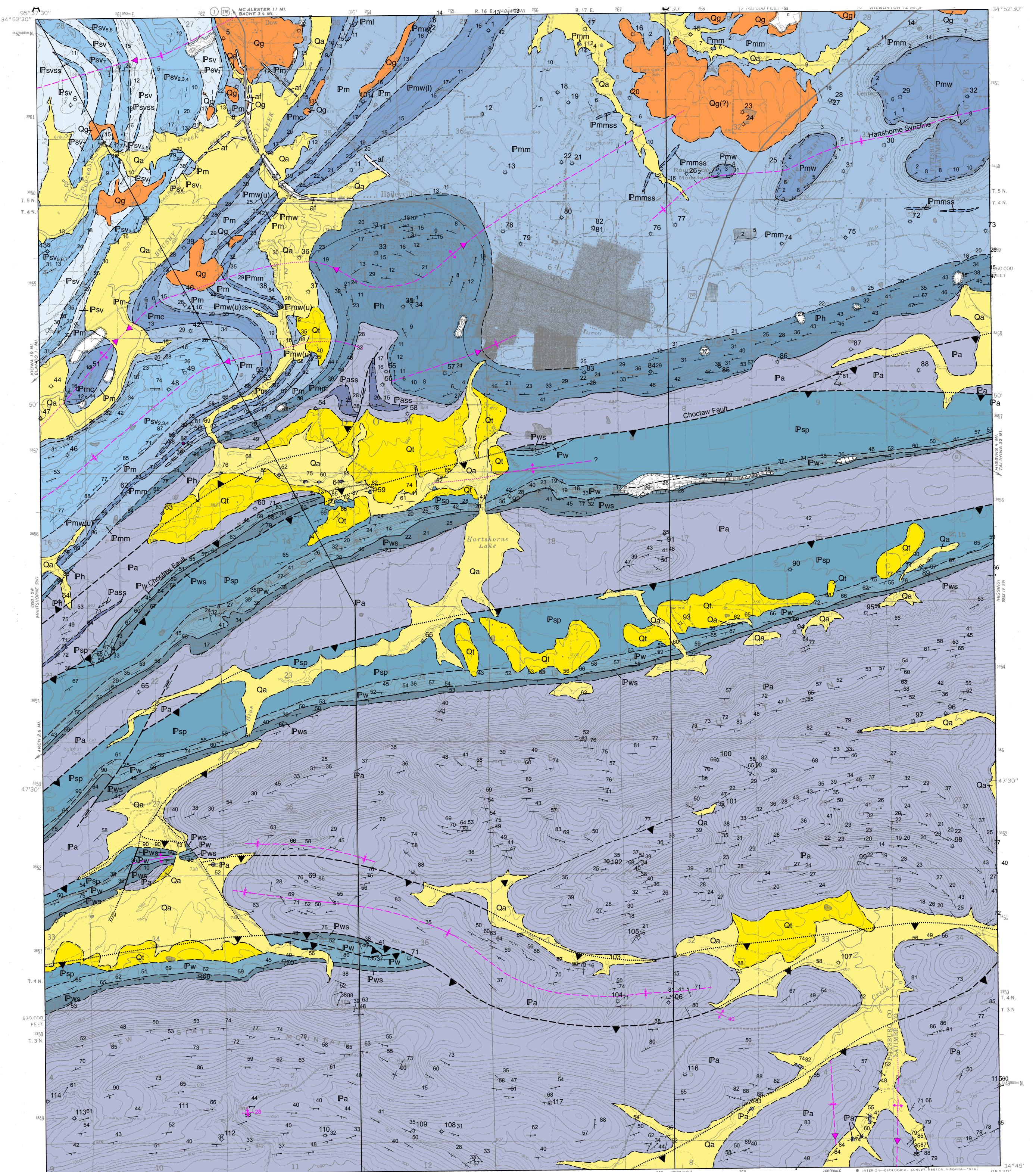


Mapped, edited, and published by the Geological Survey in cooperation with the Oklahoma Highway Department, Oklahoma Water Resources Board, and Oklahoma State Soil Conservation Board

Control by USGS and USC&GS

Topography by photogrammetric methods from aerial photographs taken 1966. Field checked 1967

Polyconic projection. 1927 North American datum
10,000-foot grid based on Oklahoma coordinate system, south zone
1000-meter Universal Transverse Mercator grid ticks, zone 15, shown in blue

Red tint indicates area in which only landmark buildings are shown
Area covered by dashed light-blue pattern is subject to controlled inundation to 597 feet by Eufaula Lake
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND BY THE OKLAHOMA GEOLOGICAL SURVEY, NORMAN, OKLAHOMA 73069
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

Revisions shown in purple compiled from aerial photographs taken 1977. Map edited 1978
This information not field checked
Purple tint indicates extension of urban areas

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U. S. Route — State Route

HARTSHORNE, OKLA.
N3445—W9530/7.5
1967
PHOTOREVISED 1978
AMS 6853 I SE—SERIES V883

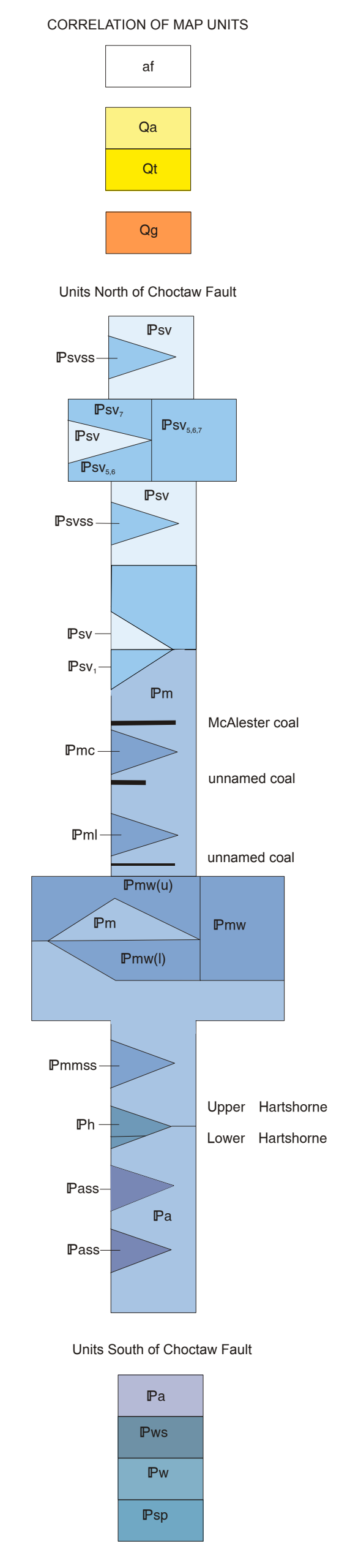
GEOLOGIC MAP OF THE HARTSHORNE 7.5' QUADRANGLE LATIMER COUNTY, OKLAHOMA

By
Neil H. Suneson

Digitized by Jacob Hernandez, 2014

Text

CORRELATION OF MAP UNITS



SYMBOLS

- CONTACT - Dashed where approximately located; queried where uncertain
- THRUST FAULT - Sawteeth on upper plate; dashed where approximately located; dotted where concealed; queried where uncertain
- FAULT - Arrows show relative horizontal movement; dashed where approximately located; dotted where concealed
- ANTICLINE - Showing crestline; arrow shows direction of plunge; dashed where approximately located; dotted where concealed; queried where uncertain
- SYNCLINE - Showing troughline; arrow shows direction of plunge; dashed where approximately located; dotted where concealed
- MINOR ANTICLINE - Showing plunge
- MINOR SYNCLINE - Showing plunge
- MINOR ANTICLINE - SYNCLINE PAIR - Showing plunge
- ▼ COAL EXPOSURE
- TRENCH
- ◪ ABANDONED SHAFT OR DOGHOLE
- SPOIL PILES FROM ABANDONED COAL MINE
- SURFACE QUARRY - Active or abandoned (a)
- STRIKE AND DIP OF BEDS
  - Strike and dip of beds, upright
  - Strike and dip of beds, overturned
  - Strike and dip of beds, facing direction unknown
  - Strike and dip of beds, approximate
  - Vertical beds, ball indicates top of beds
  - Vertical beds, facing direction unknown
- OIL AND GAS WELLS
  - ○ Drilling on December 1,1995
  - ✧ Dry hole, abandoned
  - ☼ Gas well
  - Number on map corresponds to list of wells

DESCRIPTION OF UNITS

af ARTIFICIAL FILL - Material used for road and railroad embankments.

Qa ALLUVIUM (QUATERNARY) - Gravel, sand, silt, and clay on flood plains of present-day streams. Thickness: variable, but generally less than 10 ft where observed.

Qt TERRACE DEPOSITS (QUATERNARY) - Subangular to subrounded cobbles, gravel, sand, and silt on terraces that stand about 10 - 40 ft above the beds of present-day streams. Thickness: variable, but generally less than 40 ft.

Qg GERTY SAND (QUATERNARY) - Unconsolidated gravel, sand, silt, and clay in abandoned river channel found at elevations well above present-day streams. Main constituents of the gravel are rounded cobbles and pebbles of quartz, quartzite, chert, flint, jasper, and silicified wood. In places, siliceous pebbles are scattered on weathered Savanna or McAlester Formation; however, the deposits are too thin to map as Girty Sand. Area mapped as Girty(?) Sand in N1/2 sec. 32, T. 5 N., R. 17 E. consists mostly of reddish sandy soil that contains no siliceous pebbles. Girty Sand present only in northern part of quadrangle. Thickness: variable; forms veneer generally less than 30 ft thick.

Psv SAVANNA FORMATION (PENNSYLVANIAN) - Predominantly olive gray (5Y4/1) to light olive gray (5Y5/2) shale (Psv) with several mappable dusky yellow (5Y6/4) to yellowish gray (5Y7/2) to grayish orange (10YR7/4), fine- to very fine grained, noncalcareous silty sandstone units. In quadrangles to the north and east, seven mappable and relatively continuous sandstone units are recognized (nos. 1 - 7). In this quadrangle, four units are mappable; they are (oldest to youngest) Psv1, Psv2,3,4 (undivided), Psv5,6 (undivided), and Psv7. Locally Psv5,6 and Psv7 are mapped as a single unit (Psv5,6,7). In addition, 2 thin and discontinuous sandstone units (Psvss) are present. The sandstone units are relatively well exposed and locally form ledges and cliffs as much as 15 ft high, but more typically about 3-5 ft high. Locally, individual sandstone beds form "tombstone" topography; in flat fields, sandstone beds are marked by lines of trees. Beds weather to blocks, slabs, and flagstones. Extremely irregular and contorted bedding planes that resulted from soft-sediment deformation are common. Many beds are stratified (plane-parallel, cross-, and wavy-) and ripple-marked. Less common sedimentary features include shale rip-up clasts, dish-and-pillar structures, hummocky cross-stratification, and channels. Casts and compressions of *Catamites* and *Stigmaria* are rare. The sandstones are quartzose but locally contain conspicuous feldspar and oxidized iron minerals as well as trace amounts of mica and carbonized plant material. Psvl; Psv2,3,4; Psv5,6; and Psv7 are mapped as single units, but generally contain siltstone and shale beds of varying thicknesses. Shales in the Savanna Formation are very poorly exposed. Where observed, they are sooty, organic-rich, silty, and contain iron-stained concretions as long as 18 in. The shales typically exhibit spheroidal to flaky weathering. Burrows 1 in. in diameter and as long as 1 ft are present locally. Most of the shales contain thin, unmappable sandstone and siltstone beds. The Savanna Formation is present only in the northwest part of the quadrangle. The lower part (Psv1 and Psv immediately overlying Psv1) appears to thin near and southeast of Craig. Thickness: 1700 ft.

Pm McALESTER FORMATION (PENNSYLVANIAN) - Consists of 4 named members including (oldest to youngest): McCurtain Shale (Pmm), Warner Sandstone (Pmw), LeQuire Sandstone (Pml), and Cameron Sandstone (Pmc). The Warner Sandstone Member is locally divided into lower (Pmw(l)) and upper (Pmw(u)) units. Unnamed shale labelled Pm separates the named sandstones above the lower Warner Sandstone Member where it is present. Where the lower Warner Sandstone Member is absent, the McCurtain Shale Member extends to the base of the upper Warner Sandstone Member. The McAlester Formation is present only in the northern part of the quadrangle.

The McCurtain Shale Member (Pmm) is predominantly poorly exposed olive gray (5Y3/2 to 5Y4/1), laminated, spheroidally weathering, silty shale. Ironstone concretions and trace fossils are present but uncommon. Carbonized plant material locally occurs on bedding planes. Includes platy, locally calcareous, 20-ft-thick fine-grained sandstone in C S1/2 sec. 30, T. 5 N., R. 17 E. A poorly exposed, discontinuous, unnamed but mapped (Pmmss) sandstone is locally present in the McCurtain Shale in the northeast part of the quadrangle. Thickness: 950 ft in eastern part of quadrangle, thins to about 300 ft in western part of quadrangle southeast of Craig.

The Warner Sandstone Member (Pmw) is predominantly a relatively well exposed grayish orange (10YR7/4) to yellowish gray (5Y7/2), fine- to very fine grained, noncalcareous silty sandstone. Beds typically weather to slabs or flagstones and less commonly equidimensional blocks. Individual sandstone beds vary from less than 1 to over 5 ft thick and occur as isolated beds separated from others by covered intervals that are probably shale and siltstone to stacked beds forming cliffs as high as 40 ft. Both isolated and stacked beds locally show pronounced lenticularity and thickening and thinning. Ripple marks, cross-stratification, and wavy bedding characterize most beds; some beds are unstratified, show plane-parallel stratification, and/or soft-sediment deformation features. Small amounts of mica, feldspar, and carbonized plant debris are present. Although mapped as a single unit, the Warner Sandstone Member (Pmw, Pmw(l), Pmw(u)) consists of several moderately continuous to discontinuous sandstone beds separated by covered intervals. The Warner Sandstone Member (Pmw) in the northeast corner of the quadrangle locally is medium-fine-grained, exhibits large-scale low-angle hummocky(?) cross-stratification, and locally contains channelform deposits. It may be equivalent to the lower Warner Sandstone Member (Pmw(l)) in the northwest part of the quadrangle. Thickness: Pmw - 60 ft; Pmw(l) - 225 ft in north, thins to 0 to southwest about 1 mi southeast of Craig; Pmw(u) - 130 ft; entire Warner Sandstone Member interval including shale (Pm) between upper and lower units - 600 ft in north, thins to 350 ft to southwest about 1 mi southeast of Craig.

The LeQuire Sandstone Member (Pml) is a poorly exposed silty sandstone and siltstone present only in the extreme northern part of the quadrangle immediately west of Dow Lake. Thickness: 40 ft, thins to 0 to south.
The Cameron Sandstone Member (Pmc) is a relatively well exposed, yellowish gray (5Y7/2) to dusky yellow (5Y6/4), very fine grained silty sandstone that typically weathers to flagstones that are ripple marked. Individual outcrops vary from isolated 1- to 2-ft-thick sandstone beds to stacked sandstones 30 ft thick. Although mapped as a single unit, the Cameron Sandstone Member includes covered intervals that separate sandstone beds and are probably shale and siltstone. Locally, the Cameron Sandstone Member weathers to blocks or slabs. Cpmmpn sedimentary structures, in addition to ripple marks, include cross-stratification and wavy beds; lenticular bedding (pinch and swell) and soft-sediment deformation features are rare. Most of the unit is noncalcareous; calcite cement is present in an outcrop about 300 ft east of the pond in the C E1/2 sec. 10, T. 4 N., R. 16 E. Thickness: 200 ft.

Shale in the McAlester Formation (Pm) is predominantly olive gray (5Y3/2 to 5Y4/1) to olive black (5Y2/1) silty shale that contains abundant thin siltstone beds. The shale typically weathers to thin flakes or chips and locally contains iron-oxide stained concretions and carbonized plant debris. The unit is noncalcareous except for a single calcite-cemented 6-in-thick sandstone bed about 500 ft south of the pond in the C E1/2 sec. 10, T. 4 N., R. 16 E. The shale in the McAlester Formation contains three coal beds. An unnamed coal about 10" thick about 50 ft above the top of the upper Warner Sandstone Member probably extends at least from west of Haileyville to east of Dow Lake. An unnamed coal 3 in. thick is exposed immediately below the Cameron Sandstone Member in the railroad cut in the NW1/4 sec. 35, T. 5 N., R. 16 E. The youngest coal in the McAlester Formation is the McAlester coal. It occurs about 200 ft above the top of the Cameron Sandstone Member along the north edge of the quadrangle and about 50 ft above the Cameron Sandstone Member immediately east and southeast of Craig. The coal has been extensively mined and large spoils piles occur east and southeast of Dow and east and southeast of Craig.

Thickness of McAlester Formation: 2000 ft near Haileyville, thins to about 1400 ft 1.5 mi south of Craig.

Ph HARTSHORNE FORMATION (PENNSYLVANIAN) - Predominantly grayish orange (10YR7/4) to dark yellowish orange (10YR6/6) to yellowish gray (5Y7/2), fine-grained, silty, highly ripple-marked, mostly thin-bedded (1 in. to 6 in.), relatively well exposed, noncalcareous sandstone interbedded with poorly exposed, platy-weathering siltstone and shale. Outcrops form 1/2- to 2-ft-thick tombstone topography and ledges 2 to 10 ft high; outcrops more than 10 ft high are rare. The formation is characterized by sandstone outcrops separated by covered intervals that probably overlie shale and siltstone. Ridges underlain by the Hartshorne Formation are typically littered with slabs and flagstones; near the C SW1/4 sec. 3, T. 4 N., R. 17 E., flagstones from the Hartshorne Formation were quarried to line ditches in the town of Hartshorne. Some sandstone beds are continuous for hundreds of ft; others show pronounced lenticularity and thickening and thinning. Ripple marks are ubiquitous; other common sedimentary structures include wavy bedding, trace fossils, and large- (1 to 4 ft) and small- (inches) scale cross-stratification. The sandstone is quartzose and typically contains rare mica. Iron oxide generally coats individual grains. Carbonized plant debris locally occurs on bedding planes. The upper part of the Hartshorne Formation (above the Lower Hartshorne coal) in the eastern half of the quadrangle consists of thick-bedded sandstone that typically is exposed in a dipslope. It is typically ripple-marked, unstratified, and has extremely irregular bedding planes. The Hartshorne Formation contains two named coal beds - the Lower and Upper Hartshorne coals. Numerous inclined shafts and spoils piles mark the Lower Hartshorne coal in the eastern half of the quadrangle. The Lower Hartshorne coal has also been extensively mined underground. A series of trenches, dog holes, and spoils piles marks the former surface location of the Lower Hartshorne coal in much of the western half of the quadrangle. The Upper Hartshorne coal was not identified in the eastern half of the quadrangle or in Haileyville. The Upper Hartshorne coal is marked by trenches in the NE1/4 sec. 11, T. 4 N., R. 16 E. The Lower Hartshorne coal in the east half of the quadrangle is about 4 ft thick and the Upper Hartshorne coal in the west half is about 3 to 5.5 ft thick (Hendricks, 1937, p. 52-53). The base of the Hartshorne Formation appears to be a disconformity. Thickness: about 1000 ft, thins to 0 about 1.5 mi south of Craig.

Pa ATOKA FORMATION (PENNSYLVANIAN) - North of Choctaw fault, predominantly very poorly exposed, grayish black (N2) to olive gray (5Y3/2), slightly silty, fissile to platy, mostly noncalcareous shale. Locally weathers spheroidally, contains sparse ironstone concretions, and is slightly calcareous. Typically contains thin (about 1 in.) siltstone beds and much less common sandstone beds; the thicker, mappable sandstone beds are labelled Pass. Sandstone beds in the Atoka Formation north of the Choctaw fault are poorly exposed, medium light gray (N6) to light olive gray (5Y6/1) to dusky yellow (5Y6/4) and interbedded with siltstone and shale. They are uniformly finegrained but contain a wide variety of weathering characteristics and sedimentary structures. Outcrops weather to blocks, slabs, and flagstones; individual beds vary from unstratified to parallel- to cross-stratified; large- and small-scale cross-stratification is present locally, as are soft-sediment deformation features and dish-and-pillar structures. Ripple marks and trace fossils are present locally. The sandstones are generally quartzose and contain mica; carbonized plant debris is present on some bedding planes. Most of the sandstone beds are noncalcareous, but some contain calcite. The Atoka Formation exposed north of the Choctaw fault probably represents the uppermost part of the formation. Maximum thickness exposed north of Choctaw fault: about 2000 ft, but difficult to determine due to complicated and poorly exposed structure.

South of Choctaw fault, predominantly very poorly exposed medium dark gray (N4) to light olive gray (5Y5/2) noncalcareous, fissile to platy, laminated shale with thin (mostly less than 4 in. thick) sandstone and siltstone beds. Shale locally contains ironstone concretions. Sandstone and siltstone beds typically represent Bouma Ted or Td sequences. Shale characterizes extreme lower part of Atoka Formation immediately over the Spiro sandstone; most of Atoka —— Formation higher in the section probably consists of 80% shale. Most outcrops of Atoka Formation are poorly exposed, moderate yellowish brown (10YR5/4) to grayish orange (10YR7/4) to dusky yellow (5Y6/4), noncalcareous sandstone beds that rperesent partial, repeated, and truncated Bouma sequences similar to those deposited from turbidity currents as well as unstratified sandstones similar to those deposited by mass-flow processes. Sandstone outcrops vary from walls to ledges to tombstone topography; in many places, dipslopes form extensive outcrops in which only the top of a single bed is exposed. Outcrops typically weather to slabs and flagstones. Strata occur as individual beds overlain and underlain by shale or separated by covered intervals or as stacked, amalgamated beds as thick as 30 ft. Sedimentary structures include parallel-, cross-, and wavy-stratification, dish-and-pillar structures, convolute stratification caused by soft-sediment deformation, and ripple marks. Sole marks such as trace fossils, load coasts, and flute and groove casts are common. The sandstones are silty, fine-grained, and quartzose with sparse feldspar and mica; color variation is caused by differences in the amount of iron oxide coating on sand grains. Carbonized plant debris, including *Calamites* stems as long as 8 in., locally occurs on bedding planes. A single, distinctly coarser (medium-grained) sandstone bed is present near C NW1/4 sec. 7., T. 3 N., R. 17 E. Also, calcareous sandstone beds are present in C NW1/4 NW1/4 sec. 10, T. 3 N., R. 17 E. and in the C W1/2 SE1/4 sec. 24, T. 4 N., R. 16 E. (float only). The Atoka Formation south of the Choctaw fault represents the lower and middle parts of the formation; the top is eroded. Maximum thickness exposed south of Choctaw fault: about 7600 ft.

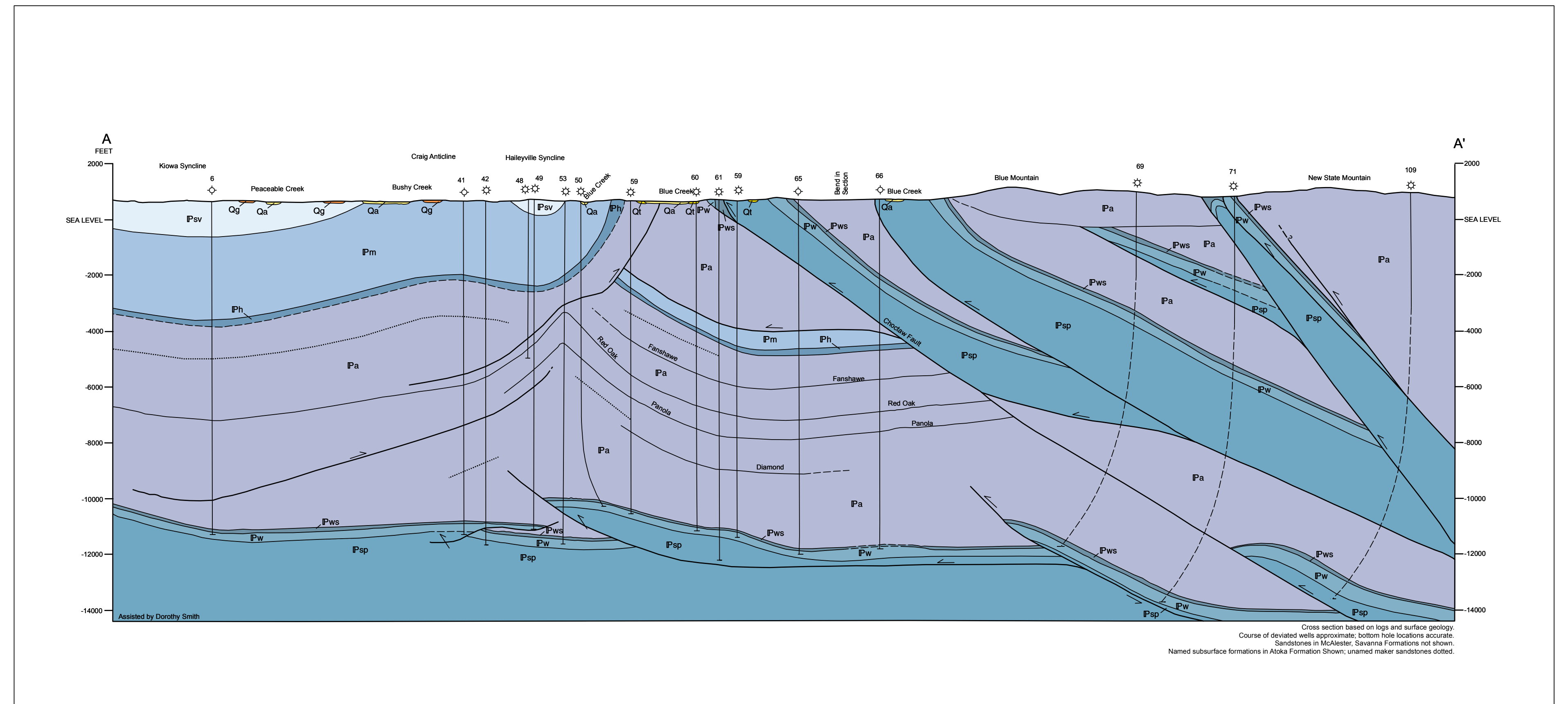
Pws SPIRO SANDSTONE (PENNSYLVANIAN) - Predominantly dark yellowish orange (10YR6/6) to grayish orange (10YR7/4) to moderate orange pink (5YR8/4), more rarely dark gray (N3) to medium light gray (N6), well-exposed, fine-grained, quartzose sandstone. The upper part of the unit also includes common spiculitic siltstone and spiculite, particularly in northern two outcrop belts, and limestone similar to the Wapanucka Limestone in all but the northern outcrop belt; and uncommon siliceous shale and/or chert in the middle outcrop belt. Outcrops vary from slopes covered with slabs and flagstones to long, low tombstone-like outcrops separated by covered intervals (probably shale) to low ledges to near-vertical walls as high as 40 ft. Spiro sandstone outcrops vary from 1 to several tens of ft thick and vary from hard and brittle to soft and vuggy. Sedimentary structures vary from laminated to parallel-stratified to cross- and wavy-stratified to large-scale crossbedded. Locally, beds pinch and swell; ripple marks, load casts, and trace fossils are rare. Channelform deposits are uncommon. In general, the sandstone beds consist mostly of moderately well-rounded quartz grains coated with yarying amounts of iron oxide. Glauconite, fossils (especially crinoids and brachiopods), and fossil molds are uncommon. In general, the sandstone is noncalcareous; rarely, however, calcite cement is present. Porosity is generally moderate. Hand specimens of spiculitic siltstone and spiculite are well-stratified ("wispy") and weather to a "spongy" appearance. Measured sections of the Spiro sandstone are described by Hinde (1992). The Spiro sandstone is generally separated from the underlying Wapanucka Limestone by a rarely exposed shale interval of varying thickness, but typically on the order of tens of ft thick. Where possible, the contact between the Spiro sandstone and Wapanucka Limestone is drawn on the lowest Spiro sandstone outcrop. Thickness of Spiro sandstone: varies greatly; about 20 ft or less (e.g., C S1/2 sec. 10, T. 4 N., R. 17 E.,) to about 300 ft (NE1/4 sec. 18, T. 4 N., R. 17 E.)

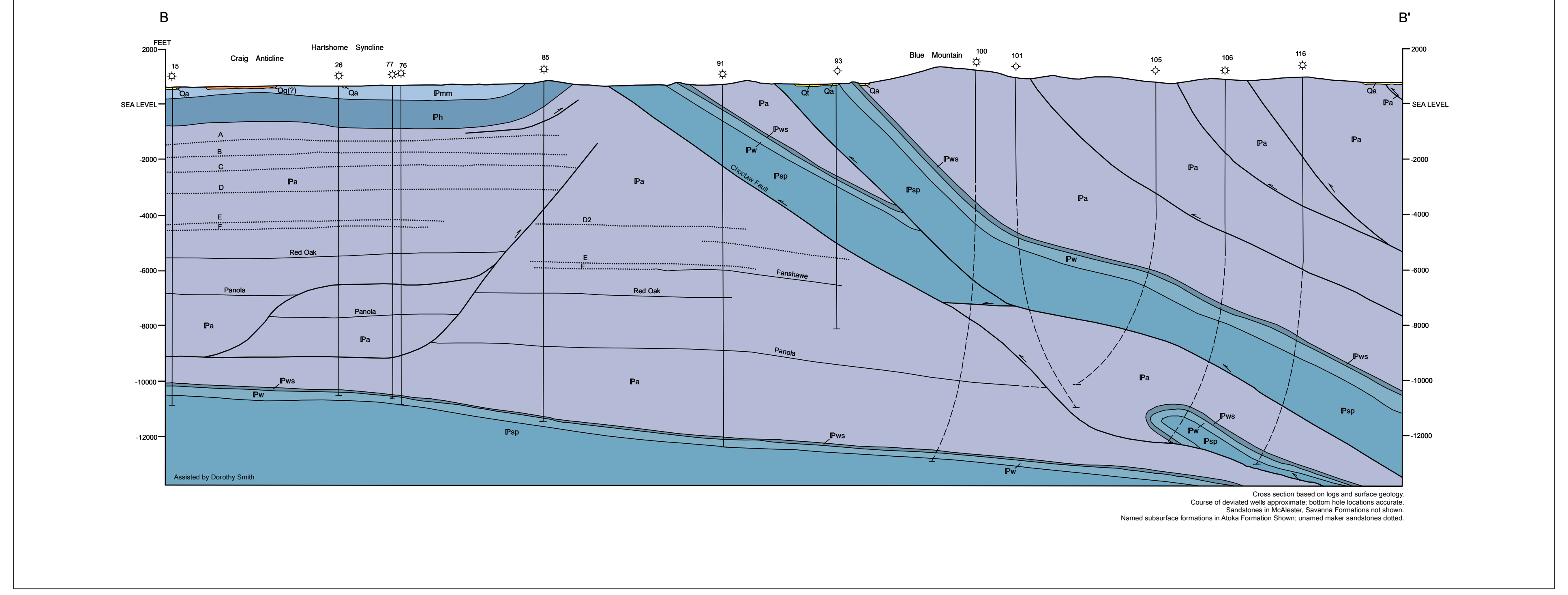
Pw WAPANUCKA LIMESTONE (PENNSYLVANIAN) - Predominantly medium gray (N5) to medium dark gray N4) to pale yellowish brown (10YR6/2), moderately well exposed, irregularly bedded limestone. Most common type of limestone is finely crystalline micrite; bioclastic limestone is less common; coarsely crystalline, sandy, spiculitic, and oolitic varieties of limestone are rare. Very rare rock types that are mapped as part of the Wapanucka Limestone include shale, spiculite, sandstone similar to that in the Spiro sandstone, and marlstone. Irregularly shaped masses of chert are common in the micrite. Outcrops of Wapanucka Limestone weather to flagstones, blocks, and boulders and locally form tombstone topography, ledges, and cliffs. Covered intervals are common and probably overlie shale. Individual beds vary from unstratified to medium-bedded (inches) to rarely finely laminated. Wavy beds, cross beds, and pinch-and-swell structures are rare. Fossils, locally replaced by sparry calcite, range from absent in some micrites to abundant in the bioclastic limestones. Crinoids are most common, brachiopods are uncommon, and coral fragments were observed in one outcrop. Some of the limestone has a slightly petroliferous odor. Fractures are typically filled with calcite. Detailed measured sections of the Wapanucka Limestone have been described by Grayson (1980). The Wapanucka Limestone is separated from the overlying Spiro sandstone by a very poorly exposed shale that is of variable thickness, but generally tens of ft thick. Where possible, the contact between the Wapanucka Limestone and Spiro sandstone is drawn at the top of this shale. Thickness of Wapanucka Limestone: about 150 ft to 600 ft.

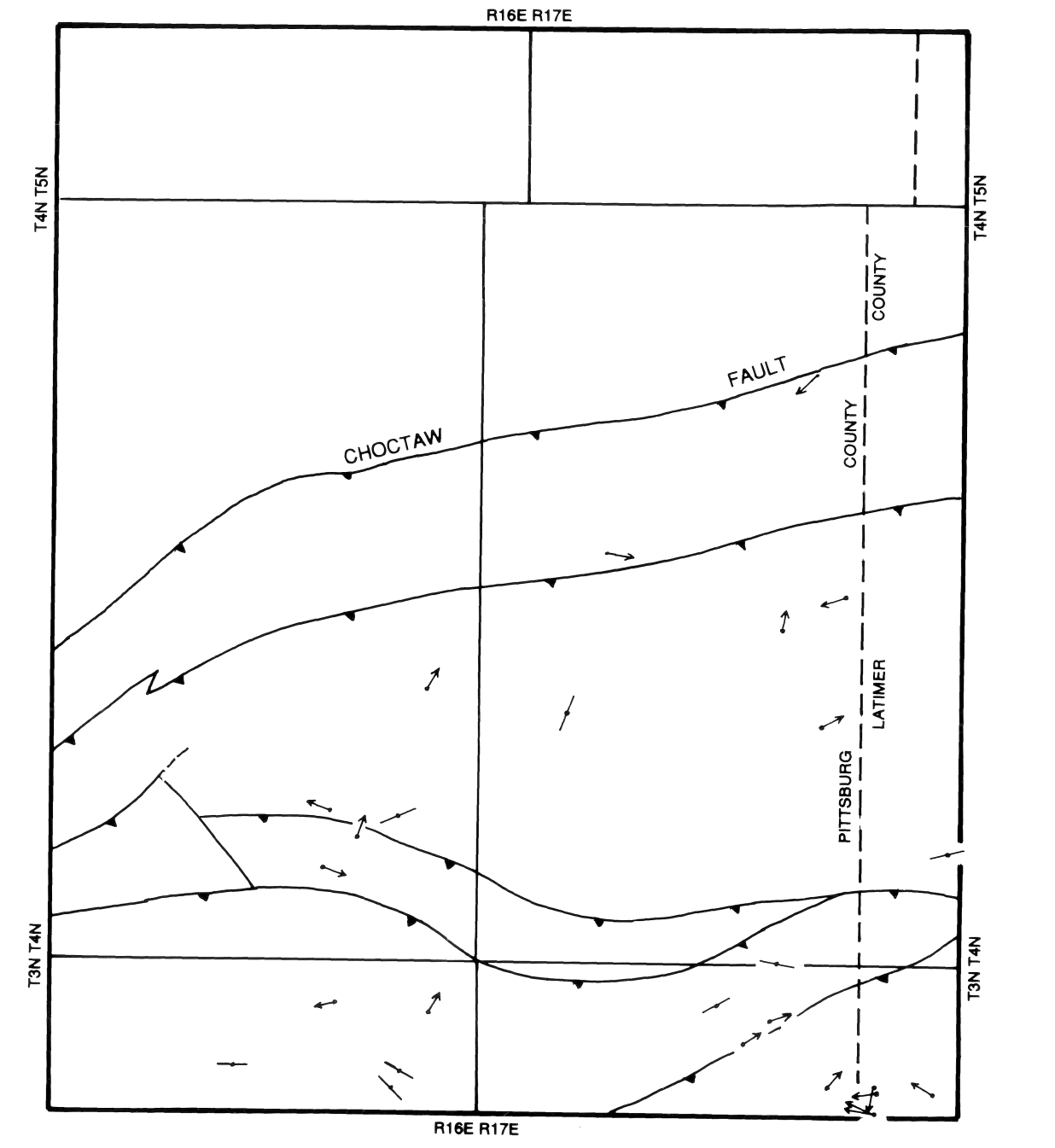
Psp “SPRINGER" FORMATION (PENNSYLVANIAN) - Predominantly very poorly exposed olive gray (5Y3/2 - 5Y4/1) to dark gray (N3), silty, slightly calcareous to noncalcareous fissile shale. Unit includes uncommon, but relatively well-exposed sandstone and limestone beds. Shale generally weathers to small chips or flakes. Locally contains ironstone concretions and rarely ironstone-filled tubes about 1 in. in diameter and several inches long that resemble burrows. Shale interbedded with thin siltstone beds that locally are calcareous, pinch and swell, and contain burrows. Uncommon sandstone beds are medium gray (N5), up to about 1 ft thick, stratified, calcareous, and contain trace fossils and conspicuous grains of glauconite. Limestone beds in the "Springer" Formation range from about 1 in. to 15 ft thick, weather to slabs and flagstones, and are medium dark gray (N4) to medium gray (N5). The texture varies from coarsely crystalline to bioclastic; some limestone beds are sandy and contain conspicuous glauconite. Crinoid and brachiopod fragments are the most common fossils. The best exposures of the limestone beds are in the S1/2 NE1/4 NW1/4 sec. 13, T. 4 N., R. 16 E. and southeast corner NE1/4 SW1/4 sec. 14, T. 4 N., R. 16 E. These limestone beds are about 100 ft below the base of the Wapanucka Limestone. Maxiumum thickness: 1550 ft, possibly as much as 2100 ft.

LIST OF WELLS SPUDDED BEFORE DECEMBER 1, 1995

OPERATOR, NUMBER, FARM NAME	SPUD DATE	TOTAL DEPTH
1. Marathon 1 Mass	9/5/72	10,471’
2. Marathon 3-25 Mass	9/3/88	6,850’
3. Marathon 4 Mass	10/21/94	11,000’
4. Vastar 2 King	4/7/95	7,260’
5. Atlantic Richfield 1 U.S. Government 27	11/13/71	9,725
6. Davis 1 Payne	6/14/82	12,000’
7. D-Pex 1 Aimerito	5/26/89	10,657’
8. Headington 1 Marcangeli	2/16/73	10,883’
9. Daniel-Price 1 Nelson	1/31/88	7,385’
10. Daniel-Price 1 City of Haileyville	7/14/86	11,302’
11. Amoco 1 -35 USA	4/10/72	10,800’
12. Marathon 1 Woods Prospect	11/3/79	11,404’
13. Marathon 2 Woods Prospect	11/28/86	11,829’
14. Vastar 5-28 USA	11/7/95	Drg
15. Arco 2 Bowman]	5/28/88	11,458’
16. Atlantic Richfield 1 Richards I	2/10/69	11,105’
17. Atlantic Richfield 2 Richards	9/21/75	6,385’
18. King 1-31 Pettit	12/2/69	10,460’
19. Arkoma 4 Pettit	1/14/88	6,808’
20. King - Tipco 1-31 Pettit	12/2/69	10,469’
21. Arkoma 2 Pettit	1/15/85	7,009’
22. Arkoma 3 Pettit 1	6/9/87	12,025’
23. Sunray DX 1 -A Casteel	4/27/68	11,490’
24. Sunray DX Casteel 1	1/14/68	11,325’
25. Oryx 3 Casteel A	8/19/95	WOR
26. Sun 2 Casteel	5/12/88	11,163’
27. Tipco 1 Jordan i	5/16/69	9,305’
28. Arkoma 2 Potichny	11/5/83	10,966’
29. Arkla 1-33 Ark Hare	6/25/92	12,300’
30. King - Tipco 1-33 Potichny I	10/17/69	11,230’
31. Arkoma 3 Potichny	12/16/86	11,945’
32. Marathon 2 Slaughter	11/15/86	12,098’
33. King1-34Whitney	12/13/68	11,354’
34. Marathon 1-1 Slaughter	7/5/73	10,791’
35. Marathon 4 Slaughter	4/22/95	7,760’
36. Marathon 2 Madden	8/27/87	11,968’
37. Marathon 1-2 Madden	11/3/73	10,595
38. Marathon 3 Madden	11/24/95	Drg
39. Headington 1 Maddux	5/16/74	11,750’
40. Ruby-Ann et al 1 George	3/1/32	1,282’
41. Pan American 1 Smallwood B	11/28/64	7,595’
Hadson 1-3 Smallwood	4/30/80	11,975’
42. Whitmar 2-3 Smallwood	1/29/82	12,400’
43. Texaco 1 -4 Camp	7/22/88	12,820’
44. Texas Oil and Gas 1 Roso	9/19/78	7,600’
45. C.W. Mcllhenny 1 Tribal Choc-Chic	11/12/41	1,655’
46. TXO 1 James	10/27/82	6,950’
47. Public Service Co. of Oklahoma 3 Choc-Chic Nations	8/11/43	1,272’
48. Pan American 1 Smallwood	8/9/63	11,852’
49. Samson 3-10 Smallwood	10/21/92	6,589’
50. Amoco 2 Smallwood	11/9/85	11,027’
51. Public Service Co. of Oklahoma 2 Thomas	12/19/41	1,400’
52. Marathon 2-11 Needham	8/4/87	12,350’
53. Marathon 3-11 Needham	4/10/88	4,850’
54. Marathon 1-11 Needham	10/31/72	11,266’
55. W.P. Lerblance Jr. 2-12 Lewis	12/1/75	6,802’
56. Marathon 3 Lewis	6/8/87	12,642’
57. Marathon 4-12 Lewis	1/4/95	13,072’
58. Marathon 1-12 Lewis	8/27/73	11,523’
59 Whitmar and Geodine 1-13 Cope	1/30/79	12,100’
60. Marathon 1-14 Needham	9/19/73	11,856
61. Samson 1 Tex	6/15/85	13,000’
62. Slawson 1-15 Lynn	12/14/86	11,179’
63. Marathon 1-15 Lynn	2/16/74	11,690’
64. Texaco 16-1 Sherrill	5/26/89	12,600’
65. Apexo 1 Spahn	8/7/74	12,709’
66. Andover24-1 Lynn	7/24/81	12,539’
67. Union Texas 1-33 Bond	5/14/82	9,732’
68. Exxon 1 Garrett B	2/22/90	12,830’
69. Texaco 26-1 Thrust Belt	8/18/93	13,420’
70. Texaco 35-1 Dromgold D	9/19/90	14,729’
71. Texaco 36-1 Silva	6/27/90	15,300’
72. King 1-3 Layden	3/14/69	11,890’
73. Arkoma 1 Sparks	11/30/86	11,762’
74. Tipco 1-4 Stine	8/1/70	11,010’
75. Arkoma 2 Stine	8/22/85	11,702’
76. Arkoma 2 Rock Island	12/21/86	11,550’
77. Tipco 1-5 Rock Island	5/16/70	11,226’
78. Arkoma 3 Hartshorne	12/26/86	10,850’
79. Arkoma 2-6 Hartshorne	6/20/83	7,000’
80. JMC 1 Belusko	1/5/89	11,415’
81. Tipco 1-6 Hartshorne	8/16/71	11,050’
82. Arkoma 4 Hartshorne	2/7/88	6,500’
83. Amoco 1-7 Rock Island	2/8/72	11,549’
84. Tipco 1-8 Rock Island	5/2/71	11,895’
85. Arkoma 2 Rock Island	7/3/87	12,220’
86. Mustang 1-9 Sweet	9/24/77	12,560’
87. Arkoma 1 Alexander	8/3/87	12,450’
88. Unit 1 PSO	6/7/80	13,300’
89. Continental 1 Wallace 15	6/5/74	7,647’
90. Continental 1 Wallace 16	2/3/74	8,192’
91. Continental 1 Wallace 17	12/27/71	13,066’
92. TXO 1 Wright	1/19/85	12,700’
93. Continental 1 Sparks 20	10/1/74	8,828’
94. Texaco 21-1 Wallace	12/6/88	13,694’
95. Tide West 1-16 Wallace	11/20/91	13,753’
96. JMC 1 Blue Mountain	8/7/90	14,000’
97. Texaco 21 -2 Wallace	6/8/94	14,460’
98. Amoco 1 Patterson	10/26/88	16,000’
99. Texaco 28-1 Manuel Rudy	12/26/89	13,591’
100. Amoco 1 Tomlin	10/24/89	14,087’
101. Texaco 29-1 Manuel Rudy B	4/15/90	14,335’
102. Exxon 1 Ellis Rudy	9/22/89	14,600’
103. Barrett 2 Davis Elliot	10/20/95	Drg
104. Exxon 1 Davis Elliot	5/3/89	15,080’
105. Zinke & Trumbo 1 -30 Blue Mountain	7/18/91	13,465’
106. Amoco 1 Zipperer	3/4/88	13,497’
107. Exxon 1 H&H Cattle Co. GU A	1/7/89	14,518’
108. Texaco 1 -2 Szenasy	11/23/92	13,620’
109. Exxon 1 Szenasy 1	4/30/89	15,000’
110. Amoco 1 Garrett A	12/31/87	15,047’
111. Amoco 2 Tschappat	11/10/95	Drg
112. Amoco 1A Tschappat	3/17/89	14,497’
113. Arco 1 Dromgold	3/15/89	14,600’
114. Texaco 4-2 Dromgold	4/3/93	14,047’
115. An-Son 1-3 Watts	4/13/91	15,110’
116. Anadarko 1-5 Watts	3/6/91	14,500’
117. Amoco 1 Watts	1/11/90	13,200’

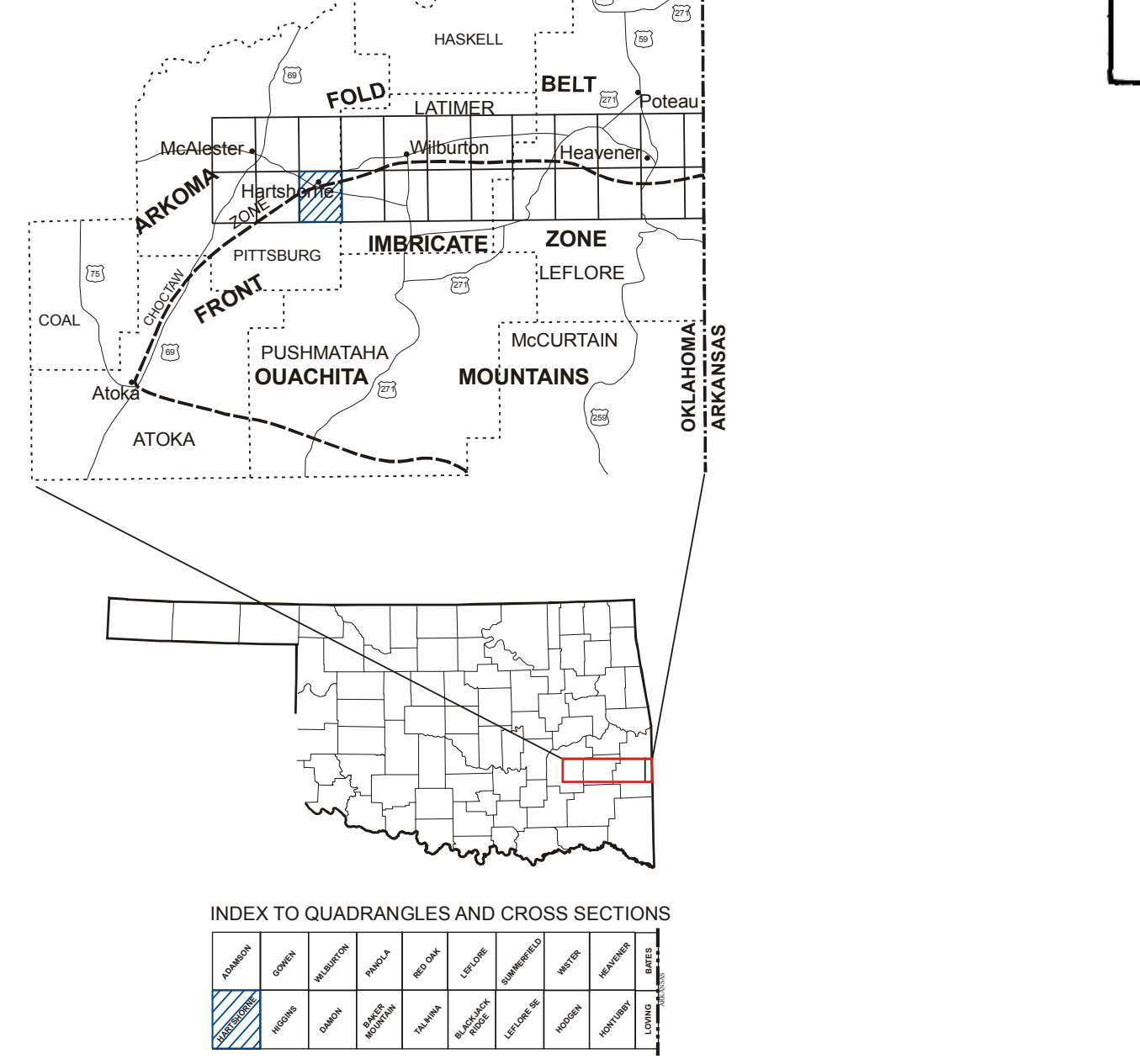




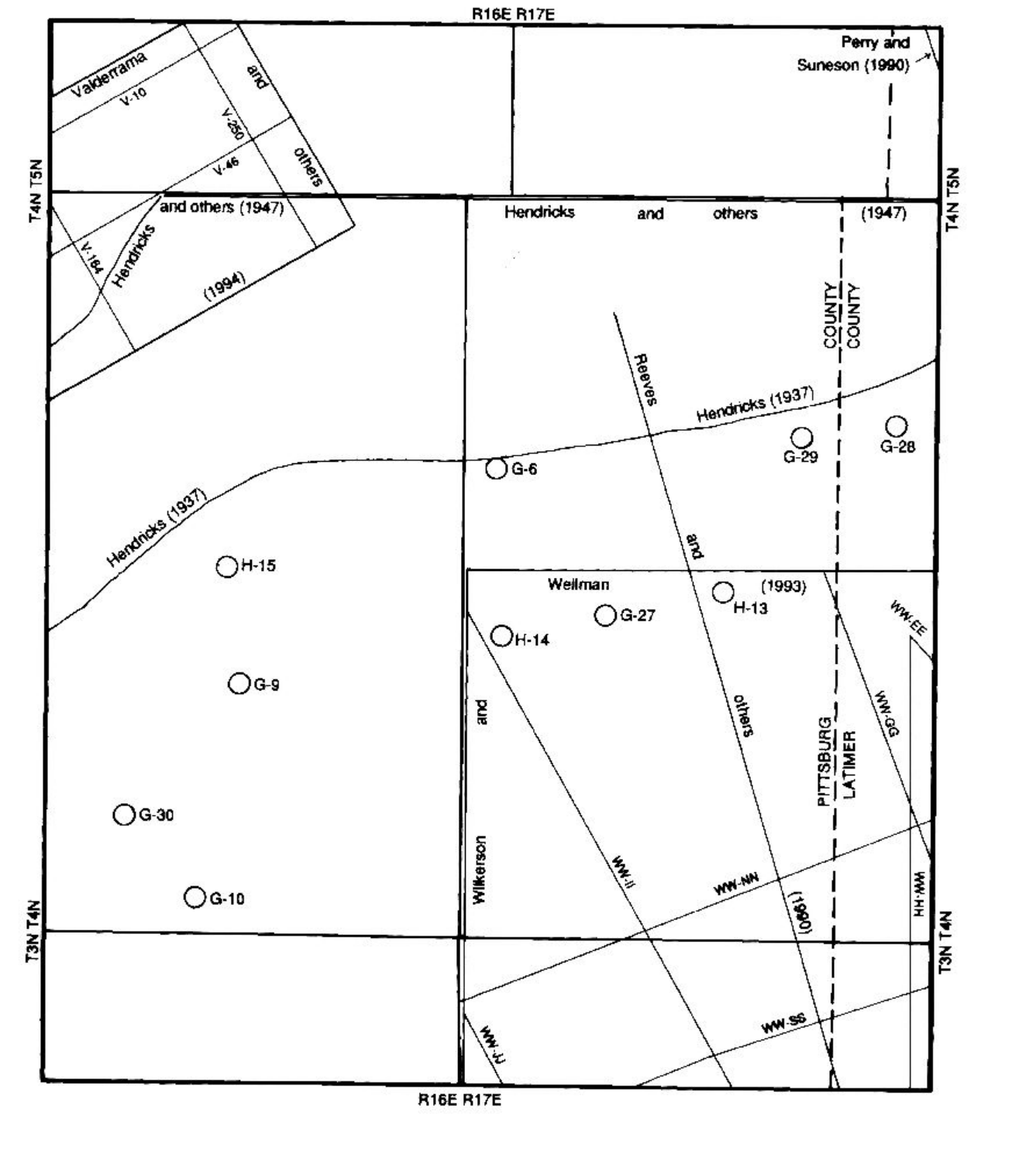


MAP OF PALEOCURRENT DIRECTIONS IN ATOKA FORMATION SOUTH OF CHOCTAW FAULT (SINGLE ROTATION ABOUT STRIKE)

Arrows indicate bearings based on flute casts; lines indicate azimuths based on groove casts; dot indicates point of measurement. Major faults shown.



INDEX TO QUADRANGLES AND CROSS SECTIONS



MAP OF PREVIOUS GEOLOGICAL AND GEOPHYSICAL STUDIES OF THE HARTSHORNE QUADRANGLE

Surface studies include geologic map of Arkoma Basin north of Choctaw fault by Hendricks (1937) and of Ouachita Mountains and southern part of Arkoma Basin by Hendricks and others (1947). Locations of Grayson's (1980) measured sections of the Wapanucka Limestone are shown with prefix G. Hinde's (1992) measured sections of the Spiro sandstone are shown with prefix H. Cross sections based on seismic data include Reeves and others (1990) and Perry and Suneson (1990). The subsurface geology of the southeast corner of the quadrangle was mapped by Wilkerson and Wellman (1993) based on closely spaced seismic lines shown with prefix WW. A 3-D seismic survey in the northwest corner of the quadrangle was reported on by Valderrama and others (1994); their cross sections are shown with prefix V.

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