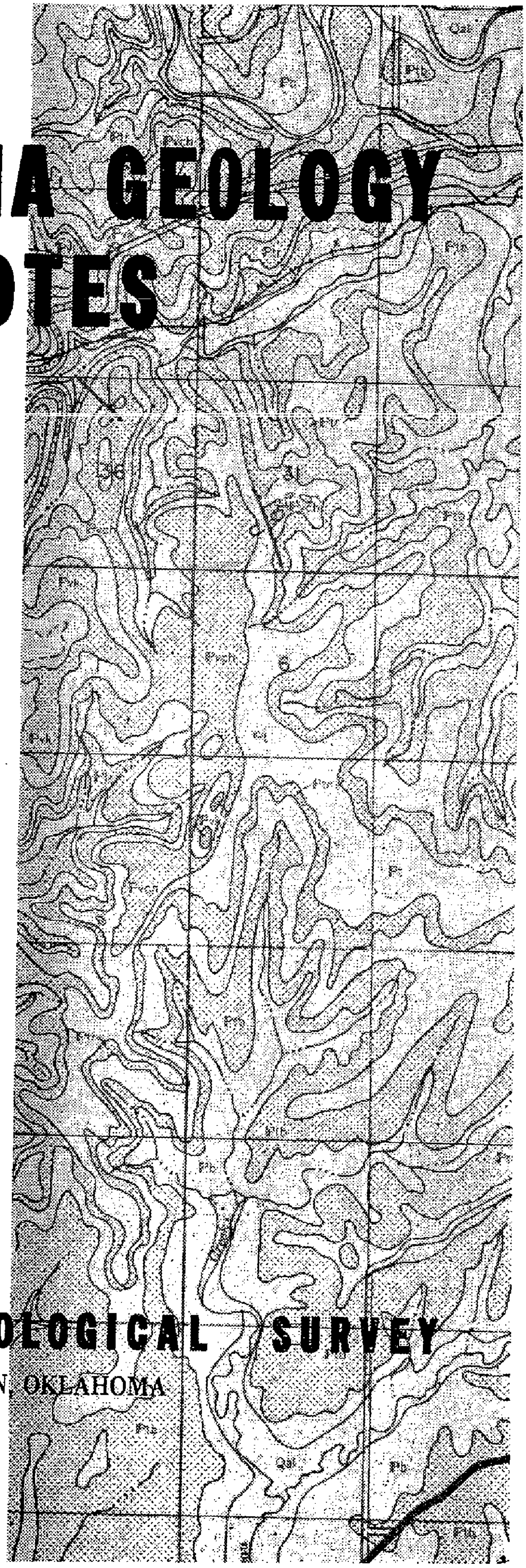
OKLAHOMA GEOLOGY NOTES



OKLAHOMA GEOLOGICAL SURVEY

NORMAN, OKLAHOMA

VOL 18, NO. 4
APRIL, 1958

STATUS OF SURVEY PUBLICATIONS

Bulletin 76. Igneous geology of the Lake Altus area, Oklahoma, by C. A. Merritt. 70 pages, 6 plates, including colored geologic map, one figure (aeromagnetic map), 10 tables. Price $2.75 bound in blue cloth, $2.00 in paper. Released January 31, 1958.

Bulletin 77. Geology of the south and west flanks of the Ozark uplift, Oklahoma, by G. G. Huffman. 281 pages, 26 tables, 22 figures, 5 colored geologic maps, structural map. Book and structural map printed, 5 colored maps past color proof. To be released in April.

Bulletin 78. Stratigraphy and paleontology of the Hunton group in the Arbuckle Mountain region. Part II. Haragan articulate brachiopods, by Thomas W. Amsden. Part III. Supplement to the Henryhouse brachiopods, by Thomas W. Amsden. Part IV. New genera of barchiopods, by Arthur J. Boucot and Thomas W. Amsden. Approximately 200 pages, 14 plates, 42 figures. In press, available in June.

Bulletin 79. Geology of Pawnee County, by Paul B. Greig. Map in drafting room. Manuscript completed.

Bulletin 80. Geology of Harper County, by Arthur J. Myers. Manuscript and maps completed. Drafting and edited started.

Bulletin 81. Geology of Creek County, by Malcolm C. Oakes and Louise Jordan. Mapping completed, drafting begun. Manuscript in first draft.

Guide Book VI. Subsurface stratigraphic names of Oklahoma, by Louise Jordan. 220 pages, 212 figures. Released December 31, 1957. Price $3.00.

Mineral Report 34. Mineral industries of Oklahoma 1956 and 1957, by Peter Grandone and William E. Ham. Ready in May.

Mineral Report 35. Gypsum resources of the Clinton-Weatherford area. Field work and chemical analyses completed.

A CHITINOZOAN FAUNULE FROM THE SYLVAN SHALE OF OKLAHOMA

L. R. WILSON

Chitinozoans are extinct marine chitinous or "pseudochitinous" microfossils whose stratigraphic range is known to be from the Middle Ordovician to the Middle Devonian. They appear to be related to the rhizopod protozoans. The lithologies from which these microfossils have been recovered in acid residues are limestones, cherts, and shales. The greatest abundance has been found in gray shales whose environment of deposition appears to have been shallow marine to brackish water.

The Sylvan shale, an Upper Ordovician formation, crops out extensively in the Arbuckle Mountains. Over much of that area it is a greenish-gray shale and contains a megascopic fauna of seven species of graptolites and one species of brachiopod (Amsden, 1957).

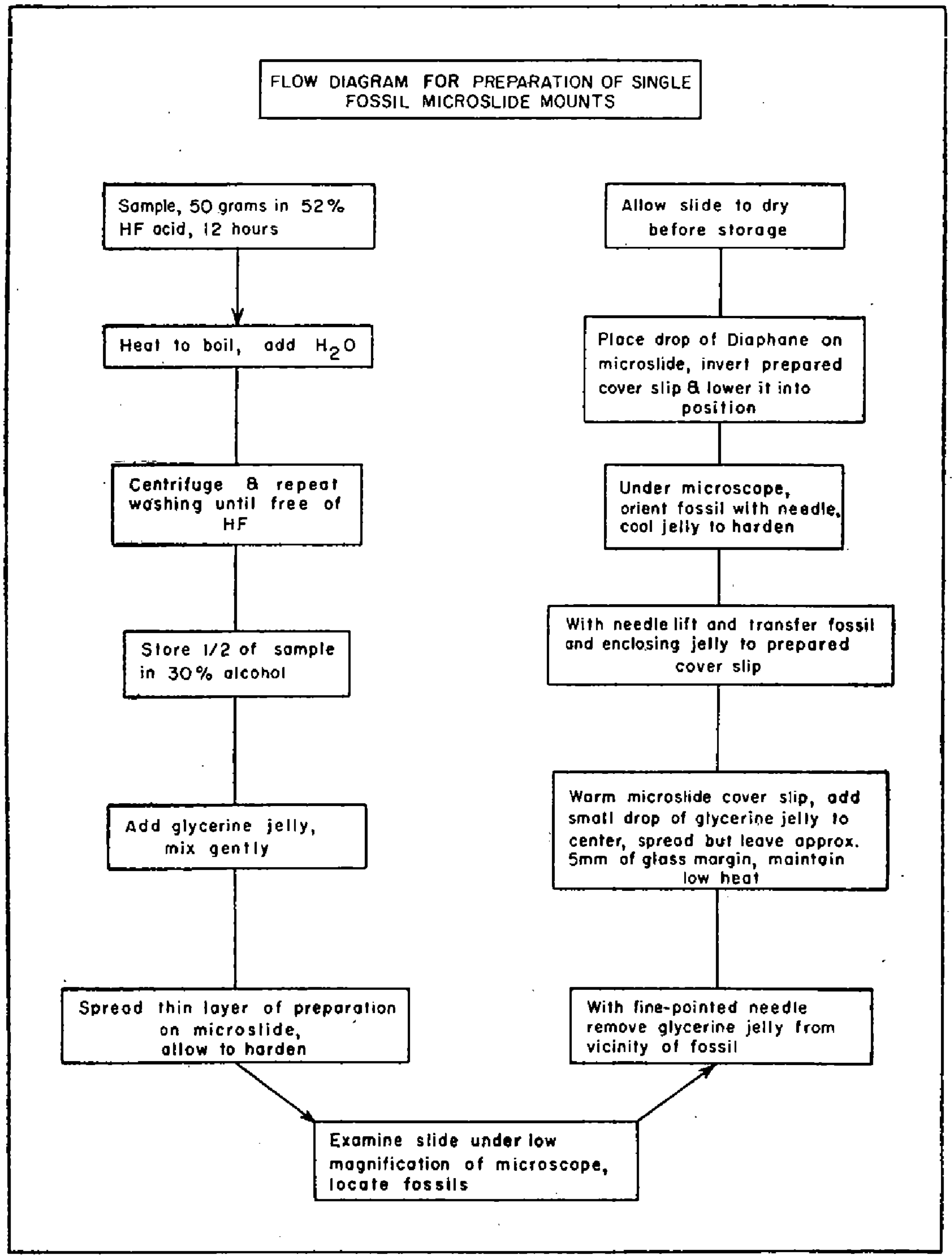
The location at which the chitinozoans reported in this note were collected is approximately four and one-half miles south of Davis on U. S. Highway 77. It is on the west side of the highway at the first exposure of the Sylvan shale as one enters the mountains from the north. The description is as follows: NE¼ SE¼ NW¼ sec. 30, T. 2 S., R. 2 E. in Murray County, Oklahoma. The Sylvan shale here is exposed in a cliff and the strata are dipping steeply. Spot samples were collected from the lower contact with the Viola limestone and up through the section at approximately five foot intervals. All of the chitinozoans reported here are from approximately one hundred feet above the base of the Sylvan shale.

The literature on Chitinozoa is sparse, consisting of less than two dozen papers, most of which are European. The name Chitinozoa was first used by Eisenack in 1931 for an undescribed group of chitinous microfossils found in the Ordovician and Silurian rocks of East Prussia. In 1933, Stauffer reported the first chitinozoan from North America under the name *Rhabdochitina? minnesotensis*. In 1942, Cooper described the additional occurrence of chitinozoans in the Ordovician, Silurian, and Devonian rocks of the United States, but published only an abstract with no localities. Whittington, in 1955 reported finding Stauffer's chitinozoan species in the Viola limestone, Upper Ordovician, of Oklahoma. The first detailed study of American chitinozoans also appeared in 1955, the work of Collinson and Schwalb. In their paper the occurrence, systematic position, paleobiology, paleoecology, systematic paleontology of families, genera, and species are discussed. Two new genera, *Ampullachitina* and *Illichitina*, eleven new species, and transfer of thirteen earlier described species to other genera are proposed.

An examination of the Sylvan shale has revealed the existence of five named Chitinozoan genera and specimens distinctive enough to warrant the description of two additional genera. A total of eleven species, all of them undescribed, were observed in the faunule. In the assemblage an abundance of hystrichosphaerids, and graptolite fragments, and also a few scolecodonts occur. In this preliminary notice the chitinozoan fauna is being illustrated without applying names other than generic where they exist. The illustrated specimens are in the University of Oklahoma geology collections.

Methods

The recovery of chitinozoans from their rock matrices is usually quite simple with the use of acids. They occur with the insoluble residues if the rocks are processed in acetic, hydrochloric, or hydrofluoric acid. Calcareous rocks should be treated first with hydrochloric acid if the use of hydrofluoric acid is anticipated. This order will prevent the formation of calcium fluoride crystals within the microfossils and reduce the associated sediment on the microslides. Chitinozoans can often be "picked" from the washed acetic or hydrochloric acid residues without further processing, but if the lithology is shale it is desirable to process the rock sample with hydrofluoric acid. A schedule of that method is shown in Figure 1. It also



includes the procedure for making single specimen microslide mounts of chitinozoans and other similar fossils.

If one desires to clear chitinozoans and make them translucent for internal study, that may be done by processing the insoluble residue with potassium chlorate and nitric acid. Care must be taken to prevent overtreatment for the fossils are destroyed soon after reaching a translucent state. When the thoroughly washed residue has been obtained the excess water is removed and the residue covered with two or three times its volume by a saturated solution of potassium chlorate. To the residue and potassium chlorate solution *carefully* add two or three times the volume of concentrated nitric acid. When the initial reaction has ceased a test slide may be made by securing with a pipette some of the residue from the bottom of the container. This residue is placed in a watch glass and carefully washed. A microslide mount may then be made of the residue and examined under the microscope. Usually the clearing process requires less than an hour to be completed and several test slides should be made. To stop the chemical reaction in the container, water is added and the residue is concentrated either by decantation or centrifuging.

Chitinozoans are amber-colored, brown, or black and require no stain, but stain may be useful if the associated microfossils are studied. Safranine 0 is a satisfactory stain for most of these fossils and they are more affected if the solution is slightly alkalized with sodium or potassium hydroxide. The degree of staining can be determined by test slides.

Photomicrography is an important part of chitinozoan studies and the employment of infrared photography and color transparencies often reveals greater detail of certain morphological structures than the usual black and white films. A striking example of photomicrography with Plus-X and Infrared films is shown on Plate 1, Figures 8 and 9. To the eye and to Plus-X film the specimen in Figure 8 is opaque under the microscope, but in photomicrographs taken with Infrared film, Figure 9, a structure is apparent at the aboral end of the chamber and presumably inside. This illustration, and others, suggests that greater use of infrared photography for morphological studies might permit the separation of closely related species. Color transparencies are easily made through the microscope and when projected reveal features not always apparent to the microscopist.

References

Amsden, Thomas W. 1957. Catalog of fossils from the Middle and Upper Ordovician of Oklahoma. Okla. Geol. Surv., Circular 43, p. 1-43.

Collinson, Charles and Howard Schwalb 1955. North American Paleozoic Chitinozoa. Ill. State Geological Survey, Rept. of Investigations 186, p. 1-33, 2 pls., 12 figs.

Cooper, C. L. 1942. North American Chitinozoa (abst.). Geol. Soc. Amer., Bull., vol. 53, p. 1828.

Eisenack, Alfred, 1931. Neue mikrofossilien des baltischen Silurs, I. Paleontologische Zeitschrift Bd. 13, Seite 74-118, Taf. 1-5.

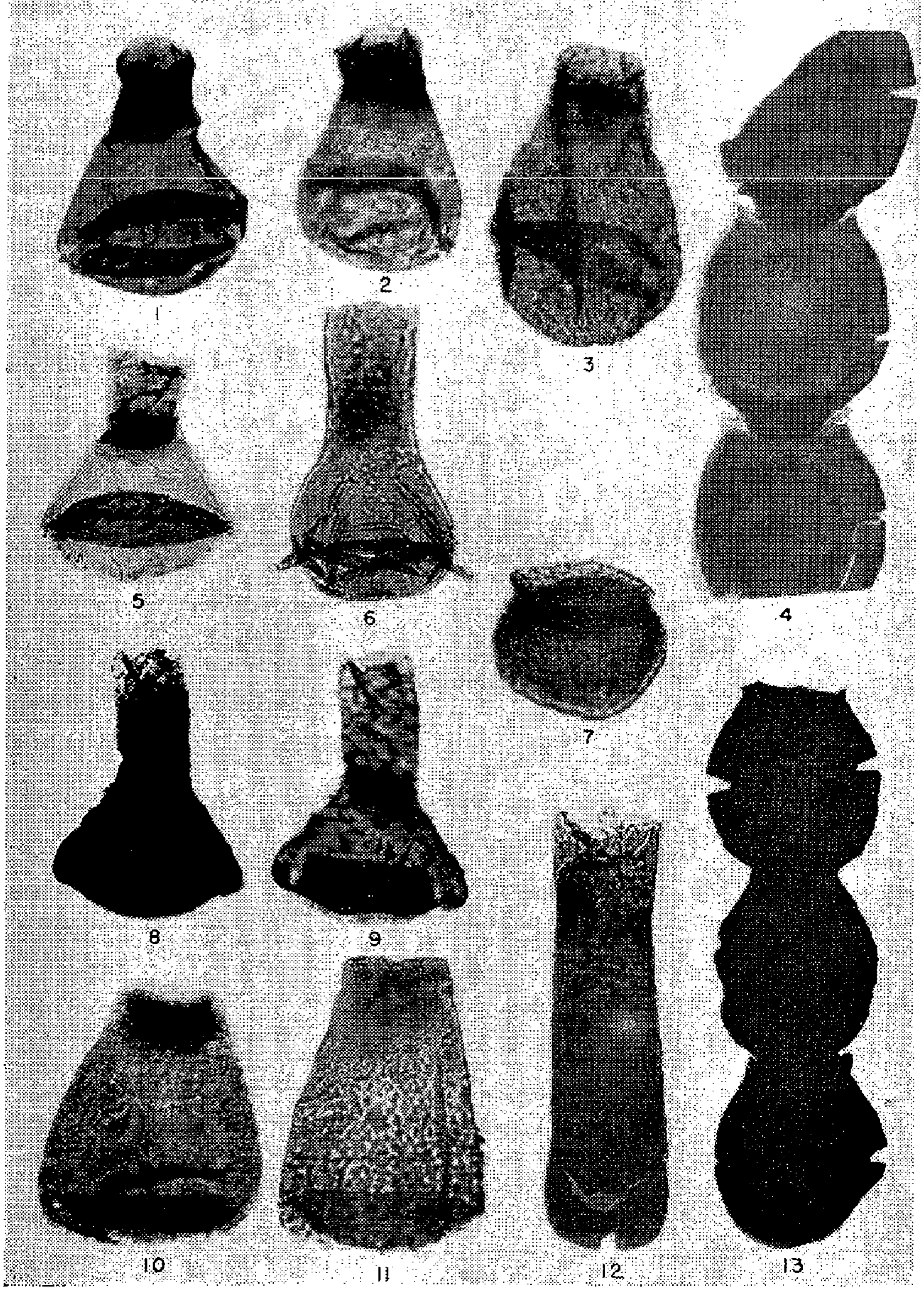
——— 1955 A. Chitinozoen, Hystrichosphären und andere Mikrofossilien aus dem *Beyrichia*–Kalk. Senckenbergiana Lethaea Bd. 36, Seite 157-88, Taf. 5, Abb. 13.

——— 1955 B. Neue Chitinozoen aus dem Silur des Baltikums und dem Devon der Eifel. Senckenbergiana Lethaea Bd. 36, Seite 311-319, Taf. 1, Abb. 1.

Stauffer, C. R. 1933. Middle Ordovician Polychaeta from Minnesota. Geol. Soc. Amer., Bull. vol. 44, p. 1173-1218, pls. 59-61.

Whittington, H. B. 1955. Additional new Ordovician graptolites and a chitinozoan from Oklahoma. Jour. Paleontology, vol. 29, pp. 837-851, pls. 83, 84, figs. 1-19.

PLATE I



Explanation of Plate I*

FIG. 1. *Lagenochitina* sp. 1. Slide No. 37. Length 48 mu, width 31 mu.
FIG. 2. *Lagenochitina* sp. 2. Slide No. 39. Length 46.5 mu, width 33 mu.
FIG. 3. *Angochitina* sp. 1. Slide No. 40. Length 49.5 mu, width 34.5 mu.
FIG. 4. *Desmochitina* sp. 1. Slide No. 46. Length 120 mu, width 37.5 mu. Compare with Figure 13, an untreated specimen.
FIG. 5. *Ampullachitina* sp. 1. Slide No. 41. Length 43.5 mu, width 37.5 mu.
FIG. 6. *Ampullachitina* sp. 2. Slide No. 44-1. Length 55 mu, width 30 mu.
FIG. 7. *Desmochitina* sp. 2. Slide No. 44-2. Length 22.5 mu, width 33 mu.
FIG. 8. Genus A, sp 1. Slide No. 11. Length 64.5 mu, width 48 mu. Specimen photographed with Plus-X film.
FIG. 9. Genus A, sp. 1. Same as Figure 8, but photographed with Infrared film. Note internal structure at aboral end and spines on surface.
FIG. 10. Genus B, sp. 1. Slide No. 44-3. Length 48 mu, width 48 mu.
FIG. 11. Genus B, sp. 1. Slide No. 48. Length 52.5 mu, width 37.5 mu.
FIG. 12. *Rhabdochitina* sp. 1. Slide No. 42-1. Length 150 mu, width 43.5 mu.
FIG. 13. *Desmochitina* sp 1. Slide No. 13. Length 105 mu, width 33 mu.

*All specimens except those in Figures 8, 9, and 13 have been treated with potassium chlorate and nitric acid to render them translucent.

New Topographic Mapping in Oklahoma

Oklahoma has long suffered from sparsity of coverage by adequate maps. They are needed for geologic work, for highway planning, for irrigation surveys, for civic development programming, for tax assessments, pipe lines, and many other purposes. The best standard map is the U. S. Geological Survey topographic quadrangle. Progress has been slow in building a coverage in Oklahoma because State agencies have not been able to contribute matching funds. Recent arrangements have greatly accelerated the mapping.

Seventeen new 7½-minute quadrangles are planned for the Tulsa Metropolitan Planning Commission, of which 8 are now published. Twelve 7½-minute quadrangles and one 15-minute quadrangle in the Oklahoma City area are now available. The Oklahoma City water district has sponsored 13 7½-minute quadrangles in its reservoir area and 13 along the pipe line route. Some of these will be printed soon. Five 15-minute and two 7½-minute quadrangles around Vance Air Force Base (Enid) are printed. Four 15-minute quadrangles around Clinton Air Force Base are nearly finished and 7 more are scheduled.

Six 7½-minute quadrangles in Ottawa County are scheduled. The Warner and Briartown sheets are to be prepared. Ten 15-minute quadrangles in McCurtain and LeFlore Counties are being surveyed. Four 15-minute quadrangles along the Red River in Bryan and Marshall Counties are in preparation. Eight 15-minute quadrangles along the Red River in southwestern Oklahoma are authorized. Twenty-three 7½-minute quadrangles in the Wichita Mountains have been issued by the Army Map Service, but the civilian edition will not be available until December 1958.

The 1/250,000 topographic map series is scheduled for completion by 1960. Fourteen sheets will be needed for full coverage, and of these 7 have been issued (the Clinton sheet was released in November).

The tabulation of topographic coverage shows:

	State Coverage	*Issued*	*Scheduled*	*Remainder*
1-250,000	14	7	7	0
1-125,000	83	38	0	45
1-62,500	317	51	32	224
1-24,000	1219	62 & AMS 24	50	1088

The 30-minute (1-125,000) maps are old and obsolete. The area of 99 15-minute quadrangles is covered only by these. In terms of 7½-minute quadrangles, of which 1,219 are needed for coverage, the present status is:

Issued at 1-24,000	62
at 1-62,500 only	148
at 1-125,000 only	412
at 1-250,000 only	124
Scheduled at 1-24,000	74
Scheduled at 1-62,500	101
Authorized at 1-62,500	19
Scheduled at 1-250,000	284

New Names for Pennsylvanian Mollusks

It has long been realized that assignment of Paleozoic clams to such living genera as *Leda, Nuculana, Nucula,* and *Yoldia* was probably not good practice. Girty set up the genus *Nuculopsis* for one species and Schenck moved many species to *Nuculopsis* and *Palaeonucula.* Elias has set up the genus *Girtyana* for a Morrowan species which had been referred to *Leda.* He also imported Chernyshev's genus *Polidevcia* for *Nuculana vaseyana, Nuculana attenuata,* and *Nuculana bellistriata* (Stevens). He placed *Yoldia glabra* in *Orthoyoldia* Verrill and Bush, a Recent subgenus of *Yoldia. Leda inflata* is placed in *Phestia* by Chernyshev. In a recent paper, Lintz has established the new genus *Culunana* for shells of the type *Leda bellistriata* Stevens and the new genus *Paleyoldia* for *Yoldia glabra* Beede and Rogers.

We now have a superfluity of generic names for nuculid and ledid shells. Oklahoma species affected are:

Leda rugosa Honess 1924 (nude name) = Girtyana honessi Elias 1956
Nucula anodontoides Meek 1871 = Palaeonucula? anodontoides
Nucula parva McChesney 1860 = Nuculopsis croneisi Schenck
Nucula wewokana Girty 1911 = Palaeonucula wewokana
Nucula arata Hall 1852 = Culunana arata
Nucula ventricosa Hall = Nuculopsis ventricosa
Leda bellistriata Stevens = Culunana bellistriata
Leda bellistriata attenuata Meek 1872 = Culunana attenuata
Leda meekana Mark = Culunana meekana
Leda prolongata Morningstar = Culunana prolongata
Yoldia glabra Beede and Rogers 1898 = Paleyoldia glabra
Nuculites vaseyana McChesney 1860 = Polidevcia vaseyana
Nuculopsis ventricosa of Girty = Nuculopsis girtyi Schenck
Nucula (Nuculopsis) subventricosa Elias 1957 = Nuculopsis subventricosa

Nucula (Nuculopsis) anodontoides minuta Elias 1957 = Palaeonucula anodontoides minuta

Lintz studied specimens of *Paleyoldia glabra* from the Wewoka near Ada and from the Otterville from near Gene Autry. His paper is on the fauna of the Ames and Brush Creek shales of the Conemaugh formation of western Maryland (Jour. Paleontology, vol. 32, p. 97-112, pl. 16, Jan. 1958). Paleontologists should not seek a classical origin of the name *Culunana* for the author states that it is an anagram of *Nuculana.*

C.C.B.

FRISCO BRACHIOPOD FROM A HUNTON CORE, POTTAWATOMIE COUNTY

THOMAS W. AMSDEN and GEORGE G. HUFFMAN

It has been the common practice of most subsurface investigators to refer the coarse- to fine-grained cherty limestones of the upper part of the Hunton to the Bois d'Arc formation. The recent stratigraphic and paleontologic study of the Hunton group in the outcrop area by Amsden (1957) suggests that at least locally the Bois d'Arc of subsurface usage may well include some Frisco strata, although in the absence of faunal data this is only conjectural. Recently the writers have identified a brachiopod, "*Rensselaeria elongata*" (Conrad), from a Hunton core obtained from the Smith Bros. No. 1 Kytle-Ray at a depth of 4,930 feet (SW¼ NE¼ NW¼ sec. 36, T. 8 N., R. 2 E., Pottawatomie County). This fossil, which is reasonably complete and well preserved, permits an accurate correlation with the Frisco formation of the outcrop area in Pontotoc and Coal Counties. In so far as the writers are aware this is the first Frisco fossil to be identified from the subsurface and therefore a brief discussion on the stratigraphic relations of the Frisco and Bois d'Arc formations is included.

The Bois d'Arc formation was described by Reeds in 1911 (p. 265), the type locality being on Bois d'Arc Creek in Pontotoc County. In his first publication this author included all of the upper part of the Hunton in this formation, although he did note that in the type area the upper 40 feet might be Oriskany in age. Some years later Reeds (1926, p. 13) removed the upper, thick-bedded limestones which carry an Oriskany fauna from the Bois d'Arc formation and placed them in the Frisco formation. In 1957 these two formations were redescribed by Amsden (p. 38-45, pl. 3) in a paper which included a discussion on lithology, fauna and surface distribution. The Bois d'Arc formation was divided into two members, the lower composed primarily of cherty marlstones, the Cravatt member, and the upper of relatively pure calcarenites (locally cherty), the Fittstown member. The contact between these two members was described as gradational and it was noted that the entire Bois d'Arc probably represented a facies of the Haragan (faunal studies made since the publication of this paper fully support the stratigraphic evidence of a facies relationship). The Fittstown member can be easily distinguished stratigraphically from the overlying Frisco formation as the latter is thicker-bedded and almost free of silt and clay. Faunally these two are distinct, the Fittstown beds carrying a Helderbergian fauna whereas the Frisco has a Deerparkian (Oriskany) fauna. Although the Frisco and Fittstown beds are readily distinguished at the surface on both stratigraphic and faunal grounds, they are lithologically enough alike to make their separation extremely difficult on the basis of subsurface data. The microfauna of the late Hunton is largely unknown, and in view of the rarity of identifiable megafossils in cores it seems probable that in most wells these surface divisions of the upper Hunton will not be recognizable.

The fossil from the Kytle-Ray core is an unusually large terebratuloid brachiopod which is over three-fourths free from the matrix (fig. 1). It has a strongly biconvex shell which is relatively thick in proportion to its width; the dimensions are: length 65 mm (estimated), width approximately 38 mm, thickness 46 mm. The posterior tip of the pedicle valve is broken, but otherwise the preservation is good, including that of the finely costellate ornamentation. The writers are not attempting a precise specific identification as the Frisco fauna is currently under detailed study by William Ventress, but this specimen is clearly a large member of the subfamily Rensselaeriinae, and is similar in many respects to *Rensselaeria elongata* (Conrad 1839; see Cloud 1942, p. 57, pl. 4, figs. 21-24) from the Oriskany sandstone.

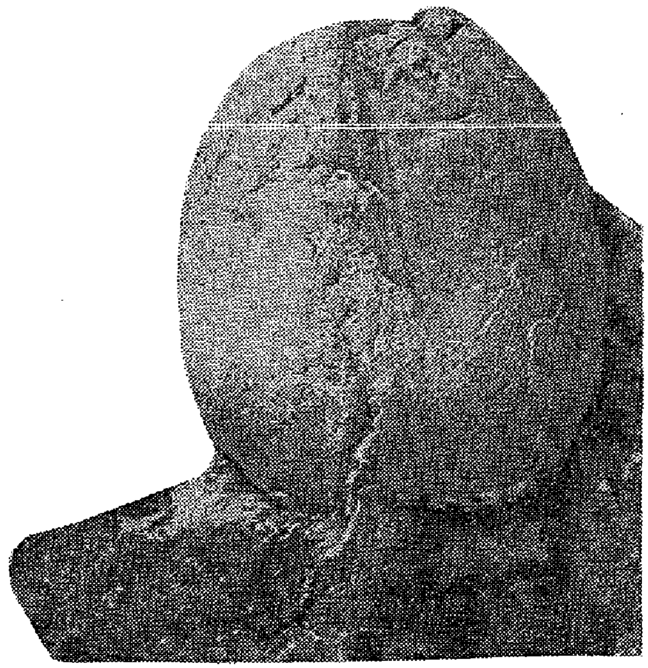


FIGURE 1. Lateral view of "*Rensselaeria elongata*" (Conrad) (x1). This specimen is from a core taken at a depth of 4930 feet, Smith Bros., No. 1 Kytle-Ray; SW NE NW sec. 36, T. 8 N, R. 2 E., Pottawatomie County.

"R. elongata" is certainly a Frisco fossil of Deerparkian age. Amsden has collected similar large terebratuloids from strata of undoubted Frisco age in the outcrop area. Moreover, extensive collecting from the Bois d'Arc formation has failed to yield any large costellate Rensselaeriinae, the only terebratuloid in this formation being the small, paucicostate *Rensselaerina haraganana* Cloud (which is also present in the Haragan formation).

The enclosing matrix is an oil-stained, coarse-grained, fossiliferous limestone that is predominantly a bioclastic calcarenite. Much of the fossil debris is crinoidal and shows some evidence of fragmentation and recrystallization. The HCl insoluble residue (calculated by weight) is a surprising 30 percent, with most of the residue composed of clear, subangular quartz fragments ranging up to 0.2 mm in diameter. The Frisco at the surface is also predominantly a bioclastic calcarenite (locally cherty), but it differs in having a much lower insoluble residue. Four different specimens of Frisco have been chemically analyzed and these have a $CaCO_3$ content ranging from 97 percent to over 99 percent (Amsden 1957, p. 48). The $MgCO_3$ content is also low, less than one percent, and this is probably also true of the rock from the core as it reacts strongly to dilute HCl.

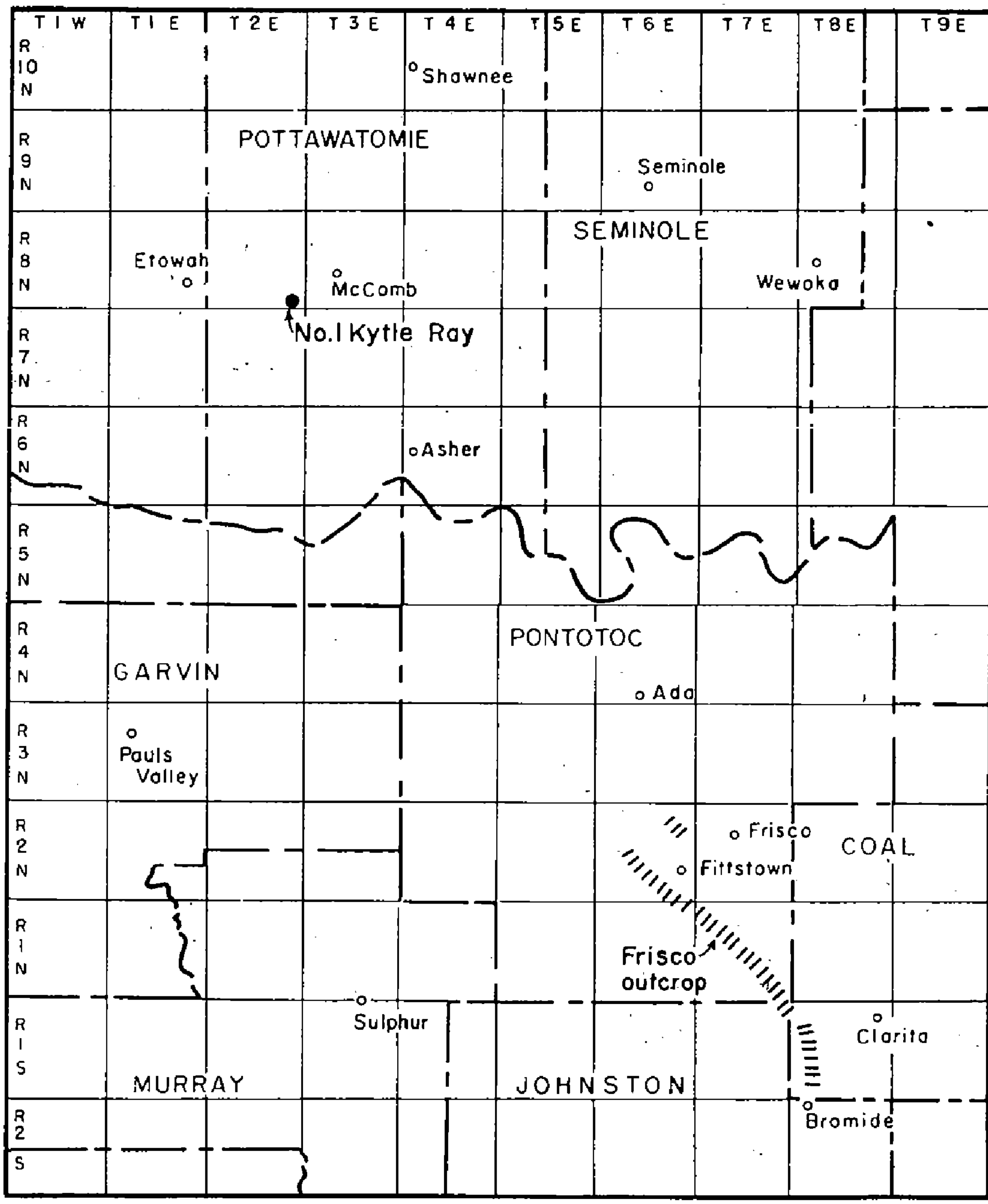


FIGURE 2. Map showing the location of the Kytle-Ray well and the surface distribution of the Frisco formation in its type area, Arbuckle Mountain region.

The relationship of the Kytle-Ray well to the outcrop of the Frisco formation in the type area is shown in figure 2. The Frisco formation has also been identified in the vicinity of Marble City in the northern part of Sequoyah County (Schuchert 1922, p. 669; Huffman 1958, p. 33-35).

REFERENCES

Amsden, T. W., 1957. Stratigraphy and paleontology of the Hunton group in the Arbuckle Mountain region: Part I—Introduction to stratigraphy: Oklahoma Geol. Survey, Circular 44, p. 1-57.

Cloud, P. E., Jr., 1942. Terebratuloid Brachiopoda of the Silurian and Devonian: Geol. Society of America, Special Paper No. 33, p. 1-182, 26 pls.

Huffman, G. G., 1958. Geology of the flanks of the Ozark uplift: Oklahoma Geol. Survey, Bull. 77, p. 1-281, illustrations and maps.

Reeds, C. A., 1911. The Hunton formation of Oklahoma: American Jour. Sci., vol. 182, p. 256-268.

Reeds, C. A., 1926. The Arbuckle Mountains, Oklahoma: American Museum Nat. History, Jour., vol. 26, p. 463-474, 11 figs.; Oklahoma Geol. Survey, Circular No. 14, p. 1-15, 11 figs.

Schuchert, C., 1922. Devonian of Oklahoma, with special reference to the Oriskany and Camden formations: Geol. Survey of America, Bull., vol. 33, p. 665-670.

Final Chapter of Redoak Hollow Fauna

Dr. Maxim K. Elias has completed his study of the fauna of the Redoak Hollow sandstone member of the Goddard formation. Part 4: Gastropoda, Scaphopoda, Cephalopoda, Ostracoda, Thoracica, and Problematica appeared in the Journal of Paleontology, vol. 32, no. 1, p. 1-57, January 1958. The total fauna consists of:

	genera	new genera	species	new species
Foraminifera	4	0	4	0
Porifera	2	0	4	3
Crinoidea	6	0	6	2
Echinoidea	1	0	1	0
Annelida	2	0	2	1
Penetrating organisms	3	0	3	1
Bryozoa	17	1	41	22
Brachiopoda	20	0	31	11
Pelecypoda	26	1	37	15
Gastropoda	16	0	21	6
Scaphopoda	2	0	2	0
Cephalopoda	4	0	5	2
Trilobita	1	0	1	0
Ostracoda	15	0	23	14
Thoracica	2	1	3	3
Problematica	2	1	2	1
Total	123	4	186	81

The weight of the fossil evidence is that the Goddard is Mississippian in age. In that case, Penn Caney becomes a misnomer and should be eliminated from stratigraphic terminology.

The nude names of Elias' paper of 1956 continue to cause confusion. The following nude names are validated or otherwise treated in 1958.

1956 nude name	*1958 name*
Bucanopsis reticulatus	B. (Retispira?) reticulata
Baylea (Trepospira) inflata	B. (T.) stellaeformis Hyde
	B. (T.) inflata n. sp. on p. 8
Cerithioides? gleanensis donaldi	C. ? gleanensis n. var.
Amaurotoma knighti	A. ? knighti
A. ? aspeniana floweri	A. ? knighti
Auriptygma primitia	A. sp. A, but A. primitia on p. 9
Protocycloceras randolphense meeki	Cycloceras meeki
Leaia americana	not described
Sansabella bassleri	S. keslingi
Glyptopleura geissi	G. geisi, G. geissi on p. 25, p. 35
Polytylites kelletae	P. ? kellettae
Turrilepas stenzeli	T. whithersi
Clarkeolepis clarki	C. clarkei

The above deviations illustrate the undesirable characteristics of nude names. No editor should permit their use.

Elias concludes that the Goddard shale is Mississippian in age although there are many Pennsylvanian species in its fauna. C.C.B.

A Record of *Psaronius* in the Wolfcampian of Oklahoma

David L. Vosburg
Department of Geology, University of Oklahoma, Norman

INTRODUCTION

A silicified stem fragment of the late Paleozoic tree-fern, *Psaronius* Cotta, was collected by the writer from the Wolfcampian in Osage County, Oklahoma, near the town of Fairfax. This is believed to be the first record of *Psaronius* in the state.

Psaronius was described (1832) from German specimens, and to date, most of the *Psaronius* studies have been on European material. Stenzel (1864) (1906) discussed the anatomical structure of several species, and critically reviewed the literature on *Psaronius*. Zeiller (1890) described several species from the Coal Measures and Permian of Autun and Epinac of France. A comparison between *Psaronius* and the modern Marattiaceae was made by Rudolph (1906). Hirmer (1927) developed a classification based on the number of peripheral leaf bundles observed in transverse section, and on the vertical or spiral arrangement of leaves on the stem.

Discovery and study of *Psaronius* in North America has been chiefly confined to the eastern Mid-Continent region of the United States. Farmer and Hill (1902) published a discussion of the vascular system of some Marattiaceae, and included *Psaronius* as having possible affinity with the family. Macbride (1904) described *Psaronius borealis* Macbride from the Des Moines series of the Pennsylvanian in Iowa. Farr (1914) reviewed the genus and suggested that *Psaronius* might be a seed-fern and a member of the Pteridospermae. He based his theory on the association of *Psaronius* wood with the leaves of *Pecopteris sterlzeli* (sic, Farr) which resembles the seed-bearing *Pecopteris pluckeneti* Brogriart. Hoskins (1928) included the genus in a review of Pennsylvanian plants from Illinois, and Noé (1931) reported *Psaronius* in Pennsylvanian coal-balls of Illinois and other states of the Mid-Continent region. Graham (1935) also reported the genus in coal-balls of Illinois, but made no specific determination. *Psaronius peoriensis* Gillette and *Psaronius septangulatus* Gillette were described from Illinois in 1937, with a discussion of the morphology of *Psaronius giffordi* (Lesqx.) Andrews and Mamay (1952) reported an undetermined species from the coal pits of the Pittsburg and Midway Coal Mining Company near the town of Mineral, Kansas, in the eastern part of that state.

In South America, Solms-Laubach (1904) and F. Pelourde (1912) reported one species, *Psaronius brasiliensis* Brongniart, from Brazil.

The youngest rock known to contain the genus is the Triassic Bunter beds of Germany, from which Frentzen (1920) described *Psaronius triassicus.*

The genus *Psaronius,* as reported, ranges from the Lower Coal Measures of England to the Lower Triassic of Germany. Approximately thirty-four species are described, six from North America. The greatest number is found in the Lower Permian, the Rotliegende of Europe. A review of the literature cited at the end of this paper reveals the following stratigraphic distribution of *Psaronius* species: Lower Carboniferous, one species; Middle Carboniferous, one species; Upper Carboniferous, three species; Lower Permian, twenty-seven species; Middle Permian, one species; and Lower Triassic, one species.

DESCRIPTION OF SPECIMEN

The silicified specimen of *Psaronius* sp. reported in this paper was collected during the summer field season in 1953. Unfortunately it was not found in place, but at the base of the grass-covered Foraker limestone escarpment in the NE¼ section 36, Township 25 North, Range 6 East, in Osage County, Oklahoma. Since no other stratigraphic unit occurs higher in the vicinity where the fossil was collected, and because the specimen shows little evidence of transportation, it may be assumed that the fossil weathered out of the sandstone facies of the Lower Permian Foraker limestone.

FIGURE 1. Cross section of silicified stem of *Psaronius* sp. from the Wolfcampian series near Fairfax, Oklahoma.

Before the specimen was cut for study, it measured approximately 16 cm long, 12 cm wide, and 5 cm thick. Two morphological zones are present in the specimen, the inner or stem region, and the outer or root zone. These are shown in Figure 1. The stem zone is approximately 14 centimeters in diameter, and the root zone 1.5 centimeters wide. It is assumed that a considerable portion of the root zone is missing. The vascular structure of the stem is not well enough preserved in the sections studied to make a comparison with that of described species. The roots are typical of those found in the region commonly referred to as the innermost root zone. Here they are imbedded in a dense filamentous tissue formerly interpreted as cortical. Each root is encased in a band of sclerenchyma and contains phloem and xylem. The latter, though poorly preserved, appears to have a tetrarch arrangement. The phloem and associated parenchyma are preserved only as isolated cells.

LITERATURE CITED

Andrews, H. N., and S. H. Mamay. 1952. A brief conspectus of American coal ball studies. The Palaeobotanist I:69.

Cotta, C. B. 1832. Die Dendrolithen in Bezug auf ihren inneren Bau. Leipzig.

Farmer, J. B., and Hill, T. G. 1902. On the arrangement and structure of the vascular strands in *Angiopteris evecta*, and some other Marattiaceae. Ann. Botany. vol. 16, p.371-402.

Farr, C. H. 1914. Notes on a fossil tree-fern of Iowa. Iowa Acad. Sci., Proc., vol. 21, p.59-65.

Frentzen, K. 1920. Die Flora des Buntsandsteins Badens. Badisch. geol. Landesanst., Mitt. vol. 8.

Gillette, N. J. 1937. Morphology of some American species of *Psaronius*. Bot. Gazette, vol. 99, p.80-102.

Graham, Roy. 1935. Pennsylvanian flora of Illinois as revealed in coal balls. II. Bot. Gazette, vol. 97, p.156-168.

Hirmer, M. 1927. Handbuch der Paläobotanik, I. München und Berlin.

Hoskins, J. H. 1928. Notes on the structure of Pennsylvanian plants from Illinois, II. Bot. Gazette, vol. 85, p.74-82.

Macbride, T. H. 1904-1906. On certain fossil plant remains in the Iowa herbarium. Davenport Acad. Sci., Proc., vol. 10, p.153-162.

Noé, A. C. 1931. Review of American coal ball studies. Illinois State Acad. Sci., Trans., vol. 24, p.317-320.

Pelourde, F. 1912. Observations sur le *Psaronius brasiliensis*, Ann. Sci. Nat. (Bot.), ser. ix., t. xvi.

Rudolph, K. 1906. Psaronien und Marattiaceen. Vergleichend-anatomische Untersuchung. Kaiserlichen Akademie der Wissenschaften, Denkschriften. Mathematisch-Naturwissenschaftliche Klasse. Wien, vol. 78, p.165-201.

Solms-Laubach, H. Graf zu. 1904. Uber die Schicksale der als *Psaronius brasiliensis* beschriebenen Fossilreste unserer Museen. Festschr. z. Feier des 70. Geburtstages von P. Ascherson.

Stenzel, G., in Göppert, H. R. 1864. Die fossile Flora der permischen Formation. Paleontographica, ser. B, vol. 12, p.46-82.

Stenzel, G. 1906. Die Psaronien, Beobachtungen und Betrachtungen. Beitr. z. Paläontologie und Geologie von Österreich-Ungarns und des Orients, vol. 18.

Zeiller, R. 1890. Bassin houiller et Permien d'Autun et d'Épinac. Flore fossile. Études des gîtes minéraux de la France, vol. 2, p.178-271.

Coal Resources of Oklahoma

An excellent report on the coals of Oklahoma was issued in December by the U. S. Geological Survey. The investigation was done by James V. A. Trumbull in cooperation with the Oklahoma Geological Survey.

Reserves are estimated conservatively and are not counted without reasonable proof. They are given for coal 14 inches or more thick under less than 3,000 feet of overburden. Reserves are termed "measured" where observed in working or in drill holes. "Indicated" reserves are those projected one mile. "Inferred" reserves are based upon regional knowledge and are 2 miles or more from observed points. Reserves are calculated as 3,672.82 millions of tons; remaining reserves as 3,245.49 millions of tons.

The remaining reserves can be tabulated (millions of short tons) as follows:

	Measured	*Indicated*	*Inferred*	
Coal 14 to 28 inches	124.76	419.23	627.03	1,171.02
Coal 28 to 42 inches	188.55	634.22	428.61	1,251.38
Coal 42 inches up	233.67	549.99	39.43	823.09
Total	546.98	1,603.44	1,095.07	3.245.49

Sixty percent of the reserves are under less than 1,000 feet of overburden. Reserves are estimated also by county and by coal bed. In terms of reserves LeFlore County is first, Pittsburg County second. Far behind are Latimer County, Haskell County, Okmulgee County, Coal County, and Craig County. Eight other counties have known coal reserves in beds 14 inches or more thick.

Reserves in terms of coal beds are 1. Lower Hartshorne, 2. McAlester, 3. Hartshorne, 4. Upper Hartshorne, 5. Lehigh, 6. Henryetta. Nineteen beds are differentiated and given estimated reserves.

The youngest workable coal is the Dawson coal, of Missourian age, of Tulsa and Rogers Counties. The oldest coal is the Lower Hartshorne bed.

The estimate of reserves is low because it depends almost entirely upon proven occurrence within 2 miles. Present economic conditions should be considered in order to arrive at an estimate of currently workable coal. This is being done by the Oklahoma Geological Survey which classifies as workable by stripping coal of 10 inch thickness to a depth of 30 feet, as workable by shaft coal of 30 inch thickness to a depth of 500 feet, and as workable by slope coal of 20 inch thickness to a depth of 3,000 feet.

The fine report received is "Coal resources of Oklahoma" by James V. A. Trumbull, U. S. Geological Survey Bulletin 1042-J. It is obtainable from the Superintendent of Documents, U. S. Gov't Printing Office, Washington 25, D. C. for $1.00 a copy. C.C.B.

Two Oklahoma Foraminifera

The United States National Museum has just issued a handsome volume of foraminiferal studies containing articles by six authors (Bulletin 215, 323 pages, 74 plates). Principal author is Alfred R. Loeblich, Jr., a graduate of the University of Oklahoma and now with California Research Corporation. His wife, Helen Tappan, also an O. U. graduate and daughter of Frank G. Tappan, David Ross Boyd emeritus professor of electrical engineering, is co-author of 5 of the 12 papers.

Oklahoma specimens do not enter into the studies except incidentally. *Planomalina caseyi* new species is typically from the Gault clay of England, but paratypes are reported (p. 24) from near the top of the Duck Creek formation on the west bank of the Red River in Love County.

The other Oklahoma species has a curious history. It was described as *Globigerina seminolensis* by Harlton and was believed to be from the upper part of the Glenn formation (Pennsylvanian). The locality is on the Brock anticline in Hoxbar beds at about the position of the Anadarche limestone (SW¼ SE¼ NW¼ sec. 20, T. 5 S., R. 1 E., Carter Co.). The species is represented only by a single poorly preserved specimen. It was made genotype of *Hedbergina* by Bronniman and Brown in 1956. Bolli, Loeblich and Tappan give the species a new combination, *Praeglobotruncana? seminolensis* (Harlton) (see p. 39-40, pl. 9, figs. 4a-6).

They also state that the species is Cretaceous and was either contamination in Harlton's sample or came from an unmapped Cretaceous outlier. Frederickson's map (O.G.S. Map GM-4) shows Cretaceous outcrop half a mile west of the locality. C.C.B.