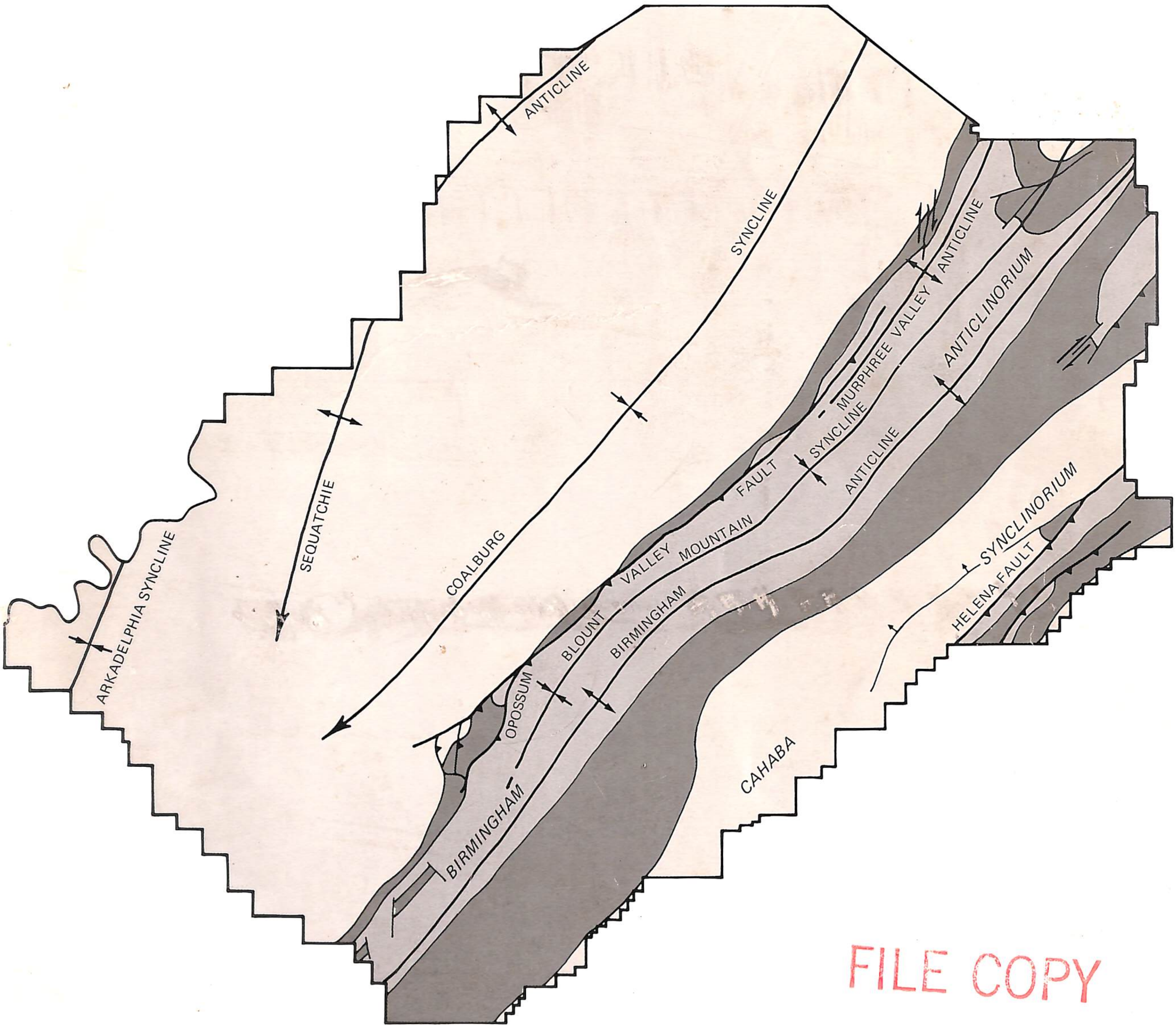
PRELIMINARY AREAL GEOLOGIC MAPS OF THE VALLEY AND RIDGE PROVINCE, JEFFERSON COUNTY, ALABAMA



GEOLOGICAL SURVEY OF ALABAMA ATLAS SERIES 10 1977

GEOLOGICAL SURVEY OF ALABAMA

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ATLAS SERIES 10

PRELIMINARY AREAL GEOLOGIC MAPS OF THE VALLEY AND RIDGE PROVINCE, JEFFERSON COUNTY, ALABAMA

By Jack T. Kidd and Samuel W. Shannon

This project was carried out as part of a cooperative program by Jefferson County, the City of Birmingham, U. S. Geological Survey and Geological Survey of Alabama.

UNIVERSITY, ALABAMA
1977

GEOLOGICAL SURVEY OF ALABAMA

University, Alabama
December 9, 1977

Honorable George C. Wallace
Governor of Alabama
Montgomery, Alabama

Dear Governor Wallace:

Transmitted herewith is a report entitled "Preliminary Areal Geologic Maps of the Valley and Ridge Province, Jefferson County, Alabama" by Jack T. Kidd and Samuel W. Shannon, which has been published as Atlas Series 10 of the Geological Survey of Alabama.

This report provides basic geologic data on the Valley and Ridge province in Jefferson County, including the greater Birmingham and adjacent areas. It is an important contribution to the geology of the state and information gained from this study will assist in future planning and more effective use of the natural resources of the area.

This report was made possible through the cooperative support of Jefferson County, the City of Birmingham, U. S. Geological Survey, and Geological Survey of Alabama.

Respectfully,

Thomas J. Joiner
State Geologist

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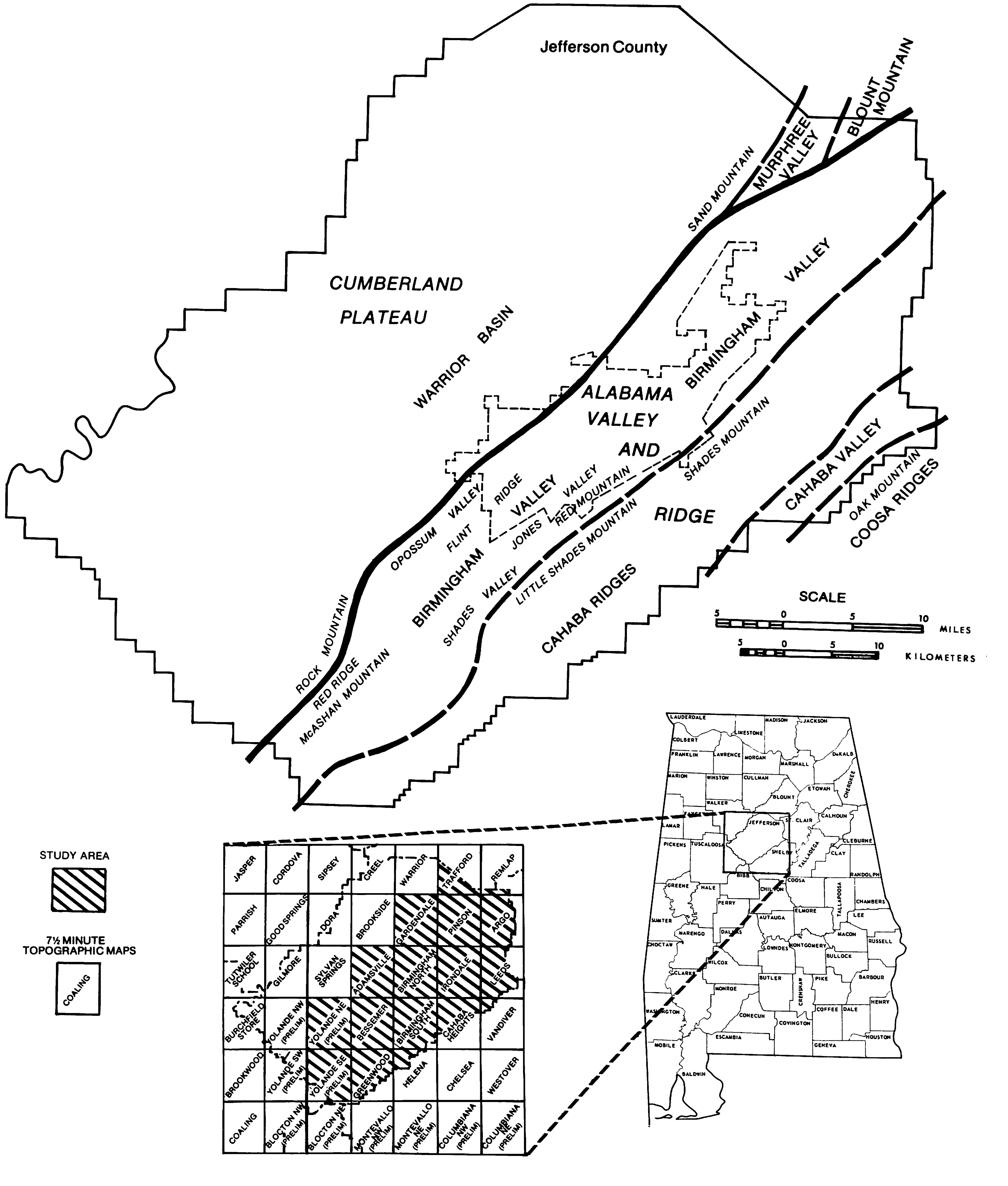


Figure. 1 —Index map of physiographic features of Jefferson County, Alabama and study area.

PRELIMINARY AREAL GEOLOGIC MAPS OF THE VALLEY AND RIDGE PROVINCE, JEFFERSON COUNTY, ALABAMA

By Jack T. Kidd and Samuel W. Shannon

ABSTRACT

The Valley and Ridge province in Jefferson County is underlain by more than 10,000 feet of sedimentary rocks that range in age from Cambrian to Holocene. Structurally, the province includes the Birmingham anticlinorium, Cahaba synclinorium, and the western edge of the Coosa synclinorium. The Birmingham anticlinorium and the Cahaba Valley area of the Cahaba and Coosa synclinoria are generally faulted and folded. The western part of the Cahaba synclinorium in Jefferson County is generally underlain by gently dipping rocks of the Pottsville and Parkwood Formations. Reconnaissance areal geology is presented on 7½-minute topographic base maps at a scale of 1:48,000 for the 17-quadrangle area. Field mapping was concentrated in the Birmingham and Cahaba Valleys, with adjacent areas compiled predominantly from previously published reports.

INTRODUCTION

This atlas includes geologic maps of the Valley and Ridge area of Jefferson County, Alabama, and brief descriptions of the rock types present. Areal geology is presented on 7½-minute topographic quadrangle maps at a scale of 1:48,000. The most recent relatively detailed geologic map covering the entire Birmingham Valley area was published in 1910 (Butts, 1910). Other, more recent maps are available but cover only parts of the Birmingham and Cahaba Valleys.

The principal areas covered by the maps are Birmingham and Cahaba Valleys in Jefferson County (fig. 1). In addition, areal geology of the surrounding areas within the county has been shown where coverage of the principal 17 quadrangles for the Birmingham and Cahaba Valleys extends into adjacent physiographic districts. Thus, the maps also provide general areal geologic data for parts of the Warrior Basin, Murphree Valley, Blount Mountain, Cahaba Ridges, and Coosa Ridges physiographic districts. The principle structural features that occur in Jefferson County are shown on a generalized geologic map (fig. 2).

The accompanying maps were compiled from data obtained through field observations. Published data were utilized where compatible with the authors' observations and interpretations. Field work was carried out from November 1976 through August 1977, using 7½-minute topographic quadrangle maps at a scale of 1:24,000 as bases for mapping.The maps are considered preliminary in nature and subject to future revision as the Geological Survey acquires more data. The Birmingham and Cahaba Valley areas in Jefferson County are covered by 19 7½-minute topographic quadrangle maps (fig. 3). This study, however, does not include the Montevallo NW and Blocton NE quadrangles, as their combined coverage of Jefferson County is less than 1.2 square miles.

ACKNOWLEDGMENTS

The authors gratefully acknowledge their appreciation to Drs. George F. Brockman and Denny Bearce of the University of Alabama in Birmingham for comments concerning the geologic maps. Acknowledgment is also due Dr. William G. Hooks and Mr. Thomas A. Simpson of the University of Alabama for information provided during this investigation.

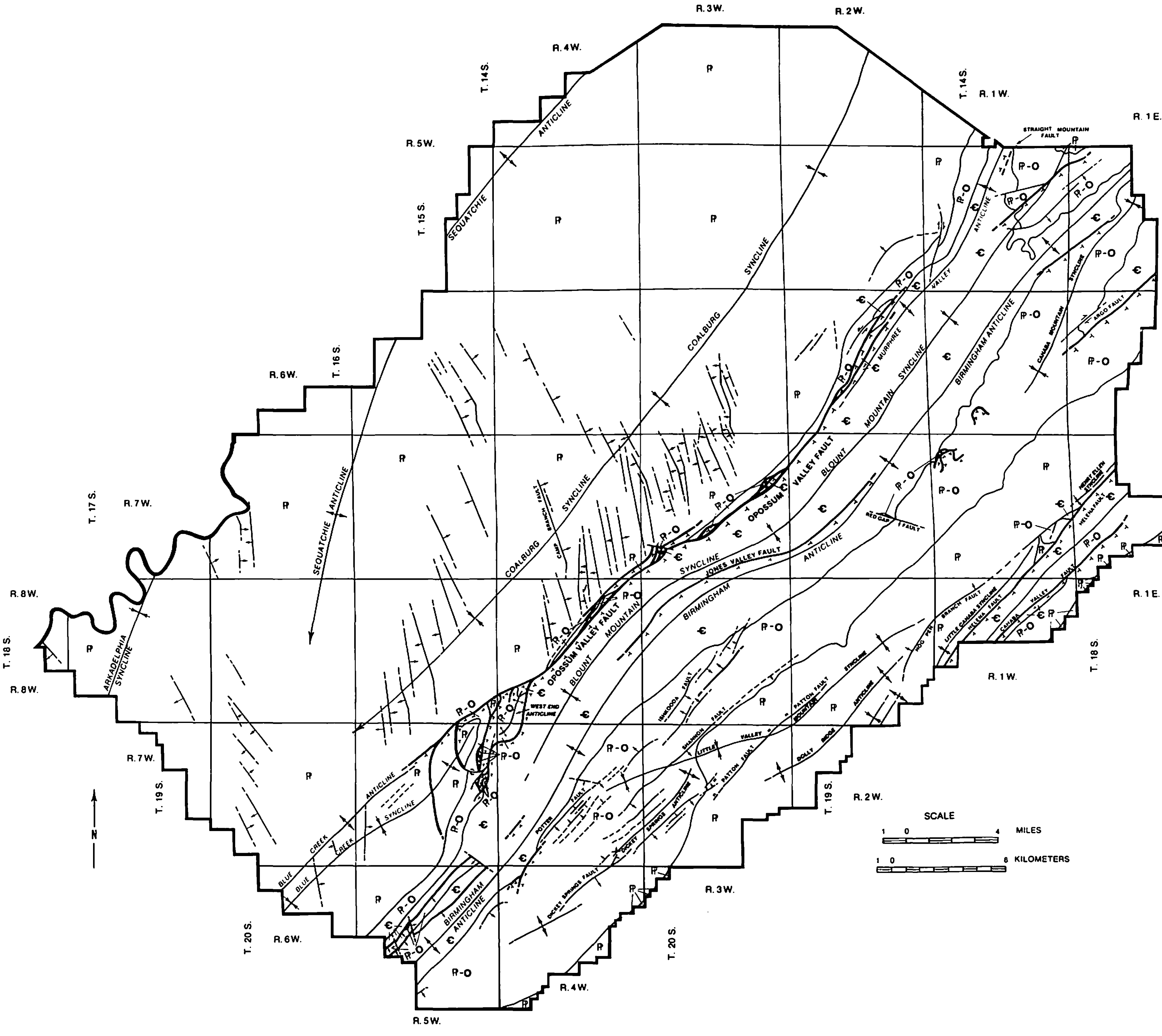
PREVIOUS INVESTIGATIONS

McCalley (1898) mapped the outcropping coal seams in the Warrior basin, including western Jefferson County. Although McCalley does not identify any structural features, the outcrop patterns of the coal seams clearly indicate major structural features such as the Sequatchie and Blue Creek anticlines. One of the most comprehensive geologic investigations in the Birmingham area was by Charles Butts (1910). Burchard and Butts (1910) studied the iron ores, fuels, and fluxes in the Birmingham area, and included a geologic map of the Birmingham Valley. A general discussion of numerous geologic exposures in Jefferson County is given in *The Paleozoic Rocks* (Butts, 1926). Butts discussed the paleontology, structure, and distribution of Paleozoic rock units throughout north Alabama including Jefferson County. A description of the geology in the southeastern part of the county is included in *Bessemer and Vandiver Quadrangles* by Butts (1927). A generalized structural map of parts of the Warrior and Cahaba coal fields by Semmes (1929) includes Jefferson County and illustrates the numerous faults mapped in the coal producing areas of central Alabama. Simpson (1965) studied ground-water problems associated with iron ore mining in the Birmingham area and included a geologic map of a part of southeast Jefferson County. Thomas (1972) described the Mississippian rock units in the county.

PHYSIOGRAPHIC SETTING

Jefferson County is located in two physiographic sections: the Alabama Valley and Ridge in the southeastern half of the county and the Cumberland Plateau in the northwestern half. The Alabama Valley and Ridge section includes Birmingham Valley, Cahaba Ridges, Cahaba Valley, and Coosa Ridges and consists of northeast-southwest trending valleys and ridges. The Cumberland Plateau section includes the Warrior Basin district in the northwestern half of the county and the southern parts of Murphree Valley and Blount Mountain districts in the northeastern part of the county. The Cumberland Plateau section is characteristically a dissected plateau of moderate relief (Sapp and Emplaincourt, 1975).

The Birmingham Valley trends northeast-southwest, is about 45 miles long,and from 3 to 7 miles wide. The valley terminates south of the Tuscaloosa-Bibb-Jefferson County boundaries where it is covered by Coastal Plain sediments. The northern end of the valley merges with Big Canoe Valley near the Jefferson-St. Clair County boundary. Birmingham Valley is bounded on the northwest by an escarpment formed by the Pottsville Formation. The escarpment is known locally as Rock Mountain to the south and Sand Mountain to the north. The northern part of Birmingham Valley is bounded by the southeastern side of Blount Mountain and the southern end of Murphree Valley. The southeastern side of Birmingham Valley is bounded by escarpments formed by the Parkwood and Pottsville Formations. In the



EXPLANATION

Pennsylvanian	P	Pottsville Formation
Pennsylvanian to Ordovician	P-O	Parkwood Formation, Floyd Shale, Bangor Limestone, Hartselle Sandstone, Pride Mountain Formation, Tuscumbia Limestone, Fort Payne Chert, Maury Formation, Chattanooga Shale, Frog Mountain Sandstone, Red Mountain Formation, Chickamauga Limestone, Attalla Chert Conglomerate Member of Chickamauga Limestone, and Ordovician undifferentiated
Cambrian (includes some Early Ordovician rocks in the Cahaba Valley)	Є	Knox Group undifferentiated, Ketona Dolomite, Conasauga Formation, and Rome Formation

(Cretaceous and Holocene deposits occur locally but are not shown)

Anticlinal axis

Anticlinal axis showing direction of plunge

Synclinal axis

Synclinal axis showing direction of plunge

Normal fault, arrow on downthrown side

Thrust fault, T on upper plate

Fault, showing relative horizontal movement

Reverse fault, R on upthrown side

Contact

Dashed where inferred

Figure 2.—Generalized geologic map of Jefferson County.

eastern part of the valley, this escarpment is known locally as Little Shades Mountain. Near the east-central part of the valley, Little Shades Mountain becomes topographically indistinct, and Shades Mountain forms the eastern boundary of Birmingham Valley. The central part of Birmingham Valley is separated into two smaller valleys by Flint Ridge. Opossum Valley lies to the west of Flint Ridge and Jones Valley to the east.

Red Mountain, located along the eastern side of the Birmingham Valley, is so named for the characteristic red soil and rocks of the iron-bearing Red Mountain Formation which crop out along the crest.

The Cahaba Valley in eastern Jefferson County (fig. 1) is separated from Birmingham Valley by the Helena fault and Cahaba Ridges. The Helena fault marks the western edge of a long narrow valley developed upon the shales of the Rome Formation. The Cahaba Ridges are northwest of the Helena fault and are a group of parallel linear ridges trending northeast-southwest formed by resistant sandstones of the Pottsville and Parkwood Formations. Valleys between the ridges are underlain by less-resistant shales of the Pottsville and Parkwood.

Cahaba Valley in Jefferson County is about 10 miles long and from 2 to 3 miles wide. The valley is drained by the Cahaba River and its tributaries and is underlain by mostly non-resistant carbonate and shale beds ranging in age from Cambrian to Mississippian. The rocks in the valley are highly folded and faulted.

The Cahaba Valley is bounded on the southeast by Oak Mountain which is one of a group of northeast-southwest trending nearly parallel linear ridges located southeast of Cahaba Valley that are known collectively as the Coosa Ridges. Oak Mountain is a prominent escarpment underlain by resistant sandstone of the Pottsville and Parkwood Formations. Valleys between the Coosa Ridges are underlain by soft shales of the Pottsville and older formations.

Blount Mountain, Murphree Valley, and the Warrior Basin districts are located in northern and western Jefferson County and lie within the Cumberland Plateau section. Blount Mountain is underlain by gently dipping beds of the Pottsville Formation and is a prominent steep-sided dissected upland. In Jefferson County, Blount Mountain is bounded on the south and southeast by Birmingham Valley and on the west by Murphree Valley. The southern end of Murphree Valley extends into northern Jefferson County and merges with the Birmingham Valley. Murphree Valley is a faulted anticlinal valley that contains inner valleys underlain by soluble carbonate rocks, and ridges underlain by beds of sandstone and chert. Murphree Valley is bounded on the west by Sand Mountain. The Warrior Basin is a dissected upland developed upon gently dipping beds of the Pottsville Formation.

GENERAL GEOLOGY

The Valley and Ridge area of Jefferson County is underlain by sedimentary rocks including sandstone, shale, limestone, dolomite and chert. Unconsolidated deposits of sand, clay, and gravel also occur. These rocks range in age from Cambrian to Holocene and their total thickness exceeds 10,000 feet. From an economic standpoint, these rocks are important as a source of coal, iron ore, fluxes, aggregate, building stone, brick clay, cement, sand, and gravel. Also, these rocks are important as aquifers of ground water. Structurally, the rocks of Jefferson County range from gently dipping rocks in the west to highly faulted and folded rocks in the east.

ROME FORMATION

The Rome Formation is about 500 feet thick and consists of greenish-gray and grayish-red shale with rare thin beds of argillaceous limestone, chert and sandstone. The Rome crops out only in the Cahaba Valley in a thin belt adjacent to the Helena thrust fault.

CONASAUGA FORMATION

The Conasauga Formation consists of thin-bedded, dark- to brownish-gray sublithographic limestone, light-olive to medium-gray shale, and brownish-gray dolomite. Chert locally occurs in the residuum as thin prismatic fragments. The Conasauga is estimated to be 1,100 to 1,900 feet thick and occurs throughout Jones and Opossum Valleys but is absent in the Cahaba Valley (Butts, 1910).

KETONA DOLOMITE

The Ketona consists of 400 to 600 feet of relatively pure chert-free light-brownish-gray to yellowish-gray, crystalline, thick-bedded dolomite with lesser amounts of brownish-gray dolomite occurring near the contact with the underlying Conasauga Formation. The Ketona is present throughout the Cahaba and Opossum Valleys, and Jones Valley north of McCalla; south of the McCalla area the Ketona is absent.

KNOX GROUP UNDIFFERENTIATED

The Knox Group consists of medium- to light-gray, thick-bedded cherty dolomite with lesser amounts of limestone and dolomitic limestone. The Knox generally weathers to irregular boulders and fragments of light-gray to grayish-pink chert and is generally unfossiliferous, although cryptozoans and gastropods occur locally. The Knox occurs throughout Jones, Opossum, and Cahaba Valleys and is estimated to be approximately 2,000 feet thick in the Birmingham area (Butts, 1926), where it consists primarily of the Copper Ridge Dolomite. In the Cahaba Valley, the Knox Group consists of, in ascending order, the Copper Ridge Dolomite, Chepultepec Dolomite, Longview Limestone and Newala Limestone. The Copper Ridge and Chepultepec are mapped as Knox Group undifferentiated, and the Longview and Newala are mapped with the overlying Ordovician undifferentiated.

ORDOVICIAN UNDIFFERENTIATED

This unit occurs only in the Cahaba Valley and is composed of about 1,000 feet of medium-bedded, light- to dark- to very dark-gray sublithographic to very coarse crystalline limestone that is fossiliferous and/or cherty in part. This interval has been subdivided by some previous authors into as many as five separate formations based on color, fossil content, and chert content. Because of the lack of exposures, maps in this Atlas indicate these rocks as one lithologic unit. The lower part of this unit includes the undifferentiated Newala Limestone and Longview Limestone of the upper part of the Knox Group.

ATTALLA CHERT CONGLOMERATE MEMBER: CHICKAMAUGA LIMESTONE

The Attalla Chert Conglomerate Member at the base of the Chickamauga Limestone occurs in scattered areas in the region, primarily in Jones Valley, and consists of two lithofacies: a light-gray to light-brownish-gray, very coarse grained, angular chert and quartz sandstone; and a reddish-orange, coarse conglomerate composed of well-rounded chert clasts up to 12 inches in diameter in a matrix of finer grained, angular to subrounded chert fragments. These two lithofacies are locally gradational, as at Ward Park in Green Springs, but the two types are generally segregated. Bedding features are generally absent, but exposures along Five Mile Creek in the SW corner of sec. 25, T. 16 S., R. 2 W., show well-developed graded bedding and cross bedding. Where present, the average thickness of the Attalla is about 20 feet and the maximum thickness is 50 feet.

CHICKAMAUGA LIMESTONE

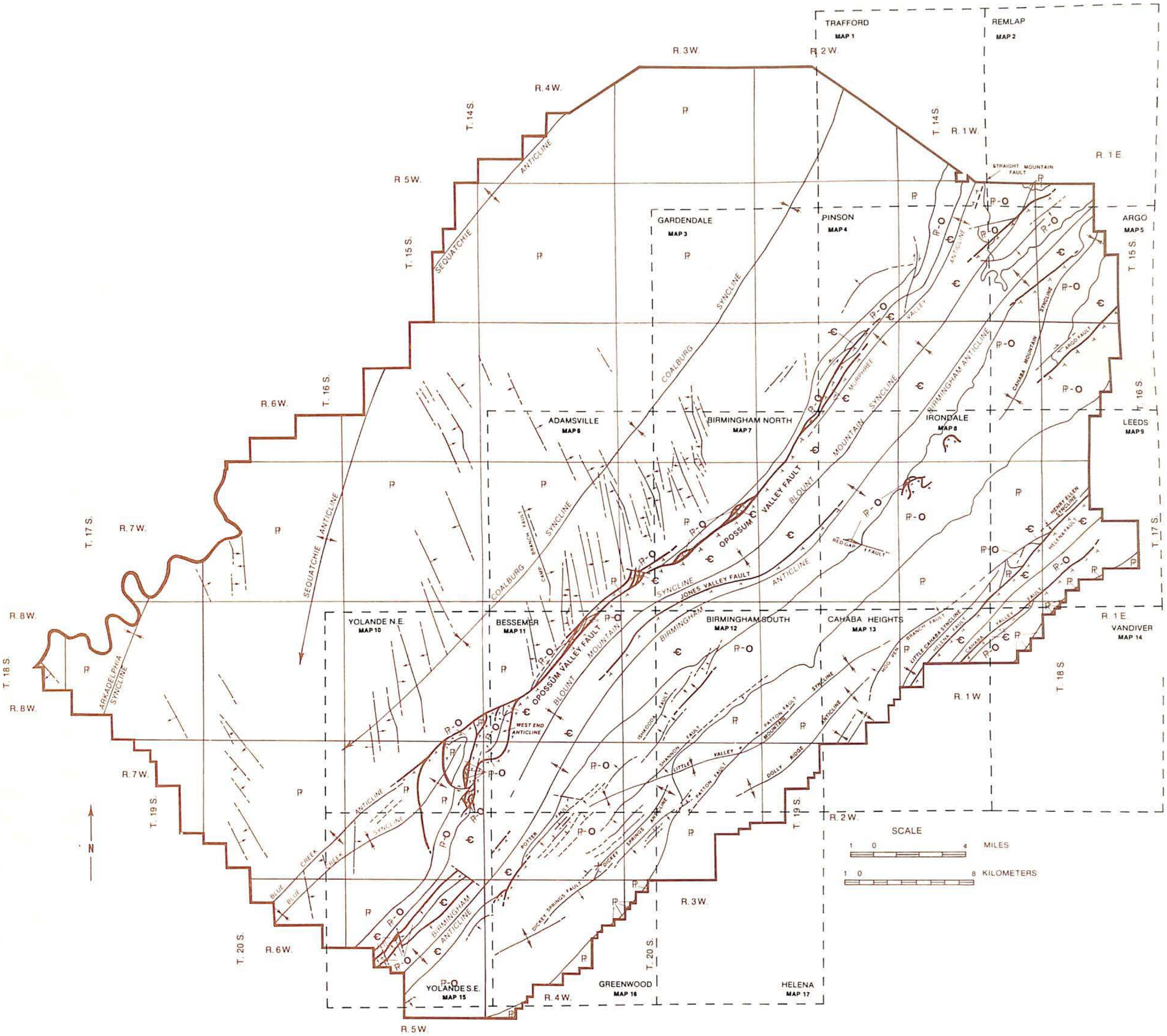
The Chickamauga Limestone consists of 200 to 500 feet of thin- to medium-bedded, sublithographic, fossiliferous limestone with some argillaceous and crystalline limestone, shale and rare bentonite? interbeds. The limestone is reddish- to greenish-gray near the base but the remainder is light-gray to bluish-gray. Bryozoans, brachiopods, and corals are the most abundant fossils in the formation. The best exposures in the county are in the abandoned quarries on Red Mountain adjacent to Gate City. The Chickamauga does not occur in the Cahaba Valley, but the upper part of the Ordovician undifferentiated may be a time equivalent.

RED MOUNTAIN FORMATION

The Red Mountain Formation consists of 200 to 500 feet of dark-reddish-brown to olive-gray siltstone, sandstone, and shale with hematite beds 5 to 30 feet thick. Thin beds of limestone may be present. The Red Mountain Formation is present throughout Jones and Opossum Valleys, but is absent east of the Helena fault in the Cahaba Valley.

FROG MOUNTAIN SANDSTONE AND CHATTANOOGA SHALE

The Frog Mountain Sandstone is older than the Chattanooga Shale and consists of 4 to 27 feet of medium- to thick-bedded, dusky-red and light- to dark-gray, coarse-grained hematitic sandstone, and light- to dark-gray hematitic sandstone and pebble conglomerate. The Chattanooga Shale is generally absent on the west side of the Birmingham Valley, and occurs sporadically along the eastern side. It consists of up to 20



EXPLANATION

Pennsylvanian	₽	Pottsville Formation
Pennsylvanian to Ordovician	₽-O	Parkwood Formation, Floyd Shale, Bangor Limestone, Hartselle Sandstone, Pride Mountain Formation, Tuscumbia Limestone, Fort Payne Chert, Maury Formation, Chattanooga Shale, Frog Mountain Sandstone, Red Mountain Formation, Chickamauga Limestone, Attalla Chert Conglomerate Member of Chickamauga Limestone, and Ordovician undifferentiated
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(Cretaceous and Holocene deposits occur locally but are not shown)

Anticlinal axis

Anticlinal axis showing direction of plunge

Synclinal axis

Synclinal axis showing direction of plunge

Normal fault, arrow on downthrown side

Thrust fault, T on upper plate

Fault, showing relative horizontal movement

Reverse fault, R on upthrown side

Contact

Dashed where inferred

Figure 3.—Index to geologic maps.

feet of brownish-black, silty, fissile shale with a few thin sandstone interbeds.

MAURY FORMATION, FORT PAYNE CHERT, AND TUSCUMBIA LIMESTONE

The Maury Formation is overlain by the Fort Payne Chert and consists of 1 to 3 feet of greenish-gray to grayish-red, thinly laminated shale that commonly contains phosphate nodules. The Maury occurs sporadically throughout the Birmingham area, and, because of its limited thickness, it is mapped with the overlying Fort Payne and Tuscumbia. The Fort Payne Chert in most exposures is highly weathered and consists of 90 to 200 feet of grayish-orange to light-gray bedded fossiliferous chert. In the northern part of the county, unweathered Fort Payne consists of dark-gray sublithographic limestone and dense dark-gray chert. Chert beds in the Fort Payne are distinct and range in thickness from a few inches to 2 feet, with irregular to smooth bedding surfaces that are commonly separated by thin shaly zones. The most characteristic fossils are crinoid columnals, brachiopods, and corals.

The Tuscumbia Limestone overlies the Fort Payne Chert and consists of thick bedded, medium-dark- to medium-gray, crystalline, oolitic, sublithographic, and bioclastic limestone that locally contains minor amounts of chert. Reported thicknesses of the Tuscumbia range from 80 feet at Vann's Quarry near Trussville (Butts, 1926) to approximately 70 feet in the Greenwood area (Newton, Copeland, and Scarbrough, 1973). The Tuscumbia does not occur in the Cahaba Valley and is rarely exposed in the Birmingham area; it has been included on the maps with the Fort Payne and Maury Formations.

PRIDE MOUNTAIN FORMATION

The Pride Mountain Formation consists of 100 to 350 feet of dark-gray fissile clay shale with locally occurring thin beds of siltstone or fine-grained quartzose sandstone, and a basal bed of oolitic limestone up to 8 feet thick. Siderite nodules and marine invertebrate fossils are common at some localities. The formation is generally poorly exposed; however, good exposures can be seen at Vann's Quarry north of Trussville. Where the overlying Hartselle Sandstone is absent, the Pride Mountain Formation is indistinguishable from the Floyd Shale and is mapped as a part of that unit.

HARTSELLE SANDSTONE

The Hartselle Sandstone is composed mainly of clean, well-sorted, light-colored, very fine- to medium-grained, cross-bedded, quartz sandstone which weathers to a sandy soil. Two main lithofacies are present in Jefferson County: a medium- to very thick-bedded, fine- to medium-grained orthoquartzite is predominant in the Birmingham Valley; and mainly thin- to medium-bedded, very fine- to fine-grained, partly argillaceous sandstone in the Cahaba Valley. The Hartselle thins to the southwest in both valleys and is absent near the county boundary. Where present, the Hartselle is as much as 120 feet thick.

BANGOR LIMESTONE

The Bangor Limestone consists of medium- to medium-light-gray, medium-bedded, primarily bioclastic or oolitic, limestone. Beds of argillaceous and sublithographic limestone and shale occur locally. The Bangor is more than 500 feet thick in the subsurface in the northwest part of the county (Thomas, 1972), thins to the southwest, and pinches out in the southwestern part of the Birmingham Valley. The Bangor is not exposed in the Cahaba Valley. Outcrops rarely exceed 150 feet in thickness as the formation readily weathers to a dark-brown soil. The best exposures in the county are in the abandoned quarries 1 mile southwest of Trussville and along the railroad track at the northeast end of Norris Railroad Yards in Irondale.

FLOYD SHALE

The Floyd Shale consists of 500 to 600 feet of dark-gray clay shale with locally occurring thin beds of siltstone. Outcrops are rare as the Floyd readily weathers to a brown or light-gray massive clay. Floyd Shale has been extensively mined for use in the ceramics industry 2 miles west of Greenwood and at Leeds.

PARKWOOD FORMATION

The Parkwood Formation is composed of interbedded sandstone, shale and mudstone. The sandstone is light to medium gray, very fine to fine grained, argillaceous, micaceous, and locally cross-bedded and ripple-marked. Sandstone beds range from less than 1 inch to 6 feet thick. Upon weathering, the sandstones become reddish-brown and commonly exhibit spheroidal weathering. Shales and mudstones in the Parkwood are medium to dark gray and commonly micaceous. Shale beds range from thin and fissile to massive, and generally weather brownish gray. The formation thickens to the southwest, ranging from about 1,400 feet in the Trussville area to over 2,400 feet south of Greenwood.

POTTSVILLE FORMATION

The Pottsville Formation consists of alternating beds of sandstone and shale with numerous coal seams and associated beds of underclay. Sandstones near the base of the formation consist predominantly of orthoquartzites with locally occurring beds of quartz pebble conglomerate. Sandstones in the upper part of the formation are generally subgraywackes composed of quartz and metamorphic rock fragments. The upper part of the Pottsville also contains most of the economically important coal seams. The Pottsville Formation is over 2,800 feet thick in west Jefferson County and is of undetermined thickness in east Jefferson County where it is highly faulted and folded.

TUSCALOOSA GROUP: COKER FORMATION

The Coker Formation consists of unconsolidated beds of sand, clay, and gravel. The sand is generally fine- to coarse-grained, grayish-orange to pale-reddish-brown quartz. The clays range from light gray to pale purple to moderate pink. Very pale-orange to grayish-orange quartz and chert gravel generally occur near the base of the formation. Secondary deposits of iron oxide (goethite-limonite) may occur locally in economic concentrations where the Tuscaloosa Group overlies deeply weathered limestone. The Coker occurs as isolated outliers in the southern part of the county where it reaches a maximum thickness of 60 feet.

QUATERNARY (?) GRAVELS

At several places in the Cahaba Valley and at one place near Chalkville are unconsolidated to semiconsolidated deposits of sand, gravel, and clay of undetermined age. The deposits consist of quartzite pebbles and cobbles, and some chert cobbles (ranging up to 10 inches in diameter), in a matrix of angular to subrounded chert fragments and/or fine- to very coarse-grained quartz and chert sand. One of the best exposures is along Interstate Highway 20 at Pine Ridge near Leeds, where about 50 feet of the deposit is exposed.

HIGH TERRACE

Unconsolidated deposits of sand and gravel of Quaternary age occur at varying elevations above streams in the southern part of the Trafford quadrangle and in the northwestern part of the Pinson quadrangle. The gravels are composed of well-rounded quartz, quartzite, and chert pebbles and cobbles. The pebbles average less than 3 inches in diameter, but cobbles may reach a diameter of 6 inches. Thickness is generally less than 10 feet (Butts, 1910).

LOW TERRACE AND ALLUVIUM

Along and immediately adjacent to the larger streams in the county are relatively recent unconsolidated deposits of gravel, sand, and silt. The constituents of these deposits have been eroded from the underlying bedrock and transported and deposited by the streams along which they occur. Chert and quartz fragments are the main components of the coarse material, but locally, fragments from any of the older rock units may occur. Thickness of these deposits rarely exceeds 30 feet.

STRUCTURAL GEOLOGY

Jefferson County is located in two structurally distinct physiographic provinces: the Appalachian Plateau to the northwest and the Valley and Ridge to the southeast (fig. 1). The Appalachian Plateau province is immediately underlain by gently dipping rocks of Pennsylvanian age; however, several major structural features do occur. The Sequatchie anticline trends northeastwardly in the county and is asymmetrical to the northwest. In extreme north Alabama, the Sequatchie is faulted on its northwest flank; however, in Jefferson County, the Sequatchie does not appear to be faulted along the flanks and is mapped as a simple anticlinal feature (fig. 2). The Arkadelphia syncline in western Jefferson County parallels the Sequatchie anticline on the northwest and is developed in the sandstones and shales of the Pottsville

Formation. The Coalburg syncline is located between the Sequatchie anticline and the western flank of the Birmingham anticlinorium. The axis of the Coalburg syncline as illustrated (fig. 2) has been interpreted from the areal configuration of the outcropping coal beds of the Pottsville Formation as mapped by McCalley (1898). Other structural features in the Plateau province in Jefferson County include the Blue Creek anticline and syncline, and numerous north-northwest-oriented, high-angle faults of relatively minor displacement.

In Jefferson County, the Valley and Ridge province includes the Birmingham anticlinorium, and the Cahaba and Coosa synclinoria. The major structural features of the Birmingham anticlinorium are the Birmingham anticline, southwestern part of Blount Mountain syncline, Jones Valley fault, and Opossum Valley fault. Numerous smaller structures are present and include West End anticline, Potter fault, Dickey Springs fault, Dickey Springs anticline, Shannon fault, Ishkooda fault, the western part of the Little Valley Mountain syncline, Red Gap fault, Argo fault, Cahaba Mountain syncline, and the southwestern part of the Murphree Valley anticline and Straight Mountain fault. Some of the structures, such as the Little Valley Mountain syncline, are located partly in the Birmingham anticlinorium and partly in the Cahaba synclinorium. The Birmingham anticline is an eroded asymmetrical fold trending northeast-southwest (Simpson, 1963). Jones Valley is parallel to the axis of the eroded and breached anticline. Blount Mountain syncline is located between the Birmingham anticline and the northwest flank of the Birmingham anticlinorium. In northeast Jefferson County the syncline includes the southwestern end of Blount Mountain.

Opossum Valley thrust fault, with a displacement of 7,000 feet or greater, is located along the northwestern limb of the Birmingham anticlinorium (Butts, 1910). The Conasauga, Ketona, or Knox Group are generally faulted into juxtaposition with younger Paleozoic rocks. Numerous faults of lesser magnitude are associated with the Opossum Valley fault and formations immediately west of Opossum Valley fault are typically overturned, deformed, faulted, and locally not exposed. Jones Valley fault is located one-eighth to one-half mile west of and parallel to the axis of the Birmingham anticline. This thrust fault has a maximum displacement of probably less than 4,500 feet where the Conasauga is faulted into juxtaposition with the Ketona and Knox. The Cahaba synclinorium is bounded by the Birmingham anticlinorium to the northwest and the Coosa synclinorium to the southeast. In Jefferson County, the Cahaba synclinorium is developed upon rocks of the Pottsville Formation, with one small area of older rocks exposed in a fault block between the Helena fault and the Hog Pen Branch fault. The Helena fault, located along the southeastern boundary of the Cahaba synclinorium, is a thrust fault with at least 10,000 feet of displacement (Butts, 1910). In Jefferson County the Helena fault generally separates the Pottsville Formation on the northwest from the Rome and Ketona on the southeast. Other structural features that have been named in the Cahaba synclinorium in Jefferson County include Little Cahaba syncline, Henry Ellen syncline, the Hog Pen Branch fault, Dolly Ridge anticline, Patton fault, and the eastern part of the Little Valley Mountain syncline.

A small part of the northwestern edge of the Coosa synclinorium is located near Leeds in eastern Jefferson County. Rocks in this part of the Coosa synclinorium range from Cambrian to Pennsylvanian and generally dip to the southeast. Locally, the rocks are folded, faulted, and overturned. The Cahaba Valley fault, located near the center of Cahaba Valley, has been thrust from the southeast and, locally, rocks as old as Cambrian or Ordovician are faulted into juxtaposition with Mississippian rocks.

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MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation: Tuscaloosa Group
PENNSYLVANIAN	ℙpv	Pottsville Formation
	ℙMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OꞒk	Knox Group undifferentiated
CAMBRIAN	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed.

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault: U, upthrown side; D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 1

TRAFFORD QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

AREAL GEOLOGY OF THE TRAFFORD
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	Ppv	Pottsville Formation
	PMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OЄk	Knox Group undifferentiated
CAMBRIAN	Єkt	Ketona Dolomite
	Єc	Conasauga Formation
	Єr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault U upthrown side, D downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 2

REMLAP QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1960
REMLAP QUADRANGLE, 7½ MINUTE SERIES
PHOTOREVISED 1970

AREAL GEOLOGY OF THE REMLAP
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910.

MAP EXPLANATION

QUATER	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETAC	Kc	Coker Formation Tuscaloosa Group
PENNSYLVA	ℙpv	Pottsville Formation
	ℙMpw	Parkwood Formation
MISSISSIP	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVO	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILU	Srm	Red Mountain Formation
ORDOV	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
CAMB	O€k	Knox Group undifferentiated
	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

- Anticlinal axis
- Anticlinal axis showing direction of plunge
- Synclinal axis
- Synclinal axis showing direction of plunge
- U / D — Normal fault U, upthrown side, D, downthrown side
- Thrust fault, T on upper plate
- Fault, showing relative horizontal movement
- R R — Reverse fault, R on upthrown side
- 45 — Strike and dip of beds
- 45 — Strike and dip of overturned beds
- Strike of vertical beds
- Horizontal beds
- Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed

GARDENDALE QUADRANGLE
ALABAMA–JEFFERSON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BIRMINGHAM COAL DISTRICT 15' QUADRANGLE

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
GARDENDALE QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

AREAL GEOLOGY OF THE GARDENDALE
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910,
and D. R. Semmes, 1929.

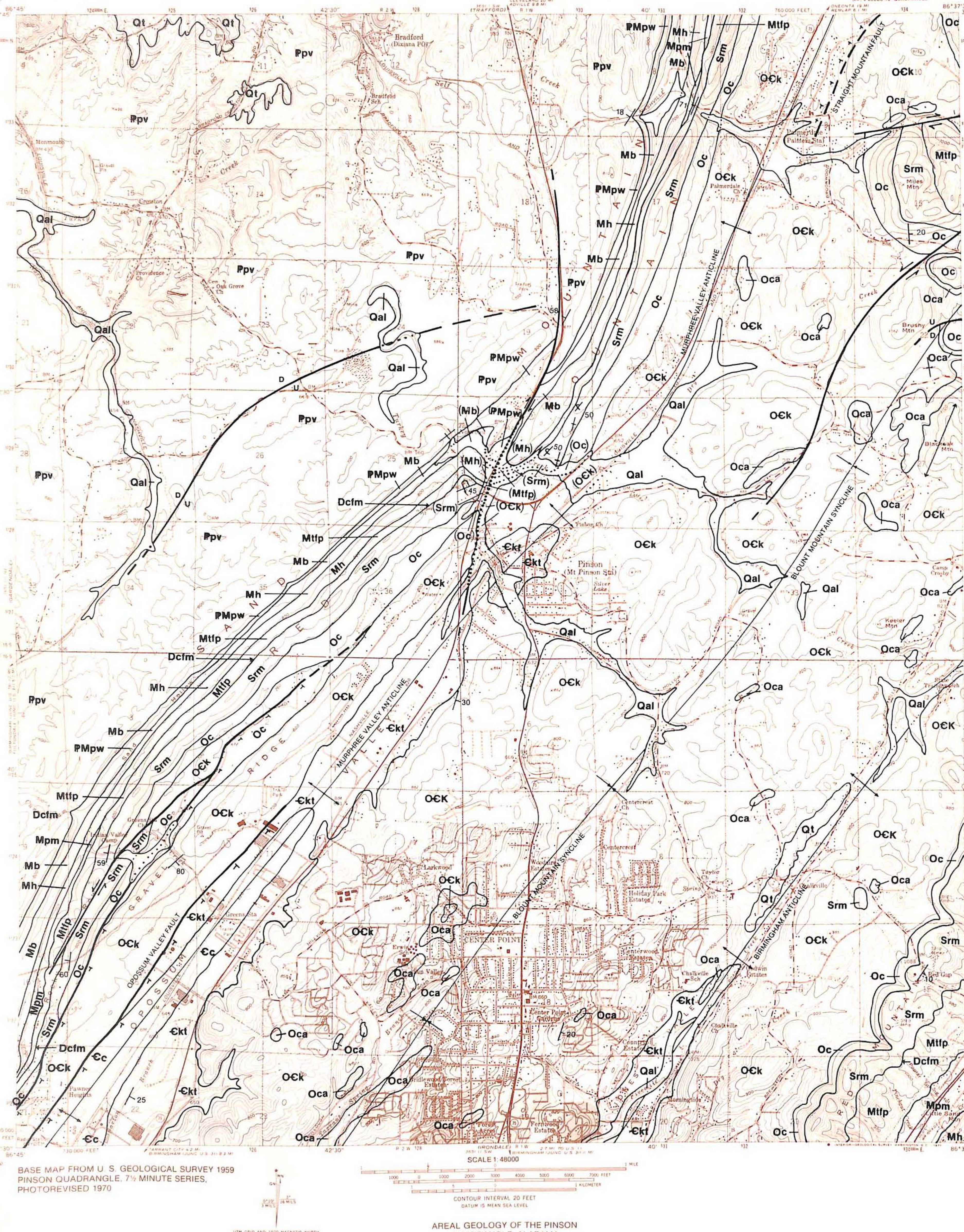
MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OꞒk	Knox Group undifferentiated
CAMBRIAN	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault: U, upthrown side; D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.



BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
PINSON QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

AREAL GEOLOGY OF THE PINSON
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910,
D. R. Semmes, 1929, and W. A. Thomas and T. J. Joiner, 1965.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dclm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault U, upthrown side, D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed

ARGO QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
ARGO QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

AREAL GEOLOGY OF THE ARGO QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910,
and W. A. Thomas and T. J. Joiner, 1965.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
PENNSYLVANIAN / MISSISSIPPIAN	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
ORDOVICIAN / CAMBRIAN	OЄk	Knox Group undifferentiated
CAMBRIAN	Єkl	Ketona Dolomite
	Єc	Conasauga Formation
	Єr	Rome Formation

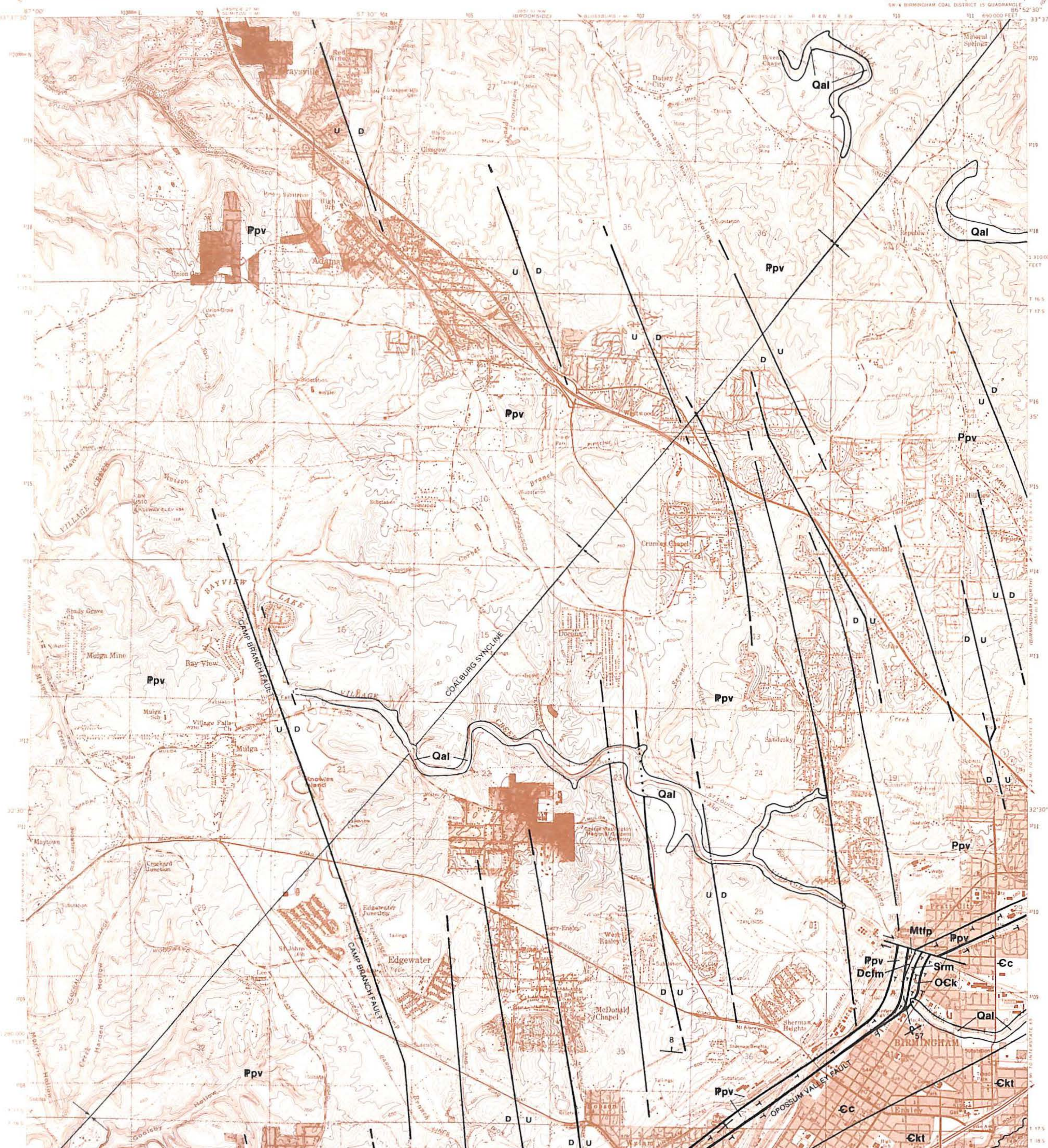
Formation symbol enclosed in parentheses where formation is concealed

- Anticlinal axis
- Anticlinal axis showing direction of plunge
- Synclinal axis
- Synclinal axis showing direction of plunge
- Normal fault: U, upthrown side. D, downthrown side
- Thrust fault, T on upper plate
- Fault, showing relative horizontal movement
- Reverse fault, R on upthrown side
- Strike and dip of beds
- Strike and dip of overturned beds
- Strike of vertical beds
- Horizontal beds
- Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 6

ADAMSVILLE QUADRANGLE
ALABAMA–JEFFERSON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
ADAMSVILLE QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

AREAL GEOLOGY OF THE ADAMSVILLE
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Charles Butts, 1910,
D. R. Semmes, 1929, and J. Bensko and W. M. Greene, 1972

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

- Anticlinal axis
- Anticlinal axis showing direction of plunge
- Synclinal axis
- Synclinal axis showing direction of plunge
- U / D — Normal fault. U, upthrown side; D, downthrown side
- Thrust fault, T on upper plate
- Fault, showing relative horizontal movement
- R R — Reverse fault, R on upthrown side
- 45 — Strike and dip of beds
- 45 — Strike and dip of overturned beds
- Strike of vertical beds
- Horizontal beds
- Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

BIRMINGHAM NORTH QUADRANGLE
ALABAMA–JEFFERSON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 BIRMINGHAM COAL DISTRICT 15' QUADRANGLE

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
BIRMINGHAM NORTH QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE BIRMINGHAM NORTH QUADRANGLE, ALABAMA

By J. T. Kidd and S. W. Shannon, 1977, with modifications from Charles Butts, 1910, D. R. Semmes, 1929, and T. Bensko and W. M. Greene, 1972.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault: U, upthrown side; D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
IRONDALE QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1: 48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE IRONDALE QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts, 1910.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OЄk	Knox Group undifferentiated
CAMBRIAN	Єkt	Ketona Dolomite
	Єc	Conasauga Formation
	Єr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U D	Normal fault U, upthrown side, D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 9

LEEDS QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
LEEDS QUADRANGLE, 7½ MINUTE SERIES
PHOTOREVISED 1970.

AREAL GEOLOGY OF THE LEEDS QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts, 1910.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

Anticlinal axis
Anticlinal axis showing direction of plunge
Synclinal axis
Synclinal axis showing direction of plunge
Normal fault U, upthrown side; D, downthrown side
Thrust fault, T on upper plate
Fault, showing relative horizontal movement
Reverse fault, R on upthrown side
Strike and dip of beds
Strike and dip of overturned beds
Strike of vertical beds
Horizontal beds
Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 10

YOLANDE NORTHEAST QUADRANGLE
ALABAMA
UNEDITED ADVANCED PRINT
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1976
UNEDITED ADVANCED PRINT OF YOLANDE NORTHEAST
QUADRANGLE, 7½ MINUTE SERIES.

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE YOLANDE NORTHEAST
QUADRANGLE, ALABAMA
By J. T. Kidd, 1977, with modifications from Henry McCalley,
1898, E. F. Burchard and Charles Butts, 1910, and D. R. Semmes,
1929.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault U, upthrown side, D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed.

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
BESSEMER QUADRANGLE, 7½ MINUTE SERIES
PHOTOREVISED 1970

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

AREAL GEOLOGY OF THE BESSEMER
QUADRANGLE, ALABAMA
By S. W. Shannon and J. T. Kidd, 1977, with modifications from
Charles Butts, 1927, D. R. Semmes, 1929, and T. A. Simpson,
1965.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OꞒk	Knox Group undifferentiated
CAMBRIAN	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U D	Normal fault. U, upthrown side. D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 12

BIRMINGHAM SOUTH QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
BIRMINGHAM SOUTH QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970.

SCALE 1: 48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

AREAL GEOLOGY OF THE BIRMINGHAM SOUTH QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts, 1927, and T. A. Simpson, 1965.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	₽pv	Pottsville Formation
	₽Mpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

Anticlinal axis

Anticlinal axis showing direction of plunge

Synclinal axis

Synclinal axis showing direction of plunge

U
D
Normal fault. U, upthrown side, D, downthrown side

Thrust fault, T on upper plate

Fault, showing relative horizontal movement

R R
Reverse fault, R on upthrown side

45
Strike and dip of beds

45
Strike and dip of overturned beds

Strike of vertical beds

Horizontal beds

Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 13

CAHABA HEIGHTS QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
CAHABA HEIGHTS QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE CAHABA HEIGHTS
QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts,
1927.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	ℙpv	Pottsville Formation
	ℙMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OꞒk	Knox Group undifferentiated
CAMBRIAN	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault U, upthrown side, D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 14

VANDIVER QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
VANDIVER QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970.

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE VANDIVER
QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts, 1927.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	ℙPv	Pottsville Formation
	ℙMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	OꞒk	Knox Group undifferentiated
CAMBRIAN	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

Anticlinal axis

Anticlinal axis showing direction of plunge

Synclinal axis

Synclinal axis showing direction of plunge

U / D — Normal fault. U, upthrown side; D, downthrown side

Thrust fault, T on upper plate

Fault, showing relative horizontal movement

R R — Reverse fault, R on upthrown side

45 — Strike and dip of beds

45 — Strike and dip of overturned beds

Strike of vertical beds

Horizontal beds

Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed.

GEOLOGICAL SURVEY OF ALABAMA
ATLAS 10-MAP 15

YOLANDE SOUTHEAST QUADRANGLE
ALABAMA
UNEDITED ADVANCED PRINT
7.5 MINUTE SERIES (TOPOGRAPHIC)

(YOLANDE NW (PRELIMINARY))

(BESSEMER)

87 07 30
33 22 30

R 6 W R 5 W

R 5 W R 4 W

(YOLANDE SW (PRELIMINARY))

(GREENWOOD)

33 15 00
87 00 00

(BLOCTON NW (PRELIMINARY))

BLOCTON NE (PRELIMINARY)

(MONTEVALLO NW (PRELIMINARY))

BASE MAP FROM U. S. GEOLOGICAL SURVEY 1976
UNEDITED ADVANCED PRINT OF YOLANDE SOUTHEAST
QUADRANGLE, 7½ MINUTE SERIES.

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE YOLANDE SOUTHEAST
QUADRANGLE, ALABAMA
By S. W. Shannon and J. T. Kidd, 1977, with modifications from
E. F. Burchard and Charles Butts, 1910, D. R. Semmes, 1929, and
T. A. Simpson, 1965.

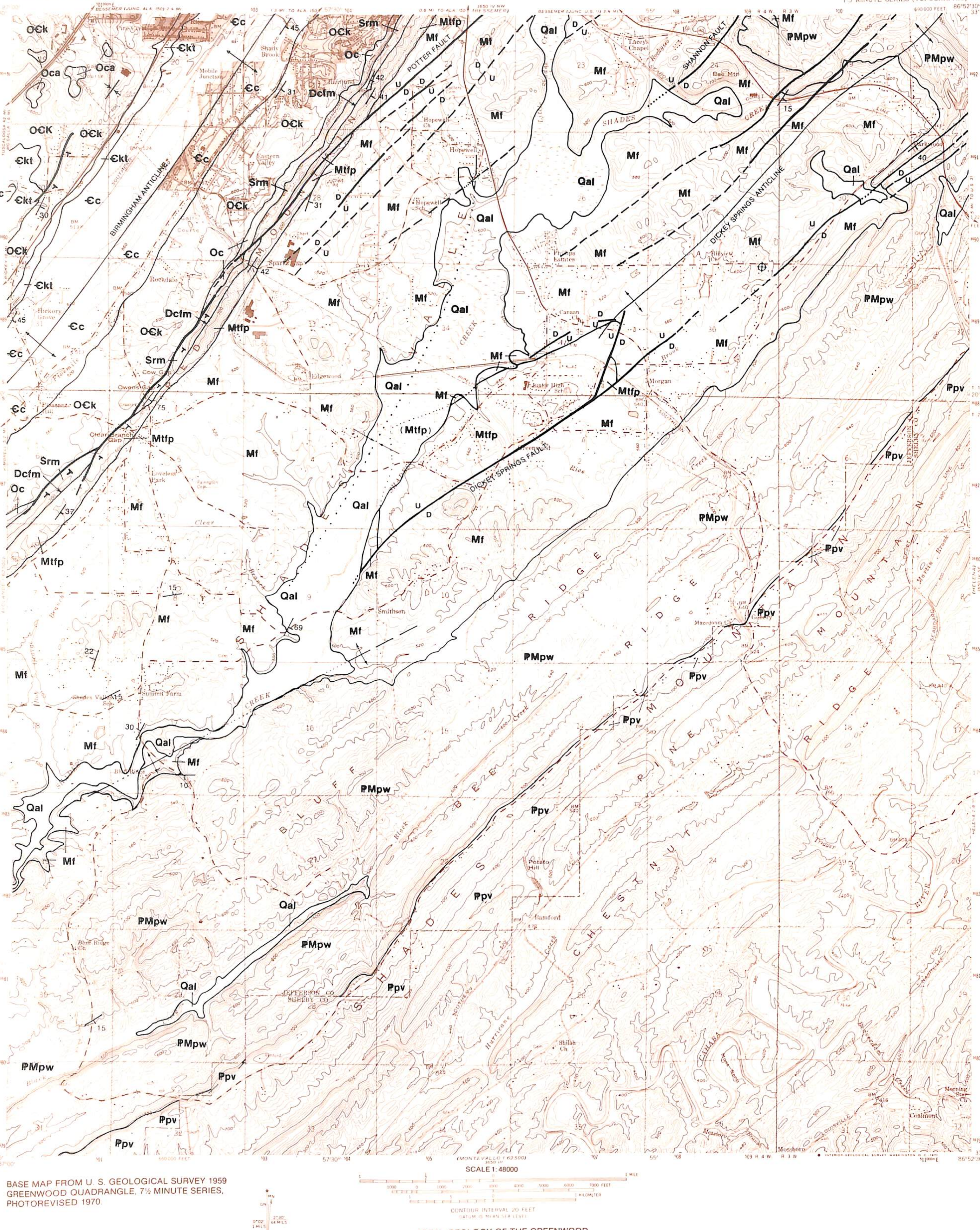
MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	₱Pv	Pottsville Formation
	₱Mpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
CAMBRIAN	OꞒk	Knox Group undifferentiated
	Ꞓkt	Ketona Dolomite
	Ꞓc	Conasauga Formation
	Ꞓr	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

	Anticlinal axis
	Anticlinal axis showing direction of plunge
	Synclinal axis
	Synclinal axis showing direction of plunge
U / D	Normal fault U, upthrown side D, downthrown side
	Thrust fault, T on upper plate
	Fault, showing relative horizontal movement
R R	Reverse fault, R on upthrown side
45	Strike and dip of beds
45	Strike and dip of overturned beds
	Strike of vertical beds
	Horizontal beds
	Contact

Contacts, faults, synclines and anticlines are dashed where inferred, dotted where concealed



BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
GREENWOOD QUADRANGLE, 7½ MINUTE SERIES,
PHOTOREVISED 1970.

AREAL GEOLOGY OF THE GREENWOOD
QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts, 1927, T. A. Simpson, 1965, and J. G. Newton, C. W. Copeland, and L. W. Scarbrough, 1973.

MAP EXPLANATION

QUATERNARY	Qal	Alluvium and low terrace deposits
	Qt	High terrace deposits
	Qt?	Possible terrace of questionable age
CRETACEOUS	Kc	Coker Formation Tuscaloosa Group
PENNSYLVANIAN	IPpv	Pottsville Formation
	IPMpw	Parkwood Formation
MISSISSIPPIAN	Mf	Floyd Shale
	Mb	Bangor Limestone
	Mh	Hartselle Sandstone
	Mpm	Pride Mountain Formation
	Mtfp	Tuscumbia Limestone, Fort Payne Chert, and Maury Formation
DEVONIAN	Dcfm	Chattanooga Shale and Frog Mountain Sandstone
SILURIAN	Srm	Red Mountain Formation
ORDOVICIAN	Oc	Chickamauga Limestone
	Oca	Attalla Chert Conglomerate Member: Chickamauga Limestone
	Ou	Ordovician undifferentiated
	O€k	Knox Group undifferentiated
CAMBRIAN	€kt	Ketona Dolomite
	€c	Conasauga Formation
	€r	Rome Formation

Formation symbol enclosed in parentheses where formation is concealed

Anticlinal axis

Anticlinal axis showing direction of plunge

Synclinal axis

Synclinal axis showing direction of plunge

U
D
Normal fault. U, upthrown side; D, downthrown side

Thrust fault, T on upper plate

Fault, showing relative horizontal movement

R R
Reverse fault, R on upthrown side

45
Strike and dip of beds

45
Strike and dip of overturned beds

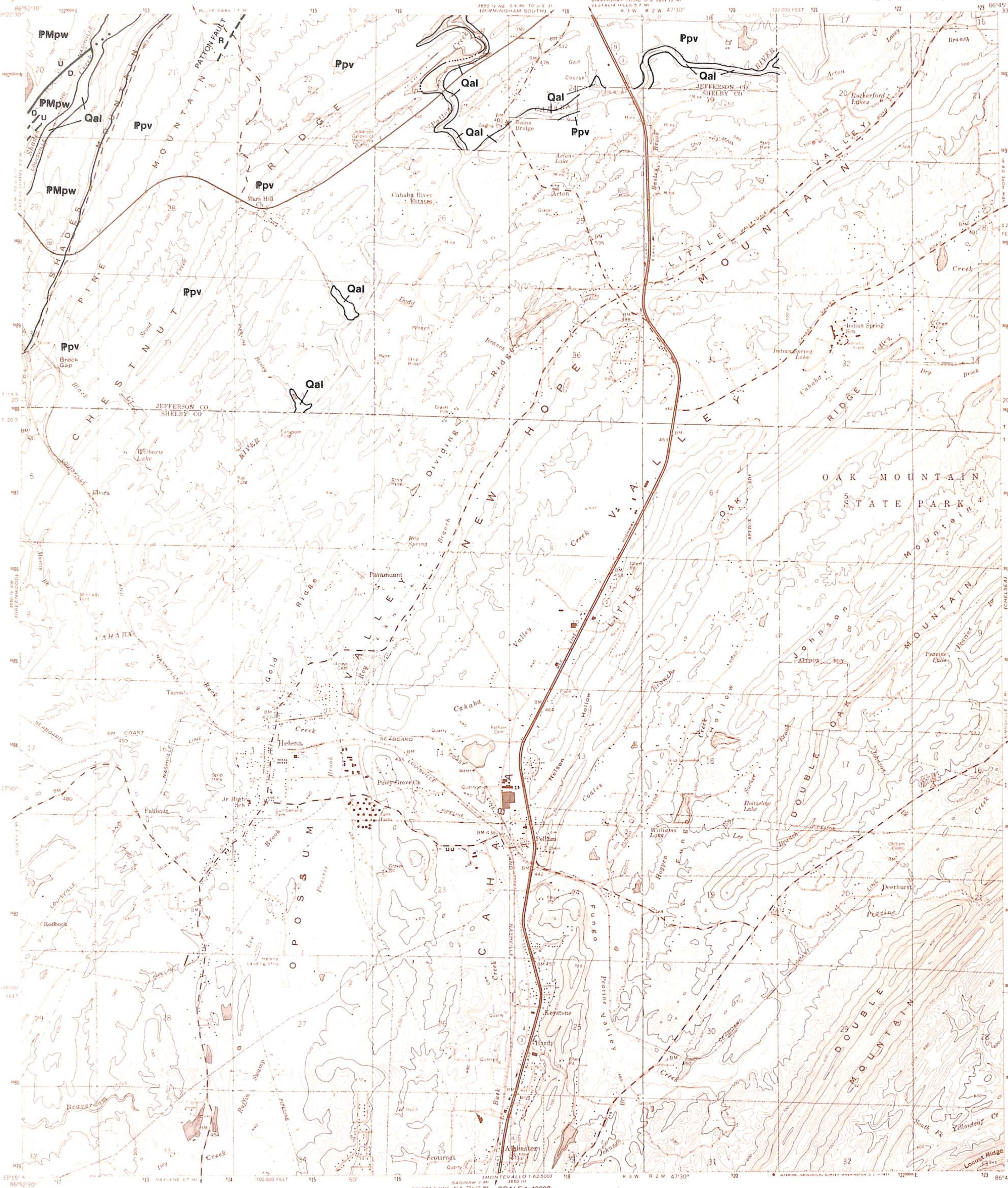
Strike of vertical beds

Horizontal beds

Contact

Contacts, faults, synclines and anticlines are dashed where inferred; dotted where concealed.

HELENA QUADRANGLE
ALABAMA
7.5 MINUTE SERIES (TOPOGRAPHIC)



BASE MAP FROM U. S. GEOLOGICAL SURVEY 1959
HELENA QUADRANGLE, 7½ MINUTE SERIES
PHOTOREVISED 1970.

SCALE 1:48000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

AREAL GEOLOGY OF THE HELENA
QUADRANGLE, ALABAMA
By S. W. Shannon, 1977, with modifications from Charles Butts,
1927, and T. A. Simpson, 1965.

GEOLOGICAL SURVEY OF ALABAMA • SERVING ALABAMA SINCE 1848 •

GEOLOGICAL RESEARCH—KEY TO ALABAMA'S FUTURE