

**Dental maturational sequence and dental tissue proportions in the early
Upper Paleolithic child from Abrigo do Lagar Velho, Portugal**

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Supporting Information

Fig. S1. Lagar Velho 1. Virtual 3D reconstruction of four deciduous and one permanent teeth assessed for linear, surface, and volumetric tissue proportions. A. deciduous upper right central incisor (Ui1, labial view); B. deciduous lower right lateral incisor (Li2, labial view); C. deciduous lower right canine (Lc, labial view); D. deciduous lower right second molar (Lm2, oblique mesio-buccal view); E. permanent lower right first molar (LM1, oblique mesio-buccal view). Enamel thickness topographic variation is rendered by means of a chromatic scale increasing from dark blue (thinner) up to red (thicker); radicular dentine is rendered in semi-transparency and the virtual filling of the pulp cavities of the deciduous teeth is shown in orange. Scale bar is 1 mm.

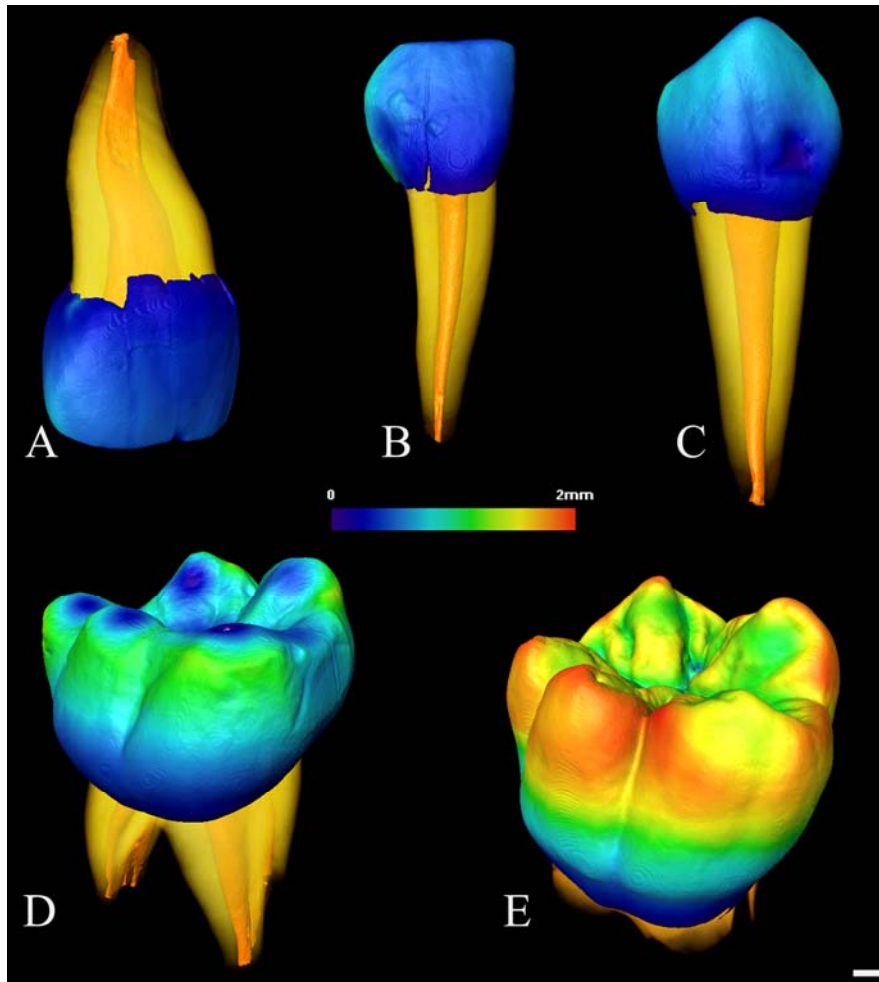


Fig. S3. Comparative estimates of the Relative Enamel Thickness (RET; scale-free relative estimate; see Methods) of four deciduous and one permanent teeth in Lagar Velho 1 (LaVe1), La Madeleine 4 (Mad4; no data are available for Ui1 and LM1), Neandertals (Neand), and extant humans (EH). RET is the AET scaled by the cube root of the crown dentine+pulp volume and multiplied by 100.

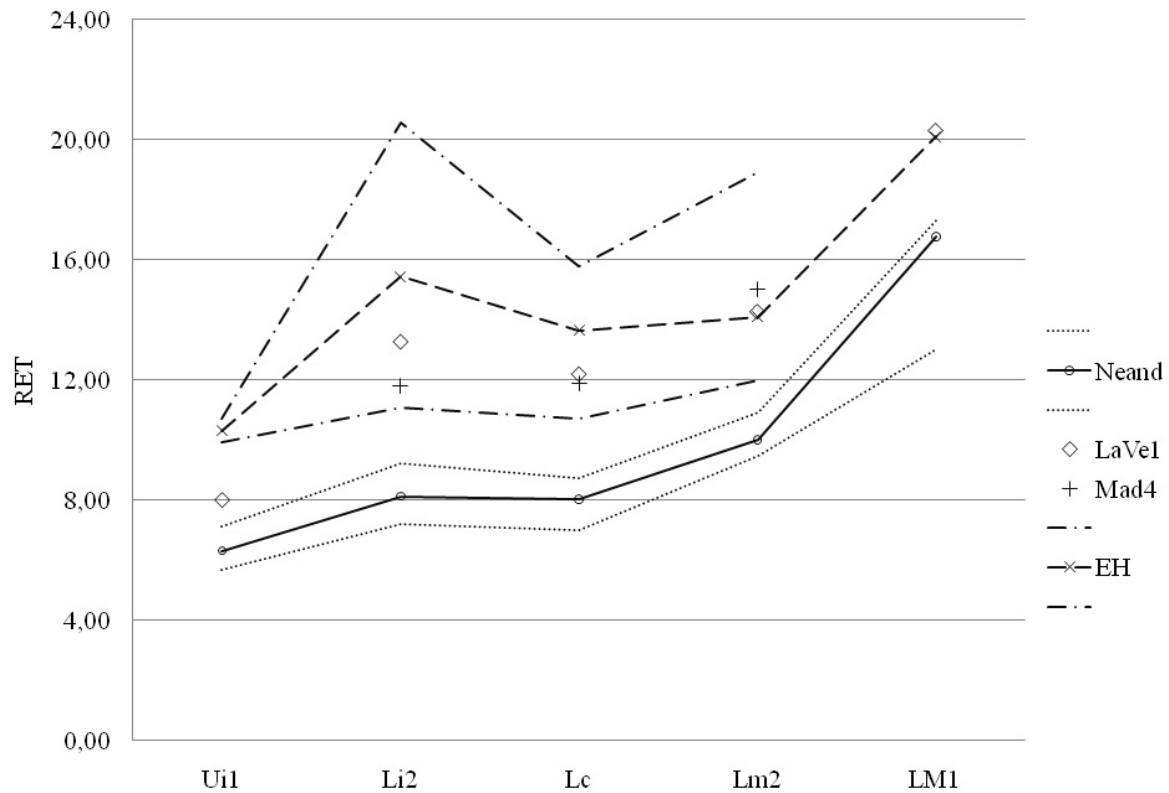


Fig. S4. Comparative enamel thickness cartographies of the deciduous lower second molar (upper) and the permanent lower first molar (lower) in: (A) a Neandertal (Roc de Marsal 1, upper; Abri Suard S14-7, lower); (B) Lagar Velho 1; (C) an extant human (EH-U57, upper; EH-U21, lower). Crowns shown in oblique mesio-buccal view. Enamel thickness topographic variation rendered by means of a chromatic scale increasing from dark blue (thinner) up to red (thicker). Scale bar is 1 mm.

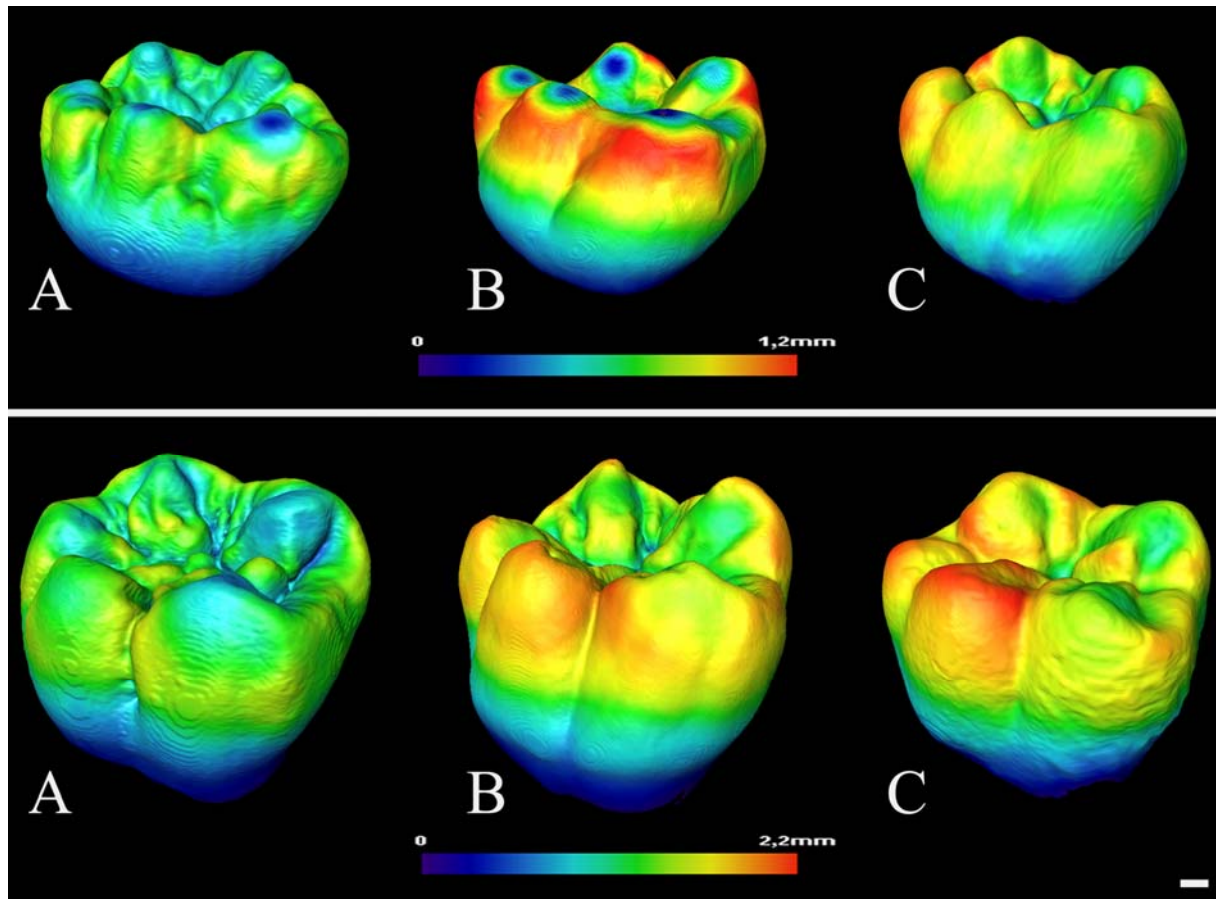


Table S1. Lagar Velho 1. Degree of maturation of the elements of the lower deciduous and permanent dentition based on the descriptions and the estimates by Hillson (1) and Hillson and Santos Coelho (2) assessed following the system developed by Moorrees et al. (3), integrated by independent estimates assessed on the original material (by PB, RM, and CD) according to the scoring system of Demirjian et al. (4) for the permanent teeth, revised by Liversidge and Molleson (5) for the deciduous teeth, modified and adapted by Bayle et al. (6).

<i>dental element</i>	<i>maturational stage</i> ¹	<i>descriptive criteria of crown and root calcification</i>
Li1	h2	Apical dentine edge is sharp and apex is closed.
Li2	h2	Apical dentine edge is sharp and apex is closed.
Lc	h2	Apical dentine edge is sharp and apex is closed.
Lm1	h2	Apical dentine edge is sharp and apex is closed.
Lm2	h1/h2/r	Because of post-mortem damage, the assessment of the maturational degree in both teeth is difficult. Root length is at least complete and a small amount of resorption possibly affects the distal root of the left tooth.
LI1	C/D	Crown formation is substantially complete but not enough of either tooth can be seen to examine the forming surface on the labial and lingual sides.
LI2	C	Crown formation is almost complete.
LC	C	The enamel formation is complete at the occlusal surface and its extension and convergence towards the cervical region is seen.
LP3	C	The enamel formation is complete at the occlusal surface and its extension and convergence towards the cervical region is seen.
LP4	B/C	While the right element is missing, only the lingual half of the developing left crown is preserved. The occlusal surface seems complete but the crown is less developed than in the first premolar.
LM1	E	In the practically complete left tooth, a plate of dentine forming the root bifurcation is seen.
LM2	B	The coalescence of cusp tips is seen.

Table S2. Lagar Velho 1. Series of possible maturational sequences (3 deciduous and 4 permanent) assessed for the mandibular dentition (represented by 5 deciduous and 7 permanent elements) following the stages modified and adapted from Liversidge and Molleson (5) for the deciduous and Demirjian et al. (4) for the permanent teeth (rev. in 6).

<i>seq. number</i>	<i>deciduous teeth</i> (<i>Li1-Li2-Lc-Lm1-Lm2</i>)	<i>permanent teeth</i> (<i>LI1-LI2-LC-LP3-LP4-LM1-LM2</i>)	<i>seq. number</i>
1	h2-h2-h2-h2-h1	C-C-C-C-B-E-B	I
2	h2-h2-h2-h2-h2	C-C-C-C-C-E-B	II
3	h2-h2-h2-h2-r	D-C-C-C-B-E-B	III
		D-C-C-C-C-E-B	IV

Table S4. Origin, reference group, age (oxygen isotope stage), and tooth-specific sample size of the microtomographic-based dental sample. Data sources: Abri Suard (France): 7, 11, 12, and original data; Abri Bourgeois-Delaunay (France): 7, 10; Roc de Marsal (France): 6–8; El Sidrón (Spain): 12; Engis (Belgium): 12, and original data; Spy (Belgium): 13; Lagar Velho (Portugal): present data; La Madeleine (France): 7–9; extant humans (worldwide): 6–10, 12, 14, and original data.

group	site/sample	age	Ui1	Li2	Lc	Lm2	LM1	total
Neandertal	Abri Suard	OIS 6		1	2	4	3	10
	Abri Bourgeois-Delaunay	OIS 5e					1	1
	Roc de Marsal	OIS 5a	2	2	2	2		8
	El Sidrón	OIS 3					2	2
	Engis	OIS 3	1				1	2
	Spy	OIS 3	1	1	1			3
Upper Paleolithic	Lagar Velho	OIS 2	1	1	1	1	1	5
	La Madeleine	OIS 2		2	1	2		5
extant	EH	present	2	4	4	7	18	35

Table S5. Maturational stage [modified and adapted from Liversidge and Molleson (5) for the deciduous and from Demirjian et al. (4) for the permanent teeth (in 6)], degree of occlusal wear (15), and general preservation quality of the enamel [ranging from "very bad" (complete enamel loss), to "very good" (no enamel loss)] directly assessed on a number of original fossil and extant (EH) teeth considered in the present analysis. Information concerning additional tooth material from other studies used in the comparative analysis of dental tissue proportions (12, 14) is not available here.

Within the factors listed in Table S5, only the degree of dental wear and the enamel preservation state may affect the results presented in Table S3. Because all specimens reached at least the degree of "crown completion" (stage>d or D, for the deciduous and permanent elements, respectively), the mineralization stage has no effect on the virtual assessment of the crown variables. Conversely, as previously noted for the dentition of the late Upper Paleolithic child from La Madeleine (9), both Lagar Velho 1 upper central and lower lateral deciduous incisors exhibit a relatively advanced degree of wear in comparison with the extant specimens used in the comparative analysis.

In Lagar Velho 1, besides the minor influence on the volumetric virtual estimates of Ui1, Li2, and Lc of artifacts related to some punctual enamel detachments at the cervix, the mesio-lower labial aspect of the crown of the deciduous canine also displays localized enamel hypoplasia (Fig. S1C), responsible for a spot-like thinning of the dental tissue.

tooth	group	site/sample	spec.	maturational stage	wear degree	enamel preservation quality
Ui1	Neandertal	Roc de Marsal	RdM1 left	h1	3/4	good
	Neandertal	Roc de Marsal	RdM1 right	h1	3/4	good
	Neandertal	Engis	Engis 2	h1	4/5	pretty good
	Neandertal	Spy	Spy 589a	h1	2	pretty good
	Upper Paleolithic	Lagar Velho	LaVe1	h2	4	pretty good
	extant	EH	EH-U21	r	2/3	good
	extant	EH	EH-U63	h1	1	good

Table S5 (cont.)

tooth	group	site/sample	spec.	maturational stage	wear degree	enamel preservation quality
Li2	Neandertal	Abri Suard	S14-3	r	4/5	very good
	Neandertal	Roc de Marsal	RdM1 left	h1	3	pretty good
	Neandertal	Roc de Marsal	RdM1 right	h2	2	good
	Neandertal	Spy	Spy 594a	g	1	very good
	Upper Paleolithic	Lagar Velho	LaVe1	h2	3/4	pretty good
	Upper Paleolithic	La Madeleine	Mad4 left	h2	2/3	good
	Upper Paleolithic	La Madeleine	Mad4 right	r	2	very good
	extant	EH	EH-Sbg1	h1	1	very good
	extant	EH	EH-Sbg3	h1	1	good
	extant	EH	EH-U21	r	1	very good
	extant	EH	EH-UdP	h1	1	very good
	Lc	Neandertal	Abri Suard	S37	f	1
Neandertal		Abri Suard	S45	g	1	good
Neandertal		Roc de Marsal	RdM1 left	g	1	good
Neandertal		Roc de Marsal	RdM1 right	g	1	good
Neandertal		Spy	Spy 645a	e	1	very good
Upper Paleolithic		Lagar Velho	LaVe1	h2	2	pretty good
Upper Paleolithic		La Madeleine	Mad4	g	1	very good
extant		EH	EH-Sbg1	f	1	good
extant		EH	EH-Sbg2	g	2/3	very good
extant		EH	EH-U21	h1	1	pretty good
extant		EH	EH-UdP	g	1	good

Supporting Information References

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