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**STRATIGRAPHIC POSITION OF THE FRANKS AND  
SEMINOLE FORMATIONS OF OKLAHOMA.**

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**BY  
GEO. D. MORGAN**



**NORMAN**

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## STRATIGRAPHIC POSITION OF THE FRANKS AND SEMINOLE FORMATIONS OF OKLAHOMA.

### INTRODUCTION.

The Franks and Seminole conglomerates of southern Oklahoma have been subjects of discussion and dispute since the days of Taff's early work in the state. During the last two years\* the writer has spent considerable time in an investigation of these and associated formations, and it is thought that data are now at hand which will largely clear up the problems which they present. Mr. A. E. Brainerd has ably assisted in most of the work and the aid and suggestions which he has given cannot be too highly valued. Credit is also due Mr. D. G. Barnett and Mr. William J. Stahl, who assisted in the capacity of instrument men.

### REVIEW OF LITERATURE.

In any discussion of the Franks and Seminole conglomerates it is essential that a review of the literature be given, otherwise there would be but slight excuse for treating the two formations together.

In 1902 Taff apparently implied a correlation of the Franks conglomerate with the Wapanucka limestone. In discussing the Wapanucka limestone on page 4 of the Atoka folio he says: "The formation comes from beneath the flat Cretaceous deposits one mile northwest of Boggy Depot and continues northwestward in its tortuous outcrops to about six miles beyond the northwest corner of the quadrangle where it becomes so thin that it cannot be traced farther. At this western extremity it joins beds of limestone conglomerate which thicken westward to enormous proportions around and across the northwestern part of the Arbuckle Mountain uplift."

In 1903 the same correlation is apparently implied on page 5 of the Tishomingo folio. Speaking of the Franks conglomerate Taff says: "A broad belt of this conglomerate extends across the northwestern part of the Arbuckle Mountains to the vicinity of Franks, in the adjoining Stonewall quadrangle. From the northwest corner of the Tishomingo quadrangle northeastward it crosses the eroded edges of the Ordovician, upper Silurian and Devonian formations. From a nearly flat position on the Hunton limestone near Franks it extends southeastward unconformably across the Woodford chert and Caney shale to a position above

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\*This article is published by permission of the Empire Gas and Fuel Company, which organization has made possible this strictly scientific investigation. The Oklahoma Geological Survey has co-operated in the work and a complete report on the entire Stonewall quadrangle of Oklahoma is now in preparation and will be published as a bulletin of the Survey. The final report will be submitted to Columbia University in partial fulfillment of the requirements for the degree of doctor of philosophy.

the latter in the upper Carboniferous section. Between Franks and the southeast corner of the Stonewall quadrangle the formation changes from a heavy limestone conglomerate interbedded with sandstone and shale, to a thinner formation of fragmental limestone, shale and sandstone. At the latter point it is found to occupy a position in the section approximately the same as that of the Wapanucka limestone, at the top of the Caney shale."

In 1904, when Taff wrote Professional Paper No. 31, his opinion that the Franks conglomerate was the approximate equivalent of the Wapanucka limestone seems unchanged.

These are the only references to the Franks conglomerate, by Taff, which have been found, but while his work is being considered it is desired to point out that in no way did he consider that formation related to the Seminole conglomerate. In the Coalgate folio he places the Seminole conglomerate at the top of his Pennsylvanian section, and when it is borne in mind that he consistently assigned the Franks to a position at the base of the Pennsylvanian it becomes obvious that he had no impression other than that the two formations were widely separated.

The name Seminole conglomerate was applied to a small area of sediments which outcrop in the northwestern part of the Coalgate quadrangle. In his definition of this formation Taff says: "About 50 feet of the lower part of the Seminole conglomerate is exposed in a small area in the northwestern corner of the Coalgate quadrangle. This part of the formation is composed of laminated or stratified subangular chert with a sprinkling of quartz pebbles from 3 inches in diameter to small grains in a cement of fine and usually ferruginous sand. The coarser conglomerate in the beds at the base is loosely cemented and on weathered surfaces it breaks down into rounded boulders and loose gravel. Forty to 50 feet from the base the conglomerate grades into brown sandstone which continues upward about 100 feet to the top of the formation. The Seminole formation crops in a rugged hilly country northwestward in Seminole Nation, making rough timbered lands."

The item of paramount importance in this definition is that Taff limits the thickness of the Seminole conglomerate to about 150 feet.

In 1910 Reeds\*\* followed Taff and assigned the Franks a position of "apparent conformity above the Caney Shale".

In 1915 Wallis\*\*\* followed Taff and correlated the Franks

\*Taff, J. A., U. S. Geol. Survey Geol. Atlas, Coalgate folio (No. 74) P. 4, 1901.

\*\*Reeds, Chester A., A report of the geological and mineral resources of the Arbuckle Mountains, Oklahoma: Okla. Geol. Survey Bull. 3, 1910.

\*\*\*Wallis, B. Franklin, The geology and economic value of the Wapanucka limestone of Oklahoma: Okla. Geol. Survey Bull. 23, 1915.

conglomerate with the Wapanucka limestone.

In 1921 Moore\* quoted a personal communication from McCoy\*\* to the effect that the Franks conglomerate had been traced from the vicinity of Sulphur northeastward across central Pontotoc County, near Ada, into Seminole County and was there found to be identical with the Seminole conglomerate. This was a wide divergence from the interpretation of Taff and at one stroke lifted the Franks conglomerate from the base to a position near the top of the Pennsylvanian section. McCoy's correlation was taken by Moore to indicate a totally different history for the Arbuckle Mountains than that previously suggested and his conclusion was that: "It seems apparent that the Arbuckles were uplifted after the time of deposition of the Pennsylvanian beds northeast of the mountains, that they were reduced to a peneplain and that gravels were strewn across the eroded edges of the beds". He believed that these gravels were represented by the Franks and Seminole conglomerates.

In the latter part of 1921 McCoy published a paper\*\*\* in which he stated that "the Franks conglomerate of the western Arbuckle region must be correlated with the Seminole conglomerate of east central Oklahoma. The conglomerate at Franks, Oklahoma, where the same received its name, cannot be traced definitely into any stratigraphic zone, but according to the position of the Wapanucka formation it has probably been erroneously correlated with that particular horizon."

In correlating the Franks conglomerate of the western Arbuckle area with the Seminole conglomerate McCoy gives a qualifying footnote in which he states that: "The conglomerate termed 'Seminole' in this paper is the main horizon in a series of conglomerates, the lower part of which was named the Seminole conglomerate by Taff in the Coalgate folio."

A summary of the various interpretations which have been published regarding the two formations follows:

1. Taff considered all the limestone conglomerates of the immediate Arbuckle area as one formation to which he gave the name Franks.
2. Taff, followed by Reeds and Wallis, considered the Franks to be situated at the base of the Pennsylvanian section and essentially equivalent to the Wapanucka limestone.
3. Taff placed the Seminole at the top of his Pennsylvanian

\*Moore, Raymond C., Folding in southern Oklahoma oil fields: Am. Assoc. Pet. Geol., Vol. 5, No. 1, p. 40, 1921.

\*\*McCoy, Alex W.

\*\*\*McCoy, Alex W., A short sketch of the paleogeography and historical geology of the Mid-Continental district and its importance to petroleum geology: Bull. Am. Assoc. Pet. Geol., Vol. 5, No. 5, 1921.

section in the Coalgate folio, i. e., above the Holdenville shale, and defined it as having a thickness of about 150 feet.

4. Moore took, quite literally, McCoy's statement that the Franks and Seminole were equivalent and drew conclusions on that basis.
5. McCoy correlated the Franks conglomerate of the western Arbuckle area with the Seminole conglomerate, but qualified this correlation by changing Taff's definition of the Seminole to embrace a much greater thickness of deposits.

#### PONTOTOC SERIES.

As previously stated the writer has had the good fortune to spend considerable time in an investigation of the formations under discussion. The particular region to which this investigation has been largely confined is the Stonewall quadrangle. This embraces parts of Pontotoc, Pottawatomie, Seminole, Coal, Johnson, Murray, and Garvin counties, and is a critical area in the present connection, because it includes the type section of the Franks conglomerate and adjoins the type section of the Seminole.

Early in the work it was observed that the strata in the western part of the Stonewall sheet were uniformly conglomeratic, and not only conglomeratic, but arkosic as well, and in some places the quantity of feldspar carried by individual beds constitutes as much as 50 per cent of the rock. In a preliminary paper\* attention was called to this arkosic series\*\* and the name Pontotoc was suggested for it. At the time of publication the boundaries of the series had not yet been carefully surveyed. The main conclusions of the paper were that the arkose occurs at the top of the Pennsylvanian section\*\*\* north of the Arbuckle Mountains, that it is of very late Pennsylvanian age, and that its initial appearance in the section marks the time at which the Arbuckle Mountains were worn down to their igneous core.

If these conclusions are essentially correct, then there must have been far earlier Pennsylvanian uplifts of the Arbuckle area, followed by long periods of erosion, in order that some 10,000 feet of early Paleozoic limestone might have been removed from the crest of the mountains before the time of deposition of the

\*Morgan, Geo. D., The arkose of the northern Arbuckle area: Okla. Geol. Survey, Cir. 11, 1922.

\*\*The term series rather than formation is used because the beds have been found to have, in common, the one characteristic of being arkosic. Several rather distinct units have been noted within the series, however, and it is thought that in the course of subsequent work these may be found sufficiently distinct to be mapped as separate formations.

\*\*\*See exception noted on p. 5 of paper mentioned

arkosic Pontotoc series. To follow this thought for a moment, it appears that if earlier uplifts occurred, thus exposing the limestone strata of the Arbuckles, then conglomerates, bearing fragments of this material, should be found in the earlier Pennsylvanian formations, and this is the case. Conglomerates bearing easily identifiable fragments of Hunton and Viola limestones have been found in abundance in the Wewoka formation, the Thurman sandstone, the Boggy formation, the Savanna and the McAlester, consequently, the idea that the Arbuckle Mountains were not uplifted during the Pennsylvanian until Seminole time may be abandoned.

#### RELATION OF CONGLOMERATES AT SULPHUR TO THE PONTOTOC SERIES.

After determining that the arkosic strata constituted a definite and mappable series, the writer followed them north and south and in the course of this work found them to include all the conglomerates in the vicinity of Sulphur which Taff had referred to as Franks.

#### RELATION OF CONGLOMERATES AT FRANKS AND SULPHUR.

As has been stated, the presence of feldspar grains in the Pontotoc strata is a most important criterion for the recognition of the series, and in view of Taff's correlation of the feldspathic conglomerates at Sulphur with the conglomeratic strata in the vicinity of Franks, it appears that the latter should also carry feldspar. This is not the case, however. A search extending over a period of several months failed to disclose a single grain of feldspar in the Franks conglomerate of the type area, and on the basis of the negative evidence thus afforded, the conclusion is here drawn that the strata in the two localities (Franks and Sulphur) are of different age and are not to be correlated. Contributory evidence, supporting this conclusion, is afforded by a comparison of the structural and faunal relations of the strata in the two areas. It was observed that the conglomerates at Franks do not have a "nearly flat position" as stated by Taff,\* but in reality are highly folded and faulted.\*\* At numerous places dips as high as 80 degrees were measured, and at a few points about a mile southwest of Franks the conglomerates were found to be overturned. This structural condition of the Franks as compared with that of the Pontotoc series shows that the latter has a uniformly low dip even where it extends far out over the flanks of the mountains. The area south of Sulphur is an illustration. Lastly, it was found that in addition to the compositional and structural differences of the conglomerates in the

\*Taff, J. A., U. S. Geol. Survey Geol. Atlas, Tishomingo Folio (No. 98). 1903.

\*\*In a later paper it will be shown that the faulting contributes important evidence with regard to the geological history of the Arbuckle area.

two areas, some of the strata at Franks are quite fossiliferous, whereas fossils in the Pontotoc series are extremely scarce.

It is thought that these three differences constitute ample evidence to justify the conclusion that the conglomerates at Franks and Sulphur are totally different in age and are not to be correlated. The criteria are important in another connection and are therefore listed in tabular form:

FRANKS CONGLOMERATE	PONTOTOC SERIES, (which includes conglomerates at Sulphur)
1. Non arkosic.	1. Arkosic.
2. Highly folded and faulted.	2. Slightly folded.
3. Fossils common with numerous species.	3. Fossils scarce, with few species.

*RELATION OF THE PONTOTOC SERIES TO THE SEMINOLE CONGLOMERATE.*

Satisfied with the conclusion that the conglomerates at Sulphur and Franks were distinct as to age and not to be correlated, the writer then followed the Pontotoc series northward and found its lower contact, which could be traced quite easily in this direction, passed about 8 miles to the west of the Seminole outcrop as defined by Taff. Since the normal dip in the region west of the type area of the Seminole averages about one degree slightly north of west, the only possible conclusion was that the two formations were separated by a great thickness of intervening strata.

Because of overlaps within these intervening beds it is impossible to give a geological section of the strata between the Pontotoc and Seminole formations which will be representative for any great distance north and south. A section taken along the north line of township 5 north, however, may be considered as an average and is given in the section included herewith.

**SEMINOLE CONGLOMERATE.**

A correlation of the conglomerates at Sulphur with the Seminole conglomerate is obviously a dangerous step. This is so, not only for the reason that the two formations are widely separated by strata, some of which are of an altogether different nature, but for the additional reason that if any attempt is made to extend the Seminole to embrace all the conglomeratic strata of the area, the Holdenville and Wewoka formations, as well as several lower ones, might well be included. Chert conglomerates of the Seminole type are quite common throughout almost the entire Pennsylvanian section of the area north and northeastward of the Arbuckle Mountains. Those which occur below the Pontotoc formation have so close a lithologic similarity as to be indistinguishable, but the conglomerates of this type within the Pontotoc series are easily recognizable because of their contained feldspar.

The Seminole formation (not the conglomerate, for this phase is developed only locally) is sufficiently distinct for the purposes of mapping. Its relation to certain key beds is now clearly established. About 100 feet above the top of the 50-foot conglomeratic phase of the type area, and resting upon what is here taken as the top of the formation, there is a thin, easily traceable limestone (DeNay limestone member) which was followed from the type area southwestward to a point southwest of Ada where it is overlapped by succeeding formations. As a check on the correlation here involved, two limestones in the underlying Holdenville formation (the Sasakwa and Homer limestone members) have been traced from the northwest corner of the Stonewall quadrangle to their point of overlap southwest of Ada, and as an additional check the very characteristic shale next above the DeNay limestone member, in the basal part of the overlying Francis formation, has been mapped.

The mapping of these several key beds has somewhat dissipated another long accepted belief regarding the Seminole. In his original description Taff states that the Seminole rests unconformably on the Holdenville and at one point in the northeastern part of sec. 18, T. 6 N., R. 8 E., in the type area the writer has observed such an unconformity. It has not, however, been noted in any other locality, and it is thought that since the publication of Taff's statement the relationship has been largely over-emphasized. This is indicated by the fact that there is but slight variation in the interval between the upper limestone member (Sasakwa) of the Holdenville formation and the basal DeNay limestone member of the overlying Francis formation. With the exception of the Pontotoc series there is a general southward thinning of all the formations in the Stonewall quadrangle but in the interval just mentioned this thinning is not in excess of the general average.

On first investigation Taff's definition of the Seminole appears quite clear, but there are several factors which contribute to confuse the geologist who attempts to apply this definition in the field. Foremost among these is the fact that if only 150 feet (which Taff gives as the approximate thickness of the Seminole) is measured upward from the base of the formation as defined by Taff, it is found that "in a northwestward direction" the Seminole formation barely extends into the old Seminole Nation. The chance for confusion here lies in that part of Taff's definition in which he says: "The Seminole formation crops on the rugged hilly country northwestward in Seminole Nation making rough timbered lands".

Other possibilities for confusion are that (1) there is now a Seminole County, the boundaries of which do not coincide with those of Seminole Nation; and (2) that there is also a town by this name which, although lying within the limits of the present

County and the old Nation, is to the west of the outcrop of the Seminole formation. The latter condition is especially confusing because chert conglomerates almost identical in appearance with those of the Seminole formation, (but in reality much higher in the section) are reported to outcrop in the vicinity of the town.

In an endeavor to eliminate these possibilities of confusion, but at the same time to follow as nearly as possible Taff's definition of the formation, the limits of the Seminole formation are here taken to be as follows:

At the base of the formation there are 30 to 50 feet of chert conglomerates or coarse brown sandstones, depending upon the local variations of this member. The basal part of this member which is taken as the bottom of the Seminole formation may be further defined as occurring about 35 feet above the Sasakwa limestone member of the underlying Holdenville formation. The Sasakwa limestone varies in thickness from 1 to 15 feet; its outcrop passes through the town of Sasakwa, and it is especially well exposed in the railroad cut and quarry about one-fourth mile south of the town.

Upward through the Seminole formation the conglomerates and sandstones become thinner and the percentage of shale increases. At the top of the formation (which in accordance with Taff's definition is taken to be about 150 feet above the base) there is a thickness of from 15 to 30 feet of almost unbroken greenish-blue shale which is capped by the DeNay limestone\* member of the overlying Francis formation. This limestone bed takes its name from DeNay school house which is located in sec. 5, T. 4 N., R. 7 E., about one-fourth mile east of the outcrop of the bed. This limestone has been traced from the northeast corner of the Stonewall quadrangle to Ada and beyond, and was found to be especially well exposed at the following points:

- In the northeastern part of sec. 13, T. 6 N., R. 7 E.
- In the northeastern part of sec. 26, T. 6 N., R. 7 E.
- Along the west line of the SW  $\frac{1}{4}$  of sec. 35, T. 6 N., R. 7 E.
- About 700 feet S. of the NE cor. sec. 9, T. 5 N., R. 7 E.
- At the NE cor. sec. 7, T. 4 N., R. 7 E.
- Where Little Creek crosses the road about 900 feet east of SW cor. sec. 13, T. 4 N., R. 6 E.

\*The DeNay limestone is taken as the upper limit of the Seminole formation, first, because it is a definite mappable bed which can be followed for many miles, and second, because it occurs about 150 feet above the base of the Seminole formation which thickness is in agreement with that assigned to the formation by Taff.

The DeNay limestone has been included as the basal bed of the Francis formation rather than the upper bed of the Seminole formation for the reason that in his definition of the Seminole, Taff does not mention any limestone member.

It is also well exposed at many points intervening between those mentioned as well as at many places further toward the southwest.

It is thought that if geologists adhere to the limits here used the confusion which has existed regarding the stratigraphic position of the Seminole formation will be eliminated.

#### FRANKS CONGLOMERATE.

Since the conglomerates at Sulphur are to be correlated with the Pontotoc series, and therefore occupy a position in the geologic section far above the Seminole conglomerate, and since they have been shown to be different in composition, structural conditions, and fossil content from the conglomerate at Franks, the question naturally arises as to the possible relation of the true Franks and Seminole conglomerates in their widely separated type areas. Before undertaking a consideration of this problem, however, it is desirable to inquire more fully into the true nature, condition, and associates of the Franks conglomerate.

The town of Franks is situated in the northern part of sec. 35, T. 2 N., R. 6 E., near the southern edge of a triangular area of Pennsylvanian sediments. The sides of the triangle converge westward and intersect in the eastern part of sec. 23, T. 2 N., R. 5 E. Beyond that point no Pennsylvanian strata are encountered until the outcrop of the Ada formation is reached in the vicinity of Roff.

In its western portion both sides of the triangle are defined by faults which bring the Pennsylvanian into contact with the older Paleozoics, but toward the east these faults diminish and die out. This area, although by no means synclinal in structure, has been referred to as the Franks syncline\* and, together with the region immediately around the town of Franks, is to be considered as the type area for the Franks conglomerate. Individual beds outcropping in the vicinity of Franks have been followed entirely across the so-called syncline so that there is no doubt that the true Franks occupies all the western portion of the triangular area here described. Toward the east, however, conditions are more complex. Beds followed eastward from the vicinity of Franks are found to swing northward and then double back westward along the northern limb of a very narrow syncline. If followed still farther they are found to continue westward for a short distance, then to swing northward again and finally to bend northeastward around the end of a broad westward plunging anticline which represents the principal structural feature of the so-called Franks syncline. Lower and lower beds are thus exposed as one travels eastward.

About one-half mile southwest of Franks, beds belonging to the upper portion of the Franks conglomerate are in faulted con-

\*Reeds, Chester A., Okla. Geol. Survey, Bull. 3, p. 49, 1910.

tact with the Hunton and Woodford formations. As already stated this fault dies out toward the east, so that in the eastern part of sec. 35, T. 2 N., R. 6 E., it lies within the Franks (that is, upper Franks is in contact with lower Franks); two miles farther east no faulting has been observed. In section 35, where the displacement diminishes so that the Franks conglomerate is present to the south of the fault, this formation is found to rest upon the Caney shale. On first examination the contact between the two formations appears to be one of conformity, but careful investigation discloses the fact that at most places the Caney shale is more highly folded than the Franks. If this contact is followed eastward lower and lower beds of the Franks are found in contact with the Caney and in sec. 6, T. 1 N., R. 7 E., a thin outcrop of Wapanucka, with its typical fauna, makes its appearance above the Caney. The point at which the Wapanucka first appears is very critical, but rock exposures there do not permit direct observation of the true relation of the strata, and evidence regarding this relationship must be secured from another source. Fortunately such a source is available.

In the west central part of sec. 6, T. 1 N., R. 7 E., a thin red limestone which carries a characteristic fauna is exposed in the basal beds of the Franks conglomerate. At the point just mentioned this stratum is about 465 feet above the Caney shale. The information to be gained by a thorough understanding of the stratigraphic position of such a key bed is of such importance that a very careful survey of its outcrop was made toward the east. Although there were short distances where it was so poorly exposed that the outcrop could not actually be followed by walking, the character, fauna, relations of overlying strata and the alignment of the exposed portions permits little doubt as to their identity.

Here, then, is the solution of the relationship between the Franks conglomerate and the Wapanucka limestone. Near the eastern edge of the Stonewall quadrangle the red limestone mentioned is found to rest just 15 feet below the Lehigh coal of the McAlester formation. The identification of this coal bed is based on its position near the top of the McAlester formation and on the presence of a very characteristic fossiliferous stratum, described by Taff, \* which rests upon the coal.

A section measured downward from the red limestone at this point shows a thickness of approximately 2,000 feet between it and the top of the Wapanucka limestone, and when it is remembered that in the western part of sec. 6, T. 1 N., R. 7 E. it is only 465 feet above the Caney shale and that the Wapanucka limestone is not there present, it is obvious not only that the formation is to be correlated with the upper part of the McAlester formation, but that it is part of an overlapping series.

In short, the lower part of the Franks conglomerate is to be correlated with the McAlester shale of Taff; it belongs to a position in the stratigraphic section far above the Wapanucka limestone, and has been erroneously correlated with the latter formation only because of the overlap which brings the upper part of the McAlester into contact with the Wapanucka, and, subsequently, the Caney, near Franks. However, only the lower part of the Franks is to be correlated with the McAlester formation. The upper portion, at least in part, is equivalent to the Savanna sandstone and the Boggy shale. The Franks syncline is so situated that the strata therein cannot be traced definitely into any formation higher than the Boggy, but there is evidence which indicates that some, and possibly all, of the formations between the Boggy and Ada formations may be represented within the syncline. This evidence rests on lithologic and faunal similarity; and as the fossils collected have not yet been fully identified, the writer hesitates to make any definite statement as to whether all or any of the formations above the Boggy are represented within the Franks syncline. In the hope of establishing a clearer understanding, however, it is desired to assume for the moment that some remnant of the true Seminole of Taff is represented within the Franks syncline.

It is to be borne in mind that a correlation of the Franks and Seminole conglomerates has been suggested. Although the authors of this hypothesis started with a conglomerate that is not equivalent to the Franks and correlated it with a conglomerate which is not equivalent to the Seminole, yet, if any remnant of the Seminole is assumed to lie within the Franks syncline, their conclusion as to the correlation of the two formations must be considered to be at least partially correct. In other words, since conglomeratic beds outcropping in the vicinity of Franks have been mapped over the entire area of the Franks syncline, any beds which are assumed to be present within the syncline are automatically assigned to the Franks. It is obvious that such a condition can only lead to confusion. If in addition to such an assumption an attempt is made to include within the Seminole all the conglomeratic strata above that formation, confusion becomes chaos. If the Franks conglomerate is to be thought of as representing the shoreward phase of all Taff's formations above the Hartshorne sandstone; if it includes the Seminole conglomerate; and if, moreover, the Seminole is to be thought of as including all the strata above it, so as to embrace the Pontotoc series, which includes the conglomerates at Sulphur; then all the formations of southern and east central Oklahoma above the Hartshorne sandstone which lie north of the Arbuckle Mountains and the Choctaw fault are to be considered as Franks or Seminole, depending on which of these supposedly synonymous terms are elected for use.

\*Taff, J. A., U. S. Geol. Survey Geol. Atlas, Coalgate Folio (No. 74), 1913.

Retention and use of the term Seminole, as defined by Taff, and the entire abolition of the name Franks, probably constitute the most logical remedy for this undesirable state of confusion. To apply this suggestion it would only be necessary to subdivide the strata of the Franks syncline into the several formations which they are thought to represent. It is realized, however, that there are grave difficulties attendant upon any attempt to abandon a term so well established as is the Franks; and, in view of its long use, it will probably be more satisfactory to retain the term Franks, but to retain it with restrictions that have not heretofore been applied. It is the writer's opinion that the term Franks should be restricted to the following Pennsylvanian strata: (1) those occurring in the type area, i. e., near the town of Franks and (2) those exposures of limestone conglomerates (and their immediately associated strata) which occur in the Arbuckle area and which, in common with the strata at Franks, have the three characteristics of being (a) fossiliferous, (b) highly folded and faulted, or both highly folded and faulted, and (c) non-arkosic.

Brief reference should be made to a small area which lies beyond the limits of the Stonewall quadrangle. This is the Mill Creek syncline of the Tishomingo quadrangle, which adjoins the Stonewall quadrangle on the south. The strata within this syncline are largely conglomeratic (although the basal limestones contain but few scattered pebbles) and were assigned by Taff to the Franks conglomerate. If we now return to the criteria used in distinguishing the conglomerates at Franks and Sulphur (see tabular form on page 10), a method is available for determining to which type (Franks or Sulphur) the strata of the Mill Creek syncline belong. The evidence is definite and is not to be denied; for even the most cursory examination of the Mill Creek strata shows that they are: (1) non-arkosic, (2) highly folded and faulted, and (3) very fossiliferous. Of the two possibilities, as to whether they are of Sulphur or Franks type, their characteristics clearly place them in the latter, but, as has been shown, an assignment to the Franks rather than to the Sulphur (Pontotoc) conglomerate means only that the beds are of comparatively early rather than very late Pennsylvanian age.

From a fossil collection taken from beds within the Mill Creek syncline, Moore\* identified *Meekella striatacostata*. The writer also found this fossil in the strata there, and although the form is generally supposed to indicate somewhat late Pennsylvanian, it seems entirely possible that this supposition is not well founded. *Meekella striatacostata* is a common fossil in the Fort Scott limestone of Kansas, which formation has been corre-

\*Moore, Raymond C., Am. Asso. Pet. Geol., Vol. 5, No. 1, p. 191.

### INTERPRETATION OF THE STRATIGRAPHIC POSITION OF THE FRANKS FORMATION.

Age	Formation	Taff 1903-4	Moore 1921	McCoy 1921	Morgan 1923
CARBONIFEROUS	Pontotoc			SEMINOLE or FRANKS	
	Ada*				
	Vamoosa*				
	Belle City* †				
	Francis*				
	Seminole		FRANKS		
	Holdenville				
	Wewoka				
	Wetumka				
	Calvin				
	Senora				
	Stuart				
	Thurman				
	Boggy				
	Savanna				FRANKS
	McAlester				
	Hartshorne				?
	Atoka				
	Wapanucka		FRANKS		
	Caney				
Sycamore					
Woodford					

\* New formations to be described in a forthcoming paper.

† Name by Boone Jones (Unpublished Mss.)

lated\* with the Calvin sandstone of east central Oklahoma. The Calvin sandstone occurs beneath the Wetumka shale, which lies below the Wewoka formation; and after a very careful study of the Wewoka fauna Girty concluded that it belonged at least as low as mid-Pennsylvanian. Apparently, therefore, *Meekella striatocostata* may be thought of as extending into or below middle Pennsylvanian and could not reasonably be taken to indicate a late Pennsylvanian age for the beds within the Mill Creek area.

In the course of the present investigation several collections were made from the Mill Creek syncline and at the top of the section was found one fossiliferous horizon which is thought to be highly important. This is a "Cup coral" zone such as is described by Goldston\*\* in his discussion of the Glenn formation, and such as occurs 15 feet below the top of the Boggy formation in the Stonewall quadrangle. The writer has never found such a zone within the Stonewall sheet except at the one horizon, and it is for that reason that the Mill Creek occurrence is considered to be of such importance. The principal "Cup coral" occurring within this supposedly contemporaneous zone both in the Stonewall and Mill Creek areas is *Campophyllum torquium*, and in both localities it is very abundant and attains a large size. If the evidence afforded by this zone is as important as it seems, it would appear that the Mill Creek section belongs to the Boggy and possibly older formations. This is in keeping with the correlation which has been suggested for the conglomerates at Franks and Mill Creek, and it also agrees with Taff's early reference of the strata of the Mill Creek syncline to his Franks conglomerate.

In conclusion, then, it may be said that:

1. The conglomerates at Franks and Sulphur are distinctly different in age, the latter belonging to the Pontotoc series.
2. The Pontotoc series, including the conglomerates at Sulphur, occurs several hundred feet above the Seminole conglomerate, and the two are not to be correlated.
3. The Seminole conglomerate, as defined by Taff, is a definite and mappable unit and should be retained as defined.
4. The Franks conglomerate represents the shoreward phase of the McAlester, Savanna, Boggy and possibly younger formations. In no way is it to be regarded as equivalent to the Wapanucka limestone. If the Franks conglomerate is

\*Idem, p. 39, also see Seibenthal, C. E., U. S. Geol. Survey Bull. 340, p. 191.

\*\*Goldston, W. L. Jr., Differentiation and structures of the Glenn formation: Am. Asso. Pet. Geol., Vol. 6, No. 1, p. 8.

regarded as containing, near its upper limits, the shoreward phase of beds higher than the Boggy, so that the Seminole conglomerate is included, the suggested correlation of the Franks and Seminole would be partially justified,—but only partly justified because the Seminole could be regarded as representing only a small portion of the Franks. By the same line of reasoning whereby the Seminole might be considered as equivalent to part of the Franks, all of the beds below the Seminole, down to and including the McAlester shale, might be assigned to that formation.

5. It is therefore suggested: (1) that the term Franks conglomerate be abandoned and that the strata comprising it be divided as nearly as possible into the formations which they represent; or (2) that the term Franks be used only in a restricted sense to apply to the Pennsylvanian strata in the type area around Franks and to those exposures of Pennsylvanian limestone conglomerates in the Arbuckle area which, in common with the strata at Franks, are found to be (a) fossiliferous, (b) highly folded or faulted, and (c) non-arkosic. Of the two suggestions, the first is more logical and, if rigidly applied, would soon end the confusion that now exists in regard to the formation. The second suggestion, however, has in its support the long use of the term Franks. It is a more general term and is, therefore, more easily applied. For these reasons it is probably desirable to preserve the term Franks; but if it is preserved, it must be limited in some manner, as here indicated.
6. The Strata of the Mill Creek syncline of the Tishomingo quadrangle are to be correlated with the beds at Franks, and are thought to represent the Boggy and possibly older formations.

