Micromammals and environmental change at Zebrarivier, central Namibia

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1. Introduction

Zebrarivier (24°31'S; 17°16'E) is a fissure-like cave situated on a ridge above the confluence of the Zebra River and a smaller stream in the Zaris Mountains of central Namibia (WENDT, 1972; pers. comm.) at an altitude of 1330 m. The vegetation of the region is Dwarf Shrub Savanna (9) dominated by Karoo shrubs and grasses (GIESS, 1971) and there are patches of Semi-desert and Savanna Transition (Escarpment Zone) (4) on the lower slopes; the normal annual rainfall is about 160 mm, received mainly in the summer (W.E. WENDT, pers. comm). The deposits are generally 115 cm thick and contain both Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts. The original excavation has been described in a preliminary report by WENDT (1972) and the larger fauna has been analysed by CRUZ-URIBE & KLEIN (1983). The present report concerns the micromammalian remains from square D1 which was excavated in 1981. It is likely that most of the small mammal remains were deposited in the site by owls, probably the barn owl *Tyto alba* in this case. One possible exception is *Petromus typicus*, dassie rat, which is almost certainly too large for the barn owl to take but could well have lived in the cave. The bats may or may not have died naturally in the cave.

2. Methods

The excavation was conducted in artificial spits because of the difficulty of determining natural breaks in the deposits (WENDT, 1972:7). This poses problems when it comes to establishing minimum numbers of animals represented in the deposits, as CRUZ-URIBE & KLEIN (1983:93) have pointed out. There appears, however, to have been a break in deposition between the MSA and LSA levels. This is suggested by the dates of 11 900 ± 90 B.P. (Pta-1996) in the LSA sequence (spit -5) and of >48 200 B.P. (Pta-2142) in the MSA sequence (spit -56) (CRUZ-URIBE & KLEIN, 1983: 97; W. E. WENDT, pers. comm.). In these circumstances it is not unreasonable to separate the LSA and MSA sequences for purposes of establishing minimum numbers of individuals. Beyond this there are two possibilities; one can assume that each spit represents a discrete unit, with no potential mixing, or that the entire sample must be treated as a homogeneous unit because there is potential mixing. The truth

Table 1: Minimum and absolute minimum numbers of individual micromammals represented in the sample from square D1 at Zebrarivier.

	MSA		LSA	
Insectivora	MNI	AMNI	MNI	AMNI
30 *Elephantulus* cf *rupestris* Smith's rock elephant shrew	—	—	6+?1	3
31 *Macroscelides proboscideus* short-eared elephant shrew	—	—	2+?1	2
36 *Crocidura cyanea* reddish-grey musk shrew	—	—	12	7
48 *Suncus varilla* lesser dwarf shrew	—	—	4	3
Chiroptera				
81 *Rhinolophus capensis* Cape horseshoe bat	1	1	2	2
97 *Hipposideros commersoni* Commerson's leaf-nosed bat	1	1	—	—
112 *Eptesicus capensis* Cape serotine	—	—	1	1
Rodentia				
201 *Saccostomus campestris* pouched mouse	—	—	1	1
211 *Steatomys parvus* tiny fat mouse	—	—	3	2
215 *Desmodillus auricularis* short-tailed gerbil	—	—	8	7
216 *Gerbillirus paeba* hairy-footed gerbil	1	1	3	2
223 *Tatera* cf *brantsii* highveld gerbil	—	—	6	5
234 *Aethomys namaquensis* Namaqua rock mouse	—	—	19	12
239 *Mus indutus* desert pygmy mouse	—	—	2	2
250 *Rhabdomys pumilio* striped mouse	—	—	16	10
260 *Otomys* cf *irroratus* vlei rat	—	—	3	2
267 *Parotomys* cf *littledalei* Littledale's whistling rat	4	3	18	13
270 *Petromyscus collinus* pygmy rock mouse	—	—	1	1
288 *Petromus typicus* dassie rat	2	2	5	3
TOTAL	9	8	114	78

see text for explanation of MNI and AMNI.
Faunal list according to SWANEPOEL *et al.* 1980.

of the matter almost certainly lies somewhere between these two extremes but, under the circumstances, there is no valid way of determining exactly where the divisions lie. One must therefore decide which of the possibilities is the most likely to be closer to reality, or even whether it makes a great deal of difference which method one chooses. Table 1 shows the results of calculating minimum numbers in two different ways. Assuming the spits to be discrete units, one calculates the minimum number of individuals (MNI) of each species represented in each spit. The minimum numbers for each spit are then added to produce the total for the site. However, should one decide to adopt the cautious approach implied by the second possibility, one would first add like bones (here left and right mandibles and maxillae) from each spit. From this total for the whole sequence or site one would then determine the absolute minimum number of individuals (AMNI). As was suggested above, the true minimum number that actually came into the site will almost certainly have been somewhere between these two estimates. Whether it matters which estimate is likely to be the more accurate will depend to a large extent upon the amount of detail required or attempted in the interpretation. In the present case the relatively low overall numbers will allow only a fairly generalised interpretation. Table 2 does show, however, that there is some variation in quantities of micromammals in the various spits.

3. Environmental interpretation

Initially it is instructive to examine the evidence of the faunal list as a whole (see Table 1). The list reflects clearly the various aspects of the topography and vegetation as they exist today (Fig. 1 & 2). There are high proportions of rock-loving species (*Elephantulus* cf *rupestris, Macroscelides proboscideus, Aethomys namaquensis,*

Fig. 1: View towards the narrow entrance of the cave (↓) in a low ridge between the Zebrarivier (behind) and a smaller tributary (towards the right).

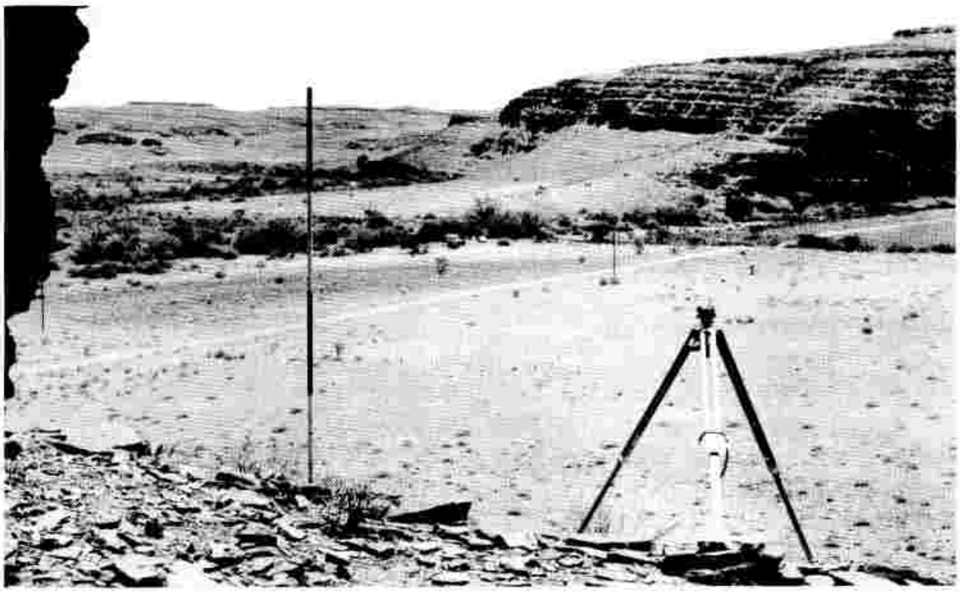

Fig. 2: View from the cave towards WNW across the gravel plains, the silt terrace (around the car), the narrow strips of riverine vegetation along the tributary and further in the background along the bed of the west-flowing Zebrarivier onto the mostly rather steep flanks of flat-topped hills of the Zaris Mountains.
Photos: W.E. WENDT

Petromyscus collinus and *Petromus typicus*) which is consistent with the mountainous nature of the area. The flatter areas, and perhaps the silt terrace near the river (W.E. WENDT, pers. comm.), are represented by *Steatomys parvus, Desmodillus auricularis, Gerbillurus paeba, Tatera* cf *brantsii* and *Parotomys* cf *littledalei.* The riverine vegetation is indicated by *Crocidura cyanea, Suncus varilla, Rhabdomys pumilio* and *Otomys cf irroratus,* while the xeric nature of the general vegetation is reflected in the presence of the elephant shrews *(E. cf rupestris, M. proboscideus),* the gerbils *(D. auricularis, G. paeba)* and various mice *(Mus indutus, P. cf littledalei, P. collinus* and *P. typicus).*

CRUZ-URIBE & KLEIN (1983) have commented at some length on the effects of small sample size on interpretations. In the present case it will suffice to mention that, while absence of a species is generally less significant than presence, this is particularly true of small samples. It is, however, conceivable that in some cases absence may have been real rather than an artefact of sample size. This is perhaps especially likely in a site such as Zebrarivier where a long period of time is represented, and also in cases where the absence is consistent in a particular part of the deposit. In the present case it is noticeable that several species are represented in the lower part of the Holocene (LSA) sequence but not in the upper part. It is possible that there was a slightly wetter phase during the period of deposition of spits -17 up to +5. This is suggested by the presence of *Suncus varilla* and *Otomys* cf *irroratus* in various of these spits but not in any others before or after that time. *Rhabdomys pumilio* is also absent from earlier spits and rather less frequent above this. W.E. WENDT (pers. comm.) has pointed out that in the terrestrial snail fauna, identified by A. ZILCH (see Appendix, Table 3) there is a greater number of species and individuals represented in spits -23 up to -6. In the micromammals it is spits -17 up to +2 which exhibit this phenomenon (Table 2). The delay in the micromammals could be due to slower reaction time in the mammals than in the invertebrates. There is also a higher proportion of reptiles (lizards and snakes) and especially amphibians (frogs) at much the same time but, interestingly, no corresponding increase in birds. In general, it seems quite likely that the greater diversity at this time could indicate more equitable conditions. Under the circumstances this would almost certainly constitute higher rainfall and, therefore, better plant cover.

There remains a flaw in the argument; the greater species diversity may be due to the fact that the samples are larger than they are in other spits. In some other spits species diversity is at its maximum since each species is represented by one individual and the number of species is initially constrained by the size of the sample rather than any other fact. Variation in sample size from spit to spit may be the significant factor and this could be due to a number of reasons that have nothing to do with the environment. For instance, a longer period of time may be represented by the deposit or the proportion of time people and owls occupied the cave may have changed. The latter is probably not the case because there is some indication (CRUZ-URIBE & KLEIN, 1983) that the macromammals follow the same general trend as the microfauna, assuming the former were left in the cave by people. The likelihood exists, therefore, that the area was in fact more productive during the terminal Pleistocene or early Holocene than it has been at any time since then. This could also be in line with evidence for moister conditions c 21 000 B.P. at Gobabeb and Homeb, extensive flooding of the Tsondab before c 14 000 B.P., and considerable lowering of the groundwater Table c 12 000 B.P. at Conception and Meob (VOGEL & VISSER, 1981).

4. Zoogeography

Apart from their uses as enviromental indicators, small mammal remains can also provide information on changes in past distribution patterns of the species concerned. In the present case they provide evidence for the past occurrence in the area of two species that are no longer found in Namibia. These are *Suncus varilla* and *Otomys* cf *irroratus*. The record of these species therefore indicates a considerable extention of range during the terminal Pleistocene, in the case of *O.* cf *irroratus*, and early Holocene, in the case of *S. varilla*. It is conceivable that these were already relict populations and that they died out subsequently due to an unfavourable change in the climate. It would be very useful to find other like-aged samples from Namibia with which it might be possible to confirm this hypothesis.

The presence of *Mus indutus* is interesting, although more material is needed to show whether or not this has continued into the present. It is only recently that the occurrence of this species, as distinct from *Mus minutoides sensu lato*, has been confirmed in southern Africa (SWANEPOEL *et al.*, 1980). The question has been discussed else-

Table 2: Minimum numbers of individual micromammals and presence of Reptilia/Amphibia and Aves in spits in square D1 at Zebravivier.

											LSA											MSA	
Insectivora	S	+23	+19	+17	+15	+11	+9	+8	+6	+5	+2	—5	—6	—12	—17	—23	—29	—35	—37	—40	—43	—48	—66
E. cf *rupestris*	1	—	1	—	—	—	—	—	—	1	1	—	—	—	1	1?	1	—	—	—	—	—	—
M. proboscideus	—	—	—	—	—	—	—	—	—	—	—	—	1?	1	1	—	—	—	—	—	—	—	—
C. cyanea	1	—	—	—	1?	1	—	—	2	—	1	—	1	1	3	—	—	1	—	—	—	—	—
S. varilla	—	—	—	—	—	—	—	—	—	1	1	—	1	—	1	—	—	—	—	—	—	—	—
Chiroptera																							
R. capensis	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	1
H. commersoni	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
E. capensis	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Rodentia																							
S. campestris	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
S. parvus	1	—	—	—	—	—	—	—	—	—	1	1?	—	—	—	—	—	—	—	—	—	—	—
D. auricularis	—	1	1	—	—	1	1	—	1	—	1	2	—	—	—	—	—	—	—	—	—	1	—
G. paeba	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—
T. cf *brantsii*	—	1	—	—	—	—	1	—	—	—	1	—	1	—	2	—	—	—	—	—	—	—	—
A. namaquensis	2	2	—	2	—	2	—	—	2	—	2	3	1	1	2	—	—	—	—	—	—	—	—
M. indutus	—	1?	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
R. pumilio	1	1	—	—	—	1	—	—	2	1	2	4	2	1	1	—	—	—	—	—	—	—	—
O. cf *irroratus*	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	—	—	—	—	—	—	—	—
P. cf *littledalei*	—	—	—	—	—	—	1	1	1	1	1	1	6	—	3	2	—	1	1	—	1	2	—
P. collinus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
P. typicus	1	—	—	—	—	—	—	—	—	—	—	—	1	2	1	—	—	—	—	1	—	1	—
TOTAL	8	6	2	2	1	5	3	1	8	4	13	12	15	8	16	3	2	5	1	1	2	4	1
Reptilia/ Amphibia	x	x	x	x	x	x	x	x	xx	x	xx	xx	xx	xx	xx	x	x	x	x	x	x	x	—
Aves	x	—	—	—	—	x	—	—	x	—	x	x	x	x	x	x	x	x	—	x	x	—	—

x present
xx more abundant

APPENDIX (Table 3)

Provisional identification of terrestrial snails from Square D 1, Zebrarivier Cave

A. ZILCH

	LSA																		MSA					
	S	+23	+19	+17	+15	+11	+9	+8	+6	+5	+2	—5	—6	—12	—17	—23	—29	—35	—37	—40	—43	—48	—66	—78
Dorcasia montana	—	—	—	—	—	—	—	—	—	—	—	—	—	1	x	x	—	—	—	x	—	1	—	—
Dorcasia connollyi	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	x	—	x
Dorcasia sp.[1]	x	—	x	x	x	x	x	x	—	—	—	x	x	x	x	—	x	x	x	—	—	—	—	—
Sculptaria namaquensis	4	1	2	2	—	—	—	—	2	—	1	—	3	—	3	4	—	1	—	—	—	—	—	—
Pupoides miniscuIus	—	—	—	1	—	—	—	—	1	1	—	2	2	3	4	7	4	4	2	—	—	—	—	1
Pupilla (Gibbulinopsis) fontana	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Euonyma sp.	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—
Xerocerastus minutus	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—
Xeroc. cf ***burchelli***	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	1	—	—	—	—
Subulinide ?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Succinea ?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Unidentified[2]	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

[1]fragments of either species
[2]apparently two different species

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where (AVERY, 1981: 272) and it is clear that more data are needed before the overall distribution of *M. indutus* can be established.

5. Conclusion

Although the sample is not large it is important in that it is only the second such sample from Namibia, the other being from Mirabib (BRAIN & BRAIN, 1977). Mirabib is in the Namib Desert; Zebrarivier is in the mountains and therefore represents a quite different region, as well as a longer period of time. It thus illustrates the potential of a long series of samples. At present, however, the evidence is suggestive but inconclusive, making clear the need for larger samples that will allow more reliable statements concerning change in past environments.

6. Acknowledgement

Dr W.E. Wendt not only supplied the sample for analysis but also provided much useful information on the site and its surroundings.

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