

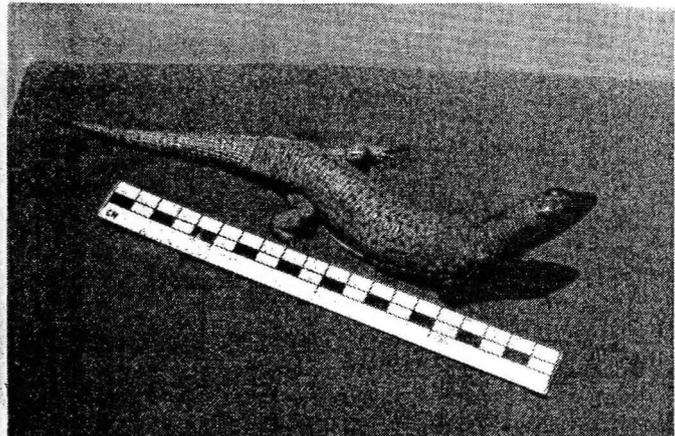
# Angolosaurus skoogi: denizen of the northern dunes

7982

The Namib Desert sand sea is characterized by a myriad of plant and animal species specially adapted to the harsh and unrelenting environment of bare desert sands. Among vertebrates it is the reptiles, primarily lizards, that perhaps best exemplify these unique adaptations. Anatomical modifications to allow "sand swimming" coupled with small size are the most obvious specializations of diurnal forms. Indeed, most of these are little more than a few grams in body mass. In the northern part of the Namib, however, lives its largest and perhaps one of its most unique sand sea inhabitants, *Angolosaurus skoogi*.

Although it was described over half a century ago, the ecology and behaviour of Mr. Skoog's lizard has been little studied until very recent times. The general distribution of *Angolosaurus* includes the northern part of the dune sea from approximately the Unjab River northward to the Mocamedes District of southern Angola. Originally described from a single specimen collected at Port Alexandre in southern Angola (Andersson 1916), these lizards were not discovered within SWA/Namibia until 1963 (Steyn 1963). The most recent work on *Angolosaurus* has benefited from extensive collaboration over the past several years between members of the DERU staff and members of the Zoology and Physiology Departments of the University of Witwatersrand (notably, Profs. S. Hanrahan and D. Mitchell). This work has focussed on several aspects of the life history and ecophysiology of *Angolosaurus*. A brief overview of some of the highlights of this work is presented below.

Among the ultrapsammophilous Namib Desert lizards, *Angolosaurus*, by far, is the largest. Males may grow to a body size of 170+ mm and weigh 100 g or more. Females, although somewhat smaller, may attain body sizes of up to 150+ mm and masses of 85 g. This is more than 14 times the size of *Aporosaura anchietae*, perhaps the most widely recognized Namib Desert lizard. Indeed, the size of *Angolosaurus* makes it the largest sand-diving lizard species in continental Africa and may have paved the way for other of its unique adaptations.



a Male *Angolosaurus skoogi* lizard

The sand dune habitat occupied by *Angolosaurus* is generally devoid of vegetation. Surprisingly, *Angolosaurus* is closely tied to vegetation as a food source. In a recent study using scat analysis (Pietruszka et al. 1986), vegetable matter was found to comprise more than 80% of the population diet. Moreover, while seasonal variation in food composition is apparent in these lizards, from 50 to 60 per cent of the vegetable matter consumed is a single plant

species, the Nara (*Acanthosicyos horrida*). Grass (*Stipagrostis* sp.), seeds and an animal component (containing 11 taxa of beetles and other arthropods) are also included in *Angolosaurus*'s diet, although each contributes considerably less to the overall diet than does Nara.

Why is Nara so important? The answer to this spans many facets of the *Angolosaurus* biology. From a nutritional standpoint Nara supplies the critical ingredient necessary for *Angolosaurus*'s dune existence — water — as its deep tap root ensures that it will always be under positive turgor pressure. Thus, *Angolosaurus* is always assured of an adequate water supply. Dramatic evidence of this lies in the observation that in their daily pattern of morning defecation, lizards also excrete more than 3 ml of urine, a highly unusual feature for any lizard and especially for one inhabiting a hyperarid environment like the Namib. It is the ready availability of water that is currently thought to allow *Angolosaurus* to take advantage of the abundant detrital food stores in the dunes which require an external water source for processing.

The focal area for *Angolosaurus* activity on a sand dune is the slipface. Although these lizards can be found in a variety of other dune-associated habitats, including the interdune gravel plains, the majority of their time is spent in close vicinity to a dune slipface. The general lack of vegetation or other surface refuges on dunes generally and on slipfaces in particular, means that in order to escape predators or the thermal stresses of high surface temperatures all animals must seek the ameliorating and protective environment of the subsurface sand (Seely & Mitchell 1986). *Angolosaurus* makes its escape in a most rapid and interesting fashion. In less than a second a given individual can disappear from the surface and over the span of only a few seconds a slipface with 25 or more *Angolosaurus* on it can become empty. This plunging behaviour was originally described as a kind of corkscrew motion that drives the lizard into the subsurface sand (Hamilton & Coetzee 1969). However, recent high speed photography under the direction of Prof. Yves Coineau has shown instead that lizards utilize strong lateral undulations of the body describing a figure eight to slice into the sand.

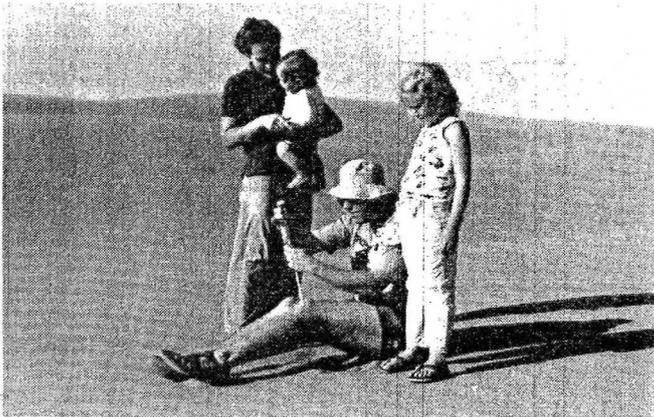
Once within the subsurface sand environment lizards are effectively protected from predators and buffered from high sand surface temperatures that may be in excess of 60° C. On the surface, however, *Angolosaurus* presumably must regulate its body temperature in some way. Recent efforts have been aimed at determining the details of this thermoregulation and focussed, in particular, on the hypothesis that follows a maxithermal strategy of body temperature regulation (Hamilton 1973, Hamilton & Coetzee 1969). One study conducted during 1986 (Pietruszka ms) approached the question indirectly by examining space-use patterns of these lizards in relation to prevailing sand surface temperatures. Little correspondence was found between the patterns of *Angolosaurus* microhabitat use and those of simultaneous temperature measurements in the occupied microhabitats, suggesting that maxithermal temperature regulation did not underlie space-use patterns. Rather, factors such as foraging, social interactions, and predator surveillance appeared to determine space-use patterns. In early 1987, DERU and Univ. of Witwatersrand staff used externally mounted thermal telemeters to measure *Angolosaurus* body temperatures coupled with simultaneous measurement of the slipface thermal gradient to more closely assess the relationship between body temperature and a lizard's location on the slipface. Preliminary results from data analyses indicate that body temperatures attained by *Angolosaurus* are considerably lower than predicted from the maxithermy hypothesis and are not strongly coupled with location over most of the slipface.

Interestingly, despite the great accessibility of the subsurface sand environment, *Angolosaurus* will, if given the chance, take refuge among the thorny branches of a nearby Nara when approached by a potential predator. Why this should be so is not entirely clear but it nonetheless highlights the close connection between

plant and lizard. Indeed, the entire social system in *Angolosaurus*, which involves the establishment of mating territories by dominant males, appears dependent upon the presence of Nara. Where healthy Nara plants are associated with slipfaces remarkably high *Angolosaurus* densities may ensue, with as many as 80 or more adults present. During the reproductive season (from about December/January to at least the end of February), dominant males establish perimeter territories along the Nara's edge. Younger, subdominant males are repeatedly repelled from these areas and often are not even allowed to feed. At the same time, reproductive aged females are actively courted as they pass through multiple territories, otherwise unmolested. Whether this process of mate selection may involve an element of choice by females is as yet unknown.

One of the most fascinating and least studied facets of *Angolosaurus* biology lies in the question "What are the limits of an *Angolosaurus* population?" From early observations of marked individuals it appeared that slipfaces with associated Naras held fairly separate and stable lizard "populations". As more information about this species is being amassed, however, this notion is giving way to that of the "meta-population" (Gill 1978). The essence of this population model as it may apply to *Angolosaurus* envisages a continual shift in the locations of small, highly localized subpopulations (called demes) in both space and time that is coupled to alterations in slipface suitability. Essentially, then, *Angolosaurus* is viewed as a kind of colonizing species, moving to those slipfaces where there is potential for successful reproduction and avoiding those where no potential exists. Thus, an *Angolosaurus* population may occupy an area of many tens or hundreds of hectares. Present evidence for such a view is circumstantial but very suggestive. We know, for example, that in the Unjab River area centres of *Angolosaurus* density are virtually always associated with healthy Nara plants. Those slipfaces without Naras contain few lizards. The average longevity of a Nara on a given slipface appears to be from 12 - 15 months, after which it is engulfed by the advancing dune and the lizards disperse. Finally, among adults, it is not unusual for individuals to leave a population centre and take up residence elsewhere.

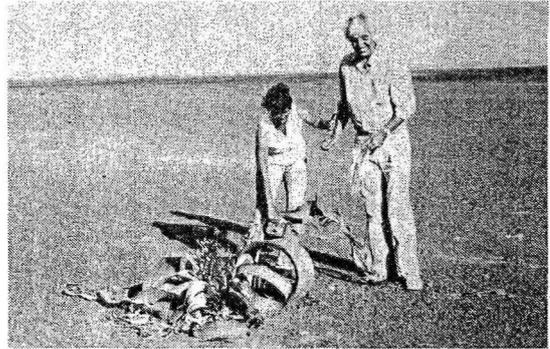
At this juncture the likelihood of a meta-population structure in *Angolosaurus* seems high, but is by no means certain. It is only one of large number of questions that remain to be answered about this fascinating denizen of the northern dunes.



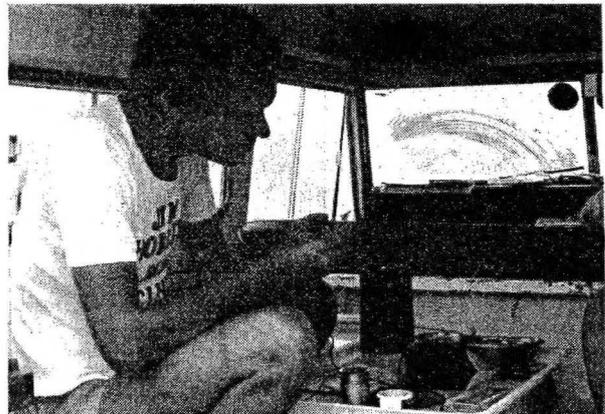
Bob Pietruszka assisted by his wife Carol and children Andrea and Serena, measuring the length of an *Angolosaurus*.

## References

- Andersson, L.G. 1916. Notes on the reptiles and bacrachians in the Zoological Museum at Gothenburg. *Meddelanden fran Goteborgs Musei Zoologiska Afdelning*, 9, 41pp.
- Gill, D.E. 1978. The metapopulation ecology of the red-spotted newt, *Notophthalmus viridescens* (Rafinesque). *Ecol. Monogr.* 48: 145 - 166.
- Hamilton, W.J. III. 1973. *Life's Color Code*. McGraw-Hill, New York.
- Hamilton, W.J. III and Coetzee, C.G. 1969. Thermoregulatory behaviour of the vegetarian lizard *Angolosaurus skoogi* on the vegetationless northern Namib Desert dunes. *Scientific Papers of the Namib Desert Research Station*. No. 47: 95-103.
- Pietruszka, R.D. 1986. Maxithermy and the thermal biology of an herbivorous dune lizard. (ms).
- Pietruszka, R.D., Hanrahan, S.A., Mitchell, D. and M.K. Seely. 1986. Lizard herbivory in a sand dune environment: the diet of *Angolosaurus skoogi*. *Oecologia* 70: 587 - 591.
- Seely, M.K. and Mitchell, D. 1986. Is the subsurface environment of the Namib Desert dunes a thermal haven for chthonic beetles? *S. Afr. J. Zool.* (in press).
- Steyn, W. 1963. *Angolosaurus skoogi* (Andersson) - a new record from South West Africa. *Cimbebasia* 6: 8 - 11.
- Dr. R.D. Pietruszka is a Research Associate with DERU



Many visitors from southern Africa and overseas visit Gobabeb during the course of a year. During 1986 more than thirty visitors carried out research in the Namib. One of the regular visitors is Prof. Gideon Louw, University of Cape Town, shown here with Blythe Loutit examining a *Welwitschia* plant.



Another regular visitor, Prof. Duncan Mitchell, University of the Witwatersrand is shown here preparing a thermal telemeter to measure temperature in an *Angolosaurus skoogi* lizard as it runs free on a Namib dune slipface.