

QUARTERLY NETWORK REPORT 88-B
on
Seismicity of Washington and Northern Oregon

April 1 through June 30, 1988

Geophysics Program
University of Washington
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INTRODUCTION

This is the second quarterly report of 1988 from the University of Washington Geophysics Program covering seismicity of all of Washington and northern Oregon. These comprehensive quarterlies have been produced since the beginning of 1984. Prior to that we published quarterlies for western Washington in 1983 and for eastern Washington from 1975 to 1983. Annual reports covering seismicity in Washington since 1969 are available from the U.W. Geophysics Program. In collaboration with the University of Washington, the State Department of Natural Resources (DNR) has published catalogs of earthquake activity in western Washington for the period 1970-1979. The DNR has published earthquake catalogs for the whole state for the period 1980-1986.

This quarterly report discusses network operations, seismicity of the region, and unusual events or findings. This report is preliminary, and subject to revision. Some earthquake locations may be revised if new data become available, such as P and S readings from Canadian seismic stations. Findings mentioned in these quarterly reports should not be cited for publication. Fig. 1 shows major geographical features in the state of Washington and northern Oregon and seismograph stations now in operation.

NETWORK OPERATIONS

Table 1 gives approximate periods of time when stations were inoperable. Data for Table 1 are compiled from weekly plots of network-wide teleseismic arrivals, plus records of maintenance and repair visits. Fig. 1 shows a map view of stations operating during the quarter.

Relatively few station changes were made to the network this quarter. Changes included permanently removing stations WEN and HH2. In addition, station SYR in eastern Washington was removed and replaced by a new station in Royal City, Wa. (RCV) (See Table 1 for removal and installation dates).

During this quarter the on-line computer system which records all data for the network was changed. Since 1980 a DEC PDP-11/34 has been the on-line recording system and a DEC PDP-11/70 has been used for analysis. In April of this year a Masscomp-5600 minicomputer was acquired

and installed by the U.S. Geological Survey in our lab to take the place of the DEC equipment. By June 1 we had software running on the Masscomp computer to do both the acquisition and analysis tasks for the network. This software is a modified version of *RAVEN*, a specialized data acquisition system from NEWT Inc. We have a software agreement with NEWT Inc. for the development of a regional network recording version of this software called *HAWK*. As of the end of the quarter the *HAWK* software running on the Masscomp computer had taken over all acquisition and analysis tasks and the DEC equipment was being phased out. The PDP-11/34 is still running as a backup system to the Masscomp; however, all recording, processing, and archiving are now routinely done on the Masscomp.

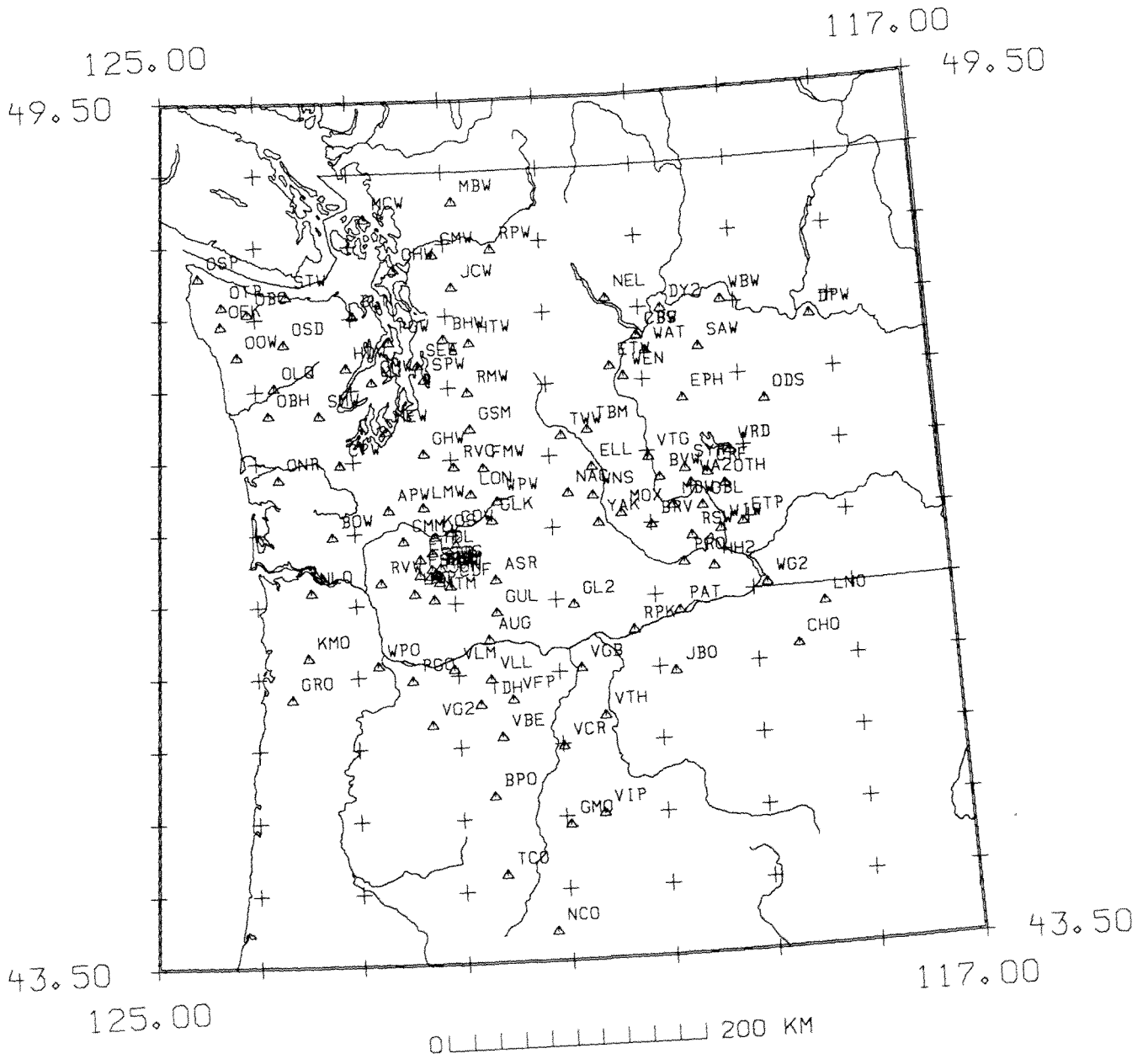


Figure 1. Seismograph stations operating during the 2nd quarter 1988.

TABLE 1
Station Outages 2nd quarter 1988

Station	Outage Dates	Comments
ASR	April 1-May 16	Dead batteries at GUL
BHW	April 1-April 6	
BRV	June 22-June 30	BPA line problem
CHO	May 4-June 30	off center frequency;intermittent
COW	May 28-June 30	Intermittent, dead
EDM	May 4-June 10	Bad batteries
ETW	April 1-April 16	
GHW	April 1-April 13	recv'r at GSM
GMW	April 1-May 25;June 18-June 30	
GUL	April 1-May 16	Dead batteries
HH2	Whole Period	Replaced by LOC on June 30.
HSR	April 1-May 4	Txmitter out
KOS	April 1-April 25	
LMW	April 25-May 11	recv'r at GSM
LO2	April 6-April 16	
LOC	Whole Period	Replaces HH2 permanently on June 30.
LON	April 6-April 16	
LVP	April 1-May 27	
MEW	Whole Period	Intermittent, low gain
MOX	June 22-June 30	BPA line problem
NAC	June 22-June 30	BPA line problem
NCO	April 1-April 6;June 26-June 30	
OBC	April 1-April 6	Off at OTR;repeater problem
OBH	Whole Period	Operated infrequently
OHW	April 1-April 25	
OLQ	Whole Period	Bad VCO
OSD	Whole Period	Dead
OSP	April 1-April 6	
PAT	April 16-June 30	Intermittent, noisy
RCV	April 1-May 27	replaces SYR
REM	April 1-June 10	
RVC	June 10-June 22	
SYR	May 27-June 30	replaced by RCV
TCO	April 6-May 28	
TDH	April 1-May 16	Dead batteries at GUL
VG2	April 1-May 4	Intermittent; noisy
WA2	April 1-April 25	
WEN	June 22-June 30	Removed June 22
WG2	Whole Period	Amplifier noise,intermittent
WNS	June 22-June 30	BPA line problem
WRD	April 6-June 30	Electrical short
YAK	June 22-June 30	BPA line problem

STATIONS USED FOR LOCATION OF EVENTS

Table 2 lists stations used in locating seismic events in Washington and Oregon. Stations marked by an asterisk (*) were supported by USGS joint operating agreement 14-08-0001-A0266. Stations marked by (\$) were supported by USGS contract 14-08-0001-21978. (+) indicates support under US Dept. of Energy contract DE-AM06-76RL02225. All other stations were supported from other sources.

The first column in the table gives the 3-letter station designator. This is followed by a symbol designating the funding agency, 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 2
Stations Operating at the End of the First Quarter 1988

STA	F	LAT	LONG	EL	NAME
APW	*	46 39 06.0	122 38 51.0	0.457	Alpha Peak
ASR	\$	46 09 02.4	121 35 33.6	1.280	Mt. Adams - Stagman Ridge
AUG	\$	45 44 10.0	121 40 50.0	0.865	Augspurgen Mtn
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
BRV	+	46 29 07.2	119 59 29.4	0.925	Black Rock Valley
BVW	+	46 48 37.8	119 52 54.1	0.707	Beverly
CHO	+	45 35 27.0	118 34 45.0	1.076	Cabbage Hill, Oregon
CBS	+	47 48 16.7	120 02 27.6	1.073	Chelan Butte, South
CDF	\$	46 06 58.2	122 02 51.0	0.780	Cedar Flats
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.
COW	\$	46 29 27.6	122 00 43.6	0.305	Cowlitz River
CPW	*	46 58 25.8	123 08 10.8	0.792	Capitol Peak
CRF	+	46 49 30.6	119 23 18.0	0.260	Corfu
DPW	+	47 52 14.3	118 12 10.2	0.892	Davenport
DY2	+	47 59 06.9	119 46 13.0	0.884	Dyer Hill 2
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 35.0	120 34 06.0	0.805	Ellensburg
EPH	+	47 21 12.8	119 35 46.2	0.628	Ephrata
ETP	+	46 27 53.4	119 03 32.4	0.250	Eltopia
ETW	+	47 36 16.2	120 19 51.6	1.475	Entiat
FL2	\$	46 11 47.0	122 21 01.0	1.378	Flat Top 2
FMW	*	46 55 54.0	121 40 19.2	1.890	Mt. Fremont

continued

STA	F	LAT	LONG	EL	NAME
FOX	+	48 19 50.0	119 42 29.0	0.896	Fox Mountain
GBL	+	46 35 51.6	119 27 35.4	0.330	Gable Mountain
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 50.2	121 36 30.7	1.320	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.
GRO	\$	45 21 04.5	123 39 43.0	0.945	Grindstone Mt., Oregon
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.
HDW	*	47 38 54.6	123 03 15.2	1.006	Hoodsport
HH2	+	46 10 18.0	119 23 01.0	0.490	Horse Heaven Hills (moved HHW)
HSR	\$	46 10 22.2	122 10 58.2	1.774	South Ridge, Mt. St. Helens
HTW	*	47 48 12.5	121 46 08.6	0.829	Haystack Lookout
JBO	\$	45 27 41.7	119 50 13.3	0.645	Jordan Butte, Oregon
JCW	*	48 11 36.6	121 55 46.2	0.616	Jim Creek
JUN	\$	46 08 48.0	122 09 10.8	1.049	June Lake
KMO	\$	45 38 07.8	123 29 22.2	0.975	Kings Mt., Oregon
KOS	\$	46 27 40.8	122 11 25.8	0.828	Kosmos
LMW	*	46 40 04.8	122 17 28.8	1.195	Ladd Mt.
LNO	+	45 52 15.8	118 17 06.0	0.768	Linton Mt., Oregon
LOC		46 43 04.8	119 25 54.6	0.201	Rohay Station
LO2		46 45 00.0	121 48 36.0	0.853	Longmire
LON		46 45 00.0	121 48 36.0	0.853	Longmire (WWSSN and DWSSN)
LVP	\$	46 04 06.0	122 24 30.0	1.170	Lakeview Peak
MBW	*	48 47 02.4	121 53 58.8	1.676	Mt. Baker
MCW	*	48 40 46.8	122 49 56.4	0.693	Mt. Constitution
MDW	+	46 36 48.0	119 45 39.0	0.330	Midway
MEW	*	47 12 07.0	122 38 45.0	0.097	McNeil Island
MOX	+	46 34 38.0	120 17 35.0	0.540	Moxie City
MTM	\$	46 01 31.8	122 12 42.0	1.121	Mt. Mitchell
NAC	+	46 44 03.8	120 49 33.2	0.738	Naches
NCO	\$	43 42 18.2	121 08 06.0	1.908	Newberry Crater, Oregon
NEL	+	48 04 41.8	120 20 17.7	1.490	Nelson Butte
NLO	*	46 05 18.0	123 27 00.0	0.900	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
ODS	+	47 18 24.0	118 44 42.0	0.523	Odessa
OFK	\$	47 57 00.0	124 21 28.1	0.134	Olympics - Forks
OHW	*	48 19 24.0	122 31 54.6	0.054	Oak Harbor
OLQ	\$	47 30 58.1	123 48 31.5	0.121	Olympics - Lake Quinault
ONR	\$	46 52 37.5	123 46 16.5	0.257	Olympics - North River
OOW	\$	47 44 12.0	124 11 22.0	0.743	Octopus West
OSD	*	47 49 15.0	123 42 06.0	2.010	Olympics - Snow Dome
OSP	\$	48 17 05.5	124 35 23.3	-	Olympics - Sooes Peak
OTH	+	46 44 20.4	119 12 59.4	0.260	Othello
OTR	\$	48 05 00.0	124 20 39.0	0.712	Olympics - Tye Ridge
PAT	+	45 52 50.1	119 45 40.1	0.300	Paterson
PGO	\$	45 28 00.0	122 27 10.0	0.237	Gresham, Oregon
PGW	*	47 49 18.8	122 35 57.7	0.122	Port Gamble
PRO	+	46 12 45.6	119 41 09.0	0.552	Prosser

continued

STA	F	LAT	LONG	EL	NAME
RCV		46 56 60.0	119 26 00.0	0.500	Royal City
REM		46 11 57.0	122 11 03.0	2.102	Rembrandt (Dome station)
RMW	*	47 27 34.9	121 48 19.2	1.024	Rattlesnake Mt. (West)
RPK	+	45 45 42.0	120 13 50.0	0.330	Roosevelt Peak
RPW	*	48 26 54.0	121 30 49.0	0.850	Rockport
RSW	+	46 23 28.2	119 35 19.2	1.037	Rattlesnake Mt. (East)
RVC	\$	46 56 34.5	121 58 17.3	1.000	Mt. Rainier - Voight Creek
RVW	*	46 08 58.2	122 44 37.2	0.460	Rose Valley
SAW	+	47 42 06.0	119 24 03.6	0.690	St. Andrews
SEA		47 39 18.0	122 18 30.0	0.030	Seattle (Wood Anderson)
SEE		47 39 18.0	122 18 30.0	0.030	Seattle Pseudo-WA (E)
SEN		47 39 18.0	122 18 30.0	0.030	Seattle Pseudo-WA (N)
SHW	*	46 11 33.0	122 14 12.0	1.423	Mt. St. Helens
SMW	*	47 19 10.2	123 20 30.0	0.840	South Mt.
SND	\$	46 12 45.0	122 11 09.0	1.800	St. Helens Microphone, unrectif
SOS	\$	46 14 38.5	122 08 12.0	1.270	Source of Smith Creek
SPW	*	47 33 13.3	122 14 45.1	0.008	Seward Park, Seattle
STD	\$	46 14 16.0	122 13 21.9	1.268	Studebaker Ridge
STW	*	48 09 02.9	123 40 13.1	0.308	Striped Peak
SYR	+	46 51 46.8	119 37 04.2	0.267	Smyrna
TBM	+	47 10 10.1	120 35 54.0	1.064	Table Mt.
TCO	\$	44 06 27.0	121 36 00.0	1.975	Three Creek Meadows, Or.
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
TWW	+	47 08 17.2	120 52 04.5	1.046	Teanaway
VBE	\$	45 03 37.2	121 35 12.6	1.544	Beaver Butte, Oregon
VCR	\$	44 58 58.2	120 59 17.3	1.015	Criterion Ridge, Oregon
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
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
VTG	+	46 57 28.8	119 59 14.4	0.208	Vantage
VTH	+	45 10 52.2	120 33 40.8	0.773	The Trough, Oregon
WA2	+	46 45 24.2	119 33 45.5	0.230	Wahluke Slope
WAT	+	47 41 55.0	119 57 15.0	0.900	Waterville
WBW	+	48 01 04.2	119 08 13.8	0.825	Wilson Butte
WEN	+	47 31 46.2	120 11 39.0	1.061	Wenatchee
WG2	+	46 01 50.25	118 51 19.95	0.511	Wallula Gap
WIW	+	46 25 48.8	119 17 13.4	0.130	Wooded Island
WNS	+	46 42 37.0	120 34 30.0	1.000	Wenas
WPO	\$	45 34 24.0	122 47 22.4	0.334	West Portland, Oregon
WPW	+	46 41 53.4	121 32 48.0	1.250	White Pass
WRD	+	46 58 11.4	119 08 36.0	0.378	Warden
YAK	+	46 31 15.8	120 31 45.2	0.619	Yakima
YEL		46 12 35.0	122 11 16.0	1.750	Yellow Rock, Mt. St. Helens

EARTHQUAKE DATA

There were 468 events processed by the University of Washington digitally recording seismic network between April 1 and June 30, 1988. Locations were determined for 327 of these in Washington and Northern Oregon; 246 were classified as earthquakes and 81 as known or suspected blasts. The remaining 141 processed events include teleseisms (97 events), regional events outside the U. W. network (22), and unlocated events within the U. W. network. Unlocated events within the U.W. network include very small earthquakes and some known blasts. For example, only a few of the frequent mine blasts at Centralia are located.

Table 3 is the catalog of earthquakes and blasts located within the network for this quarter. Fig. 2 shows all 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. 6 shows earthquakes located at Mount St. Helens ($M_c \geq 0.$)

Western Washington and Oregon

193 earthquakes were located between 43.5° and 49.5° north latitude and between 121° and 125° west longitude during the second quarter of 1988. Most of these occurred at depths less than 30 km with, as usual, a small number of earthquakes in the Puget Sound lowland at depths greater than 30 km. The largest event during the quarter occurred on June 16, and was $M_c = 3.1$, at a depth of 7.5 km. It was felt both in Carnation and Duvall, Washington. This was one of two events felt during the second quarter in western Washington. The other event occurred on April 4 in the Skagit Valley area, approximately 8 miles east of Sedro Wooley. It had a $M_c = 2.9$, and occurred at a relatively shallow depth of 2.5 km.

Eastern Washington and Oregon

During the second quarter of 1988, 53 earthquakes were located in eastern Washington. The Entiat area south of Lake Chelan was again active and one event was felt. On May 4, a $M_c = 3.3$ earthquake occurred at a depth of 6.7 km., and was felt in the Entiat area, with reports of ground shaking in Wenatchee. Earthquakes in this area are common, with about 15 to 20 small events occurring nearby each quarter.

The clustering of activity that began on October 2, 1987 near the town of Corfu, Wash. (50 km north of Richland) continued into the second quarter of 1988. In addition to the 39 events located last quarter, 11 were recorded this quarter. The progression of activity since October 2 per quarter is as follows: The fourth quarter of 1987 had 52 events, with the maximum $M_c = 2.2$. The first quarter of 1988 had 39 events with the maximum $M_c = 2.9$, and this quarter had 11 events with the maximum $M_c = 3.5$. This event occurred on May 28 with a near-surface depth (< 1 km). Most of these events occurred in late May. This was the largest earthquake to have occurred anywhere in the network this quarter, as well.

Mount St. Helens Area

The quiet that remained at the end of the last quarter in the Mt. St. Helens area continued into the second quarter of 1988. 30 earthquakes were located at Mt. St. Helens during the second quarter. Half of these were shallow, but 15 had depths greater than 15 km. The largest of these occurred on April 28, had a $M_c = 1.7$, and a depth of 5 km.

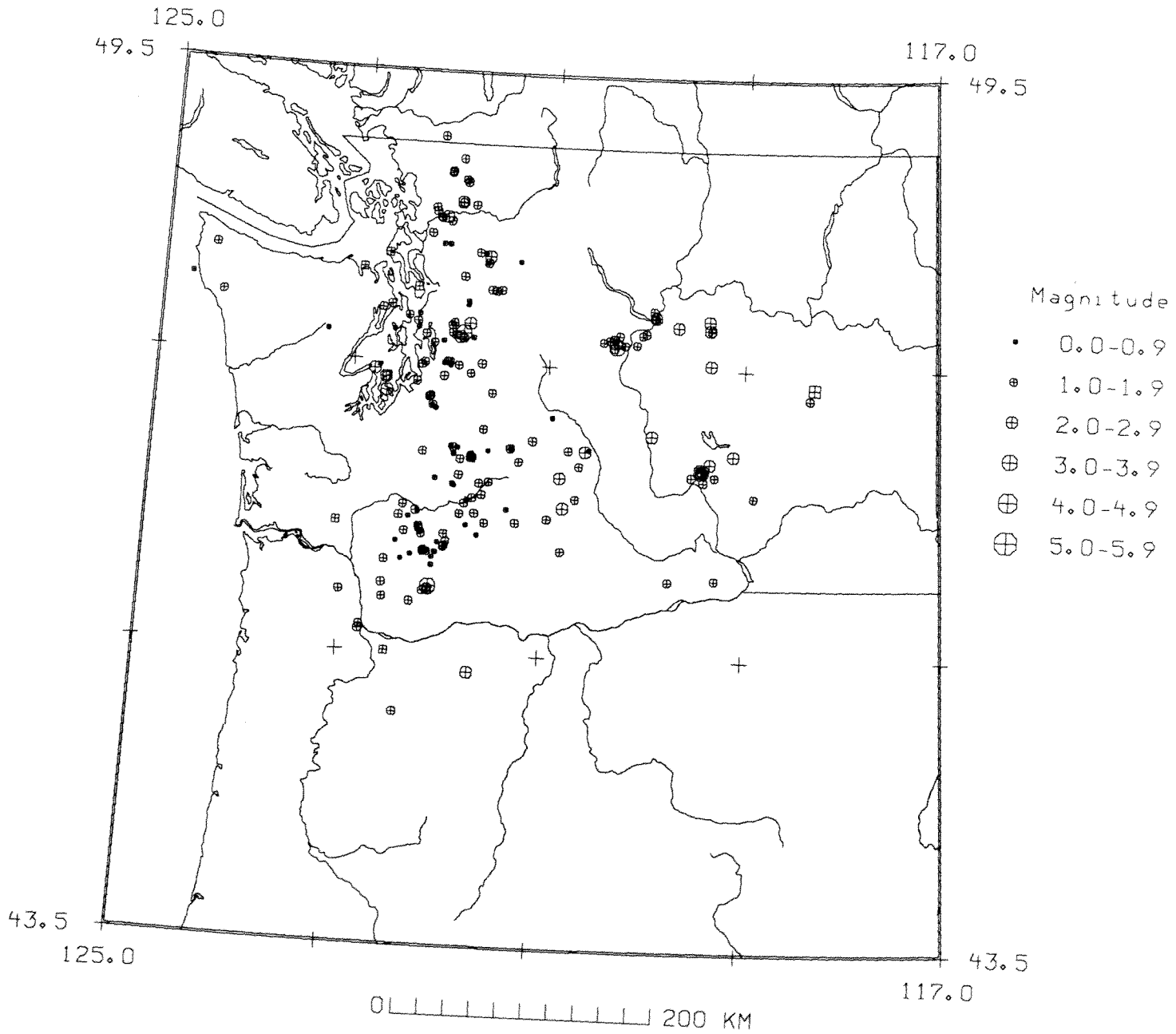


Figure 2. Earthquakes located in Washington and northern Oregon with magnitudes greater than 0.0, 2nd quarter 1988. A square symbol indicates that a event located with a depth greater than or equal to 30 km. Octagonal symbols are used for events shallower than 30 km.