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Cover Picture

Black Mesa

The vertical aerial photograph is of an area about 2.3 miles square. The area is in the northwestern corner of Cimarron County, in the far-western Panhandle, and lies about 1½ to 2 miles from both the New Mexico and Colorado borders.

Black Mesa, shown in the lower-central part of the picture, extends about three miles into Oklahoma from New Mexico. The picture shows about half of the Oklahoma part of the mesa. The highest point in the State, elevation: 4,978, is on the mesa a short distance west of the area. The junction of the Carizzo and Cimarron Rivers can be seen on the southeast corner of the picture.

Black Mesa is an erosional remnant of a basaltic lava flow which was extruded at Piney Mountain in Colorado seven miles north-northwest of the Oklahoma border. At the Oklahoma-New Mexico line the thickness of the basalt is about 85 feet but is about 50 feet at the east end. The name of the mesa comes from the dark color of this cap rock.

The mesa rises 700 feet above river level. The lava flow is either late Pliocene or Pleistocene in age. In steep sides of the mesa the following rock units are exposed in descending order below the basalt: sands and gravels of the Pliocene Ogalalla Group, thick cross-bedded sandstone of the Cretaceous Dakota Group and gray shale and sandstone of the Cretaceous Purgatoire Formation. The more gentle slopes between the mesa and the rivers expose in descending order: marl and shale of the Jurassic Morrison Formation, buff cross-bedded sandstone of the Jurassic Exeter Sandstone, and red and buff shale, marl, and conglomerate of the Triassic Dockum Group. In this region the Ogalalla Group contains common horse teeth and bones of horses and other mammals, the Purgatoire Formation carries abundant specimens of the marine pelecypod genus *Gryphea,* and the Morrison Formation contains many dinosaur bones.

—P. K. S.

Zeacrinites IN OKLAHOMA

HARRELL L. STRIMPLE*

The genus *Zeacrinites* is relatively common in some rocks of Chesterian age but has not been previously reported from Oklahoma, where it occurs in the Fayetteville Formation of Craig County. Normally the specimens found there represent a slightly advanced stage of *Z. peculiaris*.

The origin of the name *Zeacrinites* is unusual in that it was proposed by Troost in a catalog of Tennessee crinoids given orally to the American Association for the Advancement of Science in 1849 and published as a name in *Proceedings of the Association* in 1850, with the addition of the generic definition.

Troost's manuscript, which was turned over to the Smithsonian Institution for publication in 1850, included descriptions of the genus and of the genotype species *Zeacrinites magnoliaeformis* Troost. The paper was not published until 1909, and then as annotated by Elvira Wood.

In the meantime, the Troost manuscript was given to Hall for review, and Hall (1858, p. 544) published under Troost's name that author's description of the genus *Zeacrinites,* as well as his description of *Z. magnoliaeformis*. In the same publication Hall introduced the name *Zeacrinus,* but he obviously considered it to be the same as *Zeacrinites*.

The late Edwin Kirk once explained to me the unwritten agreement among crinoid workers, apparently instigated by Agassiz, to use the ending "crinus" for all names of crinoid genera, and that a change from "crinites" did not require explanation. The agreement was not formalized but was honored until 1940 when Moore and Plummer reestablished the name as *Zeacrinites*. This action was apparently proper and all generic names were revised to original endings by Bassler and Moodey (1943); yet Bassler (1938) had listed the name as *Zeacrinus* in his *Pelmatozoa Palaeozoica,* as well as other similar names. In accordance with the rules, some authors have completely abandoned the practice of using the ending "crinus" for new generic names of crinoids.

The name *Zeacrinus* must be considered a synonym of *Zeacrinites*. The genotype species is *Zeacrinites magnoliaeformis* Troost (in Hall) and the synonymy of the specific name is even more confused than that of the generic name.

The name *Zeacrinites magnoliaeformis* was first presented orally as a name only by Troost at the previously mentioned meeting of the American Association for the Advancement of Science in 1849 and subsequently appeared in print in the *Proceedings* in 1850 (p. 61) as a nomen nudum and was in Troost's manuscript which was submitted to the Smithsonian Institution for publication in 1850 and

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given to Hall for study and review. Hall (1858, p. 544) published Troost's description, giving him full credit of authorship, and thus validated the name as of 1858. In the same publication, Hall referred to the species as *Zeacrinus magnoliaeformis,* but this was in the customary style of changing the endings of "crinites" to "crinus."

Wood (1909), in her annotated version of the Troost manuscript, gave Owen and Norwood credit for the specific name, which was called "the beautiful *Encrinite,* fig. 13" by them in their report, *Researches among the Protozoic and Carboniferous rocks of central Kentucky made during the summer of 1846,* privately printed in St. Louis in 1847. This error, as to original author, was followed by Sutton and Hagan (1939, p. 84) and by Moore and Plummer (1940, p. 244). Springer (1926, p. 81) listed the species as *Zeacrinus magnoliaeformis* (Troost) Hall. Kirk (1938, p. 160) designated the species as *Zeacrinus magnoliaeformis* Troost, thus indicating that the original description was as *Zeacrinus,* which it was not. Moore and Plummer (1940, p. 245) were the first to identify the species properly as *Zeacrinites magnoliaeformis* subsequent to 1858, but, as previously noted, they erroneously cited Owen and Norwood as the authors.

Wright (1926) gave a comprehensive report of *Zeacrinites konincki* (Bather), showing the extreme variability of the plates of the posterior interradius of the dorsal cup in that Scottish species. He spelled the generic name *Zeacrinus,* following the customary designation. Sutton and Hagan (1939, p. 85) considered the variability of anal plates as presented by Springer (1926, p. 83, figs. 1-9) and rejected the specific implications because Springer diagrammed several species of the genus, some of which have subsequently been assigned to other genera. They stated, "This variation in character of the anal side is accepted by us for the genus, but we do not recognize such a variation within a given species as Springer does (1926, p. 81-83), for example in *Z. magnoliaeformis* or *Z. wortheni.*" Sutton and Hagan did not cite Wright's study, which was based on 342 dorsal cups of *Z. konincki* and 1,000 cups of *Phanocrinus calyx.* Wright's study established the fact that a norm for a species can be determined, but that a certain amount of variation among individuals is inevitable.

Wright (1952, p. 108), in his monograph on the British Carboniferous Crinoidea, misinterpreted the action taken by Kirk (1938) and stated that *Zeacrinites (Zeacrinus)* was restricted to the genotype species, *Z. magnoliaeformis.* Kirk (1938, p. 160-161) listed only that one species as "characteristic species of the genus," but he plainly stated that the genus is widely distributed in the United States and Europe. Kirk did remove numerous species from the genus at that time and established several related genera.

Sutton and Hagan (1939, p. 85) stated, "Our interpretation recognizes no species of *Zeacrinus* (now *Zeacrinites*) younger than Mississippian." Kirk (1938, p. 161) stated, "Forms referable to *Zeacrinus* (now *Zeacrinites*) may be expected in the Pennsylvanian as the genetic line continued to the Permian, *Parabursacrinus* of this age differing little from *Zeacrinus* other than in the structure of the posterior interradius." *Parabursacrinus* has only one anal plate within the cup and subsequent anal plates are in a single series, this being a normal rather than an exceptional condition. Moore and Plummer (1940, p. 245-247) described a species as *Zeacrinites*? *sellardsi* from the Graford Formation, Canyon Group, Missourian, Pennsylvanian, on Kyle Mountain, Palo Pinto County, Texas. The form has long, petal-like basal plates comparable to those of *Zeacrinites depressus* (Troost)*, and in this regard is distinct from other described species of *Zeacrinites*. The Pennsylvanian species has a single anal plate within the dorsal cup, as in *Parabursacrinus*, but that plate is followed by two plates above rather than a single series as in the latter genus. Bassler and Moodey (1943, p. 728) ascribed the species to *Zeacrinites* without question, but it is doubtful that it is an unquestionable representative of the genus.

I have been unable to find a reference to the occurrence of *Zeacrinites* in rocks of Oklahoma, although specimens are not uncommon in the Fayetteville Formation (Chesterian) of northeastern Oklahoma. Assignment of the Oklahoma specimens described below is made to *Zeacrinites peculiaris* (Miller and Gurley).

The form originally described as *Xystocrinus*? *acicilaris* Moore and Plummer (1938), from the Brentwood Limestone Member, Bloyd Formation, Morrowan Series, Pennsylvanian of northeastern Oklahoma, was unreservedly referred to *Zeacrinites* by Bassler and Moodey (1943, p. 726).

The type specimens are isolated ossicles, which are spines that make up a platform, or "umbrella," at the top of the anal sac, but a platform structure is not present in *Zeacrinites*. The characteristics of the genus *Xystocrinus* Moore and Plummer (1938), as proposed, did include such a platform but the genotype species selected by those authors, *Zeacrinus depressus* Hall=*Zeacrinites depressus* Troost [in Hall], is altogether another form as was pointed out by Kirk (1939). Moore and Plummer (1938) gave drawings of and based their description on the form presented as *Hydreionocrinus depressus* by Wetherby (1881) and subsequently described as *Hydreionocrinus spinosus* Wood [in Troost] (1909). Kirk (1939) proposed the genus *Tholocrinus* with *Hydreionocrinus spinosus* Wood as the genotype species. The Morrow species should be referred to as *Tholocrinus*? *acicularis* (Moore and Plummer).

***Zeacrinites depressus** is another species named by Hall (1858, p. 545, 546) under the authorship of Troost. It was originally designated as **Cyathocrinites depressus** by Troost in his oral discussion in 1849 and in the printed catalog in 1850, and designated as **Zeacrinus depressus** (Troost) by Hall. Wood (1909) described the species as **Hydreionocrinus depressus** (Hall) on page 92, but showed it as **Hydreionocrinus depressus** (Troost) (Hall) on the explanation of plate 11, figures 6-8, which indicates that she might have been somewhat doubtful of the proper authorship. I agree with her that the species is atypical of **Zeacrinites** but I do not think it belongs with **Hydreionocrinus**.

Genus *Zeacrinites* Troost [in Hall], 1858

Zeacrinites peculiaris (Miller and Gurley), 1896

Plate I, figures 1-5; text-figures 1-7

This species is like several other forms that have been assigned to the genus in that much confusion is involved as to its true identity.

Miller and Gurley (1896, p. 34, 35, pl. 2, figs. 17-19) described a species as *Zeacrinus peculiaris*, "found by Prof. A. G. Wetherby, in the Kaskaskia Group, in Pulaski County, Kentucky, and now in the collection of Wm. F. E. Gurley." From their text the illustrated specimen is apparently the holotype through monotypy, and the name is probably derived from what they called a "peculiar azygous area." Sutton and Hagan (1939, text-fig. 1) gave a diagrammatic illustration of the holotype. It is an advanced stage, termed Extreme Type of Developmental Trend C by Strimple (1960, p. 251), wherein the radianal is in the dominant posterior position, separating anal X from the posterior basal plate. The illustration by Miller and Gurley (1896, pl. 2, fig. 17), which is a side view of the crown, shows anal X in contact with the posterior basal, but this is apparently an error of the artist because their basal view clearly follows the description, with the radianal interposed between anal X and the posterior basal. All arms, except that of the anterior, branch with the first primibrach, which condition is considered by most authors to be a generic character of the family. In the anterior, the first bifurcation takes place with the second primibrach, a condition considered by most modern authors to be a specific character for this genus and apparently the only constant character which differentiates *Zeacrinites peculiaris* from *Z. wortheni*. Three primibrachs are reported in *Z. wortheni*, the third being axillary.

The posterior interradius in the specimen of *Z. wortheni* figured by Hall (1858, p. 683, text-fig. 111) is a long, slender radianal and an elongate anal X. The point of contact is between anal X and the posterior basal, albeit the facet is narrow. Hall's description implies that there were other specimens. He gave the horizon and locality as "In the Kaskaskia limestone: Chester, Illinois." Bassler and Moodey (1943, p. 728) gave the horizon as "Glen Dean ls.; Chester" for the Chester, Illinois, occurrence of the species. Specimens figured by Springer (1926, pl. 22, fig. 12 and pl. 23, figs. 1-8) were all from the Glen Dean Limestone in Sloan's Valley, Kentucky, and are probably not conspecific. Five crowns are in the Springer Collection of the State University of Iowa (SUI 31401, 31403, and 10967) from the Sloan's Valley, Kentucky, locality, all of which were identified as *Zeacrinus wortheni* by Springer. Having two primibrachs rather than three, they must be referred to *Zeacrinites peculiaris*.

Sutton and Hagan (1939, p. 86) ascribed two extra primibrachs in the anterior ray to *Z. wortheni* and only one extra primibrach to *Z. peculiaris*, but they did not state whether they had examined the original types of *Z. wortheni*. The formula they recommend (the

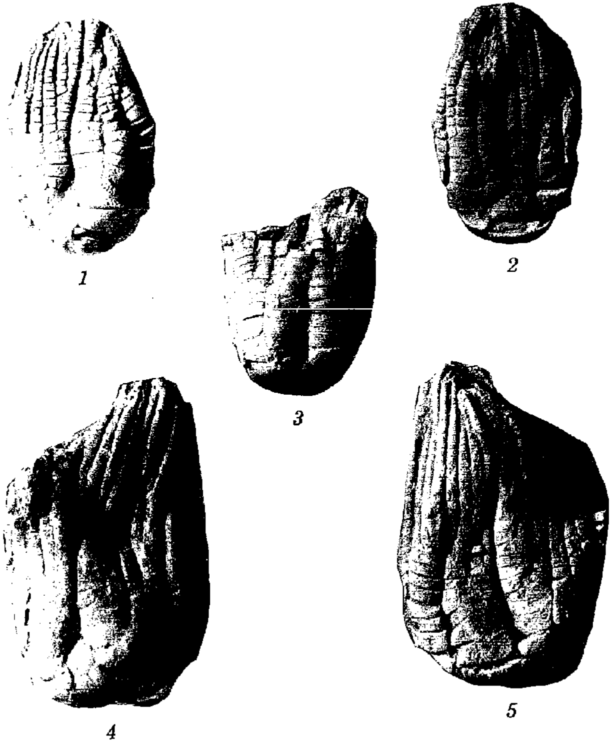


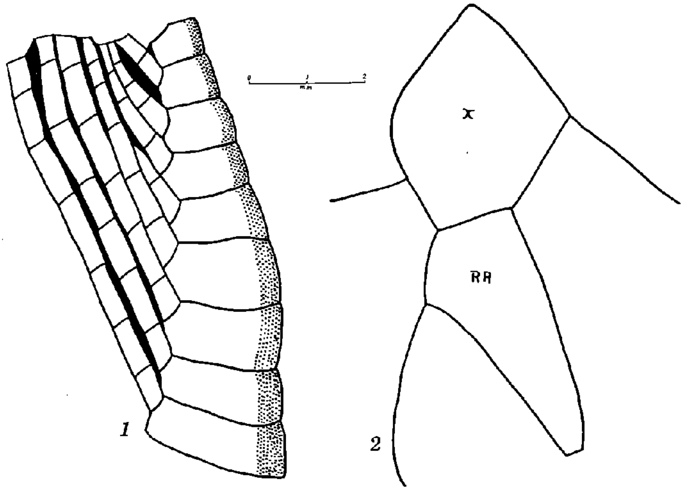
Plate I

Zeacrinites peculiaris (Miller and Gurley), x1.5

Figures 1, 2. Hypotype OU 5057, viewed from left side, showing regenerated arm and at lower right the primitive anal plates of the posterior interray; and from the right side, showing arm structure and at the upper left the thick pinnules. Oklahoma, Fayetteville Formation, Chesterian.

Figure 3. Hypotype SUI 10967, posterior view showing narrow posterior interray with radianal in dominant posterior position. Kentucky, Glen Dean Limestone Formation, Chesterian.

Figures 4, 5. Hypotype SUI 10982, crown viewed from posterior showing interray with only two anal plates in and out of the dorsal cup and with some rays complete to their normal terminations; crown from anterior with anterior ray to the left showing two primibrachs, the second being axillary.



Zeacrinites peculiaris **(Miller and Gurley), hypotype, SUI 10982**

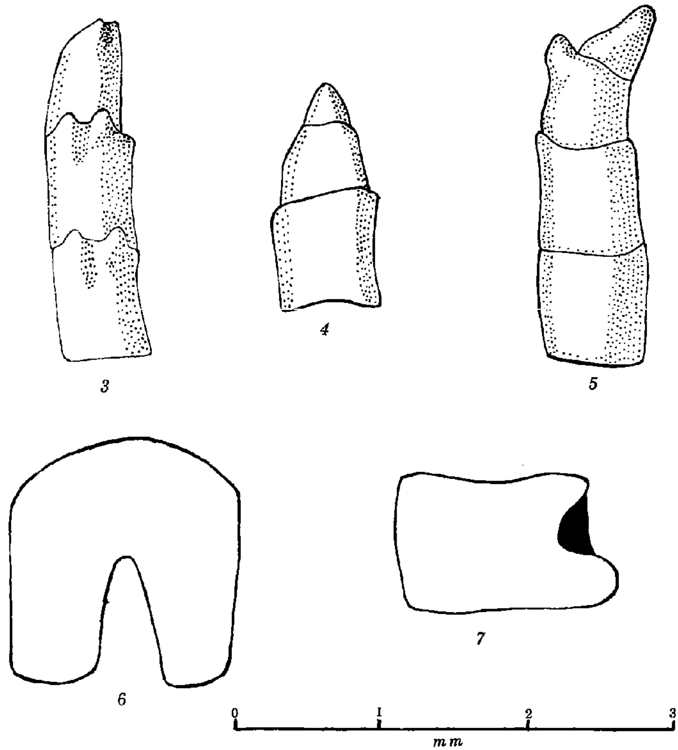
Text-figure 1. Side view of upper portion of arm showing pinnules on each brachial.

Text-figure 2. Anal plates in posterior interray with only two plates preserved in and out of the dorsal cup.

(Drawings prepared with aid of camera lucida.)

number of anal plates and their arrangement in the posterior interray, and the number of primibrachs in the anterior arm) shows that each species has five anal plates in the anal pyramid. The arrangement of the lower anal plates in the holotype of *Z. peculiaris* is slightly more advanced than the arrangement shown by Hall (1858) for *Z. wortheni.* This difference in plate arrangements in the posterior interradius has little significance in this group. Those illustrated specimens ascribed by Springer (1926, pl. 22, fig. 12 and pl. 23, figs. 1-8), to *Z. wortheni* reflect an almost complete range of possible variance. The anterior rays were either not shown by Springer, or in one instance a specimen is either aberrant or incorrectly illustrated (pl. 23, fig. 6) because it is shown to have a single primibrach in the anterior. As previously noted, specimens at hand from Springer's collections from the same locality have two primibrachs in the anterior ray and have been assigned on that basis to *Zeacrinites peculiaris.*

Four of the specimens in the Springer Collection of the State University of Iowa have the posterior interradius exposed. Specimen SUI 10967 is figured on plate I, figure 3, and is seen to have five anal plates, the lowermost being the radianal succeeded evenly above by anal X to the left and RX to the right. The two anal plates above are in series. The specimen is slightly more advanced than the holo-



Zeacrinites peculiaris (**Miller and Gurley**)

Text-figures 3-5. Terminations of three arms of hypotype SUI 10982, showing single and double spines (5 is side view).

Text-figure 6. Outline of brachial viewed from above, showing the contour of plate and the food groove.

Text-figure 7. Side view of brachial, showing facet for attachment of pinnule.

type in that RA is in a more dominant position. Two of the other specimens (SUI 31403) have five anal plates but the arrangement is quite different. Another specimen has eight anal plates, but the lower plates are in essentially the same placement as the first two. Such variation in the structure of the anal pyramids is sufficient for considering each of the four specimens as a distinct entity under the formulae proposed by Sutton and Hagan (1939).

Five crowns from the Fayetteville Formation (Chesterian) of northeastern Oklahoma are considered to be conspecific with *Zea-*

crinites peculiaris because of the structure of the lower plates of the posterior interradius, the number of primibrachs in the anterior arm, and the pattern of arm branching. The upper anal plates in the Oklahoma specimens are mostly nondescript anal-tube elements covered by the arms. The upper plates, as preserved, do not normally extend so far above the dorsal cup, are generally slightly more advanced in arrangement, and are fewer in number as compared to those of other representatives of the species. Many Oklahoma specimens have only two or three anal plates preserved in the entire pyramid.

Arm structure.—The arms are endotomous, are rather stout in lower portions, and have convex backs and flat lateral sides. The arms are closely appressed laterally in repose. Brachials are low and quadrangular, except when axillary. Each brachial carries two pinnules, one on each side. Text-figure 1 is a side view of an arm showing the mode of attachment and pinnules in place. Text-figure 7 is a side view of one brachial with the pinnule absent found high in the crown. In text-figure 6 a view from above of another brachial shows the relative size of the food groove and the contour of the arm. The outermost tips of three rays, as preserved in an Oklahoma hypotype (SUI 10982), are illustrated by text-figures 3-5. The small spinelike protuberances probably represent rudimentary ray ridges, which are not preserved on mature brachials.

All arms branch with the first primibrach except the anterior ray, which branches with the second primibrach. The number of secundibrachs appears to vary from two to four, with three the more common. Inner rays remain unbranched above this point with few exceptions, and outer rays bifurcate again with an axillary fourth to eighth tertibrach. Outer rays branch again with the fifth to, rarely, the eleventh quartibrachs.

Regeneration.—Figured hypotype OU 5057 (pl. I, figs. 1, 2) has a partly regenerated arm in the right ray of the left posterior arm. Although the specimen is somewhat distorted, it appears that the original arm was separated at the third tertibrach in the left division and at the first tertibrach in the right division. The regenerated rays are considerably smaller than the original rays but are fully developed, even to reproduction of a subsequent branching in one outer ray. The specimen is figured to show the regenerated arm as well as to demonstrate the primitive nature of its anal plates, the condition being atypical of the species and of Oklahoma hypotypes.

Relationship.—The apparent trend toward reduction of the number of anal plates and advancement in their arrangement is shown by the geologically younger Oklahoma hypotypes of the species. One specimen (SUI 10982) shows the advanced nature of the anal plates and is illustrated in text-figure 2; however, in this specimen the radianal is elongate and is in contact with the right posterior basal. Yet the upper extremity of the radianal separates anal X from the posterior basal. The arm branching of the Glen Dean and Fayetteville specimens is essentially the same.

Intimate relationship is shown between *Zeacrinites wortheni* and *Z. peculiaris.* The only essential difference between the two is the reported existence of two extra primibrachs in the anterior ray of *Z. wortheni* as compared to one extra in *Z. peculiaris*. Some question as to the probable consistency of that characteristic is raised by the observations of Wright (1952, p. 108) for *Z. konincki* (Bather). He noted that the number of primibrachs is normally three in the anterior ray even of younger specimens, but that in some specimens the number of plates is only two. I have been unable to locate the primary type of *Z. wortheni* for close comparisons and am not prepared to suggest any action until it has been re-examined, or until other bona fide type material is available.

Association.—It appears that most of the crinoids in the black fissile shales of the Fayetteville Formation of Craig County occur in thin lentils more or less as small colonies, or pockets. In one instance, I observed that the iron-stained shale lentil containing a colony of crinoids grades into a thin gray to brown limestone ¾ to 1½ inches thick. Some crinoids are preserved in the limestone, but they are difficult to detect and even more difficult to extricate. Almost all of the crinoids are cushioned by fronds of the bryozoan *Archimedes*. The fronds appear to have held the crinoid segments together until they were covered by sediment.

The following crinoids have been found in association with *Zeacrinites*:

Heliosocrinus aftonensis Strimple
Mantikosocrinus castus Strimple
Phanocrinus alexanderi Strimple
Phanocrinus cylindricus (Miller and Gurley)
Phanocrinus formosus (Worthen)
Alcimocrinus ornatus Strimple
Ulrichicrinus chesterensis Strimple
Amelecrinus erectus Strimple
Cymbiocrinus gravis Strimple
Scytalocrinus aftonensis Strimple
Aphelecrinus exoticus Strimple
Aphelecrinus planus Strimple

A comprehensive list of other forms of life present in the Fayetteville Formation was given by Huffman (1958, p. 68-71).

Horizon.—Fayetteville Formation, Chesterian (Oklahoma); Glen Dean Limestone Formation, Chesterian (Kentucky).

Location.—The Kentucky specimens used in this study apparently came from the railroad excavation at Sloan's Valley in Pulaski County. Oklahoma specimens are from east of Vinita, Craig County, OU 5057 from NW¼ SW¼ sec. 20, T. 25 N., R. 21 E., and SUI 10982 and 10983 from NW¼ SW¼ sec. 11, T. 25 N., R. 21 E.

References Cited

Cited references prior to 1943 are to be found in Bassler, R. S., and Moodey, M. W., 1943, **Bibliographic and faunal index of Paleozoic pelmatozoan echinoderms:** Geol. Soc. America, Spec. Paper 45. Other references are as follows:

Bassler, R. S., 1938, Pelmatozoa Palaeozoica (Generum et genotyporum et bibliographia), in Fossilium catalogus, I: Animalia, pt. 83: The Hague, W. Junk, 194 p.

Huffman, G. G., 1958, Geology of the [south and west] flanks of the Ozark uplift, northeastern Oklahoma: Okla. Geol. Survey, Bull. 77, 281 p.

Strimple, H. L., 1948, Notes on **Phanocrinus** from the Fayetteville Formation of northeastern Oklahoma: Jour. Paleontology, vol. 22, p. 490-493, pl. 77, text-figs. 1-8.

__________1949a, Crinoid studies; pt. 5, **Allosocrinus,** a new crinoid genus from the Pennsylvanian of Oklahoma: Bull. Amer. Paleontology, vol. 32, no. 133, p. 15-20, pl. 4, figs. 5, 6.

__________1949b, Studies of Carboniferous crinoids, pt. 4: Paleontographica Americana, vol. 3, no. 23, p. 27-30, pl. 5.

__________1951a, Some new species of Carboniferous crinoids: Bull. Amer. Paleontology, vol. 33, no. 137, p. 179-218, pl. 4, figs. 4-6.

__________1951b, Notes on **Phanocrinus cylindricus** and description of new species of Chester crinoids: Washington Acad. Sciences, Jour., vol. 41, p. 291-294, figs. 1-12.

__________1951c, New Carboniferous crinoids: Jour. Paleontology, vol. 25, p. 669- 676, pls. 98, 99.

__________1960, The posterior interradius of Carboniferous inadunate crinoids of Oklahoma: Okla. Geol. Survey, Okla. Geology Notes, vol. 20, p. 251, text-fig. 3d.

Wright, James, 1952, A monograph on the British Carboniferous Crinoidea, pt. 4: Palaeontog. Soc., vol. 106, p. 103-148.

New Theses Added to O. U. Geology Library

The following Master of Science theses were added to The University of Oklahoma Geology Library during October 1962:

Clay petrology and geochemistry of Blaine Formation (Permian), northern Blaine County, Oklahoma, by Ardell Gordon Everett.

Basic rocks of the Roosevelt-Cold Springs area, southwestern Oklahoma, by Richard E. Frech.

Subsurface geology of the Joiner City field, Carter County, Oklahoma, by John Dale Hellman.

Subsurface geology of the North Dover area, Kingfisher County, Oklahoma, by Patrick J. Hurley.

A structural study of the northern margin of the Wet Mountains, Fremont County, Colorado, by John M. Logan.

Foraminifera of the Pecan Gap Formation (Cretaceous) in northeastern Texas, by Bill E. Morgan.

Geology of the Signal Mountain area, southeastern Pushmataha County, Oklahoma, by Larry Piatt.

Petroleum geology of the Taloga-Custer City area, Dewey and Custer Counties, Oklahoma, by Houston L. Slate.

Subsurface geology of the Criner area, McClain County, Oklahoma, by Laurence E. Thomas.

The following Master of Geological Engineering theses were also added during October 1962:

Subsurface geology of Southeast Lincoln oil field, Kingfisher County, Oklahoma, by Charles A. Durham, Jr.

Sedimentology of the pre-Womble rocks of the Ouachita Mountains, Oklahoma and Arkansas, by Hulon M. Madeley.

Parameters of subsurface structural reconnaissance in the Simpson Group (Ordovician), South Norman area, Oklahoma, by George O. McDaniel, Jr.

—L. F.

The Oklahoma Rockhound's Directory

The following is a list of rock and lapidary shops in and near Oklahoma.

Oklahoma

Cardin's Rock Shop
729 East Walnut
Cushing

DubLee
4731 S. Columbia Place
Tulsa

Geological Enterprises
Box 926
Ardmore

Glen's Originals
2401 South 17th St.
Chickasha

C. J. Hibbert
5108 N. Beaver
Bethany

Painton's Rockery
Fairview

Pickard's Rock Shop
Calumet

The Rangers Motel
Seiling

Sooner Lapidary
1005 East Idaho
Norman

Out-of-State

Beach's Rock Shop
R-2
Murfreesboro, Arkansas

Boodle Lane Minerals
Box 331
Galena, Kansas

Fossil Supply Co.
6507 Sondra
Dallas 14, Texas

Roy D. Humble
2219 Lamont
Dallas, Texas

Lovelace Rock & Mineral Shop
2610 Armory Road
Wichita Falls, Texas

Mahaffey's Nevada Rock Shop
1329 West Allison St.
Nevada, Missouri

Mallison Gem Co.
3816 Kushla
Dallas 16, Texas

Oscar E. Monnig
29 Chelsea Drive
Ft. Worth 15, Texas

Jimmie & Robt. Peck
3011 Spurlock
Dallas, Texas

Survey Guide Books in Press

Two new guide books, now in press and to be issued in the early part of 1963 by the Oklahoma Geological Survey, deal with scenic and recreational areas in eastern Oklahoma. Each book is illustrated with photographs and maps depicting the geology, geography, history, and natural history of these areas. In addition they include brief descriptions of the recreational facilities available.

Guide Book XI, *Guide to Beavers Bend State Park,* is by William D. Pitt, Charles B. Spradlin, Robert E. Bell, A. M. Gibson, Cluff E. Hopla, Carl D. Riggs, George A. Moore, Charles C. Carpenter, George M. Sutton, Robert D. Burns, and Elroy L. Rice. The book consists of 46 pages with 15 illustrations and will sell for $1.00 per copy.

Guide Book XII, *A guide to the state parks and scenic areas in the Oklahoma Ozarks,* by George G. Huffman, Tyson A. Cathey, and James E. Humphrey, will contain approximately 150 pages with 56 illustrations and will sell for $3.00 per copy.

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