Undescribed hominin fossils from the Transvaal Museum faunal collections

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During the course of renewed investigation into the fossil faunas recovered from several Plio-Pleistocene deposits in the Sterkfontein Valley, 15 previously unrecognized hominin fossils were recognized in the faunal collections of the Transvaal Museum. In addition, eight hominin fossils were previously recovered from the faunal collections of the Transvaal Museum by various visitors since the early 1970s. These fossil fragments are derived from the sites of Sterkfontein, Kromdraai and possibly Swartkrans. This paper provides descriptions and illustrations of these previously undescribed materials.

Keywords: Sterkfontein, Kromdraai, Swartkrans, Hominin Cranio-dental Remains.

INTRODUCTION

Excavations at the site of Sterkfontein were carried out between 1936 and 1939 under the direction of Broom (Broom, 1936). Fossil materials were accessioned with the general Transvaal Museum prefix ‘TM’. A later episode of fossil collecting at the site from 1947 until 1949 was again initiated by Broom (1947), and fossil materials derived from this period received the site specific prefix ‘STS’ (Sterkfontein Type Site), associated with Member 4 (Partridge, 1978). In 1956, Brain discovered the first in situ stone tools from a previously unexplored part of the site, prompting renewed interest in Sterkfontein (Robinson, 1957). Materials recovered during this phase of activity received the prefix ‘SE’ (Sterkfontein Extension Site), associated with Member 5 (Partridge, 1978). Since 1966, continuous excavations have been carried out at Sterkfontein under the direction of Tobias (Tobias and Hughes, 1969); materials from this longest phase of activity are housed at the University of the Witwatersrand.

The first hominin fossils from Kromdraai were described by Broom (1938). The site is divided into two components: Kromdraai A, also known as the ‘faunal site’ because no hominin remains have as yet been recorded from this deposit, and Kromdraai B, also known as the ‘hominin site’. Broom worked the deposits at Kromdraai throughout 1936, and again briefly in 1941 (Broom, 1941). Hominin materials uncovered during these earlier episodes were given the Transvaal Museum’s general accession prefix ‘TM’. In 1955 and 1956 Brain recommenced excavations at the site (Brain, 1981), and fossils were accessioned from this point forward with the site-specific designations ‘KA’ or ‘KB’ depending on their provenance. In 1980, Vrba conducted further field work at the site (Vrba, 1981), producing several additional hominin remains, and more recently Thackeray has been working at Kromdraai since 1993 (Thackeray et al., 2001). Swartkrans was first investigated in 1948 by Broom at the behest of the University of California, Berkeley, expedition to Africa (Broom and Robinson, 1952). From the onset, hominin materials were given the site-specific designation ‘SK’. Broom died in 1951, and his assistant Robinson continued working at Swartkrans until 1953, when the site was abandoned. In 1965 Brain reopened the site, continuing the use of the ‘SK’ prefix (Brain, 1970). In 1968 the property on which Swartkrans is located was purchased by the University of the Witwatersrand, prompting Brain to change the prefix to ‘SKW’ (Swartkrans, Witwatersrand). From 1979 to 1986, Brain undertook in situ excavations (Brain, 1993), for which he provided the prefix ‘SKX’ (Swartkrans, Excavations).

The purpose of this paper is to provide descriptions and illustrations of 23 recently recovered hominin fossils from the sites of Sterkfontein, Kromdraai and probably Swartkrans. All measurements provided are in millimetres. Abbreviations: MD = mesiodistal, BL = buccolingual, CO = cervico-occlusal, ICF = inter-proximal contact facet.

DESCRIPTIONS

Sterkfontein Member 4 specimens

The specimens derived from Member 4 of Sterkfontein include a partial natural endocast with associated cranial fragments and six isolated teeth.
and tooth fragments. All were recovered from the Sterkfontein Member 4 faunal collection held at the Transvaal Museum.

**STS 1960b.** Frontal bone with partial endocast (Fig. 1). This is part of a hominin cranium preserving a portion of an endocast, approximately half of the left supraorbital torus, part of the left orbit, most of the superior part of the glabella, the roof of the right orbit and fragments of the frontal bone extending back to approximately the area of the frontal suture. The preserved bone is crushed and fragmented, retaining little morphological detail.

The visible surface of the endocast shows the longitudinal fissure, a small part of the anterior aspect of the left superior frontal gyrus and most of the right frontal gyrus, the middle frontal gyrus and a small part of the anterior aspect of the orbital sulcus. The pathways of several meningeal arteries are also clearly visible. A faint trace of the origin of the left temporal line can be seen, and its position close to the mid-sagittal plane indicates that the temporal lines would have been positioned high on the cranium. The supraorbital torus is poorly developed and the orbit size, which can only be hypothesized from the remains of the left orbit, appears to be relatively small. The development of the supraorbital torus is less marked than in specimens such as STW 505 or STS 5.

**STS 2120.** Maxillary molar fragment (Fig. 2a).
parallel grooves running from the occlusal margin towards the cervical margin; damage has obscured their extent.

STS 2218. Maxillary molar fragment (Fig. 2b). This is a poorly preserved fragment of a left maxillary molar still partially encased in breccia. All that remains is a thin sliver of the buccal face that has been vertically sectioned along the longitudinal axis of the tooth. Occlusal wear is light, as a relatively thick layer of enamel remains in this specimen. The roots are tapered towards the distal aspect, indicating that this tooth is either a second molar, or more likely a third molar.

STS 2253. RM1 (Fig. 2c). This is an almost complete molar tooth that has been broken on the buccal side, removing a portion of the protoconid and a portion of the hypoconid; there are no roots preserved. A small, breccia-filled crack runs through the hypoconulid. Occlusal wear is light, with enamel facets visible on all cusps, though no dentine is visible.

Occlusally the crown displays a rectangular outline. All five principal cusps are present and well developed; a small, breccia-filled crack runs through the hypoconulid giving the appearance of an additional cusp, but close examination reveals that no tuberculum sextum is present in this specimen. The metaconid is the largest cusp, followed by what was most likely a slightly smaller protoconid; the broken hypoconid is smaller than the mesial cusps, and was most likely larger than the entoconid; the hypoconulid is the smallest cusp. There is a moderate sized, but weakly delineated, postmetaconulid at the distal base of the metaconid. The entoconid receives a slight invagination from the lingual branch of the talonid basin, outlining a weakly developed tuberculum intermedium. The mesial marginal ridge is well developed and thick. The fovea anterior is represented by short buccal and slightly longer lingual fissures radiating from the mesial branch of the talonid basin that narrowly incises the distal trigonid ridge. The metaconid contacts the hypoconid; the mesiobuccal branch of the talonid basin is situated slightly mesial to the lingual branch, while the distobuccal branch is situated further distally, creating an asymmetrical Y-pattern. The distobuccal branch of the talonid basin is interrupted at the occlusobuccal margin by a moderately thick wall of enamel. A moderately developed fovea posterior is clearly defined. An
incomplete distal marginal ridge is only weakly developed, with a V-shaped groove positioned in the centre of the ridge allowing the fovea posterior to come into direct contact with the distal face of the tooth.

Most of the buccal face has been broken away, but a broad, deeply incised distobuccal groove is evident coursing toward the cervical margin before gradually fining out of existence just over half-way down the crown of the tooth. Lingually, a small, narrow lingual groove terminates about halfway along the crown. The cervical prominence is only weakly developed around the circumference of the tooth.

The crown measures approximately 14.3 MD and 11.8 BL.

STS 2318. Maxillary molar fragment (Fig. 2d). This specimen is a right maxillary molar cusp with extremely thickened occlusal enamel, probably representing the hypocone. There is no wear evident occlusally, and root formation had not yet commenced, indicating that this tooth was probably still forming in the crypt at the time of death of the individual. Perikymata are clearly visible on the outer surface of the tooth.

The fovea posterior is represented by a lingually directed arm that radiates from the distal end of the deeply incised groove between the hypocone and the protocone. The distal marginal ridge is low and weakly developed, and is partially incised by a groove that delineates a distinct postentoconule, the latter which displays two small, round pits near its apex. This postentoconule occupies a position corresponding to the tuberculum sextum in the mandibular molar (Robinson, 1956).

STS 2518. RM3 (Fig. 2e). This is approximately a third of a molar fragment that was refitted to STS 72, a maxillary third molar fragment previously recovered by Broom. When the two specimens are refitted, the crown is almost complete. The crack separating the fragments runs obliquely from the hypocone toward the paracone; a wedge of enamel is missing, taking much of the paracone with it. Occlusal wear is moderate and the crown has been worn to an almost flat plane; no dentine exposures are visible.

Occlusally the crown presents a trapezoidal outline. All four principal cusps are present and well developed. The protocone is the largest, followed by the paracone, metacone and hypocone in decreasing order of size. The weak fovea anterior is represented by a shallow, lingually directed fissure that delineates a moderately thick mesial marginal ridge. The buccal branch of the trigon basin is not interrupted at the occlusal margin. The distal trigon crest (crista obliqua) is well developed and complete. The well-developed distal marginal ridge is low but complete; it is occupied by two small accessory cuspules. The broad fovea posterior is represented by a long lingually directed limb, and a shorter buccally directed limb, that radiate from the distal extent of the fissure between the protocone and the hypocone.

Buccally the cervical prominence appears weak. The buccal groove is small and narrow, and rapidly obliterates. Distal to the main buccal groove, a second groove is evident, commencing where the metacone contacts the buccal accessory cuspule on the distal marginal ridge; this groove rapidly obliterates on the buccal face. Lingually the cervical prominence is weak, and the cervical margin is straight. The lingual groove is well developed and broad. A prominent Carabelli Trait is evident in the form of a series of parallel grooves on the lingual face of the protocone.

The crown measures approximately 12.4 MD and 14.7 BL.

STS 3200. Molar fragment (not illustrated). This is a badly distorted molar, the fragments of which are broken apart and encased in breccia. Occlusal wear appears to be moderate. The extreme fragmentation of the tooth has obscured any anatomical detail.

Sterkfontein Member 5 specimen
A single molar fragment was recovered from the ‘Sterkfontein Extension Site’ faunal collection held at the Transvaal Museum.

SE 1828. Maxillary molar fragment (Fig. 3). This is a badly damaged maxillary tooth fragment, probably representing the paracone and metacone of a right molar. The distobuccal corner is not reduced,
suggesting this might be a first molar. Occlusal wear is heavy, and two large dentine exposures are visible, separated by a narrow channel of occlusal enamel. A faint trace of the buccal branch of the trigon basin is barely perceptible at the centre of the enamel channel. The buccal cervical margin dips to form a peak of enamel between what remains of the two buccal roots.

Kromdraai B specimens
Two hominin specimens were recovered in July 2003 from the Kromdraai B faunal collection at the Transvaal Museum. Both are isolated teeth, the incisor representing an element not previously recorded in the Kromdraai B hominin sample (Grine, 1988).

KB 5163. RC (Fig. 4a,b,c). This is a complete, unworn enamel cap of a mandibular canine lacking any dentine or root material. This phenomenon of the deletion of root and dentine material, leaving behind enamel caps, has been previously documented at Kromdraai (Thackeray et al., 2001), and may not be a result of the young ontogenetic age of the individual.

Labially the crown surface represents an irregular pentagonal outline. The apex of the crown is positioned slightly mesial to the MD midline axis of the tooth. The distal apical edge is longer and with a steeper slope than the mesial apical edge. The mesial crown corner is more rounded than the distal crown corner, the latter being little more than a slight swelling of enamel adjacent to the cervix. A shallow distolabial groove delineates a low ridge at the distal edge of the labial face. Where this groove contacts the distal apical edge, a very slight furrowing of the distal apical edge is visible. A shallow mesiolabial groove is also evident on the labial face. No mesial or distal cuspules are present. The

Fig. 4
Dental specimens derived from Kromdraai B. KB 5163 in labial (a), lingual (b) and mesial (c) views; KB 5389 in labial (d) and lingual (e) views. Scale bar = 10 mm.
cervical margin is straight. In mesial view the labial face curves gently convexly from the apex towards the cervical margin; however, adjacent to the cervical margin the labial surface re-curves, producing a slight concavity of the labial face parallel to the cervical margin, resulting in a weakly visible cervical prominence. Perikymata are clearly visible along the entire labial face.

Lingually the cervical prominence is weak; there is no lingual tubercle. A very broad but flat median ridge is evident near the cervical margin which abruptly narrows halfway to the apex of the tooth, such that only a narrow median ridge reaches the apex. Weak, narrow mesial and distal marginal ridges arise from the cervical prominence; the mesial is slightly longer that the distal marginal ridge. The mesial and distal marginal ridges are separated from the median ridge by approximately equal-sized, broad, shallow V-shaped furrows.

The crown measures 7.6 MD and 7.9 BL.

KB 5389. LI (Fig. 4d,e). This is a fragmented crown lacking the occlusal edge, but retaining a fragment of the root. In spite of the damage to the specimen, the crown is complete apart from the broken occlusal edge. Damage has obscured any indication of the degree of attrition. Mesial and distal ICF are not visible.

Labially the cervical margin is slightly curved. A cervical prominence and mesial or distal grooves or ridges are absent. Perikymata are clearly visible around the circumference of the crown, and two small probable pit-type enamel defects are present on the labial surface. Lingually the cervical eminence is weakly developed and symmetrically disposed. There is no tubercle. The mesial and distal marginal ridges are weakly developed with low relief, separated from a broad, flat and low median ridge by shallow grooves. Although damaged, it appears that lingual shoveling is slight.

The crown is estimated to measure 8.7 MD (near occlusal margin), 3.2 BL (near occlusal margin) and 6.6 BL (at the cervix).

Specimens of uncertain provenance

A total of 13 hominin specimens of uncertain provenance was recovered from the faunal collections of the Transvaal Museum. Several of these were recovered by the author, while the remainder were retrieved by various visitors to the museum collections since the early 1970s. Based on investigation of archival records and discussions with museum staff, including Brain, as well as close examination of the preservation and patina of fossils and any adherent breccia, it was concluded that eight of these fossils could be attributed to the Hanging Remnant of Swartkrans with a fairly high degree of certainty. As a result, these fossils all received ‘SK’ designations, though it must be noted that the assumed attribution to the Hanging Remnant of Swartkrans is secondary, and must be treated with caution. The remaining five specimens remain of uncertain provenance, though in some cases possible site attributions are suggested. These five specimens received the prefix TMPAL.

SK 24626. LP3 and LP4 (Fig. 5a). These two teeth represent nearly complete, but highly fractured, crowns that were probably still forming in the crypt. The teeth are cemented together by a small channel of breccia. Occlusal wear is absent on both teeth, since they had not yet erupted. No ICF are visible, and no roots are evident for either tooth.

LP5. This is a nearly complete tooth germ lacking roots.

The crown of this specimen is irregular ovoid in outline, with both principal cusps present. The tooth is broader mesially than distally. The protoconid is well developed and slightly larger than the metaconid. The protoconid is situated slightly mesial to the BL mid-crown axis of the tooth, and the metaconid is positioned slightly more mesial than the protoconid. The apex of the protoconid is distinctly bifurcated, and a small pit occurs at the base of the bifurcation. The mesial marginal ridge is moderately developed, running from the metaconid onto the mesial face of the protoconid; a small accessory cuspulid is present near the mid-crown longitudinal axis, while at the buccal extent of the mesial marginal ridge a second low, bulbous accessory cuspulid has developed. The fovea anterior is a small, but deep, buccally directed fissure that branches from the mesial extent of the longitudinal fissure. The buccal extent of the fovea anterior is occupied by a small cuspidulid that originates at the mesial edge of the lingual face of the protoconid.

The distal marginal ridge is longer than the mesial marginal ridge; it is well developed and thick, and is dominated by two large accessory cuspulids that are demarcated by shallow furrows from each other and from the main cusps. The fovea posterior is a transverse groove that is continuous with the longitudinal fissure; the lingual limb is slightly longer than the buccal limb, and more deeply excavated.

Buccally, the mesiobuccal groove is virtually non-existent, while a shallow and poorly developed distobuccal groove can be seen running between the protoconid and the distobuccal accessory cuspulid occupying the distal marginal ridge. Immediately mesial to the distobuccal groove there is a large, ovoid depression on the buccal face that may represent some form of developmental defect. Perikymata are clearly visible.

Very little can be seen of the lingual face, though a shallow, distolingual groove is evident. The estimated crown dimensions are 10.4 MD and 12.3 BL.
Although damaged it is apparent that this tooth is heavily molarized, with a relatively large occlusal area relative to the P₃. The tooth is almost complete, but highly fractured; it is cemented to the LP₃ by a fragment of breccia. There is no wear evident, as this germ was still forming in the crypt.

Occlusally the crown presents an irregular ovoid outline. The two principal cusps are well developed, with the protoconid being larger than the metaconid. The metaconid is situated slightly more mesial than the protoconid, with both cusps distinctly mesial to the mid-crown axis. The mesial marginal ridge is thick and well developed, with two accessory cuspidulids forming, one near the midline and the other towards the buccal extent of the ridge; the accessory cuspidulids are delineated by occlusal furrows. The fovea anterior is a short, yet deep, buccally directed fissure that is continuous with the longitudinal fissure. The distal marginal ridge is very thick and very well developed; it is occupied by two large accessory cuspidulids, both of which show secondary crenulation. The fovea posterior is a fairly deep and wide transverse fissure that is continuous with the central basin of the tooth. It incises the occlusal margins, separating the principal cusps from the accessory cuspidulids of the distal marginal ridge.

On the buccal face, both the mesiobuccal and distobuccal grooves are poorly developed. The mesiobuccal groove extends from between the protoconid and the mesiobuccal accessory cuspidulid of the mesial marginal ridge, while the distobuccal groove separates the protoconid from the distobuccal accessory cuspidulid on the distal marginal ridge, thereby delineating a well-developed talonid. The lingual face has been too badly damaged to reveal any morphology.

SK 24627. Root and enamel fragments (not illustrated). These five enamel and four root fragments represent at least two separate teeth. The characteristically thickened enamel and elongated, longitudinally furrowed roots indicate that they are hominin teeth, but little else can be determined from these pieces.

SK 24628. LM’ (Fig. 5b). This is a fragment of a molar crown that preserves the protocone. Occlusal wear is light, with a gentle rounding of the cusp. A large, kidney-shaped, concave mesial ICF (3.2 CO)
is evident, although the buccal extent has been broken away. A short lingual arm of the fovea anterior is visible, which is moderately incised. Although broken in this area, it can still be seen that the lingual arm of the fovea anterior is continuous with the longitudinal fissure. The mesial marginal ridge is thick and well developed, tending to thicken as it courses buccally. Perikymata are clearly visible around the fragment.

SK 24629. LM₁ (Fig. 5c). This is a poorly preserved half of a molar crown retaining the protocone and the hypocone, as well as a small portion of the metacone. Most of the lingual root is present. Both the crown and the root are pervaded by breccia filled cracks. Occlusal wear is light, with a gentle rounding of the cusps, and there appears to be a slight bevelling towards the lingual side. A flat mesial ICF (3.4 CO) is present, as is a flat, oval distal ICF (4.5 BL; 3.6 CO).

Although part of the tooth is missing, the crown is judged to have been originally square in outline. Both the protocone and the hypocone appear to be well developed. The lingual limb of the fissure between the protocone and hypocone is interrupted at the oclusobuccal margin by a thick wall of enamel. The distal marginal ridge is thick and well developed. A well-developed distobuccal cuspule (distostyle) is evident, clearly demarcated from the metacone and the distal marginal ridge by shallow furrows. The fovea posterior is very well developed and deep, with a long lingual arm that terminates in a rounded pit, and a shorter buccal arm that is not as deeply incised; the fovea posterior is in direct contact with the groove that separates the protocone and hypocone.

Lingually, the lingual groove begins as a broad, deeply incised fissure, but terminates approximately halfway up the lingual face in a small pit. Several additional shallow furrows and low ridges are evident on the lingual faces of the protocone and hypocone; at the mesio-lingual corner of the protocone there is a small but distinct pit, and together these represent a weakly developed Carabelli Trait. The cervical prominence appears developed. Perikymata are weakly visible near the cervical line.

A single, robust lingual root is preserved, with a shallow longitudinal furrow on the lingual face, and a deep longitudinal furrow on the buccal face. The root shows a slight lingual flare as it traverses to the apex.

The MD diameter of the crown is estimated at 14.0.

SK 24630/24631. LP₂ and LP₃ (Fig. 5d). These two teeth were extracted from the same small piece of breccia, in almost anatomical position. Owing to their similar preservation and patina, as well as their close spatial proximity, it is almost certain that they are derived from the same individual.

LP₃ (SK 24631). This is a moderately preserved, near complete crown of a maxillary premolar lacking its roots as well as the lingual half of the protocone. Occlusal wear is moderate, with the crown being worn to a flat plane with a slight mesiolingual bevel. A pinpoint exposure of dentine is visible in the paracone position. A deep, concave mesial ICF (3.3 CO) for articulation with the canine is skewed buccally. The distal ICF (3.5 CO) is large, flat and centrally positioned.

The shape of the occlusal outline is ovo-rectangular. The paracone is well developed, and is situated slightly mesial to the mid-crown axis of the tooth. The longitudinal fissure is deeply incised and still clearly visible, terminating in a distinct fovea anterior. The fovea anterior is represented by a short lingual limb, and a longer buccal limb. The mesial marginal ridge is thick and well developed buccally, thinning slightly as it courses lingually. The fovea posterior is represented by long buccal limb which has been almost completely obliterated. The lingual limb has been eroded away, but a thick, well-developed distal marginal ridge is still visible.

Buccally, a weakly developed distobuccal groove is evident, and a slightly more developed distobuccal groove is also present. The cervical prominence is moderate, and the cervical margin is curved, forming a rounded peak of enamel opposite the division of the buccal roots. Perikymata are visible near the cervical line, and several linear enamel hypoplasias mark the buccal surface.

The MD diameter of the crown is 9.1.

LP₂ (SK 24630). This is a moderately preserved, near complete crown of a maxillary premolar lacking its roots as well as a distolingual fragment of the protocone. Occlusal wear is moderate, and the crown has been worn to a flat plane with a mesiolingual bevel. Small, round dentine exposures are visible in both the protocone and the paracone. A large, flattened, oval-shaped mesial ICF (7.9 BL; 3.6 CO) is lingually skewed.

Occlusally the crown outline is an irregular ovoid, with the distobuccal corner reduced behind the paracone. Both of the principal cusps are well developed; the paracone is positioned mesial to the mid-crown axis, and the protocone is situated mesial to the paracone. The longitudinal fissure is still salient, terminating in the remnant of the fovea anterior. The fovea anterior is represented by a short buccal limb, the lingual limb having been obliterated by attrition. The mesial marginal ridge is thickly developed.

Buccally the cervical prominence is well developed, and the cervical margin is gently rounded. A slight trace of a mesiobuccal groove is still evident, along with the remains of a moderately developed
distobuccal groove. Perikymata are visible on the buccal face, as well as the remnant of the lingual face. Linear enamel hypoplasia is evident on the buccal surface.

The crown is estimated at 9.7 MD and 13.5 BL. SK 24632. LM′ (not illustrated). This poorly preserved specimen represents the distal edge of a left maxillary molar. It is badly cracked and pervaded by breccia. The distal surface is dominated by a very large ICF (8.5 BL; 3.9 CO) indicating that this tooth is either a first or second maxillary molar. A portion of the hypocone remains, as does a small part of the metacone. Occlusal wear is becoming heavy, and a moderate dentine exposure is visible in the distolingual corner of the hypocone. A short segment of the longitudinal fissure is still visible, terminating in a small, rounded pit that represents the remains of a fovea posterior. The distal marginal ridge is thick and well developed. Perikymata are weakly visible near the cervical line on the distal face.

SK 24633. RM′ (Fig. 5e). This is a small wedge of a maxillary molar crown that retains the paracone, as well as small portions of the protocone and the metacone. The angulation of the mesiobuccal corner suggests that this is a second molar. Occlusal wear is moderate, and the crown has been worn down to a nearly flat plane, though no dentine exposures are visible. The mesial ICF (2.9 CO) is slightly concave, though part of it is missing owing to damage and attrition.

There is an open, U-shaped fissure running from the mesial side of the paracone down into the central fossa and then curving round to the occlusobuccal margin between the paracone and the metacone; at its mesial extent this fissure represents the fovea anterior in direct contact with the longitudinal fissure. This pattern was recognized to be consistent across maxillary second molars (Robinson, 1956). The mesial marginal ridge is thick and well developed.

The buccal limb of the U-shaped fissure is deeply incised and continues onto the buccal face as a deep buccal groove. This groove terminates abruptly approximately halfway down the buccal face, but does not form a terminal pit. Perikymata are clearly visible at the cervical margin, and distinct linear enamel hypoplasias are present on the mesial face.

TMPAL 98-7. RP3 (Fig. 6a). This is a poorly preserved maxillary premolar retaining a portion of the occlusal surface, most of the lingual root and both of the buccal roots. The lingual three-quarters of the crown, and part of the lingual root have been sheared away obliquely, leaving approximately half of the paracone. The mesiobuccal root is complete, but badly fragmented; the distobuccal root is still mostly encased in breccia. Occlusal wear of the paracone is moderate; the crown has been worn to a flat plane with a distolingual bevel. A pinpoint of dentine has been exposed in the paracone. A portion of a large distal ICF is preserved.

The paracone was probably situated mesial to the BL mid-crown axis of the tooth. The buccal face of the tooth is almost smooth, with no mesiobuccal groove, and only a trace of a distobuccal groove. The cervical enamel prominence is moderate, and the cervical line is gently rounded. Perikymata are clearly visible near the cervical margin. There are three separate roots. The two buccal roots bifurcate approximately 3.0 mm above the level of the paracone cervical margin. The lingual root is more robust than either of the buccal roots; the mesiobuccal root appears larger than the distobuccal root. The lingual root appears to have been straight with a slight mesial tilt. The mesiobuccal root projects mesially and buccally, with a distolingual curve along the apical third; it is 8.8 mm long at the paracone cervical margin.

The crown MD diameter is estimated at 10.5 mm. TMPAL 98-8. LM′ (Fig. 6b). This is the buccal half of a maxillary molar preserving part of both buccal roots. Most of the paracone is present, as well as about half of the metacone. Occlusal wear of the paracone and metacone is moderate; the occlusal surface has been worn down to a flat plane with a distolingual bevel. No dentine exposures are present, as a thick layer of enamel is still visible in the broken cross-section. A small trace of the mesial ICF remains.

What remains of the paracone and metacone shows that the cusps were well developed. The deeply incised buccal arm of the fissure separating the paracone and the metacone is interrupted at the occlusobuccal margin by a thick enamel wall. A tiny groove is visible in the paracone, probably representing the remains of the buccal limb of the fovea anterior, suggesting the mesial marginal ridge was thickly developed.

On the buccal face, the buccal groove is moderately incised and terminates in a small pit surrounded by a thin enamel wall buccally. The buccal cervical prominence is moderate, and the cervical margin tapers to form a peak of enamel between the buccal roots. Perikymata are clearly visible, and the buccal face of this tooth is pervaded by numerous pit-type enamel defects.

TMPAL 99-6. Maxillary molar fragment (Fig. 6c). This is a right maxillary molar fragment extracted from a box labelled ‘Primates of Uncertain Provenance’. Based on its preservation and patina, as well as the surrounding breccia matrix, this fossil is possibly derived from Member 4 of Sterkfontein. A portion of the protocone, as well as a smaller fragment of the hypocone, are preserved. The
lingual face of the tooth is featureless, and the fused, compressed lingual roots show no distal deviation. Together, these point towards this being a maxillary first molar.

Occlusal wear is moderate, and the cusps have been worn to a flat plane. A small, rounded dentine exposure is visible in the position of the protocone. Immediately mesiolingual to this dentine exposure is a small, shallow groove representing a faint trace of a Carabelli Trait. Lingually, the lingual groove is narrow and shallow, and rapidly fines out of existence halfway to the cervical margin. The cervical prominence is weak, and the cervical margin is almost straight, dipping to form a slight peak of enamel opposite the longitudinal fissure of the fused lingual root.

The MD diameter is estimated at 11.9 mm.

**TMPAL 99-7.** RC, (Fig. 6d,e). This is a poorly preserved mandibular canine fragment retaining most of the root as well as a portion of the crown. This specimen was recovered from a box labelled ‘Primates of Uncertain Provenance’. As with TMPAL 99-6, the preservation and patina of the specimen, along with the appearance of adherent breccia, suggest that this fossil might be derived from Member 4 of Sterkfontein.

Labially the cervical margin is straight and there is no cervical prominence. A moderate distobuccal groove is present, bounded distally by a moderate enamel ridge. A shallow horizontal furrow representing an hypoplastic defect is evident 2.6 from the cervical margin. Lingually a small mesial marginal ridge is still evident, separated from the median ridge by a very shallow mesial cleft. A small lingual cervical eminence is present, but a tubercle is lacking. The root is robust and ovotriangular in cross-section; it measures 6.5 MD and 10.4 BL; it is 21.4 long. It is straight with a slight convexity of the labial face. Both the mesial and the distal faces display shallow longitudinal furrows along the length of the root.

**TMPAL 99-9.** RM (Fig. 6f). This poorly preserved specimen is an almost complete maxillary molar crown with a portion of the mesial edge broken. 

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**Fig. 6**

Dental specimens of uncertain provenance; all specimens are in occlusal view with mesial to the top of the page unless otherwise stated. a: TMPAL 98-7; b: TMPAL 98-8; c: TMPAL 99-6; d, e: TMPAL 99-7 in lingual (d) and labial views (e); f: TMPAL 99-9. Scale bar = 10 mm.
away, removing almost half of the paracone. The occlusal surface has several cracks running through it. Occlusal wear is moderate, and the crown has been worn down to a flat surface, with a distobuccal bevel. No dentine exposures are evident. An elongated, slightly concave ICF (7.9 BL; 4.8 CO) marks the distal face of the specimen, while a small portion of the mesial ICF remains visible on the mesial face.

The occlusal outline is squared, except for a moderate mesiobuccal projection of the paracone. All four cusps are present and well developed. The protocone is the largest, the paracone and metacone about the same size, and the hypocone is the smallest cusp. The trigon basin is represented by a small, triradiate pit; the buccal limb of the trigon basin is visible, though it fines out of existence as it approaches the occlusobuccal edge. The fovea posterior is represented by a short buccal limb, the lingual limb probably having been removed by attrition. The distal marginal ridge is moderately thick, becoming thinner as it courses buccally. On the buccal surface the buccal groove extends about halfway down the remaining crown. The cervical prominence is weak. Lingually a small remnant of the lingual groove is still evident. The cervical prominence is weak, and the cervical margin appears straight. Perikymata are visible around the extent of the tooth.

The crown is estimated to measure 12.5 MD and 14.6 BL.

TAXONOMIC DIAGNOSES

In general comparison STS 1960b is consistent in size and morphology with the STS 60 endocast which has been attributed to Australopithecus africanaus (Holloway, 1975). Since there is no anatomical reason to consider this specimen as representing a hominin taxon apart from STS 60, it is tentatively assigned to cf. Australopithecus africanaus. Two of the Sterkfontein Member 4 teeth described above are complete enough to be reliably assigned to Australopithecus africanaus, STS 2253 and STS 72/2518. STS 2253 is rectangular in outline, presents an asymmetrical, Y-shaped occlusal pattern and lacks any trace of a tuberculum sextum; all these features align this specimen with Australopithecus africanaus as opposed to Paranthropus robustus or members of early Homo. STS 72/2518 displays a weak cervical prominence, a secondary buccal groove and a well-developed Carabelli Trait, all of which are consistent with Australopithecus africanaus (Robinson, 1956). The remaining Sterkfontein molar fragments (STS 2120, STS 2218, STS 2318) are not inconsistent with the hominin sample from Member 4, and are here attributed tentatively to cf. Australopithecus africanaus, with the exception of STS 3200 which is too incomplete to diagnose.

The single specimen derived from Member 5 of Sterkfontein is undiagnostic. The taxonomy of other hominin remains from this deposit, in particular the partial cranium STW 53, is in dispute, having been referred initially to Homo habilis (Hughes and Tobias, 1977) but more recently to Australopithecus africanus (Kuman and Clarke, 2000). Since the morphology of this heavily worn dental specimen is indistinct, it is here referred to Hominidae gen. et sp. indet.

Although one of the two isolated teeth recovered from Kromdraai B represents a dental element not previously known in the hominin sample from this deposit, comparison with hominin fossils from Swartkrans and Sterkfontein indicates that these specimens are most consistent with Paranthropus robustus. The canine tooth (KB 5163) is reduced in size relative to Australopithecus and early Homo, and displays a bluntly rounded apex and a nearly featureless labial face. The incisor (KB 5389) possesses a curved labial face that is almost featureless, as well as a narrow, well-defined cervical lingual eminence. However, both specimens exhibit only weakly developed grooves and marginal ridges on the lingual face, features that set them apart from the Paranthropus robustus sample known from Swartkrans.

The SK 24626 premolars exhibit weakly defined to absent buccal grooves, a pronounced cervical prominence with a distinct taper from the cervical margin inward to the cuspal apices, as well as bluntly rounded cusps, even though unworn. A distinct distal lingual groove is evident in the P3 of SK 24626, and the distal marginal ridge is thick and well developed. Likewise, the SK 24630/24631 premolars display weak buccal grooves, well-developed cervical prominences, and a thick distal marginal ridge. These features align all these premolars with Paranthropus robustus. SK 24629 is marked by a well-developed cervical prominence and a broad, well-developed lingual groove that terminates in a small pit, indicative of Paranthropus robustus. The molar fragments SK 24628 and SK 24633 display well-developed cervical prominences and buccal groove morphology consistent with Paranthropus, and are therefore tentatively assigned to cf. Paranthropus robustus. The molar fragment SK 24632 is too incomplete to estimate taxonomic affinity.

The TMPAL specimen 98-7 lacks buccal grooves and displays a moderately developed cervical prominence, aligning it with Paranthropus robustus. Similarly, TMPAL 98-8 can be attributed to Paranthropus robustus based on the moderate cervical prominence as well as the presence of
a distinct terminal pit in the buccal groove. TMPAL 99-6 might be derived from Sterkfontein Member 4. This specimen exhibits a weakly developed cervical prominence, and despite its degree of wear a Carabelli Trait is still visible; as such this specimen is tentatively attributed to cf. *Australopithecus africanus*. TMPAL 99-7 is also possibly derived from Sterkfontein Member 4 breccia. The root of this canine is very large and robust; on the crown, a distobalial groove is well developed. These features align this specimen with cf. *Australopithecus africanus*. The weak cervical prominence visible on TMPAL 99-9 suggests that this specimen is best referred to cf. *Australopithecus africanus*.

CONCLUSIONS

Broom (1938), Grine (1982a,b, 1985, 1988) and Howell (1978) recognized differences between the Kromdraai B and Swartkrans *Paranthropus* samples that they believed warranted a specific separation of the two into *P. robustus* and *P. crassidens*. The Kromdraai B teeth discussed in this paper, although aligned to *Paranthropus*, do show recognizable differences from the Sterkfontein sample, in particular in the appearance of the lingual face. One of these dental elements was not previously known at Kromdraai B, and although not conclusive, their morphological distinction merits further research. It is possible that the small sample size of available hominin material from Kromdraai B reflects individual variability rather than any taxonomic differentiation. Larger samples of hominin dentitions from this and other deposits will certainly clarify this situation. The Sterkfontein and (probably) Swartkrans materials augment the fossil samples of *Australopithecus africanus* and *Paranthropus robustus*, respectively, being consistent with materials already described from these deposits (Robinson, 1956).

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