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THE POSSIBILITY OF A LAND BRIDGE ACROSS NEBRASKA IN MISSISSIPPIAN TIME¹

E. C. REED

Nebraska Geological Survey

ABSTRACT

The lithologic and paleontologic differences between the Mississippian sediments of the Mid-Continent region and those of the northern Rocky Mountain and Black Hills regions suggest either that the Mississippian seas were not directly continuous between these two regions or that sea connections were greatly restricted. The purpose of this paper is to present and analyze the available subsurface data in Nebraska and surrounding states in the light of this problem. The study is primarily lithologic.

Mississippian sediments are known to be widely distributed in the subsurface of much of Iowa and Kansas, in southeastern and extreme southwestern Nebraska, and in southeastern Colorado. These sediments are lithologically similar to those of the Mid-Continent outcrop areas. Likewise, Mississippian sediments are known to occur widely in the subsurface of much of Wyoming, in western and northwestern South Dakota, in northwestern Colorado, and in extreme northwestern Nebraska. These sediments are lithologically similar to those of the northern Rocky Mountain outcrop areas. However, Mississippian rocks seem to be absent in the subsurface in large areas between these two regions, and the Mississippian sediments of these two regions are lithologically dissimilar.

Therefore, it appears that there was either no direct sea connection between the Mid-Continent and northern Rocky Mountain regions during the Mississippian or that the sea connection was greatly restricted. Mississippian sediments could have been deposited between these two regions and removed by post-Mississippian erosion. It is unlikely, however, that great thicknesses were removed because of the apparent absence of good evidence suggesting facial changes. However, the pre-Pennsylvanian rocks are known to be deeply buried within much of the critical area, and the subsurface has not been thoroughly tested by drilling.

Mississippian sediments seem to be absent in the subsurface of a large part of Nebraska. This condition suggests the possibility that a land bridge extended across Nebraska during Mississippian time and that there was no direct sea connection between the Mid-Continent and the northern Rocky Mountain regions during the Mississippian. It is apparent (1) that many factors should be considered in arriving at a definite conclusion; (2) that the Mississippian cannot be treated as a single unit but that special considerations must be given to the possibility that sea connections may have existed at certain times during the Mississippian and not at other times; (3) that some areas have not been explored sufficiently for positive conclusions; and (4) that the subsurface and surface evidence in states adjoining Nebraska must be considered as important parts of the picture.

Although a number of deep wells have been drilled in Nebraska, many of those in critical areas have not been drilled deeply enough to reach Mississippian or pre-Mississippian rocks. Figure 1 shows the locations of test wells drilled to rocks of Mississippian and pre-Mississippian age. Note that large untested areas exist in northeastern, north-central, western, and southwestern Nebraska. However, there is a large area in the central part of the state where the Mississippian is undoubtedly absent, and the southward thinning of the Mississippian in northwestern Nebraska suggests that these rocks may be expected to be absent in much of the "panhandle" part of western Nebraska.

Whether or not the Mississippian is represented in the east-central Nebraska Basin is open to some question because of differences of opinion among qualified subsurface geologists. A succession of dense, very finely crystalline limestones

¹ Manuscript received December 26, 1947.

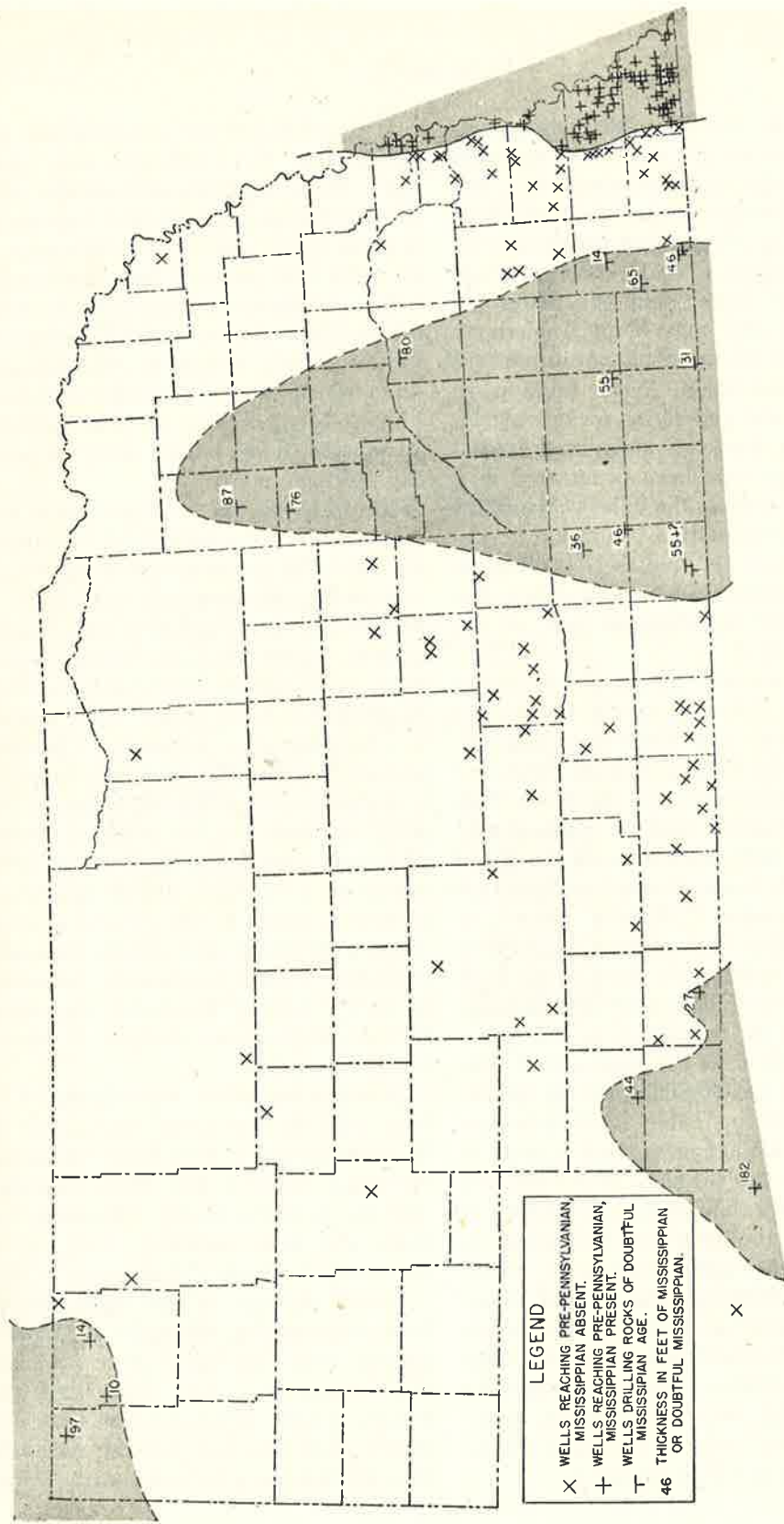


FIG. 1.—Map showing location of wells drilled in Nebraska to Mississippian or pre-Mississippian rocks. Areas shaded, where Mississippian is known to be present. Thickness of Mississippian penetrated shown, except in areas of concentrated drilling. Doubtful Mississippian rocks believed to be post-Cedar Valley Devonian by some subsurface geologists.

immediately underlies the Pennsylvanian in this area and rests, with apparent unconformity, upon relatively thin Devonian dolomites, probably of Cedar Valley age. These limestones are believed by some geologists to be Devonian, though post-Cedar Valley; but the writer believes that they may be of Kinderhook age and, therefore, should not be omitted from consideration. Their relation to overlying and underlying rocks is shown in figure 2. Rocks of undoubted Mississippian age have been penetrated in a number of wells in the Forest City Basin region in southeastern Nebraska, in several wells near the Kansas-Nebraska line in southwestern Nebraska, and in a few wells in the northwestern part of the state (fig. 1).

The dominant anticlinal structural features of Nebraska are the Cambridge Arch, which is a north-northwest extension of the Central Kansas Uplift and continues toward or into the Black Hills of South Dakota, and the Table Rock-Nehawka Arch, a north-south structural high, which is a northward continuation of the so-called "Nemaha Ridge" of Kansas. Post-Mississippian, pre-Pennsylvanian uplift took place along both these structural highs, and the Mississippian thins by truncation as the structurally high areas are approached. The thinning of the Mississippian by truncation toward the Table Rock-Nehawka Arch is shown in figures 3 and 4. In areas of close control the shale of Kinderhook age definitely thins to the northwest and north, and the individual formations in the Osage-Meramec show some north-northwest thinning. The beds of Chouteau age, however, preserve their rather uniform thickness where present and actually thicken in the eastern Nebraska Basin if the pre-Pennsylvanian, post-Cedar Valley rocks in that area should prove to be of Chouteau age.

If we eliminate the complications introduced by the Cambridge and Table Rock-Nemaha arches and assume that the Mississippian sea covered large areas of these uplifts and that the Mississippian rocks were removed by erosion prior to the deposition of Pennsylvanian sediments, there remains a broad northeast-southwest area devoid of Mississippian rocks which cannot be easily explained by post-Mississippian, pre-Pennsylvanian erosion along known lines of post-Mississippian uplift.

In comparing the relationships of the rocks in Nebraska with those in adjoining states (fig. 5), we note that this broad area lacking Mississippian rocks appears to continue northeastward into southeastern South Dakota, northwestern Iowa, and southern Minnesota and that Mississippian rocks appear to be absent in a broad area in east-central Colorado and southeastern Wyoming. This strongly suggests a land barrier between the Mid-Continent and the northern Rocky Mountain regions during much of Mississippian time. The sparse subsurface control in much of the critical area of western Nebraska and eastern Colorado precludes definite conclusions, however, as future deep drilling may encounter buried Mississippian outliers in structurally low areas.

It seems logical to conclude that it is very unlikely that great thicknesses of Mississippian rocks were deposited across Nebraska between the Mid-Continent and the northern Rocky Mountain regions and later removed. First, it is reasonable to expect that some of the "chance" drillings in this region would have encountered remnants of Mississippian rocks. Second, if large amounts of Mississippian rocks had been removed in early Pennsylvanian time, we should expect to find detrital materials from Mississippian sources in early Penn-

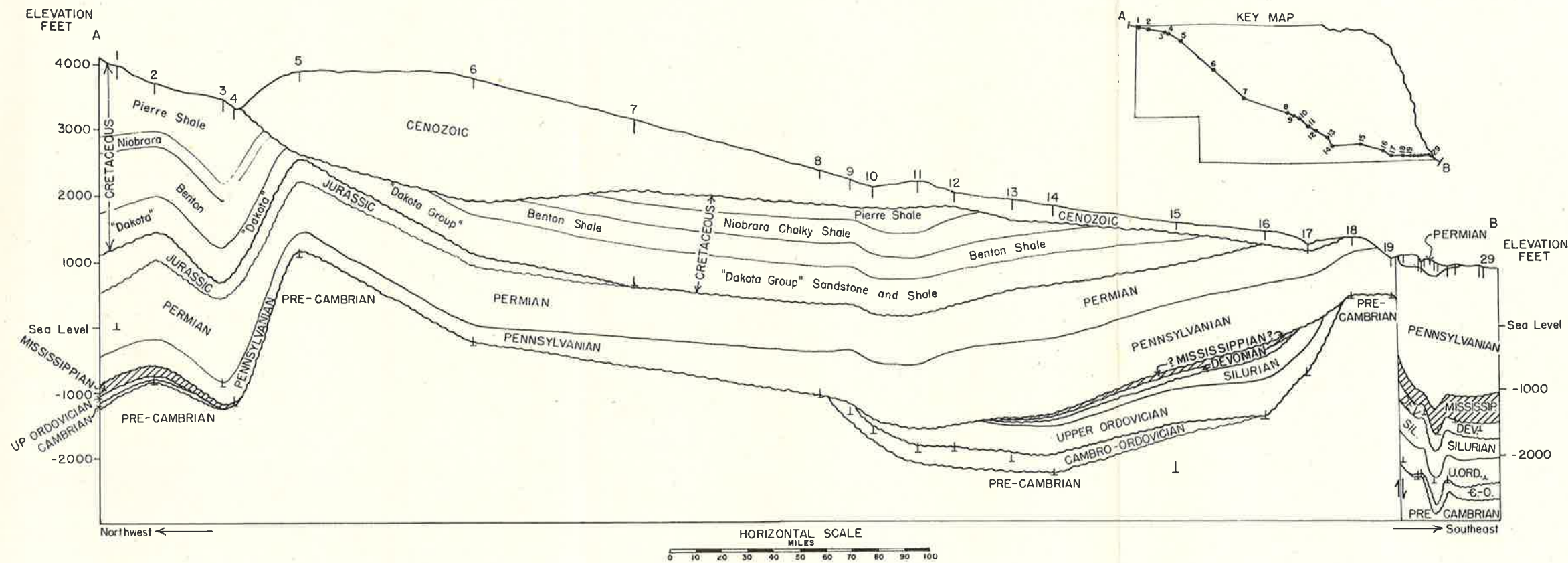


FIG. 2.—Northwest-southeast profile section across Nebraska showing relative position of Mississippian strata (*cross-hatched areas*). Note principal structural features: Forest City Basin (wells 20-29), Table Rock-Nehawka Arch (wells 18 and 19), east-central Nebraska Basin (wells 9-17), Cambridge Arch (wells 5-8), and western Nebraska Basin (wells 1-4).

O T O E C O U N T Y

N E M A H A C O U N T Y

R A N G E 1 2 E A S T

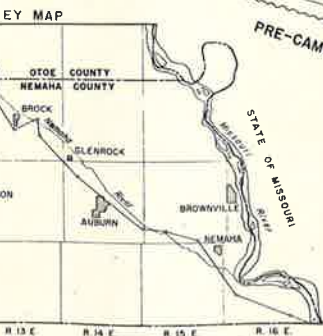
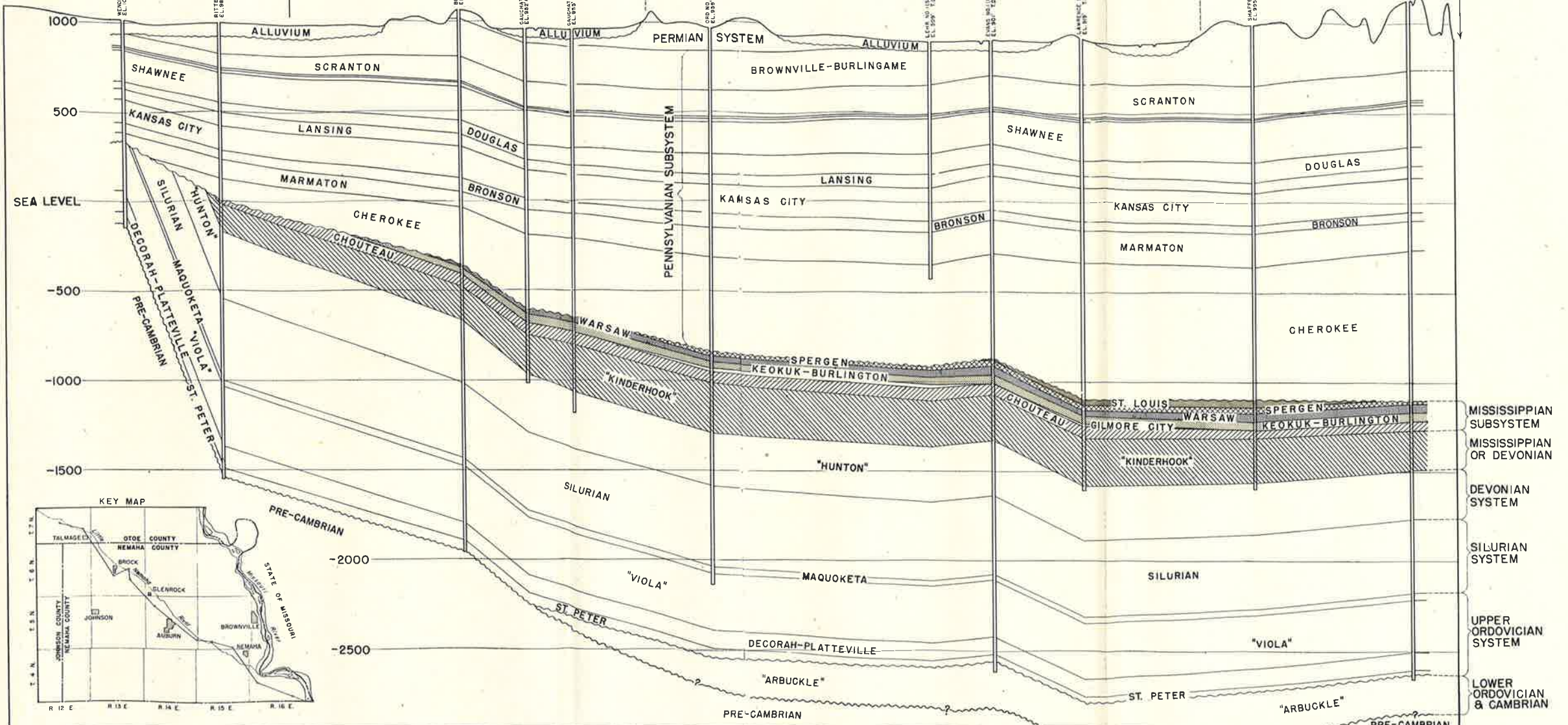
R A N G E 1 3 E A S T

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R A N G E 1 5 E A S T

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ELEVATION (FEET)

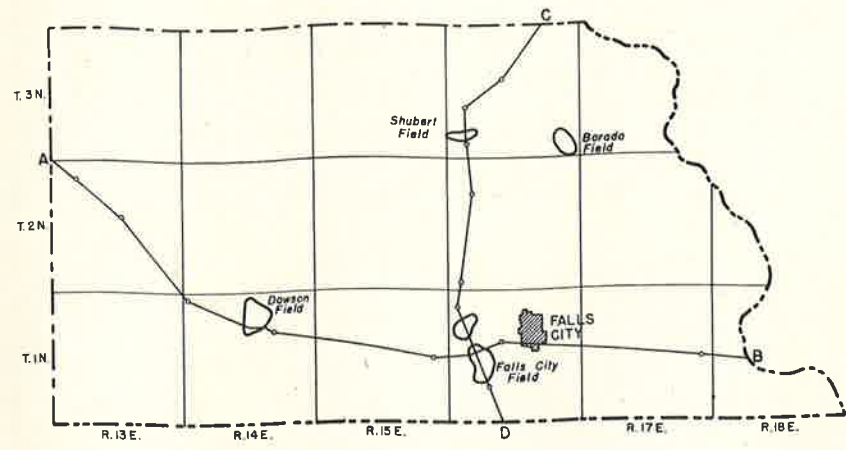


CORRELATION BY E. C. REED

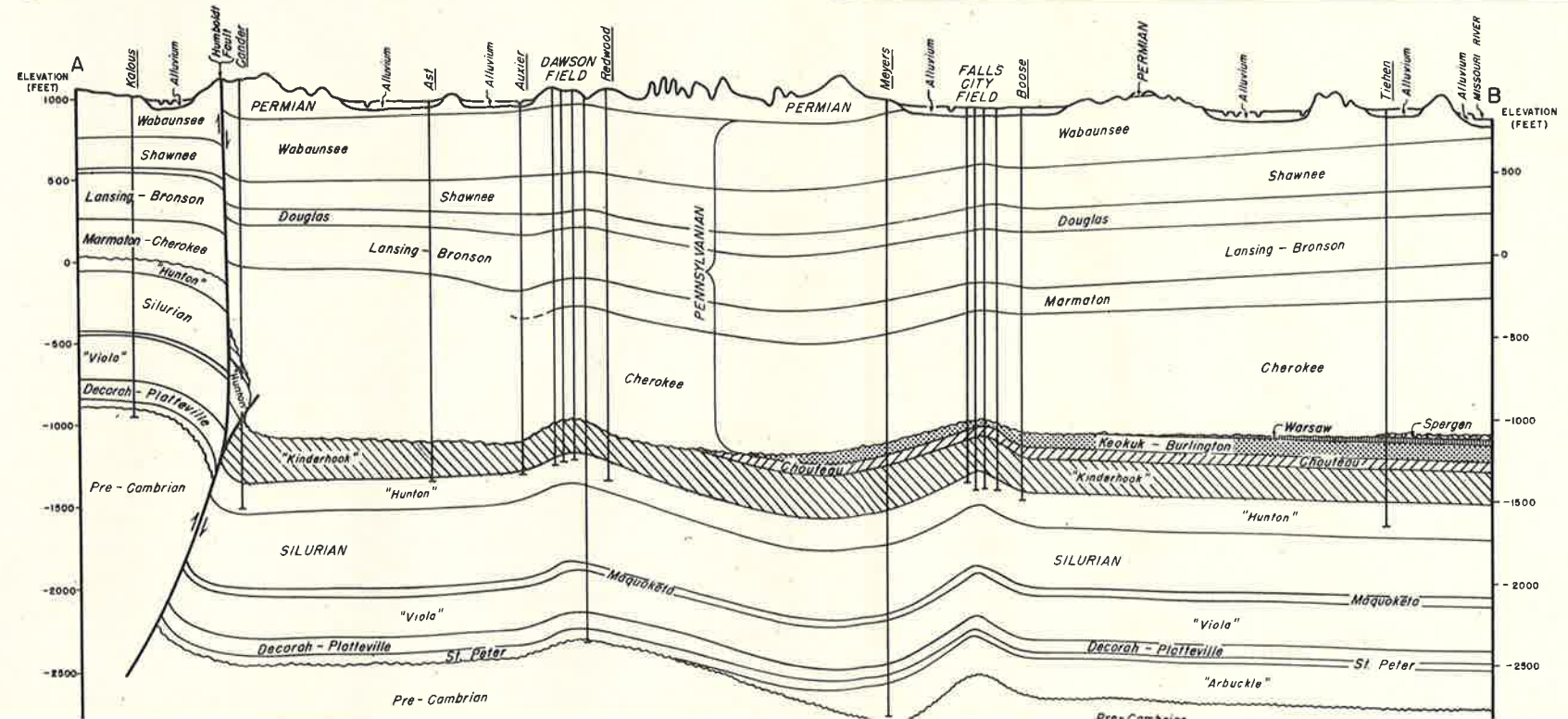
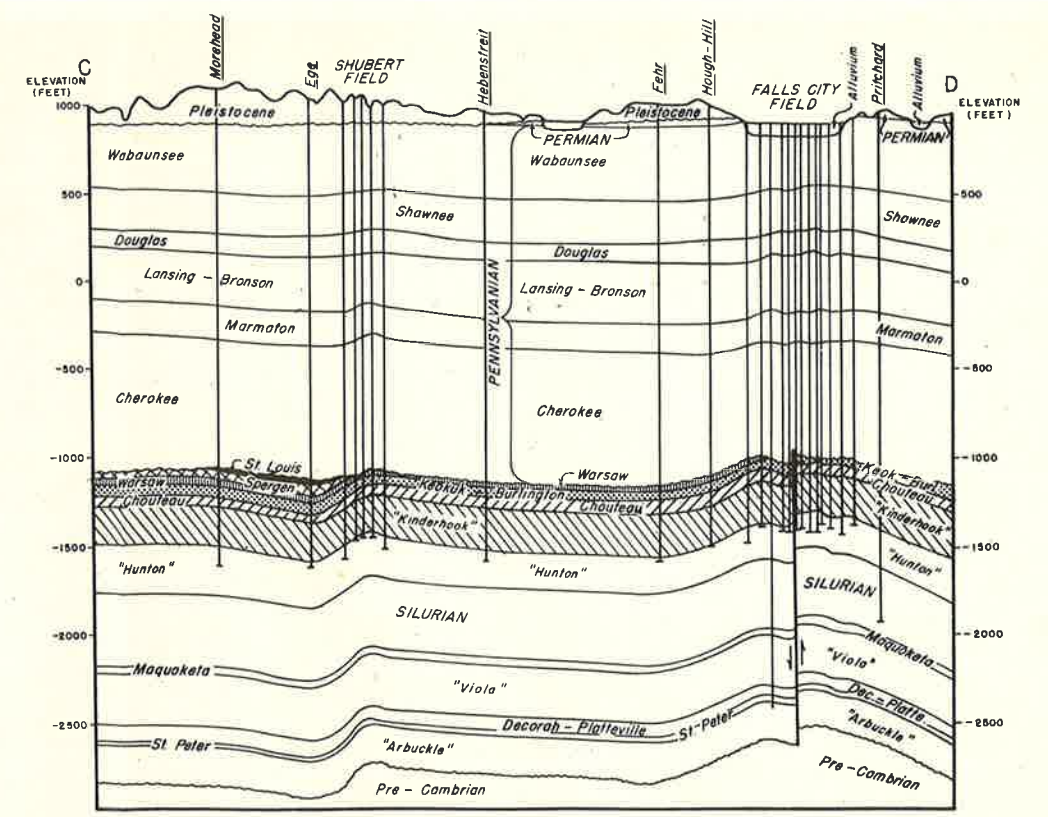
HORIZONTAL SCALE MILES

CONSERVATION AND SURVEY DIVISION
UNIVERSITY OF NEBRASKA

KEY MAP - RICHARDSON COUNTY
SHOWING LOCATIONS OF PROFILE SECTIONS



Horizontal Scale (Miles) for Profile Sections



sylvanian deposits of the basinward parts of the region. However, re-worked Mississippian materials seem to be missing except along the more southerly extensions of the Cambridge and Table Rock-Nehawka arches.

In much of this area in Nebraska, Pennsylvanian rocks rest upon the pre-Cambrian. The considerable depth of

identity over wide areas in northern Kansas and southern Nebraska but tend to disappear northward by thinning and overlap. Moreover, the Mississippian of the northern Rocky Mountain region bears little or no lithologic similarity to the post-Kinderhookian Mississippian of the Mid-Continent region, nor does it show any tendency toward facial change



FIG. 5.—Generalized Mississippian distribution map of Nebraska and adjoining states based on published and unpublished data showing generalized subsurface thickness of Mississippian limestones and dolomites in eastern Colorado, Kansas, southern Nebraska, Missouri, and Iowa. Area of no Mississippian rocks generalized and includes small thickness of Mississippian in a few places near the area margins.

weathering on the pre-Cambrian surface (more than 60 feet in some places) suggests a considerable time interval, probably longer than might be expected if the pre-Cambrian had been protected by Mississippian and older Paleozoic rocks and exposed to weathering for only shorter intervals of geologic time.

The post-Kinderhook Mississippian rocks of the northern Mid-Continent area seem to preserve their lithologic

in a southeast direction. Therefore, in view of all the evidence, it seems improbable that there was a post-Kinderhookian-Mississippian sea connection across Nebraska.

The evidence that a land barrier existed in this region throughout Kinderhookian time is not conclusive, however, because we cannot detect any marked northward or northwestward thinning of the Kinderhook limestones, except by trunca-

tion. Moreover, if the doubtful limestone interval in the east-central Nebraska Basin (fig. 1) is truly Kinderhookian and not Devonian in age, some facial change between the Mid-Continent and the northern Rocky Mountain regions is indicated, as these rocks, especially in their northern extension, are not dissimilar lithologically to the Mississippian limestones of northwestern Nebraska and adjoining southwestern South Dakota.

ACKNOWLEDGMENTS.—The author has had the opportunity of checking all the subsurface evidence in Nebraska but has had to rely on

published data in adjoining states, augmented by personal communications with survey personnel in Iowa, Kansas, South Dakota, and Wyoming. He is especially indebted to Dr. H. G. Hershey, state geologist of Iowa; Mr. Wallace Lee, of the United States Geological Survey and Kansas Geological Survey; Dr. C. L. Baker, of the South Dakota Geological Survey; and Dr. H. D. Thomas, state geologist of Wyoming, for assistance in their respective areas. He realizes that much pertinent subsurface information exists in the files of oil companies that have been engaged in regional studies, but no attempt has been made to obtain these data because much of it is confidential. He is also indebted to the authors listed in the appended bibliography for their important contributions.

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