Ordovician Fossils of the Decorah Shale Formation at Wang's Corner, MN

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Introduction

The Decorah Shale outcrop at Wang's Corner in southwestern Minnesota contains a great diversity of fossils deposited during the Middle Ordovician. This region of Minnesota was submerged beneath an ocean during this time period, and thus the fossils in this outcrop consist primarily of marine organisms such as trilobites, brachiopods, anthozoans, gastropods, crinoids, bryozoans, pelecypods, and cephalopods (Minnesota at a Glance, 1995). In this study we examined and identified fossils from this outcrop to determine the number of genera or species that existed in the area during this period. Through this examination we can determine the general biodiversity of the invertebrates that resided in this region during the Ordovician period.

Materials and Methods

We collected shale samples from Wang's Corner in southwestern Minnesota on September 26, 2005. Samples were rinsed and scrubbed prior to analysis, and in some cases subjected to dilute hydrochloric acid to more clearly reveal fossils embedded within the shale. A microscope was used to aid in identification of smaller fossils. A representative fossil for each genus or species identified was photographed and recorded with an Olympus™ digital camera.

Identification was undertaken by consulting a fossil guide distributed to students in lab titled "Ordovician Fossils of Minnesota: Twin Cities Area" (1995). We also consulted *Invertebrate Fossils* by Moore, Lalicker and Fischer (1952) as well as Dr. Clinton Cowan, Associate Professor with the Carleton College Geology Department.

Results

Fifteen different fossil types were identified among a sample size of approximately two hundred fossils visible in approximately five gallons of shale samples from the Decorah formation. All fossils identified were marine invertebrate species that existed during the Ordovician period.

Four fossils from the phylum *Brachiopoda* were found (Figure 1), which were among the most common fossil types identified in these samples. The only brachiopods found were articulate, which have a hard, calcareous shell with two valves hinged at one side (Moore, Lalicker and Fischer, 1952). Of these, one of the most prevalent was the *Platystrophia.* Also found were brachiopods from the genera *Glyptorthis, Strophomina* and *Finelburgia* (Moore, Lalicker and Fischer, 1952).

Three horn corals, of the class *Anthozoa*, were identified in these samples, as seen in Figure 2. These solitary corals are index fossils for the Paleozoic Era, originating in the Ordovician time period, and vanishing at the end of the Permian period (Cowan, personal communication). The horn corals identified were most likely of the genus species *Lambeophyllum profudum* (Minnesota at a Glance, 1995).

Three fossil samples of trilobites, an index fossil that existed only during the Paleozoic Era, were found in the Decorah Shale samples. While no intact trilobite fossils were identified, one fossil was found of a tail, cheek plate, and genal spine, shown in Figure 3. While one source suggests that *Isotelus gigas, Bumastoides milleri,* and *Eomonorachus intermidus* are the most commonly found trilobites in the Twin Cities area, positive identification is not possible because none of the species presented is in

possession of a genal spine, and the lack of an intact trilobite fossil prevents more specific identification.

One fossil type was found from the class *Pelecypoda,* or the bivalves, shown in Figure 4. This was identified as *Vanuxemia obstufsifrons* (Minnesota at a Glance, 1995). These *Pelecypoda* remains were actually found as casts within the shale of the *Pelecypoda* shells that had deteriorated prior to lithification.

Two fossil types from the class *Gastropoda*, which generally consists of the snails and mollusks, were found. These are shown in Figure 5. None of the gastropods matched the fossils typically found in the Twin Cities area, but resembled gastropods from the genera *Helicotoma* and *Liospira* (Moore, Lalicker and Fischer, 1952). These are tentative identifications as these fossils are not typically found in Minnesota, but matched the time period of other fossils identified.

Fossils found in the phylum *Bryozoa* were, in addition to the *Brachiopoda*, the most common fossils found in the Decorah Shale samples. However, the identification of these fossils beyond the phylum or class level is quite difficult. We identified at least three distinct genera (Figure 6), the *Batostoma,* the *Stictopora* and the *Prasopora,* but the difficulty of bryozoan identification makes these identifications tentative at best (Cowan, personal communication).

Several stem columnals of Crinoids were also found in shale samples, shown in Figure 7. These consisted either of ring-like structures or stacks of rings used by the organisms as shelters (Minnesota at a Glance, 1995).

Discussion

While each of the fossils discovered is known to span a large time range, all fifteen fossils existed simultaneously during the Ordovician time period (Moore, Lalicker and Fischer, 1952). Thus, this outcrop of Decorah Shale was deposited between 438 and 505 million years ago, most likely during the latter half of the period, as suggested by the fossils identified. The most important fossils used for establishing this date are the trilobites and horn corals, both of which are prominent index fossils found within the Decorah Shale.

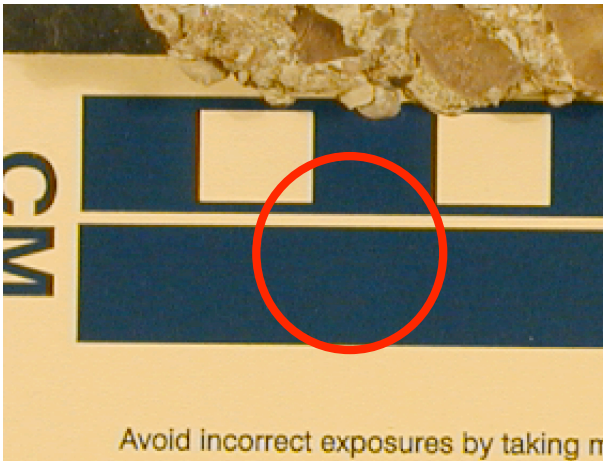
All of the fossils identified indicate the presence of a marine environment during deposition. The presence of shale indicates that the sediments were deposited in a relatively deep ocean. High concentrations of fossilized remains of delicate marine invertebrates indicate that the depositional environment was also calm enough as to not destroy their fine exoskeletons. The number of fossils found in a relatively small area also indicates that this period of time was highly conducive to supporting the wide variety of life forms evident in the Decorah Shale. It is also of note that this period of faunal diversity ended roughly 240 million years ago with the End-Permian extinction, after which the trilobite and horn coral cease to be found.

In total, the small, fossilized remains of ancient Ordovician marine invertebrates reveal much information about the time in which they were deposited. The remains of the fifteen marine invertebrates discovered in our sample reveal much regarding the time, depth, and turbidity of their deposition. More importantly, they give an indication of the relative biodiversity of a time millions of years in the past.

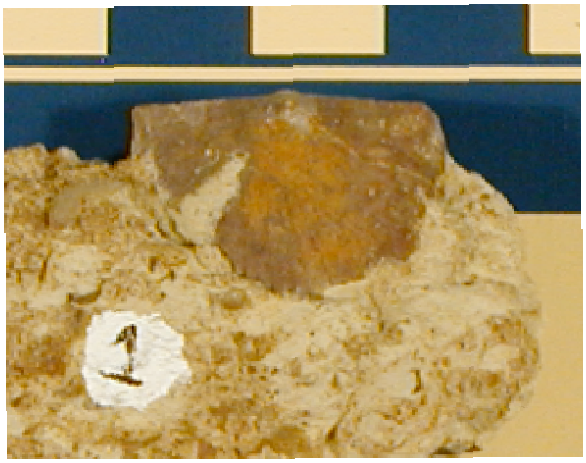
Figures

Figure 1. Examples of the phylum Brachipoda.

Glyptorphis



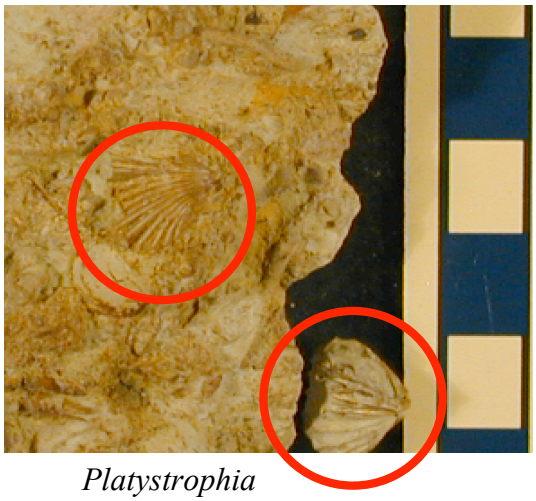
Finkelburgia



Strophomina

Figure 2. Examples of the phylum *Anthrozoa*

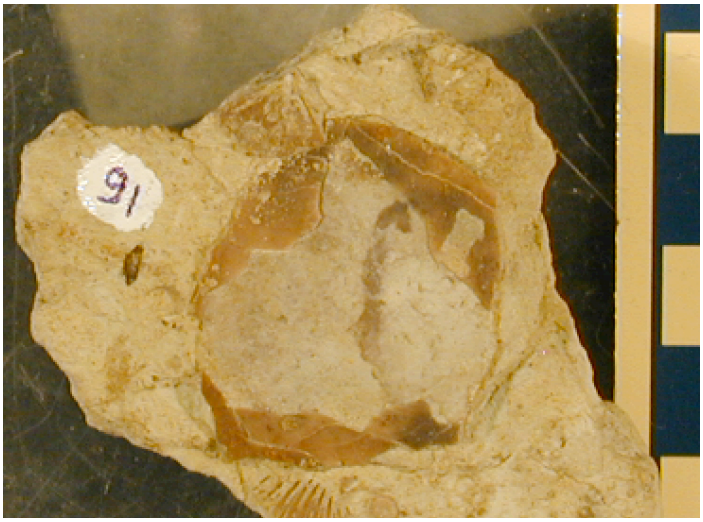
Lambeophyllum profundum
(Horn Coral)



Platystrophia

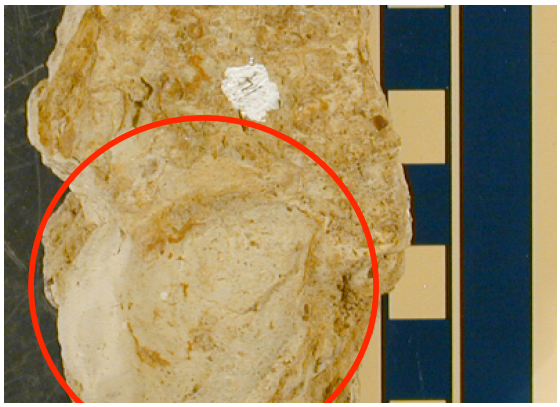
Figure 3. Examples of fragments of trilobite fossils.

1. *Calliops* (genal spine)
2. *Eomonorachus intermedis* (tail)



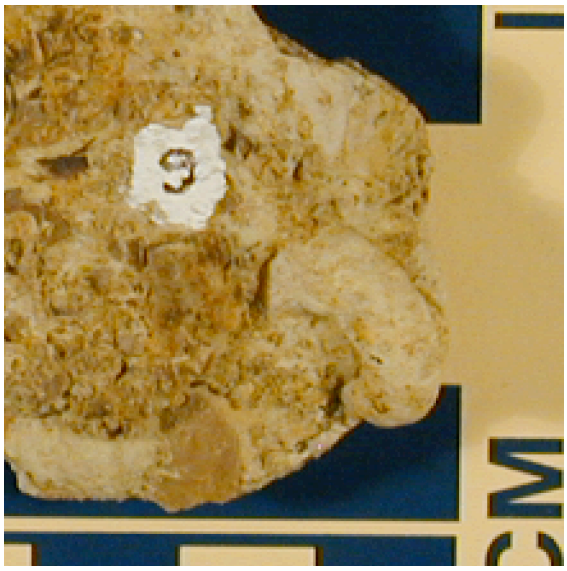
Isotelus gigas (cheek plate)

Figure 4. Examples of the class *Plecypoda.*



Vanuxemia
Obstusifrons

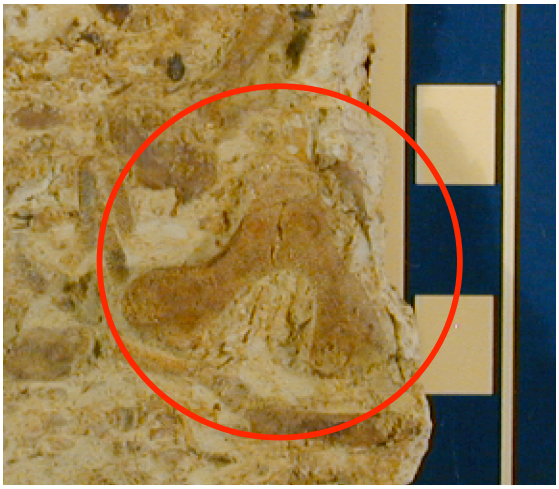
Figure 5. Examples of the class *Gastropoda.*



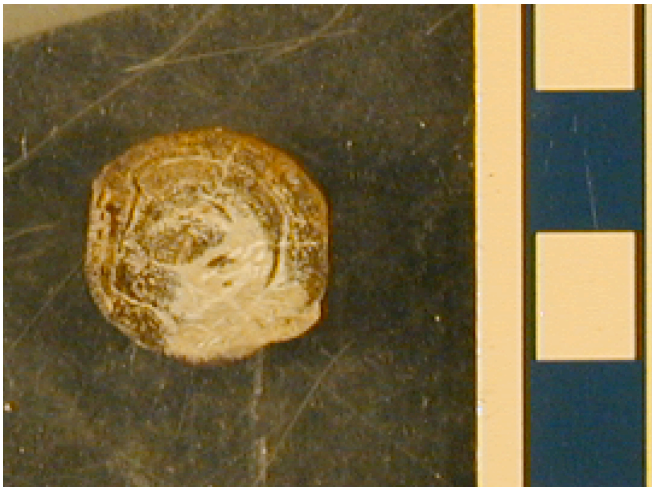
Helicotoma

Liospira

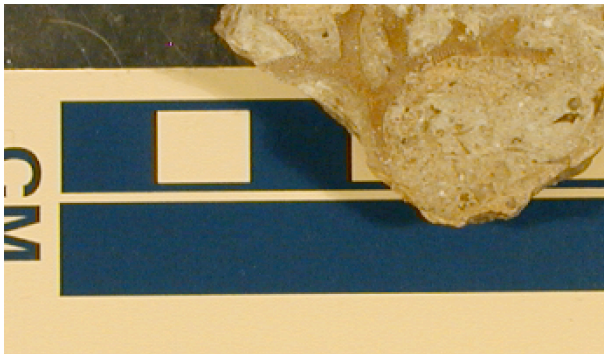
Figure 6. Examples of the phylum *Bryozoa.*



Batostoma minnesotense



Prasospora conoidea



Strictopora mutabilis

Figure 7. Examples of Crinoids.

Stem columns

Figure 8. Map of sample site, Wang's Corner, MN, from the Sogn, MN USGS quadrangle map.

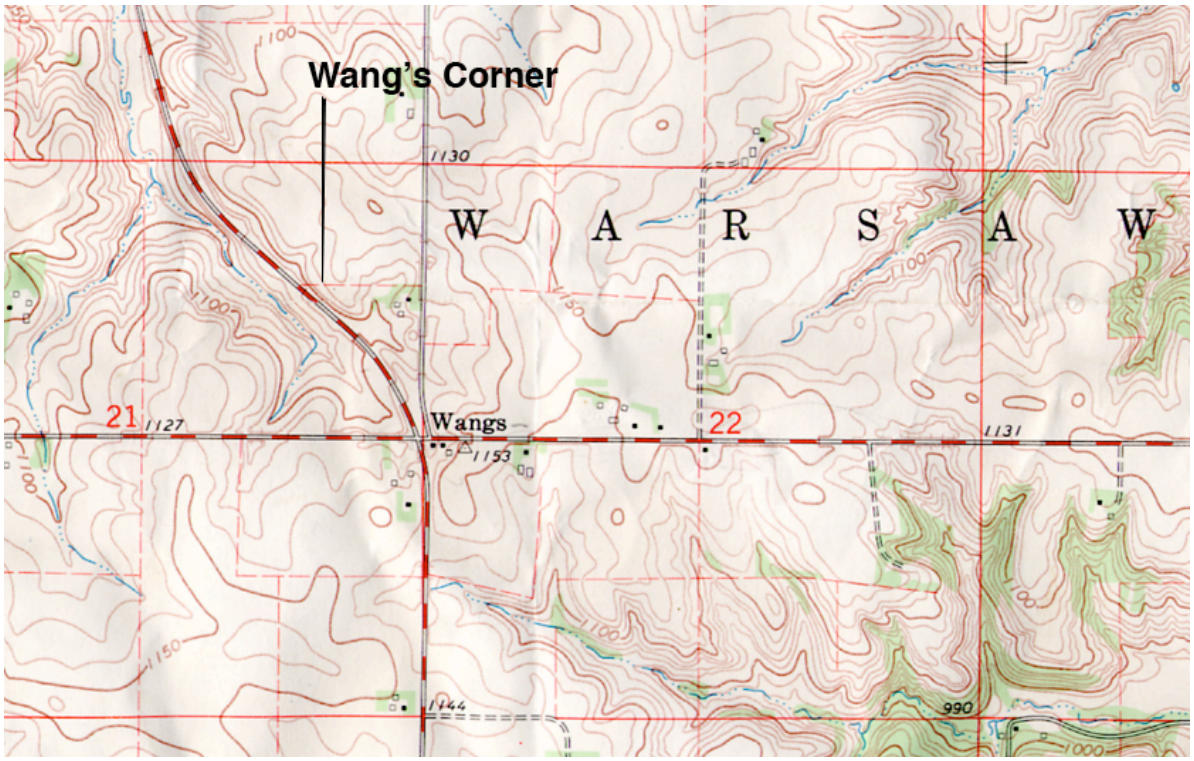


Table 1. Listing of all identified fossils.

Phylum	Class	Genus	Approximate time period
Brachiopoda	Strophomenata	Strophomena	Upper Ordivician
Brachiopoda	Articulata	Platystrophia	Middle Ordivician – Middle Silurian
Brachiopoda	Articulata	Glyptorthis	Middle Ordivician – Lower Silurian
Brachiopoda	Articulata	Pionodema	Middle Ordivician – Lower Silurian
Brachiopoda	Articulata	Finkelnburgia	Upper Cambrian – Lower Ordivician
Brachiopoda	Articulata	Platystrophia	Middle Ordivician – Middle Silurian
Cnidaria	Anthozoan		
Bryozoa	Gymnolaemata	Strictopora	
Bryozoa	Gymnolaemata	Batostoma	
Brozoa	Stenolaemata	Prasospora	
Mollusca	Pelecypoda	Vanuxemia	Ordivician
Mollusca	Gastrapoda	Helicatoma	Middle Ordivician
Mollusca	Gastrapoda	Liospora	Upper Ordivician
Mollusca	Pelecypoda	Vanuxemia	Odivician
Echinodermata	Crinoidea		
Arthropods	Trilobite (tail)	Eomonorachus	
Arthropods	Trilobite (cheek)	Isotelus	
Arthropods	Trilobite (genal spine)	Calliops	Ordivician

Literature cited

Cowan, Clinton, PhD. personal communication, November 1, 2005.

Moore, R.C., Lalicker, C.G., Fischer, A.G., 1952, Invertebrate Fossils: New York, McGraw-Hill Company, Inc., 766 p.

Mossler, J. and S. Benson, 1995, Minnesota at a Glance: Minnesota Geological Survey, University of Minnesota, p. 3.