

QUARTERLY TECHNICAL REPORT 79 - A

for

HANFORD SEISMIC NETWORK

January 1 through March 31 1979

Geophysics Program

University of Washington

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PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
UNDER CONTRACT NO. EY-76-S-06-2225
TASK AGREEMENT NO. 39

and

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
CONTRACT NO. C-10976

Operations.

No station changes have taken place during the last quarter in the regular eastern Washington seismic array. The array has been operating in a fairly stable condition. Most stations have been operating normally with only the usual technical problems due to telemetry and power failures. Several stations in the Chelan area have been down for extended periods because of the extreme cold in the early part of this quarter.

The new east flank of the Cascade stations are presently being installed. Several of the phone lines will be connected within the next week or so. All of the equipment is built, and wired together. All the stations are permitted and installation has begun.

The U.S. Geological Survey computer systems have been installed and tested. We are presently wiring the seismic stations to the online machine and hope to be testing this connection and the raw data acquisition routine within the next few weeks. The off line system is being used for some program development presently but because some of the data communications controllers are not here yet we are not using it fully. We are anticipating using the Bell Labs operating system "UNIX" as soon as we receive a licence.

Data

The area to the north east of Lake Chelan mentioned in the last report as being a new area of activity was quite active this quarter with several felt events. On January 19 at 1455Z a magnitude 4 earthquake occurred at 47 53.8 north, 119 41.2 west with a depth of

7 km. This event was felt over roughly 800 square km. There were numerous aftershocks, the largest occurring on Jan. 21 at 2040Z with a magnitude of 3. Over 9 earthquakes have been located in this area stretching through March 17 and many other earthquakes were too small to be well located. Focal mechanisms for these events show almost all dilatations and because of the shallow depth and station distribution a well controlled solution is not possible though the pattern is similar to that of the Lake Chelan activity and may be related to it.

During this quarter an unusually large number of blasts have occurred. Slightly over half of the events located in the south are known or suspected explosions. Two blasts had computed magnitudes of almost 3.5. These were construction blasts of more than 60,000 lb. of explosives in the Black Rock Valley area east of Hanford. There were over 25 additional known explosions which we have not bothered to locate. The earthquake activity in the south followed the typical pattern of previous quarters though was lighter than usual in the Saddle Mountains area.

Magnitude Study.

Our comprehensive magnitude study is nearly complete. All data have been gathered and all magnitude computations have been made. The data used in this study come from the following four sources: Wood-Anderson records recorded near ENT in 1977, Wood-Anderson records from RIC (located at the Battelle offices just north of Richland) in 1978, Wood-Anderson records from NEW (the Newport

Observatory) for 1975 through 1978, and the Eastern Washington telemetered seismic net for the years 1975 through 1978. There were 80 earthquakes where both coda length and Wood-Anderson (local) magnitudes were computed. Because several events were recorded on more than one Wood-Anderson station we have 86 computed magnitudes; 12 from ENT, 10 from RIC and 64 from NEW. All published coda-length magnitudes for these events were rescanned if there were less than six stations reporting coda lengths. Our analysis indicates that the coda length magnitude relation we have been using is the proper one within our error estimates. A formal report presenting all data and conclusions will be included in the annual technical report.

Other Studies.

The broadband digital stations have been installed in three sites across the Cascades. They have recorded several of the large earthquakes which have occurred this winter. The data reduction procedures are presently being developed to use these data for inverting for average crustal structure and attenuation.

The preliminary testing of the down hole equipment has been completed. Because of some rather unusual technical difficulties this experiment was not a complete success. Successful recording of both the down hole instrument and the surface instruments was limited to brief periods of time during which no earthquakes of a large enough size occurred to totally evaluate the technique. One result of this experiment was the discovery of the extremely high noise conditions that exist on the surface near DC-3. To properly

record background seismic levels the amplifiers were set at from 12 to 18 db more attenuation than typical sites elsewhere in eastern Washington. A new three-component down hole sensor has been ordered and should be ready for installation near the end of the next quarter.

Walla Walla Earthquake.

On April 8 at 0729Z (11:29pm the night before local time) an earthquake occurred just southwest of Walla Walla. This event was about magnitude 4 and was felt in and around Walla Walla and Milton-Freewater. Though this event occurred in the second quarter we give some preliminary information about it in this report because of the interest in events from this area. This event is located in the same area as the 1936 magnitude 5+ earthquake. Over the past 10 years this area has not had many earthquakes and is quieter than most of the rest of the central basin. The April 8 event is the largest event in the immediate area during this period and perhaps since 1936. Its preliminary location is: 45 59.6 north and 118 26.2 west with a depth of between 2 and 5 km. A preliminary attempt at a focal mechanism gives a poorly controlled solution showing a steeply dipping nodal plane striking from between north and northeast and another striking northwest southeast with a dip of about 15 degrees. The control on this solution is poor and it is possible that the interpretation may change considerably when all the data ^{are} ~~is~~ used in a complete analysis. This event does appear to be somewhat different ^{from} ~~than~~ most of the earthquakes in eastern Washington. At least two stations show strong compressional first motions which is not usually the case.

TABLE I. Eastern Washington Seismograph Stations

Station	Lat (N)	Long (W)	Elevation (M)	South Delay	North Delay	Operating Period
MDW	46 36.80	119 45.65	330	.00	.53	7/75-
SYR	46 51.78	119 37.07	260	.00	.47	7/75-
OTH	46 44.34	119 12.99	260	.00	.39	7/75-
WAH	46 45.12	119 34.68	230	.00	.55	7/75-5/78
→WA2	46 45.40	119 33.76	230	.00	.55	5/78-
CRF	46 49.51	119 23.09	260	.00	.47	7/75-
GBL	46 35.86	119 27.59	360	.00	.57	7/75-
ETP	46 27.89	119 3.54	250	.00	.30	7/75-
BDG	46 14.08	119 19.05	410	.00	.48	7/75-
→EUK	46 23.75	118 33.72	400	-.10	.26	7/75-
→PRO	46 12.76	119 41.15	600	.00	.54	7/75-
RSW	46 23.47	119 35.32	1130	.00	.62	7/75-
→PEN	45 36.72	118 45.77	460	-.15	.18	7/75-
WGW	46 2.68	118 55.96	160	.00	.35	7/75-
→WIW	46 25.93	119 17.29	130	.00	.55	7/75-
→HER	45 50.14	119 22.85	190	.00	.47	7/75-11/77
→IRG	45 53.15	119 29.92	200	.00	.47	11/77-
MFW	45 54.18	118 24.35	430	-.15	.18	7/75-
→OMK	48 28.82	119 33.65	450	-.12	.23	7/75-
→DYH	47 57.63	119 46.16	900	-.20	.07	7/75-
WBW	48 1.07	119 8.23	910	-.22	.11	7/75-
SAW	47 42.10	119 24.06	800	-.25	.06	7/75-
CBW	47 48.42	120 1.96	1290	-.30	.00	7/75-
FPW	47 58.00	120 12.77	360	-.30	.00	7/75-
→PLN	47 47.08	120 37.97	670	.00	.00	6/77-
→ETT	47 39.30	120 17.60	930	.00	.09	6/77-
→WEN	47 31.77	120 11.65	1140	-.30	.00	7/75-
→EPH	47 21.13	119 35.77	500	-.14	.20	7/75-
ODS	47 18.40	118 44.70	610	-.20	.11	7/75-
→DAV	47 38.30	118 13.56	780	-.20	.11	7/75-
WRD	46 58.19	119 8.60	410	-.05	.35	7/75-
→WAT	47 41.92	119 57.25	900	-.25	.04	11/76-
→ENT	47 40.73	120 13.80	860	-.24	.07	11/76-6/77
VTG	46 57.48	119 59.24	210	.00	.28	7/75-
→COL	48 35.60	117 52.92	810	.00	.00	7/75-4/77
→NEW	48 15.83	117 7.22	830	.00	.00	5/77-
→FMC	45 37.47	120 1.70	300	-.20	.00	1/77-
→RPK	45 45.70	120 13.83	330	-.20	.00	1/77-
→ALD	45 49.17	120 4.00	290	-.20	.00	1/77-
→RPW	48 26.90	121 30.82	850	-.20	.00	8/77-
→GLD	45 50.33	120 48.85	700	.00	.00	11/77-
→EBW	47 00.25	120 40.47	830	.00	.00	12/77-

EASTERN WASHINGTON EARTHQUAKES

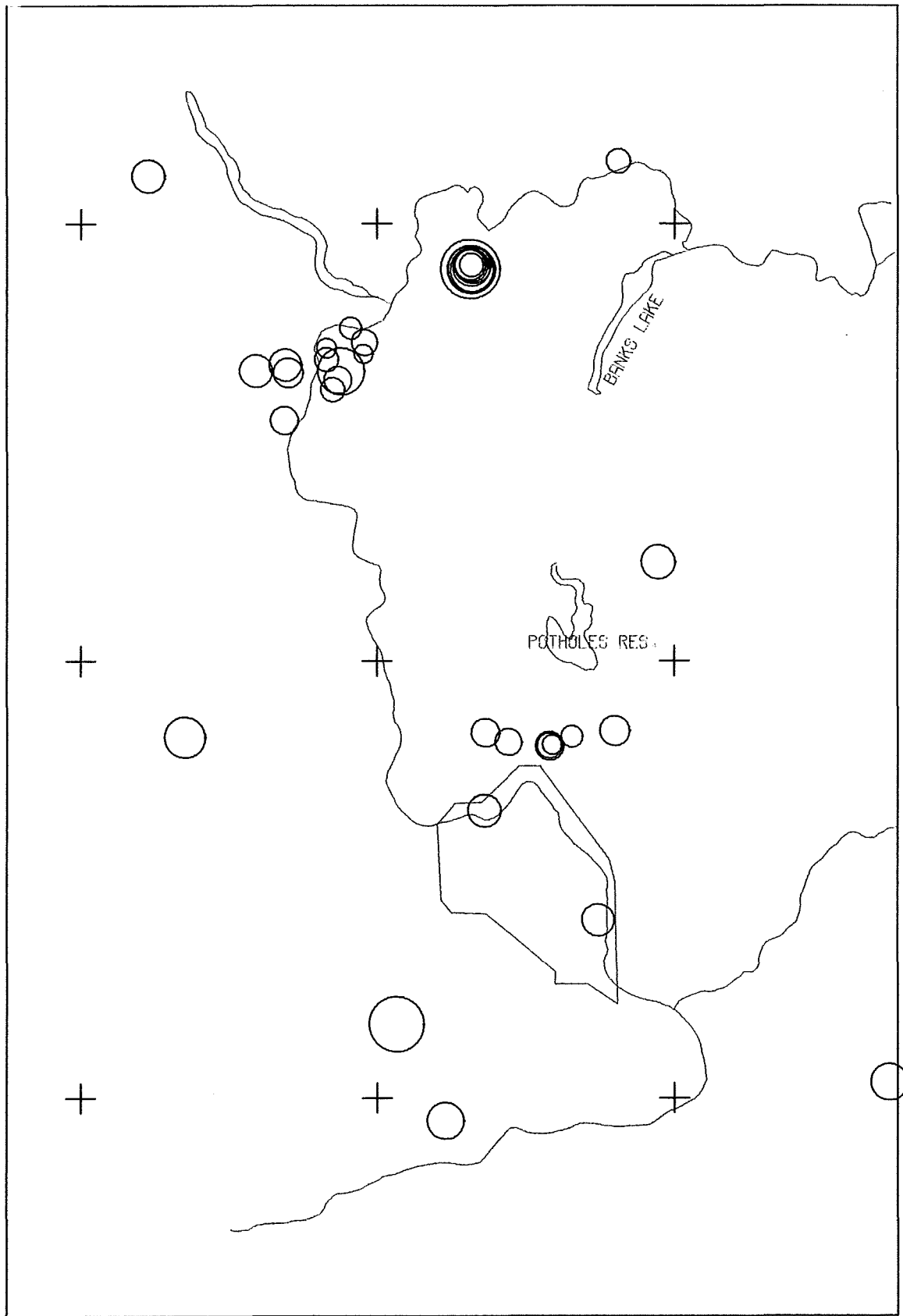
(10,78)

DATE	DAY	TIME	LAT	LONG	DEPTH	MAG	#	Q	TYPE
1/ 9/79	9	1729:26.7	47-42.83	120-19.17	8.4	.4	6	B	
1/11/79	11	20 1:25.2	45-53.79	119-19.52	0.5	2.0	7	C	X
1/16/79	16	2018:10.5	46-51.22	119-11.24	4.5	1.6	8	B	X
1/17/79	17	2312:23.5	46-51.25	119-11.13	0.5	1.6	7	D	X
1/18/79	18	1549:13.7	47-32.99	120-18.73	9.1	1.4	8	C	
1/18/79	18	2345:42.5	48- 1.13	119-36.72	0.5	1.2	5	D	X
1/19/79	19	1455:16.0	47-53.77	119-41.16	6.7	3.9	17	B	
1/19/79	19	1553:45.0	47-53.68	119-40.66	2.8	2.7	15	B	
1/19/79	19	1640:11.1	47-54.38	119-41.24	7.7	1.7	8	B	
1/19/79	19	1844:56.9	47-54.32	119-40.64	6.0	2.1	10	B	
1/19/79	19	1910:51.9	45-54.17	119-18.83	0.4	2.1	7	C	X
1/20/79	20	1031:11.6	47-54.26	119-41.02	7.2	1.8	8	B	
1/21/79	21	034:28.7	47-53.98	119-40.94	5.9	2.1	10	B	
1/21/79	21	2040: 6.1	47-53.72	119-40.95	3.2	3.0	17	B	
1/21/79	21	22 0:46.5	47-54.36	119-40.92	5.9	1.0	7	B	
1/22/79	22	1914:14.8	47-43.69	120- 2.53	4.7	1.3	10	B	
1/23/79	23	711:23.8	46-24.41	119-15.35	1.4	1.8	12	B	
1/23/79	23	819:36.5	47-45.65	120- 5.31	4.2	.9	7	B	
1/25/79	25	2328:40.2	46-13.30	119-48.66	0.5	1.9	7	D	X
1/26/79	26	23 9:11.7	46-12.28	119-50.08	0.5	1.9	6	D	X
1/28/79	28	1858:28.7	46- 2.15	118-16.64	1.5	2.1	7	D	
1/29/79	29	2140:32.9	48- 1.14	119-36.45	0.5	1.3	5	D	X
1/30/79	30	323:10.8	47-37.21	120- 8.95	10.5	1.1	7	B	
1/30/79	30	16 6:45.7	47-39.72	120- 7.24	5.1	2.9	16	B	
1/31/79	31	523: 9.0	47-42.13	120- 2.73	7.9	.7	6	B	

DATE	DAY	TIME	LAT	LONG	DEPTH	MAG	#	Q	TYPE
1/31/79	31	525:54.5	46-39.43	119-38.38	4.5	1.8	9	B	
1/31/79	31	1526:51.8	47-42.92	120-10.19	8.9	.7	6	B	
2/ 1/79	32	2018:32.4	47-32.76	121-33.86	7.5	3.1	8	D	W
2/ 6/79	37	437:58.6	47-53.77	119-41.07	3.5	2.8	12	B	
2/ 7/79	38	1852:33.8	48- 8.59	119-11.17	2.0	1.1	6	C	
2/ 8/79	39	1035:43.3	45-53.55	119-53.08	2.2	2.1	11	D	
2/ 8/79	39	2159: 0.9	46-28.10	118-59.47	1.7	1.7	5	C	P
2/ 9/79	40	112:41.0	47-41.34	120-10.19	1.5	1.1	8	D	
2/11/79	42	157:51.7	46-48.90	119-33.58	0.8	1.3	10	B	
2/13/79	44	329:11.8	46-49.55	120-38.87	1.5	2.4	18	D	
2/14/79	45	1626: 1.8	47-40.59	120-18.54	3.0	1.8	8	D	
2/15/79	46	123:32.0	45-56.84	119-46.18	0.1	2.1	7	D	
2/17/79	48	836:21.4	46-10.15	119-56.11	9.1	3.6	18	C	
2/18/79	49	956:26.1	48- 6.57	120-46.18	1.5	1.8	10	C	
2/18/79	49	2353:23.8	47-38.52	120- 7.89	10.9	1.4	8	B	
2/19/79	50	116: 4.4	46-50.15	119-38.20	1.9	1.4	10	B	
2/22/79	53	124:42.2	45-40.03	118-55.08	1.4	1.7	5	D	P
2/23/79	54	017: 2.7	46-13.22	119-48.17	1.3	1.8	6	C	P
2/23/79	54	1939:37.9	47-30.50	119- 6.39	0.5	2.3	12	C	X
2/23/79	54	2250: 4.6	46-51.52	119-10.71	0.5	1.8	8	D	X
2/28/79	59	2314:39.0	47-19.54	119- 0.92	3.0	2.7	10	C	P
2/28/79	59	2314:39.8	47-13.55	119- 3.25	3.0	1.9	8	D	
3/ 1/79	60	1929:15.5	46- 3.28	118-53.90	0.7	2.7	11	B	P
3/ 2/79	61	19 5:57.3	46-50.40	119-12.04	4.2	1.5	7	C	
3/ 3/79	62	2326:45.9	46-49.63	119-20.69	4.2	.9	5	C	

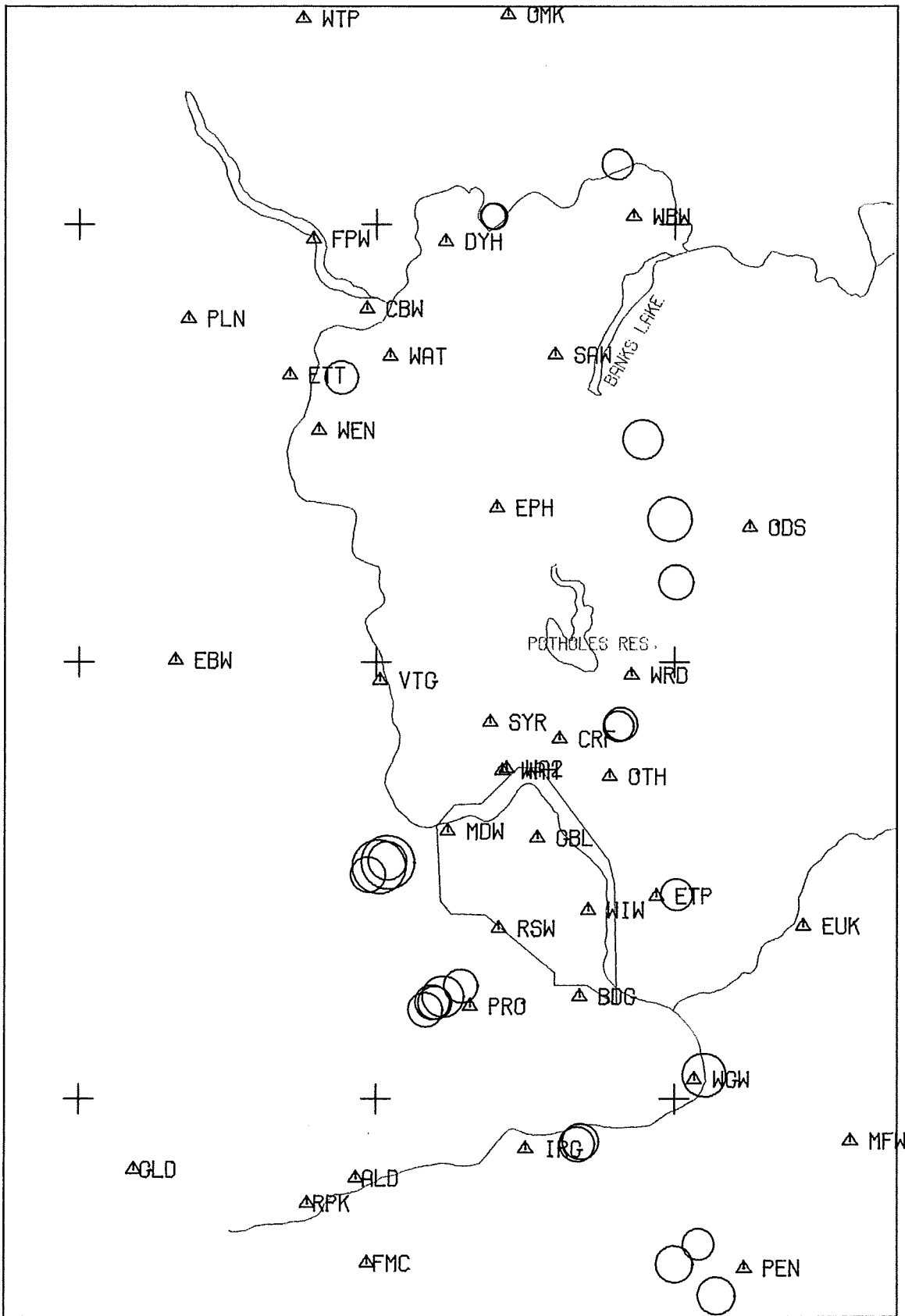
DATE	DAY	TIME	LAT	LONG	DEPTH	MAG	#	Q	TYPE
3/ 7/79	66	0 7:56.4	46-14.09	119-46.54	0.3	2.4	6	C	X
3/ 7/79	66	2251: 6.4	46-30.85	120- 1.63	0.4	2.0	7	D	X
3/ 9/79	68	1642:58.7	46-32.74	119-57.69	0.3	2.2	10	D	X
3/13/79	72	23 0:22.3	47-10.90	118-59.64	3.0	2.0	10	C	P
3/14/79	73	0 8:58.0	47-39.52	120-17.98	2.1	1.6	10	B	
3/15/79	74	2157:31.8	46-32.53	119-57.59	0.2	3.5	13	C	X
3/16/79	75	15 8: 8.4	47-39.76	120-24.43	4.0	1.8	13	C	
3/16/79	75	1916:13.9	46-48.48	119-24.71	2.2	.7	7	B	
3/16/79	75	2140:12.1	46-48.33	119-25.25	0.2	1.2	9	B	
3/16/79	75	2158:36.3	46-48.30	119-25.24	0.4	1.5	9	B	
3/17/79	76	350:26.3	47-54.36	119-41.13	7.4	1.6	10	B	
3/21/79	80	046:53.8	46-15.54	119-42.97	0.4	1.9	6	D	X
3/23/79	82	2149:23.4	46-31.93	119-59.43	0.5	3.5	11	D	X
3/27/79	86	22 0:51.0	45-32.94	118-51.42	0.5	2.2	5	D	X
3/27/79	86	23 4:52.9	47-38.98	120- 7.09	4.8	1.8	11	C	P
3/28/79	87	044:13.2	45-37.28	118-59.95	3.0	2.1	6	D	P
3/28/79	87	1857:53.1	48- 8.25	119-11.53	1.5	1.6	8	C	P

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EASTERN WASHINGTON EARTHQUAKES JAN. - MARCH, 1979
 CENTER OF MAP IS 47.00 N 119.75 W

MAGNITUDE KEY: ○ 0.0 ○ 1.3 ○ 2.7 ○ 4.0



EASTERN WASHINGTON BLASTS AND STATIONS 1979

CENTER OF MAP IS 47.00 N 119.75 W

MAGNITUDE KEY ○ 0.0 ◌ 1.3 ◌ 2.7 ◌ 4.0