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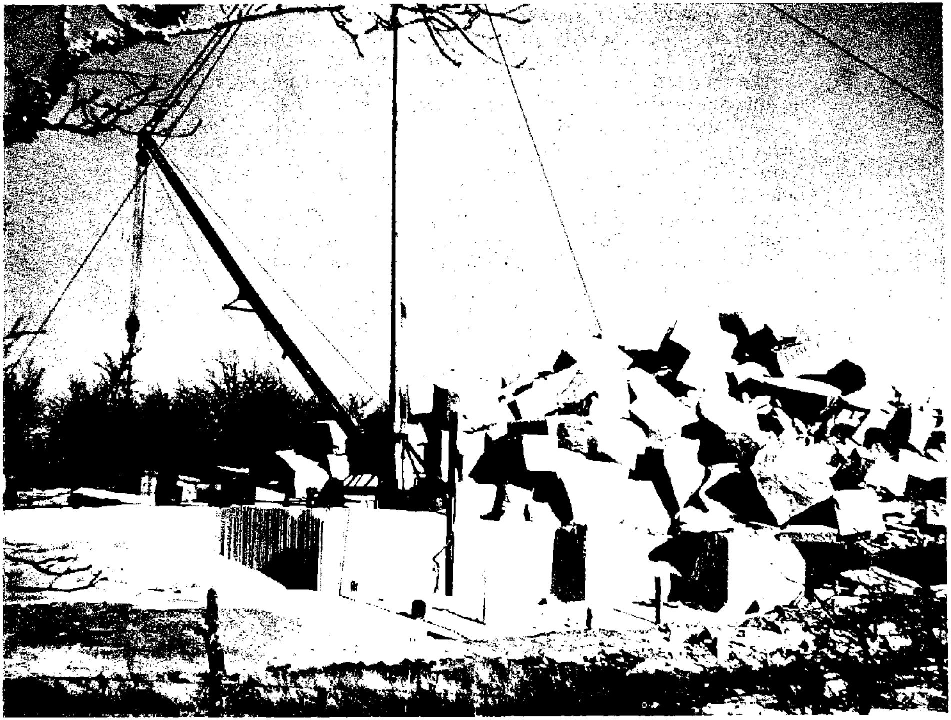
OKLAHOMA GEOLOGY NOTES



GRANITE QUARRY, JOHNSTON COUNTY

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

Cover Picture

MINERAL INDUSTRIES OF OKLAHOMA

GRANITE

Granite was one of the first stones used in Oklahoma. Both pink granite and black granite (gabbro and diorite) crop out in many bold hills of the Wichita Mountains region, and quarries were opened there in early days near the towns of Granite and Cold Springs. Low hills of pink coarse-grained granite crop out also over an extensive granite plain in the southeastern part of the Arbuckle Mountains, where the stone was worked in quarries at Tishomingo and Troy. The State Capitol in Oklahoma City, as well as post office buildings in Ardmore, Oklahoma City, and Guthrie, and the government building of the Chickasaw Nation in Tishomingo, were constructed in part from granite quarried in the Arbuckle Mountains.

All the granites in the Wichita Mountains are about 525 million years old. They were emplaced during Middle Cambrian time in the form of thick sills and irregular stocks. The rate of cooling was sufficiently different in these intrusions to produce several textural varieties, although most of the colors are shades of pink and red. The granites of the Arbuckle Mountains are much older—about 1,350 million years—and are thus of Precambrian age. Most of these granites are grayish-pink but some are dark gray.

Statistics of production of granite in Oklahoma were first recorded in 1900. Through 1963 the cumulative total was about 1.5 million tons valued at nearly $18 million. Nearly all this stone has been produced from the Wichita Mountains region, now for more than half a century the center of the granite industry in the State, and one of the well-known granite-producing districts of the world. The stone is used chiefly for monuments and for exterior trim of buildings.

At the present time five companies produce granite from six principal quarries in the Wichita Mountains and from two smaller quarries in the Arbuckle Mountains. Four large finishing plants in the Wichita Mountains—two of them near Snyder, one at Frederick, and one at Granite—saw the rough-quarried blocks into slabs, which are cut and polished to a beautiful and extremely durable finish for shipment to all parts of the United States.

Crushed granite likewise is produced intermittently for building aggregates and rip-rap, yielding a superior construction material.

Shown on the front cover is the quarry of The Century Granite Company near Mill Creek in Johnston County, near the western edge of the granite outcrops in the Arbuckle Mountains. Medium-textured grayish-pink granite quarried here is shipped for cutting and polishing at the company plant in Frederick.

—W. E. H.

THE MINERAL INDUSTRY OF OKLAHOMA IN 1963*
(Advance Summary)

ROBERT B. MCDOUGAL†

Mineral output in Oklahoma was valued at $873 million in 1963, $17.2 million more than in 1962, according to the Bartlesville, Oklahoma, office of the Bureau of Mines, U. S. Department of the Interior. Increased value of natural gas, natural-gas liquids, cement, clay, lead, lime, sand and gravel, and zinc more than offset losses in production value of coal, helium, petroleum, bentonite, gypsum, and stone. Dominant in the State's mineral industry, mineral fuels accounted for more than 94 percent of the total mineral value. Aided by the lead and zinc mining stabilization program, output of lead and zinc increased significantly. Sixteen minerals—five fuels and eleven nonfuels—were produced in Oklahoma counties. Exploration and development well drilling was widespread, although the total number of wells drilled was nearly 14 percent below that of 1962. Of 416 exploratory wells drilled, 53 were oil, 37 gas, and 326 dry. Roger Mills County was added to the list of oil-producing counties. Arkoma basin's first major natural-gas transmission line was completed near yearend. A State legislature bill raising Oklahoma oil and gas depletion allowance from 20 percent to 27.5 percent, effective in 1965, was signed into law early in June. New construction (residential, nonresidential, and public works) established a new record in 1963 as value reached nearly $1.5 billion.

MINERAL FUELS

Coal.—Slightly more than 1 million tons of coal—4 percent decline from 1962—valued at $5.7 million was produced by 14 operators at 15 mines (4 underground and 11 strip) in 7 counties. Near Hartshorne, Carbon No. 5 mine of Lone Star Steel Co. was permanently closed in September owing to dangerous roof conditions and uneconomic operating costs.

Natural gas.—Output of natural gas increased 16 percent, and value rose 18 percent above 1962. Led by Texas, Beaver, Harper, Beckham, and Garvin Counties in descending order, 64 counties reported natural-gas output. Seven gas-storage fields were used by the natural-gas industry in eight counties. Late in the year, Cities Service Gas Co. began development of an underground gas-storage field in Webb field in Grant County with completion scheduled in 1964. Estimated

*This report, U. S. Bureau of Mines, Mineral Industry Surveys Area Report IV-175, has been prepared under a cooperative agreement between the Bureau of Mines, U. S. Department of the Interior, and the Oklahoma Geological Survey, Dr. William E. Ham, Geologist, for collecting information on all minerals except fuels. The report was prepared July 20, 1964. Preliminary figures were published in Area Report IV-167, which appeared in the February 1964 issue of the Oklahoma Geology Notes, pages 19-21.

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

proved recoverable natural-gas reserves increased 5 percent to 19,139 billion cubic feet at yearend. Exploratory drilling added 382 billion cubic feet through new discoveries, and extensions and revisions added another 1,621 billion cubic feet to the gas reserves, according to the American Gas Association.

Natural-gas liquids.—Recovery of natural-gas liquids by 74 natural-gasoline and 4 cycling plants totaled about 1.4 billion gallons, a 2-percent decrease from output in 1962. New natural-gas-liquids recovery facilities placed on stream in 1963 were the 50-million-cubic-foot-per-day Mooreland plant of Pan American Petroleum Corp., the 50-million-cubic-foot-per-day Keyes plant of Colorado Interstate Gas Co., the 10-million-cubic-foot-per-day Healdton plant of Sinclair Oil & Gas Co., the 20-million-cubic-foot-per-day Enid plant of Livingston Oil Co., and the 30-million-cubic-foot-per-day Okeene plant of Pan American Petroleum Corp. Proved recoverable reserves of natural-gas liquids

TABLE I.—MINERAL PRODUCTION IN OKLAHOMA[1]

MINERAL	1962 QUANTITY	1962 VALUE (THOUSANDS)	1963 QUANTITY	1963 VALUE (THOUSANDS)
Clays[2] (thousand short tons)	737	$ 756	898	$ 911
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Helium (thousand cubic feet)	284,214	9,917	237,201	8,302
Lead (recoverable content of ores, etc.) (short tons)	2,710	499	3,192	689
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LP gases (thousand gallons)	838,903	25,223	810,894	28,981
Petroleum (crude) (thousand 42-gallon barrels)	202,732	591,977	200,238[3]	582,693[3]
Salt (thousand short tons)	5	25	4	26
Sand and gravel (thousand short tons)	4,436	4,736	5,420	6,116
Stone (thousand short tons)	14,666	18,819	13,817	16,160
Zinc (recoverable content of ores, etc.) (short tons)	10,013	2,303	13,245	3,046
Value of items that cannot be disclosed: Bentonite, cement, gem stones (1962), lime, pumice, tripoli	------	20,853	------	22,928
Total	------	$855,290[4]	------	$872,517

[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] Preliminary figure.

[4] Revised figure.

were estimated at 328.2 million barrels, a drop of 5 percent from the previous year.

Petroleum.—Output of crude petroleum in Oklahoma registered a slight drop to 200.2 million barrels in 1963 from 202.7 million barrels in 1962. Daily average production of crude oil was nearly 6.7 barrels per well, about the same as in 1962. Petroleum production was reported in 67 counties, of which Osage, Stephens, Carter, Garvin, Kingfisher, and Creek Counties led in order named. Estimated proved recoverable reserves of crude oil amounted to 1,628.1 million barrels as of December 31, 1962. The reserve was equivalent to more than 8.1 barrels of recoverable crude oil underground for each barrel of oil produced in 1963. In a move to encourage wide spacing of shallow wells and eliminate drilling of unnecessary shallow wells, the Oklahoma Corporation Commission made a revised basic formula effective for oil-well production allowables. The change permitted larger allowable increments to 20- and 40-acre wells less than 5,000 feet in depth. There was no change for wells drilled on patterns of 10 acres or less. Thirteen refineries had a total daily capacity of 411,580 barrels of crude oil and 146,930 barrels of cracked gasoline on January 1, 1963. These refineries processed about 68 percent of the State's 1963 production.

HELIUM

Helium, extracted from natural gas at the Keyes helium plant, decreased 17 percent in quantity and 16 percent in value.

NONMETALS

Nine nonmetals produced in 1963 were valued at $47.6 million—about 6 percent of the State's total mineral production value—a slight decline from 1962. Cement, clays, and sand and gravel were the only principal nonmetal commodities in which output increased in quantity and value from the previous year; gypsum and stone decreased in value although gypsum output increased.

Cement.—Output of cement by three companies at four locations was up 15 percent and value rose 11 percent. On November 1, the Dewey Portland Cement Co., Division of Martin-Marietta Corp., closed its Dewey plant and transferred work to its Rogers County plant near Tulsa, which was undergoing an expansion program to double plant capacity.

Gypsum.—Output of crude gypsum increased 4 percent above 1962, although value dropped 12 percent in the same period. Republic Gypsum Co. was constructing a $4-million wallboard plant at Duke, Jackson County. Feed for the new plant will be obtained from a quarry about 1.5 miles south of the plant.

Sand and gravel.—Johnston, Logan, McClain, Muskogee, Oklahoma, Pushmataha, and Tulsa Counties furnished 62 percent of the quantity and 70 percent of the total value of sand and gravel produced in 35 counties in 1963. Sand was used principally as building, paving, fill, and high-purity glass sand. Gravel was used largely for paving and building.

Table II.—Water Use in the Mineral Industry of Oklahoma in 1962

	Million Gallons					
	New water	Water recirculated	Total water use	Water discharged	Water consumed	New water per $ value of production in gallons
Quarries and mills	300	348	648	289	11	18.19
Coal (bituminous)	26	132	158	15	11	13.75
Metal mines and mills	38	816	854	32	6	18.87
Nonmetal mines and mills	3	----	3	3	----	1.80
Sand and gravel mines	4,874	9,215	14,089	4,781	93	1,219.14
Natural-gas processing plants	3,362	171,121	174,483	1,093	2,269	----
Petroleum	22,725	24,776	47,501	417	20,314	----
Total	31,328	206,408	237,736	6,630	22,704	97.64

Stone.—A 6-percent drop was noted in output of stone, including limestone for use in cement and lime. Comanche, Kiowa, Murray, Pontotoc, and Tulsa Counties supplied 59 percent of all stone produced in the State and 61 percent of the value. Limestone accounted for 90 percent of the total stone produced and sandstone for 1 percent; the remaining 9 percent comprised granite and chat.

Water.—Water problems, including long-range supply, quality, pollution, reuse, and treatment, received increasing attention from Federal and State agencies and private research institutions. The Federal Bureau of Mines conducted a nationwide canvass of the mineral industry to obtain 1962 water-use data. Table II is based upon results of the survey.

METALS

Lead.—Twenty-four producers reported lead output from 47 operations, compared with 19 producers at 36 operations in 1962. Output of recoverable lead in Ottawa County increased 18 percent and value increased 39 percent.

Zinc.—Recoverable zinc output in Ottawa County increased 32 percent as did the value. Twenty-five producers reported zinc ore output from 49 operations, compared with 20 producers at 40 operations.

TRI-STATE DISTRICT

Output of lead and zinc in the Tri-State district, assisted by the Lead and Zinc Mining Stabilization Program (Public Law 87-347), increased substantially over 1962. Under this program, small lead and zinc producers in the district received a total of $138,101 for sales of 2,593 tons of lead and $332,325 for sales of 11,573 tons of zinc to the General Services Administration. Lead and zinc concentrates recovered were 17 percent and 20 percent, respectively, greater than the quantity recovered in 1962; the value of the concentrates gained 26 percent and 28 percent, respectively. Oklahoma produced 75 percent of the district's lead concentrate and 79 percent of its zinc concentrate; Kansas produced 25 percent of the district's lead concentrate and 21 percent of the zinc concentrate. No production was reported from the southwest Missouri portion of the district.

Chitinozoa in the Tulip Creek Formation, Simpson Group (Ordovician), of Oklahoma*

L. R. Wilson and E. D. Dolly

The Tulip Creek Formation in southern Oklahoma contains an abundant and distinctive assemblage of Chitinozoa. This formation belongs to the Simpson Group and was placed in the Black River Stage of the Champlainian Series (Middle Ordovician) by Harris (1957) and retained there by Schramm (1964). Decker and Merritt (1931) described the stratigraphy and physical characteristics of the Simpson Group in Oklahoma, stating that the Tulip Creek Formation is 394 feet thick at the type locality, which is reported here, and consists of a basal sandstone that has been called "Wilcox" in the section north of Springer, Oklahoma. Higher are alternating shales and limestones, and toward the west a number of thin sandstones alternate with the shales. The megascopic invertebrate fauna reported consists of bryozoans, cystids, crinoids, ostracodes, trilobites, and conodonts.

COLLECTION LOCALITY

The samples examined in this study were collected 11 miles north of Ardmore on U. S. Highway 77, and about 100 yards east along Tulip Creek. The outcrop is in the NE¼ sec. 25, T. 2 S., R. 1 E., Carter County, Oklahoma. The site is structurally located on the southern limb of the complexly folded and faulted Arbuckle Mountains. The strike of the beds is essentially east-west and the southward dip ranges from nearly vertical to 75°. The lower part of the Tulip Creek Formation at this locality is covered by alluvium and only the upper 20 feet, 8 inches could be sampled. The description of this section is given below, and the seven samples (A-G) represent segments of a channel collection. It was collected by L. R. Wilson and C. C. Branson on January 13, 1961. The samples, residue preparations, and microscope slides containing the fossils described here are in the collections of the Oklahoma Geological Survey under the accession number OPC 735.

OPC 735: Outcrop in NE¼ sec. 25, T. 2 S., R. 1 E., Carter County, Oklahoma, about 100 yards east of U. S. Highway 77, 11 miles north of Ardmore.
Above sample G is the base of the Bromide Formation.

		Thickness Ft.	In.
Sample G:	Dark greenish-brown platy shale	1	0
Sample F:	Brownish fine-grained calcareous sandstone		2
	Dark greenish-brown platy shale	1	2
	Brown calcareous sandstone		3
	Greenish-gray platy shale	1	11
Sample E:	Brownish calcareous sandstone		9
	Grayish-green platy calcareous shale		8

*A study conducted under National Science Foundation Grant G-6589.

Sample D:	Reddish-brown sandstone		2
	Greenish-gray platy shale	4	6
Sample C:	Reddish-brown calcareous sandstone		2
	Green calcareous platy shale	1	2
	Brownish calcareous sandstone		2
	Olive-green to brownish platy shale		8
Sample B:	Brown calcareous sandstone		2
	Olive-green to brownish platy shale	5	0
Sample A:	Olive-green to brownish platy shale	2	9
		20	8

SAMPLE PREPARATION AND STUDY

The preparation of the Tulip Creek Formation samples for microscopic study was accomplished by digesting approximately 20 grams of rock material at a time in dilute hydrochloric acid until chemical reaction ceased. This was followed by washing and elutriation in distilled water and by digestion in 52-percent hydrofluoric acid until the silica was removed. After subsequent washings and elutriation in distilled water, the residue was examined under low magnification (Microstar microscope, 10x ocular and 5 mm objective). The technique used in the examination was to swirl approximately 5 cc of the residue in a watch glass until it was concentrated in the center. Microscope slide mounts were made from this preparation but cleared specimens were also prepared and studied. This was accomplished by removing the excess liquid from the watch glass with a pipette and adding Schulze's solution. Reaction was permitted until the desired clearing was accomplished. After additional swirling and removal of the excess liquid, the residue was washed with distilled water and a 5-percent potassium hydroxide solution was added to further clear the fossils. In most cases the potassium hydroxide was not allowed to react more than two minutes before being washed from the preparation. The above treatment generally resulted in the cleaning and concentration of many chitinozoans and hystrichosphaerids.

This chemical-treatment schedule cannot be applied to all samples because in certain rocks, such as the Sylvan Shale (Ordovician), the effect of the addition of the potassium hydroxide was found to be too drastic. In contrast, the treatment was found to be inadequate for some Polk Creek Shale (Ordovician) samples. Each rock sample must be treated with specific care if good recovery of fossils is to be accomplished. The type of rock and the degree of induration appear to be the main factors in determining the techniques to be employed and the perfection of the fossils that are recovered.

The mounting medium used in making permanent slides of the Tulip Creek Shale was Clearcol (Wilson, 1959). Fossils were removed from the concentrate and placed in a drop of Clearcol upon the cover glass and then gently distributed with a needle. The liquid was allowed to dry on a warming plate at 40°C, and then the cover glass was inverted and placed on a microscope slide in a drop of Harleco synthetic resin. This resin becomes, upon drying, a permanent and satisfactory seal.

The specimens described here were studied with a Carl Zeiss Photomicroscope and the photomicrographs were made with a Neofluar 40/0.75 objective, optivar setting 2, projective 3.2, and a medium-green filter, with Adox KB 14 film.

FOSSIL DESCRIPTIONS

Phylum PROTOZOA Goldfuss, 1818
Class RHIZOPODA Dujardin, 1841
Order CHITINOZOA Eisenack, 1931

A recent review of Chitinozoa literature has led to some doubt as to the validity of the genus *Calpichitina.* Staplin (1961) has described the fossil *Hoegisphaera glabra* which may prove to be congeneric with *Calpichitina,* but, because his description is incomplete, one must assume from his illustration (pl. 50, figs. 5-7) and from the following remarks concerning the genus that the two are similar.

> Two additional species are present in the author's collections. One occurs in the type section of the Sylvan Shale and the other in the type section of the Tulip Creek formation, both of Ordovician age, Oklahoma. The colour and texture of the walls are similar to those of Chitinozoa, but the analogy cannot be carried further.

The genus *Calpichitina* Wilson and Hedlund (1964) was described from the Sylvan Shale of Oklahoma, and the species herein described is probably from the same Tulip Creek locality noted above by Staplin. If *Calpichitina* and *Hoegisphaera* are synonymous, and the present evidence indicates that they are, it will be necessary to suppress *Calpichitina* and emend the genus *Hoegisphaera.* This the authors propose to do. Also because of the distinctiveness of the genus, it appears desirable to establish a new family of Chitinozoa to contain the genus *Hoegisphaera.*

HOEGISPHAERIDAE fam. nov.

Type genus.—**Hoegisphaera** Staplin, 1961, emended.

Tests single, noncolonial fossil organisms; subspherical or urn-shaped with low membranous collar, oral opening annulate, and a circular operculum; aboral end rounded, without structural modifications; wall 1 to 2 microns thick, opaque, bleached specimens may reveal ornamentation of low relief.

Remarks.—No established family of Chitinozoa is sufficiently inclusive to contain all the morphological structures of *Hoegisphaera;* therefore it appears desirable that an additional family be established. Structural features of the genus *Hoegisphaera* that require new family status are the presence of an operculum, low collar, simple aboral structure, and the noncolonial habit of the genus. The family Desmochitinidae contains fossils which probably are most closely related to those of Hoegisphaeridae, but they are colonial and the operculum of each test is attached to the copulum of the fossil above in a beadlike chain.

Hoegisphaera Staplin, 1961, emended
Type species.—**Hoegisphaera glabra** Staplin, 1961

Test single, subspherical, urn-shaped, slightly broader than high; operculate; oral opening annulate, approximately one-half diameter of test, collar low, may be membranous; aboral end rounded simple; unbleached specimens usually black or dark brown, bleached specimens brown to yellow; wall 1.5 to 2 microns thick, opaque to slightly translucent, outer may be smooth or variously ornamented with low-relief structures; inner smooth; operculum circular, wall similar in nature to the test, bordered by narrow thickened margin and membranous flange.

Remarks.—Ornamentation type and size of the various morphological structures appear to be taxonomic characters of specific value. The nature of the ornamentation must be viewed with suspicion because severe processing can destroy these characters. The type species, *Hoegisphaera glabra,* may be an illustration of such alteration and should be restudied. *Hoegisphaera* was described from the Duvernay Shale (Upper Devonian) of Alberta, Canada, whereas the Oklahoma specimens are from the middle and upper parts of the Ordovician System.

Wilson and Hedlund (1964), as noted above, recently published the description of the fossil *Calpichitina scabiosa* from the Sylvan Shale of Oklahoma, and in order that its nomenclature be brought up to date, the following transfer is made*.

Hoegisphaera scabiosa (Wilson and Hedlund, 1964) comb. nov.
1964. *Calpichitina scabiosa* Wilson and Hedlund, Okla. Geol. Survey, Okla. Geology Notes, vol. 24, p. 161-164, pl. 1, figs. 1-12.

Hoegisphaera bransoni sp. nov.
Plate I, figures 1-7

Holotype.—OPC 735 A-1-15. Plate I, figure 1.

Diameter 50 to 65 microns; length 39 to 49 microns; wall 1 to 1.5 microns thick; oral-opening diameter 35 to 38 microns; operculum di-

*After this manuscript had been submitted for publication, a letter, dated August 25, 1964, was received from Dr. J. Jansonius of Imperial Oil Limited, Calgary, Canada. Dr. Jansonius stated: "I think there are differences between **Hoegi[sphaera]** and **Calpi[chitina]**. For one thing the 'typical' Devonian hoegispherid forms have no collar, but only a thickened rim; also the cuticle is less pronounced two-layered than is the case in **Desmo[chitina]** and **Calpi[chitina]**. It may be wiser, therefore, not to denounce **Calpichitina,** but to acknowledge the possibility of the latter being a synonym." It is the observation of the authors that the occurrence of a collar and "two-layered" wall in **Hoegisphaera (Calpichitina)** is directly related to preservation and severity of processing. In the experiments conducted during the preparation of the chitinozoans described in this paper the collar and wall structures were easily modified by processing. Most specimens of **H. bransoni** and **H. scabiosa** are devoid of a collar. It is our opinion that a collar will be found on **H. glabra** if care is taken to process fossils of that species in the most gentle manner possible.

Explanation of Plate I

Figures 1-7. Hoegisphaera bransoni **sp. nov.**

1. **Holotype OPC 735 A-1-15. Side view showing operculum detached but associated with the test. Test diameter 61 microns, height 49 microns; wall thickness 1.5 microns; collar 4 microns high; operculum diameter 28 microns, flange 2 microns wide; ornamentation minutely verrucose to granular.**
2. **OPC 735 B-1-7. Side view showing operculum in place. Test diameter 65 microns, height 49 microns, collar 4 microns high; operculum diameter 30 microns; ornamentation of test and operculum finely verrucose, coarser toward oral end, concentrically oriented about oral opening.**
3. **OPC 735 B-1-12. Side view showing operculum in place. Test diameter 57 microns, height 47 microns, collar height 2 microns; operculum diameter 28 microns; ornamentation finely verrucose.**
4. **OPC 735 A-1-14. Side view of severely processed specimen. Test diameter 63 microns, height 39 microns, oral opening 37 microns, collar removed by processing; operculum missing; ornamentation minutely granular near collar region, remainder of test smooth.**
5. **OPC 735 B-2-9. Side view showing operculum attached and annulus with collar. Test diameter 50 microns, height 45 microns, collar 1.5 microns, annulus 2 microns wide; operculum diameter 22 microns; ornamentation irregularly verrucose.**
6. **OPC 735 B-1-14. Fragment of test and operculum in oral view. Operculum diameter 24 microns, margin 1 micron wide, annulus 1 micron wide; ornamentation of test verrucose, oriented concentrically to oral opening, operculum indistinctly verrucose, corroded center.**
7. **OPC 735 A-1-10. Operculum removed from test. Diameter 21.5 microns, thickened border 1.5 microns, flange 2 microns, ornamentation indistinctly verrucose, concentrically oriented, central portion less corroded.**

Figure 8. Conochitina **sp. A, OPC 735 D-4-2.**

8. **Side view of partially cleared specimen. Test diameter at widest portion 105 microns, narrowest portion 83 microns, height 275 microns; wall 1.5 microns thick, ornamentation reticulate net, oral-aborally compressed pattern, ridges 2-4 microns wide.**

Figure 9. Conochitina **sp. B, OPC 735 C-3-8.**

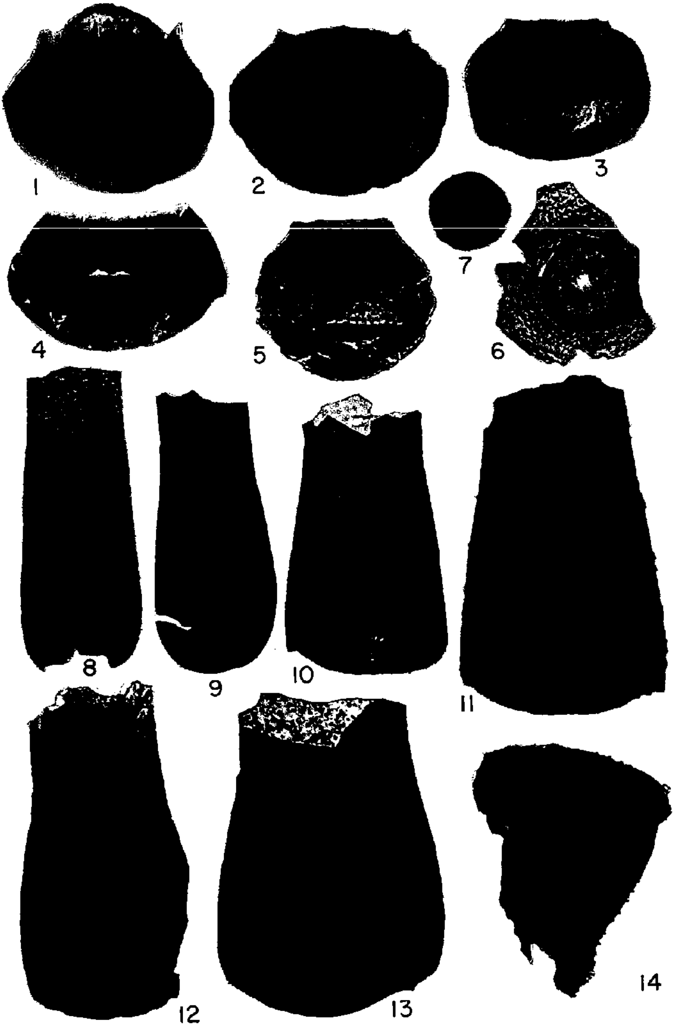
9. **Side view of a partially cleared specimen. Test at widest portion 110 microns, at narrowest portion 79 microns, oral opening 83 microns, height 245 microns; ornamentation reticulate.**

Figures 10-14. Conochitina infraspinosa **sp. nov.**

10. **OPC 735 A-1-3. Side view of partially cleared specimen showing external and internal spines on the test. Test diameter at base 69 microns, at top 51 microns, height 123 microns,**

(Explanation continued on page 230)

Plate I



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[3] Preliminary figure.

[4] Revised figure.

Family CONOCHITINIDAE Eisenack, 1931

Genus *Conochitina* Eisenack, 1931

Type species.—**Conochitina claviformis** Eisenack, 1931

Conochitina infraspinosa sp. nov.

Plate I, figures 10-14

Holotype.—OPC 735 D-1-5. Plate I, figure 12.

Test conical; diameter at base 65 to 90 microns, at neck 50 to 63 microns, height 105 to 152 microns; sides straight to slightly concave in neck region; base flat to convex, simple; oral structure not observed; wall 1.5 to 2 microns thick, opaque in unbleached specimens; ornamentation, external spines acute, 1.5 to 2 microns long, 1 micron wide at base, generally more dense near base, internal spines acute, 1 to 2 microns long, 0.5 to 1 micron wide at base, dense 2 to 4 microns apart.

Remarks.—This species is assigned to the section of the genus *Conochitina* containing *C. microcantha*. It is apparent that many unrelated forms have been assigned to *Conochitina* and that after a thorough study, which must include specimens that have been bleached to reveal internal structure, the genus should be divided into well-defined groups.

Great numbers of the above forms occur in the Tulip Creek shales, but most are fragmentary and were it not for the infraspinate character of the wall they might be mistaken for fragments of *Rhabdochitina*. This latter genus has not been definitely identified in the Tulip Creek Formation.

Conochitina sp. A

Plate I, figure 8

Typical specimen.—OPC 735 D-4-2.

Test tapered from rounded simple aboral base; diameter near aboral end 102 to 112 microns, neck region 80 to 86 microns, height 258 to 286 microns; oral structures not observed; wall 1.5 to 2 microns thick; ornamentation low reticulate wrinkles compressed oral-aborally on oral region of test, less at aboral ends, ridges 2 to 4 microns wide.

Remarks.—This chitinozoan and the following occur in less abundance than do other types in the Tulip Creek Formation. Fragmentation of most specimens prevents a more complete morphological description. Enough specimens have been observed, however, to recognize it as a probable new species, the establishment of which will be delayed pending the discovery of more complete material.

Conochitina sp. B

Plate I, figure 9

Typical specimen.—OPC 735 C-3-8.

Test tapered from round simple aboral base, lower portion slightly convexed to neck region and flaring slightly; diameter at widest part 104 to 116 microns, at neck region 74 to 82 microns, height 240 to 268 microns; oral structures not observed; ornamentation similar to above species but not so distinct.

Remarks.—Most specimens of this species are fragmentary and discovery of better material is needed before a complete description can be written.

DISTRIBUTION

The present description of Tulip Creek chitinozoans is based upon the examination of a 20-foot, 8-inch section immediately underlying the Bromide Formation, also of Ordovician age. In these rocks chitinozoans are abundant in the lower 14 feet, 7 inches and uncommon above. The rock type in which the greatest abundance was found is the green to brownish platy shales. Also, *Hoegisphaera bransoni* is more abundant in the basal portion of the section (samples A and B) than where *Conochitina* is most abundant (samples C and D). In the rock section above sample D, where chitinozoans are uncommon, hystrichosphaerids are abundant, whereas they are considerably less abundant lower in the chitinozoan beds. Megafossils, mainly bryozoans, were observed only in a thin limestone parting at the base of sample A.

References Cited

Decker, C. E., and **Merritt, C. A.**, 1931, The stratigraphy and physical characteristics of the Simpson Group: Okla. Geol. Survey, Bull. 55, 112 p., 15 pls., 11 tables, 2 figs., map.

Eisenack, Alfred, 1931, Neue Mikrofossilien des baltischen Silurs. 1.: Palaeontologische Zeitschrift, Organ der Palaeontologischen Gesellschaft, vol. 13, no. 1-4, p. 74-118, 5 pls.

Harris, R. W., 1957, Ostracoda of the Simpson Group of Oklahoma: Okla. Geol. Survey, Bull. 75, 333 p., 10 pls., 19 figs.

Schramm, M. W., Jr., 1964, Paleogeologic and quantitative lithofacies analysis, Simpson Group, Oklahoma: Amer. Assoc. Petroleum Geologists, Bull., vol. 48, p. 1164-1195.

Staplin, F. L., 1961, Reef-controlled distribution of Devonian microplankton in Alberta: Palaeontology, vol. 4, pt. 3, p. 392-424, 4 pls.

Wilson, L. R., 1959, A water miscible mountant for palynology: Okla. Geol. Survey, Okla. Geology Notes, vol. 19, p. 110-111.

Wilson, L. R., and **Hedlund, R. W.**, 1964, **Calpichitina scabiosa**, a new chitinozoan from the Sylvan Shale (Ordovician) of Oklahoma: Okla. Geol. Survey, Okla. Geology Notes, vol. 24, p. 161-164.

Two New Genera of Lower Pennsylvanian Ammonoids from Northern Arkansas

James A. McCaleb*

Recently, two new representatives of the ammonoid families Schistoceratidae and Berkhoceratidae have been found in northern Arkansas. The author extends his sincere appreciation to J. H. Quinn, University of Arkansas, and W. M. Furnish, State University of Iowa, for their aid in collection of specimens and preparation of the manuscript.

Family SCHISTOCERATIDAE Schmidt, 1929
Subfamily SCHISTOCERATINAE Schmidt, 1929

Genus *Retites* McCaleb, new genus
Type species:—**Retites semiretia** McCaleb, new species

Retites has a rounded to subrounded conch and a moderately open umbilicus, with a tendency toward lateral and ventral flattening of the whorls. The thick test is covered by reticulate ornamentation, and the transverse lirae form a deep ventral sinus and a pronounced ventrolateral sulcus. On the holotype of the type species (SUI 11683), the longitudinal lirae are least pronounced on the venter and the umbilical shoulders. This ornamentation is strongly developed in the position of the ventrolateral sulci, in association with weak grooves. Also the conch has a series of moderately pronounced transverse constrictions, which follow the same configuration as the lamellae. On the umbilical shoulder ribs are formed. The ribbing is somewhat variable, depending on conch shape, for the subrounded form has weaker ribbing. *Retites* appears to represent the earliest member of the well-known group of Pennsylvanian ammonoids, the Schistoceratidae.

The distinctive appearance of the suture alone (pl. I, fig. A) serves to define this genus and is an important characteristic for *Retites*. serving to differentiate it from several closely similar forms, such as *Reticuloceras, Branneroceras,* and *Gastrioceras.* The secondary saddle of the ventral lobe is less than one-half the height of the first lateral saddle. Prongs of the ventral lobe and the first lateral lobe are wide and asymmetric.

Initially *Retites* was identified with a form which is probably its direct descendant, *Branneroceras.* However, significant differences can be shown between these two genera. A direct comparison in the form of the suture indicates that *Retites* is more primitive. The conch measurements are listed in table I. The ornamentation on the venter is variable in *Retites* and consistent in *Branneroceras.* Constrictions are prominently developed on *Retites,* but are rare on *Branneroceras.*

The genus *Retites* occurs in the Cane Hill and Prairie Grove Members of the Hale Formation in northern Arkansas, and is not known to

*Pan American Petroleum Corporation, Casper, Wyoming.

provided suitable transportation, played important parts in the search for the locality, and helped in collection of specimens. Dr. A. G. Unklesbay of the University of Missouri provided needed information about type specimens. The Faculty Research Committee of The University of Oklahoma allotted funds for travel.

References Cited

Branson, C. C., 1935, Fresh-water invertebrates from the Morrison (Jurassic?) of Wyoming: Jour. Paleontology, vol. 9, p. 514-522, pls. 56-57.

__________ 1936, New name for a Morrison ostracode genus: Jour. Paleontology, vol. 10, p. 323.

Harper, Frances, and **Sutton, A. H.,** 1935, Ostracodes of the Morrison Formation from the Black Hills, South Dakota: Jour. Paleontology, vol. 9, p. 623-628, pl. 76.

Jones, T. P., 1886, On some fossil Ostracoda from Colorado: Geol. Magazine, ser. 3, vol. 3, p. 145-146.

Peck, R. E., 1937, Morrison Charophyta from Wyoming: Jour. Paleontology, vol. 11, p. 83-90, pl. 14.

Pinto, I. D., and **Sanguinetti, Y. T.,** 1962, A complete revision of the genera **Bisulcocypris** and **Theriosynoecum** (Ostracoda) with the world geographical and stratigraphical distribution including **Metacypris, Elpidium, Gomphocythere** and **Cytheridella:** Rio Grande do Sul, Universidade, Escola de Geologia, Publicação Especial 4, 164 p., 17 pl.

Richardson, A. L., 1950, Geology of the Mayoworth region, Johnson County, Wyoming: Wyo., Univ., unpublished Master of Arts thesis, 62 p., map.

Roth, Robert, 1933, Some Morrison Ostracoda: Jour. Paleontology, vol. 7, p. 398-406, pl. 48.

Sohn, I. G., 1958, Middle Mesozoic non-marine ostracodes of the Black Hills: Wyo. Geol. Assoc., Guidebook, 13th Ann. Field Conf., p. 120-126.

Yen, Teng-Chien, 1952, Molluscan fauna of the Morrison formation: U. S. Geol. Survey, Prof. Paper 233-B, p. 21-51.

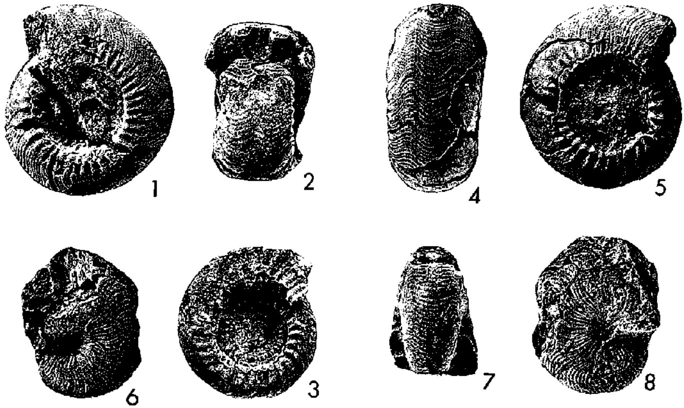
Borings in a Lenapah Fossil

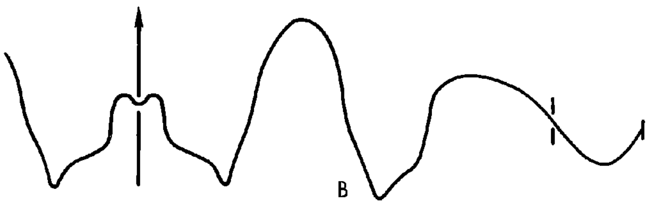
Carl C. Branson

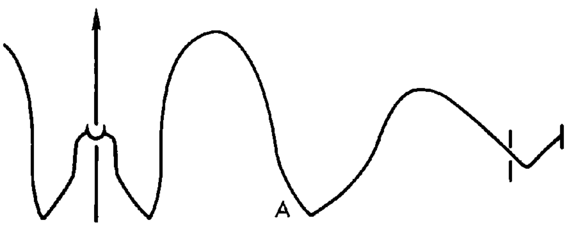
Records of pits made by a boring organism in Paleozoic shells are remarkably few. Girty figured two specimens from the Wewoka (1915, pl. 1, figs. 9, 10a) and I figured two more from the same formation (1964, p. 166, figs. 1a, 1b). A specimen collected by J. R. Faucette is recorded as from the Lenapah Limestone in NE¼ sec. 28, T. 25 N., R. 15 E., Nowata County (1954, p. 23; 1955, p. 246). The borings are in a crinoid stem segment and all are surrounded by swellings made by deposition of carbonate by the crinoid animal. The fossil cannot be distinguished from the Wewoka form.

Oakes has shown that the Lenapah Limestone is continuous with the highest sandstone of the Wewoka (1952, fig. 3). The occurrence of the boring organism in the Lenapah and Wewoka is corroboration of his correlation.

Plate I







cut in Fayetteville, Washington County, Arkansas, one block east of the campus of the University of Arkansas. Other specimens referable to this species have been found in the Prairie Grove Member of the Hale Formation. All known occurrences are in northern Arkansas.

Types.—Holotype SUI 11683, figured paratype SUI 11682, Department of Geology, State University of Iowa. Numerous unfigured specimens are in the collections of the State University of Iowa and of the University of Arkansas.

Superfamily DIMORPHOCERATACEAE Hyatt, 1884
Family BERKHOCERATIDAE Librovitch, 1957

Genus *Cymoceras* McCaleb, new genus
Type species:— **Cymoceras miseri** McCaleb, new species

The surface of the test is ornamented by a series of sinuous transverse lirae, which form a lateral salient and ventral sinus. The conch has an involute lenticular shape at a moderately early stage, with a small closed umbilicus.

The relationship of *Cymoceras* and *Neodimorphoceras* is readily apparent in the nearly identical form of the conch and ornamentation, but is less apparent in the relationship of the sutures of the two forms. Examination of immature forms of *Neodimorphoceras* (Miller and Owen, 1939, text-figs. 8, 9) indicates that the suture of *Neodimorphoceras* passed through a closely similar ontogenetic stage.

It appears *Cymoceras* is the progenitor of *Neodimorphoceras;* the first known occurrence of the latter is in the lower Winslow Formation (Quinn and Carr, 1963, table 1). It is believed that a progenitor for *Cymoceras* is in the goniatite assemblage of the slightly older Hale Formation, and specimens referable to this general lineage have been secured.

Cymoceras miseri McCaleb, new species
Plate I, figures 6-8, B

Three well-preserved specimens of *Cymoceras miseri* are available; the largest (pl. I, figs. 6-8, SUI 11633) serves as the holotype. The type has a maximum conch diameter of 17 mm, a height of 9 mm, a width of 7.5 mm, and an umbilical diameter of 0.5 mm. The conch is subrounded in the smaller paratype, becoming sublenticular in the type. Pronounced biconvex transverse lirae form a sinus in the position of the second lateral saddle, a salient in the position of the first lateral saddle, and a moderately shallow ventral sinus.

The suture (pl. I, fig. B) shows a strong affinity with *Neodimorphoceras* (Miller and Owen, 1939, text-figs. 8, 9), although it is definitely more primitive. In the smaller specimen at a diameter of 8 mm the ventral and lateral lobes are more nearly symmetrical than those figured in plate I, figure B.

Remarks.—The generic name was selected in reference to the rippled appearance of the internal mold marked by transverse ornamentation.

The specific name honors Hugh D. Miser, who has contributed greatly to the geological knowledge of the southern Midcontinent region.

It appears that *Cymoceras miseri* is the progenitor of the Middle Pennsylvanian dimorphoceratids. However, as yet no more direct evidence than the phylogenetic trends is available. From the primitive nature of the suture of *C. miseri*, it is suspected that there is yet another intermediate form between the Brentwood species and that of the Winslow Formation. With the possible exception of specimens referred by Plummer and Scott (1937, p. 340) to *Dimorphoceras politus* from the Smithwick Shale, no other occurrences of this species are known in the United States.

Occurrences.—The holotype and paratype are from the type locality of the Brentwood Member of the Bloyd Formation, on the east side of U. S. Highway 71, half a mile northeast of Woolsey, Washington County, Arkansas, SW¼ NE¼ sec. 16, T. 14 N., R. 30 W. Other specimens are possibly from the Smithwick Shale in McCulloch County, Texas. One small specimen which is referable to this species is from 100 yards northeast of the intersection of Opossum Walk Creek and Little Red River (NW¼ NW¼ sec. 29, T. 11 N., R. 15 W.), about 5 miles north of Scotland, Van Buren County, Arkansas.

Types.—Figured holotype (pl. I, figs. 6-8, B, SUI 11633) and unfigured paratype (UA Coll. L 91 WL 1), in repository, State University of Iowa.

References Cited

Miller, A. K., and **Owen, J. B.**, 1939, An ammonoid fauna from the lower Pennsylvanian Cherokee formation of Missouri: Jour. Paleontology, vol. 13, p. 141-162, pls. 17-20.

Plummer, F. B., and **Scott, Gayle**, 1937, Upper Paleozoic ammonites in Texas, in The geology of Texas, vol. 3: Texas, Univ., Bur. Econ. Geology, Bull. 3701, pt. 1, p. 1-516, 42 pls.

Quinn, J. H., and **Carr, C. L.**, 1963, New Pennsylvanian **Diaboloceras** from northwest Arkansas: Okla. Geol. Survey, Okla. Geology Notes, vol. 23, p. 111-118, pl. 1.

Gem and Mineral Show in Tulsa

With "Rockhounding is Family Fun" as the theme, the Tulsa Rock and Mineral Society will hold its third biennial show October 23-25, in the Women's Building, at the Tulsa Fairgrounds. Lapidary work, jewelry and metalcraft, fossils, and minerals will be displayed by Tulsans and by senior and junior members of seven other Oklahoma rockhound clubs. The state geological surveys of Arkansas, Missouri, and Oklahoma will also provide special exhibits. W. T. Born of the Geophysical Research Corporation, Tulsa, is chairman of the show. Basing his estimate upon the popularity of previous Tulsa rock shows, Born predicts an attendance of six to eight thousand.

Morrison Fresh-water Fauna in Wyoming

Carl C. Branson

Mr. Elmer Brock (now deceased) owned a ranch near Mayoworth, Wyoming, and in 1933 he guided E. B. Branson and me to a locality of abundant fresh-water fossils in the Morrison Formation on his ranch. I described and figured these in a published paper (Branson, 1935). The fauna consists of three species of the unionid *Vetulonaia;* five species of snail, two belonging to a new genus; and two species of ostracodes, one the type species of a new genus. The chosen generic name of the ostracode proved to be a homonym and it was renamed *Theriosynoecum* (Branson, 1936). One specimen of a charophyte oögonium was found in the material. Two years later I revisited the locality and obtained numerous charophyte oögonia, which were submitted to R. E. Peck (1937), who described them as *Chara verticillata,* (now *Sphaerochara), Aclistochara bransoni,* and *A. latitruncata* (now *Latichara*).

The ostracode fauna was compared with that described by Jones (1886) from Canon City, Colorado, and that described by Roth (1933) from the Black Hills. Later in 1935 Harper and Sutton described an ostracode faunule from the "Morrison" of Lawrence County, South Dakota. Roth's material and that of Harper and Sutton have been shown to come not from the Morrison but from the Lakota (Sohn, 1958).

The importance of obtaining new and more extensive material and of establishing the precise locality of the Mayoworth find was recognized. On June 24, 1964, J. E. Keenan of Mobil Oil Company (Casper, Wyo.) and his son John provided a jeep and accompanied me on a search for the locality. In 1935 no detailed map existed and the location was given as three miles south of Mayoworth. Keenan provided a copy of sheet 2 of Tongue-Powder River Basins Survey map of the Bureau of Reclamation. With its aid the locality was found and determined to be in and south of the saddle in SW¼ SW¼ NE¼ sec. 14, T. 44 N., R. 83 W., Johnson County, Wyoming (fig. 1, loc. A), at an elevation of 5,300 feet above sea level. The unpublished thesis of Richardson (1950) supplied a geologic map. Yen's (1952, p. 31) localities 32 and 33 may be the same as mine.

The invertebrates occur in a lentil, 0 to 18 inches thick, exposed for 100 yards along the east side of the ravine, and a small area of the lens is exposed in the saddle 300 yards southeast of the principal exposure (NE¼ NW¼ SE¼ sec. 14; fig. 1, loc. B). The eastward-draining wash contains hundreds of unionid shells eroded from the lens and deposited in the gravels along the dry wash (fig. 3).

The north end of the lens has few unionids but great quantities of dinosaur bone fragments. Mr. Brock pointed out the spot as the place that a Carnegie party excavated a dinosaur skeleton.

The lens consisted of 4 to 6 inches of dark sandy clay with numerous unionids, grading downward into greenish-gray clay. Locally are pockets of red indurated iron-rich sand and small concretions, and other pockets of fine-grained sandstone with a green clay matrix. Most of the fossils are in these pockets of very fine-grained sandstone with a green clay matrix. The irregularity of distribution of the biota is puzzling. One charophyte oögonium was found in 1933, many in 1935, but the samples collected in 1964 contain only a few internal molds. In samples taken from the lens at all levels and from several positions along its extent unionids occur in all samples, ostracodes and charophytes in but one, those in a pocket near the middle of the lateral extent of the lens.

In my 1935 paper I did not give catalog numbers of the types, all of which are deposited in the paleontological collections of the Univer-

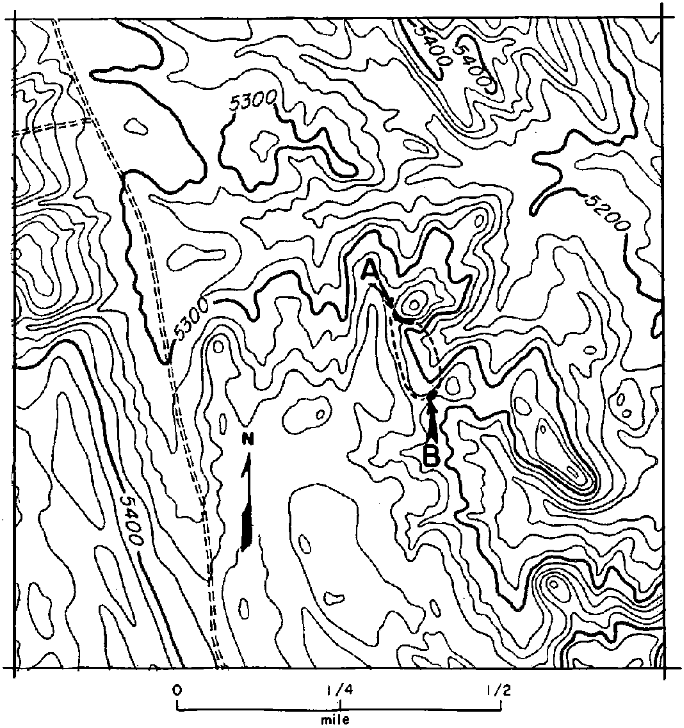


Figure 1. Topographic map of sec. 14, T. 44 N., R. 83 W., Johnson County, Wyoming. Dark areas marked A and B are present outcrops of fossiliferous lens; dashed line indicates conjectured original extent of lens before erosion. A is best locality; B is weathered remnant of the lens.

(Drawn from Bureau of Reclamation map)

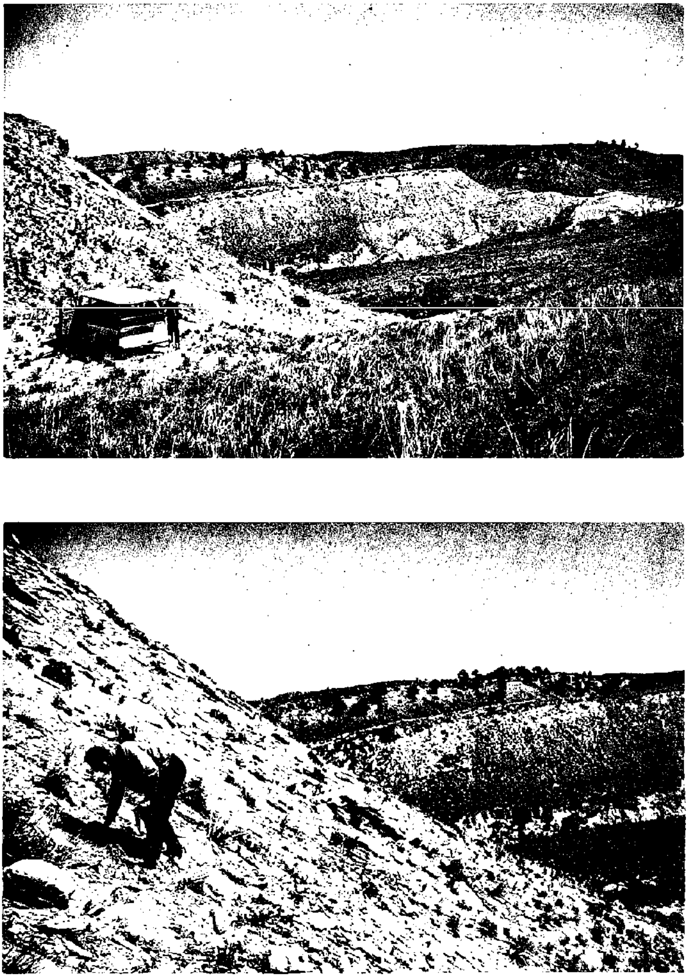


Figure 2. Two views of the Morrison Formation outcrop in which the fossil-bearing lens is exposed. This is locality A of figure 1, viewed from the northwest. The lens crops out immediately below the figure in the lower photograph.

(Photographs by J. E. Keenan)

sity of Missouri. With the kind help of A. G. Unklesbay, who supplied the catalog numbers (letter of July 15, 1964), and the use of a copy of my paper upon which my father had entered these numbers, they are here supplied.

Catalog Numbers of Types of Morrison Invertebrates
University of Missouri Collection (MU)

Vetulonaia whitei Branson, 1935		
holotype, pl. 56, figs. 1-3, 10		MU 6558
paratype, pl. 56, figs. 4, 8	(3 specimens)	MU 6570
right valve, pl. 56, fig. 5		MU 6559
left valve, pl. 56, fig. 15		MU 6556
left valve, pl. 56, figs. 12, 13		MU 6563
left valve, pl. 56, fig. 19		MU 6557
(Reillustrated by Yen, 1952, pl. 3, figs. 6a, b)		
V. ? nucalis (Meek and Hayden), 1861		
right valve, pl. 56, fig. 6		MU 6564
V. mayoworthensis Branson, 1935		
holotype, pl. 56, figs. 11, 17, 18		MU 6560
metatype, pl. 56, figs. 7, 9, 14, 16		MU 6562
(Unklesbay noted in his letter that the specimen shown as *V. whitei* and as fig. 9 is the same specimen as that of figs. 14, 16.) (Reillustrated by Yen, 1952, pl. 3, fig. 7.)		
Pentagoniostoma altispiratum Branson, 1935		
holotype, pl. 57, figs. 1-3		MU 6647
P. jurassicum Branson, 1935		
cotype ("syntype"), pl. 57, figs. 4, 6		MU 6648
cotype ("syntype"), pl. 57, fig. 5		MU 7299
(The specimen figured as figs. 4 and 6 is here selected as holotype.) (Yen, 1952, referred the species to *Tropidina*.)		
Valvata? jurassica Branson, 1935		
holotype, pl. 57, figs. 7, 8		MU 7297
(Yen, 1952, referred the species to *Liratina*.)		
Viviparus gilli Meek and Hayden, 1861		
typical specimen, pl. 57, figs. 9, 10		MU 6646
(Possibly *Amnicola gilloides* according to Yen, 1952.)		
Lioplacodes veternus? Meek and Hayden, 1861		
specimen, pl. 57, fig. 11		MU 6655
(Yen, 1952, referred the form doubtfully to *Lymnaea ativuncula*.)		
Planorbis veternus Meek and Hayden, 1861		
average specimen, pl. 57, fig. 12		MU 6653
typical specimen, pl. 57, fig. 13		MU 6654
(Referred by Yen, 1952, to *Gyraulus*.)		

Darwinula acuminata? Roth, 1934
average specimen, pl. 57, fig. 14 — MU 6652
(In view of the unsatisfactory preservation of the Morrison specimens and of the fact that Roth's species has proved to be from the Lakota, the specimen is better classified as *Darwinula* sp.)

Metacypris minnekahtensis (Roth), 1934
complete specimen, pl. 57, fig. 15 — MU 6660
another specimen, pl. 57, fig. 16 — MU 6659
(Because specimens are not well preserved and because Roth's form is from the Lakota, the specimens are better classified as *Metacypris*? sp.)

Theriosynoecum wyomingense (Branson, 1935), Branson, 1936
cotypes ("syntypes"), pl. 57, figs. 17-21 — MU 6656
(A holotype cannot be selected at this time and further study is under way.)

The ostracode genus *Theriosynoecum* has proved to be widespread geographically and to occur in Upper Jurassic and Lower Cretaceous rocks. Investigators have referred some 20 species to the genus and, by inference, some hundreds of species. This latter referral would make the genus a dumping ground for incompletely understood Upper Jurrasic and Lower Cretaceous nonmarine species, just as Pinto and Sanguinetti have used their genus *Bisulcocypris*. Further study of the Morrison specimens is being undertaken on the basis of the new collections.

The process of obtaining the information contained in this paper was made possible by several people. J. E. Keenan and his son John

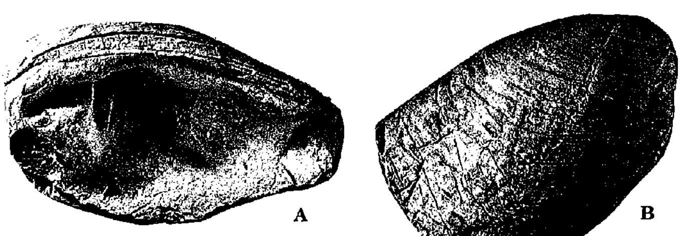


Figure 3. Vetulonaia whitei **C. Branson, x1 (OU 4530). This uninid bivalve is abundant at the Mayoworth locality.**
A. Interior of right valve of a metatype.
B. Exterior of right valve of another metatype.

(Photographs by Jan Cannon)

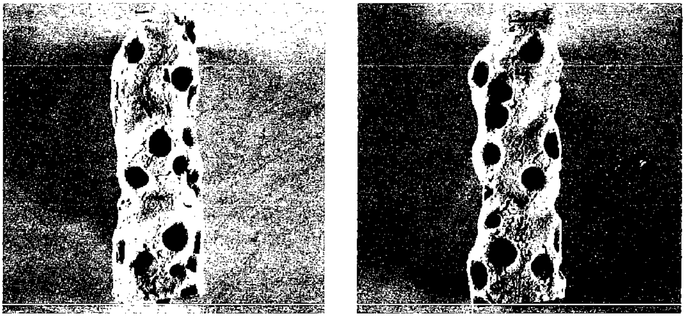


Figure 1. Two views of a portion of a crinoid column (OU 4897) pitted by a boring organism, x2.
(Photograph by Jan Cannon)

References Cited

Branson, C. C., 1964, Traces of a shell-boring organism: Okla. Geol. Survey, Okla. Geology Notes, vol. 24, p. 166-167.

Faucette, R. M., 1954, The geology of the Marmaton Group of southern Nowata County, Oklahoma: Okla., Univ., unpublished Master of Science thesis, 66 p.

__________ 1955, The geology of the Marmaton Group of southern Nowata County, Oklahoma: Tulsa Geol. Soc., Digest, vol. 23, p. 239-259.

Girty, G. H., 1915, Fauna of the Wewoka formation of Oklahoma: U. S. Geol. Survey, Bull. 544, 271 p.

Oakes, M. C., 1952, Geology and mineral resources of Tulsa County, Oklahoma: Okla. Geol. Survey, Bull. 69, 234 p.

OKLAHOMA GEOLOGY NOTES

Volume 24 October 1964 Number 10

IN THIS ISSUE

Page

The Mineral Industry of Oklahoma in 1963
ROBERT B. MCDOUGAL 219

Chitinozoa in the Tulip Creek Formation, Simpson Group (Ordovician), of Oklahoma
L. R. WILSON AND E. D. DOLLY 224

Two New Genera of Lower Pennsylvanian Ammonoids from Northern Arkansas
JAMES A. MCCALEB 233

Morrison Fresh-Water Fauna in Wyoming
CARL C. BRANSON 238

Borings in a Lenapah Fossil
CARL C. BRANSON 243

Granite 218

Gem and Mineral Show in Tulsa 237