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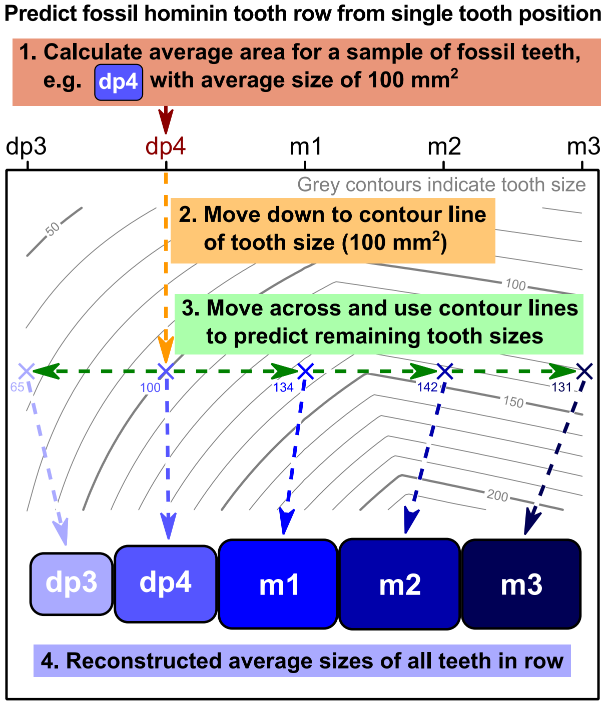
Schematic diagram of results



Supplementary Methods

Equivalencies of Inhibitory Cascade Pattern

The original formulation of the inhibitory cascade by Kavanagh *et al.*[6] established that the ratio of the m2/m1 varies with the ratio of the m3/m1 as:

$$\frac{m3}{m1} = 2 \times \left(\frac{m2}{m1}\right) - 1$$

Kavanagh *et al.*[6:430] showed that this is mathematically equivalent to m2 being 1/3 of the total area of the row. In addition, it can be shown that m2 is the average of m1 and m3 when the inhibitory cascade pattern is being followed:

$$\frac{m3}{m1} = 2 \times \left(\frac{m2}{m1}\right) - 1$$

$$2 \times \left(\frac{m2}{m1}\right) = \frac{m3}{m1} + 1$$

$$2 \times m2 = m1\left(\frac{m3}{m1} + 1\right)$$

$$m2 = (m1 + m3)/2$$

Therefore, m2 is the sum of m1 and m3 divided by 2, which is the average of m1 and m3.

We can also show that the pattern is linear when the inhibitory cascade is being followed, i.e. that the change from m1 to m2 (given by $m2 - m1$) is the same as from m2 to m3 (given by $m3 - m2$):

$$m2 = (m1 + m3)/2$$

$$2 \times m2 = m1 + m3$$

$$m2 - m1 = m3 - m2$$

Therefore, these four statements are mathematically equivalent, and all express the expected pattern according to the inhibitory cascade:

1. m3/m1 = 2×(m2/m1) – 1
2. m2 is 1/3 of the total of the tooth row.
3. m2 is the average of m1 and m3.
4. The change in sizes across three teeth, m1, m2 and m3, is linear.

All of these statements are true whether the absolute tooth size is used (e.g. in mm^2) or if they are some proportion (e.g. percentage of largest tooth in the row, or percentage of m1).

Derivation of Prediction Surface

Variables:

PropArea, area of tooth as a percentage of largest tooth in the row. *PropAreaA* and *PropAreaB* represent proportional area of tooth for regions A and B respectively.

T, tooth position (1 to 5 for dp3 to m3)

AM1, area of first molar (m1), tooth position 3

Ta, tooth position slope coefficient for *PropArea*

Aa, area of m1 slope coefficient for *PropArea*

Pb, intercept coefficient for *PropArea*

MaxArea, absolute area of largest tooth in the row

Ma, slope coefficient for *MaxArea*

Mb, intercept coefficient for *MaxArea*

Area, area of teeth for given tooth position and area of m1. *AreaA* and *AreaB* represent proportional area of tooth for regions A and B respectively.

AreaAStA area of teeth in region A for given tooth position and area of m1, standardized by *AreaA* at m1.

AreaBStA area of teeth in region B for given tooth position and area of m1, standardized by *AreaA* at m1.

We use the planar regressions that describe the proportional size of each tooth for each tooth position and the size of the m1 in that row.

General regression equation for multiple linear regression of *PropArea* vs *T* and *AM*1:

$$PropArea = Ta \times T + Aa \times AM1 + Pb \qquad \text{Eq. 1}$$

The hominin tooth size data are divided into two regions, A and B, where Region A is where tooth positions are 1, 2 and 3, while Region B is where tooth positions are 4 and 5.

OLS regression equations for Plane A (data in Region A) calculated from *Homo* data based on Eq. 1:

$$PropAreaAH = 0.2378 \times T + -0.001658 \times AM1 + 0.4406 \qquad \text{Eq. 2}$$

OLS regression equations for Plane B (data in Region B) calculated from *Homo* data based on Eq. 1:

$$PropAreaBH = -0.08217 \times T + 0.0006890 \times AM1 + 1.226 \qquad \text{Eq. 3}$$

Extended Data Fig. 10a shows the two planes. The tooth position at which the maximum tooth size occurs is the ‘reversal’ position, which is the intersection between Planes A and B. The intersection between Planes A and B can be found by setting Eq. 2 equal to Eq. 3:

$$PropAreaA = PropAreaB \qquad \text{Eq. 4}$$

$$0.2378 \times T + -0.001658 \times AM1 + 0.4406 = -0.08217 \times T + 0.0006890 \times AM1 + 1.226 \qquad \text{Eq. 5}$$

Solve Eq. 5 for *AM*1:

$$AM1H = -426.1(0.7852 - 0.3199 \times T) \qquad \text{Eq. 6}$$

MaxArea gives the expected size of the largest tooth for a given m1 size:

$$MaxArea = Ma \times AM1 + Mb \quad \text{Eq. 7}$$

Regression equation for *Homo* data based on Eq. 7 (see Extended Data Fig. 6):

$$MaxAreaH = 1.312 \times AM1 - 30.44 \quad \text{Eq. 8}$$

The area of each tooth in a row (mm^2) can be estimated by multiplying the proportional size of each tooth in the row (*PropArea*) by the expected maximum area for the size of m1 in that row (*MaxArea*).

$$Area = PropArea \times MaxArea \quad \text{Eq. 9}$$

$$= (Ta \times T + Aa \times AM1 + Pb) \times (Ma \times AM1 + Mb) \quad \text{Eq. 10}$$

Formula for *AreaAH* for *Homo* (substituting equation for Plane A (Eq. 2) and Eq. 8 into Eq. 10):

$$AreaAH = (0.2378 \times T + -0.001658 \times AM1 + 0.4406) \times (1.312 \times AM1 - 30.44) \quad \text{Eq. 11}$$

Formula for *AreaBH* for *Homo* (substituting equation for Plane B (Eq. 3) and Eq. 8 into Eq. 10):

$$AreaBH = (-0.08217 \times T + 0.0006890 \times AM1 + 1.226) \times (1.312 \times AM1 - 30.44) \quad \text{Eq. 12}$$

The resulting surfaces show how the areas of all teeth in the row can be calculated given the tooth position (T) and the area of the m1 ($AM1$) in that row (Extended Data Fig. 10b).

The expected relationship between predicted m1 size and actual m1 size is linear, where slope = 1. However, when the *Area* formulas are used to predict m1 size, the relationship between predicted m1 area and actual m1 area is not linear because the cross-section through the surface (i.e. *AreaAH*) at $T = 3$ (i.e. at m1) is not a linear function with slope = 1 and intercept = 0. For example, if the *Area* formula is used to predict the area of m1 ($AM1$), given $Area = 80$ and $T = 3$, then the predicted area of m1 is $AM1 \approx 76.1$, not the expected value of 80. The non-linear relationship is illustrated in Extended Data Fig. 10c, which is a cross-section of the cyan surface in Extended Data Fig. 10b at $T = 3$. The expected 1:1 relationship is shown in black, while *AreaAH* diverges from the 1:1 relationship.

To ensure that the cross-section at $T = 3$ is always 1:1, *Area* can be standardized by dividing by the ratio of calculated m1 area ($AM1$ when $T = 3$; Eq. 13) to m1 area (Eq. 14). This forces the prediction surface at m1 to be a 1:1 linear function of $AM1$, so m1 size is always predicted correctly. The standardized area is *AreaSt*.

$$AreaAtM1 = (Ta \times 3 + Aa \times AM1 + Pb) \times (Ma \times AM1 + Mb) \quad \text{Eq. 13}$$

$$AreaSt = \frac{Area}{\left(\frac{AreaAtM1}{AM1}\right)} \quad \text{Eq. 14}$$

$$= \frac{(Ta \times T + Aa \times AM1 + Pb) \times (Ma \times AM1 + Mb)}{\left(\frac{(Ta \times 3 + Aa \times AM1 + Pb) \times (Ma \times AM1 + Mb)}{AM1}\right)} \quad \text{Eq. 15}$$

Substituting Eq. 11 and Eq. 13 into Eq. 15 gives *AreaAH* standardized by the value of m1 on *AreaAH*:

$$AreaAHStA = \frac{AreaAH}{\left(\frac{AreaAHAtM1}{AM1}\right)} \qquad \text{Eq. 16}$$

$$AreaAHStA = \frac{(0.2378 \times T + -0.001658 \times AM1 + 0.4406) \times (1.312 \times AM1 - 30.44)}{\left(\frac{(0.2378 \times T + -0.001658 \times 3 + 0.4406) \times (1.312 \times AM1 - 30.44)}{AM1}\right)} \qquad \text{Eq. 17}$$

AreaB standardized by the value of m1 on *AreaA* is:

$$AreaBHStA \frac{AreaBH}{\left(\frac{AreaAHAtM1}{AM1}\right)} \qquad \text{Eq. 18}$$

$$AreaBHStA = \frac{(-0.08217 \times T + 0.0006890 \times AM1 + 1.226) \times (1.312 \times AM1 - 30.44)}{\left(\frac{(0.2378 \times T + -0.001658 \times 3 + 0.4406) \times (1.312 \times AM1 - 30.44)}{AM1}\right)} \qquad \text{Eq. 19}$$

To calculate the predicted sizes for a given tooth position and size, the *Area* formulas were solved for *AM1* using Wolfram Mathematica 8.0, taking the quadratic solution that corresponds with the tooth area data.

$$AM1AreaAHStA = 4.011 \times 10^{-29} \times \left(3.313 \times 10^{30} + 1.247 \times 10^{28} AreaAH - \sqrt{(-4.327 \times 10^{59} AreaAH + (-3.313 \times 10^{30} - 1.247 \times 10^{28} AreaAH - 1.788 \times 10^{30} T)^2)} + 1.788 \times 10^{30} T\right) \qquad \text{Eq. 20}$$

$$AM1AreaBHStA = 8.380 \times 10^{-24} \times \left(-1.062 \times 10^{26} - 1.436 \times 10^{23} AreaBH + 7.116 \times 10^{24} T + \sqrt{(2.385 \times 10^{49} AreaBH + (-1.062 \times 10^{26} - 1.436 \times 10^{23} AreaBH + 7.116 \times 10^{24} T)^2)}\right) \qquad \text{Eq. 21}$$

Eq. 20 and Eq. 21 are used in Supplementary Spreadsheet 1 to predict the size of the m1 in the row of Tooth X (the mean size of a sample of teeth of a given position). From the predicted size of the m1, the sizes of the remainder of the teeth in the row are predicted in Supplementary Spreadsheet 1 using Eq. 17 and Eq. 19 given the region of each tooth on the prediction surface.

OLS regression equations for Plane A (data in Region A) calculated from australopith data based on Eq. 1:

$$PropAreaAA = 0.2304 \times T + 2.379 \times 10^{-6} \times AM1 + 0.08096 \qquad \text{Eq. 22}$$

OLS regression equations for Plane B (data in Region B) calculated from australopith data based on Eq. 1:

$$PropAreaBA = 0.009631 \times T + 0.0001680 \times AM1 + 0.9062 \qquad \text{Eq. 23}$$

$$AM1A = -6037(0.8253 - 0.2208 \times T) \qquad \text{Eq. 24}$$

Max area for australopiths:

$$MaxAreaA = 1.298 \times AM1 + 0.1495 \qquad \text{Eq. 25}$$

Following the same steps as above using the australopith data give the following prediction equations:

$$AM1AreaAAStA = 1.973 \times 10^{-12} \times \left(-8.625 \times 10^{15} + 2.534 \times 10^{11} AreaAA + \sqrt{(8.341 \times 10^{28} AreaAA + (-8.625 \times 10^{15} + 2.534 \times 10^{11} AreaAA - 2.455 \times 10^{16} T)^2)} - 2.455 \times 10^{16} T\right) \quad \text{Eq. 26}$$

$$AM1AreaBAStA = 5.587 \times 10^{-17} \times \left(-4.827 \times 10^{19} + 1.267 \times 10^{14} AreaBA + \sqrt{(1.473 \times 10^{26} AreaBA + (-4.827 \times 10^{19} + 1.267 \times 10^{14} AreaBA - 5.130 \times 10^{17} T)^2)} - 5.130 \times 10^{17} T\right) \quad \text{Eq. 27}$$

Calculation of Confidence Intervals for Predictions in Supplementary Spreadsheet 1

The calculation of the 95% confidence intervals cannot be done using the usual approach[32] since the predicted means are estimated as the product of two independent distributions. The regression of the maximum tooth size is done using the model matrix (X_m), a new point (x_m) at which a prediction is made, a standard error (s_m) and the regression coefficients (β_m), and yields the distribution of the prediction (m)

$$\frac{m - \beta_m x_m}{s_m \sqrt{x_m^T (X_m^T X_m)^{-1} x_m}} \sim t(df_m).$$

The two relative size planes are regressed using a model matrix (X_p), the standard error (s_p), and regression coefficients (β_p). Once the appropriate plane is determined, the prediction (p) is distributed

$$\frac{p - \beta_p x_p}{s_p \sqrt{x_p^T (X_p^T X_p)^{-1} x_p}} \sim t(df_p).$$

A derivation of the formulas is available[32]. The product distribution of the product of these two estimates can be calculated, but has no closed form solution. As such, a numerical approach is used. For each new point, *mp* is estimated by taking a random sample of 100,000 student t variables on the appropriate number of degrees of freedom and the t variables are substituted in each equation above, and the product *mp* is taken. The 2.5th quantile and the 97.5th quantile are then taken from this resulting sample from the product distribution.

This approach works for any new point at which a model prediction is made. However, to implement this in Excel, a simplification was made to ease computational complexity. A cubic spline was fit to each of the tooth positions at intervals of 1 mm^2 in m1 size, on the range of existing m1 sizes.

Phylogenetic Tree

The phylogeny in Fig. 4 is modified from Dembo *et al.*[28] to include only taxa represented in this study. The divergence date for *P. pygmaeus* was set at 17.5 mya[33] and the split between *P. paniscus* and *P. troglodytes* at 2.1 mya[34]. The placement of *A. deyiremeda* (***) is based on the date of 3.3-3.5 mya and the phylogenetic position suggested in Haile-Selassie *et al.*[17].

Supplementary Tables

Supplementary Table 1 | *Homo sapiens* population-level mean rectangular area (mesiodistal length × maximum buccolingual width, mm²) of lower deciduous premolars and molars. These studies have data for both deciduous premolar and at least two molars from the same population, sometimes published in separate references. Sex: B, both; F, female; M, male.

Population	Sex	dp3	dp4	m1	m2	m3	Source
Icelanders	F			118.41	108.21		35
Icelanders	M			125.03	116.14		35
Icelanders	F	56.74	89.77				36
Icelanders	M	58.66	91.87				36
Chicago Whites	B	55.15	86.90				37
Chicago Whites	M			116.06	113.19	104.35	37
Jats (Haryana, India)	F	52.74	86.39	107.50	94.47		38
Jats (Haryana, India)	M	55.76	90.44	112.96	102.11		38
Yuendumu Aborigines	F	60.66	101.42				39
Yuendumu Aborigines	M	65.19	107.27				39
Yuendumu Aborigines	F			132.86	124.54	127.43	40
Yuendumu Aborigines	M			142.29	132.03	135.99	40
Michigan Whites	F	56.51	84.75	103.31	89.97		41
Michigan Whites	M	57.95	87.91	112.03	99.50		41
Burlington Growth Centre, Toronto	F	48.41	81.54	108.56	98.68		42
Burlington Growth Centre, Toronto	M	50.73	84.79	115.59	106.29		42
Late Archaic/Glacial Kame	B	54.27	93.60				43
Late Archaic/Glacial Kame	B			126.55	118.55	107.70	44
South Australian caucasoid	F	59.35	85.90	117.70	113.73		45
South Australian caucasoid	M	57.62	88.98	123.34	117.06		45

Supplementary Table 2 | *Homo sapiens* population-level mean rectangular area (mesiodistal length × buccolingual width, mm^2) of lower molars. Sex: B, both; F, female; M, male. Comp: Compilation source.

Region	Population	Sex	m1	m2	m3	Source	Comp.
Africa	American Negros	B	128.52	130.80	129.60	46	23
Africa	Negro (S. Africa)	F	118.22	112.45	111.53	47	29
Africa	Negro (S. Africa)	M	123.70	119.00	116.70	47	29
Africa	Negro (W. Africa, Teso)	B	119.45	112.72	126.28	48	29
Africa	Nubian Agriculturalist (3300-1100BC)	F	113.18	104.53	98.30	49	29
Africa	Nubian Agriculturalist (3300-1100BC)	M	124.25	116.30	109.50	49	29
Africa	Nubian Intensive Agriculturalist (1-1400AD)	F	109.65	102.89	93.98	49	29
Africa	Nubian Intensive Agriculturalist (1-1400AD)	M	120.26	112.33	105.26	49	29
Africa	Nubian Mesolithic (10000-7000BC)	F	125.10	118.81	113.83	49	29
Africa	Nubian Mesolithic (10000-7000BC)	M	139.24	130.19	124.88	49	29
Africa	San (Bushman, Kalahari nomadic)	F	111.37	110.09	95.65	50	29
Africa	San (Bushman, Kalahari nomadic)	M	114.14	110.77	102.11	50	29
Africa	San (Bushman, skeletal)	B	111.18	107.06	95.04	51	29
Africa	San (Bushman, skeletal)	F	117.72	106.05	90.24	52	29
Africa	San (Bushman, skeletal)	M	94.50	110.21	101.00	52	29
Africa	San (Bushmen, Kalahari settlers)	F	111.62	107.32	98.01	50	29
Africa	San (Bushmen, Kalahari settlers)	M	101.57	114.49	99.50	50	29
Africa	Wadi Halfa Mesolithic	B	139.15	135.70	135.70	53	23
Asia	Chinese	M	120.89	111.27	109.71	54 in 47	29
Asia	Chinese (Bronze Age Shang Dynasty)	B	120.33	112.35	108.64	55	29
Asia	Chinese (Hong Kong)	B	113.42	106.28	99.77	55	29
Asia	India (Bronze Age Harappans)	F	106.58	91.57	83.06	56	29
Asia	India (Bronze Age Harappans)	M	111.41	100.28	94.02	56	29
Asia	India (Inagaon 1700-700BC)	B	123.56	107.95	109.44	57	29
Asia	India (Ramapuram)	M	114.13	101.88	104.75	58	29
Asia	IndiaPunjabi	B	115.19	105.03	104.48	59	
Asia	Indonesians (Gilimanuk)	B	127.60	118.77	113.36	60	23
Asia	Japanese (Ainu Hokkaido)	F	111.28	97.00	89.24	61	29
Asia	Japanese (Ainu Hokkaido)	M	122.10	106.05	97.92	61	29
Asia	Japanese (Early Jomon)	F	120.99	105.04	98.94	61	29
Asia	Japanese (Early Jomon)	M	128.82	113.40	107.06	61	29
Asia	Japanese (Early Yayoi)	F	124.30	111.28	108.12	61	29
Asia	Japanese (Early Yayoi)	M	135.70	125.40	114.40	61	29
Asia	Japanese (Hokoriku)	F	116.63	108.12	91.20	62 in 47	29
Asia	Japanese (Hokoriku)	M	120.96	115.50	102.00	62 in 47	29
Asia	Japanese (Korean descent)	F	117.70	111.28	96.03	61	29
Asia	Japanese (Korean descent)	M	127.68	122.04	114.40	61	29
Asia	Japanese (Kyoto)	F	117.66	113.36	97.92	61	29

Region	Population	Sex	m1	m2	m3	Source	Comp.
Asia	Japanese (Kyoto)	M	127.65	120.91	106.05	61	29
Asia	Japanese (Tokyo, Edo Period)	F	118.77	113.36	103.95	61	29
Asia	Japanese (Tokyo, Edo Period)	M	126.50	119.78	108.07	61	29
Asia	Malay	B	125.06	115.28	106.30		23
Asia	South-east (Bronze Age Java)	B	127.20	121.03	117.71	55	29
Asia	South-east (Bronze Age Thai)	B	125.85	112.25	105.74	55	29
Asia	South-east (Java)	B	125.93	110.96	104.71	55	29
Asia	South-east (Java)	F	119.84	106.08	109.14	63	29
Asia	South-east (Java)	M	126.50	114.45	113.36	63	29
Asia	South-east (Thai)	B	123.48	112.85	113.82	55	29
Asia	Tibet	F	100.86	78.86	62.07	64	29
Asia	Tibet	M	103.50	79.94	56.40	64	29
Australia	Broadbeach	F		133.28	117.52	65	29
Australia	Broadbeach	M	142.68	151.04	139.15	65	29
Australia	Western Australia	F	119.74	126.00	119.46	66	29
Australia	Western Australia	M	139.32	136.89	133.02	66	29
Australia	Yuendumu	F	132.93	124.98	126.33	67,68	29
Australia	Yuendumu	M	142.67	132.82	132.47	67,68	29
Europe	American Whites	B	126.14	110.09	114.13		23
Europe	Caucasoid	B	120.40	115.11	111.57		23
Europe	Lapps (Skolt)	F	116.95	109.30	104.03	69	29
Europe	Lapps (Skolt)	M	123.18	115.23	108.04	69	29
Europe	Norwegian Lapps	F	111.72	96.78	88.04	22	29
Europe	Norwegian Lapps	M	113.88	105.84	94.25	22	29
North America	Dickson Mound	B	130.13	124.65	119.77	23	23
North America	Eskimo (Hall Beach)	M	131.04	122.21		70	29
North America	Eskimo (Igloolik)	F	120.99	115.56	114.49	70	29
North America	Eskimo (Igloolik)	M	132.21	126.56	128.80	70	29
North America	Eskimo, Aleut	F	115.25	121.87	117.75	71	29
North America	Eskimo, Aleut	M	122.07	118.39	112.97	71	29
North America	Indian Knoll (4160-2558BC)	F	125.96	117.16	117.07	72	29
North America	Indian Knoll (4160-2558BC)	M	133.80	123.40	120.27	72	29
North America	Ohio Valley (Adena)	F	120.58	113.14	103.94	44	29
North America	Ohio Valley (Adena)	M	124.17	119.01	108.37	44	29
North America	Ohio Valley (Hopewell)	F	120.73	112.47	111.57	44	29
North America	Ohio Valley (Hopewell)	M	132.28	124.12	119.72	44	29
North America	Pecos Pueblo (800-1100AD)	B	128.45	119.46	112.41	73	29
North America	Tennessee Archaic (6000-500BC)	B	119.77	115.67	114.17	74	29
North America	Tennessee Mississippi (1300-1550AD)	B	120.59	114.02	107.20	74	29
North America	Tennessee Woodland (700-1150AD)	B	124.65	119.23	118.26	74	29
Oceania	Bougainville (Nasioi)	F	122.49	112.78	106.49	75	29
Oceania	Bougainville (Nasioi)	M	130.74	122.10	115.53	75	29
Oceania	New Britain	B	133.48	123.52	125.91	76	23
Oceania	New Britain (West Nakanai)	M	120.75	105.00	113.30	77	29
Oceania	New Guinea (Goroka)	M	139.95	130.98	125.18	78	29
Oceania	New Guinea (Lufa)	M	139.88	130.04	120.19	78	29

Region	Population	Sex	m1	m2	m3	Source	Comp.
South America	Lengua	F	125.53	110.58	104.54	79	29
South America	Lengua	M	132.26	119.65	115.85	79	29
South America	Peruvian (2500-1000BP)	B	122.04	114.48	104.04	80	29
South America	Peruvian (4000-2500BP)	B	115.56	111.28	112.35	80	29
South America	Peruvian (6500-4000BP)	B	117.66	111.24	99.96	80	29

Supplementary Table 3 | Fossil hominin specimen-level rectangular area (mesiodistal length × buccolingual width, mm^2) of lower deciduous premolars and molars. Side: L, left; R, right; U, unknown.

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Ardipithecus ramidus	ARA-VP-1/128	L			111.1	154.7		81
Ardipithecus ramidus	ARA-VP-1/128	R			115.36		139.7	81
Ardipithecus ramidus	ARA-VP-1/129	R	35.77					81
Ardipithecus ramidus	ARA-VP-1/200	L			113.3			81
Ardipithecus ramidus	GWM16/P10	R					149.345	82
Ardipithecus ramidus	GWM3/P1	R			102	147.32		82
Ardipithecus ramidus	GWM3W/P185	L			107.625			82
Ardipithecus ramidus	GWM5SW/P56	L			118.8	148.59		82
Ardipithecus ramidus	GWM5SW/P56	R			113.42	148.59	144.64	82
Ardipithecus ramidus	GWM9N/P50	L			102.82	140.12		82
Ardipithecus ramidus	GWM9N/P50	R			107			82
Ardipithecus ramidus	KNM-TH 13150	R			115.44	149.34		83
Australopithecus afarensis	AL 128-23	L			124.32	151.25		84
Australopithecus afarensis	AL 145-35	L			174.2	218.68		84
Australopithecus afarensis	AL 188-1	R					234.08	84
Australopithecus afarensis	AL 198-1	L				153.76	176.66	84
Australopithecus afarensis	AL 200-1b	R			162.5			84
Australopithecus afarensis	AL 207-13	L				165		84
Australopithecus afarensis	AL 241-14	L			197.1			84
Australopithecus afarensis	AL 266-1	L			149.94			84
Australopithecus afarensis	AL 266-1	R			152.32	182	207	84
Australopithecus afarensis	AL 277-1	L				218.95		84
Australopithecus afarensis	AL 288-1i	L					173.24	84
Australopithecus afarensis	AL 288-1i	R			136.4	161.04	172.02	84
Australopithecus afarensis	AL 333-30	R	68					84
Australopithecus afarensis	AL 333-43	L	75.05	109.98				84
Australopithecus afarensis	AL 333-43	R	72.38	112.52				84
Australopithecus afarensis	AL 333-74	L			182.25		195.96	84
Australopithecus afarensis	AL 333w-1	L			159.72	168.75		84
Australopithecus afarensis	AL 333w-1	R			158.6	180.7		84
Australopithecus afarensis	AL 333w-12	R			166.37			84
Australopithecus afarensis	AL 333w-27	L				217.14		84
Australopithecus afarensis	AL 333w-32,60	L			174.24	211.7	204.48	84
Australopithecus afarensis	AL 333w-32,60	R					200.22	84
Australopithecus afarensis	AL 333w-48	R				152.46		84
Australopithecus afarensis	AL 333w-57	L				173.03	180	84
Australopithecus afarensis	AL 333w-59	L				201.6	183.4	84
Australopithecus afarensis	AL 400-1a	L			161.2	221.92	202.5	84
Australopithecus afarensis	AL 400-1a	R			168.91	213.15	212.52	84
Australopithecus afarensis	AL 417-1d	L			143.84	170.3	198.17	85
Australopithecus afarensis	LH 2	L		131.44				86
Australopithecus afarensis	LH 2	R	69.16	133.56	194.6			86
Australopithecus afarensis	LH 3	R	80.64		180.88			86
Australopithecus afarensis	LH 4	L				201.28		86
Australopithecus afarensis	LH 4	R			167.58		225.78	86
Australopithecus afarensis	MAK-VP-1/12	L			159.82	186.2	205.02	87
Australopithecus afarensis	MAK-VP-1/12	R			157.3	188.86	203.68	87
Australopithecus afarensis	MAK-VP-1/2	R			168.64	195	202.8	87

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Australopithecus africanus	MLD 2	U		138.43	212.8			88,89
Australopithecus africanus	MLD 5	R		125.66				89
Australopithecus africanus	Sts 18	R		123.6	209.89			90
Australopithecus africanus	Sts 24	L	62.05					91
Australopithecus africanus	Sts 24	R	60.48	98.1	150.29			89
Australopithecus africanus	Sts 4	U				188.76		90
Australopithecus africanus	Sts 41	U					197.81	90
Australopithecus africanus	Sts 52b	L				196.84	173.99	90
Australopithecus africanus	Sts 52b	R			167.7	192.96	174.15	90
Australopithecus africanus	Sts 6	U				214.2		90
Australopithecus africanus	Sts 7	L				223.38	221.76	90
Australopithecus africanus	Sts 9	U			193.7			90
Australopithecus africanus	Stw 106	L	69.92	129.54				89
Australopithecus africanus	Stw 123	L		106.7				89
Australopithecus africanus	Taung	L		124.02	185.9			88,89
Australopithecus africanus	Taung	R	69.6	123.05	189			90
Australopithecus africanus	TM 1515	U				257.04		90
Australopithecus africanus	TM 1518	U					247.16	90
Australopithecus africanus	TM 1519	U					218.23	90
Australopithecus africanus	TM 1520	U					220.8	90
Australopithecus anamensis	ARI-VP-1/352	R					170.17	92
Australopithecus anamensis	ARI-VP-3/176	R				265.68		92
Australopithecus anamensis	ARI-VP-3/80	R				178.92		92
Australopithecus anamensis	KNM-ER 20422	L			126.44			93
Australopithecus anamensis	KNM-ER 20428	L					207.7	93
Australopithecus anamensis	KNM-KP 29286	L			146.37		188.76	94
Australopithecus anamensis	KNM-KP 29286	R			145.14	203	188.94	94
Australopithecus anamensis	KNM-KP 30500	L			179.55	238.58		94
Australopithecus anamensis	KNM-KP 30500	R			180.78	233.73	227.8	94
Australopithecus anamensis	KNM-KP 34725	L	63.92		167.14	224		95
Australopithecus anamensis	KNM-KP 29281	L			151.13	172.62	175.68	94
Australopithecus anamensis	KNM-KP 29281	R			151.2	175.14	170.17	94
Australopithecus anamensis	KNM-KP 31712	L		83.43	127.05			95
Australopithecus anamensis	KNM-KP 31717	L					169.88	95
Australopithecus anamensis	KNM-KP 31729	R		82.45				95
Australopithecus anamensis	MSD-VP-3/24	L					168.74	92
Australopithecus anamensis	MSD-VP-5/16	L			143.99	173.24		92
Australopithecus deyiremeda	BRT-VP-3/14	R			158.76	204.24	211.72	17
Australopithecus sediba	MH1	R			145	185.76	205.62	96
Australopithecus sediba	MH2	R			130.98	172.02	180.34	96
Australopithecus sediba	MH2	L					176.25	96
Homo erectus (Asia)	D 211	L			162.5	133.4	113.42	97
Homo erectus (Asia)	D 211	R			162.36	141.45	118.72	97
Homo erectus (Asia)	D 2600	L				180.7	187.5	98
Homo erectus (Asia)	D 2600	R				186.26	208.81	98
Homo erectus (Asia)	D 2735	L			147.84	138.6		98
Homo erectus (Asia)	D 2735	R			154.28	145.52		98
Homo erectus (Asia)	Hexian PA 831	U					120.91	99
Homo erectus (Asia)	Hexian PA 834	U			163.75	180.88		99
Homo erectus (Asia)	Hexian PA 838	U				189.04		99
Homo erectus (Asia)	Hexian PA 839	U				191.62		99
Homo erectus (Asia)	Lantian	R			144.9	163.8		99

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Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Homo erectus (Asia)	PCG2	L		107.67				[100]
Homo erectus (Asia)	Sangiran 9	R				179.07	175.26	[101] in [97]
Homo erectus (Asia)	Sangiran 1B	U			162.5	171.6	181.25	[102]
Homo erectus (Asia)	Sangiran FS67	R	66.24					[103]
Homo erectus (Asia)	Sangiran FS72	R		134				[103]
Homo erectus (Asia)	Zhoukoudian G1-6	L			165	158.75	147.6	[104] in [97]
Homo erectus (Asia)	Zhoukoudian G1-7	R				162.54	159.96	[104] in [97]
Homo erectus (Asia)	ZKD 100	L			165			[104]
Homo erectus (Asia)	ZKD 101	U			118.65			[104]
Homo erectus (Asia)	ZKD 102	L			163.8			[104]
Homo erectus (Asia)	ZKD 106	U				135.66		[104]
Homo erectus (Asia)	ZKD 110	U				158.75		[104]
Homo erectus (Asia)	ZKD 111	U				158.76		[104]
Homo erectus (Asia)	ZKD 114	U					100	[104]
Homo erectus (Asia)	ZKD 115	U					159.96	[104]
Homo erectus (Asia)	ZKD 116	U					147.6	[104]
Homo erectus (Asia)	ZKD 117	U					102	[104]
Homo erectus (Asia)	ZKD 123	U	50.82					[104]
Homo erectus (Asia)	ZKD 125, ZKD 128	R	68.6	98.28				[104]
Homo erectus (Asia)	ZKD 126	U		94.5				[104]
Homo erectus (Asia)	ZKD 127	R		123.22				[104]
Homo erectus (Asia)	ZKD 129	R		110.88				[104]
Homo erectus (Asia)	ZKD 131	U					137.16	[104]
Homo erectus (Asia)	ZKD 134	U					113.42	[104]
Homo erectus (Asia)	ZKD 136	U					117.72	[104]
Homo erectus (Asia)	ZKD 137	U			152.1			[104]
Homo erectus (Asia)	ZKD 138	U				129.95		[104]
Homo erectus (Asia)	ZKD 147	U			143.91			[104]
Homo erectus (Asia)	ZKD 34	U			132.98			[104]
Homo erectus (Asia)	ZKD 35	R			157.5			[104]
Homo erectus (Asia)	ZKD 36	L			180.48			[104]
Homo erectus (Asia)	ZKD 38	L			99.99			[104]
Homo erectus (Asia)	ZKD 43	U				142.08		[104]
Homo erectus (Asia)	ZKD 44	U				150.65		[104]
Homo erectus (Asia)	ZKD 45	U				145.2		[104]
Homo erectus (Asia)	ZKD 51	U					147.62	[104]
Homo erectus (Asia)	ZKD 52	U					139.08	[104]
Homo erectus (Asia)	ZKD 96	R			132.16			[104]
Homo erectus (Asia)	ZKD 97	R			132.09			[104]
Homo erectus (Asia)	ZKD 98	R			171.36			[104]
Homo erectus (Asia)	ZKD 99	R			163.48			[104]
Homo erectus (Africa)	KNM-ER 1507	L	53.04	102.83				[89]
Homo erectus (Africa)	KNM-ER 1808	R					163.2	[105]
Homo erectus (Africa)	KNM-ER 820	L	71.1	100.58	131.61			[106]
Homo erectus (Africa)	KNM-ER 820	R	70.07	103.4	131.76			[106]
Homo erectus (Africa)	KNM-ER 992	L			138.43	158.6	164.82	[101] in [97]
Homo erectus (Africa)	KNM-WT 15000	L			132.98	140.3		[107]
Homo erectus (Africa)	KNM-WT 15000	R			132.09	141.36		[107]
Homo erectus (Africa)	OH 22	R			153.4	147.32		[108]
Homo erectus (Africa)	OH 51	L			172.62			[108]
Homo erectus (Africa)	Ternifine I	R			165	171.6	152.5	[109] in [110]
Homo erectus (Africa)	Ternifine II	L			182	189	167.5	[109] in [110]

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Homo erectus (Africa)	Ternifine III	R			153.75	150.06	139.2	[109] in [110]
Homo erectus (Africa)	Thomas I	L			182	198	146.37	[111] in [110]
Homo erectus (Africa)	Rabat	U			143	141.25	127.2	[102]
Homo floresiensis	LB1	R			98.04	107	95	[112]
Homo floresiensis	LB6-1	U			82	84.39	70.31	[112]
Homo habilis	OH 13	L			150.8		180.56	[113]
Homo habilis	OH 13	R			149.64	168.19	179.58	[113]
Homo habilis	OH 16	R			187.96	246.13	228.8	[113]
Homo habilis	OH 27	R					201.96	[113]
Homo habilis	OH 37	L			141.24	199.5		[113]
Homo habilis	OH 4	R					201.5	[113]
Homo habilis	OH 7	L			180.56	210.6		[113]
Homo habilis	OH 7	R			183.52			[113]
Homo heidelbergensis	Arago 1	L		100.7				[89]
Homo heidelbergensis	Arago 1	R	82.82					[89]
Homo heidelbergensis	Arago 13	U			184.96	204.4	174.2	[97]
Homo heidelbergensis	Arago 2	U			119.9	129.71	101.85	[110]
Homo heidelbergensis	Arago 22	R	68.25					[89]
Homo heidelbergensis	Arago 5	L		100.44				[89]
Homo heidelbergensis	Arago 6	R	80					[114] in [115]
Homo heidelbergensis	Arago 8	R			179.4	230.74	165	[110]
Homo heidelbergensis	AT 1	L			125.4	117.42	96.6	[110]
Homo heidelbergensis	AT 1	R			131.08	123.12	107.91	[110]
Homo heidelbergensis	AT 100	L					109	[110]
Homo heidelbergensis	AT 101	R			111.24			[110]
Homo heidelbergensis	AT 11	L				107		[110]
Homo heidelbergensis	AT 13	L					143.51	[110]
Homo heidelbergensis	AT 2	R			124.02			[110]
Homo heidelbergensis	AT 21	L			136.8			[110]
Homo heidelbergensis	AT 22, AT 75	L			111.28	106.92	98.44	[110]
Homo heidelbergensis	AT 30	R					107.67	[110]
Homo heidelbergensis	Mauer	L					129.95	[102]
Homo heidelbergensis	Mauer	R			129.92	152.4	132.98	[102]
Homo neanderthalensis	Amud 1	L			117.72	113.4	127.44	[116]
Homo neanderthalensis	Amud 1	R			118.8	116.39	121.8	[116]
Homo neanderthalensis	Amud III	R		95.68				[116]
Homo neanderthalensis	Archi	L	66.6	95.68				[117] in [115]
Homo neanderthalensis	Archi	R	69.3	98.58				[117] in [115]
Homo neanderthalensis	Barakai	U		111.1				[118] in [119]
Homo neanderthalensis	Couvin	R		87				[119]
Homo neanderthalensis	Cova Negra	R		87.87				[120]
Homo neanderthalensis	Dederiyeh 1	L	66.3	102.6	120.75			[121]
Homo neanderthalensis	Dederiyeh 1	R	68.8					[121]
Homo neanderthalensis	Dederiyeh 2	L	64.38	94.94				[122]
Homo neanderthalensis	Engis 2	R	58.8	90.9				[123] in [115]
Homo neanderthalensis	Fate 12	L				126.44		[124]
Homo neanderthalensis	Fate 2	L			113			[124]
Homo neanderthalensis	Fate 3	R					139.7	[124]
Homo neanderthalensis	Fate 5	L		85.85				[124]
Homo neanderthalensis	Fate 6	R			138.75			[124]
Homo neanderthalensis	Gibralter 2	L	72.54	108.78				[125,126]
Homo neanderthalensis	Gibralter 2	R	76.56	105.06				[125,127]

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Homo neanderthalensis	Grotte du Bison I Q5.1	R		81.7				128
Homo neanderthalensis	Grotte du Bison I S6	R		87				128
Homo neanderthalensis	Grotte du Renne 16	R				81.84		129
Homo neanderthalensis	Grotte du Renne 18	R	72.96					129
Homo neanderthalensis	Grotte du Renne 21	R				146.16		129
Homo neanderthalensis	Grotte du Renne 25	R	63					129
Homo neanderthalensis	Grotte du Renne 29	R		89				129
Homo neanderthalensis	Grotte du Renne 30	R			71.44			129
Homo neanderthalensis	Grotte du Renne 33	R	60.59					129
Homo neanderthalensis	Grotte du Renne 35	R			133.2			129
Homo neanderthalensis	Grotte du Renne 5	R				141.52		129
Homo neanderthalensis	Grotte du Renne 6	R					122.04	129
Homo neanderthalensis	Hortus 15	L		83.72				130 in 115
Homo neanderthalensis	Hortus 2	L		83.72				130 in 125
Homo neanderthalensis	KMH 1	L	65.52	92.92	84.15			131
Homo neanderthalensis	KMH 1	R	67.5	91.35				131
Homo neanderthalensis	KMH 14	L				140		131
Homo neanderthalensis	KMH 2	L				117.72	118.77	131
Homo neanderthalensis	KMH 2	R				120.99	123.17	131
Homo neanderthalensis	KMH 32	U				127.6		131
Homo neanderthalensis	Krapina 1, Krapina 7, Krapina 79	R			174.795	172.36	122.5	132
Homo neanderthalensis	Krapina 10, Krapina 77, Krapina 108	R			154.24	154.945	140.065	132
Homo neanderthalensis	Krapina 104	R			112.32			132
Homo neanderthalensis	Krapina 105	R			170			132
Homo neanderthalensis	Krapina 107	L				170.8		132
Homo neanderthalensis	Krapina 2, Krapina 84	R			125.97	141.45		132
Homo neanderthalensis	Krapina 3, Krapina 5, Krapina 82	L			154.2	142.945	140.79	132
Homo neanderthalensis	Krapina 4	L					128.26	132
Homo neanderthalensis	Krapina 51	L	77.9					132
Homo neanderthalensis	Krapina 52, Krapina 62	L		85.2025	116.28			132
Homo neanderthalensis	Krapina 53	R		109.545	151.875	160.475		132
Homo neanderthalensis	Krapina 54, Krapina 83	L			123.585	112.7		132
Homo neanderthalensis	Krapina 55, Krapina 106	L			157.3	150.93	136.53	132
Homo neanderthalensis	Krapina 57	R			143.125	143.22	129.34	132
Homo neanderthalensis	Krapina 58	L			127.53	135.09	128.4	132
Homo neanderthalensis	Krapina 58	R			129.6	136.23	132.37	132
Homo neanderthalensis	Krapina 59	L			130.98	140.3		132
Homo neanderthalensis	Krapina 59	R					133.34	132
Homo neanderthalensis	Krapina 6	L				135.85		132
Homo neanderthalensis	Krapina 63	L		115.575				132
Homo neanderthalensis	Krapina 64	L	77.42	91.91	130.68			132
Homo neanderthalensis	Krapina 65	L		102.46				132
Homo neanderthalensis	Krapina 66	L		106.5				132
Homo neanderthalensis	Krapina 68	R		112.86				132
Homo neanderthalensis	Krapina 78	L					116.48	132

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Homo neanderthalensis	Krapina 8	R					155.68	[132]
Homo neanderthalensis	Krapina 80	R			146.05			[132]
Homo neanderthalensis	Krapina 85	L					126.42	[132]
Homo neanderthalensis	Krapina 86	L				145.41		[132]
Homo neanderthalensis	Krapina 9	L					125.19	[132]
Homo neanderthalensis	La Ferrassie 4 *bis*	L		76.8				[133] in [115]
Homo neanderthalensis	La Ferrassie 8	L	62.16	101.37				[133] in [115]
Homo neanderthalensis	La Ferrassie 8	R	62.25					[133] in [115]
Homo neanderthalensis	La Quina 761	R		99.75				[134] in [119]
Homo neanderthalensis	Molare	L		118.65				[115]
Homo neanderthalensis	Molare	R	79.2	110.74				[115]
Homo neanderthalensis	Pech de lAze	R	65.25	92.92				[125]
Homo neanderthalensis	Roc de Marsal infant	L	66	96.46				[135]
Homo neanderthalensis	Roc de Marsal infant	R	65.7	99.64				[135]
Homo neanderthalensis	Salemas	L		110				[136] in [135]
Homo neanderthalensis	Scladina 4A-13	R		89.3				[119]
Homo neanderthalensis	Shanidar 1	L			105	117.72	124.2	[137]
Homo neanderthalensis	Shanidar 1	R			109.2	121	126.44	[137]
Homo neanderthalensis	Shanidar 2	L			126.44	135.6	131.04	[137]
Homo neanderthalensis	Shanidar 2	R			124.32	129.92	120.96	[137]
Homo neanderthalensis	Shanidar 6	R				148.68	156.16	[137]
Homo neanderthalensis	Shanidar 7	L	67.64	91				[138]
Homo neanderthalensis	Shanidar 7	R	61.92					[138]
Homo neanderthalensis	Tabun series IV	L		105.28				[139:209] in [119]
Homo neanderthalensis	Teshik-Tash	L	78.3	96.9				[140] in [125]
Homo neanderthalensis	Teshik-Tash	R	76.5	105.6				[140] in [125]
Paranthropus boisei	KNM-ER 1477	L	97.9	168.51				[141]
Paranthropus boisei	KNM-ER 1477	R	101.2	161.46				[141]
Paranthropus boisei	KNM-ER 3230	L			262.4	372.13	332.1	[105]
Paranthropus boisei	KNM-ER 3230	R			246.33	377.88	358.28	[105]
Paranthropus boisei	KNM-ER 729	R			248	351	418	[142]
Paranthropus boisei	OH 26	R					290.5	[113]
Paranthropus boisei	OH 30	L			252			[113]
Paranthropus boisei	OH 38	R				316.8		[113]
Paranthropus robustus	DNH 10	R					230.79	[143]
Paranthropus robustus	DNH 18	R					270.04	[143]
Paranthropus robustus	DNH 19	L				252.32		[143]
Paranthropus robustus	DNH 2	L		117.16				[143]
Paranthropus robustus	DNH 21	L				212.67	195.91	[143]
Paranthropus robustus	DNH 44	R	94.16					[143]
Paranthropus robustus	DNH 46	R			198.45			[143]
Paranthropus robustus	DNH 51	R				233.52	236.3	[143]
Paranthropus robustus	DNH 56	L		113.85				[143]
Paranthropus robustus	DNH 56	R		116				[143]
Paranthropus robustus	DNH 60	R	72.38	123.22	161.84	188.5		[143]
Paranthropus robustus	DNH 67	R			178.12			[143]
Paranthropus robustus	DNH 7	L			168.84	180.9	206.72	[144]
Paranthropus robustus	DNH 7	R				191.7	206.36	[144]
Paranthropus robustus	DNH 75	R					231.82	[143]
Paranthropus robustus	DNH 8	L			227.65	238.5	309.42	[144]

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Paranthropus robustus	DNH 8	R			223.44	229.4	291.4	144
Paranthropus robustus	KB 5223	L	74.26	128.75	179.8			88
Paranthropus robustus	KB 5223	R		128.75	178.75			88
Paranthropus robustus	SK 1	U				260.1		90
Paranthropus robustus	SK 104	U			205.5			90
Paranthropus robustus	SK 12	U					246.24	90
Paranthropus robustus	SK 1586	L				207		145
Paranthropus robustus	SK 1586	R				223.5	250.5	145
Paranthropus robustus	SK 1587	L			189.63			145
Paranthropus robustus	SK 1587	R				196.08		145
Paranthropus robustus	SK 1588	L			172.2			145
Paranthropus robustus	SK 1648	R					227.65	145
Paranthropus robustus	SK 23	L			217.56	224.96	208	90
Paranthropus robustus	SK 23	R			214.62	222	249.12	90
Paranthropus robustus	SK 25	L			205.72			90
Paranthropus robustus	SK 25	R			203	250.5		90
Paranthropus robustus	SK 34	U			208.8	270.54	297	90
Paranthropus robustus	SK 37	U				246.5		90
Paranthropus robustus	SK 3974	R			199.66			145
Paranthropus robustus	SK 3976	L			276.8			145
Paranthropus robustus	SK 3978	L	79.56	136.5				145
Paranthropus robustus	SK 3978	R	81.18	138.03				145
Paranthropus robustus	SK 438	L		141.7				89
Paranthropus robustus	SK 5	U				213		90
Paranthropus robustus	SK 55b	L		138.99	195.91			90
Paranthropus robustus	SK 55b	R			197.28	224.51	212.35	90
Paranthropus robustus	SK 6	L			243.2	275.31	292.3	90
Paranthropus robustus	SK 6	R			235.06	281.88	289.6	90
Paranthropus robustus	SK 61	L	100.7	158.27				90
Paranthropus robustus	SK 61	R	105.45	160.8	224.84			90
Paranthropus robustus	SK 62	L	85.05	143.88				90
Paranthropus robustus	SK 62	R		160.8				90
Paranthropus robustus	SK 63	L	72.54	127.2	199.8			90
Paranthropus robustus	SK 63	R	84.6	127.2	201.15			90
Paranthropus robustus	SK 64	R	92.22	134.62				90
Paranthropus robustus	SK 81	U					251.37	90
Paranthropus robustus	SK 828	U			223.08			90
Paranthropus robustus	SK 838	U			182			90
Paranthropus robustus	SK 839, SK 852	R	81					89
Paranthropus robustus	SK 840	U					206.4	90
Paranthropus robustus	SK 841	U		116.4			210.98	90
Paranthropus robustus	SK 842	U		125.24				90
Paranthropus robustus	SK 843	U			197.1	219.62		90
Paranthropus robustus	SK 844	U					215.28	90
Paranthropus robustus	SK 845	R			217.5	233.6		90
Paranthropus robustus	SK 846	U			200.1			90
Paranthropus robustus	SKW 4767	U			233.28			146
Paranthropus robustus	SKW 5	L				231.84		147
Paranthropus robustus	SKW 5	R			179.52	233.28	233.8	147
Paranthropus robustus	SKX 4446	U			221.65	270.18		148
Paranthropus robustus	SKX 4446	U			221.65	270.18		146
Paranthropus robustus	SKX 5002	L					247.42	149

Species	Specimens	Side	dp3	dp4	m1	m2	m3	Source
Paranthropus robustus	SKX 5013	U			163.2			148
Paranthropus robustus	SKX 5013	U			163.2			146
Paranthropus robustus	SKX 5014	U					258	148
Paranthropus robustus	SKX 5023	U			180.48			148
Paranthropus robustus	SKX 5023	U			180.48			146
Paranthropus robustus	TM 1536	L	79.38					89
Paranthropus robustus	TM 1536	R	76.8	116.62	149.86			88,89
Paranthropus robustus	TM 1601	R	85					89

Supplementary Table 4 | Hominin mean rectangular area (mesiodistal length × buccolingual width, mm^2) of lower deciduous premolars and molars, and number of individuals sampled at each tooth position for fossil hominin species in parentheses.

Species	dp3	dp4	m1	m2	m3
Homo sapiens	55.96	90.11	122.46	114.45	109.95
Ardipithecus ramidus	35.77 (1)	(0)	110.37 (7)	148.01 (5)	144.56 (3)
Australopithecus afarensis	72.88 (4)	121.88 (2)	165.11 (17)	186.28 (18)	199.28 (13)
Australopithecus africanus	66.93 (3)	120.80 (7)	186.97 (6)	215.66 (5)	213.31 (6)
Australopithecus anamensis	(0)	(0)	148.82 (7)	207.84 (7)	186.58 (7)
Australopithecus deyiremeda	(0)	(0)	158.76 (1)	204.24 (1)	211.72 (1)
Australopithecus sediba	(0)	(0)	137.99 (2)	178.89 (2)	191.96 (2)
Homo erectus (Asia)	61.89 (3)	111.43 (6)	150.69 (19)	160.07 (18)	141.49 (16)
Homo erectus (Africa)	61.81 (2)	102.41 (2)	155.44 (10)	162.08 (8)	151.54 (7)
Homo floresiensis	(0)	(0)	90.02 (2)	95.70 (2)	82.66 (2)
Homo habilis	(0)	(0)	165.37 (4)	206.11 (4)	203.08 (4)
Homo heidelbergensis	77.02 (3)	100.57 (2)	136.20 (9)	150.21 (7)	125.93 (9)
Homo neanderthalensis	68.61 (17)	96.52 (34)	130.50 (24)	137.74 (24)	131.57 (19)
Paranthropus boisei	99.55 (1)	164.99 (1)	251.46 (3)	347.60 (3)	351.23 (3)
Paranthropus robustus	84.02 (11)	131.00 (14)	199.79 (29)	232.09 (20)	240.40 (21)

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Supplementary Table 5 | Mean, maximum and standard deviation of prediction error rates (%) for *Homo* and australopith fossil individuals. The observed size of the tooth in the 'Predicted using' column was used to predict the sizes of each other tooth in the fossil. The average prediction errors for all tooth positions and specimens were 10.3% and 7.9% for *Homo* and australopith specimens respectively. * indicates values that include *Homo neanderthalensis* KMH 1 where m1 is incompletely developed and so does not fit predictions.

Mean Prediction Error

Taxon	Predicted using	Predicted tooth				
		dp3	**dp4**	**m1**	**m2**	**m3**
Homo						
	dp3		12.0	30.1*		
	dp4	8.6		12.7*	1.8	
	m1	17.1*	9.4*		10.2	15.5
	m2		1.2	7.0		8.7
	m3			10.1	8.5	
Australopiths						
	dp3		7.8	10.0	20.0	
	dp4	7.1		6.6	14.5	9.6
	m1	9.2	7.0		8.1	7.9
	m2	16.3	12.3	7.5		7.4
	m3		7.9	7.5	7.8	

Maximum Prediction Error

Taxon	Predicted using	Predicted tooth				
		dp3	**dp4**	**m1**	**m2**	**m3**
Homo						
	dp3		36.7	62.2*		
	dp4	26.7		46.0*	1.8	
	m1	32.8*	30.1*		34.8	54.5
	m2		1.2	21.1		29.2
	m3			26.9	22.5	
Australopiths						
	dp3		19.1	29.1	20	
	dp4	16.1		16.1	17.4	19.2
	m1	22.6	19.2		22.8	23.5
	m2	16.3	14.5	18.0		21.4
	m3		15.7	29.2	27.2	

SD of the Prediction Error

Taxon	Predicted using	Predicted tooth				
		dp3	**dp4**	**m1**	**m2**	**m3**
Homo						
	dp3		10.9	22.8*		
	dp4	7.4		16.9*		
	m1	11.1*	10.7*		7.2	12.2
	m2			4.7		7.6
	m3			6.4	6.7	
Australopiths						
	dp3		6.0	8.5		
	dp4	5.1		4.7	4.1	13.5
	m1	6.7	5.3		5.9	7.0
	m2		3.1	4.9		5.0
	m3		11.0	6.7	5.8	

Supplementary Table 6 | Great ape mean rectangular area (mesiodistal length × buccolingual width, mm^2) of lower deciduous premolars and molars. Number of individuals is in parentheses. Sex: F, female; M, male.

Species	Sex	dp3	dp4	m1	m2	m3	Source
Gorilla gorilla	F	80.24 (20)	128.55 (16)	198.74 (35)	245.75 (28)	226.61 (17)	150
Gorilla gorilla	M	89.53 (16)	144.83 (13)	222.63 (30)	280.18 (23)	260.68 (17)	150
Pan paniscus	F	36.00 (2)	55.08 (2)	86.24 (40)	92.82 (25)	78.26 (13)	30
Pan paniscus	M	36.00 (3)	55.89 (4)	87.22 (33)	90.16 (17)	75.60 (12)	30
Pan troglodytes	F	41.09 (17)	63.8 (16)	103.79 (48)	113.35 (36)	103.44 (32)	150
Pan troglodytes	M	40.53 (19)	66.1 (18)	106.37 (30)	113.76 (17)	102.43 (10)	150
Pongo pygmaeus	F	56.32 (5)	94.28 (5)	150.56 (5)	166.06 (3)	159.29 (3)	151
Pongo pygmaeus	M	67.6 (9)	104.49 (9)	161.17 (12)	179.54 (6)	183.37 (3)	151

Supplementary Table 7 | 2D and 3D measures of tooth size for six fossil hominin specimens. Rectangular area (mesiodistal length × maximum buccolingual width, MDBLArea), 3D area of the enamel-dentine junction (EDJ3DArea), cross-sectional area of the tooth at the cervix (CervixArea) and outline area of the outer enamel surface (OES2DArea) for each tooth position.

Species	Specimen	Tooth	Cervix Area	EDJ3D Area	MDBL Area	OES2D Area
Australopithecus anamensis	KNM-KP 29286	m1	115.3	226.7	148.9	129.3
Australopithecus anamensis	KNM-KP 29286	m2	160.6	279.6	198.8	168.7
Australopithecus anamensis	KNM-KP 29286	m3	148.5	255.9	193.7	159.3
Homo erectus	Sangiran 1B	m1	114.5	265.4	169.0	141.6
Homo erectus	Sangiran 1B	m2	128.3	277.7	180.8	153.9
Homo erectus	Sangiran 1B	m3	120.7	253.7	180.0	147.2
Homo neanderthalensis	Scladina 4A I	m1	73.9	216.1	124.0	102.4
Homo neanderthalensis	Scladina 4A I	m2	84.0	211.1	128.3	106.3
Homo neanderthalensis	Scladina 4A I	m3	80.5	189.2	126.5	102.3
Paranthropus boisei	KNM-ER 15930	m1	125.6	281.8	181.9	154.0
Paranthropus boisei	KNM-ER 15930	m2	164.6	320.2	244.2	201.8
Paranthropus boisei	KNM-ER 15930	m3	176.7	342.3	277.5	220.0
Paranthropus robustus	DNH 8	m1	125.8	316.0	215.9	185.5
Paranthropus robustus	DNH 8	m2	150.9	317.4	242.8	203.0
Paranthropus robustus	DNH 8	m3	163.1	370.0	304.3	243.7
Paranthropus robustus	SK 6	m1	162.0	352.7	246.2	207.3
Paranthropus robustus	SK 6	m2	190.7	373.6	286.9	234.2
Paranthropus robustus	SK 6	m3	200.4	374.5	301.3	245.3

Supplementary Table 8 | Results for multiple linear regression of proportion of maximum in tooth row (PropRowMaxP) vs tooth position (ToothNoP) and area of m1 (AreaM1) for *Homo* species.

Plane A

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.4405763  0.0940624   4.684 0.000352 ***
ToothNoP     0.2377533  0.0134270  17.707 5.56e-11 ***
AreaM1      -0.0016578  0.0006297  -2.633 0.019684 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.04591 on 14 degrees of freedom
  (14 observations deleted due to missingness)
Multiple R-squared:  0.9593,     Adjusted R-squared:  0.9535
F-statistic:   165 on 2 and 14 DF,  p-value: 1.848e-10
```

Plane B

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.2257523  0.1115384  10.990 2.86e-07 ***
ToothNoP    -0.0821669  0.0207012  -3.969   0.0022 **
AreaM1       0.0006890  0.0004452   1.548   0.1500
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03873 on 11 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared:  0.6226,     Adjusted R-squared:  0.554
F-statistic: 9.075 on 2 and 11 DF,  p-value: 0.004701
```

Supplementary Table 9 | Results for multiple linear regression of proportion of maximum in tooth row (PropRowMaxP) vs tooth position (ToothNoP) and area of m1 (AreaM1) for australopithecines.

Plane A

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 8.096e-02  7.664e-02   1.056    0.309
ToothNoP    2.304e-01  1.652e-02  13.950 1.32e-09 ***
AreaM1      2.379e-06  3.358e-04   0.007    0.994
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0576 on 14 degrees of freedom
  (17 observations deleted due to missingness)
Multiple R-squared:  0.9345,     Adjusted R-squared:  0.9251
F-statistic:  99.8 on 2 and 14 DF,  p-value: 5.197e-09
```

Plane B

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.9062316  0.0813763  11.136 5.09e-08 ***
ToothNoP    0.0096313  0.0162932   0.591    0.565
AreaM1      0.0001680  0.0002022   0.831    0.421
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03259 on 13 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared:  0.07408,    Adjusted R-squared:  -0.06837
F-statistic: 0.5201 on 2 and 13 DF,  p-value: 0.6064
```

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Supplementary Table 10 | Results for multiple linear regression of proportion of maximum in tooth row (PropRowMaxP) vs tooth position (ToothNoP) and area of m1 (AreaM1) for great apes.

Plane A

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.1729463  0.0432668   3.997  0.00312 **
ToothNoP     0.2677833  0.0135136  19.816 9.85e-09 ***
AreaM1      -0.0007271  0.0002288  -3.178  0.01121 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03822 on 9 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared:  0.9781,     Adjusted R-squared:  0.9733
F-statistic: 201.4 on 2 and 9 DF,  p-value: 3.374e-08
```

Plane B

```
Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.2875205  0.1459685   8.821 0.000311 ***
ToothNoP    -0.0836563  0.0307087  -2.724 0.041567 *
AreaM1       0.0003374  0.0003184   1.060 0.337646
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.04343 on 5 degrees of freedom
  (10 observations deleted due to missingness)
Multiple R-squared:  0.6309,     Adjusted R-squared:  0.4832
F-statistic: 4.272 on 2 and 5 DF,  p-value: 0.08279
```

Supplementary References

32 Faraway, J. *Linear Models with R*. (Chapman & Hall/CRC, 2005).
33 Schrago, C. G. & Voloch, C. M. The precision of the hominid timescale estimated by relaxed clock methods. *Journal of Evolutionary Biology* **26**, 746-755 (2013).
34 Stone, A. C. *et al.* More reliable estimates of divergence times in *Pan* using complete mtDNA sequences and accounting for population structure. *Philosophical Transactions of the Royal Society B* **365**, 3277-3288 (2010).
35 Axelsson, G. & Kirveskari, P. Crown size of permanent teeth in Icelanders. *Acta Odontol. Scand.* **41**, 181-186 (1983).
36 Axelsson, G. & Kirveskari, P. Crown size of deciduous teeth in Icelanders. *Acta Odontol. Scand.* **42**, 339-343 (1984).
37 Dahlberg, A. A. The dentition of the first agriculturists (Jarmo, Iraq). *Am. J. Phys. Anthropol.* **18**, 243-256 (1960).
38 Kaul, V. & Prakash, S. Crown dimensions of deciduous and permanent teeth of Jats from Haryana (India). *Ann. Hum. Biol.* **11**, 351-354 (1984).
39 Margetts, B. & Brown, T. Crown diameters of deciduous teeth in Australian Aboriginals. *Am. J. Phys. Anthropol.* **48**, 493-502 (1978).
40 Townsend, G. C. & Brown, T. Tooth size characteristics of Australian Aborigines. *Occasional Papers in Human Biology* **1**, 17-38 (1979).
41 Moyers, R. E., van der Linden, F. P. G. M., Riolo, M. L. & McNamara, J. A., Jr. *Standards of Human Occlusal Development*. 371 (Center for Human Growth and Development, University of Michigan, 1976).
42 Paul, K. S. This study.
43 Sciulli, P. W. Evolution of dentition in prehistoric Ohio Valley Native Americans III. Metrics of deciduous dentition. *Am. J. Phys. Anthropol.* **116**, 140-153 (2001).
44 Sciulli, P. W. Size and morphology of the permanent dentition in prehistoric Ohio Valley Amerindians. *Am. J. Phys. Anthropol.* **50**, 615-628 (1979).
45 Townsend, G. C. Tooth size in children and young adults with trisomy 21 (Down) syndrome. *Arch. Oral Biol.* **28**, 159-166 (1983).
46 Moss, M. L., Chase, P. S. & Howes, R. I. Comparative odontometry of permanent post-canine dentition of American whites and negroes. *Am. J. Phys. Anthropol.* **27**, 125-142 (1967).
47 Jacobson, A. *The Dentition of the South African Negro*. (Higginsbotham, 1982).
48 Barnes, D. S. Tooth morphology and other aspects of the Teso dentition. *Am. J. Phys. Anthropol.* **30**, 183-194 (1969).
49 Calcagno, J. M. Dental reduction in Post-Pleistocene Nubia. *Am. J. Phys. Anthropol.* **70**, 349-363 (1986).
50 van Reenen, J. F. Dental features of a low-caries primitive population. *J. Dent. Res.* **45**, 703-713 (1966).
51 Drennan, M. R. The dentition of a Bushman tribe. *Annls S. Afr. Mus.* **24**, 61-87 (1929).
52 van Reenen, J. F. in *Teeth: Form, Function and Evolution* (ed B. Kurtén) 182-203 (Columbia University Press, 1982).
53 Greene, D. L., Ewing, G. H. & Armelago, G. J. Dentition of a Mesolithic population from Wadi Halfa, Sudan. *Am. J. Phys. Anthropol.* **27**, 41-56 (1967).
54 Hosaka, T. Statistische Untersuchungen über die Zähne bei Chinesen mit besonderer Berücksichtigung der Rassenunterschiede. *Journal of Oriental Medicine* **24**, 1065–1090, 1230–1251; 10**25**: 1348–1368 (1936).
55 Brace, C. L. Tooth reduction in the Orient. *Asian Perspect.* **19**, 203-219 (1976).
56 Dutta, P. C. An odontometric analysis of molar crown characters of Bronze Age Harappans. *Anthropologischer Anzeiger* **41**, 67-72 (1983).
57 Lukacs, J. R. Tooth size variation in prehistoric India. *Am. Anthropol.* **87**, 811-825 (1985).
58 Walimbe, S. R. in *Dental Anthropology: Applications and Methods* (ed V.R. Reddy) 332-332 (Inter-India Publications, 1985).

59 Sharma, J. C. & Kaul, V. Dental morphology and odontometry in Panjabis. *Journal of the Indian Anthropological Society* **12**, 213-226 (1977).
60 Jacob, T. Racial identification of Bronze Age human dentitions from Bali, Indonesia. *J. Dent. Res.* **46**, 903-910 (1967).
61 Brace, C. L. & Nagai, M. Japanese tooth size: past and present. *Am. J. Phys. Anthropol.* **59**, 399-411 (1982).
62 Yamada, E. The anthropological study of the Japanese teeth. *J. Nippon Dent. Ass.* **25**, 15-46, 101-132, 177-208, 255-286, 329-344, 450-481, 528-560, 609-656, 710-714, 774-812 (1932).
63 Mijsberg, W. A. On sexual differences in the teeth of Japanese. *Koninklijke Akademie voor Wetenschap* **34**, 1111 (1931).
64 Sharma, J. C. Dental morphology and odontometry of the Tibetan immigrants. *Am. J. Phys. Anthropol.* **61**, 495-505 (1983).
65 Smith, P., Brown, T. & Wood, W. B. Tooth size and morphology in a recent Australian Aboriginal Population from Broadbeach, South East Queensland. *Am. J. Phys. Anthropol.* **55**, 423-432 (1981).
66 Freedman, L. & Lofgren, M. Odontometrics of Western Australian Aborigines. *Archaeol. Ocean.* **16**, 87-93 (1981).
67 Barrett, M. J., Brown, T. & MacDonald, M. R. Dental observations on Australian Aborigines: MD crown diameters of permanent teeth. *Aust. Dent. J.* **8**, 150-156 (1963).
68 Barrett, M. J., Brown, T., Arato, G. & Ozols, I. V. Dental observations on Australian Aborigines: BL diameters of deciduous and permanent teeth. *Aust. Dent. J.* **9**, 280-285 (1964).
69 Kirveskari, P., Hansson, H., Hedegard, B. & Karlsson, U. Crown size and hypodontia in permanent dentition of modern Skolt Lapps. *Am. J. Phys. Anthropol.* **48**, 107-112 (1978).
70 Mayhall, J. T. The dental morphology of the Inuit of the Canadian Central Arctic. *Ossa* **6**, 199-218 (1979).
71 Moorrees, C. F. A. *The Aleut Dentition*. (Harvard University Press, 1957).
72 Perzigian, A. J. The dentition of Indian Knoll skeletal population: odontometrics and cusp number. *Am. J. Phys. Anthropol.* **44**, 113-121 (1976).
73 Nelson, C. T. The teeth of the Indians of Pecos Pueblo. *Am. J. Phys. Anthropol.* **23**, 261-293 (1938).
74 Hinton, R. J., Smith, M. O. & Smith, F. H. Tooth size changes in prehistoric Tennessee Indians. *Hum. Biol.* **52**, 229-245 (1980).
75 Bailit, H. L., Dewitt, S. J. & Leigh, R. A. The size and morphology of Nasioi dentition. *Am. J. Phys. Anthropol.* **28**, 271-288 (1968).
76 Stein, M. R. & Epstein, J. L. The molar teeth of New Britain Melanesians. *J. Am. Dent. Assoc.* **21**, 1409-1413 (1934).
77 Turner, C. G. & Swindler, D. R. The dentition of New Britain West Nakanai Melanesians VIII Peopling of the Pacific. *Am. J. Phys. Anthropol.* **49**, 361-371 (1978).
78 Doran, G. A. & Freedman, L. Metrical features of dentition and arches of populations from Goroka and Lufa, Papua New Guinea. *Hum. Biol.* **46**, 583-594 (1974).
79 Kieser, J. A., Groeneveld, H. T. & Preston, C. B. An odontometric analysis of the Lengua Indian dentition. *Hum. Biol.* **57**, 611-620 (1985).
80 Scott, E. C. Increase of tooth size in prehistoric coastal Peru, 10,000 BP-1,000 BP. *Am. J. Phys. Anthropol.* **50**, 251-258 (1979).
81 White, T. D., Suwal, G. & Asfawi, B. *Australopithecus ramidus*, a new species of early hominid from Aramis, Ethiopia. *Nature* **371**, 306-312 (1994).
82 Semaw, S. *et al.* Early Pliocene hominids from Gona, Ethiopia. *Nature* **433**, 301-305 (2005).
83 Hill, A. Early hominid from Baringo, Kenya. *Nature* **315**, 222-224 (1985).
84 Johanson, D. C., White, T. D. & Coppens, Y. Dental remains from the Hadar Formation, Ethiopia: 1974–1977 collections. *Am. J. Phys. Anthropol.* **57**, 545-603 (1982).
85 Kimbel, W. H., Johanson, D. C. & Rak, Y. The first skull and other new discoveries of *Australopithecus afarensis* at Hadar, Ethiopia. *Nature* **368**, 449-451 (1994).

86 White, T. D. New fossil hominids from Laetolil, Tanzania. *Am. J. Phys. Anthropol.* **46**, 197–229 (1977).
87 White, T. D., Suwa, G., Simpson, S. & Asfaw, B. Jaws and teeth of *Australopithecus afarensis* from Maka, Middle Awash, Ethiopia. *Am. J. Phys. Anthropol.* **111**, 45-68 (2000).
88 Grine, F. E. A new juvenile hominid (Mammalia: Primates) from Member 3, Kromdraai Formation, Transvaal, South Africa. *Transvaal Museum Memoirs* **33** 165-239 (1982).
89 Grine, F. E. *The deciduous dentition of the Kalahari San, the South African negro and the South African Plio-Pleistocene hominids*, University of the Witwatersrand, (1984).
90 Robinson, J. T. *The dentition of the Australopithecinae*. (Transvaal Museum, 1956).
91 Grine, F. E. A new composite juvenile specimen of *Australopithecus africanus* (Mammalia, Primates) from Member 4 Sterkfontein Formation, Transvaal. *Annls S. Afr. Mus.* **84**, 169-201 (1981).
92 Haile-Selassie, Y., Saylor, B. Z., Deino, A., Alene, M. & Latimer, B. M. New hominid fossils from Woranso-Mille (Central Afar, Ethiopia) and taxonomy of early *Australopithecus*. *Am. J. Phys. Anthropol.* **141**, 406-417 (2010).
93 Coffing, K., Feibel, C., Leakey, M. & Walker, A. Four-million-year-old hominids from East Lake Turkana, Kenya. *Am. J. Phys. Anthropol.* **93**, 55-65 (1994).
94 Ward, C., Leakey, M. & Walker, A. Morphology of *Australopithecus anamensis* from Kanapoi and Allia Bay, Kenya. *J. Hum. Evol.* **41**, 255-368 (2001).
95 Leakey, M. G., Feibel, C. S., McDougall, I., Ward, C. & Walker, A. New specimens and confirmation of an early age for *Australopithecus anamensis*. *Nature* **393**, 62-66 (1998).
96 Berger, L. R. *et al. Australopithecus sediba*: A new species of Homo-like australopith from South Africa. *Science* **328**, 195-204 (2010).
97 Gabunia, L. & Vekua, A. A Plio-Pleistocene hominid from Dmanisi, East Georgia, Caucasus. *Nature* **373**, 509-512 (1995).
98 Macaluso, P. J. J. Variation in dental remains from Dmanisi, Georgia. *Anthropol. Sci.* **118**, 31-40 (2010).
99 Wu, X. & Poirier, F. E. *Human evolution in China: a metric description of the fossils and a review of the sites*. (Oxford University Press New York, 1995).
100 Zanolli, C. *et al.* Brief communication: two human fossil deciduous molars from the Sangiran Dome (Java, Indonesia): outer and inner morphology. *Am. J. Phys. Anthropol.* **147**, 472-481 (2012).
101 Roebroeks, W. Updating the earliest occupation of Europe. *Curr. Anthropol.* **35**, 301-305 (1994).
102 Howell, F. C. European and northwest African middle Pleistocene hominids. *Curr. Anthropol.* **1**, 195-232 (1960).
103 Grine, F. E. Comparison of the deciduous dentitions of African and Asian hominids. *Cour. Foursch. Inst. Senckenberg* **69**, 69-82 (1984).
104 Weidenreich, F. The dentition of *Sinanthropus pekinensis*: a comparative odontography of the hominids. *Palaeontogia Sinica, New Series D* **1 (Whole Series 101)**, 1-180 (1937).
105 Leakey, R. & Walker, A. Further hominids from the Plio-Pleistocene of Koobi Fora, Kenya. *Am. J. Phys. Anthropol.* **67**, 135-163 (1985).
106 Leakey, R. & Wood, B. New evidence of the genus *Homo* from East Rudolf, Kenya. II. *Am. J. Phys. Anthropol.* **39**, 355-368 (1973).
107 Brown, F., Harris, J., Leakey, R. & Walker, A. Early *Homo erectus* skeleton from west Lake Turkana, Kenya. *Nature* **316**, 788-792 (1985).
108 Rightmire, G. Middle Pleistocene hominids from Olduvai Gorge, northern Tanzania. *Am. J. Phys. Anthropol.* **53**, 225-241 (1980).
109 Arambourg, C. Le gisement de Ternifine II. L'Atlanthropus mauritanicus. *Archives de L'Institute de Paleontologie Humaine* **32**, 37-190 (1963).
110 Bermúdez de Castro, J. M. Dental remains from Atapuerca (Spain) I. metrics. *J. Hum. Evol.* **15**, 265-287 (1986).

111 Sausse, F. La mandibule de la carrière Thomas I (Casablanca). *Anthropologie* **79**, 81-112 (1975).
112 Morwood, M. J. *et al.* Further evidence for small-bodied hominins from the Late Pleistocene of Flores, Indonesia. *Nature* **437**, 1012-1017 (2005).
113 Tobias, P. V. *The Skulls, Endocasts, and Teeth of Homo Habilis: pt. 1-4*. Vol. 4(Cambridge University Press, 1991).
114 de Lumley, M. A. in *La Grotte de l'Hortus (Valflaunes-Herault) Etudes Quaternaires, Mémoire no. 1* 375-385 (Laboratoire de paléontologie humaine et de préhistoire, Université de Provence, 1972).
115 Mallegni, F. & Ronchitelli, A. Deciduous teeth of the Neandertal mandible from Molare Shelter, near Scario (Salerno, Italy). *Am. J. Phys. Anthropol.* **79**, 475-482 (1989).
116 Sakura, H. in *The Amud Man and His Cave Site* (eds H. Suzuki & F. Takai) 207-229 (University of Tokyo, 1970).
117 Ascenzi, A. & Sergre, A. A new Neandertal child mandible from an Upper Pleistocene site in southern Italy. *Nature* **233**, 280-283 (1971).
118 Faerman, M., Zilberman, U., Smith, P., Kharitonov, V. & Batsevitz, V. A Neanderthal infant from the Barakai Cave, Western Caucasus. *J. Hum. Evol.* **27**, 405–415 (1994).
119 Toussaint, M. *et al.* The Neandertal lower right deciduous second molar from Trou de l'Abîme at Couvin, Belgium. *J. Hum. Evol.* **58**, 56-67 (2010).
120 Arsuaga, J. *et al.* The human remains from Cova Negra (Valencia, Spain) and their place in European Pleistocene human evolution. *J. Hum. Evol.* **18**, 55-92 (1989).
121 Mizoguchi, Y. in *Neanderthal Burials. Excavations of the Dederiyeh Cave, Afrin, Syria.* (eds T Akazawa & S Muhesen) 221-262 (International Research Center for Japaneses Studies, 2002).
122 Kondo, O. & Ishida, H. in *Neanderthal Burials. Excavations of the Dederiyeh Cave, Afrin, Syria.* (eds T Akazawa & S Muhesen) 323-335 (International Research Center for Japaneses Studies, 2002).
123 Tillier, A.-M. Le crâne d'enfant d'Engis 2: un exemple de distribution des caractères juvéniles primitifs et néanderthaliens. *Bull. Soc. Roy. Belge Anthrop. Prehist.* **94**, 51-76 (1983).
124 de Lumley, M.-A. & Giacobini, G. Les néandertaliens de la Caverna delle Fate (Finale Ligure, Italie). II–Les dents. *L'Anthropologie* **117**, 305-344 (2013).
125 Tillier, A.-M. & Genet-Varcin, E. La plus ancienne mandibule d'enfant découverte en France dans le gisement de La Chaise de Vouthon (Abri Suard) en Charente. *Zeitschrift für Morphologie und Anthropologie*, 196-214 (1980).
126 Tillier, A.-M. La dentition de l'enfant moustérien Chateauneuf 2 découvert à l'abri de Hauteroche (Charente). *L'Anthropologie* **83**, 417-438 (1979).
127 Tillier, A.-M. Les enfants néanderthaliens de Devil's Tower (Gibraltar). *Zeitschrift für Morphologie und Anthropologie*, 125-148 (1982).
128 Tillier, A.-M., Hardy, M., David, F., Girard, M. & d'Iatchenko, V. À propos de deux molaires déciduales inférieures provenant des niveaux moustériens de la Grotte du Bison (Arcy-sur-Cure, Yonne, France). Un exemple de lésion cervicale inédite chez un enfant néanderthalien. *PALEO. Revue d'archéologie préhistorique* **24**, 271-278 (2013).
129 Bailey, S. E. & Hublin, J.-J. Dental remains from the Grotte du Renne at Arcy-sur-Cure (Yonne). *J. Hum. Evol.* **50**, 485-508 (2006).
130 de Lumley, M. A. *Anténéandertaliens et Néandertaliens du Bassin méditerranéen occidental européen*. (Laboratoire de paléontologie humaine et de préhistoire, Université de Provence, 1973).
131 Tillier, A.-M., Vandermeersch, B., Arensburg, B. & Chech, M. New human remains from Kebara Cave (Mount Carmel). The place of the Kebara hominids in the Levantine Mousterian fossil record. *Paléorient* **29**, 35-62 (2003).
132 Wolpoff, M. H. The Krapina dental remains. *Am. J. Phys. Anthropol.* **50**, 67-113 (1979).

133 Heim, J. L. *Les enfants néandertaliens de la Ferrassie*. (Fondation Singer Polignac. Masson, 1982).
134 Henry-Gambier, D., Maureille, B. & White, R. Vestiges humains des niveaux de l'Aurignacien ancien du site de Brassempouy (Landes). *Bull. Mém. Soc. Anthropol. Paris* **16**, 49–87 (2004).
135 Madre-Dupouy, M. *L'enfant du Roc de Marsal: étude analytique et comparative*. (Editions du Centre National de la Recherche Scientifique, 1992).
136 Ferembach, D. Les ossements humains de Salemas (Portugal). *Communicoes Servs. Geol. Port.* **48**, 165-185 (1964).
137 Trinkaus, E. Dental remains from the Shanidar adult Neanderthals. *J. Hum. Evol.* **7**, 369-382 (1978).
138 Trinkaus, E. *The Shanidar Neandertals*. (Academic Press New York, 1983).
139 McCown, T. D. & Keith, A. *The Stone Age of Mount Carmel. The Fossil Human Remains from the Levalloiso-Mousterian, volume II*. (Clarendon Press, 1939).
140 Gremiatski, M. A. in *Teshik-Tash, l'homme paleolithique* (eds M.A. Gremiatski & M.F. Nesturkh) 137-187 (Trudy Uzkekist. Fil. Akad. Nauk SSSR, 1949).
141 Day, M., Leakey, R., Walker, A. & Wood, B. New hominids from East Turkana, Kenya. *Am. J. Phys. Anthropol.* **45**, 369-435 (1976).
142 Leakey, R. E. Further evidence of lower pleistocene hominids from East Rudolf, North Kenya. *Nature* **231**, 241-245 (1971).
143 Keyser, A. W., Menter, C. G., Berger, L., Moggi-Cecchi, J. & Pickering, T. R. Drimolen: a new hominind-bearing site in Gauteng, South Africa. *S. Afr. J. Sci.* **96**, 193-197 (2000).
144 Keyser, A. The Drimolen skull: the most complete australopithecine cranium and mandible to date. *S. Afr. J. Sci.* **96**, 189-193 (2000).
145 Brain, C. New finds at the Swartkrans Australopithecine site. *Nature* **225**, 1112-1119 (1970).
146 Grine, F. E. in *Swartkrans: A Cave's Chronicle of Early Man Transvaal Museum Monograph 8* (ed C.K. Brain) 75-116 (Transvaal Museum, 1993).
147 Grine, F. E. & Daegling, D. J. New mandible of *Paranthropus robustus* from Member 1, Swartkrans Formation, South Africa. *J. Hum. Evol.* **24**, 319 - 333 (1993).
148 Grine, F. E. *Evolutionary History of the"Robust" Australopithecines*. (Aldine de Gruyter, 1988).
149 Grine, F. E. New hominid fossils from the Swartkrans Formation (1979-1986 excavations): craniodental specimens. *Am. J. Phys. Anthropol.* **79**, 409-449 (1989).
150 King, S. J. This study.
151 Catlett, K. K. & Daly, E. S. This study.