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A STUDY OF THE MIDDLE DEVONIAN WIDDER  
FORMATION OF SOUTHWESTERN ONTARIO

BY

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MUSEUM OF PALEONTOLOGY  
THE UNIVERSITY OF MICHIGAN  
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## A STUDY OF THE MIDDLE DEVONIAN WIDDER FORMATION OF SOUTHWESTERN ONTARIO

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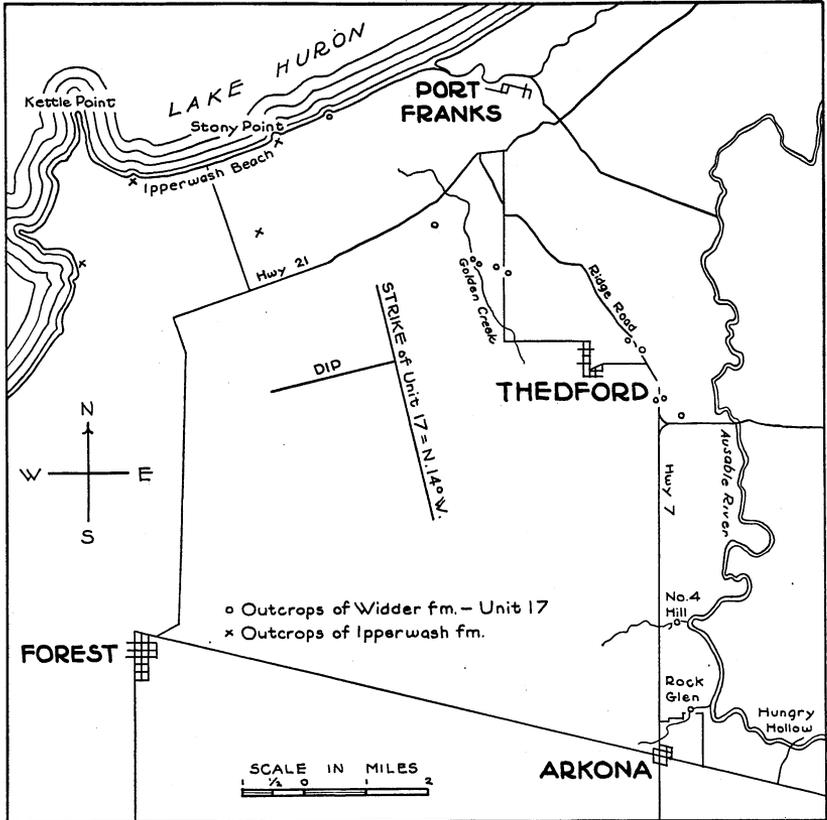
### INTRODUCTION

**T**HE IPPERWASH-THEDFORD-ARKONA region of southwestern Ontario, discussed in this report, contains many exposures of highly fossiliferous shales and limestones. It extends about ten miles south of the shore of Lake Huron and is about twelve miles in breadth. It lies largely in Bosanquet Township, Lambton County, projecting eastward into West Williams Township, Middlesex County (see Map I). Most of the fossil-bearing outcrops occur in gorges cut by the Ausable River which meanders through the eastern part of the region, or by its tributary creeks. Some of the outcrops are found in roadside ditches and abandoned quarries.

The rocks exposed in these outcrops are Middle Devonian in age and belong to the Hamilton Group. Early geologists who have worked in the region include James Hall and Alexander Murray who studied the stratigraphy and fauna of these rocks in 1855 (Murray, 1857, pp. 129-30). In the century which has elapsed since that time, the names of the local beds have undergone changes. Table I shows the revisions in the nomenclature (Stumm and Wright, 1958, p. 83).

This paper is the result of field work carried on in the Ipperwash-Thedford-Arkona region over a period of seven years. It is a study of the Widder formation with a detailed description of the strata. The formation was first described by the late Clinton R. Stauffer (1915, pp. 9-10) from a number of surface outcrops in this region. The Widder occurs toward the top of

the Middle Devonian stratigraphic column in southwestern Ontario. Another view of the stratigraphic position of the Widder formation, controlled by an interpretation of subsurface records, is discussed.



MAP. I. Ipperwash-Thedford-Arkona, Ontario, Region.

#### ACKNOWLEDGMENTS

Prompting for this study, guidance during the seven-year period of its fulfillment, and helpful criticism of the manuscript came to us from Dr. George M. Ehlers of the Museum of Paleontology, University of Michigan; he, with the authors, prepared the lectotype section employed herein. Thanks are extended to Charles Southworth of Thedford, Ontario, who, out of an experience of over sixty years of collecting and observation in the region, was of invaluable assistance in the field. The authors are also indebted to Dr. John T. Sanford of Wayne State University for much time

TABLE I  
CHANGES IN STRATIGRAPHIC NOMENCLATURE

Early Workers	Calvin 1888	Schuchert 1895	Stauffer 1915	Grabau 1917	Cooper and Warthin, 1941	Cooper and Others, 1942
Hamilton Group			Ipperwash limestone			Ipperwash limestone
			Petrolia shale			Petrolia shale
	Upper division	Upper third of the section	Widder beds		Widder formation	Widder shale
	Middle division of the Hamilton section	Middle third of the section		Encrinal limestone	Hungry Hollow formation	Hungry Hollow formation
Lower division	Lower third of the section	Olentangy shale	Arkona beds	.	Arkona shale	

devoted to stimulating comment on and review of this study.

Dr. L. B. Kellum, Dr. C. A. Arnold, and Dr. R. V. Kesling kindly reviewed the manuscript.

#### HISTORICAL BACKGROUND

The richly fossiliferous Widder formation of the Middle Devonian Hamilton group crops out in many places in the Ipperwash-Thedford-Arkona region of southwestern Ontario. It was known to the early geologists as the "upper division" (Calvin, 1888, p. 84) or the "Upper third of the section" (Schuchert, 1895, pp. 362-63). Clinton R. Stauffer named the strata the "Widder beds"; his description of this stratigraphic unit is as follows (1915, pp. 9-10):

Above the Olentangy shale comes a deposit of bluish limestones alternating with grey shales. The limestone varies from semi-crystalline to argillaceous layers which are little more than consolidated calcareous mud beds. The shale, which forms rather more than half of the subdivision, often contains small flattened concretions and is slight-

ly more indurated than the shale of the division below. Fossils are more or less abundant throughout and in some layers are fairly crowded together. This is the division which has furnished the major part of the excellent Ontario Hamilton fossils so widely known. Some layers contain faunules differing slightly from those contained in other beds of the division, but there are enough common species to bind the whole into a unit distinctly set off from the beds below. Some of these faunal zones have received distinct names, such as the Encrinal limestone,<sup>1</sup> which forms the basal layer of this division, the Coral zone, etc. These beds will receive more attention in connexion with the sections in which they are exposed. The best outcrops of this portion of the Hamilton are to be found at Rock Glen (Jones' mill) and in the glen at No. 4 hill (Austin's mill). It is better known however, from the Grand Trunk Railway cutting at the overhead bridge 1 mile east of Thedford and 1¼ miles north of the old village of Widder. It forms more or less of a ridge from Widder northward for nearly a mile beyond the railway and in this distance it is several times exposed, while its limestones are sometimes quarried for local use. It seems proper, therefore, to refer to this member as the Widder beds. The upper portion of the Widder beds consists of 8 to 10 feet of limestone which is doubtless the "middle limestone" of well drillers to the south and west. The total thickness of this division of the Hamilton is about 50 feet.

<sup>1</sup> Shimer, H. W., and A. W. Grabau; Bull. Geol. Soc. Am., vol. XIII, 1902, p. 150.

Stauffer's "Widder beds" comprise one of four formations which he described in large part from outcrops. His formations, in descending order, were the Ipperwash limestone, the Petrolia shale, the Widder beds, and

TABLE II

STAUFFER. (1915, pp. 9-11)		
MIDDLE DEVONIAN HAMILTON GROUP	IPPERWASH limestone	40'
	PETROLIA shale	?
	WIDDER beds	50'
	OLENTANGY shale	27'

STAUFFER'S FORMATIONAL NAMES

the Olentangy shale (see Table II). Stauffer named the Ipperwash limestone from two outcrops, one on either side of Ipperwash beach (1915, p. 11). The Petrolia shale took its name from a thick, soft, blue shale found in wells at Petrolia; there are no good surface exposures of this

shale anywhere in the province, according to Stauffer (1915, p. 11), who said that a blue shale inadequately exposed beneath the Ipperwash limestone at Stony Point was "probably it." He identified the shale below the Widder beds as Olentangy from its resemblance to the Ohio shale of that name (1915, p. 9).

To amplify his description of these formations, Stauffer gave detailed accounts of the various exposures where these rocks could be examined, listing the fossils to be found in each horizon (1915, pp. 157-82). Paleontologists since that time have used these sections and fossil lists as a basis for further work in the area.

Grabau (1917, p. 341) renamed the so-called Olentangy shale of the Middle Devonian of Ontario after the village of Arkona, since the Olentangy shale, in a strict sense, is of Upper Devonian age.

Cooper and Warthin (1941, p. 260) replaced the term "Widder beds" with "Widder formation." On the basis of unconformities and abrupt changes in fauna, they established the Hungry Hollow formation to include the Coral zone and the underlying Encrinal limestone, the basal member of Stauffer's Widder beds.

Cooper and others (1942, p. 1745) also established the line of demarcation between their Hungry Hollow formation and the Arkona shale below it as the bituminous shale layer containing many compressed shells of a large *Leiorhynchus*.

The sequence in the stratigraphic column of the Widder formation and of the beds lying above and below it is shown on the Devonian Correlation Chart (Cooper and others, 1942, Chart No. 4). It will be noted that these formations constitute the top of the Hamilton group in this region, with the Kettle Point black shale (Upper Devonian) lying unconformably upon the Ipperwash limestone (Table III).

#### VALIDITY OF STRATIGRAPHIC POSITION

Stauffer, in addition to setting up his formation names to identify the rocks in outcrops of southwestern Ontario, sought to relate those names to the rocks encountered in subsurface work. His reference to the upper portion of the Widder beds as ". . . doubtless the 'middle limestone' of well drillers to the south and west" (1915, p. 10) indicates his own uncertainty in this connection.

Caley accepted Stauffer's correlation of the surface and subsurface. He says ". . . in seven wells within 6 miles of Arkona there is a recognizable limestone horizon from 6 to 14 feet thick located 51 to 67 feet above the base of the Hamilton formation. This limestone, though much thinner than the Widder beds as defined by Stauffer at the outcrop, is the only differen-

tiation that can be made in well samples; it is, therefore, considered as representing that division" (Caley, 1943, p. 55). He gives a generalized section from the well cuttings of these seven wells "in the general vicinity of Arkona," with the average thicknesses, as follows (p. 55):

	<i>Feet</i>
Ipเปอร์wash limestone: thin, alternating zones of grey, crystalline limestone and soft, grey shale .....	64
Petrolia shale: soft, grey shale with small amount of grey, crystalline limestone in the upper part .....	172
Widder beds: grey, crystalline limestone .....	14
Olentangy shale: soft, grey shale with some grey limestone in the lower part .....	67

The limestone designated "Widder beds" by Caley in this section cannot be the same as the limestone designated by Stauffer at the outcrop. Since the Widder limestone of Stauffer, in the vicinity of Thedford and

TABLE III

COOPER and others (1942, Chart No. 4)	Thickness: WRIGHT & RIGHT	CALEY (1943, p. 55)	
WIDDER fm.	45'-60'	IPPERWASH limestone	64'
HUNGRY HOLLOW fm.	5'		
ARKONA shale	70' exposed	PETROLIA shale	172'
		WIDDER beds	14'
		OLENTANGY shale	67'
DELAWARE ls.		= NORFOLK fm.	

COMPARATIVE SECTIONS IN THE VICINITY OF THEDFORD AND ARKONA, ONTARIO

Arkona, is exposed at the surface, it cannot be, as Caley indicates, more than 200 feet below the surface. After having identified the limestone in wells 67 feet above the base of the Hamilton as Widder, he had, of necessity, to identify the limestone at the top of his section as Ipperwash. The Ipperwash, however, as Stauffer (1915, p. 180) stated "... lies much higher stratigraphically, in the Hamilton group than any of the beds outcropping in the immediate vicinity of Thedford."

Stauffer's formation names, modified as reported, have received wide stratigraphic and paleontologic acceptance over the forty-six years since his work was published and, with proper application to the subsurface sections, offer no difficulties.

## DESCRIPTION OF STRATA

In his original description of the "Widder beds," Stauffer (1915, p. 10) mentioned two localities where "the best outcrops of this portion of the Hamilton are to be found . . .," that is, Rock Glen and in the glen at No. 4 Hill. The thickest exposed section of the Widder formation is at the second of these localities, the glen at No. 4 Hill. This glen is about 2 miles north of Arkona, Bosanquet Township, Lambton County, Ontario, and about  $\frac{1}{2}$  mile east of Highway 7. Here, in a gorge cut by a tributary creek of the

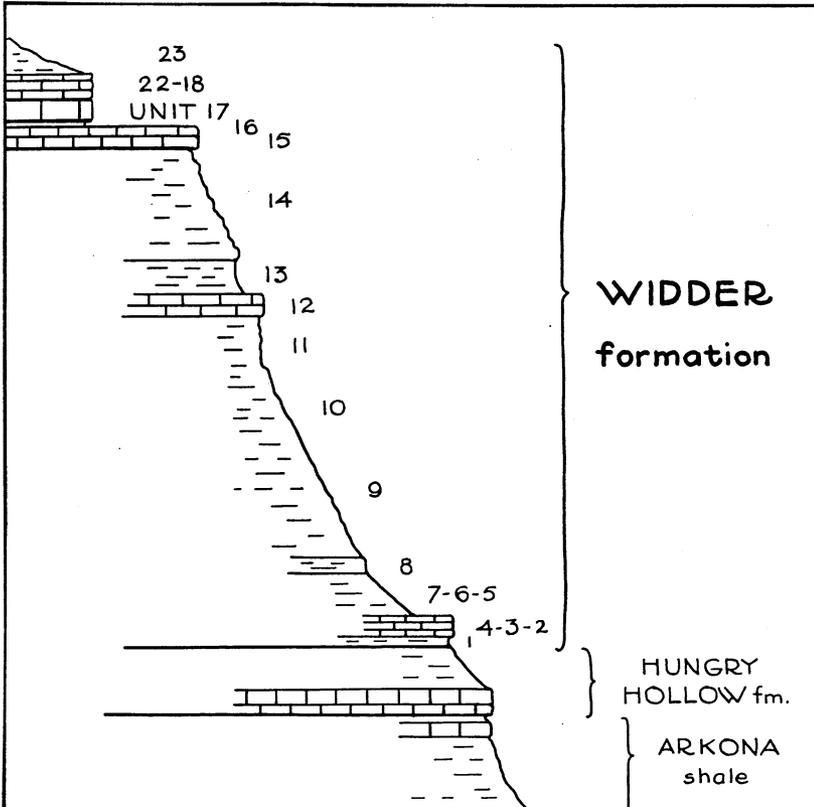


FIG. 1. Profile of the Widder Lectotype Section at No. 4 Hill.

Ausable River, about 45 feet of the Widder formation overlies the Hungry Hollow formation, below which approximately 20 feet of Arkona shale is exposed. Above the Widder formation at No. 4 Hill are soil and glacial drift.

The rocks of the Widder formation in the glen at No. 4 Hill, here designated the lectotype section, can be divided into 23 lithologic units (Fig. 1). These, with their characteristic fossils, are listed below:

DESCRIPTION OF THE WIDDER FORMATION IN GLEN AT NO. 4 HILL, ABOUT TWO MILES NORTH OF ARKONA, ONTARIO, AND ABOUT ONE-HALF MILE EAST OF HIGHWAY 7

Unit	Feet	Inches
23 Shale, highly calcareous, gray to buff-gray, with variously shaped nodules composed of hard, dark gray, finely crystalline limestone like those of Unit 14; shale contains crinoid columnals, <i>Mucrospirifer</i> sp., and a few orthoconic cephalopods .....	2	4
22 Limestone, argillaceous, buff-gray, with crinoid columnals, <i>Chonetes</i> sp., and <i>Mucrospirifer</i> sp. Unit 22 caps the upper waterfall. Units 21 to 17 inclusive appear vertically beneath Unit 22 .....	..	6
21 Limestone, buff-gray .....	..	6
20 Limestone, argillaceous, buff-gray .....	..	4
19 Limestone, similar to Unit 17, with <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau) .....	..	6
18 Limestone, argillaceous, buff-gray .....	..	3
17 Limestone, buff-gray, massive and hard, with <i>Megastrophia concava</i> (Hall), <i>Strophodonta "demissa"</i> (Conrad), and <i>Michelinoceras anax</i> (Billings); also <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), <i>Chonetes</i> sp., <i>Phacops rana</i> (Green), <i>Schuchertella</i> sp., <i>Aulocystis intermedia</i> (Nicholson), and crinoid columnals .....	1	5
16 Shale, very calcareous, buff-gray, thin-bedded, with a few calcareous nodules; unfossiliferous .....	..	6
15 Limestone, slightly argillaceous, gray, weathering to buff-gray, parting as it weathers into 1" to 3" beds; abundant <i>Aulocystis intermedia</i> (Nicholson) and less numerous specimens of a large-tubed <i>Aulocystis</i> , many crinoid columnals, a cryptostomatous bryozoan, a small <i>Athyris</i> , 2 species of <i>Chonetes</i> , <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), <i>Leiorhynchus laura</i> (Billings), <i>Schuchertella</i> sp., <i>Phacops rana</i> (Green), <i>Cornellites flabella</i> (Conrad), and ostracods. Unit 15 caps middle waterfall .....	1	3-7
14 Shale, calcareous, gray, with variously shaped nodules of dark gray, finely crystalline limestone enclosing some pyrite. Shale contains many specimens of <i>Aulocystis intermedia</i> (Nicholson) and a large-tubed <i>Aulocystis</i> and crinoid columnals, and less numerous specimens of bryozoa, a small		

Unit	Feet	Inches
<i>Athyris</i> , <i>Camarotoechia</i> sp., a small <i>Cyrtina</i> , <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), <i>Leiorhynchus laura</i> (Billings), <i>Strophodonta</i> sp., <i>Greenops boothi</i> (Green), and <i>Phacops rana</i> (Green) .....	8	5
13 Shale, gray, weathering into angular chips .....	2	6
12 Limestone, highly argillaceous, gray to buff-gray, with <i>Chonetes</i> sp., <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), and <i>Cornellites flabella</i> (Conrad) .....	1	5
11 Shale, gray, with <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau) and <i>Cyrtina</i> sp. ....	2	10
10 Shale, very calcareous, buff-gray .....	..	11
9 Shale, gray, with many specimens of <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau) and less numerous specimens of <i>Chonetes</i> sp., <i>Leiorhynchus laura</i> (Billings), and <i>Schuchertella</i> sp. ....	14	2
8 Shale, calcareous, more so in upper part than in lower, gray, composing a ledge resistant to erosion .....	1	3
7 Shale, gray, with many specimens of <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), <i>Chonetes</i> sp., <i>Greenops boothi</i> (Green), and ostracods .....	..	4
6 Shale, calcareous, buff-gray, with many specimens of a small <i>Chonetes</i> and <i>Styliolina fissurella</i> (Hall) and less numerous specimens of <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau) and <i>Leiorhynchus laura</i> (Billings) .....	..	2-3
5 Shale, buff-gray, with many specimens of a small <i>Chonetes</i> , and less numerous specimens of <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau), <i>Leiorhynchus laura</i> (Billings), <i>Greenops boothi</i> (Green) and ostracods .....	2	8
4 Limestone, argillaceous, hard, gray to buff-gray, thin-bedded at top; <i>Leiorhynchus laura</i> (Billings) in profusion throughout, <i>Mucrospirifer</i> sp. (rare), <i>Ambocoelia</i> sp., <i>Chonetes</i> sp., <i>Styliolina fissurella</i> (Hall) .....	..	8
3 Limestone, argillaceous, softer than Unit 2, thin-bedded, gray, with few specimens of <i>Chonetes</i> sp. ....	..	4
2 Limestone, argillaceous, thick-bedded, gray to buff-gray, with a few pyrite nodules; numerous specimens of <i>Leiorhynchus laura</i> (Billings), <i>Mucrospirifer thedfordensis</i> (Shimer and Grabau) and <i>Chonetes</i> sp., and less numerous specimens of <i>Ambocoelia</i> sp., <i>Cyrtina</i> sp., <i>Atrypa</i> sp., <i>Actinopteria</i> sp., and <i>Euomphalus laxis</i> Hall; most fossils in bottom 3 inches .....	..	6
1 Shale, calcareous, with thin, uneven bedding, gray to dark buff-gray, weathering into small chips; thin masses of pyrite at base of unit. Shale contains <i>Ambocoelia</i> sp., <i>Leiorhynchus</i> sp., <i>Chonetes</i> sp., <i>Mucrospirifer</i> sp., <i>Phacops</i> sp., all compressed and some "dissolved out" .....	..	9
Total thickness.....	44'8"	45'1"

Shales and limestones which, it is believed, should be placed in the Widder formation above all the units of the lectotype section occur in the bed of Golden Creek about 1 mile west of the village of Thedford. Only a generalized section of these strata can be made because small separated outcrops differing in lithology and fossils are spread over a distance of about  $\frac{1}{4}$  of a mile. Our interpretation of the sequence of lithologic units exposed along this part of Golden Creek, together with their contained fossils, is:

*Unit*

- H Shale, calcareous, with glacial striae, containing *Pholidostrophia ovata* Imbrie, a small *Mucrospirifer* sp., *Tentaculites* sp., *Atrypa* "reticularis" (Linnaeus), and *Sulcoretopora* sp.
  - G Limestone, gray, with *Mucrospirifer* sp., a small *Schuchertella* sp., *Sulcoretopora* sp., and crinoid stems.
  - F Shale, fissile, 6 to 8 inches thick, blue, weathering yellow, with glacial striae, containing *Schuchertella* sp. and crinoid stems.
  - E Limestone, argillaceous, thin-bedded, with *Schuchertella* sp., a small *Mucrospirifer* sp., *Pholidostrophia ovata* Imbrie, *Sulcoretopora* sp., and crinoid stems.
  - D Limestone, argillaceous, unevenly bedded, with much chert, containing *Pholidostrophia ovata* Imbrie and *Sulcoretopora* sp.
  - C Shale, weathering yellow, with *Spinocyrtia parvigranulata* Ehlers and Wright.
  - B Limestone, nodular, containing many large *Mucrospirifer* sp. and large *Atrypa* sp.
  - A Limestone, argillaceous, with *Arthroacantha* sp., *Camarotoechia* sp., and *Phacops rana* (Green).
- Covered interval to Unit 23.

The lithology of these beds is typically Widder; the fossils, in general, suggest a Widder assemblage although some species are peculiar to this outcrop. The authors have been unable to locate any other occurrence of any part of this section.

The relationship of the Golden Creek beds to the units of the lectotype section is shown in the record of a well, drilled in August, 1960, about  $\frac{1}{4}$  of a mile west of the highest outcrop in the bed of Golden Creek. This well was located about 1 mile from an exposure of Unit 17 and about  $\frac{1}{2}$  mile down dip from the strike. The well record, furnished by the drilling contractor, Andrew A. Heal of Watford, Ontario, appears below with the authors' interpretation at the right:

<i>Well Record</i>		<i>Authors' Interpretation</i>	
6	Top soil and sandy clay . . . . . 6'	Surface material . . . . . 6'	
5	Gritty clay . . . . . 3'6"	Widder formation? . . . . . 3'6"	
4	Lime rock . . . . . 14'6"	Widder formation (Golden Creek). 10'6"	
3	Grey shale . . . . . 39'	Widder formation (Units 1-23) . . . . 45'	
2	Lime rock . . . . . 7'	Hungry Hollow formation . . . . . 5'	
1	Grey shale . . . . . 40'	Arkona shale . . . . . 40'	

In the lectotype section, 45 feet of the Widder formation is exposed above the Hungry Hollow formation which is slightly less than 5 feet thick. In the well in the vicinity of Golden Creek the Widder is 55½ feet thick. This suggests that 10½ or possibly 14 feet of Widder strata may have been eroded from the top at No. 4 Hill and other exposures in the region.

#### CHARACTERISTICS AND SIGNIFICANCE OF UNIT 17

It will be noted in the lectotype section at No. 4 Hill (see page 294) that the highest beds of the Widder formation consist of Units 17 to 23.

Units 22 through 18 are relatively thin limestones three to 6 inches in thickness. Three of them are argillaceous, and all of them weather into thinner layers. They are well described by the local name "shellstone." Unit 17, on the other hand, is a limestone approximately 1½ feet thick; it is massive, rather finely crystalline, and resistant to erosion. This limestone has a characteristic and persistent faunal assemblage marked by *Megastrophia concava* (Hall), *Strophodonta "demissa"* (Conrad), and *Michelinoceras anax* (Billings) (see Plate I), accompanied by other fossils of less stratigraphic significance. This assemblage, coupled with the distinctive lithology of Unit 17, establishes affirmatively the identity of Unit 17 at many exposures observed in the course of these studies.

Outcrops of this key bed, Unit 17, are indicated on Map I. From the location and elevation of outcrops of Unit 17 it has been possible to determine the strike and dip of this upper Widder limestone. As indicated on the map the bed strikes approximately N. 14° W. and dips to the southwest at an average of about 32 feet to the mile.

Unit 17 of the Widder formation and the encrinal limestone of the Hungry Hollow formation serve as upper and lower controls for correlation of the beds between. The authors have employed them to ascertain the stratigraphic positions of numerous exposed units of shale and limestone of the Widder formation.

#### GEOGRAPHIC IMPLICATIONS

Apart from its value as a reference datum, Unit 17 and the other limestone layers of the upper part of the Widder formation have had an im-

portant part in the physiographic development of this region. These limestones provide a fall line for several of the tributary creeks of the Ausable River. They occur in roadside ditches and fields in a generally northwesterly trend. On the shore of Lake Huron about 2 miles west of Port Franks, they form a rocky reef visible at times of low water. Here the three fossils typical of Unit 17, *Megastrophia concava* (Hall), *Strophodonta "demissa"* (Conrad), and *Michelinoceras anax* (Billings), and the hard massive limestone of that member are apparent.

Westward from this outcrop, for a distance of about 4 miles along the shore, the more resistant beds of the formations lying above the Widder are exposed. About .9 of a mile to the southwest is Stony Point, a promontory formed of the basal beds of the Ipperwash limestone. The section of rock exposed here is approximately 5 feet thick.

About  $2\frac{1}{2}$  miles farther along the shore to the southwest, when the water level is low, an anticline can be seen above sandy Ipperwash Beach projecting into the lake. It is expressed in the uppermost beds of the Ipperwash formation, a limestone approximately 3 feet thick, capped with black chert and underlain by blue shale. The overlying Kettle Point black shale, which is the lowest formation of Upper Devonian age in this region, occurs immediately to the west of this limestone and forms a shingle beach all the way to Kettle Point, about 1 mile beyond. Stauffer mentions these outcrops of Ipperwash limestone and Kettle Point black shale, commenting on the actual varied colors of the latter (1915, pp. 180-83).

#### SUMMARY AND CONCLUSIONS

The Widder formation of Middle Devonian Hamilton age was named by Stauffer (1915, p. 10) in describing a series of shales and limestone exposed at the surface in the Ipperwash-Thedford-Arkona region of southwestern Ontario. This formation is subdivided on lithologic and paleontologic evidence into 23 units at the lectotype section, the glen at No. 4 Hill. Other outcrops in the region can be correlated with the units of that section, largely through their relationship with Unit 17.

Shales and limestones which are believed to be Widder and to lie above all the units of the lectotype section are described. They occur in an isolated exposure, in the bed of Golden Creek.

The Widder formation appears stratigraphically above the Hungry Hollow formation and the Arkona shale at some of the outcrops in the region, particularly in the glens of the creeks flowing into the Ausable River. Rocks which are placed in the stratigraphic column above the Widder formation can be seen at intervals along the shore of Lake Huron to the southwest of the Unit 17 outcrop of the Widder. The basal beds of

the Ipperwash limestone form Stony Point; the Upper Devonian Kettle Point black shale, lying upon the uppermost beds of the Ipperwash, forms Kettle Point.

Stauffer tentatively identified the Widder formation as ". . . the 'middle limestone' of well drillers to the south and west" (1915, p. 10). This correlation is proved to be impossible in the vicinity of Thedford and Arkona where the Widder occurs at the surface while the "middle limestone" lies, according to well records, more than 200 feet below the surface.

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## EXPLANATION OF PLATE I

(All specimens from Unit 17, Widder Formation)

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FIG. 1. Pedicle valve. Hypotype 43975. Fred Marton's field, about 1¾ miles southeast of Thedford, Ontario. × 1.	
FIG. 2. Brachial valve and interarea of pedicle valve of same hypotype. × 1.	
FIG. 3. Lateral view of same specimen. × 1.	
<i>Strophodonta "demissa"</i> (Conrad) .....	297
FIG. 4. Pedicle valve. Hypotype 43973. Mose Elliott's quarry, about 3½ miles northwest of Thedford, Ontario. × 1.	
FIG. 5. Lateral view of same hypotype. × 1.	
FIG. 6. Brachial valve, and beak and interarea of pedicle valve of same specimen. × 1.	
<i>Michelinoceras anax</i> (Billings) .....	297
FIG. 7. Lateral view of a steinkern of an incomplete shell; anterior one-third of rock filling of living chamber not shown. Hypotype 43889. No. 4 Hill, about 2 miles north of Arkona, Ontario, and about ½ mile east of Highway 7. × ¾.	
FIG. 8. Lateral view of another steinkern of an incomplete shell. Hypotype 43888. Jim Bell's quarry, about ¾ mile northeast of Thedford, Ontario. × ¾.	

PLATE I



