

A PRELIMINARY ASSESSMENT OF THE MICROMAMMALIAN REMAINS FROM GLADYSVALE CAVE, SOUTH AFRICA

by

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ABSTRACT

New micromammalian material from Gladysvale Cave has recently been collected by L.R. Berger and A.W. Keyser. The sample contains representatives of 29 species, of which five are insectivores, seven are bats and the remainder are rodents. Apart from one specimen which is possibly referable to the extinct species, *Proodontomys cookei*, the material appears to belong to extant species. Proportional representation of species varies between units. This may indicate different environmental conditions and therefore different ages for the deposits concerned. It could equally reflect different agents of accumulation. Taphonomic work should establish whether this is the case. In general terms, environmental conditions were apparently similar to those of today.

KEYWORDS: Micromammals, Pleistocene, systematics, environments

INTRODUCTION

Gladysvale Cave (2527DC) is one of a series of caves located in the Nascot Private Nature Reserve (previously the John Nash Game Reserve and, before that, the Jack Scott Private Nature Reserve), which mainly comprises the farm Uitkomst 499 JQ, in the Krugersdorp District of Gauteng, South Africa (Martini & Keyser 1989). The site is approximately 13 km northeast of the better-known Plio-Pleistocene hominid localities in the Sterkfontein valley, at an altitude of about 1600 m. The landscape is rugged with streams in heavily incised valleys draining northwards into the Skeerpoort River (Berger & Keyser 1992). The vegetation ranges from open grassland with scattered trees and bushes to more densely wooded valleys.

The caves are developed in a chert-rich dolomitic limestone, overlain by dolomite with shale intercalations (Berger & Keyser 1992). There are two caves, one with upper and lower chambers, that are linked below ground. The cave fill consists of the basal collapse breccia comprising dolomite and chert blocks cemented by flowstone. This breccia is overlain by a flowstone which is fossiliferous in places and is in turn overlain by highly fossiliferous layers of siltstone interbedded with flowstone. Above the bedded silts in the upper chamber there is unconsolidated cave soil overlain by another flowstone. Because much of the fossiliferous material was removed when the caves were mined for calcite it was necessary to collect palaeontological samples from isolated units of *in situ* deposit and from the dumps of discarded material. The various units discussed below are probably of different ages, with the unconsolidated units D5 and L5 perhaps younger than the Pink Breccia and S18/19 units (L.R. Berger, pers. comm.).

Collection of fossil material was originally undertaken by R. Broom (University of the Witwatersrand) in 1937 and a faunal list was published by Cooke (1963); current collection was begun in 1991 by L.R. Berger (University of the Witwatersrand) and A.W. Keyser (Council for Geoscience). Modern micromammalian material has been collected from the area by Vernon (1972) and Rautenbach (1982). As an interim measure, the present study provides an annotated list of the micromammalian taxa recovered thus far from Gladysvale Cave. The environmental implications of the micromammalian material will be considered in a separate paper and are therefore only briefly discussed here.

METHODS

Taxonomic arrangement is according to Meester *et al.* (1986) for extant taxa, and the extinct taxon is interpolated in the appropriate place. Identifications and minimum numbers of individuals (MNIs) are based on maxillae and mandibles only. The method used to calculate MNIs has been explained elsewhere (Avery, 1982). Briefly, however, this involves counting only those jaws that possess a particular, frequently preserved element, which has been determined for each species or group of species, to avoid counting the same jaw twice. The minimum number is the maximum count for any one jaw in individual samples as supplied by the excavators. These minimum numbers were summed to provide totals for seven larger units or collecting localities (Table 1).

The Shannon index of diversity, which takes into account both the number of species and the extent to which they are equally represented, is routinely calculated as a means of assessing general climatic

conditions because a higher value for the index equates with more equable climatic conditions. The index takes the form $H = - (P_i \ln P_i)$ where P_i is the proportion of the sample represented by each species. Table 1 gives a preliminary list of taxa identified and the percentage representation of each taxon in various units. Figure 1 shows this information in visual form as well as giving summary information for each unit or group of units. Lists of species collected in the area in recent times were extracted from Vernon (1972) and Rautenbach (1982), and are listed in Table 2. In the following systematic accounts distributional and habitat data are from Rautenbach (1982) unless otherwise stated.

(NB. It has been decided to retain the name Transvaal when referring to Rautenbach's [1982] monograph because redefining his distributional information to conform to present political boundaries would have introduced unnecessary complications.)

NUMERICAL RESULTS

The total sample comprises 355 individuals representing 29 micromammalian taxa (Table 1). Of these, four taxa are insectivores, seven are bats, 17 are rodents and one is an elephant shrew. The majority of the taxa are represented in less than half the seven units

analysed and the number of taxa per unit varies (Table 1; Figure 1) from 6 in L31 (with 15 only individuals) to 19 in S18.E6 (with 119 individuals). The best represented species is *Mystromys albicaudatus*. This taxon is dominant in most units at Gladysvale, as it is at the Sterkfontein valley sites, although it constitutes a smaller proportion of the sample at Gladysvale than it does in the latter area. Percentages are slightly over 50% for Kromdraai and Sterkfontein (Pocock 1987) and for Swartkrans (Avery in prep.) whereas at Gladysvale they are generally less than half that. *Aethomys chrysophilus* is the second best represented species. *Mastomys* sp. and *Elephantulus myurus* occur in all units but in lower numbers whereas *Otomys karoensis* occurs in only five units but in generally high proportions (Table 1). Values of the diversity index range between 1.71 for unit L31 and 2.31 for unit D5 (Figure 1).

SYSTEMATIC ACCOUNTS

INSECTIVORA

Soricidae

Myosorex Gray, 1838 Forest shrew

Myosorex sp. is represented in units S16.E11 and S18.E6 as well as the Pink Breccia. It has been accepted

TABLE 1

Percentage representation of micromammalian taxa in samples from various depositional units at Gladysvale Cave.

No Species	English common name	D5	L5	L31	S10 to S17	S18.E6	S19.E6	Pink Breccia
1 <i>Myosorex</i> sp.	Forest shrew					2.5	1.7	3.1
2 <i>Crociodura</i> sp.	Musk shrew	10.0	6.1					1.0
3 <i>Suncus varilla</i>	Lesser dwarf shrew	13.3	21.2					
4 <i>Amblysomus gunningi</i>	Gunning's golden mole					2.5		1.0
5 <i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat					2.5	4.8	4.1
6 <i>Hipposideros caffer</i>	Sundevall's leaf-nosed bat		6.1					
7 <i>Miniopterus schreibersii</i>	Schreiber's long-fingered bat		3.0					
8 <i>Myotis tricolor</i>	Temminck's hairy bat						0.8	
9 <i>Eptesicus hottentotus</i>	Long-tailed serotine bat						0.8	4.8
10 <i>Eptesicus capensis</i>	Cape serotine bat							4.8
11 <i>Scotophilus dinganii</i>	Yellow house bat							4.8
12 <i>Cryptomys hottentotus</i>	Common molerat			13.3	2.5	6.7	19.0	10.3
13 <i>Otomys karoensis</i>	Karoo vlei rat	3.3		20.0	22.5	23.5		15.5
14 <i>Otomys sloggetti</i>	Sloggett's vlei rat					1.7		
15 <i>Desmodillus auricularis</i>	Short-tailed gerbil					0.8		
16 <i>Tatera</i> sp.	Gerbil	3.3	3.0		2.5	0.8	4.8	1.0
17 <i>Mystromys albicaudatus</i>	White-tailed rat	6.7	3.0	20.0	20.0	29.4	19.0	27.8
18 <i>Saccostomus campestris</i>	Pouched mouse					0.8	4.8	1.0
19 <i>Dendromus melanotis</i>	Grey climbing mouse	10.0	3.0			0.8		5.2
20 <i>Steatomys</i> sp.	Fat mouse	13.3	33.3		2.5	1.7	4.8	
21 <i>Proodontomys cookei</i>								1.0
22 <i>Acomys spinosissimus</i>	Common spiny mouse	3.3			5.0	1.7		2.1
23 <i>Lemniscomys rosalia</i>	Single-striped mouse	3.3						
24 <i>Rhabdomys pumilio</i>	Striped mouse				2.5	0.8		2.1
25 <i>Dasymys incommis</i>	Water rat				2.5	1.7		
26 <i>Mus minutoides</i>	Pygmy mouse	23.3	12.1		2.5	2.5		1.0
27 <i>Mastomys</i> sp.	Multimammate mouse	3.3	3.0	13.3	10.0	5.0	4.8	5.2
28 <i>Aethomys chrysophilus</i>	Red veld rat	3.3	3.0	26.7	15.0	11.8	19.0	13.4
29 <i>Elephantulus myurus</i>	Rock elephant-shrew	3.3	3.0	6.7	5.0	6.7	4.8	5.2
SAMPLE SIZE		30	33	15	40	119	21	97

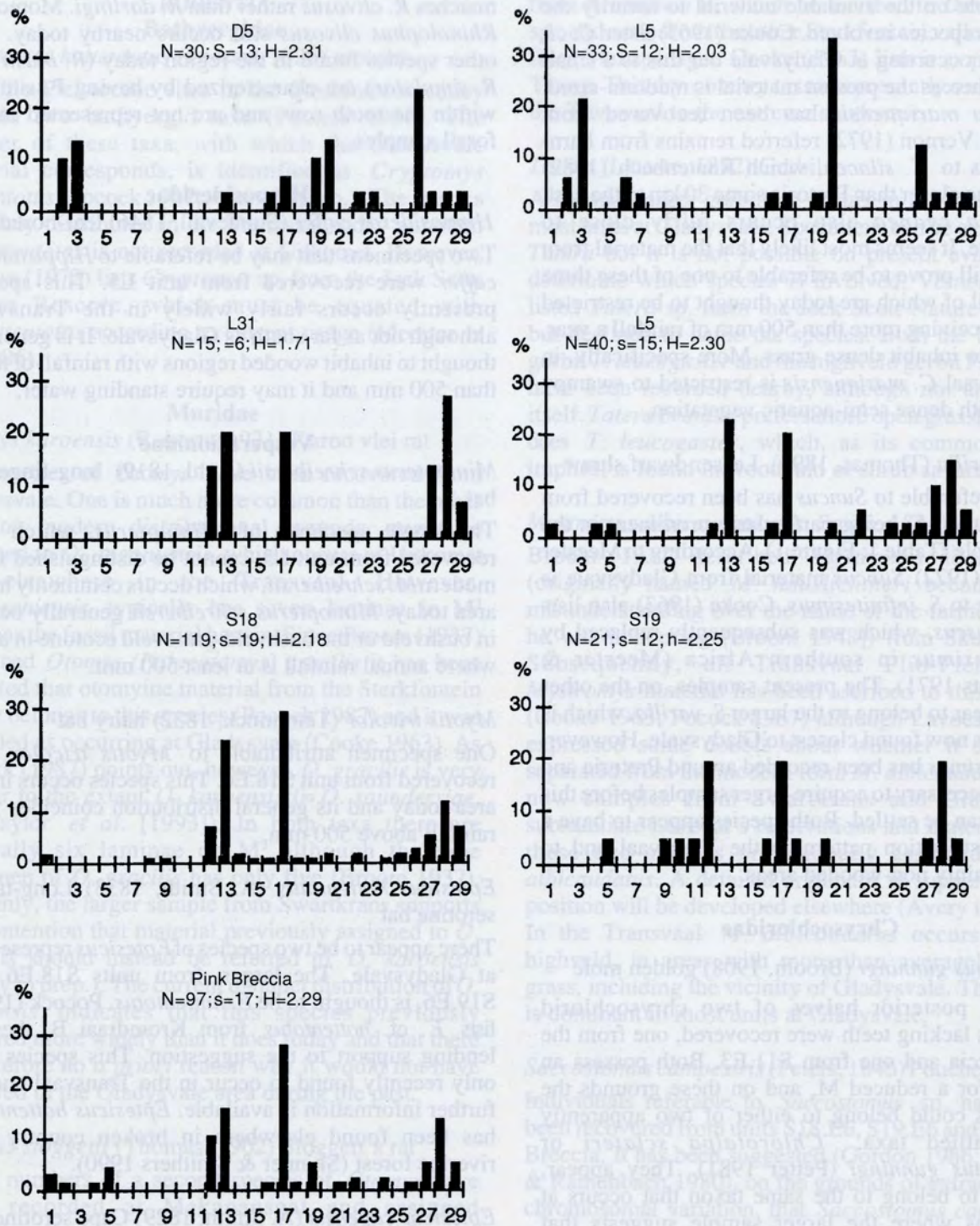


Figure 1. Percentage representation of species in various units at Gladysvale. N=minimum number of individuals; s=number of species; H=Shannon index of general diversity. See Table 1 for species name.

for some time that the species represented in the Gauteng Plio-Pleistocene sites is *M. robinsoni* (Meester 1955; Butler & Greenwood 1965; Butler 1978) and this species has previously been listed for Gladysvale (Cooke 1963). Recent examination of new samples from Swartkrans suggests, however, that *M. robinsoni* may not warrant more than subspecific separation from *M. cafer* (Avery, in prep.). The specific designation of the Gladysvale material must therefore await completion of the Swartkrans study. Vernon (1972) listed *M. cafer* from the Jack Scott

Nature Reserve but this specific identification was apparently discounted by Rautenbach (1982) who recorded only *M. varius* from the area. Both species indicate dense moist grass, probably along a stream bank, with *M. cafer* generally indicating a more forested environment than does *M. varius* in the Transvaal today.

Crocidura Wagler, 1832 Musk shrew

Material assignable to *Crocidura* sp. has been recovered from units D5, L5 and the Pink Breccia. It is

not possible on the available material to identify the *Crocidura* species involved. Cooke (1963) listed *C. cf. bicolor* as occurring at Gladysvale but this is a small species whereas the present material is medium-sized. *Crocidura mariquensis* has been recovered from Uitkomst. Vernon (1972) referred remains from barn-owl pellets to *C. silacea*, which Rautenbach (1982) recorded no closer than Pretoria some 30 km to the east. *Crocidura cyanea* also occurs fairly close to Gladysvale. It seems most likely that the material from this site will prove to be referable to one of these three species, all of which are today thought to be restricted to areas receiving more than 500 mm of rainfall a year, and tend to inhabit dense grass. More specifically, in the Transvaal *C. mariquensis* is restricted to swampy ground with dense semi-aquatic vegetation.

Suncus varilla (Thomas, 1895) Lesser dwarf shrew
Material referable to *Suncus* has been recovered from units D5 and L5, being particularly prominent in the latter sample (Table 1; Figure 1). According to Meester & Meyer (1972) *Suncus* material from Gladysvale is assignable to *S. infinitesimus*. Cooke (1963) also lists *S. cf. etruscus*, which was subsequently replaced by *S. infinitesimus* in southern Africa (Meester & Lambrechts 1971). The present samples, on the other hand, appear to belong to the larger *S. varilla*, which is the species now found closest to Gladysvale. However, *S. infinitesimus* has been recorded around Pretoria and it will be necessary to acquire larger samples before this question can be settled. Both species appear to have a similar distribution pattern in the Transvaal and to inhabit mainly non-wooded areas.

Chrysochloridae

Amblysomus gunningi (Broom, 1908) golden mole

Only the posterior halves of two chrysochlorid mandibles lacking teeth were recovered, one from the Pink Breccia and one from S11.E3. Both possess an alveolus for a reduced M_3 and on these grounds the specimens could belong to either of two apparently closely allied taxa, *Chlorotalpa sclateri* or *Amblysomus gunningi* (Petter 1981). They appear, however, to belong to the same taxon that occurs at Swartkrans where the larger sample suggests that *A. gunningi* is the species represented (Avery in prep.). Neither taxon has recently been recorded from near Gladysvale and little is known of their habitat requirements beyond the fact that both have been collected in forest and in montane areas.

CHIROPTERA

Rhinolophidae

Rhinolophus clivosus Cretzschmar, 1828 horseshoe bat
Mandibles referable to the genus *Rhinolophus* have been recovered from S17.E11, S19.E6 and the Pink Breccia. They appear to belong to a single species. This is probably *R. clivosus* because the alveolus for a very small P_3 is located outside the tooth row, and the size

matches *R. clivosus* rather than *R. darlingi*. Moreover, *Rhinolophus clivosus* still occurs nearby today. The other species found in the region today (*R. blasii* and *R. simulatrix*) are characterized by having P_3 situated within the tooth row, and are not represented in the fossil samples.

Hipposideridae

Hipposideros caffer (Sundevall, 1846) leaf-nosed bat
Two specimens that may be referable to *Hipposideros caffer* were recovered from unit L5. This species presently occurs fairly widely in the Transvaal, although not as far south as Gladysvale. It is generally thought to inhabit wooded regions with rainfall of more than 500 mm and it may require standing water.

Vespertilionidae

Miniopterus schreibersii (Kuhl, 1819) long-fingered bat

The single specimen of *Miniopterus*, which was recovered from unit L5, cannot be distinguished from modern *M. schreibersii*, which occurs commonly in the area today. *Miniopterus schreibersii* generally occurs in bushveld or the bushveld-grassveld ecotone in areas where annual rainfall is at least 500 mm.

Myotis tricolor (Temminck, 1832) hairy bat

One specimen attributable to *Myotis tricolor* was recovered from unit S18.E6. This species occurs in the area today and its general distribution coincides with rainfall above 500 mm.

Eptesicus hottentotus (A. Smith, 1833) Long-tailed serotine bat

There appear to be two species of *Eptesicus* represented at Gladysvale. The larger, from units S18.E6 and S19.E6, is thought to be *E. hottentotus*. Pocock (1987) lists *E. cf. hottentotus* from Kromdraai B, thereby lending support to the suggestion. This species was only recently found to occur in the Transvaal and no further information is available. *Eptesicus hottentotus* has been found elsewhere in broken country and riverine forest (Skinner & Smithers 1990).

Eptesicus capensis (A. Smith, 1829) Cape serotine bat

The smaller *Eptesicus* material, which was found only in S19.E6, has been assigned to *E. capensis*. This species, which occurs today in the general area, is widespread and has wide habitat tolerance, although it is attracted to open water.

Scotophilus dinganii (A. Smith, 1833) Yellow house bat

One specimen identified as *Scotophilus dinganii* was recovered from unit S19.E6. This bushveld species, which often feeds over open water, presently occurs close to Gladysvale.

RODENTIA

Bathyergidae

Cryptomys hottentotus (Lesson, 1826) molerat

The Plio-Pleistocene sites in the Sterkfontein valley contain two bathyergid taxa (Pocock 1987). The smaller of these taxa, with which the Gladysvale material corresponds, is identified as *Cryptomys hottentotus* (Pocock 1987; Avery in prep.). The species is widely distributed in the Transvaal today although *C. hottentotus* is not recorded at Uitkomst. However, Vernon (1972) lists *Cryptomys* sp. from the Jack Scott Nature Reserve, which must be equated with *C. hottentotus* according to current usage (Meester *et al.* 1986).

Muridae

Otomys karoensis (Roberts, 1931) Karoo vlei rat

Two species of *Otomys* have been recovered from Gladysvale. One is much more common than the other and, on modern distributional grounds, might be assigned to *O. angoniensis*, which occurs at Uitkomst and elsewhere in the Transvaal. However, *O. angoniensis* typically has seven laminae in M³ whereas the fossil material has six. Since Broom (1937) described *Otomys* (*Palaeotomys*) *gracilis* it has been accepted that otomyine material from the Sterkfontein valley belongs to this species (Pocock 1987) and it was recorded as occurring at Gladysvale (Cooke 1963). As Pocock (1987) points out, however, *O. gracilis* is very similar to the extant *O. karoensis* (= *O. saundersiae*, see Taylor *et al.* [1993]). In both taxa there are generally six laminae on M³ although the type specimen of *O. gracilis* has only five (Broom 1937). Certainly, the larger sample from Swartkrans supports the contention that material previously assigned to *O. gracilis* should instead be referred to *O. karoensis* (Avery in prep.). The current disjunct distribution of *O. karoensis* indicates that this species previously occurred more widely than it does today and that there is therefore no *a priori* reason why it would not have occurred in the Gladysvale area during the past.

Otomys sloggetti (Thomas, 1902) Sloggett's rat

Small numbers of a second species of *Otomys* have been recorded at Makapansgat and assigned provisionally to *O. sloggetti* (Pocock 1987). Material that may belong to this species has also been recovered from unit S18.E6 at Gladysvale. In the Transvaal the species has only been recorded from montane grassland at Wakkerstroom in the extreme southeast, although it is said to inhabit karroid vegetation in the eastern Karoo. There is no inherent reason why this high altitude species should not have previously occurred further north of its present limit.

Desmodillus auricularis (A. Smith, 1834) gerbil

One specimen attributable to *Desmodillus auricularis* was recovered from S18.E6. It is clearly a rare species since Pocock (1987) only recorded two individuals

from Kromdraai B, which he ascribed to *Desmodillus* sp., and none from the other Sterkfontein valley sites or from Makapansgat. Cooke (1963) lists it as present at Taung. This dry-country taxon is presently restricted in the Transvaal to the extreme southwest.

Tatera (Lataste, 1882) Gerbil

A second, larger gerbilline occurs in low numbers in most units at Gladysvale. Specimens can be assigned to *Tatera* but it is not possible on present evidence to determine which species is involved. Vernon (1972) listed *Tatera* sp. from the Jack Scott Nature Reserve but declined to name the species. Both the bushveld gerbil *T. leucogaster* and the highveld gerbil *T. brantsii* have been recorded nearby, although not at the site itself. *Tatera brantsii* prefers more open grassland than does *T. leucogaster*, which, as its common name implies, is found in woodland or shrub savanna.

Mystromys albicaudatus (A. Smith, 1834) rat

Broom (1937) described *Mystromys hausleitneri* (originally named *M. hauslichtneri* because of a misunderstanding over the name of the farmer whom he was honouring [Broom 1948]) from Skurveberg. Subsequently, all Transvaal Plio-Pleistocene *Mystromys* material has been ascribed to this species (Cooke 1963; Pocock 1987) although Lavocat (1956) expressed some doubts about whether it could be separated from the modern form *M. albicaudatus*. The new samples from Swartkrans and Gladysvale substantiate Lavocat's reservations and material from these two sites is provisionally assigned to *M. albicaudatus*. A detailed argument in support of this position will be developed elsewhere (Avery in prep.). In the Transvaal *M. albicaudatus* occurs on the highveld, in areas with more than averagely dense grass, including the vicinity of Gladysvale. This taxon is dominant in most units at Gladysvale.

Saccostomus campestris (Peters, 1846) Pouched mouse

Individuals referable to *Saccostomus* sp. have only been recovered from units S18.E6, S19.E6 and the Pink Breccia. It has been suggested (Gordon 1986; Gordon & Rautenbach 1980), on the grounds of extraordinary chromosomal variation, that *Saccostomus campestris* as presently accepted (Musser & Carleton 1993a) actually comprises two or more species. Already one species (*S. mearnsi* in East Africa) has been differentiated on the basis of karyotypic and morphological differences (Hubert 1978). Even if more species are formally recognized in southern Africa, their description will also require a morphological element before they can be distinguished osteologically. For the present, the material from Gladysvale is therefore perforce referred to *S. campestris*. It has not been listed as occurring in the other Plio-Pleistocene sites; neither does it occur today very close to Gladysvale. In a general way, it is documented as inhabiting woodland while, in the

Transvaal at least, its distribution shows a negative correlation with that of *Mystromys albicaudatus*. The occurrence of both forms at Gladysvale is therefore of some interest. It may also prove significant that a correlation exists between diploid number and biotic zone, with the $2n=46$ form found primarily in the Southern Savanna Woodland, including the Transvaal, and the $2n=28-44$ forms predominantly in the South West Arid zone (Gordon 1986).

Dendromus melanotis (A. Smith, 1834) climbing mouse
Dendromus specimens from Gladysvale appear referable to *D. melanotis*, as are those from Sterkfontein and Kromdraai (Pocock 1987). Vernon (1972) records the presence of *Dendromus* sp. in the Jack Scott Nature Reserve but Rautenbach (1982) shows no species of this genus closer than Pretoria. The presence of this species indicates stands of dense tall grass.

Steatomys (Peters, 1846) Fat mouse

Gladysvale *Steatomys* sp. molars are relatively broad, thereby suggesting that the species represented may be *S. pratensis* rather than *S. krebsii*. Pocock (1987), on the other hand, refers Kromdraai and Sterkfontein material to *S. krebsii* and this species apparently occurs rather closer to Gladysvale today than does *S. pratensis*. Given, however, that the present species identification is not certain and that the genus is in need of revision (Meester *et al.* 1986), it is thought preferable to follow Vernon (1972) in not assigning the material to a particular species. Although *S. pratensis* and *S. krebsii* apparently do not overlap in the Transvaal they are sometimes found together in dry sandy grassland elsewhere (Skinner & Smithers 1990).

Proodontomys cookei (Pocock, 1987)

One mandible without teeth, which possibly represents *Proodontomys cookei*, was recovered from the Pink Breccia. Further material is required to confirm the presence of this extinct taxon at Gladysvale.

Acomys spinosissimus (Peters, 1852) spiny mouse

According to the current situation (Dippenaar & Rautenbach 1986) the *Acomys* material from Gladysvale should be assigned to *A. spinosissimus* but this will require confirmation. Pocock (1987) declined to identify the material from the Sterkfontein valley and Makapansgat to species. *Acomys spinosissimus* is associated with rocky woodland areas in the Transvaal but in Mozambique it is also found on alluvium along rivers in savanna (Smithers & Lobão Tello 1976).

Lemniscomys rosalia (Thomas, 1904) Single-striped mouse

Only one specimen probably attributable to *Lemniscomys rosalia* was recovered from unit D5. This species (previously *L. griselda*) is today associated

with savanna woodland at altitudes below about 1200 m. Gladysvale lies some 400 m higher than this but a record of *Lemniscomys* sp. from Kromdraai B (Pocock 1987) supports the suggestion that this genus occurred on the highveld in the past.

Rhabdomys pumilio (Sparman, 1784) Striped mouse
 Several specimens from Gladysvale were identified as *Rhabdomys pumilio*. This species occurs in the Sterkfontein valley today and in the Transvaal generally it is associated with short dense grass in open savanna above about 1200 m.

Dasymys incomtus (Sundevall, 1847) Water rat

Specimens attributable to *Dasymys incomtus* were recovered from S16.E11 and S18.E6. *Dasymys* sp. has been recorded from Kromdraai and Sterkfontein (Pocock 1987) but has not been collected from the region in recent times. Modern distributions coincide with mean annual precipitation above 500 mm and with dense grass or semi-aquatic vegetation in swampy areas.

Mus minutoides (A. Smith, 1834) Pygmy mouse

Small numbers of *Mus minutoides* were recovered from most units. This species still occurs at Uitkomst and *Mus* sp. has been recorded in the Plio-Pleistocene sites of the Sterkfontein valley and at Makapansgat (Pocock 1987). Although it has a wide habitat tolerance *M. minutoides* generally requires good ground cover, usually in the form of grass.

Mastomys (Thomas, 1915) Multimammate mouse

The *Mastomys* material from Gladysvale is either *M. coucha* or *M. natalensis*. These two taxa were initially distinguished on cytogenetic grounds in Zimbabwe (Gordon 1978) and subsequently by multivariate analysis of cranial characters in South Africa (Dippenaar *et al.* 1993). Dippenaar *et al.* (1993) caution, however, that reliable identification is unlikely to be simple, thereby implying that it may prove impossible to identify incomplete fossil material. Modern distributions suggest *M. coucha* as the most likely species to be represented (Dippenaar *et al.* 1993; Green *et al.* 1980). Both Rautenbach (1982) and Vernon (1972) list *Praomys natalensis*. However, their work was undertaken at a time when neither *Mastomys* nor *coucha* was in use as a valid taxon so that their *P. natalensis* potentially includes both *M. coucha* and *M. natalensis* as presently accepted. Pocock (1987) lists *Praomys* sp. (= *Mastomys* as understood in current taxonomic usage) for the Sterkfontein valley and Makapansgat.

Thallomys (Thomas, 1920) Tree rat

No material referable to *Thallomys* has so far been recovered from the samples examined although Cooke (1963) lists *T. debuynei* from the site. Pocock (1987) did not record the taxon from Sterkfontein or

TABLE 2

Species recorded from the farm Uitkomst and surrounds by Rautenbach (1982) and from the Jack Scott Nature Reserve by Vernon (1972).

Species	Common Name	Uitkomst	Surrounds	Jack Scott
<i>Myosorex varius</i>	Forest shrew	x		
<i>Myosorex cafer</i>	Dark-footed forest shrew			x
<i>Crocidura mariquensis</i>	Swamp musk shrew	x		
<i>Crocidura cyanea</i>	Reddish-grey musk shrew		x	
<i>Crocidura silacea</i>	Lesser grey-brown musk shrew			x
<i>Suncus varilla</i>	Lesser dwarf shrew		x	
<i>Rhinolophus clivus</i>	Geoffroy's horseshoe bat	x		
<i>Rhinolophus blasii</i>	Peak-saddle horseshoe bat	x		
<i>Rhinolophus simulator</i>	Bushveld horseshoe bat		x	
<i>Miniopterus schreibersii</i>	Schreiber's long-fingered bat	x		
<i>Myotis tricolor</i>	Temminck's hairy bat	x		
<i>Eptesicus capensis</i>	Cape serotine bat		x	
<i>Scotophilus dinganii</i>	Yellow house bat		x	
<i>Sauromys petrophilus</i>	Flat-headed free-tailed bat		x	
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat		x	
<i>Cryptomys hottentotus</i>	Common molerat		x	
<i>Cryptomys</i> sp.	Molerat			x
<i>Otomys angoniensis</i>	Angoni vlei rat	x		
<i>Otomys irroratus</i>	Vlei rat		x	
<i>Otomys</i> sp.	Vlei rat			x
<i>Tatera leucogaster</i>	Bushveld gerbil		x	
<i>Tatera brantsii</i>	Highveld gerbil		x	
<i>Tatera</i> sp.	Gerbil			x
<i>Mystromys albicaudatus</i>	White-tailed rat		x	
<i>Dendromus</i> sp.	Climbing mouse			x
<i>Malacothrix typica</i>	Large-eared mouse			x
<i>Steatomys</i> sp.	Fat mouse			x
<i>Lemniscomys griselda</i>	Single-striped mouse		x	
<i>Rhabdomys pumilio</i>	Striped mouse		x	
<i>Mus minutoides</i>	Pygmy mouse	x		
<i>Praomys natalensis</i>	Natal multimammate mouse	x		x
<i>Thallomys paedulus</i>	Tree rat	x		
<i>Aethomys chrysophilus</i>	Red veld rat	x		
<i>Aethomys namaquensis</i>	Namaqua rock mouse	x		
<i>Aethomys</i> sp.	Veld rat/ rock mouse			x
<i>Rattus rattus</i>	House rat		x	
<i>Graphiurus murinus</i>	Woodland dormouse		x	
<i>Elephantulus myurus</i>	Rock elephant-shrew		x	x

Kromdraai but De Graaff (1961) listed *T. cf. paedulus* from Kromdraai. *Thallomys* also occurs at Swartkrans (Avery in prep.). At the time Broom (1948) described *T. debryni* three extant species of *Thallomys* were recognized. Subsequently, Meester *et al.* (1986) accepted only one species, *T. paedulus*, as occurring in southern Africa. Thereafter, Gordon (1987) showed that there were two species, with *T. paedulus* being replaced in the more arid west by *T. nigricauda*. The most recent treatment of the genus (Musser & Carleton 1993b) resurrects a third species, *T. shortridgei*, which

is known only from the south bank of the Orange River near Upington. *Thallomys paedulus* s.l. (and presumably *sensu stricto*, as well) has been recorded at Uitkomst in recent times and may yet be found in the Gladysvale deposits.

Aethomys chrysophilus (De Winton, 1897) veld rat

All *Aethomys* specimens from Gladysvale that can be identified to species apparently belong to *Aethomys chrysophilus* as currently accepted. There is, however, cytogenetic, electromorphic and spermatozoan

evidence to show that *A. chrysophilus* comprises two distinct species (Gordon & Rautenbach 1980; Gordon & Watson 1986; Visser & Robinson 1986). These are *A. chrysophilus* s.s. and another species that has yet to be formally identified (Musser & Carleton 1993). The genus is currently under review (C.T. Chimimba, pers. comm.) and it is to be hoped that morphological differences will be found that will enable the identification of the fossil material. *Aethomys chrysophilus*, as presently understood, inhabits wooded plains almost exclusively. No specimens have so far been found that are clearly referable to *A. namaquensis* although both species have been recorded from Kromdraai and Makapansgat (Pocock 1987) and recently from Uitkomst. Vernon (1972) did not distinguish his material to species.

MACROSCELIDEA

Macroscelididae

Elephantulus myurus (Thomas & Schwann, 1906)
Rock elephant-shrew

Specimens referable to *Elephantulus* appear to belong to the species *E. myurus*, which has also been recorded from the Jack Scott Nature Reserve by Vernon (1972). Rautenbach (1982) confirms that it is the only species currently found nearby although he did not find it at Uitkomst. Pocock (1987) has recorded *E. cf. brachyrhynchus* and the extinct *E. antiquus* from the Sterkfontein valley and Makapansgat. This latter form is described by Broom (1948) as having a sectorial P² very similar to that found in *E. capensis* (= *E. edwardii* [Corbet & Hanks 1968]). *Elephantulus edwardii*, in turn, shares this feature with *E. myurus* (Corbet & Hanks 1968) and it may well prove impossible to distinguish the fossil and modern forms at the species level. *Elephantulus myurus* is generally a grassland species (Corbet & Hanks 1968) but it is locally restricted to rocky outcrops.

DISCUSSION AND CONCLUSION

This preliminary analysis indicates that the micromammalian fauna from Gladysvale is almost entirely composed of extant species, many of which still occur at no great distance from the site today. Nearly the same number of species has been recorded within approximately 20 km of the site in recent times (Table 2) as was recognized in the fossil sample (Table 1). In general terms proportions of various groups are also similar although there are differences at the level of individual taxa, as would be expected. As a preliminary observation, it may therefore be noted that the taxa represented do not suggest conditions greatly different from those of the present. There is a strong indication that rainfall was above 500 mm, as it is today, and ground cover was clearly good, with bush and relatively extensive dense grass. Several species indicate moist riverine vegetation, which may suggest that rainfall was less seasonal than it is at present. Also interesting is that several species seem to indicate the presence of open water.

Percentage representation of certain species varies between units (Table 1; Figure 1). It is clear, for instance, that units D5 and L5 have different proportions, and in some cases different species, from the remainder of the units. Noticeable are the high proportions of various small species (*Crocidura* sp., *Suncus varilla*, *Dendromus melanotis*, *Steatomys* sp. and *Mus minutoides*) and low proportions of the two species (*Otomys karoensis* and *Mystromys albicaudatus*) that are prominent in the other samples. The straightforward interpretation of this is that vegetation was relatively open and climate probably drier at the time units D5 and L5 were deposited than was the case when other units were accumulated. These differences carry the further implication that the units are of a different age from the others, a conclusion supported by their unconsolidated nature, which marks them out as different from the other units.

Straightforward interpretations may, however, be very far from the truth unless they take into account a number of possible biases. For instance, the very fact that the D5 and L5 deposits differ from the others in being unconsolidated could be significant since varying post-depositional histories may have influenced preservation of the material. It is also necessary to determine whether different predators may have been responsible for the collection of the material as has been detailed in cave sites elsewhere (Andrews 1990; Fernández-Jalvo 1995), and whether the micromammal species could have been living in the cave. The differences between samples from units S18.E6 and S19.E6, which are physically contiguous (L.R. Berger, pers. comm.), may be explainable in such terms. Unit S19 contains a noticeably high number of bat species, which are likely to have been living and dying naturally in the cave. Unit S18, on the other hand, includes many more non-volant micromammals, which will almost certainly have been brought in by one or more predator species. Interpretation of the data will have to take into account such differences, which may have information potential of their own. There has, for instance, to be an explanation for why there are more bats at some times than others and why the predators and their preferences change. Conversely, the absence of the generally prominent *Otomys karoensis* from even small samples such as L5 and S19 requires an explanation, regardless of the agent of accumulation.

General diversity is fairly high in most units (Figure 1), apparently due more to high numbers of species than to equability. Apart from unit L31 where small sample size has reduced the value of the index, variation in diversity is not solely due to differing sample sizes and requires explanation. However, it will first be necessary to determine whether the variation has to do with changes in predator preferences or reflects real differences in general conditions. It would therefore not be useful to comment further at this stage.

It is clear, even from this preliminary study, that the rich micromammalian fauna from Gladysvale has the potential to provide useful information on the

environment of the site. This will have particular significance to studies aimed at establishing the conditions in which early hominids developed. By comparing the Gladysvale material with new samples from Swartkrans and Sterkfontein that are under investigation to determine it should also be possible to understand better the ecology of the early hominids at these sites.

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