“In The Footsteps of Dinosaurs”

Theater video, 4:3 projection, runs 00:05:22

Scientists:  MARTIN LOCKLEY [University of Colorado at Denver]
EMMA RAINFORTH [Ramapo College of New Jersey]
STEVE GATESY [Brown University]

Exhibit Section:  Trackways

MARTIN LOCKLEY [University of Colorado at Denver]: Dinosaur tracks have been found in many, many locations all over the world; they are truly a global phenomenon. In recent years, we’ve documented them all over North America, in Europe, in Asia, in the southern continents of South America and Africa. So they’re really being integrated into the bigger paleontological picture of the distribution of dinosaurs worldwide.

EMMA RAINFORTH [Ramapo College of New Jersey]: There are a number of things we can learn from dinosaur footprints. One of the things we might want to try to do is to reconstruct the ecosystem that the dinosaur was living in. In the case of the large trackway surface behind me, all of the footprints seem to be of the same size and shape, which indicates that they were made by basically the same type of animal; in this case, a theropod dinosaur.

We can then look at trackways from elsewhere in the Connecticut Valley and trackways of different ages, and try to reconstruct the ecosystems represented by each of those track surfaces by identifying the animals that left the tracks.

MARTIN LOCKLEY [University of Colorado at Denver]: With the study of footprints, we look at the individual track or what we call the trackway, a sequence made by the same animal.

The individual track is quite important for the anatomy of the animal — the size, the shape, the length, the width, the number of toes.

With the trackway, however, we’re dealing with steps and strides — the animal in dynamic motion — and we can use these measurements to calculate the speed of the animal and work out various aspects of its posture and gait.

MARTIN LOCKLEY [University of Colorado at Denver]: Trackways help us determine how an animal might have looked in some really important and obvious ways. The footprint that we see here is not an impression just merely of the foot skeleton — this thing had flesh on it. So firstly, we know what the animal’s fleshe out foot looked like. In addition, we may be lucky and find skin impressions, which tells us ore about the external appearance of the
EMMA RAINFORTH [Ramapo College of New Jersey]: This is the first fossil footprint that was named and described in North America. It was named in a publication by Edward Hitchcock in 1836, and he gave it the name “Ornithicus giganteus.” It’s also interesting because you can see the individual pad impressions on each toe. So for example on this toe right here, you’ve got a bulbous impression here — this is one pad with a pad in front of it — and we see pads on each of the other toes as well.

MARTIN LOCKLEY [University of Colorado at Denver]: In general, there are rules that relate the shape of the foot to the leg and the rest of the animal. Animals that tend to have short toes tend to have long limbs and short bodies. By contrast, animals that tend to have long narrow feet where the toes stick out tend to have short legs and long bodies. So this is just a piece of evidence for building the whole animal from the foot up.

STEVE GATESY [Brown University]: A shallow track is very good for understanding the morphology or the anatomy of the bottom of the foot, and also for where they placed their feet. But in terms of how their limb is actually functioning, what is happening above the ground basically isn’t preserved. Deep tracks, though, because the animal is sinking in; that volume of sediment is capturing in three dimensions evidence of how the toes moved, how the metatarsus or the sole of the foot moved. And if we can understand what’s happening at that bottom part of the limb, we can work our way up — through the ankle joint to the shin, through the knee joint to the thigh, up to the hip joint — to see how that entire limb is operating as that animal is contacting that substrate.

I got into working with 3D-animation in footprints because we discovered some unusual tracks in Greenland — extremely long, kind of slit-like toe impressions. The ripple marks and the nature of the track made it look like the mud in that part of the lake bed was extremely sloppy and soft, and so maybe these animals were dropping down onto their metatarsus — onto their sole — walking flat-footed to try to snowshoe their way across.

Well it turned out that we had turkeys in the lab at the time, and so we tried to reproduce that in a living turkey. And it was a complete failure. The birds did nothing like that at all. In fact they just plunged right on through, creating a deep track that ended up looking very much like what we saw in Greenland. And that was when the light bulb went off. We said, wait a minute, this isn’t just an animal trying to walk along the surface, it’s actually plunging in to a significant depth, and then pulling its foot out again. And this gave us — rather than a two-dimensional distortion of the surface — a real three-dimensional movement through a volume, where we knew we had captured that animal’s foot in 3D, and if we could work our way backwards, perhaps reconstruct the
motion of the foot from 210 million years ago.

**MARTIN LOCKLEY [University of Colorado at Denver]:** As a paleontologist, I find the study of dinosaur tracks particularly exciting. I think many people view paleontology as the study of dead animals. Well, that’s true, but the other side of it is that we’re trying to bring those animals back to life. And tracks — more than anything, I think — do that. We can literally follow in the footsteps of these ancient dinosaurs.