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Other than the Geologic Folio of Adams and Ulrich (1905) the immediate area of Fayetteville has never been adequately mapped. The structure of the Fayetteville fault and particularly anamolous dips into the fault trace have never been understood. The present study indicates that these dips are a product of a reversal of movement along the fault during Pleistocene and post-Pleistocene time due to isostatic readjustment. This readjustment is interpreted as being the result of stripping of the thick sediments of the Arkansas Valley.

Initial field work in the Fayetteville area was done by J. C. Branner in 1891. The most recent detailed geologic map of the area is the Adams and Ulrich (1905) Folio of the Fayetteville quadrangle. Subsequent work has been limited either to detail work on single formations in the area (W. H. Easton 1942 on the Pitkin and L. G. Henbest 1953 on the Hale) or regional studies (Croneis, 1930).

GEOGRAPHY

A portion of Prairie Township was mapped which includes all of Township 16 North, Range 30 West. The city of Fayetteville lies approximately in the center of this area. Access to the area is excellent due to the well-developed road network surrounding Fayetteville, Physiographically the area is at the northern limit of the Boston Mountain Province. Flat topped hills which are erosion remnants, stand at 1700 feet above sea level surmounting a nearly flat erosion surface at 1200 feet above sea level. The remnants represent a former surface of planation which has been interpreted by J. H. Quinn (1958) as having been initiated in Aftonian time. This surface is extensively developed throughout the Boston Mountains and the Ouachita Mountains and is sparingly represented in the Arkansas Valley. The lower surface has been interpreted by Quinn as having been initiated in Yarmouth time. The lower (1200 foot) surface has been dissected by recent stream activity. The depth of dissection is approximately 50 feet and gives rise to relatively narrow bottom valleys. Some alluviation took place in these valleys probably during Altithermal time and these deposits are now being stripped. The maximum relief of the area is approximately 500 feet. Mt. Sequoyah is the highest point and the river valley south of Mt. Sequoyah is the lowest point.

The northwestern part of the township is dotted by numerous small circular hills called "prairie mounds." These mounds will be discussed in detail by Quinn (ms. in preparation). He interprets them as the result of accumulation of wind-blown dust around circular clumps of vegetation on a leeward desert margin (J. H. Quinn personal communication).

STRATIGRAPHY

The stratigraphy of the area is summarized in the accompanying table. The rocks are Mississippian and Pennsylvanian in age. The correlations of the Mississippian are from Weller (1948).

STRUCTURE

The strata, according to Croneis (1930, p. 163), dip gently to the south and southeast, but this is not verified locally. The beds are nearly horizontal or randomly dipping a few degrees, and no definite trend was established. The only steep dips were recorded along the Fayetteville fault zone, otherwise they never exceed 6 degrees and are usually only 1 or 2 degrees. In the fault zone the beds dip steeply toward the fault trace. This structure was termed the Price Mountain syncline by Croneis (1930, p. 190).

FOLDS

Synclines: Two small synclines are located in opposite corners of the township, one in section 1 and the other in the SW$\frac{1}{4}$ of section 31. The syncline in section 31 has an axis that strikes N30E and dips 4 degrees on the limbs. The syncline in section 1 is more difficult to identify because most of the interval is covered with soil and outcrops are rare. Three dips were measured in a stream that traverses this structure, but from this in-formation alone it was difficult to define the structural axis. The general structural trend of the area was used to estimate an axial strike of N35E. The limbs of this syncline have a maximum dip of 10 degrees.

A larger syncline is present on Mount Sequoyah, including parts of sections 10, 11, 14, and 15. The axis trends N35E and extends from the center of section 15 to the NW¼ of section 11. The dips of the limbs are gentle, from 3 to 6 degrees.

An anticline lies to the west of the Mt. Sequoyah syncline and to the east of the Fayetteville fault. The axis roughly parallels the axis of the Fayetteville fault as does that of the syncline on Mt. Sequoyah. This anticline extends from the eastern half of section 16 to the NW¼ of section 11. The fold is asymmetrical with the western limb strongly folded and dipping toward the fault at an angle of 35 degrees or more, while the eastern limb dips gently with a maximum of 5 degrees.

FAULTS

Fayetteville fault: The Fayetteville fault crosses the township from section 2 on the northermost margin through section 31 in the south where it continues out of the area. This extends the fault 3 miles beyond the limits mapped by Adams and Ulrich (1905). Croneis (1930, p. 202) stated that the fault extends from the NE¼ of section 20 of Township 16 North, Range 30 West, northeastward to the eastern half of Section 2, Township 17 North, Range 29 West, that both ends of the fault pass into synclines, and that this is only a central area of a larger zone of disturbance that includes the Glade, Onda, and Cove Creek faults.

The fault follows a sinuous course as it trends N35E through the area. The fault trace is observable only at scattered points. The covered sections have been represented by straight line segments on the map. As the fault traverses the area, it passes through numerous discontinuous synclines collectively called the Price Mountain syncline. In the Fayetteville Fm and Bloyd Fm the beds have a gentle dip of 5 degrees at distances of as little as 20 feet from the fault trace but become highly deformed at the fault trace. Thus in these shales the syncline dies out.

In the SW¼ of section 20 the bedding of the Fayetteville shale has the appearance of being a faulted anticline, but in the NE$\frac{1}{4}$ of section 31 it is expressed as a faulted syncline. The width of the deformed zone in these areas is less than 50 feet, but in sections 10, 20, and 29 the dipping beds have a breadth of more than 300 feet on either side of the fault.

On the summits of hills in sections 3, 10, 16, 20, 29, and 31 these "synclinal" features are well displayed. In the NW$\frac{1}{4}$ of section 10 beds of the Atoka formation dip into the fault at an angle of 35 degrees from the southeast and 45 degrees from the northwest and both limbs steepen until they become vertical at the fault. In this area the dipping beds form an arcuate pattern that appears as a plunging synclinal nose. In the SW$\frac{1}{4}$ of section 29 beds of the Atoka are downfaulted from an elevation of 1600 to 1400 feet, and on both sides of the fault the Atoka plunges into the fault trace. These rocks were formerly mapped as the Hale formation by Adams and Ulrich (1905). Finally, the fault passes through what Branner (1888, p. 116) termed the Cato's syncline and continues out of the report area. In the center of Cato's syncline the Bloyd shale appears almost undisturbed, but beds of Brentwood limestone, directly under the Bloyd, dip into the fault at an angle of 38 degrees. This would suggest that the "synclinal" features are lost in less competent beds.

The fault "syncline" assumes an asymmetrical character in the SE$\frac{1}{4}$ of section 9, and also on a hill in the NW$\frac{1}{4}$ of section 20. In the former the western limb dips at an angle of 7 degrees, but the eastern limb dips at angles up to 45 degrees. In section 20 the Pitkin formation dips at an angle of 17 degrees to the east, while the Hale formation dips into the fault center at an angle of 60 degrees to the west.

The total vertical displacement along the fault is rarely measurable, but at a railroad cut in the SE$\frac{1}{4}$ of the NW$\frac{1}{4}$ of section 16 the displacement is approximately 50 feet. Here the beds of the Hale formation dip gently into the fault zone at an angle of 8 degrees from the north, and abut against the down-faulted Brentwood limestone. This area shows that the eastern side of the structure is down-thrown, a fact elsewhere difficult to verify due to the "synclinal" dips and similar structures. In sections 20 and 31, where displacement is in the

Fayetteville formation there is no way to estimate the amount of movement.

It appears anomalous that a fault measured in tens of miles ($6\frac{1}{2}$ miles in Fayetteville Township alone) should have so little displacement, i. e. approximately 50 feet. Considerable faulting and downwarping in the southern Boston Mountain region seems to have been associated with Atokan deposition. During Pleistocene time much of this material has been removed from the area of its thickest accumulation (Thomas 1958). If isostacy works it seems probable that some recovery may have occurred with reverse movement on the old faults formed by the initial downwarping. The downthrown side would reverse its movement and normal drag features would be reversed. Thus, the reversal of drag on the southeast side and normal drag on the northwest would give the structure the appearance of being a faulted syncline. The local anticlinal structure in the SW$\frac{1}{2}$ section 20 would indicate reverse drag on the NW side and normal drag on the SE side of the fault.

Reversal of movement seems to be taking place today. Evidence for this is that foundations of homes that straddle this structure have been subject to cracking, and Pleistocene gravels seemingly have been faulted on a similar structure to the east near Huntsville, Arkansas (Dr. H.F. Garner, oral communication).

GEOLOGIC HISTORY

The following climatic-sedimentary interpretations are the direct result of extrapolation of the mechanisms of alternate humid-arid climatic cycles as developed by J.H. Quinn (1956). His ideas have been extended to include marine sediments by H.F. Garner (manuscript, 1958).

The Boone chert and limestone probably is the product of leaching under hot humid land conditions. However, the environment of deposition was in water that was relatively cool with a pH flucuating around 7.8 in order to have alternate deposition of limestone and chert (Pettyjohn, 1957, pp. 597). The chert must be primary, or largely so, because pebbles of the chert are found in the overlying lower Batesville. There hardly seems sufficient time for the development of secondary chert in such a short interval.

Following Boone deposition the area was exposed to sub-aerial erosion. In nearby areas relief of as much as 30 feet is observable on the Boone surface and relief of 6 to 8 feet is common. During Moorefield time no sediments were deposited in the Fayetteville area or they were subsequently removed. Sediments of Moorefield age have been reported by Edmonson (1954) in western Washington County, but their age has been questioned by Ault (1958).

The Batesville sediments probably represent the products of stripping of the sub-aerially derived A zonal soil material. The sea was warm as evidenced by the limestone deposition. Fayetteville time continued the long humid period of the Mississippian. Highly organic black shales were being stripped from the land mass and deposited in a shallow sea. The Weddington sandstone probably represents sand-bar-type deposition off the mouth of a major drainage system. The sand thins rapidly to the east, south, and west of the type area in the Weddington Mountains of Washington County. The shallow water character is clearly indicated by cross bedding, and ripple marks, and the near shore character by the abundance of continental plant fossils. Upper Fayetteville time was apparently somewhat less humid as evidenced by the diminution of carbonaceous material and the presence of silt in the shale. This silt was probably derived from wind-transported material from arid deflation regions.

The Pitkin limestone seems to represent the initiation of greater aridity locally. Humid leaching of calcareous material elsewhere introduced lime into the sea to be deposited in the Fayetteville area from a warm sea. The conglomeratic character of the formation in the northern portion of the area would indicate slight uplift to the north and probable sub-aerial erosion. However, the fact that the pebbles are composed of limestone would indicate an arid climate, otherwise they would have been dissolved during sub-aerial leaching and transportation. Locally, the entire Pitkin formation was removed and is represented by scattered limestone pebbles in the base of the Hale.

The Hale sediments represent a continuation of the semi-arid climate. Sands accumulated on the land area to the north and clays with an admixture of aeolian silt accumulated in the seas. In upper

Hale time the humid climates returned. Streams stripped the sand accumulated on land during the lower Hale and carried it to the sea. The humidity is again indicated by the abundance of plant fossil fragments in these sands. A subsidence of a trough to the south in the present Arkansas Valley region probably began at this time. Freeman (1957) found that the relatively thin upper Hale sandstones could be traced laterally into part of the very thick Jackfork formation. The evidence of this subsidence is present in the Boston Mountains in the form of numerous slump structures in the Hale with movement to the south.

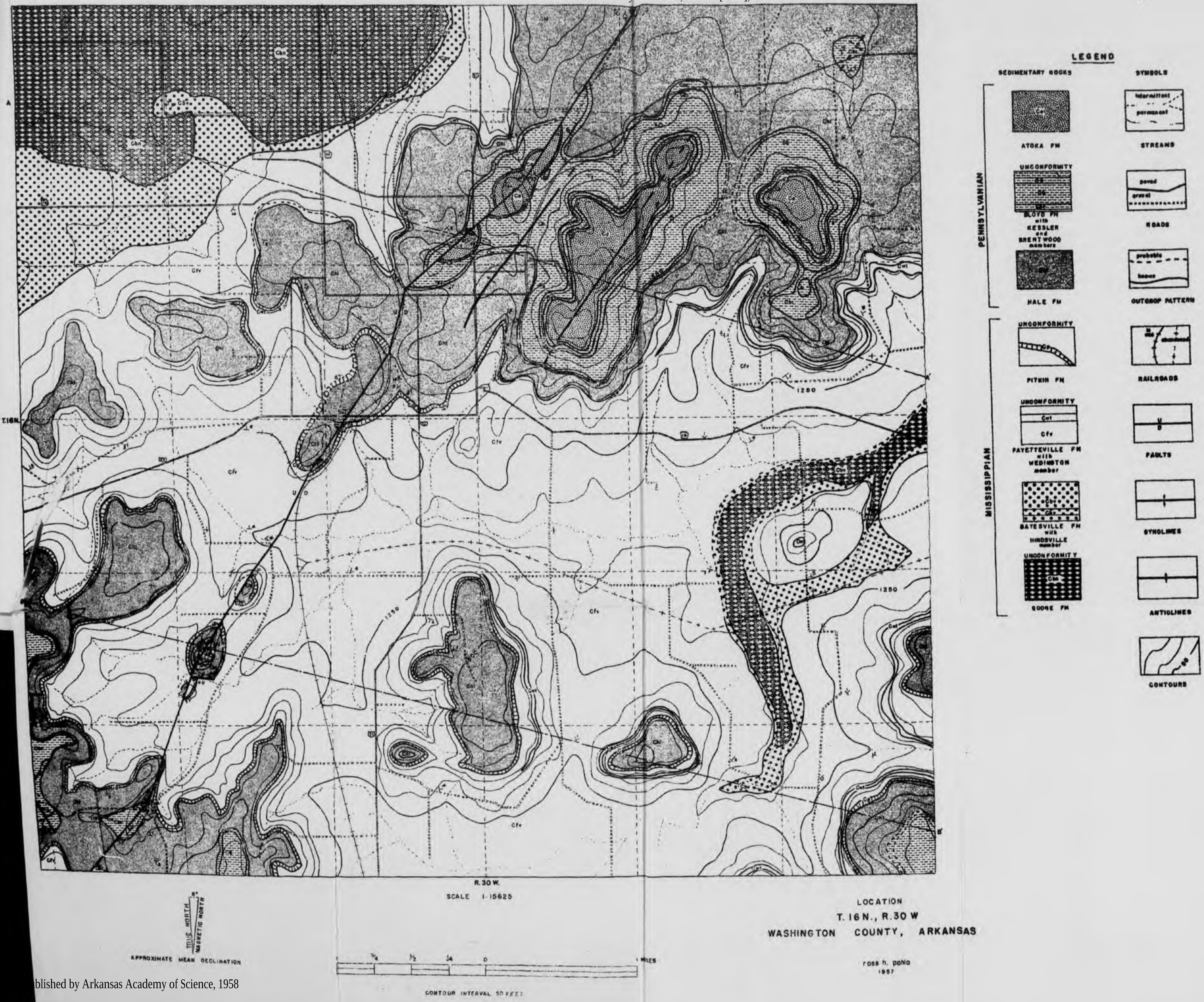
The lower Bloyd members indicate continued high humidity. The Basal Shale and Woolsey shales are again highly carboniferous and the thin Baldwin coal in the Woolsey indicates humidity. Faulting began to take place at the end of Brentwood time as found by Case and Conolly (1955) and by Knox (1957) but did not occur in the Fayetteville area. By Kessler time, however, arid climates had returned to the area as indicated by the limestone pebbles in the Kessler in the Fayetteville area and as reported by Knox (1957) and others.

The Atoka sands and silts represent alternating arid-humid climates. Silts representing arid aeolian transported materials and sands and pebbles representing more humid stripping of coarse continental residuals. A thick accumulation of Atoka sediments in the Arkansas Valley region caused loading of the crust and isostatic downwarping. This caused the development of monoclinal folds and faults in the Boston Mountains and southern Ozark region with downwarping or displacement to the south and southeast. During this dislocation the Fayetteville fault developed. At that time it undoubtedly had a much greater displacement than at present. It does not seem likely that a fault of such length would have only minor displacement. The NE trend of the structure was controlled by the earlier development of a series of N37° E trending anticlines and syncline demonstrated by Ault (1958), Hollyfield (1958), and Ratliff (1958). According to them these structures began developing in Hale time.

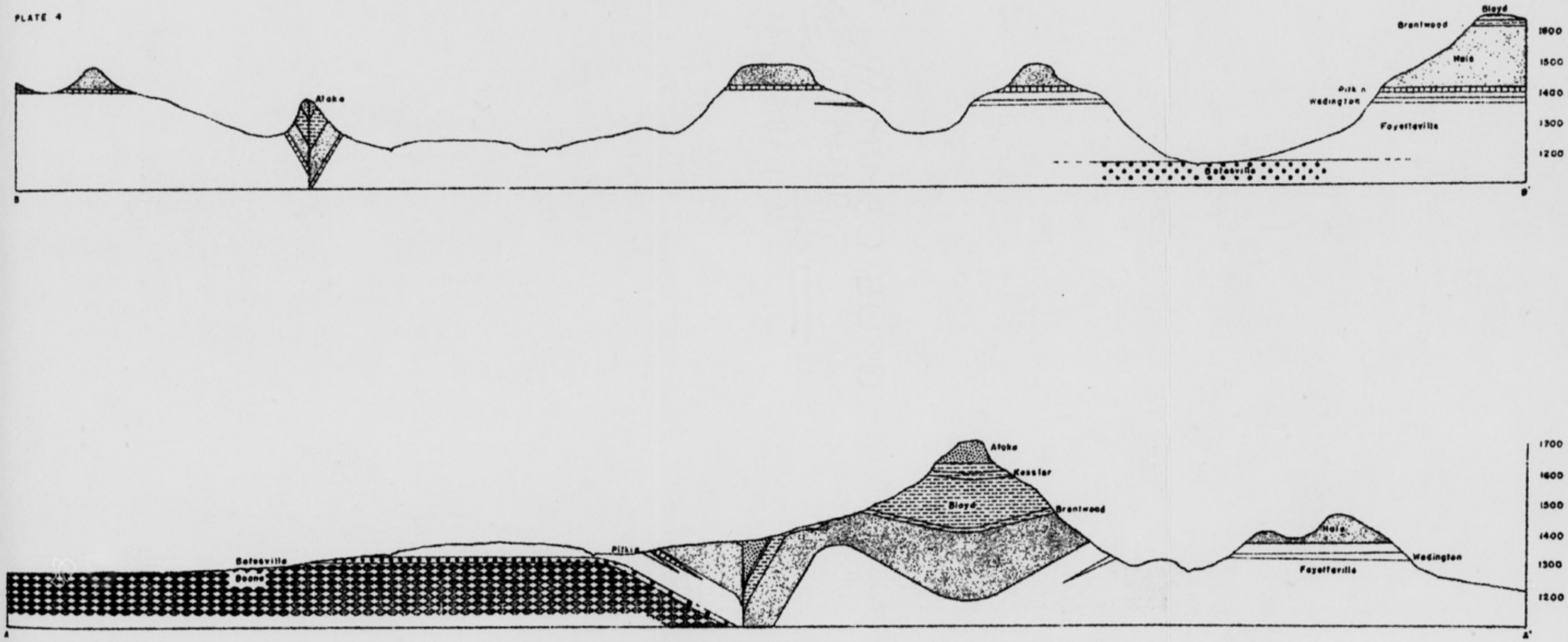
The presence at the beginning of Pleistocene time of a broad topographic arch with a NNE axis extending across the entire Arkansas Paleozoic area was postulated by Quinn (1957). J. E. Clements (1958) and H. E. Thomas (1958) have investigated

				LOCAL FORMATION OR MEMBER	LOCAL LITHOLOGY	LOCAL AREA OF EXPOSURE	LOCAL THICKNESS
PLEISTOCENE AND RECENT					Loessal soils, prarie mounds, locally derived and transported soils, sand and silt sized, boulders to 6' from ss		0 - 6'
PENNSYLVANIAN	POTTSVILLE			ATOKA FM.	Quartz silt and sand beds, flaggy, cross bedded and ripple marked. Intricate bedding in silt, green when fresh, weathers brown. Sand brown. Coarse sand grit 50' above base.	Mt Sequoyah and Pierce Mt.	68' rest removed by erosion
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	BLOYD FM.	UPPER MEM	Black fissile shale, no concretions	Mt Sequoyah Pierce Mt and hills in SE and SW corners	10'
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	BLOYD FM.	KESSLER MEM	Blue-black to red-black fossiliferous, sandy and conglomeratic limestone. Weathers dirty brown and slabby		2'-6" to 7'
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	BLOYD FM.	WOOLSEY MEM	Black fissile shale, weathers to brown and red clay. No concretions. Local Baldwin coal in middle up to 12" thick. Sand bed 2' to 4' above coal		90'
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	BLOYD FM.	BRENTWOOD MEM.	Crystalline, highly fossiliferous, blue limestone. Weathers light gray. Some sand in limestone. Pentremites !		16'-6" ave.
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	BLOYD FM.	BASAL MEM.	Black fissile shale, no concretions		0' to 20'
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	HALE FM.	PRARIE GROVE MEM	Flaggy, cross bedded, ripple marked, calcareous sandstone. Weathers to pitted surface in calcareous zones. Brown. Local limestone lenses	Extensive in NW and center. Caps hills in south.	85'
PENNSYLVANIAN	POTTSVILLE	MORROW GROUP	HALE FM.	CANE HILL MEM	Wavy bedded clayey to sandy shale, weathers redish tan. Fissile when not sandy. Thin streaks of coarse sand		15' — 45'
MISSISSIPPIAN	CHESTER	ELVIRA GROUP		PITKIN FM.	Formerly called Archimedes Limestone. North part of area: thin; red-brown, fossiliferous limestone pebble conglomerate. South part of area; massive fossiliferous gray limestone, thickening to the south. Weathers to fine granular, dark blue-gray rounded surfaces. Archimedes !	On most hills except Sections 13, 14, 15, & 16	0' to 30' Cong 3"-18"
MISSISSIPPIAN	CHESTER	ELVIRA GROUP	FAYETTEVILLE FM.	UPPER FAYETTEVILLE MEM	Upper shale; may be absent, more brown and less carbonaceous than base, fissile, argillaceous shale.	Extensive in bottom lands except in NW	Total Max 184' Sec. 33, Min 144' Sec 8 Upper Shale 0 - 70 Weddington 0 - 25
MISSISSIPPIAN	CHESTER	ELVIRA GROUP	FAYETTEVILLE FM.	WEDDINGTON MEM.	Weddington sand; ranges from dense black siliceous sandstone to brown friable sandstone, flaggy, cross bedded		
MISSISSIPPIAN	CHESTER	HAMBERG GRP	FAYETTEVILLE FM.	LOWER FAYETTEVILLE MEM	Basal shale; black, argillaceous and carbonaceous fissile shale. Ironstone and septarian concretions in middle and base. Well jointed.		
MISSISSIPPIAN	CHESTER	NEW DESIGN GROUP		BATESVILLE FM.	Sandstone, coarse to fine grained; cross bedded, brown to tan, fossiliferous	NW corner and stream valleys in SE	10' – 12'
MISSISSIPPIAN	CHESTER	NEW DESIGN GROUP		HINDSVILLE MEM.	One to two limestone beds, light blue gray, sandy, petroliferous odor. Basal Chert conglomerate with limestone matrix, pebbles to 3", 30%		0 – 2' 0 – 8"
MISSISSIPPIAN	OSAGE-MERIMEC			BOONE FM.	Thin oolite at top, dark gray, oolites up to 1/8" 70% of rock. Wavy bedded chert, bedded 3–12" thick, white on fresh surface, weathers red-brown, highly fossiliferous	NW corner and stream beds in SE	0 – 2' 38' exposed 341' drilled Sec. 34

PLATE 3. AREAL GEOLOGIC MAP



CROSS SECTIONS



VERTICAL SCALE 1:3125

planation surfaces in this area and have demonstrated the presence of such an arch. They have further demonstrated the removal of at least 2200 feet of sediments from the Arkansas Valley since early Pleistocene time. The removal of such a load should result in an isostatic rebound in the same manner as the removal of an equivalent weight of ice. On a local scale this isostatic rebound would be accommodated by movement along old planes of weakness such as the Fayetteville fault. This in turn would reduce the displacement and where the beds are competent it would develop a reverse drag.

There are several additional lines of evidence for the recency of this movement. First, along many such faults the rocks are badly shattered, and the joints are fresh and completely unhealed. Such a situation would not be expected if the total fault movement were of Pennsylvanian age. Second, Dr. H. F. Garner of the Geology Department, University of Arkansas, reports faulted Pleistocene gravels south of Huntsville, 22 miles east of Fayetteville. Third, the senior author's house straddles the trace of the Fayetteville fault and has a crack in its foundation paralleling the fault and with a measurable displacement! Unloading and isostatic readjustment seemingly is still going on today.

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