
SUBSURFACE GEOLOGICAL CROSS SECTION MCALESTER BASIN TO ANADARKO BASIN, CENTRAL OKLAHOMA

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INTRODUCTION

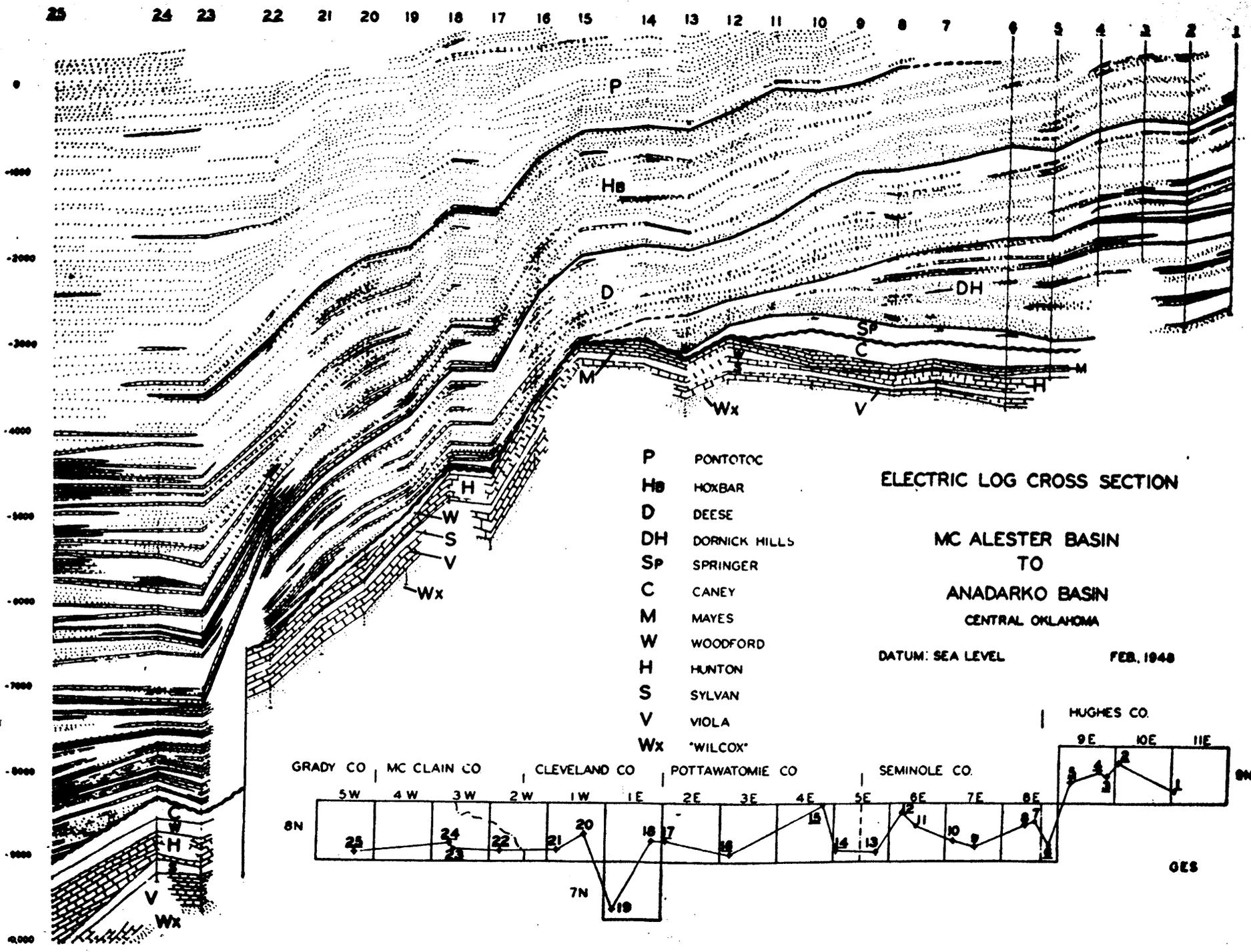
Mr. Ed Kerr, formerly a student at the University of Oklahoma, chose a special problem of correlating all the subsurface beds between the McAlester Basin and the Anadarko Basin in central Oklahoma, using only electrical well logs. His work was completed at a vertical scale of 1 inch equals 100 feet, in order to delineate each particular subsurface bed and thus to effect a more-precise correlation between individual wells, with the subsequent more-accurate correlation between the two basins.

Inasmuch as this original scale was of tremendous size, and far too large to handle, the original tracing was reduced photographically to approximately one-third the original size, whereby 1 inch vertically equals about 300 feet. For final drafting into Fig. 1 of this report, this reduced drawing was carefully redrawn on a third paper; lithology of each individual bed was shown at a scale that could be further reduced for publication. This last drafting step was ably completed by Mr. George E. Summers, Jr., advanced student of geology at the University of Oklahoma.

STRATIGRAPHY

In constructing the original cross-section diagram, each well was plotted on a sea-level datum, and the base of the Pennsylvanian system of rocks was chosen as a starting point for detailed correlations. This proved to be a highly satisfactory procedure since this particular point is readily found, and is generally agreed upon by most subsurface-geology workers in this part of Oklahoma.

For convenience in referring to the various groups of formations, and for ease in correlations, the southern-Oklahoma terminology for the Pennsylvanian system has been used. These groupings are shown with the Pontotoc at the top followed by the Hoxbar, Deese, and Dornick Hills, and with the Springer at the base. Below the Pennsylvanian, each formation is named individually.

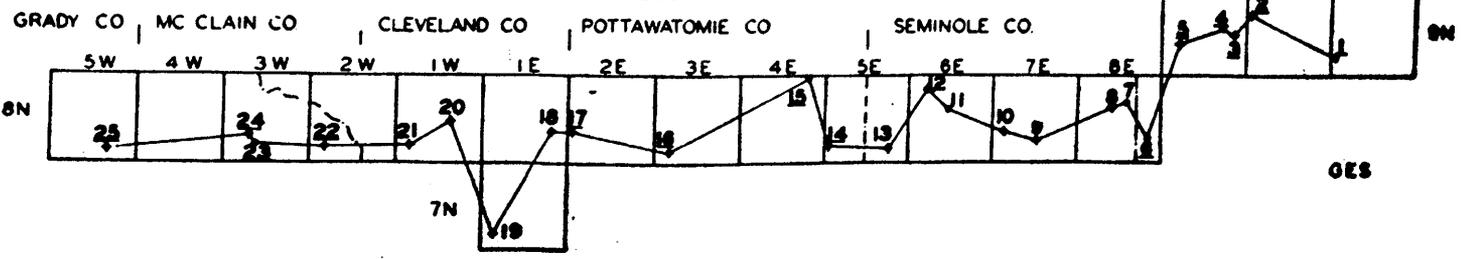


- P PONTOTOC
- Hb HOXBAR
- D DEESE
- DH DORNICK HILLS
- SP SPRINGER
- C CANEY
- M MAYES
- W WOODFORD
- H HUNTON
- S SYLVAN
- V VIOLA
- Wx 'WILCOX'

ELECTRIC LOG CROSS SECTION

MC ALESTER BASIN
TO
ANADARKO BASIN
CENTRAL OKLAHOMA

DATUM: SEA LEVEL FEB. 1948



The Pontotoc is essentially Permian in age and lies on the surface west of the latitude of Ada, Oklahoma. There is marked development of sandstones in the Pontotoc east of Cleveland County. A great number of these sandstones yield fresh water, and are so indicated by the character of the electric log. In the western part of the area, that is, in western Cleveland and McClain Counties, there are a few limestone beds of limited extent and hence of no particular value in correlation. These limestone beds, however, do indicate that the Pontotoc rocks were deposited in deeper waters in this part of the State.

Essentially equivalent to the Hoxbar of southern Oklahoma are the Virgil and Missouri series of northern Oklahoma and Kansas. This interval includes the following well-defined units of northern Oklahoma: Pawhuska limestone, Egin-Hoover sandstone, Endicott and Carmichael sandstones, Oread limestone, the Tonkawa group of sandstones and limestones, the Avant and Dewey limestones, the Hogshooter limestone, the Layton sandstone, and the Checkerboard limestone. All of these are mappable surface geological units as well as well-defined subsurface units. Correlations on this cross section are generally good in the Hoxbar.

The base of the Hoxbar and top of the Deese are placed at the base of the true Checkerboard limestone, or at the base of the Cleveland sandstone. This contact can be traced accurately completely across the area and provides perhaps the most-distinct correlation point of the cross section, with the exception of the base of the Pennsylvanian.

As the Deese is traced from east to west it is seen that the thickness is remarkably uniform. This grouping includes the thick shale interval above the Oswego, the Oswego limestone, and the Cherokee-shale group. It is one of the important oil-producing horizons in Oklahoma. The Cherokee-shale group in particular carries prolific oil-producing sandstones such as the Frue, Skinner, Red Fork, and Bartlesville sandstones. These latter sandstone beds are generally erratic and spotty in their occurrence and are difficult to correlate over any very large area.

East of Pottawatomie County, beds assignable to the Dornick Hills come into the section and thicken eastward. This grouping includes the important oil-producing formations of this part of Oklahoma—the Booch, Gilcrease, and Cromwell sandstones. Correlations in this interval are doubtful in many instances. For example, the Gilcrease sandstone lies well above the Wapanucka limestone in the eastern part of the cross section. Westward, however, the Gilcrease moves closer to the Wapanucka limestone until it rests upon it, and finally, evidently, the Wapanucka is completely cut out and the Gilcrease sandstone approaches the Cromwell sandstone.

The Springer shale (originally termed the Penn-Caney) may be recognized in subsurface from central Seminole County eastward into the McAlester Basin. This is a well-defined bed, as indicated both by the study of well samples, and by its distinctive character on the electrical well logs.

Below the unconformity at the base of the Pennsylvanian are found the Caney shale on the east, the Mayes limestone, Woodford shale, and Hunton limestone in Cleveland County. Westward, in the deeper portions of the Anadarko Basin, the Woodford is found at the base of the Pennsylvanian, while west of the big fault the Caney-shale-Sycamore-limestone section lies immediately below the Pennsylvanian.

The Caney-shale, Mayes-limestone, and Woodford-shale units are all thin in western Seminole County and absent in Cleveland County. On the other hand, the thickness of the Hunton limestone throughout the cross section depends upon the amount of erosion which took place in post-Hunton, pre-Woodford time. The Sylvan shale is remarkably uniform in thickness in the cross section, being regionally thicker in the Anadarko Basin.

The First Wilcox sandstone, most prolific oil-producing horizon in the Seminole area, seems to change into dolomites and siliceous limestone west of Seminole County. At the same time, the interval from the top of the Viola

limestone to the so-called Wilcox sandstone thickens greatly. The most plausible explanation for this seems to be that the First Wilcox is a sandy phase of the Viola, Trenton member, while the Second Wilcox sandstone is essentially equivalent to the First Bromide sandstone as recognized in Cleveland County and on to the west. This would place the top of the Simpson group (which carries the Bromide formation) below the First Wilcox sandstone. Space does not permit a more-thorough discussion of this problem.

STRUCTURE

From a structural standpoint, this cross section shows that the upper and middle Pennsylvanian beds have a more-or-less regular westward dip from the McAlester Basin, westward across Seminole, Pottawatomie, and Cleveland Counties, on into the Anadarko Basin. The lower Pennsylvanian, however, thickens greatly in the McAlester Basin, and evidently pinches out toward the west, on the Seminole uplift.

The major fault in McClain County has been only recently recognized.¹ It is post basal Pennsylvanian, pre-Deese, and probably lower Pennsylvanian in age; and, even though evidently associated with the well-known Nemaha Granite Ridge deformation, it is not a continuation of this line of folding. The correct interpretation of the age of this fault, its mechanics, and its relationship to oil production in this general area, are now being studied.

SEDIMENTATION

The preponderance of sandstones in the Hoxbar east of McClain County and the general increase of limestone in McClain and Grady Counties may indicate in a general manner the mode of deposition of the Hoxbar. The sandstones are evidently near-shore deposits, while in the deeper parts of the Anadarko Basin, limestones were being deposited. Thus limestones may be the same age as sandstones, and many correlation lines on this cross section so indicate.

Much the same conditions of sedimentation prevailed during the Deese, with more limestones in the deeper part of the basin to the west, while sandstones predominate in the eastern part of the cross section. This fact may contribute to the solution of the problem of correlations of the Cherokee sandstones so well-known and named in Seminole County, with equivalent beds in Cleveland and McClain Counties.

CONCLUSION

This cross section is a preliminary study of subsurface correlations in this area of Oklahoma. It seems to be evident that correlations from bed to bed, in subsurface, are unreliable, while correlations of groups of formations, like the one attempted here, appear to be on a fairly sound basis. This latter method of approach should yield considerable exact information for subsurface work in Oklahoma, and should assist in the precise type of this work now so essential for finding new petroleum reserves.

¹This fault, so well shown on this cross section has heretofore been unnamed. Owing to its increasing importance both to the subsurface geology of Oklahoma, and its relationship to the many oil fields now being developed along the eastern edge of the Anadarko Basin, Mr. Lynn Jacobsen has undertaken a detailed study of the fault, as work leading toward the degree of master of science at the University of Oklahoma.