STATE OF ARKANSAS

Arkansas Geological Commission

Norman F. Williams, Geologist-Director

INFORMATION CIRCULAR 25

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By
O. A. Wise and W. M. Caplan

Little Rock, Arkansas

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SILURIAN AND DEVONIAN ROCKS OF NORTHERN ARKANSAS

O. A. Wise and W. M. Caplan[1]

ABSTRACT

The Silurian and Devonian rocks of northern Arkansas are widespread in the subsurface reaching an aggregate thickness of over 480 feet in Pope County. This thickening may continue southward into the Ouachita region.

The surface exposures are generally restricted to the Springfield Plateau physiographic province where outcrop thicknesses are quite variable due to contemporaneous, and post-depositional erosion. No single formation is well-developed on the outcrop across the entire area, although the Chattanooga Shale is rather extensive in the northwestern and the St. Clair Limestone in the northeastern, portions of the region.

The regional structural strike of the Silurian and Devonian formations in northern Arkansas is generally east-west, and the dip is to the south. The angle of dip is slight in the Ozark region and becomes increasingly steeper to the south into and across the Arkansas Valley where it becomes mantled by a thick wedge of Pennsylvanian and Mississippian sediments.

SILURIAN SYSTEM

Rocks of Silurian age are exposed in a few scattered outcrops in the Ozark region of north-central Arkansas. The outcrops are generally restricted to the Springfield Plateau physiographic province (see Figure 1). The Silurian rocks are predominantly carbonates and have been assigned to the Brassfield Limestone (Ulrich, 1911), the St. Clair Limestone (Penrose, 1891), and the Lafferty Limestone (Miser, 1920) (see Figure 2).

Recent field observations and paleontological data suggest that a part of the Cason Shale, previously considered as Ordovician by a number of workers, is also Silurian and is possibly a facies of the Brassfield Limestone.

The Silurian section of north Arkansas has for the most part been treated as an undifferentiated unit in the subsurface. It ranges in thickness from a feather edge (due to truncation) to over 250 feet in the Arkansas Valley (see Figure 3). This thickening appears to reach its maximum in the southern part of the Valley and begins a thinning trend which indicates the possibility of a separate basin, not directly connected to the Ouachitas where the Silurian is represented by over 1200 feet of clastic rocks. Insufficient evidence is available at present to indicate whether the nature of the change from Ozark to Ouachita facies is one of transition, overthrust, or separate basin deposition.

Rocks thought to be Silurian in age have been identified in well cuttings from Pulaski and Crittenden Counties, Arkansas, and DeSoto County, Mississippi, indicating the extension of Silurian rocks into the Mississippi Embayment.

BRASSFIELD LIMESTONE

The Brassfield Limestone was named for exposures in Madison County, Kentucky, by Foerste (1905), and was identified in Arkansas by Ulrich in 1911.

Miser (1922) found Brassfield fossils (replaced by manganese oxide) at the Montgomery Mine 6 miles northeast of Cushman, Independence County, Arkansas, and stated that they came from residual clays lying on the Cason Shale (Ordovician). He

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[1]Geologists, Arkansas Geological Commission, Little Rock, Arkansas.

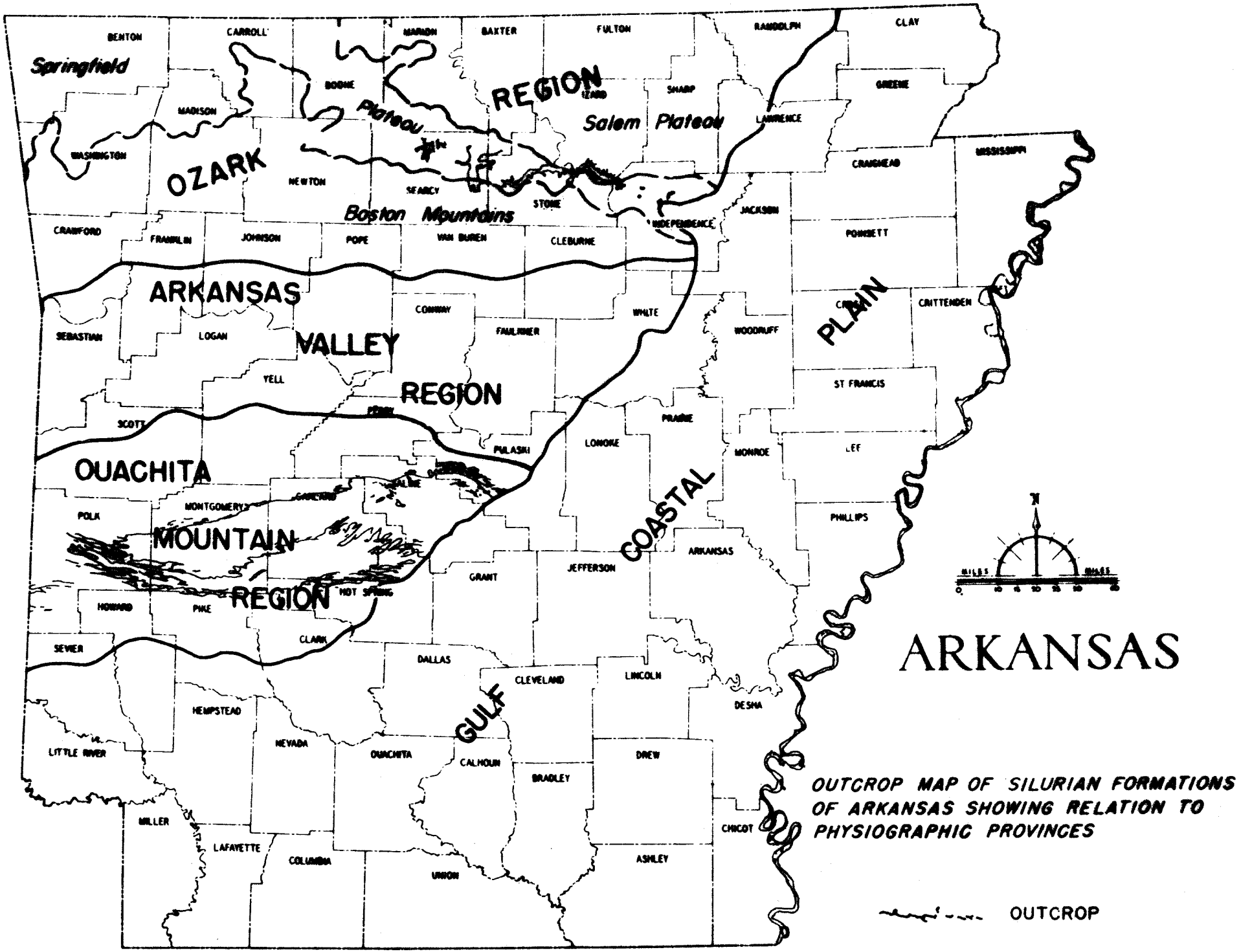

BENTON
CARROLL
MARION
BAXTER
FULTON
RANDOLPH
CLAY
Springfield
BOONE
REGION
IZARD
SHARP
GREENE
MADISON
Plateau
Salem Plateau
LAWRENCE
WASHINGTON
OZARK
NEWTON
SEARCY
STONE
CRAIGHEAD
MISSISSIPPI
Boston Mountains
INDEPENDENCE
JACKSON
CRAWFORD
FRANKLIN
JOHNSON
POPE
VAN BUREN
CLEBURNE
POINSETT
ARKANSAS
CONWAY
WHITE
CRITTENDEN
PLAIN
SEBASTIAN
LOGAN
VALLEY
FAULKNER
WOODRUFF
YELL
REGION
ST FRANCIS
PERRY
SCOTT
PRAIRIE
PULASKI
LONOKE
MONROE
LEE
OUACHITA
MONTGOMERY
GARLAND
POLK
COASTAL
PHILLIPS
MOUNTAIN
ARKANSAS
GRANT
JEFFERSON
REGION
HOT SPRING
HOWARD
PIKE
CLARK
SEVIER
DALLAS
CLEVELAND
LINCOLN
DESHA
HEMPSTEAD
GULF
LITTLE RIVER
NEVADA
OUACHITA
CALHOUN
BRADLEY
DREW
MILLER
LAFAYETTE
COLUMBIA
UNION
ASHLEY
CHICOT
N
MILES
0
10
15
20
25
30
35
ARKANSAS
OUTCROP MAP OF SILURIAN FORMATIONS OF ARKANSAS SHOWING RELATION TO PHYSIOGRAPHIC PROVINCES
OUTCROP

PLATE 1

CORRELATION CHART OF DEVONIAN & SILURIAN SYSTEMS IN ARKANSAS

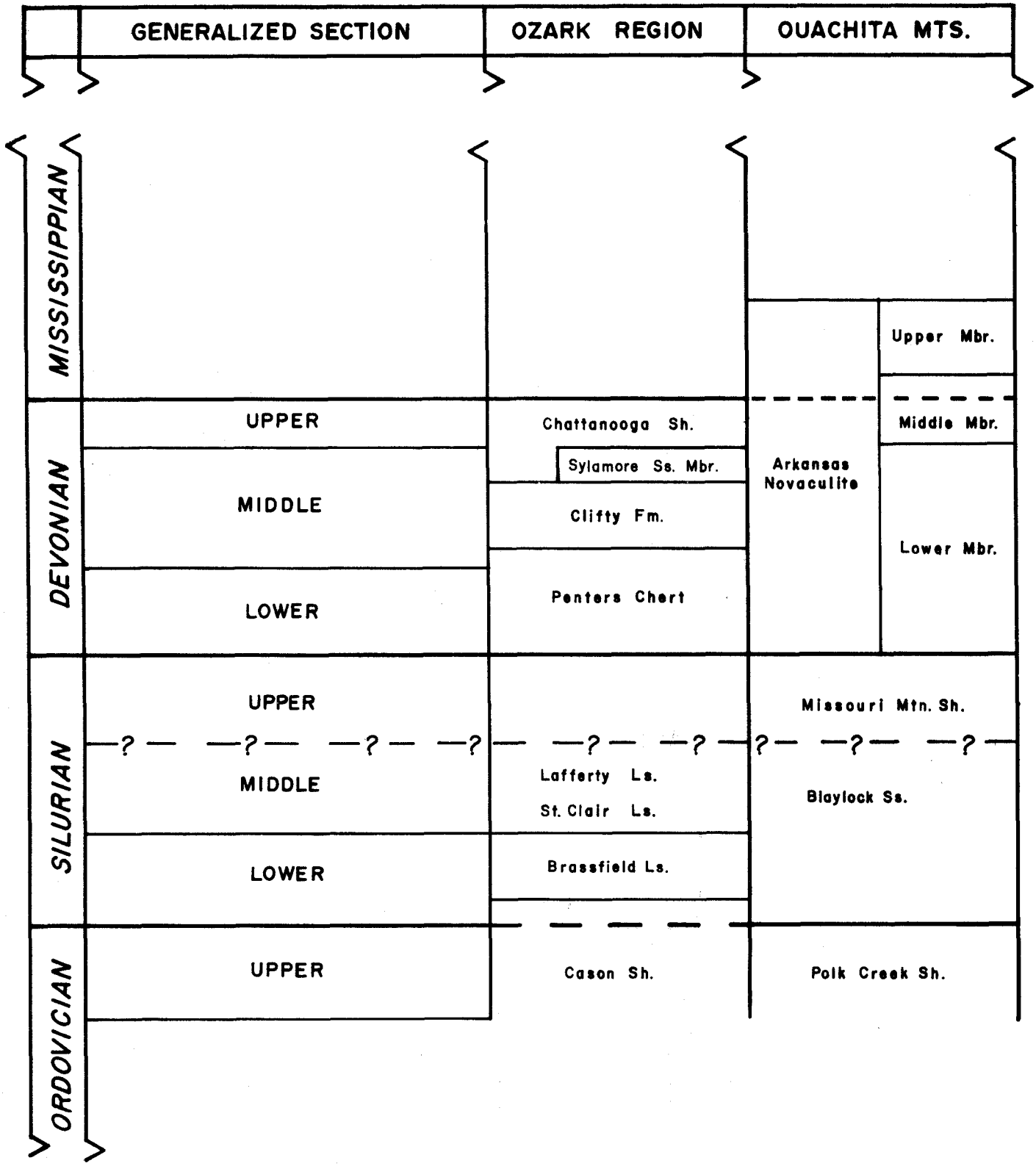
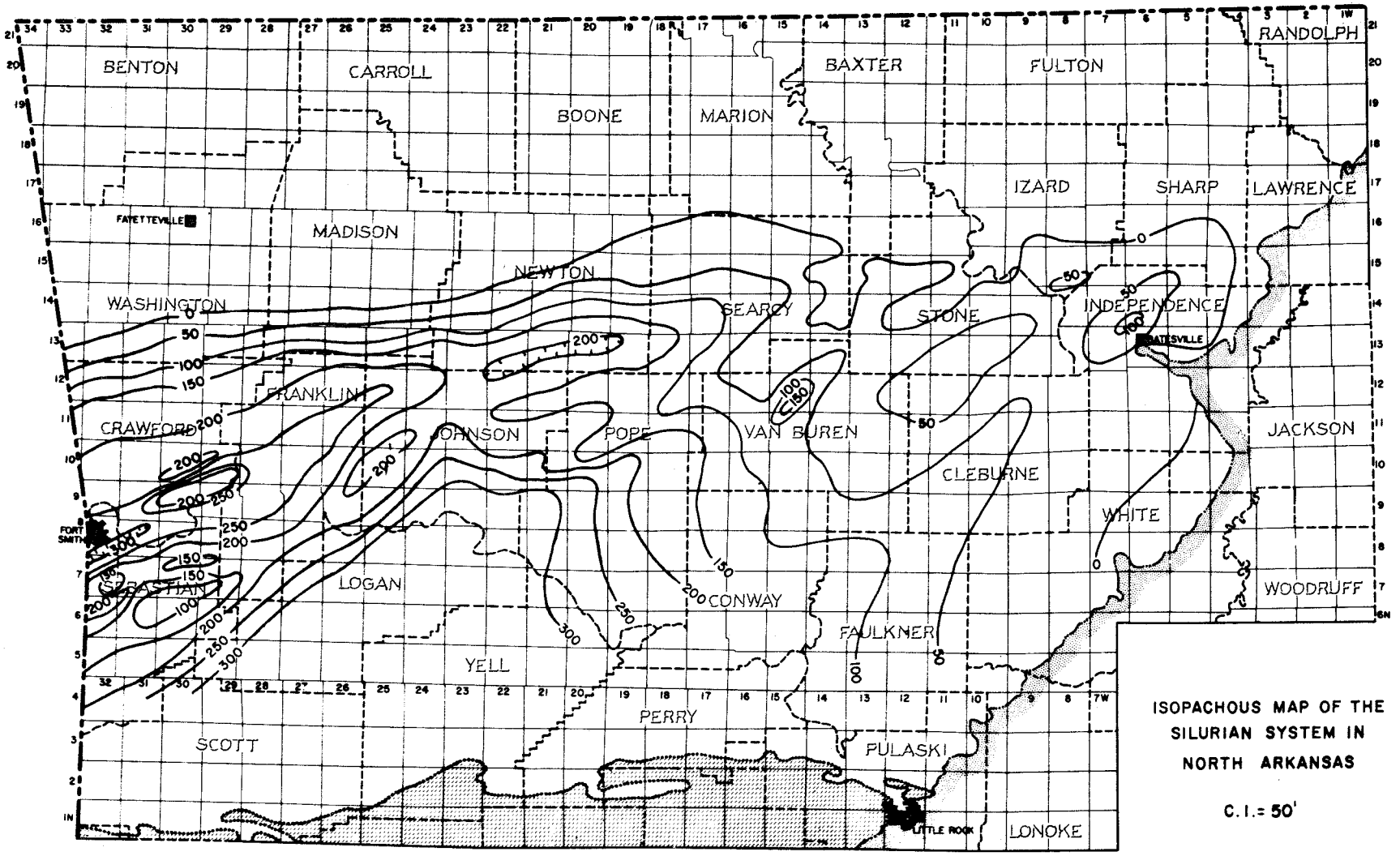


TABLE 1



ISOPACHOUS MAP OF THE SILURIAN SYSTEM IN NORTH ARKANSAS

C.I.= 50'

SCALE IN MILES

0 5 10 20 30 40 50

PLATE 2.

also mentioned exposures of Brassfield in the Yellville Quadrangle, Arkansas.

Maher and Lantz (1953) mapped exposures of Brassfield which attain a maximum thickness of 26 feet in the northern part of the Marshall Quadrangle in the Gilbert area of Searcy County, Arkansas. Here they described the formation as consisting of beds of coarsely crystalline fossiliferous limestone about a foot thick, containing crinoids, brachiopods, trilobites, and an abundance of calcite-filled vugs. They stated that while the Brassfield resembled the St. Clair there were recognizable lithologic differences.

Recent stripping operations at the Love Hollow Quarry, Izard County, Arkansas, have exposed a fossiliferous limestone on the north and south sides of the main quarry pit, within the Cason Shale. The exposure on the north side of the pit was removed before it could be sampled or described. The exposure on the south side occurs in the middle of a 10-foot thick bed of Cason Shale. At this latter exposure the limestone is 100 feet long, lensing out to the east and west. It is 3 feet thick at the thickest point, being equally divided between two rock types; the lower foot and a half consisting of white oolitic limestone, and the upper foot and a half being a coarsely crystalline fossiliferous sparite quite similar to the Ordovician Fernvale Limestone that underlies the Cason Shale.

Amsden made a collection of fossils while examining this outcrop and states (written communication, 1967) that "the limestone bed in the Cason Shale at Love Hollow Quarry carries the brachiopod *Triplesia alata.*" This fossil had previously been described from the Brassfield of Arkansas by Ulrich and Cooper (Amsden, 1965).

Craig (written communication, 1967) states that conodonts, collected at Love Hollow Quarry from the lower part of the Cason Shale, indicate a Late Ordovician age; and that the conodonts from the "pelmatozoan limestone are definitely Early Silurian in age."

This would, in effect, make the shale mapped as Cason at Love Hollow in part Ordovician and in part Silurian, and presents the possibility that in some localities the limestone underlying that shale may be Silurian and not Fernvale (Upper Ordovician). It is also quite possible that the fossils found by Miser in the "residual clays" at the Montgomery Mine were in place in the weathered shale facies of this interval.

The question of the age of the Cason Shale is not a new subject. In the Arkansas Geological Survey Report for 1892 (p. 284), H. S. Williams states that the St. Clair Limestone, and the Cason Shale contain a Silurian fauna and that the "Polk Bayou Limestone" (now called Fernvale) contains an Ordovician fauna. Ulrich considered the Cason Shale age to be Ordovician in 1904, and Silurian in 1911.

Miser (1922) placed the Cason in the Ordovician. However, in 1964 (personal communication) he indicated that he was not satisfied with this placement, and thought a re-examination was in order.

Although the relationship of the shales and limestone of the Cason-Brassfield interval is of considerable interest, it does not appear, at this time, that any useful purpose could be served by changing the existing nomenclature, or adding a new name or names to those presently in general use. However, if in the future this sequence could be extended either on the surface or in the subsurface so as to be of some benefit in stratigraphic work, it might then justify the introduction of new terminology.

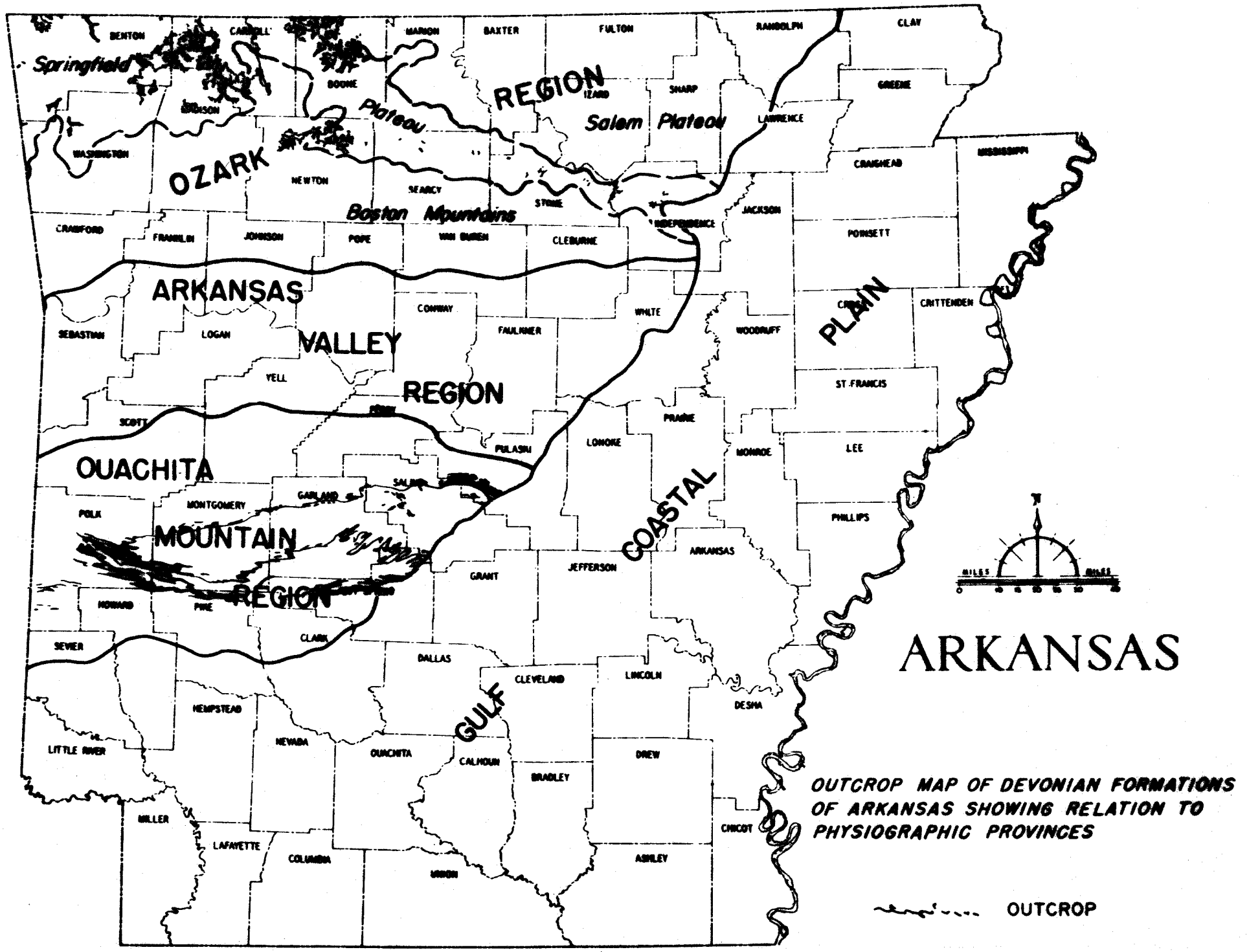
The Brassfield Limestone is correlated with the Brassfield of Kentucky, Missouri and Tennessee, and is equivalent or partially equivalent to the Chimneyhill Formation of Oklahoma (Caplan, 1954).

ST. CLAIR LIMESTONE

The St. Clair, as originally described by Penrose (1891), included the interval now mapped as Kimmswick Limestone (Ordovician) through Lafferty (Silurian). Williams (1892) redefined the St. Clair to include only that part now mapped as the St. Clair and Lafferty. The Lafferty, until separated by Miser (1920) was variously referred to as upper or gray-dense St. Clair.

Surface exposures are scattered in the north-central part of Arkansas principally between Batesville, Independence County, and Harrison, Boone County, and attain a maximum outcrop thickness of 100 feet. The St. Clair is thought to be widely distributed in the subsurface, but thickness data are not readily available.

Usually, the St. Clair is characterized as being a gray to pink, fossiliferous limestone with a micritic matrix. Locally the St. Clair contains an appreciable amount of sparry cement with spar-filled cavities


BENTON
CARROLL
MARION
BAXTER
FULTON
RANDOLPH
CLAY
Springfield
BOONE
IZARD
SHARP
GREENE
Plateau
REGION
Salem Plateau
LAWRENCE
WASHINGTON
OZARK
NEWTON
SEARCY
STONE
CRAIGHEAD
MISSISSIPPI
Boston Mountains
INDEPENDENCE
JACKSON
CRAWFORD
FRANKLIN
JOHNSON
POPE
VAN BUREN
CLEBURNE
POINSETT
ARKANSAS
CONWAY
WHITE
CRITTENDEN
SEBASTIAN
LOGAN
VALLEY
FAULKNER
WOODRUFF
PLAIN
YELL
REGION
ST. FRANCIS
SCOTT
PRAIRIE
PULASKI
LONOKE
MONROE
LEE
OUACHITA
SALINE
GARLAND
MONTGOMERY
POLK
COASTAL
PHILLIPS
MOUNTAIN
ARKANSAS
GRANT
JEFFERSON
REGION
HOWARD
PIKE
CLARK
SEVIER
DALLAS
CLEVELAND
LINCOLN
HEMPSTEAD
DESHA
GULF
LITTLE RIVER
NEVADA
OUACHITA
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DREW
MILLER
LAFAYETTE
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PLATE 3.