SUMMARY OF PRELIMINARY RESULTS OF FIELD STUDIES IN 1952 IN THE GOOSE CREEK DISTRICT, CASSIA COUNTY, IDAHO, BOXELDER COUNTY, UTAH, AND ELKO COUNTY, NEVADA

By W. J. Mapel and W. J. Hail, Jr.

Trace Elements Memorandum Report 432

UNITED STATES DEPARTMENT OF THE INTERIOR

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By W. J. Mapel and W. J. Hail, Jr.

ABSTRACT

Uranium-bearing carbonaceous shale and lignite occur in the Salt Lake formation of lower Pliocene age in an area of about 60 square miles in T. 16 S., R. 21 E., southern Cassia County, Idaho, and parts of adjacent townships in Idaho, Utah, and Nevada. The uranium is concentrated in the Barrett carbonaceous shale zone in the trough of a broad syncline. Carbonaceous shales and lignites in the Barrett zone have been sampled at 54 localities in this area. Analyses of samples taken at 38 of these localities had been received as of February 1, 1953. Beds 1 foot or more thick contain 0.01 percent uranium at 15 localities, and the top 1 foot of a 7-foot bed of carbonaceous shale contains 0.12 percent uranium at 1 locality.

Inferred reserves of uranium in the Barrett zone in T. 16 S., R. 21 E., Idaho, total 2,230 short tons in beds more than 1.5 feet thick having an average grade of 0.005 percent or more uranium.

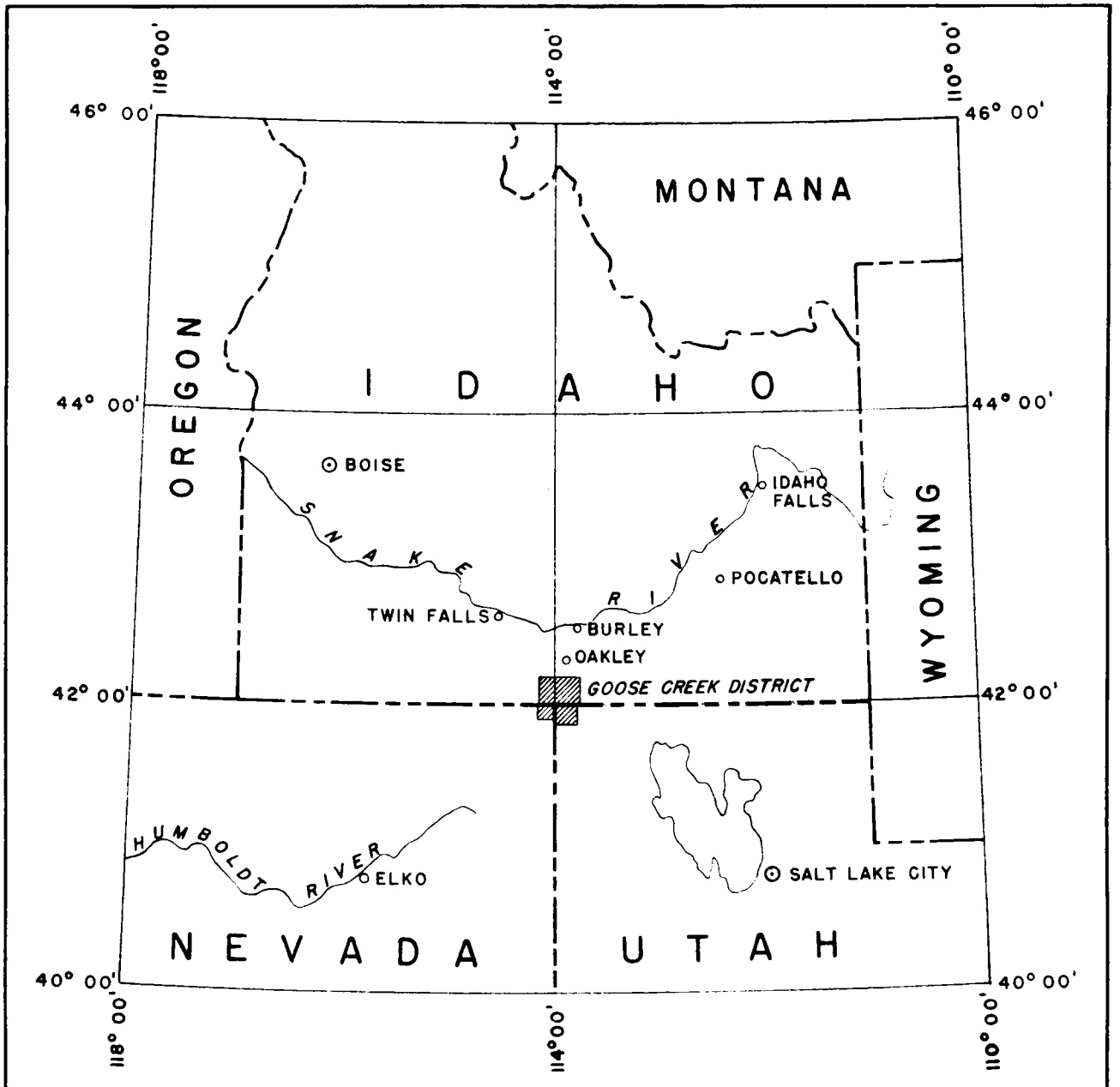
Core drilling is planned in 3 geologically favorable areas in T. 16 S., R. 21 E., Idaho, with the purposes of extending the uranium reserves and of determining the vertical distribution of uranium in the unweathered Barrett zone.

INTRODUCTION

The Goose Creek district is in southern Cassia County, Idaho, and in adjacent parts of Boxelder County, Utah, and Elko County, Nev. (fig. 1). The northern edge of the district is about 25 miles south of Burley, Idaho. A detailed geologic investigation in this area was undertaken during the summer of 1952 by the U. S. Geological Survey on behalf of the U. S. Atomic Energy Commission. The purpose of the work was to map uranium-bearing carbonaceous shale and lignite which occur in Tertiary volcanic sediments in the area, and to determine the tonnage of uranium present. This report summarizes the results of detailed mapping and sampling completed during 1952 with particular reference to an area of about 60 square miles in T. 16 S., R. 21 E., Cassia County, Idaho, and parts of adjacent townships in Idaho, Utah, and Nevada. It supplements an earlier report based on reconnaissance studies in the Goose Creek district in 1951 (Hail and Gill, 1953). A more complete report is being prepared.

FIELD WORK

Field work in the Goose Creek district during 1952 included detailed geologic mapping of an area of about 260 square miles on aerial photographs at a scale of about 1:30,000; sampling of carbonaceous shale and lignite at the outcrop and in auger holes; compilation of data for use in constructing a structure contour map; and stratigraphic studies of the uranium-bearing



INDEX MAP SHOWING LOCATION
OF GOOSE CREEK DISTRICT

FIG. 1

Tertiary volcanic sediments. About 300 samples of carbonaceous shale or lignite were collected from measured sections at 60 localities and submitted to the Trace Elements Section Washington Laboratory for uranium analysis. Analyses had been received for about two-thirds of these samples as of February 1, 1953. In addition, 35 samples of volcanic ash, limestone, shale, bentonite, and other rock materials from the area, and 18 water samples from springs and streams were collected and have been analyzed for uranium by the Geological Survey's Trace Elements Section Denver Laboratory.

STRATIGRAPHY

Uranium-bearing carbonaceous shale and lignite in the Goose Creek district occur in the Salt Lake formation of Pliocene age. The Salt Lake formation is as much as 2,400 feet thick and consists mainly of white friable permeable volcanic ash. Thin beds of sandstone, pebble and boulder conglomerate, bentonite and carbonaceous shale and lignite occur in the lower 950 to 1,250 feet. The next higher 500 feet contains from one to four cliff-forming beds of black to reddish-brown welded tuff as much as 100 feet thick. As much as 700 feet of grayish-orange volcanic ash and thin beds of conglomerate overlie the welded tuffs along the eastern side of the district, but at most places these beds have been removed by erosion. The lithology of the formation is shown by the generalized stratigraphic section (fig. 2). In the northern part of the area, the welded tuffs in the upper part

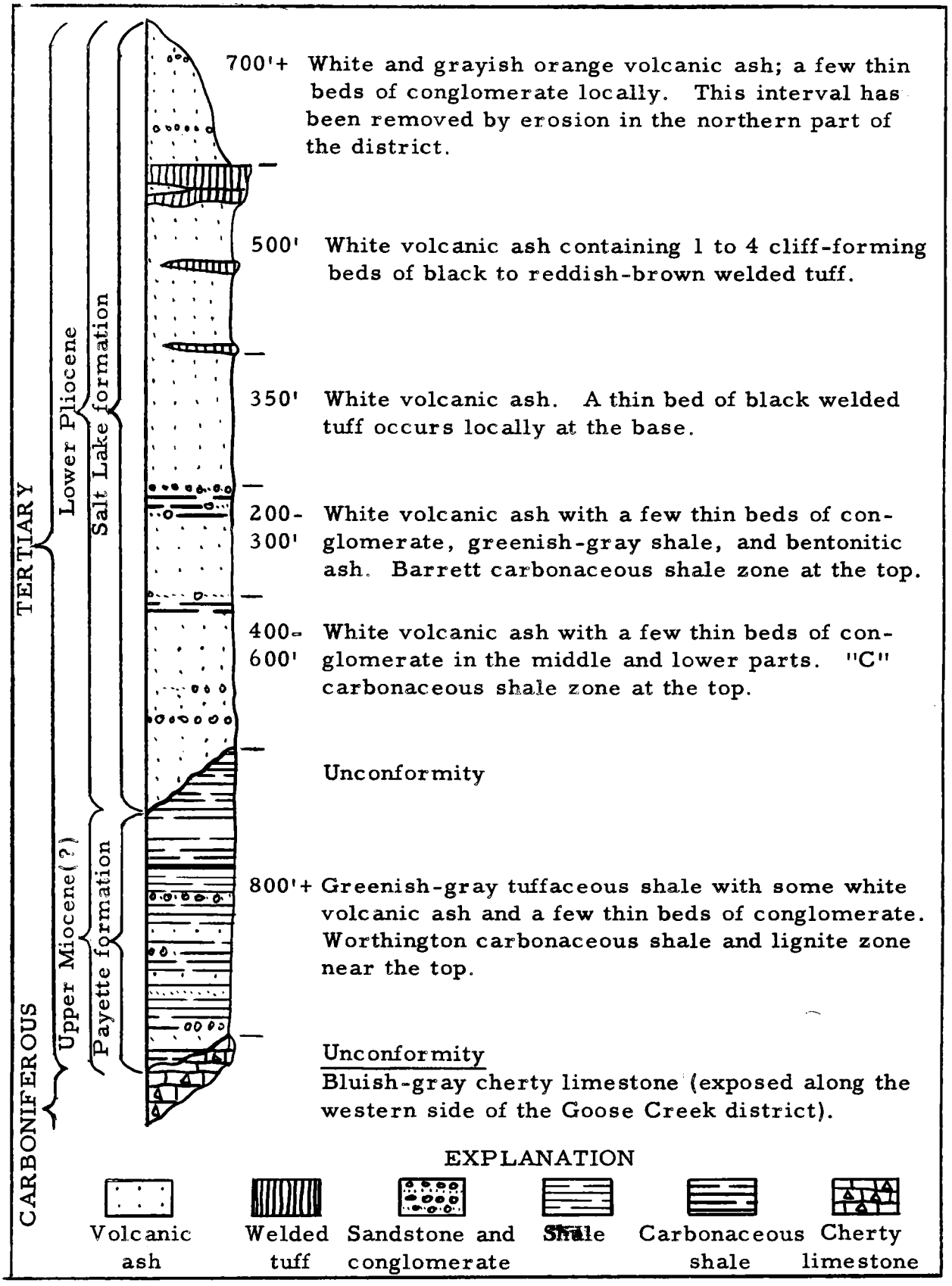


Fig. 2. Generalized stratigraphic section of the Salt Lake and Payette formations in the central part of the Goose Creek district.

of the formation form high mesas and plateaus bordered by steep gullied slopes; in the southern part, where the welded tuffs and overlying strata have been removed by erosion, the much less resistant beds which make up the lower part of the formation form gently rolling hills or flats.

The Payette formation of Miocene (?) age unconformably underlies the Salt Lake formation. The Payette formation has a total exposed thickness of about 800 feet and crops out in the western part of the district. It consists of greenish gray tuffaceous shale with lesser amounts of white volcanic ash and a few thin beds of carbonaceous shale and conglomerate. The generalized stratigraphic section (fig. 2) shows the lithology of the formation. No concentrations of uranium are known in the carbonaceous shales of the Payette formation in the district.

STRUCTURE

The Tertiary rocks of the Goose Creek district occupy an elongate northerly trending basin bordered on the east, south, and west by Paleozoic or pre-Cambrian limestone and quartzite, and on the north by Pleistocene basaltic lavas of the Snake River plain. The major structural feature of the central and northern parts of the district is the Goose Creek syncline, a broad, northeasterly-trending fold, the axis of which coincides in general with the valley of Goose Creek. Beds on the west flank of the syncline dip about 8° SE, and on the east flank about 2° NW.

The Goose Creek syncline dies out southward near the southern part of the area shown by the geologic map (fig. 3) in a complex system of northerly or northeasterly-trending normal faults. At Birch Creek, in sec. 25, T. 16 S., R. 21 E., beds of grayish-orange volcanic ash at the top of the Salt Lake formation are faulted opposite uraniferous carbonaceous shale in the middle part of the formation, giving a maxiumum net displacement across the fault zone of at least 900 feet downdropped on the east. A series of normal faults trending northeastward cut the west flank of the Goose Creek syncline in the northwestern part of the same township. The maximum displacements along these faults range from less than 50 feet to about 200 feet.

MINERALIZED BEDS

Concentrations of uranium in the Goose Creek district occur mainly in carbonaceous shale or lignite in the Barrett carbonaceous shale zone, which lies from 600 to 900 feet above the base of the Salt Lake formation. The Barrett zone ranges in thickness from less than 1 foot to 80 feet, and consists of 1 to 10 beds of carbonaceous shale or lignite interbedded with volcanic ash, greenish-gray shale, sandstone, and conglomerate. The zone may be traced for tens of miles; however, individual beds of carbonaceous shale in the zone are lenticular and some pinch out or are replaced by non-carbonaceous beds within a few hundred feet. In the area shown by

the geologic map (fig. 3), the Barrett zone is thickest west of Goose Creek beneath the Coal Banks Creek-Beaverdam Creek divide, where locally it contains thin beds and streaks of lignite or black lignitic shale. Elsewhere, carbonaceous beds in the zone are fissile brown shale grading to brown volcanic ash. Lignite in the Barrett zone burns to form 30 to 50 percent ash; the carbonaceous shales average about 85 percent ash.

DISTRIBUTION OF URANIUM

Figure 4 shows graphic sections of the Barrett zone in the central part of the Goose Creek district together with the intervals sampled and the percent uranium contained in the samples analyzed to date. Except for two isolated occurrences of uranium in the Barrett zone along Trapper Creek, about 5 miles north of the area shown by figure 3, uranium in more than trace amounts is known only in the trough of the Goose Creek syncline in T. 16 S., R. 21 E., in a northeasterly-trending strip about 6 miles long and 4 1/2 miles wide. The Barrett zone containing traces of uranium crops out to the west and southwest of this strip on the northwestern limb of the Goose Creek syncline; to the north, east, and south the zone dips, or is faulted, beneath the surface and could not be sampled.

Carbonaceous shales in the Barrett zone have been sampled at 54 localities in the area shown by figure 3, including 15 localities sampled in 1951 by Hail and Gill. Analyses of samples taken at 38 of these localities had been received as of February 1, 1953. Beds 1 foot or more thick contain 0.01 percent or more uranium at 14 localities and the top 1 foot of a 7-foot thick bed of carbonaceous shale contains 0.12 percent uranium at 1 locality (no. 47, figures 3 and 4).

The coincidence of the area of high uranium concentration and the position of the Goose Creek synclinal axis suggests that enrichment of the shale has been controlled by the syncline. Hail and Gill (1953) postulate that the uranium was leached from the volcanic ash of the Salt Lake formation and carried to its present position by groundwater. Concentrations of uranium in beds more than 3 feet thick in most places are greatest in the upper half of the bed, and commonly are greatest in the upper third of the bed, suggesting that secondary uranium may have been introduced from above after deposition of the shales.

A concentration of 0.009 percent uranium in the top 1 foot of a bed of carbonaceous shale at least 3 feet thick was found by Hail and Gill (1953) in a carbonaceous shale zone which crops out about 160 feet stratigraphically below the Barrett zone, in sec. 25, T. 16 S., R. 21 E. Except for this occurrence, concentrations of uranium greater than 0.006 percent have not been found in carbonaceous beds other than those in the Barrett zone.

It should be noted, however, that such beds either are not present or are not exposed near the axis of the Goose Creek syncline and therefore could not be sampled in what appears to be the most favorable area geologically.

RESERVES

Table 1 shows the estimated reserves of uranium in T. 16 S., R. 21 E., based on sampling and reconnaissance mapping done by Hail and Gill (1953). The figures given will be modified when all of the analytical data are received. It is expected that as a result of the work done in 1952, estimates of uranium reserves will be increased on the order of 25 to 50 percent.

PLANS

About 2,000 feet of core drilling in the Goose Creek district is planned during the 1953 field season. The purposes of this drilling are twofold: (1) Core drilling in areas adjacent to deposits of high uranium concentration or in areas favorably situated geologically, particularly along the axis of the Goose Creek syncline, might show that concentrations of 0.1 percent uranium are not rare in the district, and that relatively high-grade beds 3 to 4 feet thick are continuous enough to warrant development. (2) Fresh samples of carbonaceous shale obtained in cores will provide a valuable source of material for study of the vertical distribution of uranium in the unweathered Barrett zone.

Table 1. --Inferred uranium reserves in the Barrett zone, T. 16 S., R. 21 E., Cassia County, Idaho 1/

Thickness (weighted average in feet)	Area (Acres)	Uranium (weighted average percent)	Total carb. shale (short tons)	Total uranium (short tons)	Estimated reserves under less than 100' of overburden	
					Carb. shale (short tons)	Uranium (short tons)
In beds 1.5 to 3.0 feet thick containing 0.005 percent or more uranium 2/						
2.5	3,410	0.0056	9,400,000	530	2,300,000	130
In beds 3.0 feet or more thick containing 0.005 percent or more uranium 2/						
4.2	4,050	0.009	19,000,000	1,700	1,800,000	160
3.5	7,460	0.008	28,400,000	2,230	4,100,000	290

1/ Reserve figures based on work done in 1951 (Hail and Gill, 1953).
2/ 1,100 short tons of carbonaceous shale per acre-foot used in all calculations (based on an average apparent sp. gravity of .83 for 6 samples of weathered material).

Drilling is planned in three areas: (1) East of Goose Creek in secs. 12, 13, 23, 24, 25, 26, 34, and 35, T. 16 S., R. 21 E., carbonaceous shales in the Barrett zone contain greater than 0.01 percent uranium at several places and as much as 0.12 percent uranium at locality 47. In much of this area the Barrett zone is beneath less than 100 feet of overburden and proven reserves of uranium may be recovered by stripping. (2) West of Goose Creek in secs. 27, 28, and 33 the Barrett zone is under relatively shallow cover near the axis of the Goose Creek syncline. Nearby, beds in the zone have burned to form clinker suggesting that lignite is present, which, if radioactive, could be beneficiated by burning. (3) At Coal Banks Creek in secs. 3 and 9 the Barrett zone contains small concentrations of uranium at some places. If groundwater movement has been impeded by the normal faulting in this area, significant concentrations of uranium might be expected locally on the up-dip side of the faults.

UNPUBLISHED REPORT

Hail, W. J., Jr., and Gill, J. R., 1953, Radioactive carbonaceous shale and lignite deposits in the Goose Creek district, Cassia County, Idaho: U. S. Geol. Survey Trace Elements Invs. Rept. 272.

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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Base map compiled from Bureau of Land Management township plats, aerial photographs and plane-table triangulation.

EXPLANATION

Tsl

Salt Lake formation

White volcanic ash with some welded rhyolitic tuff and a few lenticular beds of conglomerate. Thin beds of carbonaceous shale or lignite in the middle and lower parts.

Tp

Payette formation

Greenish-gray tuffaceous shale and white volcanic ash; few thin beds of carbonaceous shale and conglomerate.

Pliocene
Miocene(?)
TERTIARY

Outcrop of uranium-bearing lignite or carbonaceous shale

Dashed where approximately located. 16 refers to measured section; numbers followed by (A) indicate auger holes.

Outcrop of burned lignite or carbonaceous shale

Dashed line shows the limit of clinkered surface rock.

U / D

Normal fault

U is upthrown side; D is downthrown side. Dashed where approximately located.

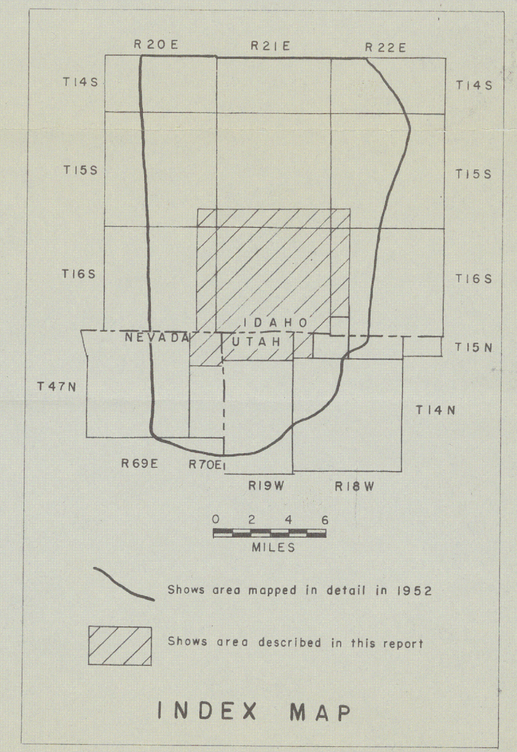
Strike and dip of beds

Abandoned lignite mine

Section corner found

0 1/2 1 2 MILES

Areas recommended for core drilling



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Geology by:
W. J. Mapel, W. J. Hail,
J. E. Conkin, J. N. Babcock.

FIGURE 3
GEOLOGIC MAP OF THE CENTRAL PART OF THE GOOSE CREEK DISTRICT
CASSIA COUNTY, IDAHO, BOXELDER COUNTY, UTAH, AND ELKO COUNTY, NEVADA.
1953

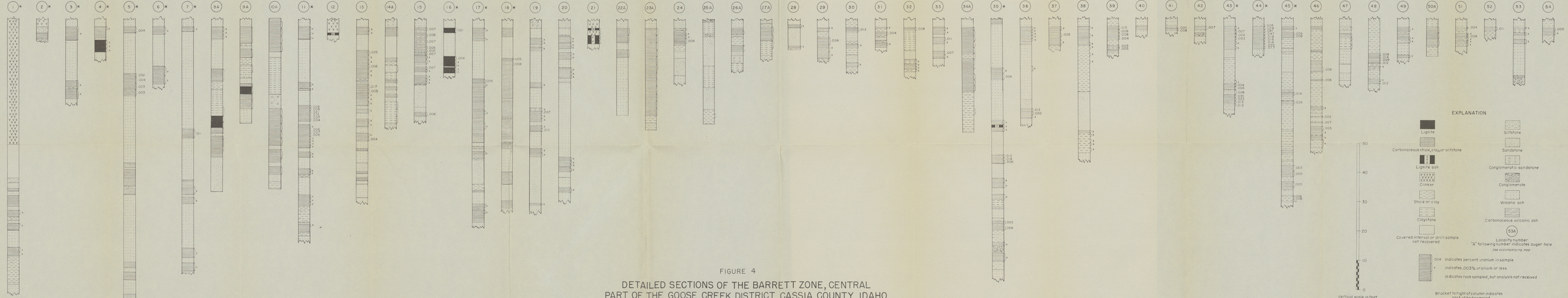

FIGURE 4

DETAILED SECTIONS OF THE BARRETT ZONE, CENTRAL PART OF THE GOOSE CREEK DISTRICT, CASSIA COUNTY, IDAHO

Sections marked with an asterisk (*) were described and sampled by Hail and Gill in 1951, the remainder were described and sampled in 1952.