GEOLOGY OF THE PENNSYLVANIAN SYSTEM OF GEORGIA

GEOLOGIC ATLAS 2

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Prepared in cooperation with the U.S. Geological Survey.

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Cordaite and Sigillaria trees modified from drawings by Jerry Jenkins in Plant Fossils of West Virginia, 1978, by William H. Gillespie and others, West Virginia Geological and Economic Survey.

Atlanta
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INTRODUCTION

In the 1970's, the U.S. Geological Survey recognized the need for basic data on Georgia coal in order to determine Georgia's contribution to U.S. energy resource potential. A coal investigation program was begun in 1977. The objectives were to: determine the quality, quantity, and distribution of coal resources in Georgia, with emphasis on the correlation and continuity of coal beds; and to determine the areal extent, thickness, chemical composition, rank, and lateral changes in the coal beds by collecting, interpreting, and computerizing surface and subsurface statigraphic and analytical data. Special attention was to be given to delineating metallurgical and steam coal deposits. An integral part of the entire study was to be the determination of the areal extent, thickness, and lithic variations of the coal-bearing strata, the depositional controls and systems, and the post-depositional structural features.

The efforts of earlier workers in the area were invaluable in expediting the present study, and effort was made to use all previous work. Two publications proved to be of particular value: S.W. McCallie's A Preliminary Report on the Coal Deposits of Georgia (1904); and V.H. Johnson's Coal Deposits on Sand and Lookout Mountains, Dade and Walker Counties, Georgia (1946). In addition, the works of W.C. Culbertson (1963), and Wilson, Jewell, and Luther (1956) were used in developing stratigraphic nomenclature. The many other works in the "Selected References" pertain to various aspects of the geology of the Pennsylvanian System in Georgia. However, all of the data on the maps are "original" in the sense that none was taken from previous work without having been checked in the field. The distribution of rock units and structural interpretations are based entirely on the author's observations. Locations for many of the coal outcrops and abandoned mines were gleaned from the literature; but all were located in the field, plotted with horizontal and vertical control, and described.

The maps in this atlas show the distribution of rock units, the major structural features, and the precise locations of coal outcrops, coal mines (underground and surface), selected core holes drilled by the U.S. Bureau of Mines (BM designation) and by the Georgia Power Company (GP designation). The sample locations for coal-quality analyses and map data stations are tied to information stored in, and retrievable from, the U.S. Geological Survey's National Coal Resources Data System (NCRDS). The locations of all these features are tied vertically and horizontally to the 7.5-minute topographic maps which serve as an excellent base. The maps are of such a scale (1:24,000) that they can readily be used for mineral-resource evaluation and planning.

Two other parts of the study have been published separately, and are designed to be used in conjunction with this atlas. Each publication gives details of a particular aspect of the study: Quality of Coal Resources Underlying Sand and Lookout Mountains, Georgia and Alabama and Analyses of Coal from Northwest Georgia by Coleman, Crawford, and Medlin, 1986.

The following text presents a brief summary of this study.

STRATIGRAPHY

The stratigraphic nomenclature used in this report is modified from that of Culbertson (1963), and Wilson, Jewell, and Luther (1956). Coal-bed designations are modified from those of Johnson (1946). Coal bed correlations are shown in Table 1.

MISSISSIPPIAN
Pennington Formation

The upper part of the Pennington consists of dark gray, silty shale and siltstone which contain marine invertebrate fossils; at one locality well-preserved plant fossils are mixed with marine invertebrates. Laterally, the shale and siltstone intertongue with sandstone, which is generally fine- to medium-grained, thin- to medium-bedded and commonly crossbedded (planar). These sandstones are usually lenticular, and 10 to 25 feet thick, but in places they are more than 100 feet thick. Massive beds of quartz-pebble conglomerate, several tens of feet thick, are common.

The very uppermost Pennington generally consists of an interbedded sequence of: gray, calcareous siltstone (up to 35 feet thick), massive, with blocky to spheroidal weathering; impure, iron-rich (sideritic) limestone beds generally less than 2 feet thick, but laterally persistent; greenish gray to maroon shales; and fine-grained sandstones. All of these lithologies, with a total thickness of 50 to 65 feet, contain marine invertebrates.

MISSISSIPPIAN - PENNSYLVANIAN BOUNDARY

The Mississippian - Pennsylvanian boundary is placed at the contact between the Pennington Formation and the Raccoon Mountain Member of the Gizzard Formation. The Pennington - Raccoon Mountain boundary was placed below the lowermost coal bed and above the uppermost carbonate bed containing abundant marine invertebrate fossils. These lithologic criteria allowed the boundary to be picked within a few tens of feet of section throughout the area. Subsequently, marine fossils collected from the carbonates in the uppermost Pennington and plant fossils collected from Raccoon Mountain coal-associated shales verified this formation boundary as being the Mississippian - Pennsylvanian systemic boundary on Lookout Mountain and Sand Mountain (Dade County) in Georgia.

In the Pennsylvanian outliers on Sand Mountain (Catoosa Co.), Little Sand Mountain, and Rock Mountain, the Raccoon Mountain Member of the Gizzard Formation appears to be more marine, and contains coal only as thin carbonaceous zones and scarce small lenses. In these outliers, the Mississippian - Pennsylvanian boundary is based on marine fossils (Crawford, 1983b).

In Georgia, the systemic boundary appears to be transitional or gradational, based on physical relationships. However, plant fossils indicate a late Early Pennsylvanian age for the coal-bearing sequences, comparable to the New River Formation in the Pennsylvanian System stratotype (Gillespie and Crawford, 1985, p. 249, Table 1 and p. 252). "Although the underlying Upper Mississippian sequence is essentially complete, a hiatus is indicated by the absence of beds containing the lower Early Pennsylvanian Pocahontas flora." (Englund, Gillespie, and others, 1985, p. 73).

PENNSYLVANIAN
Gizzard Formation

Raccoon Mountain Member

The Raccoon Mountain Member consists of interbedded shale, siltstone, and fine- to medium-grained sandstone. Siderite nodules are common in the gray shales; flaser bedding is pervasive in the shale and siltstone; and shale clasts are common in the thin-bedded sandstones.

In Georgia, the Raccoon Mountain Member has a maximum thickness of about 275 feet on the north end of Sand Mountain, near the type locality in Scratch Ankle Hollow (New Home quad.). In this area, the lenticular sandstone bodies have their maximum development, some attaining a thickness of 40 feet. There are five coal beds in the Raccoon Mountain Member; they are, from youngest to oldest, the AEtna (No. 8), the Dade (No. 9), the Rattlesnake (No. 9A), the Red Ash (No. 10), and the Mill Creek (No. 11).

Southward and eastward from the type locality, the Raccoon Mountain Member thins to less than 100 feet. Associated with this overall thinning, the lenticular sandstone bodies are thinner (10 to 15 feet) and have less lateral extent; also, there are fewer coal beds in the thinner parts of the sequence.

Warren Point Member

The Warren Point Member consists primarily of medium- to coarse-grained sandstones, and conglomeratic sandstones. There are extensive lenses of quartz-pebble conglomerate in both the lower and upper parts, with the middle containing relatively less conglomerate. Low-angle planar crossbedding is common. The base of the Warren Point is very uneven, with channeling into siltstones, shales, and coal beds of the underlying Raccoon Mountain Member. Shale and siderite clasts and thin distorted lenticular coals are abundant in basal "rubble zones."

The thickness of the Warren Point varies from less than 100 feet to greater than 200 feet, and averages about 150 feet. Everywhere it weathers massive and is a cliff-former.

A lenticular coal bed, the Cliff (No. 7, or Underwood), is sporadically developed in the Warren Point.

Signal Point Shale Member

The Signal Point Shale Member is primarily a dark gray shale and silty shale, with flaser bedding. Locally, it contains appreciable interbedded siltstone and thin-bedded sandstone. Thickness ranges from less than 20 feet to greater than 100 feet, with 40- to 60-foot thicknesses being most common.

There are two coal beds in the Signal Point Shale Member: the Upper Cliff No. 1 (No. 6) coal bed in the upper part; and the Upper Cliff No. 2 (No. 6A) coal bed in the lower part.

Crab Orchard Mountains Formation

Sewanee Member

The Sewanee Member is primarily a fine- to coarse-grained sandstone, generally feldspathic, and usually thin-bedded, with planar cross-bedding common and well-developed. However, conglomeratic sandstone and quartz-pebble conglomerate in thick massive beds are common, particularly in the lower part of the Sewanee Member and in the middle part, directly overlying a sporadic shale unit. The lower part of the Sewanee commonly contains coal clasts and shale clasts; lenticular channel sands in the lower part intertongue with shales and siltstones.

The Sewanee is about 250 to 300 feet thick, weathers massive, and is a cliff-former.

The thin shale unit near the middle of the Sewanee, seldom more than 20 feet thick and generally overlain by quartz-pebble conglomerate, contains the Lahusage (No. 5A) coal bed.

Whitwell Shale Member

The Whitwell Shale Member, about 200 feet thick, consists of interbedded shale, siltstone, and fine-grained sandstone. Flaser bedding is common in the shale and siltstone; sandstones are generally thin-bedded, often lenticular, and contain thin planar crossbed sets.

There are two coal beds in the Whitwell Shale Member. The Sewanee (No. 5) coal bed lies approximately 15 to 20 feet above the base of the Whitwell Shale Member; the Tatum (No. 4) coal bed lies 50 to 100 feet below the top of the Whitwell Shale Member.

Newton Sandstone Member

The Newton Sandstone Member consists of feldspathic sandstone, mostly fine- to medium-grained, but some is coarse-grained; it is mostly in beds and crossbed sets less than 3 feet thick, but is medium-bedded and massive in part.

Thickness of this unit varies between about 100 and 150 feet. No coals beds were found in the Newton Sandstone Member.

Vandever Member

The Vandever Member is a thick sequence, about 400 feet, of interbedded shales, siltstones, and sandstones, which contains three coal beds.

The upper 300 feet of the Vandever consists primarily of shale, siltstone, and fine-grained lenticular sandstone. There is a marine invertebrate fossil zone about 25 feet above the base of this upper 300-foot interval (contact with the Durham Sandstone Bed), and about 10 feet above the "A" (No. 1) coal bed. The Durham Sandstone Bed, a persistent sandstone bed within the Vandever, is 20 to 30 feet thick, and lies approximately 15 feet below the "A" (No. 1) coal bed.

The Durham Marker (No. 2) coal bed is about 15 feet below the base of the Durham Sandstone Bed, within the lower part of the Vandever Member. Approximately 45 feet below the Durham Marker (No. 2) coal bed lies the Durham (No. 3) coal bed. The No. 3 coal bed is about 10 feet above the base of the Vandever Member.

Rockcastle Member

Capping two small knobs south-southwest of Durham on Round Mountain (Durham 7.5-min. quadrangle) is 20 to 30 feet of medium-grained, slightly feldspathic sandstone, in beds up to 4 feet thick and in part cross-bedded. This sandstone is the youngest Pennsylvanian rock unit in Georgia, and is interpreted as the Rockcastle Member of the Crab Orchard Mountains Formation, based strictly on lithology and position in the stratigraphic sequence.

STRUCTURE

Lookout Mountain and Pigeon Mountain consist of a series of NNE-trencing doubly plunging anticlines and synclines. In Georgia, the structurally lowest parts of Lookout Mountain are centered around Durham (Dade and Walker Counties) and north of Cloudland between East Fork Little River and Middle Fork Little River (Chattooga County). A third, smaller, structurally low area straddles the Georgia-Alabama boundary at the Walker-Chattooga County line. The youngest Paleozoic rocks in Georgia are preserved in these areas.

Fox Mountain is generally synclinal. Little Sand Mountain consists of a series of NNE-trending doubly plunging anticlines and synclines; Rock Mountain is gently synclinal; and Sand Mountain (Catoosa County) is only a small erosional remnant dipping to the ESE. The part of Sand Mountain (Dade County) in Georgia consists of a broad syncline with gently dipping limbs and a low-angle plunge to the SSW. Lookout Mountain, Pigeon Mountain, and Fox Mountain are more complexly deformed than is Sand Mountain (Dade County).

The folds are everywhere complicated by high-angle reverse faults and low-angle thrust faults of quite variable magnitudes. Small-scale reverse and thrust faults are exposed in coal strip mines, such as the Sand Mountain Minerals Pullen Mine and the Hanes Mining Company Roy Massingale Mine (Map Stas. 40 and 9 on the New Home quadrangle); and in underground mines, such as the Tatum Gulch (New Camp) Mine (Map Sta. 25, New Home quadrangle), and the Phoenix Iron and Coal Co. Mine (Map Sta. 9, Trenton quadrangle). These exposures in man-made openings are temporary, and are soon masked or obliterated by weathering. Creek exposures of faults, such as those along Lively Creek on the Bridgeport, Ala. and New Home, Ga. quadrangles (Map Sta. 95, New Home quadrangle) tend to be exposed for longer periods of time.

Large-scale low-angle overthrust faulting is indicated by thick breccia zones, such as that exposed near the Castle Rock Mine (Map Sta. 68, New Home quadrangle) where there is a breccia zone approximately 60 feet thick at the Pennington (Mississippian) - Raccoon Mountain (Pennsylvanian) contract. This likely represents a decollement zone as described by Harris and Milici (1977).

Large-scale high-angle reverse faulting is most spectacularly illustrated by the vertical beds and topographic features along the east side of Lookout Mountain. Here, high-angle reverse faults have displaced Upper Mississippian and Lower Pennsylvanian rocks between Bowers Gap and Nickajack Gap, Walker County. Two subparallel faults strike NNE and are vertical to steeply dipping ESE. The western fault of the pair is the Steven Gap fault, named for exposures along Georgia highways 136 and 157, at Steven Gap; the eastern fault is the High Point fault, named for its relationship to this prominent topographic feature (Crawford, 1983a). Both faults are interpreted as ramps of, or splays from, the Lookout Valley fault (Chowns and Waters, 1978). The Lookout Valley fault may be equivalent to the Cranmore Cove fault of Tennessee as described by Milici and Leamon (1975). The magnitude of displacement is best shown by the High Point fault in the vicinity of High Point, where gently dipping rocks of the Pennington Shale (Upper Mississippian) have been brought in contact with steeply dipping rocks of the Warren Point Member of the Gizzard Formation (Lower Pennsylvanian); this juxtaposition indicates a minimum vertical displacement of about 350 feet.

A high-angle fault showing a similar relationship between gently dipping and steeply dipping beds was mapped along the east side of Fox Mountain, and is herein named the Fox Mountain fault. Still another similar relationship was noted in the steeply dipping to nearly vertical beds along the southeast side of Little Sand Mountain NNE of Crystal Springs.

AGE OF THE PENNSYLVANIAN ROCKS IN GEORGIA, AND THEIR RELATIONSHIP TO UNDERLYING STRATA

The strata which directly underlie the Pennsylvanian rocks in Georgia have been mapped as the Pennington Formation and contain macrofauna of late Chesterian age (T.W. Henry and Mackenzie Gordon, Jr., 1982*). Calcareous foraminifera indicate a similar age (Mark Rich, University of Georgia, oral communication, 1983). Macroflora from these rocks are Namurian "A" and correlate with those of the Upper Mississippian part of the Bluestone Formation in the eastern Appalachians (Gillespie and Crawford, 1985).

Strata directly above these Upper Mississippian Pennington rocks are mapped as the Raccoon Mountain Member of the Gizzard Formation. Plant megafossils from this unit indicate an Early Pennsylvanian age equivalent to the New River Formation of the proposed Pennsylvanian System stratotype in the central Appalachians, and Namurian "C" - Westphalian "A" of Europe (Gillespie and Crawford, 1985). Sparse, non-diverse marine macrofauna from the Raccoon Mountain Member suggest an Early Pennsylvanian age (T.W. Henry and Mackenzie Gordon, Jr., 1982*).

It is in the structurally low and topographically high area around Durham (Dade and Walker Counties) that the youngest Paleozoic rocks in Georgia are preserved. Here, above the No. 1 coal bed, a marine-fossil zone has yielded an invertebrate fauna which includes a goniatite, tentatively identified as Gastrioceras sp. These beds can be no older than late Morrowan (Early, but not earliest, Pennsylvanian) and probably are middle Morrowan (latest Early Pennsylvanian) in age (T.W. Henry and Mackenzie Gordon, Jr., 1982*). Plant data from this part of the section suggest correlation with the upper part of the New River Formation (late Early Pennsylvanian age) of the proposed stratotype for the Lower Pennsylvanian Series (Gillespie and Crawford, 1985).

Although very earliest Pennsylvanian age has not yet been paleontologically established for the Raccoon Mountain Member of the Gizzard Formation, field relationships indicate that, in Georgia, the Raccoon Mountain Member is conformable with the underlying Upper Mississippian Pennington Formation. Indeed, there is more evidence for erosion, missing intervals, and disconformity within the Pennsylvanian than there is in the proximity of the Mississippian - Pennsylvanian boundary; paleontological evidence, however, indicates a hiatus at this boundary.

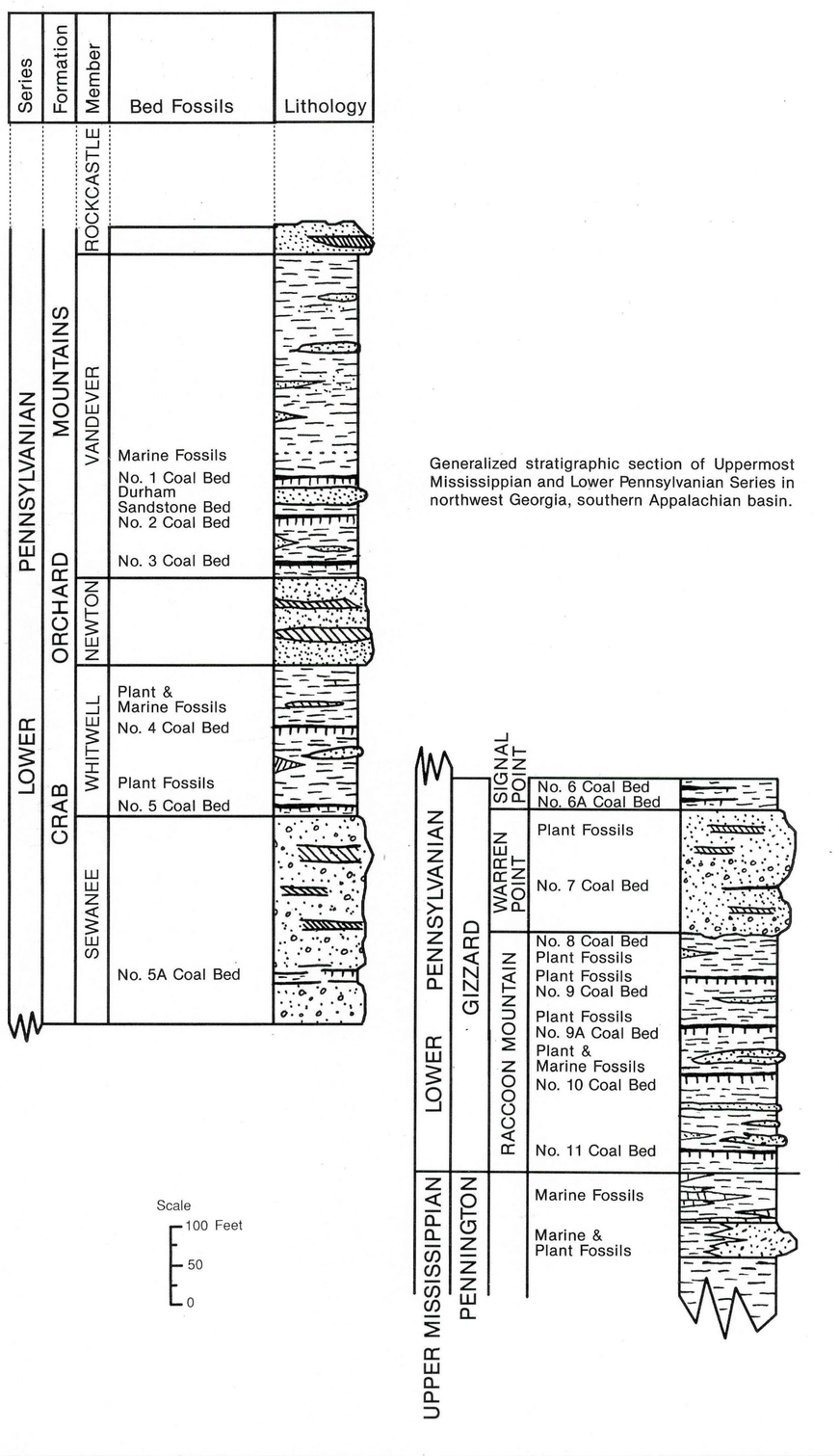
*Marine invertebrate fossils have been examined by Thomas W. Henry and Mackenzie Gordon, Jr., of the U.S. Geological Survey.

COAL QUALITY

A comprehensive study of the quality of Georgia coals was conducted as an integral part of this overall coal investigation. Results have been published in the Georgia Geological Survey Bulletin 102 and Information Circular 76 (Coleman, Crawford, and Medlin, 1986).

These coal-quality reports characterize the quality of the coal beds underlying Sand Mountain, Lookout Mountain, and Pigeon Mountain in Georgia and adjacent northeast Alabama. This characterization includes not only ultimate and proximate analyses, forms-of-sulfer, free-swelling index, and the heating value, but also the major-, minor-, and trace-element concentrations in the coal beds. The distribution, occurrence, thickness, and stratigraphic position of the coal beds are discussed on a bed-by-bed basis. Geological and analytical data are presented for 47 coal samples collected and analyzed during the current study.

Coal bed designations and correlations used in these reports are given in Table 1.



Generalized stratigraphic section of Uppermost Mississippian and Lower Pennsylvanian Series in northwest Georgia, southern Appalachian basin.

CRAWFORD (This Report) 1984 modified from	JOHNSON 1946	CRAMER 1979	BERGENBACK 1978	CULBERTSON 1963	WILSON, JEWELL & LUTHER 1956	BUTTS & GILDERSLEEVE 1948	COULTER 1947	GILDERSLEEVE 1946	TROXELL 1946	McCALLIE 1904	SPENCER 1893	HAYES 1892	COLTON & McCALLEY 1891	SAFFORD 1869
No.1	(LM) No. 1 A		(Sou Cum Pl) No. 12											
No.2	(LM) No. 2 Durham Marker													
No.3	No. 3	(LM) No. 5 Durham	(Sou Cum Pl) No. 11 (Sou Tenn) Lantana			(LM) No. 5		(LM) No. 5 Double Coal Bed		(LM) Durham				
No.4	No. 4	(LM) No. 4 Durham	(Sou Tenn) No. 10 Sewanee	(LM) Tatum						(LM) Tatum				
No.5	No. 5 Vandever Marker		(Sou Tenn) No. 9 (Sou Tenn) Richland	Sewanee	(Sou Tenn) Richland								(Tenn) Kelley	
No.5a														
No.6	No. 6 Whitwell Marker		(Sou Tenn) No. 7 (Sou Tenn) Wilder (Sou Tenn) Angel	UpperCliff 1	(Sou Tenn) Wilder					(LM, SM) UpperCliff			(ALA, LM, SM) Sewanee	
No.6a			(Sou Tenn) No. 6	(ALA) UpperCliff 2 (SM) Underwood	(Sou Tenn) Lower Wilder					UpperCliff			(ALA, LM, SM) Sewanee	
No.7	No. 7 Cliff		(Sou Tenn) No. 5	(LM, ALA) Underwood						UpperCliff				
No.8	No. 8 No. 10		(Sou Tenn) Nelson	Cliff		Etna	Cliff	Etna	Bluff	AEtna Castle Rock Raccoon Cliff (LM) Bluff	AEtna		Main Etna Cliff	Cliff
No.9	No. 9 No. 8 No. 10		(Sou Tenn) Goodrich							Dade Cliff			Dade Cole City Eureka	
No.9a	No. 9 No. 10									(SM) Rattlesnake Reese		(AEtna Dist) Dade	(SM) Red Ash	
No.10	No. 10									Red Ash				
No.11	No. 11				Mill Creek Sale Creek			Mill Creek						

Symbols
Ala -Alabama
LM - Lookout Mountain
SM - Sand Mountain
Sou Cum Pl - Southern Cumberland Plateau
Sou Tenn - Southern Tennessee

CORRELATION - GEORGIA COAL BEDS

TABLE 1

EXPLANATION

- •7 Map station—location and number
- •Z Map station—location and number for data entered into the U.S. Geological Survey National Coal Resources Data System (NCRDS)
- X No. 4 Coal bed outcrop and coal bed number
- X No. 4 Map station with coal bed outcrop and coal bed number
- ○ BMDH20 Core hole drilled by U.S. Bureau of Mines
- ○ BMGP6 Core hole drilled by U.S. Bureau of Mines for Georgia Power Company
- ⊗ Sample No. 2 GA/ALA Coal Sample—location and number
- Coal mine or prospect, underground, adit
  Massey Mine
  Frick Prospect Name, if known
- Coal mine—strip
  Lookout Mtn. Coal 6.—Mine Operator
  Chattooga No. 1—Mine name
  Upper Cliff No. 2—Coal bed designation used by company (see correlation chart)
- Lithologic boundary—all contacts are approximate
- BWP—Elevation at base of Warren Point—by hand level
- BRM—Elevation at base of Raccoon Mountain—by hand level
- ⊕ Bedding—horizontal
- Bedding—vertical
- Bedding—inclined
- Axis of plunging anticline
- Axis of plunging syncline
- D/U Fault, high-angle; U on upthrown block

Plate No. 1

UNITED STATES
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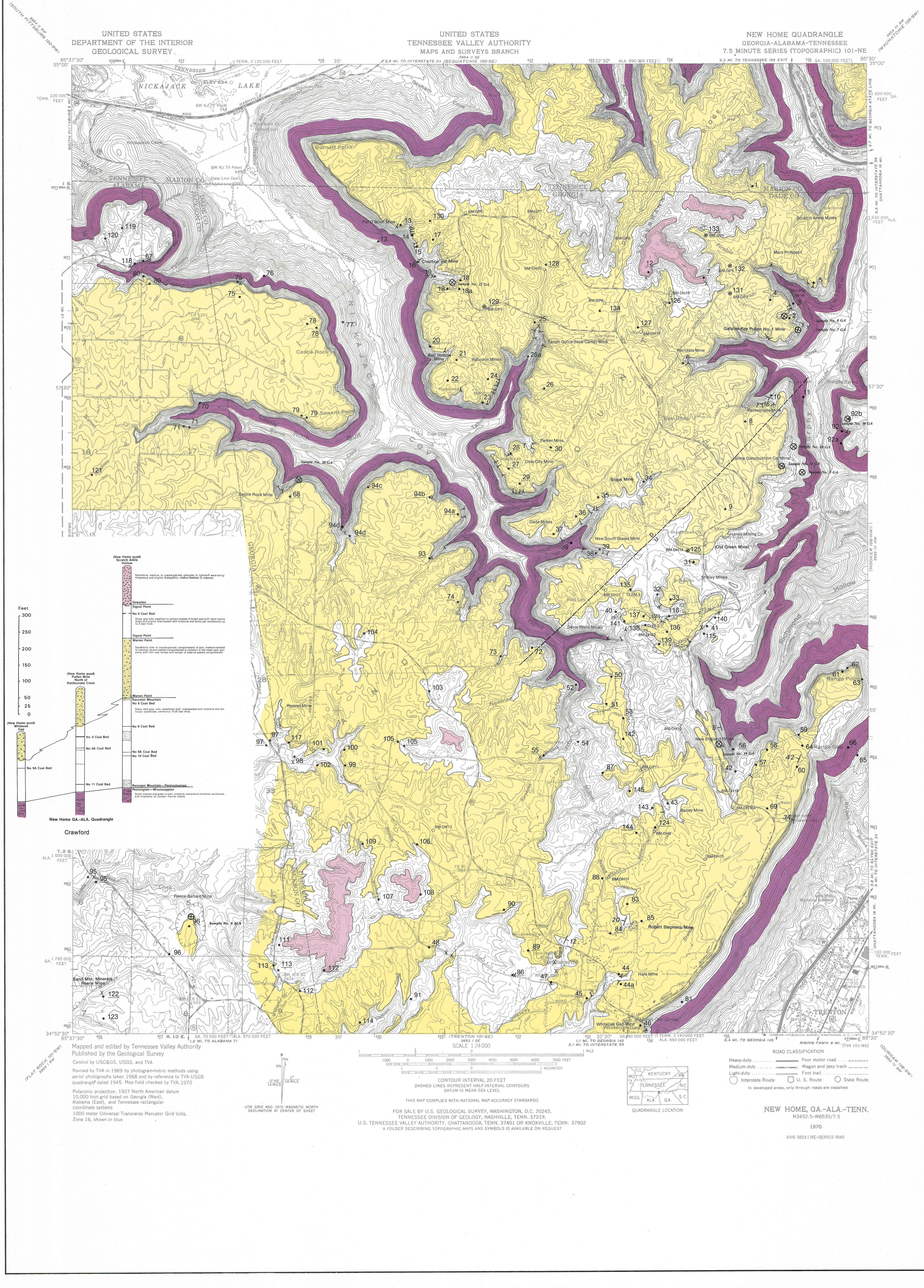
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

NEW HOME QUADRANGLE
GEORGIA-ALABAMA-TENNESSEE
7.5 MINUTE SERIES (TOPOGRAPHIC) 101-NE



Mapped and edited by Tennessee Valley Authority
Published by the Geological Survey

Control by USC&GS, USGS, and TVA

Revised by TVA in 1969 by photogrammetric methods using aerial photographs taken 1968 and by reference to TVA-USGS quadrangle dated 1945. Map field checked by TVA, 1970

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West), Alabama (East), and Tennessee rectangular coordinate systems
1000 meter Universal Transverse Mercator Grid ticks, Zone 16, shown in blue

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242,
TENNESSEE DIVISION OF GEOLOGY, NASHVILLE, TENN. 37219,
U.S. TENNESSEE VALLEY AUTHORITY, CHATTANOOGA, TENN. 37401 OR KNOXVILLE, TENN. 37902
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty	Poor motor road
Medium-duty	Wagon and jeep track
Light-duty	Foot trail
Interstate Route	U. S. Route / State Route

In developed areas, only through roads are classified

NEW HOME, GA.-ALA.-TENN.
N3452.5-W8530/7.5

1970

AMS 3853 I NE-SERIES V845

Plate No. 2

UNITED STATES
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TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

HOOKER QUADRANGLE
GEORGIA-TENNESSEE
7.5 MINUTE SERIES (TOPOGRAPHIC) 106-NW

Feet
300
250
200
150
100
50
25
0

Sandstone, fine- to coarse-grained, conglomeratic in part, medium-bedded to massive. Quartz-pebble conglomerate is common in the lower part, generally with thin coal lenses and lenses of siderite pebble conglomerate.

Warren Point

Raccoon Mountain

No 8 Coal Bed

No 9 Coal Bed

No 9A Coal Bed

No 10 Coal Bed

No 11 Coal Bed

Raccoon Mountain—Pennsylvanian

Pennington—Mississippian

Shale, maroon and green in part, siltstone, calcareous siltstone, sandstone, and limestone; all contain marine fossils.

Hooker, GA. Quadrangle—Lawson, Windy and Tatum Mountains

Brackett

Feet
300
250
200
150
100
50
25
0

Sandstone, medium- to coarse-grained; massive.

Newton

Whitwell

Shale and silty shale, gray, weathers brown and buff; interlayered with siltstone and fine-grained lenticular, thin-bedded sandstones; lenses up to 5 feet thick; sandy toward base

No 4 Coal Bed

No 5 Coal Bed

Whitwell

Sewanee

Sandstone, fine- to coarse-grained, feldspathic, pink-weathering; generally thin-bedded, but massive in part; planar crossbedding common and well developed; conglomeratic at the base, in part; some interlayered shale and siltstone, particularly near the base

Sewanee

Signal Point
No 6 Coal Bed
Signal Point

Shale, silty shale, and thin-bedded sandstone, interlayered; flaser bedding; dark-gray, weathered buff

Warren Point

Sandstone, medium- to coarse-grained, conglomeratic in part, with conglomerate lenses, massive, feldspathic in part; Uneven base, with channeling into underlying siltstones and shale; thin lenticular coals near the base

Upper Part—conglomeratic sandstone and conglomerate; crossbedded

Lower Part—fine- to medium-grained with shale clasts; some quartz-pebble and siderite pebble conglomerate

Warren Point

Raccoon Mountain
No 9 Coal Bed

Shale, silty shale, and siltstone, gray thin-bedded, with siderite nodules; flaser bedding and crossbedding are common. Contains abundant plant fossil debris; weathers buff to yellow-brown; contains lenticular sandstones

No 11 Coal Bed

Raccoon Mountain—Pennsylvanian

Pennington—Mississippian

Interbedded maroon shale, siltstone, and sandstone, with thin limestones. Iron-rich siltstones and fine-grained sandstones, both with abundant shale clasts, are interlayered with the shale

Hooker, GA. Quadrangle (except for Lawson, Windy and Tatum Mountains)

Crawford and Brackett

Control by USC&GS, USGS, GGS, and TVA

Revised by TVA in 1969 by photogrammetric methods using aerial photographs taken 1968 and by reference to TVA-USGS quadrangle dated 1945. Map field checked by TVA, 1970

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) and Tennessee rectangular coordinate systems
1000 meter Universal Transverse Mercator Grid ticks, Zone 16, shown in blue

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty ..... Poor motor road .....
Medium-duty ..... Wagon and jeep track _ _ _ _
Light-duty ..... Foot trail .....
Interstate Route U. S. Route State Route

In cleveloped areas, only through roads are classified

HOOKER, GA.–TENN.
N3452.5-W8522.5/7.5
1970
AMS 3953 IV NW-SERIES V845

(TVA 106-NW)

Brown Bros. Coal Co.
Pump Gulf Mine
1982 Permit
ID-09-00947

Sample No. 25 GA

Fuggett Branch Coal Mine

Coal Sample No. 18 GA

Sample No. 18 GA
Brown Bros. Coal Co.
Church Property Mine
Elev. ~1664'

Plate No. 3

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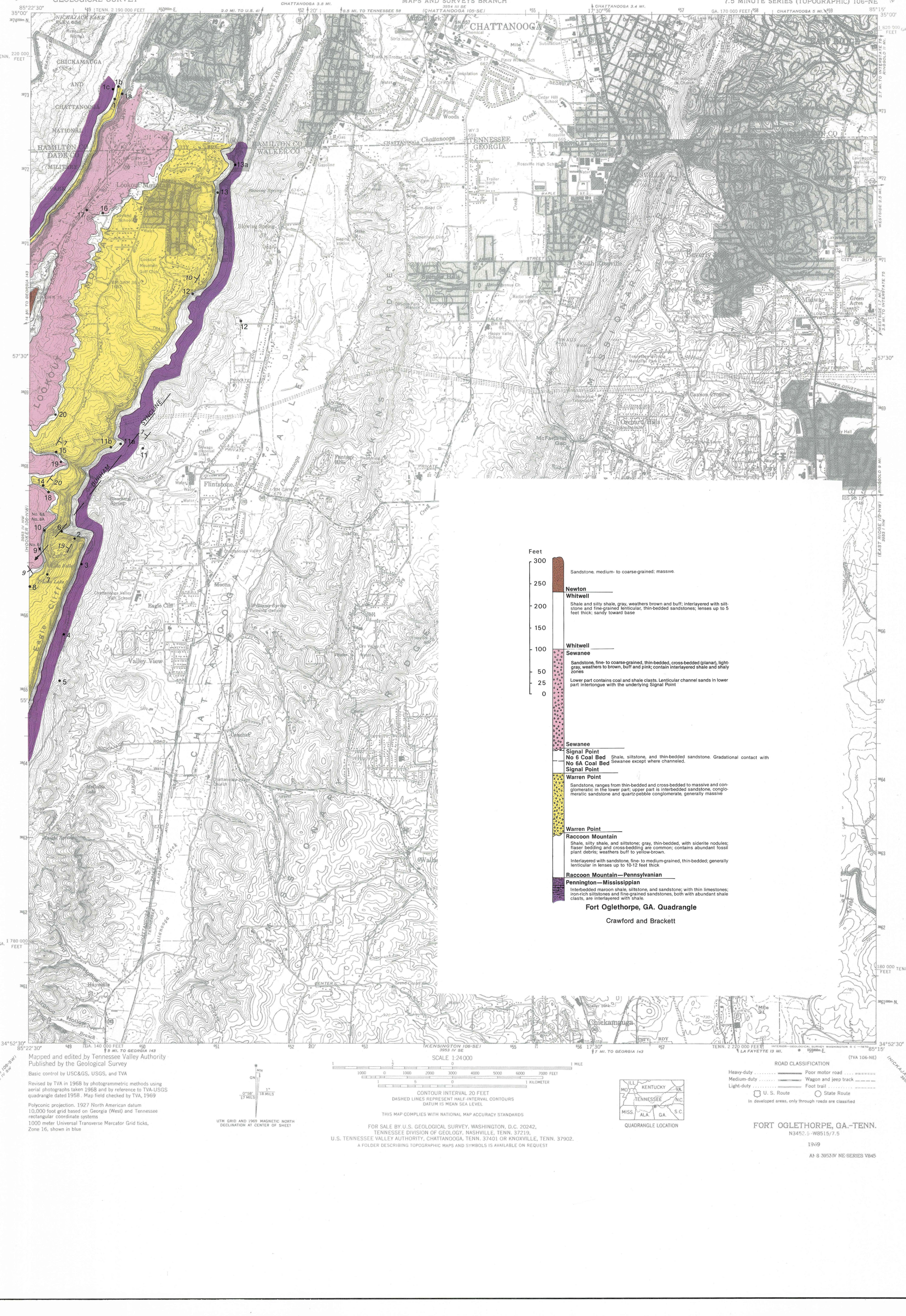
FORT OGLETHORPE QUADRANGLE
GEORGIA-TENNESSEE
7.5 MINUTE SERIES (TOPOGRAPHIC) 106-NE



Feet

- 300
- 250
- 200
- 150
- 100
- 50
- 25
- 0

Sandstone, medium- to coarse-grained; massive.

Newton

Whitwell

Shale and silty shale, gray, weathers brown and buff; interlayered with siltstone and fine-grained lenticular, thin-bedded sandstones; lenses up to 5 feet thick; sandy toward base

Whitwell

Sewanee

Sandstone, fine- to coarse-grained, thin-bedded, cross-bedded (planar), light-gray, weathers to brown, buff and pink; contain interlayered shale and shaly zones

Lower part contains coal and shale clasts. Lenticular channel sands in lower part intertongue with the underlying Signal Point

Sewanee

Signal Point
No 6 Coal Bed
No 6A Coal Bed
Signal Point

Shale, siltstone, and thin-bedded sandstone. Gradational contact with Sewanee except where channeled.

Warren Point

Sandstone, ranges from thin-bedded and cross-bedded to massive and conglomeratic in the lower part; upper part is interbedded sandstone, conglomeratic sandstone and quartz-pebble conglomerate, generally massive

Warren Point

Raccoon Mountain

Shale, silty shale, and siltstone; gray, thin-bedded, with siderite nodules; flaser bedding and cross-bedding are common; contains abundant fossil plant debris; weathers buff to yellow-brown.

Interlayered with sandstone, fine- to medium-grained, thin-bedded; generally lenticular in lenses up to 10-12 feet thick

Raccoon Mountain—Pennsylvanian

Pennington—Mississippian

Interbedded maroon shale, siltstone, and sandstone; with thin limestones; iron-rich siltstones and fine-grained sandstones, both with abundant shale clasts, are interlayered with shale.

Fort Oglethorpe, GA. Quadrangle

Crawford and Brackett

Mapped and edited by Tennessee Valley Authority
Published by the Geological Survey

Basic control by USC&GS, USGS, and TVA

Revised by TVA in 1968 by photogrammetric methods using aerial photographs taken 1968 and by reference to TVA-USGS quadrangle dated 1958. Map field checked by TVA, 1969

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) and Tennessee rectangular coordinate systems
1000 meter Universal Transverse Mercator Grid ticks, Zone 16, shown in blue

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN GN 0°58' 17 MILS 1° 18 MILS

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U.S. GEOLOGICAL SURVEY, WASHINGTON, D.C. 20242,
TENNESSEE DIVISION OF GEOLOGY, NASHVILLE, TENN. 37219,
U.S. TENNESSEE VALLEY AUTHORITY, CHATTANOOGA, TENN. 37401 OR KNOXVILLE, TENN. 37902.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty	Poor motor road
Medium-duty	Wagon and jeep track
Light-duty	Foot trail
U. S. Route	State Route

In developed areas, only through roads are classified

FORT OGLETHORPE, GA.-TENN.
N3452.5-W8515/7.5

1969

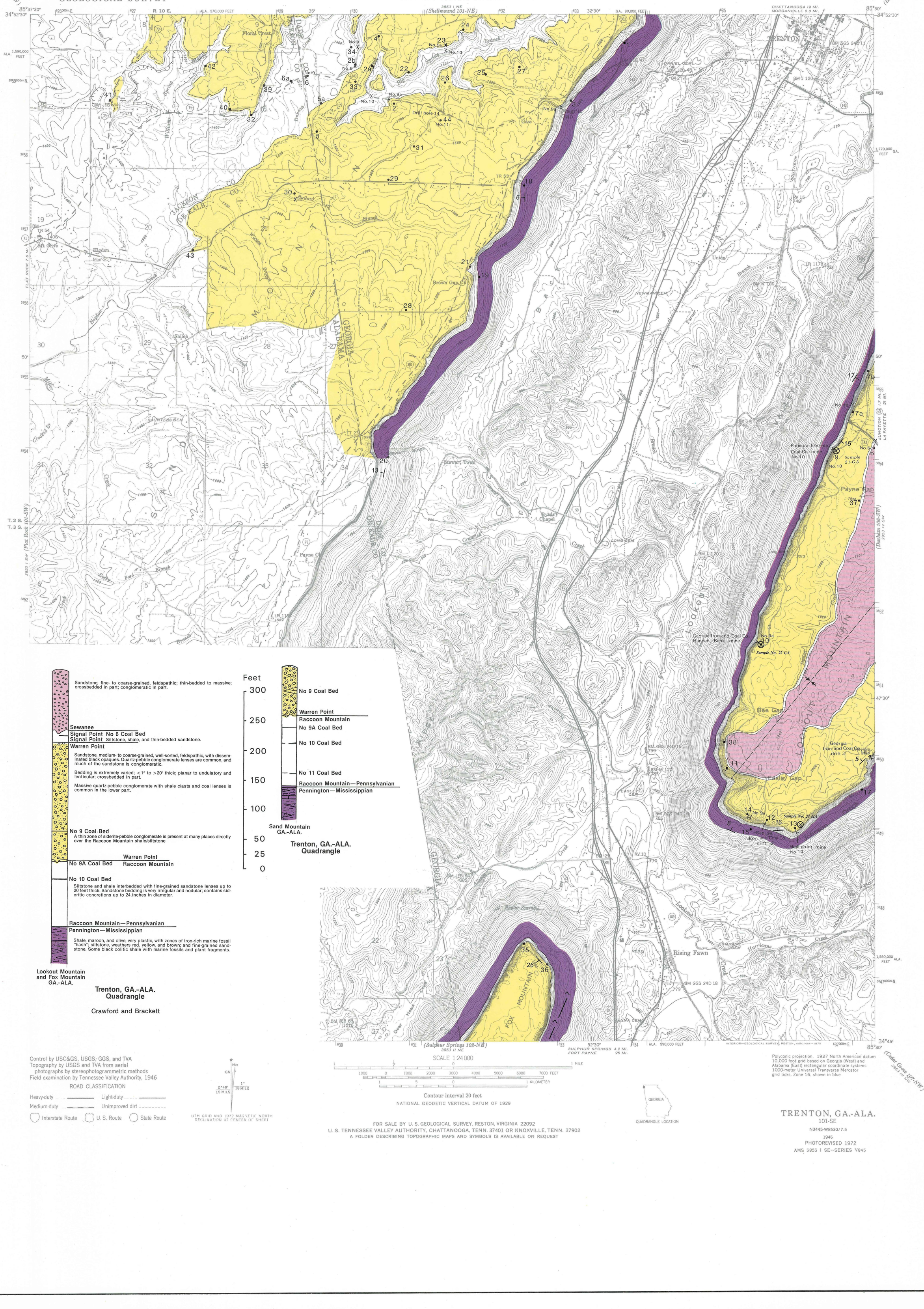
AMS 3953 IV NE-SERIES V845

Plate No. 4

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS DIVISION

GEORGIA-ALABAMA
TRENTON QUADRANGLE
101-SE



Sewanee
Signal Point No 6 Coal Bed

Signal Point Siltstone, shale, and thin-bedded sandstone.

Warren Point
Sandstone, medium- to coarse-grained, well-sorted, feldspathic, with disseminated black opaques. Quartz-pebble conglomerate lenses are common, and much of the sandstone is conglomeratic.

Bedding is extremely varied; <1″ to >20′ thick; planar to undulatory and lenticular; crossbedded in part.

Massive quartz-pebble conglomerate with shale clasts and coal lenses is common in the lower part.

No 9 Coal Bed
A thin zone of siderite-pebble conglomerate is present at many places directly over the Raccoon Mountain shale/siltstone

Warren Point
No 9A Coal Bed — **Raccoon Mountain**

No 10 Coal Bed

Siltstone and shale interbedded with fine-grained sandstone lenses up to 20 feet thick. Sandstone bedding is very irregular and nodular; contains siderite concretions up to 24 inches in diameter.

Raccoon Mountain—Pennsylvanian
Pennington—Mississippian

Shale, maroon, and olive, very plastic, with zones of iron-rich marine fossil "hash"; siltstone, weathers red, yellow, and brown; and fine-grained sandstone. Some black oolitic shale with marine fossils and plant fragments.

Lookout Mountain and Fox Mountain GA.–ALA.

Trenton, GA.–ALA. Quadrangle

Crawford and Brackett

Feet
300
250
200
150
100
50
25
0

No 9 Coal Bed
Warren Point
Raccoon Mountain
No 9A Coal Bed
No 10 Coal Bed
No 11 Coal Bed
Raccoon Mountain—Pennsylvanian
Pennington—Mississippian

Sand Mountain GA.–ALA.

Trenton, GA.–ALA. Quadrangle

Control by USC&GS, USGS, GGS, and TVA
Topography by USGS and TVA from aerial photographs by stereophotogrammetric methods
Field examination by Tennessee Valley Authority, 1946

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — U. S. Route — State Route

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
GN 0°49′ 15 MILS — MN 1° 18 MILS

SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

Contour interval 20 feet
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GEORGIA
QUADRANGLE LOCATION

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) and Alabama (East) rectangular coordinate systems
1000-meter Universal Transverse Mercator grid ticks, Zone 16, shown in blue

FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
U. S. TENNESSEE VALLEY AUTHORITY, CHATTANOOGA, TENN. 37401 OR KNOXVILLE, TENN. 37902
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

TRENTON, GA.-ALA.
101-SE
N3445-W8530/7.5
1946
PHOTOREVISED 1972
AMS 3853 I SE--SERIES V845

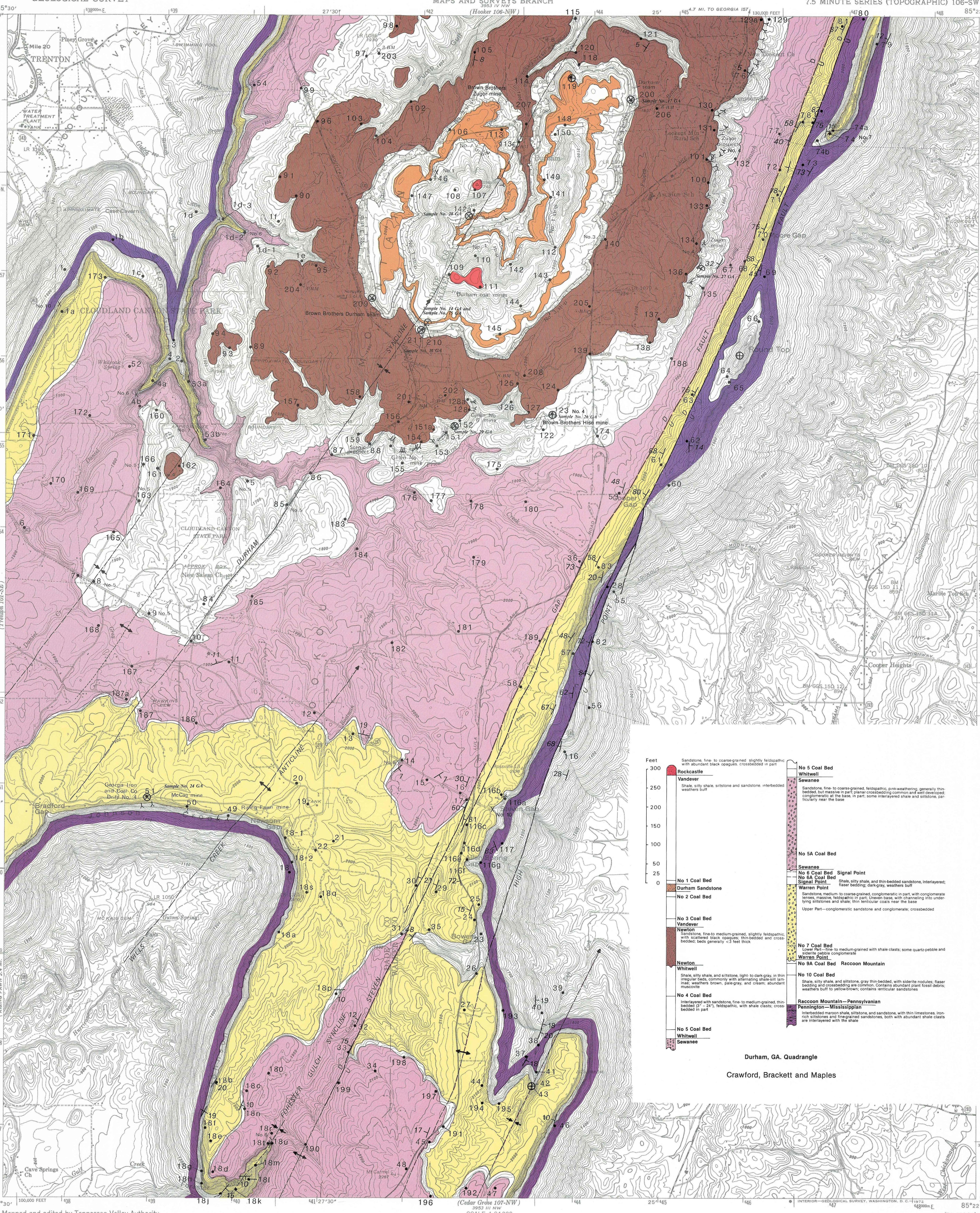
INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975

Plate No. 5

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

DURHAM QUADRANGLE
GEORGIA
7.5 MINUTE SERIES (TOPOGRAPHIC) 106-SW



Mapped and edited by Tennessee Valley Authority
Published by the Geological Survey

Control by USC&GS, USGS, GGS, and TVA

Topography by USGS by photogrammetric methods.
Map field checked by TVA, 1946

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) rectangular coordinate system
1000 meter Universal Transverse Mercator Grid ticks, Zone 16, shown in blue

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242,
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty	Poor motor road
Medium-duty	Wagon and jeep track
Light-duty	Foot trail
U. S. Route	State Route

DURHAM, GA.
N3445-W8522.5/7.5

1946
PHOTOREVISED 1969
AMS 3953 IV SW-SERIES V845

Plate No. 6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS DIVISION

ALABAMA-GEORGIA
SULPHUR SPRINGS QUADRANGLE
102-NE

Feet

- 300
- 250
- 200
- 150
- 100
- 50
- 25
- 0

No 5A Coal Bed

Sandstone, medium- to coarse-grained, conglomeratic sandstone, and quartz-pebble conglomerate; massive in the lower part, and conglomeratic

Sewanee

Signal Point
No 6 Coal Bed
Signal Point
Siltstone, shale, and thin-bedded sandstone, interbedded

Warren Point

Sandstone, fine- to coarse-grained, feldspathic; crossbedded in sets up to 20 feet thick; ranges from thin- and medium-bedded to massive. Channels 10's of feet deep contain massive conglomeratic sandstone and quartz-pebble conglomerate. Siderite-pebble conglomerate at lower contact
Thick shale lense developed north of Tatum Gulf

Warren Point
Raccoon Mountain
No 9A Coal Bed

Marine Fossil Zone
No 10 Coal Bed
Siltstone, shale, and fine-grained sandstone interlayered; bedding is irregular; clay clasts are common in the siltstone and sandstone

Raccoon Mountain—Pennsylvanian
Pennington—Mississippian

Shale, maroon and olive, very plastic, with thin iron-rich marine fossil debris zones; interbedded with shale, siltstone, and lenticular sandstones.

Limestone; dark-gray to red crinoid-blastoid-brachiopod packstone, with scattered chert nodules

Thick sandstone lenses (125 feet) with conglomerate lenses >25 feet thick developed in Pigeon Mountain.

Black shale with phosphatic pellets and abundant marine fossils mixed with plant debris near the top of the Pennington on Fox Mountain

Sulphur Springs, ALA.-GA., Cedar Grove, GA. and Estelle, GA. Quadrangles

Sulphur Springs by Crawford and Lumsden

Control by USC&GS, USGS, GGS, and TVA
Topography by USGS and TVA from aerial photographs by stereophotogrammetric methods
Field examination by Tennessee Valley Authority, 1946

ROAD CLASSIFICATION

Heavy-duty ——— Light-duty - - -
Medium-duty ——— Unimproved dirt = = = =
Interstate Route · U. S. Route · State Route

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Contour interval 20 feet
Occasional 10 foot contours shown by broken lines
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Polyconic projection. 1927 North American datum
10,000 foot grid based on Alabama (East) and Georgia (West) rectangular coordinate systems
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

SULPHUR SPRINGS, ALA.-GA.
102-NE
N3437.5-W8530/7.5
1946
AMS 3853 II NE—SERIES V844
PHOTOREVISED 1972

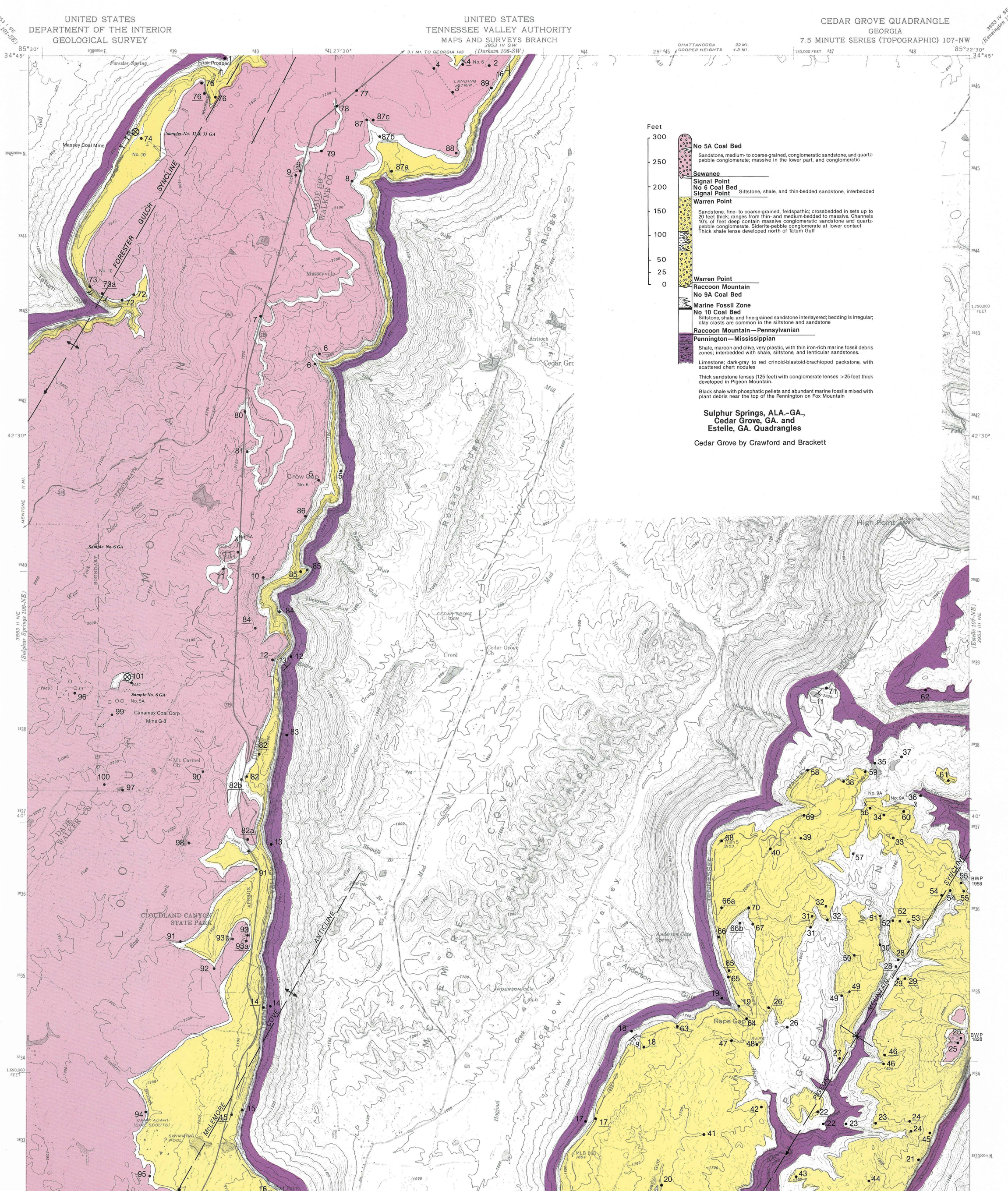
SCALE 1:24 000
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1975

Plate No. 7

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS BRANCH

CEDAR GROVE QUADRANGLE
GEORGIA
7.5 MINUTE SERIES (TOPOGRAPHIC) 107-NW



Feet
300
250
200
150
100
50
25
0

No 5A Coal Bed

Sandstone, medium- to coarse-grained, conglomeratic sandstone, and quartz-pebble conglomerate; massive in the lower part, and conglomeratic

Sewanee

Signal Point
No 6 Coal Bed
Signal Point Siltstone, shale, and thin-bedded sandstone, interbedded

Warren Point

Sandstone, fine- to coarse-grained, feldspathic; crossbedded in sets up to 20 feet thick; ranges from thin- and medium-bedded to massive. Channels 10's of feet deep contain massive conglomeratic sandstone and quartz-pebble conglomerate. Siderite-pebble conglomerate at lower contact
Thick shale lense developed north of Tatum Gulf

Warren Point

Raccoon Mountain
No 9A Coal Bed

Marine Fossil Zone
No 10 Coal Bed

Siltstone, shale, and fine-grained sandstone interlayered; bedding is irregular; clay clasts are common in the siltstone and sandstone

Raccoon Mountain—Pennsylvanian

Pennington—Mississippian

Shale, maroon and olive, very plastic, with thin iron-rich marine fossil debris zones; interbedded with shale, siltstone, and lenticular sandstones.

Limestone; dark-gray to red crinoid-blastoid-brachiopod packstone, with scattered chert nodules

Thick sandstone lenses (125 feet) with conglomerate lenses >25 feet thick developed in Pigeon Mountain.

Black shale with phosphatic pellets and abundant marine fossils mixed with plant debris near the top of the Pennington on Fox Mountain

Sulphur Springs, ALA.-GA., Cedar Grove, GA. and Estelle, GA. Quadrangles

Cedar Grove by Crawford and Brackett

Mapped and edited by Tennessee Valley Authority
Published by the Geological Survey

Control by USC&GS, USGS, and TVA

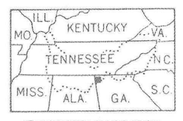
Topography by USGS and TVA by photogrammetric methods.
Map field checked by TVA, 1946

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West)
rectangular coordinate system
1000 meter Universal Transverse Mercator Grid ticks,
Zone 16, shown in blue

MN GN
½° 9 MILS 0°53' 16 MILS
UTM GRID AND 1969 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL



QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty	Poor motor road
Medium-duty	Wagon and jeep track
Light-duty	Foot trail
U. S. Route	State Route

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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CEDAR GROVE, GA.
N3437.5—W8522.5/7.5

1946

PHOTOREVISED 1969

AMS 3953 III NW-SERIES V845

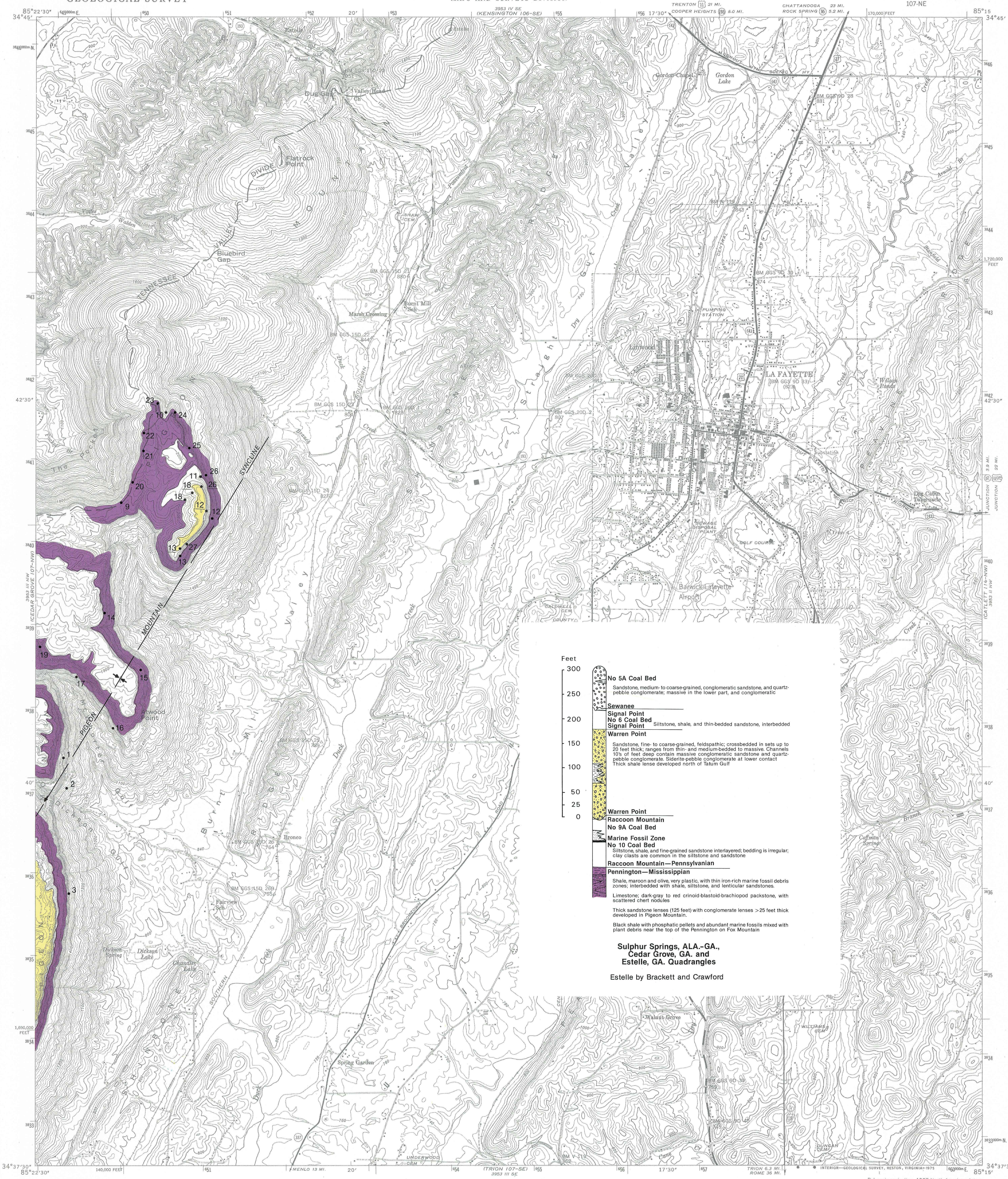
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972

Plate No. 8

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS DIVISION

GEORGIA
(WALKER COUNTY)
ESTELLE QUADRANGLE
107-NE



TRENTON 11 21 MI.
COOPER HEIGHTS 193 8.0 MI.
CHATTANOOGA 23 MI.
ROCK SPRING 95 5.2 MI.
3953 IV SE (KENSINGTON 106-SE)
Estelle
Dug Gap
Valley Head Ch
Flatrock Point
DIVIDE
TENNESSEE VALLEY
Bluebird Gap
Walden Br
Gordon Chapel
Gordon Lake
LOOKOUT MTN SCENIC HY
Marsh Crossing
Burnt Mill Sch
Straight Gut
Dry Creek
PUMPING STATION
Linwood
LA FAYETTE
Wilson Ponds
Log Cabin Tabernacle
SEWAGE DISPOSAL PLANT
GOLF COURSE
Barwick-Lafayette Airport
PIGEON MOUNTAIN SYNCLINE
Atwood Point
Dickson Gulf
Bronco
Fairview Sch
Dickson Spring
Dickson Lake
Chandler Lake
Spring Garden
Walnut Grove
WILLIAMS CEM
DUNCAN CEM
UNDERWOOD CEM
Coffman Spring
(CEDAR GROVE 107-NW) 3953 III NW
(CATLETT 114-NW) 3953 II NW
JUNCTION 95 3.9 MI.
JUNCTION 41 76 22 MI.
MENLO 13 MI.
(TRION 107-SE) 3953 III SE
TRION 6.3 MI.
ROME 36 MI.
INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1975
Feet
300
250
200
150
100
50
25
0
No 5A Coal Bed
Sandstone, medium- to coarse-grained, conglomeratic sandstone, and quartz-pebble conglomerate; massive in the lower part, and conglomeratic
Sewanee
Signal Point
No 6 Coal Bed
Signal Point
Siltstone, shale, and thin-bedded sandstone, interbedded
Warren Point
Sandstone, fine- to coarse-grained, feldspathic; crossbedded in sets up to 20 feet thick; ranges from thin- and medium-bedded to massive. Channels 10's of feet deep contain massive conglomeratic sandstone and quartz-pebble conglomerate. Siderite-pebble conglomerate at lower contact Thick shale lense developed north of Tatum Gulf
Warren Point
Raccoon Mountain
No 9A Coal Bed
Marine Fossil Zone
No 10 Coal Bed
Siltstone, shale, and fine-grained sandstone interlayered; bedding is irregular; clay clasts are common in the siltstone and sandstone
Raccoon Mountain—Pennsylvanian
Pennington—Mississippian
Shale, maroon and olive, very plastic, with thin iron-rich marine fossil debris zones; interbedded with shale, siltstone, and lenticular sandstones.
Limestone; dark-gray to red crinoid-blastoid-brachiopod packstone, with scattered chert nodules
Thick sandstone lenses (125 feet) with conglomerate lenses >25 feet thick developed in Pigeon Mountain.
Black shale with phosphatic pellets and abundant marine fossils mixed with plant debris near the top of the Pennington on Fox Mountain
Sulphur Springs, ALA.-GA., Cedar Grove, GA. and Estelle, GA. Quadrangles
Estelle by Brackett and Crawford

Control by USC&GS, USGS, and GGS
Topography by USGS and TVA from aerial photographs by stereophotogrammetric methods
Field examination by Tennessee Valley Authority, 1946

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

Contour interval 20 feet
Occasional 10 foot contours shown by broken lines
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
AND U. S. TENNESSEE VALLEY AUTHORITY, CHATTANOOGA, TENN. 37401 OR KNOXVILLE, TENN. 37902,
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, Zone 16, shown in blue

ROUTES USUALLY TRAVELED
HARD, IMPERVIOUS SURFACES
OTHER SURFACE IMPROVEMENTS
U. S. ROUTE
STATE ROUTE

ESTELLE, GA.
107-NE
N3437.5-W8515/7.5
1946
PHOTOREVISED 1972
AMS 3953 III NE—SERIES V845

Plate No. 9

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS DIVISION

ALABAMA-GEORGIA
VALLEY HEAD QUADRANGLE
102-SE

(Sulphur Springs 102-NE) (Cedar Grove 107-NW) (Dupont Valley 108-SW) (Dougherty Gap 107-SW)

Feet

300
250
200
150
100
50
25
0

Sandstone, medium- to coarse-grained, feldspathic, thin-bedded to massive; planar crossbedding in part

Newton
Whitwell

Shale, silty, dark-gray, flaser bedding; siltstone; and sandstone, fine- to medium-grained, thin-bedded

No 4 Coal Bed

No 5 Coal Bed
Whitwell
Sewanee

Sandstone, medium- to coarse-grained, feldspathic and slightly micaceous; thin- to medium-bedded, crossbedded

No 5A Coal Bed

Interbedded with conglomeratic sandstone and quartz-pebble conglomerate

The middle and lower parts are more conglomeratic, and contain thick massive conglomerate channel lenses; beds of gentle planar crossbeds are as thick as 15 feet

Sewanee
Signal Point
No 6 Coal Bed

Shale, silty, interbedded with siltstone

Signal Point
Warren Point

Sandstone, fine- to coarse-grained, feldspathic, conglomeratic; crossbedded in part, thin planar sets; generally thin- to medium-bedded; more massive in lower part; rubble zones fill basal channels

Warren Point
Raccoon Mountain
No 9A Coal Bed

Siltstone, greenish gray, weathers tan to buff; shaly in upper part; with thin sandstone lenses; sandstone more abundant in the lower part

No 10 Coal Bed

No 11 Coal Bed
Raccoon Mountain—Pennsylvanian
Pennington—Mississippian

Siltstone, greenish, weathers brown with "pinhead" orange spots; thin maroon and green shale in upper part

Calcareous siltstone, pale gray, weathers brown; mm-scale layering, but weathers massive; fine coal fragments

Limestone, sideritic and siliceous; gray, crystalline, with marine fossils

Sandstone, with marine and plant fossils

Dougherty Gap, GA. and Lyerly, GA. Quadrangles
Valley Head, ALA.-GA. and Jamestown, ALA.-GA. Quadrangles

Crawford, Knight and Lumsden

MN GN
1° 18 MILS
0°49' 15 MILS

UTM GRID AND 1983 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

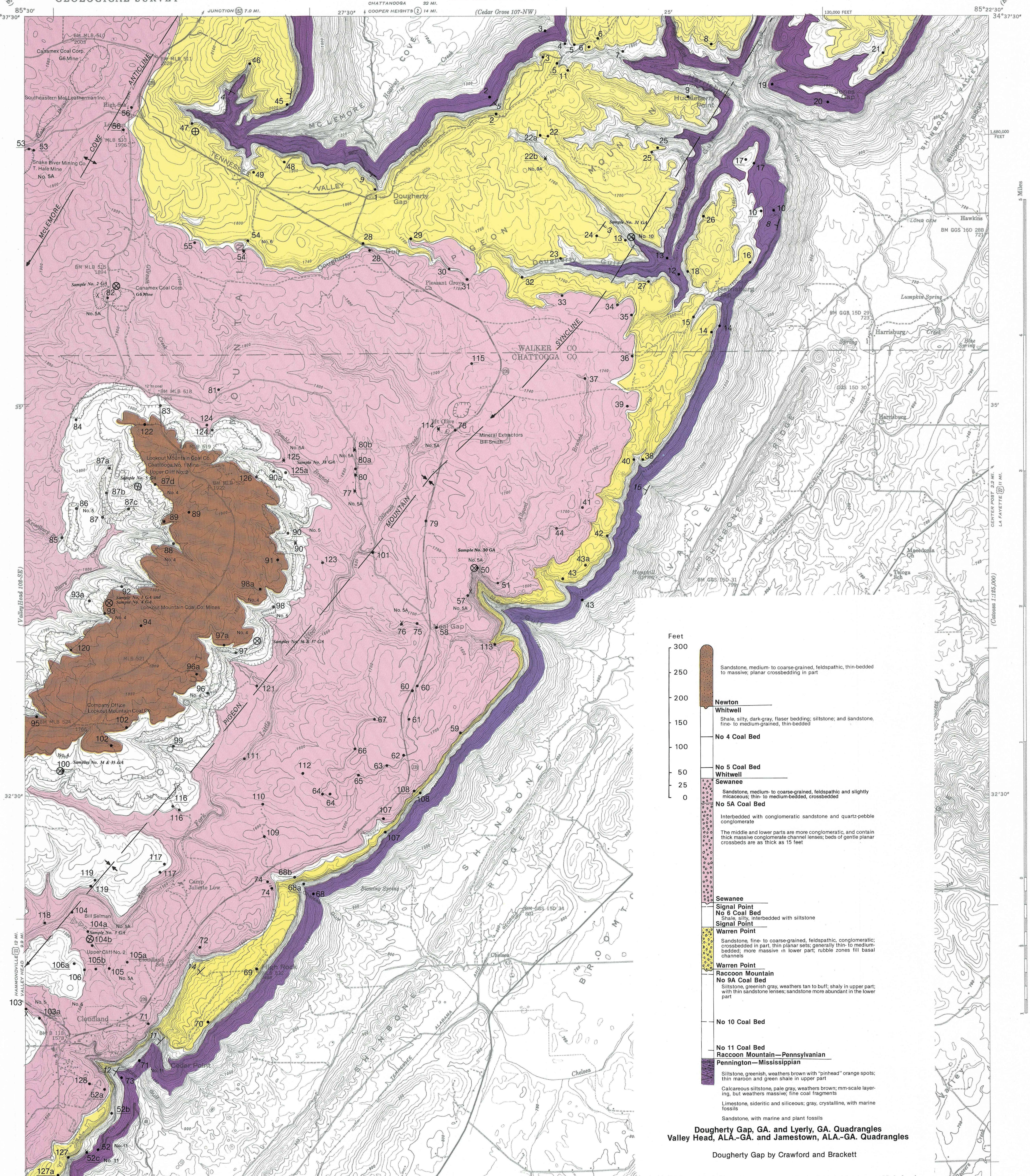
CONTOUR INTERVAL 20 FEET

Plate No. 10

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
TENNESSEE VALLEY AUTHORITY
MAPS AND SURVEYS DIVISION

GEORGIA
DOUGHERTY GAP QUADRANGLE
107-SW



(Sulphur Springs 102-NE)
(Estelle 107-NE)
(Cedar Grove 107-NW)
CHATTANOOGA 32 MI.
COOPER HEIGHTS 14 MI.
JUNCTION 157 7.0 MI.
McLEMORE COVE ANTICLINE
TENNESSEE VALLEY DIVIDE
PIGEON MOUNTAIN SYNCLINE
PIGEON MOUNTAIN
Dougherty Gap
Dougherty Gulf
Huckleberry Point
Jones Gap
Harrisburg Gap
Harrisburg
Lumpkin Spring
Blue Spring
Hawkins
WALKER CO
CHATTOOGA CO
SHINBONE VALLEY
SHINBONE RIDGE
Neal Gap
Cloudland
Cedar Point
High Rock
Camp Juliette Low
Blowing Spring
Chelsea
Macedonia Ch
Teloga Sch
Canamex Coal Corp. G6 Mine
Southeastern Met Leatherman Inc.
Snake River Mining Co. T. Hale Mine
Lookout Mountain Coal Co. Chattooga No. 1 Mine Upper Cliff No. 2
Lookout Mountain Coal Co. Mines
Company Office Lookout Mountain Coal Co.
Mineral Extractors Bill Smith
Bill Selman
Upper Cliff No. 2
Sample No. 1 GA and Sample No. 4 GA
Sample No. 2 GA
Sample No. 3 GA
Sample No. 5 GA
Sample No. 30 GA
Sample No. 31 GA
Samples No. 34 & 35 GA
Samples No. 36 & 37 GA
Sample No. 38 GA
(Valley Head 102-SE)
HAMMONDVILLE 11 12 MI.
VALLEY HEAD 9.9 MI.
CENTER POST 2.2 MI.
LA FAYETTE 27 11 MI.
(Catoosa 1:125,000)
(Rome 1:125,000)
MENLO 1.5 MI.
SUMMERVILLE 27 11 MI.
JUNCTION 48 1.5 MI.
Feet
300
250
200
150
100
50
25
0
Sandstone, medium- to coarse-grained, feldspathic, thin-bedded to massive; planar crossbedding in part
Newton
Whitwell
Shale, silty, dark-gray, flaser bedding; siltstone; and sandstone, fine- to medium-grained, thin-bedded
No 4 Coal Bed
No 5 Coal Bed
Whitwell
Sewanee
Sandstone, medium- to coarse-grained, feldspathic and slightly micaceous; thin- to medium-bedded, crossbedded
No 5A Coal Bed
Interbedded with conglomeratic sandstone and quartz-pebble conglomerate
The middle and lower parts are more conglomeratic, and contain thick massive conglomerate channel lenses; beds of gentle planar crossbeds are as thick as 15 feet
Sewanee
Signal Point
No 6 Coal Bed
Shale, silty, interbedded with siltstone
Signal Point
Warren Point
Sandstone, fine- to coarse-grained, feldspathic, conglomeratic; crossbedded in part, thin planar sets; generally thin- to medium-bedded; more massive in lower part; rubble zones fill basal channels
Warren Point
Raccoon Mountain
No 9A Coal Bed
Siltstone, greenish gray, weathers tan to buff; shaly in upper part; with thin sandstone lenses; sandstone more abundant in the lower part
No 10 Coal Bed
No 11 Coal Bed
Raccoon Mountain—Pennsylvanian
Pennington—Mississippian
Siltstone, greenish, weathers brown with "pinhead" orange spots; thin maroon and green shale in upper part
Calcareous siltstone, pale gray, weathers brown; mm-scale layering, but weathers massive; fine coal fragments
Limestone, sideritic and siliceous; gray, crystalline, with marine fossils
Sandstone, with marine and plant fossils
Dougherty Gap, GA. and Lyerly, GA. Quadrangles
Valley Head, ALA.-GA. and Jamestown, ALA.-GA. Quadrangles
Dougherty Gap by Crawford and Brackett

Reproduced by the U. S. Coast and Geodetic Survey 1947

Scale 1/24 000

1 ½ 0 1 2 Miles

5000 0 5000 10000 Feet

1 ½ 0 1 2 Kilometers

Contour interval 20 feet
Datum is mean sea level

TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1947

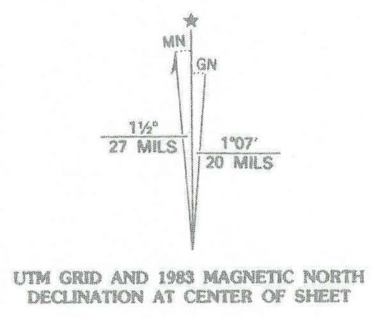
Polyconic projection. 1927 North American datum
10,000 foot grid based on Georgia (West) rectangular coordinate system

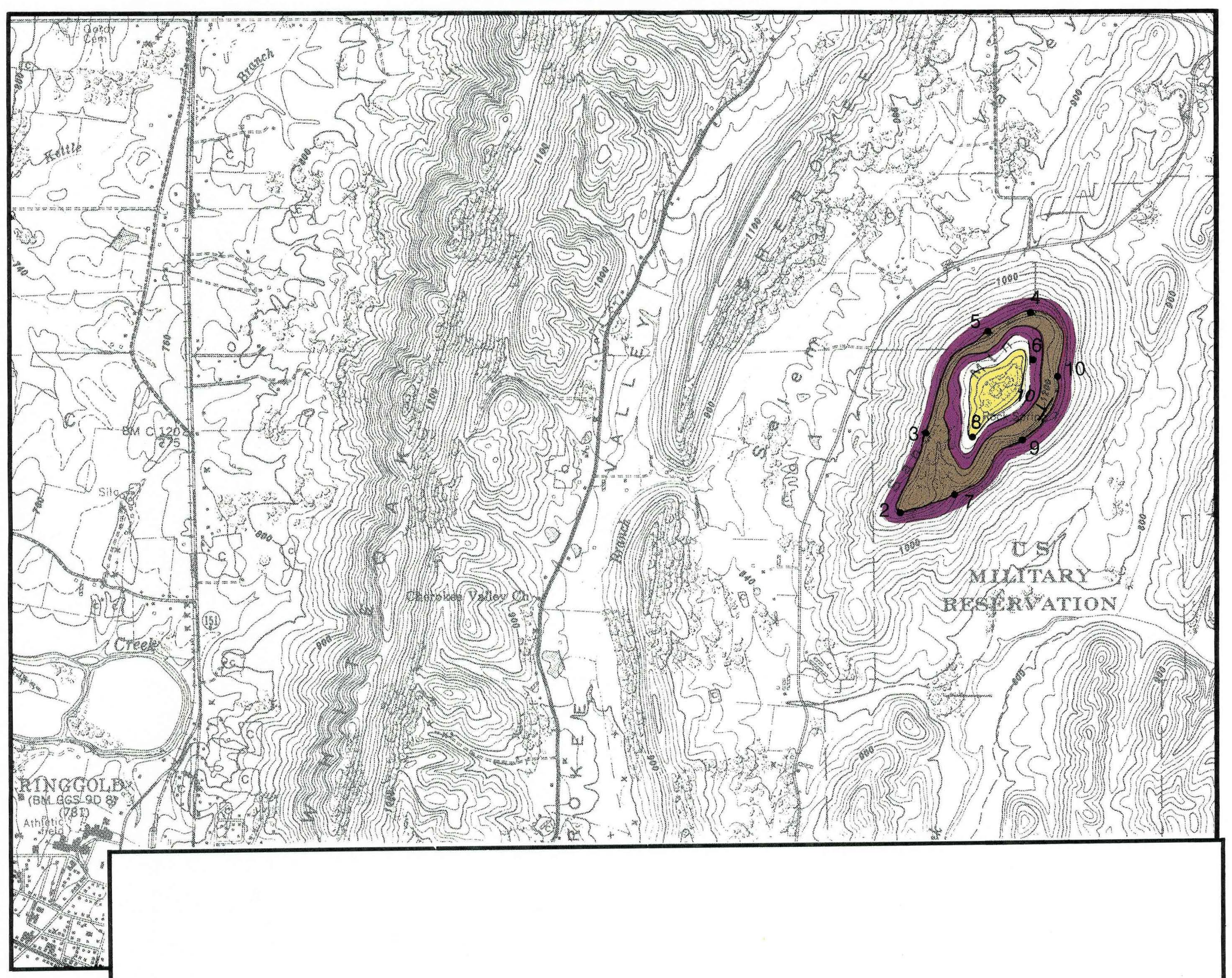
ROUTES USUALLY TRAVELED
HARD, IMPERVIOUS SURFACES
OTHER SURFACE IMPROVEMENTS
11 U. S. ROUTE
48 STATE ROUTE

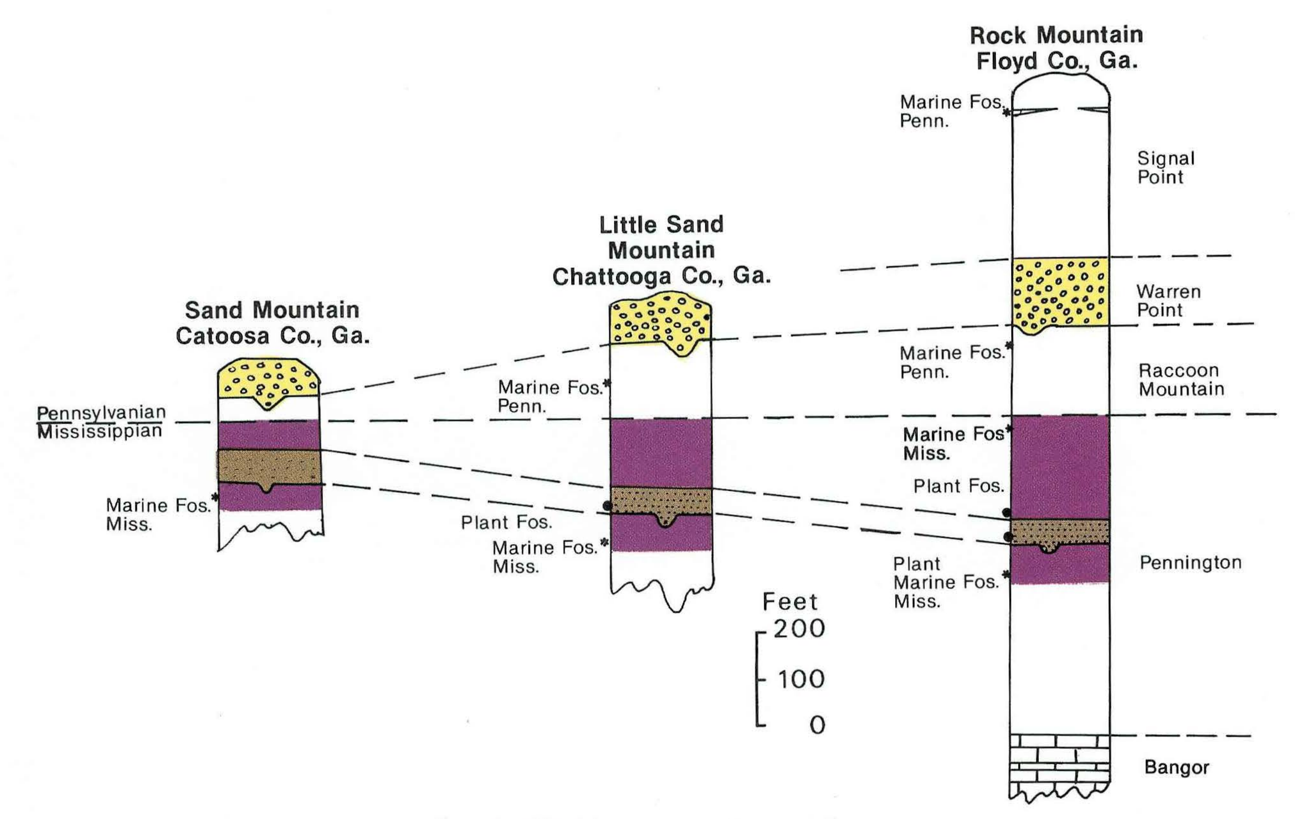
DOUGHERTY GAP, GA.
107-SW
Edition of 1947
N3430-W8522.5/7.5

Plate No. 11

RINGGOLD, GA QUADRANGLE

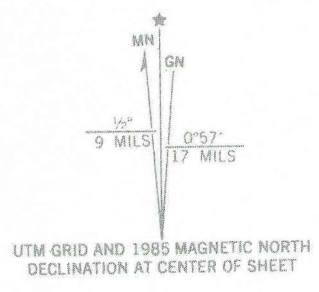


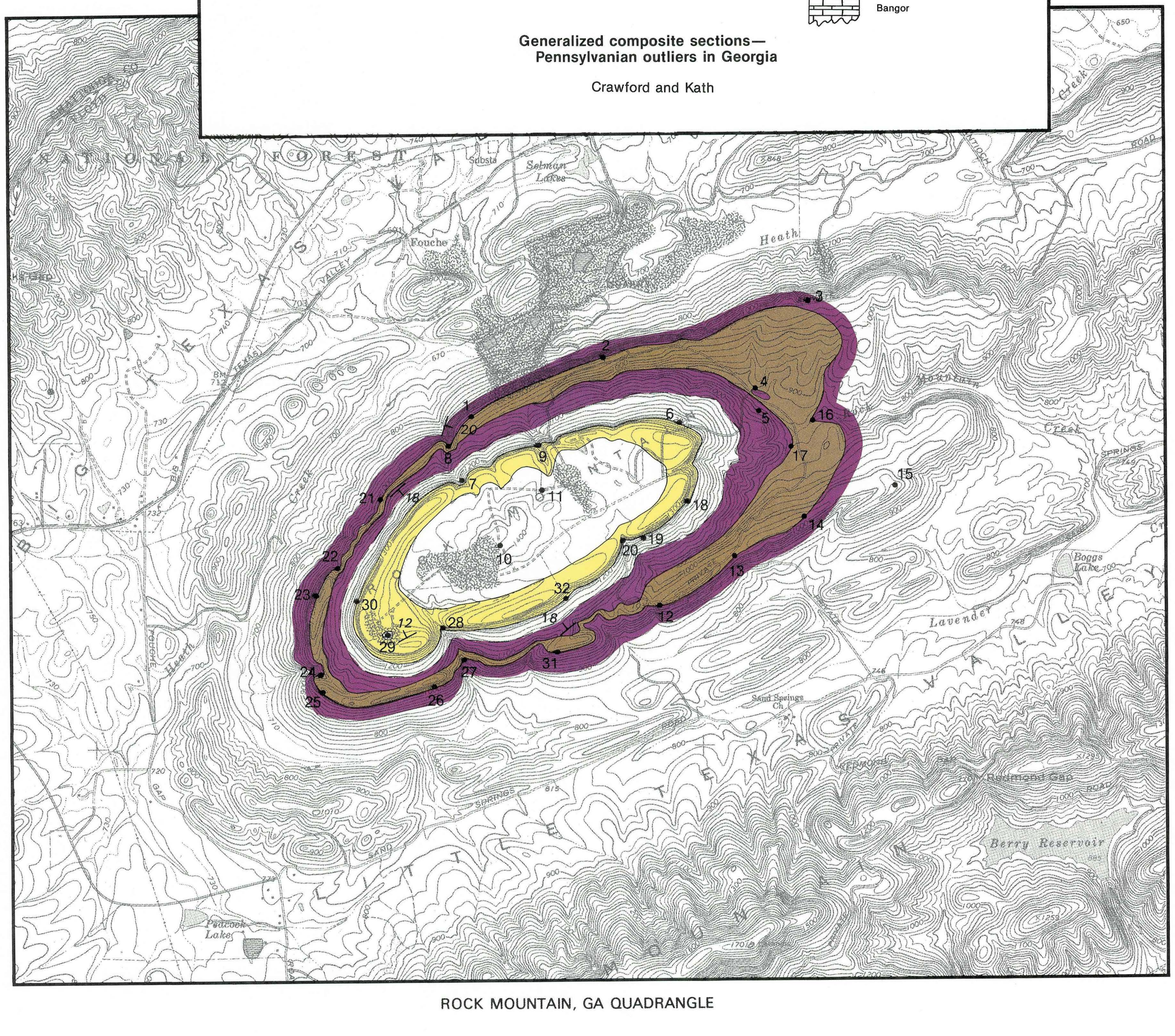




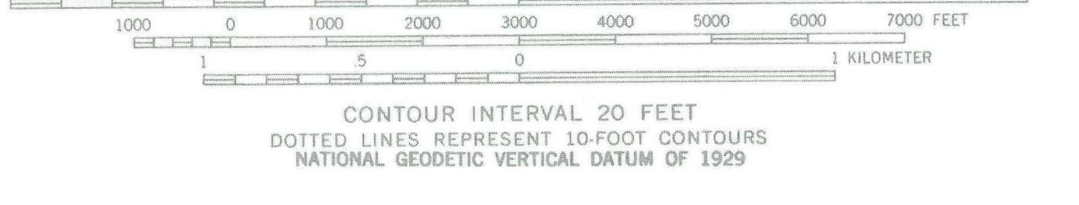
Generalized composite sections—
Pennsylvanian outliers in Georgia

Crawford and Kath





ROCK MOUNTAIN, GA QUADRANGLE

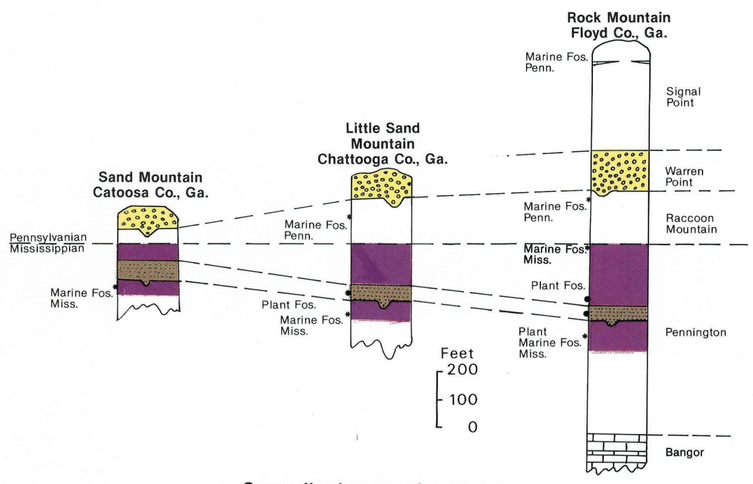


CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Plate No. 12

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBLIGNA QUADRANGLE
GEORGIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



**Generalized composite sections—
Pennsylvanian outliers in Georgia**

Crawford

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Georgia coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 16, shown in blue

UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Medium-duty ——— Light-duty ———
Unimproved dirt ==========

GEORGIA
QUADRANGLE LOCATION

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

SUBLIGNA, GA.
N3430—W8507.5/7.5

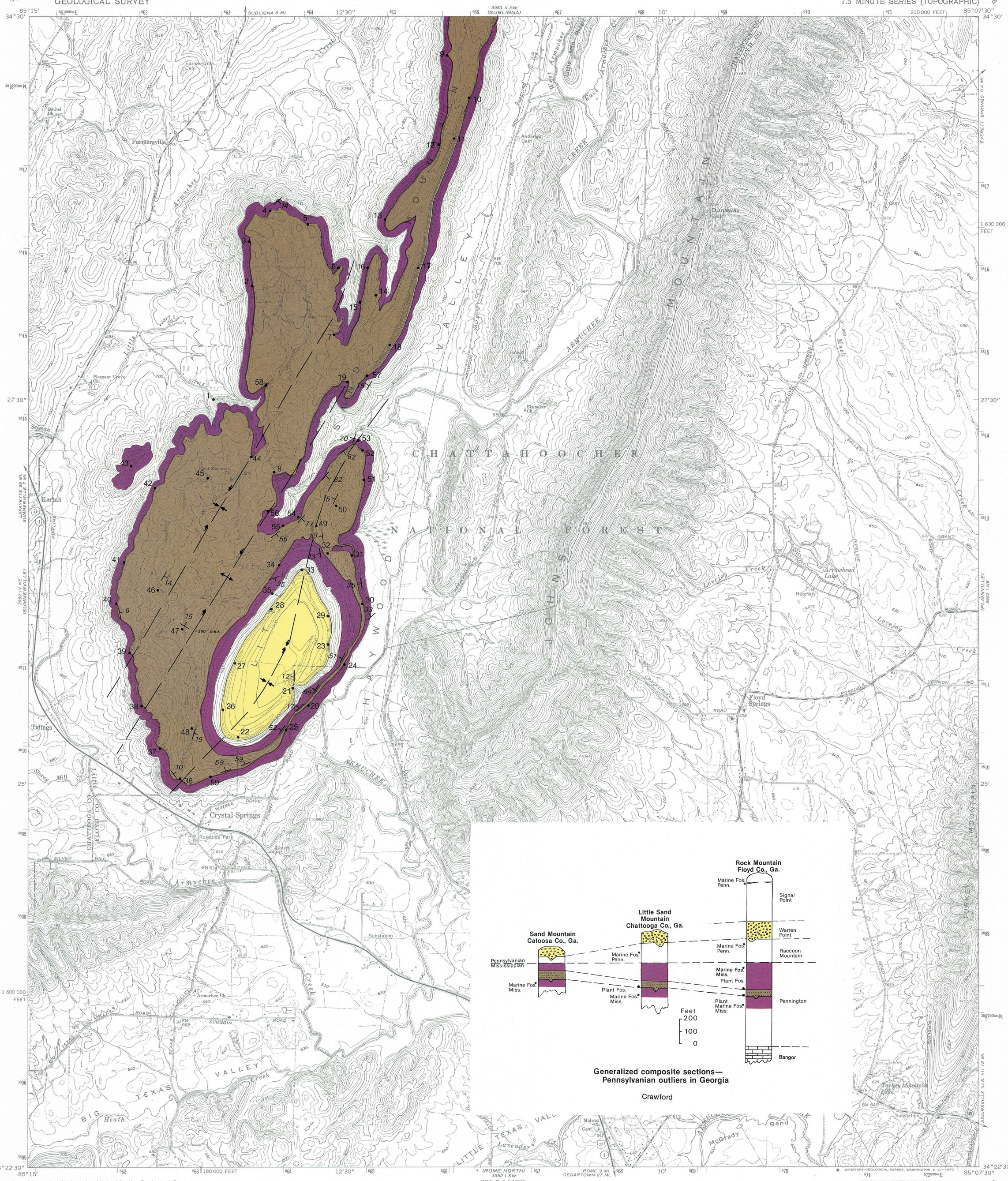
1967

AMS 3953 II SW—SERIES V845

Plate No. 13

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ARMUCHEE QUADRANGLE
GEORGIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1964. Field checked 1968

Polyconic projection. 1927 North American datum
10,000-foot grid based on Georgia coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks, zone 16, shown in blue

MN GN
1° 18 MILS
1°02' 18 MILS
UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

**Generalized composite sections—
Pennsylvanian outliers in Georgia**

Crawford

GEORGIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Primary highway, all weather, hard surface
Secondary highway, all weather, hard surface
Light-duty road, all weather, improved surface
Unimproved road, fair or dry weather
U. S. Route
State Route

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1970

ARMUCHEE, GA.
N3422.5—W8507.5/7.5

1968

AMS 3952 I NW—SERIES V845

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