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INTER-OFFICE MEMORANDUM

SUBJECT: Microearthquake Reconnaissance near Beulah Hot Springs, Oregon

DATE March 8, 1976

TO: W. M. Dolan, H. J. Olson, H. D. Pilkington

cc: Jerry Roth

FROM: A. L. Lange

During 10 days in February, 1975, Micro Geophysics Corporation operated a single MEQ-800 smoked paper seismographs at three sites near Beulah Reservoir (Figure 1). The operating schedule is shown in Figure 2. Only on the records of the first site, did any activity appear that resembled microearthquakes in signature (Figure 3). Because no similar activity appeared on the subsequent records at the other sites, it was concluded that the events were "...very local and possibly related to near-surface rock cracking".[1] Alternate freezing and thawing of the Juntura tuff outcrop on which the seismometer was planted might explain the noises.

The uncertainty of the results prompted us to repeat the monitoring during Summer 1975, using two MEQ-800 seismograhs side-by-side, with their seismometers approximately 200m apart (Figure 1, 4a, b). A Mark Products L-4C vertical 1 hz seismometer was planted in the identical spot of the February Site 1, 900m SSW of the southern hot spring, on the east side of the reservoir (Figure 4a). The more southern seismometer was a 4 hz vertical geophone. The operator was John Towers. Gains ranged between 84 and 96 db, depending on ambient noise. Wind and 60 hz AC noise obliterated parts of some records. On 12 days only one seismometer operated and on 2 days, neither instrument was running. Some of the failures were due to weak batteries, some to gear-slippage, and others to the operator's unfamiliarity with the instruments.

Events were seen on one or the other records that resembled microearthquakes in signature, similar to those observed in the February survey (Figure 4); however, during the 13 days in which both recorders functioned, no events resembling microearthquakes appeared simultaneously on both traces. We concluded from this that the apparent events are not microearthquakes, or at best are earth adjustments so small and close to the seismometer to be of no significance to the geothermal program.

In conclusion, it appears that the geothermal manifestations at Beulah reservoir are not accompanied by microearthquakes, and to the extent that we believe seismicity essential to a productive geothermal reservoir, the results are not encouraging.

Arthur L. Lange

Arthur L. Lange

All:d

1. MICRO GEOPHYSICS CORPORATION (1975) Reconnaissance Seismicity Report on the Beulah Reservoir Prospect, Malheur County, Oregon. Private report to AMAX.

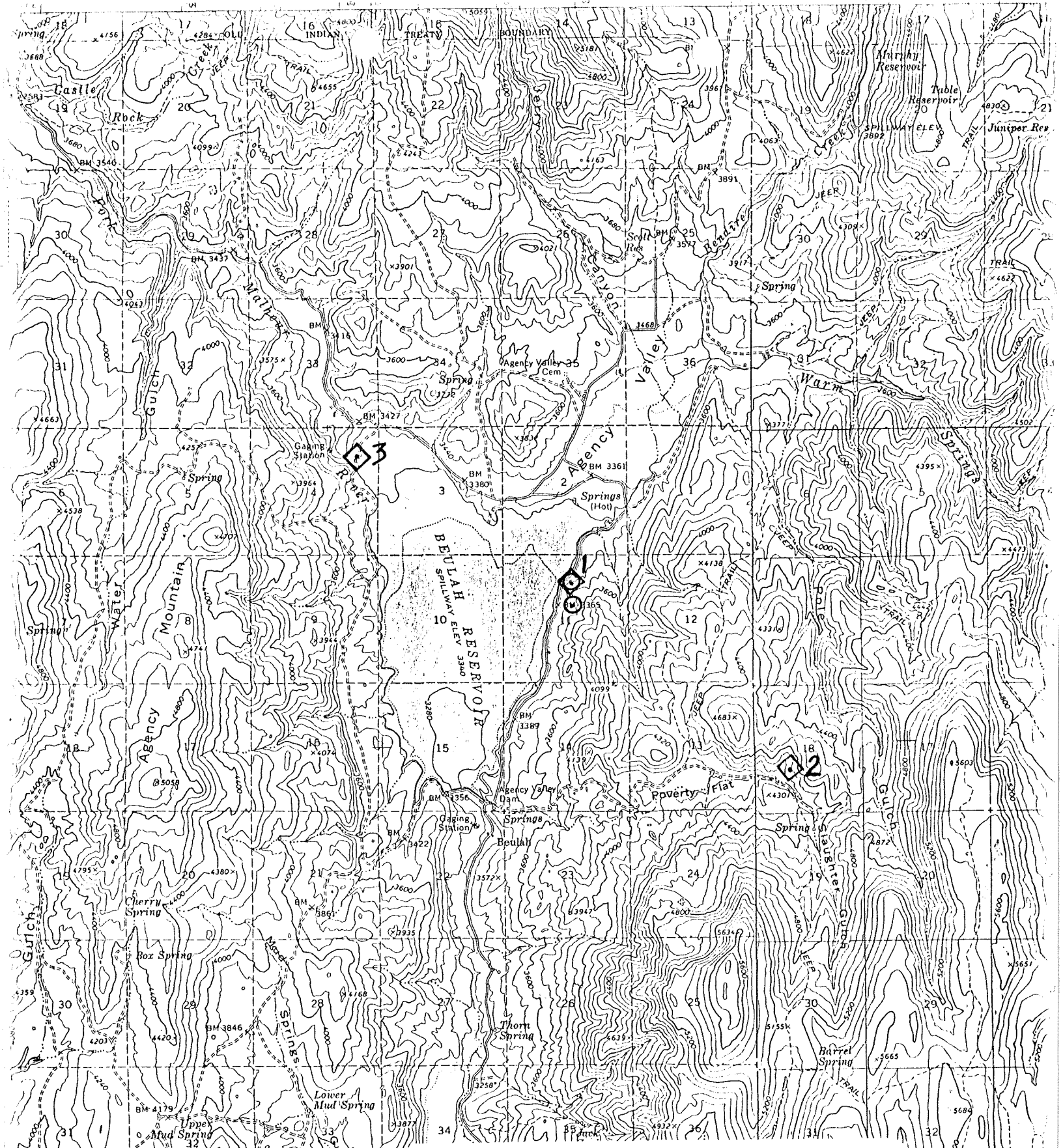


Figure 1. Location of Micro Geophysics' seismograph sites (diamonds); Amax sites (circles).

1 0 1 2 3 4 MILES

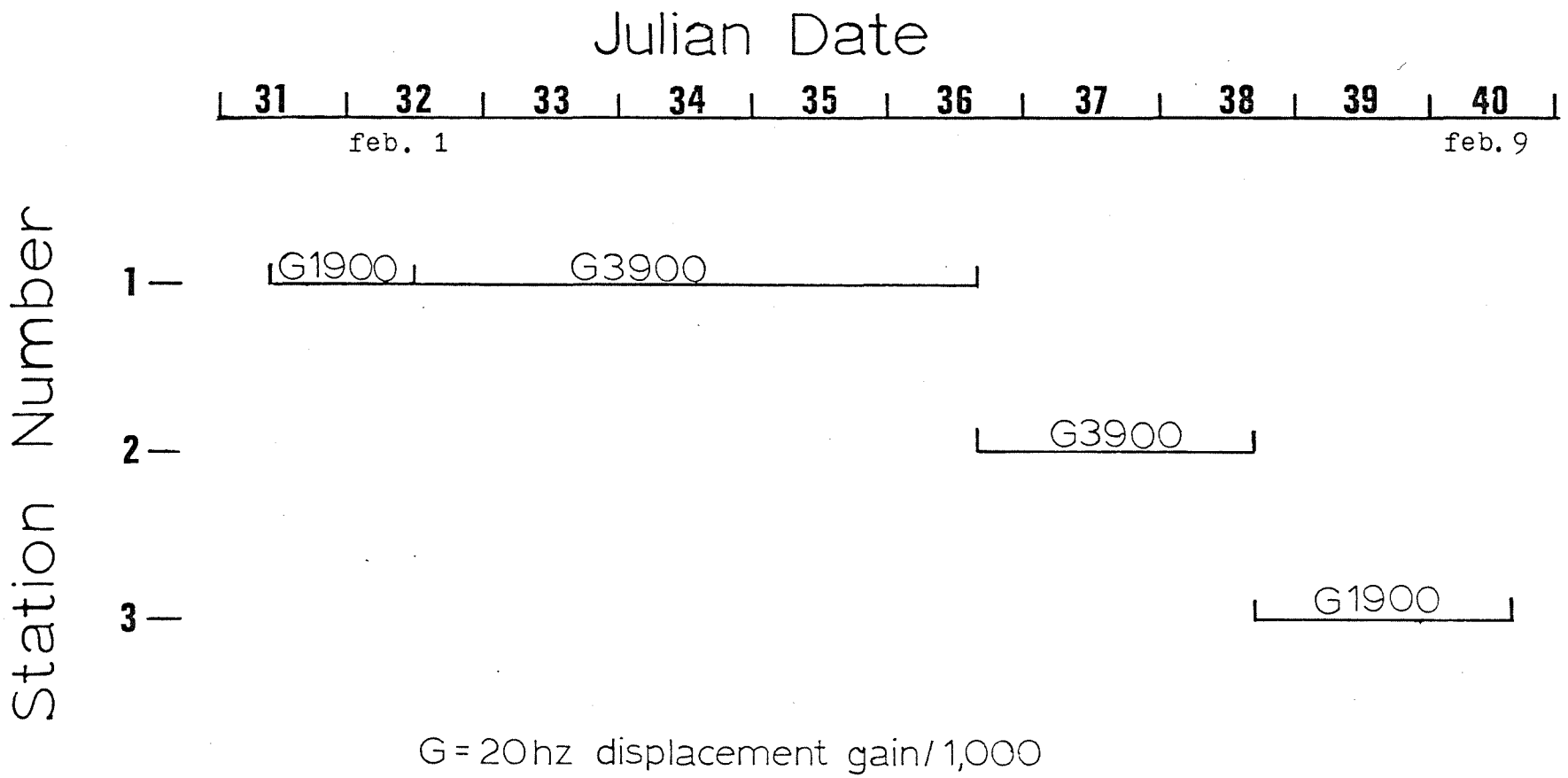
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 80 FEET
DOTTED LINES REPRESENT 40-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

OPERATING SCHEDULE
BEULAH RESERVOIR, OREGAN

MICRO GEOPHYSICS RECONNAISSANCE



G = 20hz displacement gain/1,000

Figure 2

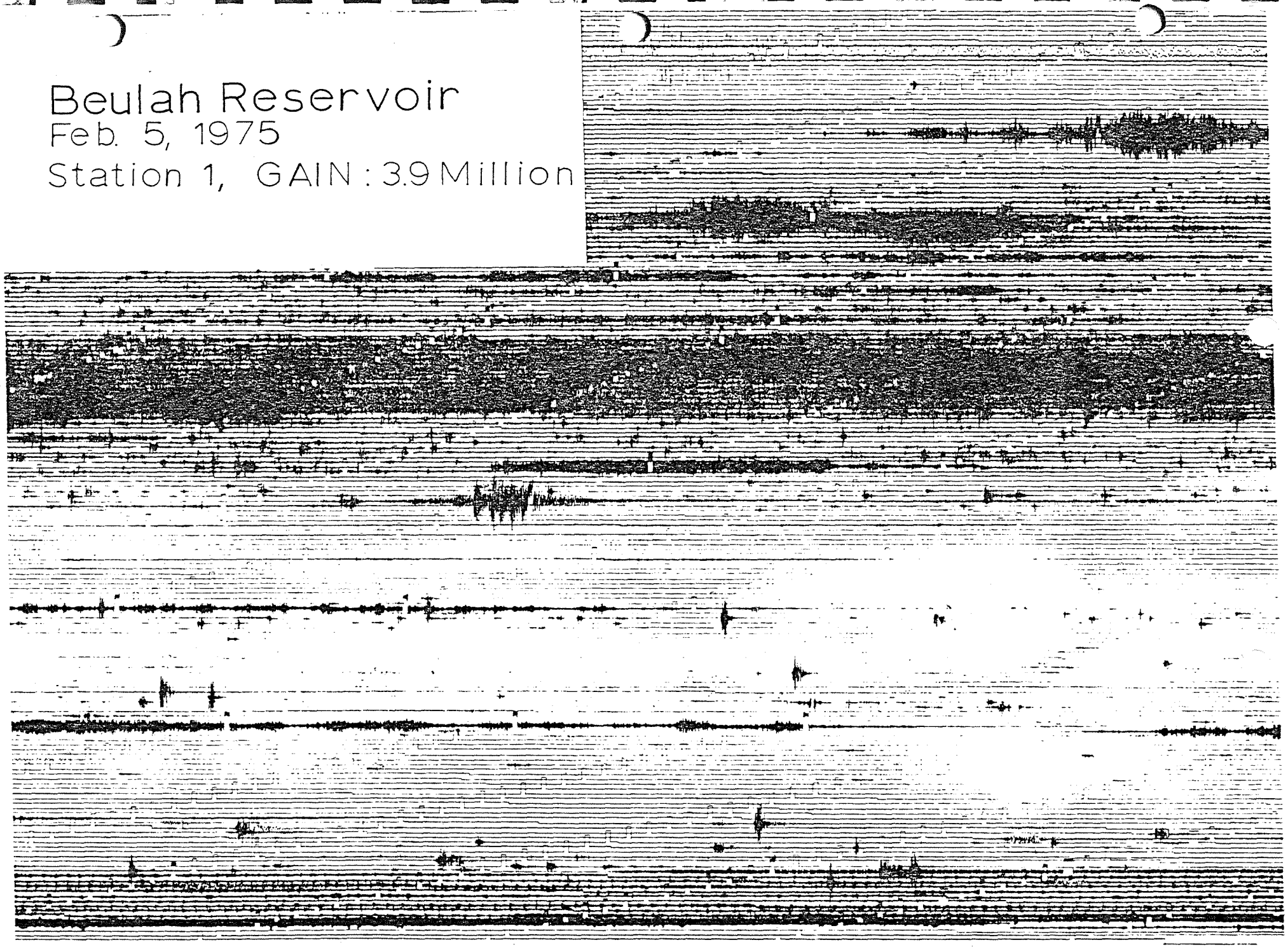
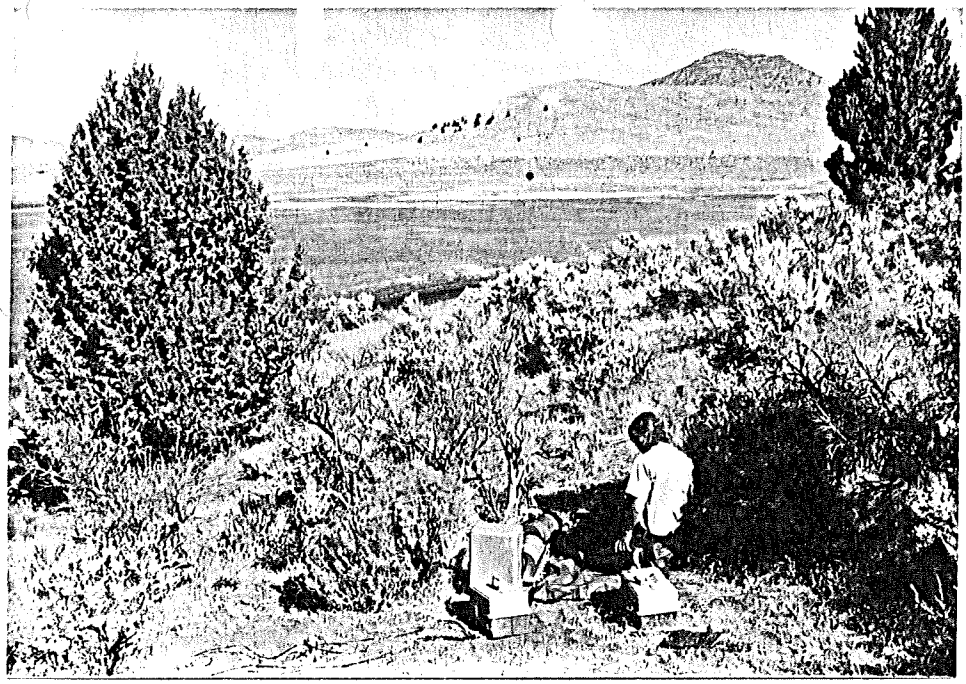
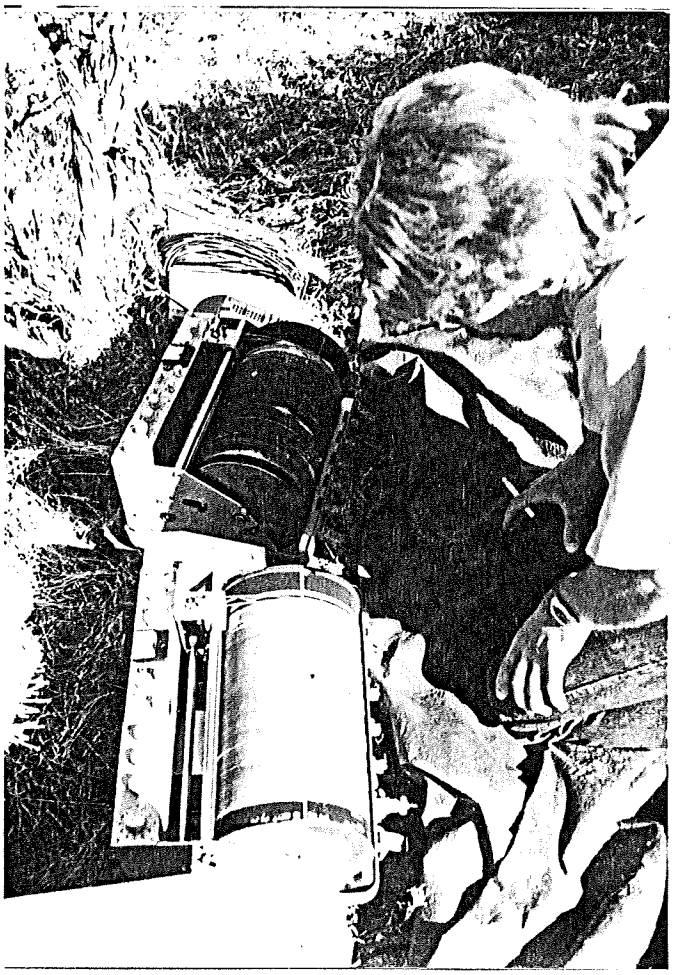


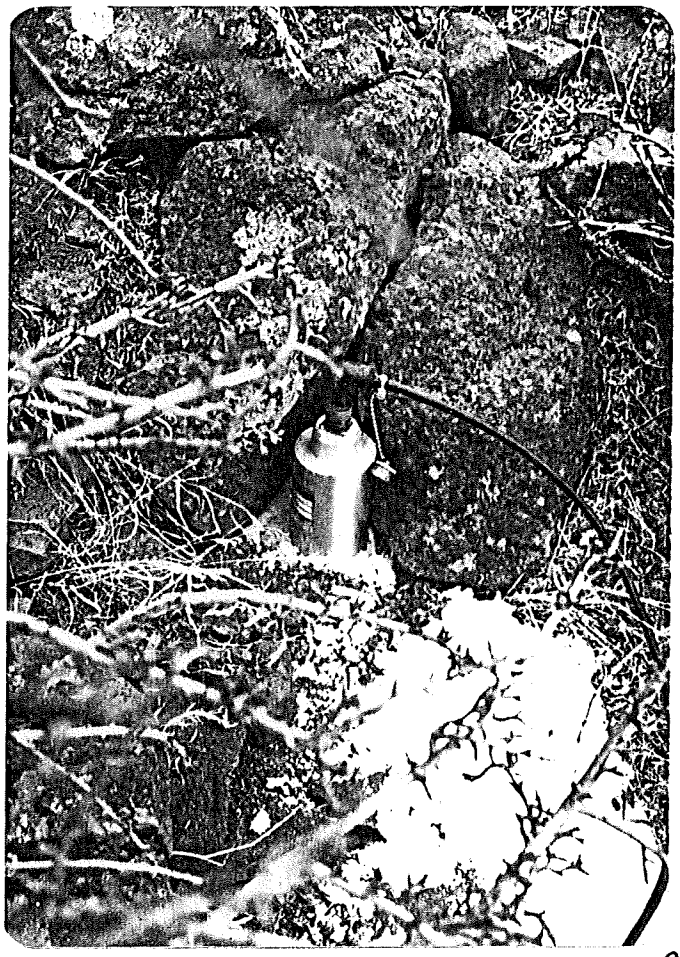
Figure 3. Portion of record from Micro Geophysics' Site 1, showing pseudo-microearthquakes.



a.



b.



c.

Figure 4.
a. Amax' seismograph site, overlooking northern end of Beulah Reservoir.
b. The two recorders operating side-by-side.
c. The L-4C seismometer cemented to outcrop.

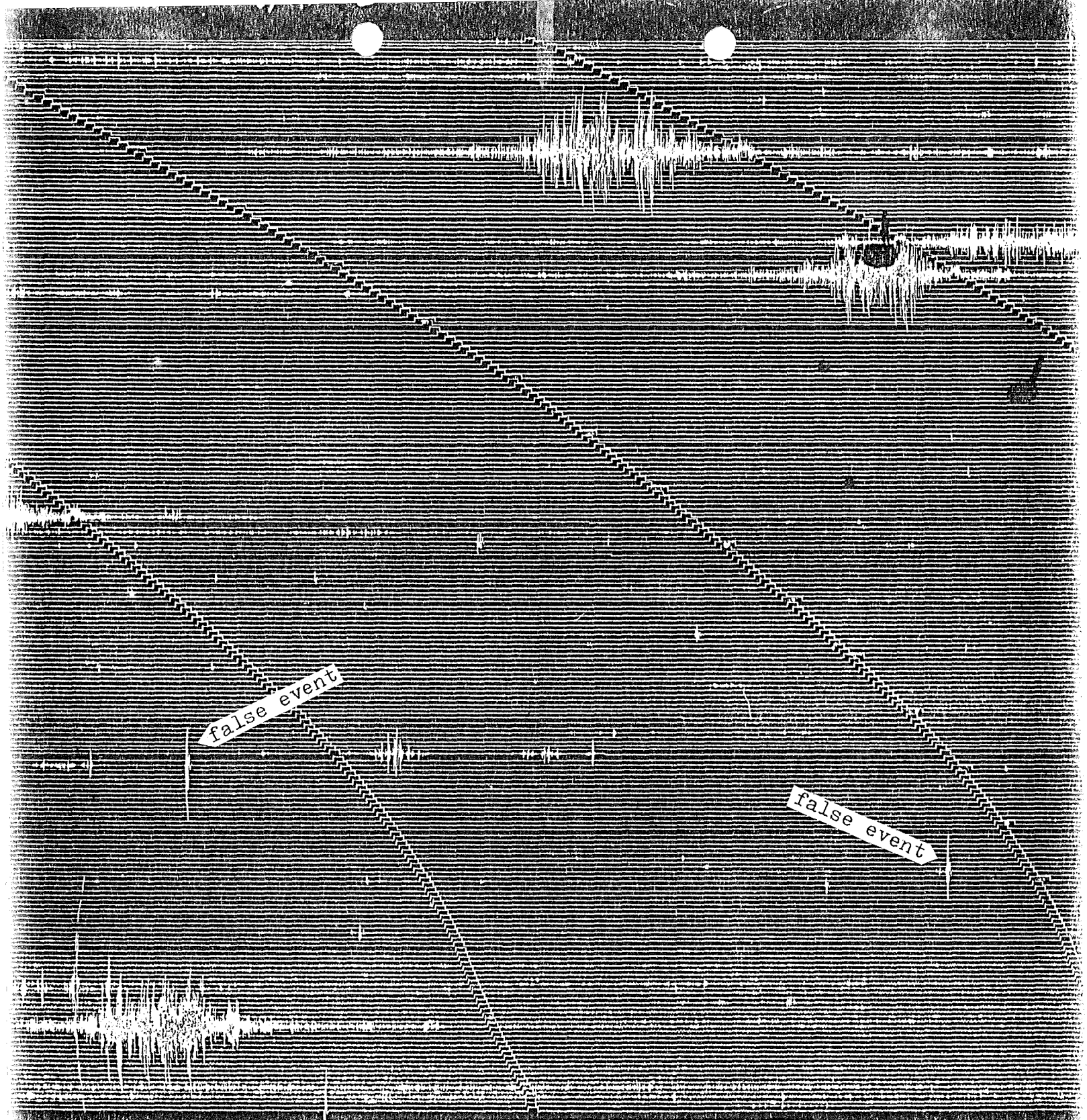


Figure 5. Portion of Amax' North Station record showing pseudo-microearthquakes. These events did not appear on the record of the seismometer 200m to the south.