

hidden in the earth: prehistoric PEI



EPISODE DESCRIPTION

Have you ever wondered what PEI looked like 290 million years ago? In episode 2, we explore PEI's geological history, beginning even before the time of dinosaurs, flowers, and birds. Learn about why our soil is red, how we were once at the centre of the world, and what incredible fossils have been found on the island.

Contact the provincial archaeologist by email (archaeology@gov.pe.ca) or by phone (902-368-6895) if you believe you've found a fossil. Contact Parks Canada at 1-877-852-3100 for potential fossils found in PEI National Park.

Features guest interviews: Dr. John Calder, Bob Sweet and Samantha Kelly.

John: Prince Edward Island has a history. But its story begins far, far beyond the birth of the nation, the arrival of European settlers, the Mi'kmaq, or even the first humans. It's story is older than the island itself, which was born of climate change and rising seas just 7000 years ago. The red cliffs of the island had their origins in a world before the dinosaurs in a time some 290 million years ago.

EPISODE SCRIPT

Bold = interview quotes

Italics = sound effects

Regular = my narration

Music swells up. Ocean sounds. Rowing in canoe.

Welcome to the hidden island - a podcast where we talk about local Island history. My name's Fiona Steele, and I'll be your host for this journey.

So far, we've mostly covered human history of Prince Edward Island. But today, we're travelling further back in time with the help of geologist John Calder. And by further back, I mean 290 million years further back - otherwise known as the Permian Period. We're talking before flowers. Before birds. Before dinosaurs. That time doesn't even feel real to me, but to John Calder, it's what he studies. He even wrote an entire book about the geological history of PEI called "Island at the Centre of the World."

John: Hi, I'm John Calder. I don't usually say so, but I'm a doctor of geology. And I have worked in geology and paleontology, mostly in Nova Scotia, but around the Maritimes, on Prince Edward Island, which was all part of the same world 300 million years ago, the time where I focus. I've worked around the world as well. I teach at St. Mary's University, and I'm on the faculty at Dalhousie as an adjunct.

You might be wondering what John meant when he talked about PEI being part of the same world. We'll get there, just hang on. First, we need to do a little crash course to lay some groundwork:

Music introduces.

Geologists agree that the earth was created 4.6 billion years ago. Yeah, billions. I'm no geologist, so I'm going to skip the exact details. But what's important to know is that this planet has known 3 different eras, beginning with the Paleozoic Era 359 million years ago. This is when the Earth's landmass was all one supercontinent called Pangea. Basically, that means all the land was smushed together, so there were no separate continents like we see today. That's what John meant when he talked about PEI being part of the same world.

Geologists divide the Paleozoic Era into different periods, including the Carboniferous Period, then the Permian Period. The Permian Period lasted from about 300 million years ago to 252 million years ago. That's what we're looking at today, and the early Permian Period is when PEI was first formed.

After the Permian period came the Mesozoic Era.

The Mesozoic era is what you usually think of when you picture fossils. It contains the Triassic, Jurassic, and Cretaceous periods. Even if you don't know geological history like me, the Jurassic period rings a bell, eh? This is the time of dinosaurs, flowers, birds – all that fun stuff you see in movies and books. This era is when the Earth's continents began separating to become what they look like today.

After the Mesozoic Era came the Cenozoic Era. It began 66 million years ago and continues today.

Music fades out.

Okay, thanks for bearing with me. We've got a solid base of understanding, and now we can look more closely at the Permian Period.

John: It's an in between world, between the coal age and the dinosaurs – a time period of this great warming. It's a time period when the Earth's continents and actually the plates of the Earth's crust have moved together into this giant jigsaw puzzle to form a huge supercontinent, which scientists called Pangea. It's Greek for 'one Earth,' which is a lovely sentiment. And right at the heart of that supercontinent, Pangea, right on the equator, was the land that is now Prince Edward Island. And so it really is, it's a snapshot if you like, a representation of this giant supercontinent Pangea, in the world of the early Permian. PEI is really the poster child for that time.

You might be wondering what even makes the Permian Period interesting if there's no dinosaurs. After all, that's usually what we associate with history millions of years old. Let's imagine travelling there together, using a passage from John Calder's book.

Early Permian sounds: insects, growling, wind, rivers, trees, leaves moving, footsteps. All

Come with me back through time, back before the first humans, the first mammals, the last dinosaurs, the first flowering plants, the first birds, back before the first dinosaurs, to a time almost 300 million years ago.

From space, the Earth looked very different from today. One giant continent straddled the equator, and at the heart of the world, the land that would one day be Prince Edward Island. This is our destination.

This is Permian PEI. *All sounds fade out.*

Of course, this soundscape you just heard is an educated guess because our little canoe could never truly travel there. But when you picture the world like this, PEI being a tropical land near the equator – it's pretty neat.

So, the next question is: what happened? How did we become an Island in the first place? Again, the answer lies 300 million years ago.

John: So, the red rocks of PEI invariably formed from large scale rivers that were through-flowing across Prince Edward Island, from a distance, probably the Appalachian Mountains, going far towards a distant sea, perhaps near what is now Europe. So, most of our rocks, the sandstones, in particular, are the remnants of these ancient river systems. And the softer rocks, the shales, mudstones that occur as well are the rocks that formed from sediment that overflowed those rivers onto the banks of the rivers into the floodplains. So basically, it's a story of these rivers, coursing across what's now PEI on their way to a distant sea, out towards where what is now Europe.

Although we wouldn't become an island along the Northumberland strait for millions of years later, this is PEI's creation story. As these ancient rivers flowed, the sediment left eventually formed what would be Prince Edward Island's base. That is why we're almost entirely made up of sandstone, and it's what created the lovely red rocks the Island is so well known for. So, the next time you're on a beach, you can think that the sandstone cliffs are almost 300 million years old.

Or, if you grew up in an old farmhouse like me, your basement steps might be made from sandstone. I had no idea that I was stepping on something hundreds of millions of years old every time I went to the basement to grab a paint can.

But that's a side note. Let's think of those rivers again, leaving sediment behind to form the land that would make PEI.

River sounds, some footsteps here and there.

John: And impressed in those in those sediments, before they turned into rock is a course to cross what's now PEI. And as they flooded their banks, laid fresh sediment, animals of the day that walked across that those muddy sediments left their footprints in the sediments. The turned to rock and after hundreds of millions of years are revealing themselves as erosion spills those rocks that have gone to the shores. And lo and behold, their footprints are found for us today. It's almost like – I'm constantly looking when I walk around on city sidewalks, looking for imprints of cats and birds and sometimes humans that leaves a mark in the freshly laid cement. And it's very similar in a way to the overtopping of these rivers with fresh mud. And as it started to dry under the tropical sun of Pangea, animals have long left their left their footprints for us to find. And that's one of the most common fossils of animal life on PEI.

River sounds fade out.

Those fossils are called trackways, and we even have some in our collection. Footprints in stone might not sound as interesting as bone fossils, but to Samantha Kelly they're still fascinating. Samantha is our Curator of History with the PEI Museum & Heritage Foundation.

Samantha: Well, we're pretty lucky because we have a series of trackways in the collection. So those are basically just fossilized footprints. As well, actually now we have some other geological specimens, as we have some fossilized wood. But the trackways are probably the most exciting things that we hold in the provincial artifact collection.

Samantha: So for me, the trackways are exciting because it's actually a representation of something that was living as opposed to when we have the bones, it's something that has been deceased. So we can see through the trackway how the creature moved, in some cases, we can see the texture of their skin, how big they would have been, you can kind of estimate the size of based on their step width. But it gives us a real example of, or real insight into the creatures that were living on the island, you know, upwards of 300 million years ago.

These trackways represent something amazing. Instead of seeing bones and trying to recreate what they would've looked like, instead we can actually see a memory of how animals once lived. John Calder said geology is a language – a language of the Earth. Through reading sedimentary rocks on the Island, you can see all sorts of layers. These layers show history, if you know to read them. You can find evidence of floods, what rivers travelled through where, and sometimes even what plants lived and died there through finding them fossilized into the earth.

I'll be honest here, I'm not that big into science. It just isn't my thing. But when John said that, it reminded me of storytelling. You just have to look just a little harder to find the voice. That's fascinating.

And there's still likely fossils undiscovered on PEI because people keep finding new ones every couple of years. One trackway in our collection was found by a couple by the name of Bob and Pat Sweet in 2019.

I talked to Bob about their find.

Bob: So, we found it in in Cumberland, which is on the south shore of the island. We were there visiting with my son and his family who had rented a cottage there. They're from Edmonton and they were on vacation. And so, this was on the actual date was July 4. And so, we were all down there, my family on PEI and my wife and I, and the folks from Edmonton. And so, we were out on the beach with our grandsons, three of them, and just walking the beach and doing some beach combing.

Bob: The Kids have never been on the beach before, so, they're fascinated with the shells and the rocks and the jellyfish and in everything you can find. So, we happen to be walking in this area that was a large outcropping of stones and whatnot. And they're picking away shells and snails and that sort of thing. But all of a sudden I heard one of the boys mention that they found a rock with some cat tracks on it. So, I went over to him to see what he was looking at. And lo and behold, here was this rock with these footprints.

While Bob's grandson thought it was cat tracks, Bob figured it was something important, and a lot older than a domesticated cat. So, they ended up taking it home.

Bob: A few days later, I just happened to be at my barber getting a haircut one morning, and I knew that he had an interest in fossils because he had actually shown me one that he had in the basement of his barber shop. It was a fossil of some vegetation that he had found. And so we're discussing that, and I've got a piece, he suggested that maybe that I would be interested in in determining just how old and what possible animal would have made those tracks. I say to him, 'Yeah, I sure would.'

Bob's barber sent him to the PEI Museum and Heritage Foundation, and then Bob lent the fossil to the PEI Museum so our staff could get the right people to study it better. A few weeks later, Bob permanently donated the trackway. It's in our collection, and it was on display this past spring when we hosted a two-day pop-up museum with different fossils.

Bob did say one other thing as well.

Bob: I guess I would reiterate that I think it's important that the province find a way to let the public know that when they do find things like this on the beach, that they should just leave it where they find it and notify somebody. Because we were unaware of the protocol around that, and I felt bad about it later. But I mean, it's too late then. It happened. But anyway, so I think it's important that they find a way to notify the public and inform them. Because with all the erosion that's going on, and, you know, climate change, and the tides and rising sea levels, there's going to be more and more of this sort of thing coming in being exposed. And it would be very, I think, very prudent for the province to let people know that they should contact somebody to talk them along where they were this was. Take a picture of it first. You know, I mean, that would have satisfied us if we've just had a picture of it. So, you can tell people have found it, but just my suggestion.

That's exactly right, and pretty much what Samantha told me as well.

Samantha: So, if you think that you found something, it's very important to leave it in the ground. And because then that will later on provide context to either the archaeologists or the paleontologists come and look at it. And then you would contact archaeology with the province, you could contact us as well. But it's really important to try to preserve the area that the example has been found. And if for whatever reason you do remove it from the ground, again, contact archaeology or us. It's also very important to not remove these pieces from the island because they're effectively jigsaw puzzle pieces. And the more that we have of those pieces and can fit them all together, the easier for us to the easier it is for us to be able to tell a more fulsome and comprehensive story of that time period, because we're talking about 300 million years ago, right? It's, it's kind of beyond even sort of being able to like quantify it so far in the past.

Samantha: So on the island, probably every example of something that we found has been unique in the sense that it's part of a bigger group, but not exactly the same as other species. So we have quite a lot of unique paleontological history on PEI. And it's really exciting. I think, you know, I think for me to realize that trackways are essentially just sand, like it's just fossilized sand. So, they can just easily disappear. You know, and we find them by accident, every example that we found, I say we, but it's actually like people that have, but every example that's been found has been found by somebody just out for a walk on the beach, or just kind of looking around at the rocks. No one has ever no specialist has ever found an example. They've just been found by random people.

I think it would be pretty neat to find a fossil, and definitely a better story to tell than finding the usual seaglass. I'll put the contact information for the provincial archaeologist in our show description, so you have it in case you find anything. If you keep your eyes peeled along the shore, you just might find something.

But let's go back to when Sam said we have a lot of unique geological history on PEI. That's something John Calder said as well.

John: It's, it's a remarkable thing. When you think of the diversity of Canada's geology, what we call geo diversity, or geo heritage, it's really remarkable, because we have rocks going back to the very oldest rocks on planet earth over 4 billion years ago, right up to rocks just formed, basically forming now. And to think that the only record of life on land in the Permian period is really on Prince Edward Island is remarkable. Now, in the north of Canada, they're exceptional exposures from the Permian, of the sea, of the marine record of ocean life and whatnot, but life on land, for whatever reason, is recorded best in all of Canada, right here on Prince Edward Island. It's a really rare snapshot of life at this time, we can go to other places around the world, the southwest of the US, and to Germany, for example, and see similar records of life from the Permian. But in Canada, PEI is it.

In fact, two incredible fossils were found on the Island. John told me the story of both, and the first one was discovered in 1845.

John: So first of all, in my book, I called it the creature in the well. The most probably, it's always tricky to say the most important fossil but historically, for sure, the most important fossil found in Prince Edward Island was found by a farmer of Scottish descent, Donald MacLeod, who is digging a well in 1845. And it was near French River, New London area. And I wish I could have been there to see this sense of wonder and how perplexed they must have been when they pulled up, from a depth of 21 feet nine inches from the bottom of this well that they were digging, what looks like it must have looked like a bear skull. Really wild fangs stuck into the upper mandible or the massive jaw. Quite even more profound than that of a bear. And why would they have thought? What would they have thought? Because 1845 was just after the word dinosaurs had been coined in England, by Sir Richard Owen. Most people in the world didn't even know the existence of dinosaurs. Now, this was not a dinosaur. But even the idea that races of such incredible animals once lived on earth was really largely unknown at this time. So I really wonder, what did Donald MacLeod think when he pulled this up? Was it a creature that had died in in a biblical flood perhaps, like what on earth? So to his credit, he did not throw it away. He kept it in the advice of a young William Dawson, a geologist who would become very famous and become knighted as Sir William Dawson, who lived in Pictou County, right across the street. And Dawson came over to investigate. He took the into his care took this fossil that Donald MacLeod had cared for, for at least two years before and took it and made its way down to Joseph, who was one of the first people in North America to work on dinosaurs. And he did think it was a dinosaur. And it turns out now we know it was actually a predecessor of dinosaurs - actually not a direct descendant at all. It's often pictured in dinosaur books. It's a four legged sail-back reptile, it's actually on the evolutionary line towards mammals. We know these, you'll see them in books called Dimetrodon, but this is the very first of those animals called Dimetrodon.

This Dimetrodon fossil was the first of its kind ever found, and another wasn't located until 25 years later in Texas. These animals actually predate the first dinosaurs by 50 million years. The Dimetrodon was a fearsome carnivore, with powerful jaws and a big sail back. Some species grew to 6 feet tall, and 15 feet long. Picture something like an alligator, with a shorter jaw and a half circle sail attached to its back. Or you could just google it and save me the trouble. Either works.

So, that's one amazing find on PEI. Another fossil found was in 1995 by a ten-year-old boy.

John: Two young boys down and around Cape Egmont, Egmont Bay were playing on the shore, as a little boy should, literally stumbled across a slab that had this incredible fossil embedded and displayed across the surface.

John: Those two boys were Michael Arsenault and his friend Alex Lapp. Well, they didn't know what they found. They thought perhaps this was a dinosaur. And Michael kept it in a box in under his bed for a very long time. Eventually, it made its way to the Royal Ontario Museum, where it was studied by a team including Sean Modesto and others. And they named it *Erpetonyx arsenaultorum*, after the Arsenault family. That beautiful, wonderful crawling creature is the only one of its kind. Again, a first on Prince Edward Island. This creature still remains the only one of its kind ever found on the planet Earth. And it was incredibly preserved right from the tip of its nose right The tip of its tail, every tiny little bone preserved in place. It's one of the most beautifully preserved reptile fossils from the fossil record, frankly.

Let's give some context: we're talking about hundreds of bones being preserved in a creature only about a foot long. These are some pretty neat finds, and I've only highlighted three out of countless fossils in Island history.

John: And we have all those. We have everything from plant life, very primitive animal life right up to the topmost highly of all life forms of the day, all preserved here on Prince Edward Island. And I think a lot of people are really surprised to learn that we have that fossil record here in Prince Edward Island. And it really is remarkable and recent discoveries are making it even more so.

This is all fun and good, but I mentioned there were two eras after the Permian Period. You might be wondering: what happened? What ended the Permian Period and brought on the Mesozoic era, which was the age of the dinosaurs?

I'll tell you: a series of events called The Great Dying 252 million years ago.

This was the closest planet Earth came to complete extinction of all life.

Here's what was lost: 96 per cent of marine species and 70 per cent of land animals.

Scientists think it was probably caused by volcanic activity, although they're not entirely sure what triggered it. However, they do know a huge spike in Earth's temperatures played a key role. As the waters warmed, the oxygen levels dropped, making it harder for marine species to survive.

If this sounds familiar to you, it should.

John: So, the end of the Permian period, which by the way, is not recorded in Canada – it's not recorded on Prince Edward Island – the Permian extended several million years. And it ended just before the Triassic, the Dawn of the Dinosaurs. But at the end of the Permian period came the greatest extinction event in the history of life on Earth, when, in some cases, 90% of species of a certain lineage went extinct, and in some cases, the entire lineage went extinct.

John: It was the greatest, it was the closest brush of total death for life on the planet that's ever happened. The troubling thing is we don't have a clear understanding of what happened, which is a little troubling when you're one of the life forms living on earth today. It would seem that runaway global warming was likely, if not the main contributor, it was certainly played a huge role in that extinction event. But at that time, life was wiped out, not entirely, but close to it, both in the oceans and on land.

It took millions of years for life to bounce back after The Great Dying. I don't think we want that to happen to humanity.

Although the amount of global warming we're seeing today is only about a tenth of what caused The Great Dying, it's still significant. This time, it's caused by human activity, and it isn't slowing down.

We're seeing the impacts even here on the Island already. PEI's coastline is eroding about 30 centimeters per year, but that's on average. Some areas are eroding much faster. In some cases, a single storm event can take out 26-33 feet of shoreline. And with powerful storms becoming more common through climate change, this is important to know. Along with erosion, rising sea levels impact the Island as well. As climate change causes sea levels to rise, it will permanently flood low-lying coastal land. Although this is a gradual process, when we combine this with more frequent and intense storms, it's a bad combination of lost shoreline and flooding.

John: Climate change is a serious thing. And I think we fool ourselves into thinking in the wintertime, especially, a little warmer not a bad thing. But when we see the rampant wildfires out of control around the Earth, we see species going extinct, we see the coral reefs disappearing in the oceans. This is not just simply a slight change in the temperature in the thermometer. This is a whole scale change that we're witnessing of life on this planet. And I do hope that it doesn't proceed to the point that it did at the end of the Permian period.

History repeating itself is a well-known quote, and maybe it's famous for a reason. Or can we move forward in a positive way, now that we know the past and know what not to do? That's a question for all of us, and it's not a rhetorical one.

Theme music comes up a few seconds before the credits.

The Hidden Island is a production by the PEI Museum & Heritage Foundation. You can find us on our social media or at peimuseum.ca, where you can also make a donation to The Foundation. As a not-for-profit, donations help fund fun projects like this podcast.

Thank you to John Calder, Samantha Kelly, and Bob Sweet for taking the time to chat with me. As well, thank you to Adam Gallant, who provides our theme music. Finally, thanks to our sponsors: Nimrods and Upstreet Brewing.

I hope you enjoyed this episode!

ADDITIONAL READING

"Island at the Centre of the World" *John Calder*

"Time and Place: An Environmental History of Prince Edward Island"
Edward MacDonald, Joshua MacFadyen, Irené Novaczek (Authors)

