BUREAU OF ECONOMIC GEOLOGY
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GEOLOGIC QUADRANGLE MAP NO. 25

Geology of the Johnson City Quadrangle, Blanco County, Texas

BY

VIRGIL E. BARNES

November 1963

THE UNIVERSITY OF TEXAS
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TO ACCOMPANY MAP—GEOLOGIC
QUADRANGLE MAP NO. 25

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VIRGIL E. BARNES

CONTENTS

GENERAL SETTING

Johnson City quadrangle is entirely within the Pedernales River basin in the southeastern part of the Llano region. Although there are remnants of the Edwards Plateau in adjacent quadrangles, within this quadrangle only Buffalo Peak reaches nearly to the plateau level.

The geology of the Johnson City quadrangle is shown on a U.S. Geological Survey 7½ minute topographic quadrangle map—contour interval 20 feet, scale 1:24,000. The relief in the quadrangle is about 610 feet; elevations range from about 1,050 feet where Pedernales River leaves the quadrangle to slightly more than 1,660 feet at the top of Buffalo Peak.

The quadrangle is drained by Pedernales River and its tributaries—North Grape, Spring, Hickory, Buffalo, Hardin Russell, Cottonwood, Salter Spring, Towhead, Flat, Town, and Deer creeks and other unnamed drainages.

Johnson City quadrangle is high on the southeastern side of the Llano uplift. Precambrian, Cambrian, and Ordovician rocks crop out in about two-thirds of the quadrangle; Cretaceous rocks and some Quaternary surficial deposits occupy the remainder. Faults related to the Ouachita structural belt trend mostly in northeastward-southwestward directions ranging from almost north-south to almost east-west. Paleozoic rocks mostly dip southeastward at angles up to about 10 degrees, and the relatively flat-lying Cretaceous rocks dip eastward about 12 feet per mile.

Discussions of stratigraphy, structural, economic, and geophysical problems are in cited references. This publication on the Johnson City quadrangle is the first of a series of central Texas geologic quadrangle maps which will be compiled as topographic bases become available. An index map for geologic maps already published on planimetric bases and others planned for publication on the new topographic bases is shown with the geologic map.

The eastern two-thirds of the Johnson City quadrangle, mapped geologically in 1942 and 1943 by the writer and L. E. Warren, was published as part of a planimetric map (Cloud and Barnes, 1948, Pl. 3). With the assistance of L. E. Warren and A. R. Palmer, the rest of the area was mapped geologically and a gravity survey completed by 1948.

GEOLOGIC FORMATIONS

PRECAMBRIAN ROCKS

IGNEOUS ROCKS

Town Mountain Granite

Town Mountain Granite belonging to the Grape Creek granite mass (Barnes, Dawson, and Parkinson, 1947, p. 45) crops out in several places along the western edge of the quadrangle and along Hickory Creek. The two northwesternmost outcrops are separated by a graben of Hickory Sandstone and some of the outcrops to the south are buried hills that perhaps reached as high as the base of the Cap Mountain Limestone before the Cap Mountain was eroded.

The granite is light pink, coarse grained, somewhat porphyritic, and composed mostly of microcline, quartz, plagioclase, and some biotite. Accessory minerals are magnetite, fluorite, apatite, titanite, and zircon. The granite contains a few small pegmatites, aplite bodies, and quartz veins.

A Town Mountain(?) Granite dome exhumed by Pedernales River extends into the North Grape Creek quadrangle (Barnes, 1952b), where it is designated as Oatman Creek Granite. Evidence favors assigning this outcrop to the Town Mountain Granite. A gravity survey by Barnes, Romberg, and Anderson (1954a, 1954b, 1955) shows this outcrop to be in a gravity minimum associated with the Grape Creek granite mass. As Town Mountain Granite masses are characterized by gravity minima, this buried hill may be a phase within the Town Mountain Granite rather than Oatman Creek Granite. Oatman Creek Granite in the Llano region occurs in separate bodies and in bodies adjacent to Town Mountain Granite masses but is unknown within a Town Mountain Granite mass. The grain size of this granite is larger than normal for Oatman Creek Granite and the granite lacks cataclastic texture, a common characteristic of Oatman Creek Granite.

As described by Barnes, Dawson, and Parkinson (1947, pp. 51–52), the granite has an average grain size of 10 mm, is brownish tinged with red and yellowish green, and takes an exceptionally brilliant polish. It is composed mostly of microperthite and quartz with lesser amounts of hornblende and biotite. Plagioclase is very scarce and is present as crystals associated with the femic minerals. Accessory minerals are magnetite, apatite, and zircon.

This buried granite hill, before it was exposed and eroded, may have reached almost to the base of the Lion Mountain Sandstone. Quaquaversal dips in the Cap Mountain Limestone adjacent to the granite are interpreted as due to intrastratal solution, evidenced by abundant stylolites. The contact of the granite and limestone is well exposed east of Pedernales River.

PALEOZOIC ROCKS

CAMBRIAN SYSTEM (MIDDLE AND UPPER CAMBRIAN)

Riley Formation

Hickory Sandstone Member.—The Hickory Sandstone crops out in five fault blocks in the northwestern part of the Johnson City quadrangle. In thickness and appearance it resembles the Hickory Sandstone described in the White Creek section of Blowout quadrangle (Barnes, 1952a) where it is 276 feet thick. Wise (MS.) found no measurable section exposing the entire thickness of the sandstone. He estimated that about 150 feet of the lower part is exposed half a mile north of Sandy.

In its lower part the Hickory is massive, cross-bedded, coarse grained, and in places near its base contains microcline granules and conglomerate lenses. In its middle part beds are thinner and cross-bedding is on a smaller scale. In its upper part clay and silt are abundant; topographically this unit forms a soil-covered bench. The sand in the Hickory is poorly sorted, mostly angular to subrounded, and most grains have rough surfaces.

The Hickory Sandstone supports deciduous trees, prominent among which are the broad-leaf oaks, in contrast to the overlying Cap Mountain Limestone which supports cedar, live-oak, and an assortment of daggers and cacti.

Trilobites collected by Palmer (1954) from locality 6-9A are *Bolaspidella prooculis* and *Modocia* cf. *M. oweni* and from locality 6-20A, *Baltagnostus* cf. *B. centerensis*, *Bolaspidella prooculis*, and *Modocia* cf. *M. oweni*. The locality data given by Palmer are in error—locality 6-9A is 0.8 mile airline east-northeast of Sandy, not just south as stated; and locality 6-20A is 1.7 miles airline due south of Sandy, not just west as stated. Fossils at locality 6-10B are linguloid brachiopods.

Wise (MS.) found 5 species of trilobites and 1 species of phosphatic brachiopod in the *Bolaspidella* zone, which is mostly in the upper part of the Hickory Sandstone in this area.

Cap Mountain Limestone Member.—Outcrops consist of a narrow graben west of Sandy, a semicircular exposure around the exhumed granite dome on Pedernales River, and, in the northwestern part of the quadrangle, a 1.5-mile wide northeast-southwest-trending belt offset by the Hogthief Bend fault. The entire sequence is exposed along Hickory Creek and Pedernales River and likewise on the opposite side of the fault along North Grape Greek and Pedernales River.

The Cap Mountain Limestone is similar to that described in the White Creek section of Blowout quadrangle (Barnes, 1952a); Wise (MS.) estimated that the Cap Mountain is slightly less than 500 feet thick. He measured and described 407 feet of the upper and lower parts of the member in his Hickory Creek section, and the lower 59 feet is again described in his Sandy Post-office section.

The lower part of the Cap Mountain, mostly calcareous sandstone and sandy limestone, forms a scarp above the soil-covered Hickory Sandstone bench. Upward, sand is less abundant and the middle part of the member is a distinctly jointed, relatively pure, massive limestone. The joints have been widened by solution and show clearly on aerial photographs.

The upper 98 feet of the member is described by Barnes (1956, p. 57) in the Klett-Walker section, which extends southward from the exhumed granite dome along Pedernales River. In this section the lower 53 feet of rock is fine-grained, mottled weathering, greenish-gray to yellowish-gray, slightly glauconitic, massively bedded dolomite containing sporadically distributed crystals of galena. The overlying 24 feet of rock is fine- to medium-grained, yellowish-gray to greenish-gray, sparsely to very glauconitic dolomite and limestone containing a few trilobites, with a 3-foot bed of siltstone at the top. The remaining 21 feet of rock is mostly coarse-grained, coarsely glauconitic, trilobitic limestone, except for one 3-foot interval which is a coquinite of phosphatic brachiopods.

Brachiopods collected by Palmer (1954, p. 786) from locality 6-10A are *Angulotreta postapicalis*. The locality data given by Palmer are in error—locality 6-10A is 1.0 mile due east of Sandy, not south as stated.

Wise (MS.) collected fossils from three zones in the Cap Mountain; the number of species identified are listed in table 1.

TABLE 1

Zone	Number of species of fossils		
	Trilobites	Brachiopods, phosphatic	Miscellaneous and undetermined
Coosina	12	1	3
Coosella	14	3	0
Cedarina-Cedaria	5	2	1

Lion Mountain Sandstone Member.—The Lion Mountain Sandstone also encircles the exhumed granite dome along Pedernales River and in the northwestern part of the quadrangle forms a narrow northeast-southwest-trending outcrop interrupted by faults. The rocks weather to a bench 400 to 500 feet wide with widely scattered live-oak mottes. The only rock normally exposed is fragments of trilobite coquinite. The bench is distinctly visible on aerial photographs.

In the Klett-Walker section (Barnes, 1956, p. 56) the Lion Mountain is 31 feet thick, which is less than its normal thickness in the Llano region. Wise (MS.) found the Lion Mountain to be 42 feet thick in the Gipson ranch section and 46 feet thick in the nearby Hickory Creek section. The thinness of the Lion Mountain in the Klett-Walker section may in part be the result of restricted sedimentation over the buried granite dome and to some extent due to southward regional thinning. The bottom 2-foot bed in the Klett-Walker section is very fine-grained glauconitic sandstone followed by 17 feet of coarse-grained, slightly sandy, mostly cross-bedded, variably glauconitic, light olive-gray to greenish-gray and dark greenish-gray to off-white limestone and greensand. The greensand is light olive gray where shaly and grayish olive green where composed of glauconite. The white limestone is a trilobite coquinite, and trilobites and phosphatic brachiopods including acrotretids are common in the rest of the rock. The next 10 feet is mostly medium-grained, grayish olive-green greensand composed of glauconite, a minor amount of shale, and a few thin cross-beds of trilobite coquinite limestone. The top 2 feet of the Lion Mountain is much weathered, moderate olive-brown, glauconitic shale.

Fossils collected at localities 6-24A and 6-24B are phosphatic brachiopods. Wise (MS.) identified 9 species of trilobites and 2 species of phosphatic brachiopods in the *Aphelaspis* zone, which is essentially coextensive with the Lion Mountain Sandstone Member.

Wilberns Formation

Welge Sandstone Member.—The very narrow Welge Sandstone outcrop forms a scarp parallel to the Lion Mountain Sandstone bench in the northwestern part of the quadrangle and encircling the exhumed granite dome on Pedernales River. Another small exposure south of the main outcrop is along a fault. In the Klett-Walker section (Barnes, 1956, p. 56) the Welge is 12 feet thick. It is coarse-grained, dark yellowish-brown to pale yellowish-brown, cross-bedded quartz sandstone; locally it is quartzite. In sunlight the rock glitters as light is reflected from secondary crystal faces. Beds range from 4 inches to 4 feet in thickness; glauconite and shaly beds are scarce. Elsewhere in the Johnson City quadrangle the basal bed contains 0.25- to 0.5-inch quartz pebbles but none this large were seen in the line of section.

Wise (MS.) measured 6 feet of Welge Sandstone in the Gipson ranch section and noted that in this section it is very glauconitic. He stated that within his map area the Welge is coarser at the base.

Trilobites were first collected from the basal part of the Welge sandstone in the Llano region near the mouth of Buffalo Creek by Leo Hendricks, of Texas Christian University. Josiah Bridge of the U.S. Geological Survey recognized that these trilobites were related to some in the Morgan Creek Limestone, thus furnishing the first paleontological evidence for placing the Welge in the Wilberns Formation rather than in the Riley Formation.

Morgan Creek Limestone Member.—Morgan Creek Limestone encircles the

exhumed granite dome on Pedernales River and extends northeastward across one small fault to where it is overlapped by Cretaceous rocks. From here to the northeastern corner of the quadrangle it crops out only along creeks. Another outcrop is in Hogthief Bend where the rocks are down-dropped to the northwest along the Hogthief Bend fault.

In the Klett-Walker section (Barnes, 1956, pp. 54–56) the Morgan Creek Limestone is 126 feet thick, and in the Gipson ranch section (Wise, MS.) it is reported to be 149 feet thick. In the Klett-Walker section, the lower 18 feet is thick bedded, stylolitic, coarse grained, massive, glauconitic and in part oolitic, ranging from a calcareous sandstone at the base to a slightly sandy limestone at the top. It is mostly pale yellowish brown and grayish orange pink, along with some pale red and light olive gray, whereas elsewhere in the Llano region this part of the Morgan Creek is pale red or even deeper red. Some of the ooids are dolomitized and much of the limestone is composed of fossil fragments. Identifiable fossils are scarce.

The upper 108 feet of the Morgan Creek is composed of alternating beds of fine-grained and coarse-grained limestone formed mostly of organic debris. Aphanitic to microgranular stromatolites are common in the upper part. Colors are varied, commonly medium gray to greenish gray, yellowish gray, brownish gray, light olive gray, and dark yellowish orange where dolomitic. Glauconite is sparse to very abundant; fine grained in the fine-grained silty beds and commonly coarse grained in the coarse-grained beds.

Fossils in the Morgan Creek Limestone include numerous trilobites, phosphatic brachiopods, and in the upper two-thirds numerous calcitic brachiopods, some of which are silicified toward the top of the member. Bell and Ellinwood (1962) illustrated and described a few fossils from the Klett-Walker section and Barnes and Bell (MS.) made faunal lists. Additional collections of brachiopods made from localities 6-23A, 6-24C, and 6-24D are in part silicified.

Numerous fossil collections made by Wise (MS.) from four zones in the lower half of the Wilberns Formation are mostly from the Morgan Creek Limestone. The number of species identified are listed in table 2.

TABLE 2

Zone	Number of species of fossils: Trilobites	Brachiopods: Phosphatic	Brachiopods: Calcitic	Miscellaneous and undetermined
Ptychaspis-Prosaukia	11	1	1	1
Conaspis	8	3	5	1
Elvinia	23	1	0	0
Dunderbergia	4	1	0	0

Point Peak Member.—The Point Peak Member is coextensive with the Morgan Creek Limestone and crops out southeast of it. In both the Klett-Walker section (Barnes, 1956, p. 54) and the Gipson ranch section (Wise, MS.), it is 25 feet thick. These are by far the thinnest sections of Point Peak measured in the Llano region.

The Point Peak is mostly fine-grained, silty, thin-bedded (0.25 to 0.5 inch, maximum 3 inches), greenish-gray limestone containing thin beds of intraformational conglomerate and two stromatolite zones each about 2 feet thick. The upper two feet of the member is thin-bedded, silty dolomite containing a 4-inch, oolitic, cherty bed.

The rapid southward thinning of the Point Peak in Blanco County appears to be the result of either (1) gradation of silty Point Peak sediment laterally to dolomite of the San Saba Member, or (2) cutting off of the silt supply by a stromatolitic reef, resulting in a relatively thin accumulation of silty sediment south of the reef.

San Saba Member.—Subsequent to publications on the Blowout quadrangle (Barnes, 1952a) and the North Grape Creek quadrangle (Barnes, 1952b)—both adjoining the Johnson City quadrangle—Barnes and Bell (1954) proposed a change in nomenclature to bring Wilberns terminology into conformity with Ellenburger terminology. The names "Pedernales Dolomite" and "San Saba Limestone" on the map and in the text of North Grape Creek quadrangle are no longer used. Instead these rocks are included in the San Saba—the top member of the Wilberns Formation. Where dolomite and limestone are mapped separately, they are shown as dolomitic and calcitic facies of the San Saba Member. They are comparable in rank to the dolomitic and calcitic facies mapped in the overlying Threadgill Member and other units of the Ellenburger Group.

The San Saba Member, where not concealed by Cretaceous rocks, forms a wide northeast-southwest-trending outcrop belt passing through the center of the Johnson City quadrangle. Another outcrop of the lower part of the member is in Hogthief Bend along the northwest side of the Hogthief Bend fault.

Barnes (Cloud and Barnes, 1948, pp. 341–342, Pls. 3, 12) measured 195 feet of San Saba Member beds ("Pedernales Dolomite") in the upstream Pedernales River section. About 3 miles to the northeast, the Stratoray Oil Corporation No. 1 Stribling well (completed in 1955) penetrated 310 feet of San Saba beds. The outcrop pattern in the vicinity of the well indicates that as much as 130 feet of higher San Saba beds are also present in this area so that total estimated thickness is 440 feet. This is more than twice the thickness measured in the upstream Pedernales River section. It seems clear that in the measured section a fault cuts out about 250 feet of the uppermost San Saba beds. The thickness estimate of 440 feet is supported by an even thicker section of San Saba beds found to the south in the Roland K. Blumberg No. 1 Wagner well (Barnes, 1959, Pls. 1, 3).

Of the lower 121 feet of San Saba beds measured in the Klett-Walker section (Barnes, 1956, pp. 53–54), the lower 87 feet is fine-grained, yellowish-gray, medium-bedded (6–12 inches) dolomite containing one 8-foot and one 4-foot oolitic zone. The upper 34 feet is coarse-grained, light yellowish-gray, massive dolomite which weathers into rounded, solution-pitted, boulder-like masses.

In the upstream Pedernales River section the lower 86 feet of the San Saba is fine-grained dolomite similar to that in the Klett-Walker section, except that the upper 15 feet contains dirty white to rusty, porous to compact, fossiliferous quartzose chert (loc. 6-5A). The overlying 104 feet is massive, coarse-grained, light gray and pinkish-gray dolomite with some dull dark reddish-purple mottles. Somewhere in this sequence, perhaps near the top as judged from comparison with the section in the Stratoray Oil Corporation No. 1 Stribling, is the fault that cuts out an estimated 250 feet of section. The dolomite in the well corresponding to the faulted-out part of the upstream Pedernales River section is mostly fine and very fine grained. The top 5 feet of the San Saba in this section is medium gray to yellowish-gray, microgranular dolomite.

In the southwestern part of the quad-

rangle, the upper part of the San Saba is fine-grained dolomite; lateral intergradation of fine- and coarse-grained dolomite has been mapped. Also in this area the San Saba Member contains a few masses of white, aphanitic limestone which grades into coarse-grained dolomite.

Fossils from six collections in the San Saba Member were identified by P. E. Cloud, Jr., U.S. Geological Survey, and W. C. Bell, Department of Geology, The University of Texas, as follows:

LOCALITY	FOSSILS
2-46B	*Finkelnburgia* sp.
	Scaevogyra cf. *swezeyi* Whitfield
2-56A	*Plectotrophia* cf. *P. bridgei* Ulrich & Cooper
2-57C	*Finkelnburgia* sp.
	Schizopea cf. *elevata* (Ulrich and Bridge)
	Dirhachopea cf. *D. normalis* Ulrich and Bridge
	Sinuopea spp.
	New cyrtocarinate ecculiomphalid gastropod genus
	Stenopilus sp.
	Saukiinid trilobite
6-3A	*Scaevogyra* cf. *S. swezeyi* Whitfield
	Plethometopus sp.
6-4A	*Xenorthis* sp.
	Anconochilus barnesi Knight
	Hypseloconus sp.
	Plethopeltis (?)
	Unidentified trilobites
6-5G	Cf. *Finkelnburgia*
	Dirhachopea sp.
	Cf. *Hypseloconus*
	New genera aff. *Ecculiomphalus*

Inadvertently, Barnes (Cloud and Barnes, 1948, p. 342) listed locality 6-4A as locality 2-4A.

ORDOVICIAN SYSTEM (LOWER ORDOVICIAN)

ELLENBURGER GROUP

Tanyard Formation

Threadgill Member.—In the Johnson City area the position of the San Saba-Threadgill boundary in reference to the position of the Cambrian-Ordovician boundary is unknown because of lack of paleontologic evidence. The uppermost part of the San Saba could be Ordovician or the lower part of the Threadgill could be Cambrian. The boundary between the members, where in dolomite, is placed at the top of the fine-grained dolomite above the highest Cambrian fossils and at the bottom of coarse-grained dolomite below the lowest Ordovician fossils.

The Threadgill Member crops out in three areas, one along Pedernales River north-northwest of Johnson City, one along the edge of the southwestern part of the quadrangle, and the third north of U.S. Highway 290 west of Towhead Creek. The latter is a small outcrop. It is probably Threadgill but the possibility of its being San Saba or Staendebach must not be ruled out.

In the Johnson City area, the Threadgill Member is 242 feet thick (Cloud and Barnes, 1948, pp. 312, 339–341) and mostly coarse-grained, light gray dolomite, except between Pedernales River and Towhead Creek where 182 feet of white to light gray, aphanitic limestone was measured. This limestone body intergrades laterally with coarse-grained dolomite, the dominant Threadgill rock type in this part of the Llano region. Similar intergradation of limestone and dolomite was mapped in the southwestern part of the quadrangle.

Fossils collected from quartzose chert in the Threadgill Member were identified by P. E. Cloud, Jr., U. S. Geological Survey, as follows:

LOCALITY	FOSSILS
6-5C	*Sinuopea* sp.
	Ozarkina sp.
	Ophileta sp.
	Schizopea (?)
6-5D	*Sinuopea* (?)
	Schizopea (?)
	Trilobite
6-5F	*Euconia* (?)
	Ectenoceras (?)
	High-spired *Ophileta* sp.

The Staendebach *Ophileta* in chert from locality 6-5F must be float from nearby Cretaceous conglomerate.

Staendebach Member.—The outcrop belt of the Staendebach Member, interrupted by faults and Cretaceous cover, extends from a point 1 mile north of Johnson City in a north-northeast direction for a distance of 4 miles and westward from the same point for a distance of 3 miles. The westernmost outcrops are inliers surrounded by Cretaceous rocks.

In the Johnson City quadrangle the Staendebach Member is mostly dolomite but some limestone occurs in the west. Cloud and Barnes (1948, pp. 312–313, 337–339) included in the Staendebach the upper 50 feet of rock in the Towhead Creek section and the lower 365 feet of rock in the downstream Pedernales River section. These two sections, comprising 415 feet of rock, are believed to account for all of the Staendebach Member in this area. The same thickness of Staendebach was penetrated in the Roland K. Blumberg No. 1 Wagner well to the south (Barnes, 1959, Pls. 1, 3).

The 50 feet of Staendebach described in the Towhead Creek section is dolomite, in part fine grained and in part medium to coarse grained, mostly light gray with a pinkish cast, medium bedded, and somewhat cherty. The Staendebach in the downstream Pedernales River section is mostly medium- to thick-bedded dolomite. The lower 200 feet is mostly fine to medium grained, contains some fine- to very fine-grained dolomite, and ranges in color from yellowish gray to medium gray and brownish gray. The upper 165 feet is mostly light gray to yellowish-gray, medium-grained dolomite. Chert, characteristic of the Staendebach, is mostly porcelaneous, white to off-white, dolomoldic to compact, in part oolitic, and near the top of the section (loc. 2-59A) very fossiliferous. (*See* Cloud and Barnes, 1948, p. 337, for faunal list.)

Eleven other fossil collections made from Staendebach rocks have been identified by W. C. Bell, Department of Geology, The University of Texas, P. E. Cloud, Jr., U. S. Geological Survey, and R. H. Flower, New Mexico Institute of Mining and Technology, as follows:

LOCALITY	FOSSILS
2-57A	*Ophileta* sp.
	Gasconadia cf. *G. putilla* (Sardeson)
	Schizopea grandis (Ulrich & Bridge)
	Hydrozoan? or trepostomatous bryozoan?
	Sinuopea regalis Butts
2-57B	*Ozarkina* sp.
	Finkelnburgia (?)
	Trilobite
2-58B	Cf. *Gasconadia putilla* (Sardeson) (?)
	Roubidouxia sp.
	Hystricurus sp.
	Nautiloid(?)
	Ophileta sp.
2-58D	Fragmentary gastropods
	Brevicone cephalopods
6-5A	"*Helicotoma*"(?)
	Ophileta sp.
	Gasconadia sp.
	Dakeoceras sp.
	Clarkeoceras sp.
	Caseoceras (?)
	Conocerina sp.
6-5B	*Ophileta* sp.
	Sinuopea cf. *humerosa* Butts
6-6A	*Ophileta* sp.
	Ozarkina typica Ulrich & Bridge
	Gasconadia putilla (Sardeson)
	Sinuopea cf. *S. humerosa* Butts
	Schizopea grandis (Ulrich & Bridge)
	Cystid plates
	Clarkeoceras (?)
6-6B	*Ophileta* sp.
	Helicotoma (?)
	Lytospira (?)

	Gasconadia cf. *G. putilla* (Sardeson)
	Sinuopea sp.
	Trilobite
6-6C	*Ozarkina* sp.
6-14A	*Lytospira* sp.
	Conocerina, n. sp.
6-15A	*Helicotoma uniangulata* (Hall)
	Lytospira sp.
	Ophileta sp.
	Ozarkina typica Ulrich & Bridge
	Ozarkina complanata Ulrich & Bridge
	Sinuopea sp.
	Paraplethopeltis sp.
	Ectenoceras sp.

Gorman fossils present in the collection from locality 2-58B are float from Gorman rocks east of the nearby fault.

Gorman Formation

The Gorman Formation in the Johnson City quadrangle is represented by a lower dolomitic facies and an upper calcitic facies. The dolomitic facies crops out (1) 2.5 miles northeast of Johnson City along Pedernales River, (2) in a graben 3 miles north-northeast of Johnson City, and (3) at the edge of overlapping Cretaceous rocks in two other areas, one just north and one 2 miles west-northwest of Johnson City. Calcitic Gorman crops out south of the dolomitic Gorman in the fault blocks north-northeast and northeast of Johnson City and in the latter extends south of the road leading eastward to Honeycut Bend. The boundary between the two facies is coincident with the *Archaeoscyphia* bed where found; elsewhere it divides rock that is predominantly limestone from rock that is predominantly dolomite.

The lower 14 feet of the Gorman dolomitic facies, described by Cloud and Barnes (1948, p. 337) in the downstream Pedernales River section, is mostly microgranular, in part sandy, and cherty. All of the Gorman Formation has been described (Cloud and Barnes, 1948, pp. 331–336) in the upstream Honeycut Bend section, 2 miles east of the Johnson City quadrangle, where the dolomitic facies is 246 feet thick and the calcitic facies 244 feet thick. Here the boundary is 10 feet beneath the *Archaeoscyphia* bed. In this section 23 feet of limestone and 223 feet of dolomite comprise the dolomitic facies, and of the dolomite, 174 feet is microgranular and 49 feet is mostly fine grained. The calcitic facies is almost half dolomite, of which about 85 feet is microgranular and the rest mostly fine grained. Throughout this section the limestone is aphanitic, slightly sandy beds occur at many levels, and chert is common. Dolomite, especially where fine to medium grained, commonly grades laterally to limestone and *vice versa*. No two sections have the same proportion of limestone and dolomite. Likewise, the Gorman rocks in the Johnson City quadrangle do not have the same proportion of limestone and dolomite as in the upstream Honeycut Bend section although the same rock types are present.

Fossils collected from the Gorman Formation were identified by P. E. Cloud, Jr., U.S. Geological Survey, as follows:

LOCALITY	FOSSILS
2-58C	*Rhombella umbilicata* (Ulrich & Bridge)
	Ophileta
2-59B	*Lecanospira*
2-59C	*Rhombella umbilicata* (Ulrich & Bridge)

Honeycut Formation

The Honeycut Formation crops out in two areas about 2 miles east from Johnson City, one along Pedernales River and the other north of the road to Honeycut Bend. Not more than 50 to 100 feet of the lower part of the formation is present. The rocks exposed are alternating beds of light to medium gray aphanitic limestone and light to medium gray to yellowish-gray, microgranular to fine-grained dolomite. Some beds are slightly sandy, some are cherty, and all are well exposed along Pedernales River, where at the point on the map marked "F" the basal bed of the Honeycut Formation contains numerous *Xenelasma*.

Fossils from locality 2-60C near the base of the Honeycut were identified by P. E. Cloud, Jr., U. S. Geological Survey, as 3 species of *Jeffersonia* and gastropods.

MESOZOIC ROCKS

CRETACEOUS SYSTEM (LOWER CRETACEOUS)

Trinity Group

Shingle Hills Formation

Hensell Sand Member.—The Hensell Member (Barnes, 1948) rests on an irregular erosional surface carved on Paleozoic rocks ranging in age from Cambrian Morgan Creek Limestone to Ordovician Honeycut rocks. Northwestward it laps out against the erosion surface, and ridges and hills of Paleozoic rock in several places in the northern and western parts of the quadrangle interrupt the continuity of the Hensell outcrop. The Hensell is thickest in the southeastern part of the quadrangle where it may be as much as 100 feet thick in the southern reach of the Hensell-filled channel that crosses Pedernales River east of Johnson City.

A large area of conglomerate is mapped at the base of the Hensell northwest of Johnson City and conglomerate, not separately mapped, occupies much of the Hensell-filled channel crossing Pedernales River. In general, the Hensell becomes finer grained upward ranging from conglomerate in places at the base to abundant silt and clay in the upper part; however, tongues of coarser grained material commonly occur at various levels depending to some extent on the nearness laterally of pre-Cretaceous rocks. The kind of pre-Cretaceous rock from which the Hensell is derived influences its composition and character. The lower part of the Hensell is mostly red, other colors are common, and upward the reds give way to various shades of gray, yellowish gray and greenish gray.

Within the Johnson City quadrangle, the vegetation on the Hensell is similar to that on the overlying Glen Rose, indicating that much calcareous material is present perhaps both as caliche and detrital limestone derived from Paleozoic rocks. Johnson City and most of the cultivated land within the quadrangle are on Hensell outcrop.

Glen Rose Limestone Member.—The Glen Rose Limestone crops out mostly in the northeastern and southern parts of the Johnson City quadrangle. It rests directly on Paleozoic rocks in the northwestern part of the quadrangle and locally in the northeastern, southwestern, and southeastern parts of the quadrangle.

The Glen Rose may be as much as 260 feet thick in the Johnson City quadrangle in the vicinity of Buffalo Peak. It consists of alternating beds of limestone, dolomite, clay, silt, and sand or, more precisely, beds composed of various proportions and combinations of these materials. The beds vary in their resistance to erosion, producing a "stair-step" topography. The less easily eroded beds of limestone, dolomite, and, locally in its lower part, calcite-cemented sandstone, form the tread of the steps and the softer less resistant zones between form the risers.

The base of the Glen Rose Limestone is placed at the base of the lowest scarp-forming bed. In tracing the contact westward, as scarp-forming beds fade, the

contact rises to the base of the next higher scarp-forming bed. Most of this contact was traced between observed points with the aid of a stereoscope.

Gulfward from the Johnson City quadrangle, a thin fossiliferous zone near the middle of the Glen Rose has been called the *Salenia texana* zone (George, 1947, p. 17; and Whitney, 1952, p. 66). The top of this zone is characterized by a bed containing *Corbula*. Within the quadrangle *Salenia texana* was not found and the *Corbula* bed is poorly developed. It has been mapped where present, and westward in the northern part of the quadrangle where it can no longer be found, the approximate horizon of *Corbula* was traced with the aid of a stereoscope to its intersection with the eroded surface of the Paleozoic sequence.

The Glen Rose is mostly suited to ranching, although flatter areas in the lower part are cultivated. In general, the vegetation on the Glen Rose is sparser than on other units, indicating the relative sterility of its soil.

Fredericksburg Group

Walnut Clay.—Walnut Clay containing abundant *Exogyra* crops out in the northern part of the quadrangle near the top of Buffalo Peak. Its outcrop width is so narrow that it is represented on the map by a line and its thickness is probably less than 5 feet.

Comanche Peak Limestone.—The lower part of the Comanche Peak Limestone forms the top of Buffalo Peak. As in other adjacent quadrangles, the limestone is argillaceous and soft.

CENOZOIC ROCKS

QUATERNARY SYSTEM

Recent Series

Alluvium.—Deposits of alluvium occur mostly along Town, Flat, and Towhead creeks, and Pedernales River. Large pecan trees grew in the alluvium along Pedernales River at the time the area was mapped, but in 1952 most of the pecan trees were destroyed by a record-breaking flood, which also carried away much of the alluvium. Narrow belts and patches of alluvium follow some of the lesser drainages but are insignificant and have not been mapped. Most of the alluvium along Town, Towhead, and Flat creeks is cultivated.

SUBSURFACE GEOLOGY

Two-thirds of the surface area of the Johnson City quadrangle is formed by Paleozoic rocks. All units of the Cambrian and Lower Ordovician are represented, and these same units occur beneath the Cretaceous rocks of the quadrangle. Two wells spudded in Cretaceous rocks were drilled through the Cretaceous into Paleozoic rocks, and one, the Stratoray Oil Corporation No. 1 Stribling about 4.5 miles north-northeast of Johnson City, bottomed in Precambrian coarse-grained Town Mountain Granite. This well penetrated the following units:

Stratigraphic unit	*Thickness in feet*	*Depth in feet*
Cretaceous		
Hensell Sand	70	0– 70
Cambrian		
Wilberns Formation	485	70– 555
San Saba Member	310	70– 380
Point Peak Member	30	380– 410
Morgan Creek Limestone Member	135	410– 545
Welge Sandstone Member	10	545– 555
Riley Formation	785	555–1,340
Lion Mountain Sandstone Member	35	555– 590
Cap Mountain Limestone Member	510	590–1,100
Hickory Sandstone Member	240	1,100–1,340
Precambrian		
Town Mountain Granite	15	1,340–1,355

From the other well, the Winans and Forbes No. 1 Buckner 1 mile south of Johnson City, samples are few; however, the following units can be identified:

- Gorman Formation—dolomitic facies
- Tanyard Formation
  - Staendebach Member—dolomitic facies
  - Threadgill Member—dolomitic facies
- Wilberns Formation
  - San Saba Member—dolomitic and calcitic facies

Sources of information about the Precambrian rocks upon which the Paleozoic rocks lie are limited to outcrops of granite in the western part of the quadrangle, granite in the Stratoray Oil Corporation No. 1 Stribling, and to gravity and magnetic data (fig. 1). The gravity data show a gravity minimum in the western part of the quadrangle and a gravity trough extending from the west toward the Stribling well. Generally in the Llano region, large gravity minima are associated with Town Mountain Granite (Romberg and Barnes, 1944; Barnes, Romberg, and Anderson, 1954a, 1954b, 1955). The shape of the gravity minimum and trough and the presence of Town Mountain Granite in the Stribling well indicate that the Paleozoic rocks in the western and northern halves of the quadrangle may be underlain by Town Mountain Granite of the Grape Creek granite mass (fig. 1).

The rocks which cause the fairly weak gravity maximum and fairly strong magnetic maximum in the southeastern part of the quadrangle are not known. However, similar-strength magnetic maxima in the Fredericksburg area are associated with diorite, and the broad gravity maximum could be produced by Packsaddle schist.

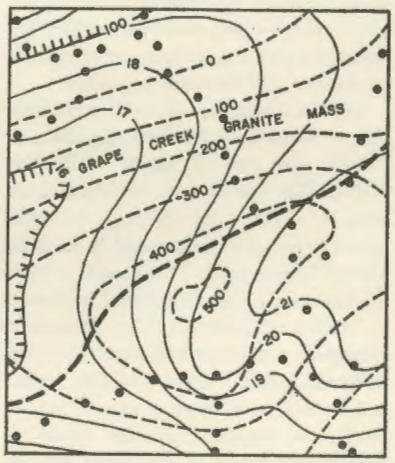

Fig. 1. Gravity and magnetic data, Johnson City quadrangle, Texas. Solid lines—gravitational force in milligals (relative); dashed lines—magnetic force in gammas (relative); dots—points of gravity observation.

MINERAL RESOURCES

The mineral resources of the quadrangle are limited to nonmetallic construction materials and water except for a minor occurrence of lead and zinc about the exhumed granite dome along Pedernales River. Most of the soils (except those developed on the Hensell and on alluvium) are not suited to agriculture. The greater part of the quadrangle is ranch land.

CONSTRUCTION MATERIALS

Dimension stone.—Granite has been described by Barnes, Dawson, and Parkinson (1947, pp. 25, 48–53) from the North Grape Creek [Rocky Creek] quadrangle (Barnes, 1952b; MS.). Similar granite is present in the Johnson City quadrangle. The granite of the exhumed granite hill along Pedernales River takes an excellent polish and has an unusually attractive color, making it a desirable monumental and ornamental stone.

Other building stone localities described include sandstone and limestone (Barnes, Dawson, and Parkinson, 1947, pp. 123–124, 130–133). The one deposit of sandstone sampled is situated 1 mile east of Sandy between localities 6-9A and 6-10A. The sandstone is mottled dark red on a dull pale-red background. It is composed mostly of quartz; microcline, plagioclase, and glauconite are common; and a small amount of calcite, muscovite, and limonite is present.

One limestone deposit, used in the past and of value only for local building, is 1 mile due east of Sandy at locality 6-10A. The limestone is brownish gray with a slight greenish cast, contains bright green glauconite, and is in beds about 6 inches thick. This deposit is near the base of the Cap Mountain Limestone.

Another deposit of Cap Mountain Limestone was examined along the road to Sandy, where it crosses Buffalo Creek, and here beds between 6 and 10 inches thick are common. Similar stone is widely distributed in the broad belt of Cap Mountain Limestone extending to the southwest as well as in the parallel belt of Morgan Creek Limestone.

Crushed stone.—Crushed stone of good quality can be produced from all the Ordovician and some of the Cambrian units within the quadrangle, and there are suitable deposits near all dam sites. The same units crop out in the Johnson City quadrangle as in the Texas Construction Material Company quarries south of Burnet (Barnes, 1958, pp. 24–25) which, in addition to crushed stone, produces chemical dolomite. The San Saba and Threadgill Members along Pedernales River contain rock of similar grade, as shown by analyses (Cloud and Barnes, 1948, pp. 377–378, anal. 12–28). Most of the Paleozoic dolomite in the quadrangle can be used for production of surfacing granules. Some attractively colored stone is suitable for terrazzo chip production.

Sand and gravel.—The small deposits of alluvium along Pedernales River, composed of poorly sorted material up to the size of large boulders, are of little value for the production of sand and gravel. The deposits along Towhead and Flat creeks, composed of material ranging in hardness from friable limestone to chert derived from Cretaceous rocks, are unsuited for the production of sand and gravel.

Road material.—On the Johnson City topographic quadrangle map, 16 road material pits are labeled "borrow pits" and 2 are labeled "gravel pits"; the reason for the distinction is unknown. Two pits, one near where U. S. Highway 281 leaves the quadrangle to the north and the other near where it leaves it to the south, are almost 1,000 feet long.

A few of the smaller pits, present at the time the quadrangle was mapped geologically, are in calichified conglomerate at the base of the Hensell, in marly material in the Glen Rose, and in calichified colluvium. It is likely that the newer pits are in similar material. Most of the material produced has been used for base course material in highway construction and for surfacing secondary roads.

LEAD AND ZINC

Barnes (1956, pp. 28–30) described the occurrence of lead and zinc in the vicinity of the exhumed granite dome along Pedernales River. The lead occurs as galena (lead sulfide) and is readily visible in Cap Mountain Limestone near its contact with the granite. Zinc, possibly as sphalerite (zinc sulfide) is also present. Lead ranges from 0.01 to 1.47 (aver. 0.31) percent and zinc ranges from 0.00 to 0.21 (aver. 0.14) percent in 13 analyses. Such small amounts of lead and zinc indicate that the deposit, at least where sampled near the surface, is not of economic importance. Possibly there are larger deposits controlled by the contact between Cap Mountain Limestone and the Hickory Sandstone where the contact intersects the granite at a depth of about 400 to 500 feet or more. Similar stratigraphic relations appear to have controlled the formation of ore bodies in the southeast Missouri lead district, where buried hills intersect the contact between the Cambrian Bonneterre Dolomite and the underlying Lamotte Sandstone.

WATER

A ground-water survey of Blanco County (Barnes and Cumley, 1942) inventoried, within the quadrangle, 36 water wells, 2 oil tests, and 6 springs. Of the 21 or so wells situated in Hensell and Glen Rose outcrop areas, most appear to have bottomed in Paleozoic rocks including Cap Mountain Limestone, dolomitic San Saba, Tanyard Formation, and Gorman Formation. Three wells situated on Glen Rose Limestone produce water probably from the Hensell Sand. Seven wells in the area of Hickory outcrop and 5 situated on Cap Mountain Limestone produce from the Hickory Sandstone. Of the 6 springs inventoried, one each is in the Hickory Sandstone, Cap Mountain Limestone, Morgan Creek Limestone, San Saba Member, Staendebach Member, and Glen Rose Limestone.

The water wells range in depth from 21 to 298 feet and the depths of the two oil tests are 1,210 and 1,585 feet. At the time of the inventory (1942), the water surface ranged from 2 to 106 feet below the surface. Total solids ranged from 280 to 1,162 parts per million, except for one well high in nitrate which contained 2,175 parts per million.

The Hensell Sand in the southern part of the quadrangle contains water, at least locally, and in the northeastern part of the quadrangle Hensell-filled erosion channels in Paleozoic rocks are probably water-bearing.

Southeastward-dipping Hickory Sandstone in the northwestern part of the quadrangle is a good aquifer. In the subsurface to the east, it produces artesian flow in the Stribling ranch well situated

about 1 mile north-northwest of the Stratoray Oil Corporation No. 1 Stribling well in which Hickory water rose to near the surface. In the western part of Johnson City, west of the fault along which Gorman rocks to the east are dropped against Staendebach rocks to the west, the water-bearing part of the Hickory is probably at a depth of 2,000 feet, providing the Hickory has not lapped out against a buried hill of Precambrian rock.

Lion Mountain Sandstone and Welge Sandstone, present in the subsurface in the southeastern two-thirds of the quadrangle, are about 700 feet nearer to the surface than the Hickory Sandstone. The quality of these sandstones as aquifers is unknown; however, the Welge at least probably carries water in places.

Some water is present locally in the rest of the Paleozoic rocks in fractures, solution channels, and perhaps in some of the slightly porous coarse-grained dolomite, but finding it will be fortuitous.

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