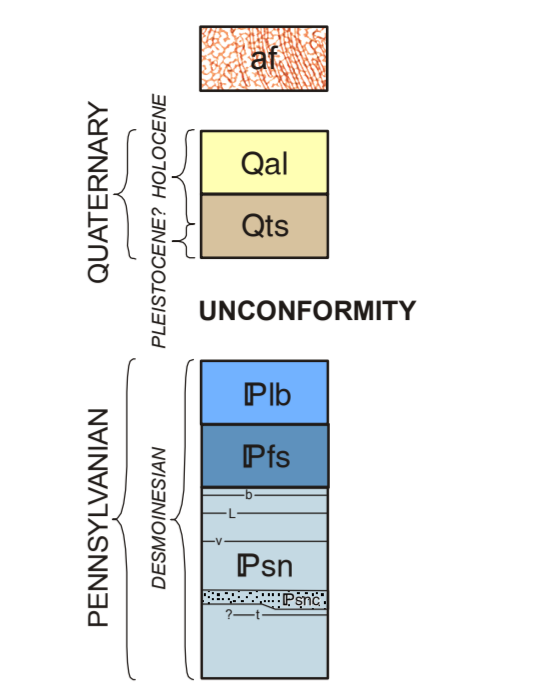
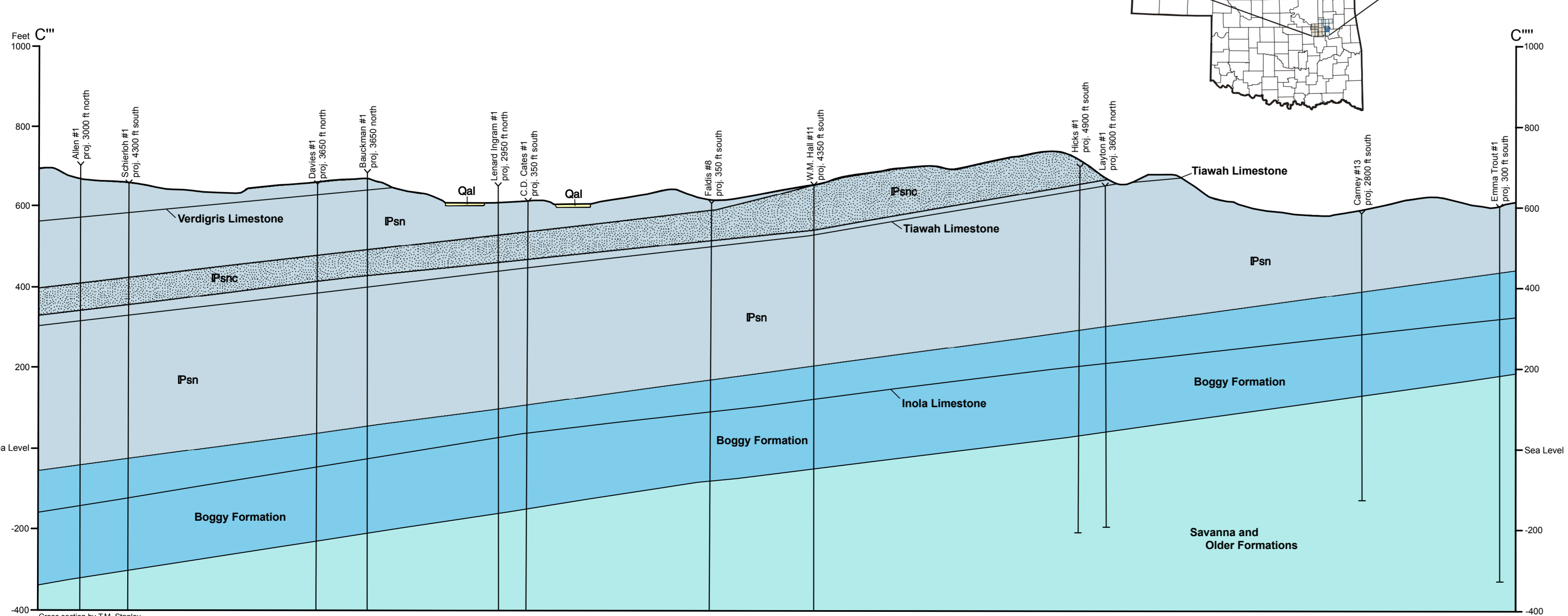
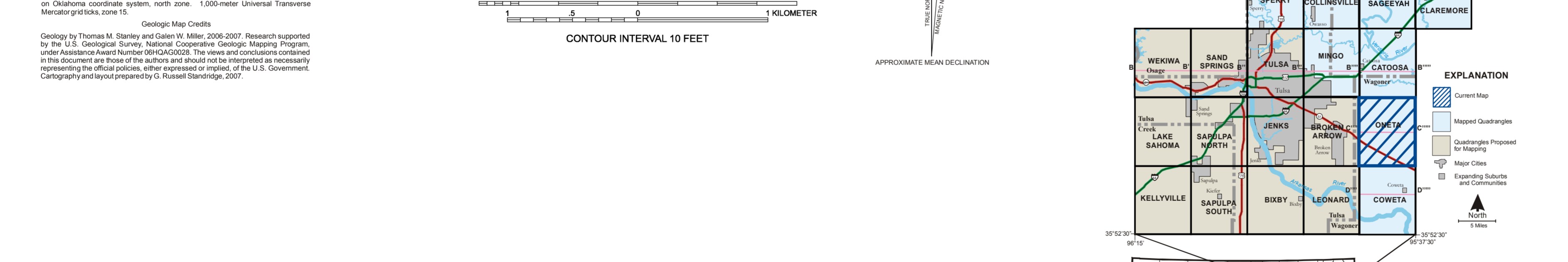
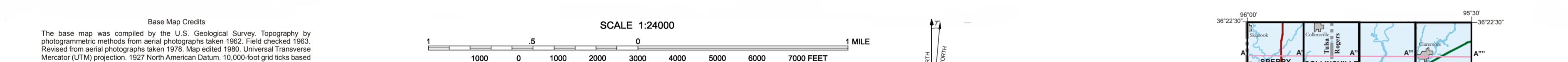


CORRELATION OF MAP UNITS



DESCRIPTION OF UNITS

- Qal** ARTIFICIAL FILL (Holocene) - Natural or artificial talus, slumps, and tailings covering formally exposed areas around active and inactive mining operations.
- Qts** ALLUVIUM (Holocene) - Clay, silt, sand, and gravel in channels and on flood plains bordering 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.
- Pib** 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 at most 20 ft; averages closer to 10 ft thick.
- Pfs** LABETTE FORMATION (Pennsylvanian, Desmoinesian) - Medium light gray (N6) to dusky yellow (5Y6/4), occasionally light olive gray (5Y5/2), laminated, very silty to sandy, micaceous mudstone to claystone; prevailing lithology depending on percent of coarser grained clastics found within unit. Only the basal 5 to 10 ft of formation is exposed in the far northwest corner of quadrangle.
- Psn** FORT SCOTT FORMATION (Pennsylvanian, Desmoinesian) - In the Oneta Quadrangle the formation consists of only two members, they are, 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 claystone; upper 5-8' a light brownish gray (5YR6/1), blocky-bedded, silty, calcareous, fossiliferous claystone. 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 thick locally.
 - 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 stratolitic bedding; limestone in upper 1' to 3' of member exhibiting wavy laminated bedding and more fragmentary bioclasts compared to lower parts of member. Fossils dominated by spirifer and productid brachiopods, and crinoid debris, algae and fusulinids common in some intervals. Thickness from 5 to 10 ft, averaging close to 7 ft.
- Pinc** SENORA FORMATION (Pennsylvanian, Desmoinesian) - Complex sequence of silty and concretionary claystone interbedded with a number of mappable limestone and sandstone members and beds including: b, Breezy Hill Limestone, L, Lagonda Sandstone, v, Verdigris Limestone; IPsn, Chelsea Sandstone; t, Tiawah Limestone; and various minor sandstone intervals and coal beds (including: Cowalla sandstone, and the Iron Post, Crowburg, and Mineral coal beds).
 - A silty to sandy claystone, interlaminated with 0.16-1' thick very fine-grained sandstone and siltstone beds is the predominant lithology of the formation, silt and sand content increasing adjacent to significant sandstone intervals (such as the Chelsea or Lagonda Sandstones), claystone 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), typically, shale associated with concretionary zones tend to be more orange or brown, instead of gray in hue; clay is predominant cement, calcite rare.
 - Clayshales immediately above coal seams tends to be harder, silt-free, slightly phosphatic, with slightly thicker bedding laminae, and are weakly calcareous; color of these shale intervals usually a medium dark gray (N4).
 - The interlaminated sandstones and siltstones 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.
 - Ironstone and calcite concretions occur sporadically throughout the shale section, but concentrations may occur just above the Verdigris Limestone, and just above any of the major coal beds; concretions stratigraphically associated with coal composed predominantly of hematite, occurring as 0.5-2' thick, discontinuous beds, or as narrow zones composed of small (between 1-2") individual, hollow, ovoid-shaped clasts; color a light red (5R6/6) to moderate red (5R5/4). Concretions stratigraphically associated with the Verdigris composed of a medium dark gray (N4), dense, micritic limestone; small goniatite cephalopods common within calcite concretions.
 - Overall, thickness of the formation is 800 to 850 ft based on cross section.
 - 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 claystone; however, upper 2-5' a light brownish gray (5YR6/1) to pale brown (5YR5/2), laminated, slightly silty, calcareous, fossiliferous claystone. Phosphate nodules throughout lower part of member, occurring as 0.25-0.5', ovoid-shaped clasts. Thickness from 3-4 ft.
 - Breezy Hill Limestone (b): Grayish orange (10YR7/4), yellowish gray (5Y7/2), pale olive (10Y6/2), to medium light gray (N6), with local dark yellowish orange streaks along bedding contacts and fractures, alternating thin to medium, wavy bedded, whole-fossil and skeletal wackestone. Bedding varies from 3-16" thick, with thinner bedding characterized by skeletal textures, and medium bedding having a characteristically whole-fossil texture. Large inoprotocysts, other small products (Desmoinesia) and melobolids 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 contain casts of weathered out pyrite crystals, which have subsequently turned to goethite and hematite. 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.
 - Kinnison Shale: Moderate yellowish brown (10YR5/4) to medium light gray (N6), fissile to well-laminated, fossiliferous silty claystone. Silt and sand increasing toward top of member. Base occurs at the top of the Iron Post coal. Due to extreme thickness of the underlying Lagonda Sandstone this shale interval rarely exceeds 1 ft, and averages closer to 8" 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 underlay not well-developed. Thickness about 6 to 8 inches.
 - Lagonda Sandstone (L): Grayish orange (10YR7/4), dark yellowish orange (10YR6/6), to very pale orange (10YR8/2), friable to moderately indurated, thin- to medium-bedded, sometimes wavy laminated, trough-cross-bedded, fine- to very fine-grained, slightly siliceous sandstone; shale partings may occur between cross-bed sets; sandstone mostly very clean, with rounded to well-rounded quartz grains, but it does become more argillaceous and micaceous toward top; calcite cement rare. Bedding varies from less than 1/16" thick to as much as 24" thick; bedded material more common in the basal two-thirds of the member; ripple-bedded surfaces associated with internal tabular cross-lamination common in upper one-third of member. Molds of Lingulodictus and Lurensia may occur locally. Thickness ranges from 20 ft, to as much as 50 ft thick in the northern part of quad.
 - Verdigris Limestone (v): medium dark gray (N4) skeletal mudstone; but may weather to a medium light gray (N6), grayish brown (5Y4/2), or grayish orange (10YR7/4) color. Represented either by a single massive bed, or by a couple of 9-12" thick, wavy, skeletal mudstone beds; top 3-4" becoming a wavy laminated whole-fossil mudstone to wackestone, with large productid brachiopods and large crinoid stems. Chert pods, or silica replacement of limestone along bedding surfaces common. Thickness about 2 to 3 ft.
 - Crowburg coal: Poorly exposed in map area, where observed in old mine workings represented by a black (N1) to grayish black (N2) to 1.5 to 2 ft thick coal seam overlying a comparably thick very light gray (N8) to light bluish gray (5B7/1) underlay. Locally, a pair of 9-12" thick, whole-fossil mudstones separated by a 6" thick claystone interval, informally named the McNabb limestone by some geologists, occurs immediately below the underlay.
 - Chelsea Sandstone (Pinc, c, c.t): Variable sandstone unit that can be loosely segregated into two zones. Lower zone well exposed, consisting of a pale reddish brown (10YR4/2), dark yellowish brown (10YR7/4), grayish orange (10YR8/2), to locally moderate yellow (5Y7/6), pale greenish yellow (10YB/2), or pale olive (10Y6/2), moderately indurated, medium- to thin-bedded, fine- to medium-grained, calcareous trough-cross-bedded sandstone. Trough cross-bed sets vary from 0.5" to 3" thick, average 5" thick; locally graded, with siltstone, sandstone, and limestone pebble conglomerate set within a medium-grained sand matrix at base, which grades upward into a fine-grained sandstone. Thickness of basal Chelsea varies from 50 to 70 ft, but averages closer to 60 ft. Upper zone of the Chelsea poorly exposed, evidenced often times only by the presence of a sandy loam soil, as opposed to a clay loam; where exposed consists of a pale yellowish brown (10YR6/2) to light brown (5YR6/4), friable, thin-bedded to often planar laminated, weakly calcareous, micaceous, fine-grained sandstone. Thickness varying from 15 to 25 ft thick, averaging closer to 17 ft. Typically, base of the Chelsea resides 10 to 20 ft above the base of the Tiawah Limestone; locally it may be as high as 30 ft above. Where the Chelsea was mapped in close proximity to the Tiawah, base of the sandstone labeled with a 'c.t.'. Overall thickness of the Chelsea Sandstone varies between 70 to 100 ft.
 - Tiawah Limestone (t, c.t): Similar to the Verdigris Limestone in texture and thickness, usually a grayish orange pink (5Y7/2) to very pale orange (10YR7/2), locally light brownish gray (5YR6/1) to pale yellowish brown (10YR6/2), with dark yellowish orange (10YR6/6) splotches; generally a massive bed of whole-fossil mudstone in lower half, grading into a wavy laminated skeletal wackestone in upper half. Fossils usually large crinoid stems with large productid and spirifer brachiopods. Thickness varies from 2 to 4 ft thick. Outcrops of the Tiawah Limestone were not observed south of Coal Creek in the map area. Where the Tiawah was mapped in close proximity to the Chelsea, base of the limestone labeled with a 'c.t'.
 - Tabo coal: Rarely observed; black (N1) to grayish black (N2), 1-2" thick coal seam, with a 2-3" thick underlay immediately below.
 - White sandstone: Normally a yellowish gray (5Y7/2) to pale greenish yellow (10YB/2) color, but can be a very pale orange (10YR8/2) to pale yellowish orange (10YR6/6) in deeply weathered exposures; moderately indurated, fine-grained, slightly micaceous, siliceous sandstone. Bedding planar, medium, varying from 11-16" thick; some tabular cross-bedding observed at the base of unit in some exposures. Thickness from 2-4 ft thick.
 - Upper Taft sandstone: Overall, a grayish orange (10YR7/4), becoming dark yellowish orange (10YR6/6) in upper third, moderately indurated, medium- to thin-bedded, fine- to very fine-grained, micaceous, calcareous sandstone, with shale interbeds and partings. Interval can be segregated into 3 general lithologic zones: basal zone, usually 2-3' thick, consisting of medium- to thin planar bedding, with bedding ranging from 0.5-4" thick, shale partings common, sandstone is slightly calcareous; middle zone consists of about 3 ft of alternating beds of sandstone and shale, each about 3-4" thick, sandstone indurated and slightly calcareous, the upper sandstone zone is moderately indurated, siliceous, and thin- to medium-rough-cross-bedded; Upper Taft sandstone zone is 5 to 7 ft thick.



GEOLOGIC MAP OF THE ONETA 7.5' QUADRANGLE, WAGONER COUNTY, OKLAHOMA
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