APPENDIX A

PALAENTOLOGICAL IMPACT ASSESSMENT: PROPOSED DEVELOPMENT OF 150 PV SOLAR ENERGY FACILITY ON PORTION 2 OF FARM ROODE PAN IN ORANIA, NORTHERN CAPE.

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31 March 2017

1. EXECUTIVE SUMMARY

Dr Mirriam Tawane was appointed by Meso Heritage Consultants to undertake a palaeontological impact assessment on farm, on portion 2 of farm Roode Pan, Orania, Thembelihle Local Municipality, Pixley Ka Seme District Northern Cape for a possible development of a 150 PV Solar Energy Facility.

Possible palaeontological remains were observed, however these were of a low impact rating and as such, the proposed development is supported. However possible fencing of the bedrock should be considered if it is in very close proximity with the location of the proposed development.

2. BACKGROUND INFORMATION

The best prediction of the presence of fossils in any unstudied area is the underlying stratigraphic units. Northern Cape has a vast abundance of fossils. The geological and fossil heritage covers over 2.7 billion of earth history. Stromatolites, although only observed in boreholes have been discovered in the Northern Cape. These were found in the carbonate rocks of the Ventersdorp Supergroup in the northern part of the province and date back to 2.7 billion years ago. (Almond, 2009). Most of the Northern Cape is underlain by granites and gneisses of the Namaqua Metamorphic rocks that are between one and two billion years old. These early Precambrian rocks do not contain fossils. However, much of the remaining area features older and younger sedimentary rocks or low grade slightly metamorphosed sediments that are known to contain fossils or are potentially fossiliferous. Northwards of the province, the Northern Cape is underlain by the Ventersdorp supergroup, that overlays the early Precambrian rocks. The Precambriam Allanridge formation of the Ventersdorp supergroup is not palaeotologically significant. The ventersdorp supergroup is overlain by the Karoo Supergroup.

The Mbizane formation of the Dwyka group is usually dominated by the laminated mudrocks with thin diamictites, lonestones and calcareous concretions (Almond, 2010). Dwyka group is known for its poor fossil record due to the glacial climates that prevailed during much of the Late Carboniferous to Permian periods in Southern Africa. However some were deposited during the periods of glacial retreat (McLachlan & Anderson 1973, Visser *et al*., 1977,). Dwyka group (320-290 Ma) in the Northern Cape has yielded anthropod trackways, trace fossils, organic microfossils and rare invertebrates such as molluscs, fish, vascular plants and Glosopteris flowers (Anderson, 1976; Anderson, 1981; Plumstead, 1969; Bamford, 2000).

The dwyka group is overlain by the laminated mudrocks of the Prince Albert formation of the Ecca group. These well-laminated basinal mudrocks are sometimes carbonaceous and contain a variety of diagenic concretions enriched carbonate minerals. Some of these are richly fossiliferous. (Almond, 2010; Visser, 1982). The Ecca group (290-266 Ma) have yielded non marine trace fossils, vascular plants, and Palynomorphs of Glossopteris flowers (Almond, 2009; Bamford, 2000).

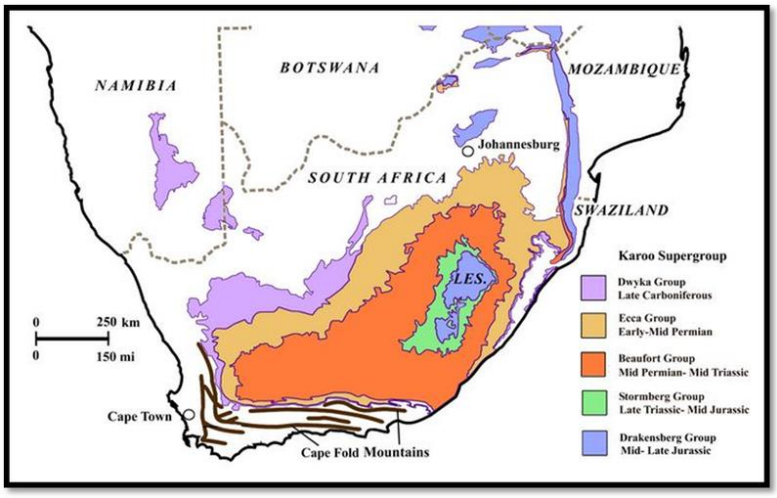

Figure 1: Stratigraphy of South African provinces.

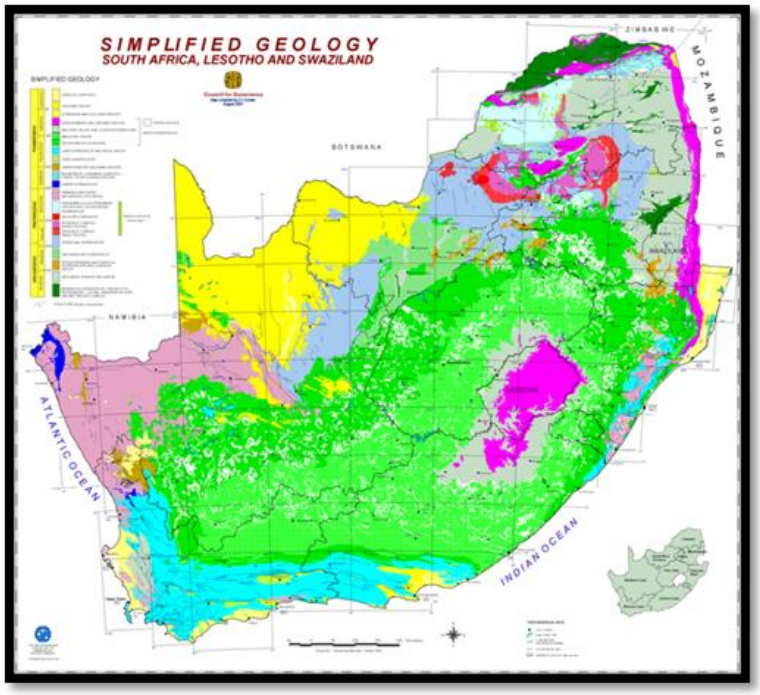

Figure 2: Geological map of South Africa indicating the geology of Orania (Overlain mainly by Karoo Dwyka and Ecca groups of the Karoo Supergroup).

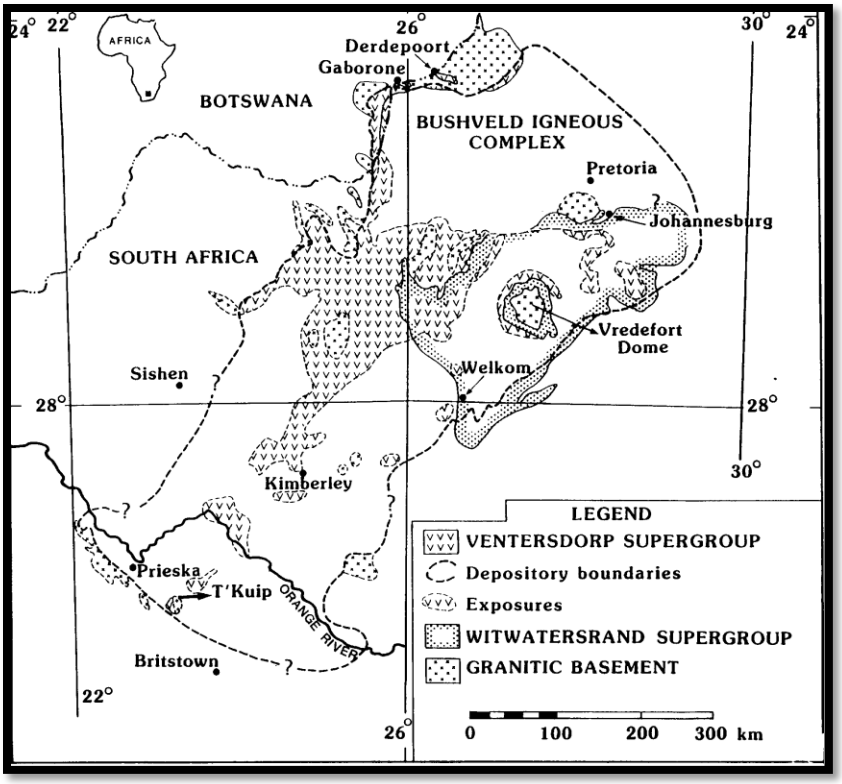

Figure 3: Stratigraphy map showing the distribution of the Ventersdorp Supergroup in the Northern Cape. Pic from Van Der Westhuizen, *et al*, 1991.

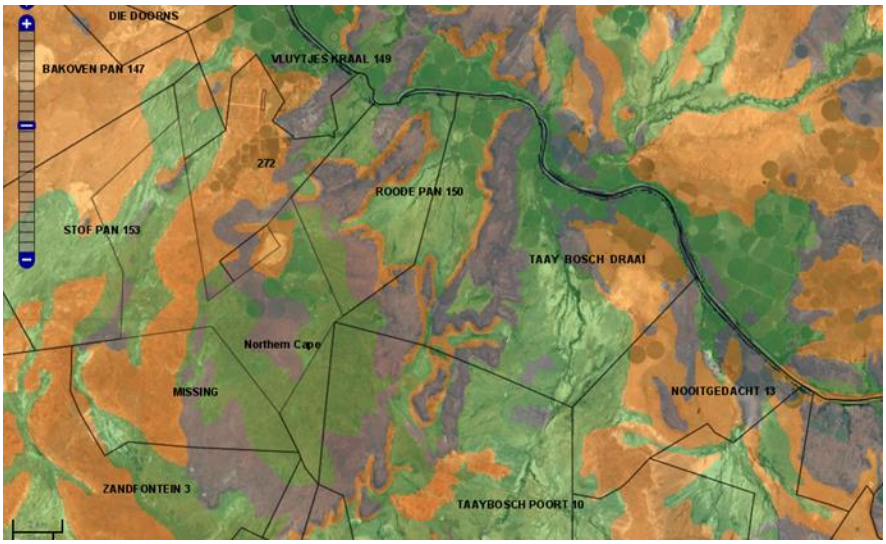

Figure 4: Palaeosensitivity map of Roode Pan indicating the possible presence of fossils in the area.

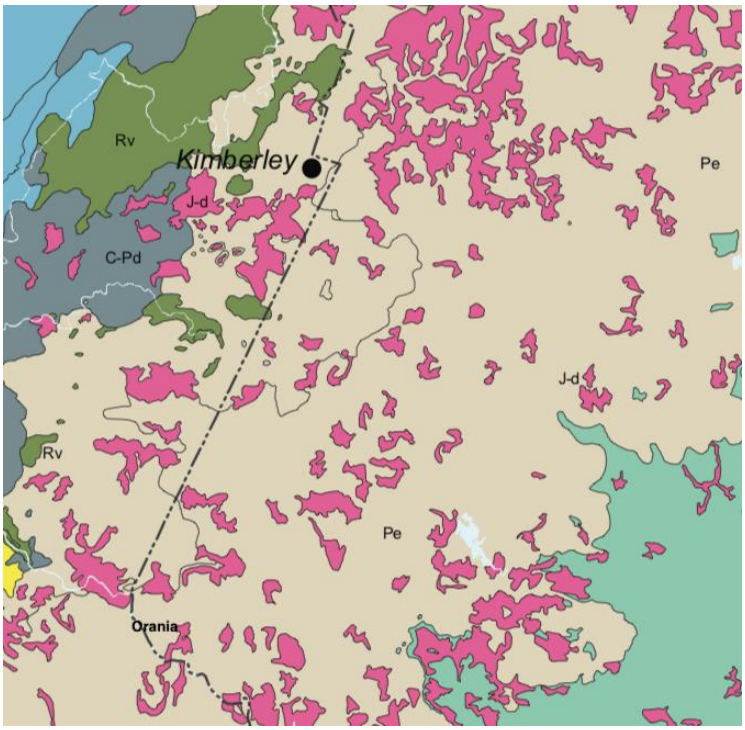

Figure 5: Geological Map of Orania underlain by shale, sandstone (light pink) and surrounded by dorelite (dark pink). Source http://www.geoscience.org.za/images/DownloadableMaterial/RSA_Geology.pdf

3. PHYSICAL SURVEY

The possible area of development is found within a slight to heavily dense grassland. Shrubs are fairy distributed along the plains, but become denser on the periphery of the proposed development area. The landscape is not rocky, but has patches of few flat bedrocks distributed somewhat circularly along the plains. A heap of metamorphosis (sedimentary) rocks (Figure 7) are scattered loosely on the plains and others are still embedded on the grounds. No palaeontological materials were found during the assessment of the proposed development site. Similar results were obtained by several studies while surveying farms between Hopetown-Kimberly areas. (Almond, 2010; Almond, 2012; Almond, 2015; Environworks environmental consultants).

There is ripple like and circular like structures on some of the flatbeds of rocks. Most of these structures are eroding, whereas others are still very intact on the bedrocks. Several explanations could be offered to these. These structures (Figure 9) could possibly be septarian calcite concretions or nodules. The other alternative could be stromatolite.

A concretion is a concentration of a chemical compound in the form of a grain or nodule of varying size, shape and hardness found in a rock. A nodule is a small, irregularly rounded mass of a mineral that has a contrasting composition from the enclosing sedimentary rock. The difference between the two is that the concretions are formed from mineral precipitation around some kind of nucleus while a nodule is a replacement body. Without a cross section of the structure it is difficult to offer a definite irrefutable labeling. (Canada department of agriculture, 1976; Smith, 1995; Hudson, *et al*, 2001; Viglietti, *et al*, 2013; Alessandretti, *et al*, 2015). However, these lie outside of the proposed development.

Stromatolites have been recorded in other regions of the Northern Cape. (Young, 1932; Beukes, 1977; Altermann *et al*, 1991). Stromalolites are layered mould, columns, and sheet-like sedimentary rocks. They are the first forms of life on earth and their presence on any locality should be treated with care. The bedrock should not be disturbed and further investigation with a geologist should be considered.

Figure 6: The map of the proposed development area (in blue) in relation to the bedrock (white arrow)

Figure 7: Dolerite rocks or metamorphic rocks clustered in the plains.

Figure 8: A possible septarian calcite concretions on the sedimentary rock.

Figure 9: Possible circular calcite nodules on a sedimentary rock.

4. PALAEONTOLOGICAL SITE SIGNIFICANCE AND MITIGATION MEASURES

The proposed site development site has no palaeontological significance. The presence of the bedrock with possible stromatolite-like structures on rocks should not be disturbed, until further investigation has been carried out. A possible fencing while development takes place should be considered. Palaeontological materials usually occur underground and embedded in rocks. The absence of the resources in the surface does not indicate that the area does not have the resources at all. Care should be given when the area is being worked on. Should any palaeontological materials be found during the implementation of the development, relevant authorities at SAHRA should be contacted immediately.

5. CONCLUSION AND RECOMMENDATION

The proposed development is supported. However possible fencing of the bedrock should be considered if it is in very close proximity with the location of the proposed development. As with any survey, palaeontological materials lie sub-surface and may be therefore unidentifiable to the surveyor until unearthed during the development process. It is important for the developer to note that should any archaeological/ or grave site be discovered during construction, SAHRA/Northern Cape Provincial Heritage Authority should be notified and a heritage specialist must be commissioned to study the contents of such a site.

6. ACKNOWLEDGEMENTS

I would like to acknowledge Meso Heritage Consultants for the opportunity to perform the Palaeotological impact assessment, as well as Mr Henry Rich for allowing us access to the farm.

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