OKLAHOMA GEOLOGICAL SURVEY

GUIDE BOOK III

FIELD CONFERENCE

ON

GEOLOGY OF THE ARBUCKLE MOUNTAIN REGION

Part 1. Geology of the Arbuckle and Timbered Hills Groups

April 22-23, 1955

Part 2. Regional Stratigraphy and Structure of the Arbuckle Mountain Region

April 29-30, 1955

by

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The colored geologic map in pocket, "Geologic Map and Sections of the Arbuckle Mountains, Oklahoma", published by the Oklahoma Geological Survey and issued February 14, 1955, is based primarily on field work by W. E. Ham beginning in 1943 and continuing into 1954. In the last half of this period Ham was ably assisted by Myron E. McKinley, graduate student in the University of Oklahoma and Assistant Geologist of the Oklahoma Geological Survey. Other graduate students of the University of Oklahoma who participated in the program are:

James C. Barker, M. S., 1950
Robert J. Dunham, M. S., 1951
Martin P. Gillert, M. S., 1952

The field maps, made with aerial photographs at scales ranging from 8 inches equal 1 mile to 3 inches equal 1 mile, contain much more detail than could be shown at the printing scale (1/72,000) of the accompanying regional map. Four detailed maps covering the Arbuckle Mountains are to be published later by the Oklahoma Geological Survey at a scale of 2 inches equal 1 mile.

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GUIDE BOOK III

PART I

GEOLOGY OF THE ARBUCKLE AND TIMBERED HILLS GROUPS IN THE ARBUCKLE MOUNTAINS

GENERAL STATEMENT

Arbuckle Group

The Arbuckle group of carbonate rocks, Upper Cambrian and Lower Ordovician in age, is the thickest stratigraphic unit in the Arbuckle Mountain region. It has a maximum thickness of 6,700 feet, well over half the thickness of all pre-Pennsylvanian rocks, and it crops out over approximately 375 square miles. Rocks of the Arbuckle group therefore dominate all others in the Arbuckle Mountains.

The earlier investigations of Taff, Ulrich, and Decker have been refined by field work conducted under the auspices of the Oklahoma Geological Survey beginning in 1943, and at the present time a usable classification has been erected, through which the several formations of the Arbuckle group have been mapped in all parts of the Arbuckle Mountains. Shown in Figures 1 and 2 are the named formations, their probable correlation, and some of the fossil zones that have been widely used in the field. Only two of the formations - Butterly and Fort Sill - maintain essentially a uniform lithology throughout the length of the region. Two others - Royer and Signal Mountain - are locally absent as a result of limestone-dolomite facies; and each of the four formations of Ordovician age shows pronounced regional facies, from limestone in the west to dolomite in the east.

Eastward and northward from the Arbuckle anticline, where it has its maximum thickness of 6,700 feet and the rocks are mostly limestone, the Arbuckle group thins to approximately 4,000 feet and the rocks are mostly dolomite. Accompanying the eastward thinning is an increase in the percentage of sand. The eastern and northern structural provinces of the Arbuckle Mountains, including the Mill Creek syncline, Belton anticline, and Hunton anticline, represent sites of shelf deposition in Cambrian and Lower Ordovician time, which closely approximated the environment in the Ozark region of Arkansas and Missouri. The Reagan fault separates these shelf sediments from the thicker sediments of the more rapidly subsiding basin, particularly those of the Arbuckle anticline but including also the closely related sediments of the Tishomingo anticline.

The marker zones of formations in the Arbuckle group are identified by fossils, thin but persistent beds of sandstone or sandy sequences, occurrences and type of chert, occurrence of glauconite, and various combinations of these characters. Fossil zones are particularly useful because the silicified remains occur in limestone and dolomite alike. When used in conjunction with other criteria, fossils supply perhaps the most reliable means of correlation, and some of the best fossil zones are believed to be strictly time horizons. General criteria of formations are given below:

West Spring Creek. Upper half: generally thin-bedded, fine-grained dolomite; thin sandstones; slightly cherty; Pomatotrema, Didymograptus, Syntrophopsis, certain species of Ceratopea. Lower half: Thick-bedded limestone or dolomite; thin sandstones and relative concentration of chert in basal part; Ceratopea ankylosa.

Kindblade. Normally contains least sand and chert of all Ordovician Arbuckle formations; spicular chert in association with Archaeoscyphia is notably good marker for lower part of formation; Tritoechia throughout; Ceratopea tennesseensis in upper third; C. keithi in Hunton anticline; undescribed species of Ceratopea in lower part.

Cool Creek. Normally contains most sand, chert, and siliceous oolite of all formations of Arbuckle group; thin sandstone generally at base; abundant algae; Diaphelasma, Lecanospira, and Imbricatia in upper third; sand is non-feldspathic in west, feldspathic in east.

McKenzie Hill. Oldest chert-bearing formation of Arbuckle group; non-sandy in west except for gray arkose in lower part; tripolitic chert in lower-middle part;

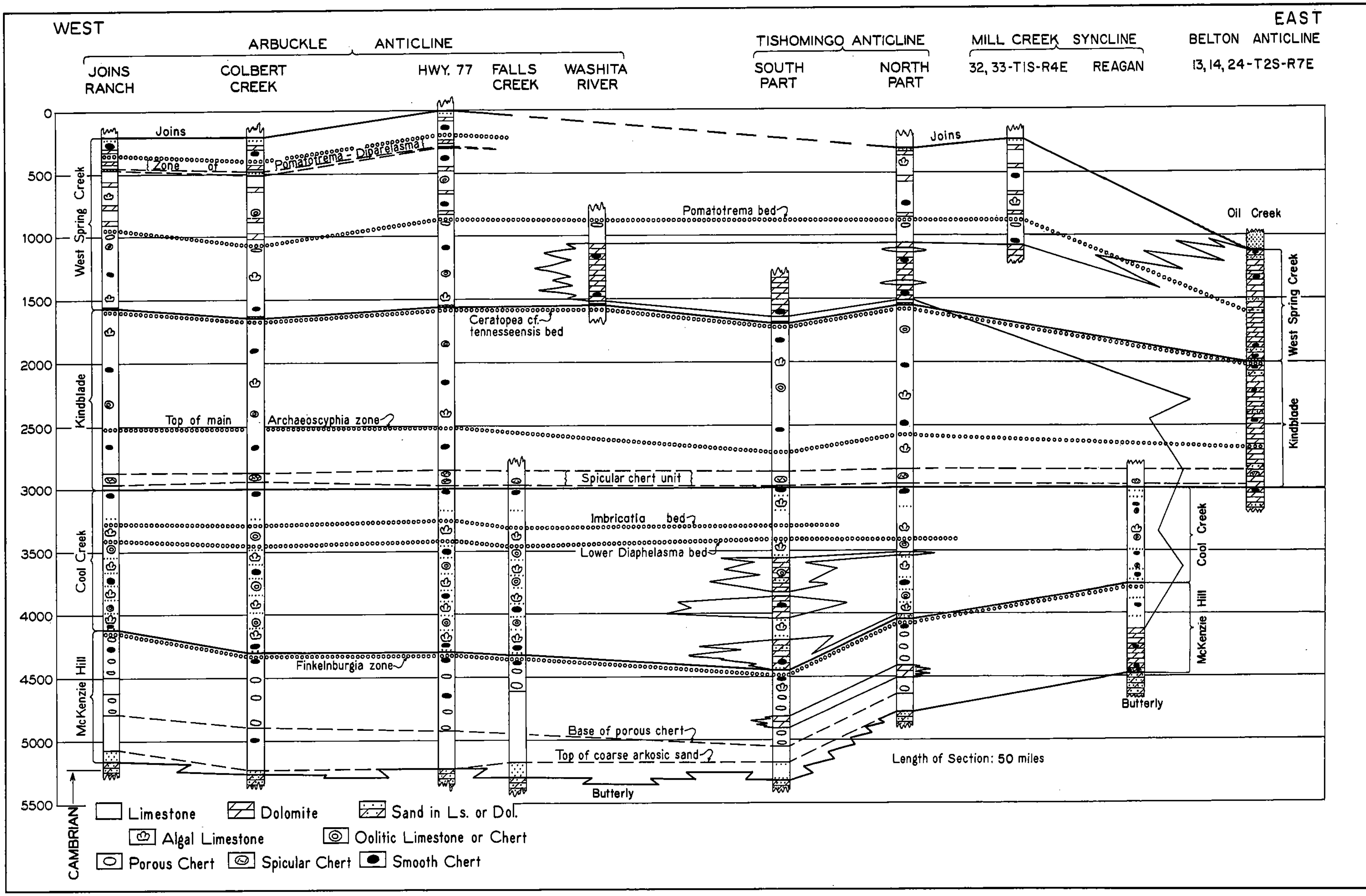


Figure 1. Measured outcrop sections of Ordovician Arbuckle strata in the Arbuckle Mountains. Note eastward thinning and gradation of limestone into dolomite.

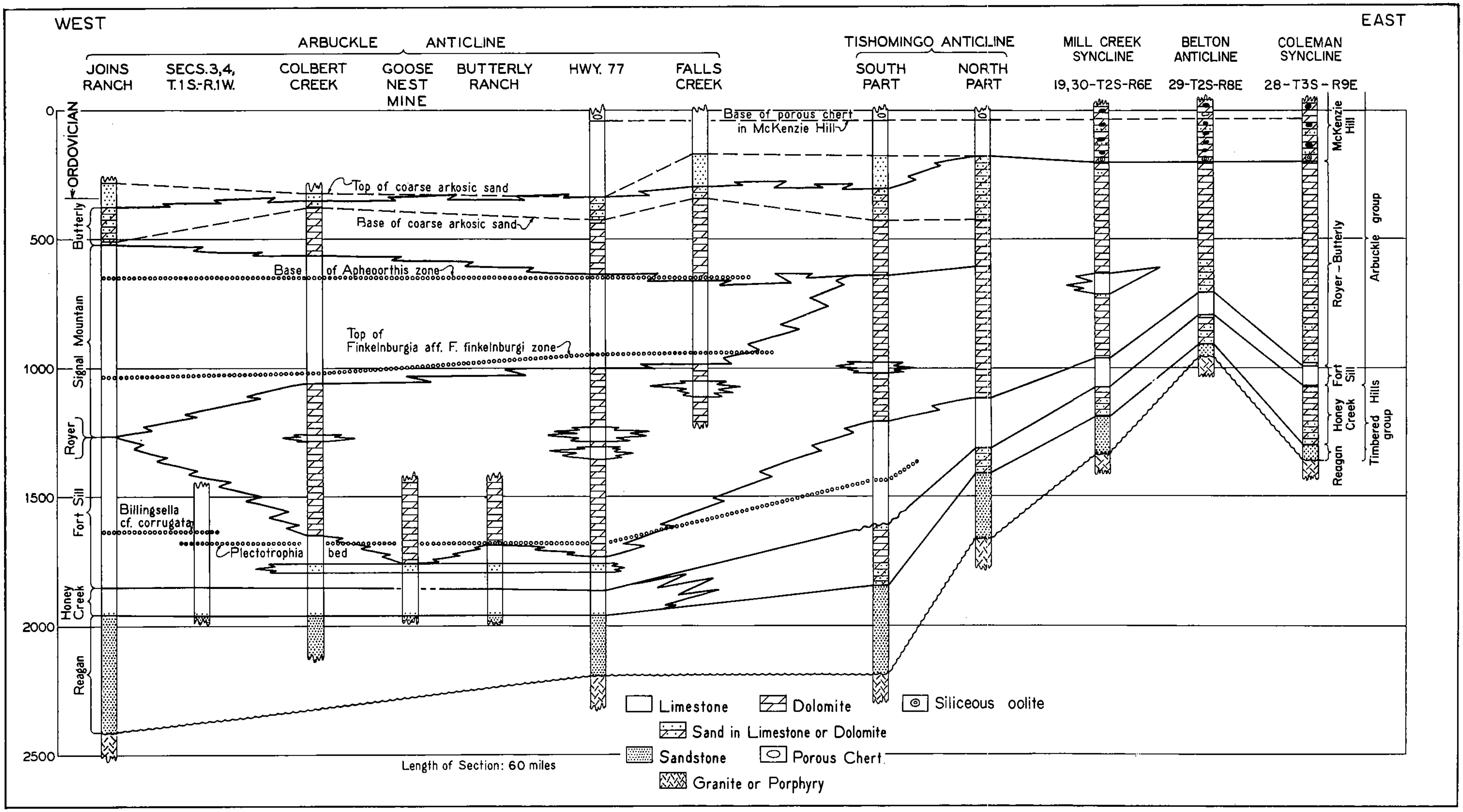


Figure 2. Measured outcrop sections of Cambrian strata in the Arbuckle Mountains. Note eastward thinning and gradation of limestone into dolomite.

thin sandstones extend nearly to base of formation in east; siliceous oolite at base in east; Tetralobula (rare), Finkelnburgia arbucklensis, Lytospira.

Butterly. Dolomite, generally containing coarse feldspathic sand in upper part; non-cherty; glauconite in traces.

Signal Mountain. Dark-colored granular limestone; non-cherty; generally non-sandy; glauconite in residues; Apheoorthis, Finkelnburgia auriculata, Fasciculina, trilobites.

Royer. Nearly pure dolomite, generally coarse-crystalline; non-cherty; generally non-sandy; glauconite in traces.

Fort Sill. White to gray limestone, fine-grained; chert rare; normally non-sandy; sponge spicules in west; Billingsella corrugata, Plectotrophia, trilobites.

Timbered Hills Group

This group consists of the Reagan sandstone and overlying Honey Creek formation, Upper Cambrian in age, comprising the first sediments deposited on the pre-Cambrian igneous rocks of the region. Owing to irregularities on this erosional surface, the Reagan shows a wide range in thickness, from 30 to 460 feet, and is locally absent by non-deposition where granite islands stood above the sea at the close of Reagan time. The Honey Creek likewise shows a wide range in thickness, from 63 to 235 feet, and is absent around some buried hills.

The Reagan is a sandstone formation composed principally of quartz grains with irregular distribution of pink feldspar and glauconite. It is poorly sorted and poorly cemented except for local zones indurated by quartz cement that presumably was deposited from circulating ground waters. Bedding surfaces in general are obscure, irregular, or cross-laminated, although locally the beds are evenly stratified and well defined. The color is predominantly buff but ranges through different shades of brown and red. It is non-calcareous in most exposures.

The basal beds normally are somewhat conglomeratic and contain pebbles of granite, rhyolite porphyry, and vein quartz in a matrix of sand. The texture of the overlying beds and of the formation as a whole is medium- to coarse-grained, with numerous thin pebble layers of sandy quartz conglomerate.

The Honey Creek formation is limestone in the Arbuckle anticline and dolomite in all other exposures of the Arbuckle Mountains, thus establishing the regional facies pattern that was followed later by rocks of the Arbuckle group. It is glauconitic in all areas and where composed of dolomite it consists of a lower sandy division and an upper slightly sandy division. A zone of Billingsella in the lower division is the most conspicuous fossil in the formation.

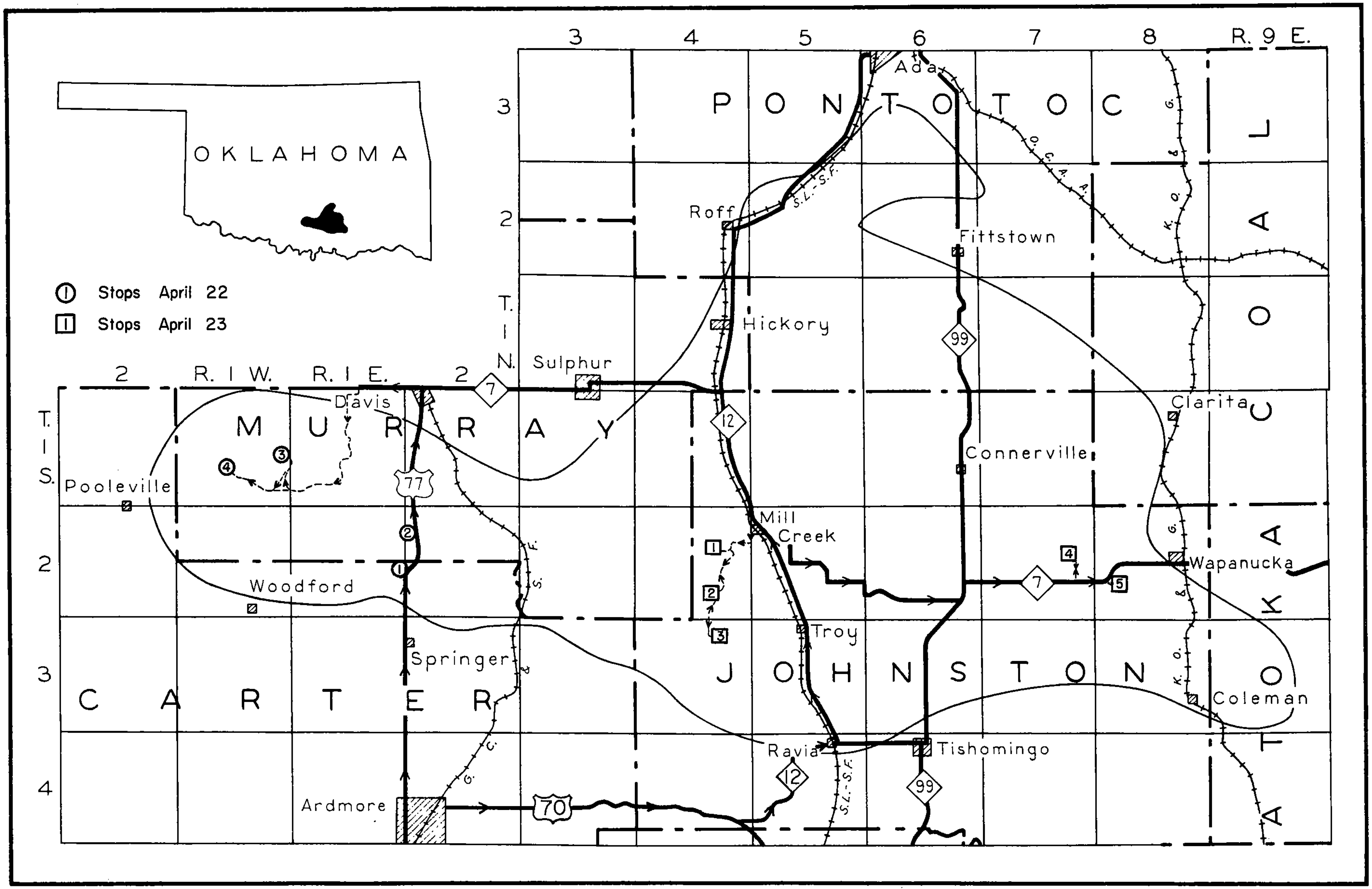


Figure 3. Route map for field trip April 22-23, 1955.

ROAD LOG FOR FIELD TRIP

April 22, 1955

Assembly Point

Assemble at northwest edge of Ardmore, on U. S. Highway 77 at 12th St., NW. Cars line up on highway shoulder opposite English Village Motel, heading north. Caravan leaves at 7:30 A.M.

Special Instruction

As most of the outcrops visited are on large ranches where pastures are subject to disastrous prairie fires, it is absolutely necessary for all participants to be EXTREMELY CAREFUL WITH FIRE. Carelessness with fire might result in a permanent ban on organized field trips in this region.

Mileage

0.00 Assembly point.

4.2 Caddo Creek.

9.0 Springer. Stone schoolhouse on right.

10.4 Intersection with Oklahoma Hwy. 53.

11.7 Sycamore limestone in roadcut.

11.8 Woodford formation in roadcut.

11.9 Haragan marlstone in roadcut.

11.95 Chimneyhill limestone in roadcut.

12.10 Sylvan shale, covered in valley.

12.2 Viola limestone exposed for 0.2 mile in roadcuts.

12.4 Begin section of Simpson group.

12.9 Turn left off Hwy. 77 through aluminum gate and park cars in pasture on outcrops of Joins limestone.

STOP 1. Section of West Creek formation at locality of its maximum known thickness, 1,560 feet. The following section is generalized from detailed measurements made in the excellent roadcuts along Hwy. 77, W½ SW¼ sec. 19, T. 2 S., R. 2 E. Strike N. 55 W., dip 55°-58° SW.

	Thickness (feet)
Joins limestone:	
Thin-bedded limestone conglomerate and granular limestone containing glauconite.	
West Spring Creek limestone:	
6. Laminated dolomitic limestone, interstratified with calcarenite, limestone conglomerate, algal limestone, and a few thin sandy limestones	185.4
5. Mottled gray and yellowish dolomitic limestone, in thick, massive-bedded layers interstratified with calcarenite and intraformational limestone conglomerate. Porous chert in irregular stringers and nodules at base. *Pomatotrema murale* Ulrich and Cooper and *Ceratopea* sp. 1 range through the zone, and *Diparelasma typicum* Ulrich and Cooper is present 10 feet above the base. The unit is widely distributed, the base being mapped as the base of the Pomatotrema-Diparelasma (pd) zone	99.0

4. Sandy limestone, light gray, containing sandy chert nodules at top, locally grading into sandstone. Excellent marker bed in Arbuckle anticline 9.0

3. Laminated dolomitic limestone, in beds 1 to 13 feet thick, interstratified with compact fine-grained limestone, limestone conglomerate, calcarenite, algal limes stone, oolitic limestone, and thin sandy limestone. Chert nodules uncommon. Base of dolomitic upper division of West Spring Creek fm.. . . . . 511.1

2. Mottled dolomitic limestone in thick beds, interstratified with compact calcarenite. Irregular, porous chert nodules along bedding surfaces. Pomatotrema oklahomense Ulrich and Cooper 32 feet above base; Polytoechia subrotunda Ulrich and Cooper at base. Didymograptus 8 feet above base. 83.7

1. Thick-bedded calcarenite, mottled dolomitic limestone, algal limestone, and oolitic limestone, in beds 1 to 9 feet thick, alternating with laminated dolomitic limestone in beds 1 to 7 feet thick. Gray chert nodules uncommon. Sandy dolomitic limestone 6 feet thick at base and 58 feet above base. Ceratopea sp. 2 is found 71 feet below top and Ceratopea ankylosa Cullison 400 feet above base. 671.4

1,559.6

Kindblade limestone:
Thick-bedded gray limestone containing Ceratopea tennesseensis Oder 30 feet below top.

Return to cars and continue north on Hwy. 77.

13.3 Kindblade-West Spring Creek contact.

13.65 Thick-bedded ls. containing abundant silicified Archaeoscyphia, marker zone for lower Kindblade. Highway shoulders are too narrow to permit a stop here. Good outcrops are just south of trees in filled cave east of highway.

14.5 Turn left through aluminum gate opposite entrance to Chapman Ranch headquarters. Follow pasture road westward over Butterly dolomite, then northwestward along swale on lower McKenzie Hill.

15.2 Park cars in pasture.

STOP 2. Walk northeastward over an excellently exposed homoclinal section of Butterly dolomite, Signal Mountain limestone, and Royer dolomite. Dip 45°-46° SW. NE¼ NE¼ sec. 13 and SE¼ SE¼ sec. 12, T. 2 S., R. 1 E. (See also Figure 14, in Part 2 of Guide Book.) Measured section as follows:

McKenzie Hill limestone: Thickness (feet)
Dark gray limestone, fine-grained, slightly dolomitic, thick-bedded, containing a few chert nodules.

Butterly dolomite:
4. Sandy dolomite, gray, medium crystalline, thick-bedded, interstratified with (a) laminated, yellowish-gray dolomite, finely crystalline, (b) thick-bedded highly dolomitic limestone, and (c) laminated very fine-grained limestone 90.0

3. Dolomite, gray, coarse-crystalline, thick-bedded, interstratified with laminated fine-crystalline dolomite containing aggregates of milky-white quartz druse; non-sandy. 31.0

2. Gray dolomite, coarsely crystalline, thick-bedded, non-sandy. 70.0

1. Gray dolomite, medium- to coarse-crystalline, massive-bedded, in part weathering thin-bedded,

containing aggregates of milky-white quartz druse. Coarse arkosic sand at top. Apheoorthis at base. 106.0

297.0

Signal Mountain limestone:

Gray limestone, medium-crystalline to granular, slightly dolomitic; intercalcated thick- and thin-bedded layers mostly 1-3 feet thick. Non-cherty. Traces of glauconite in pellets and green flakes. Apheoorthis ornata 15 feet below top. Finkelnburgia auriculata Cooper 27-52 feet above base (species closely related to F. finkelnburgi). Oil stains locally present 365.0

Royer dolomite:

8. Dark gray dolomite, medium-crystalline, locally mottled in shades of brown; weathers to beds 1 to 3 inches thick. 66.0

7. Dolomite, grading from light to dark gray, typically coarse-crystalline, in massive layers 1 to 5 feet thick, weathering to dark gray, pitted blocks. Dark gray dolomite yields asphaltic odor when struck by hammer . . . 158.5

6. Yellowish-gray dolomite, fine-crystalline, laminated, very tough and compact 5.0

5. Dolomitic limestone, light gray, fine-grained and compact; coarsely crystalline light gray dolomite in stringers and irregular patches, commonly 15 to 25 percent. Well-defined beds 4 to 12 inches thick 55.0

4. Dolomite, nearly white grading to pink, very coarsely crystalline (2-5 mm.), thick beds weathering light gray, pitted 18.0

3. Dolomitic limestone, light gray, fine-grained; pink and yellowish-orange dolomite in coarse-crystalline patches and stringers. Beds 3 to 12 inches thick. 42.0

2. Light gray dolomite, locally mottled with pink, coarsely crystalline; beds massive, pitted 75.0

1. Dolomite, light gray to grayish-yellow and pale brown, coarse-crystalline to fine-crystalline, massive-bedded . 314.5

734.0

Fort Sill limestone:

Dolomitic limestone, blue-gray, fine-grained, with lacy patches, irregular knots, and stringers of medium-crystalline light brown dolomite; mostly thick-bedded . . . . about 20 feet exposed

Return to cars and retrace route to Hwy. 77.

16.0 Turn left (north) on highway.

16.5 Chapman Ranch fault. Lower Fort Sill on southwest thrust-faulted over upper Royer on northeast. For next 2 miles travel on Royer dolomite in axial part of East Timbered Hills anticline. East Timbered Hills, composed of pre-Cambrian Colbert porphyry, on left (west).

19.2 Turner Falls lookout.

21.1 Cedarvale.

21.5 Junction with Oklahoma Hwys. 77D and 7B. Continue ahead.

22.1 Washita River.

25.6 Davis. Turn left (west) on Oklahoma Hwy. 7.

26.5 Washita River.

29.2 Turn left (south) on graveled road.

29.5 Turn right.

30.0 Turn left. Cen. E. line NE¼ sec. 4, T. 1 S., R. 1 E. In cen. SW¼ NE¼ of same section is Frankfort No. 1 Hale, which in February-March, 1955, proved first commercial oil from Arbuckle rocks in southern Oklahoma. On drillstem test Frankfort recovered 5,500 feet of oil from dolomite in West Spring Creek fm. at a depth of approximately 6,000 feet.

32.2 Aluminum gate.

32.05 Colbert Creek. Crops in stream and to left are Viola and Bromide, overturned on north flank of Arbuckle anticline.

33.1 Crest of hill. Upper West Spring Creek, overturned.

33.3 Crest of hill. On Kindblade ls. Rounded hills of Viola to east; West Timbered Hills to west.

33.8 Trace of Washita Valley fault.

34.3 At Y in road. Turn left past feed house.

34.4 Wire gate on E-W fence.

34.9 Earthen tank on left.

35.1 At feed house. Curve right along feed troughs.

35.8 Wire gate on N-S fence.

36.65 Wire gate. Windmill and earthen tank on right. Hill of brown iron ore 300 feet south of dam.

38.1 Wire gate on N-S fence. White house on right, windmill on left. SE cor. sec. 25, T. 1 S., R. 1 W.

38.3 Curve north.

39.1 Wire gate.

40.5 Park cars in pasture. Lunch stop. Please help in keeping the grounds clean.

40.9 Continue ahead to house and park cars. This is the original headquarters for the old Royer ranch, for which the Royer dolomite was named.

STOP 3. Reagan sandstone in the locality of its maximum known thickness in Oklahoma. Rocks exposed on south slope of West Timbered Hills, striking N.70° W. and dipping 12° SW. Walk northward past barn 2,000 feet to north-facing escarpment capped by basal Reagan beds. Measured section units 1-4 in SE¼ and units 5-7 in cen. SW¼ sec. 24, T. 1 S., R. 1 W.

	Thickness (feet)
Honey Creek limestone:	
Limestone, very glauconitic and silty, gray to greenish-gray and brown, finely crystalline and compact, grading upward into coarsely crystalline glauconitic limestone. Trilobites common in coarse-textured beds.	105.0
Reagan sandstone:	
7. Sandstone, buff to reddish-brown and purplish-red, medium- to coarse-grained. Contains abundant glauconite .	43.0
6. Sandstone, mostly pale brown, fine-grained, partly laminated, containing abundant glauconite	108.0
5. Sandstone, light to dark brown, medium- to coarse-grained, slightly glauconitic, case-hardened locally, beds poorly stratified.	81.0

4. Sandstone, brown to gray, medium-grained, slightly glauconitic, locally containing conglomeratic lenses, poorly stratified. 36.0

3. Sandstone, deep to pale brownish-purple with hematite, dominantly medium-grained but containing also thin layers of quartz conglomerate and fine-grained sandstone. Secondary enlargements of quartz grains common. Mostly thin-bedded and locally cross-bedded. Weathers to layers 1-4 inches thick. 150.0

2. Sandstone, reddish-brown to buff, coarse-grained, poorly sorted. Marked cross-bedding locally. Beds compact and silica-cemented, weathering massive to fluted 30.0

1. Rhyolite-quartz conglomerate, orange-red to buff; most pebbles sub-rounded, about 1 inch in diameter. Beds evenly stratified, 1-2 feet thick. Well-exposed in steep scrap face. Contact with pre-Cambrian Colbert porphyry concealed on debris-covered slope 12.0

Thickness of Reagan sandstone 460.0

Return to cars and retrace route to fence.

41.9 Turn right through wire gate. Curve southward.

42.7 Intersection of pasture roads. Turn right along south edge of ephemeral lake.

43.4 Tank on left (south) across fence. Continue westward.

43.7 On good outcrops of Signal Mountain limestone in southwest-dipping homoclinal succession.

44.0 Wire gate on N-S section-line fence; 700 feet north of SE cor. sec. 27, T. 1 S., R. 1 W. Take faint road northwestward.

44.45 Low hill of brown iron ore. Drive slowly around north edge over rough rocks.

45.0 Rocky road. Drive carefully.

45.1 Brass plate set in concrete on left. Azimuth mark of U. S. Coast and Geodetic Survey. Curve left.

45.2 Curve right onto faint trail and continue northwest.

45.5 Park cars in pasture about 800 feet south of iron ore hill, NE¼ NW¼ SE¼ sec. 28 T. 1 S., R. 1 W.

STOP 4. Walk northwestward to top of Butterly dolomite and follow line of measured section down to base of Fort Sill limestone, as shown in Figure 4. In this area the Signal Mountain and Fort Sill limestones have their maximum thickness in the Arbuckle Mountains, and the Royer dolomite normally between them is absent. Following is a measured section generalized from detailed outcrop samples and measurements.

McKenzie Hill limestone: Thickness (feet)

Coarse sandy limestone, dark gray, fine-grained to granular, in alternating thick-and thin-bedded strata, grading upward to thick-bedded non-sandy limestone.

Butterly dolomite:
Sandy dolomite; dark gray to light gray and brown, in coarsely crystalline, massive-bedded layers intercalcated with thin-bedded, fine-grained, partly laminated dolomite. Sand is highly feldspathic and partly coarse-textured. Top beds grade erratically into limestone 148.0

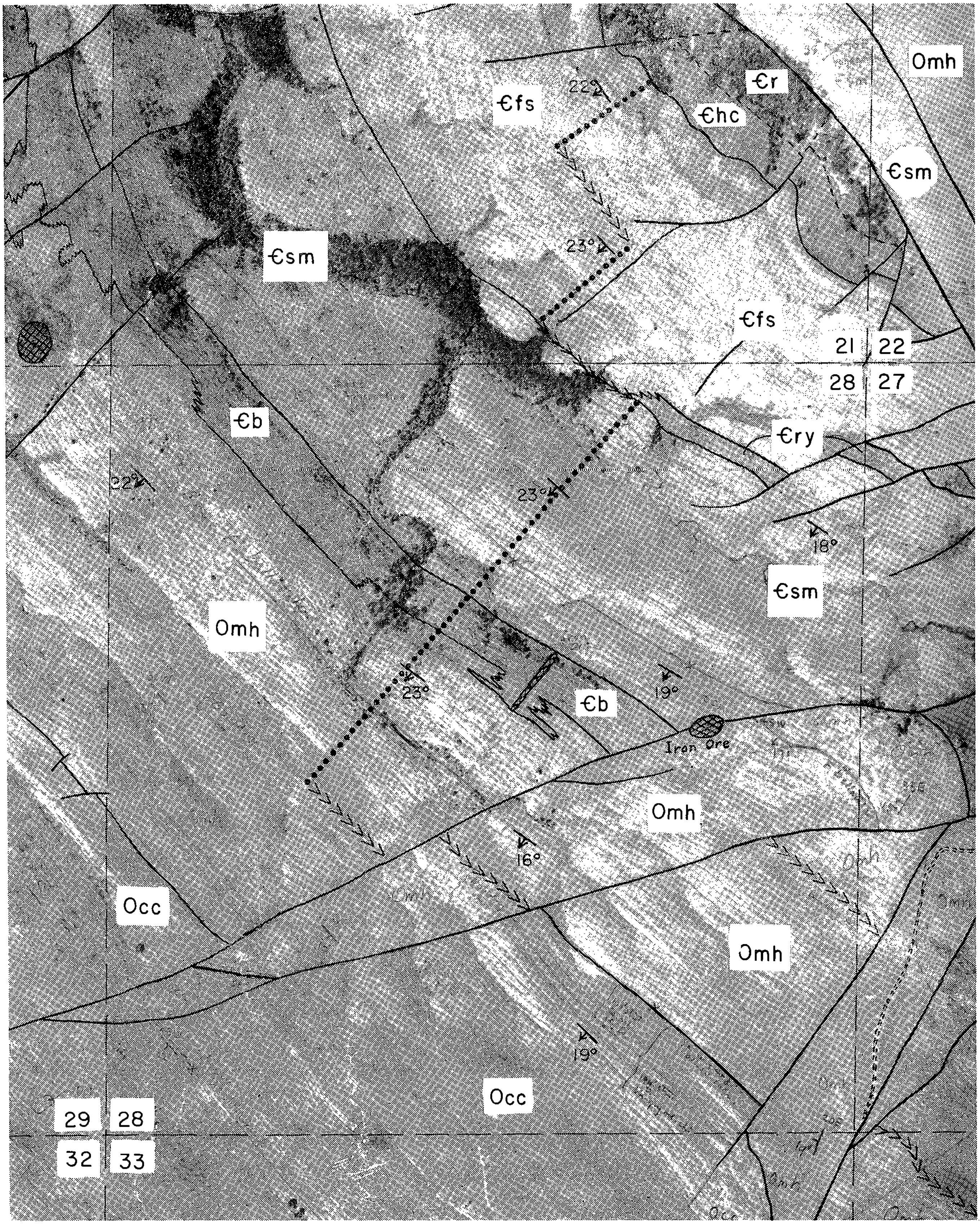


Figure 4. Aerial photograph showing geology in secs. 21 and 28, T. 1 S., R. 1 W., Murray County. Excellent exposures of Cambrian Arbuckle strata.
Stop 4. Sampled section along line of dots.

Signal Mountain limestone:

6.	Dark gray limestone, fine-granular, mottled with 5 to 25 percent of brown, finely crystalline dolomite; alternating thick-bedded and thin-bedded units.	99.0
5.	Gray limestone, finely granular, in beds 2 to 6 inches thick. Apheoorthis throughout.	31.0
4.	Limestone, dark blue-gray, fine-grained, thick- to thin-bedded, dolomitic; intercalated with granular dolomitic limestone	134.0
3.	Dark gray limestone, fine-grained to medium-granular, slightly dolomitic and glauconitic, in alternating resistant and non-resistant beds.	258.0
2.	Thin-bedded limestone, gray, consisting of interstratified flat pebble conglomerate and granular to fine-grained limestone, each containing scattered grains of glauconite. Well-preserved Finkelnburgia auriculata Cooper throughout zone.	74.0
1.	Thin-bedded limestone conglomerate and coarsely granular limestone slightly glauconitic and dolomitic. Some detrital dolomite in spheriodal grains. Billingsella rectangulata Cooper 100 feet above base and Cymbithyris hami Cooper 126 feet above base	148.0
		744.0

Fort Sill limestone:

6.	Thick-bedded gray limestone showing prominent algal structures. Observed only where Royer dolomite is absent. . . .	35.0
5.	Light gray limestone, fine-grained and very compact, massive-bedded, partly mottled with dolomite, alternating with thinner bedded granular limestone. Anastomosing chert and hexactinellid sponge spicules uncommon. Billingsella corrugata Ulrich and Cooper and Billingsella n. sp. in lower 250 feet. Royer dolomite replaces these beds in all but the western part of the region.	350.0
4.	Gray limestone, thin-bedded, granular. Principal zone of Billingsella corrugata Ulrich and Cooper at base, which is consistently 210 feet above base of formation	10.0
3.	Gray to pale lilac-colored limestone, fine-grained and compact, containing anastomosing porous chert and abundant sponge spicules in the west. A few inter-bedded thin granular limestones. Lower part mottled with brownish dolomite, thick-bedded, generally capping a small escarpment. Horizon of Plectotrophia bridgei Ulrich and Cooper and Mesonomia n. sp. 73 feet above base of formation. Royer dolomite nowhere in southern Arbuckle Mountains descends below base of this unit.	93.0
2.	Silty limestone, thin-bedded, gray to brownish, slightly glauconitic, generally laminated or cross-laminated, crops out in small scarp face. Silt content diminishes westward.	60.0
1.	Gray and purplish limestones, fine-grained and compact, slightly glauconitic; thin-bedded granular limestone as interbeds containing hexactinellid sponge spicules. Girvanella-like algae near base locally..	70.0
		587.0

Honey Creek limestone:

Gray limestone, medium-to fine-crystalline, slightly glauconitic, contain-intercalated laminae of fine sandy limestone; grades below into coarse-crystalline fossiliferous limestone, sandy at base.

Return to cars and retrace route to Ardmore.

47.1 Wire gate.

48.2 Ephemeral lake.

48.3 Intersection of trails. Continue ahead (east).

48.65 Wire gate.

49.3 Wire gate. White house on left.

55.0 Colbert Creek. Aluminum gate ahead.

61.7 Davis. Stop Sign. Turn right (south) on Hwy. 77.

85.6 Ardmore. English Village Motel.

End of trip for April 22.

ROAD LOG FOR FIELD TRIP

April 23, 1955

Assembly Point

Assemble at northwest edge of Ardmore, on U. S. Highway 77 at 12th St., NW. Cars line up on highway shoulder opposite English Village Motel, heading north. Caravan leaves at 7:30 A.M.

Special Instructions

As most of the outcrops visited are on large ranches where pastures are subject to disastrous prairie fires, it is absolutely necessary for all participants to be EXTREMELY CAREFUL WITH FIRE. Carelessness with fire might result in a permanent ban on organized field trips in this region.

Mileage

~~0.00 Assembly point. Turn right (east) on 12th Street.~~

.65 Jog left, then right.

1.0 U. S. Hwy. 70 (Washington Street). Turn left.

1.1 Turn right.

9.4 Dickson. Junction with Okla. Hwy. 18. Continue ahead on Hwy. 70.

12.6 Carter-Johnston County line.

15.5 Enter Mannsville.

18.4 Turn left on Okla. Hwy. 12. Caution.

21.1 Russet School.

23.9 Washita River.

26.7 Entering Ravia.

27.1 Frisco RR. Caution.

27.3 Okla. Hwy. 22. Turn left.

33.8 Troy. On Tishomingo granite.

35.1 Plant of Rock Products Manufacturing Corp. High-purity dolomite from Royer fm. is quarried 3 miles west of plant and crushed for glassmaking and mineral feeds.

40.3 Mill Creek. Turn left at Tydol Station.

40.4 Turn left.

40.6 Frisco RR. Two tracks. Caution.

40.95 Turn right (west).

41.6 Threemile Creek.

42.1 Turn left (south). NE cor. sec. 14, T. 2 S., R.4 E.

42.2 Mill Creek.

42.35 Turn right on trail.

42.75 Fork in road. Curve right.

42.85 Drive to fence and park in pasture. On Tishomingo granite. Granite hills to south approximately 100 feet high have the greatest relief developed on granite surface in this region.

STOP 1. Sedimentary features of Cambrian strata around buried granite hills. In the northern part of the Tishomingo anticline are the only buried granite hills known in the Arbuckle Mountains. All occur as granite inliers surrounded by strata of the Reagan, Honey Creek, Fort Sill, and Royer formations. Of the four known inliers, the three that occur in the NW¼ NW¼ sec. 14 and NE¼ sec. 15, T. 2 S., R. 4 E. are to be visited at this stop. (See Figure 5).

All the rocks deposited around the granite inliers are abnormally thin, the Reagan being 30-250 feet, Honey Creek 63-97 feet, Fort Sill 193 feet, and Royer 513 feet. Furthermore, the Fort Sill formation shows abrupt gradation of limestone into dolomite in the vicinity of the buried hills, and the inference is clear that both thinness and dolomitization here are related to deposition in extremely shallow water around the shores of the granite islands.

The dolomites of the Honey Creek, Fort Sill, and Royer formations which surround the granite inliers show peripheral dips ranging between 4° and 40°, the steeper dips being on the west sides and the gentler ones on the east sides of the inliers. These dips have been modified by regional tilting, so that the present recorded dip is greater or less than that ascribable to initial deposition. The regional tilting of the Tishomingo anticline that took place in Pennsylvanian time, and resulted in the present dip of the rocks, averages about 15° westward for the area of granite inliers. To restore the correct initial dip it is necessary, therefore, to deduct 15° from all west dips and to add 15° to all east dips. For example, a 30° W. recorded dip becomes 15° W. initial dip and 8° E. recorded dip becomes 23° E. initial dip; and similarly a 4° W. recorded dip becomes 11° E. initial dip because the subtraction is algebraic and in this instance the dip direction is reversed. When corrected for regional tilting in this manner it is evident that the initial dips around the pre-Cambrian hills invariably are peripheral and range between 1° and 25°, average about 10° . The irregularities in magnitude of dip undoubtedly are owed to the irregular configuration of the surfurace of the granite hills at the time the sedimentary beds were deposited.

The height of the highest islands at the beginning of Reagan time was at least 1,000 feet, as 944 feet of sediments were deposited adjacent to the largest inlier before it was covered.

Return to cars and retrace route to graveled road.

43.4 Turn right.

43.6 Bridge.

44.3 Cattle guard.
Contact of Tishomingo granite and Reagan sandstone, poorly exposed south of road. Strike on Reagan is N. 12° W., dip 15° west.

44.5 OPTIONAL STOP. Park on side of road.
Look right (northward) across abandoned field along strike of Reagan sandstone to a low hill of granite, showing overlapping contact. The Reagan overlaps this granite hill, decreasing from a thickness of 290 feet to 30 feet along a horizontal distance of 1,000 feet. The rate of overlap is slightly more than 1,300 feet per mile and the calculated slope on the granite is 14½°.

In the road ahead are outcrops of typical Reagan sandstone, which is highly feldspathic and conglomeratic, and contains some glauconite.

44.8 Contact of Reagan sandstone and Honey Creek formation, poorly exposed.

44.9 Bee Creek.

45.0 At curve in road.

OPTIONAL STOP. Park in front of house.
Uppermost beds of Honey Creek formation exposed in roadcut and in low scarp face. The formation here consists of glauconitic sandy and non-sandy dolomite. In the Mill Creek area it ranges in thickness from 63 to 234 feet, being thinnest where the Reagan is thin as a result of deposition over buried

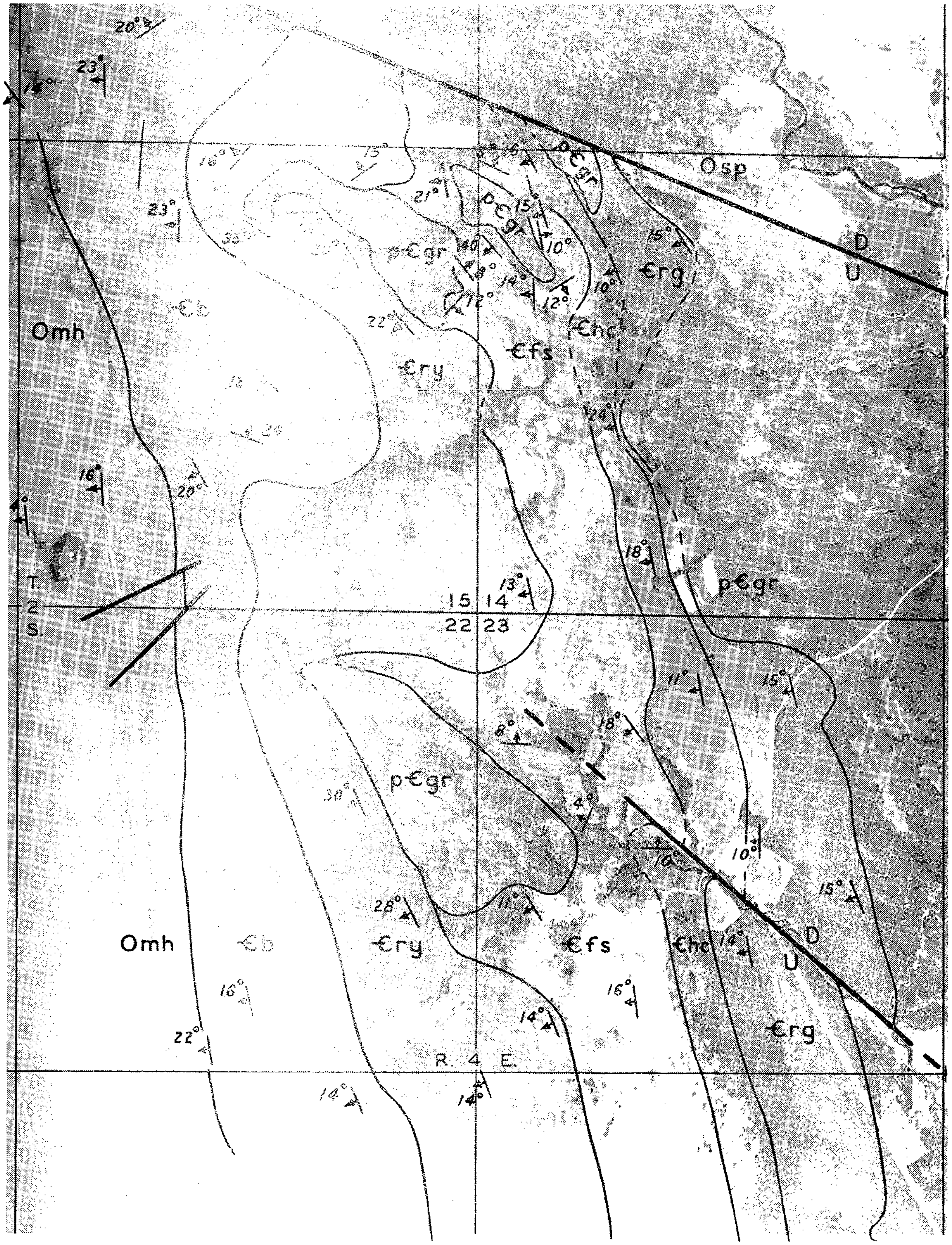


Figure 5. Aerial photograph showing geology of Cambrian strata around granite inliers in secs. **14, 15,** 22, and 23, T. 2S., R. 4 E., Johnston County.
(Okla. Geol. Survey Circular 26, 1949, frontispiece)

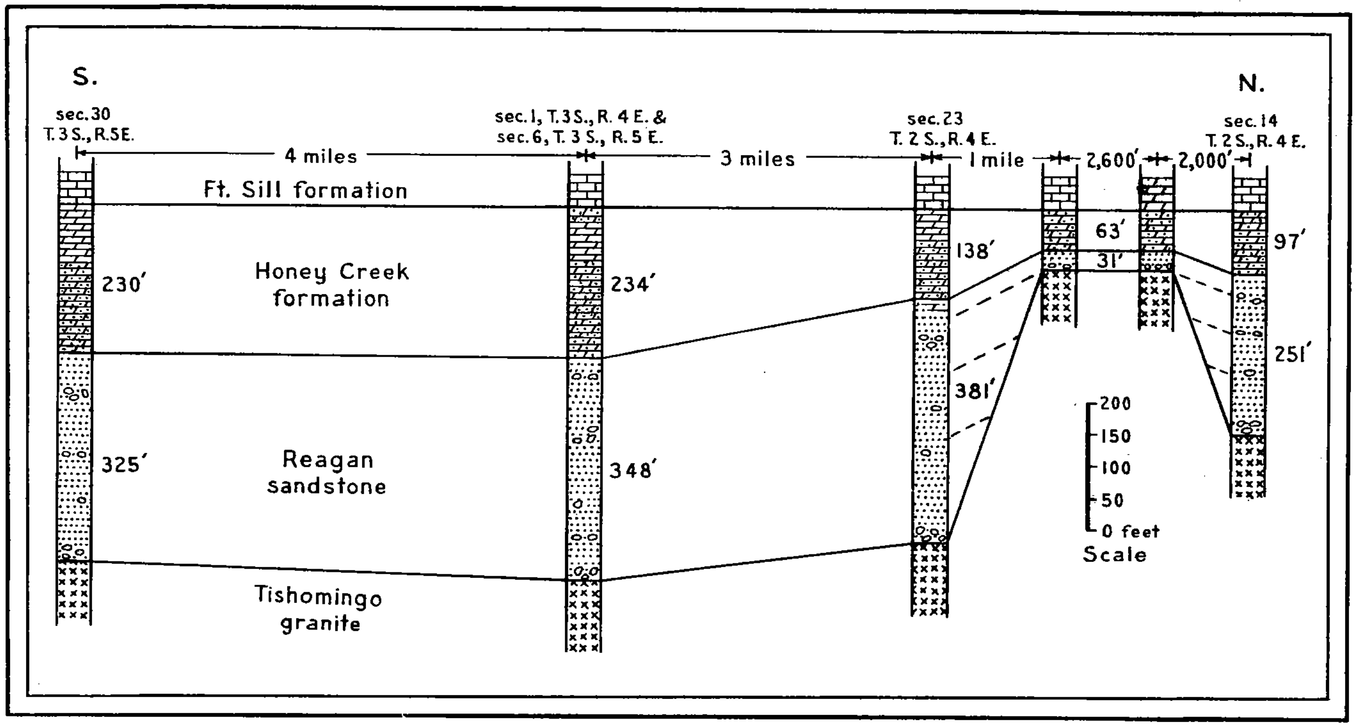


Figure 6. Stratigraphic sections of Reagan and Honey Creek formations in the Tishomingo anticline, showing marked thinning over a buried granite hill in northern part of area. (Okla. Geol. Survey Circular 26, 1949, fig. 3, p. 32.)

granite hills. In the eastern part of the Arbuckle Mountains the Honey Creek formation is entirely dolomite whereas in the western part it is limestone.

Overlying beds, partly exposed along road, are fine-grained white limestones at the base of the Fort Sill formation, containing spherical algae about 1 inch in diameter.

Continue south along road.

45.5 Cattle guard.

46.2 Park cars on side of road.

STOP 2. Typical section of Fort Sill, Royer, and Butterly formations in the Tishomingo anticline. The Fort Sill formation in this area, south from the granite inliers, is composed mostly of limestone, and has increased in thickness from 193 feet to 400 feet. The Royer and Butterly dolomites are in contact, there being no limestone to represent the Signal Mountain formation.

The following section was measured and sampled 1 mile south, in the SW¼ sec. 36, T. 2 S., R. 4 E. and the NE¼ sec. 2, T. 3 S., R. 4 E., where the rocks are better exposed.

	Thickness (feet)
McKensie Hill limestone:	
Limestone, dark gray, fine-grained, slightly dolomitic; massive beds in units 5-10 feet thick interstratified with thin-bedded marly limestone. Chert nodules rare.	
Butterly dolomite: 333.0 feet thick.	
13. Dolomite, gray, finely crystalline and compact; disseminated and nodular chert; beds 6 inches thick; weathers smooth, dark gray. Silicified brachiopods and cephalopods, poorly preserved.	17.0
12. Dolomite, gray to yellowish, medium- to coarse-crystalline; a few beds sandy, drusy quartz; beds 6 to 12 inches thick; weathers gray to brownish . . .	44.0
11. Covered across meadow. Probably dolomite.	44.0

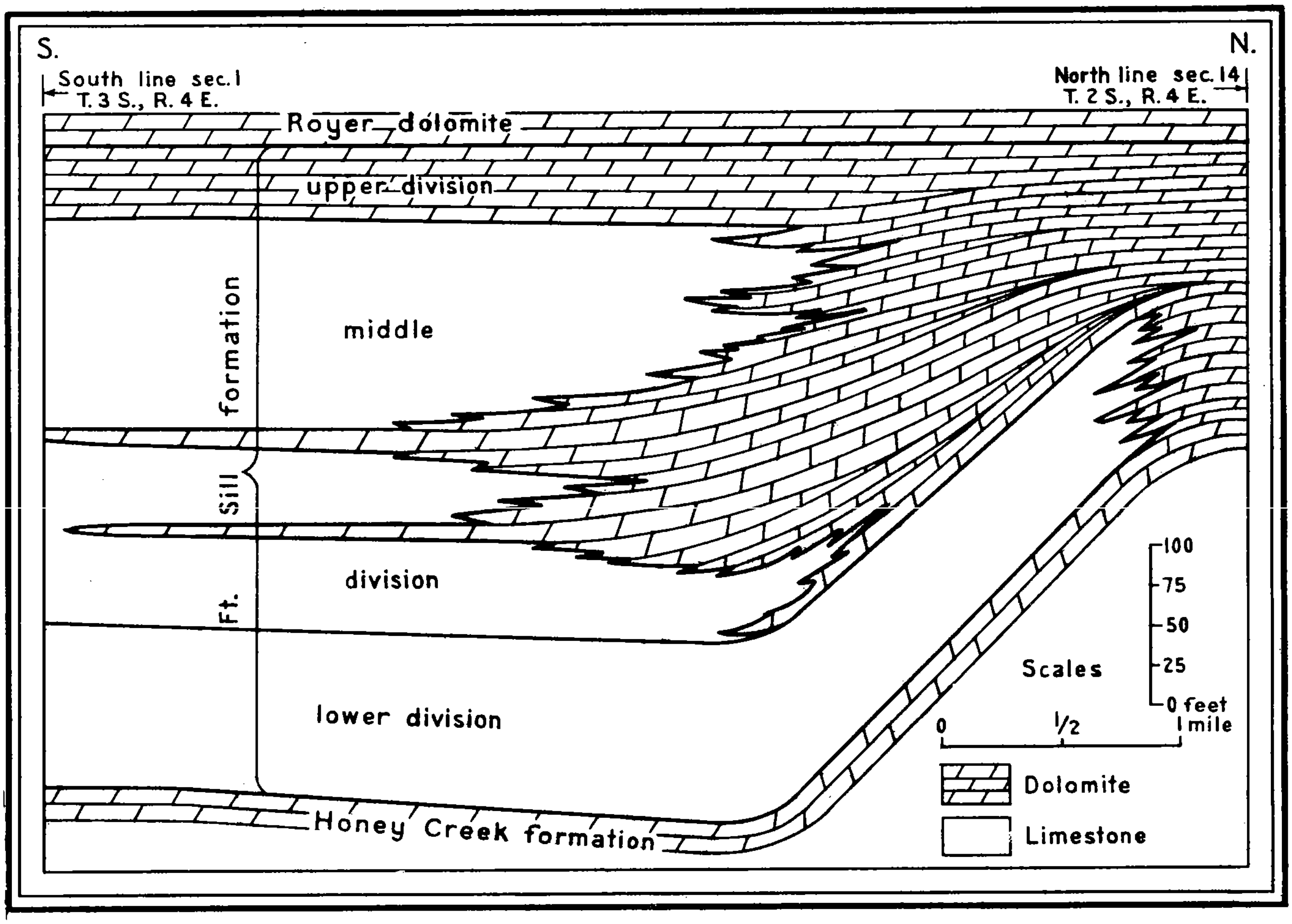


Figure 7. Generalized section of Fort Sill formation in northern part of Tishomingo anticline, showing northward thinning and gradation of limestone into dolomite. (Okla. Geol. Survey Circular 26, 1949, p. 41)

10.	Dolomite, gray to yellowish, finely crystalline, sandy; disseminated quartz druse; mostly thin beds, 2 to 6 inches thick, that weather light gray to pale tan	33.0
9.	Dolomite, mottled gray and brick-red, coarse-crystalline; disseminated quartz druse; massive beds 1 to 3 feet thick; weathers dark gray, honeycombed	44.0
8.	Dolomite, gray to tan, finely crystalline, laminated; beds 2 to 4 inches thick; weathers smooth and pale cream to dead white	5.0
7.	Dolomite, gray, coarsely crystalline; massive beds 1 to 3 feet thick; weathers dark gray, honeycombed	12.0
6.	Dolomite, gray to tan, finely crystalline, laminated; beds 2 to 4 inches thick; weathers smooth and pale cream to dead white	6.0
5.	Dolomite, gray, finely crystalline; quartz druse; beds 6 to 12 inches thick; weathers light gray, smooth to slightly pitted	25.0
4.	Dolomite, gray, coarse-crystalline, massive beds 1 to 3 feet thick; weathers dark gray, honeycombed	55.0

3.	Dolomite, gray to tan, finely crystalline, laminated; beds 2 to 4 inches thick; weather smooth and pale cream to dead white	6.0
2.	Dolomite, light gray, coarse-crystalline; disseminated quartz druse; massive beds 1 to 3 feet thick; weathers dark gray, honeycombed	37.0
1.	Dolomite, gray to tan, finely crystalline, laminated; beds 2 to 4 inches thick; weathers smooth and pale cream to dead white	5.0

Royer dolomite: 566.5 feet thick.

11.	Dolomite, light gray to pink and light brown coarse-crystalline; disseminated quartz druse, and chert; beds 2 to 3 feet thick; weathers dark gray, honeycombed	29.5
10.	Dolomite, like above, without quartz druse and chert .	77.0
9.	Covered across meadow	33.0
8.	Dolomite, light gray to pink and light brown, coarse-crystalline; beds 2 to 3 feet thick; weathers light to dark gray, honeycombed	44.0
7.	Dolomite, tan to light chocolate, medium-crystalline, very uniform sugary texture; beds 4 to 10 inches thick; weathers to light gray smooth blocks with rough feel .	55.0
6.	Dolomite, gray to tan, medium-crystalline; beds 2 to 3 feet thick; weathers gray, slightly pitted to honeycombed	33.0
5.	Dolomite, gray to tan, medium-crystalline; beds 2 to 6 inches thick; weathers light tan to gray slightly pitted blocks	66.0
4.	Limestone, dark gray, fine grained, contains 5 to 15 percent dolomite in lacy, crystalline aggregates; beds 6 to 12 inches thick; weathers light blue-gray, thin-bedded .	42.0
3.	Dolomite, gray to tan, medium-crystalline; beds 3 to 10 inches thick; weathers smooth to slightly pitted with sugary-textured surface.	55.0
2.	Dolomite, light gray to pink, coarse-crystalline; massive beds 1 to 3 feet thick; weathers dark gray, honeycombed	88.0
1.	Dolomite, light chocolate-brown to gray, medium-crystalline, sugary texture; beds 1 to 2 feet thick; weathers dark gray, slightly to deeply pitted	44.0

Fort Sill limestone: 400.6 feet thick.

8.	Dolomite, gray to tan, medium-crystalline; beds 1 to 2 feet thick; weathers to dark gray blocks, some smooth and some slightly pitted	44.0
7.	Limestone, dolomitic, gray, finely crystalline; weathers to brownish-gray layers 1 to 2 inches thick	11.0
6.	Limestone, dark gray to brownish, mottled by patches of brown medium-crystalline dolomite; fine grained; dolomite commonly about 10 to 25 percent, although small lenses are completely dolomitized; massive beds 1 to 3 feet thick in ledges 5 to 7 feet thick, interbedded with marly, dolomitic limestone that is poorly exposed on grassy benches	119.0
5.	Dolomite, gray, medium-crystalline; beds 4 to 12 inches thick; weathers to yellowish, pitted blocks	11.0
4.	Limestone, dolomitic, dark gray to light brown, fine-crystalline calcite groundmass with reticulate masses	

Figure 8. Aerial photograph showing geology and fault-controlled dolomite in secs. 2, 3, 10, and 11, T. 3 S., R. 4 E., Johnston County. Butterly and Royer are stratigraphic dolomites. Diagonally ruled areas are fault-controlled dolomite in Cool Creek and McKenzie Hill limestones.

tan, medium-crystalline dolomite; about 25 percent dolomite; at base a conglomerate of limestone pebbles set in a sandy matrix; mostly thin-bedded. 49.5

3. Dolomite, gray, medium-crystalline, a little drusy quartz; beds 3 to 4 inches thick; weathers to yellow-brown blocks, some smooth and some deeply pitted. 5.0

2. Limestone, dolomitic, mottled dark gray and light brown; fine-grained limestone with reticulations and irregular patches of medium-crystalline, tan dolomite; some beds have lenses of dolomite as much as 15 feet long; beds 2 to 6 inches thick; weathers to layers 1 inch thick . . 56.5

1. Limestone, slightly dolomitic, gray to greenish gray, fine crystalline and compact; contains lacework of brownish dolomite that weathers into positive relief; massive-bedded strata at top; beds 6 to 12 inches thick; at base a 3 foot bed of arkosic limestone that channels into underlying Honey Creek dolomite; weathers to dark gray boulders. 104.6

Continue ahead.

46.8 Cattle guard; 600 feet east of SW cor. sec. 26, T. 2 S., R. 4 E.

47.2 Outcrops of McKenzie Hill limestone.

47.9 Cattle guard.

48.85 Cattle guard.

49.0 Turn left through wire gate.

49.4 Park cars in meadow.

STOP 3. SW¼ SW¼ sec. 2, T. 3 S., R. 4 E. See Figure 8. Dolomite bodies of tectonic replacement origin, characterized by irregular shape, abrupt lateral transition into limestone, and association with faults, are present in all limestone formations of Arbuckle group in the southern Arbuckle Mountains. They are most common in the Cool Creek, McKenzie Hill, and lower division of the West Spring Creek formation, and least common in the Signal Mountain and Kindblade formations. In the Arbuckle anticline the bodies are mostly small and widely scattered, whereas in the Tishomingo anticline they are much more numerous and the bodies themselves are thicker and more extensive.

The largest and thickest bodies, which are in the Ordovician formations of the Tishomingo anticline, originate from faults whose stratigraphic displacement normally is less than 100 feet, the dolomitized bodies disappearing or becoming smaller in the vicinity of the larger, through-going faults. This suggests that the dolomitizing solutions were locally derived, probably from connate waters trapped within the Ordovician limestones or the underlying Cambrian dolomites, and freed for migration during the folding of the Arbuckle Mountains in middle and late Pennsylvanian time.

That the dolomites grade laterally into limestone outward from faults is conclusively shown at many localities where the rocks are mostly exposed, so that there is no doubt about the accuracy of the field observations. Probably the best example is along a hinge fault, in the south-central part of the Tishomingo anticline, that trends northeast through the NE¼ sec. 10 and NW¼ NW¼ sec. 11, T. 3 S., R. 4 E. In this locality a sequence of dolomite embracing all the McKenzie Hill formation and the lower part of the Cool Creek formation, a thickness of approximately 1,100 feet, grades southeastward irregularly into limestone within a distance of 2.5 miles, and most of this lateral transition takes place within one mile. A half mile northward from the controlling fault the McKenzie Hill formation consists of limestone except for two thin stringers of dolomite.

LUNCH STOP. Please do not leave trash in pasture.

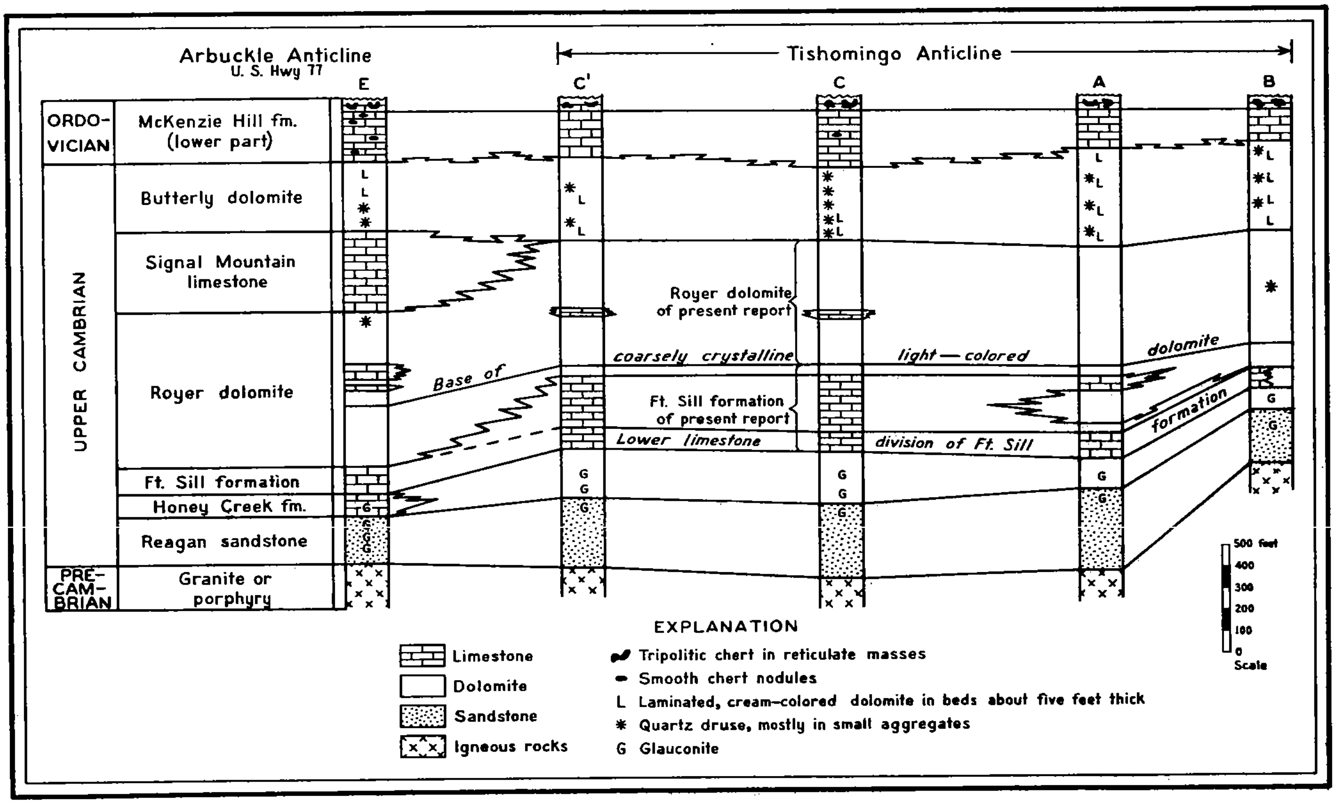


Figure 9. Correlation of measured outcrop sections of Cambrian strata in the Tishomingo anticline with the section on U.S. Highway 77.
A. S½ sec. 22 and S½ sec. 23, T. 2 S., R. 4 E.
B. Secs. 14 and 15, T. 2 S., R. 4 E.
C. N½ sec. 1 and NE¼ sec. 2, T. 3 S., R. 4 E.; SW¼ sec. 36, T. 2 S., R. 4 E.; and NW¼ sec. 6, T. 3 S., R. 5 E.
C'. NW¼ sec. 13 and NE¼ sec. 14, T. 3 S., R. 4 E., and N½ sec. 30, T. 3 S., R. 5 E.
E. SW¼ sec. 1 and NW¼ sec. 12, T. 2 S., R. 1 E.
(Okla. Geol. Survey Circular 26, 1949, p. 23)

Retrace route to Mill Creek.

57.4 Tydol station. Continue ahead (east) past school.

57.7 Turn right (south) on Oklahoma Hwy. 7.

67.0 Turn left (east).

68.8 Turn right (south). NE cor. sec. 17, T. 2 S., R. 5 E. Outcrops of Atoka sandstone and Wapanucka limestone in roadcuts ahead.

69.8 Turn left (east).

69.9 Woodford formation in roadcut on hill.

71.65 Curve right (southeast).

71.9 West Spring Creek dolomite in a small fault segment at south edge of Mill Creek syncline.

72.1 Curve right (south).

72.2 Cross Reagan fault onto Tishomingo granite.

72.8 Curve left (east).

73.6 Cross Reagan fault from granite onto McKenzie Hill dolomite.

74.0 Crossing outcrops of Cool Creek dolomite.

74.8 Turn right (south). NE cor. sec. 25, T. 2 S., R. 5 E.

75.1 Outcrops of Butterly dolomite on hill.

75.2 Cross Reagan fault onto Tishomingo granite.

75.65 Reagan. Turn left (east).

75.8 Ballard Park. Curve right over Pennington Creek.

80.0 Cross Mill Creek fault, passing from granite onto Honey Creek dolomite.

80.4 Turn left (north). Junction with Oklahoma Hwy. 99. Outcrops ahead, particularly on left, are limestone of Cool Creek formation. Eastward from here the Cool Creek is composed entirely of dolomite.

81.0 Cross Blue River fault onto Tishomingo granite.

81.3 Curve right on Oklahoma Hwy. 7.

84.1 Blue River.

87.5 Section line road. Turn left (north). SE cor. sec. 23, T. 2 S., R. 7 E.

87.9 Cross branch of Sulphur fault zone, leaving granite and passing onto Cool Creek dolomite, which is mostly concealed by residual sandy and cherty soil.

88.5 Turn right (west). NE cor. sec. 23, T. 2 S., R. 7 E.

88.8 Park cars on side of road. Walk north on east side of north-trending stream valley over middle and upper Kindblade. On northeast flank of Belton anticline.

<u>STOP 4</u>. In the SE¼ sec. 14, T. 2 S., R. 7 E. and parts of adjoining sections to the east are the best exposed outcrops of Kindblade and West Spring Creek strata in the eastern part of the Arbuckle Mountains. Both formations are composed entirely of dolomite, but contain silicified fossils that permit positive correlation with limestone equivalents in the western part of the region. Only the Kindblade outcrops will be examined at this stop, as the West Spring Creek outcrops are inaccessible to a large group. Section of Kindblade formation, C. N½ SW¼ and C. SE¼ sec. 14, T. 2 S., R. 7 E. Strike N. 40°-50° W., dip 24°-30° NE.

	Thickness (feet)
West Spring Creek formation: Dolomitic sandstone 7 feet thick at base, overlain by thick-bedded cherty dolomite and laminated sandy dolomite.	
Kindblade formation: 997 feet thick.	
10. Dolomite, light gray to brownish-gray, fine- to medium-crystalline, locally containing smooth chert nodules, interstratified with laminated, fine-crystalline, sandy dolomite. Zone of <u>Ceratopea tennesseensis</u> is 5 feet below top	178.0
9. Dolomite, gray, medium-crystalline. <u>Tritoechia typica</u> and <u>Finkelnburgia cullisoni</u> in well-silicified valves occur through unit, but are concentrated in bed 1-3 feet thick at base	25.0
8. Dolomite, medium gray, interstratified medium- and fine-grained strata 1-2 feet thick. Smooth chert nodules, silicified calcarenite, and siliceous oolite rare. <u>Orospira</u> and <u>Tritoechia delicatula</u> in middle of unit	185.0
7. Dolomitic sandstone and sandy laminated dolomite. . .	6.0
6. Dolomite, medium-gray, fine- to medium-crystalline, in beds 6-18 inches thick. Smooth chert and silicified calcarenite rare. <u>Tritoechia delicatula</u> in upper part.	265.0

5. Dolomite, gray, medium-crystalline, thick-bedded. <u>Ceratopea</u> and <u>Archaeoscyphia</u> in basal 2 feet 20.0

4. Dolomite, gray, fine- to medium-crystalline, slightly cherty, smooth weathering 36.0

3. Dolomite, gray to cream-colored and pink, slightly cherty; medium-crystalline beds interstratified with fine-crystalline laminated interbeds. Typical lower Kindblade <u>Ceratopea</u> at top 110.0

2. Sandstone, slightly dolomitic, nearly white 2.0

1. Dolomite, grayish-brown, medium-crystalline, slightly cherty, containing laminated interbeds. Gray, smooth, spicular chert nodules 112 feet above base. 170.00

Cool Creek formation:
Dolomitic sandstone and sandy dolomite, interstratified with non-sandy dolomite. Beds slightly cherty, medium crystalline — About 160 feet exposed.

Return to cars. Continue ahead.

89.6 Turn around in driveway and return east.

90.6 Turn right (south).

91.6 Turn left (east) on Hwy. 7.

92.0 Plainview School on left.

93.1 Continue ahead on graveled road. Hwy. 7 curves left.

93.6 Turn right.

93.7 Wire gate. Turn left (east) on pasture road.

94.1 Park cars. West edge of the Bromide Junction syncline, a local feature on the northeast flank of the Belton anticline, where the thinnest section of Cambrian strata in the Arbuckle Mountains is exposed. The following section was measured by M. E. McKinley in the NE¼ NW¼ sec. 29 and the SW¼ SE¼ sec. 20, T. 2 S., R. 8 E. Strike N. 50°-60° W., dip 25°NE.

	Thickness (feet)
Cool Creek formation: (lower part only - remainder faulted)	
Dolomite, light cream to light gray, fine- to medium-crystalline, thin- to medium-bedded, in part laminated. Contains fairly abundant chert and large amounts of sand of the Simpson type (well-sorted, well-rounded, frosted and pitted, with a high degree of sphericity). There is one bed of sandstone about 6 inches thick 50 feet above the base. Sequence contains considerable chert, dolomite, and sandy dolomite breccia	76.5 exposed
McKenzie Hill formation: 498.1 feet thick.	
Dolomite, cream to tannish gray, medium-to coarse-crystalline, medium- to thick-bedded, with a few thin interbeds of fine-crystalline light cream colored laminated dolomite. Chert, both chalcedonic and micro-crystalline, is abundant in nodules throughout the unit. Coarse gray arkosic sand is also abundant in many beds.	273.7
Dolomite, cream to light tan and tannish gray, medium-crystalline, thick- to massive-bedded with thin interbeds of thin-bedded laminated fine-crystalline, cream colored dolomite. Non-sandy and relatively non-cherty, except for a few small nodules of silicified calcarenite and a small amount of porous chert	61.2
Dolomite, cream to tan and grayish tan, medium-crystalline, medium- to thick-bedded, with thin interbedded units of thin-bedded, in part laminated dolomite.	

Abundant coarse gray arkosic sand in lower part, giving way to fine, well-sorted, well-rounded quartzose sand in the upper part of the unit. Silicified calcarenite marks the base of the formation	163.2
Butterly-Royer sequence: 510 feet thick.	
Dolomite, gray to cream and tannish gray, medium-crystalline, thick- to massive-bedded, containing a few units from 2 to 5 feet thick of thin-bedded, laminated cream to buff dolomite. Abundant quartz druse in some beds. Upper part contains coarse gray arkosic sand	197.2
Dolomite, gray to tannish gray, medium-crystalline, very thick-bedded to massive-bedded, in beds 1 to 3 feet thick, alternating with sequences of: dolomite, light gray to cream, fine-crystalline, thin-bedded, silty, laminated, in units 5 to 10 feet thick. Coarse- to medium-grained gray and pink arkosic sand found throughout the sequence, but especially in the lower and middle parts. Quartz druse in small "blossoms" (2 mm. or less in diameter) disseminated in many beds in the upper part of the unit .	313.2
Fort Sill formation: 88.4 feet thick.	
Limestone, light gray to brown, pelitic, medium-bedded, containing irregular dolomite stringers; interbedded with fine-grained, thin-bedded limestone with shaly and silty partings. In the lower part of the formation are several thick beds of gray medium-crystalline dolomite. There are a few beds of limestone pebble conglomerate in the lower part, and there is a 6 inch bed of edgewise dolomitic limestone conglomerate about 10 feet below the top. The interbeds are poorly exposed. At base is a 4 foot sequence of calcilutite, gray, medium-bedded and dolomitic	88.4
Honey Creek formation: 112.6 feet thick.	
Dolomite, gray to light gray and brownish gray, fine- to coarse-crystalline, thin- to medium-bedded, sand not abundant, glauconite present but not abundant	29.6
Dolomite, dark gray to light gray and tan, medium- to coarse-crystalline, medium- to very thick-bedded, with a few thin (1 to 2 feet thick) intervals of medium- to fine-crystalline sandy laminated dolomite. Sand is not abundant in this unit, but is present in several beds, and is fine to medium in grain size. Glauconite is present but abundant only in a few beds. The base of the _Billingsella_ zone is 69.1 feet above the base of the Honey Creek, in this interval. Zone is 9.3 feet thick and the top of the zone, or highest bed containing _Billingsella_ is 34.9 feet below the top	33.6
Dolomite, gray to tan, fine- to medium-crystalline, thin-bedded with thin intervals (1 to 3 feet thick) of medium-bedded, medium-crystalline dolomite. Fine and very fine sand is abundant in many beds and the unit contains a few sequences 6 inches to 1 foot thick of very sandy dolomite or dolomitic sandstone. Entire unit is glauconitic, especially at base.	49.4
Reagan sandstone: 52.5 feet thick.	
Sandstone, red to brownish red, thin-bedded, fairly well-sorted. Contains angular grains of quartz and feldspar with abundant glauconite	27.2
Sandstone, pink to red, poorly sorted, thin- to medium-bedded, angular quartz and feldspar grains. Feldspar largely altered to clay. Small amount of hematite cement	22.3
Conglomerate, quartz pebble, thick-bedded, pebbles and granules ranging in size from 2 to 6 mm., accompanied by medium-grained arkosic sand	3.0

Pre-Cambrian Tishomingo granite:

Coarse crystalline pink granite. Well-exposed in this area. Separated from overlying Reagan sandstone by major unconformity.

Return to cars and retrace route to Hwy. 7. North-bound and south-bound traffic return to Oklahoma Hwy. 99. East-bound traffic may follow Hwy. 7 to Wapanucka and Atoka.

End of trip.

End of Part 1.

TABLE I

THICKNESSES OF PRE-PENNSYLVANIAN ROCKS OF THE ARBUCKLE MOUNTAINS, BY STRUCTURAL PROVINCES

System	Formation	Arbuckle anticline 275-820'*	Tishomingo anticline 820'*	Mill Creek syncline 140'	Belton anticline-Wapanucka syncline 375'	Hunton anticline 250-315'
Mississippian	Caney shale	Thickest in western and northern areas.				
Mississippian	Sycamore ls.	300-350'*	230-295'	1-5'	0 (probably grades into lower part of Caney)	0
Mississippian / Devonian	Woodford fm.	285-390'	350-370'	425'	250-560'* Thickens eastward.	400'
Devonian / Silurian	Hunton group	0-350' Absent locally on south flank by pre-Woodford erosion. Silurian formations thick; Devonian formations thin.	250' Devonian formations thick; Silurian formations thin	250' Silurian formations locally absent by pre-Haragan erosion. Devonian formations thick.	125-210' Silurian formations eroded and thin beneath pre-Haragan unconformity. Glauconitic ls. increases to maximum thickness (63') eastward.	150-375'* Thick Silurian formations in north, truncated southward and overlapped by Haragan.
Ordovician	Sylvan shale	250-335'*	270'	200'	150'	175'
Ordovician	Viola ls.	600-800'* Thickness increases westward.	600'	450'	430-520' Area of thickest "Fernvale"	400' Thinnest in region
Ordovician	Simpson group	2,000-2,300'* All formations present. Most limestones are bioclastic calcarenites. Thickest sands are in Tulip Creek.	1,600' Same as in Arbuckle anticline, except formations are thinner.	1,850' Tulip Creek absent by facies change. McLish contains "birdseye" ls. Thickest sands are in Oil Creek.	1,500' Thickest sands are in Oil Creek. McLish ls. is mostly "birdseye" ls.; also contains dolomite. Tulip Creek absent by facies change; Joins absent by truncation.	1,000' Thickest sands are in McLish.
Ordovician	Upper and Middle Arbuckle	5,000-5,200'* All limestone except for thin dolomite interbeds.	5,000' About 75% limestone and 25% dolomite	3,750' Limestone grading into dolomite near faults.	3,300' All dolomite. Much more sand than in western provinces.	About 1,500' exposed. All dolomite.
Cambrian	Lower Arbuckle	1,500'* Mostly limestone in west, grading by carbonate facies eastward so that 1,000' is dolomite.	1,350' All dolomite except Fort Sill limestone. No limestone of Signal Mountain age.	900' All dolomite except Fort Sill ls., 115 feet thick.	600-875' All dolomite except Fort Sill ls., 90-135' thick.	Not exposed
Cambrian	Honey Creek fm.	90-110' Coarse-grained glauconitic ls.	230' Dolomite, very sandy in lower half. Glauconitic.	110' Dolomite, very sandy in lower half. Glauconitic.	115-250'* Dolomite, very sandy in lower half. Glauconitic.	Not exposed
Cambrian	Reagan ss.	230-460'* Thickest in western area.	350' average	150'	50-140'	Not exposed
	*Thickest in Arbuckle Mountain region	Total Normal Thickness: 11,600'	11,100'	8,200'	7,350'	6,900' (probable total)

GUIDE BOOK III

PART 2

REGIONAL STRATIGRAPHY AND STRUCTURE OF THE ARBUCKLE MOUNTAIN REGION

GENERAL STATEMENT

Pre-Pennsylvanian. Well over half the thickness of the pre-Pennsylvanian stratified rocks of the Arbuckle Mountains is in the Arbuckle and Timbered Hills groups, discussed in part 1 of this Guide Book. Rocks lying above the Arbuckle group range in age from Middle Ordovician through Mississippian, and have a combined thickness in the Arbuckle anticline of 4,500 feet (Table I). These same rocks have a combined thickness of only 2,500 feet in the Hunton anticline, a sedimentary shelf area marked not only by thinness of sediments but also by prominent unconformities and by certain lithologic facies that are quite different from those of the Arbuckle anticline. The dividing line between the shelf area and the rapidly subsiding basin is the south margin of the Mill Creek syncline - the Reagan fault - which also divides the basin and shelf rocks of the Arbuckle group. South and west of this line, in the Arbuckle and Tishomingo anticlines, the rocks are strongly folded, locally overturned, and locally thrust-faulted; but northward and eastward, particularly in the Belton and Hunton anticlines, the rocks are folded into gently dipping block-faulted structures. Locally steep dips in the northern area are associated with major faults.

The hinge line between the contrasting northern and southern provinces coincides approximately with the narrow, down-faulted Mill Creek syncline, which transects and roughly bisects the Arbuckle Mountain region.

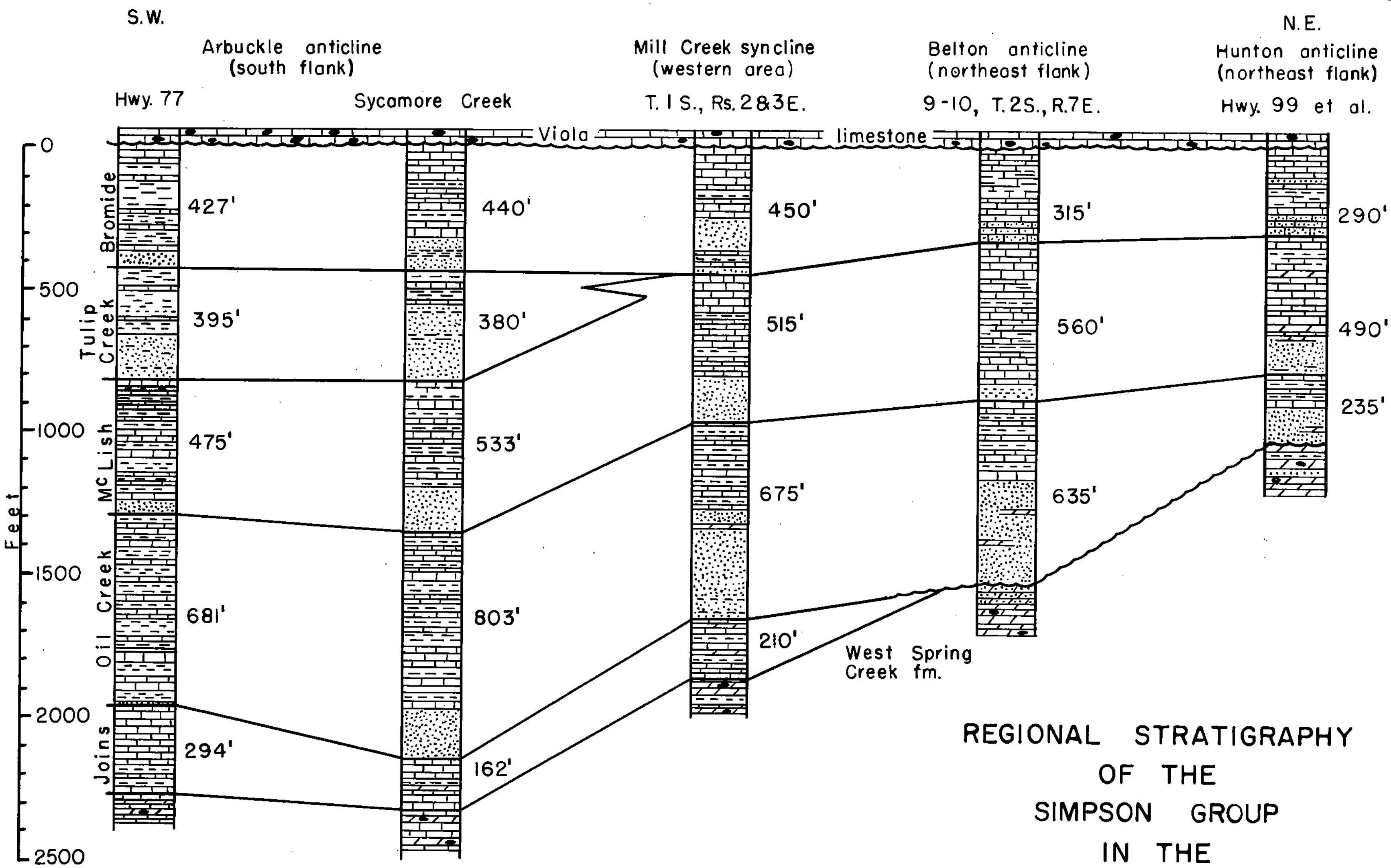
The thickest pre-Pennsylvanian, post-Arbuckle sequence is the Simpson group, the regional stratigraphy of which is shown in Figure 10. Individual formations thin eastward, the Tulip Creek formation disappears by facies intergradation into the lower part of the Bromide formation, the Joins is absent through truncation at the base of the Oil Creek sandstone, and the McLish formation grades from bioclastic calcarenite into "birdseye" limestone. Note also that the thickest sands are in the Oil Creek formation of the Mill Creek syncline and Belton anticline, and in the Tulip Creek formation of the Arbuckle anticline. The sandstone member of the McLish formation is 50-165 feet thick, it is the most constant sand horizon in the Simpson group, and it is the thickest sand in the Hunton anticline. The Oil Creek sandstone, which in the central part of the region is the thickest in the Simpson group, disappears westward on the south flank of the Arbuckle anticline.

The Viola limestone ("Trenton Viola" of subsurface), together with the overlying coarse-grained "Fernvale" limestone, crops out in a conspicuous ridge throughout the Arbuckle Mountain region, making it a valuable unit for field mapping. It ranges from a maximum thickness of 800 feet in the Arbuckle anticline to a minimum thickness of 400 feet in the Hunton anticline. This northeastward thinning is due to less sedimentation on the slowly subsiding shelf than in the rapidly subsiding basin, for the stratigraphic units that characterize the formation are everywhere present in the region (Wengerd, Bull. A.A.P.G., vol. 32, 1948, pp. 2183-2253).

The principal net changes in total thickness of the pre-Pennsylvanian rocks are in the Arbuckle group, Simpson group, and Viola limestone, which together total 10,000 feet in the basin and 5,500 feet on the shelf.

The Sylvan shale is a constant horizon across the Arbuckle Mountains, yet it too shows the characteristic northeastward thinning and a loss of about half its maximum thickness. Field outcrop measurements of the Sylvan are not everywhere reliable for stratigraphic evaluation of the formation, as there is notable thickening and thinning resulting from plastic flow during strong folding. The thicknesses recorded in Table I are those taken from structurally reliable measurements.

Regional stratigraphy of the Hunton group is illustrated by the measured sections shown in Figure 11. Some contacts and points of correlation, however, are in doubt now just as they were when the rocks were studied by Taff and Reeds in the period 1900-1910. The Haragan-Henryhouse contact still remains difficult to locate



REGIONAL STRATIGRAPHY
OF THE
SIMPSON GROUP
IN THE
ARBUCKLE MOUNTAINS

From original and published sources
W. E. Ham

Figure 10. Guide Book III, 1955

in the field, because of closely similar lithology and fossils above and below it, despite the fact that the rocks are separated by an unconformity embracing Upper Silurian and part of Lower Devonian time. Fortunately the thickness of questionable rocks at most localities is small.

As a group, the Hunton formations show no consistent regional trend. The greatest total thickness, 375 feet, is in the Lawrence uplift at the northern edge of the region, where all older formations are thinnest. The thickest section of Silurian rocks, slightly more than 300 feet, is in this area; yet on the east flank of the Hunton anticline (still in the same structural province) the Silurian rocks are only 70 feet thick and the the Devonian rocks have their maximum thickness - 230 feet.

A thick Silurian section also is present at the opposite edge of the Mountains, on the south flank of the Arbuckle anticline; but in the region between, in the Tishomingo anticline and Mill Creek syncline, rocks of the Silurian system are notably thinner than elsewhere and even are locally absent. Much of this range in thickness is attributable to uplift, erosion, and onlap during post-Henryhouse, pre-Haragan time. The obvious inference from these general relations is that in the post-Henryhouse, pre-Haragan interval the central parts of the region were uplifted and eroded more than the northern and southern parts.

This unconformity between the Henryhouse and Haragan formations records the first period of major structural warping in the Arbuckle Mountain region since Reagan time. It was closely followed, however, by a post-Bois d'Arc, pre-Woodford uplift that resulted in locally complete removal by erosion of the Hunton group on the south flank of the Arbuckle anticline.

The Woodford formation, like the Hunton group before it, does not follow the earlier established trends. Its maximum thickness of 560 feet is at the south edge of the Wapanucka syncline, nearly at the southeastern border of the region. In other parts of the Arbuckle Mountains the formation normally has a thickness of 300-400 feet.

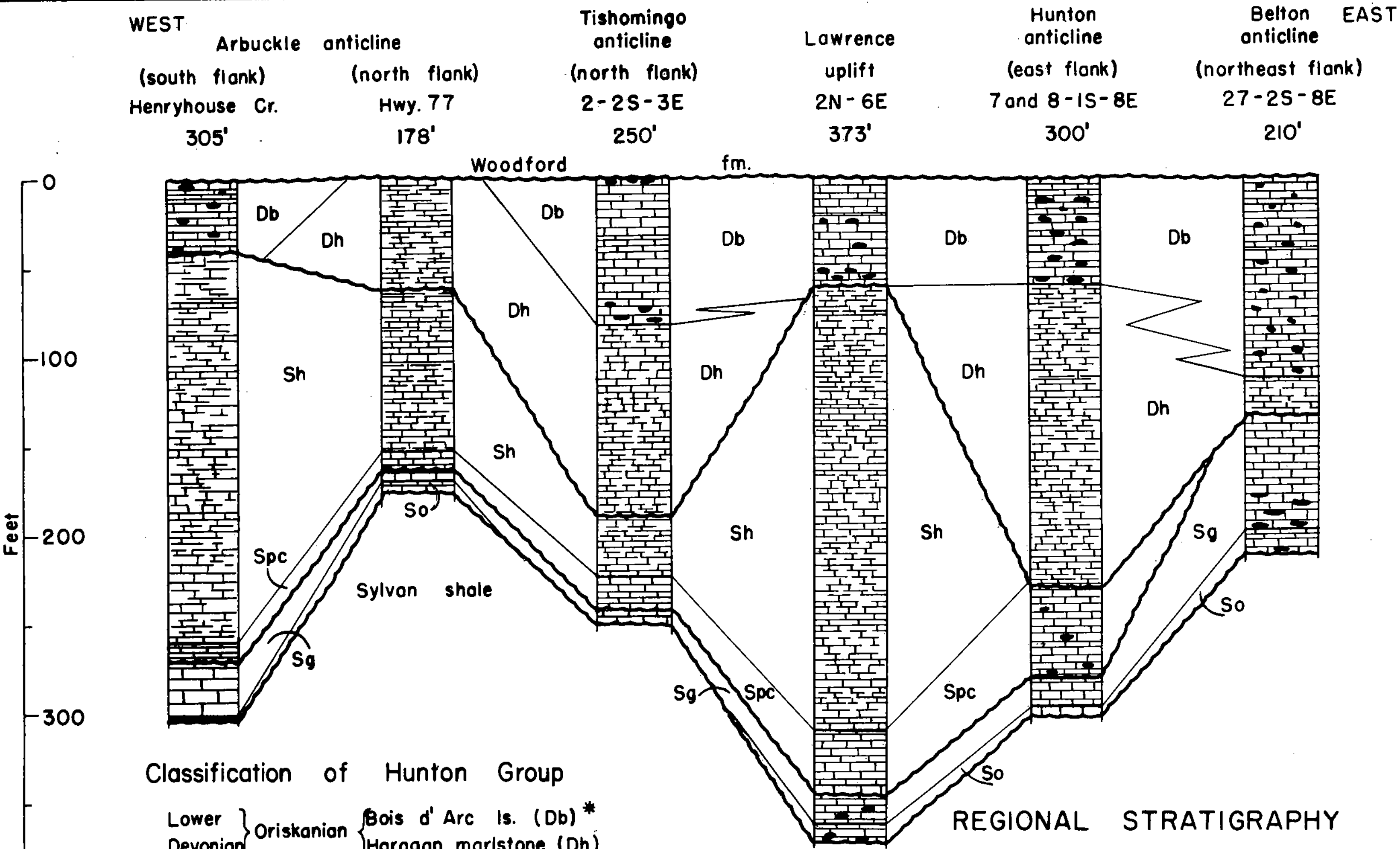
The Sycamore limestone is a facies of the Arbuckle and Tishomingo anticlines, where it generally is about 300 feet thick. On the north flank of the Tishomingo anticline the Sycamore begins to lose its massive-bedded character, interfingering with thick beds of Caney shale. In the adjoining Mill Creek syncline the Sycamore is 1-5 feet thick, and northward it is represented by thin limestone beds and discontinuous calcareous lenses in the lower part of the Caney shale. The maximum thickness of Caney-Sycamore rocks is nearly 1,200 feet in the Arbuckle anticline, compared with a normal thickness of about 350 feet in the Hunton anticline and Wapanucka syncline. The regional distinction between basin and shelf established in Cambrian and Ordovician time thus re-appears in Mississippian time, although during the Silurian-Devonian interval this distinction is not marked.

Pennsylvanian. Rocks of Pennsylvanian age crop out around most of the Arbuckle Mountains and are preserved within it in the Mill Creek syncline, Wapanucka syncline, and Franks graben. Springer and Dornick Hills (Wapanucka and Atoka) strata were deposited in thick sequences eastward in the coal basin and southward in the Ardmore basin. Within and adjoining the Arbuckle Mountains these strata generally are nonconglomeratic, but the younger Pennsylvanian rocks are conglomerate-bearing and record the beginning and close of mountain-building in the Arbuckle Mountain region. The following discussion of these conglomerates and structural interpretations made from them is taken chiefly from an article published by Ham in Bull. A.A.P.G., vol. 38, 1954, pp. 2035-2045.

The four principal conglomerate sequences within and contiguous to the Arbuckle Mountains are "Franks," Deese, Collings Ranch, and Vanoss. All but the Vanoss, the youngest, are preserved in synclinal grabens and are moderately to strongly folded and faulted.

The "Franks" and Deese conglomerates are closely related, both being deposited at about the same time in synclinal areas bordering the Hunton anticline, which began to emerge as a broad domal fold in McAlester (early Desmoinesian) time. The Hunton anticline remained emergent until late Virgilian time, when the western margin was covered by conglomerates and shales of the Vanoss formation. Uplift of the Hunton anticline was accompanied by contribution of coarse clastics to the bordering marine areas of deposition, particularly in the northern area around Ada and in the present sites of the Franks graben and Mill Creek syncline.

According to Morgan (Okla. Bur. Geol., Bull. 2, 1924) about 1,500 feet of conglomeratic strata collected in the Franks graben, ranging in age from McAlester



Classification of Hunton Group

Lower Devonian	Oriskanian	Bois d' Arc ls. (Db) *	
		Haragan marlstone (Dh)	
Middle Silurian	Niagaran	Henryhouse marlstone (Sh)	
		Pink crinoidal ls. (Spc)	Chimneyhill ls.
Lower Silurian	Alexandrian	Glauconitic ls. (Sg)	Chimneyhill ls.
		Oolitic ls. (So)	Chimneyhill ls.

*Frisco ls. at top locally

REGIONAL STRATIGRAPHY
OF THE
HUNTON GROUP
IN THE
ARBUCKLE MOUNTAINS

From original and published sources
W. E. Ham

Figure 11. Guide Book III, 1955

DEESE ROCKS IN THE CENTRAL AND WESTERN ARBUCKLE MOUNTAINS

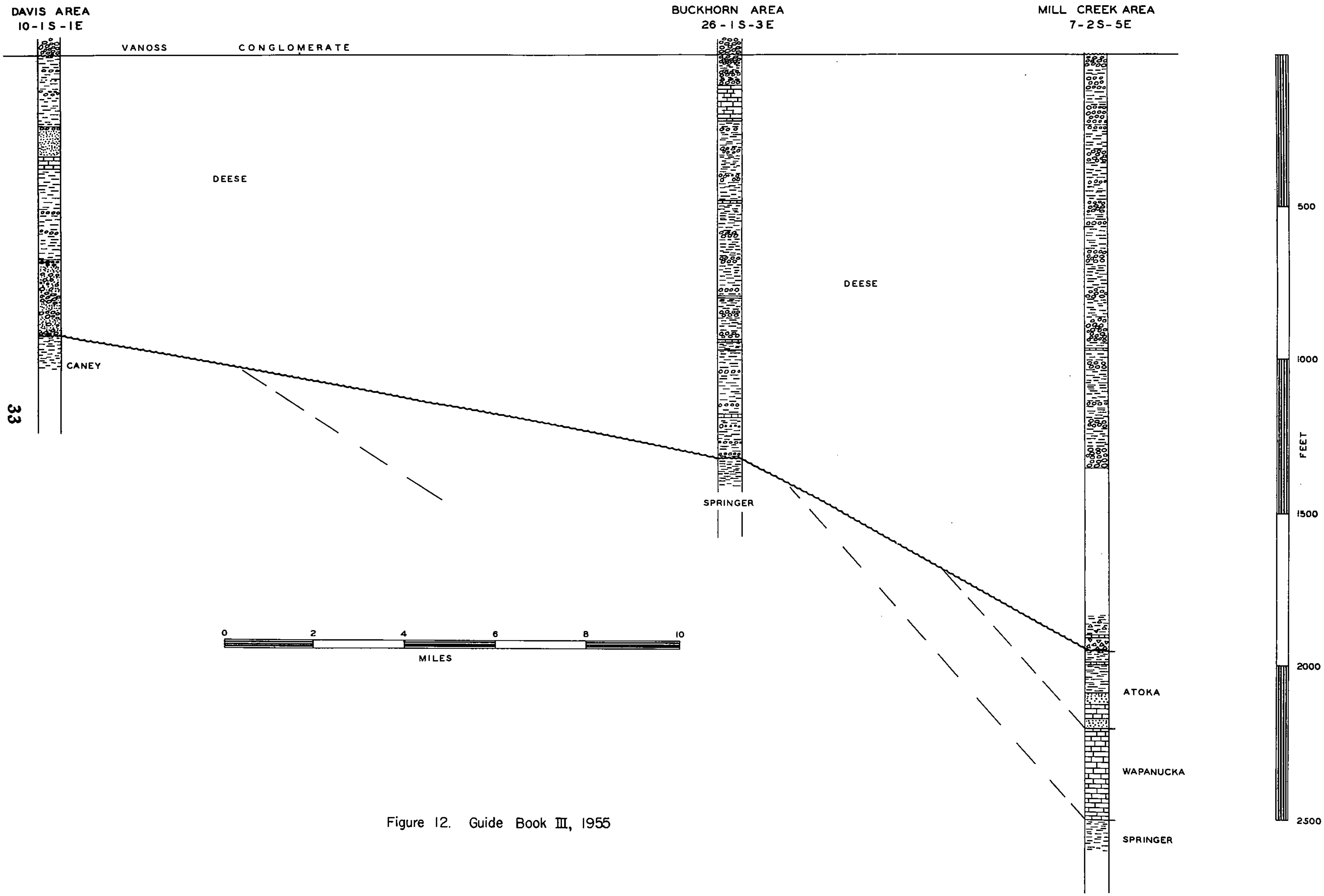


Figure 12. Guide Book III, 1955

through Francis, or through much of Desmoinesian and part of Missourian time. These rocks have been called Franks conglomerate.

Outside the Franks graben younger conglomeratic strata, especially in the Ada formation, accumulated on the northern edge of the Hunton anticline and around the northwest side of the Lawrence uplift. The faults bordering the Franks graben and the steep dips within it were produced in post-Francis, pre-Ada time, as the main fault of the graben passes beneath the Ada formation northwestward, in the north-central part of T. 2 N., R. 5 E. The time of faulting and folding is probably early Virgilian, and is believed to coincide with the beginning of strong folding in the Arbuckle anticline on the southwest. Both the "Franks" and Deese participated in this strong folding, whereas the Collings Ranch and Vanoss were deposited after the folding was accomplished, and thus are related to a later period of orogeny.

The Deese conglomerates in the Mill Creek syncline (Figure 12) are similar in most respects to the "Franks." In the vicinity of Mill Creek, sec. 7, T. 2 S., R. 5 E., the Deese is about 1,950 feet thick (top eroded) and consists of pebble-cobble limestone conglomerates interstratified with red and gray shales and a few thin limestones. The conglomerate sequence rests disconformably on the Atoka formation. The oldest conglomerates, at the bottom of which the base of the Deese is placed, are made up largely of Woodford chert, the first resistant formation to be exposed by erosion of the Hunton anticline, whereas the conglomerates higher in the section are made up chiefly of Hunton and Viola limestones.

In the Buckhorn area south of Sulphur, sec. 26, T. 1 S., R. 3 E., the Deese is 1,300 feet thick and here also consists of conglomerates interbedded with marine shales and limestones. The top is eroded and is covered by Vanoss conglomerate. The youngest conglomerates exposed contain limestone pebbles and cobbles from the Oil Creek formation and from the uppermost part of the Arbuckle group. Fusulines from the fossiliferous limestones and shales were identified for the writer as Fusulina and Wedekindellina by the Paleontological Laboratory, Midland, Texas, and were assigned a lower Cherokee (principally Boggy) age. In the Buckhorn area of the Mill Creek syncline the Deese rests disconformably on Springer shale (Lower Pennsylvanian).

Deese rocks in the Mill Creek syncline of the central Arbuckle Mountains normally dip 30°-70°, but are overturned near major faults in the Buckhorn area; and about 1 mile east of Mill Creek the Wapanucka limestone is locally overturned, although the Deese itself, which in this area is structurally conformable with the Wapanucka, does not crop out at the localities where overturning may be observed.

The westernmost outcrops assignable to Deese are in the Lake Classen area, secs. 2, 9, and 10, T. 1 S., R. 1 E., on the northeast flank of the Arbuckle anticline. In a regional sense these outcrops are also on the south flank of the Mill Creek syncline, and thus are related to the Buckhorn and Mill Creek areas. According to Dunham (Bull. A.A.P.G., vol. 39, pp. 1-30, 1955) the sequence consists of shales, conglomerates, fossiliferous limestone, and sandstone totalling about 1,100 feet in thickness, the top being eroded and covered by Vanoss conglomerate. An age assignment to upper Deese (Wetumka-Wewoka) was made from Fusulina contained in fossiliferous limestone 360 feet below the top at one locality; and the possibility was recognized that the beds above the occurrence of Fusulina are of early Missourian age. The conglomeratic Deese rocks in the Lake Classen area rest disconformably on Caney shale (Mississippian). They are steeply dipping to locally overturned, and are structurally conformable with the older folded rocks of the Arbuckle anticline.

The foregoing discussion of the Deese and "Franks" establishes the point that they are orogenic products from the first great period of uplift in the Arbuckle Mountains, which began as broad domal folding of the Hunton anticline in early Desmoinesian (early Deese) time. It also is clear that these conglomerates were closely folded, locally overturned, and faulted in late Pennsylvanian time. This later deformation, to which the name Arbuckle orogeny has long been applied, produced the structurally complex Arbuckle anticline and the major folds of the Ardmore basin, and was certainly the most intense deformation to affect the Arbuckle Mountains. The folding can be dated from the evidence seen in the Ardmore basin as post-Hoxbar, from the Mill Creek syncline and Lake Classen area as post-Deese, and from the Franks graben as post-Francis (middle Missourian). From a comparison with widely distributed marine rocks north of the mountains, the date of the Arbuckle orogeny can be correlated with the Missouri-Virgil unconformity at the base of the Vanoosa formation, and with the unconformity at the base of the Ada formation, in the middle part of the Virgil series. According to Tanner (Bull. A.A.P.G., vol. 38, 1954, pp. 886-899) the unconformity at the base of the Ada is pronounced and marks the last important orogenic activity in the northern part of the Arbuckle Mountains. In the writer's opinion the Arbuckle orogeny reached its culmination in early Virgilian time, within the post-Missouri, pre-Ada interval.

The Collings Ranch and Vanoss conglomerates rest with pronounced angular unconformity on older rocks that were steeply folded during culmination of the Arbuckle orogeny. The conglomerates resulting from this uplift were deposited peripheral to the Arbuckle Mountains, but are exposed now only around the Arbuckle anticline and northward into the Sulphur area. Most of these clastic sediments were derived from the Arbuckle and Tishomingo anticlines.

The Collings Ranch was the first, thickest, and coarsest orogenic deposit following this folding. It doubtless was spread widely in irregular sites of deposition, but the mountain system was still actively rising and thus most of the conglomerate was uplifted, eroded, and lost. The only area where the conglomerate has been extensively preserved is in the synclinal graben on Highway 77.

A late phase of Arbuckle orogeny, chiefly faulting and uplift without strong folding, came in the last stage of deposition of the Collings Ranch conglomerate. At this time the syncline on Highway 77 was faulted as a graben, and dips probably were steepened locally. Some of the faults bordering the graben extend northwestward to the edge of the mountains where they pass underneath the Vanoss conglomerate, thereby showing the Vanoss to be younger than Collings Ranch.

The Vanoss formation in the vicinity of the Arbuckle Mountains consists of a lower conglomerate member and an upper shale member (Figure 16). Their combined maximum thickness is about 1,550 feet. The conglomerate member has a maximum thickness of 650 feet and is restricted to the northern edge of the mountains, in the area between Sulphur and Hennepin. Northward from Sulphur the conglomerate member disappears by interfingering into the shale member, whereas westward and southward around the Arbuckle anticline it is overlapped by the shale member. Both members locally contain abundant feldspar and granite fragments. At most places the rocks have gentle dips and are not faulted, although in a few areas they dip as much as 40° and are cut by small faults whose displacement dies out upward in the conglomerate sequence. Such post-Vanoss local deformation was produced by the dying pulsation of the Arbuckle orogeny.

In summary, the four principal conglomerates in the Arbuckle Mountains region are readily divisible into two general groups, an older consisting of "Franks" and Deese, and a younger consisting of Collings Ranch and Vanoss. Each group is characterized by the rocks of which the pebbles and cobbles in the conglomerates are composed (Table II). The "Franks" and Deese contain rocks chiefly from Hunton through uppermost Arbuckle; the Collings Ranch, being younger, contains mostly upper and middle Arbuckle rocks; and the Vanoss, being youngest, contains granite, feldspar, and vein quartz from pre-Cambrian rocks that were exposed only after the highest uplift and deepest erosion of the Arbuckle Mountains.

TABLE II. PRINCIPAL CONGLOMERATE SEQUENCES WITHIN AND CONTIGUOUS TO ARBUCKLE MOUNTAINS

Conglomerate Sequence	Maximum Tickness (Feet)	Character	Structural Relations	Oldest Rocks Represented	Occurrence	Age
Shale mbr. Vanoss Conglomerate mbr.	900 650	Maroon shale Limestone conglomerate grading into red shale. Non-follifierous	Gentle dips Mostly unfaulted Angular unconformity on older rocks	Pre-Cambrian granite	Borders northwest margin of Arbuckle Mountains	Late Virgilian (Pontotoc)
Collings Ranch	2,000 (Top eroded)	Thick-bedded limestone boulder conglomerate. Non-fossiliferous	Moderate dips Strongly faulted Angular unconformity on older rocks	Mostly Ordovician Arbuckle. Reagan (Cambrian) very rare	Graben within Arbuckle anticline	Middle Virgilian (Ada?)
Deese	1,950 (Top eroded)	Conglomerate interbedded with fossiliferous shales, limestones, and sandstones	Locally overturned Strongly faulted Disconformable on older rocks	Simpson and uppermost Arbuckle	Mill Creek graben and northeast flank of Arbuckle anticline	Chiefly Desmoinesian (Boggy-Wewoka) and possibly early Missourian
"Franks"	1,500	Conglomerate interbedded with and grading into fossiliferous shales, limestones, and sandstones	Vertical dips Strongly faulted	Uppermost Arbuckle	Franks graben	Desmoinesian and Missourian (McAlester through Francis)

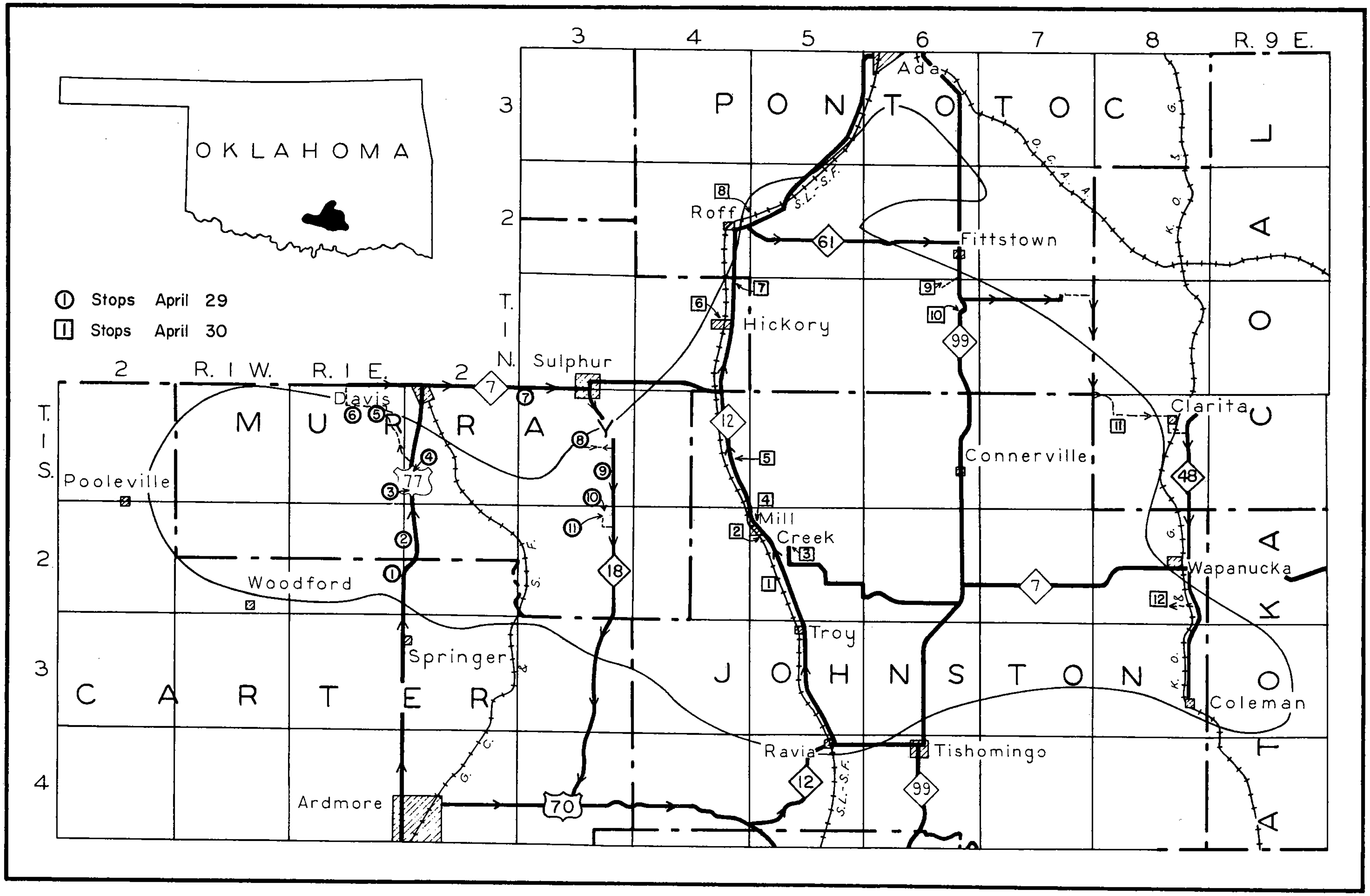


Figure 13. Route map for field trip April 29-30, 1955.

ROAD LOG FOR FIELD TRIP

April 29, 1955

Assembly Point

Assemble at northwest edge of Ardmore, on U.S. Highway 77 at 12th St., NW. Cars line up on highway shoulder opposite English Village Motel, heading north. Caravan leaves at 7:30 A.M.

Special Instruction

As most of the outcrops visited are on large ranches where pastures are subject to disastrous prairie fires, it is absolutely necessary for all participants to be EXTREMELY CAREFUL WITH FIRE. Carelessness with fire might result in a permanent ban on organized field trips in this region.

Mileage

0.00 Assembly point. Go north on Hwy. 77.

4.2 Caddo Creek.

9.0 Springer. Stone schoolhouse on right.

10.4 Intersection with Oklahoma Hwy. 53.

11.7 Sycamore limestone in roadcut.

11.8 Woodford formation in roadcut.

11.9 Haragan marlstone in roadcut.

11.95 Chimneyhill limestone in roadcut.

12.10 Sylvan shale, covered in valley.

12.2 Viola limestone exposed for 0.2 mile in roadcuts.

12.3 Turn left (west) over cattleguard and park cars south of road.

STOP 1. Section of the Simpson group along Highway 77, on south flank of the Arbuckle anticline, where the sequence is 2,273 feet thick and nearly the thickest of the Arbuckle region. This is the type locality for the Tulip Creek formation, which contains a basal sandstone 165 feet thick. All formations of the Simpson group are present, but the sandstones of the McLish and Oil Creek formations are abnormally thin.

Section exposed in NE¼ sec. 25, T. 2 S., R. 1 E. and SW¼ SW¼ sec. 19, T. 2 S., R. 2 E. Strike N. 50°W., dip 55° southwest. The section, abbreviated from Decker's published report (Okla. Geol. Survey Bull. 55, 1931), is shown graphically in Figure 10. The basal sand thicknesses are as follows: Bromide, 50 feet; Tulip Creek, 165 feet; McLish, 55 feet; and Oil Creek, 19 feet.

Note that the limestones of this section, except the fine-grained "Bromide dense" at the top of the Simpson group, are typically composed of fragmented fossil remains and are classed as bioclastic calcarenites.

Return to cars and retrace route to Hwy. 77.

12.4 Turn left (north).

12.9 Top of Arbuckle group. For a measured section of the West Spring Creek formation, excellently exposed in the highway roadcuts, see Stop 1 in road log for trip April 22 in Part 1 of this Guide Book. The formation is 1,560 feet thick, the thickest in the Arbuckle Mountains.

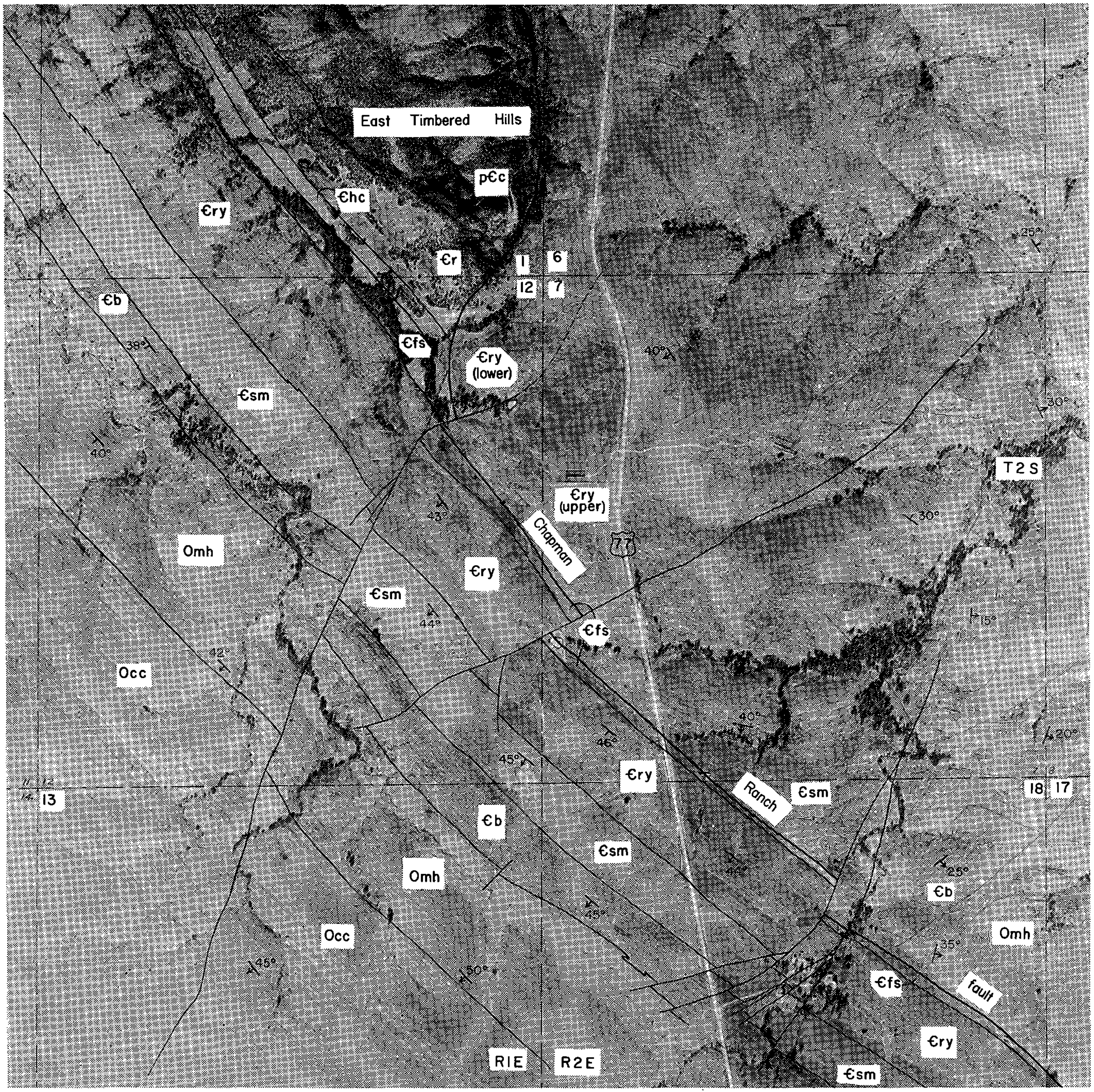


Figure 14. Aerial photograph showing geology between Chapman Ranch headquarters and East Timbered Hills.

13.3 Base of West Spring Creek formation, marked by 6-foot bed of sandy dolomitic limestone. Excellent exposures on right are popularly called tombstone topography, in allusion to the parallel rows of resistant limestone beds jutting upward above the shallow furrows between.

13.65 Thick-bedded limestone just above base of Kindblade formation.

14.4 Cambrian-Ordovician boundary, placed at the top of the craggy-weathering Butterly dolomite.

14.5 Entrance to Chapman Ranch headquarters on right.

15.0 Pull over as far as possible off highway and park cars. Cross fence on west side of road and walk to earthen tank.

STOP 2. NW¼ SW¼ SW¼ sec. 7, T. 2 S., R. 2 E. (See Figure 14). One of the major faults within the Arbuckle anticline trends from the Chapman Ranch headquarters northwestward along the east flank of the East Timbered Hills. This is the Chapman Ranch fault. At three localities in the vicinity of U.S. Highway 77 it is offset by younger faults, one of which will be seen at this stop. The offsetting is of considerable significance because, in addition to showing two periods of faulting, it affords a means of determining the dip of the major fault, which here is parallel with bedding and dips 45° southwest. Older beds (Fort Sill) lie on younger (Royer) and the fault is doubtless a bedding thrust.

It can be demonstrated that the offsetting fault is of the hinge type and therefore has a large component of dip-slip movement. The trace of the major fault is parallel with the Fort Sill-Royer contact on the overthrust side and also has the same horizontal spacing from it on opposite sides of the offsetting fault, which is possible only if the fault and the Fort Sill-Royer contact have the same direction and amount of dip. Stratigraphic displacement increases southeastward past the ranch headquarters, where the overthrust side rests on Cool Creek limestone.

This thrust and others similar to it south of the West Timbered Hills are believed to be the earliest faults formed during the folding of the Arbuckle anticline. They either terminate against younger faults or are offset by them.

The Chapman Ranch fault curves northward on the east flank of the East Timbered Hills, where Fort Sill and Honey Creek limestones are overturned 17° toward the east (present dip: 73° SW) and form the locally overturned east flank of the East Timbered Hills anticline. This illustrates the point that overturning occurs not only on the north flank of the Arbuckle anticline, which is well known, but also in the axial part of the anticline as well as locally on the south flank.

To judge from the dip of the sedimentary beds the fault at this locality has a higher angle of dip than observed previously, yet it is fundamentally the same in having older rocks (Colbert porphyry) moved from the southwest onto younger (Honey Creek and Fort Sill).

At the north edge of the East Timbered Hills, south of Turner Falls, this thrust fault is apparently cut off by younger faults belonging to a system that extends the entire length of the Arbuckle anticline.

Return to cars and continue ahead. For next 2 miles travel on Royer dolomite in axial part of East Timbered Hills anticline.

17.3 Cool Creek limestone on left. Slow for curve ahead.

18.0 Turner Falls lookout. Park cars and walk ahead along shoulder of highway to outcrops of Collings Ranch conglomerate on hairpin curve.

STOP 3. SE¼ NE¼ sec. 36, T. 1 S., R. 1 E. See Figure 15.

The Collings Ranch conglomerate exposed in the vicinity of the hairpin curve on Highway 77 is at least 2,000 feet thick and thus is much thicker than the upper Pennsylvanian Vanoss conglomerate which borders the north and west flanks of the Arbuckle Mountains. In addition this limestone boulder conglomerate is steeply folded, having dips commonly of 40° and locally as much as

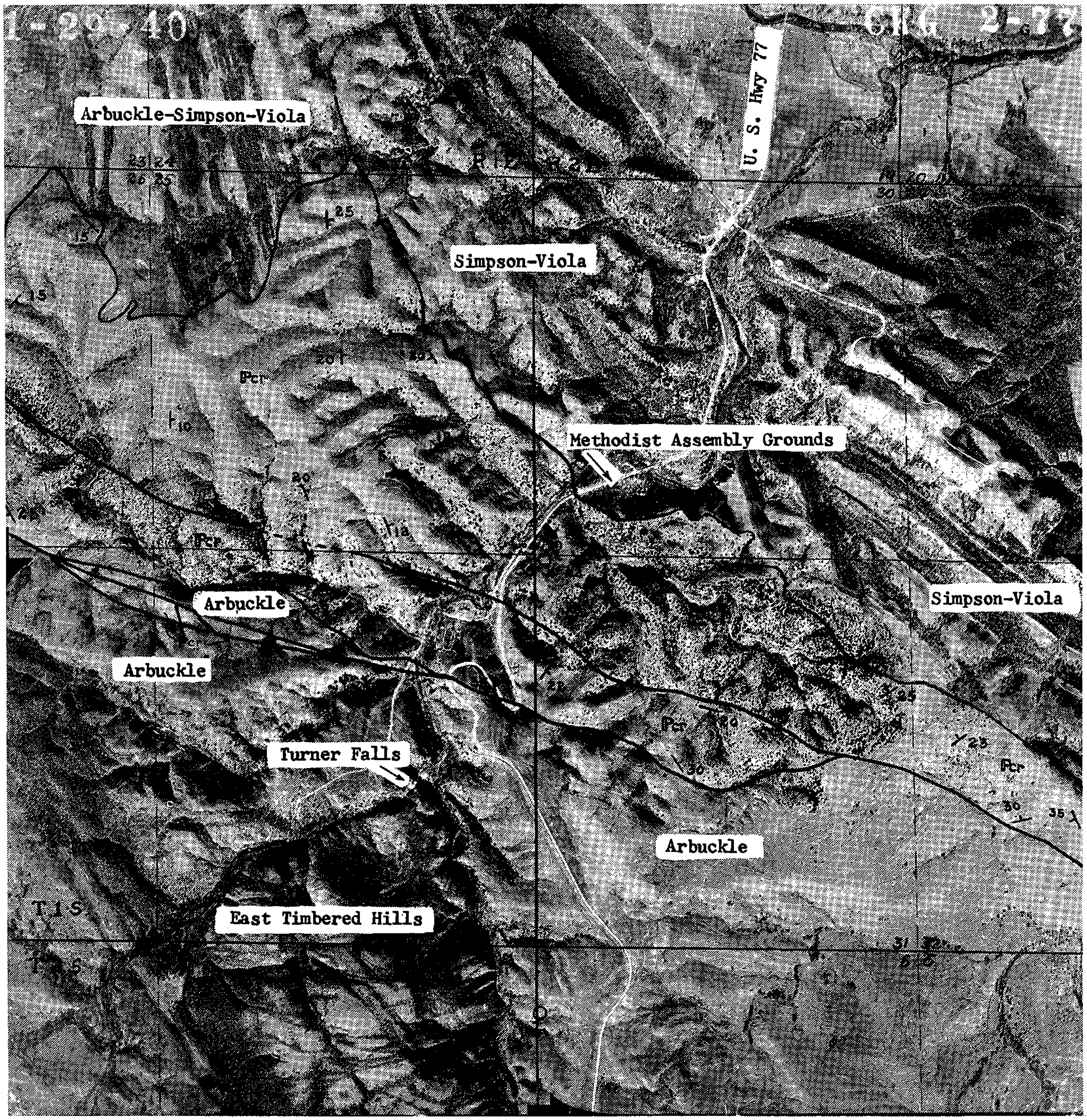


Figure 15. Aerial photograph showing principal outcrop area of Collings Ranch conglomerate (IPcr) and its relation to older rocks.

as 90°, and also is intricately involved in a system of faults that cuts Arbuckle and post-Arbuckle strata. Accordingly it is believed that this conglomerate is older than Vanoss and probably is the first orogenic product derived from the Arbuckle anticline. From regional considerations the conglomerate is believed to be equivalent in age to the Ada formation (late Virgil), which borders the western part of the Hunton anticline between Roff and Fitzhugh.

The Collings Ranch conglomerate rests with marked angular unconformity on steeply dipping rocks of the Arbuckle anticline. This unconformable contact is particularly well displayed in the NW¼ sec. 25 and the NE¼ sec. 26, T. 1 S., R. 1 E.; and in the south-central part of sec. 30, T. 1 S., R. 2 E., where conglomerate beds cap vertically dipping Viola limestone on the hill directly south of the Methodist Assembly Grounds. At all these localities the conglomerate beds dip 5°-25°, compared with a normal dip of 70° or more in the underlying strata. Exposed bedrocks beneath the conglomerate are the West Spring Creek formation of the Arbuckle group (Lower Ordovician); Joins, Oil Creek, McLish, Tulip Creek, and Bromide formations of the Simpson group (Middle Ordovician); and the Viola limestone (Middle Ordovician).

With the exception of a few very small areas, all other conglomerate-bedrock contacts are fault planes at which the conglomerate is sharply cut off against Arbuckle, Simpson, and Viola formations. Faulting is particularly conspicuous at the north and south boundaries of the graben in which the beds are contained. The north fault probably is continuous along the graben, but is concealed for about 0.5 mile east of Highway 77 by a cover of young conglomerate beds that extend into the graben from the north, near the Methodist Assembly Grounds. This occurrence indicates that most, but not all, of the Collings Ranch had been deposited before faulting ceased at this locality. The south fault of the graben is one of the principal through-going faults of the Arbuckle Mountains. It has nearly vertical dip and is well exposed in 3 cuts on the hairpin curve.

Return to cars and continue ahead.

19.4 Travertine-cemented terrace deposits along Honey Creek near Methodist Assembly Grounds. These coarse sediments contain much rhyolite porphyry derived from the East Timbered Hills. East of Honey Creek the Collings Ranch conglomerate caps a bluff of steeply dipping Viola limestone.

19.9 Cedarvale.

20.5 Viola limestone in roadcut.

21.1 Sylvan shale in roadcut.

21.2 Drive slowly around curve and park by Canyon Breeze Motel. Walk back to roadcut in Hunton limestone.

STOP 4. North flank of Arbuckle anticline, characterized by dips that are steep to overturned. Section of Hunton limestone in SE¼ NE¼ NW¼ sec. 30, T. 1 S., R. 2 E., Murray County, 4 miles south of Davis. Lower part measured in roadcut on west side of U.S. Highway 77; upper part along west bank of Honey Creek east of highway. Strike N. 70° W., dip vertical. Section measured by direct contact with 6-foot rule.

	Thickness (feet)
Woodford formation:	
Black and dull green fissile shale.	Not measured
Hunton group: 178 feet thick.	
Haragan limestone (?):	
Argillaceous calcilutite, cream-colored, in compact beds mostly 1-3 inches thick, non-cherty, fossils scarce. Camarocrinus at base	61.0
Henryhouse formation: 91.8 feet thick.	
6. Argillaceous calcilutite, cream-colored, in compact beds 6 inches to 1 foot thick. Brick-red mottling in lower 10 feet. Dayia (?), Calymene, Encrinurus in bed 1½ feet below top	31.0

5.	Argillaceous calcilutite, pale greenish-gray weathering to cream and pale brown, in very tough and compact beds 2-6 inches thick, intercalated with thin calcareous siltstones in lower 4 feet.	32.0
4.	Calcareous siltstone, argillaceous, greenish-gray to yellowish-brown, with thin interstratified layers of calcareous shale in lower part. Beds poorly defined, mostly 2-4 inches thick. Glassia (?) in lower 6 feet	8.8
3.	Calcareous argillaceous siltstone, dark cream-colored, beds 1-3 feet thick, interstratified with olive-green silty shale, fissile, in beds about 6 inches thick. Six beds of shale including one at top and base .	11.0
2.	Silty limestone, brownish-gray, finely granular, in massive strata weathering to beds 1-2 feet thick. Abundant manganese oxide dendrites. No fossils observed	6.6
1.	Argillaceous calcilutite, very compact, cream-colored, in thick-bedded strata weathering to layers 0.5-1 foot thick. Abundant manganese oxide dendrites. No fossils and no crinoid columnals observed	3.4
Pink crinoidal limestone:		
2.	Cream-colored calcilutite, slightly argillaceous, with sparsely scattered pink crinoid columnals, in very compact beds 2-6 inches thick. Pisocrinus and Stephanocrinus.	10.7
1.	Olive-green shale, highly plastic when wet. . . .	1.0
Glauconitic limestone:		
	Light gray limestone, medium-crystalline, thick-bedded. Glauconite in disseminated grains and concentrated in thin argillaceous layers. Fossils very scarce. . . .	5.4
Oolitic limestone:		
	Light gray to pale brownish oolitic limestone in a thick-bedded unit. Crinoid columnals abundant in lower 4 feet	7.0
Sylvan shale:		
	Green plastic shale.	

Return to cars and continue ahead.

21.3 Turn left on Oklahoma Hwy. 7B. Drive on Caney shale along northeast edge of Sycamore hogback.

22.6 Entrance to Camp Classen.

22.7 Overturned Sycamore and Caney exposed along creek to left.

25.0 Turn left (west) on section line road.

25.1 Red shale and conglomerate of Vanoss fm. overlain by terrace sands in road-cut on left.

25.45 Turn left through wire gate opposite cattle guard, and park in field.

STOP 5. Conglomerate member of Vanoss formation folded in a northwest-plunging syncline, locally showing dips as high as 45°. NE$\frac{1}{4}$ sec. 11, T. 1 S., R. 1 E. At this locality the Vanoss has its steepest dips in the Arbuckle Mountain region, being one of the few places where the Vanoss has participated in the dying phases of the Arbuckle orogeny. At other localities around the western part of the Arbuckle anticline the lower beds of the Vanoss conglomerate are folded and faulted, whereas the upper conglomerate beds and

STRATIGRAPHIC SECTIONS ALONG STRIKE OF VANOSS FORMATION ON WESTERN AND NORTHERN BORDERS OF ARBUCKLE MTNS.

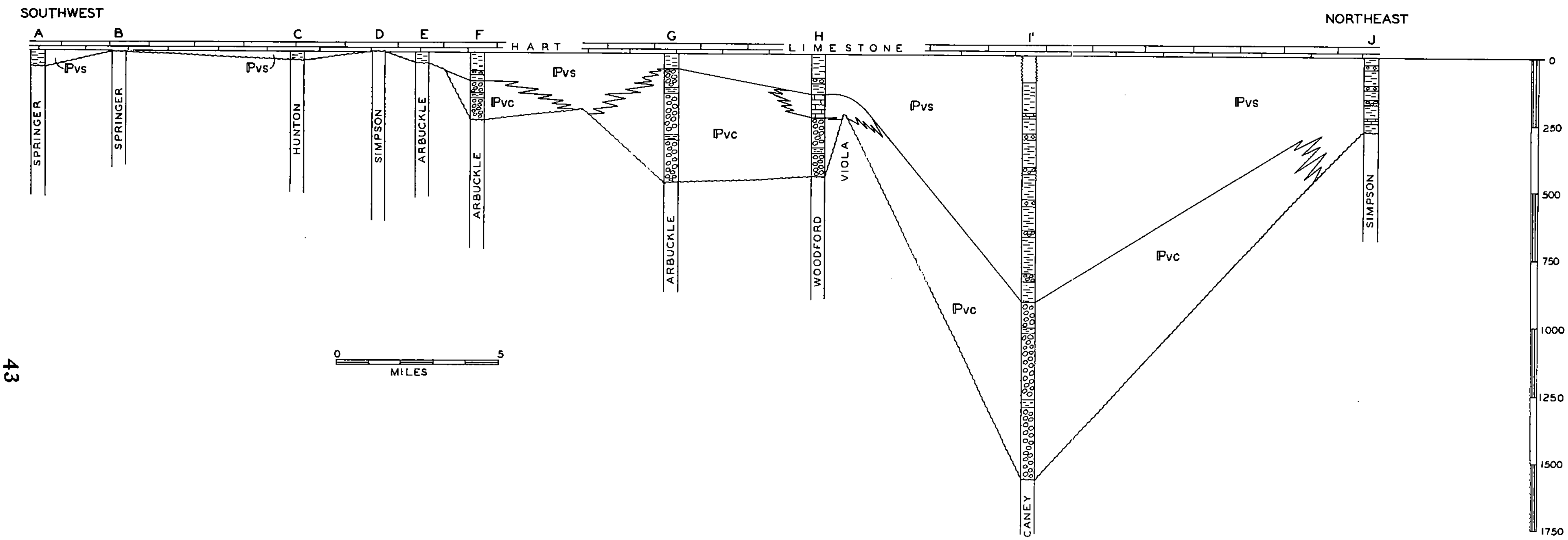


Figure 16. IPvc, conglomerate member;
IPvs, shale member.

A. NE$\frac{1}{4}$ NW$\frac{1}{4}$ sec. 33, T. 2 S., R. 1 W.
B. SE$\frac{1}{4}$ NW$\frac{1}{4}$ sec. 30, T. 2 S., R. 1 W.
C. SE$\frac{1}{4}$ NW$\frac{1}{4}$ sec. 1, T. 2 S., R. 2 W.
D. C. S$\frac{1}{2}$ sec. 23, T. 1 S., R. 2 W.
F. Secs. 7 and 17, T. 1 S., R. 1 W.
G. Sec. 6, T. 1 S., R. 1 E. and sec. 31, T. 1 N., R. 1 E.
H. Secs. 2 and 11, T. 1 S., R. 1 E.
I'. Anderson Prichard, Meyers No. 1, NE$\frac{1}{4}$ SW$\frac{1}{4}$ SE$\frac{1}{4}$ sec. 2, T. 1 S., R. 2 E.
J. Secs. 5, 6, 8, and 9, T. 1 N., R. 4 E. and sec. 1, T. 2 N., R. 3 E.

overlying shale member of the Vanoss are dipping 1^{o}-3^{o} and are unfaulted, indicating that by the close of Vanoss time all orogeny had ceased. See Figure 16 for thicknesses and facies relations of the Vanoss formation.

Return in cars to wire gate.

25.5 Turn left (west).

25.7 Algae-encrusted pebbles in shale member of Vanoss formation.

25.9 Limestone 73 feet thick in conglomerate member of Vanoss formation, its thickest development in the region.

26.2 Intersection. NE cor. sec. 10, T. 1 S., R. 1 E. Continue ahead on outcrops of Vanoss shale.

26.7 Enter area of Vanoss conglomerate outcrops on winding road.

27.3 Park cars on side of road. Walk south across fence to outcrops of Deese formation.

STOP 6. NW¼ sec. 10, T. 1 S., R. 1 E. The thickest exposures of the Deese formation on the northeast flank of the Arbuckle anticline are contained here in the Wilson syncline, where 920 feet of Deese strata lie unconformably on Caney shale and are unconformably truncated by Vanoss conglomerate (Dunham, Bull. A.A.P.G., vol. 39, pp. 1-30, 1955). The syncline plunges northwestward, and its eastern limb is vertical or overturned. The Deese rocks thus have been strongly folded, like the older rocks of the Arbuckle anticline, during the Arbuckle orogeny.

A generalized measured section in this area, cited from Dunham, includes in ascending order a basal conglomerate 250 feet thick, shale 300 feet thick, fusuline-bearing limestone 41 feet thick, sandstone 95 feet thick, and shale 235 feet thick.

Return to cars and continue ahead.

27.4 Turn right (north) at Y.

27.5 Vanoss conglomerate.

27.6 Base of Vanoss shale.

27.8 Calcareous red shale in Vanoss formation in stream cut on right.

28.2 Approximate horizon of Hart limestone (base of Stratford formation) at which base of Permian is now placed.

28.4 Turn right (east). Frankfort No. 1 Hale is half mile west, where first commercial oil from Arbuckle group in southern Oklahoma was discovered early in 1955.

28.8 Calcareous red shale of Stratford formation in roadcut on left.

28.9 Turn left (north).

29.2 Turn right (east) on Okla. Hwy 7.

31.9 Washita River.

32.8 Davis. Stop Sign. Join U.S. Hwy. 77. Continue ahead.

33.0 Santa Fe RR. 4 tracks. Caution.

33.2 Traffic light. Continue ahead on Okla. Hwy. 7.

38.2 Pull off on shoulder and park cars. SW¼ SW¼ SW¼ sec. 31, T. 1 N., R. 3 E.

STOP 7. In roadcuts on both sides of highway are excellent exposures of maroon shale and lenses of arkose in shale member of Vanoss formation. Feldspar-rich sandstones and conglomerates characterize the Vanoss formation in the region east of Davis and northward, the feldspar having been derived from extensive outcrops of pre-Cambrian Tishomingo granite in the Tishomingo and Belton anticlines to the southeast. As feldspar is lacking in the underlying Ada formation and in the Collings Ranch conglomerate, it is clear that exposure of the granite took place in post-Ada, pre-Vanoss time, after its highest uplift resulting from the Arbuckle orogeny.

Westward from Davis and around the western margin of the Arbuckle Mountains, feldspar is rare in the Vanoss formation, but south of the region near the Ardmore air base at Gene Autry, feldspar also is abundant. From these relations it is clear that the Tishomingo anticline was the principal source of feldspar for the Vanoss and younger formations.

Return to cars and continue ahead.

38.3 Sandy Creek.

40.8 Entering Sulphur.

41.3 Traffic light. Turn right (south).

41.9 Enter Platt National Park.

42.0 Curve right, then left to parking area. <u>Lunch stop</u>. Platt National Park was established in 1902 to preserve and feature numerous mineral springs. In the south wall of Rock Creek ahead are excellent exposures of Vanoss conglomerate, showing the characteristic low dip and lack of faulting of these strata in the Sulphur area. About 3 miles northeast of Sulphur the conglomerate member disappears by interfingering with and gradation into the upper or shale member of the Vanoss formation.

Return to cars and continue westward across Rock Creek, following curving park road southward, then eastward to Hwy. 18.

43.8 Turn right on Oklahoma Hwy. 18.

43.9 Leave Park.

44.1 Interbedded conglomerate and red shale of Vanoss in roadcut on left.

44.3 Upper Bromide limestone in roadcuts.

44.5 Vanoss conglomerate on right.

44.9 "Birdseye" limestone of McLish formation in abandoned quarries on left.

46.3 Oil Creek limestone in roadcuts.

46.4 Turn right (west) on graveled road. NE cor. sec. 23, T. 1 S., R. 3 E.

46.9 Deese conglomerate and red shale in roadcuts and gravel pits to north.

47.4 NE cor. sec. 22, T. 1 S., R. 3 E. On Oil Creek limestone.

47.6 Water-filled quarry in asphaltic sand of Oil Creek formation on right. Note unconformable contact with overlying Vanoss conglomerate.

47.9 Water-filled pits on opposite sides of road are in Oil Creek sandstone.

48.3 Turn right over cattleguard. Continue ahead to parking area.

48.6 Park cars. Walk ahead to quarries in asphaltic sand being worked by Southern Rock Asphalt Co.

<u>STOP 8</u>. At western edge of outcrops in the Mill Creek syncline, SW¼ sec. 15, T. 1 S., R. 3 E. The quarry face, about 70 feet high, is in the sandstone member of the Oil Creek formation, which is approximately 350 feet thick and has been the source for most of the asphaltic sandstone quarried in this district since 1890. The asphaltic sand contains about 6-8 percent bitumen. It is loaded directly from the face by power shovels and trucked to the company's plant near Dougherty, where it is crushed and mixed with asphaltic limestone of the Viola formation, and sold for road-surfacing material.

The unconformable and slightly channeled contact with the overlying Vanoss conglomerate may be seen near the top of the quarry face at left. The richest deposits of asphaltic rock in the Arbuckle Mountain region are in the western part of the Mill Creek syncline, in strata of the Oil Creek, McLish, Bromide, and Viola formations, directly beneath the unconformity at the base of the Vanoss. The area in which these deposits have been worked covers about 5 square miles. Erosion of the Vanoss and subsequent decomposition of the petroleum into asphalt has destroyed what probably at one time were commercial pools. Through these excavations made for asphaltic rock, however, it is now possible for geologists to stand inside the reservoir bed of a "fossil" oil pool.

Return to cars and retrace route to Hwy. 18.

50.8 Hwy. 18. Turn right (south).

50.9 On right is pit quarry in Oil Creek sandstone, now water-filled, formerly worked for glass sand by the Sulphur Silica Co. Oil Creek limestone lies at top of west wall, dipping 17 southwest. Traces of asphalt were found in this quarry.

51.7 Turn right through wire gate opposite white frame house and park in field.

STOP 9. Buckhorn asphalt quarry, and section of Deese formation along Dry Branch of Buckhorn Creek. See Figure 17 for aerial photograph of area and Figure 12 for graphic section.

In this area at the western edge of the Mill Creek syncline in the best-exposed sequence of Middle Pennsylvanian conglomerate-bearing rocks of the Arbuckle Mountain region. Fusulinids collected from this sequence were examined by the Paleontological Laboratory, Midland, Texas, and determined to be species of the genera Fusulina and Wedekindellina, indicating Deese or Desmoinesian age. In the opinion of the Paleontological Laboratory, most species were of lower "Cherokee" or Boggy age. Fusulinids from other outcrops in this area were determined to be as young as Stuart, from which it may be inferred that the full sequence is approximately equivalent to the Deese formation of the Ardmore basin. On the accompanying color map of the Arbuckle Mountains, the term Deese formation has been applied to these rocks.

In the Buckhorn area the Deese rests on Springer shale (lower Pennsylvanian) without structural disconformity (see Figure 17) and is overlain by Vanoss conglomerate.

Measured section of Middle Pennsylvanian sequence in vicinity of Dry Branch of Buckhorn Creek, S½ SE¼ sec. 23 and central part of sec. 26, T. 1 S., R. 3 E., Murray County, 4½ miles south of Sulphur. Strike mostly N. 60 E., dip 30°-32° northwest.

	Thickness (feet)
Vanoss formation:	
Limestone boulder conglomerate and uncemented gravel, consisting principally of rocks from the Arbuckle group, together with some Reagan sandstone and locally with pebbles of feldspar and granite.	
Deese formation: 1,321 feet thick.	
11. Limestone cobble cgl., poorly cemented, composed chiefly of rocks from the Viola ls., in layers 2-10 feet thick, interbedded with gray-green and reddish shale; poorly exposed	100
10. Marly limestone, cherty, containing abundant fusulinids 20 feet above base. Asphaltic ls. quarry (Buckhorn deposit) in upper part, C. SE¼ SE¼ sec. 23, where cephalopods, gastropods, and silicified and carbonized wood are present	115
9. Red and gray shales interbedded with ls. cobble conglomerate and gravel, in beds 5 to 20 feet thick; cobbles consist principally of Hunton limestone in lower part and of Viola limestone in upper part. Conglomerate beds worked for gravel in SE¼ sec. 23	265

Figure 17. Aerial photograph showing outcrops of Deese rocks in western part of Mill Creek syncline.

8. Marly limestone containing thin beds of calcareous shale. Brachiopods, gastropods, and abundant fusulinids. Bed is well exposed at dam on creek, 1,250 feet north and 350 feet east of cen. sec. 26. . . . 7

7. Red and gray shale with interbedded limestone conglomerate, grading upward into gray fissile shale at top 305

6. Sandy limestone, dark gray, sparingly fossiliferous . . . 6

5. Limestone conglomerate and thin limestones interbedded with red and gray-green shale 170

4. Thin-bedded limestone with shale partings containing abundant fusulinids and some brachiopods. 3

3. Red and gray shale containing a few beds of limestone cobble conglomerate. 210

2. d. Green fossiliferous shale containing fusulinids, 5 feet thick.

   c. Coarse crinoidal limestone, fossiliferous, 1 foot thick.

   b. Green shale, unfossiliferous, 3 feet thick.

   a. Coarse crinoidal limestone containing fusulinids, 1 foot thick 10

1. Red and gray shales containing thin beds of sandy, conglomeratic ls. and limestone conglomerate 130

Springer shale:
Dark gray fissile shale containing thin siderite beds and concretions.

Return to cars and continue south on Hwy. 18.

53.1 Road intersection. NE cor. sec. 35, T. 1 S., R. 3 E.

53.7 Little Buckhorn Creek. In stream bed to left is an exposed fault between Woodford and Caney. The fault dips 70° S. to the Caney shale, the downthrown side, and therefore is a normal fault. Smaller faults in Arbuckle Mountain region generally are normal rather than reverse.

54.0 Park cars on highway shoulders.

STOP 10. Walk downstream (westward) on branch of Little Buckhorn Creek. Note excellent exposures of Woodford shale and outcrop of Sycamore limestone, here 3 feet thick as contrasted with approximately 300 feet one mile south, across the Reagan fault. In exposures south of the fault, on the north flank of the Tishomingo anticline, the Sycamore consists typically of orange-weathering silty limestone but also contains many interstratified beds of Caney-type shale. These shale beds evidently coalesce northward, and the few calcareous beds that do continue represent the lower part of the Sycamore formation. Silty, orange-weathering limestone assignable to the Sycamore formation, between typical Woodford and typical Caney, is generally only 2-5 feet thick in the Mill Creek syncline south of Sulphur.

Continue downstream along Little Buckhorn Creek to the Reagan fault, which separates the Tishomingo anticline from the Mill Creek syncline. Cen. NW¼ NE¼ sec. 2, T. 2 S., R. 3 E. A fault-line escarpment 5 feet high crosses the creek, forming a waterfall. On the west bank a pit has been dug in which the fault is well exposed and has vertical dip. Siliceous shale and beds of chert of the Woodford formation are on the north or upthrown side, and bluish-black fissile shale of the Caney formation is on the south side. The Caney here contains its typically developed phosphate nodules.

This is the best exposure of the Reagan fault known to the writer in the Arbuckle Mountains.

Return to cars and continue ahead.

54.9 Junction with road to Mill Creek. Continue ahead on Hwy. 18.

55.2 Basal Viola and upper Bromide crosses highway in east-trending ridge.

55.3 Turn right (west) at Central Baptist Church. NE cor. sec. 11, T. 2 S., R. 3 E.

55.8 Turn right (north) to ranch house and continue through gate to barn.

56.2 Park cars and walk to Hunton outcrops on west bank of Chilli Creek.

STOP 11. All formations of the Hunton group, except the Frisco limestone, are present at this locality and are typical in thickness and character of most outcrops in the Tishomingo anticline, including the area around White Mound. Note in Figure 11 that the Bois d'Arc limestone, here 81 feet thick, characterizes the Hunton group in the central and eastern parts of the Arbuckle Mountains but is lacking because of pre-Woodford erosion in most parts of the Arbuckle anticline.

The following section was measured at this locality, NE¼ NE¼ SW¼ sec. 2, T. 2 S., R. 3 E. Strike N. 75° W., dip 48° north in upper beds.

Hunton group: 249 feet thick.	Thickness (feet)
Bois d'Arc limestone: 81 feet thick.	
2. Limestone, coarse-grained, partly glauconitic, granular, thin-bedded, abundantly fossiliferous, contains a 4-inch chert bed 3 feet below top. Rocks discolored and oxidized in upper part.	36.0
1. Limestone, light gray, finely granular to aphanitic, containing chert nodules in the lower 13 feet and glauconite in upper 15 feet	45.0
Haragan marl:	
Calcareous yellowish-gray shale with a few thin beds of marlstone, well-exposed in ravines. <u>Meristella</u>, <u>Rensselaerina</u>, <u>Levenea</u>, <u>Rhipidomella</u> in upper part; <u>Orthostrophia</u> in lower part; <u>Camarocrinus</u> bulbs at base	110.0
Henryhouse formation:	
Marlstones, dark cream-colored and reddish, beds mostly 2-6 inches thick, fossils extremely scarce . .	33.0
Chimneyhill group:	
3. Limestone, aphanitic, containing pink crinoid stem fragments, in well-bedded layers 3-10 inches thick, "Pink crinoidal limestone" . . .	15.0
2. Shale, greenish-gray, covered	1.0
1. Glauconitic limestone, medium crystalline, thick-bedded	9.0

Return to cars and retrace route to Hwy. 18.

57.2 Hwy. 18. Turn right (south).

60.3 Nebo store. NE cor. sec. 26, T. 2 S., R. 3 E.

61.1 Oil Creek limestone in roadcuts for 0.5 mile ahead.

62.4 Leave Murray County, enter Carter County. McLish limestone in roadcuts.

63.1 West Spring Creek limestone, on south flank of Arbuckle anticline. The Washita Valley fault, which is the south boundary of the Tishomingo anticline in this area, is concealed to north beneath alluvium.

63.3 Interbedded limestone and laminated dolomite near top of West Spring Creek formation.

63.5 Oil Creek limestone. Oil Creek sandstone and Joins formation are mostly covered to north.

64.1 Viola limestone in roadcut.

65.5 Sycamore limestone is well-exposed in quarry along hogback to east of highway. Three miles east on Oil Creek the Sycamore is 295 feet thick.

70.9 Washita River.

74.4 Dickson. Turn right (west) on U.S. Hwy. 70.

82.1 Frisco RR. underpass, east edge of Ardmore.

83.5 Ardmore Post Office. End of trip for April 29.

ROAD LOG FOR FIELD TRIP

April 30, 1955

Assembly Point

Assemble at northwest edge of Ardmore, on U.S. Highway 77 at 12th St., NW. Cars line up on highway shoulder opposite English Village Motel, heading north. Caravan leaves at 7:30 A.M.

<u>PLEASE BE CAREFUL WITH FIRE</u>

Mileage

0.00 Assembly point. Turn right (east) on 12th Street.

.65 Jog left, then right.

1.0 U.S. Hwy. 70 (Washington Street). Turn left.

1.1 Turn right.

9.4 Dickson. Junction with Oklahoma Hwy. 18. Continue ahead on Hwy. 70.

12.6 Carter-Johnston County line.

15.5 Enter Mannsville.

18.4 Turn left on Oklahoma Hwy. 12. <u>Caution</u>.

21.1 Russet School.

23.9 Washita River.

26.1 Trace of Washita Valley fault, which in this area is inferred to have steep dips, locally north and south.

26.7 Entering Ravia.

27.1 Frisco RR. <u>Caution</u>.

27.3 Oklahoma Hwy. 22. Turn left.

33.8 Troy. On pre-Cambrian Tishomingo granite in central part of Tishomingo anticline. This granite crops out in a nearly level plain in Troy area, except for low hills at 10-Acre Rock east of Troy, where granite for State Capitol in Oklahoma City was quarried.

35.1 Plant of Rock Products Manufacturing Corp. High-purity dolomite from Royer fm. is quarried 3 miles west of plant and crushed for glassmaking and mineral feeds.

37.0 Turn left (west) across Frisco RR.

37.2 <u>STOP 1</u>. Century Granite Company quarry in cen. SW¼ SW¼ sec. 20, T. 2 S., R. 5 E. The rock is coarse-grained biotite Tishomingo granite, part of an igneous complex that makes up the oldest rocks exposed in the Arbuckle Mountain region. This locality is in the Tishomingo anticline, near the northwest corner of the granite outcrop area. Farther east the granite is locally porphyritic, containing pink feldspar phenocrysts 1-2 inches long.

In the north wall of the quarry are biotite-rich schlieren that indicate plastic flow of the granite in pre-Cambrian time. The age of the granite is not known from radioactive determinations, but it probably is late pre-Cambrian.

The quarry has been developed as a pit in a boss or low rounded granite hill, chosen because the stone is massive and free from closely spaced joints. The first step in quarrying is to separate large blocks from the solid ledge. This is accomplished by channeling, a process by which holes approximately

10 feet deep are drilled vertically into the rock and the space between holes (webs) cut out or broached. The block is then removed by drilling horizontal holes at the base and shooting with black blasting powder. The "rough saw blocks" are shipped to the company's plant at Snyder in the Wichita Mountains for sawing and processing into polished slabs for exterior trim.

Return to cars and retrace route to highway.

37.4 Oklahoma Hwy. 12. Turn left (north).

38.15 Reagan fault. Granite exposed in stream to left and West Spring Creek formation in roadcut ahead. Stratigraphic displacement along the fault in this area probably is at least 9,000 feet.

38.3 Oil Creek limestone in roadcut. The rocks are complexly faulted, but dip generally northward on the south flank of the Mill Creek syncline.

38.6 Hunton limestone in roadcut.

40.3 Entering Mill Creek. Turn right (east) at Tydol Station.

40.4 School on right.

40.6 Turn right (south) on Oklahoma Hwy. 7.

40.9 Turn right through iron gate and follow trail.

41.1 Quarry. Park cars in pasture.

STOP 2. $S\frac{1}{2}$ $NW\frac{1}{4}$ $SW\frac{1}{4}$ sec. 7, T. 2 S., R. 5 E. Outcrops of Wapanucka limestone in quarry used for crushed stone for paving Hwy. 12. Strike N. 60° W., dip 23° northeast.

In the synclinal fold centering around Mill Creek are the best exposures of Wapanucka limestone, Atoka formation, and Deese formation in the central part of the Mill Creek syncline. Westward from Mill Creek the Wapanucka and Atoka have been removed by pre-Deese erosion, so that in the area south of Sulphur the Deese rests on Springer (See Figure 12).

The following composite section near Mill Creek shows the general character of the exposed Pennsylvanian rocks.

	Thickness (feet)
Deese formation: 1,950 feet thick (top eroded).	
2. Limestone pebble-cobble conglomerate interbedded with red and gray shales and thin fossiliferous limestones. Mostly poorly exposed	1,350
1. Shale and a few thin beds of crinoidal limestone, mostly covered, containing chert breccia-conglomerate and siliceous shales in basal part	600
Atoka formation:	
Interstratified beds of shale, sandstone, and fine-grained limestone. Sandstone 30-60 feet thick occurs at base. Fusulinids from this sequence were identified by Charles Ryniker as *Fusulinella* of Atokan age . . .	245
Wapanucka limestone:	
Limestone, gray and pale brown, fine- to coarse-grained, partly crinoidal, partly oolitic, locally containing smooth dark gray chert nodules. Abundant productid and spiriferid brachiopods in some beds	550
Springer formation:	
Dark gray and greenish-gray shale containing lenses and thin beds of siderite. Uppermost beds exposed in roadcut south of quarry.	

Return to cars and retrace route to highway.

41.3 Oklahoma Hwy. 7. Turn right (east).

43.1 Turn right (south). NE cor. sec. 17, T. 2 S., R. 5 E.

43.2 Park along shoulder of highway.

STOP 3. Basal sandstone of Atoka formation, 55 feet thick, crops out in east roadcut of highway. Strike east, dip 45° north. The sandstone is fine-grained, pale reddish-brown, and locally cross-bedded. A few thin shales are interstratified in the sequence. The underlying limestones of the Wapanucka formation are poorly exposed, and the contact itself is concealed.

Turn around in road and follow Hwy. 7 to Mill Creek.

46.2 Traffic light in Mill Creek. Turn right (north) on Hwys. 7 and 12.

46.3 Park along shoulder on highway.

STOP 4. Exposures of Deese formation in east roadcut. The outcrops are beds of limestone-chert pebble conglomerate interstratified with red and greenish-gray shales. A few poorly preserved fossils are present in some of the shales. The rocks strike N. 30° W. and dip 60° southwest, and lie just north of the axis of the Mill Creek syncline.

Continue ahead.

46.4 Mill Creek fault, the medial fault of the Mill Creek syncline, concealed by alluvium. Deese is faulted against Oil Creek limestone, the stratigraphic displacement being about 5,500 feet.

46.8 At right (east) is water-filled quarry in Oil Creek sandstone formerly worked for glass sand. Plant of Pennsylvania Glass Sand Corp. in distance. The new quarries lie southeast of the plant, where a face 70 feet high is worked on the west limb of a southward-plunging syncline.

Figure 18. Homogeneous, pure silica sand in the Oil Creek formation in quarry of Pennsylvania Glass Sand Corp. at Mill Creek, SE¼ NW¼ sec. 6, T. 2 S., R. 5 E., on north flank of Mill Creek syncline. In the Mill Creek syncline and adjoining Belton anticline the Oil Creek sandstone is 350-400 feet thick, the thickest of all Simpson sands in the Arbuckle Mountains. Photo by M. E. McKinley.

47.1 On right are highest beds of the West Spring Creek formation, dipping gently southward beneath the Oil Creek sandstone.

47.2 Blue River fault, bringing uppermost West Spring Creek into contact with the Cool Creek formation at the south edge of the Belton anticline. The stratigraphic displacement is about 2,500 feet, and thus the net downward displacement on the north limb of the Mill Creek syncline totals 8,000 feet. In this area the Mill Creek syncline is 3 miles wide.

47.3 Cherty and oolitic dolomite of Cool Creek formation in roadcuts.

48.5 Kindblade dolomite, dipping 15° northward.

50.1 Park just off highway opposite gate. Walk west to cuts along railroad. SE¼ SE¼ SE¼ sec. 24, T. 1 S., R. 4 E.

<u>STOP 5</u>. South branch of Sulphur fault zone, separating Simpson strata of the Sulphur syncline on the north from Arbuckle strata of the Belton anticline on the south. In these major structural features the rocks generally dip less than 20°, but near large faults the dips are greatly steepened. The Oil Creek limestone in the railroad cuts at this locality dips 70° northwest, and the Kindblade dolomite south of the fault dips 55° northward. The fault is between Kindblade and Oil Creek sandstone, which is concealed by alluvium in the valley.

Continue north on highway.

50.5 McLish limestone, dipping gently southward in Sulphur syncline.

51.2 Oil Creek limestone dipping gently eastward.

51.4 North fault of Sulphur fault zone. Cross onto sandy dolomites in middle part of West Spring Creek formation. Stratigraphic displacement on fault is about 500 feet. Cross onto Hunton anticline.

53.8 West Spring Creek dolomite in roadcuts.

53.9 Hwy. 7 curves left. Continue ahead on Hwy. 12. Leave Johnston County, enter Murray County.

57.3 Junction with Oklahoma Hwy. 31. Continue ahead on Hwy. 12. At top of West Spring Creek dolomite.

58.2 Hickory. Hickory fault strikes east across highway, separating Oil Creek sandstone on south from West Spring Creek dolomite on north.

58.8 Base of Oil Creek sandstone, dipping 11° northwest into the North Hickory syncline.

59.1 Turn left through gate.

59.25 Park cars in field. NE¼ SE¼ sec. 11, T. 1 N., R. 4 E.

<u>STOP 6</u>. Quarry of Oklahoma Glass Sand Co., which works the top beds of the Oil Creek sandstone in a face 65 feet high. The beds dip 12° northwestward. At the top of the face on the north wall are the basal beds of the Oil Creek limestone, which crop out for about 200 feet northward and are then cut off by a northeast-trending fault. In the railroad cut north of the quarry, the Oil Creek limestone is in fault contact with West Spring Creek dolomite, although the fault itself is not exposed.

The sandstone member of the Oil Creek formation, part of which contains high-purity glass sand, is 230 feet thick near Hickory, on the northwest flank of the Hunton anticline. Whereas this sand is approximately 400 feet thick in the Mill Creek syncline and Belton anticline, it thins northward and eastward to about 125 feet. At Hickory the sand has an intermediate thickness.

The fault can be traced eastward across the highway by the low ridge of quartzitic boulders, where the Oil Creek sand has been indurated against the fault.

<u>Lunch Stop</u>. Please do not leave trash in the field.

Return to highway.

59.4 Turn left (north).

60.9 Park on shoulder of highway. SW¼ NW¼ NW¼ sec. 1, T. 1 N., R. 4 E.

STOP 7. Unconformable contact of West Spring Creek dolomite, near top of formation, with conglomerate in the upper part of the Ada formation, in east roadcut. Pebbles in the conglomerate are laminated dolomite and chert, both derived from the underlying formation. Low-angle dips such as observed here are characteristic of the Hunton anticline, a broad dome in whose axis the oldest exposed rocks are Kindblade dolomite.

The Ada formation at this locality contains red shales, gray sandstone, and beds of conglomerate.

Continue ahead.

62.05 Leave Murray County, enter Pontotoc County.

64.0 Enter Roff.

64.5 Curve right (east). Join Oklahoma Hwy. 61.

64.8 Turn left (north) and continue past school.

65.45 Frisco RR. Caution.

65.7 Curve right (east) and continue on winding road.

66.15 Turn right past tool house.

66.3 Park cars in field.

STOP 8. Quarry of Mid-Continent Glass Sand Co. SE¼ NW¼ SE¼ sec. 13, T. 2 N., R. 4 E. About 40 feet of McLish sandstone is worked in well-bedded strata that dip gently southeastward (see Figure 19). In this area, at the northern edge of the Hunton anticline, the McLish sandstone member is approximately 160 feet thick and is the thickest sand of the Simpson group.

Figure 19. McLish sandstone in quarry of Mid-Continent Glass Sand Company at Roff, SE¼ NW¼ SE¼ sec. 13, T. 2 N., R. 4 E., at north edge of Hunton anticline. In the Hunton anticline the McLish sandstone, 150 feet thick, is the thickest of all Simpson sands.

Quarry operations consist of drilling and shooting the sand, disaggregation by a hydraulic monitor, and pumping to the processing plant where it is washed, subjected to flotation, and sold chiefly as melting sand for the manufacture of glass.

Return to cars and retrace route to Roff.

66.65 Turn left on Hwys. 12 and 61.

67.35 Turn right on Hwy. 61.

67.75 Fault between McLish sandstone and West Spring Creek dolomite in roadcut on left. Fault is vertical.

68.4 Oil Creek sandstone. Faulted contact with West Spring Creek dolomite is concealed.

69.15 Cross onto West Spring Creek from Oil Creek sand at normal contact.

70.7 Intersection. NE cor. sec. 28, T. 2 N., R. 5 E.

72.4 Minor folds in West Spring Creek dolomite. Travelling along north flank of Hunton anticline.

74.5 Oil Creek limestone in north roadcut.

74.9 McLish limestone, typical "birdseye" lithology.

75.2 Conglomerate of upper Des Moines (Deese) age. In type area of Taff's Franks conglomerate.

79.0 Stop sign. Turn right (south). Junction with Oklahoma Hwy. 99.

79.15 Shales and thin sandstones of Boggy fm. in roadcuts.

79.5 Fittstown.

81.1 Turn right (west) on graveled road.

81.8 Cattleguard. Viola limestone in cut ahead.

82.2 Turn right.

82.3 Park cars in yard. NW$\frac{1}{4}$ NW$\frac{1}{4}$ sec. 2, T. 1 N., R. 6 E.

STOP 9. Townsend quarry. The distinctive "birdseye" limestone of the McLish formation, which on the northeast flank of the Hunton anticline is 200-400 feet thick, has been worked as building stone in this area for many years. The even-bedded layers are separated by green shale partings that facilitate quarrying into slabs for home veneering and for flagstones.

These strata are characterized by irregular flecks and masses of clear calcite, distributed chiefly in spaces within fine-grained limestone that was precipitated as encrustations of blue-green algae. Other organic remains, principally gastropods, also are present and are filled with calcite.

The "birdseve" lithology, of the kind seen in the quarry, occurs in the Arbuckle Mountains only in the McLish formation of the Mill Creek syncline and northward. It is the most distinctive rock type of the Simpson group.

Retrace route to highway.

83.5 Turn right (south).

84.3 Woodford formation in roadcuts.

84.5 Sheep Creek.

84.6 Hwy. 61 turns left. Continue ahead.

85.25 Park cars on side of road near abandoned quarry.

Figure 20. "Birdseye" limestone of McLish formation in Townsend quarry, NW¼ NW¼ sec. 2, T. 1 N., R. 6 E., northeast flank of Hunton anticline. This distinctive rock is 200-400 feet thick and characterizes the McLish limestone in the Hunton anticline. Photo by M.E. McKinley.

STOP 10. Section of Viola limestone and Bromide formation in roadcuts on west side of Hwy. 99, SW¼ sec. 12, T. 1 N., R. 6 E., on northeast flank of Hunton anticline. In this area both formations have their minimum thickness within the Arbuckle Mountain region.

A Viola thickness of 402 feet was measured at this locality by Wengerd (Bull. A.A.P.G., vol. 32, pp. 2200-2201, 1948), who included 80 feet of "Fernvale" limestone at the top. The four lower members of the Viola described by him are fossiliferous cherty limestones marked at the base by porous-weathering chert. This basal member is characterized throughout the region by laminar chert and by an abundance of graptolites.

The Bromide formation is 290 feet thick on Hwy. 99, according to M. P. Gillert (M.S. thesis, Univ. of Okla., 1952). The fine-grained limestone at the top of the formation, popularly called "Bromide dense", is 30 feet thick, and the remaining part consists of interbedded limestones and shales. Coarse sand grains occur in the lower 80 feet, but there is no well-defined sandstone body in the formation.

Return to cars. Turn around and go north.

85.9 Turn right (east) on Okla. Hwy. 61.

86.5 Haragan and Bois d'Arc limestones in ridge and quarry on left.

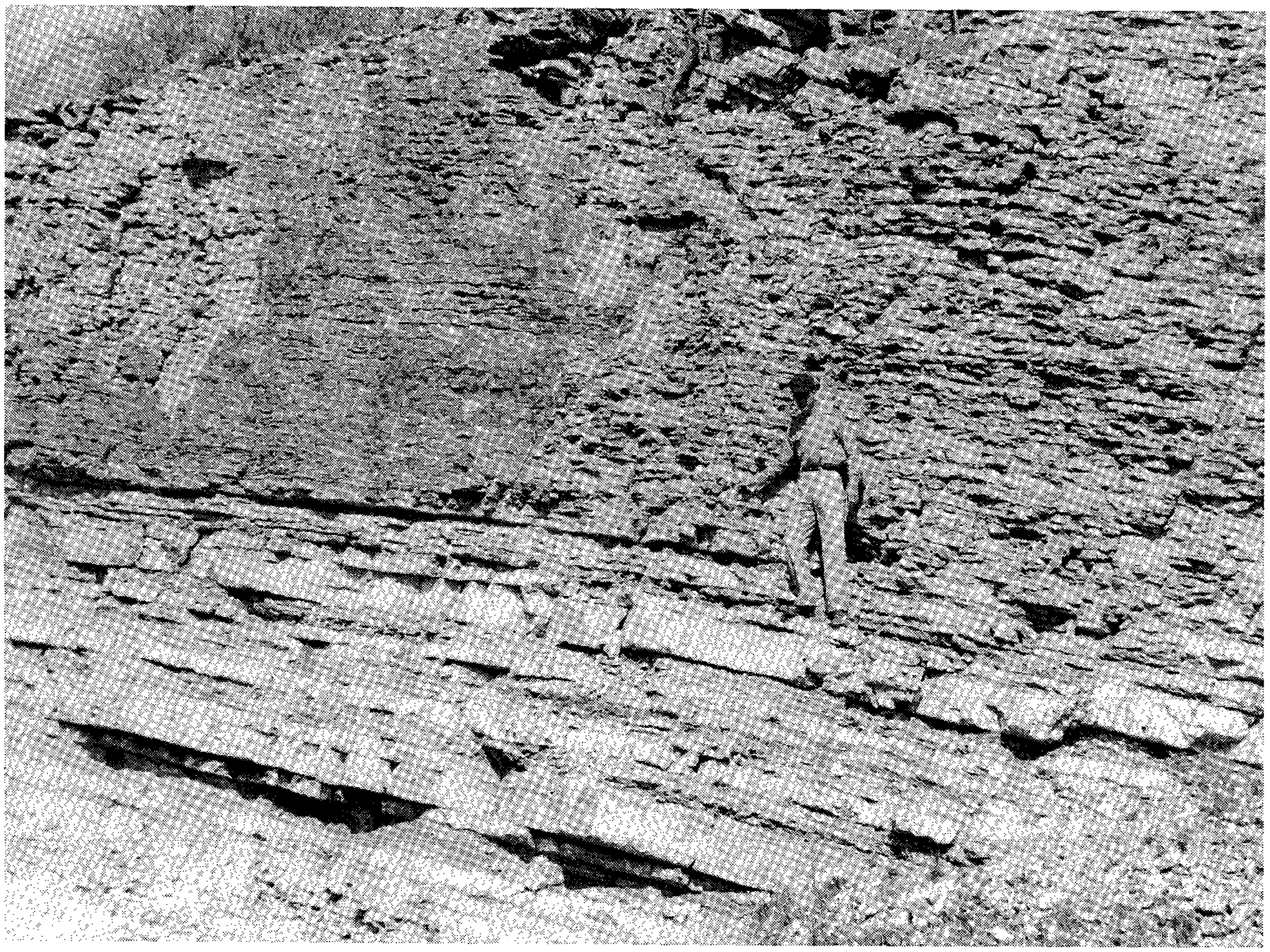


Figure 21. Contact of Viola limestone and underlying Bromide formation (at man's feet) in roadcut on Oklahoma Highway 99, NW¼ NE¼ SW¼ sec. 12, T. 1 N., R. 6 E., on northeast flank of Hunton anticline. Both formations are thinner here than elsewhere in the Arbuckle Mountains. Photo by M. E. McKinley.

92.2 Jesse. Jog left, then right. School on left. Leave Hwy. 61.

93.1 Turn right (south) on Pontotoc-Coal County line.

93.5 Allen's grocery. Continue ahead.

95.8 Sandstone in lower part of Atoka formation.

96.2 Goose Creek. Springer shale exposure in banks to right.

96.3 Caney shale and large concretion in roadcut.

98.7 Turn left (east). SE cor. sec. 36, T. 1 N., R. 7 E. Enter Coal County.

99.35 Curve right. Wapanucka limestone in roadcut and ridge.

100.45 Turn left (east). NW cor. sec. 8, T. 1 S., R. 8 E.

100.7 Turn right (south) toward farm house.

101.2 Go past house, through two wire gates, and park by barn.

STOP 11. Hunton townsite, type locality of Hunton group. The village of Hunton, as well as Viola, Sylvan, and Simpson, have vanished long ago. All are former villages whose names Taff used for formations in the period before 1904.

Following is the section measured in secs. 7 and 8, T. 1 S., R. 8 E., east flank of Hunton anticline; dip 3° east in lower part.

	Thickness (feet)
Woodford formation:	
Dark gray shale interstratified with thin beds of chert.	Not measured
Hunton group: 300 feet thick.	
Bois d'Arc limestone:	
Yellowish thin-bedded argillaceous limestone containing chert nodules at base, overlain by medium-crystalline limestone containing abundant chert nodules and thin beds. Includes 10 feet of medium-crystalline non-cherty limestone (Frisco) at top..	60
Haragan marlstone:	
Blue-gray friable marlstone, weathering cream-colored, interstratified with thin beds of argillaceous limestone. Numerous fossils. Crops out in scarp face	170
Pink crinoidal limestone:	
Pink limestone, thick- to thin-bedded, containing abundant crinoid columnals in upper part; lower part cream-colored calcilutite in even-bedded layers. Maximum thickness in region	50
Glauconitic limestone:	
Gray, medium-crystalline, even-grained limestone, containing abundant glauconite and a few chert nodules.	15
Oolitic limestone:	
Yellowish to gray massive limestone containing numerous oolites and pisolites. Chert nodules occur locally.	5
Sylvan shale:	
Gray-green plastic clay shale.	

An important unconformity separates the Haragan (Oriskanian) from the pink crinoidal limestone (Niagaran). All the Henryhouse has been removed by truncation; and farther south in the Hunton anticline, secs. 32 and 33,

T. 1 S., R. 8 E., the magnitude of unconformity is even more, as the pink crinoidal limestone is only 8 feet thick. Farther southeast (see Stop 12) all the Niagaran rocks are missing through erosion, and the Haragan rests on glauconitic limestone.

Retrace route to section-line road.

101.6 Turn right (east).

102.7 Wapanucka limestone, well-exposed in roadcuts through ridge.

104.2 Woodford outcrops in roadcut on hill.

104.7 Turn right (south).

105.05 Curve left, entering Clarita. Cross onto Caney shale.

105.5 Stop sign. Turn right.

106.0 Turn left (east).

106.5 K. O. and G. RR. Caution.

106.8 Okla. Hwy. 48. Turn right (south). Wapanucka forms ridge to east.

108.6 Bridge on Tell Creek. Curved approach. Caution. Springer shale.

109.15 Wapanucka limestone.

111.0 Enter Johnston County, leave Coal County. On Atoka fm.

111.8 Bridge on Delaware Creek. Curved approach. Caution.

113.5 Bridge on Sandy Creek.

114.1 Stop sign in Wapanucka. Continue ahead on Hwy. 48.

114.6 Wapanucka limestone, dipping 27° northeast.

116.2 Turn left (west).

116.25 K. O. and G. RR. Caution.

116.9 Woodford fm. in tree-covered ridge.

117.5 Turn right (north). SE cor. sec. 27, T. 2 S., R. 8 E. On sand of Paluxy formation, Trinity group.

117.9 Park cars in road. Walk 1,000 feet northwest, past house to ridge.

STOP 12. Excellent exposures of Hunton group, northeast flank of Belton anticline; dips steep to vertical along Sulphur fault zone. At this locality the Henryhouse and pink crinoidal limestones are absent because of pre-Haragan erosion; and the glauconitic limestone has its maximum thickness in the Arbuckle Mountain region.

Section of Hunton group measured 1,000 feet west and 2,500 feet north of SE cor. sec. 27, T. 2 S., R. 8 E., Johnston County, in well-exposed outcrops in hogback.

	Thickness (feet)
Woodford siliceous shale:	
White to pale brown laminated siliceous shale.	Not measured
Hunton group: 209.5 geet thick.	
Bois d'Arc limestone:	
7. Light gray to pale cream-colored limestone, fine-textured, conchoidally fracturing ("dense") to finely granular; abundant elongated, porous, "cotton-rock" chert nodules. Beds mostly 6 inches thick. *Dalmanites* and *Delthyris perlamellosus* observed, though sparingly fossiliferous.	112.0

Haragan marlstone:

6. Dark cream-colored, argillaceous limestone, very finely granular, filled with manganese oxide dendrites; beds 1-3 inches thick, easily weathered and mostly covered. Levenea and Orthostrophia cf. strophomenoides.		20.0

Chimneyhill limestone:

5. Glauconitic limestone: Light gray limestone, pale brownish in lower part, with scattered dark green glauconite grains persisting to the top bed; even-grained, medium crystalline strata mostly 1 foot thick but ranging from 6 inches to 2 feet. Light gray bands of chert in lower 20 feet. No fossils observed		63.5

Oolitic limestone:

4. Light gray oolitic limestone, massive bed.	1.5	
3. Light brown oolitic limestone, beds 2-4 inches thick	8.0	
2. White oolitic and pisolitic limestone units interstratified in a massive bed. Chert nodules locally	3.5	
1. Dark golden-brown limestone, argillaceous, with abundant silicified crinoid columnals. Thin-bedded	1.0	14.0

Sylvan shale:

Olive-green, plastic, fissile shale . . . . Not measured

End of trip.

Return to Wapanucka, thence westward to Oklahoma Hwy. 99 and southward to Ardmore through Tishomingo and Ravia.