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The geological heritage of Tundavala (Angola): An integrated approach to its characterisation

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ABSTRACT

This paper presents the results obtained using a qualitative assessment approach to characterise the geological heritage of Tundavala (Huila, Angola), needed in order to support a future classification proposal for the territory to ensure its preservation, as well as to promote geotourism, thus contributing towards sustainable local development.

In order to characterise the geological heritage of Tundavala a set of various types of data for the different contents displaying heritage value was collected and processed. It was analysed in an integrated manner, taking into consideration data on the meanings attributed to Tundavala by scientific communities (degree of relevance), and public perceptions of such meanings (abstract perceptiveness).

The results allow us to recognise in Tundavala, an object displaying heritage value, more than one type of content – documental, symbolic and scenic – which provides it with a degree of regional relevance and enhances its value as an element that incorporates the geological heritage of the earth.

The methodologies used to characterise the geological heritage of Tundavala are independent of any national, regional and/or local legislation on geoconservation, whether they exist or not, and thus represents a useful tool for evaluating geological heritage in any place on earth, particularly in countries and/or regions where local geological knowledge is sparse and/or there is little public awareness of geoconservation.

1. Introduction

Geodiversity, considered as geological assemblages, their relationship, properties interpretations and systems (Gray, 2004), is an important natural factor underpinning biological, cultural and landscape diversity, as well as an important parameter that should be considered in the assessment and management of natural areas (IUCN, 2008). Like biodiversity conservation, geodiversity conservation is a social concern. As argued by the IUCN (2012a), biodiversity benefits from geodiversity conservation and thus from the resilience created by proper geoconservation.

Geoconservation requires inventory and evaluation procedures which play a decisive role in the implementation of any subsequent conservation, by evaluating and monitoring the geological heritage (Henriques et al., 2011). Geoconservation strategies must strengthen the complexity of the field, with regard to both scale and scientific requirements (Erikstad, 2013), and the ethical values of geoconservation have to be perceived not only as environmental resources but also as part of the global cultural heritage (Bruno and Perrotta, 2012).

As pointed by Pena dos Reis and Henriques (2009), geological objects refer to a wide range of geological features from microscopic (e.g., minerals) to gigantic (e.g., mountain belts) dimensions. The evaluation of geological objects displaying heritage value, which include both natural geological sites and the heritage associated with geological sites (e.g., the fossil collections stored in museums; Schemm-Gregory and Henriques, 2013), should not be limited to statements by scientific communities regarding their geological properties without also considering the attributes socially assigned to them (Pena dos Reis and Henriques, 2009; Bruno and Perrotta, 2012).

This view is also emphasised by Eriskstad (2013), who considers the local sense of place and local geoheritage perspectives as the key to management initiatives directed towards implementing sustainable development measures (Segnestam, 2002), namely through geotourism, which represents an opportunity for many countries and regions to promote an identity that is unique to a particular place (Dowling, 2011).

Geotourism is a form of natural tourism that focuses specifically on geology and landscape, representing a process for promoting

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tourism based on geosites which fosters geoheritage conservation through appropriate sustainability measures, advances sound geological understanding through interpretation and education, and generates tourist or visitor satisfaction (Dowling, 2011), as well potential economic benefits (Simpson, 2008; Hose and Vasiljević, 2012). Moreover, it is a comprehensive means of transferring and exchanging information (Fuertes-Gutiérrez and Fernández-Martínez, 2012) as a basic requirement to support environmental management, maximise opportunities and minimise adverse impacts through environmentally sustainable development and planning (Dowling and Newsome, 2010).

Reimold (1999) has highlighted the importance of the protection of natural sites in Africa as a bonus for ecotourism and geotourism. Although some authors have debated the efficiency of legislation and rules for the conservation of the geological heritage, especially in South Africa (Cairncross, 2011; Ruban, 2012), some important works emphasise the relevance of exploring African geodiversity as the key to scientific development and support cultural initiatives for sustainable development (Reimold, 1999; De Wit and Anderson, 2003; Alfama et al., 2008; Johnson et al., 2010; Dawson, 2010; Fauvelle-Aymar et al., 2010; Tavares et al., 2012; Henriques et al., 2012, among others). These approaches are supported by most African countries, which have recognised the importance of preserving natural resources, and 45 of them already subscribe to the World Heritage Convention, thereby agreeing to identify and nominate properties within their national territory to be considered for inclusion in the World Heritage List as cultural, natural or mixed properties (Schlüter, 2006; UNESCO, 2010).

In 1991 Angola ratified the Convention (UNESCO, 2010) but as yet none of the 962 properties (745 cultural, 188 natural and 29 mixed properties) that form part of the cultural and natural heritage included in the World Heritage List are located in its territory (UNESCO, 2012). However, as a State Party to the World Heritage Convention, Angola has a responsibility to "ensure the identification, nomination, protection, conservation, presentation, and transmission to future generations of the cultural and natural heritage found within its territory", "integrate heritage protection into comprehensive planning programmes", "take appropriate legal, scientific, technical, administrative and financial measures to protect the heritage" and "submit to the World Heritage Committee an inventory of properties suitable for inscription on the World Heritage List" (pp. 3–4).

As in many other regions all over the world, the nature conservation policies implemented in Angola have led to the approval of legal instruments that have created misconceptions of nature, confusing it with its biological component only (Henriques, 2004). As stated in the National Biodiversity Strategy and Action Plan of Angola (2007–2012), "the legal framework in the country is composed of a series of environmental laws for different sectors, namely land, fisheries, water resources, petroleum and mines, as well as laws on the protection of biological diversity and management and pollution control" (NBSAP, 2006, p. 9). Protected Areas in Angola include 6 National Parks, 1 Regional Natural Park, 2 Integral Natural Reserves and 4 Partial Natural Reserves, corresponding to 82,000 Km^2, or 6.6% of the country (SCEAP, 2012), mainly directed towards the conservation of biodiversity and the biological heritage.

In this paper the geological heritage of an emblematic site in Angola (the Tundavala Gorge) is described in terms of its geological content and social recognition, in order to support future geoconservation actions to foster sustainable development and planning. The paper will address the following: (1) a geological characterisation of the Tundavala site; (2) its geoheritage contents and values; and (3) geoconservation strategies and action proposals. The results may serve to support ongoing perspectives for the growing tourism in Huíla Province (SDCI, 2004). In addition, they represent a contribution to the production of a global inventory of important African geological sites for classification and prioritisation purposes (Schlüter, 2006), as well as the need to pursue a unified African geoconservation strategy (Reimold, 1999) such as the "Gondwana Alive Corridors" project (De Wit and Anderson, 2003) which preceded the ongoing "Africa Alive Corridors" project (Toteu et al., 2010).

2. The Tundavala site: location and geological framework

The Tundavala Gorge, which "offers stunning views of the Huila plateau and Namibe" (SDCI, 2004, p. 39), is often described as a place to visit in the south of Angola, because of its tourism potential, reflecting a strong "imageability" in the observer (Ode et al., 2008). The Tundavala belvedere overlooking the incise gorge (Fig. 1) provides a clear north-western view of over 10,000 square kilometres towards Namibe, situated about 130 km away on the coast (Fig. 2). The site is mentioned in the National Biodiversity Strategy and Action Plan (2007–2012) (NBSAP, 2006) as one of the areas in Angola that should be protected, especially taking its landscape values into account, given that it is considered one of the wonders of Angola (Percival, 2009).

The Tundavala site is located on the edge of the Humpata Plateau (13°22′S; 14°49′E) about 20 km from Lubango, the capital of Huíla Province (Southwest Angola; Fig. 3). This table forms a structure corresponding to the Serra da Chela, ending in the west in imposing cliffs standing about 1000 m high (e.g., Bimbe and Leba in the south) that define the boundaries of a volcanic-sedimentary intracratonic basin from the Paleo-Meso-Proterozoic era, mainly deposited within an interval of 1947–1810 Ma (Pereira et al., 2011) and analogous to others located in the Congo Craton (Pereira and De Waele, 2008). The inner part of this so-called Angolan Block of the Congo Craton (e.g., Carvalho et al., 2000; Delor et al., 2008) has remained stable since the Limpopo-Liberain (c. 2680 Ma to c. 2820 Ma) and Eburneano and/or Tadilian (c. 2100 Ma to c. 2000 Ma) orogenic cycles, unlike the peripheral zones, which have been reactivated during the Maiombian (1300 ± 200 Ma), Kibarin (1300 ± 100 Ma) and Pan-African orogenic cycles (c. 975 Ma to c. 550 Ma) (e.g., Carvalho, 1983; Carvalho and Alves, 1993; Ferreira da Silva, 2009; Lopes et al., 2012).

The edge of the Humpata Plateau has very rugged facets alternating between NW–SE and NE–SW orientations. They form small polygons in the west and south-west, whereas towards the north-east their appearance is dendriform (Lopes et al., 2012). These features are represented by fractures and deep canyons opening westwards, of which the Tundavala Gorge, standing more

Fig. 1. View of Tundavala Gorge looking towards distant Namibe in the west.