



CONTEXT

PRESSURES & POTENTIALS OF
BOLT'S FARM



▲
FIGURE 2.1
BOLT'S FARM
LOCATION
(Author , 2016)

PRESSURES & POTENTIALS

OF BOLT'S FARM

The site is located in the North-eastern quadrant of what is referred to in historical literature as Bolt's Farm. It is located towards the Krugersdorp border of the Cradle, and comprises more than 30 fossiliferous loci of different ages, ranging in age from between 1.5 and 4.5 million years old ago (Gommery and Potze 2013:2). Bolt's Farm contains the oldest fossils discovered in the Cradle so far. Today Bolt's Farm is divided into three properties, namely Klinkert's, Greensleeves and the Main Quarry (Gommery and Potze 2013:2). With each new epoch, the landscape is altered, with some alterations such as the quarry being more evident, and leaving scars in the landscape.

The fossiliferous findings and the impact of the quarry on Bolt's Farm are, however, only two of the potentials and pressures of the site, with the historical, economic, and social landscapes of the site all contributing to the current and future state of the landscape of Bolt's Farm.

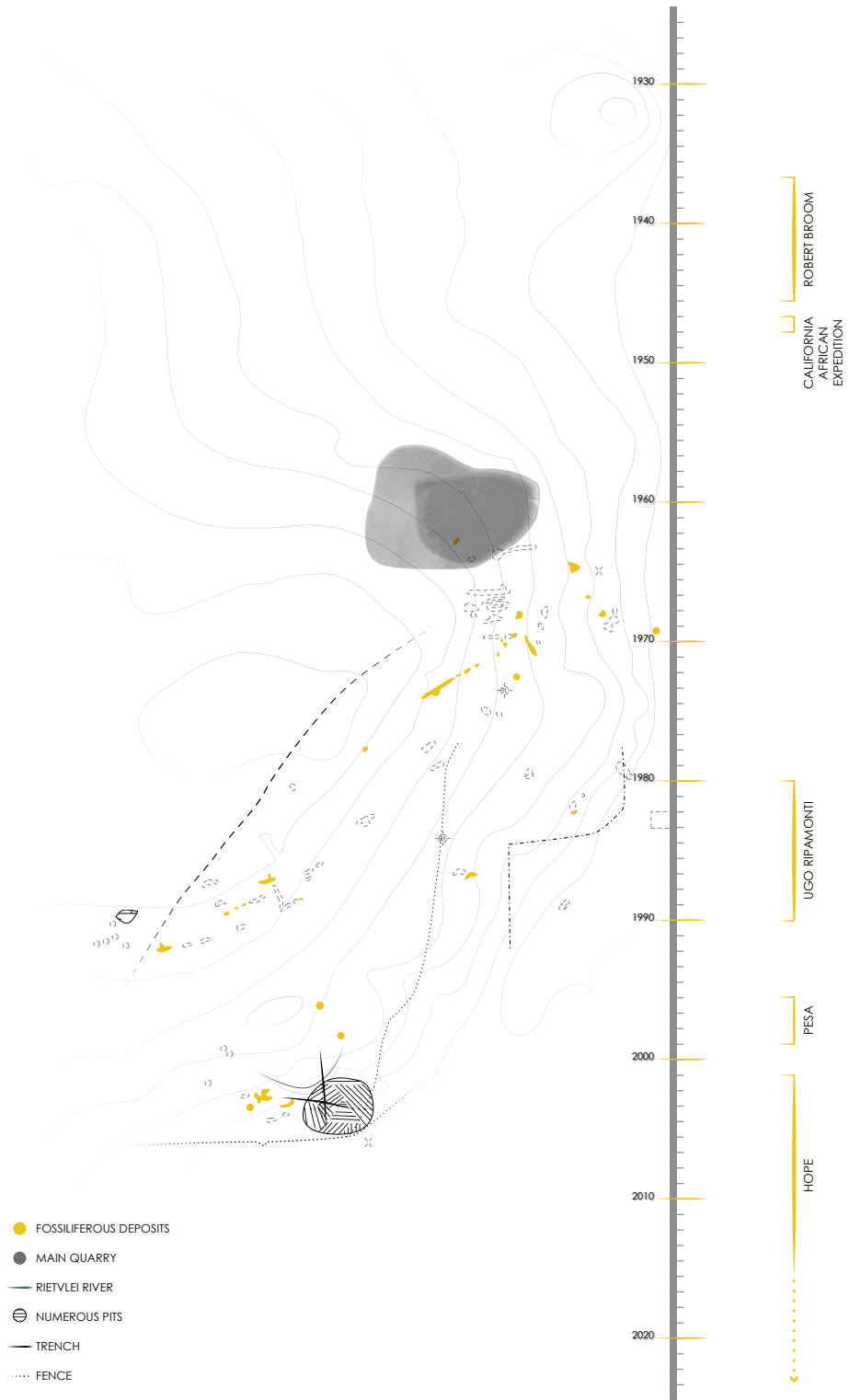
2.1 HISTORICAL LANDSCAPE

The fossiliferous deposits at Bolt's Farm represent the longest chronological sequence within the region of the Cradle, illustrating the impact of climatic changes over the course of this period (Gommery and Potze 2013:2). Although no hominid remains, with the exception of one tooth, have been discovered at Bolt's Farm,

the vast span in age of the numerous fossiliferous sites within this area allows palaeontologists to study the adaption of hominids to this habitat, as well as their relationship to fauna in the changing environment brought about by climatic change (Gommery et al. 2010:10).

Since the first collection of fossils at Bolt's Farm in 1936 by Dr. Robert Broom, five major phases of fieldwork have taken place (Fig. 1). The current fieldwork on Bolt's Farm is focused on a few active digs, including Aves Cave, located south-west of the quarry. Breccia's, sedimentary rocks containing fossil fragments collected during previous years at Cobra Cave are prepared by scientists from the Ditsong Museum. This cave is one of only two sites where Chiroptera fossils were discovered (Gommery and Potze 2013:6). Although the quarry yielded many original fossils, including some collected by Broom, it is not included as part of the National or World Heritage Site, due to the destruction of the habitat brought about by mining (Gauteng Provincial Government n.d.).

If one visits the site today, the collection of caves and sinkholes of Bolt's Farm bears little significance to the everyday tourist, and is a site where the archaeological and palaeontological significance of the landscape is only apparent to those who have emerged themselves in the research thereof (Gauteng Provincial Government n.d.:15).



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 FIGURE 2.2
 FIELDWORK PHASES
 AT BOLT'S FARM
 (Author , 2016)

2.2 ECONOMIC LANDSCAPE

2.2.1 HYDRO-VULNERABILITY

Bolt's Farm is located above the Zwartkrans Aquifer Compartment, and lies immediately north of the Riet Spruit, a river which has been severely contaminated by acid mine drainage from the mines of the West Rand, as well as municipal wastewater from Rand Sewage Works. All the caves located on Bolt's Farm either intersect the water table, or are located immediately above it (Hobbs 2011:189). Upstream from Bolt's Farm, the Riet Spruit loses as much as 32ML/d of contaminated water to the karst system. This not only contaminates the groundwater, but also has led to a 4m rise of the water table. Caves which extend below the groundwater elevation (~1450 m above mean sea level), display a very high vulnerability to water quality as well as quantity brought about by groundwater level fluctuations. The fossiliferous discoveries of Bolt's Farm located in the caves extending below the water table elevation are thus under threat (World Heritage Committee 2013:101); this includes Aladdin's Cave, which has been exposed by quarry mining activities (Hobbs 2011:189).

The treatment of the point sources of contamination is the most effective means of limiting further damage to the site. However, the responsibility for remediation lies with government authorities and mining officials, who have shown little interest in dealing with the destruction caused downstream to date (Witthüser 2016). Mitigation measures can, however, be put in place upstream from Bolt's Farm, to lessen the impacts of the deteriorated water quality on the sensitive karst landscape (Hobbs 2011:189). These measures include the containment and treatment of mine

water at the decant at Tweelopie Spruit, the placement of limestone in the channels of the Tweelopie and Riet Spruits to lower the pH of the mine water in passage, and the planting of an acid mine treatment wetland along the Riet Spruit (Witthüser 2016).

2.2.2 MINING ACTIVITY

Apart from the impact that mining activities on the West Rand have had on the Cradle of Humankind, mining activity occurs within the Cradle itself. This includes the Sterkfontein Quarry located on Bolt's Farm (Hobbs 2011:184). The stone aggregate quarry, although not decommissioned, has been inactive since 1992, due to unstable geological conditions at the base of the quarry. The quarry is visible from the main route between the Sterkfontein caves and Maropeng, and creates a scar in this otherwise seemingly pristine landscape. Mining operations at the quarry have severely damaged or destroyed many caves exacerbated by the quarry pit, which pierced the water table, and thus altered the hydraulic recharge rate of the Zwartkrans aquifer (The South African Karst Working Group 2010:206).

Although the presence of the quarry is seen as a major threat to the Cradle (Annexure B), the quarry has unlocked educational potential in the landscape, displaying the resistance of the geological features to vibrations and blasting, as well as the impact of the oxidation rate to exposed caves. Both students and researchers from the geological and palaeontological departments of the University of the Witwatersrand regularly visit the quarry site as part of their educational programmes (The South African Karst Working Group 2010:206).

2.3.1 AGRICULTURE & (PERI)-URBANISATION

Poor farming practices and urbanisation are two of the biggest threats to the ecology of the karst system of the Cradle (Annexure B). This is firstly due to the impact on the water quality and quantity. With the increased use of groundwater for irrigation purposes, the water table drops, not only altering the humidity level in the caves on which bats are dependant, but also affecting the structural stability of the caves (The South African Karst Working Group 2010:359). The water quality is in turn affected by pesticides, which not only poison the borehole water consumed by the local community, but also destroy the karst-ecosystem, by exterminating aquatic life, in turn poisoning or starving other cave-dwelling creatures.

Informal settlements near Bolt's Farm also impact the water quality, with sinkholes and caves being used as garbage dumps, and pit latrines being placed over these openings, due to ease of drainage (Witthüser 2016). These settlements also threaten the population dynamics and foraging patterns of cave-dwelling bat populations in the Cradle, such as *Rhinolophus clivosus*, *Miniopterus schreibersii*, *Myotis tricolor*, and *Nycteris thebaica* (The South African Karst Working Group 2010:360). The existence of the bats in the area however, has a positive, often unrealised agricultural impact, by serving as natural pest control, as they forage for the insects within the agricultural land (The South African Karst Working Group 2010:359).

2.3 SOCIAL LANDSCAPE

2.3.1 CHIROPTERA OF THE CRADLE OF HUMANKIND

Bats are classified under the Chiroptera family, a term meaning 'flying mammal'. Bats are the only true flying mammal, and although there are no endemic bat species in South Africa, many of the caves, sinkholes, and abandoned mines in the Cradle serve as ideal roosting spaces for bats, contributing to the biodiversity of the region (The South African Karst Working Group 2010:16). The insectivorous cave dwelling *Nycteris thebaica* (common slit-faced bat), *Myotis tricolor* (Temminck's hairy bat), *Miniopterus schreibersii natalensis* (Schreiber's long-fingered bat), *Rhinolophus blasii* (peaksaddle horseshoe bat) and *Rhinolophus clivosus* (Geoffroy's horseshoe bat) have all been reported in the vicinity of the Cradle.

Various researchers have conducted or are still conducting research on the Chiroptera of the Cradle, and these parties include J.F. Durand from the Zoology Department at the University of Johannesburg, who conducted research on karst ecology, aquatic health and geo-tourism; M. van der Merwe from the Department of Zoology at the University of Pretoria, focusing on bat reproduction, migration, roosting and feeding habitats; D. Peinke from the Department of Agriculture, Conservation and Environment (GDACE), focusing on the identification and protection of sensitive roosting environments; and the various researchers from the Transvaal Museum of the Northern Flagship Institute (NFI), collecting cave-dwelling bat specimens (The South African Karst Working Group 2010:98).

With the abandonment of the caves by hominids and mammalian predators, bats have become the most important, present day active importers of organic matter into caves, serving as a crucial link between photosynthetic processes on the surface of the landscape, and the troglobitic end-consumers residing within the caves. As



▶ FIGURE 2.3
STONES FROM QUARRY
(Author , 2016)



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FIGURE 2.4
ENTRANCE TO
ALLADIN'S CAVE
(Author , 2016)



▲ FIGURE 2.5
KARST NETWORK
(Krige, G , 2016)

a result of the variety of habitats within the Cradle, roosting and feeding ranges of multiple bat species is possible in the Cradle, leading to the result of overlapping roosting sites, as well as bats being active throughout the entire night (The South African Karst Working Group 2010:360).

The Cradle is home to one bat species of particular importance, namely Schreiber's long-fingered bat. The bat species is listed as a Red Data listed species, which migrates to the Cradle annually. The habitat of Schreiber's long-fingered bat is under threat, as this species is susceptible to temperature and humidity change, both aspects being affected by various components within the Cradle (Durand 2007).

2.3.2 THE ECOLOGY OF THE KARST SYSTEM

The northern Bushveld and southern Grassland Biomes that constitute the Cradle support a diverse variety of habitats, including hills, grasslands, water streams, and vleilands, which in turn support a rich diversity of fauna, including the insects on which the bat species feed (The South African Karst Working Group 2010:16). The insects in turn support a larger food web within the caves, including micro-organisms, fungi, and crustaceans, that depend on organic matter imported by the bat populations.

The karst ecosystem not only provides the ideal habitat for bat roosting and hibernation, but also supports and provides shelter for a variety of fauna and flora, both on the surface, and in the subterranean layers of the landscape. Some cave openings provide the ideal conditions for moss and fern species to flourish and provide shelter, shade and cooling air during the extreme heat during the Bushveld summers, to both antelope and baboons (The South

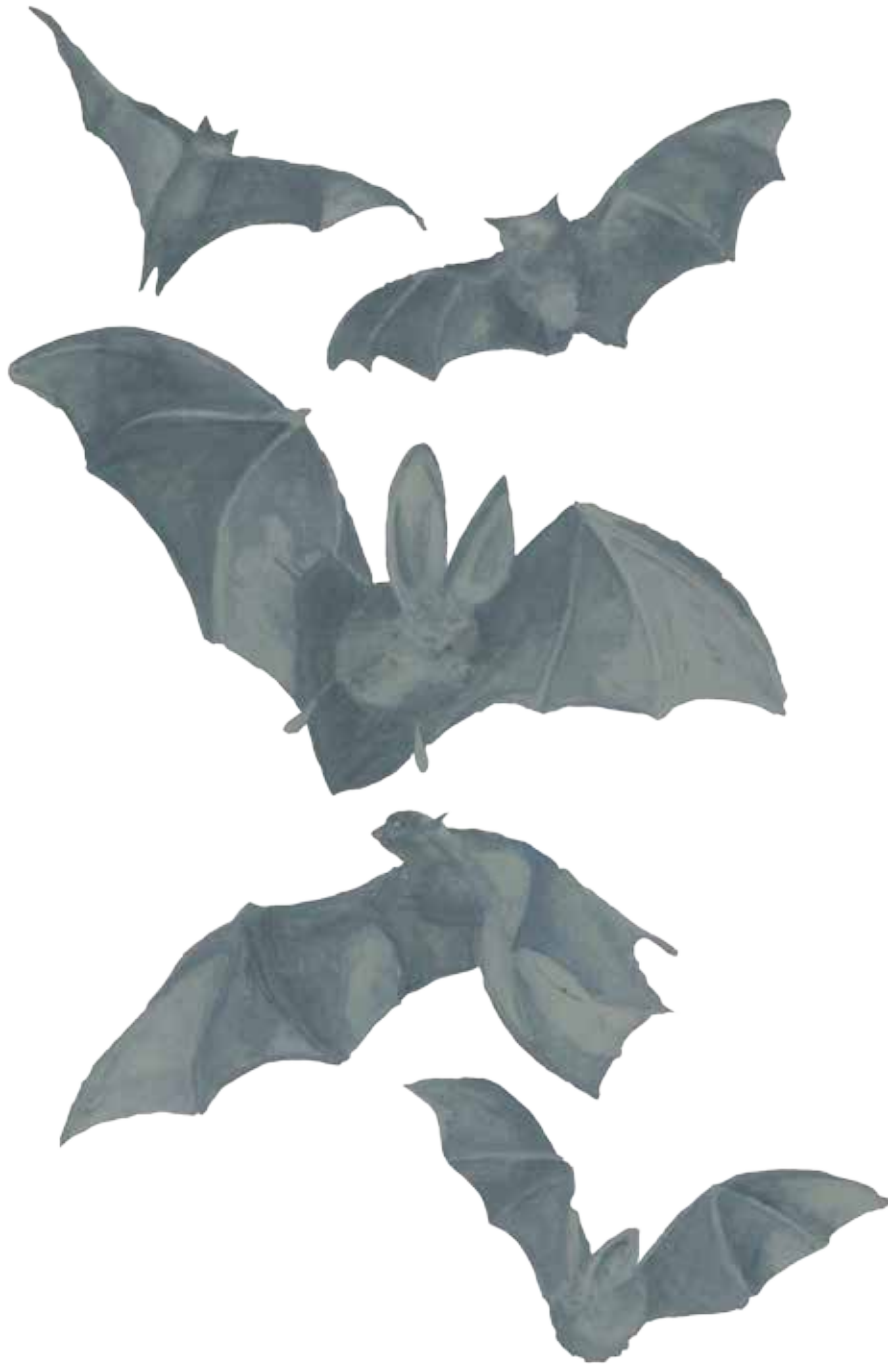
African Karst Working Group 2010:330). These cave openings are, however, also ideal habitats for invasive alien species, such as the *Pyracantha*, commonly known as the fire-thorn, decreasing the biodiversity and causing the deterioration of breccias over time.

On the surface of Bolt's Farm one finds a relatively unspoilt grassland, dotted with remarkable geophytes and edible plant species, such as *Hypoxis*, which are collected by the local informal and farming communities (Gauteng Provincial Government n.d:17).

2.3.3 CHIROPTERA CONSERVATION THROUGH WILDLIFE TOURISM

Tourism is one of the greatest income generators annually in the world, as well as in South Africa. The social and environmental impacts of mass tourism, however threaten the sustainability of tourism in most countries. The new emerging market of eco- and wildlife tourism is one of the fastest growing sectors in the tourism industry, and is seen as a sustainable alternative to mass tourism. Wildlife tourism includes three dimensions, namely: consumptive wildlife tourism, including hunting and fishing; low consumptive wildlife tourism, where wildlife is kept in captivity; and non-consumptive wildlife tourism, where wildlife is viewed and experienced in a habitat (Pennisi et al. 2004:198).

Wildlife tourism and the conservation of wildlife through tourism depend on promoting environmental awareness and providing environmental protection (Pennisi et al. 2004:195). Wildlife tourism has been successfully implemented to conserve endangered species, such as the Mountain gorillas in Uganda, while providing economic benefits to the local community (Pennisi et al. 2004:196).



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FIGURE 2.6
CHIROPTERA
(Author , 2016)



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FIGURE 2.7
WILDFLOWERS ON
BOLT'S FARM
(Author , 2016)

For non-consumptive wildlife tourism to be viable, viewing areas are often centred around locations where predictable aspects of the focal animal's behaviour occurs. These locations can be natural or artificial, such as a watering hole or salt licks (Pennisi et al. 2004:201). The concept of bat tourism becomes feasible when one takes into consideration the predictability of time in the evening when bats emerge from their roosting sites, as well as the specific location of bat roosting sites, be these natural, such as a cave, or artificial in the case of roosting boxes or bridges.

The gathering of wildlife watchers around predictable sighting areas might, however, negatively effect on the focal animal, if these gatherings are not managed correctly. This has been seen in California, where bird watching, a non-consumptive wildlife experience, has altered the nesting patterns of birds and endangered hatchlings (Pennisi et al. 2004:201).

Commercial show caves in the Cradle, although not focused on wildlife, or more specifically bat tourism, have been negatively affected by the tourism industry. The first impact can be observed at the entrance of the commercial caves, where the structure of the caves is altered to accommodate the movement of visitors (The South African Karst Working Group 2010:299). This continues throughout the cave with the construction of pathways, access routes and stairways. The structural changes to the cave alter ventilation, which in turn alter both the temperature and humidity in the cave, two aspects on which Schreiber's long-fingered bat relies. Bat watching, as with all wildlife recreation, must thus be implemented in such a way as to not disturb the bat colonies, or the environment in which they reside. One measure to preserve the cave habitats of the bats is to prevent cave intrusion. In Yucatan, Mexico, this strategy was

implemented by placing metal bars at cave entrances (Pennisi et al. 2004:201). Another strategy is the provision of artificial roosting areas, where access and the internal climate of the roosting area can be controlled, without impacting on a larger ecosystem.

