THE YEGUA PROBLEM

By

H. B. Stenzel

University of Texas Bulletin 3820

Pre-print release by Bureau of Economic Geology
The University of Texas, Austin, Texas

E. H. Sellards, Director

January, 1938

FOREWORD

Doctor Stenzel's report on "The Yegua Problem" consists of two distinct parts. One part treats the facts and observations in the field and laboratory. The other part treats the question of nomenclatorial procedure. The latter part raises a question in which many geologists will be interested. They are invited to make their opinions known to the Bureau of Economic Geology so that this question may be settled to their satisfaction, before the final printing of the report.

E.H.Sellards, Director

- - - - -

YEGUA PROBLEM

By

H. B. Stenzel

Acknowledgments

The present report contains observations which go back several years and were slow in the making. Recently the work was speeded up for presentation at the convention of the American Association of Petroleum Geologists in New Orleans. It would hardly have been possible to finish the work were it not for the cordial cooperation and help extended by friends and colleagues.

Paul L. and E. R. Applin, C. L. Baker, B. W. Blanpied and Roy T. Hazzard, Alexander Deussen, Julia A. Gardner, Marcus A. Hanna, W. B. McCarter, C. L.Moody, Helen J. Plummer, and A. C. Veatch have kindly helped and supplied needed information. The Committee on Geologic Names, U. S. Geological Survey, has assisted in the nomenclatorial question.

The writer wishes to express his thanks for their generous help.

INTRODUCTION

The beds of the Yegua formation represent a fairly well defined, although not entirely homogeneous, unit. The formation is composed of such rock types as lignites, lignitic shales, lignitic silty and sandy shales, and brown or gray lignitic sands. Among these the brown, silty or sandy, lignitic clay-shales predominate. All rock types occurring in the formation have the common bond of containing lignitic matter, although the content varies in wide boundaries from bed to bed. That the unit is a well defined one may be gathered from the fact that it took the early geological explorers of Texas but two years to outline the formation roughly and largely correctly from one end of Texas to the other. Particularly E. T. Dumble[1] recognized early that the sedimentary types of the Yegua belong together. William Kennedy[2] also noticed early the importance of silicified wood as a characteristic component of the Yegua beds. He wrote: "In many places they contain quantities of silicified wood, forming a strong contrast with the beautifully opalized wood of the succeeding deposits."

THE STRATIGRAPHIC PROBLEM

In spite of the well defined nature of the Yegua beds numerous difficulties have arisen. An illustration of the difficulties encountered may be related here. When the new geologic map of the State of Texas was being compiled by the United States Geological Survey it was found that geologists placed the lower boundary of the Yegua formation at different horizons, stratigraphically

---

1/ Dumble, E. T., The Cenozoic deposits of Texas: Jour.Geol., vol. 2, p.552,1894.

2/ Kennedy, William, A section from Terrell, Kaufman County, to Sabine Pass on the Gulf of Mexico: Texas Geol. Surv., 3d Ann. Rept., p. 59, 1892.

as much as 250 feet apart. As a result the location of the boundary lines on maps differed as much as 5 miles. Even the final edition of the map has not eliminated these discrepancies. Another result of this uncertainty as to the placing of the base of the Yegua is miscorrelations of beds. An example of these miscorrelations is to be found in F. B. Plummer's account of the Tertiary of Texas.[3] There the correlation of the central Texas with the east Texas Claiborne column is erroneous. The columns were taken from two authors who located the base of the Yegua in a different manner. As a result, the line which connects the base of the Yegua from one column to the other connects non-homotaxial beds. The Yegua-Crockett contact line should instead go nearly level between these two columns. These examples demonstrate that there is urgent need for revision or redefinition of the boundaries of the Yegua.

If the Yegua formation is a fairly well defined unit, why then do such difficulties arise? They are in a great measure due to the non-marine nature of the formation. Non-marine formations always have presented difficulties in correlation. One needs only to mention as classical examples of such problems the Wealdon of southern England and the Laramie problem in this country. The chief cause of our difficulties is that the Yegua formation has not yielded a marine fauna. We do not know how marine Yegua fossils would look if we had them and cannot compare them with those of the over- or underlying marine formations. Only in the Rio Grande region[4] does the Yegua carry some fossil shells. Oyster beds make their appearance there. But the fauna of these oyster beds is poor in number of species although it is rich in individuals, a condition characteristic of brackish water faunas. The beds contain perhaps only three or four

---

3/ Plummer, F. B., Cenozoic systems in Texas, in The Geology of Texas, Vol. I, pt. 3, Univ. Texas Bull. 3232, p. 612, 1932 /1933/.

4/ Trowbridge, A. C., Tertiary and Quaternary geology of the lower Rio Grande region, Texas: U. S. Geol. Surv., Bull. 837, pp. 131-132, 1932.

species which are merely brackish water forms and useless for stratigraphic correlation.[5]

Our present problem is therefore not so much the nature, composition, and origin of the Yegua formation itself as the location and nature of its upper and lower boundaries. In order to understand and define these boundaries it is necessary to study the under- and overlying formations in detail. Hence, the following pages are devoted largely to an account of the under- and overlying formations. In other words, I shall not describe but circumscribe the Yegua formation in the following pages.

LOWER BOUNDARY

The location of the lower boundary of the Yegua has been a problem of long standing. To attack the problem we will have to consider stratigraphic sections in east and central Texas.

The first section considered here is well exposed in east Texas along U. S. highway No. 75 in Madison and Leon counties[6] on the west side of Trinity River. Briefly the section is as follows: At the bottom are the non-marine Sparta sands, which are 250 feet thick and composed of lignitic sands and brown or gray, silty shales. The Sparta sands grade upward by interfingering into the Stone City beds,[7] which are about 80 feet thick and composed of glauconitic, sandy layers and some brown shales. The Stone City beds are at least partly marine and have yielded a characteristic fauna. A widespread disconformity cuts

---

5/ Kane and Gierhart seem to think that a more richly fossiliferous Yegua facies carries from Mexico into Texas. However, it is impossible to state definitely that these beds are not Crockett. Compare Kane, W.G., and Gierhart, G.B., Areal geology of Eocene in northeastern Mexico: Bull. Amer. Assoc. Petr. Geol., vol. 19, p. 1375, 1935.

6/ Stenzel, H. B., Geologic map of Leon County, Texas, scale 1:48,000: Bureau of Economic Geology, 1937.

7/ Stenzel, H. B., A new formation in the Claiborne group: Univ. Texas Bull. 3501, pp. 267-279, 1936.

off the top of the Stone City beds abruptly. Above this disconformity lies the Crockett[8] formation and higher up the Yegua. However, certain useful subdivisions of these formations may be recognized and mapped easily in this region. The first member above the disconformity is composed chiefly of gray, calcareous, fossiliferous, glauconitic, marine shales. Impure limestones, highly glauconitic beds, and various concretions are common but subordinate. This member is 70 feet thick and is called the Wheelock member (Ewk). The type locality is Wheelock Prairie in Brazos and Robertson counties where 80 years ago the first Crockett fossils were collected. These fossils were described by W. M. Gabb.[9] The Wheelock marls change upward partly by interfingering and partly by imperceptible transition into the Landrum shale member (Eld). The lower part of this member consists of black-brown, unctuous, non-glauconitic shales of brackish water origin with some interbedded lentils of calcareous, glauconitic, marine shales and glauconites. But these lentils are subordinate. Upward the Landrum shales become less unctuous and plastic and more silty. The black-brown, uniformly distributed color gives way to a speckled brown produced by lignitized plant remains. This upper part of the Landrum shale member is non-marine. The entire Landrum shale member is 110 feet thick. The type locality is Two-Mile Creek in southeastern Leon County, which flows through J. L. Landrum Survey. At the top the Landrum shales become sandy and are interbedded with sand beds of increasing thickness. This transition and interfingering lead over to the next higher member, the Spiller sand (Esp). The Spiller sand consists chiefly of gray or

---

8/ Crockett is used here as originally defined; compare Wendlandt, E. A., and Knebel, G. M., Lower Claiborne of east Texas, with special reference to Mount Sylvan dome and salt movements: Bull. Amer. Assoc. Petr. Geol., vol. 13, pp. 1347-1375, 1929. Some writers use Cook Mountain for Crockett. This is not advisable because the original Cook Mountain included the Crockett and the Stone City, two formations which are separated by a widespread disconformity.

9/ Gabb, W. M., Descriptions of new species of American Tertiary and Cretaceous fossils: Acad. Nat. Sci. Philadelphia, J. (2) 4, pp. 375-406, 1860.

brown, lignitic sands with some brown shale partings. The thickness is 105 feet. The type locality is near Spiller's Store in southeastern Leon County. Above the Spiller sand lies the Mount Tabor shale member (Emt), which consists of brown, partly calcareous shales. The shales contain subordinate beds of glauconitic marl and black, impure limestone, both rich in marine fossils. This member is apparently partly brackish and marine in origin. The thickness is about 45 feet. The type locality is at Mount Tabor School in northern Madison County. The Mount Tabor contains the stratigraphically highest marine Claiborne fauna of east Texas. The uppermost beds of the Mount Tabor contain in many localities a hard layer of glauconitic sandstone or calcareous clay ironstone. This bed forms a prominent cuesta in many places. All beds above this member are non-marine, although they combine to a thickness of 800 to 900 feet. At the base of these non-marine beds one finds a lenticular sand body, the Bryan sand. This sand thickens and thins and is even absent in some places. It thickens at the expense of the overlying beds. The greatest known thickness of 122 feet was encountered in Rio Bravo Oil Company Lanza No. 2 core test in Brazos County. This basal sand is gray, loose, cross-bedded, and lignitic; it is an important water-bearing horizon. The type locality is along State highway No. 21 from 2.1 to 3.75 miles west of the courthouse in Bryan, Brazos County. The beds above the sand are variable; but gray, brown, or greenish-brown, silty, lignitic shales predominate. Silicified wood makes its first appearance in these beds.

All geologists agree that these silicified wood-bearing beds belong to the Yegua; they also agree that the Wheelock member belongs to the Crockett (or Cook Mountain) formation. But where the members in between belong is not agreed upon.

If we want to draw a boundary between the Crockett (or Cook Mountain) on one hand and the Yegua formation on the other we have a great number of choices. We could place that boundary anywhere between the top of the Wheelock

member and the base of the Bryan sand. However, the boundary we choose must be not only convenient but also logical. Certain convenient places located at lithologic boundaries suggest themselves immediately.

(1) For instance, a possible place for that boundary would be the base of the Bryan sand. This choice has the advantages of placing all fossiliferous and marine beds in the Crockett and leaving the overlying Yegua well defined as an entirely non-marine formation, but it has the great disadvantage of including in the Crockett (or Cook Mountain) formation four unlike, marine and non-marine members. In that case the Yegua would be exclusively a non-marine formation, but the Crockett a mixed formation containing large thicknesses of non-marine beds.

(2) Another possible place for the boundary would be the top of the Wheelock member. In that case the Crockett (or Cook Mountain) would be a single unit of gray, calcareous, glauconitic, marine shales, but the Yegua would have in its lower part three different members, the Landrum, Spiller, and Mount Tabor. Two of these members would be marine or partly marine. This choice has evidently its advantages and disadvantages like our first choice.

(3) A third possible place would be the top of the Landrum member. This boundary would have the advantage of placing all sands in the Yegua and restricting the Crockett to a unit composed of shales only. But the disadvantage of this arrangement is that the upper part of the Crockett would contain lignitic, non-marine beds and the lower Yegua would contain some marine, calcareous, and shaly layers in the Mount Tabor member.

Any other place would have the disadvantage of leaving the Crockett as well as the Yegua composed of unlike, marine and non-marine members. All places proposed here and any other places that might be proposed have their advantages as well as their pronounced disadvantages. No matter where the boundary is put, we cannot restrict both the Crockett and the Yegua to lithologically uniform beds. One place is as good as another and it is impossible to decide in favor of any one

place on a reliable or scientific basis so long as we consider the lithologic composition of the beds alone. In order to arrive at a logical conclusion we must use other evidence besides lithologic composition. Such additional evidence is the fauna and flora of the beds and the study of available breaks in sedimentation. In the following pages I shall give four reasons for placing the Crockett-Yegua boundary at one particular level. For these same reasons any other level for the Crockett-Yegua boundary is definitely excluded.

The fauna of the fossiliferous members of this section is well known today, because extensive collections have been made at several localities. The fauna of the Wheelock member, for instance, is well represented at Little Brazos River in Brazos County.[10] It consists there of several hundred well defined species. The fauna of the lower Landrum is best collected in Two-Mile Creek near Two-Mile Negro Church[11] in Leon County, where numerous exposures afford a good insight into the stratigraphy of the Landrum. This fauna is also very rich and varied in number of species. The fauna of the Mount Tabor is difficult to obtain because the shales of this member leach and disintegrate very rapidly, so that

---

10/ Description of the location (Bureau of Economic Geology locality No. 21-T-1): On banks and in bed of Little Brazos River, from bridge of State highway No. 21 upstream for about 0.3 mile; 9.43 miles west of courthouse in Bryan by speedometer; in eastern part of W. Mathis Survey, Brazos County. Best available topographic map: Brazos River (sheet 1), State Reclamation Department, Austin, Texas, advance sheet. For list of fossils, see Renick, B. C., and Stenzel, H.B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, pp. 99-105, column 4, 1931. This locality is the same as No. 727 in Palmer, K.Van W., The Claibornian Scaphopoda, Gastropoda, and Dibranchiate Cephalopoda of the Southern United States: Bull. Amer. Pal.,no. 32 (vol. 7, p. 10), 1937. The description of locality No. 727 is given incorrectly in that book.

11/ The best locality is Bureau of Economic Geology locality No. 145-T-71: left bank of Two-Mile Creek at first ford above the Two-Mile Church, between the fence of Emma & E.J.Houston land and fence of Gary D. Woods 300-acre tract but in west corner of Emma & E.J.Houston land (said to belong to Mr. King), F.L.Landrum Survey, Leon County, Texas. Compare Stenzel, H. B., Geologic map of Leon County, Texas, Bureau of Economic Geology, 1937.

fresh exposures are scarce. However, fair collecting is found in Leon[12] and Burleson[13] counties.

The three members, Wheelock, Landrum, and Mount Tabor, have numerous species in common. Most of the abundant and some of the rare Crockett species range through all three members. Examples of the former are Dentalium minutistriatum Gabb, Corbula conradi Dall, Ficopsis texana Harris, and Latirus moorei Gabb. Some of the species which occur in only one member are restricted to a small region and do not range far horizontally in the member. Such species are obviously local.

The striking feature of the three faunas is their similarity. They are so similar that it is at present impossible to tell the three members apart by their fossils. The three faunas are also clearly lower Claiborne faunas and are easily distinguished from such upper Claiborne faunas as the one from the Gosport sand at Claiborne Landing in Alabama. The presence of such a uniform fauna from the base of the Wheelock to the top of the Mount Tabor makes it impossible to place the Crockett-Yegua boundary anywhere else but above the Mount Tabor beds.

Fossil plants are unfortunately very rare, and exploited localities are very few in spite of the diligent work of E. W. Berry and O. M. Ball. Such scanty data cannot give any reliable information for stratigraphic purposes. However,

---

12/ Best locality in Leon County is Bureau of Economic Geology locality No. 145-T-80: Right bank of dry branch in woods about 200 feet below fence and tank in south corner of F. C. Wilson 100-acre tract, Felix A. Richardson Survey, Leon County, Texas. (Above mentioned fence is probably the west line of the survey.) Compare Stenzel, H. B., Geologic map of Leon County, Texas, Bureau of Economic Geology, 1937.

13/ The following locality is important: Jonas Tarver 40-acre tract, near southwest corner of A. Kuykendall Survey, about 5 miles southwest of Stone City, airline distance, eastern Burleson County, Texas. Compare Renick, B. C., and Stenzel, H. B., The lower Claiborne on the Brazos River, Texas: Univ. Texas Bull. 3101, p. 98, 1931. The stratigraphic position of the locality near Edge, Brazos County, Texas, mentioned in that report, is doubtful. It might be Landrum.

the occurrence of silicified wood[14] is of importance to the problem.

Silicified wood or rather chalcedonized wood is common in some non-marine formations of the Coastal Plain, but is absent in others. For instance, the non-marine Wilcox is rich in silicified wood, but the equally non-marine Queen City and Sparta are apparently free of it. Silicified wood is a sensitive indicator of certain conditions of non-marine deposition. These conditions prevailed in Wilcox and Yegua times but did not exist during Carrizo, Queen City, and Sparta times.

Silicified wood has not been found in non-marine beds below the Bryan sand, such as the Spiller or upper Landrum beds, although these beds are non-marine and have a composition similar to some beds above the Bryan sand. This significant fact emphasizes the unity of the Yegua beds from the Bryan sand up. Therefore, the presence of silicified wood in these beds favors the location of the Crockett-Yegua boundary at the base of the Bryan sand.

Breaks in sedimentation, i.e., disconformities and the like, should be of utmost importance in this question. However, continued search for sedimentation breaks has failed to bring them to light in the Wheelock, Landrum, and Spiller section, although numerous fresh exposures are available in that region. The Mount Tabor and Bryan are not so well exposed, but even in this section no indication of a break was found. It seems to the writer that the entire Crockett-Yegua series of beds is a conformable sequence with interfingerings or gradual transitions between succeeding members.

A. C. Ellisor[15] has indicated that the Yegua overlaps certain underlying beds in Texas west of Angelina County. The place of this overlap in the section under discussion would be between the Mount Tabor shale and the Bryan

---

[14] The importance of silicified wood as a special facies marker for certain non-marine formations was pointed out to the writer by Dr. T.L.Bailey whose keen observations have contributed much to the knowledge of the Tertiary.

[15] Ellisor, A. C., Correlation of the Claiborne of east Texas with the Claiborne of Louisiana: Bull. Amer. Assoc. Petr. Geol., vol. 13, p. 1339, 1929.

sand. Should this overlap prove to be present, it would be a third and weighty argument for the placing of the Crockett-Yegua boundary at the top of the Mount Tabor.

A fourth argument for this particular location of the boundary is obtained by mapping these members across country. The writer has been able to do some reconnaissance mapping from Trinity River westward to beyond Colorado River. Fortunately this region includes important lateral changes in the composition and nature of the beds and contains some of the most important type localities of older formation names. The sections which we are going to compare now are the Leon and Madison County, the Robertson and Brazos County, and the Bastrop County sections. The four members, the Wheelock, Landrum, Spiller, and Mount Tabor, behave differently as they are traced westward. The Wheelock remains practically unchanged throughout the region. The Landrum member decreases in thickness rapidly. In Leon County it is 110 feet thick; in Brazos County at a distance of 45 miles from Leon County it has decreased to 50 feet without much change in composition. In Bastrop County, 60 miles to the west of Brazos County, the Landrum is still 50 feet thick. However, its composition has changed slightly to a more uniform, brown, gypsiferous or calcareous shale series containing a few silty shale beds at the base. The Spiller sand shows the most pronounced change westward. In Leon County it is 105 feet thick. In Brazos County it is 65 feet thick and has changed into a very clayey sand or sandy clay with few sand beds. This change apparently continues westward, because in Bastrop County the sand has practically disappeared. The only remnants of the Spiller that could be found were two or three sand beds of about 1 or 2 feet thickness which occur at the top of the Landrum shales interbedded with them. The Mount Tabor shales are 45 feet thick in Madison and Leon counties, but in Brazos County they attain a thickness of 165 feet. They continue as an important member westward and become

more calcareous and marine. In Bastrop County they are rather similar to the Wheelock member; nevertheless, brown-colored, calcareous shales still predominate in the Mount Tabor.

The Wheelock-Mount Tabor section along and south of Colorado River consists of a series of more or less calcareous shales, because the Spiller sand has disappeared and the Wheelock, Landrum, and Mount Tabor have become more similar. On the other hand, the contrast between the Wheelock-Mount Tabor section and the overlying Yegua beds has become more pronounced. The lower section is calcareous, marly, marine, and devoid of silicified wood; the beds above the Mount Tabor are non-calcareous, lignitic, non-marine, and rich in silicified wood.

In the region south of Colorado River no geologist has hesitated to place the Crockett-Yegua boundary at the top of the Mount Tabor member. It is the uniformly accepted boundary in that region. Were one to place the Crockett-Yegua boundary below the Mount Tabor, the result would be an impossible boundary. The lithologic differences within the Wheelock-Mount Tabor section are so slight that one could neither map nor use such a boundary. For these reasons all geologists have agreed on the location of the Yegua-Crockett boundary south of Colorado River.

We must determine the location of the Crockett-Yegua boundary in east Texas by the same criteria that we use to determine it in the region south of Colorado River. We cannot place the Mount Tabor in the Crockett in one region and in the Yegua in another. South of Colorado River the top of the Mount Tabor is the only possible place for that boundary. The same place must be chosen all along the strike. This is the fourth and perhaps most convincing argument for that particular location of the boundary.

At it happens, the location of the Yegua-Crockett boundary advocated here is exactly the same as that published by Wendlandt and Knebel[16] in 1929. The present study attests to the good judgment and insight of the field geologists who worked out the stratigraphy of that report.

UPPER BOUNDARY

In contrast to the lower boundary of the Yegua, the upper boundary has not presented such great difficulties until recently. Originally mistakes were made in the location of the upper limit of the Yegua in that here and there the brown shales of the Caddell formation of the Jackson were included with the Yegua. These errors in mapping have now been recognized. As a consequence the upper boundary of the Yegua in Texas is well known and well defined except for one instance which is to be discussed later on.

Some examples of the Yegua-Jackson contact in Texas may be described here in order to explain its features.

In Grimes County, the Yegua-Jackson contact is exposed in the road cuts 0.4 mile north of the store and road T at Keith. The Yegua consists there of poorly bedded to massive, brown, lignitic, silty mudstone or clay which contains some lignitized plant remains. The overlying Jackson is composed of loose, slightly glauconitic, gray sand and indurated, richly glauconitic, red sandstones which are well bedded. They rest on a wavy erosion surface which bevels the Yegua bedding in places. The boundary between the Yegua and Jackson is sharp; a transition does not exist. Glauconite grains occur in the Jackson only, lignitized plant remains in the Yegua only.

16/ Wendlandt, E. A., and Knebel, G. M., Lower Claiborne of east Texas, with special reference to Mount Sylvan dome and salt movements: Bull. Amer. Assoc. Petr. Geol., vol. 13, pp. 1347-1375, 1929.

In Brazos County, the freshest outcrops are in a deeply incised gorge of a right hand tributary of Hopes Creek, in the oakwoods on Phillip Hensarling's land in the northern part of James Hope Survey. There the uppermost Yegua consists of a massive, brown, silty clay which contains numerous twig-shaped pieces of dark brown clay. These may possibly be cavities produced by ancient plant roots and filled in during Yegua times. The upper boundary is uneven, wavy and clearly erosional. The Jackson above consists of soft, gray, marine sand with brown shale partings. The shale partings are well bedded but wavy; they are deposited on the ripple marks of the sands. Although the shale is uniformly brown it does not contain lignite fragments as the Yegua clay. A few feet above the contact, glauconitic sands appear in the Jackson section. Occasionally one finds borings extending from the Jackson into the Yegua for a few inches. Such borings are filled with Jackson materials.

The Yegua-Jackson contacts in Brazos and Grimes counties are very similar to some of the disconformable contacts which L. W. Stephenson[17] has described from the Cretaceous. Stephenson's article on the unconformities contains, in spite of its regrettable brevity, a wealth of information on the methods employed to detect Coastal Plain disconformities. Stephenson's criteria are particularly important because they are based on a wide experience and numerous observations in the field. The criteria are useful not only in the Cretaceous but also in the Tertiary. The Yegua-Jackson contacts are disconformities in the sense used by Stephenson and compare favorably with the Cretaceous disconformities discussed by that author.

Numerous other exposures in east Texas have similar Yegua-Jackson contacts. These disconformable Yegua-Jackson contacts are much too numerous to be explained as local, unrelated disconformities. They line up to form a widespread,

---

17/ Stephenson, L. W., Unconformities in Upper Cretaceous series of Texas: Bull. Amer. Assoc. Petr. Geol., vol. 13, pp. 1323-1334, 1929.

regional disconformity possibly representing a large time interval. This conclusion is very much strengthened by observations in Louisiana and Mississippi which are discussed below. Hitherto, authors have stated generally that the Texas Jackson overlies the Yegua conformably.

It seems, offhand, that such a clear-cut disconformity should make it possible to outline the top of the Yegua formation so definitely that difficulties should not appear. Nevertheless, large difficulties have arisen recently. They derive wholly from one locality on Sabine River in Texas. A clear understanding of that locality is of utmost importance in our problem. The locality is discussed in considerable detail here.

A. C. Veatch[18] investigated the outcrops along Sabine River with great care at a time when detailed observations of the Tertiary were rare. In his remarkable work the formations were mapped across the river from Louisiana into Texas. All outcrops along the river were described, mentioned, or located by numbers on the map. Of special interest to us are his localities 29 and 30. Locality 29 is above Robinson's Ferry; the exposure consists of a 6-foot shelf of dark-colored clay which belongs to the unfossiliferous, lignitic shales of the Yegua. However, Veatch used the name Cocksfield Ferry beds instead of Yegua in that report. Locality 30 is about three-fourths of a mile below Robinson's Ferry in the middle of a long west to east reach; the exposure consists of 5 feet of very fossiliferous blue clay, with two large concretions of hard, fossiliferous limestone. One of these concretions is over 5 feet thick. The outcrop yielded a rather extensive Jackson fauna. Veatch had not the least doubt about his mapping of the Yegua-Jackson contact on the banks of the river.

The next publication to cover the area is by Alexander Deussen.[19]

18/ Veatch, A.C., The geography and geology of the Sabine River, in A report on the geology of Louisiana: Louisiana Geol. Surv., vol. 6, pp. 101-148, 1902.
Important additional information was given by A. C. Veatch in a letter to H.B. Stenzel dated February 28, 1938.

19/ Deussen, Alexander, Geology and underground waters of the southeastern part of the Texas Coastal Plain: U.S.Geol.Surv., Water-Supply Paper 335, 1914.

Deussen's admirable report brought among other important data one addition to the outcrops on the Sabine River banks. He discovered a locality which was apparently not exposed at the time A. C. Veatch studied the river. This locality is one-quarter of a mile below Robinson's Ferry and lies between localities 29 and 30 of A. C. Veatch's report. The exposure consists of highly fossiliferous material. Alexander Deussen[20] wrote concerning this locality:

> "When I was doing the field work many years ago for this Water-Supply Paper 335, I was studying the section on Sabine River, and in the course of this study came to Robinson's Ferry.
>
> "The fossils that I listed on Plate IV that accompanies this paper, section exposed along Sabine River, were collected at this outcrop. The determinations were by Dr.Vaughan.
>
> "At the time I collected, the stage of the water was very low, and this exposure was on the right bank of the river and just above the water level and at the base of the bluff.
>
> "I am not aware that other people have made collections from this same locality, but I believe Miss Ellisor has been so much interested in the problem that they have made additional collections, but on this point I cannot be certain.
>
> "I do recall, however, that at the time I had very considerable argument with both Dall and Vaughan and they made a careful examination of the collections and decided that the material was Claiborne. It was for this reason that I included this locality in the Yegua and not the Jackson."

If this locality be actually Yegua it would be the only marine Yegua locality in Texas aside from the brackish water beds in the Rio Grande region.

Several years later the locality assumed great importance because J.A. Cushman and A. C. Ellisor[21] described a new species of foraminifer from it. They named the foraminifer Nonionella cockfieldensis, thereby indicating that it was supposed to come from marine Cockfield or Yegua. A.C.Ellisor has shown by careful subsurface correlations that the foraminifer is an important subsurface

---

20/ Letter to H. B. Stenzel dated January 31, 1938.

21/ Cushman, J. A., and Ellisor, A. C., Two new Texas Foraminifera: Contr. Cushman Lab. Foram. Res., vol. 9, pp. 95-96, pl. 10, 1933.

guide fossil in the Coastal Plain. The Nonionella cockfieldensis zone is generally called the Cockfield, although a fossil zone should not be called by a locality name like a mappable surface formation.

The assumption that the Nonionella zone is of Yegua age and represents the gulfward, marine equivalent of the non-marine Yegua at the surface rests entirely on the age determination of the fossil mollusks from Deussen's locality.

What are these fossils? Are they beyond a doubt Claiborne in age? A reexamination of this fauna in the light of present-day knowledge should obviously be crucial. Doctor Julia Gardner had the kindness to reexamine Deussen's original collection. She wrote[22] about this fauna:

> "We have always considered the molluscan fauna from Robinson's Ferry to be Jackson in age, and I see no evidence for a reversal of that opinion. The fauna includes close to a hundred species, the majority of them small. Lloyd G. Henbest was good enough to look at some of the siftings from the matrix in which the Mollusca occur, and he reports Nonionella cockfieldensis, so there is little doubt but that we are talking about the same locality. The number of opisthobranchs, pyramidellids, lucinoids, and leptonacids is unusually high, and, for one reason or another, I find these of very little use in an age determination such as this. The species most heavily weighted is a Turritella at least subspecifically identifical with arenicola Conrad from Moodys Branch, Mississippi. It is the most common of the univalves at Robinson's Ferry, and both juveniles and adults are represented by well-preserved individuals. Furthermore, Turritella arenicola and its subspecies, among them branneri Harris from White Bluff, is in the western Gulf among the most widely distributed of the diagnostic Jackson species. The specimens of young Calyptraphorus, too, are affiliated with the Jackson species rather than with that from Claiborne Bluff. The volutes are also juvenile and referable to the petrosa group, but they do not agree exactly with any of the described forms with which they have been compared. There is also a small and fairly common capulid which may be that referred by Veatch to Capulus americanus, but americanus is unsculptured and the Robinson's Ferry species is radially lirate. The curious Umbrella cited by Veatch has not been recovered in any of the later collections. The small and abundant Corbula, which is probably that referred to oniscus, is apprently new. So is the Periploma, which is also common and a good facies indicator. The difference in facies is probably a factor in explaining the want of similarity between the Robinson's Ferry fauna and the sandy-bottom fauna from Montgomery, Louisiana."

22/ Letter to H. B. Stenzel dated January 21, 1938.

In addition to the fossil mollusks, the microfauna of the same locality has distinct Jackson affinities. H. J. Plummer[23] stated that:

> "The faunal assemblage of that locality is strongly Jacksonian in the presence of the distinctive species Siphonina jacksonensis C. & A., Nonion inexcavatum C. & A., Nonionella hantkeni spissa C., and Anomalina dibollensis C. & A. These four species are abundant in the sample".

A list of the species from the type locality of Nonionella cockfieldensis Cushman and Ellisor, one-fourth of a mile below Robinson's Ferry, Sabine County, Texas (Ellisor collection), identified by H. J. Plummer is given here:

Nonionella cockfieldensis Cushman & Ellisor
Siphonina jacksonensis Cushman & Applin
Nonion inexcavatum (Cushman & Applin)
Nonionella hantkeni (Cushman & Applin) var. spissa Cushman
Glandulina laevigata (D'Orb.) var. ovata Cushman & Applin
Bulimina jacksonensis? Cushman & Applin (1 poor specimen)
Anomalina dibollensis Cushman & Applin
Pseudopolymorphina dumblei (Cushman & Applin)
Textularia dibollensis Cushman & Applin
Loxostoma claibornense? Cushman (1 specimen)
Hemicristellaria sp.
Eponides jacksonensis? (Cushman & Applin) (1 fairly good specimen that appears to exhibit the very oblique sutures of the Jackson form, but more material is necessary to confirm this tentative identification)
Guttulina sp.
Globulina sp.
Quinqueloculina sp.
Quinqueloculina sp.
Massalina sp.

J. B. Garrett[24] had shown sometime ago that Nonionella cockfieldensis is associated in Alabama with Jackson fossils, both small and large, in beds that always have been considered Jackson in age. The importance of Garrett's work lies in the stratigraphic section exposed at his locality. The locality is famous Claiborne Landing, Alabama. The microfauna listed by Garrett contains Nonionella

---

[23] Note to H. B. Stenzel on February 18, 1938.

[24] Garrett, J. B., Jr., Occurrence of Nonionella cockfieldensis at Claiborne, Alabama: Jour. Pal., vol. 10, pp. 785-786, 1936.

cockfieldensis and occurs in beds of the Ocala limestone. One of the beds in which it occurs is the well known "Scutella"-bed. These beds have always been regarded as Jackson in age and have been traced laterally into the Jackson.[25] They lie with a sharp boundary on the richly fossiliferous Gosport sand. The latter is the type of the upper Claiborne. Therefore, the Nonionella zone is at this place definitely younger than the upper Claiborne and is of Jackson age.

The list of fossils identified by J. B. Garrett is given below. To these should be added the echinoid Periarchus lyelli (Conrad) which is found in the so-called "Scutella"-bed.

Foraminifera:

Textularia dibollensis Cushman & Applin
Textularia mississippiensis Cushman
Textularia recta Cushman
Textularia sp.
Quinqueloculina longirostra D'Orbigny
Spiroloculina grateloupi D'Orbigny
Miliola saxorum Lamarck
Robulus alato-limbatus (Gümbel)
Robulus propinquus (Hantken)
Robulus sp.
Planularia truncana (Gümbel)
Marginulina sp.
Dentalina hantkeni Cushman
Nodosaria fissicostata (Gümbel)
Nodosaria latejugata Gümbel
Nodosaria vertebralis (Batsch)
Lagena sulcata (Walker & Jacob)
Guttulina irregularis (D'Orbigny)
Guttulina irregularis, fistulose var.
Guttulina spicaeformis (Roemer)
Globulina gibba D'Orbigny
Globulina gibba, fistulose var.
Globulina gibba D'Orbigny var. tuberculata D'Orbigny
Globulina minuta (Roemer)
Globulina munsteri (Reuss)
Globulina rotundata (Bornemann)
Glandulina laevigata D'Orbigny
Sigmomorphina jacksonensis (Cushman)
Polymorphina advena Cushman
Ramulina sp.
Nonion advenum (Cushman)
Nonion inexcavatum (Cushman & Applin)
Nonion micrum Cole

25/ Cooke, C. W., The age of the Ocala limestone: U. S. Geol. Surv., Prof. Paper 95, 1915.

Nonion planatum Cushman & Thomas
Nonionella cockfieldensis Cushman & Ellisor
Nonionella jacksonensis Cushman
Nonionella hantkeni (Cushman & Applin)
Nonionella hantkeni var. spissa Cushman
Camerina sp.
Operculina mariannensis Vaughan
Bolivinella sp.
Virgulina dibollensis Cushman & Applin
Bolivina jacksonensis Cushman & Applin
Bolivina sp.
Reussella eocena (Cushman)
Angulogerina ocalana Cushman
Trifarina bradyi Cushman var. advena Cushman
Discorbis assulata Cushman
Discorbis globulo-spinosa Cushman
Discorbis hemisphaerica Cushman
Lamarckina ocalana Cushman
Gyroidina soldanii D'Orbigny var.
Eponides jacksonensis (Cushman & Applin)
Siphonina advena Cushman var. eocenica Cushman & Applin
Siphonina cf. jacksonensis Cushman & Applin
Pulvinulinella exigua (H.B.Brady)
Globigerina sp.
Anomalina sp.
Planulina cf. byramensis (Cushman)
Cibicides americanus (Cushman)
Cibicides lobatulus (Walker & Jacob)
Cibicides mississippiensis (Cushman)
Cibicides pseudoungerianus (Cushman)
Cibicides yazooensis Cushman
Gypsina globula (Reuss)

Ostracoda:

Cytherella sp.
Cytherelloidea montgomeryensis Howe
Bairdia sp.
Paracypris franquesi Howe & Chambers
Cytheridea caldwellensis Howe & Chambers
Cytheridea grigsbyi Howe & Chambers
Cytheridea montgomeryensis Howe & Chambers
Paracytheridea belhavenensis Howe & Chambers
Cytheropteron montgomeryensis Howe & Chambers
Eocytheropteron spurgeonae Howe & Chambers
Cythereis deusseni Howe & Chambers
Cythereis florienensis Howe & Chambers
Cythereis gibsonensis Howe & Chambers
Cythereis hysonensis Howe & Chambers
Cythereis israelskyi Howe & Pyeatt
Cythereis jacksonensis Howe & Pyeatt
Cythereis montgomeryensis Howe & Chambers
Cythereis yazooensis Howe & Chambers
Cytheretta alexanderi Howe & Chambers
Brachycythere watervalleyensis Howe & Chambers

Faunal evidence bearing on the age of the type locality of the Nonionella zone proves it to be Jackson in age. However, this is not the entire problem, because even if the locality is Jackson in age according to the fossil content, one might argue the following conditions: the uppermost Yegua might be marine at that locality and of Jackson age although the Yegua lower down in the section is Claiborne in age. In other words, here might be exposed the natural transition from Claiborne to Jackson. It is then not sufficient to prove that the type locality of the Nonionella zone is Jackson in age. We must prove in addition that the Nonionella-bearing beds are not Yegua beds at all.

First of all, we should remember again that the Yegua-Jackson contact in east Texas is disconformable, representing probably a large time interval. This condition would make a transition from Claiborne to Jackson highly improbable.

The locality on Sabine River does not lend itself to any interpretation of that nature, because it is an isolated outcrop surrounded by alluvium. It is impossible to ascertain the relationship of the beds at that outcrop either to the Jackson downstream or to the lignitic shales of the true Yegua upstream.

Farther east, the best outcrop is the bluff on the east bank of Red River, below the ferry and west of the cemetery, about 1 mile south of Montgomery, Grant Parish, Louisiana. This excellent outcrop shows the Yegua and Jackson. The details of the section have been described by several authors.[26] They need not be repeated here.

The Jackson Moodys marl at Montgomery Bluff is characterized by several large foraminifera, Camerina moodybranchensis Gravell and Hanna, Operculina vaughani Cushman, Lepidocyclina mortoni Cushman, and Discocylina sp. A Gravell and Hanna. These large foraminifera are described in detail by Gravell

---

26/ Vaughan, T. W., A brief contribution to the geology and paleontology of northwestern Louisiana: U. S. Geol. Surv., Bull. 142, pl. 1, fig. 8, 1896.
Harris, G. D., and Veatch, A. C., A preliminary report on the geology of Louisiana: Louisiana Geol. Surv., Rept. for 1899, pp. 1-138, 1899.

and Hanna.[27] The foraminifera are found in a gray-green, richly fossiliferous, calcareous and glauconitic marl. The marl contains numerous large boulders. Boulders collected by the writer are up to 7 inches long and up to 4 inches thick; they weigh up to 5 pounds. Some, but not all, of the boulders are well rounded. The boulders are composed of a gray, dense, glauconitic limestone, which is probably of Tertiary age. Attached to the surface of the boulders are many sessile organisms. Such sessile forms are oysters, bryozoa, corals, and alcyonarians. These animals require a solid substratum for attachment and growth. In addition the boulders are pock-marked with numerous holes which were made by boring mussels. Complete bivalve shells are preserved in natural position in some of the holes. These boring mussels too indicate that the boulders were hard and exposed to the sea water at Jackton time. This condition obviously excludes any possibility that the boulders are concretions. They are undoubtedly eroded fragments of rocks older than the bed which encloses them. The limestone composing the boulders is not known to the writer as an outcropping bed. It is probable that it does not exist as an outcrop today, because it may have been entirely destroyed by erosion during Jackson time. The boulders may not have been moved a very long distance from their source;nevertheless, all were moved sufficiently to acquire some rounding. As the boulders are numerous, large, and heavy they must have required heavy wave action for transportation and erosion. Heavy wave action and numerous, large boulders could not have failed to erode deeply the ground over which they were moved. Or, to state the same idea in stratigraphic terms, wherever numerous,large boulders occur in marine Tertiary beds of the Coastal Plain there must be a large disconformity beneath. In this particular case the soft, sandy, lignitic shales of the underlying Yegua could not possibly

---

[27] Gravell, D. W., and Hanna, M. A., Larger Foraminifera from the Moody's Branch marl, Jackson Eocene, of Texas, Louisiana, and Mississippi: Jour. Pal., vol. 9, pp. 327-340, 1935.

have withstood the pounding of waves and boulders. A certain amount of the top of the Yegua must have been removed during Jackson time.

There are also other signs of a disconformity between the Jackson and the Yegua at Montgomery Bluff. Glauconitic marl is found below the basal, boulder-bearing bed of the Moodys marl. This glauconitic marl fills irregular, branching, pipe-like bodies which extend in any direction through the beds below the boulder-bearing horizon. Some pipe-like bodies are even vertical. They connect upward with the overlying glauconitic marl beds of the Jackson, but end blindly in the underlying beds. These pipe-like bodies are bore holes made by boring animals such as clams or crustaceans. They were made at the bottom of the Jackson sea in very shallow water and filled in during earliest Jackson time by sediment sifting in from above. These bore holes remind one of the pipes at the base of the Austin chalk which were figured by L. W. Stephenson.

The Yegua-Jackson contact is a disconformity in east Texas and adjoining Louisiana. Therefore, it must be conceded that the contact is also disconformable in Sabine River valley. Although the contact itself is not exposed in the banks of Sabine River it is most probable that the disconformity lies below the Nonionella-bearing beds. In that case the Nonionella zone belongs wholly to the Jackson on account of its fauna and its stratigraphic connection and is separated from the Yegua or Cockfield by a widespread disconformity.

The disconformity on which the basal Jackson rests has generally been overlooked. However, its widespread nature makes it a rather important stratigraphic break in the Coastal Plain. The disconformity is traceable eastward and appears to extend into Alabama.

At the well known outcrop in Moodys Branch at Jackson, Hinds County, Mississippi, the basal Jackson glauconitic, argillaceous sand rests on a wavy, eroded surface of the Yegua. The bedding in the Yegua is cut by the erosion surface. There is, of course, no transition between Jackson and Yegua at that

place; the boundary is sharp. This disconformity has already been suspected by W. H. Monroe[28] and indicated by Stephenson, Logan, and Waring.[29]

LATERAL BOUNDARY

We have now limited the Yegua in the stratigraphic section by defining its base and top. The revised Yegua is a convenient and natural stratigraphic division composed of non-marine beds and limited at the top and bottom by marine formations. As far as outcropping beds north of Colorado River are concerned, the Yegua represents an epoch of widespread recession of the Tertiary Gulf of Mexico. This epoch was preceded by the extensive, although fluctuating, marine ingression of Crockett time and followed by the widespread advance of the sea during early Jackson time.

By limiting the Yegua in this manner we have limited it to non-marine beds. As stratigraphy is based on marine fossils we do not have any direct means of obtaining the age of the Yegua, because it does not carry a marine fauna. Indirectly, of course, we have limited the age of the Yegua as younger than Crockett, which is lower Claiborne in age, and older than basal Jackson. Nevertheless, we would like to have a better stratigraphic determination of the age of the Yegua. A careful determination has quite recently been made by Blanpied and Hazzard.[30] Before their study C. W. Cooke had supposed, but not proved,

---

28/ Monroe, W. H., The Jackson gas field, Hinds and Rankin counties, Mississippi: U. S. Geol. Surv., Bull. 831, pp. 7-8, 1932.

29/ Stephenson, L. W., Logan, W. N., and Waring, G. A., The groundwater resources of Mississippi: U. S. Geol. Surv., Water-Supply Paper 576, generalized section opposite p. 28, 1928.

30/ Blanpied, B. W., and Hazzard, R. T., Structure and stratigraphy of the Hatchetigbee anticline and Jackson fault, Alabama: manuscript. Blanpied and Hazzard generously allowed the writer to read and use their manuscript. The paragraphs treating the Gosport are based on their report.

that the Yegua interfingers laterally with the marine and richly fossiliferous Gosport sand of western Alabama. This supposition was based on the occurrence of lignitic shale lentils or tongues in the Gosport sand at some outcrops.[31]

Such occurrence of lignitic lentils is in itself not a strict proof that the Gosport and Yegua interfinger, because such lentils occur in many otherwise strictly marine formations and the lentils were not definitely proved to be Yegua. Blanpied and Hazzard have supplied the proof by tracing the formations in considerable detail. Their work supports Cooke's conclusions fully. These two authors also had available a number of important core drill samples in Alabama. The samples showed the relationship of the Gosport and Yegua. In one core hole, for instance, the basal part of the Gosport sand showed an interbedding of fossiliferous greensand and gray-brown clays. Although the two formations interfinger, the Gosport is found above lignitic shales of the Yegua in all core holes. This means that only the uppermost parts of the Yegua are replaced by the Gosport, while the parts below persist unchanged for some distance eastward. However, these lower parts wedge out eastward gradually, so that at Claiborne Landing 17 feet of Gosport sand rest on beds equivalent to the Crockett of Texas.

These relations seem to indicate that only the uppermost Yegua correlates with the Gosport. That portion of the Yegua must be of upper Claiborne age. The parts below are probably also upper Claiborne in age although no accurate proof can be given. However, they may possibly but not probably be of lower Claiborne age, provided there is a transition between Crockett or Crockett equivalents and the overlying Yegua.

---

[31] Cooke, C. W., The Cenozoic formations: Geol. Surv. Alabama, Spec. Rept. 14, p. 273, 1926.

---------- Correlation of the Eocene formations in Mississippi and Alabama: U. S. Geol. Surv., Prof. Paper 140, p. 136, 1925.

Smith, E. A., Johnson, L. C., Langdon, D. W., Jr., Report on the geology of the Coastal Plain of Alabama: Geol. Surv. Alabama, p. 126, 1894.

THE NOMENCLATORIAL QUESTION

Hitherto we have considered only the factual evidence bearing on the Yegua problem. The problem consists not only of a factual or observational part but also of a nomenclatorial part. The nomenclatorial question is discussed in the following pages.

LUFKIN OR ANGELINA COUNTY DEPOSITS

The beds which we have called Yegua in the preceding part of this report were first given a separate name by Kennedy in May, 1892.[32] He called them the Lufkin or Angelina County deposits. Naturally at that time it was hardly possible to define the beds with much certainty and some misconceptions crept into his description. One must remember also that the time available to Kennedy was very limited. Houston County, for instance, was mapped within two months. The basal beds of the Lufkin deposits as he gives them are not the same everywhere, and as to his correlation of the basal beds Kennedy entertained considerable doubts which are clearly expressed in the paragraph at the bottom of page 59. Near Alto in Cherokee County the base of the Lufkin beds is given at places which we consider basal Sparta today. In Houston County,[33] the base of Kennedy's boundary rises in the section, according to our present interpretation of the stratigraphy, from basal Sparta to basal Landrum. It is to be expected that the lithologic description of Kennedy's Lufkin deposits reflects this condition. He writes at one place (p. 59) that they consist of gray, white and blue sands, sometimes laminated and cross-bedded, which indicates that possibly he had Sparta

---

32/ Kennedy, William, A section from Terrell, Kaufman County, to Sabine Pass on the Gulf of Mexico: Texas Geol. Surv., 3d Ann. Rept., pp. 41-125, 1892.

33/ Kennedy, William, Houston County: Texas Geol. Surv., 3d Ann. Rept., pp. 3-40, 1892.

beds in mind. On the other hand, he writes that in many places the deposits contain quantities of silicified wood, which indicates Yegua beds as we understand them now. However, this mix-up is for four reasons not so bad as it seems at first glance. First, the choice of Lufkin as the type place clearly indicates that Kennedy had the present-day Yegua in mind; second, the mix-up concerns only the basal part and not the bulk of his formation; third, he had already excluded the Cook's Mountain as a separate formation; fourth, the definition of the Yegua contains exactly the same mix-up. As his Cook's Mountain roughly corresponds to the Crockett, his mapping in Cherokee County is to be considered erroneous. Thus it appears that Kennedy gave the name "Lufkin or Angelina County deposits" to beds which correspond roughly to the bulk of the Yegua formation in the present report, although he may have included in the Lufkin certain upper members of the Crockett as we are defining that formation in the present report.

YEGUA DIVISION

E. T. Dumble introduced the name Yegua division for the beds at a later date[34] than Kennedy. The letter of transmittal of Kennedy's report is dated May 1, 1892; the letter of Dumble's report November 1, 1892. In addition to this dating by letter of transmission, Dumble himself stated in a later report[35] that his Yegua beds were proposed at a later date than Kennedy's Lufkin.

In the report on the brown coal and lignite of Texas Dumble renamed Kennedy's Lufkin or Angelina County deposits, calling them Yegua division. However, he used Kennedy's text almost word for word for the first two pages of his description of the Yegua. One will notice readily that Dumble's account of his

---

34/ Dumble, E. T., Report on the brown coal and lignite of Texas; character, formation, occurrence, and fuel uses: Texas Geol. Surv., 3d Ann. Rept., pp. 3-40, 1892.

35/ Dumble, E. T., The middle and upper Eocene of Texas: Texas Acad. Sci., Tr.11, pp. 50-51, 1911.

Yegua on page 149, top, to page 151, line 7, is almost an exact copy of Kennedy's report on pages 58 to 60. Dumble even mentions in one place, page 149, line 10 from bottom, "the upper portion of Lufkin deposits" which he failed to replace by his own term Yegua. In the succeeding pages Dumble gave his own account of the Yegua in the Brazos, Colorado, and Rio Grande sections. Thus Dumble was able to trace these beds nearly through the entire width of Texas. This admirable feat will always remain a monument to Dumble's energy and ability. Aside from this extension of the beds along the strike to the southwest, Dumble also corrected their age. Kennedy had considered the Lufkin deposits and the succeeding Fayette sands and Fleming beds as Miocene. However, on page 61 Kennedy stated that fossils found in the Fayette were referred to the Eocene by W. H. Dall on the strength of the existence of the cast of what appeared to be a Cardita planicosta. Dumble evidently drew the necessary conclusion from Dalls' determination and placed the Yegua and Fayette in the Eocene. Dumble recognized that his Yegua and Kennedy's Lufkin were exact equivalents. In a later publication[36] he stated:

> "In the Third Annual Report of the Geological Survey of Texas, Mr. W. Kennedy, in his paper on this Section from Terrell to Sabine Pass gives the details of the section as he made it from the Angelina River to Corrigan along the line of the H. E. & W. T. Ry. He describes the Lufkin or Angelina County deposits as extending from the Angelina River southward across the Neches River and the Fayette sand as extending from the south side of the Neches, where it overlay the Angelina beds, southward to and beyond Corrigan, where it was overlain by the Flemming clays. Later, when the Yegua beds were differentiated along the Brazos drainage, the Angelina beds were correlated with them, owing to their position above the recognized Marine beds and below the supposed Fayette, and the Flemming beds were called Frio."

Naturally Dumble had to make an error of correlation identical with that of Kennedy in Cherokee County, because Dumble used that part of Kennedy's report.

From all this it appears that Dumble's Yegua is a substitute name for Kennedy's Lufkin or Angelina County. Yegua was substituted without any reasons

---

36/ Dumble, E. T., The middle and upper Eocene of Texas: Texas Acad. Sci., Tr. 11, p. 50, 1911.

being given for that procedure. Possibly Kennedy's name was considered merely a local or temporary name among the members of the Geological Survey of Texas.

There are at present no rules to govern the choice of type localities for a geological formation. Kennedy did not give any type locality for his Lufkin or Angelina County deposits; but from the name he gave it, it is apparent that the type locality should preferably be located near Lufkin. That would place the type locality in about the middle of the Yegua as it is understood by the writer.

Dumble also did not designate a type locality for his Yegua in the report of 1892, which is not surprising because at that time type localities did not receive such strict attention as today. By a peculiar accident he even omitted in 1892 all mention of the localities along Elm Creek, a tributary of Yegua Creek in Lee County, although he designated these localities very definitely as type localities many years later.[37] There is little doubt that these localities were visited by Dumble before the appearance of his report on the brown coal and lignite of Texas, because in a later report[38] he stated that he took a party consisting of Messrs. Cragin, Kennedy, Singley, and Ragsdale through Lee, Washington, and Waller counties, leaving Austin May 16, 1892. This date is about 7 months earlier than the date of transmittal of the brown coal report, the latter being December 12, 1892.

The type localities of Dumble's Yegua are located, as he pointed out in 1920, along the basal boundary of his Yegua. At these localities there are found many fossiliferous layers, of which some belong to fossiliferous lentils in the basal part of Dumble's Yegua. These localities were visited and examined

---

37/ Dumble, E. T., The geology of east Texas: Univ. Texas Bull. 1869, pp. 102-106, 1918 [1920].

38/ Dumble, E. T., (Report of State Geologist for 1892): Texas Geol. Surv., 4th Ann. Rept., p. xxv, 1893.

critically by J. Gardner.[39] M. M. Stadnichenko[40] reported on the foraminifera and ostracoda of the localities. The writer has also visited these localities in Lee County and found that what Dumble called Cook's Mountain at that place is the writer's Wheelock member and what Dumble understood to be basal Yegua is lower Landrum by correlation. Dumble's original definition of the Yegua includes, therefore, the Landrum shale, the Spiller sand, the Mount Tabor shale, and the Yegua of the present writer. Had the present writer followed the original definition of the Yegua strictly he would have had to call the Wheelock member Cook's Mountain and to include all beds above the Wheelock member in the Yegua. Factual evidence discussed on preceding pages makes such procedure inadvisable.

COCKSFIELD FERRY BEDS

The next name applied to the beds was Cocksfield Ferry beds. This name was introduced by T. W. Vaughan in 1895.[41] Vaughan's work was in northwestern Louisiana. At that time Dumble's Yegua had not been traced eastward up to the east boundary of Texas. Therefore, Vaughan could not tie his section in with the Texas section and was fully justified in introducing a name for the unit which he recognized clearly. According to Vaughan the type locality of these beds is Cocksfield Ferry, about halfway between St. Maurice and Montgomery, which would put the type locality in about the middle of the formation as understood by the present writer.

39/ Gardner, Julia, The correlation of the marine Yegua of the type sections: Jour. Pal., vol. 1, pp. 245-251, 1927.

40/ Stadnichenko, Maria M., The Foraminifera and Ostracoda of the marine Yegua of the type sections: Jour. Pal., vol. 1, pp. 221-243, 1927.

41/ Vaughan, T. W., The stratigraphy of northwestern Louisiana: Amer. Geol., vol. 15, pp. 205-229, 1895.

Harris[42] and Veatch[43] were able to correlate the Louisiana and east Texas sections as early as 1902. This correlation was apparently the first of its kind. According to these two authors, Cocksfield Ferry and Jackson together correspond to the Yegua of east Texas. That the Jackson was thought to correspond with part of the Yegua is due to the fact that at that time no Jackson was known in east Texas. But these details are of no consequence to our present problem. The important fact is that Harris and Veatch were able to correlate the Cocksfield Ferry and Yegua beds roughly. By the time Alexander Deussen[44] investigated east Texas it was known that the Yegua of east Texas and the Cocksfield Ferry of Louisiana were stratigraphic equivalents. Throughout Deussen's report Yegua is used in preference to Cocksfield Ferry. Vaughan, who collaborated and discussed problems with Deussen for that publication, apparently recognized the priority of Yegua over Cocksfield Ferry.

In recent times the term simplified to Cockfield has been revived and is used even today by some writers. However, the term Cockfield has acquired two different, unrelated uses: one, the original use meaning the non-fossiliferous, sandy, lignitic, non-marine shales of Claiborne age; another, new use meaning the zone of Nonionella cockfieldensis Cushman and Ellisor, which is of Jackson age and probably separated from the original Cockfield by a disconformity of large size. To avoid confusion both usages of the term Cockfield should be dropped.

42/ Harris, G. D., The geology of the Mississippi embayment with special reference to the State of Louisiana, in A report on the geology of Louisiana: Louisiana Geol. Surv., vol. 6, p. 21, 1902.

43/ Veatch, A. C., The geography and geology of the Sabine River, in A report on the geology of Louisiana: Louisiana Geol. Surv., vol. 6, pp. 130-131, 140-141, 1892.

44/ Deussen, Alexander, Geology and underground waters of the southeastern part of the Texas Coastal Plain: U. S. Geol. Surv., Water-Supply Paper 335, 1914.

CONCLUSION

The three terms Lufkin, Yegua, and Cockfield have been used for the beds in question in the past. Today two of the terms are in more or less wide use. All three terms have their advocates. However, I believe few advocates of one term or the other have up to now had sufficient data at hand to judge correctly. Most certainly we should first consider and weigh the factual evidence, that is the observations in the field. This factual evidence is paramount and the name which we use must be adapted to fit the hard and unavoidable facts.

The retention of the name Yegua in this report should not be construed as an approval or commitment of any sort. On the contrary, the writer advocates the use of Lufkin as a name for these beds. The reasons for this preference are detailed in the nomenclatorial discussion in the preceding pages and are summarized below in table form. However, the writer has refrained from introducing Lufkin in a formal manner, because he feels that prior to such a nomenclatorial change the question should be brought to the attention of other workers interested in this problem. Nevertheless the writer might be permitted to point out that a decision should be made now, because postponement would increase confusion. It might also be pointed out that since a decision must be made it would be just as feasible to reintroduce the name Lufkin as to retain one of the other terms. The occasion for consideration of a change is now here.

SUMMARIZED NOMENCLATORIAL DATA

	Pro	Con
Lufkin or Angelina County Deposits Date: May, 1892 Author: W. Kennedy Type locality: Probably near Lufkin, Angelina County, Texas Definition: Same as Yegua	Priority over Yegua and Cocksfield Type locality lies in middle of the section Misuse of name almost entirely absent Description of beds independent; exactly the same as Yegua description	Common usage is nearly nil Redefining of boundaries needed
Yegua Division Date: Nov., 1892 Author: E. T. Dumble Type locality: Yegua Creek, Lee County, Texas	Common usage favors Yegua	Priority none Type locality lies in lower part of Crockett Misuse of name restricted to basal beds Description not independent; chiefly based on Lufkin description Redefining of boundaries needed
Cocksfield Ferry Beds Date: 1895 Author: T.W.Vaughan Type locality: Cocksfield Ferry on Red River, La.	Type locality lies in middle of the section Description clear, precise	Priority none Common usage is small Misuse of name common, for the *Nonionella cockfieldensis* zone of Jackson Redefining of boundary needed