WEEK 3 READING ROCKS

ACT – Anusuya Chinsamy-Turan
RS – Roger Smith

ACT Today we sitting in the Iziko SA Museum in Cape Town. And it's a real privilege for us to have with us here today Roger Smith. Roger Smith is a palaeontologist based at the museum. And he's spent a life time working in the Permian and Triassic rocks of the Karoo Basin of South Africa. So Roger it'll be really, absolutely wonderful if you can try to summarise all this 30 years of work in a nutshell for us.

RS Well, thank you. I started back in 1976, in fact, looking for uranium. And it was, at that time, a strategic mineral that they needed to know which layers of rock they could find uranium in. And uranium had been found in the Karoo, but they wanted to find more. So I was sent out there first to do biostratigraphy using the fossil vertebrates as an indication of which age the rocks were. So I could then tell them where the most likely places to find more uranium. So that was the very first three-year project. That introduced me then to the mammal-like reptiles, of course. Therapsids that at that time were more than just animals to be used for biostratigraphy. I was more… Getting more and more involved with how they lived and how they died. And how those ecosystems changed through time. And I was looking at the late Permian period at that time. And working up through the late Permian, I saw the evolution taking place within the therapsids and the march towards mammalness, as they all call it. So I was intrigued then, not just by the, how this was happening, but why it was happening. So I became much more, let's say, the question that I was asking, was what drove the evolutionary transitions towards mammalness?

ACT And could you see the paleoenvironmental changes? I mean was it very clear in the rocks that the environment was changing?

RS Yes, being a geologist, as well as a palaeontologist, I'm as much interested in reading the rocks as the fossils themselves. So, my interest in the fossils sort of diminishes as soon as it's out of the rock. But seeing the rock… The fossils in the rocks, that of course gave me a lot of extra information about environments, about surface processes of these ancient flood-plains. Because it's all really flood-plain deposits. And how those flood-plains were getting wetter and getting drier. And the processes that led to the actual fossilisation of the bones that were lying around on the surface. So that's taphonomy, which is what I specialised in at that time.

ACT Do we see between the Permian and Triassic, are there changes we can find within the rocks? And does that help us say something about what happened at the end of the Permian?

RS Yes, of course. So it wasn't long before I got up to that very dramatic change in the rock record that, in the Karoo Basin, especially, it manifests itself as a distinct drying of the environment. So the rocks in the late Permian are predominantly blue-grey and contain these big lumbering herbivorous mammal-like reptiles. And suddenly there's a rapid transition, over about five meters, into predominantly red and maroon coloured rocks. The reason for that happening, after much research, is appears to be a drying out of the flood-plains. The water-tables dropped and it caused then the vegetation to die off. The flood-plains became barren and exposed and oxidised. So the reddening is caused by the oxidisation of iron in the soils. In the sort of tropical soils, if you like, of the earliest Triassic. And coincident with that, of course, was a rapid change in the fauna. In fact, an extinction of many of the Permian herbivores and the carnivores. And then the arrival, very soon after, of new forms. Especially the archosauromorphs, which were the very first indications of dinosaurs in the Karoo Basin.

ACT Yes. That's fabulous. What I'm wondering about is, you know, when we look at the late Permian we see there's a drying out. And in terms of the fossils themselves,

I mean, do you find, kind of aggregates of fossils together? I mean, is that something common in the landscape? You know, maybe around waterholes or things like that?

RS During this great drought event, we do find aggregations of juveniles in much more open, shallow depressions. Which is interpreted as dried-up waterholes. Although the juveniles were huddling into a depression, perhaps, at times of cold snaps. But definitely, the bone beds, as such, where there are multiple animals all of the same tax… All the same animal, all the same type of animal. All aggregated into the same place happens a lot more in that early Triassic drought period than it does in the late Permian.

ACT So what is your pet hypothesis about why there was the end of the Permian extinction event?

RS My pet hypothesis is drought. On land, that is. And we have been able, with a lot of palaeomagnetism and radio metric dating now, to make sure that the on land and the marine extinctions were synchronous, at the same time. So we're pretty sure, then, that it is a global effect, and were… We are recording in the Karoo Basin, a great drought. At the very self-same time that, in the marine realm, they were recording acidification and de-oxygenation of the marine realm. Caused, almost certainly by a rapid increase in atmospheric temperature, globally. The most likely cause is volcanism. Massive outpourings of basaltic lava in the northern Pangaean area, in what's now the Russian… Northern Russia.

ACT Roger, thank you very much for talking to us. It's been absolutely fabulous to hear about your research. And we wish you well in your further research that you are doing.