FEBRUARY 1964

Volume 24, Number 2

$2.00 per year, $0.25 per copy

OKLAHOMA GEOLOGY NOTES

LIMESTONE QUARRY, COMANCHE COUNTY

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

Cover Picture

MINERAL INDUSTRIES OF OKLAHOMA

LIMESTONE AGGREGATE

Limestone is abundant in northeastern Oklahoma, the Wichita Mountains, south-central Oklahoma (including the Arbuckle Mountains area), and southern Oklahoma from Ardmore eastward to the Arkansas state line. Its principal use is as aggregate in the building of roads and in other heavy construction. The production of limestone aggregate in the State increases progressively from year to year in tonnage and value, each of which has more than doubled since 1953. Production of limestone aggregate in 1962 was 12,579,000 tons valued at $15,793,000. Pictured on the cover is the largest limestone-aggregate quarry in the State, the Richards Spur quarry of the Dolese Brothers Company, near Lawton, Comanche County. The quarry, in almost continuous operation since 1904, produces crushed limestone for aggregate as well as for other purposes from the Cool Creek and Kindblade Formations of the Arbuckle Group at the east end of the Limestone Hills.

—A. N.

(U. S. Army photograph)

THE MINERAL INDUSTRY OF OKLAHOMA IN 1963*
(Preliminary)

ROBERT B. McDOUGAL†

The value of mineral production in Oklahoma increased to an estimated $857 million in 1963 from $855 million in 1962, according to the Bartlesville, Oklahoma, office of the Bureau of Mines, U. S. Department of the Interior. Improved sales in natural-gas liquids in the fuels segment, cement and stone in the nonmetals, and lead and zinc in the metals segment of the industry more than offset value losses in coal, helium, petroleum, bentonite, gypsum, lime, pumice, salt, and tripoli. Mineral fuels remained the State's dominant mineral industry, accounting for more than 90 percent of the 1963 total mineral value.

MINERAL FUELS

Coal.—Output of coal in Oklahoma declined appreciably. Much of the decline was attributable to permanent closure of the Lone Star Steel Co. Carbon No. 5 mine east of McAlester in Pittsburg County. Potentially unsafe conditions and uneconomic operating costs were cited as reasons for closing the mine.

Natural gas.— Marketed output of natural gas increased more than 3 percent in volume and 4 percent in value. In November, Arkansas Louisiana Gas Co. completed its Arkoma basin pipeline from Paris, Arkansas, westward to the Centrahoma gas field in Coal County, Oklahoma. First to be connected was the rich Wilburton field in Latimer County. Gathering systems were being installed to connect the Red Oak, Spiro, and Centrahoma fields in Latimer, Le Flore, and Coal Counties, respectively.

Natural-gas liquids.—Natural-gas liquids, recovered by 70 natural-gasoline plants and 3 cycling plants, reached a new record of 1,406 million gallons. Five new natural-gasoline plants were under construction or completed by year end. In the Northeast Enid field, Garfield County, Livingston Oil Co. completed a gas processing plant with an initial capacity of 20 million cubic feet per day (MMcfd). Pan American Petroleum Corp. completed its Okeene gas processing plant, which has an initial capacity of approximately 30 MMcfd. Pan American Petroleum Corporation's new 50 MMcfd gas processing plant near Mooreland, Woodward County, went on stream in April. Plans were announced by Champlin Oil Refining Co. and four partners to build a 40-MMcfd plant near Enid. Sinclair Oil & Gas Co. planned to build a 10-MMcfd refrigeration absorption-type gas processing plant in the Healdton field of Carter County. Humble Oil & Refining Co. doubled daily capacity to 107 MMcfd at its Dover-Hennessey plant.

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*This report, U. S. Bureau of Mines, Mineral Industry Surveys Area Report IV-167, was prepared December 10, 1963.

†Geologist, U. S. Bureau of Mines, Division of Mineral Resources, Region IV.

Petroleum.—An estimated 202 million barrels of crude petroleum was produced in 1963, a slight drop from the previous year. Final 1962 figures indicated production was up nearly 5 percent above 1961. The daily petroleum production allowable was retained by the Corporation Commission at 34 percent of the basic depth-acreage formula from January 1963 through April; because of an excess of stocks, the May rate was reduced to 30 percent and remained at that level through December.

In a move to encourage wider spacing of shallow wells and to eliminate drilling of unnecessary shallow wells, the State Corporation Commission in May put into effect a revised basic formula for oil-well production allowables. The change gave larger allowable increments to 20- and 40-acre wells less than 5,000 feet in depth. For wells

TABLE 1.—MINERAL PRODUCTION IN OKLAHOMA[1]

MINERAL	1962 QUANTITY	1962 VALUE (THOUSANDS)	1963 PRELIMINARY QUANTITY	1963 PRELIMINARY VALUE (THOUSANDS)
Clays (thousand short tons)	737[2]	$ 756[2]	766	$ 785
Coal (thousand short tons)	1,048	6,978	950	[3]
Gypsum (thousand short tons	509	1,668	[3]	[3]
Helium (thousand cubic feet)	284,214	9,917	232,470	8,136
Lead (recoverable contents of ores, etc.) (short tons)	2,710	499	3,000	660
Natural gas (million cubic feet)	1,060,717	135,772	1,095,800	141,400
Natural-gas liquids:				
Natural gasoline and cycle products (thousand gallons)	552,795	35,764	564,400	37,300
LP gases (thousand gallons)	838,903	25,223	841,900	26,100
Petroleum (crude) thousand 42-gallon barrels)	202,732	591,977	201,700	584,930
Salt (common) (thousand short tons)	5	25	3	15
Sand and gravel (thousand short tons)	4,436	4,736	4,500	4,900
Stone (thousand short tons)	14,666	18,819	15,820	19,073
Zinc (recoverable content of ores, etc.) (short tons)	10,013	2,303	12,800	3,046
Value of items that cannot be disclosed: Bentonite (1962), cement, gem stones (1962), lime, pumice, tripoli, and value indicated by footnote 3	----	20,853	----	30,812
Total Oklahoma	----	$855,290[4]	----	$857,157

[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producer).
[2]Excludes bentonite; included with "Value of items that cannot be disclosed."
[3]Included with "Value of items that cannot be disclosed."
[4]Revised figure.

drilled on patterns of 10 acres or less, there was no change in the basic formula.

The Oil and Gas Journal reported a total of 4,133 exploratory and development wells drilled in the first 11 months of 1963 compared with 4,748 wells for the same period in 1962. This is a drop of 13 percent in development-well drilling and a decline of 2 percent in test-well drilling.

On January 1, 1963, 14 refineries were operating in the State, according to the Oil and Gas Journal. These refineries had a total capacity of 412,625 barrels of crude oil per calendar day, a drop of 3 percent over that of 1962.

NONMETALS

Estimated value of nonmetals (clays, gypsum, pumice, salt, sand and gravel, stone, tripoli, cement, and lime) produced in Oklahoma in 1963 totaled $49.3 million, more than 5 percent greater than in 1962.

Dewey Portland Cement Co., Division of Martin-Marietta Corp., stepped up production at its Dewey plant in March after being closed for several months; then on November 1, the plant was permanently shut down. The company doubled capacity of its cement plant in Rogers County, northeast of Tulsa.

Republic Gypsum Co. began construction of a $4-million gypsum wallboard plant near Duke.

Oklahoma Brick Co. began construction of a $ 1-million brick plant south of El Reno. Capacity will be approximately 50,000 bricks per day.

Total outlay for construction in the first 10 months of 1963 was nearly 20 percent ahead of the volume in the same period of 1962. Residential building contributed about 11 percent of the total rise in construction. Commercial building, manufacturing building, public works construction, and State highway construction increased; public utility construction decreased.

The U. S. Army Corps of Engineers (Tulsa district) continued construction at two dams, Eufaula Dam on Canadian River and Keystone Dam on Arkansas River. A third dam, Oologah Dam on Verdigris River, was completed in May and dedicated in July. The Markham Ferry project, being constructed on Grand River by the Grand River Dam Authority, was about on schedule.

METALS

Mine production in terms of recoverable lead and zinc, all from Ottawa County, increased 11 percent and 28 percent, respectively. Concentrates recovered in 1963 amounted to 3,000 tons of recoverable lead and 12,800 tons of recoverable zinc.

Smelters.—Three horizontal-retort zinc plants operated in 1963. They were American Metal Climax, Inc., at Blackwell; The Eagle-Picher Co., at Henryetta; and National Zinc Co., at Bartlesville.

Tri-State district.—Nearly 69 percent of the district's lead concentrates and 75 percent of the zinc concentrates were produced in the Oklahoma portion of the Tri-State district; Kansas produced over 31 percent of the lead concentrates and 25 percent of the zinc concentrates. The southwest Missouri portion of the district last reported production in 1957.

RELATIONSHIP BETWEEN *Diploblastus kirkwoodensis* AND *Platyceras (Platyceras)*

HAROLD L. LEVIN* AND ROBERT O. FAY

In 1936, Dr. Courtney Werner collected about 90 specimens of blastoids from the upper part of the St. Louis Limestone (Middle Mississippian) at the old quarry half a mile southwest of Vigus, St. Louis County, Missouri. The exact location is SE¼ SW¼ SW¼ NW¼ sec. 16, T. 46 N., R. 5 E., from the top bed of the quarry 50 feet above the floor, in the upper one-third of the St. Louis Limestone. About 10 of the specimens had small helicospiral gastropods on the anal side of the oral surface. The blastoid belongs to the species now named *Diploblastus kirkwoodensis* (Shumard) and the gastropod was identified by Dr. Ellis Yochelson of the U. S. National Museum as *Platyceras (Platyceras)* Conrad.

The only previous reference to this type of relationship in blastoids is that of Meek and Worthen (1868, p. 386) who mentioned a relationship between *Pentremites* and an attached *Platyceras:*

> For instance, we have now before us one of these shells attached to the side of **Pentremites Godoni,** so as entirely to cover one of the pseudambulacral fields and two of the intermediate areas, and yet the sinuosities of its lips conform so exactly to the irregularities of the side of the **Pentremite** that the connection looks as if it might have been air tight. The corresponding undulations of the lines of growth likewise show clearly that this nice adaptation of the margins of the lip to the irregularities of the surface of the **Pentremite** could not have resulted from accidental pressure when the edge of the lip was somewhat yielding, since the curves in the marks of growth are seen to extend up the sides of the shell some distance from the margin, where there could have been no flexibility.

Bowsher (1955, p. 2) showed that previous studies of crinoid-gastropod associations date back as far as 1843 and that similar cystoid-gastropod relationships also occur. In each instance, the margin of the gastropod grows in accordance with the substratum, so that smooth to intricate apertural margins may be developed in the same species, depending upon the host.

In our specimens, the blastoids are 3 to 7 mm long, with the gastropods covering the anal opening and adjacent regions. The gastropods are capuliform to helicoidally coiled, with early coils in contact. They range from 3 to 5 mm in length and from 1½ to 3 mm in width, with expansion at a uniform rate and with smooth simple apertural margins. The gastropods occupy various positions over the anal opening, with the direction of coiling generally in an aboral

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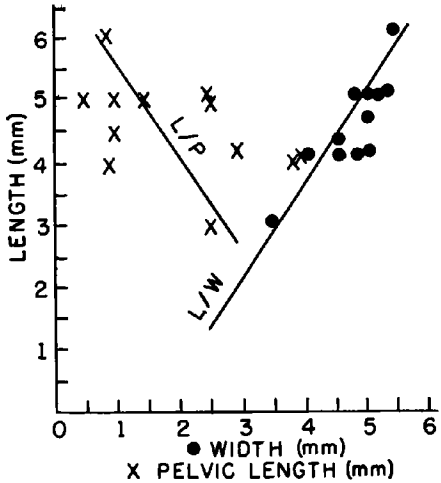
disposition. Probably the small size and smooth surface of the blastoid account for the small size and simple nature of the gastropod and its margin. No attempt is here made to assign the specimens to a new or previously named species, although it should be noted that the gastropod is smaller than previously described species of *Platyceras*.

The genus *Diploblastus* (Fay, 1961, p. 62) includes small globular blastoids from Middle to Upper Mississippian rocks in North America. A comprehensive study of this genus was not undertaken, but it is clear that several species probably exist. The type species is *D. glaber* (Meek and Worthen) from the St. Louis Limestone of Hardin County, Illinois. It is wider than high and has a concave base with no pelvis. The type specimens for *D. kirkwoodensis* (Shumard) are in the U. S. National Museum, and are now part of the Springer collection and hence unavailable for loan. A simple statistical study of 12 specimens reveals that a small specimen has a highly convex base and that larger specimens have a more flattened base, and that larger specimens are longer than wide. Shumard's types came from the St. Louis Limestone along the Pacific Railway cut near Kirkwood, St. Louis County, Missouri, and were named *Elaeacrinus kirkwoodensis*. The description is that of a large specimen, with a small pelvis, and there is little doubt that our specimens belong to the same species. Comparison of mature specimens shows that *D. glaber* is wider than



Text-figure 1. Diploblastus kirkwoodensis **(Shumard). Scatter diagram of length/width ratio and length/pelvic-length ratio in twelve selected specimens. The width increases at a slower rate than the length and at greater length the pelvis is relatively shorter, or the base is relatively flatter.**

high, with a definite concave base and no protruding pelvis, whereas *D. kirkwoodensis* is longer than wide and has a protruding pelvis. Some of the specimens from the Ste. Genevieve Limestone of Kentucky are much wider than high and have a high pelvis. These should be referred to a third species, probably *D. sphaeroidalis* (Miller and Gurley).

The relationship between *Platyceras (Platyceras)* and *Diploblastus kirkwoodensis* appears to have been coprophagous. The gastropod apparently lived on the feces of the blastoid and benefited by the association. Apparently the blastoid was neither harmed nor benefited by this action and lived a passive existence.

Diploblastus kirkwoodensis (Shumard), 1863

Plates I-III; text-figure 1

Elaeacrinus kirkwoodensis Shumard, 1863, p. 113.
Cryptoblastus? kirkwoodensis (Etheridge and Carpenter), 1886, p. 232.
Cryptoblastus kirkwoodensis (Keyes), 1894, p. 139, pl. 18, figs. 8a,b.
Mesoblastus kirkwoodensis (Bassler and Moodey), 1943, p. 223.

The description is that of plesiotype 820070 E, supplemented by observations of the other specimens where needed. The plesiotypes are from a different locality from that of the original types, but both are in western St. Louis County, Missouri.

Theca calcitic, subglobular, 3 mm long by 3.5 mm wide, with pelvis 0.5 mm long and vault 2.5 mm long. A study of 12 specimens revealed that the longer the specimen the narrower it is, so that one specimen 6 mm long is only 5.5 mm wide (text-fig. 1). Stem round, crenellar, with small round lumen, gradually tapering distally from point of attachment, where it is about 0.5 mm wide. Basals 3, about 1.5 mm wide, with slightly concave adoral margins and strongly convex aboral margins, with azygous basal in "D-E" position, and pelvic angle 140 degrees.

Radials 5, each 2 mm long by 1.5 mm wide, with long, wide radial sinus, 1 mm wide, with rounded radial lip, slightly recurved below. Radials overlap deltoids, with an angle of 115 degrees along radiodeltoid suture, with center at junction of adoral tips of adjacent radial limbs.

Explanation of Plate I

Plesiotypes of Diploblastus kirkwoodensis (Shumard) with coprophagous Platyceras, x6.3

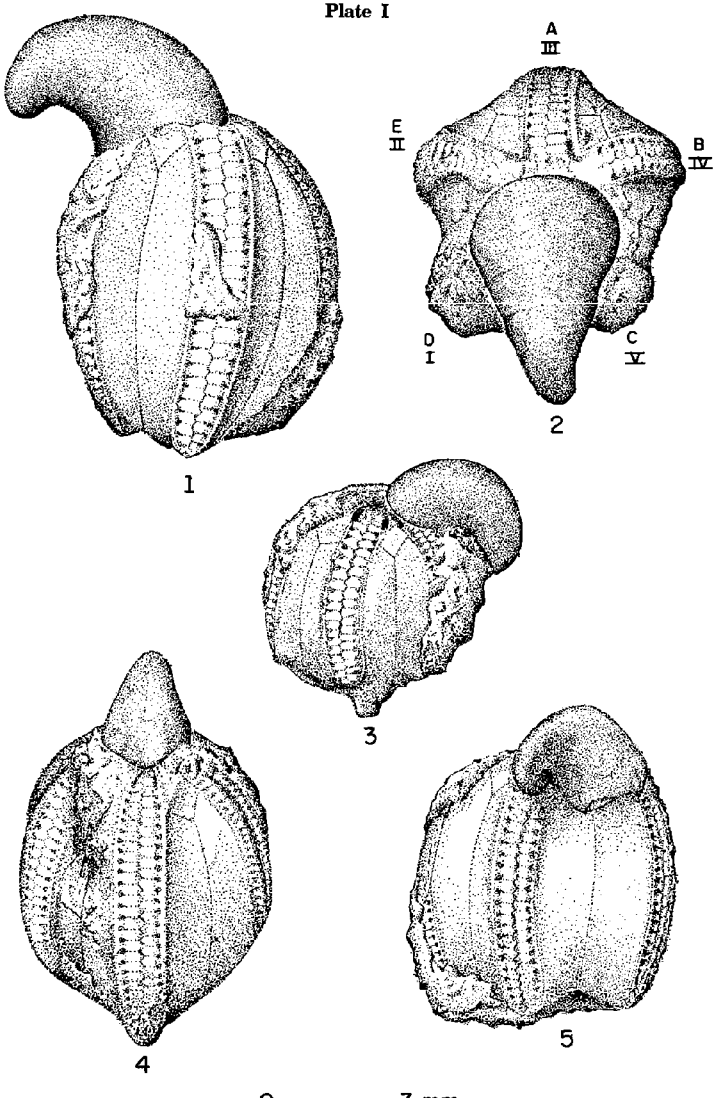
Figures 1, 2. **"B-C" and oral views of specimen 820070 A, showing aboral coiling of Platyceras.**

Figure 3. **"D-E" view of specimen 820070 B showing aboral and somewhat lateral coiling of Platyceras.**

Figure 4. **"A" view of specimen 820070 D, showing aboral coiling of Platyceras.**

Figure 5. **"C-D" view of specimen 820070 C, showing lateral coiling of Platyceras.**

Plate I



Deltoids 4, seen in side view, each 1 mm long by 0.75 mm wide, with broad deltoid lip notched by a paired spiracle near the adoral end. Each spiracle has a wide ellipsoidal opening at the margins of the ambulacra, with a shallow U-shaped portion on the deltoid lip connecting the adjacent openings. On the anal side, 4 deltoids are present around an anispiracle, with the superdeltoid and hypodeltoid well exposed, and the two cryptodeltoids mostly hidden. The hypodeltoid extends downward aborally slightly farther than the aboral extension of the other four deltoid bodies.

Ambulacra 5, with lancet covered by side plates at aboral tip and exposed almost one-third its width at the adoral end. Side plates dumbbell-shaped, with about 14 in the length of an ambulacrum or 50 in 10 mm length of an ambulacrum. Pores simple, with a single pore between adjacent side plates, excavated along radial and deltoid margins. Two hydrospire folds are on each side of an ambulacrum, without a hydrospire plate. Each side plate has about 5 cover-plate lobes along the main food groove and about 3 cover-plate lobes along the side food groove. The outer side plates are small teardrop-shaped plates just admedial to each pore. The brachioles are attached to side plate-outer side plate pairs, so that one brachiolar rests upon a side-plate body and the other brachiolar plate rests upon the adjacent adoral outer side plate. Each brachiolar is hemielliptical in top view and subquadrangular in side view, being about 0.2 mm high by 0.2 mm wide by 0.1 mm thick, and they are alternately arranged in a biserial zigzag manner.

The surfaces of the plates are ornamented with fine growth lines subparallel to plate margins.

Types and occurrence.—Plesiotypes with attached gastropods, 820070 A, B, C, D, J (J has 4 specimens); plesiotypes, complete

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Explanation of Plate II

Diploblastus kirkwoodensis **(Shumard)**

Figures 1-3. **Oral, "D" ambulacral, and aboral views of plesiotype 820070 E, showing azygous basal in "D-E" position, x7.3.**

Figures 4, 5. **Oral and "B-C" views of plesiotype 820070 B, showing aboral and lateral coiling of** Platyceras, **x6.5.**

Figures 6, 7. **"B-C" and "C-D" views of plesiotype 820070 A, showing aboral coiling of** Platyceras, **x3.6 and x4.0, respectively.**

Figure 8. **"D" view of plesiotype 820070 C, showing lateral coiling of** Platyceras, **x5.0.**

Figure 9. **"A" ambulacrum of plesiotype 820070 H, showing simple pores between side plates, x5.8.**

Figure 10. **"D" ambulacral view of plesiotype 820070 F, showing flattened pelvis of a larger specimen, x7.3.**

Figure 11. **"C-D" view of plesiotype 820070 D, with** Platyceras **coiled aborally, x5.8.**

Figure 12. **"A" view of plesiotype 820070 I, showing basal attachment of stem, x5.8.**

Figure 13. **Oral view of etched and polished summit of plesiotype 820070 G, showing cryptodeltoids, x5.4.**

Plate II

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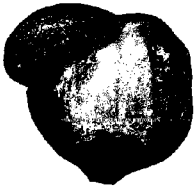

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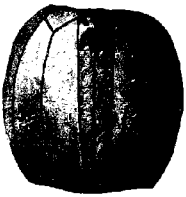

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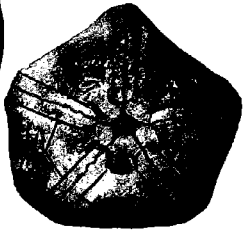

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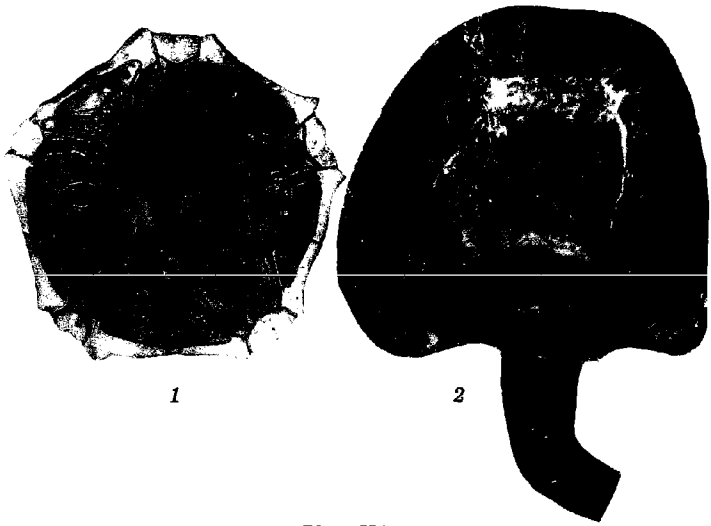

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Plate III

Diploblastus kirkwoodensis **(Shumard)**

Figure 1. Oral view of polished cross section, showing two hydrospire folds on each side of an ambulacrum. Plesiotype, OU 5233, x9.0.

Figure 2. "A-E" interambulacral view, showing stem. Plesiotype, OU 5237, x10.0.

specimens 820070 E, F, G, I, K (10 specimens); plesiotypes, incomplete specimens (70), 820070; plesiotype, figured ambulacrum, 820070 H, Washington University paleontology collection, St. Louis, Missouri. Plesiotypes, OU 5233 (polished cross section), OU 5234-5237 (4 specimens: 1 complete, 2 with brachioles, 1 with stem), University of Oklahoma paleontology collection.

All are from upper one-third of St. Louis Limestone, top bed of old quarry, 50 feet above floor, in SE¼ SW¼ SW¼ NW¼ sec. 16, T. 46 N., R. 5 E., half a mile southwest of Vigus, northwestern St. Louis County, Missouri. Collected by Dr. Courtney Werner, 1936.

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Paladin morrowensis (MATHER) FROM WASHINGTON COUNTY, ARKANSAS

JOHN D. TAYLOR*

Four essentially complete trilobite cephala (pl. I, figs. 2-5) and one pygidium (pl. I, fig. 6) have recently been collected from Morrowan rocks in Washington County, Arkansas. All of these fragments appear referable to *Paladin morrowensis* (Mather, 1915). The new specimens and the holotype of that species are illustrated here (pl. I). Mather (1915) referred a specimen from the Brentwood Limestone near Sawney Hollow, Adair County, Oklahoma, to *Griffithides morrowensis*. Weller (1936) placed that species in a new genus, *Paladin*. Whittington (1954) transferred the holotype to *Paladin (Paladin) morrowensis* (Mather, 1915).

The cephalon of the holotype has a papillose surface and a flat marginal band anterior to the glabella. Ten to twelve striations are present on the cephalic border. The glabella is wider near the anterior marginal band. An occipital lobe and two equal glabellar lobes, which are set in indentations of the occipital lobe, divide the posterior end of the glabella. The available material does not appear to differ significantly from the holotype.

Location.—Specimens from Kessler Mountain were collected from the upper part of the Hale Formation or the lower part of the Bloyd Formation in SW¼ NW¼ SW¼ NW¼ sec. 31, T. 16 N., R. 30 W. An additional cephalon was collected from the Brentwood Member of the Bloyd Formation in SW¼ NE¼ sec. 16, T. 14 N., R. 30 W., near Woolsey, Arkansas.

Remarks.—The Kessler Mountain specimens are in association with a goniatite cephalopod, *Reticuloceras* (Quinn, 1962).

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Explanation of Plate I

Figure 1. Paladin morrowensis **(Mather). Dorsal view of holotype cephalon. Walker Museum, 16174. Measurements: sagittal, 7 mm; transverse, 11 mm.**

Figures 2-5. Paladin morrowensis **(Mather). Dorsal views of cephala. University of Arkansas Collection.**
2. L-91-WL, 182. Measurements: sagittal, 8 mm; transverse, 11 mm.
3. L-115-KM, 6. Measurements: sagittal, 9 mm; transverse, 12 mm.
4. L-115-KM, 7. Measurements: sagittal, 9 mm; transverse, 12 mm.
5. L-115-KM, 8. Measurements: sagittal, 10 mm; transverse, 15 mm.

Figure 6. Paladin morrowensis **(Mather). Dorsal view of pygidium. University of Arkansas Collection, L-115-KM, 9. Measurements: sagittal, 9 mm; transverse, 12 mm.**

Repository.—The holotype (16174), an incomplete specimen from the Brentwood Limestone, Morrowan age, Lower Pennsylvanian, Sawney Hollow, Oklahoma, is in the Walker Museum, University of Chicago. The new specimens illustrated in this paper are recorded in the Geology Department Catalogue of Invertebrate Fossils at the University of Arkansas.

Plate I

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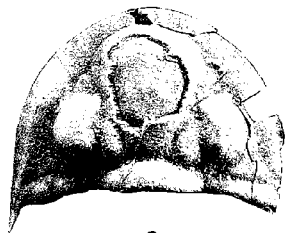

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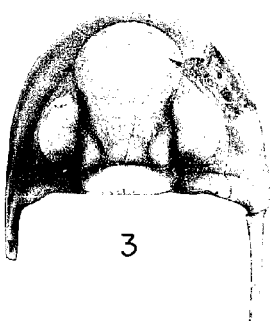

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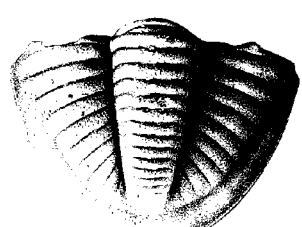

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Spelling of an Oklahoma Name

Carl C. Branson

A copy of the black-and-white preliminary topographic map of the Sageeyah quadrangle, Rogers County, Oklahoma, has reached here. On it in two places is the name Oolagah. The topographic branch of the U. S. Geological Survey was notified of this error and replied that it is following a decision of the U. S. Board of Geographic Names. The decision appears in the *Sixth Report of the United States Geographic Board, 1890 to 1932* (1933, p. 573). The decision is surely in error. The city and township names are spelled Oologah by the citizens, on the official highway map of Oklahoma, and in *Oklahoma, a Guide to the Sooner State* (p. 240, 415). On the U. S. G. S. Nowata quadrangle (1914) the name of the township is spelled Oologah, but on the Claremore quadrangle (1914) the township and town names are Oolagah, as is the town name on the 1 to 250,000 topographic map, Tulsa sheet. *The Times Atlas of the World* (pl. 109) shows it as Oolagah. The *U. S. Official Postal Guide* (Part 1, Domestic, July 1953, p. 377) lists the post office as Oologah.

Wilmarth in *Lexicon of Geologic Names of United States* (U. S. Geol. Survey, Bull. 896, 1938, p. 1552) spelled the formation name and the town name Oologah. The entry in *The Columbia Lippincott Gazeteer of the World* (1962, p. 1383) is "Oologah or Oolagah," but in it is the Oologah reservoir.

The Oklahoma Geological Survey has been consistent in using the form Oologah and the name appears with that spelling in dozens of its publications. The Board of Geographic Names is being asked to rescind its earlier decision, and it is hoped that the action can be taken in time to permit use of the proper spelling on the topographic maps of the area.

Mrs. Alice M. Timmons of the Phillips Collection, Bizzell Library, The University of Oklahoma, has determined that the name is derived from that of an important Cherokee, Houston Benge. The Cherokee form of the name is Oologulah, meaning clouds.

TAXONOMY OF THE SPORE GENERA *Lycospora* AND *Cirratriradites* IN THE CROWEBURG COAL*

L. R. WILSON AND W. S. HOFFMEISTER†

The spore and pollen flora in the Oklahoma Croweburg coal, described by Wilson and Hoffmeister in 1956, was reported as consisting of 48 species in 13 genera. Twelve species and one new genus *(Vestispora)* were described. One species of *Lycospora* and three of *Cirratriradites* were recognized, two of the latter as new. For some years the treatment of *Lycospora* and *Cirratriradites* in this paper has been unsatisfactory, and this note is an attempt to bring the taxonomy of several species of these two genera into order with recent concepts.

The most abundant spore species in the Croweburg coal was reported as *Cirratriradites punctatus* (Kosanke, 1950) Hoffmeister, Staplin, and Malloy, 1955. In nine channel sections of the Croweburg coal, collected along the outcrop in Oklahoma for a distance of approximately 70 miles, this species ranges in abundance from 25 to 47.5 percent of the fossils. It averages 42.1 percent over the length of the outcrop in Oklahoma. Kosanke (1950) originally described the species in the genus *Lycospora*. Because of the nature of the equatorial flange and the marked triradiate ridges on the proximal surface, it was transferred to *Cirratriradites* by Hoffmeister, Staplin, and Malloy (1955). Comparison with the type species of *Cirratriradites (C. maculatus* Wilson and Coe, 1940) clearly shows that *C. punctatus* should be returned to the genus *Lycospora*.

Lycospora brevijuga Kosanke, 1950, is reported in the Croweburg coal as occurring generally but not abundantly. Probably the specimens identified as *L. brevijuga* are variations of *L. punctata* which have been modified by preservation and/or preparation of the coal for study. A thorough study of *Lycospora* may reveal that several closely allied species are in reality variations of one. Slight alterations in the preparation of a single coal sample containing *Lycospora* produce structural variations in the specimens that are transitional from species to species.

Cirratriradites crassus Wilson and Hoffmeister, 1956, probably should be retained in its assigned genus, although a distal fovea is seen on few of the specimens. The large size and general resemblance to *C. maculatus* gives this spore species greater relationship with the genus *Cirratriradites* than with any other genus.

The structure of *Cirratriradites intermedius* Wilson and Hoffmeister, 1956, more closely resembles that of the genus *Lycospora* than of *Cirratriradites* and the species should be transferred accordingly. The characteristics that make this transfer desirable are the absence of a distal fovea, the restriction of the triradiate ridges to the spore

*One project supported by National Science Foundation Grant No. G-22083.

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body, and the fact that the equatorial flange is normally widest in the inter-radial areas. The following generic transfer is proposed.

Lycospora intermedia (Wilson and Hoffmeister, 1956) comb. nov. *Cirratriradites intermedius* Wilson and Hoffmeister, 1956. Plant microfossils of the Croweburg coal, Oklahoma Geological Survey, Circular 32, p. 14, pl. II, fig. 9.

A reexamination of specimens of this species reveals that, although many specimens have a granulose body wall, others, including the holotype, are microvermiculate or microreticulate. This structure is illustrated in the photomicrographs. Those specimens which appear to be better preserved have the granulose ornament, whereas those.

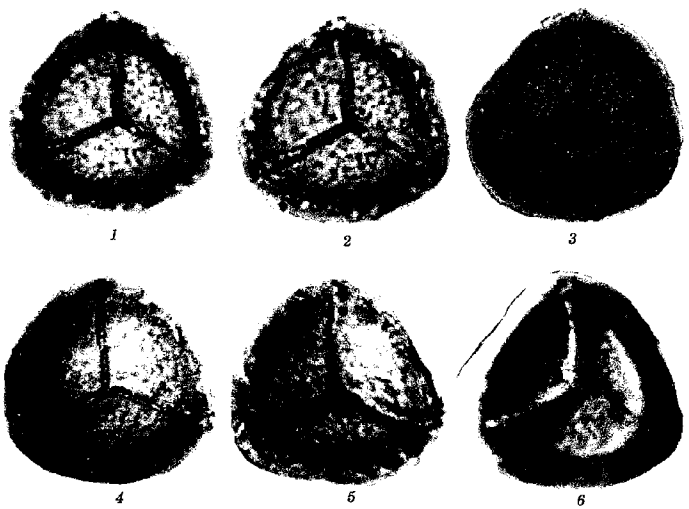

Plate I

Lycospora intermedia **(Wilson and Hoffmeister, 1956) Wilson and Hoffmeister comb. nov. Holotype, 47.6 by 48.8 microns. Slide 1 WH 3B.**

Figure 1. Bright-field optics, high focal plane
Figure 2. Low focal plane
Figure 3. Phase-contrast optics, low focal plane
Figure 4. Phase-contrast optics, high focal plane
Figure 5. Phase-contrast optics, higher focal plane
Figure 6. Partial dark-field optics, high focal plane

Note. All photomicrographs with Carl Zeiss Photomicroscope, Neofluar 40/0.75 objective, Optivar setting 2, Projective 3.2 and medium green filter, Adox KB 14 film.

specimens whose walls have not been so well preserved, or have been slightly overmacerated, show the microvermiculate structure.

References Cited

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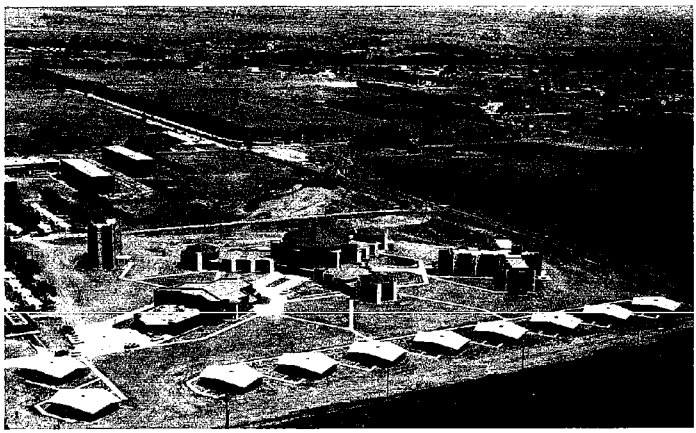
State Geologists Will Meet in Norman on Seventy-fifth Anniversary of the Run

The Association of American State Geologists will meet in Norman on April 20 and 21, 1964. This session will be the fifty-sixth annual meeting of the organization, which last met in Norman in 1929. The membership of the AASG consists of the forty-seven state geologists (three states have no geological survey) and of the director of the Puerto Rico Geology and Mineralogy Section. The directors of the Geological Survey of Canada, of the Instituto Geologico de Mexico, and of each of the geological surveys of Canadian provinces are invited to attend and to participate. On the second day representatives of the Federal agencies, the United States Geological Survey and the United States Bureau of Mines, will report their activities, and in particular those projects affecting State affairs.

The meeting will be held in the Oklahoma Center for Continuing Education in Forum Room A. Housing and meals are available in the Center. The facility was opened in 1962 and was built from funds granted by the Kellogg Foundation, appropriated by the Oklahoma legislature, and supplemented by self-liquidating bonds. Housing is available in Sooner House (twin bedrooms) and in the 10 cottages. Meals are served in The Commons at low cost.

The meeting will be succeeded by a field trip to see outstanding features of the Arbuckle Mountains and the Criner Hills.

In the week is the 75th anniversary of the Run which opened Oklahoma Territory to settlement (April 22, 1889). Other runs were in 1891, 1892, 1893, 1895, and a lottery was held in 1901. During the 1889 run Norman, Oklahoma City, and other central Oklahoma towns were first settled. Those who beat the gun were known as Sooners, and Oklahoma is now called the Sooner State.



OKLAHOMA CENTER FOR CONTINUING EDUCATION
SITE OF
FIFTY-SIXTH ANNUAL MEETING
ASSOCIATION OF AMERICAN STATE GEOLOGISTS
April 20-21, 1964

OKLAHOMA GEOLOGY NOTES

Volume 24 February 1964 Number 2

IN THIS ISSUE