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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Ichnology: Dinosaur Tracks

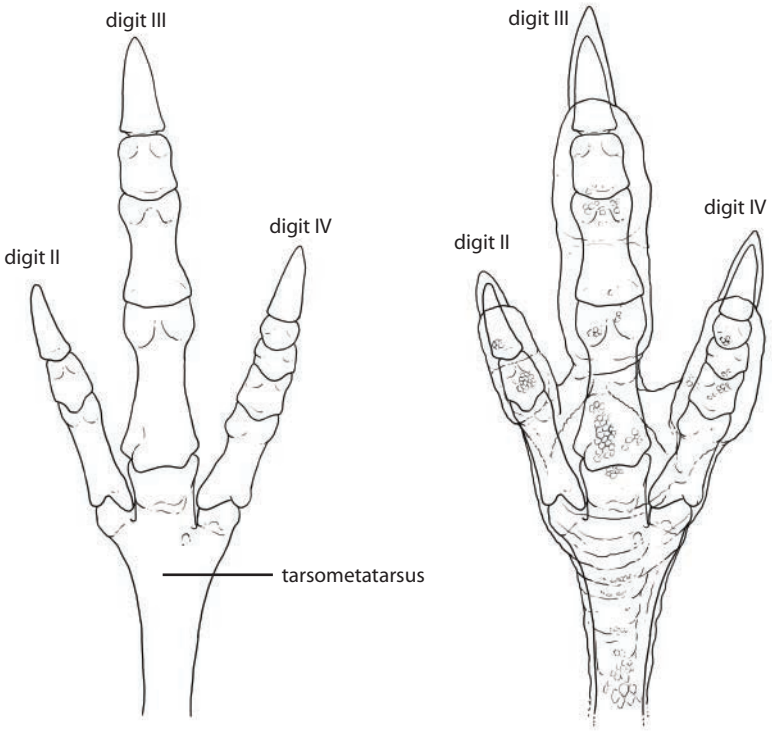
Ichnology is a branch of paleontology focusing on the study of trace fossils, such as tracks, burrows, gnaw marks, and feces. Pretty much anything made by a living plant or animal. You can read more about the last one (coprolites) in issue #30. The word ichnology comes from the Greek word *ikhnos*, meaning footprint, or track, which is what we'll focus on this time.

The problem with tracks (and many other trace fossils), is we don't have a clear identity of exactly what made them. Once an animal steps down and makes a track, they leave! At least with a bone, we can identify what that bone comes from, or where in the body. Tracks are trickier. Like our example in issue #25 of *Ophiomorpha* (burrow) and *Callianassa* (shrimp that made the burrow), a trace fossil gets a different descriptive name from the organism that made it.

With dinosaurs, most of the time scientists only have the bones to work with, so must make guesses on what the tracks they leave behind would look like. Other times, they find fossilized tracks, and guess at what kind of animal made them. Sometimes they get them right, other times terribly wrong! There have been times where finding tracks have actually changed how we view an animal, or answered questions about how they moved on land (such as with pterosaurs, the flying reptiles).

We can use modern animals as learning tools – especially birds, in the case of dinosaur tracks. We have the living animal with all the soft tissue, we have the bones, AND we can observe the tracks that the animal makes. Putting all three of these together can help us figure out connections when we're missing information from fossil animals.

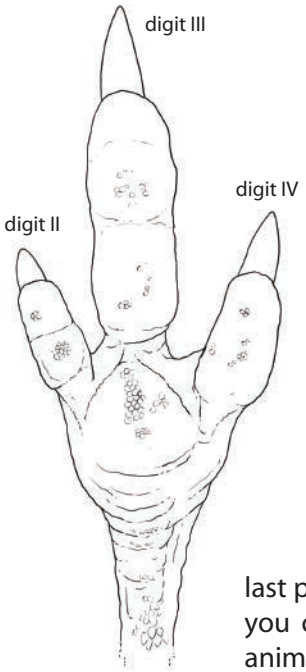
Before we get in to fossil tracks, let's work with an animal alive today that is very dinosaur-like: emu. Emu are large flightless birds with three toes. You may be more familiar with ostriches, but they have modified feet with 2 toes, which is why we're using emu in our example.



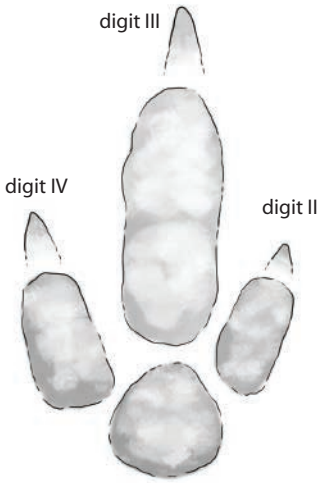
Ok - bear with me here. Above left I have drawn a LEFT emu foot, from below. So what you see is the bottom of the left foot, not the top. We call their toes digits, pes, or phalanges, depending on what we're discussing. An emu, and many dinosaurs, have lost digit I (your big toe) - while others have rotated it around to the back of the foot, like perching birds (sparrows, crows, etc.) and many meat eating dinosaurs. It's then called a halux. On some dinosaurs it's really tiny, and can't do much - like the dew claw on a dog.

The drawing on the right are the bones of the emu foot, with an outline of where the soft tissue would be. The pads on the feet, a little bit of skin and scales, muscles, etc. When looking at footprints, we notice deeper spots where pads are, and higher spots where wrinkles were. Wrinkles occur where your skin needs to bend and flex - such as over bone joints.

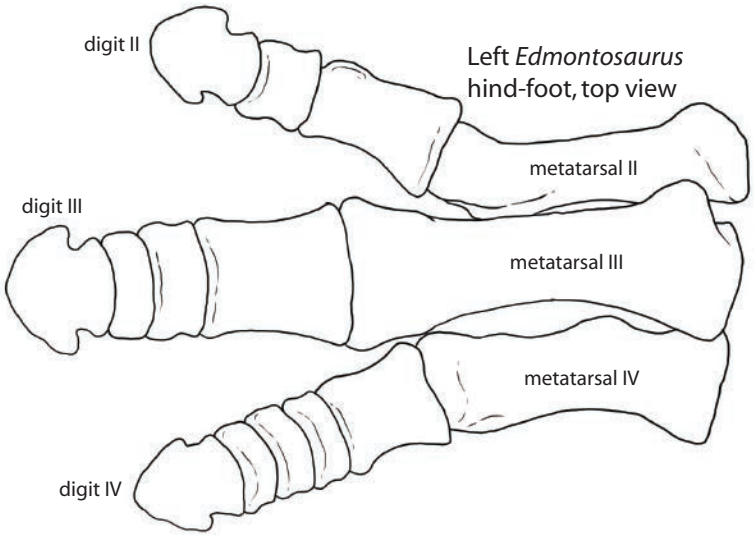
There are definitely some wrinkles in the skin on that right emu foot, but maybe not as many as you might imagine. Digit IV is made from 4 bones, plus the claw - but the bones are very short and squat. They act together and flex a little, but not as much as your fingers would where they attach to your knuckle.



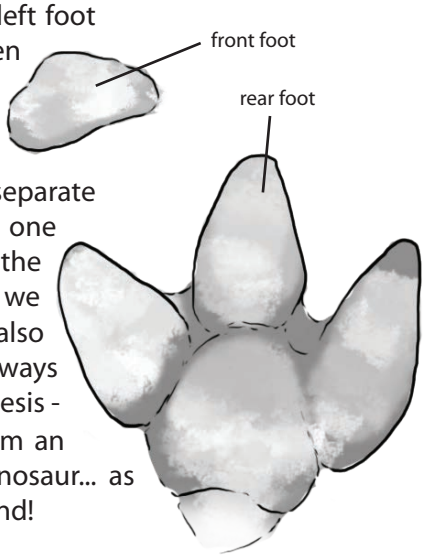
Emu

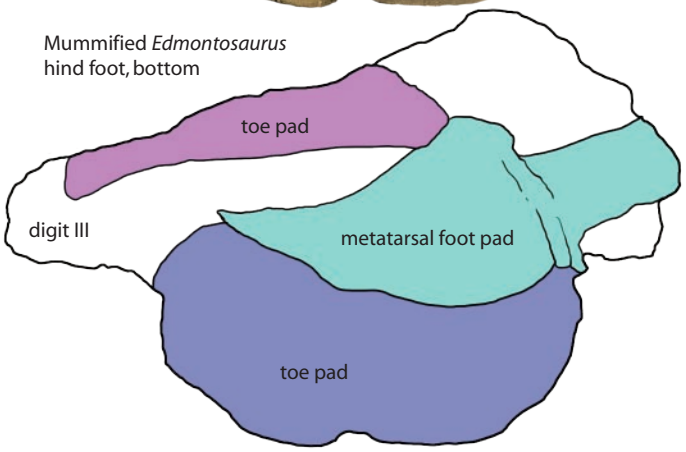


At left is the emu foot from the last page, but with the bones removed so you can see the pads easier. When the animal steps and makes a track, think of it like when you use a stamp - you get a reverse image of the rubber, so the track is backwards to the foot. On the track at top-right, you can see the dents of where the thicker toe pads are, including the base of what is called the tarsometatarsus. This is simply a fusing of the metatarsals in birds - what you can see as the flat part of your foot, before the toes. Even the claw tips can be seen in tracks.



Above is the rear-left foot of an *Edmontosaurus*, seen from the top. Their feet are a little different from our emu in the metatarsal area - they still have three separate long bones, rather than one fused bone connecting to the toes. Based on our emu, we might guess that it would also have large toe-pads. Trackways found support this hypothesis - at right is a rear track from an ornithopod (bird-foot) dinosaur... as well as a track from the hand!



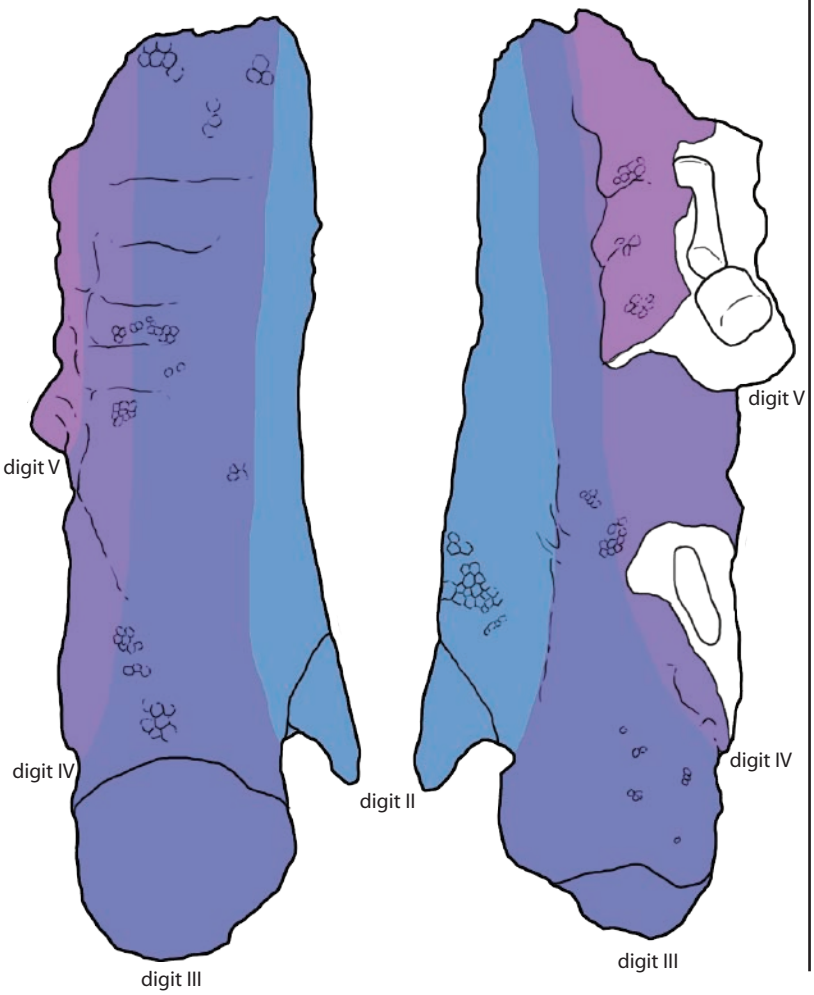


But how can we be SURE that the track came from a foot similar to our *Edmontosaurus*?! If we're very lucky, we find a foot with soft tissue, much like Dakota the Dinomummy, from FIND issue #32. Some people used to think that duck-billed dinosaur feet were webbed for a more watery habitat. When the dinomummy was found, and work began on the feet - it was discovered quite quickly that the toes were not webbed. They did have wide toe-pads however! In the line-drawing above, the middle toe, digit III, is tucked a little farther back so the toe-pad there is difficult to see.

Tracks at home

Many animals have pads on their feet. Some have pads to help the animal move silently. Some have wide toes to walk on squishy wet soil, shifting sands, or soft snow. Can you guess what the tracks below are from?

Mummified right front foot (hand) of *Edmontosaurus*, top view (left), and bottom view (right).

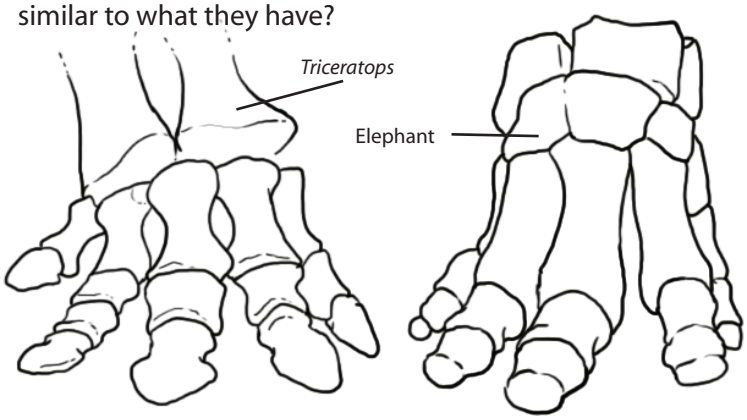


If you look at the hand of Dakota the dinomummy, at left, you may notice some interesting things. The ends of digits II and III have hoof-like nails, while digits IV and V do not have any claws or nails. When this animal walked on all fours, using its front arms for stability, most of the weight came down on digit III, with a little weight distributed to digits II and IV.

If you take your right hand, hide your thumb, tape your middle three fingers together, then try to bear walk on the tips of your now mittened-fingers, that's pretty much what *Edmontosaurus* was doing.

Tricera-tootsies

You are given the task to draw a living *Triceratops* foot. You go to your museum, find their *Triceratops* skeleton, and draw down the bones. Your friend suggests you use an elephant as inspiration - because don't the bones look similar to what they have?



You're not so sure... an elephant is a mammal, and isn't very closely related to dinosaurs. You just learned about emu feet though... do you draw separate toes? Or a big pad?

You research tracks left by each animal - does this change your mind?