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## Endostructural morphology of the *Homo naledi* mandibular premolars

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The taxonomic position of the recently discovered species *Homo naledi* is still uncertain. One of the many distinctive aspects of the dentition of the species is the external morphology of the mandibular third premolar, which has two roots and is fully bicuspid, a configuration which is unusual for late-Middle Pleistocene *Homo*. The fourth premolar is also bicuspid, and both premolars have a notably symmetrical occlusal outline [1]. In this study, we examine the endostructural morphology of the premolar tooth crowns as the surface of the dentine crown in particular is known to carry important taxonomic information and elucidate the developmental basis of premolar crown morphology.

We use micro-tomography to image the enamel-dentine junction (EDJ) of *H. naledi* mandibular premolars from both the Dinaledi and the Lesedi chambers, and use geometric morphometrics to quantitatively compare the EDJ morphology to specimens of early *Homo*, *Paranthropus robustus*, *Australopithecus africanus*, *Homo neanderthalensis* and *Homo sapiens* (n=76). Additionally, we investigate patterns in the size relationship between the P3 and P4 among the study taxa using centroid size.

The mandibular premolar EDJ morphology of *H. naledi* from the Dinaledi Chamber is distinctive and consistent. Both the P3s and P4s display a tall well-developed metaconid and strongly developed mesial marginal ridges, while the P4 shows a relatively mesiodistally elongated crown. The P3 and P4 are distinct from a number of early *Homo* specimens. In particular, the *H. naledi* premolars can be distinguished from KNM-ER 1802 (*Homo sp.*), as well as KNM-ER 992, the type specimen of *Homo ergaster* [2]. Swartkrans *Homo* specimen SKX 21204 clusters closely with KNM-ER 992, particularly for the P4, and is also quite distinct from *H. naledi*. Premolars from the Lesedi chamber, although worn, are consistent with the morphology seen in the Dinaledi chamber, clustering closely with these *H. naledi* specimens in the geometric morphometric analysis, although they are slightly larger in size.

Finally, we find that when considering centroid size, *P. robustus* and *A. africanus* show a P4>P3 pattern, which is also found in modern humans, and in early *Homo* specimens KNM-ER 1802 and SKX 21204. In KNM-ER 992, the premolars are approximately equal in size. *H. naledi* however shows the pattern P3>P4, which is distinctive among our sample.

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