

QUARTERLY NETWORK REPORT 2005-B

on

Seismicity of Washington and Oregon

April 1 through June 30, 2005

Pacific Northwest Seismograph 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.

Seismograph network operation in Washington and Oregon is supported by the following contracts:

U.S. Geological Survey
Joint Operating Agreement O4HQAG005
and

Pacific Northwest National Laboratory, operated by Battelle for the U.S. Dept. of Energy
Contract 259116-A-B3

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INTRODUCTION

This is the second quarterly report of 2005 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.

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. In these reports we provide special coverage (figures, counts, listings, etc.) of earthquake swarms, aftershock sequences, etc.

This quarterly report discusses network operations, seismicity of the region, unusual events or findings, and our educational and outreach activities. 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 will be included only in the 4th quarter report. Lists of currently operating stations are available on-line through web page <http://www.pnsn.org/OPS/stations.html>.

NETWORK OPERATIONS

Lists of currently operating stations are available on-line through web page <http://www.pnsn.org/OPS/stations.html>. 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.

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
ALVY	05/02/05-05/26/05	No communications
BEVT	05/02/05-05/20/05	Dead
BEVT	05/20/05-End	Removed for repair
BHW	03/14/04-04/19/05	Very noisy; transmitter problems
BULL	03/28/05-End	Dead
BURN	04/11/05-05/20/05	Dead
COLT	04/11/05-06/02/05	No communications
COLT	06/02/05-End	Removed for repair
FL2	11/28/04-06/16/05	Dead; seismometer problem
GL2	10/21/04-End	Dead
GLK	11/26/04-05/13/05	Noisy
GNW	01/01/05-05/12/05	Bad E component
GPW	03/16/04-End	Dead
GRCC	06/06/05-End	No communications
GTWN	06/01/05-End	Dead; telemetry being moved for bldg. renovation
HDW	12/28/04-04/21/05	Dead battery
HSO	05/08/05-05/21/05	Noisy
JBO	10/15/04-End	Noisy
KEEL	05/30/05-End	Dead
KFAL	06/13/05-End	Dead; possible firewall problem
KICC	03/04/05-End	Bad timing
LCW	05/08/05-06/02/05	Noisy
LNO	06/07/05-End	Dead; subcarrier problem
LTY	04/13/05-05/13/05	No communications
MBKE	06/07/05-End	Dead; possible K2 problem
MBW	12/07/04-04/14/05	Dead; shut down relay site due to radio interference
MCW	12/07/04-04/14/05	Dead. bad seismometer
MIDE	04/14/05	Installed – St. Helens
NCO	05/08/05-06/07/05	Noisy

TABLE 1 - Station outages and installations

Station	Outage Dates	Comment
NED	04/06/05	Installed – St. Helens
OBH	01/31/02-End	Temp. removed for logging
ON2	03/01/05-04/27/05	Noisy
OSR	03/01/05-04/27/05	Dead
PERL	01/29/05-04/26/05	No communications
PGW	10/08/03-End	Dead
RCS	06/11/05-End	Noisy
RER	10/20/04-01/31/05	Noisy
RHAZ	06/26/05-End	Dead
RMW	12/07/04-06/07/05	Dead
RVC	12/05/03-05/21/05	Noisy
RVW	02/23/05-06/21/05	Dead
SEA.HH?	12/05/03-End	Disconnected for renovation
SBES	05/18/05-End	Short period noisy
SFER	09/01/04-End	Short period dead; needs removal
SMNR	06/23/05-End	Temp. removed for work on the bldg.
SMW	06/20/03-05/27/05	Intermittent; equalization problem
SOPS	08/27/02-End	K2 flash-memory problem
SP2	11/14/04-06/23/05	Bad timing
SSS1	03/05/05-End	Dead
STW	04/28/05-05/08/05	Noisy
TDL	11/28/04-05/25/05	Dead; animal ate through seismometer cable
TOLO	10/15/04-05/14/05	No communications
TTW	01/01/05-06/13/05	Bad E component
VBE	02/17/05-03/20/05	Intermittent; usually very noisy
VBE	04/12/05-05/04/05	Noisy
VGB	09/23/04-End	Intermittent; usually very noisy
VVHS	04/11/05-04/29/05	No communications
VVHS	05/27/05-06/14/05	No communications
WAT	04/16/05-05/04/05	Dead; discriminator needed to be adjusted

Mt. St. Helens eruption, 2004-2005

Beginning on September 23, 2004 a series of small earthquakes at Mount St. Helens signaled the beginning of the first dome-building eruption at the volcano since 1986. The small earthquakes soon escalated into the most vigorous seismic activity at Mount St. Helens since the catastrophic eruption of 1980. Continuous seismic data from short-period stations near Mt. St. Helens are archived at the PNSN and streamed to the IRIS BUD archive. New procedures were implemented to rapidly handle the large volume of data so the PNSN and Cascade Volcanoes Observatory could assess the significance of the rapidly changing seismicity. For details, see the 2004-D and 2005-A quarterly reports.

- ***MSH Equipment; destruction and replacement*** - Stations SEP, MIDE, and NED were destroyed during the ash and steam eruption of March 8. SEP was replaced on March 15. Station NED was reinstalled on April 6 and station MIDE was reinstalled on April 14. All done by the staff of CVO.

PNSN Personnel changes

Two new staff members joined the PNSN this quarter. Karl Hagel is an electronics technician who will maintain our analog radio-telemetered stations and other equipment in the lab and field.. Bill Gustafson is a programmer who is implementing new code and helping to improve the robustness of our computer operations.

Strong Motion Instrumentation Update

Two ANSS stations, funded through the Oregon Department of Geology and Mineral Industries (DOGAMI), were installed in southern Oregon this quarter. USGS Staff completed the installations in early May. Station SOUA is located on the Southern Oregon University campus in Ashland in a free field enclosure installed by University staff, students, and volunteers.

Station UMPQ is installed at the Umpqua Community College campus in Roseburg. College staff installed the free field enclosure. Both stations have K2 seismographs with internal episensors. Telemetry for both stations is TCP/IP.

Computer Hardware Update

Scossa continues to be our main data collection computer, and *tremito* provides additional computational power for manual processing of earthquake data and acts as a fileserver for all the other networked computers in the group.

Use of PNSN Data

The IRIS Data Management Center reports 2,181 requests for PNSN trace-data this quarter. Nearly 52,500,000 traces were requested. The number of traces requested remains at an elevated level compared to a “typical” quarter.

EARTHQUAKE DATA – 2005-B

Between April 1 and June 30, 2005, 2,742 events were digitally recorded and processed at the University of Washington. Thousands of additional unlocated events occurred at Mount St. Helens associated with the dome-building eruption which began in late September 2004. Locations in Washington, Oregon, or southernmost British Columbia were determined for 2,134 of these events; 2,062 were classified as earthquakes and 72 as known or suspected blasts. The remaining processed events include teleseisms (167 events), regional events outside the PNSN (178), and unlocated events within the PNSN, mostly at Mt. St. Helens. Due to the extremely large number of events, only a representative sample of Mount 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. Frequent mining blasts occur near Centralia, Washington and we routinely locate them.

Table 2 lists earthquakes reported to have been felt during this quarter. Events with ShakeMaps or Community Internet Intensity Maps (CIIM) are indicated. This quarter, one event generated a ShakeMap. Four events produced “CIIM” maps (<http://pasadena.wr.usgs.gov/shake/pnw/>), which convert "felt" reports sent by the general public (via Internet) into numeric intensity values. CIIM maps show the average intensity by zip code.

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 ($M_c \geq 0$).

Figure 2. Blasts and probable blasts ($M_c \geq 0$).

Figure 3. Earthquakes located near Mt. St. Helens ($M_c \geq 0$).

Figure 4. Earthquakes located near Mt. Rainier ($M_c \geq 0$).

TABLE 2 - Felt Earthquakes during the 2nd Quarter of 2005

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	CIIM	Shake Map
yy/mm/dd hh:mm:ss	deg.	deg.	km	MI			
05/05/18 14:46:23	48.14	122.60	27.2	2.6	35.4 km WNW of Everett, WA	✓	
05/06/15 02:50:57	41.32	126.03	10.0	7.2 (USGS)	160.6 km WSW of Crescent City, CA	✓	
05/06/17 06:21:34	40.18	127.54	10.0	6.4 (USGS)	295.0 km WSW of Eureka, CA	✓	
05/06/25 13:49:11	45.52	122.63	14.9	2.7	2.0 km SW of Portland, OR	✓	✓
05/06/29 14:37:14	46.65	120.61	10.0	3.5	10.1 km NW of Yakima, WA		

OREGON

During the second quarter of 2005, 39 earthquakes were located in Oregon between 42.0 degrees and 45.5 degrees north latitude, and between 117 degrees and 125 degrees west longitude. The most notable earthquakes in Oregon this quarter were a M 2.7 quake at about 15 km depth located near Portland, OR on June 25 (UTC), and a M 2.8 event at about 1 km depth located near Mount Hood, Oregon on April 6 (UTC). Three quakes, M 1.4 – 2.5, were located 30-50 km southwest of Newport, OR near the location of a magnitude 4.9 earthquake on July 12, 2004 (see the 2004C quarterly for details). Like the events offshore of Newport in 2004, this quarter's quakes were at depths greater than 25 km.

South of Oregon, two sizable earthquakes occurred offshore northern California on June 15 UTC (USGS magnitude 7.2) and June 17 UTC (USGS magnitude 6.4). These earthquakes lie outside the PNSN network, and they were located by the NEIC. PNSN personnel learned of the events through the news media. The June 15 UTC earthquake triggered a tsunami alert for the coasts of California, Oregon, and Washington. Although no significant tsunami resulted and the alert was called off within an hour or so, the event exposed a number of glitches in notification systems and evacuation plans. A NOAA weather

radio problem prevented the alert from being broadcast along the northwest coast of Washington, and another problem apparently delayed delivery of the alert message to responders in California.

WESTERN WASHINGTON SEISMICITY

During the first quarter of 2005, 1,946 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. Two earthquakes were felt this quarter in western Washington.

Excluding Mt. St. Helens, the largest earthquake in western Washington this quarter was a magnitude 2.6 event on May 18 (UTC), located about 35 km west-north-west of Everett at a depth of about 27 km and reported felt in the area. The deepest earthquake in western Washington this quarter was a magnitude 2.1 event at about 62 km depth located about 28 km west of Everett, WA on April 4 (UTC).

WASHINGTON CASCADE VOLCANOES

Mount St. Helens

Mount St. Helens seismicity and dome building eruption continued through this quarter. The eruptive episode began with a vigorous sequence of seismic activity starting on September 23, 2004. Activity accelerated into early October. The most energetic seismicity occurred on Oct. 1-5 when several phreatic explosions and half-hour to hour-long periods of harmonic tremor interrupted and temporarily calmed extremely high rates of magnitude 3+ seismicity. Seismicity fell following after Oct. 5, though frequent, but smaller earthquakes have continued through this quarter. Because of the high rates of seismicity, only a representative sample of Mount St. Helens events were located using conventional manual processing. Figure 3 shows located volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown. See the operations section for details on destruction, replacement and new instrument installation during the first quarter.

This quarter, 1,655 earthquakes were located in the area shown in Fig. 3 using conventional manual processing procedures (including 1,597 earthquakes between magnitude 1.0 and 2.9, and 5 slightly larger events with magnitudes between 3.0 and 3.4. Most of the larger events are associated with rockfalls off the new dome. Rockfalls expose glowing hot rocks in the core of the whaleback, and flashes of light continue to be recorded simultaneously with rockfall signals. Digitally enhanced nighttime volcano-cam images (http://www.luscombe-carter.com/mount_st_helens/index.html) show variations in the intensity of glow from the new dome. At times a steady glow is visible, while sudden brief bursts of light (likely rockfalls) are seen at other times. Volcano-Tectonic earthquakes continue to occur with a somewhat regular inter-occurrence time which has varied slowly over days and weeks.

All locatable earthquakes in the 2004/2005 sequence are relatively shallow. No events occurred at depths exceeding 2 km. The vigorous seismicity last quarter and the tectonic events this quarter tended to be located on the boundary between the old and new domes near the vent that appeared in early October, 2004.

Estimating counts of Mount St. Helens seismicity using automated counting procedures and data from station YEL suggests that about 70,000 earthquakes magnitude 0.1 or larger (about 31 events/hour) occurred at Mount St. Helens during the 2nd quarter of 2005. Although in seismically quiet times our catalog of events at Mount St. Helens is complete to about magnitude 0.0, only a small subset of this quarter's activity was processed using our normal procedure.

Correction of 2005A Mount St. Helens Event Count While checking the event count at Mt. St. Helens for this quarterly report, an error in the previous quarterly was noted. Automated counting procedures and data from station YEL suggest that about 240,000 earthquakes magnitude 0.1 or larger (about 91 events/hour) occurred at Mount St. Helens during the 1st quarter of 2005 (Last quarter's report erroneously estimated the number of 1st quarter events at 70,000.).

Mount Rainier

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). Two events flagged "L" or "S" were located at Mount Rainier this quarter and 163 "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.

A total of 74 tectonic events (37 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. The largest tectonic earthquake located near Mt. Rainier this quarter was a magnitude 1.9 event on May 28 (UTC), located about 13 km northeast of Morton, WA at about 16 km depth. This quarter, 40 tectonic earthquakes 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 21 (15 of them smaller than magnitude 0.0 and thus not shown in Fig. 4) higher-frequency tectonic-style earthquakes and the remaining events were scattered around the cone of Rainier as shown in Fig. 4.

EASTERN WASHINGTON SEISMICITY

During the second quarter of 2005, 75 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 earthquake recorded in eastern Washington this quarter was a magnitude 3.5 event on June 29. It occurred at about 10 km depth, was located about 10 km northwest-of Yakima, and was reported to have been felt locally.

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

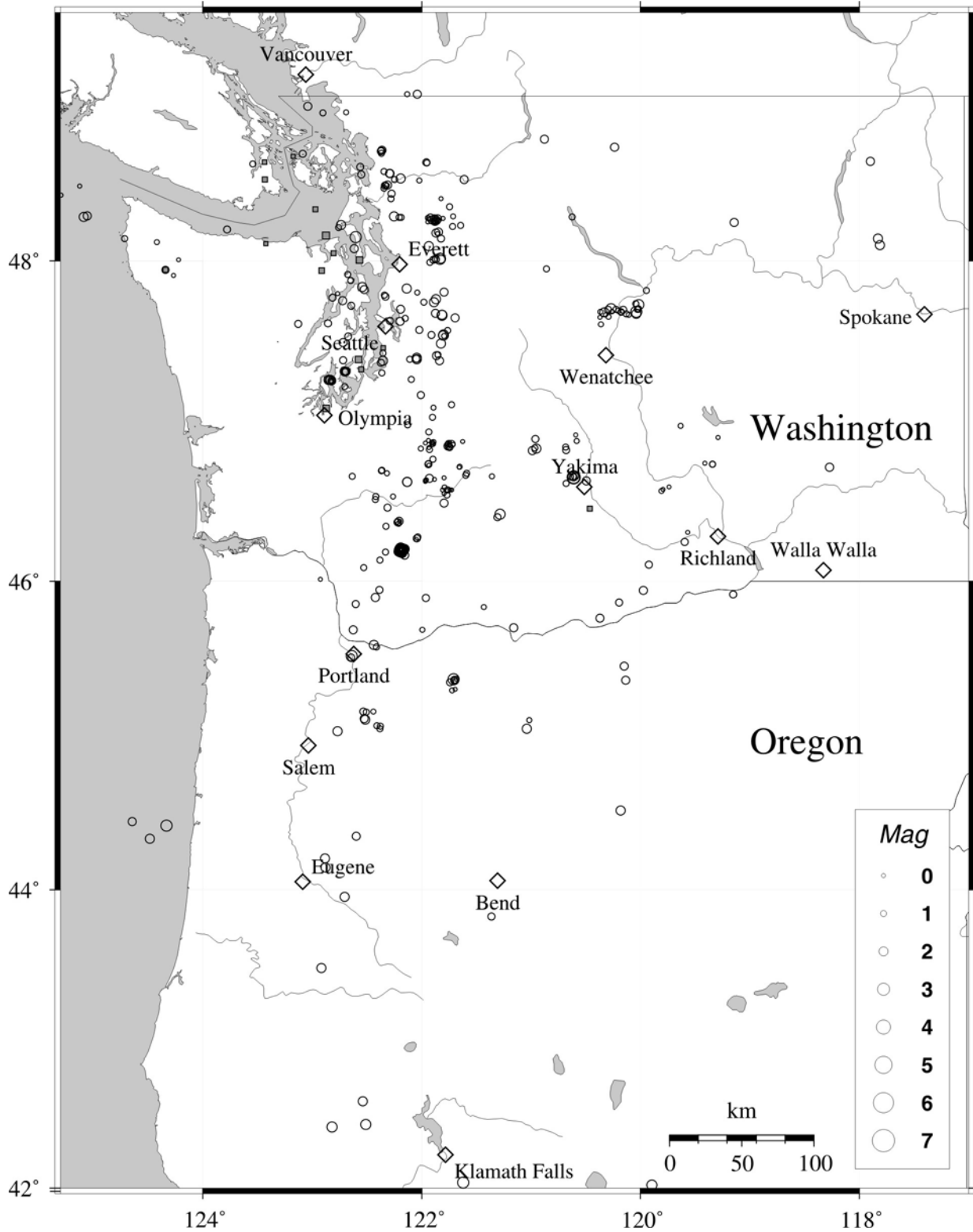


Figure 1 Earthquakes with magnitude greater than or equal to 0.0 ($M_c \geq 0.0$). Unfilled diamonds represent cities. Quakes shallower than 30 km are indicated by circles, and deeper quakes by filled squares.

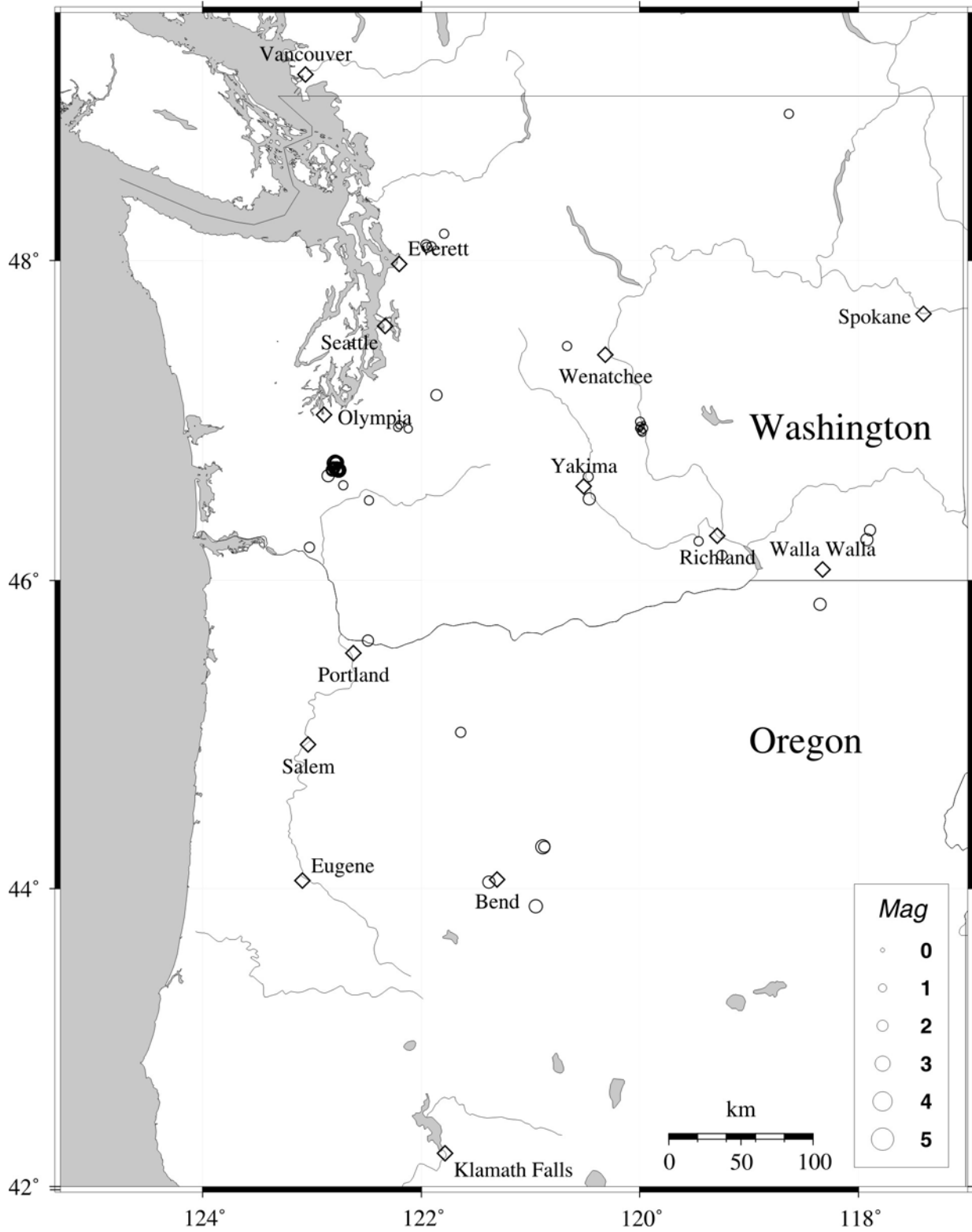


Figure 2. Blasts and probable blasts. Unfilled diamonds represent cities.

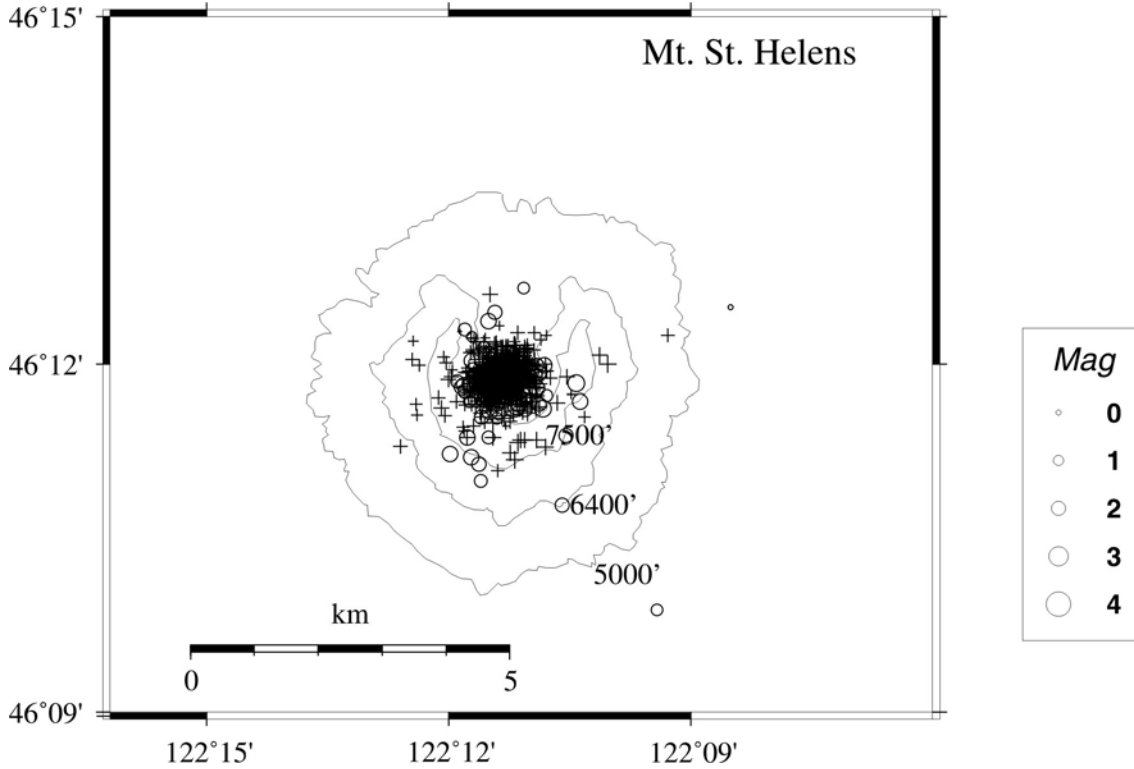


Figure 3 - Selected Earthquake at Mt. St. Helens; M>0.0

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.

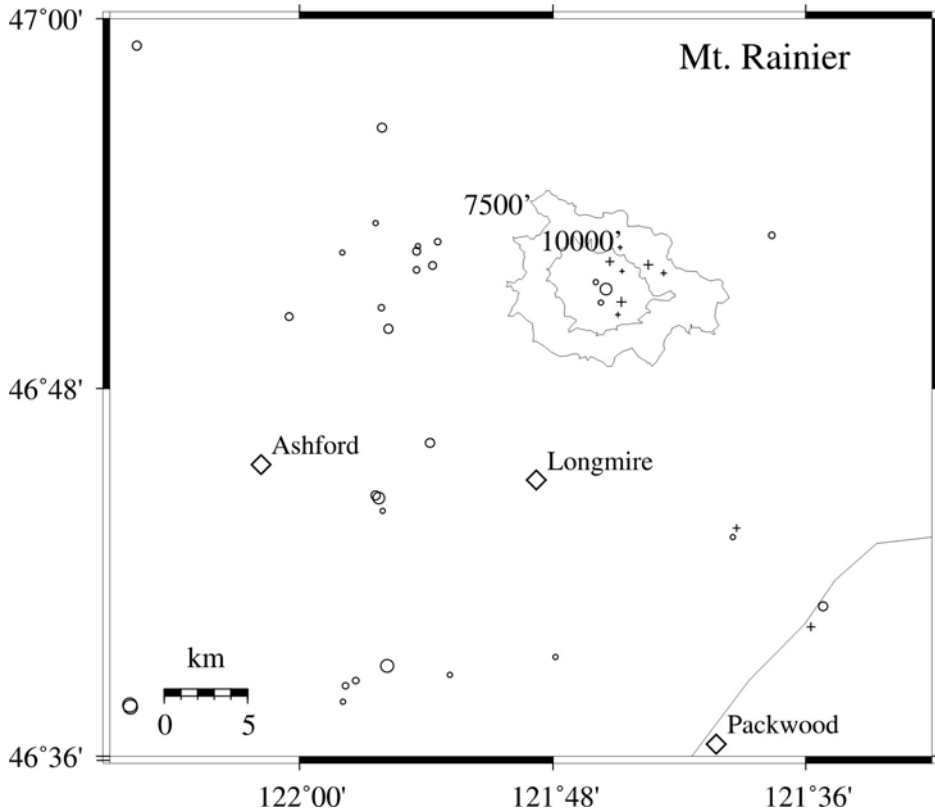


Figure 4. Earthquakes at Mt. Rainier; M>0.0

EARTHQUAKE CATALOG, 2005-B

This quarter's catalog lists earthquakes of magnitude 2.0 or larger, except at Mt. St. Helens, where only events of magnitude 3.0 or larger are shown. 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

Apr-05											
DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
3	16:41:13	46 11.69	122 11.47	1.19	3.0	22/022	49	0.14	AA	S4	
4	4:41:02	48 00.30	122 33.97	62.30	2.1	48/048	54	0.20	BA	P3	
4	5:43:41	46 11.75	122 11.34	0.94	3.4	32/032	45	0.18	BA	S4	
4	10:56:35	46 11.81	122 11.46	0.62	3.2	29/029	47	0.22	BA	S4	
5	4:16:15	46 11.64	122 11.19	1.03	3.3	38/038	35	0.31	CA	S4	
5	13:56:31	47 29.40	121 49.30	21.70	2.0	40/043	60	0.35	CA	P3	
6	17:36:42	48 13.16	122 44.06	18.87*	2.0	22/024	66	0.19	BA	P3	
6	22:57:41	45 22.37	121 42.38	1.31	2.8	37/037	53	0.34	CB	O0	
9	8:01:19	46 11.65	122 11.15	1.03	3.0	27/027	43	0.32	CA	S4	
12	6:07:27	44 08.77	122 52.73	3.87\$	2.0	18/021	57	0.26	BC	O0	
13	4:51:06	44 25.32	124 20.00	28.90	2.5	13/013	247	0.41	CD	O0	
19	12:30:44	47 39.90	121 48.70	17.69	2.3	36/038	56	0.20	BA	P3	
21	11:55:12	47 40.13	121 48.73	17.79	2.1	38/040	61	0.23	BA	P3	
29	8:06:55	47 23.58	122 02.68	7.06*	2.1	40/042	42	0.23	BB	P3	
29	22:45:57	45 02.23	122 46.12	7.57	2.1	7/007	265	0.28	DD	O0	
May-05											
DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	4:56:04	48 09.29	122 52.46	52.32	2.3	30/031	80	0.17	BA	P3	
1	22:07:30	47 41.36	120 02.35	4.87	2.8	29/030	50	0.38	CC	N3	
3	19:06:22	45 35.47	122 26.26	8.75	2.0	17/018	89	0.18	BB	C3	
13	16:20:44	48 00.86	121 50.02	17.00	2.6	41/043	60	0.57	DA	P3	
16	20:38:42	44 31.27	120 10.82	11.80	2.0	11/011	234	0.27	CD	O0	
18	14:46:24	48 08.84	122 36.24	27.22	2.6	59/059	36	0.29	BA	P3	F
19	21:44:03	47 41.10	120 19.87	3.32	2.0	14/014	87	0.10	AB	N3	
20	6:20:59	47 42.39	120 16.23	3.78	2.4	31/033	57	0.31	CC	N3	
24	1:34:14	47 43.85	120 00.81	5.81	2.2	24/027	50	0.29	BA	N3	
31	5:57:04	46 50.31	120 57.19	1.62\$	2.1	29/030	60	0.37	CC	C3	
Jun-05											
DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
10	1:05:41	47 32.63	121 47.99	18.16	2.4	40/043	84	0.20	BA	P3	
10	2:19:49	47 32.50	121 48.20	18.42	2.0	29/032	83	0.19	BA	P3	
12	0:26:43	42 01.30	119 53.75	12.90	2.3	7/008	303	0.29	CD	K3	
12	0:44:39	46 25.49	121 17.03	9.49	2.2	36/037	39	0.39	CC	C3	
14	1:32:51	45 03.11	121 02.48	19.45	2.1	18/019	81	0.12	AA	O0	
14	22:42:02	42 24.84	122 49.14	8.76	2.2	4/004	202	0.16	BD	K3	
15	2:50:57	41 19.50	126 02.24	10.00*	7.2	45/045	280	0.74	DD	J1	R
17	6:21:34	40 10.94	127 32.74	10.00*	6.4	30/030	314	0.30	BD	J1	R
20	8:45:55	47 23.06	122 21.17	18.29	2.0	24/026	66	0.17	BA	P3	
21	12:30:08	46 39.39	120 36.76	10.43*	2.9	38/038	50	0.16	BB	E3	
23	17:01:31	42 25.87	122 30.62	5.78	2.2	6/006	122	0.07	AC	K3	

24	12:03:55	47 23.65	122 34.74	50.50	2.0	37/039	36	0.23	BA	P3	
25	13:49:11	45 31.27	122 38.24	14.87	2.7	43/043	58	0.21	BA	C3	F
29	14:37:14	46 39.38	120 36.62	9.96	3.5	39/039	50	0.20	BB	E3	F
29	23:18:14	42 02.33	121 37.21	0.02*	2.7	8/008	187	0.10	AD	K3	

OUTREACH ACTIVITIES

The PNSN staff and faculty participate in an educational outreach program designed to better inform the public, educators, businesses, policy makers, government agencies, engineers, and the emergency management community about earthquake, volcano and related hazards. Our program offers lectures, classes, lab tours, workshops, consultations, and electronic and printed information products. Special attention is paid to the information needs of the media. We provide information directly to the public through information sheets, an audio library, email, and via the Internet at <http://www.pnsn.org>.

Audio Library, Phone

The Seismology Lab responded to over 100 calls from the general public, Emergency Managers and government agencies, and another 60 calls from the Media. In addition, the PNSN audio library system received 360 calls this quarter. The audio library provides several recordings. We have a regularly updated message concerning current seismic activity, and there are also recordings describing seismic hazards in Washington and Oregon and earthquake prediction. Callers to the audio library have the option of being transferred to the Seismology Lab for additional information.

Internet outreach

In 2004 URL www.pnsn.org was moved to a University server when www.ess.washington.edu, the Dept. of Earth and Space Sciences (ESS) server, was overwhelmed with internet traffic due to the eruption of Mt. St. Helens in Sept. 2004. The Dec. 26th Sumatra & Andaman Islands earthquake and tsunami again caused overload of the ESS server.

This quarter, the entire ESS site was augmented by additional high-traffic, high-security servers operated by the University's Computer & Communications (C&C) unit, which provided dual separated web servers located in different UW locations to provide "fail-over" redundancy, each with Gigabit backbone access. The C&C machines use a round-robin-type dynamic network service (DNS) to balance load. The startup hardware cost for this system was \$6000, and annual operations will cost about \$3,000 a year which is being paid by the Dept. of Earth and Space Sciences, a welcome and useful contribution to PNSN operations. The authoritative "master" web server was upgraded in June. This ESS departmental computer supplies updates every 5 minutes to the C&C high capacity servers.

PNSN staff replied to about 250 e-mail messages from the public seeking information on a variety of topics via the seis_info@ess.washington.edu email address. Ruth Ludwin managed this service this quarter, typically responding to routine questions within a day. Complex or sensitive questions are routed to the appropriate staff person for a more in-depth response. Requests may include complex scientific inquiries, assistance with hazard assessments and legal issues, consultations with government agencies, and support for engineering issues related to strong motion data.

Information Products

Four CIIM Maps and one ShakeMap were generated for this quarter. See the "Earthquake Data" section for details.

CISN display servers are receiving and displaying PNSN recent earthquake data and now provide links to the PNSN ShakeMaps, which are automatically generated following significant earthquakes. The CISN Display version 1 was released in December 2004 and distributed to 24 select users including lifeline operators, emergency managers, and large businesses. This product will first supplement and later replace the CUBE based RACE (Rapid Alert for Cascadia Earthquakes) systems currently deployed.

The Seattle ShakeMap Working Group, led by Ivan Wong, has submitted a proposal to FEMA to build high resolution ShakeMaps in the greater Seattle area and to push data to FEMA, WSEMD, and Seattle EM to aid in response and to improve loss estimation. Steve Palmer and colleagues at the Washington State Department of Natural Resources Division of Geology offered to help lay the groundwork for the Seattle ShakeMap Project by testing various ways to compile higher resolution NEHRP soils map grids for the State of Washington using the best available data. A number of meetings and conversations were held and the new grided maps will be available in August 2005.

K-20 Education Outreach

PNSN and USGS staff gave 11 Seismology Lab tours and presentations for K-12 students and teachers, serving about 240 students this quarter. Bill Steele also gave two assemblies at Briarcrest Elementary School to about 300 students on “How Mt. St. Helens Works”. The PNSN maintains an email list-service of over 50 local K-20 educators and subscribers interested in earth-sciences education, and occasionally send out messages on events of special interest.

Media Relations

The PNSN staff frequently provides interviews, research support, and referrals to radio, television, film, and print media. The PNSN organizes press conferences, contributes to TV and radio news programs and talk shows, and provides field opportunities linking reporters with working scientists. Staff members also assist news organizations, authors, television producers, and independent documentary makers to design accurate and informative stories and programs related to earthquake and volcano hazards. PNSN staff work to link reporters and producers developing stories with the appropriate research institutions, agencies, and scientists working in the areas to be covered by the piece. The PNSN coordinates the release of information and media relations with the USGS Western Region, the Cascades Volcano Observatory, and the Oregon Department of Geology and Mineral Industries (DOGAMI).

The ongoing eruption of Mount St. Helens (MSH) continued to stimulate media inquiries but at a much reduced level from the last quarter. PNSN staff were called upon to help plan a variety of news stories, documentaries and films related to the December 26th, 2004 Banda Aceh Earthquake and Tsunami. Our own Cascadia Subduction Zone was the focus of many of these productions and reports. Films produced by the Discovery Channel, National Geographic and the BBC were aired on regional television.

In addition to the ongoing eruption updates, PNSN staff and, in particular, Director Steve Malone, provided a large number of interviews and assisted in the development of radio and television programs commemorating the 25th Anniversary of the 1980 Mt. St. Helens Eruption.

PNSN staff were very involved in the release and coverage of the EERI Seattle Fault Scenario and the CREW Cascadia Earthquake Scenario. Both scenarios attracted significant media coverage.

A June 15 UTC M 7.2 earthquake off the coast of California triggered a brief tsunami warning for the coasts of California, Oregon, and Washington. The warning was issued by the Alaska Tsunami Warning Center (ATWC), and did not involve the PNSN directly, although the local media response was considerable, and the seismology lab remained open until 11 PM to accommodate interview requests.

Throughout the quarter, PNSN scientists participated in morning science conferences with CVO three times a week to share data and interpretations, and develop “talking points” for use in interviews.

Meetings, Presentations and Visitors

- A Northwest Science Writers Association meeting was hosted by the PNSN and Cynthia Gardner, Steve Malone, and Bill Steele spoke to the group about the eruption of Mt. St. Helens, and scientist-media relations.
- PNSN and UW management continued to work with State of Washington representatives to obtain State funding to meet State agency information needs.
- Bill Steele assisted the Cascadia Region Earthquake Workgroup with the development and roll out of the CREW Cascadia Earthquake Scenario at the State Partners in Preparedness Conference and with the submission of an Op-Ed article published by the Seattle Post Intelligencer.
- The PNSN participated in University-sponsored events including an Alumni Open House, the Arts and Sciences Celebration of Distinction program and poster session, and provided a lab tour while meeting with Regent and past Governor Dan Evans.
- Steve Malone provided the Presidential speech at the Seismological Society of America (SSA) Conference in Reno, NV.
- 2005 SSA presentations by PNSN faculty, staff and graduate students:
 - **High-resolution 3D Travel-time Tomography Using Controlled Sources and Earthquakes: Application to the Seattle Basin and Vicinity** CROSSON, R. S.,
 - **The Origins of the Advanced National Seismic System** FILSON, J. R., ARABASZ, W. J., BENZ, H. M. and BULAND, R., GEE, L. S., MALONE, S. D., and OPPENHEIMER, D.
 - **Broadband Seismic Monitoring of Recent Activity at Mount Saint Helens, Washington** HORTON, S. P., BRACKMAN, T., WATSON, C., WITHERS, M., PATTERSON, G., and BODIN, P., NORRIS, R.; MORAN, S., and QAMAR, T.
 - **The 2004-2005 Eruption of Mount Saint Helens: Possible Links between Seismicity and Physical Changes in the New Lava Dome** MORAN, S. C. and VALLANCE, J. W., QAMAR, A. I. and MALONE, S. D.

- **Rapid Analysis of Earthquake Data during the 2004-2005 Dome-building Eruption of Mount Saint Helens** QAMAR, A. and MALONE, S. D., and MORAN, S.
- **Azimuthal Patterns in High-frequency Energy Observed at Mount Saint Helens, Washington: Implications for Near-surface Structure** THELEN, W. A. and MALONE, S. D
- **Pacific Northwest Seismograph Network (PNSN) as Part of ANSS** THOMAS, G., QAMAR, A., BARBEROPOULOU, A., LINDQUIST, P. C., and MALONE, S. D.
- **Source Parameters of Microearthquakes at Mount St. Helens (USA)** TUSA, G. and GRESTA, S.; and MALONE, S. D.

- UWTV recorded a May 1, 2005 public lecture on Mt. St. Helens given by PNSN Director Stephen D. Malone. The lecture is scheduled for a half-dozen re-broadcasts on UWTV in the near future. Dr. Malone was also videotaped presenting a lecture on predicting earthquake and volcanic eruptions to the UW Program on the Environment and the UW Alumni Club . This lecture has been broadcast on a public-access channel.

- Steve Malone provided lectures on Mt. St. Helens during a visit to Italy at the INGV (National Institute of Geophysics and Volcanology) and the University of Pisa.

- The PNSN hosted many meetings this quarter including The Contingency Planners and Recovery Managers (CPARM), Seattle ShakeMap Workgroup, and the University of Washington Emergency Planning Group.

- Ruth Ludwin presented a poster and participated in a panel discussion at the NSF Tsunami Deposits Workshop hosted June 12-15 by the Dept. of Earth and Space Sciences. <http://earthweb.ess.washington.edu/tsunami2/deposits/>.

- Staff scientist Ruth Ludwin was first author on a paper titled **Dating the 1700 Cascadia Earthquake - Great Coastal Earthquakes in Native Stories**, 2005, R. S. Ludwin, R. Dennis, D. Carver, A. D. McMillan, R. Losey, J. Clague, C. Jonientz-Trisler, J. Bovechop, J. Wray, and K. James, Seismological Research Letters, V. 76, No. 2

- Bill Steele gave a number of invited talks including the Oregon Telecommunications Associations Annual Conference in Bend Oregon. A talk for the Thoracic Oncology Conference, and the University Rotary Club.