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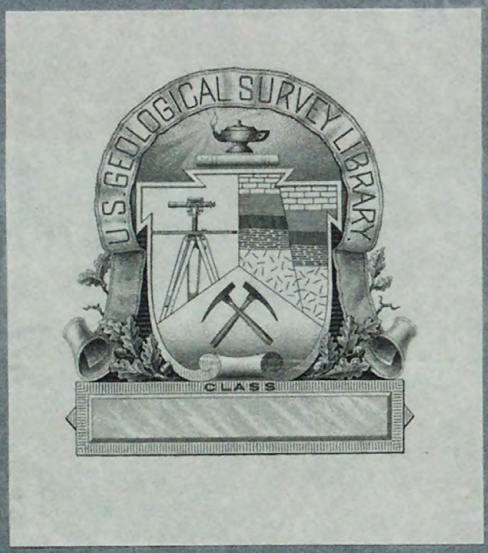
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INFRARED IMAGERY OF LORDSBURG - SILVER CITY AREA, NEW MEXICO

by

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Geologic Applications Program, Research Task 160-75-01-44-10
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1. Infrared imagery of Lordsburg-Silver City area, New Mexico, by Walden P. Pratt. 13 p., 5 figs. 601 E. Cedar Ave., Flagstaff, Ariz. 86001.

2. Geology of the Quartzsite quadrangle, Arizona, by Fred K. Miller. Map, explanation, cross-sections (1 sheet), scale 1:48,000. 1012 Federal Bldg., Denver, Colo. 80202; 8102 Federal Office Bldg., Salt Lake City, Utah 84111; 7638 Federal Bldg., Los Angeles, Calif. 90012; 504 Custom House, San Francisco, Calif. 94111. Material from which copy can be made at private expense is available in the San Francisco office.

3. Preliminary interpretation of aeromagnetic and gravity data near the large aperture seismic array, Montana, by Isidore Zietz, Carter Hearn, and Donald Plouff. 23 p., 9 figs.

4. Bibliography of geology and geography of Ecuador, by Roger B. Colton. 65 p.

5. Geology and geochemistry of the Wanamu-Blue Mountains area, Waini SW, Guyana, by B. E. Kilpatrick. 34 p., 8 figs., 7 tables.

6. Evaluation of a periscopic aircraft sextant as a surveying tool during advanced systems field test 3, by R. L. Sutton. 9 p., 1 pl., 5 photographs, 1 table. 601 E. Cedar Ave., Flagstaff, Ariz. 86001.

7. Alaskan gravity base station network, by David F. Barnes. 21 p. text, 3 p. index, 31 p. tables, 1 fig. Brooks Bldg., College, Alaska 99701; 441 Federal Bldg., Juneau, Alaska 99801; 108 Skyline Bldg., 508 2nd Ave., Anchorage, Alaska 99501; 678 U. S. Court House Bldg., Spokane, Wash. 99201; 504 Custom House, San Francisco, Calif. 94111; 7638 Federal Bldg., Los Angeles, Calif. 90012; 1012 Federal Bldg., Denver, Colo. 80202; and in Alaska Div. of Mines and Minerals, 509 Goldstein Bldg., Juneau, Alaska 99801; 3001 Porcupine Drive, Anchorage, Alaska 99504; and University Ave., College, Alaska 99701. Material from which copy can be made at private expense is available in the Alaskan Geology Branch, USGS, 345 Middlefield Rd., Menlo Park, Calif. 94025.

8. A distinction between bedrock and unconsolidated deposits on 3-5μ infrared imagery of the Yellowstone rhyolite plateau, by Robert L. Christiansen. 5 p., 2 figs. 601 E. Cedar Ave., Flagstaff, Ariz. 86001.

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INFRARED IMAGERY OF LORDSBURG-SILVER CITY AREA, NEW MEXICO

by

Walden P. Pratt

ABSTRACT

Night time infrared imagery of the area between Lordsburg and Silver City, New Mexico, indicates numerous applications of studies of the geology and hydrology of desert regions. Tertiary volcanic rocks consisting of flows and welded tuffs show good tonal contrasts within themselves. Precambrian granites and gneisses appear mottled. Water courses appear as dark streaks, cold water springs as dark patches, and water standing in ponds and reservoirs is bright in contrast to the darker (cooler) surrounding materials.

INTRODUCTION

Infrared imagery, in the 8-14μ band, was obtained on July 31, 1966, at 10:43 p.m. by HRB Singer using a Lockheed Lodestar aircraft. Weather conditions at the time consisted of scattered clouds with occasional showers. The image covers a strip about 6 miles wide, extending about 15 miles N. 30° E. from Lordsburg, New Mexico, and thence 33 miles N. 84° E. to a point 7 miles east-southeast of the Grant County (Silver City) airport. The area is mainly a large desert expanse of pediment gravels and bolson deposits, including Gila Conglomerate. The flight line passes over the southern part of the Big Burro Mountains but is too far south to cover the geologically interesting bedrock parts of the Silver City area.

The image was examined in detail to determine what geologic or hydrologic features can be interpreted from it; possible correlations have been checked by reference to published maps by Dane and Bachman (1961), Gillerman (1953), and Paige (1916). Noteworthy features are indicated on sketch maps accompanying the images and are listed in detail at the end of this report; they are summarized here:

Cultural features: Buildings are easily discernible as abnormally dark spots, and paved roads as bright lines. A few unpaved roads show faintly bright.

Topography: The infrared imagery shows no expression of topographic features as such, although it does give some suggestion of topography through its portrayal of drainage patterns.

Geology: The area is underlain largely by pediment gravels and alluvium, and by smaller areas of Precambrian granite and gneiss, Tertiary stocks and dikes, and Tertiary volcanic rocks -- flows and welded tuffs. The volcanic rocks show good tonal contrasts within themselves -- light and dark bands -- which must be related to lithologic differences, but there is little or no contrast between the darker bands of the volcanics and the grays of the Precambrian rocks and the gravels. The general area of the Precambrian rocks appears somewhat mottled, in contrast to the relatively even grays of the gravels and alluvium. In one area are some lighter patches that may be correlative with small Tertiary rhyolite plugs. The large mineralized Tertiary stock near Tyrone shows no apparent contrast, but probably is too close to the edge of the image to permit recognition even if it produced a strong contrast.

The extent and depth of soil cover in the bedrock areas undoubtedly has some masking effect on possible tonal contrasts. It may be that the volcanics are more discernible than other rock types only where they (1) consist of interbedded contrasting lithologies and (2) form steep slopes on which little soil can accumulate.

Hydrology: Standing water, in cattle ponds or other reservoirs, produces definite "hot spots", presumably because it is warmer at night than the surrounding land. In contrast, water courses are marked by dark streaks, and a few very dark spots correspond to springs. Assuming the darker tones are caused by groundwater at or near the surface, then

infrared imagery could be used very effectively in the search for ground-water supplies in relatively arid regions.

Most of the larger water courses are bounded on each side by a narrow strip of lighter gray tone which passes gradually into the medium gray beyond. This may be the expression of the slightly higher (and hence drier) surface of natural levees.

DETAILED NOTES ON LORDSBURG-SILVER CITY IR IMAGERY

From West to East

Figure 1 near here - numbers below refer to locations on sketch map.

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1. Lordsburg
2. (Omitted)
3. Rectangular reservoir. Bright image suggests either warm water or no water.
4. Small bright dots in this area probably are standing water in cattle ponds.
5. Light and dark gray streaks are alternating divides and channels, respectively, in outwash area of Thompson Canyon.

Figure 2 near here - numbers below refer to locations on sketch map.

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6. Ranch house.
7. Approximate area of Precambrian granite and minor gneiss. Dissection pattern is slightly more dense than on flats to west, and overall tone

is faintly brighter. G. O. Bachman suggests (oral communication) that faint mottling in the granite may be due to the contrast between outcrops of relatively unweathered granite (low porosity, drier, hence brighter tone) and intervening areas where the granite has weathered to a well-sorted quartz-feldspar gravel (high porosity, more moist, hence darker tone). Light bands at A are probably related to lithologic differences in some way. Geologic map (Dane and Bachman, 1961) shows three Tertiary dikes in this area. Nothing visible on the image seems to correspond to these dikes, but faint lineaments B and C are light areas apparently not related to drainage, and may possibly be unmapped dikes. (Vertical black and white photography might clarify). Dark spot D indicates cold spring water.

8. Arcuate zone of conspicuous banding is caused by Tertiary volcanic rocks. According to Bachman (oral communication), these are welded tuffs of generally silicic composition, containing nothing more mafic than latite. The banding may be due to differences in degree of welding, either because of its direct effect on thermal properties of the material, or because of its effect on permeability and hence on saturation. It is not possible at this time to determine which tones correspond to which degree of welding.

Figure 3 near here - numbers below refer to locations on sketch map.

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9. Broad mottled area of Gila Conglomerate. Cause of light patches unknown.

10. Line marks approximate location of fault contact between Gila Conglomerate and Precambrian, as plotted from the geologic map (Dane and Bachman, 1961); not evident on image.

11. Broad area of Precambrian granite.

12. Concentrations of light patches within Precambrian; cause unknown, but may be like mottling (see par. 7 above). Eastward-trending lines are faint lineaments that may represent east-northeast-trending Tertiary dikes shwon on geologic map; scale and angle of image preclude positive correlation.

13. Approximate area of south end of large Laramide copper-bearing porphyry now being developed for open-pit mining (Tyrone). Intrusive shows no characteristic pattern in image, but is very close to edge of image and hence not well covered.

14. Lineaments of unknown cause.

Figure 4 near here - numbers below refer to locations on sketch map.

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15. Dark spot is in area of several inactive mine shafts; may be a shack.

16, 17. Approximate locations of Tertiary rhyolite plugs, coinciding with areas of several white patches on image; possible correlation. However, geologic map shows several other, smaller plugs west of 16, and near 17, which do not seem to show on image. Cause of light patches 17A unknown.

18. Approximate eastern contact of Precambrian granite with Gila Conglomerate. Faintly evident on image as a contrast between mottled gray (granite) and unmottled (Gila).

19. Intermittent cattle pond -- dark.

20. Cattle pond -- light.

21. Broad pediment and flats of Gila Conglomerate and Quaternary bolson deposits.

Figure 5 near here - numbers below refer to locations on sketch map.

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22. Grant County airport -- landing strip and parking lots appear bright.

23. House (dark spot).

24, 25. Abnormally dark parts of unnamed gully must represent groundwater close to surface, possibly as a result of influx at pumping station (26) upstream.

27. South edge of tailings pile from Kennecott mill at Hurley. Contrasting light and dark tones presumably reflect degree of drying-out of individual areas of tailings.

28. Darker areas surrounded by light bands are small mesas formed on flat-lying volcanic rocks -- silicic tuffs (light) overlain by basaltic andesite flows (dark).

29. Strong lineament, cause unknown.

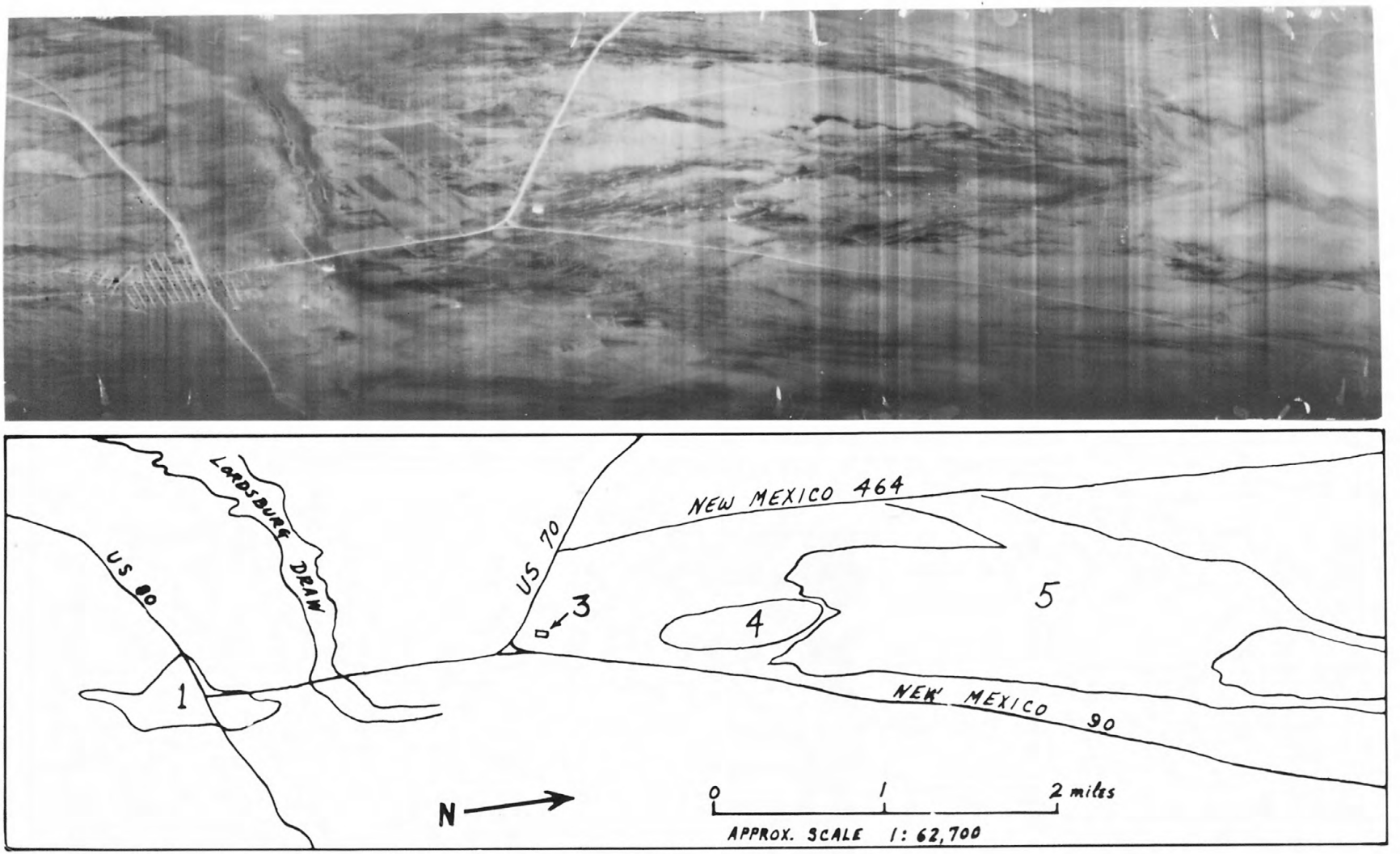

Figure 1. Infrared image and geologic sketch map of the Lordsburg area, New Mexico.

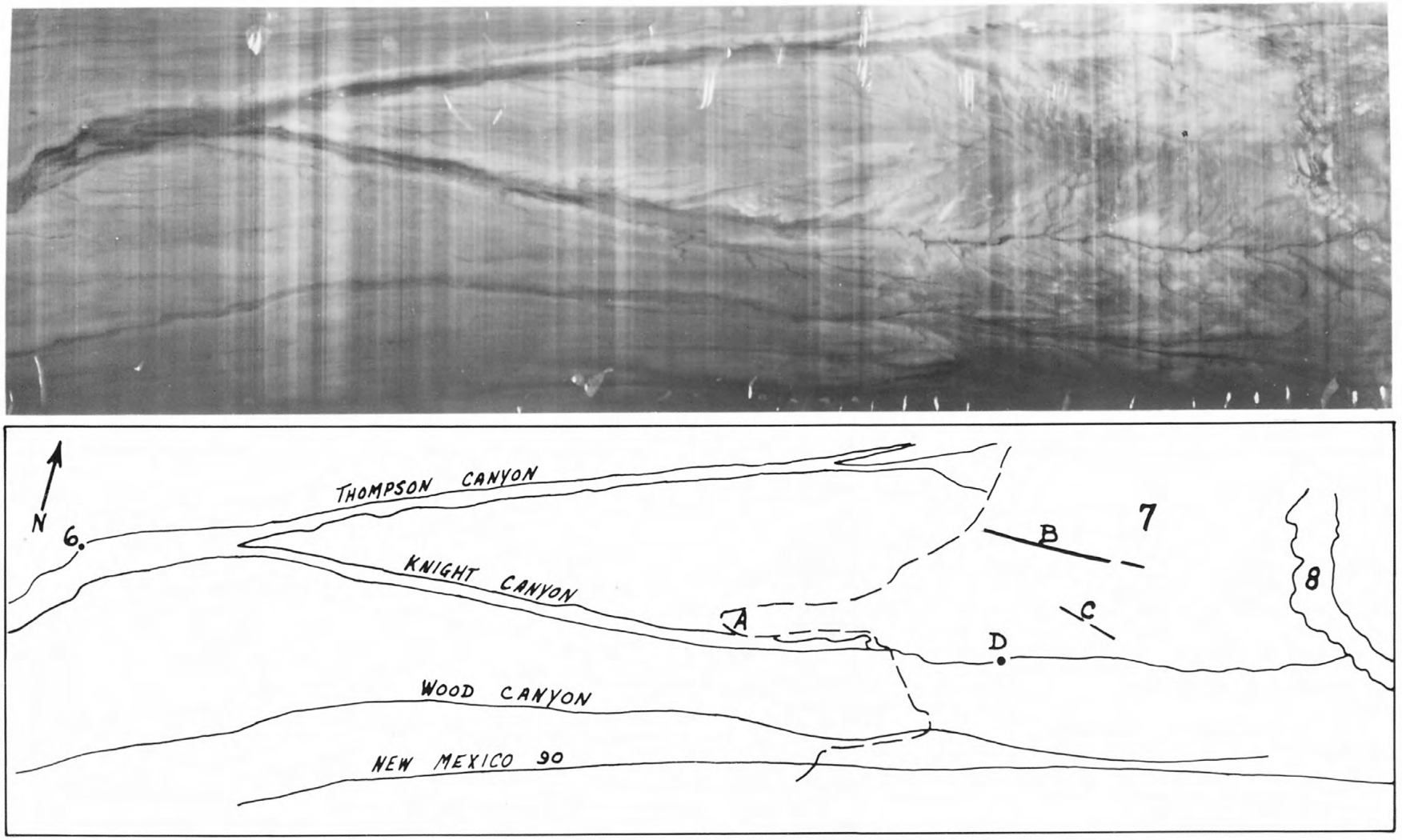

Figure 2. Infrared image and geologic sketch map of the Thompson, Knight and Wood Canyon areas, New Mexico.

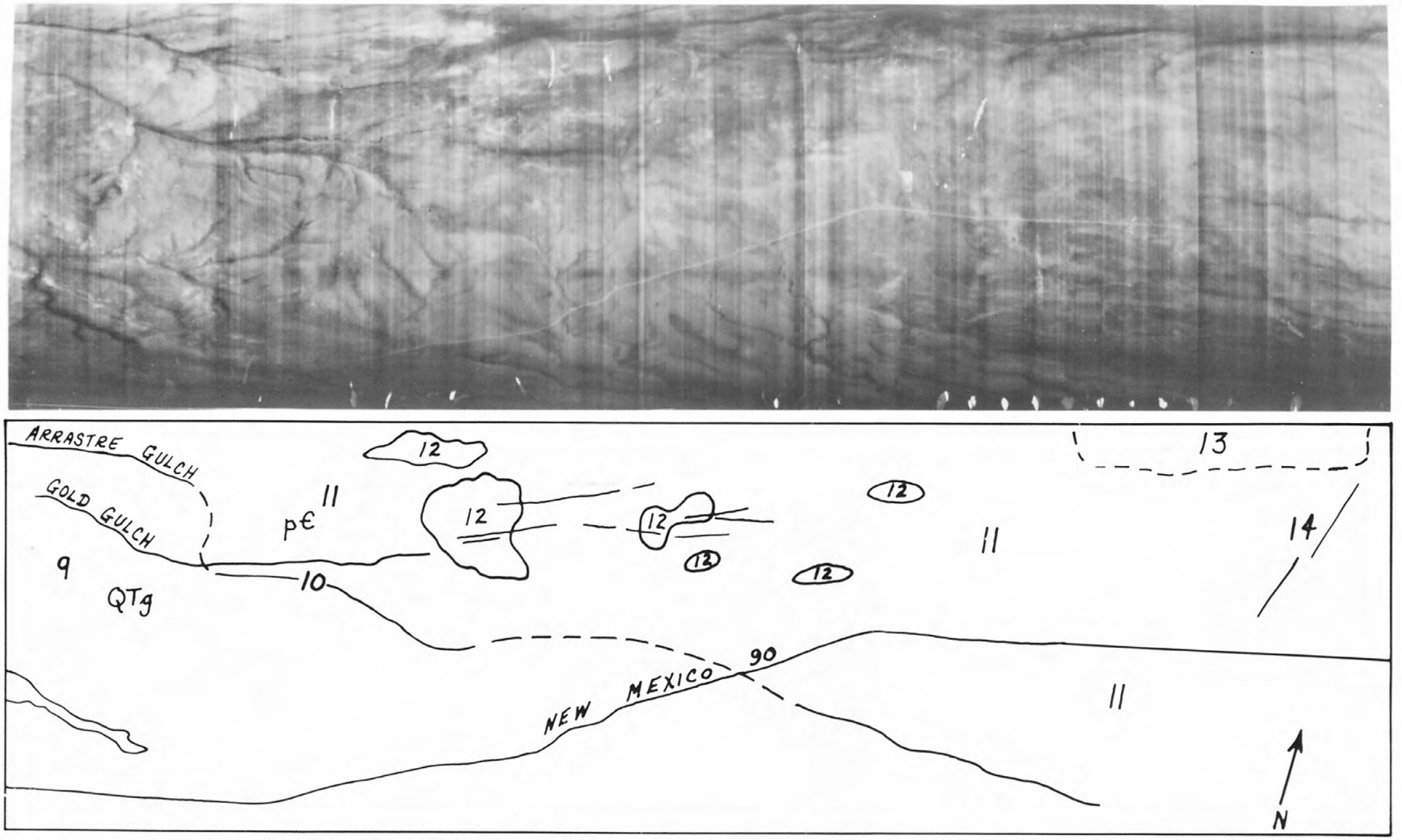

Figure 3. Infrared image and geologic sketch map of the Gold Gulch area, New Mexico.

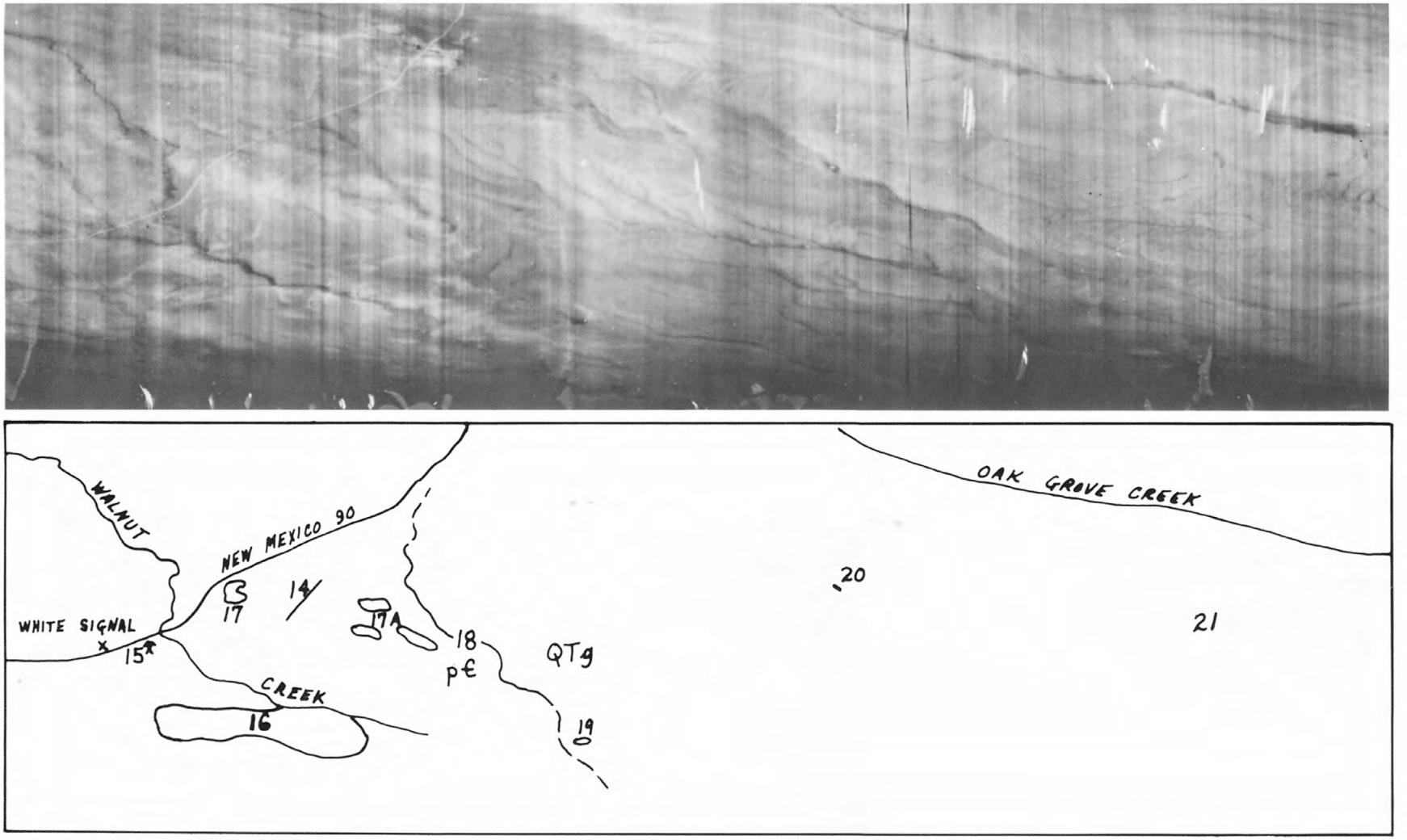

Figure 4. Infrared image and geologic sketch map of the White Signal area, New Mexico.

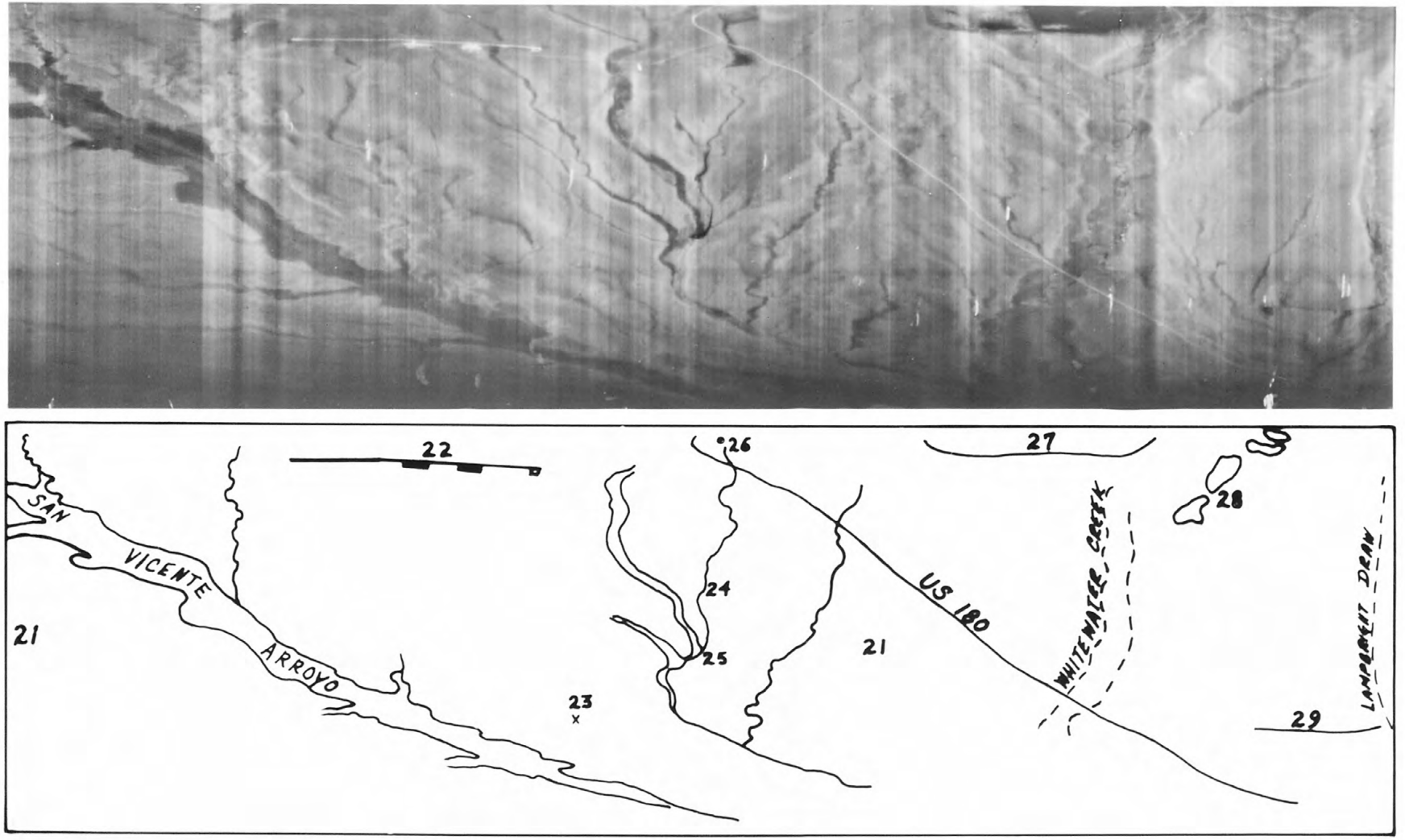

Figure 5. Infrared image and geologic sketch map of the Silver City airport area, Grant County, New Mexico.

REFERENCES

Dane, C. H., and Bachman, G. O., 1961, Preliminary geologic map of the southwestern part of New Mexico: U. S. Geol. Survey Misc. Geol. Inv. Map I-344, scale 1:380,160.

Gillerman, Elliot, 1953, White Signal uranium deposits, in N. Mex. Geol. Soc., Guidebook, 4th Field Conf., Oct. 1953, p. 133-137.

Paige, Sidney, 1916, Description of the Silver City quadrangle: U. S. Geol. Survey Geol. Atlas, Folio 199, 19 p.