

Dental tissue proportions in fossil orangutans from mainland Asia and Indonesia

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Supplementary Information

Supplementary Methods

A total of 186 fossil orangutan postcanine teeth were imaged with a Skyscan 1172 micro-computed tomograph (micro-CT) at the Max Planck Institute for

Evolutionary Anthropology at 100 kV, 100 mA, with an aluminum-copper filter and isometric voxel sizes of 14 to 39 microns. Of these, 153 fossil teeth (Table 1) were deemed sufficiently preserved for 2D enamel thickness quantification (detailed below). Thirteen molars were of uncertain position in the molar row, which is a common complication with isolated hominoid remains.¹ The Sumatran material is detailed in Hooijer² and includes 88 molars from Lida Ajer, Sibrambang and Djamboe Caves. These caves have been suggested to be temporally equivalent to the Javan Punung deposits,³ which have been dated to 118-128 thousand years ago (kya).⁴ However, Harrison⁵ and others (reviewed in ³) believe that these fossils date from the Holocene. Further study is necessary to resolve this. Three molars are also included from the Late Pleistocene Bornean site Niah Cave.^{6,7} The mainland Asian material includes 14 teeth from Duoi U'Oi Cave, Vietnam (dated to 66 kya⁸), 10 teeth from Gangian (Tubo) Cave, China (dated to 94-220 kya⁹), and 38 teeth from the Chinese apothecary collections of the Senckenberg Institute¹⁰ and the Chinese Institute for Vertebrate Paleontology and Paleoanthropology. This unproven material is believed to come from Middle Pleistocene southern Chinese deposits.¹¹

Virtual 2D section planes were generated from three-dimensional (3D) models with VG Studio MAX 2.0 software (Volume Graphics, Inc.). For premolars, the buccal and lingual cusps of 3D models were aligned in an occlusal view, the dentine horn tip of the buccal cusp was set as the center of rotation, and a perpendicular plane was created. To generate a buccal-lingual 2D section along the axis of the tooth, the model was rotated to locate the plane midway between the maximum buccal-lingual bi-cervical diameter and the maximum cervical enamel

extension (Figure 1A). For molar teeth, the 3D coordinates of the two mesial dentine horn tips and two pulpal horn tips were first found and recorded. Molar 2D planes were located as the midpoint between the dentine horn and pulp tips using rotational vectors (with a dentine horn tip set as the center of rotation). This method was designed to yield a 2D plane perpendicular to the developmental axis of the crown that captures the maximum extension of cervical enamel (Figure 1B), as is standard practice for physical sectioning. When 2D sections demonstrated light to moderate wear, the outer enamel surface was manually reconstructed prior to quantification (based on the profiles of unworn teeth) (Supplementary Figure 1). Corrections were also made when small areas of cervical enamel were missing (based on the curvature and orientation of the outer enamel surface relative to the enamel-dentine junction). Sections with heavy wear, or with both cervices missing, were excluded.

Supplementary References

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Supplementary Table 1. Fossil *Homo sapiens* molar material employed in Figure 5.

Site	Individual
Dar es Soltane II, Morocco	Dar es-Soltan II-4
Equus Cave, South Africa	EQ H5
Grotte des Contrebandiers, Morocco	H
Jebel Irhoud, Morocco	Irhoud 3
Jebel Qafzeh, Israel	Qafzeh 10
Jebel Qafzeh, Israel	Qafzeh 15
Die Kelders Cave, South Africa	SAM-AP 6242
Die Kelders Cave, South Africa	SAM-AP 6277
Grotte des Contrebandiers, Morocco	T3b
Grotte des Contrebandiers, Morocco	"Temara mandible"

Primary data are from Smith *et al.*¹²

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Supplementary Figure 1. Example of minor molar wear reconstruction (dotted line).



Profiles of unworn teeth are employed to correct light to moderate wear.
The scale bar in the lower right is equal to 5 mm.

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