AMAX EXPLORATION, INC.
4704 HARLAN STREET • DENVER, COLORADO 80212

Jhmonaz

INTER-OFFICE MEMORANDUM

SUBJECT: Microearthquakes Recorded at Dog Valley Mountain, Utah DATE June 23, 1976

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

FROM: A. L. Lange

The Amax dual-channel seismograph was operated in the Rowley Mine of Dog Valley Mountain, 11km north of Cove Fort, Utah, for an interval of eight days between 13 and 22 May 1976 (Figure 1, 4). From the Utah State Geologic Map it appears that the mine lies in either the Devonian Sevy dolomite or Mississippian Redwall limestone, or both. The seismometers were placed approximately 150m apart within the mine. J. Deymonaz and A. Lange operated the instrument.

Method of analysis:

Epicentral distances were computed from the S-P times of the individual events. Two velocity assumptions were used to produce alternate solutions: A) 3.7km/sec., corresponding to the uppermost layer of the model of Mueller & Landisman (1971) (Figure 1); and B) 5.0km/sec., assumed for a shallow zone of composite Paleozoic sediments (Figure 2). Where possible, the focal depths were assumed to lie at 2km; those for which this depth was too great to yield solutions were plotted for their surface range and marked by stars. The figures show the distribution of epicentral distances plotted along a line extending SSW from the mine through Dog Valley. The concentric circles of Figure 1 illustrate the complete loci. The line shown should be regarded as the most likely direction of origin, based on previous Senturion surveys.

Findings:

During the eight days of monitoring, 54 close-in events were observed (S-P intervals less than 4 seconds). Four additional events lying between about 20 to 80km were logged, as well as numerous regional shocks and teleseisms. The distributions of the close-in events are plotted in Figures 1 and 2, based on the alternate velocity assumptions of 3.7 and 5.0km/sec. (see above). Five events ($\frac{v}{v}$) showed no resolvable phases and are concluded to have originated almost directly under the site. Of the remainder, 43 events fell either between the site and Dog Valley (at 3.7km/sec.), or (at the higher velocity) under Dog Valley proper. Six events occurred closer to Cove Fort. My experience leads me to prefer the higher velocity solutions of Figure 2 in this particular environment.

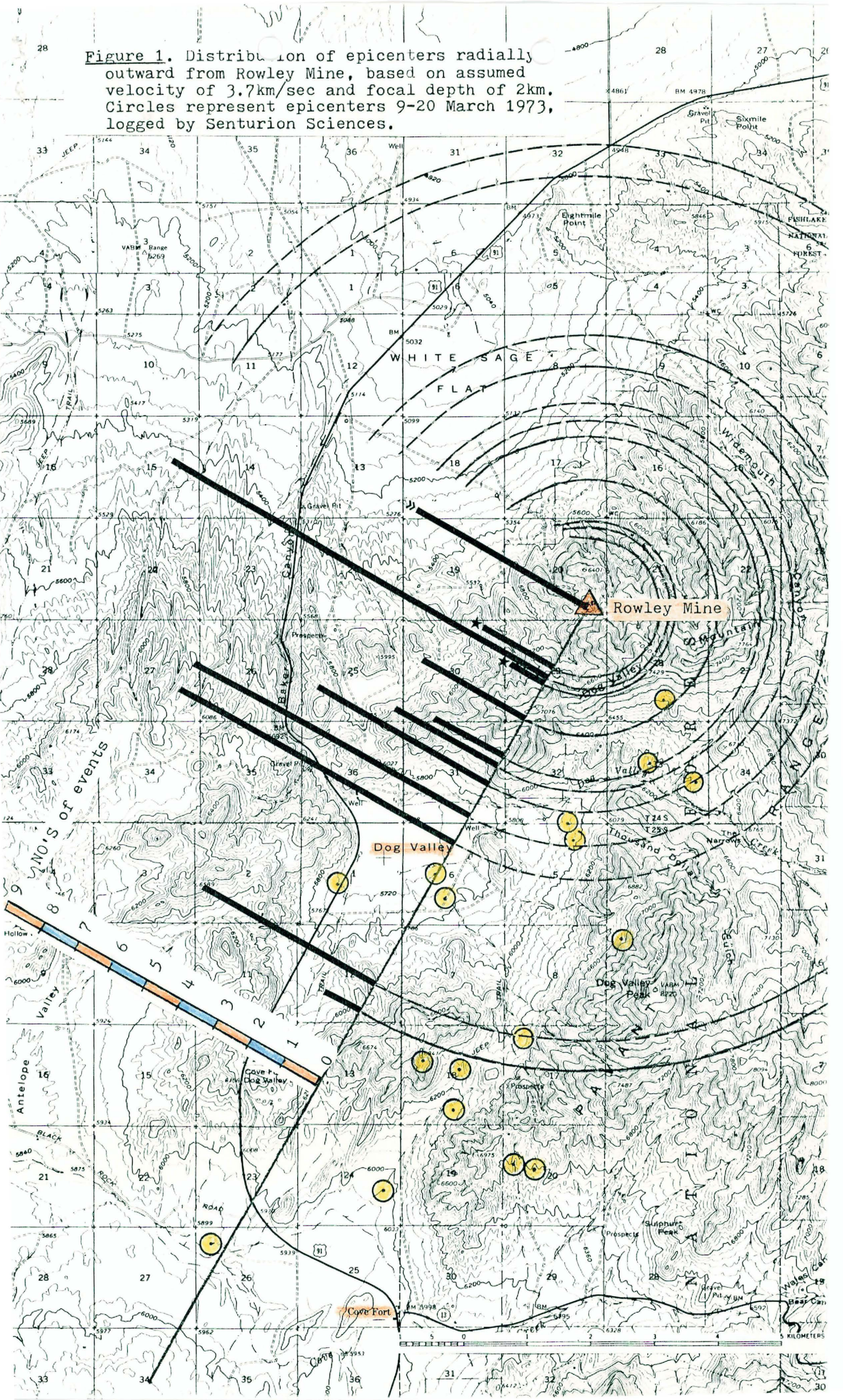


Figure 1. Distribution of epicenters radially outward from Rowley Mine, based on assumed velocity of 3.7km/sec and focal depth of 2km. Circles represent epicenters 9-20 March 1973, logged by Senturion Sciences.

Figure 2. Distribution of epicenters radially outward from Rowley Mine, based on assumed velocity of 5.0km/sec and focal depth of 2km. Circles represent epicenters 9-20 March 1973, logged by Senturion Sciences.

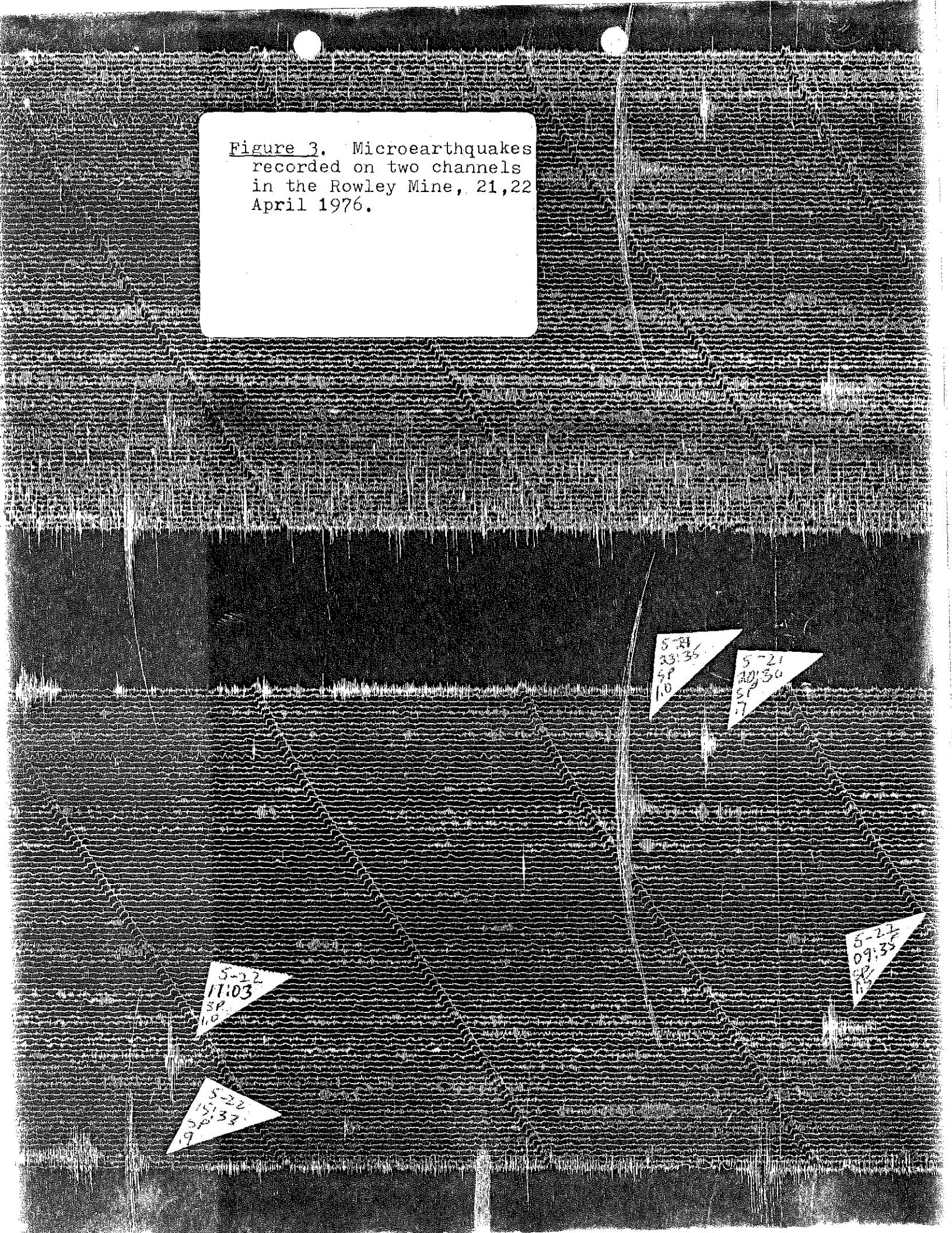
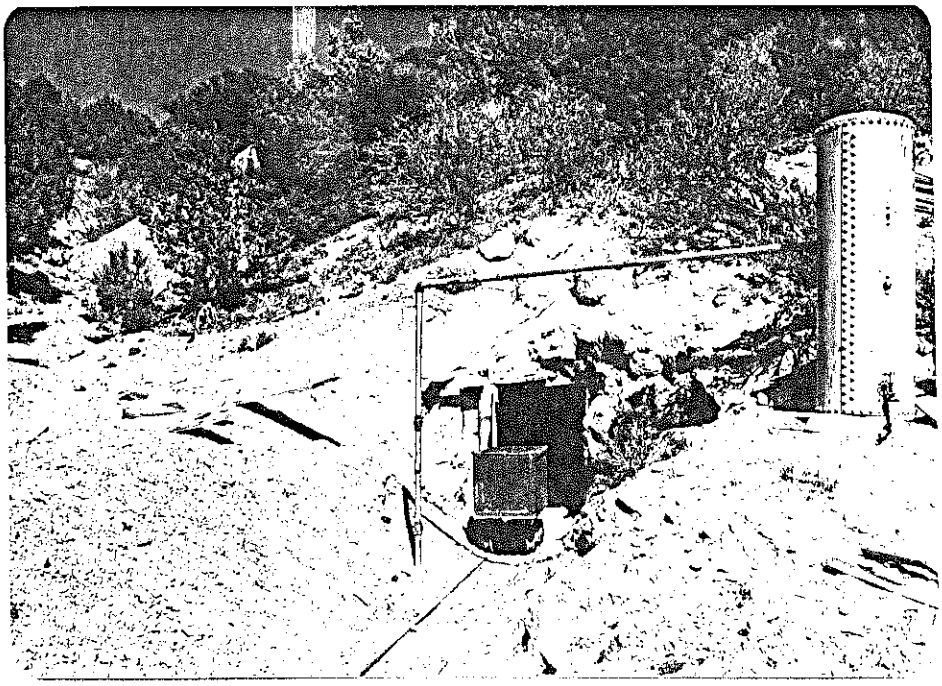


Figure 3. Microearthquakes recorded on two channels in the Rowley Mine, 21,22 April 1976.



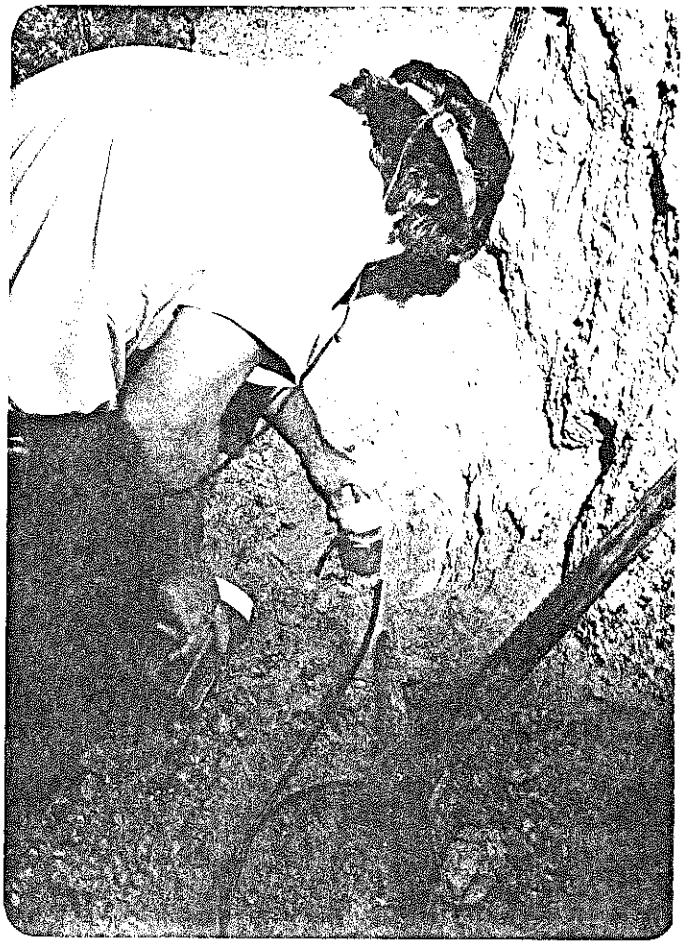


Figure 4. The Rowley Mine and recording site within.

Since the incident energy of the microearthquakes falls off rapidly with distance, it is quite possible that a higher rate of seismicity occurs around Cove Fort and Sulphurdale than we were able to detect at our site. A station placed farther south could determine this.

Conclusions:

The region immediately surrounding the Rowley Mine site is seismically active. Based on Senturion's findings, the most likely direction for this activity is to the south or southwest of the site (cf., Memo: 19 April 1976). On this assumption, Dog Valley is highly active. Seismicity occurs also between Dog Valley and Cove Fort. The rather high rate of occurrence (an average of 7 events per day) indicates that some of the faults in this highly disturbed zone are still very active. This activity is probably genetically related to and perhaps induced by thermal fluids.

Recommendations:

Since our single instrument recorded 7 events per day during its monitoring period, we can expect considerably more microearthquakes to appear if a network of 8 or more stations is operated. Such a survey, using digital tape recorders could adequately sample the area between Sulphurdale and Kanosh, with a station spacing that should permit mapping of the active faults to depth and determination of focal depths and structure. The exercise would contribute toward understanding the relationship of geothermal fluids and seismicity. In addition, regional and teleseismic events could be utilized to determine the possible existence of magma and deep crustal structure.

A ten-day high-resolution microearthquake survey costing $15,000. is recommended for the Cove Fort area.

Arthur L. Lange

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