APRIL 1965
Volume 25, Number 4
$2.00 PER YEAR • $0.25 PER COPY

OKLAHOMA GEOLOGY NOTES

JOSEPH ALEXANDER TAFF

OKLAHOMA GEOLOGICAL SURVEY • THE UNIVERSITY OF OKLAHOMA • NORMAN, OKLAHOMA

Cover Picture

JOSEPH ALEXANDER TAFF

J. A. Taff, geologist of the U. S. Geological Survey, assigned to work in Indian Territory for a 10-year period beginning 1897, demonstrated such a remarkable grasp of geology and accomplished such a prodigious amount of excellent work in those early days that all Oklahoma geologists will forever be indebted to him. Specializing in the areal, stratigraphic, structural, and economic geology of southern Oklahoma, he (1) mapped and published reports covering nearly 6,000 square miles in the Paleozoic rocks of the Arbuckle, Wichita, and Ouachita Mountains and in the Ozark uplift, (2) did the first extensive mapping of coal beds in Oklahoma, and (3) was the nomenclator of more than 30 important stratigraphic units, most names of which are in use today. Taff so elucidated the concepts of geology in the regions where he worked that the basic tenets he advanced are now accepted after nearly 60 years of work by many other geologists.

To Taff we owe at the very least the establishment of fundamental stratigraphic sequences and the introduction of many stratigraphic names, the value and usefulness of which have been proved by time. Reagan, Arbuckle, Simpson, Viola, Sylvan, Hunton, Woodford, Sycamore, and Caney — mostly names of small or extinct hamlets in the Arbuckle Mountains — have outlived Taff and the towns themselves as stratigraphic names which have been taken from outcrops of the Arbuckle and the Wichita Mountains and extended in subsurface by petroleum geologists throughout Oklahoma and into Kansas and Texas as well. In the Ouachita Mountains and adjoining area of east-central Oklahoma Taff first worked with and named the Stanley, Jackfork, Wapanucka, Atoka, Hartshorne, McAlester, Savanna, Boggy, Thurman, Stuart, Senora, Calvin, Wetumka, Wewoka, Holdenville, and Seminole. All these names are familiar to and are used by modern geologists searching for petroleum, coal, asphalt, asphaltite, limestone, and cement resources, following the lead of this remarkable man.

Taff is the acknowledged father of southern Oklahoma geology. Presented with the opportunity to geologize in a virgin field, he proved to be the right man at the right time in the right place, excelling in all he did.

The talents of Taff were contributed to Oklahoma for less than one-fifth of his long professional career. Born in 1862 in Tennessee, he was educated at the University of Arkansas and at the University of Texas, receiving a Bachelor of Science degree in geology from the latter school in 1894. During his educational period he worked first with the Arkansas Geological Survey and then with the Texas Geological Survey, turning after graduation to the U. S. Geological Survey. Leaving the Survey in 1908, he began a long career as geologist for the Southern Pacific Company. Taff retired in 1937 and died at Palo Alto, California, in 1944.

The cover picture is taken from a detailed biography of Taff published by his good friend and fellow student of Oklahoma geology, H. D. Miser. This work (Geol. Soc. America, Proc., 1950, p. 227-235) was freely consulted in the preparation of this note.

— W. E. H.

Zatrachys serratus Cope (Amphibia: Labyrinthodontia) from McClain County, Oklahoma

Everett C. Olson*

INTRODUCTION

James Green and William Perrin recently discovered the skull of a rather uncommon, extinct amphibian, *Zatrachys serratus* Cope, in rocks exposed about 3 miles southwest of Byars, McClain County, Oklahoma (Branson, 1965; p. 98 of this issue). The specimen was brought to the attention of Carl C. Branson, Director of the Oklahoma Geological Survey, who turned it over to the writer for study and description. The find is of interest both as the first record of this genus of amphibian in Oklahoma and as a source of information concerning the morphology and variation of *Zatrachys*.

The genus was first described in 1878 (Cope, 1878), upon the basis of fragmentary specimens from the Lower Permian of Texas. Since that time relatively few specimens had been found until the discovery of a good series of skulls made in the course of excavations in the Lower Permian of New Mexico by parties from the University of California at Berkeley in the 1930's. The confusion that had surrounded the taxonomy of *Zatrachys* was resolved by Langston (1953), as the result of work based largely upon the New Mexico specimens.

In his report Langston showed that all skulls of this general type, including those once referred to *Platyhystrix* (Williston, 1916), pertained to *Zatrachys* and that of the five named species of *Zatrachys* only two, *Z. serratus* Cope and *Z. micropthalmus* Cope, could be shown to be valid. In addition, he found one specimen in the New Mexico collections that did not fit well into either of these two species. This specimen was merely designated as *Zatrachys* sp. In making his species determinations Langston assumed that there was a wide range of intraspecies variation.

The new skull from Oklahoma is referred to the best known species, *Zatrachys serratus* Cope, for reasons that are given in the closing section of this report.

Horizon and locality. — The specimen (OUSM 2-0-515) was found in the Gearyan strata of the Lower Permian, Wolfcampian. This places it as an approximate age equivalent of both the Texas and New Mexico specimens of *Zatrachys*. It was preserved in shale, which was interbedded with sandstone. The precise locality is the SW¼ SW¼ sec. 33, T. 5 N., R. 2 E., McClain County. Associated with the specimen were vertebrae of *Diadectes*, a large, heavily built animal generally assigned to the reptiles but considered by some to be an aberrant amphibian (Romer, 1964).

DESCRIPTION AND DISCUSSION

Most of the important features of the skull are shown in the dorsal and palatal views in figure 1 and in the photographs of figure 3.

*Walker Museum, University of Chicago.

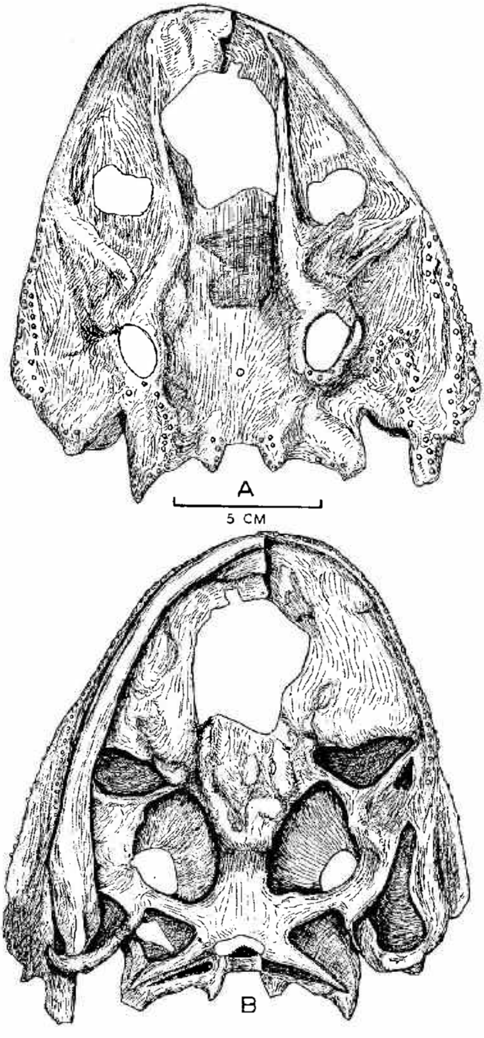

Figure 1. The skull of *Zatrachys serratus* Cope from McClain County, Oklahoma (OUSM 2-0-515).
A. Dorsal view. Note pustulae (somewhat emphasized).
B. Ventral view.

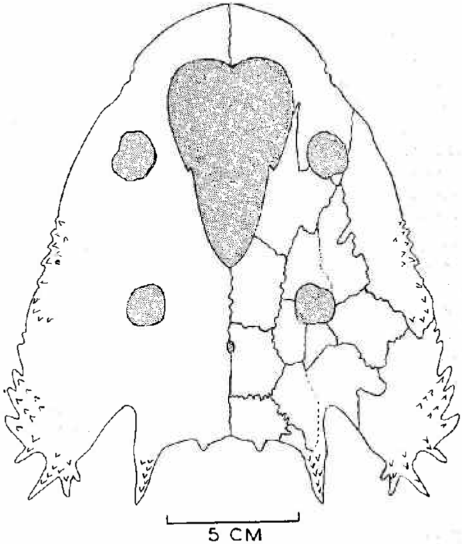

Figure 2. A reconstruction of the skull of Zatrachys serratus **Cope based upon specimen from New Mexico and redrawn after Langston (1953). Compare spinosity and general proportions with those of the Oklahoma specimen shown in figure 1.**

Although no sutures between the skull elements are visible, considerable detail is present. The skull has been flattened dorsoventrally and the palate has been somewhat damaged below the broad opening, the rostral fontanel, shown on the dorsal surface. This fontanel, which gives the skull an odd appearance, is a natural feature, although in the Oklahoma specimen the margins are somewhat damaged.

The measurements of the skull, taken to correspond with the measurements used by Langston, are given in table I. Two sets of measurements for New Mexico specimens from Langston (1953, table 3) are entered, one representing the largest of his specimens and the other the smallest. Langston noted a tendency for spinosity to increase with size and interpreted the differences between skulls of somewhat similar size as due to sexual dimorphism. These contentions are reasonably well supported by his materials, although the limited numbers in the series, as he noted, makes interpretation open to some question.

The Oklahoma specimen compares favorably in size and proportions of the skull with the largest of the New Mexico specimens, although some inaccuracy due to distortion in both cases enters in. The new specimen shows strongly developed quadratojugal spines but little evidence of the high degree of spinosity of the adult forms in the Langston series, as shown in his reconstruction and sketches of the series (Langston, 1953, figs. 13, 19). An outline sketch based upon Langston's figure 13 is given in figure 2 of this paper to illustrate the nature of this difference.

The posterior and posterolateral margins and ridges on the skull platform in the Oklahoma specimen are marked by the presence of distinct, pustulose excrescences. These pustulae are smoothly rounded and ovoid except as the outline is broken at their basal attachments to the bones of the skull. They seem to be more or less equivalent in position to the spinosities shown in the Langston reconstruction. They are rounded rather than sharp, however, and do not seem to be incipient spines. They represent a rather different expression of the general tendency to spinosity, already known to be highly variable but heretofore confined to a common pattern somewhat different from that shown in the Oklahoma skull.

The palatal of the Oklahoma specimen, figure 1B, does not reveal any important differences from other specimens of *Z. serratus* Cope. A peculiar feature of this genus, shown in the figure, is the posterior

TABLE I. — MEASUREMENTS OF SKULL CHARACTERS OF *Zatrachys serratus* COPE

(Measurements in mm)

	UCMP[1] 34180	UCMP[1] 34178	OUSM[2] 2-O-515
Length of skull to end of quadrate	104	158	155
Length of skull to end of tabular cornu	—	181[3]	166
Length of face to center of orbit	71	108	109
Length of skull table from center of orbit	27.5	41	36
Length of upper tooth row (outer curve)	84	126	130
Length of rostral fontanel	47	79	60+
Length of rostrum from center of naris	34[3]	51[3]	71
Length of naris	—	—	14
Length of orbit	12	17.6	20
Maximum width of skull	118	158+	150
Maximum width of rostral fontanel	29	36	30
Length of interpterygoid vacuity	24	34	38
Width of interpterygoid vacuity	23	28	26
Length of mandible (outer curve)	121	—	165

1 University of California Museum of Paleontology; specimen from New Mexico; measurements from Langston (1953, table 3).

2 The University of Oklahoma, Stovall Museum; specimen from Oklahoma.

3 Estimated.

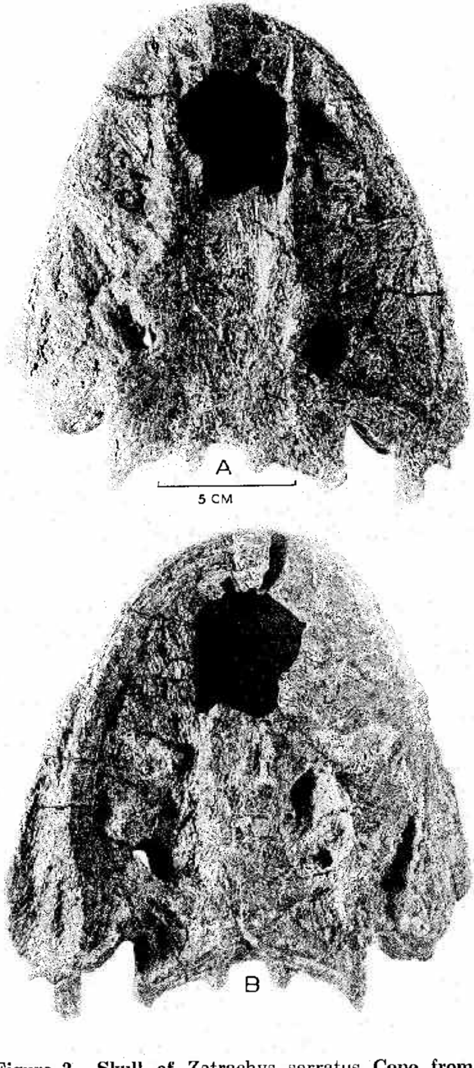

Figure 3. Skull of Zatrachys serratus **Cope from McClain County, Oklahoma (OUSM 2-0-515).**

A. Dorsal view.
B. Ventral view.

positions of the internal nares, matched by a posterior position of the external nares on the dorsal surface of the skull. This is a condition found in many aquatic reptiles, but unusual and difficult to interpret in amphibians in which respiration presumably could be carried on only intermittently.

The ramus of the left side of the lower jaw is preserved in normal position. The jaw is long and slender and has a strong ventral keel along the posterior basal margin. The temporal chamber, in which the posterior part of the adductor series of the lower jaw was housed, is small but somewhat deeper than that shown in the crushed specimen. These muscles, more or less equivalent to the external adductor series of reptiles, were so short that they could have played only a relatively minor role in the closing of the jaws. The principal adduction of the jaws appears to have been carried out by a more anterior part of the adductor-muscle system, one which originated on the ventral surface of the skull roof above and anterior to the interpterygoidal vacuities. Those muscles could exert maximum forces when the jaws were open but were relatively ineffective when the jaws were nearly closed. This is an example of the general system described as kinetic-inertial by the writer in an earlier paper (Olson, 1961). *Zatrachys* lacks the deep, heavy ramus of the lower jaws associated with the full development of this system and, in the absence of this feature, adduction was probably relatively weak. Use of the jaws presumably was much the same as it is in many frogs and salamanders of the present-day amphibian fauna.

SPECIES ASSIGNMENT

The specimen has been assigned to *Zatrachys serratus* Cope upon the basis of the proportions of the skull. Clearly it lies closer to this species than to *Z. micropthalmus* Cope, and it is proportionately different from the unnamed species noted by Langston (1953). Within limits of variation that appear to be normal for species of the genus, correspondence of over-all proportions is good between the Oklahoma specimen and those of the New Mexico series of *Z. serratus* Cope.

The development of spinosity in the Oklahoma specimen, however, resembles that of the smaller specimens from New Mexico, and is quite different from that in the larger individuals with which it compares in size. This is probably a highly variable character, perhaps one that may be rather strongly influenced by local conditions during ontogeny. It is the kind of feature that tends to be different in partially isolated, local populations of many species. Thus it seems insufficient as a basis for inferring a specific difference between the specimens from Oklahoma and New Mexico.

Reference of specimens from Texas, New Mexico, and Oklahoma to *Z. serratus* Cope implies that this species had a wide geographic range, one much more extensive than is characteristic of most of the other species of this time. Occurrences in these states are more or less contemporaneous, although precise time equivalency cannot be demonstrated. For the most part, although many genera are common to New Mexico, Texas, and Oklahoma at this time, few species are common. In addition some generic differences between amphibians of New Mexico and those of the more eastern regions suggest a lack of completely free communication between the two areas. Considerable isolation is suggested by both of these facts and argues against the interpretation of the identity of the species of *Zatrachys* in New Mexico with those in Texas and Oklahoma.

Eventually it may turn out that assignment of specimens of *Zatrachys* from this wide range to common species has overlooked differences not apparent or interpretable upon the basis of relatively few individuals. Although no such differentiation is now possible, the recognition of a common species should not be taken as conclusive evidence of free interchange between the western and eastern parts of the terrestrial Permian deposits of the Southwest during the Early Permian.

References Cited

Branson C. C., 1965, Geology of Byars fossil site: Okla. Geol. Survey, Okla. Geology Notes, vol. 25, p. 98.

Cope, E. D., 1878, Descriptions of extinct Batrachia and Reptilia from the Permian formations of Texas: Amer. Philos. Soc., Proc., vol. 17, p. 182-193.

Langston, Wann, Jr., 1953, Permian amphibians from New Mexico: Calif., Univ., Pubs. Geol. Sciences, vol. 29, p. 349-416.

Olson, E. C., 1961, Jaw mechanisms: rhipidistians, amphibians, reptiles: Amer. Zoologist, vol. 1, p. 205-215.

Romer, A. S., 1964, **Diadectes** as an amphibian: Copeia, 1964, no. 4, p. 718-719.

Williston, S. W., 1916, Synopsis of the American Permo-carboniferous Tetrapoda: Chicago, Univ., Walker Museum, Contr., vol. 1, p. 203-206.

Geology of Byars Fossil Site

Carl C. Branson

The paper describing and illustrating a fossil amphibian (Olson, 1965; p. 91-97 of this issue) was based upon a specimen collected in the SW¼ SW¼ sec. 33, T. 5 N., R. 2 E., McClain County, Oklahoma. The discoverers of the locality (Bill Perrin and Jim Green) showed me the locality on February 14, 1965, and at that time found one more vertebra of *Diadectes*. The site is a badlands area some 10 acres in area, with gullies up to 50 feet deep. The geologic section (estimated from memory) is as follows:

	THICKNESS (FEET)
Pleistocene terrace gravel	5
White, cross-bedded sandstone	3
Maroon mudstone	8
Mudstone, hematite concretions, probably source of vertebrate fossils	3
Mudstone, variegated	30

The stratigraphic level is difficult to determine. The geologic map of Cleveland and McClain Counties (Anderson, 1927, pl. 1) shows the locality as in the lower part of the Wellington Shale, but the text (p. 10) would seem to equate the strata with the top of the Stillwater (name abandoned) formation. The geologic map of Garvin County (the locality is but a few yards north of the Garvin-McClain county line) shows the locality as in Unit 1 of the Enid group (Dott, 1927, pl. 1), a 140-foot unit placed as equivalent to the lower part of the Stillwater formation and to the lower part of the Gearyan (table 1, p. 132). The graphic section (fig. 19, p. 125) shows Unit 1 as having been measured in T. 4 N., R. 2 E., the area of the vertebrate locality. From the description (p. 124) the vertebrates came from the middle part above 40 feet of sandstone.

Water-worn fragments of bone of unidentifiable nature were reported by Dott (1927, footnote, p. 131) from Unit 1 south of Pauls Valley.

The mudstone below the vertebrate-bearing bed yields half-dollar-sized disks of malachite-impregnated sandstone. The area was in 1897 and 1898 worked for copper, and a small amount of concentrates was produced (Merritt, 1940, unnumbered 8th page).

References Cited

Anderson, G. E., 1927, Geology of Cleveland and McClain Counties: Okla. Geol. Survey, Bull. 40-N, 18 p., **also in** Bull. 40, vol. 2, p. 179-192 (1930).

Dott, R. H., 1927, Geology of Garvin County: Okla. Geol. Survey, Bull. 40-K, pt. I, 31 p., **also in** Bull. 40, vol. 2, p. 119-143 (1930).

Merritt, C. A., 1940, Copper in the "red beds" of Oklahoma: Okla. Geol. Survey, Mineral Rept. 8, 17 p.

Olson, E. C., 1965, **Zatrachys serratus** Cope (Amphibia: Labyrinthodontia) from McClain County, Oklahoma: Okla. Geol. Survey, Okla. Geology Notes, vol. 25, p. 91-97.

Arid and Semiarid Climates in Oklahoma, 1923-1958

Arthur H. Doerr*

The vicissitudes of Oklahoma's climate are famous or, more accurately, infamous. Extreme variations from "normal" conditions are commonplace, but much of what is said about Oklahoma's climate is based upon half-truths and hearsay. Cycles of good years and bad typify the climate, and semiaridity or aridity are constant specters.

One convenient, and singularly appropriate, method of measuring the extent of dry conditions is the first Thornthwaite climatic classification (Thornthwaite, 1931, 1933; Hare, 1951).

The Thornthwaite classes are based upon P-E indices derived from the following equation:

$$(\text{P-E index}) \quad \sum_{n1}^{12} \quad 115 \left(\frac{P}{T-10} \right)_n \quad \frac{10}{9}$$

Where

Σ	Summation of twelve monthly ratios
P	Monthly mean precipitation (inches)
T	Monthly mean temperature (degrees F)
n	The particular month

Yields

Humidity Province	Vegetation	P-E Index
A	Rain forest	>127
B	Forest	64-127
C	Grasslands	32-63
D	Steppe	16-31
E	Desert	<16

The method is convenient because it lends itself to mass data-processing techniques, and it is appropriate because C. Warren Thornthwaite was a staff member at The University of Oklahoma when the classification scheme was developed.

In this study the first Thornthwaite climatic classification was applied on an annual, mean, and frequency basis for 89 weather stations in Oklahoma for the 36-year period from 1923 to 1958. Such a period permitted examination of three postulated 11+-year precipitation cycles. Stations were chosen to provide a close grid of coverage, and most stations are less than 40 miles from neighboring stations.

All D (steppe) (semiarid) and E (desert) (arid) stations were set apart for separate cartographic treatment. These annual maps depicting arid and semiarid regions are compared to mean and frequency maps for the period 1923-1958.

Both the Thornthwaite mean and frequency maps (figs. 1, 2) show only the Panhandle as semiarid, and no part of Oklahoma can be classified as arid. During the 1923-1958 period only four years, 1923, 1941, 1942, and 1944, lacked semiarid or arid conditions.

*Department of Geography, The University of Oklahoma.

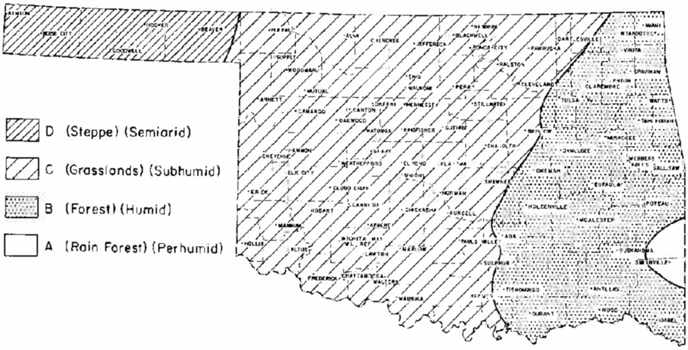

Figure 1. Thornthwaite mean P-E map for period 1923-1958.

The years 1924 (fig. 3), 1925 (fig. 4), and 1927 (fig. 5) experienced semiarid conditions over a larger area than mean conditions, whereas 1926 (fig. 6), 1928 (fig. 7), and 1929 (fig. 8) had semiarid areas about equal to or less than mean conditions. During the 1920's no part of the State experienced arid conditions.

The dark days of the 1930's could hardly have been forecast by conditions extant in 1930 (fig. 9), 1931 (fig. 10), or 1932 (fig. 11), but the full fury of drought descended in 1933 when the western third of Oklahoma was semiarid and large sections of the Panhandle were arid (fig. 12). The year 1934 (fig. 13) was a hard year, and although 1935 (fig. 14) afforded some diminution in the hard-hit area, 1936 saw the spread of semiarid conditions over half the State (fig. 15). Recovery was slow and sporadic in the last years of the 1930's (figs. 16-18).

The pall of dust in the 1930's and the spread of human misery were graphically portrayed in Steinbeck's *Grapes of Wrath* and by U. S. Soil Conservation Service photographs. "Black blizzards" and "Okies" became a part of the language as war clouds grew in Europe.

Fortunately, Jupiter Pluvius smiled during the 1940's, the Earth's wounds healed, and Oklahoma produced bumper crops to help feed a hungry world. Although semiarid conditions occurred in most years of the 1940-1950 decade, the climatic austerity of the 1930's was not repeated (figs. 19-25).

The 1950's crept in like a lamb (figs. 26, 27), but by 1952 (fig. 28) the ghost of the 1930's had returned. Except for a brief interval in 1955 the middle years of the 1950's were bad (figs. 29-32). Recovery began in 1957 (fig. 33) and after 1958 (fig. 34) conditions returned to near "normal."

In many ways the period of the 1950's mirrored those of the 1930's, but extreme hardship and emigration in the 1950's were largely eliminated because of the application of appropriate soil-conservation

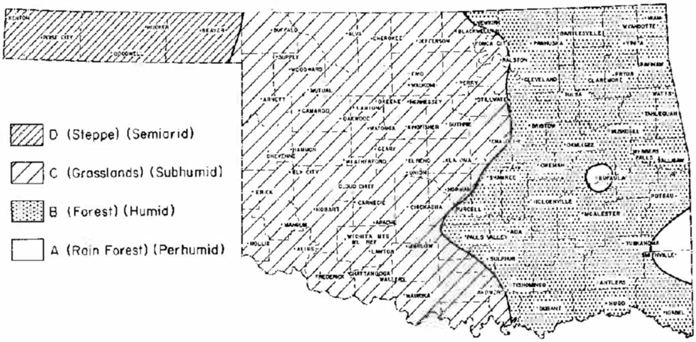

Figure 2. Thornthwaite frequency P-E map for period 1923-1958.

techniques. Irrigation and crop insurance took most of the sting out of the drought of the 1950's, but western Oklahoma must realize that recurrent drought is a fact of life.

More than half of the State experienced semiarid conditions some time during the period under study, and the Panhandle and a small area in the extreme western section of the State had desert conditions (fig. 35). Only the eastern and southeastern sections of the State escaped semiarid conditions, and every station except those in the extreme southeast were subhumid at some time in the interval from 1923 to 1958.

A number of causes, including sun-spot activity and solar tides, have been suggested to account for the pulse of precipitation followed by drought in Oklahoma, but causality has not yet been established. Annual P-E maps for 1923-1958 do clearly reveal, however, something approaching the postulated 11+-year precipitation cycle. The years ahead will reveal correspondence or discrepancy to past patterns. Upon the basis of the recent past much of Oklahoma must be categorized as an area subject to considerable drought risk.

J. R. Castelli drafted the illustrations for this paper.

References Cited

Hare, F. K., 1951, Climatic classification, in London essays in geography: Cambridge, Mass., Harvard Univ. Press, p. 121-128.

Thornthwaite, C. W., 1931, The climates of North America according to a new classification: Geog. Review, vol. 21, p. 633-635.

__________ 1933, The climates of the Earth: Geog. Review, vol. 23, p. 433-440.

(Figures 3-35 appear on pages 102-112)

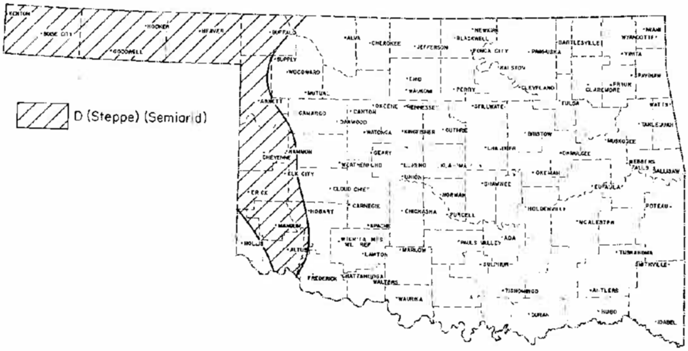

Figure 3. Map showing extent of dry conditions in 1924.

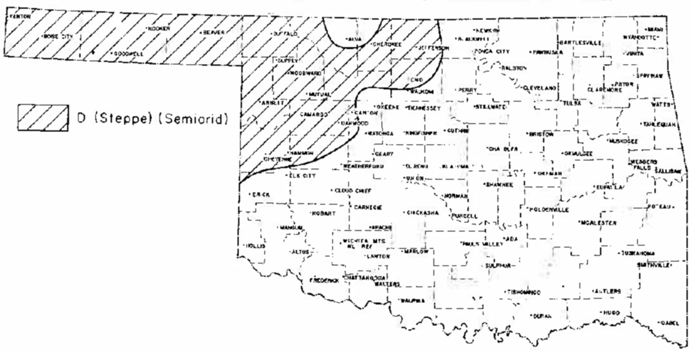

Figure 4. Map showing extent of dry conditions in 1925.

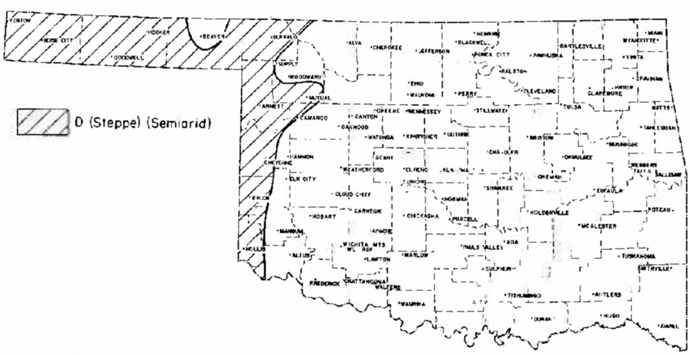

Figure 5. Map showing extent of dry conditions in 1927.

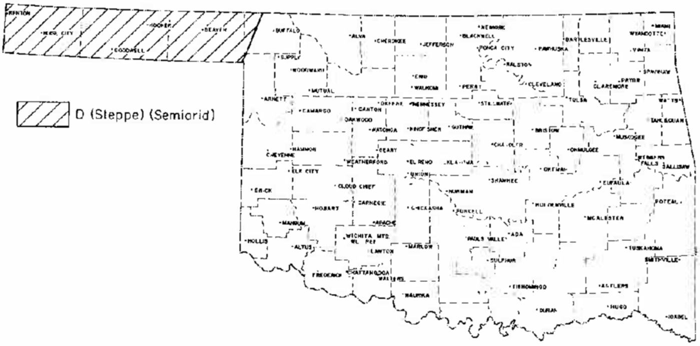

Figure 6. Map showing extent of dry conditions in 1926.

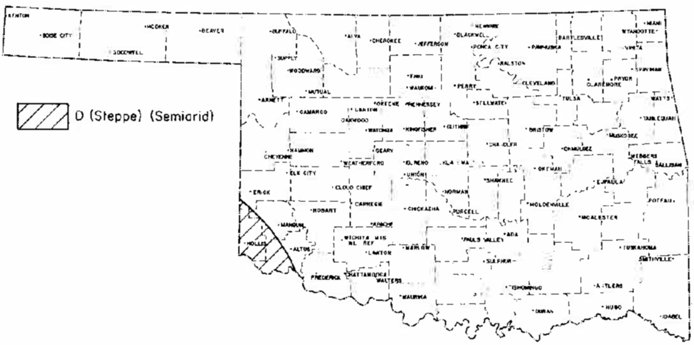

Figure 7. Map showing extent of dry conditions in 1928.

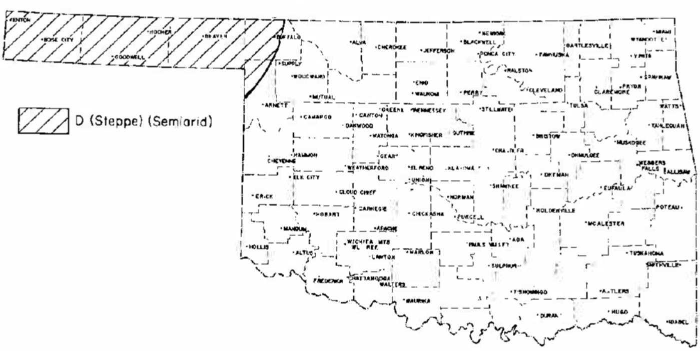

Figure 8. Map showing extent of dry conditions in 1929.

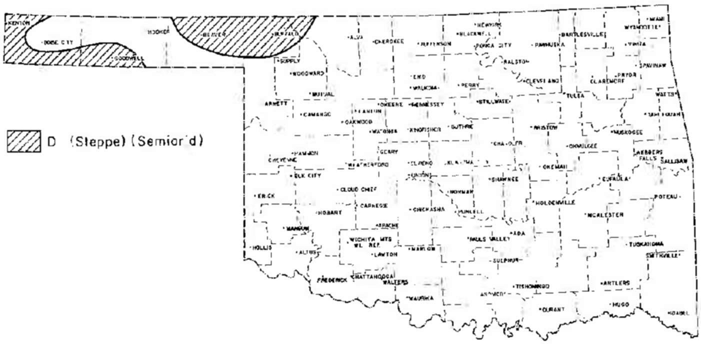

Figure 9. Map showing extent of dry conditions in 1930.

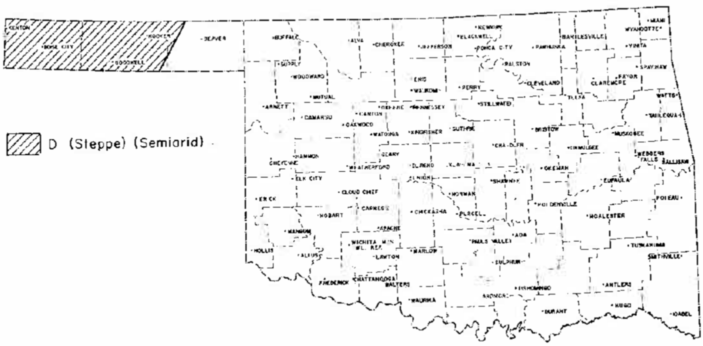

Figure 10. Map showing extent of dry conditions in 1931.

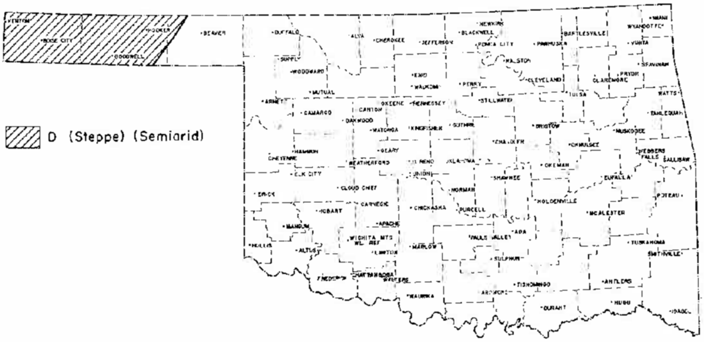

Figure 11. Map showing extent of dry conditions in 1932.

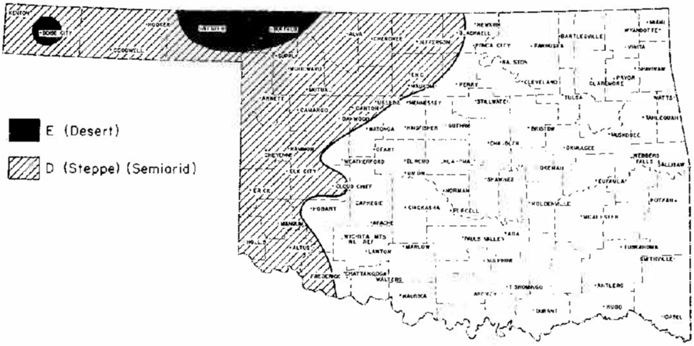

Figure 12. Map showing extent of dry conditions in 1933.

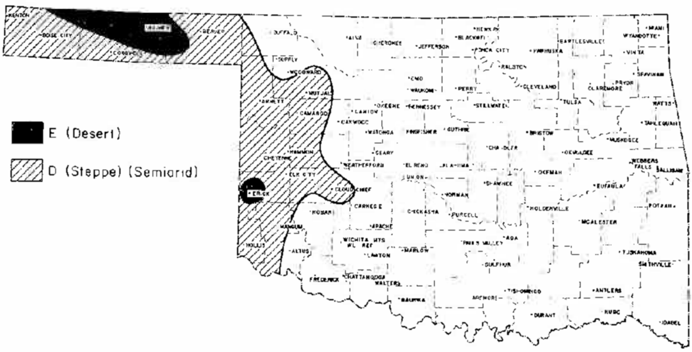

Figure 13. Map showing extent of dry conditions in 1934.

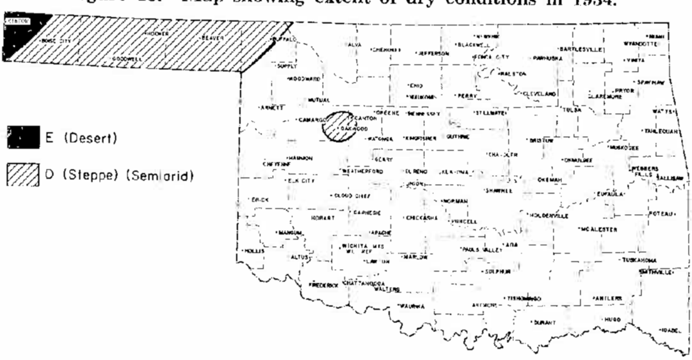

Figure 14. Map showing extent of dry conditions in 1935.

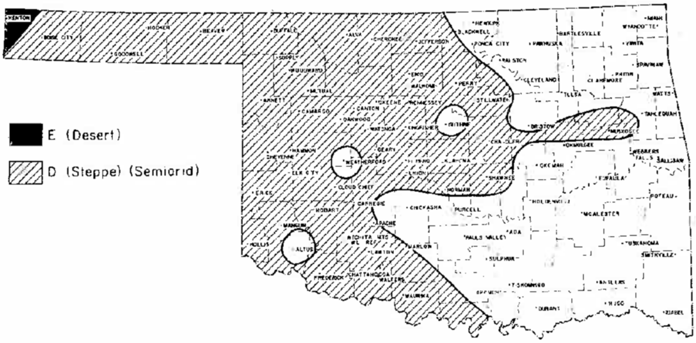

Figure 15. Map showing extent of dry conditions in 1936.

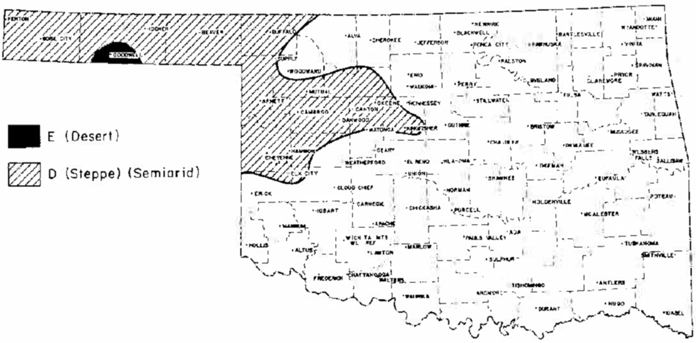

Figure 16. Map showing extent of dry conditions in 1937.

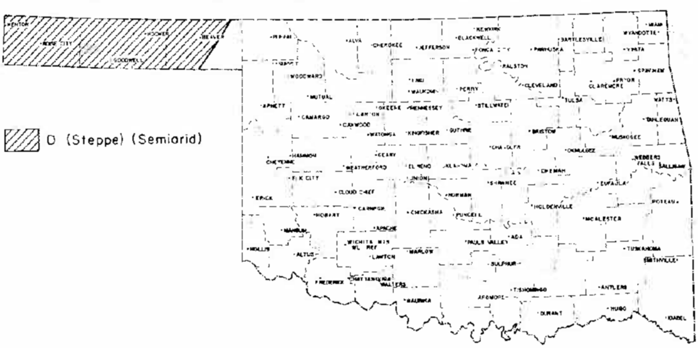

Figure 17. Map showing extent of dry conditions in 1938.

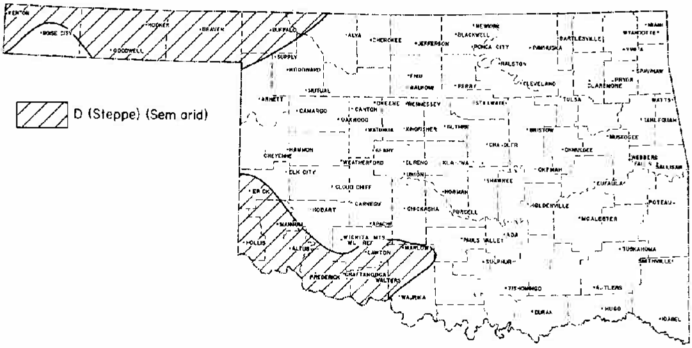

Figure 18. Map showing extent of dry conditions in 1939.

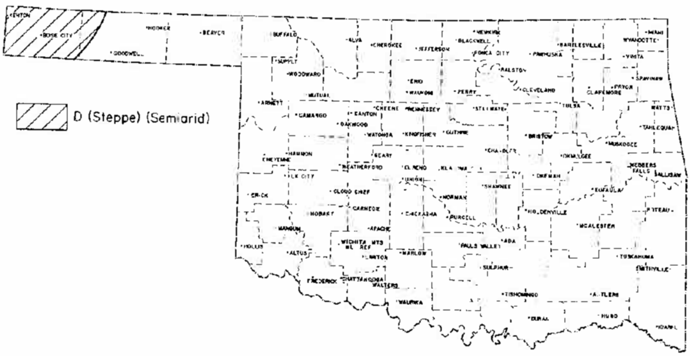

Figure 19. Map showing extent of dry conditions in 1940.

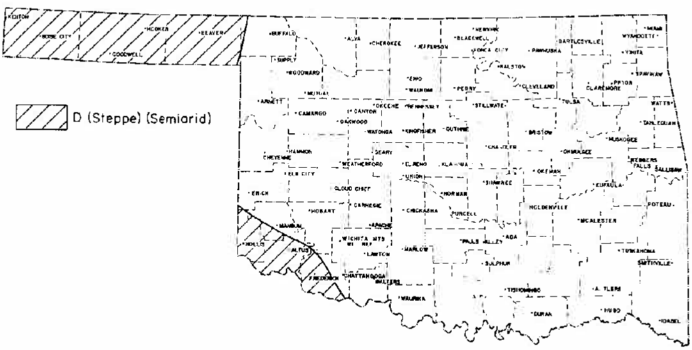

Figure 20. Map showing extent of dry conditions in 1943.

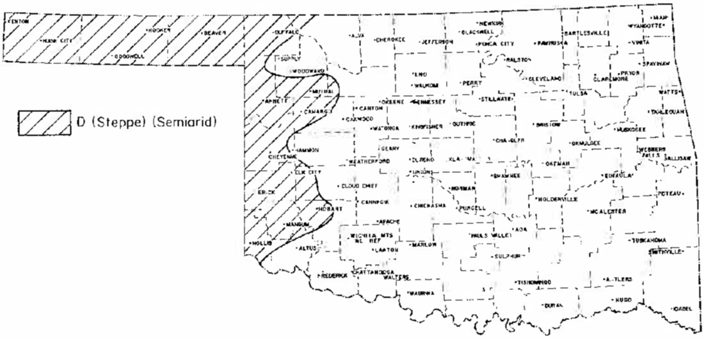

Figure 21. Map showing extent of dry conditions in 1945.

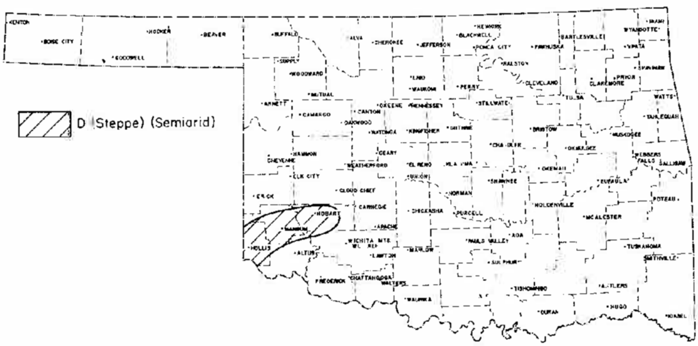

Figure 22. Map showing extent of dry conditions in 1946.

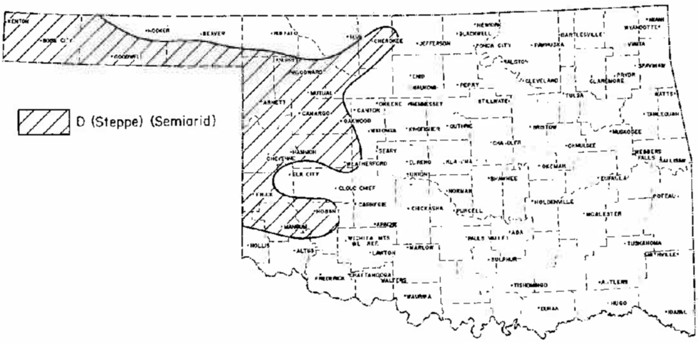

Figure 23. Map showing extent of dry conditions in 1947.

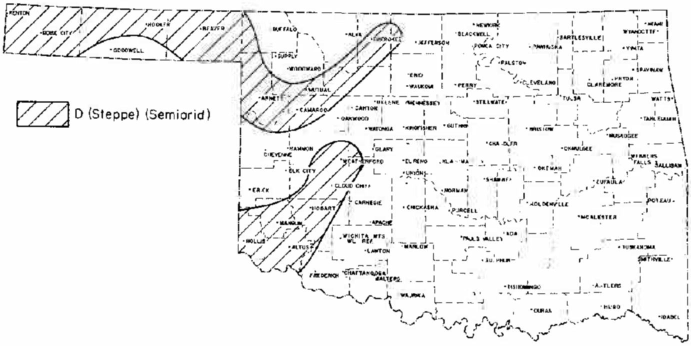

Figure 24. Map showing extent of dry conditions in 1948.

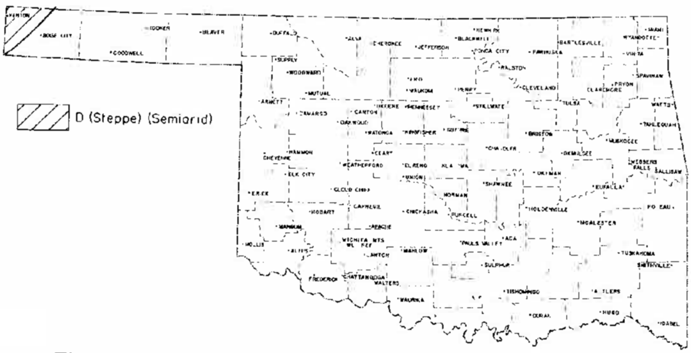

Figure 25. Map showing extent of dry conditions in 1949.

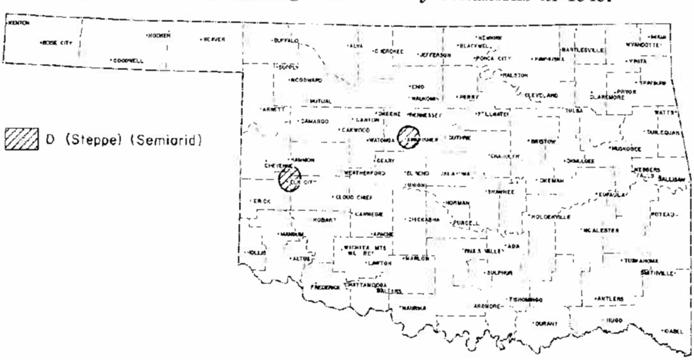

Figure 26. Map showing extent of dry conditions in 1950.

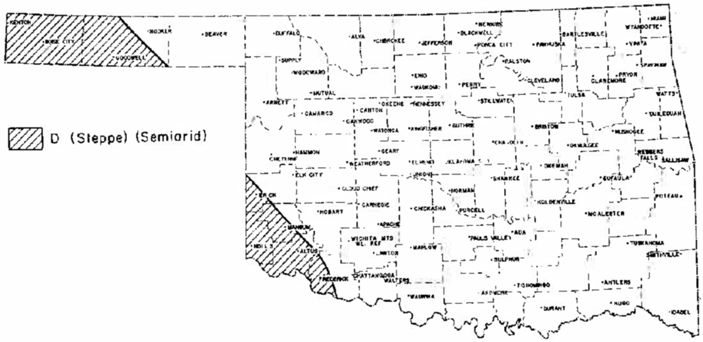

Figure 27. Map showing extent of dry conditions in 1951.

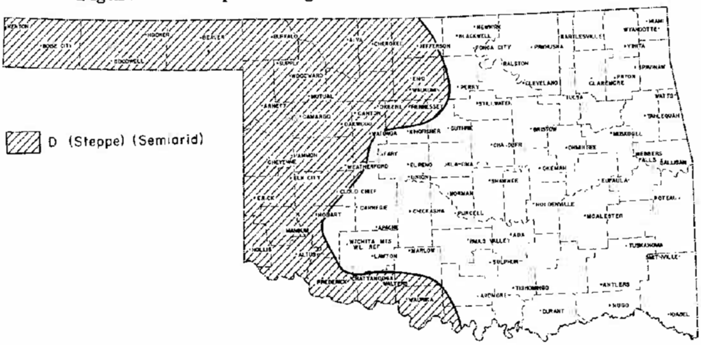

Figure 28. Map showing extent of dry conditions in 1952.

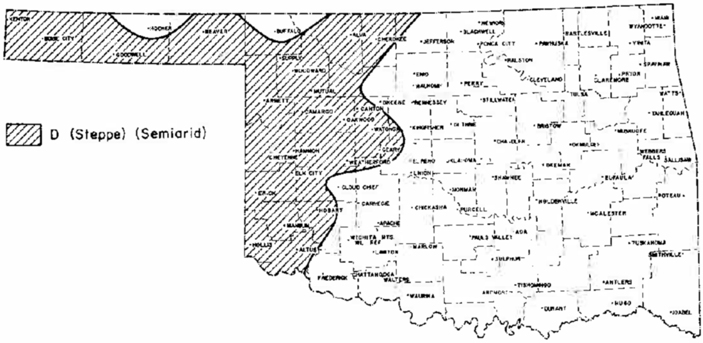

Figure 29. Map showing extent of dry conditions in 1953.

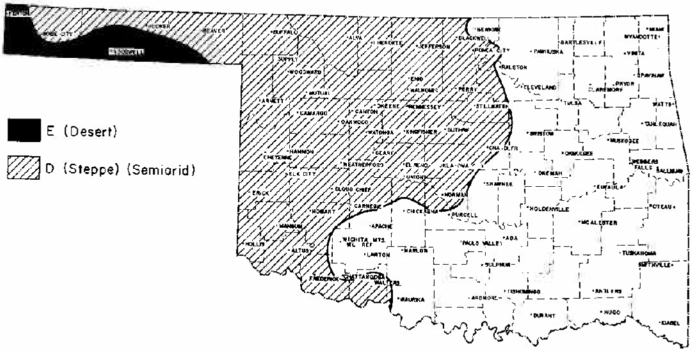

Figure 30. Map showing extent of dry conditions in 1954.

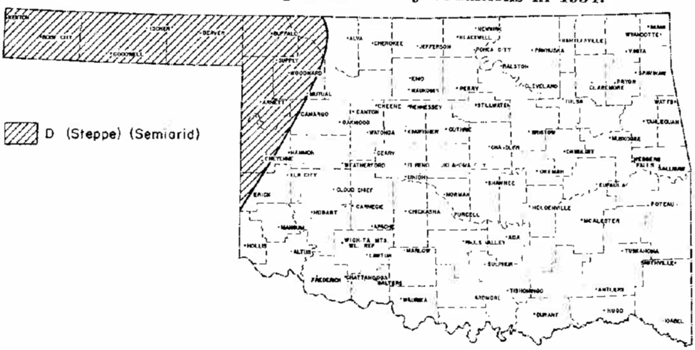

Figure 31. Map showing extent of dry conditions in 1955.

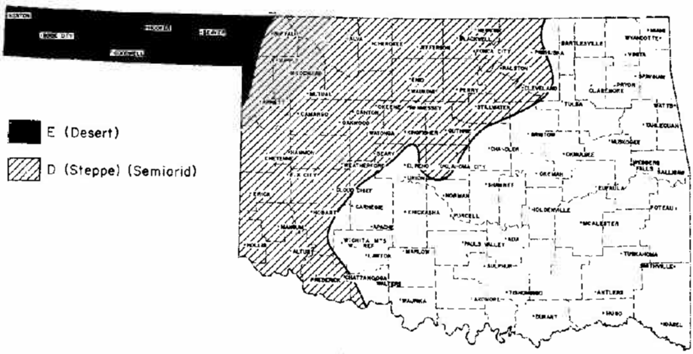

Figure 32. Map showing extent of dry conditions in 1956.

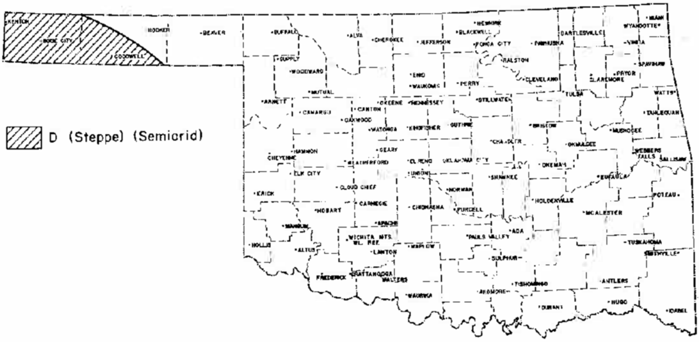

Figure 33. Map showing extent of dry conditions in 1957.

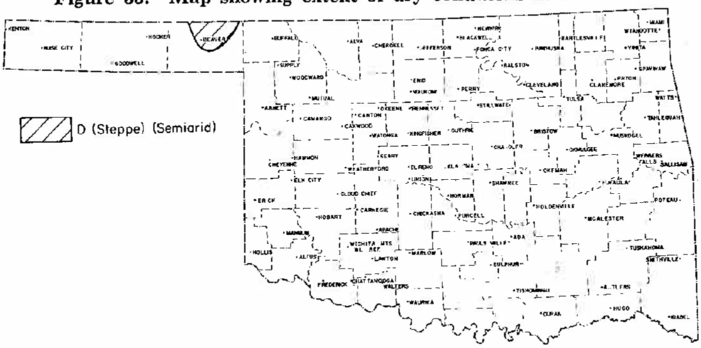

Figure 34. Map showing extent of dry conditions in 1958.

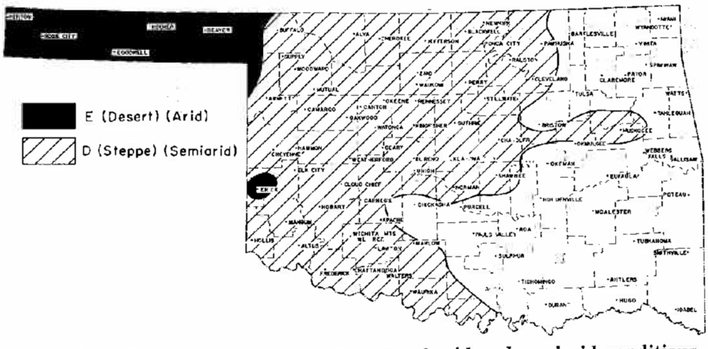

Figure 35. Map showing maximum extent of arid and semiarid conditions, 1923-1958.

Checkerboard Limestone

Carl C. Branson

The descriptive name Checkerboard was applied to the limestone unit above the Seminole Formation (Pennsylvanian, Missourian) by geologists of the early part of the century. Hutchison (1907, p. 71-76) referred to the Kansas unit, the Parsons Limestone, but used the name Tulsa limestone for the bed exposed from Tulsa southwestward to Nuyaka Creek. Hutchison (1911, p. 157) stated that his Tulsa limestone is the bed "that is known as the 'Checker board limestone' in the region of the Glenn pool."

Smith (1914, p. 41) mentioned the 2.5-foot limestone and said that "it is known to drillers as the Checkerboard lime." It is quite apparent that drillers do not recognize jointing and that actually the bed is the Checkerboard lime of surface geologists.

Bloesch (1917, p. 134-135) noted that the Checkerboard limestone occurs in the Tulsa-Glenpool areas and that its southward equivalent is west of Holdenville in the Seminole Hills. Fath (1917a, fig. 15, p.

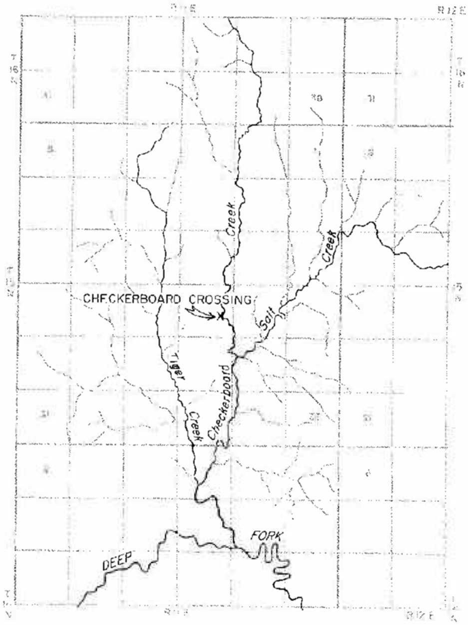

Figure 1. Map of Checkerboard Crossing area showing Checkerboard Creek and its principal tributaries.

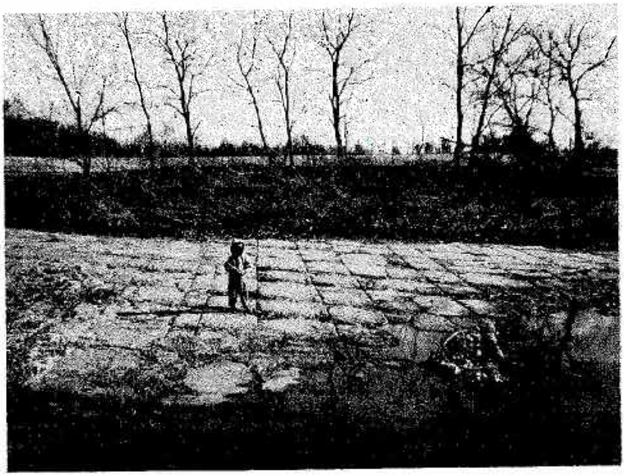

Figure 2. Jointed Checkerboard Limestone at Checkerboard Crossing of Checkerboard Creek, Okmulgee County.
(Photograph by Dave Logan)

75) showed Checkerboard lime, with a note that it is probably not in wells of the Bristow district. Oklahoma Geological Survey (1917, p. 158) mentioned "checkerboard lime of the drillers," and Fath (1917b, p. 370-371) gave the first identification of specific outcrops and described them. He wrote of the old "Checkerboard Crossing" of Flat Rock Creek near the east-west quarter line of sec. 22, T. 15 N., R. 11 E.

Gould (1925, p. 72) referred to the Checkerboard limestone member of the Coffeyville formation, described the jointed limestone, and designated the exposures on Checkerboard Creek as the type locality, rather casually mentioning Checkerboard Crossing as a "good exposure."

The main creek is given as Flat Rock Creek, with branches West Flat Rock Creek and East Flat Rock Creek, on the U. S. Geological Survey Nuyaka quadrangle, surveyed in 1896, published in 1901, reprinted in 1949. The Kiefer 15-minute quadrangle (surveyed 1914, printed 1916) shows no Flat Rock Creek, shows the west branch as Tiger Creek, the east branch as Salt Creek, and the main branch as Checkerboard Creek (fig. 1). Because the name is distinctive and the main branch is Checkerboard Creek, the former Flat Rock Creek to its junction with Deep Fork in SW¼ sec. 11, T. 14 N., R. 11 E., should be Checkerboard Creek, with tributaries Tiger Creek and Salt Creek.

The Checkerboard Limestone is 2.5 feet thick at the type locality. One set of joints strikes north, the other N 70° W (Oakes, 1963, p. 60). Further discussion of the limestone is in county reports and in Wolfson (1963).

The guide to Oklahoma (Ruth, 1957, p. 411) refers to the feature as the Giants' Highway. The owner (according to M. C. Oakes) advertises the feature as a prehistoric road. Mr. Dave Logan of Okmulgee has kindly made a picture available (fig. 2), a picture he took while leading the Flintstone Rock Club of Okmulgee on a field trip last spring.

References Cited

Bloesch, Edward, 1917, North-south correlations of the Pennsylvanian of Oklahoma: Southwestern Assoc. Petroleum Geologists, Bull., vol. 1, p. 134-135.

Fath, A. E., 1917a, Structure of the northern part of the Bristow quadrangle, Creek County, Oklahoma, with reference to petroleum and natural gas: U. S. Geol. Survey, Bull. 661, p. 69-99.

__________ 1917b, A structural reconnaissance in the vicinity of Beggs, in Petroleum and natural gas in Oklahoma, pt. 2: Okla. Geol. Survey, Bull. 19, p. 369-383.

Gould, C. N., 1925, Index to the stratigraphy of Oklahoma: Okla. Geol. Survey, Bull. 35, 115 p.

Hutchison, L. L., 1907, The stratigraphy of Oklahoma north of the parallel of thirty-five degrees and thirty minutes: Okla., Univ., unpublished Bachelor of Arts thesis, 155 p., map.

__________ 1911, Preliminary report on the rock asphalt, asphaltite, petroleum and natural gas in Oklahoma: Okla. Geol. Survey, Bull. 2, 256 p.

Oakes, M. C., 1963, Geology and water resources of Okmulgee County, pt. 1 of Geology and water resources of Okmulgee County, Oklahoma: Okla. Geol. Survey, Bull. 91, p. 7-80, 129-160.

Oklahoma Geological Survey, 1917, Petroleum and natural gas in Oklahoma, pt. 2: Okla. Geol. Survey, Bull. 19, 536 p.

Ruth, Kent, 1957, Oklahoma: A guide to the Sooner State: Norman, Univ. Okla. Press, 532 p.

Smith, C. D., 1914, The Glenn oil and gas pool and vicinity, Oklahoma: U. S. Geol. Survey, Bull. 541, p. 34-48.

Wolfson, M. S., 1963, Stratigraphy and paleoecology of the Checkerboard Formation (Pennsylvanian) of northeastern Oklahoma: Okla., Univ., unpublished Master of Science thesis, 121 p.

New Theses Added to O. U. Geology Library

The following Master of Science thesis was added to The University of Oklahoma Geology Library in March 1965.

Quantitative electrical study of the Laverty-Hoover sand (Pennsylvanian), Harper County, Oklahoma, by Ying-Yan Huang.

Henryhouse Ostracodes

Oklahoma Geological Survey Bulletin 108, *Ostracodes of the Henryhouse Formation (Silurian) in Oklahoma,* by Robert F. Lundin, is tentatively scheduled for publication in April 1965. The report describes a distinctive fauna indicating a late Middle or early Late Silurian age for the Henryhouse Formation. The fauna comprises forty-six species (twenty-two new), twenty-eight genera (one new), and seventeen families. Of special interest are: (1) the first report of a species (*Rakverella*? sp.) of the Piretellidae in rocks younger than Ordovician, (2) the first reported occurrence of *Grammalomatella* in North America, and (3) the first reported occurrence of *Hollinella, Healdia,* and *Amphissella* in rocks older than Devonian. Eleven ostracode species, previously reported as occurring in the Haragan Formation, are now known to be restricted to the Henryhouse.

The report contains 104 pages, 18 plates, 45 text-figures, and 16 tables. Price: $3.50 cloth bound, $2.50 paper bound.

OKLAHOMA GEOLOGY NOTES

Volume 25 April 1965 Number 4

IN THIS ISSUE