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GEOLOGICAL REPORT
on
COAL POSSIBILITIES
in
GEARY COUNTY KANSAS

by
A. B. Boyle, Jr.
August 26 1922.

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The data upon which this report is based was obtained by the writer from field studies made during the latter part of July.

It has been repeatedly stated, by various citizens of Geary County, that coal seams of commercial quality and quantity exist in the vicinity of Junction City, a station on the Union Pacific Railroad.

In order to verify such statements, and also to gather such other data of a geological nature as would relate to the possibilities of oil and gas in this general region, the present investigation was conducted.

The coal fields of the Western Interior
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These were
GEOGRAPHIC RELATIONS.

The general location of The Western Interior Coal Field and its boundaries and relations to Political subdivisions are well known. The field lies well within the prairie plains of the Mississippi Valley and is a portion of the great featureless plain having no marked geographic divisions. Such divisions as are recognized are mainly political and commercial.

Although the general tendency of all the rock beds is to dip westerly, 10 to 20 feet per mile, the superimposed drainage is strikingly to the east. In going from Denver to Junction City, a distance of about 500-miles, there is an actual drop of 4,100-feet, or an average fall of about 8-feet per mile.

The stream valleys have not been deeply eroded, and as a result the maximum relief features are moderate and for the most part subdued. The relief existing is expressed mainly in low rounded hills, and notably flat uplands. Occasionally a resistant rock-bed outcrops, and at such points forms a rather steep bluff which joins the uplands with the comparatively flat floor of the larger river valley.

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GEOLOGIC RELATIONS.

The Western Interior Coal Field has not as yet been accurately surveyed, and its exact extent is therefore not definitely known. The productive regions, in a broad way, are included in an area of about 94,000- square miles, part

of which lies in Iowa, Missouri, Kansas, Arkansas, Indian Territory, and Texas.

Roughly the extreme western limit of the coal beds is about 100-miles west of the east boundary line of Kansas. A north-south line passing through Junction City will fairly accurately represent the western limits of the producing area.

The Coal Measures of The Western Interior Field are of Carboniferous Age. The Carboniferous strata in America are broadly divided into three series, which are, from above downward, the Permian; the Upper Carboniferous proper or Pennsylvanian; and the Lower Carboniferous or Mississippian. These geologic terms are in current use.

The first of these, the Permian, is of small economic importance. The last named only contains coal in the eastern states. The chief interest, so far as this report is concerned, therefore, centers in the Pennsylvanian series.

STRATIGRAPHY.

The coal bearing deposits of the Western Interior Coal Field are known as the Upper and the Lower Coal Measures. These terms have been long used in coal literature. The Lower Coal Measures are found chiefly in the Mississippian formation while the Upper Coal Measures are limited to the Pennsylvanian group of rocks. The shallow coal beds in Geary County certainly belongs to the Pennsylvanian series.

Both measures involve great deposits of limestones, sandstones, shales, fire-clays, and the coal beds proper. The limestones are probably least abundant, and shales, in their various phases argillaceous; (claylike); bituminous, calcareous, and arenaceous (slaty); most plentiful.

The coal measures (not the coal seams themselves) tend to increase in thickness westward from their outcrop. There is also a gradual increase in maximum thickness from north to south. In Kansas the thickness of the measures reaches about 3,000-feet, but unfortunately the coal beds thin progressively as one passes westward.

It appears that the present known westward limit of the coal beds represents the old shore-line conditions under which the carbonaceous matter was originally accumulated. The significance of this may be appreciated when it is stated that irregular shore lines, both as regards the direction as well as the depth of the water, profoundly affect the geographic distribution and thickness of the accumulations deposited therein. Coal materials deposited near shore are subject to foreign materials, and usually show irregular and patchy distribution of the beds. Often they contain partings of clay, slate, and sandstone, and in more limited amounts other

objectionable substances grouped as impurities, such as sulphur, iron oxides, etc. Commonly, near shore deposits are characterized by numerous irregularities in thickness .

STRUCTURE.

The structure of this part of the field (the western margin of the Western Interior Coal Field) is quite simple. With few exceptions the prevailing dips are slightly north of west. Locally, small wrinkles, anticlines, and domes are in evidence, but they are relatively rare, and where they do occur and are of the proper form, they furnish favorable points for oil-well drilling operations. There are numerous and important irregularities in the coal beds proper, but these are principally due to conditions prevailing at the time of their deposition rather than to later deformation.

Many of the folds are of gentle amount, and their presence and limits can be determined only by careful instrumental survey. Such work will be done in time, with probable material results.

PHYSIOGRAPHY.

Alternation of shale bands with beds of limestone and sandstone, together with the very gentle westward dips, have yielded to erosion in such a manner as to produce rather simple physiographic types. For the most part bench lands and bottom lands result. The connecting form joining the two is nearly always a short steep slope, often marked by an outcrop of some resistant limestone or sandstone bed, usually the former.

The most resistant member frequently outlines the extent of the various formations as one passes eastward. This feature is shown in part by color schemes on Plate I. Beginning at the west middle margin of the map the first irregular line encountered as one passes in an easterly direction, represents the east limits of the Dakota Formation, the resistant rock being sandstone. The same explanation applies for each of the other colored areas.

From the train window, as well as from travelling the auto roads, one often notices a distinctive outcrop of solid rock. Such an outcrop often establishes the top-most point of the steep slope.

This view is taken looking north across Fort Riley Training grounds. The main feature of the view is the low flat-floored valley of Kansas River.

Near the skyline in the far distance is to be seen a nearly level upland treeless plain. The top of this plain represents the dividing line between the Pennsylvanian series immediately below, and the Permian above. The River Valley is cut into the Pennsylvanian shales.

Mention has been made of a resistant rock bed which often determines the top of the steep slope joining the valley with the upland. This view, taken from the moving train, shows such a ledge of solid rock. The observer is looking north, and the gentle dip, (scarcely noticeable) is indicated by the flatness of the rock bed. From such outcrops large amounts of stone are taken for local use.

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MINERAL RESOURCES.

COAL.

In the western margin of the Western Interior Coal Field, the coal is very irregularly developed along the various coal horizons. Indeed, it has so far proved impossible to make a general section showing even the coal horizons which would be of more than local value.

This patchy distribution of the coal is not the result of later faulting or other dynamic phenomena, but is due to the conditions under which the coal was accumulated.

Only one actual bed of coal was found in place and observed by the writer. This is located some 15-miles south east from Junction City, on Clarks Creek. The prospect is situated on the west bank of the creek, and is designated on the map as Prospect No. I. Here, 17-inches of coal was observed. The coal sample for study was obtained from the breast of the coal seam at the end of an adit 67-feet from the portal. The roof is a heavy massive limestone which yields fossils provisionally assigned to the Upper Carboniferous time-scale. The floor consists of a black shaly sandstone. The seam contains several stringers or bands of clay-shale, so distributed, and in such amounts, as to make it difficult and expensive for economical separation. The delapidated condition of the adit, together with the crowded quarters at the end of the adit, made it impracticable to obtain a view of the coal seam as it actually appears.

A coal prospect north west from Junction City about 18-miles has been reported. This is designated upon the map Plate I, as Prospect No. 2. An attempt was made to examine this but the guide, a reputed coal miner and prospector, admitted he was lost when we got into the field, and the actual opening was never seen. The best that could be done under these circumstances was to accept his statements regarding the kind of coal and the thickness of the seam. He stated that the coal measures 14-inches; that it contains slate partings; and that it is of poor grade.

Aside from the coal observed at Prospect No. I. no coal in any form was seen at other points. Black shale has been mistaken for coal at several points. The showings at Prospect No. I. are far from encouraging. It is believed that Prospect No. 2. represents essentially the same grade of coal, and further that it is stratigraphically equivalent to if not identical with that at Prospect No. I.

It is only fair to state that the local citizens feel that the prospects do not fairly represent the coal conditions. Some feel that if the adits can be lengthened the

coal may improve in quality as well as in thickness. While this view is a favorable conception to entertain, it is not supported by geological facts and is not compatible with the modern observations relating to the origin of coal seams.

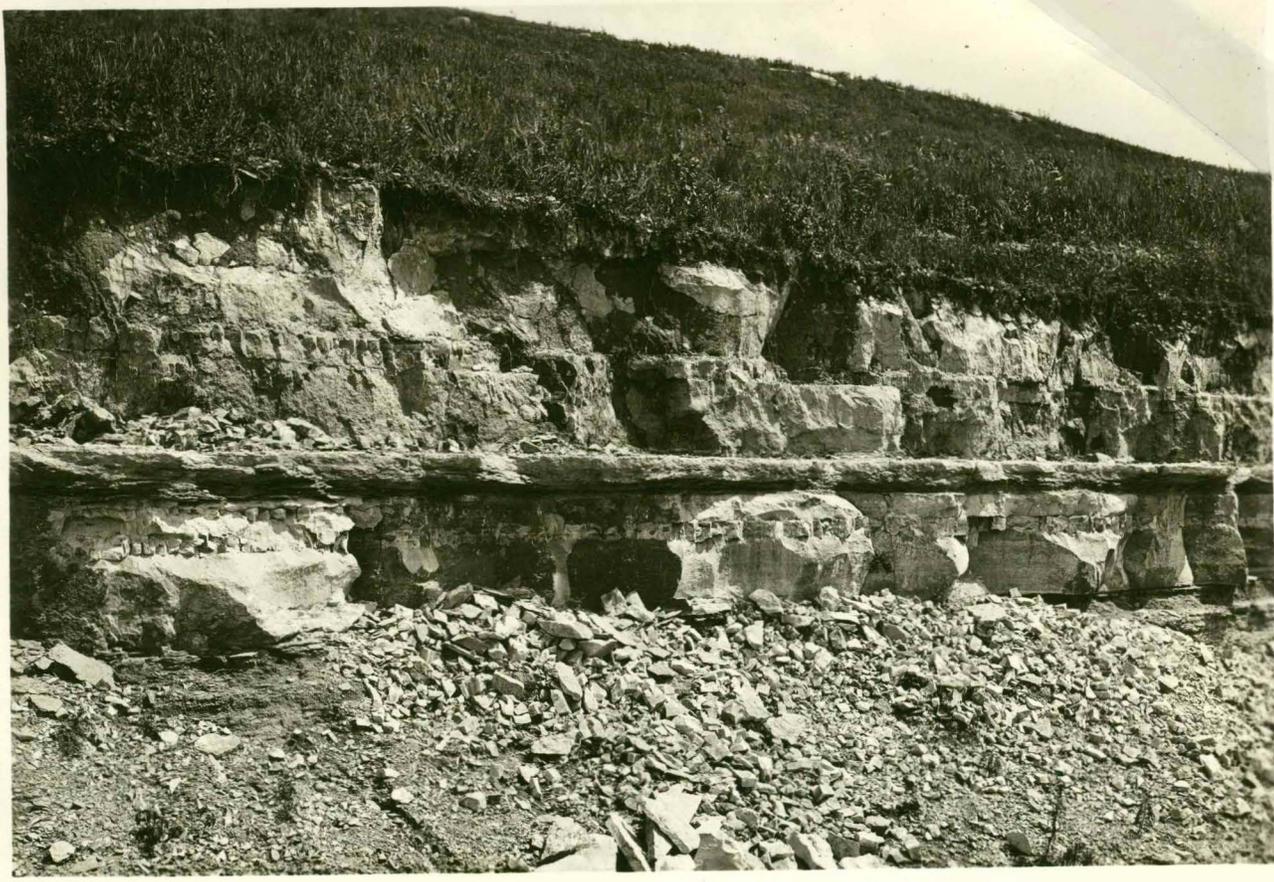
When pressure is brought to bear upon this phase of the situation, another position is taken that if such coal seams should fail, possibly commercial deposits will be found at depth. Such assumptions when unsupported by fact and a much more critical examination, become evidence of imaginative powers only, and plunges one into far-fetched speculations which are dangerous and untrustworthy. Usually such observers assume an accuracy of observation which is unexampled in exploratory survey.

Some data obtained from well-logs may here be introduced which will tend to throw definite light upon this mooted question. Plate II, has been prepared to show the approximate position of wells which have been sunk in the hopes of encountering oil. The logs of these wells are a matter of definite record*, and the data will therefore not be introduced in detail. Suffice it to say that each well encountered granite rock after having penetrated the entire series of stratified rocks. In only two wells was there any evidence of coal at all, and no coal whatever was reported from any drill hole in Geary County. The significance of this evidence is far-reaching, and when grouped with the data obtained from the surface-coal-showings, the evidence is conclusive.

The steep slope joining the upland with the valley is usually covered with vegetation. At one point where a road had been under construction, the characteristic features of the structure are plainly marked. This view shows the upper members of the Carboniferous formation. Massive beds of limestone, thin beds of shale, with a dark coaly streak near the middle of the view can be seen. The observer is looking south.

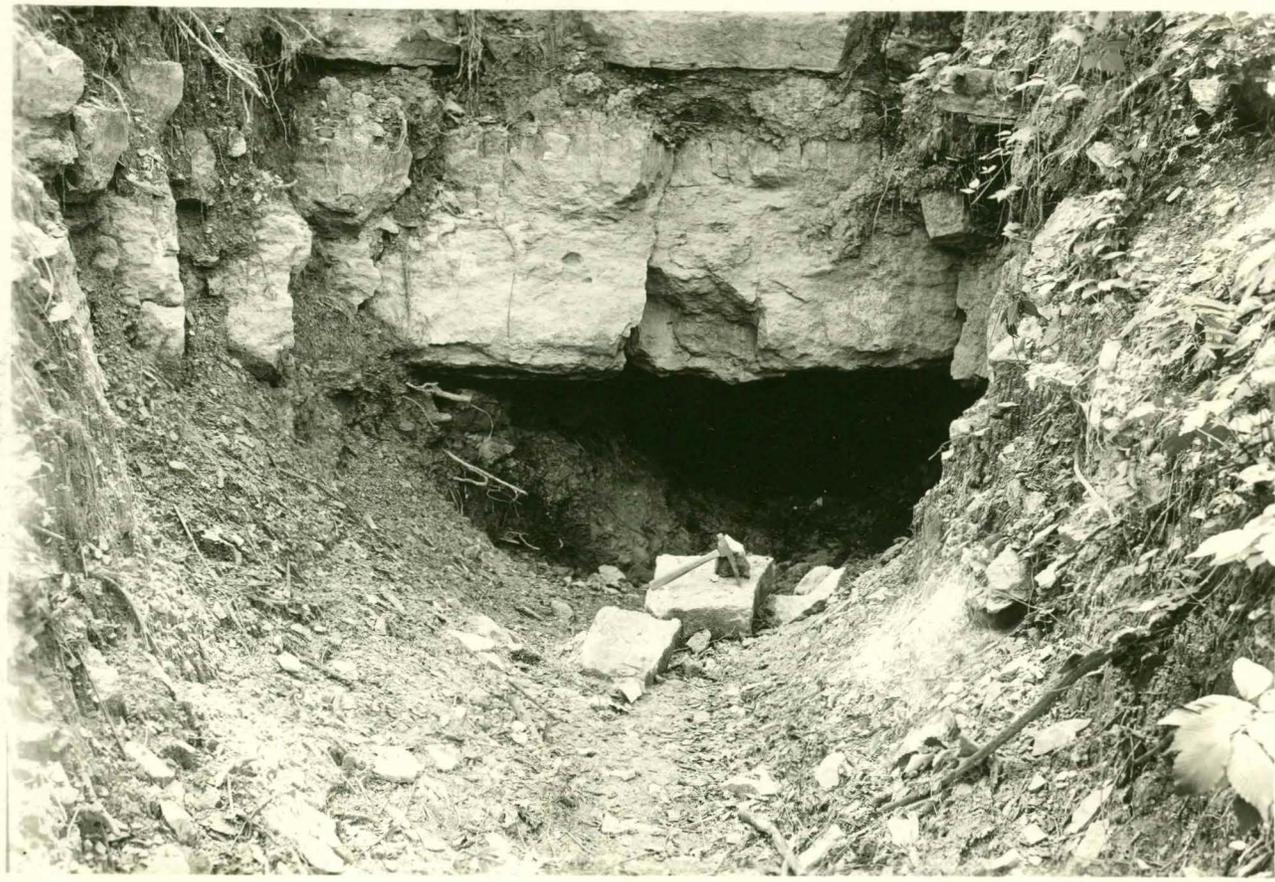
This view shows the portal of Prospect No. I. mentioned in the text. As will be seen the roof consists of a heavy to massive limestone member of the Pennsylvanian series of rocks. Some of the impure coal can be seen on the left side of the adit a short distance in from the portal. The floor is a dark shale. The opening is about 6-feet wide by three feet high. No commercial coal was ever taken from this adit. A feature not shown by the view, is the fact that immediately under the limestone and above the 17-inch coal seam there is a bed of shale. This has a tendency to separate from the roof, and mix with the coal during the process of mining.

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OIL & GAS.

Brief mention should be made that in the Permian as well as in the Pennsylvanian formations there are beds of shale which could easily be a source of origin for petroleum. There are likewise, beds of sand which would act as reservoirs for oil. It follows therefore, that where the structural features are satisfactory and favorable, there is likelihood of entrapped bodies of petroleum and gas. In the Permian series the petroleum is likely to be of the asphalt base variety.

As previously stated the larger structural features are of the synclinal form, but within the synclinal structure there are local upward bending flexures, any one of which may yield petroleum or gas.

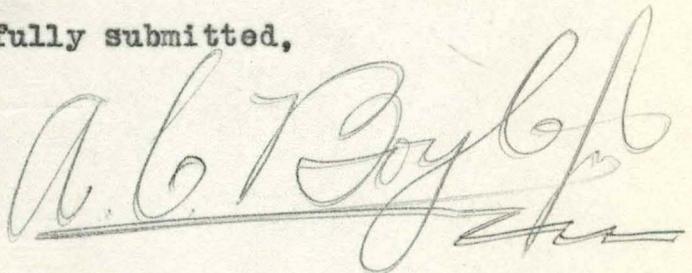
A generalized cross-section from the Rocky Mountains to the St. Francis Mountains is shown on Plate III. This is taken through central Kansas, and fairly represents the conditions in Geary County. Here, are shown the approximate position; geographical extent; and thickness of the chief stratified formations as they rest upon the granite mass below.

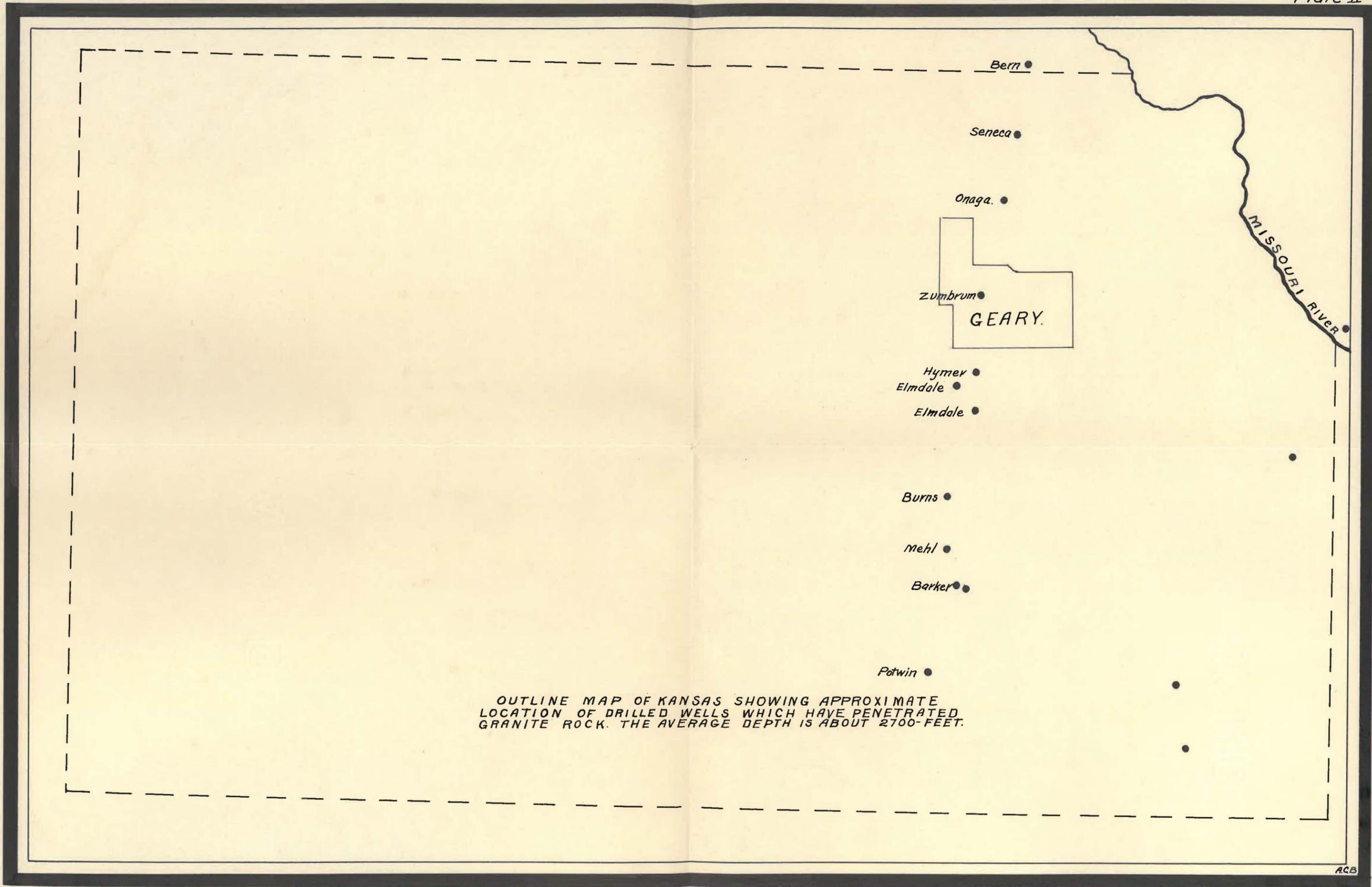
CONCLUSIONS.

By way of summary it may be stated with reasonable certainty, that the chances of obtaining coal in commercial quantities in Geary County, Kansas, are extremely doubtful. This is due to the fact ~~that~~ that no beds exist which have sufficient thickness. Furthermore those which do exist are so low in heat value, and so contaminated with impurities, that the product cannot be employed as a fuel.

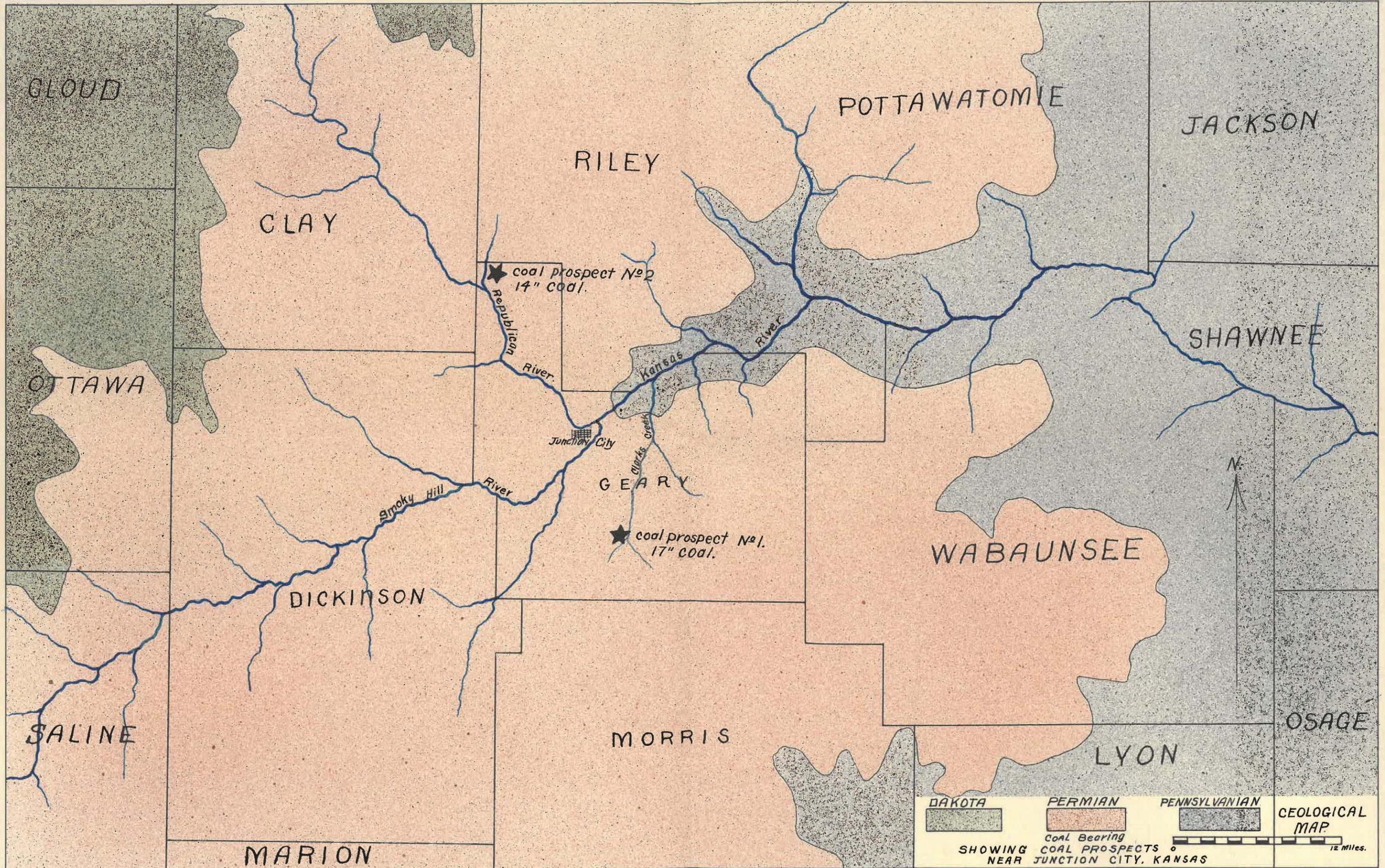
Respectfully submitted,

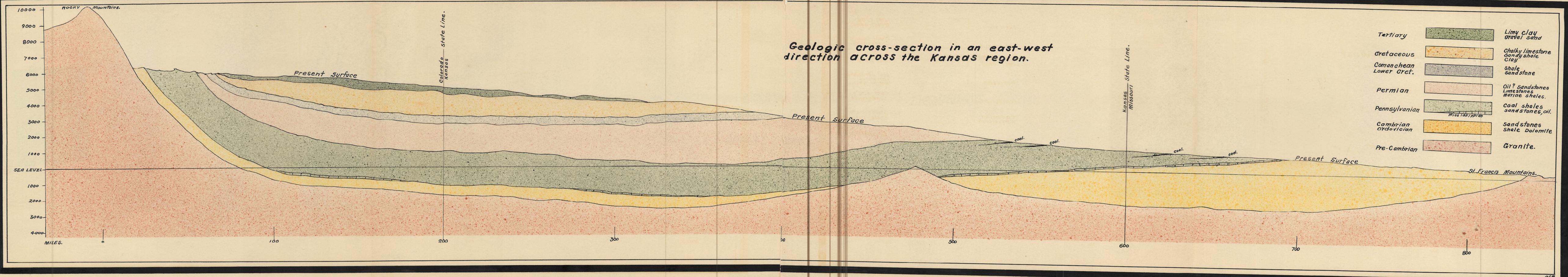
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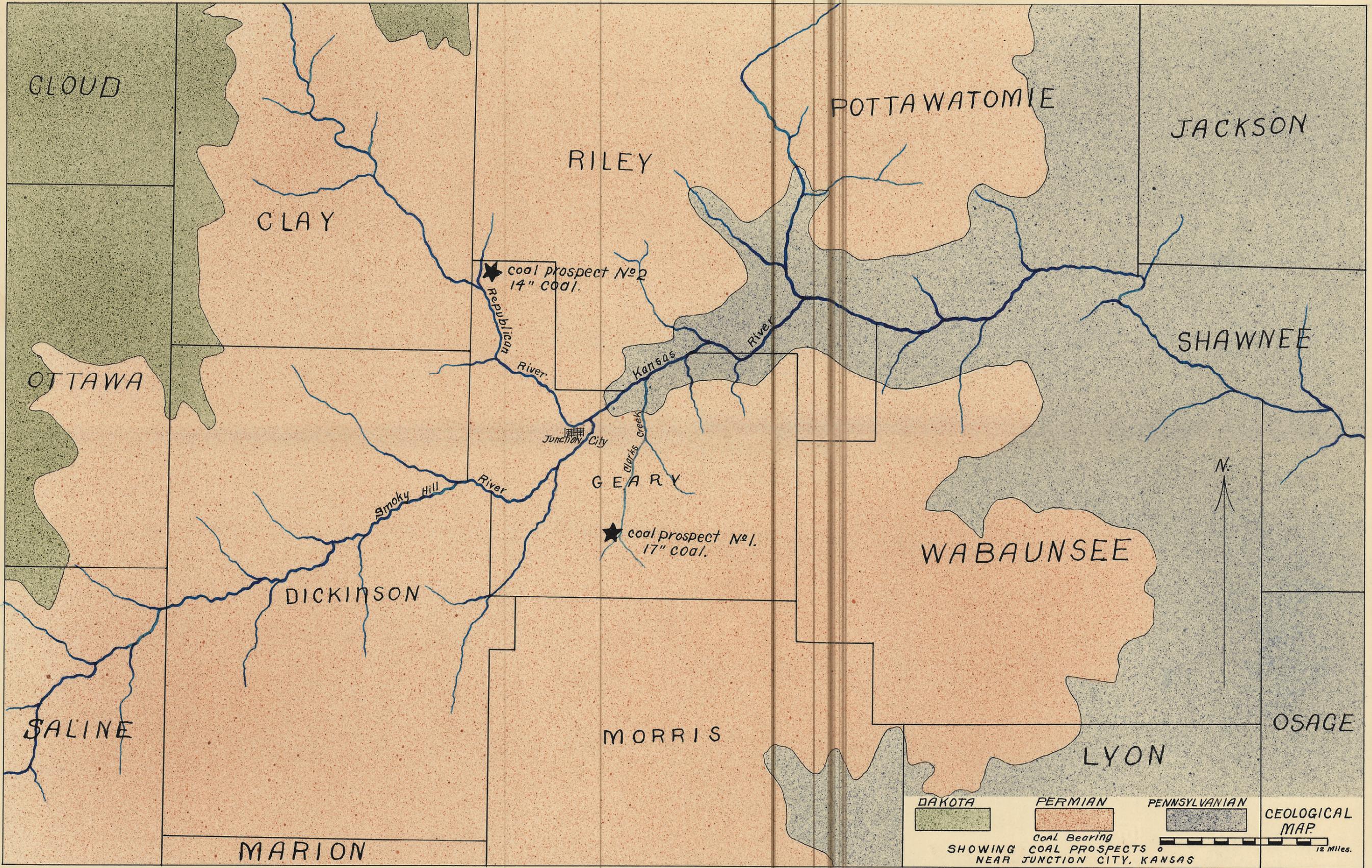
A. C. Boyle



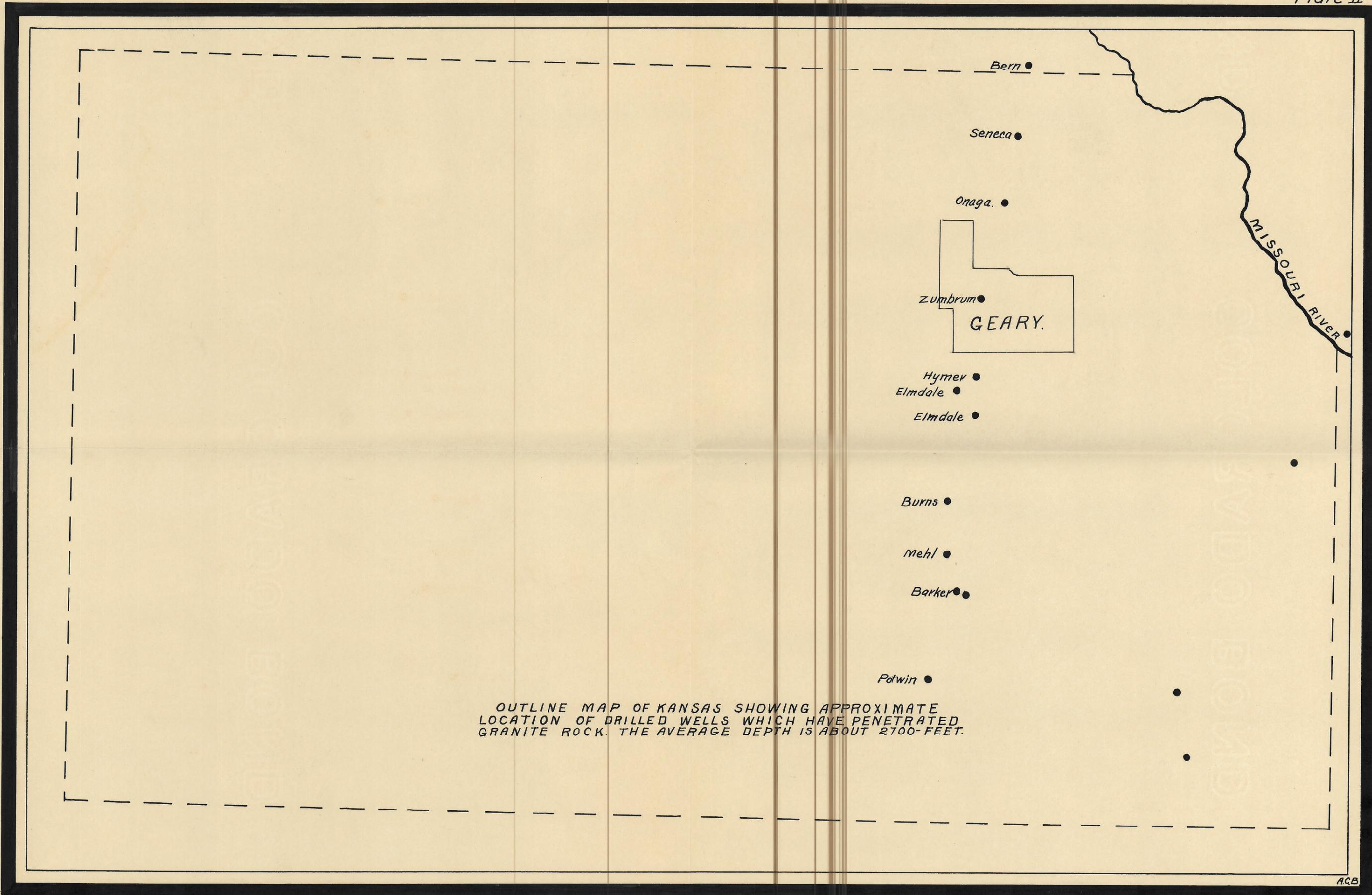
OUTLINE MAP OF KANSAS SHOWING APPROXIMATE LOCATION OF DRILLED WELLS WHICH HAVE PENETRATED GRANITE ROCK. THE AVERAGE DEPTH IS ABOUT 2700- FEET.







CEOLOGICAL MAP
 SHOWING COAL PROSPECTS
 NEAR JUNCTION CITY, KANSAS



OUTLINE MAP OF KANSAS SHOWING APPROXIMATE
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GRANITE ROCK. THE AVERAGE DEPTH IS ABOUT 2700- FEET.