The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 1 Issue 4 April, 2012

From Your Editor

Welcome to the latest issue. I hope everyone has been enjoying the newsletter. I'm sending it out to over 200 people already. It is going well but I really would like to see some more contributions. Some people offered when I sent out early announcements so it is time to pay up. While Bob Sheridan is a great and prolific writer, I don't want to rely on him to carry this thing. I need your help.

I have a favorite saying about fossil collecting that I want to share with you. It resonates with me and I have shared it with readers every so often through the years.

"Fossil hunting is by far the most fascinating of all sports. The hunter never knows what his bag will be, perhaps nothing, perhaps a creature never before seen by human eyes! The fossil hunter does not kill, he resurrects. And the result of his sport is to add to the sum of human pleasure and to the treasures of human knowledge"

George Gaylord Simpson

The Paleontograph was created in 2012 to continue what was originally the newsletter of The New Jersey Paleontological Society. The Paleontograph publishes articles, book reviews, personal accounts, and anything else that relates to Paleontology and fossils. Feel free to submit both technical and non-technical work. We try to appeal to a wide range of people interested in fossils. Articles about localities, specific types of fossils, fossil preparation, shows or events, museum displays, field trips, websites are all welcome.

This newsletter is meant to be one by and for the readers. Issues will come out when there is enough content to fill an issue. I encourage all to submit contributions. It will be interesting, informative and fun to read. It can become whatever the readers and contributors want it to be, so it will be a work in progress. TC, January 2012

Edited by Tom Caggiano and distributed at no charge

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What Is It?

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One of my hobbies, besides fossil collecting of course, is collecting sand from every place I have traveled. If you have ever looked at sand under a microscope you know the incredible beauty and amazing diversity of sand from different places. When I find sand with fossils in it, I am like a kid in a candy store, with two hobbies combining under the lens of a microscope. I am no expert by any means; I just enjoy the beauty of it all. Sometimes I find things and I have no idea what I have found and usually it's enough that it looks cool. This time I have found something I have become very curious about. While looking through some sand I collected from Key West Florida, I came across the objects in the photos. I am pretty sure they are fossils but I could be wrong, though I have collected and studied shells for a long time and have never seen anything that resembles what I have found. So, whether or not they are fossils, if anyone has an idea of what they might be I would love to solve the mystery. Not sure where the line is drawn between Micro/Macro fossils, but you can see by the ruler these are quite small. Any input would be helpful, Thanks.

What did Deinonychus do with its Killing Claw?

Bob Sheridan January 21, 2012

The first bit of background concerns dromaeosaurs (named after Dromaeosaurus), which are tiny to medium theropods with long arms, stiff tails, small curved teeth, and relatively big brains (big for a reptile, that is). The most famous feature is a large claw on the second toe, which could be swung through a large angle, judging from the toe joints. Dromaeosaurs are still thought to be the closest branch of theropods to birds, and many specimens from China show traces of feathers (as do other non-dromaeosaur theropods). Deinonychus (discovered by John Ostrom in the 1960's) is the iconic representative for dromaeosaurs, although not the biggest or first discovered. Deinonychus is obviously the inspiration for the "Velociraptors" in *Jurassic Park*, although they were shown in the movie much larger than they really are.

The second bit of background has to do with older ideas about the origin of flight. Given the assumption that dromaeosaurs are ancestors to birds, one would have to find some way for a running dinosaur to use its arms in such a way as to eventually give rise to flapping flight. This is usually referred to as a "ground up" model. The other origin model is called "trees down," where animals climbing in trees learn to glide and eventually to fly. Originally the "ground up" model tended to be associated with the dinosaurian origins of birds, and the "animals" in "trees down" were thought not to be dinosaurs because dromaeosaurs known at the time were too large to climb trees. Eventually many bird-sized dromaeosaurs were discovered (including presumed gliders like Microraptor). Also whether dromaeosaurs or birds came first became a new debate. Thus, simple models such as "ground up" and "trees down" seem less useful nowadays. However, I am mentioning them because a novel "ground up" mechanism appears in today's story.

What did Deinonychus (and by extension all the dromaeosaurs) do with its large foot claw? The idea of Deinonychus standing on one foot and using its other foot as a switchblade probably inspired the revival of the idea of dinosaurs as "warm-blooded" or at least "energetic." Other classic ideas include Deinonychus using the claw to climb onto the back of a larger prey animal, or even climb trees.

A paper from Fowler et al. (2011) suggests another use for the claw based on extant birds of prey (raptors). A sub-group of raptors called the Accipitridae (which includes hawks and eagles) also has an enlarged claw on the second toe. This is used to help hold down prey while it is being dismembered by the beak. This the authors call the "Raptor Prey Restraint" model. To support this model for Deinonychusm the authors measured a number of attributes of the toe bones and claws of 52 theropod specimens plus a large number of extant raptors. When these parameters are plotted into two-dimension by a correspondence analysis, raptors tend to fall into familiar families. Deinonychus falls closest to Accipitridae, as expected, although its features are extreme relative to these raptors. An important parameter here is the relative length of the toe bones in the second toe; the animals with larger claws tend to have shorter proximal phalanges and the second toe is overall shorter. This makes sense mechanically: if you want to maximize the force exerted by the claw, you need to keep the claw close to the joint.

Interestingly, if you apply correspondence analysis to only the theropods, we see Deinonychus and Archaeopteryx are neighbors. However, troodonts, which are considered a sister group to dromaeosaurs and have a slightly enlarged second toe claw, unexpectedly have somewhat different foot characteristics relative to Deinonychus.

By analogy with the Accipitridae we can imagine Deinonychus with one foot on the ground and one foot on struggling prey animal. How does it keep from toppling over? The suggestion is that the feathered arms could be flapped to steady itself, much as raptors do now. Eventually, it is speculated, such "stability flapping" could give rise to flapping flight.

Sources:

Fowler, D.W.; Freedman, E.A.; Scanella, J.B.; Kambic, R.E.
" The predatory ecology of Deinonychus and the origin of flapping in birds. "
PLoS ONE 2011, 6, e28964

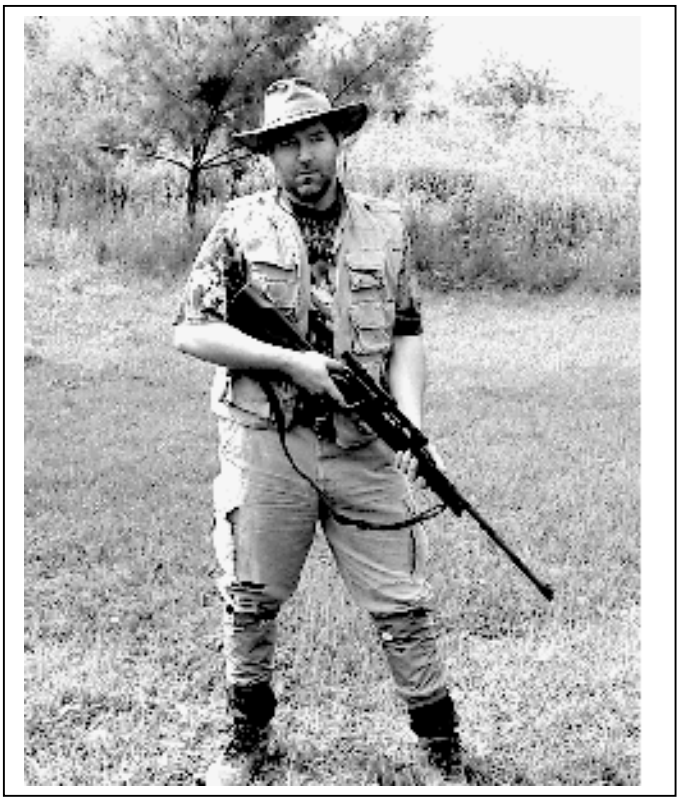
Last of the Titans: Big Game Trilobite Hunting

Exclusive to
The Paleontograph
By special correspondent
Geoffrey Notkin

Well-to-do society types and those wealthy enough to afford luxurious and expensive furnishings will, by now, know all about the recent surge in popularity of mounted trilobite cephalons. These imposing, and somewhat unsettling, spiked and armored shells can be found hanging - stuffed, varnished, and polished - high up on some of New York City's most fashionable parlor walls. Each oversized trophy head - the largest measuring nearly four feet from one crystal-lensed compound eye to the other - was once attached to the thorax of a giant arthropod named *Phacops imperator* which, earlier this century, ravaged parts of upstate New York. This dangerous predator has now largely been displaced, its natural environment steadily disappearing as a result of new housing developments and urban creep. Hence the recent price rise on these increasingly scarce trophy heads! A few packs of resilient and aggressive trilobites appear to have survived in largely inaccessible sections of the Catskill mountains, where they occasionally wreak havoc upon groups of hikers, and the odd poacher.

Each fall, oblivious to the danger, a few hardened big game hunters converge on the small town of Sharon Springs, New York. It has long been the prime staging area for those daring enough, and wily enough, to stalk the deadly and elusive wild trilobite *Phacops imperator*. The number of hunters - much like their prey - has dwindled sharply in recent years, but the most determined still continue to arrive in their Hummers and army surplus armored cars. "It's just not the same without ole 'Big' Bill Vandercamp," reflects veteran bushwacker and retired boho revolutionary, Ed Pole Jr., of Mohawk, New York. "Big Bill and the boys'd comes up here every year in their Chevys with big guns . . . an' I mean big guns . . . them 44 Magnums and elephant rifles with armor piercing and dum-dums. None o' them pansy lightweight German dilly-dally sniper rifles that them yuppies bring up from New Jersey, no sir. You bump into a angry trilo with one o' them fancypants toy rifles, and yer bullets'll just bounce right off his head, "Kerpingg!" And that makes 'em real mad [laughs]."

"Big" Bill Vandercamp remains a legend among trilobite hunters, and rightly so. In 1984 he bagged the largest Phacops ever recorded in North America. It's monstrous cephalon is today prominently displayed above the entranceway to the Hall of Invertebrates in the Ilion Museum of Paleontology, where it has frightened many a small child into a quiet and respectful life of monastic servitude. Mr. Vandercamp made a comfortable living as a tracker and field guide for hunters seeking the ultimate big game thrill: a close encounter with *Phacops imperator*. Experienced hunters from as far away as Auckland, New Zealand, and Krasnojarsk in Siberia have traveled to upstate New York in order to work with the expert gamesman.



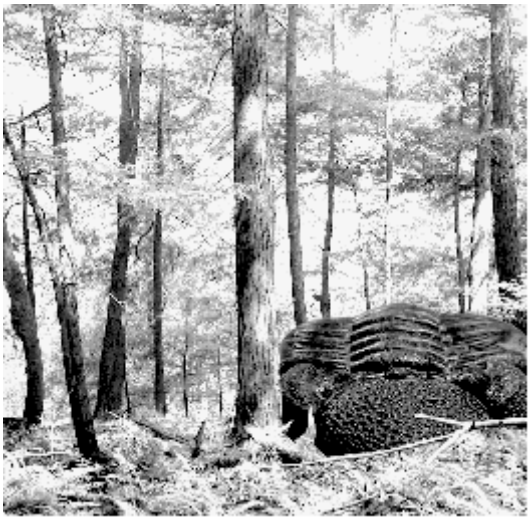
The late "Big Bill Vandercamp"

In 2001, Mr. Vandercamp and a team of heavily-armed telemarketers disappeared into the steep, wooded hills above the rural hamlet of Blenheim, New York. Several mangled balls of clothing were later found under a covered bridge - the only remains ever recovered of the party of eight men and their petite mule, Tipsy.

Big Game Hunting Cont'd

The locals - suspicious and wary of visitors at the best of times - are today largely unwilling to act as guides for trilobite-hunting expeditions, even though they can earn as much as $2,000 per trip. "It's just nart worth it, innit? Nart worth it at all," says Missy Sherman, longtime owner of Dalmanite's Ammo, Bait 'n' Tackle, which has been a popular hangout for visiting hunters since the 1940s. "We 'ad plenty o' guides back in the day, yessir. Fightin' even for a chance to git up in them woods with them shooters, they were. But since Mr. Bill gone missin' ain't nobody goin' to git nowhere."

How many giant trilobites are really slithering about in the limestone caves 1,200 feet above town? That's anybody's guess, and the estimates we received varied both according to the time of day and the type of bars that we canvassed. Informed opinions ranged from "Probably none" (Mr. Charlie Kanute, enjoying a civilized lunch at the Paradoxides Inn, 2:15 pm), to "At least thousands" (Mr. Jim Bob Huxley, working on his third zombie cocktail at Whinney's MegaPub Rana, 11:52 pm). What is certain is that nobody has seen a live *Phacops imperator* for close on two years, and it is possible that the last of the titans has finally died, or perhaps just moved on to more remote locales.



A Trilobite in the wild

Things were very different back in the 1880s, when a captive trilobite was one of Herkimer County's biggest attractions. Captured as a mere pup, the trilobite - affectionately known to townsfolk as "Little Petey" - grew to almost seventeen feet in length, and on Federal holidays was paraded around the county seat strapped to the top of a Mohawk and Schenectady Railroad box car. An editorial in The Mohawk Valley Gazette from February 29, 1883 described Little Petey as " . . . that Devilish insect monstre (sic) of Brobdingnagian proportions. A Beaste so stupefying and horride as to make one instantly reach for one's pocket Bible and hurry with no delaye to do God's good worke." Local lore has it that Little Petey lived to be well over a hundred. In later years, the venerable arthropod was cared for by a blind seamstress who taught it to repeat the names of all the Governors of the State of New York, in order; a trick the creature is reported to have performed annually on the mayor's birthday. Little Petey's remains are said to have been interred in a quiet churchyard in Herkimer, New York. An exhumation of the supposed grave, conducted in 1967 by the State University, produced only the heads of two Victorian dolls and a scribbled note which read, "Gone back to the Silurian. Thanks for the fourteen pairs of mittens. Love, Pete."

A New Problematical Animal from the Burgess Shale

Bob Sheridan January 28, 2012

The Burgess Shale, noted for the exceptional preservation of soft-bodied animals from the Cambrian, has been under study for just over 100 years. Many of the animals remain "problematica," i.e. they cannot be unambiguously affiliated with familiar groups of animals. One may remember the debates from the 80's and 90's whether the problematica represent phyla that went extinct after the Cambrian (as often argued by Stephen Jay Gould), or just extreme versions of modern phyla, e.g. sponges, molluscs, or arthropods (as counter-argued by Simon Conway Morris).

I recently read a report (O'Brien and Caron, 2011) of a new problematic animal from the Burgess Shale. I was not aware that there are several Burgess Shale quarries aside from the original one worked by Charles Walcott. The new animal is from the "Tulip beds," which is named for the "tulip-like" fossils found there in abundance. The authors have collected over 1000 specimens, which are generally over 20 cm long (very large for a Cambrian animal). As with most Burgess Shale specimens, these are just thin films on rock. One has to infer 3D structure by looking at different specimens squashed flat from different directions. **Cont'd**

Burgess problem Cont'd

The new animal, given the name *Siphusauctum gregarium* ("large cup occurring in flocks"), is indeed tulip-like, with an ovoid bulb (calyx) on a stem with a small holdfast at the bottom of the stem. There appears to be an internal structure to the bulb: inside the outer wall there are six feather- or comb-like structures (to my eyes very much like tulip petals!). There appears to be a tube in the center of the calyx, wide at the bottom and narrow at the top (a digestive system?). The stem seems to be formed by two concentric tubes. The diameter of the stem is about one-quarter the diameter of the calyx, and the length of the stem is about 1.5 to 3 times the length of the calyx. Since there is little bending of the stem, it is likely it was fairly rigid. However, because the length of the stem varies among specimens, it seems plausible that it could expand or contract along its length.

Looking at Siphusauctum, one is superficially reminded of crinoids, both because of the shape (calyx on a stalk) and the fact that specimens are found together in large numbers. However, Siphusauctum has no hard parts and no arms. Also, the stem is relatively short, wide, and not segmented. There is another Cambrian animal from China called Dinomischus that might be related, but the authors can eliminate relationships to other known Cambrian animals with stalks. As with many Burgess Shale animals, it is hard to relate Siphusauctum to familiar phyla.

The authors suggest that Siphusauctum was a sessile filter feeder. The current in its environment was probably very mild because its holdfast is very small. Water might be drawn into the calyx from openings in the bottom and pumped upward by the "combs" or by muscles forming the wall of the calyx. Food would be gathered at the mouth at the bottom of the calyx, digested, and expelled at the top.

Sources:

O'Brien, L.J.; Caron, J.-B.
"A new stalked filter-feeder from the Middle Cambrian Burgess Shale, British Columbia, Canada."
PLoS ONE, 2012, 7, e29233

Surprisingly Modern Crustacean Bits from the Cambrian

Bob Sheridan February 11, 2012

Crustaceans (shrimp, crabs, water fleas, barnacles, etc.) are a subtype of arthropod characterized by having legs with two branches (one branch holds the gills). While there are crustacean-like arthropods known from the Cambrian, the fossil record of unambiguous crustaceans is sparse.
Here we need a sidebar about three types of modern crustaceans: branchiopods, copepods, and ostracods. These are all small (smaller than 1 cm, but almost always smaller than a few millimeters), almost entirely aquatic or marine, and make up a large portion of plankton. Their cuticles are not mineralized, except for the clam-like shells of the ostracods. They eat algae or other microscopic detritus.

Today's story is about disarticulated crustacean parts from the Middle and Late Cambrian Deadwood Formation (Western Canada) as described by Harvey et al. (2012). These specimens are isolated by dissolving chunks of mudstone in hydrofluoric acid. Some parts of the Deadwood mudstone is rich in crustacean mandibles. There are at least four types. One type of mandible has a D-shaped plate (a "molar") with parallel grooves. This is very like the mandibles in crown-group branchiopods called anostracans. These mandibles are >200 uM long, which would predict a body length of 10-15 millimeters for the whole animal. The second type of mandible has spiky "teeth" protruding along one edge, with short bristles pointing in the direction of the teeth. Similar mandibles are found in many crustaceans, but the authors feel they most closely resemble the mandibles of copepods. Assuming proportions of modern copepods, the body length would be 1-2 millimeters. The third type of mandible is an elongated plate. It has a hole in the center. At one end is a set of cusps, hooks, and bristles. These resemble the mandibles of ostracods. The predicted body length is 1-2 millimeters. The fourth type is not easily identified with a modern group.

Cont'd

Cambrian Crustacean Cont'd
Another type of fossil in the Deadwood Formation consists of limb-like appendages with coplanar bristles. These resemble combs or feathers. They are very much like the "filter plates" on the limbs of branchiopods, which are used for gathering food.

These types of anatomical features have not been seen before in Cambrian fossils and it implies that modern types of crustaceans appeared very early, up to 100 or 200 million years earlier than the next oldest example in the fossil record.

Sources:

Harvey, T.H.P.; Velez, M.L.; Butterfield, N.J. "Exceptionally preserved crustaceans from western Canada reveal a cryptic Cambrian radiation." Proc. Natl. Acad. Sci. USA 2012, 109, 1589-1592.

Earliest Known Dinosaur Nesting Site

Bob Sheridan February 20, 2012

There are many examples of dinosaur nests, which can be defined as places where many eggs are found together. In some cases one can identify the dinosaur that laid the eggs because there are bones of embryos inside the eggs or there are remains of the babies near the nest. Eggs are known for oviraptors, sauropods, and hadrosaurs. Almost all known nests are from the Late Cretaceous, although isolated eggs and crushed eggshells are found in older sediments. A recent report by Reisz et al. (2012) describes a nesting site from the Middle Jurassic of South Africa, which has been under study since 2006. This nesting site is about 100 Myr. older than previously know nesting sites.

The nesting site is comprised of nearly 100 eggs in 10 clutches with the largest clutch being composed of 34 eggs. There are four levels of eggs separated by layers of red siltstone, indicating the same ground was visited repeatedly. The total thickness of the egg-containing layer is about 2 meters. The individual eggs are more or less spherical with a diameter of about 7 cm. and are arranged in a single layer. To the authors, that means the mother dinosaur arranged them after laying. The eggshells are thin (0.1 millimeter).

As to the identity of the eggs, they resemble isolated eggs described in 1976 that contain embryos of Massospondylus. In the layers containing the eggs are many small (< 15 millimeter) footprints, although no long trackways. There are both fore- and hind-foot prints that could plausibly be assigned to juvenile Massospondylus.

Remains of Massospondylus have been found in Africa, South America and Arizona, so it is a pretty well known dinosaur. Massospondylus ("longer vertebrae") is a sauropodomorph (what used to be called "prosauropods"): medium-sized (up to 6 meters) herbivores with long necks, and small heads. Their legs are longer than their arms, indicating that they were at least sometimes bipedal. (Interesting that the babies walked on four feet around the nests.) They have five fingers and five toes, and the thumb bears a large claw. Massospondylus (from the Middle Jurassic) resembles a smaller, slimmer version of the more famous sauropodomorph Plateosaurus (from the Late Triassic).

There is a relationship among egg-laying vertebrates between the log of the clutch volume and the log of the body mass of the animal that lays the eggs. This relationship is slightly different for animals that care for their young (e.g. birds) and those that show limited care (e.g. crocodiles), with the latter having slightly larger clutches per body weight. Assuming the clutch volume from the described nests, Massospondylus would fall with the animals showing parental care. Sauropodomorphs like Massospondylus are usually thought to be the ancestors of sauropods, which reached enormous size in the Late Jurassic. It is usually assumed that sauropods did not show parental care because of the large difference in size between the adults and juveniles. So if we assume Massospondylus practiced parental care and sauropods didn't, it would be plausible that parental care was lost as sauropods became larger.

Sources:

Reisz, R.R.; Evans, D.C.; Roberts, E.M.; Sues, H.-D.; Yates, A.M.
"Oldest known dinosaurian nesting site and reproductive biology of Early Jurassic sauropodomorph Massospondylus."
Proc. Natl. Acad. Sci. USA 2012, 109, 2428-2433.

The Mid-Devonian Gilboa Forest

Bob Sheridan March 4, 2012

The Riverside Quarry in Gilboa, New York (Schoharie County) is famous for its fossil stumps, which where discovered in the 1920s. These stumps, which are Middle Devonian in age, are actually sandstone casts that fill hollow spaces in the matrix, are anywhere from 0.5 to 2 meters in diameter, but only a one or two meters tall at most. The stumps appear as upright cylinders with rounded bottoms, and there usually are no large roots preserved. The outside of the stumps are textured with “scales.” Stein et al. (2007), by relating the features of the Gilboa stumps to the trunks of fossils found elsewhere in New York, was able to identify the stumps as belonging to a fossil tree called Eospermatopteris. To us, Eospermatoperis would appear to be a pretty weird "tree". It appears to have a long tapering unbranched trunk at least 6 meters high, with a dozen or so 1 meter-long branches radiating off the very top of the trunk. Gilboa is still the earliest known "forest," where plants grew to tree-size and grew together in large numbers.

The Riverside Quarry has been further excavated and 1,200 square meters of what would be the forest floor has been exposed. The exposed layer was described last week by the same collaborators (Stein et al. 2012). There are examples of the stumps with their roots still attached, something no seen before. Also one can see ~200 root mounds with roots that are 1-2 cm in diameter radiating from a central basin. These probably represent the roots of the stumps that had been previously been removed. In some cases there are two root mounds intertwined.

Another type of fossil plant is present in large numbers. There are horizontal stems exceeding 4 meters in length and 13 cm in diameter. Some segments of the stems are enveloped by unbranched roots about 5 millimeters in diameter. These stems are pyritized and one can see woody structures inside them, much like the woody structures in another Devonian plant Teraxylopteris. Occasionally within the matrix one can find "aerial branches" attached to these stems. This implies that plants like Teraxylopteris probably grew underground and sent branches above ground. Based on the association of the stems and the root bundles, it is likely that these plants wrapped themselves around the Eospermatoperis trunks.

Finally, the authors describe a single horizontally preserved tree from the family Lycopsida (club mosses). This tree is 11 centimeters in diameter and has broad longitudinal ridges. The surface of the tree is covered with attachment scars. Smaller lycopsids are known from Riverside Quarry.

There are two inferences to be gained here. First, we see at least three kinds of "trees" growing in the same location, indicating Devonian forests were more complex than a single plant growing in bunches. Second, since it is the horizontal stems that are woody and not the much taller Eospermatoperis, one cannot argue, as is sometimes done, that plants first evolved wood to be able to grow taller.

Finally, the author feel that the cross-bedded sandstone deposits that the plants occur in is more indicative of an environment close to the shoreline than a tranquil swamp, and that flooding from the sea occasionally killed such forests.

Sources:

Meyer-Berthaud, B.; Decombeix, A.-L. "In the shade of the oldest forest." Nature 2012, 483, 41-42.

Stein, W.E.; Mannolini, F.; Hernick, L.V.; Landing, E.; Berry, C.M. “Giant cladoxylopsid trees resolve the enigma of the Earth’s earliest forest stumps at Gilboa.” Nature 2007, 446, 904-862.

Stein, W.E.; Berry, C.M.; Hernick, L.V.; Mannlini, F. "Surprisingly complex community discovered in mid-Devonian fossil forest at Gilboa."
Nature 2012, 483, 78-81.