GEOLOGY OF THE ARBUCKLE MOUNTAINS SOUTH-CENTRAL OKLAHOMA

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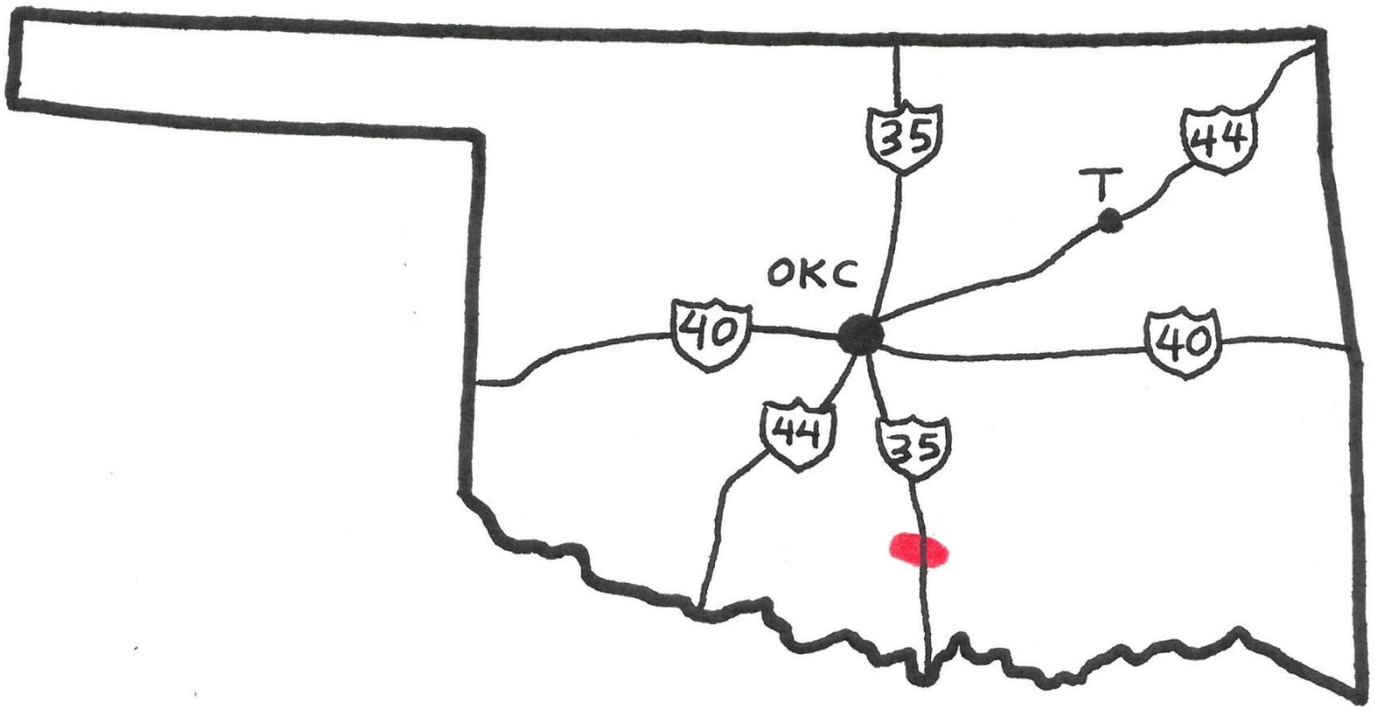
ARBUCKLE MOUNTAINS – GENERAL GEOLOGY

The Arbuckle Mountains are a low relief, broad massif with prominent hogbacks on both the northern and southern sides. In a very generalized sense, the Arbuckle Mountains are an anticline, cut by a variety of faults and with smaller folds superimposed. The rocks exposed span much of the Paleozoic. The oldest rocks exposed are the Lower-Middle Cambrian Colbert Rhyolite. This is overlain by an unusually thick and mostly conformable succession of Upper Cambrian through Lower Devonian mostly carbonate rocks. Their great thickness and completeness as compared to other areas of the southern midcontinent (Llano Uplift of central Texas; Ozark Dome of southern Missouri) is the result of great subsidence in the Oklahoma Aulacogen. The Ardmore Basin lies to the south of the Arbuckle Mountains; the rocks there are predominantly Upper Mississippian and Pennsylvanian siliciclastics. The northern and western flanks are overlapped by Pennsylvanian conglomerates, which were eroded off the Arbuckle Mountains immediately post-uplift. Simultaneously, strike-slip faulting created a graben in the middle of the Arbuckle Mountains which filled in with limestone pebble conglomerate. Much of the broad massif of the Arbuckle Mountains is underlain by Upper Cambrian and Lower to lower Middle Ordovician carbonate rocks and minor siliciclastics. Resistant carbonates and siltstones of the upper Middle Ordovician through Mississippian form hogbacks on the flanks of the Arbuckle Mountains. Driving Interstate Highway 35 across the Arbuckle Mountains affords an excellent geologic cross section of both their stratigraphy and their structure, as well as scenic views of the landscape that shows the influence of the bedrock geology and geologic history.

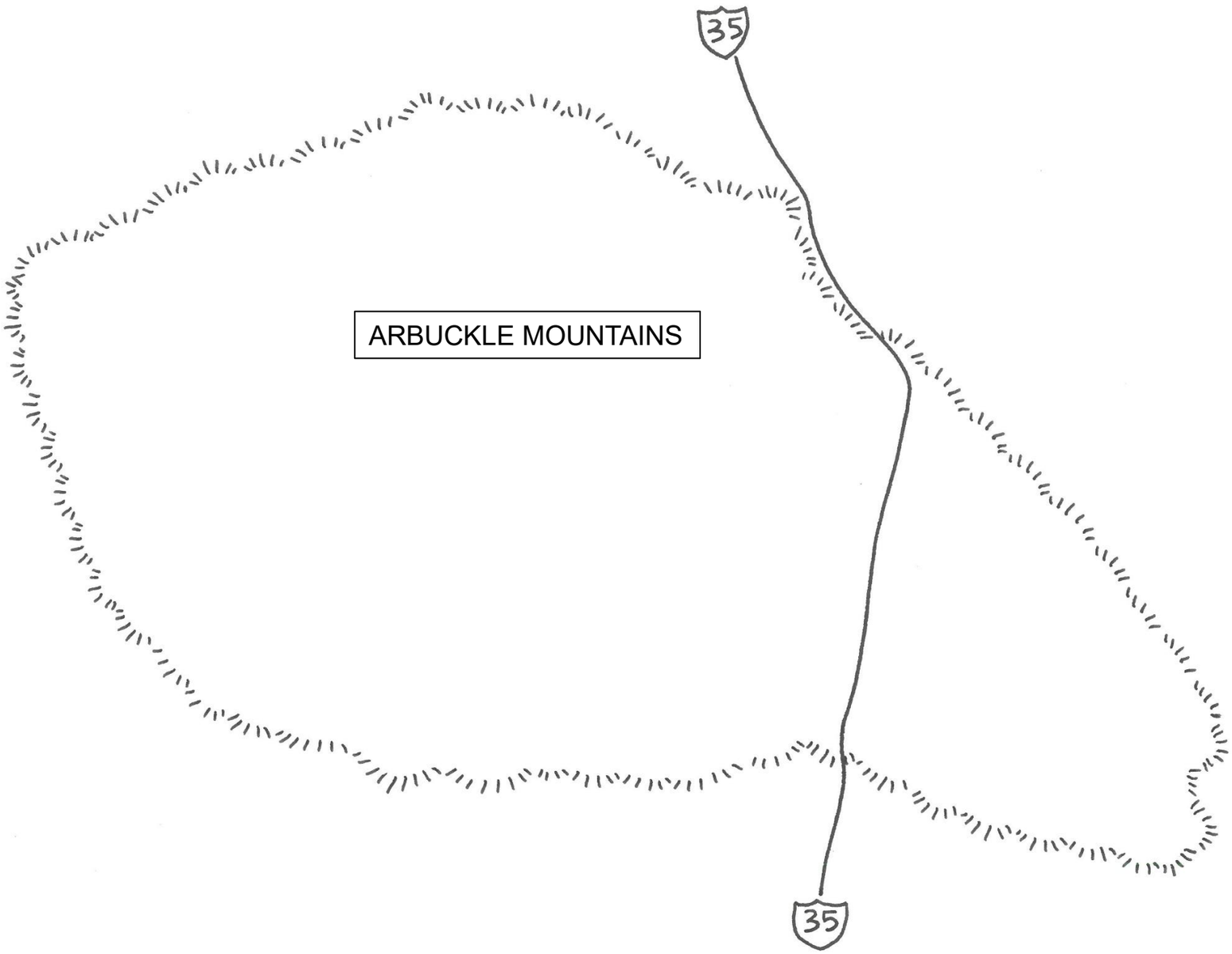
ARBUCKLE MOUNTAINS – SUMMARY OF GEOLOGIC HISTORY

Very late during the Proterozoic, as the supercontinent of Rodinia rifted apart, the southern margin of Laurentia was established well to the south of Oklahoma. However, during the Early and Mid Cambrian a new rift formed near the southern edge of the Ouachita Mountains, and extending south around the Llano Uplift and then west-northwest into the Big Bend region of Texas. One of the failed rift arms extended across southcentral and southwestern Oklahoma; this is the Southern Oklahoma Aulacogen. Initially it was the site of extensive igneous activity, now exposed as the rhyolites at the core of the Arbuckle Anticline (and much more extensively in the Wichita Mountains). During the Late Cambrian through the Early Devonian, the Southern Oklahoma Aulacogen was the site of great subsidence and the deposition of an unusually thick and mostly conformable succession of shallow marine carbonates with minor siliciclastics. During the Late Paleozoic, as Gondwanaland was assembled, compressional tectonics dominated the southern and eastern margins of Laurentia, forming the greater Appalachian Mountain belt. In southern Oklahoma, the most significant uplift, folding, and faulting occurred during the Mid Pennsylvanian. The Arbuckle Mountains were formed at this time. Erosion of the newly uplifted mountains resulted in an apron of conglomerate flanking the Arbuckle Mountains.

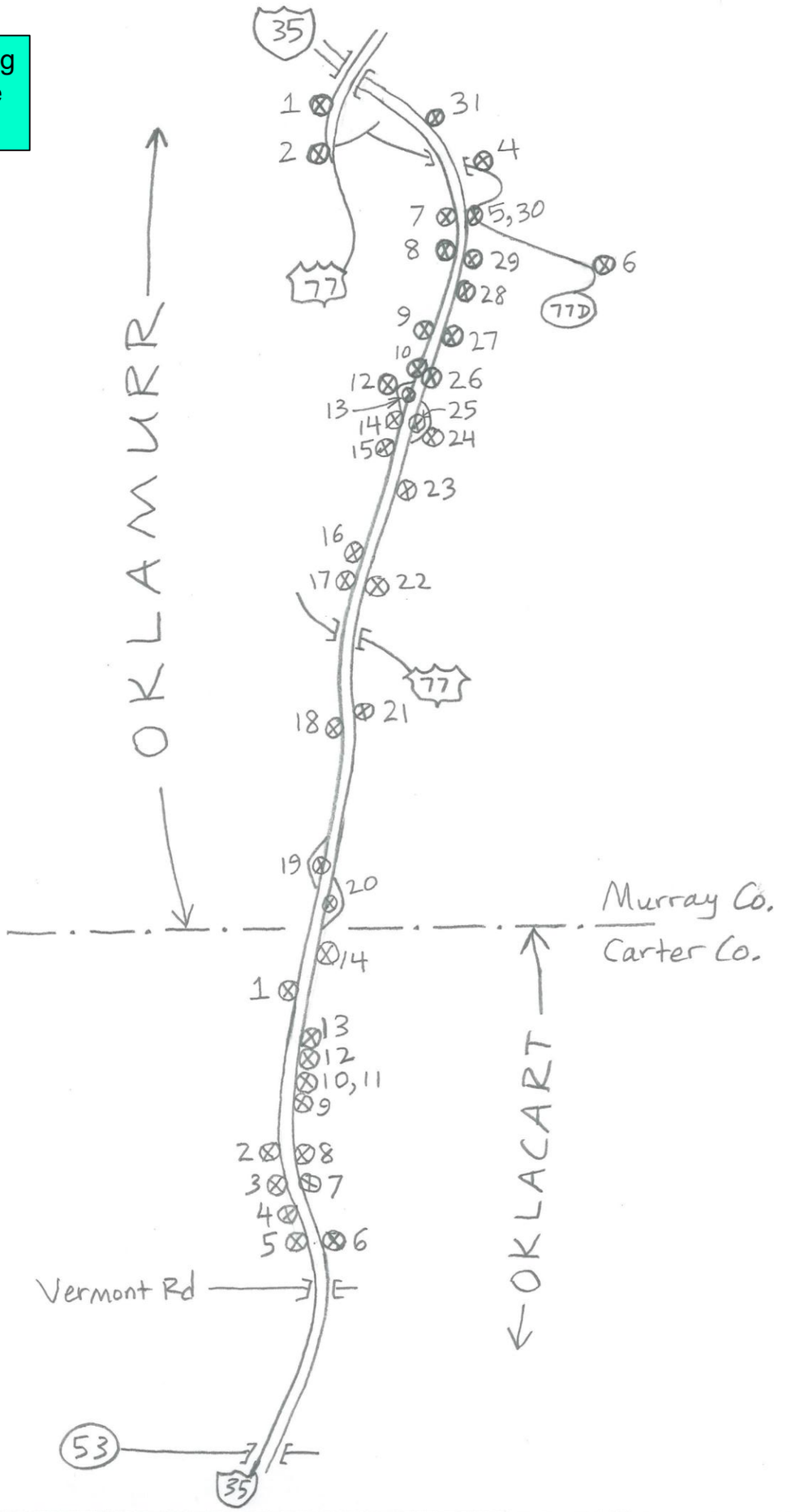
Map of Oklahoma showing location of the Arbuckle Mountains (red oval area in south-central OK), the major Interstate Highways, and Oklahoma City (OKC) and Tulsa (T).



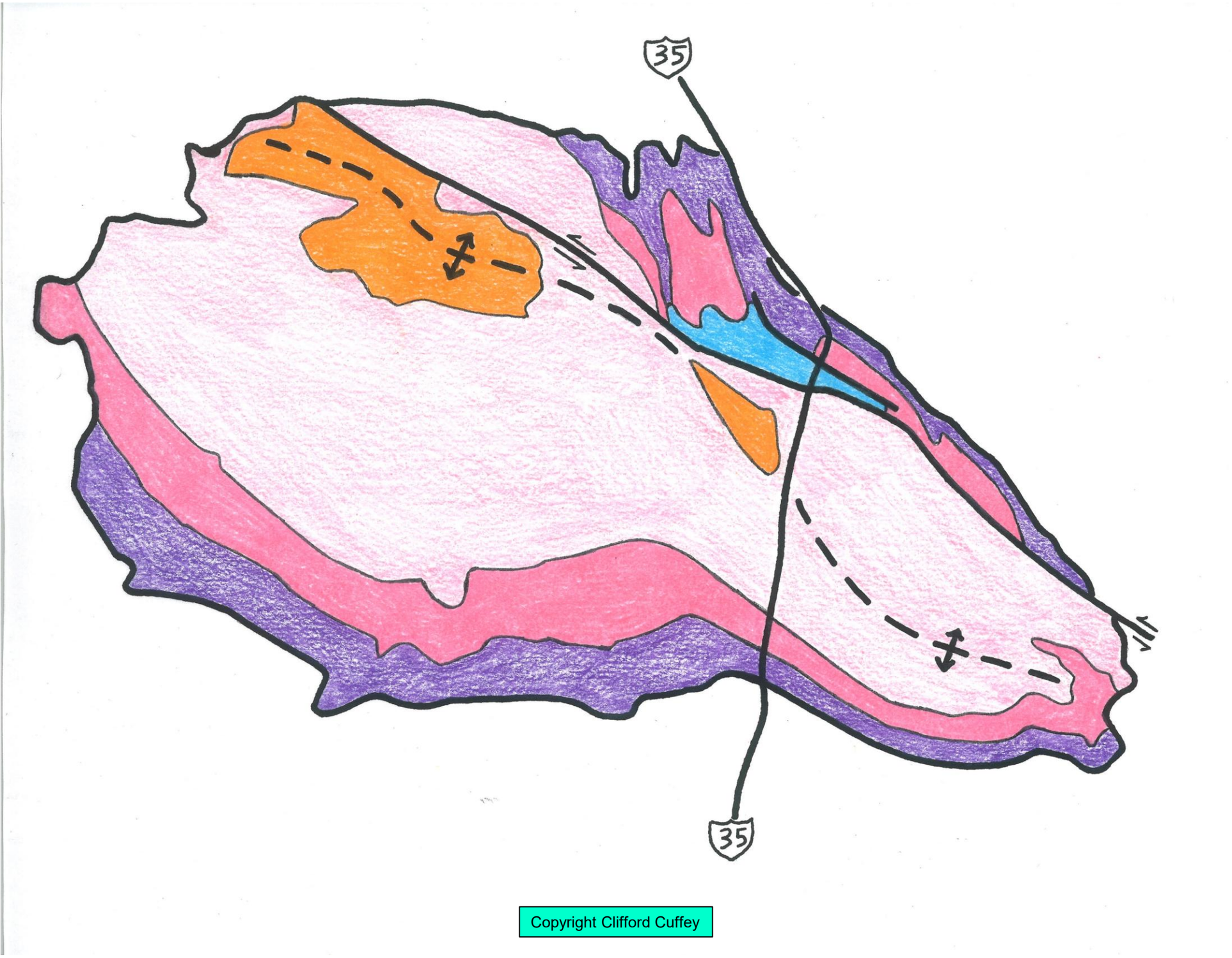
General geographic map of the Arbuckle Mountains, with I-35.



Generalized locations of the outcrops along I-35 (and adjacent roads) that illustrate the geology of the Arbuckle Mountains.



Simplified geologic map of the Arbuckle Mountains. Orange: Cambrian volcanics and sedimentary rocks. Light pink: Lower Ordovician Arbuckle Group carbonates. Pink: lower Middle Ordovician Simpson Group carbonates and siliciclastics. Purple: upper Middle Ordovician through Mississippian hogback-forming carbonates and siliciclastics.



Simplified geologic cross section of the Arbuckle Mountains along I-35. Light pink: Lower Ordovician Arbuckle Group carbonates. Pink: lower Middle Ordovician Simpson Group carbonates and siliciclastics. Purple: upper Middle Ordovician through Mississippian hogback-forming carbonates and siliciclastics.

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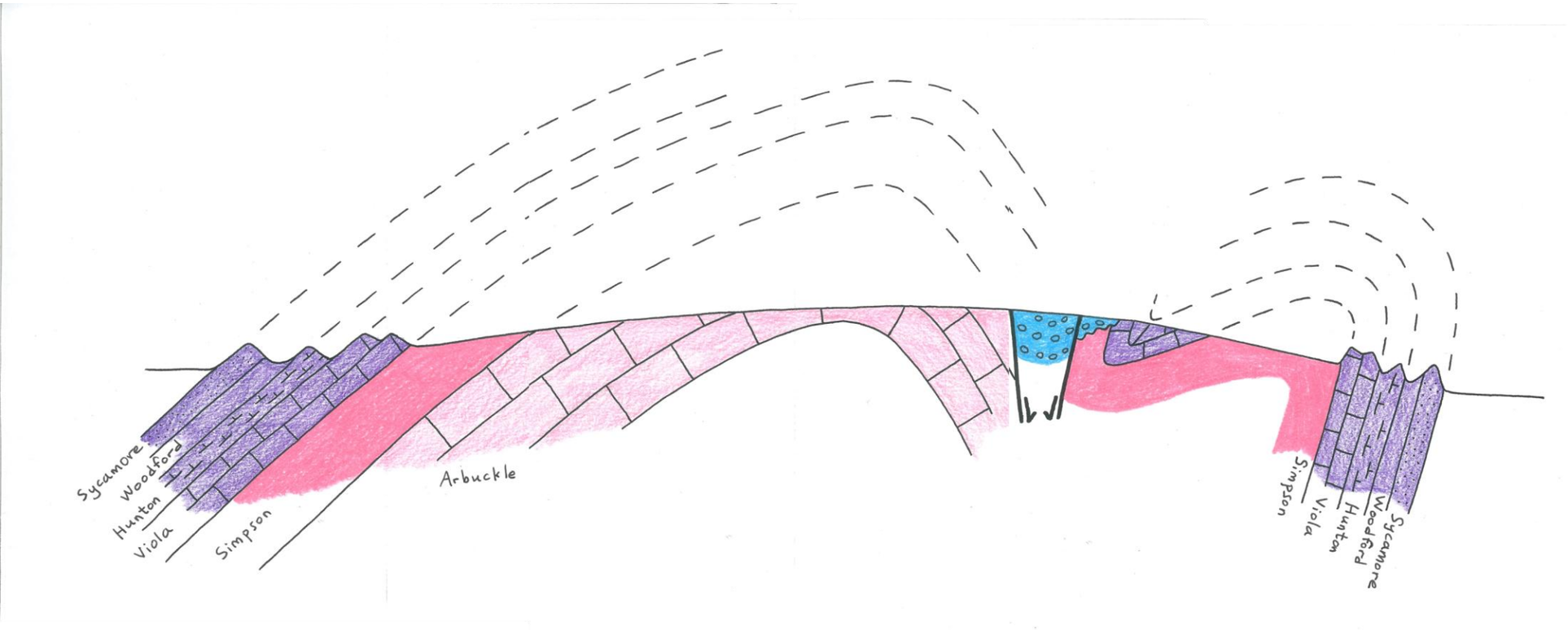

Simplified geologic cross section of the Arbuckle Mountains along I-35, annotated with representative photos to show large-scale structure.

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ARBUCKLE MOUNTAINS SCENERY

OKLAMURR-6: View from hilltop adjacent to OK77D east of I-35. Note the hogback ridges in the foreground and middle ground that are the northern edge of the Arbuckle Mountains; and the flat plains in the distance to the north of the Arbuckle Mountains.

FA91-10-06

OKLAMURR-6

OKLAMURR-5: View from OK77D looking northeast across I-35. Note the hogback ridges in the foreground and middle ground that are the northern edge of the Arbuckle Mountains.

FA91-05-08

OKLAMURR-5

OKLAMURR-12: Scenic view from rest area. Typical low relief topography of the Arbuckle Mountains massif. Note the hogback ridges in the middle ground that are the northern edge of the Arbuckle Mountains; and the flat plains in the distance to the north of the Arbuckle Mountains.

FA90-07-26

OKLAMURR-12

OKLAMURR-12: Scenic view from rest area. Typical low relief topography of the Arbuckle Mountains massif.

FA90-07-27

OKLAMURR-12

OKLAMURR-24: Scenic overlook on the east side of I-35.
Typical low relief topography of the Arbuckle Mountains massif.

FA90-08-15

OKLAMURR-24

OKLAMURR-6: View from hilltop adjacent to OK77D east of I-35. High point of the Arbuckle Mountains held up by the Lower-Middle Cambrian rhyolites at the core of the Arbuckle Anticline.

FA91-05-11

OKLAMURR-6

OKLACART-11: Tombstone topography on the south flank of the Arbuckle Mountains; Arbuckle Group (Upper Cambrian-Lower Ordovician).

FA06-49-29

OKLACART-11

OKLACART-11: Tombstone topography on the south flank of the Arbuckle Mountains; Arbuckle Group (Upper Cambrian-Lower Ordovician).

FA06-49-30

OKLACART-11

OKLACART-10: Tombstone topography on the south flank of the Arbuckle Mountains; Arbuckle Group (Upper Cambrian-Lower Ordovician).

FA01-02-29

OKLACART-10

OKLACART-19: Scenic view of south edge of Arbuckle Mountains near the village of Woodford, OK. Here the southern edge is the prominent hogback held up by the Mississippian Sycamore Formation.

FA06-53-37

OKLACART-19

ARBUCKLE MOUNTAINS OUTCROPS
1-35 SOUTHBOUND

OKLAMURR-1: Roadcut on west side of US77; Sycamore Formation (Mississippian); dipping steeply south, but overturned (faces north).

FA06-48-08

OKLAMURR-1

OKLAMURR-4: Roadcut on OK77D; Woodford Shale (Upper Devonian & basal Mississippian); dip near vertical, faces north.

TG01-03-26

OKLAMURR-4

OKLAMURR-2: Roadcut on west side of US77; Hunton Group (Silurian-Lower Devonian) overlying Sylvan Shale (Upper Ordovician); dipping steeply north, faces north.

FA90-PRA-29

OKLAMURR-2

OKLAMURR-7: Roadcut on west side of I-35; Viola Limestone (Middle-Upper Ordovician); very steep north dip, faces north.

FA91-05-07

OKLAMURR-7

OKLAMURR-8: Roadcut on west side of I-35; Viola Limestone (Middle-Upper Ordovician) and Bromide Formation (lower Middle Ordovician); dipping south, but overturned (faces north).

TG01-02-29

OKLAMURR-8

OKLAMURR-8: Roadcut on west side of I-35; Viola Limestone (Middle-Upper Ordovician) and Bromide Formation (lower Middle Ordovician); dipping south, but overturned (faces north).

FA06-53-21

OKLAMURR-8

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-28

OKLAMURR-9

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-27

OKLAMURR-9

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-22

OKLAMURR-9

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-17

OKLAMURR-9

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-15

OKLAMURR-9

OKLAMURR-9: Long roadcut on west side of I-35; Bromide Fm overlain by Viola Ls (Middle-Upper Ordovician), first dipping moderately south and upright, then folded into syncline, then dipping steeply south and overturned; overlain with angular unconformity by the Collings Ranch Conglomerate (Pennsylvanian).

FA06-46-12

OKLAMURR-9

OKLAMURR-10: Long roadcut on east side of southbound lanes of I-35; Collings Ranch Conglomerate (Pennsylvanian) warped into broad syncline.

FA91-05-19

OKLAMURR-10

OKLAMURR-13: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); steep north dip and faces north.

TG01-01-28

OKLAMURR-13

OKLAMURR-14: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); steep north dip and faces north.

FA06-50-04

OKLAMURR-14

OKLAMURR-15: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); more or less flat lying.

FA06-50-05

OKLAMURR-15

OKLAMURR-16: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); dipping gently south and upright.

FA06-50-06

OKLAMURR-16

OKLAMURR-17: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks heavily folded and faulted (both normal and reverse).

SU92-01-05

OKLAMURR-17

OKLAMURR-17: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks heavily folded and faulted (both normal and reverse).

TG01-01-34

OKLAMURR-17

OKLAMURR-17: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks heavily folded and faulted (both normal and reverse).

TG01-01-35

OKLAMURR-17

OKLAMURR-18: Roadcut on both sides of the southbound lanes of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA06-52-28

OKLAMURR-18

OKLAMURR-19: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA06-52-32

OKLAMURR-19

OKLACART-1: Roadcut on west side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

WI96-05-36

OKLACART-1

OKLACART-2: Roadcut on west side of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

FA06-49-07

OKLACART-2

OKLACART-3: Roadcut on west side of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

FA06-49-09

OKLACART-3

OKLACART-4: Roadcut on west side of I-35; Hunton Group (Silurian-Lower Devonian); rocks dip south and are upright.

PA90-PRA-28

OKLACART-4

OKLACART-5: Roadcut on west side of I-35; Woodford Shale (Upper Devonian and basal Mississippian) overlain by Sycamore Formation (Mississippian); rocks dip south and are upright.

FA06-50-20

OKLACART-5

ARBUCKLE MOUNTAINS OUTCROPS
1-35 NORTHBOUND

OKLACART-6: Roadcut on east side of I-35; Woodford Shale (Upper Devonian and basal Mississippian) overlain by Sycamore Formation (Mississippian); rocks dip south and are upright.

FA01-01-36

OKLACART-6

OKLACART-7: Roadcuts on both sides of northbound lanes of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

TGO1-01-03

OKLACART-7

OKLACART-7: Roadcuts on both sides of northbound lanes of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

FA06-49-26

OKLACART-7

OKLACART-8: Roadcuts on both sides of northbound lanes of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

TG01-01-05

OKLACART-8

OKLACART-8: Roadcuts on both sides of northbound lanes of I-35; Viola Limestone (Middle-Upper Ordovician); rocks dip south and are upright.

FA06-49-28

OKLACART-8

OKLACART-9: Roadcut on east side of I-35; Oil Creek Formation (lower Middle Ordovician); rocks dip south and are upright.

FA90-PRA-27

OKLACART-9

OKLACART-12: Roadcut on east side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

photosFA90-08-10

OKLACART-12

OKLACART-12: Roadcut on east side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA90-08-11

OKLACART-12

OKLACART-12: Roadcut on east side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA90-08-12

OKLACART-12

OKLACART-14: Roadcut along I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA06-48-36

OKLACART-14

OKLAMURR-20: Roadcut along I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip south and are upright.

FA06-51-01

OKLAMURR-20

OKLAMURR-21: Roadcut along I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); dip uncertain, but probably south.

FA06-51-03

OKLAMURR-21

OKLAMURR-22: Roadcut on east side of I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip gently south, but are faulted (reverse).

TG01-03-30

OKLAMURR-22

OKLAMURR-23: Roadcut along I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dipping gently north.

FA06-50-24

OKLAMURR-23

OKLAMURR-25: Roadcut along I-35; Arbuckle Group (Upper Cambrian-Lower Ordovician); rocks dip steeply north and are upright.

FA06-51-04

OKLAMURR-25

OKLAMURR-26: Roadcut along west side of northbound lanes of I-35; Collings Ranch Conglomerate (Pennsylvanian) warped into broad syncline.

FA06-50-27

OKLAMURR-26

OKLAMURR-26: Roadcut along west side of northbound lanes of I-35; Collings Ranch Conglomerate (Pennsylvanian) warped into broad syncline.

FA06-50-30

OKLAMURR-26

OKLAMURR-26: Roadcut along west side of northbound lanes of I-35; Collings Ranch Conglomerate (Pennsylvanian) warped into broad syncline.

FA06-50-33

OKLAMURR-26

OKLAMURR-27: Roadcut along east side of I-35; Bromide Formation and Viola Limestone (Middle-Upper Ordovician); dipping south and upright.

FA06-52-04

OKLAMURR-27

OKLAMURR-27: Roadcut along east side of I-35; Bromide Formation and Viola Limestone (Middle-Upper Ordovician); dipping south and upright.

FA06-52-06

OKLAMURR-27

OKLAMURR-28: Roadcut along east side of I-35; Tulip Creek and McLish Formations (lower Middle Ordovician); dipping steeply south but overturned (face north).

FA06-52-10

OKLAMURR-28

OKLAMURR-29: Roadcut along east side of I-35; Bromide Formation and Viola Limestone (Middle-Upper Ordovician); dipping steeply south but overturned (face north).

FA06-52-18

OKLAMURR-29

OKLAMURR-29: Roadcut along east side of I-35; Bromide Formation and Viola Limestone (Middle-Upper Ordovician); dipping steeply south but overturned (face north).

FA06-52-19

OKLAMURR-29

OKLAMURR-30: Roadcut along east side of I-35; Viola Limestone (Middle-Upper Ordovician); dipping steeply south but overturned (face north).

photos

OKLAMURR-30

OKLAMURR-31: Roadcut on east side of I-35; Sycamore Formation (Mississippian); dipping steeply south but overturned (face north).

FA06-52-23

OKLAMURR-31