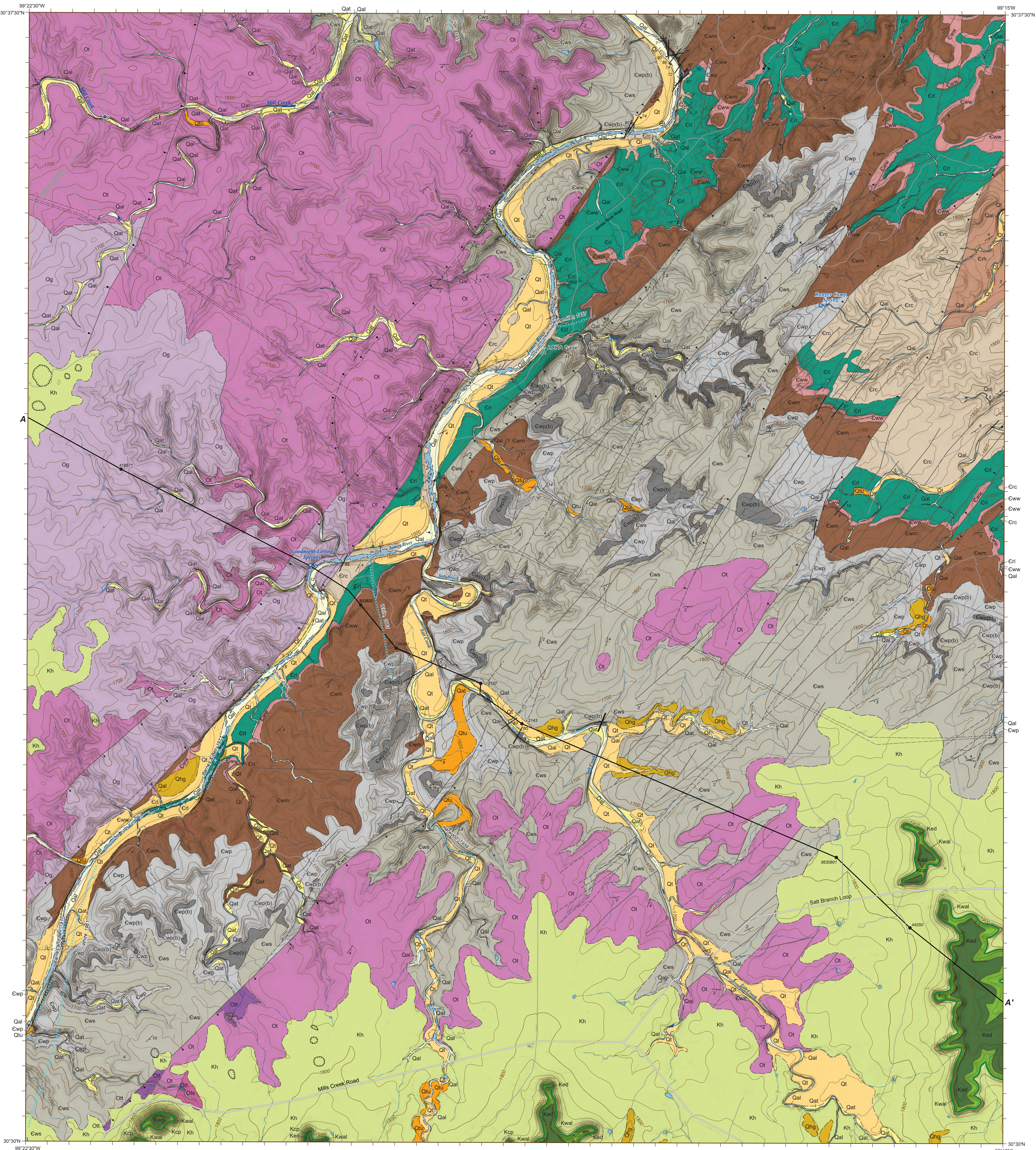
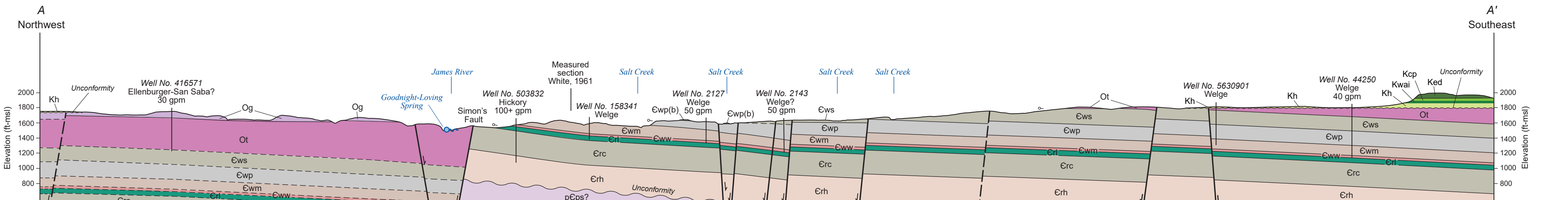
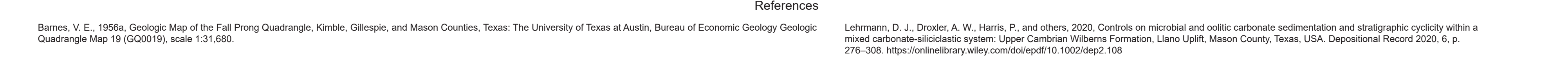
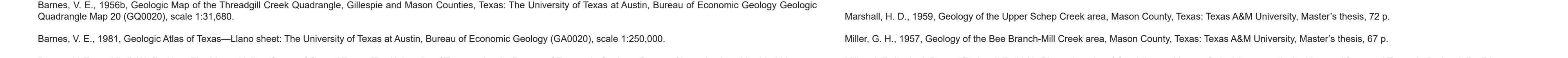
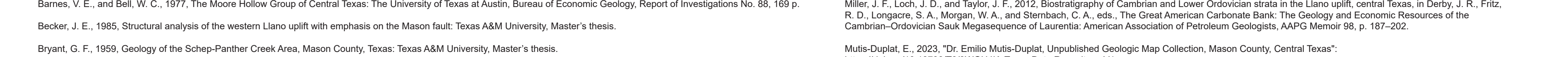
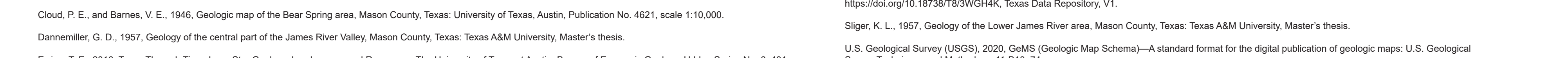
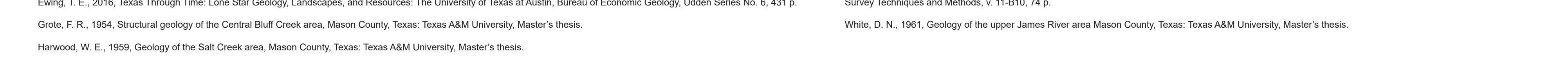
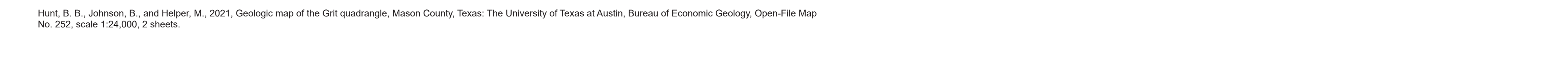


GEOLOGIC MAP OF THE MONUMENT MOUNTAIN SE QUADRANGLE MASON COUNTY, TEXAS

Brian B. Hunt
2023



- SURFICIAL DEPOSITS**
- Qal**—**Alluvium** (Holocene)—Sand and gravel. Unconsolidated sediments along active stream channels. Point bars and other depositional features apparent on aerial photos and lidar. Locally contains sparse vegetation and bedrock exposures.
 - Qat**—**Alluvium and terrace** (Holocene)—Sand, silt, and clay. Unconsolidated sediments on generally flat, broad terraces above and adjacent to active stream channels. Flat surface represents overbank deposits, low terraces, and local colluvium. Contains well-developed soils and vegetation.
 - Qt**—**Terrace** (Pleistocene)—Cobbles, sand, silt, and clay. Alluvial terrace elevated above normal stream and river levels and forms a flat bench that is heavily vegetated or may be cleared and cultivated. Locally consists of colluvium laterally merging into alluvial materials proximal to channel. Up to 20 ft thick.
 - Qtu**—**Terrace, undifferentiated** (Pleistocene)—Cobbles, sand, silt, and clay. Undifferentiated remnant alluvial terrace deposits elevated above active stream levels. Heavily vegetated or cleared and cultivated. Locally consists of colluvium laterally merging into alluvial materials proximal to channel. Up to 20 ft thick.
 - Qhg**—**High Gravels** (Pleistocene)—Conglomerate. Poorly bedded conglomerate composed of calcite-cemented rounded to subrounded cobbles of Paleozoic and Cretaceous chert, limestone, and dolomite. Interpreted to be older remnant terraces, first called Lange's Mill Conglomerate, and colluvium (Cloud and Barnes, 1946; Barnes, 1956a, 1956b; Harwood, 1959). Up to 30 ft thick locally as isolated deposits at high above active stream and river channels and floodplains.

- UNCONFORMITY**
FREDERICKSBURG DIVISION
- Kcd**—**Edwards** (late Early Cretaceous (middle Albian; Comanchean Provincial Epoch))—Limestone to dolomitic limestone. Micritic to fine crystalline, yellow to brownish-gray, well-bedded, local rustidist fossils, and vuggy porosity. Forms ledges and caps hills as a resistant and densely vegetated unit. The base of the Edwards Limestone is mapped by a riser (slope break) bed near the first occurrence of chert within thin limestone beds and above the more recessive and nodular Comanche Peak Limestone. Up to about 50 ft thick in the quadrangle.
 - Kcp**—**Comanche Peak Limestone** (late Early Cretaceous (middle Albian; Comanchean Provincial Epoch))—Argillaceous, nodular limestone and dolomitic limestone. Fine-grained to microcrystalline, pale yellow, orange to gray, argillaceous, nodular to well-bedded. Fossiliferous at the base (Monopleura, Toucasia, Pectin). Generally forms recessive slopes with locally resistant beds. Top of the Comanche Peak Limestone is mapped below the first riser of chert-bearing limestone. The base of the Comanche Peak grades into the underlying fossiliferous Walnut Clay; up to 35 ft thick (Barnes, 1956a, 1956b; Hunt and others, 2021).
 - Kkw**—**Walnut Formation** (late Early Cretaceous (Albian))—Calcareous nodular mudstone and clay. Yellowish-gray, nodular, calcareous, sandy, and fossiliferous (*Exogyra texana*) clay grading upward into argillaceous nodular limestone and the overlying Comanche Peak. Up to 2 ft thick (Barnes, 1956a).

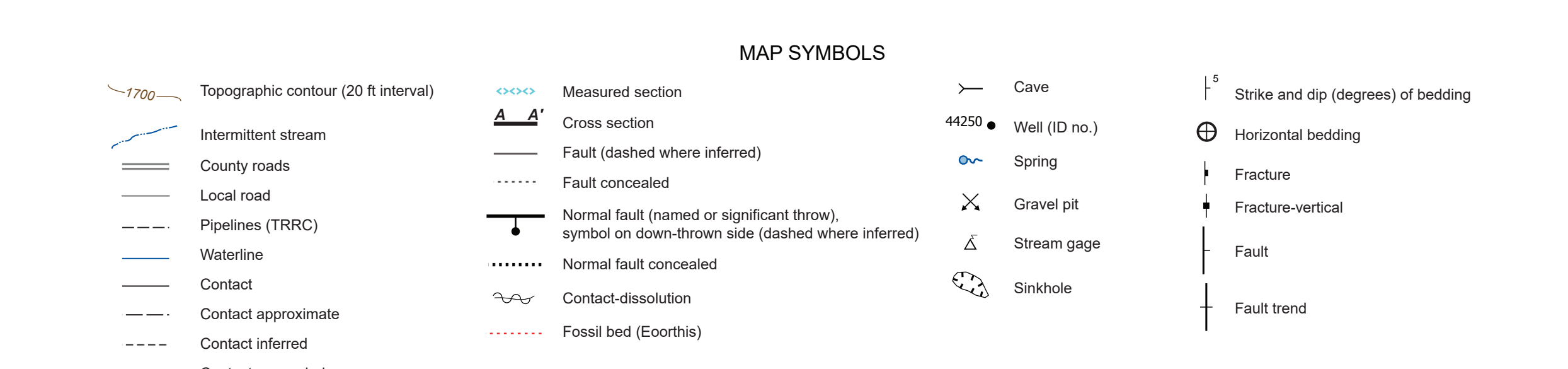
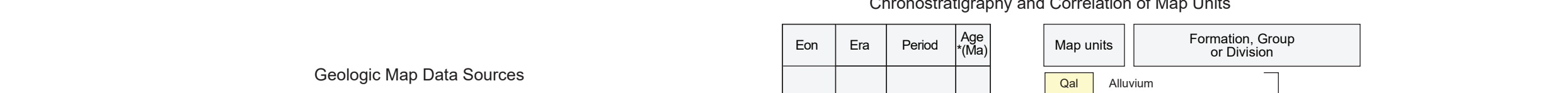
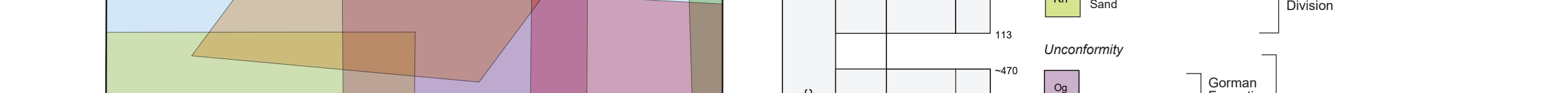
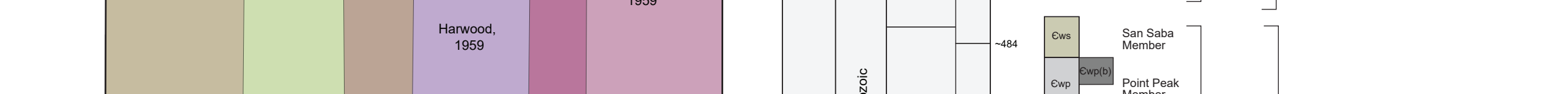
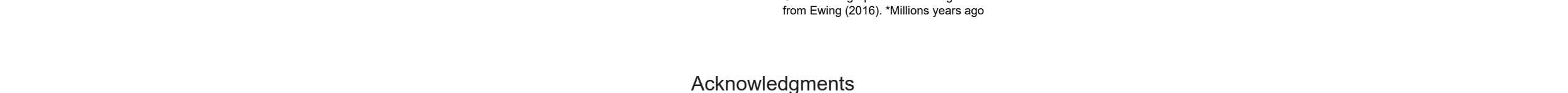
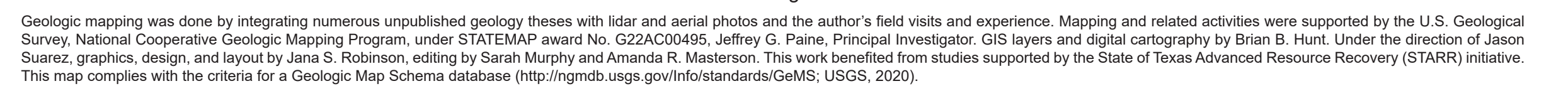
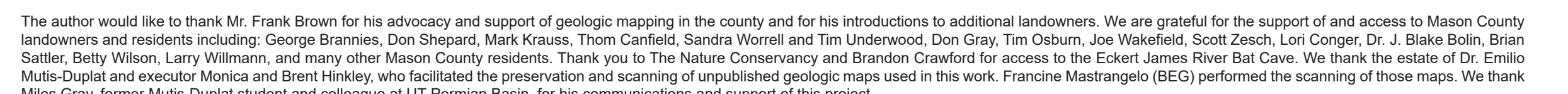
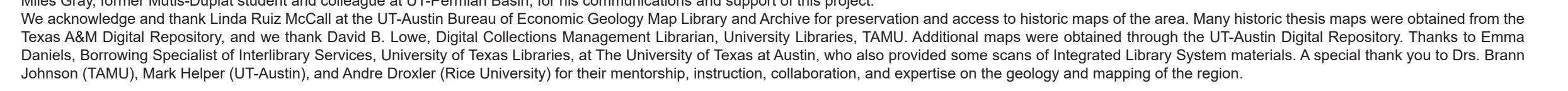
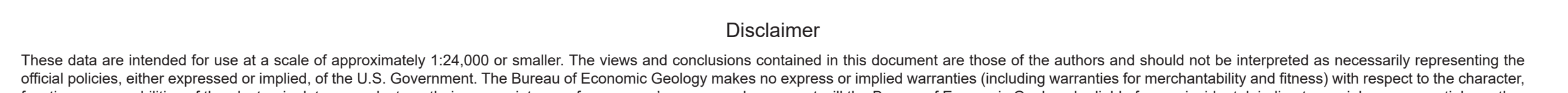
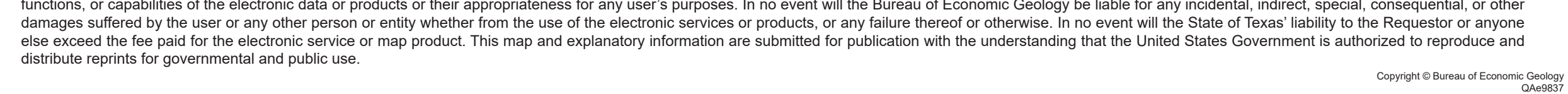
- TRINITY GROUP**
- Kh**—**Hensel Sand** (Early Cretaceous)—Calcareous quartz sandstones and mudstones with minor conglomerates. Base generally consists of variegated orange-yellow-red clastics consisting of arkose, subarkose, litharenite, calcareous sandstone, pebble conglomerate, and mudstones. Un cemented to poorly cemented friable calcite or dolomitic cement, poor bedding and sorting, angular to well-sorted, locally trough cross-bedded. Well-developed paleosols generally occur at the top of the basal clastics and contain white carbonate nodules (rhizconcretions) and stringers. Overall, the unit is poorly exposed with irregular thickness due to basal unconformity and irregular paleotopography of the Wichita Paleoplain (pre-Cretaceous erosional surface). Upper Hensel contact is sharp with overlying clay and limestone of the fossiliferous Walnut (Barnes, 1956a, 1956b; Hunt and others, 2021). Ranges from 100 ft to about 160 ft thick.

- UNCONFORMITY**
ELLENBURGER GROUP
- Limestone and dolomite. Cherty, non-glauconitic, thick to thin-bedded, sparsely fossiliferous. Limestones are generally fine-grained, light gray; dolomites are varicolored, microgranular to very coarse crystalline. Dolomites can be siliceous. Two formations are mapped in the area, the Gorman and the Tanyard Formations; the topmost Honeycrack Formation of the Ellenburger Group is absent (Cloud and Barnes, 1946). Limestone and dolomite subunits of the Ellenburger partially mapped in the study area by Cloud and Barnes (1946). The Ellenburger Group is up to about 900 ft thick.
- Og**—**Gorman Formation** (Early Ordovician)—Limestone and dolomite. Generally consists of an upper limestone unit and a lower dolomite unit (Cloud and Barnes, 1946; Becker, 1985) in the region. Lower unit consists of dolostones, cherty, poorly bedded, weather to rounded light-brown to brown-gray knobs. Total thickness is approximately 400 ft (Barnes and Bell, 1977).
 - Ot**—**Tanyard Formation** (Early Ordovician)—Limestone and dolomite. Includes the dolostones of the Staendebach Member and the limestones of the Threadgill Member. Generally non-glauconitic. Contact with the underlying San Saba Member is difficult to discern, but placed between the highest glauconitic limestone and the first occurrence of the uncalled gastropod *Lytopora gyroca* (Sliger, 1957). Total thickness about 480 ft (Barnes and Bell, 1977).
 - Ots**—**Staendebach Member** (Early Ordovician)—Dolomite. Brown to yellowish gray, microgranular to medium-grained, cherty, and poorly bedded. Weather into light brown to brown gray rounded outcrops. About 180 ft thick (Cloud and Barnes, 1946). Small exposure mapped by Barnes and Bell (1977) in the southwest part of the quadrangle.
 - Ott**—**Threadgill Member** (Early Ordovician)—Limestone. Brownish gray, microcrystalline (micritic), non-glauconitic to fossiliferous limestone with dolomitic burrows (trace fossils) and occasional chert. Thin to thickly bedded (up to several feet). Fossils include sparse gastropods (*Lytopora gyroca*) and cephalopods. Pitted and fluted weather surfaces. Relatively resistant to erosion and contains sparse vegetation forming gentle slope or hillslopes (Grote, 1954). Total thickness about 300 ft (Becker, 1985). Threadgill Member grades into overlying Staendebach Member dolomite, but with more abundant chert. Lower contact is lithologically gradational, but mapped above the highest glauconitic calcarenite of the San Saba Member (Becker, 1985; Miller and others, 2020). Limestone and dolomite subunits of the Threadgill Member mapped by Cloud and Barnes (1946) not included in this map. Small exposures mapped by Barnes and Bell (1977) in the southwest part of the quadrangle.

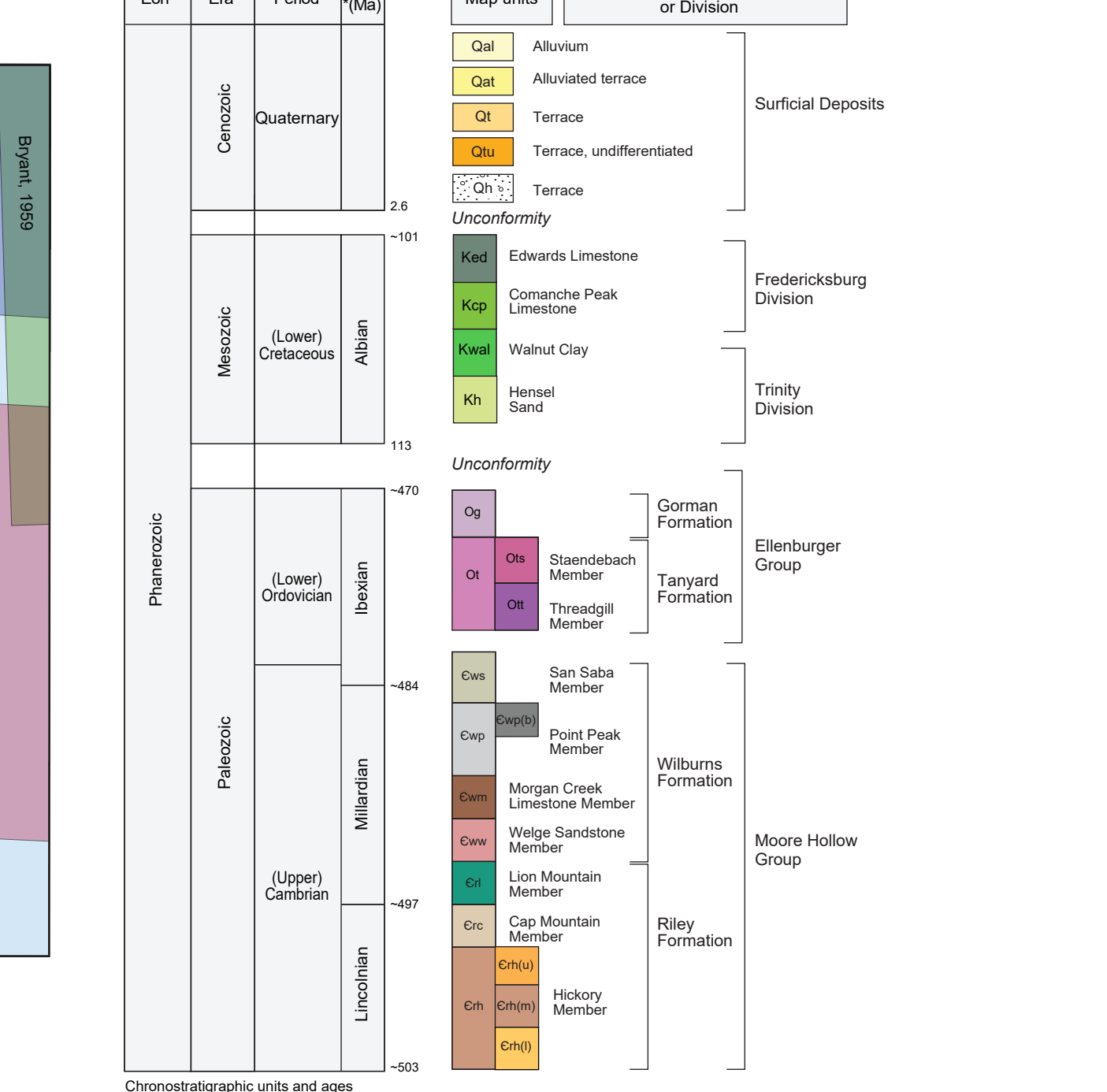
- MOORE HOLLOW GROUP**
WILBURNS FORMATION (Late Cambrian)
- Cws**—**San Saba Member** (Late Cambrian)—Calcarene. Yellowish brown to light gray, medium to coarse-grained, glauconitic, fossiliferous calcarenite. Well-bedded (up to 10 inches) calcarenite interbedded with micritic limestones with thin recessive silt units. Locally contains intraformational conglomerate interbeds, especially in the upper unit (Sliger, 1957). Unit becomes increasingly micritic, less glauconitic, and less fossiliferous toward the top. Weather characteristics include brown limonitic stains and sandy soils. Base of the San Saba is transitional into a light-colored sand with flaggy siltstone clasts creating locally favorable conditions for agricultural use. Top of the lower unit occurs at the base of the massive overlying stromatolite unit, when present. When stromatolites are absent, the top of the Point Peak Member is transitional with the overlying San Saba Member and placed below the Threadgill. Uncertainty about the upper and lower contacts results in the San Saba thickness reported to vary from 175 ft (Sliger, 1957; Barnes and Bell, 1977) to a maximum of 380 ft (Sliger, 1957).
 - Point Peak Member** (Late Cambrian)—Point Peak Member has two distinct subunits, a lower calcareous siltstone and a clastic unit, and a discontinuous upper bioherm or stromatolite (microbiolite bioherm) unit. Both units and facies within are described in detail by Lehmann and others (2020). Total thickness reported to vary from minimum values of 150 to 175 ft (Harwood, 1959; Barnes and Bell, 1977) to a maximum of 380 ft (Sliger, 1957). Variation attributed to the discontinuous upper bioherm unit and discerning the top of the unit from the similar lithology of the overlying San Saba Member.
 - Exp(b)**—**Point Peak, bioherm submember** (informal) (Late Cambrian)—Boundstones with thinly layered calcarenites and siltstones. Light-gray, white, to darker gray micritic stromatolites (microbiologic bioherms). Stromatolites often contain multiple phases of growth, defined by a white limestone outer structure (ring) up to 30 ft in diameter (in plan view). Bioherms contain an internal dolomitic (darker gray) mudstone containing oval to circular (microbial) textures up to 24 inches in diameter. In profile, relief of oval bioherms is up to 15 ft for individual clusters. Thin-bedded heterotritic units of calcarenites to siltstones occur between and drapes over bioherms with multiple dip directions. Upper Point Peak is generally non-glauconitic (Lehmann and others, 2020). The top of the Point Peak Member is transitional with the San Saba Member occurring as the first thin-bedded, glauconitic, calcarenite beds above the bioherms. When present, the upper Point Peak bioherm is more resistant than the overlying San Saba Member and may produce a topographic break. The bioherm facies is often a ridge-forming unit. The unit distinctly appears as having an irregular outcrop or feature in outcrop on lidar.
 - Cwp**—**Point Peak Member** (Late Cambrian)—Heterotritic clastic rocks. Yellowish to green-gray, thinly bedded and intercalated fine-grained sandstones, siltstones, grainstones, and packstones. Beds of varicolored intraformational conglomerates with tabular flat clasts of rounded silt limestone are common. Glauconite is abundant. Locally, beds contain ripple marks, cross-bedding, and burrows and trace fossils (Crutzen). Small stromatolite lithologies locally occur within the unit (Lehmann and others, 2020). Locally distinct index fossils include the "Plectroprotha" Zone (brachiopods), found near the top and beneath the upper bioherms (Barnes and Bell, 1977). The lower unit is easily eroded and often occurs as eroded flat hillslopes or valleys. Unit weathers into a light-colored sand with flaggy siltstone clasts creating locally favorable conditions for agricultural use. Top of the lower unit occurs at the base of the massive overlying stromatolite unit, when present. When stromatolites are absent, the top of the Point Peak Member is transitional with the overlying San Saba Member and placed below the first glauconitic calcarenite bed (Becker, 1985). The lower contact with the Morgan Creek Limestone is gradational. Base of the Point Peak Member is defined as the top of the uppermost glauconitic calcarenite and laterally continuous bed. The contact is mapped at a break in slope associated with the bench-forming character of the transition from the resistant Morgan Creek and Point Peak Member.
 - Cwm**—**Morgan Creek Limestone** (Late Cambrian)—Calcareous glauconitic sandstones and sandy glauconitic limestones. Quartz sandstone: lower sandstone is 25 ft thick, calcite-cemented, glauconitic, pink to red, fine to medium-grained, grading upward from underlying Weige Sandstone into the overlying calcareous units. Limestone (weckstone to grainstone): well-bedded, medium-to-light gray to greenish-gray, fine to coarse-grained, local sparry cement, glauconitic, and fossiliferous (brachiopods and trilobites). Fossiliferous unit overl with brachiopod bed (*Eoorthia texana*) locally present about 60 ft above base of unit (Sliger, 1957; Barnes and Bell, 1977). Overall a resistant unit forming ridges and steep hillslopes, consisting of thin to thick banks of aligning vegetation. Upper boundary is gradational and locally defined as a transition from fossiliferous limestones of the Morgan Creek into thin-bedded silt limestone and intraformational conglomerate of the Point Peak Member. This contact is often at the top of a resistant calcarenite that forms a bench below the more recessive lower Point Peak Member. The bench is often vegetated with mesquite trees. The unit is often a ridge-forming unit with laterally continuous beds apparent on lidar. About 110 ft thick (Harwood, 1959).
 - Cwv**—**Weige Sandstone Member** (Late Cambrian)—Sandstone. Quartzarenite with siltic cement, coarse to medium-grained, well-sorted with well-rounded quartz grains with quartz overgrowths. Thickly bedded (massive) to poorly bedded, non-glauconitic, yellowish-brown to orange color. Unit generally lacks sedimentary structures, and base contains reworked Lion Mountain. Grades into overlying Morgan Creek with contact placed at the occurrence of arenaceous, purple sandstone with carbonate cement and associated heavily vegetated scarps. Useful minor aquifer for human and livestock use. Up to 25 ft thick (Sliger, 1957).

- RILEY FORMATION** (Late Cambrian)
- Crl**—**Lion Mountain Member** (Late Cambrian)—Sandstone. Glauconitic, quartz-rich, green to dark-brown, fine to medium-grained, cross-bedded, locally calcite cemented. Contains white sandy limestone lenses composed of calcite cemented phosphatic brachiopod and trilobite coquina. The Lion Mountain is a recessive unit, often forming benches or valleys between more resistive overlying and underlying units. Benches or slopes with sparse vegetation develop deep reddish soil with weathering-produced iron nodules. Locally, unit has agricultural use. Thickness up to 60 ft (Sliger, 1957; Becker, 1985). Contact with the underlying Cap Mountain is placed at the first occurrence of continuous calcarenite and below the first occurrence of discontinuous in situ coquina. This calcarenite is often seen as a topographic and vegetation break. When exposed, the contact with the overlying Weige Member is sharp. The contact is mapped as a distinctive, densely vegetated slope break and as the most up-slope occurrence of iron-oxide nodules within the soil.
 - Crc**—**Cap Mountain Member** (Late Cambrian)—Sandstone and limestone. The Cap Mountain Member transitions from a lower quartz sandstone with calcite cement, into a mixed calcarenite and siltstone, to a calcarenite (limestone) at the top. Lower quartz sandstone: fine-grained, poorly sorted, glauconitic, coarse-grained sandstone with rounded to angular grains that transitions upward into a middle section of interbedded siltstone and calcarenite. This middle section grades upward into light olive-gray, prominently bedded (thicknesses up to 25 inches), glauconitic, limestone (weckstone to grainstone) with less quartz and more calcareous grains. Fossil fragments include brachiopod shells. Parts of the Cap Mountain appear similar to the Morgan Creek. The Cap Mountain is a highly resistant, scarp-forming unit, revealing vegetation lineaments along internal contacts. The unit forms moderately vegetated hills between the upper Hickory and Lion Mountain benches. It grades into the overlying Lion Mountain, but with a sharp slope contrast. Weathered outcrops and soils contain small limonite concretions near the top. Contact with the underlying Hickory Member (quartz and hematite cement) is gradational but distinct, based on the lack of calcareous cement in the Hickory. Contact is placed at the base of the more resistant calcareous cement, which is often expressed as a topographic scarp and heavily vegetated break in slope. Up to 300 ft thick (Becker, 1985).
 - Crh**—**Hickory Sandstone Member** (Late Cambrian)—Quartz sandstone. Other areas informally subdivided into three informal units (upper, middle, and lower) based upon variations in color, grain size, porosity, bedding thickness, cementation, and topographic expression. Where not differentiated, the unit generally consists of brown to red quartz sandstones. Diagenetically there is little to no calcite and no glauconite. Locally a major aquifer in the subsurface. Contact with the overlying Cap Mountain is placed at the first resistant calcareous cemented sandstone, which is often expressed as a topographic scarp and heavily vegetated break in slope. About 400 ft thick.

- MAP SYMBOLS**
- Topographic contour (20 ft interval)
 - Intermittent stream
 - County roads
 - Local road
 - Pipelines (TRRC)
 - Waterline
 - Contact
 - Contact approximate
 - Contact inferred
 - Contact concealed
 - Measured section
 - Cross section
 - Fault (dashed where inferred)
 - Fault concealed
 - Normal fault (named or significant throw), symbol on down-slope side (dashed where inferred)
 - Normal fault concealed
 - Contact-dissolution
 - Contact inferred
 - Fossil bed (Eoorthia)
 - Cave
 - Well (ID no.)
 - Spring
 - Gravel pit
 - Stream gage
 - Sinkhole
 - Strike and dip (degrees) of bedding
 - Horizontal bedding
 - Fracture
 - Fracture-vertical
 - Fault
 - Fault trend



Chronostratigraphic and Correlation of Map Units



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