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James H. Lees

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THE HISTORY OF BOYER VALLEY*

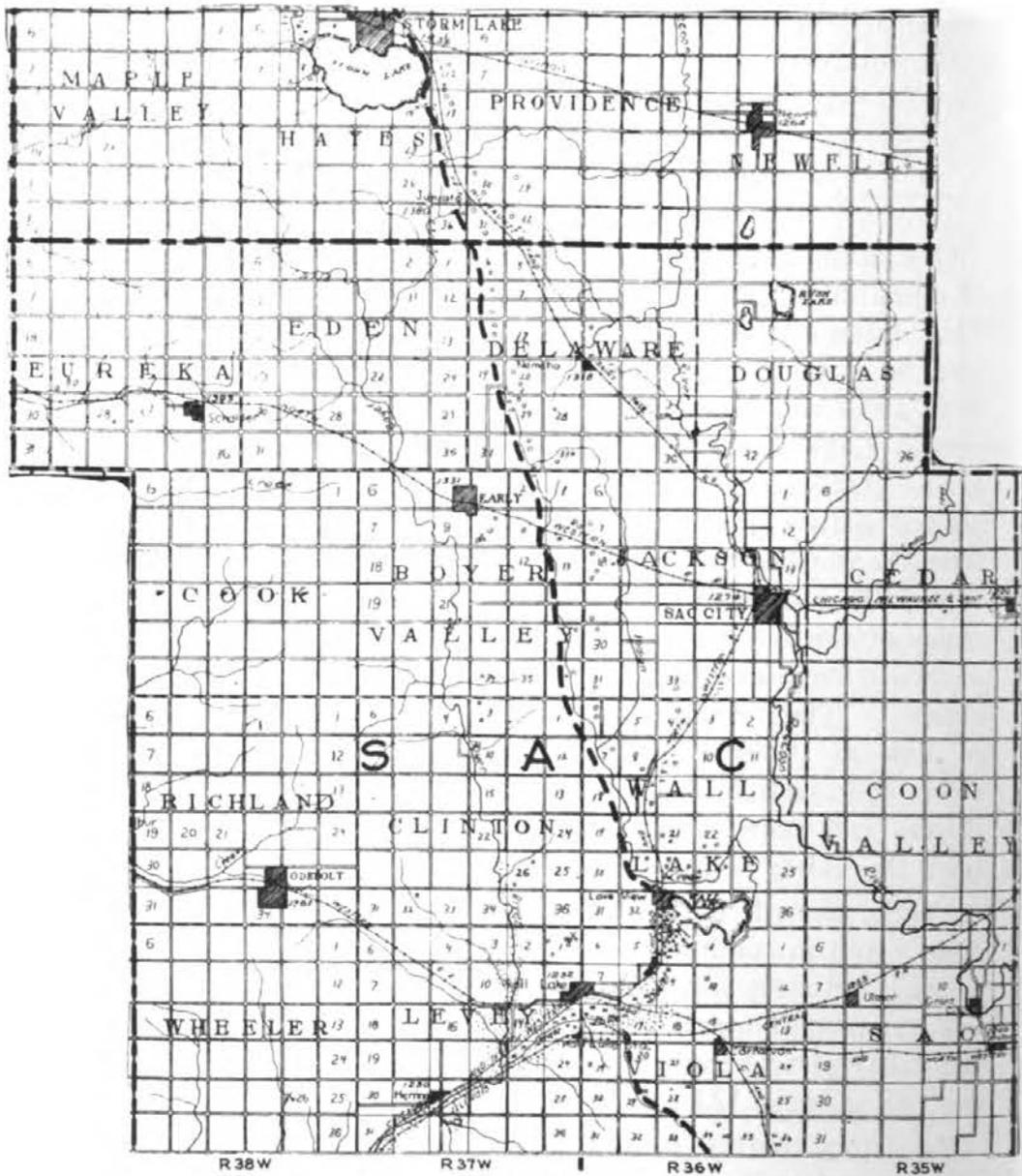
JAMES H. LEES

One of the largest streams of the Missouri slope in Iowa, and one of much importance in its influence on topography is Boyer river. This stream takes its rise in the Kansan uplands south of Storm lake, flows a little east of south across Sac county past the town of Wall Lake where it turns abruptly southwest. In this direction it crosses Crawford county, which it divides into practically equal parts. In its course across Crawford county Boyer valley is of the normal mature type but in southern Sac there opens into the valley from the northeast a broad sag which extends southwestward from Wall Lake. Digitate alluvial plains also extend several miles up the valley of the Boyer above the mouth of this sag and up the valleys of two tributaries from the eastern flank of the high ridge east of Odebolt. The flat undrained sag, although it is two or three times as wide as Boyer valley at Herring or Boyer, is nevertheless a direct continuation of it. On the other hand the present course of Boyer river north of the sag is out of line and out of harmony with the valley below. (See figure 122.)

While, as will be explained below, Boyer valley in Crawford county and in southwestern Levey township of Sac county is flat-floored and steep-sided, above the junction with the sag the valley has a sloping floor and widely flaring walls. The two profiles across the valley given herewith will make this more clear than words can do. (See figure 123.)

In strong contrast also to the valley in Crawford county is the character of the sag in the vicinity of the town of Wall Lake. Its floor is almost perfectly flat and its sides slope rather gently away to the upland, especially east of Wall Lake. West of here they are somewhat steeper and higher, in the vicinity of the valley of Boyer river and of the high ridge west of the upper Boyer.

What seems to be the most reasonable explanation of this unoccupied sag is that it is a fragment of an ancient Boyer valley which once included the basin of Wall lake, or at least a part of it, and possibly Indian creek. An arm of the sag extends to the southeast as far as Carnarvon and may represent the lower part of another



LEGEND

- Boundary of Wisconsin Drift.
- Kansan Drift-Region to west - Wisconsin Drift-Region to east.
- Wisconsin Terminal Moraine Topography,
- Wisconsin Kames
- Gravel Hills of Kansan Drift-Region
- Gravel Pits
- Swamps
- Alluvial Areas
- Areas Underlain with Gravel - Chiefly Dissected Stream Terraces.)

FIG. 122.—Map of Sac county showing the course of the upper part of Boyer river. Reduced from a portion of Carman's map of Northwestern Iowa as published in volume XXVI, Iowa Geological Survey.

branch of this old-time system. A little stream now comes down along this branch from the higher land near Breda in northwest Carroll county and empties, or did empty, into the southern arm of Wall lake.

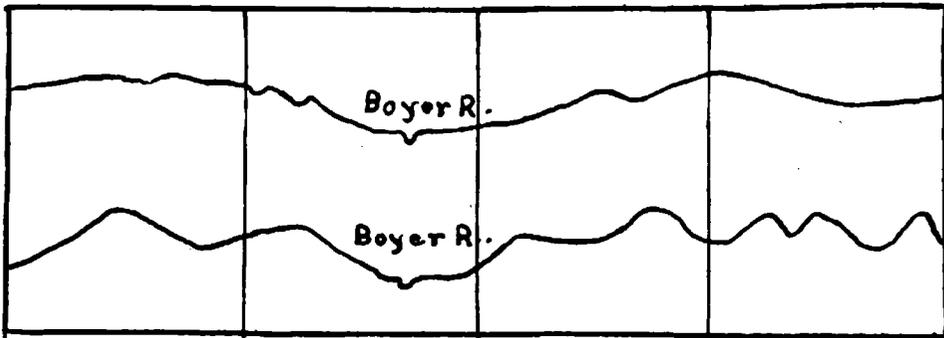


FIG. 123.—Profiles of Boyer valley. Upper profile, west of Lake View, Sac county. Lower profile, at Ellis, Crawford county. Horizontal scale, one inch equals five thousand feet. Vertical scale, one-fourth inch equals one hundred thirty feet.

It is very natural to assume that the lower part of Indian creek valley, east of Lake View, and Raccoon river above the mouth of Indian creek may have formed the main upper Boyer river. However, there are several facts which seem to stand in the way of such an assumption. Opposite Lake View the valley of Indian creek is half a mile wide and fairly flat floored. It is capacious enough to accommodate a much larger stream than the one which now occupies it. But within a mile to the west the valley is shallower and the walls are gentler. This is perfectly normal, but it seems anomalous to find on descending the valley from Lake View that about a mile and a half below the town the valley walls approach each other abruptly and from here to the mouth are nowhere more than one-fourth mile apart and in many places are so close as to leave almost no room for a flood plain. The outlet creek of Wall lake is likewise a small stream in a narrow, rather shallow valley.

Indian creek northwest of Lake View lies just within the edge of a belt of rough country known as the Wisconsin moraine which forms the margin of a sheet of glacial drift which is called the Wisconsin. This moraine is much less prominent about the lower course of Indian creek, and the country here is much smoother and more level prairie.

Wall lake is separated from the valley of Indian creek at their closest approach merely by a strip of hills and hollows not over one-fourth mile wide. The lake level is about twenty feet higher than that of Indian creek, although this probably is due to the inequalities

in the thickness of the moraine. The sag just south of Wall lake is filled with gravel to a height of thirty feet above the original floor and similar gravel no doubt underlies the lake. The assemblage of facts seems to indicate that while the ancient valley may have included the sag, the western part of Wall lake and the wide part of Indian creek near Lake View, it could hardly have included the lower part of the creek to the east.

If Raccoon river above the mouth of Indian creek once formed part of the Boyer system we should expect to find some differences in the character of the valley above and below this point. The valley above the creek mouth should show some evidence of being older than the lower part. But the evidence does not point in this direction.

Opposite the mouth of Indian creek valley Raccoon valley is remarkably wide, stretching nearly a mile from rim to rim. However, the actual flood plain is quite narrow, and is nowhere more than two hundred or three hundred yards wide. The remainder of the valley is occupied by a high second bottom or terrace which is really a valley filling of gravel and clay from the Wisconsin glacier. The old walls rise rather gently above this terrace and mark the former limits of the valley. A very significant feature of the valley filling is the fact that it extends from two miles above the mouth of Indian creek at least two or three miles below that point. That is, there is no change in the character of Raccoon valley near the mouth of Indian creek. In fact all along its course below here the valley shows evidences of its pre-Wisconsin age in its dimensions and its form.

Above the point already mentioned where the valley widens out and is partly filled by Wisconsin drift materials the valley is narrow and deep, steep bluffs flank the narrow flood plain and in its present aspects the gorge presents the appearance of post-Wisconsin age. Similar features are the rule in the valley from here to and beyond Sac City and as far at least as the north county line. In a few places, however, the valley shows what seem to be remnants of an original pre-Wisconsin drainage course. One of the best of these is in sections 25 of Delaware and 30 and 31 of Douglas townships, where the valley flares out into a wide open bay about a long oxbow. Another is just above Sac City, where the valley shows evidences of filling, and other indications of the incomplete filling of an old valley are not wanting.

The conditions seem to point, then, to a pre-Wisconsin age for Raccoon valley throughout its extent across Sac county. There can

be no doubt of this age in its lower portions. If, therefore, Raccoon valley is pre-Wisconsin in origin and its stream flowed to the Des Moines then as now, where was the pre-Wisconsin course of the upper Boyer? In view of the width of the valley of Indian creek opposite Wall lake, although it is just within the terminal moraine where deposition would naturally be great, and in view also of the narrowness of the valley farther east and of the character of Raccoon valley, it seems as if we must look for the northward continuation of the ancient Boyer valley in this wide segment of Indian creek valley and possibly in the narrower portion to the northwest. Possibly, of course, the old valley above this larger segment may have been entirely filled up and obliterated.

It seems evident from the character of the modern upper Boyer valley that it has had a different history than the valley in Crawford county, and it probably was only a branch which united with another which came from the northeast. Macbride indeed sketched such a history as this in one of his reports,¹ but later in discussing Sac and Ida counties² he postulated an *eastward* flowing Boyer river whose headwaters were gathered from the ridge which stretches between Schaller, Odebolt and Herring and now is cut through at the latter village. This theory seems to be based on the narrowness of the valley at Herring and Boyer, but it seems as though this narrowness may well be explained by the presence of the high ridge which would naturally require more work to excavate and hence might well be cleft by a valley narrower than that above or below. It may freely be admitted that the unoccupied valley in the vicinity of Wall Lake is abnormally wide but this may be accounted for in part by the fact that several streams converged south of Wall lake, and in part by the greater ease with which the river could widen its valley here than in the much deeper and more steep-sided part between Herring and Deloit. On the other hand it is hard to believe that a stream would normally make such a sharp turn as would be necessary for the present upper Boyer if it had to flow eastward past Wall Lake to the Raccoon.

Again it is only since the time of the last glacial invasion that these drainage changes could have occurred and in view of the immaturity of much of the upper part of the Raccoon valley as sketched above we should according to Macbride's theory expect similar immaturity in the Boyer at Herring. However, the valley here is

¹Geology of Cherokee and Buena Vista counties: Iowa Geol. Surv., Vol. XII, pp. 330, 331, 337.
²Geology of Sac and Ida counties: Iowa Geol. Surv., Vol. XVI, pp. 520, 523, 524, 537.

uniform with that below in its maturity, and it would be unlikely that either the very short stream postulated as rising on the eastern slope of the divide near Herring and flowing eastward past Wall Lake, or even the much longer one rising on the western side and flowing southwest, should, during the brief time allotted, have cut out such a wide valley and developed such a mature flood plain as now exist, both in the unoccupied sag valley near Wall Lake and in Boyer valley near Herring and in increasing measure to the southwest.

Professor Todd³ has recently argued that Niobrara river of northern Nebraska, during pre-Pleistocene time "followed the courses of James and Missouri rivers as far as Onawa, Iowa, thence east and northeast through Ida and Sac counties past Wall Lake and thence southeast along the Raccoon river. *This conclusion rests on a few apparently reliable reports from wells which show that the pre-glacial surface indicates a valley whose bottom is less than 900 A. T., in some cases less than 850." "The fact that Wall lake, lying on the summit, formerly drained into Boyer river and now into the Raccoon, and another fact that the Boyer rises east of the crest of the divide, has first a course east of south and at this point turns southwest" are considered to be explained by this theory. Such well records as are available to the writer do not indicate such a valley as Professor Todd postulates and while Wall lake and the sag valley doubtless partly suggested the theory it must be remembered that the lake is of late Wisconsin age while the valley is doubtless to be dated at the close of the Kansan. These facts seem to invalidate the whole argument since Professor Todd is discussing a preglacial stream.

Professor Todd further states that: "There was a fall of 350 feet from Sioux City to Wall lake." But at present the elevation of low water in Missouri river at Sioux City is 1,076 feet, while the elevation of Wall lake is about 1,225 feet. There is no indication of such a warping as would be necessary to equalize the discrepancy between these figures and the grade indicated by Todd. In fact, the evidence seems to point to uplift in northwestern Iowa during glacial times rather than to the depression which seems to be necessitated by Professor Todd's hypothesis.

Doctor Carman⁴ has recently restated the theory of an eastward flowing Boyer in his report on the Pleistocene Geology of Northwestern Iowa. Carman emphasizes the facts that the Mississippi-

³Todd, J. E., The Pleistocene History of the Missouri River: Science: N. S. Vol. XXVI, pp. 263-274.

⁴Iowa Geological Survey, Vol. XXVI, pp. 318-320, 1915.

Missouri divide is lower than the minor divide a few miles to the west and that the pattern of drainage on opposite sides of the Mississippi-Missouri divide is the same while that on opposite sides of the minor divide is different. He states his theory in the following language: "In pre-Wisconsin time the Boyer river turned eastward and passed through the Wall lake outlet toward Raccoon river. When the ice-edge blocked this eastward drainage the ponded waters in the valley broke over a low place in the great watershed near Herring, in southwestern Levey township (Sac county), and escaped to Missouri river. This course was cut so low during ice-occupancy, and the old valley to the east was so much filled that the Boyer continued to flow to the southwest and did not again take its eastward course to the Raccoon."

Some of the objections to this theory have been set forth in previous paragraphs. The fact that the pattern of drainage on opposite sides of the minor divide is different may be explained by the statement that the Boyer is close to the crest of this divide and there is little room for west-to-east tributaries to develop, while the Maple flows, in a nearly parallel course, be it noted, several miles distant from the crest, and therefore a well developed system of east-to-west tributaries drains this western slope.

The question arises as to why this overflow from the ice-ponded waters should seek escape over the highest part of the bounding rim rather than over some lower col. A study of the altitudes of the region shows that in northwest Carroll county along the margin of the Wisconsin moraine, the highest point reached by the railway between Carroll and Wall Lake is 1,366 feet, at Breda. This is practically at the upland level. The railway between Wall Lake and Odebolt crosses the high divide west of the Boyer at 1,378 feet. But in northeast Crawford county, where the Boyer has cut its valley through the ridge, the latter rises 1,500 feet or more above sea level east of the river and over 1,400 feet between the Boyer and Otter creek, while a little farther west, near Schleswig, the hills reach altitudes well over 1,500 feet above sea level. There is no obvious reason why this high plateau, apparently the highest land south of Alta, should be chosen as the locus of overflow for the glacial floodwaters. On the other hand, however, if the southwestward flowing post-Kansan Boyer be conceived of as extending its valley to the northeast by headward erosion there is apparently no reason why one of the vigorous members of its dendritic system should not work its way up the slopes of the highlands and eventually cut through what was once the real Mississippi-Missouri divide and so

come to gather in a part of the run-off which really belonged to the Raccoon system, although perhaps the Boyer never actually tapped any of the feeders of that system. This would seem to account satisfactorily for the deep narrow valley through the ridge and the broader, shallower one to the northeast of it. Then when the Wisconsin glacier overwhelmed the main stream of the upper Boyer system and the moraine obliterated its valley the empty sag remained as a testimonial to former conditions and one of the tributaries became the main stream of the system.

Note may be made here of the presence in Porter creek valley north of Boyer, as well as in Otter and Buffalo creek valleys and also in Boyer valley at several points, of gravels which are older than the Wisconsin stage and which therefore show that the present drainage features were established before the Wisconsin ice disturbed the pre-existing drainage. These gravels will be described elsewhere in connection with the geology of Crawford county.

It seems to the writer, then, to summarize, that Boyer valley originated sometime following the retreat of the Kansan glacier from western Iowa and that the river developed the course now occupied across Harrison and Crawford counties, while in Sac county there were two branches, the western of which is now the upper Boyer, while the eastern is represented by the empty sag extending from the river to Wall Lake, and beyond here perhaps by upper Indian creek. The Wisconsin glacier blotted out the upper part of this eastern branch, leaving the lower part as a partly filled, undrained marsh beyond the glacier's margin. It seems that the sag valley and the river valley as well are too mature to have been the result of Wisconsin and post-Wisconsin erosion alone. Their history goes far back of Wisconsin glaciation through the uncounted years and centuries of the development of the deep-cut topography on the Kansan plain.