

Revision of Mississippian-Devonian Boundary in White and Benton Counties, Indiana

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Introduction

The abandoned quarry of the White County Stone Company is located 5 miles south of the village of Wolcott, in the SW $\frac{1}{4}$ SW $\frac{1}{4}$ section 19, T. 26N., R. 5W., southwestern White County. The original exposures were found on a nearly flat ground moraine deposited during the Tazewell glacial substage, an unusual natural setting for bedrock outcrops. In 1929 Shrock and Malott (5) described the exposed limestone as Devonian and correlated it with the Jeffersonville limestone of southern Indiana. Their age assignment was based on sparse fossil evidence, Shrock recording the presence of the brachiopod *Spirifer divaricatus* and several corals which he did not identify in print. The 1932 Geologic Map of Indiana, however, showed the area as underlain by Mississippian rocks, and Gutschick (3) has described sponge spicules of Mississippian age collected at the quarry.

Restudy of the quarry exposures, and of samples from wells drilled in surrounding areas which were not available to Shrock and Malott at the time of their reconnaissance of the region, prove beyond doubt that a Devonian age assignment of limestone in the quarry is erroneous. The strata are Mississippian, and are a limestone facies occurring within, but near the base of, the Borden group of clastic rocks. Subsurface study of the area also indicates the need for revision of the Mississippian-Devonian boundary shown on the 1956 Geologic Map of Indiana (Scale 1:1,000,000).

Observations at White County Quarry

Shrock and Malott described the stratigraphic section at the quarry, measuring 16 feet, as consisting of alternating units of crystalline limestone and blue-gray, sandy shale. The quarry is now water-filled and abandoned, and only the upper 6 feet of the described section (Unit 6 of Shrock and Malott) is accessible. Skin-diving in the summer of 1956 indicated an actual depth of 26 feet for the quarry, but a thick layer of bottom sediment prevented any accurate determination of the character of the rocks flooring the excavation.

Megascopically, the exposed ledge consists of light tan to light gray, limonite-stained, coarsely crystalline limestone. The rock is relatively thin-bedded and fractures evenly at approximate right angles to the bedding planes. The most conspicuous feature of the fresh rock is the presence of great quantities of white crinoid fragments, some rings

¹ The author is indebted to Dr. Robert Shaver for assistance in identification of fossils from the White County quarry, and to Mr. Seymour Greenburg for petrographic study of thin-sections.

attaining a diameter of three-quarters of an inch. Although columnal segments are common, they tend to occur in localized patches in the rock, and no fragments of calices or individual plates were observed.

Studied in thin-section, the rock consists principally of fossil-fragmental, crystalline calcite, with some unrecrystallized grains of clastic calcite. Scattered dolomite rhombs may comprise up to 10 percent of the total mass. Minor chert and shredded clay particles also are present. The limestone is more siliceous upward, and insoluble residues of the ledge constitute about 16 percent of the total sample. The siliceous material is derived, at least in part, from the remains of silicified crinoid fragments.

Identifiable megafossils are the brachiopods *Spirifer carinatus* Rowley (6), *Spirifer grimesi*, and some poorly preserved cup corals, tentatively identified as *Triplophyllites dalei* (2). *S. grimesi* has been reported from Indiana by Collett (1), but *S. carinatus* has not been reported previously in the state as far as the writer can determine. *S. carinatus* is an index fossil for the Burlington (Osage) limestone of the Mississippi Valley, whereas *S. grimesi* is known from both Burlington and Keokuk beds. The fossils, together with nearby stratigraphic data, indicate assignment of the limestone to the Osage (Mississippian) rather than the Devonian. *Spirifer divaricatus*, reported by Shrock, has not been recognized in this quarry during this study.

The lip of the quarry is at an elevation of approximately 740 feet, and therefore the limestone lies above the Rockford limestone horizon in the area as shown by subsurface data. Despite the rather detrital character of the rock, there is no definite suggestion of reef structure. Moreover, it lies several hundred feet stratigraphically lower in the Borden section than the well-known bioherms at Stobo, Monroe County, and Crawfordsville, Montgomery County. The limestone probably represents a lentic or limestone facies in the lower part of the Borden group, indicating local persistence of Rockford-type sedimentation contemporaneously with commencement of Borden elastic sedimentation in adjacent areas. Shrock and Malott recognized a similar persistence of limestone deposition above the base of the Borden silty shales in this area at exposures near Goodland and at the Alter quarry northeast of Remington, Jasper County (5).

The limestone in the quarry also lies in place at a height of 40 to 100 feet above the general level of bedrock beneath the surrounding landscape. Its preservation apparently resulted from a greater relative resistance to glacial erosion than the softer silty shales occurring nearby at the same level. The limestone must have been present as a small knob or hill in preglacial time, and has suffered little from repeated erosional attack by glacial ice.

Revision of Mississippian-Devonian Boundary

The subglacial stratigraphy of much of northwestern Indiana is poorly known because of scarcity of well data in a region where outcrops are widely scattered. Fortunately, from the district surrounding the quarry, there are available for examination many sample sets from water wells, stratigraphic tests, and exploratory wells. Such examination

indicates a need for considerable revision of the Mississippian-Devonian boundary in this district as shown on the 1956 Geologic Map of Indiana. (Fig. 1). An area of more than 50 square miles in eastern Benton

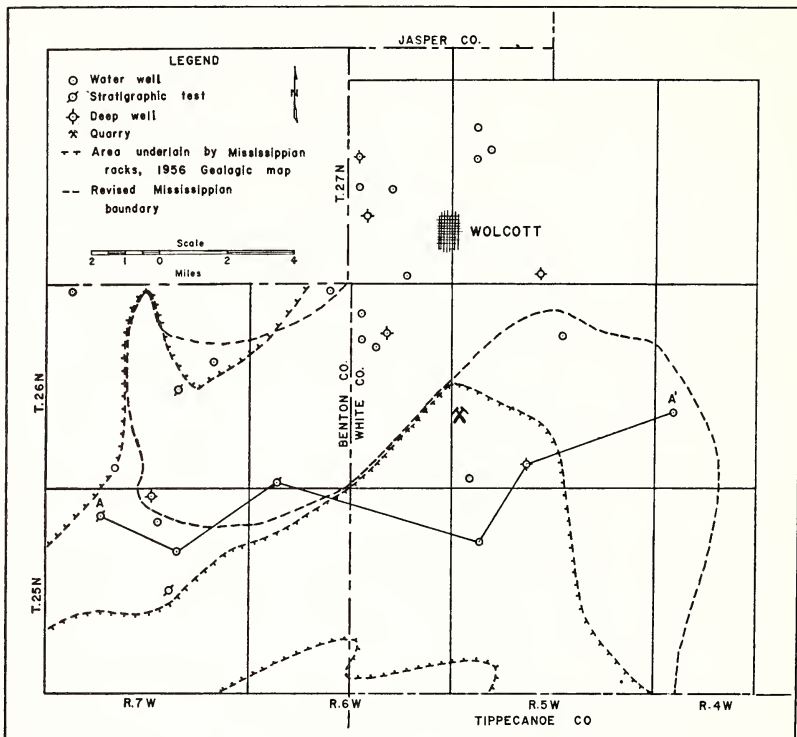


Fig. 1. Map of part of Benton and White Counties showing areal distribution of Mississippian rocks.

County and southwestern White County, shown as Devonian on the current geologic map, is actually underlain by Mississippian rocks.

Most of this extended Mississippian rock area is represented either by a northern equivalent of the Rockford limestone, lying conformably on the New Albany shale, or by green, silty shales of the basal part of the Borden group of clastic rocks. The Rockford limestone averages 14 feet in thickness, with a range of 8 to 22 feet, an unusually great thickness for this formation compared with the Rockford of southern Indiana, where thickness rarely exceeds 4 feet and never more than about 12 feet (4). The samples show that the Rockford in this district is a dolomitic limestone, cherty at the top, and containing minor glauconite and possibly chlorite.

Geologic Structure

The cross-section A-A' (Fig. 2), drawn nearly parallel to the normal regional dip, reveals some interesting structural and sedimentational-erosional irregularities. A north-south trending minor syncline, having

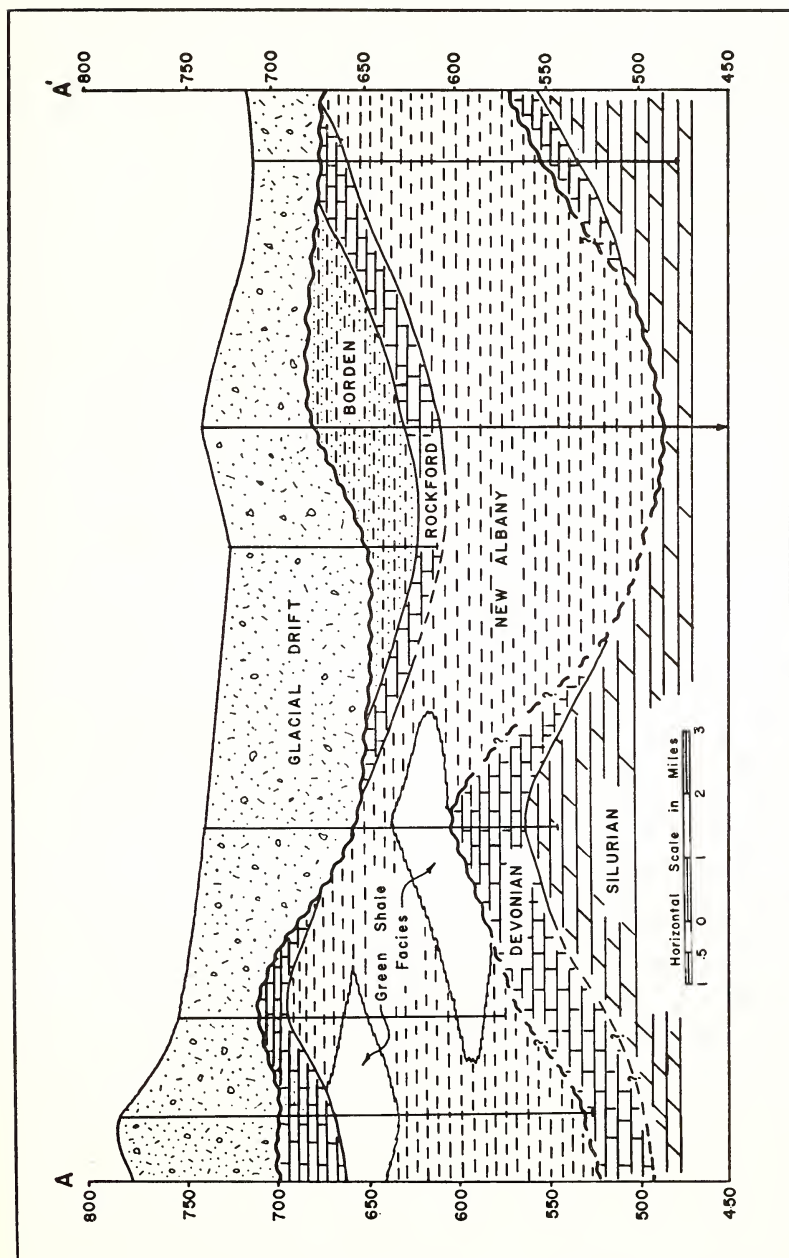


Fig. 2. Geologic cross-section across part of Benton and White Counties.

a dip reversal of about 80 feet, interrupts the normal northeastward rise of Devonian and Mississippian strata near the line between Benton and White counties. On the eastern flank of this structure, the strata again rise eastward and outcrop 5 to 7 miles beyond the point where normal regional rise would bring them to the surface. The New Albany shale thickens within this syncline, and Devonian limestone, normally 18 to 30 feet thick in the region, apparently is absent. As a result, New Albany shale rests unconformably on Silurian dolomite in southwestern White County. A New Albany-Devonian limestone unconformity in Indiana is well-known, but complete removal of Devonian limestone to create a New Albany-Silurian unconformity is not known by the writer to have been reported previously.

Summary

Carbonate rocks exposed in the White County quarry, formerly classed as Devonian, are of Middle Mississippian age. Subsurface data from eastern Benton County and southwestern White County indicate that Mississippian rocks underlie an area of 50 square miles in excess of Mississippian distribution as shown on the present geologic map of the state. The Rockford limestone is present over an extensive area in greater thickness than previously recorded in Indiana. There are evidences that more structural, erosional, and sedimentational irregularities are present in northwestern Indiana than commonly assumed. Other local studies are suggested, to assist in refining the geologic map of the state, and as a possible explorational aid in the search for industrial minerals or petroleum in a region where bedrock lithology and structure are poorly known.

Literature Cited

1. COLLETT, JOHN. 1879. Geological report on Harrison and Crawford Counties. Geol. Survey of Indiana, 10th Ann. Rept. (1878) : 334-337.
2. EATON, W. H. 1944. Corals from the Chouteau and related formations of the Mississippi Valley region. Illinois Geol. Survey, Rept. Inv. 97 : 29-93.
3. GUTSCHICK, R. C. 1954. Sponge spicules from the Lower Mississippian of Indiana and Kentucky. Am. Midland Naturalist **52**: 501-509.
4. SCHEMEHORN, N. R. 1956. Sedimentation study of the New Albany shale, Rockford limestone, and New Providence shale in Indiana. Indiana Univ., unpub. A. M. thesis : 27.
5. SHROCK, R. R. and C. A. MALOTT. 1930. Notes on some northwestern Indiana rock exposures (1929). Indiana Acad. Sci. Proc. **39**: 221-227.
6. WELLER, STUART. 1914. The Mississippian Brachiopoda of the Mississippi Valley basin. Illinois Geol. Survey, Mon. 1 : Pt. 1, 336-337, Pt. 2, 109.