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## Stratigraphic Leak at Springville Quarry

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# Dorheim: Stratigraphic Leak at Springville Quarry<sup>1</sup>

FRED H. DORHEIM<sup>2</sup>

*Abstract.* Lime Creek Shale, containing an Upper Devonian conodont fauna, is exposed below Middle Devonian rocks at a quarry near Springville, Iowa. The occurrence is interpreted as a stratigraphic leak and is cited as further evidence of this condition occurring in a karst Devonian terrain.

The conditions leading to the interpretation implied in the title of this report can be observed in a quarry located just north of Iowa Highway 64 less than a mile west of the town of Springville, Iowa. The location of the quarry is shown in figure 1.

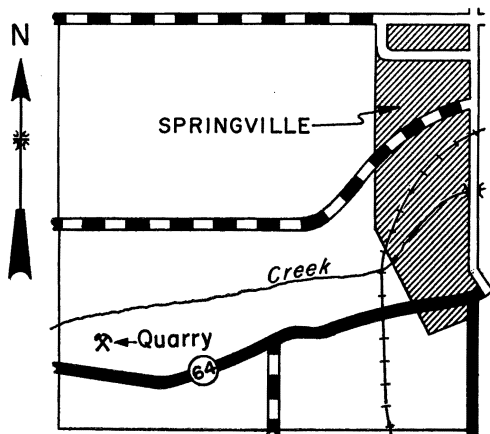


Figure 1. Location Map of the Springville Quarry.

## DISCUSSION

### *General*

The presence, at this locality, of a shale at the Silurian-Devonian boundary was first called to our attention by Wayne Youngquist, geologist for Lowe and Eschman Construction Company of Marion, Iowa. The section exposed at the quarry is graphically illustrated in figure 2.

Of particular interest is the shale represented by bed 5.

### *Stratigraphy and Lithology*

Bed 1 of the section exposed in this quarry is a badly weathered unit so broken and mixed with clay that it is removed by the quarry operators as part of the overburden. Those fragments remaining as part of the bed are a saccharoidal dolomite con-

<sup>1</sup> Presented with the permission of Dr. H. Garland Hershey, State Geologist and Director of the Iowa Geological Survey.

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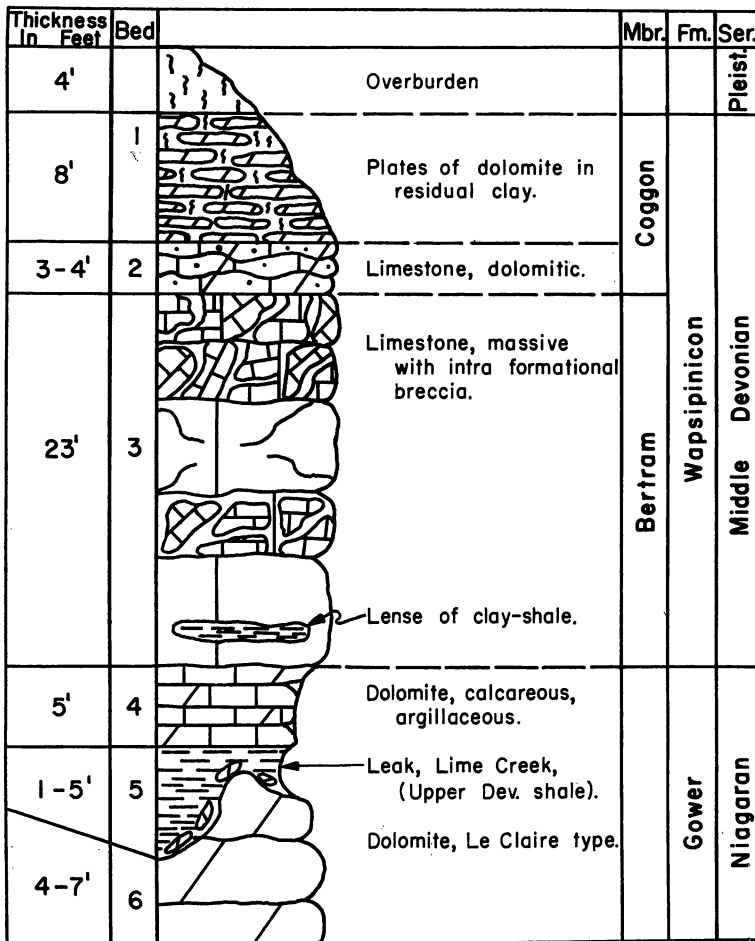


Figure 2. Stratigraphic Section as observed at the Springville Quarry.

taining molds and casts of *Emanuella Subumbonus* and, together with bed 2, are correlated with the Coggon.

The major portion of the quarry face, a massively bedded, sub-lithographic limestone breccia (bed 3), is correlated as the basal member of the Wapsipinicon, the Bertram.

The term Bertram was first proposed by Norton (1895) for a brecciated dolomite or dolomitic limestone well exposed along Big Creek near the village of Bertram. When Norton proposed the term he placed the Bertram, along with the overlying Coggon, in the Silurian. Later Norton (1916) removed both of these units from the Silurian and placed them in the Wapsipinicon, making the Bertram the basal member of the Wapsipinicon.

Stainbrook (1935) correlated the Bertram with the Otis and dropped the term Bertram. Scobey (1938) included the Bertram as part of the Coggon because of the similarities of the residues obtained from the two units. The position of the Bertram, as exposed in the Springville quarry and at other locations in Linn County, establish it as underlying the Coggon and overlying the Silurian. This supports the work of Norton (1916) in making the Bertram the basal member of the Wapsipinicon.

Stratigraphic Section as Observed at the Springville Quarry

<i>Bed</i>	<i>Description</i>	<i>Thickness</i>
Pleistocene		
	Loess and till, unclassified .....	10'
Devonian System		
Wapsipinicon Formation		
Coggon Member		
1.	Dolomite, pale yellowish-orange (10YR8/6) to pale yellowish-brown (10YR6/2), sublithographic to medium-fine saccharoidal; numerous external molds and some casts of brachiopods ( <i>Emanuella subumbonus</i> .....	8'
2.	Limestone, dolomitic, pale yellowish-brown (10YR6/2) to pale yellowish-orange (10YR8/6), very fine to medium-coarse-crystalline; pin-point, or larger, porosity; some of the pores filled with sparry calcite; subrounded quartz sand grains scattered throughout; very irregular contact .....	3 to 4'
Bertram Member		
3.	Limestone, very pale orange (10YR8/2) to grayish-orange (10YR7/4) to pale yellowish-brown (10YR6/2), brecciated, sublithographic to very fine; fractures have a roughly horizontal orientation; solution of calcite gives a slightly vesicular appearance. Larger vugs are filled with crystalline calcite; some part of the breccia show minute fragments of the rock material suspended in the sparry calcite; MnO <sub>2</sub> and Fe <sub>2</sub> O <sub>3</sub> stains and specks are common.	
	A clay-shale lens occurs near the base of bed 3. The lens is about 0.8 feet thick and 10 feet long. The shale is yellowish-gray (5Y7/2 dry to light olive-gray 5Y5/2) wet, slightly calcareous; contains numerous very small black specks of "asphaltum". Bed 3, as a unit, appears as "white" in the quarry face .....	23'
Silurian System		
Gower Formation		
4.	Dolomite; top 0.2 feet a leached grayish-orange (10YR7/4) to pale yellowish-orange (10YR8/6), calcareous to argillaceous with thin greenish-gray (5GY6/1) clay streaks. Lower 4 to 5 feet an unleached dolomite, very pale yellowish-brown (10YR7/2) to very pale-orange (10YR8/2), medium-coarse crystalline to sac-	

<i>Bed</i>	<i>Description</i>	<i>Thickness</i>
	charoidal, hard, slightly vesicular; some calcite crystals and some iron stain. This bed has a tendency to undercut in the quarry face;	
	to quarry floor .....	5'

Devonian System

Lime Creek Formation

5. Shale, grayish-green (10GY5/2) to greenish-gray (5GY6/1) clayey calcareous filled with dolomite rhombohedrons (1mm) and, along the contact, contains fragments of the adjacent beds. Upper Devonian conodonts (*Palmatolepsis sp.* and *P. schindewolfi* Mueller) have been obtained from this shale and identified by Charles Collinson. This shale varies in thickness from 1 to 5'.  
 Silurian System

Gower Formation

6. Dolomite, light brownish-gray (5YR6/1) to pale yellowish-orange (10YR8/6), fine to medium-fine, hard, vesicular. Exposed in sump -4 -7'

Beds 4 and 6 of the Springville section are placed in the Silurian because (1) their lithology is characteristic of the Gower Formation, (2) the contact between beds 3 and 4 is unconformable, and (3) the upper part of bed 4 is leached.

On the basis of conodont studies Collinson (personal communication) placed bed 5 in the to II zone of the Upper Devonian.

CONCLUSIONS

From the conditions found to exist at the Springville quarry the following conclusions are proposed:

1. The shale of bed 5 is a cavern fill, best described as a stratigraphic leak.

2. Leaks of this nature occur as the result of a karst condition on the Middle Devonian terrain.

3. Although the cavern fill at Springville represents the first recorded occurrence of a stratigraphic leak at the Devonian-Silurian boundary, in Iowa, it supports the interpretation of the Independence as a stratigraphic leak. The Independence is found below the Cedar Valley where the Cedar Valley forms the bedrock. Bed 5, of this section, is found below the Wapsipinicon in an area where the Wapsipinicon is bedrock. About the same degree of karst development is required in the two situations.

4. A karst condition was developed on the Middle Devonian terrain prior to upper Devonian deposition. Shales of lowermost Upper Devonian filled the caverns developed on this terrain.

## ACKNOWLEDGEMENTS

This study was made possible through the cooperation of Lowe and Eschman Construction Company of Marion, Iowa, who operate the quarry and who were especially cooperative in preparing the area for study and in assisting in the sampling. Dr. Charles Collinson, of the Illinois Geological Survey, made the conodont separations and identifications. Colleagues at the Iowa Geological Survey, the U.S. Geological Survey and from the department of Geology, University of Iowa were, as always, helpful in many ways.

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