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CIRCULAR NO. 40

KANKAKEE ARCH IN ILLINOIS

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REPRINTED FROM THE BULLETIN,
GEOLOGICAL SOCIETY OF AMERICA,
VOL. 49, PP. 1425-1430, 1938.



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URBANA, ILLINOIS

1938

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ABSTRACT

Recent studies have demonstrated that in Illinois (1) the structural feature designated as the Kankakee arch is a broad monocline whose axis trends northwest-southeast across the northeast part of the State, with the steep limb to the southwest, and (2) the principal and most significant movement occurred between the depositions of the Shakopee dolomite and the St. Peter sandstone, with less important movements probable at several subsequent Paleozoic times. This knowledge adds an important item to the structural history of the region and clarifies the stratigraphic succession in northeastern Illinois.

INTRODUCTION AND ACKNOWLEDGMENTS

The conception of the Kankakee arch in Illinois as presented in this paper has developed within the last 10 years, largely through collaborative studies by the Areal and the Subsurface divisions of the Illinois State Geological Survey. Consequently the information herewith represents the accomplishments not of the author alone but of several persons, especially Mr. Lewis E. Workman, in charge of the Subsurface Division, who has repeatedly contributed data from his studies, and Dr. J. Norman Payne, who has been engaged in the study of the subsurface formations for the complete geological report on the Marseilles, Ottawa, and Streator quadrangles.

EARLIER OBSERVATIONS

The first intimations of the existence of the Kankakee arch were expressed nearly 70 years ago, when the unusual occurrence and relations of the St. Peter sandstone and the "Trenton" (now Galena-Platteville) dolomite along Fox River in Kendall County were ascribed to "anticlinals" (Bannister, 1870, p. 138, 144-146). Not until 50 years later was its existence again noted, and then it was definitely located and designated as two separate but essentially continuous anticlines—the Ogle, Lee, and LaSalle counties anticline and the Morris-Kankakee anticline (Cady, 1920, p. 90, 130, 133; fig. 8). In subsequent publications, the Kankakee anticline was casually mentioned and its presence indicated (Thwaites, 1927, p. 42, pl. 1; Lamar, 1928, p. 25, pl. 3), but no special significance was ascribed to it. The term Kankakee arch and an assumed connection with the west branch of the Cincinnati arch in Indiana have existed only 5 years (Pirtle, 1932, p. 145-148, fig. 1; Bell, 1934, p. 559, fig. 1; 1935, p. 814, 820, fig. 1; Weller and Bell, 1937, p. 775, figs. 1, 4).

The structure to which these various names have been applied has no relation to, and in fact trends almost normal to, a hypothesized long tongue of Devonian land designated as the Kankakee Peninsula or Kankakeia (Schuchert, 1903, p. 149-150, pl. 21; 1910, p. 470-471, pl. 49). Subsurface studies in Illinois have shown that no such land mass existed at any time, but, instead, during Devonian times a short peninsular land mass extended north from Ozarkia to approximately the present site of Peoria. Nor is the Kankakee arch a resurrection of the hypothesized "Wabash arch" (Gorby, 1886, p. 228-241; Schuchert, 1903, p. 150) whose invalidity has been ably demonstrated (Phinney, 1891, p. 651-653; Kindle, 1903, p. 461, 463).

CURRENT OBSERVATIONS

About 10 years ago, in the course of a careful review of all regional subsurface data as a part of a complete geological study of the Oregon quadrangle, it was discovered that northeast of Oregon all of the Prairie du Chien (Ordovician) and some of the upper Cambrian strata are missing, the St. Peter sandstone resting on the lower part of the Cambrian strata down to the Trempealeau formation; whereas southwest of Oregon there is a complete sequence of strata (Ekblaw and Workman, 1930, p. 65-66). Thus a major post-Cambrian, pre-St. Peter fold and erosion were indicated, which eliminated the necessity for major faulting that had been assumed to account for the unique relations of St. Peter sandstone and Cambrian strata in East Oregon (Bevan, 1929). Additional subsurface studies showed that all or most of the Prairie du Chien series was

absent in northeastern Illinois, thus clarifying what had previously been a puzzling stratigraphic succession. The approximate southwest boundary of the major unconformity as determined by these studies was presumed to mark also the axis of the fold, which was thus identified as the structure previously recognized but whose name for convenience was

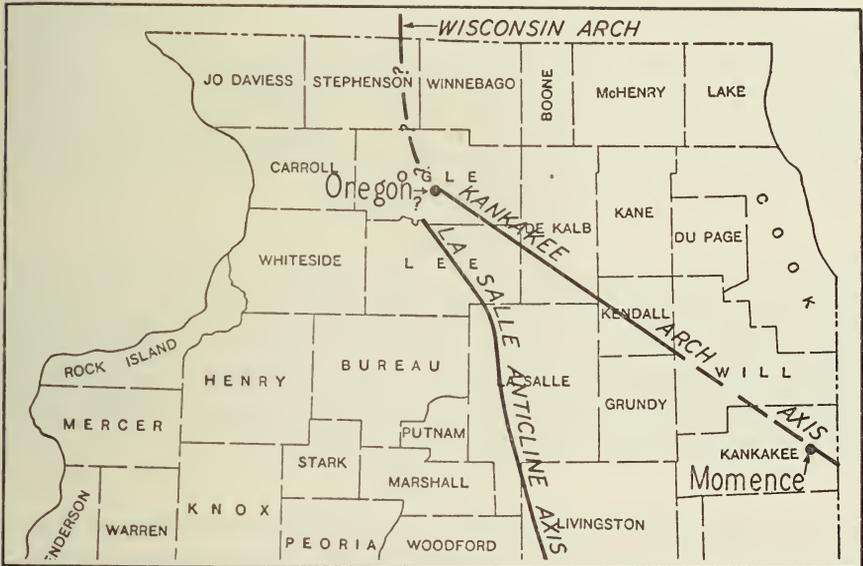


FIGURE 1.—Location of Kankakee arch and LaSalle anticline in northern Illinois

shortened to Kankakee arch. The current studies by Payne, already mentioned, have definitely established both the precise location and the exact age of the structure for a limited extent.

ESSENTIAL FEATURES

LOCATION AND TREND

The Kankakee arch in Illinois trends southeastward from Oregon at least as far as DesPlaines River, a distance of about 75 miles (Fig. 1). This trend projected coincides with that of the northwest branch of the Cincinnati arch in Indiana, and so the assumed connection of the structures seems justified. The structure has not been studied northwest of Oregon, but, as will be pointed out later, their respective ages indicate that it is more logically the direct continuation of the Wisconsin arch (Pirtle, 1932, p. 149, fig. 1) than is the LaSalle anticline (Thwaites, 1927, p. 36).

AGE

Payne's studies show that the major and most significant movement of the structure occurred between the deposition of the Shakopee and St. Peter formations. As identified from samples of well-cuttings, the remnants of Ordovician sediments on the arch belong to the Oneota formation, the oldest of the Prairie du Chien series, and there seems to be no regular thinning of the strata as they approach the arch. There may have been some movement along the arch at later periods, as at Oregon there is evidence of faulting at least post-St. Peter and more probably post-Galena in age, and faults involving the Galena formation occur in Kendall County. This later movement probably occurred between the Ordovician and Silurian, as suggested by the unconformity at the top of the Maquoketa shale in northeastern Illinois.

MAGNITUDE

The maximum differential movement at the time of the major uplift must have been between 500 and 600 feet, the equivalent of the thickness of the entire Prairie du Chien series plus the Jordan and nearly all of the Trempealeau formations at Oregon. The same relative magnitude of displacement is indicated elsewhere along the structure. Later movements probably did not exceed more than 200 feet.

CHARACTER

The original uplift was essentially a monocline, in which all of northeastern Illinois and possibly adjacent areas were almost uniformly raised 500 to 600 feet above the region to the southwest. Subsequent to uplift, the northeastern area was essentially peneplaned and then the whole region was channeled by rejuvenated streams whose valleys now mark the major unconformity at the base of the St. Peter formation.

POSSIBLE IMPLICATIONS

If the Kankakee arch be a continuation of the Wisconsin arch and the northwest arm of the Cincinnati arch, there is an interesting relation between their ages. The Wisconsin arch is believed to have started its upward movement in pre-Cambrian time (Pirtle, 1932, p. 149), with some later movements; the Kankakee arch in Illinois had its major movement in the post-Shakopee—pre-St. Peter interval, also with some later movements; the major movement of the Cincinnati arch is assigned to post-Trenton time, with some subsequent movements throughout the Paleozoic era (Phinney, 1891, p. 644-646). The occurrence of the major movement of the Kankakee arch in Illinois and the subsequent erosion in the post-Shakopee—pre-St. Peter interval possibly also provides grounds for reviving the question as to whether the break between the Cambrian and

Ordovician periods may not occur then and whether the Prairie du Chien series may not actually be a part of the Cambrian system whose strata it resembles so closely in lithology and from which it is not separated by any noticeable unconformity.

In conclusion, if the Kankakee arch proves to be the continuation of the northwest fork of the Cincinnati arch, as is now reasonably surmised, the name will provide a convenient designation for the structure to differentiate it from the rest of the Cincinnati arch. It may be suggested further that much confusion in geologic literature will be avoided if in the future the original name of Findlay arch (Phinney, 1891, p. 643) be applied to the northeast fork, as urged by Phinney (1891, p. 647-648), and the name Cincinnati be restricted to the main structure south of its bifurcation.

SUMMARY OF CONCLUSIONS

The discovery of a major early Ordovician uplift along an axis in northeastern Illinois, accompanied or immediately followed by widespread erosion, accounts for the absence of all or most of the Prairie du Chien series in northeastern Illinois, clarifies the stratigraphic correlation in that area, suggests a connection between the Wisconsin and Cincinnati arches and raises some interesting questions about potential geological relations, both structurally and historically.

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STATE GEOLOGICAL SURVEY, URBANA, ILL.

MANUSCRIPT RECEIVED BY THE SECRETARY OF THE SOCIETY, JANUARY 10, 1938.

READ BEFORE SECTION E, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, DECEMBER 31, 1937.

PUBLISHED WITH PERMISSION OF THE CHIEF, ILLINOIS STATE GEOLOGICAL SURVEY.

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