The Problem of the Welden, Sycamore and Lower Caney in the Eastern Arbuckle Mountains

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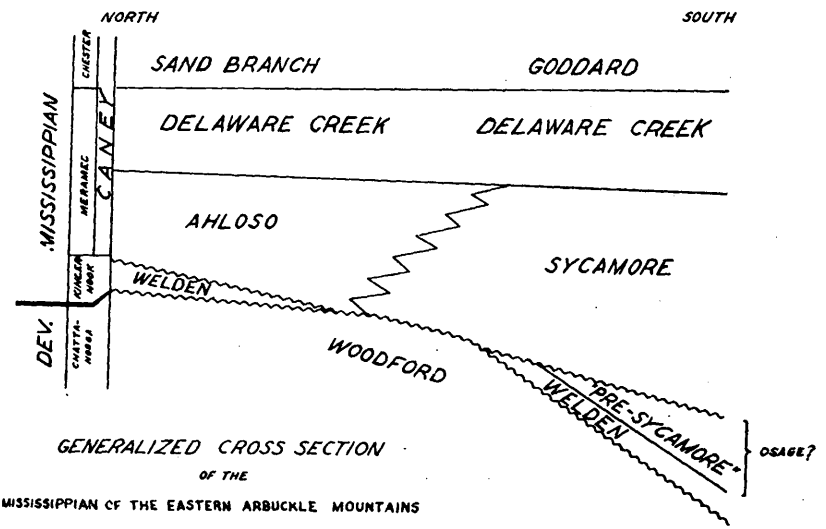
This paper is a preliminary report on an investigation being conducted by the writer. This problem was suggested by Dr. Philip A. Chenoweth and was originally intended to be a study of the stratigraphy of the Sycamore formation. However, it would be impossible to complete a study of the Sycamore without a detailed understanding of the associated formations. The primary purpose of this study is to attempt to establish a time-rock correlation between the Mississippian sections on the northern and southern flanks of the Arbuckle Mountains. Much use has been made of the work of other investigators (Elias, 1956; Huffman and Barker, 1950; Branson, 1957, and others).

Northern Arbuckle Mountains

The Mississippian section in the northern Arbuckle Mountains and the Lawrence Uplift area is composed of the Welden and Caney formations. The Welden rests unconformably on the black shales of the Woodford formation. Branson (1957, p. 79) stated that the rocks of the Chattanooga black shale group have been more or less consistently placed in the Upper Devonian by paleontologists and in the Mississippian by oil-field stratigraphers. Branson placed the Woodford in the Chattanoogan series, which is uppermost Devonian.

The Welden formation includes a light-green, blocky, glauconitic, yellowish weathering shale at the base. Cooper (1939) collected a conodont fauna from this zone, which compared favorably with the conodont fauna of the Bushberg-Hannibal horizon of Kinderhookian age in Missouri. This shale is overlain by the Welden limestone, which was at one time considered equivalent to the Sycamore limestone by Morgan (1924). This unit was named by Cooper (1931) for exposures along Welden Creek, section 22, T. 3 N., R. 6 E., Pontotoc County, Oklahoma. In the Lawrence Uplift area, this bed consists of 0 to 5 feet of light-gray to buff, fine-crystalline, argillaceous, massive, fossiliferous limestone, which weathers to a yellow or orange color. This limestone contains scattered phosphatic nodules of the same appearance as those observed in some areas in the upper part of the Woodford formation. The occurrence of these nodules presents a question as to their origin. If they were formed in place, then it appears that the conditions of deposition, under which they were formed, were very similar to the conditions of deposition in late Chattanoogan time. If, however, they were not formed in place, it is logical to assume that they were derived from the Woodford formation. The absence of other clastic material, other than clay-size particles, would also support the theory of the Woodford as a source bed. Above the limestone there is a bed of light-gray to green, blocky, glauconitic shale. This bed weathers to a yellow or pale green and is approximately 6 inches to 1 foot thick.

The lower part of the Caney formation in this area is divided into two members. The lower member is the Ahloso, which is a new name applied by Elias (1956). The Ahloso is a dark-gray to dark-brown, calcareous, blocky, silty shale. This unit has been previously referred to as the "Mayes" or "Ada Mayes" by other authors (Barker, 1951, p. 176; Kuhleman, 1951, pp. 196-200). The Ahloso has been referred to the lower Meramec by Elias and others. Overlying the Ahloso is the Delaware Creek member, also a new name applied by Elias. The contact between these two members is apparently conformable. The Delaware Creek member is a dark-gray, platy, micaceous, bituminous shale. It has been placed in the upper Meramec by Elias.



GENERALIZED CROSS SECTION
OF THE
MISSISSIPPIAN OF THE EASTERN ARBUCKLE MOUNTAINS

STEVE C. CHAMPLIN 1958

SOUTHERN ARBUCKLE MOUNTAINS

The Mississippian section on the south flank of the Arbuckle Mountains includes, in ascending order, the Welden formation, the "pre-Sycamore" sequence, the Sycamore limestone, the Delaware Creek member of the Caney formation and Goddard formation. It has been suggested by Branson (1957) and others that the Springer shale may also be Mississippian in age, but that question is not within the scope of this paper.

The Welden formation was first observed in this area by the writer at an exposure on Courtney Creek in the NW SW of section 36, T. 3 S., R. 4 E. At this locality the Welden formation is approximately 2 feet thick. At the base is a 1-foot bed of light-green, glauconitic shale, which overlies a 2-foot zone of phosphatic nodules in the upper Woodford formation. Sratigraphically and lithologically, this shale bears a remarkable similarity to the green shale which overlies the Woodford formation in the Lawrence Uplift area. The Welden limestone at this exposure is represented by a 6-inch bed of light-gray to buff, fine-crystalline, argillaceous, fossiliferous, glauconitic limestone. This limestone is identical, lithologically, to the Welden limestone of the Lawrence Uplift area and contains nodules of the same type as those observed in the type Welden. These nodules are similar to the nodules in the underlying Woodford formation, but they appear to be of a more fragmental nature. This would lend support to the theory that they were derived from erosion of the Woodford. The striking lithologic similarity, coupled with the stratigraphic position of this bed, indicates that the writer is justified in calling this bed the Welden limestone. However, this usage is subject to paleontological confirmation. Overlying the limestone is a 6-inch bed of light-gray to greenish-gray, blocky, glauconitic shale. This shale is comparable to the shale which occupies the same stratigraphic position in the Lawrence Uplift area, but there does not appear to be as great an abundance of glauconite at this locality.

The "pre-Sycamore" sequence is well exposed at the locality on Courtney Creek. It consists of approximately 45 feet of alternating beds of limestone and shale. The limestones are gray to buff, dense, slightly silty, siliceous limestones and weather to the yellow color, which is characteristic of the limestones of the Sycamore formation. The limestones range in thickness from several inches up to 3 feet. The shales of this sequence are dark-gray to dark-brown, blocky, siliceous, fucoidal shales. These shale beds range in thickness from several inches up to approximately 6 feet. The writer has recently collected a fauna from one of the shale beds approximately 30 feet above the base of the unit. A positive identification of the specimens has not been made, but the forms all appear to belong to the same brachiopod species. The specimens are poorly preserved and it is doubtful that they will be of much use in a positive age determination. As a result of the paucity of fossils in this interval, the age is questionable. Bennison (1956, p. 112) reported that Kinderhook and Osage fossils have been collected from this interval at Crusher and that they probably lie below an unconformity in the Sycamore. He stated that the type Sycamore probably comprises two distinct formations and that the lower is probably Welden in part, or "pre-Sycamore." If the writer is justified in indentifying the Welden as a unit on the south flank of the Arbuckles, then there exist both a Welden and a "pre-Sycamore." The "pre-Sycamore" or the Estate member of the Sycamore (Prestridge, 1957, pp. 27-30) is probably the representative of late Kinderhook or early Osage deposition in the Ardmore Basin. A detailed paleontologic or palynologic study of this sequence is an absolute necessity for the successful solution of this age question.

The Sycamore limestone rests upon the "pre-Sycamore" with apparent

conformity. However, faunal evidence and the presence of a glauconitic zone at the contact seem to indicate a paraconformable relationship. This relationship probably existed basinward and it would be expected to become more angular to the north. The Sycamore is slate gray to buff, dense, conchoidally fracturing, massive-bedded, argillaceous, silty to sandy limestone. It exhibits a diagnostic yellow color on the weathered surfaces, which is probably due to an abundance of finely disseminated pyrite crystals (Braun, 1958, p. 37). The massive limestone units of the Sycamore are separated by beds of dark-gray, calcareous, blocky to platy, Caney-type shale. The limestones are silty throughout and there appears to be an increase in the amount of argillaceous material toward the top. This is to be expected, as the upper part of the formation seems to represent a transition from carbonate to black shale deposition. No doubt, additional light will be shed on the question when the writer has completed insoluble residue studies of the formation. The writer considers the Sycamore to be of Meramec age, in agreement with recent investigations (Bennison, 1956; Harlton, 1956; Branson, 1957, and others).

The Caney formation in the southern Arbuckle Mountains is represented by the Delaware Creek member of Elias (1956). Elias stated that the whole section of the Caney shale in the southern Arbuckle Mountains and Ardmore Basin appears to belong to the Delaware Creek member only. The Delaware Creek is a dark-gray, thin-bedded to blocky, hard, locally siliceous shale. This shale is fairly resistant to erosion, in contrast with the softer shale of the Delaware Creek member in the northern Arbuckle Mountains. It is also more resistant than the overlying shales of the Goddard formation. Elias placed the Delaware Creek in the upper Meramec.

SUMMARY

Any study of the stratigraphic relationships within this interval is handicapped by several factors. One dominant handicap is that the zone of facies change, that was once present, has been removed by erosion over the Arbuckle Mountains. Another factor is that there is very little known about the true nature of the Tishomingo Ridge Complex. It appears that this ancient structural feature probably contributed some sediments to the early Mississippian seas. To what extent it controlled deposition of early and middle Mississippian sediments is not known. Still another major factor is the lack of a representative faunal assemblage in the "pre-Sycamore" unit. The writer is hopeful that such an assemblage will be found.

The primary contribution of this study has been the recognition of the Welden formation on the south flank of the Arbuckle Mountains. This bed has been described in the Ardmore Basin by Prestridge (1957) and in the southeastern part of the Anadarko Basin by Braun (1958). Therefore, it appears that the Welden is present throughout much of southern Oklahoma and maintains remarkably uniform lithologic characteristics throughout the area.

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