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*Corporation*

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SEISMICITY REPORT  
ON THE  
VALE PROSPECT  
MAHELUR COUNTY  
OREGON

MICRO GEOPHYSICS CORPORATION

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## ABSTRACT

A modern, high-gain (240-1900K), high-frequency (5-30hz), microseismic network with a detection threshold below magnitude 0 was operated in the area southeast of the town of Vale, Mahelur County, Oregon, for a period of ten days in February 1975. No local events were recorded, indicating a upper bound on seismicity in this area of below .1 Magnitude 0 event per day. Seismicity of this level is felt to be strong evidence that commercial geothermal reserves do not exist on this prospect.

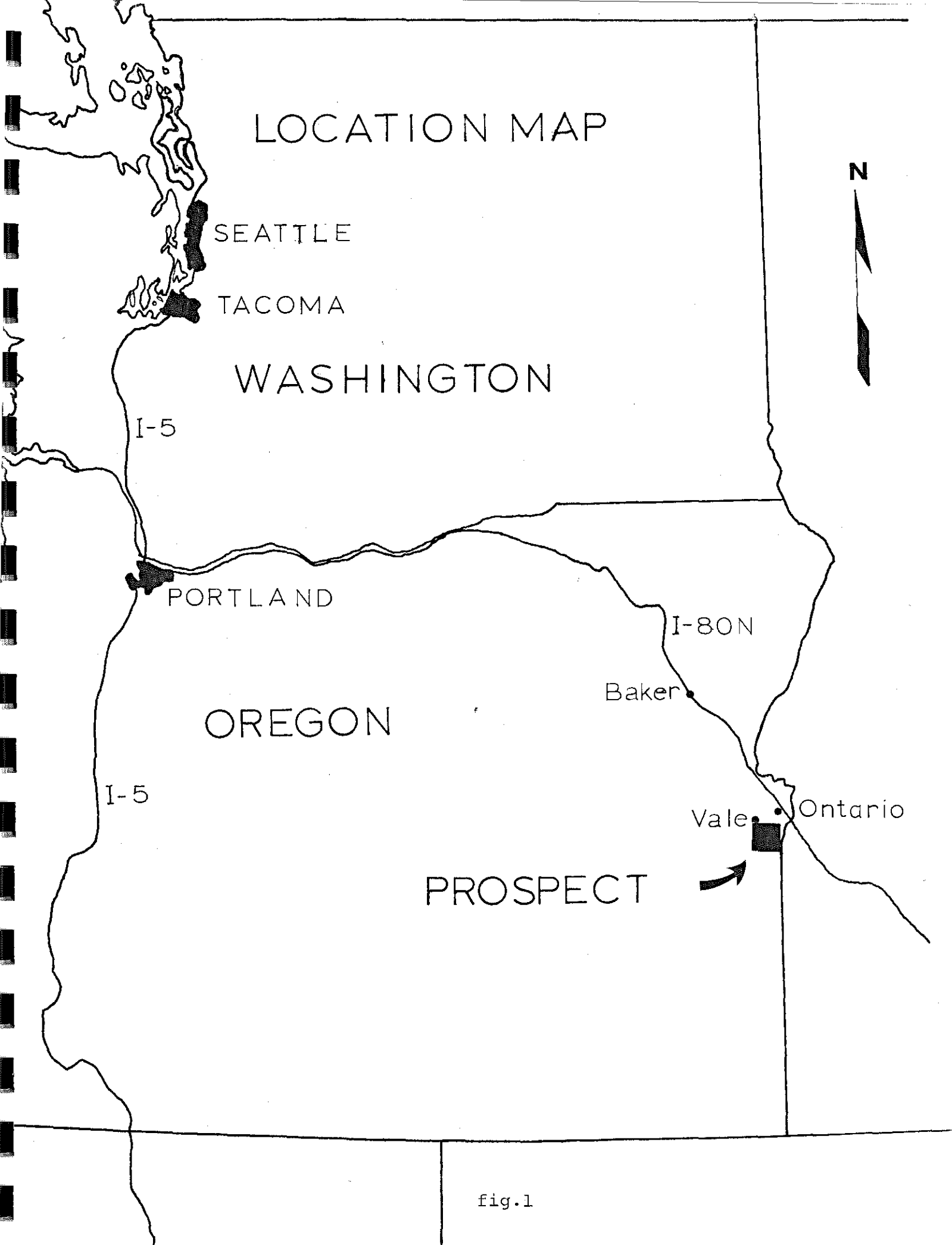


fig.1

## INTRODUCTION

An area of approximately 400km<sup>2</sup> (150 mi sq) south of Vale, Oregon, was surveyed for microearthquakes during the period January 31 to February 11, 1975. The object of this survey was to detect and locate discrete seismic events (microearthquakes) to aid in the evaluation of the geothermal potential of the area. Microearthquakes are felt by many to be a necessary ingredient of a commercial geothermal occurrence. (Lange and Westphal, 1969; Ward and Bjornson, 1971; Ward and Jacob, 1971; Hamilton and Muffler, 1972; Ward 1972).

## INSTRUMENTATION AND OPERATIONAL SUMMARY

Seven MEQ-800-B portable seismic systems equipped with digital magnetic-tape recorders were used in this survey. The Sprengnether system consists of a Mark Products model LC-4, 1-hz natural-frequency vertical seismometer, gain-stable amplifier, integral timing system, and smoked paper recording with 0.05mm stylus width and 120mm/min recording speed. The frequency characteristics of the instrument are summarized in Figure 2. (Note that velocity response is plotted; displacement response at a particular frequency,  $f$ , is obtained by multiplying the velocity response by  $2\pi f$ ). Gain changes are by 6db steps down from the arbitrarily assigned level of +120db plotted in the figure. The magnetic tape recorders record 100 twelve-bit samples per second at 800 bits per inch on 0.5 inch computer-compatible magnetic tape. Timing is based on the Sprengnether clock system, which is reset to WWVB daily and the drift

Velocity Response of System at Maximum Gain (120 db).

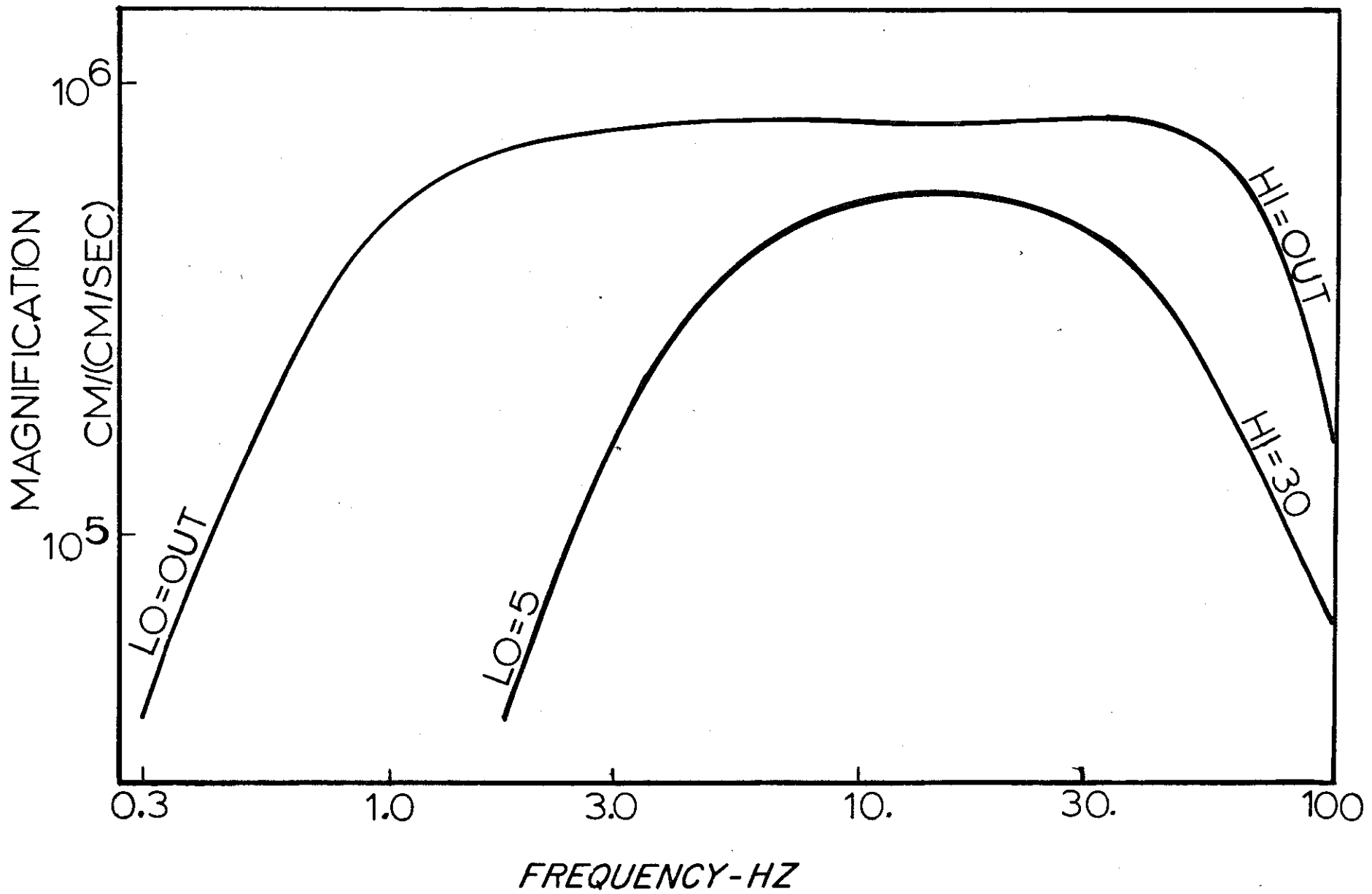


fig 2

recorded. Clock corrections are applied to the data by making a linear interpolation of the clock drift readings. Field interpretation is based on analysis of the smoked paper records. These records are read to 0.02mm (0.01 sec) with a reproducibility of  $\pm 0.03$  sec. for P-arrivals and  $\pm 0.1$  sec. for S-arrivals. The digital magnetic tape gives timing resolution of 0.01 sec.

The majority of the stations of this survey were located on outcrops of oolitic limestone of the Chalk Hills Formation. These sites were background-noise-limited to displacement gains of from 240 to 980 thousand at 20hz. Cultural activity, primarily vehicular traffic, was the largest source of noise in this survey, although wind noise noticeably detracted from record quality on two days. No events corresponding to nearby explosions or blasts were recorded. Figure 3 and Table 1 illustrate the station locations and give coordinates of the stations. Table 2 is a detailed operating summary.

#### OBSERVATIONS

Events are regarded as seismic in origin if they have the characteristic signature of an earthquake or if they appear on two or more stations with moveouts corresponding to seismic velocities. No local events were recorded in this survey. Two regional events were recorded. These events are located approximately 140km northwest of the survey area. Five teleseismic events were recorded during this survey. This number is comparable to the number of teleseismic events recorded in other surveys and is some indication that extremely high attenuation, at least in the frequency band 1-5hz, is not present in this area.

# VALE OREGON STATION LOCATIONS

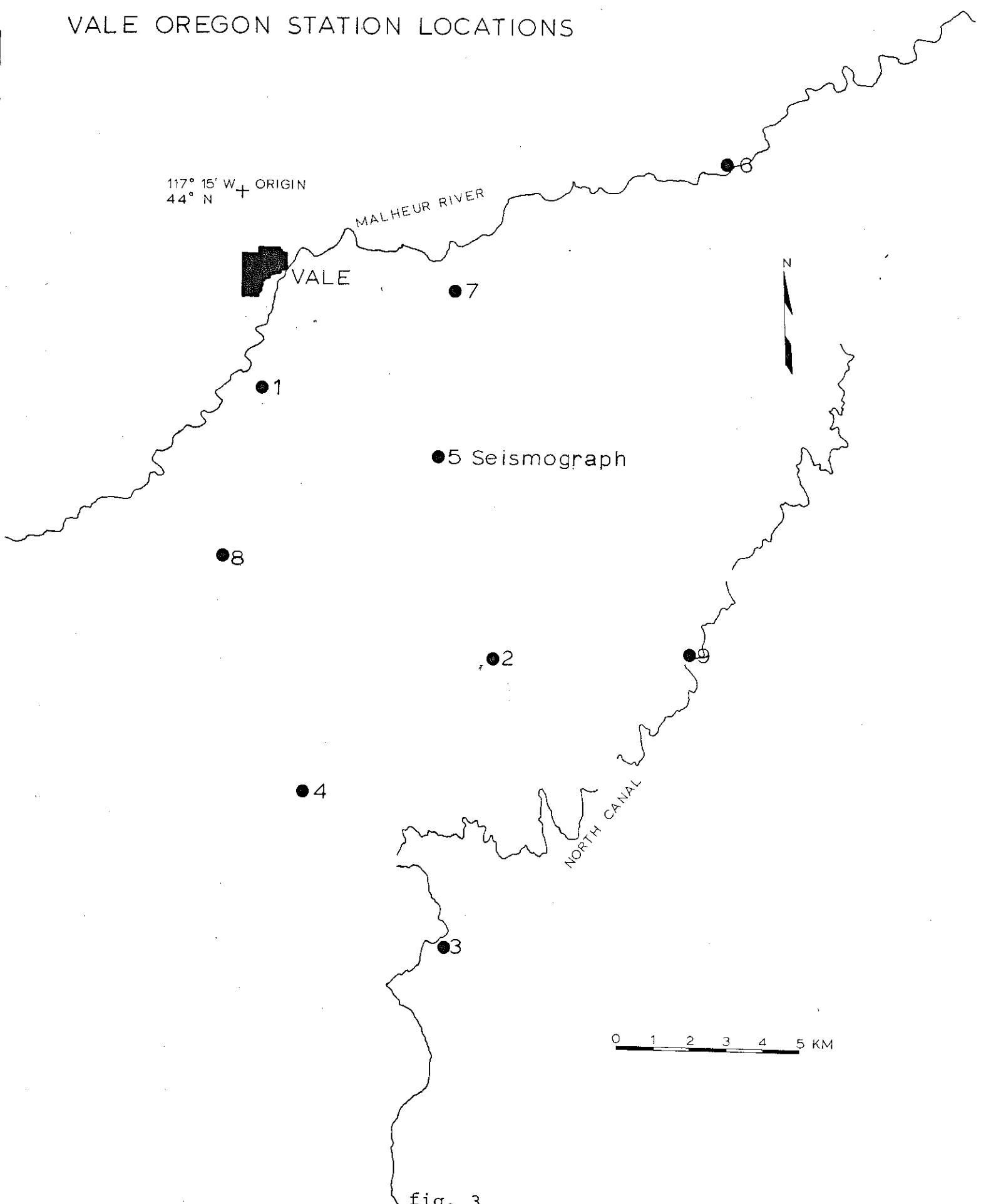


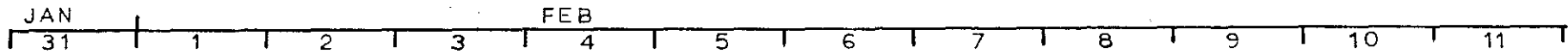
fig. 3

VALE, OREGON STATION LOCATIONS

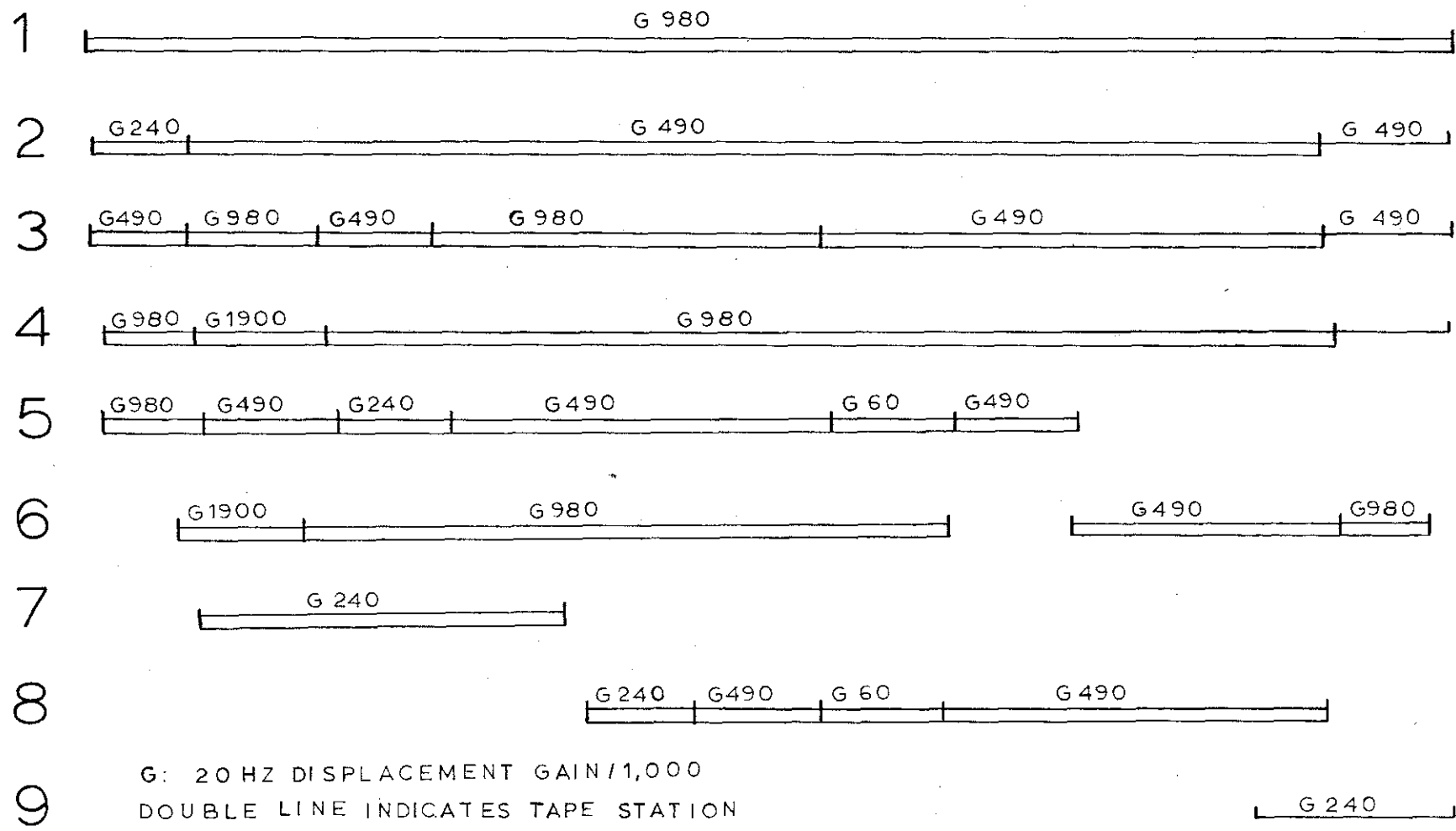
<u>STATION</u>	<u>X</u>	<u>Y</u>	<u>Z*</u>
1	.61	- 5.26	.701
2	6.59	-12.34	.811
3	5.76	-20.32	.798
4	1.69	-16.26	.808
5	5.42	- 7.12	.853
6	12.72	1.03	.677
7	5.77	- 2.52	.707
8	- .36	- 9.89	.744
9	12.28	-12.34	.774

\* Origin at 117° 15'W, 44° N, mean sea level,  
+X east, +Y north, +Z up.





STATION NUMBER



G: 20 HZ DISPLACEMENT GAIN/1,000  
 DOUBLE LINE INDICATES TAPE STATION

# OPERATING SCHEDULE, VALE OREGON

table 2

# CUMULATIVE NUMBER OF TELESEISMIC EVENTS

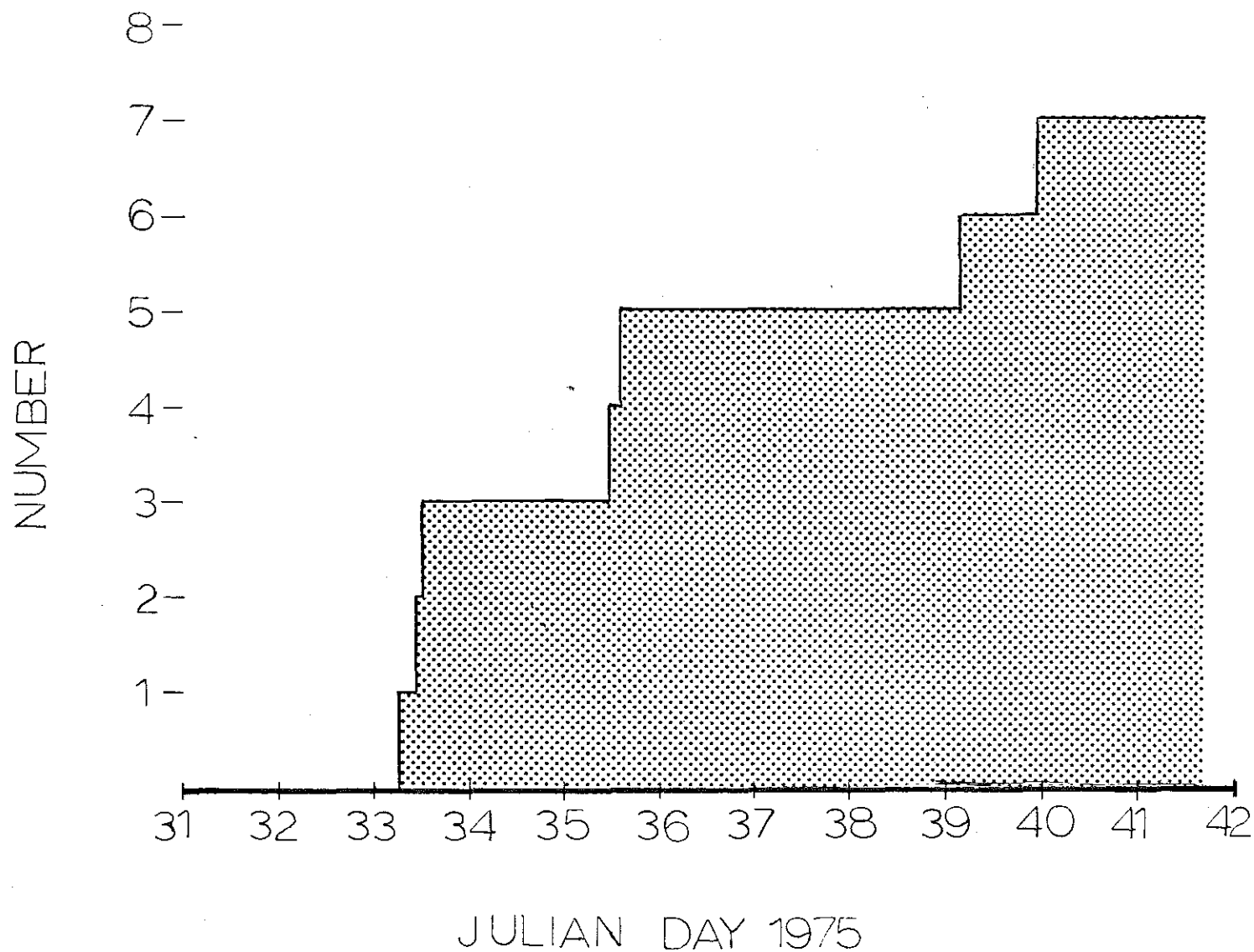


fig. 4

To examine the possibility that unrecorded events occurred in the survey area a surface detection threshold map (Figure 5) was prepared from standard amplitude versus distance relationships. (Bruce and Allen 1967). This map shows that the area of interest is substantially covered at magnitude -0.5 and thoroughly covered at magnitude 0.0. However, the geology of this area is characterized by alternating high and low velocity formations. These are naturally expected to increase the attenuation in this area. However, it is felt that this effect is small, (less than 6db) and that this array should have recorded any event of magnitude 0 or larger in the survey area.

#### INTERPRETATION

The results of this survey place a greatest upper bound on the seismicity of .1 magnitude 0 event per day. Sanford and Singh (1968) have, on the basis of 5 years of microearthquake data from Socorro, New Mexico, found that a one week sample will predict 10 year seismicity to within 1 order of magnitude at the 95% confidence level. The exact level of seismicity required to give positive evidence of geothermal potential is not known. Seismicities below 1 magnitude zero event per day have not been found in proven geothermal areas (Hamilton and Muffler, 1972; Lange and Westphal, 1969). There is a small, (less than 5%), chance that a longer recording time would record seismicity high enough to qualify this area as a geothermal prospect of merit. However, because no events were recorded in this survey there is a far higher probability that seismicity established by a long-term

M=0.0

# SURFACE DETECTION THRESHOLD MAP

M=-0.5



VALE

•1

•7

•6

•5

•8

•2

•9

•4

M=0.5

•3

M=0.0



0 1 2 3 4 5 KM

fig.5

survey would be substantially less than that reported as an upper bound here.

These results correlate with the known historical seismicity of this area. No events have been felt or recorded in the near vicinity, (50km) of this prospect. (Figure 6). Historical events have been recorded north of this prospect, in the vicinity of Baker and to the south near Rockville. The events at Rockville are reportedly related to geothermal phenomena. (Berg and Baker, 1963).

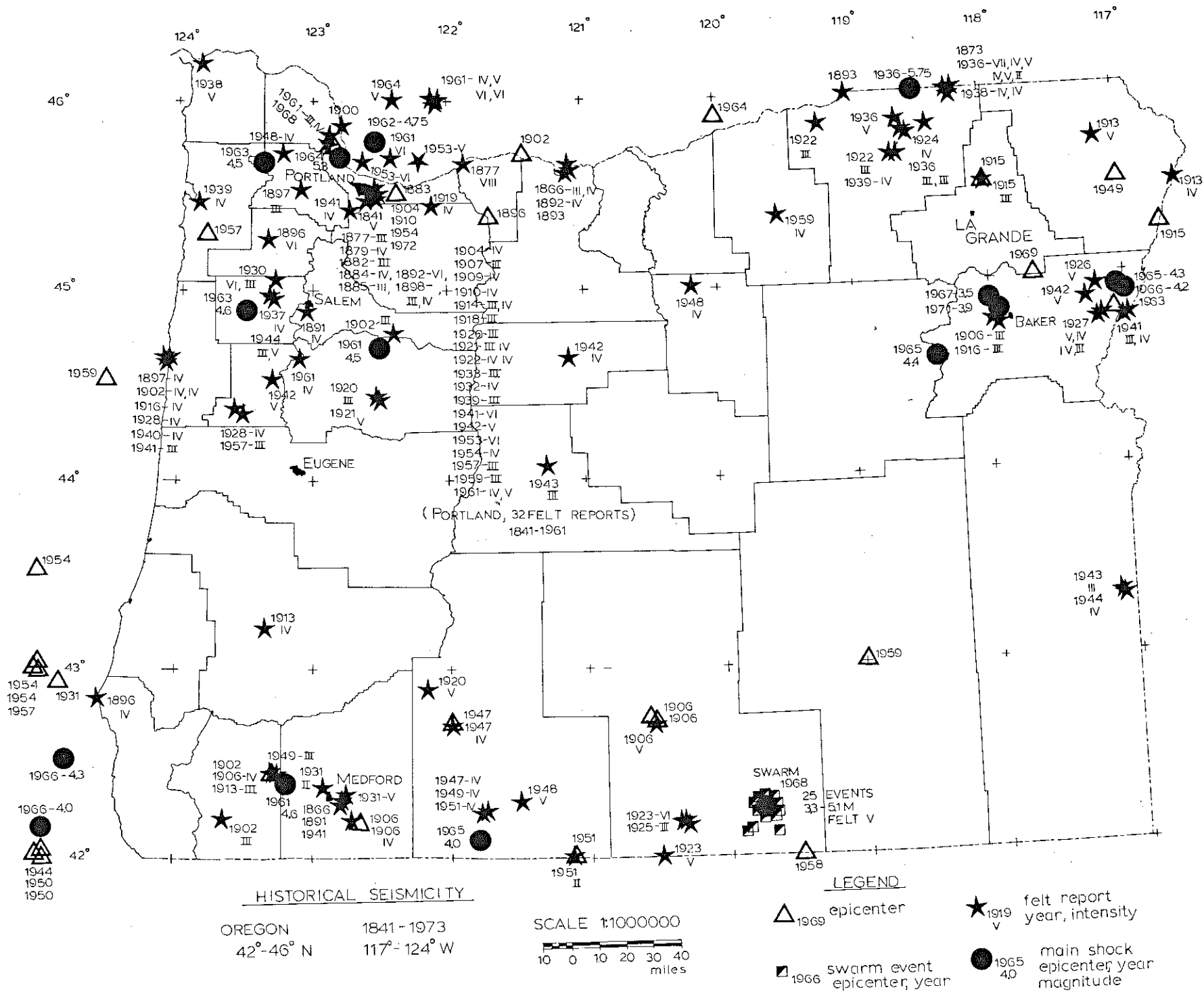


fig. 6

prepared by MGC

## CONCLUSIONS

1. Seismicity recorded in this survey is below that expected in a geothermal area.
2. Seismicity as recorded in this survey poses no threat to the structures or works of man.

## RECOMMENDATION

The data developed here should be correlated with other known data before a decision is made to abandon this area, however in the absence strong positive data from other sources no further field work is indicated for this prospect.

## REFERENCES

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