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"A LOVE OF FOSSILS BRINGS US TOGETHER"

Calendar

2018

January 13
The January MAPS meeting will be held in Room 125 of Trowbridge Hall, Univ. of Iowa.
MAPS member Tom Williams will present the program: "A Crinoid Bank in the Mississippian of Alabama" at 1:00 p.m. (See article this issue.)
The regular MAPS meeting will be at 2:00 p.m.

March 24-25
CVRMS Gem, Mineral, and Fossil Show
Theme: Crinoids—featuring many displays of crinoids
Location: Hawkeye Downs, Cedar Rapids

April 6-8
MAPS EXPO XL
Location: Sharpless Auctions
Exit 249 I-80
Iowa City, Iowa
Theme: Permian-Triassic
Keynote Speaker: Dr. Margaret Fraiser
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 **2018 EXPO** is the **Permian-Triassic**. Any paper dealing with Permian, Triassic, or/and the PTr Extinction geology or paleontology 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 February 2018**. Diagrams/Photos can be sent separately or imbedded in text.

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

DUES INFO

Please send your $20 2018 MAPS dues to:

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2237 Meadowbrook Drive S.E.
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About the Cover

Four specimens of the flexible crinoid *Onychocrinus pulaskiensis* exposed and recovered from an excavation of a crinoid bank in the Upper Mississippian Chester rocks of Alabama. See article by Tom Williams describing the excavation and the crinoid bank this issue. Photograph by Tom Williams.

A Crinoid Bank in the Mississippian of Eastern North America

Tom Williams

Crinoids were virtually not all that long ago thought of as being extinct. However, if you were to go diving in places such as the Great Barrier Reef, the Straits of Florida, the Bahamas, Figi, Truk atoll, the Red Sea, and other suitable areas you will find living crinoids. Crinoids in these areas are found associated with reefs, in lagoons, and in deeper waters over 300 feet. Occasionally, such as in the Straits of Florida, crinoids have been found living on bare rock basically all by themselves. They look similar to what is preserved in the fossil record but do differ with some crinoids having up to thirty two arms and some only five arms (Hess, Ausich, Brett, Sims 1999).

The Chesterian age units of Eastern North America are made up of significant amount of limestone and shale's and geologically make up a number of former carbonate platforms (Pashin 1993 and others). In the eastern portion of North America the carbonate platforms occurred in Northern Alabama, Kentucky, Indiana and Illinois. The carbonate platform in Northern Alabama has been described as a bank which is a part of a reef complex extending across the northern portion of the state. As described by Selley 1985 a bank is a, "A carbonate buildup which is a syn-depositional topographic high of non-resistant wave material, e.g. an oolitic shoal, a coquina bank, or a mound of crinoid debris." More simply put a reef is a buildup of biological skeletons and related material which can include crinoidal debris. Reefs and reef type deposits which a bank is are typically found in the Paleozoic shallow tropical seas in neritic environments of normal marine conditions. Overall, you tend to find Paleozoic crinoids and their associated fauna in continental shelf waters indicating that they have specific requirements for their survival. However, today's crinoids prefer colder deeper water environments (Bailey 2007, 1977).

Reef environments today occur for the most part occur in shallow tropical seas in settings such as the Great Barrier Reef of Australia or the Bahamas in the Caribbean. There is a known exception off the coast of Norway which occurs in colder deeper water. Reefs typically have four basic parts that include a back reef/shelf lagoon, the reef flat itself which can include growing reef rock, a reef front, and a fore reef (Seeley 1985). Pieces of a reef can be assembled with these basic parts or include other entities such as barrier islands. Today we classify reefs into three basic types; fringing reefs, barrier reefs, and atolls. Barrier reefs are long structures separated by a lagoon from the land. Fringing reefs are long structures that stretch out parallel to the coast but with little or no space to the land. The third is what is referred to as an atoll which is a circular structured reef usually involving an island or some sort of structure such as a volcano. This type of structure is common in the Pacific Ocean today. Atolls contain a large lagoon inside of the circular structure. The circular structure can be built up into low level islands or structures just below the surface (Seeley 1985). It is the lagoons and the off shore environments with the right conditions that provide habitat for crinoids past and present (Bailey 1978, 2007).

Paleo-Ecological conditions for crinoids

Crinoids are suspension feeder organisms, in other words filter feeders. These are organisms as defined by Bailey (2007) as, "organisms that filter or sieve microscopic food from fluid usually water. Most marine or suspension feeder consumes small plankton (microscopic algae, animals and plants or organic detritus). Some of the materials may be living, others may be dead or decayed; other particles may be feacel debris." Crinoids as filter feeders have living space limitations as a result of this survival mechanism which places their position in the fossil record as well. This helps us in the study and collection of crinoids by knowing where we may encounter them in the fossil record.

Open marine conditions begin with the salinity content of the ocean itself which typically will mean a salinity content of greater than 30%, however the water will become too saline over 40%. This type of salinity classification is referred to as ultra-haline. The creation of brine or brackish water environment through either restrictive conditions or the introduction higher salinity or freshwater will create unsuitable conditions. Paleozoic crinoids also needed relatively warm above 20 degrees Celsius for optimum conditions. This probably for the most part limited them the euphotic zone the top 100 meters of the neritic zone. This area is part of what is called the continental shelf also were the light requirements of the euphotic zone will also apply (Bailey 2007, Paleoecology WIU class notes 1978).

Turbidity is simply the amount of material suspended in the water which includes both organic and inorganic debris. Water that is too turbid inhibits light penetration even in shallow water. Turbidity is a problem for filter feeding organisms especially sessile forms or life forms with slow mechanisms for transporting themselves out of the turbid water. Typically crinoids are going to be found in clear water with low turbidity. Therefore an influx of too much silt and clay can overwhelm the filter feeders perhaps even resulting in rapid burial of the crinoids present. This may even cause an oxygen deficiency in an area causing an even faster burial (Bailey 2007, Paleoecology WIU class notes 1978).

Typical organisms associated with crinoids include organisms such as corals, both colonial and solitary, bryozoans, and other miscellaneous fauna. These three groups of animals are sessile types of organisms with similar living requirements and thrive along with crinoids. However, they too are bounded by the same kind of conditions and are commonly found intermixed with crinoids. One could conclude from this that introducing water and materials outside this narrow tolerance range to these organisms causes their elimination from this particular area at least temporally.

Geologic Time Frame and Deposition Environments of the Platform

During this time, Mississippian deposits stretched from Northern Alabama throughout the former Laurentia continent, what is now the mid-west of the United States. This area was in the tropics with shallow warm water near the equator similar to what exists today. Tectonic influences included the uprising of the Appalachian Mountains from the collision of Africa and the North American/Laurentia continents to the east. Other, more local influences such as the Nashville dome, the Ouachita Mountain, and locations farther north continued the formation of the Illinois and Michigan basins.

It was the rising of the mountains and other tectonic activity that provided possible sources of the necessary sediment for the formation of the carbonate platform/bank that was formed. The carbonate platform of Northern Alabama appears to have depositional environments that have been created as a result of two orogenic belts, the Appalachian and Ouachita (Pashin 1993). A platform or bank with clastic and carbonate tidal flats began in Kentucky and followed the orogenic belts into Alabama but thins rapidly to the southwest of this area (Chestnutt and Ettleson 1988 text fig. 4; Pashin 1993).

Moving outward from the tidal flat areas, the environment grades into the Bangor-Glen Dean formations sand belt that is a platform or bank which contains a lagoon and shoals areas, see figures 1 and 2. The lagoonal environments that contained the shoals created good conditions for crinoids and other echinoderms. Shoal type environments provided more stable substrates for crinoids stem attachment. In addition, shoals provide the necessary currents required for filter-feeding organisms see figure1. These areas tended to be of higher energy and have access to nutrients being carried up from deeper water. The crinoids living on these shoals would be controlled to some point by the wave base action from the open ocean. Fossil evidence from different types of deposits show that crinoids may have been present in more shallow areas such as intertidal zones and shallower portions of the lagoon. This occurs provided that enough water and nutrients were present to sustain life in shallower water. However, from fossil evidence crinoids appear more commonly in certain zones that provided the best combinations for entire crinoid banks to develop. Larger crinoids in particular would need some depth below the wave base where actions from waves couldn't smash them to bits or repeatedly tear them up. However, the fossil record reveals crinoids regenerated arms when this occurs, therefore, crinoids in a more rugged area are possible. So their best areas of existence in a certain place would constitute a balance of the all of the factors present (Chestnutt and Ettensohn 1999).

Outside of the Glen Dean-Bangor sand belt grades into the open marine areas of the Hartselle-Hardinsburg formations which contain various geologic materials from sandstones to shale's. Throughout this area barrier islands existed composed of units such as the Hartselle. These islands essentially were large sand bars as evidence from large sandstones of the Hartselle formation. In other cases these sands would simply create a sand bar below, keeping the open ocean from directly crashing into lagoon shoal areas and providing some level of protection, however, sand bars do migrate. It is evident from the units contained within the Bangor that influxes of shale and sand were relatively common in places. In other places no shale is present, yet the limestone is still highly fossiliferous with crinoid material but very massive in places as well (Thomas 1972 Tull 1980).

Stratigraphy of the Alabama Carbonate Platform

The Bangor limestone is Mississippian in age and part of the Chesterian series in northern Alabama. In the general area of this crinoid bank the Bangor overlies the Hartselle formation. Bangor limestone in much of Alabama is overlain by the Pennington fm, but towards the west in many places it is not present. In northwestern Alabama the lower Cretaceous gravels unconformably overlie the Bangor and towards the southwest of the Bangor limestone platform, where tongues of the Floyd shale become more common (Burdick 1982; Thomas 1972).

In Alabama, as described by Thomas (1972), "The Bangor Limestone is primarily a bioclastic limestone and oolitic limestone. Other constituents include micrite, shaly argillaceous limestone, calcerous clay shale, and in Northeast Alabama fine grained earthly dolostone." Included within the limestone are, "…small reef like masses of corals" that occur throughout the sequence. Oolitic and bio-clastic limestones with some shales inter-bedding dominate the area of the carbonate platform where crinoids have been found in Alabama. The massive oolitic limestones tend be at least fifty feet in thickness and contain the lots of reef-like coral masses. These limestones decrease in thickness toward the Warior basin in the west where the Floyd Parkwood formations are deposited. (Thomas 1972; Pashin 1993) According to Pashin (1993), "Southwestward thinning of the Bangor and passage of oolitic grainstone into wackestone and shale suggests that agitated environments of the platform were bordered on the southwest by a carbonate ramp where lower-energy biomicrite shale prevailed." Also deposits of paleo-sols in this area reveal island formation in the platform and show what Pashin describes as "shoaled bank rim" (Burdick 1982; Pashin 1993).

The Hartselle units have been described in places is as quartz arenite which means that it is almost made up entirely of quartz and probably beach sand. These deposits have also been responsible for off shore barrier islands in places thus helping to create the overall setting for the formation of this off shore crinoid bank. As the sea advanced towards these barrier islands the carbonate facies of the Bangor limestone were deposited. This carbonate platform and bank would create a substrate favorable for organisms requiring an environment in which calcium carbonate was present for the formation of shells and exoskeletons. The crinoid bank described here, is in the lower part of the Bangor and equivalent to the Glen Dean of Illinois and Indiana as noted from work by Horowitz and Butts (Smith 1967).

Crinoids in the Bank

Specimens preserved here reveal a fantastic preserved fauna in situ living position showing crinoids from immature to full size adults. Stem length reveals the longest stem encountered was five feet in length belonging to an *Onychocrinus pulaskiensis*. Numerous stems up to lengths of three feet were encountered throughout the entire excavation attached to *Onychocrinus*, and *Culmicrinus*. Though good specimens were not recovered of large *Phalcelocrinus*, they were present. The large stems of *Onychocrinus* in many cases provided a base for stems of other crinoids to wrap themselves around in particular inadunates and small camerate crinoids. The deposit also revealed that the crinoids were tiered in three to four layers. The larger *Onychocrinus*, *Culmicrinus*, *Phacelocrinus* and perhaps some of the *Aphelecrinus* made up the top layer. Next layer was composed of inadunates such as *Phanocrinus bellulus*, smaller *Aphelecrinus*, and immature crinoids of the top tier. The lower tiers would be composed of again smaller crinoids which didn't get large to begin with. Towards the substrate, the stems large siri are present and perfectly preserved which were used to anchor the specimens to the substrate. Siri are extremely fragile extensions extending from the more robust stem to assist in anchoring the crinoid. With the excellent preservation of the siri on so many specimens it only goes to reinforce the theory that this once prominent crinoid bank was buried very quickly.

Conclusion

The rock units here in Alabama show that the crinoids were living on this crinoid bank in a number of possible locations. Included in this would be crinoids living behind the barrier island complex in the lagoons in a somewhat shallower more protected positions, possibly limiting larger growth opportunity. Other deposits of this time frame in Kentucky Indiana and Illinois reveal crinoids of similar kinds and sizes, but these deposits reveal more agitation in deposition. Limitations such as agitation will limit the size of the crinoids to a certain extent and favors transportation of material including the fossils. This could also just be a factor of the fossil record and preservation. However, crinoids in at least one place of the Alabama crinoid bank are found in all sizes from immature to fully developed. These crinoids preserved and described here were killed off by an incursion of black micritic mud turned into soft shale 4 to 6 inches in thickness possibly brought up from depth by a large storm given the extensive network of preservation of crinoids in situ. This shale formed a seal thus preserving these fossils in situ as noted by the extensive network of attached stems to complete crinoid crowns that can be found. In addition, this mud incursion could have created an oxygen deficient condition making a more rapid burial possible thereby increasing preservation. Placement of this crinoid bank on this outer portion toward more open ocean would mean crinoids would have had the chance get larger with optimum conditions present. The seaward locality on this part Carbonate Platform in Northern Alabama probably represents the optimum conditions for crinoid development as well as preservation.

Sources

Burdick D.W. and Strimple H.L. 1982. Genevievian and Chesterian Crinoids of Alabama Geological Survey Bull. 121.

Bailey J.B. 2007. Outlines in Invertabrate Paleobilogy Lecture and Laboratory Notes Geology 330 Paleontology.

Bailey J.B.1978. Course and Laboratory Notes Paleoecology.

Chestnutt D.R. and Ettensohn F.R. 1988. Hombergian (Chesterian) Echinoderm Paleontology and Paleoecology, South-Central Kentucky Volume 95 Bull 330.

Hess H., Ausich W.I., Brett C.E., and Simms M.J. 1999. Fossil Crinoids Cambridge University Press.

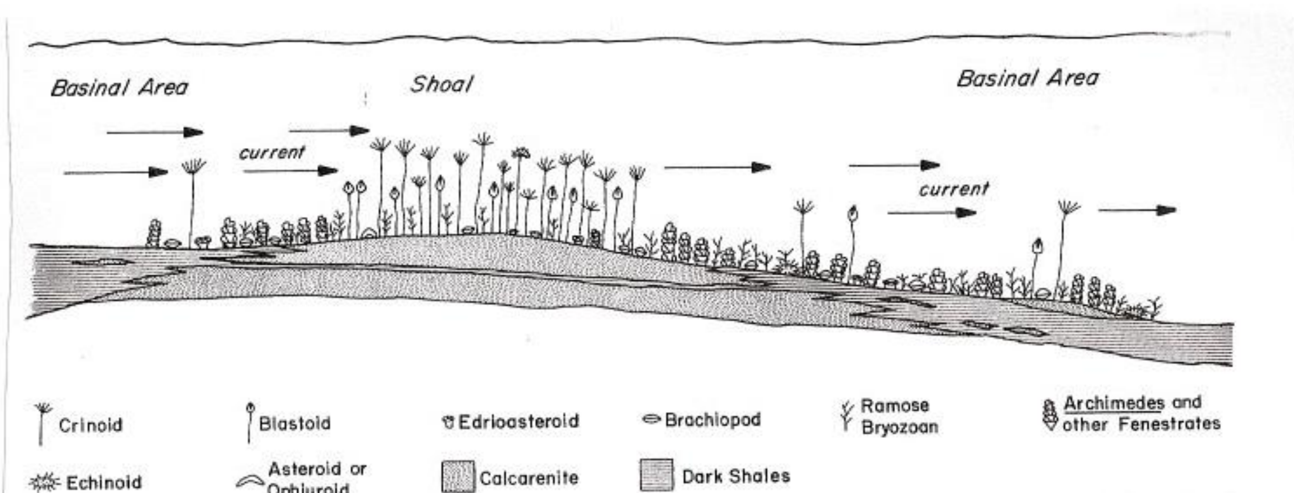
Pashin J.C. 1993. New Perspectives on the Mississippian System of Alabama, Alabama Geological Survey.

Seeley 1985. Ancient sedimentary Environments 3rd Edition Cornell University Press.

Smith W.E. 1967. A Field Guide to Mississippian Sediments in northern Alabama and south central Tennessee.

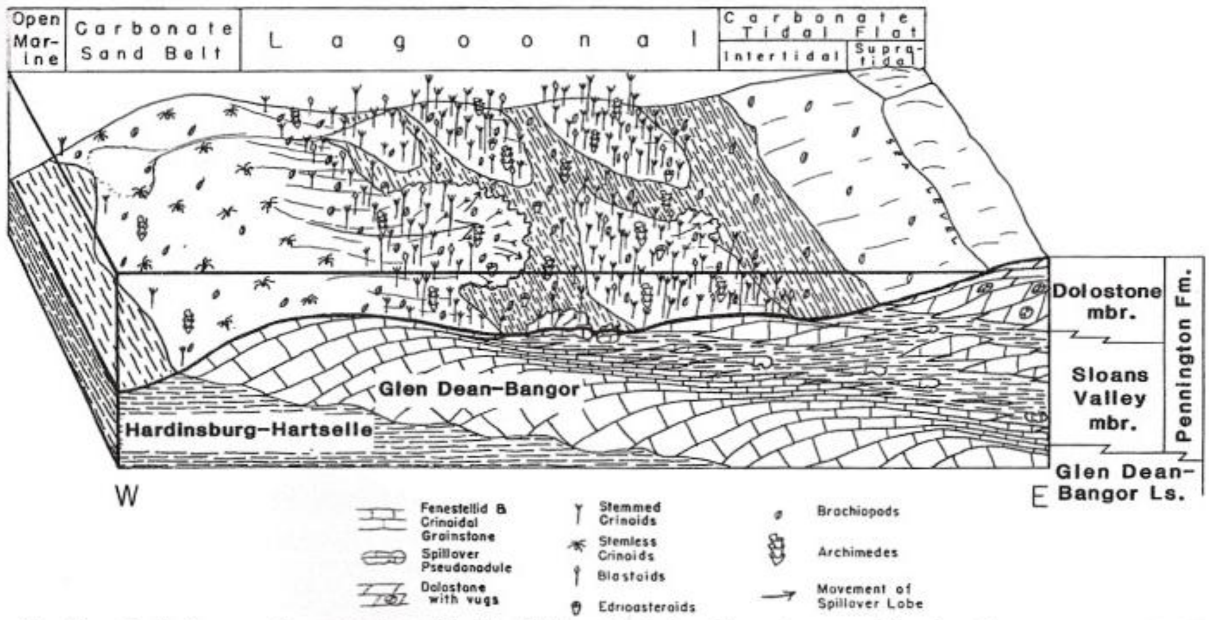
Thomas W.A. 1972. Mississippian Stratigraphy of Alabama Geological Survey of Alabama Monograph 12.

Tull J. F. 1980. Field Trips for the Southeast Section of the Geological Society of America.



Text-figure 9.—Schematic reconstruction of carbonate shoals and nearby muddy basinal areas in the Sloans Valley lagoon showing inferred stratification of suspension feeders and relative positions of common organisms on and near shoals.

Figure 1 Chestnutt D.R. Ettensohn F.R., 1988



Text-figure 6.—Environmental reconstruction of the late Middle and early Late Chesterian progradational continuum represented by the sequence of units from the Hartselle–Hardinsburg through the dolostone member of the Pennington Formation in south-central Kentucky.

Figure 2 Chestnutt D.R. Ettensohn F.R., 1988.

Onychocrinus pulaskiensis

Phanocrinus bellulus ***Zeacrinites sp.***

The Crew: Larry, Tom, Carol, Wendy, Dennis The crew working preparing specimens

(Editor's Note: This paper is reprinted in a modified version from MAPS Digest EXPO XXXI Edition, 2009.)

EURYPTERID BED (Williamsville 'A' Waterlime) WITH TRACE FOSSILS

Samuel J. Ciurca, Jr., Rochester, New York

For over 50 years, quarries in Fort Erie, Ontario, Canada (formerly Bertie Township) have provided collectors with an assortment of wonderful fossil arthropods, especially eurypterids. The quarry on the north side of Bridge Street (RQN) yielded many eurypterid specimens in previous years and is now filled in. On the south side of Bridge Street is the currently active Ridgemount Quarry South (RQS). For some little-understood reason, the region has a phenomenal concentration of fossil remains (molts, disarticulated portions and pieces, and other fossils like cephalopods, gastropods, phyllocarids and rare brachiopods). A recent photo of the quarry floor, at the level of one eurypterid horizon, accompanies this brief article.

Among the rarest of fossils collected at this site (RQS) are trace fossils interpreted to be produced by the swimming legs of a eurypterid, presumably by the most abundant eurypterid found there, viz. *Eurypterus lacustris*. The traces were originally described briefly by Ciurca in 2002, but are better understood now by the recent research of Vrazo and Ciurca (2017) who described them (and recently discovered similar structures from a quarry in Pennsylvania). Vrazo and Ciurca created a new ichnogenus and ichnospecies, *Arcuites bertiensis*, for the traces.

The rarity of the trace fossils is confirmed by previous exploration of over 50 sites across western New York and Ontario during a period of about 50 years - sites yielding eurypterids, but no traces of *Arcuites*. The most likely place they will show up again is the same quarry (RQS) if operations expose more of the eurypterid bed. The bed (Williamsville 'A' Waterlime) is 18 inches thick and the trace fossil horizon is an extremely thin bedding plane found just a few inches below the top of the unit. For a chart showing the strata of the Bertie Group, see Nudds and Selden (2008, page 76).

Added Note: All specimens of *Arcuites bertiensis* retrieved were donated to the Peabody Museum of Natural History in New Haven, Connecticut.

REFERENCES

Ciurca, S.J.Jr. 2002. A new trace fossil horizon within the late Silurian, eurypterid-bearing Bertie Group in Ontario, Canada. MAPS Digest, 25 (EXPO XXIV edition), 52-56.

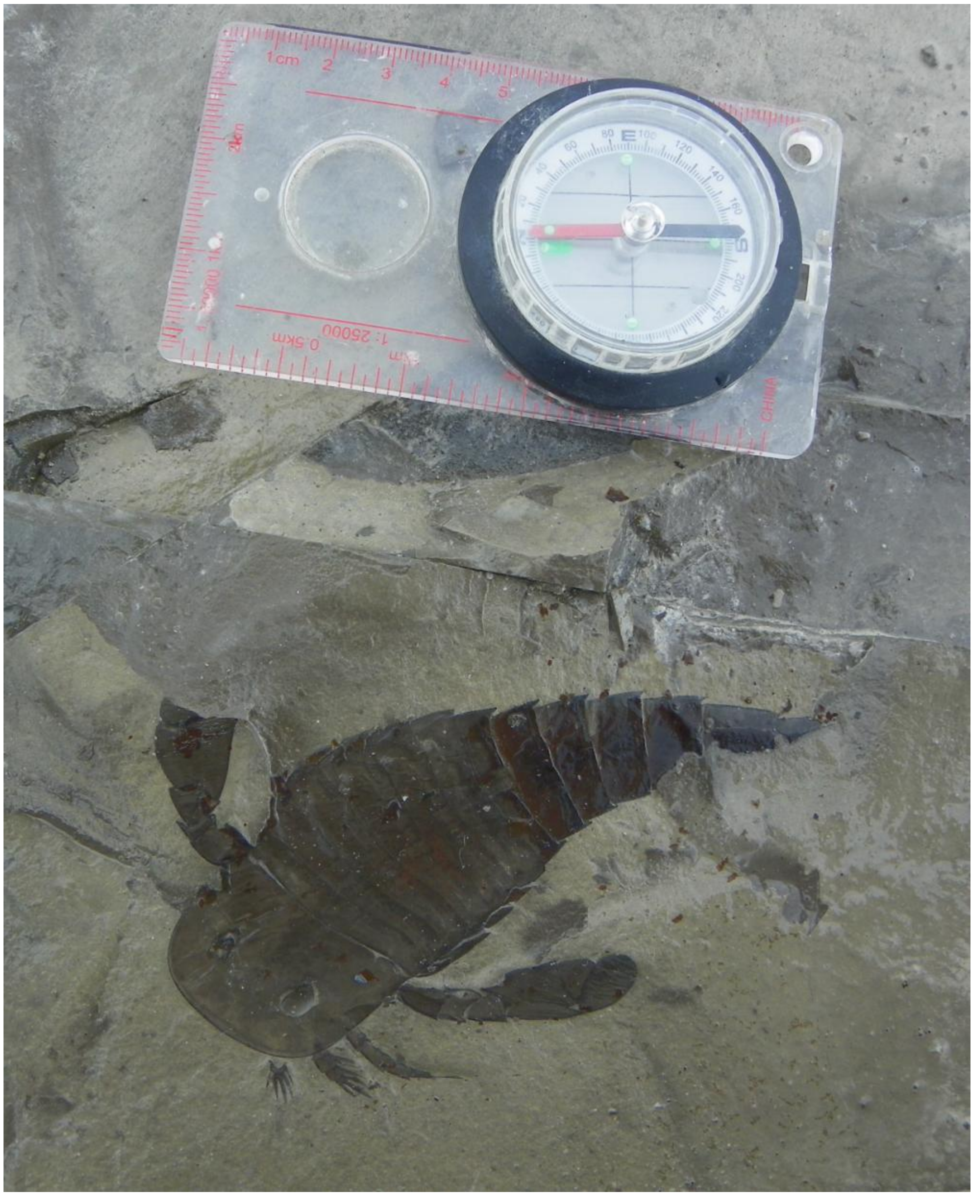
Ciurca, S.J.Jr. 1990. Eurypterid biofacies of the Silurian-Devonian evaporite sequence: Niagara Peninsula, Ontario, Canada and New York State D1-D23. In Lash, G.G. (ed.), New York State Geological Association Guidebooks, Field Trips, 62nd Annual Meeting.

Ciurca, S.J.Jr. 2010. EURYPTERIDS ILLUSTRATED (ISBN 9781450726566) 30 pp.

Vrazo, M.B., Troop, J.M., and Brett, C.E. 2014. A new eurypterid Lagerstatte from the upper Silurian of Pennsylvania. Palaios, 29, 431-448.

Vrazo, M.B. and Ciurca, S.J.Jr. 2017. New trace fossil evidence for eurypterid swimming behaviour, Palaeontology, 2017, pp. 1-18.

Nudds, J.R. and Selden, P.A. 2008. Fossil Ecosystems of North America, University of Chicago Press, 288 pp.



An example of the eurypterid, *Eurypterus lacustris* in situ in the quarry floor.

(Editor's Note: This paper is a follow-up to a paper published in MAPS Digest EXPO XXIV Edition, 2002.)

The **M**id-**A**merica **P**aleontology **S**ociety (MAPS) was formed to promote popular interest in the subject of paleontology; to encourage the proper collecting, study, preparation, and display of fossil material; and to assist other individuals, groups, and institutions interested in the various aspects of paleontology. It is a non-profit society incorporated under the laws of the State of Iowa.

Membership in MAPS is open to anyone, anywhere who is sincerely interested in fossils and the aims of the Society.

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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.

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