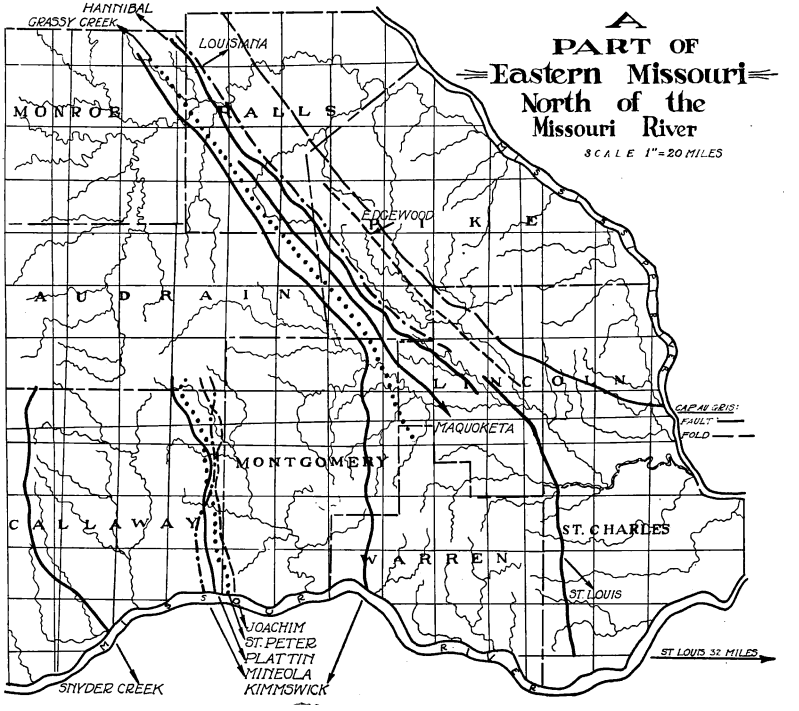
Art. XXV.—*Paleozoic Formation Margins in Missouri;* by E. B. Branson.

Several years' field work in central and eastern Missouri have brought to the writer's attention two narrow belts where several Paleozoic formations have their western margins of outcrop. It may be considered as

Fig. 1.



accidental if the margins of two formations of different ages lie in the same narrow belt, but if several formations end in the same belt there must be an underlying cause. The present margins of the formations were produced either by original deposition or by erosion before the deposition of the succeeding strata[1] (see fig. 1).

[1] Figures 27, 29, 30, 35, and 40 of the author's "Geology of Missouri" shows the distribution of some of the formations considered. Univ. of Missouri, Bull., vol. 19, no. 15, 1918.

Central Missouri Marginal Belt.

One belt, only a few miles wide, runs north-south through eastern Callaway County about 100 miles west of St. Louis. It cannot be traced south of Callaway County as the formations have been eroded away, nor north of the county on account of their being covered with younger strata. The western margins of six formations lie in this belt.

St. Peter Sandstone:—The oldest formation having its western margin in this belt is the St. Peter sandstone. Unlike the younger formations, the St. Peter extends west of the belt, but east of the belt it is a continuous formation, while to the west it occurs only as old valley fillings, and it outcrops in very limited areas. It seems likely that the formation was once continuous and that erosion has removed all but the valley fillings west of the belt, and has removed much less of it eastward. This would indicate differential uplift in the belt area The western part became somewhat higher than the eastern and underwent considerable erosion, while the eastern part suffered only little erosion. The difference in elevation of the eastern and western parts could not have been much more than 100 feet, as to the east the part of the formation that is continuous varies from 40 to 100 feet in thickness and the valley fillings below are like those to the west.

The western margin of the continuous St Peter is near the Callaway-Boone County line—in some places on one side and in some places on the other.

Joachim Dolomite:—A dolomitic limestone, identified as the Joachim, is the next higher formation that has its western margin in this belt. It appears as a thin dolomite within two or three miles of the westernmost continuous St. Peter and thickens eastward to 40 or 50 feet within 20 miles. The writer has not found it west of eastern Callaway County, though he has mapped its horizon in detail. Van Horn[2] refers a thin green shale, which occurs in Moniteau County in the river bluffs, to the Joachim. The green shale is only a few inches thick, and has nothing to correlate it with the Joachim excepting its location above the St. Peter. Lithologically it

[2] Missouri Bureau Geology & Mines, 2nd Series, 3, 36-37.

is absolutely different from the Joachim and it contains no fossils. It has been observed in only one outcrop.

The absence of sand and mud in the westernmost outcrops of the Joachim suggests an extension somewhat further westward, but the presence of the isolated St. Peter outcrops without Joachim above makes it likely that the margin of the sea was near the present margin of the formation. If this was the case the sea must have been shallow, as only a very gradual eastward slope is present.

Plattin Limestone:—The westernmost outcrops of the Plattin limestone of Middle Ordovician age are within 2 or 3 miles of the Joachim margin. The limestone occurs in patches near the Callaway-Montgomery County line, but thickens to 30 to 50 feet within 5 miles. In the southwestern part of Montgomery County it does not occur, but appears in the southeastern part. The Plattin has never been identified west of eastern Callaway County. It is unconformable on Jefferson City and St. Peter where it rests on them, and probably on Joachim. The limestone does not become more sandy or clayey on its western margin, which again suggests its extension further westward. However, its horizon has been traced over wide areas, it is a formation easily recognized, and it seems probable that the margin of its sea was near the present margin of its outcrop.

The sea in which the Plattin was deposited must have been very shallow, as the eastward depression can be detected only in distances of miles. The erosion of the Joachim before the Plattin was deposited was slight, though in some places the formation was completely removed and the underlying formations affected. This leaves the Plattin resting on St. Peter, Jefferson City, and Joachim, and makes the concordance of the western margins of the different formations the more remarkable.

Kimmswick Limestone:—The western margin of the Kimmswick limestone of Middle Ordovician age is about 30 miles east of the western margin of the Plattin. In his section across Missouri, the writer calls the westernmost Middle Ordovician limestone Kimmswick, but recent paleontological investigations have shown that the Plattin extends farther west than the Kimmswick.

The Kimmswick is a limestone of high purity at its westernmost outcrops.

Mineola Limestone:—The Kimmswick was succeeded by the Mineola limestone of the Middle Devonian. The westernmost outcrops of this formation are in almost exactly the same area as those of the three formations above discussed, though one outcrop, about 6 miles farther west, may be of Mineola age. The formation is sandy and shows evidence of near-shore deposition. It is very patchy where it occurs in central Missouri and the seas in which it was deposited must have been shallow. Eastward from its western margin it increases in thickness, but rarely reaches 30 feet. Part of the deposits are limestones of great purity which contain abundant crinoid remains, indicating seas deeper than those in which the Kimmswick, St. Peter, and Joachim were deposited.

As with the other formations, the eastward slope is very slight, amounting to about 100 feet in 50 miles. The uplift that caused the withdrawal of the sea was so slight as not to be indicated in local dips of the rocks and the dip at the margin seems no greater than at other places.

Callaway Limestone:—The Callaway limestone was deposited in the succeeding sea, which advanced about 40 miles westward of the western margins of the formations already discussed. The Callaway sea, however, soon retreated eastward, establishing a margin slightly west of the others, and in the restricted sea the Snyder Creek shales of the Upper Devonian were deposited. Their westernmost outcrops are about 20 miles west of the common margin. As in the other cases the warping that determined the sea margin was so slight as not to be detectable in short distances.

The total differential uplift in all of the cases enumerated amounted to less than 300 feet and the concordance of western margins seems very remarkable under such circumstances.

At Mineola, almost in the belt of western margins, a doming of 200 feet took place in Post-Kimmswick time and left an area of a few square miles that the Devonian seas did not cover. Though this doming coincides in part with the marginal belt, it seems to have been a

more or less independent uplift. In the marginal belt many small folds of a few feet in height occur, but seemingly they are no more numerous than outside the belt.

While the Mineola was forming on the east, the marginal belt formed the eastern margin of a sea that extended northward and westward. The barrier between the two seas was probably due to erosion rather than to warping, for it extended northeastward, striking across the ordinary trend of uplift.

Eastern Missouri Marginal Belt.

A critical marginal belt in eastern Missouri is not entirely distinct from the one discussed in the preceding paragraphs. It extended north to south from a short distance west of Hannibal to near Augusta on the Missouri River. The northern and northwestern margins of formations are not exposed, as the formations are covered by younger strata.

At the north, the western margin of the Kimmswick limestone of the Ordovician lies in the belt. From north to south the margin of the Maquoketa shales lies in it. The Edgewood formation and Sexton Creek formations of the Silurian have their western margins here. The patches of the Devonian formations, Callaway limestone and Mineola limestone, are isolated and the western margins are not determinable.

The Grassy Creek shales of the basal Mississippian were deposited in a sea with its western margin in this belt, as were, also, the Louisiana limestone and Hannibal shales of the Kinderhookian. The succeeding formations spread widely across the barrier, but the St. Louis limestone of the Mississippian reached the general belt and the Warsaw reached the southern end of it.

The western margins of many seas south of the St. Louis area seem to have been determined by the Ozark Uplift, but instead of the seas encircling the Ozarks, many of them had their western margins in north-south lines, the most important of which passed through Callaway County and through Missouri from near Hannibal southward.

In post-Pennsylvanian times a fault and sharp fold, called the Cap au Gres fault by Keyes, formed in the

belt. North and east of the fault line the country was uplifted differentially, while during the Paleozoic the major uplifts were on the south-west side of the belt. In some places, west and south dips as high as 50 degrees affect a thousand feet of strata, giving a total differential uplift of 600 to 700 feet. The movement was much larger than any that took place in the Paleozoic and probably greater than all combined. The belt remained a zone of weakness long after the close of the Paleozoic.

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