Probable Reklaw Age of a Ferruginous Conglomerate in Eastern Texas

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By LLOYD WILLIAM STEPHENSON

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PROBABLE REKLAW AGE OF A FERRUGINOUS CONGLOMERATE IN EASTERN TEXAS

By LLOYD WILLIAM STEPHENSON

ABSTRACT

The suggestion is offered that ferruginous gravel and conglomerate in eastern Texas, apparently heretofore regarded by geologists as surficial rubble or terrace deposits of Quaternary or Recent age, is a basal bed of the Reklaw member of the Mount Selman formation (Eocene). The bed is composed of fragments of ferruginous sandstone, siderite concretions, and scattered fragments of hard quartzitic sandstone, in a matrix of coarse quartz sand, probably all mainly derived by reworking from the undifferentiated Wilcox group. These components range in form from angular to well water-worn. The cementing mineral of the conglomeratic facies of the gravel is mainly limonite. The evidence for the Reklaw age of the gravel and conglomerate is afforded by the following facts: The observed outcrops are all on or near the belt of outcrop of the Reklaw member as shown on the geological map of Texas, issued by the United States Geological Survey in 1937; the bed was observed passing under sand beds interpreted to belong to the Reklaw member at two localities; the apparent absence of similar gravels and conglomerates in the belt of outcrop of the Wilcox group where, as surficial rubble or terrace deposits, they would be expected to be present at different levels, may be considered negative evidence; it seems impossible to explain by the action of any Recent or near Recent drainage systems the transportation of coarse quartzitic sandstone clastics of the Wilcox group from their original position, for the distances of 5 to 20 miles to their present position, in gravels and conglomerates at upland levels.

If the ferruginous gravel and conglomerate here described is in fact a basal conglomerate of the Reklaw member from Nevada County, Ark., at least to Wilcox County, Tex., the merits of the unconformity thus indicated versus the unconformity reputed to be present at the base of the Carrizo sand, should be critically reviewed to determine which one should be accepted as marking the base of the Claiborne group. The need for a thorough restudy of the Wilcox-Claiborne relationships in central and northeastern Texas and in southwestern Arkansas is stressed.

INTRODUCTION

The facts presented and the suggestions offered in this paper are based mainly on field observations made in central and northeastern Texas and in southwestern Arkansas during the autumn of 1942 and the spring of 1943. The immediate purpose of the investigations was a search for additional reserves of aluminum ore (bauxite) in the sediments of the Wilcox group (early Eocene). Marc Miller, field assistant, United States Geological Survey, accompanied me in 1942 in Texas, and Watson H. Monroe, geologist, United States Geological Survey, spent several days with us in the field. In May 1951, in company with Joe Lang, ground-water engineer, United States Geological Survey, I examined several additional localities near Floresville, Wilson County, and in eastern Caldwell County. No important deposits of bauxite ore were discovered, but certain facts were recorded which may have bearing on the stratigraphic relations of the Wilcox and overlying earlier Claiborne sediments of the area.

As shown on the geologic map of Texas, issued in 1937 by the United States Geological Survey, the Wilcox and lower Claiborne section in northeastern Texas includes the Wilcox group (undifferentiated), unconformably overlain by the Carrizo sand of the Claiborne group, overlain in turn by the Mount Selman formation (Claiborne). Plate 3 of the present paper is essentially a copy (reduced one half) of part of the Texas map, showing the Wilcox and lower Claiborne section, except in Leon County where the boundary lines are based on the geologic map accompanying Stenzel's report (1939) on that county.

I was not able in the time at my disposal to make a thorough study of the beds immediately underlying the Reklaw member of the Mount Selman formation in northeast Texas. However, as indicated on the following pages, occasional exposures showed that the beds below the Reklaw are mainly irregularly bedded, fine to medium, light-colored sands, sandy clays, lenses of white clay, and interbedded carbonaceous clays and lignites. No sands approaching in coarseness the more typical Carrizo sand, and no exceptionally thick beds of sand, were observed. The Carrizo is mapped as a narrow band in northeast Texas and if present should be relatively thin. However, there seemed to be no satisfactory basis at the time for distinguishing representatives of the Carrizo sand from the underlying Wilcox group west and northwest of the Tyler basin and north of an undertermined point along the strike of the formations, possibly in Robertson County. However, the Carrizo has been identified in this area by other geologists, and it may be represented by a thin section of sands and clays above the undifferentiated Wilcox group.

During the investigations many outcrops of an indurated ferruginous facies of gravel were observed and recorded on or near the belt of outcrop of the Carrizo and Recklaw units, as this belt is shown on the accompanying geologic map (pl. 3), which is essentially a copy on a reduced scale of the part of the previously cited geologic map of Texas showing these units. However, corrections were made in Leon County, following Stenzel's geologic map of that area (1939, in pocket),

and, with Murray and Thomas' small-scale map as authority (1945, p. 48), an approximate boundary of the Paleocene and Wilcox group was added in the Sabine uplift area. The conglomerate is usually present as cappings on low hills and ridges which have been protected from erosion by the resistant character of this rock. The unindurated gravel was either removed by erosion or, if present, was generally not conspicuously exposed in its down dip extension in the smooth surfaces intervening between the hills and ridges. The conglomerate was traced from Van Zandt County to the northeast and east through Texas and far into Arkansas; from the same county it was traced to the southwest as far as Wilson County. Exposed sections showing the character of the materials above the gravel or conglomerate, as the case may be, are rare, but where they do occur they seem to afford satisfactory evidence that the gravel bed indeed marks the base of the Reklaw (see sections, pp. 33, 34).

THE GRAVEL AND CONGLOMERATE

CHARACTER

The lithologic character of the gravel bed has not been studied critically. Macroscopically it appears to be composed mainly of fragments of ferruginous sandstone, oxidized pebbles derived from siderite concretions, in a matrix of coarse, poorly sorted quartz sand. Scattered through the gravel are pebbles, cobbles, and even boulders as much as 1 foot or more in length, of hard, fine-grained quartzitic sandstone derived from rock of this kind known to be present in place in the Wilcox group (see pl. 4). These components range in form from angular through subangular to well-rounded; even the quartzitic sandstone pebbles may be completely rounded (pl. 4*A*). At given outcrops the quartzitic sandstone clastics may be rare, plentiful, or very abundant. The coarser of these components, and even much of the sand matrix, are believed to have been derived mainly from the clastics of the Wilcox group, but in part from the Carrizo sand where that unit is present above the Wilcox. The cementing material of the indurated gravel (conglomerate) is iron oxide, usually in the form of limonite.

DISTRIBUTION AND RELATIONSHIPS IN VAN ZANDT COUNTY

The gravel bed was first observed poorly exposed in a ditch of the old Grand Saline-Canton road and in an adjoining field, about 7.7 miles southwest of Grand Saline, 1.4 miles southwest of Clark School, 1.15 miles northwest of Star Church, Van Zandt County (see soil and road maps of the county), 4.5 miles northeast of Canton. Here the gravel bed crops out on a slope about 10 ft below the crest of a low ridge; it is very coarse, the pebbles, cobbles, and even boulders consisting mainly of more or less water-worn, very hard, fine-grained, quartzitic sandstone, as much as 1 ft in length, but in part of oxidized siderite concretions and fragments of ferruginous sandstone. No quartz pebbles were seen. Many of the quartzitic pebbles, cobbles, and boulders bear the fossil impressions of roots and rootlets. As was later determined, the source of these quartzitic clastics is large masses of this kind of rock in place in the undifferentiated Wilcox group 8 or 9 miles to the west in Van Zandt County.

Four-tenths to 0.8 mile southeast of the gravel outcrop just described, and 0.3 to 0.7 mile northwest of Star Church, a similar gravel bed, about a foot thick, indurated in part to ferruginous conglomerate, crops out near the crests of two low hills and is closely associated with impure pisolitic bauxite materials, samples of which were assembled for study in the laboratory of the United States Geological Survey. The pisolitic structure is present in the conglomerate and in clay underlying the conglomerate. On the geological map of Texas (1937) the two hills bearing the conglomerate and associated bauxitic materials appear to be mapped as an outlier of Carrizo sand. If beds of Carrizo age are present in these hills they would have to be represented by poorly exposed, nontypical, relatively fine, more or less silty, light-colored sands and interbedded clays which underlie the conglomerate. The necessarily brief field study made at the time did not yield satisfactory data for discriminating these light-colored sands and clays from the undifferentiated Wilcox group, nor for considering them as representing the Carrizo sand in this part of Texas. According to Wendlandt and Knebel (1929, pp. 1350, 1351) and Stenzel (1951, pp. 1818–1822), the Carrizo sand is present in northeastern Texas and is separated from the underlying Wilcox group by a pronounced stratigraphic break. The relationship of the gravel to underlying beds is not clearly seen in the hills northwest of Star Church, but a better section is afforded by an exposure in a road ditch on the northeast facing slope of the valley of Little Saline Creek 3.5 miles southeast of Star Church, 1.2 miles east of Oakland School, 7.4 miles northeast of Canton.

Section in road ditch 1.2 miles east of Oakland School, Van Zandt County, Tex.

	Feet
Mount Selman formation:	
Reklaw (?) member:	
Sand and clay, weathered	5
Sand and gravel, irregularly bedded, loosely cemented to sandstone and conglomerate; pebbles are mainly ferruginous sandstone and oxidized siderite in a matrix of coarse sand; several pieces of silicified wood and one loose pebble of quartzitic sandstone were observed	5
Unconformity (undulating, sharp contact).	
Pre-Reklaw beds:	
Sand and more or less sandy clay, rather evenly bedded, light-gray, stained to reddish and pinkish tints in upper 10 to 15 ft	25
	35

The gravel at this locality is similar to that at the localities northwest of Star Church, but lacks abundant pebbles and cobbles of quartzitic sandstone and does not display bauxitic structure. The gravel is 35 or 40 ft lower (aneroid determination) than the gravel on the hills northwest of Star Church, its lower position probably being due to a low regional dip to the east or southeast.

At a locality near Saline Creek, 2.3 miles northwest of the preceding, 1.1 miles east of Star Church, a road cut reveals 16 ft of thinly stratified fine greenish-gray slightly glauconitic sand, with interlaminated soft thin flaky ironstones; about 4 ft below the top is an irregular layer of concretionary ironstone. This is a fairly typical section of the Reklaw member of the Mount Selman formation, as developed west of the Tyler basin in northeastern Texas. The road cut was not deep enough by several feet to reveal the base of the Reklaw.

Because of a broad structural uplift, the Van uplift in eastern Van Zandt County, the beds forming the upper part of the Wilcox group are nearly flat-lying and immediately underlie the surface in an extensive area north of Neches River. The beds of the Reklaw member of the Mount Selman formation and the Carrizo sand (if present) have been removed by erosion from most of this area, but here and there indurated parts of the gravel bed have resisted erosion and formed low hills capped with ferruginous conglomerate. At such places the higher beds of the Reklaw, presumably once present above the conglomerate, have been removed by erosion. These outliers, with the exception of the one northwest of Star Church and one 5 miles southwest of Grand Saline which are mapped as Carrizo sand, are not shown on the geological map (1937). The locations of several of the unmapped outliers are indicated in the list given on page 39. The main belt of outcrop of the Reklaw member swings eastward around the nose of the Van uplift, extending from the vicinity of Martins Mills in south-central Van Zandt County, eastward to Neches River near the Smith County line, thence northward near the county line to the vicinity of Silver Lake in northeastern Van Zandt County. Several occurrences of the conglomerate were observed on or near this Carrizo and Reklaw belt as shown on the geological map (see pl. 3).

SECTIONS IN WOOD AND FRANKLIN COUNTIES

An exposure in a road ditch shows the character of the main body of the Reklaw in northeast Texas and is described below. The ditch does not cut deep enough to reveal the base of the member. The conglomerate was seen, however, near the crest of the east-facing slope of Cottonwood Creek, about 2 miles west of Golden.

Section in cut of U. S. Highway 69, 0.75 mile northwest of Golden, Wood County, Tex.

	Feet
Mount Selman formation:	
Reklaw member:	
Clay and sand, thinly laminated, light-colored, with interbedded flakes of ferruginous sandstone; weathered in upper part	6
Clay, sandy, thinly laminated, dark-gray, interbedded with fine sand, with many interbedded thin flakes of ferruginous sandstone; small filled borings give to it a peculiar spotted appearance; at the base is a very irregular layer of ferruginous, micaceous sandstone 2 to 10 in. thick	6
Sand, massive, light-greenish-gray, with many filled borings; filmy clay is scattered through the sand in fine detail	7
	19

The thin filmy flakes of ferruginous sandstone mentioned in the preceding section appear to be characteristic of the main body of the Reklaw member in northeastern Texas west and northwest of the Tyler basin. The section described below, if correctly interpreted, shows 25 ft of sand of the Reklaw member, underlain by 4 ft of basal coarse ferruginous sand and gravel, underlain in turn by 8 ft of pre-Reklaw sand and clay.

Section in road ditch near fork 5.25 miles north-northeast of Quitman, 2 miles north of Forest Hill School, 0.3 mile northeast of Clover Hill Baptist Church, Wood County, Tex.

	Feet
Mount Selman formation:	
Reklaw member:	
Sand, compact, fine, partly weathered, with scattered small flakes and films of ferruginous sandstone	5
Sand, fine, ferruginous, weathered	20
Sandstone, ferruginous, medium to coarse, irregularly bedded, and coarse conglomerate, with some reworked clay balls and a few pebbles of quartzitic sandstone	4
Unconformity.	
Pre-Reklaw beds:	
Sand and clay more or less weathered, light-colored, irregularly bedded, medium to coarse, in part arkosic	8
	37

Another section which shows ferruginous gravel and conglomerate beneath 25 ft of sand of the Reklaw member is exposed near Scroggins in Franklin County.

Section in ditch of north-south road, south-facing slope of Dry Cypress Creek Valley, 0.25 mile northwest of Scroggins, Franklin County, Tex.

	Feet
Mount Selman formation:	
Reklaw member:	
Sand, mostly massive, fine, in part argillaceous, gray, mottled with pink and yellow, weathered in upper part	25
Sand and gravel, irregularly bedded, in part indurated to conglomerate; observed one piece of quartzitic sandstone in the conglomerate and three loose pieces of quartzitic sandstone	2 to 4
Unconformity (undulating).	
Pre-Reklaw beds:	
Sand, light-gray, irregularly bedded, mostly loose, with minor clay layers and lenses	18
	47±

Outcrops of the gravel and conglomerate are particularly abundant in the vicinity of Scroggins, their distribution over a north-south belt about 6 miles wide probably indicating a decided flattening of the Reklaw beds in this area. The relationships of the beds in the two preceding sections seems to show that the gravel bed passes under fine sand referable to the Reklaw member.

PROBABLE EXTENSION INTO SOUTHWESTERN ARKANSAS

Occurrences of ferruginous conglomerate on or near the belt of outcrop of the Reklaw member of the Mount Selman formation (as mapped) between Franklin County and the Arkansas line are listed on pages 38–39. Beyond the Arkansas line outcrops of ferruginous conglomerate, usually containing pebbles and cobbles of quartzitic sandstone with impressions of rootlets, and in all respects like the gravels and conglomerates already described in Texas, were observed in Nevada County, Ark., southwest and northwest of Bodcaw, southwest of Mt. Moriah, east of Lanesburg, and north of Cale. They all occur in an area mapped as Wilcox formation (geologic map of Arkansas, 1929). They are in a belt trending from southwest to northeast obliquely across the strike of the Wilcox formation (as mapped), the stratigraphic position of the ones farthest to the northeast, east of Lanesburg, probably being less than 60 ft above the top of the Midway formation. If it is assumed that the conglomerate is correctly correlated with a basal conglomerate of the Reklaw, an overlap of the Claiborne group across the Wilcox group is indicated.

It is appropriate here to direct attention to a bed of impure bauxite in the southwest corner, sec. 32, T. 9 S., R. 19 W., 5 miles east of Gurdon, Clark County; indurated ferruginous portions of this bauxite strongly resemble the impure bauxite in the low hills northeast of Star Church, Van Zandt County, Tex. (pp. 32, 33), which suggests the possibility of their being at the same stratigraphic position. A few quartz pebbles were seen in the conglomerate in Arkansas.

Between the Texas-Arkansas line and Nevada County, Ark., the Eocene formations are largely covered with surficial Pleistocene and Recent deposits of the Red River and its tributaries, and in this gap no outcrops of conglomerate resembling the basal part of the Reklaw were observed.

SOUTH OF VAN ZANDT COUNTY, TEXAS

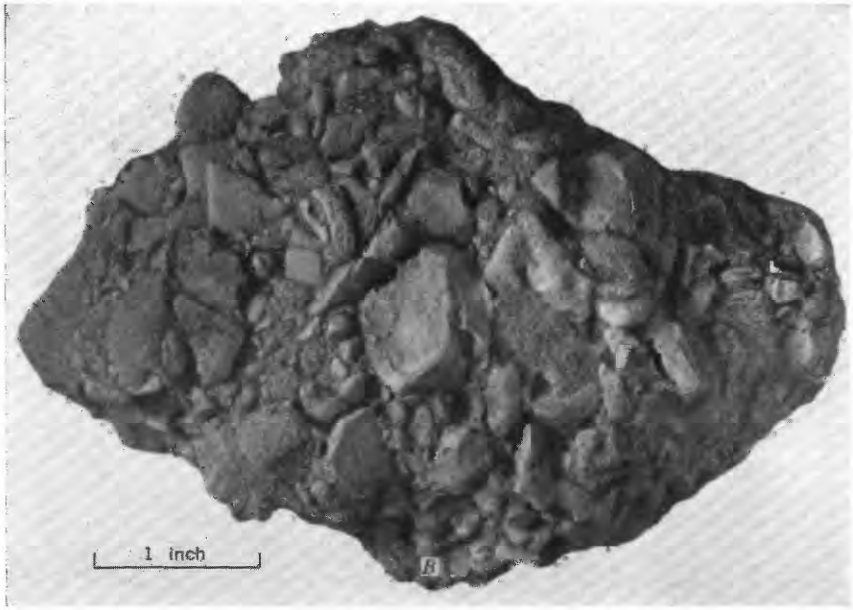
In Robertson and Milam Counties, Tex., several outcrops of light-colored sand, usually associated with more or less light-colored clay, were seen below the ferruginous conglomerate; these sands, in part moderately coarse, were not nearly so coarse as much of the typical Carrizo sand which, however, they may represent. A sand section that may represent the Carrizo is exposed in a cliff overlooking Little River Valley, north-northeast of Gause, Milam County.

Section in a cliff 2.9 miles north-northeast of Gause, Milam County, Tex.

	Feet
Mount Selman formation:	
Reklaw (?) member:	
Sandstone, ferruginous, with a band of basal conglomerate made up of pebbles of ferruginous sandstone, oxidized siderite, and quartzitic sandstone	10
Carrizo (?) sand:	
Sand, in part massive, in part laminated, with subordinate light-colored clay laminae, and with several indurated ferruginous bands	40
Sandstone, massive, light-gray, rather soft	30
Sand, poorly exposed, mostly unconsolidated, more or less laminated, more or less argillaceous	40
Concealed to base of slope	20
	140

The observed occurrences of the conglomerate in northeastern Texas west and north of the Tyler basin are all on or near the narrow belts of outcrop of the relatively thin "Carrizo" sand and Reklaw member of the Mount Selman formation (as mapped). This is true as far south as Lee County. In this direction the first evidence of the more typical sand of the Carrizo was observed 4.5 miles northwest of Tanglewood, Lee County, where fragments of very coarse, ferruginous sandstone were observed scattered about on the top and slopes of a low ridge. From this place southwestward the true Carrizo unit thickens and its belt of outcrop gradually widens to a maximum of about 10 miles in Atascosa County.

Gravel, usually indurated to ferruginous conglomerate, was observed here and there from the vicinity of Tanglewood in Lee County (pl. 4*A*, *D*), through Bastrop, Caldwell, and Gonzales Counties, as far west as a point 4 miles northwest of Floresville, Wilson County. Wherever seen, these outcrops occur on either the



SPECIMENS AND OUTCROPS OF FERRUGINOUS CONGLOMERATE, SAND, AND SANDSTONE

A. Basal ferruginous conglomerate from a ridge capped with the conglomerate, 2 miles northwest of Tanglewood, Lee County; includes a well-rounded pebble of quartzitic sandstone derived from the Wilcox group.

B. Basal ferruginous conglomerate from a roadside exposure 0.35 mile north of site of Pilot Knob School, Freestone County.

C. Irregularly bedded ferruginous sand and conglomerate (basal part of Reklaw?), in cut on U. S. Highway 84 at southwest edge of Reklaw, Cherokee County.

D. Masses of ferruginous sandstone and conglomerate (basal part of Reklaw?), in road-metal pit on a ridge about 2 miles northwest of Tanglewood, Lee County.

OUTCROPS OF QUARTZITIC SANDSTONE AND FOSSILIFEROUS FERRUGINOUS SANDSTONE

A. Mass of fine white quartzitic sandstone with root impressions, in a clay pit in the Wilcox formation, 4.4 miles northeast of Texarkana, Miller County, Ark.

B. Fossiliferous ferruginous sandstone (Eocene), overlain by ferruginous conglomerate (basal part of Reklaw?), south fork of Scruggs Creek, 4 miles north by east of Harwood (Gonzales County), in Caldwell County.

C. Upper surface of quartzitic sandstone in lower part of Wilcox group in a field near the highway, 3 miles southwest of Sulphur Springs, Hopkins County.

D. A mass of quartzitic sandstone near the highway, 3.5 miles southwest of Sulphur Springs, showing root impressions at the broken end, and pits marking the upper ends of root impressions.

western edge of the Reklaw belt or the eastern edge of the Carrizo belt (as mapped), their distribution along this restricted area tending to confirm their position as basal gravel of the Reklaw member. Here as farther north, pebbles of quartzitic sandstone from the Wilcox group are common in the conglomerate, even in its most westerly observed occurrence northwest of Floresville.

From Bastrop County southwestward through Caldwell, Gonzales, Guadalupe, and Wilson Counties, the outcrop area of the Carrizo sand is a thinly inhabited belt underlain by beds of sand, many of which are conspicuously very coarse. These sands form a relatively low, broad ridge characterized by infertile soils and supporting a cover of blackjack oaks and other sandhill vegetation. The alinement of the occurrences of the ferruginous conglomerate east of this belt along or near the western edge of the belt of outcrop of the Reklaw member seems significant.

The main body of the Carrizo sand lacks marine fossils, and its irregularly bedded sands, in part conspicuously coarse, suggest continental origin on a low coastal plain bordering the Eocene sea. There is evidence, however, that toward the end of the deposition of this sand body the sea advanced over its southeastern and southern edge along a coastline extending from Bastrop County through parts of Caldwell, Gonzales, and Wilson Counties, at least as far west as the vicinity of Leming in Atascosa County. In this shallow sea was deposited a relatively thin unit of ferruginous sand now bearing the imprints, and in places the undissolved shells, of marine fossils. The position of at least the lower part of this sand below the ferruginous conglomerate is shown by a section on the south fork of Scruggs Creek, described below. (See pl. 5*B*.) The geographic position of this fossiliferous sand shows that it must immediately overlie the main body of the Carrizo sand.

Section on south fork of Scruggs Creek just west of a north-south road, 4 miles north by east of Harwood (Gonzales County), in Caldwell County, Tex.

	Feet
Mount Selman formation:	
Reklaw ? member:	
Conglomerate, coarse, ferruginous, composed mainly of fragments of ferruginous sandstone and oxidized siderite concretions, but including pebbles of chert from the Edwards limestone and a few pebbles and cobbles derived from Wilcox quartzitic sandstone	1
Unclassified beds (Bigford?):	
Clay, red, ferruginous, weathered	2
Sandstone, ferruginous	3
Sandstone, rather soft, thin to moderately thick-bedded, somewhat irregularly bedded, ferruginous, micaceous, with fossil imprints in the lower 3 or 4 ft	9
	15

FOSSILS BELOW THE CONGLOMERATE (GARDNER'S REPORT)

The fossils collected from the section on Scruggs Creek have been identified and listed by Julia Gardner of the United States Geological Survey, whose report is quoted as follows:

Locality (2 collections) 18158 and 18187. South fork of Scruggs Creek near crossing of north-south road, 10.5 miles east-northeast of Luling, 4 miles northeast of Harwood (Gonzales County), in Caldwell County, Tex. (See road map of Caldwell County.) Collected by L. W. Stephenson and Marc Miller, December 3, 1942; Stephenson and Joe Lang, May 12, 1951.

Nuculanid, possibly a very large *Sacella;* similar to molds from localities 12468 and 12469.
Nuculanid cf. *Adrana aldrichiana* Harris from locality 12535.
Ostrea sp.
Modiolus sp.
Venericardia sp.; of moderate dimensions, more than usually convex, numerous ribs; common, and similar to those from locality 12535.
Diplodonta? sp., small, interior only; possibly *Abra* rather than *Diplodonta.*
"Cardium" sp. s. l.
Venerid?
"Tellina" sp. s. l. cf. *T. tallicheti* Harris.
Ensis? sp.
Spisula? sp.; small, trigonal, posteriorly rostrate; very abundant; cf. locality 12535.
Corbula sp. cf. *C. smithvillensis* Harris and *C. gregorioi* Dall.
Cadulus? sp.
Turritella? sp.; whorls large, finely sculptured spirally, strongly keeled about one-third of the distance back from the anterior suture.
Mold resembling a naticoid but with a varicose outer lip.
Ectinochilus? sp.; common, and similar to forms from locality 12535.
Distorsio? sp.; only a single mold.
Several indeterminate gastropod molds.
Volutocorbis sp., possibly several species; common; includes *V.* sp. cf. *V. lisbonensis* Aldrich.
Fragment of nautiloid.

The fossils listed are in a matrix of noncalcareous, ferruginous sandstone, flecked with small mica grains and a few clear and very small quartz grains. A yellowish mineral also present, which may be a form of iron oxide distinct from that which gives the brick red color to the rock. Hardness varying from soft granular to very hard. Fossils common but indicated by internal and external molds only. No shell substance preserved. This locality is strikingly similar both lithologically and faunally to locality 12535, 2 miles north of String Prarie, Bastrop County, Tex.

Gardner lists the fauna from the String Prairie locality and discusses the containing matrix as follows:

Locality 12535. East bank of Brushy Creek, 2 miles north of String Prairie, Bastrop County, Tex.

Nuculanid cf. *Adrana aldrichiana* Harris.
Nuculanid, possibly *Sacella.*
Arca sp. cf. *Anadara rhomboidella* Lea.
Arca sp. cf. *Barbatia ludoviciana* Harris.
Venericardia sp. cf. *V. densata* Conrad; fairly large for that species, very convex; very abundant.
Diplodonta sp.

Tellina sp. cf. *T. cherokeensis* Harris.
Tellina sp. s. l. cf. *T. tallicheti* Harris.
Abra? sp.
Corbula sp. cf. *C. gregorioi* Dall.
Spisula? sp.; small, trigonal, posteriorly rostrate; very abundant.
Ficopsis sp.
Ectinochilus? sp.; very abundant.
Pseudoliva sp.
Volutocorbis sp.; very abundant.

A coherent, noncalcareous ferruginous sandstone, the sand grains a clear quartz, with a red or yellowish red, probably argillaceous, dusty, interstitial filling. Fossils abundant but in the form of molds and impressions. A scattering of very small grains of mica.

Gardner reports upon fossils in the National Museum from several other localities along or near the belt of outcrop of the Reklaw between Gonzales and Atascosa Counties, as quoted below. The stratigraphic relationships of the containing matrix at these localities to the ferruginous conglomerate were not determined by the collectors.

Locality 18183. Three and one-half miles northeast of Harwood, Gonzales County, Tex.

Madracis sp.; by far the most common form.
Coral.
Nuculanids; mostly *Sacella; Adrana* possibly represented.
Ostrea sp., juvenile.
Crassatellites? sp.
Crassinella? sp.
Venericardia sp. or *Cardita* sp.
Protocardia gambrina Dall.
Abra? sp.
Corbula sp.; small, high, and numerous, suggesting *C. smithvillensis* Harris and *C. gregorioi* Dall.
Corbula sp cf. *C. texana* Gabb.
Cadulus sp.
"Natica" semilunata Lea s. l.
Fragment of shoulder of gastropod of moderate size.
Volutocorbis sp.

A calcareous, indurated mixture of ferruginous sand and fragments of shells broken before burial; the shell substance still preserved. No bedding evident or trace of any sediment pattern.

Locality 18185. Cemetery ridge at north edge of Belmont, Gonzales County, Tex.

Venericardia? sp.; fragments of strong radial sculpture that may possibly be *Cardium.*
Cardium? sp.; a many ribbed form that may be a *Cardium* of moderate size or *Venericardia;* no hinges.
Corbula sp. cf. *C. gregorioi* Dall in size and shape.
Volutocorbis sp.; rather coarsely ribbed.

An indurated sandstone highly ferruginous and highly fossiliferous along the well-defined bedding planes: beds about 0.5 in. thick marked by an occasional thin iron oxide crust and a high concentration of small fossils, mostly Corbulas. Fossils occurring only in the form of molds, no shell substance remaining. Little or no reaction to acid; surface minutely porous, specked with some light-yellowish mineral, possibly a form of iron oxide. Apparent porosity may be a form of micro-oolitic texture. Very fine flecks of mica and some minute clear grains of quartz.

Locality 18186. North edge of Belmont at south edge of cemetery, Gonzales County, Tex.

Venericardia sp.; a fragment of sculpture only.
Periploma? sp.
Parvilucina sp.
Corbula sp. cf. *C. gregorioi* Dall.
Eosurcula? sp.

Lithologic character similar in a general way to that of the matrix at locality 18185 but less indurated; not bedded conspicuously but with the same apparent porosity or micro-oolitic texture. All fossils in the form of molds only, and less concentrated.

Locality 12468. One-half mile above Willow Springs ranch house on Capote Hill road, Gonzales County, Tex.

Nucula sp.
Leda sp., possibly a large *Sacella.*
Arca sp., a single small mold.
Venericardia sp.; of moderate dimensions, more than usually convex, and having thirty ribs.
Lucinoid; fairly large, and concentrically corded.
Diplodonta; mold of interior only.
Venerid; decorated with crowded concentric lines; possibly *Cytherea.*
Ensis sp., very slender.
Corbula sp., possibly n. sp.
Sinum? sp.
Olivula? sp.; very slender.
Volutocorbis sp.
Turrids.
Levifusus sp. cf. *L. trabeatoides* Harris.

A noncalcareous red sandstone flecked with small mica grains and a few clear and very small quartz grains. A yellowish mineral also present which may be a form of iron oxide distinct from that which gives the brick-red color to the rock. Fossils common but indicated only by internal and external molds. No shell substance preserved.

Locality 12469. Boulders near Toudouze's ranch house, 3.5 miles north and 1.5 miles east of Leming, Atascosa County, Tex.

Nuculana, possibly a *Sacella* similar to that at locality 12468.
Arca sp.; fairly small.
Venericardia sp.; small, 1½ to 2 mm in diameter and about thirty ribs.
Lucinoid.
Venerid.
Abra? sp.
Corbula sp. cf. *C. gregorioi* Harris; faint posterior radial lineation.
Turritella sp.; very small.
Uzita? sp.
Volutocorbis sp.
Turritid.

Red calcareous quartz sandstone and calcareous concretions, containing possibly a few scattered grains of glauconite. Sandstone dense and hard to break. Concretions very dense, fine-grained, probably a calcareous clay, seamed with crystalline calcite and embroidered in patterns of dendritic manganese. Shells common and firmly embedded; when an attempt is made to remove them, they often break across the shell or leave the external surface on one fragment and the internal surface on the other. Concretions apparently barren.

Locality 12467. One-half mile south of Toudouze's ranch house, 4 miles northeast of Leming, Atascosa County, Tex.

Madracis sp.
Balanophyllia? sp.
Nuculana sp. cf. *N. corpulentoides* Aldrich.

Modiolus (*Mauricia*) sp. cf. *M.* (*M.*) *houstonius* Harris.
Ostrea sp.
Venericardia (*Venericor*) sp.; of moderate dimensions, more than usually convex; common.
Lucinoid?; closely threaded and of moderate size.
Diplodonta sp.
Tellina sp. cf. *T. cherokeensis* Harris.
Mactroid or venerid.
Abra? sp. cf. *A. nitens* Conrad.
Venerid.
Ensis sp.; similar to *E. lisbonensis* (Aldrich) but smaller.
Corbula sp. cf. *C. deusseni* Gardner; possibly n. sp.
Corbula sp. cf. *C. gregorioi* Dall.
Architectonica? sp.
Turritella sp.
Sinum sp.
Nassoid.
Buccitriton texanus (Gabb)?; common.
Levifusus sp.
Buccinoids.
Indeterminate gastropod.
Pseudoliva sp.
Mitra? sp.
Ancilla punctulifera (Gabb)?
Volutocorbis sp. cf. *V. lisbonensis* (Aldrich).
Volutocorbis sp.; probably immature.
Cancellaria? (*Trigonostoma*) sp.
Turrids; probably 3 species.
Turrid; cf. *Eopleurotoma*.
Terebra sp.

A noncalcareous ferruginous sandstone similar in appearance and mineral content to that from String Prairie and from 4 miles northeast of Harwood. Apparently, the shell substance is replaced in part by some iron compound; the molds obtainable from such replacements are sharper than molds formed by leaching only.

Locality 12534. Toudouze's pasture, 0.5 mile west of the ranch house, 4 miles northeast of Leming, Atascosa County, Tex.

Coral.
Barbatia sp.; a single cancellate form.
Venericardia (*Venericor*) sp.; similar to those from locality 12467 and also common.
Abra sp.; similar to those from locality 12467 but only a single indivdual; cf. *A. nitens* Conrad.
Corbula sp. cf.; *C. gregorioi* Dall.
Naticoid.
Phos? sp.
Levifusus sp.
Volutocorbis sp. cf. *V. lisbonensis* (Aldrich).
Ancilla sp. cf. *A. punctulifera* (Gabb).
Cancellaria (*Trigonostoma*) sp.
Turrids; probably 3 species.
Eosurcula? sp.
Cylichna sp.

A very fine-grained sandstone, containing a green mineral, probably glauconite, but little or no mica and few or no clay minerals; reacting feebly to acid in areas from which the shell substance has been leached; strongly, of course, if the shell substance is still retained. Very much harder than the sandstone at locality 12467.

ANALYSIS OF THE FAUNAL ASSEMBLAGES

Gardner discusses the foregoing collections of fossils as follows:

With the exception of some of the material collected near Toudouze's ranch house in Atascosa County, the fossils are preserved in the form of interior molds and, less commonly, as exterior molds. Such material offers unsatisfactory grounds for generalization.

Among the most abundant species present are a very low, transversely elongated nuculanid and a small *Rimella*-like form, possibly *Ectinochilus*, but with a less persistent axial sculpture than that of *E. texanus* (Harris), and apparently distinct from the subspecies *planus* of Harris. They are recorded only at two localities: one is 4 miles northeast of Harwood (collections 18158 and 18187), and the other 2 miles north of String Prairie (loc. 12535). The two species, the pelecypod and the gastropod, are exceptionally well characterized and conspicuously abundant at these two localities. They should be easily recognizable in imperfectly preserved and fragmentary material, but apparently they are undescribed and are unrecorded in the National Museum collections from the Wilcox and lower Claiborne of east central Texas.

The general similarity in the lithologic character of the matrices from which the fossils here listed have been taken makes any theory involving distinct facies seem dubious, but positive evidence is wanting of any age difference between the faunas containing the abundant and probably new species and the other faunas. Only two positively identified species, *Protocardia gambrina* Dall and *"Natica" semilunata Lea*, are listed, and both are from the locality 3.5 miles northeast of Harwood (loc. 18183); neither of them is restricted to a limited horizon. But both the component species and the assemblages most closely resemble the forms and faunas of the lower Claiborne, and all are contained in highly colored ferruginous clastics. Forms so abundant as the two species in question must have made their record elsewhere and, when discovered, their new associates may give the missing clue to a more exact determination of age.

Because of the similarity of their stratigraphic positions above the Carrizo sand and the similarity of the ferruginous beds partly composing them, the Reklaw and Bigford members of the Mount Selman formation have heretofore been regarded as contemporaneous. The geographic and stratigraphic positions of the fossiliferous, ferruginous sandstones north of Leming in the vicinity of Toudouze's ranch house, Atascosa County, suggests that they represent the eastward extension of the Bigford member from northern Frio County. If this is true and if the Leming and the Scruggs Creek localities should prove to represent the same zone, then, on the assumption that the conglomerate is the basal part of the Reklaw, it would appear that the Bigford is not the exact equivalent of the Reklaw, but is older and intervenes between the Carrizo sand and the Reklaw. Unfortunately the available fossil collections do not afford conclusive paleontologic evidence either for or against this possible stratigraphic relationship.

OUTCROPS OF CONGLOMERATE EAST OF TYLER BASIN

The bauxite investigations were not extended to the east side of the Tyler basin, that is, the west flank of the Sabine uplift. However, the Eocene formations shown on the geological map of Texas (1937) along the northwest side of the basin are also indicated as present on the east side where they dip gently to the

west and northwest into the basin. The undifferentiated Wilcox group is represented as cropping out in a broad area on the main part of the Sabine uplift; the Carrizo sand appears around the western and southern edge of the Wilcox area as a belt generally less than 2 miles wide but widening on the southwest flank of the uplift to a maximum of 9 miles. Paralleling the Carrizo belt on the west and south is the Reklaw member of the Mount Selman formation, whose belt of outcrop is generally narrow, but which widens in places to a maximum of about 10 miles.

The type area of the Reklaw member of the Mount Selman formation is the town of Reklaw and vicinity in east-central Cherokee County near the southwest corner of Rusk County. In the course of a hasty trip to Reklaw I saw these exposures:

On U. S. Highway 84, in Rusk County, 0.6 mile east of Reklaw, a cut shows 15 ft. of greenish-gray marine sand, weathering to yellow, brown, and reddish brown, strongly glauconitic in the upper part, sparingly glauconitic in the lower part; a few streaks of clay are present in the lower part; the sand contains a few poor imprints of shells. Presumably this is a typical section of the Reklaw member.

On the same highway at the southwest edge of Reklaw a long cut in the slope leading down to the bottom land of Mud Creek reveals the following section (pl. 4 *C*):

Section on U. S. Highway 84, in cut at southwest edge of Reklaw, Cherokee County, Tex.

	Feet
Sand, ferruginous, weathered	10
Lenses of sand and gravel, ferruginous, irregularly bedded, indurated in part to conglomerate; a few pebbles of quartzitic sandstone present	2 to 4
Unconformity.	
Sand, light-colored, rather loose, irregularly bedded, crossbedded, medium to fine	3 to 5
	17±

It was not possible at the time to determine satisfactorily the age of the gravel and conglomerate in this section. Because of the proximity of the section to Mud Creek the conglomeratic bed and the sand above it perhaps would be most apt to be considered a Pleistocene terrace deposit. However, this section is at a topographically lower level than the typical section of the Reklaw member 0.6 mile east of the town of Reklaw, and the possibility that the conglomeratic bed is a basal bed of the Reklaw member, which passes to the east beneath the main body of the member, seems worthy of consideration. Such a possibility seems strengthened by the finding of similar ferruginous conglomerates on or near outliers of the Reklaw (as mapped) at the following localities in central and northern Rusk County:

State Highway 64, 3.5 miles west by north of Henderson, about 0.3 mile east of Brumley Creek; State Highway 323, in cut on hill 3.2 miles northwest of Henderson; several outcrops along State Highway 322, between Craig, 7 miles, and Monroe, 14 miles, north of Henderson.

LIST OF CONGLOMERATE LOCALITIES

Localities at which the ferruginous gravel and/conglomerate or either were observed north, northwest, and southwest of the Tyler basin are listed below. Pebbles, cobbles, and in places boulders, of quartzite derived from beds of quartzitic sandstone in the Wilcox group were seen in the gravel or conglomerate at many places; failure to note their presence does not necessarily mean that they were absent, for they were found at nearly every locality at which a careful search was made for them. Impressions of roots and rootlets were common in the quartzitic sandstones. Pebbles of chert derived from the Edwards limestone were seen in the conglomerate only in Caldwell and Wilson Counties. The position of the conglomerate facies was generally at upland levels, many of them actually being on the divides between stream systems.

Observed Occurrences of Ferruginous Gravel and Conglomerate in Texas, Exclusive of East Side of Tyler Basin

CASS COUNTY:

- Low hill about 3.5 miles northwest of Alamo Mills, 4 miles north of Springdale. Altitude about 300 ft.
- Two localities on public road, 2.5 and 3 miles northeast of Douglasville. Altitude about 280 ft.
- Four localities on public roads near New Hope School, 0.5 mile southwest, 0.4 mile and 0.9 miles north, of New Hope School, which is 1.7 miles north of Marietta. These localities appear to be near the 350-ft contour.
- Two localities on public roads, 2 and 4 miles northwest of Marietta. These localities are near the 325-ft contour.

MORRIS COUNTY:

- Public road 1.3 miles north of Naples; noted pebbles of quartzitic sandstone. Altitude 425+ ft.
- Two localities in public road, 0.9 and 1.5 miles north by west of Naples. Altitude about 400 ft.
- Two localities in public road, 1 and 1.5 miles north by west of Omaha. Altitude about 400 ft.
- North-south public road, just north of Little Boggy Creek Valley, 4.5 miles southwest of Omaha.
- East-west road just east of Prayer Branch, 5.5 miles southwest of Omaha.

TITUS COUNTY:

- Public road, 0.8 mile northwest of Cookville.
- East-west public road, 1.8 miles south by west of Cookville.
- Two localities on public road, east and west of Swananloe Creek, 4.6 miles south by west of Cookville; numerous pebbles of quartzitic sandstone noted.

CAMP COUNTY:

- Public road, 1.4 miles north of Pittsburg.
- East of north-south road, 2.2 miles north of Pittsburg.
- East of St. Louis Southwestern Railway, north of branch of Big Cypress Creek, 4 miles north of Pittsburg.
- Two localities on public roads, 3 and 4 miles north-northeast of Pittsburg.
- Public road, southeast-facing slope, 0.2 mile southeast of New Hope Church, 4.5 miles northwest of Pittsburg; quartzitic sandstone pebbles noted.
- Public road 1.5 miles north of Leesburg.

FRANKLIN COUNTY:

About 0.25 mile south of Missouri–Kansas–Texas Railroad near county line, about 1 mile west of Newsome (Camp County); pebbles of quartzitic sandstone noted.

Public road just south of Scroggins.

North-south public road, south-facing slope of Dry Cypress Creek, 0.25 mile northwest of Scroggins; quartzitic sandstone pebbles noted; thickness 2 to 4 ft. See section on page 34.

Public road, 4.5 miles north by west of Scroggins.

Four localities on north-south roads, 2.7, 3.5, 3.7, and 3.8 miles north-northwest of Scroggins.

Two localities on east-west public road, 2.6 miles and 3.3 miles northwest of Scroggins.

Cut on State Highway 11, about 0.9 mile northwest of Winnsboro (Wood County); many cobbles and boulders of quartzitic sandstone.

HOPKINS COUNTY:

State Highway 11, 0.75 mile northwest of Franklin County line; coarse ferruginous sand and conglomerate fills a channel 5 ft deep in fine ferruginous sand and sandstone.

Same highway 5.6 and 6.2 miles northwest of Franklin County line.

Two localities just north of Wood County line, 4 and 4.3 miles west of Winnsboro (Wood County).

WOOD COUNTY:

State Highway 11, 2.4 miles east of Winnsboro; many cobbles and boulders of quartzitic sandstone.

Same highway at Chalybeate, 3.7 miles east of Winnsboro and 0.5 mile east of Chalybeate.

Same highway 6.1 and 6.3 miles east of Winnsboro.

Same highway at Camp County line.

North-south road 0.2 mile north of State Highway 11, 6 miles east of Winnsboro.

State Highway 37, 0.85 and 2.55 miles south-southwest of Winnsboro.

Same highway, 3.25 miles south-southwest of Winnsboro; thickness 1 to 2 ft; many cobbles and boulders of quartzitic sandstone with root and rootlet impressions.

North-south road, 10.5 miles north of Quitman.

Low hill, 0.25 mile west of Coke, 9 miles north of Quitman; cobbles and boulders of quartzite are abundant.

Four additional localities within 0.8 mile west and northwest of Coke.

North of northeast-southwest road, 2.7 miles west by south of Coke.

East-west road ditch, 2 miles north of Forest Hill School, 5.25 miles north-northeast of Quitman; thickness 4 ft; quartzitic sandstone pebbles noted. See section on page 33.

Public road, 5 miles north by east of Quitman, 0.2 mile northwest of Clover Hill Baptist Church; thickness 1 to 4 ft.

Public road, 0.85 mile north-northwest of Quitman.

Public road, 4.1 miles north-northwest of Quitman.

Public road, 5.4 miles north-northwest of Quitman.

Three localities in public road, 3.4, 4.6, and 5.1 miles east of Alba.

Near east-west private road to lignite mine, 3 miles south by east of Alba.

U. S. Highway 69, 1.85 miles south-southeast of Alba.

Near crest of east-facing slope of Cottonwood Creek Valley, 2.1 miles west of Golden; thickness about 1 ft; quartzitic sandstone pebbles noted.

VAN ZANDT COUNTY:

Ridge 2.5 miles east by north of Grand Saline; thickness 2 to 3 ft; cobbles of quartzitic sandstone noted.

Hill south of road, overlooking Sabine River Valley, 4.5 miles northeast of Grand Saline; thickness several feet; pebbles of quartzitic sandstone noted.

East-west road, 2.5 miles east-southeast of Grand Saline, 0.6 mile south of Texas and Pacific Railroad; pebbles and cobbles of quartzitic sandstone noted; thickness several feet.

Near public road, 2.7 miles southwest of Silver Lake.

Public road, 2.8 miles southwest of Grand Saline.

Northwest-southeast ridge, 2.9 miles southwest of Grand Saline.

Hill, 4.8 miles southwest of Grand Saline, 1.4 miles south by west of Antioch Church.

Old Grand Saline-Canton road, 7.7 miles southwest of Grand Saline, 1.4 miles southwest of Clark School; pebbles, cobbles, and boulders of quartzitic sandstone abundant in the poorly exposed gravel. See page 32.

Low hill, 7.7 miles southwest of Grand Saline, 0.3 to 0.7 mile northwest of Star Church; ferruginous, pisolitic glomerate about 1 ft thick with pebbles and cobbles of quartzitic sandstone underlain by impure bauxitic material.

Road ditch in northeast-facing slope of valley of Little Saline Creek, 7.6 miles south by west of Grand Saline, 1.2 miles east of Oakland School; pebble of quartzitic sandstone noted; thickness 5 ft. See section on page 32.

Road ditch, 7.1 miles south of Grand Saline, 1.2 miles south by west of Corinth Church.

Road ditch, 8.2 miles south by east of Grand Saline, 0.9 mile north of Glower School.

Public road, 11.8 miles south by east of Grand Saline, 1.8 miles east of Colfax.

Public road, 4 miles northeast of Ben Wheeler, 1.6 miles east by north of Bethlehem School; thickness 2 ft.

Four localities on State Highway 19 as follows: 3 miles south of Canton; 7.2 miles south of Canton (altitude about 540 ft.); 7.6 miles south of Canton (altitude about 560 ft), quartzitic sandstone boulders noted; 12 miles south of Canton, 1.6 miles north of county line at abandoned club house (altitude about 500 ft.).

East-west road, 0.3 mile west of State Highway 19, 0.3 mile north of Henderson County line. Altitude about 520 ft.

SMITH COUNTY:

Questionable, on the Van-Garden Valley road, 4.2 miles east of Van (Van Zandt County).

HENDERSON COUNTY:

North-south road, 1.2 miles south of Athens.

FREESTONE COUNTY:

Public road, 6.8 miles east by north of Fairfield, 0.35 mile north of site of Pilot Knob School; pebbles of quartzitic sandstone common.

Public road, 1.6 miles south by east of Turlington.

Road ditch, 3.2 miles east of Dew, about 0.9 mile east of site of Burleson Hill School.

Road, 1.1 miles south-southeast of site of Burleson Hill School.

ROBERTSON COUNTY:

Hill near road, 2.3 miles north of Easterly.

Cut on U. S. Highway 79, 2.8 miles northeast of Easterly.

Franklin-Bremond road, 1.5 miles northwest of Franklin; pebbles of quartzitic sandstone noted.

Calvert road, 1.6 miles west-southwest of Franklin.

MILAM COUNTY:

Cliff overlooking Little River Valley, 2.9 miles north-northeast of Gause; quartzitic sandstone pebbles noted. See section, page 34.

Road, 2.2 miles northeast of Gause, 0.5 mile northwest of International and Great Northern Railroad.

Along and near road, 1.2 miles northwest of Gause.

Ridge near road, 1.2 miles west of Gause, west of Pinoak Creek.

LEE COUNTY:

Two localities on U. S. Highway 77, 1.4 and 1.9 miles north of Tanglewood.

Ridge, 2 miles northwest of Tanglewood; pebbles of quartzitic sandstone noted (pl. 4*D*).

North of road, 2.5 miles west by south of Lexington; quartzitic sandstone pebbles noted. Altitude about 400 ft.

BASTROP COUNTY:

Public road, 4.2 miles west by north of Rosanky, 0.3 mile north of Missouri–Kansas–Texas Railroad. Altitude about 500 ft.

Piney Branch, north of northwest-southeast road, 1.6 miles north-northwest of Rosanky; 425-ft contour, 80 or 85 ft lower (down dip) from the preceding.

Road, 3.5 miles west by south of Rosanky. Altitude about 450 ft.

CALDWELL COUNTY:

McMahan road 1.4 miles west by north of Delhi; quartzitic sandstone pebbles noted. Altitude about 520 ft.

East-west road, 4.6 miles north-northeast of Harwood (Gonzales County), 11.3 miles east-northeast of Luling, west of a small branch of Sandy Creek; quartzitic sandstone pebbles and a few chert pebbles from the Edwards limestone noted. Altitude about 420 ft.

Scruggs Creek just west of north-south road, 4 miles north by east of Harwood (Gonzales County), 10.5 miles east-northeast of Luling; quartzitic sandstone pebbles noted. See section on page 35. Altitude 425 ft.

East-west road, 2.5 miles north by east of Harwood (Gonzales County), 9.4 miles east by north of Luling; quartzitic sandstone and chert pebbles noted. Altitude 475 ft.

North-south road, 1.5 miles north by west of Harwood (Gonzales County). Altitude about 425 ft.

GONZALES COUNTY:

U. S. Highway 90, 1.5 miles west of Harwood; quartzitic sandstone pebbles noted. Altitude about 375 ft.

Hill south of road overlooking Guadalupe River Valley, 3 miles west-southwest of Belmont. Altitude about 440 ft.

WILSON COUNTY:

A draw on a side road northeast of Highway 181, 3.8 miles northwest of Floresville; pebbles of quartzitic sandstone and chert from the Edwards limestone noted.

SOURCE OF QUARTZITIC PEBBLES AND COBBLES

One of the distinguishing lithologic characteristics of the gravel and conglomerate throughout the extent of its occurrence in Texas and Arkansas is the presence in it of more or less waterworn transported pebbles, cobbles, and even boulders of very fine-grained quartzitic sandstone, many of them bearing the impressions of roots and rootlets. Quartz pebbles are rare or wanting. The quartzitic pebbles and cobbles may be rare or abundant at given localities. They are especially abundant in the vicinity of Winnsboro in northeastern Wood County, Tex., where the quartzitic cobbles and boulders abound in such numbers that they have been utilized in the construction of stone fences, the walls of buildings, and in outlining walks and flower beds. The nearest observed source of this quartzitic sandstone to Winnsboro is in the vicinity of Sulphur Springs, Hopkins County (see map, pl. 3), where both southwest and east of the town masses of this kind of rock occur in place in the lower part of the Wilcox group (pl. 5). If there are no nearer sources, the distances these rocks were transported are 15 to 25 miles.

Other observed occurrences of the quartzitic sandstone in place in the Wilcox group in Texas are: 3.3 miles south by west of Emory, near a school house, in Rains County, a low hill capped by a more or less fractured and disturbed, but essentially continuous, layer of quartzitic sandstone 2 to 4 ft thick, showing many impressions of rootlets; just east of a cemetery, 8 miles west of Canton, 1.2 miles southeast of Caney Church, Van Zandt County, many large, loose boulders of quartzitic sandstone essentially in place, showing the impressions of roots and rootlets; ledge of typical quartzitic sandstone in north-facing slope of Walnut Creek Valley, 1.5 miles south of Malakoff, 600 ft west of road, Henderson County; masses of typical quartzitic sandstone with root impressions along road 1.5 miles west by north of Goetz, 13 miles east-northeast of Streetman, Freestone County; loose pieces of the quartzitic sandstone were observed at several places on the outcrop of the lower part of the Wilcox in western Freestone and southern Limestone Counties, probably indicating the occurrence of this rock at undetermined places in those areas; in northeastern Texas, south of U. S. Highway 67, 0.4 mile southwest of Simms, Bowie County, many large boulders of quartzitic sandstone essentially in place.

In Arkansas quartzitic masses bearing the impressions of roots and rootlets were observed in place in the lower part of the Wilcox formation at the following localities: at the surface and in clay pits 3.5 to 4.5 miles north-northeast of Texarkana, within 2 miles north of U. S. Highway 67 (pl. 5*A*); south of State Highway 4, 3.5 miles east-southeast of Hope, Hempstead County; road ditch two miles west by north of Sutton, 5.4 miles south-southeast of Emmet, Nevada County. Most of the quartzitic masses both in Texas and Arkansas were low in the Wilcox, but some appeared to be at higher levels.

Wherever seen in place the quartzitic sandstone bore the impressions of roots and rootlets, a characteristic later found to be useful in identifying the transported pebbles and cobbles in the gravels and conglomerates.

SIGNIFICANCE

Apparently the gravels and conglomerates described on preceding pages have been regarded heretofore as nothing more than Quaternary terrace deposits or surficial accumulations of rubble locally cemented with iron oxide to a conglomerate. The facts here recorded

seem to justify attributing to this bed a more important place in the Tertiary section of the western Gulf region. The alinement of the observed occurrences of this bed (114 localities west and north of the Tyler basin in Texas) on or near the narrow belt of outcrop of the Reklaw member of the Mount Selman formation is one outstanding fact. Another significant fact is the inclusion throughout the length of this bed of transported, more or less water-worn pebbles, cobbles, and, in places, boulders derived from beds of quartzitic sandstone bearing root impressions, in the undifferentiated Wilcox group. The resistant character of the conglomeratic portions of the bed has resulted in their preservation as outliers on low hills from which younger, softer beds have been removed; for this reason, sections showing the relation of the bed to overlying beds are rare, but two sections showing the gravel and conglomerate overlain by finer sands believed to be part of the Reklaw unit are described on pages 33, 34. Because of these facts the suggestion that the gravel and conglomerate form a basal bed of the Reklaw member and mark a widespread unconformity in the Eocene series should be given a more thorough field test than I was able to give it at the time.

During the course of the investigations the belt of outcrop of the main body of the undifferentiated Wilcox group was crossed transversely at many places between Bowie County in the northeast and Wilson County in the southwest. It is noteworthy that no outcrops of ferruginous conglomerate resembling the conglomerate described on previous pages were observed on the Wilcox belt except along its eastern edge adjacent to the belt of outcrop of the Reklaw member. If the ferruginous conglomerate is nothing more than surficial rubble or a Quaternary terrace deposit, it would seem reasonable to expect that this kind of conglomerate would be present at many place and at different levels in the Wilcox belt. Stream gravels of late Tertiary or Quaternary age observed at a few places were usually easily distinguishable from the gravels here presumed to mark the base of the Reklaw. The former have terrace-like profiles along stream valleys and a greater variety of pebbles, many of which were derived from more distant sources. The belt of outcrop of the Queen City sand member of the Mount Selman east and southeast of the Reklaw belt seemed also to lack occurrences of ferruginous conglomerate, but this area was not so extensively explored as was the Wilcox belt.

Is it possible that the ferruginous conglomerate marks the base of the Claiborne group? Should this question be answered in the affirmative, it would mean that the true Carrizo sand should be classed as Wilcox, for it lies stratigraphically below the conglomerate from Lee County at least as far to the southwest as Wilson County. Should the zone from which fossils were collected at the Scruggs Creek locality and near String Prairie be found to represent the Bigford member of the Mount Selman formation, then the Bigford would fall within the Wilcox group, for this zone also lies below the conglomerate.

Berry (1922, pp. 3, 4) correlated both the Carrizo sand and the Bigford member of the Mount Selman formation with the Wilcox group on the basis of fossil plants. Trowbridge, Deussen, and Murray and Williams also accepted this age determination, but most other authors have regarded the Carrizo as the basal formation of the Claiborne group in Texas. This opinion seems to have been based in part at least on the existence of an unconformity at the base of the Carrizo sand, which has been recognized by Trowbridge (1923, p. 91), Deussen (1924, p. 57), Wendlandt and Knebel (1929, pp. 1350, 1351), Getzendaner (1930, p. 1435), Plummer (1933, p. 613), Stenzel (1939, p. 64; 1951, pp. 1818–1822), and others. However, if the presence of an unconformity (or disconformity) marked by a basal gravel and conglomerate can be satisfactorily determined at the base of the Reklaw unit, and this unconformity can be traced from Nevada County, Ark., to Wilson County, Tex., a distance of 450 miles, its importance as a stratigraphic boundary is obvious. The relative merits of this unconformity and the one at the base of the Carrizo sand as marking the base of the Claiborne group should be reviewed, giving critical consideration to the soundness of the evidence on the basis of which the Carrizo sand has been correlated with the Claiborne group. The paleontologic evidence as interpreted by Gardner seems to favor the Claiborne age of the ferruginous fossil-bearing sandstone beneath the ferruginous conglomerate at the Scruggs Creek locality in Caldwell County. But the fossils from this locality and from all the other localities studied by her in the present connection are poorly preserved, and among them all not one species known to be restricted to a limited horizon has been identified. The evidence for the Claiborne age of these faunas would seem, therefore, to fall considerably short of finality. As Gardner has already explained (p. 37), her opinion is based largely on the Claiborne aspect of the fossil assemblages. It should be emphasized that the fossils from only one of the localities studied by Gardner, the Scruggs Creek locality, were observed to be stratigraphically below the ferruginous conglomerate. There is, however, strong paleontologic evidence that the collection from near String Prairie came from the same zone as the Scruggs Creek collection. The relationships of all the other collections to the conglomerate, whether above or below it, remain to be determined.

In conclusion, emphasis is placed on the need for a thorough, detailed study of the Wilcox-Claiborne relationships along the belt of outcrop of these groups in central and northeast Texas and in southwest Arkansas. On the assumption that ferruginous conglomerate is a

basal bed of the Reklaw member of the Mount Selman formation, the fact that many of the occurrences of the conglomerate lie geographically either a little east or a little west of the belt of outcrop of the member as mapped in 1937 (see pl: 3) indicates the need for a revision of the mapping. The presence in the conglomerate of pebbles and cobbles of quartzitic sandstone and other reworked Wilcox plastics showing various degrees of water wear, and the apparent absence of pebbles from sources to the west and north, more distant than the Edwards limestone of the Cretaceous, raises the question as to the drainage conditions that must have existed to account for the transportation of fragments of the quartzitic rock from its places of outcrop along the western part of the Wilcox belt, eastward for distances of 5 to 20 miles across a bordering coastal plain to a sea margin that extended for more than 450 miles, at least from Nevada County, Ark., to Wilson County, Tex. Apparently the drainage basins did not head inland far enough to enable the streams to erode the older formations. Another question is, what were the depositional conditions under which the fine-grained quartzitic sandstones bearing the impressions of roots and rootlets were formed at widely separated localities in early Wilcox time? The photographs reproduced in plate 5 *A*, *D*, suggest that these impressions record the presence of plants which grew under swampy or marshy conditions at the close of the deposition of this particular facies of sand. As observed, the impressions are restricted to the upper 10 or 12 in. of the rock layers.

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