Cover Picture

Lower Pliocene (Laverne) Diatoms in Oklahoma

The cover picture is a photomicrograph (x800) of diatoms from an unusual Tertiary lake deposit southeast of Beaver in Beaver County, Oklahoma. This deposit, a ledge of soft, white, chalklike rock, was noted by early investigators in this region and has received sporadic attention throughout the years, largely because of associated fossil plant leaves and vertebrates.

In 1881, F. W. Cragin termed the deposit a “chalk marl” and referred it to the “Loupe Fork Tertiary” upon the basis of some mammalian remains he collected. Cragin cited the identification of six species of diatoms in the marl by Rev. Francis Wolle, to whom he had sent a sample for identification. This is the first known reference to fossil diatoms in Oklahoma.

C. N. Gould and J. T. Lonsdale, in their account of the geology of Beaver County (Okla. Geol. Survey, Bull. 35) published two photographs of the deposit to illustrate the occurrence of the Laverne Formation in the area. The Laverne Formation had been named and described in an unpublished manuscript by V. V. Waite, which was extensively cited by Gould and Lonsdale. In 1936, R. W. Chaney and M. K. Elias, in an account of late Tertiary floras of the High Plains, published by the Carnegie Institution of Washington (Pub. 476-I), referred to the deposit as a diatomaceous marl and cited the identification of 37 species of diatoms by E. K. Lohman.

Quantitative analyses of several channel samples show that the dry rock consists of about 90 percent of material soluble in hydrochloric acid. The soluble material is chiefly (85 percent) fine calcium carbonate. The insoluble part consists almost entirely of siliceous frustules of diatoms and siliceous spicules of sponges. The cover picture, by L. R. Wilson, illustrates four genera of diatoms, the most abundant of which is the circular Melosira. The cross-shaped forms are referable to Tetracyclus, the single fusiform to Pinnularia, and the elongate one to Navicula.

—Mart P. Schemel

278
Although echinoids have been relatively common components of shallow-water faunas since the Early Paleozoic, well-preserved fossil specimens are exceedingly rare. The tests are composed of nearly discrete polygonal plates held together during life by delicate fusion and by a complex musculature. Because of their fragility, shells of the dead animals are rapidly broken by currents and by scavengers. The spines, which are entirely exterior and are balanced upon small pedestals by a type of ball-and-socket joint, fall off almost at the moment of death. Pieces of the crushed and broken tests are soon scattered. Recovery of an articulated and identifiable fossil Paleozoic echinoid would be, therefore, a noteworthy event. Despite the abundance in some formations of loose plates and spines, few echinoid species have been identified in the Paleozoic strata of Oklahoma.

A slab of limestone has been recovered from the Oologah Formation bearing the remains of what must have been a large blunt-spined sea urchin of the genus Archaeocidarid (fig. 1). The sizes of the interambulacral plates and the spines (figs. 2, 3) indicate that this form somewhat resembles the modern slate-pencil sea urchin, a relatively common resident of South Pacific waters (Buchbauer, 1938, p. 308). The cluster of spines and plates found on this slab are the only parts recovered despite an exhaustive search which turned up numerous loose plates and the barbed spines of another species.

The specimen illustrated was found in the quarry of the Chandler Materials Company, sec. 28, T. 20 N., R. 14 E., Tulsa County, Oklahoma. Quarrying operations are concentrated in the lower (Pawnee Limestone) member of the Oologah Formation of the Marmaton Group (Desmoinesian). The Pawnee at this locality is about 35 feet of heavy irregular beds of fossiliferous calcitute and calcarenite separated by thin partings of calcareous shale. Light gray is the dominant color; weathering produces a khaki-colored outer surface, and many bedding planes near the ground surface show this characteristic. C. J. Mankin (in Oklahoma City Geol. Soc., 1964, p. 65) has identified a sample of the Pawnee from a nearby locality as a partly recrystallized bryozoan-brachiopod algal biolithite. Regional studies indicate that this unit changes rapidly southward to a brittle, cherty, and calcareous shaly limestone, essentially a dolomitic calcitute. In the vicinity of Broken Arrow, T. 18 N., R. 14 E., it becomes a calcareous shale. Northward, at the latitude of Claremore, the member contains a number of large moundlike reefs composed in part of crinoidal calcirudites. In northern Oklahoma the unit is dominantly calcitute. These relationships indicate in general that this formation was laid down upon a Kansas-Oklahoma shelf, the basinward margin of which lay somewhat

*Sinclair Oil & Gas Company, Tulsa, Oklahoma.
south and east of Tulsa. Waters upon the shelf probably did not exceed 10 meters in depth; whether the limiting factor of limestone deposition south of Broken Arrow was depth of water or an increasing influx of siliceous clastics (mud and silt) from the south is a question which remains to be answered.

The ecology of modern echinoids is well known; presumably the Pennsylvanian forms occupied corresponding ecologic niches. Although some sea urchins inhabit waters of great depth, by far the largest

Figure 1. Slab of Pawnee Limestone from Tulsa County bearing broken fragments of a large echinoid, probably Archaeocidaris sp. The largest spine visible is about 6 inches long. Other fossils include productid brachiopods and bryozoans.
Figure 2. Spine of Archaeocidaris sp., approximately x1.2, from the Oologah Limestone. Specimen shows some evidence of abrasion as the milled ring is partly worn away.

Figure 3. Interambulacral plate of Archaeocidaris sp., x3.3. Secondary tubercles are aligned along the margins; a shallow circular depression rings the primary tubercle.
number of varieties is found in shallow well-aerated marine waters. On reefs and on the agitated sandy bottoms near reefs echinoids are often found in great abundance. Certain sand-ingesting species dwell in the littoral zone, browsing slowly across the sand or slightly below its surface. Owing to their water-vascular system, echinoderms are sensitive to slight variations in salinity and hydrogen ion activity of water and generally shun areas of elevated or reduced saline content and higher alkalinity, preferring normal marine waters. Preliminary studies of the Oologah Limestone and its fauna lead to the conclusion that this sediment was deposited, as mentioned above, in shallow, probably normal, marine waters. Associated algae, found in considerable abundance, attest to the relative shallowness of the water. The Chandler quarry is south of the main tract of Pawnee reef development and is in an area that probably was a slightly deeper seaward shelf. Presumably the reefs did not grow on a steep seaward-facing escarpment as do many modern coral reefs; rather they favored a slightly shallower bank margin where strong wave action was somewhat dampened.

The echinoid debris here illustrated probably belongs to the genus Archaeocidarids. Species bearing some similarity to these fragments have been described from the Permian of Great Britian (Archeocidarids verneuiliana King) and from the Pennsylvanian near Wingate, New Mexico (A. ornatus Newberry, identified by White, 1877, p. 104, pl. 6, fig. 7a). Although White and others have named species of echinoids from scattered spines and plates, this investigator prefers to await the recovery of more complete remains. As modern coral reefs are crowded with sea urchins, which inhabit every available nook and cranny, it seems quite possible that detailed studies of the Oologah bioherms may lead to the discovery of specimens better preserved than this one.

References Cited


VARIATION IN AN *Eothalassoceras*
FROM THE SEMINOLE FORMATION, OKLAHOMA

A. G. UNKLESBAY

A well-preserved specimen of *Eothalassoceras inexpectens* has been collected from nodules above the Dawson coal in the Seminole Formation.

This specimen is subglobular and involute. The maximum diameter is 24 mm and the maximum width is 13 mm. The whorls are rounded ventrally and laterally. The umbilical shoulder is distinct and the umbilicus is small, deep, and closed. At a break which discloses a cross section the width is 10.8 mm, the height is 7.3 mm, and the dorsal-ventral height is 5.2 mm.

The test, portions of which are preserved, is thin. The outer surface is marked by sinuous growth lines. Each forms a ventral sinus, a

*University of Missouri, Columbia, Missouri.

---

1

*Eothalassoceras inexpectens*, OU 5598, Seminole Formation, Oklahoma

**Figure 1.** Lateral view, x3.75.
**Figure 2.** Septal view, x3, at break which exposes inner whorls.
low rounded lateral salient, a broadly rounded lateral sinus, and a rounded dorsolateral salient over the umbilical shoulder.

The sutures are well preserved. The ventral lobe is bifid with digitate prongs. The digitations are not identical in each suture, but in most cases there are five or six points, of which two are more prominent that the others. The first lateral saddles are U-shaped with nearly parallel sides. The lateral lobe is also digitate with two or three prominent points. The second lateral saddle is asymmetrical and broadly rounded. It curves into a small lobe at the umbilicus; this lobe, in contrast to the others, is nondigitate. Along the center of the lateral zone the sutures are in contact along the ventral side of the lateral lobe.

This specimen is similar to those previously described from this same locality by Miller and Owen (1937, p. 418-421, pl. 52) and Unklesbay (1962, p. 116-118, pl. 15), but it differs slightly in details of the sutures. In this specimen the lobe at the umbilicus is nondigitate whereas in specimens of *E. inexpectens* previously described it is weakly digitate. In this respect this specimen is similar to *E. caddoense* (Plummer and Scott, 1937) but differs from that species in being somewhat more globose and less discoidal.

Both *E. inexpectens* and *E. caddoense* are based on few specimens and it is conceivable that if a larger number of specimens were available these slight differences in suture pattern and shape might be only minor variables within a species and that those specimens described are not separate and distinct.

More specimens are available in the collection at the University of Iowa and will be studied in detail at a later date.

**Occurrence.**—This specimen was collected by H. L. Strimple from a nodule above the Dawson coal in the Seminole Formation on the east side of U. S. Highway 75, C SE 1/4 NW 1/4 sec. 32, T. 22 N., R. 14 E., Tulsa County, Oklahoma.

**Repository.**—University of Oklahoma 5598.

**References Cited**


New Theses Added to O. U. Geology Library

The following Master of Science thesis was added to The University of Oklahoma Geology Library in October 1966: *Petrology of the Duncan Sandstone (Permian) of south-central Oklahoma*, by Robert P. Self.

In November, the following Master of Science theses were added: *An investigation of an ultrasonic, high pressure water flood in a linear porous medium*, by Charles Allen Ellis. *Palynology of the Francis Shale (Pennsylvanian) from near Ada, Oklahoma*, by William A. Edwards.

In the announcement of new theses which appeared in the May 1966 issue of the Notes (p. 140), the name Lawrence J. Olson, Sr., was misspelled as Olsen.

—L. F.

**ADDENDUM**

to

Techniques of Pollen and Spore Electron Microscopy
Part I.—Staining, Dehydration, and Embedding

(Oklahoma Geology Notes, vol. 26, no. 7, p. 179-186)

Critical application of the catalyst DMP-30 for embedding with Araldite-Epon resins has been emphasized (Skvarla, 1966, p. 182-183). Of particular concern was the amount of DMP-30 to add to the resin mixture, and it was stressed that, as the DMP-30 aged, this amount would undergo significant change. It was recommended that test samples be made prior to exine embedding in order to determine the correct proportion of catalyst.

Concern for properly hardened resins for thin sectioning, at least from the standpoint of catalyst, can be alleviated by substituting benzylidinemethyamine, commonly called BDMA, for DMP-30 (Mollenhauer, 1964). This catalyst has been used as a standard with Maraglas (Spurlock, Kattine, and Freeman, 1963) and Araldite (Finck, 1960) resins, but is less commonly adapted to Araldite-Epon mixtures. The principal advantage of the more fluid BDMA is the considerably longer storage life (and therefore lesser change in properties) than that of DMP-30. For most pollen and spore work, 6 to 8 drops of BDMA per 4 ml of Araldite-Epon will produce satisfactory blocks for thin sectioning. If a harder block is required the concentration should be increased to 10 to 12 drops.

**References Cited**


—J. J. S.
RECENT CUTOFFS ON THE KIAMICHI RIVER

CARL C. BRANSON

In southern Pushmataha County, Oklahoma, east of Antlers, the Kiamichi River flows on resistant Jackfork sediments, crosses the buried trace of the Boktukola fault, and flows on a broad alluvial deposit between hills of Cretaceous Antlers Sand. North of the Choctaw County line, in secs. 26, 35, T. 4 S., R. 17 E., the river swings back northward in a hairpin turn.

The hairpin turn is shown in the vertical airplane photograph of figure 1 as it existed on April 14, 1949. At that time the meander extended into secs. 1, 2, T. 5 S., R. 17 E. An abandoned eastward part

Figure 1. Vertical airplane photograph of a meander on the Kiamichi River in Pushmataha County, taken for the U. S. Department of Agriculture by Southwestern Aerial Surveys, 1949.
is now wooded and can be seen at the bottom-center of the picture. All of the area south of the meander is occupied by Pleistocene sand and gravel. Across the center of the meander a bar of sand shows the line of a potential cutoff.

An index sheet of photographs taken in 1955 by Aero Service Corporation shows the cutoff forming about 100 yards north of the presently established cutoff as shown in figure 2.

Figure 2 shows the meander as it appeared on November 9, 1962. A well-defined cutoff leaves nearly 2 miles of the old channel abandoned. The once-cultivated area on the cutoff spur is now under heavy plant cover. The entire channel is deeply entrenched in alluvium and the process of straightening and shortening will be slow.

The history of a smaller cutoff near Sawyer, about 20 miles down-

Figure 2. Vertical airplane photograph of the same area shown in figure 1, taken in 1962 for the U. S. Department of Agriculture by General Aerial Surveys.
stream, is also shown in a series of photographs. The cutoff was barely started in 1949, had become a distinct drainage in 1955, and was the main channel by 1962 (fig. 3). It has shortened the stream course nearly a mile.
## INDEX*

**Volume 26, 1966**

<table>
<thead>
<tr>
<th>Altamont Member</th>
<th>193</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsden, Thomas W.—Pettit Oölite</td>
<td>54</td>
</tr>
<tr>
<td>Ardmore basin</td>
<td>123</td>
</tr>
<tr>
<td>Arkansas</td>
<td>3, 13, 21, 43, 117</td>
</tr>
<tr>
<td>Arkoma basin</td>
<td>187</td>
</tr>
<tr>
<td>Asia</td>
<td>256</td>
</tr>
<tr>
<td>Atoka Formation</td>
<td>3, 236</td>
</tr>
<tr>
<td>Bandera Member</td>
<td>193</td>
</tr>
<tr>
<td>basement ages</td>
<td>170</td>
</tr>
<tr>
<td>basement tests</td>
<td>168</td>
</tr>
<tr>
<td>Beane, B. H., see Strimple, Harrell L.</td>
<td>35</td>
</tr>
<tr>
<td>Beaver County</td>
<td>278</td>
</tr>
<tr>
<td>Bellis, William H.—Zeolitization</td>
<td>86</td>
</tr>
<tr>
<td>see Mankin, Charles J.</td>
<td>30</td>
</tr>
<tr>
<td>bibliography—Bibliography and index of Oklahoma Geology, 1965</td>
<td>55</td>
</tr>
<tr>
<td>biostratigraphy, Pennsylvanian</td>
<td>123</td>
</tr>
<tr>
<td>Blackgum Formation</td>
<td>54</td>
</tr>
<tr>
<td>Bloyd Formation</td>
<td>3, 178</td>
</tr>
<tr>
<td>Boggy Formation</td>
<td>111</td>
</tr>
<tr>
<td>Branson, Carl C.—<em>Conocardiium</em> in the Bromide Formation (Ordovician) of Oklahoma</td>
<td>73</td>
</tr>
<tr>
<td>Fresh-water ostracode genus <em>Therosynoeicum</em></td>
<td>87</td>
</tr>
<tr>
<td>Geological highway map series</td>
<td>192</td>
</tr>
<tr>
<td>Maurice G. Mehl, 1888-1966</td>
<td>139</td>
</tr>
<tr>
<td>New genus of spiriferid brachiopod from Oklahoma and Texas</td>
<td>74</td>
</tr>
<tr>
<td>Patterns of Oklahoma prairie mounds</td>
<td>263</td>
</tr>
<tr>
<td>Recent cutoffs on the Kiamichi River</td>
<td>286</td>
</tr>
<tr>
<td><em>Reticulariina</em> in Oklahoma [see erratum, p. 224]</td>
<td>115</td>
</tr>
<tr>
<td>Sole marks in Atoka rocks of platform facies</td>
<td>236</td>
</tr>
<tr>
<td>Treatise volumes on Brachiopoda, review for Oklahoma</td>
<td>49</td>
</tr>
<tr>
<td>Upper Silurian or Lower Devonian conodonts of middle Asia and Pakistan [see erratum, p. 296]</td>
<td>256</td>
</tr>
<tr>
<td>Bromide sands, First Cambrian</td>
<td>122</td>
</tr>
<tr>
<td>Cannon, P. Jan—Infeasibility of terrestrial-type volcanism as a generator of lunar landforms</td>
<td>215</td>
</tr>
<tr>
<td>Carlton Rhyolite</td>
<td>2</td>
</tr>
<tr>
<td>Carter County</td>
<td>123, 151, 243</td>
</tr>
<tr>
<td>caudagalli structure</td>
<td>236</td>
</tr>
<tr>
<td>cement</td>
<td>31, 227</td>
</tr>
<tr>
<td>chemical analysis, granite</td>
<td>211</td>
</tr>
</tbody>
</table>

*Reference is to first page of article containing indexed item.*
Chenoweth, P. A.—Pennsylvanian slate-pencil sea urchin from the Oologah Limestone, Oklahoma 279
Type section of the Oologah Limestone 193
Cherokee County 54, 236
Choctaw County 286
clay 31, 227
clay mineralogy 210
coal 31, 227
Coal County 3
Coffeyville Formation 74
Comanche County 170, 211
copper 31, 227, 262
Craig County 111, 115
Creath, Wilgus B.—New isochilinid ostracode from the West Spring Creek Formation (Arbuckle Group) of Oklahoma 243
Cronoble, W. R., and Waddell, Dwight E.—Petrology of Lester Limestone (Desmoinesian), Carter and Love Counties, Oklahoma 151
Delaware County 142
Denison, R. E., Hetherington, E. A., Jr., and Kenny, G. S.—Isotopic-age dates from basement rocks in Oklahoma 170
Devonian 99
diagenesis 226
dolomitization 242
Dornick Hills Formation 151
Echols, Dorothy J., and Levin, Harold L.—Ordovician Chitinozoa from Missouri 134
electron microscopy 179, 210, 285
Elias, Maxim K.—Remarks on Fusulina insolita Thompson 97
errata 176, 208, 224, 296
Fayetteville Shale 115, 117
Fernvale Formation 21
Finnerty, Lucy—New theses added to O. U. Geology Library 20, 34, 84, 140, 176, 214, 239, 285
Flowerpot Shale 262
Foraker Formation 242
Freeman, Tom—“Petrographic” unconformities in the Ordovician of northern Arkansas 21
genomorphology, lunar 215
meander cutoffs 286
prairie mounds 263
Germany 38
Grady County 122
gravel 31, 227
gypsum 31, 227
Hale Formation 13
Hall, Stephen A.—Lingula in the Wellington Formation (Permian) of Oklahoma 258
Ham, William E.—Flow-banded rhyolite 2
helium 31, 227

290
Hetherington, E. A., Jr., see Denison, R. E. 170
Hiss, W. L., and Hunter H. E.—Primary orthopyroxene-spinel intergrowths in Cambrian cumulates, Wichita Mountains, Oklahoma 231
Howe, Jane—Bibliography and index of Oklahoma geology, 1965 55
Hunter, H. E., see Hiss, W. L. 231
Iowa 35, 38
isotopic-age determinations 170
Jackson County 262
Joachim Formation 21
Jordan, Louise—Basement and near-basement tests in Oklahoma, 1965 148
Statistics of Oklahoma’s petroleum industry, 1965 [see erratum, p. 208] 143
Jordan, Louise 214
Keeling, Lee A.—Advanced crude-oil recovery techniques in Oklahoma 247
Kenny, G. S., see Denison, R. E. 170
Kiamichi River 286
Kimmswick Formation 21, 134
Kindblade Formation 218
Kiowa County 210, 231
Labette Shale 193
Laverne Formation 278
lead 31, 227
Lester Limestone 151
Levin, Harold L., see Echols, Dorothy J. 134
lime 31, 227
Love County 128, 161
Lugert Granite 210
lunar landforms 215
malachite 262
Mankin, Charles J., and Bellis, William H.—Low-grade metamorphism 30
Mapes, Royal H.—Late Mississippian lycopod branch from Arkansas 117
Maquoketa Formation 134
Mazarn Formation 30
McDougal, Robert B.—The mineral industry of Oklahoma in 1965 (preliminary) 31
The mineral industry of Oklahoma in 1965 (final) 227
Mehl, Maurice G. (memorial) 139
Merritt, C. A.—Rim albite in coarse-grained Quanah Granite Wichita Mountains, Oklahoma 211
metamorphism 30
Midco Member 268
mineral industries, copper 262
statistics 31, 143, 187, 227, 247
Mississippian 13, 99, 115, 117, 142

291
Missouri
Mogharabi, Ataolah—Dolomitization in the Foraker Formation 242
Moore, Carl A.—First Bromide sands 122
Murray County 226, 243
Muskogee County 236
natural gas 31, 187, 227
natural-gas liquids 31, 227
Nichols, Clayton R.—Electron microscopy of clay particles 210
Nicholson, Alex.—Louise Jordan honored 214
Malachite in the Flowerpot Shale 262
Noble County 170, 258
Nowata Shale 193
Okfuskee County 74
Oklahoma Geological Survey—Résumé of new nomenclature published in Oklahoma Geology Notes 37
oölite 54
Oologah Limestone 193, 279
Ordovician 21, 78, 122, 134, 218, 243
Ouachita Mountains 30
paleontology
Allagecrinidae 99
Allagecrinus 99
A. americanus 99
Allocatillocrinus 99
Archaeocidaris 279
Belonechitina robusta 134
Bivalvia 78
Brachiopoda 74, 115, 258
treatise volumes 49
Bryozoa (Ectoprocta) 142, 218
Cappasporites, n. gen. 111
C. distortus, n. sp. 111
Cephalopoda 13, 43, 283
Ceramopora? unapensis, n. sp. 218
Chitinozoa 134
Cirratiradites maculatus 38
C. saturni 38
Coelenterata 178
Conocardiun 78
Conochitina 134
C. infraspinosa 134
Conodonta 256
Crinoidea 3, 99, 142
regeneration of parts 35
Cromyocrinidae 3
Cyathochitina 134
C. campanulaeformis 134
Desmaceriocrinus, n. gen. 99
D. weldenensis, n. comb. 99
diatoms 278
<table>
<thead>
<tr>
<th>Term</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dicromyocrinus</td>
<td>3</td>
</tr>
<tr>
<td>Echinodermata</td>
<td>279</td>
</tr>
<tr>
<td>Ectoprocta (Bryozoa)</td>
<td>142, 218</td>
</tr>
<tr>
<td>Eothalassoceras inexpunctens</td>
<td>283</td>
</tr>
<tr>
<td>Eridmatus, n. gen.</td>
<td>74</td>
</tr>
<tr>
<td>E. texanus, n. comb.</td>
<td>74</td>
</tr>
<tr>
<td>Foraminifera</td>
<td>97, 123</td>
</tr>
<tr>
<td>Fusulina</td>
<td>123</td>
</tr>
<tr>
<td>F. acme</td>
<td>123</td>
</tr>
<tr>
<td>F. euryteines</td>
<td>123</td>
</tr>
<tr>
<td>F. haworthi</td>
<td>123</td>
</tr>
<tr>
<td>F. insolita</td>
<td>97, 123</td>
</tr>
<tr>
<td>F. cf. F. novamexicana</td>
<td>123</td>
</tr>
<tr>
<td>F. plattensis</td>
<td>123</td>
</tr>
<tr>
<td>F. pumila</td>
<td>123</td>
</tr>
<tr>
<td>F. aff. F. whitakeri</td>
<td>123</td>
</tr>
<tr>
<td>Fusulinella</td>
<td>123</td>
</tr>
<tr>
<td>F. dakotensis</td>
<td>123</td>
</tr>
<tr>
<td>Indocrinidae, n. fam.</td>
<td>80</td>
</tr>
<tr>
<td>Isoallagecrinus, n. gen.</td>
<td>99</td>
</tr>
<tr>
<td>I. eaglei, n. sp.</td>
<td>99</td>
</tr>
<tr>
<td>I. illinoisensis</td>
<td>99</td>
</tr>
<tr>
<td>Isochilina kamara, n. sp.</td>
<td>243</td>
</tr>
<tr>
<td>I. obesiporosa, n. comb.</td>
<td>243</td>
</tr>
<tr>
<td>Kallimorphocrinus</td>
<td>99</td>
</tr>
<tr>
<td>Lepidophloiois</td>
<td>117</td>
</tr>
<tr>
<td>Lingula</td>
<td>258</td>
</tr>
<tr>
<td>Lithostrotionella</td>
<td>178</td>
</tr>
<tr>
<td>Melosira</td>
<td>278</td>
</tr>
<tr>
<td>Metacroamyocrinus</td>
<td>3</td>
</tr>
<tr>
<td>M. gillumi, n. sp.</td>
<td>3</td>
</tr>
<tr>
<td>Metaindocrinus, n. gen.</td>
<td>80</td>
</tr>
<tr>
<td>M. cooperi, n. sp.</td>
<td>80</td>
</tr>
<tr>
<td>Metallagecrinus, n. gen.</td>
<td>99</td>
</tr>
<tr>
<td>M. quinquebrachilatus, n. comb.</td>
<td>99</td>
</tr>
<tr>
<td>Mooreocrinus</td>
<td>3</td>
</tr>
<tr>
<td>Navicula</td>
<td>278</td>
</tr>
<tr>
<td>Ostracoda</td>
<td>87, 243</td>
</tr>
<tr>
<td>paleobotanical technique</td>
<td>274</td>
</tr>
<tr>
<td>palynological techniques</td>
<td>179, 257</td>
</tr>
<tr>
<td>Paracroamyocrinus, n. gen.</td>
<td>3</td>
</tr>
<tr>
<td>Parulocrinus</td>
<td>3</td>
</tr>
<tr>
<td>Peytonoceras, n. gen.</td>
<td>43</td>
</tr>
<tr>
<td>P. ornatum, n. sp.</td>
<td>43</td>
</tr>
<tr>
<td>Pinnularia</td>
<td>278</td>
</tr>
<tr>
<td>Plantae (megafossils)</td>
<td>117, 274</td>
</tr>
<tr>
<td>Plantae (microfossils)</td>
<td>38, 111, 179, 257, 278</td>
</tr>
<tr>
<td>Punctospirifer transversus</td>
<td>115</td>
</tr>
<tr>
<td>regeneration of parts in crinoids</td>
<td>35</td>
</tr>
</tbody>
</table>
résumé of new nomenclature published in Oklahoma

Geology Notes 37
Reticulariina spinosa 115
Reticuloceras 13
R. wainwrighti, n. sp. 13
Rhabdochitina 134
Rhodocrinites watersianus 35
Scalarituba? atoka, n. sp. 236
Synarmocrinus 3
S. fundundus, n. sp. 3
Tetracyclus 278
Theriosynoeicum 87
T. wyomingense 87
Triticites 123
T. irregularis 123
T. newelli 123
T. primarius 123
Wedekindella 123

Pawnee County 242
Pawnee Member 193
Pennsylvanian 3, 38, 74, 99, 111, 123, 151, 178, 193, 226, 236, 279, 283
Permian 80, 89, 99, 242, 258, 262
petrography 21, 54, 122, 151, 211, 231
petroleum production techniques 247
petroleum statistics 31, 143, 187, 227, 247
Petit Oölite 54
Plattin Formation 21, 134
Pontotoc County 74
Post Oak conglomerates 86
Pottawatomie County 170
prairie mounds 263
Precambrian 170
Pushmataha County 286
Quanah Granite 211
Quinn, James Harrison—Genus Reticuloceras in America 13
reviews
Geological highway map series 192
Treatise volumes on Brachiopoda, reviews for Oklahoma 49
Upper Silurian or Lower Devonian conodonts of middle Asia
and Pakistan 256
rhyolite 2
Roberts, John F.—Developments in the Oklahoma portion of
Rogers County 111, 193
Ross, June Phillips—Early Ordovician ectoproct from
Oklahoma 218
Rowland, T. L.—Lower Mississippian bioherm 142
St. Joe Limestone 142
salt 31, 227
sand 31, 227
Sanders, Robert B.—Techniques for mounting saccate pollen grains 257
Saunders, W. Bruce—New goniatite ammonoid from the Late Mississippian of Arkansas 43
Schemel, Mart P.—Lower Pliocene (Laverne) diatoms in Oklahoma 278
Seminole County 74
Seminole Formation 74, 283
Sequoyah County 296
Silurian 54
silver 227
sole marks 236
stone 31, 227
stratigraphy 123, 193
Strimple, Harrell L.—A unique crinoid from the Upper Permian 80
New species of cromyocrinids from Oklahoma and Arkansas 3
Some notes concerning the Allageocrinidae [see erratum, p. 176] 99
Strimple, Harrell L., and Beane, B. H.—Reproduction of lost arms on a crinoid from Le Grand, Iowa 35
Sutherland, Patrick K.—Lithostroctionella from the Pennsylvanian of Oklahoma 178
Tertiary 278
Texas 74, 80
theses added to O. U. Geology Library 20, 34, 84, 140, 176, 214, 239, 285
tripoli 31, 227
Tri-State district 31, 227
Tulsa County 279, 283
Unklesbay, A. G.—Variation in an Eothalassoceras from the Seminole Formation, Oklahoma 283
Urban, L. L.—Cappasporites, a new Pennsylvanian spore genus from the Des Moines Series of Oklahoma 111
volcanic ash 31, 227
Waddell, Dwight E.—Diagenetic fabrics 226
Pennsylvanian fusulinid biozones in southern Oklahoma 123
see Cronoble, W. R. 151
Wellington Formation 258
West Spring Creek Formation 243
Wewoka Formation 74
Wichita Mountains 86, 211, 218, 231
Wilson, L. R.—Stain technique for silicified-wood sections [see erratum, p. 296] 274
Type species of Cirratiradites Wilson and Coe, 1940 38

295
ERRATA

Oklahoma Geology Notes, Volume 26

Number 10, October 1966, page 257, line 8: For Jour. Geology read Jour. Paleontology
Number 11, November 1966, page 276, line 8: For magnetic mixture read magnetic mixer

Publication Dates, Oklahoma Geology Notes, Volume 26

The twelve numbers of this volume of the Notes were issued on the following dates during 1966:

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>PAGES</th>
<th>MONTH</th>
<th>DATE</th>
<th>NUMBER</th>
<th>PAGES</th>
<th>MONTH</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-28</td>
<td>January</td>
<td>3</td>
<td>7</td>
<td>177-208</td>
<td>July</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>29-52</td>
<td>February</td>
<td>3</td>
<td>8</td>
<td>209-224</td>
<td>August</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>53-84</td>
<td>March</td>
<td>1</td>
<td>9</td>
<td>225-240</td>
<td>September</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>85-120</td>
<td>April</td>
<td>1</td>
<td>10</td>
<td>241-260</td>
<td>October</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>121-140</td>
<td>May</td>
<td>2</td>
<td>11</td>
<td>261-276</td>
<td>November</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>141-176</td>
<td>June</td>
<td>3</td>
<td>12</td>
<td>277-296</td>
<td>December</td>
<td>1</td>
</tr>
</tbody>
</table>

OKLAHOMA GEOLOGY NOTES

Volume 26 December 1966 Number 12

IN THIS ISSUE

Page

Pennsylvania Slate-Pencil Sea Urchin from the Oologah Limestone, Oklahoma

P. A. CHENOWETH .................................................... 279

Variation in an Eothalassoceras from the Seminole Formation, Oklahoma

A. G. UNKLESBAY .................................................... 283

Recent Cutoffs on the Kiamichi River

CARL C. BRANSON ................................................. 286

Lower Pliocene (Laverne) Diatoms in Oklahoma .................. 278
New Theses Added to O. U. Geology Library .................... 285
Addendum .......................................................... 286
Index to Volume 26 .............................................. 289

296