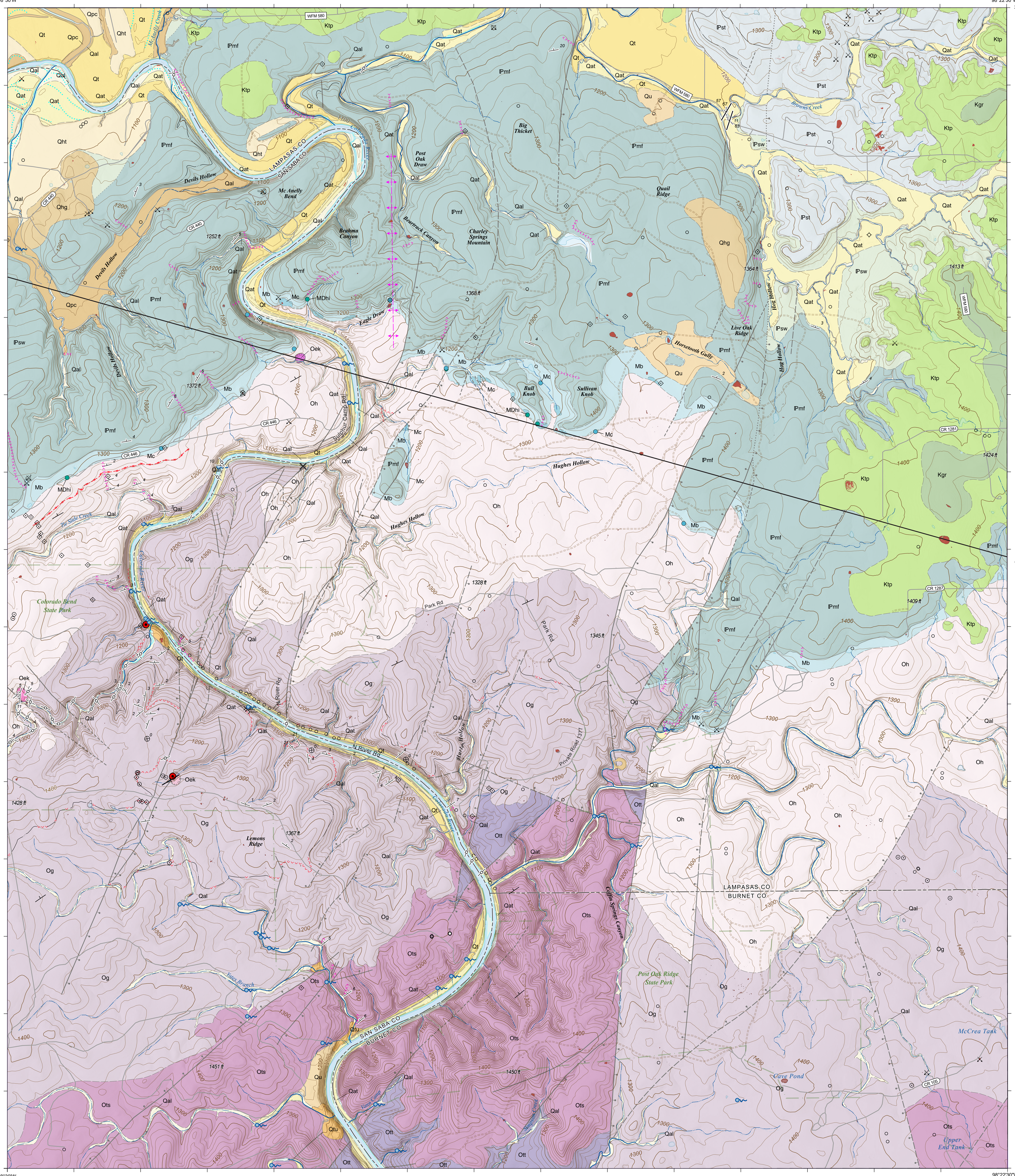
BUREAU OF ECONOMIC GEOLOGY
LORENA G. MOSCARDELLI, DIRECTOR
JACKSON SCHOOL OF GEOSCIENCES, THE UNIVERSITY OF TEXAS AT AUSTIN

In cooperation with the State of Texas Advanced Resource Recovery (STARR) Program and the
U.S. Geological Survey National Cooperative Geologic Mapping Program under STATEMAP award No. G24AC00508, 2024

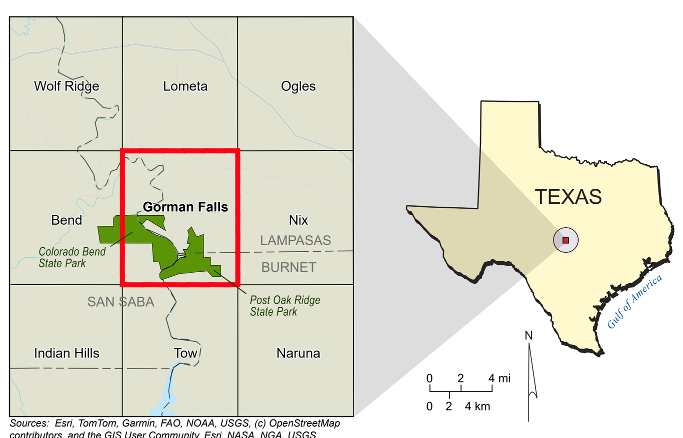


SCALE 1:24,000

0 1 2 4 MILES

0 1 2 4 KILOMETERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 14N NAD 83
CONTOUR INTERVAL 20 FT
DATUM IS MEAN SEA LEVEL



Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Esri, NASA, NGA, USGS

GEOLOGIC MAP OF THE GORMAN FALLS QUADRANGLE, SAN SABA, LAMPASAS, AND BURNET COUNTIES, TEXAS

Brian B. Hunt and Mark A. Helper

2025

GRID CONVERGENCE 0°17' (5 MILS) WEST FOR CENTER OF SHEET

GN
Grid North
Magnetic North
True North

2020 G-M ANGLE 3 ½° (60 MILS) EAST

TO CONVERT A MAGNETIC AZIMUTH TO A GRID AZIMUTH ADD G-M ANGLE

TO CONVERT A GRID AZIMUTH TO A MAGNETIC AZIMUTH SUBTRACT G-M ANGLE

Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS; User Community, Esri, NASA, NGA, USGS, FEMA, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

QUATERNARY SEDIMENTS

Qal

Qal—Alluvium (Holocene)—Unconsolidated to weakly cemented gravel, sand, silt, clay, and organic matter. Sediments range from rounded to subrounded and are sorted to poorly sorted. This alluvium is found in active drainage areas and floodplain deposits, including low terrace deposits near the floodplain level. Point bars and other depositional features are apparent on aerial and lidar imagery. While generally thick, up to 35 feet (Kier, and others, 1976), bedrock is discontinuously exposed within stream channels.

Qat

Qat—Alluviated Terrace (Holocene)—Unconsolidated to weakly cemented gravel, sand, silt, and clay, forming irregular, flat treads adjacent to active stream channels. Terraces likely represent eroded older terrace deposits that have been modified by modern flood sediments (Qal). The flat surface is indicative of recent overbank deposits often concealing older alluvial channel deposits. These terraces typically feature well-developed soils and vegetation.

Qt

Qt—Fluviatile terrace (Holocene)—Unconsolidated or weakly cemented gravel, sand, silt, and clay, forming flat, discontinuous benches elevated above and adjacent to active stream channels. These deposits may exhibit internal stratification, including bedding, cross-bedding, and fining-upward sequences, indicative of fluvial depositional processes. Compared to modern floodplain alluvium, these older deposits occur at higher elevations and exhibit similar but more extensive soil development (Kier and others, 1976).

Qht

Qht—High terrace (Holocene)—Conglomerates composed of poorly cemented Paleozoic and Cretaceous chert, limestone, and dolomite cobbles. These are remnant alluvial deposits elevated above active and possibly highest flood levels, often well-vegetated or cultivated (Kier and others, 1976).

Qtu

Qtu—Tufa (Holocene)—Tufa. Deposits of soft, porous calcium carbonate rock are admixed with rock, organic detritus and algal mats. Locally very porous and lightweight with many casts and molds of organic materials. Associated with springs, proximal streams, and waterfalls. A good example includes Gorman Falls in the Colorado Bend State Park.

Qhg

Qhg—High gravel (Pleistocene)—Caliche-cemented gravel, pebbles, and cobbles of Paleozoic and Cretaceous chert, limestone, and dolomite cobbles up to 4 inches long. Unit discontinuously occupies topographically high areas, not necessarily associated with present surface drainages nor modern flood deposits. Thickness up to 20 feet (Kier and others, 1976).

Qu

Qu—Quaternary, undifferentiated (Quaternary)— Undifferentiated gravel, sands, and clays with other possible surface units locally such as colluvium, terrace, and tufa.

Qpc

Qpc—Paleochannel (Quaternary)—Geomorphic unit defined by the banks of an abandoned channel course; occasionally occupied by tributaries, anabranches, or distributaries. Contains fine to coarse unconsolidated fluvial sediments overlain by infilling sediments and soil.

CRETACEOUS SEDIMENTARY ROCKS

Kgr

Kgr—Glen Rose Formation (Cretaceous)—Alternating fine-grained, argillaceous, light gray to white limestone and marly, light gray to yellowish gray claystone, with minor occurrences of calcareous sandstone. The limestone is locally arenaceous and dolomitic, commonly contains foraminifera and marine megafossils, and forms resistant beds with even thickness, occasionally displaying nodular surfaces. The claystone is typically recessive and can be sandy, while the sandstone occurs as discontinuous sheets and thin lenses. The unit is characterized by alternating resistant and recessive beds that erode to a distinctive stairstep topography. Thickness can reach up to 250 feet in the southeastern area, gradually thinning northwestward (Kier and others, 1976). The base of the unit is defined by a fossiliferous Texigryphaea zone.

Ktp

Ktp—Travis Peak (Cretaceous)—Calcite-cemented, red to white conglomerate and sandstone, with minor silty, sandy, white limestone. The conglomerate is sandy and contains Paleozoic limestone, dolomite, chert, and sandstone pebbles, cobbles, and boulders. The sandstone is mainly quartz, often conglomeratic and silty, and can include local fossil fragments. This unit exhibits a transition from lithic to arkosic sandstone at its base to a more calcareous composition toward the top, where boxwork textures are locally present near the contact with the overlying Glen Rose Formation. Unit thickness is highly variable, reaching up to 175 feet (Kier and others, 1976), owing to an irregular depositional surface and mapping complexities with the overlying unit. The upper contact with the Glen Rose Formation is gradational. The lower contact is unconformable with the underlying Paleozoic sediments. In the northern part of the quadrangle, this unit unconformably overlies fine, well-sorted, tan sandstones of the Pennsylvanian Strawn Formation.

PALEOZOIC SEDIMENTARY ROCKS

IPst

IPst—Strawn Group (Pennsylvanian)—Fine- to coarse-grained sandstone and mudstone. The sandstone appears in thin to massive beds, is typically brown to red, and exhibits cross-bedding and ripples. Represents the lower portion of the Strawn Group, here up to 100 feet thick in the northern part of the quadrangle (Kier and others, 1976). The unit represents a clastic influx and basin fill from the north, forming distal submarine fan deposits (Kier, 1972). Sedimentary structures include slump structures, Bouma sequences, and sole marks (Kier and others., 1976, 1979). The contact with the underlying Smithwick Formation is conformable and gradational.

IPsw

IPsw—Smithwick Shale (Pennsylvanian)—Black to brown, generally poorly exposed, fissile shale that weathers to a lighter brown. Informally divided into a lower black fissile shale and an upper, lighter-colored silty shale with ironstone concretions. Commonly contains 6-inch, rounded to irregular, iron-rich concretions and is locally gypsiferous. Interbedded with the shale are fine to medium-grained sandstone beds that increase in abundance and coarsen upward into the overlying Strawn Group. Sandstones are typically thin- to thick-bedded, brown to red, with bedforms such as grading, ripples, flute casts, groove casts, and slump features (Kier and others, 1976; Kier, 1988). Poorly fossiliferous but locally contains plant fossils, casts, trilobites, brachiopods, and cephalopods (Kier and others, 1976). Ranges in thickness from approximately 100 to 600 feet, thinning eastward and being locally absent due to non-deposition or erosion (Kier and others, 1976; Kier, 1988). A deep water, platform-margin to basin depositional setting has been inferred (Grayson and Trice, 1988).

IPmf

IPmf—Marble Falls Formation (Pennsylvannian)—Limestone with interbedded shale, characterized by rapid lateral and vertical lithological changes. The limestone ranges from white to black, weathering light to dark gray, and is very fine- to coarse-grained. Limestone is commonly oolitic and petroliferous, locally cherty and siliceous, and varies from thin-bedded to massive, typically forming resistant rocky ledges and slopes. The formation contains abundant marine fossils, including algae, crinoids, brachiopods, cephalopods, and Chaetetes (Kier and others, 1976). The limestone generally shows minor diagenetic alteration, though surface shales may be calicified (Kier, 1988). Historically, the formation was subdivided into upper, middle, and lower members (Pickens, 1959; Zachary, 1969; Kier, 1972), but more recently, it has been been divided into two members separated by an unconformity (Kier, 1988). The lower member is characterized by light to dark cherty limestone and thin shale, exhibiting high complexity and local variation. Dominant limestone types include various biomicrites, biosparites, oosparite, and pelmicrite. The upper member is mainly composed of light- to dark algal biomicrite, siliceous and spiculitic biomicrite, and shale, with higher-energy facies becoming more common higher in the section (Kier, 1988). Depositional interpretations suggest that the lower Marble Falls facies patterns are semicircular, and influenced by the structurally high Llano Uplift (Kier, 1988). In contrast, the upper Marble Falls exhibits north-south-oriented, thin, widespread facies with low depositional relief and westward migration (Kier, 1988). These characteristics indicate that the deposition occurred as algal buildups and calcarenite shoals within a platform carbonate facies, with shale and spiculite accumulating in intershoal depressions (Kier, 1988). Thickness averages about 300 feet but varies from 35 to over 400 feet (Kier and others, 1976), with the lower part specifically ranging from 66 to 150 feet (Kier, 1988; Kier and others, 1979). A few caves are known in the region, some of which occur near the base (Reddell, 1973). The base of the Marble Falls Limestone is typically a resistant ledge, that is generally conformable with the underlying Barnett Shale (Kier, 1988).

Mb

Mb—Barnett Formation (Mississippian)—Dark brown to black, thinly laminated, petroliferous shale. Poorly exposed and frequently altered to caliche at the surface. Outcrops are commonly marked by mesquite-covered or tilled benches situated between the underlying Ellenburger Group and as a recessive slope beneath overlying Marble Falls Limestone (Kier and others, 1976; Kier, 1988). Interbedded within the shale are thin beds of dark brownish-gray, micrugranular limestone, that may include brachiopod-goniatite coquinas. The upper part of the formation commonly contains small to large, ellipsoidal, black microsparite concretions up to 9 feet in diameter. These concretions emit a petroliferous odor when freshly broken, and occasional free oil can be found in their interior cracks (Kier and others, 1976; Kier, 1988). Locally, the base of the Barnett can be a finely laminated calcareous siltstone. The top of the unit is marked by a fine- to coarse-grained, packed goniatite- and pellet-bearing, phosphatic oomicrite (Kier, 1988). Goniatites (ammonoid cephalopods) are common within the formation (Kier and others, 1976). The unit typically ranges up to 50 feet thick, thinning westward and being locally absent or too thin to map (Kier and others, 1976; Kier, 1988).

Mc

Mc—Chappel Limestone (Mississippian)—Crinoid biosparite and biomicrite (wackestone to packstone) that is fine- to coarse-grained and light olive-gray to pinkish-gray or light yellowish-brown. Unit is characterized by abundant broken and disarticulated crinoid fragments, along with algae, foraminifera, brachiopods, trilobites, and conodonts. The unit is typically thin-bedded, rarely exceeding 1–2 feet in thickness. However, it can be up to 50 feet thick where it accumulated in sinks within the underlying Ellenburger Group or is preserved in post-depositional collapse features. Exposures are discontinuous or absent (Kier and others, 1972; Kier and others, 1976; Kier, 1988).

MDhi

MDhi—Ives Breccia Member (Mississippian)—Rounded to angular chert clasts cemented with silica. Present as discontinuous, small, and localized exposures in the map area (Stitt, 1964; Kier and others, 1972).

Ellenburger Group

Oek

Oek—Paleokarst (Ordovician?)—Limestone, dolostone and spar-filled breccias resulting from karst sinkhole collapse. Bedding is chaotic, highly fractured, and cemented. Likely created during the Ordovician and other times in the Paleozoic when the Ellenburger Group carbonate was subaerially exposed.

Oh

Oh—Honeycut Formation (Ordovician)—Cherty dolostone and limestone. Limestone is aphanitic, light gray, and thin- to thick-bedded; dolostone is fine-grained to microgranular, light- to yellowish-gray, and thin- to thick-bedded. Fossiliferous, containing trilobites, cephalopods, Archaeoscyphia (a sponge fossil, notably within a mappable bed (Oha)), and silicified Ceratopea (a gastropod also locally within a mappable horizon (Ohc)) (Kier and others, 1976; Cloud and Barnes, 1946). Previously divided into three informal units: a basal, microcrystalline, dark-gray dolostone and fine-grained, light- to medium-gray limestone about 160 feet thick, of which the lower 100 feet contains quartz sand. This basal unit contrasts sharply with the massive limestone at the top of the underlying Gorman Formation (Cloud and Barnes, 1948). A middle unit is about 300 feet of medium- to dark-gray dolostone with "cannon ball" chert associated with Archaeoscyphia. An upper unit, up to 220 feet thick, consists of aphanitic, brownish yellow-gray limestone with "cannon ball" chert (Cloud and Barnes, 1948; Kier and others, 1976; Kier, 1988). The formation has a maximum thickness of the formation is 678 feet but it is truncated westward by erosion (Kier and others, 1976; Kier, 1988). Cloud and Barnes (1948) mapping suggests about 200 ft of thickness on the western side of the quadrangle. Caverns and springs are less common in the Honeycut than in the underlying Gorman Formation, with Sulphur Spring being an exception (Cloud and Barnes, 1948).

Og

Og—Gorman Formation (Ordovician)—Limestone and dolostone, generally divided into an upper and lower unit. The upper unit is thin- to thick-bedded, cherty, light gray- to yellowish gray, microcrystalline limestone with lesser amounts of microcrystalline to fine-grained dolostone. The lower unit is primarily pink, yellow, brown, or medium gray, fine-grained dolostone with less chert than the upper unit. The top of the lower unit is defined by the Archaeoscyphia Zone (Oga), a sponge zone found in chert (Kier and others, 1976). The basal dolostone unit typically forms a conspicuous blocky ledge (Kier, 1988). Scattered, well-rounded quartz sand is present throughout the formation (Kier, 1988). The formation is sparingly fossiliferous, though low-spiraled gastropods are present throughout, and Archaeoscyphia are common near the middle of the formation in the Archaeoscyphia Bed (Oga) (Kier and others, 1976; Cloud and Barnes, 1946). The Gorman ranges from 300 to 475 feet thick, locally reaching up to 500 feet, and thins westward (Kier and others, 1976; Kier, 1988). It is less cherty than the underlying Tanyard Formation (Cloud and Barnes, 1948). The Gorman Formation is the principal aquifer of the Ellenburger Group, and exhibits numerous karst and paleocollapse features, and well as springs (Kier, 1988).

Tanyard Formation (Ordovician)—Thick- to thin-bedded limestone and dolostone with variable chert. In contrast to the overlying units, the Tanyard is generally coarser-grained, lighter in color, and contains no sand or Archaeoscyphia sponges. The total thickness of the Tanyard is approximately 535 to 660 feet, thinning westward (Kier and others, 1976). The formation contains the Staendebach and Threadgill Members (Cloud and Barnes, 1948; Kier, 1988). TWDB test well 41–61–804 has detailed cuttings and reports a thickness of 667 ft.

Ots

Ots—Staendebach Member (Ordovician)—Light gray to light brownish-gray, fine- to medium-grained cherty dolostone. Chert is slightly dolomoldic and oolitic and is opaque to slightly translucent. The upper third of the member contains gray, cherty limestone. Chert contains small, elongated, and aggregated algal bodies that resemble worm castings (Kier, 1988).

Ott

Ott—Threadgill Member (Ordovician)—Gray to light brownish-gray, medium- to coarse-grained dolostone. Locally, the dolostone is vuggy, and, limestone lenses occur. The transitions from limestone to dolostone are abrupt. Generally contains little chert. Thickness about 91 ft (Kier, 1988).

SUBSURFACE UNITS

Moore Hollow Group (Cambrian)—Comprised of Cambrian carbonate and siliciclastic sediments of the Wilburn and Riley Formations. TWDB test well 41–61–804 indicates a total Moore Hollow thickness of 898 ft.

Map Symbols

Geologic Points

- Contact
- Contact approximate
- Contact inferred
- Contact concealed
- Fluvial scars
- Measured section
- Archaeoscyphia bed
- Ceratopea bed
- Internal unit contact
- Axial trace of anticline, approximate

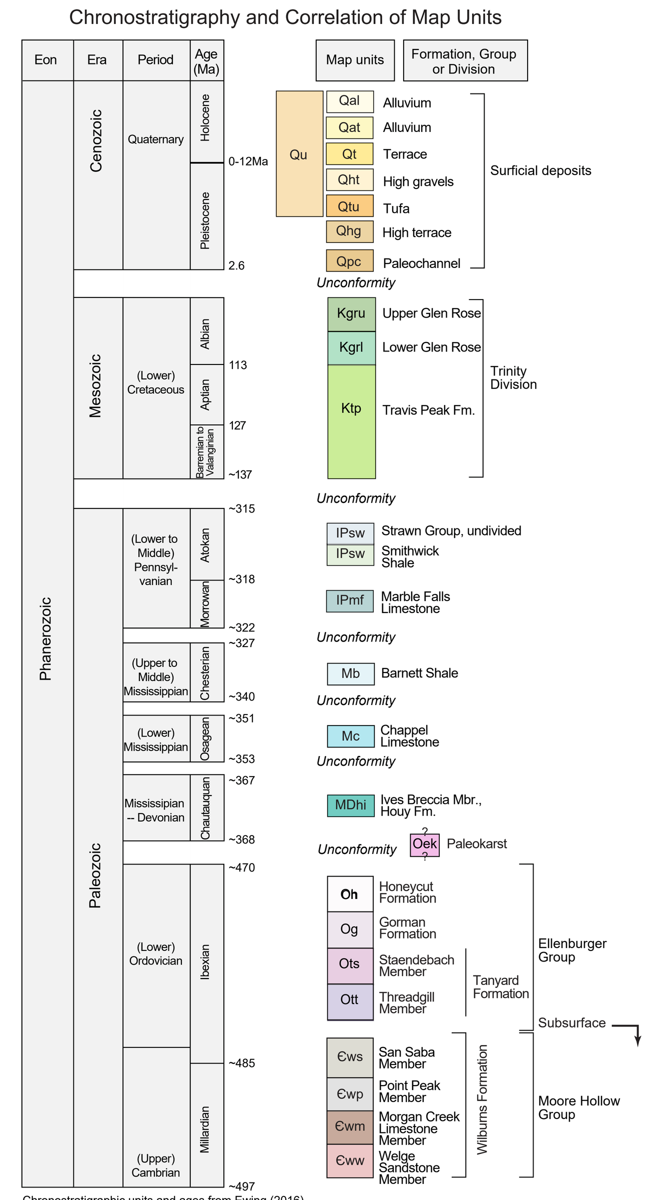
Contacts and Faults

- Fault
- Fault, inferred
- Fault, approximate
- Fault, buried
- Normal fault; ball and bar on down side
- Normal fault, approximate; ball and bar on down side
- Strike and dip of bedding
- Horizontal bedding
- Strike of fracture trend
- Strike and dip of fault
- Strike of fault

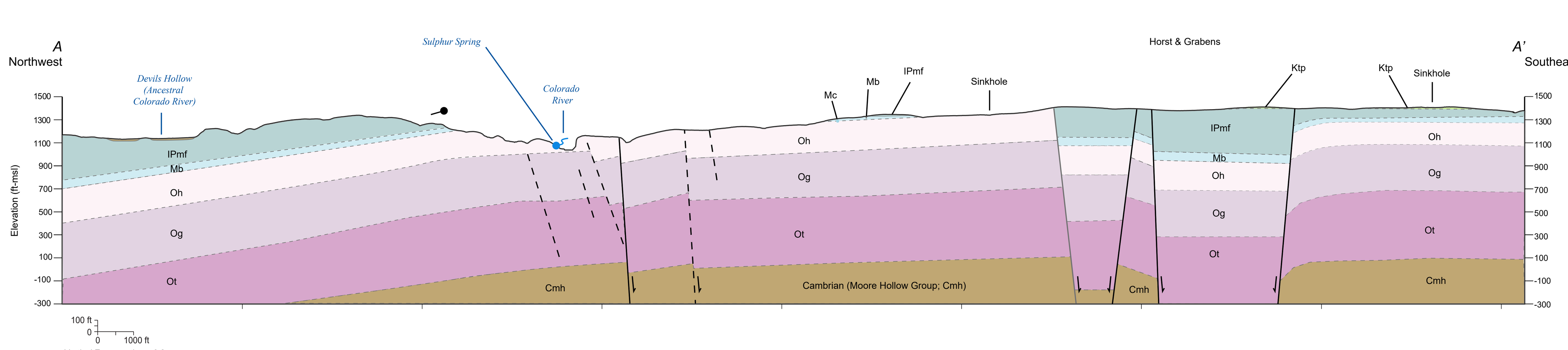
Basemap Symbols

- Topographic contour (20 ft interval)
- Intermittent stream
- County road
- Local road
- Pipeline (TRRC)
- Waterline
- Cave
- Spring
- Cross section
- State Park Boundary
- Gravel pit
- Sinkhole
- Paleokarst
- Closed depression (>0.5 m; potential karst feature)
- Public water supply well
- Test well
- Well
- Oil or gas well
- Fossil locations
- Fault outcrop

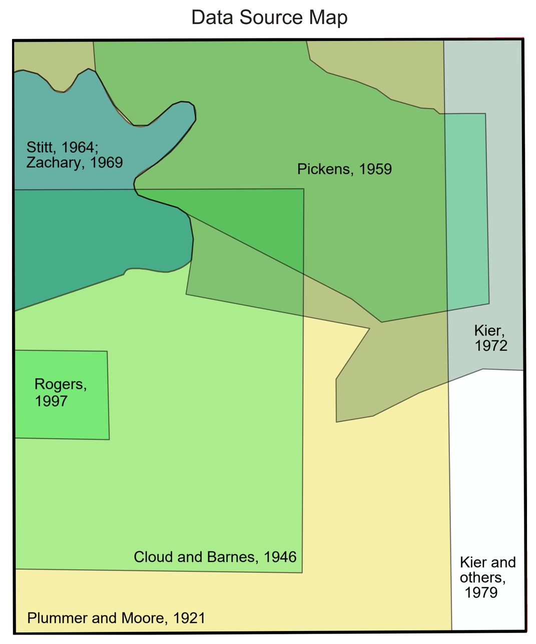
Chronostratigraphy and Correlation of Map Units



Chronostratigraphic units and ages from Ewing (2016)



Data Source Map



Acknowledgments

Geologic quadrangle mapping was done by Brian B. Hunt and Mark A. Helper, integrating published and unpublished maps with lidar, aerial photos, and the authors' field visits and judgment. Jeffrey G. Paine is the Principal Investigator for STATEMAP. GIS and digital cartography by Brian B. Hunt. Under the direction of Jason Suarez, graphics, design, and layout by Francine M. Mastrangelo, and editing by Alyssa Naley.

Mapping and related activities supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under STATEMAP award No. G24AC00508 (2024). This work benefited from studies supported by the State of Texas Advanced Resource Recovery (STARR) initiative. This map complies with the GeMS database criteria (http://ngmdb.usgs.gov/Info/standards/GeMS; USGS, 2020). Digital data, including contours, roads, aerial photos, and lidar, were obtained from the Texas Geographic Information Office (TxGIO) and the USGS TNM (https://www.usgs.gov/programs/national-geospatial program/national-map). Thank you to the Texas Water Development Board for the spring and well data, and to Evan Strickland for the data from test well 41–61–804.

The authors express their sincere gratitude to the Texas Parks and Wildlife Department for providing access to Colorado Bend State Park. We thank Greg Creacy, Natural Resources Program Director, for his support, and we extend special appreciation to Park Superintendent Allen Dees for his direct assistance. Mapping was done under scientific permit 118–24. We give special thanks to Jonathan Beall for his logistical support for fieldwork. The authors recognize the foundational work of Plummer (1940), Cloud and Barnes (1946), Pickens (1959),Stitt (1964), Zachary (1969), Kier (1972), and many researchers whose efforts have collectively advanced the understanding of the geology of the map area, with a special acknowledgment to Dr. Virgil Barnes for his numerous and significant geologic contributions to the geology of the region.

Disclaimer

References

Cloud, P.E., Jr., and Barnes, V.E., 1948, The Ellenburger Group of Central Texas: The University of Texas at Austin, Bureau of Economic Geology, Publication 4621, 474 p.

Ewing, T. E., 2016, Texas through tiime: Lone Star geology, landscapes, and resources: The University of Texas at Austin, Bureau of Economic Geology, Udden Series No. 6, 431p.

Federal Geographic Data Committee [prepared for the Federal Geographic Data Committee by the U.S. Geological Survey], 2006, FGDC Digital Cartographic Standard for Geologic Map Symbolization: Reston, Va., Federal Geographic Data Committee Document Number FGDC–STD–013-2006, 290 p., 2 plates.

Grayson, R.C., and Trice, E.L., 1988, Middle and Upper Pennsylvanian (Atokan-Missourian) strata in the Colorado River Valley of Central Texas: South-Central Section of the Geological Society of America, O. T. Hayward (ed.) Centennial Field Volume 4, p. 343–350.

Kier, R.S. 1972, Carboniferous stratigraphy of Eastern San Saba County and Western Lampasas County, Texas: The University of Texas at Austin, Ph.D. Dissertation.

Kier, R.S., Brown, L.F., Jr., Harwood, P., and Barnes, V.E., 1976, Geologic atlas of Texas, Brownwood sheet: The University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas, scale 1:250,000.

Kier, R.S., Brown, L.F., Jr., and McBride, E.F., 1979, The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States—Texas U.S. Geological Survey Professional Paper 1110–S, 45 p.

Kier, R.S. ,1988, Paleozoic strata of the Llano region, Central Texas, South-Central Section of the Geological Society of America, O. T. Hayward (ed.) Centennial Field Volume 4, p 351-360.

Pickens, W.R., 1959. Carboniferous stratigraphy of the Jackson Ranch area, Lampasas County, Texas: Master's thesis, The University of Texas at Austin.

Plummer, F.B., and Moore, R.C.,1921, Stratigraphy of the Pennsylvanian Formations of North-Central Texas. University of Texas Bulletin no. 2132, Unpublished field plane table geologic map associated with publication.

Plummer, F.B., 1940, Geologic map of San Saba County, south of 31°21': The University of Texas at Austin, Bureau of Economic Geology, Miscellaneous Map No. 28, scale 1:63,360.

Natural Resources Conservation Service (NRCS), 2025, Custom soil resource report for Blanco and Burnet Counties, Texas, Lampasas County, Texas, and San Saba County, Texas. Web report August 5, 2025.

Reddell, J.R. (ed.), 1973, The caves of San Saba County, Second Edition. Texas Speleological Survey, Vol. 3, Nos. 7–8.

Rogers, C.M., 1997, Jointing in the Gorman Falls area and its relation to Gorman Spring, Colorado Bend State Park, San Saba County, Texas: The University of Texas at Austin. Bachelor of Science, Senior Honor's thesis, 29 p.

Stafford, K.W., Shaw-Faulkner, M.G. and DeLeon, J.L., 2011, Spring hydrology of Colorado Bend State Park, Central Texas: Faculty Publications,14.

Stitt, J.H., 1964, Carboniferous stratigraphy of the Bend area, San Saba County, Texas: The University of Texas at Austin, Master's thesis.

U.S. Geological Survey National Cooperative Geologic Mapping Program, 2020, GeMS (Geologic Map Schema)—A standard format for the digital publication of geologic maps: U.S. Geological Survey Techniques and Methods, book 11, chap. B10, 74 p., https://doi.org//10.3133/tm11B10.

Zachary, D.L., 1969, Carboniferous stratigraphy of the Chappel area, San Saba County, Texas: The University of Texas at Austin, Ph.D. dissertation.

QAf582