WEEK 3 A CRISIS BEFORE THE END OF THE PERMIAN: INTERVIEW WITH A PALAEONTOLOGIST

ACT – Anusuya Chinsamy-Turan
MD – Michael Day

ACT I'm absolutely thrilled to have with me Michael Day. Mike Day is based at the Evolutionary Studies Institute where he's a post-doctoral fellow and he has the distinction of working in the exquisite Permian deposits of South Africa. Now South Africa is really well known for the reptiles of the Permian and one of the things that we do have in the Permian is a record of the end of the Permian extinction event. And that event happened about 252 million years ago, but your work, Mike, has shown that there's another extinction event that precedes this.

MD Yes.

ACT Can you tell us more about that?

MD At the end of the Middle Permian, so this is about eight million years before the end of the Permian, there was quite a different fauna in the Karoo basin, because the Middle Permian saw the rise of these mammal-like reptile faunas, these... the Therapsids. So of the Therapsid faunas that had started to appear in the Middle Permian they become very diverse by the end of the sort of middle part of the Permian. So this is about between 265 and 260 million years ago. But then at about 260 million years ago quite a lot of them go extinct, so all of these groups of mammal-like reptiles, as well as other kinds of reptiles too, of which we find fossils there.

ACT So which kind of reptiles are these? I mean are these things like Pareiasaurs or Dinocephalians or what kind of Permian reptiles were extinct then?

MD Well there's a loss of diversity across all of these groups, but in particular the Dinocephalian Therapsids, completely extinct.

ACT Really? These were big, giant reptiles, weren't they?

MD Yes, so they are fairly common or very common in South Africa at that time. They're also known from across the world, so they've been found in Eastern Africa, Brazil, China...

ACT Russia.

MD Yes, yes. So they're very weird animals, very ugly, very, very thickly built bulky animals but... and they're all fairly large at this time. And they become completely extinct across the world, so we think that this is...

ACT Across the world? Across the world. So worldwide extinction of the Dinocephalians?

MD Well there are these... all the faunas that have Dinocephalians sort of disappear at this time and so you see these Late Permian other kinds of mammal-like reptiles. Okay. And those subsequent faunas have no Dinocephalians.. Okay. That remains to be seen, but I think it's probable that it was a sort of global extinction event of these animals.

ACT So do you know what triggered that event? I mean do you have a clue if the end of the Permian and this one that occurred or preceded the extinction by eight million, were they maybe a part of the same event that lead to the extinction or do you think they're two distinct events?

MD I think they're two distinct events. In terms of proxies we have for environmental conditions at these times they show very different signals between the Middle Permian and the Late Permian.

ACT So what are these proxies that you have?

MD Things like geochemistry, looking at weathering rates of sediments as well as disruptions to the carbon cycle and oxygen cycle. These seem to suggest that at the end of the Permian, as you've probably spoken about before, there's a big shift towards greater aridity whereas in the Middle Permian it's not so clear if there's any kind of environmental change. And also there was global warming at the end of the Permian, whereas in the middle Permian there might even have actually been slight global cooling, at least in the high latitudes. So there are quite different conditions during the two extinctions... the extinction events.

ACT Okay. So what intrigues me is that, you know, we have these big, large reptiles and the Dinocephalians and the Pareiasaurs are very similarly built and we see the Pareiasaurs are affected but they don't go completely extinct. Do you have any idea why this is so? I mean is there anything about them that suggests difference in physiology or biology or habits?

MD Well, yes I think there's some preliminary isotopic studies done in these large animals of the Middle Permian before the extinction and I think they're suggesting that the Dinocephalians and Pareiasaurs actually have slightly different physiologies, but what unites them is the fact that they are the larger constituent... parts of the...

ACT Biota?

MD Of the biota yes. Yes. So possibly it's linked to the vegetation, although they have quite different feeding systems, but our understanding of the vegetation of that transition from the Middle to Late Permian is actually very poor. There's very few macro fossil sites for plants during that time and so far we haven't had much luck with pollen and the sort of small micro fossils either. So they're not really telling us what the plants are doing. So because there's no obvious evidence for environmental change, you know, increased aridity or anything it's hard to...

ACT To know for sure what happened, yes. ... to suggest what could be going on.

MD So we're now trying to pursue that and find out what could have been happening to these animals. But it's certainly the larger animals which are suffering the worst. So but, as you said, the Pareiasaurs they disappear from the Karoo basin for a short period and then they sort of...

ACT Reappear. ...

MD Reoccupy it.

ACT Exactly.

MD And at the same time the Pareiasaurs appear for the first time in Russia on the other side of Pangaea.

ACT So obviously they were better adapted to whatever those changing conditions were.

MD Possibly and because they have different teeth they were... they're maybe eating different plants and some plant that didn't suffer as badly and we don't really know what was going on in the tropical region. So obviously there was the means for these animals, the Pareiasaurs which were previously known only from Gondwana, particularly South Africa, to then make that... make the journey and disperse across Pangaea to the other side of the world.

ACT Wonderful. Well I think it's absolutely fabulous and it's so intriguing. I mean you know most people think about these big extinction events, but I think it's wonderful to know that there's also these background extinction events that are occurring. So thank you so much for coming and sharing this with us. It's really been a delight talking to you, so I'm absolutely thrilled to have you here. Thank you.

MD Thank you.