MISSISSIPPIAN PROBLEMS IN THE LAWRENCE UPLIFT, PONTOTOC COUNTY, OKLAHOMA

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The sequence of Mississippian units in the Lawrence Uplift south of Ada, Oklahoma includes, in ascending order, the Woodford shale, the Welden limestone, and the Caney formation.

The Woodford, which lies unconformably on the Hunton limestone, consists of black, fissile, bituminous shale. The average thickness based on outcrop measurement is 200 feet in the Lawrence Uplift (16). The unit thickens southward to over 625 feet. The Woodford is correlated with the Chattanooga shale of uppermost Devonian and lower Mississippian age.

The Welden limestone is separated from the Woodford by a thin bed of yellowish, clayey shale (Pre-Welden shale) from which Cooper (7) collected a conodont fauna which he compared with forms in the Bushberg-Hannibal sequence of Kinderhookian age in Missouri.

The Welden limestone, previously mapped as Sycamore (16), was named by Cooper (6) from exposures along Welden Creek, section 22, T. 3 N., R. 6 E., Pontotoc County, Oklahoma. Here the unit comprises 2 to 5 feet of blue-gray to yellow, massive, argillaceous limestone. It thins southward to extinction in the Franks Graben south of the Stonewall Fault where the basal glauconitic beds of the Caney ("Ada Mayes") rest with unconformity on the Woodford.

The age of the Welden has been the subject of considerable controversy. Although these beds were originally considered Kinderhookian by Schuchert on the basis of fossils collected by Morgan (16), the Welden was classed as St. Louis (Meramecian) by Cooper (7) who considered it younger than the Sycamore limestone of the Arbuckle Mountain area. Girty (9) compared the fauna of the Welden with that of the Sycamore and concluded that the Welden was older and probably equivalent to some part of the Kinderhookian.

The fauna collected and identified by Barker (1) from the Welden limestone includes *Proetus roundyi* Girty, *Proetus roundyi* var. *alternatus* Girty, *Selenella* (?) *subcircularis* Girty, *Chonetina subcarinata* Girty, *Brachythyris peculiaris* (Shumard), and *Rhipidomella perminuta* Girty which are common to a crinoidal limestone below the Barnett shale in San Saba County, Texas which has been included in the Chappel limestone and correlated with the Chouteau limestone of Missouri by Cloud and Barnes (5). *Chonetes* sp *cf. C. glenparkensis* Weller which is present in the Welden is common to the Chouteau limestone. Faunal evidence therefore indicates that the Welden is of Kinderhookian age and equivalent to some part of the Chouteau formation of the type section.

The Welden is overlain unconformably by the Caney formation, a sequence of units including a lower calcareous siltstone and an upper black shale. The lower calcareous phase has been considered equivalent to the subsurface "Mayes" by subsurface geologists (2, 11, 15) and is frequently referred to by them as the "Ada Mayes."

The "Ada Mayes" is composed of calcareous shales, calcareous siltstones, and concretionary limestones in ascending order. At the base is a prominent bed of glauconite which can be recognized throughout the area. Good exposures of the "Ada Mayes" are rare and thickness determinations are difficult. Approximately 25-35 feet is exposed in the Lawrence Uplift and 175-200 feet was recognized by Kuhleman (12) south of the Stonewall Fault.

The calcareous shale and limy siltstones of the "Ada Mayes" carry a brachiopod fauna including *Spirifer martiniiformis* Girty, *Leiorhynchus carboniferum* var. *polypleurum* Girty, and *Pustula hirsutiformis* (Walcott). The overlying concretionary limestones contain a molluscan fauna with *Goniatites choctawensis* Shumard, *Caneyella vaughani* Girty, *Caneyella nasuta* Girty, and *Caneyella richardsoni* Girty. These forms are characteristic of the Barnett shale of Texas, the Moorefield and Ruddell of Arkansas and the lower Mayes of Snider (18) in northeastern Oklahoma. General lithic similarity and detailed subsurface studies (17) indicate that the "Ada Mayes" and the Sycamore of the Arbuckle region are correlative and that the Sycamore is but a somewhat calcareous phase of Caney deposition (9).

Surface and subsurface correlations of the "Mayes" are not in accord at the present time. Snider (18) correlated the lower part of the Mayes formation of Mayes County, Oklahoma with the Moorefield of Arkansas which Gordon (10) considers equivalent to the St. Louis formation of Meramecian age. The Meramec age of the lower part of Snider's Mayes was recognized by Buchanan (3) who extended the term into the subsurface to include the black, argillaceous lime section in the lower part of the Caney shale. Truncation and overlap of the Osagean section by rocks of Meramec age from south to north in northeastern Oklahoma was demonstrated by Cline (4) and supported by Laudon (13, 14). On the basis of faunal affinities and lithological relationships, the lower Caney or "Ada Mayes" of the Lawrence Uplift Area is like the lower part of the Mayes of northeastern Oklahoma and the Moorefield and Ruddell formations of Arkansas.

According to Cram (8), Selk (17), and others, the "Mayes" of the subsurface is Osagean in age and represents an abrupt change from the light colored Boone chert to dark, calcareous siltstones and argillaceous limestones.

It is possible that in subsurface the Moorefield and "Ada Mayes" actually overlie beds of the Osagean age having similar lithology, grading by facies change southward from typical Boone chert and white limestone of northern Oklahoma and southern Kansas. Current investigations in northeastern Oklahoma are expected to yield new information concerning the relation of the Mayes and Boone formations on the southwest flank of the Ozark uplift.

The upper part of the Caney comprises a thick sequence of brownish-black, fissile shale and limestone concretions which have yielded *Cravenoceras richardsonianum* (Girty), a typical Mississippian goniatite. *Actinoceras vaughanianum* Girty is also present. Stratigraphically, lithologically, and faunally, the upper Caney resembles the Fayetteville shale of northeastern Oklahoma and Arkansas, classed as upper Mississippian, Chesterian.

Separation of the Caney from the overlying Pennsylvanian Springer shale is difficult in surface exposures inasmuch as the units are lithologically similar. A zone of sideritic concretions lying above the black concretionary zone of the upper Caney and containing cephalopods of Pennsylvanian affinity (Miller, personal communication 1950) is considered to mark the approximate base of the Springer in this area.

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