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GEOLOGY AND MINERALOGY

U. S. DEPARTMENT OF THE INTERIOR

URANIUM IN THE CHATTANOOGA SHALE, YOUNGS BEND AREA, EASTERN HIGHLAND RIM, TENNESSEE

By
Thomas M. Kehn

This report is preliminary and has not been edited or reviewed for conformity with U. S. Geological Survey standards and nomenclature.

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U. S. Geological Survey,
Washington, D. C.

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ABSTRACT

In December 1952 a diamond drilling project was started to obtain geologic and mining information and samples of uranium-bearing Chattanooga shale in the Youngs Bend area, near Smithville, Tennessee. This area was thought to offer a good combination of grade, thickness, and mining conditions. Thirty-six holes were drilled on 1-mile centers in an area of 32 square miles in the Youngs Bend area, and 10 exploratory holes were dilled later at more widely spaced intervals on the Eastern Highland Rim.

Thirty drill cores from the Youngs Bend area show that in 21 square miles between Dry Creek and the Center Hill Reservoir the Gassaway member of the shale has an average thickness of 15 feet and an average uranium content of 0.0060 percent. In this area 620,000,000 tons of shale contain 38,000 tons of uranium.

On the east side of Center Hill Reservoir two holes show the shale to be slightly greater in thickness and grade. Seven exploratory holes spaced at intervals of about 10 miles along the Eastern Highland Rim indicate that for a distance of about 50 miles south of Smithville the uranium content, thickness, and the structure of the shale is at least as favorable as in the Youngs Bend area. In the event of more developmental drilling, the small area east of the Reservoir and the large

region south of Smithville and should be explored further.

West of Dry Creek four of the holes show the shale to be below average in both thickness and uranium content. Likewise, the area north of Smithville on the Eastern Highland Rim, tested by three holes at about 12-mile intervals, is less promising because the uranium content of the shale decreases in that direction.

Small synclines in the 32-square mile area tend to have a somewhat thicker section of the shale, particularly the upper unit of the Gassaway member. In these places the percentage of uranium of a given shale unit is as high as elsewhere, hence where the rich topmost unit is thick the average grade of the entire Gassaway member is thereby increased.

Two feet of impure phosphatic shale of low uranium content were encountered in the top of the Chattanooga shale in two cores. It is not known to what extent this impure shale surrounds these holes, but it is believed that these are local remnants of the phosphatic shale wedge that is present at the top of the Gassaway member to the north of Smithville.

The Pine Creek site seems to offer as good a combination of grade, thickness, and geologic conditions as any now known in the shale. The shale is average in thickness and is slightly above average in uranium content.

INTRODUCTION

Previous work

Reconnaissance investigations of the uranium content of the Chattanooga shale were conducted by the U. S. Geological Survey from 1944 until 1947 in Tennessee and other States (Brill, and others, 1945; Nelson and Brill, 1947; Slaughter and Clabaugh, 1944). In 1947, the Geological Survey, on behalf of the Atomic Energy Commission, started a more detailed study of several hundred outcrops, during which several thousand samples were obtained for radiometric and chemical determinations of the uranium content. Two previous reports by Conant, Brown, and Hass (1950) and Conant and Swanson (1952) give detailed information on the geology and geographic setting of the Chattanooga shale in the area described by this report. In addition, the 1952 report summarizes the analyses then available. A later report by Glover (1954) gives results of investigations of the Chattanooga shale along the Sequatchie anticline of Tennessee and Alabama. The latter report area is 25 to 40 miles east of the present report area. (See Glover, 1954, fig. 1.)

In order to obtain detailed information on grade, thickness, and mining and geologic conditions, diamond drilling of the Chattanooga shale was started in the Youngs Bend area in December 1952 by the U. S. Bureau of Mines. The Geological Survey and Bureau of Mines cooperated in the selection of the area and location of drill sites. The Youngs Bend drilling area was chosen as offering a good combination of grade, thickness, and mining conditions. Later the drilling was extended to test the uranium content of the shale over much larger

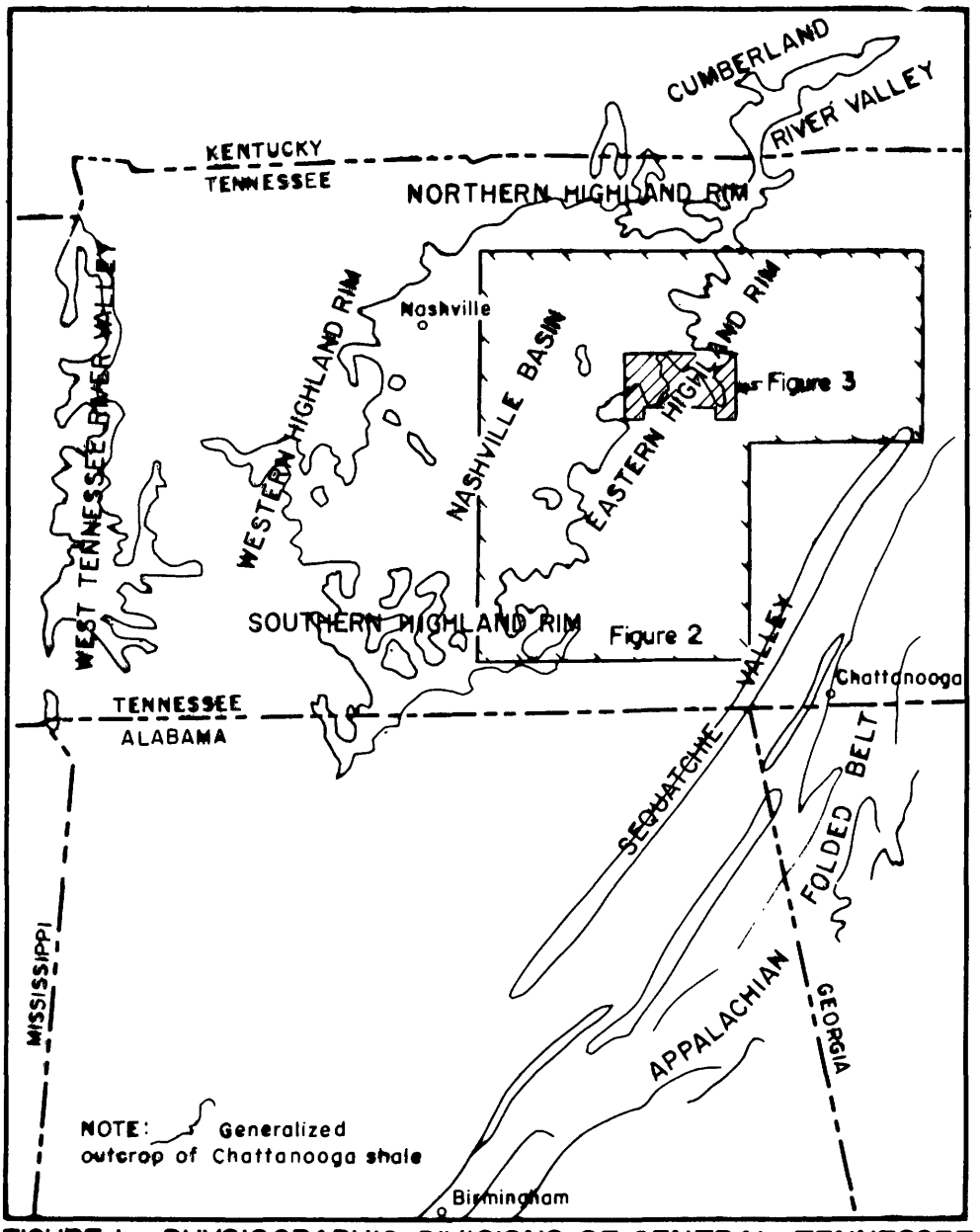

FIGURE I–. PHYSIOGRAPHIC DIVISIONS OF CENTRAL TENNESSEE AND PARTS OF ADJACENT STATES, WITH OUTLINES OF AREAS DISCUSSED IN THIS REPORT

areas along the Northern and Eastern Highland Rims of Tennessee, and near the Sequatchie anticline of Tennessee and Alabama (fig. 1). The data resulting from the drilling in these areas are presented in a report by Swanson and Kehn (1955).

This report summarizes information regarding structure, stratigraphy, and uranium content in the Youngs Bend drilling area; it also summarizes information on the thickness of the shale and its uranium content as revealed by holes scattered for about 75 miles along the Eastern Highland Rim (fig. 2).

The Youngs Bend drilling area is an east-west belt about 2 miles wide and 16 miles long, that extends from about 1 mile east of Center Hill Reservoir to about 3 miles west of Dry Creek, and passes about 2.5 miles south of Smithville, DeKalb County, Tenn. (fig. 3). This area contains about 32 square miles, of which 25 square miles are underlain by Chattanooga shale. It was tested by 36 diamond drill cores (YB-1 to -4, -6, and -7, -9 to -38).

Purpose of drilling program

The principal objectives of the drilling program were to: 1) obtain fresh samples of the shale; 2) determine the continuity of grade and thickness of the shale over a large area; 3) determine the uranium reserves in the drilled area; and 4) obtain structural and stratigraphic information.

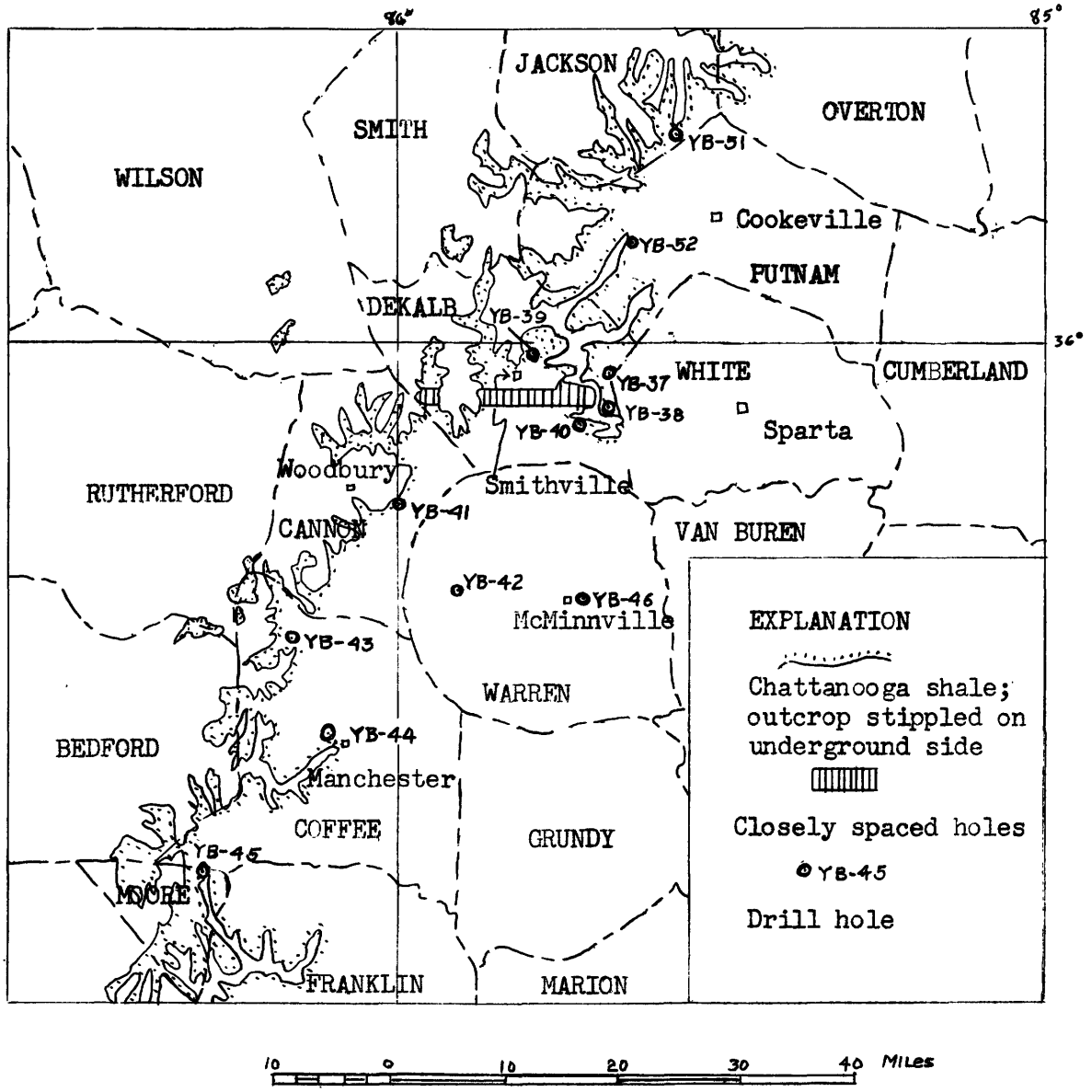

Figure 2.--Chattanooga shale drill holes along the Eastern Highland Rim.

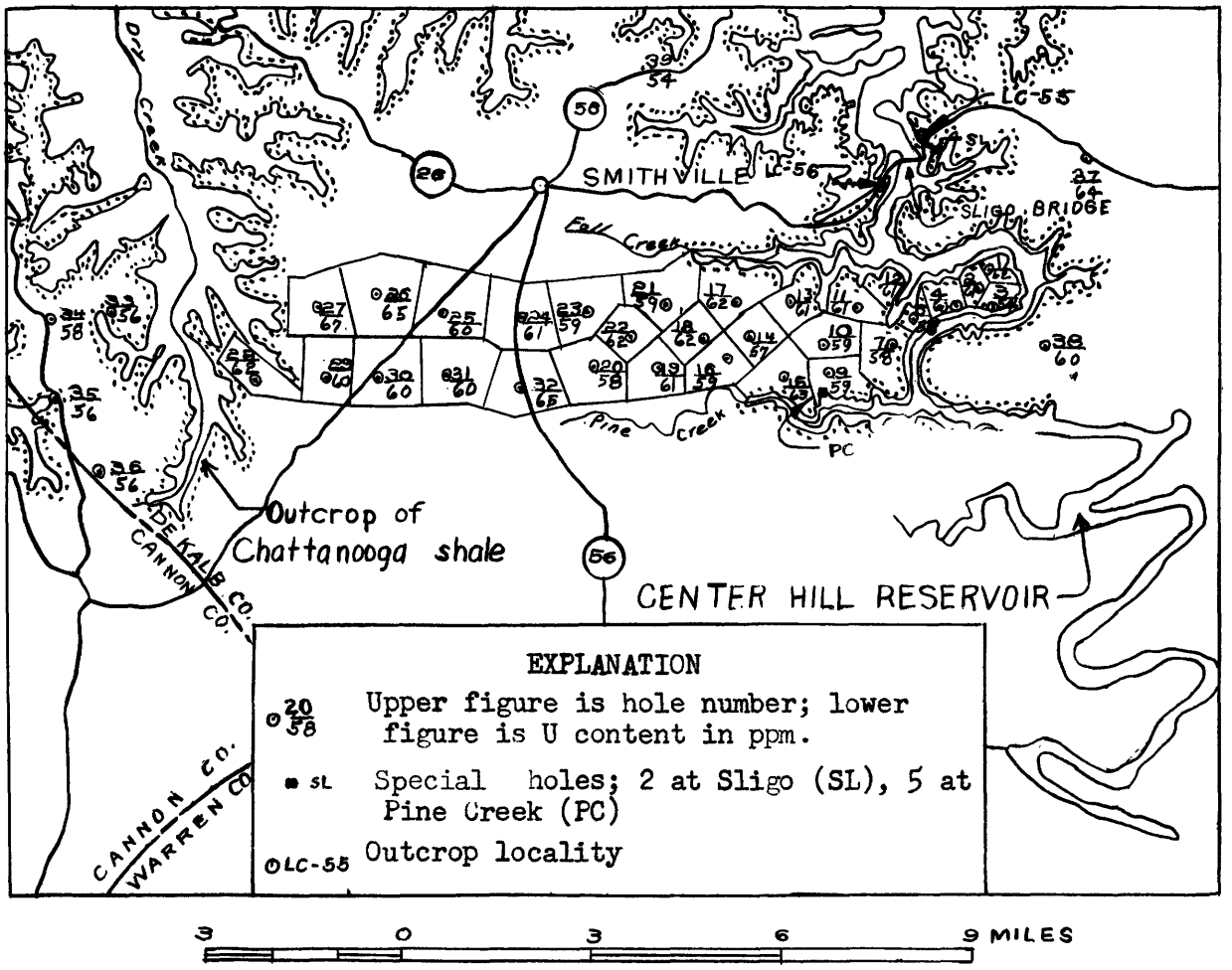

Figure 3.--Locations of drill holes and areas for which uranium reserves are estimated in the Youngs Bend area, near Smithville, Tenn.

Acknowledgments

Credit for the excellent core recovery is due the Bureau of Mines, especially to Mr. Robert. C. Hickman, engineer in charge of drilling. Lynn Glover, Julian Soren, and Stanley Byers of the Geological Survey aided in processing and logging many of the cores.

DRILLING AND SAMPLING

This report includes data on 49 of the 64 diamond drill cores of the Chattanooga shale that were obtained from December 1952 to October 1953 (figs. 2 and 3). The first 21 holes (YB-1 to -4, -6 and -7, -9 to -23) were laid out approximately on a predetermined mile-square 5-hole grid (a square grid with holes at the corners and at the center of each square). Holes YB-24 through -32 were laid out on a similar mile-square grid but without the center hole. Four holes (YB-33 to -36) were drilled on the west side of Dry Creek, and two others (YB-37 and -38) on the east side of Center Hill Reservoir.

Ten other holes (YB-39 to -46, -51 and -52) were drilled at intervals of about 10 to 15 miles for an airline distance of about 75 miles along the Eastern Highland Rim, from southern Jackson County to northern Moore County (fig. 2).

All the cores were of NX size (2 1/8 inch). The prefix YB was applied to the 36 holes drilled in the Youngs Bend area, and to the 10 widely spaced holes along the Eastern Highland Rim.

Most of the cores were taken at the drill sites by personnel of the Geological Survey. The cores were logged, sawed into longitudinal quarters, and one quarter sent to the laboratory for uranium analyses. At first the three black shale units of the Chattanooga -- the upper and lower units of the Gassaway member and the lower unit of the underlying Dowelltown member -- were divided into 1-foot samples, the lowest sample in each of the units having an irregular thickness, but not exceeding 1.5 feet. The middle unit of the Gassaway, about $2\frac{1}{2}$ feet thick, was commonly divided into two equal samples. The upper unit of the Dowelltown member, which is predominantly a succession of gray claystone and black shale beds, was divided into 2-foot samples as its uranium content was known to be appreciably lower and of less economic interest. Thirty one of the first 36 holes drilled (YB-1 to -4, -6 and -7, -9 to -38) were sampled in this manner and the samples were analyzed for ten cores (YB-1 to -4, -6 and -7, -10 to -12, and -15). It was then decided that adequate analytical information could be obtained from one sample for each of the five stratigraphic units. Consequently, the 1-foot and 2-foot samples still awaiting analyses were combined in the laboratory into composite samples representing each of the stratigraphic units, and two cores for which analyses had already been made of the 1-foot and 2-foot samples were also combined into composites (YB-1 and -15). The five remaining cores of the Youngs Bend area (YB-16, -31,

-32, -37, and -38) and the 10 cores taken elsewhere along the Eastern Highland Rim were divided into samples representing stratigraphic units. Analytical data and graphs of all these core samples are shown in the appendix.

GEOLOGY

Stratigraphy

In the area of the present report the Chattanooga shale of Late Devonian age lies unconformably on a peneplained surface of limestone, chiefly the Leipers limestone of Ordovician age. Throughout central Tennessee, however, the Chattanooga overlies 23 different formations as mapped by C. W. Wilson (1949).

The Chattanooga shale is predominantly a massive, siliceous, and pyritic black shale which breaks with a conchoidal fracture when fresh, but which is somewhat fissile when weathered. Beds and thin partings of gray claystone and siltstone are prominent in two units and are randomly present throughout the entire formation. Based on lithology and fauna, the Chattanooga shale has been divided into two members (Conant, and others, 1950; Hass, in preparation). The lower member, the Dowelltown, ranges in thickness in most of the area of this report from 13 to 17 feet and is subdivided into lower and upper units (the "Lower Black shale" and the "Middle Gray siltstone" of Conant and Swanson, 1952, p. 23). The upper member, the Gassaway, ranges in thickness on the Eastern Highland Rim from 11 to 18 feet, averaging about 15 feet, and is subdivided into lower, middle, and upper units (the "Middle Black shale", the "Upper siltstone", and the "Top Black shale" of Conant and Swanson, 1952, p. 23). The Gassaway member has the highest uranium content and is the more widespread of the two members.

A unit bearing phosphate nodules in the top 2 feet of the Chattanooga shale was encountered in two cores (YB-29 and -39), and probably corresponds to a phosphatic wedge that sets in a few miles north of the Youngs Bend drilling area and increases in thickness northward to a maximum of 8 feet in Kentucky (Hass, in preparation).

The Chattanooga shale and the greenish-gray claystone of the overlying Maury formation of early Mississippian age have commonly been considered to represent an essentially uninterrupted sequence of deposition, but paleontological studies by Hass along the Eastern Highland Rim indicate that fossils of very Late Devonian age are missing from the Chattanooga shale south of Smithville, Tenn. In the drill cores a slight unconformity at the top of the Chattanooga shale is suggested by local differences in the thickness of the upper unit of the Gassaway member, and by the local preservation, as at YB-29, of the phosphatic topmost portion of the Chattanooga shale. North of Smithville, this phosphatic unit of the shale crops out extensively, occurs in all drill cores, and contains latest Devonian fossils that are absent south of Smithville. Recognition of this phosphatic unit is important because its lower uranium content, commonly on the order of 0.004 percent, would reduce the uranium content of mill feed if it were mined with the rest of the Gassaway member.

Although only about 2½ feet thick, the Maury formation is a conspicuous unit wherever it is exposed because it differs from the underlying formations in both color and lithology. At many places

along the Eastern Highland Rim a concentration of phosphatic nodules is present at or near the base of the formation, though this concentration could not be observed in the drill cores. This basal phosphatic unit is overlain by greenish-gray to grayish-yellow claystone having scattered phosphatic nodules.

The Fort Payne chert, of early Mississippian age, conformably overlies the Maury formation. Its total thickness is about 250 feet, but in most of the drilling area the uppermost part has been removed by erosion. The lower part of the formation commonly appears more cherty than the upper part, and the lowest 25 to 50 feet consists largely of massive chert and limestone which is highly resistant to erosion.

Thickness of the Chattanooga shale

The Chattanooga shale crops out in the larger stream valleys and underlies the remainder of the report area. It ranges from slightly more than 12 feet to slightly less than 36 feet in thickness and five lithologic units were recognized at the surface and in all of the cores, except in core YB-45 where the shale is divisible only into the Dowelltown and Gassaway members. Differences in the thickness of the formation, of the two members, and of each of the five lithologic units are small throughout the area, with the larger differences in most places being near the crests or troughs of anticlines and synclines. The general direction of thickening of the shale, as shown by the structure sections and stratigraphic profiles (fig. 4, 5, and 6), is to the east or down the regional dip. The two units of the Dowelltown member and the lower and

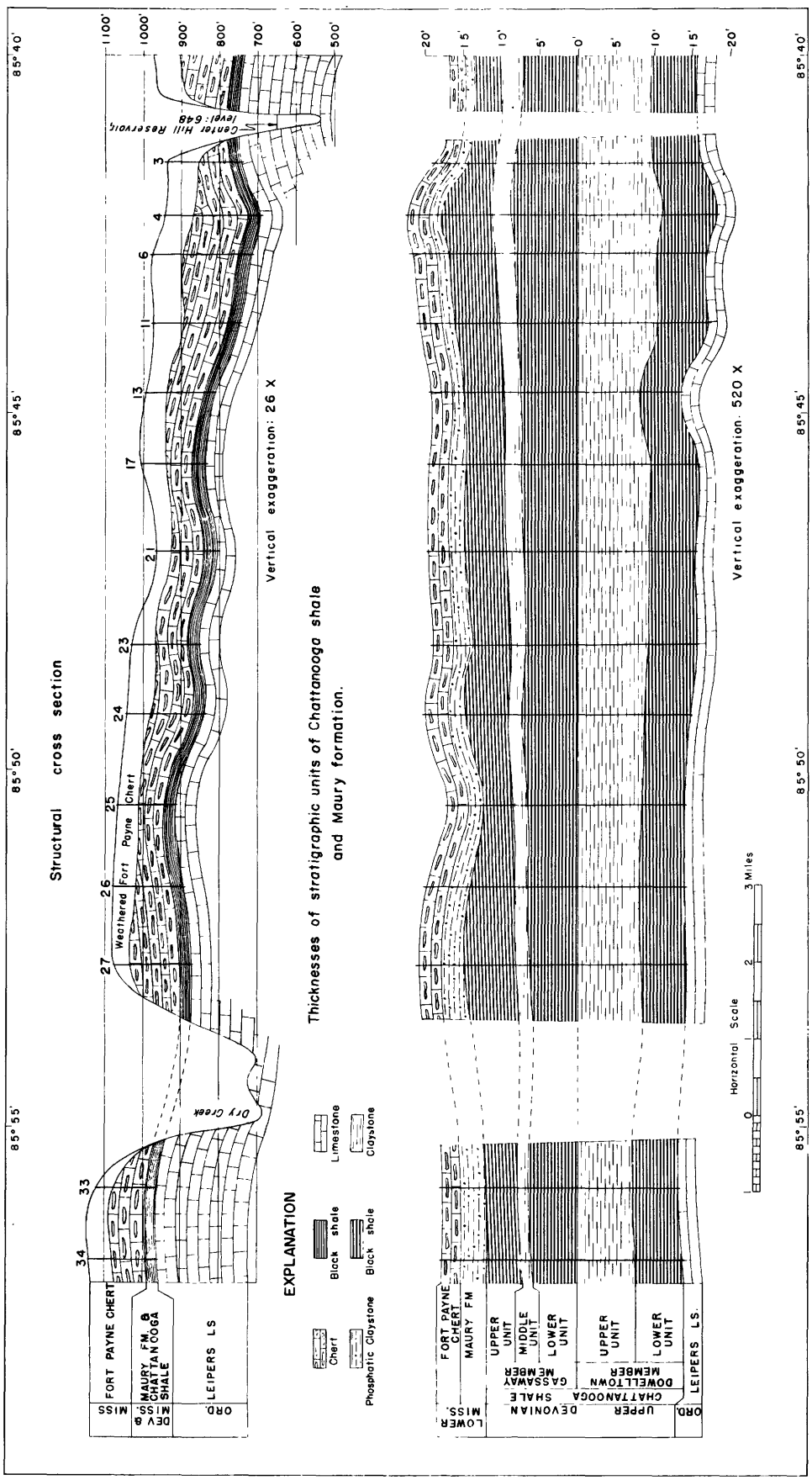

Figure 4–SECTION ALONG NORTH LINE OF DRILL HOLES, YOUNGS BEND DRILLING AREA

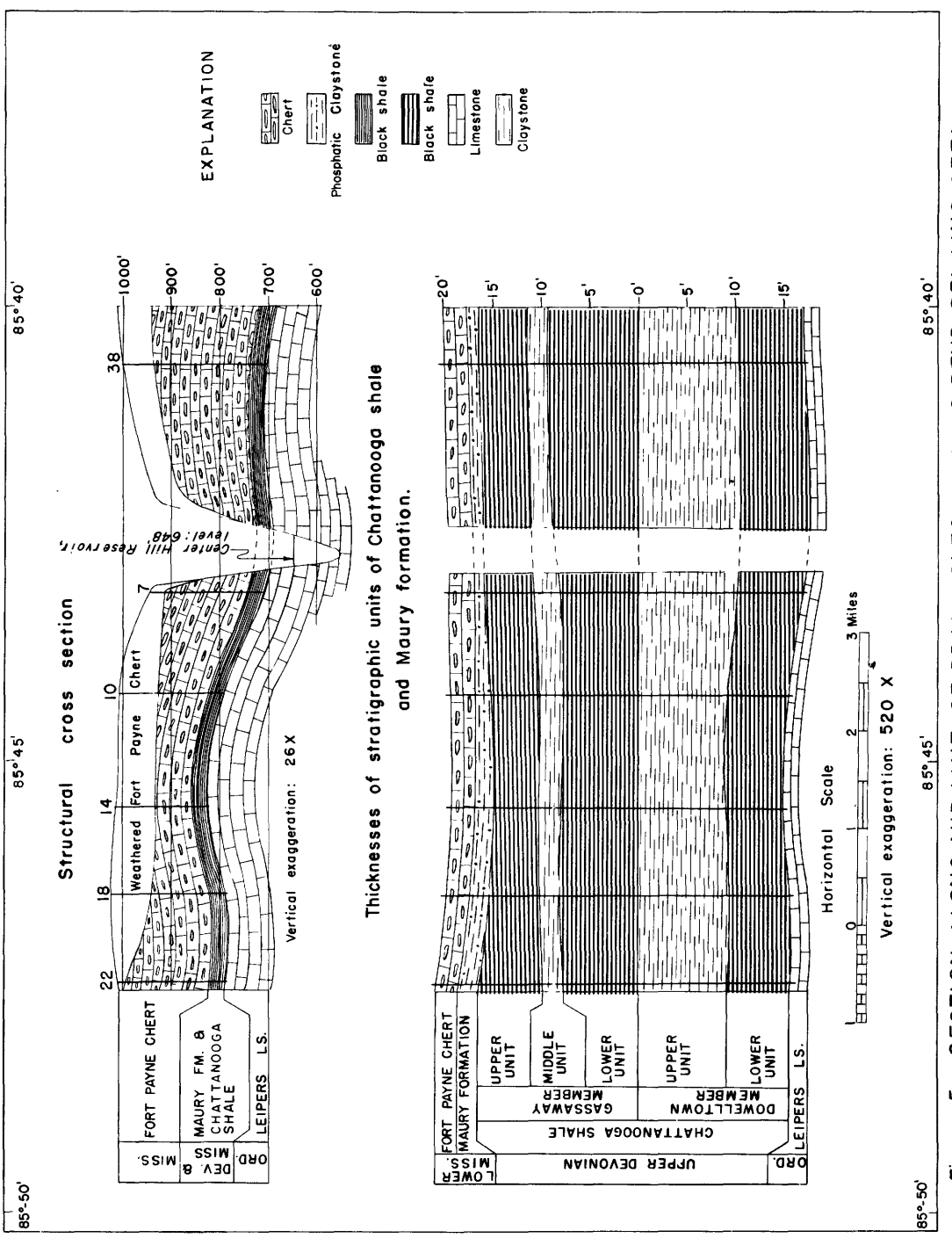

Figure 5 - SECTION ALONG MID LINE OF DRILL HOLES, YOUNGS BEND DRILLING AREA

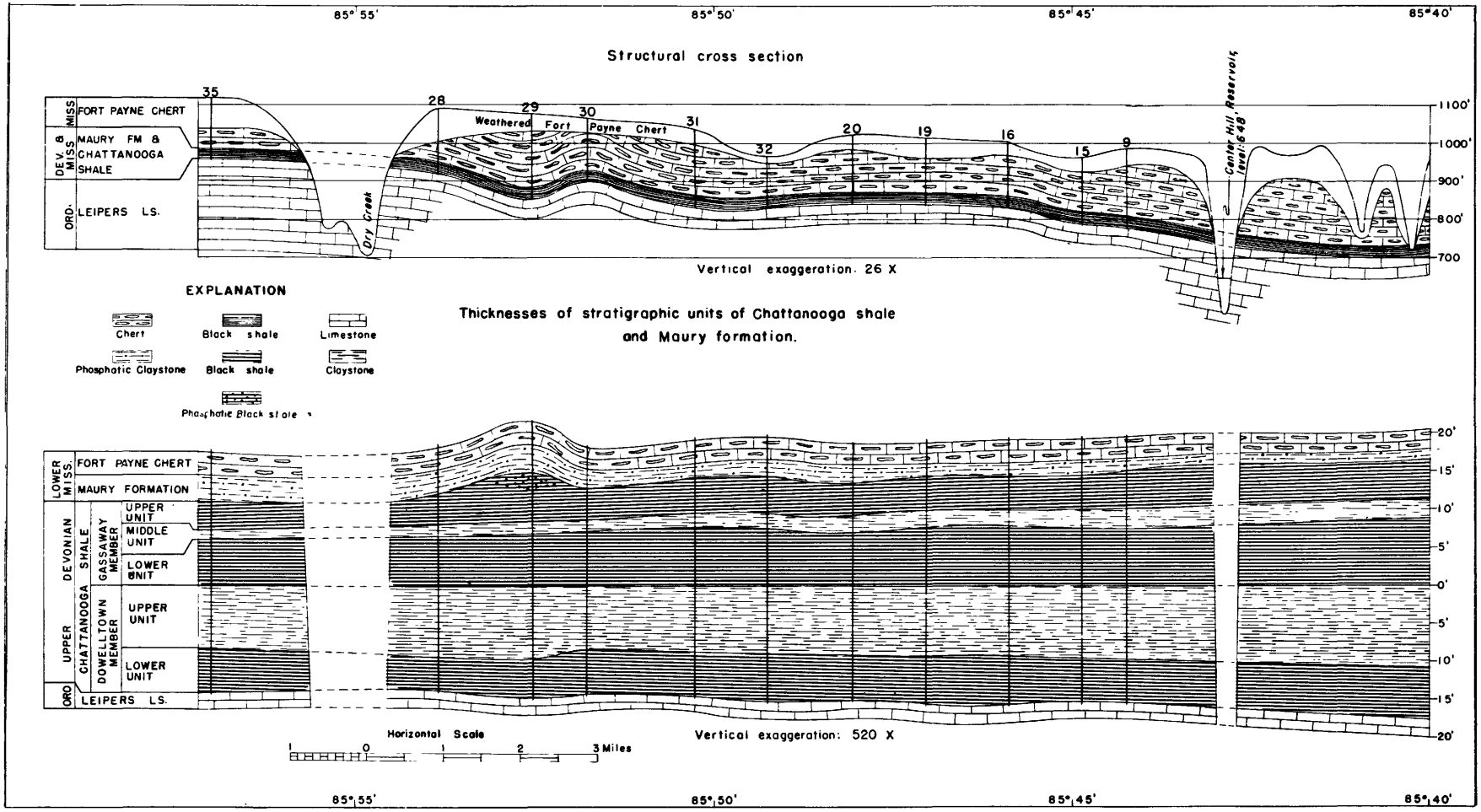

Figure 6 - SECTION ALONG SOUTH LINE OF DRILL HOLES, YOUNGS BEND DRILLING AREA

middle units of the Gassaway member are very similar in thickness from core to core but thin slightly from east to west. The upper unit of the Gassaway member, while relatively uniform in thickness, is somewhat more variable than the other units, as illustrated in the stratigraphic profiles. A maximum difference in thickness of 2.82 feet for the upper unit of the Gassaway member exists between holes YB-3 and -4 (fig. 4), which are about 0.7 mile apart. Differences of 2.8 and 2.4 feet exist in the thickness of the Chattanooga shale between YB-24 and -25 (fig. 4) and between YB-29 and -30 (fig. 6), respectively. These differences between YB-24 and -25 and between YB-29 and -30 and many of the other differences in the formational thickness are primarily due to change of thickness of the upper unit of the Gassaway member. Phosphatic shale about 2 feet thick is at the top of the upper unit of the Gassaway member in the cores from holes YB-29 and -39 (fig. 2). This phosphatic shale appears to be similar to the more extensive phosphatic shale a few miles to the north of the Youngs Bend area.

Factors that influenced the thickness of the Chattanooga shale

The phosphatic shale in cores YB-29 and -39 and the differences observed in the thickness of the Chattanooga shale are suggestive that these variations in lithology and thickness were controlled by one or more geologic events that may have occurred just before, during, or after deposition. Some of the events that may have controlled or partially controlled the changes in lithology and thickness of the Chattanooga shale are: slight arching during the time of deposition; small scale folding after deposition; irregular erosion during and after deposition;

small undulations caused by slight erosion or arching of the surface the formation was deposited on; and penecontemporaneous and later differential compaction of the fine-grained clastics of the formation.

The more important geologic events that may have controlled the observed variations in lithology and thickness in the Youngs Bend area, as inferred from the geologic field studies and from the accompanying structure sections and stratigraphic profiles, are small scale penecontemporaneous folding on the flank of the Nashville arch and slight currents intermittently and irregularly eroding the sea floor during and after deposition, but before deposition of the succeeding Maury shale. Additional evidence that appears to support the occurrence of slight folding and erosion is the presence of remnants of the phosphatic shale in the cores from YB-29 and -39, and the thickening and thinning of the formation near the troughs of many synclines and the crests of many anticlines.

Structure

The area of this report is on the east side of the Nashville Basin (fig. 1). In the Youngs Bend area the rocks generally dip east-southeast at the rate of about 15 feet per mile. Locally, minor synclines and anticlines with dips as high as 10° have been noted in the Fort Payne chert, but these structures commonly have a width of only a few hundred feet. Figures 4, 5, 6, and 7 show the structural details as interpreted from the drill core data.

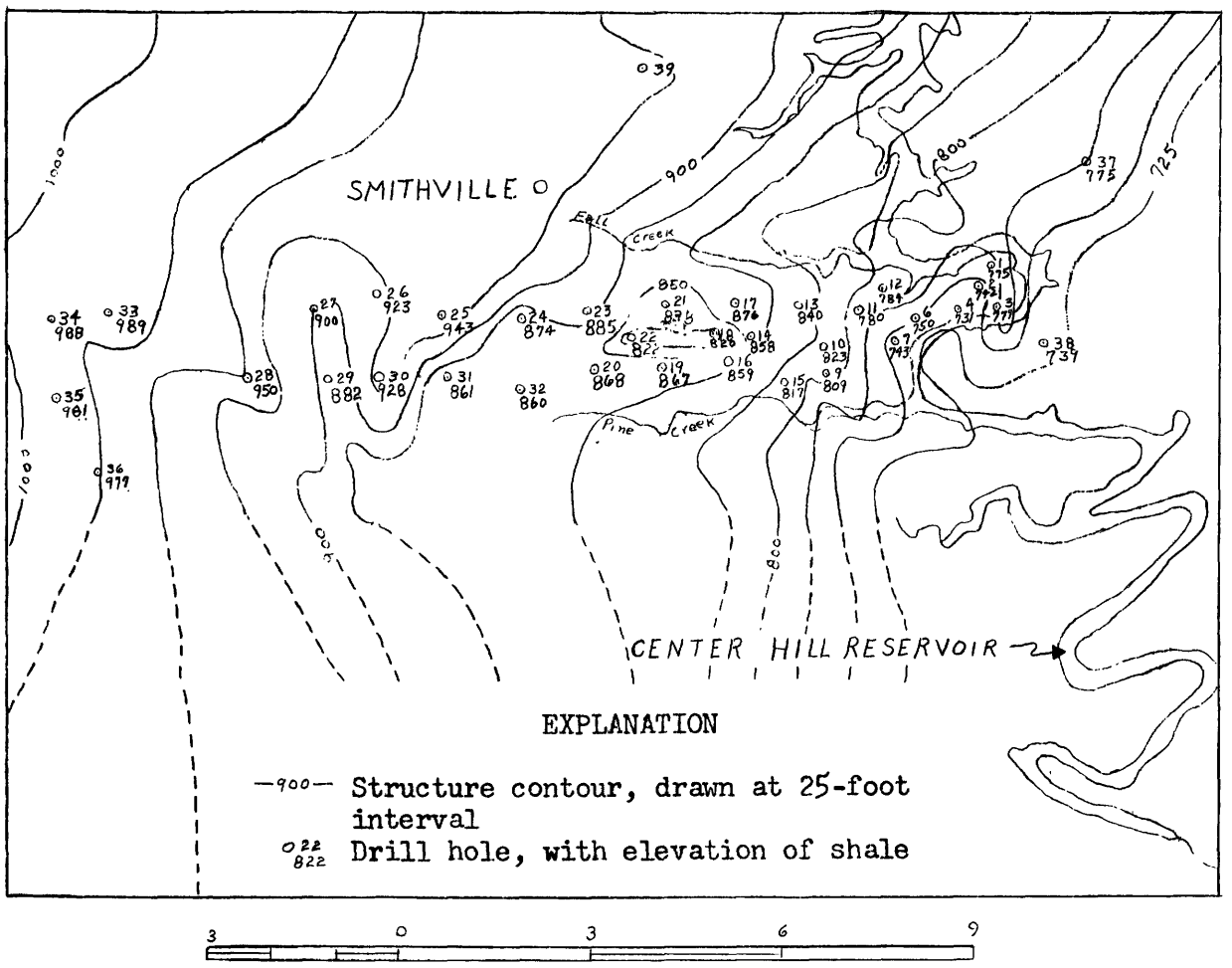

Figure 7.-- Structure contours on top of the Chattanooga shale in the Youngs Bend area, Tennessee.

Two prominent joint sets at the Sligo outcrops of the Chattanooga shale (LC-55 and -56, fig. 3) strike N. 60° W. and N. 47° E., the first being the dominant set. The joints, as observed along the Sligo outcrops, have no definite spacing, but the ones in the major set are generally 15 to 20 feet apart. The joints are less conspicuous in unweathered Fort Payne chert.

URANIUM IN YOUNGS BEND AREA

Closely spaced outcrop samples

Two special sets of outcrop samples of the Chattanooga shale were collected in 1952 at localities LC-55 and -56 by Swanson and others (Swanson and Kehn, 1955) near the approaches to Sligo bridge over the Center Hill Reservoir (fig. 2) in an attempt to ascertain any significant variation in uranium concentration in the shale within a short distance. A vertical sequence of samples of consecutive black shale beds was collected to determine any difference in uranium content from bed to bed. Fifty-three samples were taken from the massive upper unit of the Gassaway member at LC-55, the sampled beds ranging in thickness from three-eighth to $2\frac{1}{2}$ inches, and averaging about $1\frac{1}{4}$ inches. Analyses of the middle 40 samples, representing about 5.5 feet, from a few tenths of a foot below the top to about a foot above the base, showed an essentially uniform uranium content.

In order to learn of any significant lateral differences in uranium content within a short distance, 47 samples were collected from a bed

about 1.2 inches thick along the face of the two Sligo outcrops, LC-55 and LC-56, which are about 1 mile apart. Confidence in correlation of the bed at these outcrops is based on careful measurements and on the presence of distinctive siltstone partings above and below the bed at the outcrop. Analyses of these samples indicated that a given unit of the shale has an essentially uniform content for a distance of at least a mile.

Drilling results

Because of the apparent lateral uniformity of the uranium content in the outcrop samples, it was thought that the one-mile spacing of holes in the Youngs Bend drilling area would suffice to determine the uranium content of a potential mining area. The analyses of the cores are sufficiently uniform to confirm that assumption, and to indicate that the uranium content of a given stratigraphic unit of uniform lithology does not differ greatly over distances of several miles. The analyses are summarized in tables 1 and 3 and in figure 3, and full data are presented in the appendix.

The drilling and analyses have shown the following: 1) The five lithologic units of the Chattanooga shale have distinctly different uranium contents; the three richest are at the top, constituting the Gassaway member ("Upper Black shale" of earlier reports), and of these the richest is the uppermost unit ("Top Black shale" of earlier reports). 2) The Gassaway member has an average thickness of about 15 feet and contains about 0.0060 percent uranium--only four of the 36 cores depart from this average by 0.0005 percent or more, and only ten by 0.0003 percent

or more. 3) The uppermost unit of the Gassaway member has an average thickness of 5.1 feet and an average content of 0.0078 percent uranium. This uppermost unit of the Gassaway in the westernmost four holes (YB-33 to -36), which are separated from the others by Dry Creek, shows a consistently lesser thickness and lower uranium content -- averaging about 3.80 feet and 0.0074 percent respectively.

Cores of the Gassaway member from two adjacent holes, YB-26 and -27, a few miles southwest of Smithville, are richer (0.0066 percent uranium) than the general content in the Youngs Bend area, and suggest the presence of a small area where the uranium content is somewhat higher. This richness results partly from a thicker-than-average section of the rich upper unit of the Gassaway member and partly from above-average analyses of all the units. Two other cores of the Gassaway, YB-3 and -29, have uranium contents of 0.0054 and 0.0056 percent respectively, somewhat below average. In YB-3 the abnormal thinness of the rich upper unit of the Gassaway accounts in part for the low average uranium content. In YB-29 the shale in the top 2 feet contains phosphatic nodules and the uranium content of this unit is only about 0.0027 percent; if the shale in the top 2 feet is excluded from the analyses, the uranium content of the remainder of the Gassaway is about 0.0060 percent.

Departures of 0.0005 percent or less from the average are not believed to be significant, for the precision of the analyses is considered to be about $\pm$ 0.0005 percent. The average analyses of several samples are presumed to be somewhat more precise, though the degree of improvement is not known.

Uranium tonnage

For purposes of calculating reserves of shale and uranium, the Youngs Bend area between Dry Creek and Center Hill Reservoir was divided into polygons so that the area between two holes would be about equally divided (fig. 3). In that part of the area having no natural outcrop boundary a line half a mile north or south of the holes was used as the bounding line of the polygons. The area enclosed by each polygon was measured with a planimeter, and reserves were computed by assuming that the thickness and uranium content of the shale throughout each polygon was the same as in its drill core, and that the shale weighs 145 pounds per cubic foot. An area of about 21 square miles, tested by 30 holes, is estimated to contain about 620,000,000 tons of shale and about 38,000 tons of uranium (table 1).

As the westernmost four holes (YB-33 to -36) have a thinner shale section and a somewhat lower uranium content (table 3), no reserves were calculated for that area. These low averages result partially from a thinner-than-average upper unit of the Gassaway member and partly from a tendency for the uranium content to be progressively lower to the west. East of the Center Hill Reservoir cores YB-37 and -38 show about 17 feet of shale having a uranium content of about 0.0062 percent (table 3), but the amount of shale and uranium in this area cannot be calculated reliably without further drilling.

Table 1.--Reserves of uranium in the Gassaway member of the Chattanooga shale, Youngs Bend drilling area between Dry Creek and Center Hill Reservoir, DeKalb County, Tennessee (calculated by polygons; see fig. 3)

Polygon no.	Area (sq. mi.)	Gassaway thickness (feet)	Shale (millions of tons)	Uranium[1/] (percent)	Uranium (tons)
YB- 1	0.260	15.40	8.088	0.0058 a .0062 b	485
- 2	0.251	17.05	8.644	.0061 a	527
- 3	0.182	14.47	5.319	.0054 a	287
- 4	0.313	17.83	11.270	.0060 a	676
- 6	0.237	16.91	8.094	.0058 a	469
- 7	0.750	15.69	23.770	.0058 a	1,378
- 9	0.562	15.04	17.070	.0059 b	1,007
-10	0.535	14.93	16.120	.0059 a	951
-11	0.506	16.25	16.607	.0061 a	996
-12	0.280	16.65	9.417	.0061 a	574
-13	0.618	15.12	18.860	.0061 b	1,150
-14	0.490	14.52	14.370	.0057 b	819
-15	0.764	14.45	22.290	.0057 a .0063 b	1,337
-16	0.588	14.59	17.310	.0059 c	1,021
-17	0.949	14.79	28.340	.0062 b	1,757
-18	0.550	15.10	16.780	.0062 b	1,040
-19	0.628	14.25	18.060	.0061 b	1,101
-20	0.977	13.64	26.910	.0058 b	1,560
-21	0.994	14.84	29.780	.0059 b	1,757
-22	0.524	16.05	16.980	.0062 b	1,052
-23	0.926	13.97	26.120	.0059 b	1,541
-24	1.145	14.81	34.240	.0061 b	2,088
-25	1.071	12.38	26.780	.0060 b	1,606
-26	1.139	14.07	32.360	.0065 b	2,103
-27	0.990	14.96	29.900	.0067 b	2,003
-28	0.668	11.97	16.140	.0062 b	1,000
-29	0.986	14.81		.0056 b	
		(12.81)	25.500 d	.0060 d	1,530 d
-30	1.167	12.91	29.940	.0060 b	1,796
-31	1.240	14.35	35.930	.0060 c	2,155
-32	1.025	14.38	29.760	.0065 c	1,934
Totals & averages	21.30	14.86	620.749	0.0060	37,700

1/ Based on analyses by the U. S. Geological Survey Laboratory, Washington, D. C.

a Average of 1-foot samples.

b Average of composite samples made from 1-foot samples.

c Average of samples about 5 feet thick, or representing a thinner full lithologic unit.

d Top 2 feet of impure shale excluded; calculations based on 12.81 feet of shale.

Pine Creek site

The Bureau of Mines (Gardner, and others, 1954) chose a site for drilling about 5 miles southeast of Smithville on the north side of Pine Creek, a little south of the south line of holes, near YB-9 and -15 (fig. 3). Five additional cores were taken at this site for structural and mining information. These cores were logged by the Geological Survey and three were marked into sample intervals. Upon completion of the Bureau's engineering tests, the three marked cores were sent to the Survey laboratory for uranium analysis (table 2). Two of the cores of the Gassaway member, PC-1 and -3, showed a somewhat high uranium content of 0.0066 and 0.0068 percent, and the third, PC-2, showed 0.0061 percent. These holes form a triangle about 500 feet on a side south of YB-9 and -15, which showed 0.0059 and 0.0063 percent uranium. Thus, shale of average grade is within half a mile of these holes; but no geologic explanation is known for the high analyses in two of the Pine Creek holes nor for the indicated variation within a few hundred feet. It is probable that the percentage of uranium in the shale in both the Pine Creek cores and the nearby Youngs Bend cores is essentially the same, as the indicated differences are within the expectable range of error for the analyses.

On the basis of analyses, structure, and thickness of the Gassaway member of the Chattanooga shale, the Pine Creek site appears to be as suitable as any now known. The analyses of the shale in a large area near it are average or near average, the thickness of the shale is average or above for the region, and the moderate easterly or

southeasterly dip would afford drainage.

Table 2.--Uranium content and thickness of the Gassaway member of the Chattanooga shale in the Pine Creek drill holes, near Smithville, Tennessee

Hole no.	Gassaway thickness (feet)	Uranium[1/] (percent) a
PC-1	15.15	0.0066
-2	14.78	.0061
-3	14.93	.0068

1/ Based on analyses by the U. S. Geological Survey Laboratory, Washington, D. C.
a Average of samples about 5 feet thick, or representing a thinner full lithologic unit.

URANIUM IN EASTERN HIGHLAND RIM

Ten widely spaced holes were drilled to test the uranium content of the Chattanooga shale along the Eastern Highland Rim from southern Jackson County to Moore County, Tenn. (fig. 2). These holes (YB-39 to -46, -51, and -52) were spaced at intervals of about 10 to 15 miles for an airline distance of about 75 miles along the Rim. Table 3 summarizes the data on these holes.

In holes YB-39, -51, and -52, which are from 3 to 25 miles north of Smithville, the Gassaway member of the Chattanooga shale ranges in thickness from 15.44 feet to 19.73 feet, and in uranium content from 0.0050 to 0.0055 percent. This lower uranium content agrees with a previously established trend toward a progressively lower content to the north, and is caused in part, but not wholly, by the presence of the

phosphatic beds at the top of the Gassaway member. Thus the area north of Smithville apparently can be dismissed from further serious consideration.

Table 3.--Uranium content and thickness of the Gassaway member of the Chattanooga shale along the Eastern Highland Rim, Tennessee

Hole no.	Gassaway thickness (feet)	Uranium[1/] (percent)	Hole no.	Gassaway thickness (feet)	Uranium[1/] (percent)
YB-33	12.09	0.0056 a	YB-41	13.02	0.0058 b
-34	11.91	.0058 a	-42	18.35	.0062 b
-35	11.01	.0056 a	-43	11.27	.0058 b
-36	11.25	.0056 a	-44	14.80	.0065 b
-37	17.43	.0064 b	-45	12.35	.0068 b
-38	16.17	.0060 b	-46	16.40	.0066 b
-39	15.44	.0054 b	-51	16.89	.0050 b
-40	14.74	.0059 b	-52	19.73	.0055 b

1/ Based on analyses by the U. S. Geological Survey Laboratory, Washington, D. C.
a Average of composite samples made from 1-foot samples.
b Average of samples about 5 feet thick, or representing a thinner full lithologic unit.

South of Smithville seven holes (YB-40 to -46) were drilled at intervals of about 10 to 15 miles along the Eastern Highland Rim and uranium analyses of these cores indicate that shale in thickness and grade similar to that in the Youngs Bend area can be expected to continue southward about 50 miles. Throughout the area an average of 14.4 feet of shale appears to contain an average of 0.0062 percent uranium.

Even if the analyses shown in table 3 do not indicate true geographical differences in uranium content of the shale, it seems probable that from the vicinity of central DeKalb County to northern Moore County the average uranium content is at least 0.006 percent.

The geology of the Rim south from DeKalb to Moore County is similar to that in the Youngs Bend area. In all the cores except YB-45 the lithologic characteristics of the shale resemble those in the area of closely spaced drilling, for both the Gassaway and Dowelltown members of the Chattanooga are present, and the shale can be divided into the five lithologic units. In YB-45, the southernmost hole, the Chattanooga is represented by about 12 feet of shale, of which the upper 11 feet belongs to the Gassaway member and the rest to the Dowelltown member. The three lithologic units of the Gassaway were not recognized in this core.

Throughout this southern half of the Eastern Highland Rim the Fort Payne chert is similar in lithology and thickness to that in the Smithville area. Minor synclines and anticlines superimposed on the gentle southeastern regional dip, similar to those in the Youngs Bend area, are probably present.

Shale and uranium reserves in the area of exploratory drilling have not been calculated because of the distances between holes. If it is assumed that the average thickness of the shale in the Gassaway member is 15 feet and the uranium content is 0.006 percent throughout the region, the uranium content for an area extending 50 miles south of Smithville and 10 miles back from the west edge of the Rim is on the order of 1,000,000 tons.

CONCLUSIONS

The Gassaway member of the Chattanooga shale in the Youngs Bend area, near Smithville, DeKalb County, Tenn., appears to offer a good combination of grade, thickness, and geologic conditions for possible mining. The Gassaway member is about 15 feet thick and contains 0.0060 percent uranium. An area of 21 square miles, tested by 30 core holes, contains about 620,000,000 tons of shale and about 38,000 tons of uranium. Another part of the Youngs Bend area that shows promise is just east of the Center Hill Reservoir where two holes, YB-37 and -38, indicate that the Gassaway member is about 17 feet thick and has an average uranium content of 0.0062 percent.

Analyses of the 36 YB cores from the Youngs Bend area show a remarkably uniform uranium content close to 0.0060 percent, with a departure of 0.0005 percent or more in only four cores. In general, where the lithology and thickness of the shale are about the same, the uranium content can be expected to be about the same.

Drilling on the Eastern Highland Rim revealed other areas that are worthy of consideration in the event more developmental drilling is undertaken. South of Smithville, holes YB-40 to -46 indicate that for a distance of about 50 miles to the south the Gassaway member is at least as favorable as in the Youngs Bend area. Two especially favorable areas are 1) in the vicinity of holes YB-42 and -46 where the shale averages 17 feet thick and contains about 0.0064 percent uranium, and 2) in the vicinity of holes YB-44 and -45 where the shale averages 13.5 feet thick and contains about 0.0066 percent uranium. Geologic conditions are similar in all the areas.

The drilling site on Pine Creek seems to be favorable on the basis of the uranium content, thickness, and geologic conditions. Analyses of the three test cores indicate that about 15 feet of shale contains about 0.0065 percent uranium. The gentle southeast dip would supply natural drainage for a large area.

APPENDIX

Introduction

Analytical data on all the Chattanooga shale drill cores covered by this report are shown by the graphs on the following pages. All uranium determinations were made by the Geological Survey Laboratory, Washington, D. C. Thicknesses of the units as shown on these graphs are those used in preparing stratigraphic logs and taking samples. However, in preparing detailed logs of the cores some of the contacts

between units have been changed, so that some of the graphs might not agree exactly with the corresponding core units in the cross section.

Analyses of drill core samples

Youngs Bend drilling area, DeKalb County, Tenn.

YB-1

Sample number	Thickness	Uranium (percent)
1	1.57	0.0024
12	1.0	.0080
13	1.0	.0092
14	1.0	.0084
15	1.0	.0073
16	0.79	.0066
21	1.15	.0040
22	1.18	.0027
31	1.0	.0044
32	1.0	.0054
33	1.0	.0048
34	1.0	.0048
35	1.0	.0055
36	1.0	.0054
37	1.0	.0058
38	1.28	.0061
41	2.0	.0018
42	2.0	.0014
43	2.0	.0010
44	2.0	.0012
45	2.20	.0008
51	1.0	.0021
52	1.0	.0040
53	1.0	.0055
54	1.0	.0040
55	1.0	.0036
56	1.0	.0038
57	1.25	.0016
12-38*	15.40	0.0058
Composite Av		.0062

YB-2

Sample number	Thickness	Uranium (percent)
1	1.45	0.0004
12	1.0	.0099
13	1.0	.0088
14	1.0	.0082
15	1.0	.0078
16	1.0	.0077
17	1.04	.0060
21	1.0	.0047
22	1.0	.0032
23	0.71	.0029
31	1.0	.0048
32	1.0	.0050
33	1.0	.0048
34	1.0	.0047
35	1.0	.0061
36	1.0	.0057
37	1.0	.0064
38	1.30	.0064
41	2.0	.0018
42	2.0	.0009
43	2.0	.0011
44	2.0	.0014
45	2.34	.0012
51	1.0	.0027
52	1.0	.0036
53	1.0	.0054
54	1.0	.0048
55	1.0	.0040
56	1.0	.0028
57	0.66	.0011
12-38*	17.05	0.0061

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-3

Sample number	Thickness	Uranium (percent)
1	1.43	0.0012
12	1.0	.0082
13	1.0	.0089
14	1.0	.0087
15	0.7	.0070
21	1.2	.0046
22	1.25	.0028
31	1.0	.0048
32	1.0	.0055
33	1.0	.0051
34	1.0	.0047
35	1.0	.0054
36	1.0	.0053
37	1.0	.0035
38	1.32	.0037
41	2.0	.0020
42	2.0	.0010
43	2.0	.0007
44	2.0	.0010
45	1.68	.0008
51	1.0	.0017
52	1.0	.0034
53	1.0	.0058
54	1.0	.0044
55	1.0	.0030
56	1.0	.0019
57	0.39	.0010
12-38*	14.47	0.0054

YB-4

Sample number	Thickness	Uranium (percent)
1	1.77	0.0008
12	1.0	.0090
13	1.0	.0082
14	1.0	.0075
15	1.0	.0080
16	1.0	.0074
17	1.0	.0072
18	0.52	.0064
21	1.0	.0048
22	1.0	.0030
23	0.57	.0033
31	1.0	.0044
32	1.0	.0053
33	1.0	.0045
34	1.0	.0058
35	1.0	.0054
36	1.0	.0053
37	1.0	.0061
38	1.0	.0062
39	0.74	.0060
41	2.0	.0013
42	2.0	.0012
43	2.0	.0006
44	2.0	.0007
45	2.0	.0008
46	1.0	.0008
51	1.0	.0015
52	1.0	.0022
53	1.0	.0050
54	1.0	.0032
55	1.0	.0028
56	1.0	.0030
57	1.16	.0012
12-39*	17.83	0.0060

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-6

Sample number	Thickness	Uranium (percent)
1	1.48	0.0012
12	1.0	.0085
13	1.0	.0075
14	1.0	.0082
15	1.0	.0075
16	1.0	.0072
17	1.16	.0060
21	1.0	.0041
22	1.46	.0028
31	1.0	.0045
32	1.0	.0050
33	1.0	.0048
34	1.0	.0045
35	1.0	.0055
36	1.0	.0057
37	1.0	.0059
38	1.29	.0063
41	2.0	.0020
42	2.0	.0012
43	2.0	.0009
44	2.0	.0010
45	2.07	.0008
51	1.0	.0025
52	1.0	.0027
53	1.0	.0042
54	1.0	.0043
55	1.0	.0032
56	1.0	.0021
57	0.83	.0010
12-38*	16.91	0.0058

YB-7

Sample number	Thickness	Uranium (percent)
1	0.67	0.0030
12	1.0	.0080
13	1.0	.0086
14	1.0	.0080
15	1.0	.0071
16	1.11	.0067
21	1.22	.0040
22	1.23	.0028
31	1.0	.0052
32	1.0	.0048
33	1.0	.0044
34	1.0	.0050
35	1.0	.0059
36	1.0	.0058
37	1.0	.0063
38	1.13	.0056
41	2.0	.0018
42	2.0	.0010
43	2.0	.0006
44	2.0	.0009
45	2.54	.0008
51	1.0	.0018
52	1.0	.0029
53	1.0	.0086
54	1.0	.0039
55	1.0	.0030
56	1.0	.0016
57	0.79	.0013
12-38*	15.69	0.0058

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-9

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	1.47	0.004	0.0009
12	1.0	.010	
13	1.0	.010	
14	1.0	.009	0.0082
15	1.0	.009	
16	0.87	.009	
21	1.22	.007	
22	1.23	.005	0.0038
31	1.0	.008	
32	1.0	.007	
33	1.0	.007	
34	1.0	.007	
35	1.0	.009	0.0052
36	1.0	.007	
37	1.0	.008	
38	0.72	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.0	.004	
45	1.6	.006	
51	1.0	.004	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.005	
56	0.75	.006	
12-38*	15.04		0.0059

YB-10

Sample number	Thickness	Uranium (percent)
1	1.92	0.0019
12	1.0	.0086
13	1.0	.0088
14	1.0	.0077
15	1.0	.0075
16	0.8	.0065
21	1.17	.0043
22	1.18	.0031
31	1.0	.0053
32	1.0	.0049
33	1.0	.0045
34	1.0	.0051
35	1.0	.0056
36	1.0	.0061
37	1.0	.0065
38	0.78	.0055
41	2.0	.0022
42	2.0	.0006
43	2.0	.0008
44	2.0	.0008
45	1.43	.0009
51	1.0	.0022
52	1.0	.0030
53	1.0	.0043
54	1.0	.0035
55	1.0	.0030
56	0.99	.0017
12-38*	14.93	0.0059

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-11

Sample number	Thickness	Uranium (percent)
1	1.65	0.0008
12	1.0	.0092
13	1.0	.0084
14	1.0	.0085
15	1.0	.0070
16	1.0	.0072
17	0.9	.0065
21	1.16	.0045
22	1.17	.0026
31	1.0	.0050
32	1.0	.0050
33	1.0	.0048
34	1.0	.0048
35	1.0	.0058
36	1.0	.0061
37	1.0	.0060
38	1.02	.0067
41	2.0	.0017
42	2.0	.0010
43	2.0	.0008
44	2.0	.0010
45	2.25	.0008
51	1.0	.0024
52	1.0	.0030
53	1.0	.0043
54	1.0	.0036
55	1.0	.0034
56	1.0	.0028
57	0.66	.0012
12-38*	16.25	0.0061

YB-12

Sample number	Thickness	Uranium (percent)
1	1.34	0.0004
12	1.0	.0092
13	1.0	.0084
14	1.0	.0081
15	1.0	.0079
16	1.0	.0079
17	1.0	.0070
18	0.44	.0055
21	1.12	.0046
22	1.12	.0031
31	1.0	.0048
32	1.0	.0053
33	1.0	.0045
34	1.0	.0056
35	1.0	.0051
36	1.0	.0058
37	1.0	.0059
38	0.97	.0058
41	2.0	.0019
42	2.0	.0009
43	2.0	.0028
44	2.0	.0008
45	2.58	.0007
51	1.0	.0030
52	1.0	.0038
53	1.0	.0043
54	1.0	.0038
55	1.0	.0021
56	1.13	.0012
12-38*	16.65	0.0061

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-13

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	1.51	0.004	0.0023
12	1.0	.010	
13	1.0	.010	
14	1.0	.010	0.0079
15	1.0	.010	
16	1.38	.007	
21	1.10	.007	0.0036
22	1.11	.005	
31	1.0	.007	
32	1.0	.006	
33	1.0	.007	
34	1.0	.009	0.0056
35	1.0	.007	
36	1.0	.008	
37	1.0	.008	
38	0.53	.007	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.07	.003	
51	1.0	.004	
52	1.0	.005	
53	1.0	.007	
54	1.0	.006	
55	1.43	.004	
12-38*	15.12		0.0061

YB-14

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.07	0.003	0.0007
12	1.0	.009	
13	1.0	.011	
14	1.0	.010	0.0075
15	1.42	.009	
21	1.06	.007	0.0039
22	1.06	.007	
31	1.0	.008	
32	1.0	.007	
33	1.0	.006	0.0052
34	1.0	.007	
35	1.0	.007	
36	1.0	.008	
37	1.0	.008	
38	0.98	.009	
41	2.0	.004	
42	2.0	.004	
43	2.0	.004	
44	2.0	.003	
45	1.14	.004	
51	1.0	.007	
52	1.0	.006	
53	1.0	.005	
54	1.0	.006	
55	1.0	.005	
56	0.75	.004	
12-38*	14.52		0.0057

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-15

Sample number	Thickness	Uranium (percent)
1	2.05	0.0011
12	1.0	.0076
13	1.0	.0086
14	1.0	.0076
15	1.0	.0072
16	0.52	.0058
21	1.14	.0037
22	1.15	.0030
31	1.0	.0047
32	1.0	.0046
33	1.0	.0050
34	1.0	.0052
35	1.0	.0052
36	1.0	.0060
37	1.0	.0068
38	0.64	.0056
41	2.0	.0017
42	2.0	.0010
43	2.0	.0008
44	2.0	.0008
45	1.37	.0009
51	1.0	.0021
52	1.0	.0032
53	1.0	.0047
54	1.0	.0036
55	1.0	.0033
56	0.93	.0024
12-38*	14.45	0.0057
Composite Av		.0063

YB-16

Sample number	Thickness	Uranium (percent)
1	1.60	0.0005
2	4.72	.0078
3	2.19	.0036
4	7.68	.0055
5	9.18	.0009
6	6.34	.0028
2-4 *	14.59	0.0059

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-17

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.26	0.003	0.0009
12	1.0	.009	
13	1.0	.009	
14	1.0	.009	0.0084
15	1.0	.009	
16	1.13	.008	
21	1.07	.006	0.0035
22	1.08	.005	
31	1.0	.007	
32	1.0	.006	
33	1.0	.007	0.0055
34	1.0	.007	
35	1.0	.008	
36	1.0	.008	
37	1.51	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.0	.003	
45	1.24	.003	
51	1.0	.004	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.005	
56	1.28	.004	
12-37*	14.79		0.0062

YB-18

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.26	0.003	0.0002
12	1.0	.011	
13	1.0	.009	
14	1.0	.009	0.0080
15	1.0	.009	
16	1.14	.009	
21	1.10	.006	0.0038
22	1.10	.006	
31	1.0	.008	
32	1.0	.007	
33	1.0	.008	
34	1.0	.008	0.0058
35	1.0	.008	
36	1.0	.008	
37	1.0	.008	
38	0.76	.008	
41	2.0	.007	
42	2.0	.004	
43	2.0	.004	
44	2.0	.003	
45	1.52	.004	
51	1.0	.005	
52	1.0	.006	
53	1.0	.007	
54	1.0	.006	
55	1.0	.005	
56	1.33	.004	
12-38*	15.10		0.0062

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-19

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	1.8	0.004	0.0015
12	1.0	.010	0.0082
13	1.0	.009	
14	1.0	.008	
15	1.46	.009	
21	1.01	.006	0.0033
22	1.12	.005	
31	1.0	.007	0.0056
32	1.0	.006	
33	1.0	.008	
34	1.0	.008	
35	1.0	.008	
36	1.0	.008	
37	1.0	.008	
38	0.66	.008	
41	2.0	.004	
42	2.0	.004	
43	2.0	.004	
44	2.0	.003	
45	1.11	.004	
51	1.0	.004	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.005	
56	1.25	.004	
12-38*	14.25		0.0061

YB-20

Sample number	Thickness	Uranium %eU	Uranium - %chemU
1	2.27	0.004	0.0021
12	1.0	.009	0.0075
13	1.0	.009	
14	1.0	.008	
15	1.25	.007	
21	1.22	.006	0.0043
22	1.22	.007	
31	1.0	.006	0.0054
32	1.0	.007	
33	1.0	.007	
34	1.0	.007	
35	1.0	.008	
36	1.0	.008	
37	0.95	.007	
41	2.0	.004	
42	2.0	.003	
43	2.0	.004	
44	2.87	.004	
51	1.0	.004	
52	1.0	.005	
53	1.0	.007	
54	1.0	.006	
55	1.0	.005	
56	1.08	.005	
12-37*	13.64		0.0058

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-21

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.03	0.003	0.0009
12	1.0	.010	0.0076
13	1.0	.009	
14	1.0	.009	
15	1.0	.008	
16	1.28	.008	
21	1.05	.006	0.0036
22	1.06	.005	
31	1.0	.006	0.0054
32	1.0	.006	
33	1.0	.006	
34	1.0	.007	
35	1.0	.007	
36	1.0	.008	
37	1.45	.008	
41	2.0	.005	
42	2.0	.003	
43	2.0	.004	
44	2.0	.004	
45	1.23	.004	
51	1.0	.005	
52	1.0	.006	
53	1.0	.006	
54	1.0	.006	
55	1.0	.006	
56	1.11	.004	
12-37*	14.84		0.0059

YB-22

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.28	0.003	0.0008
12	1.0	.010	0.0078
13	1.0	.012	
14	1.0	.009	
15	1.0	.010	
16	1.0	.009	
17	1.36	.009	
21	1.13	.006	0.0035
22	1.14	.005	
31	1.0	.007	0.0056
32	1.0	.006	
33	1.0	.007	
34	1.0	.007	
35	1.0	.008	
36	1.0	.008	
37	1.42	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.0	.004	
45	1.29	.003	
51	1.0	.005	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.006	
56	1.0	.004	
57	0.56	.003	
12-37*	16.05		0.0062

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-23

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.50	0.004	0.0009
12	1.0	.010	
13	1.0	.010	
14	1.0	.009	0.0077
15	1.0	.009	
16	1.01	.008	
21	0.98	.006	0.0030
22	0.98	.005	
31	1.0	.008	
32	1.0	.007	
33	1.0	.007	
34	1.0	.008	0.0055
35	1.0	.008	
36	1.0	.008	
37	1.0	.008	
41	2.0	.004	
42	2.0	.003	
43	2.0	.004	
44	2.0	.003	
45	1.12	.004	
51	1.0	.006	
52	1.0	.005	
53	1.0	.007	
54	1.0	.006	
55	1.0	.005	
56	1.43	.004	
12-37*	13.97		0.0059

YB-24

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.41	0.004	0.0004
12	1.0	.010	
13	1.0	.009	
14	1.0	.010	
15	1.0	.010	0.0078
16	1.0	.008	
17	0.70	.008	
21	0.93	.007	0.0032
22	0.93	.005	
31	1.0	.007	
32	1.0	.007	
33	1.0	.007	
34	1.0	.008	0.0056
35	1.0	.008	
36	1.0	.007	
37	1.25	.008	
41	2.0	.004	
42	2.0	.004	
43	2.0	.004	
44	2.59	.004	
51	1.0	.005	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.004	
56	1.26	.004	
12-37*	14.81		0.0061

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-25

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.25	0.004	0.0015
12	1.0	.010	
13	1.0	.010	
14	1.0	.009	0.0081
15	0.93	.008	
21	0.93	.006	0.0034
22	0.93	.005	
31	1.0	.007	
32	1.0	.006	
33	1.0	.007	
34	1.0	.008	0.0055
35	1.0	.008	
36	1.0	.008	
37	0.59	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.0	.004	
45	1.33	.005	
51	1.0	.006	
52	1.0	.007	
53	1.0	.006	
54	1.0	.005	
55	0.54	.005	
12-37*	12.38		0.0060

YB-26

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.92	0.003	0.0008
12	1.0	.010	
13	1.0	.010	
14	1.0	.009	0.0080
15	1.0	.010	
16	1.0	.009	
17	0.71	.007	
21	0.86	.007	0.0037
22	0.87	.006	
31	1.0	.007	
32	1.0	.006	
33	1.0	.007	
34	1.0	.007	0.0060
35	1.0	.008	
36	1.0	.008	
37	0.63	.008	
41	2.0	.007	
42	2.0	.005	
43	2.0	.004	
44	2.04	.004	
51	1.0	.004	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.005	
56	1.0	.004	
12-37*	14.07		0.0065

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-27

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	2.94	0.004	0.0011
12	1.0	.012	
13	1.0	.010	
14	1.0	.009	
15	1.0	.012	0.0083
16	1.0	.010	
17	1.0	.010	
18	0.67	.008	
21	0.95	.006	0.0038
22	0.94	.006	
31	1.0	.007	
32	1.0	.007	
33	1.0	.010	
34	1.0	.008	0.0058
35	1.0	.008	
36	1.40	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.17	.004	
51	1.0	.005	
52	1.0	.005	
53	1.0	.007	
54	1.0	.006	
55	1.0	.005	
56	0.92	.005	
12-36*	14.96		0.0067

YB-28

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	3.20	0.004	0.0005
12	1.0	.010	
13	1.0	.011	
14	1.0	.010	0.0082
15	1.03	.009	
21	0.81	.006	0.0030
22	0.81	.005	
31	1.0	.007	
32	1.0	.007	
33	1.0	.008	
34	1.0	.009	0.0057
35	1.0	.008	
36	1.32	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.0	.004	
45	1.39	.005	
51	1.0	.007	
52	1.0	.007	
53	1.0	.006	
54	1.34	.005	
12-36*	11.97		0.0062

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-29

Sample number	Thickness	Uranium (percent)
1	3.90	0.0005
12	1.0	.0026
13	1.0	.0028
14	1.0	.0080
15	1.0	.0081
16	1.0	.0070
17	1.31	.0062
21	0.92	.0039
22	0.93	
31	1.0	.0056
32	1.0	
33	1.0	
34	1.0	
35	1.0	
36	1.0	
37	0.65	
41	2.0	
42	2.0	
43	2.0	
44	2.0	
45	1.62	
51	1.0	
52	1.0	
53	1.0	
54	1.0	
55	1.0	
12-37*	14.81	0.0056
14-37#	12.81	.0060

* Gassaway member
\# Excludes 2 feet of phosphatic shale at top of Gassaway member

YB-30

Sample number	Thickness	Uranium	
		%eU	%chemU
1	2.45	0.004	0.0015
12	1.0	.009	
13	1.0	.010	0.0078
14	1.0	.009	
15	1.02	.008	
21	1.39	.006	0.0043
22	1.40	.007	
31	1.0	.007	
32	1.0	.007	
33	1.0	.008	
34	1.0	.008	0.0056
35	1.0	.008	
36	0.90	.008	
41	2.0	.004	
42	2.0	.004	
43	2.0	.004	
44	2.45	.004	
51	1.0	.005	
52	1.0	.006	
53	1.0	.006	
54	1.0	.006	
55	1.0	.005	
56	0.80	.004	
12-36*	12.71		0.0060

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-31

Sample number	Thickness	Uranium (percent)
1	1.97	0.0028
2	4.82	.0080
3	1.95	.0031
4	7.58	.0055
5	8.53	.0012
6	6.00	.0032
2-4 *	14.35	0.0060

YB-32

Sample number	Thickness	Uranium (percent)
1	2.08	0.0016
2	4.93	.0080
3	2.02	.0042
4	7.43	.0062
5	8.92	.0012
6	6.29	.0032
2-4*	14.38	0.0065

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-33

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	3.10	0.003	0.0003
12	1.0	.007	0.0074
13	1.0	.008	
14	1.0	.008	
15	1.21	.008	
21	1.45	.005	0.0038
31	1.0	.006	0.0048
32	1.0	.006	
33	1.0	.006	
34	1.0	.006	
35	1.0	.006	
36	1.43	.007	
41	2.0	.004	
42	2.0	.003	
43	2.0	.004	
44	1.22	.003	
51	1.0	.004	
52	1.0	.005	
53	1.0	.005	
54	1.0	.005	
55	1.0	.005	
56	1.11	.004	
12-36*	12.09		0.0056

YB-34

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	3.43	0.003	0.0004
12	1.0	.008	0.0077
13	1.0	.010	
14	1.0	.009	
15	1.43	.009	
21	1.38	.005	0.0034
31	1.0	.005	0.0055
32	1.0	.006	
33	1.0	.008	
34	1.0	.007	
35	1.0	.008	
36	1.10	.008	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	1.77	.004	
51	1.0	.005	
52	1.0	.005	
53	1.0	.006	
54	1.0	.006	
55	1.0	.004	
56	1.0	.005	
12-36*	11.91		0.0058

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-35

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	3.39	0.003	0.0020
12	1.0	.010	0.0074
13	1.0	.010	
14	1.0	.009	
15	0.64	.008	
21	1.19	.005	0.0028
31	1.0	.006	0.0052
32	1.0	.007	
33	1.0	.008	
34	1.0	.008	
35	1.0	.008	
36	1.18	.007	
41	2.0	.005	
42	2.0	.004	
43	2.0	.004	
44	2.14	.004	
51	1.0	.005	
52	1.0	.005	
53	1.0	.007	
54	1.0	.006	
55	1.0	.005	
56	0.77	.005	
12-36*	11.01		0.0056

YB-36

Sample number	Thickness	Uranium %eU	Uranium %chemU
1	3.06	0.003	0.0008
12	1.0	.010	0.0077
13	1.0	.009	
14	1.23	.009	
21	1.47	.006	0.0032
31	1.0	.007	0.0052
32	1.0	.006	
33	1.0	.007	
34	1.0	.007	
35	1.0	.008	
36	1.0	.005	
37	0.55	.007	
41	2.0	.005	
42	2.0	.003	
43	2.0	.004	
44	2.0	.003	
45	1.82	.005	
51	1.0	.006	
52	1.0	.006	
53	1.0	.005	
54	0.85	.005	
12-37*	11.25		0.0056

* Gassaway member

Youngs Bend drilling area, DeKalb County, Tenn.

YB-37

Sample number	Thickness	Uranium (percent)
1	1.35	0.0018
2	6.80	.0086
3	3.01	.0033
4	7.62	.0057
5	11.50	.0012
6	5.11	.0034
2-4*	17.43	0.0064

YB-38

Sample number	Thickness	Uranium (percent)
1	1.28	0.0024
2	4.97	.0080
3	2.12	.0036
4	9.08	.0055
5	10.52	.0008
6	6.76	.0032
2-4*	16.17	0.0060

* Gassaway member

Eastern Highland Rim area, DeKalb County, Tenn.

YB-39

Sample number	Thickness	Uranium (percent)
1	3.77	0.0006
2	7.23	.0066
3	2.18	.0033
4	6.03	.0048
5	9.25	.0011
6	6.04	.0029
2-4*	15.44	0.0054

YB-40

Sample number	Thickness	Uranium (percent)
1	2.93	0.0013
2	4.16	.0079
3	2.43	.0039
4	8.15	.0054
5	10.72	.0011
6	6.88	.0033
2-4*	14.74	0.0059

* Gassaway member

Eastern Highland Rim area, Cannon and Warren Counties, Tenn.

YB-41

Sample number	Thickness	Uranium (percent)
1	3.57	0.0005
2	3.91	.0074
3	1.34	.0038
4	7.77	.0053
5	7.88	.0010
6	5.54	.0038
2-4*	13.02	0.0058

YB-42

Sample number	Thickness	Uranium (percent)
1	2.53	0.0006
2	6.50	.0080
3	1.86	.0048
4	9.99	.0052
5	9.62	.0010
6	5.02	.0032
2-4*	18.35	0.0062

* Gassaway member

Eastern Highland Rim area, Coffee County, Tenn.

YB-43

Sample number	Thickness	Uranium (percent)
1	1.70	0.0036
12	3.87	.0075
21	1.30	.0032
31	6.10	.0052
41	9.49	
51	8.42	
12-31*	11.27	0.0058

YB-44

Sample number	Thickness	Uranium (percent)
1	2.45	0.0015
2	6.64	.0085
3	1.97	.0048
4	6.19	.0049
5	9.25	.0010
6	5.41	.0035
2-4*	14.80	0.0065

* Gassaway member

Eastern Highland Rim area, Moore and Warren Counties, Tenn.

YB-45

Sample number	Thickness	Uranium (percent)
1	0.95	0.0017
12	6.73	.0072
41	5.62	.0064
12-41*	12.35	0.0068

YB-46

Sample number	Thickness	Uranium (percent)
1	1.42	0.0020
2	5.18	.0084
3	2.27	.0058
4	8.95	.0057
5	9.63	.0010
6	6.16	.0030
2-4*	16.40	0.0066

* Gassaway member

Eastern Highland Rim area, Jackson and Putnam Counties, Tenn.

YB-51

Sample number	Thickness	Uranium (percent)
1	1.30	0.0011
12	5.06	.0048
13	5.07	.0066
21	2.74	.0038
31	4.02	.0039
41	3.53	
51	3.86	
12-31*	16.89	0.0050

YB-52

Sample number	Thickness	Uranium (percent)
1	2.17	0.0047
11	1.88	.0038
12	4.68	.0064
13	4.69	.0074
21	3.14	.0037
31	5.34	.0047
41	3.45	
42	3.46	
51	3.07	
52	3.08	
11-31*	19.73	0.0055

* Gassaway member

Pine Creek test holes, DeKalb County, Tenn.

PC-1

Sample number	Thickness	Uranium (percent)
a/		
A	4.92	0.0082
B	2.43	.0046
C	7.80	.0062
a/		
a/		
A-C b/	15.15	.0066

PC-2

Sample number	Thickness	Uranium (percent)
a/		
A	4.73	0.0081
B	2.49	.0036
C	7.56	.0057
a/		
a/		
A-C b/	14.78	.0061

a/ Maury formation and Dowelltown member not sampled.
b/ Gassaway member.

Pine Creek test hole, DeKalb County, Tenn.

PC-3

Sample number	Thickness	Uranium (percent)
a/		
A	5.16	0.0084
B	2.45	.0042
C	7.32	.0065
a/		
a/		
A-C b/	14.93	.0068

a/ Maury formation and Dowelltown member not sampled.
b/ Gassaway member.

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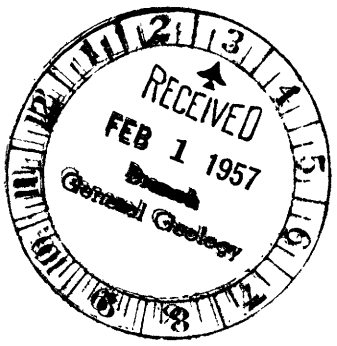
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