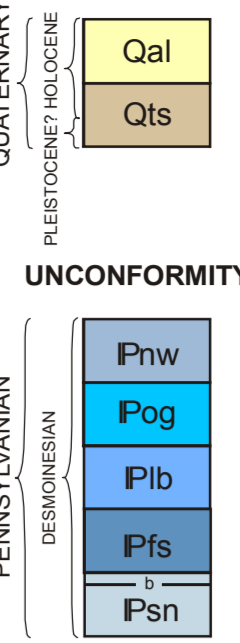
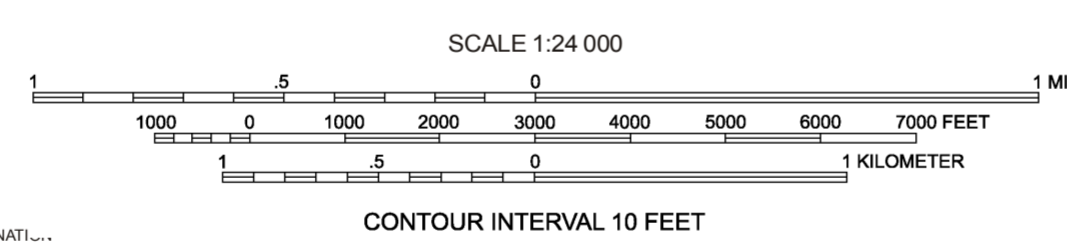


CORRELATION OF MAP UNITS



DESCRIPTION OF UNITS*

- Qal** ALLUVIUM (Holocene) - Clay, silt, sand, and gravel in channels and on flood plains of modern streams. Includes terrace deposits of similar composition located directly above and adjacent to modern channels and flood plains. Thickness: 0 to about 30 ft.
- Qts** UPPER TERRACE SANDS (Holocene and Pleistocene?) - Consists mostly of unconsolidated fine- to medium-grained quartz sand, silt, and clay, little to no gravel-sized material observed. Situated just above modern flood plains and drainages. Thickness: 0 ft to as much as 20 ft, averages closer to 8 ft thick.
- Pnw** NOWATA FORMATION (Pennsylvanian, Desmoinesian) - Rarely crops out in map area. Areas inferred to be Nowata consist of a light brown (5YR5/6) to light gray (N7) silty, clay loam soil, which probably formed from a silty claystone. Basal contact drawn along the inferred, western-most extent of outcrops of Oologah Formation. Only the basal 25 to 30 ft exposed in quad based on cross section.
- Pog** OOLOGAH FORMATION (Pennsylvanian, Desmoinesian) - Formation predominantly a medium gray (N5), medium dark gray (N4), medium bluish gray (5S5/1) to locally yellowish gray (5Y7/2) limestone, with local intervals of sandstone or fossiliferous shale. Lower third to half of formation, limestone characterized by alternating thin- to medium bedded, wavy, skeletal and whole-fossil mudstones and wackestones; generally, thinner bedded limestones of the lower part of the Oologah tend to have a wackestone texture and bluish-gray hue; bedding varies between 1-16" thick. Thin fractures filled with sparry calcite common throughout lower interval. Fossils dominated by numerous species of brachiopod, phylloid algal, and crinoid debris; fenestrate and ramose bryozoans present in thicker beds, while bivalve-filled burrows also common in some sections with a large complement of argillaceous limestone. Limestones in the upper half of exposed Oologah tend to be more regular, thin-bedded, slightly argillaceous, fossiliferous mudstones; bedding planar to slightly wavy, ranging from 2-5" thick; fossils similar to lower part, except less of a phylloid algal content. About 30-40 ft above base of formation, throughout the southern half of quad, encounter a 3-5 ft lenticular interval of pale yellowish gray (10YR6/6), weakly indurated, thin, planar beds of fine-grained, non-calcareous, argillaceous sandstone, with local shale interbeds and partings. Sandstone and shale interval appears to pinch-out after a few 10's of feet in dip direction. Oologah Limestone immediately above sandstone interval contain irregularly-shaped chert peels, most of which have been weathered out along with fossil components, suggesting paleo-karst erosion may have occurred. Near top of formation, locally find 2 to 3 ft thick, lenticular intervals of fossiliferous claystone. Shales light brown (5YR5/4) to grayish orange pink (5YR7/2) in color, slightly silty, calcareous, and laminated. Intervals appear to pinch-out after a few feet along strike and dip. Fossil components dominated by monotypic assemblages of Neochonetes, with minor Juresania and fenestrate bryozoans. Total thickness of the Oologah Formation about 110 ft.
- Pib** LABETTE FORMATION (Pennsylvanian, Desmoinesian) - Light olive gray (5Y5/2) to dusky yellow (5Y6/4), occasionally medium light gray (N6), laminated, very silty to sandy, micaceous, concretionary clayshale; concretions dusky red (5R4/2) to moderate red (5R5/4), composed of hematite and/or siderite(?), and usually occur sporadically throughout the formation as 1-3" diameter discoid-shaped clasts. Clayshale predominantly non-calcareous, although some narrow horizons are weakly calcareous (particularly those associated with abundant concretions). Locally, various non-descript very sandy or sandstone horizons occur; mostly these sand horizons are planar laminated to thin-bedded, but one at 15 ft above base of the Labette is trough-cross-bedded. Within the upper 50 ft of the formation a sequence of interbedded sandstones and shales (Peru sandstones) occurs. The Peru sandstones consist of between 2 to 4 intervals of dusky yellow (5Y6/4), moderately indurated, thin- to medium- trough-cross-bedded, fine-grained, non-calcareous sandstone; sandstone intervals vary between 5 to as much as 15 ft thick, where the thicker intervals have been variably termed the Upper and Lower Peru Sandstones by previous investigators. Each sandstone interval is separated by 7 to 10 ft thick interval of well-laminated, flaser-bedded, calcareous, interbedded mudshale and siltstone. Locally, and where the Peru sandstones are absent, a highly fossiliferous clayshale may occur within the uppermost 30 ft of the formation. These fossiliferous clayshales are typically pale yellowish brown (10YR6/2), yellowish gray (5Y7/2), to rarely moderate yellow (5Y7/6), slightly silty, calcareous and well-laminated. Fossils are dominated by Desmoinesia, Linoproductus, Juresania and Neochonetes, and with minor faunal elements consisting of small ramose bryozoans, crinoid debris and small spirifer brachiopods. The Sageyah limestone was not observed in this quadrangle. In the map area the Labette Formation varies between 220 to 260 ft thick.
- Pfs** FORT SCOTT FORMATION (Pennsylvanian, Desmoinesian) - In the Mingo Quadrangle the formation consists of only two members, in descending order: 1) the Little Osage Shale; and 2) the Blackjack Creek Limestone. Thickness of the formation is about 7 to 12 ft, averaging closer to 10 ft thick. Little Osage Shale: Similar to the Exello Shale of the Senora Formation, a medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic clayshale; upper 5-8' a light brownish gray (5YR6/1), blocky-bedded, silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness usually 5 ft, but may be as thin as 2 ft in local areas. Blackjack Creek Limestone: Light gray (N7), medium light gray (N6), light brownish gray (5YR6/1), to moderate orange pink (5YR8/4), thin, planar to wavy bedded, skeletal to whole-fossil wackestone. Bedding varies from 2" to 5" thick; wavy bedding contacts due (in part) to stromatolitic bedding; limestone upper 10-15 ft of member is blocky-bedded, silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness from 3-6 ft, averaging 4 ft. Senora Formation: A medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic clayshale; however, upper 2-5' a light brownish gray (5YR6/1) to pale brown (5YR5/2), laminated, slightly silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness from 3-6 ft, averaging 4 ft. Breezy Hill Limestone (b, fs, b): Grayish orange (10YR7/4), yellowish gray (5Y7/2), pale olive (10Y6/2), to medium light gray (N6), locally dark gray (N3), predominantly an alternating thin- to medium-, wavy bedded, whole-fossil and skeletal wackestone; bedding varies from 1-16" thick, with thinner bedding characterized by skeletal textures, and medium bedding a characteristically whole-fossil texture. Large linoproducts, other small productids (Desmoinesia) and mesolobids are the most common fossils; chaetoid sponges and large crinoid stems also present. Skeletal material usually consists of sub-angular, crinoid debris (ossicles and plates), and nondescript brachiopod shell fragments. Some exposures of the Breezy Hill contain an unusual facies consisting of a dense, dark gray colored, fossiliferous carbonate mudstone; fossils consist exclusively of well preserved, monotypic assemblages of Mesolobus; facies commonly occur near the contact with the Exello Shale. In areas on map where the Breezy Hill Limestone and Fort Scott Formation occur in close proximity the basal contact of the Breezy Hill is labeled with an 'fs, b'. Overall, the Breezy Hill is thicker and more wavy bedded than the overlying Blackjack Creek Limestone. Thickness of the unit about 7 to 8 ft. Kinross Shale: Moderate yellowish brown (10YR5/4) to medium light gray (N6), fissile to well-laminated, fossiliferous silty clayshale. Base occurs at the top of the Iron Post coal. Due to extreme thickness of the underlying Laponda Sandstone this shale interval rarely exceeds 1 ft, and averages closer to 8 inches in thickness. Iron Post coal: Where observed, coal is a single bed, black (N1) to grayish black (N2), having well-developed 2 directional cleats. Associated underclay not well-developed. Thickness about 6 to 8 inches.
- Psn** SENORA FORMATION (Pennsylvanian, Desmoinesian) - Mainly a silty to sandy clayshale, locally interlaminated with 0.16-1" thick very fine-grained sandstone and siltstone beds; clayshale bedding laminated, becoming blocky where deeply weathered; color variable, ranging from the most frequent to infrequent: medium light gray (N6), brownish gray (5YR4/1), grayish orange (10YR7/4), very pale orange (10YR8/2), dark yellowish orange (10YR6/2), pale brown (5YR5/2), light brown (5YR5/6), grayish yellow (5Y8/4), and yellowish gray (5Y7/2); clay is predominant cement, calcareous rare. Clayshales immediately above coal seams tend to be harder, silt-free, slightly phosphatic, with slightly thicker laminated bedding, and are weakly calcareous; color usually a medium dark gray (N4). The interlaminated sandstone and siltstone beds are friable to poorly indurated, usually a very pale orange (10YR8/2), pale orange (10YR8/2), or dark yellowish orange (10YR6/2), sandstone more common than siltstone, typically fine- to very fine-grained; predominant cement is clay, with a possible weak silica. Total thickness of the Senora Formation exposed in quad is about 13 ft. A number of prominent stratigraphic horizons occur in the Senora Formation, these are in descending order: Exello Shale: A medium dark gray (N4) to dark gray (N3), well-laminated to fissile, phosphatic clayshale; however, upper 2-5' a light brownish gray (5YR6/1) to pale brown (5YR5/2), laminated, slightly silty, calcareous, fossiliferous clayshale. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5", ovoid-shaped clasts. Thickness from 3-6 ft, averaging 4 ft. Breezy Hill Limestone (b, fs, b): Grayish orange (10YR7/4), yellowish gray (5Y7/2), pale olive (10Y6/2), to medium light gray (N6), locally dark gray (N3), predominantly an alternating thin- to medium-, wavy bedded, whole-fossil and skeletal wackestone; bedding varies from 1-16" thick, with thinner bedding characterized by skeletal textures, and medium bedding a characteristically whole-fossil texture. Large linoproducts, other small productids (Desmoinesia) and mesolobids are the most common fossils; chaetoid sponges and large crinoid stems also present. Skeletal material usually consists of sub-angular, crinoid debris (ossicles and plates), and nondescript brachiopod shell fragments. Some exposures of the Breezy Hill contain an unusual facies consisting of a dense, dark gray colored, fossiliferous carbonate mudstone; fossils consist exclusively of well preserved, monotypic assemblages of Mesolobus; facies commonly occur near the contact with the Exello Shale. In areas on map where the Breezy Hill Limestone and Fort Scott Formation occur in close proximity the basal contact of the Breezy Hill is labeled with an 'fs, b'. Overall, the Breezy Hill is thicker and more wavy bedded than the overlying Blackjack Creek Limestone. Thickness of the unit about 7 to 8 ft. Kinross Shale: Moderate yellowish brown (10YR5/4) to medium light gray (N6), fissile to well-laminated, fossiliferous silty clayshale. Base occurs at the top of the Iron Post coal. Due to extreme thickness of the underlying Laponda Sandstone this shale interval rarely exceeds 1 ft, and averages closer to 8 inches in thickness. Iron Post coal: Where observed, coal is a single bed, black (N1) to grayish black (N2), having well-developed 2 directional cleats. Associated underclay not well-developed. Thickness about 6 to 8 inches.

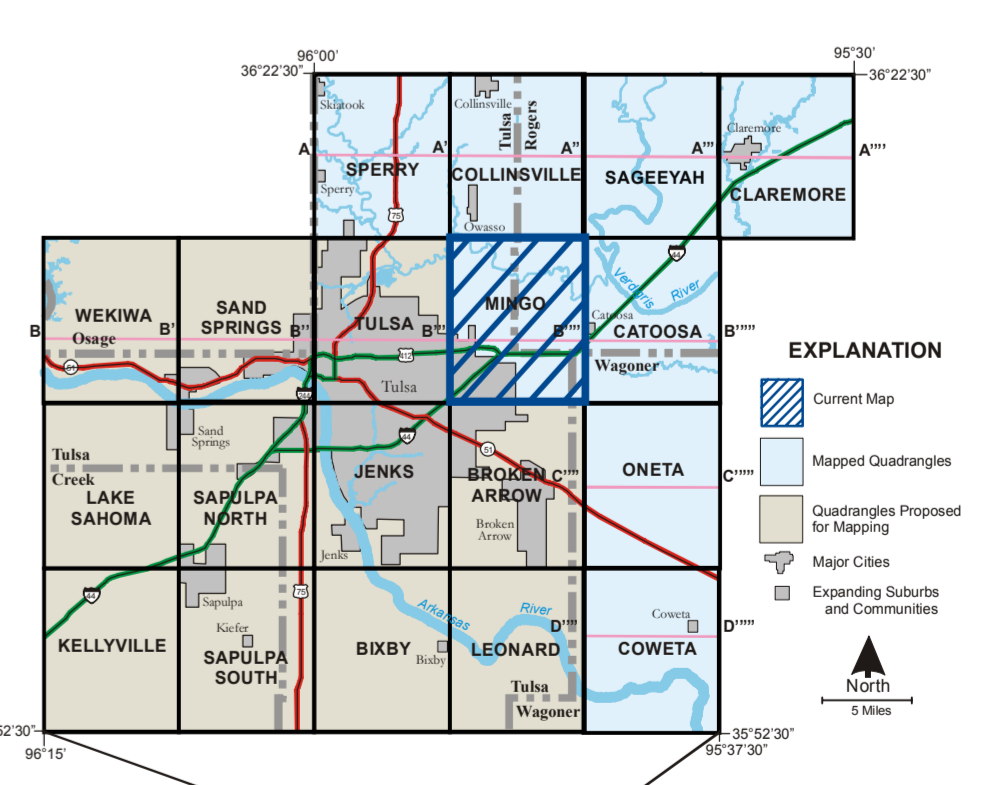
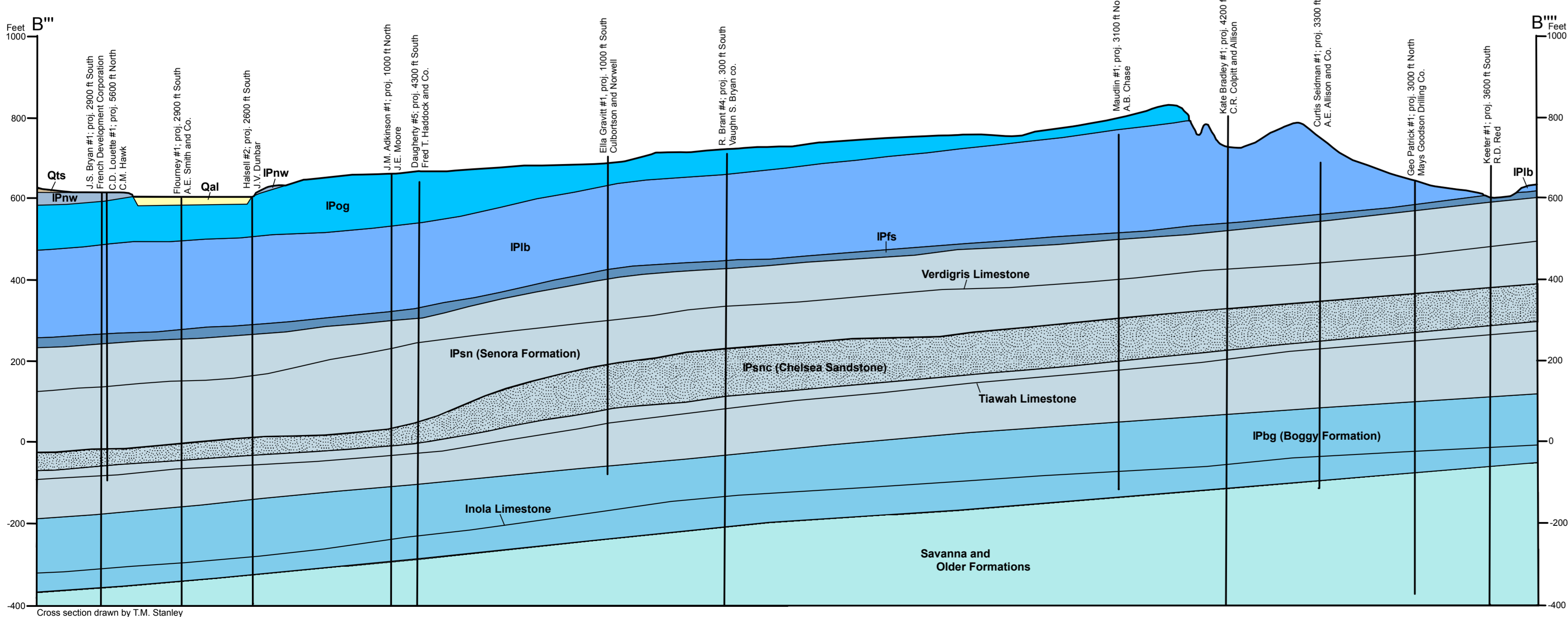


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SYMBOLS

- Unit contact; dashed where approximate
- o Outcrop, geologic observation
- * Petroleum well. Includes oil, gas, oil and gas, dry service (water supply or injection), junked and abandoned, unknown. Modified from Natural Resources Information System database



GEOLOGIC MAP OF THE MINGO 7.5' QUADRANGLE, ROGERS, TULSA, AND WAGONER COUNTIES, OKLAHOMA
Galen W. Miller and Thomas M. Stanley
2006