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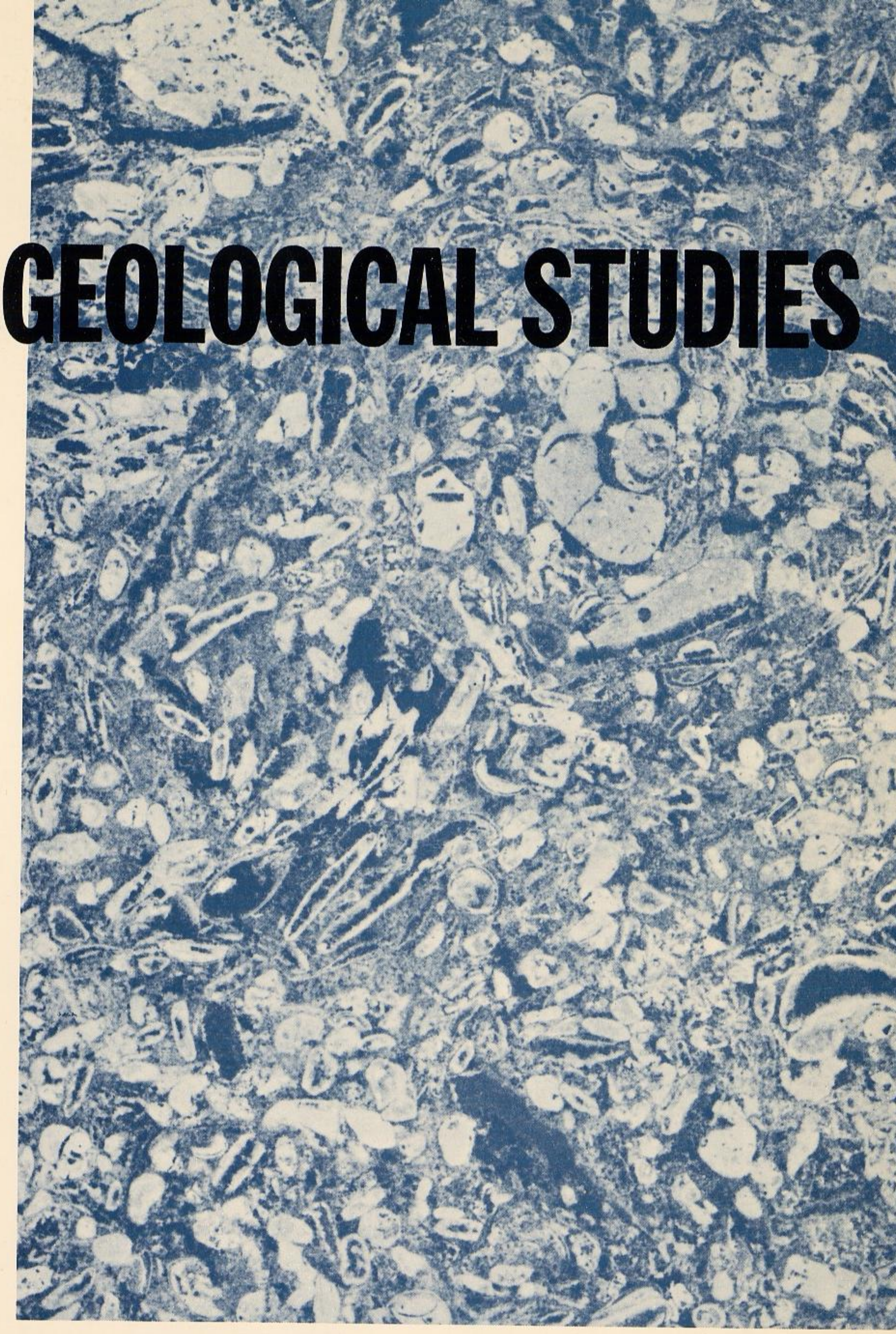

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Stratigraphy and Depositional Environments of the Glen Rose Formation, North-Central Texas

Keith W. Davis

"Creative thinking is more important than elaborate equipment--"

FRANK CARNEY, PH.D.
PROFESSOR OF GEOLOGY
BAYLOR UNIVERSITY
1929-1934

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The training of a geologist in a university covers but a few years; his education continues throughout his active life. The purposes of training geologists at Baylor University are to provide a sound basis of understanding and to foster a truly geological point of view, both of which are essential for continued professional growth. The staff considers geology to be unique among sciences since it is primarily a field science. All geologic research including that done in laboratories must be firmly supported by field observations. The student is encouraged to develop an inquiring objective attitude and to examine critically all geological concepts and principles. The development of a mature and professional attitude toward geology and geological research is a principal concern of the department.

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BAYLOR UNIVERSITY
Department of Geology
Waco, Texas
Spring, 1974

Baylor Geological Studies

The Baylor Geological Studies Bulletin is published semi-annually, Spring and Fall, by the Department of Geology at Baylor University. The Bulletin is specifically dedicated to the dissemination of geologic knowledge for the benefit of the people of Texas. The publication is designed to present the results of both pure and applied research which will ultimately be important in the economic and cultural growth of the State.

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Stratigraphy and Depositional Environments of the Glen Rose Formation, North-Central Texas

Keith W. Davis

ABSTRACT

The Glen Rose Limestone in Hamilton and Comanche Counties exhibits broadly similar characteristics to equivalent carbonate shelf outcrops of central Texas, from the type area in Somervell County to the northern edge of the Llano uplift. Hence, a depositional model based on facies relationships in Hamilton and Comanche Counties should provide a representative overview of Glen Rose shelf carbonates in central Texas.

The Glen Rose Formation is the uppermost subdivision of the Trinity Group in north-central Texas. It is underlain by and gradational with the Twin Mountains Formation which makes up the remainder of the Trinity Group. The Paluxy Sand, lowest unit of the Fredericksburg Group, unconformably overlies the Glen Rose Formation.

Outcropping strata of the Trinity Group were deposited on the central Texas platform, a broad, stable shelf area covering most of the central part of the state. Relief that had developed on the platform prior to Lower Cretaceous inundation acted as a major control on Glen Rose facies patterns. Other major factors influencing Glen Rose sediment distribution include periodic terrigenous influx and transgressive and regressive phases of eustasy. Sediment formed in the transgressive phase is principally composed of mollusc and pelletal biomicrite, whereas deposits from the regressive phase generally show the classic tidal-flat fabrics similar to those described from the Persian Gulf.

Four informal rock-stratigraphic units were recognized in the Glen Rose Formation. Three of these units occur in vertical sequence, whereas the fourth is an updip equivalent of one and possibly a portion of another of the three sequential units. Unit 1, the oldest of the units, consists of thick marl and massive limestone beds. Quartz sand is common to abundant, and faunal species diversity is low to moderate with hyaline foraminifers locally sparse. Unit 2 is composed of intramicrite, biomicrite, and pelmicrite interbedded with thick marl beds. Quartz silt and sand are locally common. Mollusc banks and reefs occur locally, with adjacent beds having a high mollusc fragment content. The unit is typified by a moderate faunal diversity with scattered concentrations of echinoids and serpulids locally abundant. Bioturbation is moderate to complete. Unit 3 is made up of dolomite, biosparite, and recrystallized limestone with an abundant admixture of quartz silt and sand. Faunal species diversity is low. Features indicating subaerial to shallow water origin found in the unit are (1) bored surfaces, (2) plant material, (3) abundant vertebrate parts, (4) channel structures, (5) calcarenite banks, and (6) low angle cross-beds composed of poorly sorted shell fragments. Unit 4, the updip unit, consists of sandstone, dolomite, clay, and marl. Limonite is common and marine fossils are generally rare to absent. Facies within these units formed bands roughly parallel to the shoreline. These bands were broad owing to the gentle slope of the sea-floor.

The biota of the formation consists of broken to whole mollusc shells and steinkerns, serpulid worm tubes, a few echinoids, agglutinated foraminifers (dominated by *Lituola subgoodlandensis*), and ostracodes (dominated by *Asciocythere rotunda*).

Environments of deposition ranged from infratidal (shallow subtidal) to supratidal. Salinities varied widely but generally remained slightly brackish to brackish.

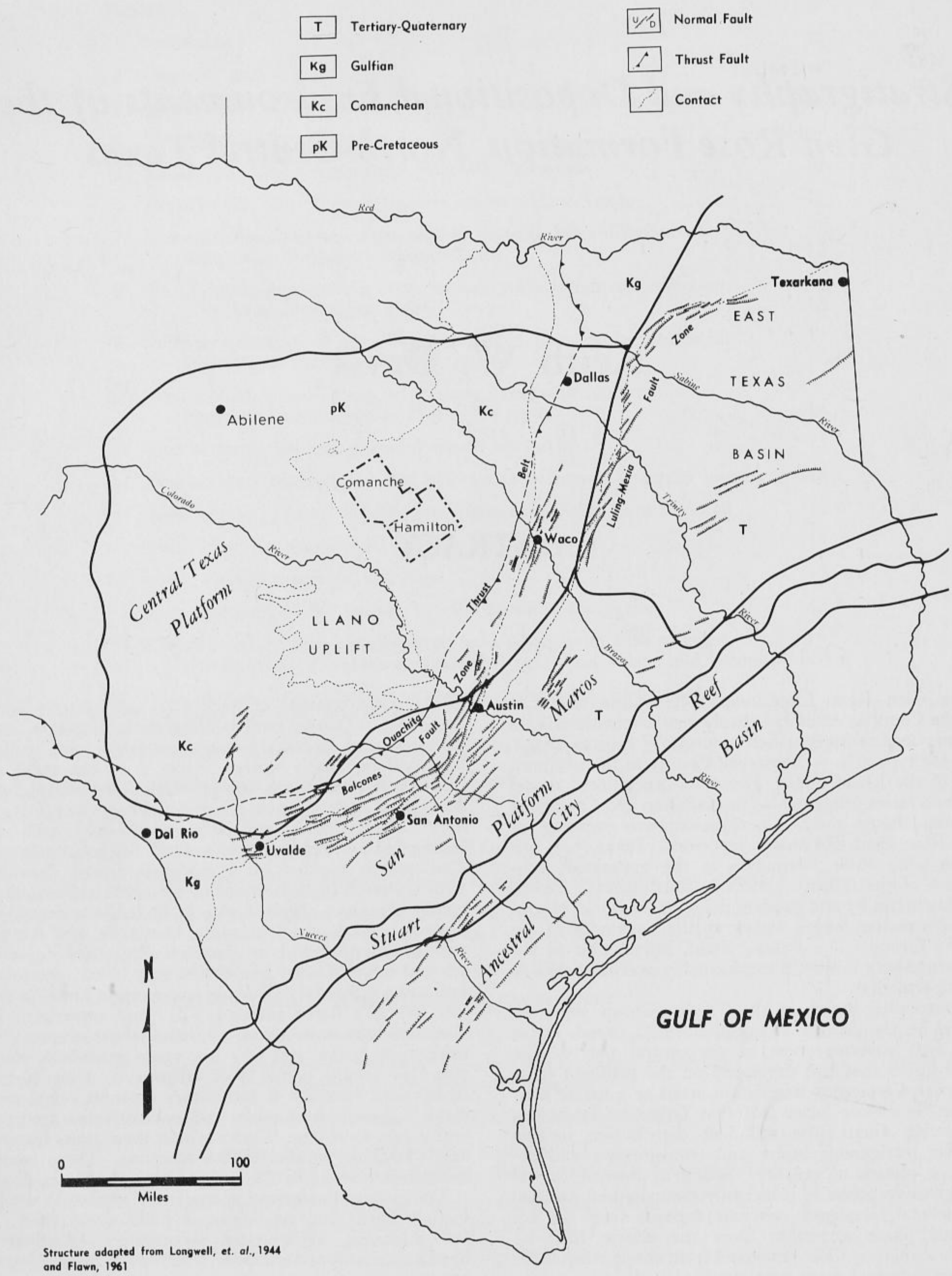

Fig. 1. Index map, showing area of study in relation to major geologic features.

INTRODUCTION*

PURPOSE

The purposes of this study were: (1) to delineate facies of the Glen Rose Formation, (2) to compile and interpret data regarding microfossils from the marls and clays of the Glen Rose, (3) to provide a depositional model to be used in interpreting the Glen Rose elsewhere in north-central Texas, and (4) to relate the stratigraphic framework in Comanche and Hamilton Counties to the much broader regional stratigraphic framework of the Glen Rose.

LOCATION

This study is based on 19 measured and described sections, several other surface localities, 30 electric or drillers' logs from Hamilton and Comanche Counties of north-central Texas (Fig. 1), and one measured section in western Erath County (Fig. 2). Many of the measured sections are located along two traverses that extend approximately perpendicular to one another. A strike section extends from Locality 1 to Locality 9 (Fig. 3) and the dip section is between Localities 6 and 35 (Fig. 4). The area of investigation includes approximately 1800 square miles.

PROCEDURES

Field work began in the early part of 1971 with assembly of a geologic map. Formation contacts were plotted on U.S.G.S. 1:24,000 and 1:62,500 topographic maps. Aerial photographs were used to provide detail of outcrop patterns. Electric logs and drillers' logs were used for subsurface control. The base map was compiled from one-inch scale Texas State Highway Department county maps. Outcrop patterns were transferred to the base map which, when completed, was reduced to half-inch scale (1/126,720).

The second phase of field work involved measuring and sampling of 20 sections, mostly in roadcuts. Weathering profiles drawn at the outcrop were used in recording outcrop descriptions and in preparing cross sections.

Samples were studied by use of thin sections and polished slabs under binocular and polarizing microscopes. Acid and stain tests were used to aid in determination of mineral compositions. Marls and clays were washed for microfossils and coarse grains and studied under binocular microscope to determine percentage compositions for major groups of microfossils, such as foraminifers, ostracodes, bones and teeth. For each sample species abundances of foraminifers and ostracodes were also determined. For individual beds, percentage composition was established by point counting two sets of 100 grains each from each sample.

Folk's classification (1962) was used to describe primary textures of limestone and dolomite, with the following exceptions:

A. Pellets that exceed the maximum size of Folk's classification (0.20 mm) and which fall into the intraclast category are indicated in the rock name by the modifier "fecal," as in fossiliferous fecal intramicrite.

B. Fossil preservation is indicated in the rock name only when fossils are fragmented. Fossils are whole or unbroken when the word fragmented is not used in the name of a fossil-dominant rock. Respective examples follow: "mollusc-fragment biomicrite" and "mollusc biomicrite."

C. Recrystallized limestones are described only as "cryptocrystalline" unless original textures are partially preserved. When original textures are preserved the rock is classified by Folk's system and degree of recrystallization is noted.

PREVIOUS INVESTIGATIONS

A detailed discussion of contributions by early workers to Texas Lower Cretaceous geology has been presented by Boone (1968, p. 9-11) in a study of the Basal Trinity sands. Therefore, previous works included here are limited to those which offered the most directly useful information for this study.

The earliest work of importance was by Vanderpool (1928), who, citing Miser (1927), correlated the Glen Rose Formation of Somervell County, Texas, to the Dierks and DeQueen limestones of Pike County, Arkansas. Vanderpool used fossils to establish the correlation, and his was the first significant work dealing with microfossils of the Trinity Group. While he emphasized ostracodes, he also mentioned several species of foraminifers and identified many macrofossils. His illustrations were valuable in recognition of a number of faunal species.

Other paleontological studies of the Glen Rose Formation included a brief article by Wrather (1922) describing dinosaur tracks in Hamilton County. A similar but more detailed article by Albritton (1942) reported 101 *Eubrontes* tracks in the Glen Rose Formation at Lake Eanes, Comanche County. The tracks are no longer exposed (Perkins and Stewart, 1971).

Stead (1951) provided a systematic description of the foraminifers of the Glen Rose Limestone in Travis, Hays, and Comal Counties of central Texas. He described the vertical distribution of species, established a zonation showing ecologic relationship between fauna and lithology and summarized the paleoecology for the Glen Rose in south-central Texas.

Whitney (1952) writing about exposures in Bandera, Blanco, Comal, Hays, and Travis Counties, described the fauna and lithology of the Glen Rose Formation and emphasized differences in fauna and faunal abundances between the massive lower units and upper alternating beds.

D. L. Frizzell (1954) described the distribution of foraminifers in Texas Cretaceous formations and provided excellent illustrations of many species.

Hendricks (1957), citing Adkins (1933) in a report on Parker County, stated that all stratigraphic units of Glen Rose Formation have sandy marginal facies that grade eastward into marls and limestones. He con-

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*A thesis submitted in partial fulfillment of the requirements for the M.S. degree in Geology, Baylor University, 1973.

cluded that the Travis Peak, Glen Rose, and Paluxy Formations are gradational and transgress the section as one formation grades laterally and vertically into the other.

In 1960, R. C. Douglass, in a study of the foraminifer genus *Orbitolina* in North America, established its utility as a marker of Lower Cretaceous Trinity strata. He also demonstrated that the Glen Rose Formation may be zoned using *Orbitolina. Orbitolina texana* (Roemer) is confined to the lower Glen Rose Limestone whereas *Orbitolina minuta* (Douglass) is found most commonly in the upper part of the formation.

In 1962, W. A. Atlee described the stratigraphic relationships of the Paluxy Sand with the overlying Walnut Clay and the underlying Glen Rose Limestone in central Texas.

In 1967, R. E. Renner divided the Glen Rose Formation of southwestern Parker County into three lithologic units: (1) a lower section of resistant, massively-bedded limestone containing *Cuculaea, Lunatia,* and coarse-grained molluscan fragments, (2) a middle section of less resistant limestone, with discontinuous bedding and an abundance of *Orbitolina texana* (the seaward equivalent of the uppermost part of the massive limestone), and (3) an upper unit of marls and discontinuous beds of resistant limestone. Also in 1967, C. Gibson described the stratigraphy of the Glen Rose limestone-sandstone transition in Parker County. R. W. Rodgers (1967) divided the Glen Rose Formation in the type area (immediately adjacent to the current study area) into three units, based on lithologic and paleontologic evidence. The lower unit consists of mollusc-fragment limestone alternating with marl, clay, and sand. The middle unit consists of clastic-free biomicrite containing *Orbitolina texana* (?), *Requienia,* and pelecypods. The upper unit is a series of alternating thin limestone and marl beds with variable admixtures of clastics. The lower part of the middle unit, the Thorp Springs Member, includes the most updip outcrops of Glen Rose Limestone in the type area.

A stratigraphic study of the Basal Trinity sands in central Texas (Boone, 1968) described the paleoplain on which Lower Cretaceous strata were deposited (Fig. 5). Boone included an interpretation of stratigraphic relationships and depositional history for the Hensel Sand, Glen Rose Formation, and Paluxy Sand (Boone, 1968, p. 46-55).

Fisher and Rodda (1967, p. 3), in an economic report on the Lower Cretaceous sands of Texas, presented a correlation table for Lower Cretaceous rock units (Table 1). The present study area falls within the north-central Texas region, and the nomenclature proposed by Fisher and Rodda has been adopted.

A stratigraphic investigation of the Trinty Group in central Texas, south of the Llano uplift, by Stricklin, Smith, and Lozo (1971) provides information about part of the ancestral Glen Rose basin and the geologic processes active therein. Two informal subdivisions of the Glen Rose Formation were proposed. The lower unit in the central Texas study consists of discontinuous, massive, bioclastic limestone, dolomite, and widely traceable alternating beds of clay and limestone, in which the uppermost unit is characterized by abundant *Corbula maritinae.* The upper division is recognizable from two evaporitic intervals and a sequence of alternating hard and soft beds. Stricklin, Smith, and Lozo report *Orbitolina texana* in both the lower and upper units contrary to the findings of Douglass (1960), who had identified the *O. texana* only in the lower part of the formation.

In 1971, Aguayo, in a facies analysis of Trinity rocks in Erath, Hood, and Somervell Counties, confirmed Rodgers' (1967) subdivisions of the Glen Rose Formation in the type area. Aguayo delineated supratidal, upper intertidal, lower intertidal, and subtidal facies and recognized six paleophysiographic features differentiated on the basis of marine energy conditions (Aguayo 1971, p. 10).

Dreyer (1971) described the stratigraphy of the Trinity Group in Coryell and Lampasas Counties, adjacent to the southeastern border of the current study area.

ACKNOWLEDGMENTS

Gratitude is expressed to Dr. Jerry N. Namy who supervised this investigation.

The following assisted in different ways and their help is gratefully acknowledged: Dr. O. T. Hayward provided suggestions leading to information sources and gave helpful discussion; Professor Richmond L. Bronaugh supplied the location of dinosaur tracks between Hamilton and Evant, Texas; Dr. Gustavo A. Morales made valuable suggestions on technical aspects of the manuscript preparation and aided in the classification of microfossils; Mr. Cliff Walker traded ideas, opinions, and arguments throughout the present study.

Special thanks are due Mr. Joe Dalton of Dalton Drilling and Service Company, who allowed the author full access to his log files and other records. Also, thanks are expressed to the ranchers in the area of investigation for information and for allowing access to outcrops. Special appreciation is extended to Dr. Robert W. Scott, The University of Texas at Arlington, for reviewing the manuscript before publication.

REGIONAL GEOLOGY

STRUCTURE

Comanchean rocks of central Texas were deposited in a region divided into two major structural provinces (Hayward and Brown, 1967, p. 31): (1) the East Texas basin, a subsiding trough; and (2) the Texas craton, a stable platform. The Balcones fault zone, which extends essentially north-south through Waco, McLennan County, is the approximate boundary between these two structural provinces.

A more comprehensive representation of structures affecting Comanchean deposition includes the Llano uplift, the San Marcos platform, and the Stuart City reef (Fig. 1 shows the central Texas platform which is approximately equivalent to the Texas craton of Hayward and Brown). During deposition of lowermost Cretaceous sediments, the Llano uplift was an island of pre-Mesozoic rocks covering several hundred square miles. The San Marcos platform was the southeastern end of the central Texas platform, and the Stuart City reef was a long ridge of shell and algal debris that marked the edge of the Lower Cretaceous shelf of southeast Texas.

The area of this study lies along the western edge of Cretaceous outcrops in north-central Texas. In this region, Cretaceous strata are of relatively uniform sequence and thickness, though they thicken gradually eastward across the central Texas platform to the Balcones fault zone where they begin to thicken rapidly downdip into the East Texas basin (Mosteller, 1970, p. 7).

Strata of the Comanchean Series in this area of the central Texas platform rest unconformably upon westward-dipping Pennsylvanian rocks (Hayward and Brown, 1967, p. 36). The erosion surface upon which initial Cretaceous sediments were deposited is called the Wichita paleoplain (Hill, 1901, p. 363), and is marked by well-developed relief of valleys and divides (Boone, 1968, p. 12). Valleys of the Wichita paleoplain mark the earliest sites of deposition of the Trinity Group (idem).

PHYSIOGRAPHY

The study area lies almost totally within the Lampasas Cut Plain of the Grand Prairie, a highly dissected, eastward-dipping plain, recognizable by the general level if its many remnant summits (Hill, 1901, p. 80), which mark divides between valleys. Surface relief ranges from gently undulating to rolling and hilly with elevations varying from 800 to 2,000 feet. Local relief may be as great as 400 feet.

Configuration of the landscape is due to differential weathering and erosion of various lithologic units principally of the Fredericksburg Group. In descending order the following formations crop out in the study area: Edwards Limestone, Comanche Peak Limestone, Walnut Clay, Paluxy Sand, Glen Rose Limestone, and the Twin Mountains Formation. Upon weathering and erosion the relatively horizontal beds produce an orderly appearance on the landscape.

The Edwards Formation in the study area is dense gray limestone, highly resistant to weathering and erosion. It caps the flat-topped divides in the southern portion of Comanche County and throughout Hamilton County.

The Comanche Peak Limestone is nodular to thin bedded marly limestone, less resistant to weathering and erosion than the Edwards Limestone. Because of this difference in erodability, the Comanche Peak usually forms steep slopes directly beneath the cap of Edwards Limestone.

The Walnut Formation is composed of clay or shale with a few limestone ledges composed of *Texigryphaea* and associated fauna. Limestone ledges are more resistant than clays and therefore form valley floors and gentle slopes on hills where the overlying formations have been eroded.

The Paluxy Formation is composed of fine, clean, friable sandstone exposed in the valley floors and on the bench formed by the top of the Glen Rose Limestone.

The outcrop area of the Glen Rose Limestone is the Glen Rose Prairie, a subdivision of the Lampasas Cut Plain. The surface of the Glen Rose Prairie is usually stony owing to decomposition of limestone ledges which, in alternation with marls, form the substructure of the prairies. The uniformity of the prairie is broken by low terraces and gently sloping benches formed by harder strata alternating with softer beds. Along the creeks small rapids and water falls exist where harder limestone beds crop out. The Glen Rose Prairie generally occurs in belts along the major streams in Comanche and Hamilton Counties (Fig. 2). In many places, especially along Warren Creek in northern Hamilton County, the banks of larger streams have steep walls exposing resistant ledges in the formation.

The Twin Mountains Formation, in northern and central Comanche County, is unconsolidated and usually supports broad flat plains. The major streams are the Leon and North Bosque Rivers, their tributaries, and Cowhouse Creek. A typical dendritic drainage pattern is present throughout the area of investigation.

STRATIGRAPHY

The physiography of the area of study is obviously related to the stratigraphy and structure of the underlying formations. In this region the strata strike N 10° E and dip about 11 to 18 feet per mile toward the East Texas basin. Individual beds thicken basinward (Fig. 6).

The Paluxy Formation, which overlies Glen Rose strata, is homogeneous, fine-grained, compact, white-to-reddish brown quartz sand with scattered lenses and laminae of dark, impure clay. The sand thickens toward the northwest through the study area (from 20 feet near Jonesboro to over 120 feet west of Comanche) and eventually coalesceses with the basal Trinity Sands beyond the updip limit of recognizable Glen Rose strata

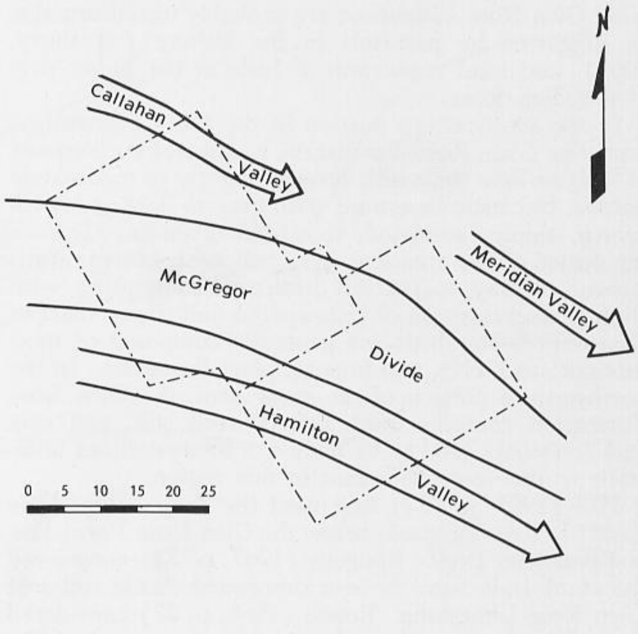


Fig. 5. Major pre-Trinity topography, Wichita Paleoplain (after Boone, 1968, p. 36).

TABLE 1. NOMENCLATURE AND CORRELATION OF LOWER CRETACEOUS ROCK UNITS

<table>
<tr><th rowspan="2">North-central Texas (subsurface, eastern part)</th><th colspan="2">Central Texas</th><th rowspan="2" colspan="2">North-central Texas</th><th rowspan="2" colspan="2">North Texas (north of Decatur)</th><th rowspan="2" colspan="2">West-central Texas (west of 99th M)</th></tr>
<tr><th>Travis County</th><th>Northeast side, Llano Uplift</th></tr>
<tr><td>Fredericksburg formations</td><td>Fredericksburg formations</td><td>Fredericksburg formations</td><td colspan="2">Fredericksburg formations</td><td colspan="2">Fredericksburg formations</td><td colspan="2">Fredericksburg formations</td></tr>
<tr><td rowspan="2">Glen Rose Limestone</td><td rowspan="2">Glen Rose Limestone</td><td>Paluxy Formation</td><td colspan="2">Paluxy Formation</td><td rowspan="6">Antlers Formation</td><td>upper unit</td><td rowspan="6">Antlers Formation</td><td>upper unit</td></tr>
<tr><td>Glen Rose Formation</td><td colspan="2">Glen Rose Formation</td><td>middle unit</td><td>middle unit</td></tr>
<tr><td>Hensel Formation</td><td>Hensel Sand</td><td rowspan="4">Travis Peak Formation</td><td rowspan="4">Twin Mountains Formation</td><td>upper unit</td><td rowspan="4">lower unit</td><td rowspan="4">lower unit</td></tr>
<tr><td rowspan="2">Pearsall Formation</td><td>Cow Creek Limestone</td><td rowspan="2">middle unit</td></tr>
<tr><td>Hammett Shale</td></tr>
<tr><td>Sligo Limestone
Hosston Formation</td><td>Sycamore Sand</td><td>lower unit</td></tr>
</table>

Unconformity (wavy line)
Tentative correlation (dashed line)

From Fisher, W. L. and Rodda, P. U. (1967) Lower Cretaceous sands of Texas: Stratigraphy and resources: Bur. Econ. Geol. Rept. Invest. 59, p. 3.

in Brown and Comanche Counties. The formation is conformable with the overlying Walnut Clay as is evidenced by the interfingering of the two formations (Atlee, 1962, p. 18). The Paluxy Sand and the underlying Glen Rose Limestone are probably unconformable as suggested by paleosols in the Paluxy (Amsbury, 1967), and local truncation of beds in the upper part of the Glen Rose.

In the southeastern portion of the area of investigation, the Glen Rose Formation is generally composed of beds of light yellowish brown, slightly to moderately porous, bioclastic limestone, with gray to light yellowish brown, thinly laminated, interbedded shales. Toward the center of the area it is light yellowish brown, argillaceous, chalky to detrital limestone alternating with slightly thicker strata of yellowish to dull brown marl or clay. The softer beds are generally composed of mixtures of sand, clay, and impure, platy limestone. In the northwestern portion of the study area, the Glen Rose Formation contains more quartz sand, silt, and clay and limestones tend to be nodular. Recrystallized limestone is also more abundant in this region.

Hill (1901, p. 152) first used the name "Bluff-Dale Sand" to describe sands below the Glen Rose Formation at Comanche Peak. Rodgers (1967, p. 33) considered the Bluff Dale Sand to be a shoreward clastic facies of Glen Rose Limestone. Boone (1968, p. 27) considered the unit to be time equivalent to the lower part of the Glen Rose Limestone of McLennan County. The Bluff Dale Sand consists of interbedded muddy sand, sandy mud, clean packsand, and calcareous mudstone and sandstone that grades into mudstone near the East Texas basin (idem).

The Bluff Dale Sand crops out in Hood, Parker, Erath, Eastland, and Comanche Counties. It extends downdip as far south as northern Bosque and Hamilton Counties, where it interfingers with the lower part of the Glen Rose Limestone. The Bluff Dale Sand was not differentiated in the study area. Instead, the Twin Mountains Formation was mapped as an undifferentiated equivalent of the Bluff Dale, Hensel, and Hosston sands.

In western Comanche County, the lower contact of the Glen Rose Formation is gradational into the Twin Mountains Formation, composed of fine to medium grained, subrounded, medium sorted, highly compacted, but friable sandstone. Because it is friable it is easily eroded.

West and north of Sidney, Comanche County, beyond the updip limit of the Glen Rose Limestone, the Twin Mountains and Paluxy sands coalesce to form the Antlers Sand. In Eastland, Callahan, and Taylor Counties, northwest of the study area, the Antlers Formation can be divided into a lower sand unit, a red bed unit, and an upper sand unit (Boone, 1968, p. 29) believed to be equivalent to Hensel Sand, Glen Rose Limestone, and the Paluxy Sand of the eastern margin of the central Texas platform.

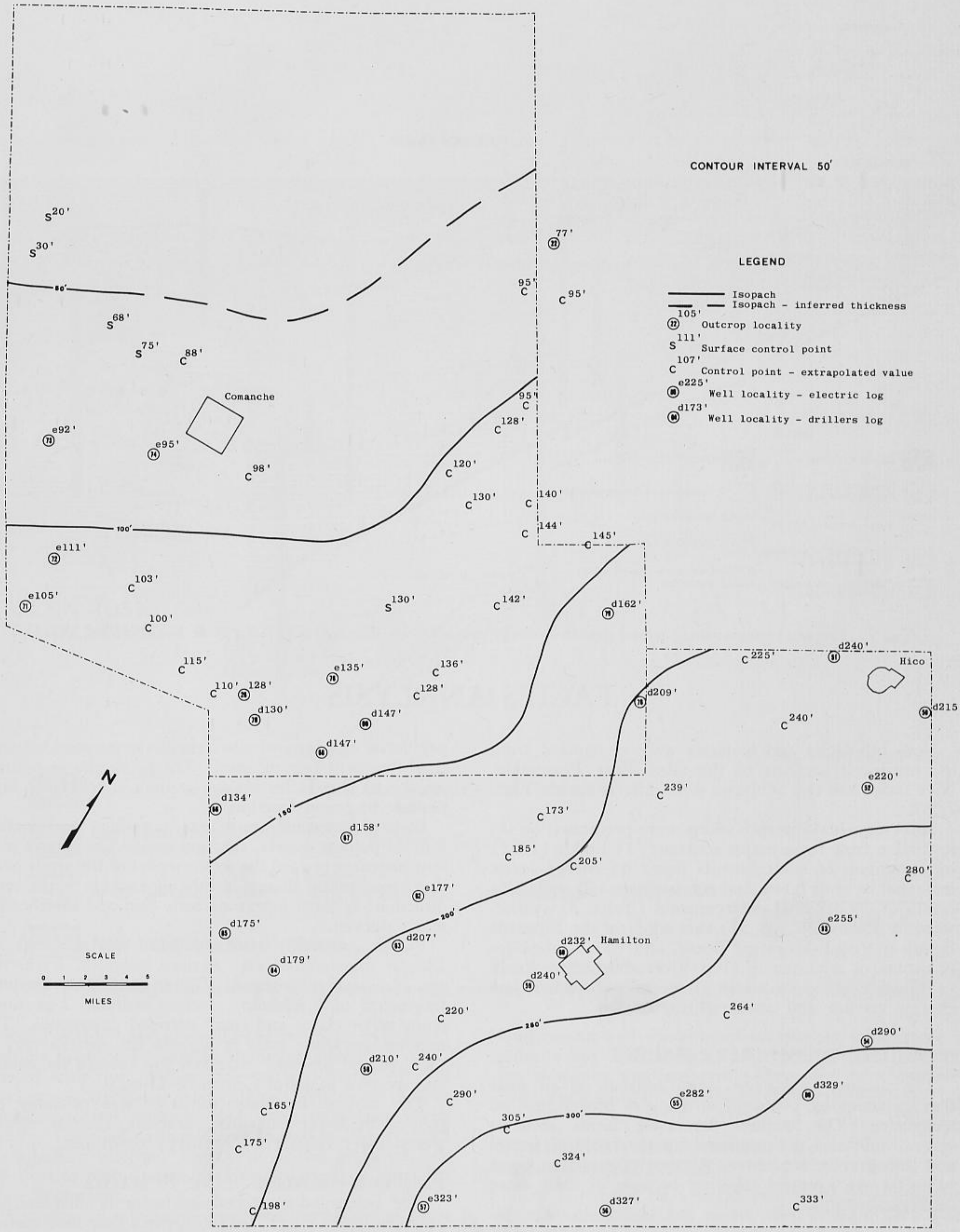


Fig. 6. Isopach map of the Glen Rose Formation, north-central Texas.

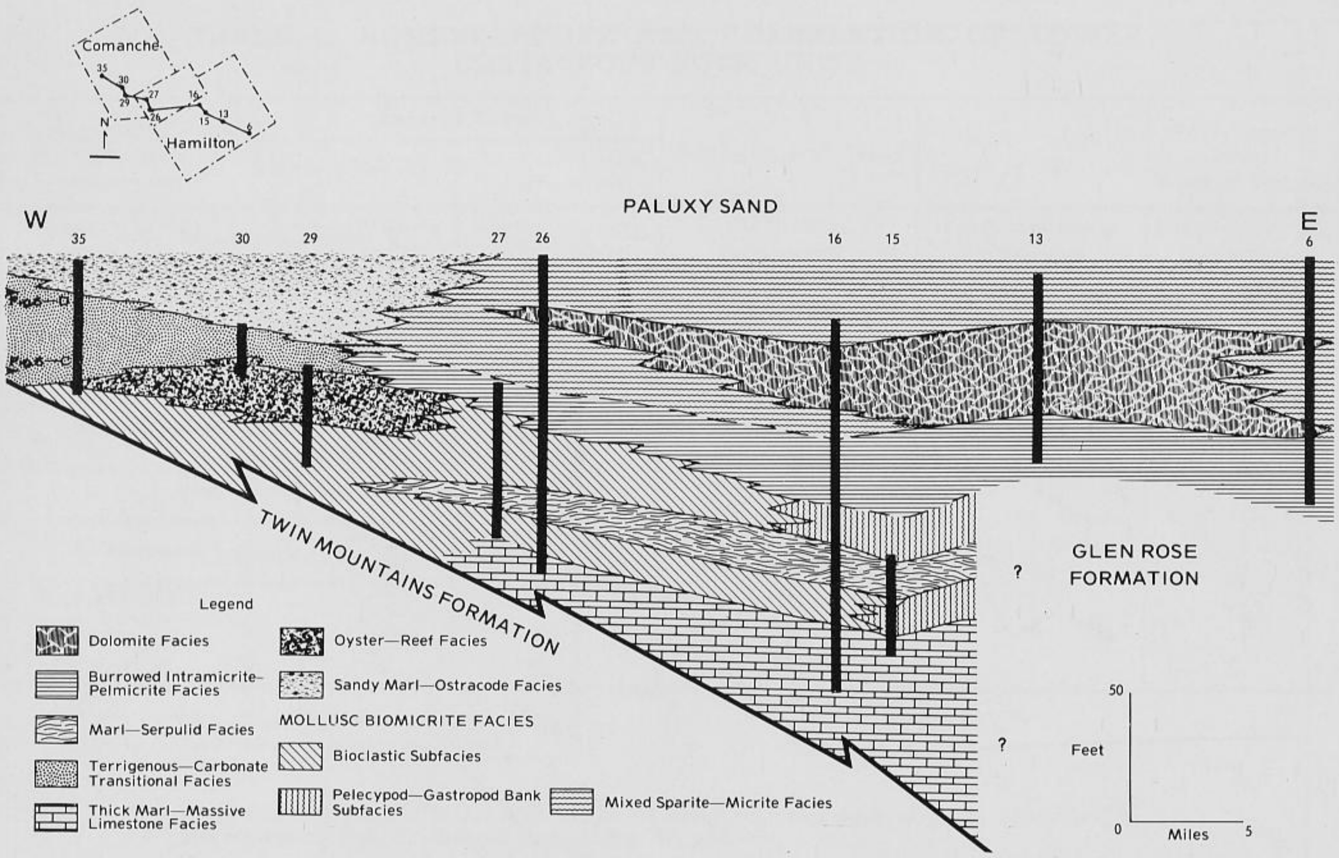


Fig. 7. East-west diagrammatic cross section showing vertical facies distribution in Glen Rose Rock, central Texas.

FACIES ANALYSIS

Both lithofacies and biofacies were recognized from the measured sections of the Glen Rose Formation. Nine facies and two subfacies were differentiated (Figs. 7, 8).

Environmental interpretations were predicated on information from three major sources: (1) Folk's (1962) interpretation of environments based on energy levels indicated by rock fabric and composition, (2) a classification of depositional environments (Table 2) synthesized by Rose (1972, p. 51) in a study of the Edwards Group of (south) central Texas, and (3) a fabric-to-environment relationship (Fig. 9) established by Roehl (1967, p. 2029) in a study of recent and ancient low energy marine and subaerial carbonates.

MOLLUSC BIOMICRITE FACIES

The mollusc biomicrite facies consists of all beds that are composed primarily of whole or broken mollusc biomicrite. The mollusc biomicrite facies includes several subfacies differentiated on the basis of faunal and petrographic attributes. Although distinctive, these subfacies are grouped together because of their close interrelationships.

Mollusc Bioclastic Subfacies

The mollusc bioclastic subfacies is made up of shell-fragment biomicrite (Fig. 10) with rare associated pelmicrite and intramicrite irregularly interbedded with shell fragment-bearing marl. The pelmicrite and intramicrite of this facies always contain a relatively high mollusc-fragment fraction.

Beds of limestone are generally nodular and contain 1 to 30 percent quartz, silt, and sand. The quartz content increases toward the western part of the study area. A corresponding change in lithology occurs in the same direction, as thick limestone beds thin and interbedded marls thicken.

Fossils commonly associated with this subfacies are *Lituola subgoodlandensis*, various miliolids, *Cytherella* sp., *Asciocythere rotunda*, *Ostrea* and other oysters; fragments of *Liopistha*, *Arca*, *Cardium*, *Tylostoma*, many other clams and small turreted gastropods. The miliolid/ostracode ratio is high in the eastern part of the area and becomes extremely low toward the central and western limits of Comanche County.

The mollusc bioclastic subfacies was probably deposited in lower intertidal, brackish shallow marine water under relatively low-energy conditions.

Pelecypod-Gastropod Bank Subfacies

The pelecypod-gastropod subfacies is characterized by a distinctive faunal assemblage in a lime mud matrix. Minor admixtures of *Ostrea*, miliolids, and red algae fragmented *Cardium*, *Pachymya*, *Arca* and *Turritella*. occur locally.

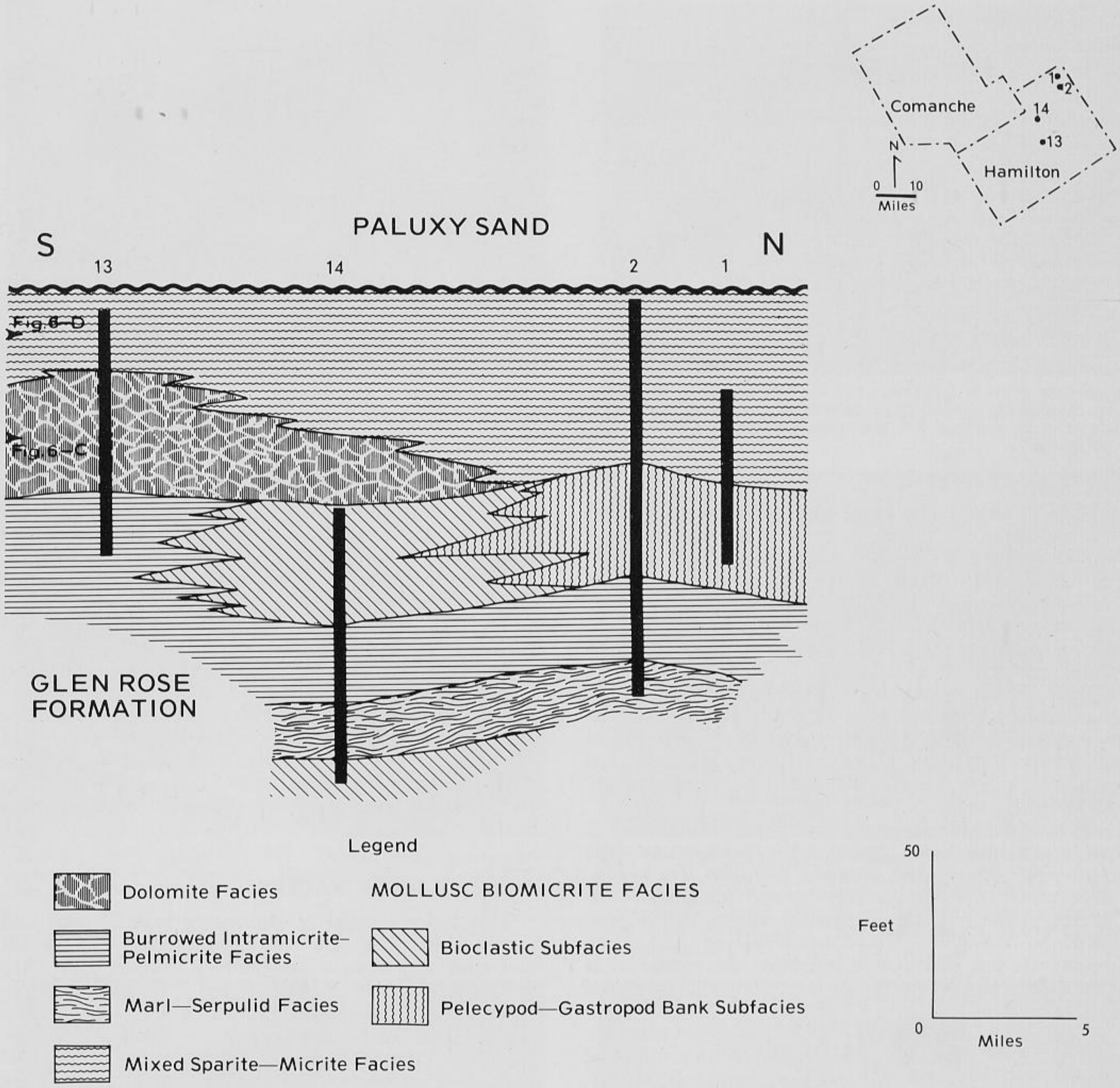


Fig. 8. North-south diagrammatic cross section showing vertical facies distribution in Glen Rose Rock, central Texas.

Rock in this interval consists of comparatively thick, nodular to massive, mollusc-steinkern biomicrite intercalated with thin mollusc-rich marls. Quartz silt and sand grains are sparse to negligible. Pellets are next in abundance after molluscs and some intraclasts occur locally. Echinoid parts compose from 0 to 10 percent of the allochem fraction. Most beds of this subfacies lack the intense bioturbation that marks most of the Glen Rose Formation.

This faunal association suggests deposition in open marine waters of normal salinity. The scarcity of terrigenous clastics indicates moderate distance from fluvial sources or low clastic influx due to temporary arid conditions on the land mass to the north and west. The mud matrix and the absence of sparites (grainstones) indicate low hydrodynamic energy conditions. Hence, the subfacies was apparently deposited in a shallow, quiet, open marine (infratidal) environment.

BURROWED INTRAMICRITE-PELMICRITE FACIES

The burrowed intramicrite-pelmicrite facies consists of pellets and intraclasts, mostly fecal in origin, in a spar or micrite matrix (Fig. 11). Micrite is dominant with The fauna consists primarily of whole or only slightly sparite developed locally. Burrowing left most limestone and marl well churned and homogenous. Many

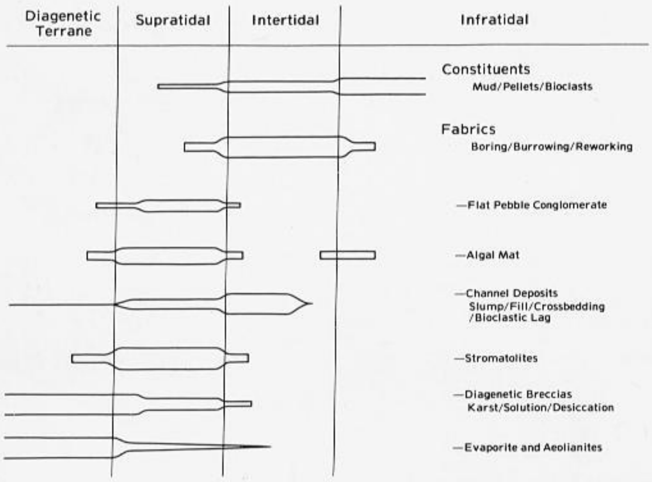


Fig. 9. Relative frequency of occurrence of potential carbonate fabrics in epeiric-tidal flat and subaerial terrace (after Roehl, 1967, p. 2029).

Fig. 10. Thin section (X 25). Poorly washed, moderately packed to packed, fossiliferous fecal intrasparite with mollusc fragments and encrusting blue-green algae. Negative print. Locality 27, bed 26.

marl beds appear as a maze of interconnected lithified burrow casts ½ to 5 centimeters in diameter. Burrowing creatures contributed heavily to the high concentration of fecal material in this facies, which compares to lower intertidal and subtidal sediments from Florida Bay. Comparable Florida Bay sediments, almost completely bioturbated by *Callianassa,* also contain a high percentage of fecal material.

Beds of this facies consist of alternating nodular-to-massive limestone and marl of nearly equal thickness. A few nodular limestone beds occur in the central and southeastern parts of Hamilton County (Localities 6 and 13), where quartz silt and sand are relatively common.

Fossils commonly associated with the burrowed intramicrite-pelmicrite facies are *Haplophragmoides trinitensis, Asciocythere rotunda, Cardium, Pachymya,* other clams, oysters, gastropods, and echinoids. The ostracodes show erratic occurrence, ranging locally from sparse to abundant. Clams, oysters, and gastropods usually are fragmented and constitute the second most abundant allochem in the facies. Echinoid parts are generally rare.

This facies is characteristic of lower intertidal to subtidal environments. The scattered occurrence of sparites indicates that moderate to high energy conditions prevailed locally for short periods of time. Highly variable faunal diversity suggests that salinities fluctuated between moderately brackish and marine.

MARL-SERPULID FACIES

This facies consists of brown, fossiliferous marl with extremely thin silty to sandy interbedded biomicrite (Fig. 12). One thin, poorly washed intrasparite (Fig. 13) was found at Locality 15. Approximately 85 percent of the beds of this interval are marl. The unvarying nature of this facies across the area of investigation makes it a useful stratigraphic marker (Figs. 3, 4).

Whole and slightly broken serpulid worm tubes are abundant in the marls. At Highland, Erath County (Locality 22), the serpulids formed colonies several inches in diameter and as much as two inches high (Fig. 14). In addition to serpulids, this facies contains abundant agglutinated Foraminifera belonging to the family *Lituolidae,* abundant *Cytherella* sp. (ostracodes), and minor amounts of small turreted gastropods, bryozoans, and fragments of dasyclad algae.

The abundance of marl in this interval suggests that carbonate accumulation was diluted by the influx of large amounts of clay. The abundance of agglutinated foraminifers and *Cytherella* indicates that the environment was dominantly brackish, an interpretation consistent with the abundance of clay. The high mud content and the rare sparite occurrence imply that deposition occurred in a low energy environment, in the intertidal zone of an estuarine-influenced marginal sea.

OYSTER-REEF FACIES

This facies consists of alternating beds of marl and oyster biostromes, 3½ feet in thickness. Quartz silt and sand, and limonite are common in most beds (Appendix I, Locality 29, beds 9-16 gives a detailed description of this facies).

Fossils of the biotope include the dominant *Ostrea,* local high concentrations of *Turritella,* few clams, and encrusting serpulids. The marls contain an abundance of *Asciocythere rotunda.*

The oyster-bank biotope appears to mark the zone of exchange between fresh water and marine salt water during a period of near eustatic stillstand of an otherwise actively migrating shoreline (transgressing and regressing). The oyster-bank assemblage is a brackish water community. *Asciocythere rotunda* has been described as a brackish water inhabitant (Vanderpool, 1928), and *Ostrea* of the Glen Rose Formation is similar to the brackish water form *Crassostrea virginica* from the Holocene of the Texas Gulf Coast.

Such factors as (1) extremes in temperature, (2) excessive deposition of sediments, and (3) other chemical and physical changes appear to contribute to temporary extinction of oyster-banks (Puffer and Emerson, 1953, p. 540). Since each sequence of prolific Glen Rose bank accumulation terminated with accumulation

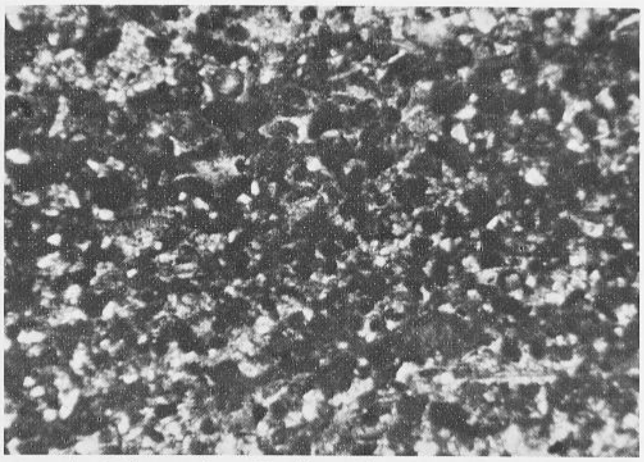


Fig. 11. Thin section (X 50). Silt and pellets in a slightly washed sparse mixed biomicrite (local high content of sparry calcite). Photomicrograph. Locality 29, bed 6.

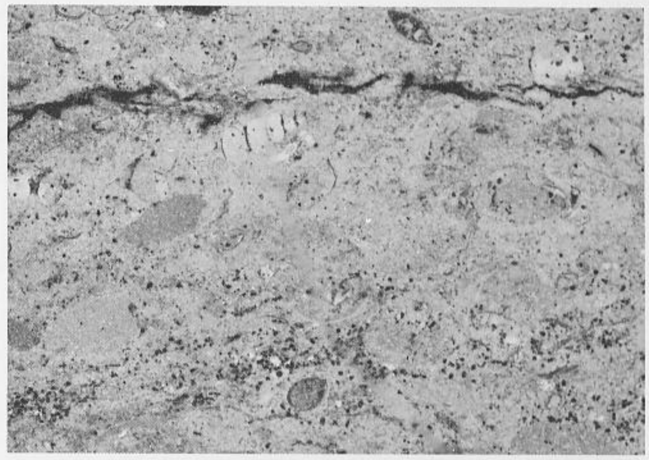


Fig. 12. Thin section (X 20). Nodular churned silty sparse pelecypod-fragment biomicrite, some wispy structures occur locally. Negative print. Locality 27, bed 8.

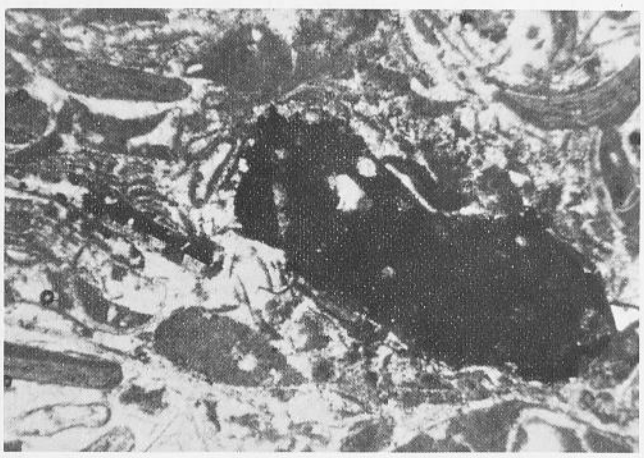


Fig. 13. Thin section (X 35). Packed fossiliferous intrasparite with plant material. Photomicrograph. Locality 15, bed 16.

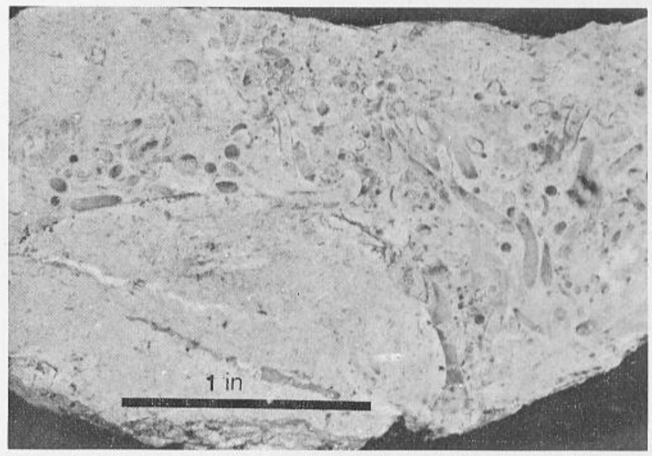


Fig. 14. Slab (X 2). Bowl-shaped serpulid colony that attached to a clam shell and grew both laterally and vertically as sediment slowly accumulated. Colony died when sedimentation rate increased to suffocate it (note top-most tubes are mud filled whereas most lower tubes contain sparry calcite). Locality 22, bed 16.

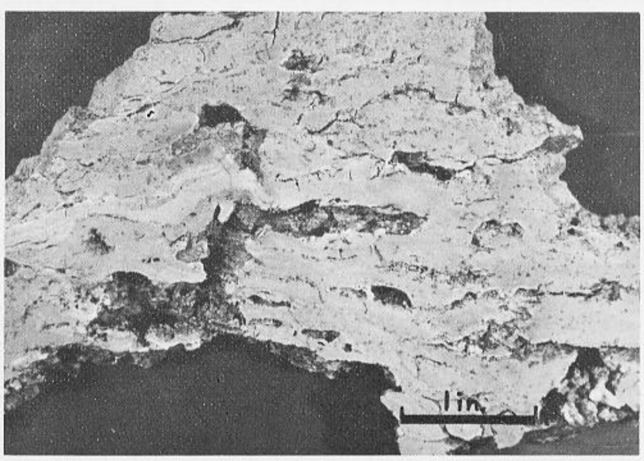


Fig. 15. Slab (X 1). Cryptocrystalline (recrystallized) limestone—cracked, disrupted, possible bird's-eye structures and laminations. Vuggy porosity may represent voids, previously filled by evaporite minerals that were subsequently removed causing partial collapse of the unlithified sediment. Interpreted as supratidal when associated with extremely shallow water deposits. Locality 26, bed 3.

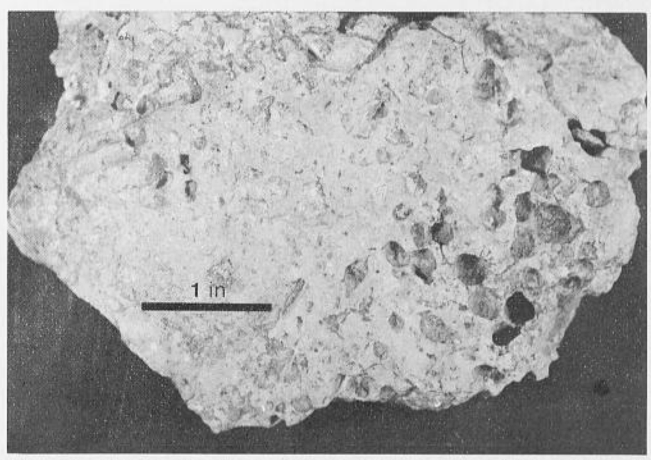


Fig. 16. Hand specimen. Clam borings in a flat cobble of dismicrite. Locality 26, bed 23.

Fig. 17. Polished slab. (X 0.9). Current oriented, poorly washed, packed, fossiliferous, fecal intrasparite with rounded, desiccated mud intraclast, mud-filled pelecypod valves and limonite. Locality 1, bed 20.

Fig. 18. Thin section. (X 35). Disarticulated ostracodes and quartz silt in silty ostracode biomicrite. Photomicrograph. Locality 27, bed 10.

of a thick blanket of terrigenous clastic sediment, it is probable that terrigenous influx was a major factor in termination of bank growth. Adjacent facies of terrigenous clastics tend to support this view (Fig. 4, Unit 4). A tongue of terrigenous clastic facies comprises the upper few feet of the Lake Eanes section (Locality 29), immediately above the oyster-bank facies. The termination of bank growth in this area probably closely corresponded with the beginning of regression of the Glen Rose sea, a factor also causing overlap of clay on the oyster banks.

The oyster-bank facies was probably deposited in warm, shallow, brackish water ranging from 1 to less than 15 feet in depth (see Puffer and Emerson, 1953, p. 540 for depth distribution of Texas Holocene oyster banks). This includes lower intertidal and infratidal (extremely shallow marine) environments.

MIXED SPARITE-MICRITE FACIES

The mixed sparite-micrite facies consists of thin alternating beds of marl and silty to sandy limestone. Most of the limestone is moderately packed to packed biomicrite or biosparite with a widely variable allochem fraction including: (1) intraclasts (Fig. 11A), (2) mollusc fragments, (3) pellets, (4) ostracodes, and (5) miliolids (in relative order of abundance).

Other rock types included in this facies are cryptocrystalline (recrystallized) limestone and sandstone. Cryptocrystalline limestone (Fig. 15) occurs regularly in the western part of the area of investigation (Localities 1, 2, 12, 13, 22 and 26). Sandstone occurs mostly in the updip part of the facies, in central and western Comanche County (Fig. 4, Locality 26).

Faunal diversity is generally low. Often only one genus was found in a particular bed. Fossils commonly associated with the facies are *Pachymya, Arca, Quinqueloculina, Asciocythere rotunda,* and *Eocytheropteron trinitensis. Ostrea, Lituola subgoodlandensis,* blue-green algae, and *Trigonia* are locally abundant. Many beds contain an abundance of shell or intraclast rollers and plates. Bioturbation is evident locally.

Low-to-moderate angle cross-bedding and channel-like features are common. Well developed bored surfaces (Fig. 16) and vertical burrows are found throughout the facies. Grain sorting is moderate to good.

Variability of fauna and lithology together with sedimentary structures indicate that the environment of deposition was upper intertidal bordering closely on lower intertidal. Minor supratidal elements such as thin stromatolites, desiccated intraclasts (Fig. 17), and cryptocrystalline limestones are associated with this facies, further indicating upper intertidal deposition (Table 2). Energy levels, indicated by subequal percentages of sparite and micrite, were intermittent, moderate to high.

SANDY MARL-OSTRACODE FACIES

The sandy marl-ostracode facies consists of thin beds of sandy to silty limestone, dolomite, and sandstone alternating with relatively thick sandy marl. Limestone is equally divided between shell-fragment biosparite and ostracode biomicrite (Fig. 18). Cross-beds (Locality 31) often characterize the biosparite, whereas the biomicrite is burrowed and nodular (Fig. 19). Bored surfaces and laminations are characteristic of sandstone beds. A few beds of mottled dolomite are also present.

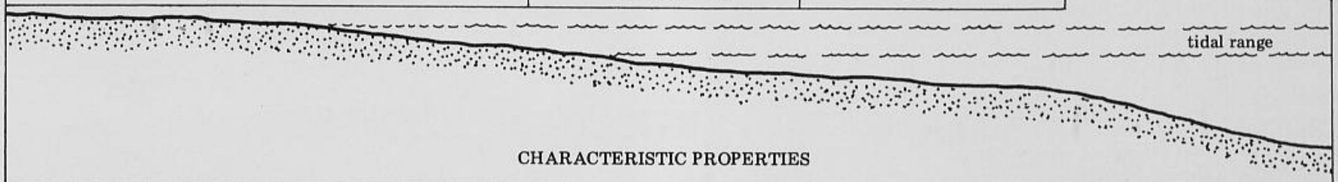
Fossils of this facies are *Asciocythere rotunda, Eocytheropteron trinitensis,* a few clams, and oysters. Blue-green algae is locally common and vertebrate parts are locally abundant. *Asciocythere rotunda,* a brackish water ostracode, is by far the dominant fossil, constituting approximately one-third of the fauna.

This facies was deposited in a brackish marsh to a very near-shore brackish beach. Water was probably less than a meter deep on the average. Energy levels fluctuated locally from high to low as evidenced by cross-bedded fragmental biosparite and silty ostracode biomicrite.

THICK MARL-MASSIVE LIMESTONE FACIES

The thick marl-massive limestone facies is composed

TABLE 2. CLASSIFICATION OF DEPOSITIONAL ENVIRONMENTS



SUPRATIDAL	INTERTIDAL	SHALLOW MARINE		OPEN SHELF
(TIDAL FLAT)		RESTRICTED	OPEN	
CHARACTERISTIC PROPERTIES				
1. Hard crusts or stromatolites 2. Mud cracks 3. Root marks 4. Gypsum or gypsum pseudomorphs, etc. 5. Thin collapse breccias 6. Storm layers 7. Fauna sparse, not diverse; snails may be common 8. Not extensively burrowed 9. Common exposure surfaces 10. Mostly mud and pellets 11. Oxidized sediments—light-colored	1. Channel-lag deposits 2. Channel-edge slumps 3. Extensive burrowing 4. Settle-out laminations 5. Wispy structures 6. Cyclic grain-size fluctuation 7. Limited fauna—oysters, snails, 1-2 foram. spp. 8. Mostly mud and pellets 9. Darker-colored sediments 10. Association with supratidal sediments	1. Limited marine fauna, more diverse than intertidal, no pelagic elements 2. Extensive burrowing 3. Wispy structures 4. Mixed grain size, mud and sand 5. Low-energy ripples and current-streaks 6. No associated supratidal sediments	1. Diverse marine fauna without pelagic elements 2. Commonly coarse grain-size, good sorting 3. Evidence of high-wave and current energy—abraded shells, cross-bedding, ripple marks 4. Scattered local banks and mounds 5. No associated supratidal features	1. Diverse marine fauna with pelagic elements—*Globigerina*, ammonites, etc. 2. Commonly argillaceous 3. Even, regular bedding 4. Facies very widely extensive 5. Commonly fine grained

From Rose, P. R. (1972) Edwards Group, surface and subsurface, central Texas: Bur. Econ. Geol. Rept. Invest. 74, p. 51.

primarily of massive ledge-forming limestones alternating with thick marls. The upper section contains a zone of recrystallized limestone and dolomite from 1 to 2 meters thick. Large calcite nodules and vuggy porosity characterize the recrystallized limestone, particularly at Locality 15. This fabric is similar to diagenetic fabrics that occur mostly in the supratidal and "diagenetic terrane" (Roehl, 1967). Toward the east, rock in this zone grades into slightly dolomitized to undolomitized biomicrite. Clay beds and thin sandstones occur locally. Silt is rare in the limestone, whereas the marl contains abundant silt and clay. Sparite occurs only in one or two beds in the lower portion of the facies.

Fossils are relatively abundant and faunal species diversity is higher in these beds than in any other facies in the study area. Ostracodes are dominant, comprising as much as 60 to 70 percent of the fauna in some beds. *Asciocythere rotunda* and *Eocytheropteron trinitensis* are the most abundant ostracodes. Foraminifers are rare to common in abundance yet the species diversity is high. This probably means the water was less turbid than normal or that periodically normal marine conditions prevailed. *Lituola subgoodlandensis* is well represented; *Orbitolina* and *Cuneolina* appear only in this facies. Oysters are locally abundant.

These beds were probably deposited in shallow, relatively clear and quiet waters. Salinities fluctuated from brackish to normal marine. Environment of deposition is believed to have been lower intertidal to infratidal.

TERRIGENOUS-CARBONATE TRANSITIONAL FACIES

The terrigenous-carbonate transitional facies consists of thin beds of sandstone; thin to massive beds of mottled dolomite; a few beds of extremely sandy, nearly barren to barren marl; and one or two dark olive-green clay beds. Structures in sandstone beds include vertical burrows (Fig. 20) and fine horizontal laminations. Most of the sand beds are friable but some are moderately cemented with calcite. Marls usually contain abundant sand and limonite with hematite locally common. Fine muscovite flakes make up 2 percent of the grains in bed 12 at Locality 12.

Fossils associated with this facies are plant material, bone, *Asciocythere rotunda,* and oysters (in order of abundance). Fossils average less than 20 percent of the grains in the facies.

These beds were deposited in a marginal continental or very near-shore environment. Salinities ranged from fresh to highly brackish, and waters were moderately to highly agitated. Clastic material migrated from the north and west toward the south and east, terminating development of the oyster-bank facies. This facies and the sandy marl-ostracode facies marks the maximum transgression of the Glen Rose sea in the study area.

DOLOMITE FACIES

The dolomite facies consists of beds composed primarily of dolomite (Figs. 21, 22). A few thin beds of nodular biomicrite and biosparite occur low in the facies. These limestones contain intraclasts (approximately 70 percent show signs of weathering or reworking), pellets, and miliolids. They also show current orientation of included allochems and current laminations. A single, dolomitic gray marl was found near the middle of the facies.

Thick beds of dark gray to dark yellowish brown dolomite dominate the lithofacies. Sedimentary structures associated with the dolomite are thin laminations and desiccation polygons. Fossils are rare (poorly preserved) to absent in the dolomite, while plant material is common to abundant (usually in bedding planes, Fig.

12). A few dolomite beds exhibit moldic porosity or fossil ghosts.

Beds adjacent to the dolomite facies show low-angle cross-bedding, intraclasts, and calcarenite mounds (Appendix, Locality 13).

This facies was deposited in a supratidal environment, though a few beds exhibit depositional fabrics that occur most often in the upper intertidal environment. Upper intertidal deposits in this facies are characterized by textures indicative of high energy environments.

ROCK-STRATIGRAPHIC UNITS

The Glen Rose Formation in Comanche and Hamilton Counties is subdivided into four informal rock-stratigraphic units (Figs. 3, 4). From youngest to oldest, Units 1, 2, and 3 occur in vertical sequence. Unit 4 is radically different in lithology from adjacent units and is separated on this basis, even though it is laterally equivalent to parts of Units 1 and 2. Most boundaries between units are abrupt and therefore easily recognized.

UNIT 1

Unit 1 consists of massive beds of limestone and cryptocrystalline limestone, thick marl beds and a few thin quartz sandstones. Quartz silt and sand are common to abundant in most beds.

Although faunal species diversity ranges from low to moderate, the unit contains the greatest species diversity of any of the units, particularly in the category of benthonic microfossils.

This unit is composed entirely of the thick marl-massive limestone facies. It was the first unit to lap onto sands and clays of the Twin Mountains Formation.

UNIT 2

Beds in Unit 2 include intramicrite, biomicrite, and pelmicrite interbedded with thick marl. Quartz sand is locally common.

Mollusc banks occur locally with mollusc bioclastic rock usually adjacent to them. Echinoids appear only in scattered local concentrations and are generally broken. Serpulids are confined to a section 15 feet thick, which is areally extensive. The lateral continuity of this section makes it a useful stratigraphic marker (Figs. 3, 4). Faunal species diversity is low to moderate, much less than that of Unit 1.

Unit 2 is a complex rock unit composed of 4 intimately related facies, (1) the marl-serpulid facies, (2) the burrowed intramicrite-pelmicrite facies, (3) the oyster-bank facies, and (4) the mollusc biomicrite facies. The mollusc biomicrite facies is further subdivided into a bioclastic subfacies and a pelecypod-gastropod bank subfacies. Distribution of facies is shown in Figures 7, 8, and 23.

UNIT 3

Unit 3 includes beds of variable thickness made up of dolomite, biosparite, intrasparite, intramicrite to biomicrite, and cryptocrystalline limestone. Dolomite beds contain either shell fragment ghosts or sparse to moderate amounts of plant material and bone fragments. Allochems dominant in the biosparite and biomicrite beds include a wide range of near-shore brackish to brackish-marine invertebrates. This fraction generally excludes echinoids. The cryptocrystalline limestone beds exhibit vuggy porosity and desiccation features such as sparite-filled cracks, collapse brecciation, desiccation polygons, and warped bedding. Quartz sand and silt are abundant throughout the unit.

Faunal species diversity is extremely low. Many beds contain one or two species of fossils while others are unfossiliferous. Some beds contain fossils reworked from other strata as indicated by fossil-rich clasts in a fossil poor matrix.

Channel structures (Fig. 24), cross-beds (Fig. 25), calcarenite mounds (Fig. 26), load casts (Fig. 27), and bored surfaces are common to this unit, while some of the dolomite beds exhibit fine laminations (Locality 13, bed 15).

This unit includes the sandy marl-ostracode facies, the mixed sparite-micrite facies, and the dolomite facies. Distribution of these facies is shown in Figures 7, 8, and 23.

UNIT 4

Unit 4 is composed of dolomite and sandstone with minor amounts of clay and marl, distinctive chiefly because of paucity of marine fossils. Limonite is more abundant here than in any other unit.

All of the beds included in the terrigenous-carbonate transitional facies belong in Unit 4 (see Fig. 4 for position of this unit in the section and Figs. 7 and 23 for distribution of the facies).

PALEONTOLOGY

The Glen Rose Formation has a moderately varied fauna. However, on a local level the species diversity often is quite low, as in the terrigenous-carbonate transitional facies and the dolomite facies. Gastropods, pelecypods, ostracodes, and agglutinated foraminifers are the most abundant faunal groups. Miliolids and serpulids are abundant only within narrow zones. Echinoids, when present in a relatively undisturbed state, although not well-represented, are important indicators of paleo-environmental conditions. Several recent studies

Fig. 19. High clastic content of the Glen Rose Formation near its northwestern limits gives the outcrop a nodular marly appearance. Locality 30.

Fig. 20. Vertical burrows in a thin bed of packsand (lower right) and possible rippled limestone beds—top of hammer. Locality 30.

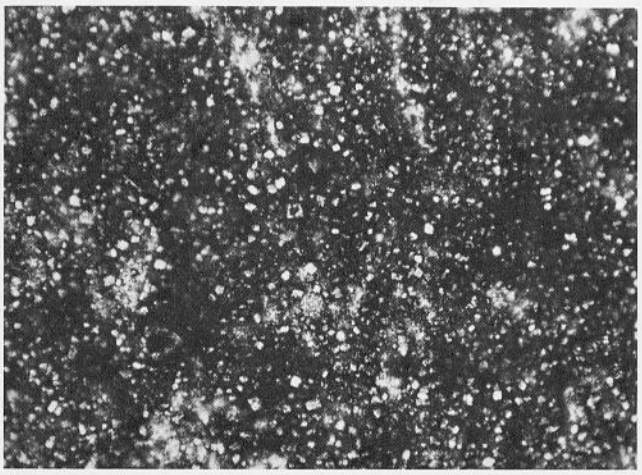


Fig. 21. Thin section. (X 35). Finely-crystalline dolomite. Photomicrograph. (X nicols). Locality 7, bed 13.

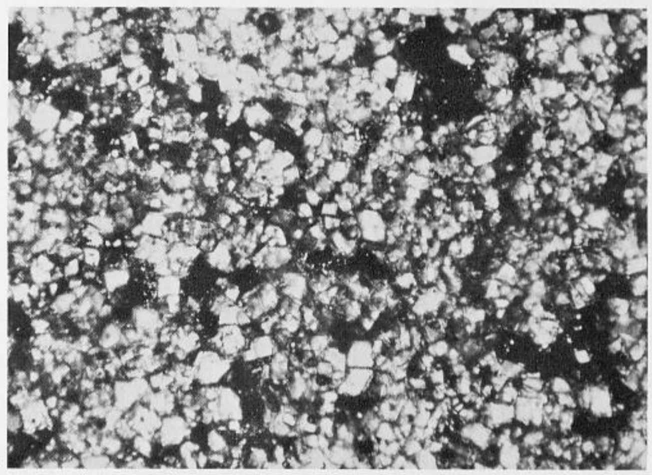


Fig. 22. Thin section. (X 35). Coarsely-crystalline dolomite. Photomicrograph. (X nicols). Locality 9, bed 10.

of the Glen Rose Formation (Stricklin, Smith, and Lozo, 1971; Aguayo, 1971; and Rodgers, 1967) list megafossils found in the unit in adjacent areas.

MEGAFOSSILS

Of the fauna in the Glen Rose Formation, pelecypods and gastropods are among the most widespread and numerous. In many areas (Localities 1, 2, 3, 12, 15, 16, 29 and 30) they are found *in situ* in large enough numbers to be considered reef or bank deposits. Genera most commonly associated with this type of accumulation are *Cardium, Pachymya, Arca, Ostrea,* and *Turritella.* At Localities 6 (bed 34) and 10 (bed 14), *Pachymya* is the only megafossil present (in common abundance), preserved as an *in situ* steinkern at both localities. At Localities 1 (bed 9) and 2 (bed 18), clam steinkerns provided a substrate for red algae. Next to *Turritella, Tylostoma* is the most abundant gastropod encountered. *Tylostoma,* although often abundant, is never well-represented in major mollusc communities. No speciments of *Toucasia* were found during this study although they are abundant in areas to the northeast (Epps, 1973; Roberson, 1972; Aguayo, 1971) and south (Stricklin, Smith, and Lozo, 1971).

Serpulids, preserved as calcareous worm tubes, occur throughout the formation but are most widespread and numerous near the base. A particularly abundant zone of individual and colonial serpulids served as one of the most useful intervals for correlation (Fig. 4).

Colonial serpulids increase in abundance to the north-northeast. At Locality 22, these annelid colonies are preserved as disk-shaped accumulations up to 9 inches in diameter and 4 inches in height. In the Glen Rose type area, serpulids formed colonies measuring up to 5 feet in diameter and as much as 1½ feet thick (Trippet, 1972; Aguayo, 1971; Rodgers, 1967) where they are found in association with dinosaur tracks. While the salinity range for modern serpulids is brackish through slightly hypersaline (Heckel, 1972), serpulids in the present study area are associated exclusively with brackish water foraminifers and ostracodes.

Serpulid colonies and individuals attach to a hard substrate (Fig. 14) and flourish best where deposition

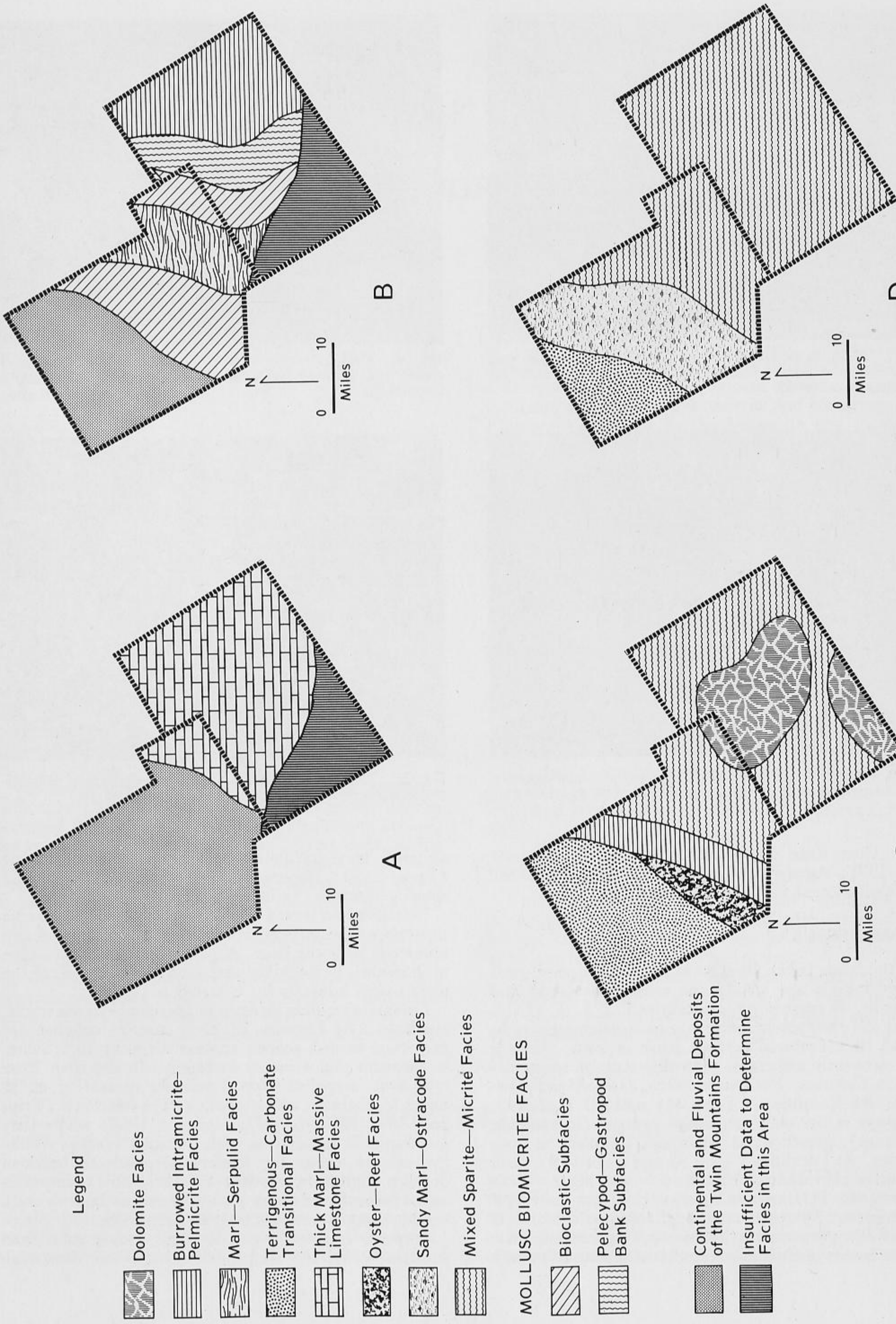


Fig. 23. Maps showing migration of Glen Rose facies at successive time intervals A, B, C, and D.

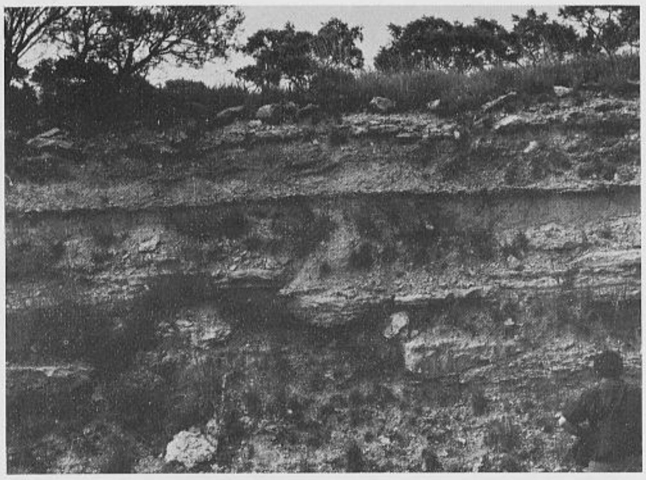


Fig. 24. Channel fill of dense, coarse mollusc-fragment biosparite cutting across soft, nodular biomicrite and marl beds. Locality 13.

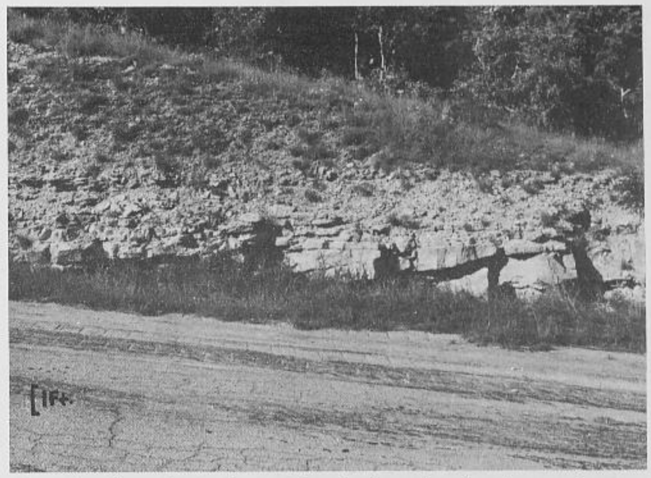


Fig. 25. Cross-beds formed in the lee of a barrier or bar are composed of a jumbled chalky glauconitic packed pelmicrite with few miliolids and oyster fragments. Locality 6.

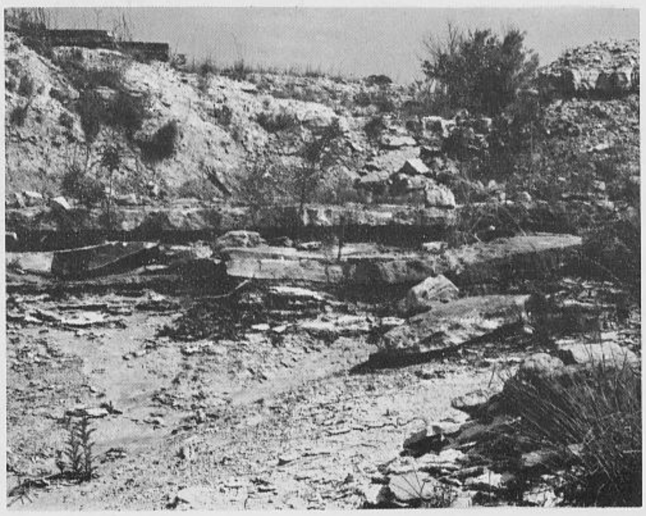


Fig. 26. Calcarenite mounds which probably represent near-shore shoals; mud cracks occur in at least two zones immediately above in the section (not shown), hammer in center for scale. Locality 13, spillway, Hamilton city reservoir.

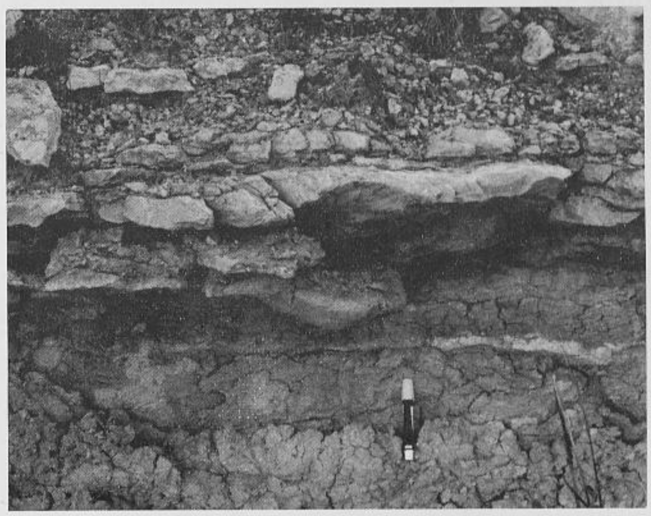


Fig. 27. Intrasparite load cast into marl. Locality 30.

rates are extremely slow. Excessive deposition beyond the growth rates of individuals or the colony often results in suffocation of the serpulids. Termination of serpulid growth most often appears to result from the rapid influx of terrigenous mud.

Echinoid fragments occur in small quantity in the central and eastern parts of the study area. Modern echinoids are exclusively marine organisms, though they are sometimes carried into adjacent, toxic environments during storms. This is the probable origin for most echinoid fragments in the Glen Rose Formation since most are broken and abraded and associated with brackish water foraminifers and ostracodes in marls and clays with moderate quantities of coarser clastic sediment. In the study area well-preserved whole to slightly broken echinoids are rare, and when present with other biologic and lithologic marine indicators, served to identify intervals of marine (infratidal) deposition. Lack of echinoids and presence of brackish to fresh water indicators helped define facies and environments mainly brackish.

Several species of echinoids have been reported from the Glen Rose Formation. In south-central Texas *Salenia texana* is associated with the "Corbula bed" regional stratigraphic marker (Stricklin, Smith, and Lozo, 1971). However, the "Corbula bed" does not appear to extend into the Glen Rose outcrop of Comanche or Hamilton Counties. Despite the absence of a well-defined "Salenia zone" or a "Corbula bed," other stratigraphic similarities allow a rough correlation to be made between south-central Texas and the study area of this report. Much of the exposed Glen Rose Formation in Comanche and Hamilton Counties is thought to be equivalent to the upper member of Stricklin, Smith, and Lozo (1971).

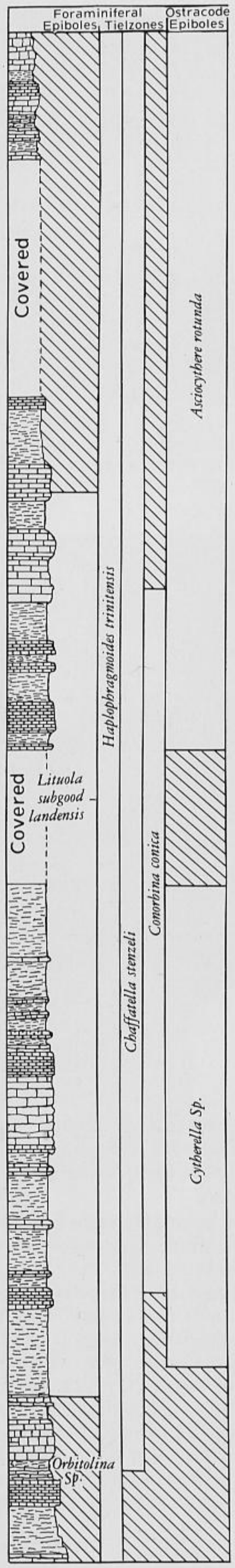


Fig. 28. Diagrammatic columnar section showing paleontologic zonation in the Glen Rose Formation of north-central Texas.

MICROFOSSILS*

Microfossil collections were obtained mainly from washed marl, clay, and sandstone samples, many of which contained a variety of echinoid, mollusc, crustacean and worm tube fragments, vertebrate parts, and plant remains along with ostracodes and a highly variable foraminifer population. Bryozoans occurred rarely in the samples. Foraminifer types (agglutinated, calcareous hyaline, etc.) were noted and gross distribution was determined.

Microfaunal Descriptions

In general, microfossils are well developed. Ostracodes have thick calcareous tests with smooth walls and less commonly ornamented walls. Most of the foraminifers are large agglutinated forms, although there are some with thick calcareous tests and very few thin, fragile hyaline forms. The latter inhabited the deepest and most quiet of the Glen Rose depositional environments.

The foraminiferal fauna is dominated by lituolids, which range throughout the formation (Fig. 28). Agglutinated forms, such as *Lituola* and *Haplophragmoides,* are abundant. Although the calcareous species outnumber the agglutinated species, they too are represented by relatively few specimens. Apart from a few planktonics, considered contaminants (Locality 16, bed 8), all of the foraminifers were benthonic.

Overall, the benthonic foraminiferal species diversity and abundance increases downward in the Glen Rose Formation. Foraminifers are most abundant in the central and southern parts of the area. When foraminifer populations decrease, ostracodes increase in abundance, probably indicating a direct relationship to salinity variations, depth of water, and rate of clastic influx. Ostracodes have a higher tolerance to these factors. Ostracodes are common throughout the area, but are particularly abundant in the northwest where the formation is less than 100 feet thick (Fig. 6). Seven genera of brackish water ostracodes (*Asciocythere, Cypridea, Cythere, Cythereis, Cytherella, Eocytheropteron,* and *Paracypris*) were identified (Stead, 1951, p. 585).

Units 1 and 2 contain a low foraminiferal species diversity, but a great abundance of *Haplophragmoides trinitensis* and *Lituola subgoodlandensis.* Miliolids are rare to common with *Quinqueloculina* and *Nummoloculina heimi* most numerous. Ostracodes are well represented with *Asciocythere rotunda, Eocytheropteron trinitensis,* and *Paracypris weatherfordensis* abundant. Oysters are common to locally abundant. Quartz sand content increases rapidly updip, vertebrate parts and plant remains are locally abundant.

Unit 3 contains moderate species diversity represented by many individuals (4-15 percent of sample). *Lituola subgoodlandensis, Buccicrenata subgoodlandensis,* and *Phenacophragma assurgens* are most abundant. *Orbitolina* occurs, only in small abundance, in a single bed (Locality 16, bed 8). Ostracodes are scattered and in variable quantities. *Cytherella* sp. and *Asciocythere*

**Editor's Note.* Xerox copies of the stratigraphic distribution of microfossils for all measured sections are available for Xerox costs.

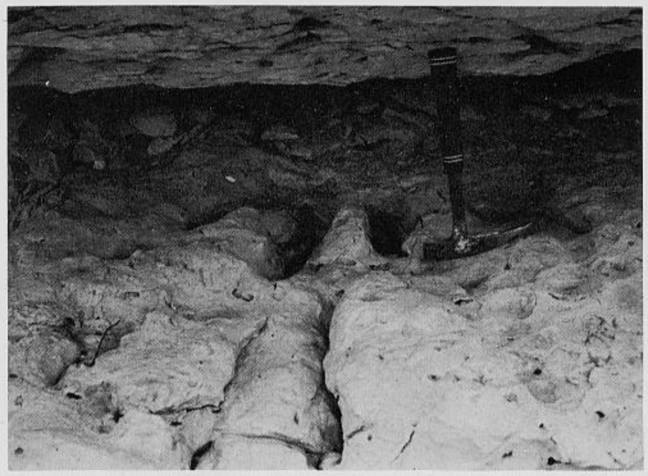


Fig. 29. Track of three-toed dinosaur in burrowed dolomite, overlain by wispy nodular fossiliferous biomicrite. Note that this track bears a striking resemblance to Shuler's (1917 and 1935) carnosaur *Eubrontes*, especially *E. glenrosensis*. Locality 37.

rotunda are most abundant. Vertebrate parts, plant remains, and quartz are negligible to absent.

A paleontologic zonation of the formation was compiled to show the relationship between the foraminifer and ostracode fauna and the lithology (Fig. 28). Two foraminifer epiboles were recognized, from the lowest to the highest: (1) *Orbitolina* sp. and (2) *Lituola subgoodlandensis* (Vanderpool, 1928). Three foraminifer teilzones were recognized. Also, two ostracode epiboles are described. Figure 28 was modified from Stead (1951) so that a comparison could be made between the Glen Rose Formation in south-central Texas and the study area of Comanche and Hamilton Counties. A comparison between Stead's zonation and that of this report shows that change in the lateral distribution of selected species is relatively slight over a distance of 150-180 miles.

Paleoecology

Shallow water indicators increase in abundance from the base to the top of the Glen Rose Formation. *Ostrea* banks become common near the top (Localities 29 and 30) indicating shallow, brackish water. Holocene *Ostrea* are usually found in scattered banks to poorly developed fringing reefs in salinities from 5,000 to 15,000 parts per million (Lowman, 1949, p. 1949). Associated ostracode genera also indicate brackish water. *Ammobaculites* is typically a brackish water form, occuring in lagoonal, near to off-shore marine, marsh, and estuary environments (Phleger, 1960, p. 165). *Ammobaculites* is common in the upper part of the formation. Jones (1956, p. 250) shows that abundance of *Ammobaculites* and other similar arenaceous forms characterizes inner neritic, lagoonal, or tidal-flat environments where water depths are from 0-5 meters and temperatures from 0° to 27° centigrade. Salinities range from 100 to 5,000 parts per million (Lowman, 1949, p. 1949). *Haplophragmoides,* another agglutinated foraminifer, presently exists in the brackish marshes of Louisiana "from the most dilute to the most saline parts of the brackish-water lake and bay area in the Mississippi delta" (idem).

Miliolids, although not widespread, constitute a high percentage of the allochems in limestone and marl at Localities 6 and 14. Beds at Locality 14 contain such a high concentration of miliolids that it could almost be classified as a miliolid facies which indicates deposition in water generally less than 15 feet deep (Griffith, Pitcher, and Rice, 1969, p. 129). However, other factors should be considered to determine specific environments of deposition. For example near Pretty Boy Rock off Vaca Key, in Florida Bay, *Quinqueloculina* and other miliolids are common to abundant in clear, shallow (1-3 foot depths), intertidal flats with relatively normal marine salinity and slightly restricted circulation.

In modern waters planktonic foraminifers increase in number of species and abundance generally with an increase in depth and circulation of water. In the Glen Rose rocks planktonic forms are absent to locally rare, while benthonic foraminifers are common. The abundance of benthonic specimens indicates shallow water and favorable bottom conditions. Circulation probably was not totally restricted because benthonic populations do not exist where bottom waters and muds are toxic at the depositional interface.

The widespread presence of wood and other land-derived plant material at many localities (Localities 7 and 13) suggests there must have been significant areas of nearby land during deposition of Glen Rose sediment in the study area.

The relative paucity of microfossils and other calcareous fossil material may have been caused by slightly acidic bottom muds in the environment of deposition. The relative lack of calcareous fossils may also have been due to recrystallization during dolomitization, which often obliterates any trace of calcareous fossils and structures. Finally, ground water movement may have leached out many of the calcareous components of the marl and clay beds during late diagenesis.

ICHNOFOSSILS

Burrows and borings are the most numerous trace fossils in the Glen Rose Formation, yet burrowing usually causes more uncertainty in stratigraphic studies than any other sedimentary structure. Organisms that burrow through sediment disturb the primary fabric destroying or significantly altering sedimentary structures that existed prior to burrowing. Burrowing homogenizes soft sediment and aids in disarticulating bivalves and ostracodes. Different burrow attributes have been associated with specific sedimentary environments (Roehl, 1967). This association is shown in the following list:

Burrow Quality	Environment
1. Local burrows	infratidal
2. Dense burrows	lower intertidal
3. Extensively churned fabrics	upper intertidal

This, in conjunction with other characteristics of the strata, aided in environmental interpretations of the formation.

Bored surfaces occur throughout the Glen Rose Formation. There has been considerable discourse on the value of such surfaces in the correlation of strata, recog-

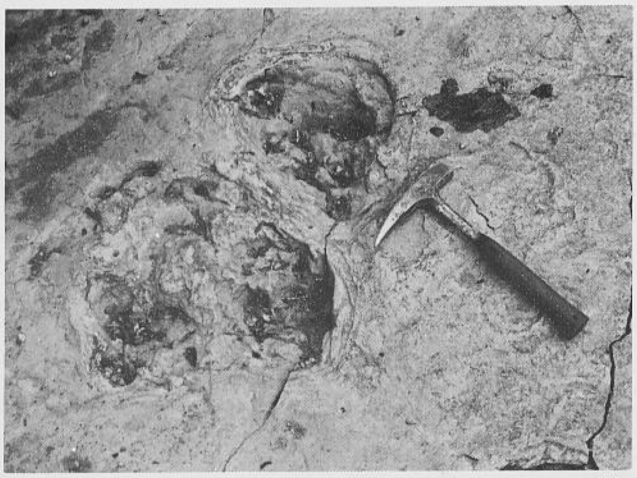


Fig. 30. Indistinctly shaped dinosaur track or tracks, possibly a sauropod track. The distinct rim around the track shows the sediment was in a highly plastic state when disturbed. Occurs approximately 2.5 feet lower in the section than the carnosaur tracks above. Locality 37.

Fig. 31. Crystal molds, probably after selenite, found only on the surface bed bearing sauropod-like tracks. This is interpreted as tidal flat in origin (similar to beds described by Illing, Wells, and Taylor, 1965, from the Persian Gulf intertidal carbonate mud flats, see also Conybeare and Crook, 1968, p. 215 for comparison plate). Locality 37.

nition of disconformities and determination of environments of deposition. Regardless of the answer, the bored surfaces in the Glen Rose did not lend themselves to correlation. They did, in some cases, help to determine the range of supratidal environments when accompanied by other diagnostic supratidal characteristics.

Tracks and trails are rare in the Glen Rose Formation though dinosaur tracks in the formation have been described by Perkins and Stewart (1971). While Perkins and Stewart (1971) summarized previously published data on dinosaur tracks in the Glen Rose, they did not mention the tracks (Figs. 29-32) at Locality 37, which occur at two different levels, each characterized by distinctly different modes of preservation and track type.

A single track (Fig. 29) was found near the top of a 4 foot thick dolomite section. It was well preserved and lacked the rim made when near-plastic sediment is pushed up around a foot. This suggests that the sediment was relatively soft from continuous water saturation and water covering the substrate was probably deep enough to support a part of the creature's weight. This track resembles those of *Eubrontes* (Shuler 1935, 1937) described as a carnosaur. Associated with the track are numerous unfilled burrows.

At the same locality several dozen poorly preserved tracks were found in a broad ledge approximately 2½ feet below the carnosaur track level. Tracks at the lower level vary widely in size but are all essentially the same shape and preservation is similar. Each bears a distinct rim (Figs. 30, 32) around the edge of the print where highly plastic sediment had been pushed out from beneath the foot of a fairly heavy creature. Water depth was apparently not great enough to support even the smallest of the dinosaurs. Tracks at the lower level were probably made by a sauropod, possibly *Pleurocoelus* (Perkins and Stewart, 1971, p. 57).

Structures that resemble small chiseled slots (Fig. 31) occur on the ledge with the sauropod tracks. Preservation of the sauropod tracks suggests that the sediment was probably exposed at the time the tracks were formed. Based on this evidence the environment of deposition may have been either supratidal or marsh. The slot-like features are interpreted as relict gypsum crystal molds suggesting a supratidal-evaporitic environment. A recent analog is found in the tidal flats of the Persian Gulf (Illing, Wells, and Taylor, 1965). Similar structures have been described and pictured by Conybeare and Crook (1968, p. 215).

DEPOSITIONAL HISTORY

Strata of the Trinity Group were deposited on the broad, relatively flat central Texas platform over which epicontinental seas slowly transgressed from the south and east, burying the existing topography beneath sediments of the Twin Mountains Formation. Deposition during Twin Mountains time innundated the local topography that had characterized the sub-Cretaceous erosion surface (Boone, 1968, p. 13). By the beginning of Glen Rose deposition, maximum local relief was probably less than 20 feet. Low relief features appear on the isopach map of the Glen Rose (Fig. 6) as (1) a high approximately over the McGregor divide (Boone, 1968, p. 36, 50) and (2) flanking lows corresponding to the Hamilton and Meridian valleys (Fig. 5).

In the study area subsidence was not as great as in the basin area farther east (Rodgers, 1967, p. 120A). Individual beds thicken only slightly toward the east across the study area. Thickening and thinning of beds probably was influenced more by sub-Cretaceous paleo-

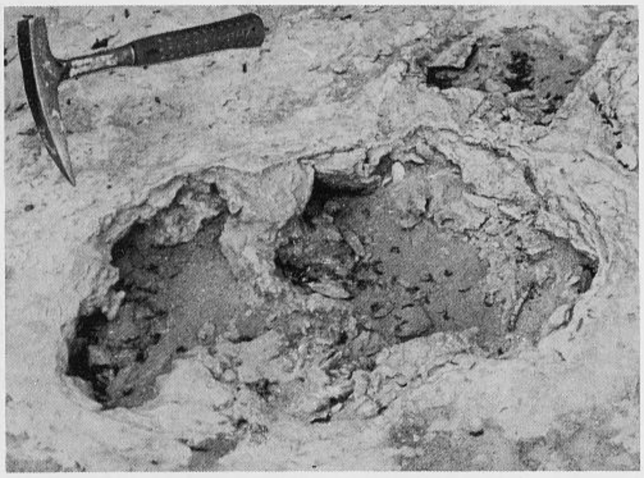


Fig. 32. Sauropod-like track similar to that of Fig. 30 but from a larger individual. Both tracks occur in the same bed. Locality 37.

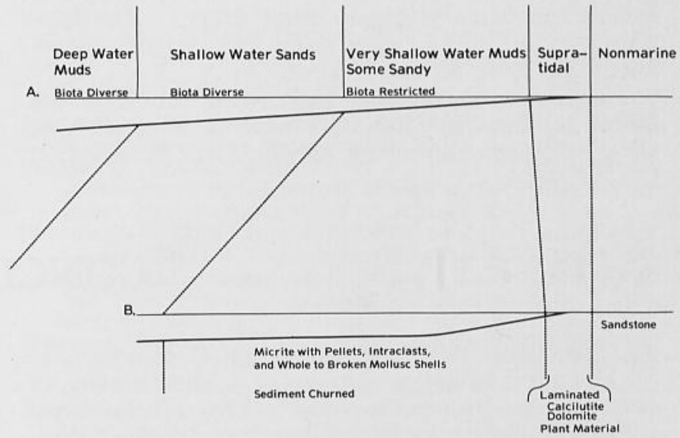


Fig. 33. Sedimentation models of (A) theoretical epeiric clear water sedimentation (modified from Irwin 1965, p. 446), and (B) the Glen Rose Formation of north-central Texas (this paper).

plain lows and highs than by differential subsidence. The gentle seaward slope and low relief of the surface on which the Glen Rose Formation was deposited produced an extremely broad tidal zone with extensive facies tracts roughly paralleling the shoreline (Fig. 23, A-D). Other factors affecting the distribution of facies were the influx of terrigenous material and eustatic changes.

As the Cretaceous sea continued to advance to the northwest, deposition of the Twin Mountains sediments progressed. Contemporary with deposition of upper Twin Mountains (Hensel) continental sediments, the first marine limestone and marl beds of the Glen Rose Formation began to form (Fig. 23A). The thick limestones and massive marls of the initial Glen Rose beds, with a fauna of echinoids, bryozoans, and a moderate variety of calcareous hyaline foraminifers, indicate deposition under near normal marine salinity in moderately quiet, clear, lower intertidal to infratidal environments. The transition zone between continental and lower intertidal environments must have been narrow during early Glen Rose time since the record shows few beds of upper intertidal character.

With continuing transgression, the Glen Rose shoreline (indicated by the boundary between continental and mollusc bioclastic sediments, Fig. 23B) progressed farther to the northwest. Low to moderate rates of marine sedimentation coupled with periodic influx of terrigenous material allowed deposition to keep pace with the slowly rising sea level. Facies bands continued to parallel the shoreline and individual facies maintained an extremely shallow-water character. Salinities ranged widely, but overall the sediments appear to have been deposited in brackish to slightly brackish and slightly restricted water.

As the Glen Rose sea neared maximum transgression, environmental conditions temporarily stabilized and fringing oyster banks began to develop in near-shore brackish waters. Basinward facies developed adjacent to the banks include the mollusc bioclastic subfacies and the pelecypod-gastropod bank subfacies. The oyster banks flourished intermittently for a brief time until terrigenous clastic sediment smothered them. Figure 7 shows the mantling relationship of the terrigenous-carbonate transitional facies to the oyster bank facies. Termination of oyster bank development and initation of high terrigenous influx marks the approximate reversal from transgression to regression of the sea.

The final phase of deposition of the Glen Rose Formation is characterized by expanding emergent marsh or sebkah-like conditions nearshore and by upper intertidal (brackish) and supratidal conditions farther to the east or basinward. Supratidal deposits occur along the axis of the McGregor divide and the Goldthwaite high (Dreyer, 1971) (Fig. 23C), both paleoplain highs. It is possible that topographic highs of the paleoplain remained as localized highs throughout Glen Rose deposition.

Truncation of the upper part of the formation by an unconformity removed part of the record of regression, but regression has been described as a relatively rapid process in the area to the south and east (Stricklin, Smith, and Lozo, 1971, p. 30).

DEPOSITIONAL MODEL

Information from a number of modern carbonate provinces has been used to establish models for interpretation of ancient carbonate deposits. This analog technique is most useful when facies trends in ancient deposits formed in environments with equivalent modern counterparts. The major problem is to recognize facies equivalents in ancient rocks.

Although the sedimentary facies of the Glen Rose Formation form a pattern of bands roughly parallel to the ancient shoreline, they do not conform to the general trend of most shallow marine deposits in reflecting successively deeper water origins. The facies trends in this study reflect origin on relatively monotonous, flat-lying sediment interfacies.

The modern depositional model most similar to conditions indicated by Glen Rose rocks is an epeiric clear water sedimentation model (Irwin, 1965, p. 445-459). A comparison between this model and a generalized sedimentation model for Glen Rose deposits is shown in Fig. 33 (after Irwin). This indicates that most of the Glen Rose deposits formed in the near-shore zone of shallowest water and low energy caused by shoaling in the adjacent basinward zone.

CONCLUSIONS

1. The Glen Rose Formation in Comanche and Hamilton Counties consists of a wide variety of rock types grouped together in nine separate facies on the basis of similar fabric and allochem characteristics. The most important aspects of the facies are indicated in the facies name. The nine identified are (1) mollusc biomicrite facies with a mollusc bioclastic subfacies and a pelecypod-gastropod bank subfacies, (2) burrowed intramicrite-pelmicrite facies, (3) marl-serpulid facies, (4) oyster-bank facies, (5) mixed sparite-micrite facies, (6) sandy marl-ostracode facies, (7) thick marl-massive limestone facies, (8) terrigenous-carbonate transitional facies, and (9) dolomite facies.
2. Four informal rock-stratigraphic units were recognized. Unit 1, the oldest unit, consists entirely of thick marl-massive limestone facies. Unit 2 is composed of mollusc biomicrite facies, burrowed intramicrite-pelmicrite facies, marl-serpulid facies, and oyster bank facies. Unit 3 is composed of mixed sparite-micrite facies, sandy marl-ostracode facies, and dolomite facies. Unit 4 consists entirely of terrigenous-carbonate transitional facies and is a lateral equivalent of Unit 2 and part of Unit 3.
3. In the study area Units 2 and 4 mark the maximum transgression of the Glen Rose sea.
4. Facies within the formation occur as parallel belts that migrated with transgression and regression.
5. Deposition kept pace with a slowly rising sea level throughout the transgressive phase. The relatively rapid regression that followed produced supratidal and high energy shoal-and-shoreline derived fabrics in the sediments.
6. Fossils consist dominantly of whole to fragmented molluscs, ostracodes, and agglutinated foraminifers. The fauna indicates that shallow, brackish, possibly slightly restricted waters persisted over most of the area. Only the westernmost deposits accumulated in fresh water.
7. Sedimentary structures diagnostic of extremely shallow water include (1) low angle cross-beds composed of poorly-sorted to unsorted mollusc shell-fragments, (2) channel structures, (3) calcarenite banks, (4) desiccated, collapse breccias of cryptocrystalline limestone, (5) dinosaur tracks associated with gypsum crystal molds in dolomite beds, (6) desiccation polygons associated with laminated dolomite, (7) clam borings, and (8) oyster shells cemented to bedding surfaces.
8. Also indicative of shallow water origin of deposits are local high concentrations of plant material including branches, stems or blades, and leaf-like fragments.
9. Stratigraphic similarities between the Glen Rose rocks of south-central Texas and the study area suggest the Glen Rose Formation exposed in Comanche and Hamilton Counties is equivalent to a part of the upper member of Stricklin, Smith, and Lozo (1971).
10. The paleoplain surface underlying Cretaceous rock apparently affected sediment distribution and character throughout Glen Rose deposition. Paleoplain highs are reflected in deposits of relatively shallow water origin while sediments over paleoplain lows tend to indicate deeper waters.

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APPENDIX

LOCALITIES AND MEASURED SECTIONS*

Locality 1. Hamilton County (31°59′N; 98°01′W). Glen Rose Limestone in roadcut 0.2 mile inside the eastern city limits of Hico on State Highway 6.

Glen Rose Limestone

32 Limestone—dense bed, current oriented, yellowish brown to brown, silty poorly washed packed oyster-fragment biosparite; ostracodes, gastropods and few intraclasts. ---- 0.2

31 Clay—light brown to green locally, *Asciocythere rotunda, Eocytheropteron trinitensis*, oysters, gastropods, clams, and serpulids. Shells fragmented and ostracodes disarticulated. ---- 0.5

30 Limestone—nodular to shaly, churned, yellowish brown to brown, slightly washed moderately packed mixed biomicrite; ostracodes, gastropods, plant material and serpulids. ---- 1.3

29 Marl—dark brown, oysters, *A. rotunda, E. trinitensis*, bryozoans, plant material, bones and teeth. Shells fragmented and ostracodes disarticulated. ---- 0.2

28 Limestone—massive, yellowish brown, locally silty poorly washed packed pelecypod-fragment biosparite; ostracodes, oysters, gastropods, and intraclast. ---- 0.9

27 Marl—few thin limestone beds included, light brown, *A. rotunda, E. trinitensis*, and serpulids. Shell fragments abundant and ostracodes disarticulated. ---- 0.9

26 Limestone—nodular, burrowed, yellowish brown, silty to sandy, sparse to packed pelecypod fragment biomicrite; clams, miliolids and gastropods; laminae of silty packed ostracode biosparite occur in upper part of bed. ---- 0.7

25 Marl—brown, *A. rotunda, E. trinitensis*, serpulids and quartz silt. Abundant shell fragments and ostracodes disarticulated. ---- 0.3

24 Limestone—thinly bedded yellowish brown, slightly washed moderately packed fossiliferous pelmicrite; clam fragments, ostracodes, oysters and serpulids. ---- 1.2

*Editor's note. Xerox copies of the stratigraphic distribution of microfossils for all measured sections are available for Xerox costs.

23 Clay—brown to green, oysters, *A. rotunda,* echinoid parts, and clams. Shells broken and ostracodes disarticulated. Microfossil content extremely low. ------1.7
22 Limestone—nodular, some load casts, current oriented, yellowish brown, poorly washed moderately packed fossiliferous fecal intrasparite; clams, oysters, gastropods, and calcareous red algae. ----------1.0
21 Marl—light brown, *A. rotunda, E. trinitensis,* clams, bryozoans and gastropods. Shells fragmented and ostracodes disarticulated. ---------------------------1.8
20 Limestone—massive, current laminated, yellowish brown, poorly washed packed fossiliferous fecal intrasparite; pelecypods, gastropods, limonite, ostracodes, encrusting blue-green algae and intraclasts. 0.5
19 Limestone—nodular, burrowed, yellowish brown, sparse mixed biomicrite; clam fragments, ostracodes, miliolids, gastropods pellets and clam steinkerns. --2.5
18 Limestone—honeycombed, dark yellowish brown, cryptocrystalline, abundant manganese dendrites. ---2.3
17 Marl—brown, gastropods, *A. rotunda, E. trinitensis,* quartz silt and plant material. Shells fragmented and ostracodes disarticulated. ----------------------2.7
16 Limestone—massive to thickly bedded, churned, light yellowish brown to dark gray, packed fossiliferous pelmicrite; clam fragments, ostracodes, gastropods, limonite and encrusting blue-green algae. --2.8
Covered. --3.1
15 Limestone—nodular, churned, light yellowish brown, packed fossiliferous pelmicrite; clam fragments, ostracodes and gastropods. -------------------------1.6
14 Marl—brown, *A. rotunda,* oysters, *E. trinitensis,* clams, and bryozoans. Shells broken and ostracodes disarticulated. -----------------------------------1.5
13 Limestone—nodular, burrowed, light brown to gray, packed gastropod biomicrite; oysters, pellets and serpulids; topped by a thin layer of packed fossiliferous intrasparite. ---------------------------------4.1
12 Marl—brown, oysters, *A. rotunda, Paracypris weatherfordensis,* bryozoans, pelecypods, *Haplophragmoides trinitensis* and serpulids. Shells fragmented and ostracodes disarticulated. ---------------1.0
Covered. --5.1
11 Limestone—blocky to nodular, churned, yellowish brown packed mollusc biomicrite; intraclasts, pellets and serpulids. ------------------------------------1.3
10 Marl—brown, echinoid parts, *E. trinitensis,* oyster fragments and gastropods. Shells broken and abraded, ostracodes disarticulated. ------------------0.9
9 Limestone—nodular, churned, yellowish brown to gray, packed to moderately packed mollusc-fragment biomicrite; oysters, gastropods, glauconite, and calcareous red algae. -----------------------------------1.2
8 Marl—brown, echinoid parts, *E. trinitensis,* oyster fragments and gastropods. Shells broken and abraded, ostracodes disarticulated. -----------------0.4
7 Limestone—nodular, dark brown to dark gray, moderately packed mollusc-fragment biomicrite; encrusting blue-green algae, intraclasts and pellets. Intraclasts weathered slightly. ---------------------0.7
6 Marl—brown, echinoid parts, *E. trinitensis,* gastropods, plant material. Fossils mostly fragmented and disarticulated. -------------------------------------0.3
5 Limestone—nodular, burrowed, churned, yellowish brown to gray, moderately packed fossiliferous fecal intramicrite; clams, gastropods, miliolids and encrusting blue-green algae. ---------------------------2.2
4 Marl—light brown, *A. rotunda* and plant material. Abundant fragmented shell material and ostracodes disarticulated. -------------------------------------0.5
3 Limestone—nodular, burrowed, yellowish brown to gray, moderately packed mollusc fragment biomicrite; clams, gastropods, oysters, pellets, and miliolids. ---------------------------------------0.6
2 Marl—light brown, *A. rotunda* and plant material. Abundant shell fragments and ostracodes disarticulated. --1.2
1 Limestone—nodular, burrowed, light brown, moderately packed fossiliferous pelmicrite; mollusc fragments, encrusting serpulids, few *Tylostoma* steinkerns and encrusting blue-green algae. Shells moderately bored. -------------------------------1.7

Total ------------------------------------48.9
Elevation of base ----------------------1020.5

LOCALITY 2. Hamilton County (31°57'N; 98°01'W). Glen Rose Limestone exposed in roadcut and in Honey Creek along F.M. 1602, 2.0 miles south of Hico.

Glen Rose Limestone

45 Limestone—nodular, churned, light yellowish brown, packed fossiliferous fecal intramicrite; mollusc fragments, echinoid parts and traces of glauconite. ------0.6
44 Marl—yellowish brown, superficial oolites, *Asciocythere rotunda* and *Eocytheropteron trinitensis.* Ostracodes disarticulated. --------------------------1.3
43 Limestone—thin bed, light yellowish brown, packed fossiliferous fecal intramicrite; clams, gastropods and ostracodes. Clams disarticulated. ---------------0.3
42 Marl—dark yellowish brown, oolites (probably superficial) and *A. rotunda,* that are mostly disarticulated. ---1.4
41 Limestone—nodular, churned, light yellowish brown, sandy, moderately packed mixed biomicrite; ostracodes, pelecypod fragments, highly oxidized limonite intraclasts and encrusting blue-green algae. ---------1.5
40 Limestone—massive, dark yellowish brown, cryptocrystalline. ---0.6
39 Marl—dark yellowish brown, grains are cryptocrystalline (recrystallized calcite). -----------------3.1
38 Limestone—massive, dark yellowish brown, cryptocrystalline. --0.3
37 Marl—dark yellowish brown, *A. rotunda* and hematite. Many grains extensively altered by recrystallization to calcite. ----------------------------2.7
36 Limestone—thin bedded, current oriented, light yellowish brown, glauconitic moderately washed packed fossiliferous intrasparite; ostracodes and quartz silt. 1.0
35 Clay—green, *A. rotunda* and *E. trinitensis.* Ostracodes broken and disarticulated. -------------------0.8
Covered. --3.1
34 Limestone—nodular, churned, yellowish brown, silty moderately packed miliolid biomicrite; pellets, limonite and molluscs. ----------------------------0.6
33 Limestone—thin bedded to shaly, light yellowish brown, slightly washed packed fecal intramicrite; miliolids, ostracodes, few clam fragments, gastropods and serpulids. ------------------------------1.6
32 Marl—light yellowish brown, superficial oolites, clams, and *A. rotunda.* Ostracodes disarticulated and broken. --------------------------------------0.6
31 Limestone—thin, irregular beds, current oriented and well-sorted, light yellowish brown, changes upward from a packed poorly washed ostracode biosparite to a packed blue-green algae-encrusted pelecypod-fragment biosparite to a sandy packed miliolid-bearing pelmicrite. Grains current oriented and well sorted. ------------------------------------2.9
30 Marl—yellowish brown, *A. rotunda, E. trinitensis* and clams. Sixty percent of bivalves and ostracodes disarticulated. -------------------------------------1.5
29 Limestone—massive, calcite nodules, dark yellowish brown, cryptocrystalline. ---------------------------1.3
28 Marl—dark yellowish brown, limonite and bone. Most grains cryptocrystalline (recrystallized calcite). --0.3
27 Limestone—thin bed, wavy silt laminae, current oriented, light yellowish brown, sandy packed pelecypod-fragment biosparite; pellets, encrusting blue-green algae, gastropods and finely disseminated limonite. ---0.4
26 Marl—thin limestone beds occur near top, yellowish brown, clams, *A. rotunda,* oysters and bone. Ostracodes disarticulated-most shells fragmented. -------4.1
25 Limestone—thin, irregular beds, burrowed, light yellowish brown, packed fossiliferous fecal intramicrite; pelecypod fragments, encrusting blue-green algae, gastropods and limonite. -------------------2.1
24 Marl—light yellowish brown, *A. rotunda, E. trinitensis,* oysters, clams, and echinoids. Bivalves and ostracodes disarticulated, broken, and bored. -------2.4

23 Limestone—thin bed, current laminated, yellowish brown, slightly washed moderately packed ostracode biomicrite; mollusc fragments, pellets, encrusting blue-green algae, intraclasts, and serpulids. ---------0.3
Covered. ---------7.8
22 Limestone—thinly bedded, current oriented, light yellowish brown, slightly washed packed fossiliferous intramicrite; pellets, molluscs, encrusting blue-green algae, ostracodes, echinoid parts and disseminated limonite. ---------1.0
21 Limestone—nodular, churned, light yellowish brown, packed fossiliferous pelmicrite; whole gastropods, pelecypod fragments, few echinoid fragments, and calcareous red algae. ---------3.1
20 Marl—nodular, light yellowish brown, *A. rotunda,* echinoid parts, and *Lituola subgoodlandensis.* Ostracodes mostly articulated; shells highly bored. ---1.2
19 Limestone—nodular, light yellowish brown, glauconitic packed fossiliferous fecal intramicrite; mollusc fragments, quartz silt and disseminated limonite.-----0.6
Covered. ---------11.2
18 Limestone—nodular, light brown, glauconitic packed mollusc biomicrite; steinkerns of *Arctica, Cardium, Turritella, Nerinea, Tylostoma,* and many others; calcareous red algae common. ---------1.2
17 Limestone—massive, current oriented, dark yellowish brown, moderately packed pelecypod biomicrite becoming a packed fossiliferous intrasparite locally; pellets, gastropods, echinoid fragments, and limonite. Pelecypods disarticulated. ---------1.0
16 Limestone—nodular, burrowed, churned, light yellowish brown, silty packed fossiliferous pelmicrite; miliolids and mollusc fragments. ---------3.4
15 Marl—nodular, laminated green to brown, oyster fragments, *A. rotunda,* gastropods, and clams. Ostracodes disarticulated and bored. ---------0.8
14 Limestone—massive to nodular, light yellowish brown, slightly washed packed fossiliferous intramicrite; pellets, mollusc fragments, encrusting blue-green algae, echinoid parts, and miliolids in clasts. Most shell fragments and clasts are rollers. ---------3.9
13 Marl—light yellowish brown, gastropods, *A. rotunda, Haplophragmoides trinitensis* and clams. Ostracodes disarticulated and broken. ---------1.0
Covered ---------9.1
Offset—beds 13-45 offset 0.4 mile south of beds 1-12.
12 Limestone—thin, irregularly bedded, light brown, packed fossiliferous fecal intramicrite with a 1-2 inch zone of glauconitic poorly washed packed intrasparite; miliolids abundant. ---------2.8
11 Marl—burrowed, light yellowish brown, *H. trinitensis, A. rotunda, E. trinitensis,* clams and serpulids. Ostracodes disarticulated and broken. ---------3.3
10 Limestone—nodular, burrow mottled, light yellowish brown, silty packed fossiliferous fecal intramicrite; miliolids. ---------2.0
9 Marl—light yellowish brown, *Cytherella* sp., *H. trinitensis,* pelecypods, and gastropods. Ostracodes disarticulated, many shells and tests broken. ---------2.8
8 Limestone—nodular, churned and burrowed, light yellowish brown, packed glauconitic fossiliferous fecal intramicrite; echinoid parts and miliolids. -----4.7
7 Marl—light yellowish brown, superficial oolites, gastropods, *Cytherella* sp., pelecypods and *L. subgoodlandensis.* Fifty percent of the ostracodes disarticulated and shells show bore marks. ---------1.9
6 Limestone—nodular, light yellowish brown, moderately packed fossiliferous intramicrite; miliolids, mollusc fragments, and ostracodes. Grains are slightly weathered. ---------1.3
5 Marl—light yellowish brown, superficial oolites, gastropods, *Cytherella* sp., pelecypods, *L. subgoodlandensis, Nuculana,* and dasyclad algal parts. Fifty percent of ostracodes disarticulated and shells show bore marks. ---------0.3
4 Limestone—thinly bedded, current laminated, light brown, slightly washed packed fecal intramicrite; pyrite going to limonite, encrusting blue-green algae, gastropods, miliolids, pelecypod fragments, and ostracodes. ---------1.4
Covered. --------- 2.8
3 Limestone—thin bed, light yellowish brown, moderately sorted packed fossiliferous intrasparite; pellets, mollusc fragments, serpulid tube fragments, and miliolids. ---------0.3
2 Marl—light yellowish brown, gastropods, *L. subgoodlandensis, Cytherella* sp., pelecypods, echinoid parts, and serpulids. Ostracodes disarticulated and most other fossils fragmented. ---------0.5
1 Limestone—nodular, light yellowish brown, well-sorted packed fossiliferous intrasparite; encrusting blue-green algae, mollusc fragments, pellets, dasyclad algal fragments. Finely disseminated limonite and miliolids. ---------3.7

Total ---------107.9
Elevation of base ---------962.0

LOCALITY 3. Hamilton County (31°55'N; 98°05'W). Paluxy Sand and Glen Rose Limestone exposed in roadcut on U.S. Highway 281 at its intersection with Honey Creek, 4.3 miles southwest of Hico.

Paluxy Sand
Thinly bedded sandstones, sandy clay, unconsolidated sand and sandy residual soil, white, gray, and orange-brown, fine grained. ---------7.0

Glen Rose Limestone
Thin alternating beds of dark yellowish brown, sandy whole oyster biomicrite and gray to light yellowish brown nodular marl. A single bed of light gray to white, silty oyster fragment biomicrite marks the upper limit of the limestone. ---------23.0

LOCALITY 4. Hamilton County (31°48'N; 98°00'W). Edwards Limestone contact with the Comanche Peak Limestone, exposed on the west slope of Twin Mountains.
Contact elevation ---------1280.0

LOCALITY 5. Hamilton County (31°43'N; 98°01'W). Paluxy Sand and Glen Rose Limestone in roadcut on State Highway 22, 0.2 mile east of Leon River.

Paluxy Sand
Sandstone and residual sandy soil, reddish brown to gray, fine grained, thin clay seams.

Glen Rose Limestone
26 Limestone—massive, some vertical burrows, light yellowish brown, moderately packed mollusc-fragment biomicrite; echinoid parts and some sand filled burrows. ---------0.6
25 Marl—light yellowish brown, rounded oyster fragments, clam fragments, ostracodes, bone and quartz sand. Most fossil fragments are lime coated. ---------2.3
24 Limestone—massive to blocky, churned, light yellowish brown, silty moderately packed mixed biomicrite; pelecypods, gastropods, miliolids, glauconite, intraclasts and echinoid parts. ---------2.6
23 Limestone—nodular, well sorted, current oriented, light yellowish brown, silty moderately packed ostracode biomicrite; steinkerns of clams, gastropods and oysters. Ostracodes disarticulated. ---------2.4
22 Limestone—massive, churned, light yellowish brown, silty moderately packed to packed mixed biomicrite; miliolids, pelecypod fragments, and gastropods. -----0.6
21 Limestone—nodular, current oriented, silty moderately packed ostracode biomicrite; oysters, *Tylostoma,* and clam steinkerns. ---------4.1
20 Limestone—nodular to massive, current oriented, light yellowish brown to dark yellowish brown, silty slightly washed packed miliolid biomicrite; thin-shelled pelecypods, ostracode fragments, and some limonite beads. ---------1.6
19 Marl—dark yellowish brown, *Asciocythere rotunda,* thin-shelled clams and echinoid parts. Bivalves and ostracodes disarticulated. ---------0.5
18 Limestone—irregularly bedded, churned, light yellowish brown, silty moderately packed pelecypod-fragment biomicrite; finely disseminated glauconite, forams, and few serpulids. ---------1.8
17 Marl—yellowish brown, *A. rotunda,* bone and few limonite lumps. ---------5.5
16 Limestone—nodular, current oriented, light brown, glauconitic moderately packed mixed biomicrite;

ostracodes, clam fragments, quartz silt and small hyaline foraminifera. ---------- 0.7
Offset—beds 16-26 offset 0.3 mile east of beds 1-15.
Covered. ---------- 5.9
15 Limestone—massive, churned, light brown, moderately packed mollusc biomicrite; serpulids, few rounded and broken intraclasts and some limonite stains. ---------- 0.7
14 Marl—yellowish brown, *A. rotunda, Eocythereopteron trinitensis,* clam fragments, echinoid parts, oysters, and bryozoans. Bivalves and ostracodes disarticulated. ---------- 3.5
13 Limestone—nodular, bored, and burrowed, pale yellowish brown, silty sparse fragmental mixed biomicrite; ostracodes and clams. Scattered dolomite crystals. ---------- 0.3
12 Marl—yellowish brown, *A. rotunda, E. trinitensis,* few echinoid parts and pelecypods. Bivalves and ostracodes disarticulated and fragmented. ---------- 2.0
11 Limestone—nodular, burrowed light yellowish brown, silty packed ostracode biomicrite; ostracodes, gastropods, pelecypod fragments, and echinoid parts. Ostracodes mostly disarticulated. ---------- 1.2
10 Marl—light yellowish brown, *A. rotunda,* miliolid, serpulids, gastropods, pelecypod fragments, and *Nuculana.* Ostracodes disarticulated. ---------- 5.0
9 Limestone—irregularly bedded, moderately sorted, light brown, packed fossiliferous intrasparite; pellets, miliolids, gastropods, encrusting blue-green algae, limonite, and large rounded micrite clasts. ---------- 2.3
8 Marl—brown, *A. rotunda,* gastropods, oysters, *Lituola subgoodlandensis,* serpulids, and few *Ammobaculites.* Bivalves and ostracodes disarticulated and most shells are broken and bored. ---------- 2.3
7 Limestone—nodular, bored, gray to light brown, silty moderately packed fossiliferous fecal intramicrite; miliolids, gastropods, and glauconite. ---------- 2.8
6 Marl—brown, oyster fragments, echinoid parts, pelecypods, and few ostracodes. Many shells fragmented, rounded and bored. ---------- 0.4
5 Limestone—nodular to massive, churned, gray to light brown, packed mixed biomicrite; miliolids and mollusc fragments—much disseminated limonite. ---------- 3.5
4 Marl—light brown, pelecypod fragments, echinoid parts, miliolids, and few ostracodes. Most shells abraded. ---------- 3.1
3 Limestone—nodular, gray to light brown, silty sparse foram biomicrite; clam fragments gastropods. 1.5
2 Marl—pale yellowish brown, pelecypod fragments, echinoid parts, *A. rotunda,* serpulids, and *L. subgoodlandensis.* Many shells abraded and ostracodes mostly disarticulated. ---------- 1.3
1 Limestone—thinly bedded, inclined burrows, gray to light brown, silty packed miliolid biomicrite; gastropods and clam fragments. ---------- 4.5

Total ---------- 63.0
Elevation of base ---------- 978.0

LOCALITY 6. Hamilton County (31°37'N; 97°54'W). Paluxy Sand and Glen Rose Limestone in roadcut on abandoned section of State Highway 36, in west bank of the Leon River, 1.35 miles west of Jonesboro.

Paluxy Sand
Sandstone and residual sandy soil, dark reddish brown, fine grained.

Glen Rose Limestone
41 Limestone—nodular, vertical burrows and borings, pale yellowish brown, silty sparse mollusc-fragment biomicrite; ostracodes. ---------- 0.3
40 Marl—yellowish brown, quartz sand, oysters, and *Asciocythere rotunda.* About 50% of ostracodes disarticulated. ---------- 0.6
39 Limestone—massive, current oriented, light yellowish brown, slightly washed moderately packed mollusc-fragment biomicrite; intraclasts. ---------- 2.4
38 Limestone—massive to shaly, current oriented, yellowish brown, silty moderately packed ostracode biomicrite; mollusc fragments. ---------- 1.2
37 Marl—laminated green and brown, ground water has altered grains. ---------- 3.9
36 Limestone—massive, burrowed, highly bored upper surface, light yellowish brown, sparse to moderately packed coarse mollusc-fragment biomicrite; ostracodes. ---------- 1.3
35 Marl—yellowish brown, *A. rotunda,* oysters, and echinoid parts. Ostracodes disarticulated. ---------- 1.5
34 Limestone—highly burrowed, light yellowish brown, moderately packed pelecypod-fragment biomicrite; ostracodes and gastropods. ---------- 0.8
Offset—beds 34-41 offset 0.2 mile northwest of beds 1-33.
33 Marl—light yellowish brown, *A. rotunda,* oysters and quartz silt. Ostracodes disarticulated. ---------- 1.0
32 Limestone—nodular to massive, light yellowish brown, glauconitic moderately packed miliolid biomicrite; oysters—grades upward to a silty fossiliferous fecal intramicrite; miliolids. Topped with a thin algal mat. ---------- 6.2
31 Limestone—massive to irregularly bedded, well-sorted, light yellowish brown, poorly washed packed fossiliferous intrasparite; miliolids. ---------- 2.5
30 Limestone—nodular to shaly, light yellowish brown, packed ostracode biomicrite; clam steinkerns, oysters and teeth. ---------- 10.4
29 Marl—yellowish brown, ground water saturation has altered grains completely. ---------- 1.0
28 Dolomite—massive to irregularly bedded, slightly burrowed, aphanocrystalline biogenic dolomite. ---------- 3.4
27 Limestone—thinly bedded to nodular, churned, light yellowish brown, sparse ostracode biomicrite; miliolids, clams, and echinoid parts. ---------- 1.3
26 Limestone—cut and fill channel structures, slightly mottled, light yellowish brown, glauconitic packed pelmicrite; oyster fragments and miliolids. ---------- 2.8
25 Marl—light yellowish brown, echinoids, oysters, clams, and ostracodes. Shells fragmented and abraded-ostracodes disarticulated. ---------- 2.8
24 Limestone—nodular to marly, highly bored upper surface, light yellowish brown, silty moderately packed fossiliferous intramicrite; clams, miliolids, gastropods, and *Trigonia* ---------- 3.5
23 Limestone—massive, churned, light yellowish brown, silty packed mixed biomicrite; miliolids, echinoid parts, and oyster fragments. ---------- 1.7
22 Limestone—nodular, slightly burrowed, light yellowish brown, moderately packed foram biomicrite; limonite. ---------- 1.4
Covered. ---------- 0.9
21 Limestone—nodular to massive, burrowed, light yellowish brown, silty packed fossiliferous fecal intramicrite; miliolids abundant, ostracode, pelecypod and enchinoid fragments rare. ---------- 1.9
20 Limestone—massive, pale yellowish brown, silty moderately packed fossiliferous fecal intramicrite; thin-shelled clams, miliolids, and finely disseminated glauconite. ---------- 1.3
19 Marl—brown, miliolids, ostracodes—*A. rotunda* and *Eocytheropteron trinitensis,* echinoid parts, and clam fragments. Ostracodes mostly disarticulated. ---------- 1.1
18 Limestone—honeycombed, dark yellowish brown, cryptocrystalline. ---------- 1.7
17 Marl—nodular, light yellowish brown, *A. rotunda,* echinoid parts, and clams. Ostracodes broken and disarticulated. ---------- 0.6
16 Limestone—honeycombed, dark yellowish brown, cryptocrystalline. ---------- 1.8
15 Marl—light yellowish brown, *E. trinitensis,* clams and echinoid parts. Ostracodes broken and disarticulated. ---------- 3.0
14 Limestone—nodular, vertical burrows and borings, light yellowish brown, silty sparse to moderately packed mixed biomicrite; ostracodes, molluscs, and glauconite. ---------- 1.0
13 Marl—laminated green and yellowish brown, *A. rotunda,* oysters, gastropods, echinoids, and clams. Ostracodes broken and disarticulated. ---------- 0.8
12 Limestone—nodular, burrowed, light yellowish brown, glauconitic packed poorly washed intrasparite; miliolids and clam fragments. ---------- 0.6
11 Marl—light yellowish brown, oysters, *E. trinitensis,* clams, echinoid parts, gastropods, and serpulids.

Most ostracodes disarticulated. ----------2.3
10 Limestone—nodular, burrowed, light yellowish brown, silty moderately packed mixed biomicrite; miliolids, fragments of clams, oysters, and gastropods, and limonite stains. ----------1.1
9 Marl—nodular, light yellowish brown, oysters, echinoid parts, clams, gastropods, *A. rotunda, Lituola subgoodlandensis*, and *Buccicrenata subgoodlandensis*. Many shells broken and ostracodes mostly disarticulated. ----------2.0
8 Limestone—thin-bedded, bored upper surface, brown, packed fecal intramicrite; miliolids, oyster fragments, and quartz silt. ----------1.6
7 Limestone—massive, wavy structures, rare burrows, light yellowish brown, poorly washed packed fecal intrasparite; miliolids. ----------0.9
6 Limestone—nodular, vertical to steeply inclined burrows, light yellowish brown, silty packed mollusc-fragment biomicrite; miliolids. ----------1.5
5 Marl—pale yellowish brown, ostracodes and oysters. Most grains are lime coated and ostracodes disarticulated. ----------1.6
4 Limestone—massive, few burrows, light yellowish brown, silty glauconitic sparse mixed biomicrite; miliolids and ostracodes. ----------1.2
3 Marl—nodular, light yellowish brown; all grains coated and unrecognizable. ----------2.2
2 Limestone—thinly bedded to nodular, light yellowish brown, silty poorly washed packed fossiliferous intrasparite becoming a silty packed miliolid biomicrite at the top; gastropods and encrusting blue-green algae. ----------2.8
1 Marl—nodular, light yellowish brown, burrow casts, *Cytherella* sp, echinoid parts and agglutinated forams. Most shells fragmented and ostracodes disarticulated. ----------3.0

Total ----------84.9
Elevation of base ----------875.0

LOCALITY 7. Hamilton County (31°34′N; 98°02′W). Glen Rose Limestone in stream cut on Plum Creek at intersection with the gravel road that lies between Ireland and Liberty.

Glen Rose Limestone

18 Limestone—massive, burrowed, light brown, moderately packed to packed coarse mollusc-fragment biomicrite; ostracodes, pellets, and miliolids. Oyster fragments show bore holes and are rounded. ----------0.8
17 Marl—light yellowish brown, gastropods, oysters, *Eocytheropteron trinitensis, Lituola subgoodlandensis, Haplophragmoides trinitensis*, bones, teeth, bryozoans, and plant material. Pelecypod shells fragmented and ostracodes disarticulated. ----------0.6
16 Limestone—massive, current oriented, light brown to yellowish brown, moderately packed to packed pelecypod-fragment biomicrite; ostracodes, miliolids, and serpulids. ----------0.5
15 Marl—light yellowish brown, clams, oysters, plant material (leaves and grasses), *E. trinitensis, Asciocythere rotunda*, bryozoans, bones, and teeth. Shells highly fragmented and ostracodes disarticulated. Low microfossil content. ----------0.3
14 Limestone—thin beds of slightly dolomitic, moderately packed to packed ostracode biomicrite; gastropods, *Cytherella* sp., plant material and clams. Ostracodes disarticulated. ----------0.2
13 Dolomite—wispy-structures, light gray to light brown, aphanocrystalline biogenic dolomite; few pockets of weathered fossils and local concentrations of plant remains. ----------0.3
12 Marl—blocky, light gray to yellowish brown, gastropods, carbonized plant remains (mainly grasses and/or stems), and *A. rotunda*. Shells highly broken, abraded, and weathered—ostracodes mostly articulated. Low microfossil content. ----------0.1
11 Limestone—shaly, churned, yellowish brown, packed ostracode biomicrite; gastropods, clam fragments, echinoid parts, and plant fragments. ----------0.2
10 Dolomite—blocky, wavy structures, yellowish brown, aphanocrystalline biogenic dolomite; plant material (branches, leaves, and grass): ½-inch layer packed with oyster fragments at top. ----------0.8
9 Marl—yellowish brown, clams, gastropods, oysters, *E. trinitensis, A. rotunda*, local high concentrations of carbonized plant remains. Shells mostly broken and ostracodes disarticulated. ----------0.1
8 Dolomite—massive to blocky, wispy laminae, yellowish brown, finely crystalline dolomite. ----------1.0
7 Marl—light yellowish brown to light brown, oolites, oysters, clams, gastropods, *Cytherella* sp., *E. trinitensis*, and echinoids. Shells broken and ostracodes disartculated. ----------0.5
6 Limestone—massive to slightly nodular, light yellowish brown to light brown, silty packed fossiliferous fecal intramicrite; fragments of oysters, ostracodes, clams, and bone. ----------0.5
5 Marl—light yellowish brown, gastropods, oysters, *Cytherella* sp., *E. trinitensis, L. subgoodlandensis*, local high concentrations of wood blocks, thin branches, leaves, and grasses. Shells mostly broken and ostracodes disarticulated. ----------0.4
4 Limestone—nodular to thinly bedded, churned, light gray to yellowish brown, sparse to moderately packed fossiliferous oomicrite; superficial oolites, plant fragments and thin-shelled clam fragments. ----------0.7
3 Marl—gray, echinoids, plant remains, oysters, *E. trinitensis* and *A. rotunda*. Shells broken and ostracodes disarticulated—bed moderately dolomitized. ----------2.2
2 Limestone—massive, current oriented, light brown, dolomitic moderately sorted, packed fossiliferous intrasparite; encrusting blue-green algae, oolites, oyster fragments, and serpulid fragments. ----------0.5
1 Marl—gray to light brown, oysters, echinoids, *L. subgoodlandensis* and local concentrations of plant remains. Shells mostly broken. ----------0.6

Total ----------10.3
Elevation of base ----------1019.7

LOCALITY 8. Hamilton County (31°34′N; 98°11′W). Edwards Limestone contact with the Comanche Peak Limestone, exposed in roadcut on U.S. Highway 84, 1.7 miles west of Evant.

Contact elevation ----------1420.0

LOCALITY 9. Hamilton County (31°27′N; 98°15′W). Paluxy Sand and Glen Rose Limestone in roadcut along the Lampasas River, 5.6 airline miles southwest of Evant.

Paluxy Sand

Sandstone, white to dark yellowish brown, thin clay seams. ----------17.7

Glen Rose Limestone

24 Limestone—blocky, dark yellowish brown, sandy cryptocrystalline limestone; abundant manganese dendrites. ----------5.0
23 Marl—dark yellowish brown, recrystallized calcite crystals and quartz silt. ----------2.3
22 Dolomite—moldic porosity, load casts, yellowish brown, coarsely crystalline, bones, teeth, and quartz sand. ----------4.3
21 Marl—yellow brown to brown, oysters and highly dolomitized and broken shell material. ----------3.7
20 Limestone—nodular, yellow brown, dolomitic moderately packed pelecypod-fragment biomicrite; ostracodes and oyster fragments. ----------1.4
19 Marl—gray, oysters, clam steinkerns and parts, *Asciocythere rotunda, Eocythereopteron trinitensis* and echinoid parts. Most shells fragmented and ostracodes disarticulated. ----------0.9
18 Limestone—nodular, vertical burrows, light gray, sandy sparse mixed biomicrite; ostracodes, echinoids, molluscs, and miliolids. ----------1.6
17 Marl—light brown, clam steinkerns and parts, echinoid parts, gastropod fragments, oyster fragments, and ostracodes, Ostracodes disarticulated and bed slightly dolomitized. ----------2.5
16 Limestone—massive, slightly burrowed, light brown, silty sparse pelecypod-fragment biomicrite; ostracode fragments. ----------1.5
15 Marl—light gray to brown, *A. rotunda* and *E. trinitensis*. Ostracodes disarticulated and bed moderately dolomitized. ----------2.1

14 Dolomite—irregular to wavy laminae, light gray, finely crystalline. ---------- 1.3
13 Marl—light brown, oysters, clam steinkerns, echinoid parts, and ostracodes. Shells mostly broken, ostracodes disarticulated and bed moderately dolomitized. ---------- 0.3
12 Dolomite—blocky, yellowish brown, coarsely crystalline, bone and limonite stain. ---------- 3.2
11 Marl—light brown, oysters, clam steinkerns and fragments, *A. rotunda* and echinoid parts. Shells broken, ostracodes disarticulated and bed slightly dolomitized. ---------- 0.4
10 Dolomite—irregular limonite stains, load casts, light brown, aphanocrystalline biogenic dolomite; plant material and pelecypod-fragments. ---------- 0.4
9 Marl—light brown to brown, *A. rotunda,* clam steinkerns and fragments, and echinoid parts. Ostracodes disarticulated and bed moderately dolomitized. ---------- 2.0
8 Limestone—wispy structures, burrowed, light brown, silty sparse pelecypod-fragment biomicrite; echinoids and ostracodes. ---------- 1.0
7 Marl—light brown, clam steinkerns and fragments, *A. rotunda, E. trinitensis,* oysters, echinoid parts, and *Buccicrenata subgoodlandensis.* Shells mostly broken and ostracodes disarticulated. ---------- 2.3
6 Limestone—wavy bedded, burrowed, light brown, sandy packed mollusc-fragment biomicrite; ostracodes, echinoids, and encrusting blue-green algae. ---------- 0.5
5 Marl—yellowish brown, echinoid parts, clam steinkerns, *A. rotunda.* Shells fragmented and ostracodes disarticulated. Thin sandy poorly washed fossiliferous intrasparites occur locally. ---------- 4.5
4 Limestone—nodular, burrowed, light brown, silty, sparse pelecypod-fragment biomicrite; ostracodes and miliolids. ---------- 2.8
3 Marl—pale brown, few thin laminae of limestone, *A. rotunda* and coated grains. Ostracodes disarticulated. ---------- 2.7
2 Dolomite—churned, dark yellowish brown, coarsely crystalline. ---------- 2.1
1 Marl—yellowish brown, limonite and quartz. Most shell material recrystallized to calcite. ---------- 4.0

Total ---------- 52.8
Elevation of base ---------- 1225.0

LOCALITY 10. Hamilton County (31°35'N; 98°12'W). Paluxy Sand and Glen Rose Limestone in Hoffman Branch of Partridge Creek, 1.0 mile northeast of West Point and 9.5 miles southwest of Hamilton.

Paluxy Sand

Sandstone, finely laminated to cross-bedded, white to yellowish brown, fine grained, vertical burrows at base of the unit. ---------- 5.0
Covered. ---------- 3.3

Glen Rose Limestone

20 Limestone—honeycombed, dark yellowish brown, dolomitic cryptocrystalline limestone. ---------- 0.8
19 Marl—dark yellowish brown, recrystallized calcite grains. ---------- 1.2
18 Limestone—burrowed, dark yellowish brown, dolomitic; cryptocrystalline limestone; few bone fragments. ---------- 1.2
17 Marl—yellowish brown to green, oysters, quartz, bones and teeth. Extremely low microfossil yield. Shells broken and abraded. ---------- 0.7
16 Limestone—nodular, burrowed, churned, pale yellowish brown, silty moderately packed ostracode-fragment biomicrite; oyster fragments, bone and teeth. ---------- 0.3
15 Marl—gray to light brown, *Asciocythere rotunda,* quartz silt, bones, teeth, echinoids and clams. Shells broken and bored; ostracodes mostly disarticulated. Low microfossil yield. ---------- 1.0
14 Limestone—nodular, burrowed, light gray, sandy sparse whole-pelecypod biomicrite; clam steinkerns—generally oriented perpendicular to bedding, fragments of ostracodes and oysters. ---------- 0.6
13 Marl—light brown, *A. rotunda,* oysters, echinoids, and clams. Shells broken and ostracodes disarticulated. ---------- 1.2
12 Limestone—nodular, churned, pale brown, silty sparse to moderately packed ostracode-fragment biomicrite; oyster fragments and bone. ---------- 0.3
11 Marl—yellowish brown to pale brown, *A. rotunda.* Ostracodes broken and disarticulated. ---------- 1.2
10 Dolomite—massive, yellowish brown, finely crystalline, bones and teeth. ---------- 4.0
9 Marl—light brown, *A. rotunda,* quartz silt, and oysters. Shells broken and bored; ostracodes disarticulated. ---------- 0.2
8 Dolomite—massive, light gray, aphanocrystalline biogenic dolomite; oyster fragments and *Quinqueloculina.* ---------- 0.9
7 Marl—light brown, *A. rotunda,* oysters, bones, teeth and clams. Shells broken and most ostracodes disarticulated. ---------- 0.2
6 Limestone—blocky, wavy structures, load casts, churned, light gray, slightly washed moderately packed mollusc-fragment biomicrite; bone, plant material, and gastropods. ---------- 0.9
5 Marl—gray, oysters, *A. rotunda* and encrusting bryozoans. Shells broken and abraded; ostracodes disarticulated. ---------- 0.4
4 Limestone—nodular, burrowed, pale yellowish brown, silty sparse pelecypod-fragment biomicrite; glauconite. ---------- 2.5
3 Marl—light brown, burrow casts, *Eocytheropteron trinitensis,* clams, oysters, and bryozonas. Shells broken and bored; ostracodes disarticulated. ---------- 0.6
2 Limestone—nodular to thinly bedded, burrowed, light brown, silty sparse mixed biomicrite, ostracode fragments, clams, and plant material. ---------- 1.6
1 Marl—light gray, slightly laminated, *A. rotunda, E. trinitensis,* and plant material (segmented blades and woody material). Shells broken and ostracodes disarticulated. Low microfossil content. ---------- 0.6

Total ---------- 20.4
Elevation of base ---------- 1215.4

LOCALITY 11. Hamilton County (31°36'N; 98°09'W). Glen Rose Limestone exposed in roadcut through the south bank of Cowhouse Creek, 7.5 miles south of Hamilton.

LOCALITY 12. Hamilton County (31°40'N; 98°15'W). Paluxy Sand and Glen Rose Limestone in road and stream cuts along Cowhouse Creek, 3.9 miles east of Pottsville.

Paluxy Sand

Sandstone, laminated, symmetrical ripple marks, light gray, highly cemented, fine grained, limonite flecks moderately abundant. ---------- 15.0

Glen Rose Limestone

26 Clay—light brown to light gray, oysters, *Asciocythere rotunda,* gastropods, limonite, and quartz sand. Ostracodes disarticulated. ---------- 5.5
25 Limestone—blocky to massive, dark yellowish brown, cryptocrystalline. ---------- 1.4
24 Marl—dark yellowish brown, grains recrystallized to calcite crystals. ---------- 1.6
23 Limestone—massive, top surface possibly heavily bored, dark yellowish brown, cryptocrystalline. ---------- 1.6
22 Marl—light yellowish brown, grains recrystallized to calcite crystals. ---------- 0.3
21 Limestone—massive, dark yellowish brown, cryptocrystalline. ---------- 1.9
20 Clay—laminated green and light gray, *A. rotunda* and quartz sand. Fifty percent of ostracodes broken and disarticulated. ---------- 1.7
19 Limestone—thin bed, pale yellowish brown, poorly washed packed fecal intrasparite; pelecypod fragments, gastropods, encrusting blue-green algae, miliolids, and glauconite locally abundant. ---------- 0.3
18 Clay—green, *A. rotunda,* oysters, and limonite. Ostracodes disarticulated and broken. All shells highly bored. Extremely low microfossil content. ---------- 1.7
17 Limestone—thin bed, top surface bored, current oriented, light yellowish brown, silty packed mixed biosparite; encrusting blue-green algae, mollusc

fragments, ostracode fragments, fecal intraclast, and miliolids. ---------- 0.5
16 Limestone—massive, light yellowish brown, slightly washed packed fecal intramicrite; molluscs. ---------- 1.2
15 Marl—dark yellowish brown, *A. rotunda,* oysters, clam and echinoid fragments, quartz silt and *Turritella.* Ostracodes broken, disarticulated and bored. 0.7
14 Limestone—thin bedded, wavy structures, bored top surface, light yellowish brown, silty moderately packed pelecypod-fragment biomicrite; miliolids, ostracodes, limonite, encrusting blue-green algae, and spore cases from calcareous red aglae. Oysters welded to bored surface. ---------- 2.4
13 Marl—light yellowish brown, *A. rotunda,* oysters, echinoids, quartz silt and gastropods. Ostracodes disarticulated and all shell fragments bored. ---------- 0.9
12 Limestone—thin bedded, wavy structures, vertical burrows, churned, light yellowish brown, silty moderately packed pelecypod-fragment biomicrite; ostracodes, serpulids, *Quinqueloculina* and limonite stains. ---------- 0.7
11 Marl—light yellowish brown, *A. rotunda,* plant material and quartz silt. Ostracodes 50% disarticulated. Low microfossil content. ---------- 0.9
10 Limestone—massive, thin discontinuous clay laminae, light yellowish brown, extremely silty moderately packed pelecypod-fragment biomicrite; ostracode and oyster fragments. Becomes a packed fecal intramicrite with abundant miliolids toward the top. ---------- 2.0
9 Marl—shaly, light yellowish brown, *A. rotunda,* clam steinkerns, oysters, echinoid fragments, encrusting bryozoans and carbonized wood. Ostracodes disarticulated. ---------- 0.8
8 Limestone—blocky to massive, thin discontinuous clay laminae, burrowed, light yellowish brown, silty moderately packed pelecypod-fragment biomicrite; ostracode fragments, disseminated plant fragments and oyster fragments. ---------- 0.6
7 Marl—light gray to light yellowish brown, *A. rotunda* and plant material—some carbonized. Ostracodes disarticulated. ---------- 4.3
6 Limestone—nodular, churned, light yellowish brown, silty mixed biomicrite; clams, ostracodes, miliolids, glauconite, and oysters. Shells are fragmented (probably from sifting by browsing organisms). ---------- 0.6
5 Dolomite—shaly, lightly bored, yellowish brown, silty, aphanocrystalline biogenic dolomite. ---------- 0.9
4 Marl—light yellowish brown, *A. rotunda, Eocytheropteron trinitensis* and *Nuculana.* Fifty percent of ostracodes disarticulated. ---------- 4.4
3 Limestone—nodular, burrowed, light yellowish brown, extremely silty moderately packed mollusc-fragmented biomicrite; echinoid parts, miliolids, serpulids, encrusting blue-green algae, and calcareous red aglae. ---------- 0.6
2 Marl—nodular to shaly, light yellowish brown, *A. rotunda,* quartz silt, clam and echinoid fragments, oysters, and *Lituola subgoodlandensis.* Ostracodes disarticulated; some clam steinkerns evident. ---------- 2.5
1 Limestone—nodular, current oriented, light yellowish brown, moderately packed to packed fossiliferous pelmicrite; pelecypod fragments, gastropods, and miliolids. ---------- 0.3

Total ---------- 40.3
Elevation of base ---------- 1247.0

LOCALITY 13. Hamilton County (31°42'N; 98°05'W). Glen Rose Limestone in spillway and roadcut 1.5 miles east of Hamilton city limits along State Highway 22, near its junction with Twomile Creek.

Glen Rose Limestone

39 Limestone—massive bed, light brown, moderately packed to packed fossiliferous fecal intramicrite; oysters and clam fragments. ---------- 0.9
38 Marl—light brown, *Asciocythere rotunda,* oysters, gastropods and quartz silt. Shells fragmented and ostracodes mostly disarticulated. Bed highly dolomitized. ---------- 0.4
37 Limestone—vertical burrows, light brown, dismicrite; fine-grained quartz silt. ---------- 0.5
36 Limestone—nodular, churned, light brown, silty moderately packed fossiliferous pelmicrite; ostracodes, and mollusc fragments. Mollusc fragments abraded and rounded. ---------- 1.3
35 Marl—light brown, quartz silt, oysters, *A. rotunda,* gastropods, and serpulids. Most grains recrystallized to calcite. ---------- 0.4
34 Limestone—dense to earthy, dark yellowish brown, cryptocrystalline. ---------- 1.9
33 Limestone—nodular, churned, light brown, sandy moderately packed ostracode biomicrite; oysters, bones and teeth. ---------- 0.6
32 Marl—yellowish brown, *A. rotunda,* hematite, and oysters. Shell fragments abundant and ostracodes mostly disarticulated. Bed highly dolomitized. ---------- 1.0
31 Limestone—thin bedded to nodular, burrowed, light brown, dolomitized packed mollusc biomicrite; intraclasts. ---------- 2.9
30 Marl—light brown, bones, teeth, plant material, *A. rotunda* and *Eocytheropteron trinitensis.* Ostracodes mostly articulate. Low microfossil content. ---------- 1.1
29 Limestone—thinly bedded, burrowed, channel bearing, light brown, packed mollusc biosparite; ostracodes. ---------- 1.8
28 Limestone—current laminated, gray, poorly washed packed pelletal intrasparite; clam fragments, encrusting blue-green algae, ostracodes and echinoid fragments. ---------- 4.4
27 Marl—gray, *A. rotunda,* plant material and *E. trinitensis.* Shell fragments abundant and ostracodes disarticulated. Bed highly dolomitized. ---------- 0.6
26 Limestone—thinly bedded, current oriented, pale yellowish brown, packed intrasparite; pellets, encrusting blue-green algae, miliolids, and serpulids. ---------- 2.1
25 Marl—gray, echinoids. Bed highly dolomitized. ---------- 0.4
24 Dolomite—gray, finely crystalline, plant fragments. 4.4
23 Dolomite—gray, extensively burrowed, aphanocrystalline biogenic dolomite; plant fragments (stems or twigs), bone, oyster shell ghosts and few clay seams. ---------- 6.7
22 Marl—gray, plant material, oysters, echinoids, ostracodes and burrow casts. Shells fragmented and ostracodes disarticulated. Bed highly dolomitized. ---------- 0.9
21 Limestone—burrowed, gray, dolomitic packed fossiliferous intramicrite; miliolids, mollusc fragments, bones and teeth. ---------- 0.6
20 Limestone—churned, gray, dolomitized packed miliolid biomicrite; gastropods, clams, plant material, intraclasts, and quartz silt. ---------- 2.4
19 Dolomite—gray, finely crystalline, plant fragments (leaves, branches, and other woody material). ---------- 2.5
18 Limestone—current laminated, light gray, poorly washed packed fossiliferous pelsparite; miliolids, ostracodes, gastropods, pelecypods, quartz sand, and plant material. ---------- 0.3
17 Limestone—burrowed, light yellowish brown, packed miliolid biomicrite; ostracodes, clams, and gastropods. ---------- 1.2
16 Limestone—current oriented, light brown, packed fossiliferous intrasparite; miliolids, gastropods, pelecypods, pellets, and encrusting blue-green algae. ---------- 1.8
15 Dolomite—dark yellowish brown, coarsely crystalline, desiccation cracks at top. ---------- 1.0
Offset—beds 15-39 offset 0.25 mile south of beds 1-14.
14 Dolomite—dark yellowish brown, finely-crystalline, earthy, moldic porosity (where shells were solutioned out) and bone. ---------- 3.7
13 Limestone—burrowed, light gray to light brown, moderately packed fossiliferous intramicrite; clam fragments, gastropods, and pellets. Intraclasts rounded and blue-green algae encrusted. ---------- 0.6
12 Marl—light brown, *A. rotunda* and *E. trinitensis.* Shell fragments abundant and ostracodes mostly disarticulated. ---------- 0.3
11 Limestone—thinly bedded, burrowed, light brown, silty moderately packed to packed ostracode bio-

sparite becoming a biomicrite rapidly upward; clam fragments. -- 0.2

10 Marl—light brown, *A. rotunda* and *E. trinitensis.* Shell fragments abundant and ostracodes mostly disarticulated. -- 0.4

9 Limestone—nodular, burrowed, light brown, moderately packed ostracode biomicrite; clam fragments, glauconite, quartz silt and echinoid parts. ---- 5.4

8 Marl—shaly burrowed zone, light brown, *A. rotunda,* echinoid parts and clams. Shells mostly fragmented and ostracodes disarticulated. ---------- 1.6

7 Limestone—nodular, burrowed, light brown, silty packed fossiliferous intramicrite; ostracodes, clams, miliolids, serpulids, gastropods, and encrusting blue-green algae. Shells fragmented and highly bored. --- 0.4

6 Marl—light brown, echinoids, burrow casts, clams (steinkerns and parts), ostracodes and plant material. Shells mostly broken and abraded; ostracodes disarticulated. ------------------------------ 2.0

5 Limestone—nodular, burrowed, light brown, silty packed pelecypod-fragment biomicrite; ostracodes, miliolids, gastropods, pellets, and encrusting blue-green algae. Shells highly bored. ---------------- 1.3

4 Marl—gray to light yellowish brown, *A. rotunda,* echinoid parts, clams, burrow casts, sponge spicules and plant material. Shells fragmented and ostracodes disarticulated. Bed moderately dolomitized. -- 4.6

3 Limestone—thinly bedded, burrowed and bored, light brown, sandy packed slightly washed mixed biomicrite; ostracodes, clam fragments, gastropods, pellets, limonite stains and serpulids. -------------- 2.4

2 Marl—light brown, burrow casts, *A. rotunda,* clams, *Lituola subgoodlandensis* and echinoid parts. Shells fragmented and ostracodes disarticulated. Bed slightly dolomitized. -------------------------- 1.0

1 Limestone—nodular, churned, light brown, moderately packed fossiliferous fecal intramicrite; clams, gastropods, whole serpulids, glauconite, limonite, and rounded weathered, mud clasts. --------------- 2.0

Total ---------------------------------- 68.0
Elevation of base -------------------- 1052.1

LOCALITY 14. Hamilton County (31°48′N; 98°07′W). Glen Rose Limestone in stream and roadcut on an old section of U.S. Highway 281, near an old railroad grade, 2.6 miles north of Eidson Lake.

Glen Rose Limestone

39 Limestone— massive, current oriented, yellowish brown, packed mollusc biosparite; encrusting blue-green algae. Bivalves disarticulated and valves highly abraded and bored. ------------------------ 1.8

38 Limestone—thinly bedded, vertical burrows, pale yellowish brown, limonite-bearing slightly to moderately washed packed fossiliferous fecal intrasparite; mollusc fragments, miliolids, encrusting blue-green algae and ostracodes. ------------------ 2.3

37 Marl—yellowish brown, oysters, *Asciocythere rotunda,* echinoid parts, gastropods, *Eocytheropteron trinitensis* and *Lituola subgoodlandensis.* Most shells fragmented and bored. ---------------------- 1.5

36 Limestone—nodular, burrow mottled, upper surface bored, yellowish brown, silty moderately packed ostracode biomicrite; molluscs, finely disseminated limonite and miliolids. --------------------------- 1.9

35 Marl—light yellowish brown, *A. rotunda,* miliolids, gastropods, clams, and *L. subgoodlandensis.* Ostracodes mostly disarticulated; shells broken, rounded, and bored. -- 2.7

34 Limestone—thinly bedded, slightly current laminated, light yellowish brown, slightly washed packed fossiliferous fecal intramicrite; mollusc-fragments and miliolids grading upward to a limonite-bearing moderately packed fossiliferous intramicrite; molluscs, serpulids, and manganese dendrites. ---------- 1.9

33 Marl—light yellowish brown, *A. rotunda,* miliolids, and gastropods. Fifty percent of ostracodes disarticulated and many grains lime coated. ----------- 1.2

32 Limestone—nodular, highly burrowed, churned, yellowish brown, moderately packed mollusc-fragment biomicrite grading upward to a current oriented, slightly washed intraclast-bearing silty packed ostracode biomicrite; mollusc fragments. Intraclasts rounded and slightly weathered; ostracodes disarticulated. ------------------------------------ 1.6

31 Marl—yellowish brown, oysters, echinoid parts, gastropods, and *A. rotunda.* Shells rounded and broken. -- 1.2

30 Limestone—nodular to massive, light yellowish brown, silty packed pelmicrite; few fragments of mollusc shells. ------------------------------------ 3.1

29 Marl—yellowish brown, oyster fragments, *A. rotunda,* echinoid parts and *E. trinitensis.* Bivalves and ostracodes disarticulated. Shells mainly broken and rounded; many grains lime coated. ------------ 1.3

28 Limestone—nodular, vertical burrows, yellowish brown, silty packed miliolid biomicrite; pellets, clam fragments, and gastropods. Borings filled by mollusc fragment pelmicrite; lacking miliolids. ----- 1.7

27 Marl—yellowish brown, echinoid parts, *Buccicrenata subgoodlandensis,* clams, ostracodes *Haplophragmoides trinitensis* and gastropods. Many grains lime coated; ostracodes disarticulated. ------------- 4.4

26 Limestone—nodular, irregular bed, intensely bored, churned, yellowish brown, silty packed mollusc-fragment biomicrite; finely disseminated limonite and pellets. ------------------------------------ 0.2

25 Marl—nodular, light yellowish brown, gastropods, *A. rotunda* and *Quinqueloculina.* Ostracodes disarticulated. Includes a thin *Nerinea*-bearing moderately packed fecal intramicrite bed. --------------- 1.0

24 Limestone—massive, light brown, slightly washed packed fossiliferous pelmicrite; mollusc fragments and slightly weathered intraclasts. ----------------- 1.8

Offset—beds 24-39 offset 0.2 mile north of beds 1-23.

23 Limestone—shaly to thinly laminated, light yellowish brown, silty moderately packed to packed fossiliferous intramicrite; clam and ostracode frag-

22 Limestone—thinly bedded, churned, light yellowish brown, moderately packed fossiliferous intrasparite; oyster fragments and some quartz silt. ------------ 1.1

21 Marl—nodular, light yellowish brown, *A. rotunda,* oysters, echinoids, *H. trinitensis* and clams. Ostracodes disarticulated and shells mainly broken. ------ 4.3

20 Limestone—massive, current laminated, light yellowish brown, silty packed fossiliferous pelmicrite grading upward to a silty packed miliolid biomicrite with pellets and finely disseminated glauconite abundant. -- 2.0

19 Marl—laminated, gray, quartz silt, *A. rotunda* and plant material. Ostracodes articulated. --------- 2.1

18 Limestone—massive to nodular, horizontal and inclined burrows abundant, wavy silt laminae, light yellowish brown, silty moderately packed to packed
ments, miliolids, and encrusting blue-green algae. -- 1.1
fossiliferous pelmicrite; molluscs, finely disseminated limonite and dasyclad algae. --------------- 9.6

17 Marl—light gray, *L. subgoodlandensis, Buccicrenata subgoodlandensis,* serpulids, *E. trinitensis* and dasyclad algae. Ostracodes disarticulated and many shells broken. ------------------------------------ 2.8

16 Limestone—thin bedded, slightly bioturbated, current laminated, light gray, silty slightly washed moderately packed to packed fossiliferous intramicrite; pellets, molluscs, and bone. Most intraclasts weathered and rounded. ------------------- 0.7

15 Marl—light gray, *Cytherella* sp., echinoid parts, serpulids, gastropods, and dasyclad algae. Most shells broken and 60% of ostracodes disarticulated. -- 3.7

14 Limestone—nodular, current oriented, light brown, slightly washed packed mixed biomicrite; mollusc fragments and disarticulated ostracodes. ----------- 1.3

13 Marl—light gray, *A rotunda, Cytherella* sp., gastropods, clams, echinoid parts, and serpulids. Ostracodes disarticulated and shells moderately bored. --- 1.6

12 Limestone—thin bedded, oscillation ripples, slightly current laminated, light yellowish brown, slightly washed packed fossiliferous intramicrite; pellets, mollusc fragments, serpulids, ostracodes, limonite, and dasyclad algae. ------------------------------- 1.2

11 Marl—light yellowish brown, *A. rotunda,* gastropods, echinoid parts, clam fragments, and dasyclad

algae. Ostracodes disarticulated. ------------------0.3
10 Limestone—massive, highly bored upper surface, light yellowish brown, moderately sorted packed fossiliferous intrasparite; echinoid parts, molluscs, encrusting blue-green algae, biserial and quinqueloculine forams. ----------------------------------2.4
9 Marl—light yellowish brown, *L. subgoodlandensis*, serpulids, echinoid parts, gastropods, and dasyclad algae. Shells moderately bored. ------------------1.0
8 Limestone—nodular, burrowed, highly bored upper surface, light yellowish brown, silty packed fossiliferous fecal intramicrite; miliolids, glauconite and pelecypod fragments. ------------------------------1.0
7 Marl—light yellowish brown, echinoid parts, gastropods, clams, *L. subgoodlandensis* and *A. rotunda*. Bivalves and ostracodes disarticulated and grains mostly lime coated. --------------------------------1.0
6 Limestone—massive to shaly, slightly current laminated, light yellowish brown, silty moderately packed pelecypod-fragment biomicrite; finely disseminated glauconite. -----------------------------0.7
5 Marl—light gray, echinoid parts, *L. subgoodlandensis*, gastropods, clams, and dasyclad algae. Most grains lime coated and dolomite replacement moderate. --0.4
4 Dolomite—massive, burrowed, brown, finely-crystalline, some quartz silt included. -----------------1.2
3 Limestone—massive, wavy structures, churned, yellowish brown, dolomitized packed fossiliferous intramicrite; mollusc fragments, miliolids, echinoid parts, and dasyclad algae. -------------------------0.6
2 Marl—nodular, yellowish brown, echinoid parts, gastropods, and dasyclad algae. Many grains lime coated. ---2.3
1 Limestone—nodular, current oriented, light brown, moderately packed fossiliferous intrasparite; mollusc fragments, miliolids, pellets, encrusting blue-green algae and traces of dasyclad algae. -----------0.6

Total ----------------------------------72.6
Elevation of base --------------------1025.0

LOCALITY 15. Hamilton County (31°45'N; 98°11'W). Glen Rose Limestone in roadcut on State Highway 36, 3.9 miles northwest of Hamilton, at the junction of Bear and Little Bear Creeks.
Glen Rose Limestone
19 Limestone—nodular, locally burrowed, yellowish brown, silty packed miliolid biomicrite; clam and ostracode fragments, serpulids, gastropods and echinoid parts. -----------------------------------2.5
Covered. --3.5
18 Limestone—flaggy, mottled, pale yellowish brown, locally silty moderately packed fossiliferous intramicrite; ostracodes, clams, gastropods, serpulids, echinoids, bone, plant material and some calcareous blue-green algae. --------------------------------1.0
17 Marl—light brown, gastropods, serpulids, *Cythere ornata, Eocytheopteron trinitensis, Paracypris weatherfordensis, Buccicrenata subgoodlandensis, Haplophragmoides trinitensis, Lituola subgoodlandensis*, bones and teeth, bryozoans, and crab claws. Shells fragmented and abraded; ostracodes disarticulated. ---------------------------------------0.7
16 Limestone—slightly burrowed, current laminated, light brown, limonite-bearing poorly washed packed fossiliferous intrasparite; pellets, clam fragments, ostracodes, gastropods, and encrusting blue-green algae. ---0.7
15 Marl—light gray, serpulids, gastropods, *B. subgoodlandensis, L. subgoodlandensis, C. ornata, E. trinitensis*, echinoids, pelecypods, and bryozoans. Shells fragmented and bored; ostracodes disarticulated.-----5.5
14 Limestone—thinly bedded, current laminated bed of light yellowish brown to yellowish brown, sandy slightly washed packed mollusc-fragment biomicrite; ostracodes, gastropods, pellets, green algal fragments, and serpulids (topped by a thinly laminated, desiccated sheet of limonite-filled fossiliferous micrite); ostracodes, clams, and quartz sand. --------0.3
13 Marl—light brown, *L. subgoodlandensis*, bryozoans, *B. subgoodlandensis*, serpulids, gastropods, echinoids, *E. trinitensis* and *C. ornata*. Shells broken and bored and ostracodes disarticulated. -----------0.9
12 Limestone—nodular, moderately burrowed, pale yellowish brown, silty moderately packed to packed fossiliferous intramicrite; clam and ostracode fragments, *Quinqueloculina*, gastropods, plant fragments, few oolites and calcareous blue-green algae; becomes dolomitic near the base. --------------------4.0
11 Limestone—blocky, mottled, dark yellowish brown, dolomitic silty sparse to packed miliolid biomicrite; clam fragments, gastropods, echinoid parts, and ostracodes. --------------------------------------1.0
10 Limestone—extremely nodular, burrowed, silty packed mixed fragmental biomicrite; clam steinkerns and fragments, *Tylostoma* and other gastropods, echinoid parts, serpulids, and crab claws. -----1.5
9 Marl—gray to green, burrow casts, *L. subgoodlandensis*, echinoid parts, gastropods, oysters, and clams. Shells broken, abraded, and slightly weathered. --0.8
8 Limestone—nodular, churned, brown, moderately washed packed fossiliferous intrasparite; pellets, molluscs, echinoid parts, and encrusting blue-green algae. Intraclasts sligthly weathered. --------------0.8
7 Marl—dark yellowish brown, echinoids, oysters, serpulid colony, *Tylostoma* and *L. subgoodlandensis*. Shells highly fragmented. -----------------------0.7
6 Marl—gray, echinoids, oysters, *L. subgoodlandensis*, serpulids, gastropods, burrow casts, and dasyclad algae. Shells highly fragmented. ------------------1.5
5 Marl—dark yellowish brown, oysters, gastropods, *L. subgoodlandensis*, echinoid parts, clams, and dasyclad algae. Shells slightly broken. ------------0.6
4 Limestone—thin beds of highly burrowed, yellowish brown, silty sparse mixed biomicrite; gastropods, miliolids, encrusting blue-green algae and pellets. ---1.5
3 Marl—dark yellowish brown, limonite, oysters, *L. subgoodlandensis, Quinqueloculina* and gastropods. Shells mostly broken. -----------------------------2.4
2 Limestone—honeycombed, dark yellowish brown, cryptocrystalline, plant material and quartz silt. ----3.7
1 Marl—yellowish brown, *L. subgoodlandensis*, oysters, gastropods, and echinoids. Shells fragmented.--2.3

Total ----------------------------------35.9
Elevation of base --------------------1081.2

LOCALITY 16. Hamilton County (31°47'N; 98°12'W). Glen Rose Limestone exposed in roadcut on State Highway 36, 1.8 miles southeast of Gentrys Mill.
Gen Rose Limestone
59 Limestone—thin beds, churned, light yellowish brown, sparse to moderately packed ostracode biomicrite; miliolids, quartz silt fragments; increasing recrystallized sparry calcite and dolomite toward the top of the bed. -------------------------------3.4
58 Limestone—shaly to nodular, light yellowish brown, moderately packed miliolid biomicrite; clam fragments, ostracodes, plant material and quartz silt. Ostracodes are mostly disarticulated. --------------1.1
57 Limestone—massive to blocky, few thin wavy horizontal laminae, light yellowish brown, sandy sparse pelecypod-fragment biomicrite; ostracodes, and echinoid parts. ------------------------------------1.3
56 Marl—brown, finely laminated, oysters, echinoid parts, *Asciocythere rotunda, Eocytheropteron trinitensis, Cythere ornata*, and plant material. Shells fragmented and ostracodes disarticulated. ---------0.3
55 Limestone—thinly bedded, some clay drapes, churned, light yellowish brown, sparse ostracode-fragment biomicrite; quartz silt. -----------------0.3
54 Marl—brown to gray, slightly laminated, *A. rotunda, E. trinitensis*, oysters, plant material and echinoid parts. -----------------------------------0.2
53 Limestone—blocky, slightly mottled, dark yellowish brown, silty micrite; high clay content. ------------0.3
52 Marl—brown to gray, slightly laminated, *A. rotunda*, oysters, and plant material. Shells fragmented and ostracodes disarticulated. --------------0.4
51 Limestone—current oriented, settle-out lamina-

tions, light yellowish brown, packed ostracode biomicrite; mollusc fragments, echinoid fragments, pellets, and quartz sand. ---------------------------0.4

50 Marl—light brown to brown, burrow casts, oysters, *A. rotunda*, echinoid parts, *Tylostoma*, bones and teeth. Shells fragmented and ostracodes disarticulated. ---0.7

49 Limestone—blocky, churned, light brown,silty moderately packed pelecypod-fragment biomicrite; ostracodes and echinoids. -----------------------------1.2

48 Marl—brown, *A. rotunda*, oysters, echinoids, bones and teeth, and plant material. Shells fragmented and abraded; ostracodes mostly disarticulated. ------0.8

47 Dolomite—nodular, gray, coarsely crystalline, plant material, sand and silt. -----------------------------0.5

Covered. --20.0

46 Limestone—massive, few wavy structures, churned, brown, packed fossiliferous intramicrite; gastropods, ostracodes, encrusting blue-green algae, echinoid fragments, and miliolids. Fossils reworked. --------1.0

45 Marl—light brown, echinoid parts, gastropods, oysters, ostracodes, and bones. Shells broken, abraded, and bored; ostracodes disarticulated. ---------------4.6

44 Limestone—nodular, churned, light yellowish brown to yellowish brown, moderately packed fossiliferous intramicrite; oyster fragments, encrusting blue-green algae, miliolids, and pellets. Shell fragments highly bored and abraded. --------------------------3.0

43 Marl—light brown, *A. rotunda*, *E. trinitensis*, oysters, gastropods, echinoid parts, serpulids, *Lituola subgoodlandensis* and *Haplophragmoides trinitensis*. Shells fragmented and ostracodes disarticulated. ----2.4

42 Limestone—nodular, burrowed, light brown, moderately packed fossiliferous pelmicrite; mollusc fragments, flat clams, echinoids, ostracodes, and plant material. ------------------------------------2.7

41 Limestone—nodular, burrowed, churned, wispy structures, light yellowish brown, moderately packed fossiliferous pelmicrite; ostracodes, limonite, echinoids, and miliolids. Few shell fragments. ---------3.5

40 Marl—dark brown, *Paracypris weatherfordensis*, bones and teeth, gastropods, and plant material. Shells fragmented and ostracodes mostly disarticulated. ---3.1

39 Limestone—massive, few wavy structures, slightly burrowed, churned, yellowish brown, packed miliolid biomicrite; mollusc fragments, ostracodes, serpulids, and encrusting blue-green algae. Oyster fragments highly abraded. -------------------------------------1.3

38 Marl—brown, burrow casts, *Nummoloculina heimi*, *L. subgoodlandensis*, *H. trinitensis*, *Quinqueloculina*, echinoids, gastropods, and *A. rotunda*. Most shells fragemented and bored; ostracodes disarticulated.--0.6

37 Limestone—massive, few thin horizontal bedding planes, slightly burrowed, light yellowish brown, sparse to moderately packed fossiliferous intramicrite; clam fragments, serpulids, oyster fragments, foraminifers and plant material. -------------------0.7

36 Marl—light brown, burrow casts, echinoids, oysters, gastropods, and *A. rotunda*. Shells fragmented and abraded; ostracodes disarticulated. -----------------2.5

35 Limestone—massive, graded bedding, light gray to light brown, poorly washed packed fossiliferous pelsparite; *Quinqueloculina*, oyster fragments, gastropods, weathered intraclasts, and echinoid parts. --2.5

34 Marl—light brown, gastropods, *H. trinitensis*, *Buccicrenata subgoodlandensis*, *P. weatherfordensis*, and *A. rotunda*. Shells fragmented and ostracodes disarticulated. --0.9

33 Limestone—thin bed, churned, slightly washed, light brown, moderately packed fossiliferous intramicrite; ostracodes, oysters, gastropods, miliolids, and plant material. Shell fragments are abraded and intraclasts are weathered and rounded. ----------0.3

Covered. --12.9

32 Marl—light brown to white locally, few thin limestone seams, serpulids, plant material, gastropods, crab claws and disarticulated ostracodes. Shells fragmented. ---------------------------------------6.5

31 Limestone—nodular, churned, light brown, silty moderately packed fossiliferous intramicrite; small clam steinkerns, gastropods, *Quinqueloculina* and disarticulated ostracodes. Fossils are reworked. ----0.4

30 Marl—light gray to brown, serpulids, echinoid parts, *Lituola camerata*, *L. subgoodlandensis* and *Quinqueloculina*, *Cytherella* sp., and *C. ornata*. Shells fragmented and ostracodes disarticulated. ---2.7

29 Limestone—fine wavy structures, highly burrowed, light brown, sandy moderately packed ostracode biomicrite; clams, plant material and bone. ---------0.3

28 Marl—light brown, serpulids, *Cytherella* sp., *P. weatherfordensis*, gastropods, serpulids, bryozoans, and *L. subgoodlandensis*. Most shells are broken but gastropods remain whole and ostracodes are mostly disarticulated. -----------------------------0.9

27 Limestone—thin beds of slightly burrowed, light brown, slightly washed packed fossiliferous intramicrite; clams, gastropods, pellets, and limonite. ---0.4

26 Marl—light brown, serpulids, *L. subgoodlandensis*, *Cytherella* sp., gastropods, bryozoans, and clams. Gastropods remain whole; other shells are broken and highly bored. --------------------------------1.3

25 Limestone—massive bed of slightly burrowed, pale yellowish brown, silty sparse mixed biomicrite; ostracodes, miliolids, clam fragments, gastropods, and echinoids. -------------------------------------0.4

24 Marl—light brown, clams, *L. subgoodlandensis* and disarticulated ostracodes. Shells fragmented. ------0.6

23 Limestone—blocky, dark yellowish brown, packed pelecypod-fragment biosparite; gastropods, ostracodes, echinoid parts, and plant material. Sparite is recrystallized probably from a micrite and clam fragments are highly leached. ----------------------0.6

22 Limestone—blocky, churned, light brown to gray, silty moderately packed fecal intramicrite; small pelecypods, miliolids, and ostracodes. --------------2.2

21 Limestone—nodular, light brown, silty sparse mixed biomicrite; clams, gastropods, *Turritella*, *Nerinea*, and echinoids, serpulids, oysters, burrow casts and dasyclad algae. ----------------------------------5.3

20 Limestone—thinly bedded, extensively burrowed, wavy structures, light yellowish brown, silty sparse mixed biomicrite; clams, ostracodes and miliolids. --0.6

19 Marl—light brown, *B. subgoodlandensis*, *L. subgoodlandensis*, clams, dasyclad algae, echinoids, and gastropods. Shells mostly broken. ----------------1.0

18 Dolomite—moldic porosity, dark yellowish brown, finely crystalline, quartz silt. -----------------------0.8

17 Limestone—honeycombed, dark yellowish brown, cryptocrystalline, quartz silt. ----------------------3.6

16 Dolomite—dark yellowish brown, finely crystalline, limonite and quartz silt. --------------------------0.8

15 Marl—light brown, *Cytherella* sp., *C. ornata*, oysters, echinoids, *L. subgoodlandensis* and several species of gastropods. Most shells fragmented and ostracodes disarticulated. ------------------------3.6

14 Limestone—nodular, burrowed, light brown, moderately packed ostracode biomicrite; oysters, echinoids, serpulids and *L. subgoodlandensis*. -----------0.5

13 Marl—light brown, *Ostrea*, echinoids, *P. weatherfordensis*, *L. subgoodlandensis* and *A. rotunda*. Shells broken and ostracodes disarticulated. -------1.0

12 Limestone—massive, churned, light brown, sparse ostracode-fragment biomicrite; clam fragments and quartz silt: one inch top layer of poorly washed packed fossiliferous fecal intrasparite. Shell fragments highly abraded. -----------------------------1.5

11 Marl—light brown to dark green, abundant clay, *E. trinitensis*, *P. weatherfordensis*, and *L. subgoodlandensis*. Shells fragmented and bored; ostracodes disarticulated. --------------------------------7.2

10 Limestone—nodular, churned, pale yellowish brown, silty sparse ostracode biomicrite; thin shelled oysters and pellets. ----------------------------------0.6

9 Sandstone—thin bed, thinly laminated, light brown, highly cemented, few ostracode fragments. ---------0.3

8 Clay—dark green to brown. *A. rotunda*, *Neobulimina minima*, *Globigerina*, and *Ostrea*. Microfossil content low. ---------------------------------------1.1

7 Limestone—nodular, highly burrowed, light brown, fossiliferous micrite; miliolids, and thin-shelled pelecypods. --3.5

6 Marl—light brown, limestone nodules included, burrow fills, *Orbitolina, B. subgoodlandensis, Cribrostomoides frizzelli, Quinqueloculina,* clams, and echinoid parts. Shells mostly broken. ---------------0.7
5 Limestone—nodular, highly burrowed, pale yellowish brown, silty sparse pelecypod-fragment biomicrite; ostracodes, encrusting blue-green algae, and gastropods. ---------------------------------------0.5
4 Limestone—thinly laminated, shaly, light gray, packed ostracode biomicrite; *Cytherella* sp., *E. trinitensis,* oysters, echinoids, and clams. ---------------0.4
3 Limestone—massive, moderately sorted, light brown, poorly washed packed fossiliferous fecal intrasparite; clam fragments, encrusting blue-green algae, miliolids, and other hyaline forams. ---------2.2
2 Marl—nodular, light brown, oysters, echinoids, *E. trinitensis* and *A. rotunda.* Shells mostly broken and slightly bored; ostracodes disarticulated. ------4.2
1 Limestone—nodular, churned, light brown to brown, moderately packed mollusc biomicrite; limonite and bone. --0.8

Total ----------------------------------129.4
Elevation of base ---------------------1086.6

LOCALITY 17. Hamilton County (31°49′N; 98°12′W). Twin Mountains Formation contact with Glen Rose Limestone in north bank of Leon River, 2.6 miles northeast of Gentrys Mill.

Contact elevation ---------------------1042.0

LOCALITY 18. Hamilton County (31°38′N; 97°54′W). Paluxy Sand and Glen Rose Limestone in Leon River, 1.7 miles northwest of Jonesboro.

Paluxy Sand

Unconsolidated sand and residual sandy soil, reddish brown to brown, fine grained. -----------------5.0

Glen Rose Limestone

Thin, alternating limestone and marl. Limestones are shell-fragment and ostracode biomicrites with pellets abundant. Marls contain ostracodes and agglutinated foraminifers. -----------------------90.0

Base elevation ------------------------850.0

LOCALITY 19. Comanche County (31°53′N; 98°20′W). Glen Rose Limestone contact with Twin Mountains Formation in roadcut, 0.1 mile north of Hazeldell.

Contact elevation ---------------------1190.0

LOCALITY 20. Comanche County (31°57′N; 98°25′W). Glen Rose Limestone contact with Twin Mountains Formation in roadcut on gravel road, 2.3 miles south of Proctor and just off F.M. 1476, near Reid Cemetery and Graham Chapel Cemetery.

Contact elevation ---------------------1280.0

LOCALITY 21. Comanche County (32°00′N; 98°24′W). Glen Rose Limestone and Twin Mountains Formation in roadcut along Walnut Creek, 1.5 miles northeast of Proctor.

Glen Rose Limestone

16 Limestone—massive to platy, churned, light brown, silty packed fossiliferous pelmicrite; clam fragments, miliolids and encrusting blue-green algae. ----------1.0
15 Marl—light brown, serpulids, gastropods, *Cytherella* sp., echinoid parts, and pelecypod fragments. Shells mostly broken, some abraded and 50% of ostracodes disarticulated. -----------------------------0.9
14 Limestone—nodular, churned, light brown, sandy packed fossiliferous fecal intramicrite; mollusc fragments, and serpulids. ------------------------------0.5
13 Marl—light brown, oysters, gastropods, echinoid parts, and clam fragments. Shells mostly broken.---0.9
12 Limestone—massive to thick-bedded, burrowed, light brown, silty packed fecal intramicrite; miliolids, gastropods, clam fragments, and echinoid parts. 1.2
11 Marl—nodular, burrowed, yellowish brown, oyster fragments, gastropods, echinoid parts, and *Lituola subgoodlandensis.* Shells fragmented. --------------3.5
10 Limestone—nodular, churned, light brown, silty moderately packed to packed miliolid biomicrite; clam fragments and pellets. -----------------------1.5
9 Marl—light brown, burrow casts, oyster fragments, echinoid parts, *L. subgoodlandensis,* and serpulids. Shells moderately abraded. ----------------------1.0
8 Limestone—nodular, churned, light brown, silty packed mollusc biomicrite; miliolids, echnoid parts, pellets, limonite stains and encrusting blue-green algae. ---2.0
7 Marl—dark yellowish brown, recrystallized calcite and scattered quartz silt. ------------------------4.3
6 Dolomite—massive, dark yellowish brown, finely crystalline dolomite. -----------------------------0.5
5 Marl—dark yellowish brown, recrystallized calcite, scattered quartz silt and hematite. ----------------10.5
4 Limestone—massive to platy, wavy structures, light brown, moderately packed pelecypod biomicrite; gastropods, pellets, and encrusting blue-green algae. 1.2
3 Marl—nodular, light brown, gastropods, echinoid parts, *Cytherella* sp., and agglutinated foraminifers. Ostracodes articulated; abundant fragmented mollusc shells. -------------------------------------7.7
2 Limestone—nodular, vertical to inclined burrows, light brown, silty mollusc-fragment biomicrite; miliolids, ostracodes, and limonite stains. ----------0.2
1 Marl—nodular, yellowish brown, grains coated, contains nodules of packed mollusc biosparite; much recrystallized calcite. ---------------------------7.1

Total ---------------------------------44.0
Elevation at base --------------------1292.0

Twin Mountains Formation

Sandstone and residual sandy soil, red-brown to brown, fine grained.

LOCALITY 22. Erath County (32°09′N; 98°26′W). Paluxy Sand, Glen Rose Limestone and Twin Mountains Formation in roadcut on F.M. 2156, 1.1 miles south of Highland.

Paluxy Sand

Sandstone, laminated to thinly bedded, low-angle cross-beds, white, fine grained, hematite abundant. 12.0

Glen Rose Limestone

41 Clay—green, fine-grained quartz sand and hematite. 1.5
40 Limestone—coquina, light gray, abraded mollusc and echinoid fragments and abundant fine-grained quartz sand. ------------------------------------0.1
39 Clay—olive-green fine-grained quartz sand and hematite. --------------------------------------1.1
38 Limestone—blocky, yellowish brown, cryptocrystalline; quartz silt common. ----------------------0.7
37 Clay—yellowish brown, fine-grained subround to round quartz sand, bone and hematite. Low microfossil content. -----------------------------------0.4
36 Limestone—honeycombed, dark yellowish brown, cryptocrystalline. --------------------------------0.7
35 Clay—light green to dark yellowish brown, subround to round, fine-grained quartz sand, bone and hematite. --------------------------------------2.4
34 Limestone—honeycombed, dark yellowish brown, cryptocrystalline. --------------------------------1.3
33 Clay—dark yellowish brown, mollusc fragments, limonite, quartz sand, bone and echinoid fragments. 1.8
32 Sandstone—highly cemented, light brown, very fine grained, subangular to subround. --------------0.1
31 Clay—green, barren. -----------------------------1.8
30 Limestone—honeycombed, vertical burrows, top surface heavily bored and thinly laminated, dark yellowish brown, cryptocrystalline. -----------------2.8
Covered. --13.7
29 Limestone—thin beds, current oriented to laminated, light brown, fossiliferous packed fecal intramicrite; ostracodes, gastropods, pelecypods, quartz sand and encrusting blue-green algae. ----------------------1.4
28 Limestone—massive, current oriented, light brown, poorly washed packed intrasparite; encrusting blue-green algae, gastropods, and ostracodes. ----------0.6
27 Limestone—nodular, churned, light yellowish brown, moderately packed fossiliferous fecal intramicrite; pelecypods, gastropods, *Quinqueloculina,* and serpulids. --0.8
26 Marl—laminated light gray to dark yellowish brown, *Asciocythere rotunda,* oysters, clams, echinoids, and gastropods. Ostracodes mainly articulated. 2.2

25 Limestone—nodular, current oriented, dark yellowish brown, silty packed mollusc biosparite; serpulids, limonite and bone. Bivalves disarticulated. ----0.4
24 Clay—dark yellowish brown, *A. rotunda*, oysters and limonite. Many grains recrystallized to calcite by ground water. ----1.0
23 Limestone—nodular, light yellowish brown, extremely silty packed to moderately packed mollusc biomicrite; serpulids abundant. ----3.0
22 Limestone—thin bed, current oriented, burrowed, yellowish brown, packed fossiliferous fecal intramicrite; molluscs and ostracodes. ----0.3
21 Marl—light brown, *A. rotunda*, oysters, clams, and gastropods. Ostracodes mainly disarticulated. ----0.4
20 Limestone—nodular, pale yellowish brown, slightly silty packed fossiliferous fecal intramicrite; fragmented molluscs and ostracodes. ----1.3
19 Marl—light brown, *A. rotunda*, oysters, and clams. Ostracodes mainly disarticulated. ----0.7
18 Limestone—nodular, churned, light brown, extremely sandy moderately packed mollusc biomicrite; serpulid fragments rare. ----1.7
17 Marl—light gray to dark yellowish brown, oysters, *A. rotunda*, clams, echinoids, bryozoans, and serpulids. Ostracodes mainly disarticulated and most shell fragments highly bored. ----1.3
16 Limestone—nodular, mud cracks, burrowed, current oriented, light yellowish brown, sandy packed mollusc biomicrite; serpulid pods, pellets and ostracodes. Pods were load cast into marl below. ----1.0
15 Marl—yellowish brown, *A. rotunda*, serpulids, clams, and gastropods. Ostracodes disarticulated. ----0.8
14 Limestone—nodular to thinly laminated, light yellowish brown, sandy sparse fecal intramicrite containing a ½-inch layer of quartz silt; ostracodes sparse in the intramicrite. ----1.1
13 Limestone—massive, light yellowish brown, sandy poorly washed packed fecal intrasparite; serpulids (colonial), pelecypods and limonite ----0.3
12 Marl—irregularly laminated light yellowish brown to light green, serpulids, *Eocythereopteron trinitensis, Cytherella* sp., echinoids, pelecypods, and gastropods. Ostracodes disarticulated. ----1.2
11 Limestone—nodular, light yellowish brown, silty poorly washed packed fecal intrasparite; foraminifers, gastropods, pelecypods, and ostracodes. Ostracodes disarticulated. ----0.3
10. Marl—light green to light yellowish brown, oysters, *E. trinitensis, Cytherella* sp., echinoids, clams, serpulids, and gastropods. Ostracodes disarticulated. ----0.6
9 Limestone—nodular, light yellowish brown, silty moderately packed fecal intramicrite; foraminifers, gastropods, clams, and ostracodes. Ostracodes disarticulated. ----0.7
8 Limestone—nodular, burrowed, yellowish brown, silty moderately packed foram biomicrite; miliolids, pellets, and abraded mollusc fragments. ----1.0
7 Marl—dark yellowish brown, oysters, clams, echinoids, and ostracodes. Ostracodes disarticulated. ----2.9
6 Limestone—massive, dark yellowish brown, cryptocrystalline. ----1.9
5 Marl—dark yellowish brown, echinoids, clams, oysters, and gastropods. Fragments rounded and abraded. ----1.9
4 Limestone—nodular, light yellowish brown, silty packed fecal intramicrite; echinoid parts, serpulids, miliolids, and oyster fragments. ----1.5
Covered. ----14.2
3 Limestone—thin bed, light brown, packed fossiliferous pelmicrite; blue-green algae, molluscs, and echinoid parts. ----0.3
2 Marl—light yellowish brown, oysters, echinoid and gastropod fragments, and *Cytherella* sp. Many shell fragments highly bored. Bed moderately dolomitized. ----0.5
1 Limestone—thinly bedded, current oriented, light brown, packed gastropod biomicrite; clam and oyster fragments and echinoid parts. ----3.2

Total ----76.9
Elevation of base ----1361.5

Twin Mountains Formation
Sandy mud to fine sandstone, gray to orange-brown.

LOCALITY 23. Comanche County (31°48'N; 98°21'W). Glen Rose Limestone in roadcut on F.M. 1702, 4 airline miles southeast of Gustine.

LOCALITY 24. Comanche County (31°44'N; 98°24'W). Walnut Clay, Paluxy Sand, and Glen Rose Limestone in roadcut on F.M. 2561, 7 airline miles southeast of Newburg.

LOCALITY 25. Comanche County (31°44'N; 98°26'W). Walnut Clay and Paluxy Sand in roadcut on F.M. 2561, 0.5 mile from Walnut Creek on the east side of Cowhouse Mountain.

LOCALITY 26. Comanche County (31°45'N; 98°29'W). Paluxy Sand and Glen Rose Limestone in roadcut on F.M. 2561, 2.6 airline miles east of Newburg.

Paluxy Sand
Sandstone and sandy residual soil, dark reddish brown, fine grained.

Glen Rose Limestone
32 Limestone—massive, slightly burrowed, bored upper surface, light gray, packed mollusc-fragment biomicrite; miliolids, ostracodes, encrusting blue-green algae and echinoid parts. ----0.7
31 Limestone—honeycombed, dark yellowish brown, cryptocrystalline limestone. ----0.5
30 Marl—yellowish brown, *Eocytheropteron trinitensis* and *Asciocythere rotunda*. Ostracodes mostly disarticulated. ----1.2
29 Limestone—honeycombed, dark yellowish brown, cryptocrystalline limestone. ----1.3
28 Sand—yellowish brown to dark yellowish brown, medium grained, irregular calcareous laminae included. ----5.7
27 Limestone—thin bed, current oriented, yellowish brown, packed intrasparite; mollusc fragments, encrusting blue-green algae, quartz silt, and bone. ----0.2
26 Marl—dark yellowish brown, *A. rotunda*, bone, quartz silt, and *E. trinitensis*. Most ostracodes disarticulated and compressed; low microfossil yield. ----2.5
25 Limestone—nodular, current laminated, brown, moderately packed glauconite fecal intramicrite; fragments of thin shelled clams and oysters. ----0.7
24 Marl—dark yellowish brown, oysters, and *A. rotunda*. Ostracodes disarticulated; shells broken. ----1.3
23 Limestone—shaly to irregularly bedded, some current lamination, bored surface, burrows vertical to inclined, yellowish brown, poorly washed packed ostracode biosparite to a slightly washed packed oyster-bearing intramicrite. ----2.3
22 Marl—yellowish brown, *A. rotunda*, bone, echinoid parts, and quartz silt. Shells broken and ostracodes disarticulated; low microfossil yield. ----3.0
Offset—beds 22-32 offset 0.5 mile south of beds 1-21.
21 Dolomite—massive, burrows, some sand laminae included, dark yellowish brown, fine grained. ----4.2
20 Marl—includes a thin mollusc-fragment coquina, light green, abraded mollusc fragments and bone. ----1.0
19 Limestone—thin bed, current oriented, light yellowish brown, packed mollusc biosparite; encrusting blue-green algae and pelecypod fragments. ----0.5
18 Limestone—thin bed, dark yellowish brown, dolomitic sparse ostracode biomicrite; encrusting blue-green algae and pelecypod fragments. ----0.5
17 Limestone—thin bed, current oriented, light yellowish brown, poorly washed packed mollusc biosparite; encrusting blue-green algae and ostracodes. ----0.5
16 Marl—dark yellowish brown, *A. rotunda*, and bone. Ostracodes mostly articulated; low microfossil yield. 0.5
15 Limestone—thin bed, current laminated, pale yellowish brown, packed mollusc biosparite; encrusting blue-green algae with few ostracodes. ----0.5
Covered. ----38.5
14 Limestone—honeycombed, layered, desiccated, dark yellowish brown, cryptocrystalline limestone. ----2.9
13 Limestone—flaggy, light gray to pale yellowish brown, slightly washed packed fossiliferous fecal

intramicrite; encrusting blue-green algae, gastropods, mollusc fragments, ostracodes, and quartz silt. 3.0
12 Limestone—nodular, vertical to inclined burrows, yellowish brown, sandy fossiliferous micrite; ostracodes, miliolids, fecal intraclast, and molluscs. ------4.8
11 Limestone—shaly, vertical burrows, pale yellowish brown, silty moderately packed ostracode biomicrite; mollusc fragments and pellets. ----------------1.1
10 Limestone—thin bed, mottled, wavy structures, pale yellowish brown, sandy sparse ostracode biomicrite; bone. --0.5
9 Marl—nodular, highly borrowed, thin, broad channel structures included, light brown, *Haplophragmoides trinitensis,* gastropods, and *A. rotunda.* Ostracodes mostly disarticulated. ------------------3.2
8 Limestone—nodular, mottled, yellowish brown, sandy sparse pelecypod-fragment biomicrite; few oyster fragments, ostracodes, and bone. ------------1.1
7 Marl—dark brown to light green, *Cytherella* sp., serpulids, echinoids, gastropods, and *Nuculana.* Ostracodes disarticulated. -------------------------5.0
6 Marl—limestone seams included, brown, serpulids, echinoids, gastropods, *Cytherella* sp., and *Lituola subgoodlandensis.* Fossils well-preserved and ostracodes mostly articulated. --------------------------5.5
5 Limestone—thin bedded, becoming shaly near top, highly burrowed, yellowish brown, extremely sandy moderately packed foraminifer biomicrite; pelecypod fragments sparse. ----------------------------1.1
4 Marl—yellowish brown, *L. subgoodlandensis,* gastropods, and *Nuculana.* ----------------------------0.3
3 Limestone—extensively burrowed, nodular to thin bedded, light yellowish brown, silty packed pelmicrite; molluscs, ostracode and echinoid fragments. Becomes a layered, desiccated dark yellowish brown cryptocrystalline limestone in the upper two feet of the bed. --5.5
2 Marl—nodular, light brown, grains. Mostly recrystallized to calcite or partially dissolved. ------------3.5
1 Limestone—honeycombed, dark yellowish brown, cryptocrystalline; manganese dendrites scattered throughout. ------------------------------------8.0

Total ---------------------------------111.1
Elevation of base ------------------1316.0

LOCALITY 27. Comanche County (31°48′N; 98°29′W). Glen Rose Limestone in roadcut on F.M. 1476, 1.4 miles west of Petitt School and 5.2 miles southwest of Gustine.
Glen Rose Limestone
32 Limestone—thinly bedded, current oriented, brown, packed fecal intrasparite; encrusting blue-green algae, gastropods, and clams. ----------------------2.1
31 Marl—light brown, *Asciocythere rotunda* and *Haplophragmoides trinitensis.* Shells broken and ostracodes mostly disarticulated. --------------------1.2
30 Limestone—thinly bedded, burrowed, load cast, light brown, slightly washed packed fossiliferous pelmicrite; ostracodes, pelecypod fragments, gastropods, limonite, and intraclasts. -----------------1.1
29 Marl—light brown, superficial oolites, clam steinkerns, bones and teeth. Shells broken. -----------0.5
28 Limestone—nodular, churned, yellowish brown, moderately packed pelecypod biomicrite; serpulids, gastropods, oysters, and ostracodes ----------------1.2
27 Marl—light brown, oysters, *A. rotunda,* and clam fragments. Shells broken and 50% of ostracodes disarticulated. -------------------------------------1.6
26 Limestone—irregularly bedded, light brown, poorly washed moderately packed to packed fossiliferous fecal intrasparite; clams, oyster fragments, encrusting blue-green algae, and hyaline forams. -----0.7
25 Marl—light brown, *A. rotunda,* gastropods, and *H. trinitensis.* Shells mostly broken and ostracodes 50% disarticulated. Low microfossil content. ------1.1
24 Limestone—nodular, burrowed, brown, packed mollusc biomicrite; clam fragments, *A. rotunda,* gastropods, bone, pellets, and forams. ----------------4.8
23 Marl—light brown, *A. rotunda,* clam fragments, *H. trinitensis.* Ostracodes mostly disarticulated. ----0.3
22 Limestone—nodular, burrowed, light brown, packed fossiliferous fecal intramicrite; gastropods, clams, limonite, ostracodes, and encrusting blue-green algae. 0.3
21 Marl—light brown, *A. rotunda, Cytherella* sp., and *H. trinitensis.* Abundant fragmented shell material and ostracodes disarticulated. --------------------1.0
20 Limestone—nodular, burrowed, light yellowish brown, silty packed mixed biomicrite; miliolids, oysters, clam steinkerns and fragments. ------------2.0
Covered. --8.0
19 Limestone—nodular, burrowed, wavy silt laminae, light brown, silty to sandy sparse mollusc biomicrite; clam fragments, gastropods, and finely disseminated limonite. --------------------------------4.4
18 Marl—light brown, ostracodes, and gastropods. Abundant fragmented shell material and ostracodes disarticulated. ----------------------------------0.5
17 Limestone—massive, churned, yellowish brown, silty packed pelecypod-fragment biomicrite; miliolids, gastropods, serpulids, and disseminated glauconite. --1.4
16 Limestone—nodular, churned, yellowish brown, moderately packed mollusc biomicrite; clams, gastropods, limonite pellets, disseminated glauconite, and encrusting blue-green algae. ----------------1.7
15 Marl—light brown, oolites, gastropods, echinoids, clams, and *Eocytheropteron trinitensis.* Ostracodes disarticulated. ---------------------------------1.3
14 Limestone—nodular, burrowed, root mottled, brown, silty moderately packed mollusc-fragment biomicrite; clams, gastropods, ostracodes, oysters, bone, pellets, and encrusting blue-green algae. -----------1.1
13 Marl—light brown, echinoids, serpulids, and ostracodes. Shells mainly fragmented and ostracodes disarticulated. ---------------------------------3.4
12 Limestone—thinly laminated sheet, light yellowish brown, fossiliferous micrite; pelecypod fragments, finely disseminated plant material and quartz silt. ---0.4
11 Marl—light brown, gastropods, *Cytherella* sp., serpulids, and *Nuculana.* Gastropods whole; other shells fragmented and 50% of ostracodes disarticulated. ---------------------------------------0.6
10 Limestone—shaly, churned, light yellowish brown, silty sparse mixed biomicrite; ostracodes, clam fragments, and serpulids. --------------------------0.4
9 Marl—light brown, *Cytherella* sp., serpulids, gastropods, bryozoans, and clams. Most shells fragmented and bored; ostracodes disarticulated. -------0.9
8 Limestone—nodular, churned, yellowish brown, silty sparse pelecypod-fragment biomicrite; ostracodes, serpulids, gastropods, and miliolids. ---------0.5
7 Marl—brown, gastropods, *Lituola subgoodlandensis,* serpulids, *Cytherella* sp., and echinoid parts. Shells fragmented and bored. ----------------------------0.9
6 Limestone—massive to shaly, burrowed, yellowish brown, silty packed fossiliferous pelmicrite; miliolids, clam fragments, oyster fragments, serpulids, and encrusting blue-green algae. ------------------1.3
5 Marl—light brown, *L. subgoodlandensis,* and gastropods. Abundant abraded shell fragments. --------0.5
4 Limestone—nodular, churned, yellowish brown, silty to sandy packed pelecypod-fragment biomicrite; miliolids, *L. subgoodlandensis,* gastropods, and finely disseminated glauconite. ---------------------------0.7
3 Marl—light brown, *L. subgoodlandensis, Cytherella* sp., serpulids, and crab claws. Shells fragmented and bored; ostracodes disarticulated. --------------2.1
2 Limestone—massive to shaly, wavy clay seams, yellowish brown to gray, silty packed pelecypod-fragment biomicrite; miliolids, oyster fragments, serpulids, and finely disseminated glauconite. ------------1.8
1 Marl—brown, almost entirely composed of small worm tubes, some echinoid parts. -----------------2.1

Total ----------------------------------51.9
Elevation of base ---------------------1341.8

LOCALITY 28. Comanche County (31°45′N; 98°34′W). Glen Rose Limestone contact with Twin Mountains Formation exposed along gravel road near the South Leon River and 3 airline miles west-southwest of Newburg.
Contact elevation ---------------------1385.0

LOCALITY 29. Comanche County (31°51'N; 98°37'W). Glen Rose Limestone in spillway of Lake Eanes, 50 yards west of the Comanche filtration plant, 2 airline miles south of Comanche.

Glen Rose Limestone

18 Limestone—honeycombed, dark yellowish brown, silty recrystallized sparite; no fossils. ---------------0.6
17 Marl—dark yellowish brown, limonite, quartz silt, round and abraded shell fragments, and oolites. Low microfossil yield. ---------------2.0
16 Limestone—nodular to massive, burrowed, yellowish brown, silty packed gastropod biomicrite; pelecypod fragments and limonite. ---------------1.9
15 Marl—light yellowish brown, *Asciocythere rotunda*, clams, *Cytherella* sp., *Eocytheropteron trinitensis*, and quartz silt. Shells broken and bored; ostracodes 50% disarticulated. Low microfossil yield. --1.2
14 Limestone—nodular, vertical to inclined burrows, churned, pale yellowish brown, silty moderately packed ostracode biomicrite; clams, limonite, encrusting blue-green algae, and gastropods. --------1.9
13 Marl—light yellowish brown, *A. rotunda*, *E. trinitensis*, quartz silt, and molluscs. Shells broken and ostracodes mostly disarticulated. Low microfossil yield. ---------------1.7
12 Limestone—nodular to massive, vertical burrows and borings, yellowish brown, moderately packed oyster biomicrite; clams, gastropods, and limonite. Lower 5 inches is a silty moderately packed ostracode biomicrite; pelecypods and few foraminifers. --2.3
11 Marl—yellowish brown, *A. rotunda*, *E. trinitensis*, oysters, limonite, and gastropods. Shells broken and abraded; ostracodes disarticulated. Low microfossil yield. ---------------0.8
10 Limestone—nodular, burrowed, yellowish brown, packed mollusc biomicrite; pellets and limonite. ----3.2
9 Marl—nodular, yellow brown, *A. rotunda*, oysters, *E. trinitensis*, quartz silt, and gastropods. Shells broken and abraded; ostracodes disarticulated. -----4.3
8 Limestone—massive, bored top surface, wavy structures, dark yellowish brown, silty sparse ostracode biomicrite; pelecypod fragments and manganese dendrites. Top bored surface is a laminated sandstone with high calcium carbonate content. ---------1.3
7 Marl—zones of micrite filled burrow casts vertical burrows, light brown to light gray, *A. rotunda*, *Haplophragmoides trinitensis*, *Cytherella* sp., clams, gastropods, and *E. trinitensis*. Shells bored and ostracodes mostly disarticulated. ---------------6.0
6 Limestone—nodular to bedded, laminated near top, burrowed, light brown, silty sparse mixed biomicrite; ostracodes, pelecypods, miliolids, and pellets. --1.2
5 Marl—light brown, *A. rotunda*, clams, *E. trinitensis*, echinoids, *H. trinitensis*, oysters, *Paracypris weatherfordensis*, and gastropods. Shells broken and bored; ostracodes disarticulated. ---------------1.6
4 Limestone—flaggy to shaly beds, burrowed, churned, light brown, silty sparse ostracode biomicrite; limonite and molluscs. ---------------1.5
3 Marl—moderately burrowed, brown, *A. rotunda*, echinoid parts, *E. trinitensis*, oysters, and clams. Shells broken and bored; ostracodes disarticulated. 1.0
2 Limestone—nodular, churned, branching burrows, yellowish brown, silty moderately packed mollusc biomicrite; fecal pellets and limonite. -------------1.5
1 Marl—dark yellowish brown to green, limonite, quartz silt and hematite. ---------------2.7

Total ---------------36.7
Elevation of base ---------------1450.0

LOCALITY 30. Comanche County (31°53'N; 98°39'W). Glen Rose Limestone in roadcut on U.S. Highway 377, 1.4 miles west of Comanche.

Glen Rose Limestone

19 Limestone—flaggy, slightly burrowed, yellowish brown, packed ostracode biomicrite; oysters, bone fragments, gastropods, and clam fragments. --------0.2
18 Marl—pale yellowish brown, *Asciocythere rotunda*, oysters, gastropods, bones and teeth, charophytes and angular to subround quartz. Shells broken and ostracodes mostly disarticulated. ---------------1.0
17 Limestone—nodular, slightly burrowed, churned, pale yellowsh brown, poorly washed packed fossiliferous intrasparite; gastropods, clams, pellets, encrusting blue-green algae and bone. ---------------1.5
16 Marl—yellowish brown, dark gray horizontal laminae, *A. rotunda* common, bones and teeth, and quartz. Shells broken and ostracodes disarticulated. 1.2
15 Sandstone—irregularly bedded, yellowish brown, few thin clay laminae, grains mainly subangular, plant fragments, few fragments of flat clams and ostracodes. ---------------1.1
14 Marl—yellowish brown, quartz sand, limonite and hematite. Microfossil content negligible. -----------0.5
13 Sandstone—light brown to pale gray, vertical burrows, thin horizontal laminae locally abundant. -----1.0
12 Clay—yellowish brown to green at the base, quartz sand, hematite, and limonite. Microfossil content negligible. ---------------2.9
11 Limestone—churned, yellowish brown, sandy moderately packed oyster-fragment biomicrite; gastropods (*Tylostoma* dominant), serpulids, and quartz.--0.2
10 Marl—yellowish brown, oysters, gastropods, *A. rotunda*, bones and teeth. Shells broken and abraded; ostracodes disarticulated. ---------------0.9
9 Limestone—nodular, churned, dark brown, sandy pelecypod biomicrite; gastropods (some *Turritella*), ostracodes, scattered serpulids, and teeth (grinders). 1.0
8 Marl—yellowish brown, quartz sand, oysters, and bone. Shells broken, abraded, and bored. ----------1.0
7 Limestone—churned, pale yellowish brown, sandy poorly washed moderately packed fossiliferous fecal intrasparite; ostracodes, clams, miliolids, bone and limonite. ---------------0.4
6 Marl—yellowish brown, quartz sand, and *A. rotunda*. Ostracodes mostly broken. ---------------2.5
5 Limestone—nodular, churned, yellowish brown, silty moderately packed mollusc biomicrite; some large clam steinkerns, bone and dasyclad algae. ----0.4
4 Marl—yellowish brown, *A. rotunda*, oysters, bones and teeth. Shells broken and ostracodes disarticulated. ---------------0.9
3 Limestone—thinly bedded, slightly burrowed, light brown, moderately packed pelecypod-fragment biomicrite; ostracodes, bone and quartz silt. ----------0.8
2 Marl—yellowish brown, oysters, *A. rotunda*, *Paracypris weatherfordensis*, quartz sand, and bones and teeth. Shells broken and ostracodes disarticulated. ---------------0.4
1 Limestone—nodular, churned, yellowish brown, silty packed fossiliferous pelsparite; molluscs, limonite crystals, and serpulid clusters. ---------------0.5

Total ---------------18.4
Elevation of base ---------------1484.6

LOCALITY 31. Comanche County (31°53'N; 98°40'W). Steeply dipping cross-beds of Glen Rose Limestone in stream bed, 500 yards north from U.S. Highway 67, 3.85 miles west of Comanche.

LOCALITY 32. Comanche County (31°55'N; 98°39'W). Glen Rose Limestone contact with Twin Mountains Formation well exposed in stream and roadcut along Duncan Creek, 2.5 miles northwest of Comanche.

Contact elevation ---------------1452.0

LOCALITY 33. Comanche County (31°55'N; 98°42'W). Edwards Limestone, Comanche Peak Limestone, Walnut Clay, and Paluxy Sand well exposed in private roadcut up the northeast side of Long Mountain, off F.M. 1689, 4.3 miles west of Comanche.

LOCALITY 34. Comanche County (31°52'N; 98°43'W). Edwards Limestone contact with the Comanche Peak Limestone, exposed in roadcut on U.S Highway 67, 6.6 miles west of Comanche.

Contact elevation ---------------1800.0

LOCALITY 35. Comanche County (31°55'N; 98°46'W). Glen Rose Limestone in roadcut on gravel road 0.1 mile east of Rabbit Creek and 3.3 miles southwest of Sidney.

Glen Rose Limestone

23 Dolomite—mottled, dark yellowish brown, finely crystalline dolomite 0.8
22 Marl—yellowish brown, *Asciocythere rotunda,* clams, *Eocytheropteron trinitensis,* limonite, *Cytherella* sp., gastropods, and *Haplophragmoides trinitensis.* Ostracodes mostly disarticulated; abundant fragmented shell material. 5.6
21 Sandstone—few vertical borings, laminated alternating sand and sandy carbonate mud, some thin shelled clams and few ostracodes. 0.5
20 Marl—yellowish brown, *A. rotunda, Cytherella* sp., *E. trinitensis,* and clams. Fifty percent of ostracodes disarticulated. 1.6
19 Limestone—nodular, churned, light yellowish brown, sandy moderately packed ostracode-fragment biomicrite; fragments of clams, gastropods, serpulids, and some limonite stain. 1.0
18 Marl—nodular, light brown, *A. rotunda,* quartz silt, *E. trinitensis, Cytherella* sp., and hematite. Ostracodes disarticulated and shell fragments abundant. 5.1
17 Limestone—thin bed of current-oriented, yellowish brown, sandy moderately packed intraclast bearing algal biomicrite; ostracodes, clam fragments, gastropods, and encrusting blue-green algae; upper few inches become finely laminated sandstone, bearing limonite, mud clasts, fragments of gastropods and clams. 0.7
16 Marl—nodular, yellowish brown, grains mainly recrystallized to calcite. 2.4
15 Marl—nodular, yellowish brown, quartz silt, hematite, limonite and bone. 2.0
14 Sandstone—bioturbated (burrows filled with loosely cemented sand and mud), yellowish brown, calcium carbonate cemented. 0.4
13 Sandstone—laminated, light brown, fine grained. ...1.2
12 Sand—light brown, fine-grained quartz, limonite. ...0.6
11 Dolomite—thin bed, yellowish brown, finely crystalline dolomite. 0.4
10 Limestone—thin bed, yellowish brown, recrystallized calcite. 0.2
9 Dolomite—massive, mottled, yellowish brown, silty aphanocrystalline biogenic dolomite; some mollusc fragments. 1.4
8 Marl—yellowish brown, oyster fragments, hematite, echinoid parts, and limonite. 2.2
7 Clay—green, quartz silt, limonite, and bone. Low residual grain content. 0.3
6 Dolomite—mottled, yellowish brown, finely crystalline dolomite; quartz sand and silt locally common and bone. 12.3
5 Sandstone—highly burrowed, yellowish brown, abundant carbonate cement. 0.4
4 Marl—yellowish brown, fine-grained quartz sand and limonite. 6.0
3 Limestone—thin bed of light brown, poorly sorted silty packed fossiliferous intrasparite; mollusc fragments, encrusting blue-green algae and scattered clay clasts. 0.7
2 Marl—yellowish brown, oyster fragments, clams, gastropods, and ostracodes. Bed highly dolomitized and shells broken. 1.2
1 Dolomite—mottled, yellowish brown, sandy medium crystalline dolomite. 2.6

Total 49.6
Elevation of base 1520.0

Locality 36. Hamilton County (31°47′N; 98°13′W). Glen Rose Limestone and Twin Mountains Formation in streamcut, 0.8 mile south of Gentrys Mill.

Glen Rose Limestone

9 Limestone—thinly bedded, bored top surface, pale yellowish brown to light gray, silty sparse miliolid biomicrite; thin-shelled clam fragments, echinoid parts and scattered limonite. 2.7
8 Marl—laminated light green and light brown, *Eocytheropteron trinitensis,* seruplids, oysters, clams, and echinoid parts. Shells mostly fragmented and ostracodes disarticulated. 0.4
7 Limestone—marly, nodular, light yellowish brown, sparse echinoid-fragment biomicrite; serpulids, ostracodes, teeth and plant material. 0.6
6 Limestone—nodular, burrowed, pale yellowish brown to light gray, sandy to silty moderately packed fossiliferous intramicrite; abundant clam steinkerns, *Turritella,* serpulids, echinoid parts, disseminated carbonized plant material and teeth. ...6.1
5 Marl—dark gray, gypsum, quartz silt, oysters, echinoid parts and vertebrate teeth. Shell fragments abundant. 0.8
4 Limestone—nodular, extremely burrowed, light brown, extremely silty packed fossiliferous pelmicrite; molluscs, echinoid parts, encrusting blue-green algae, scattered miliolids, and serpulids. 2.1
3 Limonite—laminated, dark yellowish brown, gypsum, quartz sand and silt. 0.5
2 Marl—olive gray, quartz sand and silt, limonite and gypsum. 1.0
1 Clay—green with dark yellowish brown patches, quartz sand and silt, limonite pebbles and highly abraded clam fragments. Extremely low microfossil yield. 9.0

Total 23.2

Twin Mountains Formation

Sandstone—packsand, white, poorly sorted, angular to subangular grains. 12.4
Elevation of base 1064.6

Locality 37. Hamilton County (31°35′N; 98°08′W). Dinosaur tracks and gypsum crystal molds in the Glen Rose Limestone in stream cut in the Cowhouse Creek, on the John Newman ranch, 1.05 miles north west of Parsley Crossing and 7.0 miles north of Evant.

Locality 50. Hamilton County (31°59′N; 97°59′W). Dalton Drilling and Service Co., #1.

Locality 51. Hamilton County (31°59′N; 98°04′W). Dalton Drilling and Service Co., #1 W. E. Putty.

Locality 52. Hamilton County (31°55′N; 99°00′W). Jones Brothers, #1 D. M. Proffitt.

Locality 53. Hamilton County (31°49′N; 97°57′W). Amerada Petroleum Corp., #1 John Briscoe.

Locality 54. Hamilton County (31°50′N; 97°59′W). Dalton Drilling and Service Co.

Locality 55. Hamilton County (31°40′N; 98°00′W). Louisiana Coastal Petroleum Corp., #1 E. B. James.

Locality 56. Hamilton County (31°34′N; 98°00′W). Dalton Drilling and Service Co., #1 D. Turner.

Locality 57. Hamilton County (31°30′N; 98°08′W). American Manufacturing Company, #1 T. W. Winters.

Locality 58. Hamilton County (31°34′N; 98°14′W). Dalton Drilling and Service Co., #1 J. W. Adams.

Locality 59. Hamilton County (31°41′N; 98°09′W). Dalton Drilling and Service Co., #1 Roy Chumney.

Locality 60. Hamilton County (31°48′N; 98°08′W). Dalton Drilling and Service Co., #1 F. Williamson.

Locality 61. (Deleted)

Locality 62. Hamilton County (31°41′N; 98°16′W). Shell Oil Co., #1 Jewell Christianson.

Locality 63. Hamilton County (31°39′N; 98°16′W). Dalton Drilling and Service Co., #1 A. Marwitz.

Locality 64. Hamilton County (31°35′N; 98°20′W). Dalton Drilling and Service Co., #1 Russel Sprague.

Locality 65. Hamilton County (31°36′N; 98°23′W). Dalton Drilling and Service Co., #1 T. O. Harrell.

Locality 66. Hamilton County (31°40′N; 98°27′W). Dalton Drilling and Service Co., #1 Roy Pickard.

LOCALITY 67. Hamilton County (31°42′N; 98°20′W). Dalton Drilling and Service Co., #1.

LOCALITY 68. Comanche County (31°44′N; 98°23′W). Dalton Drilling and Service Co., #1 Ray Jones.

LOCALITY 69. Comanche County (31°46′N; 98°23′W). Dalton Drilling and Service Co., #1 M. C. Hughitt.

LOCALITY 70. Comanche County, (31°44′N; 98°27′W). Dalton Drilling and Service Co., #1.

LOCALITY 71. Comanche County (31°43′N; 98°40′W). United North and South Development, #1 J. B. Aldridge.

LOCALITY 72. Comanche County (31°46′N; 98°40′W). Jack C. Staley, #1 R. M. Ratliff.

LOCALITY 73. Comanche County (31°50′N; 98°43′W). Lloyd N. Smith, #1 Gail Dudley.

LOCALITY 74. Comanche County (31°52′N; 98°38′W). Sun Oil Co., #1 E. E. Bryson.

LOCALITY 75 (Deleted)

LOCALITY 76. Comanche County (31°47′N; 98°25′W). State Well No. 41-13 (c-17 and c-18).

LOCALITY 77 (Deleted)

LOCALITY 78. Comanche County (31°52′N; 98°12′W). Dalton Drilling and Service Co., #1 Ralph Shank.

LOCALITY 79. Comanche County (31°56′N; 98°15′W). Dalton Drilling and Service Co., #1 Chester Wylie.

LOCALITY 80. Hamilton County (31°43′N; 97°54′W). Dalton Drilling and Service Co., #1 J. D. Wilbanks.

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2. Atlee, William A. (1962) The Lower Cretaceous Paluxy Sand in central Texas: Baylor Geological Studies Bull. No. 2 (Spring). $1.00 per copy. Out of print.
3. Henningsen, E. Robert (1962) Water diagenesis in Lower Cretaceous Trinity aquifers of central Texas: Baylor Geological Studies Bull. No. 3 (Fall). $1.00 per copy. Out of print.
4. Silver, Burr A. (1963) The Bluebonnet Member, Lake Waco Formation (Upper Cretaceous), central Texas—A lagoonal deposit: Baylor Geological Studies Bull. No. 4 (Spring). $1.00 per copy.
5. Brown, Johnnie B. (1963) The role of geology in a unified conservation program, Flat Top Ranch, Bosque County, Texas: Baylor Geological Studies Bull. No. 5 (Fall). $1.00 per copy. Out of print.
6. Beall, Arthur O., Jr. (1964) Stratigraphy of the Taylor Formation (Upper Cretaceous), east-central Texas: Baylor Geological Studies Bull. No. 6 (Spring). $1.00 per copy.
7. Spencer, Jean M. (1964) Geologic factors controlling mutation and evolution—A review: Baylor Geological Studies Bull. No. 7 (Fall). $1.00 per copy. Out of print.

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8. Part I: Geology (1965) Geology and urban development by Peter T. Flawn; Geology of Waco by J. M. Burket: Baylor Geological Studies Bull. No. 8 (Spring). $1.00 per copy.
9. Part II: Soils (1965) Soils and urban development of Waco by W. R. Elder: Baylor Geological Studies Bull. No. 9 (Fall). $1.00 per copy.
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15. Boone, Peter A. (1968) Stratigraphy of the basal Trinity (Lower Cretaceous) sands, central Texas: Baylor Geological Studies Bull. No. 15 (Fall). $1.00 per copy.
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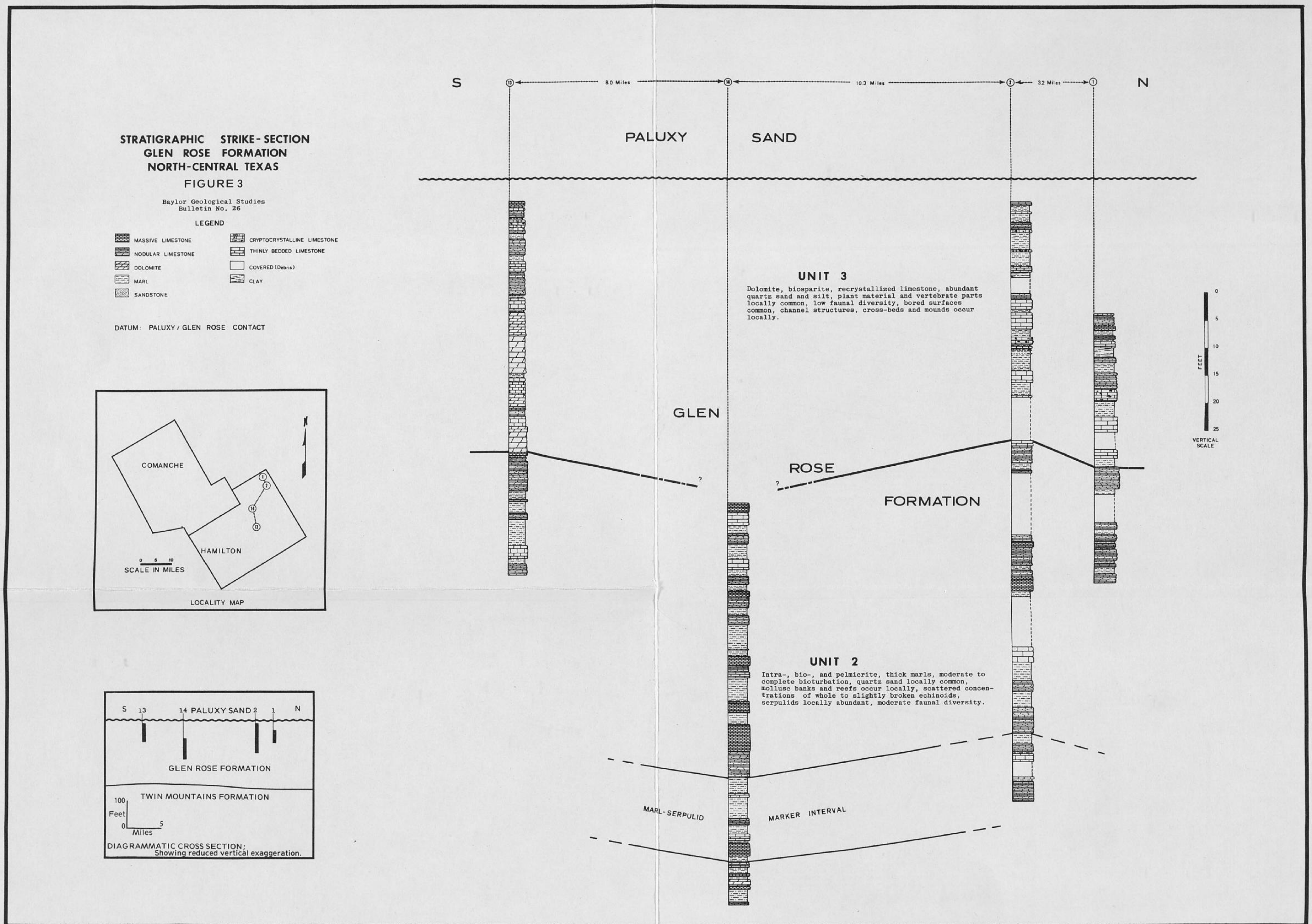

STRATIGRAPHIC STRIKE-SECTION
GLEN ROSE FORMATION
NORTH-CENTRAL TEXAS

FIGURE 3

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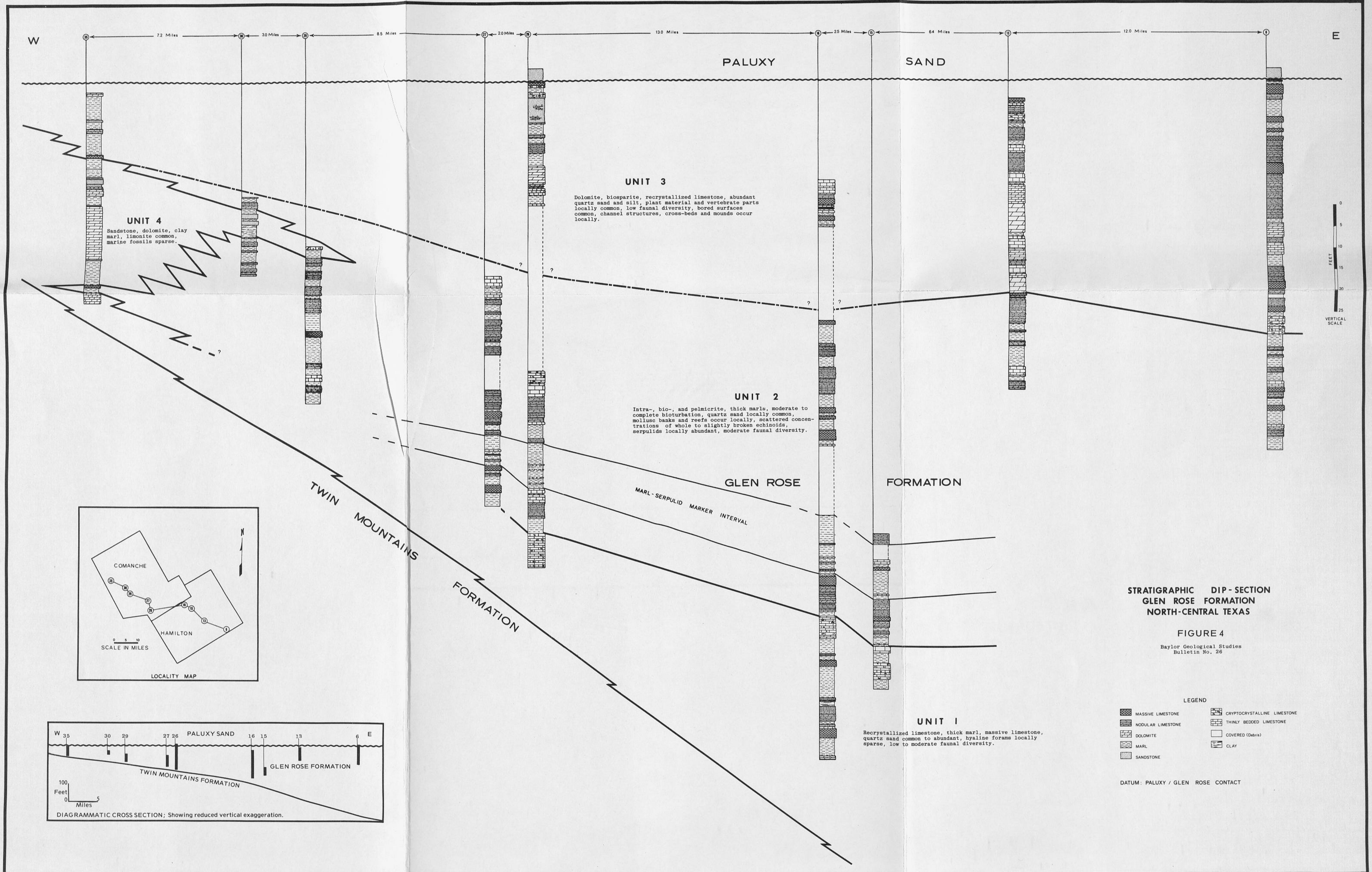

STRATIGRAPHIC DIP-SECTION
GLEN ROSE FORMATION
NORTH-CENTRAL TEXAS

FIGURE 4

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GEOLOGIC
MAP
LEGEND
Kuf
Upper Fredericksburg Undifferentiated
Kpa
Paluxy Formation
Kgr
Glen Rose Formation
Ktm
Twin Mountains Formation
P
pre-Cretaceous
Fredericksburg
Trinity
Lower Cretaceous
Pre-Cretaceous/Twin Mountains Contact after Bain 1973.
Outcrop Localities (below 58)
Well Localities (above 58)
Line of Section
Indefinite Contact
SCALES
MILES
Comanche and Hamilton counties, Texas
Baylor Geological Studies Bulletin No. 26
EASTLAND COUNTY
ERATH COUNTY
BOSQUE COUNTY
CORYELL COUNTY
LAMPASAS CO
MILLS COUNTY
BROWN COUNTY

FIGURE 2

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