A FAULT ALONG BRYANT'S CREEK, NORTHERN MONROE COUNTY

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Introduction. This fault was noted during the summer of 1931, in connection with work on the Harrodsburg-Borden contact in northeastern Monroe County, for the State Geological Survey. The displacement is by no means confined to the vicinity of Bryant's Creek, but is best displayed at various places along its course. Up to the present time, the writers have done little work toward determining the exact structural conditions produced by the fault, but a fairly accurate determination of the line of movement has been made.

Although it has been generally known that there are certain structural irregularities in the area, apparently no detailed study had ever been made. Stockdale, in his recent publication on the Borden rocks of southern Indiana, mentioned the fault and drew it as an apparent extension of the Mt. Carmel (Unionville) Fault, on his general structural map.[1]

It is quite probable that the fault is connected with the Mt. Carmel fault farther to the south and east, but an accurate determination of the fault zone in the southeastern part of the area is practically impossible, as it lies in the broad, flat valley of Bean Blossom Creek.

Description of the Region. The fault lies in parts of Marion and Washington townships, northern Monroe County, T10N, R1E and R1W. The major portion of the land is included in the Morgan-Monroe Counties State Forest area.

The northern part is a well-dissected upland, with long divides and deep-cut ravines and stream valleys, while the broad, level valley of Bean Blossom Creek forms the southern boundary. The tops of the ridges have an elevation of 850 to 900 feet, while the streams have cut down to between 625 and 700 feet.

The Harrodsburg limestone is the highest formation, capping the higher ridges to a thickness of from 0 to 75 feet. This is underlain by the upper Borden rocks, named the Edwardsville Formation by Stockdale. There are no other formations exposed in the area.

It is primarily upon the position, dip and displacement of the Harrodsburg limestone that the determination of the fault line and its amount of throw has been based.

Position of the Fault. From the north, the fault enters Monroe County probably in the valley of Hacker's Creek, in the center of the north half of Section 1, Washington Township, one-fourth to one-half mile east of State Road 37. The trend here is probably south of south-

[1] Stockdale, P. B. The Borden (Knobstone) Rocks of Southern Indiana. Ind. Dept. Conserv. Div. Geol., Publication no. 98, pp. 313, 315, plate 7, 1931.

"Proc. Ind. Acad. Sci., vol. 41, 1931 (1932)."

east, although accurate data is lacking. That it is present for some distance north into Morgan County is evidenced by low-lying beds of limestone three-fourths of a mile north of the county line. The displacement passes a short distance east of Road 37 in the west half of the southeast quarter of Section 1, where it enters the drainage area of Bryant's Creek. From here, it continues to somewhere near the boundary between Washington and Marion townships, Sections 12 and 7, the trend being 30 to 35 degrees east of south. At this point, a change of direction is noted, the direction becoming approximately 45 degrees east of south, the fault crossing the headwaters of Bryant's Creek at the center of the south half of Section 7, and continuing to the northwest quarter of Section 17, Marion Township. From this point on, evidence based on the position of the limestone is lacking, although signs of displacement can be noted in the Borden sandstones and shales in the beds of several tributary streams of Greasy Creek in Section 17 and the southwest corner of Section 16. The fault, however, may lie farther to the west, in the main valley of Greasy Creek, as shown by the alternate broken line on the map. If it continues, as it most likely does, in its general southeasterly direction, it probably connects with the Mt. Carmel fault in the vicinity of Fleener's Bridge over Bean Blossom Creek, in the northwest corner of Section 34.

Amount of Throw. The displacement is practically vertical, with the downthrow on the southwest. The rift zone, in several places, appears to be quite wide, with a suggestion of perhaps two stages of faulting. This feature was noted also, by Logan, along the Mt. Carmel fault in Lawrence County.[2] The total width of the zone of displacement appears, at several places, to vary from 25 to 50 feet, and may be as much as 100 feet at others.

The amount of throw probably varies from 75 to 125 feet. This conclusion has been reached by subtracting the elevations of the base of the Harrodsburg near the fault from the calculated normal elevation, and from the elevations of tops of several ridges on the upthrow side, which are capped with a few feet of Harrodsburg. The elevation of the Harrodsburg, using a normal dip of about 33 feet per mile, slightly south of west, should be between 870 and 900 feet along the fault. The actual elevations, however, range from 770 to 810 feet. The Harrodsburg-Borden contact has been found, in other localities, to be variable, and this fact may account, to some extent, at least, for the apparent differences in the amount of throw.

The base of the limestone, at distances varying from one-fourth to one-half mile back from the rift zone, is generally 15 to 20 feet lower than that nearest the line, giving evidence of some drag on the downthrown Harrodsburg.

Conditions in the Fault Zone. The actual rift, as displayed by exposures of the downfaulted Harrodsburg, is distinctly visible in a steep bluff along the main headwaters of Bryant's Creek, in the center of the south half of Section 7, Marion Township. Here the fairly massive

[2] Logan, W. N. Handbook of Indiana Geology, p. 840, 1922.

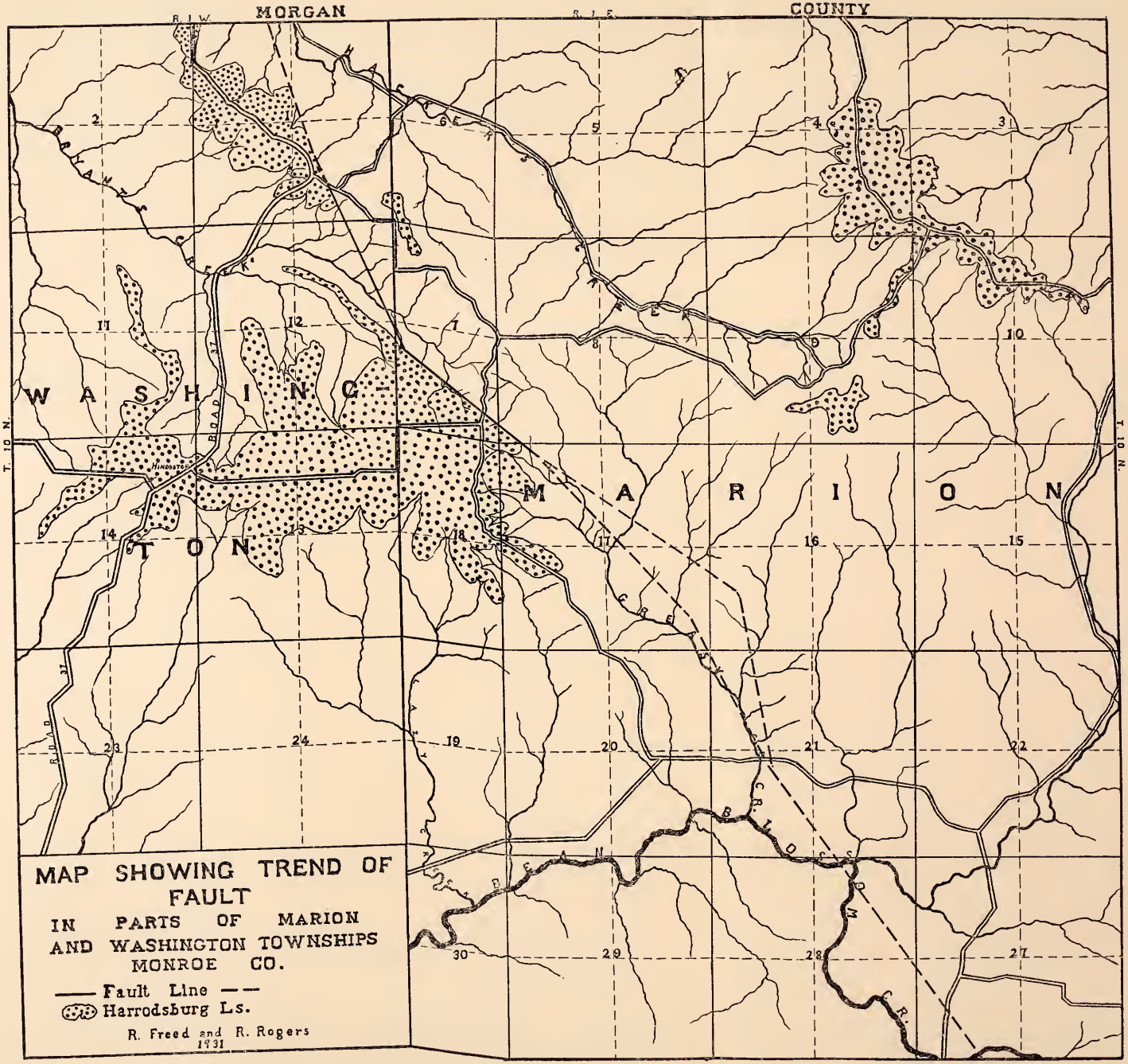
MORGAN
COUNTY
R. 1 W.
R. 1 E.
T. 10 N.
T. 10 N.
WASHINGTON
MARION
HINDSTON
ROAD 37
ROAD 37
BRAMFORD CREEK
CRESTY CREEK
CRESTY CREEK
BLOOMINGTON
BEAN
CR.
MAP SHOWING TREND OF FAULT
IN PARTS OF MARION
AND WASHINGTON TOWNSHIPS
MONROE CO.
Fault Line
Harrodsburg Ls.
R. Freed and R. Rogers
1931

Figure 1.

limestone is separated from the equally massive Borden sandstone by a fractured, weathered zone of both limestone and sandstone, about 15 feet in thickness. The Harrodsburg-Borden contact, seen in the stream bed 100 feet to the south, has an elevation of approximately 800 feet.

The above described section is the only one in which the actual fracture zone between Harrodsburg and Borden is visible, but in the southeast quarter of Section 1, Washington Township, the location can be determined to within about 100 feet. A gully extends south from a secondary road, one-eighth mile southeast of State Road 37. The base of the Harrodsburg here is at 795 feet. Two hundred feet to the east, a second gully has been formed. Massive sandstone is exposed on the slopes leading to this latter ravine, at an elevation of at least 840 feet. Thus the fault is between the two ravines, trending in a north-northwesterly direction.

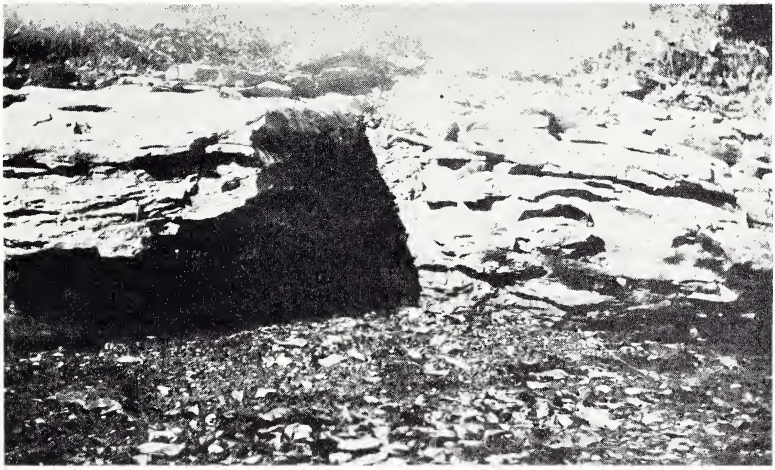

Fig. 2. Brecciated zone in bank of Bryant's Creek, east edge of Sec. 12, T10N, R1W, Washington Township.

Between the two localities just described, the fault apparently crosses Bryant's Creek at the eastern edge of Section 12, Washington Township. A weathered, brecciated zone, 16-18 inches across, is exposed in the creek bank. (See Fig. 2). Although it is hardly probable that the major fault surface is exposed at this point, slickensides were found, and some slipping must have taken place. The trend here is 32 degrees west of north. A sharp ravine, which enters the valley from the southeast, appears to occupy, for the most part, the fault zone.

Two small ravines in the southeastern part of Section 7, Marion Township, head in Borden sandstone and pass through several feet of limestone, showing that they have cut across the fault.

The base of the Harrodsburg in a ravine which extends toward the southeast, in the northwest corner of Section 17, is at 790 feet. A tributary ravine, entering from the north a short distance below the contact, passes through nothing but sandstone, although it heads in a

divide which has an elevation of 865 feet. The location of the fault zone is evidently near the junction of the two ravines.

Other Features Associated with the Fault. An interesting feature present near the displacement is a series of sinkholes in the southern half of Section 7, Marion Township. Similar conditions have been reported from the vicinity of the Mt. Carmel Fault in Lawrence County. The sinks are developed in the limestone, about 50 feet from the zone of displacement.

Another feature, which suggests partial control of drainage by the fracture zone, is seen in the northeast quarter of Section 12, Washington Township. Three ravines within a distance of approximately three-eighths of a mile, heading in a southwesterly direction, have their courses abruptly changed to the northwest for a distance of from 100 to 200 feet, after which they again abruptly resume their original direction. It is quite possible that, due to the more easily eroded material in the fracture zone, the drainage turned and followed it for a short distance.

There appear to be many tension cracks and joints produced by the movement in the Borden sandstones and shales exposed in the beds of many streams in the area. These were little used as criteria, however, as this formation is easily susceptible to jointing and associated features produced by its variable character and composition, which may prove very deceptive to one not well acquainted with it.

The writers believe that interesting structural features are present on the downthrow side of the fault, due to the apparently irregular amount of displacement, and future work may disclose several minor anticlinal structures, such as the present farther to the south in Monroe and in Lawrence counties.