

# Stratigraphy of the Blue River Group (Mississippian) in Putnam County, Indiana<sup>1</sup>

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## Abstract

This study substantiated the existence of several marker beds in the Blue River Group in Putnam County. This project involved 27 drill cores, totalling 2,400 feet, which were taken from south-central Putnam County and examined by binocular microscope. Thin sections of the rocks were studied with a polarizing microscope.

The Paoli-St. Genevieve contact is easily chosen where a basal Paoli shale or a Bryantsville Breccia bed is present. Within the St. Genevieve Limestone, the uppermost member (Levias) is characterized by a high percentage of oolitic limestones, whereas the lowermost member (Fredonia) is composed dominantly of micritic and skeletal limestones. The middle member (Spar Mountain), where present, ranges in lithology from an argillaceous limestone to a calcareous sandstone. Within each member, no lithology is persistent enough to serve as a marker bed, and intra-member correlations are made with difficulty. Two persistent units within the St. Louis Limestone are a thinly-bedded cherty micritic limestone and a chalky siliceous dolomite. The St. Louis index fossil, *Lithostrotion proliferum*, was found in three cores and served as an additional source of stratigraphic control.

## Introduction

Putnam County is in west-central Indiana, near the northern limit of outcrop of limestones of the Blue River Group (Fig. 1). These limestones show a depositional thinning from south to north across the county; in places, mainly in the northern part of the county, they are absent because of Pennsylvanian or Pleistocene erosion.

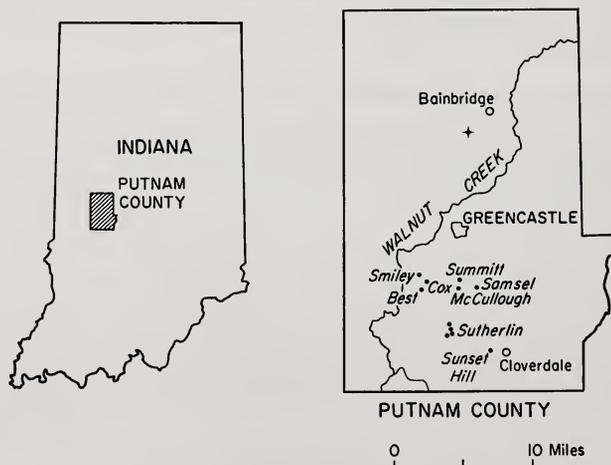


FIGURE 1. Map showing the location of Putnam County and locations of core sites involved in this study.

<sup>1</sup> Publication authorized by the State Geologist, Indiana Geological Survey.

In an effort to locate limestones thick and pure enough for industrial uses, the Ohio and Indiana Stone Corporation conducted an exploration program during 1971 and 1972. Fifteen cores were taken from the company's Sunset Hill property (Fig. 1). Four cores were taken from the Sutherlin farm, two each from the McCullough and Summitt farms, and one each from the Best, Cox, Samsel, and Smiley farms. In addition to the examination and description of these cores, exposures of Blue River limestone at the Harris Stone Service, Inc., quarry near Bainbridge and at Cataract Falls in Owen County were visited. The outcrop sections at these localities have previously been described by Smith *et al.* (7) and Malott (3).

### Stratigraphy

#### St. Louis Limestone

Because the Ohio and Indiana Stone Corporation was mainly interested in the Ste. Genevieve Limestone as a source of high-purity limestone, few cores were drilled very far into the underlying, lower purity, St. Louis Limestone. Where it was cored, the upper St. Louis consists dominantly of two persistent lithologies. The first, and uppermost, is a thinly-bedded cherty micritic limestone. Thin (<1 cm) shale beds and mudcracks are common along bedding planes. The micritic limestone appears lithographic in hand specimen, but thin section analyses show most of the material to be microskeletal, largely foraminiferal tests. The chert in this unit is bedded and highly fossiliferous, containing mostly fenestrate bryozoan fragments and pieces of brachiopod shells. This unit, because of its persistence and lack of variation, makes a useful marker bed for the top of the St. Louis in Putnam County.

Ten to 25 feet beneath the top of the St. Louis Limestone is the second persistent unit, a dolomite which is very porous, soft, chalky, and high in silica. This unit is generally very light gray to light green and contains scattered streaks of glauconite. Aiding in stratigraphic assignments was *Lithostrotion proliferum*, a St. Louis marker fossil. It was found in 3 cores at a depth of 11 to 13 feet beneath the top of the St. Louis Limestone.

#### Ste. Genevieve Limestone

The Ste. Genevieve Limestone consists of three members recognized in Indiana, in ascending order, the Fredonia, Spar Mountain (formerly called the Rosiclare Member), and Levias Members (D. D. Carr, unpublished data). In Putnam County, the Fredonia Member is 25 to 35 feet thick and consists of complexly interfingering micritic and skeletal limestones with scattered lenses of pelletal and oolitic limestones (4). Massive blocks of the Mississippian coral *Syringopora* have been identified near the base of the member (4). Malott (3) identified the Lost River Chert Bed, a lower part of the Fredonia, in only one section described from Putnam County. In the cores studied for this paper, chert is present in many places, but at any of several stratigraphic levels, and thus the Lost River Chert Bed is not easily identified. Pinsak (6) placed the base of the Ste. Genevieve Limestone at the base of a dolomite or oolite bed. In Putnam County, however, Fredonia oolites are rare and dolomite beds vary in number and stratigraphic position, or are absent at some places.

PERIOD	SERIES	GROUP	FORMATION, MEMBER, AND BED		
PENNSYLVANIAN	Pottsville	Raccoon Creek	Monsfield Formation		
			-----		
MISSISSIPPIAN	Chesterian	West Baden	Elwren Formation		
			Reelsville Limestone		
			Somple Formation		
			Beaver Bend Limestone		
			Bethel Formation		
	Valmeieran	Blue River	Pooli Limestone		
			Ste. Genevieve Limestone	Levias Member	Bryantsville Breccia
				Spar Mountain Member	
				Fredonia Member	Lost River Chert
			St. Louis Limestone		

FIGURE 2. Stratigraphic column showing Mississippian and Pennsylvanian rocks in Putnam County.

The Spar Mountain Member ranges in lithology from an argillaceous limestone to a calcareous sandstone and is generally cross-bedded in outcrop. In a few cores, no lithology representing the Spar Mountain Member could be identified, but in other cores, more than 8 feet of quartz sandstone were seen. This sandstone is relatively poorly sorted with subrounded to subangular quartz grains, which are medium to fine grained. Quartz grains were found in some cores to be interspersed in a dominantly oolitic limestone. Rarely, quartz serves as the nucleus of carbonate oolites, a feature previously noted in Putnam County by Bieber (1).

The Levias Member is 30 to 35 feet thick and is characterized by a high percentage of oolitic limestones. Thickest oolite accumulations have been noted in southern Putnam County where Kissling (3) reported that Ste. Genevieve oolites occur in linear bodies with small lateral dimensions. Correlation of individual oolite bodies in widely separated areas is difficult. In Putnam County, the Bryantsville Breccia Bed, which corresponds to the top of the Ste. Genevieve Limestone, is commonly not more than 1 foot thick and is composed of a basal, often brecciated, oolitic limestone with abundant algal structures, some of which have been replaced by chert. The upper part of the

Bryantsville commonly consists of slightly rounded fragments of micritic limestone, only slightly rotated from the horizontal, which have been cemented with micritic mud. In one core, dark angular argillaceous limestone fragments were seen embedded in a coarse-grained white calcite cement. In thin section, the framework grains included in the Bryantsville breccia are normally rounded, and often are intraclasts, composite detrital grains of oolitic limestone.

#### Paoli Limestone and Younger Rocks

The Paoli Limestone is present only in the southernmost cores. It has a maximum thickness of 6 feet and is usually composed of one or more beds of green calcareous shale, with a middle oolitic and skeletal limestone. Overlying rocks of the Elwren Formation, Reelsville Limestone, Sample Formation, Beaver Bend Limestone, and Bethel Formation were present in three cores at the Sunset Hill location. These units have a maximum thickness of 40 feet. In one core, 20 feet of the Mansfield Formation (Pennsylvanian) was found unconformably overlying the Elwren Formation.

#### Stratigraphic Relationships

The first cross section, Figure 3, is roughly parallel to strike of the outcrop belt of Mississippian limestones in Putnam County. The cores are from the Sunset Hill property of the Ohio and Indiana Stone Corp. The following stratigraphic relationships shown on the cross sections are noteworthy:

- 1) A basal Paoli shale is widespread.
- 2) The Levias Member of the Ste. Genevieve Limestone consists of a regular sequence of lithologies: in ascending order; oolitic, micritic, oolitic.
- 3) There are three stratigraphic levels of chert: the upper chert represents Spar Mountain time; the middle chert correlates perhaps with the Lost River Chert Bed of the Fredonia Member; and the lower chert is included in the St. Louis Limestone.
- 4) Correlation of limestone textures within the Fredonia Member is difficult because of an apparently unpredictable interfingering of the micritic and skeletal lithologies.
- 5) Basal Ste. Genevieve dolomites occur sporadically. None are present in Core 19A, but two dolomites are seen in Core 13.
- 6) A thinly bedded cherty micritic limestone consistently appears as the top of the St. Louis Limestone.
- 7) A porous siliceous dolomite is present in every core drilled to great enough depth.

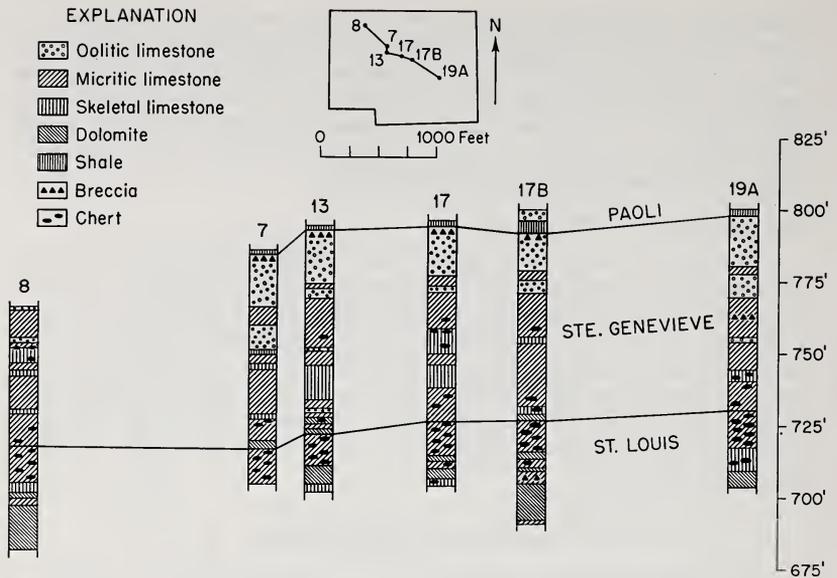


FIGURE 3. Stratigraphic cross section of Mississippian rocks at the Sunset Hill property of the Ohio and Indiana Stone Corp. Section is almost parallel to regional strike of Mississippian limestones in Putnam County.

The cross section in Figure 4 is drawn approximately perpendicular to the strike of the limestones within the Sunset Hill property. The following observations are noted:

- 1) The Paoli Limestone apparently thins to the northeast.
- 2) The Levias Member does not exhibit the simple succession of oolitic-micritic-oolitic lithologies.
- 3) The Spar Mountain Member appears more consistent in lithology. It is identifiable primarily as a green calcareous sandstone a few inches to 1 foot thick. The limestones below this sandstone commonly contain coarse fragments of dark chert and quartz.
- 4) The lower part of the Fredonia Member contains varying number of chert and dolomite beds.
- 5) A thinly bedded micritic limestone with fossiliferous chert persists at the top of the St. Louis Limestone. *Lithostrotion proliferum*, the St. Louis marker fossil, was found in Core 19, 12 feet below the top of this micritic bed.
- 6) A chalky porous dolomite lower in the St. Louis Limestone, consistently appears in every core drilled to a great enough depth.

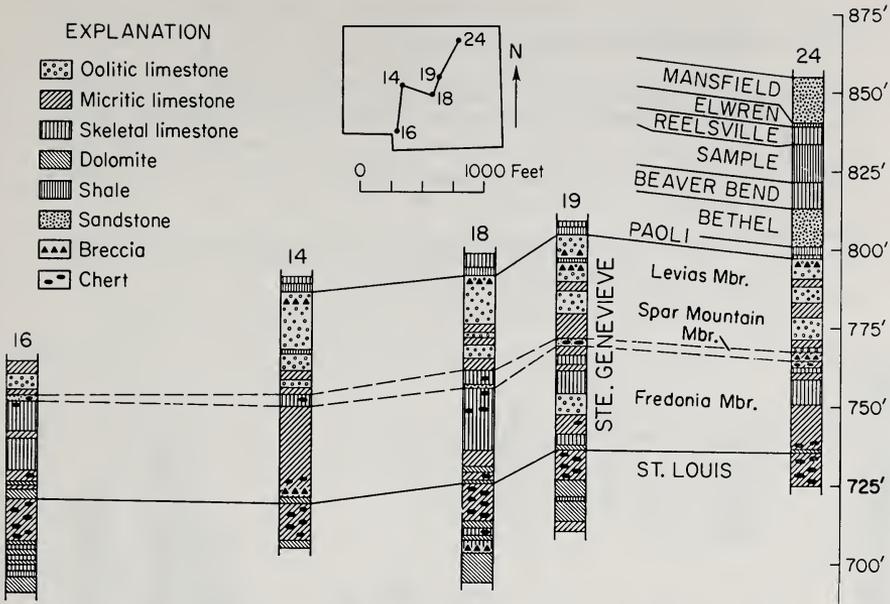


FIGURE 4. Stratigraphic cross section of Mississippian rocks at the Sunset Hill property of the Ohio and Indiana Stone Corp. Section is almost parallel to regional dip of Mississippian limestones in Putnam County.

The cores included in the cross section in Figure 5 were taken from a large area of southern Putnam County. The lines of cross section are roughly parallel to regional attitudes of beds. The following observations are noted:

- 1) The Paoli Limestone can be identified only at the Sunset Hill location.
- 2) The Levias Member does not exhibit the succession of oolitic-micritic-oolitic lithologies. Skeletal limestone and calcareous shale beds are commonly found.
- 3) Brecciation is not confined to the Bryantsville; other breccias are found sporadically in the Levias Member (5).
- 4) Eight feet of calcareous sandstone, representing the Spar Mountain Member, was found in Cores 2 and 6. Another core within 1000 feet of Core 2 showed no evidence of noncarbonate deposition other than a few grains scattered in an oolitic limestone.
- 5) The Lost River Chert Bed is difficult to identify. Chert is found at different stratigraphic levels from core to core.
- 6) The micritic and skeletal facies within the Fredonia Member interfinger randomly, with no obviously persistent marker beds.

- 7) The number of lower Ste. Genevieve dolomite beds vary from four in Core 7 to none in Core 1.
- 8) The upper St. Louis cherty limestone persists as in Cross Sections 3 and 4 and displays little noticeable variation within the study area. The marker fossil, *Lithostrotion proliferum*, occurs from 11 to 13 feet below the top of this unit in Cores 1 and 5.
- 9) A chalky porous dolomite persists in the St. Louis Limestone and occurs at the base of most cores.

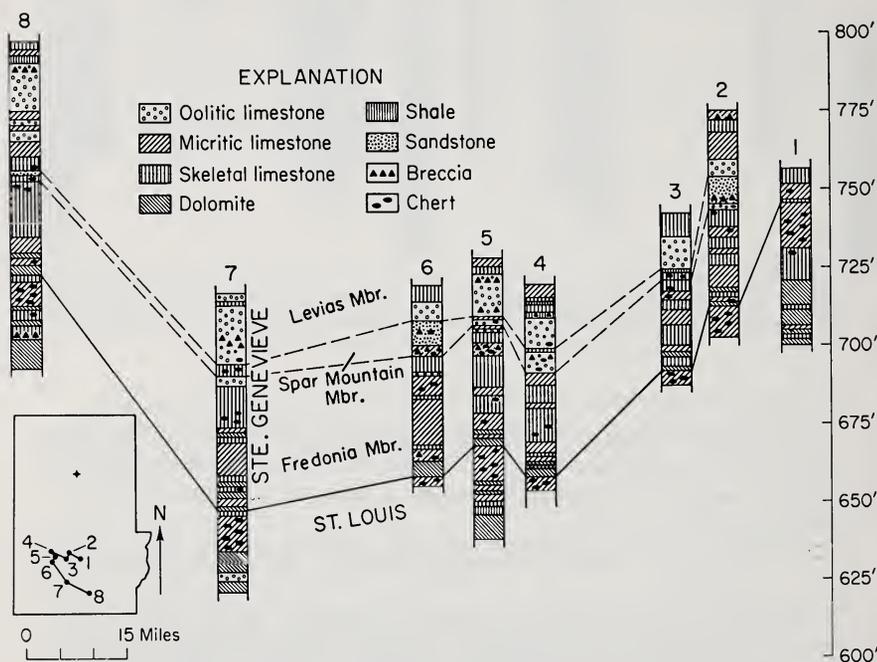


FIGURE 5. Stratigraphic cross section of Mississippian rocks in Putnam County. Cores 1 through 4 lie along regional dip and Cores 5 through 8 lie along regional strike of Mississippian limestones in Putnam County.

#### Acknowledgments

The author wishes to thank Mr. Bruce Mason, vice president, The France Stone Co., and the staff of the Ohio and Indiana Stone Corporation for courtesies extended. This study was made possible by a grant from the Nona France Foundation.

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