

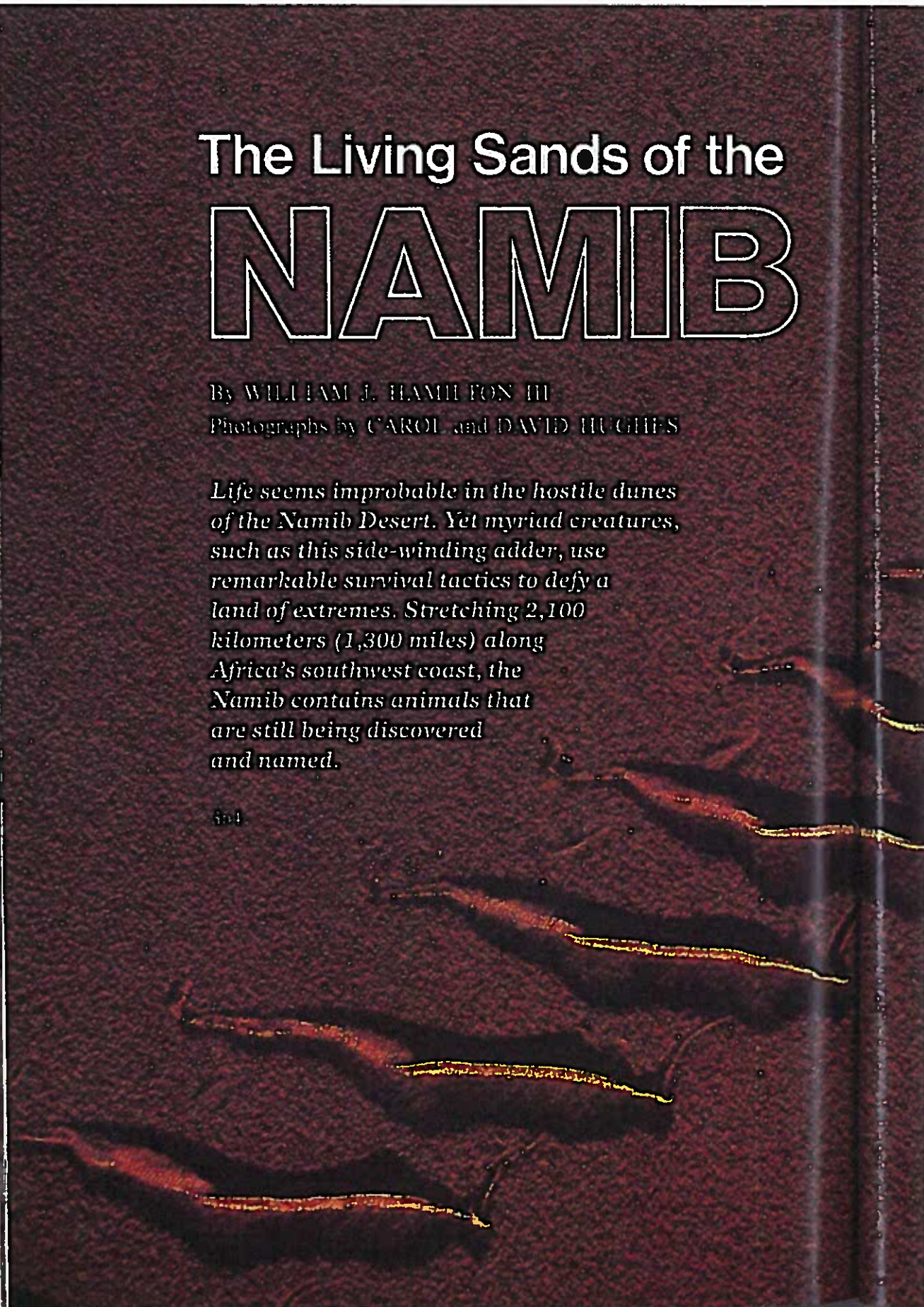
The Living Sands of the NAMIB

By WILLIAM J. HAMILTON III

Photographs by CAROL and DAVID HUGHES

Life seems improbable in the hostile dunes of the Namib Desert. Yet myriad creatures, such as this side-winding adder, use remarkable survival tactics to defy a land of extremes. Stretching 2,100 kilometers (1,300 miles) along Africa's southwest coast, the Namib contains animals that are still being discovered and named.

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THREE HOURS before first light I climb in thickening fog through soft sand several hundred meters above the dune base. At the crest of these wind-carved sands, a loose rank of black beetles faces the fog. On this mist, the first in three weeks, these insects' survival depends, for here in Africa's coastal Namib Desert, fog is a critical source of life-giving water.

These glistening insects have emerged from the chill lower slip face, the downwind slope, where they had waited for a fog long in coming. They have staggered, numb with cold, up the steep sands, where they perch near the dune crests to catch the densest, wettest fog. Balanced head downward on their legs, they pirouette to hold their backs to the wet breeze. The blowing fog strikes their backs, water collects and trickles down to their mouths. Thus the head-stander beetles drink and survive (page 368).

Hard to believe? So is the Namib Desert and some of its other strange life forms.

A great sand sea along Africa's South Atlantic coast, the Namib gives South-West Africa its new name, Namibia. It is a region caught in political and social change, as caretaker South Africa eases old controls and tries to reconcile plans for Namibia's autonomy with internal and external factions.*

Coastal fringe of a vast arid land, the Namib stretches 2,100 kilometers (1,300 miles) from the Olifants River in Cape Province, South Africa, northward well into Angola. The seaward part of this little-known territory receives almost no rain and little fog. Eighty kilometers inland, the nourishing mist arrives fewer than 60 days a year. Fog is generated when warm moist air from the open Atlantic blows over the cold Benguela Current that sweeps up from Antarctica, along the west coast of Africa.

In the first half of this century an Austrian entomologist, Charles Koch, collected and described insects from Africa's arid lands. When Dr. Koch reached the Namib, he was amazed to discover a life system different from anything he had ever experienced or

read about. He found a cornucopia of indigenous life: beetles of all colors and shapes—black, white, and candy-striped—spiders of the night and spiders of the day. He saw lizards, including strange barking geckos and another that plodded at night on padlike feet across barren sands.

Dr. Koch found among the desert inhabitants evidence of major bodily adjustment to the parched Namib environment. To study this unique ecosystem, he established in 1963 a research station at Gobabeb, the site of an abandoned Hottentot village.

It was this strange Namib world—biologically still little understood—that awaited me when I took up field studies at the Namib Desert Research Station. When Dr. Koch died in 1970, his assistant and my friend Mary Seely became director. Mary and I have collaborated recently in studies of the fog-water adaptations of desert insects. Much of this article's content represents our joint observations.

It was on a morning of dense blowing fog, while Mary and I were watching by flashlight those head-stander beetles mentioned earlier, that another Namib life riddle resolved itself before us.

Button beetles (*Lepidochora*), a species ubiquitous in the dunes, were digging furrows in the sand. Always before, we had thought they were simply having trouble burying themselves against the coming midday heat. But now we comprehended yet another astonishing water-using strategy.

"Look," I said, "the furrows are all parallel to each other and perpendicular to the flow of the fog wind."

"Yes. And the button beetles aren't gathered at the ends of the trails, as they would be if they were simply plowing themselves in," Mary remarked. "They're lined up along the ridges. They must be making fog traps."

*See "Namibia, Nearly a Nation?" by Bryan Hodgson, in the June 1982 NATIONAL GEOGRAPHIC.

The author, a professor in the Division of Environmental Studies at the University of California at Davis, specializes in the complex relationship of oases to deserts. Over a span of 15 years, Dr. Hamilton has made a total of eight trips to the Namib Desert.



And so they were. The tiny raised sand ridges intercepted the billowing mist and soaked up its moisture. In the following weeks we carefully measured the beetle tracks: their orientation to the fog winds (always perpendicular) and their water content (always greater than the surrounding sand—until the beetles crept back along them, sucking up the collected moisture). The beetles, individually marked and put on the scales before and after drinking, showed an immediate gain in weight.

IT IS indeed a strange place, the Namib. Its dunes rise from parallel inter-dune valleys (we call them "streets") to windy crests. In this world of swirling sand live animal species that flourish without ever seeing a living plant. Wind and drifting detritus—plant and animal fragments—activate residents of the dune alps: beetles and spiders, lizards and snakes.

By contrast, on gentle sand slopes at the bases of the dunes and in the intervening streets, rare rainy times produce sudden vegetative growth. As much as 50 millimeters of rain breaks the central desert's dormancy. Deep-buried lily bulbs sprout and flourish. Grasses and other specialized plants turn inter-dune valleys into meadows.

Life absent for a decade now thrives for a few months or even years. Families of turkey-size bustards stride through the valleys, feasting on multitudes of unwary beetles that have known no predators for a dozen generations. Thousands of finches and larks come to harvest grass seeds.

Seeds and stems swirl about the unvegetated dune crests, making possible the Namib's special wonder, the detritus ecosystem. On the loose, high sands, no large predators intrude, and the small animals' reproductive orgy will only dwindle years later, as the last of the seeds and grasses are devoured or buried.

It's been our good fortune that in the past 12 years three good rains have saturated areas near the research station. Apart from nurturing lesser creatures, the relatively moist conditions have helped mammals flourish on the inter-dune flats. Gerbils, Africa's counterparts to America's kangaroo rats, multiply in oasis refuges and spread deep into the desert. Jackals, which hunt

them down, breed beneath the scant cover of spiny bunchgrasses. Oryx, large desert antelope that for years have dwindled in numbers, now snort, mate, calve, and wander, foraging on rejuvenated grasses.

We know that in a few years, unless substantial new rain falls, the fruits of these scant waterings will be exhausted. In the very first months of the wet time we watched the annual grasses go to seed, dry, and blow away. The perennials also began to decline, but they stretched their life span by reaching their roots ever deeper.

As the land dries out, oryx begin to quit the dunes, seeking gravel plains where thunderstorms provide temporary grass gardens. There they mix with thousands of mountain zebra. Famished antelope and zebra can consume all the grasses before they are three inches high. In the depths of a drought I have watched oryx fight, in some cases to the death, over a water hole they had dug in a dry riverbed. The desert's unpredictability, for them as for me, is an unending challenge.

An extraordinary perennial plant, *Welwitschia*, is unique to the Namib. Leathery-leaved, octopus-like when mature, it outlives every drought. Scientific accounts of this sprawling, unlikely plant have placed it on the brink of extinction. Not true. In places we found them common, almost weed-like. Ragged and scarce at the edges of their range, welwitschias thrive along the inner fringe of the northern coast, where dry washes meet the dunes. They draw for years on storm water stored in streambed gravel.

During dry periods, welwitschias may wither at the tips of their leaves. Then rains come again, leaves turn from red ocher to green, and growth accelerates. Thin grasses spring up between these desert patriarchs, attracting antelope and zebra. Inevitable drought returns, grasses crumble and blow away, and antelope and zebra trudge off to the horizon, following storm clouds whose thunder promises rain they may not yield. But hardy welwitschias live on, some for a thousand years and more.

Namib life forms, while numerous, are widely scattered, especially during the driest times. To witness desert creatures' full range of behavior, we utilized marvelous little vehicles: three-wheeled motorcycles.

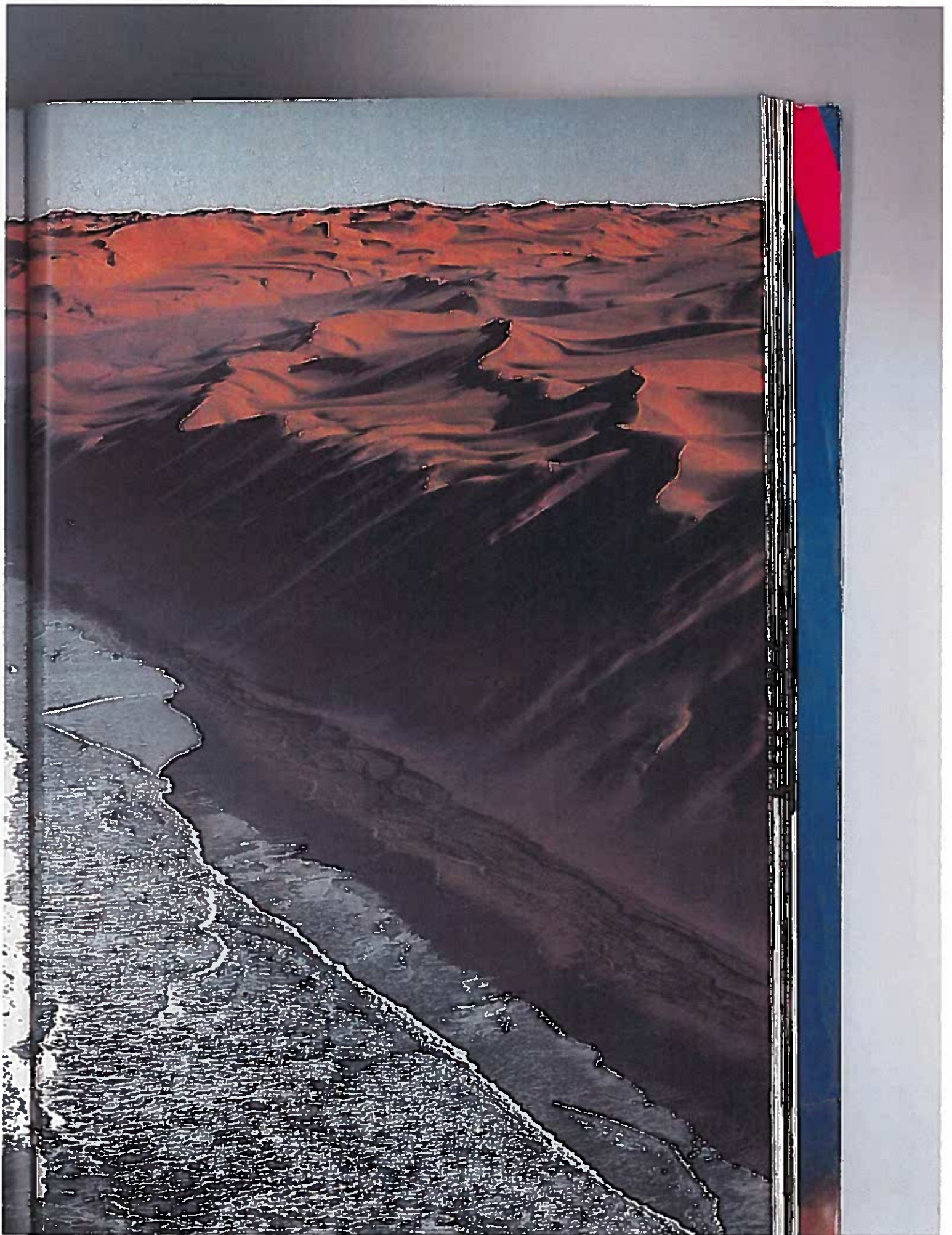


WILLIAM J. HAMILTON III (ABOVE); ROD BORLAND (BELOW)

Shrouds of fog—lifeblood of a land where years pass without rain—form when warm Atlantic winds meet the cold coastal current borne from Antarctica. About 60 times a year the nearly ever-present mist offshore of the Great Dune Sea (right) thickens and moves inland as fog, the main source of water for many Namib dwellers.

One beetle, called a head-stander (above), tilts on a dune crest to drink fog droplets trickling down its body. The nocturnal gecko (below) may gather precious condensation as it licks and cleans its lidless eyes.





With their bulging soft tires they can easily surmount the highest dune and take us far across the treeless sands, offering us encounters with the rarest desert life.

ON A NOVEMBER MORNING—springtime in the Southern Hemisphere—I roll out of my sleeping bag after a night alone deep in the dunes. This dawn is without fog; there will be no insects for two hours. I am down to two gallons of water, but this is the last day of my week-long field trip, and I drink my fill from my plastic jug, its water cool for the only time during the day.

Dawn usually breaks silently and windless in the Namib. At first light the night creatures vanish; their telltale tracks trace curious calligraphy on the sands. Barking geckos have ranged in short loops only a meter or two from their burrows. Silverfish, their small prey, may leave no track at all. Marks of other creatures, the dancing white lady spider in particular, show that they move about unafraid.

On gravel flats between the dunes, traces of larger vertebrates, including humans, may linger for years—almost forever. Where oryx cross crumbling schists, they etch tracks several centimeters deep. In one



Food is water for Namib predators, which gather most of their moisture from the body fluids of their prey.

Monstrous jaws enable this four-centimeter-long solifuge (right) to attack a locust of equal length. Although this arthropod forages for beetles on the dunes, it generally hunts in the gravel flats between them.

With a flick of its sticky tongue, a chameleon (top left) snags one of the Namib's many species of beetles. These chameleons live around the vegetation on the borders of the 80- to 160-kilometer-wide desert. Detritus from vegetation blows through the dunes every day and, much like plankton in the sea, provides the basis of the Namib food chain.

A female Namib wasp (left) hides a dancing white lady spider from competitors after paralyzing it with her sting. Next the wasp crawls a short distance away and digs a nest. Uncovering her victim, she drags it to the nest and buries it again after laying an egg on it. When the wasp larva hatches, the still living spider will be its first meal.

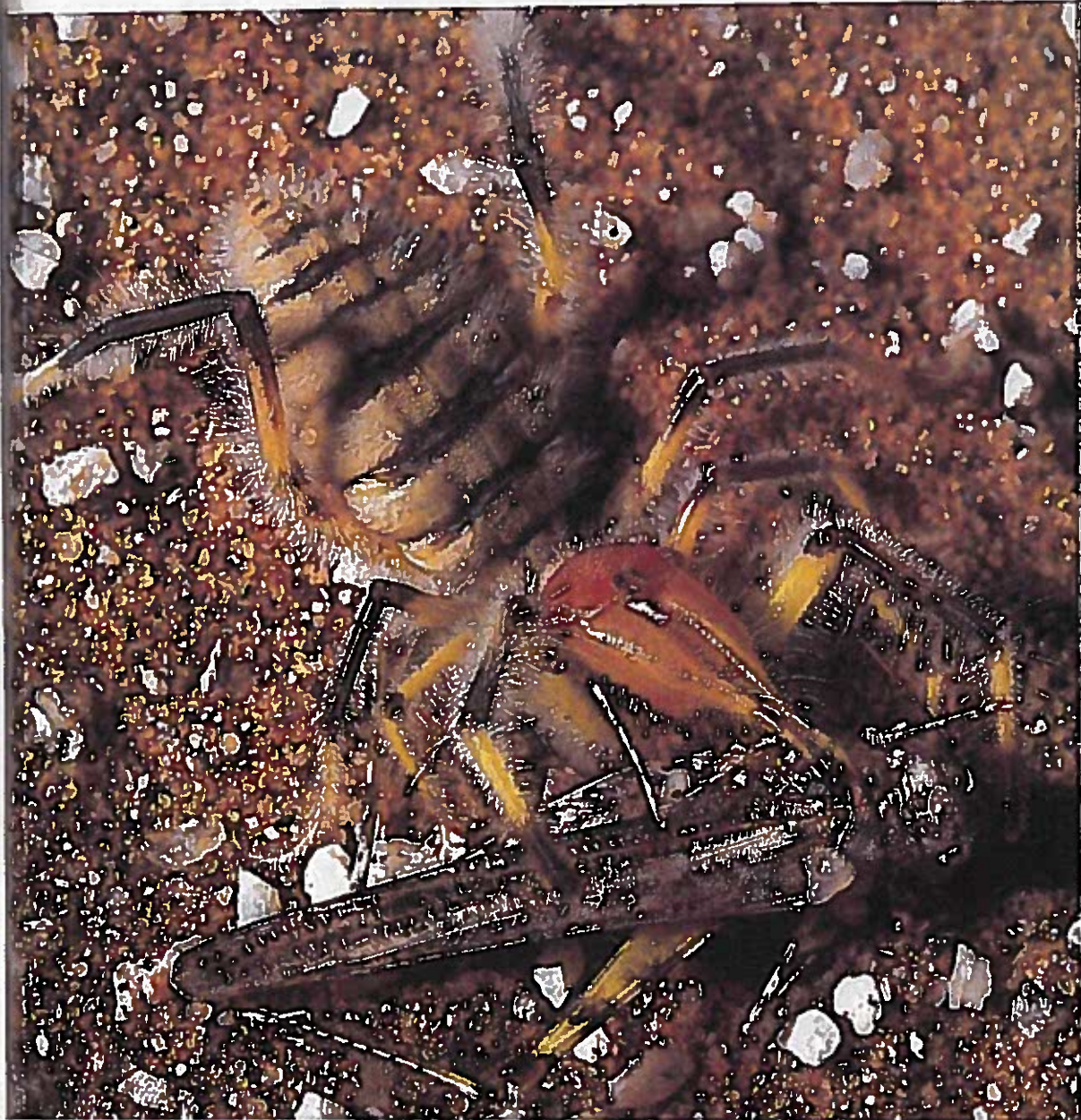
place, 30-year-old traces of the vehicle of a diamond prospector still show plainly.

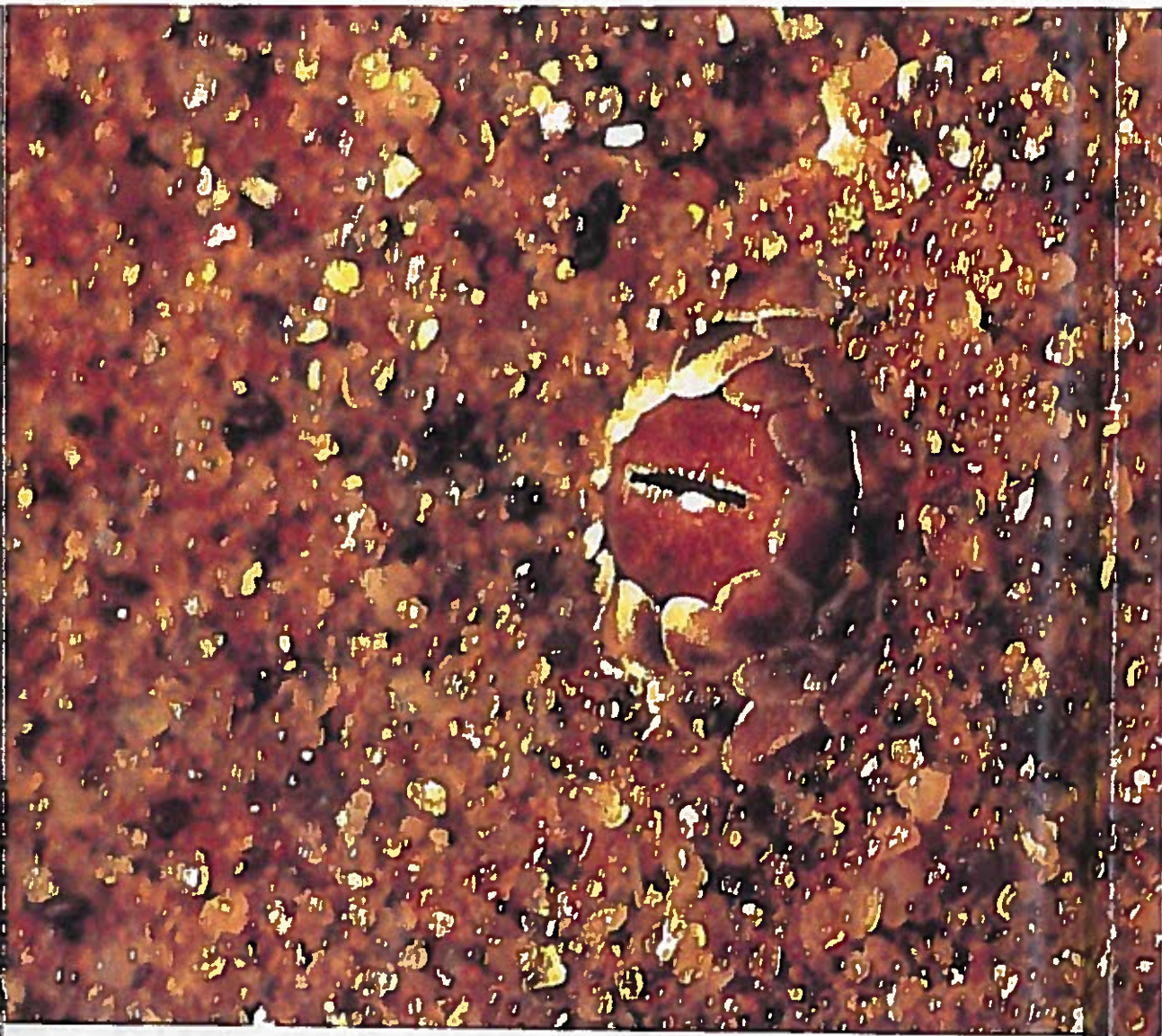
Namib dawns are chilly, and most daytime invertebrate life becomes active hours later, when surface sands have warmed. The first creatures astir are the comical little *Aporosaura* lizards that live in the soft dune slip faces. Poking out heads and necks, they first absorb heat from the thin covering of surface sand. After emerging and warming further, they scamper off to inspect one another and to rummage about in the overnight accumulation of detritus for a breakfast of seeds and beetle larvae.

Quickly the day turns warm. Beetles are

out in force. Armored with a hard chitinous covering, they show no fear of the lizards. Both lizards and beetles prefer to feed on parts of other creatures, but mostly they have to settle for seeds.

Smaller and more active, the male beetles are more interested in females than in food. To claim exclusive access to their chosen mates, some seize the females and ride them like miniature cowboys, steering their "steeds" to fend off other suitors. One species, while clasping the female with its forelegs, lashes out with its hind legs, springlike, kicking rivals away. The beetles are not mating now, only staking claims. Actual





copulation will take place beneath the sand.

A shiny brown-black scarab is out looking for oryx dung to drag to her spacious underground dwelling, food for her larvae. She positions jelly-bean-size pellets between her hind legs. Sometimes the rearmost pellet rolls—she is partly wheeled along.

In the Namib, as in most deserts, mid-morning “warm enough” is quickly followed by “too hot.” Lizards, beetles, termites, and spiders are all abroad. Termites race across the sand, gathering pieces of dead grass. Today they will have a scant 20 minutes to work before midday heat forces them to quit until afternoon. Soon all surface dwellers must burrow a few centimeters to inky blackness and a more moderate ambience.

For most Namib life forms, the sand surface and the first half meter down are the limits of existence. But for some, margins of safety and survival are measured in fractions of a body length. Almost all desert insects are flightless; on the surface, their microcosm is one of temperature extremes. At midday, surface sand temperatures can rise to 66°C (150°F), well beyond the tolerance of any small resident.

Now the heat sears: The sand stage is vacant. I find protection under a few yards of nylon stretched from my motorcycle to pegs stuck in the ground. I shove aside sand to find a cooler resting-place for my backside. Now I'll have a few hours to read, day-dream, reminisce. . . .



In deadly disguise, a side-winding adder exposes only its eyes as it waits for prey to approach (above). When a lizard nears, the snake strikes, injecting venom, then swallows the lizard whole (left). Although only distantly related, the Namib adder and the sidewinder rattlesnake of North American deserts have many traits in common.

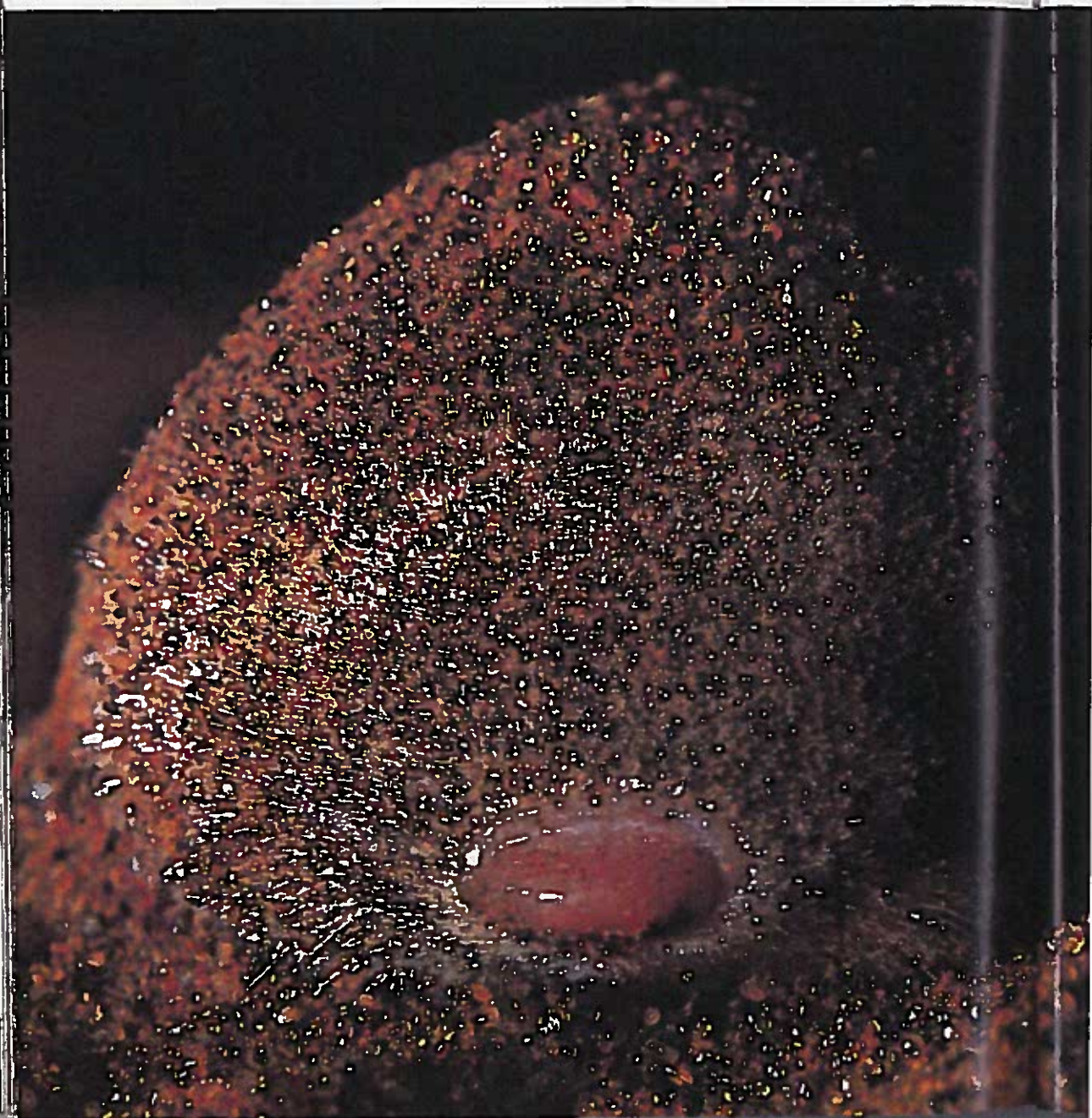
BY THREE, I'm bored and set out prematurely to continue my patrol. The sands have begun to cool but are still too hot for bare feet.

First out are some beetles that, like me, have emerged too soon. They can't return through the hot sand without being cooked. To stay cool and alive, they rise on spindly legs, stilt-like, reaching to cooler air a body length away.

I come upon a favorite of mine—little *Cardiosis*, a yellow-and-black afternoon beetle that climbs to the top of the dunes to

catch freshets of wind. Volkswagen-shaped, no larger than a pepper seed, it races across wind-lashed slip faces, chasing scuds of detritus in the alpine crests of its sandy world.

Soon an indescribable vitality pervades the sands. As the heat moderates, I trudge along, alert for tracks and movement. A sand-colored solifuge, or sun spider, whisks by, tracking back and forth, hunting. Actually an eight-legged arthropod, but not a true spider, it curls its abdomen straight up into the air, perhaps to avoid having its insides fried. It comes upon a *Cardiosis*,



shallowly buried. Suddenly the sun spider has the beetle on its back and at once begins to suck its body juices.

In the mellow afternoon, beetles and other insects appear everywhere, racing across the dunes' slip faces, inspecting fragments of breeze-stirred debris. As sands cool, I take off my shoes and shirt.

I continue my walk and nearly stub my toe on an unaccustomed object—a bur-nished, roughly oval russet stone. It's a pre-historic axhead, left by Stone Age hunters who ranged across this desert. Throughout

the now unpeopled Namib, scores of multi-colored stone axes strew the gravel flats and lie buried beneath the dunes.

Mary Seely once took me to a secret place 50 kilometers southwest of the research station, where stone hand axes lie scattered on the flat streets between towering dunes.

"How could people have existed here?" I asked. "I couldn't walk this far, much less stalk an antelope, and get back to water. There'd be no point in carrying hand axes when I had to haul in all the water I could manage in ostrich-egg shells."

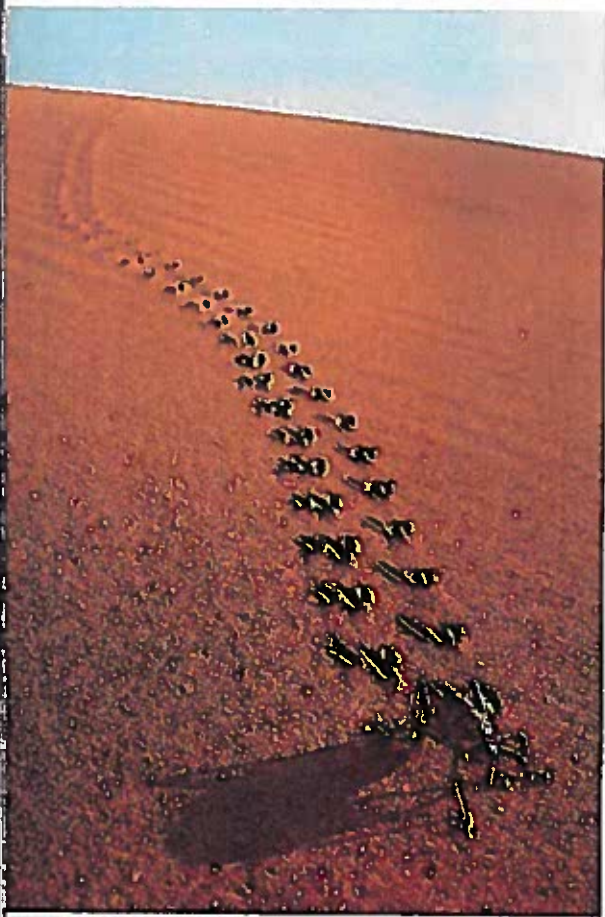


Dancing to beat the heat, the lizard Aporosaura lifts its legs (top), then dives beneath the sand before midday surface temperatures climb as high as 66°C (150°F). Ironically, in the early morning it must warm up on its belly (above).

Following its nose, the blind and nocturnal golden mole (left) tunnels just below the surface for prey.

"You're right," Mary agreed. "Under present conditions, living here would have been impossible. But see—we're at the end of an ancient river that flowed into the dunes here. Trees must once have flourished in the stream's outflow, where an early people lived. The axes are their only trace; they left no other clues. The river has long since disappeared. Their bones are a part of the Namib dust."

Dusk descends on my walk. The first night creatures are emerging. Saucer-



Nocturnal traffic patterns of zigzagging beetles and a bounding gerbil (facing page) linger at dawn before the Namib's winds clear the slate. A corn cricket (above), uncommon in the heart of the dunes, briefly leaves its own distinctive signature on this desert realm, only recently marked by the footprints of modern man.

shaped button beetles are circling about. On our approach they squeak an alarm, then dive into the soft high dunes. Soon other actors appear on this red Mars-scape. Moonlight, reflecting from the sand, turns furry dancing white lady spiders an eerie dull red as they prance on tiptoe for reasons we are only beginning to understand. Geckos walk on their paddle-like feet, foraging for insects. Voracious golden moles glide under the sand. But I must soon slip into my sleeping bag.

About 3 a.m. I am awakened by sand blowing in my face. I am up with a start. The dampness exaggerates the chill, and I pull on long johns and zip my parka tight. Back at the station Mary will be out in the dunes too, hunting for marked beetles carefully weighed the previous evening.

By four the fog is swirling all around; visibility is nil. My flashlight reveals a veil of tiny droplets slanting by. By six the button beetles have dug their moisture-catching furrows, drunk their fill, and are back below the dune surface.

By nine the fog has lifted. It breaks up into puffs of cloud painted pink by light reflected from the red sands. Now the sun thrusts warmth to the dunes again. In another hour lizards will poke out heads. A daily cycle passes, another begins.

ITS UNIQUE CREATURES and their strange ways should make the Namib a mecca for biologists. But the region is politically troubled. Today it takes a light step in southern Africa to stay in grace.

And now the Namib is under pressure from mining interests. Uranium lies beneath its sands. Mines for copper and diamonds are developing, and technicians and workers are assembling from all over the world. Vehicle wheels scar desert surfaces, their tracks to last for centuries.

In the sandy heart of the desert, far beyond the last human trace, problems seem remote. Deep in the great dunes, I have never seen another person who did not go there with me. Only satellites, relentlessly tracking black night skies, intrude into this solemn hiatus to remind me of my own humanity, and that against human onslaughts not even the Namib's empty horizons will remain inviolate. □

