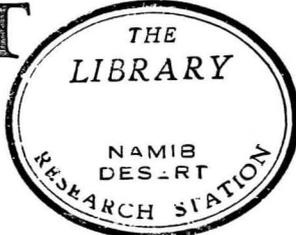


Deserts - Namib - Biogeog
Kunene River 9/5

THE ANCIENT NAMIB DESERT

Edward S. Ross

Photographs by the author



Pacific Discovery XXV (4): 2-13, 1972
915

POSSIBLY the oldest of all deserts, the Namib fringes 1300 miles of the Atlantic coast of Africa southward from Angola to just beyond the Orange River's mouth in South Africa. In contrast to the vast Sahara, covering some eight million square kilometers, the Namib comprises a mere 270,000 square kilometers. However, what the Namib lacks in size and historical interest is more than offset by its greater significance to biologists. It is the only true desert in Africa south of the Equator. For example, the neighboring Kalahari, better known because of its bushmen, is not a true desert, for its parched condition is due more to

rapid soil drainage than to lack of rainfall. The Namib's great scientific interest probably results from uninterrupted millions of years of aridity. There has been time for much to happen to its biota, for deserts along the southwestern coast of Africa may be as old as the continent itself. If we are to accept the theory of drifting continents, as most scientists now do, Africa began slowly separating from what is now South America at the end of the Jurassic period. When the ever-broadening ocean between the young continents became sufficiently wide there appeared a counter-clockwise-circulating sea current, the Benguela



portion of which is cold as it flows north along the southwestern shores of Africa. The air over this current is colder than that over adjacent shores. As sea winds blow inland across the warmer land, the air's capacity to hold moisture increases, and thus no rain clouds form. Another cause of aridity is that the Namib receives little rain from the east. Precipitation from the Indian Ocean falls on eastern ranges and the vast width of the continent also insures that such rains will not reach the Namib. The third important cause of aridity is the fact that portions of the Namib lie in the Earth's southern dry latitudes where downward currents in the atmosphere prevent the rise of moist air which results in rain cloud formation.

The Namib is not without some moisture, however, for dense fog banks hang offshore. In the cool of night, especially in winter, winds carry the fog as much as thirty or forty miles inland. At such times the desert is dampened, particularly where hills rise, and catch the full impact of the west winds. This moisture supports a good growth of lichens and succulents in a few scattered high places. In certain locations grows one of Earth's strangest plants, *Welwitschia mirabilis*.

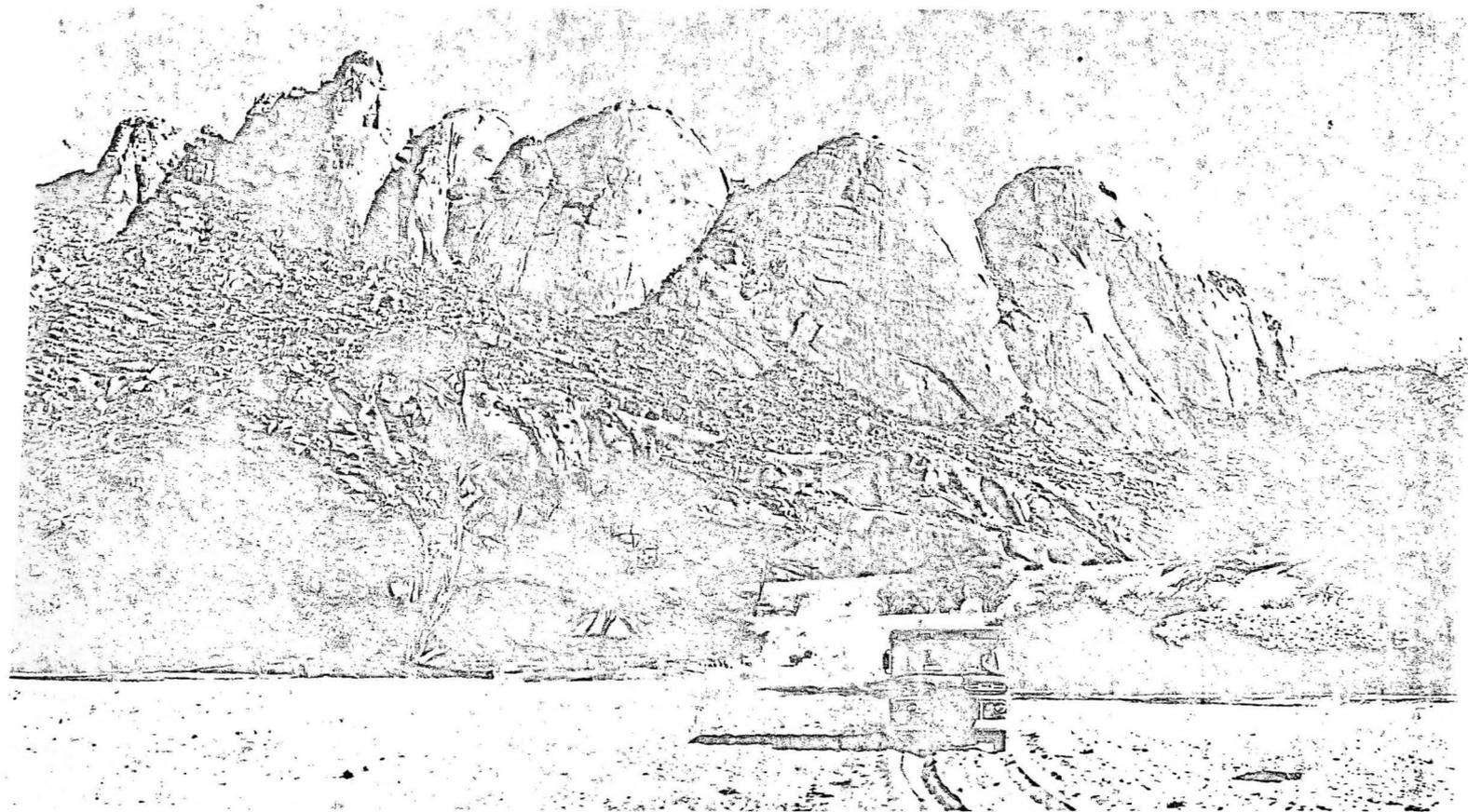
On the eastern fringes of the Namib other remarkable plants struggle for existence on gravel plains and rocky foothills—the kokerboom (a tree aloe), stone succulents, cactus-like euphorbias and milkweeds, and grotesque members of the grape family. But perhaps the greatest biological experience is to visit the dunes south of Kuiseb River.

During three California Academy of Sciences safaris, two of which were partially supported by the National Geographic Society, I repeatedly travelled the length of the Namib and crisscrossed it in many a latitude. My companions during the most recent visit included my daughter, Martha; Carol McMillan, a student anthropologist; and Alan Stephen, a student entomologist. We journeyed over all roads, good or bad, in order to see as many environments as possible. Side roads led us to fascinating lonely places such as the Erongo Mountains, the Brandberg with its famous "White Lady" Bushman painting, and our favorite campground, the *Grosse Spitzkopf*, also known as Bushman's Paradise. Most of these mountains are fragments of ancient Precambrian granite time-weathered and fractured into crannies once used as shelters by early man. Such early living sites are easily recognized, for the ground about them is littered with stone tools and flakes. Those with good cave paintings are protected by law.

Our base of operations during each visit to



Left, Dr. Ross atop a dune crest in the Namib. Behind him is the line of riverine forest, watered by the underground flow of the Kuiseb River. Above, the three biotic worlds of the central Namib—high dunes, the thin strip of riverine forest, and rocky flats. (Gemini V photo; north-to-south distance is 80 miles.)



Ancient, granitic Grosse Spitzkopf rises spectacularly over one of many sandy riverbed crossings faced by visitors to the Namib Desert.

the Namib was the Namib Desert Research Station at Gobabeb on the Kuiseb River, some seventy miles southeast of Walvis Bay. The central figure at the station during our visits was the late Dr. Charles Koch, who had come to Africa from Austria in 1949 as a member of an expedition sponsored jointly by the University of California and the Transvaal Museum. He was a world authority on Tenebrionidae, a family of usually-black beetles which flourish in all desert regions. However, on his first visit Dr. Koch quickly noted that the Namib has the richest and most interesting assortment of these beetles. Furthermore, almost all were new to science. He sent paratypes of hundreds of new species to the California Academy of Sciences.

While willingly enduring the inevitable discomforts of desert treks, Dr. Koch dreamed of having a comfortable Namib field station where he could reside the year round while studying the desert's ecology. This dream was realized in the cluster of small modern buildings and weather instruments at Gobabeb. It draws scientists from all over the world, and their studies in this superlative desert should have great value in advancing the understanding of deserts everywhere.

Once primarily a field station of Pretoria's Transvaal Museum, Dr. Koch's Shangri-la is now the seat of the Desert Ecological Research Unit of the Republic of South Africa, as well as a First-

order Weather Station of the Department of Transport.

Dr. Koch and his Director, Dr. V. FitzSimons, positioned the station with loving care. It is very favorably isolated, yet sufficiently close to the necessities of Walvis Bay. Geographically centered in the Namib, it is also astride the desert's three main biotypes: (1) the vast red dunes extending three hundred miles southward, (2) the gravel plains with rock outcrops stretching at least as far northward, and (3) the riverine forest of the Kuiseb River bed. There is also an east-west blend of zones from sea to mountains. The game sanctuary status of this portion of the Namib insures preservation of the whole environment.

On our very first night at Gobabeb we made a point of penetrating the vast red dunes towering on the southern horizon across the river bed. The encounters we had in this seemingly-empty world proved to be among the most exciting we could have found anywhere. At dusk the blue glow of our ultraviolet light began to attract insects. Such lights draw more specimens because insects are sensitive to short wavelengths of light. Much to our consternation, however, heavy inch-long scarab beetles began hailing down on us. They came into camp by the thousands and began to burrow into our supplies and the dinner that was being prepared. Finally we had to do what entomologists

dread—turn off the lights and give up collecting. The remainder of the evening was spent enjoying the desert's darkness and sounds.

The next morning to our surprise the mosquito bar of the tent was drenched with dew. Outside, all was shrouded in sea fog despite our being more than forty miles inland. The Namib owes much of its biotic richness to this frequent source of moisture. But the desert plants and animals must utilize such dampness early in the morning, for the fog soon melts away and the sun quickly dessicates the desert from a cloudless sky.

One afternoon particularly strong southwest sea winds buffeted our tent and across the Kuisch River bed plumes of sand smoked off of each towering dune and swirled down the lee like snow on a blizzard-swept drift.

Acting as a great aeolian plow, the winds were turning up scattered organic debris buried earlier by sand storms sweeping out of the vegetated East and the river bed. Once blown back over sandy crests, the light fragments accumulated in wind-rows in each sheltered vale.

"The dunes are alive," said Dr. Koch. "Now's the time to put on goggles, button up collars, and get up there in the thick of things. Look closely in the debris lines. All sorts of creatures come out to eat such concentrations."

I trudged up to a dune's most unpleasant place during a storm—its uppermost height. There, as sand blasted against my boots with tremendous force, I found *Cardiosis*, one of the strangest of Namib's dune beetles. They are little black globules boldly patterned with yellow and, with only hair-like legs, the beetles move best by being blown in the wind. Between gusts they snatch up food morsels scattered on the dune. I saw one of the beetles gripping a section of spider leg in its jaws but before I could snap a picture the wind rolled it away. When I caught up with it again it still had the tidbit and was vigorously chewing on it during the brief calm. With the next gust it tumbled along but repeated the furtive eating during the next short opportunity.

Where sand cascades in curtains over the dune crest I saw large, glossy-black tenebrionid beetles of the genus *Onymacris*. While some of these scurried about with mating intentions, others busily gnawed on dead insects disinterred by the wind. During the day only insects were evident. The spiders, reptiles, and rodents were avoiding wind and light exposure by remaining beneath the dune's surface.

As the day ended the wind gradually subsided

and the redness of the dune's iron oxide-coated sand grains intensified in a rich orange glow. Dune and surface ripple shadows blackened as the sun lowered. This was our time to be atop the highest dune to savor a circular view of the Namib. Southward was a strange horizon of north-south dune ranges, each a thousand feet high separated by flat sand-paved valleys. Turning north, we saw our camp, a tiny dot at the edge of the trees growing on the underground flow of the Kuisch River. Beyond, fading into the haze, were seemingly endless gray flats studded with wind-carved granite outcrops.

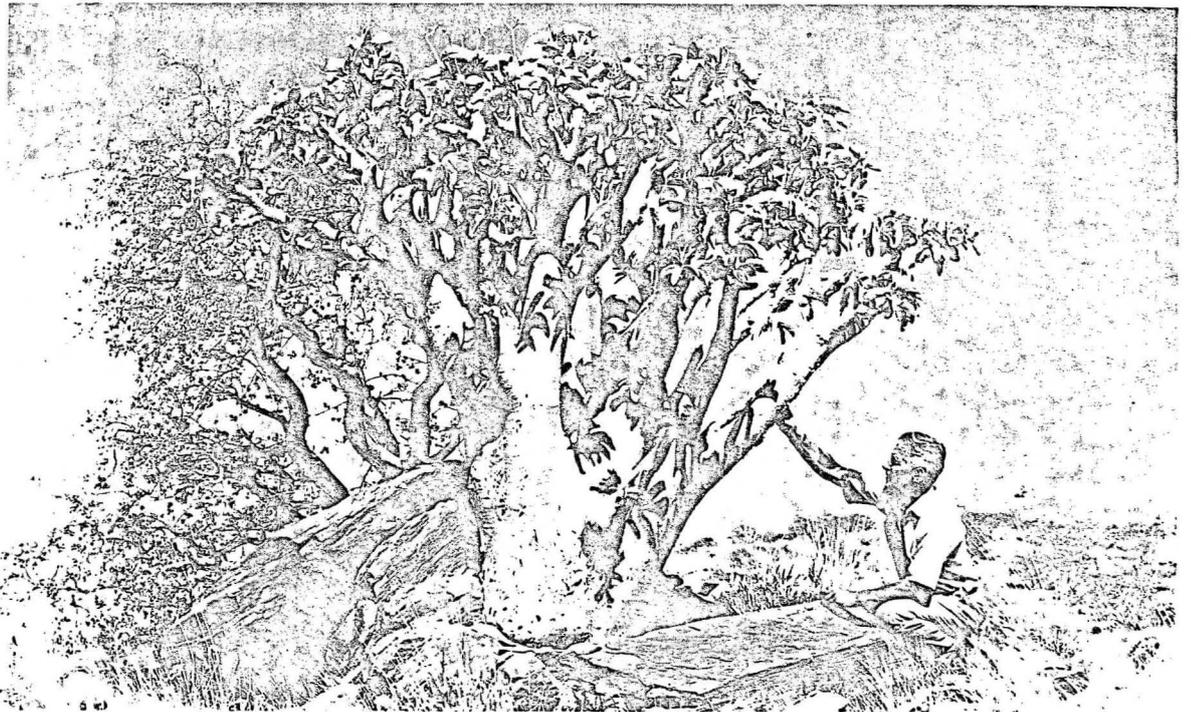
The approaching darkness and our great distance from camp reminded us that we had best return for supper and prepare to go back into the dunes at night to observe activities of the nocturnal shift of animal life.

A rest in camp is a welcome relief from an afternoon's tiring up and down struggle on soft dunes. It is a time for washing sand off of bodies and out of reddened eyes and, not the least, for a refreshing sundowner drink. The music of the



Right, the Kokerboom, a tree aloe. This one supports the communal straw nest of scores of sociable weaver birds.

Grape plants adopt many forms in Africa from elephantoid trees, right, in rocky foothills to sprawling monstrosities, far right, found in the northwestern Namib. In wet tropical Africa still other species grow as terrestrial vines.



cocktail hour is the conversation of romancing *Ptenopus* geckos inhabiting rock and tree crevices. Each of the several similar-appearing species has its own peculiar language, and this fact caused herpetologists to examine more closely the geckos and discover the existence of a complex of species.

We couldn't relax very long, however, for lanterns had to be filled and tested, collecting bottles assembled, and cameras cleaned and readied for action. Eric Holm of the research station staff offered to come by our camp with his Land Rover and take us as far out into the dunes as he could drive. He wanted to hunt the dune's elusive golden moles and his wife came along to help. We crammed into the Land Rover and held on firmly as Eric, a veteran of almost-nightly, harrowing Kuiseb crossings, skillfully slithered and bounced his vehicle at full tilt across the deep sands of the river bed. Soon we were racing southward across more than a mile of the relatively hard sand of a flat between dunes.

A mountainous dune suddenly loomed ahead in the darkness and barred further driving. While we still had momentum, Eric broadly arced the vehicle to point in the return direction. We did not stop until he felt a hard spot beneath his wheels. This is important, because the critical time in driving on sand is the initial start when the wheels may dig in and become stuck.

We quickly divided up the lanterns and collecting equipment and eagerly started off toward the inviting dunes. Before leaving the Land Rover, however, Eric wisely set out a red signal light so

that we could find the vehicle again. Other lights were placed along the route. Becoming lost is a real hazard, especially on nights when the wind quickly erases footprints. It is necessary to remind oneself that there are no humans for hundreds of miles to the south and but few in other directions.

During the day only a few dune creatures are active but at night, especially after the strong afternoon winds, much is exposed to view. The most common creatures are tenebrionid beetles, especially the disc-like *Lepidochora*. There may be as many as five species of disc beetles on one dune, and all have a habit of nosing downward into the sand when disturbed.

A shout of "gecko" was heard and we converged to see the graceful little creature. These lizards, *Palmatogecko rangei*, have exceeding beautiful pink and white coloration and huge eyes obviously adapted for better night vision. By completely avoiding sunlight, these geckos can survive in spite of their almost completely transparent skin which reveals their internal organs—especially the bluish eyeballs, skeleton, and blood vessels. Even more remarkable, the gecko's feet are broadly-webbed. This feature, found in no other lizards, is evidence of ages of evolutionary improvement for plodding across soft sand. Broad feet also aid digging to escape danger and to evade the light and heat of day.

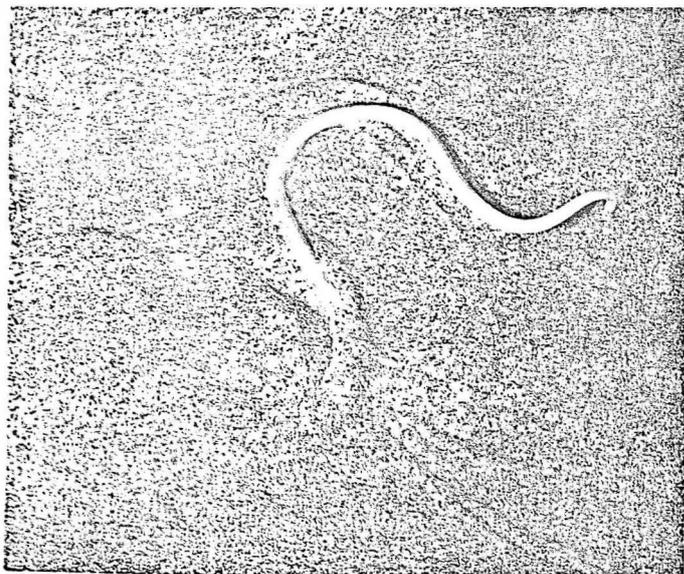
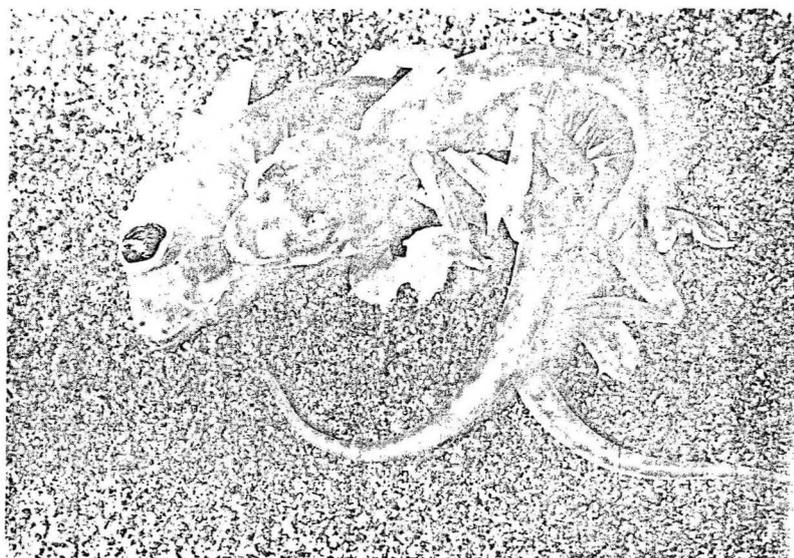
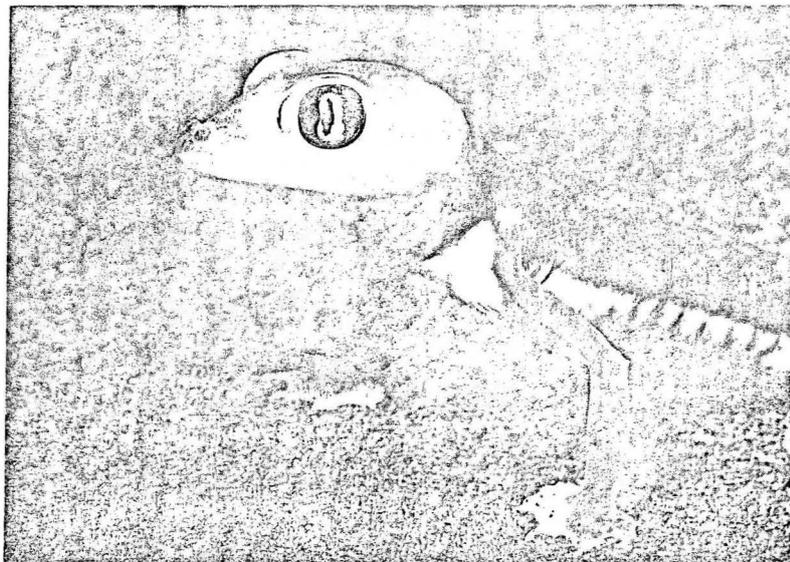
We often saw lone geckos walking about on broad expanses of sand. Our approach disturbed them little. They would even chase nocturnal wasps accompanying the glow of our lights. It is

quite likely that sand vipers are the chief enemies of the geckos. No one has seen one attacked in the field but captive snakes readily eat the lizards. When placed near a viper a gecko rises very high and stiff on its legs and snaps at the snake with remarkable ferocity. But inevitably, the snake's venom decides the issue and, as the gecko succumbs, it is slowly swallowed tail first.

During our many excursions on the dunes we divided into small lantern-sharing groups. Visual or voice contact had to be maintained because the interdune valleys can be hundreds of feet deep and it would be possible to become separated forever. An experienced dune trekker learns to take sightings on the stars in case it is necessary to navigate back to camp or vehicle.

We soon became expert animal trackers. The tracks are so numerous and varied that it is all too easy to become distracted by a strange new one before catching up with the maker of the one being traced. Most inviting are the disconnected arcs of sand vipers looping in the manner of the American sidewinder rattlesnake. One quickly learns to read the direction a snake has gone by impressions of its track: the back rim is higher than the front edge. Even while climbing a dune slope a snake can progress as fast as one can follow. Once we traced a viper track for more than a half mile but at the end no snake was apparent. However, we knew what to expect and avoided ripples in the sand outlining the buried viper.

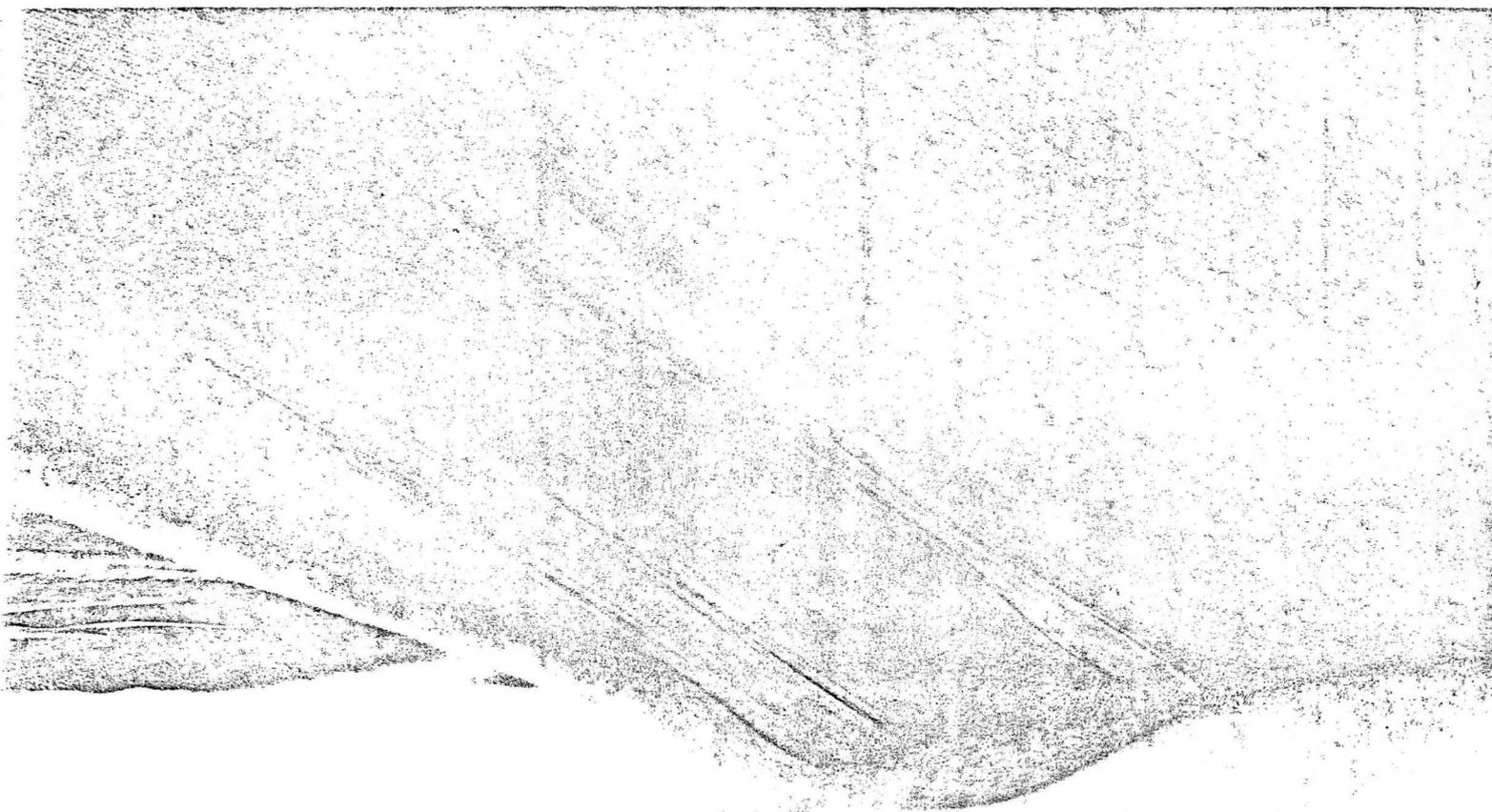
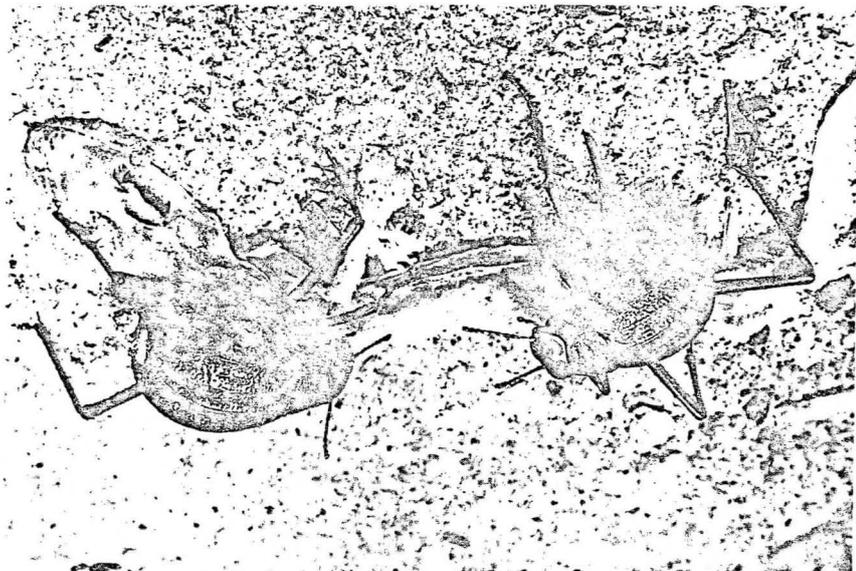
Our shovel flipped out the beautifully adapted snake. It was a full grown *Bitis peringueyi*, yet only fifteen inches long. Its fine scales, both in color and texture, perfectly matched the reddish sand.



Namib dune skinks resemble large earthworms. Here one writhes back into the sand after being tossed out by a shovel.

Top, Palmatogeckoes are the only web-footed lizards. Center, a pair of palmatogeckoes mating. Bottom, a palmatogecko using its webbed feet to dig quickly into the sand.

Top, afternoon winds plume sand off of dune crests, uncovering and concentrating plant and animal debris which serves as food for many Namib insects. (Photo by William J. Hamilton III.) Left, toward evening ground beetles (family Tenebrionidae) are the most obvious insects on the dunes. These *Onymacris* are devouring a shriveled web-footed gecko. They also scavenge plant debris. They are diurnal, but other members of the family, such as the disc-like *Lepidochora*, right, are nocturnal.

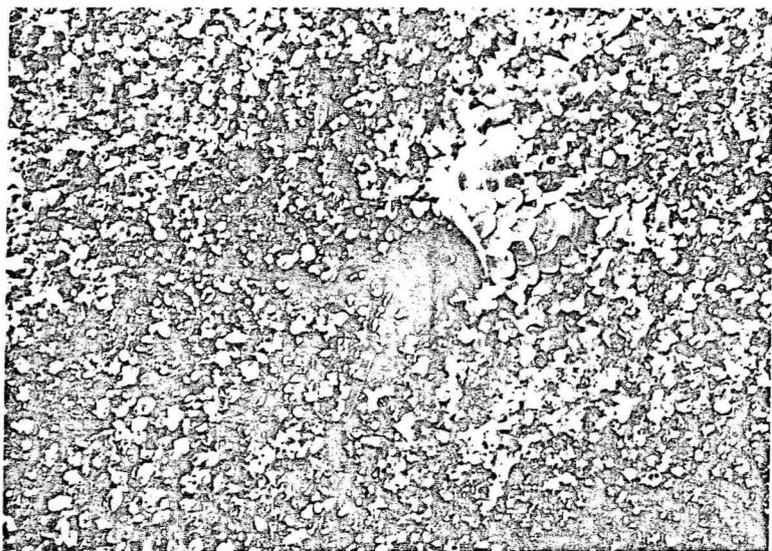
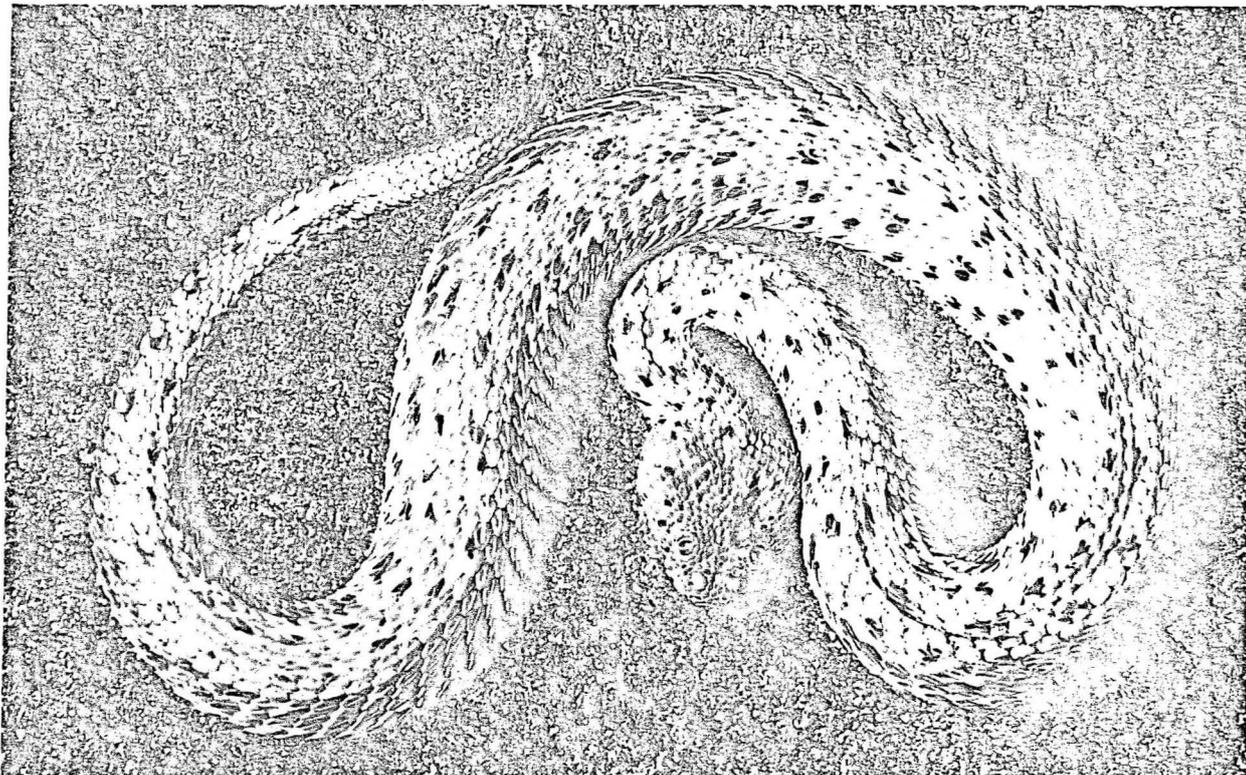




Below, *Welwitschia mirabilis*, found only in scattered places in the Namib, is one of the world's strangest plants. Although often radial in growth, the plant has only two lifetime leaves which split as they grow. This plant has a ring of male catkins surrounding a dead, woody center. Female plants have fir-like cones. *Welwitschias* are gymnosperms, most closely related to Mormon Tea, a common shrub of the American West.



Right, the Namib viper matches the sand in color and texture. Its head-top eyes enable it to watch for prey even though completely buried except for eyes and tongue, below, while waiting the approach of potential food, perhaps a gecko.



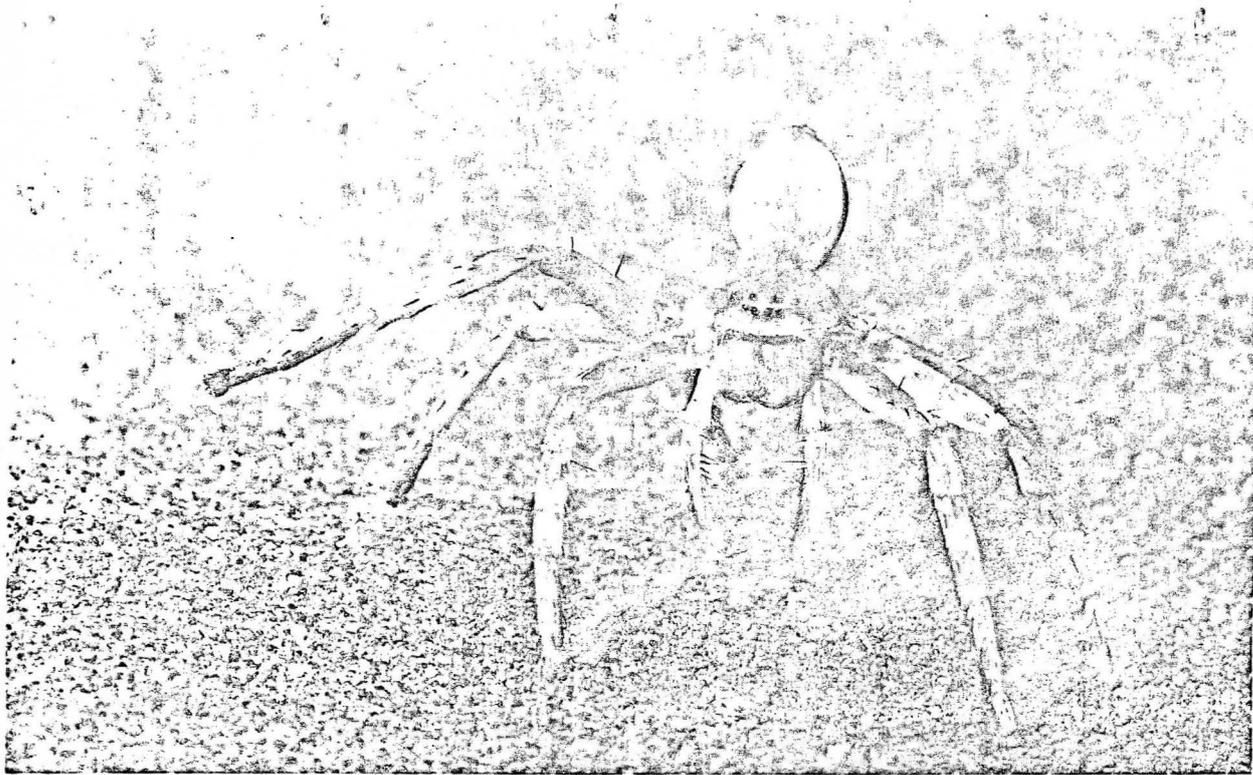
The snake quickly wriggled backward into the sand except for two cat-like eyes peering from among the sand grains and the flick of its tongue. We noted that the snake's eyes are located almost atop the head rather than on its sides. This adaptation permits the snake to become almost completely buried and yet see any approaching prey or danger. It is easy to imagine how an unwary creature could blunder within the striking reach of a snake thus concealed. The snake's burial must also reduce its chances of being discovered by night predators, such as owls.

Another curious dune track is a series of sinuous streaks marking the periodic surface ventures of these eel-like reptiles of the dunes. As with other

dune creatures, one must trace forward to the lead point and there quickly scoop out the track-maker. In this case one throws out a writhing, worm-like thing which must be pounced on before it swims back into the depths of the dune. It takes quite a bit of scientific salesmanship to convince the layman that these wormlike creatures are lizards. The head is no bigger than the blunt tail and the body scales so fine that they do not dull the gloss of the slippery surface. The eyes are nonfunctional and the mouth tiny. There are absolutely no legs and the scientific placement of such a creature could only have been decided by great herpetological insight based on comparisons of other species of lizards in intermediate stages of becoming worm-like.

The food of these lizards must be the larvae of tenebrionid beetles burrowing in the sand. These are so sparsely dispersed in the sand, however, that great energy would be fruitlessly expended if the lizards searched entirely beneath the resistant surface. Periodic movement in the open increases the hunting territory and also the chances of encountering an edible tidbit on the surface.

Similar two-level foraging is also the habit of the legless lizard's chief enemy—the golden desert mole, *Eremitalpa granti namibensis*. These soft, silky, tan-and-white balls of fur are entirely blind. All other senses are little used except perhaps touch. The species is restricted to the soft, shifting sand of southwestern Africa. The existence of the Namib subspecies became known from bones compressed in an owl pellet. During many dune excursions our party assisted in the capture of the largest series



When approached, a dancing spider wheels about, left, to face danger. Its ultimate defense is to roll up like a wheel with legs as spokes, below, and roll down the slope of the dune.

taken since the subspecies was discovered in 1957.

Tools of a mole hunter consist of a shovel and a square of chicken wire supported by side sticks. The hunt begins with the usual tracking. A mole's subsurface wanderings are marked by longitudinal ridges but, unlike other moles, the Namib species emerges periodically for short surface runs with its nose occasionally dipping into the sand. As in the case of the legless lizards, this apparently increases chances of contacting food. One evening's romp by a mole may extend more than a mile.

To find a mole, Eric Holm patiently sought the head end of a set of the peculiar tracks. There Mrs. Holm held the chicken wire upright while Eric vigorously shoveled sand through the screen. The idea is to dig faster than the mole and throw it against the wire. Once exposed, a quick grab, unconcerned about the chances of getting a severe nip on the hands, is required to make the final capture. After many unsuccessful attempts to dig out a mole—at least a whole specimen—one appreciates why these rodents so long escaped discovery.

Much more apparent are the fairly numerous gerbils—hopping desert rodents, very similar in appearance to the kangaroo rat of the American Southwest. To get good pictures, several of us, acting like a pack of hounds, closed in on all sides of a gerbil. The animal could then be approached.

Sand dunes would seem to be the last place to expect to find spiders, but the Namib is a favorite hunting ground for spider specialists. Dr. Koch was the first to call attention to the interesting spider fauna and to coin the appropriate name

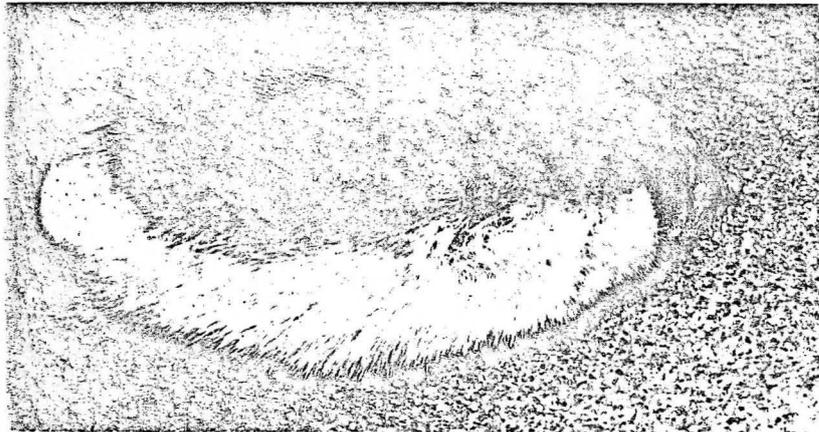


“dancing spiders” for the most bizarre species. If he were not such a respected scientist his first reports would have been regarded as pure fantasy.

The dancing spiders are very pale and one is even chalk-white. The latter is very large, spanning four inches of sand with its long spindly legs. When disturbed it rises high and cavorts about on tip tarsi in the manner of a ballet dancer. If teased too often with the tweezers the spider boldly attacks, wrapping its legs and fangs about the offending tool. To my knowledge no one has been bitten by such a spider, so we have no information of the effect of its venom. No species of its family, the Sparassidae, is regarded as dangerous.

If every warning pirouette, prance, and pounce

Right, Eric Holm throws sand against a screen held by Mrs. Holm, trying to catch a mole while William Hamilton and Allen Stephen stand ready to take a turn at the vigorous digging. Below, the rare golden mole, which lacks all senses except touch and smell. When released it immediately dives back into the sand.



of the spider fails, then a final and most remarkable defense is used. The spider simply folds up and rolls away. Down the dune slope it goes, faster than any predator can follow. I decided that photographing a spider tumbling down a dark slope would be quite a challenge. While I waited, ready to flash a picture some twenty-five feet below a spider, a companion teased it into a roll. After several hopeful attempts, I was confident that I had gotten at least one picture in focus. Actually, I got several sharp pictures. Each revealed that the spiders wheel along on edge throwing up a wake of flying sand grains. The body of the spider is the hub of a wheel and the joints, its eight legs, the rim.

It is easy to conceive how such a remarkable bail-out from danger evolved. Most spiders, and many insects, simply drop to the ground if molested. Should a spider's world be a steep dune slope, the instinctive drop simply results in a long, rapid roll.

These are but a few of the dune's nocturnally

active creatures. Morning light finds them vanished except for their tracks etched in the sand.

Another scientist in the Namib during one of my visits was former Academy staff member Dr. William Hamilton III, of the University of California, Davis. He was studying the intriguing question of how diurnal insects have adapted to the extreme desert environment. He had noted that inasmuch as most animals in the desert are cold-blooded — especially insects and reptiles — one would expect their body temperatures to fluctuate closely with environmental temperature. However, Bill's studies were beginning to show that seemingly cold-blooded desert animals actually maintain fairly constant body temperatures. They don't get hotter and hotter on a hot day or colder and colder on a cold day. They are also able to keep up activity in spite of the numbing chill prevalent early and late in the day. To do so they may resort to a varied repertoire of behavioral and structural adaptations, rather than physiological mechanisms. Most desert animals cannot afford the luxury of cooling the body through evaporation of surface moisture as humans and other warm-blooded animals do.

In other deserts optimum temperatures usually occur at night and thus almost all desert animals are nocturnal. But many of the Namib's insects are diurnal and Bill Hamilton discovered that they regulate their body temperature almost as well as warm blooded animals (homeotherms) by moving from place to place in the thermal mosaic created by the convoluted sands, sparse vegetation, and varied exposures.

In addition to day and night activity-rhythms for avoiding extreme desert heat and desiccation,

many desert animals and plants synchronize their activity periods with seasons. Many are active only during a short rainy season and disappear in the dry season in a resistant phase, such as a seed, an egg, a cocoon, or by secreting themselves in some sheltered niche. In short, they are desert evaders. They are active only at times of the day or year when the desert really isn't a desert.

However, the true Namib has no regular rainy season. There are only times of the day, or the year, with more, or less, fog. Maximum fog dampness occurs early in the morning when the temperature and activity rate of cold-blooded animals is lowest. To record how rapidly such creatures can warm up, Dr. Hamilton was equipped with sensitive needle-shaped thermometers for taking periodic body temperature readings of all sorts of small creatures.

Particular attention was given to Dr. Koch's black desert beetles, for Bill Hamilton's records showed that, thanks to blackness, they absorb environmental heat very rapidly. This enables them to scurry about early enough to eat food fleetingly damp from morning mist. It was concluded that dark pigmentation must have much to do with the regulation of body heat.

These are but a few glimpses into the lively

yet seemingly-lifeless quietude of the Namib. Scientists can easily become entrancingly entrapped by studies in the depths of this almost neglected world of life. It will take years of penetrating investigating by many specialists to fully understand each element of the environment. And all these interpretations will have to be coordinated to reveal the intricate interdependence of all Namib species.

The Namib region appears to have always been a quiet eddy in the turbulent rapidly flowing stream of life. While elsewhere great forests, marshes, gigantic monsters have come and gone, the Namib must have been—at least after Africa became a continent—ever-constantly a desert. Much of the entire span of evolutionary time has been available for fine tooling and crafting its life products and for testing them under the severest of conditions.

Thus, during each visit to the Namib, I feel that I am attending a sneak preview of the spectacular adaptations to aridity that I might see in more familiar deserts if I could return to Earth millions of years hence. Other desert areas, however, are certain to experience the usual wet-to-dry cycles and disturbance by man's ever-increasing population. Thus the Namib may truly be considered a one-of-a-kind place on Earth. ❧

This great rock will shade the expedition camp in the afternoon. Beneath the rock's opposite side is a cave formerly used by Bushmen for afternoon shelter.

