

CHRISTOPH HEUBECK / JENA UNIVERSITY

Above, left to right: The Makhonjwa Mountains preserve pre-history in rock; visitors can see geological formations up close; a beautiful protea that occurs in these mountains.

At South Africa's most recently appointed UNESCO World Heritage site, the earliest evidence of life on Earth is revealed in rock. **Hlengiwe Magagula** unlocks some of the geological treasures.

# ROCK of ages

Following the R40 between Barberton and the Swazi border, the Geotrail puts the focus on unique geological features.

LESELY JANE HAMILTON-FYNCH / BIRDBIC

**“This is globally unique, it’s the only place you can see these with the naked eye.”**



Some of the geological features date back 340 million years and show what could be the earliest form of life known, a type of bacteria.

It takes a couple of heart-thumping hours to climb to the summit of Emlembe, but it’s worth it. As you recover, you can sit in eSwatini (formerly Swaziland) with your feet in South Africa and admire the view over the Barberton Makhonjwa Mountains – the most recently acclaimed World Heritage site under the banner and protection of UNESCO, the United Nations Educational, Scientific and Cultural Organisation. This area has long been popular with geology geeks and its new status promises to put this little-visited corner of Mpumalanga on the tourist map.

This is my land; my ancestors tended cattle on these slopes. Until recently, though, I’d no idea it was deserving of the ultimate accolade from the United Nations body charged with protecting world heritage. That’s because most of the treasures are unseen, hidden below ground. I don’t mean minerals for mining. Yes, there was a brief gold rush in the 1880s that created Barberton, the town, and asbestos was, until recently, extracted at the Swazi border town of Bulembu, which is where my climb started.

The main reason these mountains received the much-coveted nod from UNESCO is that they embrace some of the oldest and best-preserved geological features on our planet. To see anything comparable, I’d need to travel to Australia or Greenland. But the Makhonjwa Mountains, geologically known as the Barberton Greenstone Belt, are much more accessible and diverse, allowing scientists to study an unmatched 340 million years of continuous geological activity.

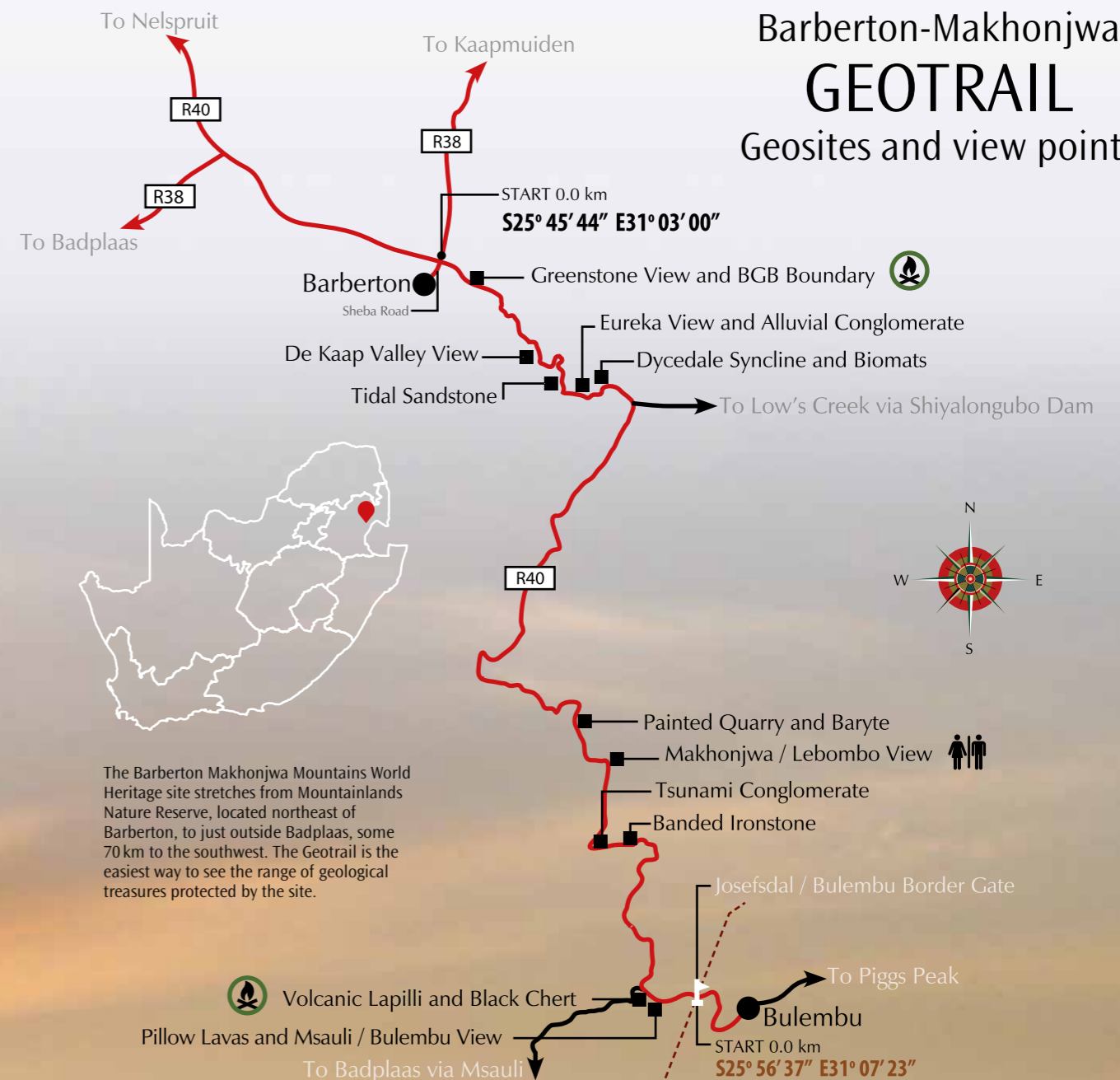
The winding R40 is a road I have travelled often, but the recent World Heritage accolade made me slow down and explore. Conveniently, this route from Barberton to the Swazi border creates cuttings which expose features that span the full period. The Barberton Makhonjwa Geotrail was created in 2014 and it’s punctuated by lay-bys with displays telling the mind-bending geological story.

Earlier in the day I was lucky to be in the company of Tony Ferrar, who, along with geology professor Chris Heubeck, has literally written the book on the Geotrail (*Barberton-Makhonjwa Geotrail: Geosites and View Points*, Hamilton-Fynch for the Barberton Tourism and Biodiversity Corridor or BATOBIC). Tony was a member of the team, led by BATOBIC and supported by funding from the National Department of Tourism, who lobbied for World Heritage status. Their work finally bore fruit at the World Heritage Committee meeting in Bahrain in July 2018.

Tony is primarily an ecologist and told me why this area is not just for geo-geeks. The rocks show evidence of what could be the earliest form of life known. As the Earth slowly cooled and its crust solidified, chemical processes created the first life: primitive forms of bacteria. At Site 5 (Dycedale Syncline) on the Geotrail, 8.2 kilometres from Barberton, Tony showed me microfossil patterns, dark laminations in sandstone, that are believed to be these bacteria. “This is globally unique,” said Tony. “It’s the only place in the world you can see these with the naked eye.” (Even today, some bacteria are known to form biological mats called stromatolites in shallow coastal waters.)

# Barberton-Makhonjwa GEOTRAIL

## Geosites and view points



The Barberton Makhonjwa Mountains World Heritage site stretches from Mountainlands Nature Reserve, located northeast of Barberton, to just outside Badplaas, some 70 km to the southwest. The Geotrail is the easiest way to see the range of geological treasures protected by the site.

**These rocks formed in the Archaean period beginning some 3.5 billion years ago, when the Earth seethed with volcanic flows, and no life existed.**



LESLEY LANE, HAMILTON-FINCH / BATOBIC

Professor Christoph Heubeck explaining the origin and significance of banded iron formation.

The antiquity of these mountains is difficult to take in. Three hundred and forty million years give me the same vertigo as looking into the night sky and trying to comprehend the universe. These rocks were formed in the Archaean period (see box below) when the Earth seethed with volcanic flows and no life existed. (By comparison, the Himalayas are youngsters at 80 million years old.)

Each stop on the trail had a story to tell. One serves as an outdoor museum with a representative display of rock types. At another, Tony splashed water on the surface of the most ancient rock type to highlight tiny round features that he described as “volcanic hailstones”.

Reclining on my montane grass tuft, brain

officially full, I took in the panorama of grassy Highveld ridges, steep valleys sheltering native forest and pine plantations. I had a new appreciation for the epic cycle of life represented in these ancient mountains. The minerals are essential for plants, feeding the moist grasslands that are naturally fire-dependent and have very high biodiversity. And the plants and animals sustain us, too, of course.

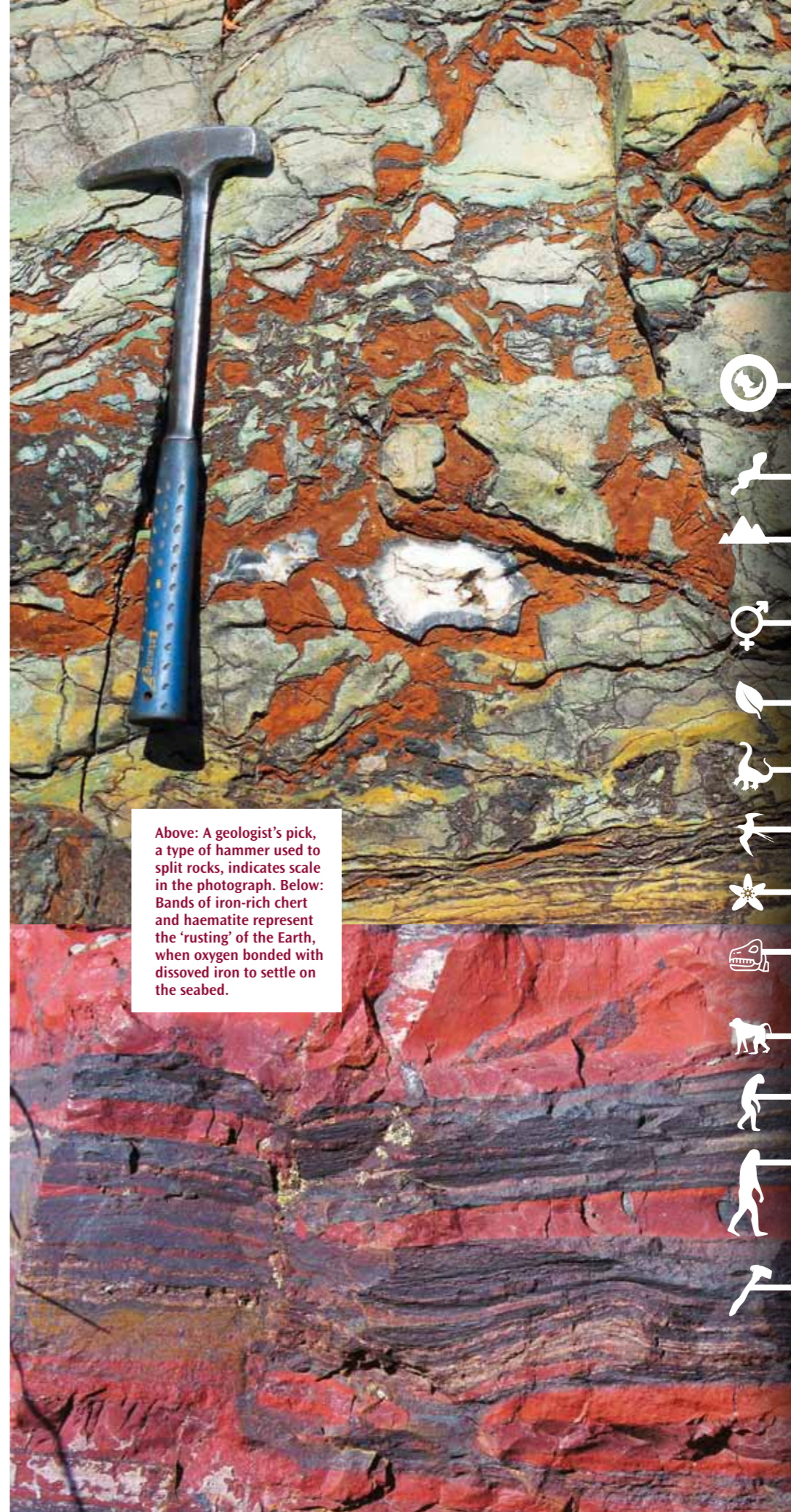
But for how much longer? If we don't protect our natural heritage, and the whole planet, we face extinction. As Tony said, “It makes me wonder whether in a million years to come, there will be any evidence of human existence in the geological record.”

### Rock formation decoded

If you thought the Barberton Supergroup was an entry for *Idols*, you'll be better informed after a visit to this new World Heritage site. The Barberton Supergroup refers to the region of ancient rocks now protected in the Barberton Makhonjwa Mountains. Here are some terms that you will get to know:

- **Archaean period.** Some 4 billion to 2.5 billion years ago and the time of the first rock formations, and first evidence of single-celled life on Earth, fossilised bacteria. (Prior to the Archaean was a period known as the Hadean.)
- **Barberton Supergroup.** This is also known as the Barberton Greenstone Belt and comprises three age-separated sub-groups: Onverwacht (oldest, mostly volcanic); Fig Tree (sediments and volcanic); and Moodies (youngest, sandy sediments).
- **Black chert.** A hard, fine-grained sediment composed of crystallised silica.
- **Pillow lava.** Rock formations resulting from the extrusion of lava under water.
- **Stromatolites.** Microbial mats formed in shallow water by cyanobacteria.
- **Subduction.** The process where a tectonic plate moves under another.
- **Transvaal sediments (the Highveld).** These buried the volcanic rocks for 2.5 billion years – protecting from both erosion and subduction. In geological terms, they are now eroding fast. This covering was eroded off only during the breaking up of Gondwanaland, 180 million years ago.
- **Volcanic lapilli.** Little ash-balls that fell from the air during volcanic eruptions.
- **Volcanic rock.** The Barberton Greenstone Belt strata were deposited horizontally in volcanic flows and later squeezed and folded by horizontal pressure from rising granite plutons (rocky outcrops). Most strata are now nearly vertical. After folding, the whole mountain range was buried by sedimentary layers.

CHRISTOPH HEUBECK / JENA UNIVERSITY



Above: A geologist's pick, a type of hammer used to split rocks, indicates scale in the photograph. Below: Bands of iron-rich chert and haematite represent the 'rusting' of the Earth, when oxygen bonded with dissolved iron to settle on the seabed.



## Timeline

Consider this: if the Earth was, say, 24 hours old, we humans appeared at just 77 seconds before midnight. That's a mere 0.004% of the Earth's history, and a *lot* happened before our debut.

**4.6 billion years ago:** the origin of the Earth

**3.8 billion years ago:** first life arises

**3.5–3.2 billion years ago:** formation of the Barberton Supergroup

**1.1 billion years ago:** first sexually reproducing organisms develop

**475 million years ago:** first land plants appear

**225 million years ago:** the dinosaurs evolve

**150 million years ago:** first birds take flight

**130 million years ago:** first flowering plants evolve

**65 million years ago:** dinosaurs and ammonites become extinct

**14 million years ago:** the first great apes appear

**2.5 million years ago:** the genus *Homo* evolves

**1.8 million years ago:** *Homo gautengensis*, the earliest-known South African hominin, walks the Earth

**43 000 years ago:**

Earliest evidence of humans mining (in Ngwenya, Swaziland)



The Geotrail offers magnificent views of the mountainscape while interpretation boards shed light on the geological features that can be observed all around.

## TRIP PLANNER

You don't have to be a geo-geek to enjoy a visit to this area: it's for anyone who enjoys being off the beaten track, and you'll have places to yourself, at least until word gets out ...

Take the Makhonjwa Mountains in as a side trip to the Kruger National Park, especially if you're travelling from KwaZulu-Natal. If approaching from the west, turn off the N4 at Machadodorp (eNtokozweni). From the south, approach via the R33 and Badplaas. And if you pack your passport, the Geotrail can be combined with a trip to eSwatini (the border post at Josefsdal is open from 08:00 to 16:00). It is hoped this World Heritage site will be extended over the border because 20 percent of the Barberton Greenstone Belt falls in Swaziland.

The tourism office in Crown Street in Barberton is the place to pick up a map (open from 07:30 to 16:00 Monday to Friday, and from 09:00 to 13:00 on Saturdays). Contact Astrid Christianson on 082 959 6670 (astrid@barberton.co.za or www.barberton.co.za). Make time for a visit to the museum (entry free of charge) on Pilgrim Street and the little mining museum on De Villiers Street.

To reach the Geotrail (free to access), follow the signs for the R40 and Josefsdal. The Le-bombo viewpoint, 25km from Barberton, is the best spot for a picnic and it has toilet facilities. For information about the World Heritage site and guided geo-tours, contact Mark Ngwenyama at BATOBIC on 079 501 4249, (mark@barberton.co.za or www.geotrail.co.za). Tony Ferrar also offers tours of the Geotrail; contact him on 072 376 2581 or at tony@rockyoldearth.co.za.

Those with more time can drive the 220km Genesis Route (see www.mpumalanga.com for more), which covers the entire World Heritage site. In total, the site protects over 113 000 hectares; about 60% falls into proclaimed nature reserves, including the 45 000-hectare Songimvelo Reserve, an unspoilt wilderness and home to elephant, hyena and white rhino.

This World Heritage site is wonderful for birding, with accessible trails in the Barberton Nature Reserve and the Mountainland Nature Reserve, close to Barberton. Hikers can enjoy the two-day Queen Rose trail (a mountain-bike trail is being developed), while 4x4 drivers can explore the 100-hectare Ebutsini Trail.

CHRISTOPH HEUBECK / JENA UNIVERSITY

# SA's World Heritage Sites



The Barberton Makhonjwa Mountains World Heritage site is the first in Mpumalanga, and the second geological site in South Africa after the Vredefort Dome.

There's a high bar to clear in order to be acknowledged as a UNESCO World Heritage site. It is both an honour and a statement that the place must be protected for future generations. South Africa has nine others.



**ISIMANGALISO WETLAND PARK.** The lovely coastal area in KwaZulu-Natal is listed for its outstanding range of pristine marine, coastal, wetland, estuarine and terrestrial environments.



**CAPE FLORAL REGION PROTECTED AREAS.** Comprises eight sites, each a habitat for fynbos and other endemic species.

PETER LINDGREN, KARIN SCHEMBRUCKER, ANTONIE VERMELLEN, JULIO REIS



**RICHTERSVELD CULTURAL AND BOTANICAL LANDSCAPE.** As the name suggests, this area is protected for both its Nama pastoral heritage, and the delicate mountain desert landscape.



**FOSSIL HOMINID SITES OF SOUTH AFRICA.** A number of sites in Gauteng including Sterkfontein and Cradle of Humankind.



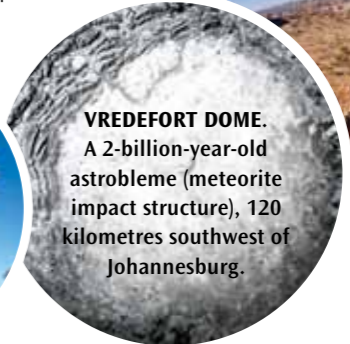
**MALOTI-DRAKENSBERG PARK.** A transnational World Heritage site shared with Lesotho, Maloti-Drakensberg Park is protected for its exceptional natural beauty that includes sculptural basaltic buttresses and golden sandstone ramparts.



**ROBBEN ISLAND.** One of two World Heritage sites in the Western Cape, it is protected for its significance in South Africa's history, in particular its use as a prison.



**MAPUNGUBWE CULTURAL LANDSCAPE.** This savannah landscape on the banks of the Limpopo and Shashe rivers is recognised for the remnants of the Mapungubwe kingdom.



**VREDEFORT DOME.** A 2-billion-year-old astrobale (meteorite impact structure), 120 kilometres southwest of Johannesburg.



**✚KHOMANI CULTURAL LANDSCAPE.** The Kalahari Gemsbok National Park is listed as an example of continuous human adaptation and survival in a harsh environment.

A further five South African sites are listed by UNESCO as tentative and await consideration: the Nelson Mandela Legacy sites, Liberation Heritage Route, Succulent Karoo Protected Areas, Early Farmsteads of the Cape Winelands and Pleistocene Occupation sites. H