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Enamel-dentine junction morphology in *Australopithecus sediba*

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The hypodigm of *Australopithecus sediba* includes two partial skeletons (MH1 and MH2) from Malapa, South Africa, dated to 1.977 Ma [1-2]. The relationship between *A. sediba* and other hominin taxa remains unresolved, although there are similarities across the skeleton with *Australopithecus africanus*, and some features suggested to resemble early *Homo*. Studies of dental morphology are useful in resolving issues of hominin systematics, and both MH1 and MH2 preserve large portions of the dentition. Previous analysis of the enamel surface morphology of these teeth suggest that they resemble those of *Australopithecus africanus*, but are distinguished from this taxon by the small size of the teeth [3-4]. Studying the internal morphology of hominin teeth can provide additional taxonomically relevant information, particularly in the case of worn teeth (as in MH2) [5]. Here we investigate the enamel-dentine junction (EDJ) morphology of *A. sediba*, examining the EDJ expression of a number of important discrete traits, as well as quantifying overall tooth morphology using geometric morphometrics and comparing to *Australopithecus africanus*, *Paranthropus robustus*, *Homo habilis* and *Homo erectus*.

We find that the shape of the postcanine teeth of *A. sediba* is most similar to *A. africanus* overall, including in the maxillary third molars which provide good distinction between *A. africanus* and early *Homo*. However, as previously noted, the *A. sediba* teeth are very small. In the MH1 maxilla, all teeth except the fourth premolar are smaller than those of *A. africanus*. In the mandibular teeth, MH2 is smaller still; all teeth are below the size range of *A. africanus*, while the I₂-P₃ of this specimen are also smaller than those of *H. habilis* and *H. erectus*.

Contrary to previous observations at the enamel surface [3], the mandibular molars of MH1 show no lingual accessory cusps (C7) at the enamel-dentine junction, while only the M₁ has a distal accessory cusp (C6). This arrangement in the M1 and M2 is typical of *Australopithecus*, although the absence of accessory cusps in the M₃ is unusual among specimens of *Australopithecus*, *Paranthropus* and *H. habilis* (but is seen in *H. erectus* specimen KNM-ER 992). Alternatively, the M₃ of MH2 has both lingual and distal accessory cusps, as is the case in a number of taxa. Other features that resemble *A. africanus* and differ from *P. robustus* and early *Homo* include the well-developed molar protostylids that extend mesially beyond the level of the protoconid, and marked buccal grooves on the P₄.

In conclusion, the overall tooth shape and discrete trait expression in *A. sediba* most closely resemble that of *A. africanus*, and are well distinguished from *P. robustus* and most early *Homo* specimens. In particular, the M₃ shape and lack of a M₁ lingual accessory cusp in MH1 distinguish the specimen from *H. habilis*. However, as previously noted, the teeth of *A. sediba* are notable by their small size, which for some tooth positions are within the range of *Homo*, and in others is even smaller than *H. habilis* or *H. erectus*.

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