TAXONOMY OF THE STERKFONTEIN FOSSIL CERCOPITHECINAE: THE PAPIONINI OF MEMBERS 2 AND 4 (GAUTENG, SOUTH AFRICA)

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October 16, 2006

To my wife, Alison

"Wheresoever she was; there was Eden."
Mark Twain (1904)
– *The Diaries of Adam and Eve*

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This analysis originated on a trip to South Africa in 2000 and evolved into what you see before you. Along the way, its path was modified and forever altered by those individuals with whom I came into contact. Without those interactions, I must say this analysis would not be what it is today.

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friend, today. A better friend could not be imagined. David Nelson, a professor at the University of South Alabama, changed my life when I took his course, Comparative Vertebrate Anatomy, and I begin to see the evidence for homology and common decent. The way I saw the world forever changed. Sheldon Gottlieb, also a professor at South, was a great promoter of evolution and was always willing to spark a lively debate on the intricacies of the science and religion debate. To each of them, I provide thanks. At Indiana, Dan Osborne was a great friend and has on many occasions served as a sounding board for my ideas. I always enjoyed the time that I spent with Dan and Britta Grieshaber while at IU. Charles Egeland has also been a source of entertainment and motivation over the years, as he is one of the most driven individuals that I know. Over the years, several people with whom I have had the pleasure of getting to know while in South Africa have provided hours of support and entertainment. They are: Morris Sutton, Dorian Staps, Kerstin Engel, Mathias Huck and Job Kibii, Vic Mackey and Cletus Van Damme. To each, I am thankful for the time that we spent together.

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been someone that I could look up to, and the person that taught me much about girls, cars and life in general. To them, I offer the most sincere heartfelt thanks, and hope that I have made them proud.

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As Bob Hope once said, "When we recall the past, we usually find that it is the simplest things - not the great occasions - that in retrospect give off the greatest glow of happiness." Nothing could be nearer to the truth; I look forward to creating more memories with all of you.

ABSTRACT

Jason L. Heaton

TAXONOMY OF THE STERKFONTEIN FOSSIL CERCOPITHECINAE: THE PAPIONINI OF MEMBERS 2 AND 4 (GAUTENG, SOUTH AFRICA)

At Taung, the discovery of fossil baboons drew the attention of Raymond Dart, in effect leading to the first discovery of *Australopithecus* remains. Since then, fossil cercopithecoids have served as useful taxa indicating the presence of hominid fossils in South African cave sites and providing valuable evolutionary data from the African Plio-Pleistocene.

The aim of this study was to conduct a complete taxonomic reanalysis of the fossil cercopithecoids from Sterkfontein, focusing upon the craniodental remains of the Papionini from Members 2 (~3.3 Ma) and 4 (~2.6 Ma). This analysis included all specimens attributed to *Parapapio* and *Papio*, genera closely related to modern mangabeys and baboons, respectively.

Morphological data, mainly craniodental, were analyzed and classified to genus-species, if possible. Assessments of inter- and intra-specific variation among the primates were completed in order to determine the relative frequency of each species. Upon re-evaluation of the papionin taxonomy, the data were used to re-evaluate South Africa cercopithecoid biochronology via paleontological statistical techniques, such as Unitary Associations and Correspondence Analyses.

This analysis identified a suite of morphological characters that can be reliably used to identify the fossil papionin species. Results suggest the existence of three sympatric papionin species during the accumulation of Members 2 and 4, rather than the six to seven species suggested by earlier analyses. Overestimates of primate biodiversity were found to result from two conditions: (1) an artificial bias in the pre-1966 primate collections (i.e. poor provenance) and (2) simple misidentifications of fragmentary specimens. In the biochronological framework developed here, Sterkfontein Member 2 was found to represent the oldest papionins in South Africa.

The results of this analysis have far-reaching implications for primate, including hominid, evolution. The fossil evidence for the origin of modern baboons, as presented here, is now in agreement with current genetic models. Additionally, as shown here, papionins may prove to be useful indicators of hominid speciation events; perhaps, providing insight into the 'robust' clade debate. And lastly, this analysis shows that papionins may be used broadly as biostratigraphic indicators providing an alternative means of dating South African sites in the absence of more absolute dating methods.

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CHAPTER ONE
INTRODUCTION

Statement of the Problem

In the early 1930s, hominid and cercopithecoid fossils began to be recovered from the site of Sterkfontein (Figure 1-1). The site produced the first adult australopithecine (Broom, 1937) and the first species of a new fossil genus of cercopithecoid, *Parapapio* (Jones, 1937). Since then, Sterkfontein has continued to produce notable specimens of each group, as evidenced, for example, by the remarkable discovery of the skull and associated skeleton of an *Australopithecus* individual (Clarke, 1998, 1999; Clarke and Tobias, 1995). Additionally, Sterkfontein remains significant because it has produced more cercopithecoid remains than any other site in South Africa. In the past, the rate of recovery far exceeded the rate of analysis and interest in the cercopithecoids. Remarkably, the last large scale analysis of the taxonomy of these primates was conducted over thirty years ago by William Eisenhart (1974), whose research focused primarily upon specimens from Member 4 of the deposit. Continued excavations since that time have increased the sample to >3500 specimens including both the University of Witwatersrand – Medical School and the Transvaal Museum collections (personal observation, 2001-2006), and a need for a systematic reanalysis of this collection has been noted by several specialists (Eisenhart, 1974; Frost, 2001; Maier, 1970; Szalay and Delson, 1979).

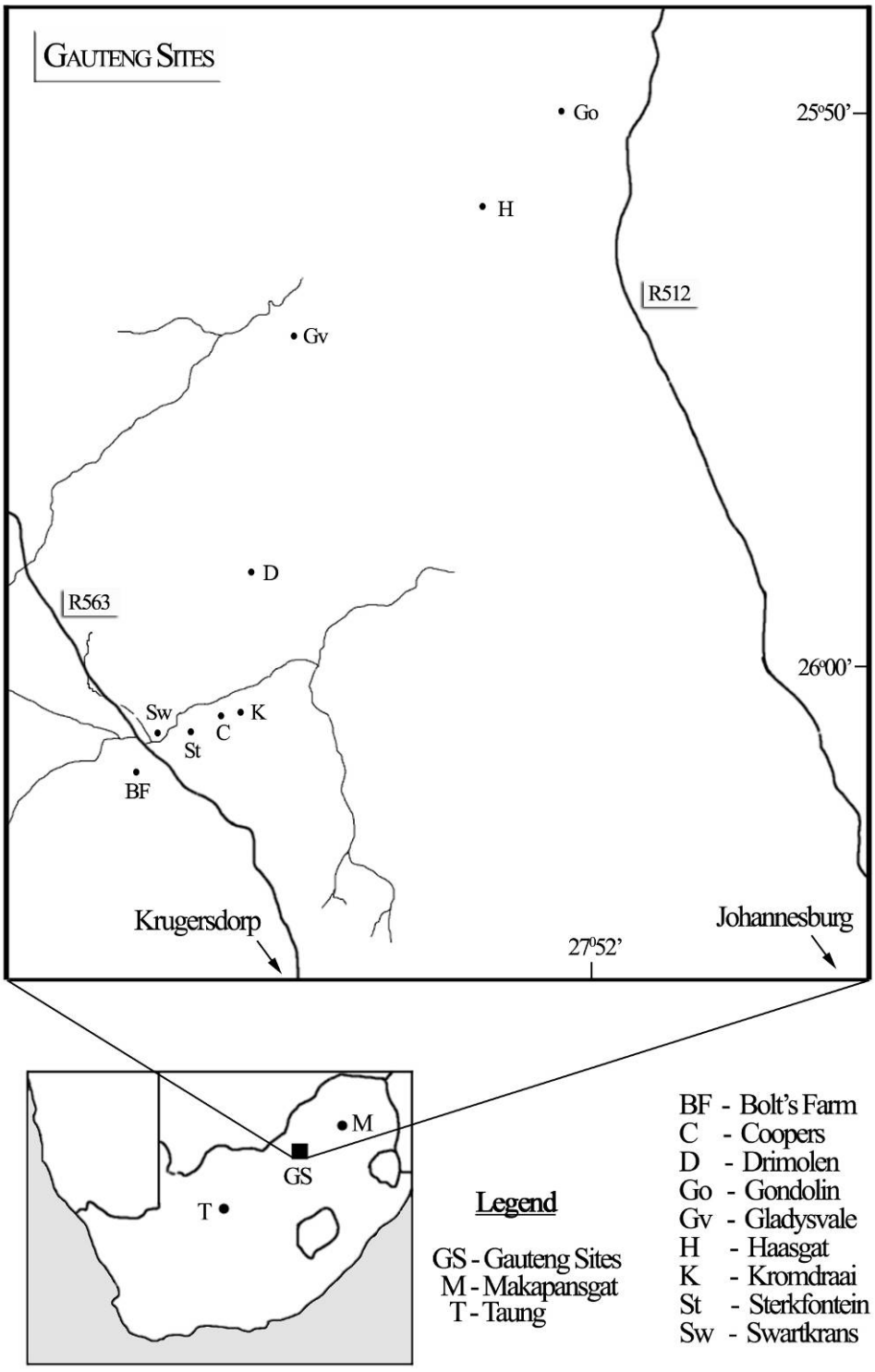


Figure 1-1. Overview of Gauteng Sites. Major South African fossil hominid sites in close proximity to Sterkfontein are shown in relation to non-Gauteng sites (adapted from Kuman and Clarke 2000).

Thus, the aim of this study was to conduct a complete taxonomic re-evaluation of the fossil cercopithecoids from Sterkfontein with a focus upon cranio-dental remains, as no direct associations between crania and post-crania have been made to date. A small sample of new, more complete cercopithecoid material, derived from Member 2 of the Sterkfontein Formation (Pickering et al., 2004a) were also included to aid in the identification and description of the fossil papionins.

Previously, analyses of South African fossil cercopithecoids were hampered due to the fragmentary nature of the fossils. For example, Freedman and Stenhouse (1972) discovered that multivariate analyses could not be productively applied to the Sterkfontein sample, and as a result, could only attribute a relatively small portion of the collection to species and/or sex. Consequently, the number of non-human primate species in Sterkfontein Member 4 is unresolved with estimates ranging from four to seven species (Eisenhart, 1974; Freedman and Stenhouse, 1972). Nevertheless, most of the cercopithecoid sample from Sterkfontein can be securely attributed to either *Papio* or *Parapapio*.

Currently, the relationship between these two genera is not clearly understood, but some have suggested that the origin of the genus *Papio* might rest in an early population of *Parapapio* (Delson, 1973; Jolly, 1966; Simons, 1972). Arguments have also been presented that some portion of the *Parapapio* specimens can in fact be attributed to *Cercocebus* spp. (Delson, 1984; Szalay and Delson, 1979), a phylogeny also favored by Fleagle (1999). Renewed interest in the relationships between the papionini genera (Disotell, 1994, 1996, 2000; Fleagle and McGraw, 1999, 2002; Harris, 2000; Harris and

Disotell, 1998) emphasize the importance of the three *Parapapio* species at Sterkfontein for understanding baboon evolution.

More significant to the paleoanthropologist, the papionins have featured prominently in debates concerning the age of the Sterkfontein deposits (Berger et al., 2002; Clarke, 1994, 2002; Clarke and Tobias, 1995, 1996; McKee, 1996a; Partridge et al., 2003; Partridge et al., 1999). Therefore, it is imperative that an updated analysis of the Sterkfontein cercopithecoids be performed, as the presence of a single taxon (e.g. *Papio hamadryas robinsoni*) may suggest dates later than 1.7 million years ago (Ma) for significant portions of the Sterkfontein Formation.

In addition to the papionins of Sterkfontein, a fossil colobine, *Cercopithecoides williamsi* has been identified in the deposit. Fortunately, *C. williamsi* and the fossil papionin, *Pp. jonesi*, have also been identified in East Africa and could potentially function as biostratigraphic linkages between East and South African deposits. However, in South Africa, both species were identified in the deposits of most hominid-bearing sites, providing little temporal differentiation among South African sites. For instance, *C. williamsi* and *Pp. jonesi* are present in the arguably oldest (Partridge et al., 2003) South African deposit, Sterkfontein Member 2 (Pickering et al., 2004a), as well as more recent deposits like Swartkrans II (Freedman, 1957). Therefore, the presence/absence of *C. williamsi* and *Pp. jonesi* are not reliable indicators of a deposit's age at any site in southern Africa, as both species appear to be chronologically insensitive. As a result, this analysis focused upon the fossil papionins of Sterkfontein, as they have been the most controversial and exhibit the greatest potential as biostratigraphic indicators.

As this analysis will show, some general patterns were observed which can be used to chronologically tie South African sites into large biostratigraphic categories. In these site comparisons, it was discovered that the site which appeared to be the most taxonomically similar to Sterkfontein was the fossil site of Taung. For that reason, the relationship between the two sites is considered in greater detail later in this analysis. Before discussing the potential use of fossil cercopithecoids in the Sterkfontein Valley, a brief discussion of the Sterkfontein stratigraphy is in order.

Sterkfontein Stratigraphy Overview

The sometimes problematic and complex stratigraphy of Sterkfontein has hindered many taxonomic analyses, as secure designations of the origin of a specimen are necessary to understand the diachronic and synchronic relationships among taxa (Heaton and Pickering, 2005). The following discussion of the Sterkfontein stratigraphy, artifact industries and hominid associations is meant to briefly introduce readers to the history of the site. For more exhaustive surveys, see Brain (1981), Clarke and Kuman (2000) and Klein (1999).

The first plan and section of the Sterkfontein deposit (Cooke, 1938) suggested that the cavern was one continuous deposit (Brain, 1958; Cooke, 1938). In 1957-1958 during Extension Site excavations, Robinson (1962) observed irregularities in the Sterkfontein deposit that did not agree with the presence of a single conformable deposit. Rather, Robinson (1962) argued that the Sterkfontein deposit represented three discernible members. From oldest to youngest, these members were: (1) Lower Breccia, (2) Middle Breccia and (3) Upper Breccia.

Renewed excavations at Sterkfontein began in 1966 by Tobias and Hughes (1969). In the decades to follow, the stratigraphy came to be seen as divided into six depositional members ranging from Member 1, the oldest, to Member 6, the most recent (Partridge, 1978). Member 1, the basal member, appears to be non-fossiliferous (Clarke, 1994). Tobias (1979) had investigated the Silberberg Grotto, an underground cavern containing Members 2 and 3 (Figure 1-2). Member 2 was not particularly productive until Clarke's discovery of StW 573 (see Clarke, 1998).

Member 2 has also yielded numerous cercopithecoid and carnivore remains (Clarke, 1994, 1998; Pickering et al., 2004a). Preliminary estimates have suggested dates over 3.3 million years old (Clarke, 1999; Partridge et al., 1999) for the Member 2 deposit with dates as old as 4.17 millions years (Partridge et al., 2003) suggested, as well. McKee (1996a) criticized early dates given by Clarke (1999) and has suggested that Member 2 may be closer in age to Member 4 (~ 2.5-2.6 Ma). The absence of significant bovid remains in this member makes the resolution of cercopithecoid biochronology particularly important.

In the past, attempts have been made to correlate South and East African sites using cercopithecoid remains, as an alternative means of determining a sites biochronological date. The absence of significant faunal remains from Member 2 previously precluded biostratigraphic comparisons of this member to other sites in Africa; although mention was made in a previous analysis (Delson, 1984) of Members 4 and 5. Renewed investigation into the Grotto, containing Member 2, has increased the cercopithecoid sample sufficiently for intra- and inter-site comparisons.

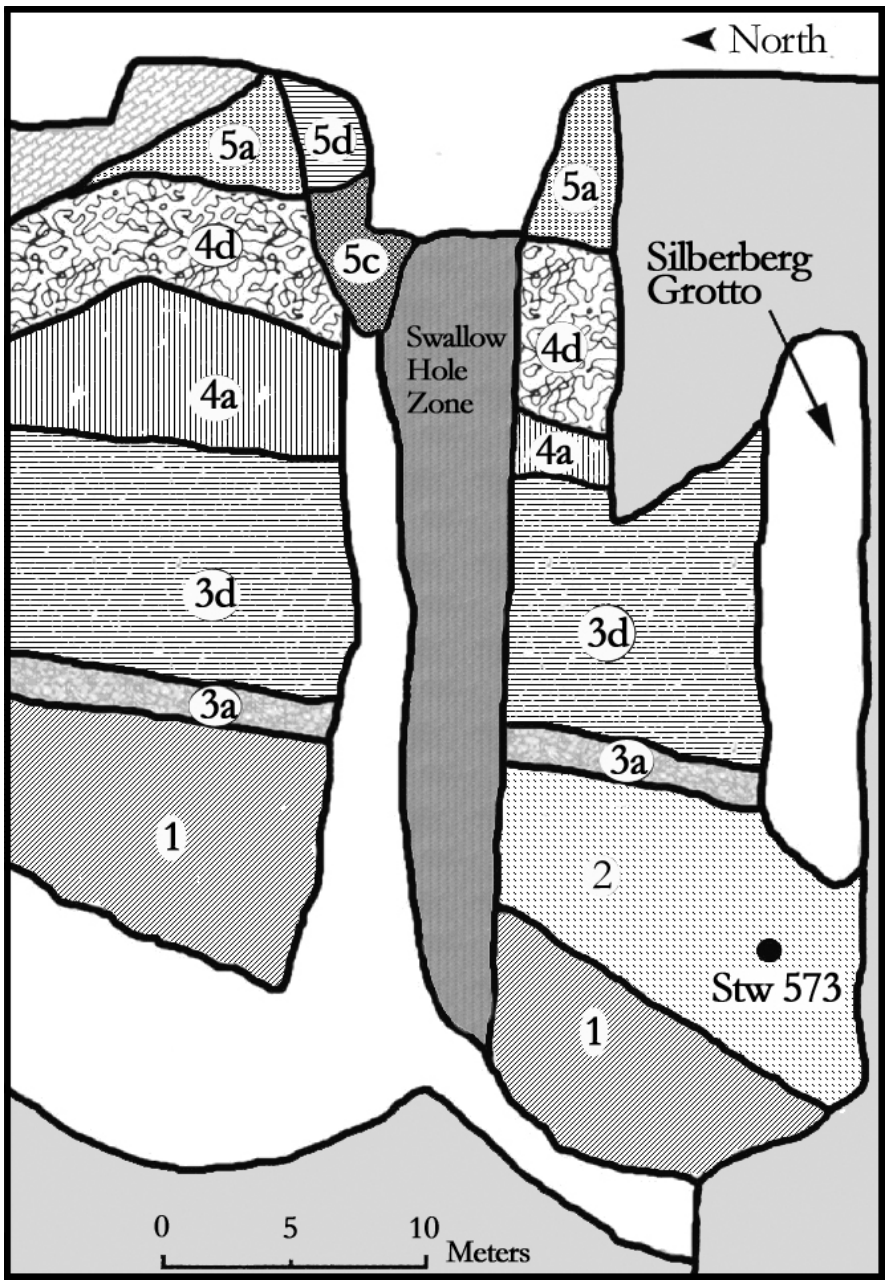


Figure 1-2. North-South section through the Sterkfontein Formation. Note the relationship of Member 4d and Member 5c (adapted from Partridge, 2000; Partridge and Watt, 1991).

Additionally, Members 4 and 5 have yielded sufficient faunal material to allow comparisons with East African sites. Currently, dates for Member 4 are in the range of 2.8-2.4 Ma (Clarke, 1994; Delson, 1984; Partridge, 1986; Vrba, 1985), a date roughly corroborated by ESR (Schwarcz et al., 1994) and paleomagnetism (Jones et al., 1986). As noted by Kuman and Clarke (2000), blocks attributed to Member 4 were identified in the Member 5 extension site excavations of 1957-1958 (Robinson, 1962). However, Robinson (1962) did not supply the provenance for the Member 4 blocks, but Kuman and Clarke (2000) have suggested that they may have been the isolated remnants of collapsed Member 4 breccia which once filled part of the Member 5 area. These interdigitations of the Member 4 and 5 deposits are clearly observable in a plan section of the Sterkfontein Formation (Figure 1-3).

Member 5 probably formed around 2.0-1.4 Ma (Clarke, 1994; Delson, 1984; Partridge, 1986; Vrba, 1985). Recently, Berger et al (2002) have suggested a later date for Member 4 , closer in age to Member 5 than previously concluded, suggesting an age as young as 1.5 Ma for Member 4. However, this conclusion was largely based upon the suggestion that the large-bodied papionin, *P. h. robinsoni* was present during the deposition of Member 4 (Berger et al., 2002; Delson, 1984; Eisenhart, 1974). As a result, the presence of *P. h. robinsoni* becomes central to any analyses of the papionini, and Heaton and Pickering (2005) have suggested that its presence in the Member 4 sample is artificial. A full discussion of the presence and/or absence of *P. h. robinsoni* in the Sterkfontein deposits and the circumstances surrounding its prior identification are outlined in Chapter Seven.

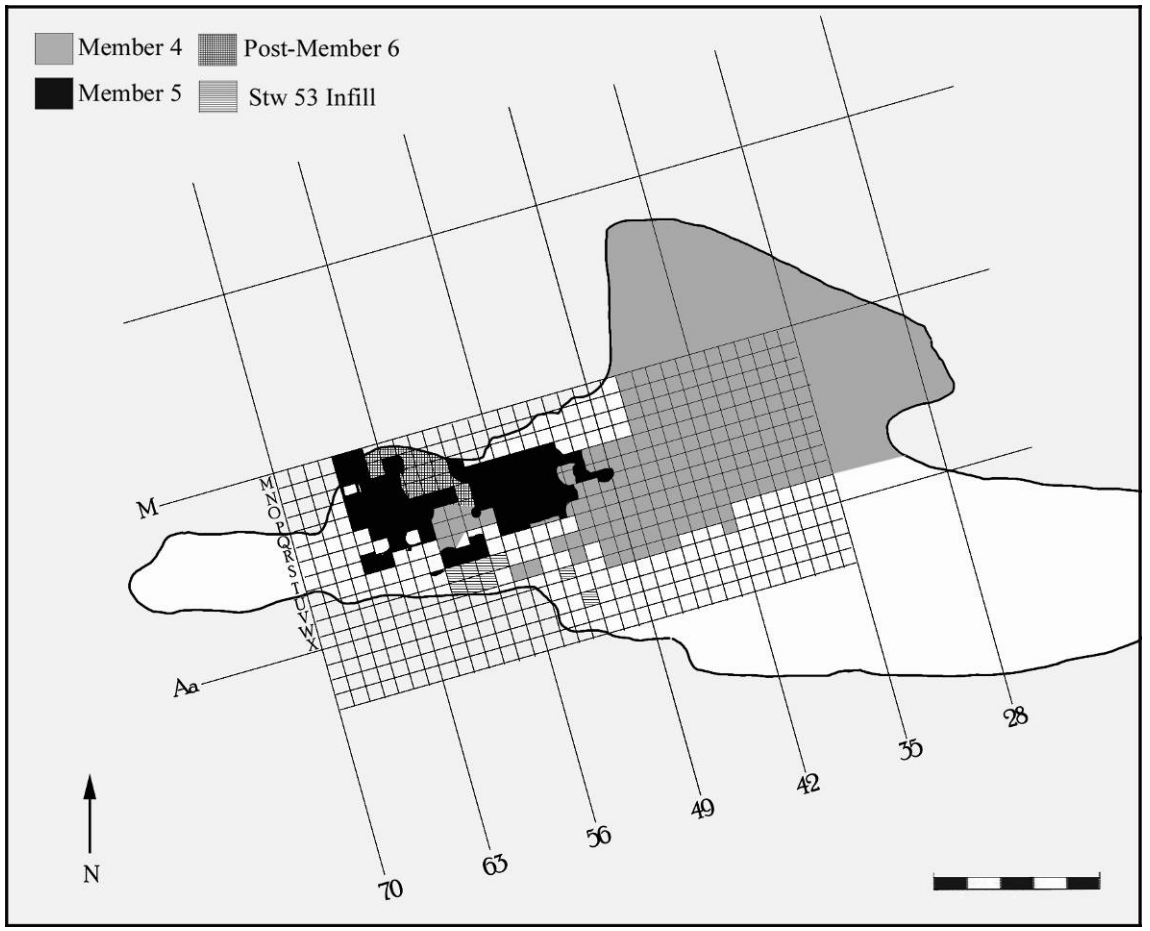


Figure 1-3. Surface Plan of Sterkfontein. The relative positions of Member 4 (Type Site), Member 5, the Stw 53 Infill and the post-Member 6 Infill are shown above. Note, the interdigitations of the Member 4 and 5 deposits between grid squares 49 and 63 (adapted from Kuman and Clarke 2000).

Furthermore supporting an earlier date for Member 4, artifacts have only been identified in portions of the Member 5 deposit (Kuman, 1994a, 1994b, 1998; Kuman and Clarke, 2000) although they appear at East African sites, such as Gona (Semaw, 2000; Semaw et al., 1997) approximately 2.6 Ma, roughly around the same time as the deposition of Member 4. The archaeological data is supported by the hominid remains from the two members, as well. Clarke (1988) has suggested the presence of possibly, two species of australopithecines in Member 4 with the notable absence of the genus *Homo*. While in contrast, *Homo* has been identified in Member 5 alongside the robust genus, *Paranthropus* (Kuman and Clarke, 2000). These observations along with evidence to be discussed later suggest that Member 4 of the Sterkfontein deposit is significantly older than Member 5 with an age greater than 2.0 Ma. Further refinement of the faunal dates of Member 4 and 5 must rely upon additional lines of evidence.

Lastly, Member 6 of the Sterkfontein formation is dated to after 200 thousand years ago (ka) (Clarke, 1994; Delson, 1984; Partridge, 1986; Vrba, 1985) and is of little significance to this analysis. Primates of modern form, most specifically *Papio hamadryas*, make their appearance much earlier in Member 5 and persist relatively unchanged for 1.5 millions years.

As mentioned previously, this analysis focuses upon the controversial Member 4 papionins and the newly discovered Member 2 remains. The following discussion reveals the convoluted nature of cercopithecoid species nomenclature in southern Africa and provides a glimpse into its impact on our understanding of hominid evolution.

History of South African Cercopithecoid Nomenclature

Early Cercopithecoid Discoveries

During the late nineteenth century, South Africa saw a growing interest in the mining of underground lime deposits for commercial exploitation. As an unexpected consequence, fossil mammals were recovered during the mining operations, and their importance was immediately recognized. At Taung, the discovery of fossil baboons drew the attention of Raymond Dart, in effect, leading to the discovery of the first *Australopithecus* remains (Tobias, 1984).

The aforementioned, first identified cercopithecoid fossils from Taung were demonstrated at a meeting of the Royal Society of South Africa in 1920. Haughton (1925) identified these specimens, as part of his newly created species, *Papio antiquus*. In a later analysis, Gear (1926) argued that the fossil material included two newly named species for which he suggested the names, *P. africanus* and *P. izodi*. In his analysis, Gear (1926) refers to Haughton's notes, but was unfortunately, unaware of the prior classification made by Haughton (1925). In Gear's (1926) classification, all of the specimens examined by Haughton (1925) were attributed to the newly created species of *P. africanus*. Two new specimens from the Anatomy Department's collection formed the second Taung species, *P. izodi*. Thus, Gear's (1926) naming of the species *P. africanus* was made in error. According to the International Code of Zoological Nomenclature (ICZN), Haughton's (1925) earlier species designation takes precedence over Gear's (1926). However, as noted in other analyses (e.g. Freedman 1957), *Papio izodi* is considered a valid taxon, and the name is still applied to a portion of the Taung material.

Recent evidence (McKee 1993; Heaton and Pickering 2005) has suggested the presence of *P. izodi* in portions of the Sterkfontein deposit, a discussion which we return to later.

Referring back to the earlier analyses, neither Haughton (1925) nor Gear (1926) made the appropriate type designations, as there was no reference to the specimen which was considered to be the holotype of *P. antiquus*. It was not until a much later analysis (Jones, 1937) that two specimens were designated (Figures 1-4 and 1-5), as lectotypes, of *P. antiquus* and *P. izodi*. Jones (1937) concluded that these were the most likely specimens which Gear (1926) would have considered to be the types for the two Taung species.

In subsequent analyses (Broom, 1934, 1940; Broom and Jensen, 1946; Jones, 1937), the state of these two species were repeatedly debated and altered. Initially, Broom (1934) not only failed to recognize the species *P. antiquus*, as a valid taxon, but also failed to realize that Haughton's (1925) description did not include the Anatomy Department specimens (i.e. the *P. izodi* sample). As a result, it was concluded that the fossil cercopithecoids from Taung represented a single species, which Broom (1934) mistakenly identified as *P. africanus* (Haughton) and later attributed to the genus *Parapapio* (Broom, 1940). In his analysis, Freedman (1957) concluded that *P. antiquus* was more appropriately attributed to the genus *Parapapio*, not *Papio*. Furthermore, Freedman (1957) suggested that *P. izodi* was in fact a member of the genus, *Papio*, contra the arguments of Jones (1937). As a result, the species names for Haughton (1925) and Gear's (1926) species became *Parapapio antiquus* and *Papio izodi* which are taxonomic designations widely accepted today, but as will be revealed in this analysis, a portion of the Sterkfontein materials exhibits morphological similarities to the Taung material. Consequently, the Taung sample may need further revision.

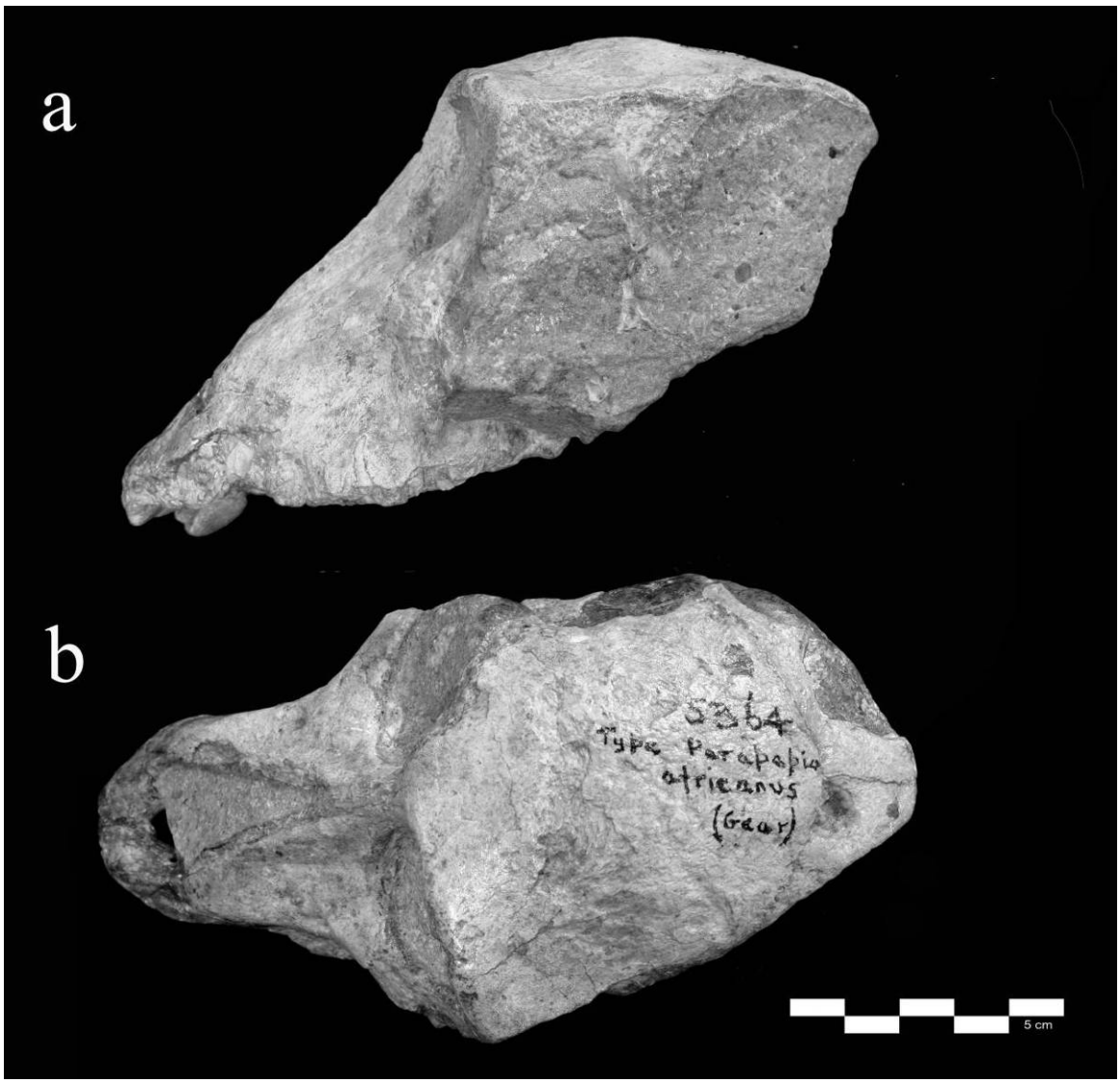


Figure 1-4. Type Specimen of *Parapapio antiquus.* Partial cranium shown in (a) left norma lateralis and (b) norma verticalis.

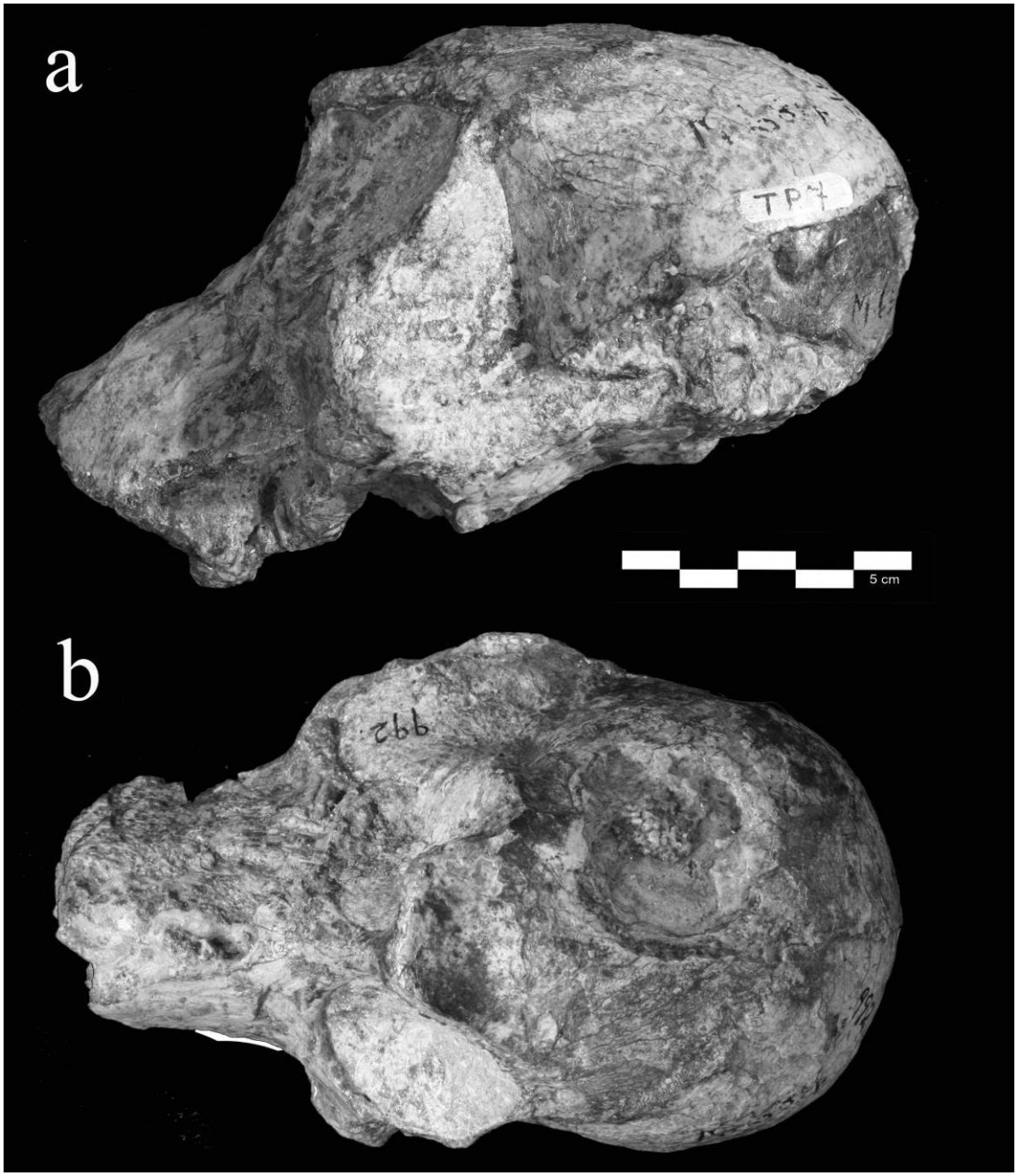


Figure 1-5. Type Specimen of *Papio izodi.* Partial cranium shown in (a) left norma lateralis and (b) norma verticalis.

The Sterkfontein Papionini Problem

The genus *Parapapio* was created by Jones (1937) for a group of fossil cercopithecoids from the fossil hominid site of Sterkfontein (Broom, 1937) and is still in use today. At the time, Jones' (1937) genus included only one species, *Parapapio broomi* (Figure 1-6). Upon discovering additional material, Broom (1940) concluded that the Sterkfontein material was too variable to be accommodated in one species. In tooth size, the then-available specimens, still few in number, fell distinctly into three groups. As a result, Broom (1940) interpreted the tooth-size differences to be differences in body size. Since by description, *Parapapio* was a non-dimorphic species (Jones, 1937), Broom (1940) concluded that the tri-modal dental distribution represented three distinct species of *Parapapio*. Two new species of *Parapapio* were created in the Broom (1940) taxonomic scheme. The two new species were *Pp. whitei* (Figure 1-7), the largest of the *Parapapio* species, and *Pp. jonesi* (Figure 1-8), the smallest. Broom (1940) maintained the species name, *Pp. broomi*, for the medium-sized *Parapapio* specimens.

Most taxonomic arguments about *Parapapio* have centered on the validity of Broom's (1940) species trichotomy. For example, Brain (1981) commented that "it seems remarkable that three closely related species of *Parapapio* differing only in size, should have lived synchronously in the immediate vicinity of Sterkfontein and Makapansgat." The consensus is that the inter-specific distinctions among *Parapapio* are ill-defined and ambiguous (Broom, 1940; Clarke, 1999; Clarke and Tobias, 1995; Eisenhart, 1974; Freedman, 1957, 1961, 1965; Freedman and Stenhouse, 1972; Frost, 2001; Szalay and Delson, 1979; Thackeray, 2004).

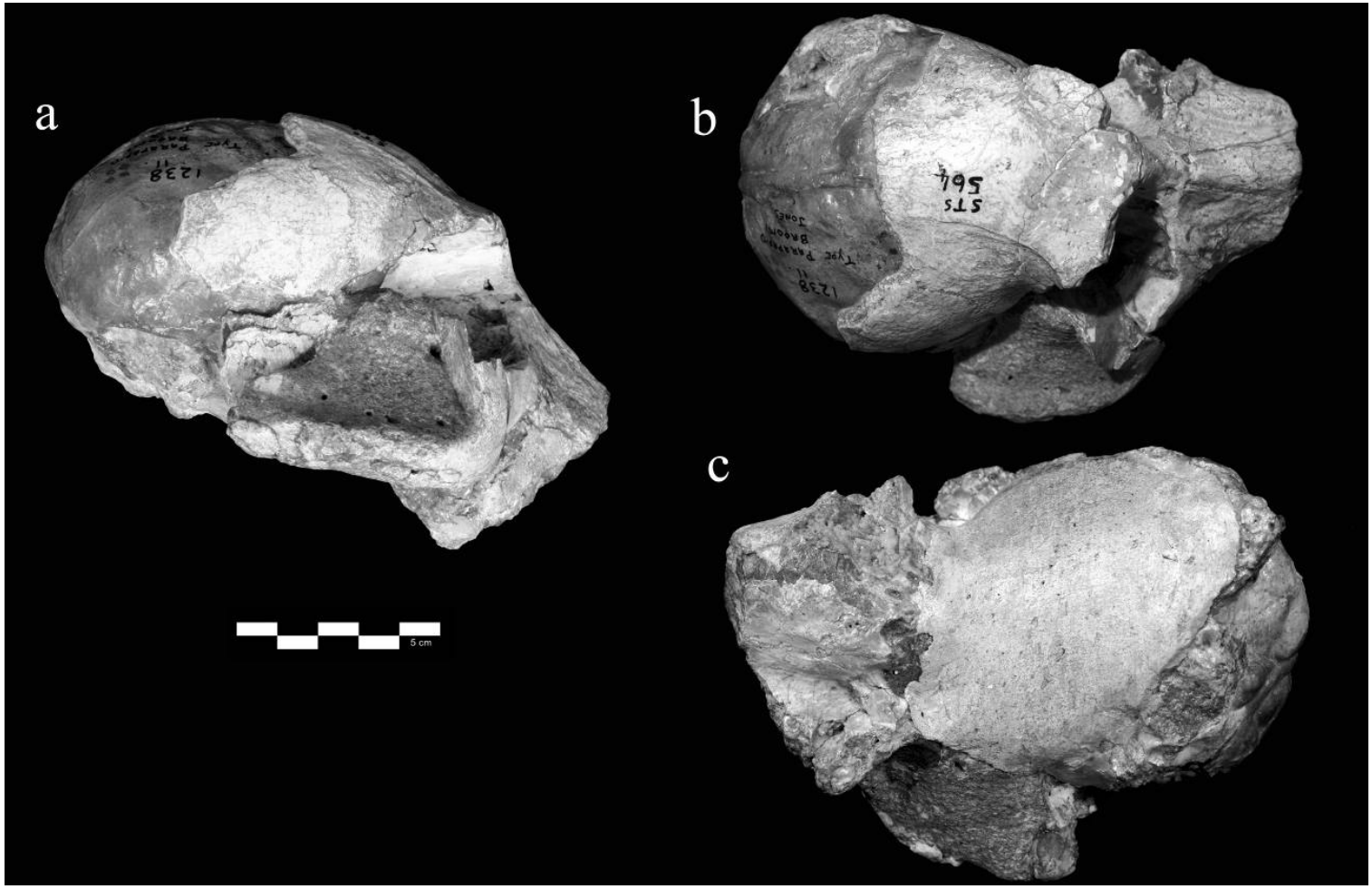


Figure 1-6. Type Specimen of *Parapapio broomi.* Partial cranium shown in (a) right norma lateralis, (b) norma verticalis and (c) norma basalis.

Figure 1-7. Type Specimen of *Parapapio whitei.* Partial mandible shown in (a) right lateral and (b) occlusal views.

Freedman (1957) noted that new material began to bridge the gaps between the three initially distinct species. But, the fragmentary nature of the Sterkfontein sample was a compounding problem in delineating the *Parapapio* species. Relatively few crania were available for study and most taxonomic classifications of the group relied heavily upon dental size differences that were then interpreted to be differences among the *Parapapio* species (Broom, 1940; Eisenhart, 1974; Freedman, 1957; Freedman and Stenhouse, 1972).

As the *Parapapio* material included three species ranging in size from small (e.g. *Pp. jonesi*) to large (e.g. *Pp. whitei*), it was possible that they represented a chronocline at

Sterkfontein. However, once the smallest species, *Pp. jonesi*, was identified at the later occurring sites of Swartkrans and Kromdraai (Freedman, 1957, 1970; Freedman and Brain, 1972, 1977), the suggestion of a species chronocline was rejected (Brain, 1981).

Freedman (1957) began to compare the Sterkfontein material to that of aforementioned Taung specimens and concluded that the two species, *Pp. antiquus* and *Pp. broomi*, were similar in tooth size but differed in skull shape. Freedman (1957) went on to argue that the *Parapapio* species at Sterkfontein probably differed more in cranial characters than in dental features, but nevertheless, retained Broom's (1940) species trichotomy.

Eisenhart (1974) argued that the Sterkfontein specimens exhibited considerable overlap in dental dimensions and for this reason, suggested that tooth size alone was not a reliable indicator on which to base species assignments. As a result, Eisenhart (1974) was able to assign only 35% of the specimens in his analysis to a species. Additionally, Eisenhart (1974) reasoned that the three species division of the Sterkfontein material did not seem to best reflect the diversity in cranial morphology of the *Parapapio*/*Papio* sample from the type site (Member 4).

To add to the complexity of the taxonomic status of *Parapapio*, it is well-agreed (Eisenhart, 1974; Szalay and Delson, 1979) that the dentition of *Parapapio* is probably indistinguishable morphologically from *Papio*, and that the main anatomical difference between the genera lies in the profile of the muzzle when viewed laterally (Figure 1-9). However, even, this supposedly distinguishing characteristic of *Parapapio* has been questioned.

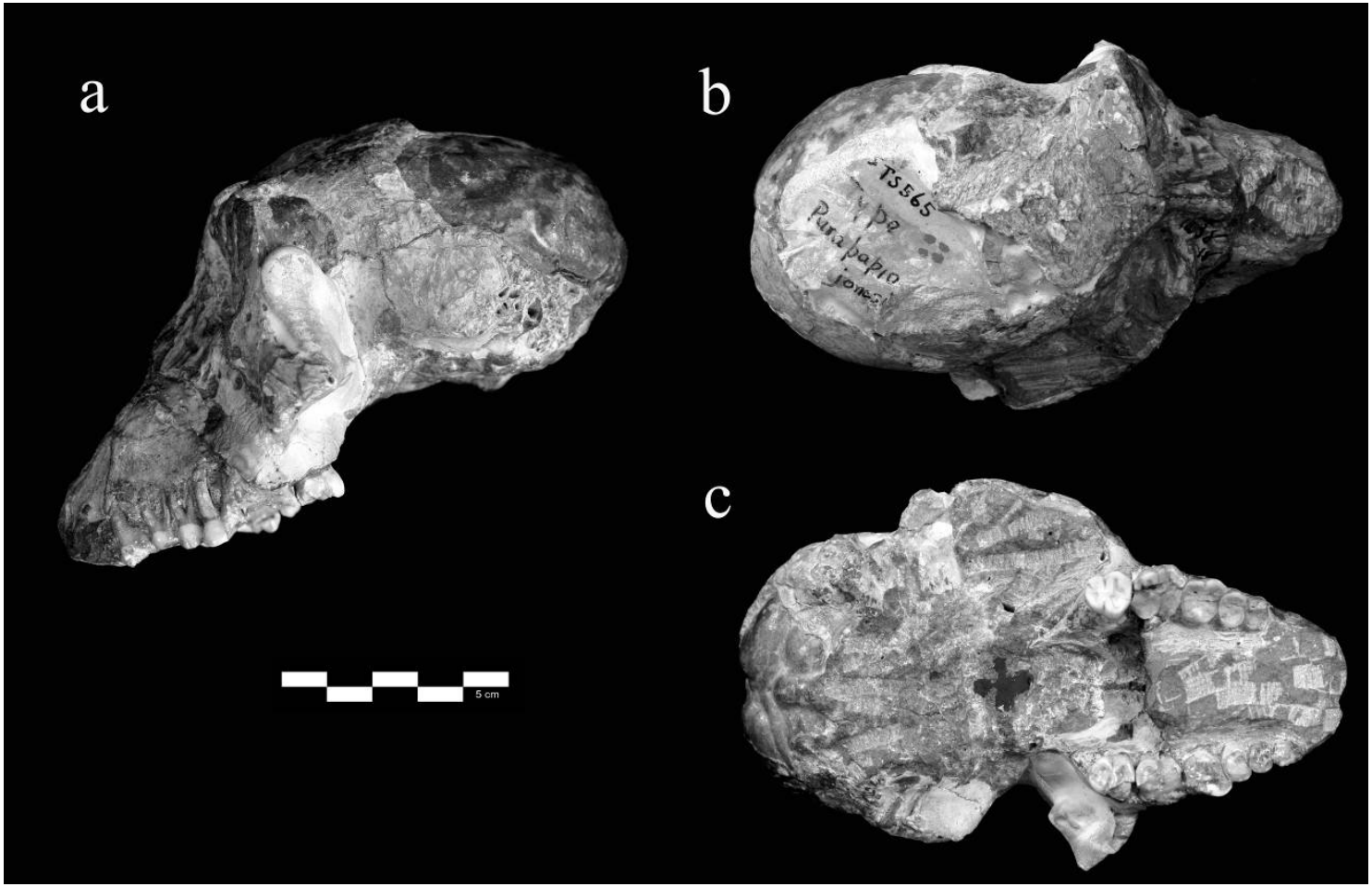


Figure 1-8. Type Specimen of *Parapapio jonesi.* Partial cranium shown in (a) left norma lateralis, (b) norma verticalis and (c) norma basalis.

In a study of the mandible and cranium of *Papio hamadryas ursinus*, Jones (1978) observed muzzle morphology that would be attributable to *Parapapio* if identified in in the fossil record in a troop with individuals exhibiting 'typical' *Papio* morphology. As the creator of the genus *Parapapio* (Jones, 1937), Jones (1978) suggested reconsidering the status of the genus and the usefulness of the muzzle profile as a taxonomically diagnostic feature among the fossil papionins.

Additionally, many of the characteristic features of *Parapapio* (such as, a straight-line nasal profile, an elongated and well-rounded braincase and molar teeth that are broad with considerable bucco-lingual flare) can be found in extant species of *Cercocebus*, *C. torquatus* (Eisenhart, 1974). This has led some researchers to suggest that some *Parapapio* specimens may be attributable to the genus *Cercocebus* (Szalay and Delson, 1979) or that *Parapapio* may have been the ancestral stock from which the Papionini genera evolved (Delson, 1973; Simons, 1972).

Many of the problems with previous classifications resulted from the lack of good specimens on which to base these analyses. *Parapapio broomi*, as Broom (1940) discussed, was based by Jones (1937) upon a type specimen represented by an imperfect cranium in which the dentition was very poorly preserved. As a result, Broom (1940) redefined the dental characters of this species. The correct identification of *Pp. broomi* is of particular importance, as it shows that some portion of the deposits in the Makapan Valley correspond broadly in age with those of Sterkfontein (Kitching et al., 1948; McKee, 1995; McKee et al., 1995; Mollett, 1947).

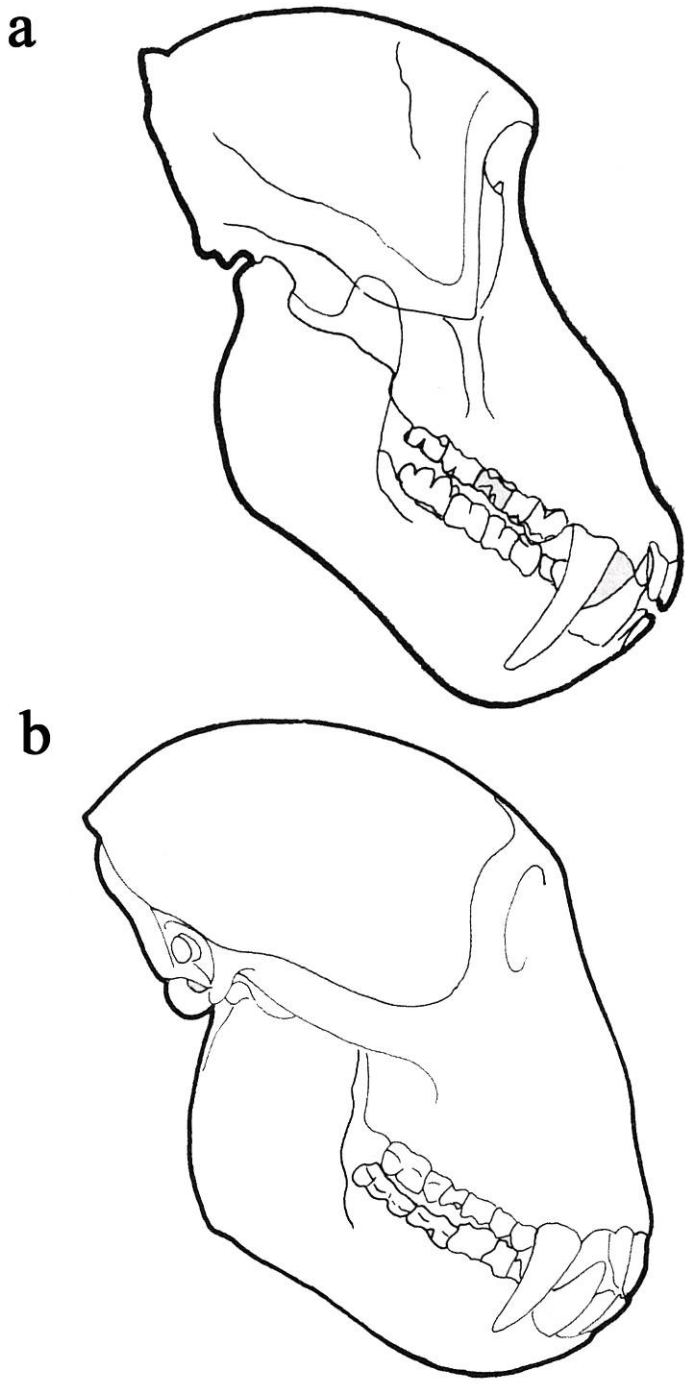


Figure 1-9. Sterkfontein Papionin Cranial Comparison. The differences in profile are most marked in the nasal region as shown here in (a) extant *Papio* and (b) fossil *Parapapio* (adapted from Brain 1981). Note; specimens are not to same scale.

Parapapio broomi specimens began to be identified in the material at Makapansgat in the late 1940's (Kitching et al., 1948; Mollett, 1947). However, Broom and Hughes (1949) argued that the Makapansgat papionin were distinct from the Sterkfontein *Parapapio* and attributed the specimens to a new species, *Pp. makapani*. Similarly, Kitching (1952) identified a new species, *Brachygnathopithecus peppercorni*, in the Makapansgat cercopithecoid material. In a later analysis, Freedman (1957) rejected the validity of the two species, *Pp. makapani* and *B. peppercorni* showing that the two species fit well within the *Pp. broomi* material from Member 4 of Sterkfontein, concluding that both species were invalid.

Furthermore, papionin specimens recovered from Kromdraai (KA 195 and KA 194) were attributed to the genus, *Parapapio*, and identified as the species, *Pp. coronatus* (Broom and Robinson, 1950) and *Pp. angusticeps* (Broom, 1940), respectively. Once again, the specimens were shown to be incorrectly classified. Freedman (1957) described *Pp. coronatus* (Figure 1-10), as a species with 'unknown affinities'. Presently, the taxon appears to be invalid, as most specimens of the scant *Pp. coronatus* material display features consistent with the *Theropithecus* specimens found at Kromdraai. Regarding Broom's (1940) *Pp. angusticeps* species (Figure 1-11), Freedman (1957) suggested that *Pp. angusticeps* shared more features in common with the genus, *Papio* and therefore, assigned the specimens to the species, *Papio angusticeps*.

Representatives of the three *Parapapio* species for which Sterkfontein serve as the type, *Pp. whitei*, *Pp. broomi* and *Pp. jonesi*, are known from other South African sites, such as Taung, Swartkrans and Bolt's Farm (Brain, 1981; Delson, 1984). The genus is also known from several East African sites (Hill et al., 1992; Kalb et al., 1982; Leakey, 1988;

Patterson, 1968; Simons and Delson, 1978; White et al., 1994), but their relationship to the South African taxa is currently unknown. Therefore, it is imperative that the taxonomy of this group be clearly defined in light of new evidence and this group's phylogeny reconsidered.

Today, only four species of *Parapapio* are recognized in the fossil cercopithecoid sample of South Africa. Species, such as *Pp. broomi, Pp. jonesi* and *Pp. whitei* are recognized, albeit controversially, at the Sterkfontein Valley Sites and Makapansgat. In contrast, the species of *Pp. antiquus* has only been identified in the Taung material. The taxonomic scheme that I propose in this thesis derives from the observation that *Pp. antiquus* and *Pp. broomi* samples share more features in common than previously suggested (Delson, 1984; Eisenhart, 1974; Freedman, 1957). The two species are designated as sub-species of a single species, *Pp. broomi.* My analysis supports referring all Taung specimens to *Pp. broomi antiquus,* and the Sterkfontein material to *P. broomi broomi.* The species *Pp. whitei* appears to be an invalid taxon, as the type specimen, Sts 563, belongs to a male *Pp. broomi broomi.* I contend that only three sub-species in two species of *Parapapio* exist in the South African deposits: (1) *Pp. broomi broomi*, (2) *Pp. broomi antiquus* and (3) *Pp. jonesi*.

Study Significance

Maier (1970) has acknowledged that taxonomic schemes for Plio-Pleistocene Cercopithecoidea in South Africa were, "unsatisfactory" and part of a "working model, reflecting morphological diversity, but possibly far from representing natural units". Due

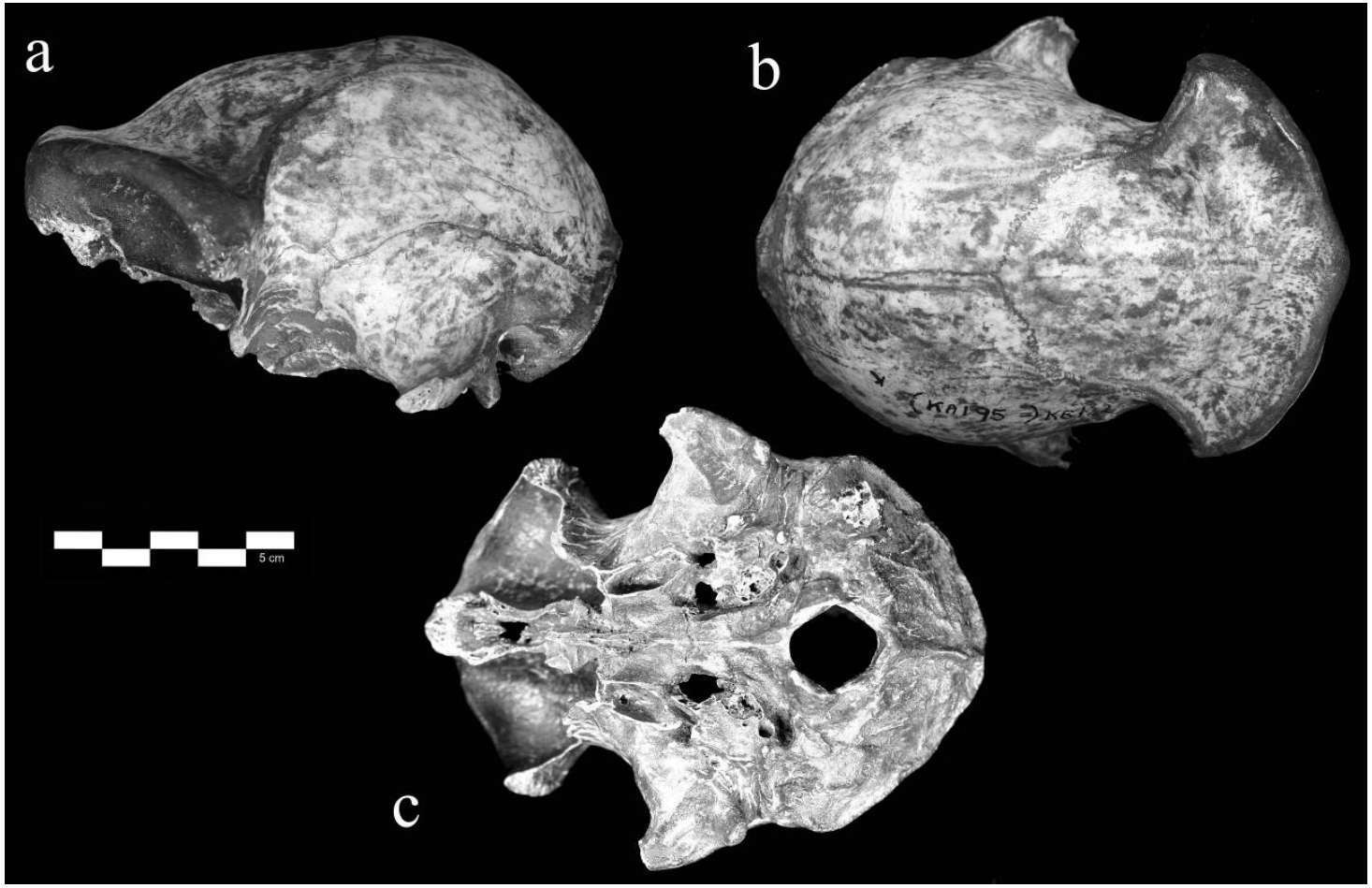


Figure 1-10. Type Specimen of *Parapapio coronatus.* Partial cranium shown in (a) left norma lateralis, (b) norma verticalis and (c) norma basalis.

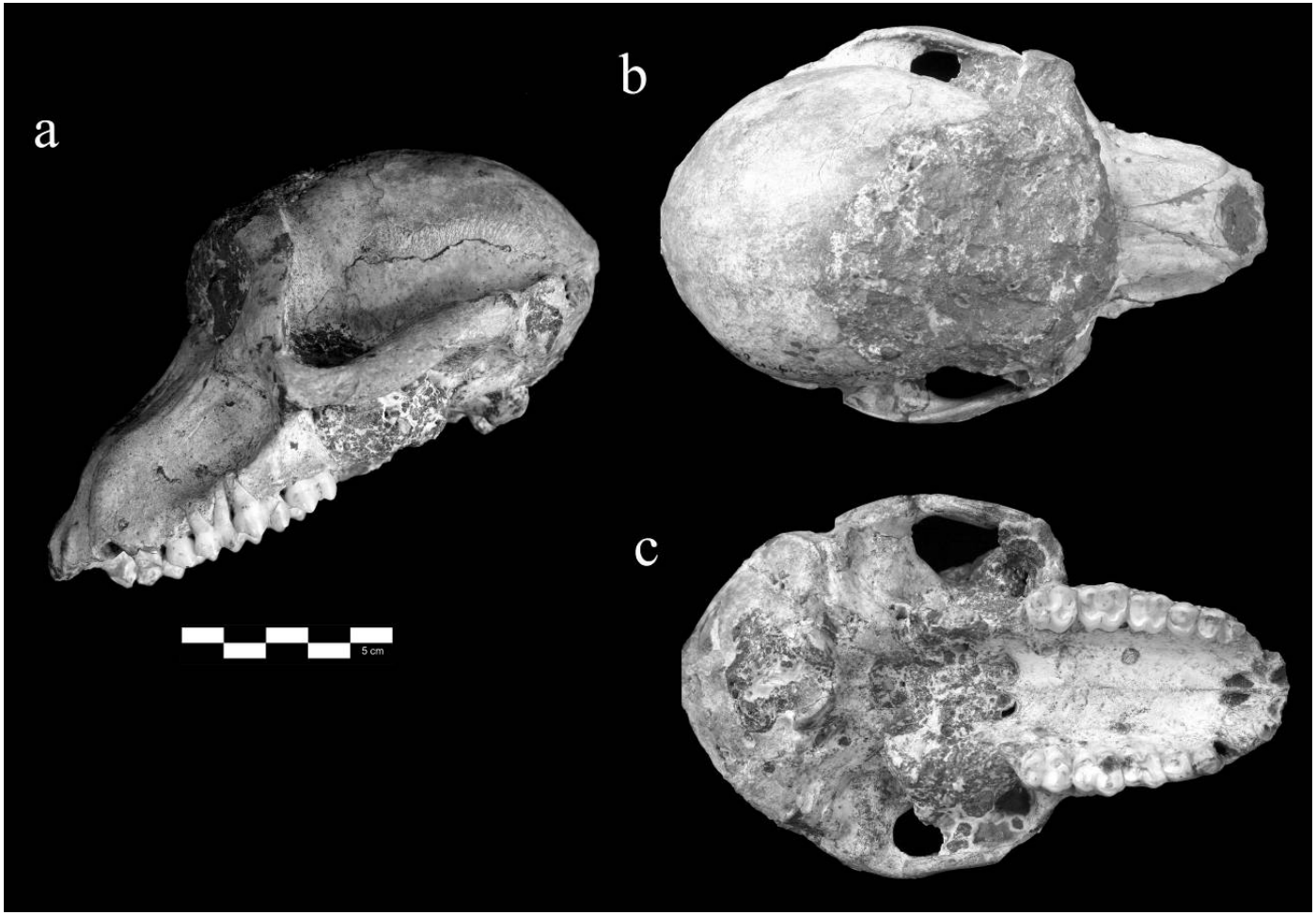


Figure 1-11. Type Specimen of *Papio angusticeps*. Partial cranium shown in (a) left norma lateralis, (b) norma verticalis and (c) norma basalis.

to the shortcomings of previously applied techniques, it was hoped that an analysis using both discrete and non-discrete traits, such as that proposed here, would reveal new patterns of variation within the cercopithecoid sample of Sterkfontein not previously recognized. Prior taxonomic analyses (Eisenhart, 1974; Freedman, 1957; Freedman and Stenhouse, 1972) have had little success using multivariate analyses due to the fragmentary nature of the assemblage itself. Instead, they have relied upon univariate and bivariate measures of variation to distinguish the species. Since then, excavations have enlarged the cercopithecoid sample and have provided a few remarkably complete specimens. The largest portion of these complete specimens comes from the Member 2 deposit of Sterkfontein which has been previously noted for its contents of a remarkably preserved fauna (Clarke, 1998, 1999; Clarke and Tobias, 1995; Pickering et al., 2004a).

A successful analysis will not only have significant implications for the understanding of cercopithecoid evolution in southern Africa, but also for the evolution of hominids within the region. For example, a few recent analyses (Berger et al., 2002; McKee, 1995, 1996a, 1996b) of the Sterkfontein fauna have questioned the recent estimated age of Sterkfontein Member 2 (Partridge et al., 2003; Partridge et al., 1999). Uniquely, the Member 2 faunal assemblage appears to be dominated by primates and carnivores, almost to the exclusion of other species (Clarke, 1994; Pickering et al., 2004a) and in the absence of other taxa, fossil primates have been shown to be useful taxa for providing biostratigraphic dates among South African sites (Delson, 1984, 1988). Delson (1984) stated that he looks forward to, "fossils from Southern site units older than Makapan (perhaps, Sterkfontein Member 1-3?), as well as more definite dating of the several known units." Thus, it is critical that the taxonomy of the fossil

cercopithecoids within the site of Sterkfontein be rendered as accurately as possible in order to provide secure biostratigraphic dates using the available framework (i.e. Delson's [1984] African Cercopithecoid Zones) and to provide additional means to understanding the evolution of hominids with which they shared the palaeolandscape.

Renewed study of the fossil cercopithecoids should also lead to a fresh understanding of the paleoenvironment during Member 2 and 4 times. Eeley and Foley (1999) have shown that in extant primates, as species richness increases, range sizes decreases and primates become more specialized in terms of the number of habitats and food types utilized. If as the present evidence at Sterkfontein suggests, the high species diversity during Member 4 times may then indicate a more forested habitat much in the agreement of present reconstructions (Avery, 2001; Bamford, 1999; Kuman and Clarke, 2000). However, caution should be exercised at reaching this conclusion, as the high levels of species at Sterkfontein appear to rather reflect ill-defined species distinctions and misconceptions concerning morphological variation. Earlier analyses of the Sterkfontein paleoenvironment (Vrba, 1975; 1976; 1980) relied heavily upon the bovidae as environmental indicators. Vrba (1976) argued that the member 4 bovids indicated a medium density woodland with a substantial open component. Correspondingly, Reed's (1997) analysis of the overall faunal community indicated a period of open woodlands for Member 4. However, Vrba (1980) argued that a faunal shift in Member 5 indicated a period of less bush and tree cover than the earlier Member 4 deposit. A paleoenvironmental analysis of the Member 2 fauna in which the primates featured prominently indicated an environment similar to that of the later-occurring Member 4 deposit (Pickering et al., 2004a).

Additionally, isotope analyses have also been successfully applied to South African sites, as a means of inferring diet and the paleoenvironment (Lee-Thorp et al., 1994; Schoeninger, 1995; Sillen et al., 1995; Van Der Merwe and Thackeray, 1997). Some recent carbon isotope analyses have shown that some portion of the *Pp. broomi broomi* and *Pp. jonesi* samples propose similar, if not identical diets (Thackeray, 2004; Van Der Merwe et al., 2003). This fact suggests that some of the *Parapapio* species may have been competing for resources at Sterkfontein.

Finally, three of the four to six species recognizable at Sterkfontein, *Pp. broomi broomi*, *Pp. jonesi* and "*Pp. whitei*", serve as type specimens for species that are also purportedly represented at other African Plio-Pleistocene sites of importance (e.g. Delson, 1984; Freedman, 1957, 1960, 1961, 1965, 1970; Freedman and Brain, 1972, 1977; Freedman and Stenhouse, 1972; Frost, 2001; Keyser, 2000; Keyser et al., 2000; Patterson, 1968). The correct identification and documentation of the presence or absence of these primates at Sterkfontein could have far-reaching implications for the understanding of cercopithecoids at several other African sites and their biogeographic distribution (Benefit and McCrossin, 1990; Benefit, 1999).

Generic Level Descriptions

As noted previously, this analysis focuses upon the two genera of fossil papionins at Sterkfontein, *Papio* and *Parapapio*. Additionally, each species is given its own unique chapter and as a result, some members of the same genera are discussed separately. Therefore, generic descriptions are given here prior to the discussion of individual Sterkfontein papionin species. These descriptions are largely based upon those appearing in Eisenhart (1974), Freedman (1957) and Szalay and Delson (1979).

Papio Erxleben, 1777

Diagnosis: The cranium of the genus is characterized by a secondarily elongated muzzle, as observed in males. In norma lateralis, the muzzle dorsum exhibits a sharp anteorbital drop near glabella. Anterior to the orbits, the muzzle gradually slopes downward to alveolar point. In males, the muzzle dorsum is flattened and exhibits well-developed maxillary ridges. Typically, maxillary fossae are present in both sexes. Morphologically, the teeth are indistinguishable from those of other Papionini species. Sexual dimorphism is quite marked in all subspecies of this genus. The type species is *Papio hamadryas papio* (Desmarest, 1820). The genus includes both extant and extinct taxa.

Parapapio Jones, 1937

Diagnosis: The cranium is characterized in norma lateralis by a straight-line nasal profile. In both sexes, the line from glabella to nasion is either straight or gently concave. The anteorbital drop of *Papio* is not present in this genus. The supraorbital tori are weakly developed and do not project anteriorly resembling the state observed in immature *Papio* specimens. Neither deep maxillary fossae nor well-developed maxillary ridges are observed in *Parapapio*. Sexual dimorphism is usually moderate in the cranium, but the sex differences are in size and not morphology. There are little sexually dimorphic size differences in the dentition with the exception being the canines and the sectorial P_3. Morphologically, the teeth are indistinguishable from other species of the Papionini. The type species established by Jones (1937) is *Parapapio broomi*. The genus includes only extinct taxa.

CHAPTER TWO
MATERIALS AND METHODS

Introduction

A pilot study funded by the David C. Skomp Fellowship of Indiana University was conducted in 2001 focusing primarily on a sample of fossil primate specimens from the Type Site (Member 4) of Sterkfontein. The goal of the study was to determine the extent of the collection in the number of cranial and post-cranial elements, to assess the nature of the collection and to test the usefulness of a natural log (ln) method of differentiating the *Parapapio* species. Several cranio-dental measurements of randomly selected *Parapapio* specimens were used in an attempt to determine alternative means of separating the groups, rather than relying exclusively upon M_3 length. Due to the fragmentary nature of these specimens, the analysis consequently focused upon dental remains.

The study considered many variables, but the one hypothesized to have the most potential in differentiating the species was considered to be the ln transformation of the mandibular molars, as discussed by Gingerich (1981). The use of log transformations for differentiating species in extant taxa had been assessed by Vitzthum (1986) which concluded that species were not easily diagnosed with transformations.

On the other hand, the transformations revealed some differential patterning in the Sterkfontein material. Results of the General Linear Model (GLM) were however

not significant ($p > 0.10$) when a priori judgments were made, and specimens were assigned to species groups. The near significance of the test was undoubtedly due to the circularity of assigning species based upon size, and then, using a measurement of size to differentiate the specimens. When the dispersal of ln transformations was viewed, the sample approximated a normal distribution curve showing no clear differential patterning. Eisenhart (1974) noted the presence of similar tooth sizes in specimens exhibiting drastically different cranial morphology. For this reason, the present analysis has abandoned the use of ln transformations in favor of a combined set of discrete and non-discrete traits, as discussed below.

Study Sample

In order to control sources of variation, the site of Sterkfontein formed the largest portion of the sample in this analysis; as a result, the main source of variation was temporal which is desirable in studies of fossil morphological variation (Plavcan and Cope, 2001). Additionally, comparisons were made between the specimens from Sterkfontein and a sample of partial and/or whole specimens from other significant South African sites, such as Taung, Makapansgat and Swartkrans.

This analysis included 3036 fossil cercopithecoid specimens Sterkfontein derived mainly from Members 2 and 4. Of these, approximately 2300 specimens are held within the fossil collections of the University of the Witwatersrand, Medical School in Johannesburg, South Africa (Sp and Swp material). The provenance of these specimens was considered when deciding to include a specimen into the study, as much of the Sterkfontein collection was recovered from miners refuse. A list of the dumps and their origination within the Sterkfontein deposit is shown in Table 2-1. As is shown below,

some dumps were better provenanced than others. Only those specimens that could be confidently attributed to Members 2 and 4 were included in this analysis.

Table 2-1. Sterkfontein Dumps and Their Associated Members.

Dump	Member
1	5
2	5
3	5
4	6?
5	6?
6	6?
7	6
8	4-6?, largely 5
9	5?, largely 4
10	4 - between type and extension
11	5-6
12	4
13	4?
14	4-5
15	4
16	6?
17	4
18	4
19	3-5, largely 4
20	2

The approximately 800 remaining cercopithecoid specimens – all purportedly from Member 4 – were curated at the Transvaal Museum, Pretoria, South Africa (Sts material). All of the cercopithecoid specimens from the Transvaal Museum were included in this analysis, but as was noted by Heaton and Pickering (2005), the homogeneity of the Member 4 (Sts) material is questionable.

Appendices I and II serve as catalogs for cercopithecoid fossils in the Witwatersrand collection and Appendices III and IV list those held in the Transvaal

Museum collection. Additionally as a means for comparison, cercopithecoid specimens from the sites of Swartkrans, Makapansgat, Drimolen, Bolt's Farm and Taung were compared to the Sterkfontein sample.

Research Questions, Evidence and Methods

Methods Used in Taxonomic Analyses

Regarding the fragmentary nature of the Sterkfontein sample, Freedman (1957) noted that, "the specific identity of some specimens is uncertain and in this regard, strict accuracy is at present not possible." And while the number of available specimens has increased, the relative completeness of the Sterkfontein site has not. The number of isolated teeth now in the collection is large (~150) while the number of complete crania has only increased by a few specimens. The exception to this is Member 2 of the Sterkfontein Formation which has provided the first complete male *P. izodi* cranium from Sterkfontein.

For the remainder of the collection, all specimens were identified to anatomical element, and as far as possible, to taxon. Each specimen was described anatomically with descriptions relevant to either functional morphology and/or taxonomy. For isolated teeth or cranial elements lacking diagnostic morphology, specimens were assigned to one of four cercopithecoid molar type categories following Delson (1973). These groups were: (1) Cercopithecini, (2) Papionini, (3) Theropithecina and (4) Colobinae. However, of significance here, members of the papionini are difficult to distinguish based solely upon dental remains. Sex and species identifications here were conservative. If a specimen did not possess any distinctive morphology, it was assigned to the broadest/most general taxonomic category which in some cases was the level of

tribe. In addition to taxonomic categorizations, both, quantitative and qualitative, data were collected on the cercopithecoid sample.

Quantitative Data

Dental measurements were collected using the PC interface of a Hillson-Fitzgerald® dental caliper and a Mitutoyo digital caliper. The lists of measurements taken are shown in Tables 2-2 and 2-3. As data were collected, they were entered directly into a Microsoft Access XP® database. Digital photographs were also taken of most specimens, except isolated teeth, using a Canon Digital Rebel® SLR camera using both, a Canon 18-50mm EF-S lens and a Canon 50mm Macro lens.

Quantitative measures have been shown to be useful in differentiating the groups in this study. One such measure is the degree of molar flare computed in a specimen. This feature can be used to assess the variability within the assemblage, as it is largely composed of members of the papionini with some possible members of *Cercocebus*. Within extant genera, *Lophocebus*, *Cercocebus* and, possibly, *Mandrillus* exhibit greater degrees of flare than other Papionini (Frost, 2001). Additionally, molar flare can be used to differentiate the Papionini from other taxa, such as the Cercopithecini and Colobinae. One exception is the sub-tribe Allenopithecina (Strasser and Delson, 1987) which exhibits highly flaring molars, not characteristic of the Cercopithecini. Frost (2001) suggests that this may be a retention of an ancestral cercopithecine trait, but adds that the cercopithecini can be differentiated from the papionini on the basis of the loss of the M_3 hypoconulid in the Cercopithecini.

Table 2-2. Measurement Descriptions for Incisors, Canines and Premolars. Definitions from Freedman (1957) and Frost (2001).

	Measurement	Description
Incisors and Canines	Breadth	Maximum bucco-lingual dimension
	Length	Maximum mesio-distal dimension
	Height	Crown height from cervix to apex, measured on buccal surface
Upper Premolars	Breadth	Maximum bucco-lingual dimension
	Length	Maximum mesio-distal dimension
	Intercusp	Distance between paracone and protocone
	Height	Crown height from cervix to apex, measured on buccal surface
Lower Third Premolar	Breadth	Maximum bucco-lingual dimension
	Length	Maximum mesio-distal dimension
	Flange Length	Distance from apex of protocone to the end of the mesio-buccal flange
	Height	Crown height from cervix to apex, measured on lingual surface
Lower Fourth Premolar	Breadth	Maximum bucco-lingual dimension
	Length	Maximum mesio-distal dimension
	Intercusp	Distance between protoconid and metaconid
	Notch Height	Height of notch above the cervix, measured on the lingual side
	Height	Crown height from cervix to protoconid, measured on the lingual side

Table 2-3. Measurement Descriptions for Molars. Definitions from Freedman (1957) and Frost (2001).

	Measurement	Description
Molars	Mesial Breadth	Maximum bucco-lingual dimension across the mesial loph(id)
	Mesial Notch Breadth	Maximum bucco-lingual dimension across the mesial loph(id), measured at the height of the buccal notch (uppers) or the lingual notch (lowers)
	Distal Breadth	Maximum bucco-lingual dimension across the distal loph(id)
	Distal Notch Breadth	Maximum bucco-lingual dimension across the distal loph(id), measured at the height of the buccal notch (uppers) or the lingual notch (lowers)
	Hypoconulid Breadth[1]	Bucco-lingual dimension across the middle of the hypoconulid
	Length	Maximum mesio-distal dimension
	Mesial Intercusp	Dimension of the paracone to protocone on uppers, or protoconid and metaconid on lowers
	Distal Intercusp	Dimension of the metacone and hypocone on uppers, or hypoconid and entoconid on lowers
	Buccal Intercusp	Dimension of paracone and metacone on uppers, or protoconid and hypoconid on lowers
	Lingual Intercusp	Dimension of paracone and hypocone on uppers, or metaconid and entoconid on lowers
	Notch Height	Height of the buccal notch on uppers or the lingual notch on lowers
	Height	Crown height above the cervix to paracone on uppers, or apex to metaconid on lowers

[1] Freedman (1957) noted that hypoconulid breadth is an unreliable measurement.

As Eisenhart (1974) suggests, tooth size alone appears to be a less reliable indicator of phylogenetic affinities within *Parapapio* than has previously been proposed (Broom, 1940; Freedman, 1957; 1960; 1961; 1965; Freedman and Stenhouse, 1972).

With regard to the Sterkfontein primates, Eisenhart (1974) has suggested that some of the differences in dental morphology may be species specific, but suggests that the size of the Sterkfontein collection and the duration of accumulation, may also account for much of its variability. Some recent analyses (Frost et al., 2003; Singleton, 2002) of papionin cranial morphology have successfully utilized geometric morphometric (GM) techniques. Geometric morphometric techniques were attempted, but ultimately, not performed on the Sterkfontein sample, as a result of the fragmentary nature of the cercopithecoids. Many of the cranial landmarks were not present on all specimens, and these three-dimensional techniques are difficult to apply in cases where specimens may be missing multiple data points (Bookstein, 1991; Marcus, 1993). Therefore, standard two-dimensional measures were favored.

Recently, Fleagle and McGraw (2002) have shown several cranio-dental and post-cranial measurements which have proven useful in differentiating the Papionini into distinct phylogenetic groups. These measurements and indices have been included in this analysis, as phylogenetic studies of this sort have not been attempted on the Sterkfontein cercopithecoid sample. All indices, descriptive statistics and tests of variance will be calculated using SPSS version 13.0 (SPSS Inc., Chicago, Illinois).

Qualitative Data

In order to determine the relative age of the papionins, individuals were scored based upon the degree of wear observed in the molars or premolars. As a result, each individual tooth will receive a wear score (WS) following the procedure outlined in detail by Delson (1973). The wear scoring method is based upon the degree of dentine exposure across a loph(id) (Table 2-4). For premolars, the calculation of the WS is a

simple estimation of the degree of wear across the occlusal surface whereas molars require evaluation of wear across both lobes. The result is a range of WS's from 0 (fresh) to 8 (heavily worn) for premolars and 0 (fresh) to 16 (heavily worn) for permanent and deciduous molars (Table 2-5).

Table 2-4. Posterior Dentition Wear Morphology. Seven forms of wear scoring, as recognized by Delson (1973). Shape represents dentine exposure.

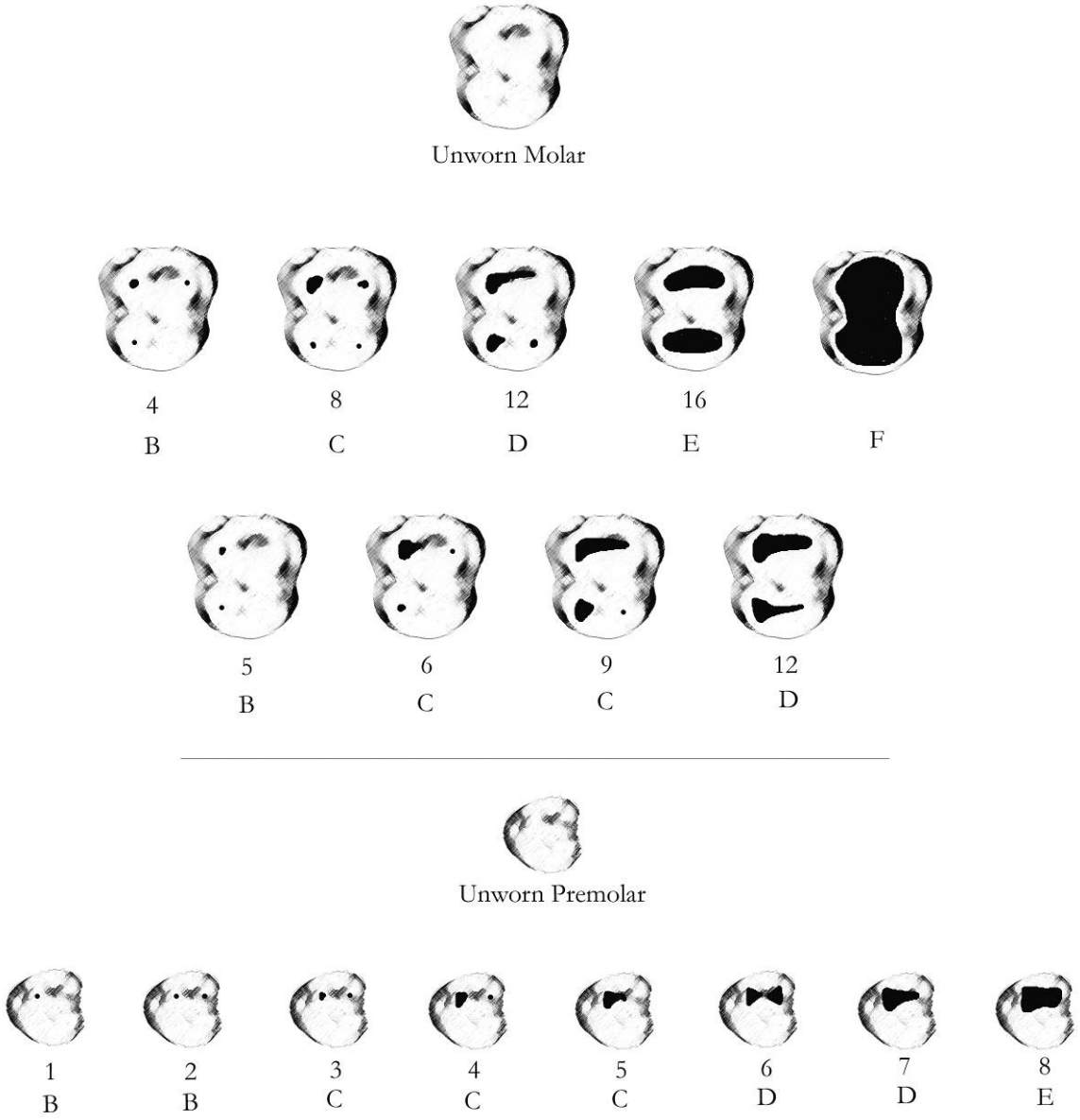
Wear Morphology	Score	Shape
Fresh, unworn	0	
Point wear	1	
Circular (exposure of dentine)	2	
Asymmetrical	3	
Narrow Flask (across loph(id))	5	
Wide Flask (across loph(id))	7	
Oval (across loph(id))	8	

Delson (1973) also used a wear grading system in order to assess the potential differences in length and/or width, as a result of wear. However, the letter grading system was not used here; but rather, the WS's were based solely upon numerical designations. A graphic representation of the potential progression of wear in both a molar and premolar are shown in Figure 2-1.

Table 2-5. Posterior Dentition Wear Grading. As noted below, the range of possible wear scores for premolars vary from 0 (fresh) to 8 (heavily worn) while molars vary from 0 (fresh) to 16 (heavily worn). Table modified after Delson (1973).

Wear Grade	P3-P4	dM1-M3
A	0	0
B	1-2	1-5
C	3-5	6-9
D	6-7	10-13
E	8	14-16
F	Margin or notch breakdown, ovals in contact	
X	Wear not given or noted	

Figure 2-1. Posterior Dentition Wear in the Papionini. Shown below is the typical progression of wear in a left M_{1-2} and a left P_4. Darkened areas represent dentine exposure. Wear scores and grades are given for each example. (Adapted from Delson 1973: Figure 25).



Also as newly discovered and remarkably complete specimens have been recovered from Sterkfontein in recent years (Clarke, 1998; Pickering et al., 2004a), this analysis will include an analysis of discrete traits to accompany the dental data (Table 2-6). Previous analyses (Eisenhart, 1974; Freedman, 1957; Jones, 1937) have found differences in muzzle profile to be significantly different among the papionin genera at Sterkfontein. The diagnostic features assessed here relate to muzzle morphology, as it allows comparisons between complete crania and fragmentary muzzle remains in the South African sample.

Table 2-6. Discrete Trait and State List. The following characters were assessed along with quantitative measures to evaluate the morphological differences among specimens with similar tooth sizes.

Character	*Discrete State*
Anteorbital Profile	Steep
	Slightly Concave
	Straight-line
Maxillary Fossa	Well-developed
	Moderately Developed
	Lightly Developed
	Absent
Maxillary Ridge	Well-developed
	Moderately Developed
	Lightly Developed
	Absent
Palatal Shape	Horse-shoe
	Elongated Horse-shoe
	Parallel toothrows
Zygomatic Orientation	Perpendicular to Rostrum
	Antero-laterally fleeting

Methods Used in Biostratigraphic Analyses

Any taxonomic revision of the Sterkfontein cercopithecoids must be accompanied by a re-evaluation of their place among other Gauteng and non-Gauteng

sites. Therefore, some paleontological specific calculations, such as Correspondence Analyses (CA), Unitary Associations (UA), Spindle Diagrams and Biostratigraphy Graphs were completed using the software program PAST, Paleontological Statistics (Hammer et al., 2001). In most cases, presence/absence data for species were recorded for the major sites in South Africa. An intensive review of paleontological statistics and the use of PAST is provided by Hammer and Harper (2005). The paleontological data were used to determine the usefulness of the fossil cercopithecoids, as biostratigraphic indicators, in southern Africa. The more "objective" methods of quantitative biostratigraphy (Armstrong, 1999; Cubitt and Reyment, 1982; Sadler, 2004; Tipper, 1988) were favored here with the hope of minimizing stratigraphic contradictions and maximizing correlations between taxa.

Once taxa were identified, the UA method (Guex, 1991) was conducted in order to provide a biostratigraphic zonation for the South African cercopithecoids. UA's are based on taxa associations rather than events and are a conservative means for biostratigraphic computations (Hammer and Harper, 2005). During the analysis, the sites and/or localities were divided into their smallest categories, typically Members. Once numerical ranges were computed, the sites and species were correlated using the calculated UA's. If a site contained taxa which placed it uniquely into a Unitary Association, the UA group was noted. However, when a locality lacked differentiating taxa, only a UA group range could be given.

The cercopithecoid taxa were also analyzed for patterns of superposition. The goal was to learn the stratigraphic sequences which might exist between the cercopithecoid species (i.e. which species are always found above or below other taxa).

This allows a relative comparison and grouping of sites, as older as or younger than others.

Previously, seriation of the South African taxa, including cercopithecoids, has been attempted (McKee, 1995; McKee et al., 1995), but a more modern method of assessing taxa groupings is Correspondence Analysis (Hammer and Harper, 2005). Currently, Correspondence analysis (CA) is the most popular method for assessing groupings and geographic trends (Greenacre, 1984; Jongman et al., 1995; Legendre and Legendre, 1998). Correspondence analyses are similar to Principal Components Analysis (PCA). However, CA attempts to position both samples and taxa in the same space while maintaining the correspondence between the two (Hammer and Harper, 2005). Therefore, sites with similar taxonomic compositions should group together in the CA. A CA was conducted here to provide a more refined grouping of sites, as compared to the gross results of the UA. The results of these biostratigraphic analyses are discussed separately in Chapter Eight.

Research Questions

Before the collection of any data, as outlined above, this analysis began with a set of research hypotheses, as shown in Table 2-7. Results of the hypotheses are discussed in Chapters Six and Seven, and the discussion of the Biostratigraphic analyses are presented in Chapter Eight.

Table 2-7. Research Hypotheses.

Research Hypothesis	Discussed Within:
Parapapio whitei is a valid and distinct taxon.	Chapter Seven
Parapapio broomi and *Parapapio jonesi* represent the same species.	Chapter Six
Taung papionins (*Pp. antiquus* and *P. izodi*) are similar to the Sterkfontein papionins (*Pp. broomi* and *Papio* sp.).	Chapter Six
Parapapio broomi exhibits a distally reduced M^3.	Chapter Six
Sterkfontein papionin taxa have P4/M1 ratios similar to that of *Papio*.	Chapter Six
A collection bias exists in the older (pre-1966) material.	Chapter Seven

Site Abbreviations and Location of Curation

The set of abbreviations used to indicate the site and the location of curation for the specimens consulted in this analysis are given in Table 2-8.

Table 2-8. South African Site Abbreviations and Locations of Curation.

	Site and Location of Curation
BF	Bolt's Farm, Department of Anatomy, University of the Witwatersrand, Johannesburg
KA	Kromdraai A, Department of Palaeontology, Transvaal Museum, Pretoria
MP	Makapansgat, Department of Anatomy, University of the Witwatersrand, Johannesburg
SAM	Taung, Natural History Collection – Palaeontology, South African Museum, Cape Town
SB	Schurweberg, Department of Palaeontology, Transvaal Museum, Pretoria
SK	Swartkrans, Department of Palaeontology, Transvaal Museum, Pretoria
SP	Sterkfontein (Pre-1966), Department of Anatomy, University of the Witwatersrand, Johannesburg
STS	Sterkfontein (Pre-1966), Department of Palaeontology, Transvaal Museum, Pretoria
SWP	Sterkfontein (Post-1966), Department of Anatomy, University of the Witwatersrand, Johannesburg
T	Taung, Department of Anatomy, University of the Witwatersrand, Johannesburg and Department of Palaeontology, Transvaal Museum, Pretoria
TP	Taung, Department of Anatomy, University of the Witwatersrand, Johannesburg
ZA	Extant Baboon Sample, Hunterian Museum, Department of Anatomy, University of the Witwatersrand, Johannesburg

CHAPTER THREE
PARAPAPIO BROOMI

Parapapio broomi (Jones 1937)

(= or including *Parapapio broomi* (Broom, 1940; Broom and Jensen, 1946; Cooke, 1952; Dart, 1949; Eisenhart, 1974; Freedman, 1957; Jones, 1937; Kitching et al., 1948; Mollett, 1947). *Parapapio broomi* (small) (Eisenhart, 1974). *Parapapio whitei* (Broom, 1940, 1948; Broom and Jensen, 1946; Broom and Robinson, 1950; Eisenhart, 1974; Freedman, 1957, 1965; Freedman and Stenhouse, 1972; Hopwood and Hollyfield, 1954). *Brachygnathopithecus peppercorni* (Kitching, 1952).

Holotype: Sts 564, an edentulous and highly fragmented female cranium.

Repository of Type Specimen: Department of Palaeontology, Transvaal Museum, Pretoria, South Africa.

Type Site: Sterkfontein, Gauteng, South Africa.

Referred Material: Sixty-five specimens from Members 2 and 4. See Table 3-1 for list of specimens.

Introduction

Of the species-identifiable papionin specimens from Members 2 and 4 of the Sterkfontein deposit, *Pp. broomi* remains the most common papionin. *Parapapio broomi* comprises approximately 39.4% of the papionin sample compared to the 32.7% and 27.9% of *P. izodi* and *Pp. jonesi*, respectively.

Table 3-1. Specimens Attributed to *Parapapio broomi.*

	Sex		
	Female	Male	Indet.
Specimen Number	Sts 255	Sts 253	St 2119
	Sts 259	Sts 260	Sts 250
	Sts 363	Sts 323	Sts 264
	Sts 388 a	Sts 534	Sts 273
	Sts 388 b	Sts 563	Sts 296
	Sts 397	Swp 246	Sts 358
	Sts 562	Swp 1459	Sts 383
	Swp 389	Swp 1728	Sts 383 a
	Swp 476	Swp 1879	Sts 385 a
	Swp 1377	Swp 1884	Sts 432
	Swp 1460	Swp 2102	Sts 530
	Swp 1736 a		Sts 544
			Sts 2117
			Sts 4208
			Swp Un1
			Swp 5
			Swp 14
			Swp 19
			Swp 30
			Swp 87
			Swp 261
			Swp 279
			Swp 315
			Swp 324
			Swp 1023
			Swp 1230
			Swp 1772
			Swp 1775
			Swp 1797
			Swp 1874
			Swp 2223
			Swp 2850
			Swp 2882
			Swp 2887
			Swp 2915
			Swp 2919
			Swp 2929
			Swp 2937
			Swp 2939
			Swp 2940
			Swp 2945
			Swp 2946
			Swp 2951

The taxonomic identity of the *Pp. broomi* specimens is based upon several fragmentary specimens; therefore, it will be useful to draw comparisons between the Sterkfontein sample and an exceptional representative of the 'classic' *Pp. broomi* morphology, Bolt's Farm 43 (Figure 3-1). It should be noted that while BF 43 displays much of the 'typical' *Pp. broomi* morphology, it is more robustly built than the much earlier occurring Sterkfontein sample, most specifically in the facial region near the supraorbital tori.

Sts 533/534 remains the most complete male of this species identified to date. Eisenhart (1974) suggested that Sts 533, a mandible, possibly belonged with Sts 534, a partial cranium, and assigned the specimens to *Pp. broomi.* This taxonomic identification is in disagreement with an earlier analysis (Freedman 1957), but one which this analysis supports.

Sts 534 is a partial cranium preserving most of the muzzle on both sides, posterior to the canine eminence, and the right half of the neurocranium (Figure 3-2). The premaxillae and the zygomatic arches are missing and/or highly damaged. The palate of Sts 534 is fairly intact, but lacks the anterior dentition. Luckily, other *Pp. broomi* specimens preserve anatomical regions missing for Sts 533/534, and together, provide a relatively complete view of the Sterkfontein *Pp. broomi* anatomy.

As initially proposed, a distinguishing characteristic of the genus *Parapapio* was considered to be the lack of sexual dimorphism in each species. In this analysis, it was discovered that sexual dimorphism was marked in the species *Pp. broomi.* This dimorphism is most readily observed in slight differences in the rostrum and features of the anteorbital region. Contrary to previous analyses (Eisenhart 1974; Freedman 1957),

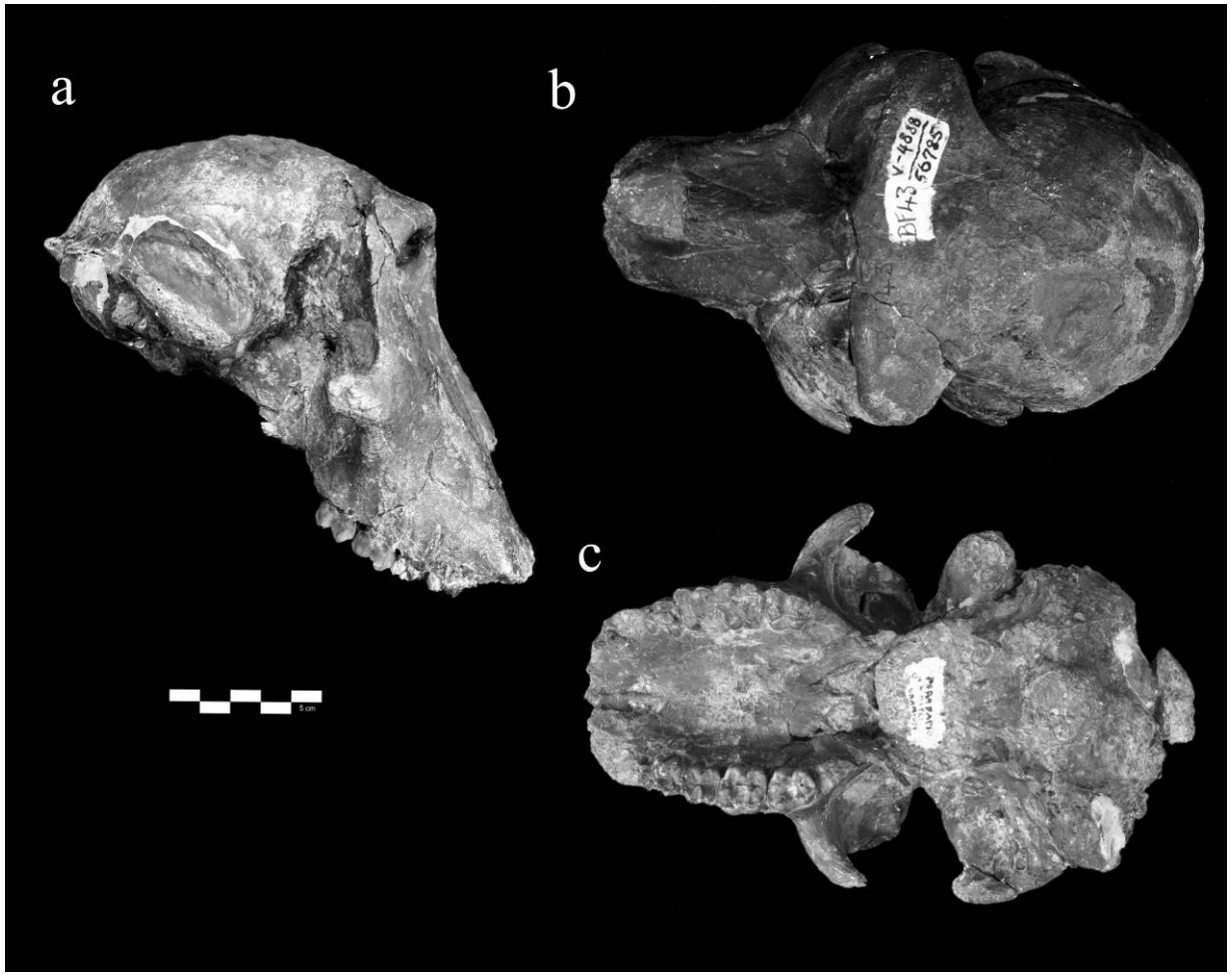


Figure 3-1. Bolt's Farm 43. A 'typical' *Parapapio broomi* from the Sterkfontein Valley site of Bolt's Farm. However, BF 43 is slightly later occurring than the Sterkfontein material and is comparatively more robustly built.

Figure 3-2. Sts 534 – Male *Parapapio broomi*. The most complete *Parapapio broomi* partial cranium from Sterkfontein associated with a mandible, Sts 533 (not shown).

males of *Pp. broomi* display a secondarily-elongated muzzle similar to modern baboons, but developed to a much lesser degree (Figure 3-3). On the other hand, females display muzzles which appear to be size-proportionate to their cranial size. The specific details of anatomical similarities and differences between the sexes will be described in greater detail below.

Description

Much of the anatomy of the papionins and its description centers upon differences in craniological form, as morphologically the teeth of *Papio* and *Parapapio* are

relatively indistinguishable. As an example, the shape of the muzzle dorsum, when viewed laterally, is a useful means to distinguish among papionin species at Sterkfontein. Eisenhart (1974) had difficulties with this feature, as at the time of his analysis, no specimens preserved this anatomical region. Since his analysis, a few less-fragmentary specimens have been recovered from the Silberberg Grotto (Dump 20) and Member 2 excavations. In this sample, specimens of *Pp. broomi* show a greater degree of variability in the anteorbital region than was previously accepted.

Cranium

Frontal

Both, males and females, exhibit very little development of supraorbital tori which contrasts greatly with the tori of *Papio* specimens at Sterkfontein. But, weakly-developed tori are indicative of the genus *Parapapio*, not just *Pp. broomi*, and cannot be used singly as a feature to distinguish among papionins at the site. The tori are consistently weakly developed in both sexes in both their medial and lateral dimensions. The result is a rather flat appearing anterior frontal.

In both *Pp. broomi* sexes, such as Sts 534 (male) and Sts 564 (female), an ophryonic groove does not appear to be present, but in most specimens, the region is damaged. Well-developed temporal lines can be observed emerging from the lateral margins of the supraorbital tori. Temporal lines cannot be visualized in the male Sterkfontein specimens, as few preserve this region. However, in the female, Sts 564, the temporal line is well-developed as it leaves the lateral edge of the supraorbital tori and travels medially toward the sagittal suture. Just posterior to the point of greatest post-orbital constriction, the temporal line begins to weaken until it finally fades into the

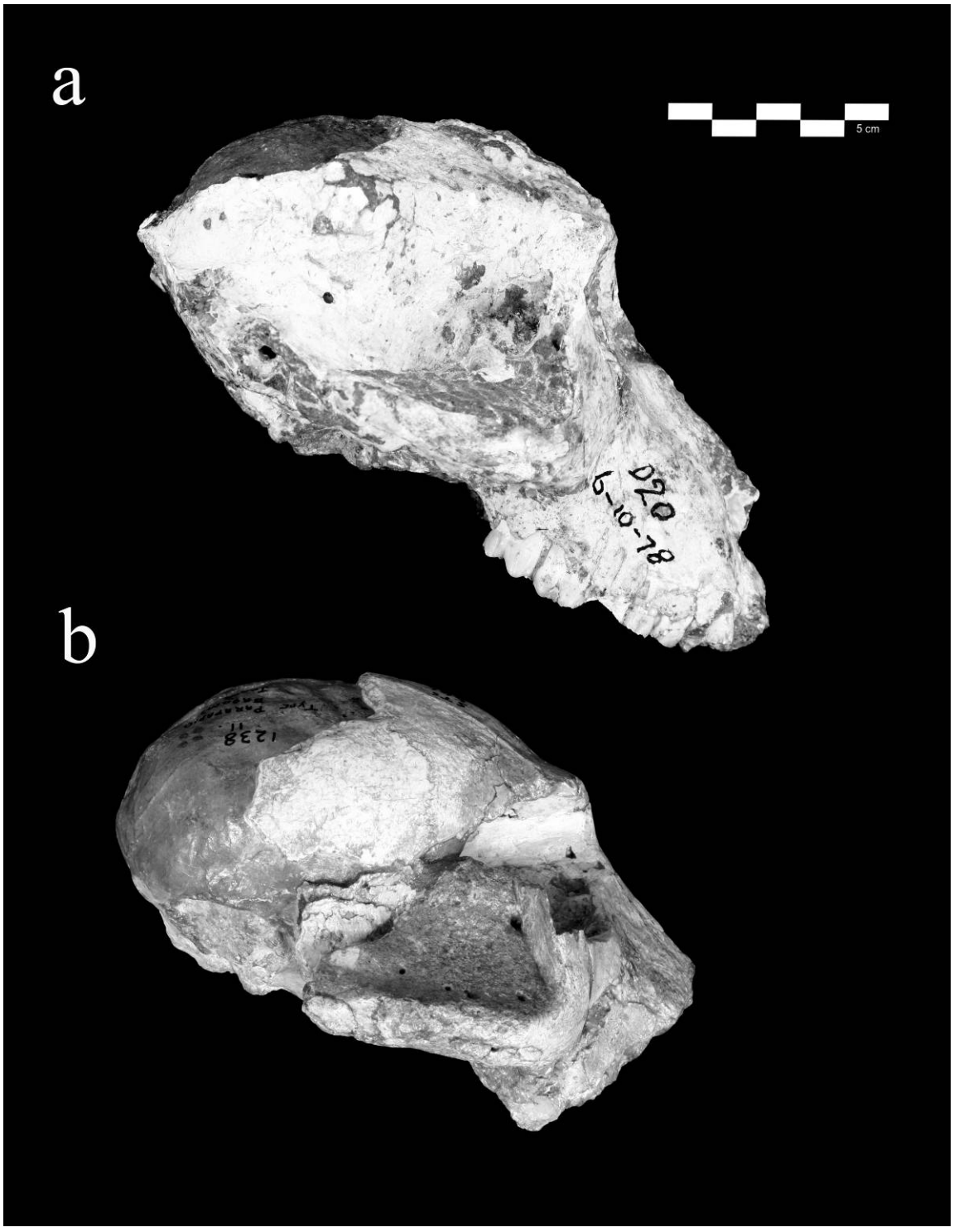


Figure 3-3. Male and Female *Parapapio broomi*. Shown above are representatives of the *Parapapio broomi* sexes: (a) Swp 1728 – a male and (b) Sts 564 – a female.

cranial surface near the coronal suture. The temporal lines cannot be traced posterior to this suture. The male *Pp. broomi* from Bolt's Farm, BF 43, exhibits temporal line morphology indistinguishable from that of Sts 564; therefore, suggesting that had male morphology been observable among the Sterkfontein sample, it would not have differed greatly from that of the observed females.

Post-orbital constriction approximates the degree observed in female extant *Papio* specimens. The narrowest portion of the cranium is slightly posterior to the external surface of the greater wing of the sphenoid.

Rostrum

At first glance, Sts 534, a *Pp. broomi* male, appears to possess a straight-line profile from glabella to rhinion. But, this was discovered to be an expression of the fragmentary nature of this specimen, not a reflection of its 'true' anatomy. A straight-line nasal profile appears to be present in other *Pp. broomi* males, such as Swp 1731, but again, they are usually the result of fragmentation – Swp 1731 is missing the supraorbital region completely. When specimens preserving this region in its entirety are consulted, both sexes appear to possess a slight anteorbital drop, not a straight-line nasal profile. The *Pp. broomi* anteorbital drop is neither as dramatic as that observed in the *P. izodi* specimens of Sterkfontein, nor as that among extant *Papio*, but rather, somewhere between these species and that of *Pp. jonesi* from Sterkfontein.

The anteorbital drop in Swp 1728, a male, and Sts 564, a female, is presented as a slightly concave region between glabella and rhinion. The steepest portion of this drop is found between glabella and nasion. The slightly concave anteorbital region is consistently found throughout the range of *Pp. broomi* at Sterkfontein – Member 2 (Swp

1728) and Member 4 (Sts 564) – and is shown to persist in *Pp. broomi* specimens from much later occurring sites, such as Bolt's Farm (BF 43).

In the region of the anteorbital drop, glabella typically protrudes only slightly from the weakly developed supraorbital tori. The remainder of this region is typically 'papionin'. The inter-orbital distance in *Pp. broomi* is narrow and is accompanied by somewhat circular orbits.

A distinctive feature of *Pp. broomi* is that the nasal bones are slightly raised above the muzzle dorsum in comparison to the remainder of the rostrum. From the nasal bones, the rostrum angles inferio-laterally until its junction with the maxillary ridges. Contrary to previous analyses, maxillary ridges are shown to exist in the *Pp. broomi* specimens from Sterkfontein. The ridges are present in both sexes and are lightly developed in all observed specimens (Figure 3-4). Typically, maxillary ridges are larger and more developed in males (Swp 1731), as opposed to females (Sts 564), but in neither sex do the ridges approach the size of that observed in extant male *Papio* specimens.

Unfortunately, no specimens preserve the maxillary ridges in their entirety, but a clear picture can be derived from a composite of female and male specimens preserving portions of the anatomy. In Sts 564, a female, the ridges arise posteriorly from the zygomatic, near the inferio-lateral margin of the orbit which appears to be typical of the species. The maxillary ridges continue to travel anteriorly until they fade into the canine eminence, as can be seen in Swp 1731, a fragmentary male *Pp. broomi* specimen. In Swp 1731, the maxillary ridges appear to flair, as they approach the canine eminence. In females, this phenomenon cannot be verified, as no specimens preserve this region, and the anterior flaring may be the result of the much larger and dimorphic canine of the

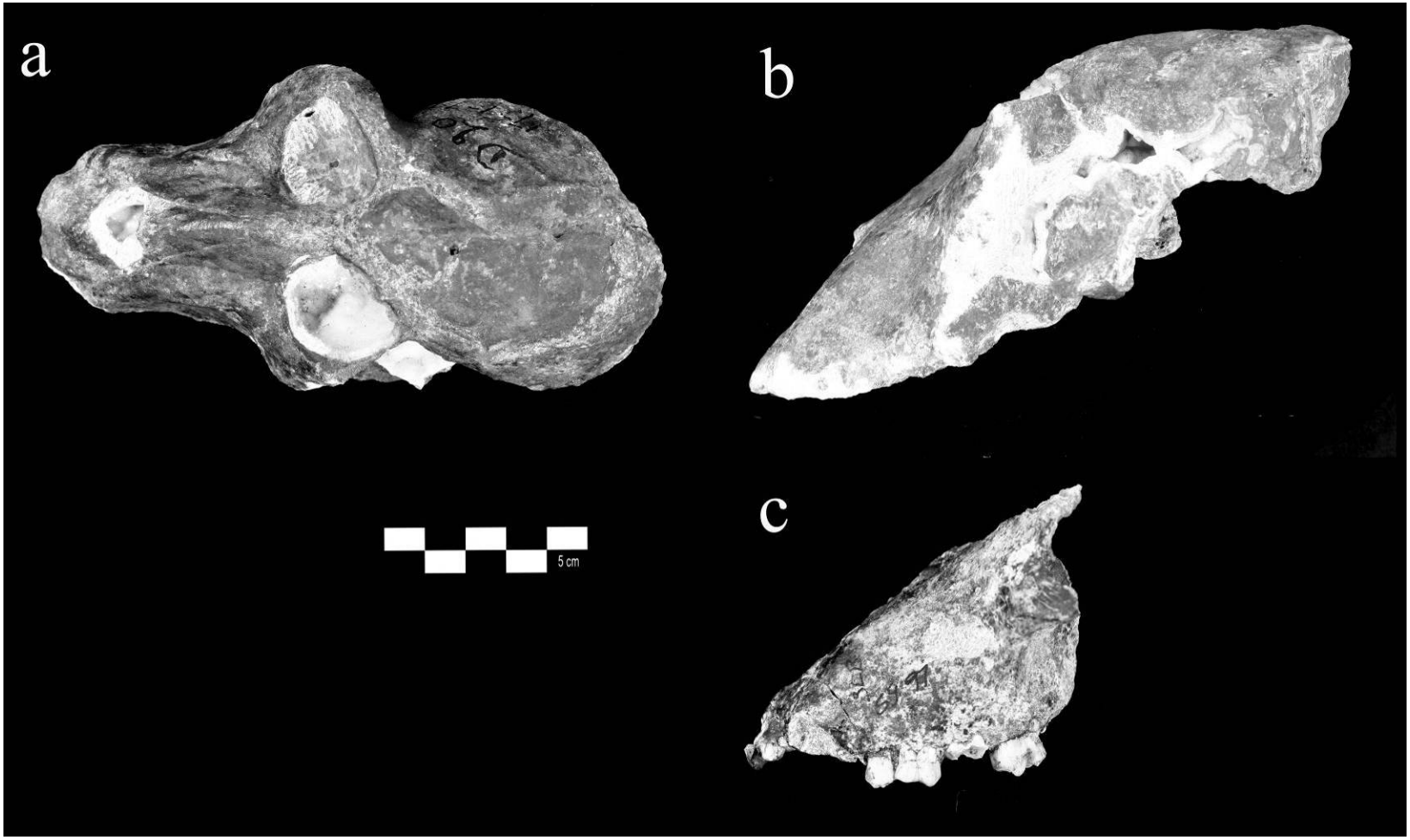


Figure 3-4. Maxillary Ridge Morphology of *Parapapio broomi*. Maxillary ridges are moderately developed in *Pp. broomi*, as shown in (a) norma verticalis and (b) norma lateralis views of Swp 1731 and the (c) norma lateralis view of Swp Un 1.

males. Therefore, maxillary ridge flaring near the canine eminence may not be a species specific trait.

Additionally, both sexes exhibit lightly developed maxillary fossae just inferior to the maxillary ridges – Swp 1731, a male and Sts 564, a female. This is contradictory to Freedman's (1957) conclusion that the maxillary fossae may be completely absent in females while in males the fossae may be present in varying degrees, or may altogether be absent. It should be noted that in *Pp. broomi*, the fossae are more the result of the presence of well-developed maxillary ridges, rather than a distinct depression in the maxillary bone (e.g. like that observed in *Papio*). The result is maxillary fossae that are slightly concave when viewed in bucco-lingual cross-section.

Consequently, the product is a rostrum that in cross-section appears to be a pyramid sitting atop a slightly bi-concave hourglass. The widest points of the muzzle are to be found both at the maxillary ridges and at the buccal surface of the palatal alveolus. This feature appears to be consistent across males and females at Sterkfontein, and rostral shape is a feature that can be used to diagnose the papionin species at Sterkfontein.

The state of the premaxillae of *Pp. broomi* cannot be determined, as the anterior muzzle of most specimens attributed to this species is heavily damaged. The specimen, Sts 254a, previously used by Freedman (1957) to describe this anatomical region is in this analysis attributed to the species *P. izodi*. The damaged outline of the nasal aperture of Swp 1731, a male *Pp. broomi*, approximates an ellipse, but is possibly slightly wider at is posterior margin. The 'true' nature of this anatomical structure must await the recovery of more complete *Pp. broomi* crania.

Palate

When viewed from norma basalis, the differences in the male and female muzzle become apparent (Figure 3-5). In Swp 1884, a male *Pp. broomi* specimen, the palate appears to be elongated anteriorly when compared to that of the female specimen, Sts 385a. Female *Pp. broomi* specimens appear to be roughly horse-shoe shaped displaying a slightly convex curve in each palatal half. The female palate, Sts 385a, appears to be rather broad in comparison to the palate of the male, Swp 1884. This is mainly the result of sexually dimorphic size differences among *Pp. broomi* and the secondarily elongated male muzzle. The male muzzle, Swp 1884, exhibits maxillary toothrows that are noticeably more parallel than that of female specimens from Sterkfontein. This observation may possibly result from the much larger canines of male, e.g. Swp 246, resulting in a palate that is as wide at the canine, as it is at the posterior dentition. It should be noted that male specimens do show some convexity in their palatal dentition, but with the elongation of their muzzles, much of the convexity has been lost. The recovery of more complete specimens from Sterkfontein will reveal whether these are 'true' male-female differences, or reflections of a fragmentary sample.

In the male, Sts 253, the posterior palatine foramina appear to be rather large for a specimen of this size, and unfortunately, no females preserve this region intact. As a result, the range of size variation in the foramina is currently not known, and it is questionable, as to whether Sts 253 is typical for the species. Additionally, the palatine foramina do not appear to be protected by a lingula, but Sts 253 is slightly damaged in this area and observations are tentative.

The palatal dentition is papionin in form and provides little aid in differentiating

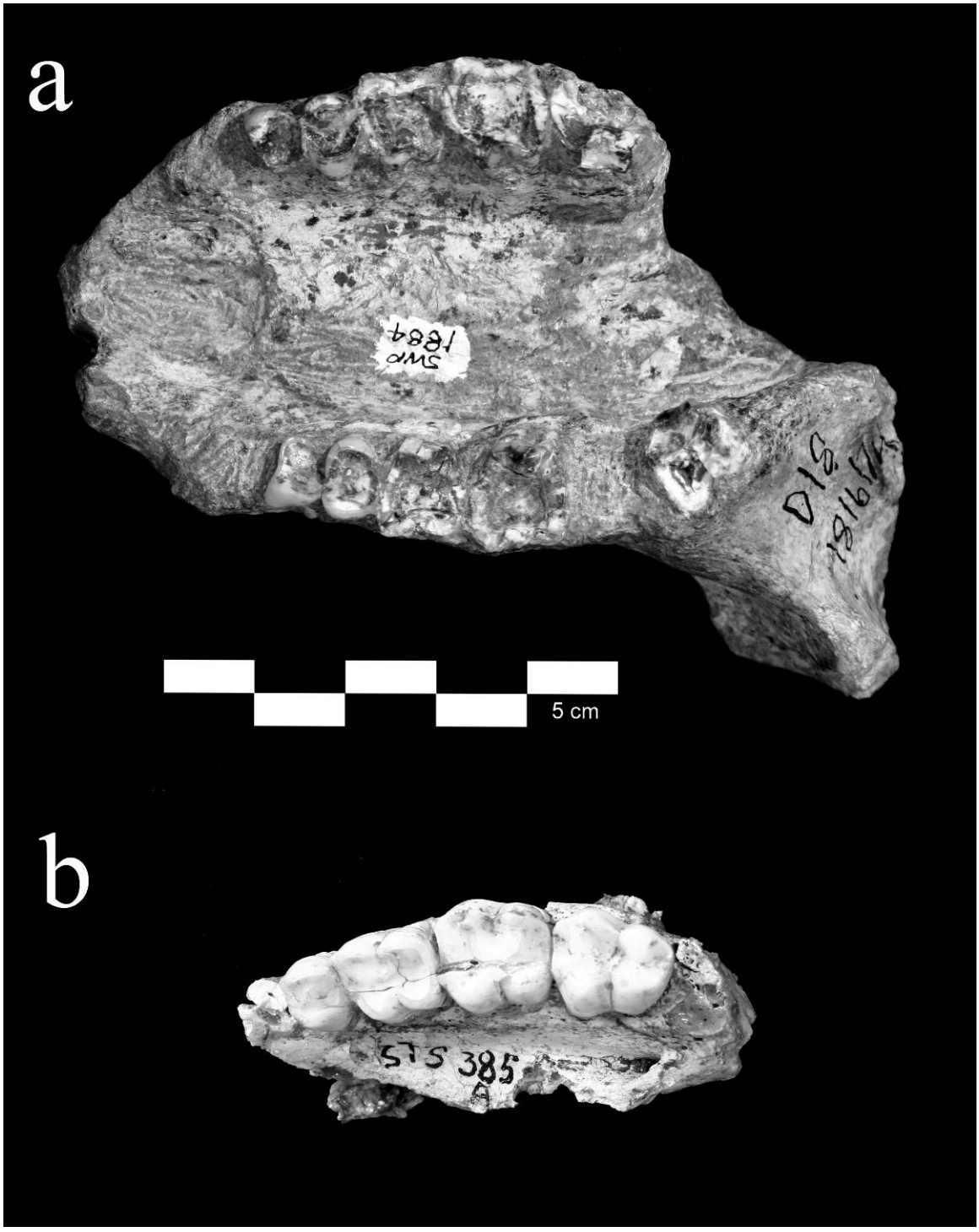


Figure 3-5. Palatal Morphology of *Parapapio broomi*. (a) Swp 1884, a male *Pp. broomi* specimen exhibits an elongated horse-shoe shaped palate while the female (b) Sts 385 exhibits a horse-shoe shaped palate which is rounded throughout the arch.

between the species at Sterkfontein. As discussed previously in brief, the exception to this rule is the posterior dentition – a size discrepancy between premolars and molars. We will return to a discussion of this observation in Chapter Six of this analysis.

Most notably, the canine of *Pp. broomi* was found to be significantly sexually dimorphic (Figure 3-6). In females, Swp 389 and Swp 324, the canine approximates in size, the breadth and length, of the third premolar. In contrast, the canine of male *Pp. broomi* specimens is approximately twice as large in these dimensions, as seen in Swp 246 and the alveolus of Swp Un 1. Canine height comparison cannot be made at this time, as no *Pp. broomi* females provide an intact canine. Observations of male *Pp. broomi* specimens, such as Swp 246 and Sts 260, show that the male canine was larger than any other papionin at Sterkfontein. The canine is not as large as that of extant *Papio*, but is significantly large for a papionin of this sample's age (pre-2.0 Ma).

In Swp 246, a large canine diastema is observed between the lateral incisor and the canine, and is comparable in size to that of other males at the site, Swp 1884 and Swp Un 1. The diastema in females, Swp 324 and Swp 389, is only proportionally smaller, but still easily visible.

Mid-Face and Zygomatic Arch

The root of the zygomatic and its origin appears to vary with both, age and sex. In *Pp. broomi* males, Sts 534 and Swp 1879, the root of the zygomatic appears to originate near the distal loph of M^2 and the mesial loph of M^3, respectively. In the only female preserving this region, Swp 389, the root origin appears to be nearer to the mesial loph of M^3.

The size of the zygomatic arch was previously unknown in earlier analyses, as this

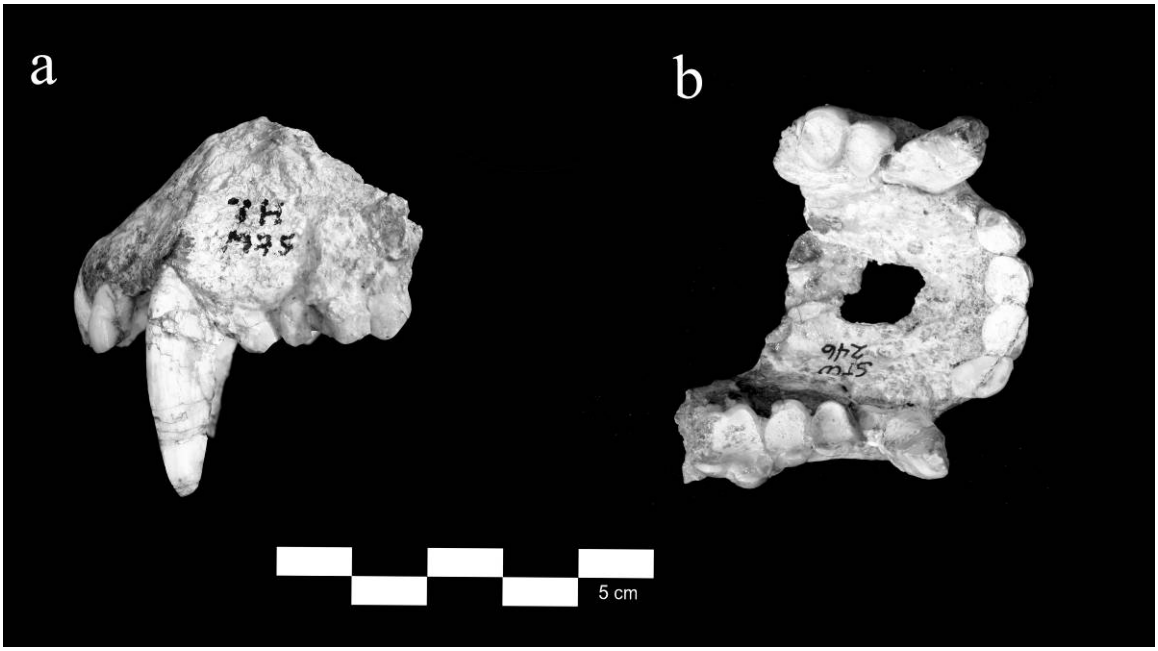


Figure 3-6. Male Canine Morphology of *Parapapio broomi*. Swp 246, a male *Pp. broomi* exhibits the typical sexually dimorphic canine in (a) norma lateralis and (b) occlusal views.

region was heavily fragmented in most specimens. But, new evidence suggests that the zygomatic arches in both, male and female, *Pp. broomi*'s, were well-developed. Morphology in the male and female arches are slightly different; the male zygomatic being only slightly larger, as a result of their secondarily elongate muzzle. In Swp 389, a female, the zygomatic arch can be seen to maintain a uniform thickness throughout its extent. The arch in the male, Swp 1728, is again similar, but much more difficult to observe due to adhering breccia. In Sts 534, a male, and Swp 389, a female, the large post-glenoid processes typical of this species can be observed.

The zygomatic arch in females, such as Sts 564, moves from the zygomatic bone to the temporal along roughly the same horizontal plane while in males, as observed in Swp 1728, the zygomatic can be seen to move acutely superior as it nears the temporal

bone. At the posterior termination of the zygomatic arch, a small crest is formed which then becomes a slight nuchal crest in males (e.g. Sts 534). In females, the nature of this crest is unknown, as no specimens preserve this region intact. The temporal fossae do not appear large in specimens preserving this region.

Orbit

In observable specimens, the orbits appear sub-circular with the most inferior portion being located near the zygomatico-maxillary suture. The eyes appear relatively large in respect to the face in the females, such as Sts 564, while in males (e.g. Sts 534) the expanded rostrum causes the orbits to appear smaller. But in absolute terms, the orbits in males and females are roughly equal in size.

The distance between the orbits is typical of the other papionins. The inter-orbital distance is relatively small in respect to the remainder of the cranium. The distance is at its narrowest near the fronto-nasal suture. The orbital region is very lightly built.

The genus is distinctive in its supraorbital region when compared to the other genus, *Papio*, found at Sterkfontein. Swp 389, a large female *Pp. broomi*, displays a lightly built supraorbital region, and the tori are continuous across the superior margin of the orbit. The most anterior projecting region of the orbit is near glabella. Unfortunately, no males at Sterkfontein are complete enough in this region to make further comparisons, but Swp 389 is strikingly similar to BF 43, a male *Pp. broomi*, from Bolt's Farm.

Calvaria and Temporal

Posterior to the gracile tori, the cranium begins to rise until the approximate point of bregma upon which the calvarium begins to steadily curve inferiorly. The posterior region of the cranium appears to be well-rounded, but overall, the cranium appears to tend toward dolichocephaly. Females of *Pp. broomi*, such as Sts 564, exhibit a more globular neurocranium than males (e.g. Sts 534) which appear to have more dolichocephalic crania. Nonetheless, the crania of both sexes are not as rounded as that observed in the females of extant *Papio*.

Posteriorly, the male, Sts 534, exhibits a lightly developed nuchal crest. The crest appears to be its thickest near inion and weaken as it stretches anteriorly toward the external acoustic meatus. The presence and state of a nuchal crest in females cannot be verified, as no females preserve this cranial region intact. The nuchal plane in Sts 564, a female, is more rounded and less inclined from the horizontal plane than in the *Pp. broomi* males. For example, a *Pp. broomi* male, Sts 534, exhibits a nuchal plane that is more sub-circular and inclined significantly from the horizontal plane. Inion is very weakly developed in the specimens that preserve the region.

Very few specimens preserve an undamaged temporal bone. The post-glenoid process of the temporal bone exhibits a wide breadth and appears high in both males (e.g. Sts 534) and females (e.g. Swp 389). As previously mentioned, the posterior root of the zygomatic appears to be heavily built in both sexes.

Mandible

A few complete specimens of *Pp. broomi* exist, and a description of mandibular morphology, as observed in both sexes, is now possible. In previous analyses, Sts 533, a

mandible associated with Sts 534, was used for mandibular description. But, Sts 533 was badly damaged, and more complete specimens are now available.

Males and females of *Pp. broomi* are distinct in a few features. For example, females, such as Sts 363 and Sts 562, display a mandibular symphysis that is comparatively long ending distally near the distal aspect of M_1. This can be observed in both, lateral and occlusal, views (Figure 3-7). Females also display rather shallow mandibular corpora. In contrast, the symphysis of the male, Sts 563, is steeper and appears to end near the middle of the sectorial P_3. This can only be estimated in the current specimen, as the posterior aspect of the symphysis is obscured by breccia. Males also exhibit mandibular corpora that are comparatively deeper than females of this species.

On the anterior surface of the mandible in both sexes, converging lines can be visualized. The male mandibles appear to be more robustly built in the symphyseal region than the females. On the posterior surface of the symphysis, the symphyseal foramen can be observed in several female specimens, Swp 1736 and Sts 363, but no males preserve this region. A short incisal shelf can be observed in Sts 363, a female, extending posteriorly from the incisors to near the distal P_3 level.

Mandibular fossae are not present in male or female *Pp. broomi* specimens. This is interesting considering that both males and females exhibit distinct, but lightly built maxillary fossae. Rather, the lateral surface of the corpus appears slightly convex in cross-section compared to extant and fossil *Papio* which display a more concave cross-section resulting from the presence of mandibular fossae. Sts 563, a male *Pp. broomi*,

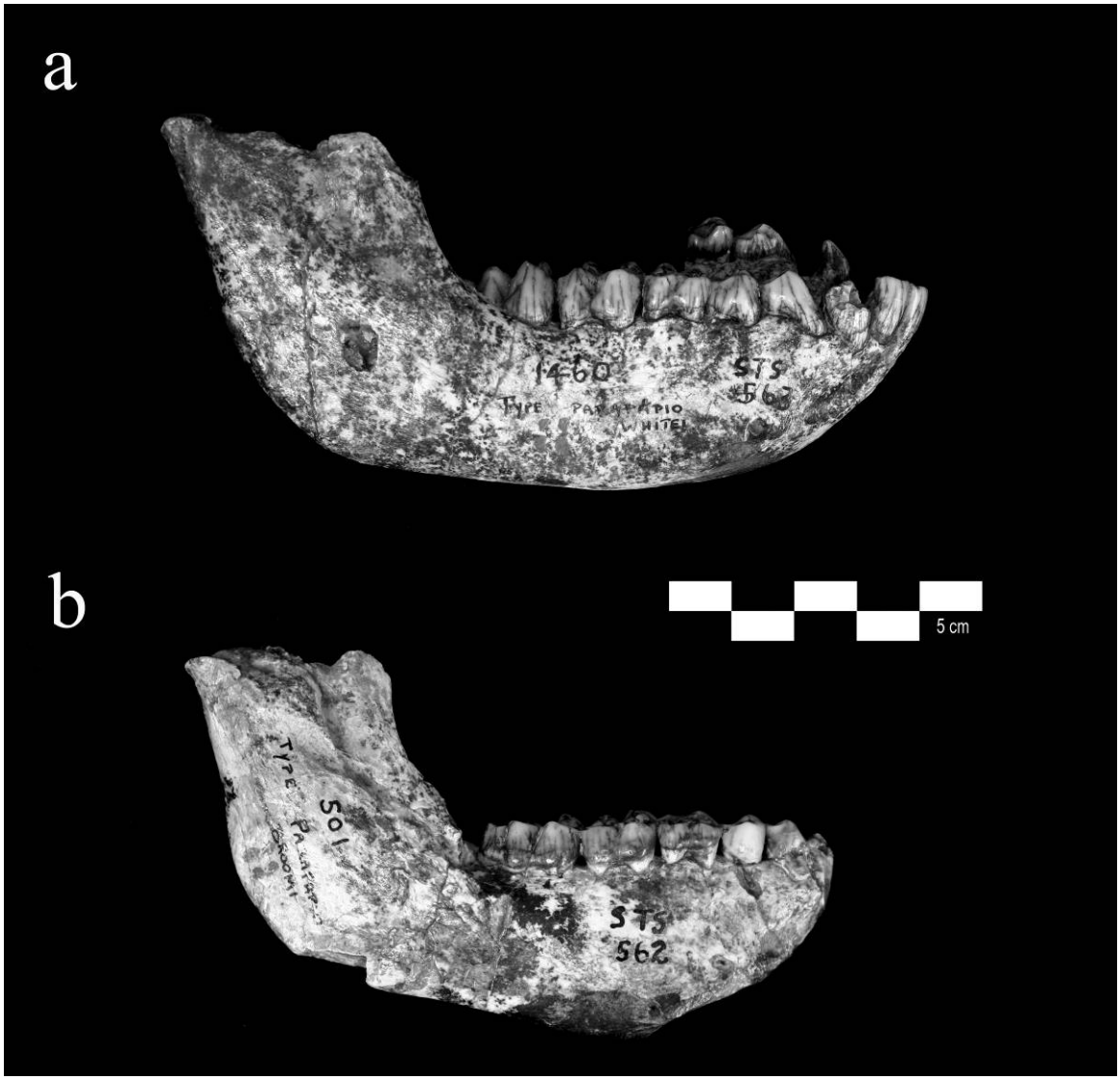


Figure 3-7. Mandibular Morphology of *Parapapio broomi*. Shown above are (a) Sts 563 – a male *Pp. broomi* and (b) Sts 562 – a female *Pp. broomi*. Note, the male, Sts 563, was the Type Specimen for the now redundant species, *Pp. whitei*.

possesses multiple mental foramina while in the females, only a single foramen can be observed.

In occlusal view, Sts 323 and Sts 363, a male and female, respectively, display v-shaped mandibular corpora (Figure 3-8). No specimens in the male sample display bilaterally undamaged corpora. Therefore, female mandibular morphology is considered

Figure 3-8. Additional *Parapapio broomi* Mandibular Comparisons. Above are the female *Pp. broomi*, Sts 363, and the male, Sts 363, shown in (a and c) norma lateralis and (b and d)occlusal views, respectively.

to be typical for the species. While the corpora, as a whole, appear to be v-shaped, the posterior dentition appears to be nearly parallel. In lateral view, the mandibular corpus in the male, Sts 563, and the female, Sts 562, appear to be deepest at the level of the mesial loph of M_2. From this point posteriorly, the corpus curves smoothly toward gonion.

Sts 563 and Sts 363 display fairly intact gonial regions. In these specimens, the gonial angle is greater than ninety degrees and is derived from a smooth curve arising from the inferior margin of the mandibular corpus. Additionally, the ascending ramus of *Pp. broomi* appears to be medially flexed along its posterior margin, as can be seen in the

male, Sts 563, and female, Sts 562, specimens. Only Sts 562 and Sts 563 preserve coronoid and condyloid processes. The region is slightly damaged in both specimens, but the sigmoid notch appears shallow in both sexes.

Dentition

In terms of dentition, *Pp. broomi* is among the largest species at Sterkfontein. Unfortunately, all three papionin species at Sterkfontein, *Pp. broomi*, *Pp. jonesi* and *P. izodi* exhibit a great deal of overlap in most dimensions. The only exception is the canines of *Pp. broomi* which appear to be the most dimorphic, and largest, of the Sterkfontein sample. The differences between the male and female dental characters is not significant, but is readily recognizable.

Additionally, *Pp. broomi* appears to be very similar in both, overall cranial morphology and dentition, to the *Parapapio* species at Taung, *Pp. antiquus*. Previously, the reduction of the distal loph of the M^3 in *Pp. antiquus* was used to distinguish it from the other *Parapapio* species, most specifically from *Pp. broomi* (Eisenhart, 1974; Freedman, 1957). However, reduced M^3's were observed in the Sterkfontein *Pp. broomi* sample, as well. Further discussion of this significant finding is reserved for Chapter Six of this document.

As noted by Eisenhart (Eisenhart, 1974), sexual dimorphism is apparent in the cranium of *Pp. broomi,* but the differences in dental dimensions only significantly differed in sexually dimorphic teeth (e.g. canines and sectorial premolars). The mean centered coefficient of variations (CV) are listed below (Table 3-2) along with the descriptive statistics for the combined sample (i.e. both members and both sexes). Individual measurements for each specimen analyzed are listed below under the dental categories.

As can be observed in Table 3-2, a large degree of variation exists in the hypoconulid breadth of the *Pp. broomi* sample, as exhibited by its high CV. However, the breadth of the hypoconulid is difficult to reliably measure, as noted by Freedman (1957) who has previously discussed its inaccuracy.

Table 3-2. Descriptive Statistics for *Parapapio broomi.* Note, measurements given in millimeters (mm).

	N	Minimum	Maximum	Mean	Std. Deviation	CV
I^1 Length	1	7.7	7.7	7.7		
I^2 Length	2	4.7	5.6	5.2	0.6	0.12
I^1 Breadth	3	6.3	6.4	6.3	0.1	0.01
I_1 Length	3	5.4	5.8	5.6	0.2	0.03
I_1 Height	2	9.6	10.7	10.2	0.8	0.08
I_2 Breath	2	6.0	6.4	6.2	0.3	0.05
I_2 Length	2	4.8	5.5	5.2	0.5	0.10
I_2 Height	1	9.3	9.3	9.3		
C^1 Breadth	6	7.0	8.7	7.7	0.6	0.08
C^1 Length	2	6.8	11.2	9.0	3.1	0.35
C^1 Height	2	12.6	27.6	20.1	10.6	0.53
C_1 Breadth	1	5.8	5.8	5.8		
C_1 Length	1	7.3	7.3	7.3		
C_1 Height	1	14.2	14.2	14.2		
P^3 Breadth	15	5.0	8.7	7.3	0.9	0.12
P^3 Length	16	4.5	6.6	5.5	0.6	0.10
P^3 Height	3	4.5	8.6	6.5	2.1	0.31
P^4 Breadth	23	6.1	9.8	8.2	0.9	0.11
P^4 Length	24	5.0	7.6	6.2	0.6	0.10
P^4 Height	4	4.4	6.8	5.9	1.1	0.19
P_3 Breadth	11	4.7	6.6	5.7	0.7	0.13
P_3 Length	11	5.1	18.2	7.5	3.7	0.50
P_3 Height	4	4.8	8.1	6.1	1.4	0.23
P_3 Flange Height	5	3.4	15.5	9.9	4.5	0.45
P_4 Breadth	12	6.7	7.7	7.2	0.3	0.04
P_4 Length	14	5.9	8.6	7.0	0.8	0.11

	N	Minimum	Maximum	Mean	Std. Deviation	CV
P_4 Height	5	3.5	5.5	4.6	0.7	0.16
M^1 Mesial Breadth	18	8.3	10.3	9.4	0.6	0.06
M^1 Distal Breadth	18	7.6	9.6	8.8	0.5	0.06
M^1 Length	24	6.8	10.6	8.9	0.8	0.09
M^1 Height	6	5.0	6.0	5.6	0.4	0.07
M^2 Mesial Breadth	24	9.4	12.8	11.2	0.9	0.08
M^2 Distal Breadth	24	8.7	12.2	10.4	0.8	0.07
M^2 Length	27	8.1	12.8	10.6	1.0	0.10
M^2 Height	7	6.4	7.4	6.9	0.5	0.07
M^3 Mesial Breadth	24	9.2	13.7	11.0	1.0	0.09
M^3 Distal Breadth	22	7.4	11.2	9.1	0.9	0.10
M^3 Length	24	9.1	12.3	10.7	0.8	0.07
M^3 Height	12	5.9	7.6	6.8	0.5	0.08
M_1 Mesial Breadth	9	7.5	9.2	8.3	0.6	0.07
M_1 Distal Breadth	10	7.8	9.1	8.3	0.5	0.06
M_1 Length	13	7.0	10.3	8.6	0.9	0.10
M_1 Height	1	4.3	4.3	4.3		
M_2 Mesial Breadth	12	9.5	11.9	10.3	0.8	0.07
M_2 Distal Breadth	10	8.9	11.0	9.8	0.5	0.05
M_2 Length	18	9.6	12.6	11.1	0.9	0.08
M_2 Height	4	5.7	7.4	6.4	0.8	0.12
M_3 Mesial Breadth	10	8.6	11.4	10.3	0.8	0.08
M_3 Distal Breadth	10	7.4	10.1	9.4	0.9	0.09
M_3 Hypoconulid Breadth	11	5.0	14.6	7.2	2.6	0.36
M_3 Length	13	12.5	15.4	14.4	0.9	0.06
M_3 Height	6	6.0	8.0	6.9	0.8	0.12

Incisors

Previously, little evidence of the morphology of the *Pp. broomi* incisors was available (Eisenhart, 1974). In this study, no females have been identified with measurable maxillary incisors. The available maxillary incisors exhibit morphology similar to that of the extinct Sterkfontein papionins and extant *Papio*. The lateral

maxillary incisor (I^2) is slightly smaller in all dimensions than the mesial maxillary incisor (I^1), but the data are still scarce for this species (Table 3-3). Additionally, Sts 260, a male *Pp. broomi* exhibits a small diastema between the I^2 and C^1.

Table 3-3. I^1 and I^2 Dimensions (mm) for *Parapapio broomi.*

		I^1 Breadth	I^1 Length	I^2 Breadth	I^2 Length
Male	Sts 260				4.7
	Swp 246	5.7	5.7	5.6	5.3
Indet.	Sts 530		7.7		5.6

The lower incisor sample is represented by both sexes, but again, there are few individuals represented (Table 3-4). In this analysis, Sts 563, the type specimen of *Pp. whitei*, has been identified as a male *Pp. broomi.* The specimen, Sts 563, is nearly identical in all dimensions to that of Sts 323, a specimen previously identified as a male *Pp. broomi* (Eisenhart, 1974; Freedman, 1957). The mandible, Sts 563, also fits well with male *Pp. broomi* crania from Sterkfontein and Taung. The mandibular incisors of the *Pp. broomi* sample are typically papionin exhibiting the same morphology as the maxillary incisors (i.e. smaller I^2). The greatest dimension in the mandibular incisors is the height, but unfortunately, only one specimen was measurable (Table 3-4).

Table 3-4. I_1 and I_2 Dimensions (mm) for *Parapapio broomi.*

		I_1 Breadth	I_1 Length	I_2 Breadth	I_2 Length	I_2 Height
Female	Swp 1377	6.4	5.8			
Male	Sts 323	6.3	5.6	6.0	5.5	
	Sts 563	6.3	5.4	6.4	4.8	9.3

Additionally, the mandibular incisors are lacking enamel on their lingual surface, a feature observed in extant *Papio.* Regrettably, no specimens preserved both the

mandibular and maxillary incisors. Therefore, their relative sizes cannot be compared, but the typical papionin pattern of larger maxillary incisors would be expected.

Canines

Maxillary and mandibular canines are represented in the Sterkfontein *Pp. broomi* sample, and the degree of variation between the sexes can be visualized (Table 3-5). The *Pp. broomi* canines are sexually dimorphic and the height of the male maxillary canine (e.g. Sts 260) is over twice that of the female (e.g. Swp 1460). The dimorphism is less pronounced in maxillary canine length, and virtually non-existent in maxillary canine breadth.

The only specimen preserving the mandibular canines is Sts 563, the *Pp. whitei* type specimen. The Sts 563 C_1 is just over half the size of the male C^1's in this sample. Typically, the mandibular canine is smaller than its maxillary counterpart, but unfortunately, there are no associated crania and mandibles in the Sterkfontein sample. Therefore, the size of the C^1 that the individual represented by Sts 563 would have possessed is not currently known.

Table 3-5. C^1 and C_1 Dimensions (mm) for *Parapapio broomi.*

		C^1 Breadth	C^1 Length	C^1 Height	C_1 Breadth	C_1 Length	C_1 Height
Female	Swp 476	7.3					
	Swp 1460	7.6	6.8	12.6			
Male	Sts 253	7.0					
	Sts 260	8.7	11.2	27.6			
	Sts 563				5.8	7.3	14.2
	Swp 246	7.7	10.0	26.7			
	Swp 1728	8.1					
Indet.	Swp 2946	7.3					

As mentioned previously, the canines and premolars of the *Pp. broomi* sample are the only significant differences observed in the group. In the some dimensions, the

males are typically much larger, sometimes approaching two times the size of the females.

Premolars

The *Pp. broomi* posterior dentition – premolars and molars – is better represented than incisors and canines in the *Pp. broomi* sample. However, this is typical for all papionin species in the Sterkfontein deposit. The sample also contains a wide range of individuals from the various age groups from young adults to older adults, as noted by their given wear score (WS).

Table 3-6. P^3 Dimensions (mm) for *Parapapio broomi.*

		WS	P^3 Breadth	P^3 Length	P^3 Height
Female	Sts 259		7.4	5.5	
	Swp 389	8	6.5	4.6	
	Swp 476	8	7.6	5.5	
	Swp 1460		7.3	5.7	6.5
Male	Sts 253	3	8.1	5.9	
	Sts 260		7.5	6.2	
	Swp 246	8	7.2	5.0	
	Swp 1728		7.4	5.7	
	Swp 1879		7.6	6.6	
	Swp 1884	8	6.8	5.4	
Indet.	Sts 530		6.6	4.5	
	Swp 14	4	7.3	5.5	
	Swp 19	3	6.7	4.8	
	Swp 1772		8.3	5.8	8.6
	Swp 1775	4		5.4	
	Swp 2937		5.0	6.2	4.5
	Swp 2946	f	8.7	5.2	

The height of the maxillary premolars, however, is quite variable, and undoubtedly related to the degree of wear and age of the individual. The age of all individuals could not be derived, as some specimens were fragmented and a wear score

could not reliably be estimated. However, in the current sample, very little difference can be observed in the range of heights for similarly aged individuals.

Table 3-7. P^4 Dimensions (mm) for *Parapapio broomi.*

		WS	P^4 Breadth	P^4 Length	P^4 Height
Female	Sts 259		8.1	5.5	
	Swp 389	8	7.1	5.0	
	Swp 476	8	8.6	5.7	
	Swp 1460		7.8	6.6	
Male	Sts 253	5	8.6	6.4	
	Sts 260		8.4	6.2	
	Swp 246	8	8.2	6.3	
	Swp 1459	8		5.9	
	Swp 1728		8.7	6.8	
	Swp 1879	3	8.5	6.5	
	Swp 1884	8	8.3	5.8	
Indet.	Swp Un1	4	8.8	7.0	
	Sts 250	8	7.3	6.3	
	Sts 383		8.5	6.6	6.8
	Sts 385 a	5	8.0	5.4	
	Sts 544	2	7.2	5.9	6.7
	Swp 14	4	8.6	6.1	
	Swp 19	3	7.9	6.0	
	Swp 261		8.8	6.1	
	Swp 1230	7	8.2	6.2	5.8
	Swp 1772		9.8	6.6	
	Swp 1775	4	8.3	7.6	
	Swp 2882	0a	6.5	6.6	
	Swp 2937		6.1	5.2	4.4
	Swp 2946	f	9.4	5.9	

The sexual dimorphism that was observed in the canines can also be observed in some portions of the premolars. In the maxillary premolars, P^3 and P^4, there is very little dimorphism exhibited between the *Pp. broomi* sexes (Tables 3-6 and 3-7). The P^3 and P^4 of male and female *Pp. broomi* specimens are similar in breadth, length and height. There is a wide degree of overlap, and males do not appear to possess larger maxillary premolars than females. Of the maxillary premolars, the P^4 appears to be slightly larger

in all dimensions. Sts 259, a female *Pp. broomi* exhibits a P^4 that is larger in breadth than the P^3, but of similar length. This appears to be consistent within the species.

The greatest difference between the maxillary and mandibular premolars appears to be in breadth, as the flange length of the mandibular premolars does not have an equivalent in the maxillary dentition. The breadth of the maxillary premolars appears to be larger than that of the mandibular premolars. The difference between the P^4 and P_4 of the *Pp. broomi* is the most notable. In both sexes, the mandibular premolar appears to be smaller in breadth than its maxillary equivalent. The means of the two groups, maxillary versus mandibular, is misleading, as more females are represented in the maxillary sample. But individually, the dimensional difference between the maxillary and mandibular premolars appears to persist.

Within the mandibular premolars, sexually dimorphism is relatively marked. The degree of dimorphism observed in the Sterkfontein *Pp. broomi* sample is among the highest of any of the remaining papionin species. In the male, the sectorial P_3 is larger in all dimensions (Table 3-8). Males and females appear to overlap with regard to P_3 breadth, but in length, height and flange length the differences between the sexes are dramatically distinct. Sts 323, a male *Pp. broomi*, exhibits a flange length 84% larger than the available female, Sts 255. It is not clear if this dramatic difference is typical for the species, but the other dimensions support the considerable size differences between males and females.

Table 3-8. P_3 Dimensions (mm) for *Parapapio broomi.*

		WS	P_3 Breadth	P_3 Length	P_3 Height	P_3 Flange Length
Female	Sts 255		4.7	5.7	5.7	8.4
	Sts 363		5.7	5.3		
	Swp 1377	8	4.9	5.1		
	Swp 1736 a	8	6.3	5.9		
Male	Sts 323		6.6	8.1	8.1	15.5
	Sts 563		5.7	8.4	4.8	10.3
Indet.	Sts 264		6.6	5.1		
	Sts 296		5.6	7.4		12.1
	Sts 358		6.3	8.2		
	Swp 315	8	4.8	6.9		
	Swp 2915	1b	5.1	6.4	5.9	3.4

Sexual dimorphism is again reduced in the P_4 of *Pp. broomi* (Table 3-9). The *Pp. broomi* male, Sts 323, whose P_3 flange length was nearly twice the size of the female, Sts 255, exhibits breadth and height dimensions only slight larger than its sexual counterpart. Length, however, remains different between the two sexes.

Table 3-9. P_4 Dimensions (mm) for *Parapapio broomi.*

		WS	P_4 Breadth	P_4 Length	P_4 Height
Female	Sts 255	4	6.9	6.0	4.4
	Sts 363		7.2	6.8	
	Sts 562		7.6	6.8	
	Swp 1377	8	7.4	6.3	
	Swp 1736 a	8	7.3	7.9	
Male	Sts 323		7.3	7.5	4.6
	Sts 563	3	7.4	7.2	4.8
Indet.	Sts 264		6.8	5.9	
	Sts 296		7.7	6.5	3.5
	Sts 358			8.6	
	Swp 315	8	7.0	6.3	
	Swp 1797	8	7.5	7.1	
	Swp 2915	0a	6.7	7.1	5.5
	Swp 2939			7.8	

Molars

Even in this mixed sample, the degree of sexual dimorphism is not marked. The molars of both sexes exhibit a large degree of overlap. However the males are marginally larger in most cases. Tables 3-10 through 3-15 provide the molar data for the *Pp. broomi* sample.

Table 3-10. M^1 Dimensions (mm)for *Parapapio broomi.*

		WS	M^1 Mesial Breadth	M^1 Distal Breadth	M^1 Length	M^1 Height
Female	Sts 259		9.9	9.3	8.2	
	Swp 389	15	8.3	7.6	8.1	
	Swp 476	f	9.7	9.3	7.9	
	Swp 1460				9.1	
Male	Sts 253	12	9.5	9.6	8.8	
	Sts 260	16	9.7	8.9	9.1	
	Swp 246	f	10.6	8.1	9.5	
	Swp 1459	16			8.4	
	Swp 1728				8.9	
	Swp 1879	10	9.9	9.0	9.5	
	Swp 1884	16			9.0	
Indet.	Swp Un1	11	9.1	9.1	9.5	
	Sts 250	16			6.8	
	Sts 383	6	9.4	8.8	9.6	6.0
	Sts 385 a	16	9.5	8.4	9.0	5.8
	Sts 530		9.1	9.1	8.8	5.0
	Sts 544	8	8.6	7.8	8.9	5.8
	Sts 4208			8.6		
	Swp 14	16	9.8	8.8	9.4	
	Swp 19	15	9.1	8.4	8.1	
	Swp 261		10.0	9.0	9.6	
	Swp 1023				8.4	
	Swp 1230	15	9.6	9.1	7.9	
	Swp 1772	7	10.3	9.5	9.8	
	Swp 1775	16			8.5	
	Swp 2882	0a	8.4	8.3	9.0	5.3
	Swp 2951		9.9		10.6	5.4

The molars are bilophodont which is possibly a derived cercopithecoid characteristic (Strasser and Delson, 1987). More specifically, the molars of *Pp. broomi* are typically papionin in overall morphology, and are not distinguishable from other

papionins at Sterkfontein. Lingual notches are present on the maxillary molars while the mandibular molars exhibit buccal notches.

Table 3-11. M^2 Dimensions (mm) for *Parapapio broomi.*

		WS	M^2 Mesial Breadth	M^2 Distal Breadth	M^2 Length	M^2 Height
Female	Sts 259		12.6	11.3	10.2	
	Sts 388 a	7	11.4	10.4	10.8	7.2
	Swp 389		9.4	8.7	8.7	
	Swp 476	16	11.9	11.1	10.9	
	Swp 1460		10.8	10.8	11.3	
Male	Sts 253	10		10.5	11.1	
	Sts 260	16	11.8	10.7	11.5	
	Swp 1459	16			9.7	
	Swp 1728		11.1	10.5	11.4	
	Swp 1879	8	12.1	11.0	11.4	
	Swp 1884	16	10.6			
	Swp 2102				11.5	
Indet.	St 2119	16			8.1	
	Sts 250	16			8.7	
	Sts 273	16	11.2	10.3	10.9	
	Sts 383	1	10.7	9.8	10.9	7.3
	Sts 385 a	13	11.4	10.3	10.1	
	Sts 530		10.4	10.0	10.2	7.4
	Sts 544	6	10.4	9.7	10.3	6.5
	Sts 4208	5	11.1	9.7	10.7	6.4
	Swp 14	8	10.8	9.7	10.8	
	Swp 19	8	9.9	9.9	10.1	
	Swp 30	16	11.9	11.1	11.5	
	Swp 261		11.5	10.6	11.0	
	Swp 1023	12	11.4	10.4	10.6	
	Swp 1230	11	11.2	10.3	11.0	
	Swp 1772		12.8			
	Swp 1775	6	11.9	11.1	11.9	
	Swp 1874	16	12.0	12.2		
	Swp 2882	0a	9.4	8.8	9.3	7.3
	Swp 2946	16f	11.9	10.7	11.2	6.4
	Swp 2951	3b		10.9	12.8	

The greatest portion of the molar sample was sexually indeterminate, because in the absence of sexually diagnostic canines or premolars, molar size is not clearly indicative of sex. In *Pp. broomi*, the fourth premolar is more similar in size and shape to

the molar than in extant *Papio*. The same can be said for the molar- to-premolar ratio in *Pp. jonesi*. Molar-to-premolar ratios have been shown to be a useful indicator of distinguishing groups among the papionini (Fleagle and McGraw, 2002) and may be a feature of cladistic value with respect to the extinct papionins.

Table 3-12. M^3 Dimensions (mm) for *Parapapio broomi.*

		WS	M^3 Mesial Breadth	M^3 Distal Breadth	M^3 Length	M^3 Height
Female	Sts 259		12.6	11.2	12.3	
	Sts 388 a	3	11.4	8.6	10.5	7.4
	Sts 388 b		11.7	8.7	10.9	7.3
	Sts 397	10	10.3	8.3		
	Swp 389	4	9.2	7.7	9.1	5.9
Male	Sts 260	16	11.9		11.5	
	Sts 534	13	11.5	9.2	11.3	6.8
	Swp 1459	13			9.9	
	Swp 1728		10.9	9.4	11.4	6.6
	Swp 1879	7	11.8	9.8	11.2	
	Swp 1884				9.5	
	Swp 2102				10.8	
Indet.	Swp Un 1		11.4	10.8	12.0	
	St 2119		10.8			
	Sts 250	16	10.8	8.7	10.1	
	Sts 273	11	9.5	7.4	9.9	
	Sts 383	0	10.2	7.9	11.1	
	Sts 385 a	5	11.0	8.8	11.0	6.9
	Sts 432	1	10.2	9.0	11.4	7.6
	Sts 530		10.4	9.2	10.1	
	Sts 544	1	10.3	8.8	10.3	7.6
	Swp 30	16	10.9	9.5	10.7	
	Swp 87	4	10.7	9.1	10.7	
	Swp 1023	8	10.3	8.5	10.4	
	Swp 1230	3	11.4	9.6	11.4	6.2
	Swp 1775	1	11.2	9.3	10.4	6.6
	Swp 1874	16	13.7	10.2		
	Swp 2945	12d	9.8	8.8	9.8	6.4
	Swp 2946	5b	10.8	9.2	11.1	6.8

The molar pattern in *Pp. broomi* appears to show that the M^2 and M^3 are similar in size, and both are larger than the M^1 (Tables 3-10 through 3-12). As such, the maxillary pattern in *Pp. broomi* appears to show the following: $M^1 < M^2 = M^3$. This pattern holds

true for all dental dimensions in the *Pp. broomi* sample, except for the length of the M^3. The length of the M^3 is longer than either the M^1 or M^2, as its complement, M_3, possesses a hypoconulid.

The maxillary molars also exhibit mesial breadths relatively longer in respect to their distal widths which remains true for the *Pp. broomi* M1, M2 and M3. This is possibly a retention of the ancestral catarrhine pattern (Szalay and Delson, 1979).

Table 3-13. M_1 Dimensions (mm) of *Parapapio broomi.*

		WS	M_1 Mesial Breadth	M_1 Distal Breadth	M_1 Length	M_1 Height
Female	Sts 255	16	7.5	7.8	8.0	
	Sts 562	16	8.8	8.6	9.1	
	Swp 1377	16	8.0	8.3	8.9	
	Swp 1736 a	f	9.2	9.1	8.9	
Male	Sts 323		7.8	7.9	9.9	
	Sts 563	12	8.1	7.9	8.9	4.3
Indet.	Sts 264		9.0	8.0	8.1	
	Sts 2117	15			8.1	
	Swp 5	15	8.8	9.0	10.3	
	Swp 315	f	7.8	7.9	7.0	
	Swp 1797	16			8.4	
	Swp 2223			8.1		
	Swp 2919				8.9	
	Swp 2937	f			7.9	

As stated previously, males and females cannot be sexed based on maxillary molar morphology. This is valid for the mandibular dentition, as well. On average, the mandibular molars appear smaller in some dimensions than their maxillary counterparts, but this is most probably an artifact of the sex representation in each sample. Unfortunately, as stated previously, there are few associated crania and mandibles that preserve sufficient morphology for the maxillary and mandibular morphology to be compared.

In contrast to the consistent pattern observed in the maxillary dentition, the mandibular molars cannot be typified by any one mesial breadth-to-distal breadth pattern. The M_1 *Pp. broomi* sample includes some individuals that possess larger mesial breadths than distal, and others in which the opposite pattern can be observed. For example, the female, Sts 255, displays a distal breadth marginally larger than its mesial breadth. The *Pp. broomi* specimens appear to possess mesial and distal breadths very similar in size (i.e. square M_1's) which may explain the mixed pattern observed in the Sterkfontein sample (Table 3-14).

Table 3-14. M_2 Dimensions (mm) for *Parapapio broomi.*

		WS	M_2 Mesial Breadth	M_2 Distal Breadth	M_2 Length	M_2 Height
Female	Sts 363	16			9.7	
	Sts 562	12	10.4	9.7	11.1	
	Swp 1377	12	10.4	9.7	11.0	
	Swp 1736 a	15	10.3	9.8	12.1	
Male	Sts 563	6	10.4	9.8	12.2	5.7
Indet.	Sts 264		10.4		10.5	
	Sts 358				12.5	
	Sts 383 a				10.3	
	Swp 5	5	11.6	11.0	12.0	7.4
	Swp 279	f	9.5	9.8	10.1	
	Swp 315	f	9.6	9.8	9.6	
	Swp 1797		11.9			
	Swp 2223	7	10.4	9.6	11.2	
	Swp 2850				10.6	
	Swp 2887				12.6	
	Swp 2915	2b	9.6	8.9	11.4	6.0
	Swp 2919				10.9	
	Swp 2937	f			11.2	
	Swp 2939	2b	9.6	9.8	11.7	6.6

The square molar pattern applies to the M_2 and M_3 samples, as well (Tables 3-14 and 4-15). The M_3 possesses a hypoconulid typical of the other papionins at Sterkfontein. The hypoconulid dimensional differences between the Sterkfontein

papionin groups is difficult to measure, as the hypoconulid cannot be reliably measured (Freedman, 1957).

Table 3-15. M_3 Dimensions (mm) for *Parapapio broomi.*

		WS	M_3 Mesial Breadth	M_3 Distal Breadth	M_3 Hypoconulid Breadth	M_3 Length	M_3 Height
Female	Sts 363					15.4	
	Sts 562	7	10.0	9.5	6.7	14.5	6.0
	Swp 1377	4	10.3	10.0	6.7	13.4	6.3
	Swp 1736 a	10	10.4	10.1	7.2	15.4	
Male	Sts 563	0	10.5	9.5	6.0	14.7	7.4
Indet.	Sts 383 a	5	8.6	7.4	5.0	12.5	6.1
	Swp 5	1	11.4	10.1	5.4	14.7	8.0
	Swp 279	16	11.1	9.6	6.8	14.7	
	Swp 2223	1	10.2	9.4	7.2	15.4	7.4
	Swp 2850					13.4	
	Swp 2919					14.5	
	Swp 2929		9.6	8.3	6.5	14.1	
	Swp 2937	f			14.6		
	Swp 2940	16e	10.6	9.8	6.6	14.4	

Anatomical Summation

Pp. broomi can be diagnosed by several features. Firstly, the maxillary ridges of *Pp. broomi* are well-developed; typically, the most developed of any of the Sterkfontein papionins. Additionally, the maxillary fossae are moderately developed and appear to be morphologically midway between the fossae observed in *Pp. jonesi*, the least developed, and *P. izodi*, the most developed. The anteorbital region is typically *Parapapio* (i.e. straight-line nasal profile); however, the region appears to be more variable in *Pp. broomi* than in its smaller *Parapapio* counterpart, *Pp. jonesi*. *Pp. broomi* also shares with *Pp. jonesi* antero-laterally fleeting zygomatics – another feature that can be used to distinguish the two *Parapapio* species from the sole *Papio* taxon in Members 2 and 4. *Pp. broomi* may also be distinguished from *Pp. jonesi* and *P. izodi* by the degree of sexual dimorphism present

in the *Pp. broomi* sample; the largest of the Member 2 and 4 papionins. The dentition of *Pp. broomi* is non-diagnostic and typically papionin. However, the premolar-to-molar ratios of the two *Parapapio* species are more similar to each other than either is to *P. izodi* (see Chapter Six).

CHAPTER FOUR
PARAPAPIO JONESI

Parapapio jonesi (Broom 1940)

(= or including *Parapapio jonesi* Broom 1946; Kitching, Wells and Westphal, 1948; Dart, 1949; Hopwood and Hollyfield, 1954; Freedman, 1957; Eisenhart, 1974. *Cercopithecoides williamsi* Broom and Hughes, 1949)

Holotype: Sts 565, a damaged partial cranium belonging to a female with near complete dentition.

Repository of Type Specimen: Department of Palaeontology, Transvaal Museum, Pretoria, South Africa.

Type Site: Sterkfontein, Gauteng, South Africa.

Referred Material: Fifty-one specimens from Members 2 and 4. See Table 4-1 for list of specimens.

Introduction

In earlier analyses (Broom, 1940; Eisenhart, 1974; Freedman, 1957), tooth-size was considered to be a significant indicator of species affinity. The usefulness of tooth size alone in species designation is questionable; however with *Pp. jonesi* being the smallest of the papionins, its tooth-size continues to serve as a reliable means of identification. Nevertheless, the current analysis utilized non-discrete, as well as discrete, traits to distinguish *Pp. jonesi* from the other papionins.

Table 4-1. Specimens attributed to *Parapapio jonesi.*

	Sex		
	Female	Male	Indet.
Specimen Number	Sts 329	Sp 9	Sp 8b
	Sts 355	Sts 348	Sp 12
	Sts 565	Sts 367	Sts 301
	Swp 270	Sts 368 a	Sts 306
	Swp 1742	Swp 1	Sts 333
		Swp 11	Sts 340
		Swp 245/15	Sts 369 a
		Swp 1727	Sts 381a
		Swp 2947	Sts 421
			Sts 456
			Sts 3053
			Swp 3
			Swp 7
			Swp 9
			Swp 13
			Swp 17
			Swp 22
			Swp 59
			Swp 83
			Swp 273
			Swp 379
			Swp 389
			Swp 548
			Swp 1230
			Swp 1283 b
			Swp 1293
			Swp 1412
			Swp 1441
			Swp 1448
			Swp 1449
			Swp 1738
			Swp 1745
			Swp 1784
			Swp 1796
			Swp 2914
			Swp 2935
			Swp 2936
			Swp 2938

As this papionin is the smallest, it is, also the least well-preserved. Very few specimens are complete, and most of the *Pp. jonesi* sample is highly fragmentary. Undoubtedly, this is most probably related to their bone density, as density has been shown to be a probable indicator of preservation (Pickering and Carlson, 2002). The other, slightly larger papionins, *Pp. broomi* and *P. izodi,* are represented by more complete specimens. However, the Member 2 fauna have long been known for their completeness (Clarke, 1998, 1999; Pickering et al., 2004a), and two relatively complete males have been recovered from Member 2. Here I will describe male and female *Pp. jonesi* cranial morphology.

Description

Of the attributed specimens at Sterkfontein Members 2 and 4, *Parapapio jonesi* represents approximately 29.7% of the sample. Of the three papionin species, *Pp. jonesi* proved the most difficult to sex, at least in part due to the fragmentary nature of the collection. Additionally, most of the *Pp. jonesi* specimens were represented by mandibular and/or maxillary fragments. Only, three relatively complete crania – two males and one female – are now assigned to *Pp. jonesi.* The female is the well-known type specimen, Sts 565, from Member 4 while the males, Swp 1727 and Swp 2947, derive from Member 2 of the Sterkfontein deposit (Figure 4-1).

Prior to the discovery of Swp 1727 and Swp 2947, most of the male *Pp. jonesi* morphology was known from Swp 245/15, a relatively complete mandible. As a result, information about *Pp. jonesi* cranial morphology was derived from the fragmentary type specimen, Sts 565.

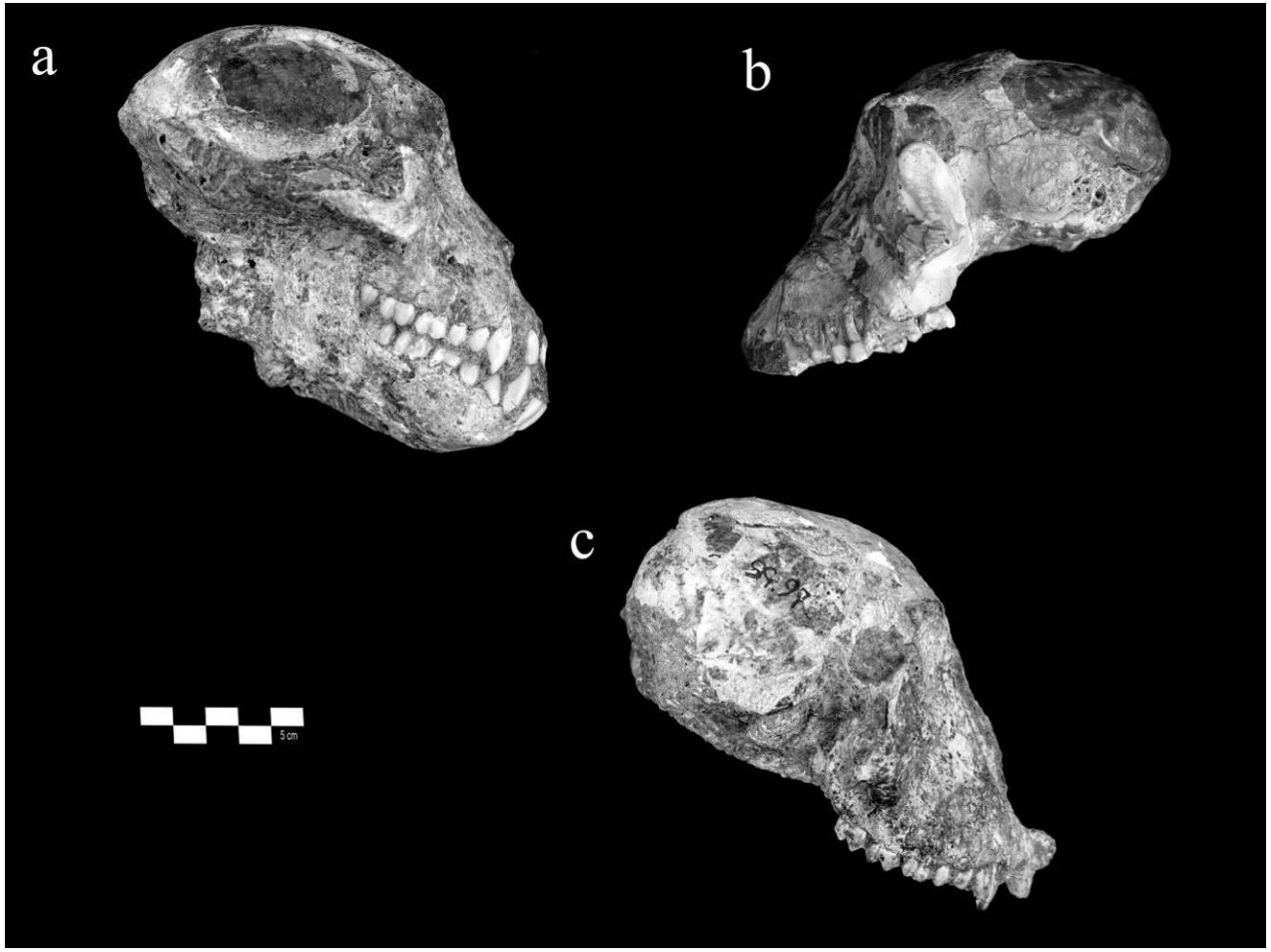


Figure 4-1. Male and Female *Parapapio jonesi* Comparisons. Shown above are *Parapapio jonesi* males (a) Swp 1727 and (c) Swp 2947 and (b) the female type specimen, Sts 565.

The female morphology was similar enough to the male to not have posed a significant problem for systematists. Now though, the differences and similarities between the *Pp. jonesi* sexes can be highlighted in both cranial and mandibular morphology. The data is still insufficient to define the degree of intra-specific variability that should be expected within a *Pp. jonesi* population. However, an adequate amount of information is now available to describe the characteristics that define *Pp. jonesi* morphology and the ways in which *Pp. jonesi* can be diagnosed from other papionins at Sterkfontein.

Cranium

Frontal

In all of the available *Pp. jonesi* cranial specimens, the frontals are damaged to varying degrees, but as a group, the specimens are complete enough to get a picture of the underlying morphology of the species. In *Pp. jonesi*, supraorbital tori are practically absent. In the female, Sts 565, the region is damaged. So, the extent of supraorbital development in the female of the species is unknown, but the tori are only faintly visible even in male specimens (e.g. Swp 2947). Rather, the supraorbital region appears relatively flat, as can be seen in both males, Swp 1727 and Swp 2947. The tori of both, males and females, are postero-laterally directed. The supraorbital tori appear to be uniform in thickness across the orbit of the male, Swp 2947. Additionally, glabella appears to be the most anteriorly projecting structure in the supraorbital region of both sexes.

Directly from the tori, the frontal begins to rise giving *Pp. jonesi* a more globular neurocranium than that of other papionin species at Sterkfontein, *Pp. broomi* or *Pp. izodi*.

Parapapio jonesi does not possess a well-developed ophryonic groove, but immediately posterior to its expected placement, a slight increase in the cranial cavity can be detected.

The degree of post-orbital constriction is difficult to gauge, as the temporal fossae of all cranial specimens are filled to varying degrees with breccia on one or both sides. For what can be visualized, *Pp. jonesi* appears to posses a moderate level of post-orbital constriction. The degree of constriction appears to be similar in the males, Swp 2947 and Swp 1727, and the female, Sts 565 and is typical for the genus, *Parapapio*.

Rostrum

Previously, male morphology was only represented by a few isolated muzzles. With the new specimens, the complete rostral region can be visualized and its relation to the neurocranium be discussed. Of the Sterkfontein papionins, the anteorbital region of *Pp. jonesi* appears to be the most morphologically consistent. This may possibly be the result of the small number of specimens preserving this region.

Both, the males and the female, exhibit high and stout muzzles. The anteorbital drop appears to be only slightly concave from glabella to rhinion. In *Pp. jonesi,* the muzzle is relatively shorter and nasal bones more sharply inclined when compared to that of the other Sterkfontein *Parapapio*, *Pp. broomi.* This can even be recognized in the isolated muzzle, Sts 367. The result is a muzzle that can be described as a straight line from glabella to alveolar point in most *P. izodi* crania. The exception is the male, Swp 1727, which exhibits a slightly elevated rhinion. A straight-line nasal profile was considered to be a distinguishing characteristic of *Parapapio*, but the region is highly variable in *Pp. broomi,* as discussed in the previous chapter. Currently, *Parapapio jonesi*

appears to be the only species for which this taxonomic character can currently be applied successfully.

In cross-section, the muzzle of the males, Swp 1727 and Swp 2947, and the female, Sts 565, reveals a muzzle shape best described as most closely resembling a parabola (Figure 4-2). The nasal bones are at the apex of the parabola. The breadth of the nasals is difficult to estimate reliably, as most specimens are damaged, but in the male, Sts 367, the nasals appear to be broad. The posterior third of the nasal aperture is surrounded by the nasal bones. In shape, the nasal aperture is ovoid. Also, the nasal aperture is wide in relation to the remainder of the muzzle. The width of the female, Sts 565, is misleading, as the nasal aperture is filled with breccia and slightly damaged giving it an overly broad appearance. In both sexes, the premaxillae appear to be wide, but again, the exact nature of their morphology is obscured by the fragmentary nature of the sample.

In contrast to other Sterkfontein papionins, *Pp. broomi* and *P. izodi,* the shape of the *Pp. jonesi* muzzle is not significantly affected by the presence of maxillary fossae. The maxillary fossae of *Pp. jonesi* can be observed in Sts 565, Swp 1727 and Swp 2947, but are present only as an extremely shallow depression. The maxillary ridges are also barely visible, but appear to travel from the root of the zygomatic to the canines. The maxillary fossae and ridges of *Pp. jonesi* are the most lightly built of the Sterkfontein papionins. Sts 367, an isolated male muzzle, exhibits slightly more well-developed maxillary fossae and ridges than the other cranial specimens. This may be a reflection of the robustness of this individual, but may hint that the feature (e.g. maxillary ridges and fossae) is more

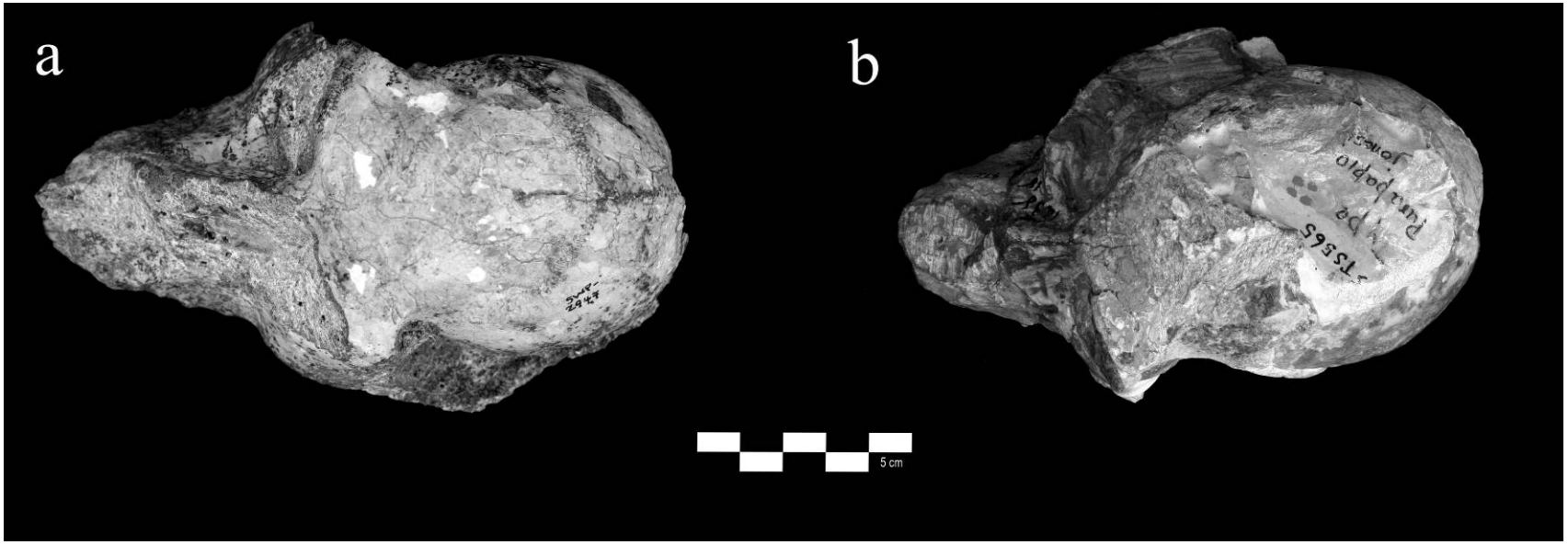


Figure 4-2. ***Parapapio jonesi*** **Rostrum Comparison.** Shown above in norma verticalis are (a) Swp 2947, a male and (b) Sts 565, a female.

variable than currently concluded. The recovery of more material should provide clues to the variability that should be expected in *Pp. jonesi.*

The available *Pp. jonesi* material does not appear to possess infra-orbital depressions. In Sts 565, the female *Pp. jonesi,* a small infraorbital depression is detected, but is in unclear, as to whether the depression is due to a 'true' infra-orbital depression, or perhaps, a reflection of the slightly anterior flexed zygomatics. The only species at Sterkfontein exhibiting well-developed infra-orbital depressions is *P. izodi*, discussed in the next chapter. As a result, the absence of infraorbital depressions is characteristic of the genus *Parapapio*, and not a feature that would be useful for identifying *Pp. jonesi.*

Palate

In both sexes, the palate of *Pp. jonesi* can be best described as horseshoe-shaped and similar to the female *Pp. broomi* morphology. The breadth of the palate is at its widest near the mesial loph of M^2. Unfortunately, the depth cannot be visualized, as the specimens either are obscured by breccia (e.g. Sts 565 and Sts 367) or have mandibles still attached to the maxillae (i.e. Swp 1727). The only specimen in which the palatal surface can be seen is Swp 2947 (Figure 4-3). Breccia covers 80% of the palate, but the visible portion of the palate appears to be shallow. Additionally, the breccia and/or adhering mandibles obscure other palatal features, such as the palatine bones and foramina, the incisive foramina and the premaxillae. Therefore, little can be said about the state of the aforementioned structures.

Mid-Face and Zygomatic Arch

The differences in males and females of *Pp. jonesi* appear to exhibit continuity. The morphology in both sexes appears to be very similar with only size related

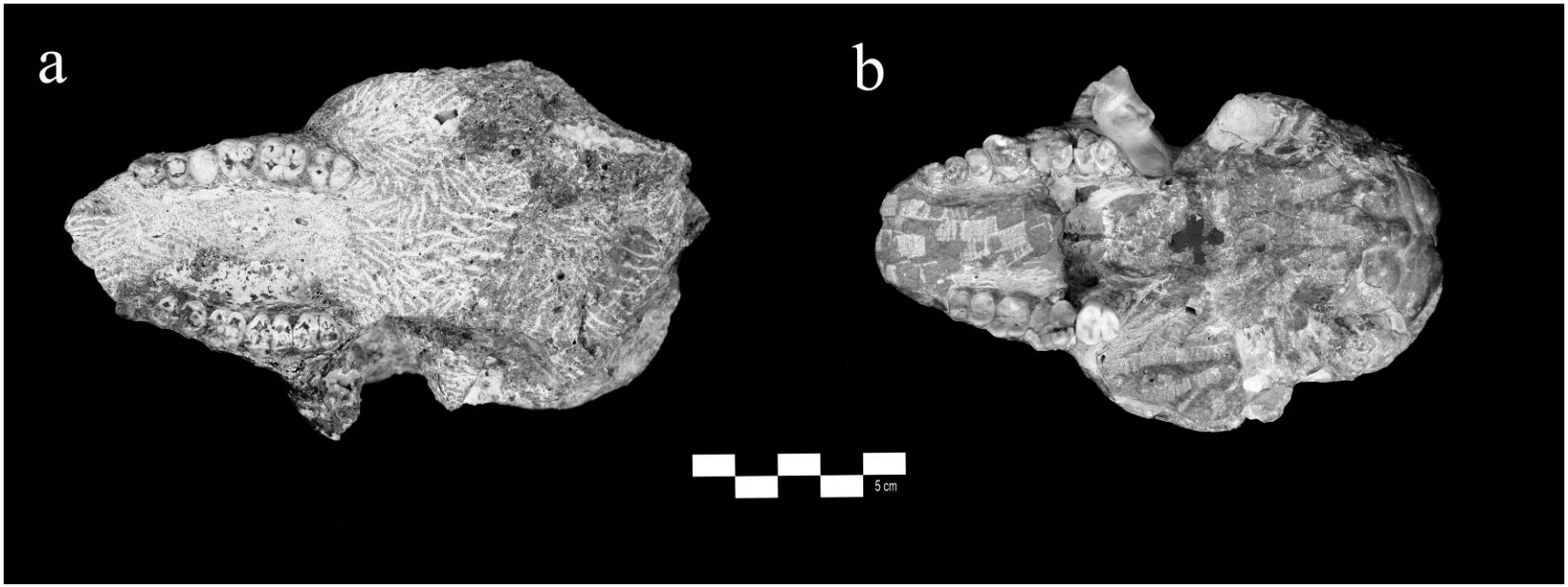


Figure 4-3. Palatal Morphology of *Parapapio jonesi*. Shown above in norma basalis are (a) Swp 2947, a male and (b) Sts 565, a female. Note, most of palatal morphology is obscured by adhering breccia.

differences. Further samples may show the species to be more variable that can currently be concluded from the available data (i.e. three complete crania). The root of the zygomatic appears to show some reliability in its placement in *Pp. jonesi.* In both sexes, the anterior root of the zygomatic arises near the level of the mesial M^2. Although, in available female, Sts 565, the placement is slightly posterior (e.g. distal M^2) to that of the two males, Swp 1727 and Swp 2947.

The zygomatics also appear to present morphology that is slightly dissimilar to that of the other papionins at Sterkfontein. In *Pp. broomi,* the zygomatics are postero-laterally oriented which is in direct contrast to that of *P. izodi.* The zygomatics of *P. izodi,* are anteriorly flexed (e.g. parallel to the coronal plane) with a well-developed and diagnostic infraorbital depressions. Yet, the morphology observed in *Pp. jonesi* appears to be an amalgamation of the features found in the *Pp. broomi* and *P. izodi.* In Swp 2947 and Sts 5656, the zygomatics are more posteriorly flexed than those previously discussed in the species, *Pp. broomi.* Additionally, *Pp. jonesi* possesses a slight infraorbital depression which is not typically observed in its sister species, *Pp. broomi.* This depression can be observed in males, Swp 2947 and Swp 1727, and the female, Sts 565. The infraorbital depression appears to be developed to a similar degree as that observed in the maxillary fossae in *Pp. jonesi.*

Orbit

As previously mentioned, the supraorbital region of *Pp. jonesi* exhibits gracile appearing tori. This is a diagnostic characteristic of the genus and cannot be used to distinguish among the *Parapapio* species. On the other hand, the orbits of *Pp. jonesi* are more circular than the other Sterkfontein papionins. In the female, Sts 565, the orbit

appears to be slightly more circular than in the males, Swp 2947 and Swp 1727. But, this is not a taxonomically diagnostic feature. The orbits are set high upon the face and are large in respect to the remainder of the splanchnocranium.

In addition, the inter-orbital distance observed in *Pp. jonesi* is typically papionin, as exhibited by a small inter-orbital distance. The inter-orbital constriction appears to be greatest at a point slightly inferior to the fronto-nasal suture – similar to that seen in *Pp. broomi*.

Calvaria and Temporal

The crania of *Pp. jonesi* are comparatively complete for the few available specimens, and a few generalizations can be drawn from the existing material. For instance, *Pp. jonesi* does not possess a well-developed or pronounced glabellar region. In Swp 1727, glabella does not protrude anteriorly past the lightly built supraorbital tori. Sts 565 appears to possess a more developed and prominent glabella than the two available males. It is not clear, at present, as to whether this is a reflection of the fragmentary nature of Sts 565, or if this is normal intra-specific variation for the species. Further specimens are needed.

The neurocranium of *Pp. jonesi* is among the most globular of the Sterkfontein papionins. For example, Sts 565 exhibits a cranium which is well-rounded from glabella to bregma. The exact nature of the parietal and occipital regions of Sts 565 is not known. The cranial vault is fractured in these regions, and only an endocast is present. Nevertheless, the males, Swp 1727 and Swp 2947, exhibit rounded crania, as well. The males appear to have relatively elongated crania with respect to Sts 565, but the roundness of Swp 2947, a male, may be a reflection of its fragmented occiput.

In lateral view, the nuchal region appears to be lightly built in *Pp. jonesi*, as typical of other Sterkfontein papionins, but only, Swp 1727 possesses an undamaged occipital region. In Swp 1727, the nuchal region is slightly more developed when compared to the existing *Pp. jonesi* specimens. Near inion, the cranium appears to project posteriorly into an external occipital protuberance. The protuberance is not visible in either Sts 565 or Swp 2947, as the specimens are incomplete in this region. Therefore, the exact nature of the nuchal region in *Pp. jonesi* will require the discovery of additional specimens.

The post-glenoid processes of the three crania are also damaged. Therefore, the assessment of the processes is not possible with the material currently available.

Mandible

Similarly to the cranial material, the mandibular sample is fragmentary and relatively few specimens could be assigned to a sex. The sample is dominated by specimens possessing elements of the posterior dentition, but not the sexually dimorphic anterior dentition (i.e. sectorial P_3). In the absence of the P_3, sexual attribution cannot assertively be accomplished, as males and female dental measurements in *Pp. jonesi* exhibit some distributional overlap.

A young adult male specimen, Swp 245/15, is perhaps the most complete *Pp. jonesi* of the Sterkfontein sample (Figure 4-4). In Swp 245/15, the left toothrow is complete, but the right is missing the M_2 and M_3. The symphysis is well-preserved and the ascending ramus is complete, but missing the coronoid and condyloid processes. The mandibular corpus of *Pp. jonesi* appears to be slender in males, Swp 245/15 and Swp 11, and females, Swp 1742 and Sts 355. The corpus also appears to be slender relative to its thickness when viewed laterally.

Figure 4-4. Mandibular Morphology of *Parapapio jonesi*. The male *Pp. jonesi* specimen, Swp 245/15, is shown in (a) norma lateralis and (b) occlusal views, and similarly, the female, Swp 1742, is illustrated in (c) norma lateralis and (d) occlusal views.

The depth of the mandibular corpus appears to increase from the symphysis to about the level of the mesial loph of M_2 in Swp 245/15. This is consistent with the morphology observed in other male *Pp. jonesi* specimens, Swp 11 and Swp 1. In contrast, the greatest corpus depth in Swp 1742, a fragmentary female mandible is near gonion. Breccia adhering to Swp 1742 may obscure some of the anatomical morphology. So, the irregularity in mandibular depth observed in Swp 1742 may rather be a reflection of its fragmentary and obscure nature. The mandibular corpus appears to be v-shaped in Sp 9, a male, and Swp 1742, a female. Swp 245/15 exhibits abnormal corporal morphology and appears to be bilaterally distorted. While the corpus approaches a v-shape, the posterior dentition are typically parallel in males, and in the females, the posterior dentition appears to be slightly horse-shoe shaped.

Furthermore, the anterior surface of the mandibular symphysis is sexually variable in *Pp. jonesi*. In the male, Swp 245/15, the symphysis slopes more dramatically than the symphysis of Swp 1742, an adult female. The mandibular symphysis appears to end inferiorly at the level of the sectorial P_3 in the males, while the female symphysis terminates slightly posterior to the mesial loph of M_1. Additionally, the male mandibular symphysis appears to be slightly more robustly built.

On the posterior surface of the symphysis, an incisal shelf can be observed. In the male, Swp 245/15, the shelf appears to end near the distal surface of the P_3. Although the female specimens possess a slightly more sloping symphysis, Swp 1742 appears to possess a shelf that is similar in nature to that of the male. On the other hand, a female, Swp 270, has a more slightly terminating incisal shelf. The shelf in Swp 270 ends nearer to the distal half of the P_4.

Swp 245/15, a male, does not appear to possess a mandibular fossa. As the most complete specimen, its morphology is considered to be typical for the species and is consistent with the other available specimens. For example, Swp 1742, a fragmentary female, does not possess a mandibular fossa and neither does Swp 11, a male *Pp. jonesi.* The absence of mandibular fossae is typical of the genus, *Parapapio* and can be used to distinguish *Parapapio* from *Papio* material. Mental foramina are present on a few specimens and appear to be sexually variable. The male, Sts 348, displays two foramina on its lateral surface while the female, Sts 355, possess a single foramen.

Several specimens display well-preserved mandibular rami consistent with *Pp. jonesi* cranial morphology. *Parapapio jonesi* crania display short stout muzzles and equally possess, mandibular rami that are short and broad. This is most perceptible in specimens, such as Swp 1 and Swp 245/15, in which the breadth of the ramus is over 50% larger than the corpus. The condyle is only preserved in a single specimen, Swp 1. In this specimen, the condyle appears to be superior to the coronoid process. However, the coronoid of Swp 1 is damaged and possibly not representative of typical *Pp. jonesi* morphology.

Dentition

Morphologically, the dentition of *Pp. jonesi* is very similar to that of the other Sterkfontein papionins. However, as the result of the recovery of additional material, *Parapapio jonesi*'s dentition, particularly male dentition, is now better known than in previous analyses (Eisenhart 1974; Freedman 1957).

Table 4-2. Descriptive Statistics for the *Parapapio jonesi* Dentition. Note, measurements given in millimeters (mm).

	N	Minimum	Maximum	Mean	Std. Deviation	CV
I^1 Breadth	1	6.2	6.2	6.2		
I^1 Length	3	7.0	7.3	7.1	0.1	0.02
I1 Height	3	9.9	13.1	12.0	1.8	0.15
I^2 Breadth	1	5.3	5.3	5.3		
I^2 Length	2	4.8	5.3	5.0	0.3	0.07
I^2 Height	2	9.4	10.8	10.1	1.0	0.10
I_1 Breadth	4	5.1	6.3	5.9	0.5	0.09
I_1 Length	6	4.5	5.9	5.3	0.5	0.10
I_1 Height	5	3.8	13.4	9.2	3.9	0.43
I_2 Breadth	4	4.5	6.2	5.5	0.7	0.13
I_2 Length	6	3.6	4.7	4.3	0.4	0.10
I_2 Height	4	5.1	10.3	8.9	2.5	0.28
C^1 Breadth	4	5.0	5.8	5.5	0.4	0.07
C^1 Length	4	5.5	7.2	6.6	0.8	0.12
C^1 Height	3	11.5	14.3	12.6	1.5	0.12
C_1 Breadth	5	3.7	8.9	6.1	1.9	0.30
C_1 Length	7	3.7	8.8	5.9	1.6	0.27
C_1 Height	6	9.8	21.6	12.7	4.5	0.35
P^3 Breadth	7	6.5	7.8	6.9	0.4	0.06
P^3 Length	8	4.4	6.1	5.1	0.5	0.11
P^3 Height	2	4.6	6.8	5.7	1.6	0.27
P^4 Breadth	8	7.1	9.7	7.9	0.9	0.11
P^4 Length	9	5.0	6.4	5.8	0.5	0.09
P^4 Height	4	5.7	7.2	6.1	0.7	0.12
P_3 Breadth	14	4.6	7.1	5.8	0.9	0.16
P_3 Length	14	4.8	9.6	7.1	1.3	0.18
P_3 Height	7	6.3	9.0	7.5	1.1	0.14
P_3 Flange Length	8	2.7	16.6	8.9	5.1	0.57
P_4 Breadth	17	5.5	7.2	6.2	0.5	0.08
P_4 Length	19	6.0	7.4	6.6	0.4	0.07
P_4 Height	10	3.8	5.9	5.0	0.7	0.13
M^1 Mesial Breadth	8	8.3	9.6	8.8	0.5	0.06

	N	Minimum	Maximum	Mean	Std. Deviation	CV
M^1 Distal Breadth	6	7.4	9.1	8.0	0.6	0.08
M^1 Length	7	7.9	9.4	8.5	0.5	0.06
M^1 Height	1	4.9	4.9	4.9		
M^2 Mesial Breadth	6	9.1	11.2	9.9	0.8	0.08
M^2 Distal Breadth	5	8.5	10.3	9.3	0.7	0.08
M^2 Length	7	8.7	11.0	9.9	0.7	0.07
M^2 Height	1	6.2	6.2	6.2		
M^3 Mesial Breadth	7	8.9	11.4	9.7	0.9	0.10
M^3 Distal Breadth	7	7.5	9.6	8.2	0.8	0.09
M^3 Length	7	8.9	11.4	9.7	0.9	0.09
M^3 Height	6	5.9	6.7	6.4	0.3	0.05
M_1 Mesial Breadth	22	6.3	8.3	7.1	0.6	0.08
M_1 Distal Breadth	23	6.0	8.4	7.2	0.6	0.09
M_1 Length	29	6.0	10.5	8.5	1.0	0.11
M_1 Height	11	3.7	5.6	4.8	0.6	0.13
M_2 Mesial Breadth	27	7.3	9.9	8.8	0.6	0.07
M_2 Distal Breadth	30	7.0	10.0	8.4	0.7	0.08
M_2 Length	31	8.8	11.9	10.3	0.7	0.07
M_2 Height	16	4.9	6.6	5.9	0.5	0.08
M_3 Mesial Breadth	27	8.1	10.9	9.3	0.7	0.08
M_3 Distal Breadth	27	6.3	9.6	8.2	0.7	0.09
M_3 Hypoconulid Breadth	27	4.0	13.6	5.8	2.2	0.39
M_3 Length	27	6.0	14.1	12.7	1.5	0.12
M_3 Height	14	2.8	7.5	6.2	1.2	0.19

The male dentition can now be observed in two complete crania where previously it was only represented by a few fragmentary mandibular fragments. Table 4-2 shows the descriptive statistics for the Sterkfontein *Pp. jonesi* sample. In terms of dentition, the Sterkfontein *Pp. jonesi* sample is comparable in size to that of Swartkrans and Kromdraai.

Incisors

The *Pp. jonesi* upper incisor sample is only represented by a few male specimens (Table 4-3). The adult female type, Sts 565, possesses a damaged anterior dentition, and no further maxillae possessing this region have been confidently assigned to the female sample. In the males, the incisors are broad and high. The I^1 is slightly wider than the I^2, but is noticeably greater in length and height. But, the measurements of the two complete male crania assigned to *Pp. jonesi* should be considered merely estimates, as breccia still adhered to some surfaces of the specimens' dentition.

Table 4-3. I^1 and I^2 Dimensions (mm) for *Parapapio jonesi*.

		I^1 Breadth	I^1 Length	I^1 Height	I^2 Breadth	I^2 Length	I^2 Height
Male	Sts 368 a	6.2	7.3	13.1	5.3	4.8	10.8
	Swp 1727		7.0	13.1		5.3	9.4
	Swp 2947		7.1	9.9			

In Sts 355 and Swp 245/15, the lingual surface of the lower incisors does not contain any enamel – a feature observed in extant *Papio*, as well. The lower incisors of both sexes are much better represented than the upper incisor sample (Table 4-4). Sts 355 is the best preserved female mandible of *Pp. jonesi*, and the only specimen, displaying an undamaged incisor row.

The incisors of both, Swp 245/15 and Sts 355, reflect the pattern observed in the upper male sample. The incisors are high and broad, but in contrast to the upper incisors, the degree of difference between the I_1 and I_2 is much less marked in both sexes. The two lower incisors, I_1 and I_2, are appreciably closer in size in all measured dimensions than their maxillary counterparts. However, Sts 355, an adult female,

exhibits an I_1 and I_2 that is slightly larger in breadth than the male, Swp 245/15. Nevertheless, Swp 245/15 is larger in all other dental dimensions.

Table 4-4. I_1 and I_2 Dimensions (mm) for *Parapapio jonesi.*

		I_1 Breadth	I_1 Length	I_1 Height	I_2 Breadth	I_2 Length	I_2 Height
Female	Sts 355	5.9	4.5	6.6	5.8	4.0	5.1
Male	Swp 245/15	5.1	5.0	11.6	4.5	4.6	9.9
	Swp 1727		5.3	10.6		4.7	10.2
Indet.	Sts 340	6.2	5.9	13.4	6.2	3.6	10.3
	Swp 7	6.3	5.1		5.6	4.4	
	Swp 1784		5.8	13.8		4.7	

Canines

The upper canines of the male were previously unknown, but with the recovery of Swp 1727 and Swp 2947, the male morphology can now be described (Table 4-5). When compared to extant male *Papio* specimens, the canines of male *Pp. jonesi* are small. In reality, the height of the male canines, Swp 1727 and Swp 2947, approach the size of canine height observed in extant female baboons. At Sterkfontein, *Pp. jonesi* canines are moderate in size with respect to canines of the other papionin species, *Pp. broomi* and *P. izodi*.

Table 4-5. C^1 and C_1 Dimensions (mm) for *Parapapio jonesi.*

		C^1 Breadth	C^1 Length	C^1 Height	C_1 Breadth	C_1 Length	C_1 Height
Female	Sts 355				3.7	6.5	9.8
	Sts 565	5.4	5.5				
	Swp 1742				5.9	4.5	10.4
Male	Sts 348				5.7	8.8	12.7
	Sts 368 a	5.8	7.1	14.3			
	Swp 245/15				8.9	6.2	21.6
	Swp 1727		7.2	12.1		5.9	10.6
	Swp 2947	5.7	6.7	11.5			
Indet.	Sts 301	5.0					
	Swp 7				6.4	3.7	
	Swp 2935					5.8	11.3

The distinguishing characteristic of *Pp. jonesi* is the greater length-to-height ratio, as compared to *Pp. broomi* males. The C^1's in *Pp. jonesi* appear to be short and stout, not elongated, as in *Pp. broomi* males. Unfortunately, the upper canine height in females cannot be compared to the males, as Sts 565, the female type, is heavily fragmented.

However, the canine sample for *Pp. jonesi* appears to be highly dimorphic according to the differences in the lower canine dimensions. The greatest difference between the two sexes can be observed in the height of the canine. Males exhibit a moderate degree of variability in C_1 height. Specimens, such Swp 1727, exhibit C_1 heights approximately 50% larger than that of the largest female while Swp 245/15 is over twice the size of the largest female. However, the range of variation is perhaps not representative, as both sexes are described by only a few fragmentary specimens.

Premolars

Compared to *Pp. broomi*, the sexual dimorphism of the *Pp. jonesi* sample is not marked in the premolar dentition (Tables 4-6 through 4-9). For all premolars, except the sectorial P_3, the sexes show a wide degree of overlap. In most cases, isolated premolars and molars cannot be identified to the sex, due to the dimensional similarities between males and females.

In most dimensions, the male P_3 sample is larger than the female (Table 4-8). Yet, the flange length of the P_3 is the only significantly larger dimension in the male specimens when compared to the female sample. The cutting edge of the P_3 (i.e. the flange length) is again over 50-100% larger than that of the available female specimens. So, sexual dimorphism is present in *Pp. jonesi,* but only in the canines and sectorial premolars.

Table 4-6. P^3 Dimensions (mm) for *Parapapio jonesi.*

		WS	P^3 Breadth	P^3 Length	P^3 Height
Female	Sts 565	8	6.7	4.4	
Male	Sts 368 a		6.9	5.6	6.8
	Swp 1727			5.0	
	Swp 2947	8e	6.8	5.2	4.6
Indet.	Sts 1	0	7.8	6.1	
	Sts 456		6.9	5.3	
	Swp 59	1	6.7	4.9	
	Swp 389	8	6.5	4.6	

The premolars of the *Parapapio* species at Sterkfontein more closely approximate the size of their molars. This observation gives the impression that the size of the posterior dentition gradually increases from P3-M2, then decreases in size again from M2-M3. However, in *P. izodi*, the molars are appreciably larger than the premolars and specimens are easily differentiated between genera (see Chapter Six).

Table 4-7. P^4 Dimensions (mm) for *Parapapio jonesi.*

		WS	P^4 Breadth	P^4 Length	P^4 Height
Female	Sts 565	8	7.4	5.5	
Male	Sts 368 a		8.1	5.7	7.2
	Swp 1727			5.3	
	Swp 2947	8e	7.3	6.3	5.7
Indet.	Sts 301	0	9.7	6.4	
	Sts 456	5	7.2	5.4	5.8
	Swp 59	2	8.1	6.1	
	Swp 389	8	7.1	5.0	
	Swp 1230	7	8.2	6.2	5.8

Table 4-8. P_3 Dimensions (mm) for *Parapapio jonesi.*

		WS	P_3 Breadth	P_3 Length	P_3 Height	P_3 Flange Length
Female	Sts 329		4.6	6.3		8.4
	Sts 355		4.8	4.8		7.8
	Swp 1742		6.2	5.8		
Male	Sp 9		6.5	7.7	7.5	16.6
	Sts 348		4.9	7.5	6.7	2.7
	Swp 1		7.1	6.0		
	Swp 245/15		5.0	7.6	6.6	15.8
	Swp 2947		7.1	6.6	6.3	
Indet.	Sts 0306	0	6.8	7.1		
	Sts 3053		4.7	9.6		10.3
	Swp 3		5.7	6.9	7.7	4.8
	Swp 1441	6	5.3	6.4		
	Swp 2936	0a	5.9	9.0	8.7	5.1
	Swp 2938		6.4	8.2	9.0	

Table 4-9. P_4 Dimensions (mm) for *Parapapio jonesi.*

		WS	P_4 Breadth	P_4 Length	P_4 Height
Female	Sts 329	2	5.8	6.7	4.9
	Sts 355	7	6.1	6.0	
	Swp 270	8	6.1	6.0	
	Swp 1742	7	6.8	6.5	
Male	Sp 9	2	6.4	6.9	5.2
	Swp 1	2	6.9	6.8	4.6
	Swp 245/15	1	5.5	6.6	5.6
	Swp 1727	8f		6.5	
Indet.	Sp 8b	15	5.7	6.8	
	Sp 12	2	7.2		
	Sts 381a		6.2	6.9	5.9
	Sts 3053	8		7.4	
	Swp 3	1	5.5	6.9	5.6
	Swp 9	4	6.0	6.0	3.8
	Swp 13			6.9	
	Swp 273	4	5.7	6.8	
	Swp 1412		6.0	6.1	4.6
	Swp 1441	8	6.4	6.2	
	Swp 2936	0a	6.4	7.3	5.7
	Swp 2938		6.5	6.1	4.5

Molars

As mentioned previously, the maxillary toothrows of *Pp. jonesi* appear outwardly convex (e.g. horse-shoe shaped). In relation to the size of the cranium, the maxillary molars of the complete *Pp. jonesi* crania (i.e. Swp 1727, Swp 2947 and Sts 565) appear small. The molars are not distinct and can only be described as exhibiting the generalized papionin pattern (see Delson, 1973). In the absence of canines and premolars, *Pp. jonesi* specimens are difficult to attribute to a sex category. This statement holds true for all Sterkfontein papionins, but sometimes, even in the presence of dimorphic teeth, sexing is impossible due to the wide overlap in dental dimensions in the *Pp. jonesi* sample (see Tables 4-10 through 4-15).

Table 4-10. M^1 Dimensions (mm) for *Parapapio jonesi.*

		WS	M^1 Breadth	M^1 Distal Breadth	M^1 Length	M^1 Height
Female	Sts 565	16	8.6	7.7	8.6	
Male	Sts 367				8.7	
	Sts 368 a		9.6			
	Swp 2947	14d	8.4	7.9	8.1	4.9
Indet.	Sts 333	3	8.6	7.4	9.4	
	Sts 456		8.5			
	Swp 59	9	8.9	8.5	8.7	
	Swp 389	15	8.3	7.6	8.1	
	Swp 1230	15	9.6	9.1	7.9	

As in *Pp. broomi*, the mesial breadth of all of the maxillary molars is larger than the distal breadth. This is a characteristic trait of cercopithecids common among the papionini (Szalay and Delson, 1979).

Table 4-11. M^2 Dimensions (mm) for *Parapapio jonesi.*

		WS	M^2 Mesial Breadth	M^2 Distal Breadth	M^2 Length	M^2 Height
Female	Sts 565	16	10.1	9.7	9.6	
Male	Sts 367	16			10.2	
	Swp 2947	10c	9.1	8.5	9.7	6.2
Indet.	Sts 333				10.3	
	Swp 59	7	10.3	9.5	9.7	
	Swp 389		9.4	8.7	8.7	
	Swp 1230	11	11.2	10.3	11.0	
	Swp 2914		9.1			

Table 4-12. M^3 Dimensions (mm) for *Parapapio jonesi.*

		WS	M^3 Mesial Breadth	M^3 Distal Breadth	M^3 Length	M^3 Height
Female	Sts 565	8	9.1	7.5	8.9	
Male	Sts 367		10.6	8.2	9.4	6.7
	Swp 2947	8e	9.1	7.5	9.4	6.4
Indet.	Swp 59	1	9.6	8.5	9.6	6.5
	Swp 389	8	9.2	7.7	9.1	5.9
	Swp 1230		11.4	9.6	11.4	6.2
	Swp 2914		8.9	8.7	10.4	6.6

The mandibular molars of Swp 245/15, a young adult male, exhibit high and widely separated cusps. Each loph is characterized by wide and well-developed enamel pillars, but the enamel pillars are not as developed as those observed in *Theropithecus*. Between each loph, a relatively broad buccal cleft can be observed. These buccal clefts are reminiscent of those found in the much larger papionin species, *Papio (Dinopithecus) ingens*, found at Swartkrans. *Pp. jonesi* also displays little buccal flare from the cervix to the apex of the molar teeth. The teeth are only slightly convex on their buccal surface.

Table 4-13. M_1 Dimensions (mm) for *Parapapio jonesi.*

		WS	M_1 Mesial Breadth	M_1 Distal Breadth	M_1 Length	M_1 Height
Female	Sts 329	15	6.9	7.1	8.5	4.1
	Sts 355	16	6.9	6.9	8.0	
	Swp 270	16	6.4	6.4	7.6	
	Swp 1742	16		8.4	7.8	
Male	Sp 9	15			8.8	
	Swp 1	16	7.8	7.9	9.0	4.4
	Swp 245/15	8	7.8	7.5	9.1	
	Swp 1727	16f			8.9	
Indet.	Sp 8b	8	6.5	7.0	8.1	
	Sp 12	15	8.3	8.4	10.2	
	Sts 306	5	6.8	6.8	9.2	5.6
	Sts 340		6.4	6.3	7.5	3.7
	Sts 381a	13	6.7	6.9	9.1	4.9
	Sts 3053	16			6.0	
	Swp 3	7			9.4	
	Swp 9	11	7.1		7.4	
	Swp 13	14	7.8	7.4	8.6	
	Swp 22	16		6.8	7.5	
	Swp 83	13	7.4	7.2	9.0	
	Swp 273	16			7.7	
	Swp 379	13	7.6	7.4	9.3	5.3
	Swp 548	16	6.7	6.8	7.7	
	Swp 1283 b		6.3	6.0	8.5	4.6
	Swp 1412	7	6.5	6.4	8.4	
	Swp 1441	16	7.2	7.7	8.1	
	Swp 1738		7.0	7.0	9.0	4.7
	Swp 1784		7.8	7.8	10.5	5.4
	Swp 2936	12d	7.4	7.5	9.7	5.6
	Swp 2938		7.8	7.8	7.7	4.5

Overall, the variation observed in the molar dentition is low. However, the breadth of the hypoconulid exhibits a high degree of variability (CV = 0.39). The variable pattern can be observed in viewing the differences in the male specimens, Swp 11 and Swp 245/15. In Swp 11, the hypoconulid is broad relative to the distal loph of the M_3. In contrast, Swp 245/15 exhibits a small hypoconulid. This pattern is observed in the female sample, as well (e.g. Swp 1742 and Sts 329).

Table 4-14. M_2 Dimensions (mm) for *Parapapio jonesi.*

		WS	M_2 Mesial Breadth	M_2 Distal Breadth	M_2 Length	M_2 Height
Female	Sts 329	6	8.4	8.0	11.1	6.2
	Sts 355	15	8.7	8.7	10.3	
	Swp 270	16	8.2	8.0	8.8	
	Swp 1742	10	9.7	9.3	10.4	
Male	Sp 9	8	9.5	9.1	10.5	6.3
	Swp 1	19	9.1	8.3	10.2	5.8
	Swp 11	9	8.8	8.3	10.0	
	Swp 245/15	3	8.7	8.5	10.7	5.6
	Swp 1727				9.9	
Indet.	Sp 8 b	2	8.3	7.5	10.0	
	Sp 12	8	9.9	10.0	11.8	
	Sts 306	0		7.4	9.4	
	Sts 340		7.3	7.0	9.9	5.3
	Sts 381 a		9.1	8.4	11.0	6.0
	Sts 421		8.6	8.0	10.4	4.9
	Sts 3053	16	9.1	9.2	9.4	
	Swp 3		8.6	8.1	10.9	5.6
	Swp 9	11	8.8	7.8	10.3	
	Swp 13		9.4	8.7	10.4	
	Swp 17			8.5		
	Swp 22	16	8.5	8.3	9.7	
	Swp 83	5	8.9	9.0	10.6	5.9
	Swp 273	15	8.5	8.6	10.3	
	Swp 379	5	9.1	8.4	10.7	6.6
	Swp 548	14	8.5	7.9	9.5	
	Swp 1412	2	8.0	7.8	10.1	6.3
	Swp 1441	15			10.3	
	Swp 1448			9.2		
	Swp 1449				9.4	
	Swp 1784		9.3	9.3	11.9	6.3
	Swp 1796		8.3	8.2	11.4	5.4
	Swp 2935	3b	8.0	7.7	9.5	5.2
	Swp 2936	4b	8.8	8.1	11.2	6.2
	Swp 2938		9.7	8.7	10.7	6.2

Table 4-15. M_3 Dimensions (mm) for *Parapapio jonesi.*

		WS	M_3 Mesial Breadth	M_3 Distal Breadth	M_3 Hypoconulid Breadth	M_3 Length	M_3 Height
Female	Sts 329	2	8.3	7.4	4.5	13.3	6.6
	Swp 270	12	9.1	8.0	4.6	11.4	
	Swp 1742	4	9.8	9.1	5.9	13.3	5.5
Male	Sp 9	3	9.4	8.2	5.6	14.0	6.8
	Swp 1	4	9.6	8.4	5.1	13.0	
	Swp 11	4		8.9	8.2	4.7	12.6
	Swp 245/15	0	8.5	8.2	4.0	13.0	6.7
Indet.	Sp 8 b	1	8.5	7.9	5.7	13.0	
	Sp 12	2	9.7	6.3	13.6		
	Sts 369 a		10.0	8.9	5.9	14.0	5.0
	Sts 421			8.2	4.4	12.6	6.3
	Sts 3053	16	10.7	7.9	4.9	12.0	
	Swp 3		8.5	7.3	4.4	12.9	6.9
	Swp 9	1	8.8	7.4	4.8	11.0	6.3
	Swp 13	5	10.9	9.6	7.8	14.1	7.5
	Swp 17	2	9.6	8.3	6.6	13.0	
	Swp 22	4	8.8	8.0	5.0	12.4	
	Swp 83	1	8.9	8.4	6.1	13.3	
	Swp 273	9	9.1	8.1	4.6	13.2	6.3
	Swp 379	2	9.1	8.1	4.7	13.3	7.4
	Swp 548	13	9.4	8.3	5.1	12.7	
	Swp 1293	4	9.9	9.6	5.8	14.1	
	Swp 1441	12	9.1	8.7	4.8	13.0	
	Swp 1448	2	9.2	8.6	5.4	13.5	6.8
	Swp 1449					12.5	
	Swp 1745	11	8.1	7.6	4.0	13.0	
	Swp 1796		8.3				
	Swp 2935		9.7	8.5	12.3	6.0	2.8
	Swp 2936	1b	8.8	7.9	4.8	13.5	6.4
	Swp 2938		10.0	9.1	5.3	12.3	

Anatomical Summation

Pp. jonesi, the smallest of the Sterkfontein papionins, can be diagnosed using a few key features. Typically, the anteorbital region of the *Pp. jonesi* sample presents a more straight-line nasal profile from glabella to nasion than either of the remaining papionin taxa. Just as with *Pp. broomi*, *Pp. jonesi* exhibits no development of supraorbital tori and an ophryonic groove is not present in either species. The *Pp. jonesi* muzzle morphology is

diagnostic among the Sterkfontein papionins. *Pp. jonesi* typically displays lightly-developed maxillary ridges paired with lightly-developed maxillary fossae. The *Pp. jonesi* palate is the least prognathic of the papionins resulting in similar palatal morphology in both males and females. Both sexes typically display horse-shoe shaped palatal outlines when the palate is viewed from norma basalis. The zygomatics of *Pp. jonesi* are typically *Parapapio* and are antero-laterally fleeting. The *Pp. jonesi* dentition is papionin in morphology and displays premolar-to-molar ratios similar to *Pp. broomi*.

CHAPTER FIVE
PAPIO IZODI

Papio izodi (Gear 1926)

(= or including *Papio izodi* Gear 1926; Jones, 1937; Freedman, 1957. *Papio africanus* Broom, 1934, in part. *Papio sp.* Eisenhart, 1974. *Papio wellsi*, Freedman 1961. *Parapapio broomi* (small) Eisenhart 1974. *Parapapio izodi* Broom 1940, 1948; Dart, 1949; Hopwood and Hollyfield, 1954. *Parapapio whitei* Freedman, 1965.)

Holotype: TP 7, formerly known as AD 992 (lectotype), a severely damaged female cranium, selected by Jones (1937) to represent species. Maxillary dentition is fragmentary.

Repository of Type Specimen: Department of Anatomical Sciences, University of the Witwatersrand, Johannesburg, South Africa.

Type Site: Taung, North West Province, South Africa.

Referred Material: Fifty-four specimens from Members 2 and 4. See Table 5-1 for list of specimens.

Introduction

Previous analyses of the *Papio* specimens from Sterkfontein depended heavily upon the Sts material for descriptions, as very little of the Swp material had been recovered at the time (Eisenhart, 1974; Freedman, 1957, 1970; Freedman and Stenhouse,

1972). In the influential analysis of the Sterkfontein papionins, Eisenhart (1974) correctly identified a specimen, Sts 262 (Figure 5-1), as a member of the genus *Papio*, but was unable to attribute the specimen further to a species. In a later analysis, McKee (1993) identified the specimen as belonging to the fossil papionin species, *Papio izodi*. Until this analysis, Sts 262 was the only specimen in Member 4 of Sterkfontein referred to *P. izodi*. This analysis corroborates McKee's observation and identifies additional specimens of *P. izodi* from Sterkfontein. In this analysis, *P. izodi* is the second-most commonly occurring papionin taxon at Sterkfontein. The recent recovery of comparatively complete crania from the Member 2 excavations has significantly contributed to these identifications. As a result, descriptions of male and female *Papio izodi* morphology, as it is known from Sterkfontein, are now possible.

Papio izodi is represented by 54 specimens from both Members 2 and 4. This material includes specimens (e.g. Swp 31) previously attributed to *P. h. robinsoni*. The significance of these 'misidentified' specimens in sorting out the taxonomy of the Sterkfontein papionins is profound. Most specimens exhibiting large molars were routinely categorized as members of *P. h. robinsoni*, with little other anatomical support for that designation.

A specimen now attributed to *P. izodi*, Swp 31, was used by Berger et al (2002) to argue for a young date of Sterkfontein Member 4 based upon their identification of this specimen as belonging to the large *Papio* species, *P. h. robinsoni*. Closer analysis during the course of this study revealed that much of the morphology of this specimen is clearly *P.*

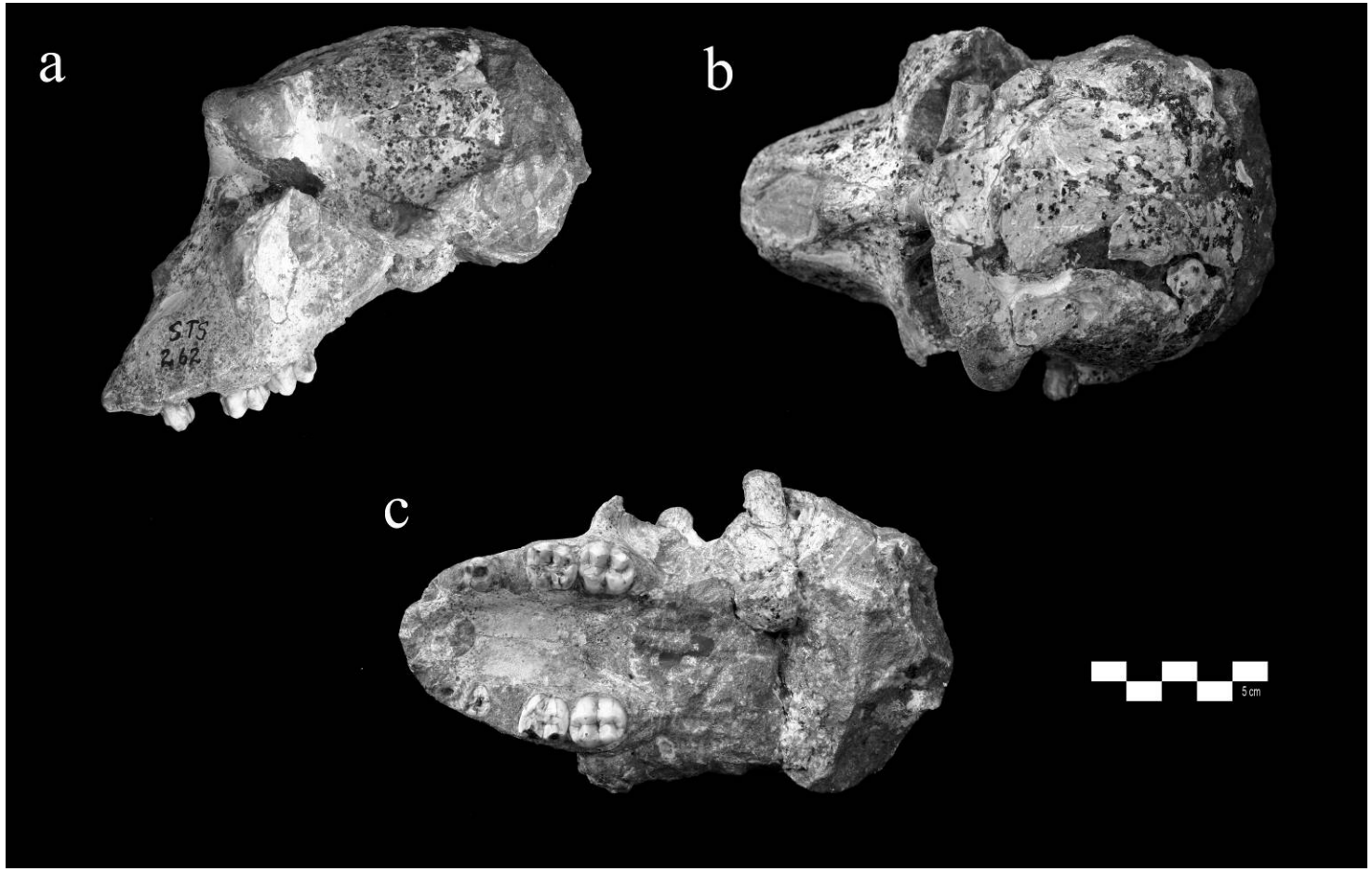


Figure 5-1. Sts 262 – a juvenile *Papio izodi*. Sts 262 was the first, and only, specimen identified of *P. izodi* until this analysis. Its fragmentary and juvenile morphology complicates its diagnosis, but more recent discoveries, have provided relatively complete adult forms for comparison.

izodi. Much of the confusion in assigning this specimen to a species derived from incorrect conclusions regarding the size of this specimen.

Table 5-1. Specimens Assigned to *Papio izodi.*

	Sex		
	Female	Male	Indet.
Specimen Number	Sts 254 a	Sp 10	Sp 22
	Sts 254 b	Sts 263	Sp 24
	Sts 262	Sts 370 a	Sts 251
	Sts 274	Sts 370 b	Sts 266
	Sts 352	Sts 414 a	Sts 267
	Swp 4	Sts 414 b	Sts 268
	Swp 10	Swp 2	Sts 277
	Swp 27	Swp 12	Sts 280
	Swp 2946	Swp 29	Sts 303
	Swp 2948	Swp 29a	Sts 322
		Swp 31	Sts 325
		Swp 58	Sts 330
		Swp Un2	Sts 335
			Sts 374a
			Sts 396 a
			Sts 398 a
			Sts 410 a
			Sts 410 b
			Sts 411 b
			Sts 411a
			Sts 416 a
			Sts 542
			Sts 548
			Sts 2122a
			Swp 21
			Swp 282
			Swp 365a
			Swp 376
			Swp 422
			Swp 472
			Swp 1017
			Swp 1733
			Swp 1774
			Swp 1882
			Swp 2848
			Swp 2907
			Swp 2943
			Swp 2953

The fragmentary palate, Swp 31, (Figure 5-2) does appear broad for its size. However, its morphology is not biological in nature. Upon closer analysis, an 8mm strip of breccia separating the palate into left and right halves can be observed (Figure 5-3b). When the breccia is accounted for, the specimen is clearly identifiable as *P. izodi*, not only in tooth size, but in multiple other features associated with the rostrum (Figure 5-3c). As a result, a critical eye was cast upon specimens attributed to large *Papio* species and the enigmatic *Pp. broomi* (small) species of Eisenhart (1974). Most of the specimens attributed to these two groups, *Papio* and *Pp. broomi* (small), now appear to belong to one species, *P. izodi*. A small number of problematic large-bodied specimens still exist in the Sterkfontein collection, but these are only found in the pre-1966 (Sts) collection. An artificial collection bias has been suggested to account for the pre-1966 bias by Heaton and Pickering (2005). A topic dealt with in greater detail in Chapter Seven of this thesis. The remainder of this discussion focuses upon features that aid in diagnosing *P. izodi* from similarly sized Papionins at Sterkfontein.

Description

The first *P. izodi* to be identified at Sterkfontein (McKee, 1993) was referred to *Parapapio broomi* by Freedman (1957), but Sts 262 displays diagnostic *Papio* features in the anteorbital region of the cranium (i.e. the fronto-nasal region). Just as with Sts 251, a sub-adult *P. izodi*, many features are not developed to the degree in which they are observed in the mature adult form. However, a few adult specimens belonging to *P. izodi* have been recovered from Member 2. In dental and cranial dimensions, *Papio izodi*

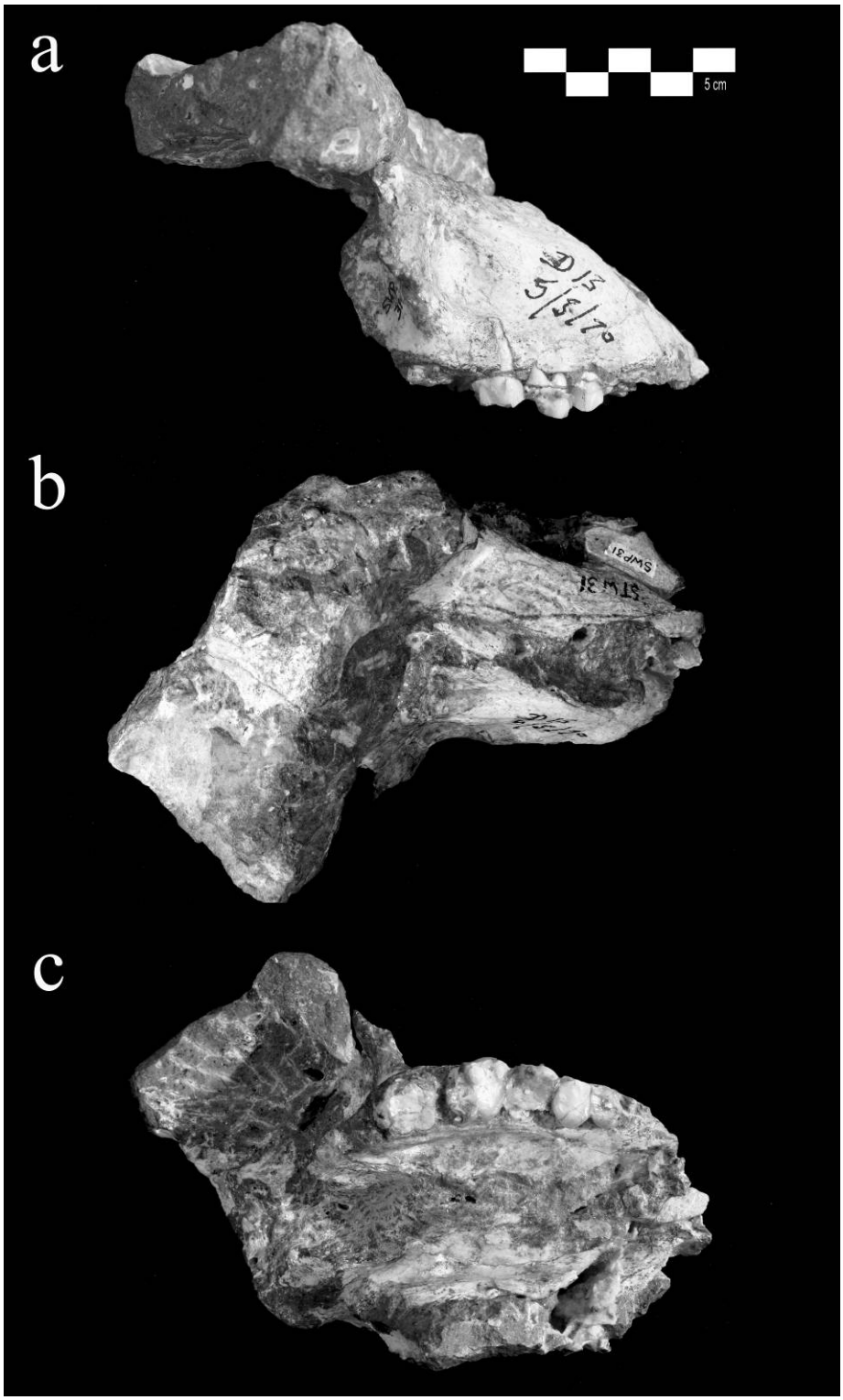


Figure 5-2. Swp 31 – Purported *Papio hamadryas robinsoni* from Sterkfontein Member 4. Shown here are (a) right norma lateralis, (b) norma verticalis and (c) palatal views of Swp 31. Note, specimen is highly fragmented and an 8mm strip of breccia currently separates the palate into left and right halves.

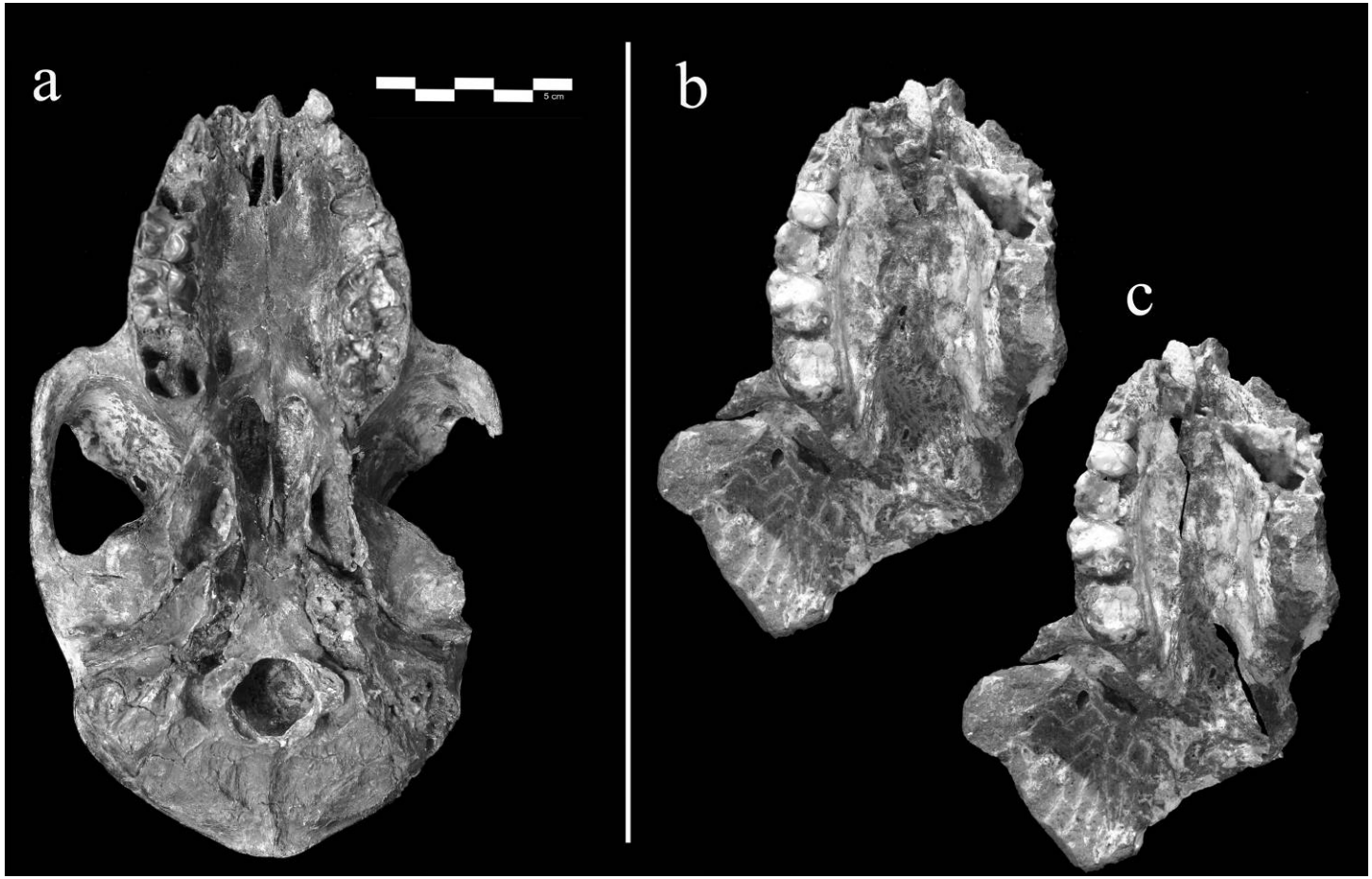


Figure 5-3. *Papio izodi* Type Specimen and Swp 31. Shown here are (a) the type of *P. izodi,* TP 7, (b) the purported *P. h. robinsoni,* Swp 31 and (c) a digitally modified photograph of Swp 31. Note, only, the breccia was removed from the photograph shown in (c) and several points of articulation between the left and right halves were maintained.

specimens from Sterkfontein compare well with *Papio izodi* samples from Taung, as will be discussed in Chapter Six.

Cranium

Frontal

The supraorbital region of *P. izodi* is a diagnostic feature among the papionin genera at Sterkfontein. Many juveniles, sub-adults and adults preserve this region, and a complete description of this region is now possible. The supraorbital tori and the nature of glabella are of 'typical' *Papio* form in both sub-adults (Sts 262 and Swp 2948), and adults (Swp Un2 and Swp 2946; Figure 5-4). The torus is well-pronounced in both sexes and appears to thicken laterally in the sub-adult specimen, Sts 262. This lateral thickening is less developed in the well-preserved adult specimens, Swp Un2 and Swp 2946. Glabella is well-pronounced in this species, and the supraorbital tori appear to originate from this point reaching their maximum height approximately mid-orbit before descending laterally. Tori thickness is roughly consistent across the orbits of the male and female specimens, Swp Un2 and Swp 2946, respectively.

Arising laterally from the tori, the origin of the temporal lines can be traced back posteriorly. Of the available specimens, Swp 2946 exhibits the best preserved examples of this region. The temporal lines originate anteriorly at the lateral most point of the supraorbital torus and parallel the frontal until the point of maximum post-orbital constriction. Posterior to the constriction, the temporal lines continue their medial trace, as the neurocranium begins to expand laterally. The temporal lines can be traced posteriorly to a position slightly anterior to the coronal suture. The lines cannot be

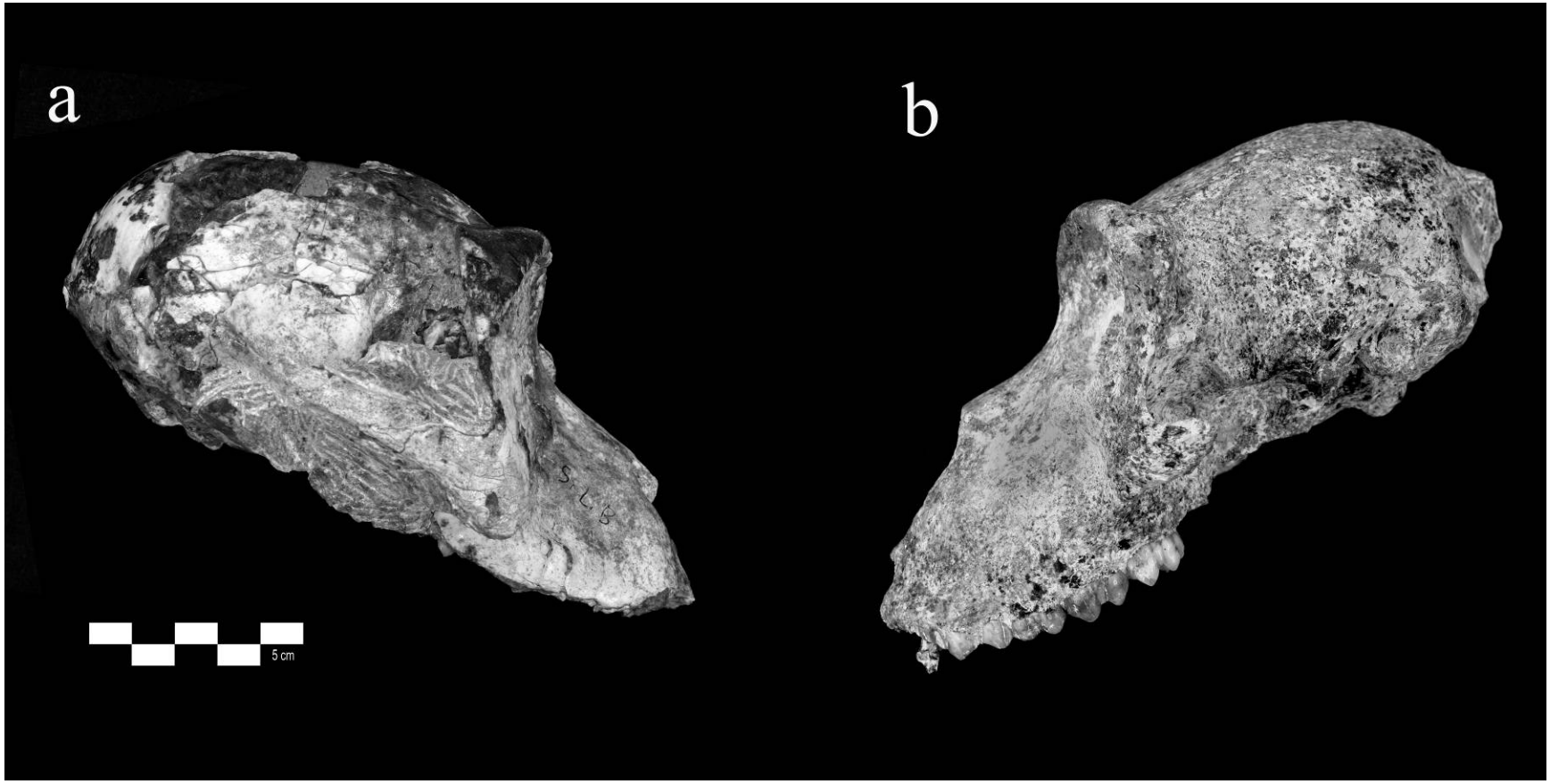


Figure 5-4. Female and Male *Papio izodi* Cranial Morphology. Shown here in norma lateralis are a female (a) Swp 2946 and a male (b) Swp Un2 *P. izodi*. Note, the secondarily elongate muzzle of the male.

traced posterior to the coronal suture in any specimens, male or female. Additionally, the degree of post-orbital constriction observed in male and female *P. izodi* specimens approximates the level of constriction observed in extant female baboons.

Posterior to the tori, a well-developed ophryonic groove can be observed from both, norma lateralis and norma verticalis. This region is best preserved in Swp 2946, but the male, Swp Un2 and Swp 2948, a sub-adult female, present the best lateral view of this region. When viewed in Frankfurt horizontal, the cranium begins to rise just posterior to the ophryonic groove and reaches a high point near bregma. Then immediately posterior to bregma, the calvaria begins to curve toward inion.

Rostrum

P. izodi specimens possess a narrow inter-orbital breadth. This feature is typical of all papionins at Sterkfontein. It is therefore not a useful diagnostic feature for assigning papionins to species, but is useful for separating papionins at Sterkfontein from other cercopithecoids (e.g. *Cercopithecoides williamsi*).

Additionally, the muzzle of *P. izodi* displays a smooth concavity from glabella to the prosthion. Three remarkably complete specimens from Member 2 exhibit the amount of variability that can be observed in the glabellar region of *P. izodi.* These specimens are: (1) Swp 2946, (2) Swp 2948 and (3) an un-numbered *P. izodi* male hereafter referred to as Swp Un2. Swp 2948 and Swp Un2 are here suggested to best represent 'archetypal' *P. izodi* female and male morphology, respectively. Both specimens, Swp Un2 and Swp 2948, display nasals with a smooth concavity from nasion to rhinion. Previously, an accurate description of this region was difficult, as the only specimen referred to this taxon, Sts 262, was damaged near rhinion. Recent discoveries

have shown the damage of Sts 262 to not have been a significant factor in the determination of its morphology, and it was a good approximation of *P. izodi* specimens at Sterkfontein. Although slightly damaged, Sts 262 exhibits the typical anteorbital drop observed in *Papio*, particularly *P. izodi* specimens from South Africa. Furthermore, slight differences in the morphology between males and females in this region are observed, possibly related to the secondary elongation of the rostrum in males. Swp Un2, a male *P. izodi*, exhibits a longer rostrum than the females from this site (e.g. Swp 2948). Swp Un2 displays the 'typical' anteorbital drop of *P. izodi* from glabella to rhinion, but additionally, displays a second concavity from rhinion to prosthion. The exact nature of this second concavity cannot be known from Swp Un2, as the premaxillae are damaged near prosthion, but the region appears to be longer and more concave than that of the female, Swp 2948 (Figure 5-4).

Interestingly, the species appears to be more variable in the distinctive anteorbital region than previously thought. Swp 2946, a specimen from Member 2, had previously been assigned to the species *Pp. broomi* by Pickering and colleagues (2004a). This diagnosis was based upon a suite of features, but the state of the glabellar region, specifically the anteorbital drop, played the greatest role in its misidentification. In all *P. izodi* specimens except Swp 2946, the anteorbital region displays a sharp drop from glabella to rhinion, as described previously. This concavity is more abrupt in males than in females. But, Swp 2946, an adult female *P. izodi*, displays an anteorbital region reminiscent of the species *Pp. broomi*. The area surrounding the nasal aperture, both anteriorly and posteriorly, is slightly damaged. The damage does not significantly affect the morphology of this region, but may play a small role in the misleading straight-line

appearance of the glabellar region when viewed laterally. If the specimen had not been damaged, it is concluded that Swp 2946 would still have displayed an anteorbital drop deviant from the 'typical' *P. izodi* morphology (e.g. Swp 2948).

The nasal aperture, damaged in most specimens, appears to be typically ovoid in both males and females. The only major difference between males and females derives from the relatively larger muzzles that males of *P. izodi* possess. In males, the nasal aperture appears to be slightly elongated relative to that of female specimens. The difference does not appear to be significant, as most papionins at Sterkfontein share similar morphology regardless of taxonomic identities.

In all available *P. izodi* specimens from Sterkfontein, the maxillary ridges are not as well developed as in some species at Sterkfontein (e.g. *Pp. broomi*). When a maxillary ridge is present, it is the result of the presence of a well-developed maxillary fossa, and its state is directly correlated with the maxillary fossa. The larger the fossa, the more developed the maxillary ridge.

The development of maxillary fossae is variable within *P. izodi*, as some specimens exhibit larger fossae than others, but this state may be age and/or sex related. Specimens, such as Swp 2946 and Swp Un2, exhibit the typical maxillary depression observed in *P. izodi* specimens. In contrast, Sts 262, a sub-adult female, exhibits a shallow maxillary fossa which is not as well developed as in the adult *P. izodi* specimens. In comparison, Swp 2948, a sub-adult female, although displaying a *Pp. broomi*-like anteorbital region, is diagnostic *P. izodi* in this anatomical region. Viewed in norma verticalis, the development of a well-defined maxillary fossa just inferior to a slight maxillary ridge can be visualized. In Swp Un2, an adult male, the maxillary fossa appears

to be developed to a comparable degree, as that in female *P. izodi* specimens. Therefore, age appears to be a more important factor in determining maxillary fossae development in *P. izodi* when compared to the sex of the individual specimens.

Additionally, the maxillary fossae of all *P. izodi* specimens are carried posteriorly onto the zygomatic resulting in a diagnostic infraorbital depression resulting from anterior facing zygomatics (Figure 5-5). In Sts 262, the maxillae are only slightly depressed infra-orbitally, again, presumably due to the young age of this specimen. In contrast, the adult infraorbital depression is usually well-developed, as in Swp 2948 and Swp Un2. These maxillary fossae and infraorbital depressions are typical for *P. izodi* and can be used to diagnose members of this species from other members of the papionina at Sterkfontein.

One of the few specimens preserving the pre-maxillary region, Sts 262, shows relatively narrow premaxillae. Additionally, the anterior margins of the nasal aperture are outlined by the premaxillae. Adult morphology may differ slightly from that of Sts 262, a sub-adult female, but no other *P. izodi* specimens display undamaged premaxillae. The only relatively complete male, Swp Un2, is heavily damaged in this region, while some adult female specimens, Swp 2946 and Swp 2948, appear similar to the morphology observed in Sts 262. The anterior margin of the premaxillae is damaged in most specimens, but the alveoli for the incisors are still present in Swp 2946 and Sts 262. The features of this region will be discussed in the next section on the *P. izodi* palate.

Palate

Sts 262 displays a typical *P. izodi* short, broad palate and can be described as horse-shoe shaped. The palate of *P. izodi* males (e.g. Swp Un2) differs by being

Figure 5-5. Zygomatic and Infraorbital Morphology of *Papio izodi*. Shown here in norma verticalis is Swp 2.

secondarily elongated resulting in an elongated horse-shoe shaped palate. Males display the typical curvature of the posterior dentition, most notably the molars, while the incisors and canine alveoli are less curved than in the females (Figure 5-6). The palate of *P. izodi* appears to be narrow, a result of the relatively large molars of the species. This false impression is more pronounced in females (Swp 2946) than in males (Swp Un2). In actual fact, the palate is of comparable breadth to similarly sized *Parapapio* specimens. In Swp Un2, an adult male, the palate is comparatively long, but in both sexes, the palate is broadest across the mesial loph of M^2. In both, males and females of *P. izodi*, the hard palate is shallow, and the palatine foramina are moderately developed.

When viewing the palate of *P. izodi*, the relatively large molars become a diagnostic feature that can be used to separate these groups (*Papio* vs. *Parapapio*). The palate of Swp 2946 is among the best preserved of all the *P. izodi* specimens with median and transverse palatine sutures, as well as the premaxillae suture, preserved. Fortunately, the palatine bones are relatively complete. The posterior palatine foramina of Swp 2946 are partially filled by breccia, but appear to be typically *Papio* in form. The foramina can be better visualized in a few male specimens, such as Swp 29a and Swp 12. The posterior nasal spine is visible in some specimens, such as Swp 2946. Superio-inferior structures to the spine, such as the greater wing of the sphenoid, preserve very little anatomical detail, as most are damaged or covered in breccia. On its right side, Swp 2946 preserves the medial and lateral plates of the pterygoid processes, and these sphenoidal structures are indistinguishable from extant *Papio*.

The moderately developed incisive foramina are anteriorly situated on the palate around the level of C^1. As a result of their placement, the incisive foramina are

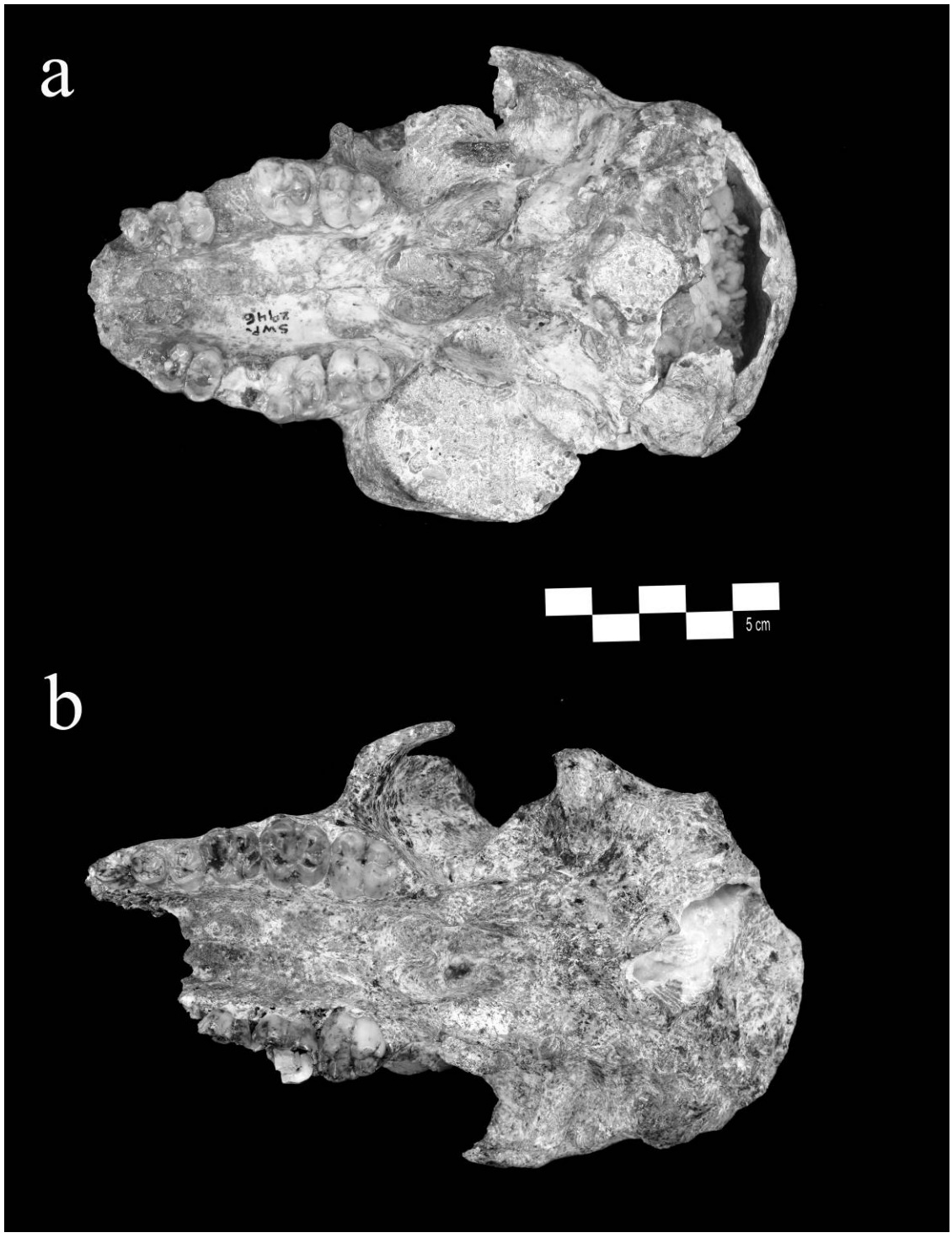


Figure 5-6. Palatal Morphology of *Papio izodi*. Shown here in norma basalis are (a) Swp 2946, a female *P. izodi* and (b) Swp Un2, a male *P. izodi*.

completely enclosed in the premaxillae, whereas in most cases of extant *Papio*, the incisive foramina are bisected by the premaxillary-maxillary suture with portions of the foramina located in both bones. In Sts 262 and Swp 2946, the foramina are filled with breccia, but the premaxillary-maxillary suture can be seen posterior to the foramina.

During the course of this analysis, only insignificant age-related differences in the palatal anatomy of *P. izodi* specimens were observed. For example, a sub-adult specimen, Sts 262, displays many of the features typical adult *P. izodi* morphology, but usually, to a lesser degree. The only differences between adult and sub-adult palatal morphology are related to the dentition of the specimen, Sts 262. In Sts 262, neither the left nor the right canine is present, but the alveoli can be visualized. The canine appears not to be sexually dimorphic in this species (see dentition discussion). In Swp Un2, much of the C^1 crown is missing, but length and breadth measurements are determinable. The measurements of the C^1 of Swp Un2 are only slightly larger than those of its P^3. In Swp 12, an additional adult male, only the C^1 alveolus is visible, but the specimen exhibits the 'typical' male non-sexually dimorphic canine. The same is true for females of the species (e.g. Swp 2946). Additionally, the small size of the canine alveolus suggests that as an adult, Sts 262 would have been a female.

Mid-face and Zygomatic Arch

As with many features in *P. izodi*, the zygomatic exhibits some age-related morphological differences. For example, in Sts 262, a sub-adult female, the zygomatic bone appears to be lightly built, but observations are tentative, as very little of the zygomatic arch remains. In specimens preserving more of this region, the zygomatic and arch appear more heavily built (e.g. Swp 12 and Swp 29a) suggesting that the lightly built

state of the zygomatics in Sts 262 may be age-related. The zygomatics, especially the lateral margins, are directed more anteriorly than other Papionins at Sterkfontein. The zygomatics of Sts 262, although a sub-adult, are in other features typical of the morphology observed of *P. izodi* specimens at Sterkfontein and parallel *P. izodi* specimens (S.A.M. 11728, T.-13, TP 11) from the fossil site of Taung. In Sts 262, the antero-inferior root of the zygomatic arch originates at the mesial loph of the M^2. In contrast, adult specimens of *P. izodi* exhibit some variability in the placement of the anterior root. In female specimens, the root originates, as far anterior as the distal loph of M^2 (e.g. Swp 29a) and as far posterior as the mesial loph of the M^3 (e.g. Swp 2946). In the most complete adult male from Sterkfontein, Swp Un2, the zygomatic root is placed posteriorly at the level of the mesial loph of M^3. An additional male specimen, Swp 12, though fragmentary, exhibits a zygomatic root with morphology matching that of Swp Un2. Differences in the form of placement of the zygomatic may show some sex related differences, but many of the specimens exhibiting the morphology in this region are of undetermined sex. It is clear, though, that sub-adult specimens have smaller muzzles and accompanying those smaller muzzles, are more anteriorly placed zygomatics.

The plane of the zygomatics, both, the lateral and mesial margins, are directed more perpendicularly to the occlusal plane than in other species at Sterkfontein, such as *Pp. broomi* which have lateral margins which are posteriorly oriented. In conjunction with the perpendicular zygomatics, all specimens attributed to *P. izodi* display an infraorbital fossa diagnostic of the species (see detailed discussion in Rostrum section). The infraorbital fossa is consistently present in adults, but its state varies with age, as well. In the adult male, Swp Un2, and female, Swp 2946, specimens, the adult infra-orbital fossa

is well-developed while in Sts 262, a sub-adult female, the fossa is only lightly developed (Figure 5-7).

The temporal fossae of adult *P. izodi*'s, such as Swp 2946, appear to be slightly larger in size than that observed in comparably sized extant females. In Sts 262, a sub-adult female, the left temporal fossa does not appear to be as large, as the fragmentary adult male, Swp 12, or the female, Swp 2946, but this region in Sts 262 is highly fragmented. Developmental age and sex may also play a role in the size of the temporal fossa, as Sts 262, a female, is significantly younger than Swp 12.

Orbit

Orbital shape in *P. izodi* at Sterkfontein appears to be a conservative feature with specimens showing relatively low levels of variability in the feature. Sts 262, a sub-adult female, displays typical Sterkfontein *Papio* orbital anatomy. The orbits are large relative to the face and are sub-circular in shape. The most inferior point of the orbit appears to be just medial to center of the orbit. The orbits in adult males (Swp Un2) and females (Swp 2946) exhibit similar morphology to that of the sub-adult (Sts 262), but the orbits are proportionately smaller in the adults. Additionally, in Swp Un2, the most lateral

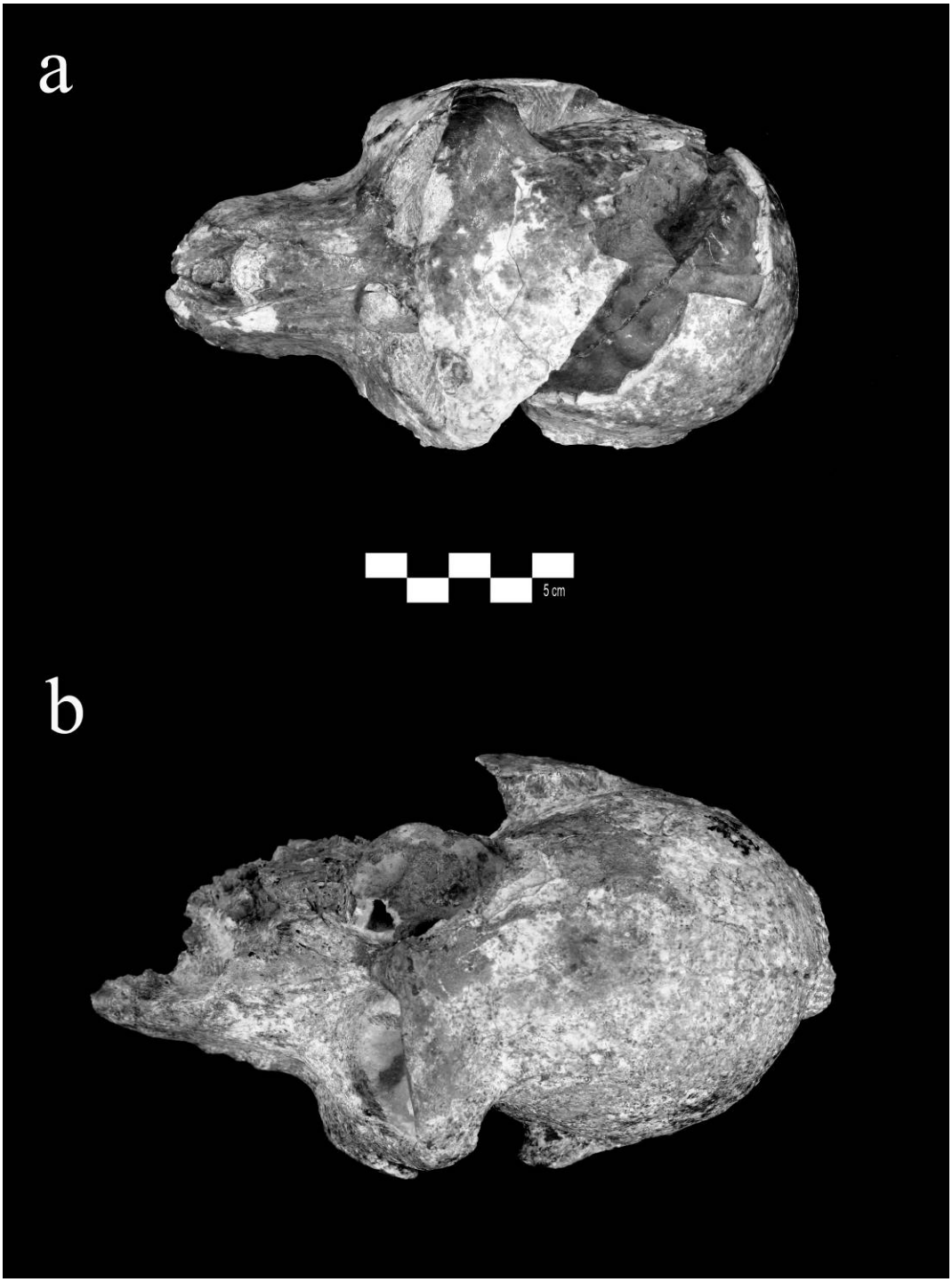


Figure 5-7. Rostral Morphology of *Papio izodi*. Shown here in norma verticalis are (a) Swp 2946, a female *P. izodi* and (b) Swp Un2, a male *P. izodi*.

portion of the orbit appears to be near superior margin, a trait reflected in females (e.g. Swp 2946), but to a lesser degree. Additionally, the inter-orbital distance is small – a feature typical of all papionins at Sterkfontein. The narrowest point of inter-orbital constriction is situated near the front-nasal suture.

In comparison to the genus *Parapapio*, the orbital region of *P. izodi* (e.g. Swp Un2 and Swp 2946) is developed more robustly (Figure 6-7). Among the boundaries of the orbit, the inferior, medial and lateral orbital margins are comparatively thin, but well defined. In contrast, the supraorbital tori are well-developed and are thickest near their lateral margins.

Calvaria and Temporal

The calvaria of the available *P. izodi* specimens appear relatively consistent. Although posteriorly fragmented, Sts 262 displays a well-rounded cranium. In most of the parietal and occipital regions, cranial bone is absent and/or fragmentary. Those regions are additionally obscured by unworked breccia. Although some cranial measurements were estimated, cranial breadth appears to be greatest in the region of the mastoid processes of the temporal bones. The left side of Sts 262 is less fragmentary than the right. It is on the left side of this specimen that a probable nuchal crest is visualized. The well-developed crest appears to originate at the termination of the posterior root of the zygomatic and continues posteriorly to inion, although obscured by breccia. The difficulty of this crest is that it is present in a sub-adult specimen (Sts 262) while adult specimens, such as Sts 254a, exhibit little if any evidence of a nuchal crest. Yet, these characteristics are consistent with the observations of adult *P. izodi* specimens. Swp 2946, a female, and Swp Un2, a male, display very similarly shaped crania with Swp

Un2 being only slightly longer. In a lateral view of the male, Swp Un2, a breccia obscured protuberance exists near inion, but its exact nature is undeterminable. Fortunately, Swp 2953, a male(?) cranium with a fractured muzzle, preserves this region. A well-developed external occipital protuberance can be observed in Swp 2953. In spite of that, a well-developed nuchal crest does not appear to be associated with any of the *P. izodi* specimens, even among the males, Swp Un2 and Swp 2953.

Mandible

Currently, very few mandibles of *P. izodi* are preserved in the Sterkfontein sample. Much of the sample is heavily fragmented preserving only small portions of the mandibular anatomy. The only associated specimens of *P. izodi* are Swp 29a, a fragmentary male cranium, and Swp 29b, a fragmentary mandible (Figure 6-8). Therefore, the following description of *P. izodi* mandibular features is largely based upon this specimen and comparisons with other taxonomically identifiable specimens of *P. izodi*.

Swp 29b is a left mandibular corpus with a partial ascending ramus lacking the anterior dentition. Additionally, much of the posterior dentition (P^3-M^3) is represented by only buccal enamel, but mandibular anatomy can be viewed buccally. The preserved portion of the anterior margin of the mandible exhibits a receding symphyseal region. The lateral surface of Swp 29b appears to be exfoliated for much of its surface. Sts 370, a sub-adult male, also exhibits an exfoliated mandibular corpus. However, the weathering observed on the specimen does not obscure its morphology, and no evidence of mandibular fossae appears on any of the available *P. izodi* specimens.

Figure 5-8. Swp 29a-b, an Associated Mandible and Cranium of *Papio izodi*.

The antero-inferior edge of the mandible terminates near the mesial margin of the P_3. The inferior margins of Swp 29b are fragmented, but in Swp 282, this region is preserved. On the lingual side of Swp 282, the inferior margin is significantly narrower than the alveolar portion of the mandible. Gonion is absent in Swp 29b and is damaged in most other specimens (e.g. Sts 370a and Sts 374a). The corpus appears to be only slightly smaller in dimension than the ascending ramus. In Sts 352, the mandibular

corpus appears to have its greatest depth around the level of mesial M^2, but few other specimens preserve this region (see also, Sts 374a).

The ascending ramus is broad in its anterior-posterior dimension, but its exact height can only be estimated. Laterally, the height appears to be low when compared to the depth of the mandibular corpus. In Swp 29b, the condyloid process of the mandible is preserved and appears to be buttressed to a greater extinct on its medial aspect than that observed in extant *Papio*. Additionally, the mandibular condyle of Swp 29b is rectangular in cross-section while in extant *Papio*, the condyle is more sesamoidal. The coronoid process of Sts 374a is more angular than comparable extant specimens, and the process is placed in an inferior position to the posteriorly placed condyloid process. But, Sts 374a appears to be damaged in the area, and conclusions regarding this region of the anatomy should wait for the recovery of more complete specimens. In all other available specimens, the coronoid process is fragmented; therefore, the extent of the sigmoid notch is indeterminable.

When viewed laterally, the external oblique ridge obscures the M_3 hypoconulid. This feature can be observed in Sts 352 (female?) and Swp 29b (male) and appears to be a predictable feature in *P. izodi*. In occlusal view, Sts 335 and Sts 370 appear to display a v-shaped toothrow, but both specimens are fragmentary and/or distorted. So, the exact nature of the mandibular toothrow cannot be reliably determined. A short incisal shelf extends posteriorly to around the distal P_3 level.

Dentition

In most *P. izodi* specimens, anterior dental elements, such as incisors, are absent, and therefore, only, a cursory description of these elements is attempted below (see Table 5-2 for metric data).

Table 5-2. Descriptive Statistics for *Papio izodi.* Note, measurements given in millimeters (mm).

	N	Minimum	Maximum	Mean	Std. Deviation	CV
I^1 Length	1	6.1	6.1	6.1		
I^1 Height	1	8.9	8.9	8.9		
I^2 Length	1	4.9	4.9	4.9		
I^2 Height	1	8.9	8.9	8.9		
I_2 Breadth	1	6.4	6.4	6.4		
I_2 Length	1	5.0	5.0	5.0		
I_2 Height	1	10.2	10.2	10.2		
C^1 Breadth	7	5.7	7.3	6.8	0.5	0.08
C^1 Length	4	6.7	8.3	7.3	0.7	0.10
C^1 Height	2	11.9	14.9	13.4	2.1	0.16
C_1 Breadth	2	5.1	7.1	6.1	1.4	0.23
P^3 Breadth	20	6.7	9.0	7.5	0.6	0.09
P^3 Length	18	5.0	6.7	5.8	0.6	0.10
P^3 Height	9	6.0	8.9	7.3	1.0	0.14
P^4 Breadth	27	7.3	9.4	8.3	0.6	0.07
P^4 Length	26	4.9	7.2	6.2	0.6	0.10
P^4 Height	12	5.4	8.2	7.0	1.0	0.14
P_3 Breadth	6	5.0	6.2	5.5	0.5	0.09
P_3 Length	8	5.4	7.2	6.3	0.6	0.10
P_3 Height	5	3.8	14.1	6.9	4.2	0.61
P_3 Flange Length	4	5.5	12.9	9.7	3.1	0.32
P_4 Breadth	10	5.9	7.1	6.6	0.4	0.06
P_4 Length	11	5.9	7.4	6.6	0.5	0.07
P_4 Height	7	4.2	5.9	5.1	0.7	0.13
M^1 Mesial Breadth	24	7.9	11.1	9.6	0.7	0.07
M^1 Distal Breadth	24	6.3	10.9	8.9	0.9	0.10

	N	Minimum	Maximum	Mean	Std. Deviation	CV
M^1 Length	29	7.0	12.9	9.3	1.1	0.12
M^1 Height	6	4.3	6.6	5.5	0.8	0.15
M^2 Mesial Breadth	29	8.3	13.0	11.0	1.0	0.09
M^2 Distal Breadth	30	8.2	12.5	10.1	0.9	0.09
M^2 Length	31	9.7	12.8	10.8	0.9	0.08
M^2 Height	11	6.2	9.7	7.6	1.1	0.14
M^2 Mesial Breadth	18	8.8	12.7	10.7	1.0	0.10
M^3 Distal Breadth	17	7.6	11.7	9.2	1.1	0.12
M^3 Length	22	9.6	13.4	10.8	1.0	0.09
M^3 Height	9	6.2	8.1	7.1	0.6	0.09
M_1 Mesial Breadth	11	7.1	9.7	7.8	0.7	0.09
M_1 Distal Breadth	12	6.7	9.6	7.9	0.9	0.12
M_1 Length	12	7.9	10.2	9.1	0.8	0.09
M_1 Height	6	4.5	5.7	5.1	0.5	0.10
M_2 Mesial Breadth	13	8.6	10.8	9.5	0.7	0.07
M_2 Distal Breadth	12	8.3	10.3	9.2	0.7	0.08
M_2 Length	15	10.3	13.2	11.1	0.8	0.07
M_2 Height	5	5.9	7.2	6.4	0.5	0.08
M_3 Mesial Breadth	9	8.7	10.7	9.6	0.7	0.07
M_3 Distal Breadth	9	7.4	10.4	8.8	0.9	0.10
M_3 Hypoconulid Breadth	9	4.2	7.0	5.7	1.1	0.19
M_3 Length	12	11.7	15.0	13.4	1.0	0.07
M_3 Height	4	7.2	8.3	7.7	0.5	0.06

However, the anterior dentition is only useful in distinguishing papionin from non-papionin specimens (e.g. *C. williamsi*) and usually, other anatomical features can be used in absence of this information.

In the Sterkfontein sample, the posterior dentition is much better represented in the taxonomically identifiable elements. Additionally, the posterior dentition is more useful in distinguishing among the various papionins at Sterkfontein – specifically, *Papio*

and *Parapapio*. The relationship between the size of the premolars and molars are of greatest worth in differentiating the papionin species at Sterkfontein and may suggest phylogenetic affinities with one or more groups in the extant Papionini (see Chapter Six).

Incisors

Swp 29a is the only specimen taxonomically identified to *P. izodi* that preserves the anterior dentition relatively intact. Labially, the incisors of Swp 29a appear typically papionin. On the left side, the I^1 and I^2 are preserved. The I^1 is larger in both, length and height, dimensions when compared to the I^2. The lingual surface of the incisors is covered with breccia; therefore, no further anatomical detail of the maxillary incisors of Swp 29a can be derived.

A mandible, Sts 414a, preserves both incisors, I_1 and I_2, on the left side. The right I_1 appears to be distorted anteriorly, but the aforementioned, left incisors seem to be relatively intact. The mandibular incisors reflect the morphology of the maxillary incisors. The I_1 is larger than the I_2, but to a lesser degree than that observed in the maxillary incisors. In spite of minor damage, the lingual surface of I_1 and I_2 can be visualized, and the I_1 and I_2 are devoid of any lingual enamel – a feature common among fossil and extant papionins.

Table 5-3. I^1 and I^2 Dimensions (mm) of *Papio izodi.*

		I^1 Breadth	I^1 Length	I^1 Height	I^2 Length	I^2 Height
Male	Sts 414 a		6.1	8.9	4.9	8.9
	Swp 58	7.4	6.4	10.7		

Table 5-4. I_1 and I_2 Dimensions (mm) of *Papio izodi.*

		I_2 Breadth	I_2 Length	I_2 Height
Male	Sts 370 a	6.4	5.0	10.2

Canines

As mentioned previously, *P. izodi* exhibits low levels of sexual dimorphism in cranio-dental features. Yet, canines are typically dimorphic among extant papionins, especially *Papio*, but very little dimorphism is observed among male and female *P. izodi* specimens at Sterkfontein (Table 5-5). In Swp Un2, an adult male, the left canine is damaged, but the remaining dental fragment indicates that C^1 would have been only slightly broader than the P^3. Additionally, *P. izodi* specimens exhibited heavily worn canines suggesting a possible side-to-side grinding motion during mastication (Ron Clarke, personal communication).

Table 5-5. C^1 and C_1 Dimensions (mm) of *Papio izodi.*

		C^1 Breadth	C^1 Length	C_1 Breadth	C_1 Breadth
Female	Sts 254 b	5.7	7.3		
	Swp 2946	7.3			
	Swp 2948	6.6	6.9		
Male	Sts 263	6.9			
	Sts 370 a				7.1
	Sts 370 b	7.0	8.3	14.9	
	Sts 414 a				5.1
	Swp 29a	7.1	6.7	11.9	
	Swp Un2	6.7			

Premolars

The posterior dentition of *P. izodi* is comparatively better preserved than the anterior dentition. As mentioned previously, this is typical of the entire Sterkfontein papionin sample. The posterior dental *P. izodi* sample contains a wide range of ages from

relatively young adults to very old adults, as indicated by their premolar and molar wear scores (Table 5-6).

Table 5-6. P^3 Dimensions (mm) of *Papio izodi.*

		WS	P^3 Breadth	P^3 Length	P^3 Height
Female	Sts 254 a		7.9	5.1	
	Swp 10		7.3	6.3	7.0
	Swp 27	8	7.3	5.4	
	Swp 2946		8.7	5.2	
	Swp 2948		7.2		
Male	Sp 10		6.8	5.5	7.8
	Sts 263	0	7.0	6.7	8.9
	Sts 370 b		7.6	6.5	7.6
	Sts 414 b		7.2	5.8	6.2
	Swp 12	8	7.2	5.0	
	Swp 29 a		7.9	6.1	
	Swp 58		7.5	5.3	
	Swp Un2	7	7.9	6.4	6.0
Indet.	Sp 22	2	8.3	5.5	8.3
	Sts 266	0	6.8	6.1	6.1
	Sts 267	6	7.2		
	Sts 277		6.7	5.9	
	Sts 398 a	8	7.2	5.4	
	Swp 21	0	9.0	6.4	7.6
	Swp 472		7.2	5.4	
	Swp 1774	8	6.7	5.0	
	Swp 1882		7.1	5.7	

In *P. izodi*, the canine was not observed to be highly sexually dimorphic, and this pattern was repeated in the maxillary and mandibular premolars. The maxillary premolars, P^3 and P^4, exhibited very little dimorphism between the sexes of *P. izodi* breadth, length and height (Tables 5-6 and 5-7).

A wide degree of overlap exists within the sample, but Sts 263, a male, appears to possess a premolar that diverges from the 'typical' *P. izodi* morphology. However, the P^3 is from a young adult male which exhibited very little premolar wear. The aberrant

dimension, P^3 height, is most probably a reflection of the specimen's young age, and not a divergent morphology.

Table 5-7. P^4 Dimensions (mm) of *Papio izodi.*

		WS	P^4 Breadth	P^4 Length	P^4 Height
Female	Sts 254 a		9.4	5.7	
	Sts 262		7.4	6.4	5.4
	Swp 10		8.1	6.3	7.1
	Swp 27	4	7.9	5.8	
	Swp 2946	f	9.4	5.9	
	Swp 2948		7.7		
Male	Sp 10		7.3	6.2	7.5
	Sts 263	1	7.9	7.0	8.2
	Sts 370 b		8.4	6.7	8.1
	Sts 414 b		8.1	6.1	7.0
	Swp 2	1	8.6	7.1	6.9
	Swp 12	8	8.7	6.2	
	Swp 29a		9.1	6.6	
	Swp 31	4	9.3	7.2	
	Swp 58		8.4	5.9	
	Swp Un2	7	8.6	7.1	5.4
Indet.	Sp 22	3	8.6	5.8	
	Sp 24	8	7.8	6.1	
	Sts 251		8.3	6.5	8.0
	Sts 266	1	7.5	6.4	7.8
	Sts 267	6	8.3	4.9	
	Sts 277		7.5	6.5	
	Sts 330	8	8.2	5.6	
	Sts 398 a	8	7.8	5.2	
	Sts 548		8.6	6.1	
	Swp 21	0	9.2	6.7	6.6
	Swp 472		8.0	5.5	
	Swp 1017	0	8.7	6.8	7.0
	Swp 1882		8.1	5.5	
	Swp 2907		8.3	5.5	6.2

The maxillary dentition of the *P. izodi* sample is better preserved than that of the mandibular dentition. But, some generalizations can be drawn from the sample. The greatest difference in the maxillary and mandibular premolar sample was in the breadth dimension, only. However, this does not include comparisons of flange length, as the maxillary dentition does not have a corresponding measurement.

Table 5-8. P_3 Dimensions (mm) of *Papio izodi.*

		WS	P_3 Breadth	P_3 Length	P_3 Height	P_3 Flange Length
Female	Sts 352		6.2	6.0	4.1	9.9
	Swp 4	0	5.0	6.8	6.3	
Male	Sts 370 a		5.8	7.2		12.9
	Sts 414 a		5.7	6.7	14.1	
	Swp 29			5.5		
Indet.	Sts 280		5.3	6.3	6.1	10.4
	Sts 335		5.0	6.1	3.8	5.5
	Sts 548			5.4		

Overall, the breadth of the maxillary premolars appears to be dramatically larger than that of the mandibular premolars (Tables 5-6 through 5-9), but this trend was also observed in the *Pp. broomi* sample. The difference between the P^3 and P_3 of the *P. izodi* sample was the most notable observed.

In both sexes, the mandibular premolar appears to be smaller in breadth than its maxillary equivalent. Although the maxillary sample is represented by over twice as many teeth, the difference is not a reflection of varying representations of the sexes (i.e. more females in one sample). Individually, the dimensional difference appears to persist.

Within the mandibular premolars, sexually dimorphism is relatively unmarked. However, the exception is the flange length of the sectorial premolar. In *P. izodi* males, the sectorial P_3 is slightly larger and in only the flange length (Table 5-8). In all other

dimensions, males and females overlap, significantly. The P_3 breadth and length of both sexes are nearly indistinguishable. Sts 370a, a male *P. izodi*, exhibits a flange length only 24% larger than the female, Sts 352. In comparison, a male *Pp. broomi* specimen possessed a flange length over 84% larger than that of the female *Pp. broomi* specimens. Therefore, the degree of dimorphism observed in the *P. izodi* sample is relatively small for the Sterkfontein papionin sample. The lack of significant sexual dimorphism is again observed in the P_4 of *P. izodi* (Table 5-9). Presently, it is not clear if this is typical for the species, but other dental dimensions support this apparent lack of sexual dimorphism in the *P. izodi* sample.

Table 5-9. P_4 Dimensions (mm) of *Papio izodi.*

		WS	P_4 Breadth	P_4 Length	P_4 Height
Female	Sts 352	3	7.1	7.0	5.1
	Swp 4	0	5.9	5.9	4.7
Male	Sts 370 a	1	6.3	7.4	5.9
	Sts 414 a		6.9	6.3	5.7
	Swp 29			6.8	
Indet.	Sts 280		6.2	6.3	4.4
	Sts 335	6	6.8	6.1	
	Sts 411a		6.1	6.4	5.6
	Sts 542	7	6.9	7.3	4.2
	Swp 282		6.7	6.7	
	Swp 2848		6.6	6.8	

Molars

Morphologically, the molars are indistinguishable from the typical papionin. Tables 5-10 through 5-15 provide the molar data for the *P. izodi* sample. Again, the degree of sexual dimorphism in the *P. izodi* sample is not marked. However, the relatively larger molars when compared to the breadth and length of the *P. izodi* premolars are somewhat diagnostic among the papionin sample at Sterkfontein. Even in

the presence of premolars, sex determination was complicated by the fact that these typically dimorphic teeth were rather deceptive.

Table 5-10. M^1 Dimensions (mm) for *Papio izodi.*

		WS	M^1 Mesial Breadth	M^1 Distal Breadth	M^1 Length	M^1 Height
Female	Sts 254 a		10.0	9.4	8.6	
	Sts 274		8.9	8.8	9.6	
	Swp 10		9.4	8.9	9.9	
	Swp 27	16			8.3	
Male	Sp 10				8.5	
	Sts 263	5	9.7	9.5	10.3	6.0
	Sts 370 b		10.9	10.9	10.6	
	Sts 414 b		9.0	8.1	9.0	5.6
	Swp 2	12	9.8	8.9	9.6	
	Swp 29a	16	10.0	9.5	9.9	
	Swp 31				9.0	
	Swp 58		9.6	9.0	9.7	
	Swp Un2		9.5	9.3	10.5	4.8
Indet.	Sp 22	8	9.4	8.8	8.5	
	Sp 24	16			8.2	
	Sts 251	8	9.7	8.7	9.4	5.5
	Sts 266	10	8.6	8.1	9.1	
	Sts 267	16	9.5	9.0	9.1	
	Sts 277	6	9.6	8.3	9.7	
	Sts 330	16	9.3	9.0	8.6	
	Sts 398 a	16	9.6		8.6	
	Sts 410 a		10.2	9.4	10.4	
	Sts 548		9.6	9.1	9.7	
	Swp 21	1	11.1	10.3	12.9	
	Swp 365a		7.9	7.5	8.0	
	Swp 376		9.5	8.9	10.1	6.6
	Swp 472		10.1	9.5	8.4	
	Swp 1017	4	9.2	8.4	10.3	6.1
	Swp 1733	0	10.0	9.2	10.2	
	Swp 1774	16	9.3	8.8	8.5	
	Swp 1882		8.9	8.5	9.1	
	Swp 2943			6.3	7.0	4.3

In *P. izodi*, the fourth premolar was smaller in size and shape than the first molar. Interestingly, the molar- to-premolar ratio in *P. izodi* was the most similar of the Sterkfontein papionins to that of extant *Papio*. As previously mentioned, molar-to-

premolar ratios were shown to be useful indicators of taxonomic groups within the papionini (Fleagle and McGraw, 2002) and may be a feature of cladistic value with respect to the extinct papionins.

Table 5-11. M2 Dimensions (mm) for *Papio izodi.*

		WS	M^2 Mesial Breadth	M^2 Distal Breadth	M^2 Length	M^2 Height
Female	Sts 262	7	10.2	9.1	10.4	
	Sts 274	6	10.4	9.4	10.4	
	Swp 10		10.9	9.8	11.4	
	Swp 27	13	10.4	9.3	9.8	
	Swp 2946	16f	11.9	10.7	11.2	6.2
Male	Sp 10		10.0	9.4	9.8	6.3
	Sts 263	0	11.1	11.0	12.7	8.7
	Sts 370 b		12.4	12.1	12.5	8.5
	Sts 414 b		10.6	9.6	11.0	6.9
	Swp 2	1	12.1	10.6	12.1	
	Swp 12	16	10.7	9.9	9.9	
	Swp 29a	7	11.9	10.7	12.1	
	Swp 31				11.4	
	Swp 58		11.8	11.0	10.7	7.4
	Swp Un2		12.5	11.0	12.8	7.2
Indet.	Sp 22			10.2	10.0	
	Sp 24		11.2	10.2	9.7	
	Sts 251	2	11.0	9.8	10.5	7.2
	Sts 266	3	10.0	9.6	10.3	7.0
	Sts 267	13	11.9	10.9	10.4	7.6
	Sts 277	2	10.4	9.6	10.1	
	Sts 303		13.0	12.5	11.5	
	Sts 322		10.3	9.1	10.9	
	Sts 325	0	10.4	10.0	10.1	7.9
	Sts 330	13	10.9	10.6	10.3	
	Sts 398 a	13	11.0	10.3	10.0	
	Sts 410 a		10.3	8.2	10.1	9.7
	Sts 548		11.8	10.7	11.7	
	Sts 2122a	10	10.1		11.4	
	Swp 365a		8.3	8.3	10.7	
	Swp 472		11.2	10.2	10.3	
	Swp 1017	0	10.7	8.8	11.1	7.9
	Swp 1774	10	11.3	10.3	10.4	
	Swp 1882		10.8	11.0	12.2	6.9
	Swp 2907			9.8		

Table 5-12. M^3 Dimensions of *Papio izodi.* Note, measurements given in millimeters (mm).

		WS	M^3 Mesial Breadth	M^3 Distal Breadth	M^3 Length	M^3 Height
Female	Sts 262	2	11.0	10.1	11.6	6.2
	Swp 27	6	9.7	8.2	9.9	
	Swp 2946	5b	10.8	9.2	11.1	6.8
Male	Sts 414 b		8.8	7.6	10.1	7.6
	Swp 12	9	10.3	9.2	10.6	
	Swp 29 a				12.5	
	Swp 0058		10.6	9.0	10.9	8.0
	Swp Un2		12.6	10.0	12.3	8.1
Indet.	Sp 22	0	11.3	8.7	10.8	7.1
	Sp 24		9.9		9.9	
	Sts 251	0	10.5	8.2	10.3	
	Sts 266	1	9.8	8.2	10.4	
	Sts 267	11	10.9	9.8	11.0	7.3
	Sts 303		12.7	11.7	11.7	
	Sts 322		12.1	10.9	13.4	
	Sts 325	0	9.8	7.7	10.2	7.7
	Sts 330	4	10.0	8.3	10.0	
	Sts 396 a	16			10.3	
	Sts 398 a	3	10.7	8.9	10.7	6.7
	Sts 416 a				10.3	
	Sts 2122a				10.8	
	Swp 472		11.4	9.7	11.2	6.3
	Swp 1774	4	10.9	10.0	9.6	

The *P. izodi* sample appears to exhibit M_2 and M_3's which are very similar in size, and both are larger than the M^1 (Tables 5-13 through 5-15). Second mandibular molars appear to exhibit similar and sometimes slightly larger distal breadths when compared to the third mandibular molars. As such, the mandibular molars in *P. izodi* appear to show the following pattern with respect to molar breadth: $M^1 < M^2 = M^3$. However, the pattern appears to be slightly different with respect to molar length. Again, the M_2 is larger with respect to the M_1, but due to the presence of the hypoconulid, the M_3 is comparatively longer than the M_2.

Table 5-13. M_1 Dimensions (mm) of *Papio izodi.*

			M_1 Mesial	M_1 Distal	M_1	M_1
		WS	Breadth	Breadth	Length	Length
Female	Sts 352	10		9.4	9.9	
	Swp 4	10	7.7	7.5	8.7	5.5
Male	Sts 370 a	8	8.0	8.4	9.9	5.4
	Sts 414 a		7.3	7.2	9.2	5.7
Indet.	Sts 268		7.7	7.9	9.9	
	Sts 280		7.3	7.0	8.1	5.1
	Sts 335	16	7.9	8.6	9.0	
	Sts 411 b	11	7.5	6.7	9.0	4.5
	Sts 411a	9	7.1	7.1	9.0	4.5
	Sts 416 a		9.7	9.6	10.2	
	Swp 282		8.5	8.1	8.1	
	Swp 2848		7.5	7.3	7.9	

Table 5-14. M_2 Dimensions (mm) of *Papio izodi.*

			M_2 Mesial	M_2 Distal	M_2	M_2
		WS	Breadth	Breadth	Length	Height
Female	Sts 352	7	10.6	10.3	12.0	6.6
	Swp 4	2	9.2	8.6	10.5	6.0
Male	Sts 370 a	1	9.9	10.0	13.2	7.2
	Sts 414 a		9.4	8.4	10.4	6.5
	Swp 29				11.2	
Indet.	Sts 268	7	9.3	9.3	11.6	
	Sts 280		8.8		10.4	
	Sts 335	16	10.8	10.2	11.2	
	Sts 374a	12	9.2	8.9	10.4	
	Sts 411a	2	8.8	8.3	11.7	5.9
	Sts 416 a	16	9.8	9.7	10.3	
	Sts 542	16	9.4	9.3	10.7	
	Swp 282		10.1		11.6	
	Swp 422	16		9.1	10.8	
	Swp 2848		8.6	8.6	10.3	

As previously noted, males and females cannot be sexed based upon molar morphology. Females, in some cases, exhibit molars which are larger than males in the same sample resulting in a wide range of overlap between the sexes. As much of the dentition is non-sexually dimorphic, sex assignment of isolated mandibular or maxillary

fragments is precarious. In *P. izodi,* sexual assignment can only confidently be accomplished with additional pieces of information, such as palatal shape or in the best case, the presence of a P_3.

Table 5-15. M_3 Dimensions (mm) of *Papio izodi.*

		WS	M_3 Mesial Breadth	M_3 Distal Breadth	M_3 Hypoconulid Breadth	M_3 Length	M_3 Height
Female	Sts 352	3	10.6	10.4	7.0	15.0	7.6
Male	Sts 414 a		9.4	7.4	4.2	14.7	7.2
Indet.	Sts 280					13.5	
	Sts 335	7	10.7	9.7	6.2	13.3	
	Sts 374a	7	9.3	8.8	4.9	12.1	
	Sts 410 b			8.0	4.3	13.3	8.3
	Sts 411 b	0	9.0	8.4	6.0	14.0	7.5
	Sts 416 a	16	10.0			13.5	
	Sts 542	7	9.2	8.4	5.4	12.6	
	Sts 548					13.1	
	Swp 422	8	9.7	8.9	7.0	14.1	
	Swp 2848		8.7	9.1	6.4	11.7	

Anatomical Summation

P. izodi is more easily diagnosed from the other papionin taxa, because the other two taxa, *Pp. broomi* and *Pp. jonesi* share several features in common. Most probably, these features reflect the more recent common ancestry of the *Parapapio* groups. However, even during Member 2, *P. izodi* was diagnostically a member of the genus *Papio* in many features. For example, both sexes exhibited well-developed supraorbital tori which distinguish the species from the other Sterkfontein papionins. Additionally, *P. izodi* displays a distinct, sharp anteorbital drop from glabella – another differentiating character. However, the maxillary ridges are lightly developed, as in *Pp. jonesi*; but unlike *Pp. jonesi*, the maxillary fossae in *P. izodi* are the most developed of any Sterkfontein papionins. The maxillary fossae for *P. izodi* exhibit their greatest depth near the

zygomatico-maxillary suture and are present as infraorbital depressions – a state not observed in *Parapapio*. Additionally, the zygomatics are more anteriorly oriented and are typically perpendicular to the rostrum in *P. izodi*. Palatal shape varies depending upon sex and is similar to form to that observed in *Pp. broomi*. However, in comparison to the *Parapapio* species, *P. izodi* molars are larger with respect to their premolars (i.e. smaller premolar-to-molar ratio) and are more similar to the extant *Papio* groups (see Chapter Six).

CHAPTER SIX
DISTINGUISHING THE STERKFONTEIN PAPIONINA

During the course of this analysis, it became apparent that several discrete and non-discrete traits existed which could be used for taxonomically diagnostic purposes (Table 6-1). With regard to cranial features, most anatomical differences were observed in either the anteorbital region or the muzzle proper. Isolated mandibles were difficult to identify to species and in some cases could not be attributed to even the generic level. However, some differences in dental size and proportions were indicative of genus and/or species, as well. Most of the analyses relied heavily upon complete or partially complete crania, as a means to understand the relationships between the diagnostic features of each taxon. As Eisenhart (1974) noted, there is a great deal of overlap in most dimensions of the papionin taxa, and to date, dental dimensions alone have proven ineffective for making taxonomic distinctions (see Eisenhart, 1974; Freedman, 1957; Freedman and Stenhouse, 1972). Therefore, the approach taken here, one of using not only dental dimensions, but also a suite of discrete traits, appears to be a somewhat successful approach.

Earlier analyses (Eisenhart 1974; Freedman 1957) suggested that members of the species *Pp. broomi* exhibited a straight-line nasal profile from glabella to nasion, but more recently recovered material exhibits anteorbital regions mid-way between *Pp. jonesi* (i.e. high-stout muzzle with a straight-line profile) and *P. izodi* (i.e. a distinct anteorbital drop

reminiscent of modern *Papio*). Additionally, intra-specific variability in the degree of anteorbital drop among the papionins of Sterkfontein is much more variable than previously considered.

Interestingly, many of the specimens attributed to *Pp. broomi* (small) by Eisenhart (1974) were in fact *P. izodi* specimens. In many features, there is morphological overlap between *P. izodi* and *Pp. broomi* specimens. In fact, this analysis suggests that anteorbital drop *alone* is not a reliable feature upon which to base species designations. Supporting this argument, Jones (1978) found the anteorbital region to be highly variable among interbreeding groups of modern *Papio*. Jones (1978) questioned the diagnosis of the genus he created, *Parapapio*, suggesting that the anteorbital region was perhaps more variable than his initial diagnosis allowed (Jones, 1937). Typically, members of the genus display no supraorbital tori while *P. izodi* displays a well-developed supraorbital region. The difficulty arises when dealing with juveniles of the papionin species in which adult morphology may not yet be apparent, as in Swp 2948. Additionally, palatal shape in Swp 2948 was also difficult to distinguish from that of the 'typical' *Pp. broomi* morphology. Thus, it was concluded that both, palatal shape and anteorbital drop, are overlapping characters in *P. izodi* and *Pp. broomi*, and as a result, should not be used in isolation to determine species assignments. Other features must be used in conjunction with these features to support any taxonomic designations to these species.

On the other hand, males of *P. izodi* and *Pp. jonesi* were also readily distinguishable on the basis of cranial morphology, most specifically in the anteorbital region. *Pp. jonesi* specimens display short, stout and high muzzles while *P. izodi* specimens display varying

Table 6-1. Diagnostic Characters of the Sterkfontein Papionins. For greater detail on a particular anatomical element, see Chapters Three (*Pp. broomi*), Four (*Pp. jonesi*) or Five (*P. izodi*).

	Anteorbital Region	**Maxillary Fossa**	**Maxillary Ridge**	**P4/M1 Ratio***	**Palatal Shape**	**Zygomatic Orientation**
Papio izodi	steep drop	well-developed, projecting onto infraorbital region	lightly-developed	Max. - 56.1 Mand. - 62.8	♀ - Horse-shoe ♂ - Elongated horse-shoe	perpendicular to rostrum
Parapapio broomi	Gradual drop, but variable	moderately developed	well-developed	Max. - 60.0 Mand. - 68.8	♀ - Horse-shoe ♂ - Elongated horse-shoe	antero-lateral fleeting
Parapapio jonesi	high, stout - straight-line	lightly developed	lightly-developed	Max. 61.3 Mand. - 66.8	♀, ♂ - Horse-shoe	antero-lateral fleeting

* P4/M1 Ratio calculated as: 100 x **(**((P4 m-d x b-l)**/**(M1 m-d x b-l)**)** following Fleagle and McGraw (2002)

Note: m-d = mesio-distal (breadth), b-l = bucco-lingual (length)

degrees of concavity in the anteorbital region. In most cases, this anteorbital drop can be significant and parallels that observed in modern *Papio* specimens, but again, this feature can be variable in the extinct species considered here. Therefore, the morphology of the anteorbital region alone can be misleading, but when used in conjunction with other features (e.g. presence of infraorbital fossa), classification is quite reliable.

The differences in the papionin species became apparent when the maxillary fossae and/or infraorbital depressions were assessed in individuals preserving the region. It was observed that *P. izodi* displayed the most marked maxillary fossae and were the only species exhibiting well-developed infraorbital depressions. The maxillary fossae in males and females of *P. izodi* resembled those observed in the female of extant *Papio* groups. The fossae were shallowest on the anterior muzzle and grew in depth, as they approached the infraorbital region.

In the *Parapapio* species, the maxillary fossae are no less diagnostic than those of *P. izodi*, but are developed to a lesser degree. In *Pp. broomi* and *Pp. jonesi*, the maxillary fossae are present as shallow depressions throughout their range. The maxillary fossae of *Pp. broomi* are more the result of well-developed maxillary ridges than well-developed maxillary fossae. The shallow fossae of *Pp. jonesi* are paired with lightly built maxillary ridges. When maxillary fossae are used in conjunction with maxillary ridges, species diagnosis can be quite confidently made.

Additionally, the zygomatics allow separation of the Sterkfontein papionins, but unfortunately, can only be used to separate the genera. *Parapapio* specimens display zygomatics which are antero-laterally fleeting – the lateral margins of the zygomatics project posteriorly. In contrast, the zygomatics of *P. izodi* are directed perpendicularly to

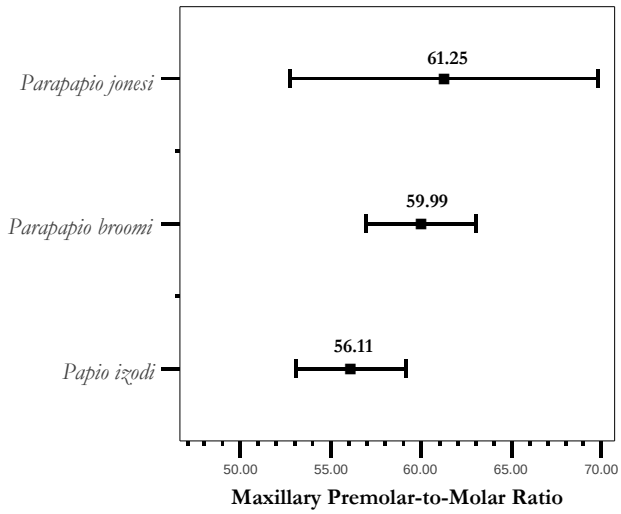
the rostrum. There appears to be little variability within this diagnostic feature, but diagnoses utilizing the direction of the zygomatics should be supplemented with other anatomical details, when possible.

As mentioned previously, the Sterkfontein papionins display a substantial amount of overlap, especially in dental characters. It was discovered that specimens of *P. izodi* were typically larger in most tooth dimensions than those of the genus *Parapapio*, particularly *Pp. jonesi*. But, unless the specimen is at the upper-end of the *Pp. broomi – P. izodi* range or lower-end of the *P. jonesi* range, dental dimensions alone would be ineffective in diagnosing taxa.

One feature was deemed exceptionally useful and widely used in this analysis to distinguish among the papionin species at Sterkfontein was the premolar-to-molar ratio. Previously, Fleagle and McGraw (1999; 2002) had employed premolar to molar ratios to distinguish species within the extant papionini. In their analysis, it was demonstrated that the papionins could be separated into two groups: (1) a group with reduced posterior premolars (e.g. *Lophocebus*, *Papio* and *Theropithecus*) and (2) a group with enlarged maxillary and mandibular posterior premolars (e.g. *Cercocebus* and *Mandrillus*)[1]. This method was productively applied to the Sterkfontein fossil sample, and systematic differences in the size of the posterior premolars were found to be identifiable among the papionins at Sterkfontein (Figure 6-1). For example, specimens attributed to *P. izodi* always displayed a reduced premolar consistent with that observed among modern *Papio*.

[1] The reduction or enlargement of posterior premolars was observed in both, the maxillary and mandibular, dentition.

a)



b)

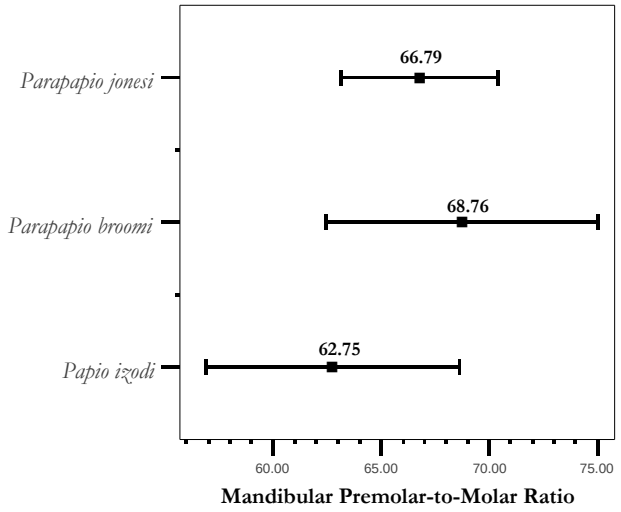


Figure 6-1. Premolar-to-Molar Ratios in Sterkfontein Papionins. Shown above the mean premolar-to-molar ratios for the three papionin taxa at Sterkfontein in the (a) maxillary and (b) mandibular dentition. Error bars represent the 95% confidence interval for the mean.

On the other hand, specimens attributed to both species of *Parapapio* at Sterkfontein, *Pp. jonesi* and *Pp. broomi*, display comparatively enlarged premolars relative the remainder of the posterior dentition. So, the relative size of the fourth premolar to the first, or second, molar was a secure way in arriving at taxonomic identifications among the papionins at Sterkfontein. In *Parapapio*, the premolar enlargement, as discussed here, is in respect to comparisons with *P. izodi*, and not an suggestion that *Parapapio* exhibits molarized premolars, as extant *Cercocebus* and *Mandrillus* do. Previously, *Cercocebus* had been identified at Makapansgat (Eisenhart, 1974), but no specimens exhibiting premolar-to-molar ratios similar to the extant *Cercocebus-Mandrillus* clade have been identified at Sterkfontein.

When compared to the data given by Fleagle and McGraw (2002), all Sterkfontein papionins exhibited P4/M1 morphology similar to the *Papio-Theropithecus-Lophocebus* clade and exhibit similar levels of variation (Table 6-2). At Sterkfontein, *P. izodi* was already exhibiting modern *Papio* premolar-to-molar proportions during the Pliocene, showing that this trait evolved before the origin of extant *Papio*. Moreover, the *Parapapio* groups, paticularly *Parapapio broomi*, were found to share a number of dental features in common with extant *Lophocebus*. For example, *Pp. broomi* and *Lophocebus* both share: (1) reduced M^3 distal lophs, as discussed in the next section and (2) similar premolar-to-molar ratios.

As a result, the *Parapapio* species at Sterkfontein appear to be too derived to have given rise to later *Papio* species. The early, small bodied species of *Papio* from Sterkfontein, *P. izodi*, was already diagnostically within the genus. Therefore, the divergence between the *Parapapio-Papio* groups must have occurred prior to Sterkfontein

Table 6-2. Degree of Premolar Molarization in Sterkfontein Papionins. For extinct taxa, the mean and standard deviation are given for both, maxillary and mandibular, toothrows. Sample size (N) is given in parentheses following extinct taxa descriptive statistics. P4/M1 Ratio calculated as: 100 x **(**(P4 m-d x b-l)/(M1 m-d x b-l)**)** following Fleagle and McGraw (2002).

[1] Extinct data from this analysis

[2] Extant data taken from Fleagle and McGraw (2002: Table 1)

		P^4/M^1	P_4/M_1
	Extinct[1]		
	Papio izodi ♂♀	56.1 ± 6.2 (18)	62.8 ± 7.0 (8)
	Parapapio broomi ♂♀	60.0 ± 5.7 (16)	68.8 ± 7.5 (8)
	Parapapio jonesi ♂♀	61.3 ± 6.3 (5)	66.8 ± 6.8 (12)
	Extant[2]		
Lophocebus – Papio – Theropithecus Clade	*Lophocebus albigena* ♂	58.6 ± 5.4	58.9 ± 5.5
	Lophocebus albigena ♀	57.2 ± 4.8	55.6 ± 7.9
	Papio hamadryas ♂	56.0 ± 5.5	60.1 ± 5.5
	Papio hamadryas ♀	56.7 ± 5.8	61.9 ± 11.5
	Theropithecus gelada ♂	59.0 ± 7.6	57.0
	Theropithecus gelada ♀	54.0	58.3
Cercocebus – Mandrillus Clade	*Cercocebus torquatus* ♂	77.9 ± 12.8	81.2 ± 11.7
	Cercocebus torquatus ♀	77.4	82.3
	Cercocebus agilis ♂	86.7 ± 5.9	88.9 ± 12.8
	Cercocebus agilis ♀	82.7 ± 7.8	86.0 ± 7.4
	Cercocebus atys ♂	78.7 ± 12	84.3 ± 7.9
	Cercocebus atys ♀	75.0 ± 4.6	79.1 ± 10
	Mandrillus sphinx ♂	84.2 ± 16.6	94.1 ± 15.1
	Mandrillus sphinx ♀	84.8 ± 3.3	88.4 ± 7.2
	Mandrillus leucophaeus ♂	81.5	80.6
	Mandrillus leucophaeus ♀	83.0	80.7
	Macaca nemestrina ♂	78.6	82.4
	Macaca nemestrina ♀	80.6	86.6

Member 2 times. However, the *Parapapio* groups may be ancestral to the *Lophocebus* species, as fossil representatives of this genus or its ancestors are currently rare (Groves, 1978, 2000). Further analyses may reveal the true relationship between the extinct *Parapapio* and the extant *Lophocebus* species.

Besides the above similarities to extant groups, the Sterkfontein papionins were also noted to share some morphological features with species from other South African sites. This analysis revealed some continuity across southern Africa from Taung to Makapansgat. However, in terms of taxa represented, Taung appears to be the most similar to the older members of Sterkfontein, Members 2 and 4. Yet, this does not fit with conventional wisdom, and therefore, an explanation of the problem follows below.

Taxonomic Relationships of Sterkfontein and Taung

Currently, only two taxa are confidently identified at Taung, *P. izodi* and *Pp. antiquus*. As shown here, *P. izodi* is one of the most commonly occurring taxa at Sterkfontein suggesting that there might a temporal and/or geographic link between the Sterkfontein and Taung fauna. Therefore, a brief reanalysis of the Taung cercopithecoids was completed focusing upon the Transvaal Museum, University of the Witwatersrand and South African Museum collections. The type specimen of *Pp. antiquus* is derived from the Taung sample, and initial analyses suggest that the Taung *Parapapio* shared many similarities with the Sterkfontein specimens Although Eisenhart (1974) admitted similarities between the *Pp. antiquus* and *Pp. broomi* dentition, they were still considered to be distinct taxon based upon cranial features. Additionally, Freedman (1957, 1965) suggested that *Pp. antiquus* could be distinguished from other taxa on its

possession of a distally reduced M^3. Both of these conclusions are rejected here based on the following arguments.

Out of five Taung *Pp. antiquus* specimens, the mesial loph was approximately 1.3 times larger than the distal loph (i.e. mesial breadth divided by distal breadth). In the same feature at Sterkfontein, the mesial loph was on average 1.2 times larger than the distal loph in the combined Member 2 and 4 *Pp. broomi* samples. The difference between the two samples, Taung (e.g. 1.3) and Sterkfontein (1.2) can be explained by the relative frequency of males in the two samples. In the Taung sample, four out of five specimens used to compute the relative size of the M^3 lophs were female. While on the other hand, the Sterkfontein sample included 22 specimens, most of which were of male or indeterminate sex.

The Taung sample shows that females display more greatly reduced M^3 distal lophs than males, and this is repeated in the Sterkfontein sample. For example, the ratio of mesial breadth-to-distal breadth in T 20, a female from Taung, was 1.39 while a male from Taung, SAM 5356, exhibited a mesial loph that was approximately 1.13 times larger than its distal loph. Interestingly, a male specimen, Swp 1728, exhibits one of the least reduced M^3's in the Sterkfontein sample, but still, displays a more reduced M^3 than its counterpart, SAM 5356, at Taung (e.g. 1.19 versus 1.13). One of the three Sterkfontein male specimens, Sts 534, exhibits a ratio (1.25) which falls within range of the Taung females (1.19-1.41). Additionally, female Sterkfontein specimens, such as Sts 388, Sts 397 and Sts 389, display mesial breadth-to-distal breadth ratios indistinguishable from those of the Taung females, T17, T20 and T16. Figure 6-2 shows a comparison between Sterkfontein *Pp. broomi* and Taung *Pp. antiquus* specimens.

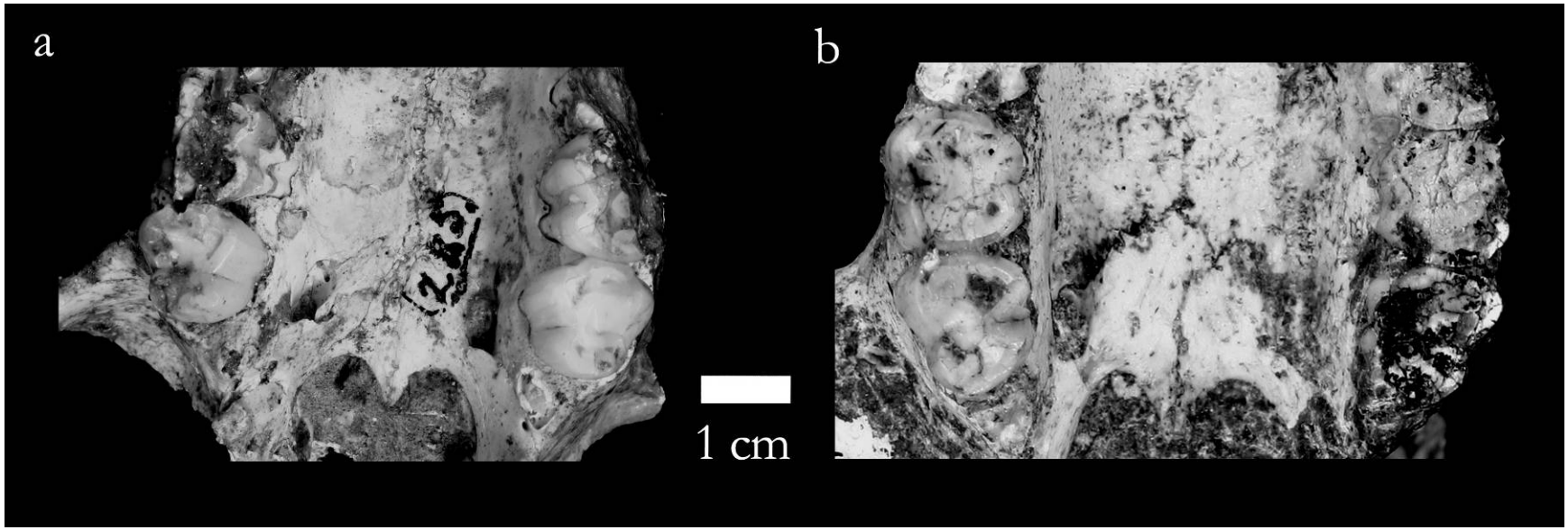


Figure 6-2. M^3 Distal Loph Reduction at Taung and Sterkfontein. Shown below are (a) T17, a female *Pp. antiquus* and (b) Swp 1728, a male *Pp. broomi.*

In these samples, the degree of reduction of the M^3 appears to be allometrically related with smaller individuals exhibiting higher degrees of distal breadth reduction. Therefore, it would follow that the Taung specimens exhibit a slightly more reduced M^3 than the Sterkfontein sample, because they are also slightly smaller in overall cranial size. The same allometric trend – larger overall size, slightly less reduced distal lophs – is reflected in the *Pp. broomi* material from Makapansgat. However, the degree of difference is not significant enough to distinguish the two taxa based upon this feature, as the samples exhibit considerable overlap. As a result, the suggestion is made here that the two species, *Pp. antiquus* and *Pp. broomi* are perhaps only regional variants of the same species. Additional support for this argument can be found in the cranial features of the *Pp. antiquus* group, as well.

Using the character suite outline in Table 6-1, *Pp. antiquus* appears to be most similar to the Sterkfontein *Pp. broomi* sample. These comparisons were based upon the edentulous *Pp. antiquus* type specimen, SAM 5364, and those specimens comparing favorably with the type. The *Pp. antiquus* samples was observed to display: (1) lightly developed supraorbital tori, (2) an anteorbital region with a gradual, but sometimes variable, drop, (3) well-developed maxillary ridges with moderately developed fossae, (4) a palate that is horse-shoe shaped, more elongated in males, (5) zygomatics which are antero-lateral fleeting and (6) premolar-to-molar ratios consistent with *Pp. broomi*. For comparison, Table 6-3 records selected premolar-to-molar ratios among a few of the South African sites displaying a range of cercopithecoid taxa.

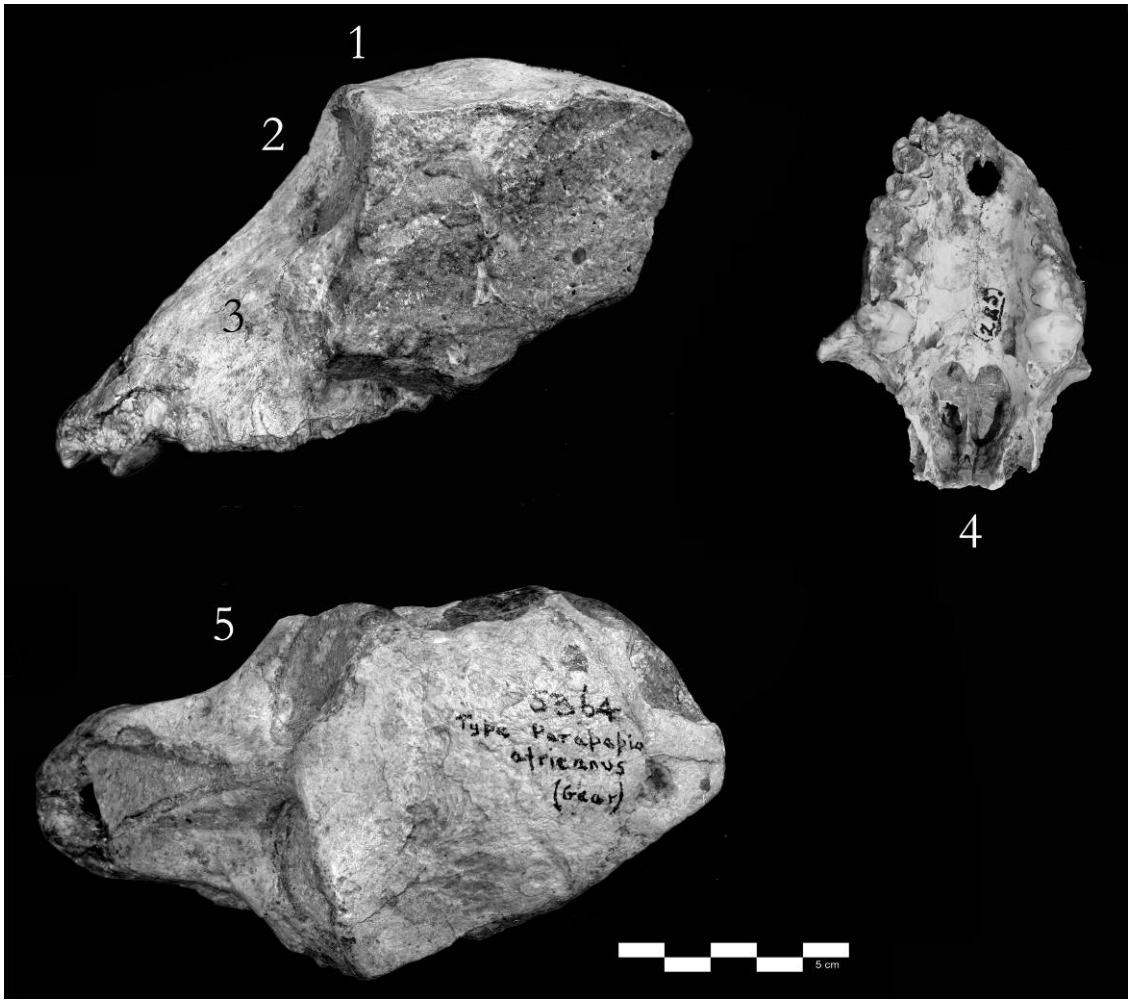


Figure 6-3. Diagnostic *Parapapio antiquus* Features. Shown above is the partial cranium of the type specimen, SAM 5364 and T17, a fragmentary muzzle. As discussed above, the features are: (1) lightly developed supraorbital tori, (2) anteorbital region with a gradual drop, (3) well-developed maxillary ridges with moderately developed fossae, (4) a palate that is horse-shoe shaped and (5) antero-lateral fleeting zygomatics.

However, one of the *Pp. antiquus* premolar-to-molar ratios is not consistent with the remainder of the Taung sample. SAM 11731 exhibits a premolar-to-molar ratio of 75.1, reminiscent of the *Cercocebus-Mandrillus* clade while other *Pp. antiquus* specimens exhibit ratios consistent with *Pp. broomi* and therefore, the *Lophocebus-Mandrillus-Theropithecus* clade. This may simply reflect a misidentification of SAM 11731 and/or possibly suggest the presence of an as yet unidentified species, as the two species at Taung, *P. izodi* and *Pp. antiquus*, display less molarized premolars. Further analysis is

needed to determine if a third species exists at Taung; however, the specimens of *Pp. antiquus*, as a group, are still more similar to the Sterkfontein *Pp. broomi* than any other South African fossil cercopithecoid. However, the problem remains that the provenance of much of the Taung deposit was not reliably controlled, and as will be shown in Chapter Seven, unreliable provenance can dramatically affect a site's taxonomy.

Table 6-3. Comparative Site Premolar-to-Molar Ratios. Listed below are premolar-to-molar ratios for the major South African sites and taxa. Shown are Kromdraai A, Makapansgat, Swartkrans and Taung. Species designations are the authors and were made during the course of this analysis.

	Species	P^4/M^1	P^4/M^1
KA 194	*P. angusticeps*	60.8	
KA 605	*G. major*	63.2	
MP 2	*Pp. broomi*	60	
MP 11	*Pp. jonesi*		69.5
MP 12	*Pp. jonesi*		55.4
MP 15	*Pp. jonesi*		68.5
MP 17	*Pp. broomi*	51.9	
MP 18	*Pp. jonesi*		66.2
MP 44	*T. darti*		71.1
MP 66	*T. darti*	59.7	
MP 72	*C. williamsi*		75
MP 77	*Pp. broomi*	60.1	
MP 87	*Pp. broomi*	63.6	
MP 174	*Pp. broomi*	50.6	
SAM 11731	*Pp. antiquus*		75.1
SK 408	*P. robinsoni*		71.5
SK 409	*P. robinsoni*		68.4
SK 546	*P. ingens*	61.7	
SK 604 a	*P. ingens*	62.1	
SK 14083	*P. robinsoni*		66
T 10	*Pp. antiquus*	62.8	
T 17	*P. izodi*	65.7	
T 88-17	*Pp. antiquus*	61.9	
TP 89-154	*Pp. antiquus*	65.8	

Based upon these observations, *Pp. antiquus* currently appears to have been more geographically distributed than previously concluded (i.e. from Taung to Sterkfontein to Makapansgat). A trend in overall size was also detected ranging from Taung, as the smallest of the group to Makapansgat, the largest. The *Pp. broomi* material from Sterkfontein falls directly between the two sites in both morphology and location. Therefore, it is suggested here that the *Pp. antiquus* and *Pp. broomi* samples do in fact belong to the same species, *Pp. broomi.* This taxonomic designation follows the Principle of Priority as outlined by the International Code of Zoological Nomenclature (ICZN). In this scenario, *Pp. broomi*, a junior synonym for *Pp. antiquus*, takes precedence because of its widespread usage in the literature. Recommendations here would be to consider *Pp. antiquus*, a *nomen oblitum*[2] while replacing it with *Pp. broomi*, a *nomen protectum*[3].

As such, the following names are suggested for the *Pp. broomi* groups: (a) Taung – *Pp. broomi antiquus* (Haughton, 1925) and (b) Sterkfontein and Makapansgat – *Pp. broomi broomi* (Jones, 1937). The sub-species' names reflect the taxonomic history of the groups and the conservativeness of sub-species designations proposed here. Morphologically, the *Pp. broomi* sub-species compare well with the main difference simply being slight variations in overall size, as mentioned previously. Nevertheless, until the exact nature of the Taung *Pp. broomi* specimens can be determined – and the existence of a third species be answered – the sub-species designations should be utilized.

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[2] A name that has priority for a taxon, but is nevertheless not used in order to continue usage of a widely used and accepted name.

[3] A name given precedence over an unused senior synonym which has been designated a *nomen oblitum*.

CHAPTER SEVEN
THE *P. H. ROBINSONI* PROBLEM AND THE FATE OF *PP. WHITEI*

At Swartkrans, the pioneering work of C.K. Brain began a period of more enlightened views of cave site formation and taphonomy in South Africa. As Brain noted, the complex nature of cave sites brings with it a set of unique problems (see Brain 1981). These may include difficulties in identifying: (1) food remains resulting from carnivore activity, (2) food remains resulting from hominid activity, (3) the role of porcupine and owls, and ultimately, (4) the complex stratigraphic relationships of assemblages within the cave, itself. Depending upon local factors, cave sites may form through a varying combination of these factors, and perhaps, some not discussed here. For example, Member 2 of the Sterkfontein Formation appears to have been formed as a result of a natural occurring death-trap (Pickering et al., 2004a) while evidence from Member 4 suggests that carnivores played a larger role in its accumulation (Pickering et al., 2004b).

As a result, taxonomists must take into account the role of taphonomy in the formation of their sample, most especially when discussing questions of faunal biodiversity. However, Brain (1981) was aware that natural factors were not the only ones that must be accounted for in studies of this nature. Brain (1981) proposed the existence of a potential bias against post-cranial elements in early Sterkfontein

collections, which was attributed to the ease with which cranial elements could be identified and collected. When you factor in the long history of sites, like Sterkfontein and Taung, sample consistency may become an issue. Provenance in early excavations may not have been as tightly controlled as that of the last 40 years.

The Presence of an Artificial Collection Bias

Aware of the potential bias, this analysis considered the problem posed by Brain (1981). Was the Sterkfontein sample biased in some artificial way? My analysis corroborates Brain's assertion, as a clear and determinable bias was observed in the fossil cercopithecoid sample from Sterkfontein. Whether this bias is also reflected in other portions of the Sterkfontein sample (i.e. carnivore, hominid, etc) remains to be answered. However, the evidence would suggest that the bias is not restricted to the non-hominid primate collections.

In this analysis, the question of bias was limited to the cercopithecoid sample, only. The numbers of cranial and postcranial element specimens were calculated for Member 2 (c. 4.0 – 3.0 Ma.), Member 4 (c. 2.8 – 2.6 Ma.) and Member 5 (c. 2.0 – 1.4 Ma.). Comparisons of the observed values revealed a strong predominance of cranial specimens in the earlier (pre-1966) Sts collections. Of the 884 identifiable primate specimens from the Sts sample, only 50, less than 6%, of those were postcranial (Figure 7-1). In comparison, the Swp sample (post-1966) contained 2168 identifiable primate elements. Of those, 1446 were craniodental specimens and 722 were postcranial specimens. So while the post-1966 collection is approximately 2.5 times larger than the

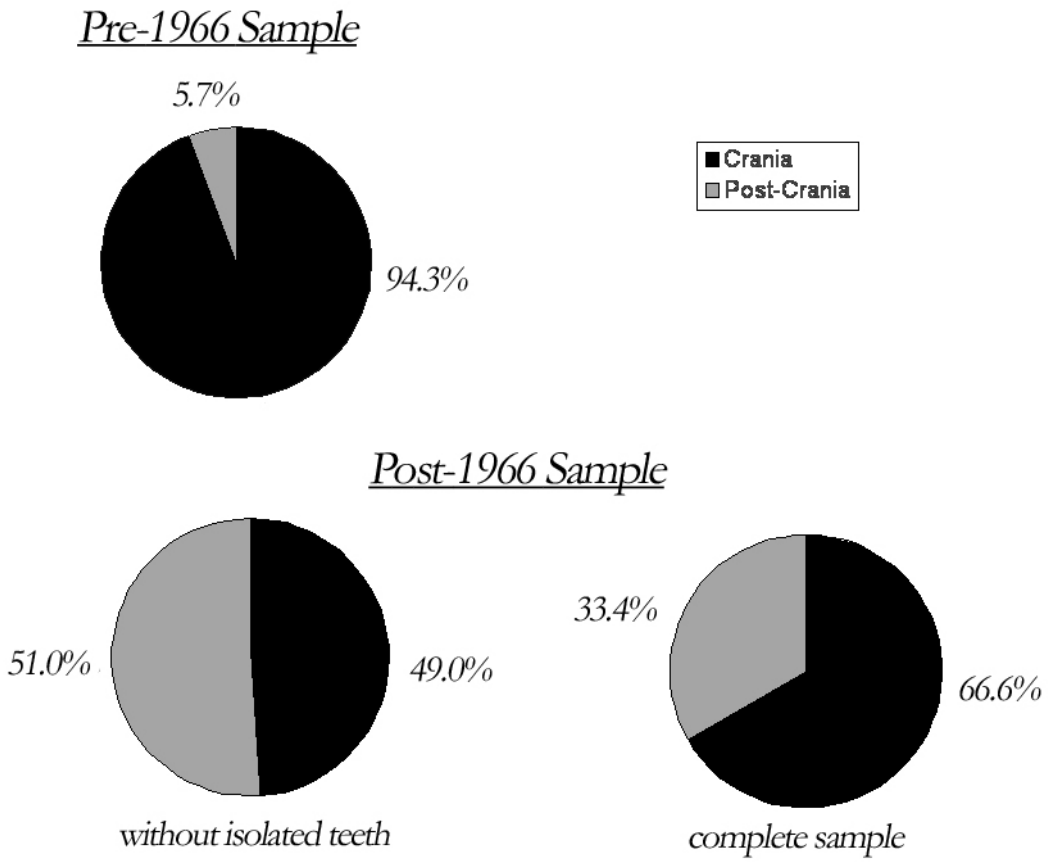

Figure 7-1. Sterkfontein Collection Comparison. Cranial-to-postcranial element percentages show a clear and determinable bias against postcranial elements in the pre-1966 collection.

pre-1966 sample, the post-1966 primate post-cranial collection is nearly 14.5 times larger.

When the isolated teeth are removed from both collections, the cranial to post-cranial ratio from the Swp (post-1966) sample is nearly 1:1; while a 20:1 ratio is observed in the Sts (pre-1966) sample. Neither ratio approximates the value expected from the deposition of complete primate skeletons. The divergence from the expected ratio in the Swp sample might be explained with reference to density-mediated attrition, while analyst selectivity is implicated in the clear bias for more easily identified skeletal

elements (i.e. craniodental remains) that exist in the Sterkfontein Sts sample. Importantly, this collection bias has significant implications for previously published taxonomies of fossil primates from South Africa. The obvious effect of irregular collection practices is that specimens may be identified in samples in which they did not naturally occur. As a result, specimens may be attributed to specific geological members without much stratigraphic control, and in South Africa, cercopithecoid species have been used, somewhat successfully, to relatively date the sites in Gauteng, the North West Province and the Northern Province. Therefore, the reliability of species identification depends upon the homogeneity of the fossil sample from which it is taken. A bias may not only affect concepts of species richness at sites, but may potentially pose problems for biostratigraphic dates when the taxa in question are utilized. Nowhere is this more evident than when considering the large-bodied papionins and their occurrence in Member 4 of Sterkfontein.

The Papio robinsoni *problem*

A recent analysis (Berger et al., 2002) argued that the presence of large-bodied papionins, most specifically *P. h. robinsoni*, signified a potentially young age (~ 1.5 Ma) for Member 4 of the Sterkfontein Formation. However, as presented here, the occurrence of *P. h. robinsoni* appears to be the result of the artificial collection bias, as discussed above. Specimens attributed to *P. h. robinsoni* do not exist in the Swp (post-1966) sample, but only in the artificially biased Sts or Sp samples. An example is Sp 1, a large-bodied papionin, from the biased pre-1966 collection whose size rivals that of males from extant *Papio* samples (Figure 7-2). The large body size of extant *Papio* and some Sp and/or Sts specimens, such as Sp 1, is in dramatic contrast to the *Papio* specimens observed in the

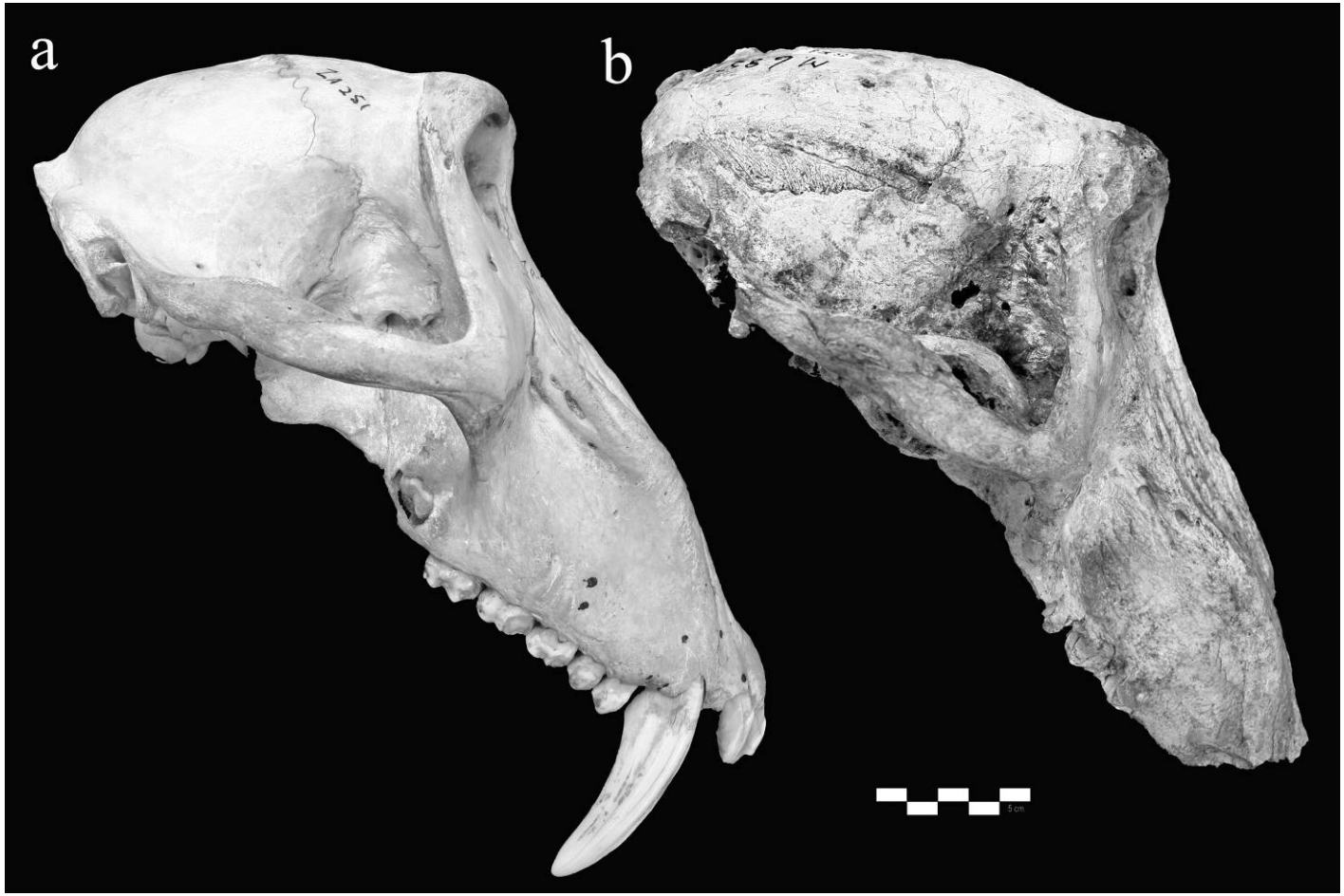

Figure 7-2. Large-bodied Papionin Comparison. Shown are: (a) Za 251, a male *Papio hamadryas ursinus* and (b) Sp 1, an unidentified large-bodied *Papio*. The provenance of Sp 1 is questionable and derives from the pre-1966 Sterkfontein collections. The extant specimen, Za 251, is a young adult male.

Swp (post-1966) collection (Figure 7-3). However, Sp1 is not an isolated example. Sts 365, a male mandible, is close in both size and morphology to the mandible of Za 251, an extant male *Papio* (Figure 7-4c). Sts 365, also, exhibits a modern-like sectorial premolar exceeding its complement in Za 251 in overall size. Additionally, Sts 265, a right maxillary fragment, exhibits an M^2 and M^3 which is similar in morphology to SB 7, the type specimen of *P. (Dinopithecus) ingens*. Consequently, large-bodied papionins have been identified at Sterkfontein, but unfortunately, only in the pre-1966 (Sts or Sp) collections of Member 4 – collections with a clear artificial bias.

Papio hamadryas robinsoni and *Theropithecus oswaldi* have been documented in the later occurring Member 5 deposit at Sterkfontein (Delson, 1984; Pickering, 1999). However, their presence in the older deposits of Member 4, must now be questioned. To date, no specimens representing any of the large-bodied species of *Papio* or *Theropithecus* have been identified in the post-1966 (i.e. Swp) Member 4 sample. Specimens attributed to large-bodied species in previous analyses (e.g. Berger et al., 2002) that are derived from the post-1966 Swp collection were simply misidentifications. For example, Swp 31, a *P. izodi* specimen, exhibits a fragmented and distorted palate which led to its previous attribution to the large-bodied *P. h. robinsoni*. However, as previously discussed in Chapter Five, an 8mm section of breccia separates the palate into left and right halves; thereby, giving the false impression of an overly broad palate (Figure 7-5). When the breccia is accounted for, the palate matches well with the type specimen of *P. izodi*, TP 7 (Figure 5-3). Features, such as a horse-shoe shaped palate, the nature of the maxillary fossae and dental measurements, indicate that this specimen is a small-bodied *P. izodi*, not the much larger *P. h. robinsoni*.

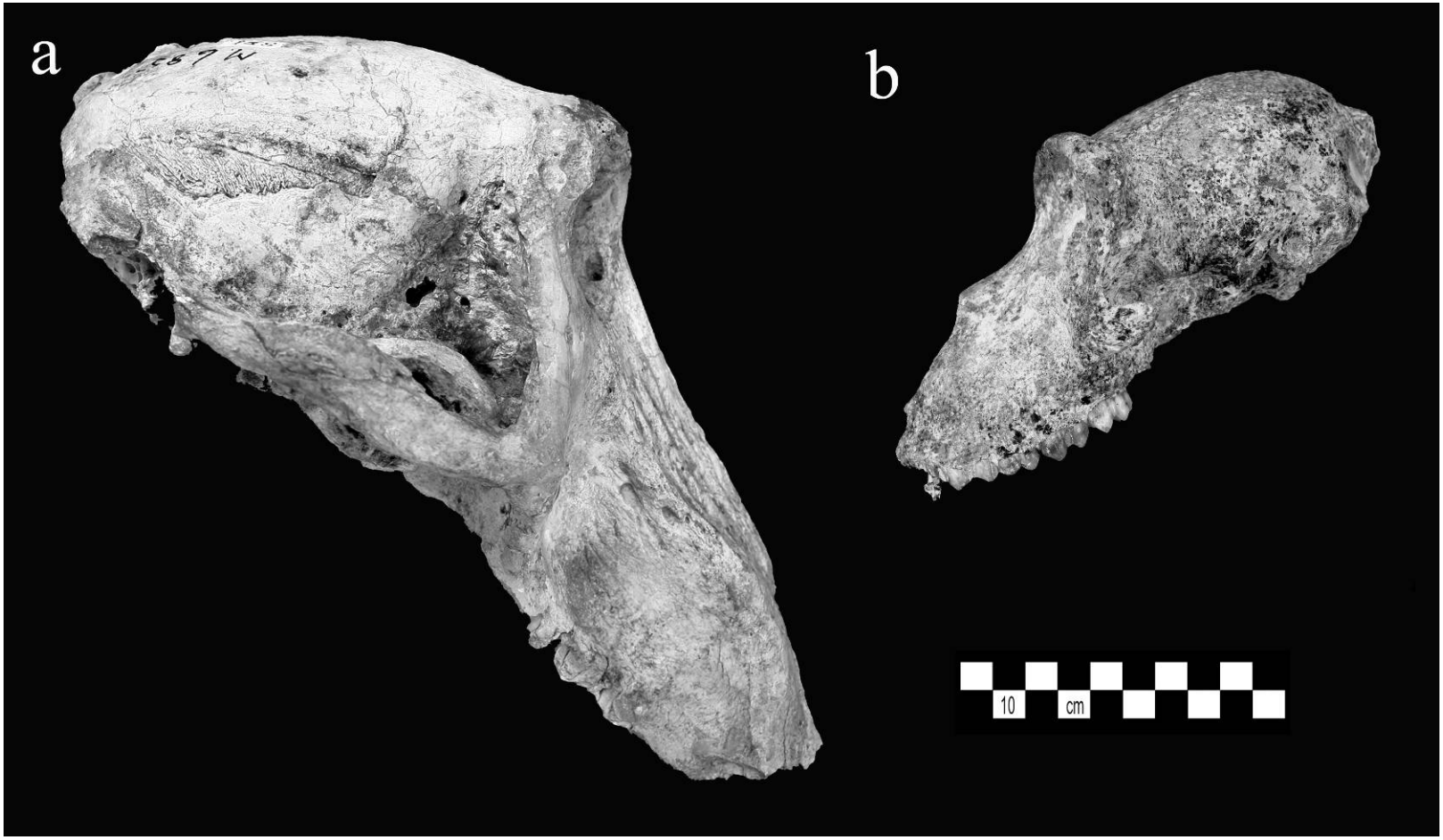

Figure 7-3. Example of Pre- and Post-1966 Papionins. Shown here are: (a) Sp 1, an unidentified large-bodied papionin and Swp Un2, a male *P. izodi*, from Member 2. Sp 1 is representative of some of the large-bodied specimens identified in the pre-1966 collections while all specimens attributed to *Papio* from the post-1966 excavations are more similar in size to Swp Un2.

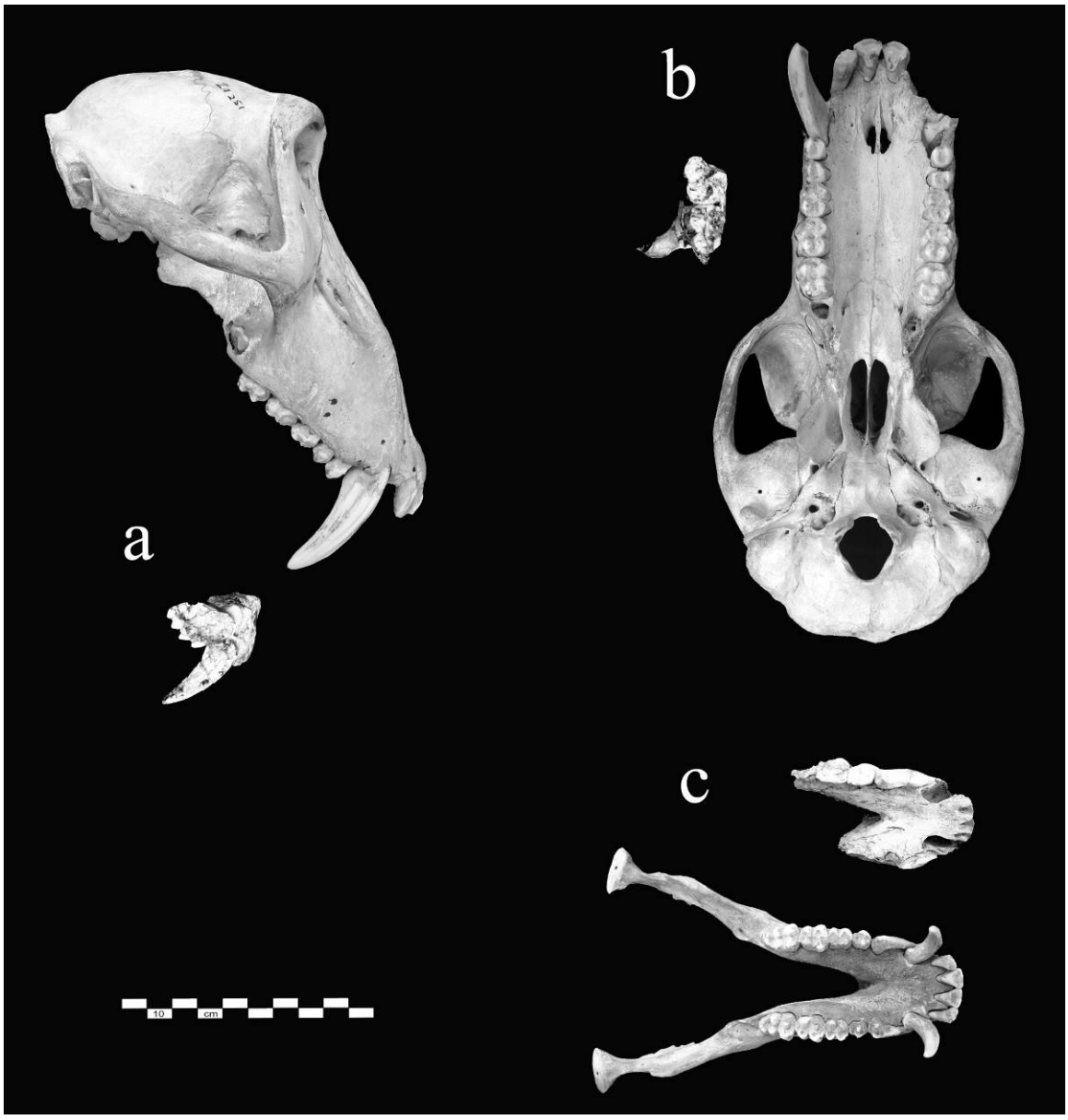

Figure 7-4. Large-bodied Papionins from the Biased Sts Sample. All of the above comparisons are with Za 251, an extant male *Papio*. Shown above are (a) Sts 350 and Za 251 in norma lateralis, (b) Sts 265 and Za 251 in norma basalis and (c) Sts 365 and Za 251 in occlusal view.

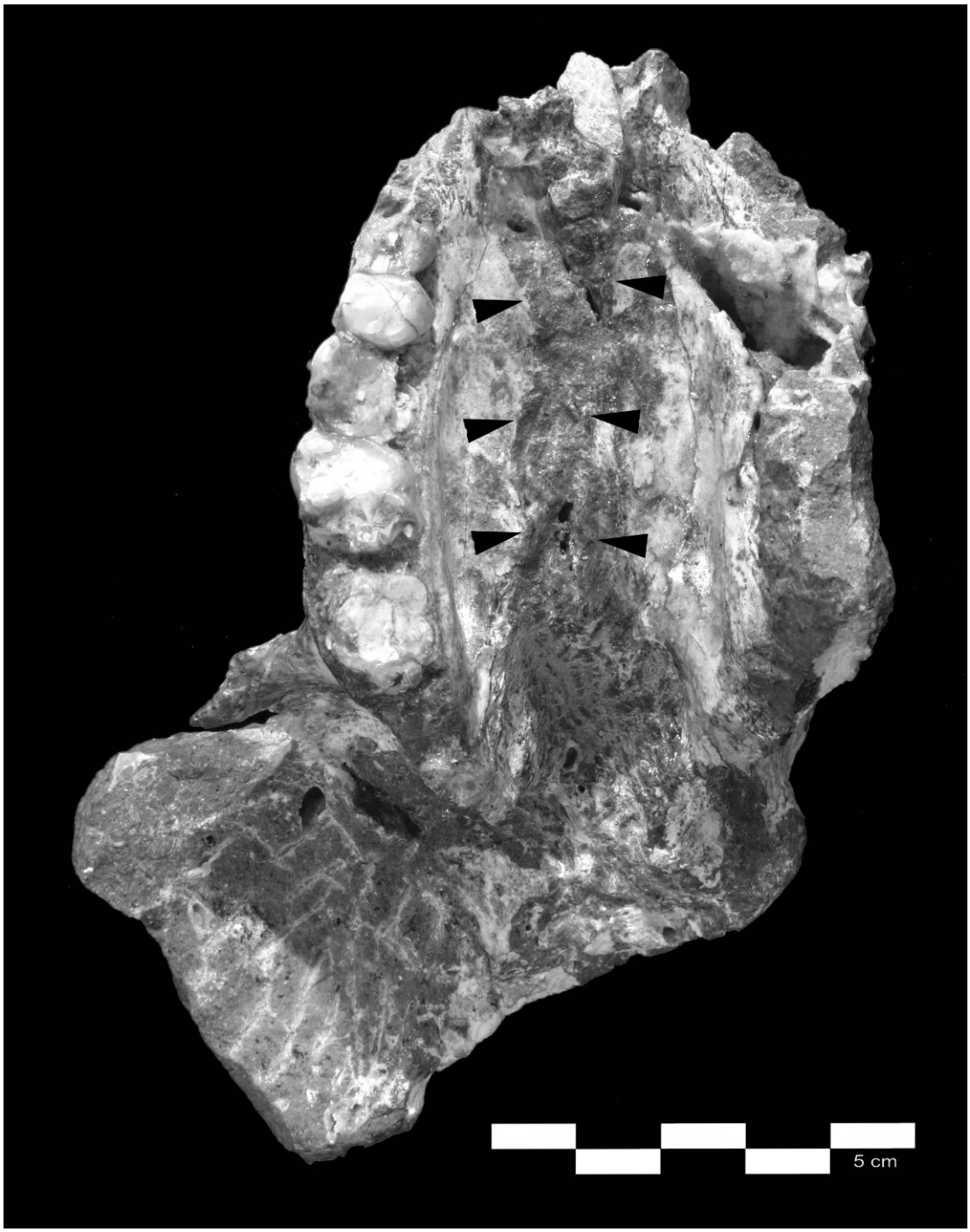

Figure 7-5. Swp 31 - A Misidentified *Papio izodi.* Shown above is Swp 31, a specimen previously attributed to *P. h. robinsoni*. Note, breccia separating the palate into left and right halves. Arrowheads mark the outer margins of the breccia. See Chapter Five for full discussion and Figure 5-3 for comparison between Swp 31 and TP 7, the *P. izodi* type specimen.

Therefore, it can be argued that the large-bodied *Papio* species are observed in the Sterkfontein Member 4 collections only under two conditions. The first is that previous analyses assumed the pre-1966 collections were a homogenous sample, but as shown earlier (Heaton and Pickering, 2005), a clear artificial bias exists in the pre-1966 collections. As previously mentioned, Robinson (1962) recognized some Member 4 material during his Extension Site excavations in 1957-1958. It would follow that some Member 5 material may have worked its way into the pre-1966 type site excavation material. This is supported by the observation that none of the large-bodied specimens attributable to *P. h. robinsoni* have been identified in the post-1966 material although some misidentifications of this species for Member 4 have been made previously (Berger et al., 2002; Delson, 1984; Eisenhart, 1974). Provenance appears to have been a problem for the earlier collections, and therefore, a critical view should be taken when utilizing the pre-1966 collections for taxonomic analyses. Some pre-1966 Sp material is only cataloged as 'Type Site?', or in some cases, simply 'Sterkfontein'. Future taxonomic studies must account for this discrepancy and control for levels of security in provenance attribution. Analysts must be careful in assuming that the pre- and post-1966 collections are: (1) homogenous, (2) equal and (3) representative.

As a result of the artificial collection bias, some specimens in the post-1966 sample were misidentified based on the idea that the Sterkfontein collections (pre- versus post-1966) were homogenous. Specimens in the post-1966 sample which appeared to possess a large dentition were often attributed to *P. h. robinsoni* without any additional supporting morphology, as a result of the large-bodied specimens being identified in the pre-1966 material.

Consequently, all specimens previously attributed to *P. h. robinsoni* were observed to fall into one of two groups during this analysis. The first group was comprised of specimens that *do* appear to be large-bodied specimens (e.g. *P. h. robinsoni* or *P. ingens*), but which were derived only from the pre-1966 material. On the other hand, the second group was comprised of specimens who were attributed to *P. h. robinsoni*, but upon closer analysis, were confidently attributable to one of the other papionin species at Sterkfontein. Typically, this second group of misidentified specimens is now attributable to either, *Pp. broomi* or *P. izodi*. Prior to this analysis, only one specimen, Sts 262, representing *P. izodi* had been identified in the Member 4 material (Eisenhart 1974; McKee 1993). Thus, specimens exhibiting *Papio*-like morphology were often put into other species categories, usually *P. h. robinsoni*, but these identifications were in error, and most were in fact *P. izodi* individuals. As noted in Chapter Five, *P. izodi* is now the second most commonly occurring papionin taxon at Sterkfontein.

Additionally, misidentifications can cause difficulties in analyses based upon the taxonomic identification of individual specimens. A recent analysis (El-Zaatari et al., 2005) investigating the dietary specializations of South African cercopithecoids utilized several individuals from Sterkfontein. Among those specimens were individuals attributed to *P. h. robinsoni*. One of the specimens used, Sts 263, is from the biased pre-1966 collection while the other is attributed here to *P. izodi*. Therefore, any differences in taxonomic identification can produce misleading conclusions, if for example, the taxon is found to be based upon misidentified specimens.

Upon reanalysis, it was found that *P. h. robinsoni* was not the only problematic taxon at Sterkfontein. New evidence suggested that the taxonomic status of *Pp. whitei*

needed reassessing – the topic of discussion in the next section. Again, the circumstances were complicated by the artificial collection bias previously discussed.

The Fate of Parapapio whitei

As mentioned in Chapter Three, *Pp. whitei* is here concluded to be an invalid taxon. Eisenhart (1974) had previously questioned the taxonomic validity of the group based upon two observations. The first was that females of *Pp. broomi* had larger dental dimensions than their male *Pp. whitei* counterparts. This could have possibly resulted from either misidentifications and/or unidentified taphonomic factors resulting in the preservation of fewer *Pp. whitei* males. Eisenhart's second reason for questioning the validity of *Pp. whitei* was that many of the *Pp. whitei* specimens displayed features consistent with *P. h. robinsoni*. It now appears that the species, *Pp. whitei*, is actually comprised of specimens attributable to other species identified at Sterkfontein.

For instance, some portion of the *Pp. whitei* sample can be identified as the species, *Pp. broomi*, while others are identified as *P. izodi*. Males of *Pp. broomi* sample were often identified as *Pp. whitei* specimens, because as defined, *Parapapio* was a non-sexually dimorphic species. As revealed here, males were actually substantially larger than females, but the degrees of difference were in size only; cranial shape was largely unaffected by the dimorphic differences. However, the degree of sexual dimorphism does not approach that observed in extant *Papio*. Specimen misidentification undoubtedly resulted in the abnormalities in tooth sizes (i.e. females with larger teeth than males) observed by Eisenhart (1974).

Moreover, some *P. izodi* specimens were categorized as belonging to the *Pp. whitei* group, as a result of their larger molar size. Previous taxonomic analyses (Eisenhart,

1974; Freedman, 1957; Freedman and Stenhouse, 1972) depended heavily upon molar dimensions, as a means to distinguish among the *Parapapio* of Sterkfontein. Often, complete crania were not preserved in the Sterkfontein collection, and as a product, *Pp. whitei* became a taxon which was a junk category for specimens with large tooth sizes. The result was a group with ill-defined features and ultimately, the persistence of an invalid taxon.

At the time of its naming, Broom (1940) did not have a complete cranium with which to compare the type mandible of *Pp. whitei*, Sts 563. However, recent excavations have recovered crania exhibiting typical *Pp. broomi* morphology. A fragmentary male *Pp broomi antiquus* from Taung fits well with the type of "*Pp. whitei*" (Figure 7-6). For illustrative purposes, the cranium from Taung was used, in lieu of a specimen from Sterkfontein, because it is one of the most complete specimens exhibiting *Pp. broomi broomi*-like morphology. Furthermore, as mentioned in Chapter Six, the *Pp. broomi antiquus* sample from Taung is nearly indistinguishable from the Sterkfontein *Pp. broomi broomi* and can be useful in demonstrating morphological features found in the groups (i.e. *Pp. broomi*).

The addition of the "*Pp. whitei*" material to the *Pp. broomi* hypodigm did not significantly increase the range of dental dimensions in the *Pp. broomi* sample. When compared to Freedman's (1957) analysis, the range of dental measures for *Pp. broomi* in this study only slightly increased when evaluating molar dimensions (Table 7-1). In some cases, the range of the *Pp. broomi* sample decreased here, usually only by tenths of a millimeter. In a few cases, the dimensional range increased by over one millimeter with the largest single increase being 1.4 millimeters over that of Freedman's (1957) analysis.

As a result, there is no support for the presence of an additional *Parapapio* species (i.e. "*Pp. whitei*") and no feature which can be used to demonstrate that "*Pp. whitei*" was a distinct species.

Returning again to a question posed earlier (Eisenhart 1974), are portions of the "*Pp. whitei*" collection composed of members of the species, *P. h. robinsoni*? This analysis suggests that this is not the case. *P. h. robinsoni*, a valid species, does not exist at Sterkfontein, contrary to previous analyses (Berger et al., 2002; Delson, 1984; Eisenhart, 1974; McKee, 1993). During the course of this analysis, it was found that all of the Swp material attributed to *P. h. robinsoni* was attributable to other species at Sterkfontein, in most cases, *P. izodi*. The remainder of the Sterkfontein sample was collected prior to 1966 (e.g. Sts and Sp). It was in these pre-1966 samples that the only specimens attributable to a large *Papio* species were found. Additionally, evidence suggests that an artificial bias was operating the earlier collections. The pre-1966 sample is heavily biased against post-crania with cranial specimens dominating 20-to-1. Both of these observations have led to the conclusion that the pre-1966 collections are artificially biased; potentially a collector bias toward more readily identifiable elements (i.e. cranial and dental fragments). Consequently, *P. h. Robinson's* presence at Sterkfontein is highly questionable and improbable.

Thus, Eisenhart (1974) was correct to question the validity of "*Pp. whitei*", as its members do indeed belong to other species. However, all are attributable to *Pp. broomi* and *P. izodi*, not *P. h. robinsoni*. Subsequently, *Pp. whitei* can no longer be argued to represent a distinct taxon, and as Sterkfontein serves as the type-site for the species, *Pp.*

Figure 7-6. Composite of *Parapapio broomi antiquus Cranium* and "*Parapapio whitei*" Mandible. Shown above is a Taung specimen, exhibiting the 'typical' *Pp. broomi* cranial morphology in articulation with type specimen mandible of *Pp. whitei*, Sts 563. Note, the Taung specimen is fragmented in the anteorbital region, but maintains much of the diagnostic muzzle morphology.

Table 7-1. Study Comparison of Dental Measures for *Parapapio broomi.* The data shown below demonstrate the range of Freedman's (1957) *Pp. broomi* molar measurements. The *Pp. broomi* sample of this analysis includes some specimens previously attributed to *Pp. whitei.* Note, the dimensional increases are typically less than one millimeter on one or both ends of the range (measurements below are in mm).

	This study		**Freedman 1957**	
	Minimum	*Maximum*	*Minimum*	*Maximum*
M^2 Mesial Breadth	9.4	12.8	10.3	12.1
M^2 Distal Breadth	8.7	12.2	9.8	11.1
M^2 Length	8.1	12.8	9.8	11.9
M^3 Mesial Breadth	9.2	13.7	9.3	12.3
M^3 Distal Breadth	7.4	11.2	7.9	10.3
M^3 Length	9.1	12.3	10.4	12.1
M_2 Mesial Breadth	9.5	11.9	9	10.2
M_2 Distal Breadth	8.9	11	8.5	10.6
M_2 Length	9.6	12.6	10.5	12.4
M_3 Mesial Breadth	8.6	11.4	9.0	10.5
M_3 Distal Breadth	7.4	10.1	8.4	10.0
M_3 Length	12.5	15.4	13.4	15.3

whitei must be considered both a *nomen nudum*[4] and *nomen dubium*[5].

Intriguingly, only sites which possess individuals attributed to "*Pp. whitei*" are sites at which *Pp. broomi* also occurs. Preliminary analyses of the Makapansgat and Bolt's Farm *Pp. whitei* specimens suggest that their taxonomic assignments are questionable, as well, and most probably belong to the species *Pp. broomi.* Therefore, no evidence exists which suggests that a species of *Parapapio* larger than *Pp. broomi* subsisted.

In comparisons, specimens from Makapansgat and Bolt's Farm are typically slightly larger than the specimens from Sterkfontein and Taung (i.e. *Pp. broomi*). At Bolt's

[4] A name that has been published or mentioned without a proper and complete description.

[5] A name that is of unknown or doubtful application.

Farm, this is most probably due to its later date, but at Makapansgat, age is not a significant factor in the difference. Rather, a cline appears to exist across the *Pp. broomi* range. The smallest *Pp. broomi*-like specimens occur at Taung, and the largest at Makapansgat. Based upon current evidence, the *Pp. broomi* sample from Sterkfontein appears to more closely resemble the Taung specimens in size and shape, but is only slightly larger. At Bolt's Farm, *Pp. broomi* appears to be slightly more robustly built and may be more derived than the Sterkfontein specimens. However, relatively few specimens are available for comparisons between the Bolt's Farm and Sterkfontein samples. Among these South African sites, the size differences may be a reflection of the spatio-temporal distribution of *Pp. broomi,* as each group adapted to local conditions, but additional research is needed to understand the exact nature of the *Pp. antiquus/broomi*'s continuum.

Revised Taxonomic List for Sterkfontein

As a result of the invalidation of *Pp. whitei* and the recognition of an artificial collection bias, a revised taxonomic list for Members 2 and 4 of the Sterkfontein Formation is necessary (Table 7-2). In the four studies considered here (Delson, 1984; Eisenhart, 1974; Freedman, 1957; Pickering et al., 2004a), the number of papionins believed to have occurred during Member 4 range from three to six species. During the course of this analysis, it was found that the species composition of Member 2 and Member 4 were remarkably similar. Only, two species of *Parapapio* are now thought to exist in South Africa, and both species, *Pp. broomi* and *Pp. jonesi*, occur in Sterkfontein Members 2 and 4. Additionally, the small-bodied *Papio* species, *P. izodi*, has now been securely identified in the Sterkfontein deposit.

The resulting conclusion is that only three papionin species, *Pp. broomi broomi*, *Pp. jonesi* and *P. izodi* can confidently and securely be identified in the early (pre-2.0Ma) deposits of Sterkfontein (i.e. Members 2 and 4). Now with an updated taxonomic list, the aim of the next chapter is to discuss Sterkfontein's chronological position and evaluate the significance of cercopithecoids as biostratigraphic indicators in South Africa.

Table 7-2. Taxonomic List of Major Studies of the Sterkfontein Papionins. Note, list below does not include the extinct colobine species, *Cercopithecoides williamsi* which has been identified in all studies of the Sterkfontein cercopithecoids. Presently, no other fossil colobine appears to exist in southern Africa.

	Freedman (1957)	**Eisenhart (1974)**	**Delson (1984)**	**Pickering et al (2004)**	**This study**	
	Member 4	Member 4	Member 4	Member 2	Member 2	Member 4
?*Cercocebus* sp.			**X**			
Papio izodi			**X**	**X**	**X**	**X**
Papio hamadryas robinsoni		**X**	**X**			
Papio sp.		**X**				
Parapapio broomi (small)		**X**				
Parapapio broomi	**X**	**X**	**X**	**X**	**X**	**X**
Parapapio jonesi	**X**	**X**	**X**	**X**	**X**	**X**
Parapapio whitei	**X**	**X**	**X**			

CHAPTER EIGHT
BIOSTRATIGRAPHY

In order to understand Sterkfontein's place among other South African cercopithecoid and hominid bearing sites, a biostratigraphic comparison of nine major sites was conducted (Table 8-1). Some sites were further sub-divided into stratigraphic members (i.e. Sterkfontein) while some were represented by several localities (i.e. Kromdraai A and B). A total of 17 members and/or localities were consulted and the taxa comprising each member/locality were identified.

The most commonly occurring taxa at all sites was the sole South African fossil colobine, *C. williamsi* (Table 8-2). Out of the sites considered, *C. williamsi* was identified at some level in seven of the eight sites considered. The only site which did not contain any identifiable *C. williamsi* specimens was Taung. On the other hand, some cercopithecoid species, for example *Gorgopithecus major*, were identified only at single site.

Table 8-1. Sites Utilized for Biostratigraphic Comparison.

Site	Member/Locality
Bolt's Farm	Pit 6, Pit 23
Drimolen	-
Kromdraai	A, B
Makapansgat	Mbrs 2, 3, 4
Schurveburg	-
Sterkfontein	Mbrs 2, 4, 5
Swartkrans II	-
Swartkrans	Mbrs 1, 2, 3
Taung	-

Taking into account species distribution, the South African cercopithecoid sites appear to be divided into two main taxa groups, UA 1 and UA 2 (Table 8-3). The older sites, and therefore species, are found in the UA 1 group while the more recent occurring taxa fall into the UA 1 group. Small-bodied papionin species, such as *Pp. broomi* and *P. izodi*, dominate UA group 1; on the other hand, sites containing large-bodied papionins, such as *T. oswaldi* and *P. h. robinsoni*, fall into the later-occurring UA 2 group. Within each UA group, several taxa that could serve as diagnostic biostratigraphic indicators were identified.

Table 8-2. Taxon Frequency. Shown are taxa present at the nine major sites in South Africa considered in this analysis. For the purpose of this computation, Swartkrans and Swartkrans II were combined resulting in only eight sites, rather than the nine shown in Table 8-1. *Cercopithecoides williamsi* was identified at seven of the eight localities – Taung being the exception.

Species	Localities
Cercopithecoides williamsi	7
Papio robinsoni	5
Parapapio broomi	5
Parapapio jonesi	4
Papio izodi	3
Papio (Dinopithecus) ingens	2
Theropithecus oswaldi	2
Gorgopithecus major	1
Papio angusticeps	1
Theropithecus darti	1

Table 8-3. Unitary Associations. Analysis of taxa show that South African cercopithecoids can only be divided into two broad association groups. Unitary Association 1 (UA 1) contains the older taxa while UA 2 contains the younger taxa. The number of taxa in each UA group is denoted by N.

Unitary Association	N	*Pp. broomi*	*P. izodi*	*T. darti*	*C. williamsi*	*Pp. jonesi*	*T. oswaldi*	*P. angusticeps*	*P. ingens*	*P. robinsoni*	*G. major*
2	7				■	■	■	■	■	■	■
1	5	■	■	■	■	■					

Although the cercopithecoid species could not be sub-divided into finer biostratigraphic categories, it was observed that some taxa were better chronological indicators than others. The numerical ranges for each taxon were computed and the First and Last Unitary Association group appearances were calculated (Table 8-4). Two species, *C. williamsi* and *Pp. jonesi*, were identified in both Unitary Association groups, UA 1 and 2. Therefore, *C. williamsi* and *Pp. jonesi* could not reliably be used as stratigraphic indicators. However, three of the ten taxa were identified in only the first UA group (UA 1). These three taxa, *Pp. broomi*, *P. izodi* and *T. darti*, when identified together or separately indicate sites which are among the earliest in South Africa. *Theropithecus darti* was only identified at Makapansgat while *Pp. broomi* and *P. izodi* were identified at sites, such Sterkfontein (Members 2 and 4) and Taung. As mentioned previously, UA 1 appears to be dominated by small-papionins.

Table 8-4. Numerical Ranges for Cercopithecoid Taxa. As shown below, some taxa are UA specific while others, such as *Pp. jonesi* and *C. williamsi*, are identified in both UA groups. Table gives the first appearance and last appearance UA for each species.

Taxon	First UA	Last UA
Gorgopithecus major	2	2
Papio (Dinopithecus) ingens	2	2
Papio angusticeps	2	2
Papio robinsoni	2	2
Theropithecus oswaldi	2	2
Cercopithecoides williamsi	1	2
Parapapio jonesi	1	2
Papio izodi	1	1
Parapapio broomi	1	1
Theropithecus darti	1	1

In comparison, the large-bodied papionins, *G. major*, *P. ingens* and *P. h. robinsoni* were only identified in the UA 2 cercopithecoid group. Two small-bodied papionins

were identified in UA 2 (e.g. *P. angusticeps* and *Pp. jonesi*), but were usually, the only small-bodied taxon at their respective sites.

However, all of the localities considered here could be placed uniquely into one of the two UA categories based upon taxa present within the sample (Table 8-5). Sites containing *Pp. broomi*, *P. izodi* and/or *T. darti* were placed within the UA 1 group, and this included sites, such as Sterkfontein Members 2 and 4, Makapansgat and Taung[6]. If the site included any of the large-bodied papionins, the site was placed within UA group 2. This included the later-occurring sites, such as Swartkrans and Drimolen.

Sites containing a deep stratigraphic record, such as Sterkfontein, a differentiation between the earlier (Members 2 and 4) and later (Member 5) groups could be observed. Sterkfontein Member 5 falls into UA 2 based upon the presence of *T. oswaldi* and *P. h. robinsoni*. Interestingly, specimens from Bolt's Farm, Pit 23, were more similar to sites/localities in the UA 1 group while those from Pit 6 fell into the UA 2 group.

The superpositioning of taxa –positioning of one above or below another – was also considered here. Superpositions were only observed at two sites, Sterkfontein and Bolt's Farm – the only localities containing species of both UA groups (Table 8-6). *P. h. robinsoni* was observed overlying *Pp. broomi* and *P. izodi* at Sterkfontein (Members 5 vs. Members 2 and 4) and Bolt's Farm (Pit 6 vs. Pit 23). Additionally at Sterkfontein, *T. oswaldi* was observed to be superpositioned over *Pp. broomi* and *P. izodi* (Member 5 vs. Members 2 and 4). These superpositional relationships were assessed at the remaining South African cercopithecoid sites. No contradictory superpositions were observed

[6] For the sake of simplicity, *Pp. broomi* is used interchangeably here with *Pp. antiquus*, as the two appear to be at least sub-species of the same taxon (see Chapter Six).

signifying that no *P. h. robinsoni* or *T. oswaldi* specimens were observed in sediments below *Pp. broomi* or *P. izodi*. These relationships suggest that the presence of *Pp. broomi* and/or *P. izodi* would indicate an earlier date than those sites/members containing *T. oswaldi* and/or *P. h. robinsoni*.

Table 8-5. Correlation Table for Unitary Associations. Shown below are the specific UA groups for each site/member considered here.

Level	First UA	Last UA
Swartkrans II	2	2
Swartkrans Mbr 3	2	2
Swartkrans Mbr 2	2	2
Swartkrans Mbr 1	2	2
Drimolen	2	2
Bolt's Farm Pit 6	2	2
Schurveburg	2	2
Kromdraai A	2	2
Kromdraai B	2	2
Sterkfontein Mbr 5	2	2
Bolt's Farm Pit 23	1	1
Taung	1	1
Sterkfontein Mbr 4	1	1
Makapansgat Mbr 4	1	1
Makapansgat Mbr 3	1	1
Makapansgat Mbr 2	1	1
Sterkfontein Mbr 2	1	1

Table 8-6. Taxa Superpositions for South African Cercopithecoids.

Taxon above	Taxon below	Frequency	Site/Member of Later Occurring Taxa
P. h. robinsoni	*Pp. broomi*	2	Sterkfontein Mbr 5, Bolt's Farm Pit 6
T. oswaldi	*Pp. broomi*	1	Sterkfontein Mbr 5
P. h. robinsoni	*P. izodi*	1	Sterkfontein Mbr 5
T. oswaldi	*P. izodi*	1	Sterkfontein Mbr 5

From the available Unitary Association and superpositional data, a biostratigraphic graph showing species relationships across time and space can be

demonstrated (Figure 8-1). *Cercopithecoides williamsi*, the most commonly occurring taxon, has been identified in association with all nine of the remaining South African cercopithecoid taxa. Therefore, *C. williamsi* cannot successfully be used as a biostratigraphic indicator. On the other hand, *Pp. broomi* was found in association with only four other taxa, *Pp. jonesi*, *P. izodi*, *C. williamsi* and *T. darti*. Out of the four species found with *Pp. broomi*, only *T. darti* and *P. izodi*, are chronologically sensitive taxa. If any of the three taxa, *Pp. broomi*, *P. izodi* or *T. darti* is identified at a South African site, the containing member would be attributed to the UA 1 group.

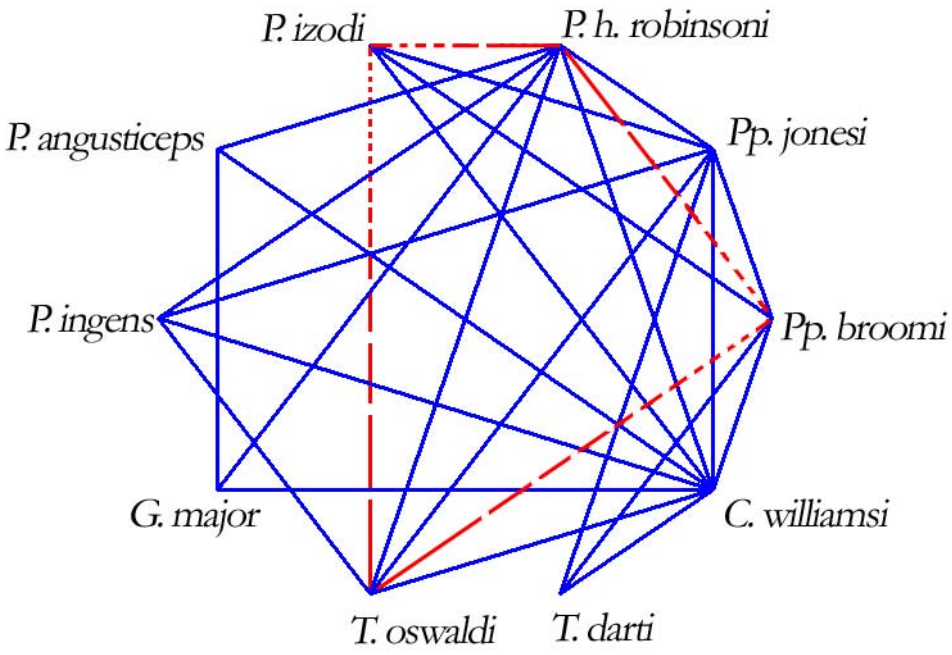

Figure 8-1. Biostratigraphic Graph for Cercopithecoid Taxa. Shown above are the taxa co-occurrences and superposition data for the South African cercopithecoids, as revealed in this analysis. Taxa co-occurrences are represented by solid blue lines. Superpositions are shown in red with dashed and dotted lines. Dashed lines represent the species above (i.e. superpositioned species); dotted lines represent species below. See Table 8-5 for more information on species superpositions.

In order to achieve further site differentiation, a CA was performed. The results, a scatterplot showing samples and taxa in the same ordination space can be seen in Figure 8-2. The resulting eigenvalues can be viewed as correlation coefficients between the species scores and the sample scores. Eigenvalue 1 (0.7533) and eigenvalue 2 (0.5948) scores account for 32.7% and 25.8% of the variability between the species and sample scores.

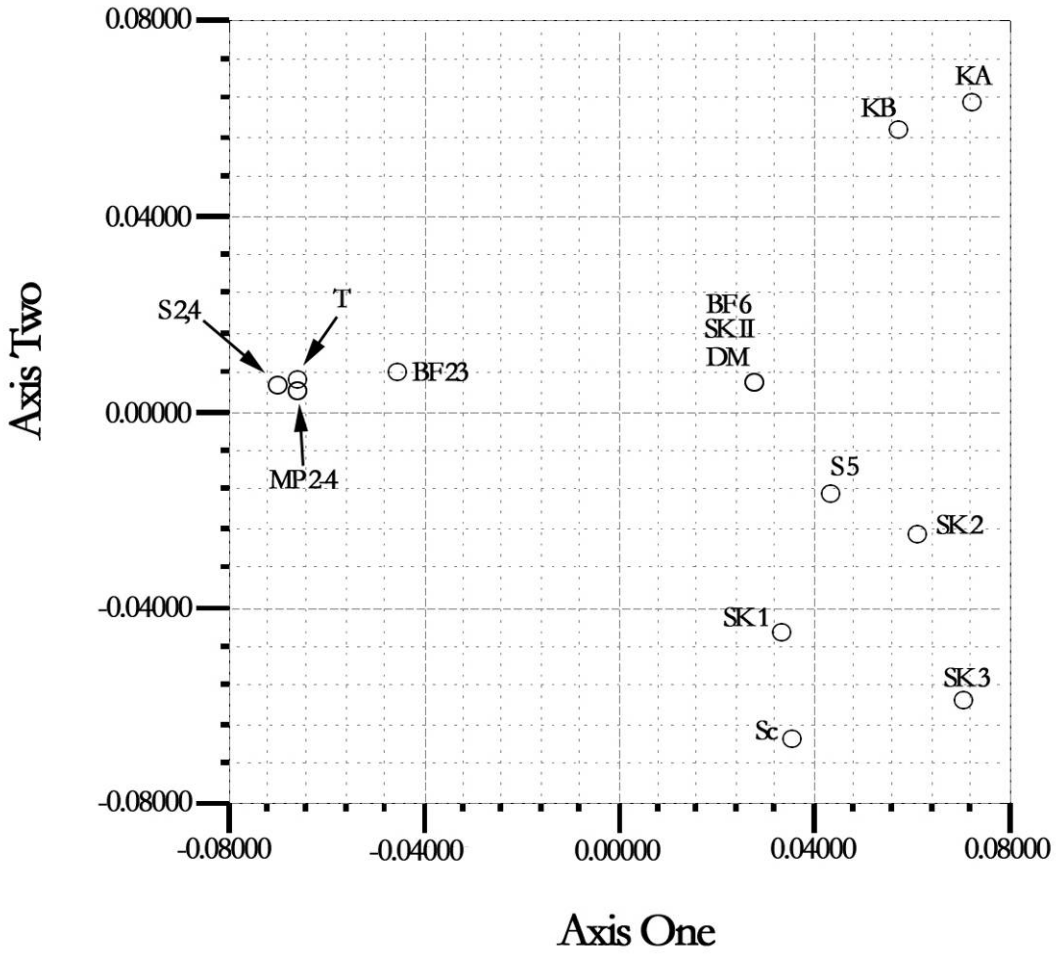

Figure 8-2. Correspondence Analysis. Legend: (BF 6) Bolt's Farm Pit 6, (BF 23) Bolt's Farm Pit 23, (DM) Drimolen, (KA) Kromdraai A, (KB) Kromdraai B, (MP 2-4) Makapansgat Members 2, 3 and 4, (Sc) Schurveburg, (SK II) Swartkrans II, (SK 1) Swartkrans Member 1, (SK 2) Swartkrans Member 2, (SK 3) Swartkrans Member 3, (S 2,4) Sterkfontein Members 2 and 4, (S 5) Sterkfontein Member 5 and (T) Taung.

Additionally, the results of the CA show a separation of the South African sites along the first and second axis. Sites containing small-bodied papionins are separated along the first axis from sites containing large-bodied papionins (Figure 8-2). Sites which are taxonomically similar are plotted together. For example, Sterkfontein Members 2 and 4 are clustered closely with Makapansgat Members 2-4 and Taung. While although the taxonomic list for each site may be slightly different, these sites appear to share more in common with each other than they do with other South African sites. Bolt's Farm Pit 23 is also clustered near the Makapansgat-Sterkfontein-Taung group. This appears to suggest that these sites and/or members are broadly similar in age, and perhaps, can only be grouped into a pre-2.0 Ma group. The group falling to the right side of Axis One in the CA scatterplot (Figure 8-2) appears to broadly represent a post-2.0 Ma group.

Axis two, on the other hand, appears to assess the taxonomic distinctness of each site. Sites with similar taxonomic classifications are clustered together, and again, the Makapansgat-Sterkfontein-Taung samples can be seen to group together. However, Kromdraai A and B are separated from the other South African sites due mainly to their unique taxonomic composition. Two species, *Gorgopithecus major* and *Papio angusticeps*, are found only at Kromdraai. In contrast, Swartkrans II, Drimolen and Bolt's Farm Pit 6 are composed of the exact same taxa, *P. h. robinsoni* and *C. williamsi*, and therefore, cluster together along the second axis of the CA scatterplot.

Chronologically distinguishing among the South African sites is difficult, as the UA analysis showed only two broad groups of separation, but some sense of chronological order was attempted. A spindle diagram showing the chronological relationships of taxa and site members is shown in Figure 8-3. The difficulty becomes

sites, such as Drimolen, which could be early or late in the chronological order, but do not contain any diagnostic taxa. The Drimolen sample contains only two cercopithecoid taxa, *C. williamsi* and *P. h. robinsoni* (Keyser, 2000; Keyser et al., 2000). Thus, chronologically it could be earlier, later or of similar in age to Swartkrans. In cases, such as this, the evaluation of other non-primate taxa will shed light upon this problem.

Being aware of the difficulties, a general pattern can be deduced for the South African taxa. Observing the spindle diagram, one can see a separation of the sites based upon the presence or absence of *Pp. broomi* and *P. izodi*. This demarcation appears to represent the separation of the pre- and post-2.0 Ma cercopithecoid taxa which is based upon the probable dates of 1.7-2.0 Ma for Kromdraai (Delson, 1988; Jones et al., 1986; Vrba, 1995). The two unique Kromdraai species, *G. major* and *P. angusticeps*, along with *P. h. robinsoni* appear to represent the first of the post-2.0 Ma groups. Beyond the post-2.0 Ma boundary, the exact order of sites becomes complicated by the fact that all of the sites, except Schurveburg, contain *P. h. robinsoni*. Regardless whether observing pre- or post-2.0 Ma groups, most sites contain the fossil colobine species, *C. williamsi*. So, the ability to chronologically distinguish the South African sites is only broadly successful (i.e. pre- vs. post-2.0 Ma), but is a reliable means of establishing relative dates among the Sterkfontein Valley sites.

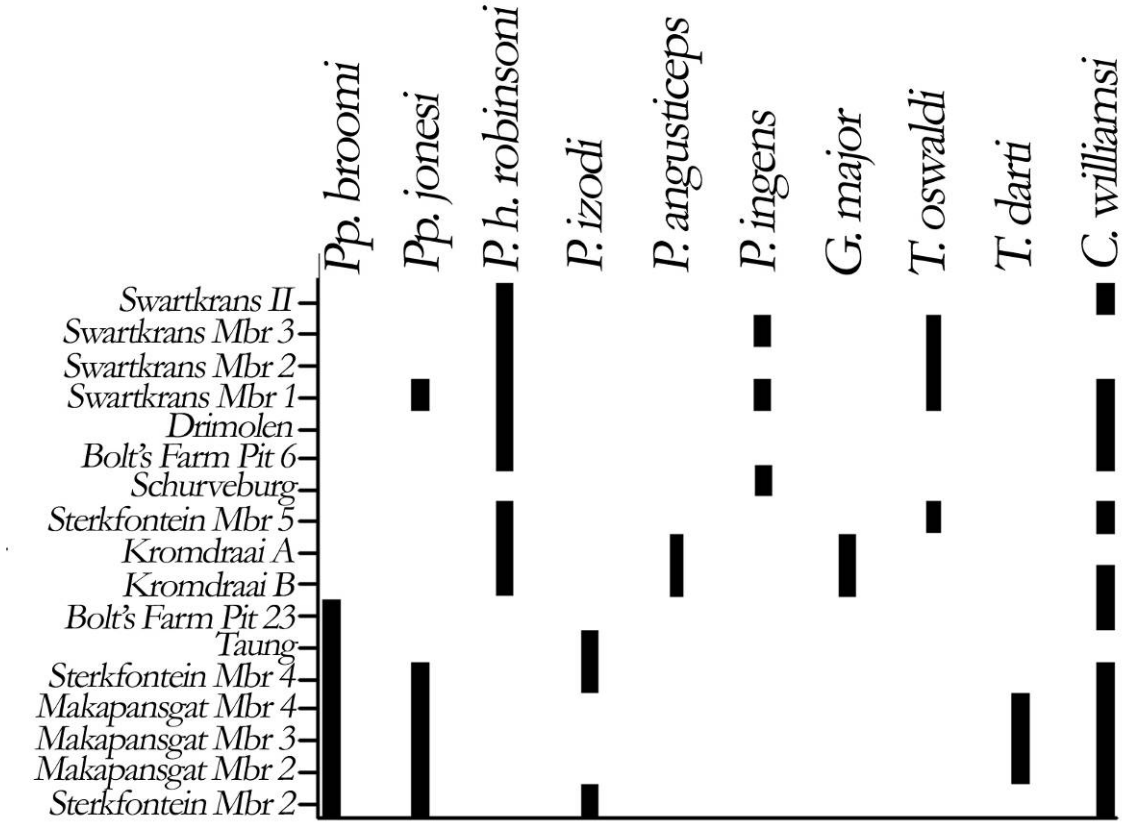

Figure 8-3. Spindle Diagram for South African Taxa. Shown above is a potential chronological sequence for the cercopithecoid taxa. The spindle diagram was computed with the goal of maintaining taxonomic continuity. All sites containing diagnostic taxa (e.g. *Pp. broomi*) were grouped together into chronological order, as a means to maintain species continuity. Site list represents a potential biostratigraphic sequence for the South African cercopithecoid sites.

CHAPTER NINE
PHYLOGEOGRAPHY AND BIODIVERSITY

Significance of Findings

As a means to understanding the inferred biodiversity of Sterkfontein, a series of research questions considering these topics were constructed and their results are discussed in previous chapters (Table 9-1). Earlier analyses demonstrated the dominance of papionins in the South African sample. Only one non-papionin cercopithecid has been identified in the South African fossil deposits to date. This species, *Cercopithecoides williamsi*, has been assigned to the sub-family Colobinae, but its exact relationship to extant taxa is currently unclear. Due to their overwhelming presence, this study centered upon the members of the tribe Papionini. Previous analyses have suggested upwards of six papionin species in the Sterkfontein Member 4 deposit, only. The key question in this analysis became whether the speciosity observed in the Papionini sample was a true reflection of cercopithecoid biodiversity at the site, or whether the high frequency of papionin species might be attributable to other investigable events.

An updated taxonomic list (Table 9-2) shows that rather than the suspected 7 species thought to exist at Sterkfontein during the accumulation of Members 2 and 4, the taxa variation can be accounted for by only four species. The speciosity of earlier analyses resulted in unrealistic views of Sterkfontein papionin biodiversity. Much of the problem resulted from the fragmentary nature of the Sterkfontein deposit, but was also

Table 9-1. Research Hypotheses and Results.

Research Hypothesis	Chapter	Result
Parapapio whitei is a valid and distinct taxon.	Seven	Rejected
Parapapio broomi and *Parapapio jonesi* represent the same species.	Six	Rejected
Taung papionins (*Pp. antiquus* and *P. izodi*) are similar to the Sterkfontein papionins (*Pp. broomi* and *Papio* sp.).	Six	Accepted
Parapapio broomi exhibits a distally reduced M^3.	Six	Accepted
Sterkfontein papionin taxa have P4/M1 ratios similar to that of *Papio*.	Six	Accepted
A collection bias exists in the older (pre-1966) material.	Seven	Rejected

compounded by the apparent artificial collection bias present in the Sts/Sp cercopithecoid sample. A suite of characteristics (Table 9-3) were found to be useful in the differentiating of the papionin species at Sterkfontein (Figure 9-1). However, taxonomies of the Sterkfontein papionins must consider the source of data, and adjust analyses accordingly, as ignoring the bias will lead to overly-speciose classifications.

Table 9-2. Updated Taxonomic List with Study and Collection Comparison. Species which were here shown to have been questionably identified in the Sterkfontein Member 4 deposit are shown with double asterisks (**). Species confidently identified are designated with only a single asterisk.

		This Study	
	Prior Analyses	**Pre-1966**	**Post-1966**
Cercopithecoides williamsi	*	*	*
Parapapio broomi	*	*	*
Parapapio jonesi	*	*	*
Parapapio whitei	**		
Papio izodi	*	*	*
Papio robinsoni	**	**	
Papio sp.	**		

With the recognition of the absence of *P. h. robinsoni* in unbiased samples and the sinking of *Pp. whitei*, only three papionin species are identified in the early Sterkfontein deposits, Members 2 and 4. The papionins – *P.izodi*, *Pp. broomi* and *Pp. jonesi* – dominate the early deposits, and the papionins of later deposits, such as Member 5, are represented by a few craniodental fragments appearing to belong to large-bodied papionins, *Theropithecus oswaldi* and *P. h. robinsoni* (Pickering, 1999). The fossil colobine, *C. williamsi*, is found throughout Sterkfontein and appears to show very little morphological variation within the deposit.

Table 9-3. Diagnostic Character Suite for Differentiating the Sterkfontein Papionini. For full discussion, see Chapter Six.

	Anteorbital Region	Maxillary Fossa	Maxillary Ridge	P4/M1 Ratio*	Palatal Shape	Zygomatic Orientation
Papio izodi	steep drop	well-developed, projecting onto infraorbital region	lightly-developed	Max. - 56.1 Mand. - 62.8	♀ - Horse-shoe ♂ - Elongated horse-shoe	perpendicular to rostum
Parapapio broomi	Gradual drop, but variable	moderately developed	well-developed	Max. - 60.0 Mand. - 68.8	♀ - Horse-shoe ♂ - Elongated horse-shoe	antero-lateral fleeting
Parapapio jonesi	high, stout - straightline	lightly developed	lightly-developed	Max. 61.3 Mand. - 66.8	♀, ♂ - Horse-shoe	antero-lateral fleeting

* P4/M1 Ratio calculated as: **(**100 x (P4 m-d x b-l)**/**(M1 m-d x b-l)**)** following Fleagle and McGraw (2002)

Note: m-d = mesio-distal (breadth), b-l = bucco-lingual (length)

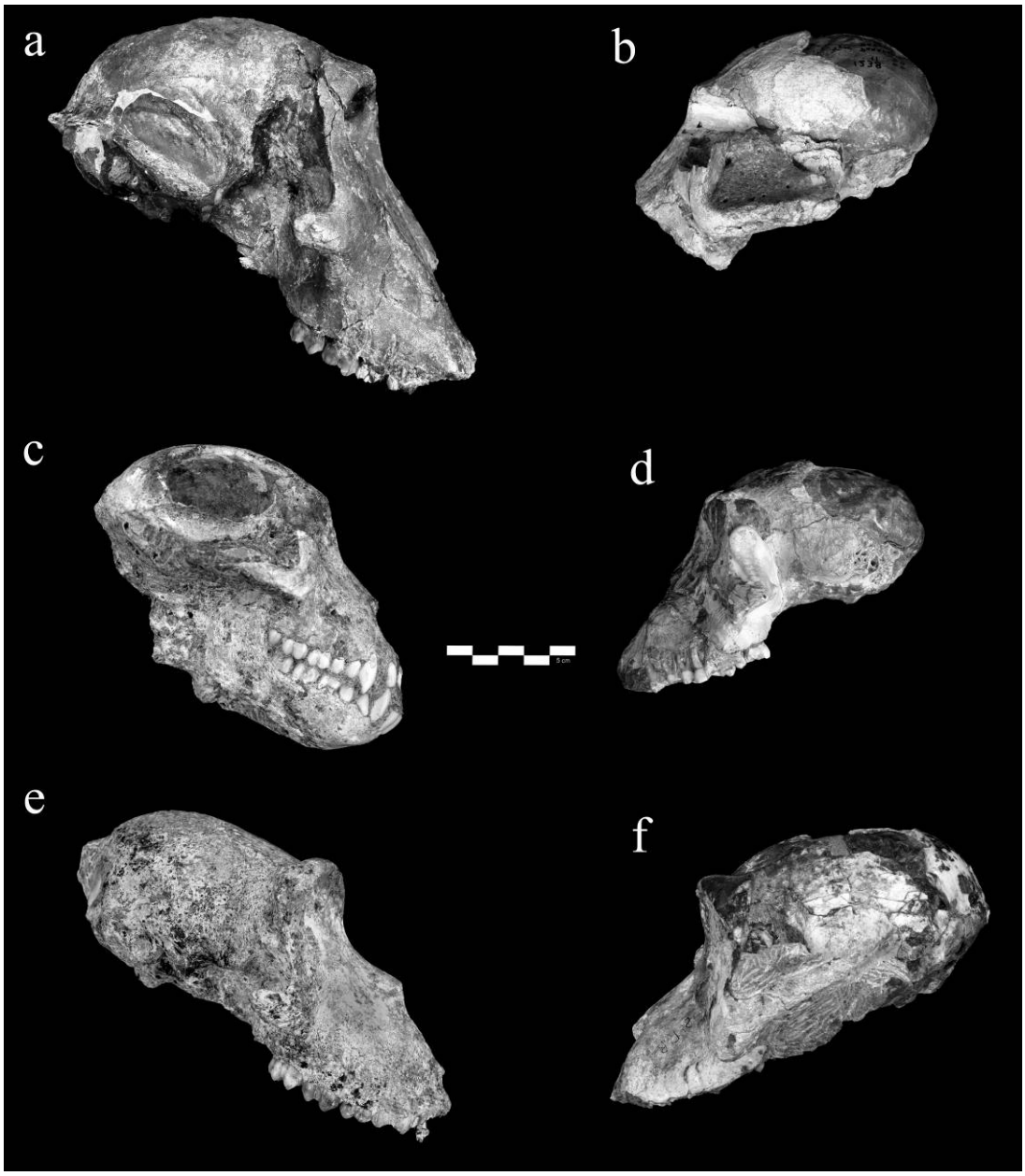

Figure 9-1. Papionin Species Comparison. Above figure shows relative size differences between papionin species and sexes. Shown are (a) *Pp. broomi broomi* ♂, (b) *Pp. broomi broomi* ♀, (c) *Pp. jonesi* ♂, (d) *Pp. jonesi* ♀, (e) *P. izodi* ♂and (f) *P. izodi* ♀. Note, *Pp. broomi broomi* ♂ is represented by a complete specimen from Bolt's Farm, as the Sterkfontein sample is heavily fragmented. However, the Bolt's Farm specimen is comparable in morphology to the Sterkfontein sample (see Chapter Four for discussion). Individual specimens shown above may have been modified (i.e. mirrored) to allow the male and female specimens to face one another. However, original unaltered pictures are for *Pp. broomi broomi*, *Pp. jonesi* and *P. izodi* are shown in Chapters Four, Five and Six, respectively. All specimens are shown to same scale (5 cm).

Additionally, the revised taxonomic classification of Sterkfontein Member 4, and the absence of *P. h. robinsoni* in the sample, is now consistent with current estimates for the origin of modern *Papio*. Modern baboons are suggested to have originated and split into a 'northern' branch and a 'southern' branch around 1.8 Ma (Jolly, 1965; 1993; 2001; Newman et al., 2003). The current dates (~2.6-2.8 Ma) for Member 4 of Sterkfontein (Clarke, 1994, 2002; Partridge et al., 1999) were in conflict with the dates for the genetic origins of extant *Papio* when some analyses identified *P. h. robinsoni* in the deposit (Delson, 1984; Eisenhart, 1974; McKee, 1993). However, the first specimens of *P. h. robinsoni* are identified in the Kromdraai A and B deposits, not Member 4 of Sterkfontein. As Klein (1999) suggests, Member 3 of the Kromdraai B deposit appears to have accumulated in the period between Sterkfontein Member 4 and Swartkrans Member 1, approximately 2.0-1.7 Ma. As such, the fossil material now compellingly supports the genetic evidence for the origins of modern *Papio*. The significance of other sites containing *P. h. robinsoni*, such as Drimolen and Swartkrans, require further research, but appear to have accumulated after the origin of the modern species.

The correct identification of the primate taxa in South Africa, especially at Sterkfontein, may have far-reaching implications for primate evolution and taxonomy. For example, taxa in portions of the Sterkfontein sample (Members 2 and 4), *Pp. broomi* and *Pp. jonesi*, appear to share many morphological features in common with extant *Lophocebus* which seems to support the suggestion that *Parapapio* is closely related to forest-dwelling mangabeys (Frost and Delson, 2002). Currently, most reconstructions of the paleoenvironment of Sterkfontein Member 4 suggest a medium-density woodland environment (Bamford, 1999; Vrba, 1974) consistent with that of a proposed ancestor to

Lophocebus. Therefore, evidence into the origins and diversification of the mangabeys may come to light in the South African cercopithecoid material.

Impact on Papionin Evolution

Based upon the available information, a tentative phylogeny of the South African cercopithecoids is presented in Figure 9-1. As discussed by Newman et al (2003), the divergence of *Lophocebus*, *Papio* and *Theropithecus* appears to have been almost simultaneous and had occurred by at least 4.0 Ma. Currently, the fossil evidence suggests that much of *Theropithecus*'s evolution took place in east Africa (Benefit, 1999), but the genus was not widely successful in South Africa. It appears that the remaining taxa discussed here (e.g. *Papio* and *Parapapio*), or rather their ancestors, moved into South Africa at some point before the deposit of Member 2 Sterkfontein. Pre-4.0 Ma cercopithecoids are rare, but two cercopithecine molars have been identified in the Pliocene deposits at Langebaanweg (Grine and Hendey, 1981). The relationship of the two molars to the remaining South African taxa is currently unknown.

Recent data suggest that the earliest occurrences of *Pp. broomi*, *Pp. jonesi* and *P. izodi* are in Member 2 of the Sterkfontein Formation. Out of the three, the most widely dispersed species was *Pp. broomi* which inhabited much of South Africa, from Taung to Makapansgat (Figure 9-2). It appears that the species originated in the Sterkfontein Valley and moved northward and southward from the center of its distribution. However, some *Parapapio* specimens have been identified in east Africa (Frost, 2001), but their relationship to the South African species is not clearly understood. Therefore, it is possible that the species originated in east Africa and migrated southward inhabiting the Makapansgat valley, first, then moving into the Sterkfontein Valley, and ultimately,

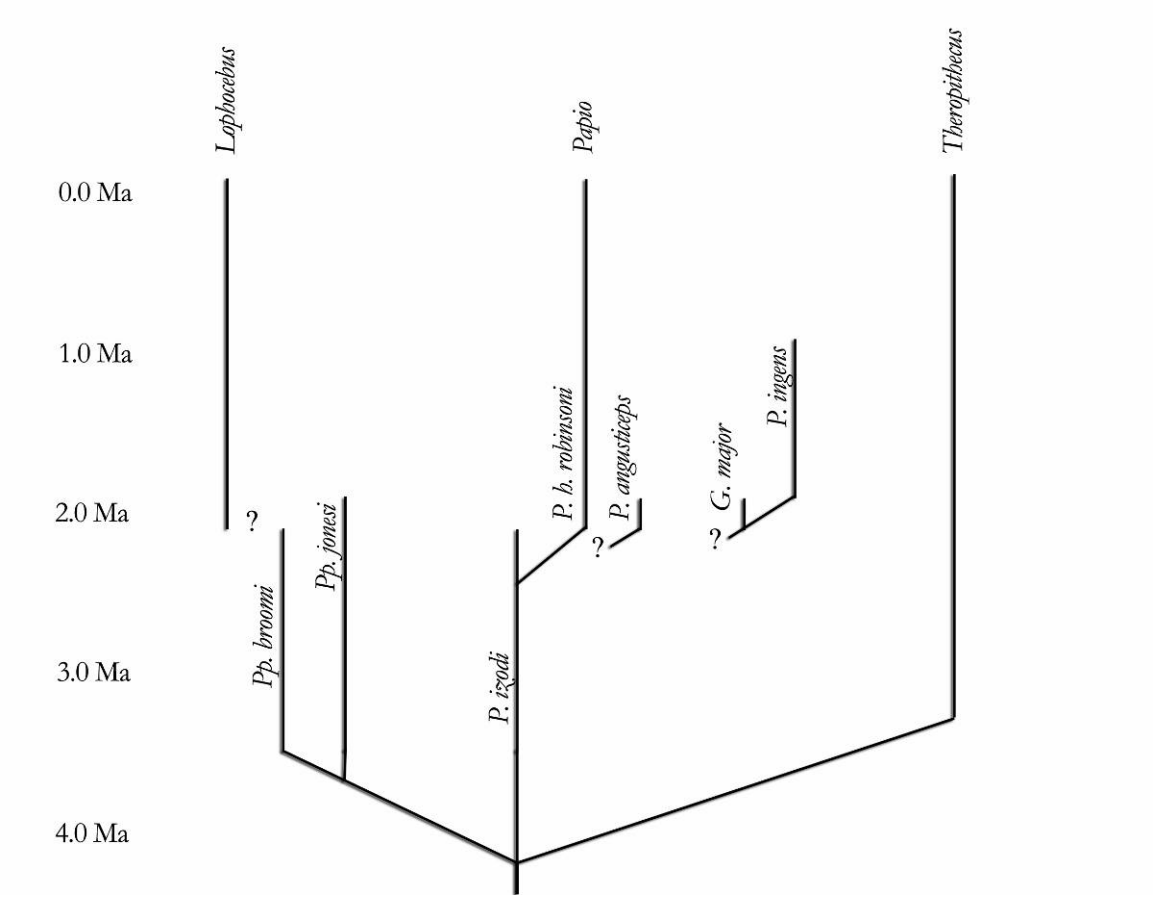

Figure 9-2. South African Cercopithecoid Phylogeny.

southward to Taung. As previously noted, *Pp. broomi* does exhibit some size related variation across its range, but only further study will reveal if that variation is spatial and/or temporal in nature.

Conversely, *P. izodi*, a species closely related to *Pp. broomi*, appears to have exhibited a more restricted distribution. *P. izodi* has been identified at Taung and Sterkfontein, but not to the north at Makapansgat. As a result, it would appear that perhaps the genus *Papio* originated in South Africa, but its pre-2.0 Ma range would have been dramatically reduced in comparison to extant *Papio*'s range. Yet, *P. izodi* may have given rise to the later occurring small and large bodied *Papio* species found in the post-2.0

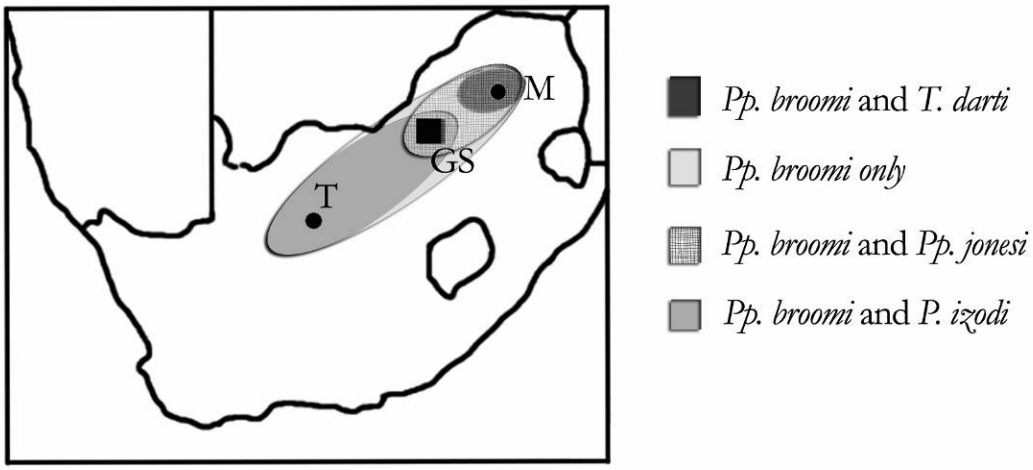

Figure 9-3. Selected South African Papionin Taxa Distributions, Pre-2.0 Ma. As shown here, *Pp. broomi* was the most widespread taxon in South Africa, but in contrast, *T. darti* has only been identified at Makapansgat. The Gauteng region was an area of overlap for many papionin taxa, see discussion below. Shown are: (GS) Gauteng Sites, see Figure 1-1 for further detail, (M) Makapansgat and (T) Taung.

Ma deposits (i.e. *P. h. robinsoni*, *P. angusticeps*, *G. major* and *P. ingens*).

For much of its history, the Sterkfontein Valley appears to have been a point of overlap for many of the papionin species. A third small bodied papionin, *Pp. jonesi*, was identified in both the Makapansgat and Sterkfontein deposits, but not to the south at Taung. Therefore, in the Sterkfontein Valley, all three species, *Pp. broomi*, *Pp. jonesi* and *P. izodi*, would have lived sympatrically in the valley for at least 500 thousand years (ka).

Interestingly, the most northern deposits, represented by Makapansgat, contain a species of *Theropithecus*, *T. darti*, not found at any other South African site. The genus *Theropithecus* originated in eastern Africa and would have migrated to South Africa sometime before the deposit of Makapansgat Member 2 (ca. 3.0 Ma). Though, the species was not successful in southern Africa, as it disappears at the end of Makapansgat Member 4 without having traveled much farther south. As noted by Benefit (1999), the

Theropithecine pattern of geographic diversity appears to be inverse to that of *Papio* and *Parapapio* and may possibly have been the result of competition for resources between similarly adapted species.

Parapapio and *Papio* were comparatively more successful than *Theropithecus* in filling the ecological niches present in the South African Plio-Pleistocene. Upon arrival, *Parapapio* appears to have adaptively radiated into two species, *Pp. broomi* and *Pp. jonesi*, as the two species are distinct in the earliest deposits. *Pp. jonesi* appears to have outlived *Pp. broomi*, as the former has been identified at Swartkrans while the latter disappears after Sterkfontein Member 4. Before its disappearance, *Pp. broomi* may have given rise to the extant *Lophocebus* group or their immediate ancestors. Though, further analysis is necessary to determine if *Pp. broomi* represents a direct ancestor to *Lophocebus*, or rather, simply a sister taxon to the modern group.

The Gauteng sites, such as Sterkfontein, appear to represent an area of great diversification among the papionins. At most sites considered in South Africa, the Pliocene appears to have been dominated by the genus *Parapapio*. However, around the Plio-Pleistocene boundary, many species found in the early South African deposits have become extinct. In the early Pleistocene, a period of rapidly changing forms can be observed at the Gauteng sites suggesting a time of rapid speciation. For example, during the interval of 2.0-1.7 Ma, four new papionin species appear, in the Sterkfontein Valley alone. Based upon the current data, *P. izodi* appears to be the most likely ancestral candidate for the post-2.0 Ma species, most specifically *P. h. robinsoni* and *P. angusticeps*, as the only South African pre-2.0 Ma member of the genus. However, the relationships between *P. izodi*, *G. major* and *P. ingens* and the remaining taxa are less clear. Preliminary

analyses suggest that *G. major* and *P. ingens* may be more closely related to each other than to other post-2.0 Ma groups, as has been noted in the phylogeny presented here (see Figure 9-1). Interestingly, *G. major*, *P. h. robinsoni* and *P. angusticeps* make their first appearance synchronously at Kromdraai immediately after the last appearance of *P. ẓodi* in the valley, Sterkfontein Member 4.

As is shown by their ranges (Figure 9-3), some post-2.0 Ma species were severely restricted in time and space. This restriction is most notable in short-lived species, such as *G. major* and *P. angusticeps*[7], which have been well-documented in the Kromdraai deposits. Additionally in the Sterkfontein Valley, *P. ingens* has only been identified at Swartkrans, but the type specimen is derived from the Schurveburg, outside of the Sterkfontein Valley. So, its restricted range, most probably, is the result of misidentifications at other Gauteng sites. In contrast, the restriction of *T. oswaldi* is simply a temporal restriction, as the sites shown in Figure 9-3 represent over 1 million years of evolution in the valley.

As mentioned earlier, Theropithecines appear to have originated in eastern Africa, and their discovery in Gauteng deposits would suggest a migration into the valley around 1.7 Ma, as they have been identified in Member 5 of Sterkfontein and Member 1 of Swartkrans. Again, however, *Theropithecus* was not successful in southern Africa and appears to have gone extinct some time after the deposition of Swartkrans Member 3.

[7] In 2003, an unpublished cercopithecoid specimen from Gladysvale, GV 4040, was identified by the author as belonging to the species *P. angusticeps*. This would extend the temporal and spatial range of the species, but further analysis is necessary to understand its relationship to the Kromdraai sample.

Nevertheless, all taxa except *P. h. robinsoni* become extinct in South Africa shortly before 1.0 Ma, near the time of the extinction of *Paranthropus robustus*. As the only primate relatives to early hominids in South Africa, our understanding of hominid migration and evolution may also be enlightened by the study of the phylogeography and evolution of these fossil cercopithecoids.

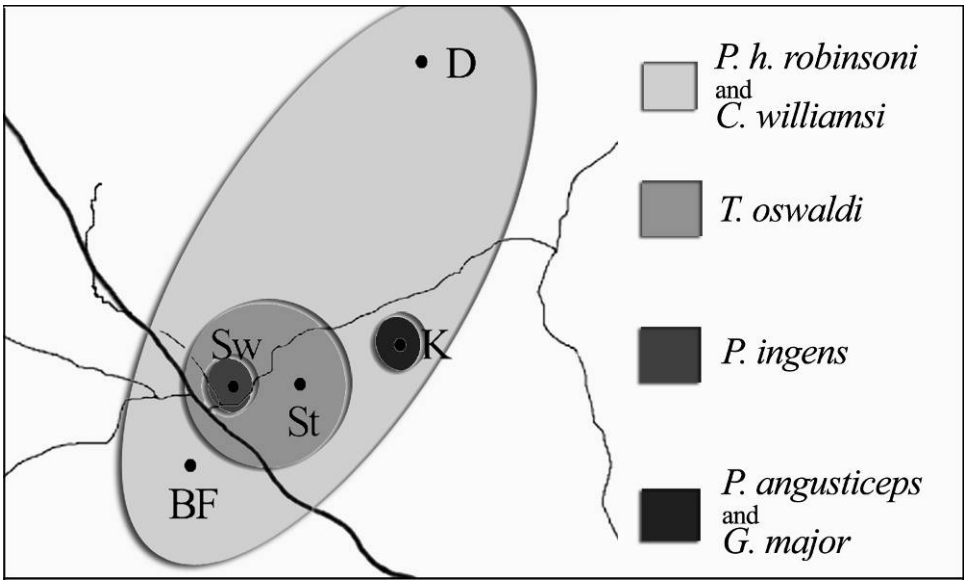

Figure 9-4. Gauteng Site Distribution of Selected Papionins, Post-2.0 Ma. Taxa shown here, with the exception of *T. oswaldi*, appear to have originated and diversified in the Gauteng region. Shown are: (BF) Bolt's Farm, (D) Drimolen, (K) Kromdraai, (St) Sterkfontein and (Sw) Swartkrans.

CHAPTER TEN
RELEVANCE TO PALAEOANTHROPOLOGY

As noted by Jolly (2001), papionins may serve as valuable analogies for hominid evolution through studies of their geographic and genetic relationships. Preliminary results from the Sterkfontein fossil data seem to suggest similarities in the timing of evolutionary events between early hominids and papionins. For example, there appears to have been a mass migration of papionin taxa prior to 4.0-3.0 Ma. This period also represents the earliest of the hominid taxa in South Africa, as Strait and Wood (1999) have suggested a southward migration of hominid taxa during this time interval. With respect to papionin taxa, this early migration appears to have been more successful than later migrations. As noted, *Theropithecus* had moved as far south as Makapansgat by 3.0 Ma, but was never successful enough to have reached the Sterkfontein Valley. This appears to hold true for the hominid taxa, as well, as very little evidence exists for continued incursions into South Africa from eastern Africa. The data suggests that early hominids moved into South Africa around the same time, as the papionins, 4.0-3.0Ma, and remained relatively isolated until possibly 2.0 Ma.

With respect to the primate data, a period of stasis appears to dominate the time between the deposition of Sterkfontein Members 2 and 4, approximately 3.3 Ma to 2.6 Ma, respectively. As previously noted, very little morphological change within the papionin taxa occurred during this interval. Unfortunately, only one hominid, Stw 573, has been recovered in the earliest member of the Sterkfontein deposit, Member 2. To

date, the Member 2 *Australopithecus* remains are encased in breccia, and complete comparisons with other australopithecine taxa are not feasible at this time (Clarke et al., 2003). So, the degree to which hominids in the Sterkfontein Valley evolved during this time period is not clearly evident.

However, at the time of the Member 4 deposit, more than one hominid species appears to have been present in the Gauteng area. Clarke (1988) has suggested that two species of early hominid existed during the accumulation of Member 4, *Australopithecus africanus* and a second species exhibiting similarities to *Paranthropus robustus*. If true, then, the data would suggest that robust australopithecines may represent a diphyletic group, as suggested by the phylogeny of Walker et al (1986). However, the cercopithecoid data do not support a general primate speciation event during the interval between Members 2 and 4.

In their analysis of hominid biogeography, Strait and Wood (1999) have noted southward migrations of east African taxa at approximately 3.0Ma and 1.8-1.5 Ma. So, it may be possible that the *Paranthropus* species shifted southward during the 3.0 Ma migration of other fauna. Though, the primate data here do not support this argument either. As noted previously, there was a pre-3.0 Ma migration of *Theropithecus*, but the most southern extent of that taxon was Makapansgat revealing the relative ineffectiveness of the east African primate taxa in competing with the already well-established South African species.

Current data suggest that the earliest diagnostic member of *P. robustus* occurs at Kromdraai B, the type site (Broom, 1938; Vrba, 1982). How far the species extends into the prehistoric past is debatable; however, as noted earlier, papionin species exhibit a

great deal of diversification around the time that *P. robustus* appears in South African deposits. During this interval, *ca.* 2.0-1.7 Ma, three papionin taxa, *Pp. broomi*, *Pp. jonesi* and *P. izodi*, became extinct at Sterkfontein while three novel species, *P. angusticeps*, *P. h. robinsoni* and *G. major* appeared for the first time alongside *P. robustus* at Kromdraai. It is likely, based upon the primate phylogeography data, that *P. robustus* is an endemic species and originated as a result of the same environmental forces that drove the speciation and extinction of other primate taxa in the Sterkfontein Valley.

On the other hand, Strait and Wood (1999) suggest a southward migration of *P. robustus* between 2.5-1.7 Ma, but this migration is unsubstantiated with respect to the primate taxa considered here. The first successful migration of an east African papionin (i.e. *Theropithecus oswaldi*) into the Gauteng region occurs during the later deposits of Sterkfontein Member 5 and Swartkrans Member 1, after the deposition of Kromdraai and first appearance of *P. robustus*. Currently, the data do not seem to support a mass primate migration near the time of the appearance of *P. robustus* lineage whether that appearance is dated to Member 4 of Sterkfontein, as Clarke (1988) would suggest, or to Kromdraai B.

Additional lines of evidence suggest that synapomorphies in the robust clade may represent developmental by-products of similar dental dimensions, rather than a recent shared ancestry (McCollum, 1999). As a result, the simplistic view of monophyly among the robust species may be an oversimplification of the actual evolutionary relationships between the taxa. As presented here, the primate phylogeographic data seem to support this argument. While not conclusive, the data suggest that evolutionary changes in the papionin taxa roughly coincided with changes in the South African hominid lineages. As

the most closely related taxa to hominids in the South Africa deposits, papionins may serve as valuable measures of mode and tempo in human evolution, as they were exposed to the similar environmental and evolutionary pressures.

By 1.0 Ma, the *P. robustus* lineage had come to an abrupt conclusion, as recorded in the Member 3 deposit of Swartkrans. Additionally, the remaining fossil cercopithecoids, *C. williamsi*, *Pp. jonesi* and *P. ingens*, had become extinct by the last appearance date (LAD) of *P. robustus*. As a result, the South African landscape around 1.0 Ma was dominated by only two primate species, one hominid, *Homo erectus*, and one papionin, *P. hamadryas*; both of which would ultimately give rise to extant taxa which remain successful today. The extinction of *P. robustus* and the majority of South African papionins may have been the result of environmental changes, competition from more successful species (i.e. species ancestral to extant groups) or some combination of those factors. But, the extent to which the primate species, both, hominid and non-hominid, interacted with one another is not currently understood.

However, the degree of interaction between closely related taxa, such as *Paranthropus*, *Australopithecus* and early *Homo*, is an interesting question. At Sterkfontein, the identification of a possible ancestor to *P. robustus* in the Member 4 deposit, while not widely accepted, provides some potential answers. As noted by Lockwood and Tobias (2005), a few of the Sterkfontein Member 4 hominids (e.g. Stw 183) exhibit features consistent with *P. robustus*. Furthermore, the high degree of variation in the Member 4 sample along with these chimeric specimens may suggest some degree of hybridization between the two hominid lineages. In fact, based upon analogies from extant sub-species of *Pan troglodytes*, hybridization between hominid taxa, such as robust and gracile

lineages would be predicted (Hunt, 2003). Therefore, when some analysts observe robust traits in some portion of the Sterkfontein Member 4 sample (Clarke, 1988; Lockwood and Tobias, 2005) or a high degree of variability (Ahern, 1998), the variation may represent gene flow between the different hominid populations in the Sterkfontein Valley.

Though, an alternative explanation for the speciosity of the Member 4 hominid sample stems from the findings of this analysis. As previously mentioned, an artificial collection bias at Sterkfontein was observed in the Type Site, Pre-1966 cercopithecoid collections. An additional compounding variable is the complexity of the Sterkfontein deposit, itself. As noted by Kuman and Clarke (2000), portions of the Member 4 and Member 5 deposits interdigitate, and blocks of Member 4 breccia were recovered by Robinson (1962) during his Extension Site excavations. Unintentionally, specimens from Member 5 could have worked their way into the Member 4 collections, or vice versa, and this argument may be supported by the attribution of a Member 4 specimen to the genus *Homo* (Kimbel and Rak, 1993). An analysis of the Sterkfontein samples is necessary to determine if the primate collection bias extends to the hominid collections. This will aid in determining if the Member 4 samples are homogenous, or if the observed hominid variation can be explained by differences in collections, as was shown in the primate samples.

BIBLIOGRAPHY

Ahern JCM (1998) Underestimating Intraspecific Variation: the problem with excluding Sts 19 from *Australopithecus*. American Journal of Physical Anthropology *105:*461-80.

Armstrong H (1999) Quantitative biostratigraphy. In DAT Harper (ed.): Numerical Paleobiology. Chicehster, UK: John Wiley, pp. 181-226.

Avery DM (2001) The Plio-Pleistocene vegetation and climate of Sterkfontein and Swartkrans, South Africa, based on micromammals. Journal of Human Evolution *41:*113-132.

Bamford M (1999) Pliocene fossil woods from an early hominid cave deposit, Sterkfontein, South Africa. South African Journal of Science *95:*231-237.

Benefit B, and McCrossin M (1990) Diet, species diversity and distribution of African fossil baboons. Kroeber Anthropological Society Papers *Nos. 71-72*.

Benefit BR (1999) Biogeography, dietary specialization and the diversification of African Plio-Pleistocene monkeys. . In TG Bromage and F Schrenk (eds.): African Biogeography, Climate Change, and Human Evolution. Oxford: Oxford University Press, pp. 172-188.

Berger LR, Lacruz R, and de Ruiter DJ (2002) Revised Age Estimates of *Australopithecus*-Bearing Deposits at Sterkfontein, South Africa. American Journal of Physical Anthropology *119:*192-197.

Bookstein FL (1991) Morphometric Tools for Landmark Data: Geometry and Biology. Cambridge: Cambridge University Press.

Brain CK (1958) The Transvaal ape-man bearing cave deposits. Pretoria: Transvaal Museum Memoirs, no. 11.

Brain CK (1981) The Hunters or the Hunted? An Introduction to African Cave Taphonomy. Chicago: U of Chicago Press.

Broom R (1934) On the fossil remains associated with *Australopithecus africanus*. South African Journal of Science *31:*471-480.

Broom R (1937) On some new Pleistocene mammals from limestone caves of the Transvaal. South African Journal of Science *33:*750-768.

Broom R (1938) The Pleistocene anthropoid apes of South Africa. Nature *142:*377-379.

Broom R (1940) The South African Pleistocene cercopithecoid apes. Annals of the Transvaal Museum *20:*89-100.

Broom R (1948) Some South African Pliocene and Pleistocene Mammals. Annals of the Transvaal Museum *21:*1-38.

Broom R, and Hughes AR (1949) Notes of the fossil baboons of the Makapan caves. South African Science *2:*194-196.

Broom R, and Jensen JS (1946) A new fossil baboon from the caves at Potgietersrust. Annals of the Transvaal Museum *20:*337-340.

Broom R, and Robinson JT (1950) A new sub-fossil baboon from Kromdraai, Transvaal. Annals of the Transvaal Museum *21:*242-245.

Clarke R (1988) A new *Australopithecus* cranium from Sterkfontein and its bearing on the ancestry of *Paranthropus*. In F Grine (ed.): Evolutionary History of the Robust Australopithecines. New york: Aldine de Gruyter, pp. 285-292.

Clarke R (1994) On some new interpretations of Sterkfontein stratigraphy. South African Journal of Science *90:*221-224.

Clarke R (1998) First ever discovery of a well-preserved skull and associated skeleton of *Australopithecus*. South African Journal of Science *94:*460-463.

Clarke R (1999) Discovery of complete arm and hand of 3.3 million-year-old *Australopithecus* skeleton from Sterkfontein. South African Journal of Science *95:*477-480.

Clarke R (2002) On the unrealistic 'Revised age estimates' for Sterkfontein. South African Journal of Science *98:*415-9.

Clarke R, and Kuman K (2000) The Sterkfontein Caves paleontological and archaeological site. Johannesburg: University of the Witswatersrand, pp. 18.

Clarke R, Partridge TC, Granger DE, Caffe, W. M, and Gibbons A (2003) Dating the Sterkfontein Fossils. Science *301:*596-597.

Clarke R, and Tobias P (1995) Sterkfontein Member 2 foot bones of the oldest South African hominid. Science *269:*521-524.

Clarke R, and Tobias P (1996) Response to McKee. Science *271:*1302.

Cooke H (1938) The Sterkfontein bone breccia: a geological note. South African Journal of Science *35:*204-208.

Cooke H, ed. (1952) Quaternary events in South Africa. Oxford: Blackwell.

Cubitt J, and Reyment R (1982) Quantitative Stratigraphic Correlation. Chichester, UK: John Wiley.

Dart RA (1949) The predatory implemental technique of *Australopithecus.* American Journal of Physical Anthropology *7:*1-38.

Delson E (1973) Fossil Colobine monkeys of the Circum-Mediterranean region and the evolutionary history of the Cercopithecidae (Primates, Mammalia). Unpublished PhD, Columbia University, New York.

Delson E (1984) Cercopithecid biochronology of the African Plio-Pleistocene: correlation among eastern and southern hominid-bearing localities. Cour. Forsch. Inst. Senckenberg *69:*199-218.

Delson E (1988) Chronology of South African australopith site units. In F Grine (ed.): Evolutionary History of the "Robust" Australopithecines. New York: Aldine, pp. 317-324.

Disotell T (1994) Generic level relationships of the Papionini (Cercopithecoidea). American Journal of Physical Anthropology *94:*47-57.

Disotell T (1996) The phylogeny of Old World monkeys. Evolutionary Anthropology *5:*18-24.

Disotell T (2000) Molecular systematics of the Cercopithecidae. In P Whitehead and C Jolly (eds.): Old World Monkeys: Cambridge University Press, pp. 29-56.

Eeley HAC, and Foley RA (1999) Species richness, species range size and ecological specialisation among African primates: geographical patterns and conservation implications. Biodiversity and Conservation *8:*1033-1056.

Eisenhart WL (1974) The Fossil Cercopithecoids of Makapansgat and Sterkfontein. Unpublished Bachelor of Arts, Harvard University, Cambridge.

El-Zaatari S, Grine F, Teaford M, and Smith H (2005) Molar microwear and dietary reconstructions of fossil Cercopithecoidea from the Plio-Pleistocene deposits of South Africa. Journal of Human Evolution *49:*180-205.

Fleagle JG (1999) Primate Adaptation and Evolution. New York: Academic Press.

Fleagle JG, and McGraw WS (1999) Skeletal and dental morphology supports diphyletic origin of baboons and mandrills. Proc. Natl. Acad. Sci. *96:*1157-1161.

Fleagle JG, and McGraw WS (2002) Skeletal and dental morphology of African papionins: unmasking a cryptic clade. Journal of Human Evolution *42:*267-292.

Freedman L (1957) The fossil cercopithecoidea of South Africa. Annals of the Transvaal Museum *23:*121-262.

Freedman L (1960) Some new fossil Cercopithecoid specimens from Makapansgat, South Africa. Paleontologia Africana *7:*7-45.

Freedman L (1961) New Cercopithecoid fossils, including a new species from Taung, Cape Province, South Africa. Annals of the South African Museum *46:*1-14.

Freedman L (1965) Fossil and sub-fossil primates from the limestone deposits at Taung, Bolt's Farm and Witkrans, South Africa. Paleontologia Africana *9:*19-48.

Freedman L (1970) A new checklist of fossil Cercopithecoidea of South Africa. Paleontologia Africana *13:*109-110.

Freedman L, and Brain CK (1972) Fossil Cercopithecoid remains from the Kromdraai australopithecine site (Mammalia: Primates). Annals of the Transvaal Museum *28:*1-16.

Freedman L, and Brain CK (1977) A re-examiniation of the Cercopithecoid fossils from Swartkrans (Mammalia: Cercopithecidae). Annals of the Transvaal Museum *30:*211-218.

Freedman L, and Stenhouse NS (1972) The *Parapapio* species of Sterkfontein, Transvaal, South Africa. Paleontologia Africana *14:*93-111.

Frost S, and Delson E (2002) Fossil Cercopithecidae from the Hadar Formation and surrounding areas of the Afar depression, Ethiopia. Journal of Human Evolution *43*.

Frost SR (2001) Fossil Cercopithecidae of the Afar Depression, Ethiopia: species, systematics and comparison to the Turkana Basin. Ph.D., City University of New York, New York.

Frost SR, Marcus LF, Bookstein FL, Reddy DP, and Delson E (2003) Cranial Allometry, Phylogeography, and Systematics of Large Bodied Papionins (Primates: Cercopithecinae) Inferred from Geometric Morphometric Analysis of Landmark Data. The Anatomical Record *275a:*1048-1072.

Gear JHS (1926) A preliminary account of the baboon remains from Taungs. South African Journal of Science *23:*731-747.

Gingerich P (1981) Variation, sexual dimorphism and social structure in the early Eocene horse, *Hyracotherium* (Mammalia, Perissodactyla). Paleobiology *7:*443-455.

Greenacre M (1984) Theory and Application of Correspondence Analysis. New York: Academic Press.

Grine FE, and Hendey QB (1981) Earliest Primate Remains from South Africa. South African Journal of Science *77:*374-376.

Groves C (1978) Phylogenetic and population systematics of the mangabeys (Primates: Cercopithecoidea). Primates *19:*1-34.

Groves C (2000) The phylogeny of the Cercopithecoidea. In P Whitehead and C Jolly (eds.): Old World Monkeys: Cambridge University Press, pp. 77-98.

Guex J (1991) Biochronological Correlations. New York: Springer Verlag.

Hammer O, Harper D, and Ryan P (2001) PAST: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontologia Electronica *4:*9.

Hammer O, and Harper DAT (2005) Paleontological Data Analysis: Blackwell Publishing.

Harris EE (2000) Molecular systematics of the Old World monkey tribe Papionini: analysis of the total available genetic sequences. Journal of Human Evolution *38:*235-256.

Harris EE, and Disotell T (1998) Nuclear gene trees and the phylogenetic relationships of the mangabeys (Primates: Papionini). Mol. Biol. Evol. *5:*626-644.

Haughton S (1925) A note on the occurrence of a species of baboon in limestone deposits near Taung. Trans. Roy. Soc. S. Africa *12:*lxviii.

Heaton JL, and Pickering TR (2005) Fossil collection biases at Sterkfontein cave and their impact on primate taxonomy. Paleoanthropology *PAS Abstracts:*A33.

Hill A, Ward S, and Brown B (1992) Anatomy and age of the Lothagam mandible. Journal of Human Evolution *22:*439-451.

Hopwood AT, and Hollyfield JP, eds. (1954) An annotated bibliography of the fossil mammals of Africa (1742-1950). London: Bulletin of the British Museum of Natural History.

Hunt K (2003) The single species hypothesis: truly dead and pushing up bushes, or still twitching and ripe for resuscitation? Human Biology *75:*485-502.

Jolly C (1965) The origins ans specialisations of the long-faced Cercopithecoidea, University of London.

Jolly C (1993) Species, sub-species and baboon systematics. In W Kimbel and L Martin (eds.): Species, Species Concepts and Primate Evolution. New York: Plenum Press.

Jolly CJ (1966) The evolution of baboons. In H Vogtborg (ed.): The Baboon in Medical Research. Austin: U of Texas Press, pp. 23-50.

Jolly CJ (2001) A proper study of mankind: analogies from the Papionin monkeys and their implications for human evolution. Yearbook of Physical Anthropology *44:*177-204.

Jones D, Brock A, and McFadden P (1986) Paleomagnetic results from the Kromdraai and Sterkfontein hominid sites. South African Journal of Science *82:*160-163.

Jones TR (1937) A new fossil from Sterkfontein, Krugersdorp, Transvaal. South African Journal of Science *33:*709-728.

Jones TR (1978) The skull and mandible of the South African baboon: A morphological study. M.Sc. thesis, U of Witwatersrand, Johannesburg.

Jongman R, ter Braak C, and van Tongeren O (1995) Data Analysis in Community and Landscape Ecology. Cambridge: Cambridge University Press.

Kalb J, Jolly CJ, Tebedge S, Mebrate A, Smart C, Oswald E, Whitehead P, Wood C, Adefris T, and Rawn-Schatzinger V (1982) Vertebrate faunas from the Awash Group, Middle Awash Valley, Afar, Ethiopia. Journal of Vertebrate Paleontology *2:*237-258.

Keyser A (2000) The Drimolen skull: the most complete australopithecine cranium and mandible to date. South African Journal of Science *96:*189-193.

Keyser A, Menter C, Moggi-Cecchi J, Pickering T, and Berger L (2000) Drimolen: a new hominid-bearing site in Gauteng, South Africa. South African Journal of Science *96:*193-197.

Kimbel WH, and Rak Y (1993) The Importance of Species Taxa in Paleoanthropology and an Argument for the Phylogenetic Concept of the Species Category. In WH Kimbel and LB Martin (eds.): Species, Species Concepts and Primate Evolution. New York: Plenum Press, pp. 461-484.

Kitching J (1952) Studies of Karoo reptiles. IV. A new type of baboon, *Brachygnathopithecus perpercorni*, gen. et sp. nov. South African Journal of Science *49:*15-17.

Kitching J, Wells LH, and Westphal E (1948) Fossil cercopithecoid primates from the Limeworks Quarry, Makapansgat, Potgietsrust. South African Journal of Science *I:*171-2.

Klein R (1999) The Human Career: human biological and cultural origins. Chicago: U of Chicago Press.

Kuman K (1994a) The archaeology of Sterkfontein -- past and present. Journal of Human Evolution *27:*471-495.

Kuman K (1994b) The archaeology of Sterkfontein: preliminary findings on site formation and cultural change. South African Journal of Science *90:*215-219.

Kuman K (1998) The earliest South African industries. In M Petraglia and R Korisettar (eds.): Early Human Behavior in Global Context: the rise and diversity of the Lower Paleolithic Record. London: Routledge Press, pp. 151-186.

Kuman K, and Clarke RJ (2000) Stratigraphy, artefact industries and hominid associations for Sterkfontein, Member 5. Journal of Human Evolution *38:*827-847.

Leakey M (1988) Fossil evidence for the evolution of the guenons. In F Gautier-Hion, J Bourliere and J Kingdon (eds.): Primate Radiation: Evolutionary Biology of the African Guenons. Cambridge: Cambridge University Press, pp. 7-12.

Lee-Thorp JA, Van der Merwe N, and Brain CK (1994) Diet of *Australopithecus robustus* at Swartkrans from stable carbon isotopic analysis. Journal of Human Evolution *27:*361-372.

Legendre P, and Legendre L (1998) Numerical Ecology. Amsterdam: Elsevier.

Lockwood C, and Tobias P (2005) Morphology and affinities of new hominin cranial remains from Member 4 of the Sterkfontein Formation, Gauteng Province, South Africa. Journal of Human Evolution *42:*389-450.

Maier W (1970) New Fossil Cercopithecoidea from the lower Pleistocene cave deposits of the Makapansgat Limeworks, South Africa. Paleontologia Africana *13:*69-107.

Marcus L (1993) Some aspects of multivariate morphometrics. In L Marcus, E Bello and A Garcia-Valdecasas (eds.): Contributions to Morphometrics. Madrid: Monografias Museo Nacional de Ciencias Naturales.

McCollum M (1999) The robust australopithecine face: a morphogenetic perspective. Science *284:*301-305.

McKee JK (1993) Taxonomic and evolutionary affinities of Papio izodi from Taung and Sterkfontein. Paleontologia Africana *30:*43-49.

McKee JK (1995) Further Chronological seriation of southern African Pliocene and Pleistocene mammalian faunal assemblages. Palaeontologia Africana *32:*11-16.

McKee JK (1996a) Faunal Evidence and Sterkfontein Member 2 Foot Bones of Early Hominid. Science *271:*1301-1302.

McKee JK (1996b) Faunal Turnover patterns in the Pliocene and Pleistocene of southern Africa. South African Journal of Science *92:*111-114.

McKee JK, Thackeray JF, and Berger LR (1995) Faunal Assemblage Seriation of Southern African Pliocene and Pleistocene Fossil Deposits. American Journal of Physical Anthropology *96:*235-250.

Mollett OD (1947) Fossil mammals from the Makapan Valley, Potgietersrust. I. Primates. South African Journal of Science *43:*295-303.

Newman T, Jolly C, and Rogers J (2003) Mitochondrial phylogeny and systematics of baboons (*Papio*). American Journal of Physical Anthropology *124:*17-27.

Partridge T (1978) Re-appraisal of lithostratigraphy of Sterkfontein hominid site. Nature *275*.

Partridge T (1986) Palaeoecology of the Pliocene and Lower Pleistocene hominids of southern Africa: How good is the chronological and palaeoenvironmental evidence? South African Journal of Science *82:*80-83.

Partridge T (2000) Hominid-bearing cave and tufa deposits. In T Partridge and R Maud (eds.): The Cenozoic of Southern Africa. Oxford: Oxford University Press, pp. 100-125.

Partridge T, Granger DE, Caffee MW, and Clarke R (2003) Lower Pliocene hominid remains from Sterkfontein. Science *300:*607-612.

Partridge T, Shaw T, Heslop D, and Clarke R (1999) The new hominid skeleton from Sterkfontein, South Africa: age and preliminary assessment. Journal of Quaternary Science *14:*293-298.

Partridge T, and Watt I (1991) The stratigraphy of the Sterkfontein hominid deposit and its relationship to the underground cave system Paleontologica africana *28:*35-40.

Patterson B (1968) The extinct baboon, *Parapapio jonesi*, in the early Pleistocene of Northwestern Kenya. Breviora *282:*1-4.

Pickering T (1999) Taphonomic interpretations of the Sterkfontein early hominid site (Gauteng, South Africa) reconsidered in light of recent evidence, University of Wisconsin, Madison.

Pickering T, and Carlson K (2002) Baboon Bone Mineral Densities: Implications for the Taphonomy of Primate Skeletons in South African Cave Sites. Journal of Archaeological Science *29:*883-896.

Pickering T, Clarke R, and Heaton J (2004a) The context of Stw 573, an early hominid skull and associated skeleton from Sterkfontein Member 2: Taphonomy and paleoenvironment. Journal of Human Evolution *46:*279-297.

Pickering T, Clarke R, and Moggi-Cecchi J (2004b) Role of carnivores in the accumulation of the Sterkfontein Member 4 hominid assemblage: A taphonomic reassessment of the complete hominid fossil sample (1936-1999). American Journal of Physical Anthropology *125:*1-15.

Plavcan JM, and Cope DA (2001) Metric Variation and Species Recognition in the Fossil Record. Evolutionary Anthropology *10:*204-222.

Reed KE (1997) Early hominid evolution and ecological change through the African Plio-Pleistocene. Journal of Human Evolution *32:*289-322.

Robinson JT (1962) Sterkfontein stratigraphy and the significance of the extension site. South African Archaeological Bulletin *17:*87-107.

Sadler P (2004) Quantitative biostratigraphy - achieving finer resolution in global correlation. Annual Review of Earth and Planetary Sciences *32:*187-213.

Schoeninger MJ (1995) Stable isotope studies in human evolution. Evolutionary Anthropology*:*83-98.

Schwarcz H, Grun R, and Tobias P (1994) ESR dating studies of the australopithecine site of Sterkfontein, South Africa. Journal of Human Evolution *26:*175-181.

Semaw S (2000) The World's oldest stone artifacts from Gona, Ethiopia: Their implications for understanding stone technology and patterns of human evolution between 2.6-2.5 million years ago. Journal of Archaeological Science *27:*1197-1214.

Semaw S, Renne P, Harris J, Feibel C, Berners R, Fesseha N, and Mowbray K (1997) 2.5-Million-Year-Old Stone Tools from Gona, Ethiopia. Nature *385:*333-6.

Sillen A, Hall G, and Armstrong R (1995) Strontium calcium ratios (Sr/Ca) and Strontium isotopic ratios (87 Sr/86 Sr) of *Australopithecus robustus* and *Homo* sp. from Swartkrans. Journla of Human Evolution *28:*277-85.

Simons E (1972) Primate Evolution: An Introduction to Man's Place in Nature. New York: MacMillan Co.

Simons E, and Delson E (1978) Cercopithecidae and Parapithecidae. In H Cooke and J Maglio (eds.): Mammalian Evolution in Africa. Cambridge: Harvard University Press, pp. 100-119.

Singleton M (2002) Patterns of cranial shape variation in the Papionini (Primates: Cercopithecinae). Journal of Human Evolution *42:*547-578.

Strait DS, and Wood B (1999) Early hominid biogeography. PNAS *96:*9196-9200.

Strasser E, and Delson E (1987) Cladistic analysis of cercopithecid relationships. Journal of Human Evolution *16:*81-99.

Szalay FS, and Delson E (1979) Evolutionary History of the Primates. New York: Academic Press.

Thackeray JF (2004) *Parapapio broomi* and *Parapapio jonesi* from Sterkfontein: males and females of one species? Annals of the Transvaal Museum *41:*79-82.

Tipper J (1988) Techniques for quantitative stratigraphic correlation: A review and annotated bibliography. Geological Magazine *125:*475-494.

Tobias PV (1979) The Silberberg Grotto, Sterkfontein, Transvaal, and its Importance in Paleoanthropological Research. South African Journal of Science *75:*161-164.

Tobias PV (1984) Dart, Taung and the 'Missing Link'. Johannesburg: Witwatersrand University Press.

Tobias PV, and Hughes AR (1969) The New Witwatersrand University Excavation at Sterkfontein: Progress Report, Some Problems and First Results. South African Archaeological Bulleting *24:*158-169.

Van Der Merwe NJ, and Thackeray JF (1997) Stable carbon isotope analysis of Plio-Pleistocene ungulate teeth from Sterkfontein, South Africa. South African Journal of Science *93:*194.

Van Der Merwe NJ, Thackeray JF, Lee-Thorp JA, and Luyt J (2003) The carbon isotope ecology and diet of *Australopithecus africanus* at Sterkfontein, South Africa. Journal of Human Evolution *55:*581-597.

Vitzthum V (1986) The role of ecological factors in odontometric variability and its implications for body size adaptations in Cercopithecidae. Unpublished Ph.D., University of Michigan.

Vrba E (1974) Chronological and ecological implications of the fossil bovidae at the Sterkfontein australopithecine site. Nature *250:*19-23.

Vrba E (1975) Some evidence of chronology and paleoecology of Sterkfontein, Swartkrans and Kromdraai from the fossil Bovidae. Nature *254:*301-304.

Vrba E (1976) The fossil bovidae of Sterkfontein, Swartkrans and Kromdraai. Pretoria: Transvaal Museum Memoirs, no. 21.

Vrba E (1980) The significance of bovid remains as indicators of environment and predations patterns. In AK Behrensmeyer and A Hill (eds.): Fossils in the Making: Vertebrate Taphonomy and Paleontology. Chicago: U of Chicago Press, pp. 247-271.

Vrba E (1982) Biostratigraphy and chronology, based particulary on Bovidae, of southern hominid-associated assemblages: Makapansgat, Sterkfontein, Taung, Kromdraai, Swartkrans; also Elandsfontein (Saldanha), Broken Hill (now Kabwe) and Cave of Hearths. In H Lundley (ed.): Congres International de Paleontologie Humaine, 1er Congres. Nice: CNRS, pp. 707-752.

Vrba E (1985) Early hominids in southern Africa: Updated observations on chronological and ecological background. In P Tobias (ed.): Hominid evolution, past, present and future. New York: Alan R. Liss, pp. 195-200.

Vrba E (1995) Paleoclimate and Evolution with an Emphasis on Human Origins. New Haven, CT: Yale University Press.

Walker A, Leakey RE, Harris JM, and Brown FH (1986) 2.5-Myr *Australopithecus boisei* from west of Lake Turkana, Kenya. Nature *322*:517-522.

White T, Suwa G, and Asfaw B (1994) *Australopithecus ramidus*, a new species of early hominid from Aramis, Ethiopia. Nature *371*:88.

APPENDIX ONE
WITWATERSRAND CERCOPITHECOID CRANIODENTAL CATALOG – SWP AND SP

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
S94-13255 pr	Member 2		*C. williamsi*	Mandible	Both	Right side present to posterior M_3 hypoconulid; difficult to say how much of left side is present because mandible disappears into breccia, then posterior teeth M_2-M_3 appear and have the inferior portion of the ascending ramus, but no coronoid or condyloid processes
SP 1	Sterkfontein, Krugersdorp		*Papio*	Cranium	Both	Very well preserved cranium, lacking left zygomatic arch, base of calvarium and teeth; very large specimen; perhaps could be *Papio ingens* or *Papio hamadryas*. Unfortunately, all teeth are missing; as well as missing basicranium. Tooth roots are present in alveoli.
SP 2	Sterkfontein			Endocast	Left	Left posterior portion of endocranium; parietal region
SP 3				Endocast	Both	Brain endocast complete anterior posterior, but basally, covered with breccia; sinuses are visible, and impressions of cranial sutures are visible. Frontal lobes are distinguishable. First specimen brought in from Sterkfontein by T. Jones, described in Jones (1937).
SP 4				Cranium	Both	Large piece of breccia showing basal portion of cranium; endocranial surface visible, but still encased in breccia.
SP 5				Endocast	Both	Endocranial cast of roof of calvarium; basicranium not preserved.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
SP 6				Endocast	Right	Endocranial cast of right superior portion of calvarium. Frontal bone and supraorbital tori present
SP 7				Cranium	Both	(a) Bone and reconstruction of calvarial roof, orbits and upper portions of muzzle. (b) Plaster and other endocranial casts
SP 8			*Pp. jonesi*	Mandible	Right	(a) Natural breccia cast (impression) of specimen b. (b) Right mandibular corpus of mandible with P_3-M_3.
SP 9			*Pp. jonesi*	Mandible	Both	Badly damaged symphysis with right and left corpora of male mandible. Right; I_2, P_3-M_3. Left; P_4-M_3; Jones (1937) and Freedman (1957) call this *Pp. broomi*. Dentition appears cuspy with a large sectorial premolar.
SP 10			*P. izodi*	Maxilla	Both	Muzzle with P^3-M^2 on right and P^3 and P^4 on left. Premolars (especially P^3) are not fully erupted. On right side, M^3 can be seen in crypt. Juvenile has small maxillary fossa and root of the zygomatics appear to be at the mesial m^2 level.
SP 11			*P. izodi*	Cranium	Both	Badly damaged skull lacking top of calvarium. Dentition present only as right M^2, partially erupted, only just reached the occlusal surface, but has been mechanically excavated out on the buccal side. Other teeth are only roots; right P^3-M^1; left side sheared off superior to the alveoli (no roots visible).

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
SP 12			*Pp. jonesi*	Mandible	Left	Left mandibular corpus with P_4-M_3
SP 13			*Pp. broomi*	Maxilla	Right	Badly damaged muzzle and palate. Right maxillary with M^3. Appears to have large canine; Typical *Pp. broomi* maxillary fossa on right side and typical *Lophocebus*-like M^3.
SP 14			*Papio*	Mandible	Both	Badly damaged mandibular corpora with badly damaged molars; left M_1-M_3, right M_2-M_3. Teeth are in poor condition; only length measurements of $M_{1\text{-}3}$ can be reliably taken.
SP 15				Cranium	Both	Posterior portion of calvarium and small portion of endocranial cast. Appears to be occipital region covered with bone, and endocast of parietal region.
SP 16				Cranium	Both	Calvarium with frontal bones, small portion of supraorbital tori and left posterior endocranial cast; has well developed supraorbital tori. Appears to be *Papio izodi* in size and shape (contra catalog).
SP 17				Cranium	Both	Well preserved calvarium, reconstructed where damaged. Preserves coronal, sagittal and lambdoidal sutures.
SP 18			*Pp. broomi*	Cranium	Both	Damaged face of juvenile. Mesial loph of right M^1 present; cf. *Pp. broomi* (catalog says *Pp. whitei*); compares well with Member 2 juveniles.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
SP 19				Cranium	Right	(a) Block of breccia with small endocranial cast , near the ?orbit (b) Bones of right base of skull and endocranial cast of adjacent region (siding by Dean Falk); temporal lobe visible on right side.
SP 20				Endocast	Both	Nice endocranial cast of posterior and basal regions of brain. Preserves cerebellum, sinuses and medulla. Cerebrum is preserved in the parietal region.
SP 21			*C. williamsi*	Mandible	Right	Right mandibular body and part of ascending ramus. Broken teeth, P_3-M_3, present.
SP 22			*P. izodi*	Maxilla	Both	Badly cracked muzzle with P^3-M^3 on right and P^4-M^3 on left. Fits well with Swp1 – though perhaps not same individual.
SP 23				Endocast	Both	Small amount of bone and endocranial cast of a basicranium.
SP 24			*P. izodi*	Cranium	Both	Right 2/3 of cranium with right orbit, inferior portions of right temporal and parietal. Preserves most of basicranium. Also, has palate, but left side is sheared and no teeth are present on left. Right side has P^4-M^3. P4 complete, M^1 missing lingual half, M^2 cracked midline (m-d) and M^3 is missing disto-buccal cusp. Appears to be *P. izodi* in dental structure (PM/M ratio). On right side, appears to have a slight hint of a supraorbital torus, but nasal region is missing/fragmented, so not definitive.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
SP 25				Cranium	Both	Frontals and parietals of cranium (both sides). Endocranial surface covered with breccia.
SP 26			*Papio*	Cranium	Left	Large block of breccia with portion of left side of cranium and next to it, part of the calotte.
SP 27				Cranium	Both	(a) eroded top of calvarium, some bone, some endocranial cast; very poor condition (c) cranial fragments.
SP 28	Sterkfontein, Krugersdorp			Endocast	Both	Endocranial cast of top of calvaria, and some bone from basicranium.
SP 29				Endocast	Indet.	Calotte with some missing portions. Endocranial cast exposed; one side only exposed.
SP 30	Type site		*Papio*	Cranium	Both	Complete cranium with right M^2-M^3 and left P^4, M^1 and M^2 –Female
SP 31	Type site?			Cranium	Right	Crushed endocast with adhering bone. Appears to be mostly the right side with attached ?frontal.
Swp 1	D13		*Pp. jonesi*	Mandible	Right	Right half of mandible, P_3-M_3 and left P_4-M_1. PM/M proportions suggest *Pp. jonesi*. P_3 fragmented so difficult to determine sectorial nature, but looks small; occlusal surface with cuspy teeth.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2	D13	5/16/1969	*P. izodi*	Maxilla	Both	Crunched palate and base of young immature adult calvaria P^4-M^2 bilaterally; appears to have well developed maxillary fossa on both sides with *Pp. broomi*-like zygomatics and dentition; M^3 visible on left from crypt.
Swp 3	D13		*Pp. jonesi*	Mandible	Both	Mandible lacking ascending rams and upper part of symphysis. Right P_3-M_1 and left P_4-M_3; missing anterior alveoli, but inferior margin seems to go to the distal P_4 range. Left M_1 missing lingual enamel; right M_1 has cracked filled with breccia. So, measurement is an estimate.
Swp 4	D13		*P. izodi*	Mandible	Both	Mandible lacking ascending rami, right P_3-M_3 and left P_3-M_2.
Swp 5	D13		*Pp. broomi*	Mandible	Left	Left half of mandible M_1-M_3 has typical *Pp. broomi*/*Pp. whitei* feature of ascending rami obscuring the M_3 (distally). Also appears to be cuspy; *Pp. broomi* sized and proportioned.
Swp 6	D13			Maxilla	Indet.	Maxillary fragment dm^1, dm^2 and M^1
Swp 7	D13		*Pp. jonesi*	Mandible	Both	Mandibular symphysis, left I_1-C and right I_1-C. Heavily worn, posterior foramen visible, and inferior margin not visible. Anterior surface appears to have well developed lines from incisors moving inferio-laterally.
Swp 8	D13	8/14/1969		Mandible	Right	Mandibular fragment with right M_3; High cusps.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 9	D13		*Pp. jonesi*	Mandible	Right	Right mandibular fragment with P_4-M_3; Proportion and size suggests *Pp. jonesi*.
Swp 10	D13	1/17/1969	*P. izodi*	Maxilla	Both	Immature palate with P^3-M^2; bilaterally fractured M^2 broken into 2 pieces, but has been glued. Dentition and palate are in excellent shape. *Pp. broomi* sized.
Swp 11			*Pp. jonesi*	Mandible	Left	Left mandibular ramus fragment with M_2-M_3; Partial ascending ramus, but no processes preserved.
Swp 12	D15		*P. izodi*	Cranium	Both	Cranium lacking calotte and supraorbital region. Preserves left and right P^3, P^4, M^2 and M^3. Catalog suggests *Pp. broomi*, but I would disagree and suggest *P. izodi*. Dentition is *P. izodi* sized and shaped, but specimen is missing diagnostic anteorbital region. Fossae do not appear to be *Pp. broomi*-like, but does resemble more *P. izodi*. Canine appears to have been small, but region is fragmented and difficult to determine exact size dimensions. Preserves complete basicranium, but lacks superior portion of muzzle and neurocranium. Right side of muzzle appears to have maxillary fossa distorted laterally so no fossa is preserved. However, on the left side, fossa appears to be *P. izodi*-like, but not developed to the degree of 'typical' *P. izodi*. Region is however damaged and may not be representative of the specimen's premortem morphology. The root of the zygomatic is

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						located between mesial and distal lophs of M^3. Preserves zygomatic arch on left side.
Swp 13	D13		*Pp. jonesi*	Mandible	Right	Right mandibular fragment P_4-M_3. Suggested to be a *P. jonesi* dentition displays high cusps.
Swp 14	D15		*Pp. broomi*	Maxilla	Both	Maxillary fragment with left P^3-M^2 and right C-M^1; Sides distorted with respect to one another. Right side superiorly shifted posteriorly.
Swp 15	D13		*Pp. jonesi*	Mandible	Left	Left ascending ramus and body with M_2 and M_3. Specimen goes with Swp 245 (see notes). M_3 not fully erupted, but has been airscribed out.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 16	D15	1/20/1970	*C. williamsi*	Mandible	Right	Right mandibular fragment with M_2 and M_3. V-shaped buccal clefts. M_2 distorted due to fracture; length can only be estimated.
Swp 17	D13		*Pp. jonesi*	Mandible	Left	Left mandibular ramus with M_3 and distal ½ M_2; contra species designation in catalog.
Swp 18	D13	5/27/1978	*Parapapio*	Maxilla	Right	Right maxillary fragment P^3-M^3. Specimen appears to have a small maxillary fossa, but fragmented so difficult to determine with confidence. M^1 missing distal cusp. Preserves deep palate; but M^3 displays small distal loph. Very *Lophocebus*-like.
Swp 19	D13		*Pp. broomi*	Maxilla	Right	Right maxillary fragment P^3-M^2;
Swp 20	D13	1/14/1970	*Parapapio*	Maxilla	Right	Maxillary fragment. Right with M^2 and M^3. Specimen looks *Pp. jonesi*-sized. Deep palate.
Swp 21	D13	8/21/1969	*P. izodi*	Maxilla	Left	Left maxillary fragment with P^3-M^1; *Pp. broomi*-sized, but no other morphology determinable.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 22	D15		*Pp. jonesi*	Mandible	Right	Right mandibular fragment with M_1-M_3. Worn very heavily; perhaps, there are two SP 22's, but this one is a maxillary fragment with left P_4 (lingual fragment), M_1 (heavily fractured), M_2 (missing buccal enamel), M_3; right P_3-M_3, appears to have had a large canine. Teeth appear *Pp. jonesi*. Maxillary fossa difficult to assess. Specimen looks almost *Pp. broomi*-like, but would cf. *Pp. jonesi*. Doesn't seem to have typical *Pp. broomi* features; muzzle looks more triangular shaped (i.e. *Pp. jonesi*). Zygomatic root originates at M_2 distal loph.
Swp 23	D14			Maxilla	Left	Left maxillary fragment of immature individual; P^3-P^4 (erupting); M^1 and M^2 present, M^3 absent.
Swp 24	D13	5/22/1970		Maxilla	Right	Badly damaged palate with right P^3-M^3. Appears to be *Pp. jonesi*, but teeth are immeasurable. Badly damaged.
Swp 25	D13			Maxilla	Both	Anterior portion of palate, left P^4-M^2, right M^1 and M^2 badly damaged; only right M^2 measurable. Exhibits deep palate.
Swp 26	D13		*C. williamsi*	Cranium	Both	Partial calvaria. Left and right orbit. Well developed tori; missing most of interorbital region. However, appears to be wide and has high cranial vault. Small portion of the basicranium present, but is in poor condition and covered with breccia.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 27	D13		*P. izodi*	Maxilla	Left	Muzzle, mainly left half with I^1-M^3; suggestive female, because of small fragmentary canine. Doesn't have maxillary fossa and is fractured in maxillary ridge region. Superior portion of muzzle sheared off. M^1 is in poor condition, but others appear to be measurable. Does possess some right incisors, but incisors are fragmentary and lingual surface of incisors is flattened against the palatal surface; only labial surface visible.
Swp 28	D14			Cranium	Both	Juvenile cranium with endocranial cast and left dm^2 and right dm^1 and dm^2.
Swp 29 a-d	D15	10/26/1968	*P. izodi*	Cranium	Left	Left half of neurocranium including the entire muzzle. (a) Left I^1-M^2, right max. I^1, C, P^3, P^4. (b) Left half of mandible with M_3 (covered with breccia) ,but appears to have the typical *Pp. broomi/whitei* feature of ascending ramus obscuring the M_3 in lateral view (see TM notes). Lengths can be measured, but most teeth are only preserved as buccal enamel. M_3 occlusal surface covered with breccia. Proximal half of right femur and distal end of right tibia. Cranial specimen compares well with Swp 31.
Swp 30	D14	3/23/1970	*Pp. broomi*	Maxilla	Left	Posterior palate and crushed left portion of facial skeleton. M^2 and M^3. Very deep palate, but unfortunately cannot tell the state of the maxillary fossae.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 31	D13		*P. izodi*	Maxilla	Right	Maxilla with badly damaged right P^4-M^3. Was placed into *P. robinsoni* by Eisenhart (1974). However, specimen was artificially distorted postmortem and appears larger than actual morphology suggests. Palate has fracture filled with breccia separating the two halves, as well left side of palate (around canine) is fractured and displaced laterally. Specimen is a definitive *P. izodi*, and not *P. robinsoni*. Left half is also shifted anteriorly with respect to right side. Berger et al (2002) argue *P. robinsoni* for their 'revised age estimates' of the Sterkfontein fauna. However, specimen has typical *P. izodi* fossa on right, no features preclude it from *P. izodi* and none suggest *P. robinsoni*; teeth are fragmentary, Breccia separating two halves is 8mm wide. Specimen compares well with types specimen of *P. izodi*.
Swp 32	D13			Mandible	Right	Right mandibular fragment with M_3; partial M_2 present but heavily damaged.
Swp 33	D13			Mandible	Right	Right mandibular fragment M_1-M_3. M_1 is damaged; only estimated length.
Swp 34	D13			Tooth	Left	Isolated crown and roots in matrix of left M2
Swp 35	D13			Maxilla	Left	Left maxillary fragment with P^4; large maxillary fossa. Wits catalog says *Pp. whitei*.
Swp 36	D13			Tooth	Right	Isolated right M_3; prominent cusps

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 37	D13			Tooth	Right	Isolated right M_3
Swp 38	D13			Tooth	Left	Isolated left M_3
Swp 39	D13			Tooth	Left	Isolated left M_3
Swp 40	D13			Tooth	Left	Isolated crown and partial root left M_3
Swp 41	D13			Tooth	Left	Isolated crown of left M_3; cuspy like *Pp. jonesi*
Swp 42	D13			Tooth	Right	Isolated crown and partial root of right M_3; cuspy, not like *Pp. broomi.*
Swp 43	D13			Tooth	Left	Isolated crown and partial root of left M_3
Swp 44	D13			Tooth	Right	Isolated crown of right M_3
Swp 45	D13			Tooth	Right	Isolated molar, probably right M^2?
Swp 46	D13	4/29/1968		Mandible	Right	Right mandibular fragment with P_4-M_2; M_1 missing buccal half; only length taken.
Swp 47	D13			Tooth	Right	Right isolated M_3 with roots
Swp 48	D13			Tooth	Left	Isolated molar probably left M^2
Swp 49	D13			Tooth	Left	Isolated crown and roots of left M^3
Swp 50	D13			Tooth	Left	Isolated crown of left M^3
Swp 51	D13			Tooth	Right	Isolated molar, probably right M_2
Swp 52	D13			Tooth	Left	Isolated left M^3 (large mesial cingulum cusp)
Swp 53	D13			Tooth	Left	Isolated, much worn, left M_3; catalog says *Pp. jonesi*, However, designation must be sized based. No root preserved.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 54	D13			Tooth	Left	Isolated crown and complete roots of left M^1 (wear facets mesially and distally); disto-lingual cusp fractured
Swp 55	D13			Tooth	Left	Isolated crown and partial roots with breccia of left M^1
Swp 56	D13			Tooth	Left	Isolated crown and partial root of left M_3
Swp 57	D13			Tooth	Left	Isolated crown and partial root of left P_3; small female-sized
Swp 58	D14		*P. izodi*	Maxilla	Both	Muzzle with C-M_3, bilaterally; female *Pp. broomi*; missing anterior dentition, and right side shows a maxillary fossa, not developed as well as in Swp 2946
Swp 59	D13		*Pp. jonesi*	Maxilla	Both	Posterior part of palate with right P^3-M^3 and left M^1-M^3; catalog says *Pp. broomi/jonesi*, but appears to be definite *Pp. jonesi*. Root of zygomatics near distal M^2. Difficult to make out diagnostic features such as ridges, fossa because of fracture. Halves appear to be moved medially toward each other
Swp 60	D13			Mandible	Both	Juvenile mandible (only lacking ascending rami) with dm_1 and dm_2. Bilaterally; also same number; isolated M_1. Doesn't have roots so probably fell out of crypt; note on glass vial just says from mandible; located in two different places morphological locations though.
Swp 61	D13			Maxilla	Right	Right mandibular fragment with M_1, roots of P_4.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 63	D13			Tooth	Right	Right molar, probably M^2 (mesial and distal wear facets); isolated crown and partial roots
Swp 64	D13			Tooth	Left	Isolated crown and partial roots of M_2, left (contra catalog)
Swp 65	D13			Tooth	Right	Isolated crown and roots of right molar, probably M_2
Swp 66	D13			Tooth	Right	Isolated crown and roots of right P_3; male
Swp 67	D13			Tooth	Left	Isolated left (contra catalog) crown and partial roots of ?M1
Swp 68	D13			Tooth	Right	Isolated crown and partial roots of right M^2
Swp 69	D13			Tooth	Right	Isolated crown and roots of right ?M_2
Swp 70	D13			Tooth	Left	Isolated crown and partial roots of left P_3; female?
Swp 71	D13			Tooth	Left	Isolated crown and roots of left P_4; heavily worn
Swp 72	D13			Tooth	Right	Isolated crown and partial root of right M^2 (might be M^1)
Swp 73	D13			Tooth	Left	Isolated crown and partial roots of left M^3
Swp 74	D13			Tooth	Right	Isolated crown and partial root of right M^1?
Swp 75	D13			Tooth	Right	Isolated crown and partial roots of right P^3
Swp 76	D13			Tooth	Right	Isolated crown and roots of right dm^1
Swp 77	D13			Tooth	Left	Isolated crown and partial root of left (contra catalog) P^4; heavily worn; kind of small may be P^3

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 78	D13			Tooth	Right	Isolated crown and roots of right P_4
Swp 79	D13			Tooth	Left	Isolated crown and root of left dm^2
Swp 80	D13			Tooth	Left	isolated crown and root of left M_2
Swp 81	D13			Tooth	Right	Isolated crown and roots of right M^3?
Swp 82	D13			Tooth	Right	Isolated crown and roots of right M_1; *C. williamsi*?
Swp 83	D13		*Pp. jonesi*	Mandible	Right	Right mandibular fragment with M_1-M_3; difficult to see any diagnostic features. Cervix fragmented
Swp 84	D13	10/29/1970		Maxilla	Left	Left maxillary fragment with I^2? and P^3 and P^4; contra catalog
Swp 85	D13			Maxilla	Left	Left maxillary fragment with dm^1 and dm^2
Swp 86	D13			Maxilla	Right	Right maxillary fragment with dm^1 and dm^2
Swp 87	D13		*Pp. broomi*	Tooth	Right	Isolated crown and root with breccia of right M^3; looks *Pp. broomi*-like with *Lophocebus*-like proportions.
Swp 88	D13			Tooth	Left	Isolated crown and very small partial root left M_2
Swp 89	D13			Tooth	Left	Isolated crown and small root fragment of left M_2
Swp 90	D14			Tooth	Right	Isolated crown and root fragment of right M_3; very cuspy; could be *C. williamsi.*
Swp 91	D13			Tooth	Left	Isolated crown of left M_2
Swp 92	D13			Tooth	Right	Isolated crown right M_2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 93	D13			Tooth	Left	Isolated crown left M_1
Swp 94	D13			Tooth	Right	Isolated crown right M_1
Swp 95	D13			Tooth	Right	Isolated crown and partial root of right M_2
Swp 96	D13			Tooth	Right	Isolated crown and partial root of right M_2
Swp 97	D13			Tooth	Indet.	Isolated crown and partial root M_1
Swp 98	D12			Tooth	Right	Isolated crown right M_1
Swp 99	D13			Tooth	Left	Isolated crown and partial root left M_2
Swp 100	D13			Tooth	Left	Isolated crown of left M_1
Swp 101	D13			Tooth	Right	Isolated crown and partial root of right M_2
Swp 102	D13			Tooth	Left	Isolated crown of left M_1
Swp 103	D13			Tooth	Right	Isolated crown of right M_2
Swp 104	D13			Tooth	Left	Isolated crown and partial roots of left dm_2
Swp 105	D13			Tooth	Right	Isolated crown and partial root of right dm_1; heavily worn though, no measures can reliably be taken.
Swp 106	D13			Tooth	Left	Isolated crown and partial root left M^2 (antimere to 107)
Swp 107	D13			Tooth	Right	Isolated crown and partial root of right upper M^2 (106 and 107 appear to be antimeres)
Swp 108	D13			Tooth	Left	Isolated crown of left M^2
Swp 109	D13			Tooth	Left	Isolated crown of left M^2?
Swp 110	D13			Tooth	Left	Isolated crown of left upper dm^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 111	D13			Tooth	Left	Isolated crown of right M^2
Swp 112	D13			Tooth	Right	Isolated crown of right M^2
Swp 113	D13			Tooth	Right	Isolated crown of right M^3
Swp 114	D13			Tooth	Left	Isolated crown and partial root of left M^3
Swp 115	D13			Tooth	Right	Isolated crown (no roots developed) of right M^2
Swp 116	D13			Tooth	Right	Isolated crown and roots of right M^2
Swp 117	D15			Tooth	Right	Isolated crown of right M^3; fragmented at cervix
Swp 118	D13			Tooth	Left	Isolated crown and partial root of left M^2
Swp 119	D13			Tooth	Left	Isolated crown and partial root of left M^1
Swp 120	D13			Tooth	Left	Isolated crown of left dm^2
Swp 121	D13			Tooth	Right	Isolated crown of right M^1
Swp 122	D15			Tooth	Left	Isolated crown of left M^2
Swp 123	D13			Tooth	Left	Isolated crown of left M^3 (roots not formed); perhaps, fell out of crypt
Swp 124	D13			Maxilla	Left	Maxillary fragment with left dm^2
Swp 125	D13			Maxilla	Left	Maxillary fragment with left dm^2 and dm^1
Swp 126	D13			Tooth	Right	Isolated crown and partial root of right M^2; poor condition
Swp 127	D13			Mandible	Left	Left P_4 in small fragment of mandible
Swp 128	D13			Tooth	Left	Isolated crown and partial root of left P_4

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 129	D13			Mandible	Right	Isolated right P_4 in small fragment of mandible
Swp 130	D13			Tooth	Right	Isolated crown and partial root of right P^4; however, appears to be a P^3, not P^4 (contra catalog).
Swp 131	D13			Tooth	Left	Isolated crown and partial root of left P^4.
Swp 132	D13			Tooth	Left	Isolated crown of left P^4.
Swp 133	D13			Tooth	Left	Isolated crown and partial root of left P^3.
Swp 134	D13			Tooth	Right	Isolated crown of right P^4.
Swp 135	D13			Tooth	Left	Isolated crown of left P^4.
Swp 136	D13			Tooth	Left	Isolated crown of left P^3.
Swp 137	D13			Maxilla	Right	Right maxillary fragment with P^3 and P^4.
Swp 138	D13			Tooth	Left	Isolated crown and roots of left upper P^3?
Swp 139	D13			Tooth	Left	Isolated crown and complete root of left C^1 (male sized).
Swp 140	D13			Tooth	Left	Isolated crown and partial root of left C^1 (female sized).
Swp 141	D13			Tooth	Left	Isolated crown and partial root of left C^1.
Swp 142	D13			Tooth	Left	Left C^1.
Swp 143	D13			Tooth	Right	Right C^1.
Swp 144	D13			Tooth	Left	Left C^1.
Swp 145	D13			Tooth	Right	Right C^1.
Swp 146	D13			Tooth	Right	Right C^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 147	D13			Tooth	Left	Left C^1.
Swp 148	D13			Tooth	Left	Left C^1.
Swp 149	D13			Tooth	Right	Right dc^1.
Swp 150	D13			Tooth	Right	Right dc^1.
Swp 151	D13			Tooth	Right	Right C_1.
Swp 152	D13			Tooth	Left	Left C_1.
Swp 153	D13			Tooth	Right	Right C_1.
Swp 154	D13			Tooth	Left	Crown fragment of left C_1.
Swp 155	D13			Tooth	Left	Left C_1.
Swp 156	D13			Tooth	Right	Fragment of right C_1.
Swp 157	D13			Tooth	Left	Left C_1.
Swp 158	D13			Tooth	Left	Left dc_1.
Swp 159	D13			Tooth	Left	Left dc_1.
Swp 160	D13			Tooth	Left	Left I^1.
Swp 161	D13			Tooth	Right	Crown fragment of right I^1.
Swp 162	D13			Tooth	Left	Isolated crown of left I^1.
Swp 163	D13			Tooth	Right	Fragmented crown of right I^1.
Swp 164	D13			Tooth	Right	Right I^1.
Swp 165	D13			Tooth	Right	Right I^1.
Swp 166	D13			Tooth	Left	Left I^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 167	D13			Tooth	Left	Left I^2?
Swp 168	D13			Tooth	Left	Left I_1
Swp 169	D13			Tooth	Right	Right I^2.
Swp 170	D13			Tooth	Right	Right I^2.
Swp 171	D13			Tooth	Left	Left I_1.
Swp 172	D13			Tooth	Right	Right I^2.
Swp 173	D13			Tooth	Right	Right upper I^2.
Swp 174	D13			Tooth	Left	Left I_2.
Swp 175	D13			Tooth	Left	Left I_2.
Swp 176	D13			Tooth	Left	Left di^1.
Swp 177	D13			Tooth	Right	Right I^1.
Swp 178	D13			Tooth	Right	Right I^1.
Swp 179	D13			Tooth	Left	Heavily worn left I^2.
Swp 180	D13			Tooth	Left	Left I^1.
Swp 181	D13			Tooth	Right	Right I^2.
Swp 182	D13			Tooth	Left	Left I^2.
Swp 183	D13			Tooth	Right	Right I_1.
Swp 184	D13			Tooth	Right	Right I_1.
Swp 185	D13			Tooth	Right	Right I_1.
Swp 186	D13			Tooth	Left	Left I_1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 187	D13			Tooth	Right	Right I_2.
Swp 188	D13			Tooth	Right	Right M_1.
Swp 189	D13			Tooth	Right	Isolated crown, no roots, of right M_3.
Swp 190	D13	6/5/1969	*C. williamsi*	Mandible	Right	Right mandibular fragment with dm_2 and M_1.
Swp 191	D13			Tooth	Left	Isolated crown and fragmented root of left M_3.
Swp 192	D13			Tooth	Left	Isolated crown in breccia of left M_3.
Swp 193	D13			Tooth	Right	Isolated crown in breccia of right M_3.
Swp 194	D13			Tooth	Left	Isolated crown of left M_3 in breccia.
Swp 195	D13			Tooth	Right	Isolated crown of right M_3 in breccia.
Swp 196	D13			Tooth	Right	Isolated crown of right M_3.
Swp 197	D13			Tooth	Right	Isolated crown and partial roots of right M_2.
Swp 198	D13			Tooth	Right	Isolated crown and roots of right M_2.
Swp 199	D13			Tooth	Left	Isolated crown of left M_2.
Swp 200	D13			Tooth	Left	Isolated crown of left M_1.
Swp 201	D13			Tooth	Right	Isolated crown right (contra catalog) dm_2 in small fragment of mandible.
Swp 202	D13			Tooth	Right	Isolated crown of right M_1; appears to be *C. williamsi*, small size with shearing crests.
Swp 203	D13			Tooth	Right	Isolated crown of right M_1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 204	D13			Tooth	Left	Left M_1? Lacking much contextual information. Specimen appears to have two roots suggesting that that side and jaw are correct.
Swp 205	D13			Tooth	Left	Crown only of left dm_2.
Swp 206	D13			Tooth	Right	Isolated crown of right dm_2.
Swp 207	D13			Tooth	Left	Isolated crown and partial roots of left M^2.
Swp 208	D13	2/7/1968		Mandible	Left	Left mandibular fragment posterior to the M_3. Does preserve neither teeth nor gonion.
Swp 209	D13	8/2/1972		Cranium	Indet.	Fragment of cranium; indet.
Swp 210	D13			Tooth	Left	Isolated crown of left M^2.
Swp 211	D13			Tooth	Right	Right M^2 or M^3.
Swp 212	D13			Tooth	Left	Left M^3?
Swp 213	D13			Tooth	Right	Right M^3.
Swp 214	D13			Tooth	Right	Isolated crown of right M^2; goes with Swp 215.
Swp 215	D13			Tooth	Right	Isolated crown of right M^3.
Swp 216	D13			Cranium	Left	Crushed face and mandible with dentition preserved on left side. Appears to be a juvenile with a left dm_1, dm_2, M_1 and M_2. Maxillary more difficult to see, but looks like dm^2, M^1, erupting M^2 and C^1. Right side of specimen mangled and fractured – no teeth identifiable. Mandible sheared just below the alveoli; roots can be visualized roots inferiorly.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 217	D13			Maxilla	Left	Left maxilla fragment with dm^1 and dm^2.
Swp 218	D13			Maxilla	Left	Left maxilla fragment with dm^2.
Swp 219	D13			Tooth	Right	Small fragment of isolated right P_3.
Swp 220	D13			Tooth	Right	Isolated crown and partial root of right P_4.
Swp 221	D13			Tooth	Right	Isolated crown of right P_4; heavily worn.
Swp 222	D13			Tooth	Right	Isolated crown of right P_4.
Swp 223	D13			Tooth	Right	Isolated crown and partial crown of right P_4.
Swp 224	D13			Tooth	Right	Isolated crown of right P_4; ws 8.
Swp 225	D13			Tooth	Left	Isolated crown of left P^4.
Swp 226	D13			Tooth	Right	Isolated crown of right P^4.
Swp 227	D13			Tooth	Right	Isolated crown of right P^4.
Swp 228	D13			Tooth	Right	Isolated crown of right P^4.
Swp 229	D13			Tooth	Left	Isolated crown of left P^3.
Swp 230	D13			Tooth	Left	Isolated crown of left I^1.
Swp 231	D13			Tooth	Left	Isolated crown of left I^1.
Swp 232	D13			Tooth	Left	Isolated left I^2; heavily worn.
Swp 233	D13			Mandible	Right	Right mandible with P_4, M_1 and M_2; could be *C. williamsi* because of deep buccal notches, but doesn't look definitive.
Swp 234	D13			Mandible	Left	Left mandible fragment with C_1, P_3, P_4 and M_1; very small; C_1 and P_3 very, very small, but is an older adult, heavily worn.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 235	D13			Mandible	Left	Mandible fragment with left P_4, P_3, C_1, I_2 and right I_2, C_1. Some measurements are possible, but teeth are in different planes and fragmented. Small P_3; female.
Swp 236	D13	8/16/1970		Maxilla	Left	Left maxilla fragment with M^1, M^2 and M^3 (erupting); small M^3 *Lophocebus*-like; M^2 missing lingual cusps; buccal enamel of P^4 also present. Root of zygomatics at distal M^2.
Swp 237	D13			Maxilla	Left	Left maxilla fragment with M^1 and M^2; papionin.
Swp 238	D13			Maxilla	Left	Left maxilla with dm^1 and dm^2; juvenile.
Swp 239	D13	3/21/1972		Maxilla	Right	Right maxilla fragment with P^4, M^2 and M^3. M^3 appears to be *Lophocebus*-like. M^3 is not in occlusion about ½ -way erupted. M^2 measurable; cf *Pp. broomi*.
Swp 240	D13			Tooth	Right	Right M_2.
Swp 241	D13			Mandible	Left	Left mandible fragment with M_1.
Swp 242	D13			Mandible	Right	Right mandible fragment with dm_2 and M_1; looks like it matches well with Swp 204. Possibly, same individual, but definitely, same species.
Swp 243	D13	1/20/1969		Mandible	Left	Left mandible fragment with M_1 and fragment of dm_2; M_2 crown in crypt. Difficult to taxonomically identify.
Swp 244	D13			Mandible	Right	Right mandible fragment with P_4 and buccal fragment of M_1; P_4 ws = 5.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 245	D13		*Pp. jonesi*	Mandible	Both	Mandibular symphysis with I_1-M_1, bilaterally; goes with Swp 15; a nice male *P. jonesi*; left I_1-M_3 present; right I_1-M_1 (specimen fragmented mesio-lingually).
Swp 246	H1		*Pp. broomi*	Maxilla	Both	Maxillary symphysis with left I^1-M^1 and right I^1-P^4. Older adult, heavily worn, matches well with *P. broomi* specimen Swp 1879, but is missing most diagnostic features. Difficult to judge fossae, etc.
Swp 247	D13			Tooth	Right	Isolated right C_1.
Swp 248	D13			Tooth	Left	Isolated left C_1.
Swp 249	D13			Tooth	Right	Isolated right C_1.
Swp 250	D13			Tooth	Left	Isolated and heavily worn left C_1.
Swp 251	D13			Tooth	Left	Left C^1.
Swp 252	D13			Tooth	Right	Isolated right C^1.
Swp 253	D13			Tooth	Left	Isolated left C^1.
Swp 254	D13			Tooth	Right	Isolated and heavily fragmented right C^1.
Swp 256	D13			Tooth	Right	Right dc^1.
Swp 257	D13			Tooth	Right	Isolated right dc^1.
Swp 258	D13			Tooth	Right	Isolated right C^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 259	D13	11/2/1971		Mandible	Both	(a) Crushed mandible with right C_1-M_2 and left P_4-M_2. (b) Right M_3. c) Condyle and coronoid process with sigmoid notch of left mandible; small P_3 female?
Swp 260	D13		*Parapapio*	Maxilla	Right	Right maxilla fragment with ½ P3, P^4, M^1 and M^2, M^3.
Swp 261	D13	1/18/1971	*Pp. broomi*	Maxilla	Left	Left maxilla fragment with P^4-M^2. Well-developed maxillary fossa; *Pp. broomi* sized, but difficult to determine. Deep palate; difficult to take wear scores.
Swp 262	D13			Tooth	Right	Isolated tooth in breccia; contra catalog right M^1?
Swp 263	D13			Tooth	Right	Isolated right M_1 in breccia.
Swp 264	D13			Tooth	Left	Isolated crown no root of left M_1.
Swp 265	D13			Tooth	Left	Isolated crown no roots in breccia of left dm_2.
Swp 266	D13	8/2/1971		Mandible	Both	Mandibular symphysis with left P_3, right P_3, mesial ½ M_1. Very small P_3 female.
Swp 267	D9			Tooth	Right	Isolated crown and partial root of right di^1.
Swp 268	D13			Tooth	Right	Isolated crown and partial root of right C^1.
Swp 269	D13			Tooth	Right	Isolated crown and partial root of right C^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 270	D13		*Pp. jonesi*	Mandible	Both	Incomplete mandible lacking incisors, both C_1's and P_3; left posterior toothrow preserved (P_4-M_3); only P_4 on right, both rami lacking. Right corpus present only to level of P_4.
Swp 271	D13			Mandible	Left	Mandible fragment from left side; damaged P_4, M_1 and M_2 and well worn.
Swp 272	D13	10/20/1969		Mandible	Left	Left M_1, M_2 and portion of mandible. Protoconid of M_1 damaged as is hypoconid of M_2. Measurements are estimates only.
Swp 273	D13		*Pp. jonesi*	Mandible	Left	Portion of left mandibular body, P_3, P_4, M_1 fragmentary and still in matrix. M_2, and M_3 preserved. Ascending ramus is lacking; very poor condition, but has proportions similar to *Pp. jonesi*.
Swp 274	D13			Mandible	Left	Left mandibular fragment with worn and damaged M_2 and M_3. Lacking ascending rami and mandibular body below roots; teeth are in very poor condition. Only M_3 length measurable.
Swp 275	D13	10/20/1969		Mandible	Left	Left lower M_3 with portion of mandible. M_3 has a damaged mesial loph.
Swp 276	D13	8/20/1976		Mandible	Left	Left mandibular fragment with M_3. M_3 damaged on entoconid; only length is measureable. Has some morphology that looks either *C. williamsi* or *Theropithecus* because of notches between cusps and infolding of enamel.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 277	D13	3/23/1969		Mandible	Left	Left mandibular fragment lacking ramus. M_3 only tooth present-damaged anteriorly and at hypoconulid. Small in size.
Swp 278	D13	1/28/1971		Mandible	Right	Right mandibular body of juvenile; with erupting I_1; dm_1,dm_2 and M_1 present. Portion of fragmented crown present may represent a premolar. Dm_2 and m_1 measureable although M_1 is just erupting and not in occlusion yet.
Swp 279	D13		*Pp. broomi*	Mandible	Right	Mandible, nearly complete on right side including larger portion of the ascending ramus. Symphyseal region lacking all teeth. Mandibular corpus present on left to level of M_1; right M_1-M_3 present.
Swp 280	D13	8/25/1969	*C. willaimsi*	Mandible	Right	Damaged mandible from right side, portion of symphyseal region preserved. Lacking all teeth except P_3, P_4. Well worn; tooth measurements are estimates. Symphyseal region is nearly vertical; specimen appears to have prominentia lateralis.
Swp 281	D13	8/8/1969		Mandible	Right	Fragmented right mandible body with symphysis; right P_3-M_2. All damaged lingually; cf *Pp. jonesi* appears to be a male as the P_3 is sectorial. Only buccal sides of teeth are present.
Swp 282	D13	4/14/1971	*P. izodi*	Mandible	Right	Right mandibular body with P_4-M_2. M_2 damaged on entoconid; cf. *Pp. broomi*.
Swp 283	D13			Mandible	Right	Fragmentary right mandibular corpus P_4-M_3 (teeth cracked and fragmentary); no measurements taken.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 284	D13	2/25/1971		Mandible	Right	Right M_2 and M_3 with portion of mandibular corpus. M_2 damaged mesially; M_3 appears to be shifted lateral on its mesial margin.
Swp 285	D13			Mandible	Right	Damaged right M_3 in small fragment of mandible. Posterior root of M_2 also present; ws-16, M_3; very fragmented.
Swp 286	D13			Tooth	Right	Right isolated M_3 crown.
Swp 287	D13			Tooth	Right	Right M_3 in small fragment of mandible.
Swp 288	D13			Tooth	Left	Left M_3, isolated.
Swp 289	D13?			Mandible	Left	Left M_1 with fragment of mandible; breccia precludes measurement.
Swp 290	D13?			Tooth	Right	Right ?dm_2 contra catalog.
Swp 291	D13?			Tooth	Right	Isolated right M^2.
Swp 292	D13?			Tooth	Right	Isolated right M^3.
Swp 293	D13			Tooth	Right	Badly damaged lower M_3 (lingual half).
Swp 294	D13			Tooth	Right	Lingually damaged right M_3.
Swp 295	D13			Tooth	Right	Isolated right M_3, damaged mesially – missing most of mesial loph.
Swp 296	D13			Mandible	Left	Left M_3 with mandibular fragment. Lingual cusps damaged.
Swp 297	D13			Tooth	Left	Isolated left M_3. Well worn with protoconid damaged.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 298	D13			Mandible	Right	Small mandibular fragment with right M_1, M_2; well worn and slightly damaged, missing most of enamel.
Swp 299	D13			Tooth	Left	Isolated left M_1 damaged distally. Missing most of distal loph and enamel.
Swp 300	D13			Mandible	Left	Mandibular fragment, left with damaged P_3, P_4 and M_1; well worn, only P_4 measureable.
Swp 301	D13			Tooth	Right	Isolated crown and partial root of right M^3.
Swp 302	D13			Tooth	Right	Isolated crown and partial root of right M^3; cusps are damaged.
Swp 303	D13			Tooth	Right	Right M^2, M^3-damaged with small portion of maxilla; in very poor condition; no measurements can reliably be taken.
Swp 304	D9			Tooth	Left	Isolated crown and partial root; left M^3; fragmented near cervix.
Swp 305	D13			Mandible	Right	Mandible fragment from right side with buccally damaged M_3; only length can be estimated.
Swp 306	D10			Mandible	Left	Small portion of left mandibular body with P_3, P_4 and M_1; measurements are estimates only.
Swp 307	D13	5/17/1968		Mandible	Right	Right half of symphysis; mandibular corpus present to level of M_1 mesial lophid. Roots of P_3, P_4, M_1; however, no measureable portions; bad condition – roots only.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 308	D13	11/30/1971		Cranium	Right	Fragmentary right orbit and palate with M^3 present bilaterally. Palate missing anterior to level of M^2; distal loph of M^2. M^3 on left side missing mesio-buccal cusp.
Swp 309	D13			Mandible	Right	Fragmentary right mandibular corpus with dm_1 and an M1 that is erupting.
Swp 310	D13	7/21/1969		Maxilla	Right	Right maxillary fragment directly below orbit, contains M^2 and M^3. Root of zygomatic at mesial M^3; lingual side of M^2 fractured. Lingual side of M^3 covered with breccia.
Swp 311	D13			Maxilla	Left	Left side maxillary fragment with P^4 and M^1; heavily worn.
Swp 312	D9			Mandible	Indet.	Small piece of breccia with worn and damaged P^4 and M^1; also associated with mandible fragments; heavily fragmented specimen.
Swp 313	D13			Maxilla	Right	Portion of maxilla from right side, with upper molar, probably M^1.
Swp 314	D13	10/15/1970		Maxilla	Right	Small portion of right maxilla with M^2 and M^3. M^2 missing disto-lingual cusp.
Swp 315	D3		*Pp. broomi*	Mandible	Both	Bilaterally crushed mandible. Incisors and canines lacking. P_3-M_1 on left; P_3-M_3 (damaged) on right. Lacking rami; teeth are heavily damaged. Most probably a *Pp. broomi* female. Only measurements that can be reliably taken are right P_4 and M_2.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 316	D3			Mandible	Both	Badly damaged mandible lacking symphysis and rami; P_3-M_2 on left and distal M_1-M_3 on right. All teeth are heavily damaged. Papionin.
Swp 317	D3			Mandible	Left	Portion of left side of juvenile mandible dm_1, dm_2 and M_1 present ?I_2 can be seen in crypt.
Swp 318	D13	10/18/1977		Maxilla	Right	Right zygomatic and adjoining section of maxilla. Roots only M^2, M^3. Tooth roots difficult to visualize; no measurements taken.
Swp 319	D3			Cranium	Both	Basicranium still in breccia. Left M^3 is the only tooth present, and it is damaged mesially.
Swp 320	D3	3/28/1973		Mandible	Left	Mandibular fragment from left side preserving I_1-P_4 region. P_3 is the only preserved tooth; large tooth – highly sectorial male.
Swp 321	D3	4/4/1973		Mandible	Right	Badly damaged mandibular fragment from the right side. Still not completely developed. P_3, P_4 and M_1 present but damaged. Teeth heavily damaged and not measureable. P_3 small; but sectorial and male in appearance; measurements can be estimated.
Swp 322	D13	5/26/1971		Maxilla	Right	Maxillary fragment form right side with M^1 (badly damaged), M^2 and M^3. Heavily worn; some measurements taken, but not many. Specimen approximates *Pp. jonesi* in size.
Swp 323	D13	9/20/1972		Maxilla	Left	Left tooth row (P^3-M^2) in maxillary bone. M^2 beginning to come into occlusion; zygomatic at mesial M^2 level. cf *Pp. broomi*.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 324	D13		*Pp. broomi*	Maxilla	Both	Bilaterally crushed muzzle, teeth are well-worn and damaged. No measurements can be reliably taken; in premolar-to-molar proportions specimen looks *Pp. broomi*.
Swp 325	D18			Maxilla	Left	Fragment of left maxilla and palate, dc^1, dm^1 present M^1 is beginning to erupt; measurements of dm^1 and dc^1 are only ones possible.
Swp 326	D13	7/19/1972		Maxilla	Left	Left maxillary palatine fragment with M^2 and M^3 (erupting).
Swp 327	D13	5/10/1972		Maxilla	Right	Right maxillary fragment with P^4, M^1 and M^2; lingual side of P^4 missing. Only mesial loph (fragmented) of M^2.
Swp 328	D13	5/28/1973		Maxilla	Both	Very badly damaged muzzle with palate; only tooth present is a damaged left M^3 and right mesio-lingual cusp of m^1. Neither measureable.
Swp 329	D13			Maxilla	Right	Damaged palate with M^3 on right side. Mesial loph not measureable; missing mesio-lingual cusp.
Swp 330	D13			Tooth	Indet.	Molar in breccia; perhaps M^1; fragmented and indet.
Swp 331	D13	8/17/1972		Maxilla	Both	Badly crushed and distorted palate and left tooth row; only P^4 is not seriously damaged; estimates of P^4 were taken.
Swp 332	D13	7/24/1972		Maxilla	Right	Right portion of muzzle; P^4 in crypt as is canine; no measurements. Palate is fragmented and C^1 can only be visualized

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						from the internal surface.
Swp 333	D3			Mandible	Right	Right mandibular fragment, P_4 in crypt, dm_2 present, roots of M_1; no measurements possible.
Swp 334	D13			Tooth	Right	Isolated crown and partial root of right C^1; fractured.
Swp 335	D3			Tooth	Left	Crown and partial root of left C^1; fragmented root.
Swp 336	D13			Tooth	Right	Right C^1; tip fractured. Very small in size; female.
Swp 337	D13			Tooth	Right	Right upper C^1; very large male.
Swp 338	D3			Tooth	Right	Isolated crown and partial root of right M^1.
Swp 339	D13			Tooth	Right	Contra catalog; right M^3.
Swp 340	D3			Tooth	Right	Isolated crown of right M^3.
Swp 341	D13			Tooth	Right	Isolated crown of right M^3.
Swp 342	D13			Tooth	Right	Isolated fragment of right I^2.
Swp 343	D13			Tooth	Left	Isolated fragment of crown of left I^1; heavily worn.
Swp 344	D3			Tooth	Right	Isolated crown and partial root of right I^2.
Swp 345	D3			Tooth	Right	Isolated crown and partial root of right I_1.
Swp 346	D13			Tooth	Right	Isolated right I_2; heavily worn.
Swp 347	D3			Tooth	Left	Isolated left I_2 crown and partial root.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 348	D13			Tooth	Left	Isolated crown and partial root of left C_1; male.
Swp 349	D13			Tooth	Left	Isolated crown and root of left C_1.
Swp 350	D3			Tooth	Left	Isolated crown and partial root of left M_1.
Swp 351	D3			Tooth	Left	Isolated crown and partial root of left M_1.
Swp 352	D13			Tooth	Right	Isolated crown and partial root of right M_1.
Swp 353	D13			Tooth	Right	Isolated crown and partial root right M_3.
Swp 354	D13			Tooth	Left	Isolated crown and root of left C_1; tip is chipped.
Swp 355	D13			Tooth	Left	Isolated crown and root of left C_1; tip chipped.
Swp 356	D13			Tooth	Right	Contra catalog; right C_1.
Swp 357	D13			Tooth	Left	Badly damaged mandible, only left M_2 is present; tooth is fragmented and only length can be estimated.
Swp 358	D13	4/26/1968		Maxilla	Right	Right half of muzzle with roots of C^1, P^3, P^4, M^1, M^2, M^3; no measurements can be reliably taken.
Swp 359	D13			Mandible		Region of gonion and base of ramus. M_3-lacks hypoconulid (M_2 perhaps); heavily worn.
Swp 360	D13			Mandible	Right	Right mandibular body in region of M_3. Base of coronoid process, no teeth; heavily fractured; is a papionin.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 361	D13	11/9/1963		Cranium		Glabellar region of frontal bone, posterior end of nasal bones; looks to have *Parapapio* morphology because of sloping interorbital region rather than distinct anteorbital drop.
Swp 362	D13	6/25/1968		Cranium	Right	Right zygomatic bone; complete. Compares well with juvenile hominid (i.e. Taung). However, appears to be a papionin.
Swp 363	D13	3/17/1971		Cranium	Both	Supraorbital tori and damaged nasal bones. Neurocranium lacking posterior to tori; difficult to discern species or even genus. Interorbital area is damaged and cant discern anteorbital region.
Swp 364	D13			Cranium	Left	Portion of cranial vault roof, frontal and left parietal; can see left temporal line; but not supraorbital tori.
Swp 365 a	D13	6/23/1970	*P. izodi*	Cranium	Left	Crushed cranium; left orbits and muzzle half left badly damaged. Both sides preserved, but cranium has been laterally compressed. Specimen preserves dm^1-dm^2, m^1-m^2 bilaterally; some measurements not possible.
Swp 365 b	D13		*P. izodi*	Endocast	Left	Partial endocast of Swp 365a.
Swp 365 c	D13		*P. izodi*	Cranium	Left	Calotte belonging to Swp 365b.
Swp 366	D14			Cranium	Right	Badly crushed calvarium, portion of right orbit present.
Swp 367	D13			Endocast	Both	Anterior and right side portions of endocast; preserves frontal and temporal lobes.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 368	D13			Endocast	Both	Fairly complete endocranial cast lacking basal region, however; parietal lobes, mainly, and partial transverse sinuses.
Swp 369	D14			Endocast	Both	Posterior and basal regions of endocranial cast. Fragments of bone present in auricular and basi-occipital regions.
Swp 370	D15			Endocast	Both	Endocranial cast and cranial bone in occipital region of cranium.
Swp 371	D13			Tooth	Right	Isolated right C^1; very small and fragmentary.
Swp 372	D13		*C. williamsi*	Cranium	Left	Portions of left temporal, parietal and sphenoid; part of frontal also present. Supraorbital torus present but displaced and damaged
Swp 373	D13			Mandible	Right	Right mandibular fragment with P_3 (unerupted) and P_4; only length p_4 measureable.
Swp 374	D13			Tooth	Right	Isolated right M_2, perhaps M_1.
Swp 375	D12			Tooth	Left	Isolated left molar, probably M^3; fragmented.
Swp 376	in situ breccia, east of type locality, grid Q/30,		*P. izodi*	Maxilla	Left	Left fragment with dm1, dm^2 and M^1; juvenile.
Swp 377	D18	8/15/1974		Mandible	Left	Left mandibular body, C_1-M_2; covered with breccia. Only P_3 can be measured reliably. Small sectorial P_3 female; difficult to visualize occlusal surfaces.
Swp 378	D18			Mandible	Left	Left corpus and small portion of ascending ramus with M_2; M_3 neither

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						present nor erupted.
Swp 379	D18		*Pp. jonesi*	Mandible	Right	Right fragment of mandible with M_1, M_2 and M_3.
Swp 380	D18	10/7/1974		Mandible	Right	Right half of mandible with ramus broken. M_3 erupting fragments of C_1 (erupting) and P_4 (fractured) present; only mesial loph of M_3 measureable.
Swp 381	D18			Mandible	Both	Most of mandibular rami. Right side, dm_1, dm_2, M_1 and dc_1 present on right; dc_1 (broken) on left. None are measureable because of fragmentation and/or breccia on dental surfaces.
Swp 382	D18			Maxilla	Both	Maxillary palatal fragment with dm^1, dm^2 and M^1 (contra catalog) on left side; right side teeth are fractured off at roots.
Swp 383	D15			Maxilla	Both	Maxillary fragment with M^3, M^2 on left and M^3, M^2 on right (all fractured); no useful information.
Swp 384	D18			Maxilla	Right	Portion of right maxilla with much worn P^4, M^1 and M^2 (broken) (contra catalog); only measurements of P^4 possible.
Swp 385	D18			Maxilla	Left	Portion of left maxilla with M^1; has nice *Pp. broomi/whitei*- sized maxillary fossa and maxillary ridge; M^1 only tooth present. Others filled with breccia and cannot visualize even alveoli.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 386	D18			Mandible	Left	Portion of left mandible with very worn ½ of ?M_3; ws = 16. Specimen missing mesial and buccal sides.
Swp 387	D18			Mandible	Right	Portions of right M_1 and mesial loph of an M_2 (contra catalog).
Swp 388	D18			Maxilla	Both	Part maxilla with I^1-M^2 on both sides (broken or well worn). Specimen appears to have small maxillary fossa on right side, but not enough of the dentition present to make any taxonomic determinations.
Swp 389	D18		*Pp. jonesi*	Cranium	Right	Right sagittal half of cranium with snout and palate and right M^1-M^3, P^3-P^4 and left P^3. Specimen has *Pp. jonesi* proportions with deep palate. *Lophocebus*-like proportions. Definitely female; very small.
Swp 390	D18		*C. williamsi*	Mandible	Left	Left mandibular fragment with M_3 crown; *C. williamsi*
Swp 391	D18			Maxilla	Left	Left maxillary fragment with M^2 And M^3; M^2 is fractured and enamel missing on all sides; M^3 missing mesio-lingual cusp and enamel chipped from distal-buccal; only length taken.
Swp 392	D18			Mandible	Right	M_3 in fragment of mandible; right side; not fully erupted (contra catalog).
Swp 393	D18			Maxilla	Left	Left maxillary fragment with much worn M^2-M^3; very small; zygomatic root arises from distal M^2 level.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 394	D18			Maxilla	Right	Isolated right M^3 (contra catalog) in small fragment of bone.
Swp 395	D18			Tooth	Left	Left P_4 (contra catalog) in fragment of bone.
Swp 396	D18			Tooth	Left	Left P^3 in fragment of bone; not fully erupted.
Swp 397	D18			Tooth	Left	Left dm_2 (contra catalog).
Swp 398				Tooth	Left	Damaged dentition in fragment of bone which appears to be left P_4-M_1
Swp 399	D18			Tooth	Indet.	Contra catalog; molar enamel fragment
Swp 400	D18			Tooth	Indet.	?molar crown fragment.
Swp 401	D18			Tooth	Indet.	Isolated molar crown and roots, may be deciduous, but heavily fragmented, so difficult to determine; very small specimen.
Swp 402	D18			Tooth	Indet.	Two teeth (left? M1-M2) broken off at top of roots
Swp 403	D18			Mandible	Right	Fragment of right mandible with M_3 and lingual fragment of M_2.
Swp 404	D18			Tooth	Left	Isolated tooth (left? M3)
Swp 405	D18			Tooth	Indet.	Fragment of incisor, but no side determination; fragmented crown and root.
Swp 406	D18			Tooth	Left	Isolated crown of left M_3.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 407	D18			Tooth	Right	Isolated fragmented crown and partial roots of right upper P^4 (contra catalog).
Swp 408	D18			Tooth	Indet.	Fragment of tooth (M3?) only partial ½ crown.
Swp 409	D18			Tooth	Left	Fragment of crown of left I1?
Swp 410	D18			Tooth	Indet.	Isolated tooth crown molar.
Swp 411	D18			Tooth	Right	Two teeth (broken) right M1-M2?
Swp 412	D18			Tooth	Left	Isolated crown I1; left.
Swp 413	D18			Tooth	Indet.	Isolated crown and partial root I2.
Swp 414	D18			Tooth	Right	Contra catalog; right lower C_1, small.
Swp 415	D18			Tooth	Indet.	Isolated crown and partial root of incisor.
Swp 416	D18			Tooth	Indet.	Two teeth fragments in fragment of bone.
Swp 417	D18			Tooth	Left	Isolated tooth left $I^?$; no root, crown only, in poor condition.
Swp 418	D18			Tooth	Right	Isolated crown right lower P_4.
Swp 419	D18			Tooth	Indet.	Isolated incisor crown fragment.
Swp 420	D18	10/22/1975		Tooth	Left	Left mandibular fragment with M_1-M_3 (all very worn or damaged); can get most measurements off of M_3.
Swp 421	D18			Tooth	Left	Broken fragment of left side of mandible, only roots of 3 teeth; however, specimen is indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 422	D18	5/1/1974	*P. izodi*	Mandible	Right	½ of mandibular corpus with ascending ramus M_3, M_2, M_1 (broken); cf *Pp. jonesi*. Heavily worn; M_2 is only preserved as the middle portion – missing enamel on all sides. M_2 damaged on mesial loph missing enamel.
Swp 423	D18	8/1/1974		Maxilla	Both	Maxilla with dm^1-m^1 on left; di^1, di^2, dm^1-dm^1; (badly crushed on right) I^1 on right erupting; right side can be measured. Right side fractured slightly. M^1 appears to have v-shaped buccal clefts and shearing crests indicative of *Cercopithecoides williamsi*.
Swp 424	D18			Mandible	Right	Fragment of right side of mandible, no teeth.
Swp 425	D18			Mandible	Left	Fragment of left side of mandible with P_3, P_4 and broken M_1; all teeth in poor condition, no measurements. Small P_3 which appears to be female.
Swp 426	D18			Mandible	Left	Fragment of left mandibular fragment with incomplete dentition, M_2-M_3?; very small in size; only estimated length.
Swp 427	D18			Tooth	Left	Left maxillary fragment with M^1? Appears to be a juvenile, however, conservatively classified as indeterminate.
Swp 428	D18			Tooth	Indet.	Isolated molar crown fragments (2), but indeterminate in a fragment of bone.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 429	D18			Mandible	Left	Contra catalog; fragment of left mandible with erupting P_3-P_4 and fragmentary M_1 present.
Swp 430	D18			Mandible	Right	Right M_3 in fragment of mandible; only distal breadth and length can be estimated; missing most of mesio-lingual side.
Swp 431	D18			Tooth	Left	Isolated crown fragment of left I2?
Swp 432	D18			Tooth	Indet.	Isolated crown and partial root of lower incisor.
Swp 433	D18			Tooth	Indet.	Molar crown fragment.
Swp 434	D18			Tooth	Indet.	Toothrow of two nearly complete and two fragmentary teeth in breccia. P3 (buccal fragment); P4-M1, M2 fragment missing disto-lingual side. All teeth in poor condition, no measurements can reliably be taken.
Swp 435	D18			Mandible	Right	Mandibular fragment with right dm_2 present.
Swp 436	D18			Tooth	Both	Three ?teeth in fragment of bone. Left P3-P4, then what appears to be an antimeric P3. However, morphology appears strange and distorted.
Swp 437	D18			Maxilla	Left?	Left? maxillary fragment with P^4 and mesial loph of M^1 fragment?
Swp 438	D18			Tooth	Left	Isolated left C^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 439	D18			Tooth	Right	Right dm1-dm2 (contra catalog); dm1 fragmented while the dm2 is complete.
Swp 440	D18			Tooth	Left	Isolated left C_1; heavily fragmented.
Swp 441	D18			Tooth	Left	Isolated tooth (broken); left max. M^3?
Swp 442	D18			Tooth	Indet.	Bone fragment with the distal portion of an M3.
Swp 443	D18			Tooth	Left	Contra catalog; isolated crown and partial roots of left maxillary M^2.
Swp 444	D18			Tooth	Left	Isolated crown and root of left M^2.
Swp 445	D18			Tooth	Indet.	Isolated tooth fragment; indet.
Swp 446	D18			Tooth	Indet.	Isolated molar fragment.
Swp 448	D18			Maxilla	Left	Contra catalog left maxillary p3-p4; p4 fragmented.
Swp 449	D18			Tooth	Indet.	Tooth fragment?
Swp 450	D18			Tooth	Indet.	Molar tooth fragment.
Swp 451	D18			Tooth	Indet.	Isolated tooth M2? (broken off at top of roots).
Swp 452	D18			Tooth	Indet.	Isolated tooth I1 (broken off at top of roots).
Swp 453	D18			Tooth	Right	Isolated dm^1 (contra catalog); right.
Swp 454	D18			Tooth	Indet.	Isolated P^3? (contra catalog).
Swp 455	D13			Tooth	Indet.	Isolated crowns of right P3-P4 (contra catalog); heavily worn.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 456	D13			Tooth	Indet.	Molar tooth fragment.
Swp 457	D18			Tooth	Indet.	Tooth fragment.
Swp 458	D18			Tooth	Right	Isolated tooth, right ?M^1; wear facets heavily worn.
Swp 459	D3			Tooth	Left	Isolated tooth, left M^3?
Swp 460	D3			Tooth	Indet.	Isolated tooth, broken, possibly I^2.
Swp 461	D3			Tooth	Left	Isolated P_4, left (contra catalog). Heavily worn, almost no enamel is present.
Swp 462	D3			Tooth	Indet.	Molar tooth fragment.
Swp 463	D3			Tooth	Indet.	Tooth fragment; indeterminate.
Swp 464	D3			Tooth	Indet.	Isolated crown and partial root of lower incisor, 1-2?
Swp 465	D3			Tooth	Indet.	Enamel tooth fragment; molar.
Swp 466	D18			Tooth	Left	Isolated crown and root with breccia of left M^3 (contra catalog).
Swp 467	D18			Tooth	Right	Isolated tooth, right M^2 (contra catalog); fractured enamel makes it falsely look like a M^3.
Swp 468	D18			Tooth	Left	Isolated crown of left P^4; fractured; no measurements can reliably be taken.
Swp 469	D18			Tooth	Right	Isolated tooth right I^1; Crown only, no roots and appears to have not developed roots yet.
Swp 470	D13			Tooth	Indet.	Crown fragment of ?I_2.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 471	D3			Maxilla	Indet.	Badly crushed maxillary and mandibular fragments with upper and lower molars and premolars (10 teeth in all); teeth are lying in various planes and difficult to tell distinguish. No measurements taken.
Swp 472	D18		*P. izodi*	Cranium	Both	Base of skull; palate with P^3-M^3 on right and M^1 (fragment), M^2 (broken) and M^3 on left. Appears to be a *Pp. broomi*, but M^3 not quite as *Lophocebus*-like as others in sample.
Swp 473	D18			Maxilla	Right	Badly crushed maxillary fragments with right ?M^2 present. Another tooth is visible; looks like it may be an M^3 erupting. Initial tooth may be an M^3, and the posterior tooth may be a displace tooth in the breccia.
Swp 474	D18			Maxilla	Left	Left maxillary fragment with part of M^3, M^2 and fragment of M^1 present. Portion of the zygomatic arch is present. Specimen looks *Pp. broomi*, but maxillary fossa region distorted. M^3 looks *Lophocebus*-like, but unfortunately is missing the lingual half.
Swp 475	D18			Mandible		Mandibular fragment with left ?M_3 (broken), M_2 and M_1; mangled specimen; indeterminate.
Swp 476	D18		*Pp. broomi*	Maxilla	Both	Portion of maxilla with palate and C^1-M^2; some are heavily fragmented. M^1 (contra catalog) on left, but enamel missing.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 477	D18			Maxilla	Both	Snout and palate complete with M^3, M^1, P^4, P^3 on left and P^4-M^3 on right. Portions of the neurocranium present, but heavily fragmented and very incomplete. Teeth not very informative and are fragmented and chipped. Palate is also distorted..
Swp 478	D18			Mandible	Left	Mandibular fragment of corpus with M_2 and a partial M_3 (unerupted).
Swp 479	D18			Maxilla	Left	Left maxillary fragment with inferior orbit; left P^4, M^1 (broken) and M^2; M^3 (unerupted).
Swp 480	D13		*C. williamsi*	Maxilla	Right	Right fragment of maxilla with zygomatic arch and M2, M3 (contra catalog) which says they are deciduous.
Swp 481	D18			Maxilla	Right	Right maxilla with fragment dm^1 and dm^2 (contra catalog); M^1 in crypt on left side; crypt on right side has been fractured and does not contain crown.
Swp 482	?			Endocast	Both	Endocranial cast with portions of bone attached; posterior frontal and parietal endocast on left. On right side, same region preserved in bone.
Swp 483	D13			Cranium	Both	Portion of basicranium; still heavily encased in breccia.
Swp 484	D13			Cranium	Indet.	Portion of crushed cranium; indeterminate.
Swp 485	D13			Cranium	Indet.	Crushed cranium; very poor condition.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 486	D13			Maxilla	Indet.	Crushed fragment of maxilla, one ?tooth present; however, indeterminate.
Swp 487	D13			Maxilla	Right	Contra catalog; maxillary fragment with three badly damaged and heavily worn teeth; right, P^3-M^1 (ws-16). All crowns cracked and fractured. No measurements taken.
Swp 488	D13			Mandible	Left	Left mandibular fragment with M_3 (contra catalog). Specimen is quite large. Mostly fragmented; cracked through whole tooth and missing distal lophid and hypoconulid portions.
Swp 489	D13			Mandible	Both	Anterior fragment of mostly right mandible preserving a small portion of the left. Specimen has fragments of incisor teeth; incisors appear to be erupting, but breccia covers most surfaces.
Swp 490	D14			Mandible	Left	Left fragment of mandible with part of ramus and fragments of M_3; heavily fragmented. Hypoconulid fractured missing portions of the buccal side near the cervix.
Swp 491	D15			Tooth	Indet.	Two molar ?teeth in a bone fragment; heavily encased in breccia.
Swp 492	D13			Mandible	Left	Left M_2-M_3 in small piece of mandible; crowns are heavily damaged.
Swp 493	D13			Tooth	Indet.	Tooth fragments in bone; indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 494	D13			Mandible	Left	Tooth row P_3-M_2 left in small fragment of mandible; heavily damaged.
Swp 495	D18		*C. williamsi*	Maxilla	Both	Muzzle and face with P^3-M^3.
Swp 496	D13	10/3/1970		Mandible	Left	Left mandibular corpus with broken M_2? In very poor condition; only small piece of enamel on tooth remains.
Swp 497	D18			Maxilla	Right	Right maxillary fragment with P^3, P^4, M^1, M^2, and ½ of M^3; *Pp. broomi* in proportions; crowns only.
Swp 521	D13			Tooth	Indet.	Enamel fragment of incisor.
Swp 546	?			Tooth	Indet.	Molar enamel fragment.
Swp 547	D18	11/21/1974		Cranium	Both	Crushed face and palate with dm^1 and dm^2 on both sides; not measureable.
Swp 548	D18		*Pp. jonesi*	Mandible	Left	Left mandibular corpus with M^1, M^2 and M^3.
Swp 549	D18	1/7/1974		Mandible	Right	Mandibular fragment with small amount of right P_3, P_4 and fragment of M_1. Small P_3 on right side. P_4 measureable others covered with breccia or fragmented; P_3 is sectorial. Identification is contra catalog description.
Swp 550	D18			Tooth	Right	Lingual ½ of crown of right M^1; heavily fragmented and covered with breccia.
Swp 551	?			Tooth	Indet.	Tooth fragment?
Swp 552	D18			Maxilla	Left	Left M^2 and M^3 in fragment of maxilla.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 553	D18			Mandible	Left	?Left mandibular M_1 (lingual root); M_2 (complete root) and M_3 (complete root). No crowns, simply roots and small pieces of breccia.
Swp 554	D18			Mandible	Right	Right mandibular tooth row (broken off at cervix). ?P_3-M_2, right (contra catalog). Crowns only; looks like *C. williamsi*. Specimen displays very high cusps and v-shaped buccal clefts; very small specimen.
Swp 555	D18			Maxilla	Right	Right M^3 with distal enamel fragment of M^2; infolding of enamel almost Theropithecine, but is heavily worn. So, difficult to determine.
Swp 556	D18			Tooth	Indet.	Isolated tooth crown M2 (contra catalog), but difficult to determine due to its fragmentary nature. Specimen is missing a portion of one loph. Definitely not M3 though.
Swp 557	D15			Tooth	Indet.	Isolated partial crown and root M_1.
Swp 558	D18			Tooth	Left	Isolated crown and partial root left I^1, heavily worn. Identification contra catalog.
Swp 559	D17			Tooth	Left	Isolated crown and partial root of left P_3; small in size.
Swp 564	D18			Tooth	Left	Crown fragment, left ?I_1.
Swp 565	?			Tooth	Left	Worn fragment, left (contra catalog) M_3.
Swp 566	D18			Tooth	Left	Tooth fragment, left M_3.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 567	D8			Tooth	Right	Distal loph of right M^3; roots not developed.
Swp 569	D18			Tooth	Left	Crown fragment, left M_2.
Swp 579	D13			Cranium	Indet.	Cranial fragment.
Swp 580	D13			Cranium	Indet.	Cranial fragment.
Swp 581	D13			Cranium	Indet.	Cranial fragment.
Swp 582	D13			Cranium	Indet.	Cranial fragment.
Swp 583	D13			Cranium	Indet.	Cranial fragment.
Swp 584	D13			Cranium	Indet.	Cranial fragment.
Swp 585	D13			Cranium	Indet.	Cranial fragment.
Swp 586	D13			Cranium	Indet.	Cranial fragment.
Swp 587	D13			Cranium	Indet.	Cranial fragment.
Swp 588	D13			Tooth	Indet.	Isolated teeth.
Swp 590	D14			Cranium	Both	Crushed neurocranium; left temporal still somewhat intact. However, cranial vault bones are crushed inward. A portion of the basicranium is present, but covered with breccia.
Swp 591	D13			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 592	D13			Cranium	Left	Cranial fragment; frontal with small piece of temporal line on left side.
Swp 593	D18			Cranium	Both	Crushed face; both frontals (distorted) and interorbital region and left side; lateral

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						and inferior orbital region preserved, as well.
Swp 594	D14			Cranium	Left	Part of cranium, ½ of the left orbit and a portion of a left parietal endocast; appears to be a ?juvenile papionin.
Swp 595	D15			Endocast	Indet.	Cranial endocast; fragment of bone still attached; indeterminate.
Swp 596	D18			Maxilla	Both	Crushed maxillary with palate with M^2 and M^3, bilaterally. Heavily worn, no reliable measurements taken.
Swp 597	D13			Cranium	Indet.	Cranial fragments; indeterminate.
Swp 598	D18			Mandible	Both	Badly crushed mandible with C_1-M_2, bilaterally. Highly fragmented and damaged, no measures taken.
Swp 599	D18			Tooth	Right	Isolated tooth distal portion of right M3.
Swp 600	?			Tooth	Indet.	Isolated dm_1.
Swp 601	D18			Tooth	Left	Isolated tooth I^2, left.
Swp 602	D3			Mandible	Both	Crushed mandible all ?teeth except C_1 on left side; very poor condition.
Swp 603	D9			Mandible	Indet.	Fragment of mandible in breccia block.
Swp 609	D18	4/28/1974		Mandible	Both	Four of five crushed teeth in matrix; appears to be anterior dentition in a mandible with an articulated right I_1-I_2. All incisors present on mandible and the right C_1. Difficult to determine genus, but may be *Cercopithecoides*.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 610	D13			Tooth	Indet.	Tooth fragment in matrix.
Swp 611	D13			Tooth	Indet.	Two worn and broken teeth in small fragment of bone.
Swp 612	D18		cf. *Papio*	Cranium	Both	Almost complete cranium with P^3 (broken), P^4, M^1 (broken), M^2 and M^3 (just erupting) on left; P^4 and M^1 (both broken) on right; has typical *Parapapio* browridge. However, specimen has large *Papio*-like dentition. Developing maxillary ridges like *Pp. broomi*, as well as fossa, however, specimen is juvenile. Appears to possess a small C^1. Most probably a juvenile *P. izodi* with cryptic morphology as the result of its developmental age.
Swp 613	D15			Cranium	Indet.	Portion of cranium preserving cranial vault bones; however, bones are indeterminate.
Swp 614	D13			Cranium	Indet.	Cranial fragment.
Swp 615	D13	3/23/1971		Cranium	Left	Cranial fragment with left orbit; very fragmented, but does have well developed temporal line. Orbit filled with breccia.
Swp 616	D13			Cranium	Indet.	Cranial fragment in matrix.
Swp 617	D13	10/13/1971		Endocast	Indet.	Endocast with fragments of skull attached; indeterminate.
Swp 618	D13			Cranium	Indet.	Various cranial fragments and teeth crushed in breccia block.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 619	D13			Cranium	Right	Portion of skull with ½ of right orbit; small individual, perhaps juvenile; small temporal line present.
Swp 62	D15	6/10/1969		Maxilla	Right	Right maxillary fragment with P^3 and P^4; lingual side of M^1.
Swp 620	D13	10/20/1970		Endocast	Indet.	Cranial fragment with small partial endocast; indeterminate.
Swp 621	D13	9/4/1970		Cranium	Indet.	Cranial fragment; indeterminate. Breccia on endocranial side.
Swp 622	D13			Cranium	Left	Cranial fragments: (a) left temporal with basicranium (b) occipital fragment and (c-d) indeterminate.
Swp 623	D18			Mandible	Both	Crushed mandible with C_1 (broken), M_2 (broken) on left and C_1, P_3, P_4 (broken) on right; not measureable.
Swp 624	D13	12/9/1969		Maxilla	Indet.	Fragment of maxilla with ?P^3 and C^1 in crypt.
Swp 625	D13	6/17/1968		Tooth	Indet.	?Molar tooth fragment in breccia.
Swp 626	D13	5/11/1978		Maxilla	Indet.	Maxillary fragment with ?P^3-P^4.
Swp 627	D15			Mandible	Indet.	Mandibular fragment, teeth broken.
Swp 628	D13			Cranium	Indet.	Cranial fragment.
Swp 629	D13			Cranium	Indet.	Five cranial fragments.
Swp 630	D13			Cranium	Indet.	Four skull fragments.
Swp 631	D13			Cranium	Indet.	Three skull fragments.
Swp 632	D14			Cranium	Indet.	Cranial fragment.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 633	D8			Cranium	Indet.	Cranial fragment.
Swp 634	D13	7/8/1971		Cranium	Left	Cranial fragment; appears to be the frontal region just superior to the left orbit of a juvenile.
Swp 635	D13	6/2/1969		Mandible	Indet.	Mandibular fragment, no teeth.
Swp 636	D13	10/20/1971		Endocast	Indet.	Cranial fragment with small portion of an endocast; indeterminate.
Swp 637	D13	4/23/1968		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 638	D13	7/27/1971		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 639	D13	5/20/1968		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 640	D13	11/28/1968		Cranium	Indet.	Cranial fragment; appears to be a small juvenile with a partial frontal (superior to orbit) and interorbital region; difficult to assign to genus.
Swp 641	D13			Cranium	Indet.	23 bone fragments.
Swp 642	D13	4/6/1970		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 643	D13	8/16/1968		Cranium	Both	Cranial fragment; appears to be the area around lambda with a small portion of the sagittal and lambdoidal sutures. Also, preserves a portion of a moderately well-developed nuchal line.
Swp 644	D13	4/15/1969		Cranium	Indet.	Cranial fragment; indeterminate cranial vault bone.
Swp 645	D15	5/25/1970		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 646	D13			Cranium	Indet.	Cranial fragment; indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 647	D13	5/26/1978		Cranium	Right	Cranial fragment; appears to be a right frontal with portions of the temporal line, but no supraorbital torus or orbit preserved.
Swp 648	D13			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 649	D13	9/9/1968		Cranium	Indet.	Cranial fragment; breccia on endocranial surface; indeterminate.
Swp 650	D13	5/3/1969		Cranium	Indet.	Cranial fragment; indeterminate. Specimen is encased in breccia.
Swp 651	D13	3/24/1970		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 652	D13			Endocast	Both	Partial endocast with cranial fragment attached; appears to be occipital region of the cranium, but difficult to determine.
Swp 653	D13			Endocast	Indet.	Partial endocast with cranial fragment attached; indeterminate.
Swp 654	D14			Endocast	Indet.	Partial endocast with cranial fragment attached; indeterminate; not very informative.
Swp 655	D15	11/26/1969		Endocast	Indet.	Partial endocast with cranial fragments; indeterminate.
Swp 656	D13			Endocast	Indet.	Partial endocast wit cranial fragments attached; indeterminate.
Swp 657	D13			Endocast	Indet.	Partial endocast with cranial fragments attached; indeterminate.
Swp 658	D13			Endocast	Indet.	Crushed cranial fragments with endocast attached; indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 659	D13			Cranium	Indet.	Cranial fragment; indeterminate with small piece of endocast; breccia covers endocranial side.
Swp 660	D13	10/28/1968		Endocast	Indet.	Partial endocast with cranial fragments attached; indeterminate.
Swp 661	D13	8/14/1969		Endocast	Both	Partial endocast with cranial fragments; appears to be a juvenile with the frontal lobe and indications of the orbits.
Swp 662	D13			Cranium	Indet.	Piece of cranial with breccia attached.
Swp 663	D13			Endocast	Both	Partial endocast with cranial fragments attached; posterior endocast (parietal region) with partial basi-occipital with foramen magnum.
Swp 664	D13	9/14/1970		Mandible	Left	Left portion of mandible with most of ramus; unerupted tooth visible?; juvenile. Specimen appears to have all the alveoli for a complete deciduous tooth set, but no teeth present except maybe dm_1 root. Most of the alveoli are filled with breccia.
Swp 665	D13	11/24/1969		Maxilla	Right	Fragment of badly damaged right maxilla; can visualize tooth roots. Specimen appears to be a juvenile with ?dm^1-dm^2.
Swp 666	D13	7/5/1968		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 667	D13	10/3/1971		Mandible	Right	Ascending ramus portion of mandible with small fragment of M_3. Condyle is fractured, but coronoid process is present.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 668	D13			Mandible	Indet.	Fragment of mandible with tooth?; heavily fragmented and not readily identifiable.
Swp 669	D13			Mandible	Right	Fragment of mandible with two tooth roots (M_2-M_3)
Swp 670	D13	10/6/1971		Mandible	Left	Fragment of mandible with two tooth roots.
Swp 671	D13	2/27/1969		Mandible	Both	Edentulous mandible. Symphysis present on left and right sides; however, inferior margin is broken. Symphyseal region appears flat like *C. williamsi*.
Swp 672	D13	8/20/1968		Mandible	Right	Fragment of mandible with one complete tooth? Appears to be a right mandible fragment with a partial P_4 (heavily damaged). No measurements can be reliably taken.
Swp 673	D13	2/8/1968		Mandible	Indet.	Mandibular fragment with three almost complete, but very worn teeth (missing lingual cusps).
Swp 674	D13 or (D15?)	10/15/1976		Mandible	Indet.	Badly crushed mandible. No complete teeth present and specimen is in very poor condition.
Swp 675	D8			Mandible	Right	Portion of mandible with two tooth fragments (M_1, M_3) on right side. No measurements can reliably be taken.
Swp 676	D13			Mandible	Left	Portion of left mandible teeth broken; p4-m1?

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 677	?			Mandible	Indet.	Fragment of mandible. Small fragment which appears to be close to the distal side of M_3. However, side is indeterminate.
Swp 678	D13			Mandible	Indet.	Fragment of mandible; no teeth.
Swp 679	D13	6/5/1968		Maxilla	Indet.	Tooth in fragment of maxilla; however, side is indeterminate. Specimen is covered with breccia.
Swp 680	D13	7/1/1969		Mandible	Left	Portion of left mandible. Specimen appears to have experienced some antemortem tooth loss.
Swp 681	D13	10/28/1968		Mandible	Left	Fragment of mandible near anterior dentition. Specimen appears to preserve a partial canine root; and perhaps some premolar and molar roots.
Swp 682	D13			Tooth	Indet.	Isolated tooth fragment.
Swp 683	D13	8/20/1968		Maxilla	Indet.	Fragment of maxilla; contra catalog.
Swp 684	D13	6/17/1968		Mandible	Left	Small fragment of mandible at gonion? Specimen possesses the roots of the M_3.
Swp 685	?			Maxilla	Indet.	Small fragment of maxilla with two teeth. Specimen appears to be distal P_4 and mesial M_2. However, difficult to say with confidence, as specimen is in poor condition.
Swp 686	D13	7/25/1969		Maxilla	Indet.	Small fragment of badly crushed maxilla. Specimen possesses a deep palate. However, no recognizable teeth are present, only the roots of $?P^4$.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 687	D15			Mandible	Left	Fragment of mandible near P_3-M_2. However, roots are only partially visible.
Swp 688	D13			Maxilla	Left	Tooth fragment in small portion of left maxilla. Specimen appears to be the lingual enamel of M^2 with M^1 and P^4 roots. M^3 crown is in crypt.
Swp 689	D13			Tooth	Indet.	Bone fragment with tooth roots?
Swp 690	D13	7/18/1968		Tooth	Indet.	Bone fragment with teeth roots? Indeterminate.
Swp 691	D13			Tooth	Indet.	Bone fragment with tooth roots? Not readily identifiable.
Swp 692	D15			Tooth	Indet.	Bone fragments with toot root?; poor condition and not readily identifiable.
Swp 1012	D7		*Papio*	Mandible	Right	Right mandible with P_4, M_1, M_2, M_3 - worn; roots of P_3 present. Specimen appears to be a male. Teeth are heavily damaged and worn. Specimen possesses a large, deep mandibular fossa. Only, length measurements can reliably be taken of dentition.
Swp 1013	D7			Tooth	Left	Isolated M^1.
Swp 1017	D11	11/8/1975	*P. izodi*	Maxilla	Left	Left maxilla with P^4, M^1 and M^2. Specimen is a sub-adult, as the M^3 has not yet erupted. Zygomatic root is at the level of mesial M^2.
Swp 1018	D10			Tooth	Left	M_3.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1019	D10			Tooth	Left	M_3.
Swp 1020	D11			Tooth	Left	M_1.
Swp 1021	D10			Tooth	Left	P^4.
Swp 1022	D15			Mandible	Right	Mandible with M_1, M_2, M_3. Specimen is crushed; siding is contra catalog. Specimen is in very poor condition.
Swp 1023	D8	6/20/1975	*Pp. broomi*	Maxilla	Right	Maxillary fragment with M^1, M^2 and M^3 (M^1 is damaged). Dentition is heavily worn. Root of zygomatic arises near mesial M^3.
Swp 1024	D15			Mandible	Left	Fragment of ascending ramus; no processes and edentulous.
Swp 1025	D15			Mandible	Right	Fragment of mandible; only gonion and ascending ramus present. Specimen is edentulous.
Swp 1026	D15			Mandible	Left	Mandibular corpus missing gonion and edentulous. Specimens preserves a portion of the ascending ramus.
Swp 1027	D15			Mandible	Left	Gonial region of mandible. Specimen appears to have M_3 roots, but slightly fragmented.
Swp 1028	D8		*C. williamsi*	Mandible	Right	Mandibular fragment with M_2 and M_3. Specimen displays high cusps and well-developed buccal clefts.
Swp 1029	D15			Mandible	Right	Very small fragment of mandible; gonion preserved.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1030	D15			Mandible	Left	Mandibular fragment with P_3 and P_4 (damaged). Specimen appears to be a male. Measurements cannot be reliably taken. Teeth are fractured, cracked and filled with breccia.
Swp 1031	D15			Tooth	Left	M_3 (damaged).
Swp 1032	D15			Tooth	Right	M_3 (damaged).
Swp 1033	?			Tooth	Indet.	Seven tooth fragments.
Swp 1034	D14			Tooth	Right	Damaged P^3.
Swp 1035	D15?			Tooth	Left	dm_1.
Swp 1036	?			Tooth	Left	dm_2.
Swp 1037	D15			Tooth	Left	I^2.
Swp 1038	D15			Tooth	Left	$?P^3/P^4$.
Swp 1039	D15			Tooth	Right	I^1.
Swp 1040	D15			Tooth	Right	M^2 (worn).
Swp 1041	D15			Tooth	Left	M^2.
Swp 1042	D15			Tooth	Right	M_1.
Swp 1043	D15			Tooth	Left	I_1/I_2.
Swp 1044	D15			Tooth	Indet.	Three very worn I^x.'s
Swp 1045	D12			Tooth	Left	M_2 (very worn). Additional molar in breccia below this specimen.
Swp 1046	D12			Tooth	Left	M^1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1047	D12			Tooth	Right	M_3. (newly erupted).
Swp 1048	D12			Tooth	Right	M_3.
Swp 1049	D12			Maxilla	Right	P^4 with half of M^1 and fractured P^3.
Swp 1051	D12			Tooth	Left	$P^{4=}$
Swp 1052	D12			Tooth	Left	P^3.
Swp 1053	D12			Tooth	Left	P^3.
Swp 1054	D12			Tooth	Left	I_2
Swp 1055	D12			Tooth	Right	I_2
Swp 1056	D12			Tooth	Right	$?I^1$ or $?I^2$
Swp 1057	D12			Tooth	Left	Isolated incisor
Swp 1058	D12			Tooth	Right	I^1
Swp 1059	D12			Tooth	Right	I_2
Swp 1060	D12			Tooth	Left	I_2
Swp 1061	D12			Mandible	Left	Breccia with dm_1, dm_2 erupting P_4 and P_3? M_3 appears on separate piece of breccia and appears to be from the left side (in process of eruption). However, M_3 may not belong to same individual.
Swp 1062	D14			Tooth	Right	P^3
Swp 1063	D14			Tooth	Right	P^3
Swp 1064	D14			Tooth	Right	P^4
Swp 1065	D14			Tooth	Left	P^4

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1066	D14			Tooth	Left	M_3
Swp 1067	D14			Tooth	Right	M_2
Swp 1068	?			Tooth	Right	M_1
Swp 1069	D14			Tooth	Right	M_1 (damaged)
Swp 1070	D14?			Tooth	Left	M^1
Swp 1071	D14			Tooth	Left	M^1
Swp 1072	D14?			Tooth	Right	P^3
Swp 1073	D14			Tooth	Right	M^1 - M^2 (very worn)
Swp 1074	D14			Tooth	Left	M^1
Swp 1075	D14?			Tooth	Left	M_1
Swp 1076	D14			Tooth	Right	M^2
Swp 1077	D14			Tooth	Right	M^1 (newly erupted)
Swp 1078	D14			Tooth	Indet.	Six molar fragments
Swp 1079	D14			Tooth	Indet.	Two tooth fragments; ?incisor and ?canine.
Swp 1080	D14			Tooth	Right	C^1
Swp 1081	D14			Tooth	Indet.	Isolated Incisor.
Swp 1082	D14			Tooth	Left	I_1
Swp 1083	D14			Tooth	Left	I_2
Swp 1084	D14			Tooth	Right	I_2
Swp 1085	D14			Tooth	Left	I^1

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1086	D14			Tooth	Indet.	Worn incisors.
Swp 1087	D14			Mandible	Right	Juvenile right mandible with broken dM_1 and dM_2.
Swp 1088	D14			Mandible	Both	Juvenile mandible (1/2 of right side missing). dm_2 (erupting) is visible on right side.
Swp 1089	D14?			Maxilla	Right	Right ½ of maxilla and ½ of mandible of a juvenile (joined). I^1, dm^2 and M^1 present. dm_1, dm_2 and M_1 (in crypt) are present. No measurements can be taken. Specimen is encased in breccia and difficult to access teeth.
Swp 1090	D14			Maxilla	Indet.	Maxillary fragment with M^1? Not measureable, very poor condition.
Swp 1091	D14			Mandible	Right	Right ½ of mandibular corpus with P_3; very small p3 appears to be female. No other teeth present. So, species designation not possible.
Swp 1092	D14			Maxilla	Left	Maxillary fragment with damaged and much worn P^3, P^4, M^1 and M^2. Very badly damaged; no other information obtainable and no measures taken.
Swp 1093	D14?			Maxilla	Left	Maxillary fragment with fragmentary remains of M^3; only mesio-buccal cusp remains. No measurements present.
Swp 1094	D14?			Tooth	Right	P3
Swp 1095	P/47 - 13'2"-14'2"			Tooth	Indet.	Isolated incisor.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1096	S46 - 4'7"-5'7"			Tooth	Left	I_2
Swp 1097	R/45 - 10'1"-10'8"			Tooth	Indet.	Worn molar.
Swp 1098	V/46 - 13'11"-14'11"			Tooth	Left	C^1
Swp 1099	P/46 -12'8"-13'8"			Tooth	Right	I_2
Swp 1100	U/47 - 14'3"-15'3"			Tooth	Right	M^2
Swp 1101	P/60-16'4"-16'6"			Tooth	Indet.	1 tooth, canine? (Female?)
Swp 1102	R/56- 10'9"-11'9"			Tooth	Right	M^3
Swp 1103	R/46 - 5'5"-6'5"			Tooth	Indet.	
Swp 1106	Q48 - 12'6"-13'6"			Cranium	Right	a) Right frontal with supra-orbital area. b) Cranial fragment. Indeterminate, but possibly temporal.
Swp 1108	Aa/46-2'9"-3'9"			Cranium	Indet.	Frontal fragment.
Swp 1121	P/45 - 12'4"-13'4"			Tooth	Left	I_2
Swp 1122	P/45 - 12'4"-13'4"			Tooth	Right	dm_2
Swp 1123	P/45 - 12'4"=13'4"			Tooth	Left	Female ?C_1
Swp 1124	P/45 -12'4"-13'4"			Tooth	Indet.	Two very worn and damaged molars.
Swp 1129	P/46 - 13'8"-14'5"			Tooth	Right	M^1
Swp 1130	U/44 - 16'10"-17'10"			Tooth	Right	M_3
Swp 1131	O/45 - 12'3"-13'3"			Tooth	Right	C^1
Swp 1132	O/45 - 12'3"-13'3"			Tooth	Indet.	Very worn and damaged molar.
Swp 1133	O/45 - 12'3"-13'3"			Tooth	Right	P_3 (very worn).

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1134	O/45 - 12'3"-13'3"			Tooth	Right	P^4
Swp 1135	O/45 - 12'3"-13'3"			Tooth	Indet.	Tooth fragment.
Swp 1136	O/45 - 12'3"-13'3"			Tooth	Left	P_3
Swp 1168	T/57 - 13'1"- 13'9"			Tooth	Indet.	Very worn, large molar.
Swp 1169	S/49 - 7'6"-8'6"			Tooth	Left	M_2
Swp 1178	X/47 - 4'11"-5'11"			Mandible	Indet.	Gonion of mandible?; indet; appears to be ascending ramus with missing condyle; however, more securely left as, indeterminate.
Swp 1179	X/47 - 4'11"-5'11"			Mandible	Left	Anterior symphysis - left I_1, C_1, P_3 and P_4. Teeth heavily fragmented, but receding symphysis suggests papionin. No measurements can be reliably taken.
Swp 1180	Q/46 - 5'8"-6'8"			Mandible	Right	Mandibular corpus with fragment of P_3;P_4, M_1 and M_2. Looks *Pp. broomi*-sized with comparatively large P_4.
Swp 1181	R/44 - 4'11"-5'11			Mandible	Indet.	Mandibular fragment with 2 tooth fragments.
Swp 1182	V/58 - 12/0"-13'3"			Tooth	Indet.	P^4.
Swp 1183	O46 - 12'2"-13'2"			Tooth	Right	I_2
Swp 1184	P/46 - 8'2"-9'2"			Tooth	Left	I^2
Swp 1185	P/46 - 7'9"-8'2"			Tooth	Indet.	Molar fragment in breccia.
Swp 1186	P/45 - 9'6"-10'6"			Tooth	Right	I_2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1187	S/45 - 6'3"-7'8"			Tooth	Left	M_1 (damaged)
Swp 1188	S/46 - 6'3"-7'3"			Tooth	Indet.	Premolar fragment.
Swp 1189	S/46 - 6'8"-7'8"			Tooth	Indet.	Damaged incisor.
Swp 1190	S/46 - 11'7"-12'7"			Tooth	Both	Three lower incisors (left I_2?, left I_1, right I_1?).
Swp 1191	S/46 - 11/7"-12'7"			Tooth	Left	dc_1
Swp 1192	S/46 - 11'7"-12'7"			Tooth	Left	P_3
Swp 1193	S/46 - 11'7"-12'7"			Tooth	Right	M^2 (damaged)
Swp 1194	W/57 - 9'2"-10'2"			Tooth	Right	M_2
Swp 1195	U/V/W/60 - 12'8"-14'0"			Tooth	Right	dc_1
Swp 1216	V/47 - 7'10"-8'10"		*T. oswaldi*	Maxilla	Left	Maxilla fragment; no dentition present.
Swp 1217	V/47 - 7'10"-8'10"			Maxilla	Right	½ of maxilla with P^4, M^1, M^2. *Pp. broomi*-like; specimen preserves shallow palate.
Swp 1218	V/47 - 7'10"-8'10"			Mandible	Right	Mandible of juvenile with dM_1 and erupting dM_2. Specimen goes with specimen Swp 1224 (left half of mandible).
Swp 1221	V/47 - 7'10"-8'10"			Maxilla	Indet.	Maxillary fragment; ?side; no dentition present.
Swp 1224	V/47 - 7'10"-8'10"			Mandible	Left	Juvenile mandible with dM_1 and dM_2; goes with Swp 1218.
Swp 1226	S/52 - 14'11"-15'11"			Mandible	Left	Small fragment of mandibular corpus with erupting M_3. Tooth is immeasurable, but distinctly papionin.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1227	X/53 - 8'2"-9'2"			Cranium	Left	Fragment of cranium. Appears to be left parietal near intersection of sagittal and lambdoidal sutures.
Swp 1228	X/53 - 9'2"-10'2"			Cranium	Indet.	Small fragment of cranium; very thin in cross-section.
Swp 1229	T/63 - 14'5"-15'5"			Cranium	Right	Zygomatic slightly inferior orbital portion.
Swp 1230	U/50 - 8'8"-9'8"		*Pp. broomi*	Maxilla	Right	Maxilla with P^4, M^1, M^2 and M^3. cf *Pp. broomi*; appears to have small maxillary fossa with deep palate. Zygomatic root is at the level of the mesial portion of the M^3.
Swp 1231	V/50 - 9'7"-10'0"			Cranium	Indet.	Fragment of cranium; indeterminate covered with breccia endocranially.
Swp 1232	N/61 - 15'11"-16'11"		*T. oswaldi*	Mandible	Both	Nearly complete mandible; lacking anterior dentition, but possesses P_3, P_4, M_1 and M_2 bilaterally and left M_3. *Theropithecus darti* with deep recessed mandibular fossae. Teeth are in poor condition.
Swp 1233	U50 - 12'8"-13'8"			Cranium	Right	Isolated complete zygomatic; not fused with maxilla.
Swp 1234	Jj/36 - 11'4"-12'4"			Mandible	Left	Edentulous mandible (contra catalog).
Swp 1235	U/60 - 17'5"-17'6"			Tooth	Indet.	Very worn molar.
Swp 1236	U/60 - 17'5"-17'6"			Tooth	Left	I^1
Swp 1237	V/57 - 8'8"-8'11"			Tooth	Indet.	Incisor.
Swp 1238	S/58 - 9'10"-10'10"			Tooth	Indet.	Tooth fragment.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1239	Jj/36 - 10'4"-11'4"			Tooth	Right	M^2
Swp 1240	Jj/36 - 10'4"-11'4"			Tooth	Left	I^2
Swp 1241	W/57 - 8'2"-9'2"			Tooth	Left	Damaged ?M_2 with ascending ramus. M_3 unerupted.
Swp 1242	V/63 - 7'6"-8'6"			Tooth	Left	C^1
Swp 1243	U/59 - 7'4"-9'4"			Tooth	Right	I_2
Swp 1244	T/61 - 16'1"-17'1"			Tooth	Left	C_1
Swp 1245	T/63 - 14'5"-15'5"			Tooth	Indet.	Damaged canine.
Swp 1246	T/60 - 12'2"-13'2"			Tooth	Left	C^1 (female?)
Swp 1247	X/53 - 9'2"-10'2"			Tooth	Right	Very worn M_3
Swp 1248	T/62 - 22'1"-23'1"		*T. oswaldi*	Tooth	Indet.	Very worn M^2?
Swp 1249	T/62 - 22'1"-23'1"			Tooth	Right	?M^2
Swp 1250	X/50 - 5'10"-6'9"			Tooth	Indet.	Very worn ?M_1
Swp 1251	N/61 - 16'11"-17'11"			Tooth	Left	M_3
Swp 1252	V/54 - 9'4"-10'4"			Tooth	Left	I_1
Swp 1253	W/50 - 7'6"-8'6"			Tooth	Left	Fragment of maxilla with M^3.
Swp 1254	Jj/36 - 11'4"-12'4"			Tooth	Left	C_1 (damaged)
Swp 1255	V/55 - 9'5"-10'5"			Tooth	Indet.	Fragment of canine.
Swp 1256	V/47 - 7'10"-8'10"		*T. oswaldi*	Tooth	Left	C_1
Swp 1257	V/47 - 7'10"-8'10"			Tooth	Right	P^3
Swp 1259	Bb/50 - 4'9"-5'9"			Cranium	Indet.	Cranial fragment; indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1260	W/59 - 7'6"-8'6"			Mandible	Right	Right ½ of juvenile mandible with damaged dm_1 and dm_2. dm_1 missing lingual side; dm_2 missing mesio-lingual cusp.
Swp 1283	U/60 - 12'5"-13'5"		*Pp. jonesi*	Mandible	Both	a) Left half of mandible with dm_1, dm_2 and M_1. b) Right half of mandible with erupting I_1 and I_2. dc_1, dm_1, dm_2, and M_1. Incisors not measureable, but are typical papionin in form. Compares with adult specimen, Swp 1743.
Swp 1288	W/60 - 9'11"-10'11"			Mandible	Both	Mandibular symphysis - no dentition. Specimen has deep anterior sloping symphyseal region, but fragmented alveoli prohibit determining extent of inferior margin.
Swp 1289	Jj/37 - 11'4"-12'4"			Cranium	Right	Cranial fragment. Right zygomatic (very complete) with frontal and maxilla junctions. Specimen missing most of zygomatic arch.
Swp 1290	Jj/37 - 11'4"-12'4"			Maxilla	Left	Maxillary fragment with M^2, M^3. Zygomatic root at level of mesial M^3. Specimen appears to have a well developed maxillary fossa.
Swp 1292	V/62 - 7'5"-8'5"			Mandible	Left	Mandibular fragment of juvenile with di_2, dc_1, dm_1 and dm_2.
Swp 1293	U/61 - 10'5"-11'5"		*Pp. jonesi*	Mandible	Left	Mandibular fragment in breccia with M_3.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1294	W/59 - 11'5"-12'5"			Cranium	Both	Cranial fragment with left and right parietals and small fragment of frontal near coronal suture on left side. Sagittal sulcus can be visualized.
Swp 1295	W/59 - 11'5"-12'5"			Cranium	Indet.	Cranial fragment; ?occipital or ?parietal. Bone is thick bone in cross-section. However, appears to be most likely the parietal.
Swp 1296	W/59 - 11'5"-12'5"			Cranium	Left	Zygomatic arch (unfused)
Swp 1297	W/60 - 10'11"-11'11'			Mandible	Right	Mandibular fragment with M_1, M_2 and M_3.
Swp 1298	U/62 -10'9"-11'9"			Mandible	Left	Mandibular fragment. Specimen mostly covered with breccia around tooth. Measurements are only estimates.
Swp 1299	U/62 - 14'0"-15'1"			Mandible	Right	Mandibular fragment with very worn M_2; only length measurement can be reliably taken.
Swp 1309	V/60 - 14'0"-15'0"			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1310	V/60 - 14'0"-15'0"			Cranium	Indet.	Cranial fragment; very thin.
Swp 1311	V/60 - 14'0"-15'0"			Cranium	Indet.	Cranial fragment; very thin and indeterminate.
Swp 1312	Jj/37 - 12'4"-13'4"			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1313	Jj/37 - 12'4"-13'4"			Cranium	Indet.	Cranial fragment - ?temporal because preserved suture appears to be the squamosal suture.
Swp 1314	Jj/37 - 12'4"-13'4"			Cranium	Indet.	Cranial fragment; juvenile orbit. Specimen may go with Swp 1315;

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						however, unsure. Very little anatomical information available on specimen.
Swp 1315	Jj/37 - 12'4"-13'4"			Cranium	Indet.	Cranial fragment; juvenile orbit?
Swp 1316	Jj/37 - 12'4"-13'4"			Cranium	Right	Cranial fragment – orbit. Right side with supraorbital notch and temporal line (very well developed); no other anatomical information available.
Swp 1317	U/62 - 8'9"-9'9"			Tooth	Indet.	dm1
Swp 1318	W/59 - 8'5"-9'5"			Tooth	Indet.	Worn, damaged molar.
Swp 1319	T/60 - 18'2"-19'2"			Tooth	Indet.	Canine?
Swp 1320	V/60 - 14'0"-15'0"			Tooth	Left	Left M^1/M^2
Swp 1321	V/61 - 11'11-12'6"			Tooth	Right	I_1?
Swp 1322	Q-S/74-76 - 5'0"-6'0"			Tooth	Left	M^2
Swp 1323	P/61 - 9'6"-10'6"			Tooth	Right	M^2
Swp 1324	T/59 - 11'7"-12'9"			Tooth	Indet.	Damaged upper premolar?
Swp 1325	V/61 - 10'11"-11'11"			Tooth	Left	damaged M_3
Swp 1326	Ii/34 - 6'6"-7'6"			Tooth	Left	Damaged I^1
Swp 1327	V/61 - 6'11"-7'11"			Tooth	Right	dm_2
Swp 1328	S/60 - 7'6"-8'6"			Tooth	Left	di^2
Swp 1329	T/60 - 19'2"-19'5"			Tooth	Indet.	Damaged molar.
Swp 1330	T/59 - 9'7"-10'7"			Tooth	Right	Very worn P^4.
Swp 1331	S/60 - 12'1"-13'6"		*T. oswaldi*	Tooth	Right	Canine (very large)

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1332	S/60 - 12'1"-13'6"			Tooth	Right	M^3
Swp 1333	Gg/41 - 5'5"-6'5"			Tooth	Indet.	Incisor fragment.
Swp 1334	T/65 - 10'6"-11'6"			Tooth	Right	M^1
Swp 1335	Jj/37 - 12'4"-13'4"			Tooth	Indet.	Molar fragment.
Swp 1336	Jj/37 - 12'4"-13'4"			Tooth	Indet.	Damaged molar.
Swp 1337	Jj/37 - 12'4"-13'4"			Tooth	Indet.	Damaged ?canine or ?premolar.
Swp 1338	Jj/37 - 12'4"-13'4"			Tooth	Right	M^3
Swp 1345	Ee/45 - 2'7"-3'7"			Mandible	Left	Left ½ of mandible with damaged dm_1, dm_2, M_1 and erupting M_2. Very small in size only length M_1 measureable.
Swp 1346	Dd/49 - 9'6"-10'6"			Mandible	Left	Mandibular piece – edentulous gonion fragment.
Swp 1347	Dd/49 - 9'6"-10'6"			Mandible	Right	½ of mandible with M_2 and M_3 embedded in breccia with other bony remains; cf ?*Pp. jonesi*.
Swp 1348	Ee/43 - 6'5"-7'5"			Mandible	Left	½ of mandible with damaged teeth (M_1 and M_2); only tooth roots no dental measurements taken.
Swp 1349	Dd/50 - 8'10"-9'10"			Maxilla	Indet.	Maxillary fragment with remains of teeth (?P^4 and?M^1). Only roots, no measurements.
Swp 1359	Dd/48 - 9'10"-10'10"			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1360	Bb/51 - 7'11"-8'11"			Tooth	Indet.	Damaged canine.
Swp 1361	P/61 - 10'6"-11'11"			Tooth	Right	M_2.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1362	M/75 - 5'8"-6'8"			Tooth	Right	right max P3
Swp 1363	D20	9/30/1982		Cranium	Left	Cranial fragment; appears to be part of the ?left temporal with root of zygomatic.
Swp 1366	D20			Maxilla	Left	Maxillary fragment with teeth on left P^3-M^2 (erupting). Tooth surfaces covered with breccia; No measurements can reliably be taken. Lengths may be estimated.
Swp 1371	U/V/W/60 - 12'8"-14'0"			Cranium	Right	Zygomatic with inferior orbital portion and zygomatic arch.
Swp 1372	U/V/W/60 - 12'8"-14'0"			Mandible	Indet.	Fragment of mandibular corpus.
Swp 1373	U/V/W 60 - 12'8"-14'0"			Maxilla	Indet.	Fragment of maxilla.
Swp 1377	Ee/50 - 8'10"-9'10"		*Pp. broomi*	Mandible	Both	Very good condition with I_1-M_3 right side and P_3-M_3 on left side. Specimen has very small P_3; evidence of a small mandibular fossa on right side. Inferior margin of mandible not present.
Swp 1378	Ee/50 - 8'10"-9'10"			Mandible	Both	Maxilla damaged with dm^1-dm^2 and M^1 on left; dm^{1-2} on right. Heavily damaged and not measured.
Swp 1379	Ee/50 - 8'10"-9'10"			Maxilla	Right	M^3 in maxillary fragment and breccia; some measurements possible.
Swp 1380	D20	11/11/1983		Endocast	Indet.	Partial endocast; not identifiable as to region.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1381	D20	11/18/1983		Cranium	Indet.	Cranial fragment appears to be frontal fragment. On endocranial surface the portion near the frontal crest leading into the sagittal sinus can be visualized.
Swp 1382	D20	11/17/1983		Cranium	Both	Cranium over endocast; appears to be slightly distorted. Right lateral portion is moved in medially. Specimen preserves sagittal suture and lambdoidal suture (superior portion). Both parietals are present with a small occipital fragment.
Swp 1389	D20			Mandible	Indet.	Mandibular fragment with remnants of P_3/P_4?
Swp 1392	D20			Maxilla	Right	Maxillary fragment with dc^1 P^3, P^4. dc^1 appears to be falling out of alveolus.
Swp 1393	D20			Mandible	Left	M_3 covered mostly in breccia; few measurements can reliably be taken.
Swp 1394	D20			Tooth	Right	M^2 (damaged).
Swp 1395	U/V/W/60 - 12'8"-14"0"		Tooth		Right	C^1
Swp 1396	Ee/50 - 8'10"-9'10"			Tooth	Right	M^2 and C^1 fragments.
Swp 1397	Ee/50 - 8'10"-9'10"			Tooth	Left	M^2
Swp 1398	Ee/50 - 8'10"-9'10"			Tooth	Left	M^2 (damaged)
Swp 1399	D20			Tooth	Left	M_1 (newly erupted)
Swp 1400	D20			Tooth	Left	dc^1 and dm_1
Swp 1401	D20			Tooth	Left	left mand M1

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1402	D20			Tooth	Left	dm_1
Swp 1409	D20			Tooth	Indet.	Fractured mandibular molar.
Swp 1412	D20		*Pp. jonesi*	Mandible	Right	½ of mandible with P_3 - M_2 (same individual as Swp 1413?). M_3 unerupted; appears to be female *Pp. jonesi*?
Swp 1413	D20		*Parapapio*	Mandible	Left	½ of mandible (damaged) with M_2 only (same individual as 1412?). M_3 unerupted.
Swp 1415	D20			Tooth	Indet.	Very small canine in breccia with bone attached; no measurements taken. Jaw is indeterminate.
Swp 1422	D20			Tooth	Left	dm^2 and M^1
Swp 1423	D20			Tooth	Left	M^1
Swp 1424	D20			Tooth	Left	dm^2
Swp 1425	D20			Tooth	Left	dm_2
Swp 1426	D20			Tooth	Left	M_1
Swp 1427	D20			Tooth	Left	M_1 (newly erupted)
Swp 1428	D20			Tooth	Indet.	Four tooth fragments/chips
Swp 1429	D20			Tooth	Indet.	Tooth chip-canine?
Swp 1430	D20			Tooth	Indet.	Damaged molar?
Swp 1431	D20			Tooth	Right	Damaged molar, M_1.
Swp 1432	D20			Tooth	Left	Left upper canine?
Swp 1433	D20			Tooth	Right	M^1

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1434	D20			Tooth	Left	Damaged molar, dm1 or dm2?
Swp 1435	D20			Tooth	Left	M_2 (newly erupted)
Swp 1436	D20			Tooth	Right	M^1 (newly erupted)
Swp 1437	D17	1/14/1976		Endocast	Indet.	Endocast; very small nondescript fragment.
Swp 1438	D20	7/15/1982		Cranium	Indet.	Cranial fragment; ?frontal.
Swp 1439	D17	4/2/1976		Tooth	Indet.	Jaw fragments in breccia with tooth ?M1 or ?M2.
Swp 1440	D18			Maxilla	Left	Maxilla with damaged teeth. On left, remains of canine P^3-M^3 while on right, remains of P^3, P^4 and M^1. Specimen is heavily damaged and worn; very old adult.
Swp 1441	D18		*Pp. jonesi*	Mandible	Left	Mandible with P_3-M_3. *Parapapio* in proportions. M_2 missing lingual enamel. Specimen most probably a female due to small sectorial P_3. Small maxillary fossa, not well developed.
Swp 1442	D18		*C. willaimsi*	Mandible	Right	Fragment of mandible and symphysis with remains of I_1, I_2, P_3, P_4, and M_1; all teeth damaged. Only P_4-M_1 measureable, but P_3 is male in form (large sectorial). Specimen preserves fragments of incisors. Appear to be very small and colobine-like.
Swp 1443	D18			Mandible	Both	Juvenile mandible with symphysis; only partial M_1 on both sides. Specimen is distorted and fragmented.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1444	D18			Mandible	Right	Fragment of juvenile mandible with dm_1 and mesial ½ of dm_1. C_1 can be visualized in crypt.
Swp 1445	D20			Mandible	Both	Juvenile mandible with dm_2 on left and right. Specimen probably has M_1 in crypt because of thickening of mandible in that area, but remainders of dentition are only roots.
Swp 1446	D20			Mandible		Co-listed with Swp 1445.
Swp 1447	D20		*Parapapio*	Mandible	Right	½ of mandible. Anterior ½ missing, but preserves M_2 and M_3 (same individual as Swp 1448?). M_2 not measurable because it is out of plane and displaced inferiorly hiding the crown.
Swp 1448	D20		*Pp. jonesi*	Mandible	Left	Mandibular fragment; anterior ½ missing, but preserves M_2 and M_3 (M_2 damaged).
Swp 1449	D20		*Pp. jonesi*	Mandible	Right	½ of mandible with P_3-M_3. Heavily worn and damaged. Proportions of P_4-M_1 appear *Pp. broomi*-like; only length measurements can be reliably taken.
Swp 1450			*Parapapio*	Mandible	Both	Juvenile mandible with left di_1, di_2, dc_1, dm_1 and dm_2 (erupting). Right di_1, di_2, dc_1 (root), dm_1 and dm_2. All teeth are heavily damaged and only dm_1 on right is measureable. dm_2 right also erupting.
Swp 1451	D20		*Parapapio*	Mandible	Left	Mandibular fragment with complete remains of P_4, M_1, M_2 (very worn) and M_3 (damaged). M_2 length measured.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1452	D20		*Parapapio*	Mandible	Left	Mandibular fragment with dm_1 and erupting dm_2 (only mesial loph visible).
Swp 1453	D20		*Parapapio*	Mandible	Right	Mandibular fragment with M_3 (not fully erupted); partial ascending ramus preserved.
Swp 1454	D20			Mandible	Right	Juvenile edentulous mandibular fragment-juvenile. Very young by size.
Swp 1455	D20			Mandible	Left	Juvenile mandibular fragment with dm_1; dm_2 and M_1. dm_2 missing lingual enamel.
Swp 1456	D20			Mandible	Right	Juvenile mandibular fragment with molar fragment. M_1 erupting, only tooth present; no measurements taken.
Swp 1457	D20			Mandible	Both	Mandibular fragment with symphysis. Remains of I_1, I_2, C_1, P_3 and P_4. Very small (female).
Swp 1458	D20		*C. williamsi*	Tooth	Right	dm^2 and M^1 (contra catalog) in maxillary fragment. Could be *C. williamsi*, but looks like Swp 1238b which is cf. *Pp. jonesi*.
Swp 1459	D20	6/20/1983	*Pp. broomi*	Maxilla	Right	Maxilla with muzzle and partial zygomatic arch on right side. Teeth on right - P^4-M^3 (very worn). Only lengths are reliable measurements. Appears to be a *Pp. broomi* with a small maxillary fossa, but difficult to determine with confidence because of preservation/fragmentation.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1460	D20		*Pp. broomi*	Maxilla	Left	Fragment with C^1-M^2; appears to be a *Pp. broomi*, because of proportions. Buccal side of molars damaged; M^2 breadths can be estimated.
Swp 1461	D20			Maxilla	Right	Edentulous fragment (siding contra catalog). Can visualize roots of P^3-M^1.
Swp 1462	D20	6/13/1983		Maxilla	Right	Fragment with M^1-M^3; *Pp. broomi*-sized and shaped.
Swp 1463	D20			Maxilla	Right	Right (contra catalog) M^3 in maxillary fragment with fractured M^2 (distal enamel).
Swp 1464	D20			Maxilla	Left	dm^2 in maxillary fragment; contra catalog. Missing mesio-buccal cusp; mesial breadth can be estimated.
Swp 1465	D20			Maxilla	Right	Fragment with dm^1 and dm^2 (very small); dm^2 not fully erupted (distal portion fragmented).
Swp 1466	D20			Mandible	Right	M_3 in mandibular fragment; only partial ascending ramus near M_3 preserved.
Swp 1467	D20		*Parapapio*	Mandible	Right	Fragment with M_1, M_2 and M_3 (unerupted), but portion of M_3 crypt appears to be present. Also, has erupting P_4 fragment.
Swp 1468	D20			Mandible	Left	dm_2 in bone fragment; not fully erupted and immeasurable. Remainder of mandible and dentition missing.
Swp 1469	D20			Endocast	Indet.	Small fragment of endocast with large amount of breccia.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1470	D20	7/22/1983		Endocast	Indet.	Endocast; very nondescript. A couple of bone fragments can be visualized in breccia, both cranial and non-cranial.
Swp 1471	D20	7/22/1983		Endocast	Indet.	Endocast of the parietal/occipital regions with sagittal sinus and transverse sinuses.
Swp 1472	D20	6/15/1983		Cranium	Right	Large fragment of cranium; appears to be partial right frontal and parietal. Interior orbit and partial temporal line can be visualized although supraorbital torus cannot.
Swp 1473	D20	7/25/1983		Cranium	Left	Cranial fragment with left orbit (frontal ½) and shows lightly developed temporal line. No supraorbital torus, but appears to be a juvenile.
Swp 1474	D20	7/26/1983		Cranium	Right	Cranial fragment; endocranial side filled with breccia. Specimen appears to be right parietal with strong, large nuchal line.
Swp 1475	D20	6/16/1983		Endocast	Indet.	Large endocast with fragments of cranium attached. Specimen appears to have frontal lobes on one end, but specimen is distorted and is difficult to identify with any confidence.
Swp 1476	D20			Cranium	Indet.	Cranial fragment?
Swp 1477	D20			Cranium	Indet.	Otic bone.
Swp 1478	D17			Tooth	Indet.	Five tooth fragments.
Swp 1479	D17			Tooth	Right	I_1
Swp 1480	D17			Tooth	Left	dm_1 and dm_2
Swp 1481	D12			Tooth	Left	M^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1482	D7			Tooth	Right	M_3
Swp 1483	D17			Tooth	Right	di^1
Swp 1484	D17			Tooth	Left	C^1
Swp 1485	D18			Tooth	Indet.	13 tooth fragments and enamel chips
Swp 1486	D20			Tooth	Indet.	Two damaged molars in bone fragment.
Swp 1487	D20?			Tooth	Indet.	Damaged dM_1 and incisor in bone fragment.
Swp 1489	D18			Tooth	Right	Right M_3? Very small hypoconulid.
Swp 1490	D18			Tooth	Left	M_3
Swp 1491	D18			Tooth	Left	M_2 or ?M_1
Swp 1492	D18			Tooth	Left	M^1
Swp 1493	D18			Tooth	Right	M_2
Swp 1494	D18			Tooth	Right	I^1
Swp 1495	D18			Tooth	Right	I_1
Swp 1496	D18			Tooth	Right	M_1
Swp 1497	D18?			Tooth	Left	M_2
Swp 1498	D18?			Tooth	Right	M_3
Swp 1499	D18			Tooth	Left	P_3
Swp 1500	D18?			Tooth	Left	I^1 (damaged)
Swp 1501	D18			Tooth	Left	P_3
Swp 1502	D18?			Tooth	Right	I_2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1503	D18			Tooth	Indet.	Damaged canine.
Swp 1504	D18?			Tooth	Left	I_1
Swp 1505	D18?			Tooth	Right	M^1?
Swp 1559	D20	2/9/1980		Cranium	Indet.	Cranium; badly damaged and fragmented pieces, indeterminate.
Swp 1638	D20?			Tooth	Left	dm_2
Swp 1639	D20			Tooth	Right	M_3
Swp 1640	D20			Tooth	Left	dm^2
Swp 1641	D20?			Tooth	Left	dm_1
Swp 1642	D20			Tooth	Right	M^1 (very worn) and very small.
Swp 1643	D20?			Tooth	Left	M^1
Swp 1644	D20?			Tooth	Left	dm_2
Swp 1645	D20			Tooth	Left	M^1
Swp 1646	D20			Tooth	Right	P_3
Swp 1647	D20?			Tooth	Right	P_4
Swp 1648	?			Tooth	Left	M_1
Swp 1649	D20			Tooth	Left	P^3 and P^4
Swp 1650	?			Tooth	Indet.	Incisor or canine.
Swp 1651	?			Mandible	Indet.	Fragment of juvenile mandible.
Swp 1652	?			Tooth	Left	I^1
Swp 1653	?			Tooth	Right	P_3

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1654	?			Tooth	Right	I^1
Swp 1655	?			Tooth	Indet.	Damaged I_1.
Swp 1656	D20			Tooth	Indet.	Five damaged canine fragments.
Swp 1657	D20			Tooth	Right	C^1
Swp 1658	D20			Tooth	Left	C^1
Swp 1659	?			Tooth	Left	dm_2
Swp 1660	D20			Tooth	Right	I_1
Swp 1661	?			Tooth	Left	M^2
Swp 1662	?			Tooth	Right	M^1 (very worn)
Swp 1663	D20			Tooth	Left	M^2 (worn)
Swp 1664	?			Tooth	Right	M_1
Swp 1665	?		*Theropithecus*	Tooth	Left	M^1
Swp 1666	D20			Tooth	Left	M_2
Swp 1667	?			Tooth	Left	I_1
Swp 1668	?			Tooth	Left	M^1
Swp 1669	?			Tooth	Left	dm_2
Swp 1670	?			Tooth	Right	M^3
Swp 1671	?			Tooth	Left	M^2
Swp 1672	D20			Tooth	Indet.	Eight tooth fragments.
Swp 1673	D19			Tooth	Left	I^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1674	D19			Tooth	Right	M_1
Swp 1675	D19			Tooth	Left	P^3
Swp 1676	D19			Tooth	Left	M_1
Swp 1677	D20	10/7/1978		Endocast	Indet.	Cranium/endocast; fragmented and not informative.
Swp 1678	D20	9/21/1978		Cranium	Indet.	Cranial fragments in breccia; indeterminate.
Swp 1679	D20	8/23/1978		Cranium	Indet.	Cranial fragments in breccia; indeterminate.
Swp 1680	D20	2/8/1978		Cranium	Both	Cranial fragments in breccia; can see endocranial surfaces with cruciform eminence and confluence of transverse and sagittal sinuses.
Swp 1681	D20	11/8/1978		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1682	D20	11/16/1978		Cranium	Left	Cranial fragment; left frontal with temporal line and superior portion of orbit with supraorbital notch and gyri impressions on endocranial surface.
Swp 1683	D20	4/3/1980		Cranium	Indet.	Cranial fragments in breccia, not identifiable.
Swp 1684	D20	7/21/1978		Endocast	Right	Endocast of ?right side only. Specimen appears to have frontal and temporal lobes. However, temporal is covered by breccia.
Swp 1685	D20	4/3/1980		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1686	D20	10/8/1978		Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1687	D20	8/24/1978		Cranium	Indet.	Cranial fragments in breccia; indeterminate.
Swp 1689	D20			Cranium	Indet.	Cranial fragment.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1690	D20			Cranium	Indet.	Cranial fragment.
Swp 1691	D20			Cranium	Indet.	Cranial fragment; indeterminate.
Swp 1692	D20			Cranium	Indet.	Cranial fragment in breccia.
Swp 1693	D20	7/26/1978		Cranium	Both	Cranial fragments (parietal mostly) with right ½ of maxilla containing di^1, di^2 and dc^1, also, on left, di^1 (erupting incisors). All teeth are in very poor condition; no measurements taken.
Swp 1694	D20	2/15/1979		Cranium	Indet.	Cranial fragment; indeterminate. Most probably cranial vault, but which specifically is undeterminable. Very fragile specimen.
Swp 1695	D20	8/22/1978		Cranium	Right	Cranial fragments with orbital region in breccia. Specimen appears to be a juvenile. Right frontal possesses a small temporal line.
Swp 1696	D20	7/28/1978		Cranium	Both	Cranium/endocast (partial). Endocast on right side from sagittal suture to temporal region. Bones present – left temporal and occipital. Specimen has root of zygomatic on temporal but does not preserve the auditory meatus.
Swp 1725	D20		*Parapapio*	Cranium	Both	Juvenile cranial fragment with endocast in places where cranial bones are missing. Specimen has di^2, dc^1, dm^1 and dm^2 bilaterally.
Swp 1726	D20	11/10/1978		Cranium	Indet.	Cranial fragments in breccia. Also, juvenile mandible, no dentition visible. Specimen is still encased in breccia and in very poor condition; needs preparation.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1727	D20		*Pp. jonesi*	Cranium	Both	Crushed cranial and mandible with right I^1 and left I^2; left I_2, C_1 and P_3 (missing). M_3 not visible.
Swp 1728	D20		*Pp. broomi*	Cranium	Both	Skull with left zygomatic and damaged (zygomatic arch missing). Where cranial fragments are missing, an endocast is exposed. Right C^1-M^3 and P^4-M^3 present. Teeth are worn and damaged.
Swp 1729	D20	11/8/1978		Cranium	Left	Juvenile cranium; orbits and left maxillary piece. Left sagittal line to temporal bone is simply breccia. No taxonomic information. Specimen does have frontal and parietal bosses. Tip of a tooth cusp is present but difficult to determine tooth, as rest of palate is in poor condition.
Swp 1730	D20	9/29/1978		Cranium	Indet.	Juvenile cranium; in orbital area endocast is exposed.
Swp 1731			*Pp. broomi*	Cranium	Both	Specimen regions superior to nasion have been sheared off in the midline. Posterior and basal portion of neurocranium missing. Morphology definite *Pp. broomi*. Note maxillary ridges. Palate does not possess any teeth. Some cranial measurements possible, but cranium distorted; seems to fit with Swp 1782, a male *Pp. broomi*.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1732	D20		*P. izodi*	Cranium	Right	Cranium with endocast partially exposed. Left side absent; specimen has right zygomatic arch and orbit. Cranium damaged in right parietal region. However, some portions of the basicranium are preserved. Basicranium however is covered with breccia. Specimen does have large maxillary fossa. Slightly developed nuchal line; no teeth are present.
Swp 1733	D20	7/20/1978	*P. izodi*	Cranium	Both	Juvenile partial skull-only maxilla, left orbit and zygomatic. A small portion of the basicranium with glenoid fossa is present. Specimen has max dm^1, dm^2 and M^1 bilaterally and I^1 (erupting).
Swp 1734	D20		*Parapapio*	Mandible	Both	Mandible with left I_1, I_2, no C_1, no P_3 (broken), P_4, M_1-M_3 (worn); right partial C_1,(damaged), P_3-P_4, M_1-M_3 (M_3 damaged-all worn). Only lengths are measureable because lingual side of each tooth is missing.
Swp 1735	D20		*C. williamsi*	Mandible	Both	Mandible with only right M_3 missing; I_2 and C_1 damaged. Specimen is missing both ascending rami; prominentia lateralis is present on left side (partially visible). Inferior margin missing, but has flat anterior margin of mandible. Specimen displays typical *C. williamsi* P_4's which lean distally.
Swp 1736	D20		*Pp. broomi*	Mandible	Both	a) Left mandible with receding chin ending about distal M_2; anterior region complete; P_3-M_3. Appears to be a female with a small piece of the right side. b) Right ½ of mandible; P_3-M_3; proportions

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						and size appear *Parapapio*.
Swp 1737	D20		*C. williamsi*	Mandible	Both	Mandible with no incisors or canines. Specimen possesses right P_4 (missing); left P_3, M_1, M_2 (damaged) and M_3 (missing). Wear scores difficult to determine. Teeth are black.
Swp 1738	D20		*Pp. jonesi*	Mandible	Both	Damaged mandible with some erupted dentition. Left I_1, I_2, dc_1, dm_2, M_1 and erupting M_2. Only dm_1 preserved on right side. M_2 is out of plane and distorted so that mesial loph projects inferiorly into the mandible. Deciduous teeth are heavily worn. Right side of mandible has corpus and ascending ramus; left side is corpus only until about M_2 level. Anterior margin of mandible has been sheared off.
Swp 1739	D20		*Parapapio*	Mandible	Both	Juvenile mandible; right newly erupted I_1, M_1; on left, remains of dm_1, dm_2 and M_1 present. M_1's are the teeth measureable.
Swp 1740	D20			Mandible	Left	Left ½ of mandible with dm_1 and dm_2 and erupting incisor?
Swp 1741	D20			Mandible	Both	Mandibular symphysis with erupting C_1 on right side.
Swp 1742	D20		*Pp. jonesi*	Mandible	Both	Mandible with left I_1, I_2 (missing) and right I_1, I_2, C_1 and P_3 (missing); on right, P_4 (damaged). Anterio-inferior margin of mandible damaged;

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						female specimen.
Swp 1743	D20		*C. williamsi*	Mandible	Right	Right 1/3 of mandible with P_4-M_3 only. No ascending ramus; specimen compares well with Swp 1283 (juvenile).
Swp 1744	D20		*Parapapio*	Mandible	Left	Mandibular fragment with M_2 and M_3. Both are missing the mesio-lingual cusps and are heavily worn.
Swp 1745	D20		*Pp. jonesi*	Mandible	Left	Mandibular fragment with much worn M_3.
Swp 1746	D20		*Parapapio*	Mandible	Left	Fragment of juvenile mandible with damaged dm_1 and dm_2; only disto-lingual cusp of dm_1 preserved and dm_2 is missing disto-buccal cusp.
Swp 1747	D20			Tooth	Indet.	P3 and P4 in bone fragment; P3 fragmented and missing flange portion. Appears to be a small male; both teeth are heavily worn.
Swp 1748	D20	9/29/1978	*Parapapio*	Maxilla	Left	Juvenile maxillary fragment with di^1, di^2, dc^1, dm^1 and erupting dm^2.
Swp 1749	D20			Mandible	Right	Right mandibular fragment with smashed teeth, P_4-M_3? Roots only; no measurements can reliably be taken. Identification is contra catalog.
Swp 1750	D20			Tooth	Left	M1 in bone fragment and breccia with smashed P3 and P4.
Swp 1751	D20		*Parapapio*	Mandible	Right	Mandibular fragment with damaged dm_2 (missing mesio-buccal cusp) and erupting M_1.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1752	D20			Mandible	Left	Mandibular ½ with erupting incisor; and erupting M_1; dm_1 and dm_2 (roots only).
Swp 1753	D20		*Parapapio*	Mandible	Left	Mandibular fragment with dm_2 and M_1.
Swp 1754	D20		*Parapapio*	Mandible	Left	M_3.
Swp 1755	D20			Mandible	Indet.	Mandibular fragment only C_1 remains.
Swp 1756	D20			Mandible	Indet.	Mandibular fragment.
Swp 1757	D20		*C. williamsi*	Mandible	Right	Mandibular fragment with C_1 (smashed) and M_1.
Swp 1758	D20		*Parapapio*	Mandible	Right	Right mandibular piece with distal fragment of dm_1 and complete dm_2; no evidence of M_1. Specimen has partial ascending ramus and gonion minus coronoid and condyloid processes.
Swp 1759	D20		*Parapapio*	Mandible	Left	Left mandibular fragment with P_3-M_2, very worn. cf. *Pp. broomi*.
Swp 1760	D20			Mandible	Right	Right (contra catalog) mandibular fragment with P_4, M_1 (damaged) and M_3 (damaged). Only P_4 can be measured.
Swp 1761	D20		*Parapapio*	Mandible	Left	Mandibular fragment with smashed M_1 and M_2, but complete M_3 (not fully erupted).
Swp 1762	D20		*Parapapio*	Mandible	Left	Juvenile mandibular fragment with di_2, dm_1 and dm_2.
Swp 1763	D20		*Parapapio*	Mandible	Both	Juvenile mandibular symphysis fragment with right di_1 (missing), but preserves dm_1, dc_1 and di_2, bilaterally.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1764	D20		*Parapapio*	Mandible	Both	Juvenile mandibular symphysis fragment with left di_1, di_2, dc_1, broken dm_1; on right, di_2, dc_1, and damaged dm_1. Measurements only taken on anterior dentition.
Swp 1765	D20	7/21/1978		Cranium	Left	Left cranial fragment with exposed endocast in breccia; frontal and temporal lobes on left can be visualized.
Swp 1766	D20		*Parapapio*	Maxilla	Both	Maxilla and portions of remaining muzzle with dm^1 and dm^2 bilaterally.
Swp 1767	D20	12/10/1978	*Parapapio*	Maxilla	Both	Maxilla and anterior portions of muzzle with dm^1 and dm^2 bilaterally and erupting left I^1; bucco-distal cusp of left dm^2 is missing.
Swp 1768	D20			Cranium	Both	Fragment of basicranium with erupting M^1 bilaterally.
Swp 1769	D20		*Parapapio*	Maxilla	Right	Maxillary fragment with P^3, P^4, M^1 and M^2.
Swp 1770	D20		*Parapapio*	Maxilla	Both	Juvenile maxillary fragment with dc^1 and dm^1 and a portion of a ?mandibular fragment with canine and two molars (distorted in breccia); right dc^1 and dm^1 measureable; similar in size to Swp 1779.
Swp 1771	D20		*Pp. broomi*	Maxilla	Left	Maxillary fragment with M2 and M3. Zygomatic root just above distal M^2. Forward facing zygomatic, but can't tell about fossa definitely. Specimen appears to have been a small individual.
Swp 1772	D20		*Pp. broomi*	Maxilla	Left	Maxillary fragment with P^3, P^4, M^1 and M^2 (fractured disto-lingually); P4 is cracked and slightly distorted. Measurements of P^4 are

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						estimates.
Swp 1773	D20		*Parapapio*	Maxilla	Left	Maxilla with I^1, I^2, C^1(erupting), P^3, P^4, dm^2, M^1, and M^2.
Swp 1774	D20		*P. izodi*	Maxilla	Left	Maxilla with very worn C^1, P^3, P^4, M^1, M^2 and M^3. C^1 is only a small buccal fragment; remainders are heavily worn.
Swp 1775	D20		*Pp. broomi*	Maxilla	Left	Maxilla with remains of C^1, P^3, P^4-M^3 intact. *Lophocebus*-like M3. M^3 and P^3 damaged buccally. Specimen has typical *Pp. broomi* maxillary fossa.
Swp 1776	D20		*Parapapio*	Maxilla	Right	Maxillary fragment with dm^1, dm^2; specimen is in very poor condition. Measurements only taken of dm^2.
Swp 1777	D20		*Parapapio*	Maxilla	Left	Maxillary fragment with M^1 and M^2.
Swp 1778	D20			Tooth	Indet.	Bone fragment with remains of M2 and M3; teeth are fragmented and are probably more conservatively indeterminate.
Swp 1779	D20		*Parapapio*	Maxilla	Right	Juvenile maxillary fragment with dc^1 and dm^1.
Swp 1780	D20			Maxilla	Left	Maxillary fragment with erupting I^1.
Swp 1781	D20		*Parapapio*	Maxilla	Right	Maxillary fragment with M^1, M^2 and M^3. Additional tooth in breccia doesn't seem to belong to same specimen. M^3 has a small extra cusp on distal surface and on lingual surface.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1782	D20		*Parapapio*	Cranium	Both	Skull – partial cranium and mandible. Specimen is crushed and distorted; however, all teeth present. Specimen appears to be comparable to Swp 1731 in comparisons of muzzles and dentition. Very few dental measurements are possible because cranium and mandible are articulated. Specimen appears to be male *Pp. broomi*.
Swp 1783	D20		*Papio*	Tooth	Indet.	Two teeth in breccia-left M2 and M3.
Swp 1784	D18		*Pp. jonesi*	Mandible	Both	Juvenile mandible – canines missing, I_1, I_2; P_3 - P_4 (erupting bilaterally); M_1-M_2 bilaterally. M_3 not erupted; incisors appear large. Specimen compares favorably with Swp 245/15. No evidence of canines, so difficult to say whether female of male, but would classify as *Pp. jonesi*.
Swp 1785	D20		*Parapapio*	Tooth	Indet.	Four teeth in bony fragments encased breccia. Two teeth damaged, other two identified as left dm1 and dm2.
Swp 1786	D20			Tooth	Indet.	Two teeth in bone and breccia - both M1?
Swp 1787	D18			Mandible	Left	Fragment of left ½ of mandible with remnants of P_3-M_2. No teeth are measureable due to fractured crowns.
Swp 1788	D18			Mandible	Indet.	Mandibular fragment; indeterminate location.
Swp 1789	D18			Mandible	Right	Right ½ of edentulous mandible. Only tooth remnant is root outline of M_3.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1790	D18?			Mandible	Right	Mandibular symphysis with remains of right P_3, P_4 and M_1. Very small P_4. No teeth are measureable, as they are only represented by partial crowns.
Swp 1791	D18			Mandible	Right	Right ½ of mandible. Damaged remnants of M_1-M_3; only partial enamel fragments. No measurements taken. M_3 does not appear to be in full occlusion.
Swp 1792	D18			Mandible	Left	Juvenile mandibular symphysis. Remains of dm_1 and erupting ?canine on left. Mandible fractured inferiorly through roots, and specimen is superiorly covered with breccia.
Swp 1793	D18			Mandible	Right	Right ½ of juvenile mandible with dm_2; M_1 in crypt
Swp 1794	D18		*Parapapio*	Mandible	Right	Right ½ of mandible with badly crushed with M_3.
Swp 1795	D18			Mandible	Right	Mandibular symphysis with remains of P_4 and M_1 (worn). Very badly damaged; no measurements taken. M_2 appears to have a WS of 16, but specimen is missing distal loph. So, WS is estimated.
Swp 1796	D18	8/23/1977	*Pp. jonesi*	Mandible	Right	Right mandibular fragment with M_2 and damaged M_1 and M_3. M_1 missing mesio-lingual cusp. M_3 missing disto-buccal and hypoconulid. Attributed to cf. *Pp. jonesi.*
Swp 1797	D18		*Pp. broomi*	Mandible	Right	Right ½ of mandible with fractured P_3, P_4, M_1, M_2 - all damaged (cracked). P_4 can be estimated, and length of M_1. Others are too damaged.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1798	D18			Mandible	Left	Left mandibular fragment with remains of M_1 and M_2. No evidence of M_3. Only partial buccal sides on specimen; no measurements were taken.
Swp 1799	D18			Mandible	Right	Juvenile mandibular fragment with dm_2; no evidence of M_1.
Swp 1800	D18			Mandible	Left	Juvenile mandibular fragment with dm_1, dm_2.
Swp 1801	D18	8/21/1977		Mandible	Left	Mandibular fragment with remains of M_2 and damaged M_3. Specimen appears to be *Pp. jonesi* in shape and size. M_2 is missing buccal half while the M_3 missing mesio-buccal cusp.
Swp 1802	D18		*Parapapio*	Mandible	Left	Left ½ of mandible with P_3. Small female; not dimorphic. Breccia covers most of the remaining dentition.
Swp 1803	D18		*Parapapio*	Mandible	Left	Left ½ of mandible with M_3, M_2 (buccal side) and M_1 (disto-buccal cusp).
Swp 1804	D18	1/16/1978	*Parapapio*	Mandible	Left	Left mandibular fragment with much worn M_1-M_3; only lengths can be estimated. Other measurements are very unreliable.
Swp 1805	D18	7/9/1977	*Parapapio*	Mandible	Left	M_3 in left mandibular fragment. Tooth is heavily fragmented with breccia filling cracked tooth surface. Specimen is immeasurable.
Swp 1806	D18		*Parapapio*	Mandible	Right	Right M_1 in mandibular fragment with distal remains of P_4. Small in size (breadth of P_4 can be estimated).
Swp 1807	D18	8/11/1971		Mandible	Indet.	Mandibular fragment with tooth enamel fragment.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1808	D18		*Parapapio*	Mandible	Right	Right mandibular fragment with much worn M_1 and fragmentary mesial remains of M_2.
Swp 1809	D18		*Parapapio*	Mandible	Right	Right mandibular fragment with M_2 and remains of M_3. Teeth are fragmented; M_3 not fully erupted. Specimen is a sub-adult. Mesio-lingual m_1 missing;
Swp 1810	D18			Mandible	Right	Right (contra catalog) mandibular fragment with damaged M_2 and M_3 (very large). Specimen is in very poor condition. Can only take length of M_3. Both teeth are fractured, cracked and distorted.
Swp 1811	D18			Mandible	Left	Left mandibular fragment with M_3-damaged. Tooth not in contact with mandible; separated by breccia. Most measurements difficult because of adhering breccia.
Swp 1812	D18	8/4/1974	*Parapapio*	Maxilla	Left	Left maxillary fragment with M_1 and M_2 – very worn. M_2 has three roots. Identification is contra catalog.
Swp 1813	D18	11/11/1977		Mandible	Left	Left mandibular fragment with remains of M_1 and M_2. Can take measurements of M_2 length; other measurements not reliable. Enamel missing on M_1 (all sides); buccal side missing on M_2.
Swp 1814	D18?			Mandible	Left	Damaged left M_3 in mandibular fragment; only mesial loph intact. Papionin.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1815	D18	11/3/1976		Mandible	Left	Left mandibular fragment with symphysis – left and right incisor, remains of left ?M_1 and M_2. No measurements possible; teeth fragmented and in poor shape.
Swp 1816	D18		*Parapapio*	Mandible	Left	Left M_3 in mandibular fragment.
Swp 1817	D18		*Parapapio*	Mandible	Left	Left mandibular fragment juvenile with dm_1 and remains of dm_2 (mesial loph).
Swp 1818	D18	8/27/1976	*Parapapio*	Maxilla	Left	Left M_1 (distal cusps only) in maxillary fragment and remains of M_2 (worn).
Swp 1819	D18			Mandible	Left	?Left M_1 in mandibular fragment-distorted position; difficult to side. No measurements taken.
Swp 1820	D18	10/29/1976		Mandible	Right	Very worn right M_3 in mandibular fragment; breadth (estimated).
Swp 1821	D18	2/6/1977		Mandible	Left	?Left M_1 in mandibular fragment.
Swp 1822	D18			Mandible	Right	Right mandibular fragment with premolars. Small sectorial P_3 female; P_4 missing lingual half.
Swp 1823	D18	5/19/1976		Mandible	Right	Right mandibular fragment with dm_2, erupting M_1 (contra catalog). dm_2 missing mesial loph.
Swp 1824	D18		*Parapapio*	Maxilla	Right	Right maxillary fragment with remains of P_4-M_3? Very badly damaged, no measurements.
Swp 1825	D18			Mandible	Right	Right mandibular fragment with M_3; not fully erupted; hypoconulid not measureable.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1826	D18			Mandible	Indet.	Mandibular fragment with remains of two molars. Very poor condition. Only partial enamel left of molars, no measurements.
Swp 1827	D18	5/1/1976		Mandible	Indet.	Mandibular fragment with remains of molars; no measurements or observations possible.
Swp 1828	D18			Mandible	Indet.	Mandibular fragment; indeterminate.
Swp 1829	D18	2/14/1975		Mandible	Indet.	Mandibular fragment with fractured molar.
Swp 1830	D18	6/9/1977	*Parapapio*	Maxilla	Right	Right maxillary fragment (left) with P^3 and P^4 (contra catalog).
Swp 1831	D18			Mandible	Indet.	Mandibular fragment with molar fragment; indeterminate. Not measureable.
Swp 1832	D18	6/28/1976		Mandible	Left	Remains of left M_3 in mandibular fragment; only partial distal loph and hypoconulid.
Swp 1833	D18	11/6/1976		Mandible	Indet.	Mandibular fragment with fragmented dm_2.
Swp 1834	D18	6/3/1975		Mandible	Right	Right mandibular fragment with remains of dm_2 and $?M_1$. No measurements, as specimen is heavily fragmented.
Swp 1835	D18	3/28/1978		Mandible	Indet.	Mandibular fragment with tooth remains; indeterminate.
Swp 1836	D18	10/3/1975		Maxilla	Indet.	Maxillary fragment with M^1 and $?dm^1$ and remains of dm^2. No measurements. M^1 not in occlusion yet (erupting).
Swp 1837	D18	2/25/1976		Mandible	Indet.	Mandibular fragment with broken M_3; fragmented so no measurements taken.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1838	D18	10/2/1975		Tooth	Indet.	Distorted piece of bone and breccia with six or seven teeth. Dentition is in various planes and difficult to attribute to sides, etc. No measurements.
Swp 1839	D18	9/9/1976		Mandible	Indet.	Mandibular fragment with mangled tooth roots. Indeterminate; however, teeth present may be M_2-M_3.
Swp 1840	D18			Mandible	Left	Mandibular fragment with M_3 tooth fragment.
Swp 1841	D18			Mandible	Left	½ of edentulous mandible. Appears to be a juvenile specimen.
Swp 1842	D18			Mandible	Right	Mandibular fragment near junction of ascending ramus and mandibular corpus. Edentulous.
Swp 1843	D18			Mandible	Left	Mandibular fragment with condyle and partial sigmoid.
Swp 1844	D18			Mandible	Right	Mandibular fragment with apparent fragment of M_3 root.
Swp 1845	D18			Mandible	Right	Right mandibular fragment with ascending ramus near M_3 but only partial hypoconulid root present.
Swp 1846	D18			Mandible	Indet.	Mandibular fragment; indeterminate.
Swp 1847	D18			Mandible	Indet.	Mandibular fragment; indeterminate.
Swp 1848	D18			Mandible	Indet.	Mandibular fragment; indeterminate.
Swp 1849	D18			Mandible	Right	½ of edentulous mandible and anterior ½ missing. Specimen does preserve condyle and all of ascending ramus; however, no coronoid process is preserved.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1850	D18			Mandible	Indet.	Mandible and maxilla (crushed and distorted) articulated. No measurements can be reliably be taken.
Swp 1851	D18?			Tooth	Right	Bone fragment with teeth encased in breccia. Right P3, P4 and M1 discernable.
Swp 1852	D18	2/16/1977	*Parapapio*	Mandible	Left	Left mandibular fragment with I_2, C_1, P_3 and P_4. Very small individual; ?female.
Swp 1853	D18	8/19/1977	*Parapapio*	Maxilla	Right	Maxillary fragment with remains of P^3, P^4 and M^1. Heavily fragmented and immeasurable. Specimen is very small in size. Only, lengths of P^3-P^4 can be estimated.
Swp 1854	D18		*Parapapio*	Maxilla	Left	Maxillary M^1 in bone fragment. No measurements; covered with plaster and fragmented. However, identification is hindered by adhering breccia.
Swp 1855	D18		*C. williamsi*	Mandible	Left	M_1 in bone fragment; contra catalog. Specimen appears to preserve remnants of v-shaped buccal clefts (i.e. *C. williamsi*).
Swp 1856	D18	3/26/1975	*Parapapio*	Maxilla	Right	Right M^3 in maxillary fragment. Small *Lophocebus*-like distal loph.
Swp 1857	D18			Mandible	Right	Contra catalog; right mandible fragment with portion of small P_3 (female); can visualize posterior foramen near symphysis.
Swp 1858	D18	7/29/1977		Maxilla	Right	Maxillary fragment with C^1 (erupting), P^3, P^4 and M^1 in very poor condition. Specimen covered mostly with breccia.
Swp 1859	D18	8/26/1977	*Parapapio*	Maxilla	Right	M^3 in bone fragment; *Lophocebus*-like in

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						appearance.
Swp 1860	D18	9/30/1977	*Parapapio*	Maxilla	Right	Maxillary fragment in breccia with M^3. Only length is measureable. Tooth fragmented around cervix on buccal side. Only occlusal portion remaining.
Swp 1861	D18	3/3/1981	*Parapapio*	Maxilla	Right	Maxillary fragment with very worn and damaged M^1-M^3-joined to ?left fragment with remains of molars. Left side is heavily fragmented, as well. Only length measurements can be taken because of fragmented crowns; specimen is in very poor shape.
Swp 1862	D18		*Parapapio*	Maxilla	Right	Juvenile maxillary fragment with dc^1, dm^1 ,dm^2 and M^1 (tilted buccally).
Swp 1863	D18		*Parapapio*	Maxilla	Right	Maxillary fragment with remains of P^4, M^1 and M^2 (buccal side).
Swp 1864	D18	1/13/1978	*Parapapio*	Maxilla	Left	Maxillary fragment with damaged M^1-M^3; very poor condition. No measurements can reliably be taken. P^4 appears to be present, as well, and might be measureable.
Swp 1865	D18		*Parapapio*	Maxilla	Left	Left maxillary fragment with M^3, M^2 and broken M^1 (partial buccal side).
Swp 1866	D18	9/17/1976	*Parapapio*	Maxilla	Left	Left maxillary fragment with broken M^2 and M^3 (intact); M^2 missing lingual cusps.
Swp 1867	D18		*Parapapio*	Maxilla	Left	Left M^3 (worn); identification contra catalog.
Swp 1868	D18		*Parapapio*	Maxilla	Right	Right maxillary fragment with ?M^1 and M^2.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1869	D18	3/13/1975	*Parapapio*	Maxilla	Both	Juvenile maxillary fragment with I^1 and di^2 bilaterally, dm^1 and dm^2 on right and remains of dm^1 and dm^2 on left. Very poor condition; much of specimen held together by glue. Only dm^1-dm^2 on right measureable.
Swp 1870	D18			Maxilla	Indet.	Maxillary fragment with evidence of small maxillary fossa; however, no teeth or roots are present.
Swp 1871	D18			Maxilla	Left	Maxillary fragment with very worn and damaged M^1-M^2. Not readily identifiable. Specimen is very badly damaged and very little of the tooth crowns are present. No measurements can reliably be taken.
Swp 1872	D18			Maxilla	Indet.	Maxillary fragment with tooth remains; indeterminate.
Swp 1873	D18	1/29/1975	*Parapapio*	Maxilla	Right	Maxillary fragment with damaged remains of M^1-M^3 in very poor condition. No measurements can be taken. Enamel is fragmented and distorted.
Swp 1874	D18	1/3/1978	*Pp. broomi*	Maxilla	Right	Maxillary fragment with M^2 and M^3. Specimen is very large and worn; could be a large male *Pp. broomi.*
Swp 1875	D18		*Parapapio*	Maxilla	Both	Maxillary fragment with left I^1 and right I^1, I^2 and d^c?; heavily worn. Breadth measurements only.
Swp 1876	D18	5/3/1976		Maxilla	Right	Maxillary fragment with dm^1, dm^2 and M^1. dm^2 and M^1 missing buccal sides of tooth.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1877	D18			Mandible	Both	Mandible with root remains on right and P^3-P^4 on left (damaged). Large male P^3. No measurements. Heavily worn – older adult; P^4 WS = 8.
Swp 1878	D18			Mandible	Indet.	Mandibular fragment with molar hypoconulid? Only small fragment, tooth identification questionable.
Swp 1879	D18		*Pp. broomi*	Maxilla	Right	Right ½ of maxilla with P^3-M^3. Male *Pp. broomi*. Specimen is quite large. Canine missing, and breccia/calcite fills the canine alveolus. Alveolus appears to be large. Specimen has typical *Pp. broomi* muzzle with maxillary ridges and fossa.
Swp 1880	D18			Cranium	Indet.	Crushed partial cranium. Partial maxilla has remains of a molar tooth. Specimen is in very poor condition and still encased in breccia.
Swp 1881	D18	8/23/1976	*Parapapio*	Maxilla	Both	Maxilla (damaged) with C^1-M^2 on right and P^4-M^2 on left (and erupting M^3). Few measurements are possible as dentition is either damaged or covered with breccia.
Swp 1882	D18		*P. izodi*	Maxilla	Both	Muzzle with left orbit and maxilla with P^3-M^2 on right and P^3-M^1 on left. Difficult to judge size of C^1. Most muzzle features are absent, and orbit is only breccia. Supraorbital region is not present; however, from superior view specimen appears to possess a *P. izodi*-type zygomatic.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1883	D18	4/18/1977	*Parapapio*	Maxilla	Left	Left maxilla with P^4-M^3 (all damaged). All teeth are missing buccal halves of cusps; only lengths are measured.
Swp 1884	D18	6/18/1974	*Pp. broomi*	Maxilla	Both	Muzzle with part of right zygomatic (distorted). P^3-M^3 bilaterally. Right M^3 displaced and all teeth worn. Right side has small *Pp. broomi*-like maxillary fossa with deep palate (near parallel toothrows - like TP 9). However, may be distortion, rather than 'true' morphology, as left side is more inferior than right.
Swp 1885	D18	10/26/1974		Maxilla	Both	Externally crushed muzzle and face of baboon with maxilla (split and crushed). Left M^1, M^2, M^3; right M^3, M^2, broken M^1, PM and C^1? Breccia still adhering to dentition, and no measurements of teeth possible.
Swp 1886	D18	2/16/1979		Cranium	Indet.	Cranial fragments in breccia; appears to be frontals with a small portion of the left maxilla showing a typical *Pp. broomi* fossa. Specimen is in very poor condition.
Swp 1887	D18	1/24/1978		Maxilla	Right	Right maxillary fragment with M^2? No measurements taken. Root of zygomatic directly above tooth.
Swp 1888	D18	7/4/1976		Cranium	Indet.	Cranial fragment with orbit. Specimen is in poor condition. Difficult to tell side, but appears to be a left from an adult.
Swp 1889	D18		*Pp. jonesi*	Maxilla	Both	Crushed maxilla with right M^1, M^2 and M^3 (damaged) and left M^2?; crushed and immeasurable.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1890	D18	9/19/1977		Maxilla	Right	Maxilla-portion of left side missing. Right P^3 (broken), P^4, M^2 and broken M^3; only P^4 and M^1 measureable.
Swp 1891	D18	3/3/1978	*Parapapio*	Maxilla	Right	Maxillary fragment with very worn M^1 and broken M^2 (missing mesio-lingual cusp).
Swp 1892	D18	10/21/1974	*Parapapio*	Maxilla	Right	Fragment of juvenile maxilla with remains of dm^2 and M^1; only roots. M^1 is represented by mesial loph – buccal side enamel. Rest of tooth, non-existent.
Swp 1893	D18	7/4/1973		Tooth	Indet.	Molar? fragment in bone and breccia; difficult to identify. Only, ½ of one loph present.
Swp 1894	D18	9/2/1976	*Parapapio*	Maxilla	Both	Crushed juvenile maxilla with dm^1 and dm^2 bilaterally. Right dm^2 not measureable. Palate is distorted.
Swp 1895	D18	3/24/1975		Maxilla	Right	Maxillary fragment with M^1 and 'exploded' M^2. M^2 looks hominid-sized because of distortion. Most measures of M^1 are possible.
Swp 1896	U/61 - 14'2"-15'1"			Cranium	Indet.	Crushed and distorted cranium. Specimen is still heavily encrusted with breccia and no other information readily available. Very poor condition.
Swp 1897	D18			Cranium	Indet.	Cranial fragment; not readily identifiable. Breccia is present on endocranial side.
Swp 1898	D18			Cranium	Indet.	Cranial fragment, breccia adhering to the endocranial surface. Cranial vault bone.
Swp 1899	D18	2/27/1978		Cranium	Indet.	Cranium (partial). Specimen is covered with

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						breccia and not readily identifiable.
Swp 1900	D18	4/8/1980		Cranium	Indet.	Cranium (partial). Specimen preserves frontals with interorbital area. Specimen looks *Parapapio*-like. Partial endocast is preserved, but overall, specimen is in very poor condition.
Swp 1901	D18	2/25/1974		Cranium	Left	Cranial fragment. Specimen appears to be left frontal with temporal line. Breccia covers area where temporal line would be visible. Also, anterior portion of frontal around orbits missing.
Swp 1902	D18	10/3/1978		Cranium	Left	Cranium (partial). Occipital with basicranial endocast. Partial left temporal bone, will little anatomically valuable information.
Swp 1903	D18	2/17/1978		Cranium	Indet.	Cranium (partial). Cranial bone fragment with partial endocast. Specimen is not readily identifiable, but appears to be a parietal fragment because of suggested presence of the lambdoidal suture.
Swp 1904	D18?			Cranium	Indet.	Cranium (partial). Only, small non-diagnostic cranial fragment.
Swp 1905	D18	6/10/1977		Cranium	Right	Cranium (partial). Not readily identifiable. However, specimen appears to be a portion of the right frontal (orbital region) and right temporal; in very poor condition.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1906	D18			Cranium	Both	Cranium (partial). Specimen appears to be a fragment of the interorbital region with the left side and partial right of a brain endocast (partial frontal lobe). On left side, a small bone fragment appearing to be the zygomatic is present. However, specimen not very informative.
Swp 1907	D18	9/18/1974		Cranium	Indet.	Cranial fragment; thin cranial vault bone, not identifiable.
Swp 1908	D18			Cranium	Indet.	Cranial fragment, not readily identifiable, very thin.
Swp 1909	D18	2/26/1975		Cranium	Right	Cranial fragment. ?Juvenile right frontal. Specimen is very small with a thin supraorbital region.
Swp 1910	D18	9/23/1977	*Parapapio*	Cranium	Both	Cranium (partial). Frontal with supraorbital ridges (*Parapapio* -like) and interorbital region. Specimen is crushed and not anatomically informative.
Swp 1911	D18	10/17/1977		Cranium	Indet.	Basicranial fragment; not identifiable.
Swp 1912	D18	7/18/1974	*Parapapio*	Cranium	Both	Frontal with orbits. *Parapapio*-like, does not possess supraorbital torus. Only, sagittal region of the frontal just superior to both orbits. Interorbital area is present as well. Anteorbital region appears to be *Parapapio*-like.
Swp 1913	D18	5/24/1976		Cranium	Indet.	Cranial fragment. Breccia is still adhering to one side. Specimen is not readily identifiable.
Swp 1914	D18	5/28/1976		Cranium	Indet.	Basicranial fragment; not readily identifiable.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1915	D18	7/10/1977		Cranium	Left	Cranium (partial). Left temporal and occipital. Can visualize basicranial structures. But, unfortunately, only in section due to fracture. Temporal is also highly fragmented, but auditory meatus is preserved.
Swp 1916	D18	9/23/1977		Cranium	Right	Cranial fragment. Specimen appears to be the right zygomatic (around orbit) with a portion of the temporal line and supraorbital torus on same side.
Swp 1917	D18	7/2/1975		Cranium	Left	Cranial fragment. Specimen appears to be left fairly complete parietal missing mostly sagittal region. Lambda and lambdoidal suture are present. Small piece of right parietal near lambda and superior portion of occipital are preserved.
Swp 1918	D18	7/29/1977		Cranium	Both	Frontal bones; very *Parapapio*-like. No tori present. Left side preserved more complete than right. Specimen has nice temporal line on left. However, line does not travel far posteriorly onto frontal. Temporal line rises from zygomatic and quickly disappears within 2cm of posterior movement on the frontal.
Swp 1919	D18	3/3/1978		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1920	D18	2/25/1977		Cranium	Indet.	Cranial fragment with breccia on endocranial surface. Not identifiable.
Swp 1921	D18	8/1/1976		Cranium	Indet.	Cranial fragment; small piece. Not identifiable.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1922	D18	3/29/1977		Cranium	Indet.	Cranial fragment; not readily identifiable. Specimen appears to be a left temporal with some cranial bone (?parietal) crushed into its cavity with some evidence of a nuchal line; but specimen is in poor condition with a substantial amount of adhering breccia.
Swp 1923	D18	7/17/1974		Cranium	Indet.	Cranial fragment; not readily identifiable. Specimen is fractured in several planes.
Swp 1924	D18	5/8/1976		Cranium	Left	Cranial fragment. Left temporal with root of zygomatic superior to glenoid fossa. Very small fragment.
Swp 1925	D18	1/3/1978		Cranium	Left	Cranial fragment. Specimen appears to be left frontal with small portion of the infraorbital area. *Parapapio* in morphology (i.e. no torus).
Swp 1926	D18			Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1928	D18			Cranium	Indet.	Indeterminate.
Swp 1929	D18			Cranium	Indet.	Cranial fragment. Specimen appears to be an occipital fragment near the cruciform eminence. Identification is difficult.
Swp 1930	D18	10/27/1975		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1931	D18	11/4/1975		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1932	D18	7/19/1976		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1933	D18	3/3/1977		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1934	D18	7/28/1978		Cranium	Indet.	Cranial fragment. Small fragile piece, not identifiable except as cranial vault?

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1935	D18	3/28/1978		Cranium	Indet.	Cranial fragment; vault bone. Small fragile fragment.
Swp 1936	D18	6/21/1976		Cranium	Indet.	Cranial fragment; not readily identifiable. Specimen appears to preserve a small temporal line?
Swp 1937	D15			Cranium	Indet.	Cranial fragment which appears to have meningeal arterial grooves on endocranial surface. Not readily identifiable.
Swp 1938	D15	10/30/1969		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1939	D15	6/10/1969		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1940	D15	2/20/1975		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1941	D15	4/20/1971		Cranium	Both	Cranium with partial endocast. Specimen preserves right complete parietal; left partial (near midline), occipital and left parietal endocast.
Swp 1942	D15	7/20/1971		Endocast	Both	Endocast with cranial fragments. Specimen appears to be a juvenile or small female. Frontal lobes around orbits are preserved with some interorbital bones. Right partial frontal bone possesses practically non-existent supraorbital torus (small individual).
Swp 1943	D15	1/21/1970		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1944	D15	3/14/1969		Cranium	Indet.	Cranial fragment; not identifiable.
Swp 1945	D15			Cranium	Indet.	Cranial fragment; very thick, but not identifiable.
Swp 1946	D20			Tooth	Right	M_3

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1947	D20			Tooth	Right	M_1
Swp 1948	D20			Maxilla	Left	left maxillary row with P^4, M^1, M^2 and erupting M^3
Swp 1949	D20			Tooth	Right	M^2
Swp 1950	D20			Tooth	Right	M_1
Swp 1951	D20			Tooth	Left	dm^1 and dm^2
Swp 1952	D20			Tooth	Right	M_3
Swp 1953	D20			Tooth	Left	M^1
Swp 1954	D20			Tooth	Left	dm_1
Swp 1955	D20			Tooth	Left	P_3 (damaged), P_4 and M_1
Swp 1956	D20		*Theropithecus*	Tooth	Left	M_2?
Swp 1957	D20			Tooth	Right	M^1
Swp 1958	D20			Tooth	Right	M_1 (worn)
Swp 1959	D20			Tooth	Right	M_3
Swp 1960	D20			Tooth	Right	M^1
Swp 1961	D20			Tooth	Right	dm^2
Swp 1962	D20			Tooth	Right	M^2?
Swp 1963	D20			Tooth	Left	M_3
Swp 1964	D20			Tooth	Right	M^1
Swp 1965	D20			Tooth	Right	dm_2
Swp 1966	D20?			Tooth	Right	r M^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1967	D20			Tooth	Indet.	damaged canine
Swp 1968	D20			Tooth	Right	M_3
Swp 1969	D20			Tooth	Left	P^3
Swp 1970	D20			Tooth	Left	M^1
Swp 1971	D20?			Tooth	Right	dm_2 (very worn)
Swp 1972	D20			Tooth	Right	I^2
Swp 1973	D20?			Tooth	Left	dm^2
Swp 1974	D20			Tooth	Left	M_1
Swp 1975	D20			Tooth	Right	I^1
Swp 1976	D20			Tooth	Left	I_2
Swp 1977	D20			Tooth	Indet.	16 tooth fragments, chips and damaged teeth
Swp 1978	D18			Tooth	Right	M_3
Swp 1979	D18			Tooth	Left	P^3
Swp 1980	D18			Tooth	Right	M^3
Swp 1981	D18			Tooth	Left	M_3
Swp 1982	D18			Tooth	Left	M_2?
Swp 1983	D18			Tooth	Left	M^1
Swp 1984	D18			Tooth	Right	P^3
Swp 1985	D18			Tooth	Left	M^1
Swp 1986	D18			Tooth	Right	P_3-P_4

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 1987	D18			Tooth	Right	M^2
Swp 1988	D18			Tooth	Right	M^1
Swp 1989	D18			Tooth	Right	M_3
Swp 1990	D18			Tooth	Left	M_1
Swp 1991	D18			Tooth	Left	M_1
Swp 1992	D18			Tooth	Right	P^3-P^4
Swp 1993	D18			Tooth	Left	dm_2
Swp 1994	D18			Tooth	Right	M^3
Swp 1995	D18			Tooth	Right	M_3
Swp 1996	D18			Tooth	Left	M_2-M_3
Swp 1997	D18			Tooth	Left	M_1
Swp 1998	D18			Tooth	Right	Damaged M_2
Swp 1999	D18			Tooth	Left	M_3
Swp 2000	D18			Tooth	Right	M_3
Swp 2001	D18			Tooth	Left	M^1
Swp 2002	D18			Tooth	Left	M^2
Swp 2003	D18			Tooth	Right	M_3
Swp 2004	D18			Tooth	Left	M_3
Swp 2005	D18		*Theropithecus*	Tooth	Right	dm^2
Swp 2006	D18			Tooth	Left	M^3?

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2007	D18			Tooth	Right	dm_2
Swp 2008	D19			Tooth	Right	P^4 and ½ of M^1
Swp 2009	D18			Tooth	Left	P^3 with fractured P^4
Swp 2010	D18			Tooth	Left	M^1
Swp 2011	D18			Tooth	Right	M_3 (damaged)
Swp 2012	D18			Tooth	Left	M^3
Swp 2013	D18			Tooth	Right	M_3
Swp 2014	D18		*Theropithecus*	Tooth	Right	M^1
Swp 2015	D18			Tooth	Right	dm_2
Swp 2016	D18			Tooth	Left	M_1
Swp 2017	D18			Tooth	Right	M^2
Swp 2018	D18			Tooth	Left	M^3 and damaged M^2
Swp 2019	D18			Tooth	Right	M^1
Swp 2020	D18			Tooth	Left	M_3
Swp 2021	D18			Tooth	Left	M^1
Swp 2022	D18			Tooth	Left	M_2
Swp 2023	D18			Tooth	Left	M^3
Swp 2024	D18			Tooth	Right	M^2
Swp 2025	D18			Tooth	Right	P^3
Swp 2026	D18			Tooth	Left	M^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2027	D18			Tooth	Left	M_1
Swp 2028	D18			Tooth	Right	P^3
Swp 2029	D18			Tooth	Left	P^4 and M^1
Swp 2030	D18			Tooth	Left	P^3
Swp 2031	D18			Tooth	Left	P^3
Swp 2032	D18			Tooth	Right	dm^2
Swp 2033	D18			Tooth	Left	P^3/P^4?
Swp 2034	D18			Tooth	Right	P^3
Swp 2035	D18			Tooth	Right	P^3
Swp 2036	D18			Tooth	Left	M^1
Swp 2037	D18			Tooth	Right	P^4
Swp 2038	D18			Tooth	Right	M_3
Swp 2039	D18			Tooth	Left	P_4 and broken M_1
Swp 2040	D18			Tooth	Left	P^3
Swp 2041	D18			Tooth	Left	M_1
Swp 2042	D18			Tooth	Left	M_1 (very worn) and portion of M_2
Swp 2043	D18			Tooth	Right	M_3 (very worn)
Swp 2044	D18			Tooth	Left	M_1?
Swp 2045	D18			Tooth	Left	dm2
Swp 2046	D18			Tooth	Left	C^1

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2047	D18			Tooth	Left	M^1
Swp 2048	D18			Tooth	Right	M^3 (very worn)
Swp 2049	D18			Tooth	Right	M_1 (small)
Swp 2050	D18			Tooth	Left	P_3
Swp 2051	D18			Tooth	Right	P^4? (very worn)
Swp 2052	D18			Tooth	Left	P_3 and broken P_4
Swp 2053	D18			Tooth	Right	M_2
Swp 2054	D18		*Theropithecus*	Tooth	Right	P^3
Swp 2055	D18			Tooth	Left	P_3
Swp 2056	D18			Tooth	Left	P_4
Swp 2057	D18			Tooth	Indet.	distorted and crushed molar(s) in breccia
Swp 2058	D18			Tooth	Left	P_3
Swp 2059	D18			Tooth	Right	dm_2
Swp 2060	D18			Tooth	Left	P^3/P^4 (very worn)
Swp 2061	D18			Tooth	Right	dm^1 and dm^2
Swp 2062	D18			Tooth	Left	P^3/P^4
Swp 2063	D18		*Theropithecus*	Tooth	Right	M_1
Swp 2064	D18			Tooth	Left	I^2 (very large)
Swp 2065	D18			Tooth	Left	I_2 (very large)
Swp 2066	D18			Tooth	Right	I^1

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2067	D18		*Theropithecus*	Tooth	Right	C^1
Swp 2068	D18			Tooth	Left	I_2
Swp 2069	D18			Tooth	Right	I_2 (di_2?)
Swp 2070	D18			Tooth	Left	I^2
Swp 2071	D18			Tooth	Right	I^1
Swp 2072	D18			Tooth	Right	I^1
Swp 2073	D18			Tooth	Indet.	left C^1 or right C_1
Swp 2074	D18			Tooth	Left	I_1
Swp 2075	D18			Tooth	Right	I^1
Swp 2076	D18			Tooth	Right	I_1 (damaged)
Swp 2077	D18			Tooth	Indet.	Canine
Swp 2078	D18			Tooth	Left	I_1 (?)
Swp 2079	D18			Tooth	Right	dc_1 (broken)
Swp 2080	D18			Tooth	Left	I_1
Swp 2081	D18			Tooth	Left	I^2 (worn)
Swp 2082	D18			Tooth	Left	I^2
Swp 2083	D18			Tooth	Right	dc^1
Swp 2084	D18			Tooth	Left	I_1
Swp 2085	D18			Tooth	Left	I^2
Swp 2086	D18			Tooth	Right	I^2

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2087	D18			Tooth	Right	I_1
Swp 2088	D18			Tooth	Left	I^2
Swp 2089	D18			Tooth	Left	I^1
Swp 2090	D18			Tooth	Left	I_1
Swp 2091	D18			Tooth	Left	I_2?
Swp 2092	D18			Tooth	Right	I^1
Swp 2093	D18			Tooth	Right	I^1
Swp 2094	D18			Tooth	Right	I^2
Swp 2095	D18			Tooth	Right	I^1 (worn)
Swp 2096	D18			Tooth	Left	I_2
Swp 2097	D18			Tooth	Left	I^1
Swp 2098	D18			Tooth	Right	I_2
Swp 2099	D18			Tooth	Indet.	Canine
Swp 2100	D18			Tooth	Left	I_2
Swp 2101	D18			Tooth	Right	I_2
Swp 2102	type site-in situ		*Pp. broomi*	Cranium	Left	Left ½ of skull with M^2, M^3 and remains of a premolar. Dentition is cracked and measurements are not possible; however, muzzle morphology looks cf. *Pp. broomi.*
Swp 2103	D18	2/8/1968	*Parapapio*	Mandible	Right	Mandibular fragment and remains of M_3. Only, length of M_3 is measurable, as tooth is represented only by lingual enamel and cusps.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2223			*Pp. broomi*	Mandible	Right	Mandibular fragment with M_1-M_3; although M_1 is fragmented on its mesio-lingual edge. Part of ascending ramus is preserved, but is fragmented.
Swp 2226	D20			Mandible	Right	Juvenile mandible, right with dm_1 and M_1. M_1 broken on the disto-buccal cusp. Measurements are estimates as teeth are slightly damaged.
Swp 2348	D20	10/18/1984		Tooth	Indet.	Small piece of breccia with tooth fragments. Mangled piece which appears to also preserve an endocast. Dentition is difficult to identify. Specimen may preserve a mandible fragment as well. ?Juvenile.
Swp 2353	D20			Cranium	Indet.	Cranial fragments; not identifiable.
Swp 2355	D20			Cranium	Indet.	Cranial fragments; not identifiable.
Swp 2602	Member 2 Excavations			Cranium	Indet.	Cranial fragment; not identifiable.
Swp 2655	Member 2 Excavations			Cranium	Both	Complete basicranium, but in very poor condition. Specimen is missing complete superior region of cranium. Preserves a M^2 and erupting M^3 on right. Teeth are in poor condition and not measurable. M^2 missing mesio-lingual cusp.
Swp 2657	Member 2 Excavations		*Papio*	Cranium	Both	Juvenile cranium. Specimen is missing left temporal/parietal regions. Remaining cranium is complete. Preserves right and left dm^1, dm^2 and M^1. Specimen could be *Papio*; however, teeth are cracked mesio-distally and may appear larger, as a result.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2848	Member 2 Excavations		*P. izodi*	Mandible	Left	Heavily worn teeth, some measurements not be possible.
Swp 2850	Member 2 Excavations		*Pp. broomi*	Mandible	Left	
Swp 2854	Member 2 Excavations		*Papio*	Cranium	Both	Interorbital region very *Papio*-like. Steep anterorbital drop; however, unable to age the specimen.
Swp 2856	Member 2 Excavations			Cranium	Both	Partial endocast on left side with right side of neurocranium. No teeth are preserved. Some tooth roots are preserved on left side.
Swp 2863	Member 2 Excavations			Cranium	Both	Right side well preserved, but left splanchnocranium more fragmentary. M^1 is erupting on both sides, but M^1 and M^2 still present on right. Only, M^2 preserved on left. Left M^1 appears to have been broken off postmortem.
Swp 2868	Member 2 Excavations			Cranium	Left	Nice endocast with orbital portion of the frontal lobe on left side, no measurements taken.
Swp 2869	Member 2 Excavations			Maxilla	Left	No measurements possible, difficult to identify fragmentary molr that is preserved.
Swp 2872	Member 2 Excavations			Tooth	Left	
Swp 2873	Member 2 Excavations			Cranium	Both	Cranium which is very similar to Swp 2854. Steep anteorbital drop suggestive of juvenile *Papio*. Only, cranial measurement possible is around the post-orbital constriction (i.e. minimum interfrontal distance)

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2877	Member 2 Excavations			Maxilla	Left	Occlusal surface not visible due to adhering breccia. M^3 is erupting, but barely visible. M^1 fractured buccally; breadth measurements of dentition are not possible.
Swp 2878	Member 2 Excavations			Cranium	Indet.	Small endocranial cast of indeterminate origin.
Swp 2882	Member 2 Excavations		*Pp. broomi*	Cranium	Both	Splanchnocranium, appears to be juvenile. M^3 not erupted. Palate is horse-shoe shaped with small maxillary fossa. Left P^4 preserved; however measurements are not possible. Right P^4 breadth and length were estimated. Specimen preserves a partial endocast.
Swp 2883	Member 2 Excavations			Cranium	Both	*Papio*-like anteorbital drop. Specimen has a light development of supraorbital tori. Supraorbital region is preserved more on right side than left.
Swp 2887	Member 2 Excavations		*Pp. broomi*	Mandible	Left	
Swp 2896	Member 2 Excavations			Maxilla	Right	Juvenile with dm^1, dm^2 and M^1. Portion of the maxilla with lower orbit, root of zygomatic, but teeth anterior to dm^1 are missing. Specimen preserves right margin of the nasal aperture. M^1 has not moved into occlusion as yet and its occlusal surface is obstructed by breccia.
Swp 2898	Member 2 Excavations			Cranium		Cranium (partial) with endocranial cast; impossible to determine anatomical origin.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2899	Member 2 Excavations			Cranium	Left	Most of left side preserved. Cranium crushed and distorted; specimen needs preparation. Teeth are immeasurable, appears to have distal portion of M^1, M^2 and perhaps some preservation of mandible.
Swp 2901	Member 2 Excavations			Cranium	Right	Frontal fragment with small piece of endocranial cast. Interorbital region is preserved, but very little anatomical detail recognizable. No measurements are possible.
Swp 2904	Member 2 Excavations			Cranium	Indet.	?Frontal fragment, but difficult to determine with confidence.
Swp 2907	Member 2 Excavations		*P. izodi*	Palate	Right	Partial cranium with palate, thoracic vertebra also commingled with cranium. *P. izodi*? Specimen has have horse-shoe shaped palate.
Swp 2909	Member 2 Excavations			Cranium	Indet.	Cranial fragment of superior orbit with portion of orbital plate of frontal and squamous portion of frontal.
Swp 2912	Member 2 Excavations		*Pp. broomi*	Mandible	Left	No measurements of dentition taken due to fragmentation.
Swp 2914	Member 2 Excavations		*Pp. jonesi*	Maxilla	Left	Measurements of M^2 possible, some of M^3, but breccia precludes most other measurements.
Swp 2915	Member 2 Excavations		*Pp. broomi*	Mandible	Left	
Swp 2916	Member 2 Excavations			Cranium	Indet.	Cranial fragment with large pieces of adhering breccia. Specimen preserves a small portion of an endocranial cast which is partially covered by a small fragment of cranial bone.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2919	Member 2 Excavations		*Pp. broomi*	Maxilla	Left	Maxillary fragment. Tooth roots, but no crowns preserved. Maxilla is covered by breccia, but exhibits the root of the zygomatic.
Swp 2921	Member 2 Excavations			Mandible	Right	Cf. *Papio*. Breadth measurements not possible because of adhering breccia.
Swp 2922	Member 2 Excavations			Maxilla	Left	
Swp 2925	Member 2 Excavations			Cranium	Indet.	Cranial fragment. No measurements possible. Specimen is composed of numerous crushed, displaced and distorted fragments. Possible *C. williamsi* because of wide interorbital distance.
Swp 2929	Member 2 Excavations		*Pp. broomi*	Mandible	Right	Heavily worn M_2 and M_3. M_2 occlusal surface not visible due to breccia.
Swp 2930	Member 2 Excavations			Maxilla	Left	Maxillary fragment. Occlusal surface obstructed so species identification is impossible. Measurements for same reason were not taken. Dentition present in outline is C^1, P^3, P^4, M^1 and M^2.
Swp 2931	Member 2 Excavations		*Pp. jonesi*	Cranium	Both	Anterior portion of muzzle with palate. Several measurements on the teeth impossible because of breccia filling palate. Most cranial measurements were not taken. Only, reliable cranial measure was muzzle Breadth at M^2 of dorsum.
Swp 2933	Member 2 Excavations			Mandible	Right	Juvenile mandible, but no measurements are possible. ?dm^1 and a couple of incisors; however, difficult to determine if incisor

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						fragments are deciduous or permanent.
Swp 2934	Member 2 Excavations			Mandible	Both	Mandibular fragment with di_1, di_2 (both sides), dc_1 (both sides), dm_1 (both sides) and an erupting dm_2 (both sides). Occlusal surface is obstructed.
Swp 2935	Member 2 Excavations		*Pp. jonesi*	Mandible	Right	M_3 not visible because of breccia, but appears to have been unerupted. P_3 partially covered by breccia, P_4 not completely visible. Occlusal surface of M_1 covered with breccia.
Swp 2936	Member 2 Excavations		*Pp. jonesi*	Mandible	Right	P_4-M_3 measurement not possible because mandible is fractured with some breccia intervening between P_4-M_1.
Swp 2937	Member 2 Excavations		*Pp. broomi*	Mandible	Right	Very old adult. Teeth worn dramatically, very little dental measurements possible.
Swp 2938	Member 2 Excavations		*Pp. jonesi*	Mandible	Both	Mandibular corpus and ascending ramus on right side; only Mandibular corpus preserved on left. Some of the dentition is present, but mandible is distorted. P_3 is heavily worn, height and length measures not possible.
Swp 2939	Member 2 Excavations		*Pp. broomi*	Mandible	Left	Mandible fragment; only complete tooth is M_2. P_4 and M_1 are missing crowns, however, roots are visible. Lingual side of M_3 is missing.
Swp 2940	Member 2 Excavations		*Pp. broomi*	Mandible	Left	Strong buccal wear. High lingual cusps.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2941	Member 2 Excavations			Mandible	Both	Complete mandible on right side; only missing gonial region. Specimen preserves both, condyloid and coronoid, processes. Full deciduous dentition is preserved. di_1, di_2 and dc_1 fragmented coronally. M_1 and M_2 visible, but immeasurable. Ramus posterior to M_2 missing.
Swp 2943	Member 2 Excavations		*P. izodi*	Cranium	Both	Cranial specimen exhibiting features typical of *P. izodi* at an early age. M^1 present, M^2 (erupting); however, dentition difficult to diagnose as breccia obscures most cuspal morphology. Specimen possesses an incisura malaris like Swp 2949 (adult – *P. izodi*). Dental measurements only possible on right M^1. Some cranial measurements possible.
Swp 2944	Member 2 Excavations			Cranium	Both	Comparable to age of Swp 2943, but much smaller. Specimen preserves deciduous dentition on right. Right most posterior potion of the palate preserved with M^1 and M^2. Frontals show no ridging - very flat (i.e. *Parapapio*-like). On right side M^1 appears to be erupting. Can see the buccal cusps, but have not fully developed. Fracture in maxilla has allowed view into crypt, teeth are stained black.
Swp 2945	Member 2 Excavations		*Pp. broomi*	Cranium	Both	On left side, zygomatic process of temporal and inferior preserved; on right side, external auditory meatus and inferior preserve. Palate preserves portions of M^2 and complete M^3's on both sides. For cranium, partial endocast

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
						is preserved on both sides, but most of neurocranium has been sheared off.
Swp 2946	Member 2 Excavations		*P. izodi*	Cranium	Both	Swp 2946 and Swp 2943 appear to be male and female of the same species, *P. izodi*. Traditionally, these specimens have been separated based upon anteorbital region, but this feature appears to be more variable than previously concluded.
Swp 2947	Member 2 Excavations		*Pp. jonesi*	Cranium	Both	Very complete cranial specimen. Basicranium appears to be preserved, but currently covered with breccia. Only portion missing from specimen is the right zygomatic arch. Right side of posterior cranium (parietal - occipital region) fractured exposing an endocast.
Swp 2948	Member 2 Excavations		*P. izodi*	Cranium	Both	M^3 not erupted, but has just pierced the alveolar process. Roots present for other teeth, as noted missing partial calvarium around coronal suture exposing a natural endocast. Teeth are fractured at cervix; except the right M^3 which is just erupting. Specimen is also missing the left side posterior to palate in the zygomatic region.
Swp 2949	Member 2 Excavations			Tooth	Right	Evidence of three roots; indeterminate.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp 2949b	Member 2 Excavations			Cranium	Both	Most of both frontal and left parietal are missing, exposing endocranial. Palate and basicranium obstructed with breccia so no tooth measurements are possible. Few cranial measurements are possible.
Swp 2950	Member 2 Excavations			Cranium	Both	Juvenile specimen still covered with large fragments of breccia. Large portions of the cranial vault are also missing exposing an endocranial cast in those sections (left frontal and left parieto-occipital at the lambdoidal suture). No measurements were taken. Breccia fills palate, right orbit and splanchnocranium and left splanchnocranium. Right I^1 appears to be partially preserved.
Swp 2951	Member 2 Excavations		*Pp. broomi*	Cranium	Left	Exhibits typical *Pp. broomi* maxillary fossa similar to that seen in *Pp. antiquus* from Taung. Specimen preserves the P^4 (erupting), M^1 and M^2 (erupted); M^2 is also fragmented.
Swp 2952	Member 2 Excavations			Calvarium	Both	Anteorbital drop appears to be *Papio*, but difficult to tell because distortion may play a role in specimens morphology. Additionally, there appears to be a glenoid fossa of a partial scapula displaced in the orbit. Breccia around the anteorbital area also makes identification tenuous.
Swp 2953	Member 2 Excavations		*P. izodi*	Cranium	Both	Specimen looks very similar in morphology to Swp 2946 in portions preserved. Anteorbital region is obscured. Therefore, distinction between *Papio* and *Parapapio* for this specimen is tenuous. Foramen magnum is fragmented.

Specimen Number	Provenance	Date	Taxon	Element	Side	Comments
Swp Un1			*Pp. broomi*	Maxilla	Left	SG 97; un-numbered specimen. Left maxilla with P^4, M^1 and M^3. Specimen appears to have possessed a large canine. Is comparable to M202 from Makapansgat. Identified as a male *Pp. broomi*.
Swp Un2			*P. izodi*	Cranium	Both	Male *Pp. izodi* from Silberberg Grotto (Member 2) as noted on specimen. Fairly complete specimen with definite *Papio* features. Specimen is indistinguishable to TP 89-11-1 (Taung). Some teeth have been damaged; therefore, some measurements not taken.

APPENDIX TWO
WITWATERSRAND CERCOPITHECOID POSTCRANIAL CATALOG – SWP AND SP

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 255	D13		Radius		Proximal end of radius
Swp 447	D3		Radius		Fragment from proximal end of radius
Swp 498	D13		Tibia	Left	Proximal end of left tibia
Swp 499	D13		Pelvis	Left	Left acetabulum of Os coxa bone
Swp 500	D16		Tibia	Right	Distal end of right tibia
Swp 501	D13		Tibia	Right	Distal end of right tibia
Swp 502	D13		Tibia	Right	Distal end of right tibia
Swp 503	D13		Tibia	Right	Distal end of right tibia
Swp 504	D13		Humerus	Right	Proximal end of right humerus
Swp 505	D13		Humerus	Left	Proximal end of left humerus
Swp 506	D18		Humerus	Right	Distal 1/3 of right humerus
Swp 507	D13		Humerus	Right	Distal end of right humerus
Swp 508	D13		Humerus	Right	Distal end of right humerus
Swp 509	D14		Humerus	Right	Distal end of right humerus
Swp 510	D13		Humerus	Left	Distal end of left humerus
Swp 511	D13		Humerus	Left	Distal end of left humerus
Swp 512	D13		Humerus	Left	Distal end of left humerus
Swp 513	D13		Radius	Left	Distal 1/3 of left radius
Swp 514	D13		Radius	Right	Proximal end of right radius
Swp 515	D15		Radius	Right	Proximal 1/3 of right radius
Swp 516	D13		Radius	Right	Proximal end of right radius
Swp 517	D13		Radius	Right	Proximal end of right radius
Swp 518	D13		Radius	Right	Proximal end of right radius
Swp 519	D18		Radius	Left	Proximal end of left radius
Swp 520	D13		Radius	Left	Proximal end of left radius
Swp 522	D13		Radius	Left	Proximal end of left radius

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 523	D13		Ulna	Right	Proximal end of right ulna
Swp 524	D13		Ulna	Right	Proximal end of right ulna
Swp 525	D18		Ulna	Right	Proximal end of right ulna
Swp 526	D13		Femur	Left	Proximal end of left femur
Swp 527	D13		Femur	Left	Proximal end of left femur
Swp 528	D13		Femur	Left	Proximal end of left femur
Swp 529	D14		Femur	Left	Proximal end of left femur
Swp 530	D13		Femur	Right	Proximal end of right femur
Swp 531	D13		Femur	Right	Proximal end of right femur
Swp 532	D13		Femur	Right	Proximal end of right femur
Swp 533	D13		Femur	Right	Proximal end of right femur
Swp 534	D13		Fibula	Right?	Distal end of fibula
Swp 535	D13		Fibula	Left?	Distal end of fibula
Swp 536	D13		Fibula	Right	Distal end of fibula
Swp 537	D18		Calcaneus	Left	Calcaneus
Swp 538	D13		Calcaneus	Left	Calcaneus
Swp 539	D13		Calcaneus	Left	Calcaneus
Swp 540	D13		Calcaneus	Right	Calcaneus
Swp 541	D13		Talus	Right	Astragalus
Swp 542	D13		Talus	Right	Astragalus
Swp 543	D13		Talus	Right	Astragalus
Swp 544	D13		Talus	Right	Astragalus
Swp 545	?		Tibia	Right	Distal end of right (contra catalog) tibia
Swp 560	D18		Tibia	Right	Proximal 1/3 right tibia
Swp 561	D15		Ulna	Right	Proximal end of right ulna
Swp 562	D14		Humerus	Left	Distal 3/4 of left humerus

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 563	D15		Tibia	Right	Distal end of right Tibia
Swp 568	D3		Calcaneus	Left	Partial calcaneus
Swp 570	D15		Radius	Right	Right proximal 1/3 radius
Swp 571	D18		Metacarpal		Metacarpal
Swp 572	D18		Metacarpal		Proximal piece of metacarpal
Swp 573	D18		Metacarpal		Proximal part of metacarpal
Swp 574	D18		Metacarpal		Metacarpal
Swp 575	?		Metacarpal		Bone fragment, part of metacarpal? distal condyle
Swp 576	D12		Metacarpal		Metacarpal
Swp 577	D18		Metacarpal		Metacarpal
Swp 578	D18		Calcaneus	Right	Calcaneus
Swp 589	D18		Humerus	Left	Distal end of left humerus
Swp 604	D14		Femur	Right	Distal end of right femur
Swp 605	D14		Femur	Left	Distal end of left femur
Swp 606	D15		Femur	Right	Proximal end of right femur
Swp 607	D14	1/22/1971	Pelvis	Right	Acetabular fragment of right ilium
Swp 608	D15		Tibia	Right	Distal 1/3 of right tibia
Swp 693	D18		Pelvis	Indet.	Pelvic bone fragment
Swp 694	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 695	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 696	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 697	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 698	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 699	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 700	D3		Pelvis	Indet.	Pelvic bone fragment
Swp 701	D13		Pelvis	Indet.	Pelvic bone fragment

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 702	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 703	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 704	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 705	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 706	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 707	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 708	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 709	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 710	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 711	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 712	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 713	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 714	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 715	?		Pelvis	Indet.	Pelvic bone fragment
Swp 716	?		Pelvis	Indet.	Pelvic bone fragment
Swp 717	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 718	D13		Pelvis	Indet.	Pelvic bone fragment
Swp 719	D13		Tibia	Indet.	Distal end of tibia
Swp 720	D14		Tibia	Indet.	Distal end of tibia
Swp 721	D13		Tibia	Indet.	Distal end of tibia
Swp 722	D13		Tibia	Indet.	Distal end of tibia and fibula (joined)
Swp 723	D13		Tibia	Indet.	Distal end of tibia
Swp 724	D13		Tibia	Indet.	Proximal end of tibia
Swp 725	D13		Humerus	Indet.	Distal end and part of diaphysis of humerus
Swp 726	D13		Hamate	Indet.	Distal end and diaphysis of humerus
Swp 727	D13		Humerus	Indet.	Distal end of humerus

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 728	D13		Humerus	Indet.	Distal portion of humerus
Swp 729	D13		Humerus	Indet.	Distal portion of humerus
Swp 730	D12		Humerus	Indet.	Distal portion of humerus
Swp 731	D13		Humerus	Indet.	Distal portion of humerus
Swp 732	D13		Femur	Indet.	Distal portion of femur
Swp 733	D13		Femur	Indet.	Distal portion of femur
Swp 734	D13		Femur	Right	Proximal portion of right femur
Swp 735	D13		Femur	Right	Proximal portion of right femur
Swp 736	D13		Femur	Indet.	Proximal portion of femur
Swp 737	D3		Femur	Right	Proximal portion of femur
Swp 738	D13		Femur	Left	Proximal portion of left femur
Swp 739	D13		Femur	Indet.	Proximal portion of femur
Swp 740	D13		Femur	Indet.	Proximal portion of femur
Swp 741	D13		Femur	Indet.	Proximal portion of femur (mostly diaphysis)
Swp 742	D13		Femur	Right	Proximal portion of right femur
Swp 743	D13		Femur	Indet.	Proximal portion of femur
Swp 744	D13		Femur	Indet.	Proximal portion of femur
Swp 745	D13		Femur	Indet.	Proximal portion of femur
Swp 746	D13		Femur	Left	Proximal portion of left femur
Swp 747	D13		Femur	Right	Proximal portion of right femur
Swp 748	D12		Femur	Left	Proximal portion of left femur
Swp 749	D13		Femur	Indet.	Proximal portion of femur
Swp 750	D13		Femur	Right	Proximal portion of right femur
Swp 751	D13		Femur	Indet.	Proximal portion of femur
Swp 752	D13		Femur	Indet.	Proximal portion of femur
Swp 753	D13		Femur	Indet.	Proximal portion of femur

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 754	D13		Femur	Right	Proximal portion of femur
Swp 755	D13		Femur	Indet.	Proximal portion of femur
Swp 756	D13		Femur	Indet.	Proximal portion of femur
Swp 757	D13		Femur	Indet.	Proximal portion of femur
Swp 758	D13		Radius	Indet.	Radius diaphysis
Swp 759	D13		Radius	Indet.	Radius diaphysis
Swp 760	D13		Radius	Indet.	Radius diaphysis
Swp 761	D13		Radius	Indet.	Radius diaphysis
Swp 762	D13		Radius	Indet.	Radius diaphysis
Swp 763	D13		Radius	Indet.	Radius diaphysis
Swp 764	D13		Radius	Indet.	Radius diaphysis
Swp 765	D13		Radius	Indet.	Radius diaphysis
Swp 766	D13		Radius	Indet.	Radius diaphysis
Swp 767	D13		Radius	Indet.	Radius diaphysis
Swp 768	D13		Radius	Indet.	Radius diaphysis
Swp 769	D13		Radius	Indet.	Radius diaphysis
Swp 770	D13		Radius	Indet.	Radius diaphysis
Swp 771	D13		Radius	Indet.	Radius diaphysis
Swp 772	D13		Radius	Indet.	Radius diaphysis
Swp 773	D13		Radius	Indet.	Radius diaphysis
Swp 774	D13		Radius	Indet.	Radius diaphysis
Swp 775	D13		Radius	Indet.	Radius diaphysis
Swp 776	D13		Radius	Indet.	Radius diaphysis
Swp 777	D13		Radius	Indet.	Radius left
Swp 778	D13		Radius	Left	Radius left
Swp 779	D13		Radius	Indet.	Radius distal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 780	D13		Radius	Indet.	Radius proximal
Swp 781	D18		Radius	Indet.	Radius proximal
Swp 782	D13		Radius	Indet.	Radius proximal
Swp 783	D13		Radius	Indet.	Radius proximal
Swp 784	D12		Radius	Indet.	Radius proximal
Swp 785	D13		Radius	Indet.	Radius proximal
Swp 786	D13?		Radius	Indet.	Radius proximal
Swp 787	D13		Radius	Indet.	Radius proximal
Swp 788	D13?		Radius	Indet.	Radius proximal
Swp 789	D13		Radius	Indet.	Radius proximal
Swp 790	D13		Radius	Indet.	Radius proximal
Swp 791	D13		Radius	Indet.	Radius proximal
Swp 792	D3		Radius	Indet.	Radius proximal
Swp 793	D13?		Radius	Indet.	Radius proximal
Swp 794	D13?		Radius	Indet.	Radius proximal
Swp 795	D13?		Radius	Indet.	Radius proximal
Swp 796	D13?		Radius	Indet.	Radius proximal
Swp 797	D13		Radius	Indet.	Radius proximal
Swp 798	D12		Radius	Indet.	Radius proximal
Swp 799	D13?		Radius	Indet.	Radius proximal
Swp 800	D13		Radius	Indet.	Radius proximal
Swp 801	D13		Radius	Indet.	Radius proximal
Swp 802	D13		Radius	Indet.	Radius proximal
Swp 803	D13		Radius	Indet.	Radius proximal
Swp 804	D13		Radius	Indet.	Radius proximal
Swp 805	D13		Radius	Indet.	Radius proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 806	D13		Radius	Indet.	Radius proximal
Swp 807	D13		Radius	Indet.	Radius proximal
Swp 808	D13		Radius	Indet.	Radius proximal
Swp 809	D13		Radius	Indet.	Radius distal
Swp 810	D13		Radius	Indet.	Radius distal
Swp 811	D13		Radius	Indet.	Radius distal
Swp 812	D13		Ulna	Indet.	Ulna distal
Swp 813	D13		Ulna	Indet.	Ulna proximal
Swp 814	D13		Ulna	Right	Ulna proximal
Swp 815	D13		Ulna	Right	Ulna proximal
Swp 816	D13		Ulna	Right	Ulna proximal
Swp 817	D13		Ulna	Left	Ulna proximal
Swp 818	D13		Ulna	Indet.	Ulna proximal
Swp 819	D13		Ulna	Indet.	Ulna proximal
Swp 820	D13		Ulna	Indet.	Ulna proximal
Swp 821	D13		Ulna	Indet.	Ulna proximal
Swp 822	D13		Ulna	Left	Ulna proximal
Swp 823	D13		Ulna	Indet.	Ulna proximal
Swp 824	D13		Ulna	Right	Ulna proximal
Swp 825	D13		Ulna	Right	Ulna proximal
Swp 826	D13		Ulna	Indet.	Ulna diaphysis
Swp 827	D13		Ulna	Indet.	Ulna diaphysis
Swp 828	?		Ulna	Indet.	Ulna diaphysis
Swp 829	D13		Ulna	Indet.	Ulna diaphysis and radius?
Swp 830	D13		Humerus	Indet.	Distal humerus and proximal ulna and proximal radius
Swp 831	D13		Femur	Indet.	Femur diaphysis

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 832	D13		Femur	Indet.	Femur diaphysis
Swp 833	D13		Femur	Indet.	Femur diaphysis
Swp 834	D13		Femur	Indet.	Femur diaphysis
Swp 835	D13		Femur	Indet.	Femur diaphysis
Swp 836	D13		Femur	Indet.	Femur diaphysis
Swp 837	D13		Femur	Indet.	Femur diaphysis
Swp 838	D13		Femur	Indet.	Femur diaphysis
Swp 839	D13		Femur	Indet.	Femur diaphysis
Swp 840	D13		Femur	Indet.	Femur diaphysis
Swp 841	D13		Femur	Indet.	Femur diaphysis
Swp 842	?		Femur	Indet.	Femur diaphysis
Swp 843	D13		Femur	Indet.	Femur diaphysis
Swp 844	D13		Femur	Indet.	Femur diaphysis
Swp 845	D13		Femur	Indet.	Femur diaphysis
Swp 846	D13		Femur	Indet.	Femur diaphysis
Swp 847	D13		Femur	Indet.	Femur diaphysis
Swp 848	D13		Femur	Indet.	Femur diaphysis
Swp 849	D13		Femur	Indet.	Femur diaphysis
Swp 850	D13		Femur	Indet.	Femur diaphysis
Swp 851	D13		Femur	Indet.	Femur diaphysis
Swp 852	D13		Femur	Indet.	Femur diaphysis
Swp 853	D13		Ulna	Right	Proximal ulna (contra catalog)
Swp 854	D13		Femur	Indet.	Femur diaphysis
Swp 855	D13		Femur	Indet.	Femur diaphysis
Swp 856	?		Femur	Indet.	Femur diaphysis
Swp 857	D13		Femur	Indet.	Femur diaphysis

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 858	D13		Femur	Indet.	Femur diaphysis
Swp 859	D13		Femur	Indet.	Femur diaphysis
Swp 860	D13		Femur	Indet.	Femur diaphysis
Swp 861	D13		Femur	Indet.	Femur diaphysis
Swp 862	D13		Femur	Indet.	Femur diaphysis
Swp 863	D13		Femur	Indet.	Femur diaphysis
Swp 864	D13		Femur	Indet.	Femur diaphysis
Swp 865	D13		Femur	Indet.	Femur diaphysis
Swp 866	D13		Femur	Indet.	Femur diaphysis
Swp 867	D13		Femur	Indet.	Femur distal
Swp 868	D13		Femur	Indet.	Femur distal
Swp 869	?		Femur	Indet.	Femur proximal
Swp 870	D13		Femur	Indet.	Femur proximal
Swp 871	D13		Femur	Indet.	Femur proximal
Swp 872	D13		Femur	Indet.	Femur proximal
Swp 873	D13		Femur	Indet.	Femur proximal
Swp 874	?		Femur	Indet.	Femur proximal (juvenile)
Swp 875	D13		Femur	Indet.	Femur proximal
Swp 876	?		Femur	Indet.	Femur proximal
Swp 877	?		Femur	Indet.	Femur proximal
Swp 878	D13		Femur	Indet.	Femur proximal
Swp 879	?		Femur	Indet.	Femur proximal
Swp 880	D13		Femur	Indet.	Femur proximal
Swp 881	D13		Femur	Indet.	Femur proximal
Swp 882	D13		Femur	Indet.	Femur proximal
Swp 883	D13		Femur	Indet.	Femur proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 884	D13		Femur	Indet.	Femur proximal
Swp 885	D13		Femur	Right	Femur proximal
Swp 886	?		Femur	Indet.	Femur proximal
Swp 887	D13		Femur	Indet.	Femur proximal
Swp 888	D13		Femur	Indet.	Femur proximal
Swp 889	?		Femur	Indet.	Femur proximal
Swp 890	D13		Femur	Indet.	Femur proximal
Swp 891	?		Femur	Indet.	Femur proximal
Swp 892	D13		Femur	Indet.	Femur proximal
Swp 893	D13		Femur	Indet.	Femur proximal
Swp 894	D13		Femur	Indet.	Femur proximal
Swp 895	?		Femur	Indet.	Femur proximal
Swp 896	D13		Femur	Indet.	Femur proximal
Swp 897	D13		Femur	Indet.	Femur proximal
Swp 898	D13		Femur	Indet.	Femur proximal
Swp 899	D13		Femur	Right	Femur proximal
Swp 900	D13		Femur	Indet.	Femur proximal
Swp 901	D13		Femur	Indet.	Femur proximal
Swp 902	D13		Femur	Indet.	Femur proximal
Swp 903	?		Femur	Indet.	Femur proximal
Swp 904	D13		Femur	Indet.	Femur proximal
Swp 905	D13		Femur	Right	Femur proximal
Swp 906	D13		Humerus	Indet.	Humerus distal
Swp 907	D13		Humerus	Indet.	Humerus distal
Swp 908	D13		Humerus	Right	Humerus distal
Swp 909	D13		Humerus	Indet.	Humerus distal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 910	D13		Humerus	Indet.	Humerus distal
Swp 911	D13		Humerus	Right	Humerus distal
Swp 912	D13		Humerus	Indet.	Humerus distal
Swp 913	?		Humerus	Indet.	Humerus distal
Swp 914	D13		Humerus	Left	Humerus distal
Swp 915	D13		Humerus	Indet.	Humerus distal
Swp 916	D13		Humerus	Indet.	Humerus distal
Swp 917	D13		Humerus	Indet.	Humerus distal
Swp 918	D13		Humerus	Indet.	Humerus distal
Swp 919	D13		Humerus	Indet.	Humerus distal
Swp 920	D13		Humerus	Indet.	Humerus distal
Swp 921	D2		Humerus	Indet.	Humerus distal
Swp 922	D13		Humerus	Indet.	Humerus distal
Swp 923	D13		Humerus	Indet.	Humerus distal
Swp 924	D13		Humerus	Left	Humerus distal
Swp 925	D13		Humerus	Indet.	Humerus distal
Swp 926	D13		Humerus	Indet.	Humerus distal
Swp 927	D13		Humerus	Indet.	Humerus distal
Swp 928	D13		Humerus	Indet.	Humerus diaphysis
Swp 929	D13		Humerus	Indet.	Humerus diaphysis
Swp 930	D13		Humerus	Indet.	Humerus diaphysis
Swp 931	D13		Humerus	Indet.	Humerus diaphysis
Swp 932	D13		Humerus	Indet.	Humerus diaphysis
Swp 933	D13		Humerus	Indet.	Humerus diaphysis
Swp 934	D13		Humerus	Indet.	Humerus diaphysis
Swp 935	D13		Humerus	Indet.	Humerus diaphysis

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 936	D13		Humerus	Indet.	Humerus diaphysis
Swp 937	D13		Humerus	Indet.	Humerus diaphysis
Swp 938	D13		Humerus	Indet.	Humerus diaphysis
Swp 939	D13		Humerus	Indet.	Humerus diaphysis
Swp 940	D13		Humerus	Indet.	Humerus diaphysis
Swp 941	D13		Humerus	Indet.	Humerus diaphysis
Swp 942	D13		Humerus	Indet.	Humerus diaphysis
Swp 943	D13		Humerus	Indet.	Humerus diaphysis
Swp 944	D13		Humerus	Indet.	Humerus diaphysis
Swp 945	D13		Humerus	Indet.	Humerus diaphysis
Swp 946	D13		Humerus	Indet.	Humerus diaphysis
Swp 947	D13		Humerus	Indet.	Humerus diaphysis
Swp 948	D13		Humerus	Indet.	Humerus diaphysis
Swp 949	D13		Humerus	Indet.	Humerus diaphysis
Swp 950	D13		Humerus	Indet.	Humerus diaphysis
Swp 951	?		Humerus	Indet.	Humerus diaphysis
Swp 952	D13		Humerus	Indet.	Humerus diaphysis
Swp 953	D13		Humerus	Indet.	Humerus diaphysis
Swp 954	D13		Humerus	Indet.	Humerus diaphysis
Swp 955	D13		Humerus	Indet.	Humerus diaphysis
Swp 956	D13		Humerus	Indet.	Humerus diaphysis
Swp 957	D13		Humerus	Indet.	Humerus diaphysis
Swp 958	D13		Humerus	Indet.	Humerus proximal
Swp 959	D13		Humerus	Indet.	Humerus proximal
Swp 960	D13		Humerus	Left	Humerus proximal
Swp 961	D13		Humerus	Indet.	Humerus proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 962	D13		Humerus	Left	Humerus proximal
Swp 963	D13		Humerus	Indet.	Humerus proximal
Swp 964	D13		Humerus	Indet.	Humerus proximal
Swp 965	D18		Humerus	Indet.	Humerus proximal
Swp 966	D13		Humerus	Indet.	Humerus proximal
Swp 967	D13		Humerus	Indet.	Humerus proximal
Swp 968	D15		Fibula	Left	Fibula
Swp 969	D14		Pelvis	Indet.	(piece)
Swp 970	D14		Pelvis	Indet.	Os coxa (piece)
Swp 971	D14		Radius	Indet.	radius diaphysis
Swp 972	D14		Radius	Indet.	radius proximal
Swp 973	D14		Radius	Indet.	radius diaphysis
Swp 974	D13		Vertebra Indet.		vertebra
Swp 975	D13		Vertebra Indet.		vertebra
Swp 976	D13		Vertebra Indet.		vertebra
Swp 977	D13		Vertebra Indet.		vertebra
Swp 978	D13		Vertebra Indet.		vertebra
Swp 979	D10		Radius	Indet.	radius proximal
Swp 980	D10		Radius	Indet.	radius diaphysis
Swp 981	D10		Radius	Indet.	radius diaphysis
Swp 982	D10		Humerus	Indet.	Humerus? Proximal; contra catalog
Swp 983	D10		Ulna	Indet.	ulna proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 984	D15		Tibia	Indet.	tibia proximal
Swp 985	D15		Tibia	Indet.	tibia proximal
Swp 986	D15		Pelvis	Indet.	Os coxa fragment
Swp 987	D15		Humerus	Left	Humerus distal
Swp 988	D15		Humerus	Indet.	Humerus diaphysis
Swp 989	D15		Humerus	Indet.	Humerus diaphysis
Swp 990	D15		Humerus	Indet.	Humerus distal
Swp 991	D15		Humerus	Indet.	Humerus diaphysis
Swp 992	D15		Humerus	Indet.	Humerus diaphysis
Swp 993	D14		Humerus	Indet.	Humerus proximal
Swp 994	D14		Humerus	Indet.	Humerus diaphysis
Swp 995	D14		Humerus	Left	Humerus distal diaphysis
Swp 996	?		Humerus	Indet.	Humerus diaphysis
Swp 997	D14		Femur	Indet.	Femur distal (contra catalog)
Swp 998	D14		Humerus	Indet.	Humerus diaphysis
Swp 999	D14		Humerus	Indet.	Humerus diaphysis
Swp 1000	D14		Humerus	Indet.	Humerus diaphysis
Swp 1001	D14		Femur	Indet.	Femur diaphysis
Swp 1002	D14		Femur	Indet.	Femur proximal
Swp 1003	D14		Femur	Indet.	Femur diaphysis
Swp 1004	D14		Femur	Indet.	Femur diaphysis
Swp 1005	D14		Femur	Indet.	Femur proximal
Swp 1006	D14		Femur	Indet.	Femur proximal
Swp 1007	D14		Femur	Indet.	Femur proximal
Swp 1008	D14		Femur	Right	Femur proximal
Swp 1009	D14		Femur	Left	Femur proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1010	D14		Femur	Indet.	Femur diaphysis
Swp 1011	D14		Femur	Left	Femur proximal
Swp 1014	D11		Tibia	Indet.	Tibia distal
Swp 1015	D3		Tibia	Left	Tibia distal
Swp 1016	D8		Humerus	Right	Humerus distal
Swp 1050	D12		metatarsal	Indet.	Metatarsal fragment (4)
Swp 1104	T/46 - 9'10"-10'10"		Ulna	Left	Ulna proximal
Swp 1105	S/48 - 13'6"-14'5"		Ulna	Indet.	Ulna diaphysis
Swp 1107	Dd/48 - 10'6"-11'5"		Femur	Indet.	Femur proximal
Swp 1109	U/44 - 10'10"-11'10"		Humerus	Right	Humerus distal
Swp 1110	Aa/48 - 4'1"-5'1"		Ulna	Left	Ulna proximal
Swp 1111	P/60 - 16'4"-16'6"		Humerus	Left	Humerus distal
Swp 1112	O/61 - 15'8"-16'8"		Ulna	Right	Ulna proximal
Swp 1113	M/61 - 12'8"-13'8"		Tibia	Left	Tibia distal
Swp 1114	D17		Femur	Left	Femur proximal
Swp 1115	D17		Femur	Indet.	Femur proximal
Swp 1116	D17		Femur	Indet.	Femur proximal
Swp 1117	D17		Femur	Indet.	Femur proximal
Swp 1118	D17		Femur	Indet.	Femur proximal
Swp 1119	Q/59 - 14'0"-15'0"		Humerus	Left	Humerus distal
Swp 1120	R/56 - 10'9"-11'9"		Tibia	Indet.	Tibia proximal
Swp 1125	O/45 - 13'3"-13'11"		Radius	Indet.	Radius proximal
Swp 1126	Aa/44 - 6'2"-7'10"		Femur	Left	Femur proximal
Swp 1127	Aa/44 - 6'2"-7'10"		Femur	Indet.	Femur proximal (diaphysis)
Swp 1128	V/49 - 13'10"-14'10"		Tibia	Left	Tibia distal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1137	U/57 - 10'5"-11'5"		Humerus	Left	Humerus distal
Swp 1138	T/57 - 11'1"-12'1"		Talus	Left	Astragalus (contra catalog)
Swp 1139	T/45 - 6'0"-7'0"		Radius	Indet.	Radius proximal
Swp 1140	W/46 - 3'11"-4'11"		Humerus	Right	Humerus distal
Swp 1141	W/46 - 3'11"-4'11"		Humerus	Right	Humerus distal
Swp 1142	U/48 - 7'6"-8'6"		Clavicle	Left	Clavicle
Swp 1143	U/48 - 7'6"-8'6"		Metatarsal	Indet.	Metatarsal
Swp 1144	U/48 - 7'6"-8'6"		Metatarsal	Indet.	Metatarsal
Swp 1145	U/48 - 7'6"-8'6"		Metatarsal	Indet.	Metatarsal
Swp 1146	U/49 - 7'6"-8'6"		Talus	Indet.	Astragalus
Swp 1147	U/49 - 7'6"-8'6"		Calcaneus	Indet.	Calcaneus
Swp 1148	Q/46 - 8'8"-9'8"		Ulna	Right	Ulna proximal
Swp 1149	P/45 - 10'6"11'6"		Tibia	Right	Tibia distal
Swp 1150	P/46 - 10'2"-11'2"		Femur	Indet.	Femur proximal
Swp 1151	P/46 - 10'2"-11'2"		Metatarsal	Indet.	Metatarsal
Swp 1152	P/45 - 13'4"-14'4"		Femur	Right	Femur right
Swp 1153	P/45 - 13'4" - 14'4"		Femur	Indet.	Femur diaphysis
Swp 1154	U/58 - 11'0"-12'0"		Femur	Left	Femur proximal
Swp 1155	R/46-6'2"-7'2"		Ulna	Indet.	Ulna proximal
Swp 1156	T/49 - 8'8"-9'8"		Ulna	Left	Ulna proximal
Swp 1157	T/47 - 8'4"-9'4"		Calcaneus	Left	Calcaneus
Swp 1158	S/48 - 9'8"-10'8"		Phalanx	Indet.	Phalanx
Swp 1159	S/48 - 9'8"-10'8"		Metatarsal	Indet.	Metatarsal
Swp 1160	S/48 - 9'8"-10'8"		Phalanx	Indet.	Phalanx
Swp 1161	T/47 - 9'4"-10'4"		Calcaneus	Right	Calcaneus
Swp 1162	V/53 - 10'9"-11'9"		Radius	Indet.	Radius proximal (very large)

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1163	X/53 - 12'10"-13'2"		Femur	Left	Femur proximal
Swp 1164	X/54 - 9'3"-10'3"		Tibia	Right	Tibia distal
Swp 1165	U/52 - 11'3"-12'3"		Humerus	Right	Humerus distal
Swp 1166	P/47 - 6'2"-7'2"		Ulna	Right	Ulna proximal
Swp 1167	R/55 - 15'1"-16'1"		Radius	Left	Radius distal
Swp 1170	X/45 - 6'10"-7'10"		Metatarsal	Indet.	Metatarsal (5^{th}?)
Swp 1171	V/47 - 5'10"-6'10"		Femur	Left	Femur proximal
Swp 1172	S/46 - 5'8"-6'8"		Pelvis	Left	Os coxa
Swp 1173	T/49 - 6'8"-7'8"		Humerus	Indet.	Humerus proximal
Swp 1174	V/48 - 6/10"-7'10"		Tibia	Right	Tibia distal
Swp 1175	U/48 - 6'6"-7'6"		Femur	Indet.	Femur distal
Swp 1176	U/48 - 6'6"-7'6"		Humerus	Left	Humerus distal
Swp 1177	O/62 - 15'9"-16'9"		Tibia	Indet.	Tibia proximal
Swp 1196	T/59 - 13'5"-14'5"		Metatarsal	Indet.	Metatarsal proximal
Swp 1197	T/63 - 13'5"-14'5"		Ulna	Left	Ulna distal
Swp 1198	V/57 - 10'3"-11'0"		Radius	Indet.	Radius proximal
Swp 1199	V/57 - 10'3"-11'0"		Humerus	Right	Humerus proximal
Swp 1200	W/57 - 9'2"-10'2"		Ulna	Left	Ulna proximal
Swp 1201	W/57 - 9'2"-10'2"		Humerus	Indet.	Humerus proximal
Swp 1202	V/60 - 16'0"-17'0"		Ulna	Indet.	Ulna proximal
Swp 1203	U/V/W/60 - 12'8"-14'0"		Femur	Left	Left femur proximal
Swp 1204	U/V/W/ 60 - 12'8"-14'0"		Radius	Indet.	Radius proximal
Swp 1205	U/57 - 5'2"-6'2"		Humerus	Right	Humerus proximal
Swp 1206	Jj/35 - 8'6"-9'5"		Femur	Indet.	Femur proximal
Swp 1207	W/56 - 9'10"-10'10"		Calcaneus	Right	Calcaneus
Swp 1208	V/63 - 8'6"-9'6"		Ulna	Left	Ulna proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1209	T/61 - 23'1"-24'1"		Rib		Rib fragment with both facets
Swp 1210	T/62 - 23'1"-24'1"		Phalanx	Indet.	Phalanx
Swp 1211	R/65 - 14'8"-15'8"		Humerus	Left	Humerus distal (almost complete)
Swp 1212	O/59 - 13'6"-14'6"		Tibia	Indet.	Tibia diaphysis
Swp 1213	R/65 - 10'8"-11'8"		Ulna	Right	Right ulna proximal
Swp 1214	U/50 - 10'8"-11'8"		Humerus	Indet.	Humerus distal
Swp 1215	T/62 - 16'1"-17'1"		Radius	Indet.	Radius proximal
Swp 1219	V/47 - 7'10"-8'10"		Radius	Indet.	Radius proximal
Swp 1220	V/47 - 7'10"-8'10"		Radius	Indet.	Radius diaphysis
Swp 1222	V/47 - 7'10"-8'10"		Phalanx	Indet.	Phalanx
Swp 1223	V/47 -7'10"-8'10"		Phalanx	Indet.	Phalanx
Swp 1225	V/47 - 7'10"-8'10"		Femur	Indet.	Femur proximal
Swp 1258	O/63 - 13'0"-14'0"		Ulna	Indet.	Ulna proximal
Swp 1261	W/59 - 7'6"-8'6"		Phalanx	Indet.	Phalanx
Swp 1262	T/59 - 9'5"-10'5"		Humerus	Left	Humerus distal
Swp 1263	Hh/38 - 8'10"-9'10"		Femur	Left	Femur proximal
Swp 1264	Gg/38 - 5'8"-6'8"		Phalanx	Indet.	Phalanx
Swp 1265	Ii/34 - 8'6"-9'6"		Metatarsal	Indet.	Metatarsal
Swp 1266	Ii/36 - 14'4"=15'4"		Femur	Indet.	Femur proximal (unfused head)
Swp 1267	V/63 - 6'9"-7'9"		Metacarpal	Indet.	Metacarpal
Swp 1268	R/47 - 6'6"-7'6"		Humerus	Indet.	Humerus distal
Swp 1269	R/48 - 10'2"-11'2"		Phalanx	Indet.	Phalanx
Swp 1270	V/63 - 4'9"-5'9"		Metacarpal	Indet.	Metacarpal?
Swp 1271	W/59 - 7'5"-8'5"		Humerus	Right	Humerus distal
Swp 1272	W/59 - 8'5"-9'5"		Ulna	Right	Ulna proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1273	T/48 - 8'6"-9'6"		Calcaneus	Left	Calcaneus
Swp 1274	T/48 - 8'6"-9'6"		Femur	Indet.	Femur distal
Swp 1275	V/44 10'10"-11'10"		Humerus	Indet.	Humerus distal
Swp 1276	T/60 - 12'4"-13'9"		Humerus	Right	Humerus proximal
Swp 1277	T/61 - 14'7"-15'9"		Tibia	Left	Tibia diaphysis
Swp 1278	V/59 - 11'0"-12'0"		Humerus	Indet.	Humerus proximal
Swp 1279	V/59 - 9'0"-10'0"		Radius	Indet.	Radius proximal
Swp 1280	Cc/44 - 5'4"-6'4"		Phalanx	Indet.	Phalanx
Swp 1281	Q/58 - 14'6"-15'3"		Humerus	Right	Humerus distal
Swp 1282	U/60 - 12'5"-13'5"		Phalanx	Indet.	Phalanx
Swp 1284	U/60 - 9'5"-10'5"		Talus	Left	Astragalus; fits on top of Swp 1157
Swp 1285	O/61 - 16'8"-17'8"		Ulna	Left	Ulna proximal
Swp 1286	U/61 - 14'2"-15'1"		Tibia	Right	Tibia distal
Swp 1287	W/58 - 14'11"-15'11"		Humerus	Left	Humerus distal
Swp 1291	V/62 - 7'5"-8'5"		Ulna	Right	Ulna proximal
Swp 1300	V/62 - 8'5"-9'5"		Femur	Left	Femur proximal
Swp 1301	V/62 - 8'5-9'5		Femur	Indet.	Femur distal
Swp 1302	T/59 - 10'7"-11'7"		Phalanx	Indet.	Phalanx
Swp 1303	P/60 - 2'9"-5'6"		Metatarsal	Indet.	Metatarsal (?)
Swp 1304	V/60 - 10'0"-11'0"		Metacarpal	Indet.	Metacarpal
Swp 1305	T/60 - 18'2"-19'2"		Patella	Indet.	Patella
Swp 1306	W/59 - 10'5"-11'5"		Radius	Indet.	Radius proximal
Swp 1307	V/60 - 12'0"-13'0"		Calcaneus	Left	Calcaneus
Swp 1308	V/60 - 12'0"-13'0"		Radius	Indet.	Radius proximal
Swp 1339	Cc/49 - 7'6"-8'6"		Metatarsal	Indet.	Metatarsal
Swp 1340	Dd/47 - 4'8"-5'8"		Metatarsal	Indet.	Metatarsal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1341	Ee/46 - 5'7"-6'7"		Phalanx	Indet.	Phalanx
Swp 1342	Ee/46 - 5'7"-6'7"		Vertebra		Vertebra indet.
Swp 1343	Ee/46 - 5'7"-6'7"		Metatarsal		Metatarsal?
Swp 1344	Cc/42 - 4'6"-5'6"		Vertebra Indet.		Vertebra
Swp 1350	Cc/46 - 3'7"-4'7"		Femur	Indet.	Femur distal (unfused)
Swp 1351	Ee/44 - 3'5"-4'5"		Femur	Indet.	femur proximal (unfused)
Swp 1352	Bb/54 - 7'2"-8'2"		Femur	Right	Femur proximal
Swp 1353	Dd/49 - 12'6"-13'6"		Femur	Indet.	Femur proximal
Swp 1354	Dd/49 - 12'6"-13'6"		Femur	Indet.	Femur diaphysis
Swp 1355	Aa/50 - 6'9"-7'9"		Femur	Indet.	Femur proximal
Swp 1356	Cc/50 - 9'4"-10'4"		Tibia	Indet.	Tibia proximal
Swp 1357	Aa/50 - 5'9"-6'9"		Tibia	Left	Tibia distal
Swp 1358	Dd/48 - 9'10"-10'10"		Ulna	Indet.	Ulna diaphysis
Swp 1364	D20		Femur	Right	Femur proximal
Swp 1365	D20		Tibia	Right	Tibia distal
Swp 1367	D20		Femur	Indet.	Femur distal (unfused)
Swp 1368	D20		Radius	Indet.	Radius proximal
Swp 1369	D20		Ulna	Indet.	Ulna distal
Swp 1374	Ee/50 - 8'10"-9'10"		Scaphoid	Right	Right scapula
Swp 1375	Ee/50 - 8'10"-9'10"		Metatarsal	Indet.	Metatarsal
Swp 1376	Ee/50 - 8'10"-9'10"		Humerus	Indet.	Humerus proximal
Swp 1383	D20		Femur	Right	Right femur proximal
Swp 1384	D20		Femur	Right	Right femur proximal
Swp 1385	D20		Femur	Indet.	Femur proximal
Swp 1386	D20		Humerus	Indet.	Humerus diaphysis

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1387	D20		Tibia	Indet.	Tibia proximal fragment
Swp 1388	D20		Humerus	Indet.	Humerus diaphysis?
Swp 1390	D20		Talus	Right	Astragalus
Swp 1391	D20		Calcaneus	Right	Calcaneus (contra catalog)
Swp 1403	D20		Ulna	Left	Ulna distal almost complete
Swp 1404	D20		Femur	Indet.	Femur proximal
Swp 1405	D20		Ulna	Indet.	Ulna distal
Swp 1406	D20		Humerus	Right	Humerus proximal
Swp 1407	D20		Lunate	Indet.	Lunate or scaphoid (contra catalog)
Swp 1408	D20		Metatarsal	Indet.	Metatarsal
Swp 1410	D20		Humerus	Left	Humerus distal
Swp 1411	D20		Tibia	Indet.	Tibia proximal
Swp 1414	D20		Femur	Indet.	Femur proximal
Swp 1416	D20		Radius	Right	Right radius proximal
Swp 1417	D20		Metatarsal	Indet.	Metatarsal
Swp 1418	D20		Radius	Indet.	Radius proximal
Swp 1419	D20		Radius	Indet.	Radius diaphysis
Swp 1420	D20		Radius	Indet.	Radius proximal
Swp 1421	D20		Radius	Indet.	Radius proximal
Swp 1506	D17		Radius	Indet.	Radius proximal
Swp 1507	D17		Radius	Indet.	Radius diaphysis
Swp 1508	D17		Humerus	Indet.	Humerus distal
Swp 1509	D13		Femur	Indet.	Femur distal
Swp 1510	18		Humerus	Left	Humerus distal;
Swp 1511	D18		Tibia	Left	Tibia distal
Swp 1512	D18		Calcaneus	Left	Calcaneus

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1513	D18		Ulna	Indet.	Ulna proximal
Swp 1514	D18		Femur	Right	Femur proximal
Swp 1515	D18		Radius	Indet.	Radius proximal
Swp 1516	D18		Metacarpal	Indet.	Metacarpal (1/2)
Swp 1517	D18		Phalanx	Indet.	Phalanx
Swp 1518	D18		Humerus	Indet.	Humerus distal
Swp 1519	D18		Radius	Indet.	Radius proximal
Swp 1520	D18		Humerus	Right	Humerus distal (crushed)
Swp 1521	D18		Radius	Indet.	Radius proximal
Swp 1522	D18		Radius	Indet.	Radius proximal
Swp 1523	D18		Femur	Indet.	Femur distal
Swp 1524	D18		Humerus	Indet.	Humerus distal
Swp 1525	D18		Femur	Indet.	Femur proximal
Swp 1526	D18?		Humerus	Indet.	Humerus distal
Swp 1527	D18		Metacarpal	Indet.	Metacarpal/tarsal
Swp 1528	D18		Metatarsal	Indet.	Metatarsal
Swp 1529	D18		Humerus	Indet.	Humerus distal
Swp 1530	D18		Radius	Indet.	Radius diaphysis
Swp 1531	D18		Ulna	Left	Ulna proximal
Swp 1532	D20		Femur	Left	Femur distal
Swp 1533	D20		Femur	Indet.	Femur diaphysis
Swp 1534	D20		Femur	Indet.	Femur distal
Swp 1535	D20		Femur	Indet.	Femur distal
Swp 1536	D20		Femur	Right	Femur proximal (very large)
Swp 1537	D20		Femur	Left	Femur proximal
Swp 1538	D20		Humerus	Indet.	Humerus proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1539	D20		Humerus	Right	Humerus proximal
Swp 1540	D20		Humerus	Left	Humerus distal
Swp 1541	D20		Humerus	Indet.	Humerus distal
Swp 1542	D20		Humerus	Right	Humerus proximal
Swp 1543	D20		Humerus	Left	Humerus distal
Swp 1544	D20		Humerus	Indet.	Humerus proximal
Swp 1545	D20		Tibia	Indet.	Tibia diaphysis
Swp 1546	D20		Tibia	Left	Tibia proximal
Swp 1547	D20		Radius	Indet.	Radius distal
Swp 1548	D20?		Tibia	Indet.	Tibia proximal (fragment of condyle)
Swp 1549	D20		Metatarsal	Indet.	Metatarsals (3) joined with tarsal bones
Swp 1550	D20		Metatarsal	Indet.	Metatarsal
Swp 1551	D20		Metatarsal	Indet.	Metatarsal
Swp 1552	D20		Radius	Indet.	Radius proximal
Swp 1553	D20		Radius	Indet.	Radius proximal
Swp 1554	D20		Ulna	Indet.	Ulna (contra catalog) diaphysis
Swp 1555	D20		Radius	Indet.	Radius diaphysis
Swp 1556	D20		Radius	Indet.	Radius diaphysis
Swp 1557	D20		Radius	Indet.	Radius diaphysis
Swp 1560	D20		Ulna	Left	Ulna proximal
Swp 1561	D20		Ulna	Right	Ulna proximal
Swp 1562	D20?		Ulna	Right	Ulna proximal
Swp 1563	D18		Ulna	Right	Ulna proximal
Swp 1564	?		Ulna	Indet.	Ulna diaphysis
Swp 1565	D18		Ulna	Indet.	Ulna diaphysis
Swp 1566	D18		Ulna	Indet.	Ulna diaphysis

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1567	D18		Ulna	Indet.	Ulna proximal
Swp 1568	D18		Ulna	Right	Ulna proximal
Swp 1569	D18		Ulna	Left	Ulna proximal
Swp 1570	D18		Ulna	Right	Ulna proximal
Swp 1571	D18		Ulna	Right	Ulna proximal
Swp 1572	D18		Ulna	Left	Ulna proximal
Swp 1573	D18		Ulna	Indet.	Ulna proximal
Swp 1574	D18		Ulna	Right	Ulna proximal
Swp 1575	?		Ulna	Left	Ulna proximal
Swp 1576	D18		Ulna	Right	Ulna proximal
Swp 1577	D18		Ulna	Left	Ulna proximal
Swp 1578	D18		Ulna	Right	Ulna proximal
Swp 1579	?		Ulna	Indet.	Ulna proximal
Swp 1580	D18		Ulna	Right	Ulna proximal
Swp 1581	D20		Humerus	Left	Humerus distal
Swp 1582	?		Humerus	Right	Humerus distal
Swp 1583	D20		Humerus	Left	Humerus distal
Swp 1584	D20		Humerus	Right	Humerus distal
Swp 1585	D20		Humerus	Right	Humerus distal and proximal piece of radius and ulna (contra catalog)
Swp 1586	D20		Humerus	Right	Humerus distal
Swp 1587	D20		Humerus	Indet.	Humerus distal?
Swp 1588	D20		Humerus	Indet.	Humerus distal? (juvenile)
Swp 1589	D20		Humerus	Right	Humerus distal
Swp 1590	D20		Ulna	Right	Ulna proximal
Swp 1591	D20		Ulna	Indet.	Ulna proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1592	D20		Ulna	Left	Ulna diaphysis
Swp 1593	D20		Ulna	Left	Ulna distal
Swp 1594	D20		Ulna	Indet.	Ulna proximal
Swp 1595	D20		Ulna	Left	Ulna proximal diaphysis
Swp 1596	?		Tibia	Right	Tibia proximal
Swp 1597	D20		Tibia	Left	Tibia proximal
Swp 1598	D20		Tibia	Indet.	Tibia proximal
Swp 1599	?		Tibia	Indet.	Tibia proximal
Swp 1600	D20		Tibia	Indet.	Tibia proximal
Swp 1601	D20		Tibia	Indet.	Tibia distal
Swp 1602	D20		Tibia	Left	Tibia distal
Swp 1603	D20		Tibia	Left	Tibia distal
Swp 1604	D18		Tibia	Right	Ulna proximal
Swp 1605	D20		Femur	Indet.	Femur distal
Swp 1606	D20		Femur	Indet.	Femur proximal (head fragment)
Swp 1607	D20		Femur	Indet.	Femur distal
Swp 1608	D20		Femur	Indet.	Femur distal
Swp 1609	D20		Femur	Indet.	Femur distal
Swp 1610	D20		Femur	Indet.	Femur distal
Swp 1611	D20		Femur	Indet.	Femur proximal
Swp 1612	D20		Femur	Right	Femur proximal
Swp 1613	D20		Femur	Indet.	Femur proximal
Swp 1614	D20		Femur	Indet.	Femur proximal
Swp 1615	D20		Femur	Indet.	Femur proximal (head fragment)
Swp 1616	D20		Femur	Indet.	Femur proximal
Swp 1617	D20		Femur	Indet.	Femur proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1618	D20		Femur	Indet.	Femur distal
Swp 1619	D20		Femur	Indet.	Femur diaphysis
Swp 1620	D20		Calcaneus	Indet.	Calcaneus
Swp 1621	D20		Phalanx	Indet.	Phalanx
Swp 1622	D20		Phalanx	Indet.	Phalanx?
Swp 1623	D20		Metatarsal	Indet.	Metatarsal/carpal
Swp 1624	D20		Metatarsal	Indet.	Metatarsal
Swp 1625	D20		Metatarsal	Indet.	Metatarsal
Swp 1626	D20		Talus	Indet.	Astragalus
Swp 1627	D20		Calcaneus	Left	Calcaneus
Swp 1628	D20?		Phalanx	Indet.	Phalanx
Swp 1629	?		Metatarsal	Indet.	Metatarsal proximal?
Swp 1630	D20		Pelvis	Left	Os coxa with acetabulum and part of iliac blade
Swp 1631	D20		Pelvis	Indet.	Pelvic fragment
Swp 1632	D20		Pelvis	Indet.	Pelvic fragment
Swp 1633	D20		Pelvis	Indet.	Pelvic fragment
Swp 1634	D20		Pelvis	Indet.	Acetabulum; pelvic fragment
Swp 1635	D20		Pelvis	Indet.	Pelvic fragment
Swp 1636	D20		Pelvis	Indet.	Pelvic fragment
Swp 1637	R/56 - 10'9"-11'9"		Phalanx	Indet.	Phalanx
Swp 1688	D20		Scapula	Left	Scapula – acromion
Swp 1697	D20		Femur	Right	Femur proximal
Swp 1698	D20		Femur	Left	Femur proximal
Swp 1699	D20		Femur	Left	Femur proximal
Swp 1700	D20		Femur	Indet.	Femur proximal
Swp 1701	D20		Femur	Indet.	Femur proximal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 1702	D20		Femur	Indet.	Femur proximal
Swp 1703	D20		Femur	Indet.	Femur proximal (head)
Swp 1704	D20		Femur	Right	Femur proximal
Swp 1705	D20		Femur	Indet.	Femur proximal
Swp 1706	D20		Femur	Left	Femur proximal
Swp 1707	D20		Femur	Indet.	Femur proximal
Swp 1708	D20		Femur	Indet.	Femur proximal
Swp 1709	D20		Femur	Left	Femur proximal
Swp 1710	D20		Femur	Indet.	Femur distal
Swp 1711	D20		Femur	Indet.	Femur distal
Swp 1712	D20		Femur	Indet.	Femur distal
Swp 1713	D20		Femur	Indet.	Femur distal
Swp 1714	D20		Femur	Left	Femur distal
Swp 1715	D20		Femur	Indet.	Femur distal
Swp 1716	D20		Femur	Indet.	Femur distal
Swp 1717	D20		Femur	Indet.	Femur distal
Swp 1718	D20		Femur	Indet.	Femur distal
Swp 1719	D20		Femur	Indet.	Femur diaphysis
Swp 1720	D20		Femur	Indet.	Femur diaphysis
Swp 1721	D20		Femur	Indet.	Femur diaphysis
Swp 1722	D20		Femur	Indet.	Femur diaphysis
Swp 1723	D20		Femur	Indet.	Femur diaphysis
Swp 1724	D20		Femur	Indet.	Femur diaphysis
Swp 2349			Pelvis	Right	Acetabulum fragment
Swp 2351			Pelvis	Indet.	Ilium fragment
Swp 2352			Pelvis	Indet.	Ilium fragment

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 2356	D20	10/18/1984	Scapula	Indet.	Scapula fragment with glenoid fossa
Swp 2357			Ulna	Indet.	Ulna diaphysis
Swp 2828	Member 2 Excavations		Humerus	Indet.	
Swp 2829	Member 2 Excavations		Femur	Left	
Swp 2830	Member 2 Excavations		Femur	Left	Femur distal
Swp 2831	Member 2 Excavations		Femur	Indet.	
Swp 2832	Member 2 Excavations		Tibia	Right	Tibia proximal
Swp 2833	Member 2 Excavations		Tibia	Indet.	Tibia proximal
Swp 2834	Member 2 Excavations		Ulna	Left	Ulna proximal
Swp 2835	Member 2 Excavations		Humerus		
Swp 2836	Member 2 Excavations		Pelvis	Right	
Swp 2837	Member 2 Excavations		Vertebra		Atlas
Swp 2838	Member 2 Excavations		Tibia	Indet.	Encased in breccia
Swp 2839	Member 2 Excavations		Pelvis	Right	

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 2840	Member 2 Excavations		Pelvis		
Swp 2841	Member 2 Excavations		Pelvis	Indet.	
Swp 2842	Member 2 Excavations		Femur	Right	Femur proximal
Swp 2843	Member 2 Excavations		Femur		Femur proximal
Swp 2844	Member 2 Excavations		Tibia	Left	Tibia distal
Swp 2845	Member 2 Excavations		Pelvis	Right	
Swp 2846	Member 2 Excavations		Femur	Indet.	
Swp 2847	Member 2 Excavations		Femur	Indet.	
Swp 2852	Member 2 Excavations		Phalanx		
Swp 2853	Member 2 Excavations		Talus	Left	
Swp 2870	Member 2 Excavations		Calcaneus	Left	Calcaneus
Swp 2871	Member 2 Excavations		Talus	Left	
Swp 2874	Member 2 Excavations		Femur	Indet.	Femur distal

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 2876	Member 2 Excavations		Pelvis	Indet.	Acetabulum
Swp 2880	Member 2 Excavations		Pelvis	Left	Os Coxa
Swp 2881	Member 2 Excavations		Humerus	Indet.	
Swp 2884	Member 2 Excavations		Tibia	Right	Tibia distal
Swp 2885	Member 2 Excavations		Humerus	Left	Humerus distal
Swp 2886	Member 2 Excavations		Tibia	Right	Tibia distal
Swp 2888	Member 2 Excavations		Humerus	Left	Humerus proximal
Swp 2889	Member 2 Excavations		Calcaneus	Left	
Swp 2890	Member 2 Excavations		Humerus		Humerus distal
Swp 2891	Member 2 Excavations		Phalanx	Indet.	
Swp 2892	Member 2 Excavations		Radius	Indet.	Radius proximal
Swp 2895	Member 2 Excavations		Humerus	Left	Humerus proximal
Swp 2897	Member 2 Excavations		Femur	Indet.	Humerus proximal?

Specimen Number	Provenance	Date	Element	Side	Comments
Swp 2900	Member 2 Excavations		Humerus	Right	Humerus proximal
Swp 2905	Member 2 Excavations		Phalanx	Indet.	
Swp 2907	Member 2 Excavations		Palate	Right	Partial cranium with palate, thoracic vertebra also commingled with cranium
Swp 2913	Member 2 Excavations		Sacrum		Sacrum lacking everything caudal to S3
Swp 2917	Member 2 Excavations		Tibia	Indet.	
Swp 2923	Member 2 Excavations		Metatarsal	Indet.	
Swp 2927	Member 2 Excavations		Vertebra Indet.		
Swp 2928	Member 2 Excavations		Rib		

APPENDIX THREE
TRANSVAAL MUSEUM CERCOPITHECOID CRANIODENTAL CATALOG – STS

Specimen Number	Provenance	Taxon	Element	Side	Comments
Graveyard	Type Site	*Papio*	Maxilla	Both	Partial palate of a papionin. M^2-M^3 present bilaterally, looks like toothrows would have been parallel, but not much of either side remaining. May possibly be very large M^1-M^2 (large).
St 405b	Type Site		Tooth	Right	M^1 (crown)
St 476	Type Site		Mandible	Indet.	Partial mandible with teeth, but needs prep. Not readily identifiable. A small cranium (cercopithecoid?) is present on the opposite side of breccia block, not necessarily the same individual.
St 1089	Type Site		Maxilla	Indet.	Maxilla with a molar fragment?
St 2095	Type Site		Mandible	Left	Mandibular fragment with two molars; siding based upon appearance of lingual side of teeth. No measurements taken; specimen still encased in breccia.
St 2103	Type Site		Mandible	Left	Edentulous mandibular corpus with P_3-M_3 roots; specimen also preserves an impression of ascending ramus. Partial cranium also present. Can visualize right side (snout, temporal and parietal region). Specimen is cf. *Pp. jonesi*, but could be a small *Pp. broomi*.
St 2113	Type Site		Maxilla	Indet.	Jaw fragment (maxilla?) with impression of teeth.
St 2119	Type Site	*Pp. broomi*	Maxilla	Both	Maxillary fragment (horse-shoe shaped) with deep relief. Specimen is an old female based upon tooth wear and estimate of upper canine size. On right side, a fairly well developed, but not deep maxillary fossa can be visualized. Most teeth cannot be measured accurately because of missing enamel.
St 2168	Type Site		Tooth	Left	M_3 with fractured/missing hypoconulid.
St 2277	Type Site		Tooth	Indet.	Molar (highly fragmented)

Specimen Number	Provenance	Taxon	Element	Side	Comments
St 2317	Type Site		Tooth	Indet.	Molar fragment; sectioned in buccal-lingual direction; encased in breccia and needs preparation.
Sts ?	Type Site		Mandible	Right	Mandibular fragment with P_4-M_2. Only lengths of M_1-M_2 can be measured, as they are fractured on the lingual side.
Sts 125	Type Site		Cranium	Indet.	Partial braincase. Specimen is encased in breccia, and only endocranial surface can be visualized. Specimen appears to be cranial vault bones. However, is in very bad condition; needs preparation.
Sts 126	Type Site		Tooth	Indet.	Isolated tooth fragment.
Sts 204	Type Site		Tooth	Indet.	Fragments of two teeth; fractured crowns of two molars? Specimen appears to be the inferior view of the molars looking directly into the pulp cavity.
Sts 250	Type Site	*Pp. broomi*	Maxilla	Both	Maxillary fragment (snout) with P^3-M^3 bilaterally. Specimen has maxillary ridges similar to *Pp. broomi* with a maxillary fossa, most noticeable on the left side. Taxonomic identification tentative as breccia covers most surfaces; specimen is also worn heavily.
Sts 251	Type Site	*P. izodi*	Maxilla	Both	Posterior portion of relatively complete snout and a portion of the braincase. Specimen missing anterior portion of muzzle. Specimen does not possess much of a supraorbital torus. Complete zygomatic on the right side. Possesses an anteorbital drop like *P. izodi*.
Sts 252	Type Site	*C. williamsi*	Maxilla	Right	Maxillary fragment with basicranium. Features present: M^2-M^3; root of zygomatic (left), zygomatic arch (posterior) present (right), but distorted and fractured. Specimen possesses a slight nuchal line and a complete foramen magnum with occipital condyles. Partial pterygoid plate present on right. A portion of the braincase is filled with breccia; M^2 and M^3 complete and measureable.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 253	Type Site	*Pp. broomi*	Maxilla	Both	Maxillary fragment with C^1-M^2, left P^3-M^1. Catalog notes that specimen is large; however, looks to be a *Pp. broomi*. M^3 unerupted. Muzzle fragmented in the areas which would have been diagnostic. C^1 appears to have been large (i.e. male), but not fully erupted yet. C^1 tip is fractured. Right C^1 appears to lean buccalward. Enamel missing on buccal right M^2 and mesio-buccal cusp of M^3 (right). Muzzle appears to be horse-shoe shaped with dental *Pp. broomi* proportions. Sts 359 is a *Pp. broomi* mandible and Sts 253 articulates well with it.
Sts 254a	Type Site	*P. izodi*	Cranium	Both	Cranium which is most similar to *P. izodi* from Member 2. Right side is complete. Left side is represented by the palate and inferior orbit, but not much else. Most of the dentition is in terrible shape. Left side measures of P^3-M^1 can be taken.
Sts 254b	Type Site	*P. izodi*	Tooth	Indet.	C^1 (tip chipped)
Sts 255	Type Site	*Pp. broomi*	Mandible	Left	Mandibular fragment with P_3-M_2 (buccal cusps).
Sts 256	Type Site		Mandible	Left	Mandibular fragment with M_2-M_3. Specimen preserves the condyle, but coronoid process and sigmoid notch are fragmented. Ascending ramus is complete. Mandibular corpus appears short with a slight mandibular fossa, just anterior and inferior to the specimen numbers.
Sts 257	Type Site	*Parapapio*	Mandible	Both	Most of right and left mandibular corpus. Specimen has mixed dentition. Very small in size. Left dm_2 fractured; incisors present but fractured and not measureable; canine and others measureable.
Sts 258	Type Site		Mandible	Both	Mandibular fragment with left M_1-M_3 and right P_3-P_4. Mandible fragmented, but looks like inferior portion reaches about mid P_4. No evidence of a mandibular fossa.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 259	Type Site	*Pp. broomi*	Maxilla	Left	Maxillary fragment with C^1-M^3. Maxillary fossa with slight maxillary ridge. Morphology of zygomatic indeterminate. Teeth are heavily worn with no information for incisors. Cf. *Pp. broomi.*
Sts 260	Type Site	*Pp. broomi*	Maxilla	Both	Maxillary fragment with left maxillary I^2, C^1 (root), M^1, M^2, M^3 (distal loph fractured) and right C^1 (large), P^3, P^4, M^1 (mesial loph). Cf. *Pp. broomi.* Left exhibits maxillary ridge similar to *Pp. broomi* with small maxillary fossa. However, difficult to judge with confidence because of fractures. Muzzle has distorted and displaced sides.
Sts 261	Type Site		Mandible	Both	Fragments of both mandibular corpi with right M_2 (lingual cusp) and M_3. Most of mandible made up of plaster; both sides possess condyles. Right side has partial coronoid process.
Sts 262	Type Site	*P. izodi*	Cranium	Both	Complete cranium with left P^4, M^2-M^3 and right M^2-M^3. Specimen has been designated as a type specimen. Basicranium filled with breccia. Specimen possesses diagnostic anteorbital drop. On toothrow, most alveoli are filled with breccia. On left, only P^4, M^2 and M^3 present. On right side, root of P^4, M^2 (missing buccal enamel) and complete M^3. Specimen has maxillary fossa and perpendicular zygomatics with well-developed, but small supraorbital tori.
Sts 263	Type Site	*P. izodi*	Maxilla	Right	Maxillary fragment with C^1-M^3 (unerupted); Specimen has been identified as *Pp. whitei* and *P. robinsoni* in the past; However, specimen has *Pp. broomi* shaped maxillary fossa. Four infraorbital foramina were observed.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 264	Type Site	*Pp. broomi*	Maxilla	Left	Maxillary fragment with C^1-M^2; specimen preserves six infraorbital foramina. Has a *Parapapio* type zygomatic with small maxillary fossa. M^3 completely fractured off at cervix, M^2 missing disto-lingual loph, M^1 missing mesio-buccal cusps.
Sts 265	Type Site	*Papio*	Maxilla	Right	Maxillary fragment with M^2 and M^3. Zygomatic appears to be very large; palatal surface not preserved. Additionally, mesio-lingual cusp of M^1 missing. Teeth are quite large. Specimen has been identified as *P. ingens*, previously.
Sts 266	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with P^3-M^3. Specimen appears to have a light maxillary fossa indicative of *Pp. broomi*, but difficult to tell. Palate is horseshoe shaped.
Sts 267	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with P^3-M^3; faint indications that a maxillary fossa is present. P^4 lingual enamel is missing.
Sts 268	Type Site	*P. izodi*	Mandible	Left	Mandibular corpus with P_4 (erupting), M_1, M_2 and M_3 (erupting). Inferior mandible fractured, but preserves a partial ascending ramus.
Sts 270	Type Site	*Parapapio*	Mandible	Right	Mandibular ramus with P_3-M_3. Toothrow is nearly complete, but M_3 is not fully erupted. Buccal side of mandible is in very poor condition. Appears to be a male based upon P_3 size. Specimen has a partial ascending ramus, but preserves no processes.
Sts 271	Type Site		Mandible	Left	Mandibular fragment with M_2-M_3. Preserves portions of mandibular corpus and ascending ramus.
Sts 272	Type Site		Maxilla		Maxilla in poor condition. Dentition is not measureable. Specimen does appear to have possessed a large canine. Dentition is cracked and expanded on all surfaces.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 273	Type Site	*Pp. broomi*	Maxilla	Right	Maxilla with a maxillary fossa indicative of *Pp. broomi.* Catalog states male, but no diagnostic features are present which can be used to determine sex. Specimen preserves a horse-shoe shaped palate with broadened molars. Heavily worn P^4 preserved. M^1 missing the mesio-lingual cusp and portions of disto-lingual. No measurements possible. However, M^2 and M^3 can be measured for measures not affected by wear.
Sts 274	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with infraorbital region. Specimen preserves the P^3-M^2. Three infraorbital foramina present. Specimen has forward facing zygomatics with slight indentation beneath orbit. Lingual cusps of P^3-P^4 missing.
Sts 275	Type Site		Mandible	Left	Mandibular fragment with M_1-M_2. Mesial, buccal and lingual enamel of M_1 missing; however, M_2 is complete and can be measured.
Sts 276	Type Site		Mandible	Right	Mandibular fragment with P_4-M_2. Specimen is heavily worn. Inferior mandible reaches mesial P_4.
Sts 277	Type Site	*P. izodi*	Maxilla	Right	Maxillary fragment with P^3-M^2. M^3 is in crypt. Specimen is in fairly good condition. Slight indentation on maxilla appearing as a fossa, but not enough of the regions is preserved to be diagnostic.
Sts 278	Type Site		Mandible	Left	Mandibular fragment with M_1 and M_3. Inferior margin appears to be slightly turned in medially.
Sts 279	Type Site	*C. williamsi*	Mandible	Left	Mandibular fragment with M_1-M_3; specimen is fractured just inferior to teeth. So, very little morphology is present on mandible. M_1 is heavily fragmented, but can visualize v-shaped buccal clefts. M_2 and M_3 are measureable, but the M_3 hypoconulid is fractured.
Sts 280	Type Site	*P. izodi*	Mandible		Mandibular fragment with P_3-M_3. Specimen is small in size; looks almost *Pp. jonesi.* Disto-buccal cusp of M_2 missing. Complete buccal side of M_3 is missing and/or covered with plaster/glue.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 281	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment with dm_2 and M_1 (erupting) bilaterally. No measurements except length of left M_1 possible because of fracture or breccia.
Sts 282	Type Site		Mandible	Right	Mandibular fragment with M_1-M_2; Delson (1981) and Eisenhart (1973) state that this is not a *Cercopithecoides*, but S. Leigh states that it is. Specimen appears to have high cusps with v-shaped buccal clefts. Also, specimen is more heavily worn on buccal side more than lingual. Fragment of prominentia lateralis also appears to be present. Specimen appears to have a small mandibular fossa.
Sts 283	Type Site		Mandible	Both	Anterior portion of a mandible. Left C_1 (erupting), P_3-P_4 preserved. Right C_1 (erupting) and P_3 preserved. Only, left P_3 and P_4 (breadth only) are measureable; remaining dentition is too damaged.
Sts 284	Type Site		Maxilla	Right	Maxillary fragment with P^3-P^4. Specimen is small in size and is missing anterior teeth. Anterior alveoli are present. Specimen possesses a lightly built maxillary fossa.
Sts 285	Type Site		Mandible	Left	Mandibular fragment with M_3. Specimen has a partial ascending ramus, but no processes are preserved.
Sts 286	Type Site		Mandible	Left	Mandibular fragment with M_3. Specimen is missing the hypoconulid (fractured). No information on the status of the mandibular on fossae. Cf. *Pp. broomi*.
Sts 287	Type Site		Maxilla	Both	Maxillary fragment with right P^3-M^2; Left tooth fragments only. Right buccal side missing on preserved teeth. Only lengths can be taken.
Sts 288	Type Site	*C. williamsi*	Mandible	Left	Mandibular fragment with M_2 and M_3. M_2 missing buccal side, but length can be measured. Molars appear to possess v-shaped buccal clefts with high cusps and buccal wear.
Sts 289	Type Site		Mandible	Right	Mandibular fragment with M_1 and mesio-buccal cusp of M_2; no other information determinable.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 290	Type Site	*C. williamsi*	Mandible	Left	Mandibular fragment with dm_2, M_1 and M_2 (unerupted); juvenile.
Sts 291	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment still suspended in breccia; very good looking tooth (i.e. not worn). All measurements possible.
Sts 292	Type Site		Maxilla	Left	M^3 (root embedded in breccia).
Sts 293	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment. Most of mandible fractured and missing except for portions surrounding tooth roots. Matrix and glue cover the buccal and lingual side of the dentition, respectively. The mesio-lingual cusp of M_1 enamel is fractured away. So, no mesial loph measurements possible. Dentition is also heavily worn. Teeth are *Pp. jonesi* in size and shape; old adult.
Sts 294	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with dc^1, dm^1, dm^2 and M^1. Lateral margins of nasal aperture preserved, but specimen is missing anterior dentition. Palate appears to be relatively deep; no evidence of a maxillary fossa.
Sts 295	Type Site	*C. williamsi*	Mandible		Mandibular fragment with part of a tooth and alveoli; no evidence of a maxillary fossa. Difficult to determine the shape/direction of the zygomatic. Teeth are heavily worn; very old specimen. Most of dentition is fracture. However, specimen is unmistakably *C. williamsi*. Specimen possesses v-shaped buccal clefts. Only , M_3 can be measured. Specimen appears to be very small in size possibly a ?female but the premolars are only roots. So, tentative sex assignment.
Sts 296	Type Site	*Pp. broomi*	Mandible	Left	Mandibular fragment of very old adult. P_3 form suggests male; heavily worn specimen. Only measurements of P_3-P_4 possible. M_1 is fractured distally. Specimen appears to possess a mandibular fossa; fairly well developed.
Sts 297	Type Site		Maxilla	Both	Maxillary fragment with left M^1-M^2 and right P^3-P^4. Left side lingual enamel of P^4 is preserved, as well. Very small palate which is filled with breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 298	Type Site		Mandible	Right	Mandibular fragment with P_4-M_3. Only, M_1 near complete. M_3 preserved as buccal enamel only. M_2 buccal cusps only. P_4 only distal portion of tooth.
Sts 299	Type Site		Mandible	Both	Anterior portion of mandible with left M_1-M_2 and right P_3, M_1. Specimen is missing most of the inferior mandible.
Sts 300	Type Site	*C. williamsi*	Mandible	Both	Mandibular fragment with right C_1, P_3, M_1, M_2 and left M_1. Specimen is a juvenile. C_1's are erupting; only tips can be visualized, but looks to be quite large. P_3 on right side not fully erupted. Only M_1 (left) and M_2 (right) can be measured. M1 on right is missing most of mesial loph, most especially the mesio-lingual cusp. Prominentia lateralis visible on left side. Corpus of mandible with small portion of ascending ramus preserved, but both sides are missing gonion (fractured).
Sts 301	Type Site	*Pp. jonesi*	Maxilla	Left	Maxillary fragment with C^1-M^2. Only, P^3-M^1 are measureable. M^2 is preserved as the mesial loph only. C^1 is fragmented and appears to be not fully erupted.
Sts 302	Type Site		Mandible	Right	Mandibular fragment with M_2 (partial) and M_3. Difficult to visualize how previous analyses got a species designation for this fragmented specimen.
Sts 303	Type Site	*P. izodi*	Maxilla	Left	Mandibular fragment with M_1-M_3. Only preserves the distal loph of M_1. Dentition is in poor condition. Measurements are estimates only.
Sts 304	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with mixed dentition. dm_2, M_1 and M_2 (erupting, but not in occlusion). Mandibular corpus fragment which is very small in size. No evidence of a mandibular fossa; some measurements are possible.
Sts 306	Type Site	*Pp. jonesi*	Mandible	Left	Mandibular fragment. Very small female?; teeth are suspended in plaster and glue.
Sts 307	Type Site		Mandible	Right	Mandibular fragment with P_3-P_4. Specimen is covered in breccia, but teeth are measureable. Mental foramen observable just below the P_4. Specimen has a small sectorial P_3.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 308	Type Site		Maxilla	Left	M^3. Specimen looks papionin. Shallow palate; can visualize roots of other teeth. Young adult, worn very little.
Sts 309	Type Site		Mandible	Right	Mandibular fragment with P_4-M_3; heavily worn, and essentially teeth only; no enamel on m1 or buccal side p4
Sts 310	Type Site		Mandible	Left	Mandibular corpus with ascending ramus. Specimen preserves dm_1 and dm_2. Can visualize tip of C_1 erupting, but immeasurable. Also mesio-lingual cusp broken on dm_1. So, no mesio-buccal measurement taken. Length was estimated.
Sts 312	Type Site		Mandible	Left	Mandibular fragment with M_1 (partial), M_2 and M_3. M_1 preserved as only a distal loph fragment. M_2 is fairly complete, and M_3 missing disto-buccal cusp.
Sts 313	Type Site		Mandible	Left	Mandibular fragment with P_3-M_2. M_1 crown fragmented, and M_2 missing lingual side. Specimen appears to have mental foramen just below P_4.
Sts 314	Type Site		Mandible	Left	Mandibular fragment with P_4 and M_2. Shallow mandibular fossa. Enamel is chipped on lingual side of both teeth. So, breadths were estimated.
Sts 315	Type Site	*Parapapio*	Maxilla	Left	Maxillary fragment with mixed dentition. dm^1, dm^2 and M^1 erupting, but not in occlusion (about 50% erupted). Left side of maxilla can be visualized in lateral view, but most of specimen is encased in breccia. Very small in size.
Sts 316	Type Site	*Parapapio*	Mandible	Left	Mandibular corpus with M_1 and M_2. M_2 only 25% erupted and immeasurable; M_1 distal loph fractured.
Sts 317	Type Site		Mandible	Left	Mandibular fragment with C_1-M_1; C_1 heavily worn. Teeth have been placed into plaster.
Sts 318	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with M^1-M^2 (fully erupted), but M^3 is still in crypt. Partial zygomatic is preserved, but unfortunately breccia and preservative material hinder much of the anatomical observations.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 319	Type Site	*Parapapio*	Maxilla	Both	Maxillary fragment with mixed dentition. Left dm^1, dm^2 and right dm^2 and unerupted M^1. Deep palate (comparatively speaking).
Sts 320	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with M_1 (erupted) and M_2 (in crypt). Specimen shows gnawing on lingual surface; however, it is difficult to tell much else with preservative on the specimen.
Sts 322	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with left P4(partial)-M3. Three to four infraorbital foramina. Maxillary fossa below the orbit. Nasal aperture present, but bones around it covered with glue.
Sts 323	Type Site	*Pp. broomi*	Mandible	Both	Mandibular fragment with left I_1, I_2, P_3-M_1 and right I_1, I_2, P_3, P_4. Specimen labeled as *Pp. whitei* (noted on actual specimen). Maxillary fossa relatively small on left side; right covered with glue. Posterior foramen visible. Anterior surface covered with glue and not visible. Inferior symphysis ends at about level of the P_4.
Sts 324	Type Site		Maxilla	Both	Maxillary fragment with mixed dentition. Very nice palate and snout. Preserves dm^1-dm^2 and M^1 (bilaterally). Both M^1's are almost fully erupted, but are not in occlusion yet.
Sts 325	Type Site	*P. izodi*	Maxilla	Right	Maxillary fragment with infraorbital region. M^2 and M^3 preserved. Three to four infraorbital foramina (foramina filled with breccia). Specimen displays forward facing zygomatics with slight depression beneath orbital region. M^2-M^3 complete, and M^3 appears *Lophocebus*-like.
Sts 326	Type Site		Mandible	Left	Mandibular fragment with M_2-M_3. Superior portion of mandible near ascending ramus preserved. Anterior portion of coronoid process preserved; however, M_2 is fractured mesio-buccally.
Sts 327	Type Site		Mandible	Right	Mandibular fragment with M_2-M_3. Mandible is highly fragmented and only on roots remains.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 328	Type Site		Mandible	Left	Mandibular fragment with M_2 (partial) and M_3 (erupting). Only very distal enamel of M_2 preserved. M_3 may not be reliably measureable because not fully erupted. Mandibular corpus preserved as only superior portion with a partial ascending ramus.
Sts 329	Type Site	*Pp. jonesi*	Mandible	Right	Mandibular fragment with P_3-M_3; small sectorial P_3. Measurements are only estimates.
Sts 330	Type Site	*P. ẓodi*	Maxilla	Right	Maxillary fragment with P_4-M_3. Specimen appears to be a *Pp. broomi*, although it was placed in the *Pp. jonesi* box. Specimen has a nicely developed maxillary fossa. Teeth also appear to have *Pp. broomi* proportions.
Sts 331	Type Site		Mandible	Both	Mandibular fragment with right C_1-M_3 and left C_1-M_2. Most teeth are measureable. Appears to be a very small individual.
Sts 332	Type Site		Cranium	Both	Basicranium and posterior palate with left P^4-M^3 and right M^2-M^3. Complete foramen magnum, right side temporal with auditory meatus, root of zygomatic and posterior $^1/_3$ to ½ of the zygomatic. Specimen exhibits a slight temporal line.
Sts 333	Type Site	*Pp. jonesi*	Cranium	Left	Cranium with frontal, orbit and maxilla with C^1 (erupting), M^1, M^2-M^3 erupting. M^3 still in crypt. Specimen may have maxillary fossa, but fracture makes identification difficult.
Sts 334	Type Site		Mandible	Both	Mandibular fragment with left M_1-M_2 and right P_4-M_1. Anterior surface of mandible fleeting; inferior surface reaches about mesial P_4. Specimen is missing the anterior dentition. M_1 left disto-lingual cusp is fragmented; right side of specimen is more complete.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 335	Type Site	*P. izodi*	Mandible	Both	Mandibular fragment with left P_4-M_3 and right P_3-M_3. Mandible is distorted. M_3's are moved medially toward each other; left side not measureable. All left teeth are missing the buccal halves (sheared off). Right side measureable but worn heavily. Specimen is missing anterior portion of mandible and is held together with plaster.
Sts 336	Type Site		Maxilla	Both	Maxillary fragment with right P^3-M^3 and left P^4, M^2. Specimen labeled as *Pp. whitei*. Only, teeth actually present are the P^4 and mesial loph of M^1, others missing, but can visualize alveoli. Specimen is more likely a *Pp. broomi*.
Sts 337	Type Site		Mandible	Both	Mandibular fragment with right C_1-M_2 and left I_2-M_1. Mandible is fractured and distorted. Right C_1 is completely out of line with remaining dentition. Very old individual; heavily worn.
Sts 338	Type Site		Mandible	Both	Mandibular fragment with right P_3-M_3, but on left side only lingual enamel of M_3 can be visualize. Other teeth are fractured and/or covered with plaster. M_2 (right) missing disto-lingual cusp. Mandible is missing inferior portion and portion anterior to P_3 (right). Two halves held together with plaster.
Sts 339	Type Site		Mandible	Right	Mandibular fragment with C_1-M3; heavily damaged. Only, M_2 is measureable.
Sts 340	Type Site	*Pp. jonesi*	Mandible	Both	Mandibular fragment with right I_1-I_2, dc_1, dm_1-dm_2, M1 and left I_1-I_2, (unerupted) C_1.
Sts 341	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment. M_3 appears abnormal because postmortem fracture has shifted the mesial and distal lophs buccally. Length measurement not taken on M_2, but all other measures possible. No M_3 measurements.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 342	Type Site	*P. izodi*	Mandible	Right	Mandibular fragment with C_1-M_3. Most teeth are damaged and immeasurable. Only tooth which can be accurately measured is M_3.
Sts 343	Type Site	*Pp. broomi*	Maxilla	Right	Maxillary fragment with partially erupted M^3. M^2 is missing but alveolus is preserved. Specimen appears to have a maxillary fossa and horse-shoe shaped palate indicative of *Pp. broomi*. Canine alveolus suggests the specimen would have possessed a large C^1.
Sts 344	Type Site	*C. williamsi*	Mandible	Left	Mandibular fragment with M_1-M_3 with coronoid and condyle processes and sigmoid notch. No symphysis. Specimen possesses a prominentia lateralis with a mandibular corpus that is short and broad. M_1 preserved (root only). Buccal side is worn more. Specimen has v-shaped buccal clefts. Gonion present and shows slight lipping.
Sts 345	Type Site	*Parapapio*	Palate	Both	Maxillary fragment with left di^1-dm^2 and right dm^1-dm^2.
Sts 346	Type Site		Mandible	Left	Mandibular fragment with a partial M_2 and M_3. Mesial loph of M_2 and hypoconulid M_3 enamel missing. Specimen preserves a portion of the ascending ramus and superior portion of the mandibular corpus.
Sts 347	Type Site	*C. williamsi*	Maxilla	Right	Maxillary fragment with C^1-M^1 (roots only), M^2 (partial crown) and M^3 (complete). Root of zygomatic appears to be *C. williamsi* in form. C^1 is immeasurable but looks male in size. Only m^3 can be measured, but is heavily worn.
Sts 348	Type Site	*Pp. jonesi*	Mandible	Left	Mandibular fragment with C_1-M_1. C_1 and P_3 are crowns; remaining dentition is roots only. Slight mandibular fossa present.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 349	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with C_1 (unerupted), dm_1-dm_2, M_1 and M_2 (unerupted). Most of mandibular corpus preserved, but missing much of anterior portion with the incisors. Inferior portion of the ascending ramus is preserved. dm_1 is fragmented leaving only enamel on the buccal side. The M_1 is the only tooth that can be measured.
Sts 350	Type Site	*C. williamsi*	Maxilla	Both	Maxillary fragment with right C^1, P^3-P^4, M^1; C^1 canine is large (i.e. male). Palate appears to be rectangular shaped, but no anterior teeth are present except right C^1. Alveoli in incisor region filled with breccia. Molar surface covered with breccia. P^3-P^4 slightly worn; left P^3 root only.
Sts 351	Type Site		Mandible	Left	Mandibular fragment with left P_3-M_3 and right C_1. Specimen is large in size. Some measurements possible; however, C_1canine fragmented though; looks definitely male. No evidence of a mandibular fossa. Mandible curves buccally inferiorly. *Papio*-sized C_1.
Sts 352	Type Site	*P. izodi*	Mandible	Left	Mandibular fragment with P_3-M_3. Specimen exhibits a shallow mandibular fossa. Sts 343 and Sts 352 may be same individual. Note, M_3 is hidden in lateral view by the ascending ramus. Bone in region of ascending ramus has been chipped away post-recovery.
Sts 353	Type Site	*C. williamsi*	Mandible	Left	Mandibular fragment with P_3-M_3; except M_1 (missing). Bucco-distal cusp of M_2 is slightly fractured. Inferior portion of mandibular symphysis ends near distal P_4. Cannot determine state of mandibular fossa.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 354	Type Site		Maxilla	Both	Maxillary fragment with right P^4-M^3 and left P^3-P^4, M^2-M^3. Plaster covers most sides of palate. Nasal bones can only be visualized superiorly. Only tooth lengths can be reliably measured. Buccal edge on all but right M^2 and unerupted M^3's is fragmented.
Sts 355	Type Site	*Pp. jonesi*	Mandible	Both	Mandibular fragment with right I_1-M_3 and left I_1-M_1. Fleeting inferior margin at about the mesial P_4 - distal P_3. Left M_1 is missing lingual enamel. Right M_3 only mesio-lingual fragment.
Sts 356	Type Site		Mandible	Right	Mandibular fragment with P_3-$M_$. Because of fragmentation, P_4 is only measureable tooth.
Sts 357	Type Site	*C. williamsi*	Maxilla	Both	Maxillary fragment with left dm^1-dm^2, M^1, M^2-M^3 (unerupted) and right M^1, M^2 (unerupted). Palate is distorted; as a result, difficult to determine exact shape. Three infraorbital foramina (left) are present. Nasal aperture fractured and missing anterior dentition. Specimen possesses forward facing zygomatics, as visualize on left.
Sts 358	Type Site	*Pp. broomi*	Mandible	Both	Mandibular fragment. Eisenhart designated as *P. robinsoni*. Specimen appears to have come from later levels. Specimen is large in size. Very few dental measurements can be taken because, as dentition is heavily worn and/or fractured. Definite male, as based upon sectorial P_3.
Sts 359	Type Site		Mandible	Both	Mandibular fragment with P_3-M_3 (bilaterally). Right side of mandible is more complete than left. Left side is missing crowns for M_1-M_2. Very old individual, heavily worn. Specimen possesses parallel tooth rows. Mandibular corpus is fragmented; difficult to assess the presence of fossae. Left side around P_4 indicates possible small fossa. P_3-M_3 lengths can be estimated.
Sts 360	Type Site		Mandible	Left	Mandibular fragment in poor condition. Left contains only tooth fragments

Specimen Number	Provenance	Taxon	Element	Side	Comments
					while right possesses P_3-M_3.
Sts 360a	Type Site		Mandible	Right	Mandibular fragment with M_3. Specimen possesses a coronoid process, but not condyle. Only bony fragment remaining is portion surrounding M_3.
Sts 361	Type Site	*C. williamsi*	Cranium	Left	Cranium. Left temporal and left basicranium. Auditory meatus, zygomatic process and small nuchal line are preserved. On basicranium, right occipital condyle and heavily fractured pterygoid plates can be visualized.
Sts 362	Type Site		Mandible	Both	Mandibular fragment with fragmentary left toothrow and right M_1-M_3. On left side, most teeth are only represented by the lingual enamel; on right, buccal enamel missing on M_2. Heavily worn on both sides. Mandibular corpus and inferior portion of ascending ramus. Buccal surfaces of mandible are not present on either side. Plaster with glue. Lengths only measured on left side; most other measures taken on right.
Sts 363	Type Site	*Pp. broomi*	Mandible	Both	Mandibular fragment with left P_3-M_3 and right C_1-M_3. Short mandible and inferior portion fleeting until the level of M_1. Only C_1 and P_4 on right and P_3-P_4 on left are measurable. Gonion turns in medially. Anterior and posterior foramina are visible.
Sts 364	Type Site	*Parapapio*	Cranium	Both	Cranium with muzzle and a partial braincase. Specimen preserves right dm^1-dm^2, M^1 and left dm^1-dm^2 and M^1. Only right M^1 measureable. Right side dentition is fractured; left side is obstructed by breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 365	Type Site	*Papio*	Mandible	Both	Mandibular fragment with partial dentition. Very large specimen previously labeled as *P. ingens*. On right side, P_3 sectorial present and left P_3-M_2. Teeth are heavily worn and buccal cusps on M_2 are missing. M_1 is also missing disto-buccal cusp. Specimen has a large well-developed maxillary fossa visible on right side. Anteriorly, the mandible appears to have well-developed lines moving inferio-laterally from incisor row; foramen is also visible on both sides of mandible (anterior-posterior). Alveoli are present for the canines and incisors. C_1 would have been large. Specimen may possibly with go with maxillary fragment Sts 265; same general size.
Sts 366	Type Site	*C. williamsi*	Mandible	Both	Mandibular fragment with right P_3-M_3 and left P_4-M_3. Short symphyseal region. Anterior surface is fractured; cannot determine extent of mandibular fossae. Specimen possesses a short and broad ramus. Prominentia lateralis on right side (left fractured). Toothrows are distorted because of fracture. No incisors or canines preserved. Sectorial P_3 (male) and P_4 (right) which leans distally. Specimen possesses v-shaped buccal clefts; however, feature is not at first obvious due to wear. Dentition worn more heavily on buccal side more than lingual.
Sts 367	Type Site	*Pp. jonesi*	Maxilla	Both	Maxillary fragment with M^1-M^3 (bilaterally). Specimen possesses maxillary ridges with *Pp. broomi*-sized maxillary fossa. Zygomatic (right) appears to flare. Only lingual cusps on right M^1-M^2. Length can be measured. M^3 is complete on right; left side M^1 is only root, M^2 only lingual cusp and M^3 is complete. M^3 is typical *Lophocebus*-like morphology.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 368a	Type Site	*Pp. jonesi*	Maxilla	Both	Maxillary fragment with right I^2-P^4 and left I^1-M^1 and roots of M^2-M^3. Three to four infraorbital foramina preserved. Specimen is missing left I^1-I^2, right I^1 (both alveoli are present) and right C^1 (fractured). Buccal cusps of right P^4 are missing. Left side, M^1 is missing disto-buccal cusp. Specimen possesses a relatively deep palate with incisive foramen.
Sts 369b	Type Site	*Pp. jonesi*	Mandible	Both	Mandibular fragment with left and right corpi. Inferior mandible terminates at the P_3 level. On right side, I_1-P_4; on left, C_1-M_1. Very small C_1 and P_3.
Sts 370a	Type Site	*P. izodi*	Mandible	Both	Mandibular fragment with left I_1-M_3 (unerupted). Right side has only buccal cusps of M_2. *Pp. broomi*?
Sts 370b	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with C^1-M^3 (unerupted). Specimen exhibits a maxillary fossa with a forward-facing zygomatic. Appears that the C^1 is not fully erupted; M^3 has also not fully erupted.
Sts 370c	Type Site	*P. izodi*	Cranium	Both	Basicranial fragment; foramen magnum and condyles preserved. Right side preserves the petrosal portion of the temporal.
Sts 370d	Type Site	*P. izodi*	Cranium	Left	Cranial fragment preserving most of greater wing of sphenoid on the left side. Foramen rotundum also preserved.
Sts 370e	Type Site	*P. izodi*	Cranium		?Cranial fragment; looks like part of an ethmoid but difficult to determine.
Sts 371	Type Site		Mandible	Both	Mandibular fragment with left P_3-M_3 and right M_1 (lingual fragment). Specimen is badly fragmented. M_3 is blocked from lateral view by the ascending ramus; very poor condition.
Sts 372	Type Site		Cranium		(b) petrosal portion of temporal, (c) left petrosal, (d) sphenoidal fragment and (e) parietal fragment.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 372a	Type Site		Maxilla	Both	Maxillary fragment with both toothrows. Various portions of cranium, also preserved. Specimen preserves the zygomatic. Evidence of shallow maxillary fossa. C^1 is very small, M^2 fractured and M^3 is missing (fractured at roots). Moderately deep palate. Specimen does not possess a forward facing zygomatic. More fleeting like *Parapapio*. Glue is present on infraorbital surface, and difficult to determine the number of infraorbital foramina (1-3?).
Sts 373a	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment which occludes with Sts 373b. I_1 erupting (bilaterally); additionally teeth preserved.
Sts 373b	Type Site	*Parapapio*	Maxilla	Both	Maxillary fragment with di^1-dc^1 (bilaterally); left side additionally preserves dm^1-dm^2, M^1 (erupting). Occludes with Sts 373a. Specimen preserves a partial inferior orbit and nearly complete nasal aperture.
Sts 374	Type Site	*P. izodi*	Mandible	Left	Mandibular fragment with ascending ramus, M_2-M_3.
Sts 374a	Type Site	*Parapapio*	Endocast	Both	Near complete endocast. Specimen preserves temporal and frontal lobes; however, it is missing the occipital lobes and midbrain. Specimen is in fair condition.
Sts 374b	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with ascending ramus, M_2-M_3. Very small specimen; could be *Pp. jonesi*. M^1 is missing mesio-lingual enamel.
Sts 375a	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment of an old adult (heavily worn dentition); Teeth are worn flat and very small in size. Specimen appears to be a female? Buccal side of M^2 is missing so no measurements were taken.
Sts 375b	Type Site	*Parapapio*	Tooth	Right	Heavily worn with a papionin lingual surface.
Sts 375c	Type Site	*Parapapio*	Tooth	Right	Tooth of an old adult; goes with Sts 375a-c, e

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 376	Type Site	*Parapapio*	Cranium	Both	Much of a flattened cranium which preserves bilaterally dm^1-dm^2 and M^1 (unerupted). Occlusal surfaces are distorted and turned lingually so that the lingual side rests on the palate. The cranial bones have collapsed into the braincase. Only, measurements of the left dm^1 and dm^2 left can be taken; others inaccessible.
Sts 377a	Type Site		Tooth		Isolated canine; complete with root and crown.
Sts 377b	Type Site		Tooth		Fragmented premolar.
Sts 378 a	Type Site		Maxilla	Both	Maxillary fragment with left C^1-M^3 and right C^1 (badly damaged).
Sts 378b	Type Site		Maxilla	Right	I^1 (worn)
Sts 378c	Type Site		Tooth	Indet.	Isolated I^x (heavily worn).
Sts 378d	Type Site		Tooth	Indet.	Isolated incisor; same specimen number belongs to a femoral fragment.
Sts 379a	Type Site		Maxilla	Right	Maxillary fragment with C^1 (erupting)-M^2. M^2 fractured and is preserved as only a root. Specimen has a well developed maxillary fossa.
Sts 379b	Type Site		Mandible	Right	Mandibular fragment with P^3-M^2. P^3 is sectorial; specimen might be a *Pp. jonesi*.
Sts 380a	Type Site		Maxilla	Left	Maxillary fragment with M^2-M^3. Specimen exhibits a shallow maxillary fossa at the root of the zygomatic. M^3 is missing majority of lingual ½ and the distal-buccal cusp is missing; in those regions only enamel remains.
Sts 380b	Type Site		Maxilla	Right	Maxillary fragment with M^2-M^3. M^2 is fractured on buccal side.
Sts 380c	Type Site		Maxilla	Left	Maxillary fragment with I^1; Specimen is heavily worn.
Sts 381	Type Site	*Pp. jonesi*	Tooth		(b) canine, (f) I^2, (g) I_x, (h) I^x

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 381c	Type Site		Tooth	Right?	C^1 with root; has been assigned to *P. jonesi*, but difficult to determine. Glue adhering to tooth surfaces makes it difficult to determine where cervix is; no measurements taken.
Sts 381d	Type Site		Tooth	Left	C_1
Sts 381e	Type Site		Tooth	Right	I^1
Sts 382a	Type Site		Mandible	Right	Mandibular fragment with M_3; no determination can be made concerning the extent of the fossa. Disto-buccal cusp of M_2 present. Portions of the inferior ascending ramus and gonion present.
Sts 383a	Type Site	*Pp. broomi*	Mandible	Right	Mandibular fragment with M_2-M_3. Lingual side of M_2 missing; M_3 fairly complete. Difficult to visualize visualize much morphology. Bone surface appears exfoliated.
Sts 383b	Type Site	*Pp. broomi*	Maxilla	Right	Maxillary fragment with C^1-M^3 (C^1 and M^3 erupting). Specimen is distorted in infraorbital region; difficult to determine the presence if a fossa is present. Specimen is exfoliated.
Sts 384	Type Site		Mandible	Right	Mandibular corpus fragment with cd_1, P_3-P_4 (erupting) and M_1.
Sts 385a	Type Site	*Pp. broomi*	Maxilla	Left	Maxillary fragment with P^3-M^3. Specimen is a partial palate; no anatomical information on fossa or zygomatic. Specimen preserves the palatine foramen (slit-like). Proportions do look *Pp. broomi* with a horse-shoe shaped palate.
Sts 386	Type Site		Tooth	Left	P_4 (crown only)
Sts 386a	Type Site		Mandible	Left	Mandibular fragment with P_3, M_1 and buccal cusps of M_3.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 387	Type Site	*Parapapio*	Mandible	Right	Specimen includes both (a) right maxillary piece P^4-M^3 and (b) right mandible piece: On both pieces, teeth are sheered nearly in ½ and covered with supportive material. Only measurement possible is length of M^3 (estimated). Specimen possesses a horse-shoe shaped palate reminiscent of *Pp. broomi* possessing only the buccal side of P^3-M^1, M^2 (¾ present buccally) and M^3 (80% buccal). Mandibular dentition, M_2-M_3 are less than 50% buccal present.
Sts 388a	Type Site	*Pp. broomi*	Maxilla	Right	Maxillary fragment with M^2-M^3. Specimen has zygomatic root which are forward facing. M^1 is present only as a root cross-section. Palatine foramen is present and appears slit like. Superior to M^1 roots is a slight appearance of a maxillary fossa.
Sts 388b	Type Site	*Pp. broomi*	Maxilla	Left	Maxillary specimen with M^3 probably goes with Sts 388a. Specimen looks *Lophocebus*-like (so does 388a).
Sts 389a	Type Site	*Papio*	Mandible	Left	Mandibular fragment with left I_1-P_3; I_1-M_2. Specimen is a large mandible with a large mandibular fossa. On left side, the mental foramina (one large and two very small) can be visualized. A strong ridge can be observed from antero-superior mandible and fades inferio-laterally. Postero-inferior mandible reaches back to about mid-distal P_3. Teeth are heavily worn, but some measurements can reliably be taken. Teeth preserved, left P_3 (broken at top of cusp), bilateral C_1's (fractured at tip); right I_2 (fractured crown), M_1 and M_2 (roots).
Sts 389b	Type Site	*Papio*	Maxilla	Right	Specimen goes with 389a (mandibular fragment). Alveoli present on I^2, C^1, P^3 and P^4 (crown) and M^1 (crown). Disto-buccal cusp of M^1 missing. Palate appears to be relatively deep. Difficult to judge status of the maxillary fossa because of maxillary fracture.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 390a	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment missing most of anterior dentition. C_1 appears to be a *Pp. broomi* female. Mandible has corpus and ascending rami. Specimen is missing most mandibular processes. No evidence of a mandibular fossa and inferior margin of anterior mandible ends about mid-P_3. Note, partial condyle on left side.
Sts 390b	Type Site	*Parapapio*	Mandible	Left	C_1. Specimen goes with Sts 390a. Very small canine; complete tooth and root.
Sts 391a	Type Site		Mandible	Right	M_2 (crown); large, but not as large as the *P. ingens* material.
Sts 391b	Type Site		Mandible	Left	M_2 (crown)
Sts 391c	Type Site		Maxilla	Left	M^1 (crown)
Sts 391d	Type Site		Mandible	Left	P_4 (crown)
Sts 391e	Type Site		Maxilla	Right	P^4 (crown)
Sts 391f	Type Site		Maxilla	Right	C^1 (enamel fragment only); no measurements taken.
Sts 391g	Type Site		Mandible	Right	P_3 (crown). No measurements.
Sts 391h	Type Site		Maxilla	Right	I^1 (labial fragment only)
Sts 391i	Type Site		Maxilla	Left	I^1 (crown). Large papionin. Root fractured. Most other measurements possible.
Sts 391j	Type Site		Maxilla	Right	I^2 (labial enamel only)
Sts 391k	Type Site		Mandible	Right	C_1 (fractured)
Sts 391l	Type Site		Mandible	Left	I_2 (labial enamel fragment)

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 392	Type Site		Cranium	Both	Cranium with partial braincase and muzzle. Specimen preserves right M^1-M^3. Specimen is heavily fragmented and distorted. Cranial bones/features preserved are the right temporal (with root of zygomatic, auditory meatus, superior lateral orbit and frontal showing a strong temporal line. Parietals transposed on top of frontal on right side; very little of the left side present. Some evidence of a light nuchal line. M^1 is missing mesio-lingual loph. Remaining dentition can be measured.
Sts 393	Type Site	*Parapapio*	Cranium	Both	Fairly complete cranium which is laterally flattened. Right complete orbit and muzzle (damaged) with C-M^3 are present. Dentition is heavily worn. Also preserved are right frontal, temporal and partial parietal and the left side muzzle and supraorbital. Anterior teeth (a few) are present, but probably immeasurable.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 394a	Type Site	*C. williamsi*	Cranium	Left	Partial cranium. Left side, not very complete, but preserves a partial muzzle and the supero-medial orbit. Teeth on left are sheared and not measureable. Also on the left, frontal (complete) and temporal; although the temporal is missing the zygomatic arch. Cannot visualize the auditory meatus. A nuchal line is preserved on the left side, fairly well developed. Palate is horse-shoe shaped with both pterygoid processes. Right side, muzzle relatively complete. Specimen exhibits a small maxillary fossa. Zygomatics are forward facing. Three infraorbital foramina. Specimen exhibits a short nasal; however, some morphology obscured by plaster. Maxilla slopes down steeply from nasal margin. Occlusal plane appears to be only slight convex. Supraorbital tori are well developed with ophryonic groove. Only anterior portion of temporal on right side, remainder missing. Basicranially, foramen magnum with condyles and sphenoid preserved. Temporal line is a prominent ridge; most of the enamel on the specimen has been fractured.
Sts 394b	Type Site	*C. williamsi*	Mandible	Both	Mandible with full dentition. Specimen goes with 394a, c. Right side, all teeth are present, but incisor enamel is fractured. Specimen has an ascending ramus, but does not preserve gonion or the processes. Right side exhibits a prominentia lateralis. Left side fractured in this area. C_1 is small in size; probably female. Ramus is broad and short. Right side appears to be distorted inward superiorly probably because of postmortem distortion. Left side, only buccal side of mandible preserved until about P_3; lingual side preserved posterior-M_3.
Sts 395a	Type Site	*Parapapio*	Cranium	Both	Much of a crushed cranium. M^3's (unerupted). Specimen is heavily distorted and damaged. No measurements; goes with 395b, c.
Sts 395b	Type Site	*Parapapio*	Tooth	Indet.	Canine, no measurements or siding.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 395c	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with M_3 (erupting). No measurements.
Sts 396a	Type Site	*P. izodi*	Cranium	Right	Cranium with partial muzzle. Specimen preserves M^3, complete orbit (right), temporal line; however, too much glue/preservative has been applied to the specimen. Well-developed maxillary fossa on right side. Zygomatic, most of temporal, frontal and parietal are preserved. Occipital is missing, but replaced with endocast. On left side only supraorbital region is preserved.
Sts 397	Type Site	*Pp. broomi*	Cranium	Both	Near complete cranium with M^1-M^3 (bilaterally). Missing cranium posterior to parietals. Foramen magnum is present. Basicranium is filled with breccia. Posterior palate is preserved. Specimen appears to be a *Pp. broomi* with diagnostic zygomatics and lightly developed maxillary fossa. *Lophocebus*-like type M^3's.
Sts 398a	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with P^3-M^3. Specimen preserves a small piece of the zygomatic root, horse-shoe shaped palate. No information on the state of the maxillary fossa. Specimen is fragmented and heavily worn. Not a young adult, as catalog states.
Sts 398b	Type Site	*P. izodi*	Cranium	Left	Cranium with left auditory region of temporal. Specimen preserves the auditory meatus, post-glenoid process and root of zygomatic.
Sts 398c	Type Site	*P. izodi*	Tooth	Right	M_2 (crown). Enamel is chipped; no measurements taken.
Sts 399a	Type Site	*Parapapio*	Mandible	Right	dm_1-dm_2 with M_1 in crypt. dm_1 (fragmented) only distal-buccal cusp present. dm_2 can be measured and length of M_1 can be estimated.
Sts 399b	Type Site	*Parapapio*	Tooth	Indet.	di?
Sts 400	Type Site		Endocast		Partial endocast with very small cranial fragment encased in breccia.
Sts 400a	Type Site		Tooth	Left	P_4 (crown)

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 400b	Type Site		Tooth	Left	I_2 (fragmented crown)
Sts 400c	Type Site		Tooth	Left	I_2 (highly fragmented); no root and no measurements.
Sts 401a	Type Site	*Parapapio*	Tooth	Left	Young adult; not heavily worn.
Sts 401b	Type Site	*Parapapio*	Tooth	Left	P_4 with both roots; slightly worn.
Sts 402a	Type Site		Tooth	Left	M^3 (crown)
Sts 402b	Type Site		Tooth	Indet.	I1? Fragmented root
Sts 403a	Type Site		Mandible	Right	Mandibular fragment with dm_2 and P_3 (erupting).
Sts 403b	Type Site		Tooth	Indet.	P^3 fragment in poor condition.
Sts 403c	Type Site		Tooth	Right	P_4 (moderately worn)
Sts 404a	Type Site		Mandible	Right	Mandibular fragment with M_2 (partial) and M_3. Species designation ot possible, although previous analyses assign to species.
Sts 404b	Type Site		Tooth	Right	P_4 (fractured)
Sts 405	Type Site		Cranium	left?	Fragmentary neurocranium. Not readily identifiable.
Sts 405a	Type Site		Tooth	Left	M^1 goes with Sts 405b.
Sts 405c	Type Site		Tooth	Right	I^1 (fragmented crown); no measurements.
Sts 406	Type Site		Cranium	Indet.	Cranium. Specimen appears to exhibit the parietal suture? Largely indiscernible fragment.
Sts 406a	Type Site		Tooth	Right	M^1-M^2. No maxilla preserved.
Sts 406b	Type Site		Tooth	Right	M^2 (missing mesio-lingual cusp)
Sts 406c	Type Site		Tooth	Right	M^3 (crown and partial root)

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 407	Type Site		Mandible	Left	Mandibular fragment with broken teeth and impression of mandible on right side.
Sts 407a	Type Site		Mandible	Right	M_1-M_2. M_1 is only the lingual side, remainder fractured and heavily worn. M_2 partially complete, but only superior most portion of the crown. So, only length can be measured accurately.
Sts 407b	Type Site		Tooth	Left	P^4 (crown)
Sts 407c	Type Site		Tooth	Indet.	Isolated molar fragment, partial crown only.
Sts 407d	Type Site		Tooth	Right	P^4 with partial roots; enamel chipped and fragmented.
Sts 407e	Type Site		Tooth	Left	P_3 (heavily fractured); no measurements taken.
Sts 408a	Type Site	*Parapapio*	Tooth	Right	Female; very small in size. Unknown species.
Sts 408b	Type Site	*Parapapio*	Tooth	Left	P_4; roots not fully formed.
Sts 409	Type Site		Endocast	Both	Almost complete endocast; missing complete frontal lobe on left side. Retains a portion of the frontal lobe on right. Specimen preserves both temporal lobes; transverse sinus can be visualize in the posterior portion of the brain.
Sts 409	Type Site		Mandible	Left	Mandibular fragment with P_3-M_3. Inferior margin of mandible is inward flexed. Teeth heavily worn. P_4 missing distal portion.
Sts 410a	Type Site	*P. izodi*	Tooth	Right	Maxillary fragment with M^2-M^3. Lingual enamel of M^1 present, but very little other detail can be observed. Breadths and lengths of M^2-M^3 can be taken; remaining measures unreliable.
Sts 410b	Type Site	*P. izodi*	Tooth	Right	M_3; Specimen also has small enamel fragment of disto-lingual cusp of M_2. Small portion of the mandible on the lingual side preserved.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 411a	Type Site	*P. izodi*	Mandible	Right	Mandibular fragment with P_4-M_2; slight depression of a fossa present. Evidence of a crypt for M_3, but specimen is not present and/or fractured in area.
Sts 411b	Type Site	*P. izodi*	Mandible	Left	Mandibular fragment with M_1, M_3 (erupting). Specimen goes with Sts 411a; which has some *C. williamsi* features. Small fragment of mandible; ascending ramus appears short.
Sts 412	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment which is fractured and distorted. Difficult to determine dentition with confidence. Only, one tooth is clearly recognizable, the M^2. A partial mesio-lingual of M^3 and the P^4 (heavily worn) can be visualized.
Sts 413	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment. On left side, a few molar roots can be visualized and a fragment of P_4 enamel. Specimen needs preparation, as mandible projects into breccia and most of it is surface is covered by breccia.
Sts 413a	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment of immature adult with M_1, empty alveolus for M_2 and M_3 in crypt. Measurements taken of M_1.
Sts 413b	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with dm_1-dm_2 and M_1. dm_1 (worn), but can be measured accurately.
Sts 414a	Type Site	*P. izodi*	Mandible	Left	Mandibular fragment with I_1-M_3; C_1 is fractured, most others complete, but in poor condition. Glue/preservative is present on the lingual side of the I's. Specimen also preserves the right I_1 and a shallow maxillary fossa with a sectorial premolar.
Sts 414b	Type Site	*P. izodi*	Maxilla	Left	Maxillary fragment with P^3-M^3. Fractured C^1 also present, but in very poor condition. Teeth measureable but slightly worn. Very little maxilla remaining, mostly plaster.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 415a	Type Site		Maxilla	Both	Maxillary fragment with left I^2-C^1, P^4 and right C^1; all are heavily worn.
Sts 416	Type Site		Maxilla	Indet.	Maxillary fragment with broken teeth and bone/tooth impressions. Specimen not very diagnostic, or helpful. Specimen is encased in breccia. Difficult to assess side. Can visualize of fragments of P^3-P^4, impressions of M^1-M^2 (root and tooth) and fragment of M^3.
Sts 416a	Type Site	*P. izodi*	Mandible	Both	Mandibular fragment with left M_1-M_3 and right M_2-M_3. Mandible is thick and distorted medially on both sides. Anterior portion is made of plaster. Only, left M_2-M_3 and right M_2 are measureable.
Sts 417a	Type Site		Tooth	Right	Isolated M3 (crown)
Sts 417b	Type Site		Tooth	Right	P^3 (crown)
Sts 418a	Type Site		Tooth	Right	C_1
Sts 418b	Type Site		Tooth	Right	I_1
Sts 418c	Type Site		Tooth	Indet.	I_1
Sts 419a	Type Site		Tooth	Right	M^1 s
Sts 419b	Type Site		Tooth	Left	I1 (crown)
Sts 420a	Type Site		Maxilla	Right	Maxillary fragment with M^1 and mesial loph of M^2.
Sts 421	Type Site		Mandible	Left	Mandibular fragment. Sex unknown; catalog suggests male. Young adult based upon tooth wear. Specimen is very small. Mandible is mostly reconstructed material with very little of original mandible present.
Sts 421	Type Site	*Pp. jonesi*	Cranium	Left	Cranial fragment; not readily identifiable, bus has partial endocast. Needs preparation and to be removed from breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 422	Type Site		Tooth	Indet.	Tooth fragments with possible cranial fragments. Needs preparation; specimen is in block of breccia.
Sts 422	Type Site		Maxilla	Right	M^1-M^2 (enamel fragmented)
Sts 423	Type Site		Mandible	Indet.	Mandibular fragment with impression of M_3; side uncertain. Specimen does preserve most of the condyle, but unfortunately, condyle is encased in breccia; specimen needs preparation.
Sts 423	Type Site		Mandible	Left	Mandibular fragment with M_2-M_3. Mainly, buccal side of specimen present, other side either fractured (M_2) or covered with plaster (M_3). Only, length measurements taken, but specimen looks *Pp. jonesi* in size and proportion.
Sts 424	Type Site		Cranium	Indet.	Neurocranial fragment. Specimen appears to be right frontal and parietal, or some portion of those. Assessment based upon what looks to be the coronal suture between the two bones.
Sts 424	Type Site		Tooth	Left	C^1, P^3-P^4; no teeth. Only, roots remaining in plaster.
Sts 425	Type Site		Mandible	Right	Mandibular fragment with M_3 (unerupted), cuspy in appearance. Papionin in form. Specimen not reliably measureable; measurements are estimates, because breccia surrounds most tooth surfaces.
Sts 426	Type Site		Mandible	Both	Mandibular fragment, mainly anterior portion. Specimen preserves the left P_3 and right P_3-P_4, M_1. Specimen possesses small P_3's. Only, enamel on buccal and mesial sides of M_1 remains. Exhibits *Parapapio* proportions.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 427	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with heavily worn teeth. Specimen preserves a partial mandible with fragmentary roots of M_1 and M_3. Appears to have had a mandibular fossa, but because of break, unable to tell to what extent the fossa was developed. Specimen appears to be covered with lacquer-like substance; unable to assess weathering.
Sts 427	Type Site		Mandible	Both	Impression of right and left mandible fragments. M_2-M_3 impression visible on left side; on right side, M_3 lingual cusps fragmented and disto-lingual fragment of M_2. Specimen appears to have high cusps like *C. williamsi*, and is approximately the same size.
Sts 428	Type Site		Cranium	Both	Much of calvaria; looking at endocranial side. Specimen is still encased in breccia.
Sts 428	Type Site		Maxilla	Right	Maxillary fragment with M^1-M^2. M^1 is distorted, arranged obliquely to M^2.
Sts 429	Type Site		Maxilla	Right	Maxillary fragment with mixed dentition. Specimen preserves dm^1, dm^2 and M^1. Lateral surface of nasal aperture present, but anterior dentition is missing. Mesio-buccal cusp of dm^1 missing.
Sts 430	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment missing processes. M_1-M_3 are present. M_1's buccal cusps are fractured; breadth measurements not possible. Teeth are from a very old adult and are heavily worn.
Sts 430	Type Site	*Parapapio*	Cranium	Both	Cranium. Specimen appears to be a partial cranium fractured slightly superior to palate. Tooth roots can be visualize on right side. Left partial orbit (inferior surface) and some basicranial bones on left side (temporal). Specimen is still encased in breccia and needs preparation.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 431	Type Site	*Parapapio*	Maxilla	Left	Maxillary fragment covered with breccia. Only, teeth are visible. Left M^1 with an M^2 in the crypt.
Sts 432	Type Site	*Pp. broomi*	Maxilla	Right	Maxillary fragment with crowns that have been sheared off at P^3-M^2. Only, M^3 is present. Can visualize the roots of all from the occlusal view. Horse-shoe shaped palate.
Sts 433	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with dc^1, dm^1-dm^2. dm^1 (worn heavily)
Sts 434	Type Site		Cranium	Indet.	Neurocranial fragment. Specimen appears to be a fragment of the ?occipital region.
Sts 434	Type Site		Mandible	Right	Mandibular fragment with M_2 and M_3. M_2 missing disto-lingual cusp.
Sts 435	Type Site	*C. williamsi*	Maxilla	Right	Maxillary fragment with dm^1-dm^2, C^1 and P^4 in crypt. Note in box, stating that Delson in 1981 suggested that Sts 290 and Sts 435 may be the same individual. Heavily worn specimen. Measurements are estimates.
Sts 436	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment of very small individual. Specimen has fractured teeth; di_1, di_2, dc_1 and dm_1 present and measureable.
Sts 436	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment. Specimen preserves a portion of the mandibular corpus and broken teeth. Contains the roots of the M3 Fragment is from anterior M3 to gonion; including a small segment of the ascending ramus; another specimen is numbered Sts 436.
Sts 437	Type Site		Mandible	Left	M_3; only mandible is the alveolus around the tooth itself.
Sts 438	Type Site		Tooth	Right	M_3. Mesio-lingual cusp fragmented. So, mesio-buccal measurement must be estimated.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 439	Type Site	*Parapapio*	Tooth	Right	Two teeth with very little alveolar bone. dm2 fractured on mesio-lingual side.
Sts 440	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with heavily worn dentition. Very old adult which appears to be male based upon the presence of a highly sectorial P_3. Lingual side of the mandible is missing; mandible very incomplete.
Sts 441	Type Site		Tooth	Indet.	Impression of a large male canine; extant *Papio*-sized. However, specimen is only a portion of the canine impression.
Sts 441	Type Site		Maxilla	Left	Maxillary fragment with P^3-M^1. M^1 (heavily worn) and fractured, no measurements reliable. P^4 also fragmented on buccal side; only p^3 can be measured.
Sts 442	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with dm_2. Only about ½ of the depth of the mandibular corpus (i.e. superior-inferior) is preserved. A portion of the ascending ramus is present but also fractured away.
Sts 442	Type Site		Endocast	Both	Partial posterior-midfrontal endocast; juvenile? Specimen appears to preserve the sagittal sinus. Right side appears to be distorted medially and covered with breccia. Left side, no temporal present.
Sts 443	Type Site		Mandible	Right	Mandibular fragment with M_3.
Sts 444	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment of a young adult; appears very large in size.
Sts 444	Type Site		Mandible	Indet.	Mandibular fragment with premolar and molar roots. Appears, as if the anterior portion is preserved; however viewing of the mandible is from the inferior edge which has been fragmented to root level. Occlusal surfaces of teeth are in breccia; needs removal and preparation.
Sts 445	Type Site		Tooth	Left	P_3 (crown) -P_4 (root)

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 446	Type Site		Mandible		Mandibular fragment with M_1-M_2; distal fragment of P_4.
Sts 447	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with M_1 and M_2; not much mandible left. Specimen looks like M_2 is not fully developed and erupted (roots look underdeveloped).
Sts 448	Type Site		Mandible	Left	Mandibular fragment with P_4-M_2 (partial), M_1 (missing lingual cusps) and M_2 (only mesio-buccal cusp).
Sts 449	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with dm_2.
Sts 450	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with buccal side fractured. Dental roots can be visualized. Teeth are in very good shape and measurements were taken.
Sts 451	Type Site		Tooth	Indet.	dm1 and dm2, catalog states right, but difficult to determine side or jaw; looks mandibular. Material (preservative?) on lingual side of dm1, only length can be taken.
Sts 452	Type Site		Tooth	Indet.	Partial isolated molar; two cusps visible.
Sts 453	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with dm_1 and dm_2. Very small in size; C_1 alveolus preserved.
Sts 454	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment, buccal side only. M^1 is fractured on mesial side and material covers the distal loph (supporting). No measurements taken on M^1 due to its condition.
Sts 455	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with mixed dentition. dm^2 (roots), P^3-P^4 (crypt). Because of adhering breccia, no teeth are measureable.
Sts 456	Type Site	*Pp. jonesi*	Maxilla	Right	Maxillary fragment with P^3-M^1. Specimen has slight indication of maxillary fossa.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 457	Type Site		Endocast	Both	Nearly complete deformed endocast. A small portion of the neurocranium is still present. Endocast flattened superiorly-inferiorly on right side. Left side temporal with root of zygomatic and auditory meatus and partial orbital.
Sts 457	Type Site		Mandible	Left	Mandibular fragment with M_1 and M_2. Very little mandible remains.
Sts 458	Type Site		Cranium	Indet.	Cranial vault fragment; no further identification.
Sts 458	Type Site		Maxilla	Right	Maxillary fragment with M^3; *Lophocebus*-like.
Sts 459	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment of young juvenile. dc, dm^1-dm^2. dm^2 not in occlusion, not fully erupted. Only dm^1 and dm^2 can be measured, but dm^2 measures should be visualize as estimates.
Sts 460	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with very little maxillary bone. Two teeth are present (M^2-M^3). Very little wear, young adult.
Sts 461	Type Site		Mandible	Left	Mandibular fragment with mixed dentition. dm_2, C_1, M_1. Specimen is small in size. No evidence of a fossa, but really unable to tell because of fracture. Lingual side of dm_2 fractured; breadths not taken. Measurements of the M_1 taken; no measurements of C_1 because only barely visible.
Sts 461	Type Site		Cranium	Indet.	Partial neurocranium, but difficult to identify cranial fragments further.
Sts 462	Type Site		Maxilla	Right	Maxillary fragment with M^1-M^2. Slight indication of maxillary fossa. P^4 and P^3 roots only.
Sts 463	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment. Inferior portion of mandible missing and incomplete. Specimen appears to be a right based on lingual notch. Tooth worn very little; immature adult.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 464	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with C^1 (erupting), P^4, but M1 is fully erupted and shows evidence of occlusion (i.e. wear). Very little remains of maxillary fragment; listed as subadult because of lack of fully erupted dentition.
Sts 465	Type Site	*Parapapio*	Maxilla	Left	Maxillary fragment with M^3.
Sts 466	Type Site		Mandible	Left	Mandibular fragment with P_3, M_1-M_2. Alveoli present for some other teeth.
Sts 467	Type Site		Cranium	Indet.	Portions of a fragmented cranial vault.
Sts 467	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment with M_2 (partial) and M_3. Distal root fragment of M_2 present, but not measureable. M_3 not fully erupted or in occlusion.
Sts 468	Type Site	*Parapapio*	Mandible	Both	dc_1, dm_1-dm_2 and m_1 present bilaterally. Also, I_1's are erupting bilaterally. Right side dm_1 and di_2 fractured buccally; disto-buccal cusp of M_1 (left) fractured.
Sts 469	Type Site		Mandible	Right	Mandibular fragment with C_1-M_3. Heavily worn; mesio-lingual chips out of enamel on P_4, M_2-M_3; some measurements possible.
Sts 470	Type Site		Maxilla	Both	Maxillary fragment of badly distorted muzzle with two molars on left and one on right.
Sts 470	Type Site		Mandible	Indet.	Mandibular fragment with tooth (?P_3).
Sts 471	Type Site		Maxilla	Right	I^1 with partial root.
Sts 472	Type Site		Tooth	Right	I1 (crown); fractured longitudinally only labial surface is remaining.
Sts 473	Type Site		Mandible	Left	I_1-I_2 (crowns); specimens connected by glue.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 474	Type Site		Maxilla		Partial palate with fractured C^1; large *Papio*-size C^1. Can only visualize tooth in cross-section – fractured, no measurements. Palate looks like parallel toothrows. Specimen needs preparation. More of specimen may exist in the breccia, as most sides are covered by breccia.
Sts 474	Type Site		Tooth	Right	I^1; heavily worn.
Sts 475	Type Site		Tooth	Left	I_2
Sts 477	Type Site		Tooth	Right	I_2; heavily worn.
Sts 478	Type Site		Tooth	Left	I_2; fragment of root with partial crown, no measurements.
Sts 478	Type Site		Maxilla	Left	Maxillary fragment. Must be two Sts 478's. Specimen exhibits the interior of the nasal surface. A few teeth from the lingual side can be visualize, but are fractured (one definite molar, but others less obvious because of fragmentary nature of specimen).
Sts 479	Type Site		Tooth	Left	I_1
Sts 480	Type Site		Tooth	Left	I_2; missing most of root, but some measurements possible.
Sts 481	Type Site		Mandible	Indet.	Mandibular fragment with molar fragments; specimen is in poor condition.
Sts 482	Type Site		Tooth	Right	I^1. Very old individual. Only 2 mm of enamel remains; remainder has been worn away.
Sts 484	Type Site		Cranium	Indet.	Most of crushed neurocranium. Nothing measureable.
Sts 484	Type Site		Tooth	Right	C_1 (crown)

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 485	Type Site		Endocast	Both	Juvenile endocast. Can visualize orbits in breccia; but specimen is mostly endocast with little or no evidence of vault bones. Frontal and parietal lobes present; however, no occipital or temporal regions preserved.
Sts 485	Type Site		Tooth	Right	C_1; tip and root fractured. Specimen is worn heavily.
Sts 486	Type Site	*Parapapio*	Tooth	Right	P_3; heavily worn on sectorial side. Old adult – sized based assumption that it is a female.
Sts 487	Type Site		Tooth	Right	C^1 (fractured); no measurements.
Sts 488	Type Site		Maxilla	Left	Maxillary fragment; most likely male. C^1 (erupting) and P^3.
Sts 489	Type Site		Tooth	Left	P^3 (crown)
Sts 490	Type Site		Tooth	Left	P_4
Sts 491	Type Site		Endocast	Indet.	Partial endocast with a few cranial bone fragments adhering to surface. Very little anatomical information visible. Note, must be two Sts 491's.
Sts 492	Type Site		Tooth	Right	P^4
Sts 493	Type Site	*Parapapio*	Tooth	Right	Young adult; tooth not worn. Specimen has some adhering matrix; catalog suggests male.
Sts 493	Type Site		Cranium	Indet.	Most of a neurocranium of a juvenile? Can visualize sagittal, nuchal and coronal sutures.
Sts 494	Type Site		Tooth	Left	P^4
Sts 494	Type Site		Cranium	Indet.	Partial cranial vault in poor condition.
Sts 495	Type Site		Tooth	Left	P^3

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 496	Type Site		Tooth	Left	P^3 (crown)
Sts 497	Type Site		Tooth	Right	P_4
Sts 498	Type Site		Tooth	Left	P^3 (worn little)
Sts 499	Type Site		Tooth	Left	P^3 (crown)
Sts 500	Type Site		Tooth	Left	P^3 (crown)
Sts 501	Type Site		Tooth	Right	P_4 (fragmented crown)
Sts 502	Type Site		Tooth	Right	P^3 (heavily worn); no measurements.
Sts 503	Type Site		Maxilla	Both	Maxillary fragment. Partial palate with tooth roots. Palate fractured superiorly. So, can visualize palate and teeth from superior view. Teeth project into the breccia; needs preparation.
Sts 503	Type Site		Tooth	Left	C_1
Sts 504	Type Site	*Parapapio*	Tooth	Left	Tooth crown only with chipped distal portion. Two fragments can be articulated to make complete tooth, measurements are possible.
Sts 505	Type Site		Tooth	Left	M_2
Sts 506	Type Site		Tooth	Right	M_2 (crown)
Sts 507	Type Site		Tooth	Right	M^1 (crown); no measurements taken.
Sts 508	Type Site		Mandible	Both	Mandibular fragment, anterior. Very small in size with v-shaped buccal clefts. Roots visible, but easily discernible. Roots look very thin and small; ?*C. williamsi*.
Sts 508	Type Site		Tooth	Left	M^3
Sts 509	Type Site		Tooth	Right	M^2 with all roots; heavily worn. Most measurements possible.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 510	Type Site	*Parapapio*	Tooth	Right	M^3. Specimen preserves mesial and lingual roots; distal root missing. Lightly worn; young adult.
Sts 511	Type Site		Tooth	Left	M_3 with partial roots.
Sts 512	Type Site		Tooth	Left	M^3 with all roots; nearly complete.
Sts 513	Type Site		Tooth	Right	M^3?; crown only.
Sts 514	Type Site		Tooth	Left	M^3.
Sts 515	Type Site		Cranium	Indet.	Neurocranium fragment. No discernible anatomy.
Sts 515	Type Site		Tooth	Right	M^1
Sts 516	Type Site	*C. williamsi*	Tooth	Right	M_3; mesio-lingual cusp fractured. V-shaped buccal clefts with high cusps.
Sts 517	Type Site		Tooth	Left	M^2; worn heavily. No measurements.
Sts 518	Type Site	*C. williamsi*	Tooth	Left	M_2; buccal wear. High cusp; v-shaped buccal clefts.
Sts 519	Type Site		Tooth	Right	M^2
Sts 520	Type Site	*Parapapio*	Tooth	Left	Crown only, fragmented roots.
Sts 521	Type Site		Tooth	Left	M_1 and M_2. M_1 complete; M_2 only mesial loph.
Sts 522	Type Site		Tooth	Left	M_1; roots not fully developed.
Sts 523	Type Site	*C. williamsi*	Tooth	Left	M_2 with mesial and distal roots
Sts 524	Type Site	*Parapapio*	Tooth	Right	Both roots present; most measurements taken. Worn lightly.
Sts 525	Type Site		Tooth	Right	M^2 with roots; fragmented enamel. No measurements taken.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 526	Type Site		Tooth	Right	M^3; can take length. Other, measures not taken, as enamel is fragmented.
Sts 527	Type Site	*Parapapio*	Tooth	Right	Tooth is lightly worn, young adult. Roots are completely fractured. Small size of distal loph; M^3.
Sts 528	Type Site	*Parapapio*	Tooth	Left	Maxillary tooth; only one root still visible (lingual side). Specimen appears to have had three roots; others fractured.
Sts 528	Type Site		Tooth	Indet.	Portions of isolated teeth. Teeth are laying in different directions on the same plane, but appears to be a medium-sized canine and a premolar/molar. Specimen needs preparation to remove breccia; no measurements taken.
Sts 529	Type Site	*Parapapio*	Tooth	Right	M_1 (unerupted). Appears if enamel is not fully formed. Vertical lines present on tooth crown. Specimen is crown only; appears to be suspended in ?clay.
Sts 529	Type Site		Tooth	Indet.	Tooth looks like a canine crown/root and couple of other tooth fragments (not identifiable, but probably premolar and molar's). Unable to determine jaw. Specimen needs preparation. Still encased in breccia.
Sts 530	Type Site	*Pp. broomi*	Endocast	Indet.	Partial brain endocast; can only visualize a few gyri. No identifiable region.
Sts 530	Type Site	*C. williamsi*	Maxilla	Both	Palate and right infraorbital region with fragmentary complete dentition. Horse-shoe-shaped palate. On left side, teeth represented by only lingual enamel fragments. On right side, I^1-I^2; breadths not measureable because specimen has been covered with glue. However, lengths are measurable. C^1 very small and chipped; P^3 fairly complete. P^3 buccal side fractured; M^1-M^2 fairly complete (measurements should be visualize as estimates.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 531	Type Site		Cranium	Both	Much of a badly distorted cranium; no teeth are measureable.
Sts 532	Type Site		Tooth	Indet.	Tip of a large broken canine, as well as an impression. Must be two Sts 532's.
Sts 532	Type Site		Mandible	Left	Labeled on specimen, *P. jonesi*. Mandibular fragment with P_3-M_3; size of P_3 suggests female. Specimen exhibits a prominentia lateralis. P_3 (complete), P_4 (fractured), M_1 (practically root only), M_2 (lingual side only) and M_3 (complete). V-shaped buccal cleft. Specimen is worn more on buccal side. Specimen is still encased in breccia.
Sts 533	Type Site		Mandible	Both	Mandibular fragment with right corpus with M_3 only and left P_3-M_3. However, surfaces are covered with glue so heavily that object is immeasurable. Only, right M_3 can be measured. Worn heavily. A separate fragmented piece contains P_3-M_2 (right).
Sts 534	Type Site	*Pp. broomi*	Mandible	Right	Mandibular fragment with dental surfaces covered with breccia. Inferior portions of the mandibular corpus and ascending ramus are absent due to shearing. M_2 can be visualized, as well as the buccal side of M_1. Only length of M_2 can be estimated, as most of occlusal surface is covered.
Sts 534	Type Site	*Pp .broomi*	Cranium	Both	Much of the right side of a cranium. C^1 is large. Only, M^3 measureable.
Sts 535	Type Site		Cranium	Left	Crushed and weathered cranium. Specimen preserves M^1-M^3; partial right toothrow also present.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 536	Type Site		Cranium	Both	Most of braincase with orbits. No muzzle. Right side of the cranial vault is nearly complete except for the occipital region. Right and left orbits fairly complete. Left side of cranium is represented by the frontal and parietal only. Specimen is in very bad condition. Appears to have been covered in preservative? As a result, most anatomical details are hidden.
Sts 537	Type Site	*C. williamsi*	Cranium	Both	Neurocranial fragment with endocranial cast. Supraorbital tori are similar to the male *C. williamsi*. Similar in brain size, as well. Interorbital distance looks very *C. williamsi*. The right zygomatic has been shifted into the right orbit, making it appear smaller in height than it actually is. Both sides have complete frontal with a faint temporal line. Calvaria raises high above the supraorbital tori, unlike in the female of this species. On the right side, temporal and parietals are preserved. Near the fractured occipital region, an endocast is preserved. On the left, the temporal is fractured, but still has the mastoid process. Major portions of the parietal are missing. Basicranially, very little anatomy of interest. Attributed here to *C. williamsi*.
Sts 538	Type Site		Cranium	Both	Nearly complete neurocranium, no splanchnocranium; right side fully complete. Left side missing temporal region and lateral frontal near the orbit. Can visualize a partial brain endocast in left orbit. Breccia fills the right eye socket. Right side shows post-orbital constriction typical of papionins. Basicranially, fairly complete. Can visualize sphenoid, foramen magnum is full of breccia. Specimen does not have much of a nuchal crest.
Sts 539	Type Site		Cranium	Both	Portions of a shattered cranium with left P^3-P^4, M^1-M^2. *Pp. broomi* muzzle with maxillary ridges.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 540	Type Site	*Parapapio*	Cranium	Right	Cranium with mixed dentition. Both orbits preserved. Splanchnocranium shifted right with respect to neurocranium. Left P^4 (unerupted), M^1 (erupted) and M^2 (unerupted). Specimen needs reconstruction; only dental measurements.
Sts 540	Type Site		Tooth	Indet.	Molar? tooth fragment; encased in breccia. Needs to be removed for definitive identification. Must be two Sts 540's.
Sts 541	Type Site		Cranium	Indet.	Fragment of neurocranium.
Sts 541	Type Site		Cranium	Both	Most of calvaria, no muzzle. Mandible also present with P_4-M_3 bilaterally; also has number Sts 419 on it. Teeth are heavily worn; very old individual. Teeth cannot be measured accurately. Specimen is missing the basicranium. Cranial vault only present by partial occipital (superior portion), parietals (1/3), inferior temporal and frontal (left). Remainder is exposed endocast. Can visualize lateral orbit on frontal, but orbit filled with breccia. Slight nuchal line present on mid-right side.
Sts 542	Type Site	*P. izodi*	Mandible	Right	Mandibular fragment attached to block of breccia. On other side of breccia, one can visualize an impression of the left mandibular ascending ramus. Right side has P_4, M_1 (root), M_2 and M_3.
Sts 543	Type Site		Mandible	Right	Mandibular fragment with P_3-P_4. Specimen has a small sectorial premolar. Breccia covers the lingual surface, some measurements possible. Anterior portion of mandible covered in breccia, as well.
Sts 544	Type Site	*Pp. broomi*	Maxilla	Left	Maxillary fragment with P^3 (broken-root only)-M^3. Horseshoe-shaped palate, but difficult to visualize any structures. Specimen appears to have a small maxillary fossa, but specimen needs preparation. *Lophocebus*-like M^3.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 546	Type Site	*Parapapio*	Cranium	Both	Cranium with mixed dentition. Complete cranium with articulated mandible. Permanent incisors erupting. Deciduous and permanent teeth present, but needs preparation. Cranium flattened severely bilaterally; no measurements.
Sts 547	Type Site		Cranium	Both	Crushed cranium, probably complete before being shattered. P^3-M^3, bilaterally. Palate probably most informative part, but still encased in breccia. Horse-shoe shaped, but proportion of teeth appear to be *Parapapio*.
Sts 548	Type Site	*P. izodi*	Maxilla	Both	(a) left maxilla with P^4-M^2, (b) mandible piece with right P4 and (c) left mandibular M_3. All specimens are suspended in one block of breccia, undoubtedly belonging to the same specimen. Specimen has previously been labeled *Pp. whitei*. Notes on particular specimens: (a) material accessible, (b) only buccal side visible and (c) only buccal side preserved.
Sts 549	Type Site		Tooth	Indet.	Fragment of isolated molar. Specimen is fragmented between lophs. Most of occlusal surface covered with breccia. Further identification not possible.
Sts 556	Type Site		Tooth	Right	C_1 (fractured tip)
Sts 557	Type Site		Mandible	Left	Mandibular fragment with P_3-M_1. M_3 (mesial portion), P_4 (complete) and M_1 (buccal cusps) preserved. Anterior mandible sloping to distal P_4. Right side shows alveoli for several teeth, but none are present.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 558	Type Site		Cranium	Both	Cranial fragment with posterior portions of the muzzle and a partial neurocranium. Muzzle is fairly complete; missing anterior-most portion. Specimen preserves very little of the supraorbital tori. A complete zygomatic on is preserved on the right side. For visible portions of the anatomy, specimen has an anteorbital drop like *P. izodi*.
Sts 558	Type Site		Mandible	Right	Mandibular fragment with corpus. Dentition present: I_1, I_2, P_3, M_1 and M_2. M_2 not fully measureable, C_1 (fragment).
Sts 559 a	Type Site	*C. williamsi*	Cranium	Both	Specimen appears to be a *C. williamsi*, because of large interorbital distance and large browridge. Catalog states that specimen is a *Parapapio*.
Sts 559 b	Type Site	*C. williamsi*	Maxilla	Left	Maxillary fragment with M^3 (unworn). Specimen appears to have shearing crests indicative of folivore (i.e. *Cercopithecoides*).
Sts 560	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment; specimen needs preparation. No features can be measured. Portions of left and right sides are present; however, only the buccal aspect of the right side and the inferior portion of the mandible are visible. Remainder of specimen is covered with breccia. P_3 looks small.
Sts 560	Type Site		Tooth	Indet.	Must be two Sts 560's in TM collection. Specimen appears to be the roots of an upper molar (3 roots?); however, specimen is embedded in breccia precluding secure identification.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 562	Type Site	*Pp. broomi*	Cranium	Both	*Pp. broomi* (female) noted on specimen not a holotype. Young adult with lightly worn M_3. Right side of mandible only. Toothrow represented by C_1–M_3. All other teeth absent. P_3 does not appear to be sectorial, but fracture prohibits strong conclusion. Exhibits a small maxillary fossa on right side.
Sts 563	Type Site	*Pp. broomi*	Mandible	Both	Mandibular fragment of immature adult – M_3 (unworn). Right side tooth row complete except missing most of C_1 crown. Left side present only to P_4, but possesses complete C_1. Left side of specimen is shifted supero-posteriorly relative to right. Mandible missing part of coronoid process. Condyle appears complete. Compare with Sts 562. Morphology similar between Sts 562 and Sts 563. Sts 562 P_3 is not sectorial, and may represent the female of the species. P_3 of 563 is sectorial. Measurements of teeth are difficult, as some distortion (i.e. incisor row) has taken place. Also, M_3 not fully erupted; had to estimate measures. C_1 measurements also estimations. Specimen possessed a small maxillary fossa on right side. *Pp. whitei* type specimen.
Sts 564	Type Site		Tooth	Indet.	Isolated molar fragment, only one loph preserved.
Sts 564	Type Site	*Pp. broomi*	Cranium	Both	*Pp. broomi*. Unable to determine age of this edentulous specimen. Basicranium is also absent. Posterior portion of cranium missing with exposed endocranial brain cast. Showing sagittal and transverse sinuses. Frontal present for the most part. Temporal line on the right side. Unclear of how much of the nasal aperture is present (appears very little). Most anterior portion of cranium is nasal aperture. Partial zygomatic is present on right side, but is suspended in breccia therefore unable to give morphological information. Specimen has a small ridge near on the nasal bones (sagittally). Can visualize a partial maxillary fossa on the right side. Specimen is fractured near zygomatico-maxillary suture. *Pp. broomi* type specimen.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 565	Type Site	*Pp. jonesi*	Cranium	Both	*Pp. jonesi* (female). Age estimated to be an adult based on M^3 wear. Teeth preserved are left C^1 (root)- M3 and right P3 (root)-M3. Basicranium not preserved. Palate is filled with breccia. Brain endocast exposed on left side from mid-temporal to 1cm past inion on right side. Bregma not preserved. Partial left zygomatic present around orbit, absent on right side. Anterior dentition absent; therefore region of nasal aperture also appears to be incomplete. Specimen does appear to have a small maxillary fossa. Most of teeth are fractured; for comparison, measurements were estimated. *Pp. jonesi* type specimen.
Sts 587	Type Site		Tooth	Right	C^1; large male canine. Specimen is embedded in breccia. Lingual side is visible. Not measurable; specimen needs preparation and removal from breccia.
Sts 790	Type Site		Tooth	Indet.	Fragment of male canine; fractured longitudinally.
Sts 890	Type Site		Maxilla	Right	Impression of right maxilla with C^1-M^2. Large impression of a C^1 estimated to be about 15.5mm in height. Can also visualize the impression of P^3-M^2. Buccal enamel fragments of M^1 are the only bone or tooth fragments remaining; impression appears to be right side.
Sts 943	Type Site		Cranium	Both	Severely crushed cranium, probably originally fairly complete. Specimen occurs in two large breccia blocks.
Sts 945	Type Site		Cranium		Anterior portion of neurocranium and partial palate. Frontal lobe endocast. Can visualize left side around the post-orbital constriction.
Sts 947	Type Site		Mandible	Both	Portions of mandibular corpi in poor condition. Specimen is encased in breccia; sheared off at the level of alveoli. Cannot visualize any of the dentition.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 991	Type Site		Cranium	Both	Most of neurocranium. No muzzle is preserved; specimen is represented mainly as frontal and parietals. Occipital regions is represented by endocast with a small piece of temporal on right. Auditory meatus is preserved.
Sts 992	Type Site		Maxilla	left?	Impression of palate with fractured teeth. Can visualize the partial palate. Broken roots of the dentition suggest left side.
Sts 995	Type Site		Cranium	Both	Anterior portion of neurocranium. Specimen appears to be a small juvenile. Can visualize the interorbital area and frontal; very small.
Sts 1000	Type Site		Cranium	Both	Complete neurocranium. No muzzle. Specimen is mostly endocast; missing cranial vault bones. Specimen is in poor condition; needs preparation and removal from breccia.
Sts 1001	Type Site		Maxilla	Indet.	Maxillary fragment with damaged dentition. Probably much of the rest of the cranium also present. Specimen is severely crushed; no features are measurable.
Sts 1002	Type Site		Endocast	Indet.	Impression of brain, unidentifiable as to region.
Sts 1002	Type Site		Endocast	Both	Most of the endocast and portion of a badly shattered palate. On left side, the condyloid and coronoid processes can be visualized. Specimen needs preparation to separate pieces and to better visualize palate.
Sts 1003	Type Site		Endocast	Right	Endocast and proximal portion of muzzle. Edentulous with only roots of m^3? Can visualize temporal lobe of brain. Occipital region covered with cranial fragments.
Sts 1005	Type Site		Maxilla	Indet.	Portions of a severely damaged muzzle; can visualize an incisor in labio-lingual cross-section.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1007	Type Site		Mandible	Both	Mandibular fragments. Two specimens are on this block of breccia. One (which the number is on) is a right ascending ramus; the secondother is the anterior part. Specimens are located on opposite sides of the block, may not represent the same individual.
Sts 1009	Type Site		Cranium	Both	Large portion of a flattened neurocranium with posterior endocast. Specimen appears as if the coronal suture was forced apart by the compressive forces.
Sts 1010	Type Site		Mandible	Indet.	Mandibular fragment with fractured dentition. Can visualize P_4-M_2 roots, but crowns are fractured. Specimen encased in breccia; could be a maxilla? Unidentifiable bone fragment in breccia near this specimen may be articulating maxilla.
Sts 1011	Type Site		Endocast	Both	Posterior portion of an endocast. Can visualize a dural venous structure, but not readily identifiable.
Sts 1012	Type Site		Cranium	Indet.	Neurocranial fragment? Where bone has fractured away a partial endocast is visible. Very little useful anatomical information.
Sts 1013	Type Site		Maxilla	Both	Portions of muzzle and associated mandible. Specimen looks papionin, but most surfaces covered by breccia. Mandible shifted to the left with respect to the maxilla. Small C_1-M_2 can be visualized on the mandible; most teeth are missing buccal enamel.
Sts 1014	Type Site		Endocast	Both	Most of an endocast, mostly superior portion. Specimen doesn't have frontal or temporal lobes, but does possess occipital lobes and transverse sinuses.
Sts 1018	Type Site		Endocast	Both	Superior portion of an endocast; frontal lobe with orbit.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1019	Type Site		Maxilla	Both	Maxillary fragment with palate and right infraorbital region. Fragmentary complete dentition preserved. Horse-shoe shaped palate. Left side, teeth represented by only lingual enamel fragments. On right, I^1-I^2 (breadths not measurable), C^1 (very small and chipped), P^3 (fairly complete), M^1-M^2 (fairly complete). Measurements should be viewed as estimates. Forward facing zygomatics and a light maxillary fossa, although difficult to visualize.
Sts 1021	Type Site		Endocast	Both	2/3 of an endocast. Right side nearly complete. Specimen retains the temporal lobe. Both sides have frontal lobes. Left side is missing the temporal and occipital.
Sts 1022	Type Site		Tooth	Indet.	Isolated molar. Specimen is fractured and difficult to determine siding and jaw. May be M_3; but difficult to say with confidence.
Sts 1023	Type Site		Cranium	Indet.	Frontal fragment with a portion of temporal region. Can visualize the temporal line which is strongly developed in this individual. Interior covered by calcite; cannot visualize endocranial surface.
Sts 1024	Type Site		Cranium		Anterior portion of the neurocranium; partial endocast preserved.
Sts 1025	Type Site		Maxilla	Indet.	Maxillary fragment; specimen still encased in breccia. Difficult to derive much anatomical information on specimen. There is an impression of a molar tooth; but only one root is visible. One tooth is present, but is covered in breccia and indiscernible (P or M?). Specimen needs preparation.
Sts 1026	Type Site		Cranium	Both	Most of cranium. Dentition broken; catalog suggests a female. Right side of muzzle present. Specimen looks like *Pp. jonesi* type specimen; however, too much of it is either fractured or covered in breccia for complete comparisons.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1027	Type Site		Cranium	Both	Fairly complete neurocranium. No muzzle. Left side shows a remarkably large nuchal crest. Midline and right posterior neurocranium is missing; endocast preserved, instead. Most of specimen cranial vault bones, although broken and fragmented. Basicranially bone is missing and has endocast (beautifully preserved) of both the temporal lobes and the midbrain (mesencephalon) leading in to the medulla oblongata (mylencephalon).
Sts 1028	Type Site		Cranium	Both	Partial braincase and muzzle. Tooth fragment on left. Specimen is not anatomically correct. Regions/features have shifted with respect to each another.
Sts 1030	Type Site		Cranium	Indet.	Shattered cranium. Very poor condition. Specimen needs preparation.
Sts 1031	Type Site		Cranium	Left	Most of a cranium. Right side of neurocranium missing. Specimen is encased in breccia and needs preparation.
Sts 1032	Type Site		Cranium	Both	Large portion of braincase with a partial endocast. Specimen appears to be the posterior portion of the cranium at the junction of the sagittal and nuchal sutures (occipital not present). Appears as if the two parietals are being forced apart from the inside because cranium is misshapened. Inferior parietal pulled laterally; sagittal suture appears to have popped open.
Sts 1034	Type Site		Endocast	Both	Posterior portion of an endocast.
Sts 1036	Type Site		Mandible	Indet.	Mandibular fragment with a molar attached (M_3?). Tooth has a fractured cusp. Mandible is suspended in breccia. In same block of breccia, what appears to be a long bone is preserved surrounded by breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1037	Type Site		Cranium	Left	Fragments of broken cranium. Impression of neurocranium and left C^1 and fragments of other teeth. C^1 is *Papio*-sized, not measureable because it projects into the breccia. Teeth, neurocranium and remaining bones project in differing planes, may not represent one individual.
Sts 1038	Type Site		Maxilla	Indet.	Completely smashed maxilla with associated mandible. Multiple teeth present, but specimens is fractured into some many planes that even if removed from breccia, might not be very useful. Teeth are fractured in every possible direction through crowns and alveoli. Maxilla might be recoverable.
Sts 1039	Type Site		Maxilla	Both	Palatal fragment with toothrow and a portion of the neurocranium. Specimen appears to have fragments of C^1-M^3, but most are missing buccal sides. M^3 appears to be complete, but is enclosed with breccia except a small region of the buccal surface. C^1 is fractured at cervix, no estimates on size.
Sts 1041	Type Site		Cranium	Right	Neurocranial fragments. Right side with small piece of temporal line; remainder of specimen just fragments of cranial vault bones.
Sts 1043	Type Site		Cranium		Much of a neurocranium and endocast. No muzzle. Can visualize the impression of a partial suture on the posterior surface.
Sts 1044	Type Site		Cranium	Both	Cranium. Looking at endocranial surface. Remainder of specimen is encased in breccia. On opposite side of breccia block, a bone appearing to be a primate pelvis (un-numbered); ilium and acetabulum can be observed.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1046	Type Site		Cranium	Both	Much of a cranium with articulated mandible. Teeth (poor condition) need preparation. Complete zygomatic is present with arch. Complete left orbit, frontal, temporal and anterior parietals, posterior portions of the muzzle. On right, mostly crushed, may be present, but the right side mandible is driven into where the right orbit would have been, if preserved. Specimen appears to be missing most of the right half of the neurocranium. Specimen needs preparation. Specimen might be good candidate for reconstruction. Looks *Pp. jonesi* in profile. Needs to be removed and reconstructed for confident species assignment.
Sts 1047	Type Site		Cranium	Indet.	Much of a neurocranium and partial muzzle. However, specimen is suspended in breccia and not readily accessible. Posterior portion of cranium represented by an endocast. Specimen needs preparation.
Sts 1048	Type Site		Cranium	Both	Much of a neurocranium and muzzle; specimen needs preparation. Completely encased in breccia.
Sts 1049	Type Site		Mandible	Indet.	Mandibular fragment. Specimen appears to possess have a large C_1 root; but specimen is fractured. Suggested male based on size and shape of P_3. No measurements. Portions of both sides visible.
Sts 1050	Type Site		Cranium	Both	Superior portion of calvaria. Supraorbital tori appear to be present but embedded in breccia. Posteriorly, nuchal lines are visible. Between the anterior and posterior cranial portions, a brain endocast is present.
Sts 1051	Type Site		Mandible	Both	Anterior mandibular fragment. Specimen is sheared at alveoli level. Difficult to determine if specimen is the inferior or superior aspect. Specimen needs preparation.
Sts 1052	Type Site		Cranium	Both	Anterior portion of braincase. Partial muzzle, no teeth visible. Frontal lobe on right side, frontal bone on left are preserved. Muzzle is damaged and section coronally.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1053	Type Site		Cranium	Indet.	Cranial fragments with partial dentition. Specimen is not readily identifiable; needs preparation to be removed from breccia.
Sts 1054	Type Site		Cranium	Both	Beautifully preserved basicranial endocast; bottom 1/3 of brain. Preserves venous and arterial systems on right side.
Sts 1055	Type Site		Endocast	Right	Posterior portion of an endocast and cranial bones. Can visualize the auditory meatus with a fractured mastoid process (showing its airiness), zygomatic arch and an endocast in the occipital region.
Sts 1056	Type Site		Mandible	Both	Mandibular fragment with right toothrow and a portion of the left corpus. Can visualize the outlines of P_3-M_3, all are only visible as roots. Anterior portion of the mandible severed at 45 degree angle postero-superiorly to antero-inferiorly.
Sts 1058	Type Site		Cranium	Both	Portion of a completely crushed cranium. Specimen is in poor condition. Can make out left palate with a couple of unidentifiable tooth fragments. Mangled disorder of bone fragments. Specimen needs preparation.
Sts 1059	Type Site		Endocast	Left	Endocast of a juvenile. Temporal and occipital lobes present. Partial frontal lobe on the lateral-most margin of the orbit preserved. Can visualize the meningeal arteries (very clearly).
Sts 1063	Type Site		Endocast	Both	Much of a fine endocast; superior portion complete. Can visualize the sagittal sinus.
Sts 1065	Type Site		Cranium	Indet.	Neurocranial fragment. Viewing the endocranial surface. Specimen appears to exhibit the conjunction of the sagittal and parietal sutures; midline. Exterior surface covered with matrix; needs preparation.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1066	Type Site		Endocast	Both	Endocast with temporal (left) and occipital (bilaterally) region. Can visualize meningeal arteries and venous sinuses.
Sts 1067	Type Site		Cranium	Right	Posterior portion of a neurocranium. Temporal with auditory meatus.
Sts 1070	Type Site		Cranium	Right	Neurocranium with a visible temporal line. The frontal bone and a 1/3 of the parietal are present. Remainder of posterior cranium is preserved as an endocast. Can visualize the interorbital distance. Specimen looks papionin. Has a well-developed temporal line, but overall small in size.
Sts 1071	Type Site		Endocast	Left	Endocast. Can visualize the frontal lobe, but only the specimen is only about 40% complete.
Sts 1072	Type Site		Cranium	Both	Nearly complete neurocranium with muzzle.
Sts 1074	Type Site		Endocast	Right	Temporal lobe of an endocast.
Sts 1075	Type Site		Cranium	Indet.	Fragment of neurocranium; no identification.
Sts 1077	Type Site		Cranium	Indet.	Posterior portion of a neurocranium; not very informative.
Sts 1078	Type Site		Cranium	Both	Almost complete endocast (composed of pure calcite). Missing most of left side; right side is nearly complete, but missing the occipital region. Small, perhaps, a juvenile. Temporal and frontal lobes present on right side.
Sts 1079	Type Site		Endocast	Left	Endocast with meningeal arteries.
Sts 1080	Type Site		Cranium	Left	Fragment of left orbit and supraorbital torus. Well-developed torus.
Sts 1081	Type Site		Cranium	Both	Superior portion of neurocranium.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1082	Type Site		Endocast	Left	Much of left endocast. Can visualize frontal lobe on left. The interorbital frontal region and the right frontal are preserved, as well. Papionin interorbital distance.
Sts 1083	Type Site		Cranium	Both	Fragment of a neurocranium. Specimen appears to be the occipital region with venous structures. Portions of the anatomical structures are covered with calcite; precisely at opisthocranion.
Sts 1085	Type Site		Mandible	Indet.	Mandibular fragment, a fractured unidentifiable tooth is present.
Sts 1088	Type Site		Cranium	Indet.	Neurocranial fragment with endocranial cast. Poor condition.
Sts 1093	Type Site		Maxilla	Indet.	Maxillary fragment with portions of two molars.
Sts 1093 16	Type Site		Tooth	Indet.	Fractured molar (M2-M3?). ½ (bucco-lingual) of the specimen is missing. Other ½ is suspended in breccia; needs preparation. Specimen appears to be a papionin.
Sts 1102	Type Site		Mandible	Right	Mandibular fragment with tooth fragments. Can clearly visualize the M_3 from the lingual side. From its appearance, specimen is sided right. Specimen is encased in breccia and needs preparation for better identification.
Sts 1109	Type Site		Cranium	Indet.	Fragment of neurocranium; small piece. No identification.
Sts 1116	Type Site		Tooth	Indet.	Part of an isolated molar tooth. Specimen is fractured through lophs? Another tooth is present, but projects into a different plane and into the breccia; both are surrounded by breccia.
Sts 1127	Type Site	*C. williamsi*	Mandible	Right	Fragment of anterior portion of a mandible. Looking at size of alveoli for the incisors and the receding chin, it appears to be a *C. williamsi.* Tentative assignment.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1160	Type Site		Mandible	Indet.	Mandibular fragment; all of crowns are missing. Specimen is encased in breccia.
Sts 1169	Type Site		Tooth	Indet.	Isolated premolar; breccia covers the occlusal surface. Specimen needs preparation.
Sts 1184	Type Site		Tooth	Right	Isolated I^1 (fractured). Length can be measured. Specimen is still encased in breccia; part of maxilla is present. Root of I^1 can be visualized.
Sts 1188	Type Site		Maxilla	Indet.	Maxillary fragment. Palatal piece with fractured C^1.
Sts 1189	Type Site		Maxilla	Both	Maxillary fragment. Palate with P^3-M^2 (bilaterally). No measurements, enclosed in breccia and fragmented.
Sts 1193	Type Site		Cranium	Indet.	Much of an extremely battered skull. Severely damaged; no useful anatomical information.
Sts 1195	Type Site		Mandible	Left	Mandibular fragment with corpus containing C_1-M_2. Specimen viewed from buccal side; however, buccal side of teeth fractured off. Small sized canine. Specimen needs preparation. Occlusal surface of teeth covered with breccia; appears to be a juvenile. M_3 in crypt.
Sts 1208	Type Site		Mandible	Both	Anterior portion of a mandible with right I_1, I_2, C_1, P_3 and P_4 while on left only the C_1 can be identified. P_3 on right side looks sectorial, but small. Shallow mandibular fossa present, as well. Most of tooth surfaces (including occlusal) covered with breccia; specimen needs preparation. Incisors are difficult to visualize.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1217	Type Site		Maxilla	Left	Maxillary fragment with tooth fragments. Appears to be a premolar and a molar crown, but breccia encases almost the entire specimen. Can only visualize the occlusal surface.
Sts 1229	Type Site		Endocast	Right	Impression of brain.
Sts 1230	Type Site		Cranium	Both	Posterior portion of neurocranium; not much discernible information. Specimen is embedded in breccia; needs preparation.
Sts 1235	Type Site		Cranium	Both	Superior portion of a neurocranium and endocast. Parietal-temporal region; terminates at occipital region.
Sts 1238	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment with mixed dentition. Right C_1, M_1 and left dm_1-dm_2, M_1 and M_2 (unerupted). Most of fairly complete mandible. Anterior portion is fragmentary. M_2's can be visualize in the crypts bilaterally. Coronoid process present on right side; both sides preserve the ascending rami.
Sts 1238	Type Site		Endocast	Left	Basal and posterior portion of an endocast.
Sts 1238	Type Site	*Parapapio*	Cranium	Left	Nearly complete left side of a cranium. Left toothrow present; all teeth are fractured at roots. Maxilla shows no evidence of a maxillary fossa, could be female *Pp. broomi* or *Pp. jonesi*. Anterior dentition or roots are not present. Most of braincase represented by endocast, not actual vault bones.
Sts 1240	Type Site		Cranium	Indet.	Cranial fragments.
Sts 1246	Type Site		Mandible	Indet.	Mandibular fragment; very small.
Sts 1253	Type Site		Cranium	Indet.	Portion of a neurocranium; not differentiable. Looks like it preserves some portion of the venous sinus structures; foramen magnum; also appears to be partially preserved. Specimen needs preparation.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1258	Type Site		Cranium	Indet.	Portion of a neurocranium. Appears to be a basicranial fragment. Specimen needs preparation.
Sts 1260	Type Site		Maxilla	Both	Portions of the muzzle and palate. Left toothrow present. Specimen projects into breccia. Can only visualize some fractured roots on left side; right side fracture goes through bone. Anatomically, not very informative; needs preparation.
Sts 1267	Type Site		Cranium	Indet.	Neurocranial fragment; not very informative.
Sts 1271	Type Site		Maxilla	Indet.	Maxillary fragment with fractured dentition. Not readily identifiable.
Sts 1275	Type Site		Cranium	Both	Neurocranium with muzzle of a severely damaged cranium.
Sts 1305	Type Site		Maxilla	Indet.	Maxillary fragment with fractured dentition.
Sts 1306	Type Site		Cranium	Indet.	Portion of a neurocranium; appears to be the anterior portion. Fracture exhibits the ethmoid (though the spongy portion) and a partial sphenoid.
Sts 1310	Type Site		Cranium	Indet.	Fragments of a neurocranium.
Sts 1311	Type Site		Tooth	Indet.	Dental fragments (unidentifiable). In same breccia block, appears to be a carnivore carnassial (stained with manganese).
Sts 1314	Type Site		Mandible	Indet.	Mandibular fragment in very poor condition with tooth fragments; not readily identifiable. Needs preparation.
Sts 1334	Type Site		Cranium	Both	Partial frontal and orbits. Parapapio-like with only faint supraorbital torus. Specimen does exhibit small interorbital distance.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1339	Type Site		Mandible	Both	Mandibular fragment of both corpi and tooth fragments. Inferior border of both sides fractured; but more so on right side, where alveoli are absent. Very sectorial P_3 on left side. Surfaces not completely visible as breccia is adhering to specimen and tooth surfaces. Heavily worn P_3.
Sts 1342	Type Site		Cranium	Indet.	Partial neurocranium. Very thin-walled; ?sagittal suture present. Specimen has material covering the internal surface of the cranium.
Sts 1343	Type Site		Palate	Right	Maxillary fragment. Palatal piece with alveoli of right toothrow; teeth and roots are absent.
Sts 1361	Type Site		Cranium	Both	Basicranial (occiput region) fragment showing venous structures; midline. Specimen encased in breccia; exterior not visible.
Sts 1372	Type Site		Mandible	Indet.	Mandibular fragment with broken roots. So, severely fragmented precludes siding. Specimen needs preparation; covered in breccia.
Sts 1374	Type Site		Maxilla	right?	Maxillary fragment ?right with I^1-C^1; very large in size.
Sts 1396	Type Site		Mandible	Indet.	Mandibular fragment with fractured tooth roots. Very little recognizable information. Appears to be ?right side.
Sts 1401	Type Site		Mandible	Right	Mandibular fragment with corpus and tooth roots; very little discernible features.
Sts 1411	Type Site		Tooth	Indet.	Partial isolated molar, coronally fractured.
Sts 1428	Type Site		Tooth	Indet.	Isolated tooth fragments scattered throughout breccia block; only roots. No discernible information.
Sts 1442	Type Site		Cranium	Indet.	Partial neurocraium; cranial vault bone?

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1449	Type Site		Cranium	Indet.	Fragments of a damaged cranium; not useful. Contained in huge block of breccia; needs preparation to remove pieces.
Sts 1451	Type Site		Maxilla	Indet.	P^3-P^4 tooth roots in maxillary fragment.
Sts 1455	Type Site		Maxilla	Both	Maxillary fragment with partial palate and fragmented tooth on right . Left side is edentulous. Teeth are fractured at cervix. Needs preparation.
Sts 1456	Type Site		Cranium	Left	Most of a complete cranium. Left side complete, missing calvaria. Specimen is completely enclosed in breccia. Can visualize endocranial surface superiorly.
Sts 1459	Type Site		Cranium	Indet.	Neurocranial fragment? Needs preparation, as specimen is in block of breccia.
Sts 1461	Type Site		Mandible	Right	Condyle of mandible; cercopithecoid?
Sts 1471	Type Site		Cranium	Indet.	Partial neurocranium; no identification.
Sts 1472	Type Site		Tooth	Indet.	Isolated canine? Combination of breccia and fragmentation makes identification less secure until further prepared.
Sts 1474	Type Site		Cranium	Indet.	Fragment of neurocranium. No anatomical information.
Sts 1479	Type Site		Tooth	Indet.	Could be a premolar or molar. Needs preparation. Can only visualize partial end of specimen (view of enamel only). Not distinguishable.
Sts 1485	Type Site		Cranium	Right	Partial cranium and mandible, articulated. Very severely damaged.
Sts 1486	Type Site		Cranium	Indet.	Partial braincase. Encased in breccia, not differentiable; poor fragment.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1494	Type Site		Maxilla	Both	Maxillary fragment with large maxillary fossa. Anterior portion is fractured.
Sts 1499	Type Site		Endocast	Both	Posterior portion of an endocast; appears to be the endocranial surface of a cranial fragment with some structures of the brain preserved (i.e. vessels).
Sts 1506	Type Site		Cranium	Left	Neurocranial fragment. Specimen appears to be the frontal. Can visualize the fronto-nasal suture and temporal bone on left side.
Sts 1516	Type Site		Maxilla	Left	Maxillary fragment with broken dentition. Specimen appears to have a small C^1. Specimen encased in breccia; needs preparation.
Sts 1519	Type Site		Mandible	Indet.	Mandibular fragment with partial tooth. Catalog suggests that it could be a carnivore.
Sts 1529	Type Site		Cranium	Indet.	Cranial and tooth fragments; mangled. Not readily identifiable.
Sts 1530	Type Site		Tooth	Indet.	Isolated incisor; fractured and covered with plaster.
Sts 1532	Type Site		Cranium	Indet.	Partial neurocranium. No discernible features.
Sts 1533	Type Site		Mandible	Both	Mandibular fragment with right corpus; left corpus to C_1. Only molar crown roots on right side visible. Specimen appears to have a ?carnivore puncture on lingual surface.
Sts 1536	Type Site		Endocast	left?	Endocast with partial neurocranium. No muzzle. Specimen preserved in travertine. Preserves temporal lobe very well.
Sts 1544	Type Site		Tooth	Both	Left I^1 and right M_1; no measurements. Most surfaces covered in breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1547	Type Site		Cranium	Indet.	Partial neurocranium. Small cranial vault fragment; no identification.
Sts 1552	Type Site		Mandible	Indet.	Mandibular fragment with fractured teeth. Not very informative. Dentition not on same level as mandible; needs preparation.
Sts 1566	Type Site		Maxilla	Indet.	Maxillary fragment with fractured dentition; heavily fractured. No discernible information.
Sts 1568	Type Site		Mandible	Both	Anterior portion of mandible. Can only visualize lingual surface of I_2. Remainder encased in breccia.
Sts 1588	Type Site		Cranium	Indet.	Partial neurocranium; unidentifiable.
Sts 1591	Type Site		Maxilla	Indet.	Maxillary fragment and tooth roots; heavily fragmented. Specimen needs preparation. Breccia covers most surfaces; difficult to visualize morphology.
Sts 1592	Type Site	*Parapapio*	Tooth	Right	Difficult to determine with confidence; specimen appears to be a mandibular fragment. Block of breccia with dentition sticking out. ?Right side.
Sts 1593	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment with dentition wholly encased in breccia. No measurements possible. Mesial loph of M^1 fractured; M^2 appears to be completely present, but covered on all sides by breccia. Only occlusal surfaces visible to a small extent.
Sts 1594	Type Site	*Parapapio*	Maxilla	Right	Maxillary fragment still encased in breccia. Specimen has M^2 and M^3; separated in space and not connected. Lengths estimated.
Sts 1615	Type Site		Cranium	Indet.	Cranial vault fragments; encased in breccia. Unidentifiable.
Sts 1618	Type Site		Mandible	Indet.	Fragment of mandible and dental roots; very small fragment.
Sts 1635	Type Site		Cranium	Indet.	Much of an extremely battered cranium. Needs preparation; in breccia block. Three infraorbital foramina observed.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1640	Type Site		Maxilla	Both	Maxillary fragment with muzzle. Left side shows *Pp. broomi* fossa with maxillary ridge. Right side, crushed and distorted in direction of left; causing toothrows to converge. Only buccal surfaces of a few teeth are visible; missing complete anterior portion (nasal aperture-forward). Specimen is encased in breccia and needs preparation.
Sts 1661	Type Site		Tooth	Indet.	Tooth root fragments; not discernible. Jaw may be present; however, specimen is buried in breccia. Needs preparation.
Sts 1669	Type Site		Tooth	Indet.	Fragments of badly damaged teeth; unidentifiable. Some roots and/or crown fragments can be visualized.
Sts 1675	Type Site		Cranium	Indet.	Neurocranial fragment; no discernible information.
Sts 1683	Type Site		Tooth	Indet.	Isolated tooth (needs preparation); currently unidentifiable. Specimen is enclosed in breccia. Can only visualize one tooth surface (partially visible).
Sts 1684	Type Site		Tooth	Indet.	Isolated tooth (needs preparation); possibly, a premolar or molar, but covered in breccia. Only, a very small piece of enamel is visible.
Sts 1688	Type Site		Cranium	Indet.	Neurocranial fragment; no discernible info.
Sts 1702	Type Site		Maxilla	Indet.	Partial palate and bascranium. Only ?lingual cusps of one molar tooth present.
Sts 1703	Type Site		Tooth	Indet.	Teeth in breccia, very large primate. Can only visualize partial enamel.
Sts 1704	Type Site		Maxilla	Right	Maxillary fragment with I^1-I^2. Can visualize some buccal surfaces of posterior teeth; unfortunately, most of specimen is covered in breccia. I^1-I^2 are fractured at roots and most measurements not possible.
Sts 1713	Type Site		Mandible	Indet.	Impression of mandible, reflecting portions of the ascending ramus and mandibular corpus.
Sts 1716	Type Site		Tooth	Indet.	Fragmented canine; large in size. Partial root and crown. Specimen still encased in breccia; needs preparation.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1722	Type Site		Tooth	Indet.	Isolated incisor (needs preparation); can only visualize a portion of the lingual surface.
Sts 1728	Type Site		Mandible	Both	Anterior portion of a mandible. Most surfaces covered by breccia and can only visualize one partial tooth crown. Mostly likely a sectorial P_3.
Sts 1748	Type Site		Maxilla	Right	Maxillary fragment with partial toothrow. Portion of right mandible articulated. Heavily fractured through bone and dentition; making it difficult to identify which teeth, or in some cases fragments, are present.
Sts 1753	Type Site	*Parapapio*	Mandible	Left	Mandibular fragment with M1 (roots), M2 and M3 (complete)are present; heavily worn, older adult.
Sts 1760	Type Site		Tooth	Left	I^1. Partial root; heavily worn. Only breadth taken.
Sts 1762	Type Site		Tooth	Indet.	Isolated molar tooth fragment, a very small piece of jaw is present. Appears that another molar is present, but not enough for diagnosis. Specimen is preserved as a small piece of enamel with roots.
Sts 1763	Type Site	*Pp. broomi*	Tooth	Indet.	*Pp. broomi* in shape and morphology. Tooth is encased in matrix and morphology is difficult to make out. Tooth appears to be a M^3; no measurements taken. Specimen shows very little wear.
Sts 1768	Type Site		Tooth	Indet.	Partial isolated molar (needs preparation); may actually be more anatomy there, but specimen is encased in breccia.
Sts 1770	Type Site		Maxilla	Indet.	Maxillary fragment with tooth fragments; very little discernible anatomy. Teeth are fractured and need preparation. Specimen still covered in breccia.
Sts 1772	Type Site		Mandible	Both	Anterior portion of mandible. Portions of both rami. Specimen is small in size; most tooth crowns fractured off. Breccia covers the incisor alveoli which would have been help in identifying the specimen.
Sts 1777	Type Site		Cranium	Indet.	Much of a severely crushed cranium; can visualize palatal surface. Most of the dentition is absent. Specimen appears to possess an erupting C^1 which is *Papio* in size.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1778	Type Site		Cranium	Indet.	Neurocranial fragment; specimen is enclosed in breccia. Needs preparation.
Sts 1785	Type Site		Tooth	Right	Isolated incisor (I1, right side?). Height can be measured. Papionin in morphology.
Sts 1788	Type Site		Mandible	Indet.	Mandibular fragment; no discernible anatomical information.
Sts 1792	Type Site		Mandible	Right	Mandibular fragment with fractured dentition. Appears to the right side. Preserves the C_1-M_1; can visualize the roots of P_3, P_4 and M_1. No teeth are measurable. Specimen has small mandibular fossa.
Sts 1794	Type Site		Mandible	Both	?Anterior portion of a mandible with fractured dentition.
Sts 1797	Type Site		Maxilla	Indet.	Very damaged piece of maxilla with fractured dental roots.
Sts 1801	Type Site		Mandible	Right	Fragment of mandibular corpus; anterior portion. Specimen preserves I_2? - M_2; very small specimen.
Sts 1810	Type Site		Cranium	Indet.	Neurocranial fragment; no discernible information.
Sts 1813	Type Site		Maxilla	Both	Anterior portion of a maxillary fragment with fractured dentition; juvenile. C^1 is erupting (tip visible). Other teeth less distinguishable because of fracture. Can only visualize the occlusal surfaces. Specimen encased in breccia.
Sts 1817	Type Site		Mandible	Right	Mandibular fragment with M^1 and M^2. Papionin. Can visualize fractured P^3, sectorial; encased in breccia and missing the lingual side. Can only visualize lingual side of M^1 and M^2, although some of the breccia has been worked away from the occlusal surface. Nothing measurable.
Sts 1828	Type Site		Tooth	Indet.	Isolated incisor; mostly a root. Lingual portion of crown fractured; a piece of enamel is present, but projects into breccia.
Sts 1836	Type Site		Tooth	Indet.	Partial isolated canine, can only visualize cross-section from superior view.
Sts 1837	Type Site		Maxilla	Right	Maxillary fragment; appears to be right side. Breccia covers most morphology; can visualize the ?distal end of a molar. Occlusal surface covered. Can also visualize internal surface of the palate (i.e. inside nasal cavity).

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1839	Type Site		Tooth	Indet.	Partial isolated incisor. Fragmented around cervix; not much of the crown or root present.
Sts 1841	Type Site		Endocast	Indet.	Partial endocast, very poor condition.
Sts 1868	Type Site		Mandible	Indet.	Mandibular fragment with corpus and symphysis. C_1 roots, need preparation. Specimen is encased in breccia block.
Sts 1895	Type Site		Maxilla	Right	M^3 (crown)
Sts 1899	Type Site		Tooth	Indet.	Isolated molar fragment, only one fragmented loph. This may go with the type specimen.
Sts 1917	Type Site	*Papio*	Maxilla	Left	Maxillary fragment. Palate with roots of premolars and molars. Specimen possesses a shallow palate; can visualize palatine foramen. Distal roots of P^3, roots of P^4-M^3 are visible. M^3 looks *Lophocebus*-like. However, M^3 is roots only not crown; so may not reflect actual morphology.
Sts 1925 b	Type Site		Mandible	Left	Mandibular fragment. Specimen looks *Pp. jonesi.* P_3 and P_4, small sectorial female?
Sts 1927	Type Site		Tooth	Indet.	Partial isolated molar; fractured bucco-lingually.
Sts 1929	Type Site		Maxilla	Indet.	Tooth fragments in piece of ?maxilla. Teeth present appear to be the C^1, P^3 (erupting) and a fragmented molar.
Sts 1934	Type Site		Tooth	Indet.	Isolated canine; similar in size to Sts 2438. Can visualize the buccal side, but difficult to determine jaw. Not all of crown is exposed; needs preparation. No measurements.
Sts 1937	Type Site	*C. williamsi*	Tooth	Indet.	Isolated incisor (needs preparation). Specimen appears to be *Cercopithecoides* in size and morphology; but is encased in breccia and not discernible.
Sts 1939	Type Site		Maxilla	Right	Maxillary fragment with impression of C^1, I^1 and I^2 on right. Papionin.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 1954	Type Site		Tooth	Indet.	Isolated molar; appears to be bilophodont. Can only visualize a small piece of enamel. Remainder of specimen covered in breccia; needs preparation.
Sts 1955	Type Site		Cranium	Indet.	Much of a neurocranium. Cranial bone fragments suspended in breccia; needs preparation. Very little identifiable information.
Sts 1957	Type Site		Cranium	Both	Partial neurocranium. No muzzle or dentition. Very small. On left side, specimen appears to possess a temporal bone with zygomatic arch. Cranium filled with calcite. Can only visualize outline of cranial vault bones.
Sts 1960 a	Type Site		Cranium	Indet.	Cranial fragment; appears to be a brow ridge. Specimen is encased in large piece of calcite. Sts 1960b goes along with this. Note, someone has suggested that it might be a hominid endocast fragment (note in box).
Sts 1963	Type Site		Cranium	Both	Specimen appears to be a calotte, but more likely is the inferior portion of two parietals and large portion of the basicranium. Difficult to determine though because sediment fills the area where the foramen magnum and venous structures would be observed. Needs preparation.
Sts 1965	Type Site		Cranium	Both	Superior portion of a small braincase; juvenile. Still encased in breccia.
Sts 1966	Type Site		Maxilla	Indet.	Partially crushed muzzle. Very badly damaged; only one cusp of one tooth visible. Not identifiable.
Sts 1969	Type Site		Cranium	Indet.	Temporal fragment with partial petrosal portion. Specimen is still encased in breccia. Needs preparation.
Sts 1970	Type Site		Cranium	Indet.	Partial neurocranium. Cranial vault fragment with missing portions represented as endocast.
Sts 1983	Type Site		Endocast	Right?	Partial endocast; lobe of ?right frontal with orbital anatomy.
Sts 1993	Type Site		Tooth	Indet.	Specimen appears to be a canine root, ?side. Needs preparation as most surfaces are covered with breccia. Crown is fractured and is covered with

Specimen Number	Provenance	Taxon	Element	Side	Comments
					?glue on its surface.
Sts 1995	Type Site		Maxilla	Indet.	Maxillary fragment in very poor condition. Needs preparation. Still encased in breccia.
Sts 2002	Type Site		Maxilla	Indet.	Remains of a completely shattered muzzle. Partial toothrow; no measurable information.
Sts 2008	Type Site		Cranium	Both	Most of an endocast and partial muzzle. Very little anatomical information. Some cranial bone fragments adhering to the endocast. Cannot visualize much snout; appears to be nasal septum.
Sts 2009	Type Site		Cranium	Both	Almost complete, but severely fractured neurocranium. No muzzle. Fragments are not in correct anatomical orientation. Needs preparation and reconstruction.
Sts 2010	Type Site		Cranium	Indet.	Several unidentifiable cranial fragments with a small fragment of endocast.
Sts 2012	Type Site		Cranium	Indet.	Neurocranial fragment with small section of endocast; enclosed in breccia.
Sts 2013	Type Site		Tooth	Indet.	Partial isolated tooth. Appears to be a deciduous incisor; difficult to determine since only partial surface is exposed. Specimen needs preparation. Specimen encased in breccia only ?labial surface is exposed.
Sts 2015	Type Site		Maxilla	Right	Maxillary fragment with fractured teeth. C^1-M^3 are visible in various planes (not all the same plane). Specimen appears to be right side because the palate can be visualized.
Sts 2015	Type Site		Cranium	Indet.	Cranial fragment. Appears to be a vault some fragment. Can only visualize outline of cranium (semi-circle); remainder is encased in breccia and needs preparation.
Sts 2016	Type Site		Tooth	Indet.	Partial isolated molar. Specimen is fractured bucco-lingually.
Sts 2017	Type Site		Mandible	Indet.	Mandibular fragment. Tooth roots; very small.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2018	Type Site		Maxilla	Right	Maxillary fragment. Palate visible, but specimen encased in breccia and teeth are fractured.
Sts 2020	Type Site		Cranium	Both	Basicranium and partial muzzle. Can visualize a potion of the sphenoid. Most of all sides are encased in breccia. Can visualize the outline of the basicranial bones.
Sts 2021	Type Site		Mandible	Left	Mandibular fragment; appears to be left side. Specimen is encased in breccia; tooth crowns are missing.
Sts 2023	Type Site		Cranium	Indet.	Partial neurocranium. No muzzle. Not readily identifiable.
Sts 2032	Type Site		Cranium	Right	Large portion of Neurocranium. No muzzle. Appears to be the parietal; preserves the middle meningeal arterial grooves.
Sts 2034	Type Site		Cranium	Indet.	Much of an extremely battered cranium; huge block of breccia. Several fragments visible, but not readily identifiable. Not anatomically useful.
Sts 2035	Type Site		Cranium	Indet.	Shattered cranium; no recoverable information.
Sts 2038	Type Site		Cranium	Both	Neurocranial fragment near midline. More left than right. Specimen ha left supraorbital region and proximal interorbital.
Sts 2043	Type Site		Cranium	Indet.	Neurocranial fragment. Can visualize endocranial surface. Specimen still attached to breccia; no discernible information.
Sts 2044	Type Site		Maxilla	Both	Maxillary fragment. Muzzle with broken teeth. *Parapapio* in profile. Only, a portion of the nasal and maxillae are present. Nasal aperture is preserved on right side. Can observe small P^3. Can visualize left zygomatic and looks ?female. Shallow developed maxillary fossa on left; appears to be other bone fragments in same breccia block (bovid? ribs).
Sts 2045	Type Site		Cranium	Indet.	Partial neurocranium. Specimen is still encased in breccia. Exterior surface visible. No discernible information.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2051	Type Site		Mandible	Both	Mandbiular fragment. Can only visualize the superior right side (fractured below alveoli) ,and on left, can visualize the same plus the lateral margins of the body (has a *Papio*-sized maxillary fossa). Needs preparation.
Sts 2058	Type Site		Mandible	Indet.	Mandibular fragment. Can visualize lingual surfaces of incisors, but they are fractured. Can only visualize tooth clearly. Rest of specimen is enclosed in breccia.
Sts 2067	Type Site		Maxilla	Indet.	Maxillary fragment with M^3. Specimen is measurable.
Sts 2071	Type Site		Maxilla	Right	Maxillary fragment with portions of the right molars. Specimen is fractured in a manner in which you are viewing the roots of the right molars superiorly. Additionally, can visualize the curvature of the palate from the internal side.
Sts 2077	Type Site		Mandible	Indet.	Mandibular fragment with three molars (needs preparation); not very identifiable.
Sts 2079	Type Site		Tooth	Indet.	Isolated molar fragment; M2? Only one side visible (buccal or lingual), remainder covered in breccia.
Sts 2084	Type Site		Mandible	Right	Mandibular fragment encased in breccia. Only lingual surfaces are visible.
Sts 2093	Type Site		Mandible	Left	Mandibular fragment; appears to be left side. Difficult to determine. Molar present, not M_3, is only roots. Specimen encased in breccia.
Sts 2103	Type Site		Mandible	Left	Mandibular fragment with P_3-M_3; Corpus with impression of ascending ramus.
Sts 2105	Type Site		Tooth	Indet.	Isolated incisor. Small in size, occlusal surface blocked by breccia. Only lingual surface is visible.
Sts 2106	Type Site		Maxilla	Indet.	Maxillary fragment with fractured dentition. Not readily identifiable. Paint for specimen numbering covers most of specimen's surface; makes identification more difficult. Teeth are represented by a few root and enamel fragments; encased in breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2111	Type Site		Cranium	Both	Anterior portion of a neurocranium. On left, temporal line appears to be present. Fragment is most of the frontal, but fracture passes through bone (exposing diploë) at 45°.
Sts 2115	Type Site		Cranium	Left	Cranial fragment. Appears to be the left tempora; covered in breccia on most sides.
Sts 2116	Type Site	*Parapapio*	Tooth	Left	Tooth suspended in breccia. Heavily worn. Appears to have roots visible on one side (buccal). Breccia precludes any measurements; except maybe length. On same breccia block, an incisor can be visualized; not well enough to identify. Appears to represent an I2.
Sts 2117	Type Site	*Pp. broomi*	Maxilla	Right	Maxillary fragment of older adult. Teeth are heavily worn. P^4 is mostly missing. Material has been used to hold teeth together on lingual side. Most of lingual side on all teeth is sheered away and covered with material. Only measurement possible is length of M^2. Appears to have horse-shoe shape of *Pp. broomi* palate; tooth shape is similar.
Sts 2118	Type Site		Mandible	Right	Mandibular fragment. Must be a couple of specimens with this number. Anterior-most portion of a mandible. Incisors and canines appear to be missing. Specimen does have a small sectorial P_3. Mostly, right portion, but small fragment of left is present. Needs preparation.
Sts 2118	Type Site		Cranium	Indet.	Appears to be two different specimens on this breccia block. One looks like frontal fragments of a juvenile? Can visualize interorbital distance and flat frontal. Posterior lobe of an endocast on same side. On opposite side of breccia block, one can visualize crown fragments of molars? Teeth seem too large to belong to other specimen. Needs preparation; both encased in breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2122	Type Site	*P. izodi*	Maxilla	Right	Maxillary fragment with deep palate. Right M^1-M^3 and left lingual enamel of M^3 only. Right side, M^1 missing mesial surface, M^2 complete and measureable, M^3 missing buccal cusps and enamel. M^3 typical papionin, not *Lophocebus*-like (i.e. not triangular); however, difficult to say with missing cusps.
Sts 2123	Type Site		Mandible	Left	P_4; most surfaces covered with breccia.
Sts 2124	Type Site		Mandible	Indet.	Mandibular and tooth fragments; pieces scattered throughout the breccia. Not measurable; needs preparation.
Sts 2130	Type Site		Tooth	Indet.	Isolated incisor, unable determine jaw and therefore side. Small enough to be an I^2; could as well be a lower.
Sts 2133	Type Site		Tooth	Indet.	Isolated male canine; very large. Immeasurable; similar in size and structure to Sts 2438. Specimen is 65% encased in breccia. Appears to be the buccal side. No side.
Sts 2139	Type Site		Tooth	Indet.	Isolated molar in jaw fragment (needs preparation). Occlusal surface and most others covered with breccia; unable to identify.
Sts 2142	Type Site		Maxilla	Indet.	Maxillary fragment with fragments of two teeth. Specimen is heavily fragmented and covered in breccia.
Sts 2143	Type Site		Endocast	Both	Anterior portion of an endocast. Exhibits the frontal lobes near the orbits.
Sts 2144	Type Site		Tooth	Indet.	Isolated P3? Top of crown has been fractured; appears to be a maxillary, but not definitive.
Sts 2146	Type Site		Tooth	Indet.	Isolated molar fragment. Cusps covered with breccia, not readily identifiable.
Sts 2147	Type Site		Tooth	Indet.	Isolated ?molar fragment. Only one loph visible. Remainder of tooth covered with breccia. Specimen may, as well, be a premolar.
Sts 2158	Type Site		Mandible	Left	Mandibular fragment. Preserves a portion of the left corpus with tooth roots. Fracture appears to have been just below most of the roots. Root tips and impression of a molar crown is visible; no other anatomical information observable.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2160	Type Site	*Pp. broomi.*	Maxilla	Both	Maxillary fragment. Edentulous specimen. Identification is debatable, but specimen has relatively large maxillary ridges. Right side exhibits evidence of a large maxillary fossa. Specimen appears to have possessed a relatively large canine (male).
Sts 2161	Type Site		Mandible	Indet.	Mandibular and tooth fragment. Encased in breccia; not easily discernible. No measurements.
Sts 2163	Type Site		Tooth	Indet.	Partial isolated tooth; very little surface exposed. Can visualize enamel and dentine where fractured.
Sts 217?	Type Site		Cranium	Left	Posterior end of neurocranium. On left, can visualize auditory meatus and glenoid fossa. Most other regions fragmented. Specimen needs preparation to remove it from the block of breccia.
Sts 2174	Type Site		Mandible	Indet.	Mandibular fragment. Superior edge (i.e. condyles) project into breccia block. Not clear whether superior portions are preserved. Can only visualize gonion. Mandible is fractured posterior to the toothrow.
Sts 2190	Type Site		Cranium	Left	Cranial fragment. Remains of a completely damaged cranium. Appears to be left side; can visualize partial palate on right. Encased in breccia. Can visualize outline of muzzle. Only partial frontal preserved. Appears to have the right temporal bone, but again, encased in the breccia. Perhaps, a few fragments of teeth are present, but covered. Specimen needs preparation.
Sts 2193	Type Site		Tooth	Indet.	Partial isolated molar. Appears to be maxillary by looking at roots. Covered in breccia; difficult to determine with confidence.
Sts 2196	Type Site		Tooth	Indet.	Isolated tooth (probably canine, needs preparation); only lingual surface visible. Rest of specimen covered in breccia.
Sts 2205	Type Site		Palate	Right	Palatal fragment with a partial toothrow. Dentition is fractured and are viewable only in cross-section; no measurements.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2206	Type Site		Tooth	Indet.	Partial isolated tooth. Specimen is suspended in breccia and not readily identifiable.
Sts 2207	Type Site		Tooth	Indet.	Fragment of isolated tooth. Heavily worn molar? Only partially visible; needs preparation.
Sts 2208	Type Site		Maxilla	Right?	Maxillary fragment with tooth roots. Impression of P^3, buccal cusps of P^4, and buccal cusps of M^3. Teeth are highly fragmented but identifiable.
Sts 2209	Type Site		Tooth	Indet.	Isolated tooth fragments; difficult to identify because breccia is blocking most surfaces. Teeth are fractured near cervix. Appears as a small C^1 and P^3. Thin piece of bone adjacent to tooth fragments could be palate, but seems very thin. Needs preparation.
Sts 2212	Type Site		Cranium	Indet.	Neurocranial fragment; needs preparation. Difficult to visualize anatomy.
Sts 2215	Type Site		Maxilla	Right	Maxillary fragment with mixed dentition. Maxilla (crushed) with I^1, dm^2, M^1, and M^2 (unerupted). Because of adhering breccia; no measurements can be taken except length of I^1.
Sts 2215	Type Site	*Parapapio*	Cranium	Indet.	Appears to be a cranial fragment, but difficult to determine. Encased in breccia and is a small piece.
Sts 2220	Type Site		Cranium	Indet.	Cranial fragment with ½ of neurocranium. Looks like calotte. Breccia and calcite cover outside of specimen. Not identifiable.
Sts 2222	Type Site		Cranium	Indet.	Small portion of neurocranium. Cannot determine region. Where bone is absent, endocast is present.
Sts 2223	Type Site		Endocast	Indet.	Appears to be a large endocast. Almost all sides are covered with breccia, needs preparation. Specimen shows very little anatomical detail.
Sts 2224	Type Site		Mandible	Indet.	Impressions of two mandibles; not very diagnostic. Large breccia block with several other bone fragments included in the matrix.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2227	Type Site		Maxilla	Indet.	Tooth fragments with maxillary fragment. Specimen encased in breccia.
Sts 2231	Type Site		Tooth	Right	Isolated M_2 (heavily fractured on the lingual side) and M_3 (fairly complete). Measurements of M_3 length, height and notch height can be taken.
Sts 2244	Type Site		Cranium	Both	Anterior portion of a braincase and muzzle. Right side, most of superior orbit, interorbital region and partial snout. Left side, only 1/3 of the supraorbital region and orbits. Remainder of the specimen encased in breccia. Papionin in morphology; little or no brow but small interorbital.
Sts 2251	Type Site		Tooth	Indet.	Fragments of isolated teeth.
Sts 2262	Type Site		Cranium	Indet.	Neurocranial fragments. No discernible information.
Sts 2264	Type Site		Cranium	Indet.	Neurocranial fragment. No identification.
Sts 2274	Type Site		Mandible	Indet.	Mandibular fragment with ?M_3. Portions of the ascending ramus and gonion preserved. Specimen is fractured through M_3. Appears to be left; needs preparation to remove it from breccia. Breccia covers all surfaces except the lingual.
Sts 2279	Type Site		Tooth	Indet.	Isolated tooth fragment. Can visualize partial tooth; may be a premolar. Still encased in breccia, needs preparation.
Sts 2280	Type Site		Mandible	Indet.	Mandibular fragment. M_3 is erupting, but not in occlusion. Other teeth, M_1 and M_2, are less recognizable, as fracture goes through alveoli and roots. Siding indeterminate.
Sts 2292	Type Site		Tooth	Indet.	Partial isolated molar. Only one loph is present; cannot determine mesial or distal.
Sts 2295	Type Site		Mandible	Indet.	Mandibular fragment with partial ?molar tooth and alveoli. Posterior portion of corpus and ascending ramus present, as well.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2297	Type Site		Tooth	Indet.	Fragment of isolated molar. However, specimen is cryptic, as most of its morphology is covered with paint and/or breccia.
Sts 2303	Type Site		Maxilla	Right	Damaged maxillary fragment. Very deep palate with parallel/straight toothrows. Breccia covers most of the superior (nasal region) muzzle. Appears to possess a large zygomatic. Needs preparation. Can visualize a molar root. Specimen looks to have possessed a relatively large canine; difficult to determine exact size.
Sts 2306	Type Site		Tooth	Indet.	Tooth fragments in ?maxilla. Can visualize roots, but very little anatomical information. Needs preparation. Breccia covers most of the specimen.
Sts 2331	Type Site		Mandible	Right	Mandibular fragment. Junction of corpus and ascending ramus. Can visualize M_3? Lingual side covered with breccia.
Sts 2333	Type Site		Cranium	Both	Mandibular fragment with right I_1-I_2, dc_1, dm_1, dm_2, M_1 and left I_1-I_2, C_1 (unerupted). Foramen visible on posterior surface of anterior mandible.
Sts 2344	Type Site		Maxilla	Indet.	Maxillary fragment. Can only visualize partial roots sheared mesio-distally. Maxillae halves appear to be compressed medio-laterally.
Sts 2348	Type Site		Tooth	Left	Isolated left P_4. Only, occlusal surface is visible. Remainder of specimen is embedded in breccia.
Sts 2350	Type Site		Maxilla	Indet.	Portion of a battered muzzle. Can make out some dental roots. Specimen is fractured to a degree rendering most features unidentifiable. Muzzle projects into breccia; needs preparation.
Sts 2352	Type Site		Cranium	Indet.	Basicranium and a partial muzzle. Not readily identifiable.
Sts 2365	Type Site		Tooth	Indet.	P^3-P^4 with an impression of a canine root to the side.
Sts 2375	Type Site		Maxilla	Indet.	Portion of a severely damaged snout. Specimen needs preparation. Presently, not much anatomical information observable.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2376	Type Site		Maxilla	Both	Portion of a palate and tooth roots. Heavily fractured, can visualize partial tooth roots/alveoli. Needs preparation. Fragments of P^3-M^3 present.
Sts 2377	Type Site		Cranium	Both	Much of neurocranium. Can visualize the supraorbital tori; very lightly built, as in *Parapapio*. Cranial vault continues until parietal. Specimen is mainly frontal and parietal fragments on right side; small fragments on left.
Sts 2388	Type Site		Cranium	Indet.	Neurocranial fragments. Looking at endocranial surface; exterior surface of bones is in breccia. Needs preparation; currently, no discernible anatomically information.
Sts 2406	Type Site		Cranium	Indet.	Impression of neurocranial fragment.
Sts 2433	Type Site		Tooth	Indet.	Partial isolated tooth. Not readily identifiable; still encased in breccia. Can visualize very little surface. Specimen appears to be a molar, as interpreted from fracture.
Sts 2438	Type Site		Tooth	Indet.	Isolated male canine; very *Papio*-like in form. Roots are fractured off. Difficult to determine side or jaw; however, appears to be maxillary. Most morphology covered with breccia.
Sts 2444	Type Site		Tooth	Indet.	Partial isolated tooth. Can visualize two faint cusps; encased in breccia. Specimen needs preparation.
Sts 2449	Type Site		Mandible	Indet.	Mandibular fragment with two molars (need preparation). Not readily identifiable.
Sts 2450	Type Site		Endocast	Indet.	Endocast of basicranium. Difficult to visualize exact location of specimen.
Sts 2475	Type Site		Mandible	Right	Mandibular fragment. Very little anatomical information. Can only visualize one cusp of a premolar or molar. Difficult to determine cusp. Appears to be a M_3. Can also visualize the impression of the corresponding M_2.
Sts 2477	Type Site		Tooth	Right	M_2, lingual surface exposed with some of the occlusal surface. Only, length can be measured. Perhaps, lingual and buccal intercusps can be measured, as

Specimen Number	Provenance	Taxon	Element	Side	Comments
					well.
Sts 2488	Type Site		Tooth	Indet.	Portions of two molars; unable to identify further. Small fragment of bone attached to one molar; not enough for identification.
Sts 2489	Type Site		Tooth	Indet.	Isolated molar; crown fractured and covered with breccia. Unidentifiable; needs preparation.
Sts 2508	Type Site		Tooth	Indet.	Isolated premolar; broken tooth off of Sts UN 2.
Sts 2510	Type Site		Mandible	Right	Mandibular fragment with fractured dentition. I_1-M_3, none of which are measurable. All are fragmented.
Sts 2512	Type Site		Tooth	Indet.	Root of male canine; very large. *Papio*-like. Looks like it would have belonged to a similarly sized individual as Sts 2438.
Sts 2525	Type Site		Mandible	Right	Mandibular corpus with tooth roots. Specimen is suspended in breccia; can visualize lingual side. Remainder covered in breccia.
Sts 2531	Type Site		Tooth	Indet.	Portions of isolated teeth, unidentifiable.
Sts 2544	Type Site		Tooth	Indet.	Unidentifiable tooth fragment. Covered in breccia. Needs preparation. Even after prep, would probably still be unidentifiable. May be root fragment.
Sts 2545	Type Site		Mandible	Right	Edentulous mandibular fragment. Most of right ascending ramus. Only, lateral side visible; specimen encased in breccia.
Sts 2548	Type Site		Tooth	Indet.	Encased in breccia; no measurements possible. Three teeth present. Appears to be buccal side of dm1 (enamel only showing), dm2 (buccal side cusps) and M1. Remainder of tooth surfaces are encased in breccia. Length of M1 can be estimated; difficult to determine which jaw and side.
Sts 2558	Type Site		Mandible	Indet.	Mandible and tooth fragments. Very little anatomical information determinable. Most covered with breccia; outline of specimen looks mandibular, but may as well be maxillary fragment.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 2570	Type Site		Mandible	Indet.	Small mandible and tooth fragments. Only, partial crowns present. Difficult to determine side or teeth present. Specimen is heavily fragmented.
Sts 2572	Type Site		Cranium	Indet.	Portions of a crushed cranium. Basicranium and posterior muzzle.
Sts 2643	Type Site		Tooth	Indet.	Portion of a damaged molar. Difficult to visualize; as specimen is covered with breccia.
Sts 3035	Type Site	*P. izodi*	Cranium	Both	Partial muzzle and orbits, fractured molar toothrow (bilaterally). Teeth are not measurable. Palate is horse-shoe shaped. Left side preserves four infraorbital foramina. Specimen possesses forward facing zygomatics. No sign of maxillary fossa.
Sts 3036	Type Site		Tooth	Left	Isolated C^1. Large in size; tip is fractured and only partial root is exposed. Needs preparation.
Sts 3037	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment. Still encased in breccia; few measurements taken. Most tooth surfaces encased in breccia. Tooth rows appear parallel. Right side M_3 missing hypoconulid due to fracture. Only portions of corpi are present and few teeth. Missing anterior portion of mandible.
Sts 3038	Type Site		Tooth	Right	Isolated M^2. Some surfaces covered in breccia. Able to measure breadth and lengths. Occlusal surface covered with breccia.
Sts 3039	Type Site		Tooth	Left	Isolated P^4; only length measurable. Remainder of specimen is covered in breccia.
Sts 3040	Type Site		Tooth	Right	Isolated I^2; only partial crown and root. Encased in breccia; no measurements.
Sts 3041	Type Site		Tooth	Right	Isolated I^2, most surfaces covered in breccia; no measurements.
Sts 3042	Type Site		Tooth	Left	Isolated I_2? Can only visualize portions of the tooth in occlusal cross-section; covered in breccia.
Sts 3043	Type Site		Mandible	Left	Mandibular fragment with a partial M_3. Very poor condition; highly fragmented and cemented in breccia.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3044	Type Site		Tooth	Left	Isolated P_3. Can only measure flange length and possibly height. Other surfaces enclosed in breccia.
Sts 3045	Type Site	*Parapapio*	Tooth	Right	Most of tooth is covered with breccia and cannot be measured. Maxillary tooth; mesial lingual cusp is nearly covered with breccia. Breadth measurements of distal loph taken. Tooth is crown only. Roots are broken off.
Sts 3046	Type Site		Tooth	Indet.	Partial isolated molar. Specimen still suspended in matrix; no measurements.
Sts 3047	Type Site	*Parapapio*	Maxilla	Left	Maxillary fragment with mesial portion of the M^2. Other than length of M^2, all other measurements can be taken. Bone still encased in breccia. Height measurements may be a little tenuous. Appears to have a horse-shoe shaped palate. Dentition compares well with *Pp. broomi* from Member 2. Specimen was assigned to *Pp. whitei/P. robinsoni* by Eisenhart.
Sts 3048	Type Site	*Parapapio*	Cranium	Both	Much of a badly damaged cranium. Specimen encased in breccia. Cranial measurements not possible; All sides not accessible. Right palate is absent. Only, P^4-M^3 present on left side. Teeth are cracked and distorted. No measurements except lengths taken. Horse-shoe shaped palate. Not able to determine if maxillary fossa present.
Sts 3049	Type Site		Tooth	Right	Isolated I^2. Heavily worn.
Sts 3050	Type Site		Tooth	Right	Isolated P^3. Fragmented crown.
Sts 3051	Type Site		Tooth	Right	Isolated M_1; crown only. Appears to have v-shaped buccal clefts. Very small in size. Doesn't appear to exhibit much molar flaring.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3052	Type Site	*Parapapio*	Maxilla	Left	Partial left palate; still encased in breccia. External surface of the maxilla (left) can be visualized. Occlusal surfaces of four teeth can be observed. Some may not be measured because breccia surrounding teeth. M^3 appears very *Lophocebus*-like in morphology. Teeth also appear to be in shape and size of *Pp. broomi.* Palate appears horse-shoe shaped, not parallel. P^4 is fractured and enamel chipped on buccal surface; only length taken.
Sts 3053	Type Site	*Pp. jonesi*	Mandible	Left	Mandibular fragment; heavily distorted. Tooth row is 45° out of synch with the ascending ramus (projects forward). Also, buccal side of mandible is missing and covered with material (glue?). Very old adult. Heavily worn; catalog states female. Size and nature of P_3 suggests *Pp. jonesi*.
Sts 3054	Type Site	*Parapapio*	Mandible	Both	Mandibular fragment; very old adult. Heavily worn; only lengths of right M_2-M_3 can be taken. Remaining dentition is fragmented. Size suggests *Pp. jonesi*; difficult to determine. Incisors look really small (*C. williamsi*), but may the result of fragmentation. Size of P_3 (right) appears to be female
Sts 3055	Type Site		Maxilla	Both	Shattered maxilla. Left side has P^3-M^3, very poor condition. Right side, only M^2 and M^3 present, same condition; no measurements.
Sts 3056	Type Site		Mandible	Right	Mandibular fragment, P_4 and M_1. Left side corpus to about M_1. Alveolus has been sheared on left. Teeth are covered with breccia and inaccessible and/or in poor condition.
Sts 3057	Type Site		Cranium	Both	Juvenile, cranial fragments. Small interorbital distance. Frontal fragment. Coronal suture visible from left to midline; suture was unfused.
Sts 3061	Type Site	*Parapapio*	Mandible	Left	Mandibular corpus with partial P_4 and M_2 (complete); no measurements for P_4 taken. Appears to have a mandibular fossa. Mandible is fractured and distorted a little. *Pp. broomi*-sized tooth, M_2.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3062	Type Site		Mandible	Right	Mandibular fragment. Heavily damaged. I_2 fragment, but not in correct plane. I_2 has been shifted buccally; very worn. Breadth measurement possible.
Sts 3063	Type Site		Cranium	Indet.	Much of a shattered and crushed cranium. No tooth crowns visible. Specimen is in a very deteriorated condition.
Sts 3064	Type Site		Tooth	Right?	Partial molar. Specimen appears to be the M_2? Lingual cusps only.
Sts 3066	Type Site		Maxilla	Left	Maxillary fragment with C^1-M^2. Heavily damaged; no tooth is greater than 40% complete. Most of dentition is only enamel fragments. Appears *Parapapio* in size.
Sts 3067	Type Site	*Parapapio*	Maxilla	Left	Fragmented articulated maxilla and mandible. No measurements are possible and difficult to determine age. Catalog suggests female. Sex based upon small appearance of the teeth. Adult with P^3-P^4.
Sts 3068	Type Site		Tooth	Right	Isolated P_4; disto-lingual surface fragmented. Crown only.
Sts 3070	Type Site	*Parapapio*	Mandible	Right	Partial M^3 (distal cusps and hypoconulid). Can visualize roots of M^2 and proximal loph M^3 where they have been sheared off. Measurements are difficult; should be viewed as estimates.
Sts 3071	Type Site		Tooth	Right	M_3, missing buccal cusps. Hypoconulid is present; length can be estimated.
Sts 3072	Type Site		Maxilla	Left	Maxillary fragment with P^4. Can visualize a partial maxilla buried in breccia. Buccal, mesial and distal sides are to an extent are covered by breccia. Can visualize a faint outline of the M^1 (mesial root). No measures.
Sts 3073	Type Site	*Parapapio*	Maxilla	Left	Maxillary fragment with mixed dentition. Specimen includes mandibular and maxillary fragments, deciduous and permanent teeth. Cannot visualize occlusal surfaces except for M^1 (erupting). Not measurable.
Sts 3076	Type Site		Cranium	Indet.	Most of severely weathered and damaged cranium; probably irreparable, very poor condition.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3078	Type Site	*Parapapio*	Mandible	Right	Mandibular fragment; fractured and covered with breccia. M_1-M_3. Old adult; heavily worn. Only M_3 can be measured; breccia is adhering to the remainder of the specimen. M_2 length can be measured. Specimen appears to have a slight concavity suggestive of a mandibular fossa.
Sts 3086	Type Site		Tooth	Left	Catalog states molar fragment; appears to be a mandibular P_4 based upon the presence of a lingual notch. Also, there is an absence of a second loph. Some measurements can be taken; looks *Papio*-sized.
Sts 3091	Type Site		Cranium	Both	Most of a neurocranium. Also, jaw and tooth fragments. Only, superior portion of neurocranium visible. Mostly endocast, remainder enclosed in breccia. Same for the jaw and tooth fragment.
Sts 3092	Type Site		Endocast	Both	Complete endocranial cast. No muzzle. Excellent preservation; can visualize most of midline structures. Right side less complete than left. On left side, can visualize both the temporal and frontal lobes.
Sts 3093	Type Site		Cranium	Both	Cranium. Orbits and fragment of frontal. Supraorbital ridges (both sides) and left zygomatic (under orbit only) are preserved. Appears to have small-sized supraorbital torus; however, larger than typical *Parapapio* (i.e. *C. williamsi* or *Papio*?).
Sts 3094	Type Site		Endocast	Right	Portion of an endocranial cast. Small size; appears to be less than ½ of right side.
Sts 3095	Type Site		Cranium	Indet.	Neurocranial fragment.
Sts 3096	Type Site		Mandible	Indet.	Mandibular fragment; difficult to determine which tooth is present. Can only visualize the distal side, crown not visible. Tooth appears to be a molar.
Sts 3097	Type Site		Cranium	Indet.	Muzzle with fractured dentition (left toothrow) and neurocranial fragments. Cranium still encased wholly in breccia. Teeth from lateral view appear papionin. *Pp. broomi* in profile? No measurements; appears as if are viewing cranium from inside-out. Toothrow is fractured down middle of teeth; difficult to determine side.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3098	Type Site		Cranium	Both	Complete neurocranium and endocast. No muzzle. Specimen has small supraorbital torus. Endocast present in occipital region. Left side, temporal and parietal are preserved. Right side, parietal side. Difficult to determine, but anteorbital region appears to drop as in *Papio*, not *Parapapio*.
Sts 3099	Type Site		Cranium	Indet.	Partial neurocranium and muzzle. Not diagnostic and heavily fragmented. Specimen does not have any measurable teeth. Encased in breccia; needs preparation.
Sts 3100	Type Site		Cranium	Both	Most of neurocranium (crushed) and partial muzzle. Right side of cranium preserves portions of the temporal and parietal bones. Right side, tooth fragment appears to be a heavily worn premolar.
Sts 3101	Type Site		Maxilla	Right	Maxillary fragment with C^1-M^1; only partial buccal surfaces are visible. Remainder covered with breccia. No measurements. Maxilla also fragmented.
Sts 3102	Type Site		Cranium	Indet.	Neurocranial fragment; appears to be parieto-occipital region (?right).
Sts 3103	Type Site		Cranium	Both	Neurocranium and a partial muzzle. Specimen is wholly encased in breccia. No measurements; needs preparation.
Sts 3104	Type Site		Cranium	Left	½ of braincase. Can only visualize outlines and a small piece of the posterior endocast. Most of the specimen covered with breccia.
Sts 3105	Type Site		Cranium	Indet.	Partial neurocranium and muzzle. Specimen appears to be a conglomeration of mangled fragments. Very poor condition; large piece of breccia.
Sts 3106	Type Site		Endocast	Both	Basicranium; beautifully preserved venous structures in occipital region.
Sts 3108	Type Site		Endocast	Right	Partial neurocranium. Specimen appears to be the posterior, right lobe. Remnants of bone can be visualized at edges; mostly endocast is exposed.
Sts 3109	Type Site		Cranium	Indet.	Partial neurocranium? Must be another Sts 3109, as well.

Specimen Number	Provenance	Taxon	Element	Side	Comments
Sts 3111	Type Site		Cranium	Indet.	Basicranium and a partial maxilla; mangled specimen. Needs preparation. Breccia adhering to specimen.
Sts 4208	Type Site	*Pp. broomi*	Maxilla	Right	teeth are held together by glue? No portion of the maxilla can be visualized. Teeth attributed to maxilla simply because of morphology; teeth also appear in a horseshoe shaped pattern indicative of P. broomi; m1 fractured both mesially and mesio-buccally. Only distal loph measurement can be taken
Sts UN 1	Type Site		Cranium	Indet.	Neurocranial fragments; bleached white. No discernible anatomical information.
Sts UN 2	Type Site		Tooth	Indet.	Specimen appears to be a P^4 (crown).
Sts UN 3	Type Site		Endocast	Both	Nice endocast of superior brain region. Preserved posteriorly unttil cerebellum. Can visualize venous and arterial structures.
Sts UN 5	Type Site		Cranium	Indet.	Cranial fragment; appears to be fragment of ?temporal with lobe impression.
Sts UN 6	Type Site		Maxilla	Right	Maxillary fragment with P^3-M^3; poor condition. Some measurements are possible. P^3 crown fractured. All teeth are heavily worn. Specimen appears to be a *Pp. broomi*. Has horse-shoe shaped maxilla.
Sts UN 7	Type Site		Mandible	Right	*Pp. broomi*; right mandibular fragment in poor condition with M_2-M_3 (unrupted). Mandible is exfoliated.
Sts UN 8	Type Site		Maxilla	Left	Maxillary fragment; appears to be a female *Pp. jonesi*.

APPENDIX FOUR
TRANSVAAL MUSEUM CERCOPITHECOID POSTCRANIAL CATALOG – STS

Specimen Number	Provenance	Element	Side	Comments
Sts 368 b	Type Site	Vertebra - Atlas		Articulated atlas and axis vertebrae in excellent condition.
Sts 370 f	Type Site	Vertebra - Axis		Axis with dens; doesn't have spinous processes but preserves most of both pedicles.
Sts 377 c	Type Site	Humerus	Right	Right distal humerus with trochlea and olecranon fossa.
Sts 378 d	Type Site	Femur	Right	Wits catalog says isolated incisor, but is actually a right femur fragment preserving lesser trochanter.
Sts 381 e	Type Site	Vertebra - Thoracic		Part of thoracic vertebra; missing most of centrum. But, preserves spinous and transverse processes.
Sts 394 c	Type Site	Vertebra - Cervical		Cervical vertebra has been attributed to *C. williamsi*. Goes with Sts 394 a and b, a nice cranium of *C. williamsi*.
Sts 415 b	Type Site	Vertebra - Lumbar		Centrum of lumbar vertebra; missing most of pedicles and spinous process.
Sts 443	Type Site	Femur	Right	Right proximal femur fragment. Greater and lesser trochanters visible, but missing head and neck. Most superior portion of specimen covered in breccia.
Sts 549	Type Site	Femur	Left	Left distal femur diaphysis with condyles.
Sts 551	Type Site	Vertebra - Cervical		Cervical vertebra; missing part of left pedicle, but otherwise complete. Both transverse foramina are preserved.
Sts 1069	Type Site	Femur	Right	Proximal right femur with greater and lesser trochanters; anterior portion covered with breccia. Only posterior side clearly viewable.
Sts 1089	Type Site	Femur	Indeterminate	Fragment of proximal femur. Difficult to side, because femur is fractured. Specimen is a longitudinal section through femur.
Sts 1092	Type Site	Femur	Indeterminate	Fragment of femur head appears to be a ?juvenile head.

Specimen Number	Provenance	Element	Side	Comments
Sts 1094	Type Site	Femur	Right	Right proximal femur; catalog says left. Specimen preserves greater and lesser trochanter and unfused femoral head; juvenile. Unfused portion missing.
Sts 1204	Type Site	Tibia	Right	Distal tibia, right with medial malleolus.
Sts 1264	Type Site	Humerus	Left	Left distal humerus (fragmentary); missing anterior half and posterior half is encased in breccia. Trochlea and capitulum can be visualized in a cross-sectional view.
Sts 1458	Type Site	Humerus	Left	Fragmentary proximal humerus; appears to be medial side of a right; but tubercles not present.
Sts 1469	Type Site	Femur	Indeterminate	Femur head needs preparation may preserve a portion of the proximal shaft.
Sts 1504	Type Site	Humerus	Left	Left distal humerus with trochlea and capitulum; posterior surface covered with breccia.
Sts 1614	Type Site	Femur	Left	Distal femur; inferior patellar surface and both condyles visible; remainder covered in breccia; compares well with Sts 549.
Sts 1663	Type Site	Tibia	Indeterminate	Distal tibia fragment; most surfaces covered with breccia.
Sts 1733	Type Site	Femur		Part of femur head and shaft, goes with Sts 1092.
Sts 1764	Type Site	Radius	Left	Distal radius; very complete.
Sts 1860	Type Site	Tibia	Indeterminate	Proximal tibia fragment. Much of both condyles preserved. Posterior surface slightly fractured. Anterior tuberosity and a portion of the anterior crest preserved.
Sts 1905	Type Site	Femur	Left	Left distal femur fragment; both condyles and patellar surface preserved.
Sts 1978	Type Site	Femur	Indeterminate	Piece of proximal femur shaft; lesser trochanter can be visualized.

Specimen Number	Provenance	Element	Side	Comments
Sts 1992	Type Site	Femur	Left	Left proximal femur; preserves head, neck, part of diaphysis and lesser trochanter. Greater trochanter has been sheared off specimen.
Sts 2050	Type Site	Femur	Left	Part of a left proximal femur with head and a portion of the lesser trochanter.
Sts 2069	Type Site	Femur	Indeterminate	Portion of a femur head.
Sts 2074	Type Site	Humerus	Right	Right distal humerus fragment; only medial side of trochlea present. Remainder of trochlea and capitulum missing; can visualize superior outline of olecranon fossa.
Sts 2109	Type Site	Femur	Right	Right proximal femur fragment preserving partial head, complete neck and lesser trochanter.
Sts 2146 8	Type Site	Pelvis	Right	Right pelvic piece with acetabulum and a portion of ilium
Sts 2150	Type Site	Femur	Indeterminate	Fragmented distal femur (medial condyle?); anterior surface covered with breccia and other condyle fragmented off. So, siding is not possible.
Sts 2185	Type Site	Humerus	Indeterminate	Fragment of proximal humerus with greater tubercle.
Sts 2188	Type Site	Femur	Indeterminate	Fragment of distal femur; fragmented condyles but can visualize patellar surface.
Sts 2201	Type Site	Humerus	Indeterminate	Fragment of distal humerus; only olecranon fossa present and part of diaphysis. Medial and lateral sides sheared off.
Sts 2219	Type Site	Humerus	Right	Right proximal humerus with greater and lesser tubercle. Medial surface is covered with breccia.
Sts 2229	Type Site	Pelvis	Right	Pelvic fragment. Acetabulum and a small piece of surrounding bone. Same side as Sts 2146.
Sts 2230	Type Site	Tibia	Right	Right proximal tibia with tibial tuberosity and crest.
Sts 2259	Type Site	Femur	Indeterminate	Femur head and proximal neck.

Specimen Number	Provenance	Element	Side	Comments
Sts 2357	Type Site	Femur	Indeterminate	Femoral head encased in breccia; only head itself is sticking out of breccia. Partial diaphysis may be present; however, specimen needs further preparation.
Sts 2379	Type Site	Femur	Indeterminate	Distal femur fragment; one fractured condyle preserved.
Sts 2422	Type Site	Femur	Left	Proximal fragment of femur. Covered in breccia, can only visualize a portion of the lesser trochanter, neck and femoral head.
Sts 2474	Type Site	Tibia	Left	Left distal tibial fragment; large in size. For size differences among the papionin compare to Sts 2563 and Sts 1204.
Sts 2521	Type Site	Femur	Right	Part of right proximal femur. Specimen preserves head and a portion of the greater trochanter.
Sts 2563	Type Site	Tibia	Right	Right distal tibia with medial malleolus.
Sts 2563 2	Type Site	Tibia	Indeterminate	Proximal tibia fragment with condyles and tibial tuberosity.
Sts 3059	Type Site	Vertebra - Thoracic		Thoracic vertebral fragment in poor condition.
Sts 3060	Type Site	Vertebra - Thoracic		Thoracic vertebral fragment in poor condition.
Sts UN 4	Type Site	Clavicle	Left	Left clavicle. Only, anterior-superior surface visible; remainder of specimen covered in breccia.

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EDUCATION

1998-2006 **Indiana University**, Bloomington, Indiana
Doctor of Philosophy in Anthropology
Major in Biological Anthropology
Major in Archaeology, Palaeoanthropology specialization
Minor in Anatomy
Minor in Human Evolutionary Studies
Master of Arts in Anthropology (awarded Nov. 2003)

1995-1998 **University of South Alabama**, Mobile, Alabama
Bachelor of Science in Biology
Bachelor of Arts in Anthropology
Minor in Chemistry

1993-1995 **Northeast Alabama Community College**, Rainsville, Alabama
Major in Biological Sciences

ACADEMIC AFFILIATIONS

2003-Present ***Stone Age Institute***
Graduate Research Associate, Indiana University, Bloomington, IN

2001-Present ***Sterkfontein Research Unit*** (SRU)
Research Associate, University of the Witwatersrand, Johannesburg, SOUTH AFRICA

1999-Present ***Center for Research into the Anthropological Foundations of Technology***
Graduate Associate, Indiana University, Bloomington, IN

DISSERTATION

Taxonomy of the Sterkfontein Fossil Cercopithecinae: The Papionini of Members 2 and 4 (Gauteng, South Africa)

RESEARCH AND TEACHING

Research Experience

2005-Present ***Primate Paleontologist.*** Swartkrans Palaeoanthropological Research Project (with Travis Pickering, University of Wisconsin-Madison)

2004 ***Taphonomist***: Mummified Baboon Remains from Misgrot Cave: Implications for Archaeological Site Formation Processes in Southern Africa (for A. Keyser and C. Menter, University of the Witwatersrand, South Africa)

2004 ***Primate Paleontologist***: Taxonomy, Taphonomy and First Description of the Fossil Cercopithecoids from the Drimolen Hominid Site (for C. Menter, University of the Witwatersrand, South Africa)

2003-Present ***Primate Paleontologist***: Taxonomy and Taphonomy of the Non-Hominid Primates from Sterkfontein Member 2 (for R.J. Clarke, University of the Witwatersrand, South Africa and T.R. Pickering, Indiana University)

2001-2006 ***Primary Investigator*** (Ph.D. Research): Taxonomy and Taphonomy of the Sterkfontein Fossil Cercopithecoids: An Emphasis on the Genus *Parapapio*

2001-Present ***Co-Primary Investigator***: Technological and Experimental analyses of chimpanzee digging sticks from Equatorial Guinea (Tulane University, USA)

2001 ***Primary Investigator***: Taxonomy of the Sterkfontein Fossil Primates (Pre-dissertation Pilot Study)

2000 ***Zooarchaeologist***: Taxonomy of the Mammalian Macrofauna from Drimolen, South Africa (for A. Keyser and C. Menter, University of the Witwatersrand, South Africa)

2000 ***Archaeologist***: Establishment of Permanent Data Points at Gladysvale, South Africa (for P. Chaushev, University of the Witwatersrand, South Africa)

1998 ***Primary Investigator***: An Experimental Study in the Handedness of Non-Human Primates: Implications for the Significance of Bouts and Repetitions

1997 ***Archaeologist***: Excavation and Analysis of Alabama's First Territorial Capital, St. Stephen's (for R. Stowe, St. Stephens Historical Commision)

1997 ***Archaeologist***: Investigation of Old Mobile, Spanish Fort and Port Dauphin, as a portion of the University of South Alabama's archaeological field school

Teaching Experience

2004-Present ***Instructor/Assistant Professor***, *Samford University, Birmingham, AL*

2004 ***Instructor***, *University of Alabama – Birmingham, AL*

2002 ***Instructor***, *Indiana University-Purdue University, Indianapolis, IN*

2000-2001 ***Instructor***, *Indiana University – Bloomington, IN*

2000 ***Associate Instructor***, *Indiana University – Bloomington, IN*

GRANTS AND AWARDS

2002 ***Graduate and Professional Student Organization (GPSO)***, *Indiana University*, for "the analysis of primate remains from the Sterkfontein fossil hominid site, Gauteng Province, South Africa"

2001 ***Grants-in-aid-of-Research (G.I.A.R.)***, Sigma Xi, for "a re-analysis of cercopithecoids from Sterkfontein, Member 2, South Africa"

2001 ***David C. Skomp Fellowship***, Indiana University, for "A Taxonomic Study of the Sterkfontein Fossil Primates"

2000 ***Summer International Enhancement Grant***, Indiana University, for "Participation in Research Programs at the sites of Drimolen, Sterkfontein and Gladysvale in South Africa"

PUBLICATIONS

Pickering, T.R., Clarke, R.J. and **J.L. Heaton** (2004) The context of Stw 573, an early hominid skull and skeleton from Sterkfontein Member 2: taphonomy and paleoenvironment. *Journal of Human Evolution* **46**:277-295.

Heaton, J.L. and T.R. Pickering (In Press) Archaeological Analysis Does Not Support Intentionality in the Production of Brushed Ends on Chimpanzee Termiting Tools. *International Journal of Primatology*.