Report to Scatec Solar South Africa (Pty) Ltd on an Appraisal of Inferred Palaeontological Sensitivity of a Site for a Potential Photo Voltaic Farm (Portions 1 and 6 of Farm Spes Bona No. 2355, near Bloemfontein, Free State province).

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SUMMARY STATEMENT

Beaufort rock rocks are present at Spes Bona but the weathering is severe. Fresh rocks will be present at depth, but well below the foundation depth) on this site. There may well be pre-mammalian (***therapsid***) terrestrial vertebrates Permo-Triassic fossils on this site but well below the foundation depth. The Palaeontological Sensitivity is Low.

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1. BACKGROUND

Scatec Solar SA (Pty) Ltd is making applications to develop photo voltaic (PV) renewable energy centres for the new generation and contribution of power into the national electrical grid. It is proposed to erect this on the farm "Spes Bona" near Bloemfontein.

2. TERMS OF REFERENCE

The Environmental Impact Assessment for this project required a Desk-Top Palaeontological Sensitivity Report to assess the possibility of Permo-Triassic fossils on this site. This was followed up by a ground-truthing field inspection on 7 April 2014.

3. INFORMATION SUPPLIED

1. Geotech report: **GEOSURE, Report to Scatec Solar SA (Pty) Ltd on an Appraisal of Inferred Geotechnical Conditions of a Site for a Potential Photo Voltaic Park at Farm Spes Bona, Bloemfontein, Free State. Reference: 187-13.Spes Bona. R01.Revision 1 Dated: 9 January 2014**

2. **Bloemfontenin Geological Map (Sheet Number 2926**) 1: 250 000 Scale Geological Map produced by the Council for Geosciences.

3. Field Trip April, 7, 2014

4. METHODS

This Desk-Top analysis entailed the use of the following:

1. Internet search for available information and analysis of any specialist literature uncovered.
2. Inspection of relevant geological maps
3. Inspection of the supplied Geotechnical Report.
4. Field inspection

5. ASSUMPTIONS & LIMITATIONS

1. The geological mapping is on a large scale (1:250 000) and contains inaccuracies (error bars unknown).
2. The Beaufort stratigraphy and nomenclature is still undergoing general scientific refinement and is subject to change. A lack of good lithostratigraphic markers in the Beaufort Group has hindered this process (van der Walt et al., 2010).

3. The fossil record is not complete (research continues) and is still being assessed and researched

6. SPES BONA GEOLOGY

The farm "***Spes Bona***" falls within the Bloemfontein (Sheet Number 2926) 1:250 000 scale geological map, produced by the SA Council for Geosciences (Fig.1). The Beaufort Group is poorly defined (Visser, 1998) and mapped on a large-scale, often from airphoto analysis.

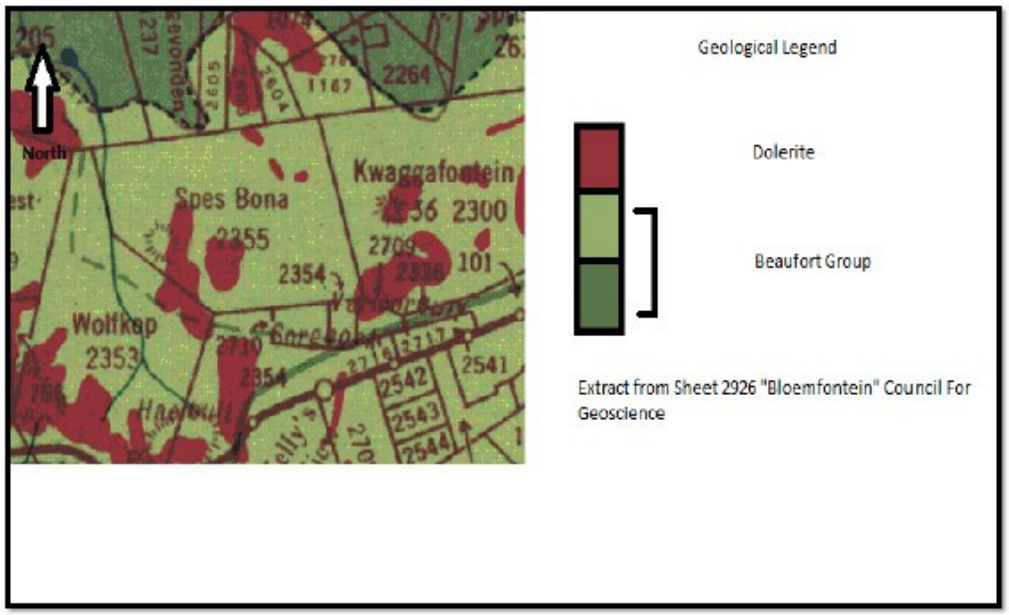

Fig. 1: Extract from Bloemfontein (2926) 1:250 000 geological map sheet. The areas in red can be excluded as they are igneous and non-fossiliferous.

According to the map (Fig 1), the farm "***Spes Bona***" is situated in lithologies of the Tarkastad Sub-Group, which is the upper part of the Beaufort Group and itself a part of the Karoo Sequence. Although it is most likely that rocks of the Tarkastad sub-group will be encountered on the farm "***Spes Bona***", the proximity of the flat to low angle, Tarkastad-Adelaide Sub-Group stratigraphic contact (exposed to the north: Fig. 1) cannot rule out the occurrence of Adelaide Sub-Group Rocks at shallow depths.

The age of the Beaufort Group (Fig. 2) is not well constrained (van der Walt (2010).The Beaufort Group ranges from Middle Permian (Kazanian – 270-260 million years ago or Ma) (Rubidge 1995) to Middle Triassic (Anisian) (Ochev & Shishkin 1989; Hancox *et al.* 1995; Hancox & Rubidge 1996; Hancox, 1998). The Tarkastad Sub-Group follows the Permo-Triassic boundary and so should post-date 252 Ma (Shen et al., 2011).

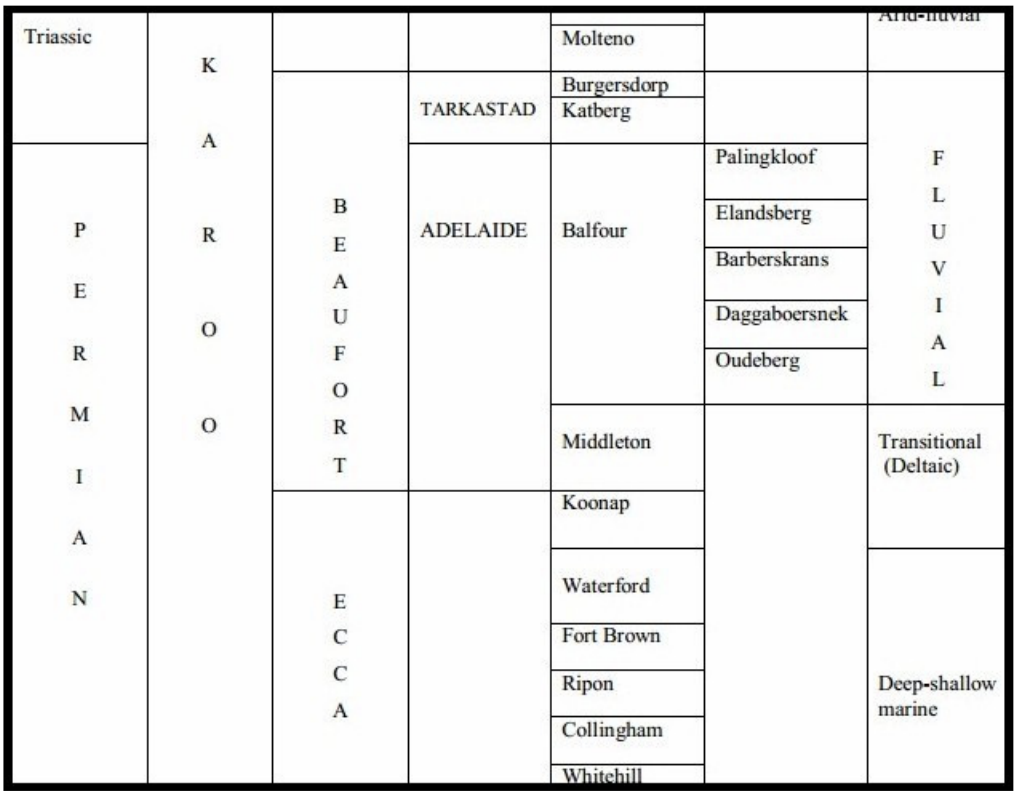

Fig. 2: Beaufort Group subdivision after Oghenekome (2013), Catuneanu and Elango (2001), Rubidge (2005) and Tordiffe et al. (1985).

7. SPES BONA PALAEONTOLOGY

Igneous Rocks

The dolerite (Fig. 1) is part of the Karoo Dolerite intrusion. This igneous rock is not fossiliferous, but there will be fossiliferous rock below, however the depth of this is unknown.

Beaufort Rocks

The global importance of the Beaufort Group is due to its assemblage of *tetrapod* fossils, as it contains one of the world's best preserved ecological assemblages of pre-mammalian (***therapsid***) terrestrial vertebrates in the world (Keyser & Smith 1979). The Beaufort is considered by many to be the global **Biostratigraphic Standard** for the non-marine Permo-Triassic period (Shishkin *et al.* 1995; Lucas 1998). In addition, the Beaufort Group also contains one of the most complete examples (non-marine) of the

Permo-Triassic (PT) boundary sequences (Smith 1995; Ward *et al.* 2000; Smith & Botha 2005; Botha & Smith 2006). The Permo-Triassic boundary represents the geological record of the Permo-Triassic extinction event, the greatest mass extinction event experienced on Earth.

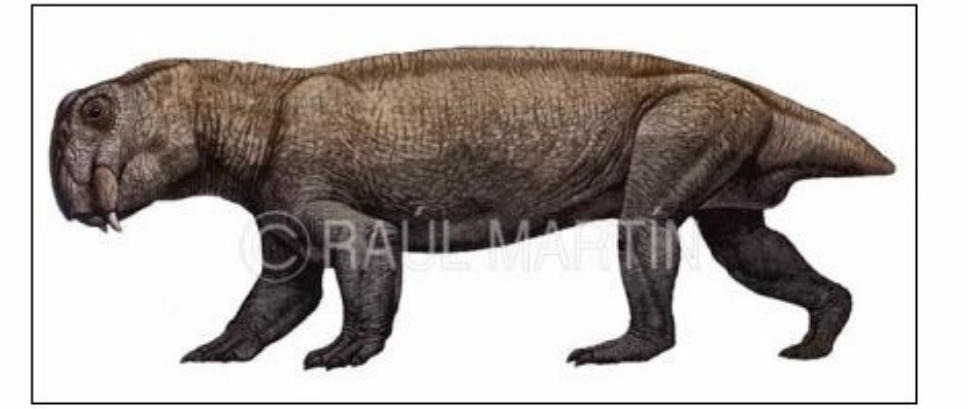

Fig. 3: Artists impression of a Lystrosaurus. Source: http://www.dinosaurusi.com/en/post/242/pictures-of-dinosaurs-lystrosaurus

From Fig 2 it can be seen that a further breakdown (according to fossil content and lithology) is possible. The inadequate lithological description on the geological map makes a desk-top analysis difficult. From the available data ***Lystrosaurus*** (Fig. 3) and ***Cynognathus*** could be present, as these are Tarkastad Sub-Group index fossils (Visser, 1998).

If the Adelaide Sub-Group is present (and will be at depth) then ***Eodicynodon***, ***Tapinocephalus***, ***Pristerognathus***, ***Tropidostoma***, ***Cistecephalus*** and ***Dicynodon*** could also be encountered (Visser, 1998).

8. GROUND TRUTHING

Ground Truthing was conducted on April 7, 2014 to verify the desktop study. The site is essentially flat with no cliffs or incised water courses (Fig.4). The soil is red and [clayey] (Fig.5). No outcrop was encountered. The site is covered by colluvium and alluvium sheetwash. The rock appears deeply weathered. Fresh rock will be present at depth, but this will be well-below the foundation depths.

Fig. 4: View of Spes Bona

Fig. 5: Close up of the Spes Bona soil.

9. SUMMARY

Table 1: FOSSIL HERITAGE THAT MAY BE PRESENT AT THE SPES BONA SITE BUT WELL BELOW THE DEPTH OF THE FOUNDATIONS.

***South African Heriatge Resources Agency** (www.sahra.org.za/)

GEOLOGICAL UNIT	ROCK TYPES& AGE	FOSSIL HERITAGE	PALAEONTOLOGICAL SENSITIVITY	RECOMMENDED MITIGATION
Adelaide Subgroup	270-252 Ma	Mammal-like reptiles	Med to high	Report findings to *SAHRA
Tarkastad Subgroup	252 - Mid Tiassic	Mammal-like reptiles	Medto high	Report findings to *SAHRA
Dolerite	igneous	none	zero	none

The fossil heritage sensitivity of this site is low within the 3D geological footprint of the proposed photo voltaic farm.

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