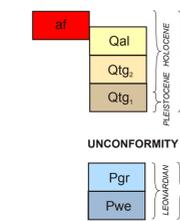


CORRELATION OF MAP UNITS



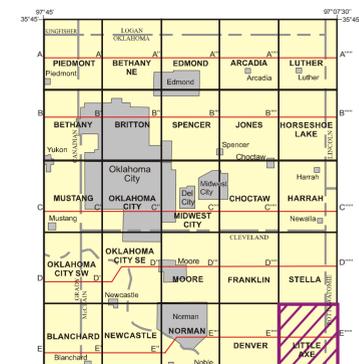
DESCRIPTION OF UNITS

- af** ARTIFICIAL FILL—Natural or artificial slumps, cavings, or talus covering formerly exposed areas. Thickness variable.
- Qal** ALLUVIUM (Holocene)—Clay, silt, sand, and gravel in channels and on modern 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.
- Qtg** REMNANTS OF TERRACE DEPOSITS (Holocene)—Concentrations of distally derived sediment, mostly very light colored, subrounded quartz grains, with minor quartzite pebbles, situated about 15-20 ft above modern flood plains. Thickness: unknown, possibly 0 to about 10 ft.
- Qtg** REMNANTS OF TERRACE DEPOSITS (Holocene and Pleistocene?)—Concentrations of distally derived sediment, mostly very light colored, subrounded quartz grains, with minor quartzite pebbles; sand may also exhibit re-working by aeolian processes into distinct dune structures; base of deposits more than 50 ft above modern flood plains. Thickness: 0 to about 20 ft.
- Pgr** GARBER FORMATION (Permian)—Sandstone, mostly fine-grained to less commonly very fine to medium-fine-grained; appears to be very fine-grained near base; moderate reddish brown (10R4/6), moderate reddish orange (10R6/6), moderate red (5R5/4), light brown (5YR5/6), and dark yellowish orange (10YR6/6); sandstone- and siltstone-pebble conglomerate, siltstone, and shale are rare. Sandstone typically porous and friable, commonly weathers to smooth, rounded outcrops; locally with platy to flaggy to rarely shaly appearance. Locally weathers to hard, dark-colored (grayish black [N2]) beds completely cemented with hematite, calcite, and/or silica. Dark-colored sandstone blocks locally form lag deposit over weathered outcrops. Large- and small-scale crossbeds, trough crossbeds common; many outcrops characterized by inclined beds and channelform deposits, although plane-parallel stratification also presents. Sandstone locally color-banded (e.g., moderate reddish brown [10R4/6], grayish red purple [5R4/2], and grayish yellow green [5GY7/2]) or with mottled appearance. Small calcareous and iron-oxide spherules occur locally on weathered surfaces. Circular iron-reduction spots very rare, except in some shale intervals. Sandstone- and siltstone-conglomerates appears to be diagenetic and may represent incipient paleosol development on a sand. Siltstone and shale sandy, color-banded (e.g., moderate reddish brown [10R4/6] and yellowish gray [5Y7/2]), stratified to unstratified. Typically soft, weathers to "badlands"-type topography. Siltstone and shale contain evidence of paleosol development such as blocky weathering, fracture surfaces marked by small slickensides, and through-going curved fractures. Thickness: about 500 ft, top not exposed.
- Pwe** WELLINGTON FORMATION (Permian)—Interbedded sandstone and shale, with minor siltstone. Shale is moderately to very silty and sandy; moderate reddish brown (10R4/6), moderate red (5R5/4), with local light greenish gray (5GY8/1) streaks; concretions and septarian nodules rare. Sandstone mostly fine- to very fine-grained, moderate orange pink (10R7/4) to moderate reddish brown (10R4/6), moderate reddish orange (10R6/6) to pale red (5R6/2), mostly porous and friable, locally with variable amounts of hematite and calcite cement. Siltstone typically color-banded consisting of pale reddish brown (10R5/4) and light greenish gray (5GY8/1) laminae. Sedimentary structures include large- and small-scale crossbeds, trough crossbeds, locally steeply inclined stratification, and less common channelform features. In places, weathers to "slickrock" appearance.

The Garber-Wellington contact becomes increasingly subjective south of the North Canadian River, and particularly subjective south of Little River. This is due to the increase in frequency of shale intervals at the base of the Garber, coupled with the increase in thickness of sandstone intervals toward the top of the Wellington. Also, the concretionary shales, common in Wellington outcrops north of the North Canadian River, are uncommon in exposures south of the river. As a consequence, the top of Wellington is based on the first occurrence of a thick (greater than 10 ft) Garber-like sandstone interval in conjunction with the last occurrence of a thick shale interval. Thickness: only upper 100-110 ft exposed in quadrangle; overall thickness varies from 670 to 750 ft based on cross section.

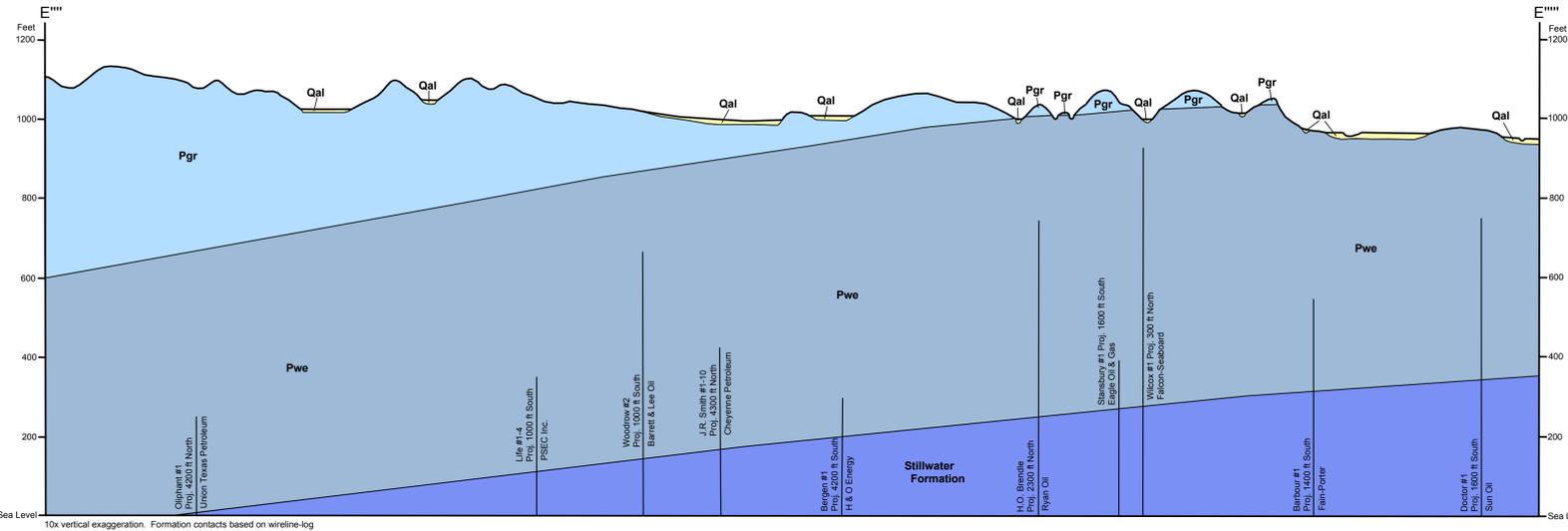
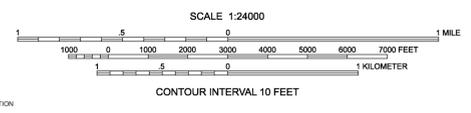
SYMBOLS

- Unit contact; dashed where approximate
- × 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.
- o Municipal water well



Base Map Credits  
The base map was compiled by the U.S. Geological Survey. Topography from aerial photographs by photogrammetric methods taken 1967. Field checked 1958. Revised from aerial photographs taken 1969 and 1975. Universal Transverse Mercator (UTM) projection 1927. North American Datum 1983. Grid and ticks based on Oklahoma coordinate system, south zone, 1,000-meter UTM grid, zone 14.

Geologic Map Credits  
Geology by Galen W. Miller and Thomas M. Stanley, 2003. Assisted by Nicole Bayler and Lori Bryan. Research supported by the U.S. Geological Survey, National Geologic Mapping Program under Award Number G012AG0002. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government. Originally published as Open-File Report OF5-2003. Map revised and published as OGG-35. Cartography and layout prepared by G. Russell Standridge, 2003.



**GEOLOGIC MAP OF THE LITTLE AXE 7.5' QUADRANGLE, CLEVELAND AND POTTAWATOMIE COUNTIES, OKLAHOMA**  
Galen W. Miller and Thomas M. Stanley  
2003