M·A·P·S Digest

Official Publication of
<u>M</u>id-<u>A</u>merica <u>P</u>aleontology <u>S</u>ociety
http://www.midamericapaleo.org

Volume 40, Number 1
Jan.-Mar., 2017

"A LOVE OF FOSSILS BRINGS US TOGETHER"

Calendar

2016

January 14
The January MAPS meeting will be held in Room 125 of Trowbridge Hall, Univ. of Iowa.
MAPS member John Catalani will present the program: "An Ordovician Konzentrat-Lagerstätte: The Dixon Mifflin Residuum Fauna" at 1:00 p.m.
The regular MAPS meeting will be at 2:00 p.m.

2017

March 25-26
CVRMS Gem, Mineral, and Fossil Show
Location: Hawkeye Downs, Cedar Rapids

March 31-April 2
MAPS EXPO XXXIX
Location: Sharpless Auctions
Exit 249 I-80
Iowa City, Iowa
Theme: Silurian Period
Keynote Speaker: Dr. Carlton Brett
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 **2017 EXPO** is the **Silurian Period**. Any paper dealing with Silurian 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 2017**. Diagrams/Photos can be sent separately or imbedded in text.

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

DUES INFO

Please send your $20 2017 MAPS dues to:

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

About the Cover

Unknown phyllocarid collected from the Welton Member of the Scotch Grove Formation (Silurian) at the Shaffton Quarry, near Camanche, Iowa, by the late Tom Walsh and donated to the UI Paleontology Repository by Peggy Walsh, with the help of the Cedar Valley Rocks and Minerals Society. Photo provided by Tiffany Adrain.

The First Land-Walkers: Mystery Solved

Kenneth Gass (kennethgass@gmail.com)

Something was walking around on the beaches five hundred million years ago. Fossilized trackways first described in the mid-1800s from Cambrian beach deposits in Quebec and given the name *Protichnites* (Greek for "first footprints") provided the evidence (Owen, 1851; Owen, 1852). Body fossils of the potential trackway-makers remained unknown for over 150 years, but candidates finally revealed themselves in Cambrian beach deposits of Blackberry Hill, Wisconsin, and a few years later in equivalent strata of the Potsdam Group in Quebec (Collette & Hagadorn, 2010). These animals were species of an extinct group of mandibulate arthropods known as euthycarcinoids, but further evidence was needed to link those animals to the trackways. This article reveals the evidence that essentially puts this mystery to rest and shows what other animals may have joined the euthycarcinoids as they began this groundbreaking transition onto land.

All fossil specimens shown in this article were collected at Blackberry Hill, Wisconsin, Elk Mound Group, Middle to Late Cambrian. The specimen number prefix "PRI" signifies the repository, Paleontological Research Institution. Unless otherwise indicated, all photographs were taken by the author.

Subaerial or subaqueous: How can we tell? −
Determining whether trace fossils were formed subaqueously (i.e., under water) or subaerially (i.e., on land, but literally under air) is not an easy task. This is especially true when we are dealing with intertidal and supratidal deposits---that is, those from the region between high and low tide, and above the high tide level, respectively. Tracks from the intertidal zone may have been produced either subaqueously or subaerially, depending on the height of the tide when the animals made the tracks. Footprints found in the supratidal zone were probably formed subaerially; however, whether a particular rock exposure was deposited in the supratidal zone or just below it is often unclear. The presence of ripple marks from waves and water currents obviously indicates a subaqueous environment, but these often remain intact after the tide recedes, and are therefore not of much value in judging whether associated footprints were produced during periods of submersion or after the tide had receded. Similarly, raindrop impressions are only known from subaerial environments but do not clearly indicate whether associated footprints were made before, during or after the rain.

In spite of these difficulties, the extreme depth of many of the surface traces at Blackberry Hill (which would not be found in an aqueous environment due to the effects of buoyancy) (Hoxie, 2005, p. 42; Seilacher, 2008, p. 256), plus the presence of *Protichnites* in coastal dune deposits of similar age (MacNaughton et al., 2002; Hagadorn, Collette & Belt, 2011, p. 314) and experimental evidence (Collette, Gass & Hagadorn, 2012, p. 445) has led to a common consensus among paleontologists of a likely subaerial origin of many of these traces.

The smoking gun − *Protichnites eremita* Hagadorn & Seilacher, 2009 is a distinctive trackway from Blackberry Hill that had a row of medial imprints between its two rows of footprints. These medial imprints were tilted to the left, each resembling a forward slash (/). Their arrangement was similar to that of shingles on a roof. The best-preserved examples show up to six right-tilted segments on each medial imprint. A smaller notch is usually present next to each of these medial imprints (FIGURE 1). To account for this peculiar combination of characters, Hagadorn and Seilacher tentatively attributed this trace to hermit behavior, whereby a scorpion-like arthropod inserted its upwardly-curving tail into a dextrally-coiled snail shell and touched the shell to the sediment as it walked, thus producing all of the peculiarities of *Protichnites eremita*—even the left-shingled medial imprints with right-tilted segments. The specific name "*eremita*" is Latin for "hermit." This explanation also provided a mechanism for the animal to withstand the dehydrating effects of a subaerial environment in the form of a humid chamber. Where this theory ran into difficulty was that, as those authors indicated, no fossils of high-spired snail shells large enough to have made the shingled medial imprints have been found in these or any other Cambrian rocks. Such snails had apparently not yet evolved.

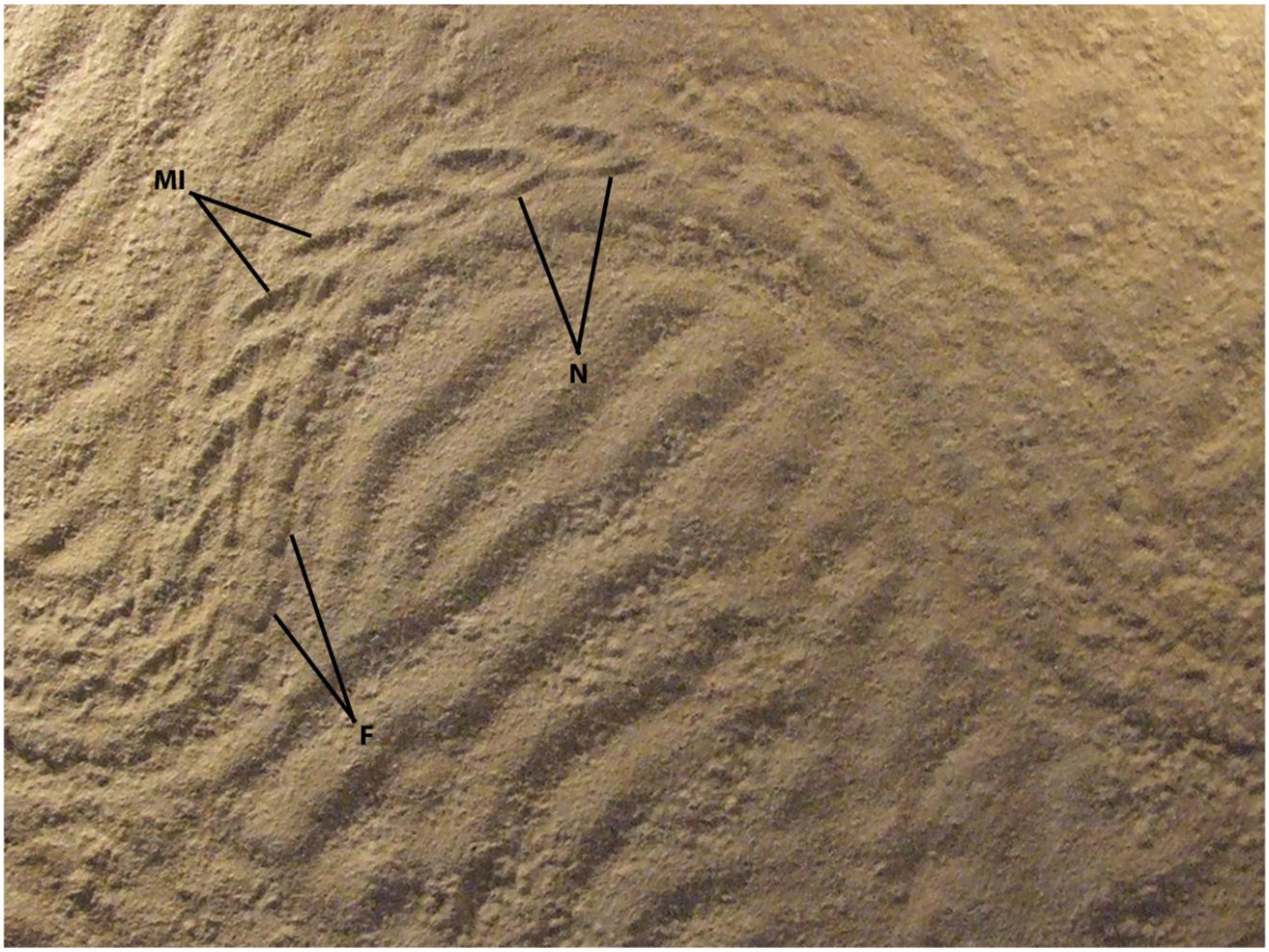

FIGURE 1. Portion of holotype of *Protichnites eremita* Form 1 on a ripple-marked surface covered by microbially mediated domal sand structures. Note the left-shingled medial imprints (MI) each with right-tilted segments and the notch (N) next to each medial imprint. Obscure footprints (F) can be seen intermittently along the shallow trough located along either side of the row of medial imprints. The trackway is ~11 cm wide. YPM IP 204961. Courtesy of the Division of Invertebrate Paleontology, Peabody Museum of Natural History, Yale University; Peabody.yale.edu. Photographed by Susan Butts. This slab was donated to the Peabody by Adolf Seilacher.

Before Hagadorn and Seilacher's article went to press, a fossil was discovered that would eventually not only overturn the hermit theory, but more importantly reveal the identity of the *Protichnites*-maker itself (Collette, Gass & Hagadorn, 2012, p. 443; Gass, 2013a; Mángano & Buatois, 2015, p. 161; Gass, 2015, p. 76). This fossil, from the same Blackberry Hill locality where all of the *Protichnites eremita* and all of the Wisconsin euthycarcinoid specimens were found essentially shows the medial furrow of a typical *Protichnites* morphing into *Protichnites eremita*'s shingled medial imprints (but in this case the shingling is only present where the animal was making a sharp right turn), complete with a similar number of right-tilted segments (FIGURE 2). This fossil shows that a snail shell was not required to make *Protichnites eremita*. It was further observed that the form and number of segments of these medial imprints are consistent with what would be expected of imprints from the tail portion of *Mosineia macnaughtoni* Collette & Hagadorn, 2010, which is the euthycarcinoid from Blackberry Hill (FIGURE 3). The smoking gun (or, as I prefer to call it, "The Rosetta stone of Blackberry Hill") had been found!

Mating behavior? − In 2012 Joseph Collette, James Hagadorn, and I published this find, designating the form *Protichnites eremita* Form 2, and referring to the original form of Hagadorn and Seilacher as Form 1. We also suggested that the notch present next to each medial imprint of Form 1 could be the impression of the tail of the smaller male, whereby the trackway is actually a composite from the male and female traveling together while mating in a manner similar to that of present-day horseshoe crabs. We suggested that the shingling of the medial imprints may have been from the female's tail being held to the side, perhaps to avoid interfering with external fertilization. This shingling may have thus served as a reproductive advantage. A tendency to favor the left side is not unknown in the Arthropoda. Buthid scorpions frequently lay their tails to the side when at rest or walking slowly (email to author from David Sissom, 23 March, 2010), and there appears to be a slight preference for the left side (Stahnke, 1966, fig. 6; Collette et al., 2012, p. 451). This interpretation of *Protichnites eremita*, if accurate, would indicate mating to be a motive for making these early excursions out of the sea.

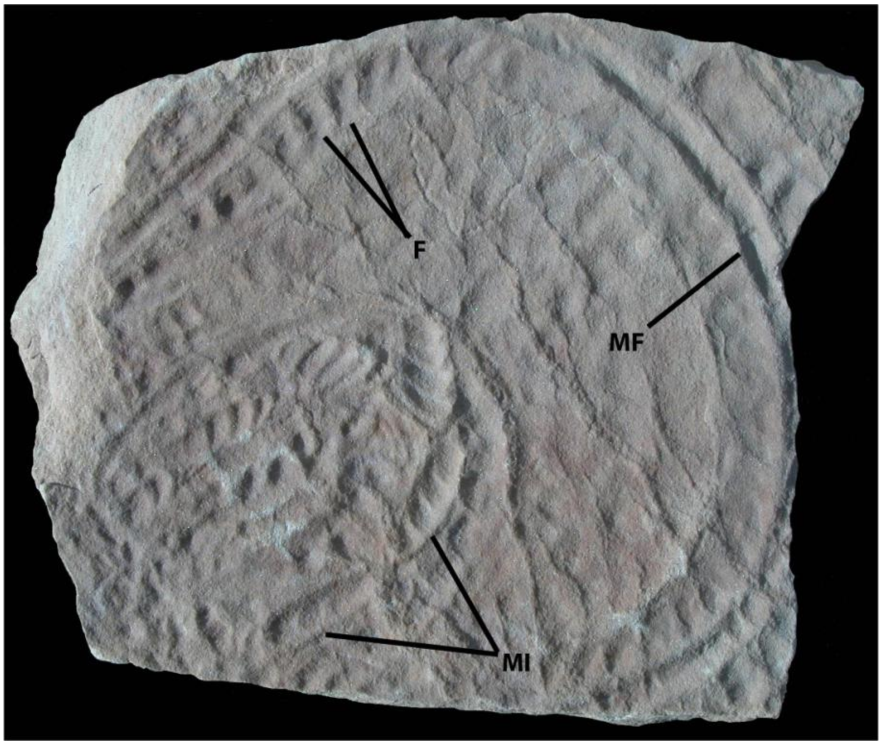

FIGURE 2. Sometimes referred to as the Rosetta stone of Blackberry Hill, this slab shows spiraling *Protichnites eremita* Form 2 on a wrinkle-textured microbial mat. Note the continuous medial furrow (MF) and dimple-shaped footprints (F) as the animal traveled in a broad arc in a clockwise direction. Note also the smeared shape, left-shingled alignment, and right-tilted segments of the tail imprints (MI) after the animal spiraled inward and negotiated the sharp right turn near the center of the photograph. The slab is ~29 cm wide along the bottom edge. Specimen number PRI 10143. Photograph courtesy of Joseph Collette.

FIGURE 3. One of the three known specimens of the euthycarcinoid *Mosineia macnaughtoni* showing seven pairs of appendages on its preabdomen and five (six?) segments on its postabdomen (tail). A tapering telson is obscurely preserved behind the last tail segment. Specimen number PRI 10145.

Experimental evidence − Discovering Form 2 was unquestionably a major breakthrough in determining the identity of the first animals to walk on land, as was discovering the body fossils themselves. But why end the proof there when we now have a way to test the hypothesis? Perhaps a series of experiments could help solidify the association and explain the tilting of the segments. With that in mind, Joe Collette and I ran experiments in which we used a model of the tail of *Mosineia* to try to duplicate the medial imprints of both forms of *Protichnites eremita* in a tub of sand. To our delight, by using a combination of simple movements of the model (essentially dragging, bouncing and turning), we were able to duplicate all of the varieties of the medial markings of *Protichnites* that we attempted, with all of their peculiarities, including the left-shingled medial imprints each with up to six right-tilted segments (Collette et al., 2012, p. 445; Dunlop, Scholtz, & Selden, 2013, p. 421; FIGURE 4). Based on the evidence provided by these fossils and experiments, there is little doubt that these Cambrian *Protichnites* were made by euthycarcinoids (Krapovickas et al., 2016, p. 71; Lozano-Fernandez et al., 2016, p. 3; FIGURE 5).

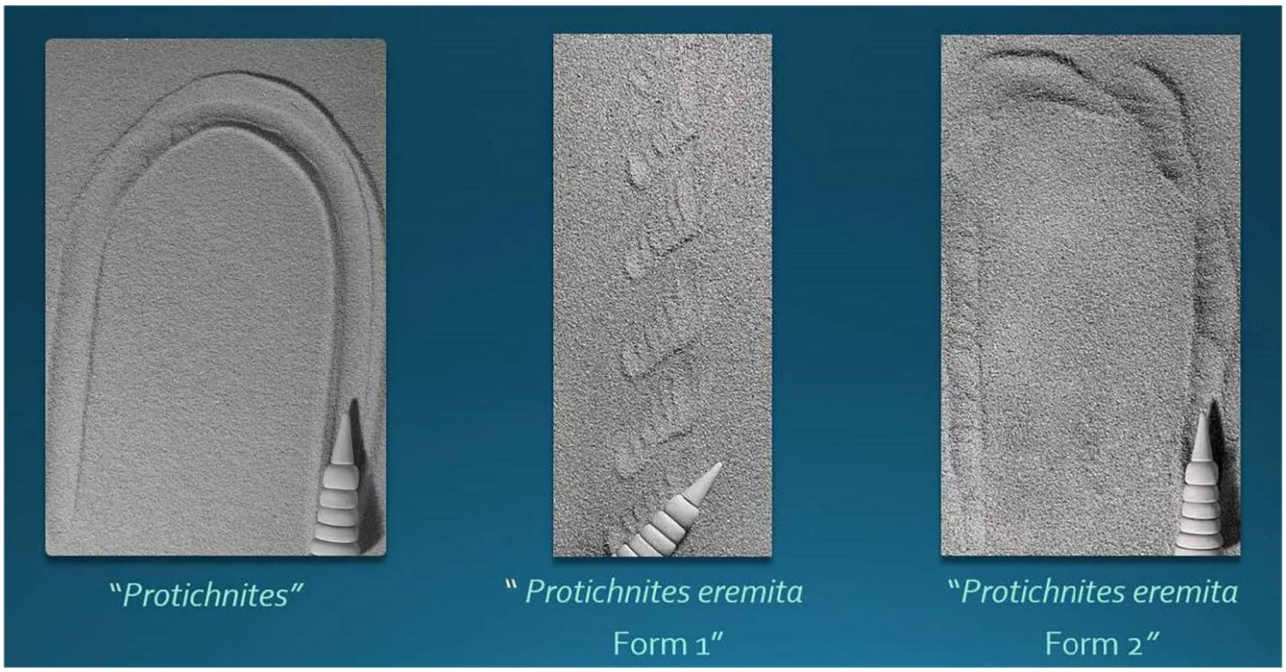

FIGURE 4. Selected experimental results showing traces made with a model of the tail of *Mosineia macnaughtoni*. As shown, the key features of the medial markings of a "conventional" *Protichnites*, *P. eremita* Form 1, and *P. eremita* Form 2 were successfully duplicated. Photographs courtesy of Joseph Collette.

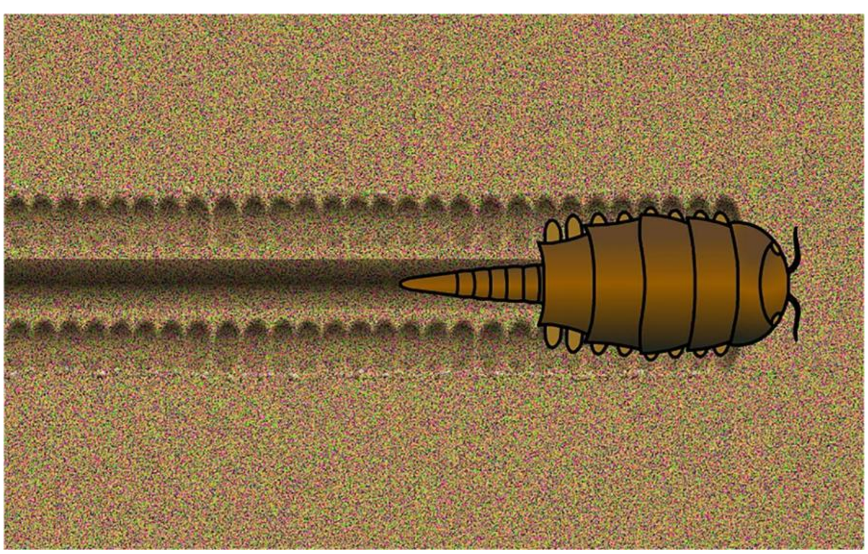

FIGURE 5. Conceptual drawing of the euthycarcinoid *Mosineia macnaughtoni* making *Protichnites* on a tidal flat. Some features are inferred based on a fossil of a resting trace attributed to this species and general features of other euthycarcinoids. The animal was about 5 in (13 cm) long. Drawn by Todd Gass.

Playing at the water's edge − Euthycarcinoids were not the only arthropods that appear to have spent some of their time on these ancient beaches. Fossils of another species from Blackberry Hill, *Arenosicaris inflata* Collette & Hagadorn, 2010, turned up unexpectedly in the intertidal deposits. This burrowing species was a phyllocarid crustacean and the oldest phyllocarid on record. Like the euthycarcinoids, phyllocarids had a mandible (although fossils of this structure have not been found yet for this particular species), carapace, and segmented tail (FIGURE 6). The bilobate resting trace *Rusophycus,* the bilobate crawling trail *Aulichnites,* and bilobate burrows resembling *Cruziana* have been found near or associated with these arthropods. Absent from coastal dune deposits, these body and associated trace fossils indicate that the animal may not have traveled as far from the water as did the euthycarcinoids. Phyllocarids survive in today's oceans, but most existing species are pelagic (i.e., free-swimming).

FIGURE 6. Splayed carapace (left) and exoskeleton (right) of the phyllocarid crustacean *Arenosicaris inflata*. The exoskeleton preserves some of the appendages, the abdomen, and the outline of the carapace; the telson is not preserved. Specimen number PRI 10133.

FIGURE 7. These "tire tracks," *Climactichnites wilsoni*, on a ripple-marked surface, were probably made by a giant slug-like animal such as a mollusk. The rounded structures are identified as the infillings of stranded (i.e., beached) scyphozoans (jellyfish).

Slime eaters? − Often occurring on the same surfaces with *Protichnites* are trackways resembling something between ladders and motorcycle tracks (Gass, 2013b). These are *Climactichnites wilsoni* Logan, 1860 (Getty & Hagadorn, 2008; FIGURE 7). While the evidence for a subaerial origin of these traces is not as strong as for *Protichnites*, the sharpness and relief of various specimens indicate that some *Climactichnites* may have been produced on land (Seilacher, 2008a, p. 42; Getty & Hagadorn, 2009, pp. 768-769). Body fossils of the animal that made this trace remain to be found. The absence of any footprints or traces from hard parts or a tail, the oval shape of resting traces sometimes found at the beginning of the trackway, and the depth of the trackways lead most authorities to conclude that the maker of *Climactichnites* was probably a soft-bodied, shellless, legless, tailless, elongated, flattened, giant slug-like animal, and possibly a mollusk (Yochelson & Fedonkin, 1993, p. 68; Getty & Hagadorn, 2009, p. 764; FIGURE 8). The presence of structures interpreted to be microbial mats on most of the surfaces on which this trace fossil is found and the meandering paths of the trackways suggest that the animals may have been feeding on this material (Seilacher & Hagadorn, 2010, p. 565). This would indicate a possible motive for coming ashore, being consistent with the events leading up to that point in Earth's history. It is generally agreed that microbial mats (i.e., layered structures consisting of sediment bound together by cyanobacteria and bacteria), which had been so abundant on the Precambrian seafloors and probably were a source of food, were greatly reduced with the introduction of a more mobile Cambrian fauna. In fact this change in substrate conditions was so dramatic that some researchers refer to it as the Cambrian Substrate Revolution (Bottjer, Hagadorn, & Dornbos, 2000). But those animals wishing to exploit a fresh microbial mat source needed only to leave the water. Microbial mats had already been flourishing on the seashores for hundreds of millions of years (Prave, 2002, p. 811), untouched by animal life. Not only might these mats and other microbial materials have provided a reason for this migration onto land, they may also help explain the exquisite preservation of these trace fossils, due to the fibrous structure of microbial mats and the "bioglue" properties of certain microbes that can bind the sediment particles together (Seilacher, 2008b, p. 255; FIGURE 9).

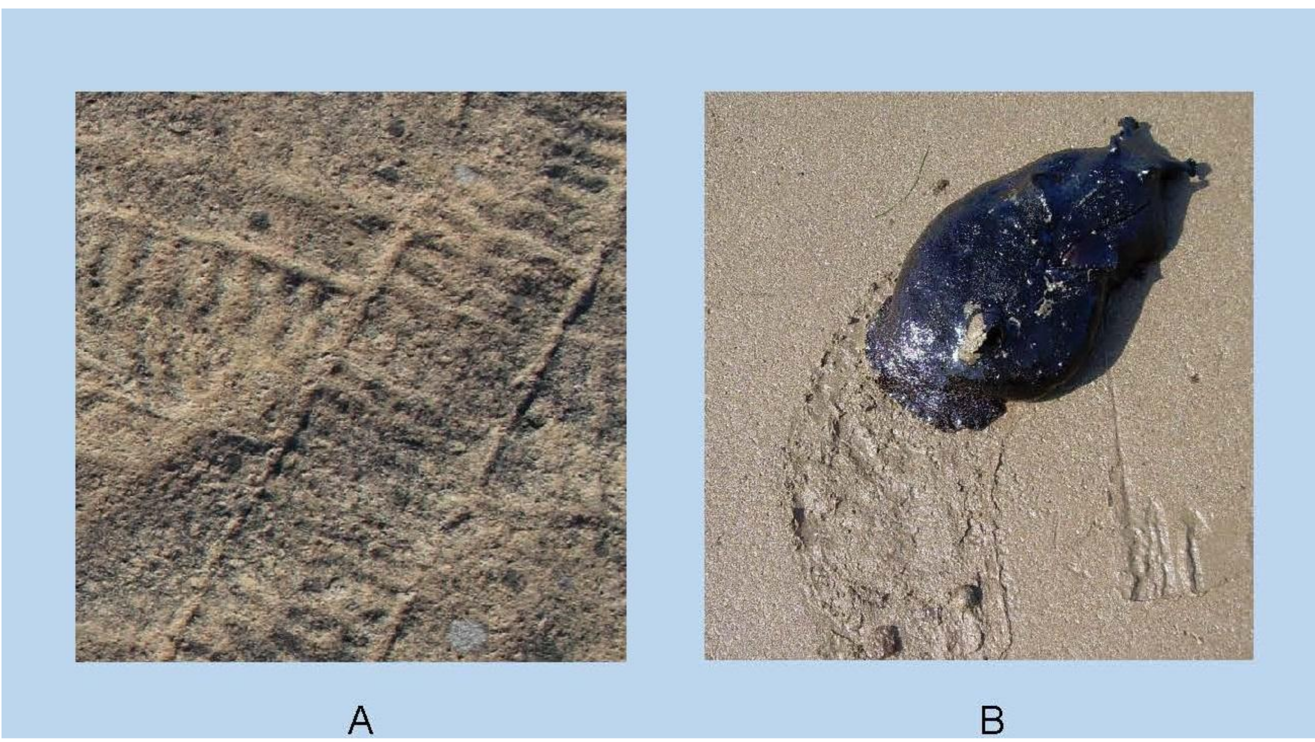

FIGURE 8. *A*, the trackway *Climactichnites wilsoni*. *B*, a modern analogue of the animal that may have made *Climactichnites*; this specimen, a black sea hare (*Aplysia*), is shown only to illustrate the general form and size (around one foot long) of the trackway-maker suggested by the fossil evidence.

Conclusion

The discoveries made in recent years have been, perhaps more than any other period in history, instrumental in our identification of the first animals to walk on land since the discovery of *Protichnites*. They serve as the last major pieces of evidence in the mystery that began in the mid-1800s. We can now say with some degree of confidence that certain euthycarcinoids and possibly a phyllocarid walked on land in the Cambrian Period, and we know of no other animals that did so earlier than this. "Molecular clock" evidence suggests that myriapods may have gone back to early Cambrian times (Lozano-Fernandez et al., 2016, p. 4), but fossil evidence for this is still lacking, and it is uncertain whether those myriapods were terrestrial. In addition, the Cambrian tidal flat fossils discussed above also suggest that an unidentified slug-like animal may have been moving about on the same beaches, but, because they were apparently legless, it may not be appropriate to say that they were walking.

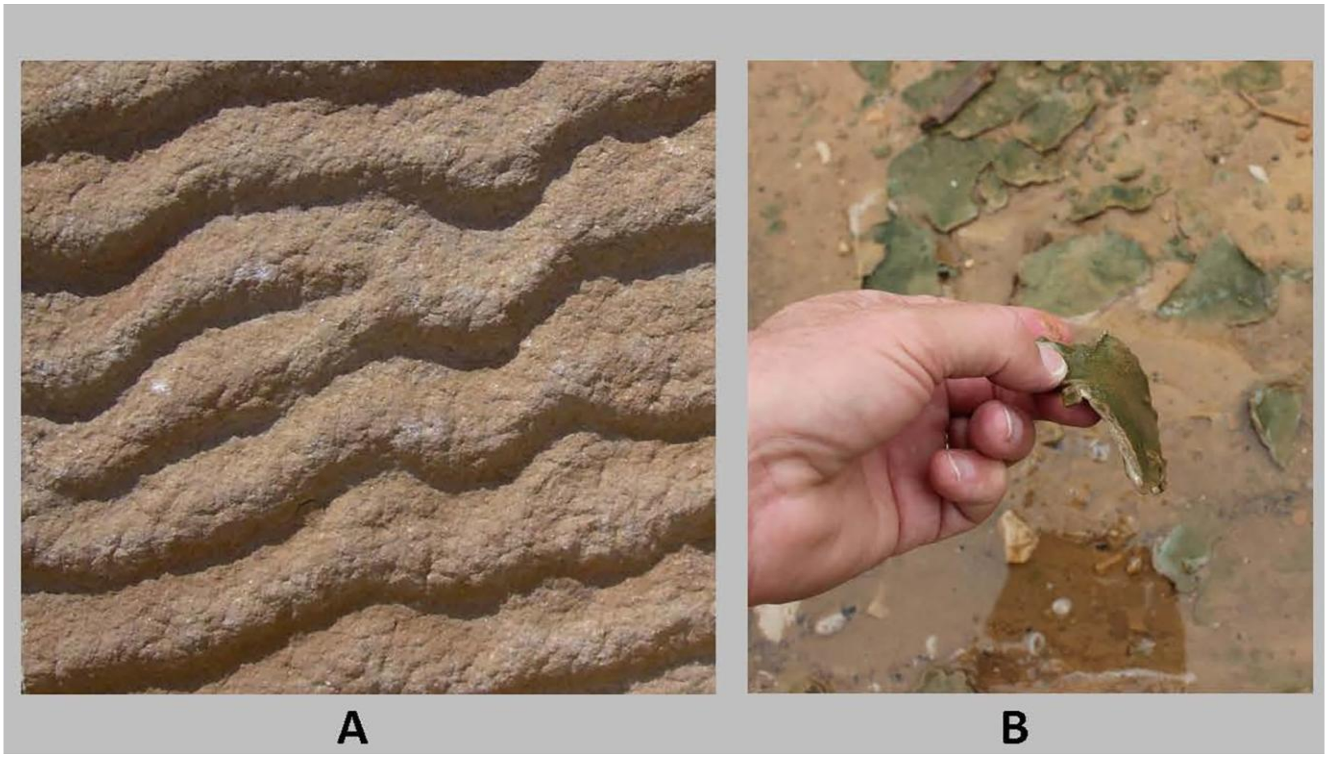

FIGURE 9. *A*, ripple-marked surface blanketed with textured microbial mat. *B*, modern-day microbial mat; its flexible, fibrous structure and “bioglue” properties bind sand particles together and thus may help explain the spectacular preservation of many of the traces from the Cambrian tidal flats. These and other microbially-mediated sedimentary structures may also have been a source of nourishment for the early land-goers, which may have been what drew some of them ashore.

These discoveries should also put to rest some misleading headlines in the popular media---made not by the authors of the taxa but by the media in order to capture interest. Those newspapers, science and nature magazines, and on-line sources refer to certain post-Cambrian animals as being the first animals to walk on land. They often refer to the myriapod *Pneumodesmus newmani* Wilson & Anderson, 2004, which was possibly one of the first **fully terrestrial** animals to walk on land, or to the Devonian tetrapod-like fish *Tiktaalik roseae* Daeschler, Shubin, & Jenkins, 2006, which may have been the first **vertebrate** to walk on land. But euthycarcinoids were clearly animals, and there is strong evidence that some of them were walking on land many millions of years before *Pneumodesmus* and *Tiktaalik*. Being fully terrestrial, air-breathing, a vertebrate, or in Man’s line of descent is not a prerequisite for being the first animal to walk on land. Until associated body fossils of other animals are discovered in rocks older than the euthycarcinoid-bearing strata described above, the honor of “first animals to walk on land” goes to Cambrian arthropods, and most likely, the euthycarcinoids.

As the first groups of animals that appear to have ventured out of the seas, even if only as temporary visitors, these Cambrian animals apparently began the animal terrestrialization process that symbolically paved the way for the later land invasions that ultimately led to every living creature we see around us.

Acknowledgments

Todd Gass discovered the "Rosetta stone," took several of the photographs, and drew the figures. Susan Butts (Yale Peabody Museum) and Joseph Collette (Minot State University) permitted me to use the indicated photographs. Gregory Dietl and Leslie Skibinski (Paleontological Research Institution) allowed me to photograph specimens in their care. Figures 3,5, and 6 were originally published in my book, *Solving the Mystery of the First Animals on Land: The Fossils of Blackberry Hill*. Siri Scientific Press (http://siriscientificpress.co.uk/) permitted me to use those photographs in the present article. The Krukowski and Nemke families permitted me to do field work on their private property. Greg Edgecombe (Natural History Museum, London) read a portion of the manuscript. Joshua Gass assisted in the field. I thank them all.

References

Bottjer, D., Hagadorn, J., & Dornbos, S. (2000). The Cambrian substrate revolution. *GSA Today*, 10(9), 1-7.

Collette, J. & Hagadorn, J. (2010). Three-dimensionally preserved arthropods from Cambrian Lagerstatten of Quebec and Wisconsin. *Journal of Paleontology*, 84(4), 646-667.

Collette, J., Gass, K., & Hagadorn, J. (2012). *Protichnites eremita* unshelled? Experimental model-based neoichnology and new evidence for a euthycarcinoid affinity for this ichnospecies. *Journal of Paleontology*, 86(3), 442-454.

Daeschler, E., Shubin, N., & Jenkins, F. (2006). A Devonian tetrapod-like fish and the evolution of the tetrapod body plan. *Nature*, 440, 757-763.

Dunlop, J., Scholtz, G., & Selden, P. (2013). Water-to-land transitions. In A. Minelli, G. Boxshall, & G. Fusco (Eds.). *Arthropod biology and evolution: Molecules, development, Morphology* (pp. 417-439). New York: Springer.

Gass, K. (2013a). A new look at the first footprints on land. In *This view of life.* Retrieved March 20, 2016, from https://evolution-institute.org/article/a-new-look-at-the-first-footprints-on-land/?source=tvol

Gass, K. (2013b). Columbus was five hundred million years late. In *This view of life*. Retrieved March 20, 2016, from https://evolution-institute.org/article/columbus-was-five-hundred-million-years-late/?source=tvol

Gass, K. (2015). *Solving the mystery of the first animals on land: The fossils of Blackberry Hill*. Manchester, UK: Siri Scientific Press.

Getty, P. & Hagadorn, J. (2008). Reinterpretation of *Climactichnites* Logan 1860 to include subsurface burrows, and erection of *Musculopodus* for resting traces of the trailmaker. *Journal of Paleontology*, 82(6), 1161-1172.

Getty, P. & Hagadorn, J. (2009). Palaeobiology of the *Climactichnites* tracemaker. *Palaeontology*, 52(4), 753-778.

Hagadorn, J., Collette, J., & Belt, E. (2011). Eolian-aquatic deposits and faunas of the Middle Cambrian Potsdam Group. *Palaios*, 26(5), 314-334.

Hagadorn, J. & Seilacher, A. (2009). Hermit arthropods 500 million years ago? *Geology*, 37.295-298.

Krapovickas, V., Mangano, M., Buatois, L., & Mariscano, C. (2016). Integrated ichnofacies models for deserts: Recurrent patterns and megatrends. *Earth-Science Reviews*, 157, 61-85.

Lozano-Fernandez, J., Carton, R., Tanner, A., Puttick, M., Blaxter, M., Vinther, J., Olesen, J., Giribet, G., Edgecombe, G., & Pisani, D. (2016). A molecular palaeobiological exploration of arthropod terrestrialization. *Philosophical Transactions of the Royal Society B*, 371, 1-12.

MacNaughton, R., Cole, J., Dalrymple, R., Braddy, S., Briggs, D., & Lukie, D. (2002). First steps on land: Arthropod trackways in Cambrian-Ordovician eolian sandstone, southeastern Ontario, Canada. *Geology*, 30, 391-394.

Mángano, M, & Buatois, L. (2015). The trace fossil record of tidal flats through the Phanerozoic: Evolutionary innovations and faunal turnover. In D. McIlroy (Ed.). *ICHNOLOGY: Papers from ICHNIA III*. Geological Association of Canada, Miscellaneous Publication 9, pp. 157-177.

Owen, R. (1851). Descriptions of the impressions on the Potsdam Sandstone, discovered by Mr. Logan in Lower Canada. *Geological Society of London Quarterly Journal*, 7, 250-252.

Owen, R. (1852). Description of the impressions and footprints of the *Protichnites* from the Potsdam Sandstone of Canada. *Geological Society of London Quarterly Journal*, 8, 214–225.

Prave, A. (2002). Life on land in the Proterozoic: Evidence from the Torrodonian rocks of Northwest Scotland. *Geology*, 30, 811-814.

Seilacher, A. (2008a). *Fossil art: An exhibition of the Geologisches Institut, Tubingen University, Germany*. Laasby, Denmark: CBM Publishing.

Seilacher, A. (2008b). Biomats, biofilms, and bioglue as preservational agents for arthropod trackways. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 270, 252-257.

Seilacher, A. & Hagadorn, J. (2010). Early molluscan evolution: Evidence from the trace fossil record. *Palaios*, 25, 565-575.

Stahnke, H. (1966). *Some aspects of scorpion behavior*. Bulletin of the Southern California Academy of Sciences, 65:65–80.

Wilson, H. & Anderson, L. (2004). Morphology and taxonomy of Palaeozoic millipedes (Diplopoda: Chilognatha: Archipolypoda) from Scotland. *Journal of Paleontology*, 78(1), 169-184.

Yochelson, E. & Fedonkin, M. (1993). *Paleobiology of* Climactichnites, *an enigmatic Late Cambrian fossil*. Smithsonian Contributions to Paleobiology, 74.

The **Mid-America Paleontology Society** (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.

Membership fee: $20.00 per household covers one year's issues of DIGESTS. All Canadian and Overseas members receive the DIGEST by air letter post. For new members and those who renew more than 3 issues past their due date, the year begins with the first available issue. Institution or Library fee is $25.00.

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

President:	Marvin Houg, 1820 30th St. Dr. SE, Cedar Rapids, IA 52403
1st Vice President:	Dale Stout, 2237 Meadowbrook Dr. SE, Cedar Rapids, IA 52403
2nd Vice President:	Tom Williams, 2122 14th St., Peru, IL 61354
Secretary:	Tiffany Adrain, Dept. of Geoscience, Univ. of Iowa, 121 Trowbridge Hall, Iowa City, IA 52242
Treasurer:	Jim Preslicka, 1439 Plum Street, Iowa City, IA 52240
Digest Editors:	John Catalani & Chris Cozart
Webmaster:	Jim Preslicka
Membership (send dues to):	Dale Stout, 2237 Meadowbrook Dr. SE, Cedar Rapids, IA 52403
Immediate Past President:	Gilbert Norris, 2623 34th Avenue Ct., Rock Island, IL 61201
Directors:	Doug DeRosear (18), Karl Stuekerjuergen (17), Gilbert Norris (16)

MID-AMERICA PALEONTOLOGY SOCIETY

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

CYATHOCRINITES