

INTER-OFFICE MEMORANDUM

SUBJECT: Search for Microearthquakes in the Beaver, Utah area      DATE May 23, 1977

TO: Bill Dolan, Harry Olson and Art Lange, G/T Staff

FROM: R. Batra

The AMAX dual-channel seismograph was operated at the Pot Gut site, about 12 km southeast of Beaver, Utah (Figure 1). The site chosen was off the South Creek Road in Beaver County, Utah. Both legs of the instrument were located on massive granodiorite rock of the Bullion Canyon series. Good coupling between the seismometer and ground enabled instrument gain levels of upto 90 db to be achieved. Generally speaking, the microseismic noise levels were high owing to intensive refraction shooting and drilling activity in the area. Care was taken to protect the geophones from surface disturbances, particularly wind, by burying the seismometer and the last 5-10 feet of the seismometer cable. The seismograph was operated continuously for approximately 3½ days between 26 Apr 77 and 30 Apr 77, by A. Lange and R. Batra.

Data and Analysis

During the period of recording, 16 microearthquakes were recorded, with epicentral distances ranging from 12 to 50 km, along with several refraction shots being conducted by Microgeophysics Corporation as part of their refraction survey across the Mineral Range.

The epicentral distances were estimated from the S-P times of each event, assuming a velocity structure based on the model developed by Mueller and Landisman (1971, Figure 2). The focal depth of each event was assumed to lie at 4 km, consistent with the average depth of microearthquakes occurring in most geothermal regions of the western United States.

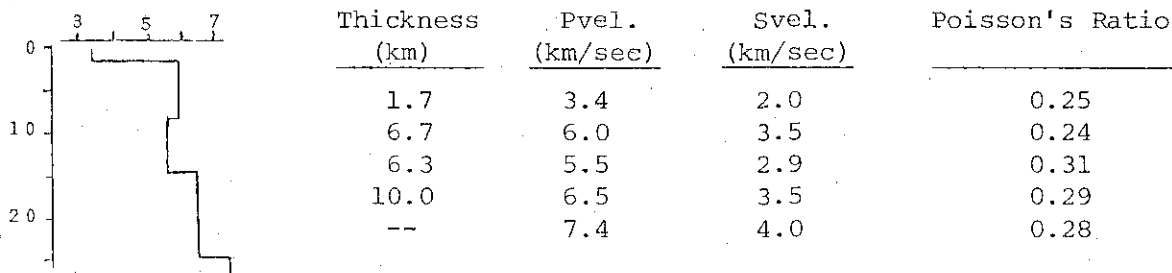


Fig. 2 Velocity - depth relationship from vicinity of Delta, Utah (Mueller & Landisman, 1971)

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and Art Lange  
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This velocity structure gives mean velocities of 4.55 km/sec for P waves and 2.63 km/sec for S waves, for earthquake foci at 4 km. For epicentral distances between 10 and 50 km, the (S-P) velocity is calculated to be 6.2, so that

$$\text{Epicentral Distance, } \Delta = 6.2 \times T(S-P) \text{ ----- (1)}$$

where,  $T(S-P)$  = Difference in times of arrival between P and S waves.

The "Seismograph Event Record" (Appendix I) shows a log of all recorded events, along with estimated epicentral distances. Of the 16 events recorded, the S phase could not be picked for 3 of the earthquakes and hence reliable estimates of their epicentral distances could not be made. Since a single station recording of an earthquake provides no azimuthal control to determine the earthquake location, three directions (Figure 1) were chosen as most likely representing the loci of seismic activity. SA represents the direction of the structural trend in the area, oriented towards Cove Fort, an area of known seismic activity in the past; SB is towards the Mineral Mountains and Roosevelt Hot Springs, an area of known hydrothermal activity; and SC is oriented towards an area of historic seismic activity. The histograms along each of the lines SA, SB and SC represent the number of earthquakes corresponding to their respective distance ranges from seismograph station S.

### Conclusions

The bar graphs show no concentration of seismic activity, at any distance from S, even if one assumes that all seismic activity originates along either one of the three azimuthal directions. It should be pointed out that the data sample represented here is extremely limited to allow adequate scientific conclusions to be made. Also, excessive refraction shooting and drilling activity in the area during the period of recording, may have masked smaller seismic events, which might otherwise have been recorded. It is recommended that 3 or 4 sites within a radius of 20 km from the POT GUT site be monitored for about 2 days each, to establish a possible pattern of seismicity in the area. The present experiment has shown that within a radius of 30 km of the POT GUT site, it is not unreasonable to expect 4-5 earthquakes per day. This is a reasonable level of seismic activity if concentrated in a zone, and the proposed 8-10 days of monitoring would help to delineate any such zone.



R. Batra

RB:mo  
Enclosures

SEISMOGRAPHIC EVENT RECORD

State: Utah

Project: Best

Leave space between records

Site: POT GUT (SE of Beaver)

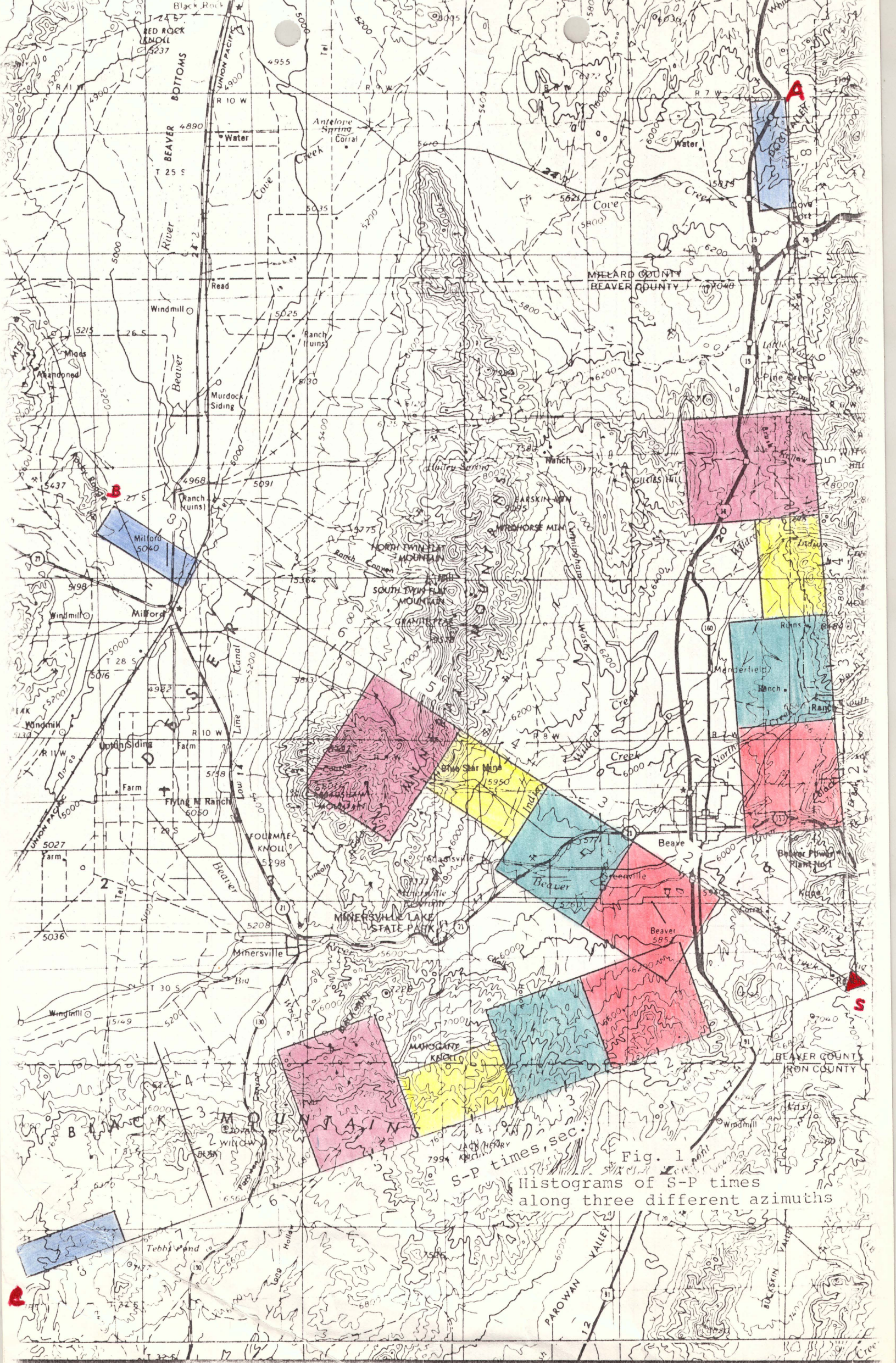
Year: 1977

Processor: R. Batra

Time type: MDT (Eg. MDT)

Event	Mo/Day	Time	S-P	* Approx. Epicentral Dist.	Comments
	26APR77	1419	5 sec	30.8	
		1600	5 sec	30.8	
		1601	-		No readable S, but very likely within 2 sec S-P.
	27APR77	0914	8 sec	50.2	Large event
	27APR77	0920	2 sec	12.3	
		1847	3 sec	18.5	
		2001	3 sec	18.5	
	28APR77	1117	5 sec	30.8	
		1208	-		S-P within about 2 sec.
	29APR77	0443	5 sec	30.8	
		0801	4.5 sec	27.7	
		0838	2.0 sec	12.3	
		1246	-		S-P within 3 or 4 secs.
		1712	4 sec	24.6	
		2343	3 sec	18.5	
	30APR77	0113	2 sec	12.3	
	*Based on assumed depth = 4 km			and $V_p = 4.55$ km/sec	
				$V_s = 2.63$ km/sec	





S-P times, sec.  
 Fig. 1  
 Histograms of S-P times  
 along three different azimuths