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NARG Newsletter

North America Research Group

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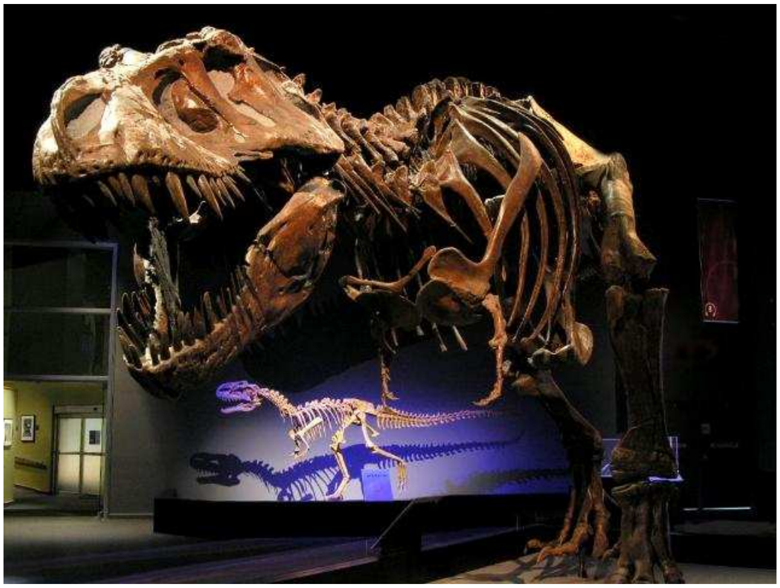
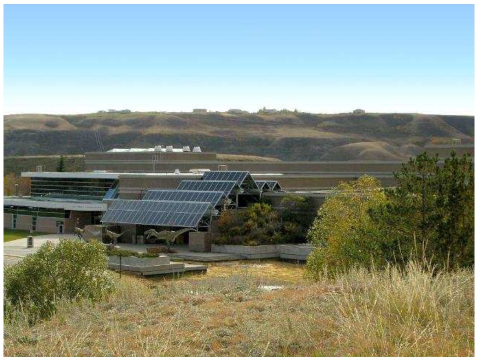
ROYAL TYRRELL MUSEUM

Robert Rosé



This museum of paleontology is a must see for all those who like vertebrate fossils, especially dinosaurs. It is located in Alberta, Canada near Drumheller, which is about 65 miles northeast of Calgary. This museum is the main repository of dinosaur material found in Canada and has a close working relationship with Dinosaur Provincial Park, 70 miles to the southeast.

The museum is housed in a modern building set amid the rocks that yield the Late Cretaceous dinosaurs. Once past the ticket booth inside get ready to meet dinosaurs!



Continued on page 2

You walk past models of two full-sized meat-eaters all fleshed out and ready to impress. In an open area beyond is a display of recent activity of the museum research personnel. To the right side of the room is a large glass window that allows visitors to see many technicians preparing fossils that are still in their plaster jackets. The prep area stations are state-of-the-art with dust collectors, masks, microscopes, compressors and every tool needed to work on the fossils (all I saw were dinos). I noticed they were using PaleoTool equipment.

The next place to go is Naylor Hall, just beyond the prep area. This hall contains several of the finest dinosaur skeletons you will ever see. Some smaller ones are on tall pedestals looking down on you while behind you is a complete T-rex. This is an awesome fossil skeleton. Small lighted displays in the wall of the Hall concentrate on aspects of vertebrate fossils ranging from a comparison of claws, to hand bone differences and teeth distinctions. At the far end of this Hall is the most complete articulated Ornithomimus skeleton ever found.

The last thing to mention on the ground floor is a display comparing mammoth and mastodon skulls. They rest in a case just at eye level so it is easy to study them. The difference in shape of the back of the skull is quite noticeable. The teeth are also a very good way to differentiate these beasts.

After climbing stairs to the second level, you enter the world of the Middle Cambrian. Here above, below and in front of you is a depiction of the world of the Burgess Shale. Many strange creatures are displayed in the diorama at 12 times life size and, as each creature is discussed, a light shines on into show you where it is. Just beyond in the next room are samples of the shale with the fossils. In real life they are quite small. There is also a nice discussion of the history of the Burgess Shale which crops out in the Canadian Rockies, who found it, and how it has been worked.

The next stop on the time line is the Devonian. Canada produces a great amount of oil from Devonian reefs. You can sit down here and watch a video about the reefs. A nicely done diorama of the reef environment shows all the invertebrate creatures that built the reef and relied on the reef to survive. Since I collect Devonian fossils, this was of particular interest to me. Paleozoic plants are next with many nice samples of trees and leaves. You then go down some stairs and encounter the Permian world of amphibians and reptiles. The nice thing about these displays is that they are well lighted and close enough to the visitor so many of the details of the fossils are visible. Many nice skeletons of reptiles and amphibians represented. Amazing how big some of them were.

After the Permian comes the Mesozoic Era where the largest collection of vertebrates is displayed. Here you can walk into a dark room where a variety of Mesozoic marine reptiles are displayed. There are short and long necked plesiosaurs, ichthyosaurs and other marine vertebrates shown as though they were swimming in the ocean. It really looks like you are underwater. Look up when you go inside and see quite an amazing sight.

Photo courtesy of the Royal Tyrrell Museum, Drumheller, Alberta .

Another room is called the Cretaceous Forest and inside is a warm, humid environment with many tropical plants that are holdovers from the Cretaceous. You get a feeling of what it must have been like walking through a forest that could have had dinosaurs in it. After the forest, get ready for an extensive walk through the evolution of the dinosaurs, featuring those dug up in Canada at Dinosaur Provincial Park. Here are enough dinosaur skeletons for the greatest enthusiast! Marvelous displays, signage, and fossil material line a meandering trail that winds its way through history. Every now and then are places to sit down and watch very entertaining videos. Enough specimens are included to show evolution at work. The collection includes the most complete suite of ceratopsid dinosaurs you will ever see illustrating the changes in frills and skull morphology through time. Most skeletons are placed on a sandy substrate in realistic settings with well-done murals behind.

After the Mesozoic you wander into the Cenozoic where most of the display is vertebrate skeletons of mammals. There are some leaves and insects in a few cases. At the end are some exhibits of Pleistocene mammals. A very large mammoth skeleton dominates.

This is a very quick survey of the fossils in the museum. Every one has their favorites so go to this museum and enjoy all the fossils and especially those of special interest to you. The quality and depth of the displays is high but be aware that not all geologic periods are represented. I highly recommend visiting. There was so much to see it took me one and a half days to complete.

For more information, visit http://www.tyrrellmuseum.com/index

Pathological Cephalopod Specimens

Mike Santino

There are times in the life of some organisms when disease, predators or genetic variation can cause an abnormal change in growth and structure. When this happens, the specimen is referred to as pathological. While the cause of the modification is speculative, the result can be very unusual.

Recent non-invasive diagnostic technology developments, such as Magnetic Resonance Imaging (MRI), applied to paleontology have revealed precise growth modifications in pathological specimens.

Following are some high resolution images of pathological Cephalopod specimens.

The first is a Belemnite (*Neoclavibelus subclavatus*) with possible exterior muscular mantle damage causing the otherwise straight guard to bend and straighten again. This damage is possibly due to a bite from a predator.

Neoclavibelus subclavatus

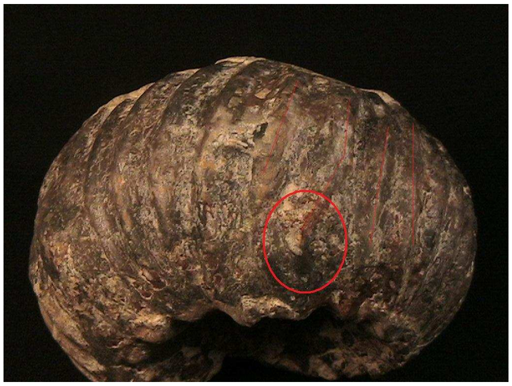
The second picture is of *Placenticeras* species with teeth marks from a bite, possibly a Plesiosaur. Marks of this type are usually in pairs showing both rows of teeth of the jaw. This one shows two, non-parallel single sets of lines. Did this dinosaur have a tooth ache and bite down on one side?

Specimens of this type are also referred to as a trace fossil. Trace fossils are important in paleontology and paleoecology because they provide information about the life habits of fossil organisms and evolution of certain behavior patterns through geologic time.

The third picture is of an *Erymnoceras coronatum* with a lump growth and rib pattern and tubercle change that may be possibly due to parasitic invasion.

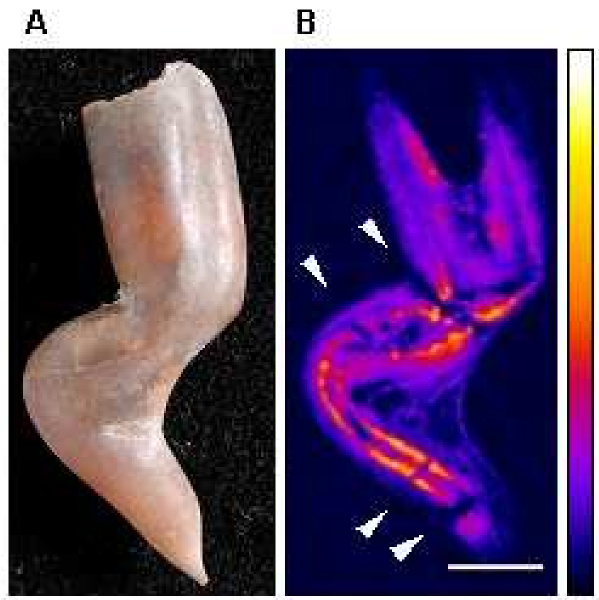
The fourth picture is of a Scaphite species with a row of tubercles (spikes) protruding from the center of the venter (outside edge or belly). Normally tubercles grow in two lateral rows along the sides of the venter on Scaphites.

Finally, the ribs of a *Sivajiceras congener?* change their normal development and change back again due to undetermined causes.



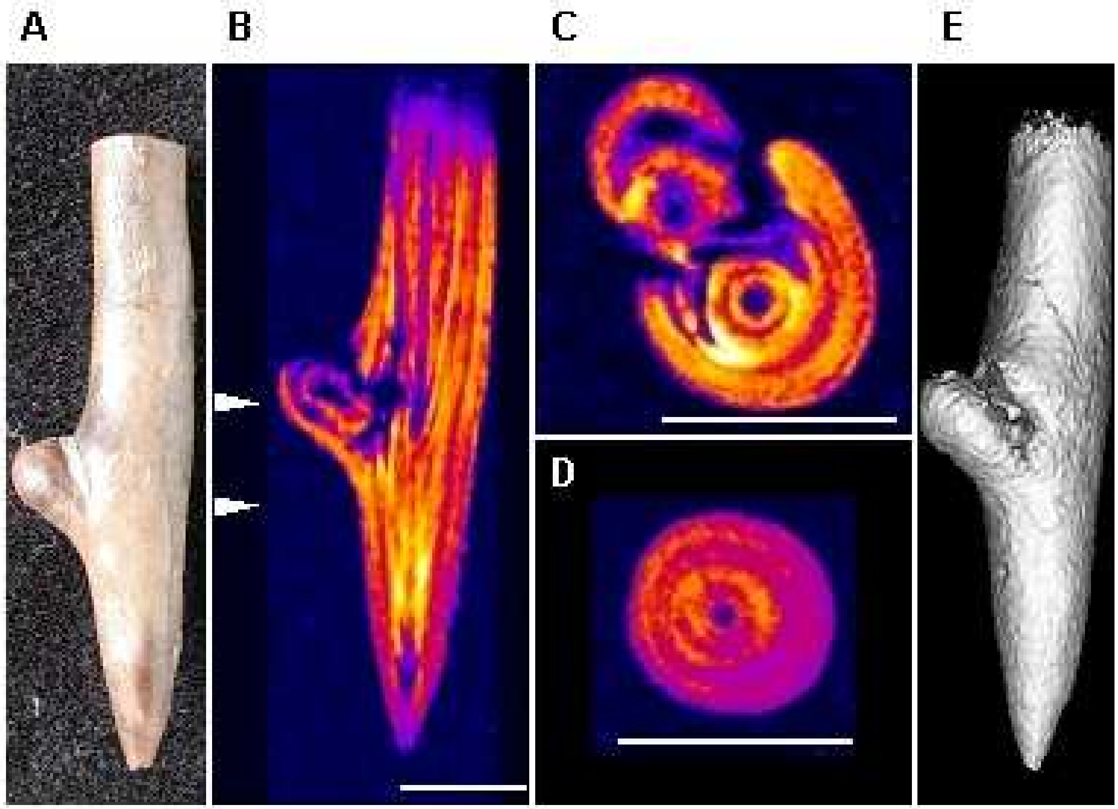
. *Erymnoceras coronatum* *Scaphite sp.* *Sivajiceras congener?*

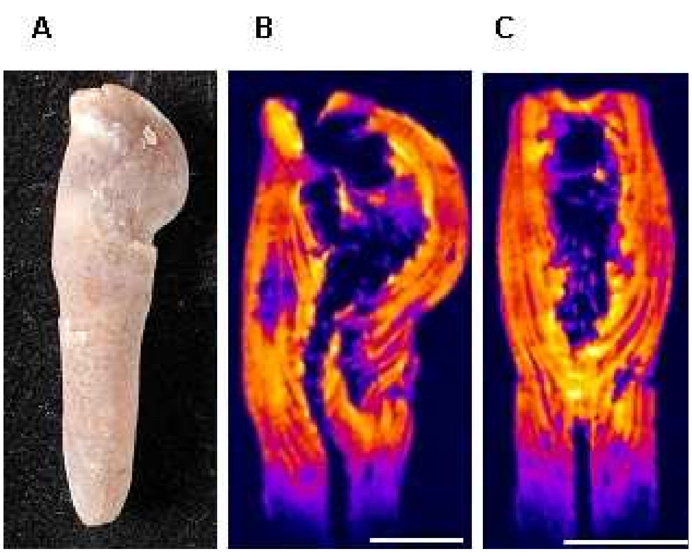
For some terrific digital imagery research using MRI see **D. Mietchen, H. Keupp, B. Manz, and F. Volke. Non-invasive diagnostics in fossils – Magnetic Resonance Imaging of pathological belemnites. 2005. www.Biogeosciences.net**. Following are some examples from this research paper**.**



Sublethal injury with fracture of the rostrum. *Gonioteuthis quadrata* (Blainville, 1827) guard with a zigzag-like deformation. **(A)**: lateral view (photomicrograph). **(B)**: median MR section. Arrow heads indicate fractures. The corresponding slice series (in steps of 125 µm) with this orientation is given in Movie 1. Acquisition parameters: Field of view (FOV): 15×15×32 mm3. Number of averages (NA): 2. Total acquisition time (Ta): 18 h. Colour scale: MR signal intensity in arbitrary units (identical for all MR images). Scale bar: 5 mm for all MR image slices.

Disturbance of the guard secreting mantle. *Neoclavibelus subclavatus* (Voltz, 1830) guard (collection of V. Kriegisch) with an anomalous protuberance, presumably caused by parasitism. **(A)**: lateral view (photomicrograph). **(B)**: median longitudinal MR section. Arrow heads indicate positions of the slices depicted in (C) and (D). **(C)**: transverse MR section through the bubble-like anomaly. **(D)**: more distal transverse MR section through normal tissue. The corresponding slice series (proximal to distal in steps of 117 μm) with transverse orientation is given in Movie 4. The radial lines are indicative of the direction of calcite crystal growth. **(E)**: 3D model of the guard, directly obtained from the MR images. FOV: 8×8×30 mm3. Tr : 952 ms. NA: 10. Ta: 87 h.





Early disturbance of the guard secreting mantle. Anomalous rostrum of *Hibolithes jaculoides* (Swinnerton, 1937). **(A)**: lateral view (photomicrograph). **(B)**: median longitudinalMR section. **(C)**: dorsal longitudinal MR section. The corresponding slice series (proximal to distal in steps of 113 μm) with transverse orientation is given in Movie 5. FOV: 13×11×29 mm3. NA: 4. Ta: 36 h.

Cephalopod Convergent Evolution

Mike Santino, Aaron Currier - technical editor

Organisms can share features as a result of convergent evolution. While natural selection, the process by which individuals reproduce more successfully at a higher rate than other individual organisms generally drives evolution, convergence occurs when distantly related species of organisms develop similar structures in response to similar environmental challenges. Here are some examples to illustrate the concept.

Nautiloid cephalopods are known to have a straight or "orthocone" shape.

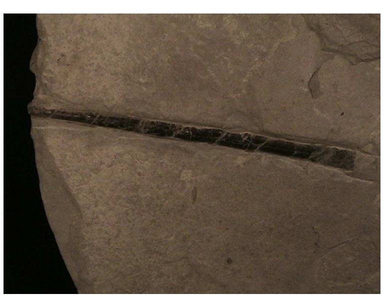
Othocone Nautiloid

Bactrites sp.

Bactritids are a family of Goniatites that evolved from Nautiloids and lived in the early Devonian period (about 400 million years ago). Bactritids are the ancestors of the first ammonoids to form into the "criocone" (coiled) shape that ammonites are typically recognized for.

Xenodiscus, a Ceratid ammonoid, is the only ammonoid to survive beyond the Permian mass extinction (250 mya). *Xenodiscus* is considered the parent of all Mesozoic ammonoids.

Xenodiscus sp.



Bochianites neocomiensis

100 million years later, just prior to the Cretaceous period, criocone ammonites evolved to form an uncoiled shape. Their descendents became the orthocone Bochianites family, members of the strangely shaped heteromorphic anclyoceratids.

Hamite sp.

Baculites scotti

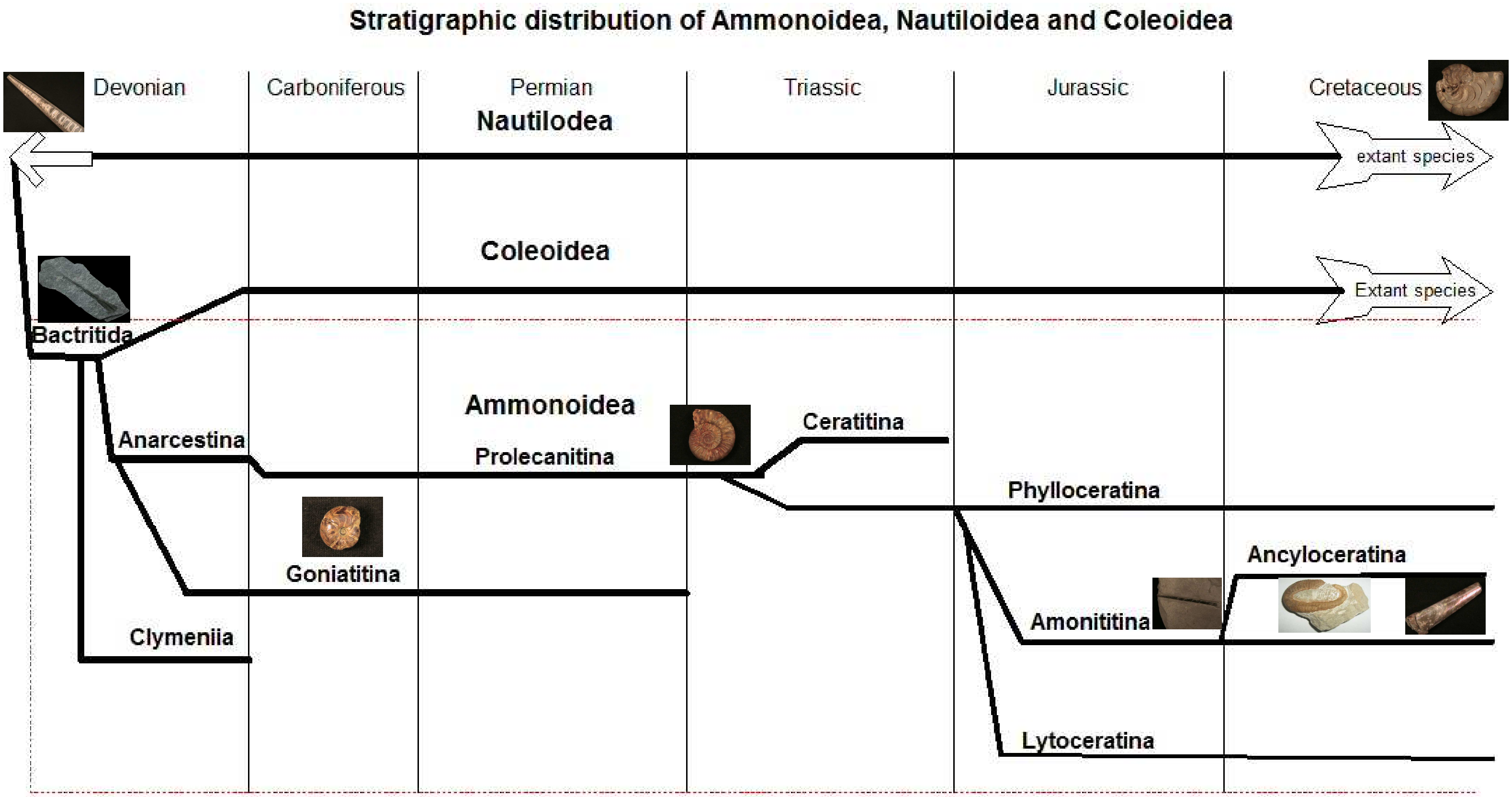
40 million years later, the C shaped Hamites of the anclyoceratids straightened out into the orthocone Baculites.

Another morphological example that supports convergent evolution is of the comparable sutures of a goniatite, *Muensteroceras oweni*, an ammonoid that died 250 million years ago, and the Aturia, a species of nautiloid from 40 mya. Typically, Nautiloids are identified by a very simple straight suture pattern, as demonstrated by the *Eutrephoceras dekai.*

Muensteroceras oweni

Aturia sp.

Eutrephoceras dekai



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This stratigraphic distribution of Cephalopods clearly displays the evolutionary time frame of convergent evolution of the species used in the examples.

Another example of convergent evolution shown by this layout is that both Nautiloids and Ammonoids developed into the cricone (coiled) structure independently presumably in response to similar environmental challenges.

North America Research Group

Jurassic crocodile discovered in Crook County, Oregon

by Andrew Bland, Robert Rosé, and Aaron D. Currier

(Article reprinted by permission from Oregon Geology vol. 68, no. 1, http://www.oregongeology.com/sub/default.htm)

In October 2005, while searching for ammonites (extinct marine cephalopods) near Suplee, Oregon (Figure 1) members of North America Research Group (NARG) discovered the remains of a sea crocodile tentatively identified as *Metriorhynchus* (Figure 2) That lived over 60 million years ago. The crocodile was not a resident of Oregon but was transported thousands of miles from the South Pacific via continental drift on a journey that took Millions of years.

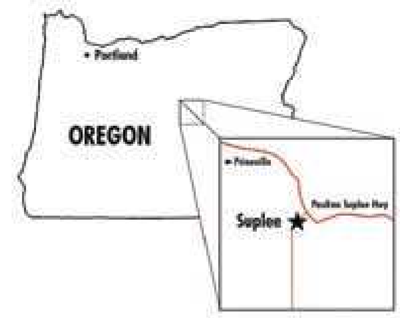

Figure 1. Location map

With the landowner's permission and assistance the specimen was carefully excavated within two days. Several large sandy limestone blocks encasing the crocodile were recovered (Figure 3). Rescued from environmental degradation and further erosion, the material was stabilized and prepared over a period of six months (Figures 4 and 5). With nearly 50 percent of the crocodile's skeletal remains preserved, it is the most complete single specimen of *Metriorhynchus* found in Oregon to date and the third from the Jurassic Snowshoe Formation.

The first crocodile specimen from Oregon was found in the late 1930s by Earl Packard, then Dean of the School of Science at Oregon State College. He collected a skull, jaw, several vertebra, and long bones of crocodiles from several localities and sent them to the Smithsonian (Orr and Orr, 1999). Nearly 40 years later these bones were described by Buffetaut (1979) and determined to be in the *Teleosaurid* family — the first in North America. It was also stated that some of the vertebrae could be from the *etriorhynchid* family. In the late 1980s Stricker and Taylor (1989) reported finding a second crocodile specimen. They stated in an abstract that the crocodile belongs to the *Metriorhynchidae* family of *Mesosuchia*. This specimen is not professionally described.

NARG donated the 2005 crocodile specimen to the Thomas Condon State Museum of Fossils at the University of Oregon. Following accession and cursory examination the specimen was shipped to the University of Iowa, where Dr. Chris Brochu, associate professor of vertebrate paleontology at the university and well known crocodile expert, will study the specimen and formally report it in the scientific literature. This work is expected to take about two years. After this step the crocodile will return to Oregon and become a permanent part of the Condon Museum at the University of Oregon.

Crook County Geology

The Snowshoe Formation crops out extensively between Suplee and Izee (Crook and Grant counties) and is geologically part of what geologists map as the Izee terrane (Orr and others, 1992). It consists of marine sandstone, sandy limestone, and siltstone overlain by claystone beds and marine volcaniclastic rocks. All sedimentary rock units change laterally, and in distances of only 16 to 24 km these units can vary significantly in lithology. The Weberg member of the Snowshoe Formation is recognized only around Suplee where limestone and calcareous sandstone are common and marine invertebrate fossils are prevalent. It is in this latter unit that crocodilian fossil remains were exhumed. These rocks represent a tropical warm-water, high-energy (turbulent), relatively shallow marine environment.

The western part of the Snowshoe Formation has been dated with some precision using ammonite biostratigraphy (Imly, 1973). The Weberg Member represents most of the Bajocian Stage of middle Jurassaic age; Taylor (1982; 1988) has detailed a biochronology of the Snowshoe Formation. The Izee terrane consists of Triassic, Jurassic, and older rocks that were deposited in the proto-Pacific Ocean more than 1,900 km south of its present latitude, and perhaps from the far western side of the Pacific basin. The Jurassic rocks here “represent the environment of a shallow marine forearc basin between a volcanic island archipelago and the oceanic subduction trench” (Orr and others, 1992, p. 254). This terrane was accreted to the North American plate during late Jurassic.

Figure 2. Artist’s rendering of the crocodile *Metriorhynchus*. Credit: Jon Hughes.

Figure 3. In situ numbered blocks of crocodile specimen. Photo: Peg Johnson.

Marine Crocodiles

The subject crocodile belongs to suborder *Thalattosuchia*, a name applied to a clade of Early Jurassic to Early Cretaceous marine crocodylomorphs. Buffetaut in 1982 assigned two families of marine crocodiles; *Teleosauridae* and *Metriorhynchidae* to the suborder *Thalattosuchia*.

Members of the *Teleosauridae* family are, characteristically, slim-bodied, marine crocodilians similar to the modern day gharial. They bear rostrate snouts, reflective of a piscivory (fish eating) niche. Especially characteristic are forelimbs, which are only one half the length of the hind limbs (Carroll, 1988). Shortened forelimbs are common in aquatic reptiles. Some early members of *Teleosauridae* have been found in terrestrial formations suggesting thalattosuchians were in transition from being semi-aquatic freshwater forms to fully marine forms. The teleosaurs retained their armor covering.

Metriorhynchids were a group of Jurassic/Cretaceous marine crocodilians with refined paddle like forelegs. Unlike the teleosaurs they lacked dermal armor covering. Their streamlined body minimized drag though water, as did a tail with a fishlike dorsal appendage. Metriorhynchids were the only group of archosaurs to become fully adapted to life at sea. The *Metriorhynchidae* family has a wide geographic distribution, with material re-ported from Britain, England, France, Switzerland, Germany, Russia, Cuba, Mexico, Argentina and Chile.

Figure 4. One of many needle-like teeth of the crocodile. 6.3 cm long.

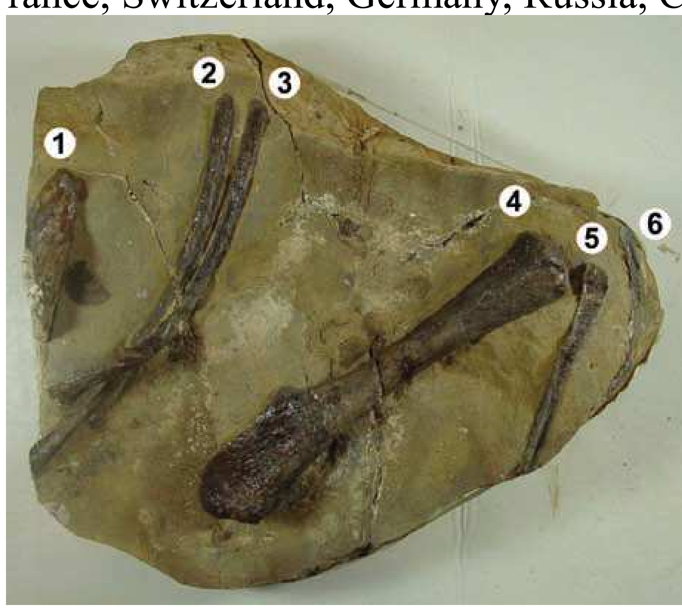

Figure 5. Prepared limestone block showing humerus and ribs of crocodile. 1, Unidentified bone, 8.25 cm; 2, rib, 21.5 cm; 3, rib, 17.75 cm; 4, ulna, 21.5 cm; 5, rib, 10.75 cm;

The type genus *Metriorhynchus* was a carnivore that spent much, if not all, of its life at sea. No *Metriorhynchus* eggs or nests have been discovered, so little is known of the reptile's reproductive life cycle. Other large marine reptiles of the Mesozoic, such as plesiosaurs and ichthyosaurs, are known to have given birth to live young at sea. Averaging around three meters in length, *Metriorhynchus* is considered to be medium sized compared to extant crocodilians.

Metriorhynchus was a versatile and opportunistic predator that fed on belemnites, ammonites, fast-moving fish, and the larger *Leedsichthys*. Occasionally *Metriorhynchus* was also capable of capturing flying animals such as pterosaurs and scavenging plesiosaur carcasses on the sea floor.

Acknowledgements:
Dr. William Orr, University of Oregon; Dr. James Martin, South Dakota School of Mines and Technology; and Dr. Christopher Brochu, University of Iowa.

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Stonerose Interpretive Center & Eocene Fossil Site

Stonerose Interpretive Center: Stonerose is the name of a fossil site, a place where impressions of plants, insects and fish that lived in and around a large lake nearly 50 million years ago can now be found in a large shale deposit. These fossils are the result of events that happened long before there were people to observe them.

Stonerose Interpretive Center is located at 15-1 N. Kean Street, on the corner of Kean Street and Highway 20 W., across from the city park in beautiful Republic, Washington. The fossil site is just a short walk from the Interpretive Center. For more information please contact us at: (509) 775-2295, or visit us on the web at: www.stonerosefossil.org

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