Reconnaissance for Uranium in the Southeastern States, 1953

By H. S. Johnson, Jr., 1926-

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Trace Elements Investigations Report 352

UNITED STATES DEPARTMENT OF THE INTERIOR
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Geology and Mineralogy

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Series A

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RECONNAISSANCE FOR URANIUM IN THE SOUTHEASTERN STATES, 1953*

By

H. S. Johnson, Jr.

December 1953

Trace Elements Investigations Report 352

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*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

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RECONNAISSANCE FOR URANIUM IN THE SOUTHEASTERN STATES, 1953

By H. S. Johnson, Jr.

ABSTRACT

During the last quarter of 1952 and most of 1953 the U. S. Geological Survey carried on a program of reconnaissance for radioactive materials in the southeastern states on behalf of the Atomic Energy Commission. In the course of the study 111 localities were examined and 43 samples were taken for radioactivity measurement at the Survey's Trace Elements laboratory in Denver, Colo.

No economic deposits of uranium were found as a result of this work, but weak radioactivity was noted at the Tungsten Mining Coperation property near Townsville, N. C.; the Comolli granite quarry near Elberton, Ga.; in the Beech and Cranberry granite near Roan Mountain, Tenn.; and in several shales in the Valley and Ridge and Appalachian Plateau provinces. Devonian through Pennsylvanian rocks in these two provinces probably constitute the most favorable ground for new discoveries of uranium in the Southeast.

INTRODUCTION

In the summer of 1952 the Geological Survey, on behalf of the Division of Raw Materials of the Atomic Energy Commission, set up a reconnaissance program for uranium and thorium in the southeastern United States. The area to be studied comprises the states of Kentucky, West Virginia, Virginia, Tennessee, North Carolina, Mississippi, Alabama, Georgia, South Carolina, and Florida. At the time objectives for the project were outlined as follows:

(1) To investigate by reconnaissance methods all reported occurrences of radioactive materials in the southeastern states for purposes of (a) making a preliminary economic evaluation of individual deposits, and (b) deciding whether or not areas adjacent to these deposits are worthy of exploration.

(2) To attempt to find new sources of radioactive materials by the study of regional geologic relationships.

(3) To compile geologic and resource data on radioactive materials in the southeastern states.

(4) To undertake, or supervise, all short-term mapping jobs for radioactive materials.

The project became active in early October of 1952 and field work was started the following December.

Previous work

When the demand for uranium started to increase during World War II, the Geological Survey began a series of reconnaissance investigations of black shales, pegmatites, phosphate rock, and monazite in the Southeast. Spot checks were also made to investigate the possible occurrence of radioactive materials in graphitic shales, asphaltic sandstones and limestones, granites, and other rocks. Early in the war, a program of mill and smelter sampling was started to insure that potentially important sources of strategic metals were not being overlooked. As the interest in radioactive materials grew, this sampling program became an important part of the search for new sources of uranium.

Out of the sampling program and reconnaissance investigations of the war years grew three full-scale Survey projects involving more detailed studies of (1) the Chattanooga shale in Kentucky, Tennessee, and Alabama; (2) monazite deposits in the Piedmont in Virginia, North Carolina, South Carolina, and Georgia; and (3) uranium in the phosphate deposits of Florida. In 1953, a fourth project was begun for the purpose of studying the occurrence of monazite and other heavy minerals in placers associated with present and old shoreline deposits in the Coastal Plain from Virginia to Florida.

Previous work by the Geological Survey in the Southeast has been summarized in an earlier report (Butler, 1952) and discussed in detail in a series of reports by Cathcart, Conant, Overstreet, Mertie, Nelson and Brill, and others. These reports have been listed by Curtis and Houser (1952).

Public samples from the Southeast

As the public became aware of the need for urainum and the value of its ores, samples began to come in to Atomic Energy Commission and Geological Survey offices with requests for analyses. During the period 1949-1951, over a thousand such samples were sent in from the ten southeastern states (Thompson, 1952). A little over 2 percent of these contained 0.01 percent or more uranium. In comparison, about 9.5 percent of the samples from the rest of the United States contained this much uranium. Follow-ups of the better samples from the Southeast have found that several have actually come from the West and the others have little or no economic possibilities. So far, no new uranium occurrences of significance have been recognized in the Southeast through a public sample.

Plans for field work

At the start of the field work the original objectives of the project were modified because it was decided that no emphasis would be placed on black shales, phosphate deposits, or the Piedmont and Coastal Plain monazite areas, as these were being studied in the course of other projects. Pegmatites were also practically eliminated as prospects because previous work indicates they are not likely to contain radioactive materials in economic quantities.

To obtain a better understanding of uranium possibilities throughout the Southeast, examinations of several areas with different geologic environments were planned. Field work proceeded on this basis and examinations were made at localities which seemed the most favorable.

GEOLOGIC SETTING

In the following general discussion of the geology and mineral deposits of the Southeast, each physiographic province (fig. 1) is discussed as a unit. The rock types, geologic history, and mineral deposits within any one province are closely related; and use of these natural subdivisions simplifies any discussion of regional geologic relationships.

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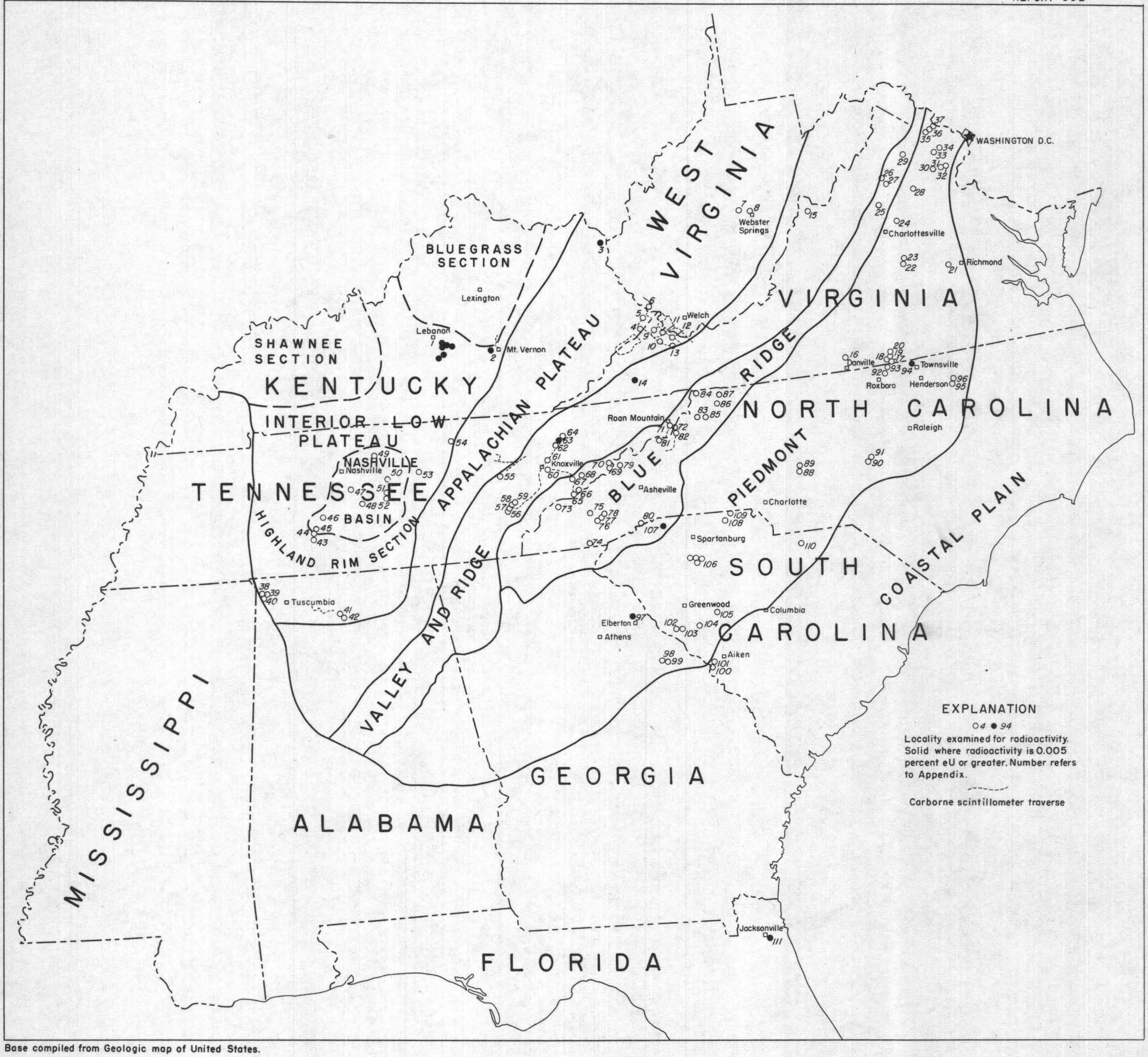

Base compiled from Geologic map of United States.

FIGURE 1.- INDEX MAP SHOWING RECONNAISSANCE INVESTIGATIONS FOR RADIOACTIVITY IN THE SOUTHEASTERN STATES

25 0 50 100 Miles

GPO 831567

Potentialities for new uranium sources in the Southeast can be crudely judged for each physiographic province by a consideration of known mineral deposits in that province. For instance, placers or other syngenetic deposits of sedimentary origin might be expected in the Coastal Plain. In the Piedmont and Blue Ridge provinces, one thinks of medium- and high-temperature veins and of primary disseminations in igneous rocks. Also, for the Appalachian Plateau one cannot help but think of the possibilities for sandstone-type deposits. Thus each physiographic province may be judged to some extent as favorable or unfavorable ground for certain types of uranium deposits.

Coastal Plain

The Coastal Plain province consists of poorly indurated sands, clays, and soft limestones ranging in age from Cretaceous to Recent. Deposits of economic rocks and minerals consist principally of sand and gravel, phosphate rock, brown iron ore, bauxite, kaolin, fuller's earth and brick and tile clays, and several oil and gas fields. Monazite-bearing placers and uranium-bearing phosphate rock are being investigated in detail by other Survey field parties.

Piedmont

The Piedmont province is composed of a complex mixture of igneous and metamorphic rocks of doubtful age. Micaceous schists and gneisses are intimately mixed with hornblendic rocks and the whole has been highly folded and faulted. Gabbroic rocks in the form of sills, pods, plugs, and stocks are common. Granitic intrusives occur in a great variety of forms ranging from small, disconnected pods to batholiths. A belt of less metamorphosed volcanic rocks of probable Paleozoic age extends across the eastern Piedmont from Virginia to Georgia. These are the rocks of the Carolina slate belt or Volcanic series. Long, relatively narrow, down-faulted blocks of Triassic clastic rocks with intruded diabase sills and dikes are also included in the Piedmont from Virginia as far south as South Carolina.

Mineral resources of the Piedmont include veins carrying tin, tungsten, gold, copper, and zinc and lead. Nonmetallic minerals such as kyanite, pyrophyllite, vermiculite, barite, topaz, spodumene, and mica are also found. In 1953 monazite-bearing placers and the igneous and metamorphic rocks from which they were derived were being investigated in detail by the Southeast Monazite project of the Geological Survey.

Blue Ridge

The Blue Ridge province consists of folded and faulted metamorphic rocks that have been thoroughly intruded and injected in some places by granite and pegmatitic material. These are apparently overlain or grade into less metamorphosed late pre-Cambrian sedimentary rocks in the southwestern part of the province; and in Virginia, there are large bodies of late pre-Cambrian volcanic rocks. Mineral deposits in the Blue Ridge province include Ducktown-type copper ores; lenticular bodies of magnetite iron ore; nickel- and chromite-bearing olivine bodies; the copper, iron, and sulfur ores of the Gossan Lead; and sparse disseminations of copper minerals in the pre-Cambrian volcanic rocks in Virginia. Nonmetallic minerals such as talc, asbestos, vermiculite, feldspar, mica, and kyanite also are found.

Valley and Ridge

The Valley and Ridge province is composed of a great thickness of sedimentary rocks ranging in age from Cambrian through Pennsylvanian. These have been folded, overturned, and overthrust to the northwest so that the province is formed largely of a succession of long, narrow overthrust blocks or slices. Erosion has formed valleys where less resistant beds outcrop. The result is a system of northeast-trending parallel valleys and ridges. Igneous activity is confined to small plugs and dikes at a few widely scattered localities.

Mineral deposits of the Valley and Ridge province include brown and red iron ores, manganese, zinc, lead, barite, bauxite, coal, and a little oil and gas.

Appalachian Plateau

The Appalachian Plateau province contains a sequence of relatively flat-lying Paleozoic sediments. Resistant Pennsylvanian shales, sandstones, and conglomerates form most of the plateau surface. A few small, basic plugs intrude these rocks in Kentucky; but other than these, no igneous rocks are known. Coal, oil, and gas are the principal mineral resources.

Interior Low Plateau

Included in the Interior Low Plateau province are the Nashville Basin, the Lexington Plain (or Bluegrass Section), the Highland Rim, and the Shawnee section. In the first two subdivisions Ordovician limestones have been exposed by the truncation of two low domes. South and east of the Nashville Basin and Lexington Plain, gently dipping Mississippian limestones, shales, and sandstones overlie the flanks of the two domes and form the rough, hilly topography of the Highland Rim. West of the Lexington Plain, Mississippian and Pennsylvanian shales and sandstones dip westward from a south- and east-facing escarpment and form the hilly Shawnee section. A few thin lamprophyre dikes cut these rocks in the western Kentucky fluorspar district, and a complex fault system was developed prior to the emplacement of vein and bedded-replacement fluorite deposits (Weller and Sutton, 1951).

Mineral resources of the Interior Low Plateau include phosphate rock, brown iron ore, rock asphalt, oil and gas, fluorite, barite, zinc, and lead. Coal is also important in the western Kentucky coal field, which is part of the Shawnee section. The Chattanooga shale, which crops out over much of the Highland Rim, constitutes a potential large, low-grade uranium reserve and is currently being studied by another project of the Geological Survey.

INVESTIGATIONS FOR RADIOACTIVITY

In the course of this project, examinations were made at 111 localities, and 43 samples were taken for laboratory checks on field determinations of radioactivity. A portable scintillation counter

(Nuclear Research Corporation Model SM-3A) and a Geiger counter with six-inch probe (Nuclear Instrument and Chemical Corporation Model 2610 A) were used to measure radioactivity in most of the field examinations. Also, rather limited use was made of a carborne scintillation counter which was developed at Oak Ridge National Laboratory. All laboratory determinations of radioactivity were made by the Geological Survey Trace Elements laboratory at Denver, Colo. Figure 1 is an index map of the southeastern states showing localities that were examined, and the Appendix gives data on radioactivity and rock types at each locality.

Climate over the Southeast is warm and moist and weathering has proceeded to depths of from several feet to 100 feet or more over much of the area. At many of the mines and prospects that were visited, it was necessary to restrict examinations to old dumps and the surface as underground workings were abandoned and inaccessible.

Coastal Plain

Only one examination, Locality No. 100, fig. 1, was made in the Coastal Plain during the current reconnaissance. Other localities in the Coastal Plain shown on fig. 1 were investigated in connection with other studies. Monazite and uraniferous phosphate rock are being studied by other projects.

Piedmont

Molybdenum, tungsten, copper, copper-gold, and gold-bearing quartz veins were examined in Virginia, North Carolina, South Carolina, and Georgia. Granite in Georgia, manganese in South Carolina, and Triassic rocks in North Carolina and Virginia were also investigated.

Very sparse amounts of a secondary uranium mineral (uranophane ?) were found along joints in granite near Elberton, Ga., (Locality No. 97) and weak radioactivity was noted associated with gouge in the Tungsten Mining Corporation mine near Townsville, N.C., (Locality No. 94).

At Townsville, huebnerite and some scheelite occur in quartz veins near an intrusive contact between granite and schist (Espenshade, 1947). Most of the richer veins are in the granite and appear to be controlled to some extent by a strong shear zone. Pyrite, galena, tetrahedrite, sphalerite, chalcopyrite, and fluorite are also present in small amounts in the veins. Radioactivity in the mine seems to be unevenly distributed in the gouge of the main shear zone, and purple fluorite appears to be a fairly good clue to its presence. No anomalous radioactivity was found in the huebnerite-bearing veins or in the granite and schist country rock. The small amount of weakly radioactive material in the shear zone probably does not warrant further work at present. However, as no radioactivity is noted in the country rock, it may be that radioactive material in the shear zone has been introduced in some way from below.

Blue Ridge

The Cranberry iron ores, copper deposits of the Ducktown-type, and barite and fluorite deposits were examined in western North Carolina; and occurrences of disseminated copper were investigated in the Catoctin formation in Virginia. The Cranberry and Beech granites near Roan Mountain, Tenn. were found to be weakly radioactive at many places. Four grab samples indicate this radioactivity to be equivalent to about 0.003 percent uranium fairly evenly distributed through the rock.

Valley and Ridge

Barite, fluorite, red iron ore, and zinc deposits were investigated in east Tennessee. The Pumpkin Valley shale of Cambrian age was found to contain about 0.004 percent equivalent uranium over much of its outcrop in Grainger County, Tenn.

Appalachian Plateau

In the past few years, several public samples of weakly radioactive sandstone have been submitted from West Virginia. Attempts to run these down have failed to verify the presence of uranium, but studies indicate that the shales, sandstones, and conglomerates of the Appalachian Plateau constitute some of the most favorable ground for uranium deposition in the southeastern states. About the only thing that seems to be lacking is a source of uranium. It is possible, however, that carbonaceous shales associated with the coal beds might, under favorable conditions, release uranium to ground water or low-temperature solutions. These carbonaceous shales are widespread throughout the coal-bearing formations and are estimated to contain from 0.002 to 0.004 percent equivalent uranium at many places.

Several carborne scintillometer traverses were made in Pike County, Ky.; Dickenson and Buchanan Counties, Va.; and Mingo and McDowell Counties, W. Va. Carbonaceous shales were noted to be slightly radioactive at many points, but nothing else was found.

Interior Low Plateau

Brown phosphate rock, asphaltic sandstone and limestone, and veins carrying fluorite, barite, zinc, and lead were examined in Alabama and Tennessee. Several promising public samples were traced and found to be of Chattanooga or Maury shale. The Chattanooga shale is the most promising potential source of uranium in the Interior Low Plateau province; and consequently it is being studied in detail by several other projects.

SUMMARY AND CONCLUSIONS

No new uranium or thorium deposits of potential economic importance were found during nearly a year's reconnaissance in the Southeast. Information gained as a result of this work is helpful, however, in the evaluation of uranium and thorium possibilities over the region as a whole.

To date, uranium-bearing phosphate rock, Chattanooga shale, and Piedmont and Coastal Plain monazite placers are the most promising resources of radioactive materials in the region.

Geologic speculation indicates that Devonian, Mississippian, and Pennsylvanian rocks in the Valley and Ridge and Appalachian Plateau provinces and the Pennsylvanian rocks of the western Kentucky coal field may constitute some of the most favorable ground for uranium deposits in the southeastern states. In these areas, lenticular, cross-bedded sandstones and conglomerates interlayered with carbonaceous shales should provide good traps for uranium ground water or telethermal solutions.

The tungsten, gold, and copper-bearing quartz veins of the Piedmont should be considered as moderately favorable prospecting ground. Except for the weak anomaly at the Tungsten Mining Corporation's mine near Townsville, N. C., no abnormal radioactivity was found in deposits of this type.

Near Stone Mountain and Elberton, Ga., there are granites which contain small amounts of secondary uranium minerals along joint surfaces. Probably these secondary minerals have been deposited from ground water which has leached uranium from sparsely disseminated accessory minerals in the weathered portion of the granite. The Cranberry and Beech granites near Roan Mountain, Tenn., also appear to be slightly more radioactive than normal. As yet, no uranium minerals have been identified; but it is possible that further search might discover segregations or "hot spots" of radioactivity somewhere in the area of Beech and Cranberry outcrop.

In the Piedmont, the rocks of the Carolina slate belt are known to include metamorphosed extrusive and tuffaceous phases. While the present work did not discover any anomalous radioactivity in these metavolcanic rocks, it seems possible that somewhere in the Volcanic series there may be tuffs or flows that are appreciably radioactive. Any search for these will be handicapped by a lack of good geologic and topographic base maps over large areas.

The Triassic shales, sandstones, and coals that occur in downfaulted blocks in the Piedmont might be expected to trap uranium, if any source is or has been available in the nearby metamorphic or igneous rocks. However, reconnaissance in these basins in North Carolina and Virginia (Reinemund et al., in preparation) has failed to find any anomalous radioactivity.

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APPENDIX

Localities examined and sampled in the southeastern states

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
1	18N-13-11	---	Channel sample 1 ft. section Chattanooga shale (Mississippian)	V. E. Swanson (written communication)
	18N-13-12	---	do.	Do.
	18N-13-13	---	do.	Do.
	18N-13-14	---	do.	Do.
	RW-4181	0.031	Pyritic concretions (?) in Chattanooga shale (Mississippian). Samples submitted by W. F. McFarland of Clementsville, Ky.	---

1/ See fig. 1.

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
1 (continued)	RW-4496	0.015	Pyritic concretions (?) in Chattanooga shale (Mississippian). Samples submitted by W. F. McFarland of Clementsville, Ky.	---
	RW-4529	.010	do.	---
	RW-4564	.012	do.	---
	RW-4568	.014	do.	---
2	HJ-4-53	.006	Chattanooga shale	PRR D-602
	RW-2344	.024	do.	Do.
3	RW-3770	.007	Shale and limonite-stained sandstone; Conemaugh (?) series (Pennsylvanian)	PRR D-543
	---	.002 2/	do.	Do.
4	---	.003 2/	Black carbonaceous shale; Pennsylvanian	---
5	---	.004 2/	do.	---
6	---	.004 2/	do.	---
7	W-122, AEC-1516	.012	Public sample of brown to black carbonaceous shale	TEM-148
	---	.003 2/	Brown to black carbonaceous shale; Pennsylvanian	Do.
8	AW-4401 RMW-314	.04	Public sample; iron-stained silt and sandstone	PRR D-561

2/ Estimated in the field.

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
8 (continued)	HJ-5-53	0.002	Selected samples of iron-stained silt and sandstones; Mauch Chunk (?) series (Mississippian)	PRR D-561
	HJ-6-53	.001	do.	Do.
	HJ-7-53	.001; < .1 V_2O_5	do.	Do.
	HJ-8-53	.001	do.	Do.
9	[illegible]	.004 2/	Black carbonaceous shale; Pennsylvanian	---
10	---	.004 2/	Brown to black carbonaceous shale; Pennsylvanian	---
11	---	.003 2/	do.	---
12	---	.004 2/	do.	---
13	---	.004 2/	Brown, iron-stained shaly siltstone and 6-inch shaly coal seam; Pennsylvanian	---
14	RW-880	.014	Iron and manganese oxides in sandy lenses in lower 50 ft. of Knox dolomite (Ord.)	PRR D-43
15	---	.000 2/	Basalt and granite felsophyre	PRR M-1435
16	---	.000 2/	Conglomerate arkose and sandstone; Triassic	PRR M-1434
17	---	.000 2/	Anaconda prospect. Copper-bearing quartz vein	PRR M-918
18	---	.000 2/	Seaboard mine. Copper-bearing quartz vein	PRR M-914

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
19	---	0.000 2/	Tuck mine. Copper-bearing quartz vein	PRR M-923
20	---	.000 2/	High Hill mine. Copper-bearing quartz vein	PRR M-925
21	---	.000 2/	Shale, siltstone, and coal; Triassic	PRR M-1433
22	---	.000 2/	Johnson mine. Gold-bearing pyrite lenses in hornblende schist and quartz-sericite schist	PRR M-879
23	---	.000 2/	Margaret mine. Gold-bearing pyrite lenses in hornblende schist and quartz-sericite schist	PRR M-878
24	---	.000 2/	Stony Point mine. Quartz-siderite (?) vein carrying a little copper	PRR M-876
25	---	.000 2/	Hightop mine. Disseminated copper mineralization in basalt; Catoctin fm. (pre-Cambrian)	PRR M-880
26	---	.000 2/	Ida mine. Disseminated copper mineralization in basalt; Catoctin fm. (pre-Cambrian)	PRR M-882
27	---	.000 2/	Stony Man Mtn. mine. Disseminated copper mineralization in basalt; Catoctin fm. (pre-Cambrian)	PRR M-881
28	---	.000 2/	Trap phase of Triassic border conglomerate	PRR M-877
29	---	.000 2/	Ambler mine. Disseminated copper mineralization in basalt; Catoctin fm. (pre-Cambrian)	PRR M-875

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
30	---	0.000 2/	Reddish brown shale and siltstone; Triassic	PRR M-868
31	---	.000 2/	Red to reddish-brown siltstone and shale with very sparsely disseminated copper mineralization; Triassic	PRR M-867
32	---	.000 2/	Red to reddish-brown siltstone and shale; Triassic	PRR M-869
33	---	.000 2/	do.	PRR M-870
34	---	.000 2/	Quarry in diabase; Triassic	PRR M-874
35	---	.000 2/	Yellowish-brown conglomeratic sandstone and red to reddish-brown siltstone and shale; Triassic	PRR M-871
36	---	.000 2/	Coarse border conglomerate; Triassic	PRR M-872
37	HJ-40-53	.001 2/	Copper, lead, and zinc mineralization sparsely disseminated in limestone; Triassic	PRR M-873
38	HJ-13-53	.000 2/	Margerum quarry. Asphaltic limestone; Mississippian	PRR M-949
	HJ-14-53	.000 2/	do.	
	HJ-15-53	.000 2/	do.	
39	HJ-16-53	.000 2/	Hargett quarry. Asphaltic sandstone; Mississippian	PRR M-948
40	---	.000 2/	Asphaltic limestone; Mississippian	PRR D-559

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
41	HJ-17-53	0.000 2/	Asphaltic sandstone; Mississippian	PRR M-950
42	HJ-18-53	.000 2/	do.	PRR M-951
43	RW-3119	.006	Maury fm.; Mississippian	PRR D-595
44	HJ-23-53	.001	Brown phosphate rock; Bigby fm. (Ord.)	PRR D-671
45	HJ-24-53	.001	Brown phosphate lump rock	PRR D-672
	HJ-25-53	.001	High grade sand	Do.
	HJ-26-53	.002	Flotation tailings	Do
46	HJ-27-53	.001	Slag from Monsanto elemental phosphorous plant	---
47	---	.000 2/	Fluorite-barite-calcite-galena-sphalerite vein in Carters limestone (Ord.)	PRR M-888
48	---	.000 2/	Barite-calcite-fluorite-galena vein in Carters limestone (Ord.)	PRR M-884
49	---	.000 2/	Barite-fluorite-galena-sphalerite vein in Carters limestone (Ord.)	PRR M-889
50	---	.000 2/	Knight mine. Sphalerite-calcite-barite-fluorite vein in Carters limestone (Ord.)	PRR M-887
51	---	.000 2/	Hoover mine. Sphalerite-calcite-barite vein in Carters limestone (Ord.)	PRR M-886
52	---	.000 2/	Pascal mine. Calcite-sphalerite vein in Lebanon limestone (Ord.)	PRR M-885
53	---	.000 2/	Alcorn prospect. Fluorite-barite-calcite vein in Catheys limestone (Ord.)	PRR M-883

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
54	AW-3025 RMW-157	0.009	Public sample submitted by T. H. McDonald of Ivyton, Tenn.	PRR D-596
	---	.000 2/	Cherty limestone and thin-bedded sandstone; Mississippian	Do.
55	HJ-2-53	.001	Selected sample red iron ore	PRR D-545
56	---	.000 2/	L. A. Wood barite grinding plant	PRR D-498
57	---	.000 2/	Stevens mine. Residual concentration of barite, iron, and manganese in weathered limestone	Do.
58	---	.000 2/	Roy mine. Residual concentration of barite, iron, and manganese in weathered limestone	PRR D-498
59	---	.000 2/	Ballard mine. Residual concentration barite, iron, and manganese in weathered limestone	Do.
60	---	.003 2/	Pumpkin Valley shale; Cambrian	PRR M-952
61	HJ-19-53	.001	Mascot mill heads	PRR D-670
	HJ-20-53	.001	Mascot jig concentrates	Do.
	HJ-21-53	.001	Mascot flotation feed	Do.
	HJ-22-53	.001	Mascot flotation concentrates	Do.
62	HJ-2-52	.004	Yellow-brown shale; Pumpkin Valley fm. (Cambrian)	PRR D-560
63	HJ-4-53	.005	do.	Do.
64	HJ-5-52	.004	do.	Do.

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
65	---	0.003 2/	Dark gray carbonaceous slates; Ocoee series (pre-Cambrian)	PRR M-945
66	HJ-1-52	.002	do.	PRR D-581
67	---	.002 2/	do.	PRR M-946
68	---	.003 2/	Phosphate and manganese minerals in Sandsuck fm. (pre-Cambrian)	PRR D-46
69	---	.000 2/	Williams barite mine	PRR M-912
70	---	.000 2/	Moccasin Gap barite mine	PRR M-915
71	HJ-10-53	.003	Cranberry granite (pre-Cambrian)	PRR D-557
	HJ-11-53	.004	Chip sample from pegmatite material in Cranberry granite (pre-Cambrian)	Do.
72	HJ-9-53	.004	Cranberry granite (pre-Cambrian)	PRR D-556
73	---	.000 2/	Fontana mine	PRR D-674
74	---	.000 2/	Otto mine	PRR M-787
75	---	.000 2/	Savannah mine	PRR M-783
76	---	.000 2/	Cullowhee mine	PRR M-784
77	---	.000 2/	Moody prospect	PRR M-785
78	---	.000 2/	Wayehutta mine	PRR M-782
79	---	.000 2/	Stackhouse mine	PRR M-913
80	---	.000 2/	Toms copper prospect	PRR M-786

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
81	HJ-12-53	0.003	Beech granite (pre-Cambrian)	PRR D-558
82	---	.000 2/	Cranberry iron mine	PRR D-555
83	---	.000 2/	Elk Knob copper mine	PRR M-781
84	---	.01 2/	Small pegmatite stringers	PRR M-953
85	---	.000 2/	Copper Knob mine	PRR M-759
86	---	.000 2/	Ore Knob copper mine	PRR M-758
87	---	.000 2/	Peachbottom copper mine	PRR M-760
88	---	.000 2/	Union copper mine	PRR D-737
89	---	.000 2/	Gold Hill mines	PRR D-738
90	---	.000 2/	Murchison mine. Coal and carbonaceous shale of Pekin fm. (Triassic)	---
91	---	.000 2/	Red-brown shale and siltstone intruded by diabase dike; Triassic	---
92	---	.000 2/	Durgy copper mine	PRR M-916
93	---	.000 2/	Blue Wing copper mine	PRR M-917
94	HJ-28-53	.004	Tungsten Mining Corp. Grab sample from shear zone	PRR D-736
	HJ-29-53	.003	Chip sample across 38 inches of shear zone	Do.
	HJ-30-53	.004	Grab sample from shear zone	Do.
	HJ-31-53	.002	Selected specimen of purple fluorite	Do.

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
94 (continued)	HJ-32-53	0.003	Grap sample from shear zone	PRR D-736
	HJ-33-53	.006	do.	Do.
	HJ-34-53	.002	Non-magnetic product from mill	Do.
	HJ-35-53	.001	Huebnerite concentrate from magnetic separator	Do.
	HJ-36-53	.002	Middlings from magnetic separator	Do.
	HJ-37-53	.001	Iron products from magnetic separator	Do.
	HJ-38-53	.001	Sulfide concentrates from flotation process	Do.
	HJ-39-53	<.001	Tailings	Do.
95	---	.000 2/	Moss-Dryden molybdenite prospect	PRR D-542
96	HJ-1-53	.004	Boy Scout-Jones molybdenum prospect	PRR D-544
97	---	.05 2/	Trace of uranophane (?) along joint in Elberton granite	PRR M-947
98	---	.000 2/	Columbia gold mine	PRR D-551
99	---	.000 2/	Park gold mine	PRR D-552
100	HJ-3-53	.002 2/	Thin seams and concretion-like masses of cobalt-bearing manganese	PRR D-509
101	---	---	Horse Creek monazite placer	---

APPENDIX--Continued

Localities examined and sampled in the southeastern states--Continued

Locality number 1/	Sample number	Equivalent uranium (percent)	Description	Reference
102	---	0.000 2/	Dorn gold mine	PRR D-554
103	---	.000 2/	Abernathy and Kehaya manganese prospect	PRR D-553
104	---	.000 2/	Quattlebaum-Landrum gold mine	PRR D-511
105	---	.000 2/	Culbreath gold mine	PRR D-510
106	---	.000 2/	Enoree vermiculite mines	PRR M-922
107	---	.02 2/	Radioactive zircons at Tigerville vermiculite mines	PRR M-921
108	---	.000 2/	Kings Creek barite mines	PRR M-920
109	---	.000 2/	Manganese schist; Battleground schist (pre-Cambrian)	PRR M-919
110	---	.000 2/	Brewer gold mine	PRR M-924
111	RW-4468	.01-0.08	Fossil bone (whale ?). Public sample submitted by Capt. F. J. Smith of Mayport, Fla.	---