file / Bully Creek Oregon

AMAX EXPLORATION, INC.

4704 HARLAN STREET • DENVER, COLORADO 80212

GL04926-4

INTER-OFFICE MEMORANDUM

SUBJECT: Microearthquake Reconnaissance near Bully Creek, Oregon DATE March 12, 1976

TO: W. M. Dolan, H. J. Olson, H. D. Pilkington, G/T Staff cc: Jerry Roth

FROM: A. L. Lange

Operation:

Two Sprengnether MEQ-800 seismographs were operated side-by-side in a mercury mine adit of Hope Butte, 5 1/2 km NNW of Bully Creek school, or about 20km NW of Vale, Oregon (Figure 1). The instruments were operated between 11 - 19 September, 1975, and produced legible records during about 90% of that interval. Gains of 90 to 96db were utilized. Portions of some records were obscured by wind noise and 60 hz AC. The operator was John Deymonaz.

The seismometers were spaced about 150m apart in a mine (Figure 2). The north one was a Mark Products L-4C 1hz vertical component seismometer planted in the mine; the south unit was a 4 hz vertical component geophone of somewhat lower response than the former. Hope Butte is composed of silicified Chalk Butte sediments.

Results:

Examination of the nine days of records revealed three local events that track on both channels. The first of these occurred at approximately 1037 MST on 14 September 1975 (Figure 3); the second, at 2004, of the same day; and the third, at 1115 on 20 September. Because the two drums were time-synchronized manually, and times set from a wristwatch, these are only approximate times. Stepouts (which would give a clue to the direction of the source) can not be reliably determined since we lacked synchronization. Amplitudes of the first event were about equal; in the case of the second and third, however, the response at the underground site was about 3 and 14 times greater, respectively, for reasons unknown. In events 1 and 3, two peaks are readable, which may correspond to P and S phases, and in both, the first or P-wave is considerably larger in amplitude than the S. If the phases are properly identified we can compute the approximate slant distance to the sources, if we estimate the following properties: a) Poisson's Ration =0.25; P-wave velocity = 4 to 5km/sec. Under these assumptions — appropriate to this environment — the slant distances become:

	Event 1	Event 3	
S-P time =	1/3	1/4	sec.
Dist. @ 4 km/sec =	1.9	1.4	km
Dist. @ 5 km/sec =	2.4	1.8	km

The maximum ranges of the two events are shown in Figure 4. Event 2 probably falls within the range of Event 3. Because the sources are unlikely to be at the surface, the actual epicenters are probably much closer to the stations, and the depths within these ranges. Three mapped normal faults fall within these radii.

Other Surveys:

MicroGeophysics Corporation operated an MEQ-800 seismograph during 2 days (8 - 9 February, 1975) near Jamieson, approximately 14km north of Hope Butte and observed no microearthquakes (Figure 5). A nine-station survey was conducted between 3 - 8 January, 1976, by the same firm (Figure 5). It had been hoped that this exercise would detect aftershocks from a series of earthquakes reported from the vicinity of Vale between September and December 1975, which included a Magnitude 1.8 event felt at Vale. No microearthquakes or aftershocks were recorded, however. No stations were installed underground during the survey.

Conclusions:

The occurrence of three microearthquakes during nine days of recording seems to represent a background incidence of seismicity for the Hope Butte area. The sources of the activity must lie within a 2.4km-radius half-sphere of the Hope Butte adit. It may be significant that during a total of 26 days of monitoring at various sites extending between Chalk Butte on the south and Jamieson on the north, the only microearthquakes recorded appeared at Hope Butte. Their coincidence with the presence of extensive alteration and mercury ore points to a geothermal relationship between the microearthquakes and hydrothermal fluids. The activity very likely represents movement along one or the other of the mapped normal faults that underlie Hope Butte. Lubrication by hydrothermal waters may provide the stimulus for the movements. The alternative explanation that these shocks are rock movements within the mine seems improbable, because the determined S-P range considerably exceeds the extent of the adits.

Recommendations:

The increased sensitivity obtainable underground is demonstrated in this operation. Wherever possible, seismograph sites should be established in mines or caves to get away from wind, cultural noises, and sounds transmitted through the air.

The use of the VR-60 dual-channel recorder now in operation elsewhere provides automatic synchronization of the two channels, so that direction to source can be determined in some cases. If MEQ-800, individual recorders are used, as they were at Hope Butte, they should be synchronized by WWVB radio signals.

Additional recording should be conducted around Hope Butte with the VE-60 over a period of time sufficient to establish the schedule of seismicity.

Arthur L. Lange

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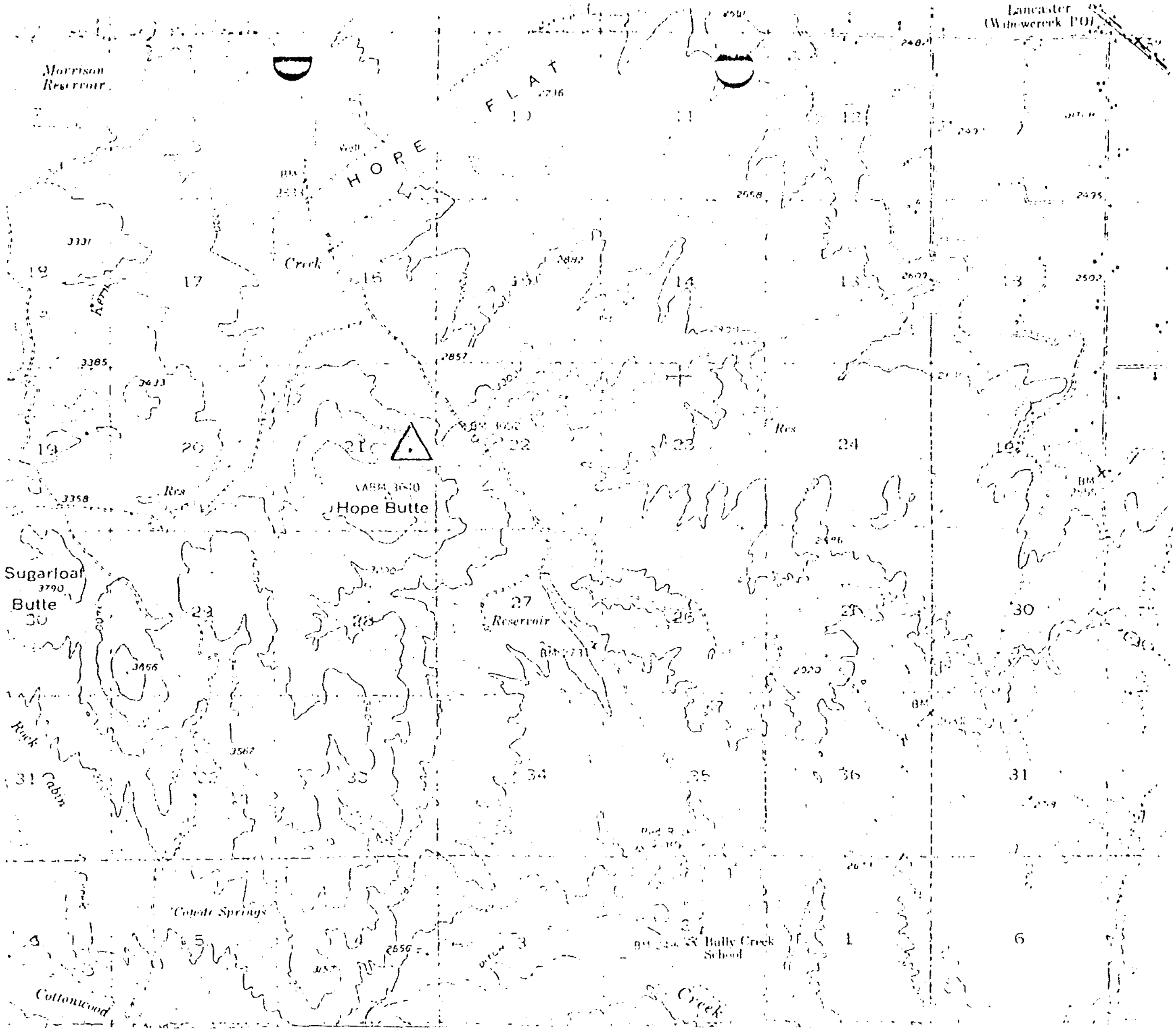

Figure 1. Location of Hope Butte.

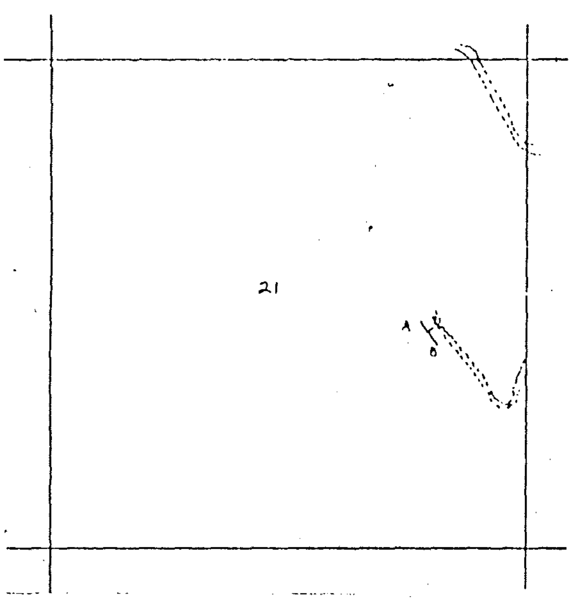

Figure 2. Approximate location of seismometers in Section 21.

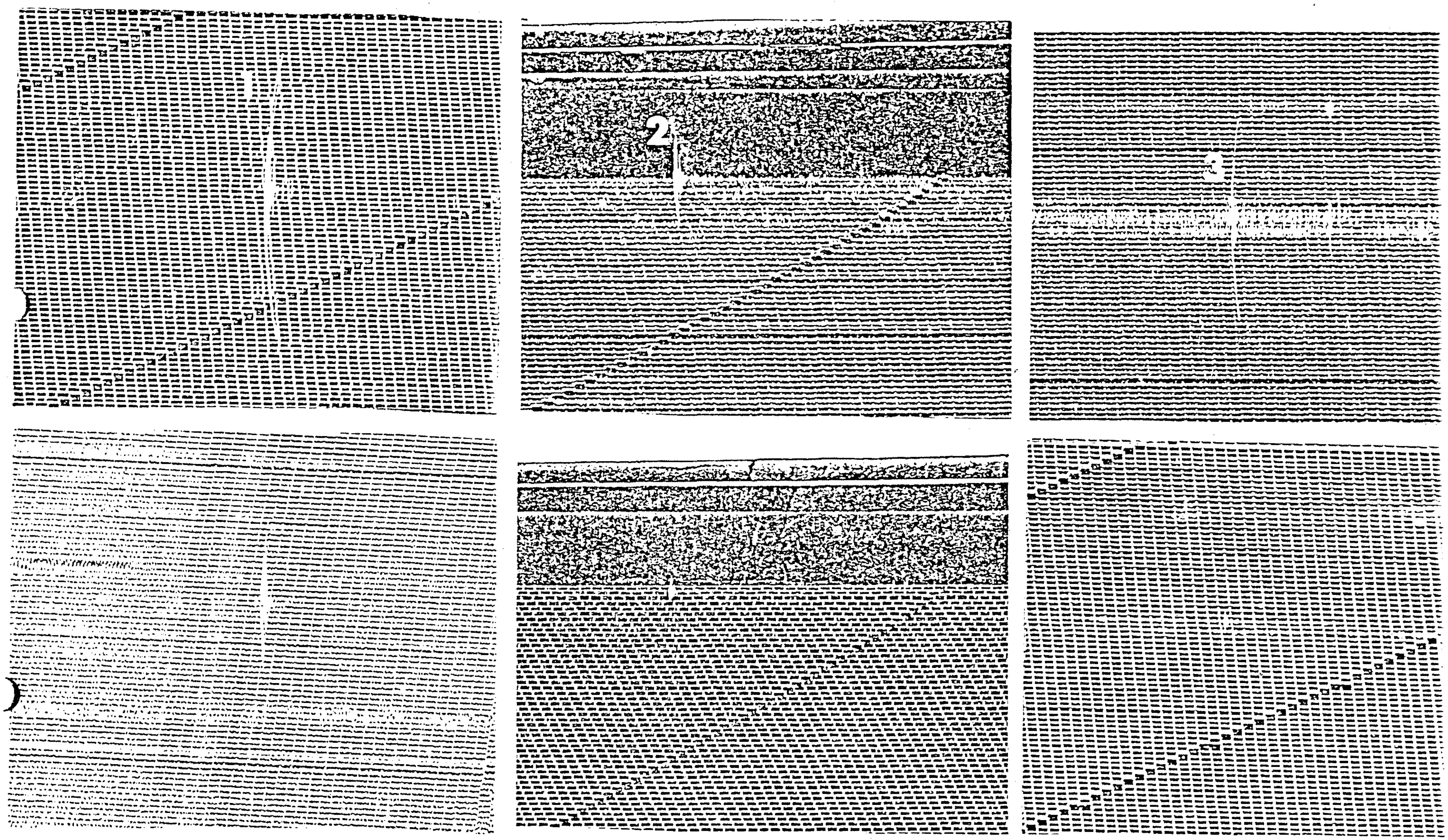

Figure 3. Three microearthquakes at Hope Butte, shown on both the north and south records, upper and lower, respectively. Gains in all cases except 3N were 96db; gain of 3N was 90db. Tic marks are seconds, each trace is 5 minutes.

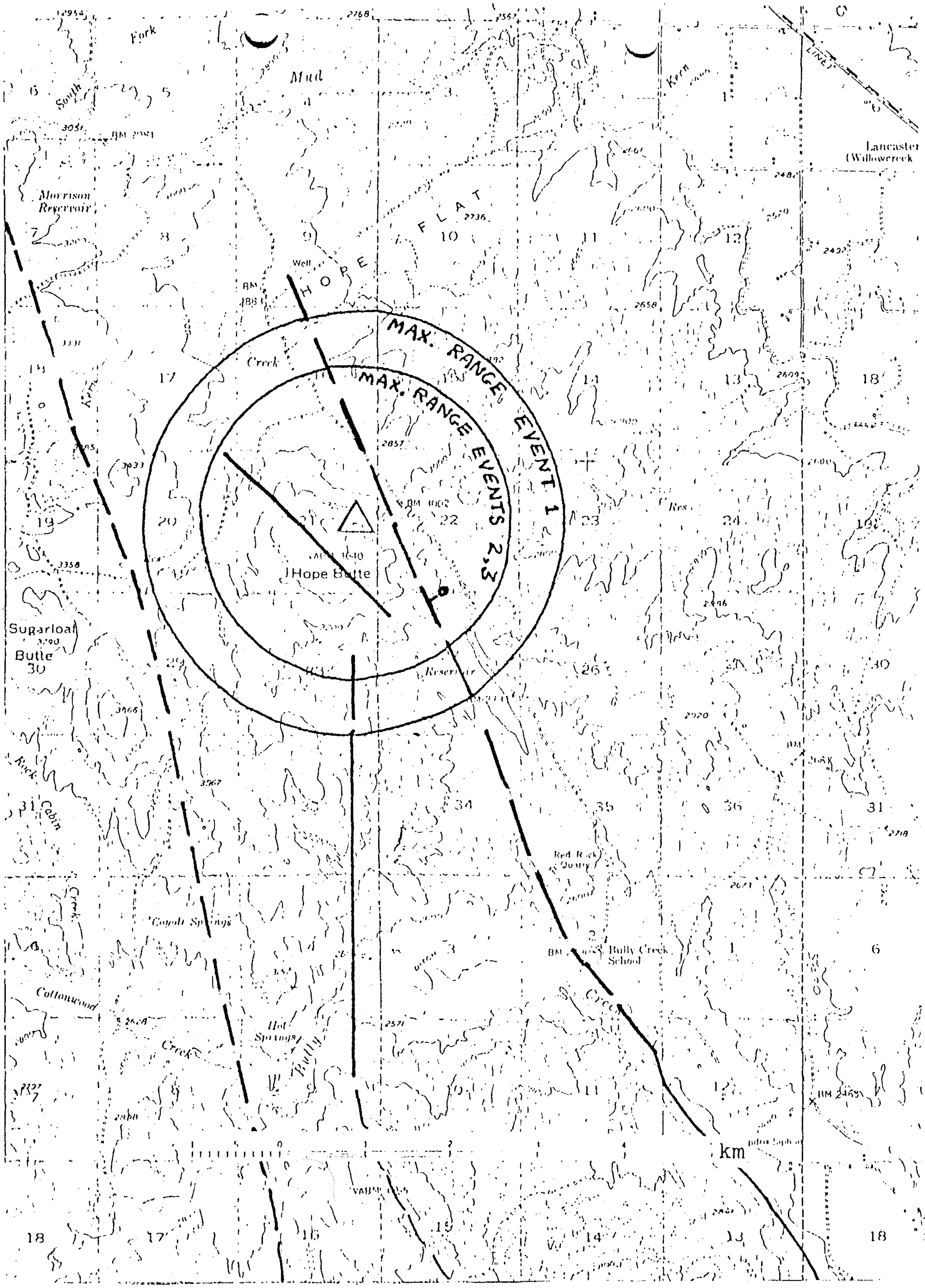

Figure 4. Loci of maximum possible ranges for the epicenters of the three microearthquakes recorded at Hope Butte. Since the movement probably originates at depth, the actual epicenters can be expected to fall well within these radii. Faults mapped by F. Dellechaie are superimposed.

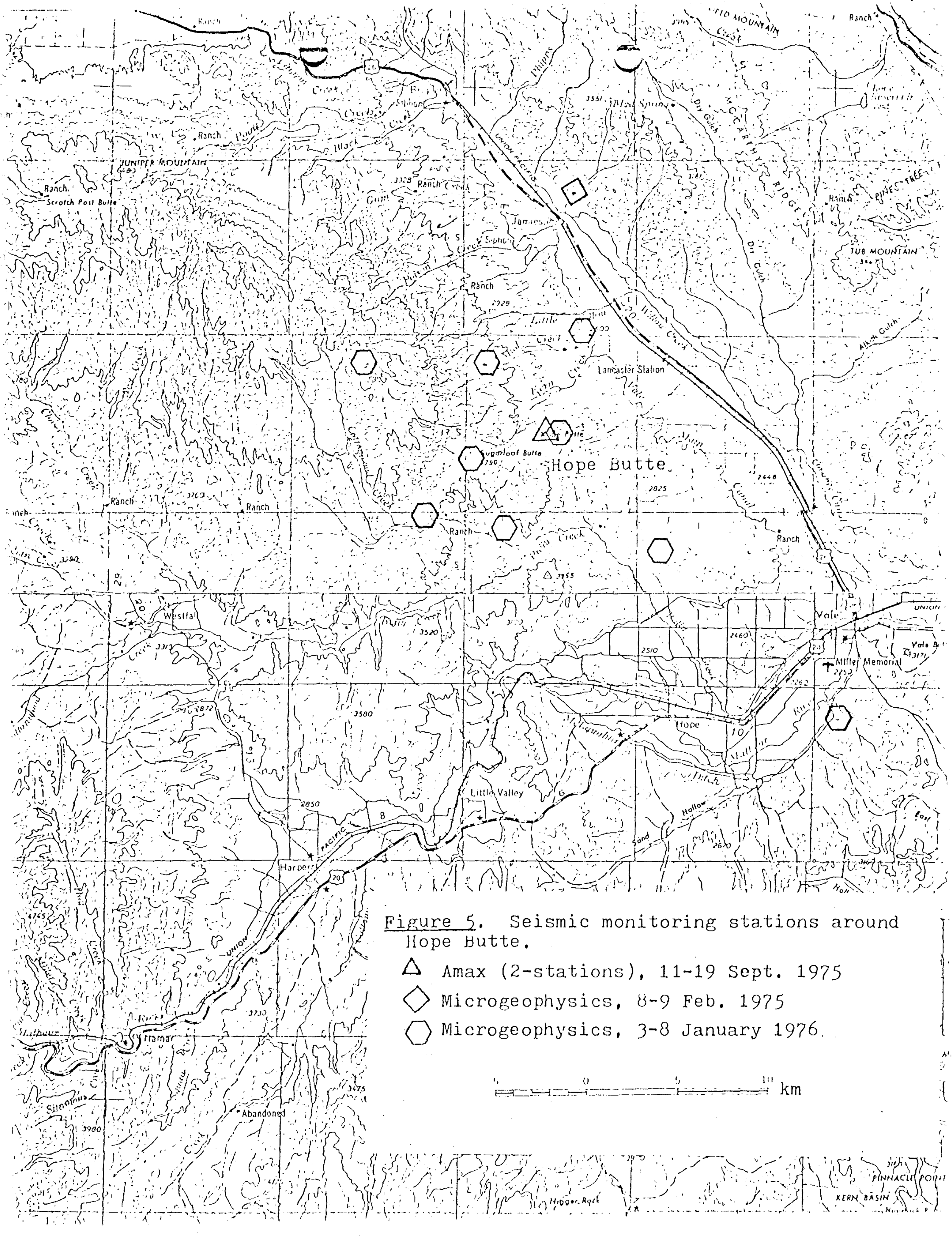

Figure 5. Seismic monitoring stations around Hope Butte.

△ Amax (2-stations), 11-19 Sept. 1975

◇ Microgeophysics, 8-9 Feb. 1975

⬡ Microgeophysics, 3-8 January 1976

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INTER-OFFICE MEMORANDUM

SUBJECT: Seismic records, Chalk Butte and Bully Creek areas DATE March 5, 1976

TO: W. O. Lockman

FROM: A. L. Lange

cc: W. M. Dolan
H. J. Olson
J. Roth
H. D. Pilkington

Chalk Butte:

Throughout historic time, no earthquakes have been recorded from the Chalk Butte area. The nearest recorded earthquake was of a magnitude 1.8 near Vale, 16 kilometers to the north, on 8 November 1975. A high-gain microseismic network with a detection threshold below magnitude 0 was operated for a period of 10 days in February, 1975, by Microgeophysics Corporation. The nine stations, deployed between Vale and Chalk Butte, detected no microearthquakes. Their conclusion is: "Seismicity as recorded in this survey poses no threat to the structures or works of man".

Bully Creek:

No earthquakes have been reported from the Vale-Bully Creek area prior to 1975. On 8 November, 1975, however, a magnitude 1.8 earthquake was reported by the USGS station at Baker, Oregon, to have occurred near Vale, and was felt at Vale. Meanwhile, James Applegate of Boise State University reports that he recorded 12 events originating near Vale in December, 1975.

Microgeophysics Corporation operated a seismic station for two days in February, 1975, near Jamieson, and recorded no microearthquakes. A nine-station microearthquake network was deployed for five days between 3-8 January, 1976, by Microgeophysics, between Vale and Hope Butte. It was anticipated that aftershocks of the December activity would be seen; however, no local seismicity was recorded. Without accurate locations for the seismicity recorded from Boise and Baker, the intermittently active structures cannot be identified, and any relationship to geothermal manifestations in the Bully Creek area must be regarded as unlikely.

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