

INTER-OFFICE MEMORANDUM

SUBJECT: Heatflow readings in the southern Mineral Mountains, DATE May 26, 1976  
Utah

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

FROM: A. L. Lange

Measurements of heatflux in mines of the southern Mineral Range during late February and early March of 1976 yielded sufficiently high values to warrant an extended survey. Confirmatory data were then sought in nearby mines and existing boreholes. The results are summarized in the map of Figure 1, in which heatflow values are plotted in heatflow units (hfu). The outlined area is enlarged in Figure 2.

Heatflux Results

Initially, heatflux values were obtained in the Lower Lincoln Mine, Cave Mine, Blue Star Mine and Beaver View Mine, using the Amax heatflux device. Values of 12.0, 13.2 and 12.0hfu were recorded from the first three sites, respectively. The Beaver View Mine produced a mean of 23hfu, on which was superimposed a diurnal variation of 1.9hfu amplitude. Because the adit descended throughout its extent, it may be a cold air trap, producing exaggerated heatflux readings. This high value, then must be regarded with skepticism.

Additional heatflux measurements were then made in nearby mines (Figure 2). An uncertain value of 12.0hfu in the Lower Cave Mine seemed to be influenced by an air draft between the planting site and the entrance. A relatively low value was obtained in the Lower Harriet Mine (1.2hfu), which may be valid. Negative heatflux passing through zero and moving positive was seen in the White Tails Mine, probably due to convection in the adit (the portal was visible from the site).

None of the heatflux readings obtained thus far may be considered representative of the regime within the rock until it has been satisfactorily repeated during the summer. On the basis of our experience thus far; however, we expect that those values not accompanied by a question mark will repeat within one or two heatflow units. Variations of this magnitude can be expected from topography also.

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### Borehole Results

Three boreholes in recrystallized limestone (probably Permian Kaibab formation) were located and logged in the vicinity of the Lincoln Mine. Gradients are displayed in Figure 3 and heatflow values computed on the basis of a conductivity of 8.0 units are plotted in Figures 1 and 2. Crystalline limestones and dolomites typically yield conductivity values between 7 and 12. All holes were logged in air except for DH-0 in which water was encountered at a depth of 160m.

The boreholes in Lincoln Gulch yielded gradients of 78 and 135°C/km corresponding to heatflows of at least 6.2 and 10.8, respectively; thereby, substantiating the high flux observed in the adjacent mine sites. A much lower gradient of 28.5°C/km (2.3hfu) was logged in the drillhole southwest of the Harriet Mine, in approximate agreement with the 1.2hfu value obtained in the Lower Harriet Mine.

### Relationship To Geology

In Figure 2, geology from the 1963 B.Y.U. Geologic Map of Southwestern Utah has been enlarged and superimposed on the heatflow data; however, geologic boundaries as represented on the map seem to contain considerable error. For example, in the published map, both the Blue Star and Beaver View tungsten mines are plotted in the Tertiary granites, whereas they actually occur in crystalline limestone (Kaibab is the nearest mapped).

Referring to the approximate map of Figure 2, we see that the Cave Mine and lower Cave Mine fall in the typically cavernous Redwall limestone of Mississippian age. The portal of the White Tails Mine is in granite, while the interior penetrates Kaibab limestone. The Lower Lincoln Mine and the two nearby boreholes are in limestone (mapped as Kaibab) and probably on the fault that is mapped running down the canyon. The Lower Harriet Mine also appears to lie in the Kaibab limestone near the Moenkopi contact. DH-0, however, is not in quartzite as shown on the map, but in recrystallized limestone, very near the granite contact. Evidently the Pt (Talisman) designation is a typographical error. The rock is more likely Pt, or Toroweap formation, containing limestone very similar to the Kaibab and normally underlying the Kaibab.

### Interpretation

Far-ranging tentative heatflux measurements in mines in limestone delineate a triangular-shaped heatflow anomaly in the southern Mineral Range south of the Cave Canyon fault. Locally in Lincoln Gulch the high values seem to be associated with a mapped fault and may be expressing circulation of warm fluids along the fault at depth (however, all nearby springs are cold). One kilometer southeast of this fault, the two readings obtained are rather low, indicating that the anomaly either terminates in this direction or is localized around the sites occupied.

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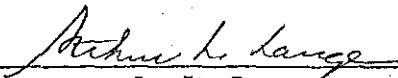
Recommendations

Heatflow values obtained thus far warrant applying for Federal leases in the triangular areas defined by the Cave, Lincoln and Blue Star Mines. Since altered limestone extends conspicuously from the Blue Star to the Beaver View Mine, this zone should also be regarded favorably.

At least one additional borehole is known in the vicinity of the Lincoln Mine, and others may exist in the southern Minerals. These should be sought out and logged. One additional heatflux mine site is available in the Honey Boy Mine (Figure 1) and other potential sites (not yet explored) are marked in orange on the map. Drilling may then be planned to determine the extent of the thermal anomaly.

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Views of the mine sites and logging are shown in Figures 3A-5B.

  
A. L. Lange

Attach.

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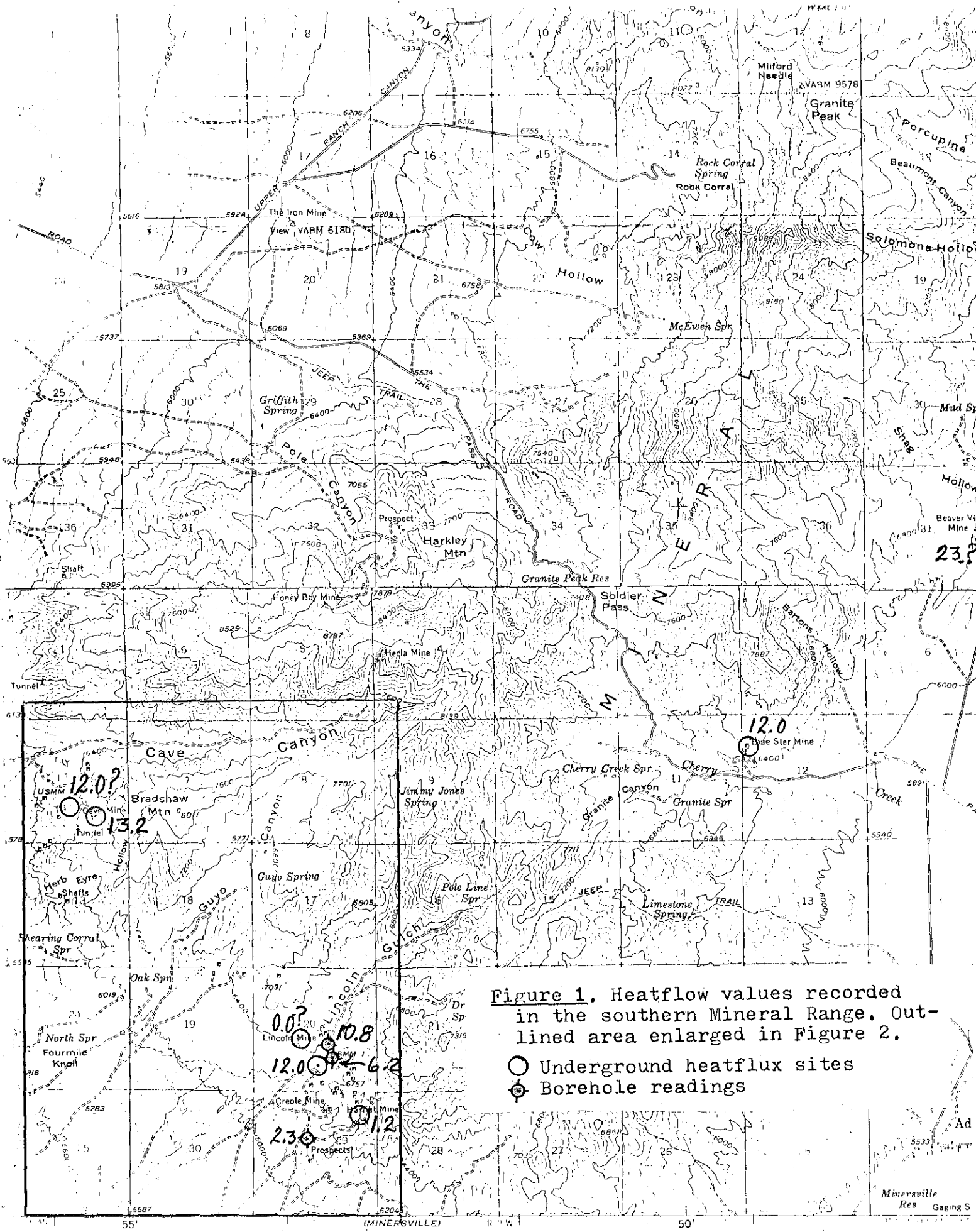
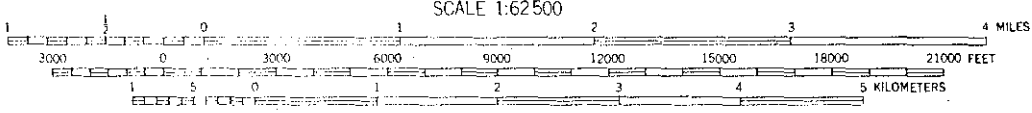


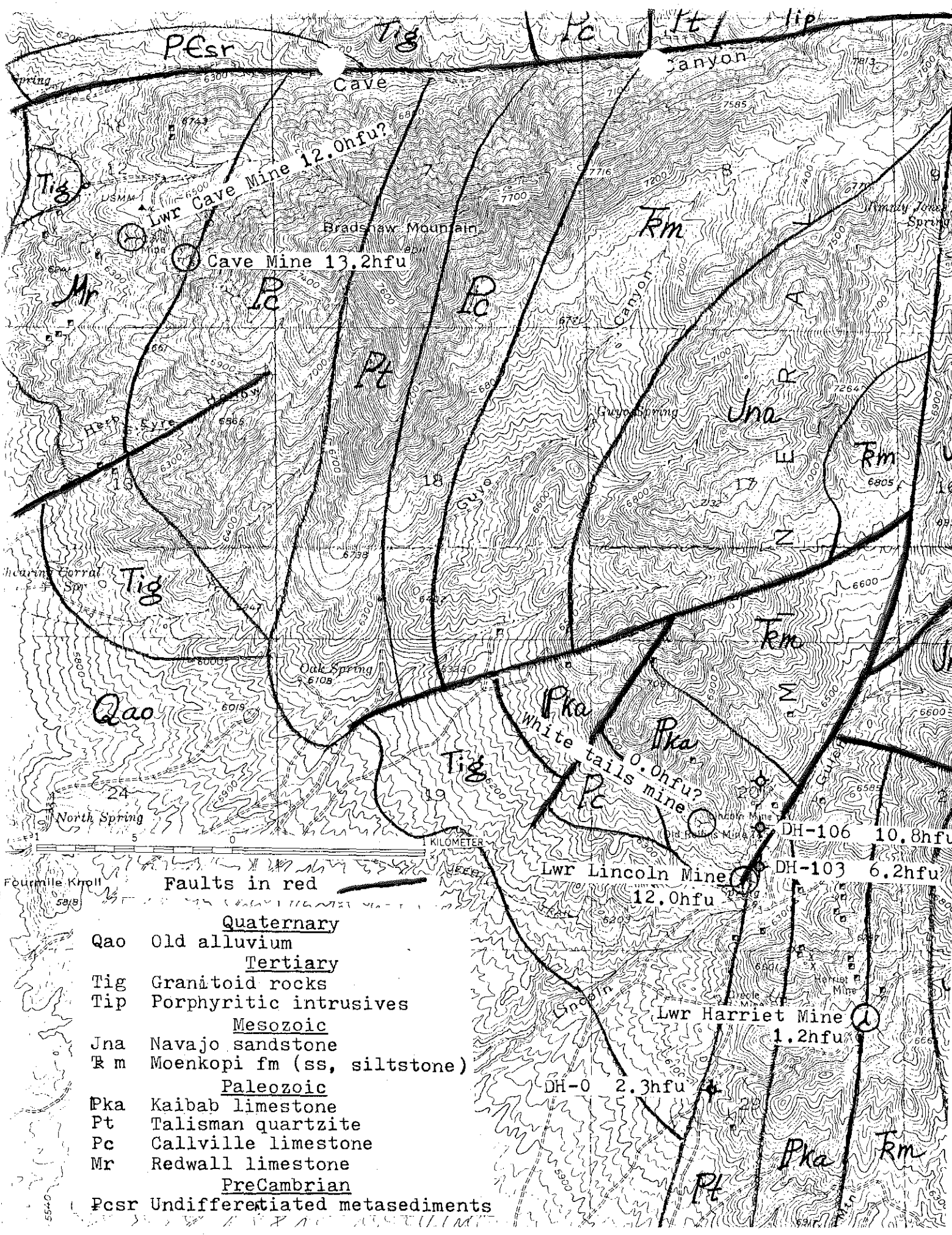
Figure 1. Heatflow values recorded in the southern Mineral Range. Outlined area enlarged in Figure 2.

- Underground heatflux sites
- ◐ Borehole readings



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- Faults in red  
Quaternary  
 Qao Old alluvium  
Tertiary  
 Tig Granitoid rocks  
 Tip Porphyritic intrusives  
Mesozoic  
 Jna Navajo sandstone  
 R m Moenkopi fm (ss, siltstone)  
Paleozoic  
 Pka Kaibab limestone  
 Pt Talisman quartzite  
 Pc Callville limestone  
 Mr Redwall limestone  
PreCambrian  
 Pcsr Undifferentiated metasediments

Figure 2. Heatflow values superimposed on geology (from Utah State map).

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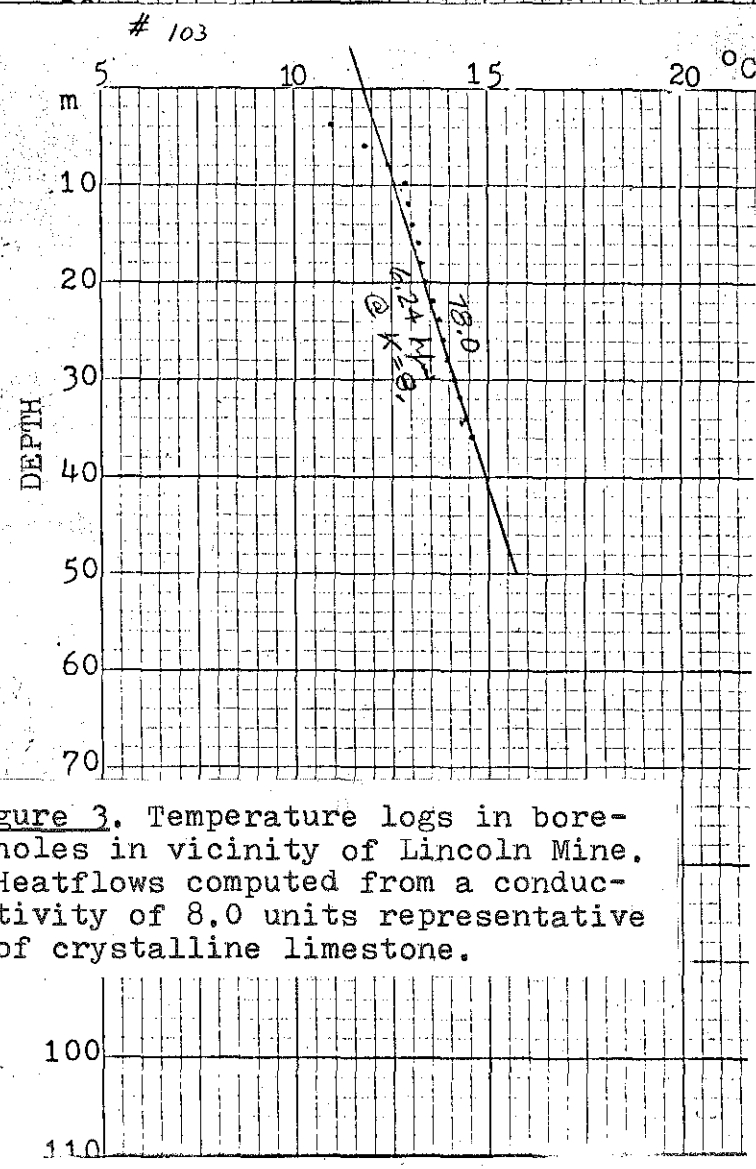
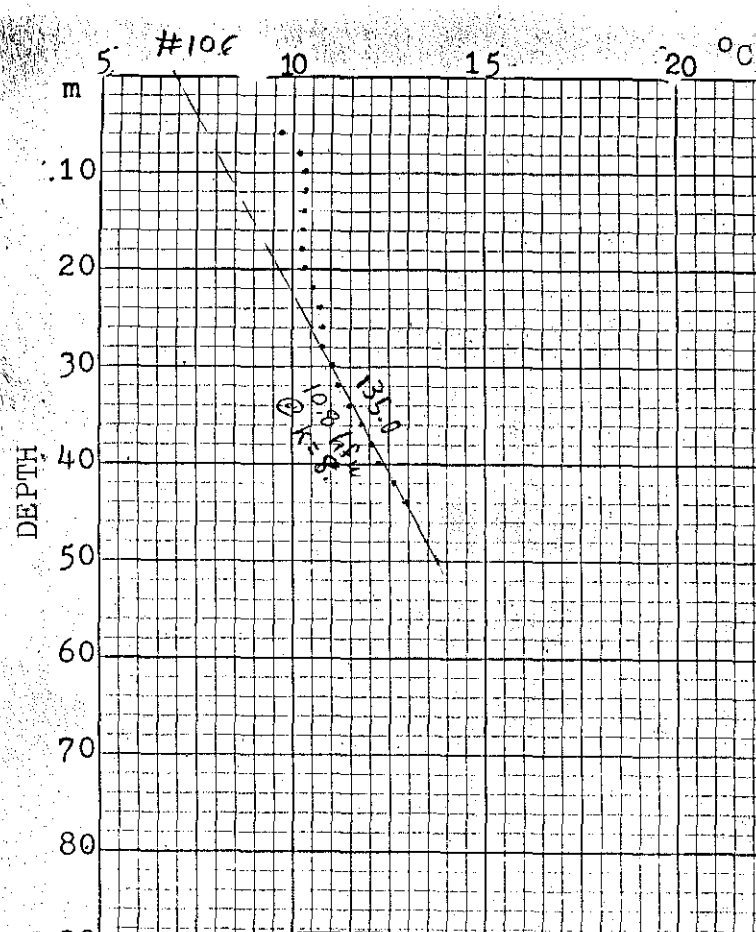
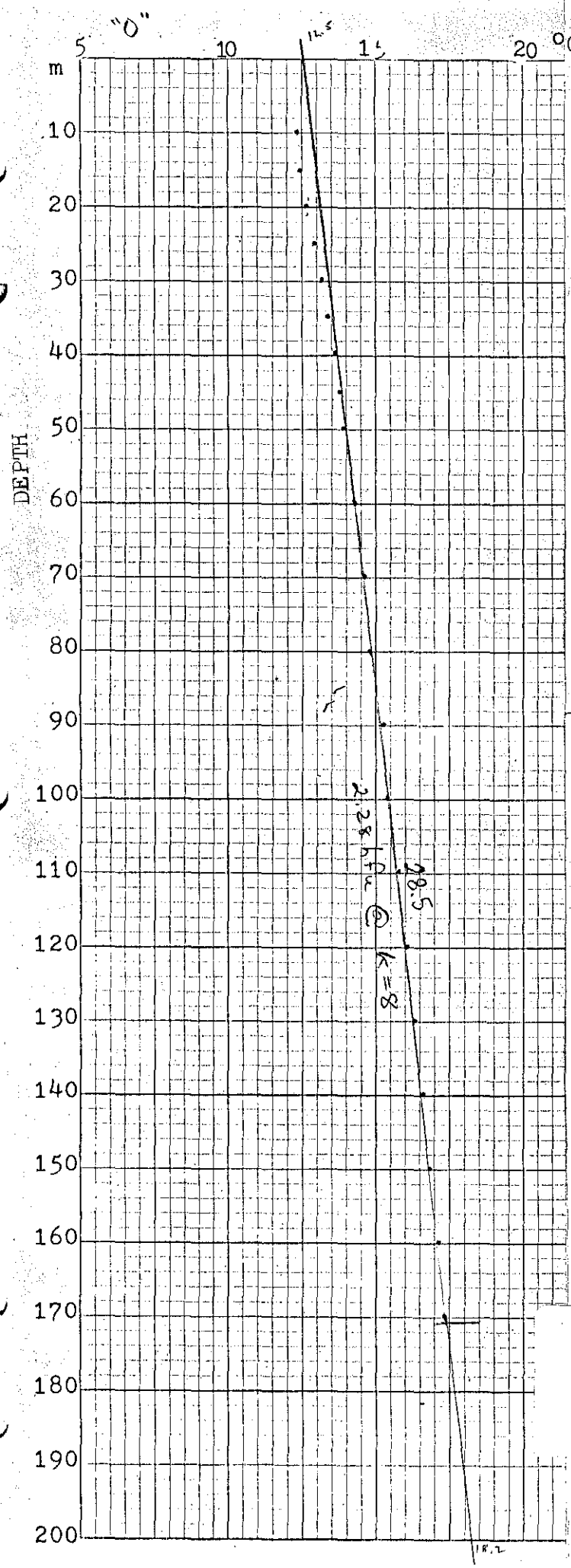


Figure 3. Temperature logs in boreholes in vicinity of Lincoln Mine. Heatflows computed from a conductivity of 8.0 units representative of crystalline limestone.

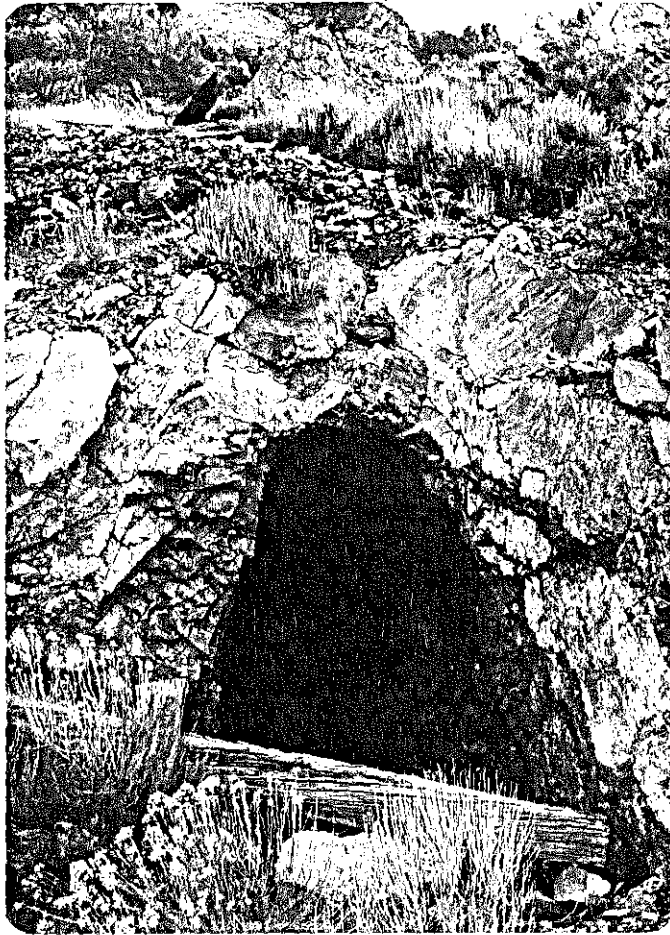
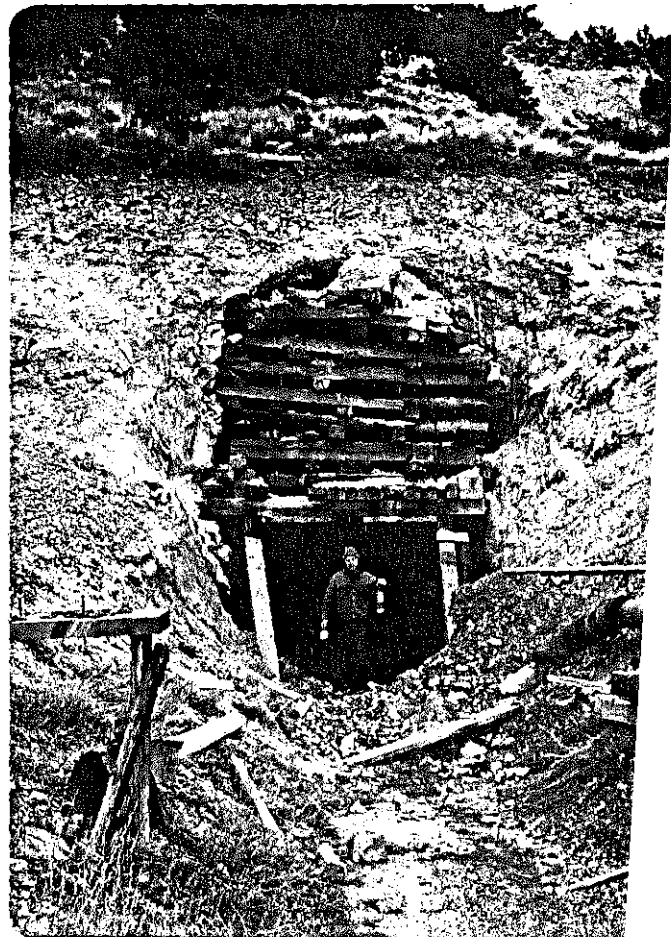


Figure 3A. Artificial  
portal of the Cave  
Mine.

Figure 3B. Portal of  
the Lower Cave Mine.





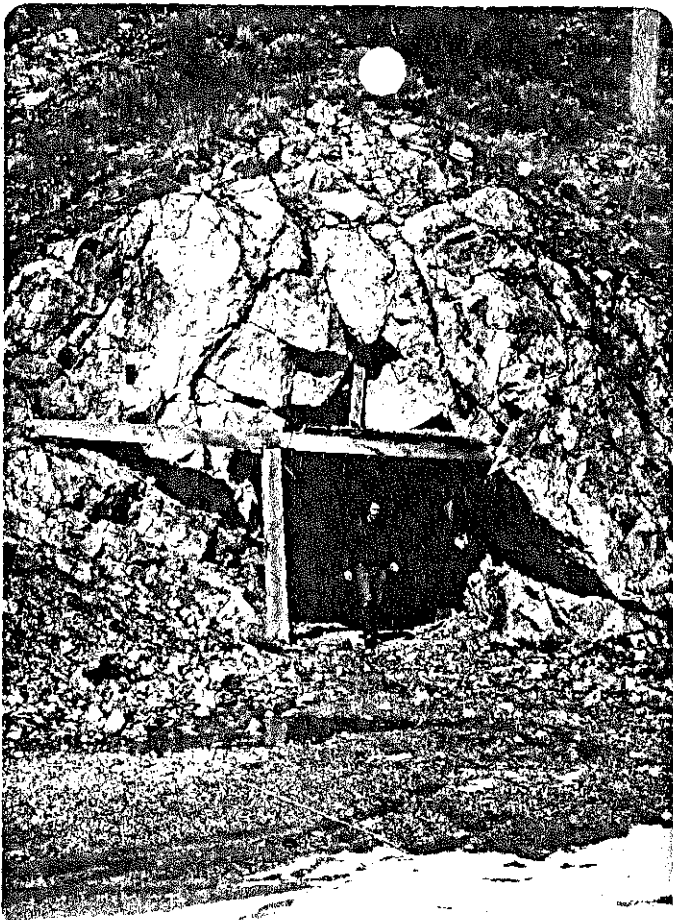


Figure 4A. Blue Star Mine



Figure 4B. Beaver View Mine

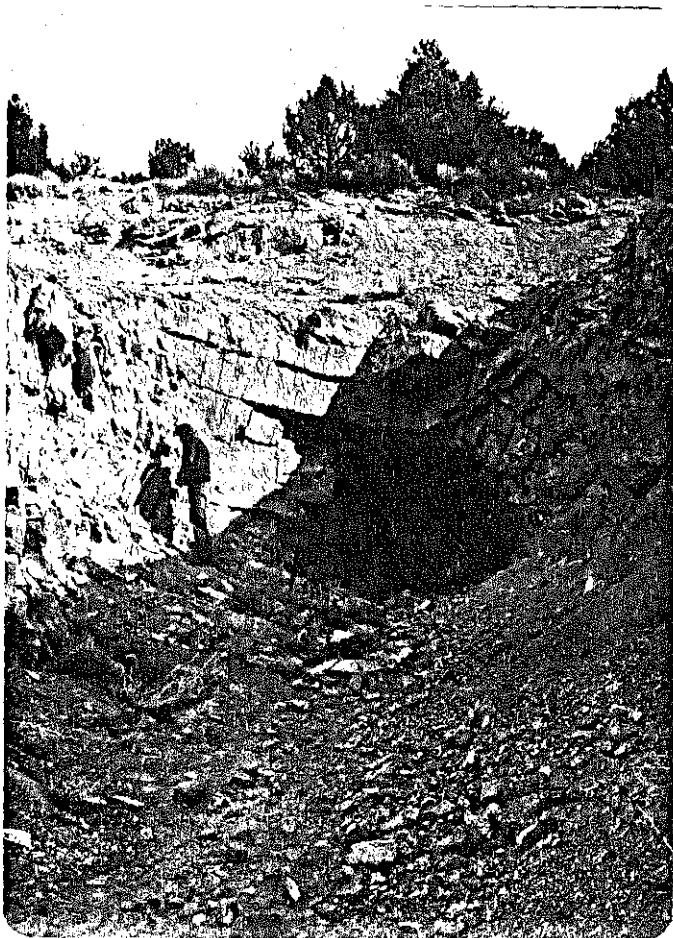


Figure 4C. Lower Lincoln Mine

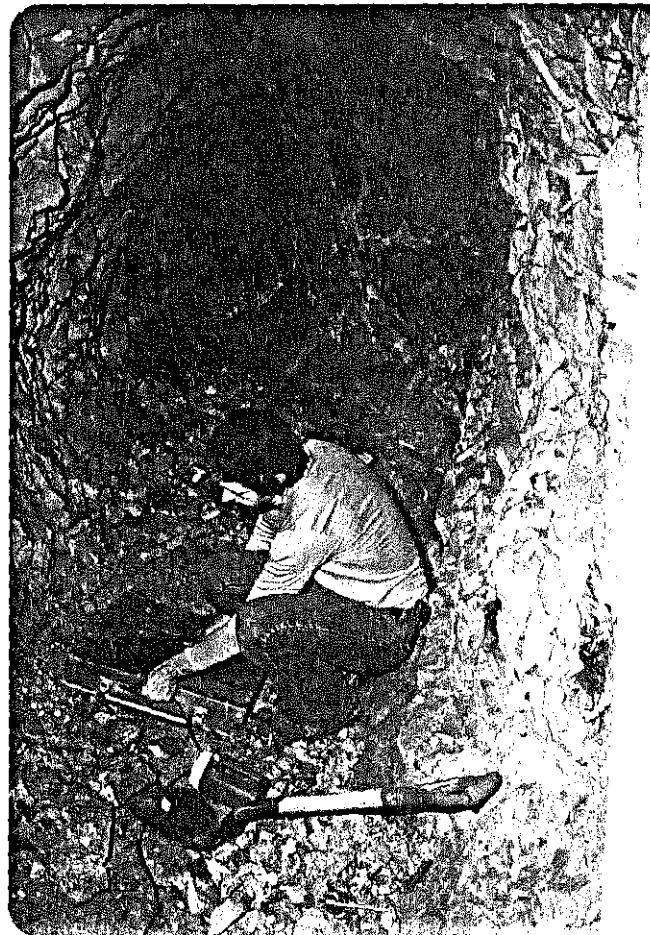


Figure 4D. Planting heatflux





Figure 5A & B. Logging Drillhole "0".