



OKLAHOMA
GEOLOGICAL SURVEY

Guide Book XII

Parks and Scenic Areas in the Oklahoma Ozarks

GEORGE G. HUFFMAN
TYSON A. CATHEY
JAMES E. HUMPHREY

1963

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CARL C. BRANSON, *Director*

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The University of Oklahoma

Norman

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Cover picture. Pensacola Dam on the Grand River, Langley, Oklahoma, seen from the west end (see page 7 for description). Photograph courtesy of Grand River Dam Authority.

A GUIDE TO THE STATE PARKS AND SCENIC AREAS IN THE OKLAHOMA OZARKS

George G. Huffman*, Tyson A. Cathey†, and James E. Humphrey‡

INTRODUCTION

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Many of the residents of northeastern Oklahoma expressed a friendly interest in the project and related to the writers vivid stories about the history and development of the region. To these people, this book is affectionately dedicated.

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LOCATION AND DESCRIPTION OF AREA

The Oklahoma Ozark Area occupies approximately 4,000 square miles in northeastern Oklahoma. It includes all of Adair, Cherokee, and Delaware Counties and portions of Craig, Mayes, Muskogee, Ottawa, Sequoyah, and Wagoner Counties.

The eastern boundary of the Oklahoma Ozark area is the Arkansas-Missouri-Oklahoma state line. The western and southern boundaries form an arcuate line from the vicinity of Miami southward to Gore, thence eastward along the Arkansas River Valley to the Arkansas line. It is bounded on the north by Cherokee County, Kansas, which adjoins Ottawa County, Oklahoma (fig. 1).

CLIMATE AND WEATHER

Northeastern Oklahoma is in a belt of warm, humid, subtropical to continental-type climate. The average temperature for July is 81.4 degrees and that for January is 38 degrees. The lowest temperature on record for this area is 27 degrees below zero in Adair County, and the highest temperature recorded is 118 degrees in Cherokee and Muskogee Counties.

Mild weather prevails during the autumn and spring months, making these seasons ideal for tourists to vacation in this area. Clear skies and dry atmosphere prevail during the summer months, with hot days and relatively cool nights. Winters are generally mild, with spells of cold alternating with periods of mild weather.

Precipitation in northeastern Oklahoma is moderate. The average annual precipitation for selected

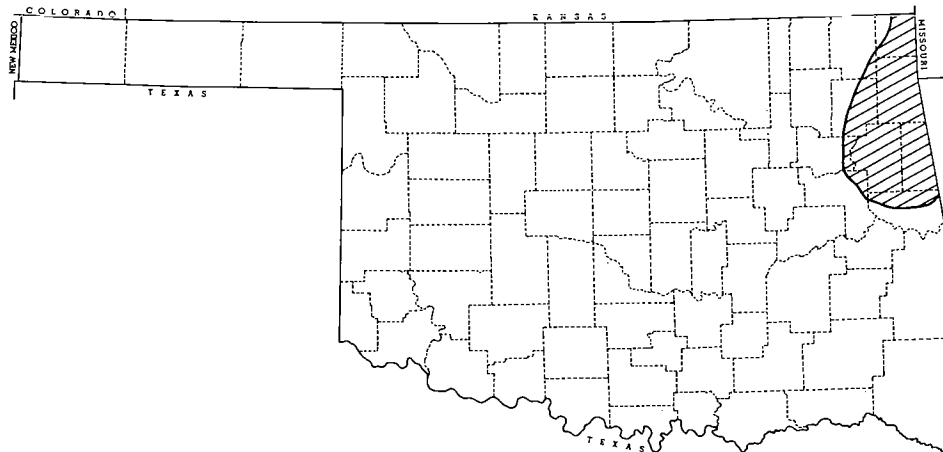


Figure 1. Map of Oklahoma showing location of the Oklahoma Ozarks.

TABLE 1.—AVERAGE PRECIPITATION IN NORTHEASTERN OKLAHOMA
(Delaware County not included—data from Climate and Man)

County	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Adair	3.33	2.61	3.35	4.79	4.98	5.31	3.40	3.33	4.99	4.24	3.52	2.99	46.84
Cherokee	2.53	1.97	3.21	4.26	4.46	4.84	3.26	3.42	4.04	4.11	2.86	2.21	41.17
Craig	2.19	1.74	3.33	4.22	5.23	5.36	3.77	3.72	3.82	3.77	2.93	2.19	42.27
Mayes	2.73	1.90	2.36	4.06	5.06	5.72	3.61	3.32	5.47	3.81	3.03	2.07	43.14
Muskogee	2.42	1.91	3.19	4.33	4.88	4.13	3.11	3.20	3.64	3.75	2.73	2.21	39.50
Ottawa	2.15	1.56	3.31	4.26	4.36	5.54	3.48	3.36	4.36	4.35	3.08	2.12	41.93
Sequoyah	3.27	2.45	2.93	4.35	5.11	4.31	2.72	3.26	3.81	4.27	2.72	2.59	41.79
Wagoner	2.40	2.01	2.99	4.14	5.91	3.46	3.92	2.52	3.64	2.93	2.11	1.86	37.89
													Average 41.81

stations in Adair, Cherokee, Craig, Mayes, Ottawa, Sequoyah, Muskogee, and Wagoner Counties is 41.81 inches. Most of the rainfall occurs during the warmer months. May and June are generally the rainiest months, whereas February is usually the driest. Snow is usually light and remains on the ground for only a few days at a time.

The first killing frost in the area occurs in late October, generally about October 20 to 25, and the last killing frost in the spring is from April 5 to 15. The average annual growing season is about 200 days.

ROADS AND RAILROADS

Northeastern Oklahoma is traversed by several state and federal highways, as well as by the Will Rogers Turnpike. Main highways are of asphaltic or concrete construction. In the northern part of the area, secondary roads follow the section lines and are numerous; in the southern and eastern portions, secondary roads follow stream valleys and are relatively few in number.

The main north-south highways which serve the area are (1) U. S. Highway 69 from Muskogee to the Kansas line along the western border; (2) State Highway 82 from Vian to Tahlequah, thence northward through Locust Grove, Spavinaw, and Langley to the junction with U. S. Highways 60, 66, and 69 east of Vinita; (3) U. S. Highway 59 from Sallisaw through Stilwell, Baron, Westville, Jay, Grove, Afton, and Miami; (4) State Highway 10 from Gore to Fort Gibson, Tahlequah, Jay, Grove, and Wyandotte.

Major east-west roads include (1) State Highway 10 across Ottawa County through Miami, thence westward into Craig County; (2) U. S. Highway 60 from west of Vinita through Afton, Fairland, and Wyandotte to the Missouri line; (3) State Highway 28 from Adair through Pensacola, Langley, and Jay; (4) State Highway 20 from Pryor to Salina, Spavinaw, and Jay to the Arkansas line; (5) State Highway 33 from Chouteau through Locust Grove and Flint to Siloam Springs, Arkansas; (6) State Highway 51 from Wagoner through Hulbert, Tahlequah, and Stilwell to the Arkansas line; (7) U. S. Highway 62 from Muskogee to Fort Gibson, Tahlequah, and Westville; (8) U. S. Highway 64 from Gore through Vian and Sallisaw; and (9) U. S. Highway 66 from Chelsea in Rogers

County to Vinita, thence northward through Miami to the Kansas line.

The recently completed Will Rogers Turnpike enters the area near Adair in Mayes County and continues diagonally across southeastern Craig County and north-central Ottawa County to the northeast corner of the State.

Five major railroad lines service the area. These are (1) St. Louis and San Francisco (Frisco), which passes through the northern part of the area on the Tulsa-St. Louis route; (2) Missouri, Kansas, and Texas, which connects Muskogee, Wagoner, Chouteau, Pryor, and Vinita; (3) Kansas, Oklahoma and Gulf, which connects Muskogee, Fort Gibson, Okay, Wagoner, Murphy, Locust Grove, Salina, Strang, Afton, and Miami; (4) Missouri Pacific, which enters the area near Wagoner, passes through Okay, Fort Gibson, Braggs, Gore, Vian, Sallisaw, and Muldrow; and (5) Kansas City Southern, which connects Sallisaw, Marble City, Bunch, Stilwell, Baron, Westville, and Watts.

RIVERS AND STREAMS

Northeastern Oklahoma lies in the drainage basin of the Arkansas River. The northern portion is drained by the Grand River, which is formed by the confluence of the Neosho and Spring Rivers near Wyandotte in Ottawa County and which flows southward into the Arkansas River near Fort Gibson. The Grand River is a mature stream with a broad, fertile floodplain. West-flowing tributaries of the Grand River, including Lost Creek, Cowskin (Elk) River, Honey Creek, Sycamore Creek, Spavinaw Creek, Salina Creek, Spring Creek, Big Hollow Creek, Clear Creek, Fourteenmile Creek, Hickory Creek, Ranger Creek, and Flower Creek, flow across the limestones and cherts of the Osage Series; hence they are spring-fed and remarkably clear. From the west, Grand River receives the waters of Cow Creek, Coal Creek, Hudson Creek, Horse Creek, Cabin Creek, Pryor Creek, Wolf Creek, Cole Creek, Brush Creek, Cat Creek, and Flat Rock Creek. These flow across the sandstones and shales of the Fayetteville, Atoka and McAlester Formations. They are muddy, sluggish, in part intermittent, and flow in channels only slightly below the general level of the land surface.

The southern and southeastern parts of this area are drained by Bayou Manard, Boudinot Creek,

Greenleaf Creek, Cedar Creek, Vian Creek, Sallisaw Creek, Lee Creek, and the Illinois River. Principal tributaries of the Illinois River include Flint Creek, Barren Fork, Caney Creek, Tahlequah Creek, Parkhill Creek, Dry Creek, Elk Creek, Signboard Creek, Burnt Cabin Creek, Salt Creek, Terrapin Creek, Linder Bend Creek, Swinner Creek, Moonshine Hollow Creek, and Deep Branch Creek.

LAKES AND DAMS*

Introduction.— The present lake system in north-eastern Oklahoma was begun in 1922 by the construction of Spavinaw Lake, a reservoir designed to furnish a dependable water supply for Tulsa. Hydroelectric development and the flood-control program were started in 1935 with the creation of the Grand River Dam Authority by the Oklahoma Legislature. Financial support for this project was procured by a loan and grant agreement with the Public Works Administration of the United States Government (Grand River Dam Authority, 1950). In 1937, the Chief of Engineers, Department of the Army, recommended a system of seven flood-control reservoirs in the Arkansas River basin as part of the flood-protection program for the Ohio River and the lower Mississippi River. The Flood-control Act of June 28, 1938, approved the system of reservoirs. Included were Pensacola, Markham Ferry, and Fort Gibson Dams on the Grand River and Tenkiller Reservoir on the Illinois River. Actual construction of Fort Gibson Dam and Reservoir was authorized by the Flood-control Act of 1941, and Tenkiller Ferry Dam was approved by Congress in the River and Harbor Act of 1946 (Corps of Army Engineers, 1946, 1948). Pensacola, Fort Gibson, and Tenkiller Ferry Projects have been completed; initial appropriations for construction of Markham Ferry Dam were made in 1955.

Grand Lake (Lake o' the Cherokees). — Pensacola Dam, which impounds Grand Lake, is located on Grand River approximately 20 miles north-east of Pryor, 5 miles north of Spavinaw, and 16 miles southeast of Vinita. The small town of Langley is at the western end of the dam, and Disney is at the eastern end. The dam is located in Mayes County, and the waters of Grand Lake cover parts of Mayes, Delaware, Craig, and Ottawa Counties (fig. 2).

The Grand River drainage area above the dam occupies 10,300 square miles. More than half of this area is rolling prairie land, typical of Kansas and Oklahoma; the rest lies in the rugged Ozark region. Grand River is formed by the confluence of Neosho and Spring Rivers near Wyandotte, Oklahoma. Principal tributaries in Oklahoma include Five Mile Creek, Warrens Branch, Lost Creek, Sycamore Creek, Cowskin (Elk) River, Honey Creek, and Drowning Creek.

Pensacola Dam impounds the waters of Grand River to form a reservoir, which at power-pool level includes 46,300 acres and at flood-control level covers 55,000 acres. The power-storage volume is 1,200,000 acre-feet and the flood-control storage is 540,000 acre feet. Total shoreline is approximately 1,300 miles.

The dam was completed in 1940 at a cost of \$27,000,000. It is a concrete structure and has the distinction of being the largest multiple arch-type dam in the world. Total length of the dam and spillways is 6,565 feet, and the height of the dam is 150 feet above the foundation. A two-lane, lighted highway runs the full length of the dam.

Pensacola Dam was taken over by the Federal Government in 1941 under Presidential order to utilize its power for the war effort. For approximately five years, it served the war plants located nearby, producing in that time more than 350,000,000 kilowatt hours per year. It was returned to the Grand River Dam Authority in 1946.

The annual primary production of the Pensacola plant is 180,000,000 kilowatt hours. Secondary energy is 120,000,000 kilowatt hours. Combined with energy from the steam plant near Pryor, the total energy is nearly 400,000,000 kilowatt hours per year. Six 20,000 horsepower turbines with a total installed capacity of 90,000 kilowatts are in operation. Electric power is distributed through the Grand River Dam Authority to towns and cities throughout northeastern Oklahoma. The abundance of electric power and an adequate water supply make this general region attractive for larger industries which are moving into the state.

Spavinaw Lakes. — Spavinaw Lakes (fig. 2), located on Spavinaw Creek in Mayes and Delaware Counties, are artificial lakes built to supply water to the city of Tulsa (figs. 3, 4). The lower lake was completed in 1922 at an approximate cost of \$8,500,000. Increased industrial demands following World War II led to construction of the Upper Spavinaw Lake (Lake Eucha) in 1952. The water is carried to Tulsa from Spavinaw through two large concrete aqueducts. Total cost of the project was about 20 million dollars.

The Lower Spavinaw Lake, located at Spavinaw, covers approximately 1,650 acres, is about 5 miles long, and impounds 31,000 acre-feet of water. The Upper Spavinaw Lake (Lake Eucha) covers 3,200 acres, is about 8 miles long, and impounds 80,000 acre-feet of water. The lower lake is serviced by Spavinaw, a typical resort town. Jay, six miles northeast of the upper lake, supplies material and food for fishermen.

Fort Gibson Lake. — The Fort Gibson Dam (fig. 5), is located on the Grand River in Wagoner and Cherokee Counties, about 8 miles above its confluence with the Arkansas River. The site is 5 miles north of Fort Gibson, 5 miles northeast of Okay, 12 miles northeast of Muskogee, and 13 miles southeast of Wagoner (fig. 7).

Fort Gibson Dam and Reservoir, constructed at

*Revised from Huffman, 1955, p. 107 - 120. Data from Corps of Army Engineers.

a cost of \$25,000,000, serve for flood control, hydroelectric power, and recreation. The shorelines have been developed into public parks, recreational areas, and a wildlife preserve. Sequoyah State Park has many recreational facilities and Western Hills Lodge, built at a cost of \$1,600,000, offers excellent accommodations.

The reservoir is approximately 39 miles long and impounds water with a surface area of 19,000 acres at normal level and 51,000 acres at flood level. It has a shoreline of 225 miles. The reservoir, when full, will have a storage capacity of 1,287,000 acre-feet, of which 365,000 acre-feet will be maintained for power and 922,000 acre-feet reserved for flood control.

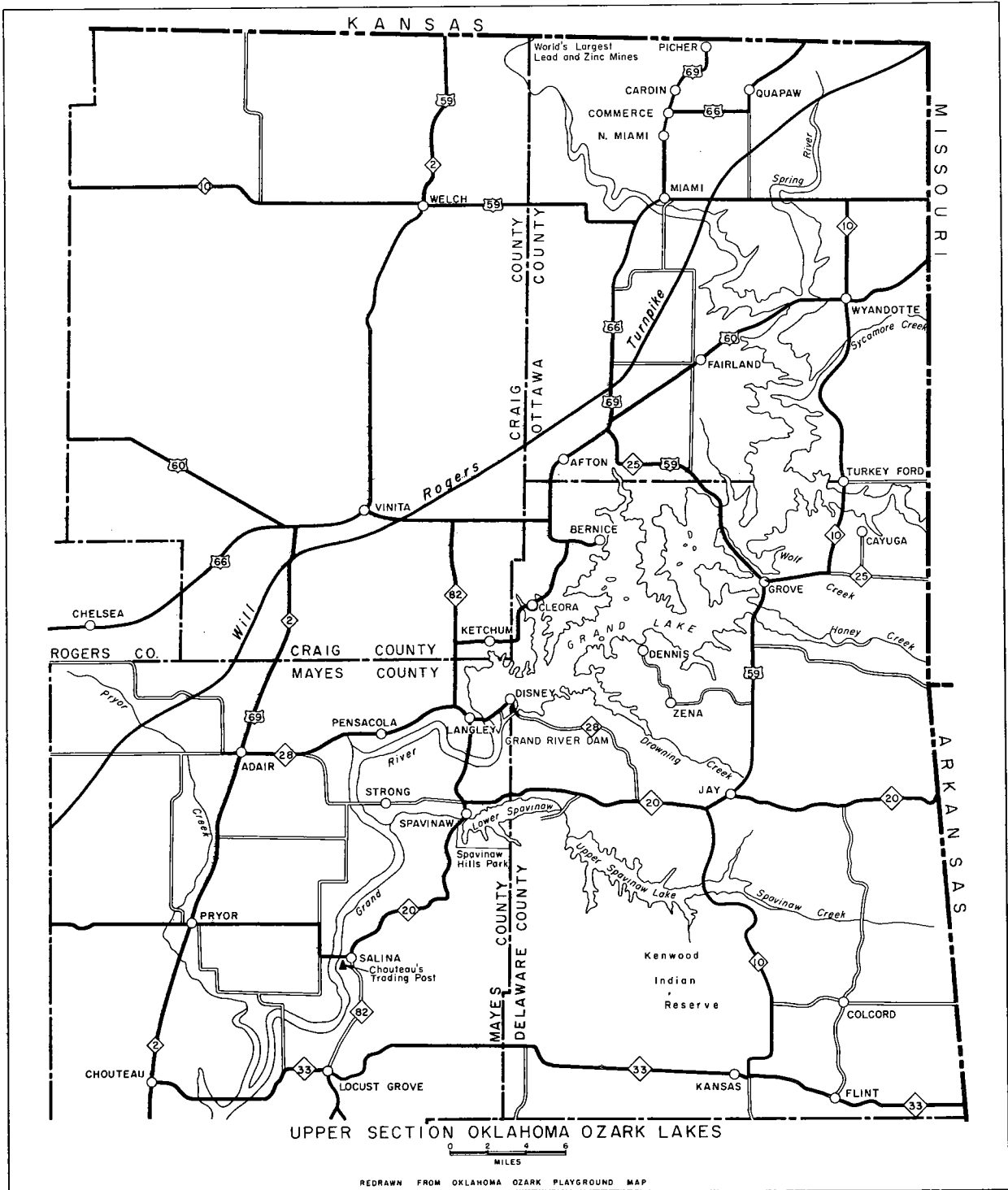


Figure 2. Map showing upper section, Oklahoma Ozark Lakes.

Among the tributary streams which enter the Fort Gibson Reservoir are Pryor Creek, Chouteau Creek, Spring Creek, Clear Creek, Fourteenmile Creek, and Ranger Creek. Tributaries from the east are spring-fed and clear; those from the west are sluggish and loaded with silt and mud.

Fort Gibson Dam has an overall length of 2,850 feet, of which 2,563 is of concrete construction and the remainder of earthen fill. The dam is 110 feet high above the foundation, and the top has an elevation of 593 feet. A highway 22 feet wide has been constructed across the dam. Installation of six 12,300-kilowatt generators provides an output of 180,700,000 kilowatt-hours per year (data from Corps of Engineers, U. S. Army, 1946).

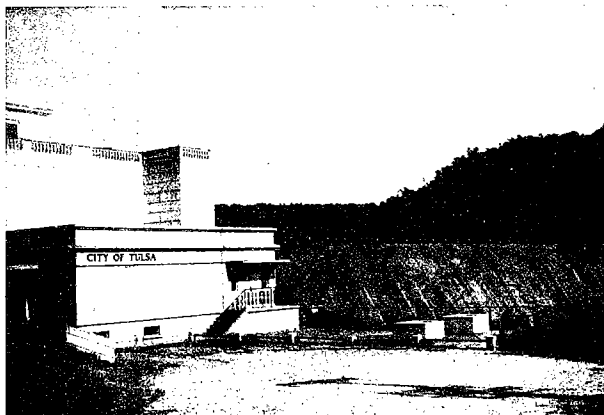


Figure 3. Dam and intake station, Lower Spavinaw Lake, Spavinaw, Oklahoma.

Tenkiller Ferry Lake. — Tenkiller Ferry Dam (fig. 6), on the Illinois River was constructed about 13 miles above the confluence of the Illinois and Arkansas Rivers and 7 miles northeast of Gore (fig. 7). During normal operation, the water stored for power purposes will form a pool 34 miles long with a shoreline of more than 100 miles and a surface area of 12,500 acres. The reservoir at the top of flood-control level is 42 miles long and covers 21,000 acres in the beautiful Cookson Hills of Cherokee and Sequoyah Counties. A maximum

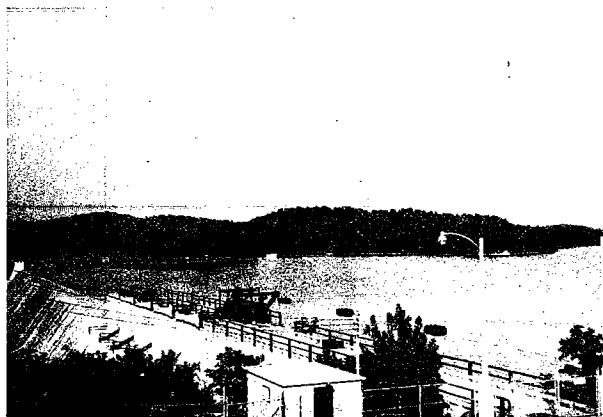


Figure 4. Recently completed dam on Upper Spavinaw Lake.

depth of 160 feet makes this the deepest lake in Oklahoma.



Figure 5. Fort Gibson Dam looking east from the parking area.

The Illinois River rises in the Boston Mountains of western Arkansas, about 15 miles southwest of Fayetteville. Spring-fed tributaries, rising in the chert hills of northeastern Oklahoma and northwestern Arkansas, assure this lake a plentiful supply of clear, blue water, which makes Tenkiller Lake the most beautiful in Oklahoma. The main tributaries which feed the lake are Flint Creek, Barren Fork, and Caney Creek.

The dam which creates Tenkiller Ferry Reservoir is an earthen-fill type with a total length of 3,000 feet, a height of 190 feet, and a crest width of 25 feet. The dam was completed in 1953 for a total cost of about 23 million dollars. The purposes of the dam are three-fold. The primary purposes are

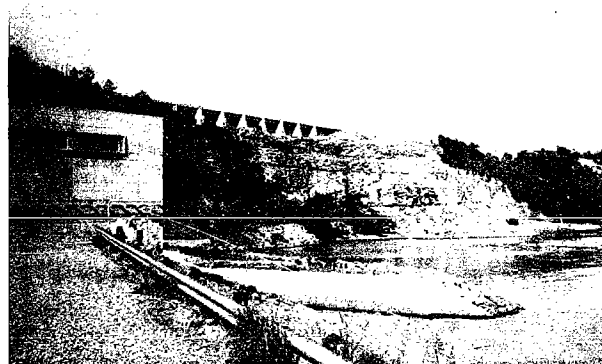


Figure 6. Spillway and power station, Tenkiller Reservoir. The earthen-fill dam is attached to the rock wall at right side of photo.

for flood control and to supply hydroelectric power. Flood protection is offered to more than 3,000 acres of land in the Illinois River Valley below the dam as well as to thousands of acres in the fertile Arkansas River Valley below the mouth of the Illinois. The power plant furnishes about 107 million kilowatt-hours of power per year through its two generating units. Storage volume of the power

pool is 630,000 acre-feet; the total storage capacity of the reservoir is 1,230,000 acre-feet. The shore-lines have been improved to provide public park and recreational facilities, including the Tenkiller State Park just northeast of the dam.

Greenleaf Lake. — Greenleaf Lake is situated on Greenleaf Creek (fig. 7), in eastern Muskogee County near the town of Braggs. It can be reached by State Highway 10 which connects Gore and Fort Gibson.

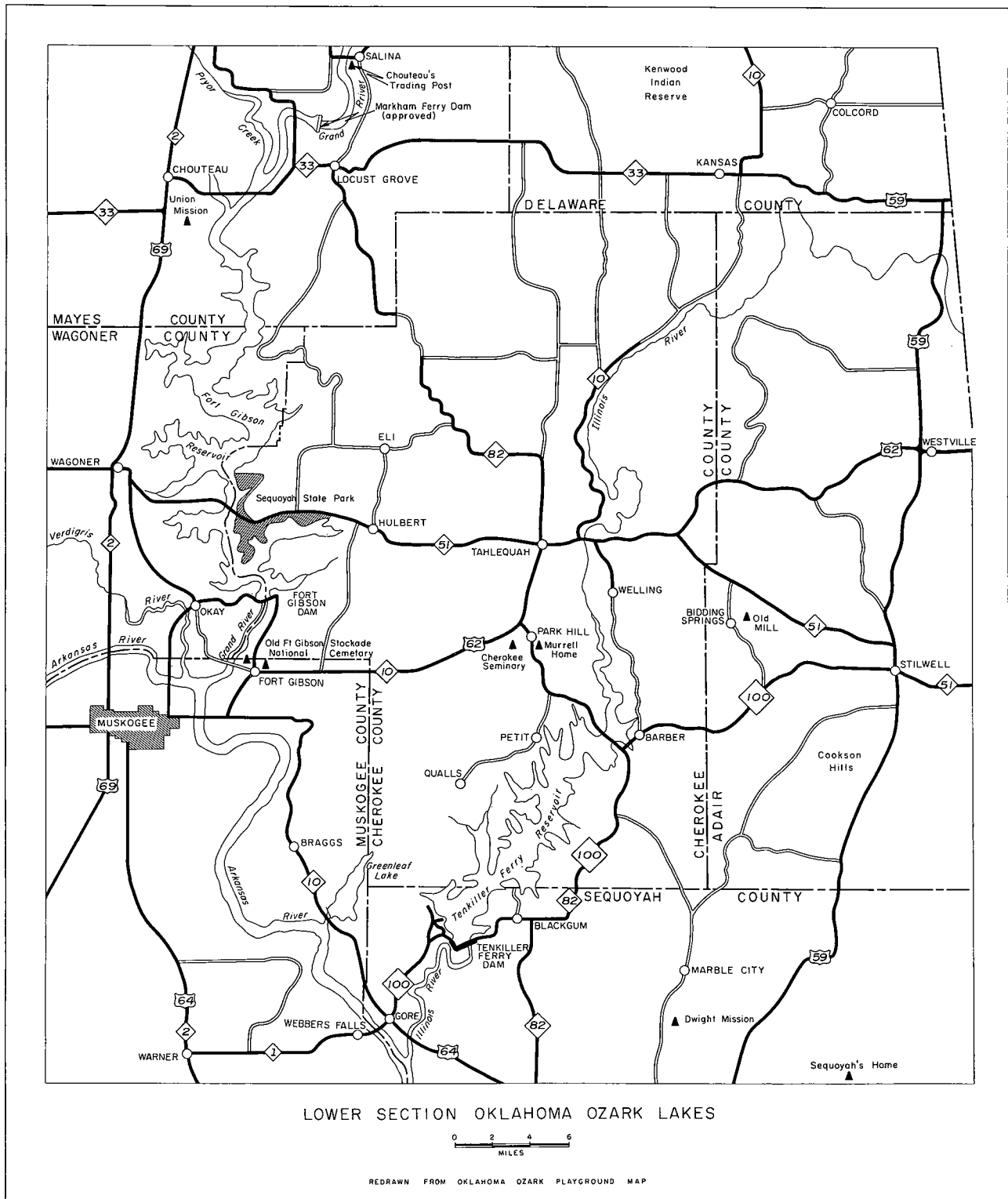


Figure 7. Map showing lower section, Oklahoma Ozark Lakes.

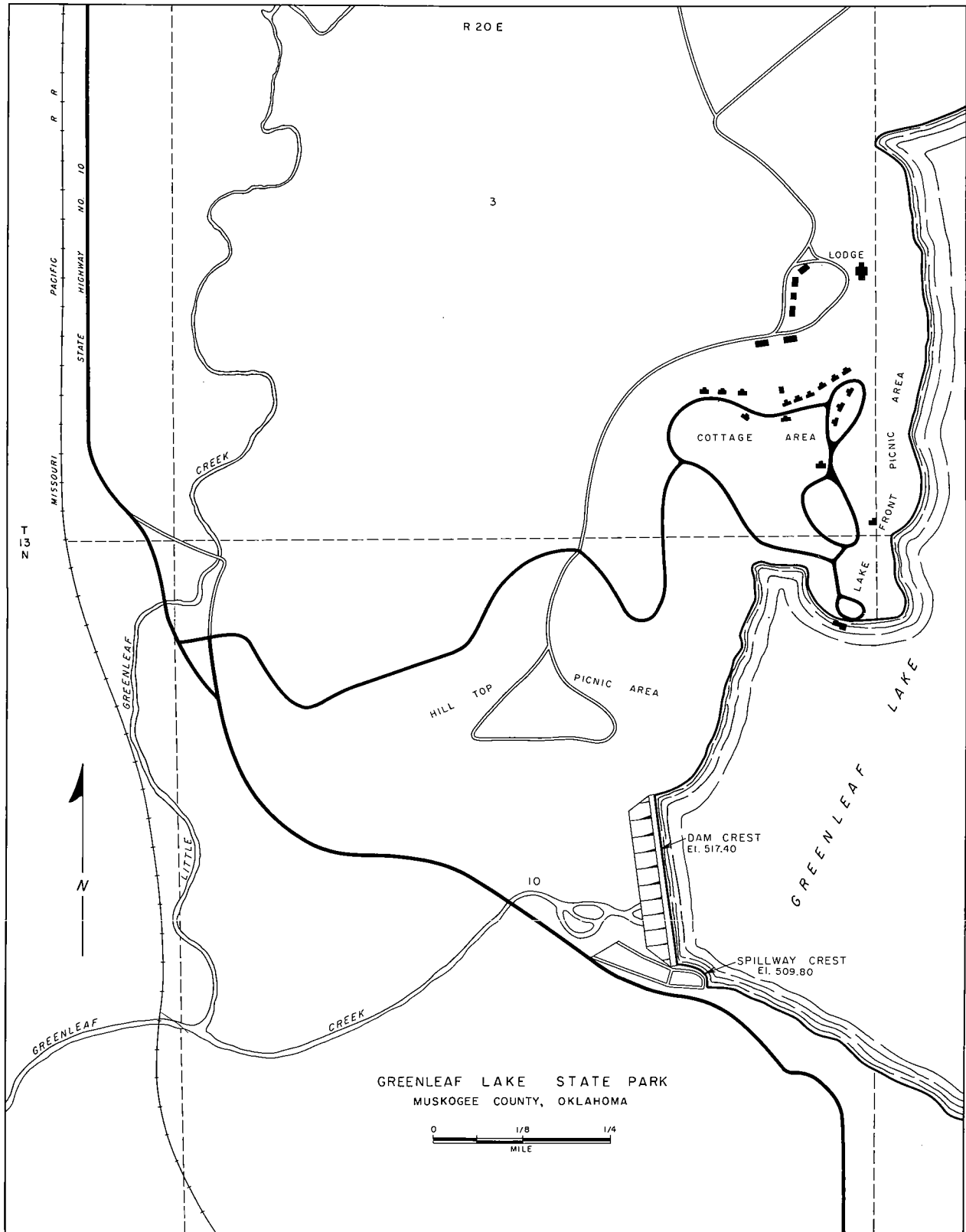


Figure 8. Greenleaf Lake State Park.

Greenleaf Lake was created by an earthen-fill dam with a concrete and rock spillway. The lake is about $4\frac{1}{2}$ miles long, has a maximum width of one-half mile, and covers 920 surface acres. During World War II, this lake was used for training amphibious landing forces stationed at Camp Gruber (Wally Wallis, *Daily Oklahoman*, May 1955). After the cessation of hostilities and the dismantlement of Camp Gruber, the lake was returned to civilian use. Bordered by Greenleaf State Park, it is used now only for recreational purposes.

STATE PARKS AND RECREATIONAL AREAS

Greenleaf Lake State Park. — Greenleaf Lake, surrounded by picturesque bluffs and forested hills, is 4 miles southeast of Braggs on State Highway 10 in Muskogee County. It is 6 miles northwest of Gore and about 20 miles southeast of Muskogee.

Greenleaf Lake State Park (fig. 8), on the shores of beautiful Greenleaf Lake has an area of 1,495 acres. The lake is well stocked with bass, crappie, wall-eyes, and channel catfish. Boats and fishing needs are available in the dock area.

Overnight accommodations include 13 rustic but modern cabins, ample camping areas, and a community building with showers and latrines. Available are 40 picnic tables, 23 grills, 2 playgrounds, a group camp, a cafe, a marina, and a bathhouse.

Greenleaf Lake is a favorite spot for fishermen and campers who enjoy its scenic beauty (fig. 9). For information about the lake and park, write to Superintendent, Greenleaf State Park, Braggs, Oklahoma.

Lake Tenkiller State Park. — Lake Tenkiller State Park is located on Pine Creek Cove on the beautiful Tenkiller Reservoir in the midst of the Cookson Hills (fig. 7). The park, 6 miles northeast of Gore, includes 1,180 acres of land bordering a



Figure 9. Greenleaf Lake as seen from Highway 10 looking northeastward.



Figure 10. Sign marking entrance to Tenkiller State Park.

12,500-acre lake which extends more than 30 miles through timbered hills and cliffs. Fishing is excellent with bass, crappie, bream, and channel catfish in abundance. The lake has been stocked recently with wall-eyed pike.

The park area (fig. 10), includes 183 picnic tables, 61 grills, 3 picnic shelters, 6 shower-latrines buildings, 3 boat ramps, 4 ski docks, an enclosed fishing dock, a playground, a marina, a beach, a cafe, and a grocery. Sleeping accommodations include a 10-room motel-type guest house, 20 duplex vacation cottages, 40 one- and two-bedroom units with fireplaces, living room, bath, and kitchenette. Rates are reasonable and reservations may be made by writing the Superintendent, Lake Tenkiller State Park, Vian, Oklahoma.



Figure 11. Entrance to Sequoyah State Park.

Sequoyah State Park. — Sequoyah State Park (figs. 11, 12), is in western Cherokee County on Fort Gibson Lake about 8 miles southeast of Wagoner, 25 miles northeast of Muskogee, and about 17 miles west of Tahlequah. The park in-

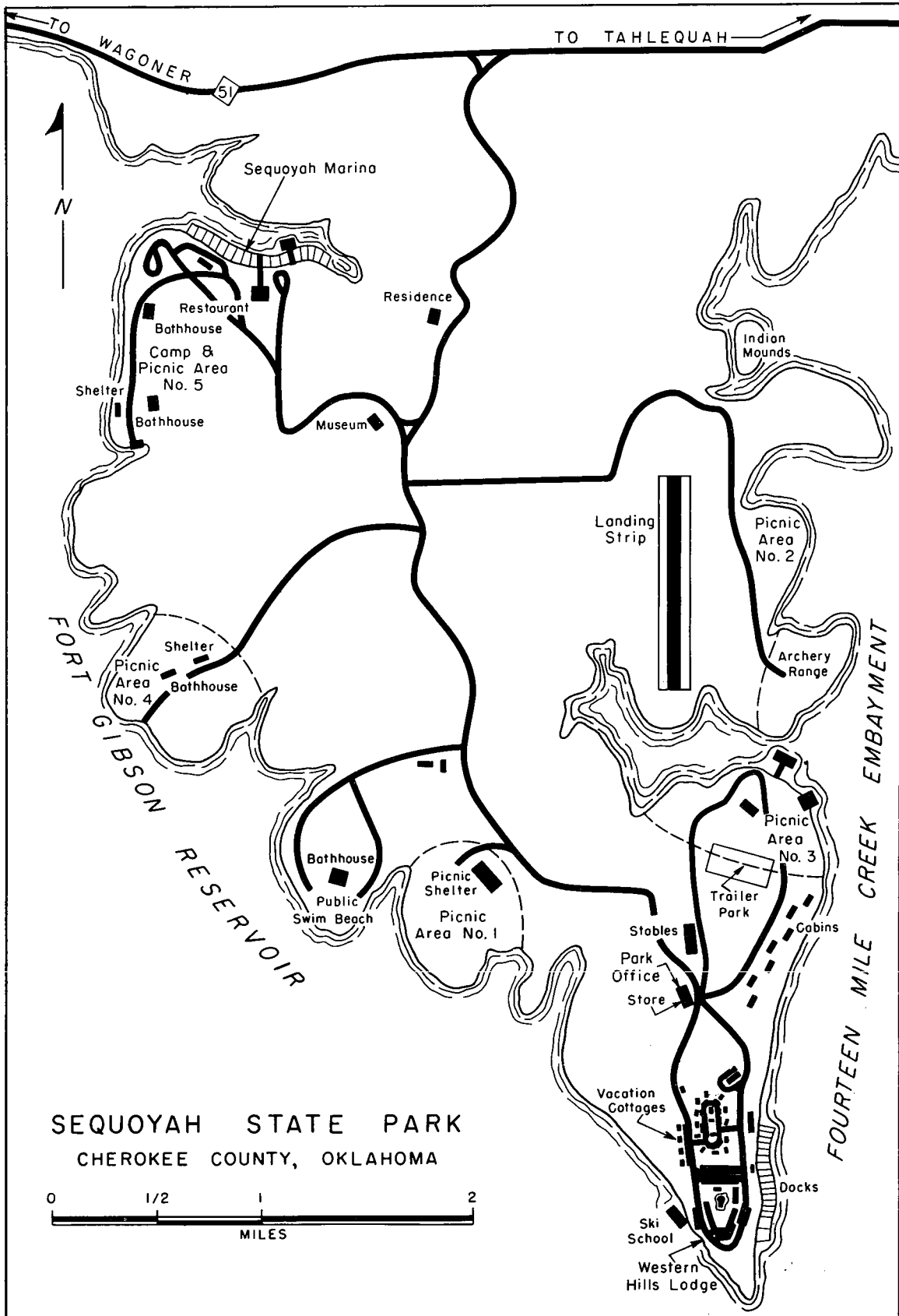


Figure 12. Map of the Sequoyah State Park on Fort Gibson Reservoir.

cludes 3,180 acres occupying the east shore and a peninsula projecting into the lake south of State Highway 51. The park overlooks the 19,100-acre lake referred to as the Fort Gibson Reservoir.

Western Hills Lodge, located near the south end of the park, offers luxurious accommodations both in the lodge and in near-by cottages. Swimming, dancing, water skiing, and dining facilities are available.

In addition to the Western Hills Lodge, Sequoyah Park has 250 picnic tables, 110 grills, 2 picnic shelters, 5 shower-latrines buildings, 4 boat ramps, a ski dock, an enclosed fishing dock, 3 playgrounds, 2 tennis courts, softball diamonds, horse-shoe courts, shuffleboard, archery range, golf course, riding stables, an air strip, a cruise boat, stage coach rides, a beach and bathhouse, a marina, and a museum.

For information about the park and its facilities, write to the Superintendent, Hulbert, Oklahoma. For reservations at Western Hills Lodge, write P. O. Box 276, Wagoner, Oklahoma, or phone Tahlequah, number 1290.

Spavinaw Hills Park. — Spavinaw Hills Park is a 1,600-acre tract on the southern bank of Lower Spavinaw Lake. The park, belonging to the city of Tulsa, is designed to protect the lake from contamination and to provide a wildlife refuge.

Spavinaw Recreation Area.—A picnic and camping area is maintained by the State Division of Recreation and State Parks in the Spavinaw Creek area west of the Spavinaw Dam and south of State Highway 20 (fig. 13). The park area is approximately 2,500 feet long and 500 feet wide. Latrines, picnic shelter, picnic tables, a playground area, bathhouse, and beach are available.

Upper Spavinaw (Eucha) Lake. — Two overnight and picnic areas are provided on Upper Spavinaw Lake. One is at the site of the old town of Eucha, about midway on the north side of the lake. The second is in the boat-basin area on the south side of the lake just east of State Highway 10 and U. S. Highway 59 near the site of the Old Vinita Club. The Sportsman Courts, Lake Eucha Cafe and Sport Shop, and the Frank Ross Rental Boat Docks are nearby.

State Recreational Areas on Grand Lake. — Five recreational areas are maintained by the State of Oklahoma in the Grand Lake area (fig. 14).

(1) *Honey Creek Park.* This is a 20-acre park on a peninsula bordered by Honey Creek Bay, one mile south and one-half mile west of Grove. Situated in a heavily wooded area, this park is ideal for picnicking and camping. Good water, picnic tables, swimming pool, showers and toilet facilities are available.

(2) *Twin Bridges Park.* This park includes 65 acres near the junction of Spring and Neosho Rivers along U. S. Highway 60 just west of Wyandotte, Ottawa County. The park is complete with modern toilet facilities, showers, electrical outlets, drinking water, boat launching, and free swimming.

(3) *Pensacola Park.* Three separate recreational areas are maintained near Pensacola Dam. These are (a) Island Area, a 26-acre tract just south of the west end of the dam, (b) Cherokee Park, an 8-acre tract at the east end of the dam in Disney, and (c) East Spillway Park, a 14-acre tract east of Disney at the spillway. These are primarily picnic areas with boating and fishing facilities.

Some favorite resort areas on Grand Lake (fig. 15):

- | | |
|------------------------|------------------------------|
| 1. Langley | 7. Ketchum |
| 2. Disney | 8. Monkey Island |
| 3. Drowning Creek Area | 9. Sailboat Bridge |
| 4. Jay-Zena Area | 10. Fairland Area |
| 5. Honey Creek Bay | 11. Wyandotte Area |
| 6. Cowskin River Arm | 12. Bernice-Horse Creek Area |

Some favorite resort areas on Tenkiller Lake (fig. 16):

- | | |
|--------------------------|---------------------------------|
| 1. Pine Creek Cove | 11. Carters Landing |
| 2. Snake Creek Cove | 12. Cherokee Landing |
| 3. Chicken Creek Point | 13. Pettit Ridge and Pettit Bay |
| 4. Ballew Ridge | 14. Burnt Cabin Ridge and Cove |
| 5. Cookson Bend | 15. Strayhorn Landing |
| 6. Carlisle Cove | 16. Islands (State Park) |
| 7. Standing Rock Landing | 17. Outlet Fishing Area |
| 8. Elk Creek Landing | 18. Spillway Parking Area |
| 9. Caney Ridge and Cove | |
| 10. Etta Bend | |

Some favorite resort areas on Fort Gibson Lake (fig. 17):

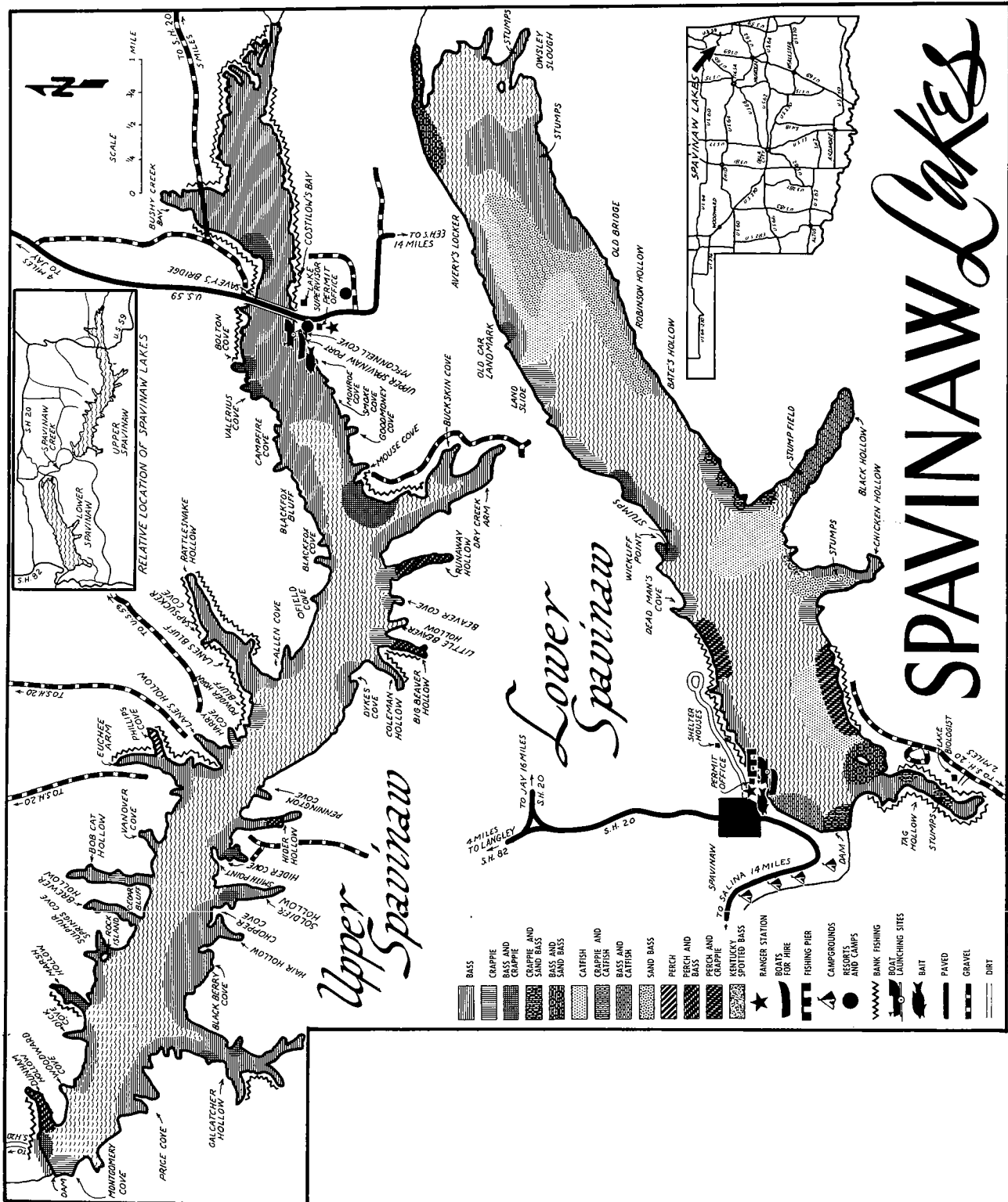
- | | |
|--------------------------------|--------------------------------------|
| 1. Damsite and downstream area | 11. Low Water Dam |
| 2. Jackson Creek and Bay | 12. Pryor Creek Area |
| 3. Taylor Ferry | 13. Spring Creek and Cedarcrest Lake |
| 4. Long Bay Landing | 14. Earbob Ferry |
| 5. Wagoner Park | 15. Big Hollow |
| 6. Whitehorn Cove | 16. Clear Creek Arm |
| 7. Snug Harbor | 17. Hulbert Landing |
| 8. Flat Rock Creek Landing | 18. Sequoyah State Park and Lodge |
| 9. Three Finger Bay | 19. Ranger Creek |
| 10. Mazie Landing | |

CITIES, TOWNS, AND COMMUNITIES

The Oklahoma Ozark area includes nine county seats, several villages, and many rural communities with the typical country store, filling station, school, and church.

The larger towns serve as the county seats. These include Miami in Ottawa County (population 12,869), Vinita in Craig County (population 6,027), Pryor in Mayes County (population 6,476), Tahlequah in Cherokee County (population 5,840), Stilwell in Adair County (population 1,916), Wagoner in Wagoner County (population 4,469), Sallisaw in Sequoyah County (population 3,351), Jay in Delaware County (population 1,120), and Muskogee in Muskogee County (population 61,866).

Smaller towns include Adair (434), Afton (1,111), Bernice (100), Braggs (279), Chouteau (958), Colcord (173), Commerce (2,378), Disney (224), Fairland (646), Fort Gibson (1,407), Gore (334), Grove (975), Hulbert (500), Kansas (300), Ketchum (255), Langley (205), Locust Grove (828), Marble City (271), Okay (419), Picher (2,553), Quapaw (850), Salina (972), Spavinaw (319), Strang (176), Vian (930), Watts (268), Westville (727), and Wyandotte (226).



SPAVINAW Lakes

Figure 13. Recreational areas and facilities on the Spavinaw Lakes (drawn by Bob Rhea and published by permission of the Oklahoma Publishing Company).

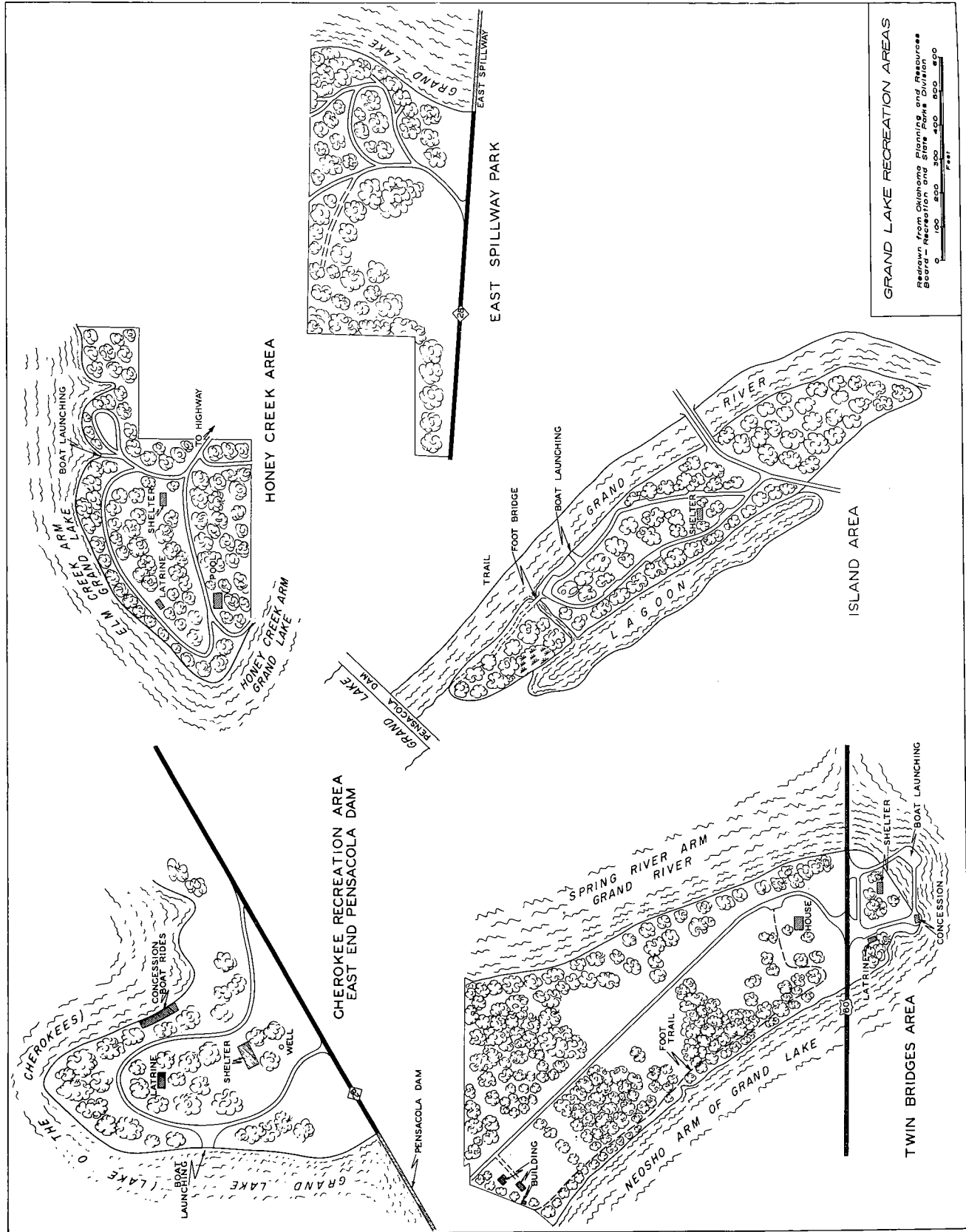
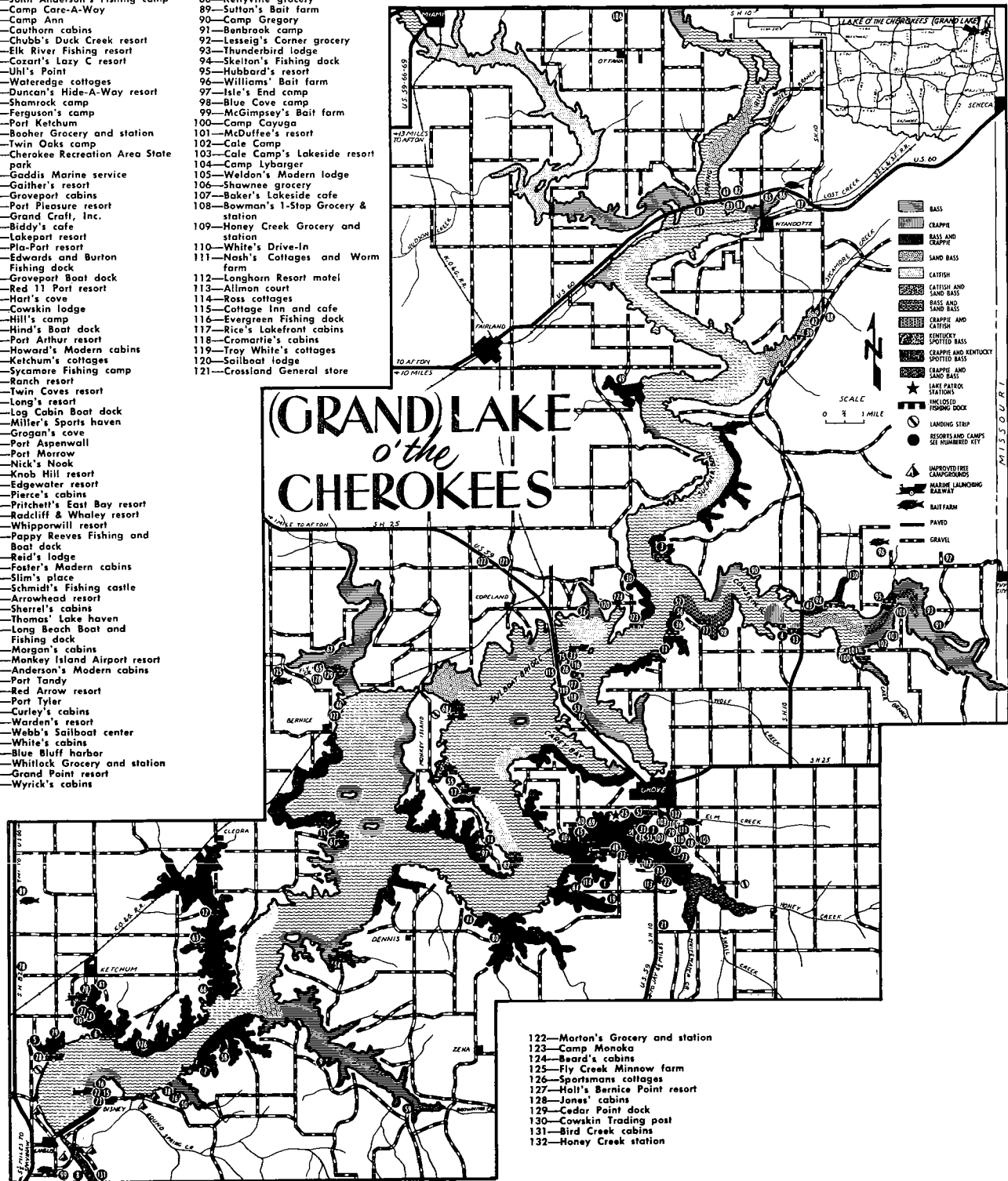


Figure 14. State recreational areas on Grand Lake.

KEY TO MAP:

- 1—Andy Anderson's resort
- 2—Port Cherokee
- 3—Paradise Point resort
- 4—King Point resort
- 5—Bosey's courts
- 6—Baxley's cabins
- 7—The Anchor resort
- 8—John Anderson's Fishing camp
- 9—Camp Care-A-Way
- 10—Camp Ann
- 11—Cauthorn cabins
- 12—Chubb's Duck Creek resort
- 13—Elk River Fishing resort
- 14—Cozart's Lazy C resort
- 15—Uhl's Point
- 16—Wateredge cottages
- 17—Duncan's Hide-A-Way resort
- 18—Shamrock camp
- 19—Ferguson's camp
- 20—Port Ketchum
- 21—Booher Grocery and station
- 22—Twin Oaks camp
- 23—Cherokee Recreation Area State park
- 24—Gaddis Marine service
- 25—Gailther's resort
- 26—Groveport cabins
- 27—Port Pleasure resort
- 28—Grand Craft, Inc.
- 29—Biddy's cafe
- 30—Lakepart resort
- 31—Pla-Port resort
- 32—Edwards and Burton Fishing dock
- 33—Groveport Boat dock
- 34—Red 11 Port resort
- 35—Hart's cove
- 36—Cowskin lodge
- 37—Hill's camp
- 38—Hind's Boat dock
- 39—Port Arthur resort
- 40—Howard's Modern cabins
- 41—Ketchum's cottages
- 42—Sycamore Fishing camp
- 43—Ranch resort
- 44—Twin Coves resort
- 45—Lang's resort
- 46—Log Cabin Boat dock
- 47—Miller's Sports haven
- 48—Grogan's cove
- 49—Port Aspenwall
- 50—Port Morrow
- 51—Nick's Nook
- 52—Knob Hill resort
- 53—Edgewater resort
- 54—Pierce's cabins
- 55—Pritchett's East Bay resort
- 56—Radcliff & Whaley resort
- 57—Whipporwill resort
- 58—Pappy Reeves Fishing and Boat dock
- 59—Reid's lodge
- 60—Foster's Modern cabins
- 61—Stim's place
- 62—Schmidt's Fishing castle
- 63—Arrowhead resort
- 64—Sherrel's cabins
- 65—Thomas' Lake haven
- 66—Long Beach Boat and Fishing dock
- 67—Morgan's cabins
- 68—Monkey Island Airport resort
- 69—Anderson's Modern cabins
- 70—Port Tandy
- 71—Red Arrow resort
- 72—Port Tyler
- 73—Curley's cabins
- 74—Warden's resort
- 75—Webb's Sailboat center
- 76—White's cabins
- 77—Blue Bluff harbor
- 78—Whitlock Grocery and station
- 79—Grand Point resort
- 80—Wyrick's cabins
- 81—Twin Bridge State park
- 82—Twin Bridge grocery
- 83—Twin Bridge Trailer park
- 84—Stappie's Motel and cafe
- 85—Hammer's station
- 86—Lost Creek Ranch Minnow f'm
- 87—Andy's Silver hook
- 88—Kellyville grocery
- 89—Sutton's Bait farm
- 90—Camp Gregory
- 91—Banbrook camp
- 92—Lesseg's Corner grocery
- 93—Thunderbird lodge
- 94—Skellton's Fishing dock
- 95—Hubbard's resort
- 96—Williams' Bait farm
- 97—Isle's End camp
- 98—Blue Cove camp
- 99—McGimpsey's Bait farm
- 100—Camp Cayuga
- 101—McDuffee's resort
- 102—Cale Camp
- 103—Cale Camp's Lakeside resort
- 104—Camp Lybarger
- 105—Weldon's Modern lodge
- 106—Shawnee groery
- 107—Baker's Lakeside cafe
- 108—Bowman's 1-Stop Grocery & station
- 109—Honey Creek Grocery and station
- 110—White's Drive-In
- 111—Nosh's Cottages and Worm farm
- 112—Longhorn Resort motel
- 113—Allman court
- 114—Ross cottages
- 115—Cottage Inn and cafe
- 116—Evergreen Fishing dock
- 117—Rice's Lakefront cabins
- 118—Cromarie's cabins
- 119—Troy White's cottages
- 120—Sailboat lodge
- 121—Crossland General store



- 122—Morton's Grocery and station
- 123—Camp Monoka
- 124—Beard's cabins
- 125—Fly Creek Minnow farm
- 126—Sportsmans cottages
- 127—Hall's Bernice Point resort
- 128—Jones' cabins
- 129—Cedar Point dock
- 130—Cowskin Trading post
- 131—Bird Creek cabins
- 132—Honey Creek station

Figure 15. Recreational areas and facilities on Grand Lake (drawn by Bob Rhea and published by permission of the Oklahoma Publishing Company).

KEY TO MAP:

CONCESSIONS, CAMPS, CABINS AND FACILITIES

- | | |
|------------------------------|----------------------------------|
| 1—Tenkiller State Park | 25—Ballew Top Cafe and Grocery |
| 2—Snake Creek Cove | 26—Cookson Hill Cabins |
| 3—Chicken Creek Point | 27—Rainbow Cabins |
| 4—Sixshooter Camp | 28—Joe Joe's Cabins |
| 5—Cookson Bend Resort | 29—Elk Creek Landing |
| 6—Palmer's Pine Cove Camp | 30—Standing Rock Village |
| 7—Greer's Pine Creek Cabins | 31—Cross Roads Cabins |
| 8—Johnson's Grocery and Cafe | 32—Crawford's Cabins |
| 9—Hall's Modern Cottages | 33—Carter Landing |
| 10—The Tackle Box | 34—Gateway Sports Shop |
| 11—Ten-Kill Courts | 35—Sisemore Ridge Landing |
| 12—Tenkiller Sports Store | 36—Brown's Terrapin Creek Cabins |
| 13—Robertson's Sport Center | 37—The Dutchman's |
| 14—Orv Tuttle's Place | 38—Cherokee Landing |
| 15—Weild's Sport Shop | 39—Petit Bay Resort |
| 16—Butler's Cabins | 40—Brownie's Pettit Bay Cabins |
| 17—Beacon Lodge | 41—Bristow's Hi-Crest Cottages |
| 18—Strayhorn Landing | 42—Holland's Cottages |
| 19—Fin and Feather Lodge | 43—Barber Store |
| 20—Charlie and Clara's Place | |
| 21—Summit Lodge | |
| 22—The Fish Tavern | |
| 23—Elbon's Sport Shop | |
| 24—Davis Store | |

SEMI-PUBLIC AREAS

- | |
|------------------------------|
| 1—Northeastern State College |
| 2—Stillwell city park |

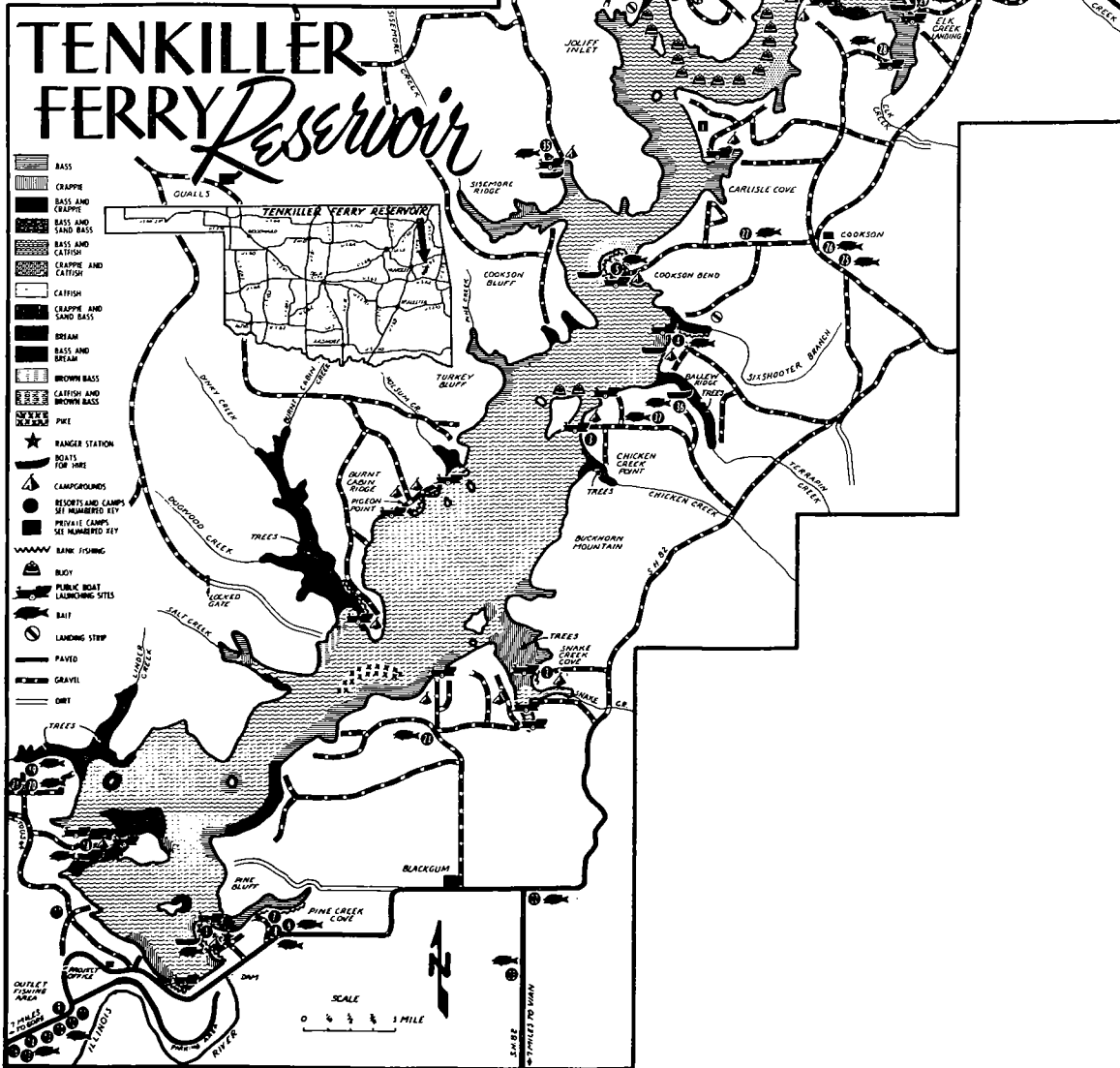


Figure 16. Map of Tenkiller Lake showing location of Tenkiller State Park (Pine Creek Cove) and other favorite recreational areas (drawn by Bob Rhea and published by permission of the Oklahoma Publishing Co.).

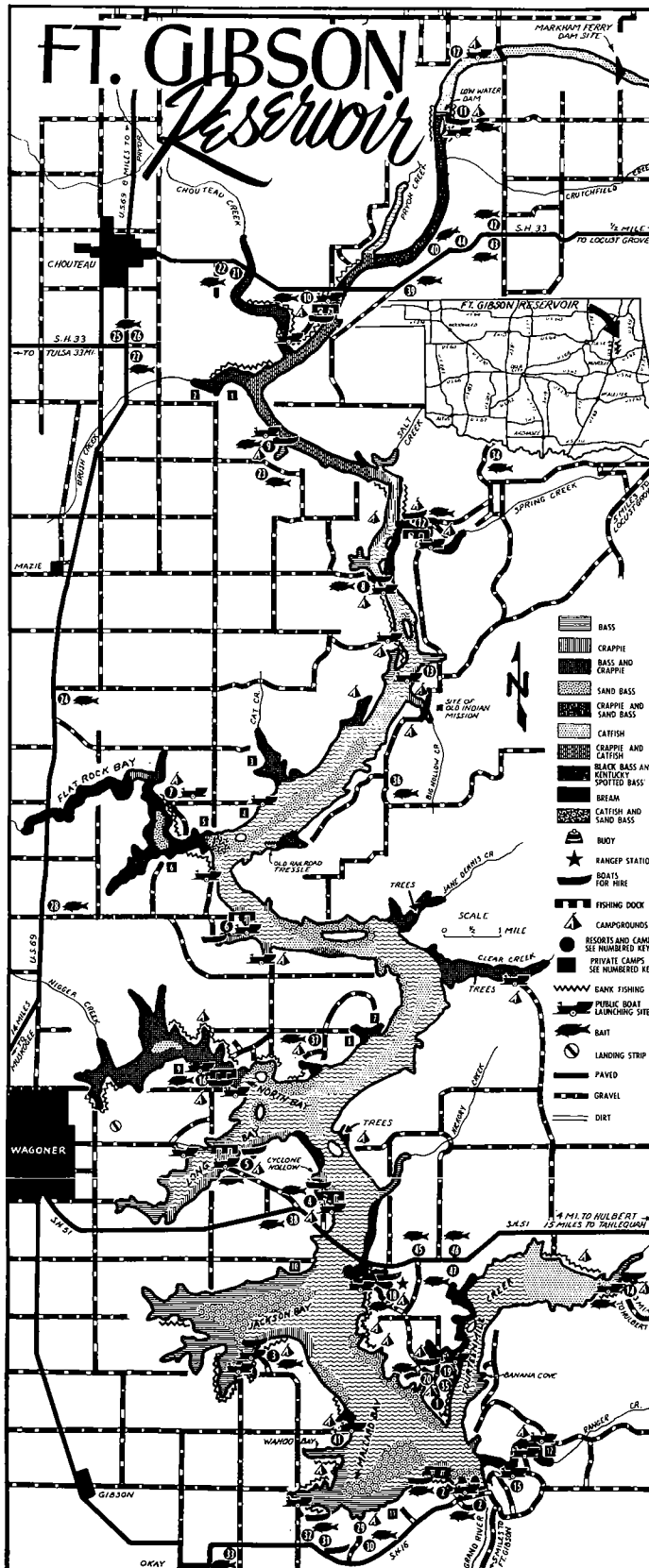


Figure 17. Map of the Fort Gibson Reservoir showing recreational areas and facilities (drawn by Bob Rhea and published by permission of the Oklahoma Publishing Co.)

Rural communities include Barber, Baron, Biding Springs, Blackgum, Chewey, Christi, Cleora, Cookson, Flint, Gideon, Kenwood, Leach, Lyons, Murphy, Moody, Oakes, Park Hill, Peggs, Pensacola, Pettit, Proctor, Qualls, Rose, Scrapper, Tere-sita, Wauhillau, Welling, and others.

POPULATION AND PEOPLES

The lands of northeastern Oklahoma were given originally to the Cherokee Nation through the Removal Treaty of 1838. White people could come into possession of any of this land only by purchasing it from the Indians, marrying an Indian, or taking it illegally.

The early railroads brought large numbers of whites into the Indian Territory as workers and sightseers. Many of these took up residence on lands owned by the Indians. In 1885, Indian Agent Robert Owen reported 25,000 whites, including 3,000 intruders, in territory owned by the Five Civilized Tribes. In 1890, Agent Leo E. Bennett reported 140,000 whites in a total population of 210,000. Of these, 64,000 were intruders, 48,000 were laborers, and 26,000 were employees of one type or another (Gittinger, 1939, p. 214).

Most of the white people who took up residence in the Oklahoma Ozark area came from Arkansas, Missouri, Illinois, Indiana, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Alabama, and Mississippi.

Present population of the nine counties comprising the Oklahoma Ozark area (Adair, Cherokee, Craig, Delaware, Mayes, Muskogee, Ottawa, Sequoyah, and Wagoner) is 204,289, according to the 1960 census. This is a decline of 16,663 from the 1950 population. Only one county, Mayes, showed an increase in population during the last ten years. All other counties showed a decrease of from 5.7 percent to 12.2 percent, with the greatest loss in Ottawa County, where the decline in lead and zinc production and the shift from crop agriculture to grazing have led the people to seek employment in the larger urban centers of Oklahoma and in other states.

Density of population in the Oklahoma Ozark area is below the national average. The average for this area is 33.6 persons per square mile and ranges from 18.5 in Delaware County to 75.4 in Muskogee County. With the exception of Ottawa and Mayes Counties, each of these northeastern counties has a non-white population of about 10 percent. Negro population amounts to about 9 percent of the total population, with the largest numbers in Wagoner and Muskogee Counties.

Indians make up a conspicuous part of the population. In 1950, the 8,394 Indians living in the area comprised 4 percent of the total population. The largest concentrations were in Cherokee County (3,119), Adair County (2,530), and Delaware County (2,311). These people are largely descendants of the Cherokees who settled here as a result of the Removal Treaty of 1838. Remnants of smaller tribes, such as the Seneca, Shawnee, Quapaw, Cayuga, Miami, Ottawa, and Wyandotte, still live in Ottawa County. Today these Indians play an important role in the cultural and economic life of the region.

ECONOMIC RESOURCES

Agriculture. — Northeastern Oklahoma is predominantly an agricultural region, and the people of this area receive more income from farming than from any other economic activity. In some of the remote sections, farming is of the subsistence type, where the family consumes all of the products of the farm and their income is supplemented by jobs in other industries. There are, however, areas in northeastern Oklahoma which produce crops and livestock on a large scale and which rank high in the state as producers.

Livestock production dominates the agricultural pattern at this time. The three leading products in order of their importance are livestock, crops, and dairy produce. The chief crops are wheat and other small grain, corn, sorghum, hay, soybeans, vegetables, and berries. The growing of strawberries on the chert-covered hills of Adair, Cherokee, and Sequoyah Counties has become an important source

TABLE 2.—COUNTY AREAS AND POPULATION FIGURES 1930 TO PRESENT
(data from United States Census of Population, U. S. Dept. of Commerce)

County	Area in Sq. Miles	1930	1940	1950	1960	Gain or loss		People per Sq. Mile
						(percent)		
Adair	569	14,756	15,755	14,918	13,112	-1,806	-12.1	23.0
Cherokee	756	17,470	21,030	18,989	17,762	-1,227	-6.5	23.5
Craig	764	15,052	21,083	18,263	16,303	-1,960	-10.7	21.3
Delaware	715	15,370	18,592	14,734	13,198	-1,536	-10.4	18.5
Mayes	676	17,883	21,668	19,743	20,073	+ 330	+ 1.7	29.7
Muskogee	820	66,424	65,914	65,573	61,866	-3,707	-5.7	75.4
Ottawa	461	38,542	35,849	32,218	28,301	-3,917	-12.2	61.4
Sequoyah	697	19,505	23,138	19,773	18,001	-1,772	-9.0	25.8
Wagoner	563	22,428	21,642	16,741	15,673	-1,068	-6.4	27.8
Total	6,021	227,430	244,671	220,952	204,289	-16,663	- 7.5	33.6 (average)

of income for the area. Adair County, which claims to be the leading strawberry producer in the country, holds a strawberry festival every year in Stilwell, "The Strawberry Capital of the World," to celebrate the crop. Vegetable growing is also important in these counties and together with the cultivation of strawberries, supports an important canning industry.

Several changes in the agricultural pattern of northeastern Oklahoma occurred during the period between 1950 and 1960. Wheat production increased steadily, corn acreage decreased, and cotton growing became almost nonexistent. Increases can be noted in the production of grain sorghum, maize, soybeans, and hay. Cattle-raising is on the increase while hog-raising is declining. Few sheep are being raised and the number of dairy cattle is decreasing. Milk production, on the other hand, has increased, indicating the improved quality of the dairy herds and the more efficient feeding methods (Census of Agriculture, 1955).

Forestry.—Most of Oklahoma's forest land is in 17 counties in the eastern part of the State. The area is divided into two well-defined belts, the Ouachitas to the southeast and the Ozarks to the northeast. Of the 9.8 million acres of land in the area, 60 percent is in forest. In the Ozarks, the percentage of land in timber is 49.5. Lumbering is an important industry in the Ouachita region but is of secondary importance in the Ozarks, where most of the timber is used for fuel and fence posts.

Hardwoods dominate the forests of northeastern Oklahoma and are classed as the oak-hickory type. Black oak and post oak make up nearly half of the net volume of the upland type.

No large saw mills operate in the Ozarks although there are many small portable mills. Lumber for local building, wood for handles, and material for one wood-treating plant and for two charcoal-processing plants constitute the major uses.

The forests of the Oklahoma Ozarks play a minor part in the overall economy of the State, but their scenic beauty is a great asset to this vacation land. The Ozark forests help regulate the flow of streams which is so important in the production of hydroelectric power. They protect the land from erosion

and furnish a refuge for the wildlife (data from *The Forest Service*, 1957).

Minerals.—According to the 1959 *Yearbook of Mineral Industries*, all counties in northeastern Oklahoma reported some mineral production for that year. Sand, gravel, coal, petroleum, natural gas, crushed rock, zinc, lead, and tripoli were produced.

Muskogee County reported production of petroleum, natural gas, sand, gravel, and crushed stone valued at \$1,765,821. The sand, gravel, and crushed stone are used primarily for road-building and construction. The Fansteel Metallurgical Corporation is producing columbium-tantalum and, when in full production, will increase the nation's supply by 50 percent. The Callery Chemical Plant is producing an energy fuel called HiCal for navy missiles.

Ottawa County, formerly an important producer of lead and zinc, produced minerals valued at \$1,025,116. All of Oklahoma's lead and zinc output was supplied by mines in this county. Because of depressed markets, most mines remained closed during 1959. At Miami, Rare Metals Plant of the Eagle-Picher Company and Winart Pottery were in operation. Chat from the lead millings was sold by five producers and tripoli was quarried by the American Tripoli Division and processed at Seneca, Missouri.

Sequoyah County ranks fifth in the State in the production of coal and is a leading producer of high quality limestone. The St. Clair Lime Company at Sallisaw produces a yearly tonnage of 200,000 to 250,000 tons, ranging in price from \$1.25 to \$30.00 per ton. It employs from 85 to 90 regular workers and supplies rock for raw stone, concrete rock, chat for asphaltic roads, stone for the glass industry, rip rap for dam construction, and CaCO₃ for fertilizer and agricultural lime. It also supplies quicklime and hydrate for carbide plants, water filter systems, oil refineries, and insecticides. Stone from this area has been used in many important buildings of the State, including the State Capitol, the Pioneer telephone building in Oklahoma City, and buildings on various campuses (based on information from Tom Rowland, St. Clair Lime Company).

TABLE 3.—VALUE OF MINERAL PRODUCTION BY COUNTIES, 1956-59*

County	1956	1957	1958	1959	Products
Adair	no data	no data	13,683	7,508	stone
Cherokee	534,420	384,200	392,116	(not released)	sand, gravel, stone
Craig	221,153	439,820	373,065	618,786	coal, stone, sand, gravel, oil, gas
Delaware	18,090	36,250	7,100	(no report)	sand and gravel
Mayes	7,009	23,967	(not released)	(not released)	stone, sand, gravel, oil
Muskogee	937,479	864,356	1,091,805	1,765,821	oil, gas, sand, gravel
Ottawa	12,511,898	6,054,064	2,541,178	1,025,116	zinc, lead, stone, tripoli, sand, gravel
Sequoyah	2,786,748	3,462,054	2,555,062	2,258,323	coal, lime, stone, natural gas
Wagoner	1,165,168	1,596,165	1,981,574	2,151,505	oil, natural gas, sand, gravel

* Based on information from Oklahoma Geological Survey Mineral Report 36, U. S. Department of Interior, Bureau of Mines Area Report IV-95, August 1959, 1959 Minerals Yearbook, Vol. III, Area Reports.

Manufacturing.—According to the Census of Manufacturing (1955), the nine counties in north-eastern Oklahoma employed 5,328 persons in 163 different manufacturing establishments. Most of the manufacturing plants are small and employ, on the average, fewer than 30 persons. The food processing industry leads in the number of individual plants, there being a total of 153.

Although agriculture dominates the economy of northeastern Oklahoma, manufacturing has made significant gains in recent years. Available power, transportation facilities, and an adequate labor supply have encouraged industries to locate in this area. Diversified industries, including clothing, rubber products, chemicals, glass, and metallurgy, have been established. Most of the new industry is located in towns around the periphery of the Ozark uplift as in Miami, Pryor, Vinita, Muskogee, and Sallisaw.

Muskogee, with 90 established industries and 4,500 industrial jobs, is the leading industrial center in the area. Muskogee has shown a steady growth since its establishment in 1875, and since 1947 eleven new plants employing 1,565 people and with an annual payroll of \$6,550,000 have been established (Oklahoma Economic Development News, April 1960).

Among Muskogee's newer industries are two glass manufacturing companies, the Brockway Glass Co. with 275 employees and the Corning Glass Works with 350 employees. The Douglass Oklahoma Corporation employs 40 persons for production of coffee makers. Coburn Manufacturing Company, the world's largest manufacturer of lens-grinding equipment, employs 100 people. The Fansteel Metallurgical Company manufactures columbium and tantalum from ores shipped from the Belgian Congo. The Callery Chemical Company employs 400 persons in its missile-fuel plant, which utilizes boron in the form of boric acid, sodium, hydrogen, and ethylene. The Acme Engineering and Manufacturing Company has 60 employees making industrial fans and blowers. The Muskogee Iron Works, established in 1909, is still one of the city's most important industries with 250 employees. H. B. Egan, who originated the famous "Camel" tire patch in 1919, still operates the Muskogee plant with 175 workers. The Klos Tent and Awning Company has been in business in Muskogee since 1920.

Situated in the midst of an agricultural region, Muskogee's food products and processing plants make up a large part of the industrial picture. This fact is shown by the presence of Griffin Grocery, Swift and Company, Taystee Bread Company, Hyde Park Canning Company, Carnation Company of Oklahoma and other similar plants.

The second most important industrial center in the Oklahoma Ozark area is Miami in Ottawa County. The first boom came to this city in 1905 with the discovery of lead and zinc five miles north of the present town. Mining operations be-

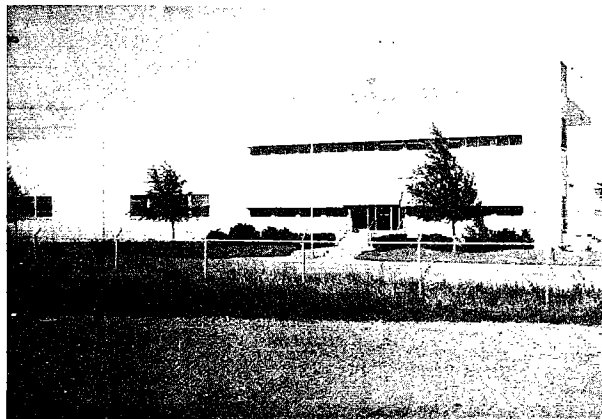


Figure 18. National Gypsum wallboard liner plant southeast of Pryor.

gan there in 1907 with the establishment of the Commerce Mining Company. In 1951, the annual production of lead and zinc concentrates from this area was estimated to be 188,000 tons. The Eagle-Picher Mining and Smelting Company operated the larger part of the area before 1959. Following the construction of Pensacola Dam in 1940 and the creation of a 55,000-acre lake, the Miami area became important as a vacation center. Rapid expansion of the city followed, as B. F. Goodrich Tire and Tube Company established a large rubber plant there. At present the plant has 1,600 people and makes more than 11,000 tires a day.

Other industries in the Miami area are (1) Miami Products Company, makers of air conditioners; (2) Blue Manufacturing Company and the Newman Industries, makers of boats; (3) Burlington Manufacturing Company, which makes clothing; (4) General Power Company Inc., which manufactures irrigation equipment; and (5) the Glen Berry Company, makers of work clothing (data from Miami Chamber of Commerce). In addition to the industries cited above, Miami has bakeries, milk-processing plants, bottling works, and meat-packing plants.



Figure 19. Bestwall Gypsum plasterboard and roofing dry-felt plant near Pryor.

Miami's industrial income is estimated to be twice that derived from agricultural pursuits in Ottawa County (Oklahoma Economic Development News, December 1958).

Pryor, in Mayes County, is rapidly becoming industrialized. The industry is centered southeast of Pryor near the Chouteau Ordnance Plant, now on an inactive basis. Adequate water, inexpensive electrical power, and an abundance of raw materials, combined with the excellent living facilities and school system in Pryor, make this an attractive area for industrial expansion. New industries located here include: (1) National Gypsum Company (fig. 18), makers of wallboard liner for plants at Fort Dodge, Iowa, Medicine Lodge, Kansas, and Rotan, Texas, which employs 75 persons with an annual payroll of \$600,000; (2) Bestwall Gypsum Company (fig. 19), makers of plasterboard paper and roofing dry felt, with a \$5,000,000 plant, 110

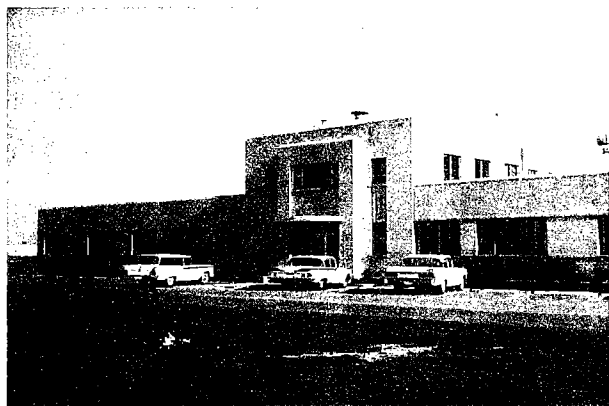


Figure 20. Office building of the John Deere chemical plant, Pryor.

employees, and an annual payroll of \$500,000; (3) Midwest Carbide Corporation, Pryor Division, makers of calcium carbide for distribution in the southern states and in South America, with a \$2,500,000 plant, 65 employees, and an annual payroll of \$300,000; (4) John Deere Chemical Company (figs. 20, 21), makers of ammonia and urea,

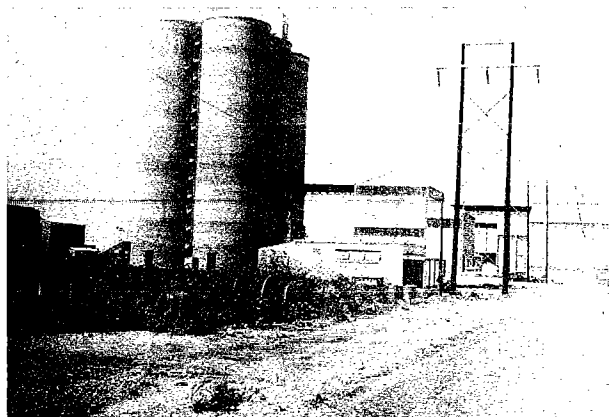


Figure 21. John Deere chemical plant, makers of ammonia and urea. Located southeast of Pryor, Oklahoma.

with a \$20,000,000 plant, 250 employees, and an annual payroll of \$1,250,000; (5) Oklahoma Cement Company (fig. 22), with a new \$8,000,000 plant, which at full capacity will employ nearly 100 persons with an estimated annual payroll of \$700,000 and an annual production of approximately \$3,250,000.

Sallisaw, in Sequoyah County, is the home of the St. Clair Lime Company, which employs 85 to 90 people. It also has the Oklahoma Creosoting Company, which employs 85 people with an annual payroll of \$125,000, and a charcoal plant.

Vinita, in Craig County, is the home of a large Munsingware plant, which manufactures ladies' hosiery.

Stilwell, county seat of Adair County, is the home of the Stilwell Canning Company, Stilwell Frozen Foods Company, Reese Tie Company, Amos Handle Company, Alabama Charcoal Company, and the Stilwell Warehouse Corporation. Adair County produces and processes approximately \$1,200,000 worth of fruits and vegetables per year (Strawberry Festival Bulletin, May 1960).

Tourist and vacation industry.—Oklahoma is rapidly becoming one of the nation's most popular

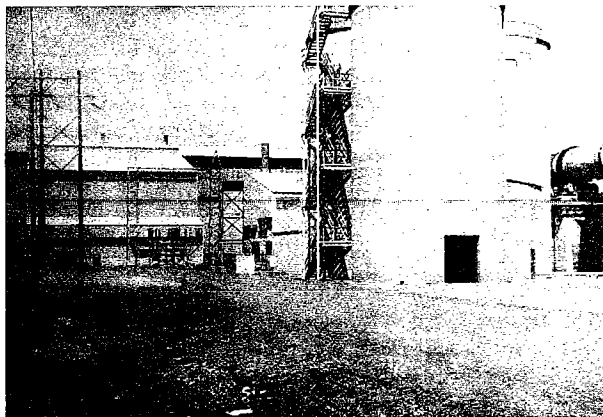


Figure 22. Two views of Oklahoma Cement plant near Pryor.

vacation lands. Information from the Oklahoma Planning and Resources Board (personal communication, Jeff Griffin, August 25, 1960) indicates a total tourist revenue for 1959 of \$151,458,000. The number of out-of-state visitors who traveled into Oklahoma in 5,890,674 cars was 15,021,221. These people spent \$109,937,520. Those who came into Oklahoma by other means, and Oklahomans themselves, spent \$41,521,000.

An analysis of the tourist industry in the Ozark area of Arkansas, Missouri, and Oklahoma, made by The University of Oklahoma Institute of Community Development (1953), shows that the tourist industry ranks second only to livestock production in total annual income produced in the Ozark region. The 1950 gross income of between \$45,000,000 and \$50,000,000 exceeded the income from manufacturing and was more than double that from the mineral industry.

During 1952, approximately 20,000,000 tourists from 47 states and several foreign countries visited the Ozark area. Of these, 5,730,852 spent at least one night in motel or tourist accommodations. It is estimated that these people spent at least \$46,095,132.54 (data from Institute of Community Development, 1953, p. 52, 75-77, 90-92).

One of the leading resort areas in the Oklahoma Ozarks is Grand Lake or Lake o' the Cherokees in Mayes, Delaware, and Ottawa Counties. An interview of Tom Poor by Vernon Snell, published in the *Oklahoma City Times*, June 15, 1960, provided the following data:

The Grand Lake area today has 110 resorts, 3,000 private homes valued at \$15,000,000, and \$7,000,000 worth of boats. The area did a \$10,000,000 business in 1959 and was expected to exceed \$12,000,000 in 1960.

PREHISTORY

PREHISTORIC PEOPLE IN NORTHEASTERN OKLAHOMA

As early as 5,000 years ago, northeastern Oklahoma was occupied by scattered tribes of people who lived by hunting and by collecting food from forests and streams. Many sites have been found which indicate a long period of occupancy, whereas other sites show several distinct periods of occupancy. The first period, known as *Archaic Time*, was characterized by three separate stages of development which indicate a gradual shift from a purely hunting and collecting culture to one in which corn cultivation played an important role.

The earliest stage, which extended from 3000 B.C. to 2250 B.C., was characterized by the atlatl, or throwing stick, which was used for hunting deer and other game. Flints belonging to these early people can be identified by broad blades and occasional coarse serrations. In addition to hunting, these early people gathered nuts and seeds, which they ground with stones and mortars. In summer, they depended largely on fruits and berries for their food. Their clothing was made of skins of animals, as indicated by the large numbers of scrapers associated with their remains.

The second part of Archaic Time, extending from 2250 B.C. to 1750 B.C., was characterized by smaller flint points with different proportions from those of the first stage. Well-formed grinding stones indicate some type of corn agriculture, and there is some evidence of basketmaking at this time.

During the third part of Archaic Time, which extended from 1750 B.C. to 1500 B.C., materials left

at the sites resembled those of the second part. An increase in the number of small arrow heads indicates that the bow and arrow had now largely replaced the throwing stick. Abundance of grinding tools shows that the people depended upon corn agriculture for their livelihood. Textile fragments and fewer scrapers imply the decline in use of skins for clothing.

The period 1500 B.C. to A.D. 500 was a transitional one, represented by the *Fourche Maline Focus*. According to Bell and Baerreis (1951), the culture of this period, although not too well defined, represents a change from a pre-pottery, archaic hunting and collecting people to one which began to make and use pottery.

From A.D. 500 to A.D. 1200, an advanced cultural development appeared in northeastern Oklahoma. This has been labeled the *Gibson Aspect* and is characterized by burial mounds and flat-topped temple mounds, surrounded by a scattered population. Other features of this culture include square to rectangular houses, multiple burials with abundant grave offerings, highly decorated and polished pottery, various kinds of pipes, ear spools, beads, shell containers, stone celts, and small arrow points (Bell and Dale, 1953).

The story of prehistoric peoples in northeastern Oklahoma ends with the *Post-Gibson* or *Fulton Aspect*, which extended from A.D. 1200 to about A.D. 1500. In some areas, the Fulton Aspect shows evidence of contact with European cultures, but in northeastern Oklahoma there is no such evidence. Krieger (1947) outlined the characteristics of the Fulton Aspect as follows: a general absence of

mounds; single extended burials concentrated in a cemetery, with grave associations close to the head; rectangular houses, with two central roof supports; a variety of pottery vessel forms, including bowls, bottles, and jars; pottery decorations, including engraving, crude encising, and fingernail gouging; and assorted artifacts, including elbow pipes of pottery and stone, conch-shell beads, sandstone hones, small stemmed or triangular arrow points, subnosed scrapers, flint drills, bone scapula hoes, and bone awls.

ARCHEOLOGICAL SITES AND EXCAVATIONS IN NORTHEASTERN OKLAHOMA

Introduction.—When it became apparent that much of the land along the major streams in northeastern Oklahoma would become flooded by the Federal River Basin Reservoir Project, an intensive effort was begun to search out and excavate enough of the archeological sites to obtain a true picture of the cultures of the early people of that area. Members of the Department of Anthropology of The University of Oklahoma were especially active in making these surveys and excavations. They received assistance and cooperation from J. Willis Stovall Museum at The University of Oklahoma, United States Park Service, Tulsa District of the U. S. Army Engineers, and the River Basin Survey Section of the Smithsonian Institution. Through the combined efforts of these agencies, a large amount of archeological data was salvaged and recorded for future generations.

As a result of the intensified effort on the part of the archeologists, 43 sites were found in the Tenkiller Reservoir area and 28 in the Fort Gibson Reservoir area. Some of the more promising sites were excavated and their contents recorded. A description of several of the more interesting sites follows.

Cookson site (Tenkiller Reservoir).—The Cookson site is near the community of Cookson in Cherokee County. No mounds were found here. The house pattern was rectangular with two central posts and a fire pit. Items found include shell-tempered pottery without decorations, stone celts, metates, manos, pitted hammer stones, stone pipes, arrow-shaft smoothers, awl scrapers, small triangular arrow points, flint knives, drills, scrapers, hammer stones, bone awls and punches, scapula hoes, bone picks, rasps, and shell hoes (Bell and Dale, 1953).

Morris site (Tenkiller Reservoir).—The Morris site is 15 miles south of Tahlequah on the east side of the Illinois River, SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 30, T. 15 N., R. 23 E. This site was occupied by two different groups of prehistoric people. It is believed that between 2000 B.C. and 5000 B.C., a seminomadic hunting and collecting people used the site. Artifacts, including long points for spears and darts, oval-shaped knives, and scrapers typical of Archaic Time have been found. House outlines, burial

places, ground stone tools, and pottery are absent.

During late prehistoric time, the Morris site was occupied by a sedentary agricultural people. This last occupancy, which occurred some 400 to 600 years ago, is characterized by scattered house sites, outdoor fire places, cemetery burials, and no mounds. Among the artifacts found from this later culture are 1,571 complete and a large number of broken arrow points; pottery bowls, jars, and bottles largely without decorations; flint knives, manos, and milling stones; nut stones and shell scrapers; flint drills; flint scrapers; double-bitted axes; stone hoes; celts; boatstones; bone flakers; and bone awls. (Bell and Dale, 1953).

Brackett site (Tenkiller Reservoir).—The Brackett site is at the junction of Barren Fork and the Illinois River on the farm of M. L. Brackett, SE $\frac{1}{4}$ sec. 18, T. 16 N., R. 23 E. The site is 600 feet wide and 1,500 feet long and contains five square house sites with four center posts each and one rectangular house site with two center posts. The dead were buried in a semiflexed position with grave offerings. Artifacts found include stone, copper-covered ear spools, arrow points, stone celts, double-bitted axes, pottery vessels, and pottery pipes (Howard, 1940). It is estimated that this site was occupied about 700 to 900 years ago by a hunting and farming tribe. One mound excavated here measured 100 feet in diameter and 7 feet in height.

Vanderpool site (Tenkiller Reservoir).—The Vanderpool site, along the former bank of the Illinois River, was excavated in 1951 by Dr. Robert E. Bell of the Department of Anthropology of The University of Oklahoma.

Three occupations were recorded: a pre-pottery one; a pottery-bearing occupation, which resembles pre-Gibson; and a late Fulton Aspect occupation. This site had circular burial pits without grave offerings and square houses with short trench entrances. Artifacts include projectile points of various kinds, knives, scrapers, manos, metates, flint-picking hammers, cup stones, stone celts, flint celts, drills, and clay-tempered pottery, few of which are decorated (Bell and Dale, 1953, p. 75-76).

Smullens I site.—The Smullens I site is on the property of Kate Smullens, ten miles north of Tahlequah, Cherokee County. This site is a rock shelter site similar to those farther east in the Ozarks. Materials found here indicate that it may have had several occupations from Archaic Time to late prehistoric time. Artifacts are not numerous but include broken pottery flint pieces, animal bones, mussel shells, bone tools, and split bone awls (Howard, 1940).

Norman site (Fort Gibson Reservoir).—This large mound, measuring 27 feet in height and 90 feet in diameter, was excavated as a joint project of the Smithsonian Institution and The University of Oklahoma. The mound was a domiciliary structure with six layers of sub-structures. Few artifacts were found except glass beads in the upper level.

These indicate that the mound was occupied in the uppermost level by people with European cultural contact. It is believed that this mound represents the Spiro Focus of the Gibson Aspect.

Harlan site (Fort Gibson Reservoir).—According to information secured from the Sequoyah State Park Museum, the Harlan site is one and one-half miles east of the museum on an island in Fourteenmile Bay of Fort Gibson Lake. Only one mound is now above the level of the lake. This mound was excavated in 1959 but little was found except normal burial remains.

Cooper site (Grand Lake Reservoir).—This site is at the former junction of Honey Creek and Grand River in Delaware County, now inundated by the waters of Grand Lake. This site yielded pottery of various designs and types, indicating that it was occupied for a long period. Hunting was important, as evidenced by the large number of points and scrapers found. Other artifacts include stone axes, knives, and grinding stones. The last indicates that these people practiced some form of corn agriculture. No traces of houses were found and the absence of burial sites indicated that they may have buried their dead in nearby rock shelters (Bell and Baerries, 1951).

Mode site, Evans site, and Cupp site (Grand Lake Area).—These three small sites are in Delaware County. From them were taken small triangular arrow points, large, stemmed points, notched points, scrapers, drills, diamond-shaped knives of stone, double-bitted axes, celts, and abrading stones.

Other sites.—Thoburn (1929) described a mound in the valley of the Neosho or Grand River in western Delaware County as being 48 feet high and covering nearly 2 acres. It was said to be of material carried from a bluff of weathered "Boone" chert about one-half mile away.

A smaller mound excavated and described by Thoburn (1929) was at the junction of Elk River

and Grand River on the Delaware-Ottawa County line. This mound was about 14 feet high and 35 feet in diameter. Excavations yielded fine specimens of pottery, copper ornaments, shell beads, and pulley-shaped ear ornaments made of stone. It is estimated that this mound contained no fewer than 50 shallow burials with the remains in a poor state of preservation. This site is now inundated by the waters of Grand Lake.

OKLAHOMA BEFORE EUROPEAN EXPLORATION

Before the Europeans visited Oklahoma and for many years following the earliest exploration, the level plains of the west were a natural pasture for vast herds of bison, which roamed the plains between the Rocky Mountains in the west and the forests of the Mississippi basin in the east (McReynolds, 1954, p. 16-17). The prairie bison migrated southward with the coming of winter and northward as the weather grew warm. Many of the Plains Indians regularly followed the bison herds, traveling on foot and carrying their weapons and utensils with them. Other tribes became more or less fixed inhabitants and hunted bison at intervals. Siouan tribes, such as the Osage, Kansas, and Crow; Caddoan bands of Wichitas and Pawnees; Kiowas, Comanches, and other tribes were dependent upon the bison herds for food, clothing, and shelter and regarded the Arkansas, Cimarron, Canadian, and Red River valleys as their homeland.

The eastern part of the Oklahoma area was an attractive hunting ground for many tribes. Here the Cherokees, Choctaws, and other tribes from east of the Mississippi River met the powerful Osages and other tribes of the Plains. Many clashes probably occurred over the use of the hunting grounds long before the arrival of the Europeans, and hostility between tribes and intertribal warfare were well established before the coming of the white man.

HISTORY

Before the Louisiana Purchase in 1803, the region now known as Oklahoma had been claimed by Spain, France, and England.

Spain's claim to the land west of the Mississippi was based on the early travels of such men as DeSoto and Coronado. DeSoto, in his memorable travels, reportedly crossed the Mississippi River on June 18, 1541, and visited the area which is now Arkansas, Oklahoma, and Kansas. He described the life of the Indians in eastern Oklahoma in the Ouachita and Illinois River valleys.

The Coronado expedition of 1541 crossed the Oklahoma area during the quest for the fabled city of Quivira. Along the Arkansas River in south-central Kansas, Coronado found the Quivira Indians living in timber-framed, grass-covered, dome-shaped huts resembling those of their Caddoan ancestors. Coronado failed to find the rich mineral wealth for which he was looking, but he gave Spain a claim to the land west of the Mississippi River (Thoburn and Wright, 1929).

France laid claim to the interior of North America as a result of the travels of Marquette and Joliet, who explored the Mississippi River in 1673, and of LaSalle, who attempted to found a colony at the mouth of the Mississippi in 1684. In 1718, LaHarpe received from the French Mississippi Company a grant of land on the upper waters of the Red River. His travels carried him up the Red River, through eastern Oklahoma, and down the Arkansas (McReynolds, 1954, p. 20). Establishment of LaHarpe's trading post was a move to check Spanish expansion.

Early French explorers were interested primarily in hunting, trapping, and trading of furs. Many of the streams and places in Oklahoma have French names. Such names as Poteau, Chouteau, Fourche Maline, Sans Bois, Spavinaw, Verdigris, Sallisaw, and Salina reflect this French influence. Many of the early French explorers married Indians, and their descendants are among the people of Oklahoma today.

During the middle part of the eighteenth century, France and England became involved in a series of arguments which culminated in the French and Indian War, with the American colonists fighting on the side of the British. The British were victorious and ended France's colonial effort in North America.

The Treaty of Paris (1763) gave the Louisiana Territory west of the Mississippi River to Spain and placed Spain and England face-to-face along the Mississippi River. Opposition to British rule caused the American Revolution in 1775, and the American colonies became free. By provisions of the Treaty of Paris, in 1783, the new United States of America extended from the Atlantic Ocean on the east to the Mississippi River on the west.

Following the French Revolution, in 1789, Napoleon Bonaparte, conqueror of western Europe, set

out to re-establish France's empire in North America. His weak neighbor to the south, Charles IV of Spain, ceded the Louisiana Territory back to France in 1800. In 1803, the Louisiana Territory was sold to America. The Louisiana Purchase included what is now Louisiana, Arkansas, Missouri, Iowa, Minnesota, Oklahoma, Nebraska, Kansas, South Dakota, Montana, Wyoming, and part of Colorado.

At the time of the Louisiana Purchase all of Oklahoma except the Panhandle was part of the Great Louisiana Territory. In 1804, it was made part of the Territory of Indiana; in 1812, it belonged to the Missouri Territory; and in 1819, it became part of the Arkansas Territory. For a time part of Oklahoma belonged to Mexico, then to the Texas Republic, and later to the state of Texas.

AMERICAN EXPLORATION IN OKLAHOMA

James B. Wilkinson expedition. — The first American expedition to touch Oklahoma soil was that of Lieutenant James B. Wilkinson in 1806. Wilkinson was a member of an expedition under the command of Lieutenant Zebulon M. Pike, who was under orders to follow the Arkansas River and explore the mountains about its headwaters in what is now the state of Colorado. Lieutenant Wilkinson became ill; and, when the expedition reached the great bend of the Arkansas, it was decided that he should return home by traveling down the Arkansas River. In an account of Wilkinson's journey down the Arkansas, we are given the first American impression of what is now Oklahoma. His trip was begun in October, and after many hardships he arrived in New Orleans in January 1807. Despite his illness, Wilkinson kept careful notes of his observations.

George C. Sibley expedition. — In May 1811, Major George C. Sibley, Indian agent at Fort Orange, Missouri, started an expedition that took him through what is now Kansas, Nebraska, and Oklahoma. He entered Oklahoma at a point near the present town of Blackwell and went on to see the Salt Plain, or Grand Saline. The party returned to the valley of the Cimarron in what today is Woods and Harper Counties. The record of this expedition gives a good description of the salt plains and of the bison.

S. H. Long expedition. — In 1820, Major S. H. Long, with Major J. R. Bell, was ordered to go to the headwaters of the Red River and travel down it to collect scientific data on the country along the river. The expedition went up the Missouri River past Council Bluffs and thence westward to the Rocky Mountains. Here Long and Bell turned south and continued until they reached the headwaters of the Arkansas River. Here a detachment under the leadership of Major Bell was ordered to traverse the course of the Arkansas.

Major Long's party continued southward until they reached what they thought was the head-

waters of the Red River. They proceeded to journey down this river which later was found to be the Canadian River. Because of this error, we have the first accurate account of central Oklahoma.

Major Long gave an excellent description of the country he passed through on his journey down the Canadian: "The small elms along this valley were bending under the weight of innumerable grape vines, now loaded with ripe fruit, the purple clusters crowded in such profusion as to give a coloring to the landscape" (Litton, 1957, p. 62).

J. R. Bell expedition.—Major J. R. Bell's party, originally a part of the Long expedition, began their trip down the Arkansas on July 24, 1820. In his journal Major Bell gave a good description of the country through which he passed. He wrote of one occasion when three of his men deserted the party and took with them some of the valuable records of the journey. At one place near the boundary of Kansas and Oklahoma today, Bell's party came upon some fields of corn and melons to which they helped themselves. The nearby Indian villages were temporarily deserted. They reached Belle Point, their destination, on September 9, 1820.

Jacob Fowler expedition.—In 1821, Jacob Fowler traveled from Fort Smith, Arkansas, to Santa Fe, New Mexico. His description of the things he saw gives one a vivid picture of Oklahoma at that time. He stopped at Bean's Salt Works on the Illinois River, where he observed that "About 55 gallons of water will make a bushil (sic) of salt. They sell the salt for one dollar per bushil."

On the Verdigris River he stopped at a trading post operated by Hugh Glen and his partner, Nathaniel Pryor, a Kentuckian who accompanied Lewis and Clark to the Pacific and fought in the Battle of New Orleans. Pryor married an Osage woman, and today the county seat of Mayes County is named for him.

The party passed Union Mission on the banks of the Neosho (Grand) River near Murphy in Mayes County. Fowler described the present site of Claremore as being beautiful. The party passed into Kansas near Frankfurt in October, 1821 (Litton, 1957).

Thomas Nuttall.—Another explorer who left an excellent record of his travels in early Oklahoma was Thomas Nuttall, an English naturalist, born in Yorkshire, England. He was interested mainly in the plant life of the region.

Nuttall arrived in Fort Smith in the spring of 1819. He made one trip into southeastern Oklahoma by way of the Poteau and the Kiamichi Rivers into what is now Choctaw County and the prairies west of Hugo. He returned to Fort Smith in June; and from July 6 until September, he explored the Arkansas, Grand, Verdigris, South Canadian, North Fork, Deep Fork, and Cimarron Rivers.

Nuttall will be remembered chiefly as a man of science. Through his painstaking studies he made solid contributions. No other explorer of the flora of North America has personally made more dis-

coveries; no writer on American plants, except Professor Asa Gray, has described more new genera and species.

The observant botanist noted changes in the vegetation: "The variety of trees which commonly forms the North American forest here begins very sensibly to diminish. We now scarcely see any other than the smooth-barked cottonwood, the elm and box elder, curled maple, and ash, all of them reduced in stature. From thence the forest begins to disappear before the pervading plain."

Nuttall made an excursion up the Grand River to visit the Osage Salt Works. On this trip he noted the bony garfish and the large gray catfish. He also noted that the salt works produced 120 bushels of salt per week and that it took 80 gallons of water to make one bushel of salt (Litton, 1957).

Washington Irving.—Washington Irving's trip to Oklahoma in 1832 was by way of St. Louis and Independence, Missouri, then overland to the northeastern part of Oklahoma territory. He mentioned stopping at the Hopefield Mission in the Neosho Valley near the present town of Ketchum in Craig County. His next stop was at the trading post of A. P. Chouteau at Salina, in Mayes County. Chouteau had accompanied Irving from St. Louis. From Salina he continued on south to Union Mission and then to Fort Gibson.

At Fort Gibson it was arranged for Irving and Charles Latrobe to accompany a troop of mounted rangers who were making a trip to the Red River through the hunting grounds of the untamed Indians of the Great Plains (Thoburn, 1932, p. 427).

Irving described this group as follows:

Here was our escort waiting our arrival; some were on horseback, some on foot, some seated on the trunks of fallen trees, some shooting at a mark. They were a heterogeneous crew, some in frock coats made of green blankets; others in leather hunting shirts, but for the most part in marvelously ill cut garments, much the worse for wear and evidently put on for rugged service.

The party followed a southwesterly direction until they reached the vicinity of Norman in Cleveland County, then northward near the present site of Oklahoma City. From there they traveled northeastward through the present Logan County into the Cimarron Valley. They continued eastward through Payne and Pawnee Counties crossing the Arkansas at the junction of the Cimarron, thence southeastward through the present site of Tulsa and back to the Chouteau Trading Post at the mouth of the Verdigris.

Irving's descriptions of incidents along the way are extremely vivid. He wrote of a meal as follows:

Having no dishes, we proceeded in hunters style, cutting off strips and slices with our hunting knives, and dipping it in salt and pepper. To do justice to Tonish's cookery, however, and the keen sauce of the prairie, never have I tasted venison so delicious. With all this our

beverage was coffee, sweetened with brown sugar and drunk out of tin cups; and such was our style of banqueting throughout this expedition, whenever provisions were plenty, and as long as flour and coffee and sugar held out. (Irving, p. 21).

The following is another example of Irving's ability to describe in detail:

We now came out upon a vast and glorious prairie, spreading out beneath the golden beams of an autumnal sun. The deep and frequent traces of buffalo showed it to be one of their favorite grazing grounds; yet none were to be seen. In the course of the morning we were overtaken by the lieutenant and several men, who had remained behind, and who came laden with spoils of buffaloes; having killed three the preceding day. One of the rangers however, had little to boast of, his horse having taken fright at the sight of buffaloes, thrown his rider and escaped into the woods (Irving, p. 112).

Charles Latrobe. — Charles J. Latrobe, an English scientist, was a member of the same party that Washington Irving accompanied into the prairies of Oklahoma. Irving described him as “. . . a man of a thousand occupations; a botanist, geologist, a hunter of beetles and butterflies, a musical amateur, a sketcher of no mean pretensions, in short, a complete virtuoso; added to which, he was a very indefatigable, if not always a very successful sportsman.”

Latrobe wrote *The Rambler in North America* in which he tells of his trip into Oklahoma.

EARLY FORTS IN NORTHEASTERN OKLAHOMA AND VICINITY

Fort Smith. — Though Fort Smith was not in Oklahoma territory, it had a great influence on the history of Oklahoma. It was built at Belle Point overlooking the junction of the Arkansas and the Poteau Rivers. The fort was built in 1817 and was occupied continuously until 1824, when troops were moved up to Fort Gibson. In 1833, it was again garrisoned for a short while. That same year Fort Coffee was built a few miles up the Arkansas River in an effort to stop the flow of whiskey into Indian Territory. Fort Smith was again abandoned. After four years, Fort Coffee was abandoned and Fort Smith was again occupied in 1838. It was used during the Civil War and was permanently abandoned in 1870.

Fort Smith played an important role in the settlement of the West. Three military roads in Oklahoma had their starting points there. The California Road came through it, and many of the wagons making the trip to California were outfitted there. For many years Fort Smith was the head of navigation on the Arkansas (Morrison, 1936).

Fort Gibson. — A decision to abandon Fort Smith in Arkansas and to station soldiers nearer the source

of intertribal trouble was made on March 8, 1824, by General Winfield Scott in command of the Western Department at his headquarters at New Orleans. The site selected was on the east side of the Grand River about three miles from its mouth. The fort was named for George Gibson, who was head of the Commissary Department of the United States Army.

Fort Gibson rendered valuable service during the interminable political feuds and disturbances arising from the tribal politics. The post was strategically located for shipping supplies for the entire western country under the control of the United States. With the coming of the railroad in 1872 the influence of the fort waned. It was finally closed near the turn of the century (Litton, 1957, p. 74).

During the Civil War, Fort Gibson was first used by the Confederate soldiers and then by the Federal troops. From that time until its final abandonment in 1890, it was garrisoned continuously. In 1930, much of the old fort was restored and today it is among Oklahoma's most interesting historical sites.

Fort Coffee. — In 1834 it was decided to abandon Fort Smith and move about twelve miles up the Arkansas River. The new fort was named Fort Coffee. It was located in a bend of the river, on a bluff about 100 feet above the river. The buildings were one-story log structures with porches on the front and rear. The roofs were covered with shingles and the floors were of rough boards. This fort was occupied for only four years, when it was abandoned and Fort Smith was again garrisoned (Wright and Thoburn, 1929).

According to McReynolds (1954), Fort Coffee was to provide a working base for operations against the “whiskey-runners.” A small cannon on the river stopped all boats entering the Indian country; this project was not entirely successful, because whiskey could be brought into the Indian nations without using the river transportation.

Fort Wayne. — Fort Wayne was built on Spavinaw Creek in 1838, in what is now Delaware County, near the Arkansas boundary a few miles north of Siloam Springs. It was abandoned in 1842. Captain Nathaniel Boone, son of Daniel Boone, was post commander there for a part of the time. During the Civil War the fort was occupied for a time by Confederate troops under Stand Watie.

EARLY TRANSPORTATION IN NORTHEASTERN OKLAHOMA

River Transportation in Oklahoma. — Transportation in what is now Oklahoma was very difficult and slow before the days of roads and railroads. The Indians either walked if traveling overland or used canoes in the streams. Horses were not introduced until the coming of the Spanish explorers. Dogs were used by the Indians to carry small loads.

The Spanish explorers traveled largely on horseback. It is thought that many of the horses brought to America by the Spanish wandered away from

their owners, became wild, multiplied, and became a source of horses for the Indians and early settlers.

The French explorers traveled, for the most part, by canoe, adopting this mode of travel from the Indians of the northeastern part of America. This method of transportation was utilized by the French fur traders to navigate such streams as the Arkansas, Grand, Illinois, Verdigris, Canadian, and Cimarron. The piroque was a dugout canoe used by the French for carrying their pelts down the rivers to the trading posts. For larger cargoes, the keelboat was used. The larger keelboats were from fifty to sixty feet in length and from fifteen to twenty feet in width. This boat was propelled by poling where the water was shallow enough. Where the water was rapid, the keelboat was pulled by means of a cordele, a rawhide towline pulled by twenty or thirty men walking along the bank; or, if the bank was covered with brush, the cordele was attached upstream to a tree and pulled by men standing on the boat. Fifteen miles was a good day's journey for a keelboat. Its load capacity was about ten to twenty tons.

The steamboat *Comet* was the first to enter the Arkansas River in 1820. The *Robert Thompson* was the first to reach Fort Smith, which was the head of navigation for many years on the Arkansas. In 1827 the *Velocipede*, *Scioto*, and *Highland Laddie* all navigated the Arkansas River to Fort Gibson.

Steamboat travel was slow and hazardous because of logs and shallows in the rivers. Several boats were lost, due to snagging on rocks and trees.

Old Military Road. — The first military road to be surveyed and built in Oklahoma extended from Fort Smith to Fort Gibson. This road, built in 1826, was about 58 miles long. Beginning at Fort Smith, the road entered Oklahoma and continued north about four miles to the present town of Greenwood, thence in a northwesterly direction to the town of Long, continuing westward and passing about two miles north of Sallisaw, thence northwestward to the site of the Dwight Mission, thence to the Arkansas River and Fort Gibson (from a map by H. D. Ragland).

The Cherokee Trail Road. — This early road, called the Cherokee Trail because it passed through Cherokee territory, had its beginning in Fort Smith, ran north of the Arkansas River crossing the Grand at Fort Gibson and continuing northwest to the Verdigris, thence up the valley of that stream for 80 miles. There it crossed the Verdigris and took a northwest course to the Arkansas River near Old Fort Mann on the Santa Fe Trail.

The Texas Road. — One branch of the Texas Road came from Baxter Springs, Kansas, and followed the divide between the Verdigris and the Grand Rivers to Fort Gibson. Another branch came from Springfield, Missouri, and Maysville, Arkansas, past Fort Wayne on the Upper Spavinaw, thence to Salina, where it joined the other branch. There were six stations between Fort Gibson and Baxter Springs where the stages could change

horses and where refreshments and lodging could be had; one station was at Wagoner, one at Chouteau, and another about ten miles north of Pryor. The others were about evenly spaced between there and Baxter Springs. From Fort Gibson the road proceeded to Texas.

The Whiskey Road. — This so-called Whiskey Road extended up the north bank of the Arkansas River from Fort Smith to Webbers Falls. The soldiers at the post were constantly engaged in efforts to prevent the introduction of whiskey into Indian Territory. Steamboats brought it up the Arkansas; but, as large shipments were easily discovered, resort was made to keelboats and canoes that could slip upstream with more secrecy. The wagon road that followed the bank of the river closely could be employed with greater success. In the 1830's and 1840's, whiskey was brought in by wagon loads to the mouth of the Canadian River and from there forwarded upstream on the Arkansas River (Foreman, 1925, p. 118).

California Road. — This was the road followed by many immigrants going to California. It started at Fort Smith and Van Buren, Arkansas. From Fort Smith it proceeded up the Arkansas River, where it crossed near Webbers Falls and then continued up the Canadian River and on to Santa Fe.

Shawnee Cattle Trail. — This is the only one of the great cattle trails that came through Oklahoma. It came up from Texas to Three Forks on the Arkansas River. Here it divided; one branch followed a route up the west side of the Grand River, the other came up the east side of the river. The destination of both these routes was Baxter Springs, Kansas.

The Missouri, Kansas and Texas Railroad (Katy). — In treaties made with the United States Government in 1866, the Indians of the Five Civilized Tribes agreed to allow one railroad to be built north and south and one to be built east and west across each of their respective nations. The Government announced that the first railroad to reach the Kansas-Oklahoma line would have priority to build across the Indian Territory. It developed into a frenzied race among three railroads: the Missouri, Kansas and Texas; the Leavenworth, Lawrence and Galveston; and the Missouri River, Fort Scott and Gulf Railroads. In the words of Daniel V. Fraser (1953): "In an epic construction race that has few parallels in the history of railroad building, "Katy" track laying and construction crews made up mostly of brawny Irishmen, out built and outfought this competition and won hands down."

The M-K-T reached the Kansas line first on June 6, 1871, and one month later was given the contract to build the first railroad into Oklahoma. The railroad was built from Baxter Springs, Kansas, down the Neosho Valley through the present sites of Welch, Vinita, and Muskogee. By 1872, it had reached Texas.

The Atlantic and Pacific (Frisco) Railroad. — The second railroad to be built in Oklahoma was

the Atlantic and Pacific, later called the Frisco Railroad. It came into Oklahoma from Missouri and in 1871 extended through Vinita in Craig County. By 1882, it had been completed to Tulsa.

INDIAN LIFE IN OKLAHOMA

Great Indian Tribes in North America.— It is estimated that, at the time of the discovery of America, there were about 700,000 Indians within the present limits of the United States. Few of these actually lived in Oklahoma. The Osages claimed part of it for their hunting ground and small bands of Comanches, Kiowas, and Wichitas lived near the Wichita Mountains. During the period 1825 to 1840, the Five Civilized Tribes, the Cherokees, Creeks, Choctaws, Chickasaws, and Seminoles, were driven from their homes east of the Mississippi River and were given a new home in what is now Oklahoma. Today, the Indians of the United States number about 380,000. Of these, 64,100 live in Oklahoma.

The early settlers along the Atlantic seaboard of North America found themselves confronted by three great stocks of Indians. In the north along the Great Lakes, and in western New York and western Pennsylvania along the headwaters of the Hudson and Ohio, were the Iroquois, embracing the five great nations of Seneca, Cayuga, Oneida, Onondaga, and Mohawk. Later the Tuscaroras came north and joined their kinsmen, forming the sixth nation. The Iroquoian Confederacy numbered some 15,000 people. Occupying as they did a strategic region, these Indians were long an important factor in American history.

Along the Atlantic seaboard in Virginia and in New England, as well as west of the Appalachian Mountains in the eastern half of the Mississippi Valley, dwelt the great Algonquin stock, embracing many tribes. Among these were the Powhatans of Virginia, the Narragansetts and Pequots of New England, and the Shawnees and Potawatomes of the west. Beyond the Mississippi lived other Algonquin tribes, such as the Blackfeet in the northwest and the Cheyenne and Arapaho farther south. East of the Mississippi this stock numbered some fifty or sixty thousand, or perhaps more.

At the base of the Great Smokies, in western North Carolina, eastern Tennessee, and extending south and east into Georgia and Alabama, was the great southern branch of the Iroquoian stock, the Cherokee. Numbering some twenty or twenty-five thousand people, who were far in advance of their northern brethren in civilization, this tribe had a great influence upon the history of the Gulf plains and the lower Mississippi basin.

South and west of the Cherokee in what is now Georgia, Alabama, Mississippi, and Florida was the Muskogean stock with its four great tribes, the Creek, Choctaw, Chickasaw, and Seminole, forming with the Cherokee that great group of Indians commonly known as the Five Civilized Tribes (Dale, 1924).

West of the Mississippi River lived the great Siouan group of wandering bison hunters. The Osage Indians belonged to this group. Other stocks were the Shoshonean, including the Comanche, Shoshone, and Ute; the Caddoan, comprising the Wichita, Caddo, and Pawnee tribes; and the Kiowa. The Cheyenne and the Arapaho tribes were of Algonquin stock (Dale, 1958, p. 106-107).

The Cherokee Nation.— The Oklahoma Ozark area is the land of the Cherokees. The Creek Nation extended into Muskogee and Wagoner Counties; and small groups of Quapaw, Peoria, Ottawa, Eastern Shawnee, Wyandot, and Seneca Indians settled in Ottawa County. The remainder (by far the greater part) of northeastern Oklahoma, became the Cherokee Nation (Cherokee West) following their removal from eastern United States.

In 1802, the state of Georgia ceded her western lands to the United States under the terms of an agreement by which the latter promised, at its own expense, to extinguish the Indian title to lands in Georgia as soon as it could be done peaceably and on favorable terms (Dale and Rader, 1930). In 1803, the Louisiana Purchase provided a great region into which it was hoped the Georgia Indians might be removed. Attempts to induce them to give up their lands and move westward were unsuccessful, however, and in the meantime more and more whites settled around the border of the Cherokee country.

Finally, in 1808, a party of Cherokee chiefs and headmen appeared in Washington for an interview with the President. They explained to him that they were closely hemmed in by the whites, who killed their game and trespassed upon their land; and in consequence many Cherokees wished to give up their lands and move to the west. The President instructed them to send an exploring party west to seek a suitable home and agreed that, when they had found lands suited to their needs, they should be given new lands acre for acre for those given up in the east.

This the Cherokees did, and in 1817 about one-third of the tribe surrendered their lands in Georgia and moved to a new territory set aside for them in what is now Arkansas, between the White and Arkansas Rivers.

They soon found, however, that they had not moved far enough westward to escape molestation by the whites. In 1828, these western Cherokees gave up their lands in Arkansas for a grant of 7,000,000 acres of land in what is now Oklahoma, and were given a perpetual outlet westward (Cherokee Strip) as far as the limits of the United States extended, which was at this time the one-hundredth meridian.

In the meantime the Cherokees in the east were advancing rapidly in civilization. Sequoyah invented his alphabet, by means of which nearly all of these Indians learned, in a short time, to read and write the Cherokee language. The tribal government was reorganized, a written constitution and

code of laws were adopted, and John Ross, a mixed-blood Cherokee, was elected as Principal Chief.

Alarmed at what seemed an attempt of the Indians to perpetuate a republic within the limits of the state of Georgia, the legislature of that state passed a series of acts extending the jurisdiction of Georgia over the Indian country, making the Indians subject to state laws and providing that no white person could live within the limits of the Cherokee Nation unless he swore allegiance to the state and secured a permit signed by the governor.

Several missionaries residing among the Cherokees were arrested under the provisions of this act and tried in Georgia courts. Two of them, S. W. Worcester and Elizur Butler, were sentenced to four years in prison. They appealed the case to the Supreme Court of the United States, which decided that the act of the Georgia legislature was contrary to the constitution and was null and void. Eventually they were pardoned, but the case attracted nation-wide attention.

At last the difficulties and perplexities of the Cherokees became so great that a small group voted favorably for removal westward. The leaders of this group were Major Ridge, his son John Ridge, Elias Boudinot, and his brother, Stand Watie.

In 1835, these men and a few of their friends and adherents signed with the commissioners of the United States the Treaty of New Echota by which the Cherokees agreed to give up all lands east of the Mississippi River, move to Indian Territory, and join the Western Cherokees within three years. This treaty was ratified by the Senate in spite of the protests of the great majority of the Cherokees, and in 1838 the removal was accomplished by the aid of troops under General Scott. So many Cherokees died on the journey and the suffering of others was so great that the road over which they journeyed was called the Trail of Tears. With this removal, the Cherokee Nation was again united (Dale and Rader, 1930, p. 137-138).

A large number of the Cherokees, to keep from being taken to Oklahoma, fled into the deeply sheltered coves of the Great Smoky Mountains on the headwaters of Deep Creek and of Oconalufita River, where the troops were unable to get them out. It was finally decreed by the government that if Tsali and his two young sons would come out and pay the supreme penalty, the rest of the Cherokees could stay. This they did, and today a large number of Cherokees live on the Qualla Reservation in Swain County, North Carolina. Later, some of those who had gone to Oklahoma returned to North Carolina to be with their friends and relatives.

From the time of the Removal until the outbreak of the Civil War, conditions in the Cherokee Indian Territory were unsettled and disturbed. There was a feeling of hatred among the Eastern Cherokees who had recently been removed to Oklahoma because only a minority of their people, led by Major Ridge, his son John Ridge, Elias Boudinot, and Stand Watie, had signed the Treaty of New Echota.

The newcomers got a friendly reception by the old settlers who set out to help them get established, but when John Ross, the leader of the majority of the new group from the east, proposed that a new constitution be submitted to the vote of the whole Nation, the old settlers refused. They felt that their government should remain in force until the next regular meeting which was to be in October, four months hence. They were willing for the new arrivals to vote in the next regular election.

On June 22, 1839, Major Ridge, John Ridge, and Elias Boudinot were attacked and killed. Stand Watie was also marked for assassination, but he was warned and escaped. Chief John Ross was blamed for having provoked the assassinations, but he strongly denied having any knowledge of the plot (Wright, 1951).

On September 6, 1839, the eastern group, under the leadership of John Ross, met at Tahlequah, where they drafted and adopted a new constitution. The next year it was adopted by the Western Cherokees at a meeting at Fort Gibson. From this time on the two factions lived together with a reasonable degree of harmony.

In 1841 a public school system was established, and in 1843, 18 schools were in operation. Before the end of the Cherokee Government the number had reached 120. Two seminaries for higher learning were established in 1851. The National Female Seminary was originally built at Park Hill, three miles southeast of Tahlequah, but was later moved to Tahlequah after the building burned. The Cherokee Male Seminary was established about one and one-half miles southwest of Tahlequah.

A number of mission schools were established, including Dwight Mission, New Springplace, near the present site of Oaks in Delaware County, Fairfield Mission near Lyons, and Baptist Mission near the present site of Westville in Adair County.

Printing presses played an important role in the education and development of the Indian people. The first printing press was brought in by Samuel A. Worcester, who became the first publisher of the *Cherokee Almanac* at Park Hill in 1836. At Tahlequah a printing press, installed in 1844, printed the *Cherokee Advocate*, in English and in Cherokee. The Baptist Mission had its own printing press and published the *Cherokee Messenger*.

When the Civil War began, the Cherokees, under the leadership of John Ross, attempted to follow a policy of neutrality although many of them were slave owners, including John Ross, the chief. But when the southern forces had some successful engagements in southern Missouri and a Cherokee regiment had been formed with Colonel Stand Watie as its leader, Ross was forced to abandon his policy of neutrality and join the Confederate forces (Wright, 1951).

The Cherokee Nation suffered greatly from the effects of the Civil War. A cleavage developed among the Cherokees which dated from the Treaty of New Echota and the murder of the two Ridges

and Elias Boudinot. This split prompted some of the Cherokees to fight on the side of the Confederacy, whereas others fought on the Union side. In the early stages of the war the Confederates had the advantage, but in the later stages the Union forces had the advantage. Many Cherokees were killed on both sides and the loss of property was great.

In 1862 the Federal "Indian Expedition" invaded Indian Territory from southern Kansas, forced Colonel Stand Watie and Colonel John Drew and their Confederate forces to retreat, captured Chief John Ross and other Cherokee officials, and then retreated into Kansas. Chief Ross was soon paroled and allowed to go to Washington and Philadelphia, where he remained until the end of the war (Wright, 1951).

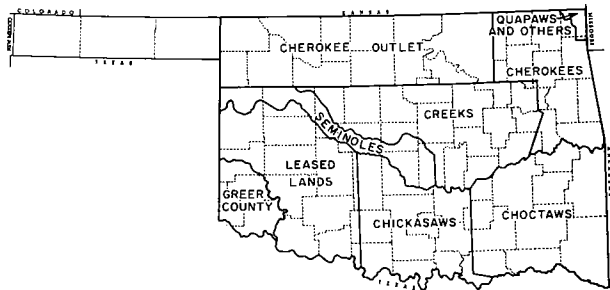


Figure 23. Indian Country, 1856-1866 (redrawn from Dale, 1958, p. 142).

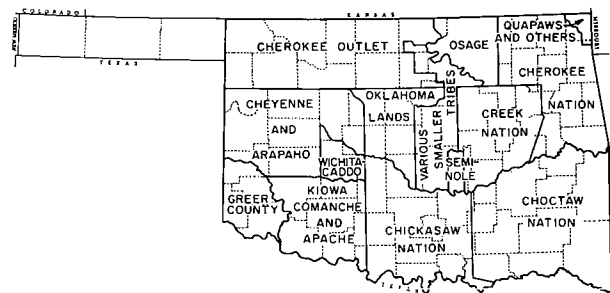


Figure 24. Indian Country, 1885 (redrawn from Dale, 1958, p. 187).

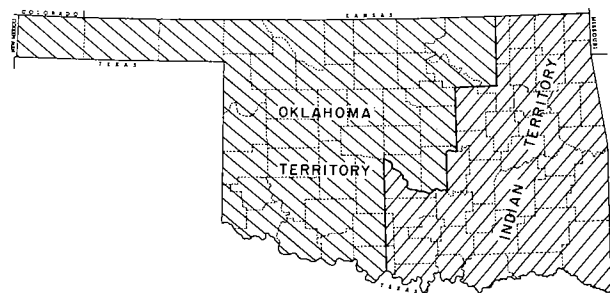


Figure 25. Twin Territories 1890-1905 (from McReynolds, 1954, p. 276; Dale, 1958, p. 256).

The Confederate Cherokees met at Tahlequah in 1862, elected Stand Watie as chief of the Cherokee Nation, and reaffirmed their allegiance to the Confederacy.

Early in 1863 the Union Cherokees met and declared the action of the southern group to be null and void and appointed Thomas Pegg to serve as acting chief of the Cherokee Nation in the absence of John Ross. From this time on there were two separate governments and two chiefs.

Both Northern and Southern Cherokees distinguished themselves throughout the campaign. Stand Watie was the outstanding leader of the Southern Cherokees and the only Indian to earn the rank of brigadier general in the Confederate Army. He was the last Confederate general to surrender at the end of the war.

After the war, delegations from both factions went to Washington for the signing of the treaty in 1866. The Southern Cherokees were represented by such men as William P. Adair, Richard Fields, Elias C. Boudinot, and John Rollin Ridge. The Northern faction was represented by John Ross and others. The Northern group finally succeeded in signing the treaty which was not agreeable to the Southern group. The Southern group did, however, eventually accept it. The treaty provided for the continuance of the Cherokee Government with some changes in its constitution and laws. Chief John Ross died August 1, 1866, and his nephew William P. Ross filled the unexpired term (Wright, 1951).

FINAL SETTLEMENT AND STATEHOOD

The years after the Civil War brought many changes to the Indian Territory. Railroads were built into the territory in 1871, giving it an outlet for cattle and other farm products. The Indians had granted right-of-ways for cattle and freight lines across the territory and had leased vast areas of rich grass for cattle grazing.

Soon there arose a demand for the opening of the Indian Territory to white settlement. The clamor became so great that in 1889, a large area of unassigned lands (2,000,000 acres) near the center of Oklahoma was opened and the great run for free homesteads got under way. Efforts were now directed toward the Cherokees to release the Cherokee Strip or Outlet which had been granted to them by the Removal Treaty of 1828. Finally, in 1890, the Cherokees sold the Cherokee Outlet to the United States, and this area was opened for settlement in 1893.

By 1890, the original Indian Territory had become divided into two territories (fig. 25). The eastern half of the present state of Oklahoma retained the designation of Indian Territory and the western half became Oklahoma Territory. The Five Civilized Tribes continued to run their own governments and retain their own capitals as before. Guthrie became the capital of the new Oklahoma Territory. Schools were organized, churches built, and territorial legislatures began to operate under

federally appointed governors. The new country began to boom. The population of the Territory grew from 50,000 in 1890 to more than 800,000 in 1906.

Soon the demand arose for statehood by the people of Oklahoma Territory. Most members of Congress wanted to join the Oklahoma and Indian Territories into a single state, but were faced with difficulties. The Indian Territory had to be prepared for statehood by abolishing the governments of the Five Civilized Tribes and by giving to each Indian his rightful share of tribal lands (Dale, 1958, p. 275-276).

The Dawes Commission was established in 1893 by an act of Congress to deal with the problems arising over the Indian Territory. Agreements were ultimately reached whereby the tribal lands were distributed and the United States was in complete control of Indian Territory, and the work of the Dawes Commission was essentially completed. Under the final agreement of 1902, each man, woman, and child of Cherokee ancestry was to receive 110 acres of average land (Wright, 1951). The Cherokee Government was officially disbanded in March 1906 but continued to operate in modified form to complete the subdivision of tribal lands until June 30, 1914.

In 1906 the Enabling Act was passed and approved (Dale and Rader, 1930, p. 641). Under the terms of this act an election was held for the choosing of delegates to the constitutional convention. This body met at Guthrie on November 20, 1906, and set to work to make the constitution of Oklahoma. This, when completed, was submitted to the people of Oklahoma for their approval or rejection at an election held on September 17, 1907. At this election state and county officers were also elected. The constitution was adopted by an overwhelming vote of the people, and President Theodore Roosevelt issued a proclamation declaring Oklahoma to be a state. On November 16, Governor-elect Charles N. Haskell was inaugurated and took the oath of office at Guthrie, and Oklahoma took her place as the forty-sixth state of the Union.



Figure 26. Sign on U. S. Highway 69 pointing out the Union Mission site.

EARLY MISSIONS AND TRADING POSTS

Union Mission. — Union Mission was established in 1821 by the Reverend Epaphras Chapman and Mr. John Vinal on the west bank of the Grand River about seven miles southeast of the present town of Chouteau, in Mayes County (figs. 26, 27). This was the first mission built in the present state of Oklahoma. A log school house was built and the first school in Oklahoma opened that year. It was discontinued in 1836 (Thoburn and Wright, 1929).



Figure 27. Union Mission marker near the grave of Reverend Chapman.

Hopefield Mission. — In 1823 an agricultural station, called Hopefield, was started about four miles south of Union Mission. Here the Indians were taught better farming methods and introduced to new and better crops under the supervision of mission workers. At the end of the season, the Indians loaded their canoes with produce and traveled down the river to Fort Gibson, where they found a ready market. The profit they made encouraged other Indians to come and join the mission. The Removal Treaty of 1828 caused the Osage Indians to move farther north and west. Therefore the Hopefield Mission was moved thirty miles north, near the mouth of Cabin Creek in Craig County, where it could better serve the

Indians. The mission was terminated in 1836 (Thornburn and Wright, 1929).

Dwight Mission. — Dwight Mission (figs. 28, 29), was established by the American Board of Commissioners for Foreign Missions of Boston in 1820-22, near Russellville, Arkansas. The Treaty of 1828 moved the Cherokee Indians from Arkansas to their new location in northeastern Oklahoma. In 1829, the Dwight Mission was moved to a new location in the Cherokee Nation, about seven miles northwest of the present site of Sallisaw in Sequoyah County (Ragland, 1956).

In 1948 the mission school at Dwight was closed and the property sold to the Synod of the Presbyterian Church of Oklahoma. It is now used for youth camps, church groups, retreats, and conferences.

Fairfield Mission. — This mission was first built in 1828 on Mulberry Creek in Polk County, Arkansas, and was known as Mulberry Mission. In 1829 it was moved to a site in Adair County, fifteen miles north of Dwight Mission. It was founded by Dr. Marcus Palmer near the present site of Stilwell.

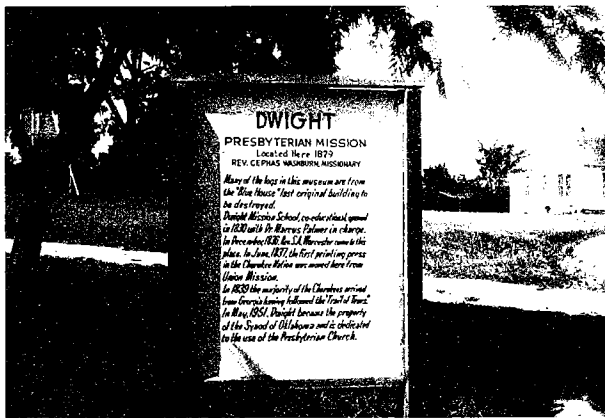


Figure 28. Sign on the ground at Dwight Mission.

Park Hill. — Park Hill was established in 1836 by Reverend Samuel A. Worcester near Tahlequah. This was the largest mission among the Indian nations. Its buildings included schools, homes for the missionaries, and a boarding hall for students. There was a large farm in connection with the mission, a grist mill, shops, and a barn.

Worcester brought the first printing press to Oklahoma and became the publisher of the *Cherokee Almanac*. He printed many works for both settlers and Indians and translated the Bible into Cherokee.

Fort Coffee Academy. — Fort Coffee Academy was established by the Methodist Mission Board as a school for Choctaw Indian boys. The church purchased the property which was formerly old Fort Coffee, situated on the south bank of the Arkansas River a few miles upstream from Fort Smith. The old log buildings of the fort were used for a while until new buildings could be erected. The school received its first pupils in February,

1844. The next year *New Hope*, a school for Indian girls, was built a few miles from Fort Coffee Academy.

Baptist Mission. — Jesse Bushyhead, a Cherokee Indian, was ordained a Baptist minister in 1833, at the Baptist Mission in Valley Town, North Carolina. In the fall of 1838, Bushyhead gathered the whole congregation at Amohee and started their journey over the Trail of Tears to the Cherokee Nation in the west. Here he established a mission near the present site of Westville in Adair County. A school was started, a printing press was secured, and the publication of the *Cherokee Messenger*, the first periodical to be published among the Cherokees, was begun. The Mission was moved to Tahlequah and later to Muskogee, where it developed into Bacone College (West, 1946, p. 106-107).

Splitlog Mission. — Splitlog Mission was established in 1869 some nine miles northeast of the present town of Grove, Delaware County. The church and carriage house, built by Chief Mathias Splitlog, stand today at the mission site.

Seneca Indian School. — Originally known as the Wyandotte Boarding School, the Seneca Indian School, named for nearby Seneca, Missouri, was established in 1872 in eastern Ottawa County. One of the early buildings still stands.

Chouteau Trading Post. — The Chouteau brothers were the first traders in the area that is now Oklahoma. About 1795, the Chouteaus induced a large number of Osage Indians to move from their homes in the Missouri Valley to the Arkansas Valley to the vicinity of Three Forks where there would be less competition with the Spanish traders. Many of them settled near the mouth of the Verdigris River, which was the head of navigation. The presence of salt springs in this area was an induce-



Figure 29. Museum built of logs from original Dwight Mission in foreground; one of the early school buildings in the background.

ment to the Indians. The Chouteaus located a trading post on the east side of the Neosho River within the present town of Salina in Mayes County (Litton, 1957, p. 86-87).

Joseph Bougie Trading Post. — Joseph Bougie, a French Canadian, established a trading post at the mouth of the Verdigris River about 1806.

Nathaniel Pryor Trading Post. — Nathaniel Pryor established a trading post at Three Forks. Being a native of Kentucky, he imported racing horses from there and sold them to the more prosperous Indians. Pryor was influential with the Osage Indians, his wife being of that tribe. He was also influential in the location of Union Mission and Fort Gibson (Litton, 1957, p. 86-87).

Other important trading posts were located along the principal streams at Webbers Falls, Fort Gibson, and Tahlequah.

SOME CITIES AND TOWNS OF HISTORIC INTEREST
(in part from Kent Ruth, Guide to the Sooner State)

Adair. — (elevation 682 feet, 1960 population 434). Adair was named for the Adair family, an important Cherokee family. Adair was the site of the famous train robbery by the Dalton gang of outlaws in July 1892 when \$17,000 in currency was taken from the Missouri-Kansas-Texas Railroad station.

Afton. — (elevation 790, 1960 population 1,111). On August 4, 1886, a man by the name of Graham opened a store in what is now Afton, a flag stop on the Frisco Railroad. Afton has been noted for many years as a hay shipping center and as a railroad division point. The *Afton News*, founded in 1892, carried the story of the extermination of the Dalton gang at Coffeyville, Kansas, in 1892 in one of its first editions. The *Afton News* is now known as the *Afton Climax*.

Braggs. — (elevation 558, 1960 population 279). Braggs was the site of Camp Gruber during World War II. Camp Gruber, now abandoned, was one of the larger camps of its kind in Oklahoma.

Fort Gibson. — (elevation 542, 1960 population 1,407). Fort Gibson was established in 1824 by

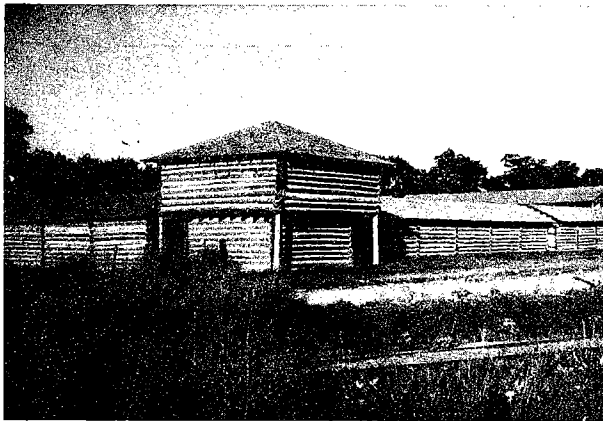


Figure 30. Restoration of historic Fort Gibson.

Colonel Matthew Arbuckle. From 1824 until 1857 it served as the chief military center of the Indian Territory. It was occupied by the Confederate Army in 1861 and reoccupied by the United States Army in 1863 under Major General James Blunt. It was officially abandoned by the army in 1890 but was restored in 1935-36 by the W. P. A. (figs. 30, 31).

Fort Gibson was an active place during the early history of Oklahoma. It was visited by Washington Irving and Charles Joseph Latrobe in 1832 and by Sam Houston, who operated a near-by trading post from 1829 to 1832. Jefferson Davis, later president of the Confederacy, was stationed here from 1833 to 1835 under General Zachary Taylor, who became U. S. President in 1849. Governor Montford Stokes, Indian commissioner from 1833-42, occupied the John Dillard Inn, located near the old fort.

The first commercial long distance telephone line was built through Fort Gibson in 1886 connecting Tahlequah and Muskogee. The old military and stage coach road from Fort Gibson to Fort Smith, Arkansas, was surveyed in 1825 and built in 1826 (first road in Oklahoma).

One mile east and about one-half mile north of Fort Gibson is the U. S. Military Cemetery, established in 1868. At present, approximately 4,000 persons are buried there. These include 2,123 Civil War dead of whom 1,967 are unknown. Several prominent persons, including Diana Rogers Houston, Captain Billy Bowlegs, and Montford Stokes, were buried there.



Figure 31. Remains of officers' quarters once used by Jefferson Davis and General Zachary Taylor.

Gore. — (elevation 480 feet, 1960 population 334). Gore was first known as Campbell, when it served as a stop on the Fort Gibson-Fort Smith stage line. Its name was changed to Illinois in 1888

and to Gore in 1907, the latter name in honor of United States Senator Thomas P. Gore.

Tenkiller Ferry Dam and Lake are seven miles northeast of Gore, and Greenleaf State Park and Lake are six miles north of Gore.

Miami. — (elevation 800 feet, 1960 population 12,869). Miami, county seat of Ottawa County, is situated on land purchased from the Ottawa Indians in 1891. It has grown from a single one-room log house into an industrial center of more than 12,000 people. It is situated in the center of the Tri-State Mining Area, and experienced its first boom from the lead and zinc mines that now honeycomb the ground beneath the towns of Commerce, Picher, Cardin, and Quapaw. The Eagle-Picher Mining Company and the B. F. Goodrich Rubber Plant play an important part in the economy of Miami.

Miami is the home of Northeastern A. and M. College, which is well known both academically and in the field of athletics. It is near Grand Lake and enjoys a profitable vacation and recreational business.

Muskogee. — (elevation 617, 1960 population 38,059). Muskogee, named for the Muskogee (Creek) Indians, lies to the south of Three Forks, the junction of the Arkansas, Verdigris, and Grand Rivers. The site, originally recommended to President Jefferson in 1805, was visited by Thomas Nuttall in 1819, who predicted its importance as a town site. Three Forks became an important trading post for Nathaniel Pryor, Auguste P. Chouteau, and others.

In 1829, the Creek Indians settled near the present site of Muskogee. Muskogee became the location of the Union Agency for the Five Civilized Tribes in 1874 and was incorporated in 1898. Agriculture, oil, and manufacturing contributed to its steady and rapid growth into one of the largest towns in Oklahoma.

Bacone Indian College is located at the northeast edge of Muskogee.

Pryor. — (elevation 627 feet, 1960 population 6,476). Pryor was named for Nathaniel Pryor, a relative of Jefferson Davis and a scout for Lewis and Clarke. He entered Indian trade at Three Forks and later established a post on Pryor Creek. He brought the first Kentucky thoroughbred horses to Oklahoma Territory.

Pryor is rapidly becoming industrialized. To the southeast is the Oklahoma Ordnance Plant (now closed), the John Deere Chemical Plant, National Gypsum Paper Plant, Bestwall Gypsum Paper Plant, Midwest Carbide Company, and the Oklahoma Cement Company. Whitaker State Orphanage is located in Pryor.

One of Pryor's oldest citizens, W. A. Graham, recently deceased, left an estate of nearly \$4,000,000, most of which was given to the town of Pryor for the construction of schools, libraries, county and city offices, parks, sewage systems, and other improvements.



Figure 32. Sign at Salina, Oklahoma.

Salina. — (elevation 618 feet, 1960 population 972). Salina was established in 1796 as the first permanent settlement in Oklahoma by Major Jean Pierre Chouteau (fig. 32). It served as the Chouteau Trading Post from 1796 to 1840; was known as Grand Salina from 1840 to 1871; was the site of the Cherokee Indian Orphanage from 1871 to 1903; and was incorporated as Salina, Oklahoma in 1913.

John Ross, chief of the Cherokees, built a brick mansion on the present site of the Salina school gymnasium. He was visited there by John Howard Payne (author of *Home Sweet Home*) in 1846. The Grand Peace Council of the Cherokee and Osage Indian Tribes was held there in 1868.

Near the site of the original trading post is a "Paradise Tree" reportedly sent from France and planted in 1796. A monument in the southeast corner of town commemorates Jesse B. Milam, chief of the Cherokee Nation, 1941-49.

Sallisaw. — (elevation 531 feet, 1960 population 3,351). Sallisaw, the county seat of Sequoyah County, was named by early French trappers for the salt deposits nearby (Salaison). Situated on the edge of the beautiful Cookson Hills, it is an important agricultural and tourist center. It is noted for coal mining and limestone quarrying industries. The town was founded in 1886 and incorporated in 1896.

A one-room log cabin eleven miles east of Sallisaw is the former home of the great Indian chief, Sequoyah, who invented the alphabet of the Cherokees. California's famous redwood trees, the Sequoias, were named for this man.

Dwight Mission (figs. 28, 29), a famous early Presbyterian mission, is located approximately seven miles northwest of Sallisaw and three miles south of Marble City.

Sallisaw also has the distinction of being the home town of Angus McDonald who wrote the book entitled *Old McDonald had a Farm*. McDonald lived on a farm approximately one mile south of Sallisaw.

Stilwell. — (elevation 1,108 feet, 1960 population 1,916). Stilwell, the county seat of Adair County,

is in the heart of the strawberry-growing country and is called "The Strawberry Capital of the World." Each year in May, a strawberry festival is held to celebrate the new crop. Stilwell is the home of a large cannery and frozen-food plant. The famous "Dogwood Tour" through the Cookson Hills passes through Stilwell on U. S. Highway 59.

The old Fairfield Mission, three miles southwest of Stilwell, was established in 1829 by Dr. Marcus Palmer, having been moved from Pope County, Arkansas, where it was known as the Mulberry Mission.

Near the small community of Bidding Springs, 12 miles northwest of Stilwell, is Golda's Old Stone Mill, one of the country's few remaining grist mills run by water power (figs. 33, 34). Built between 1830 and 1840, it was operated for many years by Dr. Nickolas Bidding and was known as Bidding Springs Mill. Today the mill is operated for the benefit of tourists.



Figure 33. Wooden mill-wheel at Golda's Old Mill near Bidding Springs.

Tahlequah. — (elevation 864 feet, 1960 population 5,840). Tahlequah, the county seat of Cherokee County, became the capital of the Cherokee Nation on September 6, 1839, at which time the constitution of the Cherokee Nation was adopted.



Figure 34. Building housing Golda's Old Mill.

The town was laid out in 1843 and in 1844, a two-story building was erected south of the public square to house the Supreme Court. The *Cherokee Advocate*, first legal newspaper in Oklahoma, was established here on September 26, 1844. By an act of the Cherokee Council in December, 1867, the Cherokee capitol was erected on the public square. The Cherokee National Prison was built in 1874.

Today the public square contains the old Cherokee capitol, now the Cherokee County courthouse. In front of the courthouse are monuments to General Stand Watie, the only full-blood Indian brigadier general in the Confederate Army, and to the Civil War dead. The supreme court building (fig. 35), and the old prison (fig. 36), are still standing.

In 1846, the Cherokees established two schools, the Female Seminary near Park Hill southeast of Tahlequah and the Male Seminary southwest of Tahlequah. The Female Seminary, which was



Figure 35. Supreme Court building of the Cherokee Nation, Tahlequah.

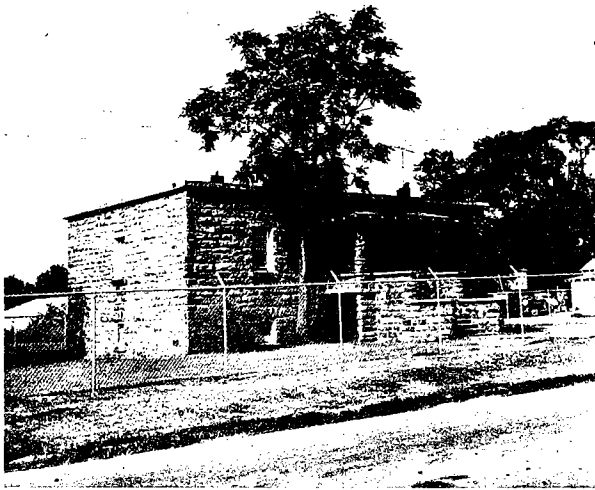


Figure 36. Old territorial prison, Tahlequah, Oklahoma.

opened in 1851, was destroyed by fire on April 10, 1887. A new building was erected in 1889 and the school was continued until statehood. The building now serves as the administration building of Northeastern State College, a coeducational institution with an enrollment of nearly 2,500.

Other important landmarks of the Cherokee Nation and the Tahlequah region are the Murrell Home (fig. 37), Worcester (Park Hill) Mission, Riley's Chapel, the Presbyterian Mission, the Old Methodist Church, and the Baptist Mission.

Vinita. — (elevation 702 feet, 1960 population 6,027). Vinita was named by Colonel E. C. Boudinot, a Cherokee Indian leader, in honor of Vinnie



Figure 37. Murrell Home, a famous landmark near Park Hill.

Ream, a sculptress. Vinita is the site of Eastern State Hospital for the mentally ill. Will Rogers Memorial Rodeo is held in Vinita each year.

Wagoner. — (elevation 588, 1960 population 4,469). Wagoner, county seat of Wagoner County, was named for a train dispatcher, "Bigfoot" Wagoner. Wagoner is the gateway to Fort Gibson Reservoir and Sequoyah State Park, which are about nine miles southeast of town. Wagoner's economy is based upon income from sportsmen and vacationists as well as upon agriculture.

HISTORICAL MARKERS IN OKLAHOMA OZARK AREA

The Oklahoma Historical Society has placed roadside markers at or near the site of famous landmarks in Oklahoma. Many of these are in northeastern Oklahoma, a region rich in the history of development of the State of Oklahoma. A brief description of these has been taken from a booklet, *Mark of Heritage*, published by the Oklahoma Historical Society, 1958, and edited by Wright and Shirk.

Chouteau's Post Marker. — Located on the public school grounds at Salina, Mayes County. Inscription reads:

Oldest permanent American settlement in State. Grew out of Chouteau's fur trade at St. Louis with Osages after they settled in this region in 1802 from Missouri. Improvements here in 1817 became residence of Col. A. P. Chouteau, West Point Grad., noted in western U. S. official life and for many posts in Indian trade.

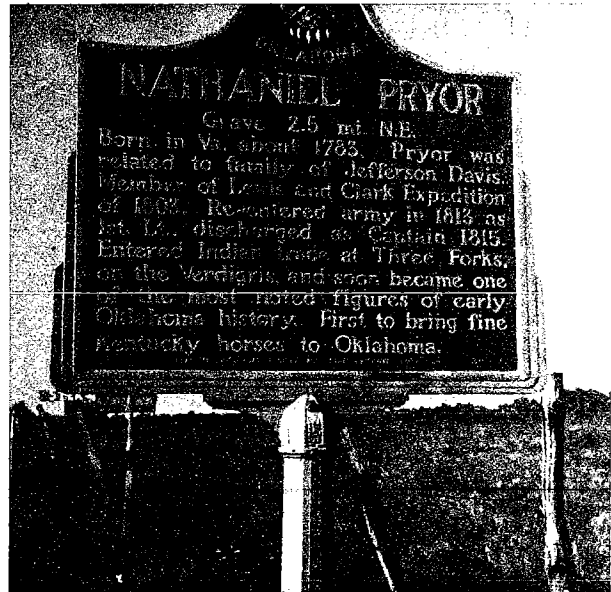


Figure 38. Sign on Highway 69 near Pryor, Oklahoma.

Nathaniel Pryor Marker. — Located on U. S. Highway 64, four miles south of Pryor, Mayes County (fig. 38). Inscription reads:

Born in Va. about 1783, Pryor was related to

family of Jefferson Davis. Member of Lewis and Clark Expedition of 1803. Re-entered army in 1813 as 1st Lt., discharged as Captain, 1815. Entered Indian trade at Three Forks, on the Verdigris, and soon became one of the most noted figures of early Oklahoma history. First to bring fine Kentucky horses to Oklahoma.

Union Mission Marker. — Located on U. S. Highway 69 about two miles north of Mazie, Mayes County (fig. 26). Inscription reads:

Site selected by Rev. E. Chapman of United Foreign Miss. Soc., and Nathaniel Pryor. Mission organized for Osages 1820, Rev. Wm. P. Vaill, Supt., and first school in Oklahoma opened on Sept. 1, 1821. First printing press located there by Rev. Samuel Worcester, and "The Child's Book," first book published in Oklahoma, 1835.

Fort Gibson Marker. — Located on public school ground at Fort Gibson, Muskogee County, U. S. Highway 62. Inscription reads:

Founded April 21, 1824, by Col. Matthew Arbuckle, 7th Inf., farthest west in chain of forts, north to south, to guard western frontier. Named for Col. George Gibson. More than 100 West Point graduates, including Lt. Jefferson Davis, served at Ft. Gibson during the 26 years before the Civil War. Hdqtrs. of Gen. Zachary Taylor, 1841. Abandoned as military post, 1890.

Webbers Falls Marker. — Located on U. S. Highway 64, west end of the bridge on Arkansas River at Webbers Falls, Muskogee County. Inscription reads:

Named for Walter Webber, Western Cherokee chief, who had a fur trading post here. Home of "Rich Joe" Van to 1844, owner of "Lacy Walker," famous quarter mile race horse, for which he named his Mississippi River steamboat. In Civil War battle, April 25, 1863, Webbers Falls was burned by Federal troops.

Tahlonteeskee Marker. — Located on U. S. Highway 64 about two miles east of Gore, Sequoyah County, and east of the Illinois River. Inscription reads:

Western Cherokee capital, 1829-39, and court ground for Cherokee Nation. Named for the Chief who secured the establishment of Dwight Mission in Arkansas Ter. His brother, John Jolly, served at this capital as chief, and Sam Houston often visited here. It was Chief Jolly who had given Houston the famous name "The Raven" — Colonah — an old Cherokee war title.

Dwight Mission Marker. — Sign is located on U. S. Highway 64 east of Vian, Sequoyah County, at junction with road north to Marble City. Inscription reads:

First established in 1821, among Western Cherokees in Pope Co., Ark. Ter., by Rev. C. Washburn, American Bd. of Foreign Missions.

Moved to this new land of the Cherokees in Ind. Ter., 1829. Site of Nicksville, postoffice named for Gen. John Nicks, whose widow, Sarah Perkins Nicks, was first woman appointed to U. S. government position in Oklahoma, 1832.

Fairfield Mission Marker. — Located about five miles south of Stilwell, Adair County, on U. S. Highway 59. Inscription reads:

Established by Dr. Marcus Palmer in 1829 under auspices of American Bd. of Foreign Missions, among western Cherokees. First located in Pope Co., Ark. Ter., and known as Mulberry Mission. Other noted missionaries of Fairfield included the Revs. Elizur Butler and Charles C. Torrey; teachers included Clarissa Palmer, Lucy Butler, Addie Torrey, and Esther Smith.

Wigwam Neosho Marker. — Located on U. S. Highway 69, one mile north of the Arkansas River bridge, Wagoner County. Inscription reads:

Was trading post in 1829-33, named and conducted by Ex-Gov. Sam Houston of Tenn., who was called Colonah (the Raven) by his Cherokee friends. As a celebrity in the Indian Ter., Houston was visited by the American author, Washington Irving, who came to this country in 1832, and made notes for his book, "A Tour of the Prairies," now an Oklahoma classic.

Seneca Agency Marker. — Located west of the Oklahoma state line in Ottawa County, just west of Seneca, Missouri, on U. S. Highway 60. Inscription reads:

Established July 4, 1832, near Buffalo Creek for the Senecas, Cayugas, Shawnees and remnants of six other tribes that came from Ohio over a Trail of Tears. As the United Nation, they signed first treaty, Dec. 29, 1832, made by U. S. Commissioners Henry Ellsworth and John Schermerhorn in Ind. Ter. Ex-Gov. Stokes, N. C., headed the Commission and was U. S. Agent for these tribes, 1836-37.

Entering Indian Territory Marker. — Sign located on U. S. Highway 66, just south of the Kansas state line, in Ottawa County. It reads:

In 1833, this area ceded to Quapaw tribe by U. S. Lands were granted Indians of 20 tribes including Seneca, Shawnee, Peoria, Miami, Ottawa, Wyandot. Wealth came to the Quapaw and to other Indians here from discovery of rich lead and zinc mines beginning 1905.

Park Hill Press Marker. — Located north of junction of U. S. Highway 62 and State Highway 82, Cherokee County. Inscription reads:

Established July 1837, Rev. S. A. Worcester, Supt. Over 25 million pages were printed in Indian languages and in English by 1861. Printers and translators were John F. Wheeler, John W. Candy, Edwin Archer, Stephen Norman. Near site are graves of Rev. and Mrs.

(Ann Orr) Worcester, and the noted Cherokee, Elias Boudinot.

Watie and Ridge Marker. — Located on State Highway 10 several miles north of junction with State Highway 25, Delaware County. It reads:

Stand Watie and his cousin, John Ridge, signed 1835 treaty for the Cherokee removal from Georgia to Ind. Ter., which caused a tribal feud. Ridge, young and talented, was assassinated, but Watie escaped their enemies. Later he was southern Cherokee leader and only Indian commissioned Brig. Gen. in the Confederate States Army.

Fort Wayne Marker. — Located on State Highway 20, about one mile west of the Arkansas line, Delaware County. Inscription reads:

Established in autumn 1839 by Lt. Col. R. B. Mason and 1st Dragoons, U. S. Army, and named in honor of Gen. "Mad" Anthony Wayne. Abandoned on May 15, 1842. Here in July 1861 Col. Stand Watie established a Confederate Army post and organized the Cherokee Mounted Rifles. Captured by Federal troops October 22, 1862, in engagement known as Battle of Fort Wayne.

Baptist Mission Marker. — Located at junction of U. S. Highway 62 and U. S. Highway 59 about a half mile west of Westville, Adair County. It reads:

Established by Rev. Jesse Bushyhead in 1839, and known as Bread Town by the Cherokees. Rev. Evan Jones was missionary in charge. The *Cherokee Messenger* printed there in August, 1844, was first periodical in Oklahoma. Mission moved to Tahlequah, 1867. Bacone College at Muskogee, still in operation, is outgrowth of the school at Baptist Mission in Tahlequah.

New Springplace Marker. — Located on State Highway 33, three miles north of Oaks, Delaware County. Inscription reads:

Cherokee Mission established by Moravian Church 1842, was outgrowth of mission begun by Springplace, Ga., in 1802. Church members were from noted Cherokee families named Adair, Fields, Hicks, McNair, Ridge, Vann, Ward, Watie. New Springplace mission transferred to Danish Lutheran Church in 1902.

Old Military Road Marker. — Located at the junction of State Highway 82 and 85, two miles west of Ketchum, Craig County. It reads:

Old Military Road crossed here: Ft. Gibson (est. 1824) to Ft. Leavenworth. Two Cabin Creek battles in Civil War fought at old ford 5 mi. SW Ketchum is last; the first store, 1860, and a stage stand were at old Sulphur Springs camp ground near here.

Fort Davis Marker. — Located on U. S. Highway 62, one mile east of Bacone, Muskogee County. It reads:

Established Nov. 1861 by General Albert Pike,

C. S. Army. Named for Pres. Jefferson Davis, who had been stationed in this region when a Lieut., U. S. Army. Nearly one million dollars spent on this post by Confederates. In second Federal invasion, Ft. Davis destroyed Dec. 27, 1862, by U. S. troops including Third Indian Home Guard Regt. under Col. W. A. Phillips.

Battle of Honey Springs Marker. — Located on U. S. Highway 69 south of Oktaha, Muskogee County. Inscription reads:

Site 2 mi. east where on July 17, 1863, Gen. J. G. Blunt with Union force of 3,000 men attacked a Confederate force under Gen. D. H. Cooper, encamped on Elk Creek. Superior arms and equipment forced the Confederates to withdraw suffering heavy losses.

Cabin Creek Battlefield Marker. — Located on U. S. Highway 69 north of Patton, Mayes County. Inscription reads:

On Sept. 18, 1864, a Confederate force of 2,000, mainly Gen. Stand Watie's Indian Brigade, intercepted a Union supply train enroute from Kansas to Ft. Gibson. The convoy of 130 wagons with supplies worth \$1.5 million was captured after a heavy engagement. Last major Civil War engagement in Indian Territory.

Union Agency Marker. — Located in parkway at entrance to VA Facility on U. S. Highway 64, west side of Muskogee. It reads:

Established July 1, 1874. Consolidated U. S. Indian Office for Five Civilized Tribes. Cornerstone of old stone building here laid Aug. 18, 1875, in ceremony led by Agent G. W. Ingalls, with address by Wm. P. Ross, Chief, Cherokee Nation; first Masonic cornerstone laying in the state, led by Rev. J. S. Murrow, Acting Grand Master in Indian Territory.

Entering Indian Territory Marker. — Located on U. S. Highway 64 just west of state line at Moffett, Sequoyah County. Inscription reads:

Home of the Five Civilized Tribes. Ft. Smith, founded 1817, was first U. S. fort in Ind. Ter. Along here the first highway in Oklahoma, 56 mi. from Ft. Smith to Ft. Gibson, was completed in 1827. Gen. Zachary Taylor, stationed at these posts in 1841-45 and later President of U. S., traveled this highway.

SOME NOTED MEN IN THE HISTORY OF NORTHEASTERN OKLAHOMA

Adair, William P. — Assistant principal chief of the Cherokees, encouraged education. He stood for the rights of the Indian and was in favor of keeping the Indian Territory intact for the Indians.

Boudinot, Elias. — A Cherokee Indian educated in Cornwall, Connecticut, where he met and married a white lady. He was described as being a man of great talent and ability. He was accused of betraying his country because he was among the minority group that signed the Treaty of New Echota in 1835 that resulted in the last removal of

the Cherokees from the east. He was murdered, it is thought, by members of the opposing Ross faction in 1839.

Boudinot, Elias C. (1835-1890) — Elias C. Boudinot was the son of Elias Boudinot. He was noted as a Cherokee lawyer, soldier, and educator. He was a nephew of Confederate General Stand Watie and achieved the rank of colonel in the Confederate Army. He was well known as a writer and speaker.

Bell, Capt. J. R. — J. R. Bell is known for leading a party down the Arkansas River in 1820. He gave an accurate description of the country along the Arkansas.

Butler, Rev. Elizur. — Served as head of the Fairfield Mission after the retirement of Dr. Marcus Palmer. Fairfield Mission was located near the present site of Stilwell in Adair County.

Catlin, George (1796-1872) — He was renowned as an American traveler and artist. He spent a great amount of time among the Indians of North America, painting and writing about them. His pictures are noted for their color and fine detail. He wrote several books on Indians including: *Manners, Customs and Conditions of the North American Indians*; *North American Portfolio*; and *Last Rambles Among the Indians*.

Chouteau, Auguste Pierre (1786-1838). — A member of the Chouteau family of traders of St. Louis. He was a graduate of the United States Military Academy and for a time served on the southwestern frontier. He is most noted for the trading posts he operated on the Saline, Grand, and near the mouth of the Verdigris Rivers, where he traded largely with the Osage Indians. Salina in Mayes County is the site of his first trading post in Oklahoma Territory.

Irving, Washington (1783-1859). — A noted author and world traveler. About 1832 he traveled from St. Louis into Indian Territory, stopping at Chouteau's Trading Post and Fort Gibson. From there he traveled with a troop of rangers into what is now central Oklahoma. He passed through or near where Norman and Oklahoma City now stand. His book, *A Tour of the Prairies*, gives an excellent description of his experiences on the trip.

Jolly, Chief John. — He was principal chief of the Cherokees in Arkansas and was a signer of the treaty in 1817, which provided for the exchange of Cherokee land in the east for land in Arkansas.

McCoy, Isaac (1784-1846). — Isaac McCoy is famous for his work in Baptist missions. He was influential in establishing the Indian Territory and in the removal of the Indians. Much of his time in Indian Territory was spent surveying boundary lines of the various Indian Nations, and at the same time he was active in establishing schools and missions.

Nuttall, Thomas (1786-1859). — Thomas Nuttall was an English naturalist famous for the study of the flora, fauna, and geology of the United States. In 1818, he made a trip into Indian Territory where he made scientific investigations along the Red,

Arkansas, Kiamichi, Grand, Verdigris, South Canadian, North Fork, Deep Fork, and Cimarron Rivers in what is now Oklahoma. When not on scientific expedition, he was in Philadelphia studying and writing. He was capable of writing equally well on botany, zoology, and geology.

Palmer, Dr. Marcus. — Founded Fairfield Mission in 1829 near the present site of Stilwell.

Pryor, Nathaniel (1783-1850). — Nathaniel Pryor was born in Virginia but went to Kentucky at an early age. He accompanied Lewis and Clark on their famous expedition to the mouth of the Columbia River. He attained the rank of captain in the U. S. Army and was active in the War of 1812. After resigning from the army he operated a trading post at Three Forks. He imported fine horses from Kentucky, which he sold to the wealthier Indians. Pryor Creek and the county seat of Mayes County are named for him.

Ridge Major. — Major Ridge was a full blood Cherokee Indian born near Hiawasse, Georgia, about 1771. He was active in the War of 1812 and served under General Jackson in the Creek War. He believed the only solution to the Indian's problem was removal to beyond the Mississippi River and was a signer of the Treaty of New Echota which later resulted in his death. He was assassinated on the morning of June 22, 1839, supposedly by the Ross faction, who were not in favor of removal.

Ridge, John. — John Ridge, the son of Major Ridge, was born in Georgia about 1801. After attending a Moravian mission school and an academy in Knoxville, Tennessee, he attended the Mission School at Cornwall, Connecticut. While there he met and married Sara Northrop. He, along with his father, Major Ridge, was a signer of the Treaty of New Echota and was murdered on the same day as was his father.

Ross, John. — John Ross was born near Lookout Mountain, Tennessee. His father was of Scotch descent and his mother was Scotch with one-fourth Cherokee blood. He served as adjutant under Jackson in the campaign against the Creeks. In 1827 he became assistant chief of the Cherokees and in 1828 became the principal chief of the Eastern Cherokees. After their removal to the West he became chief of the United Cherokee Tribe and held that position until his death. In spite of the faction that was against him, he held the position of principal chief for a period of forty years (Wright and Thoburn, 1929, p. 143).

Sequoyah (George Guess) (1770-1843). — George Guess was the son of a Cherokee mother and a white father. Even though he could not read and write English, he invented the Cherokee alphabet consisting of 85 symbols representing the various sounds of the Cherokee language. He made it possible for thousands of his people to read and write. The *Cherokee Phoenix*, edited by Elias Boudinot, was printed with columns of English and Cherokee

side by side on the page, making it possible to compare one with the other.

Watie, Stand (1806-1871). — Stand Watie was a Cherokee leader and general. His father was a full blood Cherokee and his mother was half Cherokee and half white. He was a brother of Elias Boudinot, whose real name was Buck Watie. He was a nephew of Major Ridge. Stand Watie was one of the signers of the Treaty of New Echota, along with Elias Boudinot, Major Ridge, and John Ridge, and was marked for assassination along with them but was forewarned and escaped. At the outbreak of the Civil War Stand Watie joined the Confederate forces and led a regiment of Cherokees throughout the War. He was said to have been the last Confederate general to surrender.

Worcester, Rev. Samuel A. (1798-1859). — Rev. Samuel A. Worcester came to Georgia as a missionary from Boston in 1825 to bring Christianity to the Cherokee Indians. He was sentenced and placed in prison for ignoring Georgia laws concerning white people living in the Cherokee Nation. After it became apparent that the Cherokees would not be able to live in peace in Georgia and after the signing of the Treaty of New Echota, he decided to move his missionary work into the western Cherokee Nation. In 1835 he became superintendent of Park Hill Mission near Tahlequah. Here he set up the first printing press in Oklahoma and published the *Cherokee Almanac*. He also translated and printed extracts from the Bible for the Cherokees to read, using Sequoyah's alphabet.

Chapman, Epaphrus. — He helped establish Union Mission in 1821, which was located about seven miles southeast of the present town of Chouteau on the west bank of the Grand River in Mayes County. At this time the area was occupied by Osage Indians. This was the first mission to be established in what is now Oklahoma. Reverend Chapman served as its head until his death in 1825, at the age of 32. Today his grave is preserved near the place where the mission stood.

Rogers, Chief W. C. — W. C. Rogers was elected principal chief of the Cherokee Nation in 1903. He was the last principal chief and remained in office until 1914 for the purpose of signing deeds of transfer of Cherokee lands.

Owen, R. L. — R. L. Owen, a Cherokee attorney, along with Thomas P. Gore, was the first United States senator from Oklahoma. He served as senator from 1907 to 1925.

Haskell, Charles N. — Charles N. Haskell was the first governor of Oklahoma. He was born in Ohio in 1860 and moved to Muskogee in 1901. Here he was successful in business. He founded the *New State Tribune* newspaper and through it helped to arouse a movement for statehood. He was elected to the constitutional convention in 1906 and was the majority floor leader. In 1907 he was elected governor and held office from 1907 to 1911.

Mayes, Joel B. — The Mayes family was one of the outstanding early families in Indian Territory.

One of the more illustrious members of the Mayes family was Joel B. Mayes, son of Samuel and Nancy Mayes. He was born in Georgia in 1833 and was brought to Indian Territory by his parents in 1838. He was graduated from the Male Seminary at Tahlequah in 1855 and taught two school terms near the present site of Stilwell, in Adair County. He joined the Confederacy and reached the rank of major and brigade quartermaster. He served under General Stand Watie. In 1887 he was elected chieftain of the Cherokee Nation (Meserve, 1937, p. 59).

HISTORICAL SITES IN NORTHEASTERN OKLAHOMA (from Oklahoma Historical Society, 1958)

Adair County:

1. Going Snake's Grave, 1½ mi. east of Ballard, noted Cherokee before 1850. Also Going Snake Court House, Going Snake District, Cherokee Nation, 2nd site, 4 mi. west of Westville (sec. 33, T. 18 N., R. 25 E.).
2. "Bread Town," Baptist Mission, Cherokee Nation, 1939, about 3 mi. N. Westville (sec. 13, T. 18 N., R. 25 E.).
3. "Going Snake Massacre" in April, 1872; site 9 mi. S. W. Westville, near Christie and near site of 1st Going Snake Court House, Cherokee Nation (SE¼ sec. 18, T. 17 N., R. 25 E.).
4. Site of assassination of Major Ridge, 1839, 4½ mi. E. Baron, near Arkansas line and Snake Mt.
5. Duncan O'Bryant's Grave — Baptist Mission, D. 1834 — founded "New Hope Baptist Mission," 1832; site of grave in sec. 4, T. 16 N., R. 26 E., N. W. Piney School.
6. Flint Post Office (first site) in SE sec. 20, T. 16 N., R. 25 E. 1846.
7. Flint Post Office (2nd site) Masonic Lodge at Dannenburg's place N.W. edge of Stilwell.
8. Fairfield Mission, 2 mi. S. W. Lyons (NE¼ sec. 35, T. 15 N., R. 24 E.).
9. Bidding Spring, Old Mill, about 9 mi. N. W. of Stilwell (sec. 16, T. 16 N., R. 24 E.).
10. Scott Cemetery — Old Cherokee burial customs — about 5 mi. S. W. Lyon's Cemetery, near present schoolhouse.
11. Fort Wayne, 1st site just east of Watts, 1838 (sec. 19, T. 19 N., R. 26 E.). (Fort moved N. to edge Beattie's Prairie, Delaware Co.).
12. Old Bryan House. Col. Joel M. Bryan. 7 mi. E. of Stilwell (1883).

Cherokee County:

1. Cherokee Capitol at Tahlequah, erected by order of Cherokee Council 1867, and completed early 1870's. Tahlequah site of signing of Cherokee Constitution, 1839, and designated by Cherokee Council as capital of the Nation in 1841. Other historical buildings and sites at Tahlequah include:

- (a) Cherokee Supreme Court building erected 1844, standing, housed printing press of *Cherokee Advocate*, first newspaper in Oklahoma, 1844.
 - (b) Cherokee National Prison, building standing, erected 1874.
 - (c) Presbyterian Mission School, 1890, now houses Cumberland Presbyterian Church.
 - (d) Old Methodist Church, replica of Sehon Chapel (see below) and built of same bricks, 1888.
 - (e) Baptist Mission site, established here 1867 by Rev. Evan Jones and his son, John B. Jones. First building stood about 100 yards N. of present Tahlequah High School, and second building of brick was on site of this High School.
 - (f) Bacone College, established 1880, by Rev. Almon C. Bacone. Started in the building that had been recently occupied by the late W. Buff Wyly. Known first as "Indian University." Moved to Muskogee 1882, and named Bacone College.
2. Illinois Camp Grounds, 1839, site of convention Eastern and Western Cherokees, 1½ mi. S. E. Tahlequah.
 3. Park Hill Mission, 1836, Park Hill Press here and Worcester Cemetery, at Park Hill 3 mi. S. Tahlequah (SW¼ sec. 22, T. 16 N., R. 22 E.).
 4. Cherokee Female Seminary, 1851, site ½ mi. N. E. Park Hill (SW¼ sec. 15, T. 16 N., R. 22 E.).
 5. Cherokee Male Seminary, 1852, site 2½ mi. N. W. Park Hill (NE¼ sec. 5, T. 16 N., R. 22 E.).
 6. Mission at Forks of the Illinois, 1829; site 3 mi. E. Park Hill.
 7. Cherokee Agency, 1853, 3 mi. N. W. Tahlequah (NW¼ sec. 19, T. 17 N., R. 22 E.).
 8. Riley's Chapel, Methodist, 1844, on site of Balentine home, 2 mi. S. E. Tahlequah.
 9. Murrell House ("Hunter's Home"), 1844, standing ½ mile S. Park Hill (NW¼ sec. 22, T. 16 N., R. 22 E.).
 10. Chief John Ross Home ("Rose Cottage"), 1840's, site ½ mi. S. E. Park Hill.
 11. Old Ross Cemetery, about ½ mi. from site of Ross Home. Here is grave of Chief John Ross (NW¼ sec. 23, T. 16 N., R. 22 E.).
 12. Cherokee Training School, buildings 5 mi. S. Tahlequah, 1903.
 13. Sehon Chapel, Methodist, 1 mi. E. Park Hill, 1850's.
 14. Hinton House built by an Old Settler Cherokee (ca. 1840's), purchased by Chief John Ross for one of his daughters. House standing near Murrell House, q.v., on left side of road.
 15. Springplace Mission established by Moravian Church 1838. Old walled spring and mission graves several yards east of spring to be seen. Site south of Cherokee-Delaware Co. line (and S. W. of Oaks in Delaware Co.) (NE¼ sec. 5, T. 19 N., R. 22 E.).
- Craig County:*
1. Willie Halsell College, 1891, site at Halsell and Thompson St., in Vinita.
 2. Blue Jacket on State Highway 25; S. E. about 1 mi. is old Shawnee cemetery; name of Shawnee Indian family, descendants of noted Chief Blue Jacket, settled here 1869.
 3. Old Military Road, Fort Gibson to Fort Leavenworth and Fort Scott, traces 2 mi. W. of Ketchum, 1830's; site of stage stand, 1860's, and store, about ¼ mi. N. E. of Sulphur Spring crossing on Mustang Creek (NE¼ sec. 27, T. 24 N., R. 21 E.), 2 mi. N. W. Ketchum.
- Delaware County:*
1. Seneca Agency, 1832, first site, agency established by Gov. Montfort Stokes (So. Car.), about 1½ mi. S. W. of Tiff City, Mo., on Buffalo Creek, W. of Oklahoma state line.
 2. Splitlog Church, 1896, at Cayuga, about 9 mi. N. W. Grove; church of stone erected by Chief Mathias Splitlog, and his carriage house standing W. of big spring by county road.
 3. Stand Watie's farm home on Honey Creek, 5 mi. S. and 1 mi. E. of Grove (NW¼ NW¼ SE¼ sec. 33, T. 24 N., R. 24 E.).
 4. Stand Watie's Home (on W. side of Grand River at time of death), family burial plot here; site on present "Monkey Island," peninsula of Grand Lake between two prongs of lake, about 6 mi. W. of Grove.
 5. Graves of Stand Watie and Major Ridge at Polson Cemetery, about 2 mi. N. W. Southwest City, Mo., and W. of Oklahoma state line (SW¼ sec. 28, T. 24 N., R. 25 E.).
 6. Battle of Cowskin Prairie, June, 1862 (Ohio Cavalry vs. Gen. Stand Watie) about 2 mi. N. E. of Grove; Cherokee Emancipation Act 1863, approved in Cherokee Council this vicinity, Chief Thos. Pegg.
 7. Fort Wayne, second (permanent) site, 1839; site 2 mi. west of Oklahoma line in sec. 28, T. 22 N., R. 25 E. Battle of Fort Wayne here, Oct. 22, 1862. Federal forces under command of Gen. Wm. Blunt defeated Gen. D. H. Cooper's Confederate troops.
 8. Saline Courthouse, Saline District, Cherokee Nation, 1840's; site about ¾ mi. W. of Leach near Mayes County line. Saline Courthouse massacre here, 1897.
 9. Beattie's Prairie, S. edge is location of J. P. Edmonson home and farm (Cherokee), about ¾ mi. from site of old Fort Wayne. Edmonson was member of Oklahoma Constitutional Convention.
 10. Danish Lutheran Church and Mission (SE

sec. 33, T. 20 N., R. 23 E.) established at Oaks in 1902, is outgrowth of Springplace Mission which was established in 1842 at site about 1½ mile S. W. of Oaks. (see Cherokee County for site of Springplace Mission.)

11. Dripping Springs, noted scenic site 2 mi. E. of present Flint P. O. 1898 (first called Beckwith); this was the third Flint Post Office.
12. Hildebrand's Mill. Post Office 1886. (SW¼ sec. 24, T. 20 N., R. 24 E.).

Mayes County:

1. Union Mission, 1820, first mission station in Oklahoma; site sec. 16, T. 19 N., R. 19 E., about 5 mi. N. E. Mazie.
2. Col. A. P. Chouteau residence (1822), and site of first permanent American settlement in Oklahoma, around 1804 at Salina; salt works here.
3. Nathaniel Pryor's grave, 1831; with Lewis and Clark Expedition to Pacific in 1803; military service and trader at Three Forks; location of grave about 3½ mi. S. E. Pryor (NW¼ sec. 33, T. 21 N., R. 19 E.).
4. Hopefield Mission by the A.B.C.F.M., for Osages 1823; site about 1 mi. S. E. of Pensacola, north side of Grand River on old Ft. Gibson road (SW¼ sec. 24, T. 23 N., R. 20 E.).
5. Battle of Cabin Creek (2nd battle), October, 1864, Gen. Stand Watie, C. S. A., defeat of Federal forces and capture of \$1,000,000 wagon train; site SE¼ sec. 12, T. 23 N., R. 20 E. (property of Vinita Chapter, United Daughters of the Confederacy).
6. Old Pensacola Post Office, early 1890's, old Martin home on site; located 1 mi. E. of present Pensacola (sec. 26, T. 23 N., R. 20 E.).
7. Battle of Locust Grove, 1862, Col. Stand Watie and Col. John Drew, in command of Confederate forces; battle site known as "Pipe Springs," in SE¼ SW¼ sec. 23, T. 20 N., R. 20 E.
8. Markham's Ferry (1893), site about 1 mi. downstream from the Mayes Bridge between Locust Grove and Pryor. Locust Grove is on Markham's Prairie. Leroy Markham (Cherokee) home site (1835) and old cemetery (his grave here) are on southwest corner of Markham's Prairie, in SW¼ SW¼ SW¼ sec. 31, T. 20 N., R. 20 E. Old salt lick site about 1½ mi. S. of the home site, operated by Markham in 1830's.

Muskogee County:

1. La Harpe's Expedition (French), 1719, to Tawakoni Indian village on Arkansas River, in vicinity of present Haskell and east to river; first Indian council with European nation in Oklahoma.
2. Battle between Pushmataha's hunting band

(Choctaw from Mississippi) and Joseph Bougie's trader group near mouth of Verdigris River, 1807; site probably in Muskogee County, north of Arkansas River, and E. of bridge on Arkansas River.

3. Fort Gibson established 1824, site and history significant and well known; east side of Grand River at town of Ft. Gibson.
4. Union Agency, established 1874, stone building standing on hill and north of Veterans Hospital, at Muskogee, houses Five Civilized Tribes Museum.
5. Fort Davis, Confederate Army post, 1861-62; Indian mound marks center of this extensive fort; site located 1 mi. N. of Bacone College, overlooking Arkansas River, N. E. of Muskogee (SE¼ sec. 7, T. 15 N., R. 19 E.).
6. Old Creek Agency, 1851-1874, near Fern Hill; site in S½ sec. 8, T. 16 N., R. 19 E.). Important sites here:
 - (a) Battle on east side of the community, between Creek and Cherokee Confederate forces and Cherokee and Osage Union forces.
 - (b) Agency location, footings, and bermuda grass on grounds.
 - (c) John Bemo (Seminole teacher and Baptist preacher) 1844; his homestead on south side of the community, his grave with marker.
 - (d) About ¼ mi. W. of Agency building site is site of Creek Indian court house for Muskogee District, Creek Nation 1868.
7. Rabbit Ford and Ferry, 1834, located 2½ mi. E. of original site of Muskogee (i. e. R. station), on Arkansas River near noted landmark of "Frozen Rock," in stream, on road to Fort Gibson. Site of Shorey Coodey home, near "Frozen Rock," 1830's.
8. Nevens Ferry, early 1880's, N. E. of Muskogee, on Arkansas River about 4½ mi.; site below mouth of the Grand River.
9. Battle of Elk Creek or "Honey Springs," July 17, 1836; major battle in Indian Territory during Civil War; battle formation of Union forces located about 1 mi. to 1½ mi. E. of present Oktaha, the fighting continuing south to the last attack vs. Confederate forces at Honey Springs, south side of Elk Creek at Honey Springs Confederate depot and supply camp; spring and site about 3 mi. S. in present McIntosh County, q. v.
10. Webbers Falls, first called "La Cascade" on old maps; falls in Arkansas River here noted by Lt. James B. Wilkinson were 7 feet high in 1806; settled by Walter Webber, Cherokee, 1829; Civil War battle fought here April 24, 1863; Stand Watie's forces defeated.
11. Briartown Cemetery, grave of Spring Frog (died 1859), Cherokee, marked by unusual stone bearing inscription in Cherokee language.

12. Tilden Camp Ferry, 1870's and 1880's on Canadian River, 2 mi. S. of Briartown, near present bridge on State Highway 2.
13. Cherokee Agency. First agency for Western Cherokees. E. bank of Bayou Manard (NE $\frac{1}{4}$ sec. 12, T. 15 N., R. 20 E.).
14. David Vann salt works. (SW $\frac{1}{4}$ sec. 17, T. 12 N., R. 20 E.).
15. Belle Starr headquarters (and her home) 6 mi. W. of Tilden Camp Ferry; site on Belle Starr Creek; her grave in vicinity.
16. Robertson Memorial Church built by Judge N. B. Moore, of the Creek Nation, and his wife, Augusta Robertson Moore, at Haskell, site of the Judge Moore ranch home is near the Arkansas River, east of Haskell.
17. Alice Ross Howard's home at Ft. Gibson, erected for Ranger troops in 1830's.
18. Grave of Chief Justice John Martin, of the Cherokee Nation (1839-1840), south of old stockade at Ft. Gibson.
19. Ruins of Fort Blunt breastworks (Ft. Gibson, 1863-65) between old stockade and Military Park at Ft. Gibson.
20. Citizen's Cemetery, Ft. Gibson, where many noted people were buried.
21. Traces of Military Road between Ft. Smith and Ft. Gibson, 1828, south of Ft. Gibson.

Ottawa County:

1. Old U. S. Military Trail about 1828 from Fort Leavenworth to Fort Gibson entered the Indian Territory near present U. S. Highway 64 on State line and thence south; in use long after Civil War days.
2. Seneca Agency site about 2 mi. W. of Oklahoma line and W. of Seneca, Mo.; agency location here in 1830's to 1861.
3. Wyandotte Boarding School, 1872, at Wyandotte (now Seneca Boarding School) one of early buildings still standing here.
4. Crawford, Seminary, Methodist school for Quapaw, 1834; site on Spring River, on Fort Leavenworth-Fort Smith road, in vicinity of mouth of Fivemile Creek.
5. Devil's Promenade on Spring River (ledge of rock on river), and the Quapaw powwow grounds a few hundred yards west where Quapaw Indians have held councils and powwows for many years.
6. Modoc Cemetery dating from 1874, with settlement of Modoc on reservation here; location about 2 $\frac{1}{2}$ mi. W. of Missouri-Oklahoma line.
7. Old Peoria Schoolhouse, still standing from 1874; location sec. 18, T. 28 N., R. 24 E.
8. Old Ottawa Cemetery, 1870's, noted Ottawa leaders buried here; site at Ottawa Baptist Church at Ottawa.
9. St. Mary's Mission (Catholic), 1893, founded among Quapaw Indians by Father William Ketcham; location 2 mi. E. of Quapaw and 1 $\frac{1}{2}$ mi. from old Lincolnville station.

Sequoyah County:

1. Dwight Mission, established among Cherokees in Indian Territory, 1830; location about 3 mi. S. W. of Marble City (NW $\frac{1}{4}$ sec. 2, T. 12 N., R. 23 E.), old mission cemetery with graves dating back to early 1830's on north side of mission grounds; property now owned by United Presbyterian Church Synod of Oklahoma, with many buildings of later day now used for assembly and convention meetings.
2. Tahlonteeskee, capital of the Cherokees West, 1829-1939; site on N. side of Deep Creek to west of County road, about 2 mi. E. of Gore and $\frac{1}{2}$ mi. N. U. S. Highway 64 (NE $\frac{1}{4}$ sec. 16, T. 12 N., R. 21 E.).
3. Home of Chief John Jolly, Western Cherokee Chief and friend of Sam Houston, 1830-32; site near that of Tahlonteeskee (see above) in NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 16, T. 12 N., R. 21 E. Chimney stones and vine covered tree now seen on site of Jolly's house.
4. Sequoyah's Home — famous inventor of Cherokee alphabet — erected 1830's (Log house now enclosed as historic shrine by State of Oklahoma); location about 10 mi. N. E. of Sallisaw in sec. 15, T. 12 N., R. 25 E.
5. Mackey's Salt Works operated by Samuel Mackey, 1828, an important industry here before the Civil War; site inundated in secs. 11 and 14, T. 13 N., R. 21 E., about 9 mi. N. E. of Gore.
6. Illinois District Courthouse, Cherokee Nation, near James Mackey's place on Military Road, 1848; site on E. side of Illinois River, about 2 mi. N. W. of present Blackgum Store (NW $\frac{1}{4}$ sec. 6, T. 13 N., R. 22 E.).
7. Childers Station on Muskogee-Fort Smith Road, 1870's; located about $\frac{1}{2}$ mi. S. of Sallisaw cemetery where original log house stands today (SW $\frac{1}{4}$ sec. 9, T. 11 N., R. 24 E.).
8. Lees Creek Mission, provided for by Cherokee National Council, 1848, and opened early 1850's; site about 2 mi. S. E. of present Nicut (NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 27, T. 13 N., R. 26 E.).
9. Pierce's Chapel, Methodist, 1882, located about $\frac{1}{2}$ mi. S. E. of Muldrow Cemetery; building moved to Cottonwood and is stand-

- ing today as oldest church building in county.
10. Keetoowah Society, Cherokee organization (1859) still holds annual ceremonials about 6 mi. N. of Vian, in summer.
 11. Earliest public school in county was established by Cherokee National Council, 1848, south of present Vian (in Illinois District, Cherokee Nation).
 12. Nicksville post office established 1828, by John Nicks, on site of present Dwight Mission (this region then in Crawford County, Ark. Terr.).
 13. Sequoyah District, Cherokee Nation, log courthouse early 1830's near juncture of Black Fox Fork and Skin Bayou, and about 1/2 mi. S. were reported the trees used for hanging condemned persons; new courthouse of Sequoyah District by act of Cherokee Council, 1833, built about 2 1/2 mi. S. of first site; this new building was two-story frame, and this was sold in 1902 and material used in building Baptist Church at Maple. (2d site in SW 1/4 SE 1/4 sec. 27, T. 12 N., R. 25 E.).
 14. Salt spring granted Sequoyah by Treaty of 1828, and salt works first operated by him is 1 1/2 mi. W. of Nicut (sec. 19, T. 13 N., R. 26 E.). Spring can be seen partially walled up at foot of hill about 100 yards south of Salt Branch.
 15. Bean's Salt Works operated by Richard and Mark Bean, 1817, and noted by Col. Mathew Arbuckle and Captain Bonneville. Signs of the old salt works are visible (SE 1/4 sec. 21, T. 13 N., R. 21 E.) about five miles N. of Gore on highway to Tenkiller Lake, or about 1 mi. above where Salt Creek empties into Illinois River.

Wagoner County:

1. Ebenezer Baptist Church, a Creek mission, established 1832, first Baptist church organization in Oklahoma; site S. E. of present village of Tullahassee about 2 mi.
2. Western Creek Agency, 1828-33, and Chouteau's Trading Post; site near Falls of Verdigris, E. of river at Okay.
3. Tullahassee Mission, established in Creek Nation, by Presbyterian Foreign Board, 1848, and opened in 1850; Rev. W. S. Robertson, superintendent; site N. E. of village of Tullahassee, and in NE 1/4 sec. 27, T. 16 N., R. 18 E.
4. Koweta Mission established under authority of Creek Council, by Rev. R. M. Loughridge of Presbyterian Mission Board, 1841, and school opened 1842; site where one old building from mission days is standing on State Highway 51, north side about 1 mi. E. of present Coweta (NW 1/4 sec. 18, T. 17 N., R. 16 E.).
5. Home of Chief Roley McIntosh, 1829, at

Coweta (Town), served as leading Chief of Creek Nation to 1859.

6. Wigwam Neosho, Sam Houston's home and trading post, 1830; site about 2 mi. S. E. of Okay.
7. Osage Agency, 1832, west of Falls of Verdigris River.
8. Old Creek Agency, 1835-1853, just east of old Marshall Town, and west of Verdigris River.

IMPORTANT HISTORICAL DATES IN
NORTHWESTERN OKLAHOMA
(modified from Kent Ruth, Guide to
the Sooner State)

- 1541 Coronado crossed Oklahoma in search of legendary cities of gold. De Soto crossed the Mississippi River and visited the present eastern Oklahoma border. Their travels gave Spain her claim to the land west of the Mississippi River.
- 1673 Marquette and Joliet explored the Mississippi River.
- 1682 La Salle traveled down the Mississippi, claiming for France all lands drained by that river (including Oklahoma).
- 1763 "Peace of Paris" Treaty ceded the Louisiana Territory (including Oklahoma) to Spain.
- 1800 Louisiana Territory was returned to France by Spain.
- 1803 The United States bought the Louisiana Territory from France for \$15,000,000.
- 1806 Wilkinson Expedition crossed northeastern Oklahoma.
- 1811 Sibley Expedition visited Oklahoma.
- 1819 Nuttall, famous naturalist, visited eastern Oklahoma.
- 1821 Reverend Chapman established Union Mission on Grand River and the Fowler Expedition toured eastern Oklahoma.
- 1824 Fort Gibson, first fort in Oklahoma, was established by General Matthew Arbuckle.
- 1828 Cherokee Indians began removal from Arkansas to Oklahoma; Sequoyah moved to Oklahoma; Dwight Mission established.
- 1832 Washington Irving and Charles La Trobe visited Fort Gibson and Salina.
- 1835 Samuel A. Worcester installed first Oklahoma printing press at Union Mission and published the first book in Oklahoma.
- 1836 Samuel Worcester established Park Hill Mission southeast of Tahlequah and published *Cherokee Almanac*.
- 1839 Cherokee Indians met near site of Tahlequah and drafted their constitution.
- 1843 Tahlequah became the capital of the Cherokee Nation.
- 1844 *Cherokee Advocate*, first legal newspaper in Oklahoma, was published at Tahlequah and the *Cherokee Messenger* was published at Baptist Mission near present site of Westville.

- 1851 Cherokee Female Seminary opened near Tahlequah at Park Hill.
- 1852 Tahlequah was incorporated under Cherokee law to become first incorporated town in Oklahoma.
- 1861-1865 Civil War came to Oklahoma. Stand Watie became famous as leader of Cherokee regiment under the Confederacy. Union defeated Confederate forces at Honey Springs.
- 1866 Five Civilized Tribes freed slaves; the name "Oklahoma," meaning Red People was proposed by Reverend Allen Wright, governor of the Choctaws.
- 1867 Cherokee capitol erected in Tahlequah.
- 1871 Missouri-Kansas-Texas Railroad reached the present Kansas-Oklahoma border and was granted priority across the Cherokee Nation.
- 1889 Unassigned Lands in central Oklahoma were opened to white settlement and the first run took place on April 22, 1889.
- 1893 Creation of the Dawes Commission for purposes of liquidating affairs of the Five Civilized Tribes; Cherokee Outlet was opened for white settlement.
- 1898 Congress passed Curtis Act providing for compulsory liquidation of the Five Civilized Tribes.
- 1905 The Five Civilized Tribes met in an attempt to set up a new state to be named "Sequoyah."
- 1906 Congress passed the Enabling Act providing statehood for Oklahoma; constitutional convention met at Guthrie.
- 1907 Oklahoma was admitted to the Union as the 46th state on November 16.

GEOLOGY

AN INTRODUCTION TO GEOLOGY

Geology is defined as the science of the earth, an organized body of knowledge about the globe on which we live.

The study of geology may be divided into several branches, each branch emphasizing some special phase of geology. Some of the main subdivisions of geology are listed below.

1. *Physical Geology or Physiography* — study of land forms and processes
2. *Historical Geology* — a chronological record of history of earth
3. *Paleontology* — the study of fossil plants and animals
4. *Mineralogy* — the study of minerals in the earth's crust.
5. *Petrology* — the study of the rocks of the earth
6. *Structural Geology* — study of attitude or position of rock strata
7. *Stratigraphy* — study of sequence of layered rocks in proper order
8. *Sedimentation* — study of sediments which form sedimentary rocks
9. *Economic Geology* — occurrence and distribution of useful minerals
10. *Petroleum Geology* — nature and occurrence of oil and gas

Geologic time has been separated into five great eras, the rocks of each era being set off by great breaks in the record caused by episodes of mountain making known as revolutions. The five great eras

of geologic time are Archeozoic, Proterozoic, Paleozoic, Mesozoic, and Cenozoic. The names are derived from the aspects of life found in each subdivision.

Each era of geologic time is in turn divided into several periods; the rocks deposited during a period are known as a system of rocks. Systems of rocks are, under ideal circumstances, separated by major breaks or unconformities caused by milder earth movements known as disturbances.

Geologic periods are separated into smaller chapters of earth history known as epochs. The rocks deposited during an epoch are known as a series. Many series, but not all, are separated one from another by breaks or unconformities caused by a retreat of the sea and subsequent erosion.

In addition to the time and time-rock division terms, there is another set of divisions applied to units on the local level. The fundamental unit is the formation, a sequence of layers of the same general type of rock, which seems to be related through deposition and the top and bottom of which are mappable. Several similar-appearing formations may be mapped together as a group for convenience. Formations may be divided into members on the basis of slight differences in rock type within the major unit. Members are divisible into beds or layers.

Geologic formations and groups (and some members) have geographic names, that is, they are named for some town, creek, village, or other feature where the rock is best developed. For example, the Keokuk Formation was named for the exposures along the Mississippi River at Keokuk, Iowa.

<i>Time Divisions</i>	<i>Time-Rock Divisions</i>	<i>Local Rock Divisions</i>
Era	(no term)	Group
Period	System	Formation
Epoch	Series	Member
		Bed or layer

The Geologic Time Scale is an arrangement of the major and minor subdivisions of geologic time arranged in correct order (fig. 39). For convenience the earth movements, age in years, and the dominant type of life may be shown.

GEOLOGICAL INVESTIGATIONS IN NORTHEASTERN OKLAHOMA *

According to Drake (1897, p. 327) Thomas Nuttall made several excursions into the region during his memorable travels in eastern Oklahoma. He recorded his trips up the Arkansas River to the Verdigris River, a trip up Grand River to the salt springs near Chouteau, and short excursions into the vicinities of Sallisaw and Lee Creeks.

The first notable work of geologic nature in northeastern Oklahoma was by Drake (1897). He discussed the general stratigraphy and structure of the area and made a sketch map showing the approximate position of the Mississippian-Pennsylvanian contact.

In 1903, Major G. D. Fitzhugh investigated the economic possibilities of the St. Clair Limestone for the Kansas City Southern Railroad and prepared a report for that organization (Ham and others, 1943, p. 3). The Tahlequah and Muskogee quadrangles were mapped by Taff, and the geologic folios describing these areas were published in 1905 and 1906. The Wyandotte quadrangle was mapped by Siebenthal (1907) and the Vinita quadrangle was mapped by Ohern (1914). As a result of his work in the Wyandotte quadrangle and adjoining areas, Siebenthal (1907) published a paper entitled *The Mineral resources of northeastern Oklahoma*.

Snider (1912) published a preliminary report on the lead and zinc resources of the state. This was followed (1915) by a comprehensive report on the geology of northeastern Oklahoma with emphasis on the Chester Group and its fauna.

Schuchert (1922) discussed the fauna of certain "unmapped Devonian" units near Marble City, and Gould (1925) included the Ozark Mountain section and the Carboniferous of northeastern Oklahoma in *Index to the stratigraphy of Oklahoma*.

As a part of the series of articles, *Oil and Gas in Oklahoma*, published by the Oklahoma Geological Survey (1930), Ireland summarized the geology of Ottawa, Delaware, and Mayes Counties; Cram reviewed the geology of Cherokee and Adair Counties; and Stone and Cooper reported on the geology of northern Sequoyah County.

A report on the geology of the Miami-Picher zinc and lead district was made by Weidman (1932) and a careful study of the ore deposits of the Tri-

State district was completed by Fowler and Lyden (1932).

From 1930 to 1934, Cline made extensive studies on the Osage formations of the southern Ozark region of Missouri, Arkansas, and Oklahoma, the result of which was published in 1934. Laudon (1939) studied the stratigraphy of the Osage sub-series of northeastern Oklahoma.

The Pennsylvanian stratigraphy of the Muskogee-Porum district of Muskogee and McIntosh Counties was studied by Wilson and Newell (1937). They divided the Atoka Formation into several prominent sandstone members separated by unnamed shales.

In 1943, the Oklahoma Geological Survey (Ham and others) issued a mineral report on the St. Clair Limestone near Marble City. The same year, members of the Survey investigated the relationship between the Spavinaw Granite and the overlying Cotter Dolomite near Spavinaw, Oklahoma, and made possible more precise dating of the igneous mass (Ham and Dott, 1943).

Studies by Moore (1947) resulted in the extension of the Arkansas subdivisions of the Morrow Series into northeastern Oklahoma. Recent investigations in the Oklahoma Ozarks by graduate students and faculty of The University of Oklahoma have been summarized by Huffman (1958).

GEOLOGICAL SETTING OF THE OKLAHOMA OZARKS

Physiography.—The Ozark uplift is a broad, asymmetrical dome, which occupies an area of approximately 40,000 square miles in Missouri, Arkansas, and Oklahoma. It is bounded on the southeast by the Mississippi Lowlands, on the south by the Arkansas Valley, and on the west and northwest by the Prairie Plains homocline. The axis trends northeast-southwest, passing through the St. Francis Mountains of eastern Missouri and plunging southwestward into northeastern Oklahoma.

The Ozark region can be subdivided into three physiographic provinces (fig. 40): the Salem Platform, carved on Ordovician and older rocks; the Springfield Structural Plain, underlain largely by rocks of Mississippian age, especially the Boone chert and limestones; and the Boston Mountains, a dissected plateau capped by sandstone strata of Early and Middle Pennsylvanian age.

The Ozark uplift extends into northeastern Oklahoma, including much of Ottawa, Delaware, Mayes, Wagoner, Muskogee, Cherokee, Adair, and Sequoyah Counties. Its western boundary coincides with the position of the Grand and Spring Rivers and their eastward-flowing tributaries and the southern boundary is roughly the northern side of the Arkansas River valley. Westward, the strata pass beneath the gently dipping beds of the Prairie Plains homocline and southward beneath the Arkansas Valley syncline.

The northern three-fourths of the area is in the

* Condensed from Huffman, 1958.

GEOLOGIC TIME SCALE

ERA		TIME UNITS		OROGENIES	DATE (year s)	DOMINANT LIFE	
		PERIODS AND EPOCHS					
CENOZOIC	QUATERNARY	Recent Epoch		Cascadian	12,000	Man	
		Pleistocene Epoch			1,000,000		
	TERTIARY PERIOD	Pliocene Epoch			Laramide	70,000,000	Mammals
		Miocene Epoch					
		Oligocene Epoch					
		Eocene Epoch					
Paleocene Epoch		Nevadian					
MESOZOIC	Cretaceous Period		Palisade	200,000,000			
	Jurassic Period						
	Triassic Period						
	Permian Period				Appalachian		
PALEOZOIC	Pennsylvanian Period		Carboniferous	Marathon		500,000,000	Early reptiles Scale trees Fusulinids Amphibia Crinoids Fishes, ferns Brachiopods Sea scorpions Corals Graptolites Primitive fish
	Mississippian Period						
	Devonian Period		Acadian				
	Silurian Period						
	Ordovician Period		Taconian				
	Cambrian Period						
	PROTEROZOIC	Keweenaw Period	Pre-Cambrian	Killarney or Penokean	1,000,000,000		
Huronian Period							
ARCHEOZOIC	Timiskaming Period	Algomian		Laurentian			
	Keewatin Period					3,500,000,000	Minute, soft-bodied forms

Figure 39. Geologic Time Scale.

Springfield Structural Plain, with a small portion west of the Grand River extending into the Prairie Plains Province. The southern one-fourth lies in the Boston Mountain Plateau.

The topography of the Springfield Plain is that of a deeply dissected plateau. The upland surface formed on the cherts and limestones of the "Boone formation" is characterized by flat divides, separated by deep, V-shaped stream valleys. A characteristic dendritic drainage pattern is formed.

South of the Springfield Structural Plain is a narrow belt of rugged topography of the Boston Mountain Plateau. Here a series of northeastward-trending faults separates the area into prominent fault blocks, with steep escarpment faces and gentle dip slopes, capped by the resistant sandstones of the Atoka. Stream dissection has cut deep valleys through the ridges, whereas major drainage lines are developed in the softer shales and limestone valleys paralleling the faulting.

West of the Grand River, thin Upper Mississippian and Pennsylvanian beds dip gently to the west to form the Prairie Plains homocline. Here the surface is gently rolling, with low, eastward-facing escarpments and isolated buttes capped by resistant sandstones. Obsequent and subsequent drainage is developed by the eastward-flowing tributary streams.

Relief and elevations.—The maximum relief in this area is approximately 1,300 feet. The highest elevation is 1,750 feet, on the north end of Bugger

Mountain (sec. 11, T. 16 N., R. 26 E.). Other points of maximum elevation include 1,200 feet on Sugar Mountain (sec. 28, T. 16 N., R. 23 E.); 1,550 feet in the southwest corner of Adair County; and 1,700 feet on Ross Mountain on the Oklahoma-Arkansas boundary. The lowest point, 450 feet, is along the Arkansas River, sec. 34, T. 13 N., R. 20 E.

The surface of the Springfield Plateau slopes to the west, southwest, and south. In general, the valleys have been cut 200 to 300 feet below the general level, whereas outliers and ridges rise 250 to 400 feet above the "Boone" surface.

Relief in the Boston Mountain Plateau is greater where valleys 300 to 500 feet deep are not uncommon. Tilting of fault blocks gives a stair-step effect, resulting in long, high, narrow ridges capped by gently dipping strata.

West of the Grand River, the relief is low and the surface gently undulating.

THE ROCK SEQUENCE

Stratigraphic summary.—Rocks exposed at the surface range in age from the Precambrian Spavinaw Granite to Middle Pennsylvanian Atoka, Hartshorne, and McAlester Formations (fig. 41). The Precambrian is overlain unconformably by the Lower Ordovician Cotter Dolomite near Spavinaw in the northern part of the area. In the subsurface, nearly 1,500 feet of Cambrian-Ordovician sediments intervene between the granite and the dolomite. The Cotter is exposed in the southern part of the

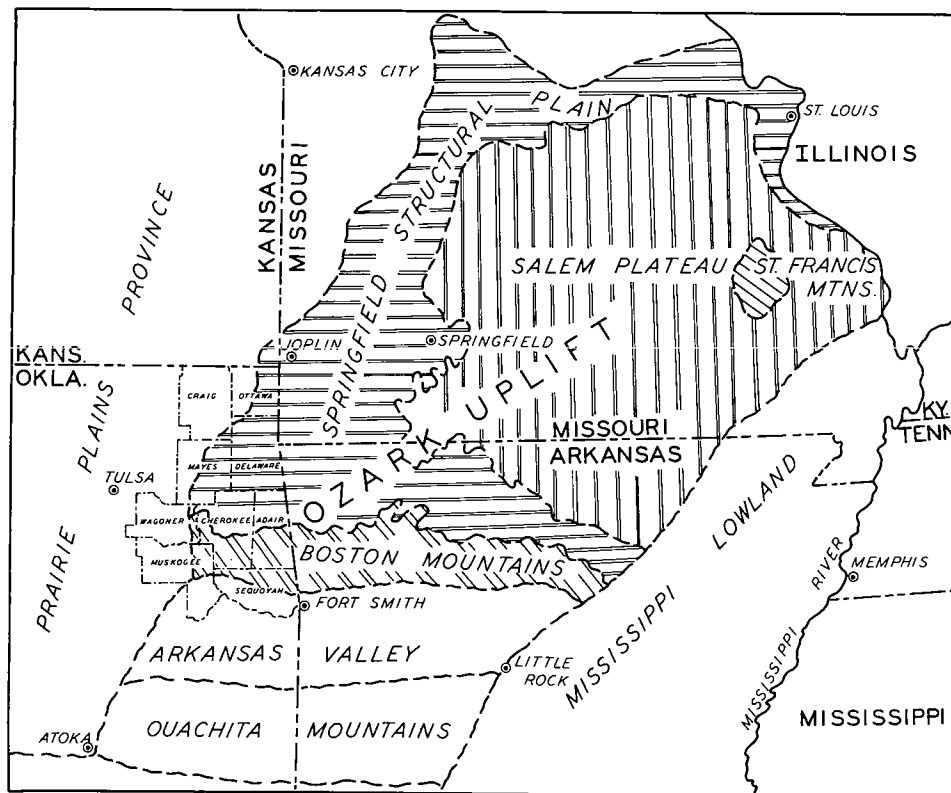


Figure 40. Ozark uplift and adjoining physiographic provinces.

SYSTEM	SERIES	GROUP AND FORMATION	ROCK	FEET	CHARACTERISTICS AND FAUNAS
PENNSYLVANIAN	DESMOINESIAN	Mc ALESTER		50-150	Dark gray to black, laminated to fissile shale with layers of clay-ironstone concretions, and with three coals and associated underclay. Marked at base by Warner sandstone.
		HARTSHORNE		0-50	Conglomerate, underclay, coal, shale, and siltstone
	ATOKAN	ATOKA		0-600	Sequence of marine and non-marine shales and sandstones with occasional limestone beds. Typically developed in Muskogee-Porum District where it includes in ascending order the Coady sandstone and overlying shale; Pope Chapel sandstone and overlying shale; Georges Fork sandstone and overlying shale; Dirty Creek sandstone and overlying shale; Webbers Falls sandstone and overlying shale; and the Blackjack School sandstone and overlying shale. Units thin northward by convergence and overlap.
	MORROWAN	BLOYD		0-200	Blue-gray, unevenly bedded, fossiliferous limestone interbedded with gray, fissile shale. Limestones fossiliferous, with abundant <i>Pentremites</i> . Thins northward to extinction near Union Mission, T.19 N.
		HALE		0-150	Massive, blue-gray, sandy limestone with basal beds of brown, calcareous sandstone. Grades laterally into cross-bedded sandstone. Weathers pitted and fluted. Thin conglomerate at base. Abundant <i>Michelinia scopulosa</i> .
MISSISSIPPIAN	CHESTERIAN	PITKIN		0-80	Gray-blue, fossiliferous, rubbly-weathering limestone characterized by abundance of <i>Archimedes (Archimediopora)</i> , <i>Diaphragmus</i> , <i>Eumetria</i> , <i>Torynifera setigera</i> . Thins northward to extinction in T.18 N. near Mayes County line.
		FAYETTEVILLE		15-185	Sequence of black, fissile shale with thin interbedded blue-black, lithographic limestone. Fossiliferous with <i>Diaphragmus</i> , <i>Eumetria</i> , <i>Spirifer increbescens</i> , <i>Spirifer leidyi</i> , <i>Torynifera setigera</i> , <i>Linoproductus ovatus</i> .
		HINDSVILLE		0-48	Gray, medium crystalline limestone with <i>Diaphragmus</i> , <i>Spirifer leidyi</i> , <i>Agassizocrinus</i> .
	MERAMECIAN	MOOREFIELD		0-100	Blue-gray to brown calcareous siltstone with <i>Leiorhynchus carboniferum</i> , and overlying black shale Gray, oolitic, cross-bedded limestone with angular chert fragments Blue-gray to brown, argillaceous limestone with <i>Leiorhynchus carboniferum</i> , <i>Moorefieldella eurekaensis</i> , <i>Spirifer arkansanum</i> , <i>Griffithides pustulosus</i> . Lies unconformably on Osagean limestones and cherts and on Chattanooga shale near Tenkiller Ferry Dam. Locally contains gray, cherty, crinoidal, glauconitic limestone at base.
			OSAGEAN	KEOKUK	0-250
	OSAGEAN	REEDS SPRING		0-175	Blue-white to tan, thin-bedded chert with beds of blue-gray, finely crystalline limestone
		ST. JOE		0-25	Gray, fine-to medium-crystalline, nodular-weathering limestone and green calcareous shale
	DEV.	KINDERHOOKIAN	CHATTANOOGA		0-70
ULSTERIAN		SALLISAW		0-25	Brown, calcareous sandstone grading upward into tan and white chert
SIL.	NIAGARAN	FRISCO		0-8	Gray, coarsely crystalline limestone, near Marble City only
		ST. CLAIR		0-200	Pinkish-white, coarsely crystalline limestone. Thins northward to extinction near Qualls, T.15 N.
ORDOVICIAN	CINCINNATIAN	SYLVAN		0-35	Yellow-brown to green, platy shale
		FERNVALE		0-25	Gray, coarsely crystalline limestone with <i>Lepidocyclus capax</i>
		FITE		0-8	Gray, lithographic, calcite-flecked limestone
	CHAMPLAINIAN	TYNER		0-75	Bright green shales and thin beds of buff sandy dolomite
		BURGEN		0-90	White to yellow, hard massive sandstone with occasional beds of sandy dolomite and green shale
	CANADIAN	COTTER		85-125	Gray to buff, finely crystalline, hard, thick-bedded dolomite with occasional thin beds of white sandstone
PRE CAMBRIAN		SPAVINAW		unknown	Red, coarse-grained granite exposed near Spavinaw, Oklahoma

Figure 41. Generalized columnar section for northeastern Oklahoma (reprinted from Okla. Geol. Survey, Bull. 77).

area near Qualls, Oklahoma, where it is succeeded by the Burgen Sandstone, Tyner Shale and Dolomite, Fite Limestone, Fernvale Limestone, and Sylvan shale, all of Ordovician age. Late Ordovician Sylvan shale is overlain unconformably by the St. Clair Limestone (Silurian), which is succeeded by the Frisco and Sallisaw Formations of Devonian age.

Devonian, Silurian, and Ordovician units are beveled northward by unconformity and are overlapped by the black Chattanooga Shale and the basal Sylamore Sandstone Member (Late Devonian and Early Mississippian age). These lie upon the Sallisaw Formation (Devonian) near Marble City in the southern part of the area and upon the Cotter Dolomite (Ordovician) near Spavinaw (fig. 42).

The Mississippian System is represented in ascending order by the St. Joe, Reeds Spring, and Keokuk Formations of Osagean age, the Moorefield Formation of Meramec age, and the Hindsville, Fayetteville, and Pitkin Formations, which are assigned to the Chesterian.

The Upper Mississippian Pitkin Formation is beveled northward by pre-Pennsylvanian erosion and is absent north of the former site of Yonkers in T. 18 N. The succeeding Morrow Series, comprising the Hale and Bloyd Formations, is truncated by pre-Atokan unconformity and is overlapped northward by Atokan and younger units (fig. 43). The Bloyd is absent north of Union Mission (T. 19 N.), and the Hale has not been recognized north of Pensacola in T. 23 N. Northward, Atokan and younger Pennsylvanian beds overlie the Fayetteville unconformably. In northern Mayes County, and in Craig and Ottawa Counties, shales of Hartshorne age and the overlying Warner Sandstone Member of the McAlester Formation overlap the Atoka and rest upon eroded Mississippian rocks.

Extensive high-level and intermediate terrace gravels are present along the Grand River and east of the Arkansas floodplain. Many of the valleys are floored with deposits of Recent alluvium.

PRECAMBRIAN ROCKS

Spavinaw Granite. — The Spavinaw Granite is a red, coarse-grained granitoid rock. The principal constituent is orthoclase, which gives the granite its distinctive red color. Quartz grains are microscopic in size and the hornblendes and micas are altered to chlorite.*

The Spavinaw Granite is exposed near Spavinaw, Oklahoma, in five small areas in sec. 15, T. 22 N., R. 21 E. The exposures are surrounded by the Cotter Dolomite, which dips away from the granite hills at angles of 5 to 10 degrees.

ORDOVICIAN SYSTEM

Cotter Dolomite. — The Cotter Formation consists largely of white to gray dolomite with minor

amounts of sandstone, shale, chert, and intraformational conglomerate. Thickness in subsurface ranges from zero to 270 feet; approximately 125 feet is exposed near Spavinaw. The Cotter is sparingly fossiliferous but contains silicified cryptozoons (algae) in upper portions.

The Cotter rests unconformably upon the Spavinaw Granite and is silicified at the contact. It is succeeded disconformably by the Burgen Sandstone near Qualls and along the Illinois River and by the black Chattanooga Shale near Spavinaw.

Burgen Sandstone. — The Burgen Formation, named for exposures in Burgen Hollow northeast of Tahlequah, consists mainly of sandstone. Color ranges from white to gray or yellow. About 100 feet thick, it is loosely cemented and friable except near the top where it is case-hardened and resistant. Thin beds of green shale and sandy dolomite are present in upper parts.

The Burgen rests unconformably on the Cotter Dolomite. It is succeeded conformably by the Tyner Formation in southern exposures and by the Chattanooga Formation north of T. 19 N.

Tyner Formation. — The Tyner Formation, named for exposures along Tyner Creek in northern Adair County, is characterized by various rock types, shale, sandstone, dolomite, and limestone. The shales are blue green and fissile; the dolomites are tan to brown, thick bedded, and sandy; the sandstones are hard, dolomitic, and grade literally into sandy dolomite. Limestone is restricted to the uppermost beds. For convenience the Tyner may be divided into (1) a lower dolomite and green shale sequence; (2) a middle green shale; and (3) an upper cherty dolomite and limestone. Thickness ranges from 80 to 90 feet. The Tyner is succeeded conformably by the Fite Limestone.

A fauna consisting of *Camarocladia rugosa* Ulrich, *Hesperorthis tricenaria* (Conrad), *Liospira americana* Billings, *Hormotoma gracilis* (Hall), and *Ceraurus pleurexanthemus* Greene reported from the Upper Tyner is indicative of Black River (Bromide) age for the upper portion. *Pseudomaria nevadensis* (Walcott), *Maclurites*, *Raphistoma cf. denticulata* Ulrich, and *Clathrospira cf. subconica* Hall in the Lower Tyner are suggestive of Chazyan (Oil Creek) age. (Huffman and Starke, 1960, p. 268-271).

Fite Limestone. — The Fite Formation, named for exposures near the Fite ranch northeast of Tahlequah, is a light-gray, dense, lithographic limestone characterized by flecks of clear calcite. It contains beds of buff, sandy dolomite near the base and appears to be transitional with the underlying Tyner. The Fite maintains a fairly uniform thickness of 8 to 10 feet throughout much of the area.

The Fite is relatively unfossiliferous. Lithologically it resembles the Corbin Ranch (Bromide dense) of the Arbuckle region. The Fite is succeeded unconformably by the Fernvale Formation.

Fernvale Limestone. — The Fernvale is a massive, coarsely crystalline, fossiliferous, light-gray

* For a detailed petrographic description see Merritt, 1960.

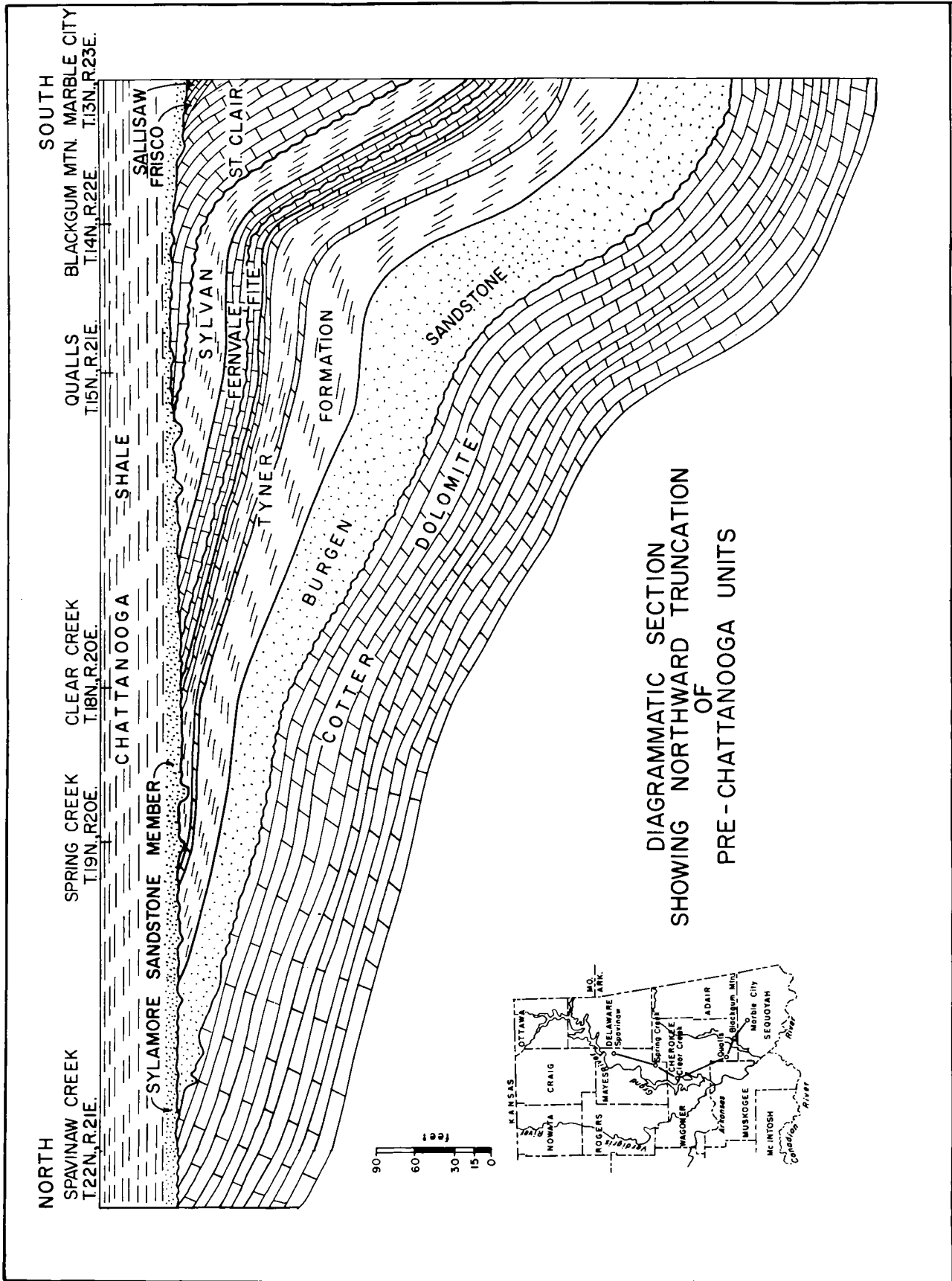


Figure 42. Diagrammatic section showing northward truncation of pre-Chattanooga units (reprinted from Okla. Geol. Survey, Bull. 77).

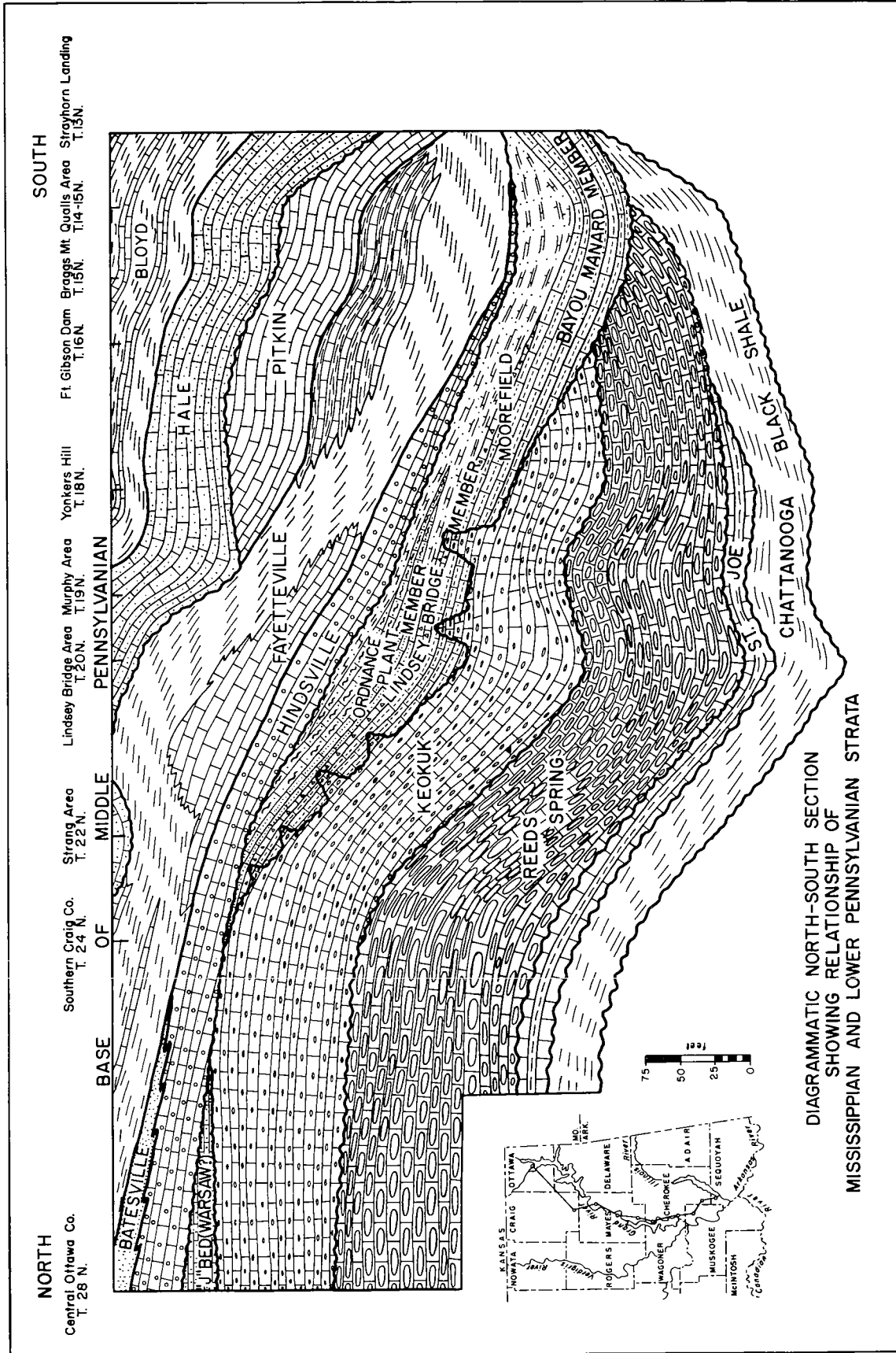


Figure 43. Diagrammatic north-south section showing relationship of Mississippian and Lower Pennsylvanian strata (reprinted from Okla. Geol. Survey, Bull. 77).

limestone. It ranges in thickness from zero to 18 feet. Abundant fossils include the brachiopods *Lepidocyclus capax* (Conrad) and *Plaesiomys subquadratus* (Hall). The Fernvale rests unconformably on the Fite Limestone and is overlain conformably by the Sylvan.

Sylvan Shale.—The Sylvan Shale ranges from dark green and fissile to brown, silty, and concretionary. It ranges in thickness from zero to 36 feet. It is succeeded unconformably by the St. Clair Limestone or by the black Chattanooga Shale. *Dicellograptus complanatus* Lapworth, a graptolite characteristic of the Sylvan Shale of the Arbuckle region, is present in the Sylvan of northeastern Oklahoma.

SILURIAN SYSTEM

St. Clair Formation.—The St. Clair is a white to pink, medium- to coarse-crystalline, massive-bedded limestone. It is relatively free from impurities and is quarried near Marble City for high-calcium lime. Traces of lead (galena), zinc (sphalerite), and oil are present in cavities within the limestone. It is more than 165 feet thick, with the maximum thickness unknown. Brachiopod fossils are numerous in the St. Clair. *Clorinda ventricosa* (Hall) and *Eospirifer* cf. *E. radiatus* (Sowerby) are characteristic.

The St. Clair lies upon the Sylvan Shale with unconformity and is succeeded unconformably by the Frisco Limestone of Devonian age.

DEVONIAN SYSTEM*

Frisco Formation.—The Frisco Formation is composed of gray, medium-crystalline, thick-bedded, fossiliferous limestone. It ranges in thickness from zero to 7 feet. Fossils are common with numerous brachiopods and gastropods. *Costellirostra peculiaris* (Conrad) and *Costispirifer arenosus* (Conrad) are characteristic.

The Frisco is correlated with the famous Oriskany Sandstone of New York state. It is overlain unconformably by the Sallisaw Formation.

Sallisaw Formation.—The Sallisaw Formation, named for exposures on Sallisaw Creek near Marble City, is composed of several rock types, the most common of which is a gray, medium-bedded, arenaceous limestone. White to light-gray chert is interbedded and a two-foot bed of brecciated chert is at the top. Thickness ranges from zero to 11 feet. The Sallisaw Formation, classed as Early Devonian, is succeeded unconformably by the Chattanooga Formation. *Amphigenia curta* (Meek and Worthen) and *Roemerella grandis* (Vanuxem) are characteristic brachiopods.

DEVONIAN-MISSISSIPPIAN ROCKS

Chattanooga Formation.—The Chattanooga Formation consists of two members, the basal Sylva-

more Sandstone and the overlying Noel Shale. The Sylamore is a white, phosphatic, friable sandstone with a maximum thickness of 18 feet. It contains small phosphatic brachiopods of the genus *Lingula*, traces of fossil wood, and molds of a primitive plant, *Cordaites*?. The Noel Member is a fissile, pyritic, carbonaceous, and bituminous shale. Thickness ranges from a few inches to more than 65 feet. Small brachiopod fragments, remains of a fish, *Diniethys*, and a unicellular plant, *Tasmanites*, have been reported. The Chattanooga Formation resembles the Woodford Shale of the Arbuckle region.

Studies of minute fossil remains known as conodonts suggest that the Chattanooga Formation is Devonian in age in lower parts and Mississippian in uppermost beds.

MISSISSIPPIAN SYSTEM

St. Joe Group.—The St. Joe Group in northeastern Oklahoma comprises three well-defined subdivisions. The uppermost (Pierson Formation) includes from zero to 25 feet of gray, thick-bedded, fine-crystalline limestone, passing locally into a thick crinoidal reef facies, which may exceed 50 feet in thickness. The middle part (Northview Formation) consists of three to five feet of gray-green calcareous shale or marlstone. The basal part (Compton Formation) is a gray, nodular-weathering, heavy-bedded limestone, ranging in thickness from zero to 10 feet.

The St. Joe is fossiliferous and has yielded an abundant fauna (Laudon, 1939, p. 327). Some of the more common forms are *Athyris lamellosa* (L'Eveillé), *Cliothyridina prouti* (Swallow), *Brachythyris suborbicularis* (Hall), *Spirifer grimesi* Hall, and *Spirifer rowleyi* Weller.

Reeds Spring Formation.—The Reeds Spring Formation consists of nearly equal amounts of thin, alternating beds of gray, fine-grained, dense, thin-bedded limestone and dark-gray to blue-gray and tan chert. The beds are resistant to erosion and, where exposed in stream valleys, form nearly vertical cliffs. The Reeds Spring has a maximum thickness of 175 feet along Salina Creek south of Salina and along the west bank of Grand River southwest of Salina.

The Reeds Spring rests unconformably on the St. Joe and older beds and is succeeded unconformably by the Keokuk Formation. Fossils are few and are difficult to collect.

Keokuk Formation.—The Keokuk consists of massive, white to buff- and gray-mottled, fossiliferous chert and irregular masses of blue-gray, dense, fine-grained limestone. Locally, reefs or bioherms of coarsely crystalline crinoidal limestone are present, as in the road cut at the Pryor cemetery. The cherty phase is typically fractured or brecciated and weathers to a soft, white tripoli. Locally near the top of the Keokuk is a bed of white, oölitic limestone known as the Short Creek oölitic.

The Keokuk ranges in thickness from zero to

* For a detailed discussion see Amsden, 1961.

nearly 250 feet, with an average of 60 to 80 feet. It overlies the Reeds Spring with unconformity and is overlain unconformably by the Moorefield and Hindsville Formations. It is missing in the southern Ozarks.

Fossils are abundant in the Keokuk in the form of molds and casts. Bryozoans and brachiopods are most abundant. Some of the more common forms are *Spirifer logani* Hall, *Spirifer keokuk* Hall, *Torynifer pseudolineata* (Hall), and *Werriea (Orthotetes) keokuk* (Hall).

Moorefield Formation. — The Moorefield Formation of northeastern Oklahoma is divided into four members, or facies. These are (1) the lower glauconitic limestone, or Tahlequah Member, (2) the argillaceous limestone, or Bayou Manard Member, (3) coarsely crystalline Lindsey Bridge Limestone Member, and (4) the Ordinance Plant Siltstone and Shale Member. Thicknesses of individual members differ, and the total thickness of Moorefield strata ranges from zero to approximately 150 feet.

The Moorefield is abundantly fossiliferous, especially in the Bayou Manard Member. Brachiopods, gastropods, pelecypods, trilobites, and corals are more common. The more diagnostic forms are *Aviculopecten batesvillensis* Weller, *Griffithides pustulosus* Snider, *Leiorhynchus carboniferum* Girty, *Moorefieldella eurekaensis* (Walcott), and *Spirifer arkansanus* Girty.

The Moorefield is assigned to the Meramec Series and correlated with the Sycamore and lower part of the Caney of the Arbuckle Mountains. It lies upon the Keokuk with unconformity and is succeeded unconformably by the Hindsville.

Hindsville Formation. — The Hindsville is a gray, medium-crystalline, thick-bedded, oölitic, fossiliferous limestone. Soft green calcareous shale is near the base; fine-grained silty beds are within; and gray, lithographic limestone is near the top. The Hindsville ranges from zero to 50 feet in thickness. It rests with unconformity upon the underlying Moorefield or upon the Keokuk where Moorefield strata are missing.

Fossils are abundant in the Hindsville Formation. Crinoids include *Agassizocrinus globosus* Worthen, *Eupachyrinus spartarius* Miller, and *Phanocrinus nitidus* (Miller and Gurley). A small blastoid, *Pentremites*, occurs in the green shale facies. Brachiopods include *Diaphragmus cestriensis* (Worthen), *Inflatia adairensis* (Drake), *Spirifer leidyi* Norwood and Pratten, *Stenoscisma cestriensis* (Snider), and others.

Fayetteville Formation. — The Fayetteville consists primarily of black fissile shales interbedded with varying amounts of gray to black, lithographic limestone. In western Arkansas and extreme eastern Oklahoma, the Wedington Sandstone Member (0 to 25 feet) occurs in the upper one-third. Thickness reaches a maximum of 165 feet.

The Fayetteville Formation lies conformably upon the Hindsville and is succeeded conformably by the Pitkin Limestone. The black shales are nearly bar-

ren of fossils but the limestones are abundantly fossiliferous. Some of the more common forms are the spiral bryozoan *Archimedes* and the brachiopods *Brachythyris ozarkensis* Snider, *Chonetes chesterensis* Weller, *Diaphragmus cestriensis* (Worthen), *Inflatia cherokeeensis* (Drake), and *Werriea (Orthotetes) kaskaskiensis* (McChesney).

The Fayetteville Shale resembles part of the Caney Shale of the Arbuckle region.

Pitkin Formation. — The Pitkin is a gray, dense, finely crystalline to lithographic limestone. Dark-gray to black shale partings are present, especially in basal portions. It ranges in thickness from zero to 80 feet, with an average of 25 to 30 feet. The Pitkin rests upon the Fayetteville with conformity but is overlain unconformably by the Hale Formation of Lower Pennsylvanian age.

Fossils are abundant in the Pitkin. Spiral bryozoans (*Archimedes*) and the blastoid *Pentremites* are most characteristic. Brachiopods include *Diaphragmus cestriensis* (Worthen), *Eumetria pitkenensis* Snider, *Spirifer leidyi* Norwood and Pratten, *Spirifer increbescens* Hall, and *Stenoscisma cestriensis* (Snider).

The Pitkin is assigned to the Upper Mississippian Chester Series and correlated with the Goddard Shale of the Arbuckles.

PENNSYLVANIAN SYSTEM

Hale Formation. — The Hale Formation is marked at the base by a conglomerate containing pebbles of underlying Mississippian rocks. Succeeding strata are gray to brown, sandy limestone which weathers pitted and fluted. The lower part grades locally into a cross-bedded, calcareous sandstone. It ranges in thickness from zero to 136 feet.

The Hale rests with great unconformity upon the Pitkin and older beds and grades upward into the Bloyd Formation. Fossils are abundant, with corals, brachiopods, and crinoids most common. Characteristic corals are *Michelinia scopulosa* Moore and Jeffords and *Striatopora oklahomensis* Snider. *Antiquatonia morrowensis* (Mather), *Composita ovata* Mather, and *Spirifer rockymontanus* Marcou are typical brachiopods. The fossil scale tree, *Lepidodendron*, occurs in sandy layers.

The Hale is the basal formation of the Morrow Series and resembles the Union Valley and Primrose Sandstones of the Arbuckle-Ardmore and the Cromwell of the subsurface geologist.

Bloyd Formation. — The Bloyd is a sequence of gray shales and interbedded limestones. The limestones are blue gray to black, fine to coarsely crystalline, and massive to thick bedded. A maximum thickness of 225 feet occurs near Stilwell. It is conformable with the underlying Hale and is overlain unconformably by the Atoka Formation. It resembles the Wapanucka Formation of the Arbuckles.

Fossils are abundant in the Bloyd. Brachiopods, bryozoans, corals, blastoids, crinoids, cephalopods, and gastropods are common. Characteristic forms

are *Composita ovata* Mather, *Ethelocrinus oklahomensis* Moore and Plummer, *Hustedia miseri* Mather, *Michelinia scopulosa* Moore and Jeffords, *Neospirifer goreii* (Mather), *Pentremites angustus* Hambach, *Pygmaeoceras pygmaeum* (Mather), *Punctospirifer kentuckiensis* (Shumard), and *Striatopora oklahomensis* (Snider).

Atoka Formation. — The Atoka Formation consists of sandstones, siltstones, shales, and a few thin limestones. The sandstones are brown, thick bedded, and iron stained. The siltstones are brown to gray, micaceous, and noncalcareous. Shales are brown to black, fissile, and iron stained. Limestones are brown, medium crystalline, and glauconitic. The Atoka ranges in thickness from zero near Vinita to 600 feet in southern exposures. It lies with great unconformity upon the Boyd and older beds and is overlapped northward by the Hartshorne-McAlester sequence.

Hartshorne Formation. — The Hartshorne is a sequence of shales, underclays, thin coals, and siltstones. A plant-like fossil, *Taonurus*, forms conspicuous markings on the siltstone layers. A total thickness of approximately 36 feet is exposed in northern Mayes and southern Craig Counties.

McAlester Formation. — The McAlester Formation is marked at the base by the Warner Sandstone, a light buff, cross-bedded unit ranging in thickness from 6 to 23 feet. It is succeeded by thin coals, underclays, shales, and siltstones. *Taonurus* is associated with the siltstones. Total thickness of the McAlester in Craig and Ottawa Counties is approximately 50 feet.

QUATERNARY SYSTEM

Alluvial deposits. — Deposits of Recent alluvium occur along the valley floors of major streams and tributaries. The most extensive is the broad floodplain of the Arkansas River east of Muskogee. A well-defined floodplain parallels the Grand River from Pensacola Dam to the junction with the Arkansas. The floodplain of the Illinois River is narrow and poorly developed.

Terrace deposits. — Terrace deposits are common in the Oklahoma Ozarks. Locally along Grand River in Wagoner and Mayes Counties, a "second bottom," or terrace, lies 20 to 40 feet above the floodplain level. High-level terrace deposits cover approximately 20 square miles near Pensacola. Extensive terrace deposits occur along Bayou Manard near Fort Gibson, along Evansville and Barren Fork Creeks northeast of Stilwell, along Grand River at the Oklahoma Ordnance Plant, T. 20 N., R. 19 E., and along State Highway 33 east of Chouteau, T. 20 N., R. 19 E.

Terrace deposits border the Arkansas River alluvium near Braggs, T. 14 N., R. 20 E., where approximately 18 square miles are covered with terrace gravels and wind-blown material from the floodplain.

Other terrace deposits are present near Fort Gibson, extending south and east to the alluvium

of Bayou Manard. These deposits include sand, silt, and gravel, some of which are wind derived from the Arkansas River floodplain.

STRUCTURE

General Regional Picture. — Northeastern Oklahoma occupies the southwest end of the Ozark uplift. The formations strike in an arcuate pattern and dip away from the axis of the uplift, toward the west and northwest in northern parts of the area and to the southwest and south in southern parts. The general regional dip of 25 to 50 feet per mile is interrupted by a series of northeast-southwestward-trending folds and faults with alignment roughly parallel to the axis of the Ozark uplift. Steeper dips are close to major faults.

Faulting is most pronounced in the Boston Mountain Plateau in Cherokee and Adair Counties, where large, parallel, normal faults divide the rocks into a series of fault blocks tilted to the southeast.

In the northern part of the area, the folds and faults die out to the west, and the dip merges with the gentle westerly dip of the Prairie Plains homocline. In the southern part, the faults disappear to the northeast in the "Boone chert" and pass southwestward into gentle anticlinal folds, which continue across the Arkansas River into the Muskogee-Forum district.

Major Structures. — The principal structural features in the Ozark uplift (fig. 44) of northeastern Oklahoma include the Miami syncline, Seneca graben, Horse Creek anticline, Whiteoak fault, Big Cabin fault, Locust Grove fault, Lost City fault, Clear Creek fault, Fourteenmile Creek fault, Gifford fault, Double Spring Creek fault, Hulbert fault, Tahlequah fault, South Muskogee fault, Qualls-Welling fault, Greenleaf Lake fault, South Qualls fault, North Cookson fault, South Cookson fault, Wauhilla fault, Blackgum fault, Red Springs fault, Linder Bend fault, Webbers Cove fault, Cedar Creek fault, Marble City fault, Lyons fault, Church fault, Little Lee Creek fault, Evansville fault, the North and South Davidson faults, and the Baron graben. The locations and trends of these are indicated on figure 44. Stratigraphic displacement on the major faults ranges from a few feet to more than 700 feet.

GEOLOGIC AND TECTONIC HISTORY

The geologic history of northeastern Oklahoma is closely related to that of the Ozark geanticline, of which it is a part. The Ozark uplift persisted as a positive feature throughout Paleozoic time with frequent oscillations to the south and to the north and with numerous inundations by shallow seas. During much of its history, portions of the uplift were sufficiently high to serve as a source (Ozarkia) for many of the clastics which accumulated around its flanks.

Sedimentary history of the Ozark region began with the advance of the Upper Cambrian seas

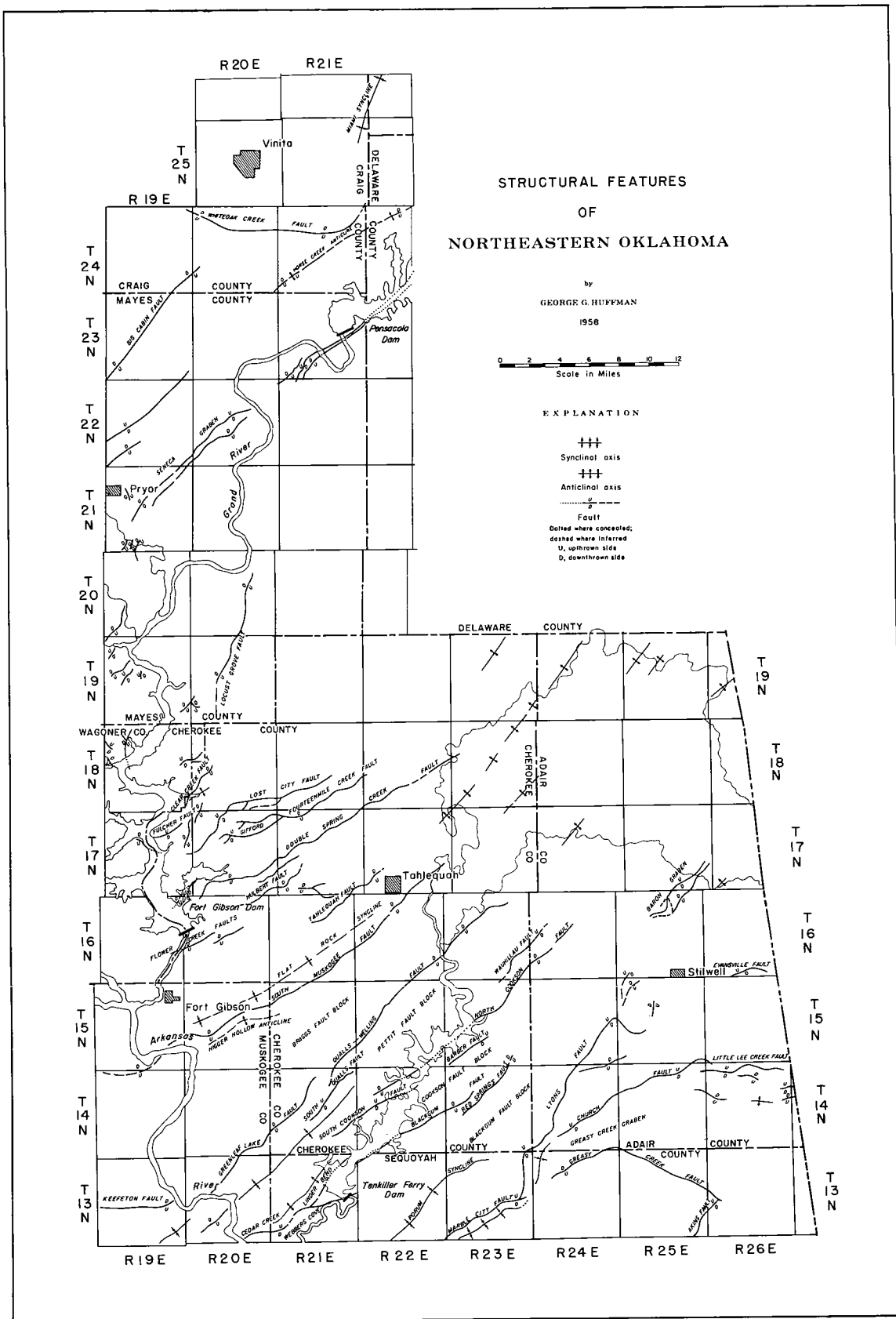


Figure 44. Structural features of northeastern Oklahoma (reprinted from Okla. Geol. Survey, Bull. 77).

UPPER PART OF GRAND LAKE

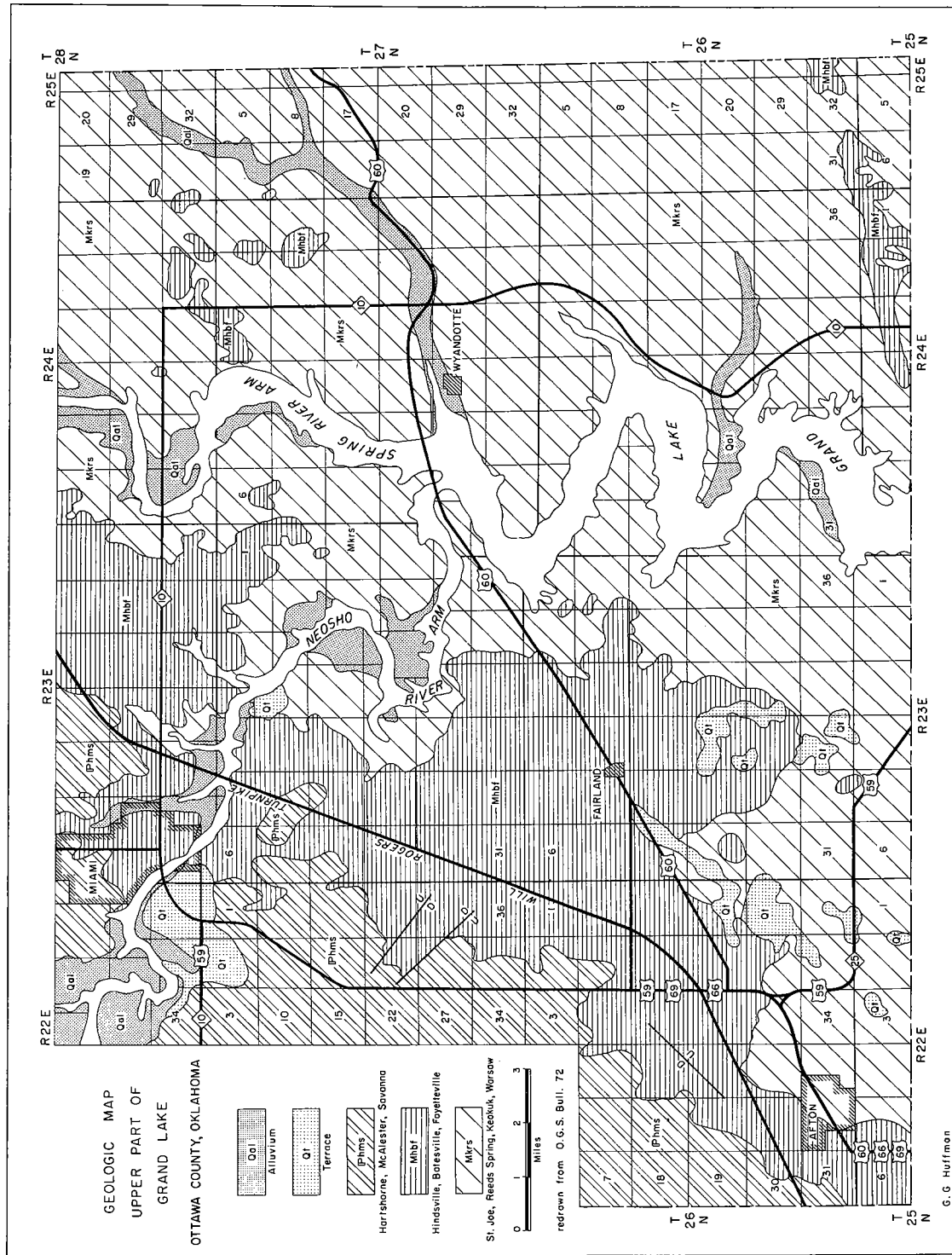
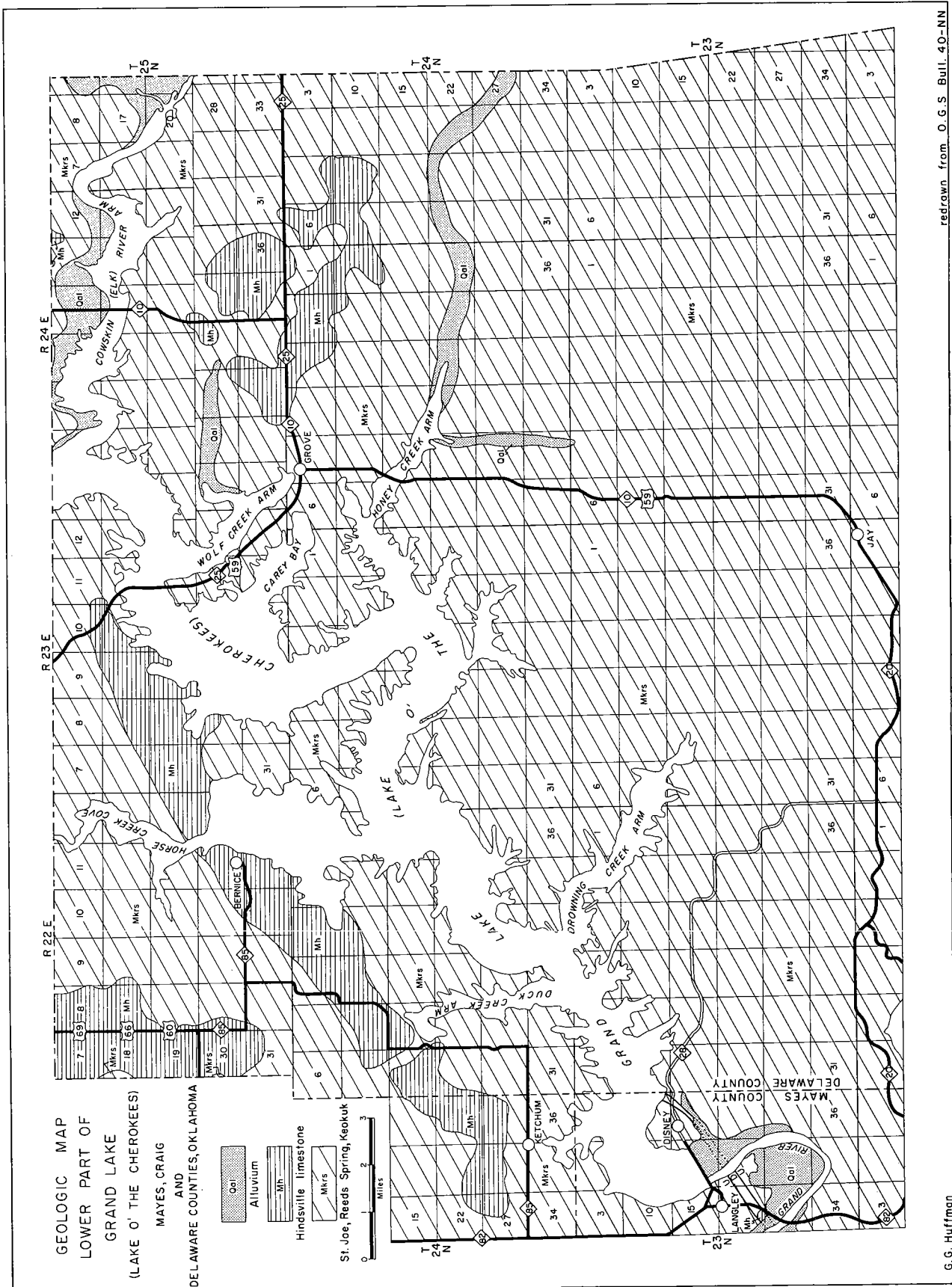


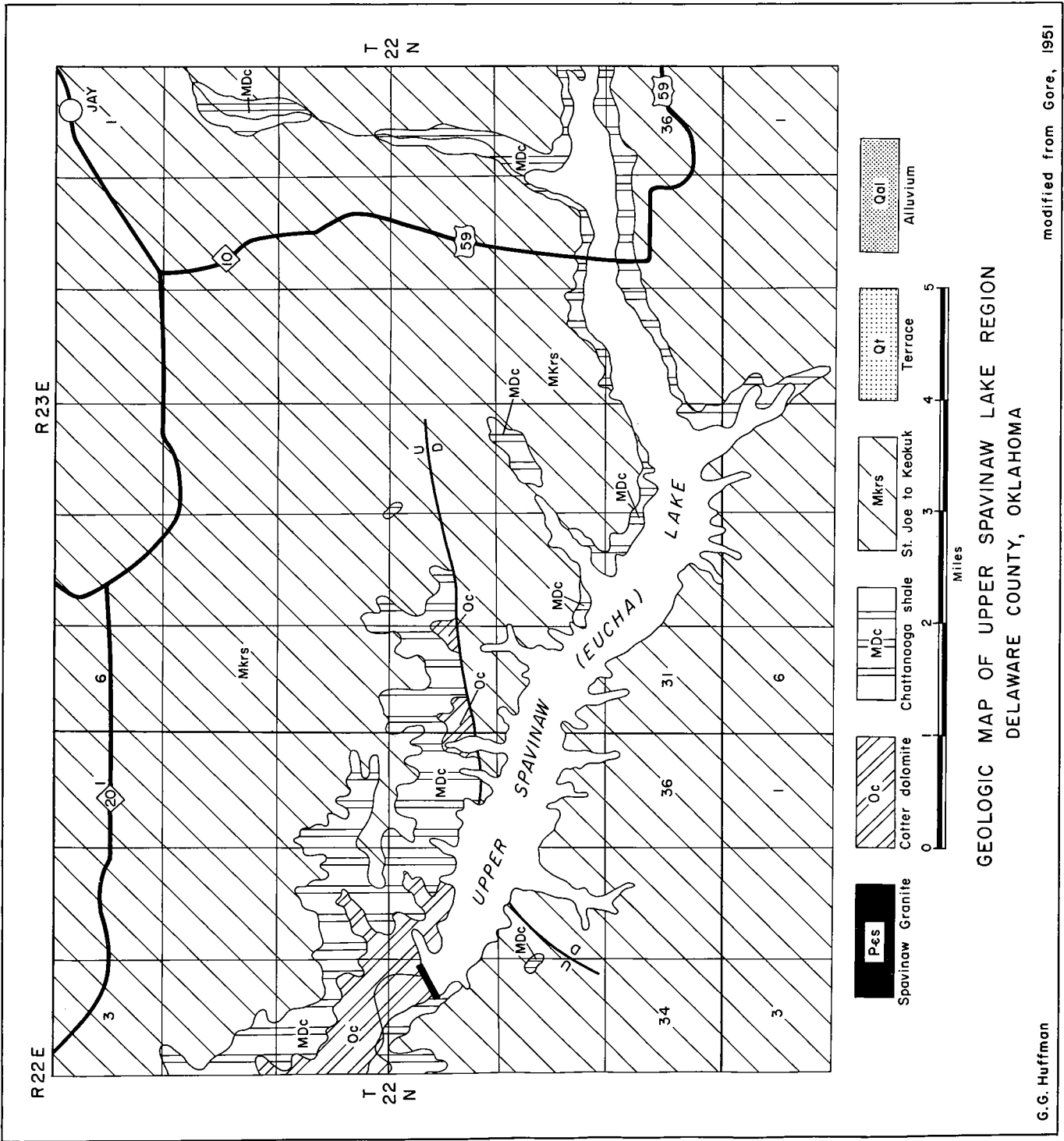
Figure 45. Geologic map of upper part of Grand Lake, Ottawa County, Oklahoma.



redrawn from O. G. S. Bull. 40-NN

Figure 46. Geologic map of lower part of Grand Lake, Mayes, Craig, and Delaware Counties, Oklahoma.

G. G. Huffman



modified from Gore, 1951

G.G. Huffman

Figure 47. Geologic map of Upper Spavinaw Lake region, Delaware County, Oklahoma.

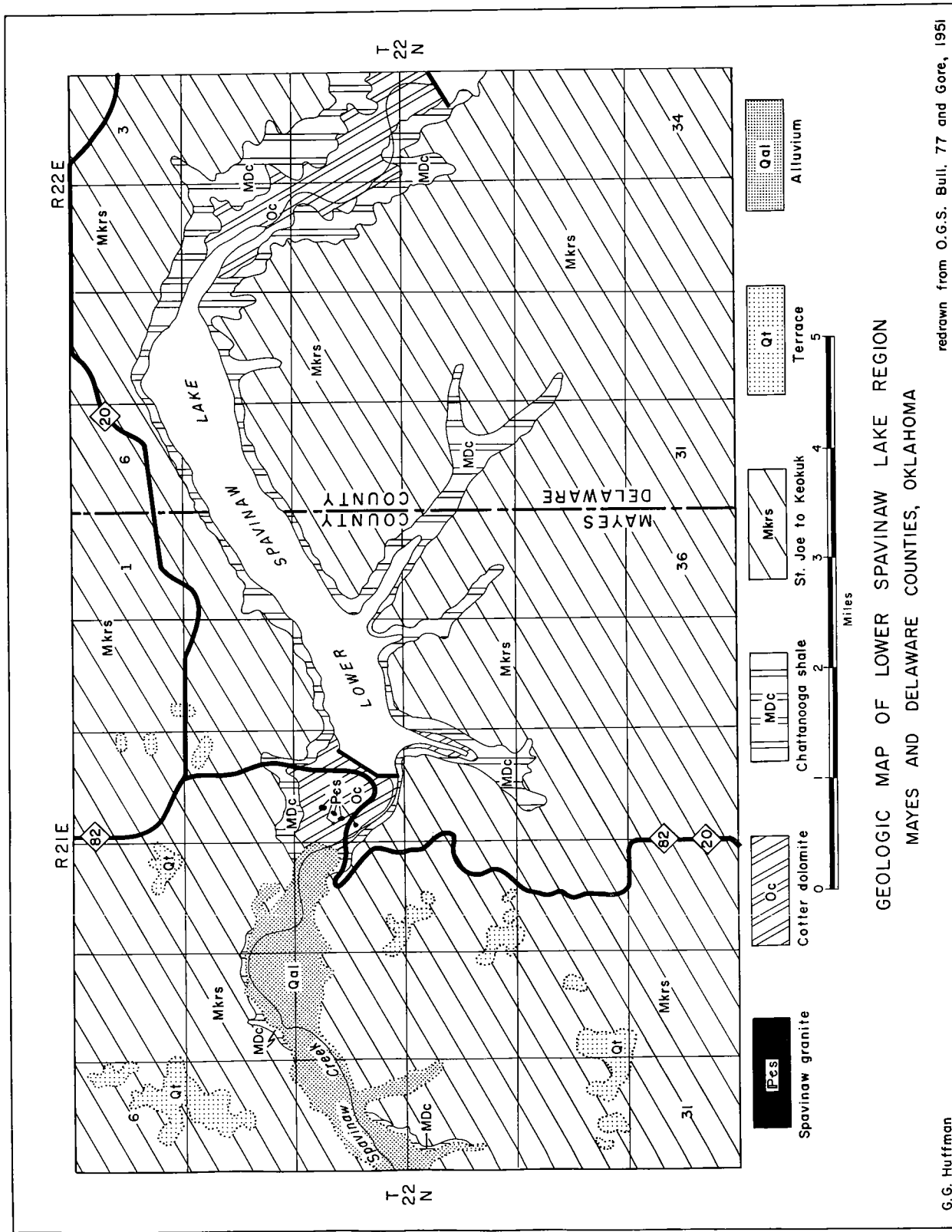


Figure 48. Geologic map of Lower Spavinaw Lake region, Mayes and Delaware Counties, Oklahoma.

G.G. Huffman

across the irregular surface of the Precambrian rocks. The oldest sedimentary rock at the surface in northeastern Oklahoma is the Cotter Dolomite, which laps across the highest knobs of the Precambrian granite near Spavinaw. The Cotter contains weathered fragments of the Spavinaw Granite in the area of overlap. The dolomitic, sandy, and algal nature of the Cotter is believed to be indicative of near-shore deposition with portions of "Ozarkia" to the east supplying the sand. Chazyan and early Black River time saw the advance of the Burgen (St. Peter) sea across the Ozark area. The Burgen Sandstone grades upward into the Tyner green shales and sandy dolomites, an offshore deposit of Chazyan and Black River age. Clearing of the seas resulted in the deposition of the lithographic limestone of the Fite. Submergence in late Ordovician Richmond time was followed by the deposition of the fossiliferous, coarsely crystalline Fernvale Limestone and the succeeding Sylvan Shale.

Emergence of probable short duration led to the removal of all but the lower portion of the Sylvan Shale. Subsequent submergence during Early Silurian time was followed by the deposition of the chemically pure St. Clair Limestone. During Oriskany time, the Frisco Limestone was deposited unconformably on the upper surface of the eroded St. Clair. Following the deposition of the Frisco, the area was again uplifted and the Frisco was subjected to extensive erosion. The Sallisaw sea advanced across an irregular surface on the Frisco and St. Clair Formations.

Northeastern Oklahoma was tilted abruptly to the south in post-Sallisaw (about Middle Devonian) time and the upturned strata of Devonian, Silurian, and Ordovician age were subjected to extensive erosion which beveled the units from south to north, removing the younger units except along the southern flank. In Late Devonian and Early Mississippian time, the Chattanooga sea advanced across the Ozark area. The basal deposit, the Sylamore, consists of irregular lenses of phosphatic sandstone deposited in the low areas on the pre-Chattanooga surface. Succeeding beds of black pyritic shale accumulated under the euxinic conditions which characterized Late Devonian-Early Mississippian deposition throughout the central interior of North America.

Clear, warm, relatively shallow seas prevailed throughout Late Kinderhookian and Osagean time. Deposition of the limestones and shales of the St. Joe Group was succeeded by the limestone and cherts of the Reeds Spring Formation. The massive Keokuk Chert was deposited initially as a thick-bedded, cross-laminated, crinoidal limestone and was replaced by silica at a much later time. Following the deposition of the Osagean Series, northeastern Oklahoma was uplifted and tilted to the north. Subsequent erosion removed most of the Osagean in southern exposures and produced an irregular, knobby surface on the northern flank.

The Moorefield sea advanced northward around the flanks of the Ozark uplift. Generally turbid conditions are indicated by the argillaceous character of the Bayou Manard Member, which overlaps the Tahlequah Member northward and lies with unconformity upon the Keokuk erosion surface. Local wave activity and erosion of the Keokuk "knobs" supplied the detrital chert, which became incorporated in the Lindsey Bridge Member. Continued northward overlap in late Moorefield time resulted in the deposition of the Ordovician Plant Siltstone.

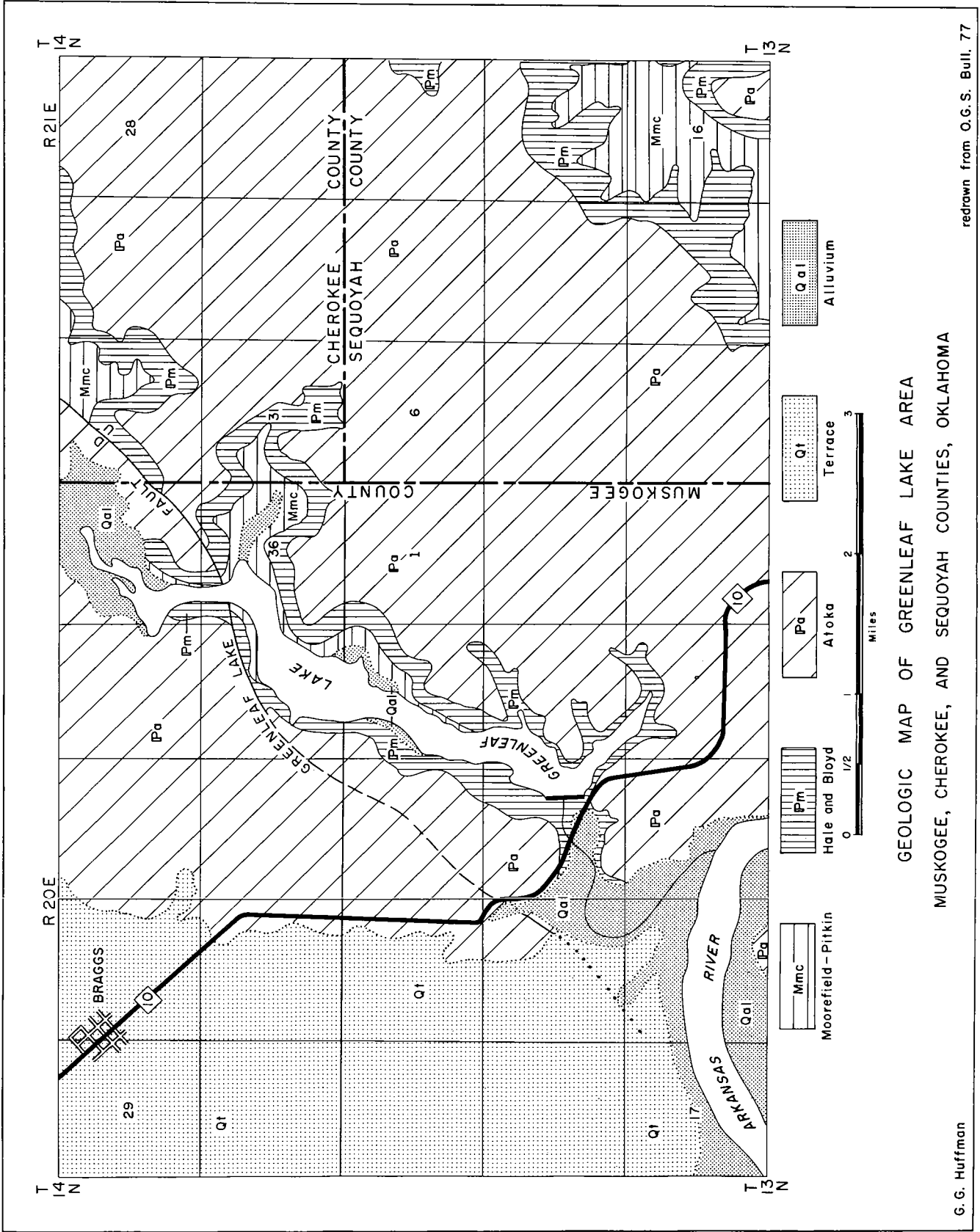
The overlying Hindsville Limestone was deposited unconformably upon the eroded surface of the Moorefield, overlapping northward to rest upon the Keokuk Chert. Northeastward, the Hindsville Limestone becomes sandy in upper portions and grades into a near-shore facies, the Batesville Sandstone. Fayetteville deposition represents the return of euxinic conditions to the Ozark area. The Wedington Sandstone Member, which is confined to exposures in eastern Adair and Delaware Counties, is a near-shore deposit with an eastern source. Abundance of lime-secreting organisms indicates warm, shallow, and relatively stable seas during Pitkin time.

Southward tilting of the Ozark area in post-Pitkin time is indicated by the northward truncation of the Pitkin. Morrowan seas advanced across the eroded surface on the Mississippian beds. Initial deposits included conglomerate and shale, followed by deposition of sandstone and limestone. Sedimentation during Bloyd time was a continuation of Hale sedimentation with no significant break in deposition.

Middle Pennsylvanian Atoka sandstone, shales, and thin limestones lie with marked unconformity upon the Morrow and older beds. Progressive northward spread of Atoka seas is indicated by overlap of younger members of the Atoka from south to north. The Atoka is overlain by a thin development of shales assigned to the Hartshorne (Reed and others, 1955); these are cyclic in nature and contain thin coals and underclays. Clastic deposition continued into McAlester time and the Warner Sandstone marks its base in Craig and Ottawa Counties. Succeeding units, previously referred to as "Cherokee" are cyclic in nature and are a reflection of the instability of the shelf area of northern Oklahoma during Middle Pennsylvanian time.

In Middle Pennsylvanian time (pre-Senora) the Ozark uplift was elevated, and a series of large, normal faults developed generally parallel to the axis of the Ozark uplift. The fault pattern in general parallels the structures in the Arkansas syncline to the south and is believed to be the result of tension created by loading in the McAlester basin to the south together with positive movements in the Ozark area causing a stretching of the rocks and associated faulting.

Peneplanation and intermittent uplift during the Pleistocene epoch are indicated by widespread up-



GEOLOGIC MAP OF GREENLEAF LAKE AREA

MUSKOGEE, CHEROKEE, AND SEQUOYAH COUNTIES, OKLAHOMA

redrawn from O.G.S. Bull. 77

G. G. Huffman

Figure 49. Geologic map of Greenleaf Lake area, Muskogee, Cherokee, and Sequoyah Counties, Oklahoma.

TENKILLER LAKE REGION

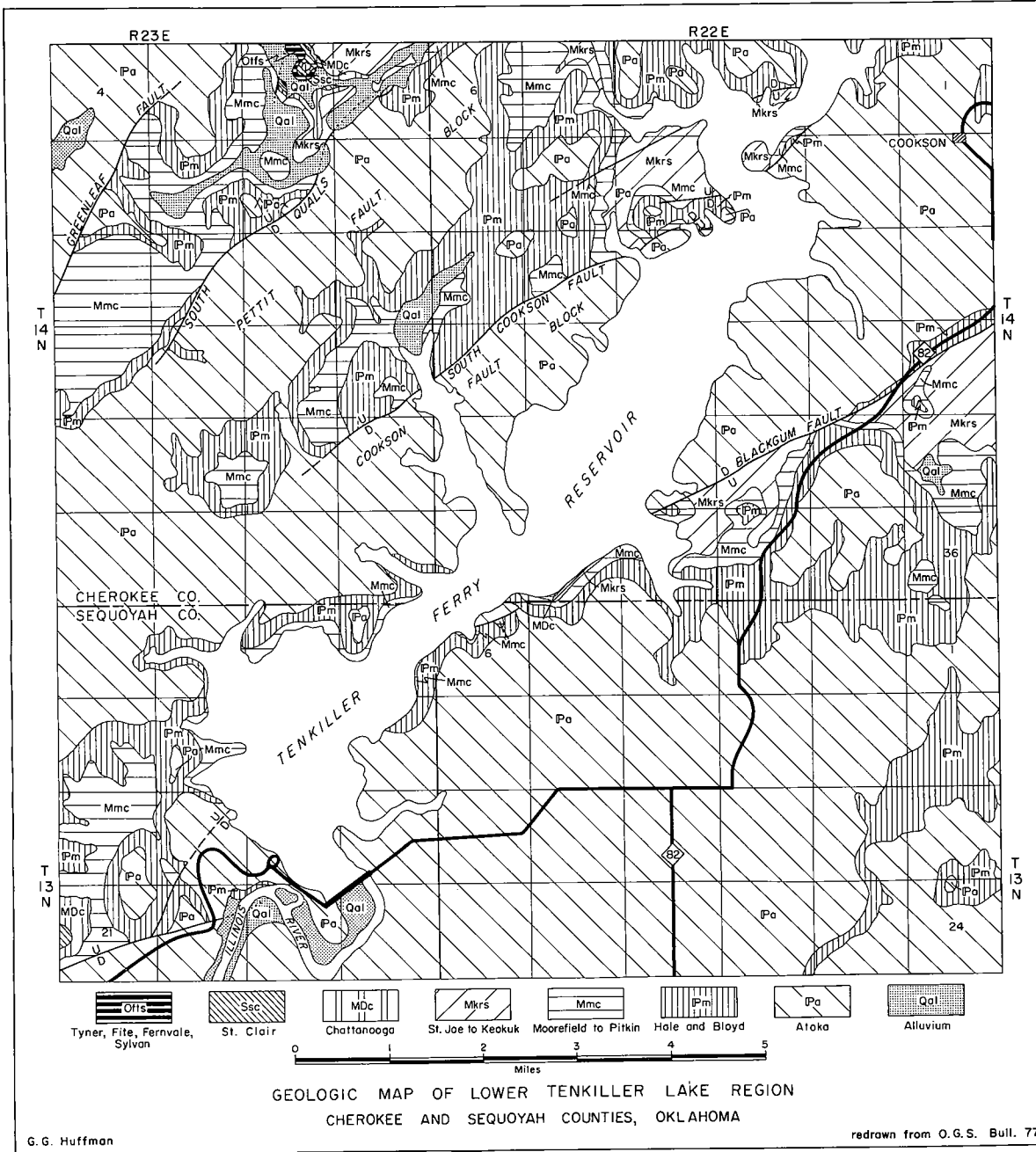


Figure 50. Geologic map of lower Tenkiller Lake region, Cherokee and Sequoyah Counties, Oklahoma.

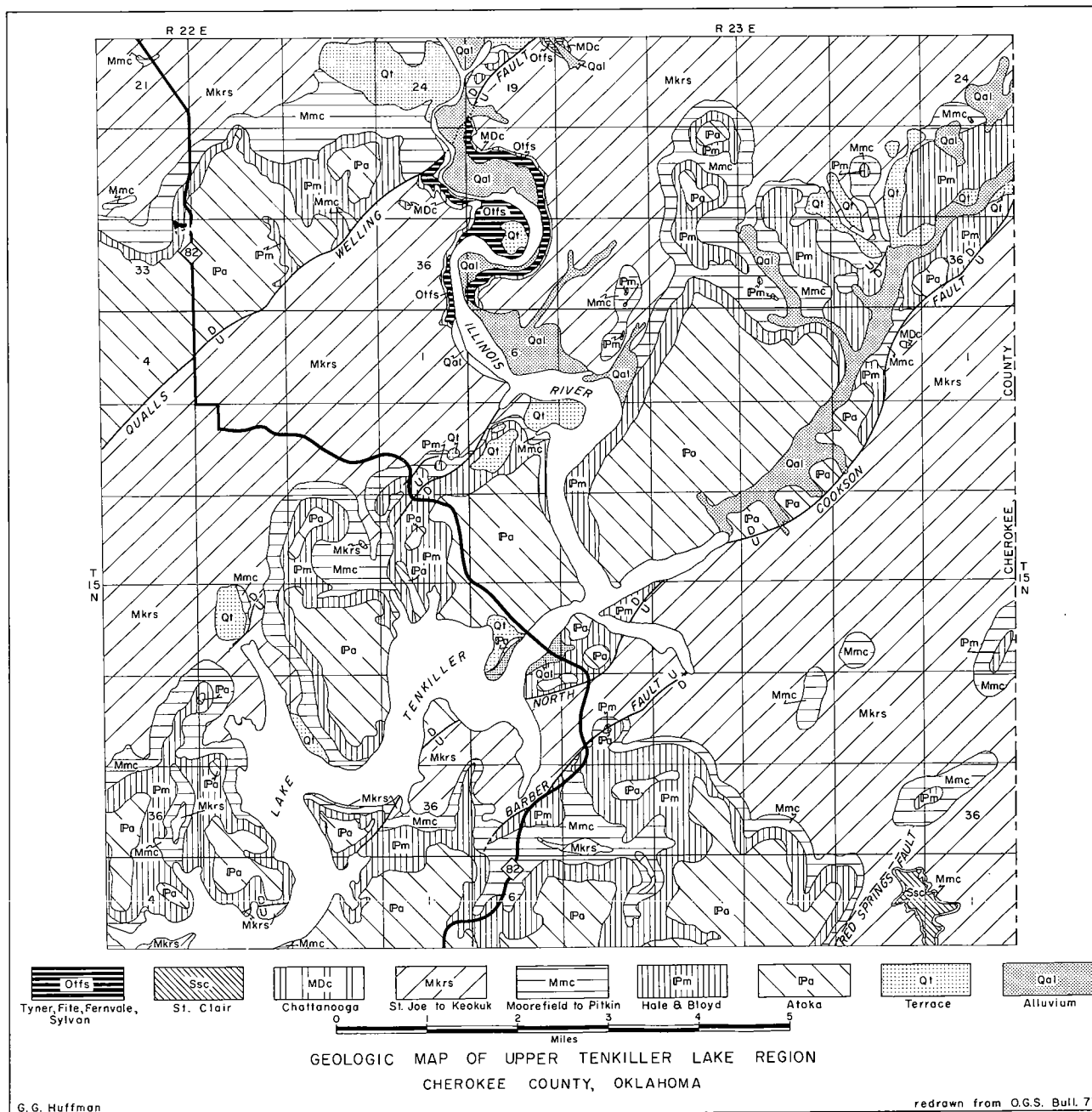


Figure 51. Geologic map of upper Tenkiller Lake region, Cherokee County, Oklahoma.

land gravels and by two distinct terrace levels above the Grand and Arkansas Rivers.

GEOLOGY OF SPECIFIC AREAS

Grand Lake or Lake O' the Cherokees (figs. 45, 46). — Pensacola Dam is built on solid rock ledges of the Reeds Spring Chert and Limestone of Mississippian age. Upper portions of the valley walls near the dam are of white, massive, Keokuk Chert. Nearly all of the reservoir is underlain by chert and limestone of Osagean age. Northwest of Miami, the Neosho River flows across the Hinds-ville Limestone (Mississippian) and the soft, relatively nonresistant beds of the Hartshorne, McAlester, Savanna, and Boggy Formations of Middle Pennsylvanian age. Tributary streams from the east rise in the chert hills and are clear and free of silt. The Neosho River and tributary streams entering from the west are muddy and heavily loaded with silt.

The beds in this area are flat lying with local departure from horizontal along the flanks of the Horse Creek anticline and in proximity to the Seneca graben, which cuts across the spillway of the Pensacola Dam east of Disney.

Spavinaw Lakes (figs. 47, 48). — Spavinaw Creek is floored by the Cotter Dolomite of Ordovician age. This is overlain by the black Chattanooga Shale, the St. Joe Limestone, and the Reeds Spring and Keokuk cherts and limestones of Mississippian age. The sequence above the Cotter may be seen at the south end of the dam on the lower lake and this sequence of units extends almost continuously around the valley walls adjacent to the lakes. The Cotter Dolomite and underlying Spavinaw Granite (Precambrian) are exposed along Spavinaw Creek west of the lower dam and in scattered crops throughout the western edge of Spavinaw.

Greenleaf Lake (fig. 49). — The dam and spillway are built on limestones of the Morrow Series of Lower Pennsylvanian age. Rock ledges in the spillway yield abundant blastoids of the *Pentremites angustus* type, as well as fragments, plates, and occasional calices of crinoids. The precipitous cliffs which border Greenleaf Lake are composed of limestones, shales, and sandstones of the Fayetteville, Pitkin, Hale, Boyd, and Atoka Formations. Greenleaf Lake fault passes approximately three-fourths of a mile northwest of the dam, parallels the northwest lake shore for nearly two miles, and then cuts across the lake, in sec. 36, T. 14 N., R. 20 E.

Tenkiller Reservoir (figs. 50, 51). — The geologic setting of this great dam is unique. It is on a large bend in the Illinois River. The neck, or spur, of this bend forms a natural barrier, which contains the tunnels and spillways; and the earthen dam is attached to the rock wall of its southern terminus. Both ends of the dam abut against the heavy ledges of the Atoka Formation. The Boyd Shale and Limestone which underlie the Atoka are exposed just west of the dam on the lower or southern side. The

Boyd-Atoka contact dips beneath the floor of the reservoir. Minor faulting in the vicinity of the penstock tunnels created only slight engineering problems during construction.

Upstream the reservoir is traversed by several northeastward-trending faults. Rocks as old as Ordovician are brought to the surface on the upthrown blocks. Exposed rocks along the shores of Tenkiller Lake include the Tyner, Fite, Fernvale, and Sylvan Formations of Ordovician age; the St. Clair of Silurian age; the Chattanooga and Sylamore of Upper Devonian-Lower Mississippian; the St. Joe, Reeds Spring, Keokuk, Moorefield, Hinds-ville, Fayetteville, and Pitkin of Mississippian age; and the Hale, Boyd, and Atoka of Pennsylvanian age.

Illinois River Valley near Tahlequah (fig. 52). — The Illinois River valley northeast of Tahlequah is floored by the Burgen Sandstone (Ordovician) and covered by a thin veneer of alluvium and terrace material. The lower parts of valley walls are formed by the green shales and dolomites of the Tyner Formation, the lithographic Fite Limestone, a truncated wedge of coarsely crystalline Fernvale Limestone, and the black Chattanooga (Noel Member) Shale. Upper portions of valley walls are composed of the St. Joe Limestone, the interbedded Reeds Spring Limestone and Chert, and the overlying massive Keokuk Chert, all of Mississippian age. The Keokuk Chert forms the surface rock of the upland areas.

Fort Gibson Reservoir (figs. 53, 54). — The Fort Gibson Dam is built on limestones of Mississippian age. The east end of the dam abuts against the black Fayetteville Shale and thin, interbedded limestones. These are overlain by the Pitkin, Hale, Boyd, and Atoka Formations. The earthen embankment at the west end of the dam is attached to a wall of upper Fayetteville and Pitkin. The prominent regional unconformity between the Upper Mississippian and the Lower Pennsylvanian, Morrow Series, is well displayed along the cliff at the west end of the dam where a good development of basal Hale Conglomerate cuts across the Pitkin strata.

The oldest rocks present in the Fort Gibson Reservoir area are of Ordovician age. The Tyner Shale crops out near the junction of Clear Creek and the Grand River, where it is brought to the surface by anticlinal flexing. The Tyner is succeeded by the Chattanooga, St. Joe, Reeds Spring, and Keokuk Formations at this locality. In the upper reaches of the reservoir, Meramec and Chester limestones and shales floor the valleys and form the lower portions of adjoining cliffs. Principal units include the Moorefield, Hinds-ville, and Fayetteville Formations. The upper portions of the valley walls are formed by the resistant Hale and Atoka Formations.

ECONOMIC POSSIBILITIES

Oil and Gas. — The prospects for oil and gas in the Oklahoma Ozarks have been summarized by

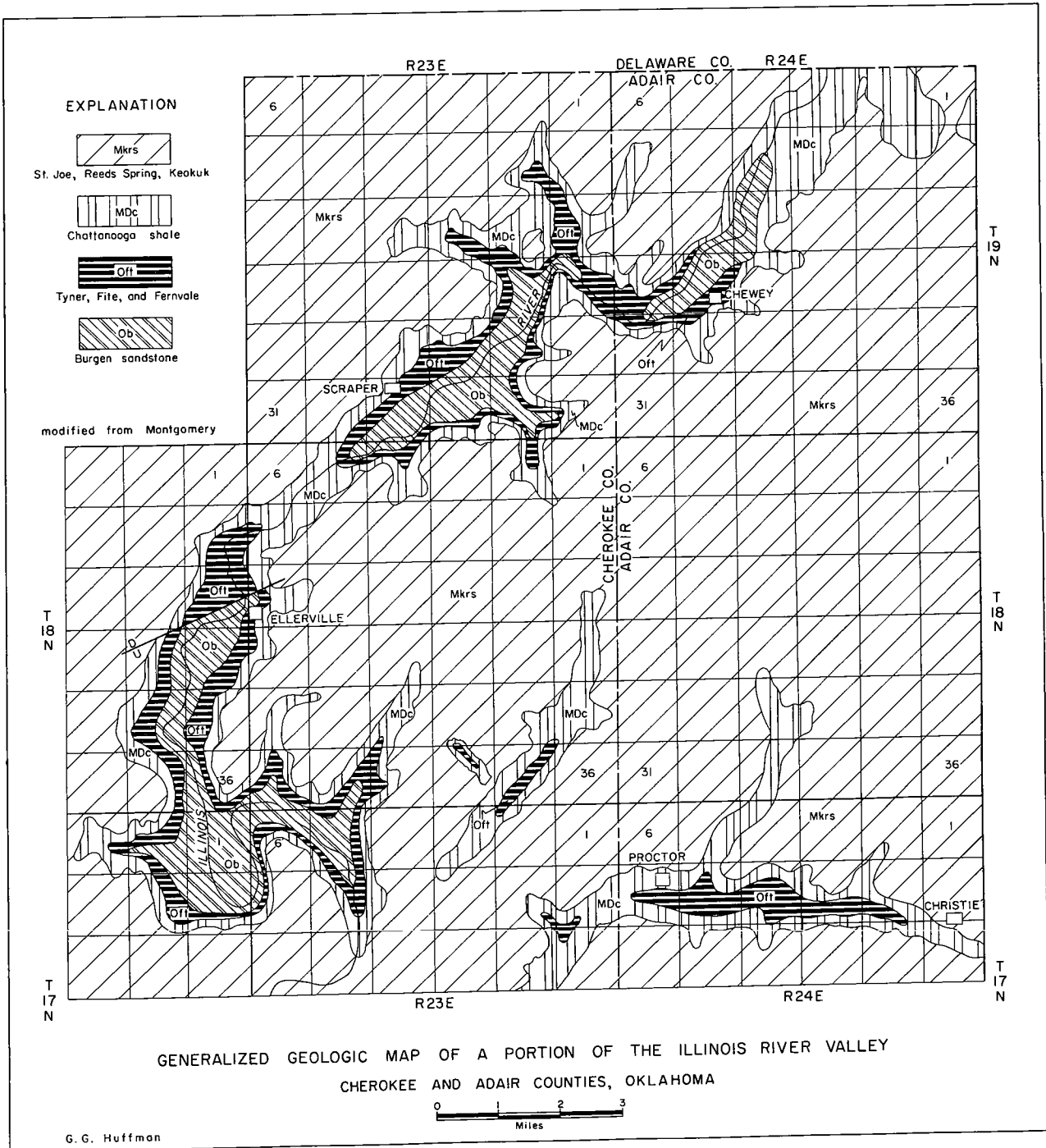


Figure 52. Generalized geologic map of a portion of the Illinois River valley, Cherokee and Adair Counties, Oklahoma.

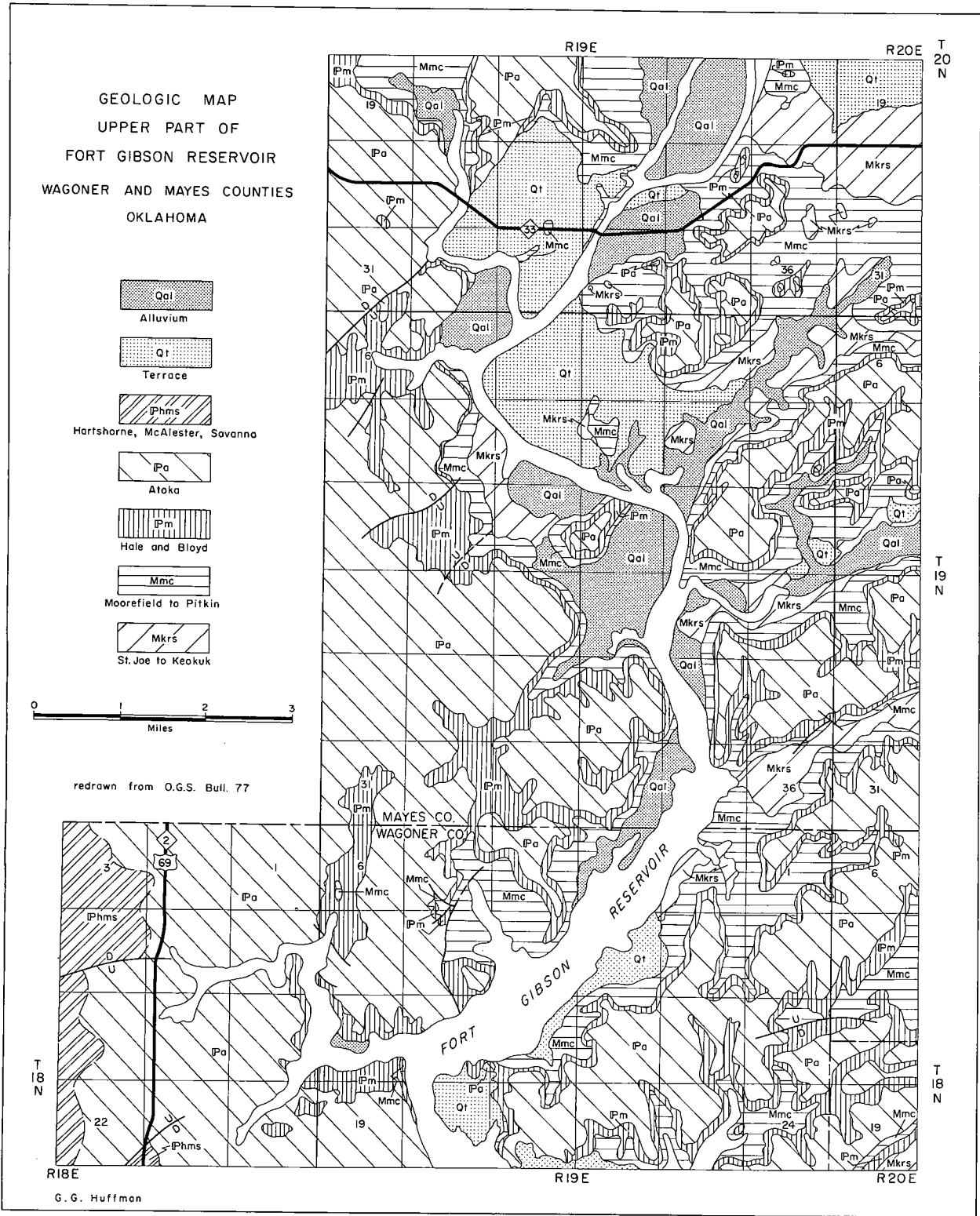


Figure 53. Geologic map, upper part of Fort Gibson Reservoir, Wagoner and Mayes Counties, Oklahoma.

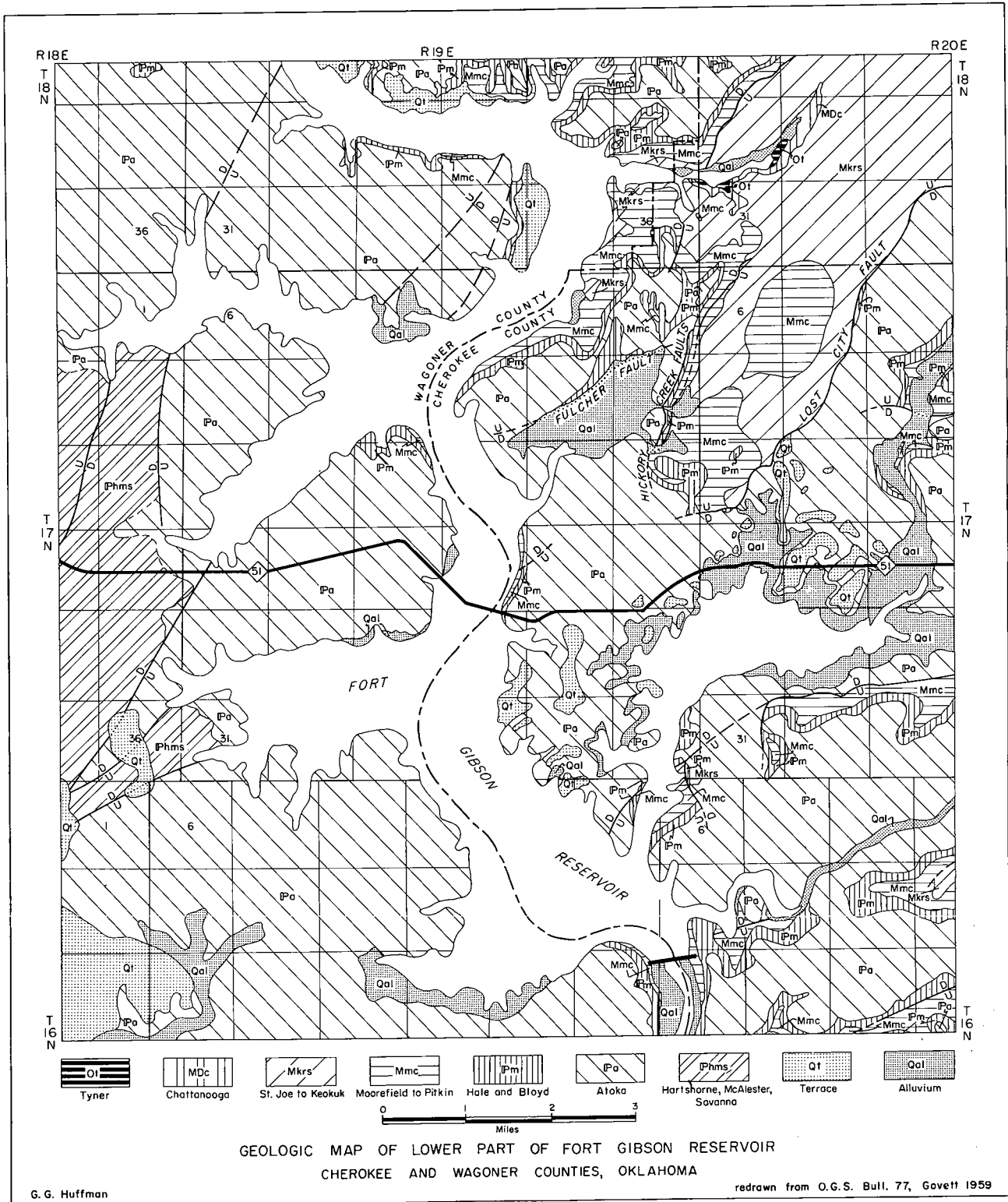


Figure 54. Geologic map of lower part of Fort Gibson Reservoir, Cherokee and Wagoner Counties, Oklahoma.

Cram (1930) and by Ireland (1930). Except for a small depleted gas field near Mazie (secs. 26, 27, T. 19 N., R. 18 E.) bordering the western edge of the area included in this study, commercial production of oil and gas has not been established. Small gas fields have been discovered near Vinita in secs. 16, 21, T. 25 N., R. 21 E., and in sec. 24, T. 25 N., R. 20 E. One shut-in gas well is in sec. 36, T. 19 N., R. 18 E., near the junction of State Highway 33 and U. S. Highway 69. A small gas well in SW $\frac{1}{4}$ sec. 33, T. 14 N., R. 24 E., supplies gas for limited domestic purposes. Recent tests in the Big Cabin Creek area, secs. 22, 23, 26, 27, have had slight indications of oil. Oil shows were encountered in a water well at the fish hatchery in Tahlequah, but commercial production in the area has not been established.

Abundant reservoir rocks, source rocks, and favorable structural anomalies are present, but the strata which produce at depth a few miles to the west are exposed or are near the surface in this area, and oil that may have been present has escaped or has been flushed out by water.

Among the potential reservoir rocks are the Burgen Sandstone, sandstones in the Tyner, the Sylamore Sandstone, the Wedington Sandstone Member of the Fayetteville Formation, the Hale Sandstone, and the sandstones in the Atoka, as well as numerous limestones, cherts, and dolomites with local porosity. Source rocks include the Tyner Shale, Sylvan Shale, Chattanooga Shale, Moorefield and Hindsville Formations, Fayetteville Shale, Bloyd Shale, and the black shales in the Atoka.

Slight indications of oil and gas have been observed at the surface in this area. Several formations, especially the Moorefield and Hindsville, are characterized by a strong bituminous odor, and the hollow interiors of fossils in the Moorefield and St. Clair have yielded small amounts of live, green oil. Gas seeps have been noted along Chouteau Creek (sec. 32, T. 20 N., R. 19 E.), on Nigger Hollow anticline (secs. 14, 15, T. 15 N., R. 20 E.), and on Salt Branch anticline (sec. 36, T. 14 N., R. 21 E.). Traces of oil and gas have been reported from water wells, and sufficient gas is obtained from the Osagean chert in sec. 10, T. 22 N., R. 20 E., and from the Atoka in sec. 1, T. 14 N., R. 21 E., for domestic purposes. Stains and asphaltic residue have been found in the Atoka Sandstone southeast of Vinita.

Oil seeps and asphaltic residue are reported from quarries in the Hindsville Limestone northeast of Adair, sec. 24, T. 23 N., R. 19 E., and in sec. 30, T. 23 N., R. 20 E. (Stoever, 1956, p. 139).

Several of the more promising structures, such as Mission Dome (secs. 8, 9, 16, T. 19 N., R. 19 E.) and Chouteau Creek anticline (sec. 32, T. 20 N., R. 19 E.), have been drilled, and quantities of salt water are now flowing from these openings. Many structures remain untested, but because of the failure of previous attempts, further drilling for oil and gas at this time is not encouraged.

Immediately west of the Ozark uplift in Muskogee, western Wagoner, Mayes, Craig, and Rogers Counties, sand conditions improve and numerous fields have been developed.

Coal. — Thin coal beds have been observed southeast of Fort Gibson, NE $\frac{1}{4}$ sec. 20, T. 15 N., R. 20 E.; along Fourteenmile Creek, sec. 1, T. 17 N., R. 20 E.; on Double Spring Creek in sec. 26, T. 17 N., R. 20 E.; and near Lost City in secs. 35 and 36, T. 18 N., R. 20 E. The coals range in thickness from 4 inches near Fort Gibson to 22 inches near Lost City, where a bed has been mined in the past.

Limestone. — Limestone for aggregate is found throughout the area, with the St. Clair, Hindsville, Hale, and Bloyd furnishing the most suitable stone. Extensive quarrying of the Hindsville in Mayes and southern Craig Counties includes operations east of Vinita in secs. 16 and 22, T. 25 N., R. 21 E., and the Weaver Brothers' operation southeast of Pryor in sec. 33, T. 21 N., R. 19 E. Oklahoma Cement Company in 1960 opened a large plant southeast of Pryor in sec. 25, T. 21 N., R. 19 E., where approximately 1,000,000 barrels of cement per year is being manufactured from the Hindsville Limestone and overlying Fayetteville Shale. A large quarry in the Hindsville and Moorefield Formations south of Stilwell in sec. 4, T. 14 N., R. 25 E., furnished crushed limestone for road surfacing. Crushed rock for the Tenkiller Ferry Dam was obtained from a quarry in the Bloyd Formation in sec. 10, T. 13 N., R. 21 E., and the crushed stone for Fort Gibson Dam was taken from a quarry in the Hale and Pitkin in sec. 15, T. 16 N., R. 20 E. Underground operations are now being conducted south of the Fort Gibson Dam in the Hale and Pitkin Formations in sec. 25, T. 16 N., R. 19 E.

High-calcium limestone for quicklime and for agricultural purposes has been obtained from the St. Clair Limestone near Marble City since 1937. Present yearly production ranges from 200,000 to 250,000 tons. Unlimited amounts of the St. Clair Limestone are present in the Marble City area on the upthrown side of the Marble City and Lyons faults. Underground quarrying operations are now in progress.

Additional exposures of the St. Clair are near Bunch in Maloy Hollow, secs. 4, 5, 9, T. 14 N., R. 24 E.; in sec. 29, T. 14 N., R. 24 E.; and in Dry Creek, secs. 1, 2, T. 14 N., R. 23 E. The top of the St. Clair is exposed northwest of Tenkiller Dam in secs. 20 and 21, T. 13 N., R. 21 E.

Crinoidal limestones in the Osagean Series along the west bank of Grand River, T. 21 N., R. 20 E., may offer a source of high-calcium limestone.

Gravel. — Unlimited quantities of rounded chert gravels are present in Mayes County along Grand River from the vicinity of State Highway 33 east of Chouteau northward to the vicinity of Pensacola (T. 23 N.). Additional deposits occur south of Baron and along the streams of Cherokee and Adair Counties. Distribution of terrace gravels is indi-

cated on the maps, and pits are shown with the appropriate symbol.

Building stone. — The Atoka Sandstone has been used rather widely as a siding for houses, especially rural homes. The upper calcareous siltstone member of the Moorefield Formation in secs. 3, 10, T. 22 N., R. 20 E., has been quarried for this purpose. Additional possibilities include the Wedington Sandstone of eastern Adair County and several limestones, especially the St. Clair. Many of the country homes are faced with cobbles and boulders of Keokuk Chert secured in a matrix of concrete. The Batesville Sandstone is quarried for rock siding in Ottawa County.

Tripoli. — Tripoli forms as a result of the leaching of soluble material from the Keokuk Chert to leave a soft, white, porous rock, which can be used for filters and abrasives. A small amount of tripoli is mined in Ottawa County, and the entire amount is processed by the American Tripoli Division of the Carborundum Company in Seneca, Missouri. The 1957 production of 22,236 tons was valued at \$67,000.

Lead and zinc. — Lead and zinc have been produced in Ottawa County since their discovery in 1905. Eagle-Picher Company, Dewey Sims Mining Company, Contact Mining Company, Mark Twain Mining Company, and Searcy-Henderson are the main producers. Declining prices forced these operations to shut down in 1959. Production for 1957 was \$5,523,000; that for 1958, approximately \$1,940,000.

Asphaltic sandstone. — Sandstone impregnated with bituminous material occurs in the Atoka Formation in southeastern Craig County. It can be seen along State Highway 82, especially in sec. 28, T. 24 N., R. 21 E.

Phosphate. — Twin beds of black, nodular phosphate are associated with the Fayetteville Formation near Marble City and in the Cookson Hills. Two localities showing maximum development are (1) south roadside SW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 15, T. 13 N., R. 23 E., where thin beds are scattered throughout 25 feet of the Fayetteville Formation, and (2) on the east branch of Terrapin Creek along an old road 2 to 2.5 miles south of the Cookson

store and in the NE $\frac{1}{4}$ sec. 24, T. 14 N., R. 22 E., where a three-inch bed of phosphate is present.

Water. — Water for domestic purposes may be obtained from several horizons. Shallow waters are present in the terrace and alluvial deposits, in the Atoka and Hale Sandstones, and in some of the porous limestones. Water from the Moorefield and Hindsville Limestones is not suitable for drinking purposes because of the release of hydrogen sulphide from decomposition of pyrite within the formation.

The best source of ground water in northeastern Oklahoma is the highly fractured and porous "Boone" chert. Quantities of soft, clear water are plentiful in nearly all parts of the area in this unit. Lack of natural filtration may render this water impure and careful analyses should be made before the water is used for human consumption.

Springs are numerous throughout the area. Generally they occur at the base of the "Boone" at the contact with the underlying Chattanooga Shale. Many large perennial springs are associated with major faults which bring the "Boone" chert against impervious strata of various ages.

Spavinaw Lakes furnish water for the city of Tulsa. Other large supplies of water include Grand River, which furnishes water for the industries near the steam generating plant of the Grand River Dam Authority southeast of Pryor, Fort Gibson Reservoir, Greenleaf Lake, and Tenkiller Ferry Reservoir.

Hydroelectric power. — Construction of the Pensacola, Fort Gibson, and Tenkiller Ferry Dams has made northeastern Oklahoma an important center of hydroelectric power (Huffman, 1955). Pensacola Dam impounds a lake covering 55,000 acres with 1,200,000 feet of power storage and 540,000 acre feet of storage for flood control. Six turbines generate more than 300,000,000 kilowatt hours of electrical energy per year. Fort Gibson Reservoir covers 51,000 acres, has a storage capacity of 1,287,000 acre feet, and a generating capacity of 180,700,000 kilowatt hours per year. Tenkiller Ferry Reservoir covers 21,000 acres, has a total storage of 1,230,000 acre feet, and furnishes 107,000,000 kilowatt hours of power per year. Additional power will be generated at the Markham Ferry Dam near Locust Grove, now under construction.

PLANT LIFE

INTRODUCTION

The plant life of this area is so varied and abundant that this region is sometimes called the botanists' paradise. It has been said that a greater variety of plant species exists here than in all of continental Europe. The picturesque green hills, splotted with white dogwood blossoms, provide an invigorating experience for the tourist who takes one of the annual guided dogwood tours originating in Sallisaw and Tahlequah. Legend holds that the cross on which Christ was crucified was made of the beautiful dogwood tree of that time and that a curse was placed upon the tree, causing it to be crooked and useless to man. The dark spots at the end of the petals are supposed to represent nail prints.

In early spring, the redbud (*Cercis canadensis*), the official state tree, stands out against a background of leafless forest. The redbud is sometimes called the Judas tree because of the legend which holds that Judas hanged himself on a tamarack (redbud) tree which was changed by a divine curse from a large beautifully shaped tree to the ill-shaped unsightly shrub.

The state floral emblem, the mistletoe, can be distinguished by its deep green and small leaves growing on the limbs of its large host tree.

FOREST TREES AND SHRUBS

Northeastern Oklahoma is principally a forest area with oak and hickory as the major types. Numerous red cedars dot the forests with green in winter. One may observe as many as seven species of oak, three or four species of elm, and two species of hickory while sitting at a picnic table near the end of one of the park roads. In the upper drier levels one will find post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), and black hickory (*Carya texana*). In the more eroded shallow soils, post oak and blackjack oak are present and, surviving the shaded areas here, the winged-elm (*Ulmus alata*) is found. In the more fertile valleys, burr oak (*Quercus macrocarpa*), white oak (*Quercus alba*), yellow oak (*Quercus muehlenbergii*), bitternut hickory (*Carya cordiformis*), and pecan (*Carya illinoensis*) are most common. Black oak (*Quercus velutina*) and mockernut hickory (*Carya tomentosa*) occur on fairly deep soils with intermediate moisture conditions (Elroy Rice, personal communication, July 1961). Along streams and in swampy areas are found water oak (*Quercus nigra*), sycamore (*Platanus occidentalis*), sweet gum (*Liquidambar styraciflua*), which is popular in the furniture industry because its wood takes a high polish, American elm (*Ulmus americana*), red elm (*Ulmus rubra*), and green ash (*Fraxinus pennsylvanica*). The persimmon (*Diospyros virginiana*) and sassafras (*Sassafras albidum*) are found in the open areas where competition is not intense. On

steep north- or northeast-facing slopes, sugar maple (*Acer saccharum*), white oak (*Quercus alba*), and Shumard's oak (*Quercus shumardii*) are common (Rice, 1961), and shagbark hickory (*Carya ovata*) may be present.

Other tree species which may be found within the Ozark area are:

Black walnut	<i>Juglans nigra</i>
American elm	<i>Ulmus americana</i>
Slippery elm	<i>Ulmus rubra</i>
Hackberry	<i>Celtis laevigata</i>
Mulberry	<i>Morus rubra</i>
Kentucky coffee tree	<i>Gymnocladus dioicus</i>
Wild plum	<i>Prunus mexicana</i> and <i>P. serotina</i>
Honey locust (long thorns)	<i>Gleditsia triacanthos</i>
Black locust (short, paired thorns)	<i>Robinia pseudoacacia</i>
Red ash	<i>Fraxinus pennsylvanica</i>
White ash	<i>Fraxinus americana</i>
Pin oak	<i>Quercus palustris</i>
Black willow	<i>Salix nigra</i>
Silver maple	<i>Acer saccharinum</i>
Hawthorn (thorn bush)	<i>Crataegus</i> (several species)
Black haw	<i>Viburnum rufidulum</i>
Osage orange (Bois d'arc)	<i>Maclura pomifera</i>
Dogwood	<i>Cornus florida</i>
Redbud	<i>Cercis canadensis</i>
Shortleaf pine	<i>Pinus echinata</i>
Red cedar	<i>Juniperus virginiana</i>
Smaller trees, vines, and shrubs common to the area are:	
Holly	<i>Ilex decidua</i>
Poison ivy (three oily leaves)	<i>Rhus radicans</i>
Sumac (browsed on by white-tail deer)	<i>Rhus aromatica</i>
Wild grape shrub	<i>Ampelopsis cordata</i>
Climbing grapevine	<i>Vitis vulpina</i> and other species
Box elder	<i>Acer negundo</i>
Common elderberry (fruit eaten by 43 species of birds)	<i>Sambucus canadensis</i>
Huckleberry (relished by natives)	<i>Vaccinium aboreum</i> and <i>V. stamineum</i>
Mountain blackberry (relished by natives)	<i>Rubus allegheniensis</i> and probably others
Buckbrush	<i>Symphoricarpos</i> <i>orbiculatus</i>
Virginia creeper	<i>Parthenocissus</i> <i>quinquefolia</i>

WILD FLOWERS AND GRASSES

The wild flowers which thrive without man's preparation of seed beds, planting, and cultivation

show forth their beauty to the nature lover who will pause to admire them. A trip through the woods of this area in spring or early summer will make the thoughtful observer feel that the Creator has reserved this beauty for those who will open their hearts and minds to it. In May and June along the roadsides, the oxeye-daisy, with slender stems terminating with one flower of white petals and yellow disk, forms a waving sea of beauty. In early spring, Indian pink is found in shaded areas and is easily distinguishable because of tall stems and red blossoms contrasting with the green background. Its sticky glandular leaves often entrap insects. The wild, or pink, azalea is found along rocky ridges in the hill regions and is interesting because of the tradition that the Cherokees brought seeds from their native North Carolina and Georgia regions and scattered them in the hills of their new home. The tall goldenrod, growing in clusters and blooming during late summer and autumn, seems to be the sentinel for the open field areas. The flower lover who likes a challenge might search for the rare stoncrop with its many small flowers on the star-shaped horizontal arms.

The visitor to this area might find jack-in-the-pulpit, or Indian-turnip, so called because the Indians are supposed to have used the bulbs for food. Brown-eyed-susan is found on roadsides or clearings and is very sensitive to changing soil content. The passionflower or apricotvine has egg-sized yellow fruit, which is edible when ripe. The mayapple, sometimes called the wild lemon, is found in rich soils in season. Many species of buttercup (small, yellow flower of early spring), larkspur (deep-welled flower of white or blue in open woods), violet (many grasslike stems from root-stock), sorrel (distinguishable leaves with pleasant acid taste), dandelion (small grasslike plant with yellow, white, rose or purple flowers), and clover (yellow, white and red, all edible by

livestock), are easily found in this region in season. Here also may be found the Indian paintbrush, several species of beardtongue, four-leaved milkweed, bitterweed, several species of phlox, several species of verbena, and skunkcabbage. From the ground-hugging dandelion of the lawn to the climbing honeysuckle of the deep forest, from the early yellow clover to the late goldenrod, the close observer can find a succession of lovely beauty during the growing season.

The most predominant grasses which the visitor to this area will see are big bluestem, little bluestem, Indian-grass, switchgrass, wildrye, cheat or wild oats and broomsedge. The big bluestem (*Andropogon gerardi*) is an important forage species and provides hay in the prairies. The little bluestem (*Andropogon scoparius*) is smaller and is found in less fertile areas than is the big bluestem. Switchgrass (*Panicum virgatum*), a tall meadow grass, less palatable and with stronger stems than big bluestem, is also found outside the meadow areas as well as in them. Indian-grass (*Sorghastrum nutans*), a dense grass with long spikelets and an abundance of white hairs which fringe the stalk, is common, as are wild oats (*Avena fatua* and *Bromus* — several species) which are similar to cultivated oats except with smaller stems and smaller, less palatable seed. Broomsedge (*Andropogon virginicus*), whose foliage and stalk are hairy and tough and not palatable to livestock, is found in sterile open hillsides and in abandoned fields. It is of low forage value at any stage, especially when mature. Johnsongrass (*Sorghum halepense*) is abundant on roadsides and open areas where the soil is of better than average fertility. If cut early, it is acceptable as hay but becomes woody and unpalatable as it matures. Prussic acid, which is extremely poisonous to cattle, may form at base of leaf at certain stages in the development of Johnsongrass.

ANIMAL LIFE

INTRODUCTION

The abundance of plant life in an area usually indicates an abundance of animal life in the same area. The type of plant life affects the type of animal life since plants are the basis for building all food chains. It has been stated formerly that the Ozark region is unusually rich in plant life; now it logically follows that the animal life is also unusually rich and varied.

In this heavily wooded area are leaf-eating insects, including larvae; wood borers; insects which live on sap of plants, grubs, and other larval forms; and some adult insects which live on roots and decaying vegetable matter. Other larger insect forms and birds live on these wood-eating forms, and the birds live on the larger predaceous insects. When birds, larger animals, and trees die, bacteria and larval forms of certain insects perform scavenger duty and the food-chain cycle is started over again.

In a general sense one can start with any creature found in an area, use a knowledge of its interrelationships, and determine what other forms are likely to be found. If large numbers of owls and hawks are present, probably many field mice, rats, other rodents, and perhaps rabbits are in the area. If coyotes are scarce, usually few rabbits are present. If flowering plants are not abundant, bees of all types will be few. When a species becomes so plentiful as to produce an over-abundance, then, if natural conditions prevail, the predator of that species will also increase. Unless man's influence is too strong or unless a disaster occurs, nature is always tending in the direction of balance.

FISHES

General discussion. — Twenty-three families and more than 150 species of fishes, most of which are found in lakes and reservoirs, are known in Oklahoma. Some of the families and many of the species are omitted in this study; therefore sportsmen should not be surprised if a species is taken which is not listed here. Fishing in this area consists of two types, commercial and game fishing. Because Oklahoma game and fish laws provide that commercial fishing is prohibited on Fridays, Saturdays, Sundays, and holidays and is prohibited within one-hundred yards of shoreline, the sportsman seldom is in conflict with the commercial fisherman. During the 1957 season, commercial fishermen harvested 451,896 pounds of fish from Grand, Ft. Gibson, and Tenkiller Lakes. Except for 4,122 pounds, all of this amount was rough or non-game, consisting of buffalo, carp, flathead catfish, gar, and drum in descending order of amount harvested. By removing a large quantity of rough fish from food competition with game fish the commercial fishing industry is helpful to sport fishing.

Due to hydro-power pool arrangements in effect at Grand, Ft. Gibson, and Tenkiller Reservoirs, the shoreline level may vary as much as thirty feet

during the year. This creates a unique food forage problem. The basic food under these conditions is the organic matter coming from the tributaries. This organic matter is food for plankton, crustaceans, insect larvae, and some small fish. These in turn are food for larger fish. The shad, although sometimes a nuisance to fishermen, is a basic link in the food chain of game fish in lakes with fluctuating shorelines.

Some old-timers of the region may remember the abundance of eel, which is now almost extinct above the dams. The eel is catodromous (spawns in salt water; exists as adult in fresh water) and is thought to spawn in the warm Atlantic region of the Bermuda Islands.

CHECK LIST OF SPECIES IN TENKILLER AND FORT GIBSON LAKES

(based on creel census by Robert M. Jenkins in 1954)

Game Fishes

White crappie	<i>Pomoxis annularis</i>
White bass	<i>Roccus chrysops</i>
Largemouth bass	<i>Micropterus salmoides</i>
Channel catfish	<i>Ictalurus punctatus</i>
Black crappie	<i>Pomoxis nigro-maculatus</i>
Spotted bass	<i>Micropterus punctulatus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>

Panfishes

Bluegill	<i>Lepomis macrochirus</i>
Warmouth	<i>Chaenobryttus coronarius</i>
Green sunfish	<i>Lepomis cyanellus</i>
Redear sunfish	<i>Lepomis microlophus</i>
Rock bass	<i>Ambloplites rupestris</i>

Food and Coarse Fishes

River carpsucker	<i>Carpionodes carpio</i>
Carp	<i>Cyprinus carpio</i>
Redhorse	<i>Moxostoma spp.</i>
Black buffalo	<i>Ictiobus niger</i>
Bigmouth buffalo	<i>Megastomatobus cyprinella</i>
Smallmouth buffalo	<i>Ictiobus bubalus</i>
Drum	<i>Aplodinatus grunniens</i>
Black bullhead	<i>Ameriurus melas</i>
Yellow bullhead	<i>Ameriurus natalis</i>
Flathead catfish	<i>Pilodictis olivaris</i>
Spotted sucker	<i>Minvirema melanops</i>
Spotted gar	<i>Lepisosteus productus</i>
Longnose gar	<i>Lepisosteus osseus</i>
American eel	<i>Anquilla bostoniensis</i>
Hogsucker	<i>Hypentelium nigricans</i>

Forage Fishes

Gizzard shad	<i>Dorosoma cepedianum</i>
Longear sunfish	<i>Lepomis megalotis</i>
Orangespotted sunfish	<i>Lepomis humilis</i>
Minnnows	27 species
Darters	8 species
Mosquito fish	1 specie
Silversides	1 specie
Stone cat	<i>Noturus flavus</i>
Slender madtom	<i>Schelbecades exilis</i>

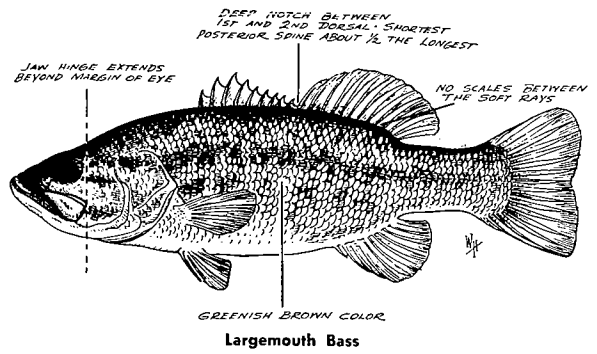
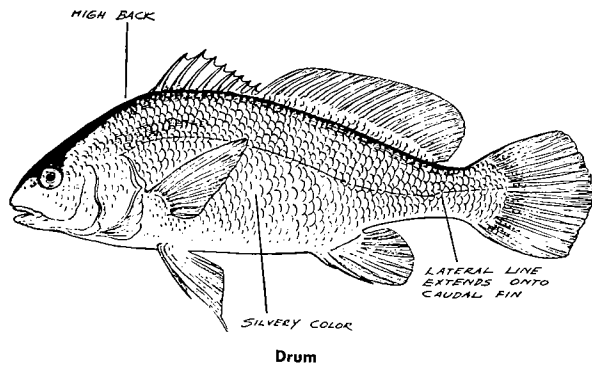
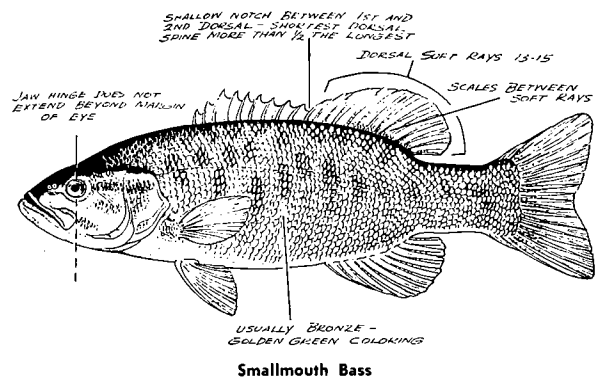
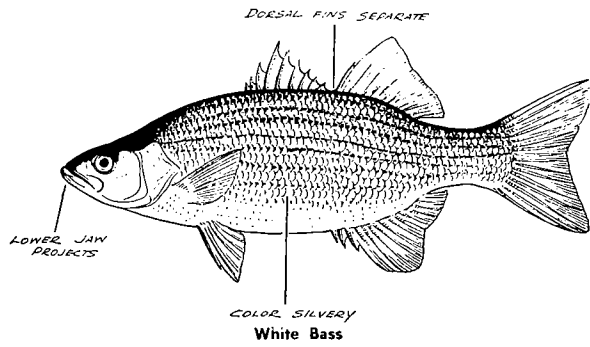
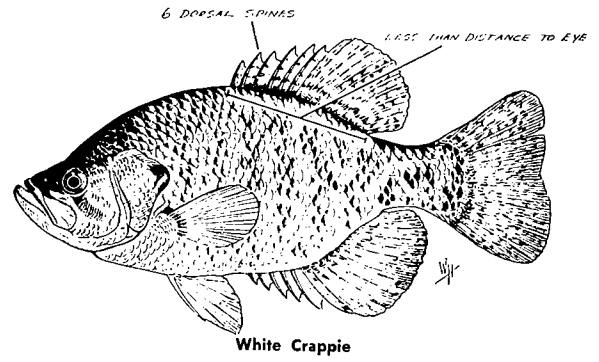
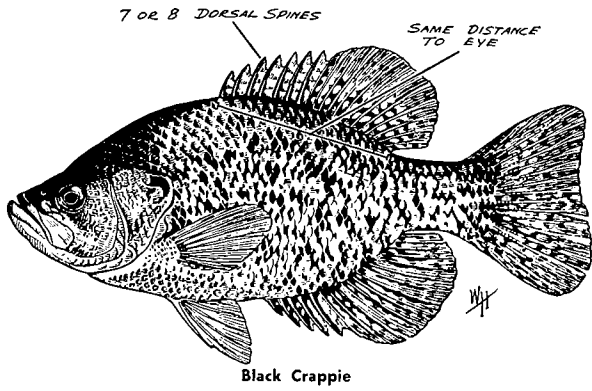


Figure 55. Some important fishes of the Oklahoma Ozarks (photographed from Ward, 1959).

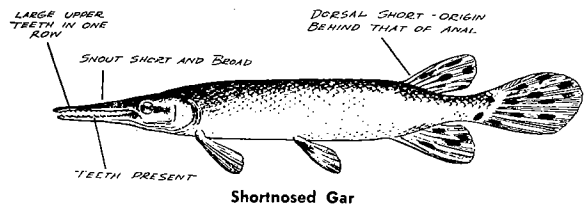
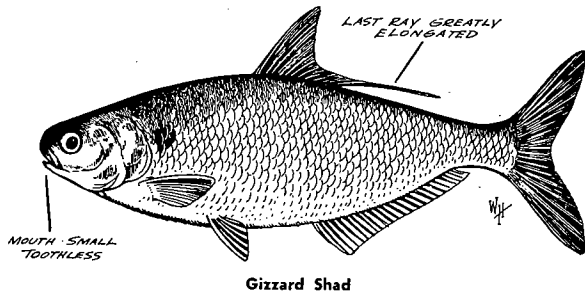
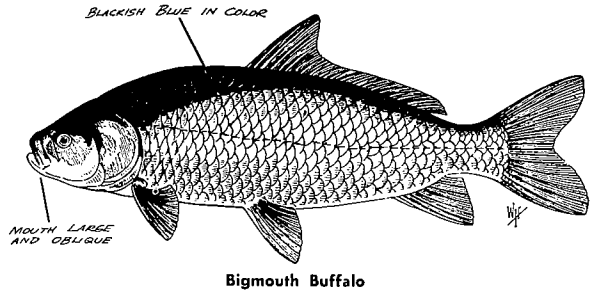
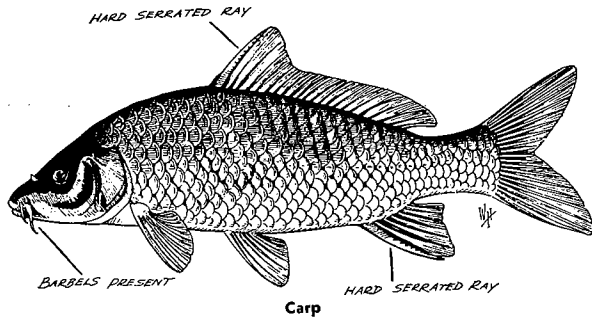
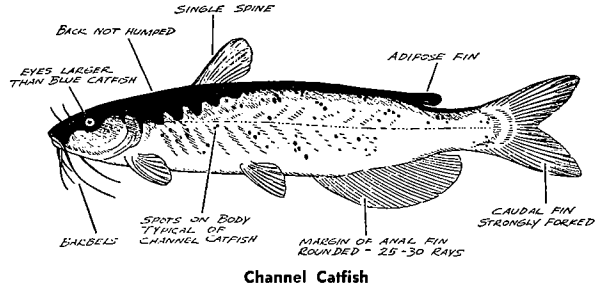
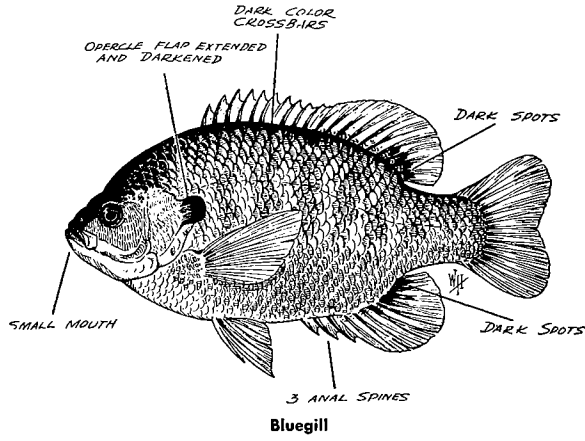


Figure 56. Some important fishes of the Oklahoma Ozarks (photographed from Ward, 1959).

DESCRIPTION OF TWELVE MOST COMMON FISHES
IN NORTHEASTERN OKLAHOMA

1. White bass (sand bass, striped bass) (*Roccus chrysops*). This is the only species of the bass family found in significant numbers in this area. Since being transplanted here from northern lakes, it has thrived. This bass is not known to live longer than six years, but it may attain a weight of five pounds and a length of eighteen inches. White bass are usually silvery in color. They travel in schools, the young in shallow waters or near shore, and feed on fish, insects, and crustaceans. Experienced fishermen recognize the commotion on the surface when a school of white bass finds a school of shad. White bass may spawn 600,000 to 1,000,000 eggs in one season. The eggs adhere to weeds or debris in lake bottom or in a tributary if a suitable one is at hand.

2. Largemouth bass (*Micropterus salmoides*). This fish belongs to the sunfish family and is probably the number-one sports fish in Oklahoma. It seems to be more or less solitary as an adult in contrast to the school habit of the white bass. It may reach a maximum of ten pounds and is greenish brown. The young feed on insects, but the adult changes to a fish diet. The female may spawn 15,000 eggs over a bed of gravel, which she sweeps free of silt with her tail. The male fish guards the nest until the fry have emerged and scattered.

3. Smallmouth bass (*Micropterus dolomieu*). The smallmouth is also a member of the sunfish family and seems to be restricted to streams in northeastern Oklahoma, especially the Illinois River. This bass is considerably smaller than the largemouth, seldom weighing more than two pounds; however, it makes up for its size in gameness. The young feed upon plankton forms, but the adult forages the bottom of lakes and streams for crayfish and deep-water fishes. The female may spawn 7,000 or more eggs and, like the largemouth, the male guards the nest.

4. Bluegill (bream) (*Lepomis macrochirus*). The bream, a member of the sunfish family, is present in practically all Oklahoma waters. It thrives in ponds and lakes and tends to overpopulate them if not held in check by fishing or predators. Bream may reach a length of twelve inches. The adult prefers deeper waters, whereas the young frequent the shallow, weedy areas.

5. White crappie (*Pomoxis annularis*). Crappies are also members of the sunfish family. The white crappie, widespread throughout the state, is present in ponds, lakes, streams, and rivers. It is one of our best large-lake fishes and can be taken by anglers throughout the year. The maximum size for Oklahoma crappie is approximately three pounds, but specimens of this size are rare. Spawning occurs in April, and the nests are similar to those of other members of the sunfish family. A female ten inches long is able to spawn approximately 14,000 eggs (Ward, 1959, p. 36).

6. Black crappie (*Pomoxis nigro-maculatus*).

The black crappie is neither as widely distributed nor so tolerant to muddy water as is the white crappie. Position of the dorsal fin and the darker color serve to distinguish the black crappie.

7. Channel catfish (*Ictalurus punctatus*). The channel cat is primarily a stream fish but, because of artificial stocking, is now common in all waters of the state. It is slick, slender, and has a silvery blue color with darker shading on back to lighter shading on ventral portion. It may reach a weight of 25 pounds but averages less than 5 pounds. Catfish are taken by trotline or deep fishing in lake currents. Catfish feed on snakes, crayfish, insects, mussels or even rodents in rare cases. The average number of eggs at one spawning is 10,000. The male drives the female from the nest soon after spawning and takes over the family duties (Ward, 1959, p. 22).

8. Carp (*Cyprinus carpio*). The carp is a native of Asia and was introduced in this country in 1877 by R. Hessel. From the 345 brought to the United States, 12,000 were distributed two years later. Twenty years after introduction, distribution was discontinued and the carp has prospered. Some people think the carp is noxious to game-fish propagation, believing it destroys nests and consumes the spawn. This charge has not been proved. Carp may attain the size of 30 pounds but are more likely to average between 5 and 10 pounds. The female may spawn from 300,000 to 700,000 eggs in one season. They belong to the minnow family.

9. Bigmouth buffalo (*Megastomatobus cyprinella*). The bigmouth buffalo is one of the largest members of the sucker family, sometimes reaching a weight of 40 pounds. It is abundant in larger streams and in slowly moving tributaries which have deep, muddy bottoms. Food includes algae, mollusks, insect larvae, and table garbage or other waste-food materials. Spawning occurs in spring in a chance manner, and no parental care is noticed during or after period of incubation.

10. Shad (*Dorosoma cepedianum*). The shad is thin and has a small dorsal fin with last ray greatly elongated. It is silver in color and is seldom more than twelve inches long. It is useless for human food but is extremely valuable as a unit in the food chain of the larger game fishes. The food consists mostly of vegetable matter on the lake and stream bottoms. It is very active, often jumping out of the water when avoiding fishes of prey or when jumping over a seine or net. Spawning occurs in early spring, usually April or early May. The eggs are scattered at random. Shad are quite prolific, but egg counts are not available (Ward, 1959, p. 12).

11. Shortnosed gar (*Lepisosteus platystomus*). Geologists have uncovered fossils revealing that fishes almost identical with our present-day gars lived millions of years ago. Thus, the gar is often referred to as a living fossil (Ward, 1959, p. 8). The gar is equipped with heavy diamond-shaped enamel scales. The alligator gar is the largest member of the family. Gars are rarely more than 4 feet

long and seldom weigh more than 20 to 30 pounds. Gars are considered noxious, although many believe they have not been proved so as yet. Gars are most active at or near the surface, as evidenced by their peculiar quiet movement and quick seizure.

12. Drum (*Aplodinatus grunniens*). Most members of the drum family are marine, but this one species is well represented in our lakes and streams. With carp and catfish, the drum is favored by commercial fishermen. Its flesh is a desirable white, much like that of the sunfishes. It may weigh as much as 40 pounds but ordinarily weighs 10 pounds or less. Feeding on microscopic organisms, crustaceans, insects, and insect larvae, it sometimes moves in large schools. The drum is so-called because of its peculiar grunting noise.

AMPHIBIANS

General discussion. — The Greeks gave this group of animals the name amphibia, or “double life.” These animals live part of their life span in water and part on land. They use gills for breathing while in water and use lungs for respiration when they live principally on land.

As adults, some amphibians never enter the water, whereas others must remain in a moist environment. Some desert species have tough dry skin, which reduces body loss of moisture; and it is said that they use body-water over and over and thus do not need to drink water except that which they obtain as dew on blades of grass. In contrast, some salamanders and water frogs must keep their skins moist or they will die.

Most amphibians have four limbs, some have only two, and a few have no limbs at all. Water forms usually have tails which are used for swimming but which disappear when they move to land. The feet of aquatic amphibians are usually webbed. The body secretion of some is poisonous and is used to help reduce body evaporation.

Tadpoles (immature frogs) and some salamanders exhibit the peculiar ability to replace lost parts. This process is called regeneration. The young of amphibians live on vegetable materials, but most adults live on other animals, usually insects, spiders, and worms.

Salamanders. — The salamanders of northeastern Oklahoma are variable as to size, form, habitat, and behavior. They are weird creatures, which seem to have emerged from past ages. The amphibious types are more likely to be found by the interested layman; and, as they are rarely seen, many of the more elusive species have been omitted here. Members of the *Ambystoma*-type congregate in large numbers during breeding season for courtship and deposition of eggs, activities that may be completed in one or in a few nights. After the first early spring rain, examine any small shallow pond in the neighborhood, or a woodland or a pasture pool, and you may find eggs laid either in large clusters or in small groups, floating at the surface of the water

or submerged and attached to sticks or debris (Conant, 1958, p. 208).

1. Mudpuppy (*Necturus maculosus*). This is one of the large salamanders, sometimes exceeding 15 inches in length. The external gills and other features produce a grotesque appearance. Some people say it barks like a dog and call it “waterdog.” It inhabits all types of permanent bodies of water. It is essentially nocturnal but may be active by day in muddy, weed-choked waters. It feeds upon small fish, fish eggs, crayfish, aquatic insects and mollusks. The general coloration is gray to rust-brown with rounded black spots of various sizes.

2. Cave salamander (*Eurycea lucifuga*). This species may be found in the twilight zone of caves where the light is weak or just outside caves beneath logs or stones. They are excellent climbers. This species is 4 to 6 inches in length, the greater part of which is tail. The color ranges from dull yellow to bright orange red. The larvae of this species have eyes which are retained if they live in the daylight area, but which degenerate to uselessness if they go deep into caves to live.

3. Oklahoma salamander (*Eurycea tynerensis*). This species is very small with a maximum length of approximately 2 inches. The cream-colored ground appearance has a heavy streaking of black. External gills are present. They may be found on the bottom of the shallow streams or under rocks in streams in northeastern Oklahoma. They are very slippery and may slide through the fingers when one tries to catch them.

4. Spotted salamander (*Ambystoma maculatum*). This is probably the most common salamander native to northeastern Oklahoma. It grows to 8 or 9 inches in length and is identified by rounded yellow or orange spots arranged in irregular rows on the sides from eye to tip of tail. The dorsal portion is bluish black and the belly is slate gray. *Ambystoma maculatum* is an early-spring breeder and frequently makes mass migrations during the warm rains to woodland ponds. From spring to autumn, it may be found beneath stones or boards or in other moist environments. As is typical of all salamanders, this one, though plentiful, seems rare because of its nocturnal habits and because most of its life is spent underground. In captivity, salamanders are easily maintained in terrariums equipped with a few inches of moist earth.

5. Small-mouthed salamander (*Ambystoma texanum*). Next to the spotted salamander, this is probably the most common form in the Ozark area. It is about the size of the spotted salamander. As indicated by the name, both the mouth and head are small. Markings may differ but are usually gray with variable intensities. This species may be found during the spring breeding season near swamps and ponds, as well as under boards and rocks in moist seasons.

Frogs and toads. — The frogs and toads of northeastern Oklahoma are represented by five general

families: Pelobatidae, Bufonidae, Hylidae, Microhylidae, and Ranidae.

1. Family Pelobatidae (spadefoot toad).

Hurter's spadefoot *Scaphiopus hurteri*

The distinguishing feature of the spadefoot is the sharp-edged, black "spade" on each hind foot (Conant, 1958, p. 252). This adaptation enables it to dig rapidly into sand or soft earth for protection. At the close of day it emerges to forage on insects. Probably the most characteristic pattern possessed by this group is the mating and breeding behavior. At the proper season it seems to explode in great numbers for these purposes. The male emerges from hibernation two or three days before the female. The spadefoot has a rather smooth skin in contrast to the warts and ridges of the common toad.

2. Family Bufonidae (common toad).

American toad *Bufo americanus*

Fowler's toad *Bufo woodhousei fowleri*

The homely hoptoad is common in this area. Toads have dry, warty skins; however, one does not get warts by handling them. In most species the female grows larger than the male. Toads remain hidden throughout most of the day and come out late in the afternoon in search of insects, spiders, and larval forms. The forked tongue, which is attached to the front of the mouth, is used to "lariat" flies which come near. It is said that a common toad is worth twenty dollars in one season to the gardener or farmer in the consumption of destructive insects. Its habitats span the gap from city back yard to mountain wilderness. Temporary pools, ditches, or shallow portions of streams are desirable breeding places. The eggs are contained in a gelatinous string with from 4,000 to 12,000 eggs in a single row. They hatch in three to twelve days into tiny black tadpoles.

3. Family Hylidae (tree frogs and their allies).

Southern cricket frog *Acris gryllus*

Gray tree frog *Hyla versicolor*

Western chorus frog *Pseudacris triseriata*

These are slim-waisted, usually long-legged frogs, and some are not much larger than a man's thumb nail. They are quiet in daytime and blend so well with the surroundings that they are difficult to see. They are most active at dusk, leaping from branch to branch and catching insects with their sticky tongues. Disks on the tips of the fingers give a vacuum effect which enables them to stick to smooth vertical surfaces, even glass, without difficulty (Conant, 1958). The inflated vocal sac beneath the chin, sometimes as large as the body of the frog, aids in the continuous trill which identifies this frog. This tiny frog is somewhat of a ventriloquist in that he is difficult to find by following the trill. The eggs are laid singly or in lots and hatch into tadpoles in two or three days.

The members of the family Hylidae, common to the Oklahoma Ozarks, include the southern cricket frog, the gray tree frog, and the western chorus frog. The southern cricket frog is a warty, non-

climbing form which possesses a slight webbing of the feet in contrast to the disc-feet of the climbers.

The gray tree frog is the largest tree frog in the region, often 2 inches long. It is seldom seen on the ground except during the breeding season. It usually forages aloft, chiefly in relatively small trees and shrubs that are near or are standing in shallow bodies of water (Conant, 1958, p. 281).

The western chorus frog is identified by its rasping trill. It may be found in early spring and in late fall near temporary bodies of water. Chorus frogs climb very little and only onto weeds and low shrubs in pursuit of insects.

4. Family Microhylidae

(narrow-mouthed toads).

Eastern narrow-mouth toad *Gastrophryne carolinensis*

Narrow-mouth toads are rare in this section but the "Eastern type" has been found. They are about the size of tree frogs but, in contrast, are plump with short legs. They often travel by running instead of by hopping. They are difficult to catch because of their habit of darting into crevices or under logs. A wide variety of habitats are used but all have two things in common — shelter and moisture. It is difficult to designate where they may be found; but, if they are in the area, they will be under boards and logs, in vegetable debris, in abandoned sawdust piles and other similar places. The food consists chiefly of insects, beetles, termites, and ants.

5. Family Ranidae (true frogs).

Bull frog *Rana catesbiana*

Green frog *Rana clamitans melanota*

Northern leopard frog *Rana pipiens pipiens*

Southern leopard frog *Rana pipiens sphenoccephala*

These frogs in general are long legged, narrow breasted, rather smooth skinned, with fingers free and toes joined by a web. Breeding males have the bases of their thumbs enlarged and their forearms are swollen.

The bullfrog is the largest of our frogs and is the bass singer of the spring grasslands festival. It is usually thought that the deepest voice belongs to the biggest bullfrog. They are aquatic and prefer the larger bodies of water such as lakes, ponds, and cattle tanks; usually they are seen near the water's edge among reeds and other vegetation which provide hiding places. The back legs of this species are considered a delicacy by many gourmets.

The green frog is abundant throughout this area and is found in shallow fresh water of springs and small mountain streams. The color at times may be more brown than green. It is smaller than the bullfrog and may grow to be about the size of the well-known leopard frog.

The northern and southern leopard frogs are comparable as to size and body structure, but the northern is of a more brilliant green with distinct dark spots. They are called leopard frogs because

the spots and bars give them a spotted appearance. They may wander well away from water in summer and hence are sometimes called meadow frogs. Some herpetologists contend that meadow frogs constitute a separate species.

REPTILES

Reptiles in general. — Reptiles are cold-blooded animals whose temperature closely approximates that of their immediate environment. When temperatures fall, reptiles become less active; when temperatures rise, they become more active as their metabolism increases and more food is needed. This process holds until temperatures exceed 70 to 80 degrees F., at which time most reptiles seek shelter from the heat. They have, of course, a maximum tolerant temperature, as has all protoplasm, at which life ceases.

Reptiles eat large quantities of carnivorous or insectivorous forms; a few eat vegetable matter. Some kinds of reptiles require live insects or other live forms as food.

Turtles. — Twelve species of turtles are mentioned here as having been found in the area by visiting herpetologists. Other species may be present and may have been found recently. The best known will be described in detail.

1. Snapping turtle (*Chelydra serpentina*). This is the large, ugly, vicious, freshwater form commonly called loggerhead. It has a large head and a long tail which is saw-toothed along the upper side. The carapace (shell) in adults ranges from almost black to brown and it has three longitudinal keels (ridges). Food includes aquatic vertebrates, fishes, mammals, carrion, and a large amount of vegetation. Large numbers are caught for making soups and stews.

2. Stinkpot (*Sternotherus odoratus*). The stinkpots are bottom crawlers and seldom leave the water except on rainy days or during mating season. These turtles have a small plastron (shell plate on underside) which gives little protection to the legs. They are abundant in many bodies of water but are not often observed except in shallow, clear waters. The close observer might see one strolling leisurely along the bottom of a clear stream in search of food. Sometimes this turtle is found in branches overhanging bodies of water.

3. Razor-backed musk turtle (*Sternotherus carinatus*). The upper shell of this turtle reminds one of the legendary razor-backed hog. The keel is more pronounced in this species, the carapace is horn-colored in older species, and the plastron is small.

4. Yellow mud turtle (*Kinosternon flavescens*). The yellow chin and throat make good distinguishing characteristics for this species, which is widely distributed but is found for the most part in streams with muddy bottoms. They may appear on land during rain, when migrating from one body of water to another, or when foraging.

5. Three-toed box turtle (*Terrapene carolina triunguis*). This little box turtle has an olive- or

horn-colored carapace and a plain yellow plastron. It is normally found in woodlands and thickets.

6. Ornate box turtle (*Terrapene ornata ornata*). The ornate box turtle is the common "terrapin" found in the prairies, in open sandy areas, or on the highways in early summer. It burrows to avoid summer heat, but rain sometimes brings incredible numbers to the surface.

7. Southern painted turtle (*Chrysemys picta*). The painted turtles are readily identified by their smooth, unkeeled shells and attractive patterns of red, yellow, and black. They live chiefly in ponds, marshes, and ditches, where the water is shallow and vegetation profuse. Their food consists of aquatic vegetation, insects, crayfish, and small mollusks (Conant, 1958, p. 54).

8. Red-eared turtle (*Pseudemys scripta elegans*). This turtle belongs to the large basking group, which may be known as sliders. The carapace of adults is usually wrinkled with numerous longitudinal furrows, and the rear margin is saw-toothed. The sliders usually have a prominent patch of red or yellow on the side of the head.

9. Chicken turtle (*Deirochelys reticularia miraria*). The light network pattern on the carapace and the extra-long, strongly striped neck are good distinguishing characteristics of this turtle. If, however, the turtle is covered with mud or algae, look at the "seat of the pants." The legs are vertically striped (Conant, 1958, p. 64).

10. Mississippi map turtle (*Graptemys kohni*). The map turtles are our most beautifully marked and grotesquely adorned turtles. All are keeled dorsally and several have vertical spines on the dorsal keel. Patterns are pronounced in the young; however, male adults retain most of the youthful beauty. When these turtles are in action, a considerable part of the body is not protected by the carapace.

11. Smooth softshell turtle (*Trionyx muticus*). These turtles are sometimes referred to as animated pancakes. They are powerful swimmers and can run with amazing speed and agility. They are the only softshells without spines, bumps, or sandpaper-like projections on the carapace (Conant, 1958, p. 70). The softshell is essentially a river turtle; however, it sometimes is found in small tributaries far inland.

12. Western spiny softshell turtle (*Trionyx spinifer hartwegi*). This is a flat softshell characterized by sandpaper-like spines on the carapace. It is found in lakes and other places where sand and mud bars are available.

Lizards. — Lizards are numerous in the Ozark area when individuals are considered; however there are relatively few species, eight commonly being found. Lizards are covered with small scales, all with a distinct keel in the center. The males of some species are brilliantly colored. Many lizards escape if grasped by the tail because the tail breaks off easily, not at a joint but in the center of a vertebra. The enemy is left with a wriggling tail

and the lizard grows a new tail (Hegner and Hegner, 1951, p. 316). If not frightened away, lizards will perform many gyrations, such as bobbing and weaving.

Skinks are small, active, alert, smooth, shiny lizards. They feed in daytime, taking shelter at night, in bad weather, and when high temperatures prevail. They thrive on insects, other arthropods, and birds' eggs. They are hard to hold when caught; often the tail breaks off, or they try to bite the captor.

1. Fence lizard (pine lizard) (*Sceloporus undulatus*). This is a small gray or brown spring lizard usually found on fences, fallen logs, or stumps. When alerted it climbs some nearby tree on the side opposite to the intruder. When the intruder circles the tree, the lizard also circles, remaining on the side opposite to the intruder. This routine may continue until the lizard is completely out of reach.

2. Collared lizard or mountain boomer (*Crotaphytus collaris collaris*). This is a large lizard with a big head; it usually runs on its hind feet as dinosaurs did in their time. The two black collar markings are always present, but coloration and patterns vary. These lizards are found in hilly, rocky, dry regions where hiding places are abundant. They eat any animal smaller than they. When caged they can be used for all types of behavioral experiments. Sometimes the boomer will take on a bold, bluffing attitude and follow a person; it will flee if pursued.

3. Texas horned lizard (*Phrynosoma cornutum*). These creatures are often called horned toads, but the term is incorrect because they are not amphibians. They are not common in this region but are beginning to inhabit the dry western part of the Ozark uplift. This lizard is flat, chubby, and scaly, and the horns usually point backward from the head.

4. Six-lined race runner (*Cnemidophorus sexlineatus*). This lizard has a dull brown color and is beautifully striped. The male is horizontally striped with six white, yellow, gray, or blue bands. This lizard is bold and is found in open fields, open woods, and marginal areas. It is medium in size and usually uses insects as food.

5. Ground skink (*Lygosoma laterale*). This little smooth golden-brown lizard is sometimes called the brown-backed skink. Often the dark dorsolateral stripes blend with ground color. This elfin reptile is found on the woodland floor in search of insects in leaves and decaying wood material. This skink has a "window" in the lower eyelid in the form of a transparent disc through which it may see when the eye is covered.

6. Coal skink (*Eumeces anthracinus*). This is a four-lined skink whose stripes extend onto the tail. It is found in the more humid portions of wooded hillsides, in the vicinity of springs, and along rocky cliffs. It does not hesitate to take refuge in shallow water when pursued.

7. Southeastern five-lined skink (*Eumeces in-*

expectatus). This five-lined lizard is found in a large variety of habitats and is able to tolerate quite dry conditions. It climbs well and is also quite at home on the ground. The Ozarks are probably the western boundary of the range of this species.

8. Western slender glass lizard (*Ophisaurus attenuatus attenuatus*). This lizard is sometimes called glass snake. Tradition holds that when the tail is broken off into several pieces, the parts will in time reassemble and become the old "snake" again. This tradition is without scientific verification. The tail is so long that the lizard resembles a snake.

Snakes. — Many people seem to have an innate fear of snakes. Howard Cross (1917) wrote:

A fear once deeply grounded in the human mind cannot easily be destroyed. This explains why we draw with uncontrolled fright when a tiny snake crosses our path. There are, of course, poisonous snakes, but we have only four of these in Oklahoma — the rattler, the copperhead, the cotton-mouth moccasin and the coral snake. All other snakes in Oklahoma are no more poisonous than rat or dog, and there is not nearly as much reason to fear them. The little spreading viper is totally devoid of poison glands and its peculiar habit of spreading its head is only a ruse to fool people, a ruse which to this day works well. The monster bull snake is as harmless as a pelican and worth a hundred times more. It spends its active life in search of gophers, rats, and mice and is one of the most effective forces in holding these destroyers in check. This snake is the only foe of the pocket gophers except the weasel, that can enter its burrow and pursue the occupant to certain death.

The head of the poisonous snake (with the exception of that of the coral snake) is triangular in shape, and is broader than the adjoining part of the body. Also, poisonous snakes have the "pit" between and below the eye and the nostril. The poisonous snakes, water snakes, garter snakes, and ground snakes bring forth their young alive and are classed as viviparous. Others are oviparous, hatching the young from eggs.

Twenty-five snakes are listed by leading herpetologists as being found in the Ozark area. These are described briefly below.

1. Diamondback water snake (*Natrix rhombifera*). Adults are usually 3 to 4 feet long and sometimes longer; have a heavy, stout body with vague, diamond-shaped patterns of brown or pale yellow on the back; and a yellow belly with brown spots. They are found in ponds, rivers, ditches and on land. Scales are keeled and the anal is divided on all *Natrix*.

Although this snake is ugly and gives off an obnoxious odor, it is beneficial in the destruction of rodents, sickly fish, and fish in overpopulated areas. It has no fangs or poison glands, but it can administer a painful bite.

2. Blotched water snake (*Natrix erythrogaster transversa*). This form is about the same size as *N. rhombifera*, but the markings are blotched and indistinct. In some specimens, dark bars are across the back. The belly is plain yellow. It is likely to be found wherever permanent waters occur.

3. Midland water snake (*Natrix sipedon pleuralis*). This form is smaller than *N. rhombifera*, and the patterns change to dark crossbands on the neck and alternating blotches farther back. The darker blotches are smaller than the spaces between them. Belly markings tend to be in pairs.

4. Graham's water snake (*Natrix grahami*). *N. grahami* measures 18 to 24 inches in length. Thin dark stripes on the sides join the belly scales. A yellow stripe occurs above on each side and a dark-bordered, pale stripe is down the middle of the back. Belly scales are yellow and may have dots in the center.

5. Midland brown snake (*Storeria dekayi wrightorum*). The brown snakes are small (9 to 12 inches long), with base colors predominant and with less conspicuous markings consisting of dark crosslines.

6. Red-sided garter snake (*Thamnophis sirtalis parietalis*). This snake is 20 to 30 inches long and has distinct stripes of yellow, blue, and green running its entire length and a red or an orange base extending down the sides. The head is rounded.

7. Western ribbon snake (*Thamnophis saurita proximus*). The western ribbon snake is 20 to 30 inches long and has longitudinal stripes of olive brown or black and a bright, mid-dorsal stripe of yellow, orange, red, or brown. The head is rounded.

8. Rough earth snake (*Haldea striatula*). This snake is small (7 to 10 inches long), with solid dull colors of brown or reddish brown. It is found under rocks, boards, and decaying trash. The head is cone-shaped and the scales are keeled.

9. Smooth earth snake (*Haldea valeriae*). This snake is comparable in size to *H. striatula* but is lighter in color; the scales are smooth and not keeled.

10. Eastern hognose snake (*Heterodon platyrhinus*). The eastern hognose is 18 to 30 inches long and is characterized by a hissing sound, by spreading of the head, by an upturned snout and by a habit of playing possum. It is common in the Ozark area and can be recognized by its brown or yellow color with dark spots in longitudinal intervals.

11. Southern ringneck snake (*Diadophis punctatus punctatus*). The ringneck, which is 10 to 14 inches long, has a spotted belly. The black spots are large, shaped like half-moons, and occupy the center of the belly scales. The neck ring is of dark pigment. This snake is found in damp swampy areas, under stones, bark, and logs. When surprised, the ringneck may throw its tail upward in a corkscrew fashion to startle the intruder for a moment; during the confusion it makes its escape.

12. Western worm snake (*Carphophis amoenus vermis*). This snake, resembling a large earthworm,

has a pink belly, pointed head, smooth scales, and a length of 7 to 10 inches. It is found under moist logs and beneath stones.

13. Eastern yellow-bellied racer (*Coluber constrictor flaviventris*). The yellow-bellied racer is 30 to 50 inches long and is somewhat smaller than the blue racer. The color varies from brown through gray and blue. The belly is yellow and the scales are smooth. This snake is at home in the fields and grasslands and likes to forage during the day. It sometimes is found on limbs of trees or in bushes where it may have been pursuing birds. Usually it will be found in grasslands or beneath rock piles or in burrows. The snakes are swift of movement, as the name implies.

14. Western coachwhip (*Masticophis flagellum testaceus*). This snake is usually solid yellow-brown or dark-brown. It is 42 to 60 inches long and is characterized by the whipping action of its tail when it is picked up by the head. It is a typical prairie snake.

15. Rough green snake (*Ophedryx aestivus*). This snake, which is from 20 to 30 inches long, is slender with plain green above and with a white or yellow belly. It is an excellent climber and feeds on vegetation-eating insects such as grasshoppers, crickets, and larvae of moths and butterflies.

16. Great Plains rat snake (*Elaphe guttata emoryi*). The Great Plains rat snake is 24 to 36 inches long and is light-gray with dark-brown splotches, which form a beautiful pattern. It has a spear-point marking between the eyes. The scales are weakly keeled. It feeds at night and is usually found in rock crevices or upon hillsides by day.

17. Black rat snake (*Elaphe obsoleta obsoleta*). This shiny black snake has a yellow or brown belly with a pattern formation toward the head. The throat is white or cream, and the scales are weakly keeled. It is 42 to 72 inches long. It has been called the mountain rat snake and the chicken snake. It feeds primarily on rats and mice.

18. Bullsnake (*Pituophis melanoleucus sayi*). The bullsnake, 50 to 60 inches long, is basically yellow with black or brown dorsal spots. The belly is yellow with black spots, especially toward the sides. Clumps of vegetation and burrows provide good hiding places and sources for food, such as rodents, birds, and bird eggs.

19. Speckled kingsnake (*Lampropeltis getulus holbrooki*). The vigorous kingsnakes, which are 36 to 46 inches long, are said to kill their prey by winding around its body and constricting it until it is dead. This particular species is basically brown or black with white or yellow spots on smooth scales. Kingsnakes eat other snakes, rabbits, lizards, small turtles, and other animal material.

20. Red milk snake (*Lampropeltis dolia sypila*). The red milk snake is 21 to 28 inches long. This species is smaller and more brilliantly colored than the speckled kingsnake. Its large red spots are separated by white or gray bands forming diamond-like figures on the dorsal area. The belly is checked

with black on white with smooth scales. Some people confuse these snakes with coral snakes. The interesting "old wives" tale holds that these snakes milked their cows.

21. Scarlet snake (*Cemophora coccinea*). This snake, which is 14 to 20 inches long, has markings similar to those of the red milk snake, but it is smaller and the colors spill over from black-surrounded red dots onto the orange-gray background. It has been called the coral mimic. It is seldom seen above ground except at night. It feeds on small snakes, lizards, and turtle eggs and is often plowed up by farmers.

22. Northern copperhead (*Agkistrodon contortrix mokeson*). This venomous snake of the pit vipers is 24 to 36 inches long. The color is russet to coppery red with the darker color producing an hour-glass effect. The head has a triangular shape and two syringe needle-like fangs through which poison is injected into the victim.

23. Western cottonmouth (*Agkistrodon piscivorus leucostoma*). These snakes closely resemble several nonpoisonous snakes. They are 30 to 42 inches long, are dark brown to black with distinctive markings on the side, and have a dark-brown or black belly. The most distinguishing characteristic of this snake is the white "cotton" mouth, observable when it throws its head upward and backward. Cottonmouths vibrate the tail when excited; water snakes do not.

24. Western pygmy rattlesnake (*Sistrurus miliarius streckeri*). This tiny rattler is only 15 to 20 inches long. It is ground colored, with darker reddish spots at regular intervals over the body. It usually is found near water.

25. Timber rattlesnake (*Crotalus horridus horridus*). The timber rattlesnake has two major color patterns or designs. The designs are similar but different shades fill the patterns in the yellow phase. The pattern consists of a brownish-yellow base with dark brown, broken bands at regular intervals spaced throughout the length of the snake. The adult snake is 36 to 54 inches long and is equipped with a set of rattles, which record the successive shedding of the skin.

BIRDS

General discussion. — To many people, birds are the most interesting of all animals. We hear their serenade when we awake in the morning and their vespers in the evening at dusk. They provide the climax of the beauty pageant of the animal kingdom, and their comical behavior pattern provides never-ending amusement to the patient observer.

The body of the bird is built for flight. Birds which fly great distances and do not need to turn abruptly have poorly developed tail feathers and long narrow wings. Birds which fly fast, such as owls, hawks, and quail, have broad curved wings and well-developed tail feathers. Birds which do not fly fast but make abrupt curves and stops, such as

the mockingbird, need average wings but long broad tail feathers to serve as rudders. Some of the large bones of the body are hollow to reduce weight. The ruby-throated hummingbird weighs less than a nickel coin. This light weight is advantageous when the bird "stands still" in midair.

Some birds have unusual feather adjustments to attract the female during the mating season. Most birds mate only for one season; however, the screech owl mates for life. Some birds feed in daytime; others take over the same feeding area at night. Birds usually maintain a high rate of metabolism and body temperature; therefore they need to feed frequently. Most birds migrate, some in continuous long flights, others so unnoticed that we do not think of them as migratory, as in the case of many of our song birds. Recent studies have shown that the whip-poor-will hibernates and may not migrate as was formerly believed.

Some birds roost on the ground, some on cliffs, some on tree limbs, and some cling to a vertical wall. Bill and feet adaptations are many and varied and are beneficial to the birds' particular need to secure food. Whiskers help the whip-poor-will net insects on the wing; sharp claws and hooked bills help tear the flesh food of hawks, owls, and eagles; and neck and bill help the heron in its method of securing food. Flight sometimes characterizes birds such as the bounding, falling, and bounding again of the woodpecker. Birds' songs are excellent means of identification although some may imitate the call of others; among these imitators are the crow, blue jay, catbird, brown thrasher, and mockingbird. Many of the larger birds which swallow the animal prey whole regurgitate the undigestible parts in pellets.

Descriptions of common birds. — About 400 species have been listed for Oklahoma and many of these are found in the northeastern part of the state. The following 53 briefly described forms are representative.

1. Pied-billed grebe (hell diver, water witch). It can swim at various levels, even with its body submerged, with only bill and eyes appearing above the surface. Its bill is short and thick with the familiar pied band. Food consists of aquatic insects and snails; during breeding season the food consists mainly of leeches.

2. Great blue heron. This heron is found the year round in Oklahoma. The summer-mating birds migrate northward as winter approaches and are replaced by others from farther south. The great blue heron is found along shorelines of lakes, where it fishes for frogs, snakes, and other small animal life found in shallow waters. It stands motionless for minutes with neck bent ready to strike for prey. Although it may take some game fish, its feeding habits are more helpful than harmful. Sometimes these herons are found along hillsides foraging for rodents.

3. Green heron (fly-up-the-creek). Its habits are similar to those of the great blue heron, but it is

a much smaller bird and it nests in small colonies as a rule. It is found along streams and tree-lined ponds. Parts of the plumage are glossed with green, but this color is not apparent unless the observer sees the bird clearly or holds it in his hands.

4. Bittern (marsh hen, stake driver). These birds are common along slow-moving tributaries and near ponds that have mud bottoms heavily infested with weeds, elders, willows, and similar vegetation that provide blinds. The bittern is usually solitary and is in flight before its presence is realized. It seems to know how to use trees and shrubs as shields until it is a safe distance from the hunter. It nests in the region among reeds about 3 or 4 feet from water, or sometimes in reeds directly above the water. Pencil-like stripes on the body resemble weed stems and give protective coloration.

5. Killdeer (killdee, killdeer plover). The killdeer is usually seen in pastures, meadows, short grass stubble, or freshly plowed fields. It is a little larger than the robin and clearly calls its own name. It has two black bands across the breast and a bright silvery sheen on the underside of body and wings. The killdeer searches for exposed insects and worms. It usually makes short runs, then stops quickly to search for food before making another short run. It is with us all year long.

6. Spotted sandpiper (teeter snipe, teeter). This bird is somewhat smaller than the killdeer and frequents shores of ponds and streams; however, it may take to the open fields if food is not plentiful near the ponds. This little bird has a comical teetering and weaving movement much as have some boxers in a prizefight. The breast is black-spotted in summer and white in winter. Nests, camouflaged by grass or weeds, are built in slight depressions in the ground.

7. Mallard (green head — male; gray duck — female). The duck best known to hunters in this area is the mallard. A few pairs nest in Oklahoma, but the birds we see in fall and winter are chiefly from northern nesting grounds. The food consists of small frogs, tadpoles, toads, lizards, small fish, and other animals found near ponds and lakes, and of corn, weed seeds, acorns, and wild rice. The mallard has provided the human race with vast quantities of eggs, flesh, and feathers for thousands of years.

8. Common merganser (fish duck, saw bill). Great flocks of common merganser visit the large lakes and ponds of Oklahoma in winter, but the species does not nest here. The long, narrow, sharp beak with teeth inclined backward helps the merganser to catch fish. It is very fond of "rough fish," especially the gizzard shad. It is interesting to watch a flock of these rugged birds dive into a school of fish just beneath the surface of the lake.

9. Eagles. The bald eagle, our national bird, winters regularly along the lakes of northeastern Oklahoma. The golden eagle visits the area occasionally. The cliffs and rugged shores of lakes and streams offer desirable protection in feeding

areas. Food consists mainly of fish, but rodents, rabbits, and other small animals may be eaten. One observer noted a great number of eagles below Tenkiller Dam feeding upon fish that were killed or stunned in passing through the hydroelectric turbines below the dam. The fortunate observer may see a pair of eagles soaring at great height on a still afternoon.

10. Osprey (fish hawk or fishing eagle). The osprey is about two-thirds the size of the golden eagle and may be mistaken for the larger bird. However, its white breast is a distinguishing feature. Herons catch fish with their bills, but ospreys catch fish with their long claws. The lucky visitor may see the osprey change from a leisurely glide into a swift dive to the surface of the lake to catch a fish.

11. Red-tailed hawk (chicken hawk). This bird may be seen in the open woodlands, on high limbs of a dead tree, or on the cross-arms of power-line poles watching for movement in weeds or leaves which indicates the presence of rabbits, rats, or mice. It has been known to take chickens but has retreated into secluded places before the advance of human activity. It is considered much more helpful than harmful. The red-tail is a permanent resident in this area and nests high in large trees.

12. Sparrow hawk (grasshopper hawk, mouse hawk, American kestrel). This little falcon is only slightly larger than a robin but has stronger wings and talons. Its principal food is grasshoppers, but it often catches mice. It hovers or "treads the air" watching for prey beneath it. It nests in cavities in trees, in holes in rocks, around bridges, in old buildings, or in similar places.

13. Greater prairie chicken. This fowl-like bird continues to be common in parts of the Ozark area. In early spring, the males gather in a selected location known as a booming-ground or a gobbling-pond, where they compete with each other by strutting, lifting the feather-tufts on the head, inflating their neck-sacs, and going through the motions of fierce battle (Carson, 1959, p. 9). The food consists of insect forms of the prairie in summer and of alfalfa hay in winter.

14. Bobwhite (quail, partridge). Each year more than one-half million Americans go into the country to hunt this plucky little fellow. A covey of quail may range from 10 to 40 birds. When flushed by the hunter, they fly in different directions, then reassemble when danger is passed. Depending upon whether the spring is early or late and rainfall is plentiful or scant, the bobwhite will hatch the brood from early June to the middle of July. It is believed that if the first nest is destroyed, the pair will make another start that summer to raise a young brood.

15. Yellow-billed cuckoo (rain crow, rain dove, kow kow). This bird is seldom seen, but it is quite common in deep-wooded areas. It stays hidden behind tree foliage while searching for caterpillars, woolly worms, and other leaf-eating larval forms.

It is larger than the robin and its long tail with white-tipped feathers is characteristic. It is called rain crow because some say its call, "soak, soak, soak" in diminishing pitch and volume, warns of rain.

16. Road runner (chaparral, chaparral cock, snake killer, lizard bird). This slender ground cuckoo has become common in the Ozark region within recent years. It may be seen along the edges of the woods, along roads, and on the shoulders of highways. It seldom flies but uses its fan-shaped tail as a rudder in a swift running movement. Its food consists mostly of lizards, snakes, toads, and insects.

17. Turkey vulture (turkey buzzard, carrion crow). The turkey vulture is not a bird of prey; but with crows, sexton beetles, other insects and animals, it performs a scavenger service. Buzzards can be seen singly, soaring high in the sky; but when one vulture comes toward the earth, others flock to that area. The presence of a number circling in one location or perched on the limbs of a dead tree usually indicates that some dead or dying animal is nearby. Ranchmen watch for buzzards when searching for lost livestock. Vultures nest in hollow trees in the deep forest or in caves. They have bald heads and hooked bill points for tearing flesh, but lack the talons of the birds of prey.

18. Screech owl (little horned owl, shivering owl). This is the smallest of owls in this region. It usually nests in deserted holes built by flickers. Its color may be gray or chestnut brown. The marking patterns are much the same except for the color effect. It is principally nocturnal and feeds upon mice, beetles, moths, frogs, and sometimes small birds. If they do come out in the daytime, they are usually attacked by smaller birds and soon seek refuge in hollow trees. As their feet and bills indicate, owls are birds of prey and are the only birds whose eyes are directed forward.

19. Great horned owl (hoot owl). This is the largest of the eared owls and is quite common in the Ozark region. These owls often live in small woodlands along valleys or creeks, even within a few hundred yards of dwellings. Shortly after dusk the familiar "who-who" may be answered by "who-who" of another owl a short distance away. This owl is sometimes called "tiger-of-the-air" because of its swift, silent manner of catching the prey. It may cause a commotion in the poultry yard, but it is more likely to feed upon other birds, or upon small mammals, including skunks.

20. Chuck-will's-widow (whip-poor-will). The call of the chuck-will's-widow is probably the most familiar night call to the millions of Americans who have lived in suburban and rural areas. Few people have seen this bird unless it was found dead in the fields. Its plumage blends so perfectly with its surroundings that one can be within a few feet of the bird and never locate it. If it is driven from its nest, it will go through all sorts of distortions, feigning injury to draw the enemy away from the

nest; then it will fly away. The bird migrates and is most active in spring at planting time. It is chiefly insectivorous, and food is usually taken on the wing.

21. Chimney swift. Swifts perch on sides of walls or chimneys but never on limbs or trees as do other birds. They use their tails for additional support as do the woodpeckers. They feed on the wing and are chiefly insectivorous. Insects in the atmosphere are more numerous near dusk; hence the greater activity of swifts at that time. Soon after dark they go to their roosts. Swifts are related to the swallows and have many of the same peculiar characteristics. They migrate in autumn to the Gulf Coast, where for weeks they gather in increasing numbers. Suddenly one night they all disappear as if the Gulf had swallowed them up, but the next spring they reappear. Their disappearance is still a mystery to ornithologists.

22. Ruby-throated hummingbird. This is the only hummingbird regularly found in eastern United States. It nests in the Ozark region but the nests are hard to find. The novice may mistake the sphinx moth for a hummingbird; however, observation will reveal the presence of feathers and other avian characteristics. This tiny, swift creature flits across the garden, pauses before an open flower to take nectar, then flits onto a telephone wire or branch to preen its feathers and observe the landscape before searching for more nectar. Analysis of motion pictures has shown that in ordinary flight a ruby-throated hummingbird beats its wings 55 to 60 times a second.

23. Belted kingfisher. The head and upper part of the body of the kingfisher seem to be disproportionately larger than the feet and tail. The plumage is blue gray, and usually the female is the more brilliantly colored. It is larger than the robin and feeds on minnows, chubs, and shallow-water fish which are useless to man. It nests in burrowed soil banks. Often the kingfisher claims ownership of certain fishing areas and drives away intruders. He is not selfish; he just wants to live.

24. Red-bellied woodpecker (zebra-back, chad). The red of the belly of this bird is hardly noticeable, the crown and nape are red, the back and wings are heavily barred, and the under parts are grayish white. Its food consists of beetle larvae and other insects, berries, seeds, and acorns. In flight it gives the same galloping movement that is typical of members of this family. Starlings sometimes move into the nest as soon as it is finished.

25. Pileated woodpecker (woodhen, log-cock, good god woodpecker, wood kate). This is the giant woodpecker of this area. Its flashing red, black, and white plumage is conspicuous as it flies through the woods or its imperious rap on a dead stump demands attention. It is very fond of carpenter ants for food.

26. Red-headed woodpecker. This beautiful creature is fast disappearing because of the ravages of starlings which break up the nest and because of its

death on the highways where it chases grasshoppers.

27. Downy woodpecker. The downy, smallest of the woodpeckers, is a friendly little fellow often seen and heard in woodlands and in shade trees along a quiet street. Many people call it little sapsucker. It is black on top except for the middle of the back which is white. The wing feathers have white spots and the tail is black except for the outer feathers, which are white banded with black. It is fond of suet tied to a limb or placed upon a window sill. In summer, it eats insects and larvae; in winter, it depends largely upon wild berries.

28. Southern flicker. The head is ashy with a red crescent, the rump is white, and the rest of upper parts are brownish, barred with black. The pinkish-brown underparts are thickly spotted with round black spots. The black crescent across the breast is typical. Flickers (or yellow-hammers) are found throughout the year. Food consists largely of ants which are picked up with the bill or the long sticky tongue. The slightly curved bill is an aid in spading up the earth. Food consists also of cherries, wild grapes, persimmons, and many kinds of berries.

29. Red-winged blackbird. The males are easily identified by scarlet wing-covert with buffy edges. They may be seen at any time of year but are most numerous at migration time in early spring. The red-wing nests in marshes and low grounds. Flocks seen in winter consist almost entirely of females and are a familiar sight around plowed fields.

30. Bronzed grackle. Its head and neck are steel blue to bottle green and always sharply defined against the bronze of the back. The grackles are easily distinguished from blackbirds because of the larger size, longer tail, and hoarse notes. Grackles usually nest in colonies and are eminently gregarious at all seasons.

31. Cowbird. The male is glossy black with head and neck of brown. The female is smaller and is plain brownish gray, paler on chin and throat. Cowbirds are social outcasts; as a rule, other birds do not associate with them. They are not known to be constant with any mate. When the urge comes to lay an egg, the female slips through the bushes until she finds the nest of some smaller bird, deposits her egg, and never returns to the nest. The young are selfish and aggressive and demand a lion's share of the food from the foster parent. Cowbirds are usually seen singly or in small groups, often in the neighborhood of feeding cattle.

32. Scissor-tailed flycatcher. This is one of the more picturesque, graceful and individualistic of American birds. His picturesqueness is due chiefly to his long, strikingly meshed tail, which he is likely to open and shut when he is excited. This ornament also serves to accentuate the grace or the erratic character of the bird's aerial gyrations, many of which apparently are indulged in simply for fun. The scissor-tailed flycatcher was adopted in 1951 as Oklahoma's state bird. Its head and back are

light pearly gray; the wings are darker, with white underparts diffused on the sides with delicate salmon pink. Observed only when the bird is in flight is a bright underwing patch of red orange overlaid on salmon pink. There is a concealed patch of red-orange on top of its head. The most distinctive characteristic is the deeply forked, black and white tail which ranges in length from six to twelve inches. Abundant in Oklahoma from April to October, it nests here in late May and fearlessly fights to defend its nest and young. The scissor-tail is the farmer's friend. Ninety-six percent of the diet consists of grasshoppers, boll weevils, beetles, and similar insects (Pearson, 1936, p. 191).

33. Purple martin, cliff swallow, and barn swallow. These are noted in flight in open areas by their graceful up and down, back and forth circling near one locality. They are searching for flying insects. They usually have bent wings with long sharp tips. Swallows nest in sheltered places; they have a good reputation, and in autumn migrate to South or Central America.

34. Eastern kingbird (bee martin). This bird is slightly smaller than the robin but is a ready warrior if other birds transgress his territory. It is the only American variety with a tail completely tipped with white. When owls, hawks, herons, or crows invade, he takes on the tactics of a fighter plane coming down from above to harass the enemy. When the enemy is chased away, he returns to his look-out perch and proudly flaps his wings. Eighty-five percent of his food consists of flying insects, although grasshoppers and other insects are a part of his diet.

35. Blue jay (jay, nest robin). Probably no other American bird more readily attracts attention than the jay. His name is sometimes synonymous with mischief. He is a cutup but is one of the handsomest of American birds. His deeds of mischief are sometimes accompanied by disturbing screams. His crest is a mark of identification. He destroys nests and eggs of other birds and yet has been known to hide seeds and acorns which grew into desirable trees.

36. Nuthatches. These little fellows are sometimes called the "upside-down birds." They are perhaps the most expert climbers among birds, as they will run nimbly up and down the trunk of a tree or the face of a cliff or stone wall, often head downward. One may even circle a limb, apparently searching for insect larvae. They are generally bluish gray or brownish gray above and white or buff beneath. The nuthatches, like chickadees and titmice, welcome feeding stations near home in winter. The nuthatch is sometimes accused of drilling holes in trees, but the construction of its bill makes this impossible.

37. Carolina chickadee. These birds are small and are sometimes called the "feathered small boy of the wintertime," as they always seem to be in fine spirits. The male has no tuft, and is black and brown above and lighter underneath. He is plump and energetic. In the most severe winter the

chickadee will sometimes break the monotony by playing in the snow or running while it is snowing. The chickadees like to feed from upside positions where they can find larval forms on the under side of leaves and cones.

38. Tufted titmouse. These are lively and active little birds found in much the same condition as the chickadee; however, the male titmouse has a tuft and usually has more of the body covered with gray. It is playful and remains with us throughout the year. These little fellows, like the chickadee and nuthatch, are very sociable except at breeding season.

39. Mockingbird (mocking thrush). He is about the size of the robin, and is pale gray with patches of white on outer tail feathers, wings, and underneath the body. He is a permanent resident where a plentiful supply of berries and seeds are available. He mimics almost any sound he can hear, even fowl sounds, other animal sounds, and sometimes sounds of numerous instruments. In mating season he may sing all through the night. He usually perches on high objects to give him wide range of vision. He is an acrobat as well as a singer.

40. Robin (migratory thrush, robin redbreast). Every child knows the robin; and most of them have watched his regular short run and stop on the lawn, and his sidewise tilting of the head to hear or see better a movement beneath the leaves or grass. When he parts the leaves or grass with his bill, you may be sure he has found a worm. If ground food is not available, he resorts to berries and seeds.

41. Eastern bluebird (blue robin, common bluebird). This bird is smaller than the robin and has bright blue upper parts with cinnamon-chestnut under parts. He usually gets worms or insects on the ground, then flies to a perch to devour the food; after a short interval he goes to the ground to forage for food again. He nests in crevices, hollow trees, and in nesting places provided by man. If food is available, he is a permanent resident.

42. Blue-gray gnatcatcher. This is a very small bird found in the crowns of tall oaks. It perches in spring position with its long tail pointing upward. Its tail feathers are black with white edges. It migrates early and usually nests by April. The blue-gray gnatcatcher is one of the sweetest singing birds of the southwest but, owing to the weakness of its voice, can be heard only a short distance. It bears a striking resemblance to the mockingbird but is about half the size.

43. Red-eyed vireo (the preacher, red-eyed greenlet). This is a small, tree-dwelling songbird. It may appear to sing from dawn to dusk, sometimes for minutes of continuous song. This amazing persistence has earned the name "preacher bird." The general appearance is greenish-gray with few distinguishing marks except the white bar over the eye. The nest usually hangs from a fork of limbs.

44. Yellow warbler (wild canary). This small, beautiful, yellow bird may have chestnut streaks on

breast and sides. The warbler, with more than thirty species in this area, is one of our milder dispositioned song birds. Cowbirds use the warbler's nest.

45. Common meadowlark (field lark, western meadowlark). This chunky, robin-size bird is perfectly at home in fields and pastures. He is often perched on wire fences, fence posts, or dead limbs. He is a brown-streaked bird with yellow under parts and a black V-like crescent on the breast. The meadowlark adds much to the environment by his singing and is helpful to farmers and gardeners (Carson, 1959, p. 41).

46. Baltimore oriole (golden robin, hang-nest). Smaller than the robin, he is a great musician and a great architect in the construction of the nest. He makes a hammock of his nest, swinging it from some drooping branch. The black of the head, back and wings in contrast to the rich orange under parts of the body, and the contrasting colors of the tail feathers make a striking picture. His personality makes him easy to remember.

47. Cardinal (Kentucky cardinal, crested redbird). This bird is somewhat smaller than the robin and is the only redbird with a tuft. His black face is also characteristic. He flies rapidly and does not remain in view long. He is cheerful, active, and industrious. The color markings of the female are more drab than those of the male. Cardinals nest in hedges, brier thickets, woodland borders, or in protected places around the home.

48. Dickcissel (black-throated bunting, little meadowlark). The dickcissel is so-named because of his call, which seems to repeat the name. These birds have the appearance of a sparrow except that they are more plump and that the male has a black "bowtie" at the throat, which is easy to recognize when he turns his head upward to give his call. They perch on fence posts, telephone wires, and high limbs of dead trees. They nest on or near the ground, and eat insect larvae and weed seed.

49. Lark sparrow (quail-head, little meadowlark). This lark is found in the open fields or among solitary trees. The markings are shades of chestnut, brownish gray, and buff; but the colors are not brilliant. It is a summer resident and thrives in proportion to the abundance of insects and weed seeds available. The nest is on or near the ground.

50. Scarlet tanager. In summer the male tanager is bright red with black wings and tail. In autumn, when he starts for South America and Central America, he puts on his traveling clothes of dull green above and greenish yellow below. This tanager nests in the tops of tall trees at the ends of limbs, sometimes 70 feet above the ground. The nest contains 3 or 4 greenish-blue eggs marked with brown specks.

51. English sparrow. This bird came from northern Europe and Asia and not just from England. It is not a sparrow but is a member of the weaverbird family. It was imported to America to exterminate canker-worms, but it showed much more in-

terest in grains, and the canker-worms are still with us. In 1852 flocks of sparrows were released in Brooklyn and nearby, and within twenty years every city on the Atlantic seaboard swarmed with them (Jordan, 1957). Sparrows breed throughout the year. These noisy, aggressive birds drive bluebirds, martins, and other desirable birds from their nesting places.

52. Indigo bunting. This is the only small bird that is entirely blue. The wings and tail have a tinge of brownish blue, but the body is solid blue. It is found in shrubbery and cut-over woods.

53. Painted bunting. The male of this species has head and neck of blue, under parts of vermillion, back of golden green, and rump and tail of purplish brown. The female is olive green above, with pale yellowish green beneath. Every bird lover should see the brilliant, distinct, gorgeous color markings of the male. One gets the never-to-be-forgotten impression of the lavish use of color. This bunting is migratory but is rather common in season in thick woods and thicket regions. Nests are usually found in bushes or small trees not more than six or eight feet above the ground.

MAMMALS

General discussion.— Seeing mammals isn't as easy as seeing birds or flowers. Mammals keep out of sight. Some have concealing colors; some burrow; many are nocturnal; yet they can be seen if one is patient, alert, and knows where to look.

The word "mammal" refers to the female's mammary glands, which provide milk for her young. This characteristic sets off mammals among the warm-blooded, backboned animals. The young are born alive, and most have varied teeth for cutting, tearing, or grinding (Zim and Hoffmeister, 1955).

With the exception of the rabbits, deer, and some rodents, the mammals of this area are carnivorous (flesh eating). Also, with few exceptions, the carnivores are beneficial in helping to keep undesirable forms in check. In destroying coyotes, man only intensifies the existing problem of controlling rodents. Rodents are the group of gnawing animals — two long upper incisors and two long lower incisors.

Descriptions of some mammals. — Of the mammals discussed below, some are common and well known by most residents of the area, whereas others are rare and have not been reported for many seasons.

1. Opossum. The opossum is quite common throughout the entire Ozark area. It is nocturnal, and in late autumn many are killed on our highways at night. It is our only native marsupial or pouched mammal. Opossums are born in litters of up to fourteen; their total weight may be less than one pound. They live in the mother's fur-lined pouch for about three months, and then are carried from place to place on the back of the mother.

2. Eastern mole. This animal is the culprit who

makes the mounds and ridges on the lawn and meadow. Moles are not likely to be seen above the ground, and we rarely dig deeply enough to excavate them. Contrary to common belief, they are not searching for roots and bulbs but prefer grubs, ground insects, and worms.

3. Bats. Bats are the only flying mammals. Their forelimbs are greatly modified and form wings different from those of birds. In bats, the fingers are greatly lengthened to support a thin membrane, which extends to the hind legs. The legs and, usually, the tail support the membrane. Bats have limited eyesight. In flight their large ears form part of a unique system for locating and avoiding objects. Bats emit a sound, too high-pitched for us to hear, which is echoed back like a radar beam. Picked up by the bat's sensitive ears, this echo indicates the direction and distance of obstacles to be avoided and of flying insects that may be seized for food (Zim and Hoffmeister, 1955). The three species most common in this area are the big brown bat, red bat, and the abundant silver-haired bat.

4. Raccoon. A raccoon can be identified by the black "mask" covering the eyes and side of the face and by the ringed tail. The three to six young are born in the hollow of a tree some distance from the ground and are blind for about three weeks. They remain with the parents until the following spring.

5. Long-tailed weasels. These are rarely found in this region, but some have been reported. They are small but long, slender animals with brown above and white below. Sometimes a whitish band crosses the face. They eat small rodents but are eaten by large hawks, owls, and cats. They are said to be the quickest of animals.

6. Mink. Until recent years mink have been common along small streams among reeds and rushes. They den in banks, the entrance of which is below water level. They are very active and use fish, water birds, and frogs as food. Furs are used commercially.

7. River otter. Otter are not common in this area but are quite noticeable when they are present. The fortunate observer might see some of these acrobatic, fun-loving, brown fellows wrestling and "ducking" each other in the water or he might see an otter "streak" down his slide into the water head first and feet folded back. Otters are carnivorous.

8. Skunks. The striped skunk with two white stripes down the back is the common and well-known skunk. They frequent forest borders, fence rows, and open meadows. Like most mammals of this area they are nocturnal and feed on small animal forms. The spotted skunk (civet cat) is smaller and less common in this area, but it has similar habits. The unique "hand-stand" is the usual warning for other animals to "flee with haste."

9. Foxes. This area is a transition zone for both the red fox from the North and the gray fox from the South. Neither is abundant here. However,

when present, they feed on rodents, small mammals, carrion, poultry and, when hungry, on fruits and berries.

10. Coyote. These hunters are sometimes mistaken for police dogs; however, the eye of the experienced woodsman quickly detects mannerisms which identify the coyote. If they are not harried, they quite often travel in pairs; also, if unharried, they leisurely traverse the same routes to hunting grounds near dusk and return to hiding about dawn. Despite efforts to exterminate them, they seem to be increasing in numbers.

11. Bob cat. This little mammal is a fearless hunter and sometimes attacks weak or handicapped animals much larger than itself. It usually feeds on the ground but is adept at climbing if necessary. The bobbed tail is characteristic along with the dark spots. In contrast to the coyote, it feeds in a restricted area of a few square miles.

12. Woodchuck. This animal is better known as ground hog. Despite the superstition, the ground hog does not return to hibernate because he has seen his shadow. He may return if gardens and wild plants are not far enough along to provide his favorite food. Because of normal weather cycles sunny weather around February 2 may be followed by a blustery, severe period.

13. Squirrels. Gray squirrels are found usually in the big timber in creek and river bottom. The fox squirrel usually is active in daytime and near where picnickers spread lunch. The flying squirrel does not fly but glides. The membrane attached to the front and rear legs permits this. They are nocturnal in contrast to the fox squirrels.

14. Pocket gopher. These are burrowing rodents with short, naked tails and fur-lined cheek pouches for carrying food. With their powerful, clawed front legs they dig tunnels, which they seldom or never leave. If the burrow is extended to the surface, small mounds of dirt are thrown up. Food consists of roots and stems (Zim and Hoffmeister, 1955).

15. Beaver. These animals are thought to have been abundant along our streams before the white man came. Few have survived the native state, but in recent months the Oklahoma Department of Wildlife Conservation has restocked Greenleaf area with beaver. These industrious architects are nocturnal and are characterized mostly by the flat tail, which is a useful propeller in swimming. Beavers mate for life.

16. Cotton rat. This is the common field rat which became so numerous and obnoxious during 1957-1959. This rodent is very destructive to gardens and farm crops. These rats may have six litters a year, each of six or more young, which begin to forage when one to two weeks old. If weeds and other cover are cleared away, birds of prey will soon bring the rat epidemic under control.

17. Muskrats. These animals build homes of weeds, rushes, and other vegetation in marshy areas. The den is above water level, but the entrance is below. Like other rats they are prolific; like

beavers the pelts are valuable; and like otters they sometimes have "slides" down a muddy bank into the water.

18. Rabbits. These meek little animals have no defense except their habitat camouflage and their ability to outdistance or to zig-zag away from the enemy. The most abundant is the small cottontail; next abundant is the jack rabbit, which is found in open areas; and least abundant is the swamp or marsh rabbit, which is between the cottontail and jack rabbit in size.

19. White-tailed or Virginia deer. Deer hunting is fast becoming popular with the sportsman. Authorities report that over one million dollars is spent annually in all phases of the deer hunting in Oklahoma. Also, authorities say that the range used by deer could support ten times the present population without competing with domestic animals for food. The average weight of bucks taken during the hunting season is 180 pounds. Game laws of Oklahoma are explicit about deer hunting.

INVERTEBRATES

General discussion. — This group includes forms not having an internal skeleton for form and support. Some of these have numerous jointed appendages (legs, antennae, tails, etc.). For example, flies have six legs and one pair of wings, whereas millipeds have many legs. Some invertebrates fly incessantly, others fly rarely, some do not fly at all. They grow by complete metamorphosis (eggs, larvae, pupa, and adult) or by incomplete metamorphosis (egg, nymph, and adult); usually molting permits growth in the nymph stage. A complete life cycle may take only a few days, as in aphids or houseflies, or it may extend over a period of years. As many as thirteen generations of aphids may occur in one season. It has been said that, if uninhibited, the progeny of one pair of aphids for one season might outweigh the human population of China.

For the most part, invertebrates respire by means of spiracles (air tubes) which penetrate the body. Members of this group may have simple or compound eyes. If simple, there usually will be more than two eyes. Compound eyes are unmovable and contain thousands (housefly 4,000, dragonfly 20,000) of facets, usually hexagon shaped. These facets, which are at right angles with the object in view, record on the optic nerve the presence of the object. Some biologists think that the facets record only movement; others say color is included.

Some ants and bees live in a highly socialized society, having caste systems, means of communication, and even social discipline.

It is thought that bees give direction to newly found nectar sources to other bees by certain dance behavior. Some of our wild flowers are cross-pollinated by specific nectar-hunting insects. These insects seem to be selective on the basis of color. Insects and insect larvae which live from green foliage are usually of two types: chewing and

sucking. Insecticides must be sprayed on the individual to kill sucking insects but may be sprayed on foliage to kill chewing insects. However, birds killed by eating poisoned insects sometimes intensify the insect menace. Some insects such as the dragon fly, feed on other insects.

Some insects are active and feed both day and night (e. g., grasshoppers); some are diurnal (e. g., cicadas), some are nocturnal (e. g., crickets). Whereas houseflies may live only a few weeks, some ants have been known to live sixteen years. Insects provide the principal food for birds, some of which eat their own weight in insects daily. Ants use aphids as cows while feeding them green vegetation. The venom of the spider wasp paralyzes the prey and preserves it for food until the young are hatched and can eat the prey.

Eggs of most arachnids and insects are produced and deposited in late summer and fall. The normal habitat of the black tarantula is under rocks and logs but when he is seen in late August crossing roads, the male is searching for a female with which to mate and produce the eggs for next year's tarantulas.

Classification of invertebrates.—The forms found in the Ozark area are listed below by habitat classification as: (I) Terrestrial (away from water), (II) Shore forms, and (III) Aquatic forms.

I. Terrestrial

A. Wooded hills and open regions

1. Flying forms
 - Flies (Diptera)
 - Butterflies (Lepidoptera)
 - Wasps and bees (Hymenoptera)
2. Non-flying forms
 - Tarantula (Arachnida)

B. Forms found on trees

1. Ants (Hymenoptera)
2. Borers — metallic wood borer (Buprestidae) noticeable by long tunnels on dead trees
3. Long-horned beetle (Cerambycidae) sometimes causing trees to die by girdling tree and breaking cambium layer
4. Termites (Isoptera) not as obvious as borers because work is done below surface
5. Parasitic wasps which range in size from tiny ant-size to 4 inches in length

C. Forms found on leaves and twigs

1. Aphids (Homoptera) — sucking mouth parts — live juice withdrawn from plant tissues
2. Chewing insects — caterpillars, leaf beetles
3. Galls — produced by flies, wasps, aphids
4. Predators — lady-bug beetles (feed on aphids), lace-wing larvae
5. Parasitic wasps and spiders

6. Cicadas (Homoptera) — sing during day
7. Crickets and katydids (Orthoptera) — sing at night

D. Forms found in lower vegetation

1. Ticks and chiggers (Arachnida)
2. Monarch butterfly (Lepidoptera) in spring and fall during migration
3. Walking stick and praying mantis (Orthoptera) — are interesting to watch as they eat grasshoppers
4. Robber fly (Diptera) — large fly which catches its prey on the wing much as a dragon fly does. Likes bees, smaller flies, and gnats as food

E. Ground forms

1. Velvet ants (Hymenoptera)
2. Blister beetles (Coleoptera)
3. Ground beetles (Coleoptera)—these are predatory on anything they can catch

F. Forms found on grasses

1. Leaf hoppers (Homoptera)
2. Grasshoppers (Orthoptera) —sometimes camouflaged in surroundings

G. Forms found beneath rocks, logs, and rotting stumps

1. Pill bugs (Crustacea)
2. Snails (Gastropoda)
3. Earthworms (Annelida)
4. Ground beetles (Coleoptera)
5. Spiders (Arachnida)
6. Springtails (Collembola)
7. Mites (Arachnida)
8. Jumping silver fish (Thysanura)
9. Scorpion (Arachnida)
10. Centipedes (Chilopoda)
11. Millipedes (Diplopoda)
12. Rhinoceros beetles (Coleoptera)

II. Shore forms

A. Near stream or lake

1. Long-jawed orb-weaver spider (Order Araneae, Family Tetragnathidae), a slender spider which often assumes a stick-like pose; spins a large, symmetrical web among bushes and tall grasses
2. Wolf spider (Family Lycosidae) abundant on the ground, especially near the water; drab in color, often carrying a sac of eggs attached to the top of the abdomen
3. Pygmy locust (Order Orthoptera, Family Tetrigidae), a drab little flightless grasshopper which frequently hops upon the water's surface
4. Toad bug (Order Hemiptera, Family Gelastocoridae), looks and acts like a tiny toad; frequently hops upon the water's surface

B. Flying just above the surface of the water

1. Flies of several kinds, and both families of damselflies listed above (Coenagrionidae most abundant); dragonflies (chiefly of the family Libellulidae).
2. Adult and subadult may flies (Ephemeridae) are most likely to be found on the vegetation near the water, but may be seen flying weakly

III. Aquatic forms

A. In swift water—swimming or clinging to rocks and logs.

1. Naiads of mayflies (Ephemeroptera)
2. Stone flies (Plecoptera)
3. Damsel flies (Odonata)
4. Dragon flies (Odonata)
5. Riffle beetles (Coleoptera)
6. Water boatman (Hemiptera)
7. Snails (Gastropoda)
8. Hellgramites (larvae of Dobson fly; Neuroptera)

B. Swimming or running on the surface of the water

1. Whirligig beetles (Order Coleoptera, Family Gyridae)
2. Water striders (Order Hemiptera, Family Gerridae)

C. Swimming freely in the water

1. Protozoa of many sorts, requiring a microscope for study
2. Rotifers of several kinds, requiring a microscope for study
3. Water fleas (Class Crustacea, Order Cladocera), usually in quiet water
4. Copepods (Class Crustacea, Order Copepoda), in stream and lake
5. Crayfish (Class Crustacea, Order Decapoda), usually on the bottom

Note: the most unusual free-swimming crustaceans are the following three groups, which occur in temporary pools, but not ordinarily in the stream or lake: fairy shrimp (Ano-

straca), tadpole shrimp (Notostraca), and clam shrimp (Conchostraca).

6. Water mites (Class Arachnida, Order Acarina)
7. Water beetles of several families (Dytiscidae, Hydrophilidae, etc.)
8. Water bugs of several families (Corixidae, Belostomatidae, etc.)
9. Mosquito wigglers (Diptera, Family Culicidae)

D. On the bottom or in the submerged vegetation

1. Hydra (Phylum Coelenterata, Class Hydrozoa)
2. Planaria (Phylum Platyhelminthes, Class Turbellaria)
3. Bristleworms (Phylum Annelida, Class Oligochaeta)

Note: An interesting leech-like oligochaete can be found on the crayfishes. It does not appear to harm its host. The bristleworms and nematodes require considerable magnification for study.

4. Fresh-water sponges and bryozoans, which will probably appear in the lake, also require microscopic study, although they can be readily seen with the unaided eye.
5. Naiads or nymphs of the mayflies, dragonflies, and damselflies listed as flying near the water.
6. Aquatic snail (Phylum Mollusca, Class Gastropoda, Order Pulmonata)
7. Mussel or clam (Phylum Mollusca, Class Pelecypoda, Order Prionodesmacea)
8. Fingernail clam (Class Pelecypoda, Order Teleodesmacea).

(All of the animals listed above as swimmers may be found on the bottom or among the vegetation.)

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