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Devonian-Mississippian Boundary, Batesville District, Northeast Arkansas

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ABSTRACT

The total record of the Devonian System in the Batesville district, northeast Arkansas is represented by the Penters Chert. Conodonts recovered from a thin limestone near the top of the Penters confirm a Lower Devonian age assignment, making this the oldest Devonian formation in northern Arkansas.

The contact of the Penters Chert and the overlying Mississippian section is a marked disconformity. Excellent exposures in the bluffs along the east side of the White River exhibit unpredictable distributions of lower Mississippian strata. The most complete representation of the Mississippian sequence includes a basal sandstone of the Bachelor Formation, overlain by several feet of St. Joe Limestone, and capped by thick limestone and chert beds of the Boone Formation. However, laterally in the outcrop, portions of the section are removed, so that the Boone Formation rests directly on the Penters in some places. The top of the Penters may develop a breccia of chert boulders cemented by a quartz-bearing carbonate. This carbonate cement contains a mixed assemblage of Upper Devonian and Lower Mississippian conodonts.

INTRODUCTION

Lithostratigraphic units forming the Devonian-Mississippian boundary are highly variable across northern Arkansas. In northwestern Arkansas the Devonian-Mississippian boundary occurs at either the contact between the Chattanooga Shale and the Bachelor Formation, or falls within the upper Chattanooga Shale (Huffman et al., 1958; Thompson and Fellows, 1970). Devonian units are sporadically developed in north central Arkansas. In the Batesville District, Independence County, Devonian time is represented by the Penters Chert (Lower Devonian) and occasionally the Chattanooga Shale. The Penters has not been mapped outside the Batesville District, but it is recognized extensively throughout the subsurface of northern Arkansas (Frezon and Glick, 1959). The Devonian-Mississippian boundary is well exposed along the Missouri-Pacific railroad cuts in the bluffs along the east side of the White River, in northwestern Independence County.

LITHOSTRATIGRAPHY

PENTERS CHERT

The Penters Chert was originally described by Miser (1920) as a gray to bluish-gray chert, for extensive exposures in the bluffs along the White River at Penters Bluff Station, Izard County, Arkansas. At the Walls Ferry Dam locality the Penters is a massive, microcrystalline chert of mottled white to gray color (Figure 1). Near the top there are occurrences of shale pockets filling presumed solution cavities. Near the base of the outcrop there are a number of discontinuous, microcrystalline limestone lenses. This limestone is light gray on a weathered surface and black on a fresh surface.

Regionally the Penters Chert unconformably overlies the Lafferty Limestone, and is unconformably overlain by the Devonian Chattanooga Shale, or the Mississippian St. Joe Limestone or Boone Formation. It ranges in thickness from zero to ninety-one feet, with an average thickness at the Walls Ferry locality of approximately fifteen feet. It is most extensively exposed in the bluffs along the White River, and is noted in Sawmill Hollow and Rutherford Hollow north of Pfeiffer, Independence County (Kinney, 1946). It is also recognized extensively in the subsurface south of the Batesville District (Frezon and Glick, 1959).

PENTERS BRECCIA

At the Walls Ferry Dam locality an extensive breccia (Figure 1) is present at the top of the Penters Chert. This breccia is composed of rounded chert boulders cemented by a micritic limestone. This cement also contains abundant floating quartz grains.

Proceeding downward in the outcrop, the chert boulders become

more angular and more closely spaced. The breccia is gradational with the chert, the lower part appearing almost bedded. Laterally along the outcrop, the breccia does not conform to bedding planes.

The breccia ranges in thickness from three to twenty-five feet, and occurs laterally along the outcrop for about 1000 feet (See Figure 2).

ST. JOE

The St. Joe Member of the Boone Formation was originally described by T. C. Hopkins (1893). It is gray to pink, fossiliferous, limestone. The primary fossil constituents are crinoid fragments. It

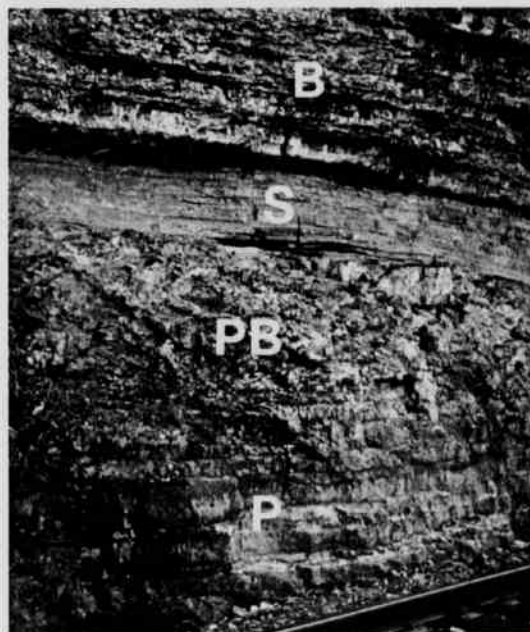


Figure 1. Lower Devonian and Lower Mississippian Strata, Walls Ferry Dam Section, Independence County, Arkansas. Penters Chert (P) overlain by chert breccia (PB) of Lower Mississippian age. St. Joe (S) and Boone (B) Formations succeed this interval.

was named for exposures at St. Joe, Searcy County, Arkansas.

At the Walls Ferry Dam locality, the St. Joe is a coarse grained, crinoidal limestone. It is thin bedded, absent locally, but ranging up to four feet in thickness (Figure 2).

The St. Joe is exposed at the surface throughout northern Arkansas. At Walls Ferry, this limestone was named the Walls Ferry Limestone (Gordon, 1965), however subsequent regional studies have shown it to be the St. Joe Limestone.

BOONE FORMATION

The Boone Formation was originally described by Branner in Simonds (1891). It was named for extensive exposures in Boone County, Arkansas. It is described as a medium gray limestone of bioclastic origin. It is interbedded with a microcrystalline chert of white to gray color, which is replacing the limestone along the bedding planes.

In places across northern Arkansas, the Boone occurs as 1) limestone, 2) chert, or 3) limestone and chert in subequal amounts. At the Walls Ferry Dam locality the Boone has developed subequal amounts of limestone and chert. At this locality it ranges in thickness from thirty to sixty feet.

The Boone formation is exposed across all of northern Arkansas, often with a red, chert-regolith developed on top.

BIOSTRATIGRAPHY

The Penters Chert and the St. Joe Limestone were sampled for conodonts at locations shown on Figure 2.

PENTERS CHERT

The Penters Chert was originally assigned a probable Lower Devonian age, based on fossils recovered from thin limestone beds at the type locality. Conodonts recovered from the limestone lenses at the Walls Ferry Dam locality were identified as *Icriodus latericrescens huddlei* (Klapper and Ziegler, 1967). This would indicate a Lower Devonian age for the Penters.

PENTERS BRECCIA

Conodonts were recovered from the breccia in large numbers. The carbonate cement yielded a mixed fauna of Upper Devonian, and

Middle Kinderhookian conodonts. The most abundant form was *Siphonodella cooperi cooperi*.

ST. JOE

The St. Joe was also sampled for conodonts, and it yielded a strictly Middle Kinderhookian fauna.

The Devonian-Mississippian boundary in northeastern Arkansas is generally between the Penters Chert and the St. Joe Limestone. However, at Walls Ferry we have determined that the boundary is at the base of the localized breccia on top of the Penters. Where the breccia is not formed, the boundary is between the St. Joe and the Penters.

CONCLUSIONS

The Penters Chert is Lower Devonian in age. The Devonian-Mississippian boundary at the Walls Ferry Dam locality is represented by a major disconformity. The breccia, containing a mixed Devonian-Mississippian fauna represents the unconformable interval. The mixed fauna indicates a reworking of the Upper Devonian strata. The St. Joe is of definite Middle Kinderhookian age, spanning the Kinderhookian-Osagean boundary (Thompson and Fellows, 1970).

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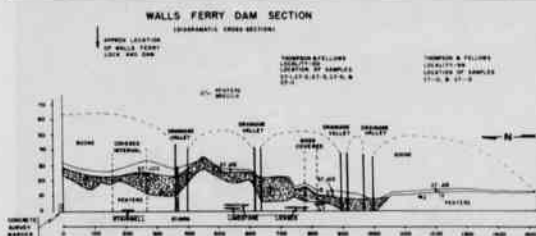


Figure 2. Diagrammatic cross-section of Lower Devonian and Lower Mississippian strata, Walls Ferry Dam Section, Independence County, Arkansas.