

THE AMERICAN UPPER ORDOVICIAN STANDARD. VI. THE COVINGTON SEQUENCE AT MAYSVILLE, KENTUCKY

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INTRODUCTION

Within the past decade, U. S. Highway 62-68 has been re-routed south of Maysville, Kentucky, and some 350 ft of Upper Ordovician strata have been exposed in unbroken sequence. Such thick, continuous exposures are not common in the Cincinnati region of Ohio, Kentucky, and Indiana, and this one would be of more than ordinary interest for that reason alone. In addition, this section is near the eastern limits of Ordovician exposure in the Cincinnati region, and thus provides detailed information as to the faunal and lithologic successions 75 miles southeast of Cincinnati where type sections of most local Upper Ordovician formations occur.

Location.—The area of study is at the southern outskirts of Maysville, Kentucky, approximately 1.2 miles south of the south end of Maysville-Aberdeen bridge along U. S. Highway 62-68. The Eden, Fairview, and McMillan formations are well exposed in six roadcuts along the west-trending highway. These exposures are in the south half of the southeast rectangle of the Maysville West 7½ minute quadrangle (1952), west from the school up the west-trending valley next south of the reservoir.

In order to describe this section accurately, we prepared a large-scale plane-table map of it (fig. 1), from which was drawn a vertically exaggerated cross-section (fig. 2) showing the boundaries between formations of the Maysville group exposed in the section. Rock and fossil specimens were collected systematically from all units exposed and studied in the laboratory. The ranges of the more significant mega- and microfossils are indicated in figure 3.

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THE LITHOLOGIC SEQUENCE

Covington Group

The shales of the Covington group were not studied intensively by us but the shale-limestone ratio in each member may prove valuable for identification. Shales of two colors dominate—dark yellow-brown (10YR4/2) and medium gray (N5). All of the shales are fissile. In the lower third of the group, shales predominate; whereas in the upper two-thirds shales are thin and are only a minor feature of the lithology. The principal megafossils of the shales are bryozoans and brachiopods. The bryozoans occur in lenses on the upper surfaces of many shale beds.

The limestones range from those that are coarse-grained, fossiliferous, and have a low silt-clay content, to those that are microgranular, unfossiliferous, and have a high silt-clay content and low-angle cross-bedding.

The relatively coarse-grained limestones are composed almost exclusively of

whole and broken bryozoans and brachiopods. A very few of the limestones are nearly pure calcium carbonate. Most limestones have some silt and clay impurities. The limestones were classified according to the system of Weiss and Norman (1960). Limestones of different classes occur randomly throughout the exposed part of the Covington group, but there are concentrations of some types that will be described for each member.

The lower third of the group consists mostly of shale, with prominent limestone ledges spaced farther apart than in the upper two-thirds of the section. A

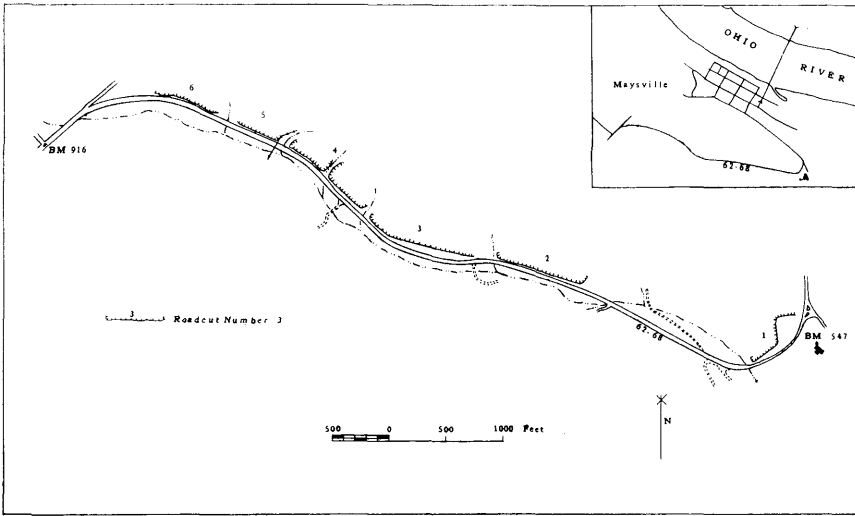


FIGURE 1. Planimetric map of a section of U. S. Highway 62-68 south of Maysville, Kentucky, along which are situated the roadside exposures of the Covington Group herein described.

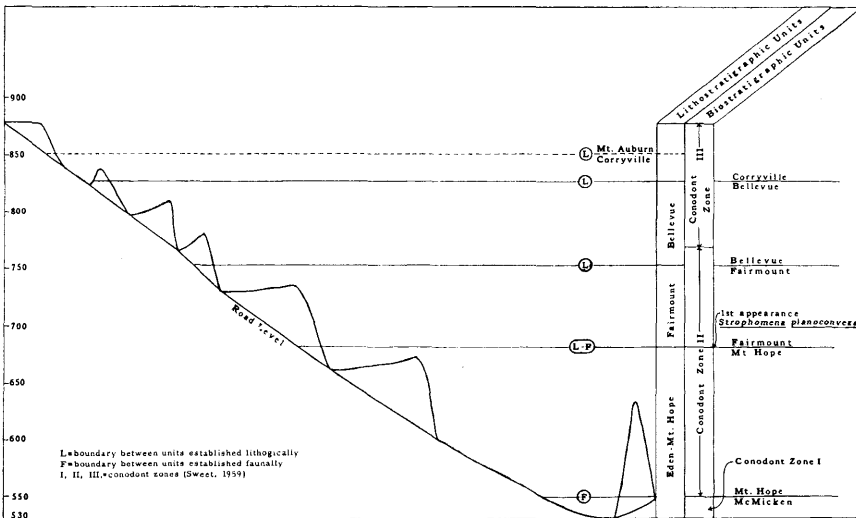


FIGURE 2. Diagrammatic cross-section of cuts mapped in figure 1. Elevation indicated in feet above mean sea level.

striking change takes place at the base of the Fairmount member, in the third roadcut. There, limestones abruptly begin to dominate and are so closely spaced that shale becomes a minor feature. Also at this point bedding planes become very irregular and the random position of brachiopod shells suggests current action. Isolated lenses of "shell hash" near the Fairmount base suggest considerable churning of sediments at this time.

From the Bellevue to the Mt. Auburn, limestones are very similar except for differences in silt-clay content. Most of these beds are irregular in thickness and very fossiliferous.

Fairview Formation

Mt. Hope Member.—Most limestones of the Mt. Hope member belong to classes 1, 4, and 5 (Weiss & Norman 1960). These constitute respectively 68, 25, and 7 percent of the limestones. Other than these, only one thin bed each of classes 2 and 3 occurs in the unit. A very accurate determination could be made in the Mt. Hope member because limestones are separated by large thicknesses of shale and form very distinct ledges. Class 1 limestone forms the thickest and most persistent ledges in this member. Classes 4 and 5 usually occur as thin interbeds in the shaly units of the member. The limestones and shales of the Mt. Hope are very evenly bedded and most limestones have smooth upper and lower surfaces. The lower two-thirds of the bedrock face in the first roadcut slopes about 25 degrees and limestones in this part weather light gray. Near the top of the cut, however, which is stratigraphically near the middle of the Mt. Hope, the slope steepens abruptly and the weathered color of the limestone changes to light brown. This is a result of the increase in thickness and resistance of class 1 limestones and closer and longer exposure to the zone of aeration.

The most important and abundant megafossils collected from the Mt. Hope are: "*Rafinesquina alternata*," *Onniella emacerata*, *O. multisecta*, *Escharopora falciformis*, *Platystrophia hopensis*, and *Zygospira modesta*. Bryozoans, including *Amplexopora septosa*, are very abundant in the Mt. Hope, but most are found in the shaly layers and are badly weathered. Crinoid columnals are also abundant in both the limestones and the shales.

The Mt. Hope member, 134 ft thick, crops out along roadcuts 1 and 2 in addition to 18 ft of the Eden formation exposed at the base of roadcut number 1.

Fairmount Member.—The Fairmount consists of four distinct lithologic units. The lowest is a 25-ft interval of class 1, 2, and 3 limestones, in that order of abundance, with very thin-bedded shales. The limestones of this unit occur in wavy beds that are not persistent laterally. Some beds are composed entirely of shingled *Strophomena planoconvexa*.

Above is about 20 ft of class 5 limestones, some of which occur in beds exceeding 1 ft in thickness. These beds are more evenly bedded than those in the remainder of the member.

The third unit is 10 ft thick and consists mostly of class 2 and 3 limestones in equal abundance, in wavy beds 3 to 5 in. thick.

The outstanding characteristic of the Fairmount member is the great dominance of limestone over shale as compared with the underlying Mt. Hope member. Each of the limestone units contains interbedded shale, but the shales vary from 0.5 to 2 in. in thickness and cannot be distinguished from a short distance away.

Some of the most abundant megafossils collected from the Fairmount are: *Hebertella sinuata*, *Strophomena planoconvexa*, "*Rafinesquina alternata*," *Constellaria florida*, and *Halloporo dalei*.

The contact between the Mt. Hope and the Fairmount is exposed near the base of the third roadcut. The Fairmount is 71 ft thick.

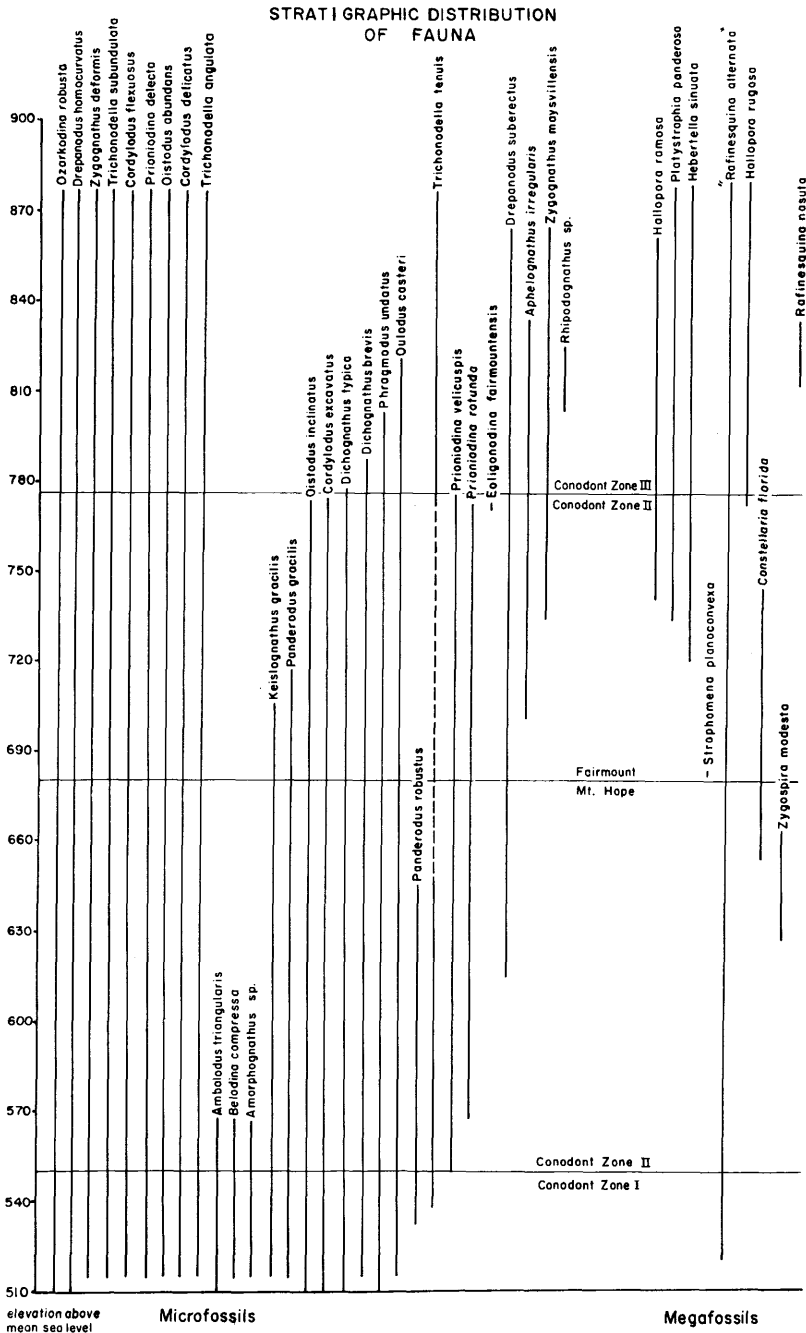


FIGURE 3. Ranges of the more significant mega- and microfossils in the Maysville roadcuts.

McMillan Formation

Bellevue Member.—The Bellevue consists of three distinct lithologic units. The lowest is 15 ft of class 4 and 5 limestones in almost equal abundance. The beds average 6 in. in thickness and change laterally from very evenly bedded to irregularly bedded in the space of a few tens of feet. These limestones weather light-blue-gray.

The 15-ft-thick second unit consists of mixed even and wavy beds of class 2 and 3 limestones, the weathered color of which is light yellow-brown. The highest Bellevue unit is 44 ft of class 1, 2, and 3 limestones in that order of abundance. The limestone beds average 3 in. in thickness and the interbedded shales average 0.5 to 2 in. in thickness. Even the thinnest shales of this unit contain discontinuous limestone layers. The limestones are irregularly bedded, but fairly continuous laterally. The weathered color is dark blue-gray.

Corryville Member.—The Corryville consists of class 1, 2, and 3 limestones in that order of abundance. The limestones average 8 to 12 in. thick and are evenly bedded with smooth upper and lower surfaces. The interbedded shales are thicker and more persistent than those in the underlying Bellevue. These beds which occur at the top of the fifth roadcut and on the flank of roadcut number 6 are in the zone of aeration and weather yellow-brown. Megafossils are very abundant in the Corryville. *Platystrophia ponderosa* becomes increasingly abundant near the top of the unit. The Corryville is 25 ft thick.

Mt. Auburn Member.—On the basis of lithology, the upper 25 ft of the highest roadcut (number 6) is Mt. Auburn. This unit consists of irregular beds of class 1, 2, and 3 limestones, in that order of abundance, and thin shales. *Platystrophia ponderosa* is the most abundant fossil in these highly fossiliferous beds. These rocks are similar to those in the Bellevue, which suggests a return to higher energy conditions in contrast with the underlying Corryville beds. The typical Mt. Auburn fauna was not found in this unit, but the lithology is similar to that of the Mt. Auburn at Cincinnati.

Contact Elevations and Unit Thicknesses of Covington Formations and Members

Contact	Location (cut and height in feet above base)	Elevation (feet above sea level)	Unit Thickness (in feet)
Corryville-Mt. Auburn	6th cut—15	852	Mt. Auburn—25
Bellevue-Corryville	5th cut—20	827	Corryville—25
Fairmount-Bellevue	4th cut—15	753	Bellevue—74
Mt. Hope-Fairmount	3rd cut—15	682	Fairmount—71
Eden-Mt. Hope	1st cut—18	548	Mt. Hope—134

THE FAUNAL SEQUENCE

The known vertical distribution of the more significant mega- and microfossils identified from the Maysville, Kentucky, section is shown in figure 3. Only the conodonts were studied in detail, for the sequence of Covington and Richmond conodont faunas is now well known (Branson, Mehl, and Branson, 1951; Sweet, et al., 1959; Pulse and Sweet, 1960), and it seemed desirable to locate in this section the well-established boundaries that separate distinct conodont zones elsewhere in the Cincinnati region.

The observed ranges of a few of the more abundant and diagnostic brachiopod and bryozoan species are shown in figure 3, primarily because several of these, singly or in combination with others, are widely used to identify faunal zones (or "formations") in the Cincinnati region.

Conodonts were collected from residues resulting from acetic acid digestion of

300-g limestone samples taken at irregular intervals through the section, but in no case farther apart than 4 ft. The upper portion of the section (above 690 ft) was sampled by R. R. Pulse and W. C. Sweet in the summer of 1958, and the conodonts obtained from their samples were made available to us for study. As figure 3 indicates, 29 conodont species were identified in samples from the Maysville, Kentucky, section. Many of these are long-ranging species and are of little detailed stratigraphic significance. Others, however, such as the group of three species found only below 570 ft, two species found only below 720 ft, and the three species found only between 550 and 775 ft, are not only represented by a considerable number of specimens, but are known to define rather persistent zones elsewhere in the Cincinnati region. The disappearance of *Phragmodus undatus* above 805 ft and the brief abundance of species of *Rhipidognathus* between 800 and 825 ft are anomalous, and no parallel sequence has heretofore been described from the Cincinnati region. That is, elsewhere, *Phragmodus undatus* is a common associate of the nine species listed on the left-hand side of figure 3, and in other sections ranges at least to the top of conodont zone III (Sweet, 1959). *Rhipidognathus*, on the other hand, has not previously been reported below conodont zone IV. This might suggest that the lower boundary of zone IV in the section at hand is between 800 and 805 ft; however, only four of the conodont species common between 800 ft and the top of the section have previously been reported from zone IV faunas, and in those faunas three of these species are very rare. Furthermore, as yet unpublished studies in progress at The Ohio State University, have established the presence of *Rhipidognathus* in the sub-Eden rocks of Kentucky.

The ranges of conodont species shown, and these brief explanations indicate that the boundary between Cincinnati conodont zones I and II is at 550 ft in the Maysville, Kentucky, section; the boundary between zones II and III is at 775 ft, and the balance of the exposed section belongs in conodont zone III, as these zones were outlined by Sweet (1959).

Strophomena planoconvexa occurs in great abundance in some 20 ft of thick-bedded limestones above 680 ft, but is rare or absent above 700 ft and was not found at all below 680 ft. Elsewhere in the Cincinnati region, the first appearance of *Strophomena planoconvexa* has been taken to mark the base of the Fairmount member of the Fairview formation.

Platystrophia hopensis has been identified as low as 550 ft and at least as high as the base of roadcut number 2 (604 ft). *Platystrophia ponderosa* is present between 735 ft and the summit of the section, and occurs with abundant *Hebertella sinuata* and bryozoans.

Rafinesquina nasula is not uncommon in rocks of Bellevue aspect between 815 and 830 ft. In other parts of the Cincinnati region, this distinctive brachiopod is commonly cited as an index to the Corryville member of the McMillan formation.

CONCLUSIONS

It has been the custom at Cincinnati to use the boundaries of faunal zones that are more or less coincident with distinctive lithologic units to mark the contacts between members and formations.

The principal results of our study have been to make careful measurements and lithologic descriptions of the Covington sequence exposed near Maysville, Kentucky, and to locate within this sequence zonal boundaries, based primarily on conodonts, which permit correlation of parts of this sequence with reference sections in Cincinnati as well as elsewhere in the Cincinnati region. In addition, our work demonstrates that rocks at Maysville, Kentucky, included within intervals defined more or less faunally at or near Cincinnati, Ohio, are different in many respects from rocks included in presumably the same faunally-defined intervals at Cincinnati. Eventually, we feel, it will be necessary to make more

critical distinctions between lithologic and faunal units in the Cincinnati region, but we feel hardly qualified to do this on the basis of our currently limited knowledge of distributional details respecting both the faunas and the rocks of the Covington group.

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