QUARTERLY NETWORK REPORT 2006-D

on

Seismicity of Washington and Oregon

October 1 through December 31, 2006

Pacific Northwest Seismic Network

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This report is prepared as a preliminary description of the seismic activity in Washington State and Oregon. Information contained in this report should be considered preliminary and not cited for publication without checking directly with network staff. The views and conclusions contained in this document should not be interpreted as necessarily representing the official policies, either express or implied, of the U.S. Government**.**

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TABLE OF CONTENTS

INTRODUCTION

This is the fourth quarterly report of 2006 from the Pacific Northwest Seismograph Network (PNSN), at the University of Washington Dept. of Earth and Space Sciences, covering seismicity of Washington and western Oregon. In these reports we provide information about network operations, our educational and outreach activities, and seismicity of the region including special coverage (figures, counts, listings, etc.) of earthquake swarms, aftershock sequences, or unusual events or findings.

This report is preliminary, and subject to revision. The PNSN routinely records signals from selected stations in adjoining networks. This improves our ability to locate earthquakes at the edges of our network. However, our earthquake locations may be revised if new data become available. Findings mentioned in these quarterly reports should not be cited for publication.

Prior to 2004, each quarterly included station tables and maps. Beginning in 2004, station tables and maps appear in the quarterly report only once a year. These tables were included in Appendix 1 of the 2006C Quarterly Report. Comprehensive quarterlies have been produced by the PNSN since the beginning of 1984. Prior to that, we published quarterly reports for western Washington in 1983 and for eastern Washington from 1975 to 1983. Annual technical reports covering seismicity in Washington since 1969 are available from the U.W. Dept. of Earth and Space Sciences. The complete PNSN earthquake catalog is available on-line, both through our web-site and through the ANSS earthquake catalog.

NETWORK OPERATIONS

Lists of currently operating stations are available on-line through web page http://www.pnsn.org/OPS/stations.html. We currently receive data from 363 stations in our network area. There are 233 stations in Washington and 110 in Oregon. These stations provide short-period data from 157 stations, strong motion data from 99 stations, and broadband data from 136 stations. The PNSN operated 234 of these stations and receives data from 129 stations operated by other seismic networks. The PNSN is receiving data from Earthscope USArray Transportable Array stations. Installation of these stations began in fall of 2005 and is ongoing. At the time of this report we were receiving data from 82 of these stations. Although we do not install or maintain the sites, keeping track of the stations in our database and configuration files has added to our workload.

Table 1 gives approximate periods of time when individual stations were inoperable. Data for Table 1 are compiled from weekly plots of network-wide teleseismic arrivals and automated and manual digital and analog signal checks, plus records of maintenance and repair visits.

Record-setting winter weather in the Pacific Northwest has taken a severe toll on our network this quarter. November produced large amounts of rain (15.63 inches in Seattle, the wettest month on record), including intense rain on Nov. 6-7 that raised rivers all over the region to all-time flood levels. Mt. Rainier National Park was severely affected, and is has been closed to the public since the November storm. We will not know the full impact of the flooding on our operations at Mt. Rainier and elsewhere until weather improves and we are able to attempt station visits. Snow and cold temperatures hit at the end of November, causing extremely icy road conditions and power outages. On December 14-15, 2006, severe wind and snow storms hit the region following flooding over the previous days. At peak, there were 1.8 million customers without power in parts of British Columbia, Washington, and Oregon. This wind storm caused at least 25 of our strong motion stations to lose communications due to power outages. As power was restored, most of these came back on line, although a number of station visits were also required. By the end of the quarter, most of the strong-motion network problems have been resolved, although a few schools are still experiencing power and network issues. Many of our short period stations in remote areas are inoperative. When the field season picks up next spring, we anticipate difficulty reaching many of our sites because of downed trees, road wash outs, etc.

One of our major short-period telemetry sites, an antenna tower at Baw Faw (also known as Boistfort) Peak that relayed radio signals from southwestern Washington, was blown over in the windstorm. Currently, none of the data relayed through this site are available (BOW, LCW, SHW, RVW, and NLO), and extensive repairs will need to be made when weather permits. A power surge, likely weather-related, also damaged equipment at Grass Mountain (GSM), another telemetry relay site.

TABLE 1 - Station outages and installations		
Station	**Outage Dates**	**Comment**
ACES	12/15/06-12/27/06	Intermittent communications
ALCT	08/16/05-End	Removed for repair
ALKI	12/08/06-12/19/06	No communications
ASR	11/30/06-12/19/06	Dead; no signal from VLL receiver, it was removed 12/19/06
ASR	12/24/06-End	Dead
AUG	11/30/06-12/19/06	Dead; no signal from VLL receiver, it was removed 12/19/06
BEVT	09/05/06-10/13/06	No communications, replaced MSS power supply
BOW	11/08/06-End	Dead
BPO	12/19/06-End	Dead
BRKS	10/26/06-End	Broadband decommissioned
CMW	10/31/06	Replaced seismometer
EARN	12/12/06-End	No communications
ELW	06/11/06-10/27/06	Intermittent communications, replaced modem
ERW	04/05/06-End	Broadband removed
ERW	12/06/06-End	K2 flash failure
FINN	12/15/06-12/24/06	No communications
FMW	12/13/06-End	Dead; bad transmitter at GSM, it was removed 12/20/06
GHW	12/13/06-End	Dead; bad transmitter at GSM, it was removed 12/20/06
GMW	12/21/06-12/28/06	Dead
GNW	05/23/06-11/01/06	Broadband E-W channel has high counts
GNW	12/11/06-12/22/06	Broadband off-center
GSM	12/13/06-End	Dead; bad transmitter at GSM, it was removed 12/20/06
GTWN	06/01/05-10/12/06	No communications; telemetry moved for bldg. renovation
GUL	11/30/06-12/19/06	Dead; no signal from VLL receiver, it was removed 12/19/06
HART	11/14/06-11/23/06	No communications
HART	12/28/06-End	Intermittent communications
HDW	11/22/06-12/07/06	Intermittent; poor solar conditions, added aircells
HOLY	12/23/06-End	No communications
HOOD	11/07/06-11/14/06	No communications
JBO	10/15/04-End	Noisy
KEEL	03/24/06-End	Removed for repair
KICC	03/04/05-12/07/06	Bad timing; station removed due to building being sold
KICC	12/14/05-12/07/06	No communications; station removed due to building being sold
KIMB	07/25/06-End	Removed for repair
KOS	11/01/06-End	Dead
LCW	12/14/06-End	Dead
LMW	10/17/06	Replaced seismometer
LMW	12/20/06-12/28/06	Dead
LTY	09/07/05-End	Intermittent communications
MEGW	12/21/06-End	Dead
NCO	12/12/06-End	Dead
NED	12/01/06-End	Dead
NIHS	12/15/06-End	K2 will not stay in blockmode
NLO	12/14/06-End	Dead
OBH	01/31/02-End	Temp. removed for logging
OOW	11/20/06-End	Dead
OSD	11/20/06-End	Dead
PCFR	12/15/06-12/22/06	No communications

TABLE 1 - Station outages and installations		
Station	**Outage Dates**	**Comment**
PCMD	12/15/06-12/22/06	No communications
PSNS	10/23/06-End	All channels are drifting
RAW	12/20/06-End	No communications
RMW	12/13/06-End	Dead
RVW	08/30/06-End	Dead
SBES	05/18/05-End	Short period noisy
SEA.HH?	12/05/03-End	Disconnected for renovation
SFER	09/01/04-End	Short period dead; needs removal
SHW	12/15/06-End	Dead
SOPS	08/27/02-End	K2 flash-memory problem
SVOH	10/25/06-11/02/06	No communications
SWFL	10/09/06	Installed, Mount St. Helens
SWID	08/06/06-10/13/06	Bad timing
SWID	11/27/06-12/18/06	Intermittent communications
TBPA	10/04/06-10/20/06	No communications
TIMB	09/29/06	Installed; Mt. Hood
TTW	12/01/05-End	Removed; strong motion sensor moved to USArray site for 2 years
UPS	05/11/06-End	Removed for building renovation
UWFH	05/01/05-End	Short period problems; needs removal
VFP	11/30/06-12/19/06	Dead; no signal from VLL receiver, it was removed 12/19/06
VIP	08/29/06-10/08/06	Dead; fire destroyed cable at VCR repeater
VLL	11/30/06-End	Dead; no signal from VLL receiver, it was removed 12/19/06
VTH	08/29/06-10/08/06	Dead; fire destroyed cable at VCR repeater
VVHS	11/14/06-11/27/06	No communications

Mt. St. Helens eruption, 2004-2006

The dome-building eruption of Mount St. Helens that began on September 23, 2004 continues. The procedure for selecting events at Mt. St. Helens to be located remains the same; triggering produces preliminary solutions for locatable events (which are manually processed), webicorders are reviewed to identify events to be manually retrieved from the continuous data stream, and the continuous data are fully reviewed only for one hour of every six.

- **MSH Equipment**

Installation of a new broadband station, SWFL, was completed on October 9, 2006. The station is located high up on the southwest flank of Mount St. Helens.

Other Station News

A new analog short period vertical component seismic station was installed at Timberline on Mt. Hood. Station TIMB was installed on September 29, 2006 by CVO staff.

Strong Motion & CREST Instrumentation Update

There were no new strong motion installations this quarter. Several future installations are planned and include the following three locations:

The Manchester Fuel Depot is a US Navy fuel depot about 17 km west-southwest of downtown Seattle. This site is ready for installation of a Guralp 5TD three channel strong motion seismograph with the exception of finalizing the combined telephone/internet telemetry path. We hope that this remaining problem will be resolved in the first quarter of 2007.

An initial site visit was paid to the Puget Sound Naval Hospital in Bremerton in order to identify a tentative location for a three channel free-field strong motion seismograph near the main hospital buildings.

USGS Seattle staff also conducted an initial site visit to Lakeview, Oregon. Three candidate seismograph sites were identified. The plan is to install a station with three channels of strong motion and one channel of short-period weak motion at one of these sites by September 2007. Data will be telemetered to Seattle in real time via the public Internet.

Computer Hardware Update

Scossa continues to be our "master" real-time data processing computer. *Tremito* acts as a live backup for *scossa*, provides additional computational power for manual processing of earthquake data and acts as a fileserver for all the other networked computers in the group. Data acquisition is done by four dedicated computers; *pigia* handles digitization of analog data, while *verme*, *milli*, and *verli* acquire digital data.

Use of PNSN Data through the IRIS DMC

The IRIS Data Management Center reports 694 requests for PNSN trace-data this quarter. Almost 20,000,000 traces were requested.

PNSN Lab Renovations

The PNSN seismology lab renovation has been nearly completed. The "Wall of Swarm," which is a cabinet that houses eight 19" monitors, three 24" monitors, and three helicorders, has replaced the former backdrop of seven helicorders. Additionally, a wall has been added between the lab and the server room to cut down on the noise in the lab and a section of wall was removed in an inner server room to allow for the complete rebuild of the discriminator rack, which will mostly likely occur this spring and summer. Final lab renovations will include furniture upgrades.

PNSN PERSONNEL CHANGES

The PNSN search for a Senior Computer Specialist was completed this quarter. Terry Bartlett was hired and began working at the PNSN in mid-November 2006. Terry is a Stanford graduate who has worked for Sun Microsystems and in law enforcement.

EARTHQUAKE DATA – 2006-D

Between October 1 and December 31, 2006, 1,191 events were digitally recorded and processed at the University of Washington. Additional unlocated events occurred at Mount St. Helens associated with the dome-building eruption that began in late September 2004. Of the processed events, locations in Washington, Oregon, or southernmost British Columbia were determined for 884 of these events; 847 were classified as earthquakes and 37 as known or suspected blasts. The remaining processed events include teleseisms (152 events), regional events outside the PNSN (63), and unlocated events within the PNSN, mostly at Mt. St. Helens. Only a representative sample of Mt.St. Helens seismicity was located. Other unlocated events within the PNSN normally include surficial events on Mt. St. Helens and Mt. Rainier, very small earthquakes, and blasts. In the past, frequent mining blasts occured near Centralia, Washington and we routinely located a sample of them. The mine at Centralia closed on November 27, and blasting there has halted.

Table 2 lists earthquakes reported to have been felt during this quarter. Events with ShakeMaps or Community Internet Intensity Maps (CIIM) are indicated. Two events this quarter were large enough to generate a ShakeMap, and five events produced "CIIM" maps (**http://pasadena.wr.usgs.gov/shake/pnw/**), which show the average intensity by zip code, determined by converting "felt" reports sent by the general public (via Internet) into numeric intensity values. Table 3 is this quarter's catalog of earthquakes M 2.0 or greater, located within the network - between 42-49.5 degrees north latitude and 117-125.3 degrees west longitude.

Figure 1. Earthquakes with magnitude greater than or equal to 0.0 (M_c >=0).
Figure 2. Blasts and probable blasts (M_c >=0).
Figure 3. Earthquakes located near Mt. St. Helens (M_c >=0).
Figure 4. Earthquakes located near Mt. Rainier (M_c >=0).

TABLE 2 - Felt Earthquakes during the 4th Quarter of 2006

DATE-TIME (UTC)		LAT(N)	LON(W)	DEP	MAG	COMMENTS	CIIM	CIIM - # of felt reports	Shake Map
yy/mm/dd	hh:mm:ss	deg.	deg.	km	Ml				
06/10/08	02:48:26	46.84	121.60	3.8	4.5	12.2 km E of Mt Rainier, WA	✔	1,284	✔
06/10/13	05:18:05	45.27	123.03	16.8	2.9	5.4 km WSW of Newberg, OR	✔	92	
06/11/06	05:34:35	45.51	122.64	15.7	2.6	3.1 km SW of Portland, OR	✔	2,554	✔
06/11/27	02:31:54	45.17	122.60	21.5	2.6	12.4 km SE of Canby, OR	✔	78	
06/11/30	17:50:59	47.68	120.20	0.6	2.5	2.8 km NNE of Entiat, WA			
06/12/11	11:00:45	49.46	119.47	0	3.4	9.3 km ESE of Penticton, BC			
06/12/19	03:02:30	45.17	122.61	19.1	2.8	11.9 km SSE of Canby, OR	✔	60	

OREGON

During the fourth quarter of 2006, 45 earthquakes were located in Oregon between 42.0 degrees and 45.5 degrees north latitude, and between 117 degrees and 125 degrees west longitude. A magnitude 2.6 earthquake on November 6 (UTC) was located at about 16 km depth about 3 km southwest of Portland (for distance measurements, the PNSN defines Portland as 45.535 N, 122.62 W; near the intersection of Broadway and NE 42nd). More than 2,500 individuals reported feeling this earthquake, using the CIIM site. Two other felt events, magnitudes 2.6 and 2.8 on Nov. 27 and Dec. 19, were located about 12 km southeast of Canby and 19 km E of Woodburn. Both were reported felt in Molalla, Oregon City, West Linn, and other towns in the vicinity.

WESTERN WASHINGTON SEISMICITY

During the fourth quarter of 2006, 743 earthquakes were located between 45.5 degrees and 49.5 degrees north latitude and between 121.0 degrees and 125.3 degrees west longitude. Most western Washington seismicity this quarter was in the Mount St. Helens area, see discussion below. The largest earthquake within the PNSN's coverage area was a magnitude 4.5 event that occurred at a depth of about 4 km on October 8 (UTC), and was located about 12 km east of Mt. Rainier. This earthquake was followed by a vigorous earthquake sequence lasting through the end of the quarter. Over 200 earthquakes were located in the area between 121.5 and 121.7 W longitude, and between 46.7 and 46.9 N latitude. Additional discussion is provided in the section on Mt. Rainier, below.

WASHINGTON CASCADE VOLCANOES

Mount St. Helens

Mount St. Helens seismicity and dome building eruption continued through this quarter. During the third and fourth quarters of 2006 seismicity decreased. Figure 3 shows located volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown. The PNSN catalog lists only a small subset of events

selected for manual processing. See the operations section for details on how events are selected for processing, and instrumentation changes, if any.

This quarter, 285 earthquakes were located in the area shown in Fig. 3 using conventional manual processing procedures (including 259 earthquakes between magnitude 1.0 and 2.9, and 20 slightly larger events with magnitudes between 3.0 and 3.4). All locatable earthquakes in the 2004/2006 sequence are relatively shallow. Only a few events have been located deeper that 2 km. Seismicity this quarter continued to be located on the boundary between the old and new domes near the vent that appeared in early October, 2004.

Seth Moran of CVO has provided counts and interpretation of seismicity during the current eruptive sequence. Seismicity at Mount St. Helens declined considerably in the 4th quarter of 2006 compared to 3rd quarter, particularly in November and December, both in terms of numbers of events and overall moment release. Occasional larger events occurred, but less frequently than during the 3rd quarter. Counts from station HSR (~2.5 km south), used for previous quarterly estimates of earthquake numbers, were judged too unreliable this quarter due to decreases in event number and event sizes as well as persistent radio noise related to weather conditions.

issues.

Mount St. Helens 2004-2006
Quarterly earthquake counts at HSR; provided by CVO.

Year	Quarter	HSR event count
2004	4th	292,352
2005	1st	123,502
	2nd	49,811
	3rd	12,085
	4th	30,315
2006	1st	30,617
	2nd	*13,236
	3rd	*1,800
	4th	*?
* - Count is an estimate, review is incomplete		

Mount Rainier

On Saturday October 7, 2006 at 07:48:26.57 PM (PDT) a magnitude 4.5 earthquake occurred at a depth of approximately 4 km about 12 kilometers east of the summit of Mt. Rainier. The earthquake was felt over a large region and associated rockfalls caused some damage to the roads in Mt. Rainier National Park. The mainshock was followed by 211 located aftershocks within the area between 121.5 and 121.7 W longitude, and between 46.7 and 46.9 N latitude. The aftershock sequence lasted through the end of the quarter, and included 70 events smaller than magnitude 0.0, 92 events magnitude 0.0 to 0.9, 41 events magnitude 1.0 to 1.9, and 8 events with magnitudes between 2.0 and 2.9.

To provide information on the developing aftershock sequence, on the morning of Oct. 8 Dr. Seth Moran of CVO installed two Guralp G6TD three-component broadband instruments in Mt Rainier National Park. One station was installed just south of Cayuse Pass (CAYP) at 46N 51' 50.7", 121W 31' 57.4" (WGS84) and one near the Owyhigh trailhead parking lot (OWYH) at 46 53' 25.0", 121 35' 37.5" (WGS84). A week later, on Monday October 16th, Dr. Moran retrieved the instruments. Unfortunately, OWYH had timing errors due to problems in getting a GPS lock. Dr. Moran was able to pick arrival times of 73 aftershocks at station CAYP and provided his picks to the PNSN, where Data Analyst Amy Wright relocated events with CAYP arrival-times.

Aftershocks located without CAYP (as shown in Fig. 4) appear to show somewhat of a NW-SE linear trend, with events towards the northwest located deeper than events located further towards the southeast. However, relocated events with readings from CAYP form a fairly tight cluster, in the horizontal as well as the vertical direction, below a geographic feature known as Cowlitz Chimney. The availability of just this one station near the aftershock region quickly resolved the question whether the linear appearance of the initial aftershock pattern was due to an inadequate station distribution or whether it was a real feature.

A total of 284 tectonic events (99 of these were smaller than magnitude 0.0, and thus are not shown in Fig. 4) were located within the region shown in Fig. 4. Of these, 212 were part of the mainshock-aftershock sequence that began on Oct. 7. This

quarter, 42 tectonic earthquakes (18 of them smaller than magnitude 0.0 and thus not shown in Fig. 4) were located in the "Western Rainier Seismic Zone" (WRSZ), a north-south trending lineation of seismicity approximately 15 km west of the summit of Mt. Rainier (for counting purposes, the western zone is defined as 46.6-47.0 degrees north latitude and 121.83-122 west longitude). Within 5 km of the summit, there were 24 (9 of them smaller than magnitude 0.0 and thus not shown in Fig. 4) higher-frequency tectonic-style earthquakes, and the remaining events in the mainshock-aftershock sequence to the east of the mountain, or were scattered around the cone of Rainier as shown in Fig. 4.

The number of events in close proximity to the cone of Mt. Rainier varies over the course of the year, since the source of much of the shallow activity is presumably ice movement or avalanching at the surface, which is seasonal in nature. Events with very low frequency signals (1-3 Hz) believed to be icequakes are assigned type "L" in the catalog. Emergent, very long duration signals, probably due to rockfalls or avalanches, are assigned type "S" (see Key to Earthquake Catalog). Four events flagged "L" or "S" was located at Mount Rainier this quarter and 49 "L" or "S" events were recorded, but were too small or too emergent to locate reliably. Type L and S events are not shown in Fig. 4.

EASTERN WASHINGTON SEISMICITY

During the fourth quarter of 2006, 63 earthquakes were located in eastern Washington in the area between 45.5 - 49.5 degrees north latitude and 117 - 121 degrees west longitude. The largest earthquakes recorded in eastern Washington this quarter were two felt earthquakes, one was magnitude 2.5 and occurred on November 30 at 17:50 UTC about 3 km north-northeast of Entiat, the other occurred on December 11 at 11:00 UTC and was located about 9 km east-southeast of Penticton, British Columbia. Both earthquakes were very shallow, and located at less than 1 km depth.

OTHER SOURCES OF EARTHQUAKE INFORMATION

We provide automatic computer-generated alert messages about significant Washington and Oregon earthquakes by e-mail, FAX or via the pager-based RACE system to institutions needing such information, and we regularly exchange phase data via e-mail with other regional seismograph network operators.

Other regional agencies provide earthquake information. These include the Geological Survey of Canada (Pacific Geoscience Centre), Sidney, B.C. **http://www.pgc.nrcan.gc.ca/seismo/table.htm** and other regional networks in the United States **http://earthquake.usgs.gov/regional/** The US Geological Survey coordinates earthquake information nationally; **http://earthquake.usgs.gov**.

Complete catalog listings are available on-line through **http://www.pnsn.org/CATDAT/catalog.html** Key to earthquake catalog can be found in the last quarterly report of each year, or at:
http://www.pnsn.org/INFO_GENERAL/PNSN_QUARTERLY_EQ_CATALOG_KEY.htm

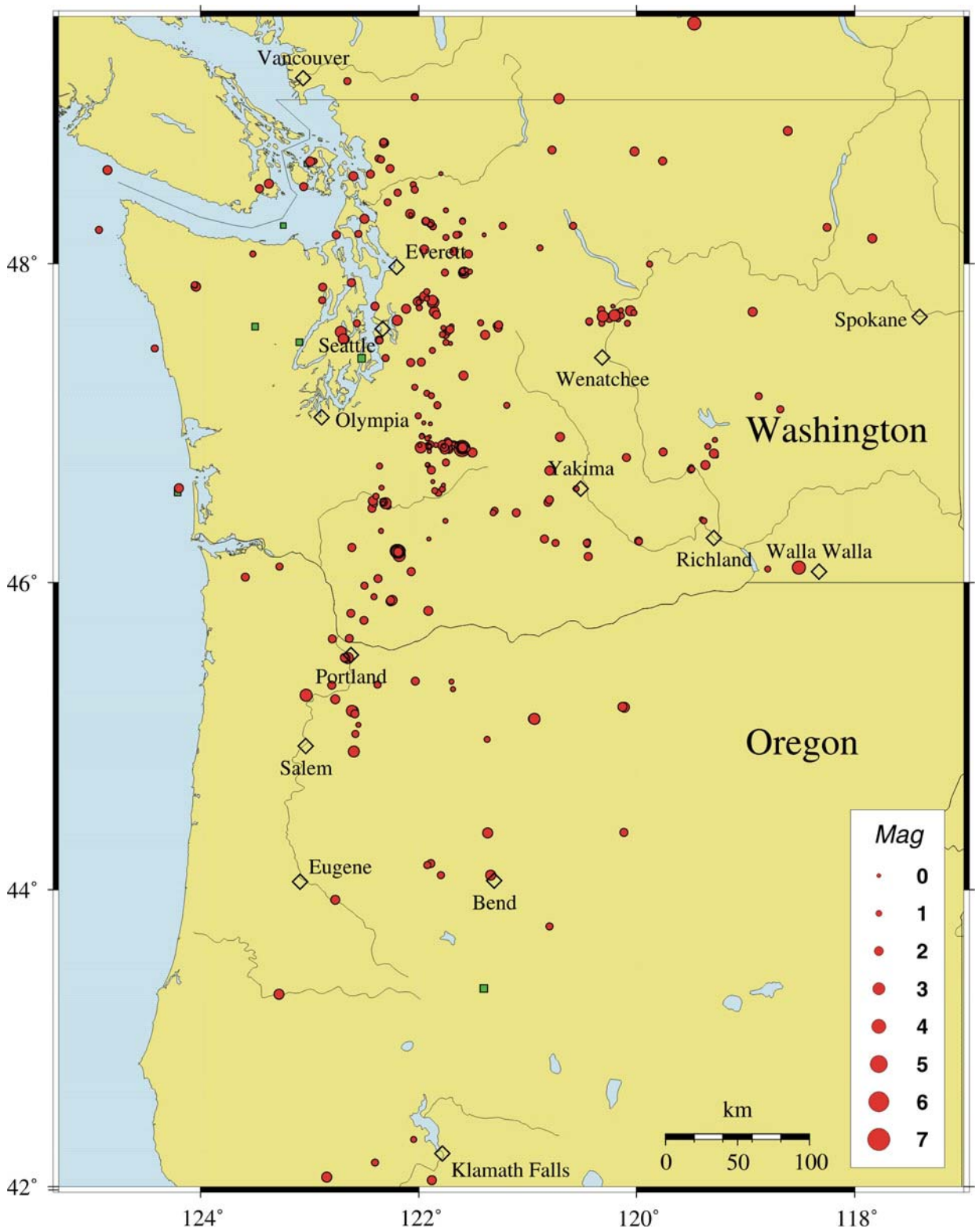

Figure 1 Earthquakes with magnitude greater than or equal to 0.0 (Mc>=0.0).
Unfilled diamonds represent cities. Quakes shallower than 30 km are indicated by circles, and deeper quakes by filled squares.

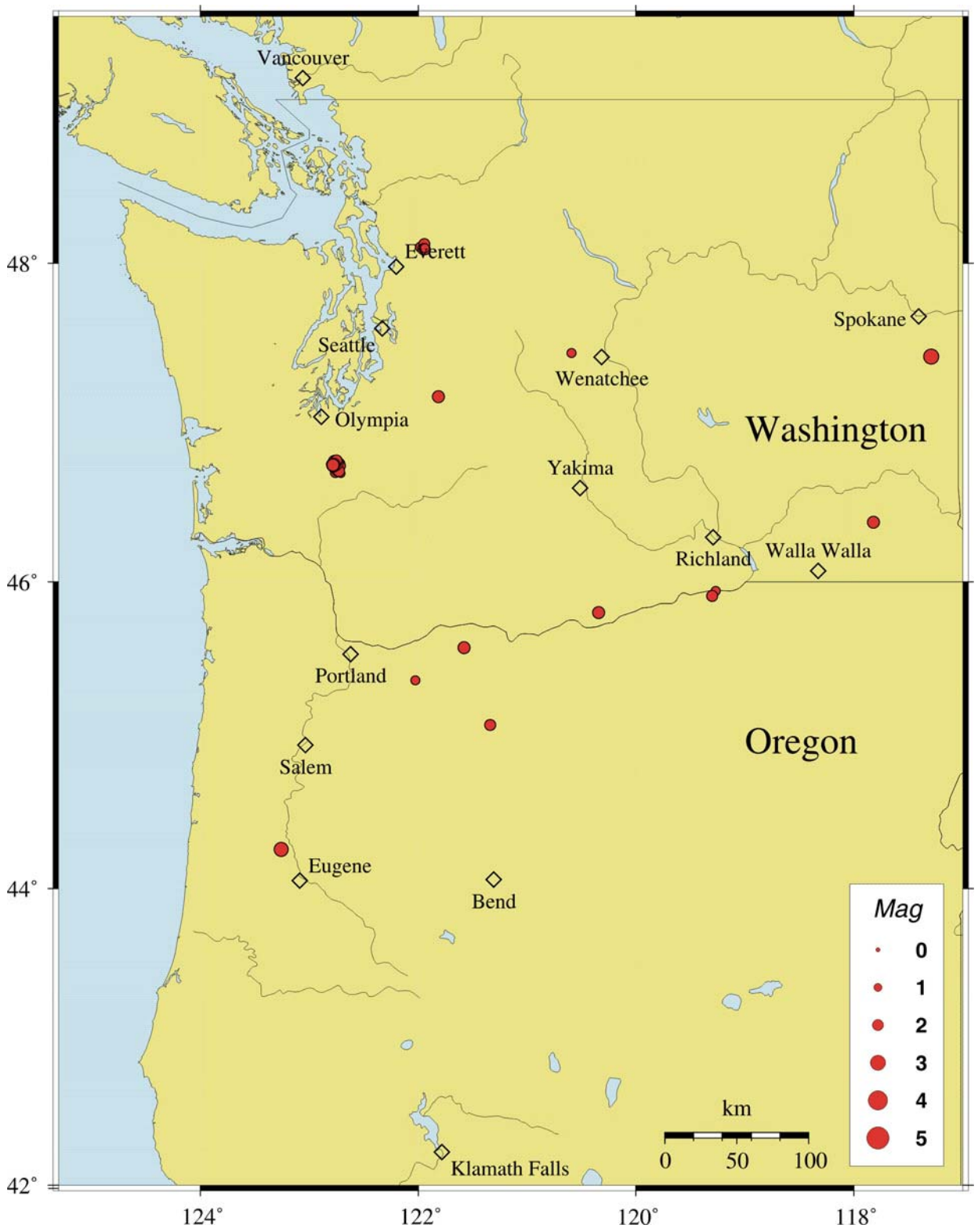

Figure 2. Blasts and probable blasts. Unfilled diamonds represent cities.

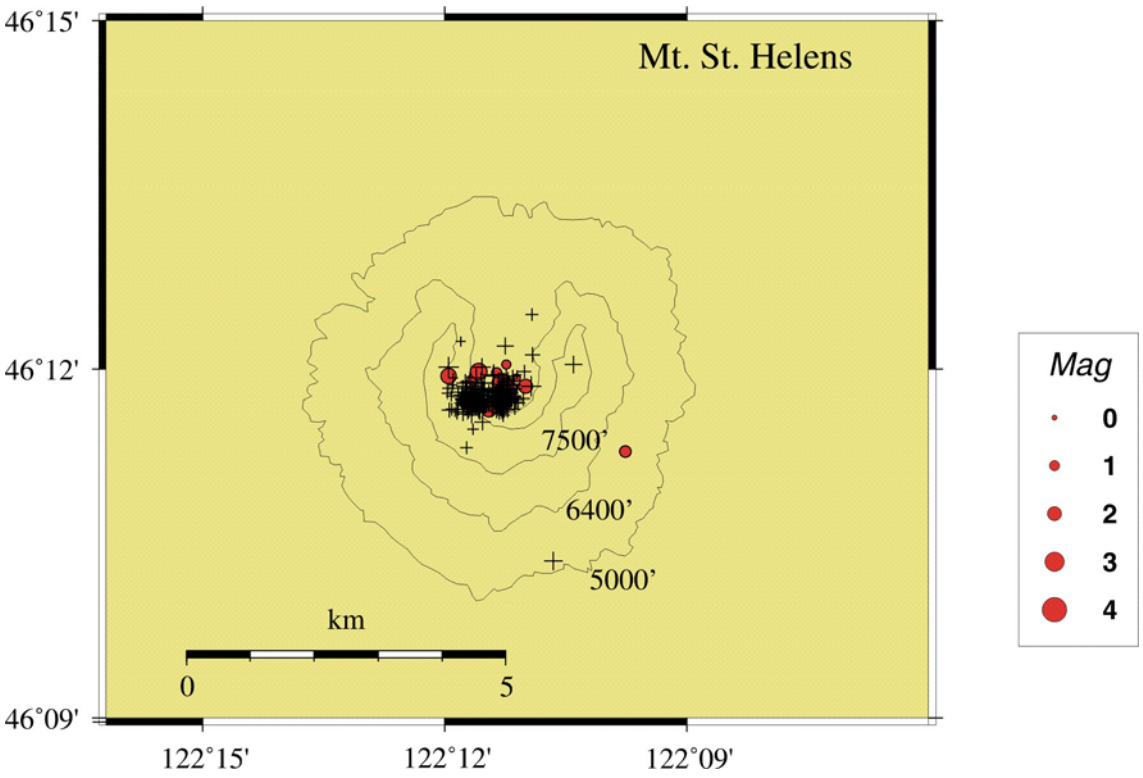

Figure 3. Selected Earthquake at Mt. St. Helens; (Mc>=0.0)
Events elected by the analyst for location are small fraction of the number of events recorded during the quarter.
Plus symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

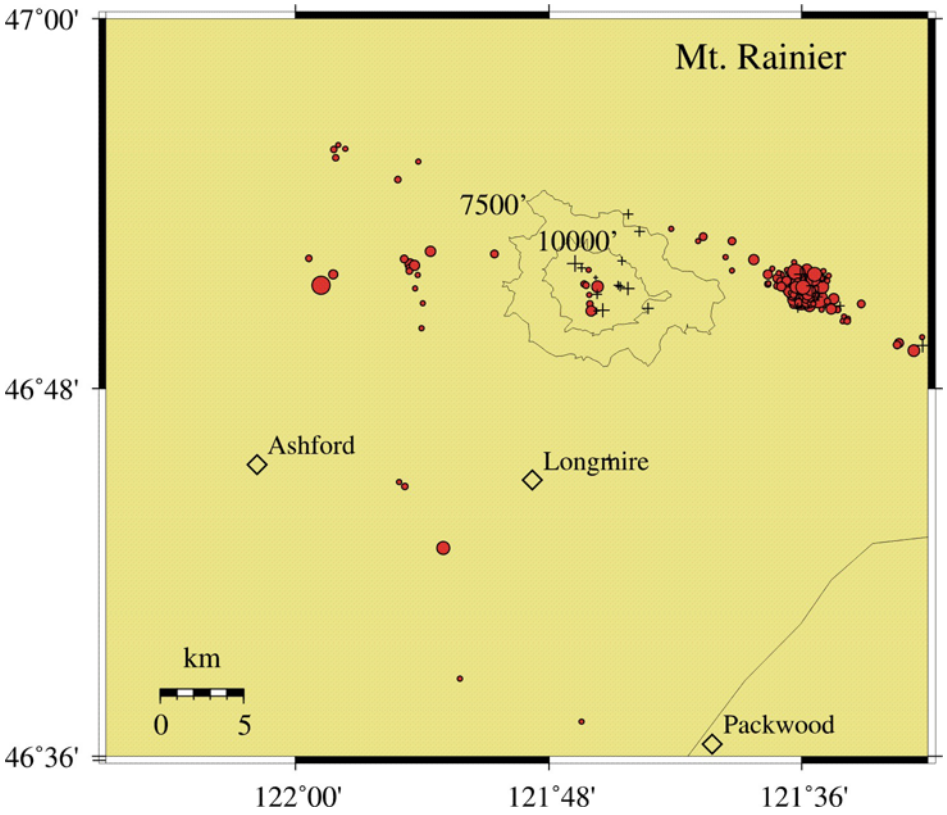

Figure 4. Earthquakes at Mt. Rainier; (Mc>=0.0)

EARTHQUAKE CATALOG, 2006-D

This quarter's catalog lists earthquakes of magnitude 2.0 or larger. Complete catalog listings are available on-line through **http://www.pnsn.org/CATDAT/catalog.html**

Key To Earthquake Catalog

Origin time (TIME): is calculated for each earthquake on the basis of multi-station arrival times. Time is given in Coordinated Universal Time (UTC), in hours:minutes:seconds. To convert to Pacific Standard Time (PST) subtract eight hours, or to Pacific Daylight Time subtract seven hours.

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

West longitude (LON): of the epicenter, in degrees and minutes.

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 fixed.

Coda-length magnitude, Mc (M): an estimate of local magnitude ML (Richter, C.F., 1958, Elementary Seismology: W.H. Freeman and Co., 768p), calculated using the coda-length/magnitude relationship determined for Washington (Crosson, R.S., 1972, Bull. Seism. Soc. Am., v. 62, p. 1133-1171). Magnitudes may be revised as we improve our analysis procedure.

NS: 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 are required. Generally, more observations improve the quality of the solution.

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

Root-mean-square residual (RMS): (observed arrival time minus predicted arrival time) at all stations used to locate the earthquake. It is only useful as a measure of the quality of the solution when 5 or more well-distributed stations are used in the solution. Good solutions are normally characterized by RMS values less than about 0.3 sec.

Quality factors (Q): Two factors indicate the general reliability of the solution (A is best quality, D is worst). Similar quality factors are used by the USGS for events located with the computer program HYPO71.

First Quality factor is a measure of the hypocenter quality based on travel-time residuals. For example:
A quality requires an RMS less than 0.15 sec.
D quality has an RMS of 0.5 sec.

Second Quality factor depends on the spatial distribution of stations around the epicenter, i.e. number of stations, their azimuthal distribution, and the minimum distance DMIN from the epicenter to a station. A quality requires a solution with 8 or more phases, GAP <= 90 degrees and DMIN <= 5 km or depth, whichever is greater. If the number of phases, NP, is 5 or fewer or GAP > 180 degrees or DMIN > 50 km the solution is assigned quality D.

Crustal velocity model (MOD): Layered velocity models appropriate to different geographic areas are used in location calculations (Ludwin, R.S., et al., 1994, Earthquake hypocenters in Washington and northern Oregon, 1987-1989, and Operation of the Washington Regional Seismograph Network, Information Circular 89, Washington State Dept. of Natural Resources).

P3 - Puget Sound model
C3 - Cascade model
S3 - Mt. St. Helens model including Elk Lake
N3 - northeastern model
E3 - southeastern model
O0 - Oregon model
K3 - Southern Oregon, Klamath Falls area model
R0 and J1 - Regional and Offshore models

Event Type (TYP): Events flagged for type use the following code:

F- earthquake reported to have been felt
P - probable explosion
L - low frequency earthquake (e.g. glacier movement, volcanic activity)
H - handpicked from helicorder records
S - Special event (e.g. rockslide, avalanche, volcanic steam emission, harmonic tremor, sonic boom), not a man-made explosion or tectonic earthquake
X - known explosion

EARTHQUAKE CATALOG, 2006-D

Oct 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
1	07:04:00.43	46 11.65	122 11.85	0.02#	3.2	13/013	118	0.60	DB	S4	
1	11:25:38.58	46 11.72	122 11.67	0.29	2.3	12/012	110	0.07	AB	S4	
1	12:46:39.17	46 11.94	122 11.40	0.04*	3.1	17/017	46	0.16	BA	S4	
1	12:52:26.00	46 11.75	122 11.20	0.08	2.2	12/013	79	0.10	AA	S4	
1	18:53:59.50	46 11.81	122 11.45	0.02*	2.0	15/015	61	0.08	AA	S4	
1	20:43:36.30	47 56.65	121 34.89	8.92$	2.5	28/030	59	0.36	CC	C3	
2	08:51:10.48	46 11.77	122 11.67	0.60	2.0	12/012	108	0.07	AB	S4	
3	05:03:02.21	47 24.87	122 31.25	54.19	2.7	75/076	36	0.22	BA	P3	
3	13:50:34.14	46 11.78	122 11.62	0.58	2.3	12/012	106	0.06	AB	S4	
4	04:39:54.23	46 11.72	122 11.68	0.32	2.3	14/014	63	0.07	AA	S4	
4	07:24:52.64	46 11.91	122 11.22	0.02#	2.8	10/010	92	0.17	BB	S4	
4	11:13:29.85	46 11.74	122 11.21	0.04*	2.0	12/015	74	0.10	AA	S4	
5	02:09:44.51	46 11.91	122 11.21	0.49	2.3	16/017	56	0.12	AA	S4	
5	10:39:59.98	46 11.81	122 11.54	0.02*	2.3	14/015	62	0.08	AA	S4	
5	20:06:34.45	46 11.80	122 11.62	0.02*	2.4	14/014	63	0.07	AA	S4	
6	13:20:12.86	46 11.75	122 11.71	0.46	2.5	15/015	64	0.07	AA	S4	
6	18:29:21.99	43 56.04	122 45.92	18.99	2.0	6/006	104	0.32	CC	O0	
6	20:18:09.51	46 11.94	122 11.39	0.05*	3.4	16/016	46	0.22	BA	S4	
6	20:28:48.46	46 11.77	122 11.54	0.03*	2.4	13/013	62	0.07	AA	S4	
7	11:11:30.97	46 11.75	122 11.23	0.04*	2.2	13/016	58	0.11	AA	S4	
7	20:13:35.20	46 11.82	122 11.52	0.02*	2.3	13/014	61	0.08	AA	S4	
8	02:48:26.65	46 50.99	121 36.00	3.82	4.5	96/096	23	0.35	CC	C3	F
8	02:54:11.46	46 50.99	121 36.05	5.27*	2.5	44/044	61	0.12	AB	C3	
8	03:07:51.05	46 51.13	121 35.39	5.47	2.8	30/031	64	0.12	AC	C3	
8	11:12:52.76	46 11.81	122 11.34	0.43	2.3	16/017	59	0.13	AA	S4	
8	20:19:58.18	46 11.69	122 11.71	0.84	2.5	17/017	46	0.08	AA	S4	
9	04:41:15.96	46 11.78	122 11.27	0.02*	2.2	14/016	58	0.11	AA	S4	
9	15:52:25.85	46 11.78	122 11.19	0.04*	2.0	13/015	53	0.11	AA	S4	
9	16:48:33.97	46 11.84	122 11.28	0.27	2.1	13/013	77	0.08	AA	S4	
10	00:24:17.91	46 11.82	122 11.58	0.04*	2.2	14/016	62	0.09	AA	S4	
10	06:06:48.75	46 11.75	122 11.34	0.53	2.2	12/014	59	0.13	AA	S4	
10	09:40:53.84	46 44.78	119 22.09	4.18	2.1	23/025	75	0.16	BB	E3	
10	15:40:22.96	46 11.68	122 11.67	0.35	2.3	13/013	112	0.07	AB	S4	
10	20:32:08.60	46 12.01	122 11.94	0.02#	3.3	10/010	87	0.61	DA	S4	
11	01:29:34.76	46 11.61	122 11.67	0.97*	2.4	14/014	75	0.10	AA	S4	
11	11:38:15.74	46 11.64	122 11.71	0.05*	2.2	16/016	64	0.09	AA	S4	
11	14:36:08.61	47 30.98	123 05.73	45.59	2.0	17/017	85	0.15	AA	P3	
11	18:15:21.66	43 18.11	123 16.95	0.03*	2.2	10/010	86	0.27	BA	O0	
11	23:42:06.48	46 11.80	122 11.28	0.31	2.1	17/019	53	0.12	AA	S4	
12	08:11:01.07	46 11.68	122 11.67	0.02*	2.3	14/014	112	0.08	AB	S4	
12	17:24:16.57	46 11.69	122 11.64	0.32	2.4	15/015	110	0.09	AB	S4	
12	20:31:04.45	48 09.35	117 50.48	3.60$	2.0	9/009	118	0.39	CC	N3	
13	00:15:59.37	46 11.74	122 11.67	0.30	2.0	14/014	63	0.08	AA	S4	
13	05:18:05.63	45 16.44	123 01.84	16.83	2.9	52/052	43	0.33	CA	O0	F
13	07:56:06.61	46 11.75	122 11.51	0.02*	2.3	16/017	61	0.09	AA	S4	

Oct 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
13	14:39:48.66	46 11.81	122 11.28	0.02*	2.7	16/016	59	0.40	CA	S4	
13	14:51:14.50	46 11.68	122 11.56	0.26	2.2	14/014	69	0.09	AA	S4	
13	18:59:53.59	44 05.80	121 20.33	0.05*	2.2	13/013	85	0.24	BA	O0	
13	22:00:08.63	46 11.71	122 11.68	0.04*	2.1	15/015	63	0.08	AA	S4	
14	05:09:53.84	46 11.69	122 11.53	0.03*	2.0	16/016	62	0.08	AA	S4	
14	13:04:21.51	46 11.71	122 11.62	0.02*	2.2	15/015	63	0.08	AA	S4	
14	14:10:01.88	46 50.90	121 35.19	6.30	2.6	40/041	41	0.15	BB	C3	
14	15:30:48.20	46 51.02	121 35.63	5.24	2.7	47/047	39	0.29	BC	C3	
14	20:20:03.55	47 39.10	122 11.91	26.18	2.3	35/035	49	0.19	BA	P3	
14	21:33:47.70	46 11.68	122 11.59	0.02*	2.3	15/015	67	0.09	AA	S4	
15	05:42:14.28	46 11.75	122 11.71	0.55	2.3	15/015	64	0.08	AA	S4	
15	13:09:39.38	46 11.74	122 11.61	0.50	2.1	14/014	63	0.09	AA	S4	
16	06:54:58.26	46 11.71	122 11.51	0.04*	2.0	15/016	83	0.11	AA	S4	
16	13:28:52.91	46 11.67	122 11.30	0.04*	2.0	12/013	75	0.11	AA	S4	
16	20:15:54.89	46 10.35	122 10.64	0.05*	2.9	12/012	107	0.61	DB	S4	
17	02:57:32.22	46 11.67	122 11.52	0.02*	2.1	15/015	70	0.09	AA	S4	
17	15:51:46.99	46 11.75	122 11.75	0.02*	2.3	14/014	64	0.08	AA	S4	
18	05:01:04.13	46 11.72	122 11.60	0.39	2.4	15/015	63	0.09	AA	S4	
18	18:37:00.97	46 11.78	122 11.64	0.57	2.3	16/016	63	0.08	AA	S4	
19	01:23:22.58	46 11.78	122 11.56	0.66	2.2	15/015	62	0.07	AA	S4	
19	08:14:28.52	46 11.65	122 11.21	0.02*	2.2	11/011	84	0.38	CA	S4	
19	19:02:55.92	46 11.77	122 11.72	0.76	2.1	14/014	64	0.06	AA	S4	
20	12:05:39.62	46 11.69	122 11.78	0.79	2.2	12/012	65	0.09	AA	S4	
20	22:01:09.27	46 11.69	122 11.28	0.04*	2.1	15/016	70	0.11	AA	S4	
20	23:25:53.34	44 22.44	121 22.00	5.70#	2.3	9/009	138	0.14	AC	O0	
21	06:01:13.40	46 11.75	122 11.29	0.26	2.4	18/019	59	0.12	AA	S4	
21	10:46:07.01	46 11.72	122 11.19	0.03*	2.6	14/015	66	0.42	CA	S4	
21	22:13:38.63	46 11.82	122 11.22	0.59	3.4	43/043	45	0.20	BA	S4	
22	17:33:20.67	46 11.75	122 11.26	0.05*	2.0	15/016	65	0.12	AA	S4	
23	00:58:17.24	46 11.68	122 11.34	0.02*	2.2	16/017	59	0.11	AA	S4	
23	10:14:14.66	46 11.72	122 11.22	0.05*	2.4	16/018	58	0.11	AA	S4	
23	10:54:17.49	47 34.76	122 42.70	21.80	2.5	59/060	28	0.18	BA	P3	
23	16:53:33.39	47 42.13	121 51.23	20.09*	2.4	33/034	47	0.15	BA	P3	
23	19:08:06.20	46 11.68	122 11.28	0.03*	2.4	14/015	71	0.11	AA	S4	
23	20:17:29.94	46 11.71	122 11.35	0.02#	3.0	14/014	69	0.35	CA	S4	
24	04:02:29.69	46 11.78	122 11.65	0.04*	2.3	17/018	63	0.10	AA	S4	
24	12:19:12.66	46 11.72	122 11.35	0.04*	2.3	16/017	59	0.11	AA	S4	
24	20:03:21.71	46 11.69	122 11.56	0.04*	2.0	13/013	97	0.09	AB	S4	
25	19:19:54.35	46 11.68	122 11.34	0.04*	2.1	15/016	59	0.11	AA	S4	
26	00:16:58.37	48 34.40	124 51.13	18.69$	2.0	4/004	299	0.50	DD	P3	
26	06:54:30.09	46 11.69	122 11.61	0.03*	2.3	14/014	65	0.08	AA	S4	
26	09:13:14.90	46 11.81	122 11.22	1.00	3.4	34/034	50	0.17	BA	S4	
26	12:59:55.82	46 11.71	122 11.64	0.03*	2.0	14/014	63	0.09	AA	S4	
27	03:11:21.94	46 11.71	122 11.53	0.38	2.3	15/015	66	0.09	AA	S4	
27	09:41:02.64	46 11.72	122 11.58	0.05*	2.0	14/014	63	0.09	AA	S4	
27	20:49:11.92	46 11.72	122 11.28	0.02*	2.1	15/016	68	0.12	AA	S4	

Oct 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
28	02:46:22.80	46 11.72	122 11.58	0.03*	2.2	15/015	64	0.09	AA	S4	
28	08:25:17.87	46 11.71	122 11.25	0.02*	2.3	15/016	69	0.11	AA	S4	
28	15:14:31.21	46 11.71	122 11.60	0.02*	2.2	14/014	65	0.09	AA	S4	
28	18:31:32.86	47 45.81	121 52.01	7.15*	2.8	42/043	35	0.25	BB	P3	
28	20:28:44.79	46 11.71	122 11.38	0.02*	2.1	14/015	68	0.13	AA	S4	
28	21:40:29.13	46 11.81	122 11.32	0.77	3.2	33/033	45	0.14	AA	S4	
29	04:59:07.37	46 11.75	122 11.67	0.04*	2.2	14/014	63	0.09	AA	S4	
29	11:55:52.80	46 11.74	122 11.62	0.20	2.0	12/012	99	0.09	AB	S4	
30	08:31:15.78	46 11.65	122 11.29	0.03*	2.1	15/016	59	0.13	AA	S4	
30	20:14:30.11	46 12.11	122 10.90	0.02*	2.2	11/011	86	0.27	BA	S4	
31	11:08:37.78	46 11.77	122 11.58	0.03*	2.3	16/016	62	0.09	AA	S4	
31	22:48:35.24	46 11.82	122 11.28	0.76	2.9	21/021	53	0.11	AA	S4	
Nov 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
1	07:51:42.12	46 11.65	122 11.28	0.03*	2.1	13/014	73	0.11	AA	S4	
2	03:09:18.07	46 11.69	122 11.30	0.04*	2.4	13/014	70	0.11	AA	S4	
2	13:50:44.58	46 11.91	122 11.60	0.02*	3.0	15/015	62	0.22	BA	S4	
2	19:47:42.95	46 11.69	122 11.60	0.02*	2.0	14/014	66	0.07	AA	S4	
4	15:25:29.06	46 11.72	122 11.26	0.04#	2.6	11/011	80	0.27	BA	S4	
5	07:12:49.98	46 51.31	121 35.06	1.14*	2.0	28/028	53	0.23	BC	C3	
5	18:43:06.91	46 11.72	122 11.28	0.10	2.0	13/014	99	0.14	AB	S4	
6	05:34:35.69	45 30.94	122 38.87	15.67	2.6	39/040	53	0.17	BA	C3	F
8	02:06:50.40	47 42.52	120 03.37	4.93	2.2	14/014	56	0.24	BB	N3	
8	19:48:01.48	46 11.75	122 11.54	0.55	2.1	13/013	63	0.07	AA	S4	
8	23:11:42.41	43 20.60	121 24.18	34.83$	2.5	7/007	281	0.68	DD	O0	
9	00:15:54.44	46 11.55	122 11.53	0.04*	2.4	9/009	159	0.10	AC	S4	
9	06:05:58.92	46 51.77	121 36.28	5.91	2.1	30/030	37	0.11	AB	C3	
9	12:04:57.68	46 11.71	122 11.10	0.02*	2.1	10/012	88	0.10	AA	S4	
9	22:09:42.63	46 11.77	122 11.47	0.58	2.3	14/014	62	0.07	AA	S4	
10	04:49:00.20	46 11.88	122 11.73	0.02*	2.8	12/012	85	0.16	BA	S4	
10	09:59:40.76	46 11.75	122 11.65	0.13	2.0	13/013	63	0.09	AA	S4	
11	11:31:10.03	46 11.72	122 11.62	0.70	2.2	12/012	63	0.07	AA	S4	
12	02:54:20.65	46 11.84	122 11.54	0.05*	2.8	15/015	57	0.13	AA	S4	
12	12:55:41.77	46 11.84	122 11.73	0.53	2.2	13/013	60	0.06	AA	S4	
13	16:06:56.76	47 46.47	121 52.39	1.21	2.2	35/039	71	0.31	CB	P3	p
13	23:05:19.69	46 11.78	122 11.58	0.60	2.2	13/013	62	0.07	AA	S4	
14	07:46:49.37	46 11.75	122 11.60	0.62	2.2	15/015	63	0.06	AA	S4	
14	16:32:39.16	46 11.72	122 11.58	0.14	2.2	12/012	63	0.08	AA	S4	
14	23:49:38.19	46 49.40	121 30.24	0.04*	2.0	16/017	88	0.17	BC	C3	
15	04:51:33.73	46 11.71	122 11.58	0.84	2.2	15/015	64	0.07	AA	S4	
15	05:48:12.62	46 51.34	121 58.78	7.21	2.6	43/044	44	0.26	BB	C3	
15	10:40:16.87	46 12.20	122 11.25	0.02*	2.6	10/010	109	0.10	AB	S4	
15	14:49:43.03	46 11.80	122 11.21	0.12	2.6	14/014	63	0.10	AA	S4	
16	20:31:15.62	46 11.65	122 11.45	1.87	2.2	10/010	107	0.20	BB	S4	
17	01:51:45.00	46 11.64	122 11.56	0.04*	2.3	13/013	111	0.07	AB	S4	
17	08:56:44.96	46 11.75	122 11.66	0.57	2.0	13/013	108	0.06	AB	S4	

Nov 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
17	16:25:14.74	46 11.88	122 11.51	0.02*	2.4	9/009	99	0.16	BB	S4	
17	17:34:54.86	45 11.68	120 06.73	6.74	2.3	7/007	190	0.31	CD	O0	
18	00:33:27.08	46 11.71	122 11.67	0.03*	2.2	13/013	63	0.07	AA	S4	
18	04:27:32.01	46 11.78	122 11.41	0.03*	2.5	10/011	83	0.26	BA	S4	
18	08:07:48.38	46 11.74	122 11.17	0.03*	2.3	12/014	67	0.11	AA	S4	
18	17:29:09.80	46 11.72	122 11.53	0.63	2.1	14/014	64	0.06	AA	S4	
19	02:06:16.78	46 11.75	122 11.19	0.68	2.1	14/016	66	0.13	AA	S4	
19	04:20:32.99	46 11.87	122 11.28	0.29	3.4	37/037	43	0.15	AA	S4	
20	07:21:08.79	46 11.71	122 11.21	0.46	2.1	13/015	69	0.10	AA	S4	
20	15:15:58.71	46 11.71	122 11.60	0.03*	2.4	13/013	64	0.08	AA	S4	
21	01:46:02.81	46 11.69	122 11.62	0.48	2.3	13/013	65	0.07	AA	S4	
21	03:07:33.75	46 11.65	122 11.93	0.03*	2.2	10/010	120	0.16	BB	S4	
21	14:52:13.44	46 11.88	122 11.68	0.03*	3.1	11/011	103	0.10	AB	S4	
22	09:38:17.58	46 11.77	122 11.28	0.13	2.1	13/014	98	0.11	AB	S4	
23	13:46:35.15	46 11.97	122 11.58	1.60	2.4	10/010	102	0.03	AB	S4	
24	15:54:03.21	46 11.74	122 11.60	0.72	2.2	11/011	62	0.06	AA	S4	
24	21:45:17.55	46 11.71	122 11.33	0.03*	3.1	17/017	66	0.11	AA	S4	
25	11:21:25.63	46 11.65	122 11.65	0.02*	2.0	11/011	68	0.07	AA	S4	
25	20:18:54.47	46 11.72	122 11.59	0.69	2.1	13/013	63	0.06	AA	S4	
26	02:12:14.87	46 11.68	122 11.61	0.04*	2.0	12/012	67	0.06	AA	S4	
26	08:31:56.98	46 11.72	122 11.68	0.05*	2.3	11/011	63	0.07	AA	S4	
26	17:34:25.08	46 11.68	122 11.51	0.04*	2.1	11/011	97	0.07	AB	S4	
27	02:31:54.06	45 10.26	122 36.09	21.52	2.6	41/041	99	0.39	CB	O0	F
27	05:03:13.21	46 51.70	121 35.37	6.26	2.0	23/025	72	0.10	AB	C3	
27	12:34:04.49	46 11.72	122 11.22	0.03*	2.2	13/015	68	0.10	AA	S4	
27	14:36:05.50	46 12.01	122 11.54	0.22	2.8	13/013	77	0.07	AA	S4	
27	21:04:56.29	46 11.72	122 11.58	0.19	2.2	12/012	63	0.07	AA	S4	
28	07:44:28.24	46 11.78	122 11.17	0.31	2.1	13/014	78	0.12	AA	S4	
28	16:33:56.35	46 11.80	122 11.65	0.85*	2.0	11/011	63	0.06	AA	S4	
29	00:58:50.75	46 11.69	122 11.72	0.20	2.2	11/011	112	0.06	AB	S4	
29	15:37:48.61	46 11.84	122 11.28	0.74	2.3	11/012	96	0.11	AB	S4	
30	00:09:06.99	46 11.75	122 11.68	0.32	2.0	11/011	109	0.06	AB	S4	
30	04:39:16.31	46 11.72	122 11.54	0.13	3.0	13/013	81	0.06	AA	S4	
30	17:50:59.68	47 40.94	120 12.18	0.63	2.5	21/023	69	0.34	CC	N3	F
Dec 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
1	05:18:30.08	46 11.88	122 11.26	0.97*	2.2	11/012	93	0.10	AB	S4	
1	11:45:44.73	47 32.10	122 41.40	22.72	2.4	41/041	36	0.18	BA	P3	
1	16:59:34.84	46 11.78	122 11.73	0.88	2.2	12/012	108	0.05	AB	S4	
1	19:38:23.87	46 50.54	121 45.42	0.04*	2.0	21/021	51	0.19	BA	C3	
2	00:10:11.91	46 11.88	122 11.54	0.49	3.4	23/023	46	0.11	AA	S4	
2	03:22:21.17	46 11.78	122 11.79	0.98*	2.3	11/011	110	0.05	AB	S4	
2	23:37:29.01	42 02.63	121 52.60	0.02*	2.0	17/017	57	0.28	BB	K3	
3	06:42:23.20	46 11.71	122 11.79	0.83	2.1	12/012	114	0.05	AB	S4	
3	17:16:56.37	46 11.78	122 11.20	0.59	2.0	12/014	96	0.11	AB	S4	
4	03:25:05.41	46 11.75	122 11.21	0.41	2.4	11/013	97	0.10	AB	S4	

Dec 2006											
DAY	**TIME**	**LAT**	**LON**	**DEPTH**	**M**	**NS/NP**	**GAP**	**RMS**	**Q**	**MOD**	**TYP**
4	06:15:52.83	46 11.81	122 11.30	0.07	3.1	15/015	62	0.08	AA	S4	
4	14:45:54.31	46 11.84	122 11.00	1.01*	2.0	12/013	56	0.16	BA	S4	
5	00:54:50.23	46 11.68	122 11.60	0.62	2.2	12/012	111	0.08	AB	S4	
5	15:44:41.87	46 11.77	122 11.21	0.02*	2.3	10/012	96	0.11	AB	S4	
6	08:41:44.28	46 11.71	122 11.69	0.30	2.3	12/012	111	0.07	AB	S4	
6	09:19:52.48	49 00.37	120 42.83	4.17$	2.2	12/013	247	0.63	DD	C3	
6	12:28:58.77	46 11.81	122 11.41	0.03*	3.1	14/014	100	0.16	BB	S4	
7	04:47:37.05	46 11.77	122 11.23	0.60	2.2	13/014	97	0.11	AB	S4	
7	14:32:55.61	46 11.74	122 11.73	0.03*	2.1	12/012	111	0.06	AB	S4	
8	00:55:56.07	42 03.95	122 50.44	3.66$	2.4	20/021	84	0.52	DC	K3	
9	17:14:00.32	47 43.37	122 06.82	21.66	2.1	31/032	54	0.25	BA	P3	
10	01:55:20.48	46 11.84	122 10.93	0.02*	3.2	16/016	57	0.50	DA	S4	
11	11:00:45.64	49 27.62	119 28.21	0.03*	3.4	4/004	276	0.08	BD	N3	F
14	13:21:32.14	46 11.74	122 11.14	0.02*	3.1	12/013	79	0.20	BA	S4	
15	01:42:00.09	47 40.46	120 18.77	0.54	2.5	24/027	98	0.20	BB	N3	
16	05:38:06.95	46 11.75	122 11.34	0.57	3.2	27/027	45	0.14	AA	S4	
18	06:09:55.82	46 11.74	122 11.17	0.03*	2.3	12/014	67	0.09	AA	S4	
18	07:18:35.08	45 06.82	120 56.28	16.44	2.1	23/025	57	0.24	BB	O0	
18	20:45:38.69	45 53.06	122 14.55	4.64	2.3	35/036	73	0.18	BC	C3	
19	03:02:30.79	45 10.32	122 36.75	19.10	2.8	55/057	43	0.34	CA	O0	F
20	00:34:48.69	46 11.87	122 11.15	0.18	2.2	17/017	55	0.10	AA	S4	
20	04:55:11.62	46 11.78	122 11.28	0.03*	2.1	9/009	103	0.10	AB	S4	
20	09:43:26.58	46 05.69	118 30.78	13.57$	3.4	47/050	56	0.39	CC	E3	
21	05:55:53.99	46 30.14	122 18.07	21.72	2.8	51/059	47	0.19	BA	C3	
21	13:59:47.30	46 12.04	122 10.39	0.02*	2.8	11/011	73	0.31	CA	S4	
24	00:53:17.17	46 11.71	122 11.08	0.03*	2.1	7/008	96	0.13	AB	S4	
24	22:03:52.02	45 07.18	120 55.82	16.11	2.0	18/018	61	0.19	BB	O0	
24	23:39:30.36	44 54.48	122 35.59	14.86	2.5	36/036	64	0.38	CA	O0	
25	12:00:52.48	46 11.62	122 11.77	0.90	2.1	7/007	106	0.07	AB	S4	
27	13:51:42.41	45 49.17	121 54.53	8.07	2.0	34/036	92	0.24	BC	C3	
27	17:42:49.23	46 11.88	122 11.28	1.07	3.1	13/013	46	0.07	AA	S4	
28	07:54:28.91	46 11.94	122 11.94	1.48	2.3	8/008	78	0.10	AA	S4	
29	06:13:47.20	45 07.06	120 55.94	14.36	2.2	26/026	37	0.17	BB	O0	
30	11:28:38.09	45 07.28	120 56.22	15.96	2.6	30/030	37	0.21	BB	O0	
31	06:22:21.80	46 35.96	124 11.74	29.59	2.0	14/014	252	0.24	BD	P3	
31	11:07:36.30	46 34.41	124 12.68	31.09	2.1	16/017	251	0.29	BD	P3	