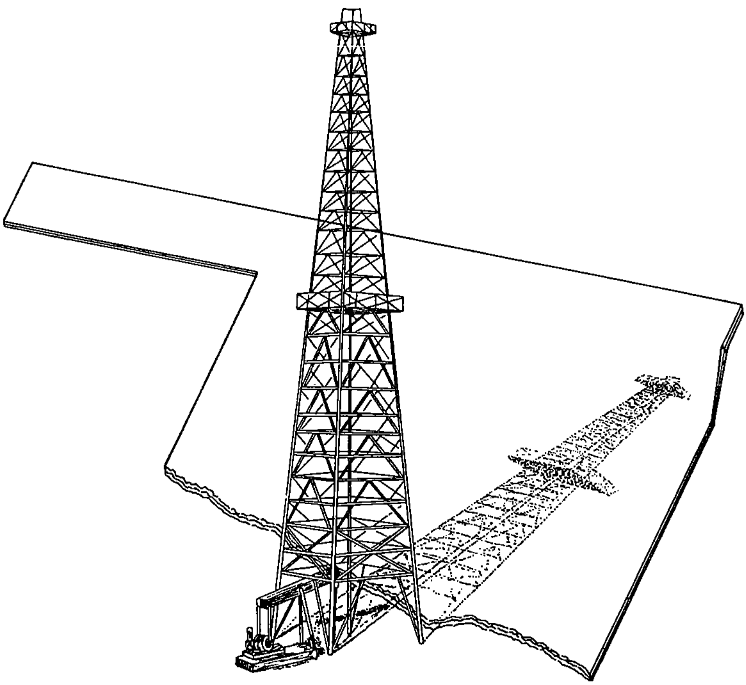
Oklahoma Geology Notes



OKLAHOMA GEOLOGICAL SURVEY
NORMAN, OKLAHOMA

Vol. 16
No. 7

July, 1956

NOTES ON THE STRATIGRAPHY ALONG THE TURNER TURNPIKE

By Louis H. Lukert

(Read before the evening meeting in the Oklahoma Club, April 13, 1956)

You have all had the pleasure today of examining the surface outcrops of the rocks from the Coffeyville formation of the lower Missouri Series, Pennsylvanian age, upward to the Garber sand of Permian age. The following remarks will deal with some of the aspects of the subsurface correlations along the Turner Turnpike which have been established by tying into earlier work some 40 to 80 miles to the north. That portion of a subsurface cross section extending for T. 23 N-R. 3 W, in northeastern Garfield County, to T. 22 N-R. 8 E, near Hominy in Osage County, published by the writer in the February 1949 bulletin of the A.A.P.G., has been used as the basis for correlations.[1]

North-South traverses, starting at the west end of the aforementioned cross section, extending southward to the West Moore field in T. 10 N-R. 4 W, a few miles southwest of Oklahoma City, and another from the east end of the published section near Hominy extending southward to the northwest part of T. 15 N.-R. 8 E, near Depew, and the connecting route of the Turnpike from a trapezoidal area of some 5,000 sq. miles. Northeastern Garfield County, the West Moore field, the vicinity of Depew, and the area around Hominy will, therefore, serve as reference points in the discussion which follows.

The division of the rocks and terminology conform to the aforementioned published cross section. No attempt is made to discuss lithology except to state that the subsurface sediments along the Turnpike are dominantly clastic as opposed to the preponderance of alternating limestones and clastic rocks occurring to the north. Perhaps the distribution and disappearance of many of the Pennsylvanian limestones, as well as other beds in the area, can be better understood if one will consider them as separate units or lentils deposited as irregular-shaped layers having variable distribution. In the subject area we are concerned with the southern terminus of many of these lentils. This discussion will deal only with some of the more persistent units commonly used in subsurface studies.

Permian rocks mantle the western three-fourths of the trapezoidal area. Surface outcrops of such limestones as the Herington, Ft. Riley, Cottonwood and Neva cannot be traced as far south as the Turner Turnpike. The Red Eagle limestone, however, does cross the Turnpike between the towns of Chandler and Stroud.

Along the west side of the area the Permian Wolfcamp series has a uniform thickness of 1,000 feet, and the Red Eagle limestone is again one of the few horizons in this series which carries through to the West Moore field. Such beds as the Herington, Winfield, Florence, Wreford and Cottonwood limestones terminate in Ts. 14 and 15 N.

[1]Lukert, L. H., Subsurface cross sections from Marion County, Kansas, to Osage County, Oklahoma. Amer. Assoc. Petroleum Geologists, Bull., vol. 33, pp. 131-152, 1949.

The Upper Pennsylvanian Virgil Series has a thickness of 400 feet near Depew, thickening to 750 feet at Hominy, 2100 feet at the West Moore field and 1500 feet in northeastern Garfield County. Virgil rocks between Hominy and Depew are largely clastic and have not been differentiated. Along the west side the Topeka and Deer Creek limestones, the Elgin sand and the Haskell limestone can be traced southward beyond the West Moore field. The Lecompton, Plattsmouth and Toronto limestones terminate in the latitude of Ts. 15 and 16 N.

The Pennsylvanian Missourian Series has a thickness of 1,000 feet in northeastern Garfield County, 1250 feet some 60 miles east near Hominy, thickening to some 1400 feet near Depew and to 1500 feet in the West Moore field. Along the west side the Cottage Grove sandstone and Dewey limestone extend southward only to T. 19 N.; while the so-called Oklahoma City Checkerboard limestone of some geologists and the Checkerboard limestone of the Tulsa area extend southward through the West Moore field. Between Hominy and Depew, sandstones in the Okesa-Wann formations mark a strong contrast with the shale and limestone section below. The Avant limestone of the outcrop, the Cottage Grove sandstone and the Dewey limestone carry southward to T. 19 N. at the longitude of R. 7 E. However, between Bristow and Sapulpa these limestones extend as far south as Ts. 15 and 16 N. and, therefore, cross the Turnpike.

It is of interest to note here that the strike of the southern extent of the Cottage Grove sandstone and Dewey limestone is in a westerly direction through T. 19 N.

Along the east side of the area the normally thin Hogshooter limestone thickens to 30 feet between Ts. 18 and 15 N. The underlying Dodds Creek, or Layton sand, carries southward into T. 16 N. but fails to reach the Turnpike at this longitude. The underlying Checkerboard limestone and Cleveland sands do carry through however.

Rocks of Des Moines age also exhibit features of interest. This series, which reaches only 400 feet in northeastern Garfield County, thickens to 650 feet near Hominy, 1100 feet southwest of Oklahoma City and to 1350 feet near Depew. They can readily be divided into the Marmaton and Cherokee groups.

A hinge line which affected the thickness and sediments of the Marmaton group extends, roughly, from the east side of the area in T. 19 N.-R. 7 E., Creek County, southwestward to T. 17 N.-R. 5 W., Kingfisher County. The Big Lime and Ft. Scott limestones show their best development on the shelf area and disappear from the top downward as one progresses in a southeasterly direction into the depositional basin. Along the Turnpike the Marmaton group contains mostly shale. While the Big Lime and Ft. Scott limestones do not carry as far south as the Turnpike near Depew between Chandler and Oklahoma City, they do extend far enough south to cross it.

The underlying Cherokee Group which ranges from 200 to 300 feet on the west side thickens to 850 feet near Depew. For the most part the Cherokee of the eastern two-thirds of the area contains the normal succession of shales, sandstones and limestones recognized by the petroleum geologists.

In conclusion, it may be stated that while the area discussed herein poses many problems in sedimentation, stratigraphy and correlation, a number of Permian and Pennsylvanian marker beds can be traced from north to south across the Turner Turnpike. Of these, the Tulsa Checkerboard limestone is considered one of the most widespread and useful subsurface markers in the area.

It is hoped that there may be some of you who will, from time to time, add knowledge to this discussion in order that the stratigraphy of this area may be better understood.

RECENT DEVELOPMENTS IN THE TURNER TURNPIKE AREA

By Harry E. Christian

(Read before the evening meeting in the Oklahoma Club, April 13, 1956)

When I first started to prepare this short talk, my first problem soon became not what to include, but what **not** to include. I found that if you don't set arbitrary geographical limits for coverage, you tend to wind up miles, literally and figuratively, from the subject. In addition, without a fixed area it is impossible to derive meaningful statistics. For these reasons, I set a limit of ten miles on each side of the Turnpike for my coverage, making a twenty-mile-wide strip from Tulsa to Oklahoma City.

This strip includes some of the older producing areas of Oklahoma. Without going into any detail, the accumulation of oil in this area is controlled by stratigraphy or structure, or by a combination of stratigraphy and structure, the purely stratigraphic traps being confined to Hunton wedge-edges and the Pennsylvanian. The stratigraphic traps in the Pennsylvanian are numerous, and are one of the outstanding features of the area.

It seems to me that statistics are necessary in order to evaluate the recent developments, and I have prepared a few figures dealing with 1955, 1954, and, in part, with 1953. However, I will discuss in detail only those discoveries completed in 1955 or 1956, or being completed in 1956.

This area is very active. It would take a lot of work to get a complete comparison with the whole State, but I think that the degree of activity is indicated by the fact that Lincoln County, through which the Turnpike passes, has for four years had more exploratory wells drilled in it than any other County in the State. Incidentally, before that Lincoln County was relatively inactive.

During 1955, a total of 71 exploratory wells were drilled in the Turnpike Area, of which 16 were completed as producers, for a success ratio of 23%. The success ratio is down from 1954, when it was 28%. However, the success ratio of 23% for the last year is about the average for the State; 1954 was just a good year.

Of course, the term "success" is not a simple one. As all of you know, there are wells completed as "discoveries" which represent more of a victory for the engineers than for the geologist or geophysicist; and some of them were completed in 1955. However, **from one year to the next,** I don't believe that these will vary significantly; and, in addition, a discovery may seem of little importance when it really is important.

The ratio of Pre-Pennsylvanian to Pennsylvanian discoveries varies widely. Curiously enough, the number of Pre-Pennsylvanian discoveries for the past three years has remained steady at two to three per year, while the number of Pennsylvanian discoveries has been unstable, ranging between a minimum of 14 in 1955 and a maximum of 27 in 1954.

Over the past three years, the most common producing horizon in the Pre-Pennsylvanian for these discoveries is the "Wilcox." The most common horizon in the Pennsylvanian, over the same period of time, is the Skinner, with the Prue, Cleveland, Checkerboard sand, and Red Fork next in importance. The Skinner was the producing horizon in over twice as many discoveries as its nearest competitor.

The so-called "Jones" sand has risen in importance in 1955 with the discovery of the East Victor Pool (15N-2, 3E) a stratigraphic trap produced by the shaleout of the "Jones" sand. The East Victor Pool is about four miles long and over two miles wide, and produces gas and condensate. An average well will make about 16,000,000 cubic feet of gas and 60 barrels of condensate on open flow through four or five inch casing. The "Jones" sand averages about 20 feet in thickness. To date, 22 wells have been completed in the pool, which has 160-acre spacing, and development is continuing. The pool is limited on the west by a dry hole which tested salt water in the "Jones." You may have noticed that I rather carefully stated that the well that limited the pool to the west tested salt water in the "Jones" sand. This is because **four** "dry holes" were drilled through the "Jones" in this pool, all of which later on were completed as producers. This certainly makes you wonder what other gas and condensate reservoirs there may be in Northeastern Oklahoma that are apparently condemned by "dry holes."

The Seward Pool, which is now a part of the North Waterloo District, is another interesting pool discovered in 1955. The discovery well is the Gulf No. 1 Cleaver in Section 36-15N-3W, which was completed flowing 176 barrels of oil per day on a 13/64" tubing choke from the Second Wilcox, which was encountered around a depth of 6300 feet. To date, thirteen producers have been completed, two of which made some salt water. Most of the wells flow but several have been completed as pumpers.

Russell Cobb, Jr. is currently completing his No. 1 Nelson, Section 3-13N-1W, as a gas-distillate discovery in the Lower Skinner, which was found at a depth of about 5500 feet. The last potential on the well was 2,500,000 cubic feet of gas and four barrels of condensate per day. The Lower Skinner is only about nine feet thick in this well. The interesting thing about this discovery is the fact that the nearest well is about a mile to the west, and that there are no other wells within two miles of the

Nelson, which certainly leaves a lot of room for expansion—and better sand development!

In another development in this general area the Athens No 1 Welch, 2-12N-1W, was completed this year flowing 5,500,000 cubic feet of gas and 12 barrels of condensate per day through a ½″ tubing choke from a Basal Pennsylvanian sand encountered at about 5800 feet. We have not as yet gotten an electric log on this well, but 8 feet of interval was perforated. This is another wide-open area: the nearest well is one and one-half miles northwest and is a dry hole.

In Section 3-14N-9E, the Berry No. 1 Coleman has recently been completed pumping 120 barrels of oil per day from an Atoka or "Dutcher" sand, which was encountered at about 3000 feet. This well, which is a workover, is in an area of scattered Atoka sand production. The Red Fork and Wilcox sands produce a mile or two to the northeast. The Coleman is the northwest offset to a dry hole which went to the producing horizon. No tests or cores were taken on the dry hole.

The Southwest Kendrick Pool was opened last year by the Rich Oil No. 1 Powers, 19-15N-5E. This well was completed flowing 264 barrels of oil per day on a ¼″ choke from 26 feet of perforations opposite the Cleveland sand, which was encountered at a depth of 2800 feet. The Powers was a workover of a dry hole drilled to the Second Wilcox in 1952. Two oil wells, one gas well, and three dry holes have since been completed. The dry holes limit the field to the east.

The Oliver No. 1 Erwin, in Section 29-15N-2E, was completed last year for about 10,000,000 cubic feet of gas per day from the Checkerboard sand to open the Southeast Fallis Pool. The pay horizon is about 14 feet thick in this well. The nearest wells are three dry holes, each about a mile from the Erwin. None of these tested the Checkerboard sand, so this field may expand further than a casual glance at the map would indicate.

There are several outstanding fields which have been discovered in recent years, aside from the 1955 and 1956 discoveries, and I would like to mention them briefly. The Southwest Mt. Vernon District (15N-2E) was discovered in January, 1954, when production was found in the Skinner. Subsequently, the Cleveland and the "Jones" sands have been found productive. Recoveries to January, 1956, have amounted to 800,000 barrels. In 1940 production was found in the Prue sand in the Kendrick Area to open the Kendrick field (15-16N-5E). In April of 1953 a well was completed in a sand developed in the top of the Oswego limestone and since then development of the Oswego has been proceeding rapidly. To January, 1956, Kendrick has produced 1,700,000 barrels.

In checking these wells against the map, it was surprising how many fell within easy seeing distance of the Turnpike—say about two miles. There were six exploratory successes in 1953 which fell within the two-mile limit, seven in 1954, and four in 1955. It seems safe, therefore, to say that there will be at least two or three successes similarly located in 1956, and others in later years. The point of this seeming digression is this—that today we glanced at and perhaps even walked on land that new exploratory successes will be drilled on. The opportunities are there—all we have to do is recognize them.

The Relationship Between Surface and Subsurface Formations Along the Turner Turnpike

By Gerald C. Maddox

(abstract)

Several Permian and Pennsylvanian limestone beds are remarkably persistent in the subsurface of northern Oklahoma. Correlations of these beds from T. 29 N., R. 2 W. southward to T. 17 N., R. 3 W., thence eastward to T. 17 N., R. 12 E., have been carried to the base of the surface casing and roughly projected to the surface. Generally the results are in surprisingly close agreement with the surface nomenclature.

The west to east cross section through T. 17 N. is, on the average, about four miles south of State Highway 33. The cross section intersects the Turner Turnpike in the western part of T. 17 N., R. 10 E. The relationship of some of the outcrops along the turnpike to the correlative subsurface formations will be made.

Features Along Turner Turnpike Studied

On April 13, 1956, a party of 120 geologists examined the important outcrops along the Turner Turnpike. Stops were made on the Hogshooter formation at Sapulpa, the Nellie Bly shale west of Sapulpa, the Iola formation near Bristow, the Pawhuska formation east of Stroud, the Grayhorse and Brownville dolomites west of Stroud, and the Red Eagle dolomite near Chandler, the Fallis sandstone near Luther, and the base of the Garber sandstone near Arcadia.

The guide book consists of 76 pages. It contains articles on Vegetation along the Turner Turnpike," by Prof. Elroy Rice, "Historical Notes," by Prof. Gaston Litton, "Stratigraphy," by Malcolm C. Oakes and Carl C. Branson, "Outline of Subsurface Geology," by R. P. Clinton, Louise Jordan, Harry Christian, and Gerald Maddox, and "General Subsurface Geology along the Turner Turnpike, Lincoln County," by Daniel A. Busch.

The guide book contains an annotated map at 3 inches to the mile along the entire route. A topographic-geologic cross-section prepared by Neville M. Curtis accompanies the map. The field trip was a cooperative enterprise of the Tulsa Geological Society, the Oklahoma City Geological Society, the Oklahoma Geological Survey, and the University of Oklahoma. The caravan started at the Tulsa gate, the members were served luncheon at Stroud, and met for dinner and an evening series of talks in Oklahoma City.

The guide book is Oklahoma Geological Survey, Guide Book IV, obtainable from the Survey offices for $2.00.

"There's more fertilizer capacity going into the Southwest . . . Latest firm to reveal expansion plans: Ozark-Mahoning Co. (Tulsa), which will build a 50,000-tons/year ammonium phosphate plant, due on stream sometime early in 1957." (Chemical Week, Dec. 24th.) This is the kind of news we like to hear. A.L.B.

Pumicite Deposit Sold

The large deposit of pumicite, commonly known as volcanic ash, that has been worked for many years near Gate, Beaver County, was sold early in March to the Stay-Ready Laboratories of Oklahoma City. Stay-Ready is a subsidiary of the Salyer Refining Company, whose president, B. M. Salyer, Jr., made the purchase announcement in the Daily Oklahoman on March 4, 1956.

The oldest active pumicite mine in Oklahoma, and the only active property in the State in recent years, the Gate deposit was owned by Winston Land Co. of Philadelphia and worked by Dyer and Kite. Pumicite was hauled from the deposit 7 miles to the plant at Gate where it was dried, sacked, and sold, mainly for use in scouring compounds, soap, paint, and as an oil absorbent.

One of the purest deposits in Oklahoma, the pumicite at Gate is as much as 75 feet thick. It accumulated probably in an ancient lake bed from volcanic glass particles blown out of explosive volcanoes in central New Mexico, and carried by wind into Oklahoma. Fossil snails and diatoms occur sporadically in the deposit. From comparative studies of the snails and of the character of the volcanic glass shards, the age of the deposit is believed to be Pleistocene (Glacial or Ice Age).

New research by Stay-Ready Laboratories is expected to develop new uses in the preparation of fertilizers and in the manufacture of glass wool. With the development of new markets Mr. Salyer said he expects to employ 40 or 50 men.

The Gate deposit is one of many in Oklahoma that have been described in Oklahoma Geological Survey Circular 27, 1949. Experimentally new uses were described in that publication, including cellular products made by heating the volcanic ash in different ways. Circular 27 is still available from the Norman office of the Geological Survey for $0.85, postpaid. W.E.H.

Rare Fossil Chiton from Ada, Oklahoma

E. A. Frederickson

A rare and unusual fossil chiton was found by William Riddle, a student in the School of Geology, during a paleontology field trip. Mr. Riddle donated the specimen to the collection of the School.

The fossil chiton is a new species of the genus **Helminthochiton,** Class Amphineura, Phylum Mollusca. The Phylum Mollusca also includes such forms as clams, snails, squids and octopodi.

The specimen was found in the shales of the lower part of the Francis formation, at the quarry of the brick plant southwest of Ada, Oklahoma. The Francis formation is assigned to the Missouri series of the Pennsylvanian system.

Fossil chitons have been reported from numerous localities in Tertiary strata in North America, and a number of genera are known from Paleozoic and Mesozoic beds in Europe. However, only three fossil chitons have been reported previously from the Paleozoic of North America. These are **Prisochiton canadensis** (Billings) from the Ordovician of Canada, and **Helminthochiton carbonarius** (Stevens) and **Helminthochiton concinnus** Richardson from the Pennsylvanian of Illinois.

The Oklahoma specimen has six of the eight plates preserved, the posterior two plates are missing. The anterior plate is semicircular, longer than wide, and slopes regularly upward from the front and sides toward what might have been an acute apex at the posterior of the valve. However, the rear portion of the valve is broken off. Median valves have elevated triangular areas pointing posteriorly, with well-defined concave lateral fields. The sutural laminae are medium-sized and are smoothly rounded. Ornamentation consists of small tubercles arranged in quincunx.

For purposes of comparison, the fossil specimen is illustrated with a recent chiton.

A description of the new species is now being prepared for publication in one of the paleontological journals.

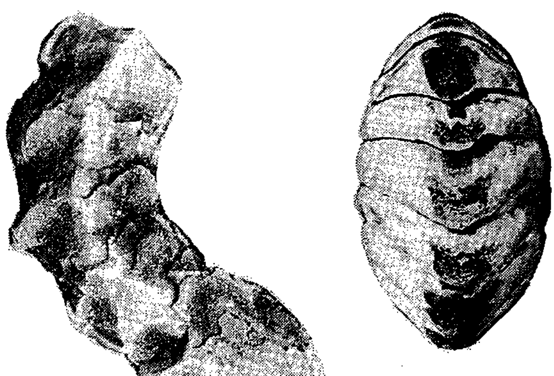


Figure 1. Left, Helminthochiton from the Francis formation, Ada, Oklahoma. Right, a recent chiton from Florida.

OKLAHOMA SIXTH IN PRODUCTION OF LEAD IN 1955

Production of lead in Oklahoma in 1955 was 15,000 short tons valued at $12,179,000, according to estimates prepared jointly by the U. S. Bureau of Mines and the Oklahoma Geological Survey. This production placed Oklahoma in sixth place among the states, behind Missouri (the leader), Idaho, Utah, Montana, and Colorado, but ahead of Washington, Arizona, and California. Total production in the United States in 1955 was 333,400 short tons of recoverable lead.

All lead produced in Oklahoma is from mines in northern Ottawa County, near Picher, where lead and zinc sulfide minerals occur in mineralized deposits in the Boone limestone of Mississippian age. W.E.H.

Button Corals are Rare Oklahoma Fossils

The stony base made by most solitary corals is conical. A small family of these corals is characterized by discoid shape, developed as deposit of stony base occurred outward and very slightly upward. The corals look like buttons, one side (the bottom marked by concentric growth lines, the other showing the characteristic radial septation.

One species was described by B. F. Howell in 1945 as **Gymnophyllum wardi,** new genus, new species. The specimen came from "a few miles west of Okmulgee, Oklahoma." The locality is probably at and near the spillway of Lake Okmulgee, a site where Foster and Newell have collected specimens. The specimens occur in the lower part of the Wewoka formation of late Desmoinesian age (Marmaton group). They are associated with brachiopods, crinoids, and mollusks.

R. M. Jeffords has recently (June 1955) made a study of the button corals. He places them in the family Porpitidae. The Oklahoma species is redescribed and figured (pp. 13-15, pl. 2, figs. 1-14, pl. 3, fig. 7, text fig. 2, nos. 6-14).

Rare Uranium Mineral Found in Oklahoma

A short paper by W. T. Huang, formerly of the faculty of the School of Geology at Oklahoma University, describes an occurrence of the rare mineral novacekite in Oklahoma. Originally described from Saxony and recently found in New Mexico, this is but the third known locality. The specimens were collected in the Wichita Mountains by Earl Smith and later by Dr. Huang. Novacekite occurs as straw yellow crystals. It is a hydrous magnesium, uranium arsenic oxide.

The article is "Novacekite from the Wichita Mountains, Oklahoma," The American Mineralogist, vol. 41, pp. 152-153, 1956.

Flora of Croweburg Coal Described

The coal bed called Henryetta coal in the Okmulgee area, Broken Arrow coal in the Claremore area, and Croweburg coal in Missouri and Kansas is the most wide-spread coal bed known. It has been traced with fair certainty from Hughes County, Oklahoma, to West Virginia. Over much of the area it has associated lithologic types of rock which help to identify it, a black, phosphatic fissile shale on it or some distance above, and a persistent limestone upon the black shale.

L. R. Wilson (University of Massachusetts) and W. S. Hoffmeister (The Carter Oil Company) have completed a study of the plant microfossils and have identified 48 species of spores, 12 of them new. The spore flora is highly characteristic and indicates correlation with the Colchester coal of Illinois. The authors illustrate four leaf cuticle types in the flora.

The paper is "Pennsylvanian plant microfossils of the Croweburg coal in Oklahoma," Oklahoma Geological Survey, Circular 32. The book has 57 pages and 5 collotype plates. Copies can be obtained from the Survey for $1.25 ($1.75 bound in blue cloth).

Dr. Hugh D. Miser just sent us a copy of the program for the Pick and Hammer Club show given April 27 in Washington. The Club satirizes U. S. Geological Survey geologists and procedures, all in good fun. Dr. Miser was portrayed singing the words which follow:

HUGH'S HUES

(Oklahoma)

O———klahoma,
Where the map is like the rising sun,
Where the rocks are bright
And the colors bright——
It's the best state map I've ever done!

O———klahoma,
Every day I see it on the wall,
And though men less wise
May criticize,
It's the best compilation of them all!

If you think that the map is immense,
It's because we have spared no expense!
So when I say "O—K—L—A—H—O—M—A"
I just say, by jiggers
You're on the map, Oklahoma
Oklahoma, O. K.

PREVIEW OF NORTHEAST TURNPIKE GEOLOGY

by Carl C. Branson

On June 2, 1956, I drove from east of Vinita to the Tulsa terminus of the Northeast Turnpike. Excepting for the crossings of Big Cabin Creek and Verdigris River, it was possible to drive on the right-of-way the entire distance. Nearly all the cuts and fills are made, most of the bridges and road crossings are nearly completed.

The Tulsa Interchange is on the Lower Ft. Scott (Blackjack Creek) limestone. North of the interchange on the slopes of Spunky Creek valley the Breezy Hill limestone and the immediately underlying Iron Post coal are well exposed. On the east side of Spunky Creek the Prue sand is well developed. The lower part is gray siltstone with black shale partings and the upper part is gray to buff fine-grained sandstone. Near the south end of the Verdigris River bridge (SW¼ sec. 21, T. 20 N., R. 15 E.) is a fine exposure of the beds from below the Croweburg coal to above the Verdigris limestone:

black shale	15 feet plus
Verdigris limestone	7 feet
fissile black shale	4 feet
siltstone	16 feet
black shale	10 feet
Croweburg coal	1.9 feet
underclay	2.0 feet
gray shale	4 feet
McNabb silty, ferruginous ls.	1 foot exposed

From the river to near Claremore exposures are few. South of Claremore the Chelsea sandstone (Skinner sand) is exposed. North of the interchange is a series of cuts in the base of the Chelsea with Tiawah limestone (Pink lime) exposed above fissile black shale. The Chelsea cuts for the next several miles show well the course sand of its lower part. The cuts here and in northwestern Mayes County are yet too fresh to reveal all of the thin units. A few rains will improve them geologically.

In Mayes County the cuts are in Taft sandstone and Bluejacket sandstone (Bartlesville sand) for several miles. Coal beds below the Bluejacket can be seen in the cuts on both sides of the valley of Little Pryor Creek. Near the north line of Mayes County the Turnpike cuts a ridge and the cut exposes 75 feet of strata.

An estimated section made from the fresh cut is as follows:

Bluejacket sandstone (channeled into underlying beds as much as 10 feet)	15 feet
Savanna formation	
laminated dark shale	5.0 feet
coal	0.1 foot
underclay	1.0 foot
gray, micaceous shale	4.0 feet

clay-ironstone (as bed in north cut, layer of concretions in south cut)	0.3 foot
black shale with siderite concretions	18.0 feet
siltstone and clay	0.8 foot
coal	0.8 foot
underclay and shale	6.0 feet
light gray siltstone	3.0 feet
black shale crowded with Marginifera, limestone concretions, fossiliferous ls.	1.0 foot
dark shale	19.0 feet

The upper coal streak is the Drywood coal, the fossil bed may be the Doneley limestone, and the Sam Creek and Spaniard limestones should be found below the road cut.

South of the Turnpike at Whiteoak Creek is a quarry in Keokuk limestone. This is on the upthrown side of the Whiteoak Creek fault. On the east side of Big Cabin Creek a borrow pit south of the road exposes Warner sandstone (Booch sand) over black shale. Cone-in-cone occurs in concretions in the upper part of the shale.

The easternmost cuts examined were those north of the Vinita interchange and near U. S. Highway 66. The suspected presence of a coal bed below the Warner sandstone was confirmed in new cuts. The section is:

Warner sandstone	10.0 feet
gray mudstone	6.0 feet
black shale	13.0 feet
coal	0.1 foot
underclay	2.0 feet
black shale	18.0 feet
siltstone	2.0 feet
coal	0.1 foot
clay shale	5.0 feet

Fayetteville shale and limestone.

All of the cuts the entire length of the Turnpike will be measured as soon as rains have washed them clean. The cuts are sure to reveal parts of the section little-known or elsewhere unexposed.

General Geologic Column along Northeast Turnpike

Ft. Scott formation
- Blackjack Creek limestone member (Oswego lime)

Excello shale

Senora formation
- Breezy Hill limestone member (Oswego lime)
- Iron Post coal
- Lagonda member (with Prue sand)
- Verdigris limestone member
- black fissile shale
- siltstone and shale (Upper Skinner sand)
- Croweburg coal (Henryetta coal)
- McNabb limestone
- unnamed shale
- Sequoyah coal
- Chelsea sandstone (Skinner sand)
- Tiawah limestone (Pink lime)
- Tebo coal
- shale and sandstone

Boggy formation
- Weir-Pittsburg coal
- Inola limestone
- Taft sandstone (Red Fork sand)
- Bluejacket sandstone (Bartlesville sand)

Savanna formation
- Drywood coal
- unnamed coal
- Doneley limestone (Brown lime)
- Rowe coal
- Sam Creek limestone (Brown lime)
- Spaniard limestone (Brown lime)

McAlester formation
- black shale with 3 coals
- Warner sandstone (Booch sand)

Hartshorne formation
- shale with 3 coals

Mississippian
- Fayetteville formation
- Hindsville limestone
- Keokuk formation