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# GLIMPSES FROM GONDOLIN: A FAUNAL ANALYSIS OF A FOSSIL SITE NEAR BROEDERSTROOM, TRANSVAAL, SOUTH AFRICA

by

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**ABSTRACT**

The faunal analysis of a Plio-pleistocene site near Broederstroom, 34km north west of Pretoria, in the Transvaal has revealed a fossil fauna possibly as old as 2 million years. A single *Homo sapiens* tooth probably more recent than the rest of the deposit was recovered. Twenty seven mammal taxa were recovered with *Redunca arundinum*, the reedbuck, being the most common and the fossil klipspringer *Oreotragus major* the next most common. A large metridiochaerine suid was well represented. Primate remains were remarkable by their absence. From damage to the bones the most likely collecting agent was leopard. The fauna suggests a hilly grassy environment with permanent water and rocky outcrops. Open grass plains must have been in relatively close vicinity of the dolomite cave.

KEY WORDS: Plio-pleistocene site, Transvaal South Africa, Fossil fauna.

## INTRODUCTION

The farm Gondolin lies about 4km SW of the small town of Broederstroom 34km NW of Pretoria and fossiliferous breccia occurs here in a former cave in the Transvaal dolomitic limestone. In 1978 permission was obtained from Mr. O'Dowd, the then owner of Gondolin, to excavate the extremely fossiliferous site. With the technical assistance of Mr. David Panagos an intensive three week excavation was undertaken at the site in January and February 1979 by E. S. Vrba. In her report to the Monuments Council in 1982, Vrba described the site as follows: "The site is a defunct Limestone quarry and the extremely rich bone-bearing breccia is a vertical remnant adhering to the Northern wall of the quarry (Figure 1). A vertical grid was attached to the breccia (Figure 2) and in January 1979 an estimated 2 cubic meters of breccia was removed during a three week excavation. During excavation two distinct breccia phases were recognised. The 43 trays (or block numbers in the catalogue) were removed to the store at the Transvaal Museum where the bones were removed from the breccia using the acetic acid process." (Vrba, 1982). Each bone has subsequently been numbered and catalogued relating to the vertical grid reference. The bone-rich breccia was situated under the travertine layer illustrated at 2,5m below datum and all 43 blocks were extracted from here (Figure 2).

Before completion of the project E. Vrba left the Museum and the project was taken over by Dr. Alan Turner but before analysis could be started he also left. In early 1991 I took on the analysis of the 90 000 odd bones recovered from the excavation.

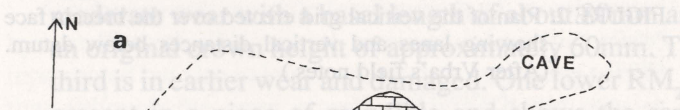


FIGURE 1:a) Overall plan of the site after Vrba's field notes.
b) Plan of the *in situ* breccia face, after Vrba's field notes.

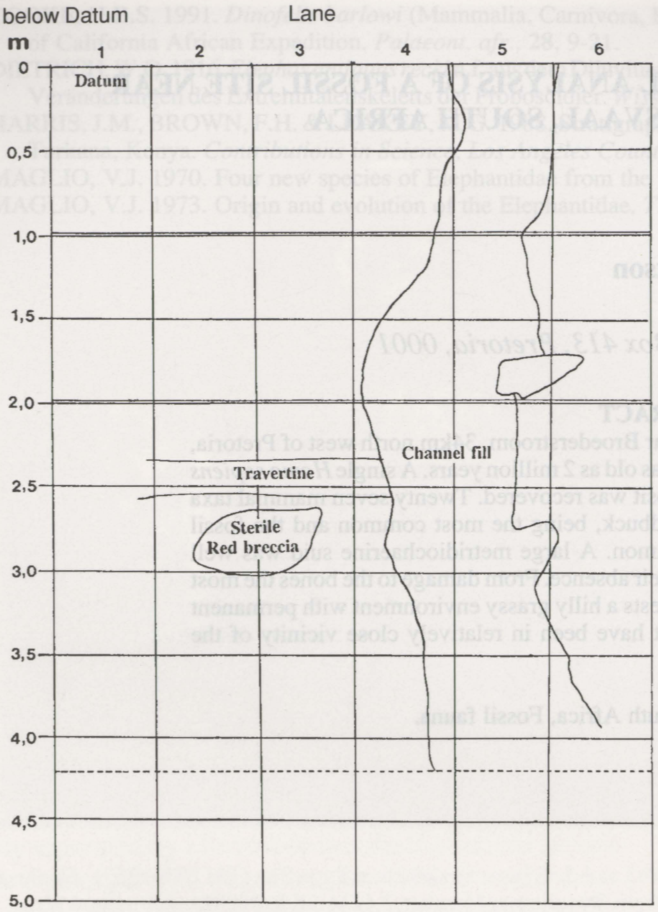


FIGURE 2: Plan of the vertical grid erected over the breccia face showing lanes and vertical distances below datum. (After Vrba's field notes.)

**TABLE 1**

**Number and sizes of the flakes recovered from the Gondolin Excavation**

| Flakes: Size (cm) | Number |
|---|---|
| 0- 1 | 179 |
| 1- 2 | 2027 |
| 2- 3 | 1510 |
| 3- 4 | 700 |
| 4- 5 | 366 |
| 5- 6 | 158 |
| 6- 7 | 82 |
| 7- 8 | 37 |
| 8- 9 | 23 |
| 9-10 | 11 |
| 10-11 | 7 |
| 11-12 | 8 |
| 12-13 | 5 |
| 13-14 | 4 |
| 14-15 | 1 |
| TOTAL | 5118 |

## RESULTS

The overall preservation of the bone was remarkable with foetal/neonatal bones being present in the collection as well as a few complete articulated elements. The bones were sorted into identifiable and non-identifiable categories. The non-identifiable bones consisted of miscellaneous pieces, of which at least 80% were smaller than 3 cm in length and 90% were smaller than 2 cm in length, and also flakes which were measured and counted (Table 1, Figure 3). It has been found that the flakes in human refuse collections commonly have lengths less than 5 cm and that those resulting from hyaena damage have a fairly even length spread between 2 and 12 cm (Brain 1981). In this study the majority of the flakes, although less than 5 cm in length, appear unlikely to be the result of human or hominid intervention. Nothing in the collection indicated anything other than large cat and porcupine accumulation and no signs of hominid modification was apparent on any of the bones. Based on the presence of extinct species the bones recovered from this site may well be as old as 2 million years and, although very well preserved, tended to be relatively brittle. The bone density in the breccia was very high. The fossiliferous breccia was harvested using electric drills and chisels and together with the acid preparation it is envisaged that this may have played a role in the flakes being relatively short.

**TABLE 2**
**Number of specimens**

| | | |
|---|---|---|
| Bones identified to 27 taxa: | 625 | |
| Bovid postcranial bones: | Bovid I | 966 |
| | Bovid II | 2134 |
| | Bovid III | 87 |
| | Bovid IV | 27 |
| | All size classes | 861 |
| Mammal species indet. bones | | 10527 |
| Micromammalian fauna | | 2028 |
| Bird bones | | 15 |
| Frog bones | | 2 |
| Flakes | | 5118 |
| Miscellaneous pieces | | 68273 |
| TOTAL | | 90663 |

The rest of the collection was processed and 27 taxa (Table 3) were identified using both modern and fossil comparative collections. The bovid postcranial bones were sorted into size classes (Table 4) according to Brain 1981. These are Bovid I, up to 23 kg live mass; Bovid II, 23-84 kg; Bovid III, 84-296 kg and Bovid IV more than 296 kg. Although most of the Bovid I postcranial material belonged to *Oreotragus major*, at least one other species was represented. No cranial material of this antelope was recovered and thus no positive species identification was made. Undoubtedly most of the Bovid II postcranial material was from *Redunca arundinum*. In those cases where the remains were considered incapable of rendering an exact identification, as in the more fragmented bovid skeletal

**TABLE 3**
**Gondolin species list and minimum number of individuals (MNI).**

| Species | Number of specimens | MNI |
|---|---|---|
| *Redunca arundinum* | 274 | 33 |
| *Oreotragus major* | 99 | 17 |
| Bovid I indet. | 4 | 1 |
| *Hippotragus equinus* | 1 | 1 |
| *Connochaetes sp.* | 15 | 4 |
| Medium alcelaphine: *Alcelaphus sp* or *Beatragus sp.* | 13 | 4 |
| *Damaliscus dorcas* | 8 | 2 |
| *Antidorcas* cf. *recki* | 1 | 1 |
| *Antidorcas* cf. *marsupialis/australis* | 2 | 1 |
| *Tragelaphus strepsiceros* | 9 | 2 |
| Tragelaphine | 1 | 1 |
| *Taurotragus oryx* | 3 | 1 |
| *Crocuta crocuta* | 5 | 1 |
| Hyaenid | 7 | |
| *Canis mesomelas* | 13 | 2 |
| Canid indet. | 5 | |
| *Procavia antiqua* | 21 | 3 |
| *Procavia transvaalensis* | 9 | 2 |
| *Hystrix makapanensis* | 34 | 4 |
| Lagomorph | 21 | 3 |
| cf. *Hipparion l. steytleri* | 3 | 1 |
| cf. *Equus capensis* | 1 | 1 |
| Equid | 3 | |
| *Metridiochoerus andrewsi* | 46 | 3 |
| Suid | 8 | |
| *Hippopotamus sp.* | 10 | 1 |
| Rhinoceros | 9 | 1 |
| **TOTAL** | **625** | **90** |

elements and those in which there was a degree of overlap in size between the bovid classes, these have been listed separately in Table 4. The other bones that were not identified any further short of putting them into skeletal element or other fairly broad categories, are listed in Table 5. A summary of the analysis follows.

## THE FOSSIL FAUNA

At the time of excavation Vrba noted the presence of at least two members of fossil-bearing breccia (Vrba, 1982). When the remains of the identified taxa were examined closely as to locality in the cave and the member they came from, it was found the majority of the species had an even distribution between the two members and on a faunal basis no conclusions could be reached as to deposition at different periods. The *Crocuta crocuta* and *Canis mesomelas* remains came from the same block. An isolated hominid tooth, positively identified as *Homo sapiens* by F.E. Grine, was recovered from the site. A visual examination of the tooth shows its state of preservation to be quite different from the other fossil material recovered and further chemical and other analyses are required to

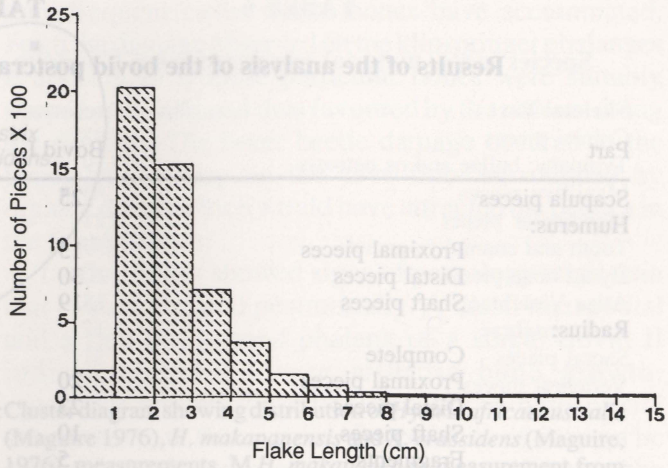


FIGURE 3: Histogram illustrating the length of flakes recovered from Gondolin.

establish whether or not it is contemporaneous with the rest of the collection.

A number of interesting extinct forms are represented at the site that indicate that the accumulation may be as old as 2 million years. Dr Basil Cooke has examined the Gondolin suids and reports as follows: "The collections include nine suid specimens, two being fragments of mandibles and one a fragment of maxilla. The maxilla contains only a well worn $LM^2$ with a rim of enamel and small enamel 'lakes' in the dentine. There are three upper third molars, two of which are possibly a pair in moderate wear with a basal length of about 80mm and an original crown height of approximately 60mm. The third is in earlier wear and damaged. One lower $RM_2$ is present in a piece of mandible and shows the same enamel features as the corresponding upper tooth. The third molar in this specimen is in moderate wear, and is an isolated $LM_3$. In each of these specimens there are six pairs of lateral pillars which are rather broad antero-posteriorly and parallel sided above the base. Two isolated lower third molars are similar but have five pairs of laterals and a posterior complex of small pillars. The basal length ranges from 77 to 84mm and the crown height of the least worn specimen is 72mm. In all the third molars, the anterior pairs of pillars show the early stages of fusion seen in *Metridiochoerus* and the second molars are typical for this genus. The teeth resemble the type of Broom's *"Notochoerus meadowsi"*, now generally regarded as a synonym of *Metridiochoerus andrewsi*, to which the Gondolin specimens may be referred. They are also similar to the specimens from Swartkrans Member 1 and lie at the upper limit of variation in the *M. andrewsi* material from Koobi Fora, East Africa. An age of between 1,5 and 1,9 Ma is suggested by morphological correlation but this is only a tentative approximation." A fine collection of postcranial material of this creature needs closer examination.

The porcupine represented in this collection is definitely larger, and differs morphologically from,

## TABLE 4

**Results of the analysis of the bovid postcranial remains that were placed in size classes.**

| Part | | Number of Specimens | | | |
|---|---|---|---|---|---|
| | | Bovid I | Bovid II | Bovid III | Bovid IV |
| Scapula pieces | | 25 | 51 | 5 | 2 |
| Humerus: | | | | | |
| | Proximal pieces | 15 | 27 | | |
| | Distal pieces | 30 | 65 | 2 | |
| | Shaft pieces | 19 | 6 | 1 | 3 |
| Radius: | | | | | |
| | Complete | | 3 | | |
| | Proximal pieces | 20 | 33 | 2 | 2 |
| | Distal pieces | 23 | 42 | 3 | 2 |
| | Shaft pieces | 10 | 8 | | |
| | Fragments | 5 | 1 | | |
| Ulna: | | | | | |
| | Proximal pieces | 26 | 62 | 4 | 2 |
| Carpals: | | | | | |
| | Radial | 20 | 45 | | |
| | Ulnar | 17 | 35 | | |
| | Intermediate | 13 | 39 | 1 | |
| | 2nd and 3rd carpal | 20 | 32 | | |
| | 4th carpal | 17 | 41 | | 1 |
| Metacarpals: | | | | | |
| | Complete | 2 | | | |
| | Proximal pieces | 15 | 42 | 1 | |
| | Distal pieces | 4 | | | |
| | Shaft pieces | 7 | | | |
| Pelvic pieces | | 39 | 115 | 9 | |
| Femur: | | | | | |
| | Complete | | 1 | | |
| | Proximal pieces | 22 | 49 | 2 | 2 |
| | Distal pieces | 34 | 55 | 4 | |
| | Shaft pieces | 8 | 4 | 3 | 1 |
| Patella | | 19 | 35 | | |
| Tibia: | | | | | |
| | Complete | 1 | 3 | | |
| | Proximal pieces | 37 | 44 | 3 | |
| | Distal pieces | 41 | 61 | 5 | |
| | Shaft pieces | 11 | 20 | | 6 |
| Calcaneus: | | | | | |
| | Complete | 8 | 12 | | |
| | Pieces | 31 | 103 | 4 | |
| Astragalus: | | | | | |
| | Complete | 19 | 43 | | 1 |
| | Pieces | 9 | 46 | 3 | 1 |
| Lateral maleolus | | 1 | 59 | | |
| 2nd and 3rd tarsal | | 20 | 39 | | |
| Central and 4th tarsal | | 23 | 67 | 2 | 2 |
| Metatarsals: | | | | | |
| | Complete | 4 | 1 | | |
| | Proximal pieces | 24 | 57 | | |
| | Distal pieces | 5 | 1 | | |
| Metapodials: | | | | | |
| | Proximal pieces | 2 | 16 | | |
| | Distal pieces | 17 | 197 | 9 | 2 |
| | Shaft pieces | 28 | 68 | | |
| 1st phalanges: | | | | | |
| | Complete | 43 | 62 | | |
| | Pieces | 65 | 133 | 7 | |
| 2nd Phalanges: | | | | | |
| | Complete | 62 | 103 | | |
| | Pieces | 36 | 69 | 15 | |
| 3rd Phalanges: | | | | | |
| | Complete | 68 | 96 | | |
| | Pieces | 6 | 39 | | |
| TOTAL | | 966 | 2134 | 87 | 27 |

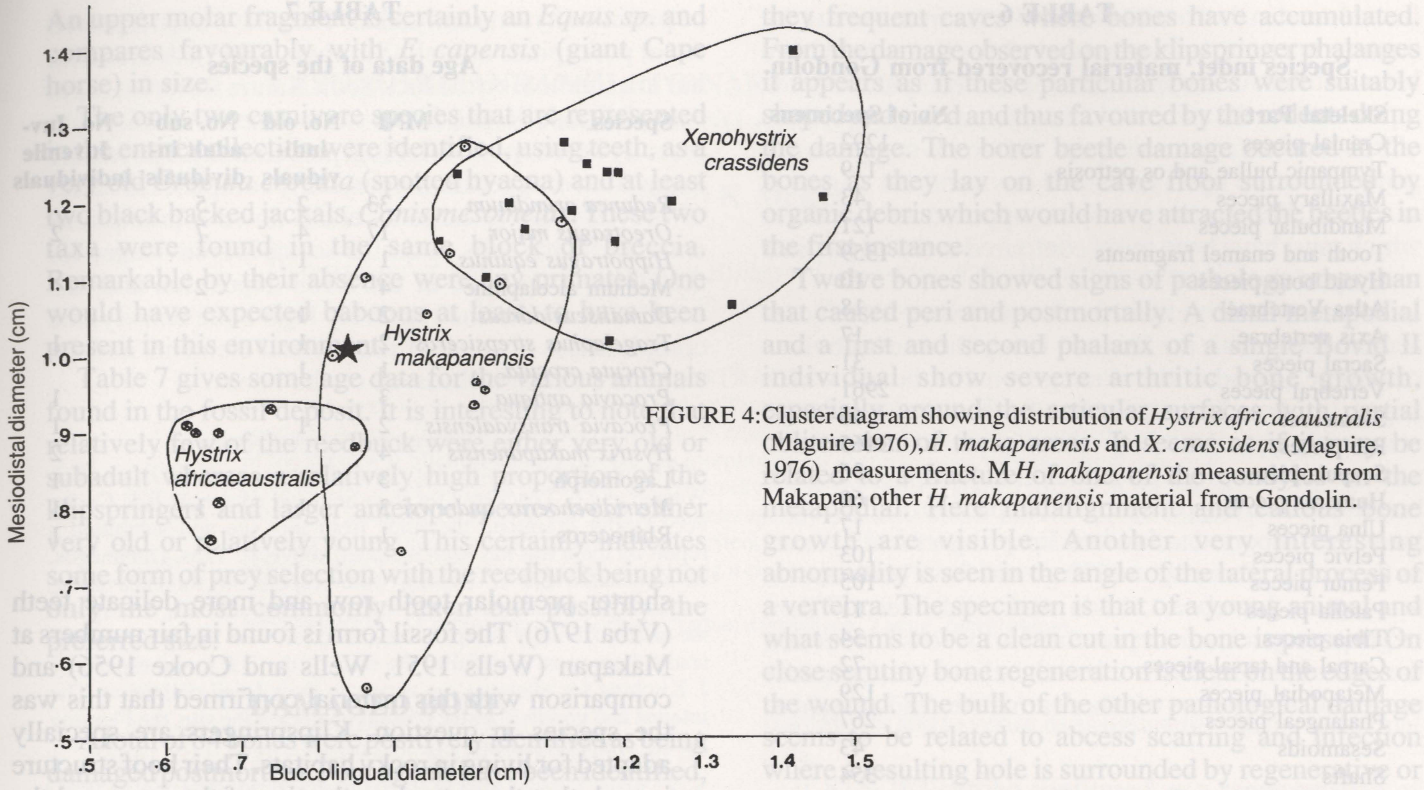


FIGURE 4: Cluster diagram showing distribution of *Hystrix africaeaustralis* (Maguire 1976), *H. makapanensis* and *X. crassidens* (Maguire, 1976) measurements. M *H. makapanensis* measurement from Makapan; other *H. makapanensis* material from Gondolin.

*Hystrix africaeaustralis*. It has provisionally been assigned to *Hystrix makapanensis* which has previously only been reported from Makapan (Maguire 1976). The other large fossil porcupine species known from these times is *Xenohystrix crassidens*, which is even more robust than *H. makapanensis* and for morphological reasons is placed in its own genus (Maguire 1976). The Gondolin material appears to differ from *X. crassidens* in the following regards:

The upper molars and premolars do not appear to be rooted in the strict sense of the word as discussed by Maguire in her dissertation (Maguire 1976).

The upper diastema of the Gondolin specimen is no more strongly curved than that of the modern porcupine; *X. crassidens* has a strongly curved diastema and the incisors are visibly smaller and more delicate.

Figure 4 shows the tooth measurements of the Gondolin material compared to the fossil species from Makapan and modern porcupine material. The postcranial bones of this porcupine are also markedly larger than the modern *Hystrix africaeaustralis* equivalents, indicating that it must have been much larger.

The lagomorph species found at Gondolin resembles most closely *Pronolagus rupestris* (Smith's red rock rabbit), although the fossil material is smaller than the material in the comparative collection. According to Smithers *P. rupestris* is the smallest of the three '*Pronolagus*' species (Smithers 1983). Unfortunately the cranial material of the fossil form is scanty and at this stage it cannot be determined whether it is a new species. *Pronolagus randensis* (Jameson's red rock rabbit) has been recorded by H.B.S. Cooke from Makapan (Brain 1981). The extant pronolagids are dependant on the availability of a rocky habitat and remain closely confined to krantzes and rocky hillsides where they graze on grass (Smithers 1983).

*Antidorcas recki*, one of the fossil springbuck, is represented by a single tooth. The larger *A. marsupialis/australis* is also represented but also in low numbers. It is interesting to note that although the open grassland-loving bovid species *Damaliscus dorcas* (blesbuck), *Connochaetes sp.* (wildebeest), the hartebeest sized alcelaphines, *Alcelaphus sp* or *Beatragus sp.* are present, it is in relatively small numbers. No differentiation has been made between *Connochaetes taurinus* (blue wildebeest) and *C. gnou* (black wildebeest) in the present study.

## TABLE 5

**List of the bovid material that was not placed in size classes**

| Skeletal part | Number of Specimens |
|---|---|
| Horn-core pieces | 82 |
| Premaxilla pieces | 12 |
| Hyoid pieces | 4 |
| Isolated incisors | 59 |
| Isolated premolars | 60 |
| Radius pieces | 13 |
| Distal ulna | 33 |
| Accessory carpal bones | 44 |
| Distal splint bones | 5 |
| 1st Tarsal bones | 41 |
| Phalanx pieces | 3 |
| Proximal sesamoid bones | 358 |
| Distal sesamoid bones | 147 |
| TOTAL | 861 |

**TABLE 6**

**Species indet. material recovered from Gondolin.**

| Skeletal Part | No of Specimens |
|---|---|
| Cranial pieces | 1292 |
| Tympanic bullae and os petrosis | 119 |
| Maxillary pieces | 43 |
| Mandibular pieces | 121 |
| Tooth and enamel fragments | 1359 |
| Hyoid bone pieces | 10 |
| Atlas Vertebrae | 18 |
| Axis vertebrae | 17 |
| Sacral pieces | 31 |
| Vertebral pieces | 2961 |
| Sternebrae | 66 |
| Rib pieces | 3165 |
| Scapula pieces | 36 |
| Humerus pieces | 60 |
| Ulna pieces | 17 |
| Pelvic pieces | 103 |
| Femur pieces | 105 |
| Patella pieces | 11 |
| Tibia pieces | 34 |
| Carpal and tarsal pieces | 72 |
| Metapodial pieces | 129 |
| Phalangeal pieces | 267 |
| Sesamoids | 43 |
| Shafts | 354 |
| Foetal bones | 38 |
| Large mammal indet. | 2 |
| Small mammal indet. | 48 |
| Mammal indet. | 2 |
| Microfauna | 2028 |
| Bird bones | 15 |
| Frog | 2 |
| Coprolites | 4 |
| Flakes (Total) | 5118 |
| Miscellaneous pieces | 68273 |
| TOTAL | 85963 |

Based on minimum number of individuals (Table 3), the most common bovid is the reedbuck, *Redunca arundinum*, a species dependant on cover in the form of tall grass or reedbeds, and a constant water supply (Smithers 1983). The *Redunca* material from Gondolin does not compare favourably with the *Redunca darti* material from Makapan where *R. darti* was the common reduncid at the time of the Limeworks deposition. Wells and Cooke (1956) and Vrba (1987) describe *R. darti* as having cheekteeth that are more robust than those of its modern counterpart. The horn structure is also different. Although the general tooth morphology of the Gondolin material is similar to the teeth of the extinct species they are slightly less robust and the premolars are smaller. Where skull and horn core material was present it supported the impression that *R. arundinum* was the closest parallel.

The klipspringer was the second most common species and it soon became apparent that it belonged to the fossil form *Oreotragus major* as opposed to the extant form *O. oreotragus*, which has a relatively

**TABLE 7**

**Age data of the species**

| Species | MNI | No. old individuals | No. sub adult individuals | No. Juvenile individuals |
|---|---|---|---|---|
| *Redunca arundinum* | 33 | 2 | 5 | |
| *Oreotragus major* | 17 | 4 | 7 | 2 |
| *Hippotragus equinus* | 1 | 1 | | |
| Medium alcelaphine | 4 | | 2 | |
| *Damaliscus dorcas* | 2 | 1 | | |
| *Tragelaphus strepsiceros* | 2 | 1 | | 1 |
| *Crocuta crocuta* | 1 | 1 | | |
| *Procavia antiqua* | 3 | | | 1 |
| *Procavia transvaalensis* | 2 | 1 | | 1 |
| *Hystrix makapanensis* | 4 | | | 2 |
| Lagomorph | 3 | | | 1 |
| *Metridiochoerus andrewsi* | 3 | 1 | 1 | 1 |
| Rhinoceros | 1 | | | 1 |

shorter premolar tooth row and more delicate teeth (Vrba 1976). The fossil form is found in fair numbers at Makapan (Wells 1951, Wells and Cooke 1956) and comparison with this material confirmed that this was the species in question. Klipspringers are specially adapted for living in rocky habitats. Their hoof structure is such that they stand on the tips of the same and the hard rim of the hoofs surrounds a soft pad that enhances grip. The lower limb skeletal structure is diagnostic. Interestingly enough although the teeth of the fossil form are generally larger and more robust than *O. oreotragus* the postcranial elements often do not appear much different in size and robusticity from those of the modern species.

The *Hippotragus equinus* (roan antelope) tooth found at Gondolin differs from *H. niger* (sable antelope) material both on measurement and morphologically. Measurements taken by Klein (1974) of these species in his study on the blue antelope were used as an aid to identification. Roan are restricted to lightly wooded savannah with extensive areas of tall grass where water is available. They are predominantly grazers and tend to be gregarious (Smithers, 1983). The tragelaphine mentioned in the species list (Table 3) is smaller than the kudu, *Tragelaphus strepsiceros*. Both the kudu and eland (*Taurotragus oryx*), are found at Gondolin and both are browsing species.

Two species of hyrax, *Procavia antiqua*, and the larger *P. transvaalensis*, have been found in modest numbers and would have made use of rocky outcrops that would have supplied enough cracks and crevices for shelter. Hippopotamus and a juvenile rhinoceros were interesting and unusual additions to the faunal list.

As far as the equids are concerned most of the postcranial material compared most favourably with *Hipparion*, the three toed horse (Churcher and Watson in press). Two upper cheekteeth that came from the same individual are extremely worn and although the protocone is not isolated as is usually the case with *Hipparion*, this may be the result of very heavy wear.

An upper molar fragment is certainly an *Equus sp.* and compares favourably with *E. capensis* (giant Cape horse) in size.

The only two carnivore species that are represented in the entire collection were identified, using teeth, as a very old *Crocuta crocuta* (spotted hyaena) and at least two black backed jackals, *Canis mesomelas*. These two taxa were found in the same block of breccia. Remarkable by their absence were any primates. One would have expected baboons at least, to have been present in this environment.

Table 7 gives some age data for the various animals found in the fossil deposit. It is interesting to note that relatively few of the reedbuck were either very old or subadult whereas a relatively high proportion of the klipspringers and larger antelope species were either very old or relatively young. This certainly indicates some form of prey selection with the reedbuck being not only the most commonly taken but possibly the preferred size.

## DAMAGED BONE

A total of 84 bones were positively identified as being damaged postmortem. Four agents have been identified, namely carnivore damage, porcupine gnawing, small rodent gnawing and borer beetle damage. As seen in Figure 5, 54 (64%) of these showed carnivore damage, 14 (17%) showed porcupine-gnawing and small rodent-gnawing and two (2%) showed borer beetle damage (Figure 5). The carnivore damage was generally found on pieces of spongy bone or the ends of long bones. The majority of the marks when viewed under the stereo microscope were very fine grooving and pitting, the type of damage that could result from a young animal chewing the bones with sharp, fine milk dentition. It is well known that leopards rear their cubs in caves and it is postulated here that one of the main collecting agents involved at Gondolin were breeding leopards which brought prey back for their cubs. The size range of the animals represented in the collection, as well as age categories, indicate that this may be a viable suggestion. A few of the bones had clear canine punctate marks on them. Characteristically when a carnivore chews a bone it shows tooth impressions on both the top and under sides of the bone. The majority of these bones were damaged on both surfaces as would be expected.

The porcupine-gnawed bones were generally the shafts of Bovid III size animals, flakes or miscellaneous pieces. Porcupines are known to bring bones to caves to gnaw in order to sharpen their incisors. Although they undoubtedly played a role here in bone accumulation it was a minor one. In purely porcupine collected assemblages over 70% of the bones are gnawed (Brain 1981; Brain 1991; Hughes 1961). The small rodent gnawing was most frequently observed on the second phalanges of *Oreotragus major*. Rodents gnaw bones to keep their ever growing incisors in trim and to provide a phosphate supplement to their diets and to this purpose they frequent caves where bones have accumulated. From the damage observed on the klipspringer phalanges it appears as if these particular bones were suitably shaped and sized and thus favoured by the rodents doing the damage. The borer beetle damage occured in the bones as they lay on the cave floor surrounded by organic debris which would have attracted the beetles in the first instance.

Twelve bones showed signs of pathology other than that caused peri and postmortally. A distal metapodial and a first and second phalanx of a single Bovid II individual show severe arthritic bone growth, especially around the articular surfaces with partial obliteration of these areas. It seems as if it may be related to a fracture of one of the condyles on the metapodial. Here malalignment and callous bone growth are visible. Another very interesting abnormality is seen in the angle of the lateral process of a vertebra. The specimen is that of a young animal and what seems to be a clean cut in the bone is present. On close scrutiny bone regeneration is clear on the edges of the wound. The bulk of the other pathological damage seems to be related to abcess scarring and infection where a resulting hole is surrounded by regenerative or reactive bone growth. Two small rodent limb bone shafts showed reunion and callous growth following fractures.

Five bone fragments had their edges rounded and appeared to have been partially digested in a carnivore's stomach.

## CONCLUSIONS

Faunally there is no clear evidence that more than one time period is represented. The site today is situated in a hilly area with rocky slopes and outcrops. Tree coverage is fair and apart from the lack of permanent water it would still be suitable for the modern equivalents of the

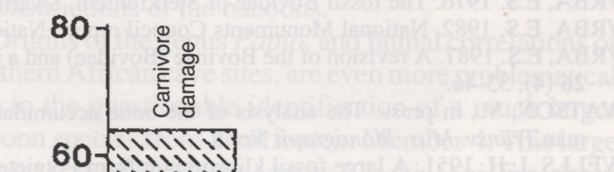


FIGURE 5: Histogram showing agents and percentages of postmortally damaged bone recovered from Gondolin.

fauna found in the fossil sample. Not far from the site the country opens up into grassland plains that would have been suitable for the springbuck and alcelaphine bovids represented in the sample. At Swartkrans the proportions of the bovid fauna are quite different suggesting a generally more open grassland environment (Brain *et al.* 1988, Watson in press) as opposed to Gondolin which must have been more contoured in the immediate vicinity of the cave.

It seems likely that the bones were carnivore-accumulated with the leopard being the most obvious candidate. Besides the damage on the bones which suggests a breeding environment, the prey species are reasonably typical for the predator in question. Reedbuck were obviously plentiful at the time and appear to have been the favoured prey species. Leopards in the Matopos have been reported to favour klipspringers and hyraxes as their prey. These spotted large cats have been known to prey on hartebeest, kudu and wildebeest. Where larger prey species are represented in the fossil collection they are often very old or subadult individuals. Leopards are renowned hunters of other carnivores and are said to be partial to hyaena and jackal. They have been reported to eat porcupines as well (Smithers, 1983). A breeding lair in a sinkhole on the Jack Scott Nature Reserve, south east of Gondolin and in the same general vicinity, has recently been reported (I. Plug, pers comm.). The female leopard has dragged numerous, fairly complete carcasses of prey species as large as eland down a precipitous entrance for her cubs. A similar scenario is envisaged for Gondolin at the time of the fossil deposition and this could account for the relatively high bone density, the completeness of some of the skeletal elements and the carnivore damage observed on the bones.


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