Eskom | Powering your world

Fact Sheet

INGULA'S FOSSIL FINDS: PAINTING A PICTURE OF THE PAST

Early in 2009 a construction worker found the first strange looking 'rocks' at Ingula. They turned out to be the fossilised remains of animals and plants many millions of years older than the dinosaurs. Prominent geologist, Dr Gideon Groenewald, was commissioned to assist with the recording of fossil finds at the construction site of Eskom's Ingula Pumped Storage Scheme.

Dr Gideon Groenewald inspecting a fossilised tree still buried in the rock

Over sixteen kilometers of tunnels were excavated at Ingula. This was done by blasting and removing rock with big excavation machines. If it not for the blasting, the fossils would never have been discovered. As layer by layer of rock was exposed, amazing fossils were exposed, revealing clues about what the area looked like millions of years ago.

A sandstone layer contained large tree fossils followed by layers of mud rock with coalified wood, infused with pyrite, which looks like gold when freshly exposed. Most of the fossils were found in mud rock, a very brittle type of rock. Any finds had to be treated with a sealant to prevent it from disintegrating.

During February and early March 2010 excavation reached a layer which, it is believed, contained evidence of *Dicynodon lacertipceps* – a plant eating mammal-like reptile of the Permian period. It also contained plant fossils, predominantly smaller samples of the *Glossopteris* family. These were taken to the Bernard Price Institute for Paleontological Research at WITS University for further examination. Samples were sent to the National Museum in Bloemfontein for recording, curating and display.

A significant discovery was made on 17 March 2010 at the inlet works area at Ingula's upper site. Large bones were identified as the lower jawbone of a Dicynodon.

Careful preparation of Ingula's fossils at Bloemfontein National Museum

By interpreting the geological evidence, Dr Groenewald painted a picture of a cool, dry climate with large wetland systems, such as the Okavango in Botswana today, with enormous trees growing on the larger sandbanks. Fossilised ripple marks indicate that the water level varied from quite shallow (10cm) to five metres deep. The deeper streams were probably faster flowing and heavily laden with silt. Deep mud and clay pools would have been lethal traps for unsuspecting animals.

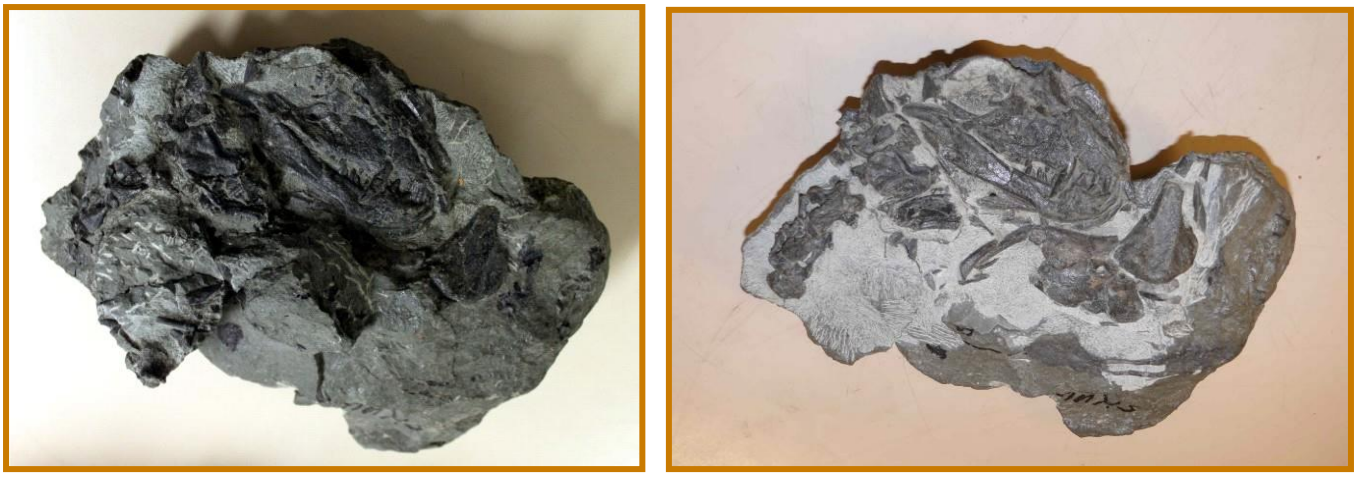
From a conglomerate layer of mud balls, wood, clumps of granite and quartzite, Dr Groenewald deduced that there were sudden floods from the southeast. These floods caused some of the big *Glossopteris* trees to fall into the streams, where they were quickly covered by sediment, helping to preserve them. The entire ecosystem where the animals and plants lived was buried about 255 million years ago.

Possible dicynodon tusk unearthed at Ingula

Recognising the significance of the fossil finds, Dr Jennifer Botha-Brink of the Bloemfontein National Museum has expressed her appreciation for the contribution and commitment by Eskom in enabling the recovery and monitoring of the fossil finds during the construction of the Ingula Pumped Storage Scheme. From the samples already delivered to them they estimate that at least two gorgonopsians (predators of that time) and 24 fossils of plant eating animals (at least two *Dinanomodon*, one *Oudenodon*, and numerous *Daptocephalus* and *Dicynodon*) have been discovered.

The likelihood that new species of animal might be present has not been ruled out. The Museum appointed additional staff to prepare the large quantity of material from Ingula.

In South Africa, all fossils are regarded as National Heritage Objects, which belong to the State. Bloemfontein Museum, as curator, will make some of the items available for display and educational purposes in the Ingula Visitors Centre.



A baby gorgonopsian fossil before preparation (left) and after preparation (right) at the Bloemfontein National Museum.

Large sections of rock containing fossils being removed by an excavator for further investigation away from construction.

The Permian Period

The Permian period, which ended with the largest mass extinction the Earth has ever experienced, started about 299 million years ago. The emerging supercontinent of Pangaea presented severe extremes of climate and environment due to its vast size. The south was cold and arid, with much of the region frozen under ice caps. Northern areas suffered increasingly from intense heat and great seasonal fluctuations between wet and dry conditions. The lush swamp forests of the Carboniferous were gradually replaced by conifers, seed ferns, and other drought-resistant plants.

An artist's impression of life during the Permian Period

Early reptiles were well placed to capitalize on the new environment. Shielded by their thicker, moisture-retaining skins, they moved in where amphibians had previously ruled. Over time, they became ideally suited to the desert-type habitats in which they thrive today.

Later, other mammal-like reptiles known as *therapsids* found an internal solution to keeping warm - scientists suspect they eventually became warm-blooded, conserving heat generated through the breakdown of food.

The *therapsids* flourished during the Permian, rapidly evolving many different forms, ranging from dinosaur-like, fanged flesh-eaters to plodding herbivores. Some species reached huge sizes, weighing over a ton. During the later Permian, smaller varieties emerged and from them the first mammals eventually evolved.

Massive Loss of Life

The Permian period came to a calamitous end 252 million years ago, marking a biological dividing line that few animals crossed. The Permian extinction - the worst extinction event in the planet's history - is estimated to have wiped out more than 90 percent of all marine species and 70 percent of land animals.

Various theories have tried to explain this mass extinction. Some scientists think a series of volcanic eruptions pumped so much debris into the atmosphere that the sun was blocked out, causing a significant drop in temperature, and preventing plant photosynthesis, which in turn caused food chains to collapse.

Other scientists point to global climate change, citing evidence for a period of sudden warming and cooling. These rapid extremes of conditions may have meant species were unable to adjust. Other theories include a catastrophic release of methane gas stored under the seabed, triggered by earthquakes or global warming, or a massive asteroid impact.

Perhaps a combination of factors was to blame. But whatever the cause, new animals and plants would evolve to fill the void. Not least among them: the dinosaurs.

(Source http://science.nationalgeographic.com/science/prehistoric-world/permian.html)

An artist's impression of life at the end of the Permian period. Dicynodon in the background, Lystrosaurus in foreground and gorgonopsian on the right.

Visitors Centre

Guided tours are conducted from the Visitors Centre during weekdays. Presentations can also be given off-site and online via MS Teams. Booking in advance is essential.

Contact: Tel. 036 342 3236 Email: ingulavisitorscentre@eskom.co.za

Produced by: **Generation Communication**
GI 0004 Revision 6 (November 2021)

For more information on Eskom related topics see the Eskom website (www.eskom.co.za).
Select the "About electricity" and "Visitors Centres"
(http://www.eskom.co.za/c/article/54/ingula-pumped-storage-scheme/)