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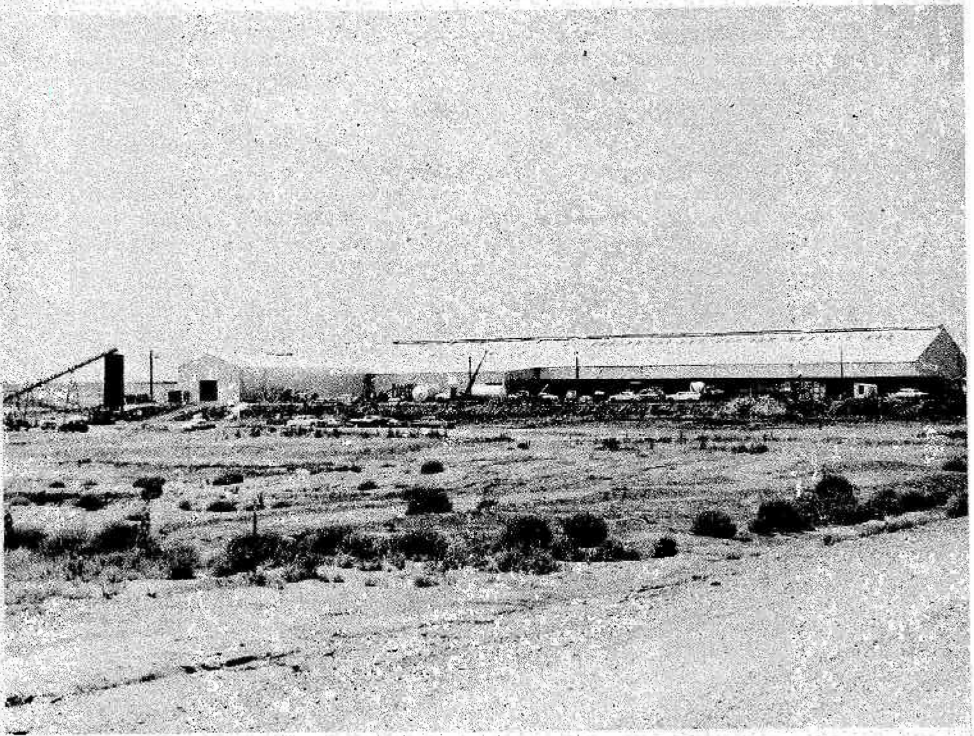
OKLAHOMA GEOLOGY NOTES



BRICK PLANT, CANADIAN COUNTY

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

Cover Picture

MINERAL INDUSTRIES OF OKLAHOMA

Clay

Man has manufactured fired-clay products in the area of Oklahoma for at least 2,000 years. The State has widely scattered usable clay deposits and, today, the material is mined in 12 counties ranging from Pittsburg and Rogers Counties in the east to Custer and Greer Counties in the west. A total of 12 operators produce an annual output of approximately 750,000 short tons, valued at about $1 per ton. The principal clay-bearing stratigraphic units used for ceramic products are the Coffeyville, Hilltop, Francis, Hennessey, Flowerpot, and Cloud Chief Formations. Of these, the Hennessey, Flowerpot, and Cloud Chief are Permian and the remainder are Pennsylvanian.

The bulk of clay produced is used in the manufacture of brick and tile, although a significant amount is consumed in pottery, portland cement, lightweight expanded-clay products, and other uses. Among the principal values of brick as a building material is the fastness of its color, which is determined entirely by the mineralogy and chemistry of the raw clay. The shade and uniformity of the basic color may be controlled by the firing process. The colors of Oklahoma brick range through the complete spectrum of red. In general, the Pennsylvanian clays produce deeper reds, whereas the Permian clays produce lighter shades of pink. Few commercial deposits of buff-burning clays have been discovered in Oklahoma.

During the past decade, the Oklahoma brick industry has undergone much modernization. Old-style beehive kilns, involving much tedious hand labor and difficulties in quality control, are being replaced by steady-process tunnel kilns, with resultant increase in production and improvement in quality. Pictured on the cover is the newest brick plant in Oklahoma, that of the Oklahoma Brick Corporation at Union City. With a capacity rated at 75,000 to 100,000 bricks per day the plant is scheduled to begin operation on the first of this month.

—A. N. & C. J. M.

(Photograph courtesy of Harry Schroeder, El Reno Daily Tribune)

ERISMODID CONODONTS IN SIMPSON (ORDOVICIAN) OF OKLAHOMA

R. W. HARRIS

Branson and Mehl (1943, p. 380, pl. 63, figs. 1, 3) briefly described and illustrated a fragmental erismodid with prominent apical cusp as *Erismodus* sp. indet. from Simpson McLish (Black River) strata cropping out on State Highway 99 south of Fittstown, Oklahoma. In the same publication (p. 385, pl. 64, fig. 17) a doubtful erismodid bar was briefly described and illustrated as *Erismodus*? sp. from Simpson upper Bromide (Black River) strata from the same general locality. Nine or ten closely crowded, compressed, short, blunt denticles characterize the oral edge of the bar that is deeply excavated aborally.

Two new erismodid basal Simpson Joins (Chazyan) species described herein are distinctly different from the aforementioned upper Simpson species, and have proved useful in identifying basal Joins strata. The new forms range apparently only through the basal twenty to thirty feet of the Joins Formation (fragments possibly observed in underlying beds of the uppermost part of the West Spring Creek Formation of the Arbuckle Group).

Figure 1 indicates stratigraphic positions of erismodids reported from the Simpson Group.

Genus *Erismodus* Branson and Mehl, 1933

Type species: **Erismodus typus** Branson and Mehl, 1933

Erismodus Branson and Mehl, 1933, Conodonts from Harding sandstone of Colorado: Mo., Univ., Studies, vol. 8, no. 1, p. 25.

This genus embraces asymmetrically arched dermal crests consisting of basally excavated, smooth to denticulate anterior and posterior bars flanking a deeply excavated apical cusp. Prominent outer basal buttress of apical cusp projects aborally into apex of the arch.

Representatives of the genus may be confused with some species of *Microcoelodus* Branson and Mehl that display arched lateral bars with an apical cusp. In *Erismodus* the cusp appears simply as an enlargement of the apical denticle of the primary bars (the cusp was a secondary denticle, until enlarged). *Microcoelodus,* however, may be considered as a primary cusp with denticles secondarily developed from its expanded base (in some species becoming barlike). This latter genus is typically more symmetrically arched; the inner basal surface of the cusp is more expanded and flaring; and the outer basal surface of the typical form is not a prominent buttress that projects into the aboral arch. *Erismodus* typically is asymmetrical; its arch is more angular; its apical cusp normally more posteriorly inclined; basal cavity of the cusp appears deeper, more pyramidal, and its inner aboral margin less expanded; and outer basal buttress of cusp projects aborally into apex of arch.

Youngquist and Cullison (1946, p. 583), in describing several Missouri Dutchtown (Ordovician) species of *Microcoelodus* with erismodid feature of prominent outer basal buttress, suggested possible intergradation between *Microcoelodus* and *Erismodus*. Sweet (1955, p. 233, 243), in describing nine species of the two aforementioned genera in Harding (Ordovician) strata of Colorado, observed that *Erismodus* is a Chazyan-Blackriverian genus, whereas *Microcoelodus* is Blackriverian in age (questionably in Devonian and Mississippian

ORDOVICIAN	RICHMONDIAN	PATTERSON RANCH	Sylvan Shale	
	TRENTONIAN		Fernvale Limestone	
			Viola Limestone	
		SIMPSON	Corbin Ranch Formation	
	BLACKRIVERIAN		Bromide Formation	<u>E.</u> sp. indet. B. & M.
			Tulip Creek Formation	
			McLish Formation	<u>E.</u>? sp. B. & M.
	CHAZYAN		Oil Creek Formation	
			Joins Formation	<u>E.</u> <u>incurvescens</u> n. sp. <u>E.</u>? <u>horridus</u> n. sp.
	CANADIAN	ARBUCKLE	West Spring Creek Limestone	
			Kindblade Formation	
			Cool Creek Formation	
			McKenzie Hill Formation	
CAMBRIAN	CROIXIAN		Four older dolomite formations	

Figure 1. Stratigraphic distribution of species of Erismodus in the Simpson Group of Oklahoma. (Detailed stratigraphy is given in Harris, 1957.)

strata). Of the four erismodid species reported from the Simpson Group of Oklahoma, two characterize Chazyan strata, and two, Blackriverian (fig. 1).

Among characteristic features of *Erismodus* are the two lateral bars, anterior and posterior. The two bars are essentially in the same plane, although slight offset and inward deflection may be observed in some species. The basal Joins species *Erismodus*? *horridus*, new species (pl. I, fig. 2a-d), displays three denticulate bars, anterior, posterior, and inner. The third (inner) bar of this form justifies establishment of a new erismodid genus, but more perfectly preserved specimens are required for types.

Erismodus incurvescens, new species
Plate I, figure 1a-d

Prominent, double-edged, asymmetrical, subscandodid cusp recurved posteriorly from apex of approximately 65-degree divergence angle of anterior and posterior denticulate bars. Posterior projection of cusp is essentially in alignment with anterior bar; posterior bar slightly inset. Cusp is noncarinate, although faint axial thickening or semicarina characterizes the buttressed base of its outer surface. Basally rounded outer and inner buttresses of the cusp embrace apex of bonelike material in aboral cavity.

The triangular (lateral profile) bonelike structure upon which the conodont is perched is somewhat flattened in axial plane (subelliptical in section), with outer surface slightly more convex than inner surface. The structure extends well into the aboral cavity, and its "Phrygian cap" apex is directed anteriorly.

Denticulate bars are slender, elongate, and distally attenuated; they are flattened to slightly excavated aborally. The slightly longer anterior bar displays seven or eight short, subscandodid denticles recurved inward and posteriorly (the three anterior denticles are longest). Five or six subcylindrical, straight, more elongate denticles on posterior bar project essentially posteriorly (without pronounced curvature). Denticles and cusp are discrete, and all display growth axes.

Several different lower Chazyan species from Quebec rather closely resembling the Joins form were observed and illustrated by Hinde (1879, pl. 15, figs. 1-5) as *Erismodus* (*Prioniodus*) *radicans* (Hinde). His figure 1 of plate 15 (see also Branson and Mehl, 1933c, pl. 12, fig. 19) is similar to the Joins species in subtriangular lateral outline of base and in curvature of cusp, but bars of the Joins form are more sharply divergent, the more numerous denticles of anterior bar are longer and more recurved, denticles of posterior bar are more numerous, the cusp is not so prominently keeled, and its buttress is not corrugated. Aforementioned *Erismodus* sp. indet. Branson and Mehl from McLish outcrops of Arbuckle Mountains displays a more erect cusp, and fewer, wider, and flatter denticles. The new Joins species differs from *E. radicans* (Hinde) (Sweet, 1955, pl. 29, figs. 22, 29), from Harding strata of Colorado, in wider divergence of bars, flatter recurvature of cusp, and in more numerous, longer, and more slender denticles. The Joins species is similar to the contemporary species, *Erismodus*? *horridus*, new species (pl. I, fig. 2a-d), in size and proportions, but differs essentially in having only two (not three) denticulate bars and in the fact that the aboral bonelike base is more compressed (elliptical in section), not pyramidal (subtriangular in section).

The new species differs from *Microcoelodus cuspus* Youngquist and Cullison, from the Dutchtown (Ordovician) of Missouri, in its more numerous denticles and in the fact that the gracefully recurved cusp is not fused with anterojacent denticles. Among other differences, the Joins form is larger and displays more denticles than do such Dutchtown species as *Microcoelodus intermedius*, *M. lobosus*, *M. spicatus*, and *M. missouriensis*.

The species apparently is limited to basal Joins strata (possibly in the underlying uppermost part of the West Spring Creek).

Holotype OMC 130 and paratype OMC 131 are from horizon 16 feet above base of Joins Formation, 50 feet beyond west side of U. S. Highway 77, south side of Arbuckle Mountains, Oklahoma.

The trivial name is derived from the Latin prefix *in* and the adjective *curvus*, meaning curved inward, referring to inward curvature of denticles on anterior bar.

Erismodus? *horridus*, new species

Plate I, figure 2a-d

Robust, double-edged, asymmetrical, subscandodid cusp (with inner carina) recurved from apex of approximately 80-degree divergence angle of anterior and posterior denticulate bars; posterior projection of cusp is in general alignment with anterior bar, although deflected inward. A third (inner) denticulate bar in inclined approximately 45 degrees downward and diagonally forward (nearer anterior bar) from base of apical cusp. Anterior and posterior keels of cusp are continuous across edges of denticles of anterior and posterior bars, respectively; inner carina of cusp is continuous across edges of denticles of inner bar. Cusp and denticles exhibit growth axes.

Basal cavity of cusp is subtriangular, to accommodate apex of subpyramidal bonelike structure upon which conodont is perched;

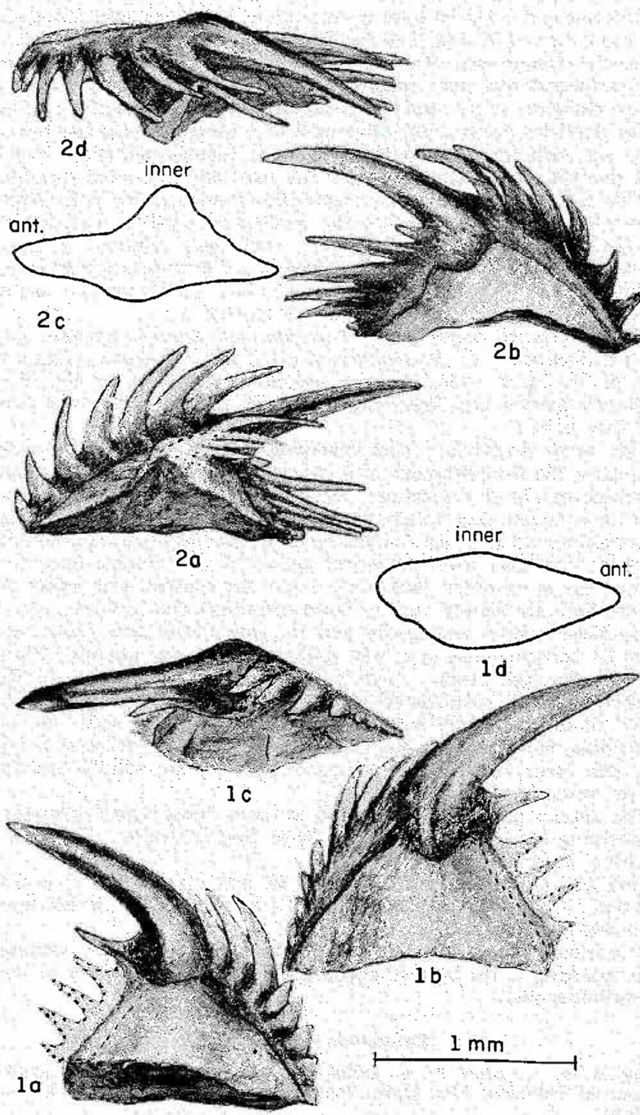
Explanation of Plate I

(Magnification x35)

Figure 1. Erismodus incurvescens, **new species**
- **a. Inner lateral view (reconstructed).**
- **b. Outer lateral view (reconstructed).**
- **c. Oral view.**
- **d. Aboral sectional view.**

Figure 2. Erismodus? horridus, **new species.**
- **a. Inner lateral view (reconstructed).**
- **b. Outer lateral view.**
- **c. Aboral sectional view.**
- **d. Oral view.**

Plate I



outer surface of pyramidal structure is curved, inner surface is angular, base is slightly concave.

Anterior and posterior bars are essentially in same plane, although latter bar is curved inward. Anterior bar is longest, bearing seven slender, slightly compressed, discrete, recurved denticles (three posterior denticles longest and most recurved). Posterior bar bears seven subacicular, elongate, fairly straight, posteriorly projecting denticles (two anterior denticles not in exact alignment with others). Inner bar bears five or six posteriorly recurved, fairly long, slender denticles (near-apical denticle apparently longest). All bars are excavated basally.

This new Joins form closely resembles contemporary *Erismodus incurvescens*, new species, in size and general proportions, but differs most obviously in possession of three (not two) denticulate bars. Furthermore, the bonelike basal structure of *E.? horridus*, new species, is subpyramidal (not an elliptical cone), and its divergence angle separating anterior and posterior bars is greater.

The divergence angle of *E.? horridus*, new species, appears the same as illustrated in *Erismodus* (*Prioniodus*) *radicans* (Hinde) (1879, pl. 15, fig. 1) (also Branson and Mehl, 1933c, pl. 12, fig. 19), but Hinde's species from lower Chazyan strata of Quebec has only two denticulate bars.

The three denticulate bars diverging from apical cusp of this form justify the establishment of a new erismodid genus (hence, the questioning herein of the genus), but a more perfect specimen is required for complete description. This prospective new genus resembles representatives of the genus *Ambalodus* Branson and Mehl that exhibit three bars diverging from an apical spine. In *Ambalodus*, however, the third bar is on outer (not inner) side of conodont, and crests of the three bars are simply basally fused serrations (not discrete, elongate denticles). Both *Ambalodus* and the prospective new genus appear to be dermal plates or crests. *Ambalodus elegans* Rhodes (1953, p. 278, pl. 20, figs. 21-25), *A. pulcher* Rhodes (1953, p. 279, pl. 20, figs. 38-41), and *A. robustus* Rhodes (1953, p. 279, pl. 20, figs. 26, 27, 32, 33) all display triple bars radiating from an apical cusp (as in *E.? horridus*, new species), but the third bar of all three forms is an outer (not inner) bar, and denticles of all bars are simply basally fused serrations of sharpened crests.

The species apparently is limited to basal Joins strata (possibly in underlying uppermost part of the West Spring Creek) in association with *E. incurvescens*, new species.

Holotype OMC 132, from horizon 16 feet above base of Joins Formation, 50 feet beyond west side of U. S. Highway 77, south side of Arbuckle Mountains, Oklahoma.

The trivial name is adapted from the Latin word *horridus* meaning bristly, referring to the bristled appearance of discrete denticles of the three radiating bars.

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Analyses of Natural Gases in Oklahoma
A Review

Louise Jordan

The Bureau of Mines has recently released Information Circular 8221, *Analyses of natural gases of the United States*, 1961, by Richard D. Miller and Geraldine P. Norrell. Samples from 434 wells from 16 states were collected during 1961 as part of the continuous survey for the occurrence of helium in natural gas conducted by the Helium Activity of the Bureau of Mines.

As of January 1, 1961, the total helium resources of the United States were estimated to be 196 million cubic feet. These reserves were calculated from helium-bearing natural gas containing 0.3 percent helium by volume. At that time, the end of 1960, approximately 94 percent was contained in five helium-bearing gas fields: (1) Hugoton field of Kansas, Oklahoma, and Texas; (2) Panhandle field of Texas; (3) Keyes field of Oklahoma; (4) Greenwood field of Kansas and Colorado; and (5) Cliffside field of Texas. However, during 1961, discovery of new resources at the Table Mesa field in San Juan County, New Mexico, added an estimated recoverable helium reserve of 850 million cubic feet. The gas contains approximately 5.4 percent helium and is processed at the Bureau of Mines Navajo Helium Plant at Shiprock, New Mexico.

In table I, analyses of natural gas from 37 wells and 2 pipelines in Oklahoma are tabulated, showing the five more important components of the natural gas and the heating value. In the report the well

TABLE I.—ANALYSES OF NATURAL GAS IN OKLAHOMA[1]

LOCATION	FORMATION	METHANE	ETHANE	PROPANE	HELIUM	NITROGEN	HEATING VALUE*
PANHANDLE OF OKLAHOMA							
22-4N-18ECM	Herington and Krider	68.5	1.7	0.3	0.6	28.5	736
20-1N- 9ECM	Red Cave	28.3	4.0	3.3	2.0	60.5	502
21-6N-10ECM	Topeka	63.0	6.4	3.6	0.7	23.5	935
25-6N-10ECM	Topeka	66.6	6.4	3.5	0.7	19.9	978
21-6N-11ECM	Topeka	65.8	6.3	3.4	0.7	21.1	940
27-6N-11ECM	Topeka	60.0	6.0	3.2	0.7	27.3	877
34-1N-24ECM	Tonkawa	84.6	6.8	3.0	0.2	3.2	1,135
4-2N- 8ECM	Morrow	75.4	5.9	2.4	0.5	14.4	980
1-2N-21ECM	Morrow	84.9	6.9	3.7	0.2	1.7	1,161
1-2N-23ECM	Morrow	82.9	7.5	4.8	0.2	1.6	1,189
2-3N- 9ECM	Morrow	68.8	4.9	2.0	0.6	22.1	880
13-4N-16ECM	Morrow	83.6	6.2	4.0	0.2	3.3	1,150
18-4N-17ECM	Morrow	84.0	6.2	3.9	0.2	3.0	1,164
19-4N-17ECM	Morrow	83.9	6.1	3.8	0.1	3.3	1,146
17-4N-24ECM	Morrow	85.5	6.1	3.7	0.2	1.8	1,158
23-4N-24ECM	Morrow	90.9	4.4	1.9	0.1	0.8	1,097
9-5N-12ECM	Morrow	59.4	5.4	3.3	0.2	29.7	850
3-5N-13ECM	Morrow	80.8	6.3	4.4	0.1	5.8	1,128
23-5N-16ECM	Morrow	83.7	6.4	4.1	0.1	3.0	1,157
23-5N-16ECM	Keyes	92.0	3.5	1.3	0.1	1.6	1,069
29-5N-27ECM	Morrow	85.0	6.7	3.7	0.1	1.5	1,177
32-6N-13ECM	Morrow	81.2	7.0	4.3	0.1	4.3	1,156
36-2N-20ECM	Chester	92.5	3.6	1.6	0.1	0.3	1,093
23-4N-24ECM	Chester	91.8	3.9	1.4	0.1	1.4	1,061
NORTHWESTERN OKLAHOMA							
17- 8N- 5W	Bromide	87.4	6.1	2.4	Tr	1.3	1,139
8-12N-11W	Cherokee	84.3	8.6	2.8	Tr	0.2	1,213
14-15N-15W	Meramec	93.2	3.2	0.8	Tr	0.4	1,081
30-17N-17W	Oswego	72.3	11.8	8.5	0.1	1.2	1,350
28-20N-11W	Chester	90.2	4.6	1.9	Tr	0.3	1,151
32-20N-11W	Chester	92.6	4.2	1.3	Tr	0.4	1,067
35-21N-17W	Chester	95.4	2.4	0.5	Tr	0.3	1,038
29-23N-15W	Hunton	82.4	8.4	3.1	0.1	2.9	1,168
2-23N-25W	Morrow	91.1	4.6	1.8	0.1	0.4	1,097
6-24N-13W	Cherokee	89.3	5.3	2.1	0.2	0.8	1,138
4-24N-25W	Morrow	82.6	7.8	4.0	Tr	1.0	1,226
19-29N-14W	Mississippian	91.7	3.9	1.4	0.1	1.7	1,080
NORTHEASTERN OKLAHOMA							
10- 7N-19E	Cromwell	95.4	1.3	0.4	0.1	0.7	1,000
PIPELINES							
Knox plant, Grady and Stephens Cos.	Bromide and Oil Creek	92.0	6.0	1.1	Tr	0.1	1,071
Alva, Woods Co.	Various	88.1	5.2	2.1	0.1	2.6	1,104

[1]All data in moles percent. Sixteen components were analyzed but only the five more important are tabulated above. Carbon dioxide content from the well in northeastern Oklahoma is 2.2 percent.

*Heating value is calculated in Btu per cubic feet, dry, at 60° F and 30 in. Hg.

name, owner, completion date, depth of sample, wellhead pressure, and open-flow potential are given.

The analyses show that heating value ranges from 502 Btu for gas from the Red Cave pay in Cimarron County to 1,350 Btu from the Oswego in the Putnam field of Dewey County. The gas from the Red Cave (20-1N-9ECM) has the greatest amount (60.5 mole percent) of nitrogen in any well, whereas the Oswego gas (30-17N-17W) has a higher value of ethane and propane than has any other well. The shallower pays, in the Panhandle, Herington, Krider, Red Cave, and Topeka all contain about 20 percent or more nitrogen. However, gases from three Morrow producers (4-2N-8ECM, 2-3N-9ECM, 9-5N 12ECM) have values of 14.4, 22.1, and 29.7, respectively, and therefore the heating values are low. Carbon dioxide content averages about 0.3 percent for 36 wells, but the gas from the Cromwell pay in northeastern Oklahoma carries 2.2 percent.

Russian Fossil Insects

A recent review by Branson (1963) of the Russian treatise on paleontology has prompted the following comments by F. M. Carpenter. Dr. Carpenter is Alexander Agassiz Professor of Zoology at Harvard University. He has kindly given permission to publish his letter in full.

"I have recently noticed your account of the Ninth Volume of Russian Osnovy (Geology Notes, October 1963), in which you state that 'Russia has either a fantastic fauna of fossil insects or a prolific group of scientists interested in these forms.' Actually, there is another alternative. Having spent three months at the Institute of Paleontology in Moscow in 1961, I can testify that Russia has *both* a fantastic fauna of fossil insects *and* a prolific group of scientists interested in them!

"The fossil insect collection at the Institute is being built up at the rate of about five thousand specimens a year, most of these being from Permian and Jurassic formations. As a rule, there is one major expedition for fossil insects a summer, this party including several of the specialists in fossil insects at the Institute. Currently there are four senior staff members at the Institute and six junior people, mainly in the category of post-doctoral students.

"The family Parelmoidae, which Rohdendorf, establishes for *Pseudelmoa* and *Parelmoa* from Oklahoma, is really not justifiable and I have synonymized it in my typescript for the insect volume of our Treatise. In general, however, I find the work of these Soviet paleoentomologists most satisfactory."

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Sole Trails on an Atoka Siltstone

Carl C. Branson

The lower part of the Atoka Formation south of Fayetteville, Arkansas, contains beds of siltstone. Dr. L. R. Wilson has systematically collected from the banks of farm ponds on his property in NE¼ SW¼ sec. 1, T. 14 N., R. 30 W., Mineral Springs Community, Washington County, Arkansas. Approximately 30 specimens are in the collection. The specimens are of some variety, but are of the same general type. Jan Cannon photographed the specimens shown in figures 1-5.

The trails are double leaflike ridges on plates of siltstone which extend outwards and curve backwards. They resemble in a general way such "burrows" as *Olivellites* Fenton and Fenton (1937a, p. 452-453) of sandstone in the Cisco Group (Virgilian) of Eastland County, Texas, and *Aulichnites* Fenton and Fenton (1937b, p. 1079-1080) from sandstones apparently the same as those from which *Olivellites* was collected, although the locality is in Parker County.

Trails of the general type are classified as *Scolicia* de Quatrefages, 1849, which has type species *S. prisca* of Eocene flysch. Specimens of *Scolicia* are regularly metameric and have a central segmented band bordered by a pair of lateral similar segments.

The form genus *Polykampton* Oaster, 1869, a Triassic form from Switzerland, is similar. The name *Nereites* has been applied to Paleozoic trails. These sole marks have been considered to be trails of nudibranchs, of annelids, or as feeding burrows, or trilobite tracks.

Figure 1. Two trails (Scolicia) on surface of a siltstone bed, Atoka Formation, x2.

Figure 2. Sole trail (Scolicia), x2.

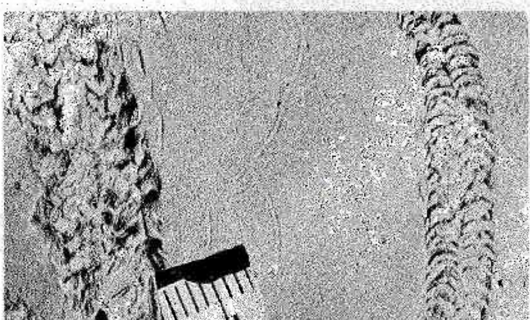

Figure 3. Narrow sole trail with tapered-off terminus. Wide confused trail at left. Narrow linears on surface between trails, x2.

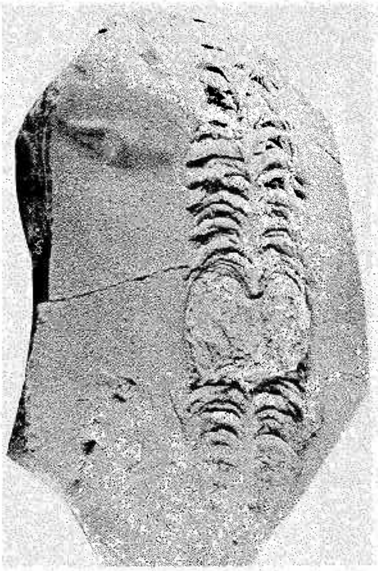

Figure 4. Sole trail with interruption in center, x2.

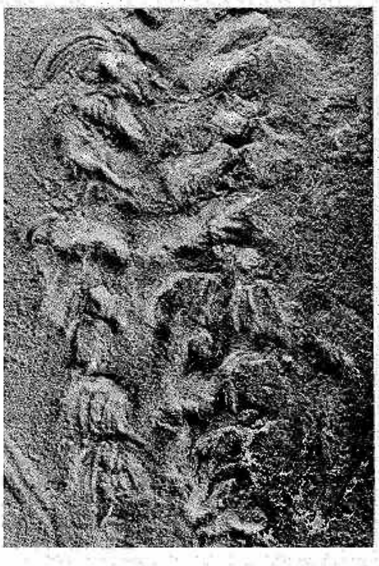

Figure 5. Sole trail with minute subordinate lateral markings, x2.

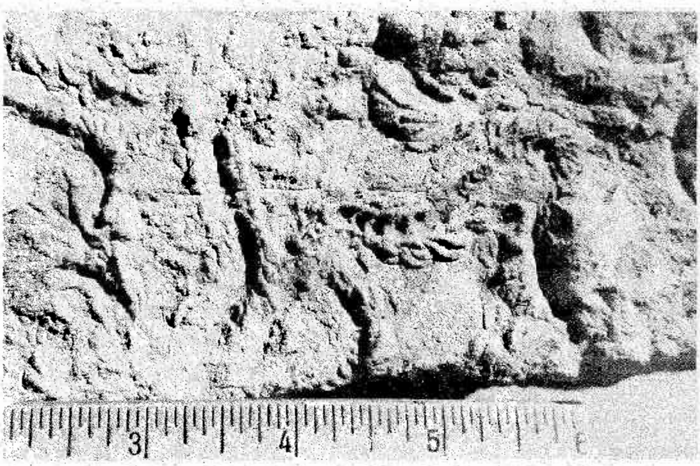

Figure 6. Sole trail in middle part of Wildhorse Mountain Formation (from Seely, 1963, fig. 13).

Figure 7. Sole trail in upper part of Wildhorse Mountain Formation (from Seely, 1963, fig. 14).

A procedure to be preferred is to classify the type of trace fossil figured here as "trails of segmented organisms." Generic and specific names seem only a nomenclatorial nuisance.

Seilacher has studied sole trails and has published several important analyses. The synthesis published by Häntzschel (1962) is most useful. Henbest studied sole marks of the Atoka (1961), but did not figure the type shown here.

The locality is in a lower unit of the Atoka Formation, perhaps the part assigned to the Winslow Formation by Quinn and Carr (1963). The figured specimens are OU 5066; other specimens are OU 5067. Seely (1963, figs. 13-14) figured similar specimens from a sandstone near the middle of the Wildhorse Mountain Formation in SE¼ NE¼ sec. 8, T. 1 S., R. 31 W., Polk County, Arkansas (fig. 6), and from near the top of the formation on Rich Mountain (fig. 7).

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Correction

In *Oklahoma Geology Notes,* volume 24, number 6, page 130, the name of the translator is incorrectly spelled. He is Ronald D. Grigsby. The title is incorrect. The Oklahoma genus is *Hedbergina,* a genus based upon *Globigerina seminolensis* Harlton, 1927, a species presumed to be from Pennsylvanian rocks of the area of the Criner Hills, but probably in Cretaceous float. The holotype and single specimen is poorly preserved, and Loeblich and Tappan (1964, p. 784) consider the species and the genus unrecognizable.

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—C. C. B.

Helium in Oklahoma
A Review

David L. Vosburg

A recent publication by Pierce, Gott, and Mytton (1964) deals with the origin, distribution, and migration of helium in the Panhandle field of Texas. Oklahoma has processed helium since 1959 from the U. S. Bureau of Mines plant at Keyes, Cimarron County. The Keyes plant in 1962 produced 292 million cubic feet of this gas, and sales to Government and industry amounted to $9.9 million (McDougal and Ham, 1962). Five major gas fields contain 94 percent of the known helium reserves in the United States. Two of these, the Keyes field in Cimarron County and a portion of the Hugoton field in Texas County, are in Oklahoma (Lipper, 1963).

The following is a brief synopsis of U. S. Geological Survey Professional Paper 454-G.

Large helium reserves are present in the western part of the Panhandle field, Texas, which covers about 5,000 square miles and is situated on the northwestward-trending Wichita-Amarillo geanticline.

Movement during Late Mississippian or Early Pennsylvanian time resulted in erosion of pre-Pennsylvanian rocks to expose the Wichita-Amarillo igneous core. Marine deposition across the core was resumed by Early Permian time. Subsequent repetitive crustal movements have resulted in the folding and faulting of this sedimentary cover, which includes rocks ranging in age from Late Pennsylvanian (Virgil-Cisco Group) to Middle Permian (Leonard-Clear Fork Group). Lithologies include "granite wash," arkose, arkosic limestone, fossiliferous limestone, dolomite, and red siltstone and shale interbedded with anhydrite.

Helium and radon (Rn^{222}), both decay products of the uranium series, are constituents of the hydrocarbons from the Panhandle field. The dominant parent radioelements of the radon and helium appear most likely to be uranium and thorium in the approximate ratio of 0.40 (thorium to uranium) based upon analyses of four radium isotopes (Ra^{226}, Ra^{223}, Ra^{224}, Ra^{228}), which are decay products of the uranium, thorium, or actinium series.

The major known source of radioactive material is a uranium-bearing carbonaceous "mineraloid," to which the term "asphaltite" is here applied in the most general sense.

The asphaltite is composed of carbon (78% to 80%), hydrogen (3% to 6%), oxygen (3%+), nitrogen (a maximum of 0.43%), with the remainder mostly metallic elements, especially arsenic, uranium (0.2% to 5%), nickel, cobalt, and iron, although copper, silver, lead, vanadium, bismuth, molybdenum, and rare earths are also present.

The asphaltite occurs as botryoidal nodules and impregnations filling secondary pore spaces and fractures. Sparsely disseminated amounts are present in the fractured Precambrian basement, Pennsylvanian-Permian "granite wash," and Permian Wolfcamp "Moore

County lime" and "Brown dolomite." Asphaltite is most abundant in the Permian Leonard "Panhandle lime" (upper part of the Wellington) and "Red Cave" (Hennessey).

Similar asphaltite has been reported from rocks of equivalent age where they crop out along the north flank of the Wichita Mountains and in cuttings from wells on the north (Anadarko basin) and south (Palo Duro basin) flanks of the Wichita-Amarillo geanticline, as well as near the western end of the Matador structure.

Calculations, based upon the available data, permit the following general statements.

The parent radioelements in rocks within and overlying the Panhandle reservoir are insufficient to account for the radiogenic helium and argon present. Analyses of gases from the Panhandle region suggest a mixing of gas from both northeast (Anadarko basin) and south (Palo Duro basin). Differential reservoir pressures, coupled with Late Cretaceous and later epeirogenic movements, provide a mechanism for spilling gas from satellite structures on each side of the geanticline into the structurally higher Panhandle field. High helium concentration within what is structurally the lowest portion of the Panhandle field suggests that such "spilling" may still be taking place. Comparison of gas analyses indicates that approximately one-fourth of the Panhandle field helium must have migrated from the north and east (Anadarko basin) and that the remaining three-fourths has moved up from the Palo Duro basin to the south. Assuming the inferred mixing ratio to be nearly correct, calculations indicate that there is sufficient radiogenic source material to the south to supply twice the assumed amount of helium and that, to the north and east, the Anadarko basin could supply ten times the calculated contribution of helium.

The paper by Pierce and his co-workers should be of interest to exploration and research geologists in Oklahoma because it offers a potential tool for the study of oil and gas migration using isotopes of the inert gases, such as helium and argon. If the parent radioelement of the helium is uranium, as the authors' evidence indicates, and if "asphaltite" is the major source of such uranium, there is direct association between the migration of helium and hydrocarbons because the asphaltite is almost certainly an organic hydrocarbon derivative.

Lithologic and stratigraphic similarity between the Panhandle field and much of the western and northwestern Anadarko basin is well known. This similarity suggests the possibility of a further investigation of isotopes which, even in trace amounts, might be recovered from the gas fields in northwestern Oklahoma northwestward into the area of the Hugoton and Keyes fields of the Oklahoma Panhandle. It seems likely that part of the possibly vast helium-generating potential of Lower Permian strata in the Anadarko basin may have moved into the Hugoton and Keyes area.

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Pierce, A. P., Gott, G. B., and **Mytton, J. W.,** 1964, Uranium and helium in the Panhandle gas field, Texas, and adjacent areas: U. S. Geol. Survey, Prof. Paper 454-G, 57 p.

Nine More Titles of Articles by C. N. Gould

Carl C. Branson

Jack D. Haley of the Division of Manuscripts recently called my attention to three items published by C. N. Gould in The University Umpire. Some years ago a list of 271 titles by Gould was published (Branson, 1959). The present nine titles duplicate some of these.

The University Umpire was issued by students of The University of Oklahoma from October 15, 1897, to 1907. It was a semimonthly until it became a monthly in 1906, and it expired with volume 10 (1906-1907). Faculty members contributed with some regularity. The Gould items are:

Oklahoma Geological Survey: The University Umpire, vol. 4, no. 4, p. 4-5, November 1, 1900 (same as in Science, new series, vol. 12, p. 559-560, October 12, 1900).

Indian pictographs: The University Umpire, vol. 4, no. 6, p. 3-5, December 1, 1900 (same as in Science, new series, vol. 11, p. 630-631, April 20, 1900, under title of *Indian pictographs in the Dakota sandstone*).

Range of the mistletoe in Oklahoma: The University Umpire, vol. 4, no. 13, p. 4-5, April 1, 1901 (same as in Plant World, vol. 4, no. 2, p. 32, February 1901).

Oklahoma bat caves: The University Umpire, vol. 4, no. 14 (as no. IX), p. 4-6, April 15, 1901 (apparently same as in Popular Science News, vol. 36, p. 225-226, 1902).

Camping among the Cherokees: The University Umpire, vol. 5, no. 4, p. 5-8, December 15, 1901.

Early days in the Arbuckles: The University Umpire, vol. 5, no. 12, p. 7-9, May 1, 1902; concluded in vol. 5, no. 13, p. 5-6, May 15, 1902.

Oklahoma names: The University Umpire, vol. 7, no. 16, p. 33-36, June 1904.

Old Fort Arbuckle in the Chickasaw Nation: The University Umpire, vol. 8, no. 1, p. 3-8, October 1, 1904.

Oklahoma waters: The University Umpire, vol. 8, no. 13, p. 2-6, April 15, 1905.

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Branson, C. C., 1959, Published work of Charles Newton Gould (1868-1949): Okla. Geol. Survey, Okla. Geology Notes, vol. 19, p. 239-252.

Sessile Foraminifera in the Pennsylvanian of Oklahoma

Carl C. Branson

Minute tubular bodies which have the appearance of worm tubes were described by Girty in 1915 (p. 40-42, pl. 5, fig. 7; pl. 6, fig. 13). He gave the new generic name *Serpulopsis* to them in 1911 (p. 124) and designated *Serpula insita* White, 1878, as type species. At that time and in 1915 Girty considered the fossil to be an abnormal type of annelid.

The type species, *Serpulopsis insita* (White) was described from fragments in shale, and the figured specimens were sessile upon a fragment of molluscan shell (White, 1883, pl. 42, fig. 8a). The species was characterized as minute, subcylindrical, tortuous. Henbest (1963) was unable to locate the types or other specimens. *Serpula insita* was collected from "an earthy, Carbonaceous layer of Coal Measure strata at Newport, Vermillion County, Ind." Bradley (1869, p. 149) reported *Serpula* from below the underclay of Coal No. 4 south of Newport and mentioned (p. 147) "great numbers of Serpulae" in "a highly fossiliferous, calcareous ironstone" exposed at low water at the mouth of Little Vermillion River. The strata exposed at Newport are now classed as Brazil Formation (highest Pottsville) near the river, and Mansfield Formation (Allegheny) in the slopes of the valley.

Henbest (1963) restudied Girty's figured specimens and other specimens from the Wewoka Formation. He showed that the shell is agglutinate, that the animal is not a burrower, and that the test has a proloculus about which the tube is coiled in the first volution. Because Girty's *Serpulopsis* has a designated type species which is little

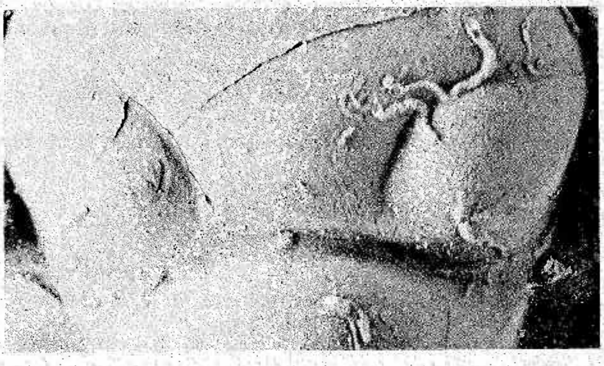

Figure 1. Minammodytes(?) **sp. Specimens adhering to cephalon of** Ameura sangamonensis, **Francis Shale. Brick plant shale pit south of Ada. x10.**
(Photograph by Neville M. Curtis, Jr.)

known and because Henbest considered that it is impossible to find an authentic neotype, Henbest gave the new name *Minammodytes* to the genus and cited *M. girtyi*, new species, as type species. The holotype of the species was selected from among those on a shell of *Composita subtilita*, the specimens figured as plate 5, figure 7 by Girty.

Loeblich and Tappan (1964) criticised Henbest for his action and contended that Girty had correctly identified *S. insita* in the Wewoka, that the specimens used by Girty are types of the genus *Serpulopsis*, and that *Minammodytes* Henbest is a junior synonym of *Serpulopsis* and *M. girtyi* a junior synonym of *S. insita*. It is here contended that Girty's genus *Serpulopsis* is based upon a presently unrecognizable fossil from rocks of mesial Desmoinesian age in western Indiana, that Girty's Oklahoma specimens are best classified, as Henbest did, as a new species, and that *Minammodytes* is actually a new genus (not merely a new name). It is unfortunate that Henbest cited it as "new name" and that he seemed to place *Serpulopsis* in synonymy. I believe he intended to place only the identification of Oklahoma specimens in synonymy. It is true that should the types of *S. insita* from Indiana be found or should neotypes be described and if these prove to be like the Wewoka specimens, then the generic name *Minammodytes* would be demonstrated to be a junior synonym, and if the Indiana form is specifically the same, *M. girtyi* a junior specific synonym.

Branson (1961) figured specimens identified as *Cornulites* (?) adhering to a trilobite cephalon from the Francis Shale. Elias (personal communication, 1961) informed me that these are probably adherent foraminifers. Henbest (1963, p. 28) doubtfully referred them to *M. girtyi*. The figure is again presented here (fig. 1).

Similar and probably related specimens have been found in Oklahoma:

On *Mooreoceras normale* from limestone in the upper part of the Nellie Bly Shale, near center sec. 1, T. 17 N., R. 10 E. (OU 3650).

On *Eolissochonetes keyesi* Muir-Wood from Boggy Shale, SW¼ sec. 3, T. 3 N., R. 7 E., Pontotoc County.

On *Reticulatia* sp. from Inola Limestone, SW¼ sec. 24, T. 17 N., R. 16 E.

On a small productid, lower part of Boggy Shale, NW cor. sec. 27, T. 3 N., R. 7 E., Pontotoc County.

On *Ameura sangamonensis* from the Francis Shale in Ada brick pit.

On *Linoproductus* sp. from same locality.

On *Neochonetes granulifer* from same locality.

On *Neochonetes granulifer* from Wewoka Formation, 0.5 mile N and 0.3 mile E of SW cor. sec. 13, T. 12 N., R. 11 E., Okfuskee County.

On *Neochonetes granulifer* from Holdenville Shale, 0.1 mile W of SE cor. sec. 36, T. 11 N., R. 9 E., Okfuskee County.

On *Chonetinella flemingi* from Wann Shale, sec. 21, T. 29 N., R. 13 E., Washington County.

On *Mesolobus* from Boggy Formation, sec. 27, T. 3 N., R. 7 E.

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Information Needed for Structure Map of Southwestern Oklahoma

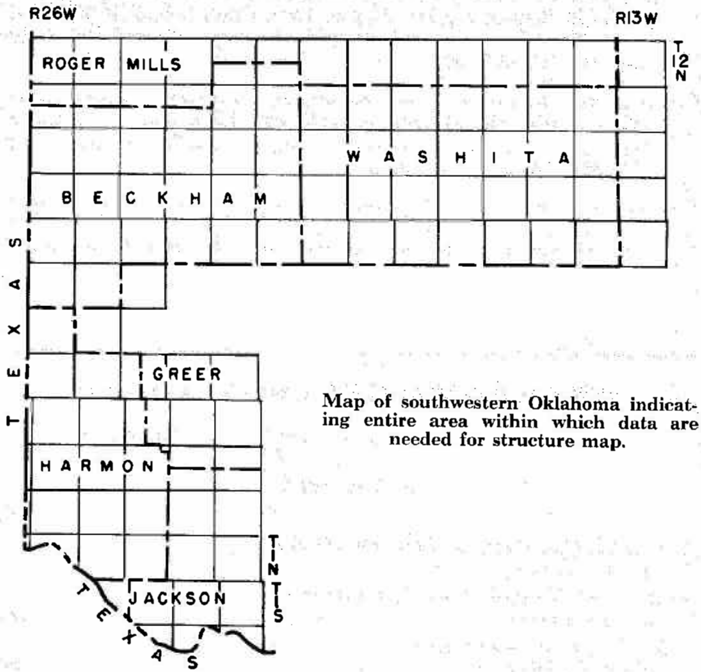
As part of a current study of the Blaine and related Permian formations the Oklahoma Geological Survey is compiling a surface and shallow-subsurface map of the Blaine Formation in southwestern Oklahoma. Compilation of subsurface portion of this study is feasible inasmuch as adequate criteria have been established to enable recognition of the datum bed on various types of logs for this sequence of interbedded gypsum and shale. The accompanying map indicates that portion of southwestern Oklahoma which is to be mapped structurally.

To date, scattered subsurface information has been obtained from electric logs, continuous cores, core-hole logs, and reliable water-well logs. Large areas still remain wherein no data are available to us, and we hope to make this study as comprehensive as possible by obtaining additional shallow-subsurface information.

Needed are data from holes more than 50 feet deep in which part or all of the Blaine Formation has been penetrated and in which the distinction between gypsum and shale can be made. The most useful logs include:

1. Lithologic descriptions of continuous cores
2. Sample logs of core holes
3. Electric logs of seismograph shot holes, water wells, or any other shallow test holes

4. Electric logs of oil and gas tests, in which recordings to within several hundred feet of the surface were made, that have not been released through Riley's Sample Log Service in Oklahoma City
5. Any other high-quality data



Map of southwestern Oklahoma indicating entire area within which data are needed for structure map.

We wish that anyone with data of the type requested would contact, or send the data to, William E. Ham or Kenneth S. Johnson at the Oklahoma Geological Survey. The source of specific information will be confidential and the data will be returned to the donor if requested.

A report on the Blaine Formation and associated strata of southwestern Oklahoma, including geologic maps, stratigraphy, economic resources, and the surface and shallow-subsurface structural map of the entire area, will be published by the Survey in about one year. Cooperation in supplying information to assist in this study will be greatly appreciated.

New Survey Publications Issued

Bulletin 98, The Blaine and related formations of northwestern Oklahoma and southern Kansas, by R. O. Fay, 238 pages, 3 figures, 24 plates. June 26, 1964. Cloth bound $4.00, paper $3.00.

Circular 65, Geology of the western part of Winding Stair Range, Latimer and Le Flore Counties, Oklahoma, by L. D. Fellows, 102 pages, 29 figures, 1 plate. July 8, 1964. Cloth bound $4.00, paper $3.00. The plate is a colored geologic map and sections of the area. Map alone $1.00.

Circular 66, Chitons from the Kindblade Formation (Lower Ordovician), Arbuckle Mountains, southern Oklahoma, by Allyn G. Smith and Donald F. Toomey, 41 pages, 2 figures, 8 plates. July 17, 1964. Paper bound $1.25.

Circular 67, The ammonoid family Girtyoceratidae in the southern Midcontinent, by J. A. McCaleb, J. H. Quinn, and W. M. Furnish, 41 pages, 8 figures, 4 plates. July 15, 1964. Paper bound $1.00.

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In This Issue