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## **Lithologic Basis for Correlation of Mississippian Rocks in the Subsurface Between Kansas and North Central Oklahoma**

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In the past subsurface rocks of Mississippian age throughout north central Oklahoma have generally been considered as a single unit and referred to as undifferentiated Meramec-Osage in age. This paper is a summary of two Master of Science theses recently completed at the University of Oklahoma by the writer and Wayne D. Thornton, in which an attempt was made to subdivide the Mississippian system in north central Oklahoma on the basis of lithology. North central Oklahoma as described for the purpose of this paper includes Alfalfa, Garfield and parts of Woods, and Grant Counties.

All descriptions of lithology were obtained from the microscopic examination of well cuttings. Lithologic descriptions of time-rock units assigned to the Mississippian system in Kansas by Clair (1948) and Lee (1940) were used as the criterion for the subdivisions proposed in this paper. Joseph R. Clair (1948) subdivided the Mississippian system into its four series, in descending order, the Chesterian, Meramecian, Osagean and Kinderhookian. With the exception of the Chesterian, he subdivided the series into formations and mapped their aerial distribution throughout the subsurface of western Kansas to the Oklahoma border. As this study is of a general nature, no attempt has been made to subdivide the Mississippian rocks in north central Oklahoma into formations as did Clair in Kansas.

### **KINDERHOOKIAN OR OSAGEAN**

In north central Oklahoma the lowermost beds assigned to the Mississippian system are a greenish-gray to light buff, fine- to medium-crys-

talline, sparsely cherty limestone overlain by light gray to brown, silty shale. This unit appears to change in facies from the limestones and shales in the west to a buff to brown dolomite and dolomitic siltstone in the east. This change in facies is similar to the transition in Kinderhookian rocks in eastern Kansas, where Lee (1940) described the gradation of the Northview shale and Compton limestone into the Chouteau limestone. However, Lee stated that there is no Chouteau equivalent present west of the Nemaha ridge and referred the rocks which overlie the Woodford shale in the vicinity of the Oklahoma and Kansas border to the St. Joe formation of Osagean age. Clair described the lowermost limestone of the Mississippian in western Kansas as a "coarsely crystalline, coarsely oolitic and extremely fossiliferous limestone, both cherty and non-cherty." He referred this limestone to the Chouteau formation and considered the unit a time equivalent to the Northview shale and Compton limestone.

Because of the controversy which exists as to the position of the St. Joe limestone as described by Lee and the Chouteau limestone as described by Clair the rocks immediately above the Woodford shale in north central Oklahoma have been considered as Kinderhookian or Osagean in age.

#### OSAGEAN

In north central Oklahoma the Kinderhookian or Osagean unit is overlain by a thick sequence of dark, silty, cherty limestones and dolomitic limestones. This unit makes up the greater part of the Mississippian system throughout the area. Clair described the Osagean series, along the Kansas Oklahoma border as being "dark-gray, drab, silty, shaley, dirty, finely crystalline dolomites, with dark gray, mottled, opaque, fossiliferous chert." This is the same as Lee's "Cowley" formation which Lee referred to the Meramec. Clair is of the opinion that the "Cowley" is a basin facies deposit of the Osage and that it continues into the Meramec, therefore making it virtually impossible to subdivide the Osagean into formations or define the Meramecian-Osagean boundary. From the examination of well cuttings it is apparent that these dark, dirty, dolomitic limestones continue into north central Oklahoma and are representative of the Osagean unit in the northeastern part of the area along the Kansas border.

In the southwestern part of the area the upper part of the Osagean unit is off-white to buff, bluish-gray, fine- to medium-crystalline cherty dolomitic limestones which grade to dark gray to brown fine crystalline dolomitic limestones in the base of the unit. Here the Osagean lithology is similar to that described by Clair exclusive to the Basin facies deposit. The chert associated with the Osagean unit is the most distinctive characteristic of the Mississippian system in north central Oklahoma. Chert is not only more abundant in the Osagean unit, it is generally semi-translucent to opaque, dark and in part microfossiliferous. Although the abundance of chert is a dominant characteristic of the Osagean rocks, there are zones in which it is absent.

Toward the base of the Osagean unit there is a brown, dense sub-lithographic, argillaceous, dolomitic limestone that is similar to the St. Joe limestone described by Clair in western Kansas. This is the most persistent lithologic zone referable to the Osagean unit throughout north central Oklahoma.

#### MERAMECIAN

Rocks referred to the Meramecian unit in north central Oklahoma are relatively thin and consist of various shades of gray, tan to buff, medium- to coarse-crystalline, fossiliferous limestones and dolomitic limestones, with light to medium-gray, semi-translucent to opaque chert. Rocks referred to the Meramec by Clair in western Kansas are divided into four

formations, the Ste. Genevieve at the top, St. Louis, Spergen and the Warsaw at the base. The Ste. Genevieve, St. Louis and Spergen formations are described as white to buff, fine- to coarsely crystalline, fossiliferous limestones to dolomitic limestones, with varying amounts of light colored semi-translucent to opaque chert. The Warsaw formation at the base of the Meramec is described by Clair as being similar in lithology to the basin facies of the Osage. Because of this similarity in lithology the base of the Meramecian unit is drawn at the first appearance of abundant, medium to dark-colored chert associated with the fine crystalline, dolomitic limestones of the Osagean unit.

#### CHESTERIAN

There has been no attempt to subdivide into formations the rock assigned to the Chesterian series in western Kansas, but Clair did describe three lithologic groups that appear to be present. The uppermost beds of the Chesterian series he described as being gray to buff, finely oolitic, slightly porous, extremely fossiliferous limestones. Below this is a section of variable thickness made up of gray, white to buff, and light brown finely crystalline, very finely sandy, dense limestones with interbedded gray, green and maroon shales. The lower lithologic group he described as being predominantly maroon and green shales, interbedded with thin, finely sandy limestones.

These three lithologic groups can be identified in the rocks of Chesterian age examined in the extreme southwestern part of the area where there is a relatively thick sequence of Chesterian rocks present. The Chesterian unit thins rapidly from the southwest to the northeast, the upper beds missing due to pre-Pennsylvanian erosion.

#### SUMMARY

By comparison of lithology, the Chesterian, Meramecian and Osagean units of the Mississippian system as subdivided in Kansas, can be correlated into north central Oklahoma and their approximate subsurface limits defined. Due to contradicting lithologic correlations and the lack of sufficient evidence to support a definite age assignment, the lowermost beds of the Mississippian system in north central Oklahoma are considered as either Kinderhookian or Osagean in age.

The Osagean unit as described by Clair is indentifiable in north central Oklahoma and constitutes the greater part of the Mississippian system throughout the area. The Meramecian unit is relatively thin where present and is distinguished from the underlying Osagean unit by its lighter color, coarser texture and lesser amount of chert. The Chesterian unit is present only in the southwest part of the area and can be distinguished from the underlying Meramecian sediments. However, it is difficult to determine the boundary between the Chesterian and overlying Pennsylvanian shales.

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