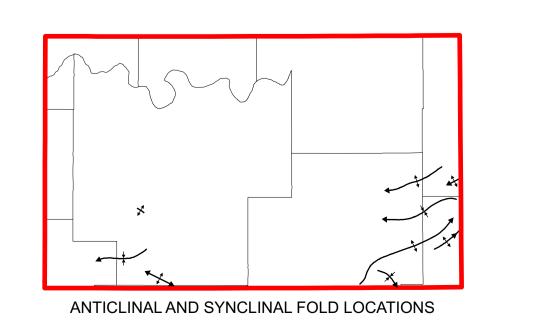
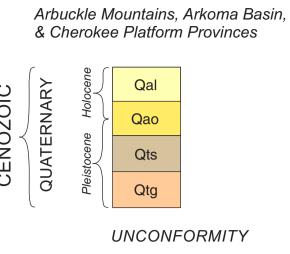


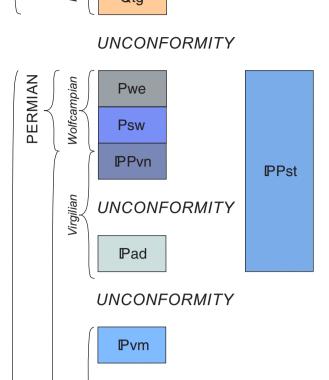
GEOLOGIC MAP OF THE ADA 30X60-MINUTE QUADRANGLE,
ATOKA, COAL, GARVIN, HUGHES, JOHNSTON, McCLAIN, MURRAY, PITTSBURG, POTTAWATOMIE, AND SEMINOLE COUNTIES, OKLAHOMA
Thomas M. Stanley and Stacey C. Evans

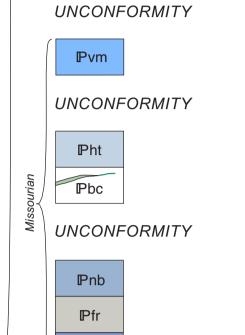


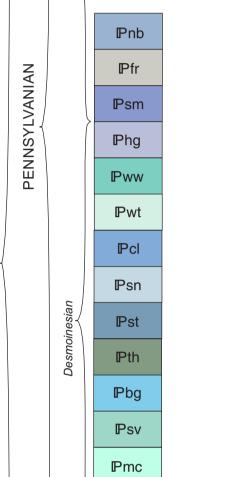
Map of Oklahoma showing the locations of the 30X60-minute quadrangles. Red shaded quadrangle represents the current

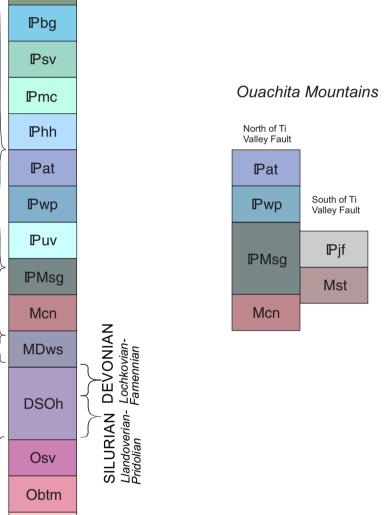
CORRELATION OF UNITS











SYMBOLS

Unit contact; dashed were approximate Normal fault; dotted where concealed; bar and ball on downthrown side Thrust fault; sawteeth on upper plate; dotted where concealed

Anticline; showing crestline, arrow shows direction of plunge; dotted where concealed

Syncline; showing crestline, arrow shows direction of plunge; dotted where concealed

× Outcrop; geologic observation

Strike and dip of beds

--- Vertical bed

⊕ Horizontal bed

11 2

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DESCRIPTION OF UNITS

- Qal ALLUVIUM—Clay, silt, sand, and some gravel composed of locally derived, unconsolidated sediment deposited in channels and on flood plains of modern rivers and
- OLDER ALLUVIUM—Clay, silt, sand, and some gravel composed of locally derived, unconsolidated sediment located between 1.5 to 6 meters above, and adjacent to, modern flood plains and alluvial valleys.
- Qts TERRACE SAND—Mostly unconsolidated sand and silt, with little clay- or gravel-sized material. Unit formed at several levels along former courses of ancient rivers and
- TERRACE GRAVEL—Mostly unconsolidated gravel and sand, with minor silt- and claysized material; deposited well above, and at several levels along the former courses of
- Pwe WELLINGTON FORMATION—Reddish-brown weathering, thin- to sometimes medium-bedded, argillaceous, fine-grained quartz arenites, with local interbeds of brown to red mudstones.

 Only the basal 10-20 meters are locally exposed along the western margin of the map

ancient rivers and streams.

- STILLWATER FORMATION—A series of red to gray mudstones and claystones nterbedded with fine-grained, lenticular quartz arenites, and very thin discontinuous beds of fine-crystalline limestones and nodular dolostones. Carbonates tend to be more common toward base of formation. The Stillwater Formation, as named and defined with type section by Patterson (1933), takes stratigraphic preference over nearly the same lithologic interval named as the Oscar Group by Shelton et al. (1985). As per Patterson (1933), the top of the Stillwater Formation is defined as the base of the Fallis Member of the Wellington Formation. Originally, the base of the Stillwater was defined at the top of the Pennsylvanian (Gould, 1926; Patterson, 1933), which has varied considerably over the years. Currently, the top of the Pennsylvanian in the Midcontinent is placed at the top of the Glenrock Limestone of the Red Eagle Formation (Nestell and Nestell, 1998). Due to the absence of Red Eagle Formation in this part of the state, the base of the Stillwater Formation is represented by the Hart Limestone. The Hart Limestone roughly correlates to the Neva Limestone of northern Oklahoma and southern Kansas (Fay, 1997). Total thickness varies from 150 to 175 meters.
- VANOSS FORMATION—Mostly multicolored mudstones and mudshales, interbedded with lenticular, fine- to coarse-grained arkoses and limestone-clast conglomerates. The top of the formation is placed at the base of the Hart Limestone. The base of the Vanoss is represented by the base of the Reading Limestone, or where absent, when arkosic sandstones of the Vanoss replace quartz arenites of the Ada Formation.

 Total thickness of the Vanoss Formation 150 meters.
- STRATFORD FORMATION—The formation consists predominantly of indurated, well-rounded limestone-clast conglomerate, calcareous and non-calcareous arkose and arkosic conglomerate, along with local occurrences of limestone and shale. It forms an apron around most of the Arbuckle Mountains, except in areas east of the Lawrence Uplift. Stratford is genetically similar to the Post Oak Formation of the Wichita Mountains. Surficial thickness ranges from 0 to as much as 40 meters; however, in the subsurface, the formation probably extends well into older Pennsylvanian and Permian rocks occurring at depths of 275 meters or greater.
- Pad ADA FORMATION—Interbedded, brown to gray weathering shales and lenticular, fine-grained quartz arenites with local cross-bedding. Chert-pebble conglomerates at the base of some sandstone beds common throughout map area.

 Total thickness of the Ada Formation varies between 12 to 60 meters.
- VAMOOSA FORMATION—Consists of locally calcareous, gray-green, blue-green, and maroon weathering shale, with yellowish-brown siltstones, fine- to coarse-grained sandstones, and thin limestones. Chert-pebble conglomerates common in the lower half of formation; the prominent (10 meter thick) Boley Conglomerate occurs at the base of the formation throughout the map area.

 The Vamoosa is eventually truncated by the overlying Ada Formation just north of Little Sandy Creek. Total thickness varies between 0 and 45 meters.
- Pht HILLTOP FORMATION—Black to dark gray, well-laminated, slightly silty clayshales. Upper third of formation shows an increase in coarse clastic material where clayshale lithology becomes interbedded with siltstone and very fine-grained sandstone intervals. The Hilltop is eventually truncated by the overlying Vamoosa Formation just north of the Pontotoc-Shawnee County line, due north of the town of Ada.

 The total thickness of the Hilltop Formation varies from 0 to ~25 meters.
- BELLE CITY LIMESTONE—Is represented by an upper (1 to 3 meters thick), planar, thin-bedded limestone and a basal (< 0.5 meters thick) limestone, separated by a dark gray, calcareous clayshale interval averaging about 4.5 meters thick. The limestones are hard and textually range from skeletal wackestones to fossiliferous carbonate mudstones.

 The unit is eventually tructated by the overlying Vamoosa Formation just north of Little Sandy Creek. Total thickness varies from 0 to a maximum of 10 meters.
- NELLIE BLY FORMATION—Consists mostly of clayshale and mudstone interbedded with some prominent sandstones, none of which can be easily separated into mappable units due to their indefinite upper and lower contacts. Sandstones typically indurated to moderately indurated, thin- to medium-bedded, fine-grained quartz arenites that vary in thickness between 6 and 25 meters. Thickness of shale intervals at least half to a quarter of that observed for the sandstone intervals. Base of formation normally mapped at the first prominent sandstone interval above the Francis Formation.

 Unit becomes truncated by the overlying Ada Formation just north of the town of Ada.

Total thickness of formation ranges between 0 and ~35 meters.

- FRANCIS FORMATION—Unit consists predominantly of black to dark gray, very fossiliferous, slightly silty clayshales interbedded with light brown, medium- to coarse-grained, moderately indurated, quartz arenites and local occurrences of limestone- and chert-clast conglomerates. Sandstones tend to be more common in the middle to upper third of the formation. Limestones may occur locally in the upper part of formation, but they do not appear to extend laterally. A more prominent limestone, the DeNay Limestone bed, occurs at the base of the formation. Texturally, it is a distinct yellowish-orange weathering, fossiliferous carbonate mudstone containing abundant crinoid stems. The unit is truncated by the overlying Ada Formation southwest of the town of Ada. Thickness ranges between 0 and 50 meters.
- SEMINOLE FORMATION—Consists of a lower sandstone interval, called the Tulsa Sandstone, and an upper suite of interbedded, laminated, concretionary, silty clayshales, mudshales, and siltstones. The Tulsa Sandstone is approximately 20 meter thick and consists of yellowish-brown, fine- to medium-grained (locally coarse-grained) quartz arenite that is frequently conglomeratic in texture.

 The unit is truncated by the overlying Ada Formation west of the town of Ada. Thickness of the Seminole Formation varies between 0 to 27 meters.
- Phg

 HOLDENVILLE GROUP—The Holdenville is primarily a grayish-green to yellowish-brown weathering, locally fossiliferous, slightly silty claystone to clayshale, interbedded with thin intervals of fine- to very fine-grained quartz arenite and thin beds of whole fossil carbonate mudstone. Two prominent limestones, the Sasakwa and Homer Limestone beds, have been reported ~10 meters below the top, and ~30 meters above the base of the formation, respectively (Tanner, 1956).

 The group forms a featheredge onlap contact between the overlying Seminole Formation and carbonates of the Lawrence uplift, just west of Ada. Thickness ranges from 0 to 55 meters.
- WEWOKA FORMATION—Consists of alternating intervals of shale and sandstone, though shale is the far more dominant lithology.

 Sandstones tend to be weakly indurated, yellowish-brown to reddish-brown weathering, fine-grained, argillaceous quartz arenites. A prominent sandstone interval forming distinct cuestas and escarpments (compared to the flat featureless planes formed on the Holdenville) occurs at the top of the formation, and is correlatable to the Jenks Sandstone of the Tulsa Metro Area.

 Shales are poorly exposed, but where observed are slightly calcareous clayshales and mudshales that are locally fossiliferous.

 Total thickness ~175 meters.
- WETUMKA SHALE—Poorly exposed in quad, mainly a grayish-yellow to yellow-brown weathering, slightly silty, fossiliferous clayshale; very thin beds of friable, argillaceous quartz arenite occur locally in the middle and base of unit.

 Total thickness ranges between 35 to 75 meters.
- CALVIN SANDSTONE—Brownish-gray to medium gray, moderately indurated to indurated, thick- to thin-bedded, argillaceous quartz arenites interbedded with thin intervals (varying from 1 to 3 meters thick) of micaceous mudstone and very silty claystone. Sandstones at top of formation tend to be thicker bedded and more indurated than those found lower in the formation. Shales tend to be more common in the lower half to two-thirds of the formation where they intertongue laterally with the sandstones. Total thickness varies between 65 and 70 meters.
- SENORA FORMATION—Lower two-thirds of formation is a light to moderate brown weathering sandstone interbedded with thin shale intervals. Sandstones are typically thin- to medium-bedded, fine- to occasionally medium-grained, argillaceous, quartz arenites. Shales occur in thin (less than 20 cm thick) intervals within sandstones, and are consistently light gray to maroon colored mudstones.

 Upper third of formation predominantly a brownish-red to maroon mudstone with local interbeds of fine- to very fine-grained quartz arenite. Sandstones tend to be more common in the upper half of this interval.

Total thickness of formation 105 meters.

- STUART SHALE—Unit a reddish-brown to brown weathering, laminated, slightly silty clayshale, with local, thin interbeds of argillaceous, fine-grained quartz arenite. Poorly exposed throughout quad.

 Thickness ~20 meters.
- THURMAN SANDSTONE—Mostly a moderate brown, fine- to medium-grained, locally coarse-grained, slightly argillaceous quartz arenite. Sandstones thin- to medium-bedded with cross-bedding and soft sediment deformation common in upper half of formation. Chert conglomerates are also common at base of most sandstone beds. Laminated shale interbeds, consisting of mudstone, occur but are not common.

Thickness ranges between 25 and 75 meters.

Thickness ranges from 3 to 90 meters.

Thickness averages 65 meters.

Thickness ~ 90 meters.

Total thickness ranges from 125 to 375 meters.

- BOGGY FORMATION—Primarily consists of shale and sandstone, with some thin limestone and coal beds. Shales are bluish, fissile clayshales containing ironstone concretions interbedded with thin, wavy sandstone plates and shaley sandstone. Sandstones are fine-grained, generally brownish or gray, and ferruginous. Members include Bluejacket Sandstone locally at the base, Inola Limestone, and the Taft Sandstone at the top.

 Thickness ranges from 380 to 850 meters.
- Psv SAVANNA FORMATION—Brown to grayish-brown sandstone and shale with several thin coal seams near middle. Sandstone is fine-grained and cherty, and tends to be the more dominant lithology, especially in the upper third of unit.

 Thickness ranges from 340 to 490 meters.
- McALESTER FORMATION—Gray to dark gray clayshale interbedded with fine-grained, buff sandstones and some prominent coal beds.
 Total thickness ranges from 350 to 740 meters.
- Phh

 HARTSHORNE FORMATION—Consists of a prominant gray to white, medium- to coarse-grained sandstone in upper two-thirds of formation, with interbedded gray shale and coal in the lower third of unit.
- Pat

 ATOKA FORMATION—The Atoka Formation consists of medium- to coarse-grained quartz arenite interbedded with black to dark gray, siderite-bearing, fissile clayshales. Sandstones tend to be concentrated in upper third of unit.
- WAPANUCKA FORMATION—Consists of a partly oolitic limestone with interbedded shale and siliceous siltstone. Within the Ouachita Mountain province, formation may include the Chickachoc Chert, an interbedded gray mudshale, medium-grained, argillaceous quartz arenite, and thin, bluish-gray chert beds and nodules. Chert lithology increases to the east to the exclusion of sandstone lithology.
- UNION VALLEY FORMATION—A local formation confined to the area of the Lawrence Uplift. Predominantly a yellowish-brown to medium gray, thin- to medium-bedded, fine- to medium-grained quartz arenite. Upper 4 meters consisting of a light gray to gray, fine- to medium-crystalline limestone.
- Pjf JACKFORK SANDSTONE—Gray, white, and tan, coarse-grained and cherty sandstone with boulders up to 2 meters in diameter.

 Thickness is ambiguous due to fault contacts between younger and older formations.
- SPRINGER GROUP—Medium to dark gray, fissile, slightly silty, locally calcareous clayshale interbedded with two to three fine- to medium-grained, argillaceous sandstones. Includes the Goddard Shale at base. The Goddard Shale is a medium to light gray, noncalcareous, fissile clayshale. Thickness is 1400 meters. In the Ouachita Mountains, the Springer Group consists of slickensided black shale containing septarian concretions and small phosphatic nodules. The presence of cephalopods distinguishes the formation from the underlying Caney Shale.

 Thickness of unit within the Ouachitas ambiguous due to prevalent fault contacts with older formations. Outside of the Ouachitas, group is as much as 1100 meters thick.
- Mst

 STANLEY SHALE—The lower beds of the Stanley Shale are green to buff siltstones and shales. Some of the siltstones contain chert and siliceous cement. Green to greenish-gray shales are present above the lower beds and alternate with siltstones up to 30 meters thick. Blue-gray to black siliceous shales occur throughout the formation and range from 4.5 to 23 meters thick. A red and green clayshale, 4.5 meters thick, occurs in the upper part of the formation. Cone-in-cone structure is common. Conodonts, spores, sponge spicules, and plant material are also present.

 Thickness indeterminable due to fault contacts between other units.
- Mcn

 CANEY SHALE—Within the Arkoma Basin and Cherokee Platform, formation is a dark gray to black, fissile, calcareous clayshale containing large septarian concretions. Within the Ouachita Mountains, the formation consists of slickensided black clayshale, averaging 6 meters thick, Interbedded with intervals of large septarian concretions, small phosphate nodules, and plant material.

 Thickness ranges from 50 to 230 meters in the Arkoma Basin, but is indeterminable due to fault contacts in the Ouachita Mountain province.
- WOODFORD SHALE, SYCAMORE & WELDEN LIMESTONES—The Woodford is a dark gray to black, fissile, siliceous clayshale and bedded chert. Chert tends to be more common in the upper third of unit. The Sycamore and Welden Limestones are nearly indistinguishable from each other and consist of bluish-gray to tan colored, silty carbonate mudstones. The Welden tends to have a greater silica content compared to the Sycamore.

 Combined thickness ranges from 135 to 240 meters, thickening to the south-southwest.
- Oh HUNTON GROUP—Light gray, fossiliferous, carbonate mudstones to grainstones, yellow to buff colored carbonate marlstones, and thin intervals of dark gray, fissile clayshales. Comprised of the Frisco, Bois d'Arc, and Haragan Formations (Devonian); the Henryhouse, Clarita, and Cochrane Formations (Silurian); and the Keel Formation (Ordovician).
- SYLVAN SHALE & VIOLA GROUP—The Sylvan Shale is a yellow to dark greenish-gray, siliceous, fissile clayshale; minor interbeds of fine-grained sandstone and siltstone may occur in the upper part of the shale. The Viola Group is composed of an upper fossiliferous limestone (wackestone to packstone in texture) called the Welling Limestone; and a lower, interbedded, cherty, unfossiliferous carbonate mudstone and fossiliferous wackestone to packstone called the Viola Springs Formation.
- Obtm

 BROMIDE, TULIP CREEK, & McLISH FORMATIONS—The Bromide Formation is predominantly a tan to yellowish-gray, very fossiliferous, whole fossil, carbonate mudstone to packstone, with occasional gray clayshale and very fine-grained sandstone interbeds; clastic material is more common in the upper half of the unit. The Tulip Creek Formation consists of a lower, reddish-brown, weakly indurated, medium-grained sandstone and an upper, olive-green, mudstone to claystone with thin interbeds of limestone. The McLish Formation is similar to the Tulip Creek Formation, having a lower light gray, friable, fine-grained sandstone and an upper greenish-gray clayshale with limestone interbeds.

 Thickness of total interval ranges from 230 to 425 meters.
- Ooj
 OIL CREEK & JOINS FORMATIONS—The Oil Creek Formation consists of a lower white to very light gray, friable to weakly indurated, featureless, fine- to medium-grained sandstone, and an upper interbedded olive-green clayshale and thin-bedded, fossiliferous limestone. The Joins Formation consists of alternating light to medium gray, thin-bedded, fossiliferous limestones with thin intervals of greenish-gray to dark gray clayshale.

 Interval thickness varies from 180 to 335 meters.
- Ows WEST SPRING CREEK FORMATION—Unit is a medium gray carbonate mudstone and intraclastic limestone. The base of the formation locally contains an appreciable amount of quartz sand detritus.

 Thickness ranges between 350 and 600 meters.
- Okn

 KINDBLADE FORMATION—Unit is a medium gray carbonate mudstone and intraclastic limestone similar to the overlying West Spring Creek Formation; however, the Kindblade Formation is usually more locally dolomitized and contains less quartz detritus than the overlying West Spring Creek. The base of the Kindblade Formation not exposed in quad, but consists of poorly bedded algal boundstones.

 Thickness ~550 meters.

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