NOTES ON THE PALEONTOLOGY OF THE OREAD LIMESTONE OF KANSAS

by

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INTRODUCTION

General Character and Synonomy of the Oread Limestone

The Oread limestone is the uppermost member of the Douglas formation, and forms one of the most important and conspicuous stratigraphic units in the Pennsylvanian of Kansas.

This limestone was named by Professor Erasmus Haworth,[1] former State Geologist of Kansas, from its outcrops on Mount Oread, the hill upon which Kansas University is located at Lawrence, Kansas.

Throughout most of its length the outcrop of the Oread consists of three limestones with two intervening shales. One of these limestones, the Lower, disappears about fifty miles from the sourthern Kansas line, but all three are persistent northward.

In this report I shall adopt the nomenclature of the Nebraska State Geological Survey for the shale members of the Oread, but retain the designations Lower, Middle and Upper when referring to the limestones.

The Lower Oread, designated as the Weeping Water in Nebraska, varies in thickness from 0 to 18 feet, but the average thickness is about ten feet. The limestone

1. Haworth, E. "The Stratigraphy of the Kansas Coal Measures". K.U.Quart. Vol.2,pp.123-124 1894

is buff and rather massive and forms prominent ledges which are usually dominated by the higher and therefore more conspicuous outcrop of the Upper Oread.

The Snyderville shale occurring between the Lower and Middle limestones is usually olive gray in color, rather clayey, and contains many irregular soft limey concretions. The thickness is usually 8 to 12 feet.

The Middle limestone, termed the Leavenworth by the Nebraska Geological Survey, is thin, dark, compact and brittle. It extends across Kansas into Oklahoma on the south and into Nebraska and Missouri on the north. To the north it may consist of two layers, but the thickness as observed by me has never been more than two feet, nor thinner than ten inches. Upon prolonged weathering the limestone becomes a dirty whitish-gray color.

The Heebner shale immediately above the Middle limestone is divided into two zones of about equal thickness, a lower black carbonaceous and a higher buff limey zone. This shale is typically about six feet thick, but thickens to thirty-five feet at St. Joseph, Mo.

The Upper limestone, called the Plattsmouth in Nebraska varies in thickness from 17 to 27 feet. It contains conspicuous amounts of chert, especially in the upper part, and is characterized by rather thin wavy bedding.

A thin oolitic cross-bedded limestone sometimes occurs above the Upper Oread. This is the so-called "Waverly Flagging" which Condra has named the Hereford limestone from outcrops near Atchison, Kansas.

Southward, the Oread is equivalent to a part of the Nelagoney formation of northern Oklahoma which consists of several hundred feet of shales and sandstones and is correlated with the Douglas formation as a whole.[2]

Beede[3] has correlated the Ames limestone of Upper Conemaugh age in eastern Ohio with the Oread limestone of Kansas.

PREVIOUS WORK

There has been no published work dealing solely with the Oread, but discussions of its character, stratigraphic position and paleontology have been included in many of the publications of the State Geological Surveys of Kansas, Nebraska and Missouri.

Perhaps the most complete resume of the paleontology of the Oread limestone published to date is contained in Volume IX of the Kansas University Geologic Survey, by Beede and Rogers.[4] Other similar publications of the Geological Survey referred to the Oread in descriptions of sections across portions of eastern Kansas, but listed the fauna

1. Personal communication from Dr. Condra.
2. Gould, C.N. Okla.G.S., Bull.35, pp.75, 1925
3. Beede, J.W. G.S.A. Bull., 33, pp.671-688, 1923
4. Beede, J.W. and Rogers, A.F., K.U.G.S. Vol.9, pp.318-373, 1908

in no such detail as the volume just mentioned.[1]

Hinds and Greene describe the Oread in a general way as it appears in northwestern Missouri, but make no attempt to list its fauna.

PRESENT INVESTIGATION

The present investigation was undertaken with a three-fold purpose: first, to gain an approximation of the entire Oread fauna with its variations at different points in Kansas; secondly, to determine as closely as possible the variations in thickness and lithology, and the changes in depositional conditions which governed them; and thirdly, to ascertain the relations to the Oread of the so-called "Waverly Flagging" or Kereford limestone.

The investigation was prosecuted at intervals over a period of several months. Sections of the limestone were measured wherever possible, and fossil collections made where practicable. In all, collections were made from some 16 localities scattered from Elgin, Kansas to Amazonia, Missouri. About twenty sections were obtained, most of them incomplete, but sufficient to record the variations in thickness and lithology within the formation.

1. Hinds and Greene "The Stratigraphy of the Pennsylvanian Series in Missouri", Mo.Bur.Geol.& Mines, Vol.13,sec.ser. pp.171, 177.

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STRATIGRAPHY

A typical section of the Oread limestone near Lawrence, Kansas has the following measurements.

	Feet	Inches	
Upper Oread	22	8	Sante Fe Quarry, Lecompton
Heebner Shale	5	8	Willard Cut, Lawrence
Middle Oread	1	7	Willard Cut, Lawrence
Snyderville Shale	12		Willard Cut, Lawrence
Lower Oread	9	6	Campus Quarry, Lawrence
Total	51	5	

These dimensions are average ones for the individual members of the limestone throughout Kansas, except for the

Lower Oread which is missing in the southern part of the state. The individual variations of these layers will be reviewed further in another part of this chapter.

The Oread outcrops in a narrow band which extends in Kansas from the middle of Chautauqua county on the south to the north-east corner of Leavenworth county. From that point its outcrop follows the valley of the Missouri River northward beyond the northern Kansas state line. The width of the Oread outcrop seldom exceeds two or three miles, and is usually less than a mile.

Topographically the Oread is marked throughout by a more or less abrupt and prominent escarpment which can be easily traced from Leavenworth to Elgin, Kansas. From Leavenworth northward it forms part of the steep bluffs of the Missouri River valley. South of Leavenworth to the vicinity of Burlington, the Oread escarpment is marked by rather high rugged hills covered with timber. Where the uplands are underlain by the Oread for considerable distances the land is rather level and has a very slight westward slope along the dip of the limestone. Further south from Burlington to the southern part of Greenwood county, the escarpment is much lower and is not wooded. It is also less noticeable because of the increasing amounts of sandstone both in the Lawrence shale below and the

Kanwaka shale above, which tend to diminish the prominence of the Oread outcrop. From the neighborhood of Fall River southward to Elgin the Oread escarpment is once more prominent, and flat narrow highlands are formed for short distances back from the eastern edge of the outcrop. At the southern Kansas line and southward as far as traced, the Oread is dominated by the overlying Elgin sandstone, a phase of the Kanwaka shale.

The Lower Oread

The Lower Oread varies in thickness from 0 to 18 feet between Toronto, Kansas and St. Joseph, Missouri. South of Toronto the Lower Oread is missing, and its place is taken by what appears to be a continuation of the Lawrence shale, which grades upward into the Snyderville shale.

The lithologic character of the limestone is more or less constant in Kansas, but from Leavenworth northward there is a change both in lithology and to a slight extent, in the character of the bedding. At Lawrence where the Lower Oread is typically exposed it is about 10 feet in thickness. This thickness appears to represent an average for this member between the neighborhood of Burlington on the south and Leavenworth on the north, although itis somewhat thicker

than this at Tonganoxie and thinner at Leavenworth. The only exposure seen north of Leavenworth was at St. Joseph where the limestone is 18 feet thick and without recognizable partings.

At Lawrence, the limestone, although lighter in the lower portions and darker throughout the upper 2 feet, is in general a dark buff in color and weathers as a single massive ledge, although the upper portion may become platey upon prolonged weathering. The upper portion may also contain small amounts of chert.

At Leavenworth the lower portion is much lighter in color than at Lawrence but the characteristic buff color upon weathering is still evident. At St. Joseph however, the limestone weathers a dark gray in color. The lower portion is a very light colored pure limestone which has been judged suitable for the manufacture of cement. This lower part grades insensibly upward into a darker and more impure zone which greatly resembles the characteristic Lower Oread at Lawrence.

The Snyderville Shale

This shale as exposed at Lawrence is from 8 to 12 feet in thickness. Its character wherever seen is more or less constant.

In general the shale is olive green in color, indistinctly laminated, and it contains large numbers of irregularly shaped lumps of calcareous matter.

The shale as a whole is not fossiliferous. Fossils have been secured from the extreme basal portion and from the upper few inches only.

The Middle Oread

The Middle Oread is characterized by its conspicuously constant lithologic character throughout the length of its outcrop, and is uniformly thin, the thickness being less than two feet wherever observed, and showing a maximum variation of only one foot between Amazonia, Missouri and Elgin, Kansas.

The limestone is unfformly dark in color, compact and brittle. Upon prolonged weathering its color becomes a dirty whitish gray, gradations of which may penetrate the limestone for an inch or so. The rock is uniformly fossiliferous, although the character is such as to preclude the ready extraction of fossils and collections from this horizon are for that reason small.

At St. Joseph the Middle Oread is represented by two layers of more or less equal thickness but otherwise the character of the limestone is essentially the same as at Lawrence.

In the southern part of the state at Elgin, portions of this horizon are more crystalline in character than at places farther north, but this character is a local variation.

The Heebner Shale

This shale varies in thickness from 5 to 35 feet but characteristically where seen in Kansas its thickness is from 5 to 7 feet.

At Lawrence, the shale is divided into two zones which are more or less constant in character and thickness from Leavenworth to Sedan, Kansas. The lower part of the shale is black, fissile, and contains a great deal of carbonaceous matter. In the shale are dark calcareous concfetions which apparently formed after deposition had taken place as the laminae of the shale are bent around them. This zone at Lawrence is about two and one-half feet thick. It grades rather abruptly upward into a yellowish buff calcareous shale above which is of approximately the samethickness.

The Upper Oread

The Upper Oread is much thicker than the other limestones in the formation ranging from 17 to 27 feet. Where observed at some localities it has been much thinner, but it appears that at these points the upper

portion had been removed by erosion. This conclusion is supported by the fact that the limestone at these points has the characteristics of the lower part of this member.

The Upper Oread is characterized typically by thin wavy bedding and the occurrence, especially throughout the upper portion, of large amounts of dark chert, which may contain fossils. This character does not hold entirely at outcrops studied in the southern part of Kansas. Here, although the thin bedding is still prominent the wavy partings are not conspicuous as in the outcrops observed in the northern part of the state.

The lithologic character of the limestone also shows a slight variance in the southern part of Kansas, but is quite constant from Lawrence northward. The rock is light colored, dense and rather tough. Upon weathering it still retains its light color, and the exterior of the rock becomes rather soft and punky. Outcrops examined at Sedan and Elgin, show the same lithologic character generally as those farther north. The rock at Elgin is more or less bluish in color and the upper portion, especially the last few feet, is distinctly crystalline and a dark gray or bluish gray in color. The absence of chert at Elgin forms one

of the most prominent differences between the limestone there and at the other localities studied.

Conditions of Oread Deposition

Study of a section of the Oread limestone with its two shale layers and impure limestones cannot but lead one to the conclusion that the formation as a whole was deposited in a shallow shifting sea. This conclusion as to the shallow and oscillatory character of the Oread sea is strengthened by the essentially non-marine character of the Lawrence shale below and the Kanwaka shales above the Oread. Twenhofel[1] writes: "The Lawrence shales were deposited as a delta over this (Iatan) limestone. Another rise of sea level led to the deposition of the Oread formation."

A consideration of the phases of Oread deposition leads one to conclude that the sea was oscillating slightly even during Oread time. That the extent of transgression was also greater during the deposition of the Middle and Upper limestones is shown by the gradual pinching out of the Lower, and its disappearance south of Toronot, Kansas. Evidently the sea continued to advance southward evenly and slowly, as the non-marine shales of the Lawrence give place at Elgin to shales containing a few small marine fossils just below the Middle

1. Twenhofel, W.H. "Treatises on Sedimentation", pp.601

limestone.

A change in the character of the sediments which was unfavorable to the survival of life as a whole, followed the Lower Oread. The Snyderville shale contains only a few fossils, and these have all been found adjacent to the limestones above and below.

During Middle Oread time the conditions were very constant over a large area, as is shown by the similarity of this layer in lithology and thickness at widely separated localities. Evidently all kinds of shallow-water life flourished in some abundance, as the Middle Oread contains large numbers of fossils.

This phase was followed by what I interpret as a shoaling of the water. The shale immediately above the Middle Oread contains considerable amounts of carbonaceous material although no leaves or other undisintegrated parts of plants have been found here. Fossil insects have been found in this layer. This leads me to think that the muck being deposited here came from nearby swampy areas along the shore. That conditions were quiet is shown by the finely laminated character of the shale.

The water cleared somewhat and the dark shale grades upward into a buff or yellowish argillaceous shale.

This change terminated with the commencement of another limestone deposition, that of the Upper Oread.

The Upper Oread sea was shallow throughout, although there were local variations. This variation is apparent at Sedan and Elgin where the water was probably clearer than farther north. I base this statement on the more crystalline character of the upper portion, the absence of shaly material present farther north, and the presence of tremendous numbers of corals at Elgin. This evidently represents only a local variation, as in general there is a distinct increase in clastic material southward.

In summary, the Oread limestone was deposited in a widespread shallow sea in which conditions were quite constant over large areas at any given time, and which was subject to very slight periodic oscillations.

Comparison of the Upper Oread and Kereford at Amazonia, Missouri

The Kereford limestone presents an interesting taxonomic problem both from the standpoint of the paleontologist and stratigrapher. In the following discussion I shall present a detailed comparison of the Kereford and the Upper Oread limestones at Amazonia, in an endeavor to determine their true relations.

The Upper Oread varies greatly in character from top to bottom, but the different zones encountered are surprisingly constant in their lateral extension. This is especially true of outcrops studied for about 150 miles southward from Amazonia.

In general the limestone may be divided into two zones, which have one rather constant character, the uneven thickness of the thinner layers as evidenced by their nodular character when weathered, and the very wavy nature of the shale partings between them.

This is particularly true of the lower half of the Upper Oread. Here the individual layers vary in thickness, but generally are not over a foot thick. Their upper and lower boundaries are very unevenand wavy, so that a twelve inch layer may vary from six inches to a foot in thickness within two feet, the layers above and below showing a similar variation, each compensating in thickness for the changes in the other layers. The wavy partings are usually thin, perhaps an inch or more thick when unweathered, and filled with platey calcareous shale, the laminations following the wavy course of the parting. These calcareous shales are full of hashed and crushed fossils, and contain many Tricites. In addition these partings are surprisingly persistent and when unweathered may be traced without a break for

considerable distances.

The rock when fresh is hard, rather tough, compact and light colored. When weathered it still retains its light color but becomes rather soft and punky on the outside. Near the top of the zone there is a rather persistent horizon containing great numbers of Pustula nebraskensis.

The second zone is several feet thick and contains large amounts of dark chert. Although usually concentrated into one or two indistinct horizons, the chert is also scattered in smaller or larger amounts throughout several feel of the rock. Towards the top of this zone the rock contains much argillaceous material, and weathers very easily, giving a weathered outcrop the appearance of thinner bedding than the lower zone. That this is not the case, at least at Amazonia, is shown by freshly exposed surfaces, which show a thicker bedding than that of the lower zone. The wavy partings are still present however. The argillaceous areas in the rock are irregular, weather easily to a soft rather fragile calcareous shaly mass, and contain great numbers of Triticites.

At the top of the Upper Oread at Amazonia is a thin layer of semi-oolitic limestone, light gray in color,

which has a decided resemblance in many respects to some of the horizons in the overlying oolite. The upper and lower boundaries of this layer do not show the wavy contours of those of the remainder of the Upper Oread. This layer marks the upper limit of the true Oread.

The Kereford limestone -

Above the Upper Oread there appears a thin layer of dark blue laminated and exceedingly fine-grained shale. This shale is about two feet thick, and grades above into an uneven lumpy zone which varies in thickness from two to three feet, and is exceedingly fossiliferous. This zone becomes more calcareous toward the top, and grades from a lumpy hard shale without perceptible bedding planes, to a lumpy argillaceous dense limestone. The thickness is somewhat variable, but the character seems to be quite constant.

The oolitic phase of the Kereford begins directly above this basal shaly bed. The limestoneis far different in character from any in the Upper Oread, excepting the upper few inches. The texture varies from semi-oolitic to very distinctly oolitic, and is perceptibly crystalline as compared with the dense compact character of most of the Oread. The boundaries of the individual layers are

straight and clean cut, the layers varying in thickness from a few inches to about two feet. The formation is fossiliferous throughout.

The most outstanding character of the rock at this horizon is its oolitic character. This is apparent at all horizons, although in some layers it is much more distinct than in others. In the indistinctly oolitic layers fragments of hashed shells and a small percentage of oolites are scattered through the matrix. Elsewhere perhaps 50 to 75 porcent of the body of the rock is composed of whitish rounded concretions. The oolites are usually small and rather oval in shape.

Although not readily apparent on a freshly broken surface, crossbedding is easily discerned on the weathered edges of the rock. The crossbedding may be further emphasized by the projecting edges of broken shells which apparently were deposited on the surface of the gently inclined laminae.

The limestone is a light buff in color when broken, and darkens upon weathering.

The phase just described is 11 feet thick at Amazonia. Near St. Joseph the thickness varies from 2 to 6 feet in a distance of less than 100 yards. This variability in thickness is not due to subsequent erosion, as the rock grades evenly into the overlying shale at every point.

The shale above the oolite is even bedded, calcareous to sandy, and contains a good deal of mica. The topmost few inches of the oolite grades rather evenly into this shale, so that the line of demarkation is not particularly abrupt. Indistinct casts of what seem to be very imperfectly preserved weed-like growths occur on the faces of the layer, and the shale also shows incipient ripple marks and other signs of shallow water deposition. No definite fossils were found. This shale is only a few feet thick and is followed by glacial drift and loess.

Comparison of Upper Cread and Kereford Faunas at Amazonia, Missouri -

A comparison of the faunas of the limestones under discussion reveals a very distinct difference, both in the new forms introduced, the old ones retained, and the total number of species contained in each.

I have collected from the Upper Cread at this point a little over thirty species. Perhaps more intensive collecting would reveal a number of the less common forms which I have not found, but the collection at hand contains almost all the species commonly found at this horizon in other localities.

Over twenty genera are present. The most numerous

class is the Brachiopoda which includes ten of the genera listed. The only common genera missing are Ambocoelia, Dielasma, and Spiriferina, of which only the latter is common at other localities. The most abundant form found here is Composita subtilita, and in this respect this locality agrees with others observed.

Bryozoans are not numerous, but the common species are present. This especially refers to the various species of Fistulipora, and Rhombopora lepidendroidea. Fennestellid forms are present, but are not sufficiently well preserved to obtain identifiable specimens.

The common protozoan, Triticites is very abundant, especially near the top of the limestone. Two species, seem to be present, but the identification is provisional as it is made on the basis of external form alone.

The most common gastropod is Bellerophon crassus. This form is very common in the Upper Oread at almost every locality studied in northern Kansas. The other gastropods noted here are almost all elements of the Upper Oread fauna at other localities.

The pelecypods, as seems to be the rule in the Upper Oread, form only a small part of the fauna. Allorisma is the most common form, and is accompanied by Pinna. The only new forms present are Myalina subquadrata, and

M.congeneris and only one specimen of each was obtained. Although there are no specimens of this species from any other locality in my collections, such occurrences have been noted by other writers.[1]

In general then, the fauna of the Upper Oread at this locality agrees in all respects with that of other localities observed and is quite typical. This is true not only in respect to the genera and species comprising the fauna, but also in the relative abundance of the individual species.

The Kereford limestone fauna

The fauna of the Kereford forms a conspicuous contrast to that of the Upper Oread.

The Kereford may be divided into two zones on the basis of faunal characters, these zones corresponding to those which are discriminated lithologically.

The shaly phase at the base contains large numbers of fossils. Composita subtilita is exceedingly abundant at this horizon, and attains to a large size. With this occurs two forms of Derbya, all thick shelled robust forms, the most common of which is the large convex Derbya robusta. At the top of the basal soft shale and continuing through the lumpy calcareous zone, there occurs a very prolific pelecypod fauna, of which the individuals

1. Beede, J.W. and Rogers, A.F. K.U.G.S. Vol. 9, pp.363-373

are extremely abundant. In addition to the forms already mentioned, this fauna includes a number of species of Myalina, Pseudomonotus, and Aviculopecten. Other pelecypods are present, but not conspicuous. The common bryozians are present, the fennestellid forms being quite abundant in the shale, but only preserved as indistinct impressions. A few specimens of Bellerophon crassus were also found at this horizon. The pelecypods and C.subtilita however, constitute over ninety percent of the fauna at this horizon.

Above the shaly zone, the crowded aspect of the fauna changes. The number of individuals are fewer, and smaller, thicker shelled forms constitute the major part of the fauna. Myalina swallowi, and fragments of other small thick shelled pelecypods are abundant. Most of the forms are not identifiable because of their broken condition of the shells.

Both Composita and Derbya disappear, and if the large pelecypods such as Myalina subquadrate, aniculopecten and Pseudeomonotis are present they have been so broken as to be unrecognizable. Large numbers of Linguals are present, accompanied by Orbiculoidea. The majority of the fossil remains seen at this horizon however, consist of the hashed remains of pelecypods.

In summary then the Kereford fauna is greatly restricted in all classes except the pelecypoda, where there has been a distinct increase both in the number of genera and species but also in the number of individuals present. In addition, the brachiopods present, especially in the oolitic phase, are those which thrive typically in very shallow water. It represents two phases, one of which is a gradational phase between the Upper Oread and the typical oolite.

Comparative Table of Upper Oread and Kereford Faunas

at Amazonia, Missouri

*abundant
#common

Upper Oread		Kereford	
Genera	Species	Genera	Species
*Triticites	2	. . .	. . .
Campophyllum	1	. . .	. . .
Fistulipora	2	Fistulipora	1
Rhombopora	1	Rhombopora	1
*Composita	1	*Composita	1
Chonetes	1	Derbya	2?
#Derbya	2	*Lingula	1
Enteletes	1	#Orbiculoidea	1
Hustedia	1	Pustula	1
Obiculoidea	1		
Productus	3		
*Pustula	3		
#Spirifer	1		
#Squamularia	1		
Bellerophon	2	Bellerophon	1
Sphaerodoma	1		
Bulimorpha	2?		
Pleurotomaria	1		
Strophostylus	1		
Allorisma	1	#Aviculopecten	1
Myalina	2	*Myalina	5
Pinna	1	#Pseudomonotis	1
Metacoceras	1		
Genera . . 23	Tot.sp. . . 33	Genera . . 11	Tot. sp. 16

DEPOSITIONAL CONCLUSIONS

It can be clearly seen from the foregoing faunal and lithologic discussion that there was a definite change in physical conditions from Oread to Kereford time. The nature of this change, and the conditions which prevailed before and after, present an interesting sedimentational study.

The Upper Oread was doubtless deposited in rather shallow impure water. This is indicated by the impure character of the rock, which contains, silica, and especially near the top, much argillaceous material. In addition, the finding of fossil wood both at Amazonia and St. Joseph shows that the shore was not far away. The uneven nature of the bedding and the hashed nature of the fossils found on the wavy shale partings further point to shallow water deposition which may have been slightly disturbed. In my opinion, the presence of greater quantities of argillaceous material toward the top of the limestone, and the semi-oolitic layer at the top of the Oread is an indication of a gradually shoaling sea, which became clearer for some reason when the last thin layer of the Upper Oread was deposited.

An abrupt change in conditions followed, most of the Oread fauna passed away and a new facies appeared. The forms that survived were robust

ones which could live in a muddy shallow sea, or forms especially suited to such environment. The change in fauna seems to indicate that the environment no longer favored the brachiopods, but was favorable to the living habits of the oyster-like pelecypods, which swarmed in the sea for a brief time. The increased amount of calcareous material toward the top of this basal shaly phase points to a gradual clearing of the water.

When the water finally cleared, the last of the common brachiopods from the Oread disappeared, and the large pelecypods became less numerous. This may have been because the distrubed physical conditions indicated by the crossbedded oolite were not favorable for the survival of this form in large numbers, or because the clear lime-depositing water which formed the oolite contained insufficient food for their survival in large numbers. Their place was taken by smaller thick shelled forms.

Twenhofel[1] points out that the Lawrence shale is a delta deposit, and from the character of the shale above the Oread it is not unlikely that this also is of non-marine origin. This conclusion tends to support my hypothesis that the Kereford is a local phase deposited during the withdrawal of

1. Twenhofel, W.H. "Treatise on Sedimentation", pp.601

the Upper Oread sea.

With these observations in mind, I am suggesting that the Kerford oolite was deposited in shallow lagoons or arms of the Upper Oread sea which were more or less widespread to the north, but were probably absent over most of Kansas. The disturbed nature of the limestone, its oolitic character, and the conspicuous lensing of the bed all point to this origin. The water must have been shallow and therefore easily disturbed, as is shown by the crossbedding, and the fragmentary condition of many of the fossils.

PALEONTOLOGY

General Faunal Observations

Reference to the faunal chart following this discussion suggests several considerations concerning the Oread fauna which I shall briefly enumerate.

The analysis of the faunas from the three members of the Oread shows that the Upper limestone is much more fossiliferous than either of the other two members. The relatively large representation from this member as compared with the two lower ones may be due in small part to the lack of good exposures of the latter, but is largely due to the more fossiliferous character of the Upper Oread, and the ease with which the fossils may be obtained from it.

I shall attempt no very detailed discrimination between the faunas of the three limestones, but will try to point out general differences which may be of practical value.

The Lower Oread contains a total of 28 species. The brachiopods predominate with 16 species, the remainder being divided more or less evenly between the gastropods, pelecypods, bryozoans, echinoderms and protozoans. The only really abundant fossil is Triticites secalicus, although the brachiopods are common. There is no common species in the Lower Oread which does not appear in the Upper Oread.

The Middle Oread contains many fossils, but the character of the limestone is such that their extraction in identifiable form is seldom possible. This necessarily restricts collections from this horizon and I doubt if my collections present a true picture of the entire Middle Oread fauna. I have in all seventeen species from this horizon, eight of which are gastropods. Five of the species are common brachiopods, the remainder divided among the pelecypods, the protozoans, and the echinoderms.

The Upper Oread far out ranks the other two members in fossil content. In addition it contains one or more indistinct faunal zones, and locally may present great variations from

the typical fauna.

Seventy-eight species are included here, but many are rare so that only a little over half that number are at all common. The brachiopods are the most abundant class, although the pelecypods almost equal them in number of species. The gastropods include ten species, but only one, Bellerophon crassus, is common. Eight species of bryozoans are contained in my collections, but only one, Fistulipora carbonaria, is really plentiful. The corals are represented by seven species, of which Lophophyllum profundum and Campophyllum torquium are common. Several species of crinoids have been found, but identifiable specimens are very rare. The cephalopods and trilobites are each represented by only one identifiable individual. Triticites plummeri and T.secalicus are both common, and the latter is extremely abundant at some horizons.

A distinct zone containing large numbers of Pustula nebraskensis is present about midway of the limestone. This has been seen at Amazonia and St. Joseph, Missouri, and at Lecompton, Kansas. Again, local variation in the fauna may result in the practical elimination of most of the forms usually present. This is illustrated at Sedan and Elgin, Kansas. At the former locality the fauna is almost entirely composed of Enteletes hemiplicata, Meekella Striatacostata, Squamularia perplexa and Spirifer cameratus

These four species make up over ninety percent of the specimens collected, and Enteletes is especially abundant. At Elgin the fauna has practically the same makeup with the addition of a zone of Campophyllum torquium about ten feet thick, so closely crowded as to form a reef-like mass.

It is worthy of note that some of themost common forms found in the Upper Oread are entirely missing from my Lower Oread collections. Five abundant species from the Upper Oread, Pustula nebraskensis, Enteletes hemiplicata, Squamularia perplexa, Bellorophon crassus and Triticites plummeri, are not represented in the Lower Oread, yet the first four are rather long ranging forms.

The shales within the Oread are in the main unfossiliferous, although microscopic forms have been obtained immediately adjacent to the limestones. These include forms present in the limestone, except for one locality near Tonganoxie which has yielded an ostracode fauna which will be treated in another paper sometime in the near future.

SYSTEMATIC PALEONTOLOGY

PROTOZOA

Family Fusulinidae Moller

Sub-family Fusulininae Staff-Wedekind

Genus Triticites Girty

Triticites plummeri Dunbar and Condra

This species of the genus Triticites is characterized externally by its sub-globose form, and it is upon this character that I am basing my identification of the specimens at hand.

Average individuals measure 5 to 6 mm. long and 2.5 to 3 mm. thick. The ends are acute, so that badly weathered specimens appear almost spherical.

Range and distribution: Upper Oread, Sedan, Lawrence, Leavenworth, St. Joseph.

Triticites secalicus Say

This protozoan which I am identifying on the basis of external form alone, is the most common fossil in the Oread. It is plentiful in all parts of the limestone, and locally may be extremely abundant.

The individuals vary in size from almost microscopic forms to others almost a centimeter in length. One of the larger specimens measured 9 mm. long and 3 mm. thick.

Range and distribution: Throughout the Oread, generally.

ANTHOZOA

Sub-class tetracoralia Haekel

Family Cyathophyllidae Milne Edwards and Haime

Genus Campophyllum Edwards and Haime

Campophyllum torquium Owen

Although present locally in large numbers in the Upper Oread, this species is not abundant in the limestone as a whole.

Its rather large horn shaped corallum, lack of prominent surface markings, more or less curved or distorted shape and thin septae which do not extend to the center characterize the species. All specimens found are incomplete.

The largest fragment found is 90 mm. long and 25 mm. in diameter at the larger end.

Range and distribution: Upper Oread, Leavenworth, Sedan and Elgin.

Genus Axophyllum Edwards and Haime

Axophyllum rude White and St. John

This species is represented by three individuals from the Upper Oread at Lecompton and Elgin.

The corallum is short, rapidly expanding to the calyx which is moderately deep at the center but quite shallow at the sides. The prominent pseudocolumella is rather flattened or oval in cross section, and striated. The septae alternate in size, the larger almost joining the pseudocolumella.

All the specimens are of about the same size. One of them is 22 mm. high, and the calyx has a diameter of 14 mm.

Range and distribution: Lecompton and Elgin, Upper Oread.

Family Zaphrentidae Milne-Edwards and Haime

Genus Lohophyllum Milne-Edwards and Haime

Lophyphyllum profundum Milne-Edwards and Haime

The common Pennsylvanian coral is found throughout Kansas wherever the Oread is exposed. Its rather elongate corallum, prominent surface striations and conspicuous columella distinguish it from theother corals af the formation. The septae are rather thick, alternating in size, and do not reach the columella. In cross section many of the septae of the first order show a definite thickening and rounding at the inner end.

A specimen of average size measured 27 mm. in length and 8 mm. in diameter at the calyx.

Range and distribution: Throughout the Oread, generally.

Lophophyllum westi? Beede

Specimens of this species are restricted to a few fragments from the Upper Oread at Lecompton and Sedan. The general corallum form is elongate, with moderately prominent longitudinal striations. As seen in cross-section the septae are sub-equal. Dissepiments are abundant in a narrow peripheral zone, common intermediately, and the center is filled with crowded dissepiments and vesicular material. In this latter zone the septae become thinner, crenulated, and rather indefinite, except for the cardinal

which continues straight across and joins the counter on the opposite side.

Exteriorly this coincides with Beede's L.westi, but differs somewhat internally, from his description.

The resemblance is sufficient however, to place it provisionally in this species.

Dimensions:

Estimated length	35 mm.
Diameter	11

Range and distribution: Upper Oread, Lecompton and Sedan.

Sub-class Alcyonaria Milne Edwards

Sub-order Tabulata Milne Edwards and Haime

Family Syringoporidae Milne Edwards and Haime

Syringopora multatennuata McChesney

A few fragments of colonies of this species have been collected from the Upper Oread at a number of different localities. The individual corallities are thick-walled, more or less irregularly spaced, and about 2 mm. in diameter. They contain well-developed infundibular tabulae. Minute connecting tubes are present.

Range and distribution: Upper Oread, Lawrence, Lecompton, Leavenworth.

Family Auloporidae Nicholson

Genus Aulopora Goldfuss

Aulopora? anna Beede

A fragment of a colony which evidently belongs to this species was found adhering to a C.torquium at Elgin.

The anastomosing basal portion of the colony forms a thick mat, from which the short funnel-like corallities project upward. The apertures are about 2 mm. in diameter. The specimen is so incomplete and weathered that no further details of structure are apparent.

Range and distribution: Upper Oread, Elgin.

Aulopora? prosseri Beede

Fragments of colonies of this species have been found in the Upper Oread at Sedan and Leavenworth.

The corallum is prostrate and branching, but not conspicuously anastomosing and crowded as in A.? anna/

Size of a complete corallum unknown.

Range and distribution: Upper Oread, Sedan and Leavenworth.

CRINOIDEA

Order Inadunata Wachsmuth and Springer

Sub-order Fistulata Wahnsmuth and Springer

Family Poteriocrinidae Roemer

Sub-family Poteriocrininae

Genus Eupachycrinus Meek and Worthen

Eupachycrinus magister Miller and Gurley

This species is represented in my collections by two badly weathered fragmentary calyses from the Upper Oread at

Lecompton. Measurements of the more complete individual are as follows: diameter 25 mm., depth about 12 mm. There is a large prominent depression on the dorsal side of the cup.

The surface is covered with large abrupt nodes, more or less sub-equal in size and of varying shapes. In addition the entire surface, nodes included, has a granulose appearance. This may possibly be due to the weathered condition of the specimens.

The preservation is so incomplete that it is impossible to determine the boundaries of the plates and other details of structure. The specimens in my collection are not as large as those figured by Beede,[1] but otherwise agree in exterior details.

Another very similar species, E.verrucosus, resembles E.magister in external details of ornamentation, but the latter form lacks the prominently beveled calyx plate edges which are present in E.verrucosus.

Range and distribution: Upper Oread, Lecompton, Kansas.

Genus Hydreionocrinus De Koninck

Hydreionocrinus subsinuatus Miller and Gurley

This species is represented in my collections by one well preserved calyx without arms.

The outline of the cup is roughly pentagonal, with a distinct concavity apparent on the anal side. The calyx is flat, the relation of width to depth being about 3-1. The dorsal side is rather concave. The infrabasals are fused into a pentagonal area a little larger than the rounded cavity of the columna, which is surrounded by a distinct ridge or collar. The basals are five in number, pentagonal, the two posterior ones a little larger than the others and somewhat irregular in shape, the others regular.

Radials rather large, touching except on the anal side, the two posterior ones somewhat smaller and modified on the sides abutting theanal column. The upper facet is straight, the widest part of the plate, and is rather prominently beveled.

The plates are thick and massive, and without exterior ornamentation.

Range and distribution: Upper Oread, Lecompton.

Genus **Zeacrinius Hall**

Zeacrinus n. sp.?

Dorsal cup is rather flat, the height equaling about one-half the width. Columna round, in a deep circular depression. Infrabasals not visible, apparently fused. Basals fine, pentagonal, thick and prominently raised into an incipient node at the center. Radials fine, pentagonal, touching except

at the anal side where they are separated by the anal column.

Radianal small, oblique and rests on the posterior basal with anal X between it and the left posterior radial.

Upper facet of the radial straight, widely beveled. Primibrachs seem to be double in character, bearing two short blunt incipient spines one above theother. Arms biserial, large, and massive, branching from the primibrach.

The edges of all the plates are beveled, particularly the upper facet of the radials. Surface is granular.

Dimensions: Diameter of cup 11 mm.; height 6 mm. These figures may not be exactly correct as the cup is somewhat distorted.

Range anddistribution: Upper Oread, Lecompton.

Sub-family Graphiocrininae Bather

Genus Ceriocrinus White

Ceriocrinus hemisphericus Shumard

This species is represented in my collections by a single somewhat weathered calyx from the lower part of the Upper Oread a few miles south of Lawrence.

The dorsal cup is almost circular in outline, and quiteflat, the relation of height to width being about 1 to 3. The infrabasals are fused at the bottom of a deep circular concavity which forms the point of attachment

for the columna. The basals are pentagonal, very large proportionally, their upper angles extending almost to the edge of the cup. The radials are not high in proportion to their width, the proportion being about 1 to 2.5. All are in contact except on the anal side where a single small anal plate is inserted and extended above the line of the upper facets of the radials.

The plates are thick and massive, the upper radial facets straight and beveled. The surface is smooth.

Diameter of cup, 14 mm.; depth 5 mm.

Range and distribution: Lower 6 feet of Upper Oread, road cut on Highway 73E about 12 miles south of Lawrence.

Genus Graphiocrinus De Koninck and Lehon

Graphiocrinus carbonarius Meek and Worthen

I am indebted to Mr. H. T. Martin for the loan of the specimen described under this species. Although represented by only the one specimen, the preservation is so complete that identification is unhesitatingly made.

The dorsal cup is small, round, bearing a deep dorsal pentagonal concavity. The infrabasals are fused within this concavity, and are hidden when the columna is attached. The basals are large, very thick and conspicuously convex, and five in number. Four of them are equal and pentagonal, the fifth on the posterior side is hexagonal and distinctly

larger, truncated above.

The radials are large, touching everywhere except on the posterior side where they are separated by the anal plate. Their upper facets are strongly and concavely beveled.

The anal plate is hexagonal and elongated, the upper projecting portion being broader and shorter than that within the cup.

The sutures are strongly and distinctly impressed. This is especially true of those between the radial plates. All the plates are gently convex, the basals notably so.

Dimensions: Diameter, 4 mm.; height, over 2 mm.

Range and distribution: Lower Cread, Lawrence.

Graphiocrinus n. sp.?

This species is represented by two beautifully preserved specimens from the collection of Mr. H. T. Martin, who has loaned them to me for identification and description.

The dorsal cup is round and quite shallow, with a deep pentagonal dorsal concavity. The infrabasals are fused, and invisible when the columna is attached. Four of the basals are medium sized, pentagonal, the fifth is hexagonal, about twice as large as the others and truncated above.

The radials are not large, touching all around except on the posterior side where they are separated by the anal plate. The upper facets are broadly and somewhat concavely

beveled.

The hexagonal anal plate is about as broad as high and rests on the posterior basal, with only the lower one-third incorporated in the cup and theupper two-thirds projecting.

None of the plates are more than slightly convex, and the sutures, although distinct, are not impressed.

This form resembles G.carbonarious in many ways, but the anal plate of the latter has a much greater elongation, the posterior basal is proportionally smaller, and the convexity of the plates is distinctly greater. The radial facets of G. carbonarious are more concave and the impression of the sutures is very much greater. In size the two forms are about equal.

Dimensions: Diameter, over 6 mm.; Height, less than 3 mm.

Range and distribution: Lower Oread, Lawrence.

Sub-family Encrininae Austin

Genus Erisocrinus Meek and Worthen

Mr. H. T. Martin has kindly loaned me several specimens of this genus which I am provisionally referring to two new species. The fossils have all been collected near Lawrence, but the exact horizon within the Oread is unknown.

Erisocrinus n. sp. A.?

Calyx very small, more or less obconic in shape. The proportion of height to diameter is about three to five.

The dorsal concavity for the attachment of the columna varies in depth, and is impressed into the infrabasal plates. The edge of the concavity is sharp and distinct, and it is about 1.5 mm. in diameter. The infrabasals are thick and rather flat. If the stem were present only the angular extremities would be visible. The length and width of the infrabasals are almost equal.

The basals are hexagonal and moderately large, their height and width about equal. The radials are much wider than high, truncated above.

The plates are thick and massive, the radials measuring almost 1.5mm. in thickness. The sutures are not prominent, the surface of the plates unornamented.

Dimensions: Diameter, 5 mm.; height, 3 mm.

Erisocrinus n. sp. BY

Calyx small, height about one-half the diameter. Surface smooth, the sutures almost invisible.

The infrabasals bend upward to form a funnel-shaped round concavity of medium depth. The outer angularity of the infrabasals extends to the dorso-most part of the calyx. They are much longer than wide, and aconsiderable portion would probably be visible if the stem were attached.

The basals are hexagonal, height and width sub-equal, each one larger than the entire infrabasal area. The radials about twice as wide as high.

The plates are rather thick, but not conspicuously so as in E. n.sp. A.

Dimensions: Height, 3.3. mm.; Diameter, 6.5 mm.

ECHINOIDEA

Family Archaescidaridae McCoy

Genus Archaeocedaris McCoy

Archaeocidaris agassizi Hall

Representation of this species is limited to one complete spine and a few more or less fragmentary plates.

The spine shows the characteristic swelling about one-third the distance above the base, and then tapers gradually to a point.

The plates are small, hexagonal, and marked by a central tubercle which extends above the collar-like annulation surrounding it. The margin is marked by a row of nodes.

Range; and distribution: All members of the Oread, throughout Kansas.

Archaeocidaris dininni White

Identification of this species is based on part of one spine from the lower part of the Upper Oread at Leavenworth. The length, irregular arrangement and abundance of the spinose processes covering the spine agree fully with both Woodruff[1] and Keyes[2] descriptions and figures.

The largest spinose process measures almost 4 mm. The diameter of the spine is about 2 mm. and is the same throughout.

Range and distribution: Lower 3 feet of the Upper Oread, Leavenworth.

MOLLUSCOIDEA

Class Bryozoa Ehrenberg

Order Cyclostamata Busk

Family Fistuliporidae Ulrich

Genus Fistulipora McCoy

Fistulipora carbonaria Ulrich

This form is abundant throughout the Oread, particularly in the top portion of the Upper Oread. The zoaria vary in size from small nodular masses to large laminated discoidal colonies as much as 6 inches or more in diameter.

The zooecia are sub-circular, and in the weathered specimens in my collection show no trace of the lunaria. The apertures are usually less than a diameter apart, with occasional wider spaces filled with vesicular tissue.

Diaphragms are crowded in the vesicular areas and abundant in the zooecia.

Range and distribution: All members of the Oread, generally.

Fistulipora carbonaria, var. nebraskensis Condra

I have one specimen from the Upper Oread which shows the very prominent raised lunaria of this variety. Doubtless

other specimens are in my collections but in order to make this varietal discrimination it would be necessary to make sections of all the material obtained.

On the specimen referred to here the lunaria are very conspicuous and highly rasied. The zooecia are circular and rather close together. The zoarium is thin and encrusting, probably a young colony.

Range and distribution: Upper Oread, Lecompton.

Fistulipora nodulifera Meek

This form is differentiated from the other species of Fistulipora in the Oread by its small, usually encrusting zoarial form and short zooecia usually without diaphragms. As all the specimens in my collection are badly weathered, I can give no description of the minute surface details.

Range and distribution: Throughout the Oread, generally.

Fistulipora zonata Girty

The zoarial form of this species is similar to F. carbonaria butthe zooecia are rather widely spaced and contain only a few thin diaphragms. The inter-zooecial spaces are filled with one or more rows of mesopore-like tubes with thickly crowded diaphragms.

A peculiar characteristic of the species is the arrangement

of these wide inter-zoecial areas with crowded diaphragms into poorly defined zones, giving a more or less banded appearance to a longitudinal section of a colony.

Externally the zoarium is so much like that of F.carbonaria that it is impossible to tell the difference if the specimen is at all weathered.

Range and distribution: Upper Oread, Lecompton

Order Cryptostomata Vine

Family Fenestellidae Kind

Genus Plypora McCoy

Polypora triangularis Rogers

The zoarium is a large foliate expansion, the specimen here described being 7 cm. high and incomplete. Branches are about .8-1 mm. wide. The fenestrules are rectangular, 2.5-3 mm. long. The obverse side of the branches is evenly concave and bears several alternating rows of small circular zooecia. The reverse side arches narrowly to an indistinct angularity, and bears a row of nodes, about 6 in the length of one fenestrule.

Range and distribution: Upper Oread, Lecompton.

Family Acanthocladiidae Zittel

Genus Septopora Prout

Septopora biserialis? Swallow

I am provisionally referring a fragmentary specimen of

which only the reverse side is exposed, to this species.

The branches number about five in 5 mm., and the fenestrules six in the same distance. The fenestrules are transversely oblong and the dissepiments are depressed.

Range and distribution: Upper Oread, Lecompton

Genus Rhombocladia Rogers

Rhombocladia delicatula Rogers

A few fragments of this unusual bryozoan were obtained near the top of the Heebner shale a few miles south of Toronto, Kansas.

The sub-rhombic apertures which appear only on one side of the zoarium, smoothly rounded reverse side, and small size distinguish the species. The zoarium is elliptical in cross section.

Range and distribution: Upper portion, Heebner shale, five miles south of Toronot, Kansas.

Family Rhabdomesontidae Vine

Genus Rhombopora Meek

Rhombopora lepidodendroidea Meek

The small branching zoarium with rhombic zooecia arranged in rows with prominent acanthopores between them characterizethis common Pennsylvanian bryozoan.

Specimens have been collected or observed in all members of the Oread wherever studied.

Class Brachiopoda Dumeril

Order Atremata Beecher

Super-family Lingulacea Waagen

Family Lingulidae Gray

Genus Lingula Bruguiere

Lingula sp.

This species is found only in the Kereford, occurring abundantly throughout the oolite, and is especially abundant along shaly zones in the rock.

The shells are small, and marked by distinct concentric lines. The beak is pointed, from which the shell widens abruptly. The sides are almost parallel, and the anterior very broadly rounded.

All the specimens studied are flattened in the rock, so that it is impossible to ascertain the true convexity of the shells. Observation of a large number of individuals seems to indicate that the umbonal region was somewhat convex, and that the shell became flatter toward the anterior end.

The widest portion of the shell seems to be near the anterior end, but from the very nature of the preservation this conclusions may be entirely erroneous.

An average specimen measures 6 mm. in length and 3.5 mm. in width.

Range and distribution: Kereford oolite, Amazonia, Missouri.

Order Neotremata Beecher

Super-family Discinacea Waagen

Family Discinidae Gray

Gray Orbiculoidea D'Orbigny

Orbiculoidea Manhattanensis Meek and Hayden

I am basing my identification on one somewhat crushed, but complete brachial valve from the Kerford oolite. The other specimens found areall fragmental.

This individual is sub-circular in outline, of moderate size, the most convex portion of the shell located about one-third of the way from the posterior margin. The shell is thick, ornamented with concentric lines which are much heavier near the anterior margin.

The diameter is about 12 mm., but a slight distortion of the valve, probably during preservation makes it appear longer than wide. The height is about 3 mm.

Range and distribution: Kereford oolite, Amazonia, Mo.

Order Protremata Beecher

Super-family Orthacea Walcott and Solvenert

Family Rhipideomellidae Zittel?

Sub-family Rhipidamellinae Zittel?

Genus Rhipidomella Oehlert

Rhipidomella pecosi Marcou

This small brachiopod is common throughout the Oread, and has a wide horizontal distribution.

Most of the specimens in my collection are distinctly smaller than those commonly described, but larger individuals are present in small numbers.

Both valves are moderately convex, the beak of the pedicle valve a little higher and more extended than the other. The sides of the shell are rounded, the anterior margin very broadly so with a very slight sinuosity apparent in some specimens near the middle.

The hinge is short, about one-third the total width of the shell, the cardinal area of both valves distinctly arched, but that of the pedicle valve much larger.

The brachial valve may bear a scarcely perceptible sinus. The surface of the valves is marked by fine radiating sub-equal striations. Concentric growth lines may or may not be present.

Dimensions: Length, 6 mm.; width, 6.5 mm.; convexity 4 mm.

Range and distribution: throughout the Oread, generally.

Sub-family Enteletinae Waagen

Genus Enteleles Fischer

Enteletes hemiplicata Hall

This is a common brachiopod in the Upper Oread and is abundant in some localities. It is readily distinguished by its sub-globose shape, the large sub-angular costae which are obsolete on the umboes of both valves but very

prominent on the anterior two-thirds of the shell, and the fine radial rounded striations which cover the entire surface. Fine growth lines may be present anteriorly in old individuals. In a normal adult shell the dorsal valve is approximately twice as large as the ventral.

The young of this species may be readily confused with A. pecosi but the resemblance is only superficial.

A large individual measured 28 mm. long, 29 mm. wide, and 25 mm. high. This is somewhat larger than the average specimen found.

Perhaps more exhaustive collecting will reveal the presence of this form in the Lower Oread, but no examples of it have been found there by the writer.

Range and distribution: Occurs generally in the Upper Oread.

Super-family Strophomenacea Schuchert

Family Strophomenidae King

Sub-family Orthotetinae Waagen

Genus Derbya Waagen

Derbya bennetti Hall and Clarke

Derbya bennetti is a common widely distributed brachiopod found throughout the Oread. In general this species is rather conspicuously bi-convex, especially as compared with

other species of the same genus found at this horizon. The brachial valve bears a distinct median sinus which may give the shell a bilobed appearance. The length of the hinge is much less than the total width of the shell.

The pedicle valve has its point of greatest convexity at the beak, and from there slopes more or less uniformly to the anterior margin. The beak is often distorted and curved, and the surface of the valve irregular and wrinkled. The cardinal area varies in height with the convexity of the pedicle valve, which is quite variable.

The dimensions of two individuals slightly smaller than the average are:

Hinge	18	16 mm
Max. width	26	24
Length	18	19
H't.cardinal area	5	7
Greatest convexity	11	14

Range and distribution general, but most abundant in the upper half of the Upper Oread.

Derbya crassa Meek and Hayden

This brachiopod is very common in the Oread, occurring in all members, and widely distributed geographically. It is distinguished by its sub-quadrate outline, thinness, the flattened aspect of the valves, and its small size.

An indistinct shallow sinus is off times present on the brach valve.

An average specimen has the following dimensions:

Hinge length	25 mm
Greatest width	32
Length	22
Length of pedicle valve	27
Thickness	8

Range and distribution: In all members of the Oread wherever studied.

Derbya cymbula Hall and Clarke

I am referring one specimen of a large Derbya collected from the Upper Oread to this species, identification being based on its large size, shape, and proportions of the valves. The individual is transversely oval in outline, the width being much greater than the length. The brachial valve is somewhat convex, and no sinus is present. The thickest part of the pedicle valve is at the beak from which it slopes toward the front, and may have been slightly concave near the anterior margin.

Dimensions:

Length	41 mm
Width at hinge	42
Greatest width	57
Greatest convexity	16

Range and distribution: Upper Oread near Lawrence.

Derbya robusta Hall

This large convex Derbya is by far the largest member of the genus in my collection. The brachial valve is very convex, the pedicle valve distinctly concave. Striations on the individuals observed were medium sized, sub-equal, and rather crowded. The cardial process is large, bifid, with irregular extremities.

A complete specimen from the Upper Oread at Amazonia has the following dimensions:

Total length		62 mm
Length of brachial valve		54
Greatest width		70
Greatest convexity	about	27

A large brachial valve from the base of the Kereford is 70 mm. long, its maximum width is 92 mm., width of the hinge 76 mm., and greatest convexity about 35 mm.

Range and distribution: Upper Oread and Kereford, Amazonia, Missouri.

Derbya sp.

I have two fragmentary individuals of this type from the Upper Oread. Shell large, moderately convex, the brachial valve being the more convex of the two. A very distinct sinus extends from the umbo for about two-thirds the length of the shell and becomes obsolete on the anterior

portion. The pedicle valve is flattened anteriorly, the most convex portion being about one-third of its length behind the beak. I think that this specimen is abnormal, and in a normal individual the posterior end of this valve would be the thickest.

The hinge line is 32 mm. long; greatest width of shell 62 mm.; length 46 mm. (estimated) brachial valve, pedicle valve 49 mm.; greatest convexity 21 mm.

This form is probably related to D.cymbula as it resembles it in shape and general proportions.

Range and distribution: Upper Oread, Lecompton and Midland, Kansas.

Genus Meekella White and St. John

Meekella striatacostata Cox

Most of the specimens of this species collected are somewhat crushed, and distorted. Its recognition, however, is rendered easy by the large angular plications which cover almost the entire surface of the valves, the fine unequal striations which are present over the entire surface, and the very convex and usually distorted pedicle valve.

No adequate measurements can be obtained from the specimens at hand, but Beede[1] gives the following measurements for an average specimen from the Upper Pennsylvanian in Kansas:

1. Beede, J.W., K.U.G.S. V. 6, p.66, 1900.

" Length	23 mm
Width	29 "
Convexity	18 "
Length of hinge	14 "
Height of cardinal area	9 " "

Range and distribution: Lower and Upper Oread, generally.

Family Productidae Gray

Sub-family Chonetinae Waagen

Genus Chonetes Fischer

Chonetes granulifer Owen

Chonetes granulifer is one of the most common brachiopods in the Oread, occurring in all the members with a wide geographic distribution. The specimens collected show considerable variation, not only in outline but in degree of arching of the shell. The gradations between the extremes noted are so well represented that it would not seem wise at this point to attempt a closer discrimination between the forms without a much more detailed study of the collections at hand.

The forms vary from those in which the hinge is much the widest part of the shell, to individuals in which the hinge is distinctly less than the greatest width. The relative proportions of width to length also show

considerable variation. The degree of convexity varies from strongly arched shells with a rather deep distinct median sinus, to flattened shells in which the convexity is barely perceptible and the sinus is practically absent.

In all individuals examined the surface is covered with fine radiating striae, and the oblique, outward pointing spines along the hinge can be readily distinguished. One specimen has also been found leaving the fine surface spines usually not preserved.

The following measurements will illustrate the extremes of variation. Both shells are of about average size.

	A	B
Width of hinge	22	16
Greatest width	22	18
Length	12.5	13
Greatest convexity	4.5	3

Range and distribution: All members of the Oread throughout Kansas.

Sub-family Productinae Waagen

Genus Marginifera Waagen

Marginifera lasallensis Worthen ?

I have experienced no difficulty in the identification of complete well-preserved specimens of this species, but the discrimination of the fragmental individuals from incomplete specimens of P.costatus on exterior characters is another matter.

The true Marginifera lasallensis, as appears from original figures and description, is moderate sized, quite convex, sub-quadrate in outline, and bears a deep broad sinus. The hinge is extended and is the widest portion of the shell. The slope of the anterior portion of the shell is very abrupt. The surface is marked by medium sized sub-equal plications which bear scattered spines, larger anteriorly.

An average specimen has the following dimensions:

Length	22 mm.
Maximum width along hinge	40
Maximum convexity	18

Range and distribution: Throughout the Oread, generally.

Marginifera longispina Sowerby

This species is a rather common one in the Oread, especially in the Upper limestone. The shells are small, practically smooth except for small spines scattered widely and irregularly over the surface. Th anterior portion of the shell is very abrupt with a rather deep sinus which becomes indistinct posteriorly.

The hinge is slightly extended, giving the shell a rather sub-quadrate outline.

An average specimen measures 12 mm. in length, length of hinge 16 mm, maximum convexity 7 mm.

Range and distribution: Throughout the Oread in Kansas.

Genus

Genus Productus Somerby

Productus cora D'Orbigny

This common brachiopod is found in considerable numbers throughout the Oread. It is distinguished from the other productids found at this horizon by the fine, sometimes rather crenulated striae, and scarcity of spines. The specimens collected vary somewhat in size and proportions, but I am sure can all be referred to this species. The chief variation aside from that of size, is in the slope of the anterior margin, which varies from being rather abrupt and short to more gentle and somewhat extended and expanded.

One of the larger specimens collected is 36 mm. long, 35 mm. wide at the widest point, 25 mm. wide at the hinge-line, and 16 mm. high.

Range and distribution: Both Lower and Upper Oread, generally.

Productus costatus Sowerby

This species is quite rare in the Oread, and the specimens hollected have all come from the northern part of the state. The individuals vary little in size. Their general shape is very similar to thatof P.reticularis, but they are distinguished from the latter by their smaller

size, coarser rounded plications which are variable in size, and the irregularly distributed large spines scattered over the surface of the pedicle valve. A shallow, fairly broad sinus is also present on the pedicle valve.

Dimensions:

Length	27 mm.
Width	34
Height	28

Range and distribution: Mostly from Upper Oread, Lawrence, Leavenworth, Amazonia, Missouri.

Productus semireticulatus Martin

This species is the largest Productus in the Oread. Although found in only small numbers, it is rather generally distributed. In addition to its large size, it is distinguished by its sub-quadrate outline, broadly distinct sinus, and moderately sized sub-equal striations bearing a few scattered scines.

Other semi-reticulate productids, notably P.costatus and M.lasallensis, resemble P.semireticulatus superficially, in outline, but may be distinguished on the basis of size as they are much larger, and the spines larger and heavier.

A normal individual from the Upper Oread at Amazonia, Missouri, measures 50 mm. in length, 70 mm. at the widest point, and is about 35 mm. high.

Range and distribution: Throughout the Oread, generally.

Genus Pustula Thomas

Pustula nebraskensis Owen

Ths species is a very abundant one in the Upper Oread, and is especially numerous in a zone near the middle of the limestone. No specimens have been found in the Lower Oread, and if present there it must be very rare.

The most conspicuous feature of P.nebraskensis is the crowded spines covering the surface. They are of different sizes, arranged roughly in concentric rows, and point downward and frontward.

The presence of a sinus seems to depend on the relative age of the individual. In the smaller specimens collected this feature is almost lacking, but in the larger ones is quite distinct.

On the average the shells are of medium size and height. Average dimensions:

Length	25 mm.
Width	20
Height	14

Range and distribution: Upper Oread generally.

Pustula punctatus Martin

Typical specimens of this species are unmistakable because of their large size and great anterior expansion. The length of the hinge is much less than the maximum

width of the shell. The beak extends posteriorly to the hinge and curves around almost ventral to it. A broad, shallow, but distinct sinus is present, and extends far up on the umbo. The shell is greatly extended anteriorly, and bears concentric rows of spines which are of two orders, the smaller being the more numerous but the less noticeable.

Length	64 mm.
Width	58
Hinge	25
Convexity	28

Range and distribution: Throughout the Oread, generally.

Pustula symmetricus McChesney

Discrimination between the two large species of the genus Pustula, P.punctata and P.symmetricus seems to be possible only with well preserved and complete specimens. I am fortunate in having obtained a few individuals which show the discriminating specific characters.

The shell of P.symmetricus is more erect than that of P.punctatus, the beak curved, but not posterior to or below the hinge-line. The hinge is almost as long as the widest part of the shell. No distinct sinus, is present. The height is much greater in proportion to the length than in B.punctatus, and the length and width are about the same.

The nature of the spine arrangement cannot be seen

on this specimen, but fragmentary specimens which are not exfoliated, and which I have referred to this species show much the same pattern as that of P.punctatus.

Dimensions:

Length	about 43 mm.
Hinge length	38
Greatest width	43
Height	24

Range and distribution: Throughout the Oread, generally.

Family Richthofeniidae Waagen

Genus Tegulifera Schellwien

Tegulifera n. sp.?

Several specimens of this peculiar brachiopod have been collected from the Upper Oread. Examination of the available literature reveals no described species identical with them, and I am provisionally referring them to a new species.

The shells are smooth, oval in outline, truncated above. The width is greater than the height. The rim of the shell is smooth. The surface is covered by irregularly spaced fine concentric lines and a few small irregularly distributed spines. Near the anterior rim there is a faint trace of radiating plications.

This form is related to T.kansasensis Girty, but differs in having a smoother less contorted shell and fewer concentric markings.

Dimensions:

Length	10 mm.
Width	13
Height	7

Range and distribution: Upper Oread, Lecompton, Leavenworth, Sedan.

Order Telatremata Beecher

Super-family Rhynchonellacea Schuchert

Family Rhynchonellidae Gray

Sub-family Rhynchonellinae Gill

Genus Pugnax Hall and Clarke

Pugnax osagensis Swallow

Two somewhat broken specimens comprise the entire representation of this species in my collection.

The shells are gibbose, transverse, abrupt anteriorly, and sub-trigonal in outline. There are three prominent costae on the fold and two in the sinus. The length of their posterior extension is uncertain because of the weathered character of the specimens, but the posterior portion of the shells appears to be smooth. The lateral plications are two in number on each side, and are much smaller than the mesial ones.

Dimensions:

Length	8 mm.
Width	9
Height	6

Range and distribution: Upper and Middle Oread, Lecompton and Lawrence.

Super-family Terebratulacea Waagen

Family Terebratulidae Gray

Sub-family Dielasmetinae Zittel?

Genus Dielasma King

Dielasma bovidens Martin

The shell is small, greatly depressed and sinuous anteriorly, compressed along the lateral margins. The pedicle valve bears a broad depression which rapidly deepens and widens anteiriorly until the entire shell is compressed at the anterior margin. The dorsal valve is convex, the line of convexity almost straight from back to front.

The pedicle beak bears a large oval foramen which is located a little anterior to the extreme end of the beak. The most convex portion of the shell is about midway of its length.

Dimensions of an average specimen:

Length	15 mm
Width	11
Convexity	9

Range and distribution: Throughout the Oread in Kansas.

Super-family Spiriferacea Waagen

Family Spiriferidae King

Sub-family Spiriferinae Zittel?

Genus Spirifer Somerby

Spirifer cameratus Morton

This common Pennsylvanian Spirifer is present in all

members of the Oread limestone, and has a wide horizontal distribution. It is distinguished by its fasiculate plications, long hinge and rather large size. Another smaller form which occurs with the larger specimens is less wide proportionally than the others collected and is thought to be the young of the species. An average individual has the following dimensions:

Length	26 mm.
Width	45
Height	17

A young individual from the base of the Upper Oread measures 11 mm. long, 13 mm. at widest point, 10 mm. at hinge, and 7 mm. high.

Range and distribution: All members of the Oread, generally.

Sub-family Reticulariinae Waagen

Genus Squamularia Gemmellaro

Squamularia perplexa McChesney

This species is not abundant in the Oread, except locally, but occurs rather constantly in small numbers. No specimens have been found in the Lower Oread. Those obtained from the Upper limestone show considerable variability in size, but otherwise their characteristics seem to be constant. The rather rounded outline, incurved beaks, very short hinge, and biconvex shape, with both valves bearing concentric rows of minute spines identify the species.

The ventral valve is much more convex than the dorsal, and the ventral curves out over that of the dorsal valve. An ill defined broad sinus is present anteriorly on the ventral valve.

The size of the specimens collected varies from very small individuals to one form which measured 22 mm. long, 22 mm. wide, and 15 mm. high. The majority of the specimens collected were about two-thirds this size.

Distribution: General throughout Kansas in the Upper Oread.

Sub-family Martiniinae Waagen

Genus Ambocoelia Hall

Ambocoelia planoconvexa Shumard

Although not particularly abundant in the Oread, this small brachiopod occurs in small numbers in almost all the sections studied.

The pedicle valve is very convex and strongly arched, with a prominent curved beak. The brachial valve is almost flat with a very inconspicuous beak. The cardinal area is rather large, the beaks being widely separated. The shell is rounded anteriorly with a tendency toward a flatter posterior outline which is broken by the highly convex rather narrow pedicle beak. The surface of the shell is smooth.

A large individual measured:

Height	5 mm.
Length	7
Width	8

Most of the specimens found were much smaller than this.

Range and distribution: All members of the Oread, throughout Kansas.

Family Suessiidae Waagen

Genus Spiriferina King

Spiriferina kentuckyensis Shumard

This small spiriferoid shell is not abundant in the Oread, but has a wide distribution.

The brachial valve bears about seven large, rather angular plications which are smallest at the sides and gnade up to a large broad central plication which forms the median fold.

The pedicle valve is conspicuously arched with a prominent pointed beak. The plications are ten in number and a well defined angular sinus is present. Crenulated growth lines cover the entire surface of the shell.

An average individual measures 6 mm. long, 9 mm. wide, and 6 mm. high.

Range and Distribution: Throughout the Oread in Kansas.

Family Rhynchaspiridae Hall and Clarke

Genus Hustedia Hall and Clarke

Hustedia mormoni Marcou

This well known brachiopod is widely distributed in the

Oread, and specimens have been noted in every collecting locality.

The individuals are small and rather gibbose, with a prominent, pointed pedicle beak bearing a foramen. The surface of the shell is ornamented with 10-14 angular costae on each valve.

An average sized specimen measured 10 mm. in length, 8 mm. in width and 7 mm. high at point of greatest convexity. Only one specimen was secured which was conspicuously larger than this, measuring 14 mm. in length, 10 mm. in width. As only one valve was present the thickness was indeterminable.

Range and distribution: All members of the Oread, throughout.

Family Athyridae Phillips

Sub-family Athyrinae Waagen

Genus Composita Brown

Composita subtilita D'Orbigny?

Composita subtilita, with the exception of the protozoan Triticites, is the most abundant fossil in the Oread limestone. Its smooth, rather rotund shell with the prominently curved beak of the pedicle valve containing a large foramen cannot be readily mistaken for any other form present. The variation within the species is rather large, both in size of individuals and in the general proportions.

The variation noted is two-fold; first, the presence or absence of a sinus or marginal depression on the pedicle valve, and secondly the degree of proportional elongation and thickening of the shell. The sinus may consist of merely a large, more or less deep and wide depression of the anterior margin of the pedicle valve, or may be less wide and deep at the margin and extend posteriorly for half the length of the shell or perhaps a little farther.

The differences in outline vary from sub-circular, the line of the circle broken posteriorly by the narrow beak, to very definitely elongate-ovate, tapering both posteriorly and anteriorly.

The largest specimen collected is 36 mm. long, 35 mm. wide, and 22 mm. high at the point of greatest convexity. As the specimen appears to be somewhat crushed, it is quite probable that the thickness should be greater. The extremes of size observed range from this specimen to those of almost microscopic size. A distinct but not prominent sinus extends from the anterior margin about half way to the beak.

An average sized specimen bearing a wide and deep marginal sinus measures 25 mm. in length, 19 mm. in width, and 16 mm. in greatest thickness.

A third specimen without a sinus or marginal depression measured 17 mm. long, 15 mm. wide, and 8 mm. thick.

I think that a great deal of the variation noted can be attributed to the difference between young and old individuals. The young shells fail to develop any but simple surface contours. This observation is supported by the fact that the sinus-bearing individuals are marked with growth lines, thickned margins, and other signs of advanced age which are absent in the other type of shell. On the other hand the proportional differences noted in the mature shells may indicate varietal or specific differences which can be discriminated by further study and observation.

Range and distribution: Found in all members of the Oread wherever studied.

MOLLUSCA

Class Pelecypoda

Order Prionadesmacea

Family Grammysiidae Fischer

Genus Chaenomya Meek

Chaenomya leavenworthensis? Meek and Hayden

I am provisionally referring one fragmentary case in my collections to this genus. The entire posterior portion of the specimen is missing, but the remainder is well enough defined to indicate its approximate systematic position.

In brief the shell is sub-cylindrical, the beaks flattened, incurved and almost touching. The dorsal margin is gently

concave immediately posterior to the umbonal region, and more or less parallel to the slightly convex ventral margin. A shallow depression is present laterally, extending from the umbonal area to the postero-ventral margin. The anterior margin is rather evenly rounded. Indistinct concentric undulations cover the surface, and are more prominent ventrally.

Dimensions:	Height	25 mm.
	Maximum convexity	22
	Length	unobtainable

Range and distribution: Upper Oread, Lecompton

Genus Edmondia De Koninck

Edmondia aspinwallensis Meek

I have one weathered cast which agrees very well with Keyes[1] figured specimen of Edmondia aspinwallensis. The shell is rather transverse, the cardinal margin curving slightly and sloping downward. Beaks appear to be incurved, only moderately convex, and located about one-third of the way behind the anterior margin.

Dimensions:

Length	32 mm.
Height	24
Convexity	12

Range and distribution: Upper Oread, Lecompton.

Genus Sedgewickia McCoy

Sedgewickia topekaensis Shumard

1. Keyes, C.R. Mo.G.S. Vol.5 pt.2 p.126 pl.47 fig. 1, 2-b 1894

This pelecypod is represented in my collections by several beautifully preserved casts from the lower part of the Upper Oread at Lecompton, Kansas, and one fragmentary specimen from the Middle Oread at Lawrence.

The shell is rather convex, the umboes being somewhat gibbose, with incurving beaks situated about one-third of the length of the shell behind the antrior margin. There is a broad flattened depression on each umbo which is represented ventrally by a slight sinuousity in the margin. A more or less distinct angularity extends from the beaks to the postero-ventral margin. The surface is ornamented by rather indistinct conecntric lines which become obsolete dorsal to the angularity just mentioned. Fine, slightly crenulated radiating rows of minute granules are present over the entire surface, but are inconspicuous on the postero-dorsal portion. These rows of granules are seemingly arranged in bunches, with 3-5 rows to a bunch.

An average specimen is 51 mm. long, 28 mm. high, and 21 mm. wide.

Range and distribution: Middle and Upper Oread, Lecompton and Lawrence.

Super-family Nuculacea

Family Nuculidae Adams

Genus Nucula Lamark

Nucula beyrichi? v. Schauroth

I am referring two small left valvesin my collection to this species. The length and height are sub-equal, and the lateral outline of the shell is sub-oval. The beak is rather prominent, pointed, but not greatly curved. A very distinct umbonal angularity slopes abruptly to the postero-ventral margin. Anterior to this the shell is covered with concentric ridges which are larger and farther apart near the ventral margin, and absent on the posterior portion of the shell. The ventral margin is broadly curved, and the shell is quite convex.

Dimensions:

Height	8 mm
Length	10
Estimated convexity of complete shell	6

Range and distribution: Middle Oread at Lawrence and Kereford at Amazonia.

Genus Nuculopsis Girty

Nuculopsis ventricosa Hall

I am referring one well preserved but slightly distorted cast from the Upper Oread to this species.

The beaks are small, and anterior. The anterior margin is slightly concave just beneath the dorsal side, then curves slightly outward below. The ventral margin is very broadly curved, the height of the shell being almost the same from front to back. The posterior margin is broadly rounded. The dorsal side is straight, and the ligamental groove beside

the hinge described by Girty[1] can be discerned on the right valve. The surface is smooth.

Dimensions:

Length	11 mm.
Height	8
Convexity	6

Range and distribution: Upper Oread, Lecompton.

Family Ledidae Adams

Genus Leda Schumacher

Leda bellistriata Stevens

Although this species is represented by very small specimens, the agreement in all essential details except size causes me to identify them with this species. It may be that this is a dwarf varietyof the species, but more material is necessary before further systematic discrimination can be attempted.

The individuals in my collection are distinguished by distinct concentric ridged markings, convexity of the anterior portion of the shell, the prolonged tapering posterior and the prominent escutcheon.

Dimensions:

Length		4 mm.
Height	less than	3
Width	over	2

Range and distribution: Top of Snyderville shale, Tonganoxie.

1. Girty, G.H. U.S.G.S. Bull. 544 p.116 1915

Genus Yoldia Mollor

Yoldia glabra Beede and Rogers

The subcentral position of the beaks, slight convexity, and lack of an umbonal ridge characterize this peculiar pelecypod. I have only an single internal cast with the posterior end missing.

The character of this species are so unique that further discussion here is unnecessary. Although abundant in some Pennsylvanian horizons, I have seen only the one fragmentary specimen in the Oread.

Dimensions:

Height	9 mm.
Convexity	4
Length	unobtainable

Range and distribution: Upper Oread, Lecompton.

Super-family Arcacea Deshayes

Family Parallelodontidae Dall

Genus Parallelodon Meek

Parallelodon sangamonensis Wortnen

Parallelodon sangamonensis is rare in the Oread, the only specimen collected consisting of part of the cast of a right valve.

The large flat radiating plications, suggestion of rectangular shape and long straight hinge agree very well with Beede's[1] description and figures, and I experience no

1. Beede, J.W. Macrodon sangamonensis, K.U.G.S. V.o p.146 pl.20 figs.2-2b

hesitancy in identifying it with this species.

The estimated length of the specimen is 48 mm. and its height 21 mm.

Range and distribution: Upper Oread, Lecompton.

Parallelodon tenuistriatus? Meek and Worthen

Identification of this species, which is represented by one badly weathered right valve, is based on size and proportions of the shell alone.

The small size, abrupt angular posterior, prominent angularity extending from the beak to the postero-ventral corner of the shell, and rectangular shape all point to its inclusion in this species.

It measures 16 mm. long, 8 mm. high, and the one valve has a convexity of 4 mm.

Range and distribution: Lower part of the Upper Oread, Lecompton, Kansas.

Super-family Pteracea Dall

Family Pinnidae Meek

Genus Pinna Linnaeus

Pinna peracuta Shumard

This species is represented in the collections at hand by fragments of internal casts, most of which are small.

This form is so well known that description is unnecessary. All specimens collected from the Oread have the anterio and posterior ends broken away.

The largest specimen found measures 105 mm. long, 20 mm. high anteriorly and 48 mm. high posteriorly; and 18 mm. thick anteriorly and 22 mm. thick at the posterior end. These dimensions give some idea of the proportional dimensions of this pelecypod.

Range and distribution: Upper Oread at Lecompton, Kansas, Amazonia and St. Joseph, Missouri.

Family Conocardiidae

Genus Conocardium Bronn

Conocardium n.sp.?

The shell is small, gibbose, the height and length sub-equal. The right umbo is distinctly smaller than the left, but this may be due to an accident of preservation. The highest portion of the shell is directly below the beaks, from which the ventral margin slopes upward, both anteriorly and posteriorly. The anterior slope is abrupt, that posteriorly is more gentle and about twice as long as the former. The hinge is straight, and apparently extended, although I cannot be certain of this detail as both the anterior and posterior extremities of the shell are missing.

The anterior lateral slope from the umbonal ridge is much less abrupt than in other members of this genus which I have observed. The shell is extended posteriorly, the height decreasing rapidly. As nearly as can be determined from the broken nature of the shell both the dorso-anterior

and dorso-posterior portions of the shell were somewhat extended and gaping.

The surface is ornamented by fine depressed radiating lines which become crowded on the umbo and farther apart anteriorly. This is especially true of the anterior portion of the shell. Posterior to the umbonal ridge these lines become indistinct, and can barely be discerned on the posterior portion of the shell. Concentric growth lines are present on the posterior two-thirds of the shell, but become obsolete anterior to the umbo. These may be very slightly raised into indistinct lamellae along the crest of the umbonal ridge, and are more prominent along the mid portion of the shell.

The intersection of the radiating and concentric markings gives the posterior surface of the shell a beautiful finely cancellated appearance.

I have been unable to locate a form identical with this in the literature, but have some hesitation about referring it to a new species without more study and more material.

Dimensions:

Height	10 mm.
Estimated length	12
Width	8

Range and distribution: Lower three feet of the Upper Oread, Lecompton.

Family Pteriidae Meek

Genus Limopteria Meek and Worthen

Limopteria longispina Cox:

Although the only specimen I have is an incomplete cast of one valve, I am referring it to this species without hesitancy on the following characters.

The intersection of the large lunule with the anterior margin forms a distinct angularity. Secondly, the umbonal ridge is deflected very sharply posteriorly, forming a high angular posterior ridge. The ventral part of the shell and a large part of the spine are missing, but the two characters just mentioned and the general elliptical-subquadrate shape of the shell with its sub-circular anterior margin and deep sinus in the posterior margin form a good index to its systematic position.

Concentric growth lines are present, and are almost parallel to the outline of the shell.

Range and distribution: Lower Oread, Lawrence.

Genus Pseudomanotus Beyrich

Pseudomonois hawni Meek and Hayden

This peculiar pelecypod is common in the Kereford but has not been found by me in the Oread, although reported from there by other writers.[1]

1. Beede, J.W. and Rogers, A.F. K.U.G.S. V.IX, p.362-373

It is distinguished by its subovate outline, gentle convexity and the rather widely separated, more or less sinuous coarse plications on the surface. These plications bear many incipient hollow spines caused by the upfolding of the edges of the laminae of the shell.

No trace of the hinge could be discerned on the specimens collected, as their preservation was imperfect.

Dimensions:

Height	42 mm.
Length	40
Convexity	unobtainable

Range and distribution: Basal part of the Kereford, Amazonia, Missouri.

Family Myalinidae Frech

Genus Myalina De Kaninck

Myalina congeneris Walcott

Next to M. subquadrata, this is the most abundant species of the genus Myalina in the Kereford and one specimen has been found by me in the Upper Oread at Amazonia.

The shell is greatly extended, the beaks tapering to an acute point. The anterior margin is straight, the posterior rather broadly rounded. The hinge makes an acute angle with the anterior margin. The shell is quite convex in the umbonal region, but becomes rather flattened ventrally and posteriorly.

The surface is covered by prominent lamellae which may imbricate near the ventral margin.

The relation of height to width is approximately two to one.

A small individual measures as follows:

Height	50 mm.
Maximum length	28

Range and distribution: Upper Oread, basal portion, Amazonia, Missouri.

Myalina kansasensis? Shumard

Specimens which seem best identified with this species have been obtained from the Kereford alone.

The individuals studied are not well preserved, and identification is based on surface characters and general proportions of the shell.

The anterior margin is somewhatconcave, and the shell is rather gibbose. The surface bears conspicuous raised concentric lamellae near the ventral margin.

No adequate measurements could be obtained because of the fragmental condition of the shells.

Range and distribution, Kereford, Amazonia, Missouri.

Myalina recurvirostris Meek and Worthen

This species is represented by one rather doubtful specimen from the Oread, and two individuals from the Kereford

oolite at Amazonia.

Identification is based on the curved and distorted attitude of the beaks, which rather clearly indicate the systematic position of these individuals.

Range and distribution: Top of the Snyderville shale, Toronto, Kansas., Kereford oolite, Amazonia, Missouri.

Myalina subquadrata Shumard

Single valves of this speces are very abundant in the basal portion of the Kereford and one occurrence has been noted in the Upper Oread.

The species is characterized by its sub-rectangular outline, large size, and the fact that the hinge makes almost a right angle with the vertical axis of the shell.

The surface is smooth except for growth lines which approach the dorsal margin almost at right angles. The anterior margin is broadly concave above the mid portion of the shell, the posterior convex toward the ventral portion, but straight for the dorsal two-thirds of its length.

As only single valves have been found, no estimate of their relative proportions can be made here.

Size of an average specimen from the base of the Kereford:

Length	45 mm.
Height	80
Convexity	unobtainable

Range and distribution: Upper Oread and Kereford, Amazonia, Missouri.

Myalina swallowi McChesney

This small Myalina is rather abundant in the Kereford oolite. Identification is based on fragmentary remains and impressions, as no complete specimens have been secured.

Because of the nature of the material on which I am basing my identification, I can give no detailed description of the species as it occurs here. The small size, convexity, cuneate form and lack of angularity along the cardinal margin of the forms studied, however, point to their inclusion in this species.

Range and distribution: Kereford oolite, Amazonia, Missouri.

Super-family Trigoniacea Bronn

Family Trigoniidae Lamarck

Genus Schizodus King

Schizodus cf. alpinus Hall

Two specimens in my collection have almost the shape and proportions of S.alpinus as figured by Girty.[1]

The casts are a little broader than long, of moderate size, and rather sub-circular in outline. The anterior is regularly curved, the ventral margin broadly so. The posterior margin is somewhat obliquely truncated. No distinct umbonal ridge is present.

Dimensions:

Length	25 mm.
Height	23
Width	15

Range and distribution: Upper Oread, Lecompton.

1. Girty, G.H. U.S.G.S. Bull. 544 p. 130 pl. 17 fig. 3 1915

Schizodus curtus? Meek and Worthen

Shell small, length and height sub-equal, of moderate convexity. The ventral margin is broadly and evenly rounded, making a distinct angularity with the truncated posterior margin.

This individual resembles Meek and Worthen's[1] figures of S.curtus, in outline, but does not answer all the details of their description as S.curtus is described as thin and compressed, and this individual is rather convex. If not identical, it is surely closely related to this species.

Dimensions:

Height	9 mm.
Length	10
Convexity	5

Range and distribution: Upper Oread, Lecompton.

Schizodus sp.

Shell small, convex, produced and more or less pointed posteriorly. The anterior and ventral margins form a continuous curve. The cardinal margin is straight and is obliquely truncated posteriorly.

An indistinct angularity extends from the beaks to the extreme posterior portion of the shell, the area above on either side of the cardinal margin being broadly flattened.

As nearly as can be determined from the weathered character

1. Meek and Worthen, Ill.G.S. Vol.5 p.582 pl.26 fig.16

of the cast the beaks are neither prominent nor incurved.

Range and distribution: Upper Oread, Lecompton.

Super-family Pectinacea Reeve

Family Pectinidae Lamarck

Genus Acanthopecten Girty

Acanthopecten carboniferous Stevens

Only one fragmentary specimen of this species, consisting of the anterior portion of one valve, has been found by the writer.

The characteristic surface ornamentation consists of radiating plications raisedat regular intervals into prominent lamellose processes, which are so regularly arranged as to appear to form concentric rows. The anterior margin is regularly spinose, the spines, which project in the plane of the shell, being formed by the coalesced sides of the individual lamellose processes.

Four rows of these processes are present on the fragmental hand, and it is evident that a large part of the shell area was so ornamented.

Range and distribution: Upper Oread, Lecompton.

Genus Aviculopecten McCoy

Aviculopecten occidentalis Shumard

The representatives of this genus in my collection are all fragmentary, and I think it unwise to attempt to

discriminate between them in detail.

I am therefore referringthem to this species on the basis of the external ornamentations alone.

Range and distribution: The specimens were obtained from all members of the Oread and the Kereford oolite.

Order Anomalodesmacea Dall

Super-family Anatinacea Dall

Family Pholadellidae Miler

Genus Allorisma King

Allorisma subcuneata Meek and Hayden

This is the most common species of pelecypod in the Oread. It is distinguished from other forms at this horizon by the prominent concentric wrinkles, most widely separated along a line from the umbo to the ventro-posterior margin, and the almost terminal position of the beaks. The hinge behind the beaks is straight, curving downward slightly at the posterior end. Anteriorly the shell curves outward slightly, then in a broad curve ventrally, the lowest point on the ventral margin being a little posterior to the umbonal region. From this point the ventral margin curves upward in a broad sweep. The posterior end is rather narrowly curved.

Specimens are not very abundant, but distribution of the species seems to be general. I have found no specimens of this

species in the Lower Oread, but have seen individuals from that horizon.

The specimens secured occur as casts, and are rather small. An individual of slightly larger than average size measured 70 mm. long, 30 mm. high and 22 mm. wide. A large individual from St. Joseph, Missouri measured 110 mm. long, 50 mm. high, and 35 mm. wide.

Range and distribution: Found throughout the Oread, but more abundant in the upper part of the Upper Oread. Distribution is general.

Order Teleodesmacea Dall

Super-family Cypricardiacea Dale

Family Pleuropnoridae Dale

Genus Pleuropnorus King

Pleuropnorus immaturus? Herrick

Shell rather small, length equal to about twice the height. Dorsal margin straight, the anterior slightly concave dorsally but convex and a little extended ventrally. The ventral margin is almost straight. The shell is convex along an umbonal ridge which extends from the beaks to the postero-ventral margin, but is rather compressed both dorsal and ventral to it. The dorsal slope of the posterior margin is about twice as long as the ventral slope.

I have only one specimen of this species, a rather poorly

preserved internal cast.

Dimensions:

Length	15 mm.
Height	7
Convexity	4

Range and distribution: Upper Oread, Lecompton.

Genus Astartella Hall

Astartella concentrica McChesney

Although represented by only two individuals, I am referring them without hesitation to this species. My identification is principally based on the presence of the widely spaced angular concentric ridges, the prominent lunule and escutcheon, and the subquadrilateral shape.

The latter character shows considerable variation among the specimens observed from other horizons and also between the two individuals in my collection. The change in shape chiefly consists of a greater or lesser convexity of the ventral margin and a difference in the degree of extension of the postrior part of the shell.

Range and distribution: Upper Oread, Lawrence, Top Snyderville shale, Toronto.

Genus Solenomya Lamark

Solenomya sp.

One rather well preserved cast from the Lower Oread at

Lawrence completes the representation of this genus in my collection.

The specimen is of medium gibbosity, the right valve smaller than the left. In the absence of further material for study, I am uncertain as to the importance of this detail, and suspect that it is merely an accident of preservation. The beaks are incurved, almost touching, and located about one-third the way behind the anterior margin. A shallow broad depression reaching to the ventral margin is present just anterior to the point of greatest convexity. In addition, an indistinct angularity extends from the umbonal region to the postero-ventral margin.

The posterior margin is slightly pointed, curving abruptly both ventrally and dorsally. The dorsal and ventral margins are straight, and continue so to the posterior one-fourth of the shell. The latter margin is slightly sinuous directly beneath the beaks. Anteriorly the shell is evenly rounded, and distinctly gaping.

Evidences of rather broad concentric undulations which become obsolete on the postero-dorsal portion of the shell are clear. The preservation is too imperfect for other ornamentation, if present, to be seen.

Dimensions:

Length	47 mm.
Width	18
Height	24

Range and distribution: Lower Oread, Lawrence.

Class Gastropoda

Family Bellerophantidae McCoy

Genus Bellerophon Montfort

Bellorophon crassus Meek and Wortnen

This ubiquitous species is present in all members of the Oread and quite abundant in parts of the Upper Oread. I have also collected specimens from the Kereford oolite.

The forms which I am referring to this species show considerable variation whose importance may only be determined by a more detailed study than I am able to make at this time.

The specimens vary in size from small individuals to those with a diameter of 2.5 to 3 inches. All are preserved as internal casts. The surface is smooth and unornamented except for growth lines. The convexity of the outer whorl varies from even and circular to brodd and rather flattened. A fissure and slit band may or may not be apparent depending on the preservation. When seen the fissure is fairly deep with sub-parallel sides, the edges of the aperature on either side slightly impressed. The size of the umbilicus is also variable, in some being moderately large and open, inothers small and almost closed.

Range and distribution: Apparently rather general, although none have been collected in southern Kansas.

Bellerophon n.sp ?

Shell small, smooth except for growth lines which are inconspicuous. Dorsum moderately rounded, shell expanded evenly anteriorly, slit band narrow, depressed very slightly throughout. No fissure present, and if present would be small as very little of shell is missing. Umbilicus small, partially filled by the inner lip. No callus is present. Aperture raniform, shell thin throughout, not thickened at the aperture.

Dimensions:

Height	10 mm.
Length	12
Width of aperture	10

Range and distribution: Middle Oread, Lawrence.

Genus Bucanopsis Ulrich

Bucanopsis n. sp.?

The individual I am referring to this species is a cast from the Upper Oread at Amazonia, Missouri.

The surface is rather flatly rounded, and covered with fine sub-equal closely crowded lirae. The carinae is narrow, distinct and slightly elevated with a slightly depressed area on each side bearing smaller and less distinct lirae than the average. The lirae extend to the anterior margin of the shell. No fissure is visible. The umbilicus is moderately large, rounded and open.

Dimensions:

Diameter of whorl	10 mm.
Width of aperture	11

Range and distribution: Upper Oread, Amazonia, Missouri.

Genus Euphemus McCoy

Euphemus carbonarium McCoy

This rather common Carboniferous gastropod is represented in my collections by two casts, both of which are somewhat distorted and weathered. They may be distinguished from a small species of Bellorophon with longitudingal striae by the fact that the striae are absent on the anterior one-third of the shell. The specimens are so badly weathered that the character of the slit-band is not apparent. The approximate height of the shell is 8 mm.

Range and distribution: Upper Oread, Lecompton, Kansas.

Genus Patellostium Waagen

Patellostium kansasensis Snumard

This species, which is represented in my collections by several specimens obtained from the base of the Snyderville shale at Lawrence has been found at no other horizon in the Oread. In proportions and surface ornamentation it agrees very well with Shumard's descrpiption of B.kansasensis, although somewhat smaller. Keyes[2] description and figures of B.bellus,

1. Bellerophon kansasensis Shumard,Trans.St.Louis Acad.Sci.Vol.1,p.204,1858
2. B.bellus Keyes, Mo.G.S. Bull., V pt.2,p.148 pl.L,fig.7 1894

although very brief, evidently refers to the same species, and I think that the two are synonymous.

The shell expands somewhat at the aperture, which is transverse. The dorsum is crossed by more than 20 prominent transverse ridges which become indistinct as they near the umbilicus, and bears a narrow angular carina. In addition to the transverse markings the shell bears fine longitudinal lirae which are quite distinct between the larger ribs, and form small nodes at their intersection with them. The carina is offset on each side by a narrow distinct furrow which becomes less distinct near the aperture. The nodes on the carina of which Shumard[1] speaks, and which he attributes to the intersection of the carina with the transverse ribs, are present but not conspicuous.

The aperture is quite transverse, with a greatly thickened inner lip. Where this lip crosses the dorsum of the inner whorl there is a conspicuous thickening forming a prominent node or hump which points downward. The fissure is distinct, in an average specimen measuring 5 mm. long and 1.5 mm. wide, with parallel sides, the edge of the lip on either side reflected slightly inward. The thickened lip almost hides the umbilicus which is small and rather shallow.

An average specimen measures 13 mm. high, and the aperture

1. Bellerophon kansasensis Shumard, Trans. St. Louis Acad. Sci. Vol. 1, p. 204, 1858.

is 14 mm. wide.

Range and distribution: Base of Snyderville shale, Lawrence.

Family Pleurotomariidae D'Orbigny

Genus Pleurotomaria Defrance

Pleurotomaria numerosa Meek and Hayden

The two fragmentary weathered specimens in my collection seem to agree with Meek and Hayden's[1] original description of this species in all respects except that they are much smaller.

The character of the surface markings especially link them with this species, and for lack of a larger number of specimens for detailed study, I experience no hesitation in so placing them.

The volutions are flattened above, rounded below, and are distnctly angular at the outer margin of the flattened area. The edges of the volutions bear three strong lirae, and the flattened surface 5-7 finer ones. The last whorl bears up to ten of the coarse lirae.

A small umbilicus is present. The aperture is broken away.

Dimensions:

Height		12 mm.
Width	about	9 at the last volution

Range and distribution: Middle Dread, Lawrence.

1. Meek and Hayden, Smith. Cont. to Knowledge, p. 46, pl. 1, fig. 14 a & b, 1865.

Pleurotomaria perhumerosa

One beautifully preserved specimen from the base of the Snyderville shale at Lawrence constitutes the entire representation of this species in my Oread collections.

The shell is conical, the body whorl occupying about one-half the height. The volutions number 5-6. The shell is smooth except for a prominent shoulder, and its only markings are quite distinct growth lines. The aperture is oval ventrally, but angular dorsally. A small shallow umbilicus is present. Height of the shell is 27 mm.

Range and distribution: Base of Snyderville shale, Lawrence.

Pleurotomaria tabulata Hall

Shell rather large, sub-conical. The volutions are five or more in number. Each whorl bears a large angular carina about the middle of its lateral surface, is more or less flattened above, and somewhat concave below. The sutures are not visible because of the weathered nature of the specimen, but must have been distinct.

The surface is ornamented by longitudinal lirae which are larger and wider spaced on the body whorl. The aperture is missing.

This form may be readily confused with P. subscalaris Meek and Worthen, but differs in that the carina is visible on all the whorls and in P. subscalaris it disappears below the suture line above the third whorl. The number of lirae on

the sides of the whorls is greater than in P.subscalaris.

The P.tabulata figured by White[1] carries a row of nodes on the carina. These are not apparent on this specimen, but may have been obliterated by weathering.

The height and width are about equal, 40 mm. but both would be greater in a complete specimen as the entire apertural portion of the body whorl is missing.

Range and distribution: Upper Cread, Amazonia, Missouri.

Family Enampnalidae de Koninck

Genus Schizostoma Bronn

Schizostoma cf. catilloides Conrad

I am referring one fragmentary specimen in my collection to this species for comparison on the basis of external form alone. The regular flat whorl and lack of indenture of the volutions form a clue to its systematic position, but otherwise the specimen is too imperfect for sure identification. The estimated whorl diameter is approximately one-half inch.

Range and distribution: Middle Cread, Lawrence.

Family Trachanematidae Zittel

Genus Strophostylus Hall

Strophostylus peoriensis McChesney

Imperfect casts of gastropods which I am referring to this

1. White,C.A. 13 Am.Rept.St.Geol.Ind. p.150,p132,fig.4 & 5.

species have been found in all members of the Oread at widely separated localities.

The spire is low and more or less flattened, the shell rapidly increasing in size. The last whorl is large and quite transverse. Sutures are moderately impressed. The volutions number one and one-half to two. The surface is smooth, although faint indications of longitudinal lirae were noted on the body whorl of a large specimen from Amazonia. I am in some doubt as to the inclusion of this specimen in the species, as it is much larger than the other similar forms in my collection. However, as it agrees in general proportions, and details of coiling with the other specimens, I shall include it with them.

Range and distribution: Lower Oread, Lawrence; Upper Oread, Lawrence and Amazonia, Missouri.

Family Neritopsidae Fischer

Genus Naticopsis McCoy

Naticopsis altonensis McChesney

Undoubted representatives of this species have appeared only in the Middle Oread, at Lawrence, where the hard brittle rock is sufficiently weathered to permit the extraction of fossils. They probably appear at other localities but the conditions of the exposures studied elsewhere have never been favorable for collecting. One

fragment from the Upper Cread at Sedan appears to have affinities with this group, but is so incomplete that more discriminating identification is impossible.

Briefly, the specimens at hand are characterized by the large and greatly extended body whorl, which bears a broad indistinct longitudinal concavity, and a distinct rather rounded shoulder, which is emphasized by the concavity. The shoulder is marked by transverse lines which are continuous with the inconspicuous growth lines on the remainder of the shell. The suture is distinctly and slightly impressed.

The number of volutions is about three, the last occupying about five-sixth of the height of the shell. The apertures of all the shells are broken away.

One of the larger specimens measures about 27 mm. in height, the last volution occupying 23 mm. of this height.

Range and distribution: Middle Cread, Lawrence.

Naticopsis tortum Meek

This specimen, a badly weathered cast, shows the rather flattened apex and greatly produced last volution of Naticopsis. I am including it in this species because of the rounded section of the last whorl, and its free, rather tortuous extension.

As nearly as I can determine, this individual is identical with N.tortum as described and figured by Morningstar,[1] from the Pottsville of Ohio.

Range and distribution: Top of Lower Cread, 12 miles south of Lawrence.

Family Pyramidellidae Gray

Genus Bulimorpha Whitfield

Bulimorpha inornata? Meek and Worthen

Although represented by only one weathered and incomplete cast, the specimen at hand agrees so well in proportions and general appearance with examples studied from the University of Kansas collections and with the descriptions and figures of Girty[2] and Keyes,[3] that I am placing it provisionally in this species.

Four volutions are present, the last one occupying about one-half of the total height of the shell. The upper volutions, perhaps 2 or 3 in number, are missing. The aperture is broken away.

The height of the specimen is 14 mm., but would probably be about 18 mm. if the entire shell were present.

Range and distribution: Upper Cread, Lecompton.

Bulimorpha sp.

I have collected from the Upper Cread at Amazonia, Missouri.

1. Morningstar O.G.S. Ser.4,Bul.25, p.257,pl.15,fig.17-18
2. Girty,G.H . U.S.G.S. Bull.544,p.222,pl.25,fig.10-10a 1915
3. Keyes,C.R. Mo.G.S. Vol.5,pt.2,p.205,pl.55,fig.6,p.189

several specimens of Bulimorpha which I so far have been unable to locate specifically in the available literature.

All the shells are characterized by a distinct narrow shoulder on all the whorls, and a deeply impressed suture. The volutions number 4-6, the body whorl occupying about one-half the total height. The surface is smoothly convex.

As nearly as can be determined from the imperfectly preserved specimens, the aperture is oval, the inner lip twisted and thickened, and extended slightly downward.

There may be two species represented here as one of the individuals is much larger and proportionally higher spired than the others.

The largest specimen is 56 mm. high, and the diamter at the body whorl is 32 mm.

Range and distribution: Upper Cread, Amazonia, Missouri.

Genus Sphaerodoma Keyes

Sphaerodoma intercalaris Meek and Worthen

The two specimens of this species in my collection are from the Middle Cread. The propottions of the shell, depression of the sutures and number of whorls agree very well with Girty's[1] figures and description. There is a variation in

1. Girty, G.H. U.S.G.S. Bull.544, p.206 pl.24 fig.1-2 1915.

gibbosity between the two specimens at hand, but as Girty[1] has noted, there is a considerable degree of this variation within the species.

In brief this form is rather high-spired, consisting of 4-5convex volutions, the last whorl equal to about two-thirds of the total height. The sutures are moderately depressed, the whorls evenly convex. The aperture is missing in both specimens.

Range and distribution: Middle Oread, Lawrence.

Sphaerodoma primigenia Conrad

This specimen, an incomplete cast, has the general proportions of S.primigenia as figured by Girty.[2] Only the one specimen has been found. The spire is short, pointed, and gibbose. The last whorl equals about one-half the total height.

This form differs from S.intercalaris in larger size and much greater proportional gibbosity.

Range and distribution: Upper Oread, Amazonia, Missouri

Genus Zygopleura Koken

Zygopleura rugosa Meek and Worthen

This species is represented by one imperfect specimen. The high spire, eight volutions, more or less depressed sutures, and large transverse costal markings place it systematically. The aperture is missing.

1. Girty,G.H. U.S.G.S. Bull.544,p.206,pl.24,fig.1-2 1916
2. Girty,G.H. U.S.G.S. Bull.544,p.208,pl.24,fig.13-17a 1915

Height of the shell (incomplete) 22 mm., diameter at last whorl about 8 mm.

Range and distribution: Middle Oread, Lawrence.

Class Cephalopoda

Family Tainoceratidae Hyatt

Genus Metacoceras Hyatt

Metacoceras cornutum Girty

A cast of part of the outer whorl of an individual of this species is in my collection from the Upper Oread at Amazonia, Missouri.

The whorl section is trapezoidal, the dorsum being the wider. The venter is almost flat, the lateral angles somewhat rounded. Each ventral shoulder bears a row of rather gentle nodes, located at the anterior end of each compartment. The suture bends into a narrow sub-angular saddle about these nodes. The venter bears a broad shallow lobe which is sub-angular at the apex.

A distinct impressed zone occupies about one-third of the width of the dorsum. A narrow rounded lobe is present in this zone, the area on either side occupied by narrow rounded asymetrical saddles.

A broad lateral lobe is present, the point of greatest convexity located about one-third of the way above the dorsum.

The sutures are 6 mm. apart at the center of the venter; 2.5 mm. on the dorsum.

Dimensions in cross-section are as follows:

Height	16 mm.
Width of venter	9
Width of dorsum	19

Range and distribution: Upper Oread, Amazonia, Missouri.

CRUSTACEA

Trilobita

Family Proetidae Corda

Genus Griffithides Portlock

Griffithides scitulus Meek and Worthen

This species is represented in the Oread collection by one fragmentary specimen which includes a complete pygidium and part of the thorax.

The axial lobe is very prominent, high and wide, and rounded on the posterior end. The pygidium is surrounded by a smooth rather wide flange.

Length of the pygidium	4.5 mm.
Maximum width	6
Width of axial lobe	2.5

Range and distribution: Upper Oread limestone, Lecompton, Kansas.

ENCRUSTACEA

Ostracoda

Genus Bairdia McCoy

Bairdia beedei? McCoy

This common Pennsylvanian ostracode is represented by a few specimens from the top of the Snyderville shale at Tonganoxie and Elgin. The individuals examined have the general rhomboidal shape, smooth shell and prominently pointed posterior attributed to Bairdia beedei, and for lack of further material and time for the determination of their exact systematic position I am including them in this species.

An average specimen is 1.5 mm. long, about .85 mm. high, and rather robust.

Range and distribution: Top of the Snyderville shale, Elgin and Tonganoxie.

	Lower Oread				Middle Oread		Upper Oread												Shales	Kereford
	4.1	6	8	21	1	4	1	2	3	5	7	8	14	15	19	20	24	25		
PROTOZOA																				
Triticites plummeri									X				?			X	X			
" secalicus	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
ANTHOZOA																				
Aulopora? anna														X						
" prosseri													X			X				
Axophyllum rude								X	X					X						
Lopnophyllum profundom	X	X						X	X	X	X	X	X			X				
" westi?								X					X							
Syringopora moltatennuata								X			X					X				
Campophyllum torquium													X	X		X	X			
ECHINODERMATA																				
Arcnaeoeidaris agassizi					X					X			X			X				
" dininni																X				
Ceriocrinus hemispherics												X								
* " sp.																				
* Erisocrinus n.sp.?																				
* " n.sp.?																				
Eupachicrinus magister								X		X										
* Graphiocrinus carbonarius																				
Hydreionocrinus subsinuatus								X												
Zeacrinus sp.								X												
BRACHIOPODA																				
Ambocoelia plauoconvexa		X						X	X	X	X	?								
Cnonetes granulijer		X						X	X	X	X	X				X	X			
Composita subtilita	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X		X
Derbya bennetti		X						X	X		X	X					X			
" crassa	X	X						X	X	X	X	X			X	?	X			?
" cymbula									X		X							X		
" robusta																	X			X
Dielasmaboridens					X			X	X	X	X									
Enteleteshemiplicata								X	X		X					X	X	X		
Hustedia mormoni		X					X	X	X	X	X				X	X	X			
Lingula sp.																				X
Marginifora lasallensis	X	X		X				X	X	X	X	X	X							

	Lower Oread				Middle Oread		Upper Oread											Snales	Kereford
	4.1	6	8	21	1	4	1	2	3	5	7	8	14	15	19	20	24	25		
Marginifora splendens	X	X		X	X				X		X	X	X		X	X				
Meekella striatacostata		X						X	X			X	X	X						
Orbiculoidea Mannattanensis																	?		15.1	X
Productus cora	X	X						X	X	X	X	X					X			
" costatus	?															X	X			
" semireticulatus		X							X	X		X	X				X	X		
Rhipidomella pecosi		X					X	X	X	X		X	X	X		X				
Pugnaxosagensis					X				X											
Pustula nebraskensis								X	X	X	X					X	X	X		?
" punctata				X						X							X			
" symmetricus									X							X	X			
Spirifera cameratus	X	X			X	X		X	X	X	X	X	X	X	X	X	X	X		
Spiriferina kyensis		X						X	X	X	X					X				
Squamularia perplexa							X	X	X		X		X	X		X	X	X		
Teguilifera n. sp.?									X			X	X							
BRYOZOA																				
Fistulipora carbonaris	X	X						X	X	X	X	X	X			X	X	X		X
" var. nebraskensis (carbonaria)									X											
" nodulifera		X								X						X	X			
" zonata											X									
Polypora triangularis								X	X											
Rhombocladia delicatula																			12.sn.#2	
Rhombopora lepidodendroides		X						X	X	X	X	X					X			X
Septopora biserialis								X												
PELOCYPODA																				
Acanthopecten carboniferous								X												
Allorisma subcuneata	X							X	X	X							X	X		
Astartella concentrica											X								12.1	
Aviculopecten occidentalis?		X																		X
Chaenomya leavenworthonsis?								X												
Conocardium n.sp.?									X											

	Lower Oread				Middle Oread		Upper Oread											Shales	Kereford
	4.1	6	8	21	1	4	1	2	3	5	7	8	14	15	19	20	24	25	
Edmondia aspenwallensis										X									
Leda bellastriata																			19.1t
Limopteria longispina		X																	
Myalina congeneris																	X		X
" kansasensis																			X
" recurvirostris																			12.1 X
" subquadrata																	X		X
" swallowi																			X
Nucula beyrichi					X														X
Nuculopsis ventricosa										X									
Parallellodon sangamandensis									X										
" tenuistriatus?									X										
Pinna peracuta									X	X							X	X	
Pleurophocus immaturus?								X											
Pseudomanatis nawni																			X
Schizodus cf. alpinus								X	X										
" curtus								X											
" sp.									X										
Sedgewickia topekaensis					X			X	X			X							
Solenamya sp.	X																		
Yoldia glabra								X											
GASTROPODS																			
Bellorophon crassus					X			X	X	X	X	X					X	X	X
" n.sp.?					X												?		
Bucanopsis? n.sp.																	X		
Bulimorphainornata								X											
" sp.																	X		
Eupnemus carbonarius								X											
Naticopsis altonensis					X	?						X							
" tortum			X																
Patellostium kansasensis																			Base 4.1,6.1
Pleurotomaria humerosa					X														
" perhumerosa																			" 4.1
" tabulata																	X		
Schizostoma cf. catilloides					X														
Sphaerodoma intercalaris					X														
" primigenia																	X		
Strophostylus peoriense		X			X							X					X		

	Lower Oread				Middle Oread		Upper Oread											Swales	Kereford
	4.1	6	8	21	1	4	1	2	3	5	7	8	14	15	19	20	24	25	
Zygopleura rugosa					X														
CEPHALOPODA																			
Metacoceras cornutum																	X		
OSTRACODA																			
Bairdia beedei																			15.17,19.17
TRILOBITA																			
Griffithides seitulus								X											

* Collected at Lawrence by Mr. H. T. Martin.

Locality Table

1. Willard Cut, one-half mile west of Lawrence, Kansas, on Victory Highway. Exposures: Entire Oread, except for upper portion of the Upper Oread.

2. Santa Fe R.R. Quarry, near the depot at Lecompton, Kansas. Exposures: Upper Oread.

3. Quarry and R.R. cut, one-fourth mile east of the depot at Lecompton, Kansas. Exposure: Upper Oread

4. Quarry near the western edge of the University of Kansas campus, Lawrence, Kansas. Exposures: Lower Oread, base of Snyderville shale.

5. Quarry one-half mile east of Santa Fe depot, Lecompton, Kansas. Exposure: Upper Oread.

6. Two quarries on the Jackman farm, one and one-half miles west of Lawrence, Kansas. Exposure: Lower Oread.

7. Quarry five miles northwest of Lawrence on Federal Highway 73 west, near Midland. Exposure: Upper Oread.

8. Road cut on highway 73 west, 12 miles south of Lawrence. Exposure: Includes all but upper portion of the Upper Oread.

10. Road cut five miles east and one-half mile north of Waverly, Kansas. Exposure: The entire Oread except for the upper portion of the Upper Oread.

12. Road cut five miles southwest of Toronto, Kansas. Exposure: Snyderville shale, Middle Oread, Heebner shale, basal three feet of Upper Oread.

14. Road cut and quarry, one mile west of Sedan, Kansas on state highway 11. Exposures: Include all but the Lower Oread and the Upper portion of the Upper.

15. A road cut, one-fourth mile north of Elgin, Kansas. Exposures include all of the Oread but the lower.

19. A road cut, two and four-tenths miles due west from Tonganoxie, Kansas. Exposures: Snyderville shale, Middle Oread, Heebner shale, basal eight feet of Upper Oread.

20. A road cut and quarry, one mile northwest of the Federal Penitentiary, Leavenworth, Kansas. Exposures: Snyderville shale, Middle Oread, Heebner shale, basal three feet of Upper Oread.

21. Quarry, one-half mile northwest of the Federal Penitentiary, Leavenworth, Kansas. Exposure: Lower Oread.

24. Stewart's quarry, one-half mile north of Amazonia, Missouri. Exposures: Upper Oread, and Kereford limestone.

25. Heumaders quarry, three and five-tenths miles north of St. Joseph, Missouri. Exposures include the entire Oread limestone and the Kereford.

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