OKLAHOMA GEOLOGICAL SURVEY
Chas. N. Gould, Director

Circular No. 18

A COMPARATIVE FAUNAL CHART OF THE MISSISSIPPIAN AND MORROW FORMATIONS OF OKLAHOMA AND ARKANSAS

By
Robert Roth
Atlantic Oil Producing Co.

NORMAN
FEBRUARY, 1929

CONTENTS

Tables

A COMPARATIVE FAUNAL CHART OF THE MISSISSIPPIAN AND MORROW FORMATIONS OF OKLAHOMA AND ARKANSAS

INTRODUCTION

The formations involved in the accompanying chart have been the subject of many discussions, and discordant ideas have evolved relative to the exact age equivalents and boundaries. The number of species coming over from the Chester into the Pottsville has been discussed by many geologists of the Mid-Continent region, who all seem to agree that the percentage is quite high. As a result of these points it is believed that a compilation of the available literature will be of considerable help to those who are working in the area and certain difficulties will be pointed out which may help others in future correlations.

METHOD OF COMPILATION

The total number of forms in the chart is about four hundred identified species which number does not include all the species in the original lists. This discrepancy is caused by the author's endeavor to eliminate all doubtful identifications. The reasons for this may readily be explained. Suppose one finds *Schwagerina* in a certain formation, which according to the range of this genera that formation would be Permian, but which part of the Permian would be indefinite. If, however, a form were referred to *Schwagerina* (?) and the enclosing formation postulated as Permian, then there would be room for doubt as the form in question might be some other form. Other examples might be enumerated to great length, but it is not necessary to do so. Using the same method suppose that the genera is established but the species is doubtful. As a result any correlations of an exact nature may be looked upon as fallacious and great care must be exercised in correlations based upon such data. This is especially so in dealing with transitional zones as between the Mississippian and Pennsylvanian, where a careful check of species is necessary and correlations by genera cannot be used any more than by questionable species. The still questionable boundary between the Permian and Pennsylvanian is a classical example of transitional faunas in Oklahoma and Kansas. Any correlations based upon genera and questionable species cannot be used in these cases.

With these facts in mind only those genera and species were used which did not have a doubt as to the exact identity, at least, the form as listed did not have an interrogation point after the genera and species. The phylogenetic arrangement is based upon

are listed alphabetically, and so are the species. The formations are listed under the authors who described them, and the fauna is checked as they occur. The number of species occurring in any one formation may be checked with any other formation on a percentage basis. This has been done in a second chart. The discussion of the two charts will follow.
the ascending order of complexity. Under the phylum the genera

DISCUSSION OF FAUNAL CHART

All the fauna listed in this chart were taken from the various lists found in the publications upon the area under discussion. Several things will be noted that have a varying effect upon the correlation by percentages. It will first be noted that in correlating two formations by the number of common forms it is important that the number of species in each formation be equal or as nearly so as possible. If they are not some erroneous deductions may be formed. For example, the Woodford has thirteen positively identified species, while the Moorefield has 73. With this number of species two different percentages may be obtained; that is, the number of forms occurring in the Woodford and also in the Moorefield is 61 per cent, while the number of forms occurring in the Moorefield and also in the Woodford is only 11 per cent. This difference is dependent upon the list from which the percentage was calculated.

A second very important factor is the number of collecting localities. Obviously the formation which has the most localities from which collections have been made is the one that has the most representative fauna. Other things being equal any comparison made between a fauna collected from 30 different localities and one from only 2 localities is bound to show some discrepancies. A formation may be fossiliferous in only a few of the places where exposed, while in other cases it may be very difficult to find a good exposure of a particular formation. As a rule the ratio between the species will not vary far from the ratio between the collections.

The third and probably most important is the stratigraphic position of the various collections. This point cannot be overemphasized and the difficulties resulting from this factor when not carefully checked will be mentioned under the Caney formation.

A fourth point is the identification of the fauna itself. Too much care cannot be used in exact classification and all of the fauna should be described, as comparisons made with certain phylums left out will not serve the purpose. For example Snider[1] worked out a number of bryozoa from the Fayetteville and prac-

1. Snider, L. C., The paleontology of the Chester group in Oklahoma: Oklahoma Geol. Survey Bull. 24, Pt. II, 1915.

tically none from the Mayes and Pitkin. Morgan[2] describes very few bryozoa from the Wapanucka limestone, yet this formascribed by Morgan[2] has very few bryozoa described, yet this formation has an abundance of bryozoa. Ostracods and foraminifera have been left out of the lists almost entirely.

In checking over the faunal list the following synonyms have been noted: *Productus ovatus* is the Mississippian form of *P. pileiformis, P. laevicostus, and P. pratteniannus,* while the Pennsylvanian form is *P. cora.* This group has been very badly mixed up. *Liorhynchus carboniferum* prepossesses *L.* aff. *mesicostale. Liorhynchus carboniferum* var. *polypleurum* prepossesses *L.* aff. *laura, Eumetria marcyi* prepossesses *E. vera,* and *E. verneuilliana. Productus adairensis* prepossesses *Marginifera adairensis. Girtyella turgida* var. *elongata* prepossesses *Harttina brevilobata* var. *marginalis. Sulcatipinna arkansana* prepossesses *Pinna arkansana. Schizodus arkansanus* prepossesses *Allorisma arkansana. Productus coloradoensis* prepossesses *P. inflatus* var. *coloradoensis. Schizostoma catilloides* prepossesses *Euomphalus catilloides.* All the forms marked with an asterisk were listed from the undifferentiated Morrow of northeastern Oklahoma by Mather.

DISCUSSION OF PERCENTAGE CHART

The percentage chart will show at a glance the percentage of forms in any formation that is carried over into any other forma-

Percentage Chart

FORMATION	MOOREFIELD	BATESVILLE	CANEY	MAYES	FAYETTEVILLE	PITKIN	WOODFORD	CANEY	WAPANUCKA	HALE	BRENTWOOD	KESSLER
MOOREFIELD	100	19	50	31	10	14	61	29	0	0	0	0
BATESVILLE	36	100	25	20	20	22	7	16	1	1	1	2
CANEY	24	9	100	7	1	2	53	48	0	0	0	0
MAYES	34	16	16	100	48	66	38	10	1	1	1	2
FAYETTEVILLE	9	14	2	42	100	68	0	1	3	1	2	2
PITKIN	9	11	2	41	48	100	0	1	0	0	1	0
WOODFORD	11	1	19	6	0	0	100	10	0	0	0	0
CANEY	23	9	94	7	1	2	46	100	10	3	5	2
WAPANUCKA	0	1	0	1	4	0	0	14	100	47	42	51
HALE	0	1	0	1	1	0	0	3	40	100	50	55
BRENTWOOD	0	1	0	1	2	2	0	7	44	61	100	55
KESSLER	0	1	0	1	1	0	0	1	28	36	30	100

2. Morgan, George D., Geology of the Stonewall Quadrangle, Oklahoma: Bur. of Geology Bull. 2, 1924.

tion. The formation names are in the same order as they appear in the faunal chart. It will be noted that two percentages are given under each formation which is explained as follows: The number of forms which are common to the Moorefield and the Batesville is 19. The total number of forms in the Moorefield is 73 and in the Batesville 98. The percentage which 19 is of 98 is set under the formation written vertically while the percentage which 19 is of 73 is put down after the formation written horizontally. In other words the percentage has been figured upon the total number of species listed under the vertical, and the result is above and to the right of the 100 per cent column. Those in the lower left hand corner are figured upon the horizontal formation.

DISCUSSION OF CROSS-SECTION

In working with the faunal chart it is thought that a rough correlation between Arkansas and Oklahoma should be attempted. This has been done in the form of five stratigraphic columns, including formations from the Kinderhook to the Pottsville. The first stratigraphic column was taken in north-central Arkansas, the second in the vicinity of Fayetteville, Arkansas, the third from the northeast corner of Oklahoma, Pryor Quadrangle, the fourth from the Tahlequah Quadrangle, and the fifth was taken from the Stonewall Quadrangle.

Formations involved are for the most part indefinitely correlated with any other section as we now know it. A brief age correlation will perhaps point out some of these difficulties. Starting at the base is the Sylamore sandstone. This sandstone marks the contact between the Mississippian and Devonian and is quite widespread as it is found in all of the sections drawn. The upper part of this sandstone is very intimately related to the overlying Chattanooga shale. In the Tahlequah Folio, the Sylamore sandstone is classified as a member of the Chattanooga shale. This sandstone is known as the Misener sand in the oil fields of central Oklahoma.

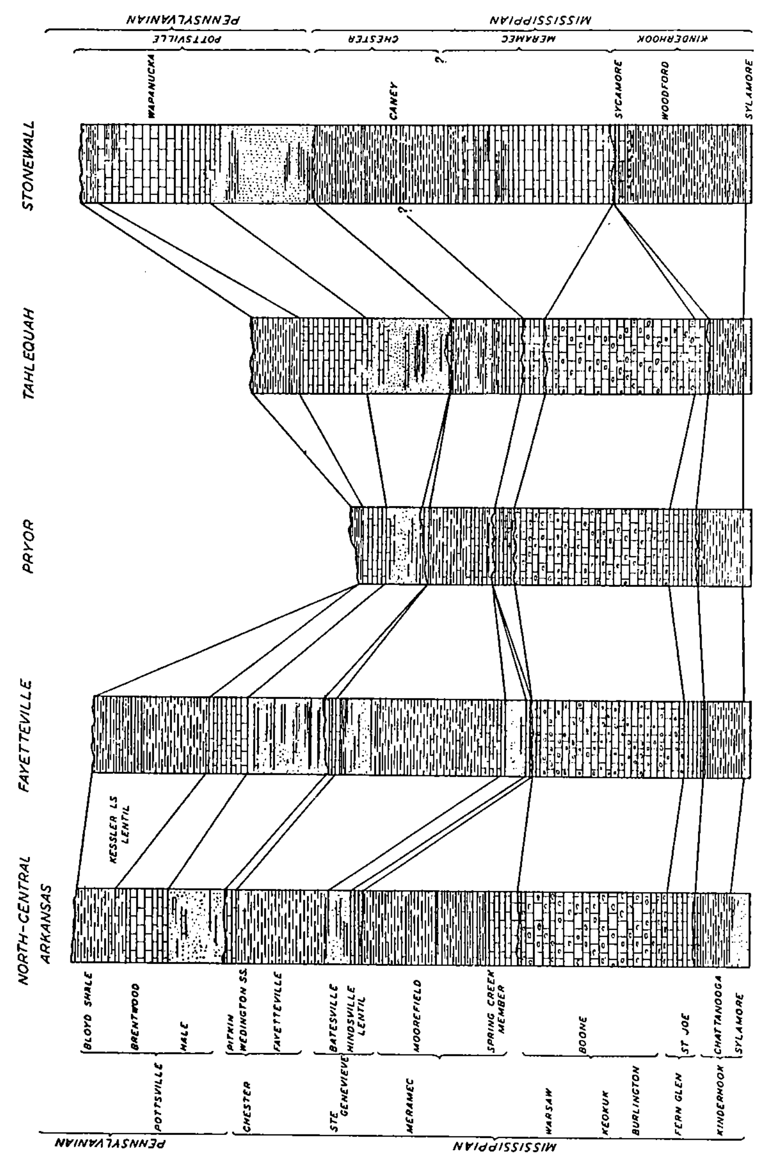
The Chattanooga shale is also very widespread. Quoting Morgan[3] on the geology of the Stonewall Quadrangle:

> This formation is of the age of the Sylamore of north Arkansas, the Chattanooga formation of Tennessee, the Ohio shale of Ohio, and the Portage and Chemung of New York. At the top it doubtless includes strata corresponding in age with the Noel shale of north Arkansas, and the basal shale of the Tullahoma formation in middle Tennessee.

This quotation Morgan uses from Taff when he describes the Woodford.

Above the Woodford, or Chattanooga, is a limestone wedge which is called the Sycamore. For the most part this limestone is

3. Op. cit., p. 46.



non-fossiliferous in megafauna. The report on the Sycamore limestone has caused considerable discussion as very few diagnostic forms have been discovered. Ulrich in Bulletin 45, Oklahoma Geological Survey and Schuchert in Bulletin 2, Bureau of Geology, place the Sycamore limestone along with the underlying Chattanooga, or Woodford shale, and Sylamore sandstone in the Kinderhook formation. Between the Woodford and Mayes is a streak of glauconite which is found in well-cuttings from a large area in east-central Oklahoma. This represents the Sycamore limestone.

The next formation is the St. Joe limestone. Girty[4] goes with considerable detail into the correlation of this crinoidal limestone which lies at the base of the Boone chert. Girty agrees with Weller in the correlation of the St. Joe limestone with the Fern Glen limestone, which in turn is correlated with the Chouteau limestone. The disagreement comes in whether the Chouteau limestone is Kinderhook or basal Osage. Girty[5] says:

> I believe that the proper boundary between the Kinderhook and the Burlington is at the base of the upper or principal oolite in the Burlington section, this strictly calcareous bed being thus thrown with the limestone series above rather than with the mainly sandstone series below. If the Burlington is thus defined, the lower Burlington fauna will, I believe, be rather sharply distinguished from the Kinderhook. * * * If the Chouteau limestone does correlate with the lower Burlington it will be necessary to redefine the Kinderhook group so as to exclude the Chouteau limestone and its correlates, and also to reclassify the section at Burlington itself so as to include with the Burlington limestone the upper oolite, commonly placed in the Kinderhook. This would diminish considerably the distribution of the Kinderhook rocks, but give greater uniformity to the Kinderhook fauna.

Above the St. Joe limestone lies the Boone chert. This formation as described in the Eureka Springs-Harrison Folio is made to include the Fern Glen, Burlington, Keokuk, and Warsaw limestone of the typical Mississippian section. Quoting from the folio[6] mentioned above:

> The lower portion of the Boone, which has been separated from the rest as the St. Joe limestone member, is the equivalent of the Fern Glen limestone, but certain beds, which are known by their fossils to be of Fern Glen age, overlie the typical St. Joe on War Eagle Creek in the Eureka Springs quadrangle. The rest of the Boone is about equally divided between the Burlington and the Keokuk and Warsaw.

The Boone formation does not contain a great many of the diagnostic Burlington and Keokuk species, though there are some present. The upper part of the Boone in the Joplin district, which

4. Girty, George H., Faunas of the Boone limestone at St. Joe, Arkansas: U. S. Geol. Survey Bull. 598, 1915.
5. Op. cit., pp. 27-28.
6. Purdue, A. H. and Miser, H. D., U. S. Geol. Survey Geol. Atlas, Eureka Springs-Harrison folio (No. 202), 1916.

comes above the Short Creek oolite, contains a few species that suggest a higher horizon than the Keokuk, and is probably of Warsaw age. This formation though very widespread is not present in the Stonewall Quadrangle.

Above the Osage lies the Moorefield shale with the Spring Creek limestone member at its base. This formation has a most unique faunal assemblage found principally in the Spring Creek limestone, and it has no direct correlative anywhere in the Mississippi valley. Certain of its fauna indicate Kaskaskian rather than Meramec age. However, it has generally been regarded by paleontologists as correlating with the Meramec ("St. Louis") group. Certain aspects of this fauna have been described from the Great Basin region and from the Eureka district of Nevada. It is equivalent to the Mayes of the Pryor Quadrangle and to the greater portion of the lower Caney in the Stonewall Quadrangle, being that portion of the Caney which is in part called Mayes by the driller around the major Seminole region.

Above the Moorefield lies the Batesville sandstone and a local limestone member at the base called Hindsville limestone. The Batesville[7] sandstone has a fauna which like the Moorefield is more or less peculiar to itself, and which has led to many arguments.

> It may be said therefore that the Batesville fauna, especially if taken in connection with the Moorefield and Fayetteville fauna, shows remarkable differences both from the Tribune and the Birdsville fauna and from the Ste. Genevieve faunas, as far as they are known to me. On the whole the evidence at hand seems to favor a correlation of the Batesville sandstone with the Cypress sandstone together with the upper part or possibly the whole of the Ste. Genevieve limestone. If this is so, it seems clear that we have in the Moorefield, Batesville, and Fayetteville formations evidence of marked difference in sedimentation from that which conditioned the formation of the Ste. Genevieve, Tribune, and Birdsville formations, that to these differences correspond others of a faunal character equally strong, such as the development of species in one area not found in the other and also more or less diversity in the time of appearance of species common to both. The facts at hand suggest that the Arkansas section belongs to a different faunal province from that of the typical section, at least so far as the upper Mississippian is concerned, and that it is inexpedient to combine the two in a standard time scale, as Mr. Ulrich has done in his revision of the Paleozoic systems.

Quoting from the Eureka Springs-Harrison Folio:

> It resembles the fauna of the Spergen limestone of Indiana. It even more closely resembles the less well known fauna of the typical Ste. Genevieve limestone, and the presence of such types as *Diaphragmus elegans*, *Spiriferina transversa*, and a few others

7. Girty, George H., The fauna of the Batesville sandstone of northern Arkansas: U. S. Geol. Survey Bull. 593, p. 25, 1915.

indicates that it is of Chester rather than of Meramec age. All of the upper Mississippian faunas of northern Arkansas present so many differences from the typical upper Mississippian faunas that an exact correlation is not yet possible. There is even some difficulty in correlating the Hindsville member paleontologically with other formations in near-by sections.

Above the Batesville sandstone occurs the Fayetteville shale, the basal part of which is represented by limestone west of Fayetteville. Its fauna is of Chester age and is more or less closely related to the faunas of the sandstone of the Batesville and of the Hindsville limestone member of the Batesville. Snider[8] says:

> The Fayetteville and Pitkin formations probably are to be correlated with the Okaw and Menard formations of the Mississippi Valley Chester section.

This formation is probably present in the upper part of the Caney as known in the region of the Stonewall Quadrangle.

Above the Fayetteville shale occurs the Pitkin limestone which is more or less erratic in its distribution. This is probably due to its position as it marks the top of the Mississippian and there is an erosional unconformity above it. Quoting from Snider:[9]

> The Pitkin limestone can be pretty definitely correlated with the Maxville limestone of Ohio and through it with the Newman and Greenbrier limestones of the Allegheny region.

Before leaving the Mississippian formations a word should be said regarding the age of the Caney shale of Oklahoma. By Caney shale the author means strictly those shales which were examined by Girty and not the shales of the Ouachita region, which in part have been called the John's Valley shale by Ulrich.[10] From a study of the faunas listed it seems that the faunas collected by Morgan in the Stonewall Quadrangle are the ones that have largely contributed to the idea that the Caney shale contains a fauna of both Chester and Pottsville ages. In the Stonewall Quadrangle Morgan lists all the forms identified by Girty in his publication on the Caney shale plus an added collection, which, from examination of the locality, shows that this collection came from the top of the Caney as described. It is from these localities that forms such as *Bellerophon crassus* and a variety, *wewokanus, Composita subtilita, Leda bellistriata, Lophophyllum profundum, Metacoceras cornutum, Nuculopsis ventricosa, Phanerotrema grayvillense, Trepospira depressa, Pustula bullata,* and many others which are very abundant forms in the Pennsylvanian, none of which come over from the Chester. It seems

8. Snider, L. C., Geology of a portion of northeastern Oklahoma: Oklahoma Geol. Survey Bull. 24, Pt. I, p. 39, 1915.
9. Op. cit., p. 43.
10. Ulrich, E. O., Fossiliferous boulders in the Ouachita "Caney" shale and the age of the shale containing them: Oklahoma Geol. Survey Bull. 45, 1927.

from this evidence that Morgan has undoubtedly made collections from shales of Morrow age, which he mistook for the true Caney shale. Girty[11] in speaking of the Batesville sandstone and Fayetteville shale, makes this statement:

> A large number of forms are common to the two formations, and the foregoing list does not, of course, include species which are common to the Caney and to the Batesville and Fayetteville, for at present I am disposed to correlate all three of the Arkansas formations with the Caney. When the distance which separates them is considered, the resemblance between the two faunas is unusually strong. On the whole it appears to me that the resemblance of the Caney fauna and that of the Moorefield shale in the Batesville Quadrangle is more notable than that between the Moorefield fauna in the Batesville Quadrangle and the same fauna relatively a short distance away at Marshall and is much stronger than with the typical Mississippian fauna with which the Moorefield is correlated.

This Caney fauna is also discussed by Kirtley Mather[12] in his paper on the fauna of the Morrow group, who says:

> Ulrich has referred the Caney shale of the Ouachita region, Arkansas-Oklahoma, to the Pottsville and * * * has stated that a part of that formation is the equivalent of the Morrow. Woodworth likewise places that formation in the Pottsville series. A comparison of the Caney fauna as described by Girty, with the Morrow fauna as now known shows only one species, *Productus cora*, common to the two formations. It is evident that the fossiliferous portion, at least, of the Caney cannot be of Pottsville age.

From an extensive regional subsurface study of well-cuttings, the author believes that the base of the Pottsville lies at the base of the Cromwell or Quinn sandstone series, which are equivalent to the sandstone below the Wapanucka limestone and are equivalent to the Hale sandstone of Arkansas. The basal part of the Cromwell or Quinn series is quite shaly in certain areas but from examinations of well-cuttings sandstones have not been noted below this series; and the upper Caney is composed of shale with a few limestone stringers, which are very sporadic. The base of the Pottsville is quite well marked to the east and southeast of the Seminole area in Oklahoma.

Unconformably above the Pitkin limestone and Caney shale of Oklahoma, as described by Girty, occurs the Morrow formation. This formation, as described in Arkansas, from the base upwards consists of the Hale sandstone, the Brentwood limestone member called the "Pentrimital", and the Bloyd shale with the Kessler limestone lentil near the top. The top is marked by an unconformity, and the next succeeding formation is the Winslow.

11. Op. cit. p. 24.
12. Mather, Kirtley F., The fauna of the Morrow group of Arkansas and Oklahoma: Bull. Denison Univ. Sci. Lab. vol. XVIII, p. 83, 1915.

Quoting from the Eureka Springs-Harrison Folio:[13]

> The passage from the Mississippian to the Pennsylvanian is marked in northern Arkansas by a pronounced faunal break. Nevertheless, the earlier Pennsylvanian formations were for a number of years placed in the Mississippian. David White was the first to assign them correctly and correlate them with the Pottsville. His conclusions were based on the fossil flora of the "coal bearing" shale of the Geological Survey of Arkansas that lies between the Brentwood and Kessler limestones—a flora which he determined as of late middle or early upper Pottsville age. Later, because the fauna of the Hale formation and of the Brentwood limestone proved to be closely related to the fauna of the Kessler limestone the Hale and the Brentwood also were placed in the Pottsville. The Hale, Brentwood, and Kessler faunas are all closely related to one another and, though of Pennsylvanian age, they are conspicuously different from the familiar Pennsylvanian faunas of Kansas, Missouri, Illinois, and other States, most of which, indeed, are geologically younger. Many of the species are undescribed, and for this reason mere lists do not give an adequate idea of these faunas.

Mather has made a comprehensive study of the Morrow fauna and finds a considerable Mississippian element. However, in checking over his lists it will be noted that many of the genera are the same in the Pennsylvanian and Mississippian, yet the species are different, and all but one or two of the forms which he lists are not found below the Pennsylvanian-Mississippian contact. All of the *Pentremites* have a different species in both ages and the same applies to the bryozoa called *Archimedes*. As a result probably the greater percentage of the species listed from the Morrow are proemial Pennsylvanian forms. Homotaxial equivalents of the Morrow fauna have not as yet been found in North America north and east of the Morrow locality. The Mercer limestone in Ohio is upper Pottsville in age, but is younger than the Morrow. This is the nearest formation which in age might be somewhere equivalent to the Morrow. In western North America conditions were more favorable for transitional deposition, and as a result, two faunas from the Cordilleran region bear rather striking resemblance to the Morrow fauna. One of these was described in 1873 by Meek from collections made at "Old Baldy" near Virginia City, Montana. The other is the lower Aubreay group described by White from collections made by the Powell Survey in the vicinity of the Uinta Mountains in Utah. In Colorado the Molas formation and the overlying Hermose limestone of the San Juan region described by Girty bear some resemblances to the Morrow formation, but they have an abundance of *Triticites secalicus*. Toward the southwest from the Morrow outcrops there is a much closer correlation—that is the Brentwood correlates with the Wapanucka limestone, and the Marble Falls limestone in the Llano-Burnett region of Texas is known to contain homotaxial equivalents of the Morrow formation. In Europe the "*Bergkalkschichten*" of Mjatschkowa, as described by Trautschold, presents the most striking similarities to the Morrow, and as a result it would appear that its correlation in North America is with the Pottsville rather than the Chester stages. However, the absence from the Mjatschkowa fauna of *Zaphrentidae, Favositidae, Pentremites*, and *Archimedes* is noteworthy. *Archimedes*, however, is known to occur in the overlying Schwagerina limestone. This correlation is a good example of how one may be led astray when using genera only. On the Brogger peninsula in Spitzbergen in latitude 79 north, longitude 12 east occurs a series of limestones called the Moskauer Stufe. The fauna from this limestone bears a close relationship to the Pottsville in North America. One other marine fauna shows a contemporaneity with the Morrow—that is the Pendleside group. This formation is a series of shales and limestones extending from Chokiar in Belgium to the west across central England to County Clare, West Ireland. This formation lies unconformably upon the Yoredale series and beneath the Millstone Grits. A great deal more information may be found in Mather's paper on the fauna of the Morrow group.

13. Purdue A. H. and Miser, H. D., Op. cit. p. 14.

BIBLIOGRAPHY

Following publications are the principal ones upon the area under consideration.

Purdue, H. A., and Miser, H. D., U. S. Geol. Survey Geol. Atlas, Eureka Springs-Harrison Folio (No. 202), Arkansas-Missouri, 1916.

Taff, Joseph A., U. S. Geol. Survey Geol. Atlas, Tahlequah Folio (No. 122), Indian Territory-Arkansas, 1905.

Snider, L. C., Pt. I, Geology of a portion of northeastern Oklahoma; Pt. II, Paleontology of the Chester group in Oklahoma: Oklahoma Geol. Survey Bull. 24, 1915.

Morgan, George D., Geology of the Stonewall Quadrangle of Oklahoma: Bur. of Geology Bull. 2, 1924.

Cooper, C. L., The Sycamore limestone: Oklahoma Geol. Survey Circ. 9, 1926.

Miser, H. D., and Honess, C. W., Age relations of the Carboniferous rocks of the Ouachita Mountains of Oklahoma and Arkansas: Oklahoma Geol. Survey Bull. 44, 1927.

Ulrich, E. O., Fossiliferous boulders in the Ouachita "Caney" shale and the age of the shale containing them: Oklahoma Geol. Survey Bull. 45, 1927.

Branner, J. C., Geological Survey of Arkansas, Ann. Rept. 1888. Also, Ann. Rept. 1890.

Mather, K. F., The fauna of the Morrow group of Arkansas and Oklahoma: Bull. Denison Univ. Sci. Lab. vol. 18, 1915.

Girty, G. H., The fauna of the Moorefield shale of Arkansas: U. S. Geol. Survey Bull. 439, 1911.

———Faunas of the Boone limestone at St. Joe, Arkansas: U. S. Geol. Survey Bull. 598, 1915.

———The fauna of the Batesville sandstone of northern Arkansas: U. S. Geol. Survey Bull. 593, 1915.

———Fauna of the so-called Boone chert near Batesville, Arkansas: U. S. Geol. Survey Bull. 595, 1915.

———The fauna of the Caney shale of Oklahoma: U. S. Geol. Survey Bull. 377, 1909.

A Comparative Faunal Chart of the Mississippian and Morrow Formations of Oklahoma and Arkansas

By
Robert Roth

SPECIES	GIRTY			SNIDER			MORGAN			MATHER		
	MOOREFIELD	BATESVILLE	CANEY	MAYES	FAYETTEVILLE	PITKIN	WOODFORD	CANEY	WAPANUCKA	HALE	BRENTWOOD	KESSLER
PROTOZOA												
Endothyra discoidea		■										
ANTHOZOA												
Amplexus corrugatus											■	
Campophyllum torquium											■	
*Chaetetes milleporaceous												
Cladochonus fragilis									■			
Lophophyllum profundum								■	■			
Michelinia eugeneae									■		■	■
Michelinia exilimura											■	
Michelinia meekana				■	■	■						
Michelinia subcylindrica									■			
Pachypora carbonaria											■	
Pachypora oklahomensis				■								
Paleacis cuneata					■							
Zaphrentis gibsoni											■	
Zaphrentis spinulosa				■	■	■						
Zaphrentis aff. spinulosa		■										
HELMINTHA												
Enchostoma bicarinatum	■											
BLASTOIDEA												
Pentremites angustus									■	■	■	
Pentremites rusticus									■		■	
CRINOIDEA												
Agassizo rinus conicus									■			
Ceriocrinus hemisphericus									■			
Cromyocrinus grandis											■	
Delocrinus dubius											■	
*Delocrinus pentanodus												
Eupachycrinus magister									■		■	
Stereobrachicrinus pustulossus									■			
BRYOZOA												
Archimedes invaginatus					■							
Archimedes confertus				■								
Archimedes distans					■							
Archimedes juvenis											■	
Archimedes proutanus				■	■							
Archimedes proutanus var.		■										
Archimedes sublaxus					■							
Batostomella dubia	■											
Batostomella parvula	■	■										
Coscinium fayettevillensis											■	■
Coscinium gracilens											■	
Cystodictya americana					■							
Cystodictya brentwoodensis									■	■	■	
*Cystodictya flexuosa												
Cystodictya labiosa					■							
*Cystodictya morrowensis												
Cystodictya nitida					■							
Cystodictya sinuomarginata										■	■	
Dictyocladia triseriata										■	■	
Fenestella cestriensis					■							
Fenestella compressa					■							
Fenestella elevatipora					■							
Fenestella mimica									■			
Fenestella morrowensis										■	■	
Fenestella afl. multispinosa	■											
Fenestella aff. rudis	■											
Fenestella serratula					■						■	
Fenestella aff. serratula		■										
Fenestella sevillensis									■			
Fenestella tenax		■										
Fenestella cf. triserialis					■							
Fenestella venusta									■	■	■	■
Glyptopora crassistoma									■		■	
Glyptopora incrustans									■			
Glyptopora aff. plumosa		■										
Glyptopora aff. punctipora		■										
Glyptopora aff. sagenella		■										
*Phyllopora cribrosa												
Phyllopora perforata										■		
Polypora anastomosa										■	■	
Polypora anastomosa var. spinicarinata										■		
Polypora cestriensis					■				■			
Polypora constricta										■	■	
Polypora elliptica											■	
Polypora halensis										■		
Polypora kesslerensis												■
Polypora magna										■	■	
Polypora purduei										■	■	
Polypora reversispina										■		
Polypora triseriata										■	■	
Polypora wasingtonensis										■	■	
Polypora spinulifera					■				■			

Faunal Chart—Continued

SPECIES, Continued	GIRTY			SNIDER			MORGAN			MATHER		
	MOOREFIELD	BATESVILLE	CANEY	MAYES	FAYETTEVILLE	PITKIN	WOODFORD	CANEY	WAPANUCKA	HALE	BRENTWOOD	KESSLER
BRACHIOPODA. CONTINUED												
Pustula sublineata								■			■	
Pustula subsulcata				■								
Reticularia setigera	■	■		■	■	■						
Rhipidomella altrirostris									■	■		
Rhipidomella arkansana	■			■								
Rhipidomella pecosi											■	
Rhynchopora magnicosta									■		■	
Schizophoria resupinoides									■	■	■	■
Schuchertella williamsi		■										
Spirifer arkansanus	■			■								
Spirifer cameratus									■			
Spirifer fayettevillensis					■							
Spirifer goreii									■	■		■
Spirifer increbescens	■	■										
Spirifer leidyi				■	■	■						
Spirifer moorefieldanus	■						■					
Spirifer opimus									■		■	
Spirifer pellaensis				■	■	■						
Spirifer rockymontanus									■	■	■	■
Spiriferina campestris									■	■	■	■
Spiriferina kentuckyensis									■			
Spiriferina spinosa		■		■	■	■						
Spiriferina subelliptica var. fayettevillensis	■											
Spiriferina transversa		■		■	■				■	■	■	■
Squamularia perplexa										■	■	■
Squamularia transversa									■	■		
PELECYPODA												
Allorisma maxvillense		■										
Allorisma neglectum		■										
Allorisma walkeri		■		■	■	■						
Allorisma walkeri var. abbreviatum	■											
Astartella concentrica									■			
Astartella variia									■			
Aviculopectan arkansanus										■		■
Aviculopectan aurisculptus										■		
Aviculopectan eurekensis				■	■	■						
Aviculopectan halensis									■	■		
Aviculopectan hertzeri												■
Aviculopectan keoughensis						■						
Aviculopectan mayesensis				■								
Aviculopectan morrowensis					■	■						
Aviculopectan occidentalis								■	■			
Aviculopectan ozarkensis				■								
Aviculopectan talboti										■		
Aviculopectan pitkinensis					■	■						
Caneyella hopkinsi		■										
Caneyella nasuta	■		■					■				
Caneyella percostata	■		■					■				
Caneyella richardsoni			■					■				
Caneyella vaughani	■		■	■				■				
Caneyella wapanuckensis	■		■					■				
Cnocardium cuneatum		■										
Cnocardium peculiare						■						
Cnocardium sniderí								■				
Cypricardella oblonga		■										
Cypricardinia laevicula											■	
Cypricardinia moorefieldana				■								
Deltopectan batesvillensis		■		■								
Deltopectan batesvillensis var.		■										
Deltopectan occidentalis										■		■
Deltopectan tahlequahensis				■								
Edmondia crassa	■	■		■		■						
Edmondia crassa var. suborbiculata				■	■	■						
Edmondia crassa var. symmetrica		■										
Edmondia equilateralis		■										
Edmondia maccoyii												■
Edmondia pitkinensis					■	■						
Edmondia subtruncata												■
Leda bellistriata								■	■	■		
Leda bellistriata attenuata								■				
Leda nasuta	■											
Leda nuculiformis		■										
Leda pandoriformis		■										
Leda vaseyana	■			■	■	■						
Leptodesma carboniferum		■										
Leptodesma spergenense var. robustum		■										
Myalina compressa				■	■	■						
Myalina cuneiformis												■
Myalina elongata		■										
Myalina illinoisensis		■										
Myalina longicardinalis						■						
Myalina monroensis		■										
Myalina orthonota										■		
Myalina recurvirostris										■		
Myalina welleriana		■										
Nucula illinoiensis						■						
Nucula kessleriana												■
Nucula parva									■	■		
Nucula rectangula	■	■			■							

Glyptopora aff. punctipora												
Glyptopora aff. sagenella		■										
*Phyllopora cribrosa		■										
Phyllopora perforata										■		
Polypora anastomosa										■	■	
Polypora anastomosa var. spinicarinata										■		
Polypora cestriensis					■				■			
Polypora constricta										■	■	
Polypora elliptica											■	
Polypora halensis										■		
Polypora kesslerensis												■
Polypora magna										■	■	
Polypora purduei										■	■	
Polypora reversispina										■		
Polypora triseriata										■	■	
Polypora wasingtonensis										■	■	
Polypora spinulifera					■				■			
Prismopora concava												■
Rhombopora attenuata												■
Rhombopora lepidodendroides									■			■
Rhombopora persimilis									■			
Rhombopora snideri									■			
Rhombopora tabulata					■							
Septopora crebripora										■		
Septopora implexa											■	
Septopora reversispina											■	
Stenopora bullata									■			
Stenopora circina									■			
Stenopora hispida									■			
Stenopora micropora									■			
Stenopora tuberculata									■		■	
Stenopora wapanuckensis									■			
Streblotrypa nicklesi					■							
Streblotrypa subspinosa					■							
Tabulipora aff. gracilis		■										
Tabulipora miseri		■										
Thamniscus furcillatus					■							

BRACHIOPODA

Ambocoelia laevicula	■			■								
Athyris cestriensis				■	■							
Avonia oklahomensis				■								
*Brachythyris laticosta												
Brachythyris ozarkensis					■							
Camarophoria cestriensis				■	■	■						
Camarotoechia purduei	■	■		■	■							
Camarotoechia purduei var. agrestis	■											
Camarotoechia purduei var. inflata		■										
Camarotoechia purduei var. laxa	■											
Chonetes arkansanus												■
Chonetes cherokeensis				■								
*Chonetes choteauensis												
Chonetes granulifer									■			
Chonetes laevis									■	■		
Chonetes oklahomensis				■	■	■						
Chonetes planumbonus var. choctawensis			■				■	■				
Chonetes sericeus	■			■		■						
Cliothyridina elegans		■										
Cliothyridina sublamellosa		■			■	■						
Composita acinus		■										
Composita arkansanum									■			
Composita biplicata												
Composita deflecta									■		■	
Composita gibbosa									■	■	■	
Composita aff. humilis	■											
Composita lewisensis				■								
Composita madisonensis var. pusilla	■											
Composita ovata									■	■	■	■
Composita ozarkana									■	■	■	■
Composita rotunda				■								
Composita subquadrata		■										
Composita subquadrata var. lateralis	■											
Composita subtilita								■	■			
Composita transversa										■	■	
Composita trinuclea				■	■	■						
Composita wasatchensis									■	■	■	■
Crania chesterensis					■							
Derbya crassa									■			
Diaphragmus elegans	■	■		■	■	■						
Diaphragmus fasciculatus	■											
Dielasma arkansanum											■	
Dielasma bilobatum											■	
Dielasma compressa				■	■							
Dielasma formosum var. whitfieldi		■										
Dielasma shumardana				■	■	■						
Dielasma subspatulatum									■	■	■	■
Eumetria costata				■	■	■						
Eumetria lata					■							
Eumetria marcyi	■	■		■	■	■					■	
Eumetria pitkinensis						■						
Girtyella brevilobata					■							
Girtyella emarginata												■
Girtyella indianensis				■	■							
Girtyella indianensis var. exporrecta					■							
Girtyella turgida var. elongata	■	■										
Harttina brevilobata	■						■					
Hustedia brentwoodensis									■	■	■	
Hustedia miseri									■	■	■	■
Hustedia mormoni								■	■			
Hustedia multicostata						■						
Lingula albapinensis	■		■					■				
Lingula batesvillae	■			■			■					
Lingula paracletus			■				■	■				
Lingulidiscina batesvillensis		■	■					■				
Lingulidiscina cf. newberryi							■					
Lingulidiscina newberryi var. caneyana	■		■				■	■				
Lingulidiscina newberryi var. marshallensis	■											
Lingulidiscina newberryi var. moorefieldana	■			■								
Lingulidiscina newberryi var. ovata	■		■					■				

Leptodesma carboniferum		■										
Leptodesma spergenense var. robustum		■										
Myalina compressa				■	■	■						
Myalina cuneiformis												■
Myalina elongata		■										
Myalina illinoisensis		■										
Myalina longicardinalis						■						
Myalina monroensis		■										
Myalina orthonota										■		
Myalina recurvirostris										■		
Myalina welleriana		■										
Nucula illinoiensis						■						
Nucula kessleriana												■
Nucula parva									■	■		
Nucula rectangula	■	■			■							
Nucula shumardiana		■										
Nuculopsis ventricosa								■				
Paleolima inequicostata												■
Parallelodon cancellosus											■	
Parallelodon multiliratus	■		■	■				■				
Parallelodon pergibbosus											■	
Parallelodon sangamonensis											■	
Pinna consimilis				■								
Pleurophorus tropidophorus										■		
Pseudomonotis inflata												■
Pseudomonotis precursor											■	
Schizodus arkansanus		■				■						
Schizodus batesvillensis	■	■										
Schizodus brannerianus		■										
Schizodus chesterensis				■		■						
Schizodus depressus		■		■	■	■						
Schizodus depressus var. abruptus		■										
Schizodus depressus var. circulus		■										
Schizodus insignis				■		■						
Schizodus morrowensis										■		
Schizodus cf. morrowensis									■			
Solenopsis nitida	■			■								
Sphenotus aff. branneri		■										
Sphenotus cherokeense				■		■						
Sphenotus constrictus		■										
Sphenotus cultellus		■										
Sphenotus halensis										■		
Sphenotus meslerianus	■											
Sphenotus aff. meslerianus		■										
Sphenotus oklahomense				■								
Sphenotus gibsonense						■						
Sphenotus quadriplicatum						■						
Sphenotus vulgaris		■										
Sphenotus washingtonense		■			■							
Streblopteria similis				■								
Sulcatipinna arkansana		■		■								
Yoldia levistriata		■										

PTEROPODA

Idiotheca rugosa			■				■					

SCAPHOPODA

Levidentalium venustum		■	■					■				

GASTROPODA

Bellerophon crassus								■				
Bellerophon crassus var. wewokanus								■			■	
Bellerophon pitkinensis						■						
Bellerophon sublaevis		■										
Bellerophon cf. sublaevis										■	■	
Bembexia nodomarginata	■			■								
Bucanopsis cancellata	■	■										
Bulimorpha canaliculata				■								
Conularia crustula?								■				
Euconospira arkansana												■
Euconospira disjuncta		■										
Euomphalus similis		■										
Euphemus carbonarius									■	■	■	
Holopea newtonensis					■	■						
Lepetopsis chesterensis										■		
Lepetopsis levettei		■										
Naticopsis genevievensis		■										
Orthonychia mayesense				■								
Patellostium branneri		■										
Phanerotrema grayvillense								■	■			
Platyceras aculirostre		■										
Platyceras parvum									■	■	■	■
Platyceras subrotundum				■	■	■						
Pleurotomaria arkansana		■										
Pleurotomaria missouriensis									■			
Pleurotomaria aff. perhumerosa		■										
Schizostoma catilloides									■	■	■	
Sphaerodoma subcorpulenta				■	■	■						
Straparollus planidorsatus				■	■	■						
Straparollus spergenensis				■								
Straparollus cf. spergenensis											■	
Strophostylus aff. carleyanus	■	■										
Strophostylus splendens		■										
Strophostylus subovatus										■		
Trepospira depressa								■				
Worthenia tabulata									■			■

CEPHALOPODA

Actinoceras vaughanianum			■					■				
Adelphoceras meslerianum	■	■	■					■				
Aptychus solidum		■										
Coelonautilus gratiosus			■					■				
Cycloceras ballianum			■					■				
Cycloceras randolphensis					■	■						
Cycloceras sequoyahensis					■	■						
Dimorphoceras oklahomae								■				

[illegible]												
Composita transversa										■	■	
Composita trinuclea				■	■	■						
Composita wasatchensis									■	■	■	■
Crania chesterensis					■							
Derbya crassa									■			
Diaphragmus elegans	■	■		■	■	■						
Diaphragmus fasciculatus	■											
Dielasma arkansanum											■	
Dielasma bilobatum											■	
Dielasma compressa				■	■							
Dielasma formosum var. whitfieldi		■										
Dielasma shumardana				■	■	■						
Dielasma subspatulatum									■	■	■	■
Eumetria costata				■	■	■						
Eumetria lata					■							
Eumetria marcyi	■	■		■	■	■					■	
Eumetria pitkinensis						■						
Girtyella brevilobata					■							
Girtyella emarginata												■
Girtyella indianensis				■	■							
Girtyella indianensis var. exporrecta					■							
Girtyella turgida var. elongata	■	■										
Harttina brevilobata	■						■					
Hustedia brentwoodensis									■	■	■	
Hustedia miseri									■	■	■	■
Hustedia mormoni								■	■			
Hustedia multicostata						■						
Lingula albapinensis	■		■					■				
Lingula batesvillae	■			■			■					
Lingula paracletus			■				■	■				
Lingulidiscina batesvillensis		■	■					■				
Lingulidiscina cf. newberryi							■					
Lingulidiscina newberryi var. caneyana	■		■				■	■				
Lingulidiscina newberryi var. marshallensis	■											
Lingulidiscina newberryi var. moorefieldana	■			■								
Lingulidiscina newberryi var. ovata	■		■					■				
Liorhynchus carboniferum	■		■	■			■	■				
Liorhynchus carboniferum var. polypleurum	■		■	■			■	■				
Martinia glabra	■			■			■					
Meekella striatocostata												■
Moorefieldella eurekensis	■			■								
Moorefieldella eurekensis var. subcuboides	■											
Orbiculoidea minuta										■	■	
Orbiculoidea missouriensis											■	
Orthotetes kaskaskiensis				■	■	■						
Orthotetes robusta										■	■	■
Orthotetes subglobosus		■										
Orthotetes subglobosus var. batesvillensis		■										
Orthotetes subglobosus var. protensus		■										
Productus arkansanus		■		■	■	■						
Productus arkansanus var. multiliratus	■			■								
Productus blairi								■				
Productus biseriatus	■											
Productus cherokeensis					■							
Productus adairensis		■		■	■							
Productus coloradoensis	■	■		■								
Productus cora								■	■	■	■	■
Productus fayettevillensis										■	■	■
Productus gallantinensis									■	■	■	■
Productus gallowayi									■			
Productus inflatus					■							
Productus moorefieldanus	■											
Productus moorefieldanus var. pusillus	■											
Productus morrowensis									■	■	■	■
Productus cf. morrowensis								■				
Productus nanus									■	■		
Productus ovatus	■	■	■	■	■	■		■				
Productus ovatus var. latior				■								
Productus ovatus var. minor					■							
Productus subsulcatus	■											
Productus subsulcatus var. janus	■											
Productus welleri									■	■	■	■
Productella hirsutiformis	■	■	■	■			■	■				
Productella hirsutiformis var. batesvillensis	■			■								
Pugnoides triangularis										■	■	
Pustula alternata				■	■	■						
Pustula biseriata				■								
Pustula bullata								■	■		■	
Pustula globosa											■	
Pustula moorefieldana				■								
Pustula nebraskensis									■		■	■
Pustula pertenuis										■	■	■
Pustula punctata									■	■	■	■

(Continued in next column)

Euconospira arkansana												■
Euconospira disjuncta		■										
Euomphalus similis		■										
Euphemus carbonarius									■	■	■	
Holopea newtonensis					■	■						
Lepetopsis chesterensis										■		
Lepetopsis levettei		■										
Naticopsis genevievensis		■										
Orthonychia mayesense				■								
Patellostium branneri		■										
Phanerotrema grayvillense								■	■			
Platyceras aculirostre		■										
Platyceras parvum									■	■	■	■
Platyceras subrotundum				■	■	■						
Pleurotomaria arkansana		■										
Pleurotomaria missouriensis									■			
Pleurotomaria aff. perhumerosa		■										
Schizostoma catilloides									■	■	■	
Sphaerodoma subcorpulenta				■	■	■						
Straparollus planidorsatus				■	■	■						
Straparollus spergenensis				■								
Straparollus cf. spergenensis											■	
Strophostylus aff. carleyanus	■	■										
Strophostylus splendens		■										
Strophostylus subovatus										■		
Trepospira depressa								■				
Worthenia tabulata									■			■

CEPHALOPODA

Actinoceras vaughanianum			■					■				
Adelphoceras meslerianum	■	■	■					■				
Aptychus solidum		■										
Coelonautilus gratiosus			■					■				
Cycloceras ballianum			■					■				
Cycloceras randolphensis					■	■						
Cycloceras sequoyahensis					■	■						
Dimorphoceras oklahomae								■				
Dryochoceras brainerdi								■				
Endolobus ornatus	■											
Eumorphoceras bisulcatum	■		■					■				
Gastrioceras angulatum									■			
Gastrioceras branneri										■		
Gastrioceras caneyanum	■	■	■					■				
Gastrioceras kansasense								■				
Gastrioceras kesslerense												■
Gastrioceras listeri								■				
Gastrioceras pygmaeum									■		■	
Gastrioceras richardsonianum	■		■					■				
Glyphioceras kentuckiensis				■								
Goniatites choctawensis	■	■	■					■				
Goniatites crenistria	■											
Goniatites newsomi	■		■									
Goniatites subcircularis	■											
Metacoceras cornutum								■				
Orthoceras caneyanum		■	■					■				
Orthoceras choctawense			■					■				
Orthoceras crebriliratum			■					■				
Orthoceras aff. crebriliratum	■											
Orthoceras eurekensis				■	■	■						
Orthoceras aff. eurekensis		■										
Orthoceras indianum		■	■					■				
Orthoceras okawense		■										
Orthoceras wapanuckense			■					■				
Probleoceras lutheri							■					
Trizonoceras lepidum			■					■				
Trizonoceras typicale			■					■				

TRILOBITA

Griffithides morrowensis									■	■	■	■
Griffithides mucronatus		■										
Griffithides pstulosus				■		■						

OSTRACODA

Bair ia attenuata	■											
Cytherella aff. benniei			■					■				
Cytherella glandella		■										
Entomis unicornis			■					■				
Glyptopleura rhomboidalis		■										
Paraparchites nicklesi	■	■										
Primita fayettevillensis		■										
Primita moorefieldana	■											
Primita seminalis		■										
Number of Species	73	98	36	80	70	50	13	57	77	65	80	43
Collecting Localities, Number of	30	16	31	21	22	10	9	14	6	4	12	2