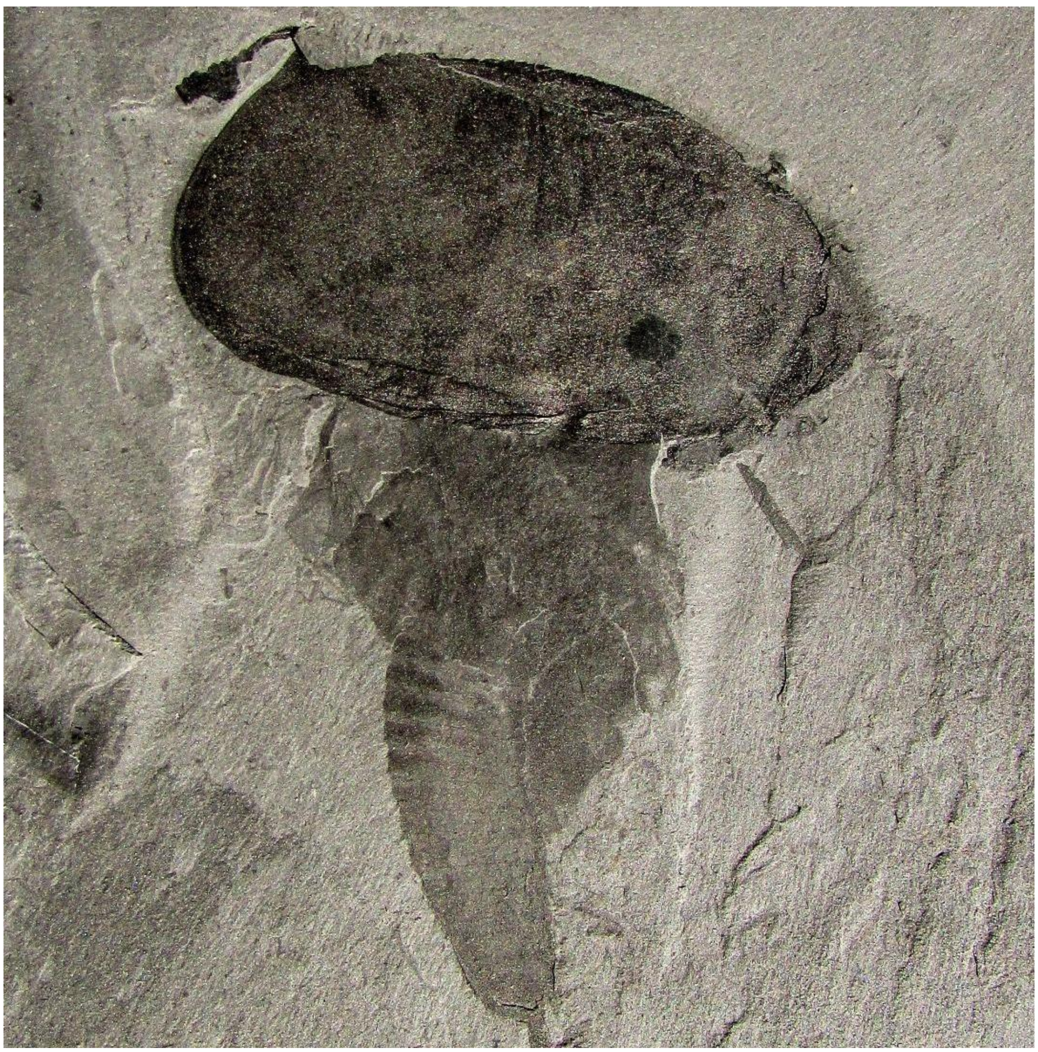
M·A·P·S Digest

Official Publication of
Mid-America Paleontology Society
http://www.midamericapaleo.org

Volume 42, Number 4
Sept.-Nov., 2019



"A LOVE OF FOSSILS BRINGS US TOGETHER"

Calendar

2019

September 20-21
CVRMS Fall Auction
Location: Amana Colonies RV Park, Amana, IA
For more info: www.cedarvalleyrockclub.org
or call Marvin Houg at 319-350-9435

2020

March 28-29
CVRMS Show
Location: Hawkeye Downs, Cedar Rapids
Theme: Meteorites

April 17-19
MAPS EXPO XLII
Location: Sharpless Auctions
Exit 249 I-80
Iowa City, Iowa
Theme: Ordovician Period
Keynote Speaker: Dr. Dennis Kolata
Topic: TBD

Contributions to Digest Needed

The Digest editors encourage the members to submit articles for publication in the Digest issues. The Digest is for the members and should reflect their interests. If you have specimens that you collected and would like to share with other members or would like to describe a favorite collecting site, please write an article in Word, Times New Roman size 12 font, single spaced with one inch margins, and send to the editors. Photos and diagrams can be e-mailed separately or incorporated in the article.
John: Fossilnautiloid@aol.com
Chris: CDCozart@aol.com

Call for Papers

The theme for the **2020 EXPO** is the **Ordovician Period**. Any paper dealing with the Ordovician fossils, specific taxonomic groups, or interesting locations or collecting sites would be appreciated. The papers should be in Word, Times New Roman, size 12 Font, single spaced with one inch margins, and e-mailed to one of the Digest Editors by the **first week of March 2020**. Diagrams and Photos can be sent separately or imbedded in text.

John: Fossilnautiloid@aol.com
Chris: CDCozart@aol.com

DUES INFO

Please send your $20 2019 MAPS dues to:

Dale Stout
2237 Meadowbrook Drive S.E.
Cedar Rapids, Iowa 52403

About the Cover

The cover for this issue features an unusually complete specimen of the Middle Cambrian phyllocarid *Canadaspis sp.* from the Wheeler Fm., Drum Mtns. Utah.

A Pathological Mammoth Molar

William W. Morgan

Mammoths, mastodons, and their living and extinct elephant cousins belong to the Order Proboscidea, i.e., the proboscis or trunk-bearing animals. In order to maintain their characteristically large size, these proboscideans devote or devoted most of each day to foraging on a diet consisting primarily of grasses, shrubs, twigs and small tree limbs. The mastication of these tough, fibrous foods requires an arduous and repetitive grinding between the opposing jaw teeth which leads first to tooth erosion and ultimately to tooth loss.

Figure 1. The exposed crown of a maxillary molar of a Columbian mammoth. The black dots encircle a single lamina. A – dentin, B – enamel ridge, C – cementum between adjacent laminae.

Tooth loss without replacement leads to starvation and as a result a limited life span. To avoid this problem, the large proboscideans have evolved a unique system of prolonged tooth development, which extends throughout much of their life. This approach involves the sequential production of six sets of teeth in each jaw or a total of twenty-four teeth over the animal's life time (Ungar, 2010). With the exception of the first tooth, the jaw teeth are molars, high crowned (hypsodont), multi-rooted, and morphologically designed to resist mechanically induced erosion. Although these animals also develop tusks, the latter are modified incisors which do not function in mastication.

Each molar tooth is composed of a series of long vertically oriented plates or laminae. In Figure 1, the crown of a partially eroded molar shows the laminae in transverse section. In this view each lamina appears as a ringed structure, which is much wider transversely compared to anteroposteriorly. Each lamina is lined circumferentially by enamel and filled with dentin (Figure1). Compared to dentin, the enamel is harder and more resistant to erosion and as a result presents a more exposed, hard grinding surface for crushing tough food materials. The individual laminae are anchored together by cementum (Ungar, 2010).

Usually one or at most two functional molar teeth are exposed to the surface of each jaw at a time (Ungar, 2010). The first tooth in the series erupts before birth and is no larger than an adult human tooth

(Lister and Bahn, 1994). Each subsequent tooth is larger and with more laminae than it immediate predecessor. As a tooth is worn down and becomes nonfunctional, it is expelled from the jaw and replaced by the next tooth in a conveyor-like system (Ungar, 2010).

Because tooth development extends throughout a major portion of the animal's life, teeth still developing in the conveyor system are potentially exposed to either internally or external perturbances that may markedly distort their normal development (Roth, 1989) (Burns et al., 2003).

Figure 2 and Figure 3 show a lateral buccal (cheek) and a lingual (tongue) view of a markedly abnormal right mandibular mammoth molar. The posterior of the molar is pushed and twisted upward so that the most posterior lamina is oriented nearly parallel rather than normally nearly vertical to the crown. Although this lamina is nearly the same level as the crown, its surface is not eroded and thus is unlikely to have been exposed to the surface. The tooth has twenty-one lamellae, which suggests it is a fifth molar (Haynes, 1991).

Figure 2. A buccal (cheek) view of the deformed right mandibular molar (obtained from Hagar's Fossils and Minerals, 2017). The size marker is a six inch ruler.

Figure 3. A lingual view of the deformed right mandibular molar.

Figure 4. A view of the crown of the deformed molar.

A view of the crown (Figure 4) shows erosion of at least the most anterior twelve lamellae. Thus, this region of the tooth was exposed to the surface and functionally involved in mastication for at least a few years before death. The narrowness of these laminae and the compactness between these structures, identify the species as *Mammuthus primigenius* (Kurtén and Anderson, 1980).

Since the anterior end of the molar does not appear to be damaged, the distortion appears to result from force exerted on the posterior end of the tooth. The absence of visible cracks in the tooth suggests that the distortion was initiated when the posterior of the tooth was not totally mineralized and thus immature and flexible enough to bend rather than break. Although it is impossible to know, if the tooth had grown and matured normally, more laminae might have been added to the posterior end of the tooth.

The absence of any other obvious injuries to the tooth suggests that underlying cause of the pathology was a chronic condition rather than an acute injury. Perhaps the distortion of the molar was due to a tumor or an abscess in the more posterior region of the mandible. Regardless of the cause, it is reasonable to assume that the pathology led, at least indirectly, to a premature demise of the animal.

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Microfossils of the Cincinnatian Series of the Upper Ordovician Arnheim Formation in the Vicinity of Florence, Kentucky.

Rich Fuchs
Dry Dredgers

About twenty years ago a member of our club, Bill Heimbrock, began working a site near Florence, in northern Kentucky. From this site came the somewhat famous “mystery fossils” or “plates.’ These were very small and looked like tiny mammoth teeth. This peaked the interest of other club members and some of us explored the site looking for the strange fossils. The area in question was in the Arnheim formation and contained an assortment of megafossils; but, it was covered by a fine sandy layer which was extremely fossiliferous. The fossils in question came from this sand and the thin limestone layer beneath it. The site is no longer accessible as the Florence Freedom baseball team built their stadium there. Since these “mystery fossils” were only about 1 mm in length, they fall under the category of microfossils.

Daniel Jones says that “microfossils are any fossils (usually small) whose distinguishing characteristics are best studied by means of a microscope.” These, then, would include complete shells, skeletons, or organisms; immature forms of megafossils; and, dissociated small-sized fragments of larger fossils. How small is small? Some suggest that this means 2 mm or smaller. Actually, some microfossils can exceed 2 mm, even doubling that size.

But, what were the “mystery fossils?’ Several years later, I was clearing a cabinet in the collections of the Cincinnati Museum Center which contained miscellaneous specimens which had to be put in the correct phyla. One small box contained a somewhat non-descript piece of limestone with a red circle on it. I grabbed a lens and what do you know—a “mystery fossil.” But this one was identified as the dentary of the bivalve (pelecypod) *Lyrodesma*. So, after a couple years of study and questioning, the “mystery” was solved.

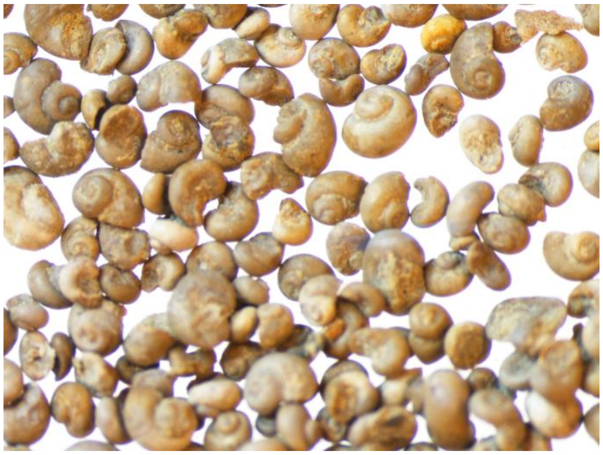
However, the sand also contained an assortment of other microfossils. Portions of this material was spread in a thin layer on a plastic dish and placed under a microscope. Using a “00” round brush with a moistened end, the microfossils were “picked” from the dish and placed in separate screw top glass vials. Several more mollusks were separated from the mixture. Two additional bivalves, *Paleoconcha faberi* and *Nuculites fabula*, were found. Both of these fully formed bivalves were less than 1.0 mm in length. *P. faberi* has a more rounded shell form and *N. fabula* has a more elongated shell form.

Paleoconcha faberi

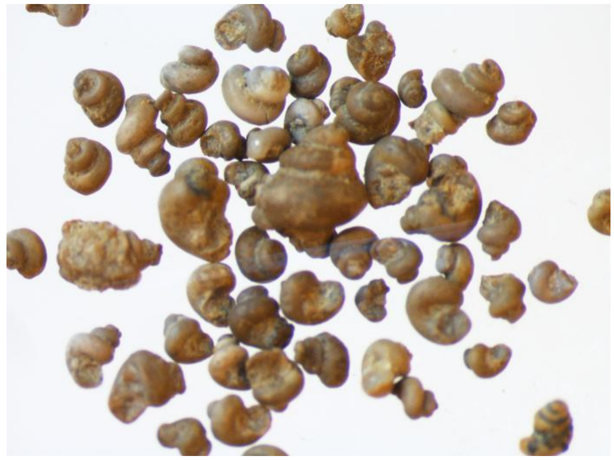
Nuculites fabula

Also present were two species of the gastropod *Cyclora*. This genus has been under study for a long time to determine if the snails are mature adults or if they are really immature specimens. The specimens are less than 1 mm across; and, this is fairly consistent. There are no larger specimens present where these are found. So, there is no size gradient. This indicates to me that they are probably adults.

The two species are *Cyclora minuta* and *Cyclora depressa*. The chief difference between the two is the height of the spire. *C. minuta* has a lower, squatty spire and *C. depressa* has a higher spire.



Cyclora minuta



Cyclora depressa

Both of these are present in vast amounts; but *C. minuta* seems to occur about four times more often than *C. depressa*.

There was also a monoplacophoran present. It is *Cyrtolites inornatus*. This is similar to *Cyrtolites ornatus*, found throughout the Cincinnatian, except that it is much smaller in size and the surface is smooth, lacking the ridges of *C. ornatus*. Like other monoplacophorans, the coiling of the shell is in one plane, giving the structure a somewhat flattened appearance. These were only a couple of millimeters in diameter.

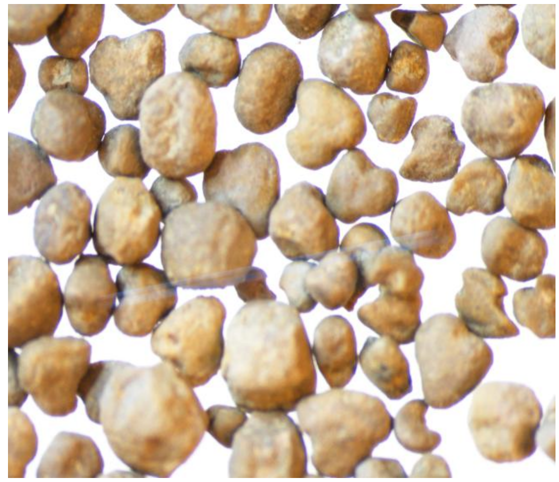
Cyrtolites inornatus

brachiopods

Brachiopods were also found in the sand. *Zygospira modesta* and *Zygospira cincinatiensis* were found; but, these probably fall into the category of megafossils. However, another brachiopod is present which I have not identified. These could be juvenal *Zygospiras* or some entirely different brachiopod. They are very small, only about I mm in cross-section. They also seem to be more elongate that the *Zygospiras*.

A somewhat rare fossil in the Cincinnatian rocks is the cyclocystoid. This is an echinoderm which is usually found as simply a ring of segments. These segments can disarticulate over time. Most of the rest of the animal is not usually present. Because of the small number of specimens, how these creatures fed and the workings of their digestive system are not very well understood. Also, they are found cemented to some other animal's shell or a hard ground. Although these are generally rare, hundreds of the individual segments of this fossil were found in the sand.

Cyclocystoid



Cyclocystoid segments

Cornulites

Several other shells belonging to fossils of "uncertain affinity" were also found in the dishes. First of all we have *Cornulites*, which is present throughout the Upper Ordovician. These are believed to be the shells of some type of worm. Although these shells can reach a centimeter or more in length, depending on the species, the ones found in the sand were under 2 mm. Some species of *Cornulites* appear in clusters while others tend to be individual shells. The shells found in the sand showed no tendency to be clustered together.

Hyolithes versailensis

Panderodus sp.

Hyolithids are another type of small shell which is also relatively rare in the Cincinnati rocks. These belong to the genus *Hyolithes*. The shells are smooth and have a flat side. They were identified by Dr. John Malinky as belonging to *Hyolithes versaillensis*. Although Hyolithids are rare in the Upper Ordovician rocks, they were present in the sand in some abundance.

A few conodonts were also found in the mixture. These are obvious by their amber color. Conodonts are tooth elements in the mouth of an animal which appears to contain a primitive backbone, meaning it could be the forerunner of primitive fish. The conodonts were present in the mouth in multiple units comprising an assemblage; but, these disarticulated after death. Since the animal contained no true bone, decay left only the hard parts, which in this case were the conodonts.

A similar, yet very different, type of microfossil was also present. These were scolecodonts. Scolecodonts are the jaw elements of polychaete annelid worms. Like conodonts, when death occurred, all of the soft parts of the animal decayed. The only hard parts were the jaw elements, composed of a chitinous material. The complete set of jaw elements in a single worm is called an assemblage and can be comprised of nine or more elements. Unlike the conodonts, these jaws are a jet black color; but, when weathered can get a copper-colored appearance. They are very fragile but can chemically withstand even strong acids. This makes removing them from the matrix a lot easier. The matrix can be dissolved leaving only the jaw elements. Strong acids will dissolve conodonts.

O. marlenediesae M I l

P. ineptus M I r

P. ineptus M I l

The Arnheim sand revealed at least six different polycheates: Elements of *Atraktoprion rectidens*, *Leptoprion* sp., *Oenonites marlenediese, Protarabellites ineptus*, and *Rhamphoprion procurvus and Hadoprion aciculata* were all found in the strata. All are named according to the system set up by Bergman and Eriksson.

***R. procurvus* M I l**

***Leptoprion* sp. M l r**

***Hadoprion aciculata* M I r**

***Hadoprion aciculate* M II l**

The elements in the apparatus in scolecodonts are numbered from the innermost elements out. The largest elements are usually the innermost and are also the most characteristic of the species. As can be seen in the photos, there is quite a variety of shapes and dentary patterns.

Additionally, crinoid plates, crinoid columnals, bits of cephalopods and bryozoans, and other very small parts of fossils were be found. One of these I called "bananas." I didn't know what they were until I described them to Jack Kallmeyer, local expert on Cincinnatian crinoids. He said that the columnals of *Cincinnaticrinus* can split into fifths. Examining the "bananas," I found that they are approximately one fifth of a circle, but are worn down, probably because of wave action. So, one problem seems to have been solved.

"Bananas"

"Mushrooms"

However, there are others still to be worked out. One of these is what I call "mushrooms." These still haven't been identified, although I think they might be some part of a cyclocystoid.

A surprise was the fact that no ostracods were present in the samples taken from the site, as they are present in other similar stratigraphic localities.

As you can see, there is still a great variety of microfossils present in this Arnheim site. These represent the nearly same diversity of fauna found throughout the Cincinnatian Arnheim formation. Although we have looked at just one formation, many of the microfossils can be found throughout a large portion of the Upper Ordovician. And, one big advantage of studying microfossils is that a large collection occupies a very small amount of space.

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MAPS meetings are held on the 2nd Saturday of October, November, January, and February and at EXPO in March or April. A picnic is held during the summer. October through February meetings are scheduled for 1 p.m. in Trowbridge Hall, University of Iowa, Iowa City, Iowa. One annual International Fossil Exposition is held in late March/early April.

The MAPS official publication, MAPS DIGEST, is published 5 times per year – Jan-Mar, EXPO EDITION, May-August, Sept-Nov, Dec. (EXPO Materials). View MAPS web page at: http://www.midamericapaleo.org

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MID-AMERICA PALEONTOLOGY SOCIETY

Mr. John Catalani
MAPS DIGEST Editor
3405 High Trail
Woodridge, IL 60517

CYATHOCRINITES