

3. Trends in postcanine occlusal morphology within the hominin clade: The case of *Paranthropus*

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Keywords: dental morphology, Plio-Pleistocene hominins, *Australopithecus*, early *Homo*

Abstract

We have examined the crowns of chimpanzee, australopith, and *Paranthropus* species and early *Homo* in order to investigate two different, widely recognized, dental trends in Plio-Pleistocene hominin evolution. They are a reduction in crown size and morphological complexity in *Homo*, and an increase in crown size and morphological complexity in *Paranthropus*. A phenetic assessment of maxillary and mandibular molar crown non-metrical traits revealed that two australopith species (*Au. africanus* and *Au. afarensis*) are much more similar to each other than either is to *Paranthropus*, and together all hominins are distinctively different from chimpanzees (*P. troglodytes* and *P. paniscus*). The difference between *Paranthropus* and australopith postcanine teeth was 20–30 times greater than that between the australopith species and the difference between the two australopith species was about half the difference between the two extant chimpanzee species. The characters that contribute to the increase in crown complexity seen in *Paranthropus* do not appear to be primitive retentions from a great ape ancestor, and there is

some evidence that the same, or a very similar, trend towards trait intensification is already present in australopiths. These traits include additional cusps on the maxillary and mandibular molars, and the expanded P₄ talonid. Early *Homo* exhibits the primitive condition for many of the molar traits, but it has also lost many other primitive traits (upper molar anterior and posterior foveae, for example) that are present in the australopiths. Relative to *Pan*, and similar to the australopiths, early *Homo* possesses a larger P₄ with a somewhat expanded talonid, but this trend is subsequently reversed in later *Homo*. Our study reveals that some of the dental trends said to be characteristic of *Homo* actually appear relatively late in human evolution.

Introduction

Half a century ago Robinson (1954a, b) proposed that an adaptive distinction be made between *Paranthropus* and *Australopithecus*. Robinson interpreted what he judged to be the distinctive morphology of *Paranthropus* from the southern African cave sites as evidence that members of this taxon were dietary specialists. His interpretation of the morphology of *Australopithecus* was that it had adopted a more generalist strategy. Initially, the attention of researchers was focused on the hominin fossil evidence from the southern African caves sites, the only relevant evidence then available. Subsequently, researchers have turned their attention to the distinction between *Paranthropus* and *Homo* instead of the distinction between *Paranthropus* and *Australopithecus* and they have focused more on the fossil hominin evidence recovered from East African sites (e.g., Tobias, 1967; Suwa, 1990; Tobias 1991; Wood, 1991).

Dental morphology has always been a major component of the morphological evidence for the distinctiveness of *Paranthropus* (e.g., Robinson, 1956; Wood, 1991). Robinson (1956) particularly emphasized the discrepancy between the size of the anterior and the postcanine teeth as well as differences in occlusal morphology (e.g., a molarized first mandibular deciduous molar, molarized mandibular premolars, and upper molars with a trigon and hypocone). Although some researchers have subsequently addressed the

differences in relative tooth size (e.g., Wood and Stack, 1980), most attention has been paid to documenting the non-metrical and metrical differences in the occlusal morphology of the deciduous and permanent postcanine teeth of *Paranthropus* and *Homo* (e.g., Wood and Abbott, 1983; Grine, 1985; Wood and Uytterschaut, 1987; Wood and Engleman, 1988).

It has been widely assumed that it is the occlusal morphology of *Paranthropus* and not *Homo* that is derived with respect to the sympleiomorphic condition for the hominin clade. Initially this was based on the explicit or implicit assumption that *Au. afarensis* was an appropriate model for the primitive condition for the hominin clade. This was not an unreasonable assumption at a time when (i) the morphology of *Au. afarensis* was interpreted as being almost entirely primitive (de Bonis et al., 1981; White et al., 1981); (ii) when it was assumed that *Au. afarensis* was similar to, if not actually, the common ancestor of all later hominins; and (iii) when the relationships among the extant higher primates were regarded as unresolved or unresolvable. However, discoveries and advances made over the course of the last decade or so have changed our interpretation of *Au. afarensis*. First, fossil evidence has been recovered of presumed hominins that are evidently more primitive than *Au. afarensis* (White et al., 1994; 1995; Senut et al., 2001; Brunet et al., 2002; Haile-Selassie et al., 2004). Second, molecular evidence now points very strongly to a sister group relationship between *Homo* and *Pan* (i.e., (((*Homo*, *Pan*) *Gorilla*) *Pongo*)) (Ruvolo, 1997). Thus, we