Fossils In North Dakota

FIND is a newsletter dedicated to helping young readers (in age or spirit) express their love of fossils and paleontology, and to help them learn more about the world under their feet. Each issue will be broken up into sections including Feature Fossils, Travel Destinations, Reader Art, Ask Mr. Lizard, and more!

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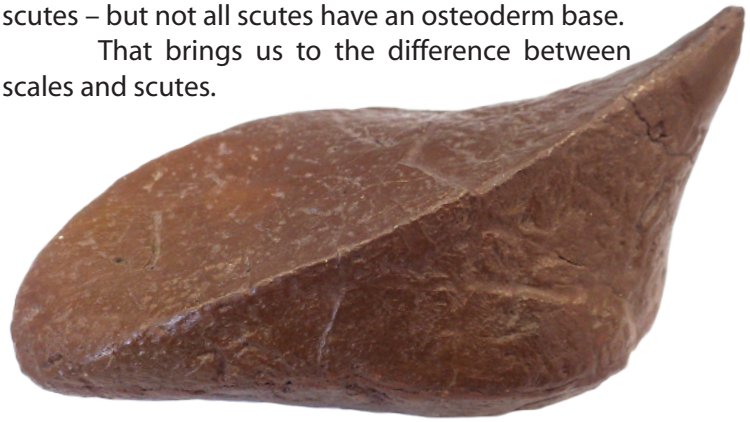
Feature Fossil: osteoderms

If I ask you to imagine bones, what do you think of? A skeleton? Maybe something you've seen in a museum, or a spooky Halloween display? Bones make a great lever system that our muscles can hook onto – they keep us from looking like a big pile of goo (like a jellyfish out of water). But not all bones belong to a skeleton – some bones are embedded within skin, and act as armor. The particular bones I'm referring to are called "osteoderms" – or bone skin. A few different groups of animals have this feature, including some dinosaurs, lizards, a few mammals, and crocodiles.

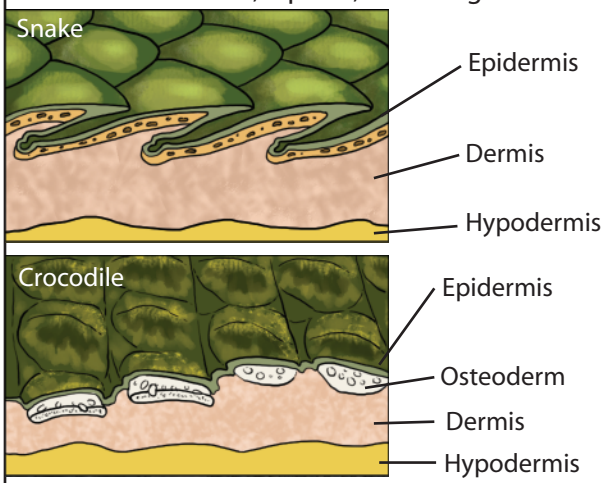
These floating skin bones are found in ankylosaurs and nodosaurs – the armor plating they're so well known for are based on osteoderms. Those bone bases were riddled with blood vessel grooves – which means the bone, as well as the tissue above, was fed a healthy supply of nutrients. Scaly structures supported by these osteoderms are called scutes – but not all scutes have an osteoderm base.

That brings us to the difference between scales and scutes.



Ankylosaur osteoderm from South Dakota - the surface is covered in blood vessel grooves.

Skin is made from different layers of tissue. Each layer has a different function, their own special set of cells, and has their own structures. The outermost layer is called the epidermis (the Greek 'epi' prefix meaning "over," "upon," "above," etc.). This layer contains cells that produce pigments for coloration, and when they die these cells collect at the surface to add in protection. This is where scales are produced, and why the outer-layer of scales are shed when birds, reptiles, and fish grow.



The middle layer of skin is called the dermis. This protected layer is where your nerve endings reside (cold, heat, pressure), along with oil and sweat glands, hair follicles, and scutes. Scutes are produced in the dermal layer, but may be covered by a scaly coating produced in the epidermis. Scutes with a bony core, are called osteoderms. It's all coming together!

Returning to the scaly and scute-y horn and keratin covers over osteoderms in ankylosaurs – that means when you see their skeletons in museums with all of those amazing armor plates in place – the spikes could have been much, much larger. That spike on the lower left? Much thicker, much pointier.

Of all of the animal groups listed earlier, crocodile osteoderms are the most common ones we come across on our fossil dig sites – and one of our favorite small bone elements to find. They're small, portable, easy to dig out and transport, fast to clean, and visually pleasing. In the field, if the external surface is facing up, we tell our volunteers it looks like Swiss cheese. The surface is pitted with circular and oval wells, and criss-crossed with vascular canals. If the internal surface is facing up, the texture varies between smooth, or a cross-hatched appearance. Crocodylian ostoderms support overlying scutes and scales, and are different shapes based on their location within the body. Those along the back have tapered ends, and overlap slightly with each other, which reduces the amount of

flexibility the animal may have bending their backs up and down, but adds a respectable amount of armor plating and protection to the animal. The blood vessels running through the osteoderms also help with thermoregulation (basking). We also find osteoderms that are more rounded in shape, that do not show signs of overlap. These are positioned more on the sides of the animal.

If you're ever out in the field with us when someone finds an osteoderm, and we say "scute" – don't worry: we understand the difference between scutes and osteoderms. However, "osteoderm" at 4 syllables, and "scute" with one – scute is just faster to say, and honestly, it's more fun. Scute! Scute! Scute!

Two crocodile (*Borealosuchus*) osteoderms found the last day of the 2022 Medora fossil dig.

V. I. P. (Very Important Paleontologist) Amelia Zietlow

My name is Amelia Zietlow, I'm a PhD Candidate in the comparative biology program at the Richard Gilder Graduate School, which is part of the American Museum of Natural History in New York City. I research both living and extinct lizards, though most of my time is spent on mosasaurs, a particular kind of giant marine lizard that lived during the very end of the age of dinosaurs.

In a perfect world, what would your dream job include?

Ideally, I'd like to have a job where I can continue to work on both living and extinct lizards, have the resources to travel to other museums, and have plenty of opportunities to share my research with the public…so my current job is actually pretty close!

Our collection wasn't the first you've visited. Have you ever been surprised by any of the fossils you have examined? Any unexpected results?

Right – the North Dakota State Museum was actually the ninth museum I've visited for research! One great thing about mosasaurs is that I'm always surprised by something in the collections, because there are so many mosasaur fossils that have never been photographed or described in the scientific literature; I have been at the AMNH for two years now, and I *still* regularly find mosasaur fossils in the collections that I've never seen before! Some of the most unexpected finds are actually at the ND Museum…but I'll have to keep those secret for now!

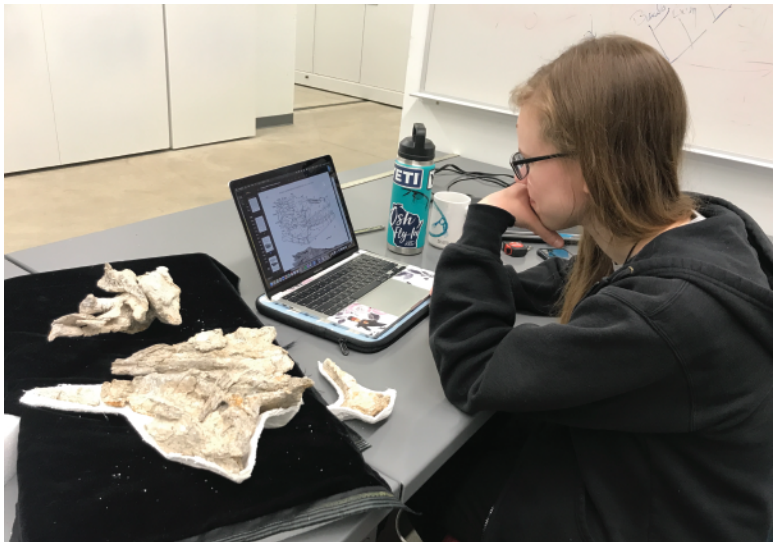
What was the coolest collection or display you were able to visit for your research? I know I've seen some awesome behind-the-scenes following you on Social Media.

There are three that really stand out to me. The first is the Field Museum in Chicago; that was my first real research visit, and one of the mosasaur skulls I was working on is out in a big display case and high up, so I needed to climb up on a ladder that barely fit in the narrow little walkway inside the case, and that's always very fun haha. The second is the Museum of Comparative Zoology at Harvard University, where I got to see a very important historical specimen: the first fossil found of *Tylosaurus*, which is the first mosasaur I researched. Finally, it's hard to beat Bunker – Bunker is the nickname for a massive *Tylosaurus* at Kansas University Museum of Natural History. Its skull is about as long as I am tall (5'7" – 1.7 m), and the entire skeleton is ~46ft long. The real fossil is impressive as it is, but they also have a cast of the entire skeleton hanging above the entryway to the museum, which is just absolutely crazy to behold.

What caused you to study mosasaurs?

When I was in my sophomore year at college, I had a meeting with my advisor about what group of animals to

study. The problem was, all my favorite dinosaurs are only known from a single fossil – *Carnotaurus*, for example – and the type of research project I was going to do required as many fossils as possible. We arrived at mosasaurs because they have a really good fossil record, both with lots of different kinds of mosasaurs, *and* many species represented by 50 or more individuals (for context, there are only about 30 good *T. rex* specimens known in the entire world!). Mosasaurs were also relevant to another research project I was working on, which was focused on geckos: they're all lizards! Finally, they are super cool, which makes them very fun to work on, very fun to talk to people about, an very good for getting people excited about biology!



Did you always want to be a paleontologist? Or did you come to it later in life?

Not at all, haha! I always loved learning about paleontology growing up, but I never thought about pursuing it as a job. My 'Plan A' was actually to become an airplane pilot – but flight school is very expensive, so then my plan was to get a business degree, to get a "regular" job in the meantime to pay for flight school. I went to Carthage College, because they had a good business program and were close to an airport with flight lessons, but also had a biology program (I've always liked biology, & wanted to continue learning about it 'for fun'), and hey, they also had paleontology, which I thought would be fun to do 'on the side'… It turned out that I enjoyed my biology classes much more than my business classes, and my paleontology professor (& advisor) was very supportive, and helped me tremendously in not only deciding that paleontology was something that I did want to pursue as a career, but that it was something that was actually *possible* for me.

Which do you prefer: fieldwork or research?

Oh man, that's tough – I like them both a lot for different reasons! Research is super cool because a lot of the time, you're the first person to see something or notice something about your topic – with paleontology specifically, you're the first person to understand these animals as they really were, 80 million years ago. That said, I love being outdoors and finding things, and fieldwork is exactly that!

Many of our young readers are interested in pursuing a career in paleontology – do you have any advice for them?

Paleontology has a bit of a reputation as a tough field to work in, but if you really want it, you will make it happen, no matter what. Books are a great place to start, & get involved with your local museum as soon as you can – volunteer in the lab, tag along on field expeditions, etc.! There's more to paleontology than just fieldwork and research – there's also scientific illustration and photography, preparation, and museum collections management. Finally, most paleontologists nowadays are very easy to reach via email – we're always happy to answer questions from young scientists!

Do you have a favorite prehistoric creature?

I'm very partial to mosasaurs of course – *Tylosaurus* is probably my favorite among those! I also really love all of the Western Interior Seaway critters, & for dinosaurs, I like the ones that look like bulls haha – *Carnotaurus* & *Nasutoceratops*!

You can follow Amelia on Twitter @TyrantLzrdQueen