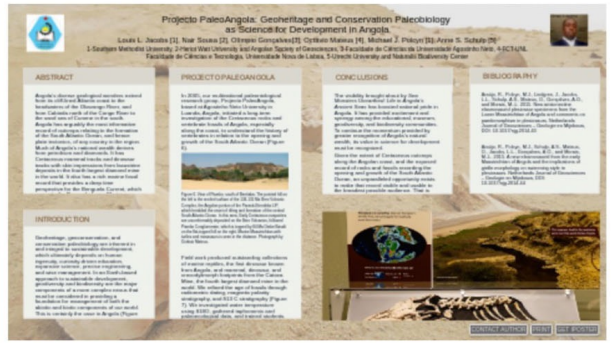
Projecto PaleoAngola: Geoheritage and Conservation Paleobiology as Science for Development in Angola



Louis L. Jacobs [1], Nair Sousa [2], Olímpio Gonçalves[3], Octávio Mateus [4], Michael J. Polcyn [1], Anne S. Schulp [5]

1-Southern Methodist University, 2-Heriot Watt University and Angolan Society of Geosciences, 3-Faculdade de Ciências da Universidade Agostinho Neto, 4-FCT-UNL Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 5-Utrecht University and Naturalis Biodiversity Center

INTRODUCTION

- **Geoheritage, geoconservation, and conservation paleobiology are inherent in and integral to sustainable development, which ultimately depends on human ingenuity, curiosity-driven education, expansive science, precise engineering, and wise management.**
- **Angola is as a unique region of geoheritage with remarkable documentation of the major phases of opening and growth of the central South Atlantic Ocean and preserves the most informative record of outcrops in the region.**

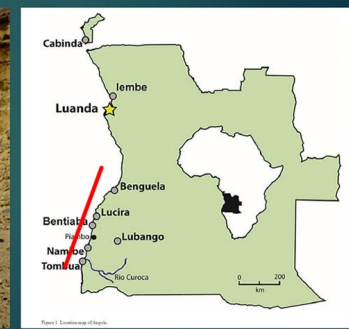


Figure 1. The Atlantic Jigsaw Puzzle and the Map of Angola with a **Black Ombe Basalt outcropping in coastal cliff at Bentiaba.**

GeoDiversity Conceptualization

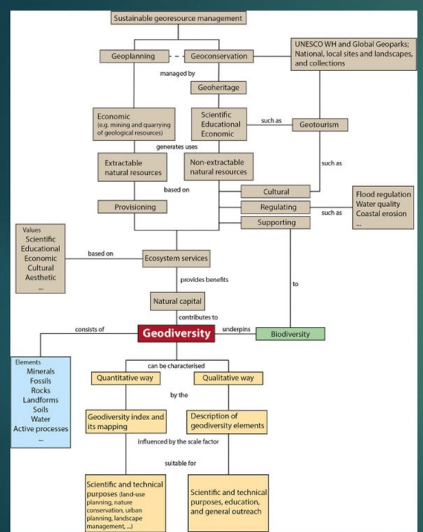


Figure 2. Geodiversity network and relationships. From Brilha et al. (2018)

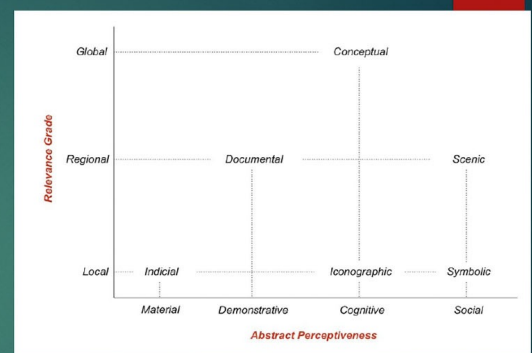


Figure 3. Relationship between relevance and abstract perception as criteria for evaluation of geosites. From Pena dos Reis and Henriques (2009)

Conservation Need = Value + Degree of Threat

Figure 4. The need to conserve geodiversity. From Medina (2012).

Quantitative Geosite Evaluation

Figure 5. Quantitative geosite evaluation to assess the spectacular coastal outcrops of Miradoura da Lua (View of the Moon), Luanda Province, which records most of the Neogene in a magnificent and beautifully exposed sedimentary prism that was scored 43/48 or 90% by Sousa (2020).

TABLE III
ASSESSING THE POTENTIAL GEOTOURISTIC USE OF A GEOSITE

UNIQUENESS AND SCENERY	Points
Geosite of Usual Beauty	1
Geosite of Low to Medium Beauty	2
Geosite of Medium to High Beauty	3
Geosite of Exceptional Beauty and Uniqueness	4
MONUMENTALITY	**Points**
2 geological aspects only 1 representative	1
2 geological aspects both are representative	2
3 geological aspects but only 1 is representative	3
3 geological aspects (Stratigr, Paleont, Geomorph)	4
RECREATIONAL POTENTIAL	**Points**
Geosite of low potential to be a local/national icon	1
Geosite of low-medium potential to be local/national icon	2
Geosite of medium-high potential to be local/national icon	3
Geosite of high potential to be local/national icon	4
SAFETY (VISITING CONDITIONS)	**Points**
Very High risky condition	1
Medium-High Risky conditions	2
Low-Medium Risky conditions	3
Very Low risky for visitors	4

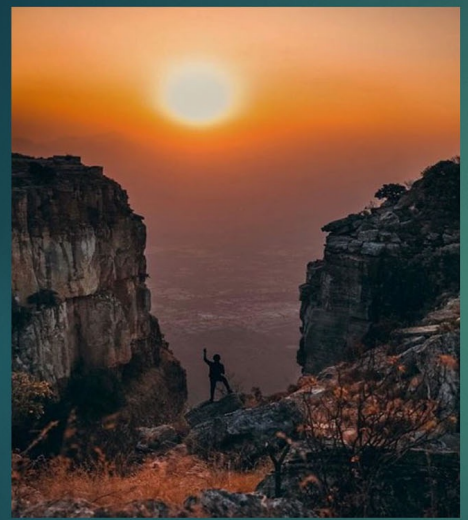
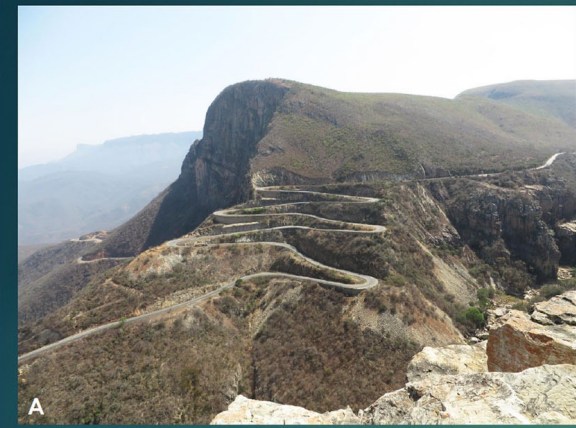


TABLE I
ASSESSING THE POTENTIAL SCIENTIFIC USE OF A GEOSITE

REPRESENTATIVENESS	Points
1 Representative Geological Aspect	1
2 Representative Geological Aspects	2
3 Representative Geological Aspects	3
4 Representative Geological Aspects	4
INTEGRITY	**Points**
High Exposure to threats	1
Medium-High Exposure	2
Low-Medium Risk Exposure	3
No risk of threats (natural/anthropogenic)	4
SCIENTIFIC KNOWLEDGE	**Points**
A very narrow range of published information	1
A low-medium range of existent information	2
A medium-high range of existent information	3
A very wide range of published information	4
ACCESSIBILITY	**Points**
High accessibility risk	1
Medium-High accessibility risk	2
Low-Medium accessibility risk	3
Low accessibility risk (asphalted roads, etc)	4

Figure 6. Quantitative geosite evaluation to assess the spectacular Tundavala, Huila Province. This magnificent and scenic beauty was scored 48/48 or 100% by Sousa (2022). Potograph by Jesse Manuel



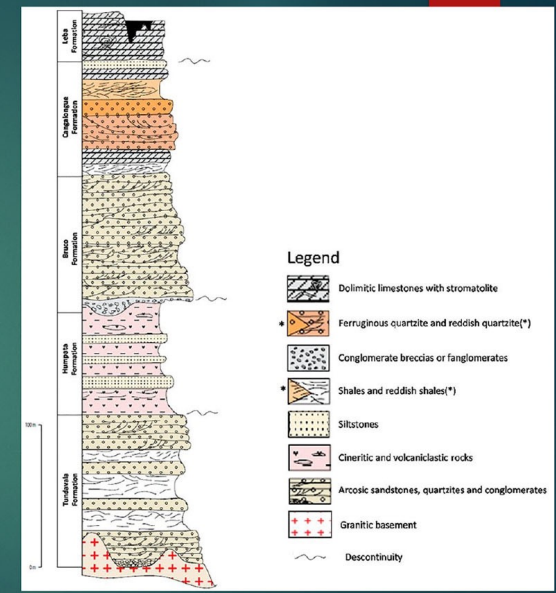


Figure 7. The geosites near Lubango: (A) Serra da Leba, with road winding up through spectacular Proterozoic granitoids capped by Chela Group sediments, and Tundavala (B), with stratigraphic section from Tavares et al. (2015). Photographs by Octavio Mateus.

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Figure 8. View of Piambo, south of Bentiaba. The pointed hill on the left is the eroded surface of the 134-131 Ma Bero Volcanic Complex, the Angolan portion of the Paraná-Etendeka LIP, which heralded the onset of rifting and formation of the central South Atlantic Ocean. In this area, Early Cretaceous evaporites are unconformably deposited on the Bero Volcanics, followed by Piambo Conglomerate, which is topped by 84 Ma Ombe Basalt on the flat-topped hill on the right. Marine Maastrichtian with turtles and mosasaurs is seen in the distance. Photograph by Octávio Mateus.

Figure 9. The exhibit, *Sea Monsters Unearthed: Life in Angola's Ancient Seas*, opened at the Smithsonian Institution's National Museum of Natural History in Washington, DC, in November 2018

Conclusion

- *Inventory* based on a Quantitative approach
- *Threat Response Plan*, often depends on local priorities and circumstances. It involves the identification of all the necessary resources to conserve geosites, considering the impacts of applying measures sustainably.
- *Management Plan* to determine actions and resources to control the potential risks that may hinder the implementation of a certain plan. Involve local communities in all conservation processes, from the implementation of the inventory to the evaluation and monitoring of the conservation areas.

Conservation Need = Value + Degree of Threat

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