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QUARTERLY NETWORK REPORT 2002-A
on
Seismicity of Washington and Oregon

January 1 through March 31, 2002

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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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INTRODUCTION

This is the first quarterly report of 2002 from the University of Washington Dept. of Earth and Space Sciences *Pacific Northwest Seismograph Network* (PNSN), 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. Beginning in 1999, the quarterly PNSN catalog listing changed; earthquakes smaller than magnitude 2.0 are no longer listed in the quarterly reports. The complete PNSN catalog is available on-line, both through our web-site and through the CNSS catalog. We will continue to 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.

NETWORK OPERATIONS

Figure 1A shows a map view of stations operating during the quarter. Figure 1B is a more detailed view of stations in the Puget Sound area. Figure 1C is a more detailed view of stations near Mt. St. Helens. 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.

Strong Motion Instrumentation and Recording Update

This quarter showed some exciting new developments for the strong motion array. For the last several years the Oregon Department of Geology and Mineral Industries (DOGAMI) has been collecting funding for strong motion instrumentation in Oregon from fees on building permits. DOGAMI, in cooperation with the USGS, developed a plan to purchase instrumentation and to have the PNSN collect, analyze, and disseminate the data.

DOGAMI purchased 3 Kinemetrics K2 instruments this quarter. Two instruments have been installed, both in BPA power substations near the Portland area. Station PERL is located in the BPA Pearl substation south of Portland, between Tualatin and Wilsonville, Oregon. Station MRIN is located in the BPA Marion substation, east of Stayton, Oregon. Both of these stations send real-time data over the BPA microwave system to the PNSN Earthworm hub in Vancouver, Washington. The data are exported from Vancouver to the UW via the Internet. Other long-standing issues with strong motion stations were resolved this quarter. Timing was established at MARY and data telemetry was completed at KNJH and RRHS.

CREST Instrument Update

The Bonneville Power Administration (BPA) has provided telemetry for four CREST stations at BPA power substations near the coast (3 along the Oregon coast, and one in southwestern Washington). All four stations were installed in October 2001. We are receiving data for three of the sites, TAKO, TOLO, and MEGW, but not for HEBO. HEBO is expected to begin receiving data in the second quarter.

Other Station News

In interesting station news, short period station OBH was temporarily removed for logging. Strong motion station CSEN was removed because the building is being remodeled.

Data Recording and EARTHWORM Update

This quarter, *scossa* remained our main EARTHWORM computer, with *milli* serving as our primary backup and *verme* as the secondary backup. *Milli* and *verme* still serve as the principal computers for data acquisition for many of the digital stations. We are currently running EARTHWORM-V5.1.

This quarter,*pigia* our new Intel-based EARTHWORM digitizer running under Windows NT, was fully integrated into our data acquisition process. On February 27, *pigia* took over as the primary digitizer for *verme* while *waggles* remained the primary digitizer for *scossa* and *milli*.

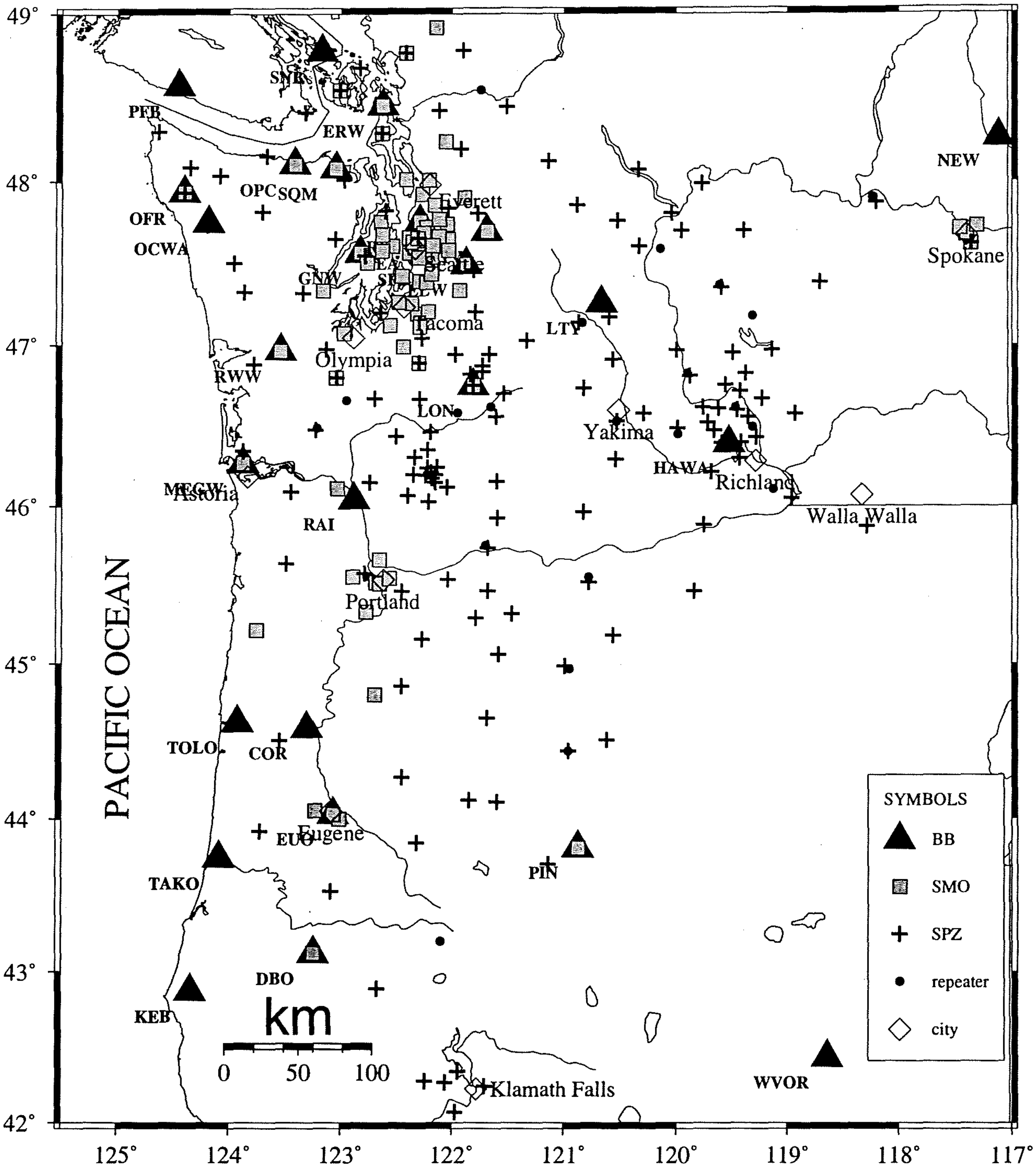

Figure 1A. Stations operating at the end of 1st quarter, 2002. Stations shown are short period vertical (SP), 3-component broadband (BB), or strong motion (SMO).

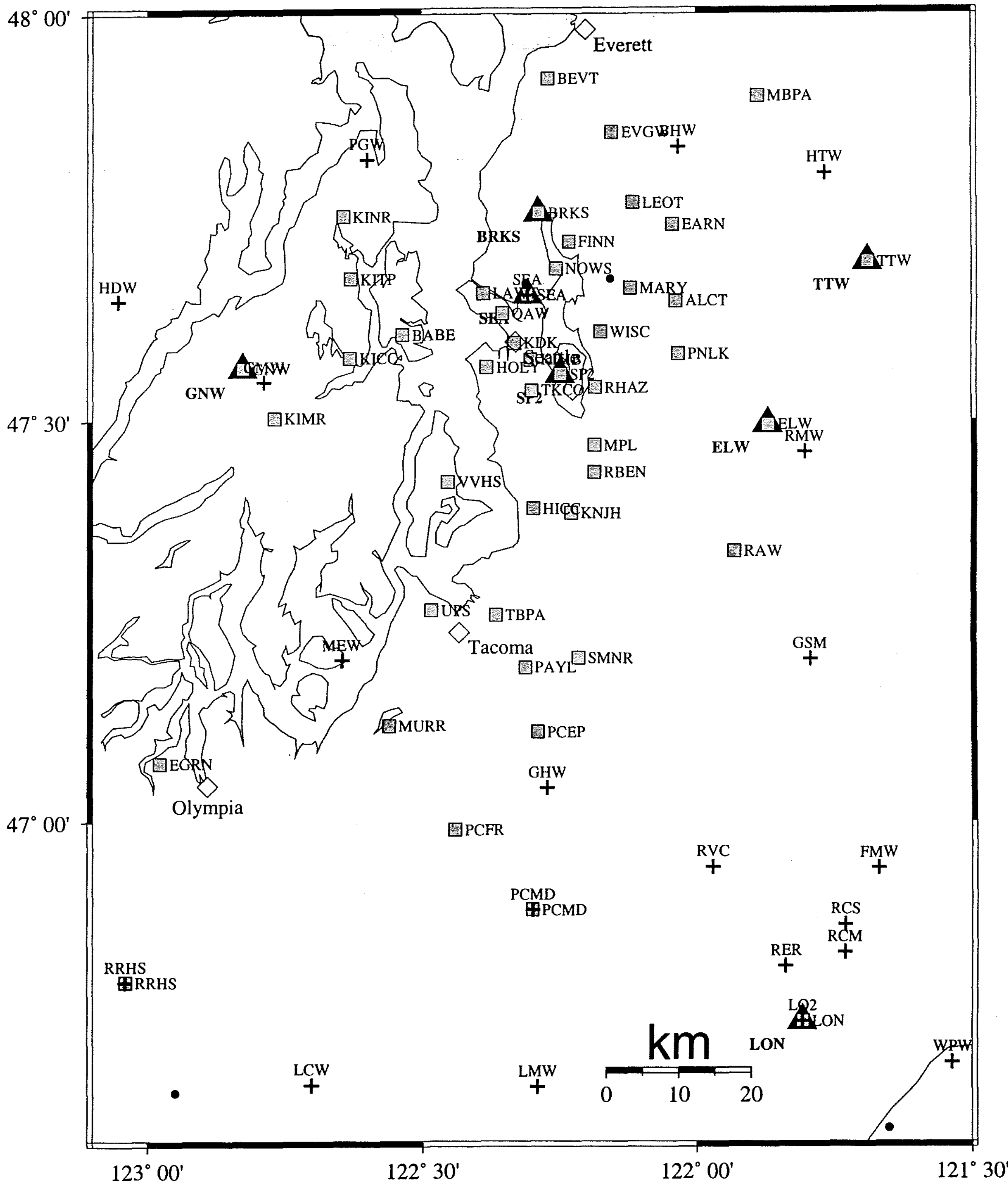

Figure 1B. Stations operating at the end of 1st quarter, 2002. Detail of Figure 1A.

TABLE 1
Station Outages, Repairs, and Installations 1st quarter 2002

Station	Outage Dates	Comments
AUG	12/19/01-01/13/02	Noisy, didn't record events
BOW	12/01/00-End	Dead because air cells have run down
BPO	12/13/01-End	Noisy, not recording events
CDF	12/13/01-End	Dead
COR.BHZ	02/03/02-03/02/02	Dead
CSEN	02/13/02-End	Removed (building being remodeled)
ELK	01/16/02-02/21/02	Dead, radio problem repaired
FMW	02/20/02-End	Dead, possible bad receiver
GLK	12/19/01-02/11/02	Noisy, didn't record events
HDW	12/08/01-02/14/02	Dead
HEBO	10/01/01-End	No telemetry
KDK	9/27/01-End	No GPS or telemetry
KITP	12/03/01-01/29/02	Removed for repair
KMO	01/19/02-02/25/02	Noisy, didn't record events
KNJH	7/9/01-01/18/02	Intermittent telemetry
LCW	12/12/01-End	Dead
MARY	5/10/01-03/11/02	No GPS
MEGW	10/21/01-02/10/02	No telemetry
MPO	01/19/02-End	Noisy, not recording events
MRIN	03/19/02	Installed (SMO)
MURR	09/21/00-End	No telemetry
NCO	11/07/01-End	Noisy, not recording events
NLO	01/9/02-01/16/02	Dead, receiver fixed 01/16/02
OBH	01/31/02-End	Temp. removed for logging
OCP	7/01-01/27/02	Dead
OFR.BH?	10/18/01-End	Bad timing (no GPS)
OFR.HH?	10/18/01-End	Bad timing (no GPS)
OOW	12/10/01-01/16/02	Dead, battery replaced 01/16/02
OSD	12/10/01-01/16/02	Offline because of OOW
PERL	03/19/02	Installed (SMO)
PGW	12/22/2001-End	Dead
RCM	8/20/01-End	Seismically dead
RCS	10/11/01-End	Running on solar power, off at night
RRHS.EHZ	11/13/01-01/08/02	No telemetry
RVW	01/19/02-01/16/02	Dead, receiver fixed 01/16/02
SEA.EL?	01/30/02	Config. of seismograph fixed
SEP	01/07/02-02/02/02	Dead
SHW	01/19/02-01/16/02	Dead, receiver fixed 01/16/02
SLF	11/20/01-End	Dead for winter
SOS	01/16/02-02/21/02	Dead, radio problem repaired
SSO	01/07/02-02/02/02	Dead
STD	01/16/02-02/21/02	Dead, radio problem repaired
TAKO	10/24/01-01/09/02	No telemetry
TBPA	11/27/01-01/04/02	Removed for repair (flood damage)
TDL	01/07/02-02/02/02	Dead
TOLO	10/23/01-01/09/02	No telemetry
VFP	12/23/01-01/06/02	Dead
WIB	01/19/02-02/12/02	Dead
WPW	5/15/01-End	Dead
WRW	11/20/01-End	Dead for winter

STATIONS USED FOR LOCATION OF EVENTS

Table 2A lists short-period, mostly vertical-component stations used in locating seismic events in Washington and Oregon. The first column in the table gives the 3-letter station designator, followed by a symbol designating the funding agency; stations marked by a percent sign (%) were supported by USGS joint operating agreement 01-HQ-AG-0011. A plus (+) indicates support under Pacific Northwest National Laboratory, Battelle contract 259116-A-B3. Stations designated "#" are USGS-maintained stations recorded at the PNSN. Stations designated by letters are operated by other networks, and telemetered to the PNSN. "M" stations are received from the Montana Bureau of Mines and Geology, "C" stations from the Canadian Pacific Geoscience Center, "U" stations from the US Geological Survey (usually USNSN stations), "N" stations from the USGS Northern California Network, and "H" stations from the Hanford Reservation via the Pacific Northwest National Labs. Other designation indicate support from other sources. Additional columns give station north latitude and west longitude (in degrees, minutes and seconds), station elevation in km, and comments indicating landmarks for which stations were named.

Table 2B lists broad-band stations used in locating seismic events in Washington and Oregon, and Table 2C lists strong-motion stations.

TABLE 2A - Short-period Stations operated by the PNSN during the first quarter 2002

STA	F	LAT	LONG	EL	NAME
ASR	%	46 09 09.9	121 36 01.6	1.357	Mt. Adams - Stagman Ridge
AUG	%	45 44 10.0	121 40 50.0	0.865	Augspurger Mtn
BBO	%	42 53 12.6	122 40 46.6	1.671	Butler Butte, Oregon
BEN	1	46 31 12.0	119 43 18.0	0.335	W PNNL station
BHW	%	47 50 12.6	122 01 55.8	0.198	Bald Hill
BLN	%	48 00 26.5	122 58 18.6	0.585	Blyn Mt.
BOW	%	46 28 30.0	123 13 41.0	0.870	Boistfort Mt.
BPO	%	44 39 06.9	121 41 19.2	1.957	Bald Peter, Oregon
BRO	%	44 16 02.5	122 27 07.1	0.135	Big Rock Lookout, Oregon
BRV	+	46 29 07.2	119 59 28.2	0.920	Black Rock Valley
BSMT	M	47 51 04.8	114 47 13.2	1.950	Bassoo Peak, MT
BUO	%	42 16 42.5	122 14 43.1	1.797	Burton Butte, Oregon
BVW	+	46 48 39.5	119 52 56.4	0.670	Beverly
CBS	+	47 48 17.4	120 02 30.0	1.067	Chelan Butte, South
CDF	%	46 07 01.4	122 02 42.1	0.756	Cedar Flats
CHMT	M	46 54 51.0	113 15 07.0	-	Chamberlain Mtn, MT
CMM	%	46 26 07.0	122 30 21.0	0.620	Crazy Man Mt.
CMW	%	48 25 25.3	122 07 08.4	1.190	Cultus Mtns.
CPW	%	46 58 25.8	123 08 10.8	0.792	Capitol Peak
CRF		46 49 30.0	119 23 13.2	0.189	orfu
DPW	+	47 52 14.3	118 12 10.2	0.892	Davenport
DY2	+	47 59 06.6	119 46 16.8	0.890	Dyer Hill 2
EDM	%	46 11 50.4	122 09 00.0	1.609	East Dome, Mt. St. Helens
ELK	%	46 18 20.0	122 20 27.0	1.270	Elk Rock
ELL	+	46 54 34.8	120 33 58.8	0.789	Ellensburg
EPH	+	47 21 22.8	119 35 45.6	0.661	Ephrata
ET3	+	46 34 38.4	118 56 15.0	0.286	Eltopia (replaces ET2)
ETW	+	47 36 15.6	120 19 56.4	1.477	Entiat
FHE	+	46 57 06.9	119 29 49.0	0.455	Frenchman Hills East
FL2	%	46 11 47.0	122 21 01.0	1.378	Flat Top 2
FMW	%	46 56 29.6	121 40 11.3	1.859	Mt. Fremont
GBB	H	46 36 31.8	119 37 40.2	0.185	PNNL Station
GBL	+	46 35 54.0	119 27 35.4	0.330	Gable Mountain
GHW	%	47 02 30.0	122 16 21.0	0.268	Garrison Hill
GL2	+	45 57 35.0	120 49 22.5	1.000	New Goldendale
GLK	%	46 33 27.6	121 36 34.3	1.305	Glacier Lake
GMO	%	44 26 20.8	120 57 22.3	1.689	Grizzly Mountain, Oregon
GMW	%	47 32 52.5	122 47 10.8	0.506	Gold Mt.
GPW	%	48 07 05.0	121 08 12.0	2.354	Glacier Peak
GSM	%	47 12 11.4	121 47 40.2	1.305	Grass Mt.
GUL	%	45 55 27.0	121 35 44.0	1.189	Guler Mt.
H2O	H	46 23 45.0	119 25 22.0	-	Water PNNL Station
HAM	%	42 04 08.3	121 58 16.0	1.999	Hamaker Mt., Oregon
HBO	%	43 50 39.5	122 19 11.9	1.615	Huckleberry Mt., Oregon
HDW	%	47 38 54.6	123 03 15.2	1.006	Hoodsport
HOG	%	42 14 32.7	121 42 20.5	1.887	Hogback Mtn., Oregon
HSO	%	43 31 33.0	123 05 24.0	1.020	Harness Mountain, Oregon
HSR	%	46 10 28.0	122 10 46.0	1.720	South Ridge, Mt. St. Helens
HTW	%	47 48 14.2	121 46 03.5	0.833	Haystack Lookout
HUO	%	44 07 10.9	121 50 53.5	2.037	Husband OR (UO)
JBO	+	45 27 41.7	119 50 13.3	0.645	Jordan Butte, Oregon
JCW	%	48 11 42.7	121 55 31.1	0.792	Jim Creek
JUN	%	46 08 50.0	122 09 04.4	1.049	June Lake
KMO	%	45 38 07.8	123 29 22.2	0.975	Kings Mt., Oregon
KOS	%	46 27 46.7	122 11 41.3	0.610	Kosmos
KTR	N	41 54 31.2	123 22 35.4	1.378	CAL-NET
LAB	%	42 16 03.3	122 03 48.7	1.774	Little Aspen Butte, Oregon
LAM	N	41 36 35.2	122 37 32.1	1.769	CAL-NET
LCCM	M	45 50 16.8	111 52 40.8	1.669	Lewis and Clark Caverns, MT
LCW	%	46 40 14.4	122 42 02.8	0.396	Lucas Creek
LMW	%	46 40 04.8	122 17 28.8	1.195	Ladd Mt.

STA	F	LAT	LONG	EL	NAME
LNO	+	45 52 18.6	118 17 06.6	0.771	Lincton Mt., Oregon
LO2	%	46 45 00.0	121 48 36.0	0.853	Longmire
LOC	+	46 43 01.2	119 25 51.0	0.210	Locke Island
LVP	%	46 03 59.4	122 24 10.2	1.134	Lakeview Peak
MBW	%	48 47 02.4	121 53 58.8	1.676	Mt. Baker
MCMT	M	44 49 39.6	112 50 55.8	2.323	McKenzie Canyon, MT
MCW	%	48 40 46.8	122 49 56.4	0.693	Mt. Constitution
MDW	+	46 36 47.4	119 45 39.6	0.330	Midway
MEW	%	47 12 07.0	122 38 45.0	0.097	McNeil Island
MJ2	+	46 33 27.0	119 21 32.4	0.146	May Junction 2
MOX	+	46 34 38.4	120 17 53.4	0.501	Moxie City
MPO	%	44 30 17.4	123 33 00.6	1.249	Mary's Peak, Oregon
MTM	%	46 01 31.8	122 12 42.0	1.121	Mt. Mitchell
NAC	+	46 43 59.4	120 49 25.2	0.728	Naches
NCO	%	43 42 14.4	121 08 18.0	1.908	Newberry Crater, Oregon
NEL	+	48 04 12.6	120 20 24.6	1.500	Nelson Butte
NLO	%	46 05 21.9	123 27 01.8	0.826	Nicolai Mt., Oregon
OBC	%	48 02 07.1	124 04 39.0	0.938	Olympics - Bonidu Creek
OBH	%	47 19 34.5	123 51 57.0	0.383	Olympics - Burnt Hill
OCP	%	48 17 53.5	124 37 30.0	0.487	Olympics - Cheeka Peak
OD2	+	47 23 15.6	118 42 34.8	0.553	Odessa site 2
OFR	%	47 56 00.0	124 23 41.0	0.152	Olympics - Forest Resource Center
ON2	%	46 52 50.8	123 46 51.8	0.257	Olympics - North River
OOW	%	47 44 03.6	124 11 10.2	0.561	Octopus West
OSD	%	47 48 59.2	123 42 13.7	2.008	Olympics - Snow Dome
OSR	%	47 30 20.3	123 57 42.0	0.815	Olympics Salmon Ridge
OT3	+	46 40 08.4	119 13 58.8	0.322	New Othello (replaces OT2 8/26)
OTR	%	48 05 00.0	124 20 39.0	0.712	Olympics - Tyee Ridge
PAT	+	45 52 55.2	119 45 08.4	0.262	Paterson
PCMD	%	46 53 20.9	122 18 00.9	0.239	PC Mountain Detachment ANSS-SMO
PGO	%	45 27 42.6	122 27 11.5	0.253	Gresham, Oregon
PGW	%	47 49 18.8	122 35 57.7	0.122	Port Gamble
PRO	+	46 12 45.6	119 41 08.4	0.553	Prosser
RCM	%	46 50 08.9	121 43 54.4	3.085	Mt. Rainier, Camp Muir
RCS	%	46 52 15.6	121 43 52.0	2.877	Mt. Rainier, Camp Schurman
RED	H	46 17 51.0	119 26 15.6	0.330	Red Mountain PNNL Station
RER	%	46 49 09.2	121 50 27.3	1.756	Mt. Rainier, Emerald Ridge
RMW	%	47 27 35.0	121 48 19.2	1.024	Rattlesnake Mt. (West)
RNO	%	43 54 58.9	123 43 25.5	0.850	Roman Nose, Oregon
RPW	%	48 26 54.0	121 30 49.0	0.850	Rockport
RRHS	%	46 47 58.6	123 02 25.4	0.047	Rochester HS ANSS-SMO
RSW	+	46 23 40.2	119 35 28.8	1.045	Rattlesnake Mt. (East)
RVC	%	46 56 34.5	121 58 17.3	1.000	Mt. Rainier - Voight Creek
RVN	%	47 01 38.6	121 20 11.9	1.885	Raven Roost (former NEHRP temp)
RVW	%	46 08 53.2	122 44 32.1	0.460	Rose Valley
SAW	+	47 42 06.0	119 24 01.8	0.701	St. Andrews
SBES	%	48 46 05.9	122 24 54.2	0.119	Silver Beach ES SMO
SEA	%	47 39 15.8	122 18 29.3	0.030	UW, Seattle (Wood Anderson BB)
SEP	#	46 12 00.7	122 11 28.1	2.116	September lobe, Mt. St. Helens
SFER	%	47 37 10.4	117 21 55.7	-	Spokane Schools, Ferris High School
SHW	%	46 11 37.1	122 14 06.5	1.425	Mt. St. Helens
SLF	%	47 45 32.0	120 31 40.0	1.750	Sugar Loaf
SMW	%	47 19 10.7	123 20 35.4	0.877	South Mtn.
SNI	H	46 27 80.0	119 39 50.0	-	PNNL station
SOS	%	46 14 38.5	122 08 12.0	1.270	Source of Smith Creek
SSO	%	44 51 21.6	122 27 37.8	1.242	Sweet Springs, Oregon
STD	%	46 14 16.0	122 13 21.9	1.268	Studebaker Ridge
STW	%	48 09 03.1	123 40 11.1	0.308	Striped Peak
SVOH	%	48 17 21.8	122 37 54.8	0.010	Skagit Valley CC ANSS-SMO
TBM	+	47 10 12.0	120 35 52.8	1.006	Table Mt.
TCO	%	44 06 27.6	121 36 02.1	1.975	Three Creek Meadows, Oregon.
TDH	%	45 17 23.4	121 47 25.2	1.541	Tom,Dick,Harry Mt., Oregon
TDL	%	46 21 03.0	122 12 57.0	1.400	Tradedollar Lake
TRW	+	46 17 32.0	120 32 31.0	0.723	Toppenish Ridge
TWW	+	47 08 17.4	120 52 06.0	1.027	Teanaway
UWFH	%	48 32 46.0	123 00 43.0	0.010	UW Friday Harbor ANSS-SMO
VBE	%	45 03 37.2	121 35 12.6	1.544	Beaver Butte, Oregon
VCR	%	44 58 58.2	120 59 17.4	1.015	Criterion Ridge, Oregon
VDB	C	49 01 34.0	122 06 10.1	0.404	Canada
VFP	%	45 19 05.0	121 27 54.3	1.716	Flag Point, Oregon
VG2	%	45 09 20.0	122 16 15.0	0.823	Goat Mt., Oregon
VGB	+	45 30 56.4	120 46 39.0	0.729	Gordon Butte, Oregon
VGZ	C	48 24 50.0	123 19 27.8	0.067	Canada
VIP	%	44 30 29.4	120 37 07.8	1.731	Ingram Pt., Oregon
VLL	%	45 27 48.0	121 40 45.0	1.195	Laurance Lk., Oregon
VLM	%	45 32 18.6	122 02 21.0	1.150	Little Larch, Oregon
VSP	%	42 20 30.0	121 57 00.0	1.539	Spence Mtn, Oregon
VT2	+	46 58 02.4	119 59 57.0	1.270	Vantage2
VTH	%	45 10 52.2	120 33 40.8	0.773	The Trough, Oregon
WA2	+	46 45 19.2	119 33 56.4	0.244	Wahluke Slope
WAT	+	47 41 55.2	119 57 14.4	0.821	Waterville
WIB	%	46 20 34.8	123 52 30.6	0.503	Willapa Bay
WIW	+	46 25 45.6	119 17 15.6	0.128	Wooded Island
WPO	%	45 34 24.0	122 47 22.4	0.334	West Portland, Oregon
WPW	%	46 41 55.7	121 32 10.1	1.280	White Pass
WRD	+	46 58 12.0	119 08 41.4	0.375	Warden
WRW	%	47 51 26.0	120 52 52.0	1.189	Wenatchee Ridge
YA2	+	46 31 36.0	120 31 48.0	0.652	Yakima
YEL	#	46 12 35.0	122 11 16.0	1.750	Yellow Rock, Mt. St. Helens
YPT	+	46 02 55.8	118 57 44.0	0.325	Yellepit

TABLE 2B

Broad-band three-component stations operating at the end of the first quarter 2002. Symbols are as in Table 2A.

STA	F	LAT	LONG	EL	NAME
BRKS	%	47 45 19.1	122 17 17.9	0.020	Brookside ANSS-SMO
COR	U	44 35 08.5	123 18 11.5	0.121	Corvallis, Oregon (OSU BB)
DBO	%	43 07 09.0	123 14 34.0	0.984	Dodson Butte, Oregon (UO CREST)
ELW	%	47 29 39.4	121 52 17.2	0.267	EchoLake BPA BB-SMO-IDS20
ERW	%	48 27 14.4	122 37 30.2	0.389	Mt. Erie SMO-IDS24 BB
EUO	%	44 01 45.7	123 04 08.2	0.160	Eugene,OR U0 CREST BB SMO
GNW	%	47 33 51.8	122 49 31.0	0.165	Green Mt CREST BB SMO
HAWA	U	46 23 32.3	119 31 57.2	0.367	Hanford Nike USNSN BB
HLID	U	43 33 45.0	114 24 49.3	1.772	Hailey, ID USNSN BB
KEB	N	42 52 20.0	124 20 03.0	0.818	Edson Butte, OR CREST BB
KRMB	N	41 31 23.0	123 54 29.0	1.265	Red Mtn, OR CREST BB
KSXB	N	41 49 51.0	123 52 33.0	-	Camp Six, OR CREST BB
LON	%	46 45 00.0	121 48 36.0	0.853	Longmire CREST BB LONLZ SMO
LTY	%	47 15 21.2	120 39 53.3	0.970	Liberty (BB)
MEGW	%	46 15 57.4	123 52 38.2	0.100	Megler, WA CREST BB SMO
NEW	U	48 15 50.0	117 07 13.0	0.760	Newport Observatory USNSN BB
OCWA	U	47 44 56.0	124 10 41.2	0.671	Octopus Mtn. USNSN BB
OFR	%	47 56 00.0	124 23 41.0	0.152	Olympics - Forest Resource Cen
OPC	%	48 06 01.0	123 24 41.8	0.090	Olympic Penn College CREST BB
PFB	C	48 34 30.0	124 26 39.8	0.465	P.Renfrew, Canada
PIN	%	43 48 40.0	120 52 19.0	1.865	Pine Mt., Oregon (U0 CREST, BB)
PNT	C	49 18 57.6	119 36 57.6	0.550	Canada, BB
RAI		46 02 25.1	122 53 06.4	1.520	Trojan Plant, Oregon
RWW	%	46 57 53.7	123 32 31.7	0.015	Ranney Well CREST BB SMO
SEA	%	47 39 15.8	122 18 29.3	0.030	UW, Seattle (Wood Anderson BB)
SNB	C	48 46 33.6	123 10 16.3	0.408	Canada BB
SP2	%	47 33 23.3	122 14 52.8	0.030	Seward Park, Seattle
SQM	%	48 04 39.0	123 02 44.0	0.030	Sequim, WA (CREST BB SMO)
TAKO	%	43 44 36.0	124 04 56.0	0.100	Tahkenitch, OR CREST BB SMO
TOLO	%	44 37 19.0	123 55 21.0	0.100	Toledo BPA, OR CREST BB SMO
TTW	%	47 41 40.7	121 41 20.0	0.542	Tolt Res, WA CREST BB SMO
WVOR	U	42 26 02.0	118 38 13.0	1.344	Wildhorse Valley, Oregon (USNSN)

Table 2C lists strong-motion, three-component stations operating in Washington and Oregon that provide data in real or near-real time to the PNSN. Several of these stations also have broad-band instruments, as noted. The "SENSOR" field designates what type of seismic sensor is used;

- A = Terra-Tech SSA-320 SLN triaxial accelerometer/Terra-Tech IDS24
- A20 = Terra-Tech SSA-320 triaxial accelerometer/Terra-Tech IDS20 recording system,
- FBA23 = Kinemetrics FBA23 accelerometers and Reftek recording system,
- EPI = Kinemetrics Episensor accelerometers and Reftek recording system.
- BB = Guralp CMG-40T 3-D broadband velocity sensor.
- BB3 = Guralp CMG3T 3-D broadband velocity sensor.
- BBZ = Broad Band sensor, PMD 2024, vertical component only.
- K2 = Kinemetrics Episensor accelerometers and K2 Recording System

The "TELEMETRY" field indicates the type of telemetry used to recover the data.

- D = dial-up,
- E = continuously telemetered via Internet from a remote EARTHWORM system
- I = continuously telemetered via Internet,
- L = continuously telemetered via dedicated lease-line telephone lines,
- L-PPP = continuously telemetered via dedicated lease-line telephone lines using PPP protocol
- M = continuously telemetered via BPA microwave
- R = continuously telemetered via spread-spectrum radio

TABLE 2C

Strong-motion three-component stations operating at the end of the first quarter 2002. Symbols are as in Table 2A.

STA	F	LAT	LONG	EL	NAME	SENSORS	TELEMETRY
ALCT	%	47 38 48.8	122 2 15.7	0.055	Alcott Elementary	K2	I
ALST	%	46 6 32.3	123 1 58.5	0.198	Alston	A20	E,M
ALVY	%	43 59 53.2	123 0 57.0	0.155	Alvey	K2	E,M
ATES	%	48 14 10.9	122 3 33.0	0.010	Trafton Elementary	K2	I
BABE	%	47 36 21.0	122 32 7.0	0.010	Blakely Elementary	K2	I
BEVT	%	47 55 12.0	122 16 12.0	0.170	Boeing Plant Everett	K2	I
BRKS	%	47 45 19.1	122 17 17.9	0.020	Brookside Elementary	K2,BBZ	I
CSEN	%	47 48 4.5	122 13 6.5	0.055	Crystal Springs Elementary	K2	I
CSO	#	45 31 1.0	122 41 22.5	0.036	Canyon	FBA23	D
DBO	%	43 7 9.0	123 14 34.0	0.984	Dodson Butte (CREST)	EPI,BB3	E,L-PPP
EARN	%	47 44 27.2	122 2 37.7	0.159	East Ridge Elementary	K2	I
EGRN	%	47 4 24.0	122 58 41.0	0.010	Evergreen State College	K2	I
ELW	%	47 29 39.4	121 52 17.2	0.267	Echo Lake	A,BB	D,M,L
ERW	%	48 27 14.4	122 37 30.2	0.389	Mount Erie	A,BB	D,L,M
EUO	%	44 1 45.7	123 4 8.2	0.160	Eugene Golf Course (CREST)	EPI,BB	E,L-PPP
EVCC	%	48 0 27.0	122 12 15.3	0.000	Everett Community College	K2	I
EVGW	%	47 51 15.8	122 9 12.2	0.010	Gateway Middle School	K2	I
FINN	%	47 43 10.2	122 13 55.9	0.121	Finn Hill Junior High	K2	I
GNW	%	47 33 51.8	122 49 31.0	0.165	Green Mountain (CREST)	EPI,BB3	L-PPP
HAO	#	45 30 33.1	122 39 24.0	0.018	Harrison	FBA23	D
HEBO	%	45 12 49.2	123 45 15.0	0.100	Mt. Hebo (CREST)	EPI,BB	M,E
HICC	%	47 23 24.4	122 17 52.4	0.115	Highline Community College	K2	I
HOLY	%	47 33 55.4	122 23 1.0	0.106	Holy Rosary School	K2	I
KDK	%	47 35 42.7	122 19 56.0	0.004	King Dome	K2	None
KEEL	%	45 33 0.8	122 53 42.4	0.067	Keeler	A20	D,E,M
KICC	%	47 34 37.9	122 37 52.4	0.010	Kitsap County Central Communications	K2	I
KIMB	%	47 34 29.3	122 18 10.1	0.069	Kimball Elementary	K2	I
KIMR	%	47 30 11.0	122 46 2.0	0.123	Moderate Risk Waste Collection Facility	K2	I
KINR	%	47 45 6.0	122 38 35.0	0.010	North Road Shed	K2	I
KITP	%	47 40 30.0	122 37 47.0	0.076	Wastewater Treatment Plant	K2	I
KNJH	%	47 23 5.0	122 13 42.0	0.010	Kent Junior High	K2	I
LANE	%	44 3 6.5	123 13 54.8	0.120	Lane	K2	E,M
LAWT	%	47 39 23.4	122 23 21.9	0.050	Lawton Elementary	A20	I
LEOT	%	47 46 4.4	122 6 56.2	0.115	Leota Junior High	K2	I
LON	%	46 45 0.0	121 48 36.0	0.853	Longmire Springs (CREST)	EPI,BB3	L-PPP
LTY	%	47 15 21.2	120 39 53.4	0.970	Liberty Heights Mine (CREST)	BB3	I
MARY	%	47 39 45.7	122 7 11.6	0.011	Marymoor Park	K2	I
MBKE	%	48 55 2.0	122 8 29.0	1.010	Kendall Elementary	K2	I
MBPA	%	47 53 54.7	121 53 20.2	0.186	Monroe	A20	D,M,L
MEGW	%	46 15 57.4	123 52 38.2	0.100	Megler (CREST)	EPI,BB	M,E
MPL	%	47 28 7.0	122 11 4.5	0.122	Maple Valley	A	D,M,L
MRIN	%	44 48 1.4	122 41 53.8	0.187	Marion	K2	M,E
MURR	%	47 7 12.0	122 33 36.0	0.100	Camp Murray	K2	None
NOWS	%	47 41 12.0	122 15 21.2	0.002	NOAA Sand Point	A20	I
OHC	%	47 20 2.0	123 9 29.0	0.010	Hood Canal Junior High	K2	I
OPC	%	48 6 1.0	123 24 41.8	0.090	Peninsula College (CREST)	EPI,BB	I
PAYL	%	47 11 34.0	122 18 46.0	0.010	Aylen Junior High	K2	I
PCEP	%	47 6 41.8	122 17 24.0	0.160	Puyallup East Sheriff Precinct	K2	I
PCFR	%	46 59 23.3	122 26 27.4	0.137	Roy Training Center	K2	I
PCMD	%	46 53 20.9	122 18 0.9	0.239	Mountain Detachment	K2	I
PERL	%	45 19 42.0	122 46 40.2	0.068	Pearl	K2	M,E
PIN	%	43 48 40.0	120 52 19.0	1.865	Pine Mtn. (CREST)	EPI,BB3	E,L-PPP
PNLK	%	47 34 54.5	122 2 1.0	0.128	Pine Lake Middle School	K2	I
QAW	%	47 37 54.3	122 21 15.5	0.140	Queen Anne	A20	L
RAW	%	47 20 14.0	121 55 53.2	0.208	Raver	A20	M,L
RBEN	%	47 26 6.7	122 11 10.0	0.152	Benson Hill Elementary	K2	I
RBO	#	45 32 27.0	122 33 51.5	0.158	Rocky Butte	FBA23	D
RHAZ	%	47 32 24.7	122 11 1.3	0.108	Hazelwood Elementary	A20	I
ROSS	%	45 39 43.0	122 39 25.0	0.061	Ross	A20	E
RRHS	%	46 47 58.6	123 2 25.4	0.047	Rochester High School	K2	I
RWW	%	46 57 53.7	123 32 31.7	0.015	Ranney Well (CREST)	EPI,BB3	L-PPP
SBES	%	48 46 5.9	122 24 54.2	0.119	Silver Beach Elementary School	K2	I
SEA	%	47 39 15.8	122 18 29.3	0.030	University of Washington	A20,PMD2023	L
SFER	%	47 37 10.4	117 21 55.7	0.000	Ferris High School	K2	I
SGAR	%	47 40 37.8	117 24 50.3	0.579	Garfield Elementary	K2	I
SMNR	%	47 12 16.6	122 12 53.4	0.010	Sumner High School	K2	I
SP2	%	47 33 23.3	122 14 52.8	0.030	Seward Park	A,BB	L
SPUD	%	47 39 53.3	117 25 35.2	0.573	Spokane Public Works (CREST)	EPI,BB	E
SQM	%	48 4 39.0	123 2 44.0	0.030	Sequim Battelle Properties (CREST)	EPI,BB	I,R
SVOH	%	48 17 21.8	122 37 54.8	0.010	Skagit Valley College Oak Harbor	K2	I
SWES	%	47 42 51.0	117 27 53.2	0.623	Westview Elementary	K2	I
SWID	%	48 0 31.0	122 24 42.0	0.010	South Whidbey Primary School	K2	I
TAKO	%	43 44 36.0	124 4 56.0	0.100	Tahkenitch (CREST)	EPI,BB	Mircrowave,E
TBPA	%	47 15 29.0	122 22 1.0	0.002	Tacoma	A20	M,L,D
TKCO	%	47 32 12.7	122 18 1.5	0.005	King County Airport	A20	I
TOLO	%	44 37 19.0	123 55 21.0	0.100	Toledo (CREST)	EPI,BB	Mircrowave,E
TTW	%	47 41 40.7	121 41 20.0	0.542	Tolt Reservoir (CREST)	EPI,BB3	I
UPS	%	47 15 50.2	122 29 1.1	0.113	University of Puget Sound	K2	I
UWFH	%	48 32 46.0	123 0 43.0	0.010	Friday Harbor Laboratories	K2	I
VVHS	%	47 25 25.1	122 27 13.1	0.095	Vashon High School	K2	I
WISC	%	47 36 32.0	122 10 27.8	0.056	Wilburton Instructional Services Center	K2	I

EARTHQUAKE DATA - 2002-A

There were 740 events digitally recorded and processed at the University of Washington between January 1 and March 31, 2002. Locations in Washington, Oregon, or southernmost British Columbia were determined for 368 of these events; 294 were classified as earthquakes and 74 as known or suspected blasts. The remaining 372 processed events include teleseisms (144 events), regional events outside the PNSN (59), and unlocated events within the PNSN. Unlocated events within the PNSN include very small earthquakes and some known blasts. Frequent mining blasts occur near Centralia, Washington and we routinely locate some of them.

Table 3A is a listing of all earthquakes reported to have been felt during this quarter, events for which ShakeMaps or Community Internet Intensity Maps (CIIM) are noted.

ShakeMap shows instrumentally measured shaking.

Shake Maps: **http://www.ess.washington.edu/shake/index.html**

CIIM maps are made using "felt" reports relayed via Internet. These "felt" reports are converted into numeric intensity values, and the CIIM map shows the average intensity by zip code.

CIIM Maps: **http://pasadena.wr.usgs.gov/shake/pnw/**

Table 3B is a listing of earthquakes magnitude 2.5 or greater with reasonably constrained focal mechanisms from P-wave first motions. Table 4, located at the end of this report, 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.

Fig. 2 shows earthquakes with magnitude greater than or equal to 0.0 ($M_c \geq 0$).

Fig. 3 shows blasts and probable blasts ($M_c \geq 0$).

Fig. 4 shows earthquakes located near Mt. Rainier ($M_c \geq 0$).

Fig. 5 shows earthquakes located at Mt. St. Helens ($M_c \geq 0$).

TABLE 3A - Felt Earthquakes during the 1st Quarter of 2002

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEPTH	MAG	COMMENTS	CIIM	ShakeMap
02/01/04 07:16:12	47.67	117.41	0.6	-0.7	0.7 km WNW of Spokane, WA		
02/01/09 03:26:54	48.11	123.12	21.8	2.9	23.4 km E of Port Angeles, WA	x	
02/01/26 14:01:46	47.13	122.13	8.5	2.4	13.7 km SW of Enumclaw, WA		
02/02/12 19:16:41	48.41	122.28	18.6	3.0	4.0 km E of Mount Vernon, WA	x	x
02/03/11 00:43:51	47.50	122.73	22.7	1.7	10.6 km SW of Bremerton, WA		

TABLE 3B - Earthquakes M 2.5 or larger during the 1st Quarter of 2002
Focal mechanisms noted where computed. Some earthquakes have more than one possible mechanism.

DATE-(UTC)-TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	STRIKE	DIP	RAKE
yy/mm/dd hh:mm:ss	deg.	deg.	km			deg.	deg.	deg.
02/01/09 03:26:54	48.12	123.13	21.8	2.9	23.4 km E of Port Angeles, WA	75	50	150
02/01/31 23:07:28	45.69	120.17	3.8	2.7	49.9 km N of Condon, OR	-	-	-
02/02/12 19:16:41	48.41	122.29	18.6	3.0	4.0 km E of Mount Vernon, WA	95	30	130
02/02/19 18:07:20	46.87	121.76	1.4	2.5	1.7 km N of Mt Rainier, WA	160	50	-120
02/02/19 18:42:29	46.86	121.75	0.0	3.2	0.8 km NE of Mt Rainier, WA	0	45	-70
02/03/11 02:48:45	46.85	119.74	2.3	2.9	21.9 km ESE of Vantage, WA	-	-	-

OREGON SEISMICITY

During the first quarter of 2002, a total of 37 earthquakes were located in Oregon between 42.0° and 45.5° north latitude, and between 117° and 125° west longitude. The largest earthquakes in Oregon this quarter was a magnitude 2.4 earthquake on January 18 UTC located at a depth of ~3.0 km, about 11 km northwest of Bend, Oregon.

In the Klamath Falls area, 18 earthquakes were located in the first quarter of 2002. Since 1994, most earthquakes in the Klamath Falls area have occurred in the aftershock zone of a pair of damaging earthquakes in September, 1993. The 1993 earthquakes were followed by a vigorous aftershock sequence which decreased over time.

WESTERN WASHINGTON SEISMICITY

During the first quarter of 2002, 219 earthquakes were located between 45.5° and 49.5° north latitude and between 121° and 125.3° west longitude. Four earthquakes were felt this quarter in western Washington. Details are in Table 3A.

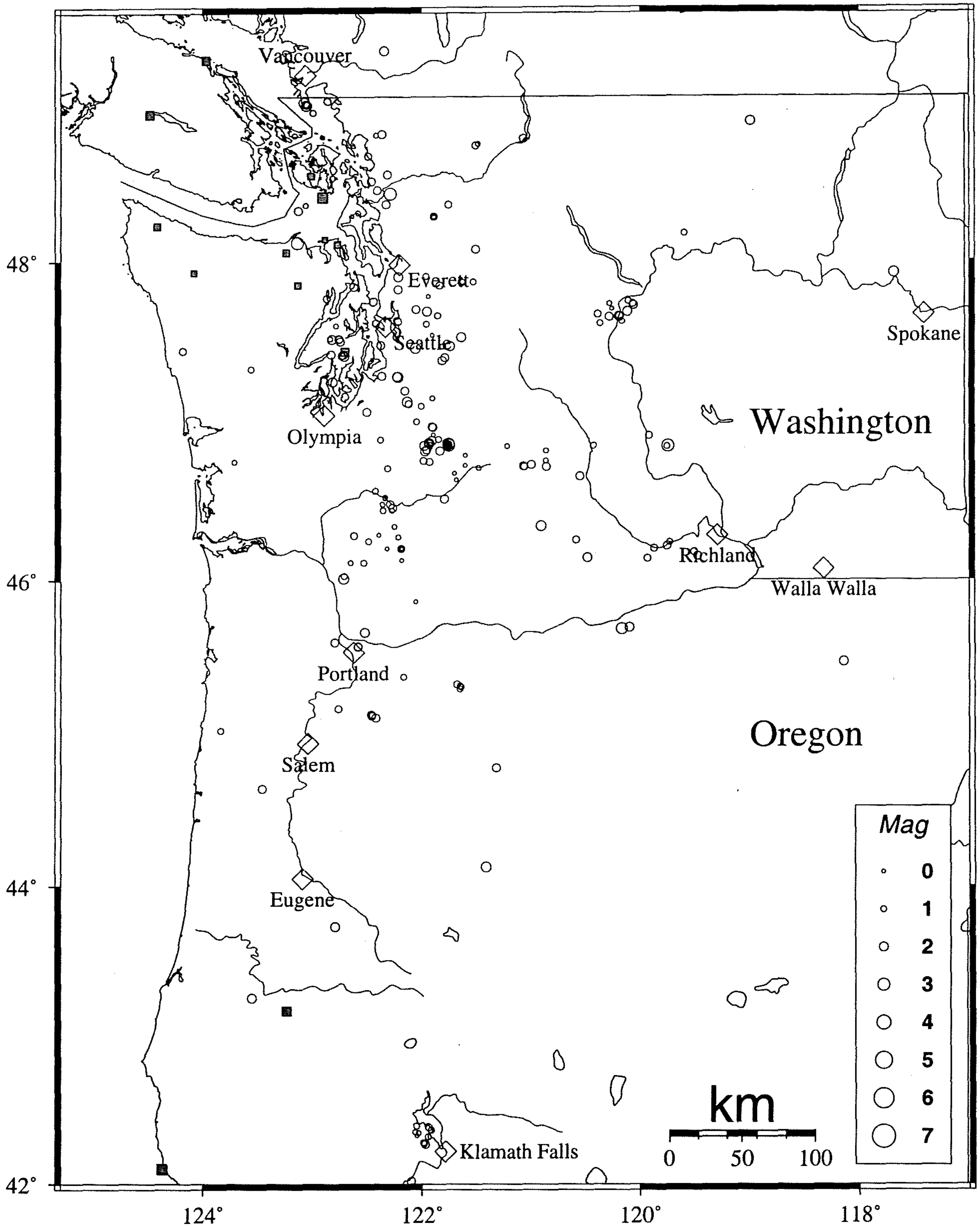

Figure 2. Located earthquakes, magnitude > 0, 1st quarter, 2002. Filled squares indicate earthquakes with depth greater than 30km. Unfilled diamonds represent cities.

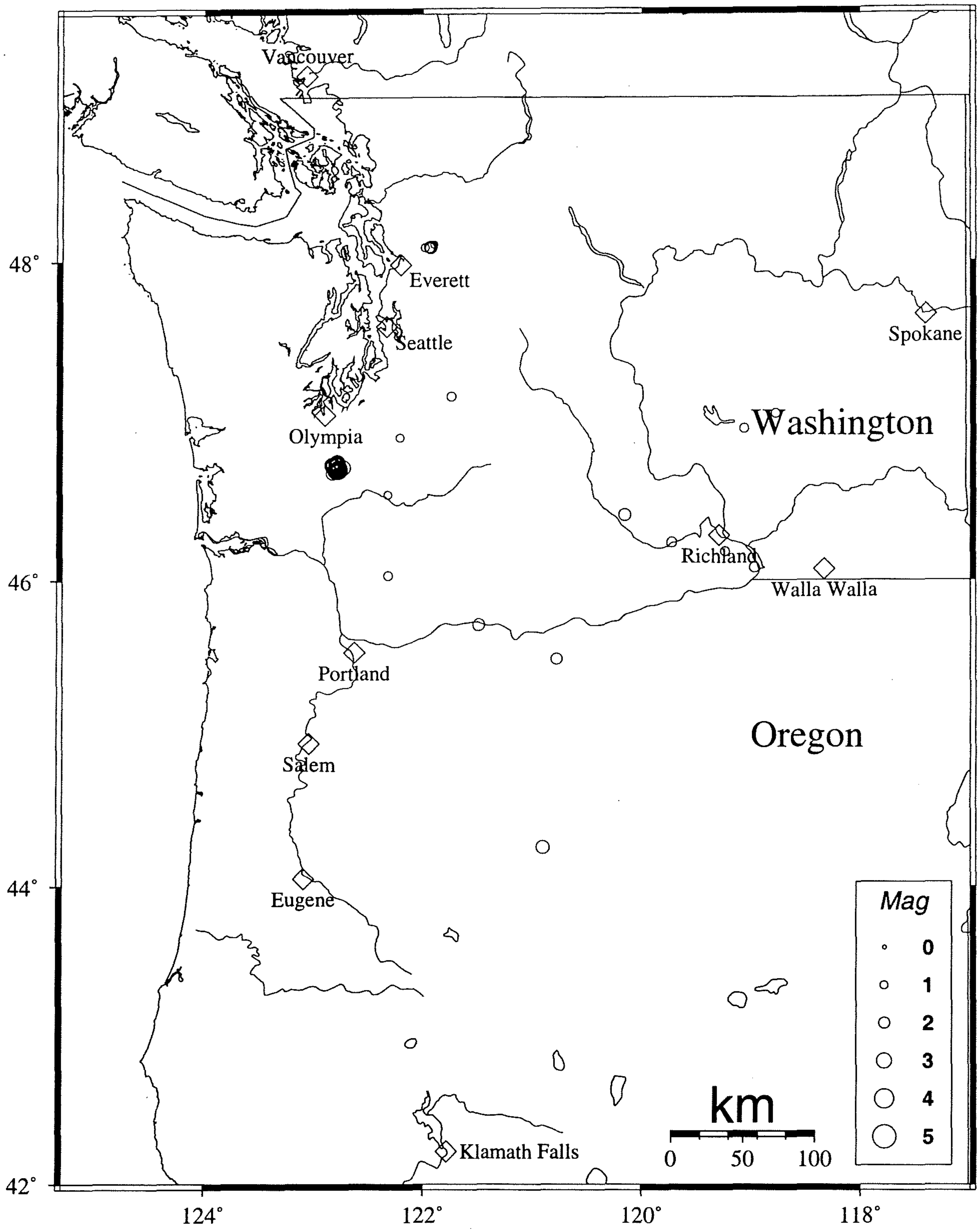

Figure 3. Blasts and probable blasts, 1st quarter, 2002. Unfilled diamonds represent cities.

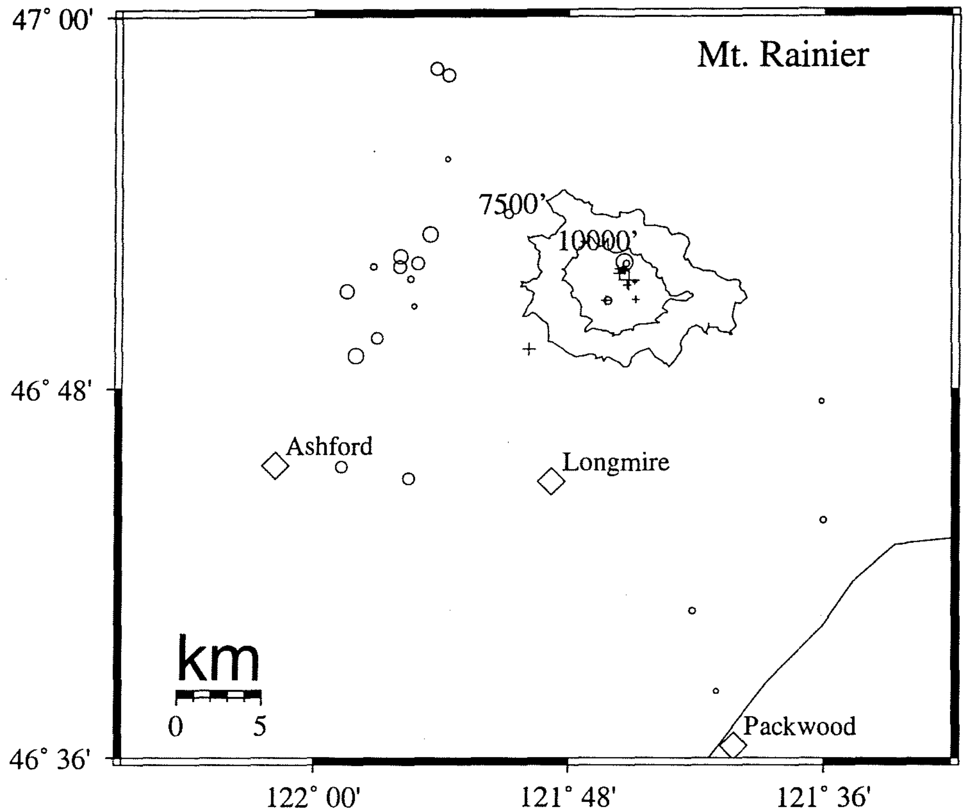

Figure 4. Earthquakes M > 0, 1st quarter, 2002. 'Plus' symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

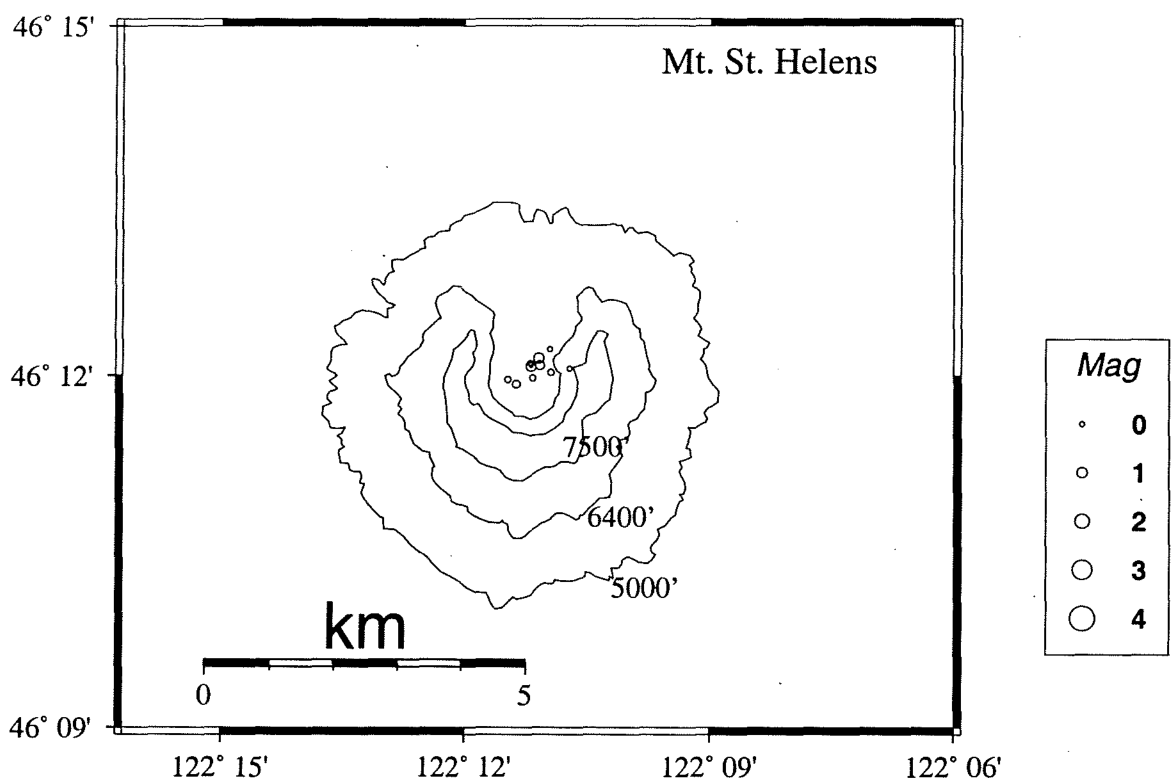

Figure 5. Earthquakes M > 0, 1st quarter, 2002. 'Plus' symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

The largest felt earthquake in western Washington was a magnitude 3.0 earthquake about 4 km east of Mount Vernon. It located at a depth of about 19 km. The deepest quake in westen Washington was a magnitude 1.0 earthquake at about 54 km, located about 42 km north-northwest of Poulsbo, WA.

CASCADE VOLCANOS

Mount Rainier Area: Figure 4 shows earthquakes near 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). There were no events flagged "L" or "S" located at Mount Rainier this quarter although 9 "L" or "S" events were recorded, but were too small to locate reliably. Type L and S events are not shown in Fig. 4.

A total of 49 tectonic events (14 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 3.2 earthquake on February 19 at 18:42 UTC, located about 0.8 km north-east of the summit at a very shallow depth (<1km). This quarter, 27 of the 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 degrees north latitude and 121.83-122 west longitude). Within 5 km of the summit, there were 16 (3 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 seen in Fig. 4.

Mount St. Helens Area: Figure 5 shows volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown.

This quarter, 44 earthquakes were located at Mount St. Helens in the area shown in Fig. 5. Of these earthquakes, 11 were magnitude 0.0 or larger and 5 were deeper than 4 km. The largest tectonic earthquake at Mount St. Helens this quarter was a magnitude 1.1 event on January 16 UTC located 0.5 km NE of Mount St. Helens at about 2 km depth.

No type "S" or "L" events were located at Mount St. Helens, and 15 "L" or "S" events too small to locate were recorded.

EASTERN WASHINGTON SEISMICITY

During the first quarter of 2002, 38 earthquakes were located in eastern Washington in the area between 45.5-49.5 degrees north latitude and 117-121 degrees west longitude. Activity in the Spokane area, discussed at length in the last two quarterlies, was quiet in the first quarter of 2002. Only one very small (M -0.7), but felt, quake was located in downtown Spokane. The largest earthquake in eastern Washington this quarter was magnitude 2.9. It had a depth of about 2 km, and was located 22 km east-southeast of Vantage.

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. The "Outreach Activities" section describes how to access PNSN data via e-mail, Internet, and World-Wide-Web. To request additional information by e-mail, contact seis_info@ess.washington.edu.

Earthquake information in the quarterlies has been published in final form by the Washington State Department of Natural Resources as information circulars entitled "Earthquake Hypocenters in Washington and Northern Oregon" covering the period 1970-1989 (see circulars Nos. 53, 56, 64-66, 72, 79, 82-84, and 89). These circulars, plus circular No. 85, "Washington State Earthquake Hazards", are available from Washington Dept. of Natural Resources, Division of Geology and Earth Resources, Post Office Box 47007, Olympia, WA. 98504-7007, or by telephone at (360) 902-1450.

Several excellent maps of Pacific Northwest seismicity are available. A very colorful perspective-view map (18" x 27") entitled "Major Earthquakes of the Pacific Northwest" depicts selected epicenters of strong earthquakes (magnitudes > 5.1) that have occurred in the Pacific Northwest. A more detailed full-color map is called "Earthquakes in Washington and Oregon 1872-1993", by Susan Goter (USGS Open-File Report 94-226A). It is accompanied by a companion pamphlet "Washington and Oregon Earthquake History and Hazards", by Yelin, Tarr, Michael, and Weaver (USGS Open-File Report 94-226B). The pamphlet is also available separately. Maps can be ordered from: "Earthquake Maps", U.S. Geological Survey, Box 25046, Federal Center, MS 967, Denver, CO 80225, phone (303) 273-8477. The price of each map is $12. (including US shipping and handling).

USGS Cascades Volcano Observatory has a video, "Perilous Beauty: The Hidden Dangers of Mount Rainier", about the risk of lahars from Mount Rainier. Copies are available through: North west Interpretive Association (NWIA), 909 First Avenue Suite 630, Seattle WA 98104, Telephon e: (206) 220-4141, Fax: (206) 220-4143.

Other regional agencies provide earthquake information. These include the Geological Survey of Canada (Pacific Geoscience Centre, Sidney, B.C.; (250) 363-6500, FAX (250) 363-6565), which produces monthly summaries of Canadian earthquakes; the US Geological Survey which produces weekly reports called "Seismicity Reports for Northern California" (USGS, attn: Steve Walter, 345 Middlefield Rd, MS-977, Menlo Park, CA, 94025) and "Weekly Earthquake Report for Southern California" (USGS, attn: Dr. Kate Hutton or Dr. Lucy Jones, CalTech, Pasadena, CA.).

Key to Earthquake Catalog in Table 4

TIME Origin 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.

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

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

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 fixed.

MAG Coda-length magnitude M_c, an estimate of local magnitude M_L (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). Where blank, data were insufficient for a reliable magnitude determination. Normally, the only earthquakes with undetermined magnitudes are very small ones. Magnitudes 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 are 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 (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.

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 USGS 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, i.e. number of stations, their azimuthal distribution, and the minimum distance (**DMIN**) from the epicenter to a station. Quality **A** requires a solution with 8 or more phases, **GAP** ≤ 90° and **DMIN** ≤ (5 km or depth, whichever is greater). If the number of phases, **NP**, is 5 or fewer or **GAP** > 180° or **DMIN** > 50 km the solution is assigned quality **D.**

MOD The crustal velocity model 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

TYP Events flagged in Table 4 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

TABLE 4

Tectonic Earthquakes, Magnitude 2.0 or larger, First Quarter, 2002.
Within an area 42-49.5 degrees north latitude and 117-125.3 degrees west longitude.

Jan 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
9	03:26:54.88	48 06.93	123 07.79	21.82	2.9	49/050	102	0.20	BB	P3	F
17	21:32:06.89	43 43.95	122 47.46	1.09	2.1	8/008	102	0.15	AC	O0	
18	22:06:06.13	44 07.55	121 24.77	2.95*	2.4	4/004	147	0.09	AD	O0	
19	02:49:21.42	48 58.07	123 03.97	17.28	2.4	14/014	238	0.09	AD	P3	
23	22:54:34.40	45 41.82	120 05.83	1.49	2.1	6/006	155	0.33	CC	E3	
26	01:21:22.32	45 28.32	118 08.54	8.49#	2.0	6/006	338	0.11	BD	O0	
26	14:01:46.49	47 07.83	122 07.94	8.51	2.4	38/039	37	0.21	BB	P3	F
28	01:57:09.08	47 31.17	122 49.08	19.39	2.1	32/032	103	0.20	BB	P3	
30	04:13:13.47	47 41.42	121 56.82	25.97	2.1	28/029	46	0.18	BA	P3	
31	12:42:24.36	46 49.06	121 58.03	6.92	2.1	20/022	69	0.10	AC	C3	
31	21:26:15.13	47 39.65	120 11.51	0.58	2.1	16/018	107	0.25	BC	N3	
31	23:07:28.38	45 41.10	120 09.96	3.84$	2.7	10/010	114	0.28	DC	E3	

Feb 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
3	06:46:14.26	42 06.26	124 22.48	31.76	2.4	10/011	213	0.31	CD	K3	
12	19:16:41.41	48 24.80	122 17.14	18.63#	3.0	56/056	64	0.34	CA	P3	F
13	07:15:45.90	46 00.42	122 42.89	19.04	2.2	35/040	48	0.20	BA	C3	
19	18:07:20.68	46 52.09	121 45.35	1.39*	2.5	40/040	41	0.37	CA	C3	
19	18:42:29.10	46 51.51	121 45.17	0.02*	3.2	46/046	37	0.37	CA	C3	
21	09:48:37.01	46 08.61	120 28.99	16.76*	2.0	23/024	106	0.28	BB	E3	
23	14:28:55.99	48 56.87	123 03.07	16.76*	2.3	25/026	226	0.30	BD	P3	
25	13:18:44.07	46 20.73	120 54.41	0.03*	2.2	9/010	122	0.32	CC	C3	
28	17:07:34.33	48 23.58	122 54.27	49.38	2.3	31/031	60	0.23	BA	P3	

Mar 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	09:50:37.21	47 54.35	122 12.70	21.30	2.0	13/017	75	0.18	BA	P3	
4	10:49:11.40	46 53.00	121 54.47	11.67	2.1	31/032	52	0.15	BA	C3	
11	02:48:45.92	46 51.03	119 44.59	2.28	2.9	25/025	41	0.16	BC	E3	
13	19:53:31.85	47 55.55	117 40.58	17.92$	2.2	13/013	146	2.25	DC	N3	
23	22:22:24.71	45 39.74	122 31.06	18.45	2.1	24/026	72	0.23	BA	C3	
24	11:05:12.26	47 27.71	122 03.19	19.79*	2.3	59/065	28	0.22	BA	P3	
25	16:10:59.77	47 41.38	120 06.68	6.45	2.0	19/024	97	0.28	BB	N3	
26	12:34:02.81	47 17.12	122 12.95	18.06	2.4	67/073	31	0.25	BA	P3	
26	12:37:10.53	47 17.34	122 13.54	18.18	2.1	33/035	47	0.14	AA	P3	

OUTREACH ACTIVITIES

The PNSN Seismology Lab staff provides an educational outreach program to better inform the public, educators, businesses, policy makers, and the emergency management community about seismicity and geologic hazards. Our outreach includes lab tours, lectures, classes and workshops, press conferences, TV and radio news programs and talk shows, field trips, and participation in regional earthquake planning efforts. We provide basic information through information sheets, an audio library, and the Internet on the World-Wide-Web (WWW): http://www.ess.washington.edu/SEIS/PNSN.

Telephone, Mail, and On-line outreach:

The PNSN audio library system received about 325 calls this quarter. Our audio library provides several recordings, a frequently updated message on current seismic activity. In addition we have a tape describing the seismic hazards in Washington and Oregon, and another on earthquake prediction.

Callers often request our one-page information and resource sheet on seismic hazards in Washington and Oregon. Thousands of these have been mailed out or distributed, and we encourage others to reproduce and further distribute this sheet. Our information sheet discussing earthquake prediction is also frequently requested. Callers to the audio library can also choose to be transferred to the Seismology Lab, where additional information is available. This quarter we responded in person to:

- 30 calls from emergency managers and government,
- 50 calls from the media,
- 30 calls from k-12 educators
- 50 from within the UW
- 20 calls from the business community
- 65 calls from the general public.

Internet outreach:

PNSN Seismic Analyst Amy Wright and other PNSN staff responded to over 325 e-mail messages from the public seeking information on a variety of topics. In addition to routine questions, complex questions sometimes require in depth responses are handled by the appropriate staff person. These replies include providing assistance with hazard assessments, consultations with government agencies, and providing strong motion data and related information to the engineering community.

The PNSN web site offers many web pages, including maps and lists of the most recent PNW earthquakes, general information on earthquakes and PNW earthquake hazards, information on past damaging PNW earthquakes, and catalogs of earthquake summary cards. Web pages on seismicity of Cascade Volcanos, and Quarterly summaries of seismicity are also included. The PNSN recent earthquake list is available through the World-Wide-Web (WWW) at: http://www.ess.washington.edu/recenteqs/

"Webicorder" pages show continuous data from PNSN seismographic stations: http://www.ess.washington.edu/SEIS/PNSN/WEBICORDER/. "ShakeMap" shows maps of instrumentally measured shaking. Table 3A indicates which events this quarter generated ShakeMaps. Shake Maps: http://www.ess.washington.edu/shake/index.html

Table 3A also indicates the felt events this quarter that generated Community Internet Intensity Maps (CIIM). CIIM maps are made using Internet reports. For a well-felt event hundreds (or thousands) of people fill out an on-line form describing their experiences during the earthquake. These "felt" reports are converted into numeric intensity values, and the CIIM map shows the average intensity by zip code. CIIM Maps: http://pasadena.wr.usgs.gov/shake/pnw/

In addition to the PNSN web site, the UW Dept. of Earth and Space Sciences and the PNSN host several other earthquake-related web sites:

- **Volcano Systems Center**, http://www.vsc.washington.edu is a cooperative effort of the UW and the USGS that links volcano-related activities of the UW Dept. of Earth and Space Sciences and Oceanography departments with related USGS activities.
- **Seismosurfing:** http://www.ess.washington.edu/seismosurfing.html is a comprehensive listing of sites worldwide that offer substantive seismology data and information. This page is mirrored at two sites in Europe.
- **The Council of the National Seismic Systems (CNSS):** http://www.cnss.org features composite listings and maps of recent U.S. earthquakes, and documentation of the EARTHWORM system.

- **"Tsunami!"** http://www.ess.washington.edu/tsunami offers many pages, including an excellent discussion on the physics of tsunamis, and short movie clips. Benjamin Cook developed it under the direction of Dr. Catherine Petroff (UW Civil Engineering).
- **The UW Dept. of Earth and Space Sciences Global Positioning System (GPS):** http://www.ess.washington.edu/GPS/gps.html site provides information on geodetic studies of crustal deformation in Washington and Oregon.

The PNSN Web Site design committee led by Ruth Ludwin has met twice this quarter to make progress in redesigning and reorganizing the PNSN Web Site. The new design, when completed later this year, will be easier to navigate through and offer standard "ANSS Products" in a manner similar to what the USGS is offering in other regions.

K-12 Education Outreach:

PNSN staff provided 24 Seismology Lab tours and presentations for K-12 students and teachers serving 475 people this quarter.

Amy Lindemuth continued to work with a team (four) of local educators on content for an upcoming web area dedicated to seismology related educational material. In addition, Amy has established an e-mail distribution list for educators intended to provide updates on local seismicity, new educational resources available from the PNSN website, and UW seismology lab activities.

Bill Steele met with John Tabor, E&O director for the IRIS Consortium to discuss possible collaborative projects. Bill Steele also represented the PNSN at the EarthScope E&O planning conference at the National Center for Atmospheric Research in Boulder, Colorado, Jan 30th – Feb. 1st.

Special Events:

This quarter was a very active one for PNSN outreach activities. The most time consuming of these was the media work in preparation for the **February 28th anniversary of the Nisqually Earthquake**. Each TV station in the Seattle region requested help and interviews in the development of their anniversary stories. The print media began development of their stories in early January and required interviews, referrals and a lot of help in the creation of unique graphics to accompany the stories. The Seattle Post Intelligencer ran stories related to the Nisqually Earthquake and earthquake hazards on no fewer than 15 pages through the week, many of those full-page spreads. USGS, UW, and WADNR scientists all contributed greatly to this media education effort as did PNSN engineering partners, CREW, and various Project Impact Community partners. Coverage of the anniversary extended into the Eastern Washington and Portland area media markets and to a lesser degree, the national media.

The Burke Museum exhibit, **"The Big One, Earthquakes in the Pacific Northwest"** that has been in development for the past year, opened on February 28th. The PNSN invited many partner organizations to a Gala Preview Reception the evening of February 27th and Bill Steele opened the Museum the next morning at 7:00 AM for more media interviews and to prepare for the Grand Opening Ceremony that occurred at 9:00 AM with FEMA Region X Director, John Pennington cutting the ribbon. PNSN Research Assistant, John Patrick Luethe continues to work for the Burke Museum providing demonstrations on weekends with funding from the Pacific Earthquake Engineering Research Center (PEER).

The PNSN's Bill Steele organized the **Seattle SHIPS** (Seismic Hazards in Puget Sound) press conference and assisted the experiments lead scientists Tom Pratt and Tom Brocher of the USGS, to manage media relations. Tom Pratt, USGS Seattle Field Office, presided over the press conference on January 25th announcing the Seattle SHIPS passive ground motion amplification experiment being deployed that week. North Seattle Community College President, Dr. Ron LaFayette, generously donated space to stage and operate the experiment from his campus. He welcomed the TV, radio, and print media reporters to the conference and said that NSCC was very happy to partner with the USGS and UW to assist in this experiment and looked forward to closer ties between students and scientists from each institution.

Professor Hiro Kanamori of Cal Tech gave a well attended public evening lecture entitled **"The Inevitable Uncertainty of Earthquakes"** sponsored by the Mindlin Foundation and UW. Members of CREW, CPARM, various Project Impact committees, and emergency managers were invited to the lecture and preceding reception at the Burke Museum. The Burke Museum, Civil Engineering Department, and the Department of Earth and Space Sciences joined the Mindlin Foundation in sponsoring the events. Dr. Kanamori maintained a tight schedule during his visit, meeting with various research groups of students and faculty and with CREW directors to discuss hazard mitigation and the promise of "early warning". Dr Kanamori also addressed Earth and Space Sciences faculty and students during the weekly seminar.

Meetings and Presentations:

Bill Steele gave a seminar at the **Forest Service Research Center** in Olympia and an evening public lecture at the **Burke Museum** entitled "Pacific Northwest Earthquake Hazards, the Nisqually Quake was Not the Big One."

The **Arcs Foundation** that provides scholarships for graduate students in the sciences, held their quarterly meeting here hosted by Earth and Space Sciences and the PNSN. Steve Malone, Guy Medema, and George Thomas gave talks and demonstrations to this enthusiastic group.

Dr. Tony Qamar chairs the Technology, Information, and Communications Sub-Committee of the **Washington Seismic Safety Committee** and organized a March 28th meeting of this group at UW. Tony also attended a meeting of the Lifelines Sub-committee on March 12th. Tony also attended the annual PANGA meeting held at the new offices of the Cascades Volcano Observatory in Vancouver, Washington on Jan. 30-31. Dr. Qamar worked with Chris Stephens of the USGS to compile a database of all strong ground motion recordings of the Nisqually Earthquake.

Dr. Steve Malone made a presentation to the **Washington State Seismic Safety Committee** Feb 7th, on current PNSN capabilities, the future with ANSS, and the PNSN's need for state support. Stephen Malone also delivered scientific talks this quarter on magma recharge at quiescent volcanos to the **Northwest Geological Society** and at a seminar for the **Cascade Volcano Observatory** (CVO). Steve continued to actively advance development of the **ANSS** (Advanced National Seismic System) **Pacific Northwest Region** through a series of activities spanning the quarter including:

- A Jan 7th Presentation to the **Oregon Seismic Safety Policy Advisory Commission** on the state of seismic monitoring in Oregon, development of a strong motion monitoring partnership with Oregon, and how these early collaborations can develop with additional congressional support for the ANSS and enhanced State of Oregon participation.
- A Jan 17 Presentation and meeting with the **Idaho Bureau of Disaster Services** and other earthquake hazard groups in Boise, ID on the operation of the PNSN and the future with ANSS.
- Mar 18 Hosted the **PNW-ANSS Advisory Committee** at UW to develop 2002 strong motion instrument siting plans, receive reports from national steering committee meetings, and from the COSMOS meeting. Also discussed were the efforts to obtain some base level of support from Washington and Oregon State who currently do not contribute to PNSN activities.

Ruth Ludwin gave a number of talks related to her research on PNW Native American stories related to earthquakes and tsunamis to:

- **Quileute Tribal Council**, La Push, Jan 31st
- **Makah Tribe and US Coast Guard**, Neah Bay, Feb 1st
- **Columbia History of Science Group**, Friday Harbor, March 1st
- **The Geologic Survey of Canada** at the Pacific Geoscience Centre, Sidney, B.C., March 4th
- **State/Local Tsunami Working Group** - WA State Emergency Management - Camp Murray (Contact with Elwha Klallam Tribe), March 15th
- **George Wright Society/National Parks Service Resource Managers**, at the Burke Museum, March 20th

The PNSN remains an active participant in a number of organizations whose goals and objectives are complementary to the PNSN mission to reduce loss of life and property due to earthquakes. Bill Steele serves on the Board of Directors of the Cascade Region Earthquake Workgroup (**CREW**), Contingency Planners and Recovery Managers (**CPARM**), serves as an advisor to a number of Project Impact Communities and renewed his membership in the **Washington State Emergency Management Association**. Bill also served on the **UW Disaster Resistant University Project** (UWDRU) this quarter and has reviewed the HIVA (Hazard Identification and Vulnerability Assessment) drafted by UWDRU staff.

QUARTERLY NETWORK REPORT 2002-B
on
Seismicity of Washington and Oregon

April 1 through June 30, 2002

Pacific Northwest Seismograph Network
Dept. of Earth and Space Sciences
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Seattle, Washington 98195-1310

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 01-HQ-AG-0011

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 2002 from the University of Washington Dept. of Earth and Space Sciences *Pacific Northwest Seismograph Network* (PNSN), 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 catalog is available on-line, both through our web-site and through the CNSS 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.

NETWORK OPERATIONS

Figure 1A shows a map view of stations operating during the quarter. Figure 1B is a more detailed view of stations in the Puget Sound area. 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.

Strong Motion Instrumentation and Recording Update

A third K2 purchased by DOGAMI was installed this quarter at station BEND, located in the University of Oregon Chandler Field Office in Bend, Oregon. The station has both the Kinemetrics Episensor strong motion accelerometer as well as a vertical Springnether S13 short period sensor. Data are digitized at the site and transmitted to UW via the internet.

Ongoing activities in Oregon include site selection for FY2003 ANSS stations. ANSS stations will be using new hardware: the Guralp CMG5 strong motion seismograph. Since the CMG5 is Internet enabled, all FY2003 ANSS stations will utilize Internet telemetry. The CMG5 seismographs were received this quarter, and are being tested. UW strong motion staff, along with technical staff from other regional networks, attended a Guralp training session hosted by the University of Nevada, Reno.

Station NIHS was installed in Kenmore, Washington, at Inglemoor High School in the Northshore School District, in early June. This station is a replacement for CSEN which was removed for building renovation.

Internet telemetry was established at ANSS station KDK. KDK, located in downtown Seattle near the former King Dome, was formerly occupied by the USGS Seattle Strong Motion Array. Attempts will be made in the future to install real-time PNSN stations at locations vacated by the USGS Array.

CREST Instrument Update

The Bonneville Power Administration (BPA) has provided telemetry for four CREST stations at BPA power substations near the coast (3 along the Oregon coast, and one in southwestern Washington). All four stations were installed in October 2001. We are now receiving data for all four of the sites, TAKO, TOLO, and MEGW, and HEBO. HEBO began transmitting data on April 25, 2002.

Data Recording and EARTHWORM Update

This quarter, *scossa* remained our main EARTHWORM computer, with *milli* serving as our primary backup and *verme* as the secondary backup. *Milli* and *verme* still serve as the principal computers for data acquisition for many of the digital stations. We are currently running EARTHWORM-V5.1.

Our new Intel-based EARTHWORM digitizer, *pigia*, running under Windows NT, is the primary digitizer for *verme* while *waggles* remained the primary digitizer for *scossa* and *milli*. Continuing problems with pigia mean that we can not yet count on this system for more than secondary backup. A failure of our

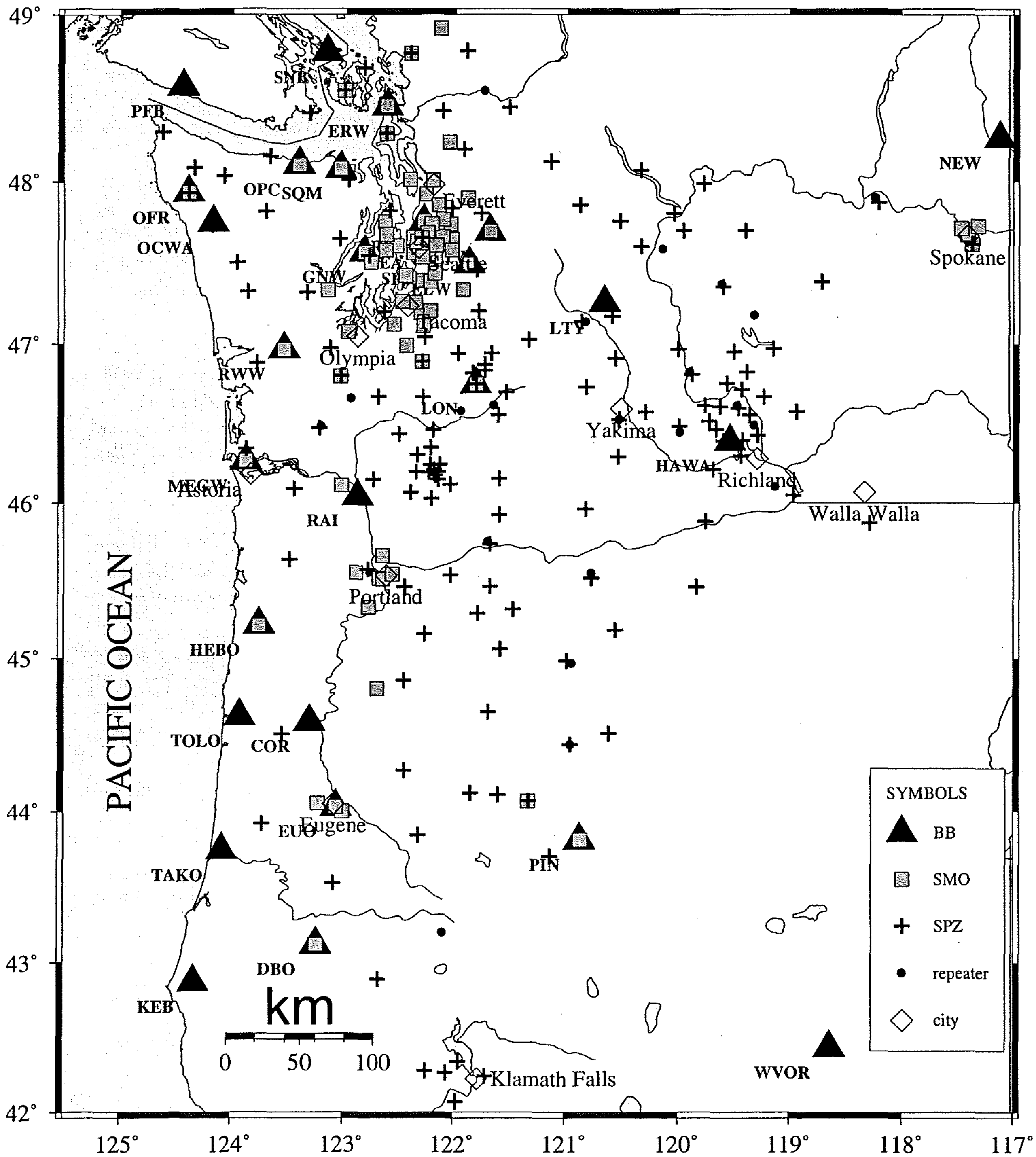


Figure 1A. Stations operating at the end of 2nd quarter, 2002. Stations shown are short period vertical (SP), 3-component broadband (BB), or strong motion (SMO).

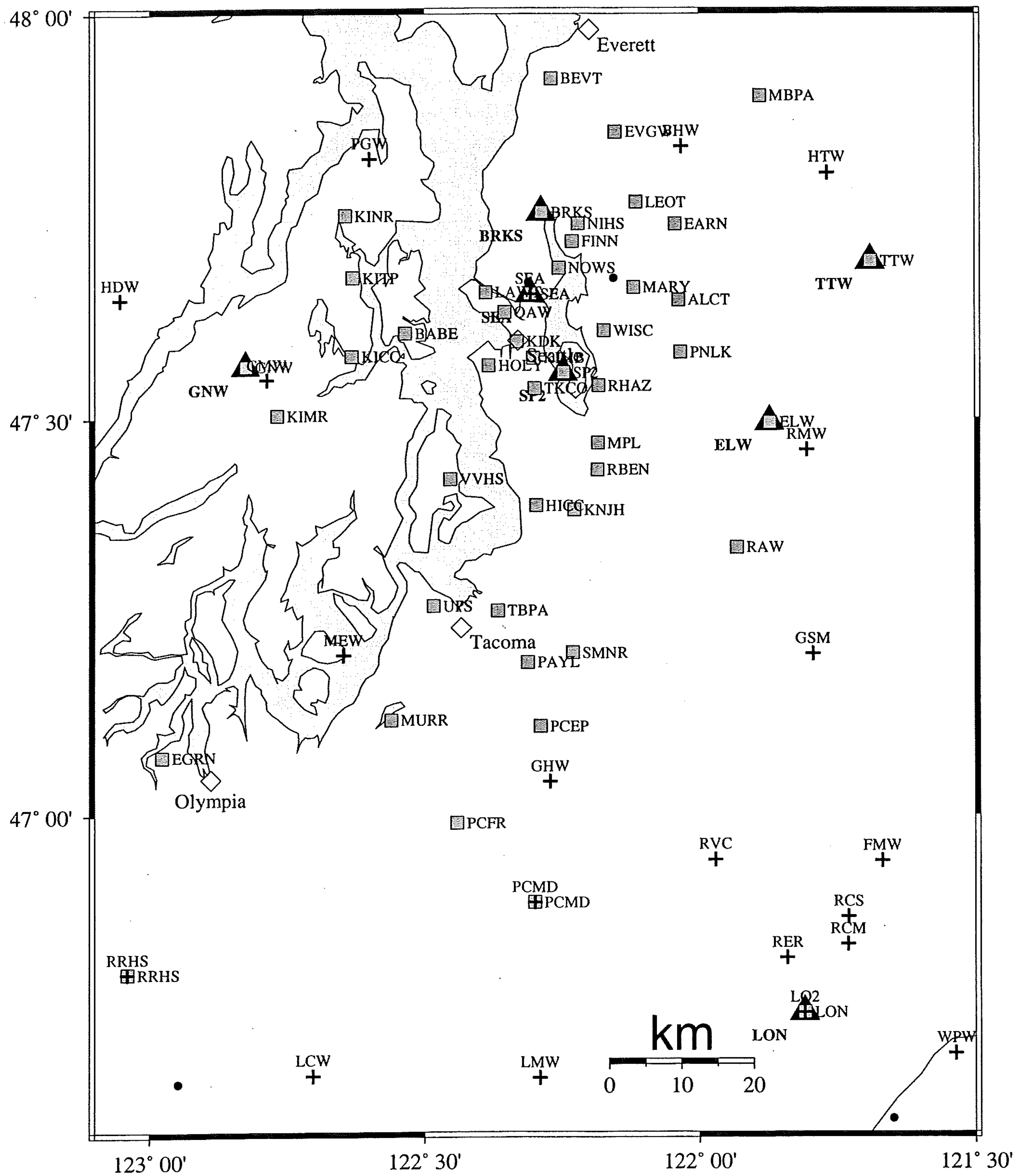


Figure 1B. Stations operating at the end of 2nd quarter, 2002. Detail of Figure 1A.

primary GPS locking clock in June required that we improvise an emergency alternative until the clock could be repaired at the factory. Only a few small earthquakes were recorded during the few hours while time was not highly accurate. However, all trace data exported to other networks had incorrect time (as much as 2 seconds error) until the primary clock was returned, because the NT-digitizer can only use this clock's IRIG-E signal to determine time.

TABLE 1
Station Outages, Repairs, and Installations 2nd quarter 2002

Station	Outage Dates	Comments
BBO	06/06/02	Seismometer replaced
BEND	04/11/02	Installed
BOW	12/01/00-06/02/02	Seismometer & VCO replaced
BRO	05/21/02-05/30/02	Qwest line down
BRO	06/12/02	New radio installed
CDF	12/13/01-04/29/02	Dead
CSEN	02/13/02-End	Removed (Replaced by NIHS)
FMW	02/20/02-End	Dead, possible bad receiver
GSM	06/21/02	Seismometer leads changed
HBO	02/09/02-06/28/02	Installed new antenna & battery
HEBO	10/01/01-04/25/02	No telemetry
HSO	05/21/02-05/30/02	Qwest line down
KDK	09/27/01-05/15/02	No GPS or telemetry
KIMB	06/19/02-End	K2 removed for repair
LCW	12/12/01-05/29/02	Dead
LVP	01/29/02-06/21/02	Station destroyed by snow, rebuilt
MPO	01/19/02-06/05/02	Noisy, not recording events
MURR	09/21/00-End	No telemetry
NCO	11/07/01-End	Noisy, not recording events
NIHS	06/03/02	Installed-SMO (replaced CSEN)
OBH	01/31/02-End	Temp. removed for logging
OFR.BH?	10/18/01-End	Bad timing (no GPS)
OFR.HH?	10/18/01-End	Bad timing (no GPS)
PGW	12/22/2001-06/28/02	Replaced aircells & VCO
RCM	08/20/01-End	Seismically dead
RCS	10/11/01-05/27/02	Running on solar power, off at night
RNO	05/21/02-05/30/02	Qwest line down
RNO	06/13/02	New radio installed
RWW	04/15/02-04/25/02	No telemetry, remote modem replaced
SHW	05/20/02-End	Noisy
SLF	11/20/01-05/07/02	Dead for winter
SP2	08/19/01-End	No GPS
VBE	04/29/02-06/30/02	Dead, battery replaced
VG2	06/29/02	Seismometer replaced
VTH	06/05/02	VCO changed
WPW	05/15/01-End	Dead
WRW	11/20/01-05/07/02	Dead for winter

STATIONS USED FOR LOCATION OF EVENTS

Table 2A lists short-period, mostly vertical-component stations used in locating seismic events in Washington and Oregon. The first column in the table gives the 3-letter station designator, followed by a symbol designating the funding agency; stations marked by a percent sign (%) were supported by USGS joint operating agreement 01-HQ-AG-0011. A plus (+) indicates support under Pacific Northwest National Laboratory, Battelle contract 259116-A-B3. Stations designated "#" are USGS-maintained stations recorded at the PNSN. Stations designated by letters are operated by other networks, and telemetered to the PNSN. "M" stations are received from the Montana Bureau of Mines and Geology, "C" stations from the Canadian Pacific Geoscience Center, "U" stations from the US Geological Survey (usually USNSN stations), "N" stations from the USGS Northern California Network, and "H" stations from the Hanford Reservation via the Pacific Northwest National Labs. Other designation indicate support from other sources. Additional columns give station north latitude and west longitude (in degrees, minutes and seconds), station elevation in km, and comments indicating landmarks for which stations were named.

Table 2B lists broad-band stations used in locating seismic events in Washington and Oregon, and Table 2C lists strong-motion stations.

TABLE 2A - Short-period Stations operating during the second quarter 2002

STA	F	LAT	LONG	EL	NAME
ASR	%	46 09 09.9	121 36 01.6	1.357	Mt. Adams - Stagman Ridge
AUG	%	45 44 10.0	121 40 50.0	0.865	Augspurger Mtn
BBO	%	42 53 12.6	122 40 46.6	1.671	Butler Butte, Oregon
BEN	1	46 31 12.0	119 43 18.0	0.335	W PNNL station
BEND	%	44 04 00.8	121 19 36.0	-	UO Bend Office, DOGAMI SMO
BHW	%	47 50 12.6	122 01 55.8	0.198	Bald Hill
BLN	%	48 00 26.5	122 58 18.6	0.585	Blyn Mt.
BOW	%	46 28 30.0	123 13 41.0	0.870	Boistfort Mt.
BPO	%	44 39 06.9	121 41 19.2	1.957	Bald Peter, Oregon
BRO	%	44 16 02.5	122 27 07.1	0.135	Big Rock Lookout, Oregon
BRV	+	46 29 07.2	119 59 28.2	0.920	Black Rock Valley
BSMT	M	47 51 04.8	114 47 13.2	1.950	Bassoo Peak, MT
BUO	%	42 16 42.5	122 14 43.1	1.797	Burton Butte, Oregon
BVW	+	46 48 39.5	119 52 56.4	0.670	Beverly
CBS	+	47 48 17.4	120 02 30.0	1.067	Chelan Butte, South
CDF	%	46 07 01.4	122 02 42.1	0.756	Cedar Flats
CHMT	M	46 54 51.0	113 15 07.0	-	Chamberlain Mtn, MT
CMM	%	46 26 07.0	122 30 21.0	0.620	Crazy Man Mt.
CMW	%	48 25 25.3	122 07 08.4	1.190	Cultus Mtns.
CPW	%	46 58 25.8	123 08 10.8	0.792	Capitol Peak
CRF		46 49 30.0	119 23 13.2	0.189	orfu
DPW	+	47 52 14.3	118 12 10.2	0.892	Davenport
DY2	+	47 59 06.6	119 46 16.8	0.890	Dyer Hill 2
EDM	%	46 11 50.4	122 09 00.0	1.609	East Dome, Mt. St. Helens
ELK	%	46 18 20.0	122 20 27.0	1.270	Elk Rock
ELL	+	46 54 34.8	120 33 58.8	0.789	Ellensburg
EPH	+	47 21 22.8	119 35 45.6	0.661	Ephrata
ET3	+	46 34 38.4	118 56 15.0	0.286	Eltopia (replaces ET2)
ETW	+	47 36 15.6	120 19 56.4	1.477	Entiat
FHE	+	46 57 06.9	119 29 49.0	0.455	Frenchman Hills East
FL2	%	46 11 47.0	122 21 01.0	1.378	Flat Top 2
FMW	%	46 56 29.6	121 40 11.3	1.859	Mt. Fremont
GBB	H	46 36 31.8	119 37 40.2	0.185	PNNL Station
GBL	+	46 35 54.0	119 27 35.4	0.330	Gable Mountain
GHW	%	47 02 30.0	122 16 21.0	0.268	Garrison Hill
GL2	+	45 57 35.0	120 49 22.5	1.000	New Goldendale
GLK	%	46 33 27.6	121 36 34.3	1.305	Glacier Lake
GMO	%	44 26 20.8	120 57 22.3	1.689	Grizzly Mountain, Oregon
GMW	%	47 32 52.5	122 47 10.8	0.506	Gold Mt.
GPW	%	48 07 05.0	121 08 12.0	2.354	Glacier Peak
GSM	%	47 12 11.4	121 47 40.2	1.305	Grass Mt.
GUL	%	45 55 27.0	121 35 44.0	1.189	Guler Mt.
H2O	H	46 23 44.5	119 25 22.7	0.175	Water PNNL Station
HAM	%	42 04 08.3	121 58 16.0	1.999	Hamaker Mt., Oregon
HBO	%	43 50 39.5	122 19 11.9	1.615	Huckleberry Mt., Oregon
HDW	%	47 38 54.6	123 03 15.2	1.006	Hoodsport
HOG	%	42 14 32.7	121 42 20.5	1.887	Hogback Mtn., Oregon
HSO	%	43 31 33.0	123 05 24.0	1.020	Harness Mountain, Oregon
HSR	%	46 10 28.0	122 10 46.0	1.720	South Ridge, Mt. St. Helens
HTW	%	47 48 14.2	121 46 03.5	0.833	Haystack Lookout
HUO	%	44 07 10.9	121 50 53.5	2.037	Husband OR (UO)
JBO	+	45 27 41.7	119 50 13.3	0.645	Jordan Butte, Oregon
JCW	%	48 11 42.7	121 55 31.1	0.792	Jim Creek
JUN	%	46 08 50.0	122 09 04.4	1.049	June Lake
KMO	%	45 38 07.8	123 29 22.2	0.975	Kings Mt., Oregon
KOS	%	46 27 46.7	122 11 41.3	0.610	Kosmos
KTR	N	41 54 31.2	123 22 35.4	1.378	CAL-NET
LAB	%	42 16 03.3	122 03 48.7	1.774	Little Aspen Butte, Oregon
LAM	N	41 36 35.2	122 37 32.1	1.769	CAL-NET
LCCM	M	45 50 16.8	111 52 40.8	1.669	Lewis and Clark Caverns, MT
LCW	%	46 40 14.4	122 42 02.8	0.396	Lucas Creek
LMW	%	46 40 04.8	122 17 28.8	1.195	Ladd Mt.
LNO	+	45 52 18.6	118 17 06.6	0.771	Lincton Mt., Oregon
LO2	%	46 45 00.0	121 48 36.0	0.853	Longmire
LOC	+	46 43 01.2	119 25 51.0	0.210	Locke Island
LVP	%	46 03 59.4	122 24 10.2	1.134	Lakeview Peak
MBW	%	48 47 02.4	121 53 58.8	1.676	Mt. Baker
MCMT	M	44 49 39.6	112 50 55.8	2.323	McKenzie Canyon, MT
MCW	%	48 40 46.8	122 49 56.4	0.693	Mt. Constitution
MDW	+	46 36 47.4	119 45 39.6	0.330	Midway
MEW	%	47 12 07.0	122 38 45.0	0.097	McNeil Island
MJ2	+	46 33 27.0	119 21 32.4	0.146	May Junction 2
MOX	+	46 34 38.4	120 17 53.4	0.501	Moxie City
MPO	%	44 30 17.4	123 33 00.6	1.249	Mary's Peak, Oregon
MTM	%	46 01 31.8	122 12 42.0	1.121	Mt. Mitchell
NAC	+	46 43 59.4	120 49 25.2	0.728	Naches
NCO	%	43 42 14.4	121 08 18.0	1.908	Newberry Crater, Oregon
NEL	+	48 04 12.6	120 20 24.6	1.500	Nelson Butte
NLO	%	46 05 21.9	123 27 01.8	0.826	Nicolai Mt., Oregon
OBC	%	48 02 07.1	124 04 39.0	0.938	Olympics - Bonidu Creek
OBH	%	47 19 34.5	123 51 57.0	0.383	Olympics - Burnt Hill
OCP	%	48 17 53.5	124 37 30.0	0.487	Olympics - Cheeka Peak
OD2	+	47 23 15.6	118 42 34.8	0.553	Odessa site 2
OFR	%	47 56 00.0	124 23 41.0	0.152	Olympics - Forest Resource Cen
ON2	%	46 52 50.8	123 46 51.8	0.257	Olympics - North River
OOW	%	47 44 03.6	124 11 10.2	0.561	Octopus West
OSD	%	47 48 59.2	123 42 13.7	2.008	Olympics - Snow Dome
OSR	%	47 30 20.3	123 57 42.0	0.815	Olympics Salmon Ridge

Table 2A, continued

STA	F	LAT	LONG	EL	NAME
OT3	+	46 40 08.4	119 13 58.8	0.322	New Othello
OTR	%	48 05 00.0	124 20 39.0	0.712	Olympics - Tyee Ridge
PAT	+	45 52 55.2	119 45 08.4	0.262	Paterson
PCMD	%	46 53 20.9	122 18 00.9	0.239	PC Mountain Detachment ANSS-SM
PGO	%	45 27 42.6	122 27 11.5	0.253	Gresham, Oregon
PGW	%	47 49 18.8	122 35 57.7	0.122	Port Gamble
PRO	+	46 12 45.6	119 41 08.4	0.553	Prosser
RCM	%	46 50 08.9	121 43 54.4	3.085	Mt. Rainier, Camp Muir
RCS	%	46 52 15.6	121 43 52.0	2.877	Mt. Rainier, Camp Schurman
RED	H	46 17 51.0	119 26 15.6	0.330	Red Mountain PNNL Station
RER	%	46 49 09.2	121 50 27.3	1.756	Mt. Rainier, Emerald Ridge
RMW	%	47 27 35.0	121 48 19.2	1.024	Rattlesnake Mt. (West)
RNO	%	43 54 58.9	123 43 25.5	0.850	Roman Nose, Oregon
RPW	%	48 26 54.0	121 30 49.0	0.850	Rockport
RRHS	%	46 47 58.6	123 02 25.4	0.047	Rochester HS ANSS-SMO
RSW	+	46 23 40.2	119 35 28.8	1.045	Rattlesnake Mt. (East)
RVC	%	46 56 34.5	121 58 17.3	1.000	Mt. Rainier - Voight Creek
RVN	%	47 01 38.6	121 20 11.9	1.885	Raven Roost (former NEHRP temp)
RVW	%	46 08 53.2	122 44 32.1	0.460	Rose Valley
SAW	+	47 42 06.0	119 24 01.8	0.701	St. Andrews
SBES	%	48 46 05.9	122 24 54.2	0.119	Silver Beach ES SMO
SEA	%	47 39 15.8	122 18 29.3	0.030	UW, Seattle (Wood Anderson BB)
SEP	#	46 12 00.7	122 11 28.1	2.116	September lobe, Mt. St. Helens
SFER	%	47 37 10.4	117 21 55.7	0.715	Spokane-Ferris High School
SHW	%	46 11 37.1	122 14 06.5	1.425	Mt. St. Helens
SLF	%	47 45 32.0	120 31 40.0	1.750	Sugar Loaf
SMW	%	47 19 10.7	123 20 35.4	0.877	South Mtn.
SNI	H	46 27 50.4	119 39 35.1	0.323	Snively PNNL station
SOS	%	46 14 38.5	122 08 12.0	1.270	Source of Smith Creek
SSO	%	44 51 21.6	122 27 37.8	1.242	Sweet Springs, Oregon
STD	%	46 14 16.0	122 13 21.9	1.268	Studebaker Ridge
STW	%	48 09 03.1	123 40 11.1	0.308	Striped Peak
SVOH	%	48 17 21.8	122 37 54.8	0.022	Skagit Valley CC ANSS-SMO
TBM	+	47 10 12.0	120 35 52.8	1.006	Table Mt.
TCO	%	44 06 27.6	121 36 02.1	1.975	Three Creek Meadows, Oregon.
TDH	%	45 17 23.4	121 47 25.2	1.541	Tom,Dick,Harry Mt., Oregon
TDL	%	46 21 03.0	122 12 57.0	1.400	Tradedollar Lake
TRW	+	46 17 32.0	120 32 31.0	0.723	Toppenish Ridge
TWW	+	47 08 17.4	120 52 06.0	1.027	Teanaway
UWFH	%	48 32 46.0	123 00 43.0	0.010	UW Friday Harbor ANSS-SMO
VBE	%	45 03 37.2	121 35 12.6	1.544	Beaver Butte, Oregon
VCR	%	44 58 58.2	120 59 17.4	1.015	Criterion Ridge, Oregon
VDB	C	49 01 34.0	122 06 10.1	0.404	Canada
VFP	%	45 19 05.0	121 27 54.3	1.716	Flag Point, Oregon
VG2	%	45 09 20.0	122 16 15.0	0.823	Goat Mt., Oregon
VGB	+	45 30 56.4	120 46 39.0	0.729	Gordon Butte, Oregon
VGZ	C	48 24 50.0	123 19 27.8	0.067	Canada
VIP	%	44 30 29.4	120 37 07.8	1.731	Ingram Pt., Oregon
VLL	%	45 27 48.0	121 40 45.0	1.195	Laurance Lk., Oregon
VLM	%	45 32 18.6	122 02 21.0	1.150	Little Larch, Oregon
VSP	%	42 20 30.0	121 57 00.0	1.539	Spence Mtn, Oregon
VT2	+	46 58 02.4	119 59 57.0	1.270	Vantage2
VTH	%	45 10 52.2	120 33 40.8	0.773	The Trough, Oregon
WA2	+	46 45 19.2	119 33 56.4	0.244	Wahluke Slope
WAT	+	47 41 55.2	119 57 14.4	0.821	Waterville
WIB	%	46 20 34.8	123 52 30.6	0.503	Willapa Bay
WIW	+	46 25 45.6	119 17 15.6	0.128	Wooded Island
WPO	%	45 34 24.0	122 47 22.4	0.334	West Portland, Oregon
WPW	%	46 41 55.7	121 32 10.1	1.280	White Pass
WRD	+	46 58 12.0	119 08 41.4	0.375	Warden
WRW	%	47 51 26.0	120 52 52.0	1.189	Wenatchee Ridge
YA2	+	46 31 36.0	120 31 48.0	0.652	Yakima
YEL	#	46 12 35.0	122 11 16.0	1.750	Yellow Rock, Mt. St. Helens
YPT	+	46 02 55.8	118 57 44.0	0.325	Yellepit

TABLE 2B

Broad-band three-component stations operating at the end of the second quarter 2002. Symbols are as in Table 2A.

STA	F	LAT	LONG	EL	NAME
BRKS	%	47 45 19.1	122 17 17.9	0.020	Brookside ANSS-SMO
COR	U	44 35 08.5	123 18 11.5	0.121	Corvallis, Oregon (OSU BB)
DBO	%	43 07 09.0	123 14 34.0	0.984	Dodson Butte, Oregon (UO CREST)
ELW	%	47 29 39.4	121 52 17.2	0.267	EchoLakeBPA BB-SMO-IDS20
ERW	%	48 27 14.4	122 37 30.2	0.389	Mt. Erie SMO-IDS24 BB
EUO	%	44 01 45.7	123 04 08.2	0.160	Eugene,OR U0 CREST BB SMO
GNW	%	47 33 51.8	122 49 31.0	0.165	Green Mt CREST BB SMO
HAWA	U	46 23 32.3	119 31 57.2	0.367	Hanford Nike USNSN BB
HEBO	%	45 12 49.2	123 45 15.0	0.875	Mt. Hebo, OR CREST BB SMO
HLID	U	43 33 45.0	114 24 49.3	1.772	Hailey, ID USNSN BB
KEB	N	42 52 20.0	124 20 03.0	0.818	Edson Butte, OR CREST BB
KRMB	N	41 31 23.0	123 54 29.0	1.265	Red Mtn, OR CREST BB
KSXB	N	41 49 51.0	123 52 33.0	-	Camp Six, OR CREST BB
LON	%	46 45 00.0	121 48 36.0	0.853	Longmire CREST BB LONLZ SMO
LTY	%	47 15 21.2	120 39 53.3	0.970	Liberty (BB)
MEGW	%	46 15 57.4	123 52 38.2	0.332	Megler, WA CREST BB SMO
NEW	U	48 15 50.0	117 07 13.0	0.760	Newport Observatory USNSN BB

Table 2B, continued

STA	F	LAT	LONG	EL	NAME
OCWA	U	47 44 56.0	124 10 41.2	0.671	Octopus Mtn. USNSN BB
OFR	%	47 56 00.0	124 23 41.0	0.152	Olympics - Forest Resource Center
OPC	%	48 06 01.0	123 24 41.8	0.090	Olympic Penn College CREST BB
PFB	C	48 34 30.0	124 26 39.8	0.465	P.Renfrew, Canada
PIN	%	43 48 40.0	120 52 19.0	1.865	Pine Mt., Oregon (U0 CREST, BB)
PNT	C	49 18 57.6	119 36 57.6	0.550	Canada, BB
RAI		46 02 25.1	122 53 06.4	1.520	Trojan Plant, Oregon (OSU BB)
RWW	%	46 57 53.7	123 32 31.7	0.015	Ranney Well CREST BB SMO
SEA	%	47 39 15.8	122 18 29.3	0.030	UW, Seattle (Wood Anderson BB)
SNB	C	48 46 33.6	123 10 16.3	0.408	Canada BB
SP2	%	47 33 23.3	122 14 52.8	0.030	Seward Park, Seattle SMO-IDS24
SQM	%	48 04 39.0	123 02 44.0	0.030	Sequim, WA (CREST BB SMO)
TAKO	%	43 44 36.0	124 04 56.0	0.100	Tahkenitch, OR CREST BB SMO
TOLO	%	44 37 19.0	123 55 21.0	0.100	Toledo BPA, OR CREST BB SMO
TTW	%	47 41 40.7	121 41 20.0	0.542	Tolt Res, WA CREST BB SMO
WVOR	U	42 26 02.0	118 38 13.0	1.344	Wildhorse Valley, Oregon (USNS)

Table 2C lists strong-motion, three-component stations operating in Washington and Oregon that provide data in real or near-real time to the PNSN. Several of these stations also have broad-band instruments, as noted. The "SENSOR" field designates what type of seismic sensor is used;

- A = Terra-Tech SSA-320 SLN triaxial accelerometer/Terra-Tech IDS24
- A20 = Terra-Tech SSA-320 triaxial accelerometer/Terra-Tech IDS20 recording system,
- FBA23 = Kinemetrics FBA23 accelerometers and Reftek recording system,
- EPI = Kinemetrics Episensor accelerometers and Reftek recording system.
- BB = Guralp CMG-40T 3-D broadband velocity sensor.
- BB3 = Guralp CMG3T 3-D broadband velocity sensor.
- BBZ = Broad Band sensor, PMD 2024, vertical component only.
- K2 = Kinemetrics Episensor accelerometers and K2 Recording System

The "TELEMETRY" field indicates the type of telemetry used to recover the data.

- D = dial-up,
- E = continuously telemetered via Internet from a remote EARTHWORM system
- I = continuously telemetered via Internet,
- L = continuously telemetered via dedicated lease-line telephone lines,
- L-PPP = continuously telemetered via dedicated lease-line telephone lines using PPP protocol
- M = continuously telemetered via BPA microwave
- R = continuously telemetered via spread-spectrum radio

TABLE 2C

Strong-motion three-component stations operating at the end of the second quarter 2002. Symbols are as in Table 2A.

STA	F	LAT	LONG	EL	NAME	SENSORS	TELEMETRY
ALCT	%	47 38 48.8	122 2 15.7	0.055	Alcott Elementary	K2	I
ALST	%	46 6 32.3	123 1 58.5	0.198	Alston	A20	E,M
ALVY	%	43 59 53.2	123 0 57.0	0.155	Alvey	K2	E,M
ATES	%	48 14 10.9	122 3 33.0	0.062	Trafton Elementary	K2	I
BABE	%	47 36 21.0	122 32 7.0	0.083	Blakely Elementary	K2	I
BEND	%	44 4 0.8	121 19 36.0	0.000	U of O Bend Field Office	K2	I
BEVT	%	47 55 12.0	122 16 12.0	0.170	Boeing Plant Everett	K2	I
BRKS	%	47 45 19.1	122 17 17.9	0.020	Brookside Elementary	K2,BBZ	I
CSO	#	45 31 1.0	122 41 22.5	0.036	Canyon	FBA23	D
DBO	%	43 7 9.0	123 14 34.0	0.984	Dodson Butte (CREST)	EPI,BB3	E,L-PPP
EARN	%	47 44 27.2	122 2 37.7	0.159	East Ridge Elementary	K2	I
EGRN	%	47 4 24.0	122 58 41.0	0.057	Evergreen State College	K2	I
ELW	%	47 29 39.4	121 52 17.2	0.267	Echo Lake	A,BB	D,M,L
ERW	%	48 27 14.4	122 37 30.2	0.389	Mount Erie	A,BB	D,L,M
EUO	%	44 1 45.7	123 4 8.2	0.160	Eugene Golf Course (CREST)	EPI,BB	E,L-PPP
EVCC	%	48 0 27.0	122 12 15.3	0.000	Everett Community College	K2	I
EVGW	%	47 51 15.8	122 9 12.2	0.010	Gateway Middle School	K2	I
FINN	%	47 43 10.2	122 13 55.9	0.121	Finn Hill Junior High	K2	I
GNW	%	47 33 51.8	122 49 31.0	0.165	Green Mountain (CREST)	EPI,BB3	L-PPP
HAO	#	45 30 33.1	122 39 24.0	0.018	Harrison	FBA23	D
HEBO	%	45 12 49.2	123 45 15.0	0.875	Mt. Hebo (CREST)	EPI,BB	M,E
HICC	%	47 23 24.4	122 17 52.4	0.115	Highline Community College	K2	I
HOLY	%	47 33 55.4	122 23 1.0	0.106	Holy Rosary School	K2	I
KDK	%	47 35 42.7	122 19 56.0	0.004	King Dome	K2	I
KEEL	%	45 33 0.8	122 53 42.4	0.067	Keeler	A20	D,E,M
KICC	%	47 34 37.9	122 37 52.4	0.017	Kitsap County Central Communications	K2	I
KIMB	%	47 34 29.3	122 18 10.1	0.069	Kimball Elementary	K2	I
KIMR	%	47 30 11.0	122 46 2.0	0.123	Moderate Risk Waste Collection Facility	K2	I

Table 2C, continued

STA	F	LAT	LONG	EL	NAME	SENSORS	TELEMETRY
KINR	%	47 45 6.0	122 38 35.0	0.008	North Road Shed	K2	I
KITP	%	47 40 30.0	122 37 47.0	0.076	Wastewater Treatment Plant	K2	I
KNJH	%	47 23 5.0	122 13 42.0	0.014	Kent Junior High	K2	I
LANE	%	44 3 6.5	123 13 54.8	0.120	Lane	K2	E,M
LAWT	%	47 39 23.4	122 23 21.9	0.050	Lawton Elementary	A20	I
LEOT	%	47 46 4.4	122 6 56.2	0.115	Leota Junior High	K2	I
LON	%	46 45 0.0	121 48 36.0	0.853	Longmire Springs (CREST)	EPI,BB3	L-PPP
LTY	%	47 15 21.2	120 39 53.4	0.970	Liberty Heights Mine (CREST)	BB3	I
MARY	%	47 39 45.7	122 7 11.6	0.011	Marymoor Park	K2	I
MBKE	%	48 55 2.0	122 8 29.0	1.010	Kendall Elementary	K2	I
MBPA	%	47 53 54.7	121 53 20.2	0.186	Monroe	A20	D,M,L
MEGW	%	46 15 57.4	123 52 38.2	0.332	Megler (CREST)	EPI,BB	M,E
MPL	%	47 28 7.0	122 11 4.5	0.122	Maple Valley	A	D,M,L
MRIN	%	44 48 1.4	122 41 53.8	0.187	Marion	K2	M,E
MURR	%	47 7 12.0	122 33 36.0	0.082	Camp Murray	K2	None
NIHS	%	47 44 29.2	122 13 17.1	0.137	Inglemoore High School	K2	I
NOWS	%	47 41 12.0	122 15 21.2	0.002	NOAA Sand Point	A20	I
OHC	%	47 20 2.0	123 9 29.0	0.010	Hood Canal Junior High	K2	I
OPC	%	48 6 1.0	123 24 41.8	0.090	Peninsula College (CREST)	EPI,BB	I
PAYL	%	47 11 34.0	122 18 46.0	0.010	Aylen Junior High	K2	I
PCEP	%	47 6 41.8	122 17 24.0	0.160	Puyallup East Sheriff Precinct	K2	I
PCFR	%	46 59 23.3	122 26 27.4	0.137	Roy Training Center	K2	I
PCMD	%	46 53 20.9	122 18 0.9	0.239	Mountain Detachment	K2	I
PERL	%	45 19 42.0	122 46 40.2	0.068	Pearl	K2	M,E
PIN	%	43 48 40.0	120 52 19.0	1.865	Pine Mtn. (CREST)	EPI,BB3	E,L-PPP
PNLK	%	47 34 54.5	122 2 1.0	0.128	Pine Lake Middle School	K2	I
QAW	%	47 37 54.3	122 21 15.5	0.140	Queen Anne	A20	L
RAW	%	47 20 14.0	121 55 53.2	0.208	Raver	A20	M,L
RBEN	%	47 26 6.7	122 11 10.0	0.152	Benson Hill Elementary	K2	I
RBO	#	45 32 27.0	122 33 51.5	0.158	Rocky Butte	FBA23	D
RHAZ	%	47 32 24.7	122 11 1.3	0.108	Hazelwood Elementary	A20	I
ROSS	%	45 39 43.0	122 39 25.0	0.061	Ross	A20	E
RRHS	%	46 47 58.6	123 2 25.4	0.047	Rochester High School	K2	I
RWW	%	46 57 53.7	123 32 31.7	0.015	Ranney Well (CREST)	EPI,BB3	L-PPP
SBES	%	48 46 5.9	122 24 54.2	0.119	Silver Beach Elementary School	K2	I
SEA	%	47 39 15.8	122 18 29.3	0.030	University of Washington	A20,PMD2023	L
SFER	%	47 37 10.4	117 21 55.7	0.715	Ferris High School	K2	I
SGAR	%	47 40 37.8	117 24 50.3	0.579	Garfield Elementary	K2	I
SMNR	%	47 12 16.6	122 13 53.4	0.022	Sumner High School	K2	I
SP2	%	47 33 23.3	122 14 52.8	0.030	Seward Park	A,BB	L
SQM	%	48 4 39.0	123 2 44.0	0.030	Sequim Battelle Properties (CREST)	EPI,BB	I,R
SVOH	%	48 17 21.8	122 37 54.8	0.022	Skagit Valley College Oak Harbor	K2	I
SWES	%	47 42 51.0	117 27 53.2	0.623	Westview Elementary	K2	I
SWID	%	48 0 31.0	122 24 42.0	0.062	South Whidbey Primary School	K2	I
TAKO	%	43 44 36.0	124 4 56.0	0.100	Tahkenitch (CREST)	EPI,BB	M,E
TBPA	%	47 15 29.0	122 22 1.0	0.002	Tacoma	A20	M,L,D
TKCO	%	47 32 12.7	122 18 1.5	0.005	King County Airport	A20	I
TOLO	%	44 37 19.0	123 55 21.0	0.100	Toledo (CREST)	EPI,BB	M,E
TTW	%	47 41 40.7	121 41 20.0	0.542	Tolt Reservoir (CREST)	EPI,BB	I
UPS	%	47 15 50.2	122 29 1.1	0.113	University of Puget Sound	K2	I
UWFH	%	48 32 46.0	123 0 43.0	0.010	Friday Harbor Laboratories	K2	I
VVHS	%	47 25 25.1	122 27 13.1	0.095	Vashon High School	K2	I
WISC	%	47 36 32.0	122 10 27.8	0.056	Wilburton Instructional Services Center	K2	I

EARTHQUAKE DATA - 2002-B

There were 1,520 events digitally recorded and processed at the University of Washington between April 1 and June 30, 2002. Locations in Washington, Oregon, or southernmost British Columbia were determined for 851 of these events; 731 were classified as earthquakes and 120 as known or suspected blasts. The remaining 669 processed events include teleseisms (144 events), regional events outside the PNSN (94), and unlocated events within the PNSN. Unlocated events within the PNSN include very small earthquakes and blasts. Frequent mining blasts occur near Centralia, Washington and we routinely locate them.

Table 3A is a listing of all earthquakes reported to have been felt during this quarter. Events with ShakeMaps or Community Internet Intensity Maps (CIIM) are indicated.

ShakeMap shows instrumentally measured shaking.

Shake Maps: **http://www.ess.washington.edu/shake/index.html**

CIIM maps are made using "felt" reports relayed via Internet. These "felt" reports are converted into numeric intensity values, and the CIIM map shows the average intensity by zip code.

CIIM Maps: **http://pasadena.wr.usgs.gov/shake/pnw/**

Table 3B is a listing of earthquakes magnitude 2.5 or greater with reasonably constrained focal mechanisms from P-wave first motions. Table 4 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.

Fig. 2 shows earthquakes with magnitude greater than or equal to 0.0 ($M_c \geq 0$).

Fig. 3 shows blasts and probable blasts ($M_c \geq 0$).

Fig. 4 shows earthquakes located near Mt. Rainier ($M_c \geq 0$).

Fig. 5 shows earthquakes located at Mt. St. Helens ($M_c \geq 0$).

Fig. 6 shows earthquakes located near Mount Hood ($M_c \geq 0$).

TABLE 3A - Felt Earthquakes during the 2nd Quarter of 2002

DATE-(UTC)-TIME .15	LAT(N)	LON(W)	DEPTH	MAG	COMMENTS	CIIM	ShakeMap
02/04/13 07:18:55	47.67	117.43	1.3	-0.2	1.6 km WNW of Spokane, WA		
02/04/14 15:20:46	47.69	117.39	2.5	-0.9	3.1 km NNE of Spokane, WA		
02/04/21 06:21:18	47.68	117.42	0.3	-0.4	1.8 km NW of Spokane, WA		
02/04/22 10:38:51	47.29	122.29	20.6	2.2	12.1 km ENE of Tacoma, WA		
02/05/01 09:09:45	48.45	119.54	3.7	2.9	10.6 km NNE of Okanogan, WA		
02/05/15 17:54:48	42.23	121.90	8.1	4.3	10.0 km W of Klamath Falls, OR		
02/05/30 01:40:16	48.87	122.20	13.8	1.6	5.9 km NNE of Deming, WA		
02/06/06 14:42:46	47.72	120.28	7.2	3.4	8.1 km NW of Entiat, WA		
02/06/16 17:11:10	47.47	122.82	16.1	3.7	18.2 km SW of Bremerton, WA	x	x
02/06/29 14:36:04	45.33	121.68	6.2	4.5	4.5 km S of Mt Hood, OR	x	
02/06/29 14:41:21	45.32	121.68	2.7	3.2	5.4 km SSE of Mt Hood, OR		
02/06/29 18:49:58	45.34	121.67	6.1	3.8	3.9 km SSE of Mt Hood, OR	x	

TABLE 3B - Earthquakes M 2.5 or larger during the 2nd Quarter of 2002
Focal mechanisms noted where computed. Some earthquakes have more than one possible mechanism.

DATE-(UTC)-TIME yy/mm/dd hh:mm:ss	LAT(N) deg.	LON(W) deg.	DEP km	MAG	COMMENTS	STRIKE deg.	DIP deg.	RAKE deg.
02/04/10 07:38:23	47.67	120.12	0.6	2.9	7.8 km E of Entiat, WA	145	5	-150
						25	55	-50
02/04/12 05:45:12	47.33	123.20	43.5	2.7	39.7 km NW of Olympia, WA	105	75	-60
02/05/01 09:09:45	48.46	119.54	3.7	2.9	10.6 km NNE of Okanogan, WA	65	65	-10
02/05/06 11:21:58	45.33	121.69	5.3	2.8	5.1 km S of Mt Hood, OR	210	85	-50
						0	35	-90
02/05/13 21:00:38	48.40	123.46	42.1	2.7	8.9 km WSW of Victoria, BC	15	70	-171
02/05/15 17:54:48	42.23	121.90	8.1	4.3	10.0 km W of Klamath Falls, OR	105	40	-131
02/05/19 17:05:27	48.30	122.19	13.7	2.7	17.1 km SE of Mount Vernon, WA	120	45	150
02/06/06 14:42:46	47.72	120.29	7.2	3.4	8.1 km NW of Entiat, WA	55	75	100
02/06/16 17:11:10	47.47	122.83	16.1	3.7	18.2 km SW of Bremerton, WA	345	75	80
02/06/29 14:36:04	45.33	121.69	6.2	4.5	4.5 km S of Mt Hood, OR	350	45	-130
02/06/29 14:41:21	45.33	121.68	2.7	3.2	5.4 km SSE of Mt Hood, OR	-	-	-
02/06/29 18:49:58	45.34	121.68	6.1	3.8	3.9 km SSE of Mt Hood, OR	350	45	-100
02/06/29 19:31:57	45.32	121.69	6.2	2.5	6.1 km S of Mt Hood, OR	60	85	10
						155	85	170
02/06/30 11:16:23	45.34	121.68	5.6	2.7	3.7 km SSE of Mt Hood, OR	325	75	-130

OREGON SEISMICITY

During the second quarter of 2002, a total of 190 earthquakes were located in Oregon between 42.0° and 45.5° north latitude, and between 117° and 125° west longitude. The largest earthquake in Oregon this quarter was a magnitude 4.5 earthquake on June 19 located at a depth of ~6 km, about 4.5 km south of Mt. Hood volcano. See the special section below on recent Mount Hood seismicity.

In the Klamath Falls area 39 earthquakes, including the largest shock in the Klamath Falls area since January of 1994, were located this quarter. On May 15, a magnitude 4.3 event was located 10 km west of Klamath Falls at about 8 km depth. Nine smaller shocks, two magnitude 2.0 or larger, were located in the following 48 hours. Since 1994, most earthquakes in the Klamath Falls area have occurred in the

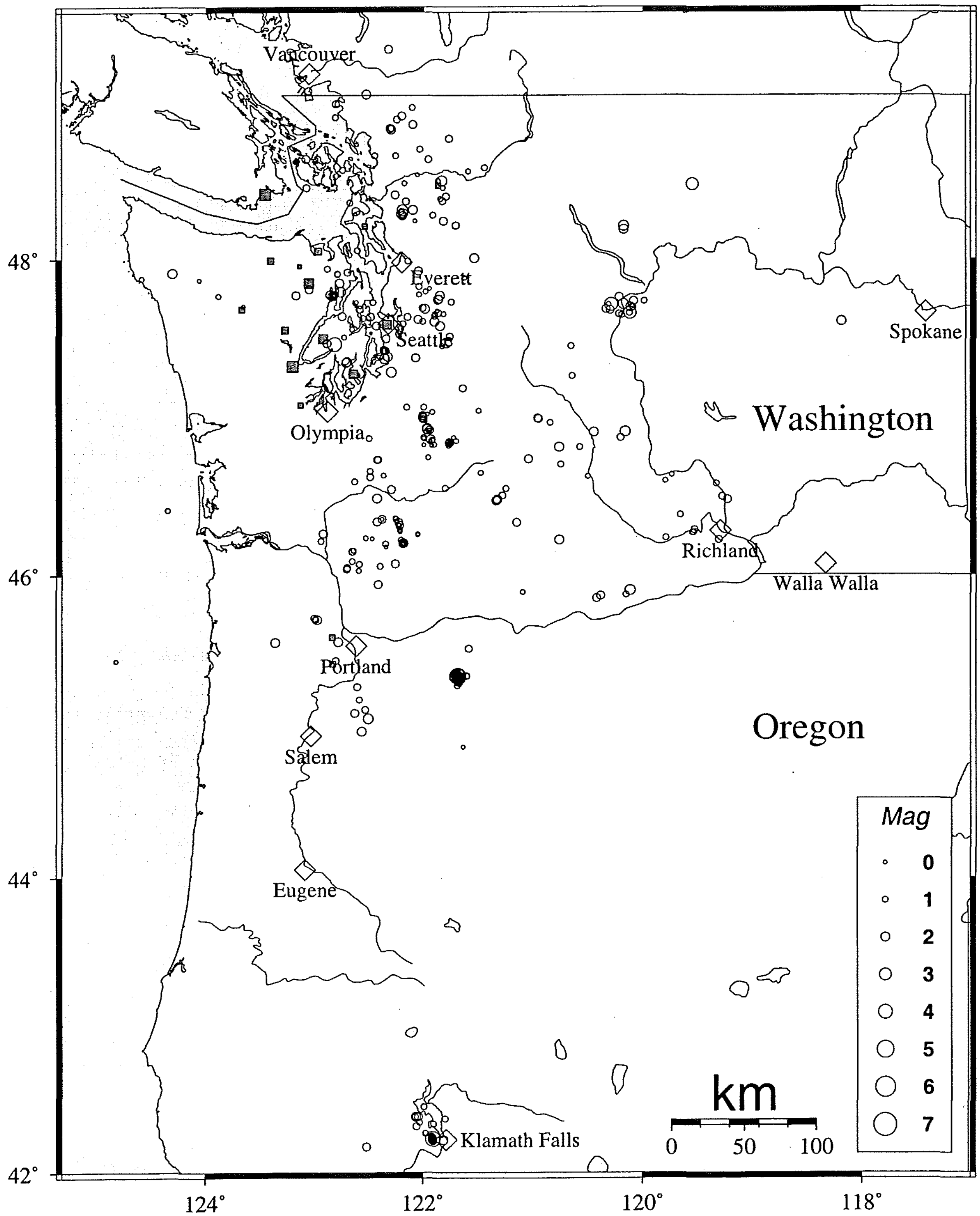


Figure 2. Located earthquakes, magnitude > 0, 2nd quarter, 2002. Filled squares indicate earthquakes with depth greater than 30km. Unfilled diamonds represent cities.

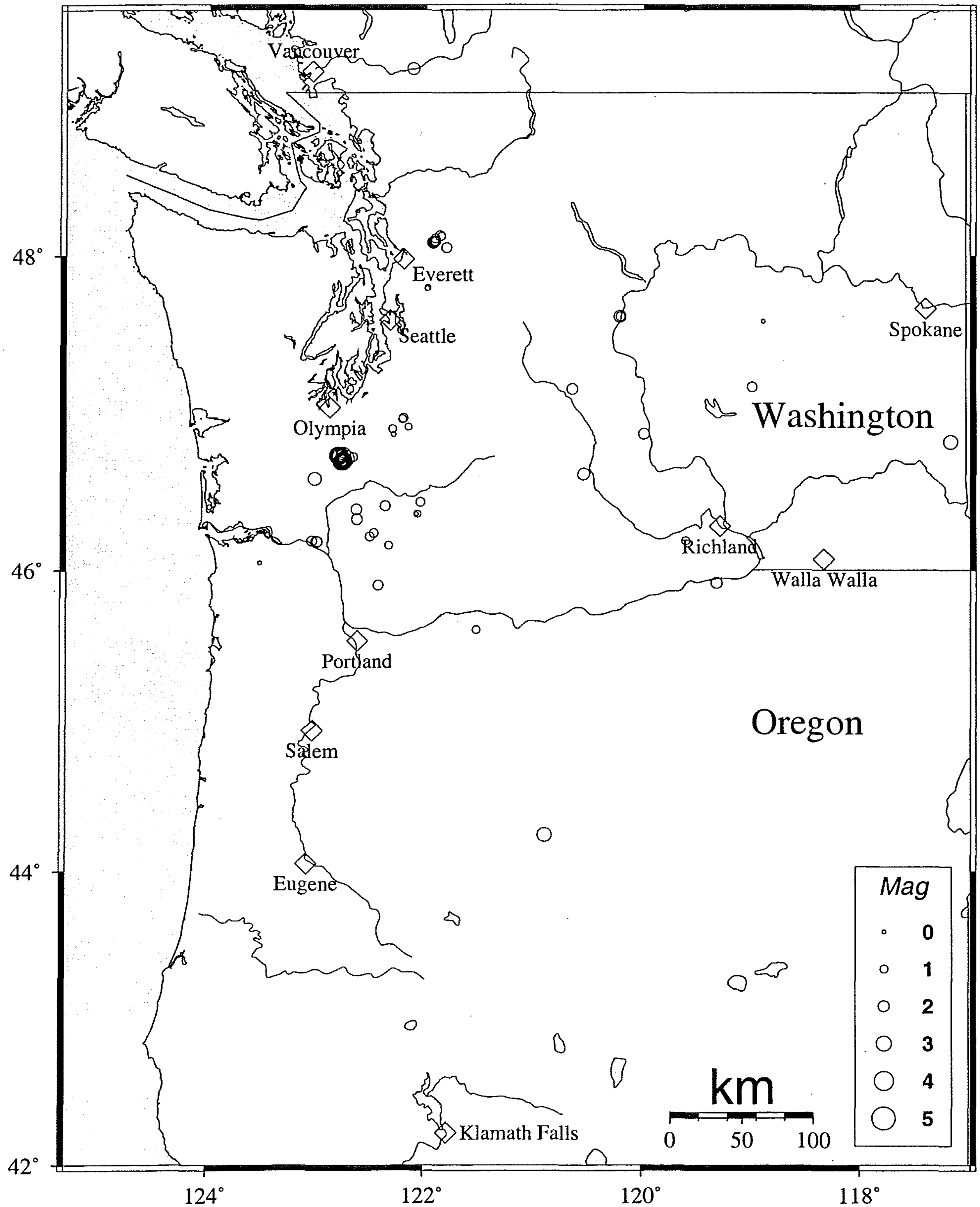


Figure 3. Blasts and probable blasts, 2nd quarter, 2002. Unfilled diamonds represent cities.

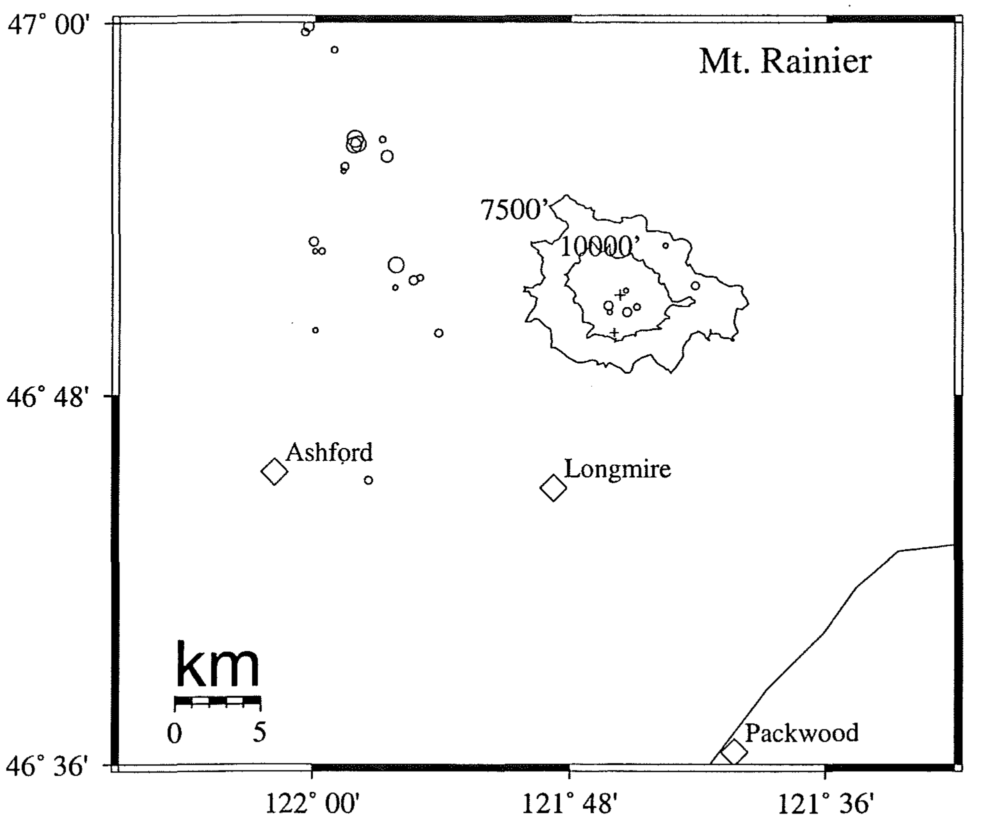


Figure 4. Earthquakes M > 0, 2nd quarter, 2002. 'Plus' symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

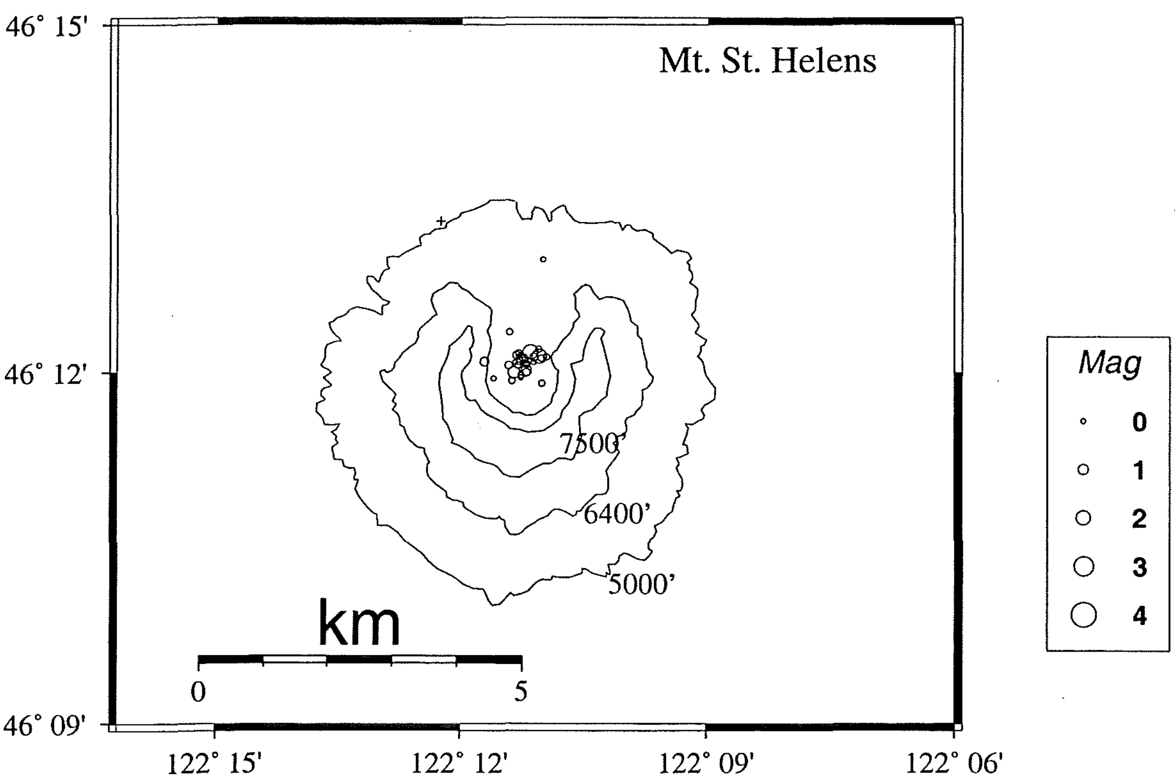


Figure 5. Earthquakes M > 0, 2nd quarter, 2002. 'Plus' symbols indicate depth less than 1 km. Circles indicate depth greater than 1 km. Elevation contours shown in feet.

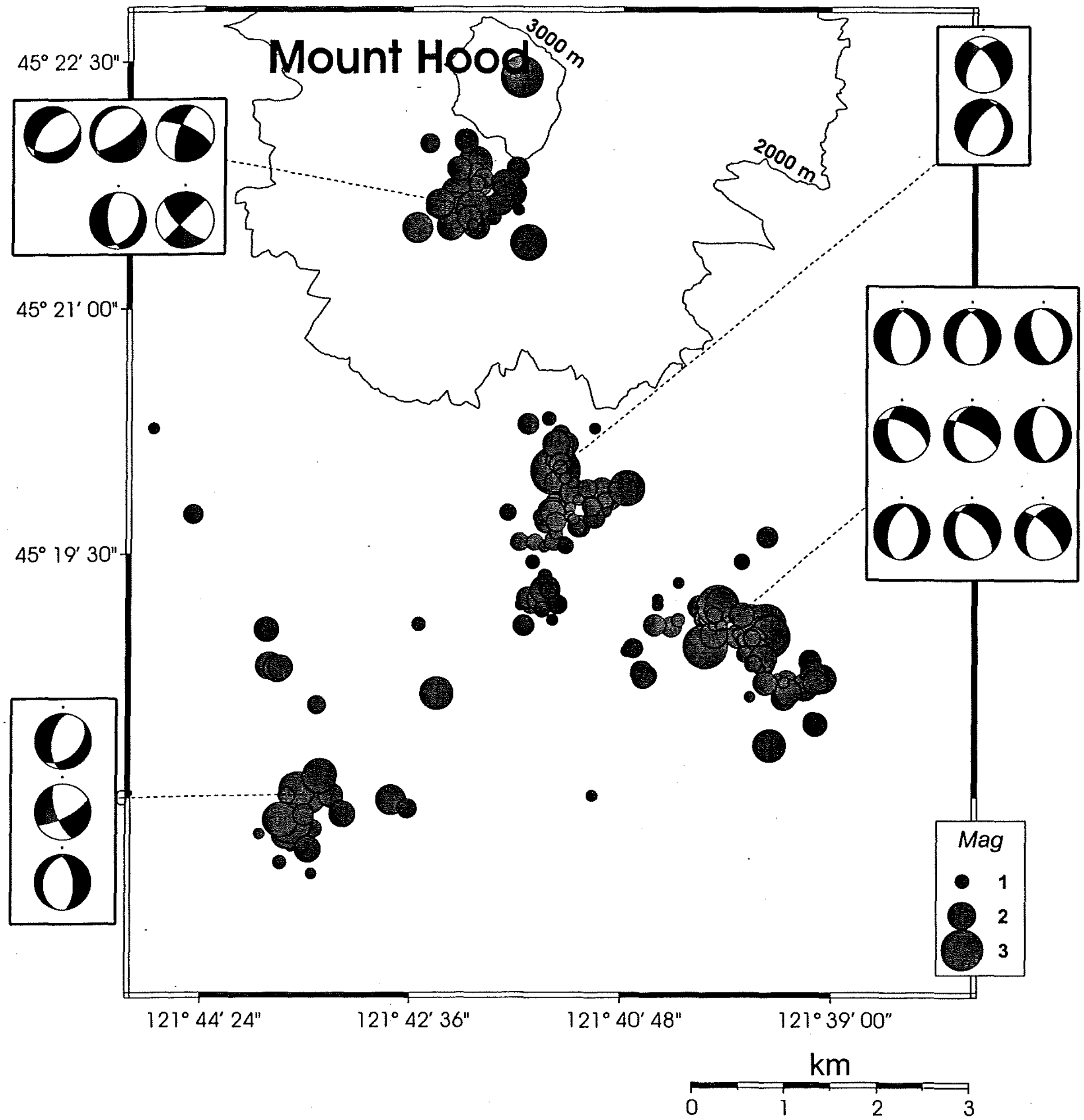
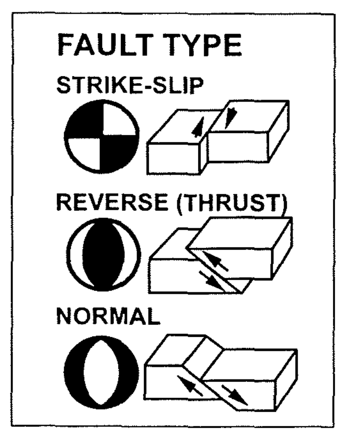


Figure 6. Relocated epicenters for selected Mt. Hood earthquakes, 1986-2001. Symbol size scaled by magnitude.. Representative lower-hemisphere focal mechanisms are indicated, with arrows pointing toward location. Mount Hood summit indicated by text position. 1000m contour lines labeled.

The Mag=4.5 earthquake at the end of June 2002, and its aftershocks, took place mostly in the south-east cluster. Additional analysis of these events will be provided next quarter.



aftershock zone of a pair of damaging earthquakes in September, 1993. The 1993 earthquakes were followed by a vigorous aftershock sequence which decreased over time.

OREGON CASCADE VOLCANOS

Mount Hood, Oregon: This quarter 145 earthquakes were located in the area around Mount Hood from 45.25 to 45.45 N latitude and 121.6 to 121.8 W longitude. Eighty-nine of the events occurred in the last two days of the quarter, June 29-30, when an unusual sequence included one foreshock (magnitude 1.1), a magnitude 4.5 main shock, and a vigorous aftershock sequence that continued into July. The June 29 UTC main shock was the largest earthquake near Mount Hood since at least the installation of the instrumental network (1981).

The 54 earthquakes earlier in the quarter, prior to June 29, included 15 events (two larger than 2.5) on May 6 UTC, 14 events on May 23-24 UTC (none larger than 2.0), 5 events on June 3 UTC (magnitudes 1.2 to 1.5) and 7 events on June 12 (only one event larger than magnitude 1.0).

Following the magnitude 4.5 main shock of June 29, J. Jones, R. Norris, and E. Barnett installed a temporary CMG-40T broadband seismograph near Mt. Hood Meadows ski resort. Acquisition began at approximately 7:30 AM, June 30 UTC. This temporary station is currently the closest instrument to most of the aftershock epicenters. Plans are underway to locate a permanent station at Mt. Hood Meadows.

Earthquake activity near Mt. Hood from 1986 through September 2001 was the subject of a poster presented at the April, 2002 meeting of the Seismological Society of America. In order to place better constraints on the cause of Mt. Hood's periodic earthquake swarms, J. Jones and S. Malone applied waveform cross-correlation to the seismograms of 241 well-constrained earthquakes near Mt. Hood, recorded by the PNSN between January 1986 and September 2001. Jones and Malone used the Xadjust waveform cross-correlation program (Dodge et al. 1995) to determine high precision relative phase arrival times. After traces were adjusted, arrival times of the 46 highest-quality events were used to determine a minimum 1-d velocity model and station corrections, using the Velest earthquake location program of Kissling et al. (1994). The full set of adjusted picks for all 241 events was then relocated using Velest. Spatial resolution is currently being further refined using the HypoDD double-difference earthquake location program of Waldhauser and Ellsworth (2001).

After relocation, the initially diffuse cluster of seismicity appears to fall into four distinct groups (Figure 6): a cluster located directly beneath the summit; a well-defined linear feature trending N-S, located about 5 km south of the summit; a well-defined linear feature trending NW-SE, located a few km SE of the second cluster; and a tight cluster of earthquakes located about 8 km SW of the summit. These features are not obvious from catalog locations alone, though using Velest with routine analyst picks is able to resolve them to a limited degree. First-motion fault plane solutions from some of the larger events have normal faulting mechanisms, in contrast to the thrust mechanisms found throughout the northwest. Because of the proximity of these events to the volcano, their swarm-like characteristics and their normal faulting mechanisms, it is possible that these events are related to volcanic processes below the mountain; however, because of their depth, fault-like alignments and main-shock/after-shock nature of the latest sequence it is equally likely that they are related to tectonic faults near the mountain. Further analysis is underway.

WESTERN WASHINGTON SEISMICITY

During the second quarter of 2002, 485 earthquakes were located between 45.5° and 49.5° north latitude and between 121° and 125.3° west longitude. Three earthquakes were felt this quarter in western Washington. Details are in Table 3A.

The largest felt earthquake in western Washington was a magnitude 3.7 earthquake about 18 km southwest of Bremerton. It located at a depth of about 16 km. The deepest quake in western Washington was a magnitude 0.6 earthquake at about 71 km, located about 13.2 km southwest of Concrete, WA.

Swift Reservoir Canal Breach, April 21st.

The Swift Reservoir Power Canal near Mount St. Helens collapsed early on Sunday, April 21st, with almost 800 million gallons of water spilling out in a few hours. A hydroelectric powerhouse was destroyed and part of a state highway was washed out. In conjuction with the collapse, the PNSN recorded a series of seismic signals starting at about 06:30:33 PDT Apr. 21. Several bursts of energy occurred in the ten to fifteen minutes following 06:30 superimposed on an increase in seismic background levels. These background signals started slowly decaying after about 06:45 and had returned completely to normal background levels by about 07:15 PDT. At 06:56:49 an impulsive seismic event occurred which was strong enough on several PNSN stations to trigger an automatic earthquake locator. With careful manual analysis of this last event it was located near the head of Yale Reservoir at very shallow depth. This is near the site of the failure and power plant. The size of this last event has an equivalent earthquake duration magnitude of 1.6. Since this event is not an earthquake and occurs at the earth's surface this duration magnitude over-estimates the energy release. We estimate an amplitude magnitude for this event of 0.9 (equivalent seismic energy of 8x10**12 ergs). The frequency distribution of the final event is somewhat different from those preceeding it.

Based on waterlevel reports provided by the Cascade Volcano Observatory and eyewitness accounts we feel that the seismic signals are consistent with the following interpretation. The short transient signals are most likely related to the failure of the walls of the canal and the increased background levels are associated with the turbulent flood of water thus released.

Provisional data from water-level recorders operated by US Geological Survey for the Cowlitz County Public Utility District show that the water level in the canal started to decline slowly as early as 03:00 PDT. At about 06:00 PDT the drop in level accelerated and by 06:45 PDT the water had dropped below the bottom of the gage (about 12 ft below normal level). An eyewitness reported the sudden failure of the canal embankment and outflow of remaining water shortly before 07:00 PDT. This final failure occurred after more than 12 ft of water had leaked out.

The seismic signals would indicate that canal integrity started failing arround 06:30 PDT. It may have been progressive over the next 10-15 minutes and included quite a bit of water. The event at 06:56 has a somewhat different character than the previous signals. It is much richer in high frequency and very impulsive. It has the characteristics of an impact or small explosion. If the final failure of the canal wall was very sudden causing a drop of a large amount of material onto a surface (not a sliding away) this would be the consistent with this signal. The released energy causing the seismic event took place over only a few seconds. It's possible that this last event was initiated by accelerating seepage through the floor of the canal and the embankment. Small slumps of material caused some sort of void, into which a large part of the embankment fell. <P> Additional information is available at:

http://www.ess.washington.edu/SEIS/PNSN/NEWS/SWIFT/welcome.html

WASHINGTON CASCADE VOLCANOS

Mount Rainier Area: Figure 4 shows earthquakes near 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). There was one located event flagged "L" at Mount Rainier this quarter although 23 "L" or "S" events were recorded, but were too small to locate reliably. Type L and S events are not shown in Fig. 4.

A total of 60 tectonic events (28 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 2.4 earthquake on May 27 at 19:33 UTC, located about 18 km west-northwest of the summit at about 13 km depth. This quarter, 34 of the 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 degrees north latitude and 121.83-122 west longitude). Within 5 km of the summit, there were 20 (13 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 seen in Fig. 4.

Mount St. Helens Area: Figure 5 shows volcano-tectonic earthquakes near Mount St. Helens. Low frequency (L) and avalanche or rockfall events (S) are not shown.

This quarter, 200 earthquakes were located at Mount St. Helens in the area shown in Fig. 5. Of these earthquakes, 36 were magnitude 0.0 or larger and 53 were deeper than 4 km. The largest tectonic earthquake at Mount St. Helens this quarter was a magnitude 1.9 event at about 2 km depth on May 22 UTC. It was located .7 km NE of the dome.

One type "S" event was located at Mount St. Helens, and 107 "L" or "S" events too small to locate were recorded.

EASTERN WASHINGTON SEISMICITY

During the second quarter of 2002, 55 earthquakes were located in eastern Washington in the area between 45.5-49.5 degrees north latitude and 117-121 degrees west longitude. Activity in the Spokane area, discussed at length in the 2001-C and 2001-D quarterlies, continued at a very low level in the second quarter of 2002. Three very small quakes (magnitudes between -0.2 and -0.9), were felt, and a fourth tiny quake, magnitude -0.8 was not reported felt. The largest earthquake in eastern Washington this quarter was magnitude 3.4. It had a depth of about 7 km, and was located 8 km northwest of Entiat. Entiat is an area with a long-lasting spatial cluster of activity. A quake of approximately 5.0 occurred there in 1959, and the 1872 (magnitude estimated at 6.8-7.4) North Cascades earthquake may have originated in this area.

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. The "Outreach Activities" section describes how to access PNSN data via e-mail, Internet, and World-Wide-Web. To request additional information by e-mail, contact seis_info@ess.washington.edu.

Earthquake information in the quarterlies has been published in final form by the Washington State Department of Natural Resources as information circulars entitled "Earthquake Hypocenters in Washington and Northern Oregon" covering the period 1970-1989 (see circulars Nos. 53, 56, 64-66, 72, 79, 82-84, and 89). These circulars, plus circular No. 85, "Washington State Earthquake Hazards", are available from Washington Dept. of Natural Resources, Division of Geology and Earth Resources, Post Office Box 47007, Olympia, WA. 98504-7007, or by telephone at (360) 902-1450.

Several excellent maps of Pacific Northwest seismicity are available. A very colorful perspective-view map (18" x 27") entitled "Major Earthquakes of the Pacific Northwest" depicts selected epicenters of strong earthquakes (magnitudes > 5.1) that have occurred in the Pacific Northwest. A more detailed full-color map is called "Earthquakes in Washington and Oregon 1872-1993", by Susan Goter (USGS Open-File Report 94-226A). It is accompanied by a companion pamphlet "Washington and Oregon Earthquake History and Hazards", by Yelin, Tarr, Michael, and Weaver (USGS Open-File Report 94-226B). The pamphlet is also available separately. Maps can be ordered from: "Earthquake Maps", U.S. Geological Survey, Box 25046, Federal Center, MS 967, Denver, CO 80225, phone (303) 273-8477. The price of each map is $12. (including US shipping and handling).

USGS Cascades Volcano Observatory has a video, "Perilous Beauty: The Hidden Dangers of Mount Rainier", about the risk of lahars from Mount Rainier. Copies are available through: North west Interpretive Association (NWIA), 909 First Avenue Suite 630, Seattle WA 98104, Telephone e: (206) 220-4141, Fax: (206) 220-4143.

Other regional agencies provide earthquake information. These include the Geological Survey of Canada (Pacific Geoscience Centre, Sidney, B.C.; (250) 363-6500, FAX (250) 363-6565), which produces monthly summaries of Canadian earthquakes; the US Geological Survey which produces weekly reports called "Seismicity Reports for Northern California" (USGS, attn: Steve Walter, 345 Middlefield Rd, MS-977, Menlo Park, CA, 94025) and "Weekly Earthquake Report for Southern California" (USGS, attn: Dr. Kate Hutton or Dr. Lucy Jones, CalTech, Pasadena, CA.).

Key to Earthquake Catalog in Table 4

TIME Origin 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.

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

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

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 fixed.

MAG Coda-length magnitude M_c, an estimate of local magnitude M_L (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). Where blank, data were insufficient for a reliable magnitude determination. Normally, the only earthquakes with undetermined magnitudes are very small ones. Magnitudes 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 are 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 (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.

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 USGS 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, i.e. number of stations, their azimuthal distribution, and the minimum distance (**DMIN**) from the epicenter to a station. Quality **A** requires a solution with 8 or more phases, **GAP** ≤ 90° and **DMIN** ≤ (5 km or depth, whichever is greater). If the number of phases, **NP**, is 5 or fewer or **GAP** > 180° or **DMIN** > 50 km the solution is assigned quality **D.**

MOD The crustal velocity model 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

TYP Events flagged in Table 4 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

TABLE 4

Tectonic Earthquakes, Magnitude 2.0 or larger, Second Quarter, 2002.
Within an area 42-49.5 degrees north latitude and 117-125.3 degrees west longitude.

Apr 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
7	06:04:40.96	45 33.53	122 47.10	16.75	2.1	20/021	78	0.15	AA	C3	
10	07:38:23.15	47 40.00	120 07.15	0.58	2.9	35/039	41	0.33	CC	N3	
10	22:26:38.38	46 52.19	121 56.15	10.91	2.1	30/035	49	0.15	AA	C3	
11	00:34:28.61	45 53.97	120 07.10	16.46	2.3	21/021	121	0.15	AB	E3	
12	05:45:12.14	47 19.79	123 12.29	43.54	2.7	60/067	42	0.26	BA	P3	
16	13:38:57.85	48 28.88	121 49.96	0.04*	2.2	17/021	107	0.25	BC	P3	
20	10:30:50.16	48 00.37	121 32.61	3.80	2.0	18/022	73	0.29	BC	C3	
22	10:38:51.72	47 17.72	122 17.91	20.62	2.2	42/044	56	0.15	BA	P3	F
29	14:05:02.47	47 46.43	121 51.11	6.21	2.0	25/030	69	0.31	CB	P3	

May 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
1	09:09:45.13	48 27.53	119 32.61	3.68	2.9	32/038	100	0.70	DD	N3	F
3	00:36:47.36	45 03.30	122 30.60	21.69	2.4	29/031	79	0.36	CB	O0	
5	00:36:58.34	47 22.77	122 21.69	18.86	2.2	72/075	29	0.20	BA	P3	
5	16:40:43.83	48 16.83	122 12.75	12.08	2.0	30/032	51	0.23	BB	P3	
6	04:45:53.17	45 19.14	121 41.39	1.14$	2.1	16/016	129	0.56	DB	O0	
6	04:47:53.25	45 19.47	121 41.14	4.99	2.5	17/017	92	0.22	BB	O0	
6	11:21:58.04	45 19.77	121 41.28	5.27	2.8	27/027	91	0.23	BB	O0	
6	13:08:27.27	45 19.76	121 41.27	4.72	2.5	18/018	134	0.23	BB	O0	
7	01:25:43.68	47 43.24	120 10.55	0.61	2.3	23/028	63	0.27	BC	N3	
7	22:25:02.01	46 55.23	120 09.40	0.04*	2.2	21/021	51	0.28	BC	E3	
10	00:22:07.81	46 29.43	122 26.00	18.83	2.0	35/047	46	0.23	BA	S3	
11	19:10:01.09	47 47.76	122 46.37	23.02	2.3	27/030	68	0.16	BA	P3	
12	20:54:16.44	46 28.78	121 20.47	2.22	2.1	25/026	58	0.11	AC	C3	
13	21:00:38.38	48 23.97	123 27.68	42.09	2.7	33/035	102	0.23	BB	P3	
14	17:13:10.55	47 51.02	123 03.60	47.65	2.1	37/043	34	0.15	BA	P3	
15	17:54:48.60	42 13.88	121 54.07	8.11	4.3	20/021	112	0.24	BB	K3	F
16	05:59:55.89	42 13.91	121 54.40	9.54	2.0	6/008	110	0.03	AC	K3	
17	05:41:52.34	42 13.33	121 54.25	3.75*	2.1	10/012	115	0.09	AC	K3	
19	17:05:27.65	48 17.99	122 11.68	13.70	2.7	51/053	52	0.31	CA	P3	
20	10:44:38.96	47 46.69	122 51.82	20.16*	2.0	37/037	79	0.18	BA	P3	
23	21:43:49.86	45 33.44	123 21.87	0.04*	2.1	10/010	170	0.20	BC	P3	
24	22:41:16.31	45 19.98	121 40.96	3.22*	2.0	10/011	89	0.14	AB	O0	
26	10:21:53.82	47 42.29	120 06.76	2.35$	2.0	19/023	51	0.43	CC	N3	
27	08:43:58.61	48 12.23	120 10.30	1.26	2.4	14/017	203	0.12	BD	N3	
27	19:33:38.77	46 56.23	121 58.09	13.15	2.4	45/047	38	0.15	AA	C3	

June 2002

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
2	15:00:59.00	47 30.31	122 55.63	41.67	2.0	25/030	59	0.27	BA	P3	
3	00:25:25.58	44 58.20	122 34.29	19.53	2.1	29/031	107	0.45	CB	O0	
3	22:34:41.44	46 56.03	121 58.15	12.99	2.1	35/040	38	0.15	AA	C3	
3	23:39:47.76	46 56.07	121 57.96	12.87	2.2	45/051	32	0.17	BA	C3	
4	05:45:55.93	47 21.24	122 43.10	29.21	2.1	68/074	56	0.18	BA	P3	
6	04:45:37.58	47 54.96	124 18.01	0.03*	2.0	14/015	128	0.29	BB	P3	
6	10:34:32.15	47 21.63	122 42.64	27.71	2.0	45/051	56	0.13	AA	P3	
6	14:42:46.11	47 43.20	120 17.24	7.17	3.4	39/041	58	0.32	CB	N3	F
12	08:17:12.45	45 42.23	122 58.82	13.93$	2.1	25/031	135	0.21	BC	P3	
15	10:06:30.73	47 36.70	118 10.85	1.50$	2.0	10/011	158	0.55	DC	N3	
15	15:01:50.43	47 28.69	121 47.57	17.81	2.2	26/027	79	0.16	BA	P3	
16	17:11:10.83	47 28.23	122 49.50	16.10#	3.7	96/096	27	0.48	CA	P3	F
19	12:28:07.26	48 16.92	122 11.38	12.97	2.1	18/020	51	0.23	BA	P3	
27	20:14:22.24	47 23.44	122 19.74	24.01	2.0	47/054	57	0.22	BA	P3	
29	14:36:04.79	45 20.09	121 41.17	6.20*	4.5	41/041	37	0.27	BB	O0	F
29	14:41:21.27	45 19.64	121 40.89	2.70	3.2	4/004	150	0.04	AD	O0	F
29	14:45:15.75	45 20.03	121 41.19	4.64	2.2	17/017	69	0.25	BB	O0	
29	15:27:52.13	45 19.76	121 41.29	6.42$	2.3	22/025	55	0.41	CB	O0	
29	16:20:03.82	45 19.28	121 41.17	5.80*	2.4	20/021	70	0.27	BB	O0	
29	16:29:22.96	45 20.02	121 41.03	5.49	2.0	17/019	114	0.29	BB	O0	
29	18:49:58.83	45 20.54	121 40.78	6.13	3.8	36/036	46	0.28	BB	O0	F

June 2002 cont'd

DAY	TIME	LAT	LON	DEPTH	M	NS/NP	GAP	RMS	Q	MOD	TYP
29	19:31:57.35	45 19.21	121 41.25	6.21*	2.5	26/027	70	0.22	BB	O0	
30	10:20:50.28	45 19.50	121 40.59	5.04	2.0	22/024	48	0.35	CB	O0	
30	11:16:23.27	45 20.64	121 40.68	5.61	2.7	33/034	42	0.32	CB	O0	

OUTREACH ACTIVITIES

The PNSN Seismology Lab staff provides an educational outreach program to better inform the public, educators, businesses, policy makers, and the emergency management community about seismicity and geologic hazards. Our outreach includes lab tours, lectures, classes and workshops, press conferences, TV and radio news programs and talk shows, field trips, and participation in regional earthquake planning efforts. We provide basic information through information sheets, an audio library, and the Internet on the World-Wide-Web (WWW): http://www.ess.washington.edu/SEIS/PNSN.

Telephone, Mail, and On-line outreach:

The PNSN audio library system received about 350 calls this quarter. Our audio library provides several recordings, a frequently updated message on current seismic activity. In addition, we have a tape describing the seismic hazards in Washington and Oregon and another on earthquake prediction.

Callers often request our one-page information and resource sheet on seismic hazards in Washington and Oregon. Thousands of these have been mailed out or distributed, and we encourage others to reproduce and further distribute this sheet. Our information sheet discussing earthquake prediction is also frequently requested. Callers to the audio library can also choose to be transferred to the Seismology Lab, where additional information is available. This quarter we responded in person to:

- 30 calls from emergency managers and government
- 60 calls from the media
- 25 calls from k-12 educators
- 35 calls from the business community
- 65 calls from the general public

The PNSN completed a major telecommunications upgrade this quarter funded by the University of Washington. The old "NorthCom" analog telephone systems were upgraded to an expandable, digital, PBX system. All Seismology Lab lines now go through the UW Emergency Communications switch to improve reliability during disasters.

Internet outreach:

PNSN Seismic Analyst Amy Wright and other PNSN staff responded to over 150 e-mail messages from the public seeking information on a variety of topics. In addition to routine questions, complex questions sometimes require in depth responses and are handled by the appropriate staff person. These replies include providing assistance with hazard assessments, consultations with government agencies, and providing strong motion data and related information to the engineering community.

The PNSN web site offers many web pages, including maps and lists of the most recent PNW earthquakes, general information on earthquakes and PNW earthquake hazards, information on past damaging PNW earthquakes, and catalogs of earthquake summary cards. Web pages on seismicity of Cascade Volcanos, and Quarterly summaries of seismicity are also included. The PNSN recent earthquake list is available through the World-Wide-Web (WWW) at: http://www.ess.washington.edu/recenteqs/

"Webicorder" pages showing continuous data from PNSN seismographic stations can be viewed at: http://www.ess.washington.edu/SEIS/PNSN/WEBICORDER/. "ShakeMap" shows maps of instrumentally measured shaking. Table 3A indicates which events this quarter generated ShakeMaps. ShakeMaps can be viewed at http://www.ess.washington.edu/shake/index.html.

Table 3A also indicates the felt events this quarter that generated Community Internet Intensity Maps (CIIM). CIIM ("Did you feel it?") maps are made using Internet submitted felt reports. For a well-felt event hundreds (or thousands) of people fill out an on-line form describing their experiences during the earthquake. These "felt" reports are converted into numeric intensity values, and the CIIM map shows the average intensity by zip code. CIIM Maps are served through: http://pasadena.wr.usgs.gov/shake/pnw/.

In addition to the PNSN web site, the UW Dept. of Earth and Space Sciences and the PNSN host several other earthquake-related web sites:

- **Volcano Systems Center**, http://www.vsc.washington.edu is a cooperative effort of the UW and the USGS that links volcano-related activities of the UW Dept. of Earth and Space Sciences and Oceanography departments with related USGS activities.
- **Seismosurfing**: http://www.ess.washington.edu/seismosurfing.html is a comprehensive listing of sites worldwide that offer substantive seismology data and information. This page is mirrored at two sites in Europe.

- **The Council of the National Seismic Systems (CNSS):** http://www.cnss.org features composite listings and maps of recent U.S. earthquakes and documentation of the EARTHWORM system.
- **"Tsunami!"** http://www.ess.washington.edu/tsunami offers many pages, including an excellent discussion on the physics of tsunamis, and short movie clips. Benjamin Cook developed it under the direction of Dr. Catherine Petroff (UW Civil Engineering).
- **The UW Dept. of Earth and Space Sciences Global Positioning System (GPS):** http://www.ess.washington.edu/GPS/gps.html site provides information on geodetic studies of crustal deformation in Washington and Oregon.

The PNSN Web Site design committee led by Ruth Ludwin has met twice this quarter to make progress in redesigning and reorganizing the PNSN Web Site. The new design, when completed later this summer, will be easier to navigate and will offer standard "ANSS Products" in a manner similar to what the USGS is offering in other regions. The new web site is being previewed at: http://www.ess.washington.edu/SEIS/PNSN/xywelcome.html to get feedback from our users.

K-12 Education Outreach:

PNSN staff provided 17 Seismology Lab tours and presentations for K-12 students and teachers serving about 400 people this quarter. PNSN student staff also operated an information booth at a two school science fairs and staffed the Burke Museum's exhibit "The Big One, Earthquake Hazards in the Pacific Northwest" over a special Saturday and Sunday public program.

PNSN research scientist Amy Lindemuth maintains an email list of over 40 local k-12 educators interested in earth sciences education. This quarter the list has discussed the release of the "*Virtual Courseware: Earthquake*" web site developed under the direction of Gary Novak, Cal State University, Los Angeles and the release of the "PNSN Educational Resources" web area, http://www.ess.washington.edu/SEIS/PNSN/EDHOME/. Amy developed this area in collaboration with Tony Qamar and several Washington State educators.

Media Relations:

PNSN staff frequently provides interviews, research support, and referrals to radio, television, film, and print media.

This quarter events that attracted particular attention included the April 21st failure of the **Swift Canal** south of Mt. St. Helens that generated a flood washing out a highway and destroying the powerhouse below it. Eight hundred million gallons of water was released in the event. Local concerns that terrorism may have been responsible where quieted by closely coordinated research and information dissemination by the PNSN staff and Ed Wolf of The Cascade Volcano Observatory. Steve Malone assembled spectra-grams and condensed seismograms that clearly showed the failure progressed over hours and was not initiated by a blast. Bill Steele provided information to the Seattle media market and CVO Chief Scientist Ed Wolf provided numerous interviews to Portland area media from Vancouver, WA and communicated with local officials.

The magnitude **3.7 earthquake near Bremerton** attracted every TV station in the Seattle area to the Seismology Lab. PNSN analyst Amy Wright provided interviews and background information.

The **Mt. Hood earthquake sequence** that began on June 29th with a magnitude 4.5 earthquake also exercised the PNSN/ CVO communications plan as both centers provided coordinated information about the Mt. Hood seismicity and the current swarm of events.

Steve Malone and Amy Wright provided interviews for a production team from the Travel Channel producing a program entitaled "The Secrets of Seattle".

Special Events:

The Cascadia Region Earthquake Workgroup (CREW) held a workshop in the coastal community of **South Bend Washington** for local businesses and policy makers. Bill Steele gave an overview of area earthquake hazards to the group as part of the CREW program to help businesses prepare to survive business disruptions due to disaster.

The PNSN organized a 3-hour workshop for **British Petroleum/ Olympic Pipeline** executives and safety officers and their conference at the Westin Hotel in Seattle. Craig Weaver, USGS, and Bill Steele, PNSN, made presentations on the hazards and PNSN monitoring and information services capabilities. Don Ballantyne, ABS Engineering gave a talk on pipeline system vulnerabilities in earthquakes. Barbara Graff, Bellevue Emergency Manager spoke on the importance of establishing good working relationships before disaster strikes and all participated in the panel discussion that followed.

Steve Malone and Bill Steele met with a Hazards Mitigation Specialist from the Government of India and a US State Department Official to discuss earthquake hazards, preparedness and mitigation during a visit sponsored by the **World Affairs Council.**

The Volcano Observatory of the South Andes hosted a visit by Steve Malone who consulted with Observatory scientists on methods of building and operating volcano monitoring networks.

The Board of Directors of the **Earthquake Engineering Research Center** met in Seattle and joined local scientists and businesses and organizations involved in earthquake hazards reduction activities to plan for the development of a **Seattle Fault Earthquake Scenario.** The meeting held at UW was very well attended and work continues under project chairman Don Ballantyne, EERI and ABS Engineering, to further define the project and find additional funding to complete and publish the scenario.

Meetings and Presentations:

Bill Steele spoke on Puget Sound earthquake hazards past and future at the **Boeing Disaster Preparedness Conference** in Seattle.

PNSN scientists Amy Lindemuth and George Thomas presented a poster at the **Geologic Society of America** conference in Corvallis, Oregon on the PNSN's Seismographs in Schools Project that will expand into Oregon this year.

Bill Steele made a presentation as part of a hazards workshop for **The American Institute of Architects**, Seattle Chapter. Tom Pratt and Brian Atwater of the USGS Seattle Field Office also made presentations followed by a lively discussion period.

Steve Malone gave a public talk at the **Burke Museum** entitled "Earthquakes and Volcanos: The Latest Science."

Amy Wright gave a talk at the **Seismological Society of America Conference** in Victoria, B.C. on the Spokane, Washington earthquake sequence and its impact on residents who heard and felt over one hundred earthquakes, some less than magnitude one.

Bill Steele presented two talks at the **Partners in Preparedness Conference** attended by about 400 public and private sector emergency managers and held in Bellevue, Washington. One talk compared ground motions and effects of the Nisqually Earthquake to likely ground motion and impacts in the Puget Sound Region from a greater than magnitude 6 Seattle Fault Earthquake. Another workshop focused on ANSS funded improvements in earthquake monitoring in the Pacific Northwest and information products and services offered by the USGS and PNSN in support of response, recovery and mitigation.

Ruth Ludwin gave a number of talks related to her research on PNW Native American stories and art work related to earthquakes and tsunamis from the Cascadia Subduction Zone at:

- **Pacific Northwest College of Art,** Portland, Oregon
- **The Oregon Department of Geology and Mineral Industries**
- **The Quileute Tribe's La Push Indian School** for both Middle and High Schools.
- **The Burke Museum,** one public presentation and another for the Burke Docents Meeting.
- **The Association of Women in Geosciences** meeting in Seattle.
- **FEMA Sponsored Tribal Emergency Management Workshop** Bow, Washington (June 20, 2002) -- The two-day workshop had representatives from 42 Washington and Oregon tribes and various Federal agencies present.

Ruth Ludwin also provided interviews to the Los Angeles Times, The Associated Press, and the Seattle Post Intelligencer who all produced articles describing her Native American stories work.

The PNSN remains an active participant in a number of organizations whose goals and objectives are complementary to the PNSN mission to reduce loss of life and property due to earthquakes. Bill Steele serves as Secretary of the Cascade Region Earthquake Workgroup (**CREW**) and represents the PNSN in The Contingency Planners and Recovery Managers (**CPARM**). Bill serves as an advisor to a number of Project Impact Communities and is a member of **The Washington State Emergency Management Association.** Tony Qamar is an active member of the **Washington State Seismic Safety Committee.**