

4. Maxillary molars cusp morphology of South African australopithecines

J. MOGGI-CECCHI

*Laboratori di Antropologia
Dipartimento di Biologia Animale e Genetica
Università di Firenze
Via del Proconsolo, 12
50122 Firenze
Italy
jacopo@unifi.it
and
Institute for Human Evolution
University of the Witwatersrand
Johannesburg, South Africa*

S. BOCCONE

*Laboratori di Antropologia
Dipartimento di Biologia Animale e Genetica
Università di Firenze
Via del Proconsolo, 12
50122 Firenze
Italy
boccone@unifi.it*

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Abstract

The South African Plio-Pleistocene sites where large numbers of fossil hominid specimens have been discovered in the last 20 years are Sterkfontein, Swartkrans and, most recently, Drimolen. Hominid specimens recovered from these sites have usually been attributed to *A. africanus* (from Sterkfontein), *A. robustus* (Swartkrans, Drimolen and Sterkfontein) and South African early *Homo* (Swartkrans, Drimolen and Sterkfontein). We recently started a research project aimed at characterizing cheek teeth cusp morphology of South African Australopithecinae employing digital photographs of their occlusal surfaces. In this paper an analysis of the basic metrical features of maxillary molar cusp areas and proportions of *A. africanus* and *A. robustus* is presented. We analyzed 92 permanent maxillary molar teeth of South African Australopithecinae. The main results suggest that: a) crown base areas of the three molars are broadly similar in *A. africanus* and *A. robustus*; b) significant differences between the two species in relative cusp areas are evident for the protocone of M¹ (with *A. africanus* larger than *A. robustus*), the paracone of

M¹, and the protocone of M² and M³ (with *A. robustus* larger than *A. africanus*); c) in the total crown area *A. robustus* shows the sequence $M^1 < M^2 < M^3$ as previously described; d) in *A. africanus* the sequence observed is $M^1 < M^2 > M^3$, as in living apes. This different sequence between *A. africanus* and *A. robustus* appears to be related mostly to differences in mesial cusp size, which in *A. robustus* shows a marked relative expansion from M¹ to M³. Also, the variability in absolute cusp areas of the *A. africanus* sample seems to be related to the presence of specimens with notably large teeth.

Introduction

The number of fossil hominid specimens recovered from southern African Plio-Pleistocene sites has dramatically increased in the last 20 years. The sites where large numbers of fossil hominid specimens have been discovered include Sterkfontein (e.g., Lockwood and Tobias, 2002; Moggi-Cecchi et al., 2006), Swartkrans (e.g., Brain, 1993) and, most recently, Drimolen (Keyser et al., 2000). Hominid specimens recovered from these sites have usually been attributed to *Australopithecus africanus* (Sterkfontein), *Australopithecus robustus* (Swartkrans, Drimolen and Sterkfontein) and southern African early *Homo* (Swartkrans, Drimolen and Sterkfontein).

Among these, the fossils recovered from the Sterkfontein Formation represent the largest collection of early hominid specimens from a single locality. Hominids from Sterkfontein Member 4 have, with few exceptions, been assigned to *A. africanus*. In recent years, some authors have suggested that, on the basis of the analysis of the cranial anatomy, a few specimens from Sterkfontein Member 4 may represent another taxon (e.g. Clarke, 1988, 1994; Lockwood and Tobias, 2002). However, different studies based on dental metrics have found no evidence for substantial heterogeneity within the Sterkfontein Member 4 hominid dental sample (Suwa, 1990; Wood, 1991a; Calcagno et al., 1999; Moggi-Cecchi, 2003).

It is becoming apparent that analytical studies of the dentition employing traditional

linear measurements (mesio-distal and buccolingual diameters) may not be the appropriate approach for addressing the issue of morphological variability within the Sterkfontein Member 4 hominid dental sample (Moggi-Cecchi, 2003). For this reason we recently started a research project aiming to characterize the dental morphology of the Sterkfontein hominid sample (in comparison with the other South African fossil hominid species) employing digital photographs of the occlusal surface of the cheek teeth. Although 2D images are just a crude approximation of the complex shape of the tooth crown, they are relatively easy and quick to collect using digital photographs, and they are more informative than the traditional linear measurements. This is because, among other things, they allow measurements of the absolute areas of the individual cusps.

Little work has been carried out on the analysis of cusp areas of the teeth of Plio-Pleistocene hominids since the series of papers by Wood and colleagues two decades ago (Wood and Abbott, 1983; Wood et al., 1983; Wood and Uytterschaut, 1987; Wood and Engleman, 1988). The number of South African dental specimens has vastly increased since then, thus allowing a more detailed analysis of issues pertaining to the intra- and interspecific variability in the fossil samples.

In this paper, we focus on the basic metrical features of maxillary molars cusp areas and proportions of *A. africanus* and *A. robustus*.