THE RICE INSTITUTE

GEOLoGY OF THE COLEMAN JUNCTION
LIMESTONE IN SHackELFORD COUNTY, TEXAS

BY

C. EUGENE COKER

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>General statement</td>
<td>1</td>
</tr>
<tr>
<td>Previous work</td>
<td>5</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>6</td>
</tr>
<tr>
<td><strong>REVIEW OF PENNSYLVANIAN-PERMIAN BOUNDARY PROBLEM</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>PERMO-CARBONIFEROUS BOUNDARY IN U.S.</strong></td>
<td>13</td>
</tr>
<tr>
<td>Northern Mid-Continent</td>
<td>13</td>
</tr>
<tr>
<td>West Texas Permian</td>
<td>14</td>
</tr>
<tr>
<td>North-central Texas</td>
<td>15</td>
</tr>
<tr>
<td><strong>COLEMAN JUNCTION LIMESTONE</strong></td>
<td>19</td>
</tr>
<tr>
<td>General</td>
<td>19</td>
</tr>
<tr>
<td>Shackelford County</td>
<td>20</td>
</tr>
<tr>
<td><strong>STRATIGRAPHY</strong></td>
<td>24</td>
</tr>
<tr>
<td>Discussion</td>
<td>24</td>
</tr>
<tr>
<td>Type of deposits</td>
<td>28</td>
</tr>
<tr>
<td>Putnam formation</td>
<td>28</td>
</tr>
<tr>
<td>Coleman Junction limestone member</td>
<td>28</td>
</tr>
<tr>
<td>Measured sections</td>
<td>31</td>
</tr>
<tr>
<td>Enclosing strata</td>
<td>36</td>
</tr>
<tr>
<td>Suggested Intra-county correlation</td>
<td>37</td>
</tr>
<tr>
<td>Sedimentary analysis</td>
<td>37</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------</td>
<td>------</td>
</tr>
<tr>
<td>PALEONTOLOGY</td>
<td>41</td>
</tr>
<tr>
<td>Introduction</td>
<td>41</td>
</tr>
<tr>
<td>Fossil descriptions</td>
<td>42</td>
</tr>
<tr>
<td>SUMMARY AND CONCLUSIONS</td>
<td>68</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>70</td>
</tr>
</tbody>
</table>
### FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Location of Shackelford County, Texas with Coleman Junction outcrop</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Outcrop trace of Coleman Junction limestone and localities of measured sections, Shackelford County, Texas</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Pennsylvanian and Permian formations and their approximate correlations</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>Diagrams showing placement of Permo-Carboniferous boundary in north-central Texas</td>
<td>16</td>
</tr>
<tr>
<td>5.</td>
<td>Columnar sections of Coleman Junction limestone in Shackelford County, Texas and suggested correlations</td>
<td>26</td>
</tr>
<tr>
<td>6.</td>
<td>Stratigraphic column showing relationship of Coleman Junction limestone to subjacent and superjacent strata</td>
<td>30</td>
</tr>
<tr>
<td>7.</td>
<td>Diagram showing results of insoluble analysis</td>
<td></td>
</tr>
</tbody>
</table>

### PLATES

<table>
<thead>
<tr>
<th>PLATE</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-X</td>
<td>Coleman Junction limestone fauna</td>
<td>72</td>
</tr>
</tbody>
</table>
INTRODUCTION

General statement

In Shackelford County, Texas, the Coleman Junction limestone is an easily recognizable, escarpment-forming unit which strikes essentially north-south across the eastern part of the county. (Fig. 1) In the southern and central portions of the county, the stratum dips to the west, but in the northern portion the bed dips north-north west. Although the limestone can be traced continuously along a north-south line, good outcrops are scattered and are usually found along creeks, in road cuts or where stock tanks have been dug.

Throughout most of the county, the Coleman Junction averages twenty-five feet in thickness and consists of limestone, shale and minor amounts of siltstone. Near the northern boundary of Shackelford County, south of the Clear Fork of the Brazos River, the bed is thinner, measuring only seventeen feet thick, and at the Shackelford-Throckmorton County line the bed is only ten feet thick.

Abundant megafossils occur in some parts of sections measured. At some localities where the limestone is more highly weathered, complete fossils can be extracted with ease. Brachiopods constitute the largest proportion of the fauna, with bryozoans and corals present in comparatively rare numbers.

In Shackelford County the Coleman Junction limestone
has been measured previously at only one locality (Fig. 2),
and a list of the fauna from the strata in question in this
county has not been prepared previously, nor does any pub-
lication on the Coleman Junction report so many different
brachiopod genera.

The purpose of this paper is to contribute addi-
tional paleontologic and stratigraphic data to the Coleman Junction
limestone, a unit represented by strata generally placed in
the Pennsylvanian-Permian transition zone.
FIG. 1. LOCATION OF SHACKELFORD COUNTY TEXAS WITH COLEMAN JUNCTION LIMESTONE OUTCROP.
Previous work

In 1892, Drake measured and described the Coleman Junction limestone from an outcrop one-half mile south of a junction (presently known as San Angelo Junction) of the now defunct Gulf-Colorado Sante Fe Railroad, Coleman County, Texas.

"This bed is about thirty feet thick and is composed mostly of limestone, but from a few miles north of the Colorado river to the north it is divided by a clay stratum. It is readily traced from the Brady mountains to the north, because it caps a well marked escarpment which from the Colorado river north is...from 50 to 100 feet high." (Drake, 1892, p.55)

Drake lists the following lithologic sequence at the type locality:

"C. Nodular or concretionary structured, brown and yellowish limestone, the layers mostly from 6 inches to one foot thick............10 to 20 feet

B. Clay.............................................10 feet

A. Dove colored limestone, splotched with yellow and red, and containing chert nodules, and at places ferruginous calcareous sand nodules.................25 feet"

(Drake, 1892, p.55)

Drake accepted Cummin's previously published (1890) divisions of the Carboniferous of Texas and placed the Coleman Junction limestone within the Albany Division, which was then considered to be the lowermost subdivision of the Permian. His conclusions as to the age of the Coleman Junction were based on stratigraphic and limited paleontologic data.

In 1921, Plummer and Moore published an article on the Pennsylvanian strata in north-central Texas.
These authors concluded that the Coleman Junction limestone member of the Putnam formation was of latest Pennsylvanian age. In comparing the north-central Texas section to the Kansas Pennsylvanian section, Plummer and Moore (1921, p.188) stated:

"There was evidently no marked change in either area at the conclusion of Pennsylvanian time and the only indication of the Permian appears to be in the transition in the invertebrate faunas. Consequently it is believed that the division line should tentatively be drawn at the most readily identifiable and easily traceable stratigraphic horizon which appears to mark the greatest change in the fauna."

Plummer and Moore believed this horizon was the Coleman Junction limestone.

Sellards (1932, 1954) considers the Coleman Junction limestone to belong to the Permian Wichita group. Lee, Nickells, Williams, Henbest (1938) and Henbest (1958) adopted the same classification.

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REVIEW OF THE PENNSYLVANIAN-PERMIAN BOUNDARY PROBLEM

In 1940, Dunbar published a paper concerning the Permian type section of Russia. Intercalated between the Moscovian and Sakmarian series in the eastern half of the Permian basin, there lies nearly 1000 feet of limestone containing specimens of *Triticites* and abundant brachiopod fauna. These 1000 feet of sediments correspond roughly to the Missouri and Virgil series of the Mid-Continent region (Fig.3). Dunbar's (1940) correlation between the Russian and United States Pennsylvanian sections is based on the *Triticites* zone and the brachiopod fauna.

The *Pseudoschwagerina* bearing Sakmarian series overlying the *Triticites* zone has been designated as the *Pseudoschwagerina* zone and is believed to be the time correlative of the Wolfcamp series of West Texas which also contains *Pseudoschwagerina*. (Dunbar, 1940, p.245)

However, many Soviet geologists refer the Sakmarian to the zone of *Triticites*, or the Upper Carboniferous, whereas most American and a few Russian geologists regard it as basal Permian.

The Sakmarian series was initially referred to the Uralian, an ill-defined term coined by De Lapparent in 1902. According to De Lapparent's classification, the Uralian has a stratigraphic range which in the U.S. would extend from the base of the Missourian series (Pennsylvanian)
to some portion of the Leonard (Permian). Dunbar restricted the Sakmarian to the lowermost Permian beds characterized by the *Pseudoschwagerina* zone fusulinids. Few Russian geologists have agreed with Dunbar's classification.

If *Pseudoschwagerina* is a diagnostic Sakmarian fossil, appearing first in the lowermost Permian, Dunbar's classification of the Russian Permian section is acceptable. On the other hand should the *Pseudoschwagerina* zone be considered as Upper Pennsylvanian, Dunbar's classification has little validity. The Permian system must be not only established with regard to the type section, but also must be delineated with reference to paleontological data in other parts of the world. As there is need for some basis of comparison, the *Pseudoschwagerina* zone is herein accepted as earliest Permian in age.

The Permian marine deposits have been utilized as the chief standard for classification, although continental floras and faunas have provided important supplements to, or have given evidence in opposition to, the "standard" Permian classification.

The greatest areas of marine Permian sediments, other than the Russian section, occur in South China and in the southwestern United States. Other areas of Permian marine sequences (Japan, the Salt Range section in India, the Carnic Alps in Austria) are either complicated structurally or are stratigraphically incomplete and therefore have serious shortcomings preventing adequate correlation.
In China and the southwestern United States, as well as Russia, fusulines are very abundant and widely distributed in Carboniferous and Permian rocks and serve as useful bases for zonation and correlation.

The *Triticites* zone (Upper Pennsylvanian) is present in the Russian and southwestern United States sections. In the Russian section *Triticites jigulensis* and *T. volgensis* pass upward from the "Upper Pennsylvanian" into the *Pseudoschwagerina* zone. Evidently there is no important faunal hiatus between the Pennsylvanian and Permian systems.

In South China, a zone marked solely by *Triticites* is not present; however, the genus *Triticites*, a common fusulinid in the *Pseudoschwagerina* zone, occurs with *Pseudoschwagerina* and *Schwagerina* in the Chuanshan limestone. The Chuanshan limestone overlies disconformably the Huanglung limestone (older than *Triticites* zone). The disconformity is apparently regional in extent because the same stratigraphic relations are found in Indo-China.

In the Permian sections listed in the foregoing there is no clear-cut line of demarcation at which to place the Pennsylvanian-Permian boundary. If there is a natural boundary between the Carboniferous and the Permian it should be indicated by an important faunal change. However, no such hiatus is in evidence and the observed overlap between the ranges of typical Pennsylvanian and Permian index fossils makes the lower Permian boundary exceedingly difficult to define. For example, can the base of the Permian be drawn where *Triticites* species of the typical *Triticites* zone
make their last appearance, or is the base of the Permian found where the first *Pseudoschwagerina* zone fossils occur. It is difficult to draw one boundary line which would satisfy every geologist. Nevertheless, the introduction of new, robust fusulinid types, in the basal Permian, is thought to be of greater significance than the continuance of the more gerontic advanced forms of the Pennsylvanian. For this reason the Permo-Carboniferous boundary is assumed to be directly beneath the world-wide *Pseudoschwagerina* zone.
<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>SERIES</th>
<th>U.S.S.R.</th>
<th>TYPE SECTION</th>
<th>TEXAS</th>
<th>KANSAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIAN</td>
<td>LEONARD</td>
<td>KUNGURIAN</td>
<td>BONE SPRINGS LS.</td>
<td>NORTH-CENTRAL TEXAS</td>
<td>SUMNER GROUP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ARTINSKIAN</td>
<td></td>
<td>CLEAR FORK GROUP</td>
<td>NOLANS LS.</td>
</tr>
<tr>
<td></td>
<td>WOLF-</td>
<td>SAKMARIAN</td>
<td></td>
<td>BELLE PLAINS FM.</td>
<td>ODELL SH.</td>
</tr>
<tr>
<td></td>
<td>CAMP</td>
<td></td>
<td></td>
<td>ELM CREEK LS.</td>
<td>DOYLE SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ADMIRAL SHALES</td>
<td>FLORENCE LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MATTFIELD SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WREFORD LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SH. &amp; LS. SEQUENCE</td>
</tr>
<tr>
<td></td>
<td>WICHITA</td>
<td></td>
<td></td>
<td>COLEMAN JUNCTION LS.</td>
<td>BEATTIE LS. (COTTONWOOD LS.)</td>
</tr>
<tr>
<td></td>
<td>GROUP</td>
<td></td>
<td></td>
<td>SANTA ANNA BRANCH SH.</td>
<td>ESKRIDGE SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SEDWICK LS.</td>
<td>NEVA LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SANTA ANNA SH.</td>
<td>ROCA SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GOLDBUSK LS.</td>
<td>RED EAGLE LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WATTS CK. SH. *1</td>
<td>LONG CK. LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CAMP COLORADO LS.</td>
<td>HUGHES CK. LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SALT CK. BEND SH.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>STOCKWETHER LS. *1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CAMP CK. SH.</td>
<td>AMERICUS LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SADDLE CK. LS. *2</td>
<td>HAMLIN SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WALDRIP LS. #3</td>
<td>FALLS CITY LS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WALDRIP LS. #2</td>
<td>HOWXSBEY SH.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WALDRIP LS. #3</td>
<td>ASPINWALL LS.</td>
</tr>
</tbody>
</table>

| PENNSYLVANIAN | VIRGIL | "UPPER CARBON-IPEROUS" | WABAUNSEE GROUP | THIRTY GROUP | WABAUNSEE GROUP |
|              |        |                        | SHAWNEE GROUP   | GRAHAM FM.   | SHAWNEE GROUP |
|              |        |                        | DOUGLAS GROUP   |             | DOUGLAS GROUP |

*1 Sellards (1932, 1954)  
*2 Cheney (1940)  
*3 Henbest (1958), This paper

**FIG. 3. PENNSYLVANIAN AND PERMIAN FORMATIONS AND THEIR APPROXIMATE CORRELATIONS (MODIFIED FROM SEVERAL AUTHORS, POST 1944)**
PERMO-CARBONIFEROUS BOUNDARY IN THE UNITED STATES

Northern Mid-Continent

In the northern Mid-Continent region, the boundary between the Pennsylvanian and Permian has been variously defined from the top of Ft. Riley limestone (Meek, Hayden 1859) down to the base of the Admire group, a stratigraphic interval of some 600 feet. In every publication, with the exception of one (Roemer 1935), the Permo-Carboniferous boundary has been listed as somewhere within this 600 foot interval.

The Pseudoschwagerina zone commonly consists of an association of the fusuline genera Pseudoschwagerina, Paraschwagerina, and Schwagerina. In the Council Grove group this zone is represented only by the latter two genera, whereas two common Wolfcamp species of Pseudoschwagerina are found in the overlying Chase group. Both groups are presently classified as Lower Permian. (Fig. 3) Below the Council Grove group, the Americus limestone appears. The Americus unit contains Schwagerina and advanced types of Triticites, both of which are common in the zone of Pseudoschwagerina. Prior to 1934, the lower Permian boundary had been placed frequently either at the base of the Council Grove group, at the base of the Chase group or at the base of the Americus limestone. Fig. 3 shows the stratigraphic location of these units.

In 1934, Moore and Moss reported an important,
though obscure, disconformity 100 feet below the Americus limestone and directly above the Brownville limestone. The disconformity can be traced from Nebraska into Oklahoma and, according to Moore and Moss, represents the boundary between the Permian and Pennsylvanian systems in this region.

Roemer (1935) placed the lower Permian boundary in the northern Mid-Continent region above the Carlton limestone of the Wellington shale in the Sumner group. Roemer's systemic boundary is erected on the assumption that the lower boundary of the Permian should be drawn at the base of strata assumed to be similar in age to those in the Artinskian, (by Russian geologists) and on the vertebrate paleontologic evidence, which points to correlation of beds above this line with Artinskian strata of Europe and of beds below the line with pre-Artinskian strata. The boundary proposed by Roemer is approximately 800 feet above that suggested by other authors.

The base of the Permian in the Mid-Continent region is generally accepted as being at the disconformity 100 feet below the Americus limestone. Typical *Pseudoschwagerina* zone fossils appear above the disconformity and Pennsylvanian types occur below it.

**West Texas Permian**

During the past fifty years, study of the West Texas Permian beds has led to general acceptance of the Wolfcamp series as the base of the Permian system. Exceptions
to this classification are notably those of authors prior to 1932 and Roemer (1935), (Fig. 4)

The Wolfcamp, characterized by *Pseudoschwagerina* zone fossils and also the ammonoid genus *Properrinites* and the brachiopod genus *Parakeyserlingia*, lies unconformably on folded Pennsylvanian formations in the Glass Mountains. In the Hueco Mountain district the Hueco limestone contains several species of fusulinids belonging to *Triticites*, *Schwagerina*, *Pseudoschwagerina*, *Schubertella* and other genera that support correlation with Wolfcamp beds.

The placement of the lower Permian boundary in Trans-Pecos Texas, according to different authors, is shown diagrammatically in Figure 4. With the discovery that the *Uddenites* fauna is Pennsylvanian rather than Permian, the Permo-Carboniferous boundary was drawn at the unconformity between the base of the Wolfcamp and the underlying *Uddenites* zone.

**North-Central Texas**

In all the Permo-Carboniferous boundary zones previously mentioned, a rather widespread unconformity is present to which the base of the Permian has been relegated. In north-central Texas, however, there is no widespread unconformity.

Unconformities are neither the only nor necessarily the best criteria for separating systems of rocks. Other frequently used methods of correlation involve actual lateral tracing of lithologies from one area to another, or
FIG. 4. DIAGRAMS SHOWING PLACEMENT OF PERMO-CARBONIFEROUS BOUNDARY IN NORTH CENTRAL AND WEST TEXAS (MOD. AFTER MOORE, 1940)
paleontological data. For example, tracing of outcrops by geologists during the past sixty years has led to a considerable degree of correlation of Permo-Carboniferous strata from Nebraska to central Texas. In conjunction with tracing of beds, the study of the faunas of the northern Mid-Continent area with those of equivalent beds in north-central Texas has led to general agreement in correlation between the two areas.

Of course, not all formations or members of formations of the northern Mid-Continent area can be traced south into north-central Texas. The Coleman Junction limestone (the uppermost member of the Putnam formation) is an excellent example. In Shackelford County, the Coleman Junction consists of some twenty-five feet of limestone; however, north of Shackelford County, in Archer County, the Coleman Junction grades laterally into red-beds. Therefore the correlation of the Coleman Junction unit with beds in the northern Mid-Continent region must be made on the basis of faunal evidence.

Lateral tracing of strata from north-central Texas to the west is also complicated, if not impossible, because 1) the Permian rocks to the west are covered by Cretaceous or younger sediments and 2) facies changes in the subsurface mitigate the usefulness of accurate lithologic correlation. Comparisons between north-central and West Texas Permo-Carboniferous rocks must be made through faunal studies.

Figure 4 illustrates the varying opinion among authors as to the exact location of the Permo-Carboniferous
boundary in north-central Texas.
COLEMAN JUNCTION LIMESTONE

General

The Lower Permian Coleman Junction limestone is the uppermost member of the Putnam formation, Lower Wichita Group of Sellards (1932). This member extends from the Colorado River in central Texas, north into Archer County where it grades laterally into redbeds of the Wichita group.

*Schwagerina emaciata* and *Schubertella kingi*, have been found in the Cottonwood limestone of Kansas and Nebraska, in the Coleman Junction limestone, and in the Hueco and Wolfcamp formations of West Texas, indicating close correlation of these beds (Dunbar and Skinner, 1937, p.635). Above the Cottonwood limestone A.K. Miller (1936) reported the occurrence of the ammonoids *Artinskia whortoni* and *Metallogoceras* sp., which correspond to the *Artinskia adkinsi* zone just above the Coleman Junction limestone. In the Wolfcamp, the zone of *Artinskia adkinsi* also appears, as does *Properrintes*, almost identical with specimens of *P. plumerri* collected from the Neva by Elias (1938). These specimens suggest correlation among the Cottonwood, Coleman Junction and upper Wolfcamp beds. Moore (1954), using the results of Thompson (1954) correlated the Coleman Junction with the Nolans limestone of the Chase group from Kansas. The Chase group is stratigraphically higher than the Council Grove group (Fig. 3) and Moore's correlation is based on the presence of identical species of fusulinids in
the various limestone layers below the Coleman Junction limestone and in the Nolan's limestone.

Thompson (1954) reported two new species, Schwagerina colemani and Oketacella cheneyi in association with Schubertella kingi, from the Coleman Junction limestone near Burkett and Santa Anna, Texas. These new types and Schubertella kingi further indicate that the Coleman Junction is Lower Permian in age. Henbest (1938) collected Schwagerina from near the Colorado River section of the Coleman Junction beds, which was probably not identical with the true S. emaciata, but which did indicate that the Coleman Junction was of Lower Permian in age.

A diligent search for fusulinids in the Coleman Junction unit in Shackelford County was undertaken. The search entailed the scrutiny of outcrops, and the collection of outcrop samples which were polished in the laboratory. No fusulinids were observed.

Shackelford County

No fusulinids were found in the limestone or shale sequences of the Coleman Junction unit in Shackelford County. The presence of fusulinids in the Coleman Junction from other regions, however, leaves little doubt as to the Permian age of the Coleman Junction limestone.

A relatively varied and abundant brachiopod fauna is found at each of the Coleman Junction sections measured in the present investigation. The specimens included: Dictyoclostus welleri, Linoproductus meniscus, Composita
subtilita, C. mira, C. mexicana, Derbya cymbula, D. multistriata, D. plattsmouthensis(?), D. hooserensis, D. crassa, D. wabaunseensis, Crania modesta, and Marginifera capaci. In addition to the brachiopods two genera of bryozoans were found and one coral species. In other papers in which the Coleman Junction or equivalent beds were represented, pelecypods and gastropods were listed. Gastropods were represented by casts in the material studied in the present investigation, but pelecypod remains were lacking.

Certain of the brachiopods listed above are long-ranging specimens in the stratigraphic column. For example, Dictyoclostus welleri ranges from the Lower Pennsylvanian of Colorado to the upper Wolfcamp of the Glass Mountains. Composita subtilita covers an equally long stratigraphic interval. Linoproductus meniscus is found in Medial Pennsylvanian strata (Kansas City group) in Kansas and in Lower Permian strata in north-central Texas. Although individual genera have a relatively great time range, the partial overlap of time ranges of the different genera permit some degree of correlation between distant areas.

Based on the brachiopod fauna cited from strata which lie close to, either above or below, the Permo-Carboniferous boundary, the brachiopod assemblage from the Coleman Junction is allied most closely with the Permian lower Gym formation of the Hueco Mountains in West Texas.

The fauna does not resemble equivalent age assemblages of the Permian from the Glass, Delaware or Franklin Mountains. The variance between the two faunas may be
controlled by different depositional environments, or merely represents the incursion of different organisms into one area and not the other. Notably present in these districts, but lacking in the lower Gym formation and the Coleman Junction limestone are ammonoids and the brachiopods Prorichthofenia and Lyttonia. Some of the larger, poorly preserved Dictyoctostus species from the Coleman Junction resemble Productus wolfcampensis and P. hessensis of the lower Gym, but the specimens collected from Shackelford County could not be precisely identified.

The correlation of the lower Gym formation with the Coleman Junction unit seems justified, but the correlation with equivalent beds in, for example, the Glass Mountains is uncertain. King (1930) correlates the lower Gym with the upper Wolfcamp through "species which seem to be of significance". The Coleman Junction may be correlated, therefore, with the upper Wolfcamp of the Glass Mountains.

Professor Imbrie, who has studied the Kansas Permian section, came to the Rice Institute and examined briefly the brachiopod specimens the writer had collected from the Coleman Junction member. In no more than a cursory examination, he noted a similarity between the latter fauna and the one he had collected from the Beattie limestone of the Council Grove Group of Kansas. The Cottonwood limestone is the lower member of the Beattie formation.

Correlation of the Cottonwood limestone and the Coleman Junction limestone is indicated by the following data: 1) the presence of Schwagerina emaciata and Schubertella
kingi in both limestones; 2) correlation of Artinskia whortoni and Metalegoceras sp. above the Cottonwood with the Artinskia adkinsi zone above the Coleman Junction; 3) the probable similarity of the brachiopod faunas.
STRATIGRAPHY

Discussion

In 1921, Plummer and Moore observed that the Coleman Junction limestone in Shackelford County was only two feet thick. Their thickness measurement was based upon one measured locality. (Fig. 2)

Moore stated in his introductory remarks on the lithology of the Coleman Junction limestone that the unit in northern Shackelford County:

"consists of a lower grayish or light buff limestone three feet thick overlain by a bright, very ferruginous layer one foot thick. On weathering the bright yellow bed breaks up into rounded yellow pieces which slump down and mingle with the light gray blocks, forming a characteristic trail around the hillside which cannot be mistaken..." (Moore, 1921, p.184)

The hard, dense, characteristically yellow limestone and the gray limestone of Plummer and Moore (1921) conformably overlies some twenty-five feet of limestone. At several localities, one of which is possibly an original section of Plummer and Moore, visited by the writer, the "Coleman Junction" has been weathered back, away from the underlying limestone strata, but at three of the six measured sections reported in this paper, the uppermost limestone strata is in contact with the limestone layers below or with the clay stratum described by Drake.

On the basis of field evidence it is proposed that the Coleman Junction limestone in Shackelford County should not be confined to the highest beds in a conformable
limestone sequence. The thickness of the measured sections of the Coleman Junction limestone varies from seventeen to thirty-five feet throughout Shackelford County, decreasing in thickness toward the northern portion of the county. Observations made from a study of electric logs supplied by the A.V. Jones and Sons Oil Company also indicate that the Coleman Junction unit is several times as thick as Plummer and Moore reported.

Figure 5 shows columnar sections of the Coleman Junction as measured in Shackelford County. In Sections 2, 3 and 4 a covered interval is shown at the base of the "Coleman Junction" of Plummer and Moore. It could be assumed that the Coleman Junction is in fact only two feet thick; however, observations and measured sections show that the Coleman Junction is the only thick limestone sequence within the Putnam formation. Fifty to seventy feet below the Coleman Junction, in the Putnam formation, limestone lenses have been recorded, (Fig. 6) but these layers are not at all similar nor are they as widespread laterally as the layers of limestone found in the Coleman Junction. At each measured locality above the top of the limestone sequence defined as the Coleman Junction in this paper, the gray-white shales of the Admiral formation are found; below the Coleman Junction, variegated shales are found containing occasional siltstone stringers of the Santa Anna Branch member of the Putnam formation. The Coleman Junction limestone then, is bounded by definite lithologic changes; shales occupy positions above and below the Coleman Junction, and
are devoid of any limestone sequences. Hence there can be little doubt that the Coleman Junction is actually 20 to 35 feet thick.

Although the Coleman Junction is 20 to 35 feet thick in the southern and central parts of the county, it decreases in thickness to the north (Section 6). North of Clear Fork of the Brazos River on Highway 283 on the Shackelford-Throckmorton County line, the Coleman Junction is represented by an estimated ten feet of yellow-ferruginous, and gray limestones. The top and bottom of the unit at this outcrop are not exposed; thus the thickness could only be estimated.

Lee, in 1938, reported that the Coleman Junction limestone was one foot, three inches thick five miles west of Woodson, Texas. Lee's location is some 10 to 15 miles north of the northern boundary of Shackelford County. This locality, although properly outside the limits of the area studied in this paper, was visited and measured. The section measures eight feet in thickness and consists of the "Coleman Junction" as defined by Plummer and Moore, (1 foot, 3 inches thick), and some seven feet of gray weathering, massive bedded limestone, below which are siltstone stringers and shales of the Putnam formation. The thickness found near Woodson substantiates the view that the Coleman Junction decreases in thickness to the north in Shackelford County, although the thickness does not decrease as rapidly as would be assumed from Lee's report.
Type of Deposits

Putnam formation

The Putnam formation on the Colorado River is one hundred and forty eight feet thick; in Shackelford County it is one hundred and seventy four feet thick; and in Throckmorton County to the north it is two hundred and five feet thick.

The lower member of the Putnam formation, the Santa Anna Branch, consists of gray calcareous shale which in some places largely exhibits a yellow-gray buff variegated color. Fine-grained sandstones and siltstone stringers are commonly present in the shales. (Fig. 6)

The Coleman Junction limestone marks the top of the Putnam formation. It is the first and only truly massive bedded limestone sequence within the Putnam formation. At the top of the limestone is the characteristically yellow-orange, ferruginous, resistant limestone termed by Plummer and Moore, the "Coleman Junction".

Coleman Junction limestone member

The Coleman Junction limestone is a fossiliferous, thin to massive bedded limestone. The matrix is generally very fine-grained and typically gray in color, except for the uppermost layer of the unit where it is bright orange. In many of the limestone layers the matrix surrounds the fragmented remains of crinoids, brachiopods and gastropods. The presence of crinoids and brachiopods is indicative of marine depositional environment.
Explanation of Figure 6.

The Admiral formation, superjacent to the Coleman Junction limestone, was measured by P.L. Applin in Callahan County (two miles east of the town of Baird, Texas, along the Baird-Putnam road) and three and one-half miles southwest of Coleman, Coleman County, Texas (as reported in Plummer and Moore, 1921, p.192). In Callahan County, the Elm Creek is a succession of limestones (two layers, 2 and 4 feet thick) and shales, amounting to twenty four feet. Plummer and Moore, (1921, p.192) in referring to the Admiral formation state, "In the field the formation is topographically expressed by a continuous high escarpment capped by white, thick, irregularly bedded limestones 20 to 50 feet thick overlying 250 to 300 feet of soft, chalky, white, gray... shale."

From electric logs showing the presence of the Elm Creek, and from brief field reconnaissance, it appears that the Elm Creek is at least 20 feet thick, but not more than fifty. The discrepancy between the Plummer and Moore text description, Applin's measured section, and the observation that west of Albany the Elm Creek is at least 20 feet thick, is brought to the reader's attention only because the thickness and lithology of the Admiral formation, as used in Figure 6, is compiled from Applin's measurements from Callahan County.
MEASURED BY APPLIN (IN PLUMMER & MOORE 1922) 2 MILES EAST OF BAIRD, TEXAS (SEE EXPLANATION IN TEXT)

FIG. 6. STRATIGRAPHIC COLUMN SHOWING RELATIONSHIP OF COLEMAN JUNCTION LS. TO SUBJACENT & SUPERJACENT STRATA.
Measured sections—(For location, see Fig. 2)

The various sections were measured with a Brunton Hand Compass. This method is employed by utilizing the dip of the beds, the height to the observer's eye-level and trigonometry to determine the true thickness of the layers. The Coleman Junction dips about one-quarter degree to the west, in southern and central Shackelford County, the strike is almost north-south. In the northern portion of the county the bed strikes north-northeast and dips, at one-quarter degree, to the north-northwest.

Section 1; 5.5 miles west of Moran, Texas, on FM road 576. (Fig. 2 for location)

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Limestone: orange to yellow, weathers orange, extremely hard, dense, very fine grained, exhibits semi-conchoidal fracture. Fossil outlines on weathered surface; internally, complete fossils which could be extracted whole......................3 feet</td>
</tr>
<tr>
<td>3.</td>
<td>Clay: gray to buff, weathers tan, calcareous, fossiliferous.........................2 feet</td>
</tr>
<tr>
<td>2.</td>
<td>Limestone: alternating beds of gray to buff, tan weathering, dense, blocky fossiliferous limestone and clay or shale lenses, one or two inches thick. Limestone layers 18 inches to 2 feet thick........17 feet</td>
</tr>
<tr>
<td>1.</td>
<td>Limestone: white chalky, weathers tan, very highly weathered..........................1 foot</td>
</tr>
</tbody>
</table>

Total thickness........................................23 feet
Section 2; 2.3 miles southwest of Albany on U.S. Highway 385, creek section of Joe B. Matthews Ranch.

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: orange-brown, weathers a darker orange color and into rounded lumps, dense, fine-grained, highly ferruginous; fossil fragments and occasional complete brachiopods. .......... 2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval. .................................. 5 feet</td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: gray to buff, weathers buff, medium fine-grained, fossil fragments very abundant, almost coquinal, replaced gastropods in the matrix and many well preserved brachiopods. .................. 3 feet</td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shale: gray-yellow, calcareous, covered interval. ........................................ 1/2 foot</td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: gray, weathers tan to yellow, medium-grained, small crystals of calcite and fossil fragments set in gray matrix, fossiliferous. ................................ 3 feet</td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: highly weathered buff colored unfossiliferous layer. .................. 1 foot</td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: medium gray, weathers light brown, assumes weathered characteristic of limestone directly above, chalky, fine-grained, scattered fossil fragments, abundant brachiopods. .......................... 3 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval with limestone float, no shale apparent. .................. 5 feet</td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: gray, weathers gray and has slightly hackled appearance, fine-grained, dense, fossiliferous, but rare fossil fragments. .......................... 2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval. ............................... 4 1/2 feet</td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limestone: gray-blue, weathers dark gray, fine-grained, hard, non-fossiliferous. .......... 2 feet</td>
</tr>
<tr>
<td></td>
<td>Total thickness: ............................ 31 feet</td>
</tr>
</tbody>
</table>
Section 3; 2.3 miles east of Albany on the U.S. Highway 180.

Coleman Junction outcrop is intersected by the highway.

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Limestone: orange-yellow, weathers orange brown, highly ferruginous, dense, fine-grained, conchoidal-like fracture, few brachiopods present. 2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval: limestone float consists of boulders from upper limestone layer, brachiopods in the float. 4½ feet</td>
</tr>
<tr>
<td>3.</td>
<td>Limestone: gray, weathers tan to buff, fine-grained, blocky; shale zones 3 inches thick separate 1 foot limestone layers, most fossiliferous in the shale zones, most varied assemblage of brachiopod fauna encountered, limestone layers less fossiliferous. 9.8 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval: abundant fossils in limestone float. 5.8 feet</td>
</tr>
<tr>
<td>2.</td>
<td>Limestone: gray to tan, weathers medium gray, fine-grained, fossiliferous. 2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval. 3 feet</td>
</tr>
<tr>
<td>1.</td>
<td>Limestone: gray, weathers buff to dark gray, very fine-grained, unfossiliferous. 2 feet</td>
</tr>
<tr>
<td></td>
<td>Total thickness. 27.2 feet</td>
</tr>
</tbody>
</table>

Section 4; 5 miles north of Albany on U.S. Highway 380, one mile east of the highway in Section 385, Texas Emigration and Land Co. Survey.

5. Limestone: yellow orange, weathers orange-brown, dense, fine-grained, conchoidal fracture, infossiliferous. 2 feet
   Covered interval. 4½ feet
<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Calcareous mudstone: dark gray, weathers tan, fine-grained, silt in calcareous matrix and present on weathered surface, blocky, unfossiliferous............4 feet</td>
</tr>
<tr>
<td>3.</td>
<td>Calcareous mudstone: tan, weathers tan to brown, fine-grained silty material in calcareous matrix, non-fossiliferous............2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval: slumped material covers most of this space, limestone lenses visible in part; limestone is gray, weathers tan, is fairly silty and contains no fossils........10$\frac{1}{2}$ feet</td>
</tr>
<tr>
<td>2.</td>
<td>Limestone: gray to tan, weathers tan to buff, dense, although most highly weathered of the limestone layers in this section, abundant brachiopods and bryozoans in matrix and on weathered surfaces in lower 2 feet; upper 1 foot does not contain any macro-fossils and few fossil fragments............3 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval: shale.........................4 feet</td>
</tr>
<tr>
<td>1.</td>
<td>Limestone: dark gray, weathers tan to buff, dense, massive limestone, replaced fossil fragments.....................2 feet</td>
</tr>
<tr>
<td></td>
<td>Total thickness.................................32 feet</td>
</tr>
</tbody>
</table>

Section 5; Farm road 2.5 miles northeast from U.S. Highway 380, 10 miles north of Albany.

Section 522 Walker Trust.

5. Limestone: orange, weathers orange-brown, ferruginous, blocky, fragmentary and whole brachiopods present...................2 feet

4. Limestone: gray, weathers buff, upper 6 inches highly weathered, abundant fossils easily broken from matrix, lower 2$\frac{1}{2}$ feet more massively bedded, more dense, mega-fossils sparsely represented..................3 feet

3. Shale: yellow to tan, weathers chalky brown, no fossils present..................5. 8 feet
<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Limestone: tan-yellow, weathers light brown, very dense, massive bedded, although blocky in places, fossil impressions. 2 feet</td>
</tr>
<tr>
<td></td>
<td>Covered interval. 7 feet</td>
</tr>
<tr>
<td>1.</td>
<td>Limestone: gray-brown, weathers buff to tan, dense limestone, small amounts of silty material present, non-fossiliferous. 1.5 feet</td>
</tr>
<tr>
<td></td>
<td>Total thickness. 21.3 feet</td>
</tr>
</tbody>
</table>

Section 6: 2 miles north of U.S. Highway 380, on road leading to Lambshead Ranch, in Section 16, adjacent to Ft. Griffin State Park.

<table>
<thead>
<tr>
<th>Unit No.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>Limestone: orange, weathers brown-orange, blocky, dense, fine-grained, highly ferruginous, fairly abundant brachiopods and fossil fragments. 3 feet</td>
</tr>
<tr>
<td>6.</td>
<td>Limestone: gray to tan, highly-weathered to tan-buff, medium fine-grained, profusion of gastropod outlines, crinoid stems and fossil fragments, scanty brachiopods. 2 feet</td>
</tr>
<tr>
<td>5.</td>
<td>Limestone: tan-gray, weathers dark-gray to brown, dense, similar to 6 above, though more finely grained, brachiopods present in small numbers, medium bedded, chert pods. 8 feet</td>
</tr>
<tr>
<td>4.</td>
<td>Limestone: gray-olive, weathers to tan-gray, medium grained, no fossils present. 1 foot</td>
</tr>
<tr>
<td>3.</td>
<td>Limestone: gray, weathers tan to gray, fine-grained, no fossils present. 1 foot</td>
</tr>
<tr>
<td>2.</td>
<td>Limestone: gray to light brown, weathers dark gray to tan, dense, very fine-grained, conchoidal fracture, no fossils apparent. 1 foot</td>
</tr>
<tr>
<td>1.</td>
<td>Limestone: dark gray, weathers gray to buff</td>
</tr>
</tbody>
</table>
Unit No.                                                                Thickness

dense, fine-grained, massive, replaced fossil outlines, no megafossils present
present..................................................1 foot

Total thickness..................................17 feet

Enclosing strata (Fig. 6)

Directly above the Coleman Junction limestone is a soft, chalky, white, gray-blue, occasionally red calcareous shale of the Admiral formation. The shale covers the escarpment of the Coleman Junction and continues upward, occasionally interrupted by thin limestone layers, to the white, thick, irregularly bedded Elm Creek limestone which marks the upper limit of the Admiral. Yellow-gray-buff colored, highly variegated shale, with occasional fine-grained sandstone lenses, underlies the Coleman Junction. The shale is the lower part of the Putnam formation.

In Sections 1 and 3, the typical Coleman Junction limestone sequence is shortened by the appearance of calcareous siltstones, below which are the Putnam formation shales. The siltstones are conformable with the Coleman Junction and may represent older sandy stingers similar to those found in the Santa Anna Branch shale, and thus should not be construed to suggest contemporaneous deposition with the lowermost Coleman Junction limestone of other areas.

Sections 1, 2, 3 and 5 have covered intervals below the outcropping limestone strata. The exact nature of the
contact is unknown. However, it appears from the constant low dip and the conformable nature of the limestone sequence that the contact is one of conformity. Shale was found in holes dug in the covered intervals. Evidently the shale is the lower member of the Putnam formation. In Section 4, the typical limestone sequence is thickened by the presence of six feet of calcareous siltstone.

**Suggested Intra-County Correlations (Fig. 5)**

A generalized sequence of beds within the Coleman Junction limestone consists of the following:

- Yellow-orange ferruginous, moderately fossiliferous limestone;
- Highly weathered, gray to buff, fossiliferous limestone;
- Dense, dark gray, non-fossiliferous limestone;
- Deeply weathered, medium gray, very fine-grained non fossiliferous limestone.

The fossiliferous units contain bryozoans and the brachiopod genera *Dictyoclostus*, *Derbya*, *Marginifera* and *Composita*. The upper bed was used by the American Association of Petroleum Geologists' mapping committee as the datum plane to map the Coleman Junction in 1929. This bed is easily recognized as the layer capping the escarpment formed by the Coleman Junction limestone.

**Sedimentary analysis**

Hand samples collected from Sections 1, 2, 4 and 6 (Fig. 2 for locations) were crushed and sifted through a U.S. Standard Series no. 10 mesh screen. The fine material (less than ten mesh) from each sample was weighed
on a Harvard Trip Balance (average weight per sample 17.4 gms.). The fine material was treated with a solution of one-tenth normal hydrochloric acid. The residue was filtered from the acid solution and weighed to determine the percentage of insoluble residue present in the samples.

The insoluble residue consists predominantly of clay size particles which are colored tan to bright orange, the color is controlled by the amount of oxidized ferruginous material present in the sample. Minor amounts of quartz grains, siliceous organic remains (sponge spicules, etc.) are found in almost all of the samples.

In Section 4 the typical limestone sequence is interrupted by two layers of calcareous siltstones. From these two layers (3 and 4) a residue was obtained which consisted essentially of fairly well-sorted, sub-angular quartz grains, one-eighth to one-sixteenth mm. in size. Figure 7 is a diagram showing the relative percentage of clay, quartz grains and organic remains in each section from which insoluble residues were obtained.

The percentage of clay, quartz grains and organic remains was differentiated by placing a portion of the insoluble residue under a microscope and counting one hundred particles which were intercepted by the cross-hair of the microscope as the sample was moved across the microscope's stage. No attempt was made to be precisely quantitative in determining the constituent ratios.

The components of the organic residue are predominantly siliceous sponge spicules of the curved and straight
monaxon types. Some of the straight monaxon (megascleres) spicules are rather long (1 to 2 mm.), suggesting a type which commonly grow next to the borders of the osculum; the small (0.5 mm), straight and curved monaxons probably represent accessory skeletal elements (microscleres) found in the sponge body.

Other types of spicules are represented, but in very small numbers. These types include one hexaxon and one tetraxon spicule.

There are several other kinds of problematical organic remains which are difficult to classify. These forms are straight tubes which, on some specimens, show an indistinct chambering. The position of the "chambers" is marked by a slight constriction of the outer surface of the tube, perpendicular to the long axis of the organism. Whether the "chambering" is due to actual growth of the organism or due to the effects of dissolving and washing of the samples is difficult to determine. In some of these specimens, internal, irregularly-spaced concentric rings can be seen, but in others the outside layer is masked by tan, rather granular material and the interior can not be studied. These latter forms vaguely resemble very small silicified Amblysiphonella or Girtyocellia sponge morphology. Another problematical fossil is represented by an aggregate of milk-white, rounded grains, suggestive of foraminiferal forms.

The sponge spicules, although comprising a much greater percentage of the organic remains, are perhaps of
less interest than the remainder of the organic constituents. Most spicules isolated from the parent sponge are of small utility in determining the relative age of a unit or in correlation of strata; their numbers far exceed their importance. The relatively small quantity of remaining organic forms are potentially of greater stratigraphic importance. If these forms are foraminifera, they would serve as useful bases for correlation purposes.

The presence of sponge spicules in one rather isolated limestone sequence seems of minor importance; however, if distinctive varieties were found above and below certain strata, the spicules might serve as a useful auxiliary tool in correlation. For example, it would be of interest to sample the shale and limestone layers above and below the Coleman Junction unit to determine whether or not a similar microfauna is present, and if so, what relationship it would have to the assemblage from the Coleman Junction. If a definitive relationship is apparent, it is possible that more accurate correlations between similar age beds could be obtained. (Plate X shows the representative forms of spicules and other micro-organisms.)
FIG. 7. DIAGRAM SHOWING RESULTS OF INSOLUBLE RESIDUE ANALYSES.
PALEONTOLOGY

Introduction

The Coleman Junction limestone is abundantly fossiliferous in the middle limestone layers, especially at Sections 2 and 3. Section 3 is one of the best fossil localities in Shackelford County; it includes corals, bryozoans and all the brachiopod species of the *Derbya*, *Dictyoclostus*, *Marginifera*, *Crania* and *Composita* genera reported herein. Section 2 contains a fauna similar to that of Section 3, but the relatively large numbers of *Derbya* species are lacking.

The greatest number of brachiopod specimens are of *Dictyoclostus* and *Composita* types, but the most varied specific types belong to the genus *Derbya*. The productid *Dictyoclostus* specimens either exhibit slight variations in shell morphology from a typical *Dictyoclostus welleri*, or are so poorly preserved that only a single species of *Dictyoclostus* is described.

The comparative rarity of bryozoans is due to poor preservation or incorporation within the limestone matrix making it virtually impossible to extract and identify the types. The predominant type of bryozoans, either collected or observed in the limestone, is of the fenestellid variety. One colonial, massive bryozoan *Cyclotrypa* was found. Clusters of small bryozoan colonies were also observed on brachiopod valves.
Fossil descriptions:

The identification of the fossils collected from the Coleman Junction unit is based on published fauna descriptions and plates. The following descriptions are syntheses of the published material and the writer's own observations as to the shell morphology of each fossil.

- **Phylum**: BRACHIOPODA
- **Class**: NEOTREMATA
- **Superfamily**: ROSTROSPIRACEA
- **Family**: ATHYRIDAE
- **Subfamily**: ATHYRINAE
- **Genus**: Composita Brown 1849

**Composita subtilita** (Hall)

Plate I, Figs.1-3; Plate II, Figs.3-6

1852 *Terebratula subtilita*. Hall, Stansbury's Expl. and Survey Great Salt Lake of Utah, p.409, pl.4, figs. 1a, 1b, 2a-c.


1915 *Composita subtilita*. Girty, Fauna of the Wewoka formation, U.S. Geol. Sur. Bull. 544, pp.96-101, pl. 12, figs.4-4c; pl.5, fig.7; pl.6, fig.13.


**Description**: *Composita subtilita* is suboval in outline with the greatest width appearing between one-third and three-fifths the distance from the anterior margin to the beak. The beak is rather narrow and is a gradual convergence of the posteriolateral margins. The anterior portion is more broadly rounded. The valves are subequal in their convexity. The pedicle beak is fairly large but is closely incurved against the brachial and is perforated at the apex.
by a small oval foramen. The incurved beak hides the delthyrium. The hinge is very short and there is no recognizable hinge line and no cardinal area, the sides of the beak rounding over to the cardinal margin.

The surface of *Composita subtilita* is smooth, except for very fine growth lines. The specimens collected were calcified and displayed a pearly luster with commonly faint, but rather regular and fine, radial striation.

**Dimensions:** dimensions of *Composita subtilita* vary greatly

<table>
<thead>
<tr>
<th>W.</th>
<th>L.</th>
<th>T.</th>
<th>mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.4</td>
<td>28.0</td>
<td>21.0</td>
<td>thick specimen</td>
</tr>
<tr>
<td>20.5</td>
<td>23.0</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>19.5</td>
<td>21.5</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>22.5</td>
<td>14.0</td>
<td></td>
</tr>
</tbody>
</table>

**Location:** *Composita subtilita* is extremely ubiquitous, occurring at every limestone layer which is fossiliferous. Section 1, nos. 4,2; Section 2, nos. 8,7,5,3,2; Section 3, nos. 5,4,2; Section 5, nos. 7,6,5,4.

**Observations:** *Composita subtilita* is the most ubiquitous specimen in the brachiopod assemblage. It is present in every section, in each fossiliferous layer. The form of the specimens is so varied as to invite subdivision into several species; however, the further subdivision of this species would likely congest the literature with newer and possibly ill-defined species.

**Range:** This species is very common throughout the Pennsylvanian System and ranges into the Leonard series of the Permian.
Composita mira (Girty)

Plate III, Figs. 1-3

1877  Athyris roissyi. Meek, U.S. Geol. Expl. 49th Par.
      Final Rept., vol. 4, pt.1, p.82, pl.9, figs.3-36.

1899  Athyris mira. Girty, Geology of the Yellowstone

1926  Composita mira Girty, in Ore Deposits of Utah, U.S.
      Geol. Sur. Prof. Paper 111, pp.646-647, pl.156,
      figs. 16-16a.

1930  Composita mira(Girty), King,R.E., Univ. Tex. Bull.
      no.3042, p.129, pl.X, fig.13; Pl.XLIV, figs.3-8.

Description: The shell is of medium size, subcircular,
slightly biconvex. The width is slightly less than the length
and is greatest anterior to mid-length. Convexity of the
shells is sub-equal.

The beak of the pedicle valve is broad and incurved
with a round apical foramen. The sinus of the pedicle valve
is low and narrow and not extended posteriorly into a tongue.
The convexity of the pedicle valve is smoothly even, being
greater in a transverse section and low and even in a longi¬
tudinal section.

The brachial valve has a pointed and small beak.
There is no break in the transverse convexity of the brachial
valve except anteriorly where there is a low fold correspond¬
ing to the pedicle sinus.

Strong, evenly curved varices of growth occur on
both valves, but due to weathering in two specimens, the
growth lines are found anteriorly. Radial striae are present
on both valves.

Dimensions:

<table>
<thead>
<tr>
<th>W.</th>
<th>L.</th>
<th>T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>25.0</td>
<td>16.5</td>
</tr>
</tbody>
</table>
Observations: The specimens identified as C. mira are generally similar to C. subtilita, but in the former the outline is more rounded, the fold and sinus are less strongly developed and the ventral sinus is not prolonged as far forward as a tongue, the convexity is more even and lower, and the growth varices are stronger. C. mira also resembles C. emarginata affinis Girty, but C. mira is rounded rather than elongate.

Range: C. mira has a range from Wolfcampian strata to the top of the Leonard (Middle Permian) from West Texas.

Composita mexicana (Hall)
Plate III, Figs. 4-6

1857 Terebratula mexicana. Hall, Emory's Rept. U.S. and Mexican Boundary Surv., vol. 1, pl. 20, fig. 2.


1930 Composita mexicana (Hall), King, R.E., Univ. Tex. Bull. no. 3042, p. 128-129, pl. XLIII, figs. 1-11.

Description: The shell is small to medium in size, subpentagonal, widest at about two-fifths the distance from the anterior margin to the beak, which is incurved. The sinus is strongly developed anteriorly, imparting a strong forward and upward deflection of the anterior margins. Convexity is low and even over most of the pedicle valve, being greater over the anterior portion of the shell.
Brachial valve is rather strongly convex, greatest at the beak, but also bearing near the front, a high narrow fold which is accentuated by strong depressions on each side.

Concentric growth lamellae occur over most of the shell, but are crowded and most strongly developed in the front. Very fine radial lirae can be seen on well-preserved portions of the shell.

**Dimensions:**

<table>
<thead>
<tr>
<th></th>
<th>W in mm</th>
<th>L in mm</th>
<th>T in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.5</td>
<td>23.0</td>
<td>14.0</td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>22.6</td>
<td>13.0</td>
<td></td>
</tr>
</tbody>
</table>

**Location:** Section 3, no.2; Section 6, no.6.

**Observations:** The strong deflections of the anterior portion of the shell caused by the anterior development of the fold and sinus, the associated marginal waves, and the subpentagonal shape are characteristics which differentiate this species from *Composita subtilita* and *C. mexicana quadalupenses* (Girty)

**Range:** Lower Gym formation to upper Leonard of West Texas; Putnam formation, Lower Permian, north-central Texas.

---

Superfamily: STOPHOMENACEA
Family: STROPHOMENIDAE
Subfamily: ORTHATETINAE
Genus: Derbya Waagen 1884 (emend. Girty 1908)

**Derbya multistriata** (Meek and Hayden)

Plate I, Figs.4-6.


Description: The shell of this specimen is of medium size, biconvex and finely lirate. The hinge-line is approximately three-fourths the greatest width of the shell, the greatest width lying near the mid-length. Normally the shell is a little wider than long.

The pedicle cardinal area is high and is inclined to almost 90° to the plane of the valves. The beak of the pedicle valve is nearly pointed and forms the apex of the shell. In the specimen illustrated the apex has been chipped away. The cardinal area is well developed to one side, but distorted to the other. The deltidium is prominent, its sides forming an apical angle of about 25°. The vertically striated perideltidial area forms an apical angle of about 70° and is slightly elevated over the horizontally marked outer area. The pedicle valve slopes with moderate convexity from the beak to the anterior margins, being most convex near the mid-length. The curvature extends to the lateral margins and increases over the posteriolateral slopes. The beak rises above the general convexity of the pedicle valve.

The brachial valve is strongly convex and highest at mid-length. The umbo is inflated and forms a straight line with the cardinal area of the pedicle valve.

Ornamentation of the shell consists of very fine radial lirae, which increase by intercalation and fine, closely spaced concentric striae. Generally the shell gives the appearance of fine and uniform liration, although at times every fourth or second lirae is coarser than the surrounding
ones.

Dimensions:

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.5</td>
<td>44.5</td>
<td>20.0</td>
</tr>
<tr>
<td>31.0</td>
<td>39.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Location: Section 3, no. 2; Section 4, no. 2.

Observations: This specimen is very closely allied to D. ciscoensis. As in the latter specimen, the D. multistriata here has a slightly convex pedicle valve, especially over the anterior margins, is finely lirate, has a high, pointed beak and a moderately convex brachial valve. As D. ciscoensis is confined to the Pennsylvanian, this specimen has been relegated to the D. multistriata common to the lower Permian.

Range: Lower Permian of the Ft. Riley limestone of Kansas and the Coleman Junction limestone, north-central Texas.

Derbya hooserensis Dunbar and Condra

Plate IV, Figs. 5-6.

1932 Derbya hooserensis Dunbar and Condra, Brachiopods of the Pennsylvanian System in Nebraska, Nebraska Geol. Survey Bull. 5, 2nd series, pp. 92-94, pl. V figs. 6-10.

Description: The shell is of medium size, transversally subquadrate, wider than long and of rather low convexity, approaching a plano-convex appearance. The hinge-line is nine-tenths the width of the shell; the greatest width appearing at mid-length. The lateral margins of the shell and the small cardinal area form almost a right triangle.

The pedicle valve is almost flat, the beak being the highest point. The shell slopes back from the beak
very gently, and towards the posteriolateral margins the shell is gently convex. The cardinal area is low with a narrow deltidium, the sides of which form an apical angle of about 40°. The height of the beak is one-fifth the length of the hinge-line. The perideltidial area is vertically striated and has an apical angle of about 90°.

On the moderately convex brachial valve is a broad, shallow, median sinus that begins just before the beak and continues to and becomes broader towards the anterior. From the umbonal area towards the posteriolateral margins the valve is gently convex.

The surface is ornamented by narrow, distinctly elevated radial lirae, although this feature is not consistent over the whole shell. Occasionally the larger striae are separated by as many as five smaller lirae. The intervening striae are the same size or slightly larger than the lirae. Accentuation of the concentric lirae on the crests of the radial lirae produces a rough appearance.

**Dimensions:**

<table>
<thead>
<tr>
<th>L.</th>
<th>W.</th>
<th>T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.0</td>
<td>35.0</td>
<td>9.0</td>
</tr>
<tr>
<td>26.5</td>
<td>35.0</td>
<td>12.0</td>
</tr>
<tr>
<td>24.5</td>
<td>31.5</td>
<td>10.5</td>
</tr>
<tr>
<td>31.0</td>
<td>41.5</td>
<td>13.5</td>
</tr>
</tbody>
</table>

**Location:** Section 3, no. 2; Section 4, no. 2

**Observations:** The distinguishing characteristics of this species are the brachial sinus; the fine but rough surface sculpture, its low cardinal area and the width of the hinge-line. It is less convex and wider than *D. benetti* and smaller than *D. deercreekensis*. It can scarcely be mistaken
for any other Derbya species, other than the two mentioned above.

**Range:** This specimen has not been observed below the Lower Permian Neva in Kansas; and is present in the Lower Permian of north-central Texas.

**Derbya cymbula** Hall and Clarke

Plate II, Figs.1-2; Plate IV, Figs.3-4, Plate V, Fig.3


1892 *Derbya affinis* Hall and Clarke, *ibid*, p. 349, pl. XI-B figs. 4, 5.

1932 *Derbya cymbula* Hall and Clarke, Dunbar and Condra, *Nebraska Geol. Survey Bull.* 5, 2nd series, pp. 97-101, pl. VIII, figs. 1-3; pl. IX, figs. 1a-d.

**Description:** The shell is of medium size, plano-convex and with very fine radial liration. The hinge-line is only slightly less than the greatest width of the shell, which appears at mid-length.

The pedicle beak is nearly one-third as high as the broadly triangular cardinal area is long. The beak is inclined to the plane of the valves at the angle of about 70°. The deltidium is narrow, strongly convex, has a faint depressed line in the middle and has an apical angle of 25°. The perideltidial area is about 75°.

The pedicle valve slopes evenly from the relatively high beak to the anterior. In one specimen there is a slight convexity just behind the beak at the mid-length, from which point the slope is flat to the anterior portion of the shell. The posteriolateral margins are slightly convex
toward the brachial valve.

The brachial valve is widest near the middle, is gently convex and in the specimens here, has a strongly convex umbo. The greatest height is near the mid-length or slightly behind it.

The surface is marked by fine, subequal, radial lirae which are elevated, narrowly rounded or subangular, and separated by narrow flat-bottomed striae. Twenty three lirae are found in the space of 1 cm; they increase by intercalation, yet maintain their fineness to the anterior margins. Concentric lines of growth are accentuated on the crests of the radial lirae.

**Dimensions:**

<table>
<thead>
<tr>
<th>L.</th>
<th>W.</th>
<th>T.</th>
<th>HEIGHT of Cardinal area mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.0</td>
<td>57.5</td>
<td>25.0</td>
<td>11.5</td>
</tr>
<tr>
<td>50.0</td>
<td>72.0</td>
<td>23.0</td>
<td>11.0</td>
</tr>
<tr>
<td>39.7</td>
<td>56.5</td>
<td>24.0</td>
<td>14.0</td>
</tr>
<tr>
<td>11.5</td>
<td>11.0</td>
<td>10.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

**Location:** Section 3, no. 2; Section 4, no. 2

**Observations:** The specimens classified as *Derbya cymbula* (Hall and Clark) have many similarities to the typical Coleman Junction *D. cymbula*, but differ from that latter species in having a more convex or even inflated umbo and a longer hinge-line.

**Range:** *Derbya cymbula* ranges from the Wabaunsee to the Neva and Garrison formations of Kansas and Nebraska to the upper Wolfcamp in West Texas, and is found in abundance in the Lower Permian of north-central Texas.
Derbya plattsmouthensis? Dunbar and Condra

Plate V, Figs. 4-6

1932 Derbya plattsmouthensis Dunbar and Condra, Nebraska

Description: The shell is of medium to large size, a little
wider than long, the hinge-line is, about two-thirds the
width of the shell. Due to a slight concavity on the pos¬
teriolateral slopes the cardinal extremities are obtusely
angular. The lateral margins are more narrow than the
broadly rounded anterior region.

The pedicle valve of this specimen has been crushed
on one side, but generally the valve is flat or slightly
concave near the anterior portion. The beak is slightly
convex and low. The posteriolateral margins are also convex.
From near the mid-length the valve becomes slightly concave
or flat towards the anterior margin. The cardinal area is
small, attaining a height of only one-sixth the width of the
hinge. The deltidium is small but prominent, having an
apical angle of 35°. The perideltidial area is marked by
vertical striations, but these striations are faint due to
the poorly preserved nature of the specimen. The apical
angle of the perideltidial area is about 130°.

The brachial valve is moderately and evenly convex,
with the exception of the concavely arched posteriolateral
slopes. This concavity, along with the matching convexity
of the pedicle valve of the same region, produces a slight
dorsal curl of the cardinal extremities. The umbo is not
inflated and detracts little from the convexity of the shell.
The greatest height of the brachial valve occurs along the mid-length.

The surface ornamentation consists of high but narrow radial lirae, separated by much wider, flat-bottomed striae. The radial lirae are high and narrow with concave sides. New lirae are added by intercalation and impart to the surface an unequal liration, each fourth one usually being the strongest. Very strong concentric lirae cover the entire surface, but are most prominent on the flat-bottomed striae.

**Dimensions:**

<table>
<thead>
<tr>
<th>L.</th>
<th>W.</th>
<th>T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.0</td>
<td>58.5</td>
<td>21.5</td>
</tr>
</tbody>
</table>

**Location:** Section 3, no.2.

**Observations:** This specimen, due to its poorly preserved nature, is doubtfully identified. The posterolateral curl, the surface ornamentation and the cardinal area are features similar to a typical *D. plattsmouthensis*, but the flat or slightly concave pedicle valve and the slightly inflated umbo departs from the general classification of this species.

**Range:** This species has been reported from the Douglas group of the Pennsylvanian to the Lower Permian in Kansas, Nebraska and north-central Texas.

*Derbya crassa* (Meek and Hayden)

Plate IX, Figs. 1, 2


**Description:** The shell is distinctly wider than long, with the greatest breadth at, or before, the hinge-line. The shell is gently biconvex with strong undulations. The cardinal extremities are angular. The sides of the shell curve gently into rounded anterior margins.

The pedicle valve is slightly convex, being highest near the beak and sloping gently to the anterior margins. The beak is low and blends in well with the convexity of the shell. From the beak to the lateral margins there is a slight concavity. The brachial valve is gently convex, highest at about mid-length, and concave towards the lateral borders.

The surface is ornamented by narrow, elevated and sharply rounded radial lirae separated by broader flat-bottomed striae. The radial lirae increase by intercalation. Fasiculation of the radii is generally marked. Concentric lirae cover the shell, but are strongest in the interspaces and weak on the summits.

**Dimensions:**

<table>
<thead>
<tr>
<th>L</th>
<th>W</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.0</td>
<td>46.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>

**Location:** Section 3, no.2.

**Observations:** The classification to this species is based
on one specimen. It has strong marked furrows across the pedicle valve which distorts the convexity and liration of the shell. However, it still bears the closet resemblance to \textit{D. crassa}.

\textbf{Range:} \textit{D. crassa} first appears in the Cherokee group of the Lower Pennsylvanian from Kansas and ranges upward to the base of the Permian group, as reported by Dunbar and Condra. It is very abundant in the northern Mid-Continent region, but no reference has been found which places it in the Permian, except for Dunbar and Condra.

\textbf{Derbya wabaunseensis} Dunbar and Condra

Plate V, Figs.1,2.

1892 \textit{?Derbya robusta} Hall and Clarke, Pal. N.Y., vol.8, pl.XI-B, fig.8.


\textbf{Description:} The shell is large, resupinate, wider than long, with the greatest length at the hinge-line and the cardinal extremities almost forming a right angle.

The pedicle valve is slightly concave over the center of the shell. The highest points on the shell are at the beak and the anterior margin. The posteriolateral margins slope from the beak, are smoothly concave and then convex at the lateral edges. The beak is small and the cardinal area low, having a height of about one-eighth the length of the hinge-line. The deltidium is low, the sides of which form an apical angle of 40°. The perideltidial area occupies about one-half of the cardinal area and has an apical angle of 110°.
The brachial valve is evenly, moderately convex over the median portion of the shell and becomes concave on the posteriolateral slopes, matching the curl of the pedicle valve. The anterior area is thick and broadly rounded.

The surface of the shell is marked by fine radial lirae of which 16 to 18 occupy a space of 10 mm. The lirae are narrowly rounded and separated by wider interspaces. The radii are crossed by fine, sharp concentric lirae.

Dimensions:

<table>
<thead>
<tr>
<th>L.</th>
<th>W.</th>
<th>T.</th>
<th>mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>57.0</td>
<td>73.0</td>
<td>17.0</td>
<td></td>
</tr>
</tbody>
</table>

Location: Section 3, no. 2.

Observations: This is the largest Derbya species collected. The large size and long-hinge-line relate this specimen to Derbyoides nebrasensis, but the latter is less resupinate, has a less full dorsal valve, and the radial lirae are finer and relatively more acute. D. wabaunseensis is much larger than D. cymbula, and it is concavo-convex rather than biconvex as in D. cymbula. D. plattsmouthensis resembles D. wabaunseensis in the low cardinal area and general outline, but the former has a gently convex pedicle valve and the surface ornamentation is different.

Range: This specimen is reported from the Neva limestone, the Hughes Creek shale and the Americus limestone of the Lower Permian from Nebraska; it has been reported also from the Lower Permian Pueblo formation of north-central Texas.
Superfamily: STROPHOMENACEA  
Family: PRODUCTIDAE  
Subfamily: PRODUCTINAE  
Genus: Dictyoclostus Muir-Wood 1930

King (1938) changed the name of a commonly occurring Coleman Junction productid, Productus semireticulatus var. hermosanus Girty (described by Plummer and Moore from the Coleman Junction, 1921) to Dictyoclostus welleri. King was following the lead of Muir-Wood (1930) in changing the name of the Productus semireticulatus group to Dictyoclostus.

Dunbar and Condra (1932) also adopted the proposal of Muir-Wood (after she had shown the confusion as to the synonymy of some of the first described species of the British Producti and had separated and established Productus productus and P. semireticulatus as two structurally distinct shell types). Dunbar and Condra use the generic name Dictyoclostus for the Productus semireticulatus group. Dunbar and Condra (1932, p.220) state, "American paleontologists have almost without exception identified this (Dictyoclostus americanus) shell as Productus semireticulatus." Later, on the same page they state, "Productus semireticulatus var. hermosanus Girty, described from the Lower Pennsylvanian of Colorado, is a somewhat smaller shell with a narrower and much more inflated umbo and with fewer and coarser spines than our shell (D. americanus)."

There are few morphological features by which the specimens of Dictyoclostus presented herein can be distinguished. But as most of the specimens are of nearly the same shape, have similar inflated umbos, small but distinct median sinuses on the pedicle valve, depressed areas below
the beak on the brachial valve and have similar surface 
ornamentation, they have all been classified as D. Welleri 
King.

**Dictyoclostus welleri** King

Plate VI, Figs.1-6; Plate VII, Figs.1-5

1921 *Productus semireticulatus* var. cf. *hermosansus* Plummer 
and Moore, Stratigraphy of the Pennsylvanian forma¬
tions of north-central Texas, Univ. Tex. Bull.2132, 
pl.25, figs.1-2.

1938 *Dictyoclostus welleri* King, Chonetidae and Productinae 
39, figs.5-8.

**Description:** *D. welleri* is a very convex species, with an 
elongate outline. The anterior portion of the species is 
broadly rounded and becomes more sharply rounded at the 
lateral margins, which are relatively straight except for the 
extended ears. The ears are large and strongly arched, but 
are not distinctly set off from the rest of the shell. The 
umbo extends well back of the hinge-line and is strongly 
inflated. Most commonly a distinct sinus is present, but 
occasionally the sinus is rarely more than a flattening of 
the median area of the shell. The lateral margins are steep 
to subparallel.

The brachial valve is symmetrically concave and 
deep, with a well defined depression in front of the beak to 
the lateral margins. The ornamentation on the brachial valve 
is composed of costae and rugae of equal importance. The 
costae are widely separated and narrow; the rugae are broad-
ly rounded.
On the pedicle valve reticulation is marked, although the costae are finer and more closely spaced than the rugae. The costae are sharply defined as on the brachial valve and the rugae are broadly rounded. Numerous fine spines ornament the pedicle valve, and on the posterior slopes of the ears are larger, more closely spaced spines. The body spines most frequently are located on costae which are stronger than the other costae. All the costae increase in size anteriorly, where they number about 5 in a space of 5mm. On the umbo the costae are much finer and more closely spaced.

Dimensions:

<table>
<thead>
<tr>
<th>L (mm)</th>
<th>W (mm)</th>
<th>T (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42.0</td>
<td>45.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

(average of 10 specimens)

Location: Section 1, nos. 4, 2; Section 2, nos. 7, 5, 4; Section 3, nos. 4, 3, 2; Section 4, no. 2; Section 5, no. 4; Section 6, nos. 7, 6, 5.

Observations: D. portlockeanus (Norwood and Pratten) and D. crassicostatus Dunbar and Condra are smaller and less elongate than D. welleri, which has, also, a narrower and more inflated umbo. D. americanus Dunbar and Condra is larger, less convex, and broader than D. welleri. D. newelli King is much more transverse, much less convex and has a flattened rather than a fully rounded umbo.

Range: D. welleri has been recorded only from the Putnam formation of the Lower Permian, in north central Texas.
Genus: Linoproductus Chao 1927

Linoproductus meniscus Dunbar and Condra

Plate IV, Figs. 1,2; Plate VIII, Figs. 1-3

1921 Productus cora Plummer and Moore (non d'Orbigny), Univ. Tex. Bull. 2132, pl. 20, fig. 15.


Description: The shell is large and of rather low convexity. The greatest width appears near mid-length, but the hinge-line is probably as wide, as the specimens here all have the lateral margins partially or totally gone.

The pedicle valve is evenly and slightly convex. The pedicle beak is obtuse, small and extends but little over the hinge-line. The pedicle umbo is broad and not inflated above the even curvature of the shell. A broad obscure median flattening appears on the anterior slopes of the pedicle valve.

The brachial valve is gently concave and has no geniculation. A slight elevation corresponding to the pedicle flattening occurs on the anterior portion of the valve. The visceral chamber is thin. The ears are low and thin.

The surface is marked by rather fine, even, radial costae, about eight occupying 5 mm. Spines are small and few, except along each half of the cardinal border, where twelve or so are located. No spines appear on the dorsal valve. The ears bear rather strong irregular wrinkles which do not extend onto the umbonal slopes. Irregular wrinkle-like varices of growth appear on the dorsal valve.
Dimensions:

\[
\begin{array}{ccc}
W. & L. & T. \\
56.5 & 43.0 & 16.5 \\
43.0 & 40.0 & 12.0
\end{array}
\]

Location: Section 2, no. 2; Section 3, no. 2; Section 4, no. 2

Observations: The large size, low even curvature, the absence of spines except along the ears, the very broad, low median pedicle sinus and the fine even radial costae serve to distinguish \textit{L. meniscus} from other \textit{linoproductid} types.

Range: The range of this specimen is from the top of the Canyon group from Texas into the lower Permian Putnam formation of north-central Texas.

Genus: Marginifera Waagen 1884

\underline{Marginifera capaci} (d'Orbigny)

Plate VIII, Figs. 4-6


Description: The shell is small, the greatest width along the hinge-line, the sides of the shell are nearly parallel.

The pedicle valve is sharply geniculate anterior to the visceral area, the visceral area and the anterior slopes being at almost right angles. The posterior portion overhangs the hinge-line and is flattened. The curvature of the shell is gently convex anterior to the geniculation. The ears are large, quadrate and sharply defined. A faint median
flattening appears at the geniculation and is more or less persistent to the anterior margin.

The brachial valve is much smaller than the pedicle, deeply concave, transverse with moderately flattened, recurved ears defined by ridges. The trail is partially present and geniculation can be seen. At the line of geniculation a thickened band marked by two or three concentric lamallae occurs.

The surface of the pedicle valve is marked by faint or obscure irregular costae. The visceral area has seven or so low obscure rugae. Sixteen spines are spread over the pedicle valve. The spines over the visceral area are very small; over the anterior slopes the spines are larger and more widely spaced, about 8 to 10 occurring there. On one ear there is one large, obliquely inclined spine.

**Dimensions:**

\[
\begin{array}{ccc}
W & L & T \\
18.5 & 16.5 & 6.5 \\
\end{array}
\text{mm.}
\]

**Location:** In one feature, the concentric lamellae at the brachial geniculation, this specimen agrees with *Marginifera splendens*. However, it is not as large and has no well developed median sinus as in *M. splendens* (Norwood and Pratten). The very much enrolled pedicle umbo, the faint sinus and large spines are characteristic of this specimen. It has one feature, the enrolled pedicle umbo which allies it to *M. haydensis* Girty, but Dunbar and Condra state that this species does not occur above the Lower Pennsylvanian.

**Range:** This specimen is reported from the Upper Pennsylvanian (Gaptank) up through the upper Gym (Lower Permian) of West
Order: NEOTREMATA
Family: CRANIDAE
Genus: Crania Retzius 1871

**Crania modesta** White and St. John

Plate VII, Figs. 4, 5.


**Description:** The shell is rather small, smooth except for concentric lines of growth near the margins which form a rim-like ring around the shell. The shell is sub-circular in outline, having a diameter of about 5 mm.

In the center of the specimen is a small circular boss which serves as base for the central adductors. Two elevated bosses are situated posteriorly to which were attached the posterior adductors.

**Dimensions:**

The diameter of the shell is ca. 5 mm.; all specimens are an estimated .5 to 1mm. thick.

**Location:** Section 3, no.2.

**Observations:** All of the valves examined are lower valves and are attached to shells of *Dictyoclostus welleri*.

**Range:** The range of *C. modesta* is from the Shawnee group of Kansas, the Deese group of Oklahoma, both Upper Pennsylvanian, to the Lower Permian of Glass and Guadalupe mountains, Texas, and the Lower Permian Coleman Junction limestone of
Phylum: BRYOZOA
Class: GYMNOLAEMATA
Order: CYCLOSTOMATA
Family: FISTULIPORIDAE
Genus: Cyclotrypa Ulrich 1890

Cyclotrypa cf. pelagia Moore and Dudley

Plate IX, Fig. 4.

1944 Cyclotrypa pelagia Moore and Dudley, Pennsylvanian and Permian Bryozoans, Kans. Geol. Surv. Bull. 52, pp. 284-285, pl. 6, fig. 3; pl. 10, fig. 3; pl. 14, figs. 1-2; pl. 18, figs. 2-4; pl. 22, figs. 1, pl. 28, figs. 1-3; pl. 32, figs. 5-7.

Description: The zooarium is small, fairly discoid in shape, composed of superposed laminae. Monticules are low, not too distinct, but fairly uniform and distant in spacing and they bear smooth maculae near the centers. The zooecial apertures are large, separated by smaller interspaces with strong peristomes and moderately developed lunaria.

Transverse sections show the subcircular form of the zooecial tubes and the slight lunarial wall flexures; the tubes are thin-walled and are separated by a single series of angular vesicles. In longitudinal section the zooecial tubes are straight, with horizontal or bent diaphragm. Isolated vesicles are formed in a tube by the bending downward of a diaphragm to join an adjacent tube. Vertical zonation is lacking in interzooecial vesicles.

Dimensions: The zooarium is 15 mm. in height, 30 mm. in width. The distance between monticules is 7 mm.; diameter of zooecia is 0.3 mm.; width of interspaces is 0.1 mm.

Location: Section 3, no. 2; Section 4, no. 2.
Observations: This species bears a close resemblance to *C. carbonaria* (Ulrich) but has somewhat smaller zooecial tubes and vesicles. The monticules are small and barely distinct and the poorly preserved external nature constitute the reasons for doubtfully identifying this species.

Order: CRYPTOSTOMATA  
Family: FENESTILLIDAE  
Genus: Polypora McCoy, 1884

**Polypora sigillaria** Moore  
Plate IX, Fig. 3.


Description: The branches of the frond are 0.7 to 0.1 mm. wide, the obverse face is nearly flat, and the reverse, gently rounded. Penistrules are elongate-ovate, 2.5 mm. long, three and one-quarter appearing in 1 cm. Dissepiments are 0.5 to 0.6 mm. wide.

The zooecia are arranged in longitudinal and alternating rows, 12 to 13 in 5 mm. The surface of the branches is marked by ridges of fine granules, the ridges bending around the elevated peristomes of the zooecia imparting a sigillaroid pattern to the branches. The reverse side is marked by striations.

Dimensions: The specimens are represented by small incomplete fronds, 1 cm. wide, a cm. long and ca. 0.5 mm. thick.

Location: Section 2, no. 3; Section 3, no. 2; Section 4, no. 2
Observations: These specimens are incomplete fronds set in a calcareous matrix and proper study was difficult. However, the sigillaroid pattern, the size of the fenestrules, branches and dissepiments fit accurately the description of a typical P. sigillaria.

Range: This bryozoa ranges from the upper Graham formation, Upper Pennsylvanian to the Coleman Junction limestone of north-central Texas.

Phylum: COELENTERATA
Class: ANTHOZOAN
Order: TETRACORALLIA
Family: ZAPHENTIDAE
Genus: Lophophyllum Milne-Edwards and Haime

Lophophyllum profundum var. radicosum Girty

Plate IX, Fig. 5.


Description: This specimen is horn-shaped, small (6 mm) and is characterized by the development of stolons, irregular growth, straight outline and a thin knife-like pseudocolumella.

Dimensions: The length is 6 mm. The coral has a 3 mm. diameter at the top and a 1.5 mm. diameter at the tapered base.

Location: Section 2, no. 2, 3; Section 3, no. 2, Section 4, no. 2

Observations: This specimen is a small solitary coral which differs from L. profundum in the development of stolons and a straight outline. Girty, in describing this variety
stated that the number of stolons on his specimens varied from a few to many, whereas *L. profundum* had none. He suggested that some *L. profundum* var. *radicosum* specimens with few stolons were intermediate between the naked *L. profundum* and the more advanced forms with many stolons.

**Range**: This solitary coral is found from the Medial Pennsylvanian Marmaton group of Kansas and ranges upwards into the strata as high as the Guadalupian of the Upper Permian of West Texas. It is a commonly occurring coral in this interval from Kansas, Oklahoma, Nebraska and Texas.
SUMMARY AND CONCLUSIONS

1. The Coleman Junction, uppermost member of the Putnam formation, consists of fossiliferous limestones with small amounts of shale and a few pod-shaped siltstone layers. The sections included in this report are seventeen to thirty-five feet thick, the member averaging twenty-three feet in thickness throughout Shackelford County.

2. It has been discovered that the thickness of the Coleman Junction strata in Shackelford County must be considered to be an average twenty feet more than the two to four feet reported by Plummer and Moore (1921).

3. A list of the fauna, predominately brachiopodan is given with the hope that the extended knowledge of the assemblage may be of use in future paleontologic studies in north-central Texas, and further that its availability will help insure more accurate correlations with equivalent-age rocks in other areas.

4. A brief report on the insoluble residues from limestones of four measured sections is presented. Aside from the inorganic residues obtained, siliceous sponge spicules and other problematical fossils are found. No previous report on the Coleman Junction unit has mentioned the presence of sponge spicules. The usefulness of spicules isolated from the parent sponge and reported from a single unit is doubtful. It is believed, however, that through careful study of
collections made from the strata enclosing the Coleman Junction limestone, sponge spicules may be found which probably bear some relationship to the ones from the Coleman Junction strata. If such a relationship is found to exist, a useful, though secondary, means of correlation may be discovered.

5. The apparent absence of fusulinids in the Coleman Junction of Shackelford County increases the difficulty in correlating the member with other equivalent-age beds. However, based on the faunal assemblage reported, the Coleman Junction is tentatively correlated to the Gym formation of the Hueco Mountains. Reports of species of Schwagerina and Schubertella kingi from the Coleman Junction of central Texas, and the presence of related forms in the lower Gym formation somewhat strengthen the suggested correlation of the two horizons.

6. In addition, it is suggested that the Coleman Junction is a correlative of the Cottonwood limestone of the Council Grove group in Kansas. There are many similarities in the megascopic faunas from the two rather widely separated limestones.
LITERATURE CITED


COLEMAN JUNCTION LIMESTONE FAUNA

Plates I-X
Explanation of Plate I

Figs. 1-3. Composita subtilita (Hall)

1-3. Brachial, pedicle and lateral views of a well preserved specimen. (x2)

(King 1930, p.130)

Figs. 4-6. Derbya multistriata (Meek and Hayden)

4-6. Posterior, pedicle and lateral views of a typical specimen. (x1)

(Dunbar and Condra 1932, p.101)
Explanation of Plate II

Figs. 1-2. Derbya cymbula Hall and Clark
1-2. Brachial and posterior view of a highly exfoliated specimen. (x1)

(Dunbar and Condra 1932, p.101)

Figs. 3-6 Composita subtilita (Hall)
3-6 Anterior, pedicle, brachial and lateral views of a well-preserved specimen. (x1.5)

(King 1930, p.130)
Explanation of Plate III

Figs. 1-3. **Composita mira** (Girty)

1-3. Pedicle, brachial and lateral views. Note sub-oval outline and low, even convexity. (x2) 
(King 1930, p.128)

Figs. 4-6. **Composita mexicana** (Hall)

4-6. Brachial, anterior and lateral views. (x2) 
(King 1930, p.128)
Explanation of Plate IV

Figs. 1-2. *Linoproductus meniscus* Dunbar and Condra
1-2. Brachial and pedicle views of nearly complete specimen. (xl)

(Dunbar and Condra 1932, p.255)

Figs. 3-4. *Derbya cymbula* Hall and Clarke
3-4. Pedicle and lateral views of a nearly complete specimen (xl)

(Dunbar and Condra 1932, p.97)

Figs. 5-6. *Derbya hooserensis* Dunbar and Condra
5-6. Brachial and posterior views. Note the brachial sinus. (xl.5)

(Dunbar and Condra 1932, p.92)
Explanation of Plate V

Figs. 1-2. **Derbya wabaunseensis** Dunbar and Condra

1-2. Brachial and posterior views of a nearly complete specimen. Note the brachial curl of the ears. (x0.5)

(Dunbar and Condra 1932, p.95)

Fig. 3. **Derbya cymbula** Hall and Clarke

3. Posterior view of incomplete, exfoliated specimen. Note the prominent convex deltidium. (x0.5)

(Dunbar and Condra 1932, p.97)

Figs. 4-6. **Derbya plattsmouthensis** Dunbar and Condra

4-6. Pedicle, posterior and lateral views of a nearly complete, exfoliated specimen. (x0.5)

(Dunbar and Condra 1932, pp.106-107)
Explanation of Plate VI

Figs. 1-6. *Dictyoclostus welleri* King

1-4. Pedicle, brachial, anterior and posterior views of a well preserved specimen. (x1)

5-6. Lateral and brachial views of another specimen. (x1)

(King 1938, p.273)
Explanation of Plate VII

Figs. 1-3. *Dictyoclostus welleri* King

1-2. Brachial and posterior view of a well-preserved specimen except for the broken ears. (xl)

3. Pedicle view of another well-preserved specimen. (xl)

(King 1938, p.273)

Figs. 4-5. *Crania modesta* White and St. John

4-5. Specimen of pedicle valves of *Dictyoclostus welleri*, showing oval form and central boss of pedicle valve. (xl,5)

(Dunbar and Condra 1932, p.51)
Explanation of Plate VIII

Figs. 1-3. *Linoprocessus meniscus* Dunbar and Condra

1-3. Brachial, lateral and posterior view of a large, nearly complete specimen. (x1)

(Dunbar and Condra 1932, pp. 225-257)

Figs. 4-6. *Marginifera capaci* (d'Orbigny)

4-6. Lateral, brachial and posterior view of only specimen collected. (x2)
Explanation of Plate IX

Figs. 1-2. *Derbya crassa* (Meek and Hayden)
1-2. Pedicle and lateral views. (x1.5)
(Dunbar and Condra 1932, pp.79)

Fig. 3. *Polypora sigillaria* Moore
3. Reverse side of an incomplete frond. (x3)
(Moore 1929, p.121)

Fig. 4. *Cyclotrypa cf. pelagia* Moore and Dudley
4. View showing complete (?) zooarium. (x2)
(Moore and Dudley 1944, p.284)

Fig. 5. *Lophophyllum profundum var. radicosum* Girty
5. Oblique side-view of representative specimen. (x2)
(Girty 1915, p.27)
Explanation of Plate X

Figs. 1-4, 6-7. Sponge spicules

1. Monaxon microscleres. Notice the bulbous end on the lower specimen and the angular end on the upper specimen. (x60)

2. Monaxon microscleres. Notice angular central curve. (x60)

3. Monaxon microscleres. Note the evenly curved outline and the rounded ends. (x60)

4. Tetraxon above; hexaxon below. (x60)

5. Monaxon microscleres, slightly curved. (x60)

6. Monaxon megosclere. (x50)

Fig. 5. Amblysiphonella ?, Girtyocoellia ?, sponges or arenaceous foraminifera ?.

5. Notice chambered structures and tiny nobs. (x60)

Fig. 8. Foraminifera ?

8. Several types of organic remains. (x60)