

Frederick E. Grine
*Departments of Anthropology
& Anatomical Sciences, State
University of New York,
Stony Brook, New York
11794, U.S.A. E-mail:
fgrine@notes.cc.sunysb.edu*

Christopher S.
Henshilwood

*Department of Anthropology,
State University of New York,
Stony Brook, New York
11794, U.S.A. and Iziko
Museums of Cape Town,
South African Museum,
PO Box 61, Cape Town,
8000 South Africa. E-mail:
chenshilwood@iziko.org*

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Additional human remains from Blombos Cave, South Africa: (1999–2000 excavations)

The uppermost Middle Stone Age (MSA) layers at Blombos Cave contain high densities of Still Bay bifacial points. Information from other regional sites places the Still Bay prior to the Howiesons Poort industry, which has been dated at 65–70 ka. The Blombos Cave MSA strata have yielded nine human teeth or dental fragments. Four that were recovered during the 1997–1998 excavations have been published elsewhere. The remaining five were discovered during the 1999–2000 field seasons; these are described here. Three of the new specimens are deciduous teeth, and two are permanent premolar and molar crown fragments. The entire dental sample probably represents at least five and as many as seven individuals. The deciduous teeth from the upper MSA levels are likely to have been exfoliated in the cave. One deciduous tooth and the permanent tooth fragments from the lower MSA levels probably represent three individuals who died in or near the cave. The Blombos Cave premolars preserve horizontal circum-cervical striae suggestive of palliative tooth pick use. Approximately half of the permanent and deciduous crown diameters exceed those of recent Africans; for the remainder, the fossil values fall among modern African sample means. The Blombos Cave tooth crowns tend to be smaller than the majority of pencon-temporaneous Neandertal teeth. The morphology of the Blombos Cave di^1 is comparable to MSA homologues from the nearby, and presumably somewhat younger site of Die Kelders Cave 1.

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Introduction

Blombos Cave (34°25'S, 21°13'E) is situated on the southern Cape coast of South Africa. It is an erosional feature in the calcified sediments of the Bredasdorp Group where they contact the underlying Table Mountain Sandstone. The cave has a floor area of some 50 m², and an additional 18 m² of *in situ* deposit is retained in front of the cave mouth by fallen calcarenite boulders. Within the cave, Later Stone Age deposits are separated from underlying Middle Stone Age (MSA) horizons by a sterile layer of quartzitic sand. To date, approximately 13 m³ of the MSA deposit has been removed from the cave.

The uppermost MSA layers contain high densities of Still Bay bifacial points. Information from other regional sites places the Still Bay before the Howiesons Poort industry, which has been dated at 65–70 ka (Miller *et al.*, 1999; Vogel, 2001). The Blombos Cave MSA strata have also yielded formal bone artefacts (Henshilwood *et al.*, 2001a), intentionally incised bone pieces and ochre (Henshilwood & Sealy, 1997; d'Errico *et al.*, 2001; Henshilwood *et al.*, 2001b). These artefacts, together with the presence of large marine fish bones add to a small body of evidence suggesting an early origin for some aspects of modern human behavior in sub-Saharan Africa (McBrearty & Brooks, 2000; Henshilwood *et al.*, 2001b).

Table 1 Human dental remains from the MSA layers of Blombos Cave (1997–2000 excavations)

Specimen	Element	Square	Excavated context	Layer	Phase
1997–1998 excavations					
SAM-AP 6264	Ldm ¹	E-4	PIP	CB/CC	BBC M1
SAM-AP 6292	RP ³	E-4	AT	CI	BBC M3
SAM-AP 6293	Rdi ¹	E-5a	CFB	CF	BBC M2
SAM-AP 6295	RP ⁴	E-4	AS	CI	BBC M3
1999–2000 excavations					
SAM-AP 6303	RP ³ or P ⁴	E-4d	CK	CK	BBC M3
SAM-AP 8928	Rdm ¹	E-5c	CC	CC	BBC M1
SAM-AP 8971	Ldm ²	D-2d	CD(sl)	CD	BBC M1
SAM-AP 8972	M frag.	D-4d	CJ	CJ	BBC M3
SAM-AP 8973	Ldi ¹	E-4	<CJ	?CK	BBC M3

Excavation of the MSA strata in 1997–1998 produced four isolated human teeth that were recovered by screen washing (Table 1). These have been described by Grine *et al.* (2000). Continued excavation of the Blombos Cave MSA sediments in 1999–2000 has resulted in the recovery of five additional human teeth or dental fragments (Table 1; Figure 1). These most recent finds, also recovered by screen washing, are described here. Three of the new specimens are deciduous teeth; two are small fragments of permanent premolar and molar crowns. To date, no human osteological remains have been identified from the MSA strata of Blombos Cave.

Descriptions

SAM-AP 6303 [Figure 2(a)]. This is a fragment of permanent premolar crown. It is judged probably to represent the mesio-lingual quadrant of an RP³ or RP⁴. Occlusal enamel is worn flat, and a remnant of a slightly concave dentine exposure is preserved. The degree of wear is similar to that on the SAM-AP 6295 premolar fragment. Part of the interproximal contact facet (ICF) is preserved. Numerous fine, parallel striae are present on the enamel cervical to the

ICF and the adjacent root surface. These striae are present also on the other two Blombos Cave premolar fragments (SAM-AP 6292 and 6295) (Grine *et al.*, 2000).

SAM-AP 8928 [Figure 2(b)]. This is a complete, albeit very heavily worn crown of an Rdm¹. All that remains of the resorbed root is a sharp, scalloped margin around the crown cervix. The crown preserves a substantial ridge of calculus along its buccal side and over the lingual half of the distal side, where it runs on to the root. Wear has obliterated occlusal enamel except for small patches mesio- and distobuccally. There is a small mesial ICF; the deeply incised distal ICF cuts into the dentine creating an enamel step along its lingual margin. The crown has a somewhat trapezoidal occlusal outline. It appears that the hypocone and metacone were substantially smaller than the mesial cusps. A moderate tuberculum molare is delineated by a shallow, vertical mesiobuccal fissure.

SAM-AP 8971 [Figure 2(c)]. This is a very heavily worn crown of an Ldm². The largely resorbed root preserves a remnant of the furcation of the two buccal radicularae and an indentation between the mesiobuccal and lingual radicularae, which indicate that the neck was short (i.e., nontaurodont).

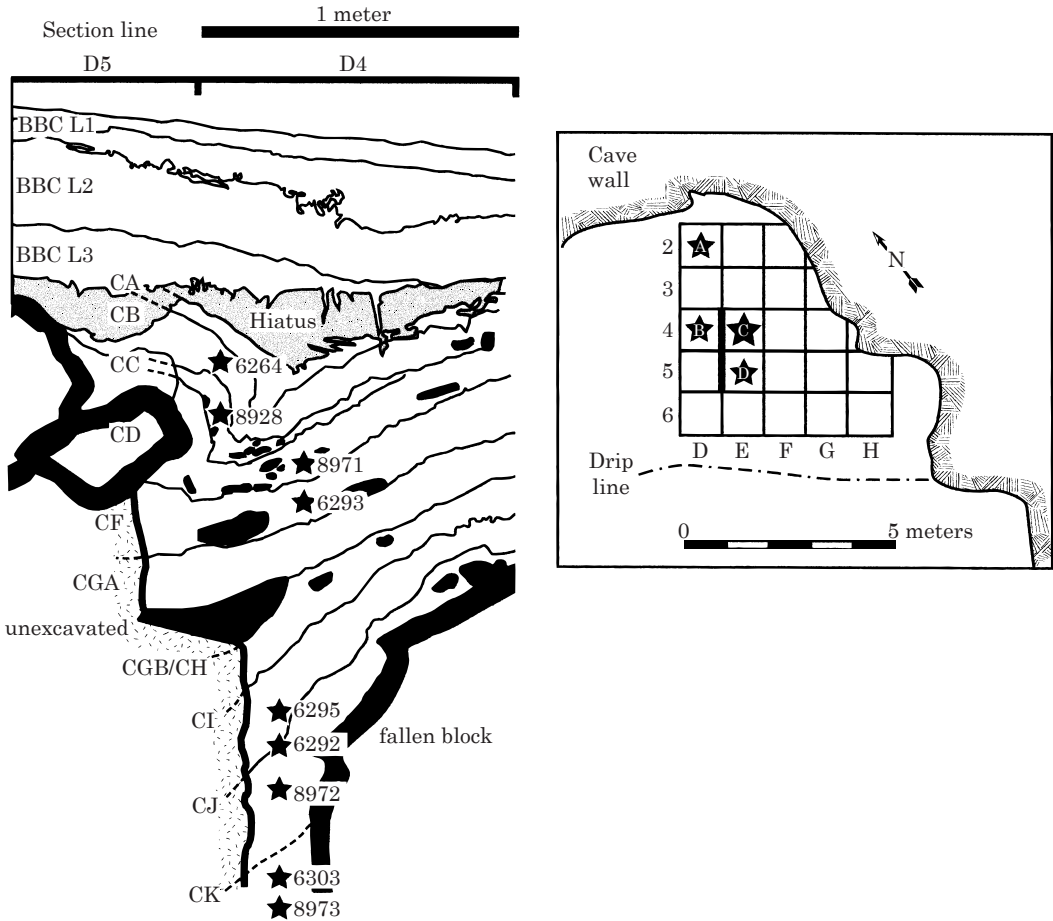


Figure 1. Blombos Cave. Map with excavation grid showing location of human teeth (stars), and stratigraphic section along grid line "D" showing projected locations of the human teeth (the position of SAM-AP 8971 is translated from section D2). The thick line along D4–D5 in the map is represented in section. BBC L1–L3 are Later Stone Age layers. The hiatus between the LSA and MSA strata is sterile sand. Black items are calcarenite blocks. ★A SAM-AP 8971; ★B SAM-AP 8972; ★C SAM-AP 6264, 6292, 6295, 6303, 8973; ★D SAM-AP 6293, 8928.

Occlusal wear has reduced the crown to a concave dentine surface with only a tiny patch of enamel along the groove between the paracone and metacone. The enamel margin around the crown disappears mesiolingually, where the occlusal surface has been worn beyond the cervical margin. A small remnant of the mesial ICF is preserved. The distal ICF extends across the entire distal crown surface. There is a heavy

deposit of calculus covering the cervical enamel and adjacent root around most of the crown periphery.

SAM-AP 8972 (no illustration). This is a small fragment of the crown of a maxillary permanent molar. It preserves part of the occlusal and buccal surfaces. Occlusal enamel on either side of the occlusal fissure between the paracone and metacone is worn flat.

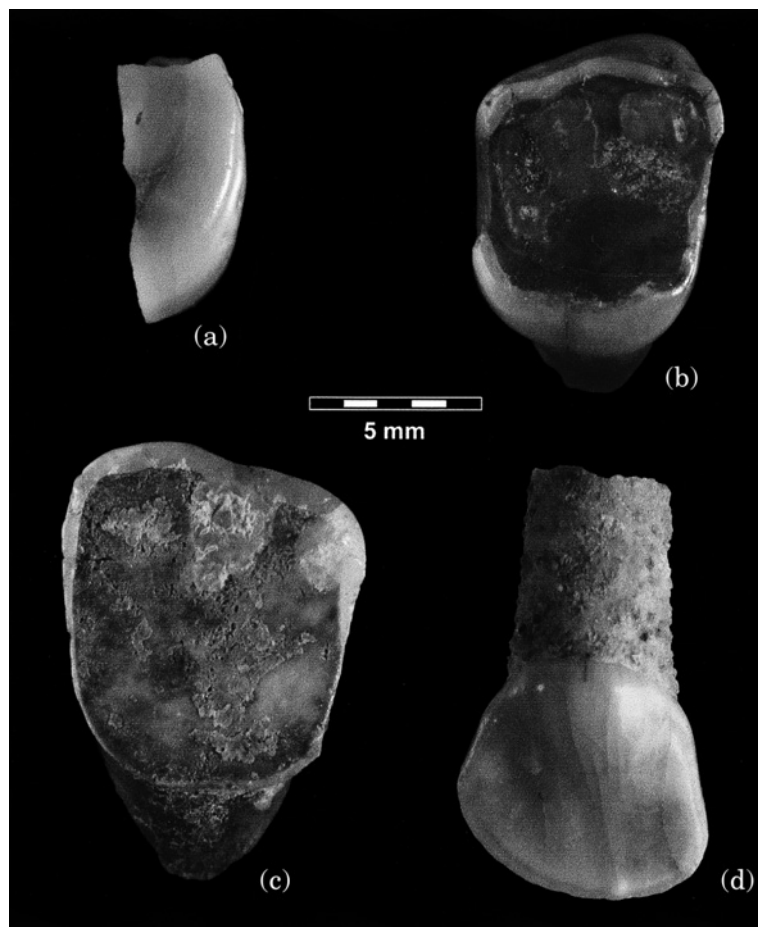


Figure 2. Human dental remains from the MSA strata of Blombos Cave (1999–2000 excavations). (a) SAM-AP 6303, ?RP^{3/4} frag., occlusal view, ?mesial to right; (b) SAM-AP 8928, Rdm¹, occlusal view, mesial to right; (c) SAM-AP 8971, Ldm², occlusal view, mesial to left; (d) SAM-AP 8973, Ldi¹, lingual view, mesial to right.

SAM-AP 8973 [Figure 2(d)]. This is a complete, unworn crown and developing root of an Ldi¹. The root, which is approximately 5.6 mm long, is judged to be some 60% complete. This indicates an age of death, or traumatic extractive loss of the tooth, at an age of less than ca. 1.5 years by modern standards (Kronfeld & Schour, 1939), although only this one set of developmental values has been published for deciduous incisors (Smith, 1991). The labial crown outline is slightly tapered cervically, and the mesio-incisal and especially the

disto-incisal corners are rounded. Labial enamel is slightly roughened with a number of tiny hypoplastic pits concentrated over the incisal third of the crown. The incisal edge is slightly crenulated. A single, small mamelon is delineated near the mesial end. The crown is 7.3 mm high. Lingually, there is no mesial marginal ridge, no median ridge, and the distal marginal ridge is short and weakly developed. The slight cervical swelling is skewed somewhat distally, and it supports a tiny cuspule at the terminus of the distal marginal ridge. The crown is not shoved.

Individual associations

Grine *et al.* (2000) suggested that while the two deciduous teeth from the 1997–1998 seasons (SAM-AP 6264, 6293) might represent a single individual, several stratigraphic units spanning about 0.5 m in depth separate them. Moreover, resorption of the root has progressed further on the SAM-AP 6264 Ldm¹ than on the SAM-AP 6293 Rdi¹. Because this is developmentally incongruous (the di¹ would normally be shed before the dm¹), it is unlikely that these two deciduous teeth derive from one individual. Grine *et al.* (2000) also opined that the two premolar fragments (SAM-AP 6292, 6295) probably derive from a single individual, but that the deciduous and permanent teeth are not associated.

With regard to the entire sample, it is morphologically feasible that the SAM-AP 8928 Rdm¹ could be associated with the SAM-AP 8971 Ldm², as both deciduous molars display considerable occlusal wear and root resorption. It is quite possible that they were exfoliated by a single individual, although their stratigraphic and horizontal separation might mitigate against this relationship.

Neither of the foregoing deciduous molars is associated with the SAM-AP 6293 Rdi¹, because root resorption has progressed further on the molars than on the incisor, which is developmentally incongruous. It would appear, therefore, that this deciduous incisor represents a (probably exfoliated) tooth from a separate individual.

The SAM-AP 6264 Ldm¹ is not associated with any of the other deciduous teeth in the upper stratigraphic horizons. As noted above, its root displays a greater degree of resorption than would be expected were it related to the SAM-AP 6293 Rdi¹. It is not the antimere of the SAM-AP 8928 Rdm¹ because the latter displays a greater degree of occlusal wear, and it lacks any manifestation of the marked enamel hypoplasia on

SAM-AP 6264. It is unlikely to represent the same individual as the SAM-AP 8971 Ldm² because, although they display comparable occlusal wear, their interproximal surfaces do not match.

The premolar and molar fragments from the lower units (SAM-AP 6292, 6295, 8972) could represent the dental remains of a single individual. The SAM-AP 6303 premolar fragment could likewise be associated with at least some of these other three permanent tooth fragments (SAM-AP 6303 could, of course, be associated with all of them if one of the premolar fragments has been attributed incorrectly). The Ldi¹ from the lowermost horizon (SAM-AP 8973) was unerupted, and is therefore not associated with any of the other dental specimens from the deposit.

Thus, it is likely that at least five individuals are represented to date in the Blombos Cave MSA strata. All but one (or two) of the individuals represented in the site were juveniles. The deciduous teeth in the higher stratigraphic units (Layers CB–CF) are considered likely to have been exfoliated in the normal course of dental replacement. By contrast, the deciduous incisor and the permanent crown fragments from the lower units (Layers CI–CK) probably represent a young child (ca. <1.5 years) and one (or two) post-childhood individual(s) who lost their teeth through trauma, or who died in or near the cave.

Comparisons of crown dimensions

Except for the SAM-AP 8973 di¹, all of the Blombos Cave teeth are heavily worn and/or incomplete. Thus, the only useful comparative data for most of this sample relate to crown size. The mesiodistal (MD) and buccolingual (BL) diameters of the Blombos Cave MSA tooth crowns are recorded in Table 2.

Comparison with data for modern sub-Saharan African populations reveals that the

Table 2 Crown diameters of Blombos MSA human teeth (mm)

Specimen	MD meas.	MD est.	BL meas.	BL est.
SAM-AP 6293 di ¹	7.5	(7.8)	5.7	5.7
SAM-AP 6264 dm ¹	7.2	7.5	8.9	8.9
SAM-AP 6292 P ³	—	—	9.8	9.9
SAM-AP 6295 P ⁴	—	—	—	—
SAM-AP 6303 P ^{3/4}	—	—	—	—
SAM-AP 8973 di ¹	7.7	7.7	5.2	5.2
SAM-AP 8928 dm ¹	7.2	7.5	9.9	9.9
SAM-AP 8971 dm ²	8.9	9.3	10.3	10.5
SAM-AP 8972 M frag.	—	—	—	—

Abbreviations: MD meas., measured mesiodistal diameter; MD est., estimated original mesiodistal diameter; BL meas., measured buccolingual diameter; BL est., estimated original buccolingual diameter.

Table 3 Mesiodistal and buccolingual diameters of di¹

	Sex	<i>n</i>	\bar{x}	S.D.	Obs. range	Reference
MD diameter						
SAM-AP 6293		1	(7.8)			
SAM-AP 8973		1	7.7			
South African	♂+♀	21	6.5	0.5	5.8–7.5	Grine (1986)
San	♂+♀	58	6.8	0.4	6.0–7.9	Grine (1984)
Liberian	♂+♀	21	6.9	0.4	—	Moss & Chase (1966)
Neandertal	♂+♀	15	7.7	0.6	6.5–9.1	Grine <i>et al.</i> (1991)*
BL diameter						
SAM-AP 6293		1	5.7			
SAM-AP 8973		1	5.2			
South African	♂+♀	22	5.0	0.4	4.2–5.9	Grine (1986)
San	♂+♀	59	5.1	0.3	4.5–5.8	Grine (1984)
Liberian	♂+♀	21	5.0	0.3	—	Moss & Chase (1966)
Neandertal	♂+♀	15	6.1	0.4	5.4–6.9	Grine <i>et al.</i> (1991)*

*The Neandertal sample includes specimens from Chateaufneuf, Engis, Kebara, Tabun, La Ferrassie, Hortus, Krapina, Lazaret, Neussing, Pech de l'Aze, Roc de Marsal, Shanidar, Staroselje and Subalyuk. See Grine *et al.* (1991; Table 6, p. 384) for references from which the measurements are taken.

MD diameters of the Blombos Cave di¹s fall at the upper limits of the observed ranges of modern South African and San samples, and just about 2 S.D. above the means for these and a modern Liberian sample (Table 3). The Blombos values are the same as the mean recorded for a Neandertal sample. The BL diameter of the SAM-AP 8973 di¹ falls just above the means for the three modern African samples, while this dimension of the other Blombos Cave di¹ (SAM-AP 6293) is slightly larger, falling just about 2 S.D. above the corresponding

modern African sample means. The BL diameters of the two Blombos Cave di¹s fall either below or within the lower third of an observed Neandertal sample range (Table 3).

The MD diameters of both Blombos Cave dm¹s are identical. This value falls among the means for four recent African samples, and just within the lower observed limit and about 2 S.D. below the mean of a Neandertal sample (Table 4). The BL diameter of the SAM-AP 8928 dm¹ falls above the observed ranges and beyond

Table 4 Mesiodistal and buccolingual diameters of dm¹

	Sex	<i>n</i>	\bar{x}	S.D.	Obs. range	Reference
MD diameter						
SAM-AP 6264		1	7.5			
SAM-AP 8928		1	7.5			
South African	♂+♀	35	7.4	0.4	6.3–8.1	Grine (1986)
San	♂+♀	92	7.4	0.5	6.2–8.6	Grine (1984)
Liberian	♂+♀	21	7.7	0.4	—	Moss & Chase (1966)
Rwandan	♂+♀	16	7.7	—	—	Brabant (1963)
Neandertal	♂+♀	9	8.2	0.5	7.4–8.9	Grine <i>et al.</i> (2000)*
BL diameter						
SAM-AP 6264		1	8.9			
SAM-AP 8928		1	9.9			
South African	♂+♀	35	8.6	0.5	7.4–9.6	Grine (1986)
San	♂+♀	97	8.6	0.4	7.4–9.4	Grine (1984)
Liberian	♂+♀	21	8.5	0.3	—	Moss & Chase (1966)
Rwandan	♂+♀	16	9.2	—	—	Brabant (1963)
Neandertal	♂+♀	10	9.4	0.4	8.6–9.8	Grine <i>et al.</i> (2000)*

*The Neandertal sample includes: Chateaufneuf, Gibraltar, Krapina, La Ferrassie, La Quina and Pech de l'Aze. See Grine *et al.* (2000; Table 5, p. 762) for references from which the measurements are taken.

2 S.D. of the means of several modern African samples, and at the upper limit of the observed Neandertal sample range. The BL diameter of the other Blombos Cave dm¹ (SAM-AP 6264), however, falls among the corresponding means recorded for four modern African samples, and just within the lower observed limit of a Neandertal sample.

The MD diameter of SAM-AP 8971 dm² falls among the means recorded for four recent African samples; it falls below, but within 1 S.D. of the mean of a Neandertal sample (Table 5). The BL diameter of this tooth falls at the upper observed limits and just about 2 S.D. above the means for three recent African samples, but it is close to the means recorded for a fourth modern African (Rwandan) sample and a Neandertal sample.

Within the small Blombos Cave sample, some of the crown dimensions tend to be large by comparison with recent African homologues (e.g., MD diameter of both di¹s, the BL diameter of one of the dm¹s, and perhaps the BL diameters of one of the di¹s and the dm²). In most of these

instances, the Blombos values fall comfortably within the ranges of roughly pencontemporaneous Neandertal samples. However, in all other instances, including the BL diameters of the second di¹ and the second dm¹, the Blombos Cave crown values fall among recent African sample means, and are smaller than the majority of Neandertal homologues.

Thus, some of the Blombos Cave teeth tend to be larger than those of the majority of recent sub-Saharan Africans, while in other instances they are comparable to recent homologues. The human dental record for the later MSA of sub-Saharan Africa is quite paltry. In addition to the teeth from Blombos Cave, a handful of specimens is known from sites such as Klasies River Mouth (Singer & Wymer, 1982; Rightmire & Deacon, 1991), Equus Cave (Grine & Klein, 1985), Sea Harvest (Grine & Klein, 1993), Mumba Rock Shelter (Bräuer & Mehlman, 1988), Die Kelders (Grine, 2000), Witkrans Cave (McCrossin, 1993), and Mumbwa Caves (Pearson *et al.*, 2000). Some, but not all of the teeth from these

Table 5 Mesiodistal and buccolingual diameters of dm^2

	Sex	<i>n</i>	\bar{x}	S.D.	Obs. range	Reference
MD diameter						
SAM-AP 8971		1	9.3			
South African	♂+♀	30	8.9	0.7	7.9–10.7	Grine (1986)
San	♂+♀	99	8.8	0.4	7.5–10.0	Grine (1984)
Liberian	♂+♀	20	9.2	0.4	—	Moss & Chase (1966)
Rwandan	♂+♀	18	9.5	—	—	Brabant (1963)
Neandertal	♂+♀	21	9.8	0.7	8.9–11.4	Grine <i>et al.</i> (1991)*
BL diameter						
SAM-AP 8971		1	10.5			
South African	♂+♀	30	9.6	0.5	8.7–10.7	Grine (1986)
San	♂+♀	102	9.6	0.4	8.5–10.5	Grine (1984)
Liberian	♂+♀	20	9.7	0.5	—	Moss & Chase (1966)
Rwandan	♂+♀	18	10.4	—	—	Brabant (1963)
Neandertal	♂+♀	21	10.6	0.5	9.8–11.5	Grine <i>et al.</i> (1991)*

*The Neandertal sample includes specimens from Amud, Chateaufort, Engis, Gibraltar, Kebara, Krapina, Kulna, La Ferrassie, La Quina, Pech de l'Aze, Roc de Marsal, Shanidar, Staroselje, Subalyuk, Tabun, and Teshik-Tash. See Grine *et al.* (1991; Table 6, p. 384) for references from which the measurements are taken.

later Pleistocene sites tend to be large by comparison with recent African homologues. This, of course, is not surprising, since large tooth size is plesiomorphic for *Homo sapiens*, and crown reduction has been documented from even more recent archaeological samples to living populations (e.g., Frayer, 1977; Smith, 1982; Brace & Vizthum, 1984). At Blombos Cave and other South African MSA sites (e.g., Die Kelders, Klasies River Mouth) some dental dimensions exceed those of recent Africans (and approach those of Neandertals) whereas others do not. This may reflect the process of dental reduction within southern Africa during the MSA, and it may speak also to possibly higher levels of sexual dimorphism than are exhibited within recent populations.

Comparisons of crown morphology

The only tooth from Blombos Cave for which morphological features of the crown (or root) can be ascertained is the SAM-AP 8973 di^1 . This crown has a tiny lingual tubercle at the terminus of the distal

marginal ridge. A lingual tubercle is very infrequent among recent indigenous peoples of southern Africa [0% of South African di^1 s ($n=23$ individuals), and 9% of San di^1 s ($n=49$ individuals)] (Grine, 1986, 1990). The moderate, distally skewed cervical enamel prominence of the Blombos di^1 finds weaker and more symmetrical development on the majority of South African (72%) and San (86%) homologues. The Blombos incisor is not shoveled, which is in keeping with recent southern African populations. Except for the presence of a tiny lingual tubercle, the Blombos di^1 is very similar to homologues from the MSA strata of the nearby, albeit somewhat younger site of Die Kelders (Grine, 2000).

Antemortem crown abrasion

The SAM-AP 6303 premolar fragment displays a number of fine, horizontal scratches on the interproximal surface cervical to the ICF. The other two premolar crown fragments from Blombos Cave also display such fine grooves (Grine *et al.*, 2000).

Interproximal grooving has been documented in numerous recent and archaeological samples (Ungar *et al.*, 2001 and references therein). Most of the recorded instances involve the posterior permanent teeth from P4 through M3. These grooves are usually attributed to the use of a palliative toothpick (Frayer, 1991), although alternative etiologies have been suggested (e.g., Wallace, 1974; Brown & Molnar, 1990). Frayer (1991) has observed that if task-activities, such as sinew stripping, were the cause of the interproximal grooves, then they should be represented on the occlusal or juxta-occlusal surfaces. None of the Blombos Cave premolar crown fragments displays any manifestation of striae beyond the confines of the interproximal face cervical to the ICF.

Examination of dental remains from other MSA sites in South Africa has revealed several premolars and molars from Klasies River Mouth, Die Kelders, Border Cave and Equus Cave with similarly faint horizontal striae between the ICF and cervical margin (Grine *et al.*, 2000).

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