

# **Palaeontological Impact Assessment for Solar Power Project, Adelaide**

**Prepared for: SDP**

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## **Background**

An environmental approval process has commenced in terms of R543 of the National Environmental Management Act (1998) relating to the proposed establishment of a “hub” or “farm” of concentrated photovoltaic panels to be used in the generation of approximately 14 MW of power on a property at Adelaide in the Eastern Cape (figs, 1&2).

The applicant, Scatec Solar SA (Pty) Ltd, a solar power production company, wishes to introduce power to the electricity grid in terms of the REFIT or “feed in tariff” structure presently on offer by Eskom. The establishment of a solar power generation facility requires authorisation from the National Department of Environmental Affairs.

The application for authorisation requires the undertaking of a basic assessment Process. SDP were commissioned to carry out the Basic Assessment. They subcontracted Rob Gess Consulting to carry out a Palaeontological Impact Assessment.



## Geology

The entire area, including and surrounding the proposed developmental area is underlain by sediments belonging to the Balfour Formation (Adelaide subgroup, Beaufort Group, Karoo Supergroup).

The strata of the **Karoo Supergroup** were deposited within the Karoo sedimentary Basin, which resulted from shortening and thickening of the southern margin of Africa, with coeval folding and uplift of the Cape Supergroup strata along its southern margin. The Karoo Supergroup strata are between 310 and 182 million years old and span the Upper Carboniferous to Middle Jurassic Periods. During this interval the basin evolved from an inland sea flooded by a melting ice cap, to a giant lake (the Ecca Lake) fed by seasonal meandering (and at times braided) rivers. This lake steadily shrank as it filled with sediment and the basin's rate of subsidence stabilised. The land became increasingly arid and was covered with wind blown sand towards the end of its cycle.

As the Ecca Lake silted up a subaerial (exposed) shoreline began to develop, initially in the south east of the basin. The lake steadily shrank towards the centre of the basin, leaving behind flat silty plains across which long rivers meandered from the Cape Mountains towards the much reduced lake. Sands were deposited along the river channels whereas periodic flooding deposited muds on the broad flood plains. These in time came to form the interbedded sandstones and mudstones of the Koonap, Middleton and **Balfour** formations of the **Adelaide Subgroup, Beaufort Group** (Karoo Supergroup), within the Eastern Cape.

## Palaeontology

The flood planes of the **Beaufort Group (Karoo Supergroup)** provide an internationally important record of life during the early diversification of land vertebrates. Giant amphibians coexisted with diapsid reptiles (the ancestors of dinosaurs, birds and most modern reptiles), anapsids (which probably include the ancestors of tortoises) and synapsids, the dominant group of the time which included the diverse therapsids (including the ancestors of mammals). Rocks of the Beaufort Group provide the world's most complete record of the important transition from early reptiles to mammals.

Therapsid diversity, along with that of most plant and animals was decimated during the end-Permian extinction event, a serious contender for the most severe extinction event to affect life on Earth. Ongoing research on the effects of this extinction event is facilitated by the detailed record, afforded by Beaufort Group strata, of life immediately before and after the event, as well as the gradual recovery of life afterwards.

The Beaufort Group is subdivided into a series of biostratigraphic units on the basis of its faunal content. Though including the upper *Cistephalus* Assemblage Zone and lowermost *Lystrosaurus* Assemblage Zones, the **Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup)** largely corresponds to the *Dicynodon* Assemblage Zone. Characterised by the co-occurrence of *Dicynodon* and *Theriongnathus* this zone demonstrates

the Beaufort Groups greatest diversity of vertebrates, including numerous taxa of dicynodont, biarmosuchian, gorgonopsian and therocephalian and cynodont therapsid Synapsida, together with diverse captorhinid Reptilia and less well represented eosuchian Reptilia, Amphibia and Pisces. *Glossopteris* flora plants and trace fossils are also described.

A marked faunal change occurs between the *Dicynodon* and *Lystrosaurus* Assemblage Zones approaching the top of the Balfour Formation, corresponding with the major extinction event associated with the Permo-triassic boundary.

The *Lystrosaurus* Assemblage Zone is dominated by a single genus of dicynodont, *Lystrosaurus*, which together with the captorhinid reptile, *Procolophon*, characterise this zone. Biarmosuchian and gorgonopsian Therapsida do not survive into the *Lystrosaurus* Assemblage Zone, though therocephalian and cynodontian Therapsida exhibit moderate abundance. Captorhinid Reptilia are reduced, however an unprecedented diversity of giant amphibians characterises this interval.

The effects of the end Permian extinction event are also evident in the extensive and important record of fossil plants present in the rocks of the Karoo. Whereas faunas of Permian age are dominated by a wide range of early seed plants, the Glossopteridales (which probably include the ancestors of modern gymnosperms and ultimately angiosperms), this group appears to have gone entirely extinct during the end-Permian extinction. The rocks of the Karoo provide an unrivalled sequential record of these changes and the diversification of other groups of plants in the aftermath of the extinction. The strata of the Karoo basin have also yielded fossil insects and insect leaf damage of a range of ages.

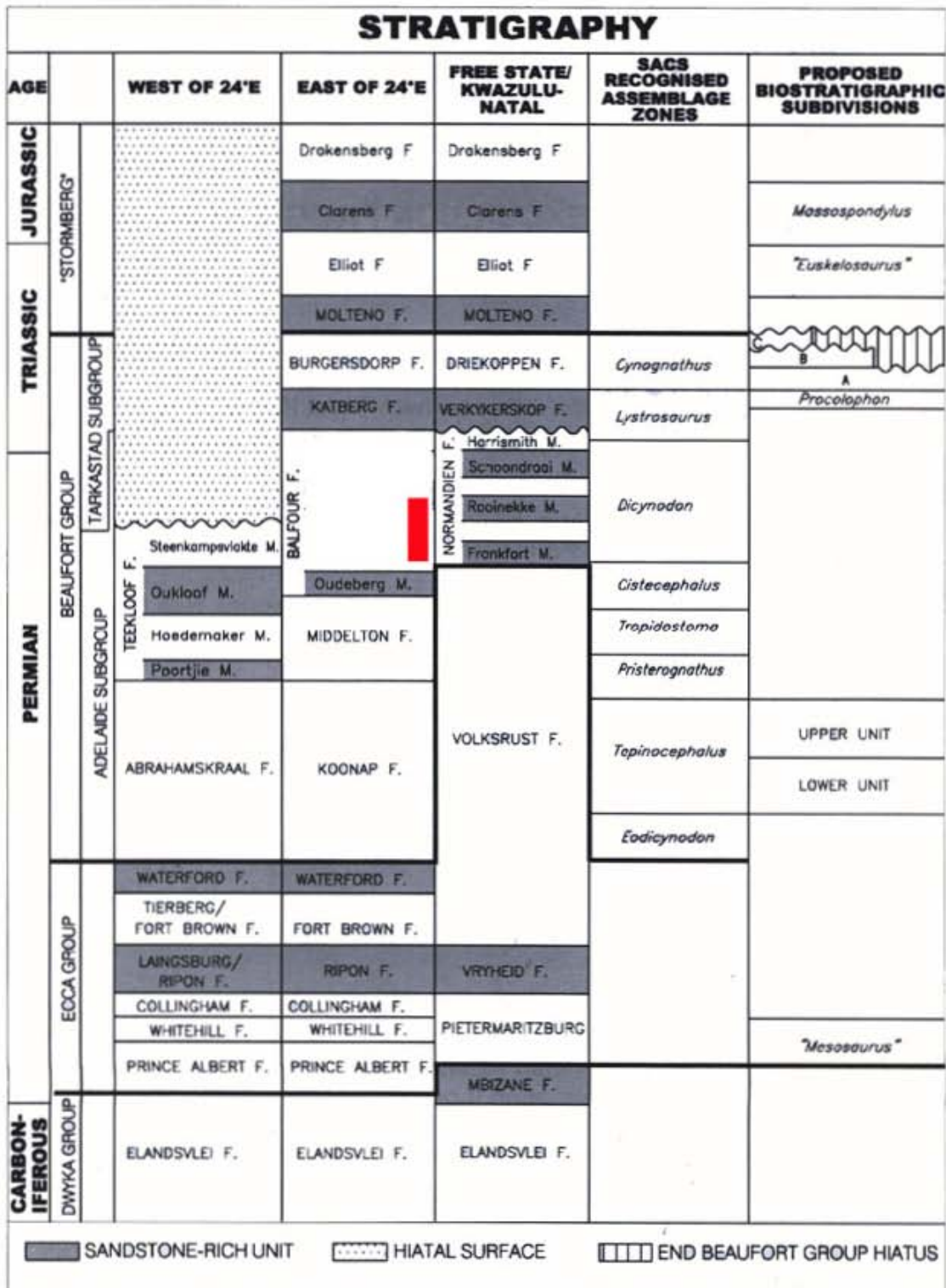


Figure 3: Karoo stratigraphy and biostratigraphy (after Smith *et al.*, 2012). Red lines indicate approximate stratigraphic intervals impacted by proposed development.



## Site Visit

The proposed developmental area was exhaustively surveyed on foot on the 30<sup>th</sup> of April 2012.

The area consists of north easterly orientated slope, backing onto a ridge capped with a fragmented layer of resistant sandstone (Figure 4 left).

The area is largely underlain by mudstone, with thin sandstone interbeds. No outcrop is found on the higher (more south easterly) portion of the slope (Figure 4 right). Fairly abundant outcrops including two dams and a number of erosional channels are found along the lower (more north westerly) portion of the study area (Figures 5 and 6).

Although all outcrop was examined very little of palaeontological interest was observed.

Small invertebrate burrow traces (Figure 7) were noted in the most south easterly corner, plant fragments (Figure 8) were noted in the large dam (Figure 6) in the east central part of the area (visible on Figure 2) and palaeo mudcracks were observed in the north eastern corner (Figure 9).



Figure 4: South westerly portion of the site, weathered sandstone hill capping at left.



Figure 5: Balfour Formation (Beaufort Group) mudstones east of the substation (in background).



Figure 6: Balfour Formation mudstones exposed in a dam (visible in figure 2) north east of the substation.





Figure 7: Traces of small vertical invertebrate burrows in the south east corner of the area.



Figure 8: Plant fragments in mudstone in the large dam (fig. 6), scale bar = 4cm.



Figure 9: Sandstone filling palaeomudcracks in the north east corner of the study area.

**Conclusions and recommendations**

Although potentially palaeontologically important mudstones of the Balfour Formation are exposed in the east of the study area very little palaeontological material was located during the foot survey. That which was noted is not considered significant.

As little excavation or disturbance is expected during this project it seems very unlikely that any important palaeontological resources will be disturbed during this development.

Should any fossil bones or leaves be noticed during construction they should immediately be reported to a professional palaeontologist.

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