

The Buddha Outlier of the Mansfield Sandstone Lawrence County, Indiana

CLYDE A. MALOTT, Indiana University

The purpose of this paper is to describe and depict the relationships of a small isolated outlier of the pebbly phase of the Mansfield sandstone formation of basal Pennsylvanian age, resting deeply in the Mississippian system, located near the cross-roads hamlet of Buddha, Lawrence County, Indiana, some 10 miles or more east of the general outcrop of the Mansfield formation. Figures 1 and 2 have been prepared to show the geologic, topographic and geographic relations of the occurrence of the Buddha outlier of this basal formation of the Pennsylvania system so unexpectedly remote from the main body of the formation and so surprisingly different in its stratigraphic surroundings. The presence of this outlier in the Buddha locality, some seven miles southeast of Bedford, was called to the attention of the writer some years ago by T. M. Bushnell of Purdue University, but it was not until recently that the outlier was investigated.

The Buddha outlier is located about one-half of a mile north of Buddha in sections 9 and 10, T. 4 N., R. 1 E. It occupies in part an easterly extending spur of dissected upland and in part the northern edge of a small section of the sinkhole upland surface, representing the Mitchell plain of southern Indiana as developed on the upland divide between the deeply entrenched valleys of East White River and Guthrie Creek. (See Figs. 1 and 2.) The small section of upland sinkhole plain is approximately 700 feet above sea level and 200 feet or slightly more above the alluviated valleys of these streams. On the upland surface are scattered patches of waterworn gravels composed of bronzed chert and small geodes, showing in some of the shallow road-cuts. These gravels represent the Lafayette upland gravels occurring so widely in the unglaciated section of southern Indiana. Normally these gravels are in place at elevations between 700 and 800 feet in altitude. Perhaps some of the gravels of the Buddha locality represent redepositions, or are residual on the limestone plain which has been lowered somewhat by subsoil solution, especially those at altitudes less than about 740 feet. A hill in section 14, about two and one-half miles southeast of Buddha, reaches an altitude of 800 feet, as shown on the Bedford Quadrangle topographic sheet, and the Lafayette gravel in place is apparently 60 feet deep. In none of the gravels of the locality were white vein-quartz pebbles observed, though it is not uncommon for them to be present in many of the Lafayette gravel areas in southern Indiana. These gravels are mentioned here because it should be made clear that they are in no way to be confused with the Buddha outlier of pebbly sandstone.

The Buddha outlier of the pebbly phase of the Mansfield formation is a narrow strip of outcrop not exceeding 100 yards in width and ex-

tending nearly east and west for a distance of about one-half of a mile. (See Fig. 1.) It forms an undulating divide or ridge rising slightly above the general level of the upland plain of the Buddha locality. The maximum thickness of the remnant does not appear to exceed 20 feet. The base was not found exposed at any place, but it appears to be about 730 feet in altitude. The maximum altitude of the ridge does not exceed 750 feet. Exposures are numerous in the form of massive boulders or surfaces on the undulating ridge and numerous free boulders or blocks of various sizes occur along the hill-side edges of the

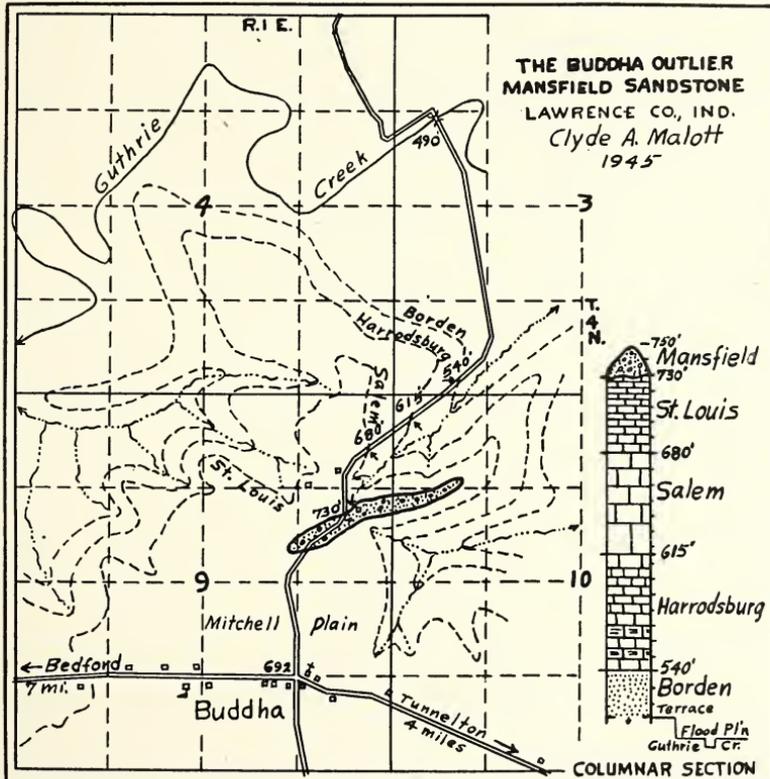


Fig. 1. Sketch of the Buddha outlier of the Mansfield pebbly sandstone showing its topographic and geologic relations.

formation, and numerous smaller pebbly boulders derived from the formation extend as float down the ravine running northeast from the deposit. No sections of the formation were available for study.

The formation appears to consist mostly of coarse quartz sand, grit and small pebbles, either loosely held together or firmly bound by iron oxide. Little local material derived from the surrounding formations appears to be incorporated in the formation, even in parts which appear to be close to the base. The sand is angular and subangular

with a minor amount of rounded grains, all of clear vitreous quartz. The grit, consisting of particles ranging from one-tenth to three-tenths inches in size, is dominantly angular and subangular, though some rounded fragments are not uncommon. The pebbles, either scattered through the sand and grit or massed in streaks in the cross-bedding of the of the formation, vary in size from small peas up to as much as one inch across. They are all quite rounded and the larger ones are elongated rather than spherical or subspherical. The grit and pebbles are composed of admixtures of opaque milky quartz, iron-stained quartz, pale-blue vitreous quartz, and clear vitreous quartz. A small quantity of dull, porous chert was observed in some of the hand specimens which were collected. The sand, grit and smoothed pebbles are rather poorly assorted, except in certain massed bands in the cross-bedding where the pebbles dominate. No true bedding was observed in any of the exposures. While the larger exposures are massive and difficult to break with a hammer, the formation does not appear to be thoroughly cemented. The cementing material is composed almost entirely of infiltrated iron oxide. The pieces of float composed almost entirely of pebbles break up readily when struck with a hammer.

The same description, perhaps with some variations, may be given to certain outcrops of the basal Mansfield sandstone formation elsewhere in Indiana, notably one and one-half miles west of Williams in the western part of Lawrence County, the Trinity Springs and Shoals localities in Martin County, and the Lafayette Spring locality east of Cannelton in Perry County. Since the basal Mansfield sandstone formation is the only Paleozoic formation known in Indiana with such a composition of quartz grit and quartz pebbles, it is only logical to conclude that the Buddha deposit is an isolated remnant of the Mansfield which once connected with the main body of the formation now many miles west down the dip from the severed and remote Buddha outlier.

The remoteness of the Buddha outlier from the main body of the Mansfield formation is only one of its unusual relations. It rests on the St. Louis limestone only 50 feet above the base of that formation. (See Fig. 1.) The base of the main body of the Mansfield formation down the dip in the western part of Lawrence County rests on various members of the Chester series, normally above the Cypress and Golconda formations which are respectively 395 and 440 feet higher stratigraphically than the position of the Buddha outlier on the lower part of the St. Louis limestone. This signifies that the pre-Mansfield erosion was as much as 440 feet deeper into the Mississippian system in the Buddha locality than it was in the area of the main body of the Mansfield in the western part of Lawrence County. The following formations with their normal thicknesses in the Huron locality were apparently eroded away before the deposition of the Buddha representative of the basal Mansfield formation:

Golconda	45 feet.
Cypress	35 feet.
Beech Creek	15 feet.

Elwren	35 feet.
Reelsville	5 feet.
Sample	30 feet.
Beaver Bend	15 feet.
Mooretown	20 feet.
Paoli	20 feet.
Aux Vases	5 feet.
Ste. Genevieve	115 feet.
St. Louis	110 feet (of the upper part).

No other locality in Indiana is known to have such a great stratigraphic range in the overlap of the base of the Mansfield sandstone.

The basal Mansfield where composed of or containing quartz pebbles, such as the Buddha representative, is largely confined to fillings in the more deeply eroded valley-like depressions in the underlying formations upon which the Mansfield unconformable rests. In the area of the eastern margin of the formation through Indiana the basal parts of the Mansfield are composed of its more normal sandstone phase or of a shale where it occupies its normal stratigraphic position. The pebbly phase

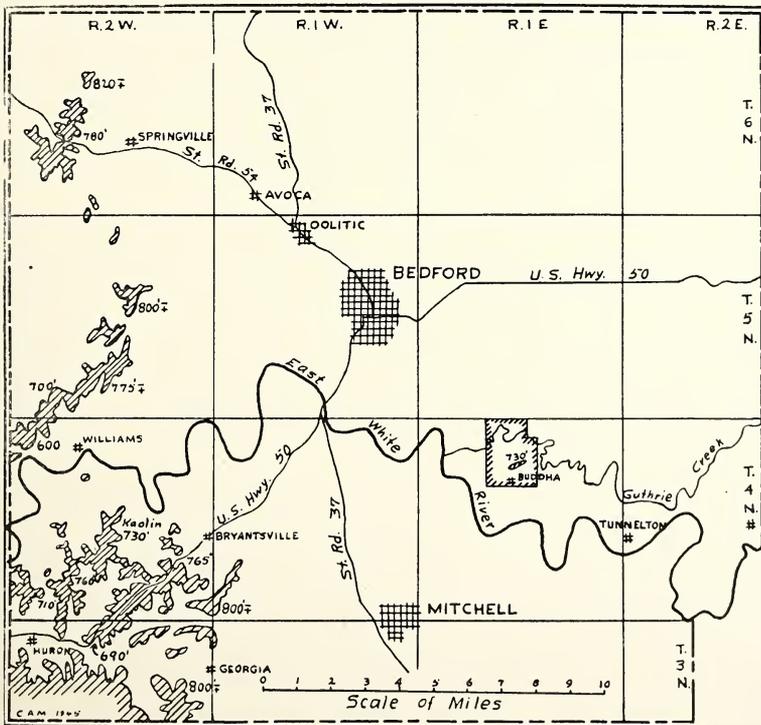


Fig. 2. Sketch of Lawrence County, Indiana, showing the position of the Buddha outlier in its remote relation to the ridge-crest outcrop of the basal Mansfield in the western part of the County. Figures express the variable altitudes of the Mansfield base.

is characteristic only of its base where it bites deeply below the normal stratigraphic position of the locality where such phases of the formation occur. Accordingly, the Buddha outlier is very likely a remnant of a Mansfield filling in a deep pre-Mansfield valley.

Some of the variabilities in the altitudes of the base of the Mansfield formation in the western part of Lawrence County are shown in Fig 2. The base of the eastern edge of the much eroded and dissected fringe of the main body of the Mansfield is at an altitude generally of about 800 feet, which is 70 feet higher than the altitude of the base of the Buddha outlier 10 miles away up the dip to the east. But the main body of the Mansfield in the southwestern part of Lawrence County has considerable variation in the altitudes of its base, especially west of the eastern fringe where data on the base are more readily available. The normal stratigraphic position of the base in Lawrence County is on the Cypress and Golconda formations, but in the Bryantsville-Huron area the base digs deeply below its normal stratigraphic position, in places coming below the Beech Creek limestone, and has a local relief in excess of 100 feet. On U. S. Highway, 50, one and one-half miles southwest of Bryantsville, the base rests on the Elwren shale at an altitude of 765 feet. At the old kaolin mines three miles west of Byrantsville, the Mansfield base of coarse, cross-bedded, massive sandstone is at the horizon of the Beech Creek limestone about 700 feet in altitude. Two miles southwest of the kaolin mines, the base of the Mansfield is at its normal position on the Golconda formation at an altitude of 760 feet. These altitudes not only represent the westerly dip of all the formations of some 30 feet per mile, but they show a variation in stratigraphic position as well.

It is in the locality west of Williams, however, that the Mansfield bites most deeply into the Chester formations. Here, a loose, pebbly phase of the Mansfield rests on or near the Beaver Bend limestone at an altitude of 595 feet, stratigraphically 120 and 165 feet respectively below the tops of the Cypress and Golconda formations. The loose, pebbly Mansfield has been dug or quarried for road material just north of the overhead bridge across the railway on State Road 450. Some redeposited iron-stained clay derived from the pre-Mansfield clay residue of the Beaver Bend limestone occurs in the base of the Mansfield in the quarry pits, along with some fragments of redeposited white kaolin. The pebbly phase of the Mansfield here occupies a pre-Mansfield valley as much as 150 feet below the nearby pre-Mansfield uplands. This old pre-Mansfield valley with its pebbly fill of the Mansfield formation extends west and southwest some four miles to the well developed, pebble-filled pre-Pennsylvanian valley in the Indian and Trinity Springs locality, mapped and described some years ago by the writer. It is not unreasonable to speculate on the possibility that the Buddha outlier is a remnant of the pebbly filling deposited in this same pre-Pennsylvanian valley.

It is quite certain that the Buddha outlier is an isolated remnant of the pebbly phase of the Mansfield deposited in a pre-Pennsylvanian valley trough which was cut deeply below the normal position of the

Mansfield base. It appears too deep, however, to be wholly accounted for by a pre-Pennsylvanian valley alone. It indicates severe truncation eastward of the underlying formations previous to the deposition of the Mansfield sandstone, and suggests that some aspects of the presence of a pre-Mansfield Chester escarpment, perhaps not greatly unlike the one which today lies just west of Mitchell between the main body of the Mansfield and the Buddha outlier.