DENVER MUSEUM OF NATURE&SCIENCE

A Q&A about the Discovery

With the team's research leaders, vertebrate paleontologist **Tyler Lyson**, and paleobotanist **Ian Miller**, both of whom are curators at the Denver Museum of Nature & Science.

Q: How big a deal is this discovery?

Miller: 66 million years ago, the course of life on Earth changed fundamentally. We were hit by a massive asteroid that wiped out ecosystems across the planet. The time afterward has been shrouded in mystery. We haven't had a good collection of fossils to really understand the very bottom of the tree of life that leads to the present day. And this incredible discovery is shedding new light on that time period.

Lyson: All modern mammals – including humans – can trace our origins back to those earliest survivors of the impact. Now we have the animal fossils, the plant fossils, and we have an amazing timeline from the first one million years after the extinction of the dinosaurs, which just happens to be the origin of the modern world. We found these amazing fossils in one of the most poorly understood intervals of time.

Q: So this is the first time that scientists have been able to piece together a coherent picture of that first million years after the dinosaur extinctions?

Lyson: Yeah, definitely. It's the first time that we can piece together four key things: the animals, plants, temperature, and then the timeline. We can really look at the recovery of a whole ecosystem for the first time.

Q: The discovery site – Corral Bluffs – is not exactly terra nova for fossil hunters. How were these specimens overlooked?

Miller: Scientists exploring this area 100 years ago commented on the fact that they weren't finding any fossils.

Lyson: Our first time out at Corral Bluffs, we hiked around for a few days and found basically nothing. I could fit all the fossils I found in one hand.

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Q: What changed? What was your *Aha!* moment?

Lyson: All paleontologists have what we call a search image. We key in on certain rocks or color of rock, certain depositional environments. Vertebrate paleontologists usually look for bone weathering out of the ground. That wasn't working at Corral Bluffs. I started thinking, "there's got to be a different way of looking for these fossils."

Then I had an experience looking for fossils in South Africa. There my colleagues look for a certain type of rock, not for bone. They search for concretions, which is a kind of rock that forms around an organic nucleus. Sometimes that organic nucleus can be bone.

Miller: Tyler came back from south Africa with this idea for a new search image and was like, "I'm going to knock it out of the park. We're going to find this stuff." And I'm like, "Yeah, sure, Tyler. That sounds great." We had some hints we were on the right track, and Tyler had found a couple of really cool things in our museum collections that indicated this might be possible. Putting those pieces together, we went back out to Corral Bluffs in the fall of 2016. That's when it all kicked off.

Lyson: I had changed my search image from bones to concretions. That's how we cracked the code and blew it wide open. I split open a concretion and saw a mammal skull smiling back at me. And then I looked around and saw concretions just littering the landscape and was like, "Oh man, here we go."

Once you have the right search image, you could see fossils everywhere. But if you didn't have it, you were blind to them.

Sure enough, we found like four or five mammal skulls within a few minutes. That was one of the most remarkable moments in my life.

Q: You realized you'd hit the jackpot?

Lyson: That first week felt like anything was possible, because we just kept on finding one crazy fossil after another. We found a jaw, and then we found a skull, and then we found more skulls, and more skulls. It was a goose-bumps moment for me.

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Miller: You could spend a whole career and not find a single skull from that time in Earth's history. We were finding a skull about every 15 minutes once we figured out what to look for. It happened that quickly.

Q: Then I suppose the fun was over?

Lyson: Right? We just found all these cool fossils. It's like, now what do we do? That winter, we sat down and hammered out a plan.

We're all specialists in our own little area. I study reptiles, and here I found all these amazing mammals. One of the first things we needed to do was to identify the mammals. Also, we needed to figure out the age of the rocks, and we needed to figure out where the K-T boundary was at Corral Bluffs. I reached out to a handful of folks that I went to grad school with.

Q: What was their reaction?

Lyson: It came as a shock to a lot of them. In this interval of time, you just don't find mammals like that, and that complete. They were like, "Where?" And I said, "Near Colorado Springs." And they were like, "*What?* That area's been looked at over and over again." Usually we think of big discoveries happening in a new area, and this was by no means a new area.

Miller: Scientists are usually really excited to be part of a project that's going to change the way we think about life on Earth, about the story of how we got to this moment. If you had to choose one million years in Earth's history that you really want to look at carefully, this would be it.

Lyson: We knew virtually nothing about this interval of time. Here we are finding all these amazing fossils from right smack dab in that critical interval. People were certainly energized by it.

Q: As a team you could then make sense of what you'd found?

Lyson: No one scientist could put this story together – it's impossible. Everybody worked together to make it happen. There was a lot of blood, sweat, and tears. We ended up collecting nearly a thousand vertebrate fossils, over 6000 plant fossils, and our colleagues counted over 37,000 pollen grains as part of this study! That just blows me away!

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Miller: We documented changes in the landscape after the impact, from a world dominated by palms to a world dominated by a more diverse group of trees. And then we saw the animal species change in lockstep fashion. And then we lined that up with changes in the environment, temperature. Putting all those pieces together, I was like, "Holy cow, is this possible? Is this really true?" It turns out we really were able to paint a picture of the emergence of our modern world – and that's phenomenal.

Q: What's next?

Lyson: This recovery pattern we're seeing at Corral Bluffs is the gold standard for one area, and now it'd be great to see if it's normal or abnormal.

The exciting thing is that this is not the end of the story. This is the start of something big.

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