.48	120 37.45	14.66	2.6	22/23	0	0.22	BA	E3	
83/10/20	09:44:58.46	46 43.02	119 35.04	1.86	3.4	28/32	0	0.16	BA	E3	
83/11/14	11:19:00.40	46 39.32	120 35.99	7.87	3.8	30/30	0	0.19	BC	E3	F
83/12/03	20:20:13.86	46 46.43	120 38.47	8.08	2.5	28/30	0	0.31	CB	E3	
83/12/05	07:24:18.61	46 54.89	120 42.78	7.76$	3.8	33/33	0	0.18	BB	E3	F
84/01/13	21:07:52.07	46 16.10	118 08.43	0.03*	2.7	19/20	0	0.31	CD	E3	
84/04/11	03:07:42.05	47 32.10	120 11.13	8.02	4.3	30/30	0	0.27	BA	N3	F
84/04/29	22:11:34.53	46 40.32	118 58.49	2.21	2.8	23/25	0	0.21	BC	E3	
84/04/30	11:02:32.79	46 02.43	119 52.69	0.03*	2.8	21/21	0	0.20	BC	E3	
84/06/02	11:04:57.02	46 39.54	120 35.99	8.08	2.6	23/25	0	0.29	BC	E3	
84/06/06	19:49:52.54	45 58.44	118 26.19	6.15	2.7	13/13	0	0.27	CD	E3	
84/06/18	19:34:08.93	45 29.17	118 50.41	5.96	3.1	11/11	0	0.21	CD	E3	
84/08/24	04:43:07.21	47 38.97	120 57.29	0.75$	3.0	41/43	0	0.33	CC	C3	F
84/10/10	03:24:18.24	47 54.22	119 04.75	15.39	3.0	17/17	0	0.28	BC	N3	F

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
84/12/15	10:55:14.82	47 04.13	120 05.56	0.03*	2.6	34/35	0	0.36	CC	N3	
84/12/17	03:52:47.62	47 04.28	120 05.61	7.29	2.6	35/35	0	0.43	CC	N3	
84/12/18	18:24:20.44	47 16.82	117 08.15	24.78	2.8	12/12	0	0.21	CD	N3	
85/01/08	23:56:42.47	47 03.36	120 05.61	0.58	2.8	34/34	0	0.37	CC	N3	
85/01/09	02:51:26.21	47 03.61	120 05.24	0.65	2.8	35/35	0	0.37	CC	N3	
85/01/09	05:46:13.26	47 03.83	120 05.65	0.34	3.3	37/37	0	0.42	CC	N3	
85/01/14	21:39:23.21	46 48.37	118 17.05	15.79	2.6	16/18	0	0.32	CD	E3	
85/01/25	07:28:54.49	46 29.99	120 37.93	16.63	3.1	28/28	0	0.27	BA	E3	
85/01/31	03:02:35.09	47 03.57	120 05.03	0.29	3.3	32/32	0	0.36	CC	N3	
85/01/31	15:11:12.18	46 42.93	119 59.01	4.80	2.7	17/18	0	0.12	AC	E3	
85/02/02	14:49:50.10	46 43.22	119 59.54	5.96	2.6	24/27	0	0.22	BC	E3	
85/02/09	11:10:35.78	47 47.12	119 27.27	0.04*	2.6	5/09	0	0.90	DD	N1	H
85/02/10	20:29:31.72	45 42.27	119 38.07	18.41	3.9	20/22	0	0.14	AD	E3	F
85/03/02	11:51:59.31	46 48.36	120 54.36	5.51	2.6	31/32	0	0.17	BB	C3	
85/03/09	01:31:24.44	46 59.07	118 35.41	3.41	3.3	28/28	0	0.36	CD	E3	
85/03/23	20:29:51.93	47 52.83	120 51.17	1.45$	2.6	23/25	0	0.36	CC	C3	
85/04/11	23:50:05.63	47 40.30	120 03.25	0.74	2.7	4/06	0	0.40	DD	N3	H
85/04/19	10:52:44.29	46 53.83	120 17.02	5.35	3.2	38/40	0	0.33	CC	E3	
85/04/30	20:44:54.34	46 53.51	117 10.25	39.63*	2.7	12/14	0	0.35	CD	E3	
85/06/09	01:24:51.45	46 40.51	118 58.60	3.21	3.2	28/28	0	0.25	BC	E3	
85/06/17	07:00:17.26	47 03.48	120 04.62	0.28	3.0	35/35	0	0.42	CC	N3	
85/06/22	02:36:58.69	44 49.17	121 11.71	6.37	2.8	8/08	0	0.15	BD	C3	
85/06/26	20:42:56.02	47 13.99	119 51.66	2.30$	2.5	29/29	0	0.29	BC	N3	
85/06/29	00:45:32.45	46 54.89	119 07.33	3.52	2.7	26/28	0	0.26	BC	E3	
85/07/16	21:13:16.33	46 11.36	121 00.53	0.02*	3.2	35/35	0	0.19	BC	C3	
85/07/22	23:31:27.28	47 46.38	119 27.13	0.55	2.5	16/16	0	0.22	BB	N3	
85/07/24	21:53:18.64	47 46.23	119 27.30	0.04*	2.7	18/19	0	0.26	BB	N3	
85/08/02	23:29:45.13	45 27.11	119 57.04	1.21$	2.6	16/16	0	0.34	CD	E3	
85/08/24	16:03:33.93	46 13.30	117 54.47	0.02*	2.7	19/19	0	0.41	CD	E3	
85/09/23	20:00:19.75	46 32.10	117 47.10	0.03*	2.5	16/16	0	0.33	CD	E3	
85/09/27	19:20:15.39	47 46.15	119 23.57	0.61	2.5	17/19	0	0.23	BB	N3	
85/10/01	05:25:21.60	46 47.78	120 02.87	1.09	3.0	34/35	0	0.24	BC	E3	
85/10/01	06:53:11.58	46 47.32	120 02.84	1.71	3.0	34/35	0	0.29	BC	E3	
85/10/01	06:54:09.75	46 47.82	120 02.70	1.42$	2.5	31/32	0	0.35	CC	E3	
85/10/03	10:12:44.09	46 11.09	121 16.92	1.82$	2.7	33/33	0	0.30	BC	C3	
85/10/03	11:46:45.20	46 11.17	121 16.85	0.02*	2.5	29/29	0	0.25	BC	C3	
85/10/10	10:06:40.72	47 44.95	120 15.93	7.04	3.2	34/34	0	0.30	BB	N3	
85/10/27	22:14:42.32	46 24.57	119 10.88	1.36	2.5	23/24	0	0.28	BB	E3	
85/10/27	22:19:25.24	46 23.93	119 11.54	2.40	2.8	22/22	0	0.23	BB	E3	
85/11/22	18:09:56.76	47 15.76	119 21.07	20.82	3.2	30/31	0	0.28	BB	N3	
85/12/03	18:54:18.12	46 09.93	119 36.20	1.61	2.9	4/06	0	0.05	BD	E3	H
85/12/03	21:56:52.86	46 55.79	119 35.16	0.41#	2.6	3/04	0	0.15	BD	E3	H
85/12/26	18:19:23.26	45 59.31	118 25.63	3.78	2.6	14/14	0	0.20	BD	E3	
86/02/04	01:59:07.17	46 02.64	118 48.60	7.80	3.2	21/22	0	0.16	BB	E3	
86/03/04	12:24:27.45	46 55.40	120 39.41	9.81	2.5	30/32	0	0.24	BA	E3	
86/04/08	10:57:37.58	47 46.20	120 13.81	13.76	3.3	10/14	0	0.34	CD	N3	F
86/04/09	17:10:33.82	47 09.77	119 57.75	3.36	2.6	23/23	0	0.28	BC	N3	
86/06/10	13:56:44.69	49 16.67	120 44.08	0.05*	3.2	15/20	0	0.73	DD	C3	
86/06/11	06:12:42.33	47 46.56	120 10.08	8.57	2.7	18/23	0	0.38	CB	N3	F
86/06/20	16:55:50.87	46 28.20	120 54.79	3.42	2.8	50/54	0	0.22	BC	C3	
86/09/01	21:32:43.96	46 43.11	119 17.11	14.09	3.4	18/19	0	0.09	AA	E3	
86/11/08	14:54:13.10	46 51.54	120 34.82	8.42#	2.9	32/34	0	0.24	BA	E3	
86/11/10	15:17:14.62	45 12.24	120 00.81	9.75	2.5	15/15	0	0.26	CD	E3	
86/12/08	03:32:33.93	45 58.60	118 57.18	19.53	2.6	19/24	0	0.29	BB	E3	
87/01/12	12:17:29.47	49 23.99	119 42.09	0.02*	3.7	21/25	0	0.32	CD	N3	R
87/02/13	20:01:53.82	49 26.97	120 31.98	14.18	3.0	12/15	0	0.62	DD	C3	R
87/02/28	14:56:10.54	47 49.99	120 02.89	0.54	2.6	25/31	0	0.27	BA	N3	F
87/06/11	19:50:16.98	46 46.65	120 41.64	17.23	3.0	33/42	0	0.35	CA	E3	
87/06/30	02:04:27.09	44 57.57	121 01.34	0.02*	2.8	17/18	0	0.47	CC	C3	
87/09/08	05:02:15.81	45 11.03	120 05.11	0.02*	3.1	22/22	0	0.38	CC	C3	F
87/09/29	16:20:27.11	45 11.15	120 06.65	0.02*	2.7	17/18	0	0.42	CC	C3	F
87/10/05	22:20:12.63	47 04.25	120 05.48	0.71	2.6	32/32	0	0.32	CC	N3	
87/12/02	07:12:57.46	46 40.49	120 41.03	18.20	4.1	37/40	0	0.26	BA	E3	F
87/12/02	09:02:24.27	46 40.75	120 40.39	17.80	4.3	38/39	0	0.37	CA	E3	F
87/12/20	07:38:25.13	47 46.56	119 22.02	0.03*	2.7	19/21	0	0.31	CB	N3	F

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
88/01/17	22:44:29.64	46 44.79	119 21.01	0.62	2.6	29/32	0	0.17	BB	E3	
88/02/02	05:49:56.11	46 44.51	119 23.77	0.51	2.9	32/35	0	0.24	BA	E3	
88/02/03	19:45:40.43	46 44.46	119 23.83	2.33	2.9	27/31	0	0.17	BA	E3	
88/02/06	12:51:44.81	47 39.98	120 01.42	7.15	3.0	32/36	0	0.26	BA	N3	F
88/02/14	02:55:23.83	45 34.62	120 08.96	16.58	2.5	28/28	0	0.23	BC	E3	
88/02/20	23:55:47.92	45 11.93	120 05.91	3.55	2.7	25/27	0	0.36	CC	C3	
88/03/15	00:59:17.97	47 48.42	120 50.78	10.30	2.5	21/25	0	0.39	CC	C3	
88/03/18	07:40:57.54	46 21.01	119 15.95	0.60	2.6	26/29	0	0.28	BB	E3	
88/03/18	08:24:43.40	46 21.03	119 16.09	0.05*	2.5	24/26	0	0.33	CB	E3	
88/03/29	22:44:04.66	44 46.66	117 51.93	18.70	2.7	11/15	0	0.77	DD	C3	

Probable Blasts 1969-March 1988

44.0°-49.5°N, 117.0°-121.5°W, M≥2.5

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
69/04/10	01:12:12.49	46 43.13	117 51.97	0.02*	2.5	6/11	0	0.24	BD	E3	X
69/04/24	01:43:01.74	46 44.62	117 48.24	0.40	2.7	6/09	0	0.24	DD	E3	X
69/05/01	00:52:38.53	48 03.02	118 49.55	24.04	2.5	5/06	0	0.13	CD	E3	X
69/05/09	19:06:09.64	47 40.45	119 45.68	2.08	3.0	5/09	0	0.16	CD	N3	P
69/05/19	18:59:26.28	47 49.51	118 13.42	19.22$	3.3	5/09	0	0.25	DD	N3	P
69/07/24	07:08:11.80	47 41.16	120 16.29	0.04*	2.5	5/07	0	0.25	BD	N3	P
69/08/01	15:58:25.54	47 45.44	119 31.63	12.64	2.8	4/06	0	0.45	DD	N3	P
69/08/04	15:31:10.07	47 42.36	119 53.72	18.02$	3.1	5/06	0	0.11	DD	N3	P
69/08/05	23:39:25.52	46 35.45	118 07.45	1.36$	2.6	6/12	0	0.24	CD	E3	X
69/08/08	17:04:51.80	47 45.73	119 28.05	7.36	2.8	5/08	0	0.35	DD	N3	P
69/08/14	16:31:47.59	47 36.49	119 33.51	1.71	3.3	6/07	0	0.16	CD	N3	P
69/09/12	00:21:53.05	46 34.10	118 26.18	4.08$	2.5	6/09	0	0.54	DD	E3	X
69/09/13	08:30:47.68	47 46.08	119 26.40	1.47	3.0	5/08	0	0.20	BD	N3	P
69/09/27	01:02:46.44	46 37.14	118 01.21	11.41*	2.8	7/08	0	0.09	AD	E3	X
69/10/02	00:59:03.33	46 57.41	118 28.84	0.04*	2.5	7/10	0	0.30	BD	E3	P
69/10/06	22:30:19.13	46 53.56	120 30.93	13.19	2.5	6/09	0	0.11	BD	E3	X
69/10/21	20:48:17.04	47 34.35	118 09.87	7.70	2.6	6/09	0	0.26	DD	N3	P
69/10/28	00:39:47.11	46 49.89	120 24.96	7.74	2.6	6/09	0	0.09	BD	E3	X
69/10/29	00:34:37.42	46 51.89	120 26.55	23.28	2.7	5/08	0	0.31	CD	E3	X
69/10/30	16:16:36.65	46 50.01	120 24.52	2.24$	2.6	4/07	0	0.07	BD	E3	X
69/11/01	00:00:24.28	46 50.91	120 24.10	5.23$	2.6	5/08	0	0.08	BD	E3	X
69/11/01	01:12:47.60	46 51.31	120 26.94	12.77	2.9	5/08	0	0.12	BD	E3	X
69/11/05	00:41:28.51	47 11.69	118 08.99	6.26	3.2	5/09	0	0.18	CD	N3	P
69/11/06	00:21:30.87	46 48.81	120 25.46	11.76	2.5	6/10	0	0.11	BD	E3	X
69/11/21	16:31:56.46	46 37.28	118 54.96	2.92	3.6	7/07	0	0.12	AD	E3	X
70/01/10	01:17:20.29	46 55.42	118 12.90	1.83$	2.5	6/10	0	0.34	DD	E3	P
70/01/30	00:35:31.38	46 50.12	118 17.40	1.94*	2.7	7/10	0	0.24	BD	E3	P
70/02/09	06:19:36.74	47 38.76	120 16.71	0.02*	2.7	6/09	0	0.16	BD	N3	P
70/03/19	13:03:51.01	46 38.71	118 46.83	5.06	2.5	7/09	0	0.16	BD	E3	P
70/03/25	00:23:35.01	46 40.10	118 16.47	0.38*	2.5	7/09	0	0.23	BD	E3	P
70/04/04	02:40:13.73	46 13.70	120 04.80	0.03*	2.7	7/09	0	0.33	CD	E3	X
70/04/22	22:02:59.77	46 17.93	120 09.31	0.04*	2.6	7/10	0	0.06	AD	E3	X
70/04/29	02:28:56.57	46 17.98	120 08.27	0.02*	2.5	6/07	0	0.08	AD	E3	X
70/06/22	00:53:56.91	46 25.71	120 09.06	0.02*	2.8	6/08	0	0.11	AD	E3	X
70/07/14	02:42:00.37	46 20.51	117 45.06	0.05*	2.7	10/14	0	0.16	BD	E3	P
70/11/22	00:45:03.50	46 49.67	120 21.62	1.62	2.9	14/19	0	0.08	AD	E3	X
70/11/29	23:15:53.94	46 13.51	120 06.92	4.63	3.0	12/16	0	0.32	CD	E3	P
70/12/09	17:10:24.82	46 55.57	120 55.06	13.14$	3.5	14/15	0	0.36	DD	C3	P
70/12/09	23:19:45.42	46 16.21	119 57.07	1.27	2.8	15/16	0	0.17	BD	E3	X
71/01/04	16:10:33.84	46 13.85	119 21.79	0.04*	3.1	16/16	0	0.25	BD	E3	X
71/01/22	21:59:37.68	48 29.60	118 10.69	0.02#	3.1	13/15	0	4.19	DD	E3	X
71/02/19	22:50:01.54	46 44.21	120 29.04	13.82	2.6	13/14	0	0.09	BD	E3	X
71/02/26	22:55:01.09	46 43.93	120 24.48	4.58#	2.8	12/13	0	0.16	BD	E3	X
71/03/05	20:58:48.46	46 43.98	120 31.67	12.42$	2.5	12/14	0	0.09	BD	E3	X
71/09/22	18:04:50.37	46 39.53	120 48.96	24.05*	2.5	10/16	0	0.29	BD	E3	X
71/10/13	21:21:29.86	47 05.73	118 49.67	3.51	2.7	10/13	0	0.23	BC	E3	X
73/07/20	00:44:27.55	46 47.84	117 33.61	0.04*	2.5	16/21	0	0.23	BD	E3	P
75/08/12	18:31:48.53	46 36.79	119 32.92	2.99	2.7	10/10	0	0.04	AB	E3	P
76/07/02	20:01:23.80	46 36.80	119 32.88	2.47	3.0	9/09	0	0.06	AB	E3	X
76/07/09	20:35:03.89	47 58.08	118 17.70	7.90	2.9	11/11	0	0.11	AC	N3	X
76/12/09	23:59:13.49	47 36.31	119 18.14	0.73	2.7	8/08	0	0.06	AC	N3	X
76/12/11	21:45:10.81	47 36.93	119 39.37	0.64	2.7	8/10	0	0.08	AC	N3	X
77/12/09	19:46:23.17	48 12.38	119 08.85	0.76	2.6	10/10	0	0.12	BD	N3	P
78/02/20	21:23:16.09	45 53.79	119 39.00	0.02*	3.2	8/11	0	0.25	BC	E3	X
78/03/10	19:07:17.10	47 37.11	119 54.01	0.66	2.5	10/10	0	0.07	AB	N3	X
78/05/02	21:04:06.79	46 30.81	118 34.92	6.69	3.1	10/10	0	0.17	CD	E3	P
78/12/11	23:34:01.86	47 52.08	118 10.92	7.87	3.1	8/08	0	0.05	AD	N3	X
78/12/22	17:06:10.85	45 51.18	119 22.59	11.83$	2.6	5/05	0	0.18	DD	E3	P
79/03/01	19:29:15.55	46 02.85	118 54.34	1.84	2.7	10/10	0	0.11	AB	E3	P
79/03/15	21:57:31.59	46 32.03	119 58.80	0.03*	3.5	13/13	0	0.19	BD	E3	X

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
79/03/23	21:49:23.31	46 31.66	120 00.27	0.03*	3.5	10/10	0	0.05	AD	E3	X
79/04/24	19:52:23.58	47 43.48	119 26.54	0.43	2.8	10/10	0	0.14	AB	N3	P
79/05/14	23:22:19.62	48 00.69	119 12.10	0.29	3.1	7/07	0	0.17	BC	N3	P
80/01/03	22:26:35.90	47 53.18	118 09.21	6.50	3.2	11/11	0	0.10	AC	N3	P
80/11/07	00:04:36.06	46 56.97	119 28.23	1.20	2.6	13/14	0	0.11	AC	E3	P
81/03/07	19:28:02.79	47 49.18	119 49.21	2.76	2.5	19/24	0	0.10	AC	N3	P
81/04/04	00:57:57.94	47 08.76	118 38.55	8.24	2.5	20/20	0	0.20	BC	N3	P
81/04/23	18:36:32.89	47 37.35	119 53.95	3.34	2.7	20/23	0	0.12	BB	N3	P
81/06/18	18:11:19.30	47 37.90	120 01.82	0.03*	2.6	19/20	0	0.28	BB	N3	P
81/06/29	00:19:25.11	47 01.85	120 13.17	0.28	2.7	29/29	0	0.42	CC	N3	P
82/08/16	23:13:58.13	45 24.56	121 26.54	3.39	2.6	15/15	0	0.23	BC	C3	P
82/10/12	01:30:21.39	45 59.76	119 17.29	0.04*	2.8	20/20	0	0.18	BC	E3	X
82/10/30	22:40:57.17	45 59.94	119 17.25	0.04*	2.7	23/23	0	0.22	BC	E3	X
82/11/23	21:39:25.32	45 59.84	119 17.32	0.02*	3.2	25/25	0	0.16	BC	E3	X
83/06/10	21:26:18.82	48 05.86	118 58.76	5.74	2.6	16/17	0	0.22	BC	N3	X
83/06/14	21:11:56.50	47 32.38	118 47.16	6.15	2.6	18/19	0	0.29	BC	N3	P
83/06/17	23:09:19.69	48 05.61	118 58.53	5.58	2.8	17/19	0	0.16	BC	N3	X
83/09/07	02:14:33.08	47 53.38	118 20.16	7.84	2.6	16/16	0	0.27	BD	N3	X
83/09/10	01:03:37.40	47 53.28	118 20.16	9.37	3.1	19/19	0	0.39	CD	N3	X
83/10/06	17:20:02.42	47 51.88	118 02.89	10.13$	2.5	6/08	0	0.34	CD	N3	P
83/10/21	20:36:23.78	45 39.60	118 54.94	1.63	2.7	13/13	0	0.25	BC	E3	P
84/01/12	21:52:43.48	46 25.60	120 09.09	0.02*	2.5	26/26	0	0.32	CC	E3	P
84/01/18	23:42:43.72	45 18.62	119 40.42	0.04*	2.5	18/19	0	0.34	CD	E3	P
84/02/02	01:12:16.70	47 39.30	117 34.50	5.44	2.6	6/09	0	0.46	DD	N3	P
84/03/20	22:57:00.54	47 29.10	118 39.73	0.58	2.5	21/21	0	0.25	BC	N3	P
84/03/23	18:26:53.06	45 59.76	119 17.53	0.03*	3.3	23/23	0	0.24	BC	E3	P
84/03/28	22:01:40.40	47 28.81	118 38.70	4.16$	2.6	20/20	0	0.22	CC	N3	P
84/04/27	19:13:34.97	46 58.11	120 22.77	4.05$	2.6	26/26	0	0.17	BC	E3	P
84/05/14	20:01:27.40	46 07.41	119 12.28	0.03*	2.5	20/20	0	0.24	BC	E3	X
84/07/28	02:25:30.68	46 35.71	120 22.95	0.65	2.7	31/33	0	0.34	CC	E3	X
84/08/10	21:11:48.98	46 07.51	119 47.27	0.02*	2.5	18/18	0	0.16	BC	E3	P
84/08/14	21:44:11.23	47 07.15	118 46.04	5.51	2.6	22/22	0	0.25	BD	N3	P
84/08/17	22:21:35.10	47 07.99	118 33.85	9.01	2.5	20/20	0	0.16	BD	N3	P
84/08/19	10:59:59.92	46 58.69	119 11.72	2.28	2.7	29/29	0	0.15	BB	E3	X
84/08/23	09:02:00.04	46 40.56	119 27.93	0.03*	2.7	31/31	0	0.15	AB	E3	X
84/08/25	01:26:53.60	46 36.05	120 22.11	0.04*	2.6	30/30	0	0.27	BA	E3	X
84/09/07	22:58:35.55	46 04.45	119 36.42	0.02*	2.5	21/21	0	0.29	BC	E3	P
84/09/16	23:10:49.27	47 48.72	119 22.22	0.72	2.7	19/22	0	0.17	BC	N3	P
84/09/17	02:27:34.12	47 48.75	119 22.06	0.02*	2.8	19/21	0	0.24	BC	N3	P
84/09/26	19:33:12.96	46 42.85	117 52.04	0.03*	2.5	22/22	0	0.37	CD	E3	P
84/10/04	18:57:47.70	46 06.33	120 01.54	0.03*	2.9	24/24	0	0.29	BC	E3	P
84/10/28	15:53:06.66	47 56.08	119 35.50	9.82	2.7	10/10	0	0.31	CD	N3	P
84/11/19	01:17:35.91	47 09.80	118 21.18	7.75	2.6	25/25	0	0.30	BC	N3	P
84/12/06	23:30:20.95	46 25.33	120 08.74	0.02*	2.6	25/25	0	0.25	BC	E3	P
85/01/28	16:52:11.72	45 58.04	119 54.66	0.02*	2.6	16/16	0	0.21	BC	E3	P
85/01/31	18:39:44.96	45 57.87	119 54.15	0.04*	2.8	20/20	0	0.27	BC	E3	P
85/01/31	21:05:36.98	45 57.27	118 50.21	1.82	2.7	17/18	0	0.21	BC	E3	P
85/02/19	22:02:17.68	46 57.72	118 33.92	0.02*	2.7	24/24	0	0.27	BD	E3	P
85/02/27	00:20:59.46	45 57.68	119 54.38	0.05*	2.6	19/19	0	0.23	BC	E3	P
85/03/01	21:28:29.90	45 48.30	119 00.96	0.02*	2.6	18/19	0	0.22	BC	E3	P
85/03/18	22:47:11.93	45 01.32	120 41.91	4.49	3.0	12/12	0	0.71	DD	E3	P
85/03/20	00:57:34.08	45 57.79	119 54.28	0.02*	3.1	24/24	0	0.22	BC	E3	P
85/04/17	22:59:16.92	45 52.74	119 18.92	0.03*	2.6	24/24	0	0.25	BC	E3	P
85/04/30	20:10:20.49	45 52.90	119 19.23	0.02*	2.5	22/22	0	0.31	CC	E3	P
85/06/19	18:42:47.42	46 17.88	120 20.29	0.03*	2.5	20/20	0	0.24	BC	E3	P
85/06/21	19:34:28.32	46 18.13	120 19.92	0.03*	2.5	18/18	0	0.16	BC	E3	P
85/11/18	23:49:30.07	46 15.11	119 37.10	0.04*	2.9	28/28	0	0.22	BB	E3	P
85/12/06	00:44:26.23	46 25.09	120 08.73	0.04*	2.6	20/21	0	0.23	BC	E3	P
85/12/08	20:22:19.39	46 56.78	119 33.47	0.04*	2.8	33/33	0	0.17	BC	E3	P
85/12/19	23:24:52.38	46 15.00	119 36.81	0.03*	2.8	25/25	0	0.25	BC	E3	P
86/01/16	00:50:40.08	46 15.09	119 37.08	0.02*	3.0	26/26	0	0.22	BB	E3	P
86/01/22	00:45:45.88	46 27.57	118 59.86	2.54	2.6	24/24	0	0.20	BB	E3	X
86/01/29	00:56:12.80	46 15.24	119 36.93	0.05*	2.9	25/25	0	0.19	BB	E3	P
86/01/29	23:52:16.41	46 27.13	119 00.44	2.38	2.6	22/22	0	0.24	BC	E3	X
86/02/01	00:33:44.71	46 27.14	118 59.82	2.77	2.6	21/21	0	0.20	BB	E3	X

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
86/02/05	22:40:36.00	46 15.22	119 36.98	0.04*	2.8	26/26	0	0.21	BB	E3	P
86/03/02	16:50:15.77	46 18.69	119 47.03	0.03*	2.8	29/29	0	0.31	CC	E3	P
87/06/12	19:05:40.69	49 25.93	120 25.09	0.02*	2.8	7/07	0	0.18	BD	C3	X
87/07/16	23:21:59.11	47 28.10	117 01.44	0.04*	3.0	9/11	0	0.51	DD	N3	P
87/08/28	23:12:49.73	46 58.81	118 32.98	2.37	2.5	27/27	0	0.32	CD	E3	P
87/11/06	00:39:04.03	44 39.86	121 10.72	0.04*	2.5	11/12	0	0.33	CC	C3	P
88/02/03	23:19:39.06	46 13.38	119 44.04	0.02*	2.5	16/18	0	0.23	BA	E3	P
88/02/07	22:15:29.57	45 24.28	119 41.10	27.54	2.5	19/19	0	0.50	CD	C3	P
88/02/28	20:47:11.17	45 34.27	119 53.08	0.04*	2.6	21/21	0	0.18	BC	E3	P
88/03/17	20:36:24.54	46 07.94	119 46.98	0.03*	2.6	25/25	0	0.25	BC	E3	P
88/03/17	20:50:06.74	47 03.15	119 54.14	0.02*	2.5	27/30	0	0.33	CC	N3	P

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44.0 ° –19.0 ° N, 117.0 ° -121.5 ° W

July 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	23:21:52.63	47 39.97	118 04.30	8.03	2.4	16/17	288	0.37	CD	N3	P
2	19:03:39.90	46 02.52	121 28.68	23.38	1.2	4/04	223	0.	AD	C3	
5	10:27:35.97	47 38.69	120 04.87	0.52	0.7	5/08	155	0.09	AD	N3	
11	05:32:35.38	46 40.91	121 02.48	9.64	0.4	4/04	300	0.	AD	C3	
16	17:47:37.11	46 57.76	120 26.28	16.78	2.3	29/37	34	0.28	BA	E3	
16	23:21:59.11	47 28.10	117 01.44	0.04*	3.0	9/11	305	0.51	DD	N3	P
17	23:55:05.30	46 40.92	121 28.61	8.75	1.9	19/22	84	0.54	DA	C3	
19	09:25:56.59	46 28.17	120 28.68	14.46	1.0	5/07	267	0.17	BD	E3	
20	16:50:05.80	46 48.17	120 41.81	11.65	2.3	30/33	29	0.34	CB	C3	
21	20:34:09.78	46 49.12	120 41.93	9.72	1.6	12/13	90	0.22	BB	C3	
22	20:32:06.97	47 53.24	119 21.81	8.55$	1.8	11/13	119	0.38	CC	N3	
25	12:53:52.62	47 39.61	120 11.16	4.19	1.5	9/13	105	0.23	BC	N3	
25	14:09:28.99	46 34.05	119 33.25	15.59	0.3	6/09	100	0.12	AC	E3	
25	20:01:14.47	46 31.43	121 22.94	0.04*	1.0	14/16	111	0.16	BC	C3	
25	22:19:51.98	46 30.35	121 23.14	7.76	0.8	6/08	279	0.47	CD	C3	
26	17:20:45.42	47 40.92	120 11.54	4.86	1.1	6/11	170	0.07	AC	N3	
27	23:12:53.55	45 35.89	120 44.27	0.03*	2.4	25/25	96	0.35	CB	C3	X
30	07:48:11.28	46 31.27	121 23.55	0.04*	1.2	22/25	110	0.24	BC	C3	
30	17:08:11.94	46 31.65	121 23.02	4.94	1.4	15/16	145	0.14	AC	C3	
30	22:41:55.39	46 33.94	119 11.25	15.82	1.8	20/27	116	0.13	AB	E3	
31	22:34:51.71	47 40.37	120 11.40	3.69	0.6	4/08	164	0.14	BD	N3	

Aug 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	12:35:48.68	47 40.29	120 11.24	6.29	0.8	5/09	162	0.07	AD	N3	
3	22:41:25.38	46 49.61	117 22.43	34.28#	0.6	5/05	330	0.11	BD	E3	
4	21:38:51.50	47 08.45	118 31.20	9.92	2.1	18/18	192	0.38	CD	N3	
5	05:28:16.00	47 12.85	121 15.36	21.09	1.6	11/14	60	0.23	BB	C3	
6	09:38:06.62	48 39.71	119 33.30	10.29	1.9	8/09	294	0.54	DD	N3	
6	18:09:38.28	46 38.16	121 18.10	0.02*	0.5	4/07	242	0.25	BD	C3	
7	09:04:34.33	46 59.65	120 34.22	6.90	1.6	13/15	124	0.33	CB	E3	
7	22:20:18.76	46 25.47	118 07.31	0.04*	2.1	15/17	226	0.37	CD	E3	
8	11:25:24.48	45 10.11	120 51.93	26.07	1.8	15/16	190	0.26	BD	O0	
8	13:32:36.59	47 38.94	120 14.84	0.51	2.2	24/28	50	0.44	CB	N3	
8	21:42:58.82	45 10.14	120 52.38	25.05	1.6	15/16	189	0.30	BD	O0	
8	22:13:22.83	47 41.82	120 12.11	4.02	1.1	3/05	226	0.	AD	N3	
9	03:32:09.96	45 08.67	120 51.62	27.97*	2.4	31/37	194	0.31	CD	O0	F
10	16:12:23.66	46 48.51	119 25.64	0.43	0.9	9/14	117	0.19	BB	E3	
12	17:52:32.15	47 08.29	118 31.70	8.58	2.0	17/17	199	0.23	BD	N3	
14	07:32:17.24	45 09.69	120 52.42	24.98	1.6	13/16	190	0.31	CD	O0	
14	20:09:31.12	45 09.85	120 52.26	17.06	1.5	6/07	190	0.03	AD	O0	
15	13:05:12.19	46 39.14	121 26.27	6.52	1.1	14/18	90	0.26	BB	C3	
17	12:35:50.40	47 43.20	120 19.71	0.02*	2.0	22/27	94	0.17	BC	N3	
18	05:15:47.76	45 08.63	120 51.65	25.17	2.1	21/24	194	0.37	CD	O0	
19	20:18:55.34	47 40.51	120 18.13	5.21	0.8	5/08	213	0.05	AD	N3	
19	23:13:03.67	47 45.89	120 00.84	7.06	1.4	6/10	92	0.07	AC	N3	
20	04:55:16.88	45 10.14	120 52.65	20.61	1.7	11/15	189	0.30	CD	O0	
20	05:45:02.07	45 09.48	120 52.30	23.68	1.8	18/20	191	0.40	CD	O0	
21	10:14:46.16	45 09.03	120 50.98	13.66	1.8	10/13	84	0.17	BB	O0	
21	17:44:16.06	45 09.10	120 50.36	15.85	1.4	9/11	84	0.23	BB	O0	
21	20:55:34.89	47 07.05	120 37.23	9.14	2.0	29/34	59	0.41	CA	N3	
22	04:53:21.41	45 08.89	120 51.76	17.58	1.0	9/11	83	0.10	AB	O0	
22	17:28:16.81	45 09.57	120 50.79	15.75	1.5	12/14	82	0.31	CB	O0	
22	19:53:22.43	45 10.15	120 51.01	10.65	1.3	9/13	79	0.26	BC	O0	
22	21:22:11.48	47 09.47	118 20.39	5.98*	2.3	21/21	208	0.31	CD	N3	P
23	06:21:05.60	47 42.81	120 19.59	7.05	0.5	6/10	232	0.05	AD	N3	
24	03:08:32.42	45 09.03	120 50.70	18.68	1.8	13/16	84	0.30	CB	O0	
24	05:04:51.01	45 09.14	120 51.27	12.34	1.4	12/15	83	0.25	BB	O0	
24	07:13:46.82	45 09.61	120 50.27	16.04	1.1	8/11	82	0.20	BB	O0	

Aug 1987 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
24	08:47:35.43	45 09.05	120 51.19	13.63	1.4	13/16	83	0.25	BB	O0	
24	09:09:19.03	45 09.02	120 50.71	15.05	1.3	10/13	84	0.21	BB	O0	
24	09:18:01.13	45 09.03	120 51.49	15.44	1.2	9/11	83	0.11	AB	O0	
24	10:18:47.05	45 09.32	120 51.01	15.46	1.4	11/14	82	0.27	BB	O0	
24	19:16:08.96	45 08.56	120 50.06	18.05	1.0	6/07	87	0.12	AC	O0	
24	21:31:17.71	46 42.99	120 16.53	6.25	1.0	10/10	78	0.33	CC	E3	
25	21:25:11.13	47 43.30	120 10.90	5.04	1.1	6/10	122	0.06	AC	N3	
27	01:54:28.03	46 48.71	119 25.86	0.04*	2.2	30/33	50	0.28	BA	E3	
27	12:29:10.53	46 49.04	119 26.05	0.03*	1.9	20/26	47	0.26	BA	E3	
27	22:48:05.59	48 17.97	119 32.25	0.92	2.2	6/07	258	0.10	BD	N3	
27	23:54:25.87	46 38.62	121 09.43	4.47$	1.4	21/24	97	0.26	BC	C3	
28	03:57:22.82	48 58.34	120 57.10	35.63$	2.4	5/06	259	0.24	CD	C3	
28	23:12:49.73	46 58.81	118 32.98	2.37	2.5	27/27	199	0.32	CD	E3	P
29	02:10:50.76	46 38.98	120 57.99	5.93	1.6	19/25	58	0.27	BC	C3	
29	05:45:37.97	46 30.52	120 28.23	13.75	0.8	5/07	226	0.32	CD	E3	

Sept 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
3	04:09:59.44	47 56.96	121 02.03	0.78$	2.1	30/35	109	0.46	CD	C3	
3	04:22:29.53	47 57.03	121 02.23	1.03$	1.7	19/21	109	0.33	CD	C3	
3	18:30:49.37	46 13.04	118 04.54	25.25*	1.8	11/17	290	0.29	BD	E3	P
4	23:15:47.92	44 48.93	119 41.08	12.57	2.4	23/23	235	0.40	CD	O0	
7	04:35:10.25	46 57.25	120 26.46	17.78	1.3	20/22	73	0.21	BA	E3	
7	05:14:32.46	46 23.77	120 48.85	0.03*	1.2	4/07	243	0.39	CD	C3	
8	05:02:15.66	45 11.47	120 04.32	13.01	3.1	37/37	140	0.51	DC	O0	F
8	05:27:24.85	45 11.23	120 03.97	16.14	1.9	18/18	179	0.48	CC	O0	
8	18:34:19.81	46 56.62	118 24.50	9.19	2.1	17/18	214	0.36	CD	E3	
9	07:13:08.16	45 11.13	120 02.21	17.91	2.3	23/23	183	0.27	BD	O0	
9	07:32:09.74	45 11.68	120 03.87	0.03*	2.4	25/25	178	0.43	CC	O0	
11	17:39:26.75	45 11.10	120 04.89	0.03*	1.7	7/07	177	0.43	CC	O0	
13	15:44:55.31	47 12.40	121 25.41	10.00*	0.9	5/07	184	0.11	AD	C3	
15	11:30:51.23	46 48.56	119 25.91	0.41	1.1	7/12	118	0.22	BB	E3	
15	15:46:15.81	47 42.94	120 01.00	5.44	0.5	5/09	140	0.07	AD	N3	
16	12:36:58.34	47 43.35	120 10.44	0.66	1.7	14/20	120	0.30	CC	N3	
22	00:27:51.43	47 41.41	120 04.74	2.76	1.5	10/13	92	0.17	BB	N3	
22	07:40:07.56	45 59.37	120 40.48	12.96#	1.8	14/16	126	0.35	CB	E3	
23	00:22:47.45	47 46.87	120 27.60	15.28	1.1	8/12	103	0.29	BB	N3	
23	19:33:56.91	47 01.70	120 56.21	0.02*	1.5	13/15	123	0.47	CC	C3	
24	07:55:57.35	47 30.97	120 38.22	1.20*	0.7	13/16	71	0.19	BC	C3	
24	18:28:34.95	46 35.76	121 16.40	0.05*	1.9	36/39	54	0.40	CC	C3	
27	14:18:24.14	47 43.79	120 02.70	2.68	2.0	20/24	98	0.24	BB	N3	
27	16:17:33.32	48 24.82	120 44.63	5.23	2.0	9/10	187	0.09	BD	C3	
28	17:16:50.56	48 15.52	119 30.67	0.03*	2.1	13/15	195	0.35	CD	N3	
29	12:11:30.26	46 48.47	119 26.26	0.03*	1.7	19/24	51	0.25	BA	E3	
29	16:20:26.48	45 10.57	120 03.67	20.09	2.7	24/25	181	0.35	CD	O0	F
30	22:57:13.73	46 43.91	120 09.82	3.05	1.8	19/19	55	0.34	CC	E3	

Oct 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	00:29:49.56	47 04.55	120 04.72	0.59	1.5	20/22	57	0.34	CC	N3	
5	22:20:12.63	47 04.25	120 05.48	0.71	2.6	32/32	57	0.32	CC	N3	
6	09:40:36.46	46 43.14	121 01.30	6.33$	1.2	11/15	128	0.31	CC	C3	
7	00:11:13.90	46 20.58	119 15.38	0.02*	2.0	13/16	158	0.21	BC	E3	
7	00:23:21.81	46 20.64	119 15.91	0.02*	1.1	4/06	155	0.11	AD	E3	
8	19:16:17.16	46 21.39	119 16.12	7.60#	1.1	4/08	150	0.16	BD	E3	
11	20:38:45.41	45 10.77	120 04.88	3.25$	2.0	12/13	164	0.40	CC	O0	
15	09:42:26.70	46 47.54	121 04.83	5.99	1.2	8/11	139	0.29	BC	C3	
16	18:21:56.14	48 43.78	120 03.53	0.83$	2.1	14/16	212	0.36	DD	N3	
17	20:23:51.84	47 48.07	119 24.29	0.03*	1.9	16/19	92	0.45	CC	N3	
19	20:44:43.92	46 50.66	118 17.55	0.03*	2.3	26/26	176	0.32	CD	E3	P
22	19:17:25.31	46 01.38	119 58.66	0.02*	2.2	17/17	94	0.36	CC	E3	P
23	01:20:33.13	47 43.52	120 16.89	0.63	0.9	5/08	158	0.25	BD	N3	
24	11:25:04.08	46 41.31	121 01.63	6.54	1.2	9/11	136	0.42	CC	C3	

Oct 1987 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
24	16:23:31.56	47 43.51	120 15.79	0.67	1.5	7/10	150	0.12	AC	N3	
24	21:19:26.45	46 43.94	121 01.77	3.82	1.1	8/08	125	0.24	CC	C3	
26	19:36:52.16	46 01.20	119 58.11	0.02*	2.2	19/19	94	0.27	BC	E3	P
29	23:46:16.64	46 46.73	117 10.44	0.02*	2.2	14/14	280	0.57	DD	E3	P

Nov 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	13:52:51.07	47 40.09	120 07.43	7.67	0.8	7/12	112	0.17	BB	N3	
2	10:26:24.14	48 27.96	118 35.75	23.92#	1.4	7/07	264	0.18	BD	N3	
2	13:11:55.14	46 46.13	119 23.51	3.85	0.9	7/12	101	0.10	AB	E3	
3	04:09:16.80	47 15.32	119 54.85	5.79	2.0	17/19	96	0.30	BC	N3	
4	10:51:41.56	46 43.04	119 21.00	5.92*	0.6	6/10	135	0.17	BC	E3	
4	13:23:19.03	46 42.99	119 20.72	2.48	1.4	15/21	96	0.29	BC	E3	
5	17:12:04.92	47 58.95	121 22.78	3.62$	2.3	12/13	129	1.13	DC	C3	P
5	17:12:13.00	48 01.29	121 19.51	0.03*	1.8	10/10	117	1.07	DC	C3	P
5	18:22:28.84	48 08.68	120 52.22	0.99	2.0	18/19	147	0.38	CC	C3	
6	00:39:03.12	44 39.53	121 09.46	0.10	2.5	12/13	89	0.33	CC	O0	P
6	15:19:18.51	46 43.02	119 18.41	9.87	0.6	6/10	150	0.44	CC	E3	
6	18:10:39.56	46 42.86	119 21.16	2.61	1.3	14/19	65	0.15	AC	E3	
7	18:51:00.22	46 24.78	119 41.42	0.47	-0.2	4/07	120	0.93	DD	E3	
10	13:21:28.09	46 43.16	119 20.87	3.43	0.7	7/11	93	0.11	AC	E3	
10	14:36:06.43	46 42.96	119 21.45	0.04*	1.0	10/15	65	0.16	BC	E3	
15	07:13:53.10	46 44.25	119 20.27	3.58	0.3	6/09	121	0.13	AC	E3	
16	23:57:00.38	46 45.19	119 22.40	3.44$	0.9	8/13	72	0.44	CB	E3	
17	14:34:58.13	46 36.07	119 44.26	16.99	0.9	8/13	82	0.10	AA	E3	
17	22:58:18.27	46 59.28	117 24.51	40.65$	2.4	9/09	267	0.27	CD	E3	P
18	12:42:24.63	45 12.16	120 05.28	0.02*	2.3	31/31	162	0.53	DC	O0	
19	00:48:08.01	47 33.96	120 10.25	0.37	1.8	10/10	58	0.28	BA	N3	P
19	05:02:35.59	45 11.59	120 04.37	0.03*	1.7	20/20	177	0.48	CC	O0	
19	22:37:48.62	46 57.61	120 25.16	4.48	1.9	14/14	67	0.32	CC	E3	
20	01:03:32.99	46 30.70	121 23.33	0.02*	1.3	20/22	116	0.23	BC	C3	
20	21:45:33.29	46 52.16	117 28.06	3.20#	2.2	13/14	268	0.78	DD	E3	
22	12:10:49.96	46 44.92	119 22.55	0.04*	1.9	21/24	74	0.22	BB	E3	
22	14:29:50.27	46 36.80	119 57.20	9.87	1.7	19/24	73	0.21	BB	E3	
23	04:16:38.93	47 47.13	120 09.01	12.78	0.8	6/09	225	0.20	BD	N3	
24	05:49:33.56	47 00.67	120 21.36	8.26	1.8	22/23	58	0.33	CC	N3	
24	21:12:06.83	46 30.23	120 26.32	18.67	0.5	5/07	218	0.67	DD	E3	
25	19:16:23.97	47 30.41	118 49.93	0.75	1.6	17/19	114	0.36	CC	N3	
25	22:08:48.43	46 57.80	120 24.79	2.69	2.1	29/30	46	0.34	CC	E3	
27	09:25:37.71	46 48.08	119 24.10	0.02*	0.9	7/11	88	0.16	BB	E3	
27	13:40:17.39	46 57.82	120 24.87	3.35	1.8	26/27	48	0.25	BC	E3	
27	14:27:56.42	46 57.87	120 24.61	3.30	1.7	21/21	48	0.35	CC	E3	
28	10:14:55.88	47 43.37	120 11.03	0.60	1.2	6/08	224	0.49	CD	N3	
29	04:52:33.47	47 41.28	120 12.23	0.71	2.0	19/22	128	0.19	BC	N3	
30	22:32:23.64	46 42.73	119 21.30	0.02*	1.5	14/18	66	0.27	BC	E3	

Dec 1987

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	00:41:09.15	48 10.17	120 52.98	8.66$	2.0	20/21	176	0.68	DD	C3	
1	04:18:28.92	46 44.65	119 22.29	4.70	1.0	10/14	72	0.19	BB	E3	
2	07:12:57.46	46 40.49	120 41.03	18.20	4.1	37/40	40	0.26	BA	E3	F
2	07:24:20.54	46 40.81	120 42.79	13.48	1.3	8/12	163	0.29	BC	C3	
2	07:25:54.48	46 38.09	120 42.88	8.21*	1.1	6/07	144	0.15	AC	C3	
2	09:02:24.27	46 40.75	120 40.39	17.80	4.3	38/39	35	0.37	CA	E3	F
2	09:11:26.93	46 39.90	120 40.98	16.16	0.6	6/08	129	0.27	BC	E3	
2	15:33:40.46	46 45.25	119 22.58	0.02*	1.3	13/17	61	0.15	BB	E3	
2	19:41:09.35	46 39.77	120 44.44	15.63	0.8	5/08	186	0.44	CD	C3	
2	23:21:51.02	46 39.04	120 46.10	18.50	0.9	6/10	206	0.42	CD	C3	
3	01:05:56.42	46 37.44	120 47.75	19.45	0.9	4/06	269	0.37	CD	C3	
3	09:03:57.68	46 42.78	119 21.82	0.02*	0.9	6/10	118	0.17	BC	E3	
3	15:37:15.82	46 43.33	119 21.05	7.65*	0.6	7/12	72	0.40	CB	E3	
3	17:58:29.64	46 21.09	119 15.69	0.04*	1.6	16/20	154	0.23	BC	E3	
4	00:35:53.80	46 43.12	119 21.27	5.65	0.7	10/14	73	0.19	BB	E3	

Dec 1987 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
4	01:48:02.08	46 45.25	119 22.78	0.03*	2.2	27/32	59	0.24	BB	E3	
4	09:55:35.34	46 45.29	119 23.25	5.35$	0.8	8/11	104	0.24	BB	E3	
4	15:51:01.13	46 39.85	120 41.03	17.63	1.3	11/12	129	0.21	BB	E3	
5	08:03:46.28	46 42.68	119 20.56	3.99	0.8	8/12	99	0.16	BC	E3	
5	09:38:52.52	47 47.18	119 23.28	0.46	1.7	10/10	88	0.38	CB	N3	
6	17:17:24.53	46 20.82	119 15.06	0.80	1.9	20/25	159	0.26	BC	E3	
6	19:34:15.68	46 43.04	119 21.51	5.24	0.8	7/11	92	0.16	BC	E3	
7	09:54:41.35	46 42.81	119 21.08	0.03*	0.9	9/14	66	0.18	BC	E3	
10	04:24:19.72	46 42.55	119 21.54	0.54	1.0	8/12	138	0.37	CC	E3	
10	22:27:51.08	46 45.47	119 21.77	7.04*	0.9	5/09	101	0.20	BD	E3	
11	21:04:29.84	46 44.78	119 22.14	1.07	1.8	16/20	59	0.19	BB	E3	
12	08:26:49.84	47 41.11	120 12.16	0.66	0.8	4/07	225	0.10	AD	N3	
12	14:37:30.70	47 46.09	119 25.07	0.55	1.7	12/14	129	0.33	CB	N3	
12	17:49:34.91	48 10.34	121 18.32	19.69$	0.6	3/05	253	0.23	DD	C3	
13	05:55:45.85	45 59.46	118 22.10	2.52	2.1	16/17	182	0.25	BD	E3	
13	22:13:56.51	46 44.81	119 21.78	0.03*	0.7	7/12	107	0.07	AB	E3	
14	06:29:33.56	47 45.53	120 17.30	0.83	1.0	9/12	188	0.06	AD	N3	
14	07:48:35.48	46 44.41	119 41.90	17.75	1.8	21/25	34	0.17	BA	E3	
14	18:26:52.05	46 01.24	119 57.77	0.03*	2.0	15/15	93	0.25	BC	E3	P
15	13:05:34.85	46 42.96	119 22.55	2.56	0.8	8/10	82	0.11	BC	E3	
15	14:38:04.44	46 43.47	119 22.79	3.44	0.5	8/11	85	0.31	CC	E3	
16	09:54:40.06	46 38.68	120 45.08	3.19	0.5	4/06	201	0.05	BD	C3	
16	09:54:44.95	46 41.87	120 43.44	11.52	0.7	14/16	114	0.33	CB	C3	
17	18:35:36.46	46 45.32	119 23.21	0.04*	0.9	8/12	98	0.23	BB	E3	
20	07:14:40.58	47 46.09	119 21.67	0.64	1.2	6/10	118	0.36	CC	N3	F
20	07:28:51.85	47 44.44	119 21.18	16.67	1.1	6/08	120	0.24	BC	N3	F
20	07:38:25.13	47 46.56	119 22.02	0.03*	2.7	19/21	84	0.31	CB	N3	F
20	18:43:26.39	46 45.01	119 22.23	0.04*	1.9	27/33	58	0.25	BB	E3	
21	02:59:57.95	46 44.55	119 21.64	0.03*	1.0	12/15	58	0.25	BB	E3	
21	23:23:41.20	46 37.05	118 52.76	1.76	2.0	28/30	197	0.23	BD	E3	
22	00:55:13.69	46 44.67	119 21.25	5.52	0.3	4/08	137	0.14	AD	E3	
22	00:56:42.98	46 44.68	119 21.53	0.03*	0.5	6/11	111	0.12	AC	E3	
22	04:53:11.45	46 44.64	119 21.55	0.05*	0.5	7/12	112	0.11	AB	E3	
22	05:15:01.07	46 44.70	119 22.14	0.04*	0.7	9/13	58	0.14	AB	E3	
24	02:45:44.31	46 44.83	119 21.70	0.04*	0.9	10/15	76	0.14	AB	E3	
24	17:01:24.52	46 42.64	119 22.39	2.99	0.7	10/13	63	0.13	BC	E3	
25	04:32:23.25	46 44.84	119 21.51	0.04*	1.6	21/27	61	0.22	BB	E3	
25	13:08:48.28	46 44.63	119 21.44	0.02*	0.9	11/15	59	0.12	AB	E3	
26	01:52:06.42	46 44.89	119 21.31	4.58$	0.9	10/15	62	0.17	BB	E3	
26	16:34:31.90	46 44.24	119 21.89	2.07	1.4	15/20	80	0.15	BB	E3	
26	16:35:18.36	46 44.43	119 22.15	1.72	2.1	23/28	53	0.25	BB	E3	
26	17:48:13.45	46 44.29	119 21.69	2.65	1.5	17/22	53	0.17	BB	E3	
26	19:36:30.36	46 44.63	119 21.56	0.04*	1.5	17/21	59	0.18	BB	E3	
27	07:37:35.29	46 42.60	119 22.59	0.03*	0.9	11/16	62	0.16	BC	E3	
27	13:20:58.14	46 44.59	119 21.90	5.04	0.7	6/11	111	0.08	AC	E3	
27	13:48:05.80	46 44.42	119 21.74	0.03*	0.9	13/20	57	0.17	BB	E3	
27	13:59:39.55	46 44.61	119 22.23	0.66	1.7	20/22	55	0.11	AB	E3	
27	14:10:09.22	46 44.43	119 21.84	0.05*	1.1	14/20	57	0.19	BB	E3	
28	09:39:52.68	47 42.60	120 04.58	5.59*	1.2	6/11	170	0.14	AC	N3	
28	19:29:08.05	46 44.59	119 21.37	0.42	0.9	10/14	59	0.19	BB	E3	
28	21:22:15.01	46 42.66	119 22.71	0.04*	0.5	10/15	91	0.25	BC	E3	
29	08:16:55.30	46 26.49	119 15.43	0.04*	0.9	11/15	117	0.24	BB	E3	
30	22:08:24.57	46 42.90	119 22.48	1.38	2.2	23/26	61	0.21	BC	E3	
31	03:45:47.20	46 43.11	119 22.36	5.50	0.6	8/10	66	0.13	AC	E3	

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DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	05:01:51.24	46 44.78	119 21.47	0.04*	1.2	14/18	60	0.16	BB	E3	
1	23:36:03.80	46 44.98	119 22.50	0.03*	1.9	22/27	57	0.20	BB	E3	
2	01:20:48.42	47 48.06	120 03.59	3.85	0.7	4/06	208	0.02	AD	N3	
3	08:02:48.96	46 44.67	119 21.93	0.02*	0.9	10/13	104	0.13	AB	E3	
3	09:58:24.35	46 42.42	119 22.80	0.02*	1.0	12/16	76	0.14	AC	E3	
4	05:47:04.11	46 44.72	119 21.66	0.04*	0.9	10/13	60	0.13	AB	E3	
4	07:08:13.74	46 45.11	119 22.20	0.03*	1.1	12/16	106	0.15	BB	E3	

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DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
4	19:52:42.17	46 44.50	119 21.86	1.41	1.7	19/23	54	0.22	BB	E3	
5	17:26:47.57	46 45.11	119 21.04	4.43	0.8	9/11	117	0.21	BB	E3	
5	20:12:43.51	46 59.11	119 13.00	0.04*	1.7	13/14	130	0.28	BC	E3	P
6	02:03:05.16	46 45.47	119 23.76	6.22	0.5	5/09	96	0.12	AD	E3	
6	06:24:50.10	46 44.86	119 21.36	0.04*	1.7	15/20	97	0.13	AB	E3	
6	19:03:53.73	46 15.22	120 33.53	11.13#	1.4	12/13	146	0.27	BC	E3	
7	14:31:35.73	46 43.56	119 21.90	5.19$	0.5	8/13	91	0.28	CC	E3	
7	16:04:29.22	45 56.20	120 13.01	8.54#	1.6	13/14	173	0.22	BC	E3	
8	05:42:07.37	46 04.32	119 43.37	9.59	1.4	14/17	120	0.23	BB	E3	
8	05:43:47.04	46 03.05	119 43.64	13.30	1.3	15/19	124	0.21	BB	E3	
8	06:01:54.17	46 03.48	119 45.30	8.47$	1.3	14/18	157	0.48	CC	E3	
9	06:30:15.48	46 03.35	119 44.55	9.47*	1.3	18/21	119	0.16	BB	E3	
9	06:31:44.26	46 03.21	119 45.03	9.34$	1.3	13/16	156	0.24	CC	E3	
10	13:17:32.64	47 43.59	120 18.56	4.68	1.8	13/18	184	0.14	BD	N3	
10	13:41:24.13	46 03.67	119 44.79	8.22$	1.5	18/20	116	0.15	CC	E3	
11	10:18:13.51	47 46.92	119 21.70	0.65	2.3	13/18	86	0.31	CB	N3	
13	07:57:15.93	46 55.08	120 42.19	3.93	0.7	5/08	126	0.23	BD	E3	
13	09:26:37.67	46 44.19	119 22.49	4.87	0.7	9/15	54	0.19	BB	E3	
13	10:26:09.70	46 44.48	119 21.16	0.54	0.8	8/14	80	0.15	BB	E3	
13	16:09:32.59	46 44.57	119 21.55	0.03*	0.5	7/11	70	0.19	BB	E3	
14	09:37:54.24	44 38.28	121 20.18	20.74	2.4	10/10	210	0.36	CD	O0	
14	10:43:19.44	46 44.69	119 20.93	1.64	1.3	13/17	78	0.11	AB	E3	
14	23:13:09.60	46 37.28	118 54.41	2.26	2.1	25/26	192	0.19	BD	E3	
15	07:47:19.83	46 45.14	119 21.18	0.02*	2.4	22/27	61	0.17	BC	E3	
15	09:25:03.43	46 44.35	119 21.91	4.98#	1.3	14/18	53	0.36	CC	E3	
16	14:42:22.31	46 44.80	119 20.80	4.30*	1.0	10/15	62	0.21	BB	E3	
17	13:36:21.34	46 44.40	119 21.91	0.03*	1.0	11/16	79	0.16	BB	E3	
17	22:44:29.64	46 44.79	119 21.01	0.62	2.6	29/32	58	0.17	BB	E3	
17	23:10:39.04	46 44.60	119 21.16	0.03*	1.3	15/18	56	0.13	AB	E3	
18	04:09:04.72	46 44.97	119 20.96	0.03*	0.7	8/13	75	0.17	BB	E3	
18	04:31:15.72	46 44.64	119 20.86	0.04*	0.5	6/09	114	0.07	AC	E3	
18	05:40:26.08	46 44.38	119 22.45	0.03*	0.8	10/15	55	0.25	BB	E3	
18	05:48:17.84	46 44.47	119 21.45	0.03*	0.6	8/13	113	0.24	BB	E3	
18	09:39:44.85	46 44.13	119 22.15	0.02*	0.8	8/11	114	0.27	BC	E3	
18	19:06:55.99	46 44.59	119 23.48	0.02*	1.3	14/18	55	0.17	BB	E3	
18	19:39:42.22	46 44.95	119 21.24	4.15	0.4	6/09	109	0.15	AC	E3	
18	20:28:25.77	46 44.66	119 21.09	0.04*	2.0	27/31	56	0.23	BB	E3	
18	20:30:50.32	46 44.88	119 20.69	0.02*	1.4	13/17	59	0.13	AB	E3	
19	06:07:53.63	46 44.55	119 20.87	0.04*	1.7	18/22	60	0.13	AB	E3	
21	07:02:47.42	46 44.81	119 21.07	0.03*	0.9	11/16	62	0.14	AB	E3	
21	13:17:31.78	46 44.65	119 20.92	0.05*	0.6	8/13	63	0.27	BB	E3	
21	15:02:41.58	46 44.79	119 20.98	0.03*	0.7	7/11	66	0.13	AB	E3	
21	16:06:19.13	46 44.65	119 24.12	0.42	1.5	18/21	53	0.10	AB	E3	
21	22:18:59.88	46 44.58	119 23.74	0.02*	1.3	15/21	54	0.15	BB	E3	
22	10:37:09.55	46 13.35	119 53.32	12.34	1.7	21/24	194	0.18	BD	E3	
22	10:41:11.51	46 13.31	119 53.58	12.36	2.1	26/28	83	0.20	BB	E3	
22	11:08:52.94	46 13.16	119 53.19	11.73	1.4	18/20	127	0.24	BB	E3	
22	11:42:38.46	46 44.60	119 23.50	4.33	1.0	9/15	78	0.17	BB	E3	
22	12:03:56.18	46 13.03	119 53.85	11.85	1.5	22/26	128	0.23	BB	E3	
22	21:04:14.11	47 00.01	119 13.03	0.02*	1.7	19/20	82	0.25	BB	E3	P
22	22:16:47.22	47 09.19	118 37.00	5.67	2.0	17/17	191	0.31	CD	N3	P
22	23:46:27.67	46 44.62	119 20.58	0.04*	0.8	8/11	112	0.10	AB	E3	
24	06:23:05.78	46 44.43	119 23.05	2.66	1.0	10/16	54	0.22	BB	E3	
24	14:40:03.58	47 42.11	120 13.45	0.69	1.6	16/21	137	0.43	CC	N3	
24	19:47:45.45	46 44.69	119 20.96	0.04*	1.0	13/18	61	0.17	BB	E3	
24	20:52:25.34	47 43.13	120 17.30	3.53$	2.1	31/36	57	0.39	CC	N3	
24	22:52:29.55	46 44.70	119 20.54	4.62	0.9	9/12	62	0.16	BB	E3	
25	21:11:43.44	46 13.75	119 43.65	0.04*	2.1	21/22	66	0.21	BA	E3	
27	20:18:25.16	46 59.85	119 12.79	1.08	1.5	18/20	74	0.38	CB	E3	P
29	10:36:00.75	46 42.24	119 23.19	0.05*	1.1	12/17	63	0.16	BA	E3	
31	02:16:19.75	48 13.12	119 22.81	0.94	1.5	8/10	216	0.15	BD	N3	
31	08:19:16.51	46 44.45	119 23.60	2.50	1.0	8/13	75	0.13	AA	E3	

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DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	02:02:40.93	46 27.19	119 16.11	0.03*	1.2	12/15	123	0.29	BB	E3	

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DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	15:06:05.59	46 44.64	119 21.05	0.03*	0.9	8/14	113	0.23	BB	E3	
2	05:20:46.30	46 44.48	119 23.58	0.02*	1.2	16/24	54	0.17	BA	E3	
2	05:25:26.14	46 44.54	119 23.68	0.02*	0.8	9/15	105	0.11	AB	E3	
2	05:49:56.11	46 44.51	119 23.77	0.51	2.9	32/35	53	0.24	BA	E3	
2	09:03:08.15	46 44.48	119 23.93	1.26	0.7	8/12	86	0.14	AA	E3	
2	11:30:05.62	46 44.36	119 20.72	0.03*	0.7	8/14	115	0.23	BB	E3	
2	11:36:13.20	46 44.61	119 23.87	1.24	1.2	11/18	56	0.12	AA	E3	
2	13:27:01.56	46 44.41	119 24.30	0.12	0.9	11/16	82	0.18	BA	E3	
2	14:52:10.29	46 44.52	119 23.51	0.41	0.8	9/17	57	0.27	BA	E3	
2	16:53:41.17	46 44.40	119 23.87	2.16	1.1	9/14	86	0.14	AA	E3	
2	17:27:04.36	46 44.44	119 23.90	0.02*	2.1	25/31	53	0.26	BA	E3	
2	21:31:51.16	47 00.30	119 12.15	0.02*	1.4	10/13	168	0.41	CC	N3	P
3	06:39:57.41	46 44.58	119 23.70	2.23	1.0	9/15	74	0.14	AA	E3	
3	06:51:33.27	46 44.66	119 23.66	0.03*	1.0	12/16	74	0.19	BA	E3	
3	07:24:38.64	46 44.38	119 23.79	2.71	1.2	11/18	75	0.12	AA	E3	
3	19:45:40.43	46 44.46	119 23.83	2.33	2.9	27/31	52	0.17	BA	E3	
3	21:24:05.94	46 44.48	119 24.12	1.55	1.9	21/28	52	0.19	BA	E3	
3	22:58:28.87	46 44.49	119 24.07	2.17	1.3	10/15	74	0.09	AA	E3	
3	23:10:39.77	46 44.45	119 23.79	1.24	1.9	23/30	52	0.24	BA	E3	
3	23:11:34.30	46 44.53	119 24.21	2.42	1.1	10/16	84	0.11	AA	E3	
3	23:19:39.06	46 13.38	119 44.04	0.02*	2.5	16/18	75	0.23	BA	E3	P
4	00:21:18.81	46 44.39	119 23.94	1.10	1.1	9/14	85	0.09	AA	E3	
4	10:36:01.57	46 50.95	119 45.32	0.02*	1.1	7/10	137	0.07	AC	E3	
5	02:48:26.87	46 44.54	119 24.04	2.52	0.8	8/11	104	0.07	AB	E3	
6	04:30:39.79	46 44.56	119 23.78	0.03*	2.1	24/29	54	0.24	BA	E3	
6	12:51:44.81	47 39.98	120 01.42	7.15	3.0	32/36	32	0.26	BA	N3	F
7	00:29:58.38	46 35.77	118 59.27	5.23$	1.9	21/23	123	0.42	CC	E3	
7	17:02:14.70	47 47.11	120 38.05	4.52	1.7	14/18	98	0.48	CC	C3	
7	20:23:21.90	46 25.00	120 46.55	1.76$	1.1	9/11	119	0.41	CC	C3	
7	22:15:27.61	45 21.36	119 37.30	21.16	2.5	19/19	232	0.20	BD	O0	P
8	01:50:40.27	46 43.97	119 23.85	0.85	0.6	6/12	110	0.21	BC	E3	
9	11:53:10.47	46 26.88	119 16.31	0.04*	1.0	10/14	126	0.24	BB	E3	
9	12:08:23.32	46 44.37	119 20.39	0.03*	0.8	9/15	65	0.19	BB	E3	
9	15:08:54.99	45 50.19	120 50.00	7.84	2.1	26/28	69	0.21	BB	C3	
9	18:03:28.09	45 51.04	120 51.55	5.99*	1.7	19/20	117	0.25	BC	C3	
9	19:18:05.85	46 30.00	120 45.06	1.05	0.7	4/08	265	0.16	BD	C3	
10	03:42:27.89	46 44.66	119 24.20	2.18	1.3	11/18	58	0.26	BA	E3	
10	06:22:44.35	46 44.80	119 23.93	1.11	1.3	11/18	57	0.11	AA	E3	
10	21:58:42.52	46 37.64	118 54.26	2.38	2.3	28/29	155	0.20	BC	E3	
11	13:38:51.89	46 44.38	119 26.32	0.03*	1.7	16/21	48	0.12	AA	E3	
14	02:55:23.83	45 34.62	120 08.96	16.58	2.5	28/28	143	0.23	BC	E3	
14	05:16:19.20	48 12.69	118 56.75	9.26	1.7	7/08	222	0.18	BD	N3	
16	12:26:17.74	46 40.74	119 49.71	5.38*	0.7	8/12	107	0.39	CB	E3	
17	21:08:08.00	46 57.19	119 04.40	2.90	1.9	22/24	146	0.17	BC	E3	P
18	10:10:07.31	46 44.97	119 23.62	0.02*	1.5	17/25	57	0.22	BA	E3	
19	08:02:34.30	46 34.27	119 48.87	19.25	1.3	19/29	95	0.13	AB	E3	
20	10:18:20.57	45 13.02	120 07.02	2.42$	2.1	31/33	166	0.56	DC	O0	
20	23:55:47.60	45 12.98	120 06.34	14.11*	2.7	52/54	143	0.44	CC	O0	
23	00:00:41.50	46 59.22	119 14.47	0.03*	1.9	17/18	71	0.20	BB	E3	P
23	20:08:56.36	46 44.71	119 21.34	0.51	0.9	8/13	61	0.21	BB	E3	
23	21:51:43.28	46 07.32	119 28.59	0.04*	1.8	23/24	112	0.23	BC	E3	P
24	12:43:00.64	47 02.16	119 25.47	0.04*	2.3	30/33	49	0.48	CC	N3	
24	20:00:39.71	47 41.25	120 13.51	0.79	0.8	4/07	176	0.05	AD	N3	
25	01:15:09.91	47 01.19	119 27.15	0.87	1.7	18/20	62	0.30	BC	N3	
25	21:44:02.35	46 31.30	121 23.43	0.02*	2.2	38/41	83	0.25	BC	C3	
25	22:05:24.02	46 31.09	121 21.87	2.84$	1.5	17/19	169	0.13	BC	C3	
26	08:37:46.88	46 44.43	119 21.20	0.03*	1.0	8/13	116	0.15	AB	E3	
26	16:01:08.14	46 40.41	119 34.87	7.16	0.6	8/13	65	0.07	AB	E3	
26	20:13:41.71	46 05.32	118 46.12	0.96	2.1	18/18	122	0.19	BB	E3	P
26	23:50:47.86	47 42.44	120 03.90	5.52	1.6	10/13	163	0.19	BC	N3	
26	23:53:29.51	46 59.31	119 14.68	2.50*	2.1	23/23	61	0.14	AB	E3	P
27	04:31:01.74	47 44.95	120 02.39	2.52	1.3	8/13	123	0.18	BB	N3	
27	22:12:32.75	44 22.01	121 02.62	1.95*	2.1	8/08	120	0.13	AC	O0	P
28	19:46:29.53	46 49.93	120 33.81	20.64	0.8	5/08	146	0.36	CD	E3	
28	20:47:11.17	45 34.27	119 53.08	0.04*	2.6	21/21	144	0.18	BC	E3	P

Feb 1988 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP

Mar 1988

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	21:42:11.09	45 30.04	117 44.57	0.03*	1.8	11/11	318	0.66	DD	E3	
3	12:58:53.88	46 42.44	119 27.21	0.03*	1.8	14/20	57	0.17	BA	E3	
3	22:20:01.05	46 37.18	118 52.43	1.59	1.6	17/17	199	0.08	AD	E3	P
8	01:01:43.47	46 52.34	120 35.56	7.94	1.2	8/11	83	0.12	AA	E3	
8	01:28:40.57	46 31.17	118 35.57	5.40	2.1	29/32	150	0.37	CC	E3	
8	05:41:54.34	46 42.41	119 27.36	0.03*	1.5	13/19	52	0.11	AA	E3	
8	07:16:29.00	46 39.71	119 30.90	18.08	0.7	9/15	86	0.13	AA	E3	
10	22:27:38.08	47 03.13	119 54.98	0.04*	2.2	25/26	62	0.39	CC	N3	P
11	08:36:44.56	47 42.26	120 01.86	4.60	1.7	7/13	118	0.07	AB	N3	
14	04:58:20.29	47 43.27	120 13.75	1.07*	1.3	7/10	175	0.16	BC	N3	
14	18:35:32.82	47 40.41	120 18.22	1.89	1.1	5/08	203	0.27	CD	N3	
15	00:59:17.97	47 48.42	120 50.78	10.30	2.5	21/25	87	0.39	CC	C3	
15	01:16:19.12	46 05.68	119 51.23	0.02*	1.6	11/11	95	0.15	AC	E3	P
15	08:15:55.43	46 44.54	119 22.94	1.63	0.9	6/12	108	0.13	AC	E3	
17	20:36:24.54	46 07.94	119 46.98	0.03*	2.6	25/25	105	0.25	BC	E3	P
17	20:50:06.74	47 03.15	119 54.14	0.02*	2.5	27/30	49	0.33	CC	N3	P
18	07:40:57.54	46 21.01	119 15.95	0.60	2.6	26/29	77	0.28	BB	E3	
18	08:24:43.40	46 21.03	119 16.09	0.05*	2.5	24/26	86	0.33	CB	E3	
18	12:06:36.58	47 44.45	120 19.75	0.76	1.0	6/11	197	0.21	BD	N3	
18	14:15:15.81	46 21.02	119 16.00	0.03*	1.5	14/18	106	0.26	BB	E3	
18	19:55:01.13	46 54.10	120 44.09	9.12	2.1	23/26	40	0.43	CB	C3	
19	00:12:59.72	47 42.30	121 28.98	9.05	1.3	11/13	107	0.53	DC	C3	
19	02:53:51.45	46 20.85	119 16.49	0.04*	1.2	12/16	192	0.25	BD	E3	
20	02:17:10.10	46 40.88	120 37.67	21.35	0.6	6/08	134	0.46	CC	E3	
21	20:13:59.54	46 50.83	119 43.15	0.52	0.9	5/10	136	0.22	BD	E3	
22	01:22:23.14	46 54.91	119 06.91	3.02	1.8	24/24	142	0.18	BC	E3	
23	21:12:40.42	46 37.31	118 50.93	3.72$	1.3	9/11	252	0.14	BD	E3	P
24	02:13:00.94	46 40.54	119 42.12	0.04*	0.2	6/07	164	0.31	CC	E3	
24	02:13:05.31	46 38.74	119 38.24	0.03*	1.0	8/14	134	0.23	BC	E3	
24	23:27:34.50	46 38.49	119 38.15	5.42	0.9	6/09	127	0.19	BC	E3	
25	22:46:52.30	46 55.04	119 05.53	1.85*	2.1	27/30	120	0.18	BB	E3	
28	18:16:11.64	46 31.79	120 04.01	17.17	1.3	13/17	137	0.24	BC	E3	
29	08:14:31.00	46 52.68	120 43.10	9.26	1.2	5/09	131	0.44	CD	C3	
29	09:58:55.75	45 41.71	120 18.29	13.99$	1.9	19/20	165	0.34	CC	E3	
29	20:47:54.92	46 04.55	119 47.17	8.58$	1.3	11/13	258	0.46	CD	E3	P
29	22:44:05.90	44 49.66	118 01.77	18.32#	2.7	17/21	269	0.98	DD	O0	
30	21:46:15.94	45 43.81	118 15.91	28.95$	1.9	8/11	243	0.52	DD	E3	

Apr 1988

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	18:12:52.91	47 40.72	120 27.34	0.61	1.9	22/25	114	0.23	BC	N3	
1	22:05:50.91	46 54.95	119 06.40	3.09	2.6	30/34	118	0.19	BB	E3	
2	00:48:45.13	46 59.04	121 08.45	0.02*	1.8	12/12	157	0.19	BC	C3	L
4	11:35:10.40	46 49.34	119 23.69	1.55	1.0	8/12	124	0.27	BB	E3	
6	23:44:00.08	47 23.04	118 17.60	45.93	2.0	11/13	257	0.44	CD	N3	
7	23:25:18.81	47 02.62	119 56.34	0.03*	2.6	24/24	83	0.38	CC	N3	
8	07:33:59.99	47 43.94	120 03.59	4.70	1.7	17/23	98	0.26	BB	N3	
11	23:35:08.86	48 12.46	121 20.60	10.06	0.7	4/07	247	0.35	CD	C3	
12	15:08:02.43	47 18.42	118 20.28	18.21$	1.9	14/16	207	0.45	DD	N3	
12	23:59:17.68	47 16.24	118 32.62	24.10	2.4	5/05	190	0.43	DD	N3	P
18	21:06:41.54	45 53.81	119 17.40	24.08$	2.1	13/13	157	0.28	CC	E3	P
22	09:42:11.12	47 51.35	119 55.82	0.68	2.9	21/28	90	0.29	BC	N3	
22	13:12:33.95	47 51.16	119 55.96	0.66	1.9	14/20	89	0.23	BB	N3	
22	21:16:00.19	47 51.02	119 56.26	3.85	1.5	7/13	89	0.08	AB	N3	
23	07:47:04.15	47 39.94	120 07.02	4.56	1.8	25/29	104	0.37	CC	N3	
24	19:42:00.40	46 56.04	120 34.21	19.45	0.8	3/06	221	0.10	BD	E3	
26	10:11:46.88	47 40.03	120 18.54	5.75	1.3	7/11	163	0.08	AC	N3	
27	15:39:16.23	46 49.26	120 39.87	13.65	1.4	8/13	108	0.19	BB	E3	
28	20:11:12.18	46 55.67	121 21.96	0.04*	1.3	29/32	66	0.29	BC	C3	
28	22:05:03.23	46 46.01	119 31.77	20.09	1.9	27/35	39	0.20	BA	E3	

Apr 1988 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
30	11:29:44.37	47 39.69	120 14.25	0.04*	1.5	6/11	122	0.09	AC	N3	
30	19:22:52.97	46 55.49	120 46.62	4.52	1.2	8/12	137	0.19	BC	C3	

May 1988

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	15:56:15.59	47 46.38	119 21.18	0.62	1.5	6/08	150	0.53	DC	N3	
2	16:21:21.79	47 46.80	119 21.85	0.02*	2.6	21/25	85	0.30	BB	N3	
5	00:18:13.45	47 39.07	120 19.27	6.72	3.3	33/38	49	0.32	CA	N3	F
5	23:14:37.84	44 38.49	121 08.52	8.19	0.	7/07	91	0.56	DC	O0	P
6	19:17:13.10	46 35.66	120 41.47	0.03*	1.9	6/11	203	0.34	CD	E3	
8	08:59:11.87	46 13.93	120 49.18	0.04*	1.8	23/24	91	0.44	CC	C3	
10	18:33:44.18	46 36.72	118 55.30	2.08	1.4	8/09	229	0.18	BD	E3	P
11	05:29:58.15	47 06.87	120 30.48	0.27	1.7	23/23	66	0.47	CB	N3	P
12	10:25:44.68	47 51.32	119 56.21	0.62	1.5	10/13	91	0.08	AB	N3	
12	15:16:57.77	46 44.19	120 51.09	8.15	2.4	33/36	54	0.34	CA	C3	
12	16:03:12.70	46 02.66	119 44.41	8.90*	1.6	16/18	194	0.24	BD	E3	
13	04:52:59.75	46 49.12	119 24.96	5.19	0.9	7/13	143	0.21	BC	E3	
13	18:19:49.74	46 48.35	119 25.48	0.02*	2.2	22/26	62	0.37	CA	E3	
15	02:32:51.50	46 27.02	120 58.00	0.02*	1.0	6/06	285	0.28	BD	C3	
16	19:19:43.18	46 55.65	121 21.62	0.03*	1.1	18/19	81	0.18	BC	C3	
21	04:08:28.42	47 08.94	120 57.13	17.13	0.9	13/15	64	0.34	CA	N3	
21	05:54:22.22	46 30.36	121 22.62	7.34	0.9	4/06	290	0.02	AD	C3	
23	17:52:59.26	46 55.50	121 21.29	2.38	0.8	9/10	147	0.06	AC	C3	
23	20:17:38.52	46 48.35	119 25.47	0.03*	1.5	12/16	105	0.12	AC	E3	
24	18:38:21.38	46 37.73	118 53.76	2.67	1.5	12/14	193	0.11	AD	E3	
25	19:27:35.82	46 55.48	121 21.39	1.24	0.9	10/10	147	0.19	BC	C3	
27	17:04:36.72	45 07.73	120 03.45	21.86	2.4	21/22	232	0.58	DD	O0	P
28	00:34:05.47	47 47.59	119 41.61	19.26	2.5	21/24	74	0.44	CB	N3	
28	09:02:43.96	46 48.63	119 25.68	0.02*	3.5	28/32	54	0.24	BA	E3	
28	15:23:19.07	46 48.74	119 26.01	0.03*	1.0	8/12	135	0.14	AB	E3	
31	13:09:21.92	47 54.12	119 57.14	0.73	1.8	15/21	111	0.49	CC	N3	
31	14:09:28.63	46 48.62	119 25.83	0.03*	2.9	29/29	52	0.26	BA	E3	
31	14:11:31.34	46 48.44	119 25.81	0.03*	2.2	20/25	56	0.12	AA	E3	
31	14:12:25.82	46 48.75	119 25.86	0.04*	1.7	13/16	78	0.17	BA	E3	
31	19:23:57.84	46 48.64	119 25.89	0.02*	2.4	24/27	51	0.31	CA	E3	
31	21:06:48.60	46 49.95	119 26.29	3.96	0.9	5/07	233	0.08	AD	E3	

June 1988

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	00:59:16.51	46 44.09	119 24.48	0.04*	1.7	14/19	79	0.16	BC	E3	
5	06:20:04.74	46 51.54	119 20.87	12.96	2.0	15/20	145	0.17	BC	E3	
6	15:24:37.85	46 56.03	120 34.96	0.05*	1.6	8/08	96	0.49	CB	E3	P
8	04:42:18.25	46 46.15	119 17.64	2.62*	1.0	8/11	168	0.21	BC	E3	
9	19:19:02.19	45 12.50	120 05.93	0.05*	2.0	9/10	171	0.36	CC	C3	P
10	03:26:54.62	46 04.62	118 46.23	1.25	2.0	16/17	120	0.31	CB	E3	P
11	01:17:38.77	46 31.84	120 48.84	0.68$	2.3	24/25	41	0.43	CC	C3	
16	18:05:51.13	46 04.68	118 45.82	1.58	2.1	13/15	138	0.15	AC	E3	P
18	11:45:56.68	47 41.61	120 23.65	0.92	1.5	8/11	207	0.21	BD	N3	
23	03:12:31.26	46 50.25	121 16.36	8.30	1.1	7/10	264	0.15	BD	C3	
24	07:13:18.55	46 25.04	121 16.95	1.17	1.3	9/11	173	0.31	CC	C3	
24	12:17:32.62	47 32.09	119 21.14	0.05*	2.4	24/26	52	0.49	CC	N3	
25	04:33:12.67	46 03.52	119 16.55	0.37#	1.6	15/17	159	0.48	CC	E3	
25	11:33:56.03	46 55.47	120 36.46	1.99	2.7	28/28	61	0.48	CA	E3	
25	14:57:29.75	47 38.51	120 20.68	7.97	1.4	10/14	128	0.26	BB	N3	
26	06:06:46.21	47 44.69	120 01.32	0.60	1.6	12/16	73	0.45	CB	N3	
27	15:01:48.07	47 42.51	120 21.13	0.55	1.8	12/16	105	0.18	BC	N3	
28	02:56:09.78	47 43.60	120 17.71	0.66	1.7	14/18	99	0.37	CC	N3	
30	04:28:02.27	47 50.43	119 22.48	0.71	2.3	17/21	103	0.32	CC	N3	
30	16:58:31.96	46 19.69	119 52.59	0.04*	2.0	18/20	109	0.32	CC	E3	P

EXPLANATION OF CATALOGS in APPENDICES I, II, and III

The locations of earthquakes reported in Appendices I, II, and III have been determined using the computer program *spong,* which is an adaptation of a program originally written by Bob Herrmann at Saint Louis University. In each column of the Catalog the following information is given:

TIME Origin time is calculated for each earthquake on the basis of multistation arrival times. Time is given in **Coordinated Universal Time** (UTC), in hours:minutes:seconds. To convert to Pacific Standard Time (PST) subtract 8 hours, or to Pacific daylight time subtract 7 hours.

LAT North latitude, in degrees and minutes, of the epicenter.

LONG West longitude, in degrees and minutes, of the epicenter.

DEPTH The depth, given in kilometers, is usually freely calculated from the arrival-time data. In some instances, the depth must be fixed arbitrarily to obtain a convergent solution. Such depths are noted by an asterisk (*) in the column immediately following the depth. A $ or a # following the depth mean that the maximum number of iterations has been exceeded without meeting convergence tests and both the location and depth have been arbitrarily fixed.

MAG Coda magnitude, M_c (Crosson, R.S., 1972, Bull. Seism. Soc. Am., v. 62, p. 1133-1171) For tectonic earthquakes in Washington, M_c is an estimate of local Richter magnitude, M_L (Richter, C.F., 1958, Elementary Seismology, W.H. Freeman and Co.). Where blank, data were insufficient for a reliable magnitude determination. Normally, the only earthquakes with undetermined magnitudes are very small ones. Magnitude values may be revised as we improve our analysis procedure.

NS/NP **NS** is the number of station observations, and **NP** the number of P and S phases used to calculate the earthquake location. A minimum of three stations and four phases is required. Generally, more observations improve the quality of the solution.

GAP Azimuthal gap. The largest angle (relative to the epicenter) containing no stations.

RMS The root mean square residual taken about the mean of the station first-arrival residuals. It is only useful as a measure of the quality of the solution when five or more well distributed stations are used in the solution. Good solutions are normally characterized by **RMS** values less than about 0.3 sec.

Q Two **Quality factors** indicate the general reliability of the solution (**A** is best quality, **D** is worst). Similar quality factors are used by the U. S. Geological Survey for events located with the computer program HYPO71. The first letter is a measure of the hypocenter quality based on travel time residuals. For example: **A** quality requires an **RMS** less than 0.15 sec while an **RMS** of 0.5 sec or more is **D** quality (estimates of the uncertainty in hypocenter location also affect this quality parameter). The second letter of the quality code depends on the spatial distribution of stations around the epicenter, that is, number of stations, their azimuthal distribution, and the minimum distance (**DMIN**) from the epicenter to a station. Quality **A** requires a solution with eight or more phases, **GAP** $\leq 90^\circ$ and **DMIN** $\leq$ (5 km or calculated depth of earthquake, whichever is greater). If the number

of phases, **NP**, is five or less, or **GAP** > 180°, or **DMIN** > 50 km, the solution is assigned quality **D.**

MOD The crustal velocity model used in location calculations (refer to Figure III-1 and Table below).

P3 - Puget Sound model
C3 - Cascade model
S3 - Mount St. Helens model including Elk Lake
N3 - northeastern model
E3 - southeastern model

TYP Earthquake classification.

F - earthquakes reported to have been felt
P - probable explosion
L - low-frequency earthquakes
H - hand-picked from helicorder records
X - known explosion
9 - information about earthquake obtained from another agency

Regions corresponding to different velocity models are shown in Figure III-1. Velocity in each layer is assumed constant. S-wave velocity is assumed to be 0.577 times that of the P-wave velocity. The table below summarizes the velocity models applicable to earthquakes in eastern Washington. V is the velocity in each layer and depth is the distance from the earth's surface (reference plane) to the top of each layer.

Southeast (E3)		**Northeast (N3)**	
V (km/sec)	Depth (km)	V (km/sec)	Depth (km)
3.70	0.0	5.1	0.0
5.15	0.4	6.1	0.5
6.10	8.5	6.4	14.0
6.40	13.0	7.1	24.0
7.10	23.0	7.9	38.0
7.90	38.0		

Cascade (C3)	
V (km/sec)	Depth (km)
5.1	0.0
6.0	1.0
6.6	10.0
6.8	18.0
7.1	34.0
7.8	43.0

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