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Microfaunal remains from Mirabib: some evidence of palaeo-ecological changes in the Namib

by

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ABSTRACT

Microfaunal remains, derived from disintegrated owl pellets, from stratified dateable remains in the Mirabib shelter, were used to determine palaeo-ecological changes in the Namib. It was estimated that a minimum of 2308 individual animals, of which 87% were found to be either gerbils or geckos, contributed to the remains studied. The evidence suggests that dune sand was not present within the owl-hunting range of Mirabib during the 6000 years for which faunal evidence was available. The overall indications for the last 6000 years suggest that a more favourable habitat was present during the accumulation of these sediments than is the case today.

1 INTRODUCTION (by C. K. B.)

The Mirabib shelter, intensively studied by Dr Sandelowsky, contains evidence of human occupation over more than 8000 years. It also contains a wealth of microfaunal remains from the regurgitated pellets of owls—owls which used the shelter as a roost or breeding site. The remains are preserved in stratified, dateable layers and therefore represent an extremely valuable record of small animal life available to the owls in the immediate vicinity of the Mirabib Hills over thousands of years.

The faunal composition of owl pellet remains can provide useful information about the habitat in which the animals lived. The potential of the Mirabib area from this point of view was recently explored (Brain 1974) when two collections of owl pellets, one from Mirabib and the other from Homeb on the Kuiseb River 30 km to the south east were analysed. It was found that differences in the faunal composition of the two collections reflected differences in habitat between the two locations. The Homeb owl roost provided access to the dune sand areas south of the Kuiseb River as well as to rocky, gravelly and river bed situations. Owls hunting from the Mirabib roost would not have access to the dune sand environment and so would have hunted animals living on gravel plain and rocky substrates only. The most striking difference in the faunal composition of the two prey samples centred round the incidence of the golden mole, *Eremitalpa granti namibensis.* This species is widespread in the arid west of southern Africa but the subspecies *namibensis* is restricted to the dune areas of the central Namib (Coetzee 1969). The prefered substrate is loose dune sand, in which the golden mole "swims", although penetration into the silts of the Kuiseb River bed has also been noted (Holm 1969). *Eremitalpa* individuals constituted 15 % of the animals in the Homeb prey sample, but were entirely absent from the Mirabib collection.

It seems reasonable to assume therefore that the presence of *Eremitalpa* in a prey sample indicates

TABLE 1: Minimum numbers of individuals for each of the taxa in the various squares and levels

Level	Rodents								Insectivores						Birds		Reptiles				Invertebrates			Totals	
	Gerbillinae		Dendro-murinae		*Petromys* sp		Other rodents		Macros-celidae		Soricidae		Chrysochlor-idae		Aves indet		Gekkonidae		*Chamaeleo* sp		Solifugae		Insecta indet		
Square B 35	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n	%
Surface—datum	89	59,3	0	0	0	0	0	0	10	6,7	0	0	0	0	11	7,3	34	22,7	0	0	6	4,0	×	150	100,0
0— 5 cm	59	43,4	2	1,4	0	0	0	0	2	1,5	0	0	0	0	3	2,2	69	50,7	0	0	1	0,7	×	136	99,9
5—10 cm	41	56,9	1	1,4	0	0	0	0	6	8,3	2	2,8	0	0	1	1,4	21	29,2	0	0	0	0	×	72	100,0
10—15 cm	72	38,5	0	0	3	1,6	0	0	10	5,3	0	0	0	0	4	2,1	98	52,4	0	0	0	0	×	187	99,9
15—20 cm	52	80,0	1	1,5	0	0	0	0	1	1,5	0	0	0	0	1	1,5	10	15,4	0	0	0	0	×	65	99,9
20—25 cm	60	56,1	4	3,7	0	0	0	0	6	5,6	0	0	0	0	2	1,9	35	32,7	0	0	0	0		107	100,0
25—30 cm	19	43,2	2	4,5	0	0	0	0	2	4,5	0	0	0	0	3	6,8	18	40,9	0	0	0	0	×	44	99,9
30—35 cm	3	37,5	0	0	0	0	0	0	0	0	0	0	0	0	3	37,5	2	25,0	0	0	0	0		8	100,0
35—40 cm	1	33,3	0	0	0	0	0	0	0	0	0	0	0	0	1	33,3	1	33,3	0	0	0	0		3	100,0
40—45 cm	1	50,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	50,0	0	0	0	0		2	100,0
	397	51,3	10		3		0		37		2		0		29		289		0		7		×	774	
Square C 35																									
Surface—datum	30	58,8	0	0	0	0	0	0	1	2,0	0	0	0	0	1	2,0	19	37,3	0	0	0	0	×	51	100,1
0— 5 cm	10	76,9	0	0	1	7,7	0	0	0	0	0	0	0	0	0	0	2	15,4	0	0	0	0	×	13	100,0
5—10 cm	31	81,6	1	2,6	0	0	0	0	0	0	0	0	0	0	1	2,6	5	13,2	0	0	0	0		38	100,0
10—15 cm	64	56,1	16	14,0	0	0	1	0,9	1	0,9	0	0	0	0	1	0,9	31	27,2	0	0	0	0	×	114	100,0
15—20 cm	100	69,0	7	4,8	0	0	1	0,7	1	0,7	0	0	0	0	3	2,1	33	22,8	0	0	0	0	×	145	100,1
20—25 cm	148	73,3	33	16,3	0	0	1	0,5	2	1,0	0	0	1	0,5	2	1,0	15	7,4	0	0	0	0	×	202	100,0
25—30 cm	41	65,1	8	12,7	0	0	3	4,8	1	1,6	0	0	0	0	2	3,2	8	12,7	0	0	0	0		63	100,1
30—35 cm	35	74,5	5	10,6	0	0	1	2,1	1	2,1	0	0	0	0	2	4,2	3	6,4	0	0	0	0		47	99,9
35—40 cm	9	81,8	1	9,1	0	0	0	0	0	0	0	0	0	0	0	0	1	9,1	0	0	0	0		11	100,0
40—45 cm	3	50,0	0	0	0	0	0	0	0	0	0	0	0	0	1	16,7	2	33,3	0	0	0	0		6	100,0
45—50 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100,0	0	0	0	0	0	0		1	100,0
50—55 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
55—60 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0
60—65 cm	2	66,7	1	33,3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	100,0
	473	68,2	72		1		7		7		0		1		14		119		0		0			694	
Square D 35																									
Surface—datum	1	16,7	0	0	0	0	0	0	1	16,7	0	0	0	0	0	0	4	66,7	0	0	0	0		6	100,1
0— 5 cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100,0	0	0	0	0		1	100,0
5—10 cm	6	40,0	0	0	0	0	0	0	0	0	0	0	0	0	1	6,7	8	53,3	0	0	0	0		15	100,0
10—15 cm	24	58,5	0	0	0	0	0	0	1	2,4	0	0	0	0	1	2,4	15	36,6	0	0	0	0		41	99,9
15—20 cm	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20—25 cm	27	62,8	3	7,0	0	0	0	0	1	2,3	0	0	0	0	2	4,6	9	20,9	1	2,3	0	0		43	99,9
25—30 cm	72	55,8	14	10,8	0	0	1	0,8	2	1,5	0	0	0	0	0	0	41	31,5	0	0	0	0		130	100,0
30—35 cm	57	70,4	7	8,6	0	0	2	2,4	2	2,5	0	0	0	0	0	0	13	16,1	0	0	0	0		81	100,0
35—40 cm	65	66,3	10	10,2	1	1,0	2	2,0	2	2,0	0	0	0	0	1	1,0	17	17,3	0	0	0	0		98	99,8
40—45 cm	42	85,7	1	2,0	0	0	0	0	1	2,0	0	0	0	0	0	0	5	10,2	0	0	0	0		49	99,9
45—50 cm	13	59,1	3	13,6	0	0	2	9,0	1	4,5	0	0	0	0	0	0	3	13,6	0	0	0	0		22	99,8
50—55 cm	1	50,0	0	0	0	0	1	50,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	100,0
55—60 cm	3	75,0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	25,0	0	0	0	0		4	100,0
	311		38		1		8		11		0		0		5		117		1		0			492	

TABLE 1 (continued)

Level	Rodents								Insectivores						Birds		Reptiles				Invertebrates			Totals	
	Gerbillinae		Dendro-murinae		*Petromys* sp		Other rodents		Macros-celidae		Soricidae		Chrysochlor-idae		Aves indet		Gekkonidae		*Chamaeleo* sp		Solifugae		Insecta indet		
Square E 35	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n	%
Surface—datum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0— 5 cm	6	46,2	0	0	0	0	1	7,7	0	0	0	0	0	0	0	0	6	46,2	0	0	0	0		13	100,1
5—10 cm	1	25,0	0	0	0	0	1	25,0	0	0	0	0	0	0	0	0	2	50,0	0	0	0	0		4	100,0
10—15 cm	14	40,0	0	0	1	2,9	0	0	3	8,6	0	0	0	0	3	8,6	14	40,0	0	0	0	0		35	100,1
15—20 cm	21	61,8	0	0	0	0	0	0	1	2,9	0	0	0	0	1	2,9	11	32,4	0	0	0	0		34	100,0
20—25 cm	28	59,6	1	2,1	1	2,1	1	2,1	2	4,3	0	0	0	0	1	2,1	13	27,7	0	0	0	0		47	100,0
25—30 cm	24	63,2	1	2,6	0	0	0	0	1	2,6	0	0	0	0	0	0	12	31,6	0	0	0	0		38	100,0
30—35 cm	25	73,5	1	2,9	1	2,9	0	0	1	2,9	0	0	0	0	0	0	6	17,7	0	0	0	0		34	99,9
35—40 cm	21	65,6	1	3,1	0	0	1	3,1	1	3,1	0	0	0	0	1	3,1	7	21,9	0	0	0	0		32	99,9
40—45 cm	42	68,9	5	8,2	1	1,6	0	0	1	1,6	0	0	0	0	1	1,6	11	18,0	0	0	0	0	×	61	99,9
45—50 cm	26	66,7	5	12,8	1	2,6	0	0	1	2,6	1	2,6	0	0	1	2,6	4	10,3	0	0	0	0		39	100,2
50—55 cm	5	62,5	1	12,5	0	0	0	0	1	12,5	0	0	0	0	0	0	1	12,5	0	0	0	0		8	100,0
55—bedrock	1	33,3	0	0	0	0	0	0	1	33,3	0	0	0	0	0	0	1	33,3	0	0	0	0		3	100,0
	214		15		5		4		13		1		0		8		88		0		0			348	
Overall Totals	1395		135		10		19		68		3		1		56		613		1		7			2308	

TABLE 2: Summary

Level	Rodents								Insectivores						Birds		Reptiles				Invertebrates			Totals
	Gerbillinae		Dendro-murinae		*Petromys* sp		Other rodents		Macros-celidae		Soricidae		Chrysochlor-idae		Aves indet		Gekkonidae		*Chamaeleo* sp		Solifugae		Insecta indet	
Combined squares 35 B—E	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n
Surface—datum	120	58,3	0	0	0	0	0	0	12	5,8	0	0	0	0	11	5,3	57	27,7	0	0	6	2,9	×	206
0— 5 cm	75	46,0	2	1,2	1	0,6	1	1,2	2	1,2	0	0	0	0	3	1,8	78	47,9	0	0	1	0,6	×	163
5—10 cm	79	61,3	2	1,6	0	0	1	0,8	6	4,7	2	1,6	0	0	3	2,3	36	27,9	0	0	0	0	×	129
10—15 cm	174	46,5	16	4,3	4	1,1	1	0,3	15	4,0	0	0	0	0	6	1,6	158	42,2	0	0	0	0	×	374
15—20 cm	173	70,0	8	3,2	0	0	1	0,4	3	1,2	0	0	0	0	8	3,2	54	21,9	0	0	0	0	×	247
20—25 cm	263	65,9	41	10,3	1	0,3	2	0,5	11	2,8	0	0	1	0,3	7	1,8	72	18,1	1	0,3	0	0	×	399
25—30 cm	156	56,7	25	9,1	0	0	4	1,5	6	2,2	0	0	0	0	5	1,8	79	28,7	0	0	0	0	×	275
30—35 cm	120	70,6	13	7,7	1	0,6	3	1,8	4	2,4	0	0	0	0	5	2,9	24	14,1	0	0	0	0		170
35—40 cm	96	66,7	12	8,3	1	0,7	3	2,1	3	2,1	0	0	0	0	3	2,1	26	18,1	0	0	0	0		144
40—45 cm	88	74,0	6	5,0	1	0,8	0	0	2	1,7	0	0	0	0	3	2,5	19	16,0	0	0	0	0	×	119
45—50 cm	39	62,9	8	12,9	1	1,6	2	3,2	2	3,2	1	1,6	0	0	2	3,2	7	11,3	0	0	0	0		62
50—55 cm	6	60,0	1	10,0	0	0	1	10,0	1	10,0	0	0	0	0	0	0	1	10,0	0	0	0	0		10
55—60 cm	6	60,0	1	10,0	0	0	0	0	1	10,0	0	0	0	0	0	0	2	20,0	0	0	0	0		10
Overall Totals	1395		135		10		19		68		3		1		56		613		1		7			2308

the presence of an aeolean sand habitat within the hunting range of the owls. It is unfortunate that we do not know what the typical limits of a barn owl's hunting range are. Presumably the range would be larger in situations where prey is scarce. All that can be said at present is that owls using the Mirabib roost do not fly the 25 km to the nearest dune sand in order to catch their prey.

In the light of the *Eremitalpa* considerations, it was immediately apparent that the stratified, dateable remains in the Mirabib shelter could tell us whether the dunes, currently restricted to the area south of the Kuiseb, had at any stage in the timespan involved crossed the river and spread to the north. The Kuiseb River forms a very spectacular dividing line between the duneland to the south and gravel plains to the north; it would be of great interest to know whether this barrier has been of long standing. Evaluation of other faunal elements in the sample could also perhaps throw light on the nature of the Mirabib habitat as it existed in the past.

2 THE MICROFAUNAL SAMPLE AND ITS ANALYSIS (by V.B.)

The excavation of the Mirabib shelter has been described in detail (Sandelowsky 1974, and this volume). A horizontal grid was laid out and 14 square metres have been excavated by Dr Sandelowsky. The datum level conformed to the natural surface over part of the area involved but dipped to 10 cms below the surface in some squares. Excavation of the loose deposit was undertaken with great care in 5 cm spits, all sediment being screened so that cultural, plant and faunal material could be removed by hand from the screens. The microfaunal material was placed in paper packets marked according to square and level.

For the purpose of the present analysis, four squares, designated 35 B—E were selected. These formed part of the original trial trench orientated approximately at right angles to the trend of the back wall of the shelter, and situated immediately below the ledges used as owl roosts and breeding sites over a considerable period of time.

Microfaunal remains, derived from disintegrated owl pellets, occurred in all levels to a depth of 55—60 cms, but were absent in the lowest levels of the profile; they were less numerous below 40 cms than above it. Likewise, remains were most numerous in the square closest to the owl roost, i.e. square 35 B. The abundance of bones declined progressively in the sequence of squares 35 B—E. Samples from every 5 cm spit in each of the four squares were sorted and analysed separately. Sorting was done under an illuminated magnifier, the aim being to remove all parts which could be used in the compilation of a table reflecting the minimum numbers of individual animals which had contributed to the sample.

The method used in compiling a list of the minimum numbers of individual animals consisted of isolating and counting diagnostic parts of the animals involved. The individual count for each taxon would be based on that part of the skeleton which occurred most abundantly. The remains tended to be very fragmentary, doubtless due to trampling by men and animals within the shelter. Complete skulls were invariably absent.

In the case of rodents and insectivores, all maxillary and mandibular pieces were sorted out. These were then separated taxonomically and re-sorted into left and right maxillary or mandibular pieces. Minimum numbers for each taxon per level were then determined. It was found that many elements in a golden mole skeleton are easily recognisable and all these would have been removed, had they occurred. The same is true of bird bones — the count of birds was based on a wide variety of cranial and post-cranial parts.

Reptile numbers were based on counts of left and right maxillary and mandibular pieces, while numbers of sun spiders (Solifugae) were estimated on the occurrence of characteristic mouthparts. No attempt was made to estimate the numbers of individual insects per level or square. Presence or absence of insect remains was simply noted.

It was estimated that a minimum of 2308 individual animals had contributed to the remains in the four squares studied. Of these, 774 occurred in square 35 B (closest to the owl roost), 694 in C, 492 in D and 348 in E (furthest from the roost). Details of the minimum numbers of individuals for each of the taxa in the various squares and levels are given in Table 1.

It will be seen that 2008, or 87 %, of all the individual animals represented in the whole sample were found to be either gerbils or geckos: these creatures have formed the staple diet of Mirabib owls for thousands of years. Nevertheless, a variety of other animals is also represented. Some comments on the various taxa are now provided.

2.1 Subfamily Gerbillinae: the gerbils.

Gerbils comprise by far the largest faunal component. They apparently consist mostly of *Gerbillurus vallinus* individuals though *G. paeba* is likely to be represented as well. Definite separation of the fragmentary material is difficult. *Desmodillus auricularis* is also likely to be present in small numbers; separation of these from *Gerbillurus* specimens is possible if the alveoli of the first molars are counted. According to Coetzee (1972), *Desmodillus* first molars have three alveoli, *Gerbillurus* have four. Unfortunately, the diagnostic tympanic bullae of the gerbil skulls are never preserved in the Mirabib material.

2.2 Subfamily Dendromurinae

Fragmentary remains of dendromurines may be recognised by the well-developed "masseter knobs" present on the maxillae (Coetzee 1972). In his checklist of mammals of the Mirabib area, Stuart (1976) does not record the presence of dendromurines, but it is known that the long-eared desert mouse, *Malacothrix typica* is difficult to trap (Smithers 1971).

All the dendromurine remains from Mirabib are provisionally assigned to *Malacothrix typica,* though further study on a larger sample is desirable.
Petromys sp. remains are likely to belong to the extant species *P. typicus,* the dassie rat, known from the area.

2.3 Other rodents

Remains of rodent taxa other than those already referred to are rare, but do occur. Further study is warranted, preferably on a larger sample including remains from other grid squares.

Genera represented include *Rhabdomys, Aethomys* and *Petromyscus.*

2.4 Macroscelidae

Three different form of elephant shrew are known from the Mirabib area: *Macroscelides proboscideus, Elephantulus rupestris* and *E. intufi.* All are likely to be represented in the remains although separation into the species has not yet been made.

2.5 Soricidae

Remains of only three individual shrews were found. They are provisionally referred to *Crocidura sp. C. cyanea* is known to occur at Gobabeb.

2.6 Chrysochloridae

The golden mole *Eremitalpa granti namibensis* is present in the dune area south of the Kuiseb River. The single humerus found is referred to this species.

2.7 Aves

The bird remains have not yet been studied in detail. All come from small birds of approximately lark-size.

2.8 Gekkonidae

Most of the geckos represented in the sample are comparatively large ones and are thought to come from *Pachydactylus bibroni,* a common species on the rocky outcrops. Other forms may also be represented, such as *Chondrodactylus* and the smaller *Ptenopus.*

2.9 Chamaeleo sp.

The mandible of a single Namaqua chameleon, *Chamaeleo namaquensis* was found.

2.10 Solifugae

Sun spiders, as yet undetermined specifically, are regularly preyed upon by contemporary barn owls at Mirabib. Their remains are found in the upper levels of the cave deposit.

2.11 Insecta

The presence of beetles, largely Tenebrionids, was noted in many of the layers, as reflected in Table 1. No attempt was made to estimate numbers of individuals or to identify species present.

3 INTERPRETATION OF THE RESULTS (by C.K.B.)

The purpose of this study is to establish what animals are represented in each level of the cave sediment and to draw conclusions, if possible, from these remains concerning past environmental conditions. In particular answers were sought to two specific questions:

1. Did the dunes cross the Kuiseb River at any stage during the time spanned by the remains?
2. Is there evidence of rainfall or habitat change during the period?

The major features apparent in the composition of the sample as a whole are:

(a) The spectrum of prey animals is dominated by gerbils and geckos.

(b) The long-eared desert mouse, *Malacothrix typica,* was well-represented in the past but declines towards the top of the sequence and is absent in the uppermost layer.

(c) Rodents, other than gerbils and dendromurines, occur at very low frequency.

(d) Elephant shrews (Macroscelids) are represented throughout the deposit in small numbers.

(e) Shrews (Soricids) and golden moles (Chrysochlorids) are virtually absent.

(f) Birds, as yet unidentified, are a consistent but small component of the owls' prey.

(g) The only reptile, other than geckos, represented in the remains was a Namaqua chameleon, *Chamaeleo namaquensis.*

(h) Parts of sun spiders (Solifugae) are found in the uppermost levels only. It is possible that their chitinous mouthparts have decomposed in the lower layers, if they had been present there.

(i) Tenebrionid beetle remains occur in small numbers at various depths.

Some evidence bearing on the two questions posed earlier will now be considered.

1. *Did the dunes cross the Kuiseb at any stage during the time-span of the remains?*

As mentioned earlier in this paper, the golden mole *Eremitalpa granti namibensis* is a common inhabitant of the dune sand areas to the south of the Kuiseb River. Pellets collected from a barn owl roost at Homeb on the Kuiseb River contained a 15 % *Eremitalpa* component among its prey items (Brain 1974). Those from the gravel plain/rock habitat of Mirabib itself contained no *Eremitalpa* remains. It therefore seems reasonable to assume that, had the dunes advanced to the vicinity of Mirabib in the past, the associated *Eremitalpa* populations would have moved with them. The remains from all levels of the Mirabib excavation were carefully examined for traces of *Eremitalpa;* a single humerus was found in the 20—25 cms sample and is probably 3000—4000 years old. Apart from the presence of this single individual, the presence of which is difficult to explain, the Mirabib prey sample is devoid of golden mole remains.

The evidence suggests that dune sand was not present within the owl-hunting range of Mirabib during the 6000 years or so for which we have faunal evidence. It is very likely that the Kuiseb River served as an effective barrier to northward dune migration over this period.

2. *Is there evidence of rainfall or habitat change during the period?*

There is indeed some information to be gained on past environmental conditions from

(a) the occurrence of *Malacothrix*

(b) an evaluation of the gerbil/gecko relationship.

(a) *Malacothrix typica,* the long-eared desert mouse is widely distributed in the arid areas of southern Africa. Coetzee (1972) states that this species "prefers soil rich in lime content" and that, in South West Africa, it is found in the eastern areas and Ovamboland as well as in his survey of mammals of Botswana, Smithers (1971) found *Malacothrix* to be widespread in the Kalahari and states: "the species is particularly associated with short grass on hard ground, occurring on the fringes of pans with a cover of karroid bush, or on hard calcareous ground".

As is apparent in Figure 1, *Malacothrix* remains occur throughout the Mirabib profile, with the exception of the uppermost layer. It is quite possible that a small *Malacothrix* population exists in the Mirabib area today but its presence has not been recorded due to difficulties in trapping this species. As shown in Figure 1, the highest percentage abundances of *Malacothrix* are associated with the "vegetation-rich" and "sandy" layers, suggesting that a more favourable habitat was present during the accumulation of these sediments than is the case today.

(b) *The gerbil/gecko relationship*

An interesting aspect of the percentage abundance figures given in Table 2 is that, in all layers where the samples are sufficiently large to be meaningful (ie. from surface to 40 cms), a remarkable relationship exists between the percentage abundance of gerbils and that of geckos. The results are presented in Figure 2 where it is visually apparent that the relationship in each layer is a reciprocal one — where the percentage abundance of gerbils increases, that of geckos declines.

Gerbils and geckos constitute the major component in the prey of owls at Mirabib. A study of contemporary owl pellets, collected at regular intervals in the Mirabib Hills, is being made (Stuart and Brain, in preparation). This study has provided a key to the understanding of the gerbil/gecko ratios in the prey of the owls. 1974 and 1975 were exceptionally wet years in the Namib Park resulting in more luxuriant growth of grass round Mirabib than had been seen for many years. In response to the more favourable conditions, the gerbil populations on the grass-covered plains increased dramatically; occupied burrows could be observed in far greater abundance than had been the case before.

It appears from the owl pellet study that barn owls favour gerbils as prey when these are readily available, but fall back on geckos as a stop-gap when rodents are more difficult to obtain. The sample of pellets collected at Mirabib in August 1972, before local conditions improved as a result of the exceptional rains, contained 60 % gerbils and 21 % geckos (Brain 1974). It seems likely that the remains came largely from rock-living *Pachydactylus* individuals.

With the improvement of conditions at Mirabib, the new pellets were found to contain gerbils to the almost total exclusion of other prey; the representation of geckos became insignificant. One may confidently predict however that, as the grass cover at Mirabib

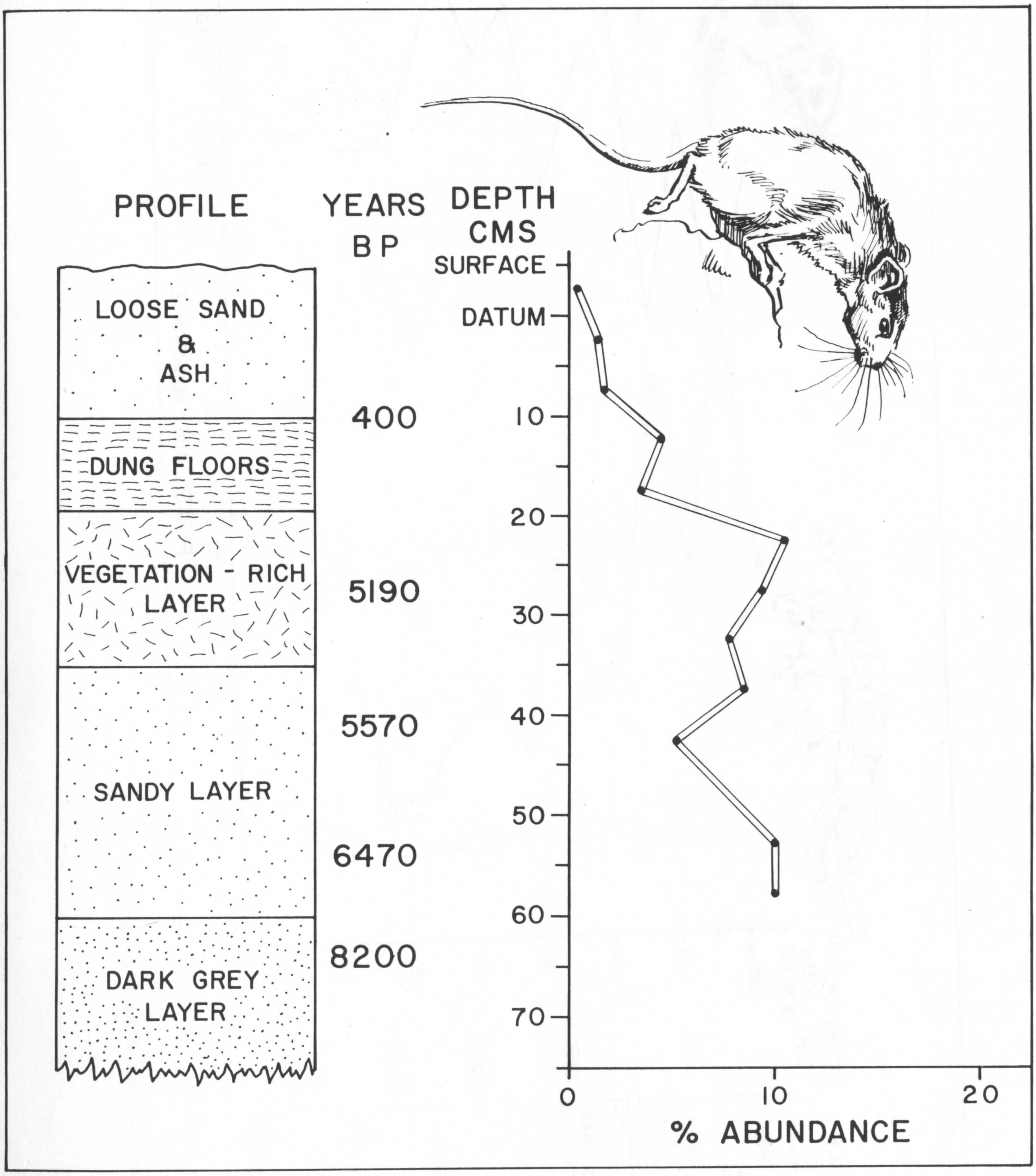

Figure 1: Occurence of *Malacothrix* remains in the Mirabib profile.

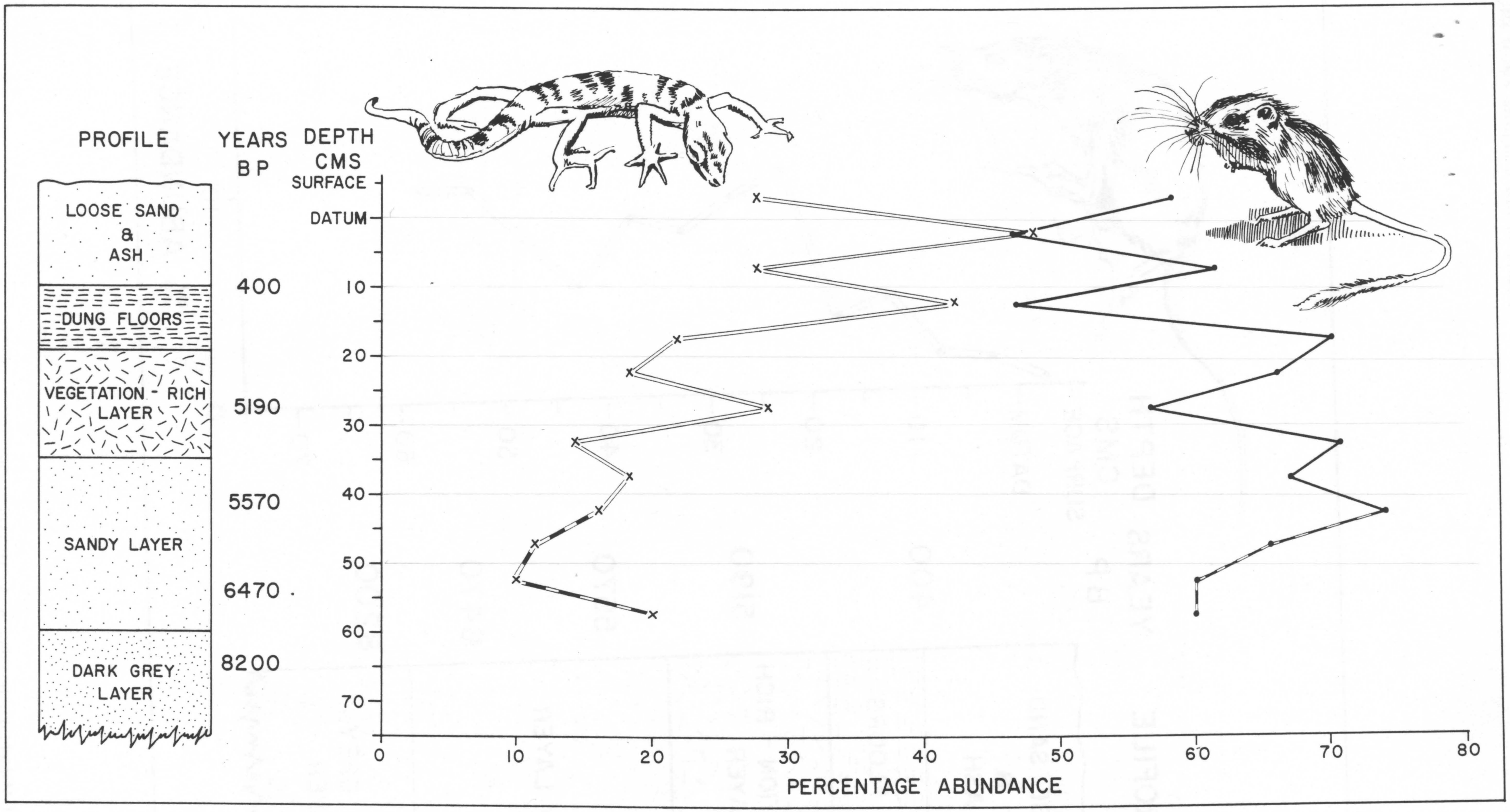

Figure 2: Percentage abundance of gerbils and geckos

gradually deteriorates again, the abundance of gerbils will decrease and geckos will once again figure more prominently in the prey samples.

It would be very valuable if data could be collected on the response of gerbil and gecko populations to the periodic and dramatic changes in rainfall which occur in the Namib. It seems unlikely that the geckos would be able to increase their numbers as rapidly in response to better conditions as is the case with gerbils. The rock-living geckos probably represent a fairly stable, standing resource which can be preyed upon at any time.

On the basis of this reasoning, the graphs for percentage abundance of gerbils and geckos in the various Mirabib layers (Fig. 2.) may be interpreted. Layers showing high gerbil percentages, with associated low gecko ones, suggest times of higher rainfall, more luxuriant vegetation and larger gerbil populations.. Conversely, layers with lower gerbil percentages, but higher gecko ones, suggest drier times when the owls relied more heavily on the gecko resource.

Referring to the graphs in Figure two, layers suggest conditions drier than those of today (by "today" is meant recent years prior to the exceptional seasons of 1974-6). These are the 0—5 cms and 10—15 cms levels, both of which probably accumulated somewhere within the last 500 years. Level 25—30 cms, dated at approximately 5200 years B.P., suggests conditions very like those of today, while all the rest appear to reflect wetter conditions.

The overall indication for the last 6000 years is that conditions were consistently more favourable than they are at present, with the exception of two dry periods within the last 500 years.

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