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# A PRELIMINARY ESTIMATE OF THE AGE OF THE GLADYSVALE AUSTRALOPITHECINE SITE

by

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**ABSTRACT**

Excavations conducted at the Gladysvale site in the Transvaal, South Africa during 1991 –1992 have revealed an abundant Plio-Pleistocene fossil fauna from the limeworks breccia dumps and *in situ* decalcified deposits. To date, over 600 specifically identifiable macro-mammalian specimens have been recovered including the remains of *Australopithecus*. These identifications have revealed that the Gladysvale site has an extremely diverse macro-mammalian faunal assemblage equal to many other South African Plio-Pleistocene fossil sites. Comparison of the Gladysvale macro-mammalian fauna with those of the other early hominid-associated sites in South Africa indicates an age for the deposit(s) at Gladysvale between 1.7 - 2.5 m.a.. In addition , the Kromdraai A macro-mammalian assemblage is considered to be closer in age to the Gladysvale assemblage than any other South African faunal assemblage.

KEY WORDS: *Australopthecus*, Gladysvale, Macro-mammalian chronology

## INTRODUCTION

In November of 1991, a joint excavation project by the Palaeo-Anthropology Research Unit and the South African Geological Survey was undertaken at the Gladysvale fossil site in the Krugersdorp District, approximately 13 km east of Sterkfontein. The excavation of the site has resulted in the recovery of over 600 identifiable fossil faunal remains from the calcified and decalcified cave sediments. Most of the fossil fauna was recovered from the large external and internal breccia dumps which were the result of lime mining operations conducted by the Norton family of Krugersdorp from 1902 - 1910 (H. Norton personal communication). At present , the focus of the excavation activities is on the sampling of the various *in situ* deposits, and this work in particular has yielded a rich faunal assemblage. In April of 1992, the first fossil hominid remains were recovered from the cave breccias. These have been preliminarily identified as *Australopithecus* cf. *africanus* (Berger 1992, Berger *et al.* in press). The discovery of early hominid material from Gladysvale has led to the need to assess the relative chronological position of the site's sediments in relation to the other South African hominid bearing sites. Fortunately, Gladysvale has an abundant and diverse fauna which readily allows for the comparison of its fossil mammals on a broad basis with those of other less faunally abundant sites and with those sites possessing comparable faunal abundance.

The Gladysvale site has been known as a rich fossil deposit since Robert Broom first visited the cave in the mid-1930's and recovered the fossilized remains of several extinct animals (Broom and Schepers 1946). Despite the site's richness in fossil bone, it was not until recently that the breccias were extensively sampled. Only a few fossils had previously been identified from the site, most of these were recovered by the University of California, Berkeley expedition of 1947-48, and primarily identified and listed by Cooke (1963, 1978). The three chambers of the cave were explored and mapped in the late 1980's (Martini and Keyser 1989).

Since the discovery of the Taung skull in 1924, and the subsequent recovery of large numbers of Plio-Pleistocene hominid remains from the four Transvaal hominid sites, Makapansgat, Sterkfontein, Swartkrans and Kromdraai B, our anatomical knowledge of the australopithecines has greatly improved. However, despite the work of numerous researchers (Wells 1967, 1969, Partridge 1982, 1985, 1986, Vrba 1982, 1985, Delson 1984, 1988, Vogel 1985, Pocock 1987 ), neither the absolute nor the relative chronological age of these fossil deposits has as yet been established with any degree of confidence.

The fundamental problem facing Plio-Pleistocene excavations in South Africa is the lack of an absolute dating method of the sediments and breccias from which the fossils were recovered. Unfortunately, in southern Africa we were forced to rely mainly on comparative faunal dating with the well dated East African sites and to a lesser extent palaeo-magnetic correlations where obtainable. In addition, problems arise due to the very nature of cave deposits in which excavations are conducted. The type and diversity of the fossils which are found in the cave breccias are directly related to the collecting agent(s) and the environment in the immediate vicinity

of the cave entrance (see Brain 1981 for a review). It is therefore an advantage when attempting to place a faunal assemblage in relative chronological position to have access to many different fossil sites in geographically diverse areas so that a more realistic assessment of relative faunal content can be made. In addition, the more diverse the fauna recovered from a site, the easier it is to determine the relative chronological position of that site's deposit or deposits.

In the following discussion , the macro-mammalian fauna of Gladysvale is reviewed with the view of placing the Gladysvale assemblage in a relative chronological position by contrasting its fauna with those of the other South African Plio-Pleistocene fossil deposits. To achieve this goal it is not neccessary to discuss all of the macro-mammalian species that have been recovered to date, but for informative purposes the whole of the identified Gladysvale macro-mammalian species are listed in Table 1.

**TABLE 1**

**List of Macro-Mammals from Gladysvale**

| | |
|---|---|
| PRIMATES | |
| Cercopithecidae | |
| *Cercopithecoides williamsi* | 1 |
| *Papio* cf *izodi* | 1 |
| *Papio* cf. *robinsoni* | 1 |
| *Theropithecus oswaldi* | 2 |
| Hominidae | |
| *Australopithecus* cf. *africanus* | 1 |
| PERISSODACTYLA | |
| Equidae | |
| *Equus* cf *burchelli* | 1 |
| *Equus capensis* | 5 |
| *Hipparion* sp. | 1 |
| Rhinocerotidae | |
| *Diceros bicornis* | 1 |
| PROBOSCIDEA | |
| Elephantidae | |
| *Elephas* sp. | 1 |
| HYRACOIDEA | |
| Procavidae | |
| *Procavia antiqua* | 2 |
| *Procavia transvaalensis* | 2 |
| CARNIVORA | |
| Hyaenidae | |
| *Pachycrocuta bellax* | 3 |
| *Crocuta crocuta* | 1 |
| Canidae | |
| cf. *Nyctereutes* sp. | 1 |
| *Canis* sp. | 1 |
| Felidae | |
| *Panthera* cf. *leo* | 1 |
| *Panthera* cf. *pardus* | 1 |
| *Dinofelis* cf. *piveteaui* | 1 |
| *Dinofelis* sp. | 1 |
| ARTIODACTYLA | |
| Suidae | |
| *Potamochoeroides* cf. *shawi* | 3 |
| *Kolpochoerus* cf. *paiceae* | 1 |
| *Phacochoerus* cf. *antiquus* | 1 |
| *Potamochoerus porcus* | 1 |
| Bovidae | |
| *Syncerus caffer* | 2 |
| *Pelorovis* sp. | 1 |
| *Makapania broomi* | 2 |
| *Tragelaphus angasii* | 1 |
| *Tragelaphus strepsiceros* | 3 |
| *Taurotragus oryx* | 2 |
| *Redunca* cf. *arundinum* | 2 |
| *Redunca fulvorufula* | 2 |
| *Redunca* cf. *darti* | 1 |
| *Kobus* cf. *ellipsiprymnus* | 1 |
| *Kobus leche* | 2 |
| *Hippotragus equinus* | 3 |
| *Connochaetes* c.f. *gnou* | 1 |
| *Connochaetes taurinus* | 2 |
| *Alcelaphus* sp. | 7 |
| *Alcelaphus buselaphus* | 3 |
| *Damaliscus dorcas* | 3 |
| *Damaliscus* sp. | 1 |
| *Megalotragus* sp. | 1 |
| *Aepyceros* cf. *melampus* | 2 |
| *Antidorcas cf. marsupialis* | 1 |
| *Antidorcas bondi* | 3 |
| *Antidorcas recki* | 1 |
| *Oreotragus* cf. *oreotragus* | 1 |
| *Oreotragus major* | 2 |
| *Pelea capreolus* | |

**Note** : The number to the right of a species name indicates the minimum number of individuals of that species recovered from Gladysvale.

## Bovidae

Gladysvale (GV) has a diverse fossil bovid fauna with 26 species representing 16 genera. Most of the species have been recovered during the course of the current excavation and all identifications have been made by I. Plug of the Transvaal Museum. The bovid fauna will be discussed in greater detail in a separate paper (Plug and Keyser in preparation).

Six species of bovids found at Gladysvale are considered to have become extinct in South Africa at the latest in the early Pleistocene. The remainder of the bovid species are either unknown outside sites dated in the latest Pleistocene in southern Africa or are species which have known time ranges spanning the greater part of the Plio-Pleistocene. If taxa such as *Kobus leche* and *Pelorovis* sp., for which there is no previous South African Pliocene record, are excluded from the analysis, then the Gladysvale bovid fauna is similar to, albeit still more diverse than, the bovid fauna of Swartkrans Members 1 (SK 1) and 2 (SK 2) , Kromdraai localities B (KB) and A (KA), and Sterkfontein Member 5 (ST 5) (Vrba 1982, 1985; Brain 1981). When the later Pleistocene forms are considered in light of the greater diversity of species which are being sampled at Gladysvale , it is most likely that these forms indicate a more recent component mixed with the Pliocene fauna at Gladysvale. However, in certain cases the possibility cannot be excluded that the first chronological occurrences of some forms are being recorded at Gladysvale.

### Suidae

Four species of Suidae from Gladysvale have been identified by Cooke (1963, 1978, personal communication). At Gladysvale, the extinct species *Potamochoeroides shawi*, known from Makapansgat Member 3 (Mk 3), has been found together in the same breccia with the extant species *Potamochoerus porcus* (bushpig). The species *Kolpochoerus* cf. *paiceae* and *Phacochoerus antiquus* (= *modestus*) have been recorded in southern Africa only from the early to mid Pleistocene (Cooke and Wilson 1978).

The possibility of younger infilling sediments might explain the presence of *K. paiceae* in the assemblage, or the site may indicate the earliest South African occurence of this species. The presence of a fossil specimen of *Potamochoerus porcus* found together with the extinct form *Potamochoeroides shawi* is extremely interesting as little is known of the fossil history of the extant bushpig. If the presence of *P. shawi* is indicative of the Pliocene as has been suggested by Bender (1992), then the presence of *P.* cf. *antiquus* and *K. paiceae* suggest a mixed assemblage.

### Equidae

Equids are recovered from Gladysvale with some frequency and are currently being analyzed by V. Watson of the Transvaal Museum. To date, a minimum number of seven individuals have been identified of which the predominant species is the megadont horse *Equus capensis*. Two other species of equidae, *E.* cf. *burchelli* and *Hipparion sp.*, have been tentatively identified from isolated teeth. Whilst equids are not of particular value in dating the deposits at Gladysvale, the presence of *E. burchelli* may place an upper limit on the earliest deposition of the infill at or around the time of the latest deposition of Sterkfontein member 4 (ST 4).

## PRIMATES

At present, four species of cercopithecidae and one of hominidae have been identified from Gladysvale. Whereas primates in general are rare, they may prove to have considerable importance in dating the assemblage if and when more specimens are recovered. The non-human primate specimens are currently being analyzed by J.K. McKee of the University of the Witwatersrand. The four cercopithecid taxa consist of one specimen of *Papio* cf. *izodi*, one *Cercopithecoides williamsi*, one *P.* cf. *robinsoni*, and two *Theropithecus oswaldi*. Two hominid teeth have been recovered at Gladysvale which have been tentatively identified as belonging to the species *Australopithecus* cf. *africanus* (Berger *et. al.* 1993.).

The presence of *P.* cf. *izodi* in the assemblage links Gladysvale with the South African Pliocene deposits of the Taung Hrdlicka site (TH), Makapansgat Member 3 (Mk 3), and ST 4. However, if the specimens of *T. oswaldi* and *P.* cf. *robinsoni* prove to be contemporaneous with *P.* cf. *izodi* at Gladysvale, then this would associate the site's assemblage with an age slightly younger than ST 4 but older than the deposits of ST 5, Sk 1 and KA - B. The presence of the hominid *A.* cf. *africanus* supports such an age, theoretically representing an age of deposition which is prior to the appearance of the southern African "robust" and *Homo* lineages.

### Carnivora

The most common carnivore in the Gladysvale assemblage is the giant hyaena *Pachycrocuta bellax (=Hyaena bellax )* (Werdelin and Solournias 1991) followed in abundance by *Dinofelis piveteaui* and another *Dinofelis sp.*, *Canis sp* , *Crocuta crocuta* , *Panthera* cf. *leo*, and *P.* cf. *pardus* (Berger in preparation). Up until now *D. piveteaui* has been recorded only from the KA faunal assemblage. The single *Canis* specimen is an approximately 60% complete skeleton of a wolf-sized hunting dog ( Berger in preparation). The only other wolf-sized hunting dog specimens known from the South African fossil record are two isolated teeth of *Canis atrox* Broom from the KA site, and a large canid incisor from Sterkfontein Member 5 (Broom 1948; Turner 1987).

Whereas the large carnivores are particularly abundant in the Gladysvale assemblage comprising some 11% of the total fauna, only one small carnivore has been recovered. The identification of the genus *Nyctereutes* , comparable to the Asian racoon dog, which is also known from the KA and Coopers assemblages (Turner 1986), is extremely tentative and is based on a single upper canine (Berger in preparation).

## SUMMARY AND CONCLUSIONS

The recently recovered fossil faunal remains from the Gladysvale site indicate a probable age for the older assemblage(s) in the mid to late Pliocene. While there is a strong possibility that two or more faunal units are present at the site, the currently available Gladysvale fossil fauna indicate the likelihood that no assemblage at Gladysvale is as old as the assemblage of Mk 3 . However, due to the presence of several species known only from the southern African Pleistocene , it is possible that there are deposits at Gladysvale younger than the SK 2 assemblage.

The carnivores are important in establishing a relative chronology of the older deposits at this early stage of excavations. Previously, the genus *Pachycrocuta* had been recovered only from the Mk 3, ST 4 and 5, KA and the Baard's Quarry assemblages (Hendey 1974, Brain 1981, Turner 1986). Since there is considerable debate regarding the age of the KA - KB assemblages, the youngest occurence of this species which can be established with some confidence is at ST 5. The absence of this very distinctive species at KB and SK 1 supports the idea that the KA assemblage is more closely related in time to the mid to early-late Pliocene deposits of ST 5 and ST 4. Additionally, the presence of the wolf-sized dog which is comparable to the specimens of *Canis atrox* from KA and possibly a specimen from ST 5, would tend to associate chronologically the Gladysvale assemblage with these two deposits.

Whilst it is believed that there are justifiable reasons for

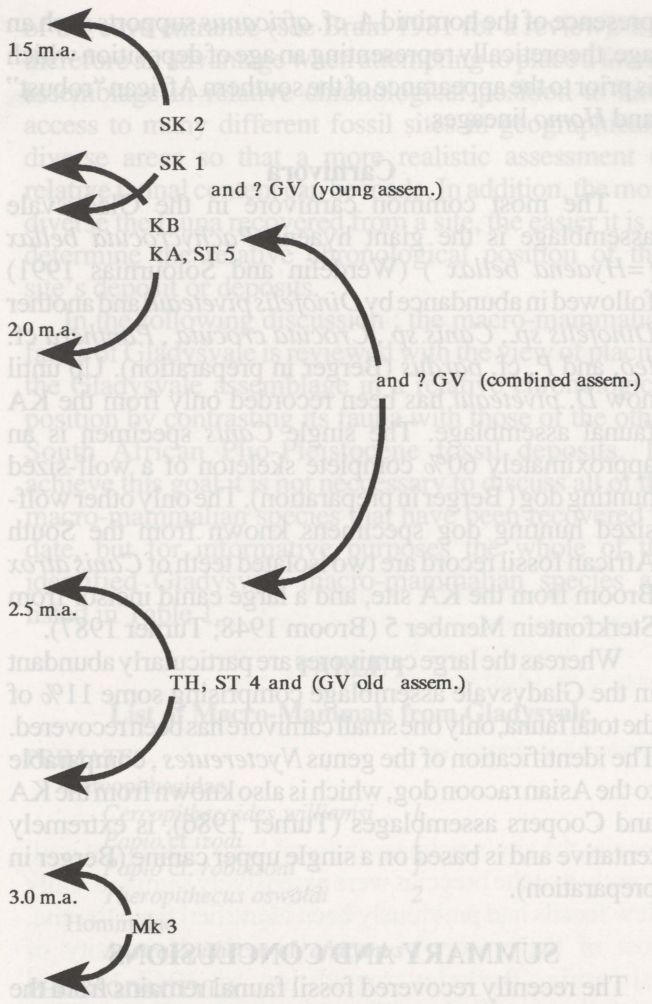


Figure 1: Authors reconstruction of the relative chronological position of the hominid-associated South African Pliocene and Early Pleistocene fossil sites based on the macro-mammals and on the work of Wells (1967, 1969), Partridge (1982, 1985, 1986), Vrba (1982, 1985), Delson (1984, 1988), Vogel (1985), Pocock (1987) and McKee (personal communication). Numbers to the left are in millions of years before present. Abreviations for sites follow those given in the text. Lines and arrows indicate most likely time span for a given site.

associating the whole faunal assemblage of KA more closely with those of KB and SK 1, more so than with those of ST 4 and Mk 3, the author would strongly support the idea that the KA assemblage is as old as or older than the assemblage of ST 5. If this is correct, then the KA assemblage may be somewhat older than has previously been suggested (Vrba 1982, 1985; Vrba and Panagos 1983; Delson 1984, 1988; Pocock 1987). The Gladysvale large carnivore assemblage is comparable to that of the KA assemblage with only a few additional as yet specifically unidentified species recovered from Gladysvale which are not found at KA. This implies that the Gladysvale assemblage(s) in general is/are closely related in time to the KA assemblage.

In contrast to the carnivore assemblage, the bovid fauna suggests a chronologically mixed assemblage. In the presence of early to mid Pliocene forms such as *Makapania* apparently more recent elements such a *Damaliscus dorcas*, *Antidorcus marsupialis*, *Connochaetes gnou*, *Kobus leche* and *Syncerus caffer* are present. Whether these species represent a Pleistocene assemblage at Gladysvale, or whether they represent the earliest known occurence of these forms will only be established in future *in-situ* excavations. The suid fauna strongly indicates a mixed chronological assemblage. However, it is likely that the earliest occurence of the species *Potamochoerus porcus* is recorded at Gladysvale as it is found together with the Pliocene species *Potamochoeroides shawi*.

Figure 1 indicates a possible relative chronological position of the early Gladysvale faunal assemblage. Based on the above analysis of the macro-mammals, and considering the Gladysvale fauna as a single assemblage, this would place Gladysvale chronologically between 2.5 and 2.0 m.a., or just prior to the deposition of the KA site. If two or more units exist at Gladysvale then this would place the oldest assemblage(s) at or around the age of the ST 4 assemblage (±2.5 - 3.0 m.a.), and the younger assemblage(s) at, or younger than, the SK 1,2 and KA -B assemblages (±1.65 - 2.0 m.a.).

At this early stage of the excavation it is not possible to define differing members or units within the deposit. Further excavations will reveal whether the Gladysvale fill consists of a single deposition or two or more periods of deposition spanning a considerable length of time.

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