

HEART OF DARKNESS

The secrets of Gabon's underground world are being discovered. Scientist Richard Oslisly leads an expedition into the darkness, going where no man has gone before...

BIRD CRIES pierced the canopy as the forest slowly awoke, but otherwise everything was calm. A wisp of smoke still rose from the embers of our campfire as we set out to fathom the mysteries of the crocodile cave. The caves were three kilometres from the camp, and we followed a trail that had been re-opened last year. The vegetation had reasserted its rights and the path, often hard to follow, was crisscrossed by the tracks of elephant and buffalo. The area is swampland for most of the year and difficult to negotiate.

Finding the caves in such conditions was no easy task, especially as our GPS coordinates were approximate, forcing us to rely on other signs to guide us. Instead, we 'read the ground', looking for surface fractures, dolines and karst models that eventually led us off the trail into an area littered with ruiniform calcareous blocks which still bore the traces of erosion and contained sections of ancient galleries.

Paradoxically, in the tropical forest it's the smell that tells you there are caves nearby. The odour of bat guano is so distinctive, so persistent and so nauseating that you never forget it. Now I only need to approach a cave and my nose alerts me to the proximity of a colony of bats and, by extension, their habitat.

Five minutes later I entered the cave, fighting back against foul stench. Piercing the darkness, my torch beam revealed the dimensions of the place as well as several bats. They began squeaking and beating their wings and within seconds the entire colony was in motion. A tremendous commotion in the distance grew louder and louder as the first bats emerged. The bats had a wingspan of about 60cm and could fly at great speed, but thanks to their ability to emit sonar pulses and process returning echoes (echolocation), they veered away from me at the last possible moment, avoiding collision.

Cave commotion

I moved further into the gallery, which was five metres high and perfectly straight. The stifling, pestilential stench of guano was so overwhelming that I began retching uncontrollably. The continuous stream of bats became so dense that collisions were inevitable. They crashed into my arms, legs and head, fell to the ground and scabbled around, trying to regain the sides of the gallery. Trying to make your way through a bat colony is an ordeal. You have to cover your face, for the beating of thousands of wings creates a powerful current of air which plasters you in stinking urine and faeces.

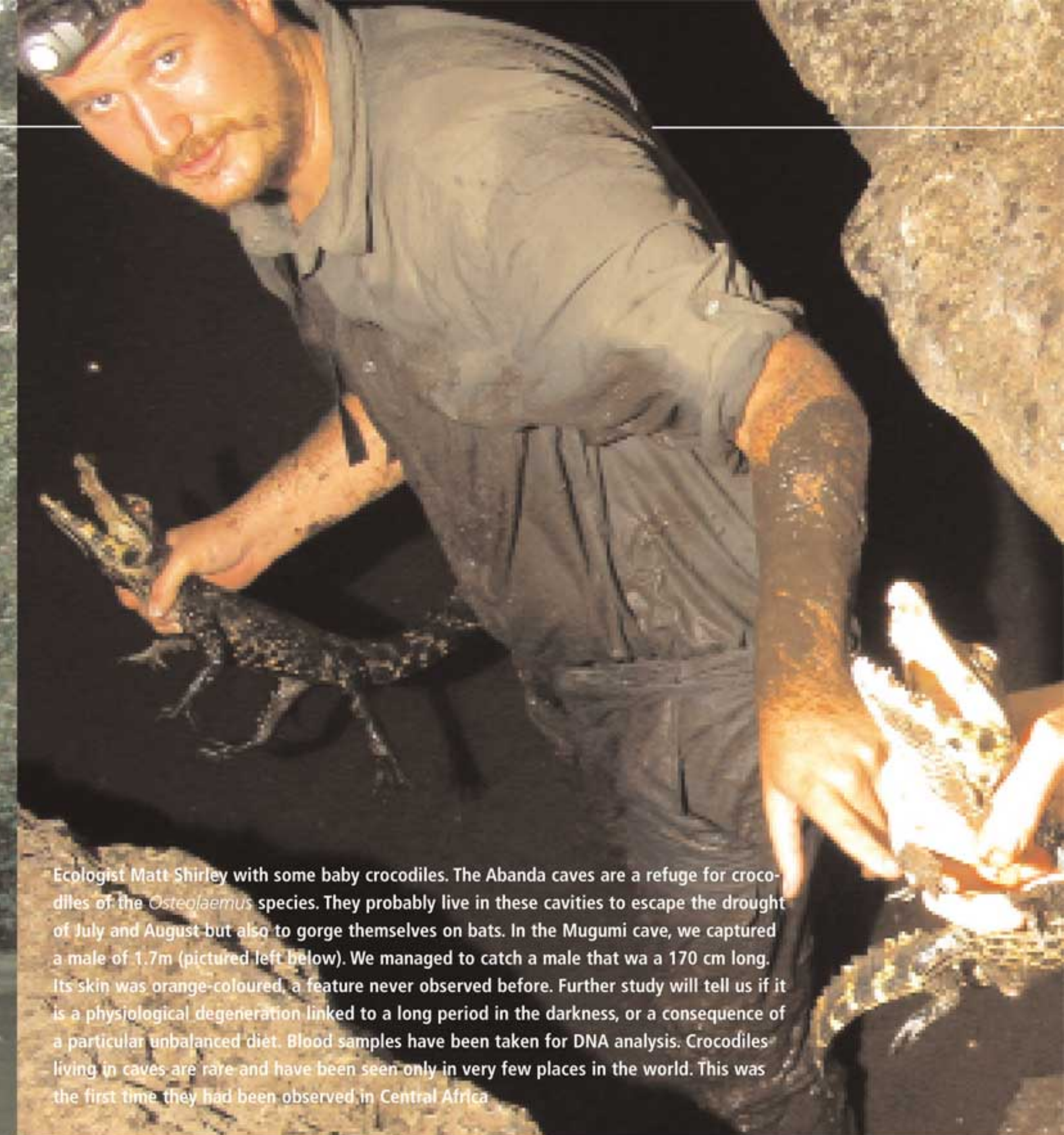
There were no twists or turns in the gallery so I pushed on. The caves in this part of →



Deep inside a protected forest in the heart of Gabon's Ogooué Maritime province, explorers first came across the Abanda caves a few years ago. They found to their astonishment that they were inhabited by crocodiles. In 2010, a multidisciplinary scientific expedition, led by archaeologist Richard Oslisly (pictured here), set out to study these mysterious caves



Reaching the crocodile caves of Abanda was one of the challenges of the caving expedition. It involved a long drive across Gabon on bumpy dirt tracks to reach Omboué and the Liambissi research station. We then travelled by pirogue across the Fernan Vaz lagoon and down the River Olandé before reaching a forestry camp. After that, we struggled through the forest on foot



Ecologist Matt Shirley with some baby crocodiles. The Abanda caves are a refuge for crocodiles of the *Osteoleaemus* species. They probably live in these cavities to escape the drought of July and August but also to gorge themselves on bats. In the Mugumi cave, we captured a male of 1.7m (pictured left below). We managed to catch a male that was 170 cm long. Its skin was orange-coloured, a feature never observed before. Further study will tell us if it is a physiological degeneration linked to a long period in the darkness, or a consequence of a particular unbalanced diet. Blood samples have been taken for DNA analysis. Crocodiles living in caves are rare and have been seen only in very few places in the world. This was the first time they had been observed in Central Africa

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Gabon are hollowed in Turonian limestone that originated as carbonated deposits on the seabed 90 million years ago. Over time, the deposits solidified into yellow ochre-coloured rock which was eventually pushed to the surface by tectonic action. In Gabon, limestone can be found on the coastal strip, while dolomitic limestone occurs in the Nyanga and Ngounié river basins and in the Lastoursville area. Each of these carbonated formations was formed in different periods ranging from 70 million to two billion years ago. These latter examples are part of the oldest unaltered sedimentary deposits in the world and contain fossils of the earliest traces of life on earth.

The gallery finally divided into a network of narrow passages. At ground level, 15 metres ahead, I suddenly saw two huge eyes reflecting the beam of my torch. Inching forward, I realised it was an old crocodile about 1.8 metres long. Its hide was dark and huge teeth emerged from its jaw. We stared at each other. What should I do? The creature with-

drew into a niche in the rock. The team's crocodile expert wasn't with me, and I wasn't about to go any further. We would return tomorrow, better equipped to confront the beast in its lair.

Saurians often shelter in recesses in the banks of rivers or swamps, but the presence of crocodiles in caves is highly unusual. They are known to inhabit caves in Madagascar's Ankara nature reserve, and in Mauritania a few Nile crocodiles manage to survive in the humid atmosphere of caverns in the middle of the Sahara.

Pinpoints of light

It was not late, but the day was well advanced when I emerged and joined my companions. Night falls swiftly on the equator, and it was dark by the time we began the trek back to the camp. I could feel the breeze on my skin and the fresh air gradually helped me to forget the foul smell of the cave. The forest was full of the sounds of insects, birds and frogs, an extraordinary cacophony of kss-

ssss, tu-dit tu-dit, gloup-gloup gloup-gloup, kraaaa, dze-dze-dze, blip-blip blip-blip. Animals froze in the beam of our torches; a duiker, a small antelope, stood stunned and motionless in our path. The impenetrable darkness was pocked with pinpoints of light, the eyes of dozens of moths. At one point, hearing the snapping and cracking of branches, we feared an elephant was headed our way.

As everyone prepared to turn in, our entomologist, Thibaut, who has a passion for noctuids (owl moths that fly only at night), set up a light trap at the edge of the camp. An ultraviolet lamp in a wooden frame with a sheet stretched over it would burn throughout the night, attracting thousands of insects. Thibaut would meticulously harvest the sphinx moths and giant silk moths (*saturniidae*, his favourite species) as well as praying mantises and the various beetles that came to rest on the sheet. No one has yet conducted a systematic, exhaustive study of such fauna, and noctuids may be a good



indicator for monitoring the biodiversity of Gabon's tropical forest. All the specimens collected by the expedition were identified by their DNA and added to the database being constructed by the International Barcode of Life (IBOL) project, the largest biodiversity genomes initiative ever undertaken.

The next day brought more surprises. We set off early and headed for Mugumbi cave, a little to the north of the area we had explored the day before. The cave's entrance was situated at the foot of a small limestone escarpment, where a series of rifts had created an underground network of galleries.

Matt and I went in, our feet instantly sinking into 30cm of black mud which was almost certainly guano. There were fewer bats here, but their waste supported an abundance of microfauna which served as a source of food for secondary fauna. The place teemed with springtails, woodlice, earthworms, spiders, crickets, tailless whip scorpions, small predators and snakes. Our headlamps attracted clouds of midges which swirled around our heads. They are not dangerous, but there were so many of them that they invaded every available orifice – nostrils, ears, mouth and eyes.

Not far from the entrance we glimpsed small crocodiles scuttling into a flooded

passage. We followed them and, sinking ever deeper into a vile cesspool, prepared the trapping gear. Matt pitched into the water and ducked into the cramped tunnel in which his favourite prey had taken refuge. Crouching in the thick mud, he manipulated his snake tongs and trapped a small crocodile. The young animal struggled furiously, squealing for its mother. Matt taped its jaws together and put it in a sack, where it soon calmed down. One by one, he caught the whole family. Hugging his bulging sack, he finally extracted himself from the ooze and made his way out into the fresh air.

The five crocodiles we trapped were carefully identified, measured and marked. Blood samples were taken in order to determine their DNA with greater precision. Two hours later, they were all released back into the cave.

While Matt measured his beasts, it was my turn to take the plunge. The roof of the flooded gallery was so low that I was forced to bend over as I waded through the waist-high water. In these aquatic conditions, I surveyed the cave's topography collecting the data to make a map that would tell us more about its origins. Using a laser distance meter, I took all the measurements I needed and recorded them in a notebook, along with →



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sketches and observations of my surroundings. With every step I stirred up the mud, causing bubbles of methane to rise to the surface. A bat skimmed too close to the water, fell in and struggled desperately to extricate itself. Its limbs were adapted for flight, but they weren't much use for swimming. I abandoned it to its sad fate, an easy prey for an aquatic predator with long teeth.

The ceiling got lower and lower until it was no more than 30cm above the water. I had to bend double, trying to keep my mouth above the stagnant liquid in order to breathe. The passage opened out, but once through I spotted a crocodile swimming on the surface. It seemed to be afraid and fled. My heart pounding, I got on with my work, nervously keeping an eye on the back of the gallery into which the beast had disappeared. The

passage rapidly narrowed and I decided to call it a day: there was a crocodile lurking a few metres ahead, and if I crawled on through the water I'd be trapped.

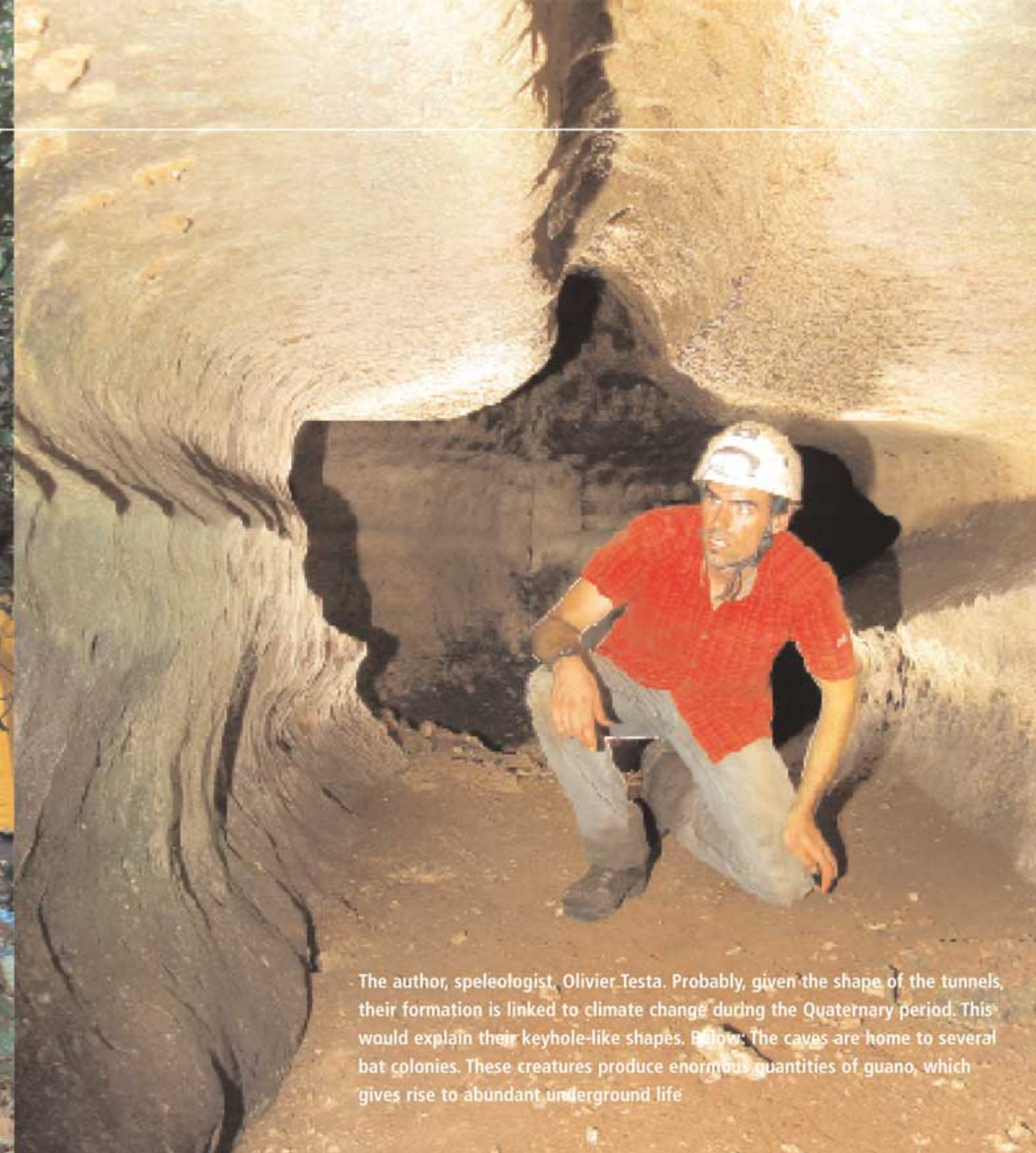
We continued to explore the area around Mugumbi cave. A cave is never an isolated phenomenon. If geological, geomorphological and hydrological conditions have resulted in the formation of one cave, there are usually others in the vicinity. Walking along the base of the limestone face containing the entrance to our crocodile cave, we found several small cavities, all angled in the same direction but none as spacious as the first. Climbing a small mound, we found ourselves on the top of the escarpment. The vegetation was dense and the team split up, advancing in parallel in order to comb the area systematically. We noted several circular depressions. These

dolines, decanting points for the water that penetrates to the core of the karst, had collapsed in places and provided access to a network of underlying galleries.

We hadn't brought any climbing gear, which we needed to descend the bell-shaped sides of these sinkholes so I rigged up a makeshift harness from bits of webbing, found a length of rope in my rucksack and descended into the first pit, which was about seven metres deep. While waiting for an initial wave of bats to fly past, I studied the ground, over which swarmed a mass of cockroaches, beetles, spiders and worms.

Moving deeper into the cave, I suddenly caught sight of a big crocodile lurking at the back of the small gallery. At the sight of its exposed white teeth I yelled for Matt, who descended by the same method. The beast

OLIVIER TESTA/RICHARD OSISLY

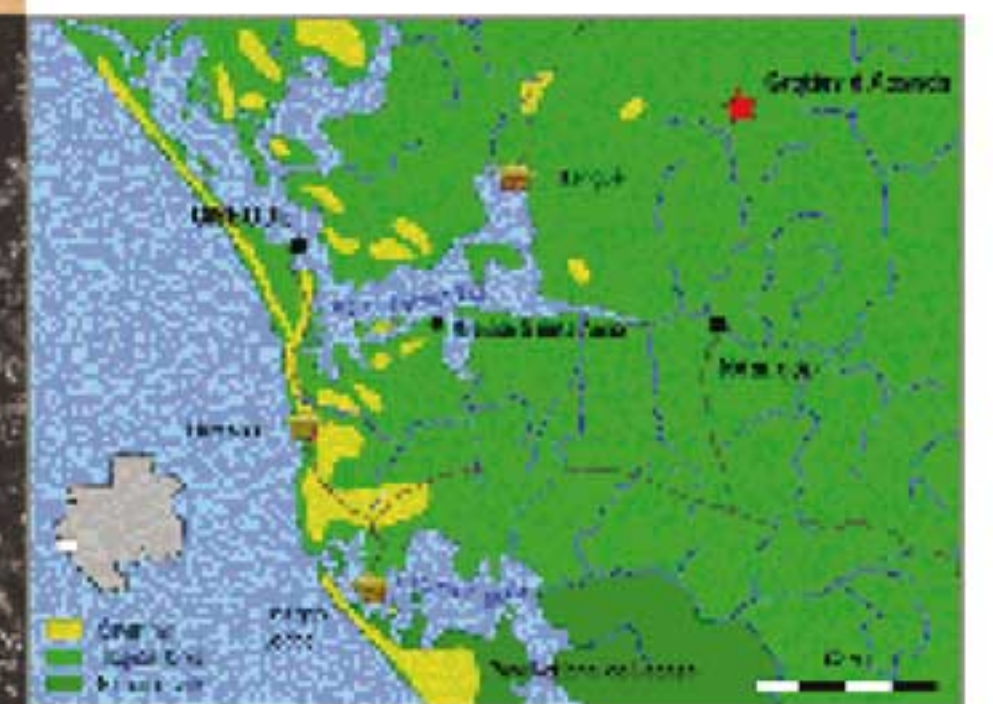


The author, speleologist, Olivier Testa. Probably, given the shape of the tunnels, their formation is linked to climate change during the Quaternary period. This would explain their keyhole-like shapes. Below: The caves are home to several bat colonies. These creatures produce enormous quantities of guano, which gives rise to abundant underground life

was passive, putting up no fight at all, and Matt trapped it easily. When we hoisted it to the surface we immediately realised that this was no dwarf crocodile (*Osteolaemus tetraspis*) like the others. It wasn't so much its size (a big male over 1.7m in length) or its slenderness that surprised us, but the patches of orange-tinged skin on its head. Its belly too was covered in remarkable, rather beautiful bright orange scales. We measured, weighed and marked him, took a sample of his blood and sent him back to his fetid lair.

Having already revealed ancient traces of human habitation and rituals, fossils (unique in caves) of the planet's earliest life forms and diggings in rocks known to be among the hardest in existence, Gabon's caves had astonished us yet again with this highly enigmatic discovery. By the end of the expedition, we had found nine crocodiles in four different, unconnected caves. How did they get there? Had their initial point of entry been blocked by a landslide? What is their ecology? How did they acquire their orange colouring? Do they represent the development of a new species? Are there more of them? All questions we shall try to answer during our next expedition in August 2011... ■

Story by Olivier Testa, scientific background by Richard Oslisly



Cave expedition

The Abanda 2010 expedition was mounted by the Institute of Development Research (IRD) at the University of Rouen. Considerable logistical support was provided by Campement Liambissi and Dr Marco Marti. Our thanks also to CENAREST and Gabon's National Parks Agency.

The members of the scientific team were: team leader, archaeologist, Richard Oslisly; speleologist Olivier Testa; ecologist Thibaud Decaëns; soil geochemist Rolf Mabicka; physician and speleologist Marco Marti; geologist David Sebag; ecologist Matt Shirley, Olivier Testa

Follow the expedition at:
www.abanda-expedition.org