The Paleontograph

A newsletter for those interested in all aspects of Paleontology
Volume 1 Issue 3 March, 2012

From Your Editor

Welcome to our third issue. So far, so good. Articles have continued to come in and not just from Bob Sheridan. The last issue produced many more compliments and many more subscribers.

Please think about contributing an article or something. At this point we have managed to get out one issue per month but as I said when I began, issues will come out when there is enough material to fill one. I would not like to have to relay on Bob Sheridan and a couple of others but instead have a large contingent of writers. If we get enough people, one or two articles per year each, would be enough to have ten great issues per year.

Next month is April. My old newsletter used to have an April Fools issue which would have entertaining and spoof articles. There are a couple that still make me laugh when I think about them. I may try and dig a few out for next month.

As always, I am open to comments and submissions.

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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Tombs of the Turonian

Derek Yoost

New Jersey is not known for having exotic paleontological localities. This distinction is much more deserving of far flung places such as Mongolia, Morocco or China. Yet one of these world-class sites rests in our very own back yard. In a small clay pit in the middle of the suburbs of Central New Jersey rests the oldest and most abundant deposits of Late Cretaceous amber in North America.

Ed Otte & Derek Yoost in hand dug hole looking for amber

This locality is an open pit, the remains of the once profitable clay mining industry. The clay here is very pure and perfect for the manufacture of bricks. The sands, clays, and gravel are part of the Raritan formation and were laid down as continental and marginal marine deposits during the Turonian, 90 to 94 million years ago. These deposits can have a wide range of environments: river channel fill, deltaic flood plain, estuary – lagoon, and "mangrove" swamp. In the process of mining the clay, workers uncovered dark layers of fossilized "peat" called lignite. It is in these black layers that the amber occurs.

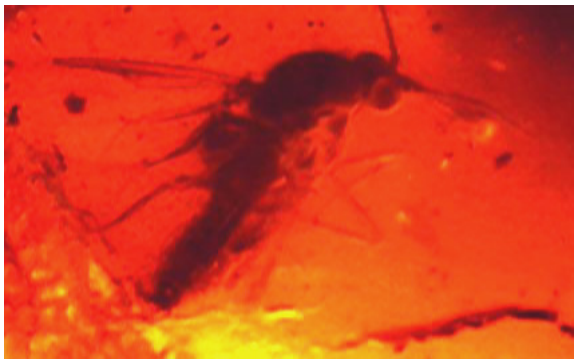
A nice "Gemstone" find!

The source of all the amber from the Late Cretaceous worldwide is almost certainly from Cupressaceae, the cedars. The cedars in New Jersey, however, were tropical cedars and not the temperate cedars around today. This is corroborated by chemical analysis of the amber, cedar fibers in the amber, and the fact that most of the carbonized wood found in these pits is from cedar trees. The clincher was finding a cedar log with amber filling the cracks in the wood. Amber occurs mostly as very small drips and nuggets between 1 to 10 millimeters, but some multiple flow pieces can get exceedingly large, up to 20 centimeters long.

This site represents one of the few snap-shots when flowering plants were just beginning to diversify and the insects along with them. Some of the flower structures seem to suggest that the complex symbiosis between plant and insect were just starting to form.

The Sayreville locality, and other small sites around the state, sports an impressive resume; the oldest known brown lace wing, true mouth, black fly, the most primitive ant, and the oldest bird feather and termite in North America. A biting fly, resembling a mosquito, found in 1995 possessed a proboscis long enough to feed on large reptiles including dinosaurs. Most of the more than 140 genera of insects and other arthropods are new to science.

Biting Midge *Culicoides yoosti* Borkent



Tombs Cont'd

Some of the botanical inclusions include the oldest mushroom and flower in amber. Further, there are at least 100 new species of flowers, both in and out of the amber.

During the Late Cretaceous, the then coast of New Jersey was covered with dense stands of tropical cedars trees. Every once in a while a Nor'easter would barrel through disrupting the calm in the forest. Lighting strikes produced fires that raged uncontrolled damaging the trees. In order to heal themselves, the cedars produced copious amounts of resin to seal the places where the wounds occurred. This resin oozed over branches and dripped down trunks like golden honey. While still somewhat fluid, but not solid, insects and other arthropods became entrapped. With their legs and wings helplessly tangled in the resin, more flows sealed the insect in a perfect time capsule. The river that flowed through the forest was in flood and deposited sand, clay, logs, and of course, resin over a deltaic flood plain. Then more sand and clay was layered on top preserving it for the millennia. During the millions of years that passed the amber polymerized and cross-linked and in the process preserved the cargo inside. Amber diggers then uncovered the golden treasure and polished these pieces to reveal the snap shots to the past.

Once the animal becomes entrapped in the resin the process of embalming takes place. The resin removes the water from the corpse and replaces it with the terpenes (volatiles) from within the resin. This preserves the internal organs, cells, and even the sub-cellular structures without any tissue shrinkage. Unlike most other ambers (excluding Dominican), New Jersey amber preserves these structures more frequently. Although there has been no genetic research done on this fauna due to the rarity of animal inclusions, there is undoubtedly DNA preserved as well.

When the site was open, the collecting was somewhat challenging. The conditions varied from artic blasts of snow in the winter to boiling heat in the summer. Since there are no trees to stop the breezes, the site is almost always windy. Digging for amber on every windy day can remind you of collecting in the Sahara Desert since blowing sand up to 50 Mph gets into eyes, ears, and hair. The original owners stopped mining the clay due to the fact that they hit the water table. Most holes that are dug quickly fill with water which then has to be bailed out. Once the clay gets wet, the bottom of the hole and the lower half of the collectors are usually covered with gooey mud that tenaciously clings to everything. The clay is unusually dense and hard to dig through. The easiest way is to cut out blocks with shovels and picks and then heave them out of the hole. Once an area has been cleared of clay, the lignite can then be chunked out and broken up by hand to release the amber. This has to be done with the greatest of care because large pieces of amber can be shattered by hitting them with the shovel or pick.

Once home and cleaned, the amber has to be protected. All amber is susceptible to two types of degradation. One is caused by Ultra Violet radiation. UV light breaks the cross-linked bonds that hold the polymerized material together. This manifests itself as crazing (fine spider web like cracks) on the surface of the amber piece. The second is oxidation. This oxidizes the amber which will eventually whiten and crumble. To prevent this, keep amber out of direct sunlight and store in a sealed container with a little moisture.

Collecting Dec. 26 1995 in 2 feet of snow

Tombs Cont'd

Late Cretaceous amber is hard but unfortunately, extremely brittle and fractured. This is due to the cross-linked chains of hydrocarbons that make up the amber. The cross-linking makes NJ amber harder than most other ambers. For this reason it is unsuitable for most jewelry. Even when amber is found, only about 20% or less is clear enough to see any inclusions. About one out of every 100 pieces has animal or plant inclusions (excluding detritus – small plant debris).

Looking for insects and other inclusions through the surface of the amber is almost impossible. If you are lucky the amber breaks in just the right place to get a fresh surface to look at the inclusions. This almost never happens. Inclusions are the weak point in the amber, so if it is going to break, it will probably be THROUGH the inclusion. Most of the time, the crazed surface has to be removed.

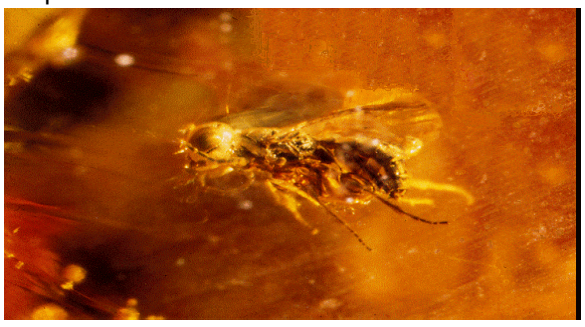
The easiest way is to purchase 600 and 1500 grit wet-dry automotive sand paper. Using plenty of water, you can grind the patina off to the desired level, being careful not to grind into the inclusion. After the 1500, then it is just a matter of some light polishing. Tumbling is also a good and easy way to screen large amounts of amber. Start with 700 grit for a few days. Thoroughly wash these pieces and replace with 1200 or smaller grit for 2 weeks. Then touch up with a polishing wheel and metallic oxide polishing compound.

The most common insects found in the amber are scale insects and parasitoid wasps, but other types of wasps, midges, flies, beetles, and other arthropods such as spiders are infrequently found. Very rarely, pseudoscorpions, mantids, and ants (the famous *Sphecomyrma freyi*) turn up.

Besides the amber, there are complete leaves that were found in certain layers in the clay. These layers were located in the back wall of the pit by the railroad tracks. Rarely even conifer cones can be preserved in these clay layers. Since the clay is still soft, collecting these leaves and stabilizing them was a little difficult. Once collected and safe at home, the leaves had to be dried out over several days, monitoring the progress. If cracks formed, white glue was used to fill them. After drying, a few heavy coats of clear plastic spray helped to stabilize the carbon film of the leaf to the clay. Then a coat polyurethane was applied to seal them.

Typical plant fossil in the clay.

If not for the Herculean efforts of amateur and professional paleontologists, most of these finds would not have surfaced. Just about every available weekend collectors were digging holes toward the center of the earth, stopping reluctantly at the ground water. The amber then had to be cleaned and screened for inclusions. Once found, interesting insects usually found their way into the expert hands of Dr. David Grimaldi, Curator of Entomology at the American Museum of Natural History. A surprising amount of the arthropods turn out to be species that are new to science. This further underscores the importance of this site. This is why the collectors were preserving as much of this prehistory as they could before it fell under the bulldozers blade. Before the site was featured on an episode of the series ***Paleoworld***, the museum in New York excavated the remaining amber fearing hordes of collectors. The site is now posted. The fate of an industrial park is currently planned for the amber locality thus prematurely ending a vast unwritten chapter of the Turonian.



A parasitoid wasp

Phytoliths and the Thickness of Tooth Enamel

Bob Sheridan December 24, 2011

Tooth enamel can vary in thickness from species to species, depending on diet. This is true of modern apes and extinct hominins. One species with extremely thick enamel is *Paranthropus boisei,* which lived ~2 to ~1 Myr. ago. Originally named Zinjanthropus , nicknamed "Nutcracker Man", and until a few years ago known as *Australopithecus boisei*, P. boisei is a small-brained hominin with extremely robust jaws and very large teeth. It has been traditionally assumed that these anatomical features went with a diet of hard or tough plant material such as nuts, seeds, or tubers. In a recent article Rabenold et al. (2010) suggest and alternative explanation.

First, I need to remind the reader of phytoliths. These are small (a few micrometers) grains of silicon dioxide (basically sand) embedded in plant stems and leaves. Rabenold et al. took a series of living apes and prosimians such as the aye-aye and noted from the literature the percentage of most abundant plants in their diet and the amount of phytoliths in those plants. In this way one could relate the thickness of enamel in these animals to the abundance of phytoliths in the diet. (Modern humans are not included, perhaps because the diet is too culturally determined.) Enamel thickness is measured in RET (relative enamel thickness) units.

The authors found that there is a very high correlation between thick tooth enamel and a primate diet with abundant phytoliths, and much lower correlation with hard foods. The lowest RET (9.5) belongs to the bearded saki, which is a New World Monkey. It's diet consists of immature seeds and fruit. The highest RET (21.7) belongs to the aye-aye. The aye-aye, which does not include many hard plant material in its diet, but it does chew bamboo and palm stems, which are rich in phytoliths.

This correlation is really not a new idea. It has been assumed that fossil horses, for instance, developed higher crowns on their teeth when they switched to grazing on grass. The high phytolith content of grass wears the teeth down quickly, and one needs to have tall teeth to last over the lifetime of the animal. This study just extends the idea specifically to primates.

P. boisei has thicker enamel that any primate in this study (RET=34.9), so some extrapolation is involved, but the implication is that P. boisei could have a diet of very abrasive plant material. This is consistent with the work of Cerling et al. (2011) who measured carbon isotope abundances in P. boisei enamel. That work suggested a diet rich in C-4 plants. Grasses and sedges are abundant C-4 plants, and grasses have high phytolith content, as mentioned before. Also a diet of abrasive rather than hard foods is consistent with the microscopic tooth abrasion patterns on P. boisei teeth.

Sources:

Cerling, T.E.; Mbua, E.; Kirera, F.M.; Manthi, F.K.; Grine, F.E.; Leaky, M.G.; Sponheimer, M.; Uno, K.T. "Diet of Paranthropus boisei in the early Pleistocene of East Africa."
Proc. Natl. Acad. Sci. USA 2011, 208, 9337-9341.

Rabenold, D.; Pearson, O.M.
"Abrasive, silica phytoliths and the evolution of thick molar enamel in primates, with implications for the diet of Paranthropus boisei."
PLoS ONE 2011, 6, e28379.

Yet Another Explanation for Doushantuo Embryos?

Bob Sheridan January 14, 2012

One very persistent topic in the paleo literature since the late 90's has been the identity of the "Doushantuo embryos" from the Late Precambrian of China. These appear to be small (0.1-0.2 mm) clusters with anywhere from a handful to thousands of "cells." The cells may or may not be roughly the same size, and, depending on the state of preservation, the cluster may or may not be surrounded by a membrane with a characteristic texture. The membrane may in turn be surrounded by "wall" with spines. The original idea was that these represent embryos of "metazoans", i.e. multicellular animals of modern phyla. There are no fossils of such animals in the Precambrian, but we would expect such animals to exist that long ago based on a number of lines of reasoning.

Cont'd

Embryos Cont'd
The embryos fall into several categories based on the type of membrane and arrangement of cells and are given genus names such as Megasphaera, Tianzushania, and Spiraliacellula.

I must have reviewed at least a dozen articles about the "embryos" for the Paleontograph over the past 12 years. A lot of conclusions are being drawn about the ancestry of certain large animal groups based on the details of these fossils. However, a lot of things seem inconsistent with them being embryos:
1) The "cells" are very large, much larger than most cells in modern animals.
2) Embryos with thousands of cells should have formed blastulas or gastrulas already, not stayed as a undifferentiated cluster.
3) The embryos are much more common as fossils than you'd expect since the early stages of embryos do not last very long.
4) We never see later stage embryos with distinct organs.

Alternative explanations to the "embryo" hypothesis have been proposed. After all, a cluster of packed spheres could be a number of things. One of the most recent and radical suggestions is from Bailey et al. (2007) who proposed the "embryos" are really clusters of giant sulfur bacteria. Last month a paper in Science (Huldtgren et al., 2011) made an additional suggestion. These authors used synchotron radiation x-ray tomographic microscopy (basically CAT scans of tiny objects) to study hundreds of Doushantuo embryos of different types. A consistent observation is that each cell contains a single spherical body. A parsimonious explanation is that this represents the cell nucleus. In a few cases the body is dumbbell-shaped, consistent with cell division. Nuclei in these embryos have been noticed before, but the resolution in the current study is excellent. The presence of unambiguous nuclei immediately eliminates the "giant sulfur bacteria" explanation, since bacteria do not contain organized nuclei.

The authors note that the Tianzushania-type embryos (which contain a large number of cells) can deviate from a spherical shape, sometimes looking more like a peanut, or having finger-like protrusions. They also note that the cells in the Spiraliacellula-type embryos have a helix or worm-like shape. Finally, the authors note that the cell division in these embryos is palintomic, which means that as cells divide, they do not gain volume, so the entire embryo stays the same size. None of these characteristics is seen in modern metazoan embryos.

The authors suggest that the Doushantuo embryos resemble various stages in the non-sexual reproductive process of holozoans. Holozoans are eucaryotes (which have a nucleus) that are single-celled but may form colonies of the same cell type. They are "animals" but not "metazoans." They point to single-celled fish parasite Ichthyophonus, which produces a large single cell cyst, which then divides palintomically into many tiny cells, which are eventually released from the cyst. A commentary in the same issue of *Science* (Butterfield et al., 2011) suggests yet another possibility. The green algae Volvox also produces a cyst that divides palintomically. As icing on the cake, Volvox cysts also have an outer wall with spines as do some Doushantuo embryos. So, while we can say the Doushantuo embryos are probably not metazoans, we cannot tell for sure at this point whether they are holozoans or algae.

Sources:

Bailey, J.V.; Joye, S.B.; Kalanetra, K.M.; Flood, B.E.; Corsetti, F.A.
"Evidence of giant sulfur bacteria in Neoproterozoic phosphorites "
Nature 2007 445,198-201. (A)

Butterfield, N.J.
"Terminal development in Ediacaran embryology."
Science 2011 334, p. 1655-1666.

Huldtgren, T.; Cunningham, J.A.; Yin, C.; Stampanoni, M.; Marone, F.; Donoghue, P.C.J.; Bengtson, S.
"Fossilized nuclei and germination structures identify Ediacaran 'embryos' as encysting protists."
Science 2011, 334, 1696-1699.

Ed. Note:
From Wikipedia, the free encyclopedia

The **Doushantuo Formation** (Chinese: *dǒu shān tuó*) is a Lagerstätte in Guizhou Province, China that is notable for being one of the oldest fossil beds to contain highly preserved fossils. The formation is of particular interest because it appears to cover the boundary between the problematic organisms of the Ediacaran geological period and the more familiar fauna of the Cambrian explosion of lifeforms whose descendents are recognizable.

The New Dinocephalian Pampaphoneus and What It Says About Pangea

Bob Sheridan February 4, 2012

First topic: Dinocephalians ("terrible heads"). These are medium (cow size) to large (rhino size) mammal-like reptiles that lived from the Early to Middle Permian. One distinguishing feature is that the upper and lower incisors interlocked when the mouth was closed and there was some shearing occlusion of the teeth in the herbivores. Most had thickened skulls and/or horns (for head-butting?). They came in three varieties: Anteosauria (mostly carnivores), Estemmenosuchiae (mostly herbivores), and Tapinocephalia (mostly herbivores).

Second topic: Pangea. It is now well established that before 200 Myr. ago, all land on earth was joined into a single super-continent called Pangea. In the Middle Jurassic, the first major breakup occurred where Laurasia broke from Gondwana. Laurasia eventually fractured into the northern continents (North America, Europe, Asia), while Gondwana gave rise to the southern continents: (South America, Africa, Australia, Antarctica). I was not aware until recently that there are actually two plausible models of Pangea in the Early Permian (A and B) having to do with the relative placement of the block of land that later became Gondwana relative to Laurasia. There is not enough data at present to resolve this issue beyond doubt, and it remains controversial. The major difference for the purpose of this story is: in Pangea-B, what is now Russia is close to what is now South America, without any major barriers between them, while in Pangea-A there is a bigger distance, and what is now the Appalachian mountain range would have been a barrier.

In a recent paper Cisneros et al. (2012) describe a new specimen of an anteosaurine dinocephalian from the Middle Permian (~270-260 Myr.) of southern Brazil. The specimen consists of a skull 32 cm long, which would make it medium-size for an anteosaur. They named this animal *Pampaphoneus biccai* ("killer of the pampas" + named after Jose Bicca, the owner of the land on which the specimen was found). Pampaphoneus has four maxillary incisors on each side that interlock with those of the mandible. It has large curving upper canines. The teeth behind the canines are small and rounded.

Phylogenetic analysis places Pampaphoneus with all the other anteosaurines. The important point here is that the animals most closely related to Pampaphoneus are from Kazakhstan, Russia, and South Africa. This implies that Pampaphoneus-like animals were able to migrate easily between all those locations, and the authors feel this favors Pangea-B.

Sources:

Cisneros, J.C.; Abdala, F.; Atayman-Guven, S.; Rubidge, B.S.; Spengor, A.M.C.; Schultz, C.L. "Carnivorous dinocephalian from the Middle Permian of Brazil and tetrapod dispersal in Pangea."
Proc. Natl. Acad. Sci. 2012, 109, 1584-1588.

New Coon Creek paper available

Neal Larson writes:

I have a recently paper published on the cephalopod fauna of Coon Creek, Tennessee (Late Campanian, Gulf Coast). This manuscript was originally written in 2002 and accepted for publication in 2004 by the Tennessee Dept. of Geology. Unfortunately they failed to publish the Coon Creek Monograph and so the paper languished until last fall when I went through and revised and updated it. It has now been accepted and is published in the Journal of Paleontological Sciences - an online Journal.

You can also find the contributions of W. A. Cobban at this site. For the Coon Creek Paper (Plates are downloaded separately) go to:
http://www.aaps-journal.org/journal-contributions.html

For the Paleontological Contributions of William A. Cobban go to:
http://www.aaps-journal.org/
then click underneath Bill's photo on the blue print.

Ed. Note:
The Journal Of Paleontological Sciences is an online journal sponsored by The Association of Applied Paleontological Sciences. The AAPS is the association that represents commercial paleontologists. Membership is open to amateurs also.
Go to http://www.aaps.net/ for more info.

For those of you that don't know of William A. Cobban, he is a scientist that has worked for the USGS and has amassed an incredible body of work.

Baby *T-Rex* in the Living Room?

Frank Haase, Knetzgau, Germany

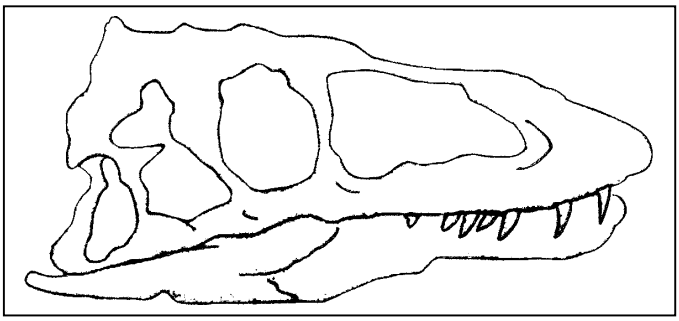
In a series of articles about unusual occupations, Der Spiegel (20 Januar 2012) highlighted the career of Mr. Tjard Kusche, a free-lance preparator of fossils. Like many of us, his feet were set upon the path he would follow by his parents, who took him on a geological excursion into the Eifel mountains when he was thirteen. During what Americans might call high school work-study, he did a tour of practice, extracting Eocene fossils from the Messel site, world-famous for the quality of preservation. He later trained as a preparator in Switzerland.

His visit to the Tucson Show in 2001 was a revelation of the commercial possibilities in the fossil market. Following that experience, he went to work in Los Angeles, preparing fossils to decorate the homes of Nicholas Cage, John Carpenter, Brad Pitt and other luminaries. Family matters necessitated his return to Schleswig-Holstein. He regrets that his opportunities are now less, simply because the German market for his skills is much smaller.

So what does this have to do with *T. rex?* Those of us who have dealt with media people quickly learned that no matter what the story may be, the reporters will tell the story *they* want the audience to hear. I suspect that in this case, the designation, "baby T. rex," was introduced to excite interest in what otherwise is a straightforward recital. There *is* a dinosaur in Mr. Kusche's living room, which he is extracting from matrix for an unnamed American client. Obviously a theropod, probably Late Cretaceous, the article says it came from Mongolia. The quality of preservation suggests to me the Nemegt, rather than the Djadochta formation as the origin.

I enclose a sketch of the skull, which is about 18 inches long. Most of the skeleton is still enclosed in plaster jackets, but it is believed to be complete and thirteen feet long. It is also believed to have been one and a half years old at death. How that was arrived at, the author does not say. Perhaps he used Mary Schweitzer's formula. Since a head-body ratio is currently impossible to do, I see nothing in the skull as illustrated to indicate infantile, let alone juvenile characteristics. For that matter, the skull appears to be of the standard theropod pattern without any particular specializations. *T. rex* incisors do have a distinctive, easily recognizable shape, but the article does not refer to that. Instead it says that identification is based on the serrated cheek teeth. Now a single character may suffice for the average cladist, but serrated teeth are possessed by tyrannosaurs, tarbosaurs, daspletosaurs, gorgosaurs, troodonts and many others. And besides, since when has *Tyrannosaurus rex* been known from Mongolia? Were it not so extensively restored, I would say that *Nanotyrannus* bears comparison with Mr. Kusche's "baby." However, since it is private property, we will probably never know what it really is.

The “baby T-Rex”



A Tucson Style Show Comes to the Big Apple

Show promoter Eons Expositions is doing something long overdue. This May, the first NYC Metro Show will open just a few minutes from downtown New York City in New Jersey. The show will run May 10 thru 13 at The Meadowlands Exposition Center (http://www.mecexpo.com/).

To date there is an impressive selection of Gem, Mineral and Fossil dealers. Many of them are Tucson and Denver show regulars. There will be five full sized Dinosaur mounts as well as the first East Coast showing of The American Woman sculpture.

For those of you from that area that have never been to Tucson, this will be your chance to see what it is like.
For more info go to:
http://www.nycmetroshow.com/index.html