# Chapter 13

# THE DENTITION OF THE SCLADINA I-4A JUVENILE NEANDERTAL

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## 1. Introduction

Teeth found in cave sediments are usually well preserved and represent the most frequent hominin fossils.

Beginning with the first detailed studies of Neandertal remains these fossils always interested palaeontologists who have been describing them in more or less details. This was for instance the case with the remains from Spy (Fraipont & Lohest, 1887) and La Chapelle-aux-Saints (Boule, 1911-1913) as well as in some overviews (Patte, 1959-1961).

Even if Neandertal teeth contain much morphological information, for a long time they were not widely used for taxonomic and phylogenetic purposes, mainly because this taxon and anatomically modern humans, notably Upper Palaeolithics, share numerous non-metric features (Bailey & Hublin, 2006). It is true that some traits are sometimes mistakenly viewed as typical of Neandertals (e.g. shovelling). It has, however, been shown that Neandertals exhibit a specific dental pattern characterized by the high frequency of some traits and their combination, not only when the entire dentition is taken into consideration but also isolated teeth (Bailey, 2002[a], 2006[a]).

The purpose of this chapter is to provide a description of the 24 Scladina teeth, belonging to a rare example of juvenile western European Neandertal which is dated, probably from MIS 5b or MIS 5a. The choice was made to seek the associations of morphological features which, mainly based on the work of S. Bailey, distinguish the teeth of Neandertals from other taxa. More specific aspects of the teeth, such as enamel thickness, enamel dentine junction, and root morphology are analysed in other chapters (respectively Chapters 14, 15 & 16).

## 2. Materials and methods

Table 1 presents all 24 teeth recovered from former units 4A and 3 of Scladina Cave, either found isolated or within the mandible and maxilla (erupted or completely embedded). After analysis, it is absolutely certain that all the teeth found in the former Layer 4A belong to the same juvenile individual, as has been thought since the first palaeoanthropological discoveries (Otte et al. 1993; Toussaint et al., 1998). It was also understood that the three teeth first assigned to the base of Layer 3 actually belonged to the same child as the fossils found in former Layer 4A. This observation also confirmed the secondary position at least of all the Neandertal remains already put

| Teeth inventory number | Anatomical Tooth Identification | Status | Refiting |
|---|---|---|---|
| Scla 4A-1/$M_1$ | mandibular right first molar | in situ: erupted | |
| Scla 4A-1/$M_2$ | mandibular right second molar | in situ: erupted | |
| Scla 4A-1/$M_3$ | mandibular right third molar (crown) | in situ: unerupted | |
| Scla 4A-1/$P_2$ | mandibular right second premolar | in situ: unerupted | |
| Scla 4A-2/$P^2$ | maxillary right second premolar | in situ: unerupted | |
| Scla 4A-3 | maxillary right second molar | isolated | fits in 4A-4 |
| Scla 4A-4 | maxillary right first molar | isolated | fits in 4A-2 |
| Scla 4A-5 | deciduous maxillary right second molar | isolated | fits in 4A-2 |
| Scla 4A-6 | mandibular right first premolar | isolated | fits in 4A-1 |
| Scla4A-7 | deciduous maxillary right first molar | isolated | fits in 4A-2 |
| Scla 4A-8 | maxillary right third molar | isolated | fits with 4A-3 |
| Scla 4A-9/$M_1$ | mandibular left first molar | in situ: erupted | |
| Scla 4A-9/$M_2$ | mandibular left second molar | in situ: erupted | |
| Scla 4A-9/$P_2$ | mandibular left second premolar | in situ: unerupted | |
| Scla 4A-11 | maxillary right central incisor | isolated | fits in 4A-2 |
| Scla 4A-12 | mandibular right canine | isolated | fits in 4A-1 & 9 |
| Scla 4A-13 | deciduous mandibular right second molar | isolated | fits in 4A-1 |
| Scla 4A-14 | maxillary right lateral incisor | isolated | fits in 4A-2 |
| Scla 4A-15 | mandibular right central incisor | isolated | fits in 4A-9 |
| Scla 4A-16 | maxillary right canine | isolated | fits in 4A-2 |
| Scla 4A-17 | maxillary left lateral incisor | isolated | |
| Scla 4A-18 | maxillary left canine | isolated | |
| Scla 4A-19 | mandibular left lateral incisor | isolated | fits in 4A-9 |
| Scla 4A-20 | mandibular right lateral incisor | isolated | fits in 4A-9 |

Table 1: List of all the Scladina juvenile teeth. **In situ** = tooth still attached to the mandible or maxilla, either erupted or unerupted; **isolated** = the tooth was found isolated in sediments. Except when noted as deciduous, all teeth are to be considered as permanent.

in evidence by their planimetric distribution (see Chapters 5 & 7).

Small variations in the identification occurred in the preliminary articles published about the remains of the Scladina Juvenile; they are presented in Table 2. This chapter provides the final determinations based on a detailed study of each tooth.

The descriptions of the 24 Scladina teeth focus on diagnostic morphological features of Neandertal teeth, in accordance with recent dental anthropological studies (notably by Bailey 2002[a], 2002[b], 2004[a], 2004[b], 2006[a], 2006[b]; Bailey & Lynch, 2005; Bailey & Hublin, 2006; Bailey et al., 2011). The terminology used for cusp identification follows that of classic procedures (see e.g. Hillson, 1996; Scott & Turner, 1997). Occlusal wear has been scored according to Molnar (1971). Non-metric data were collected following the worldwide international standard for morphological study, the Arizona State University Dental Anthropology System, or ASUDAS, developed to reduce subjectivity in tooth description. These non-metric traits are scored by using a set of plaques and descriptions of the corresponding variations (Turner et al., 1991; Scott & Turner, 1997) that were developed for modern humans. On hominin fossils, it sometimes appears that trait expressions may exceed the grades found in modern humans; in Scladina for instance, the labial face of the permanent maxillary central incisor is, mesiodistally, more convex than in the ASUDAS UI-1 curvature, grade 4. The micro-CT data used for this study were recorded at the University of Antwerp and at the Max Planck Institute in Leipzig.

All teeth were compared to a sample of similar specimens from different periods: Early Neandertals (EN), Late Neandertals (LN), Middle Palaeolithic Modern Humans (MPMH), Upper Palaeolithic Modern Humans (UPMH) as well as Middle Ages/submodern Modern *Homo sapiens sapiens* (MHSS) from the city of Liège (Belgium). The first four groups are mainly part of the file prepared by C. Verna (2006) in her PhD thesis and developed thereafter as well as some data collected by the present author. The modern group consists of personal measurements by the author.

Univariate analyses using the method developed by F. Houët (2001) were carried out to compare the MD (mesiodistal) and BL (buccolingual) measurements of the Scladina teeth with the above mentioned samples:

| Tooth Inventory Number | Otte et al., 1993 | Toussaint et al., 1998 | Semal et al., 2005 | Pirson et al., 2005 | Toussaint et al., 2011 | Present chapter | Conclusion |
|---|---|---|---|---|---|---|---|
| **Scla 4A-1** | Right hemimandible | Right hemimandible | Right hemimandible | Right hemimandible | Right hemimandible | Right hemimandible | identical |
| **Scla 4A-2** | Right maxilla fragment | Right maxilla fragment | Right maxilla | Right maxilla fragment | Right maxilla fragment | Right maxilla fragment | identical |
| **Scla 4A-3** | $RM^2$ | $RM^2$ | $RM^2$ | $RM^2$ | $RM^2$ | $RM^2$ | identical |
| **Scla 4A-4** | $RM^1$ | $RM^1$ | $RM^1$ | $RM^1$ | $RM^1$ | $RM^1$ | identical |
| **Scla 4A-5** | | $Rdm^2$ | $Rdm^2$ | $Rdm^2$ | $Rdm^2$ | $Rdm^2$ | identical |
| **Scla 4A-6** | | $RP_1$ | | $RP_1$ | $RP_1$ | $RP_1$ | identical |
| **Scla 4A-7** | | $Rdm^1$ | $Rdm^1$ | $Rdm^1$ | $Rdm^1$ | $Rdm^1$ | identical |
| **Scla 4A-8** | | M3 (unspecified) | $LM_3$ | $LM_3$ | $LM_3$ | $RM^3$ | different |
| **Scla 4A-9** | | Left hemimandible | Left hemimandible | Left hemimandible | Left hemimandible | Left hemimandible | identical |
| **Scla 4A-10** | | | | LC, | | | declassified |
| **Scla 4A-11** | | | $RI^1$ | $RI^1$ | $RI^1$ | $RI^1$ | identical |
| **Scla 4A-12** | | | $R\bar{C}$ | $R\bar{C}$ | $R\bar{C}$ | $R\bar{C}$ | identical |
| **Scla 4A-13** | | | | $Rdm_2$ | $Rdm_2$ | $Rdm_2$ | identical |
| **Scla 4A-14** | | | $RI^2$ | $RI^2$ | $RI^2$ | $RI^2$ | identical |
| **Scla 4A-15** | | | $RI_2$ | $RI_2$ | $RI_2$ | $RI_1$ | different |
| **Scla 4A-16** | | | $R\underline{C}$ | $R\underline{C}$ | $R\underline{C}$ | $R\underline{C}$ | identical |
| **Scla 4A-17 (= Scla 3-2)** | $LI^2$ | | $LI^2$ | $LI^2$ | $LI^2$ | $LI^2$ | identical |
| **Scla 4A-18 (= Scla 3-3)** | $L\underline{C}$ | | $L\underline{C}$ | $L\underline{C}$ | $L\underline{C}$ | $L\underline{C}$ | identical |
| **Scla 4A-19 (=Scla 3-4)** | | | | Permanent mandibular I (unspecified) | Permanent mandibular I (unspecified) | $LI_2$ | more precise |
| **Scla 4A-20** | | | | | | $RI_2$ | |

**Table 2:** Variations in the identification of the teeth of the Scladina Child (**I** = incisor; **C** = canine; **P** = premolar; **M** & **m** = molar; **d** = decidous; **R** = right; **L** = left; subscript number or ¯ = mandibular tooth; superscript number or _ = maxillary tooth).

— Probabilistic distances (DP) compare the measurement of a fossil to parameters of a reference population, according to the formula DP = student law (Abs (x–m) / s; n–1; 2);

— ECRA ("*écart centré réduit ajusté*" of Houët, 2001) = (x–m) / inverse student law (0.05; n-1) * s.

In both formulas, x = individual value, m = sample mean, s = standard deviation, n = number of fossils. In tables corresponding to each tooth, numbers in brown indicate values of DP and ECRA that diverge significantly from the estimated variation of the reference population (DP > 0.05 or < -0.05; ECRA > 1 or < -1).

Bivariate biometric comparisons were conducted from the mesiodistal and buccolingual diameters of the crown to try to clarify the taxonomic position of the Scladina teeth. The bivariate comparisons made use of the well-known technique of equiprobable ellipses (Defrise-Gussenhoven, 1955); 95% confidence ellipses were plotted using the statistical software package PAST (PAlaeontological STatistics, version 1.77, 2008; Hammer et al., 2001).

Above each tooth description, the following information is given:

— the anatomical identification of the fossil;

— the identification number given during the palaeoanthropological study;

— the identification number given either on the field at the time of discovery or later during laboratory sorting of the palaeontological material found in the cave, without any reference to the human or non-human nature of the fossil;

— the date of the discovery;

— the date the fossil was identified as human (sometimes this is a precise date, sometimes only a year and a month);

— the excavation square of the discovery;

— the position of the fossil in the first stratigraphical interpretation;

— the new stratigraphical position: most probable unit (and sometimes layer); in brackets, potential unit (see Chapter 5 for more details).

# 3. Description of the Scladina I-4A teeth

## 3.1. Permanent maxillary right central incisor, RI[1]

**Palaeoanthropological identification**: Scla 4A-11
**Field identification**: Sc 1990-81-47
**Date of discovery**: 13 March 1990
**Date of identification**: May 2000
**Square**: G27
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: units 4A-POC or 3-INF (units 4A-IP, 4A-CHE, 3-SUP)

### 3.1.1. Description (Figure 1)

This permanent maxillary central incisor fits perfectly in the corresponding tooth socket of the Scla 4A-2 right maxillary fragment, found in Square D30, former Layer 4A, at a distance of more than 4 m.

The crown is completely formed and the root fully occluded but its tip is broken. The crown and the root exhibit numerous microfissures, along their length and perpendicular to it. No pathological conditions are noted.

The incisal rim of the crown presents minor transversal occlusal wear, without significant dentine exposure (grade 2, according to Molnar, 1971). The rounded occluso-distal angle is only slightly concerned by the occlusal wear. The incisal plane of wear slants slightly towards the lingual surface.

The lingual surface of the crown is shovel-shaped (ASUDAS, grade 3). Both mesial and distal marginal ridges are well marked but do not contact the cingulum. They circumscribe a shallow area, the lingual fossa. A large but shallow interruption groove dissects the distal marginal ridge from the cingulum, without reaching the cervix. Two extensions of the *tuberculum*, or lingual tubercles (*tuberculum dentale*), are present but lack free apexes. The height of both tubercles is 6.6 mm, from the cervix, while the height of the crown is 10.5 mm on the lingual face. First observed on the outer enamel surface (OES), all these features are also visible, and even more marked, on the enamel dentine junction surface (EDJ).

When viewed from the occlusal aspect, the labial face is mesiodistally strongly convex (more than in the ASUDAS UI-1 curvature, grade 4). This face also exhibits an irregular superior-inferior convexity, from the cervical line to the incisal edge. In detail, as seen in mesial or distal views, the labial face is convex near the cervix, then becomes oblique in the inferior half adjacent to the incisal edge. Double shovelling is not present as the labial surface is smooth (ASUDAS, grade 0).

Both side edges of the crown asymmetrically diverge from the cervix: the distal edge is more rounded and lower than the mesial one, and the

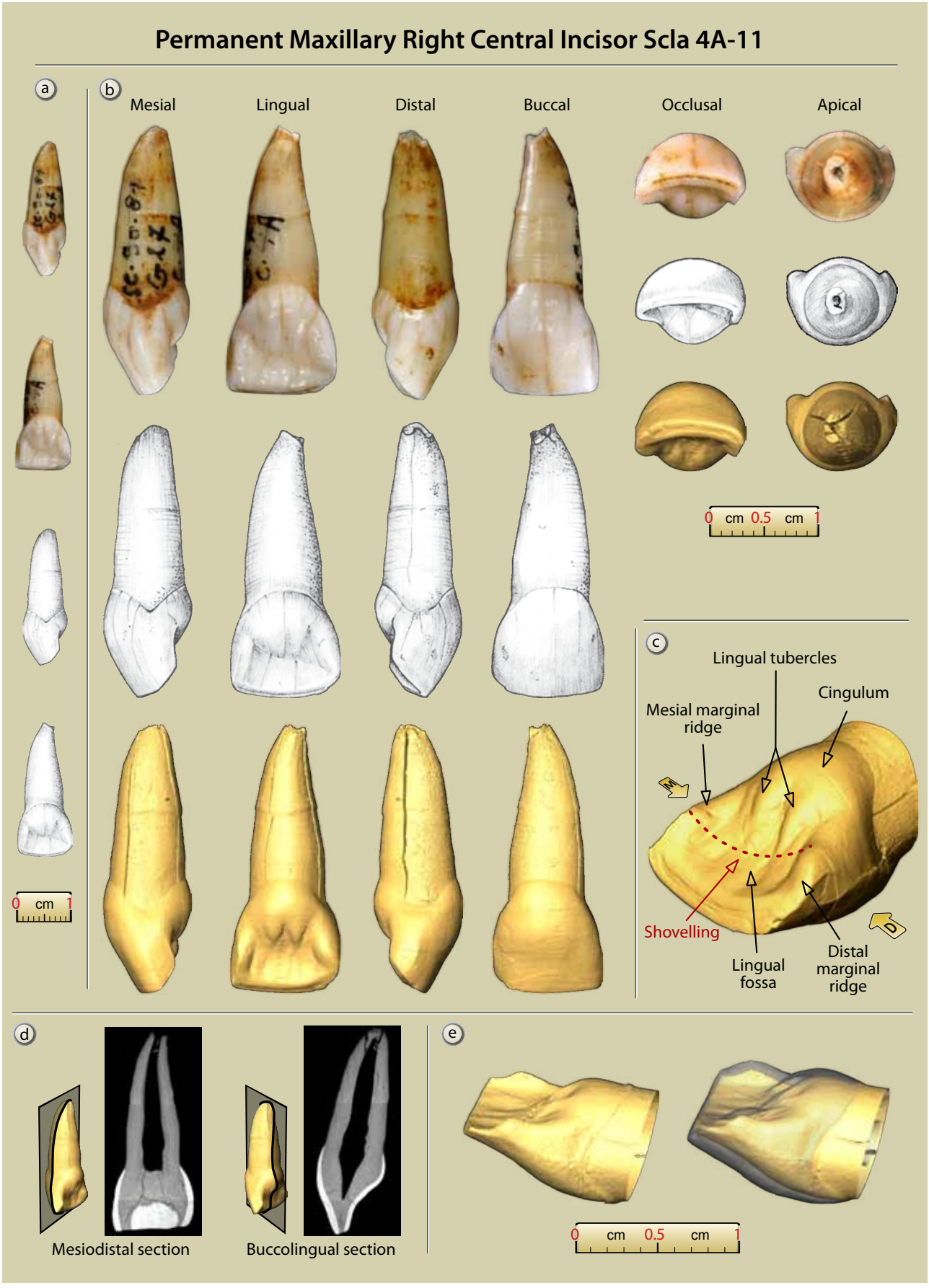


**Figure 1:** Scla 4A-11 permanent maxillary right central incisor: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the incisor (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

mesioincisal corner is sharp. The incisal ridge, which is slightly convex downward, slightly slopes from the mesial up to the distal sides.

On the mesial and distal marginal ridges, near the cervical rim, are interproximal wear facets indicating that the tooth was functional. The mesial facet is flat and is vertically elongated with rounded upper angles. It has no subvertical grooves. Its height is 4.4 mm and its width 2.5 mm. The distal facet is smaller and narrower with a rounded upper extremity; height: 3.6 mm and width: 1.7 mm. There are no subvertical grooves.

As usual on incisors, the V-convexity of the enamel line is more marked on the mesial face than on the distal one.

The lingual length of the root is about 14 mm in its actual state of preservation, but as the tip is damaged, at least 1.3 mm has to be added to get the original length which is then 15.3 mm or slightly more. The section of the root is rounded. The apical third of the root is anteriorly convex, when viewed from the side. No longitudinal root groove is present.

### 3.1.2. Taxonomy

Neandertal maxillary central incisorts exhibit a distinctive combination of features which makes them particularly useful for distinguishing between Neandertals and modern humans (Crummett, 1995; Bailey & Hublin, 2006; Bailey, 2006[a]): strong expression of lingual marginal ridges and associated marked shovelling, labial convexity, developed lingual tubercles, and superior-inferior convexity of the crown and root when viewed from the side. All these features can be found, in moderate degrees, in Early Modern Humans, but it is the high frequency of the combination of all of them and of their marked expression that make Neandertals distinctive (Table 3).

The permanent Scla 4A-11 maxillary right central incisor of Scladina exhibits the distinctive combination of features of Neandertals.

### 3.1.3. Morphometric analysis

Measurements of Scla 4A-11 are as follows:

**MD**: 9.90 mm
**BL**: 7.98 mm
**MD at the cervix**: 6.95 mm
**BL at the cervix**: 6.95 mm
**Length of the root**: 15.3 mm in its current state of preservation
**Total length of the tooth**: 24.67 mm in its current state of preservation

Using Bailey (2006[b])'s data, the length of the Scla 4A-11 root (± 15.3 mm) fits just between the ranges of variation of Neandertals (15.7–19.7 mm) and modern humans (11.7–15.2 mm). More recent results (Le Cabec et al., Chapter 16) confirm that Scladina has comparatively very short incisor roots compared to those of the other MIS 5 Neandertals. On the other hand, Scladina displays the largest pulp cavities.

The MD and BL diameters of Scla 4A-11 depart significantly from the average of the different comparison samples only in the case of modern humans (MHSS), both in the case of the DP probabilistic distance and ECRA (Table 4). MD and BL diameters of the crown are, in the bivariate graph of Figure 2, compared to the ellipses (95%) of Early and Late Neandertals as well as of MPMH, UPMH and MHSS. Partial overlap of the equiprobable ellipses indicate that the dimensions of the crown of the central incisor crowns permanent only provide limited taxonomic indications. And indeed, in the case of Scla 4A-11, the tooth is located in the central area where the four ellipses of fossils remains overlap, but outside the 95% ellipse of MHSS.

| Permanent Maxillary Central Incisors | Modality | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-11 |
|---|---|---|---|---|---|
| Lingual marginal ridges/shovelling | presence (grade 2 or above) | (92)-100% | 33.3% | 50% | yes |
| | strong expression (grade 4 or above) | > 50% | no | no | grade 3 |
| Labial convexity | presence | > 95% | 50% | 18.8% | yes |
| | expression | grade 4 or above: 71% | weak (≤ grade 3) | weak (≤ grade 3) | > grade 4 |
| Lingual tubercles(s) | presence | 100% | 50% | 58.3% | yes |
| | strong expression | yes | weak | weak | moderate |
| Double shovelling | presence | 4,30% | no | no | no |
| | expression | weak (grade 1) | | | |

**Table 3:** Distinctive anatomical features on permanent maxillary central incisors of Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-11.

| Scladina | | Diameter | Value | | | |
|---|---|---|---|---|---|---|
| RI[1] (Scla 4A-11) | | MD | 9.9 | | | |
| | | BL | 7.98 | | | |
| **Comparison Samples** | **N** | **Diameter** | **Mean** | **Stand. Dev.** | **DP** | **ECRA** |
| EN right & left | 21 | MD | 9.871 | 0.846 | 0.973 | 0.016 |
| | 22 | BL | 8.795 | 0.527 | 0.137 | −0.744 |
| LN right & left | 27 | MD | 9.235 | 0.626 | 0.298 | 0.517 |
| | 32 | BL | 8.050 | 0.489 | 0.887 | −0.070 |
| MPMH right & left | 11 | MD | 9.809 | 0.763 | 0.908 | 0.053 |
| | 9 | BL | 8.156 | 0.482 | 0.725 | −0.158 |
| UPMH right & left | 36 | MD | 8.739 | 1.040 | 0.272 | 0.550 |
| | 37 | BL | 7.532 | 0.420 | 0.293 | 0.526 |
| MHSS right & left | 92 | MD | 8.136 | 0.642 | **0.007** | **1.384** |
| | 92 | BL | 6.888 | 0.473 | **0.023** | **1.163** |

**Table 4:** Scla 4A-11 (permanent maxillary right central incisor): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

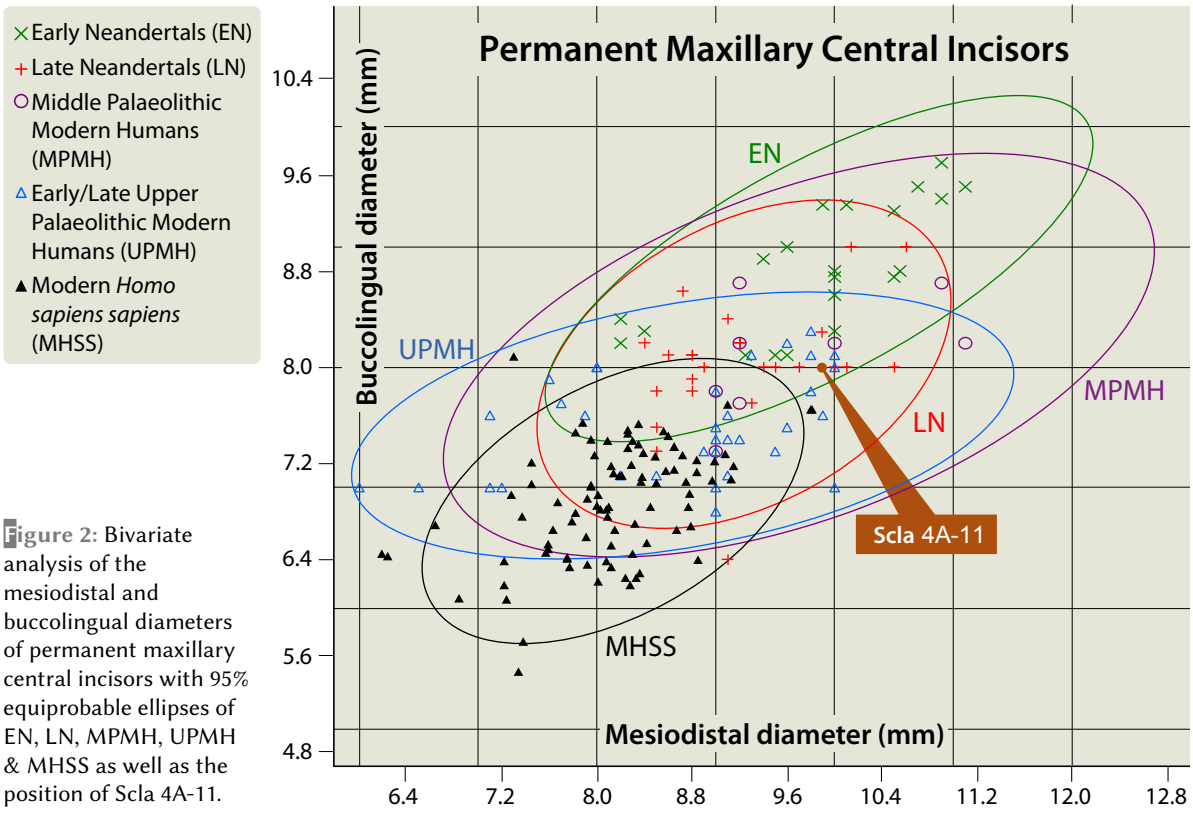


**Figure 2:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary central incisors with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-11.

## 3.2. Permanent maxillary lateral incisors, I²

### 3.2.1. Description

*Permanent maxillary left lateral incisor, LI² (Figure 3)*

**Palaeoanthropological identification**: Scla 4A-17 (= Scla 3-2)
**Field identification**: Sc 1991-526-1
**Date of discovery**: 17 October 1991
**Date of identification**: October 1993
**Square**: F27
**Stratigraphic position**:
— **Former stratigraphy**: 3, then 4A
— **New stratigraphy**: Unit 4A-POC (units 4A-IP, 4A-CHE, 3-INF)

The crown and the root are completely formed and erupted. The specimen is well preserved. However, it is labiolingually cracked in two nearly equal parts along its longitudinal axis. It exhibits secondary longitudinal and transversal cracks on the crown. No pathological conditions are noted.

The incisal rim is slightly worn, a bit rounded anterio-posteriorly, but without exposing the dentine (stage 2 of Molnar, 1971). The tooth was functional.

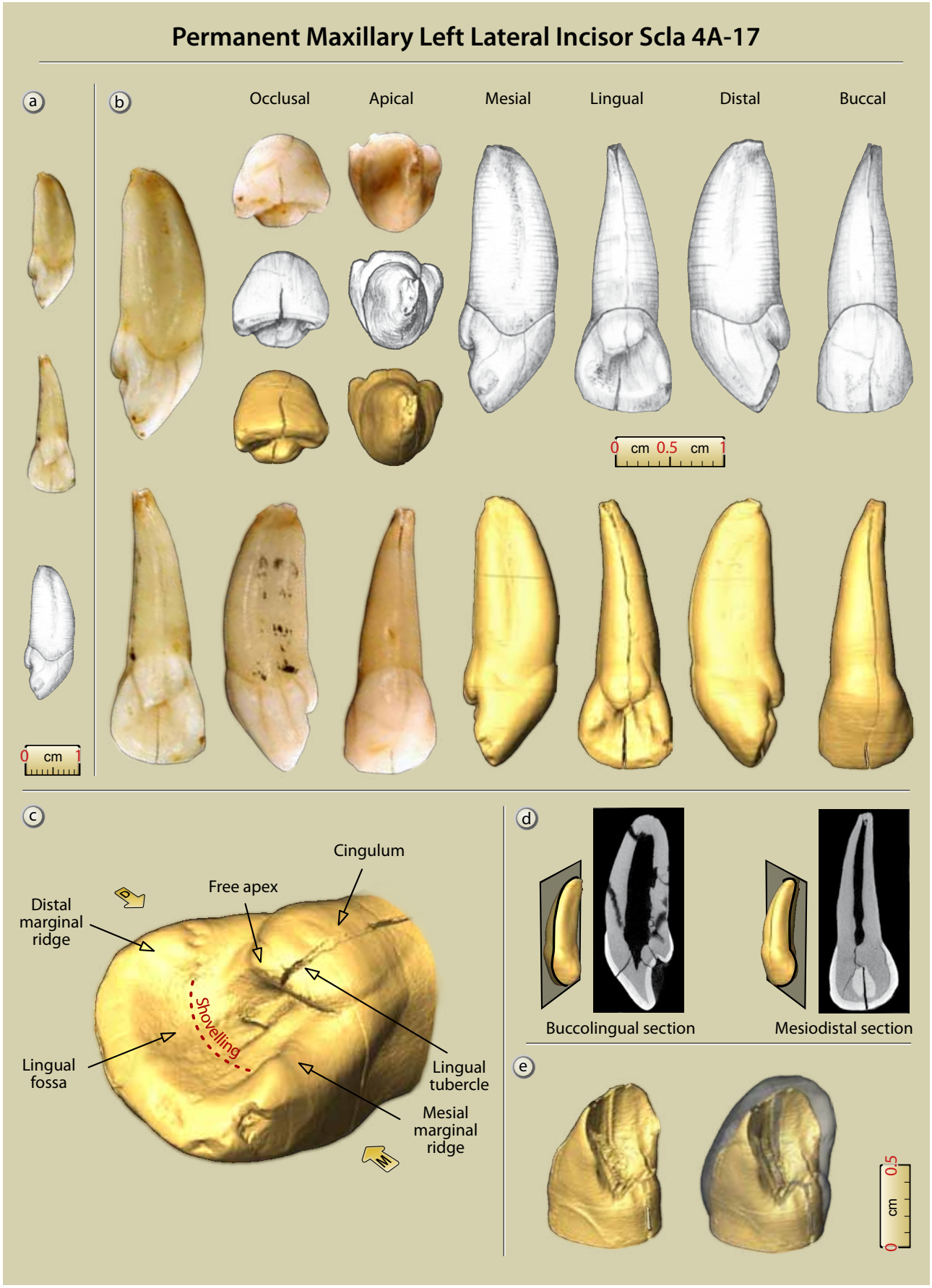


**Figure 3:** Scla 4A-17 permanent maxillary left lateral incisor: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the incisor (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

The labial surface of the crown is mesiodistally convex, as in ASUDAS, grade 4. In mesial view, this face is strongly convex in its cervical part, then becomes nearly flat in the direction of the incisal edge. In anterior view, the labial surface is smooth, without double shovelling (ASUDAS, grade 0). Both side edges of the crown asymmetrically diverge from the cervix: the distal edge is more rounded and lower than the mesial one, and the incisal ridge, which is slightly convex downward, rises slightly distally.

The lingual surface of the crown is shovel-shaped, as in ASUDAS, grade 4. Both mesial and distal marginal ridges are well developed. They circumscribe a fairly deep lingual fossa.

The lingual tubercle, the striking feature of the moderate cingulum, is better marked than on the central maxillary incisor Scla 4A-11. It looks like a marked cuspule with a free apex (grade 6 in Turner et al., 1991: 16, and even more pronounced than on ASU UC DAR, grade 5). In lingual view, the lower part of the tubercle is vertically divided by a slight groove. Two interruption grooves dissect the tubercle from both the distal and the mesial marginal ridges. Both go up to the cervix but none of them are expressed on the root. The shape of the lingual tubercle is slightly asymmetric when viewed from the lingual side. Distally, it is closer to the incisal edge than it is mesially, so that its free border looks obliquely truncated. In its mesial part, the lingual fossa also exhibits two blunt vertical crests. The usual mamelons of the incisal edge have been worn away.

The maximum height of the tubercle from the cervix is around 4.7 mm, while the total height of the crown is 10.2 mm.

On the mesial and distal faces, the enamel line dips inferiorly, forming a rounded V-shape with its tip in the direction of the incisal rim. As usual on incisors, canines, and premolars, this V-shaped convexity is better marked on the mesial face than on the distal one.

An interproximal wear facet for the central maxillary incisor is present. It is flat, vertically elongated, and nearly vertically divided in two. It does not exhibit subvertical grooves. Its width is 1.5 mm. The tooth does not have a distal interproximal wear facet.

The length of the root is about 14.7 mm on its lingual border and 15.1 on its labial one. The section of the root is irregularly elliptical with flattened sides and an anterior-posterior long axis; two shallow longitudinal root grooves run on the mesial and distal sides of the root, the mesial one being a bit more pronounced.

When viewed from the side, the root is anteriorly convex and this convexity is in continuity with that of the crown. So, the complete profile of the tooth, crown and root included, is globally convex. In labial or lingual views, the tip of the root bends distally.

### *Permanent maxillary right lateral incisor, RI² (Figure 4)*

**Palaeoanthropological identification**: Scla 4A-14
**Field identification**: Sc-1990-37-1
**Date of discovery**: 22 February 1990
**Date of identification**: 14 December 2004
**Square**: H27
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: units 4A-POC or 3-INF (units 4A-IP, 4A-CHE, 3-SUP)

This specimen fits well in the corresponding socket of the Scla 4A-2 right maxilla, found in Square D30, at a distance of more than 5 m. No pathological conditions are noted.

The morphology of this tooth is similar to the corresponding permanent maxillary left lateral incisor Scla 4A-17.

The crown and the root are completely formed and erupted. The specimen is well preserved, though it exhibits longitudinal and transversal cracks on the crown and a marked longitudinal crack on the buccal face of the root.

The incisal rim is slightly worn, a bit rounded, but does not expose the dentine (stage 2 of Molnar, 1971). In addition, two small chips of enamel are missing from the buccal face of the incisal rim, one at the mesial angle and another one 2 mm off the distal angle. The tooth was functional.

The labial face of the crown is extremely close to that of its antimere: mesiodistally convex (ASUDAS, grade 4), strongly convex in mesial view near the cervix, smooth without double shovelling, distal angle more rounded than the mesial one, and the incisal edge distally. Like its antimere, the lingual surface of the crown exhibits marked shovelling (as in ASUDAS, grade 4), both marginal and distal developed ridges, a deep lingual fossa, a moderate cingulum with an asymmetric lingual tubercle forming a free apex (grade 6 in Turner et al., 1991: 16), two interruption grooves, a *tuberculum* extension, two blunt vertical crests between

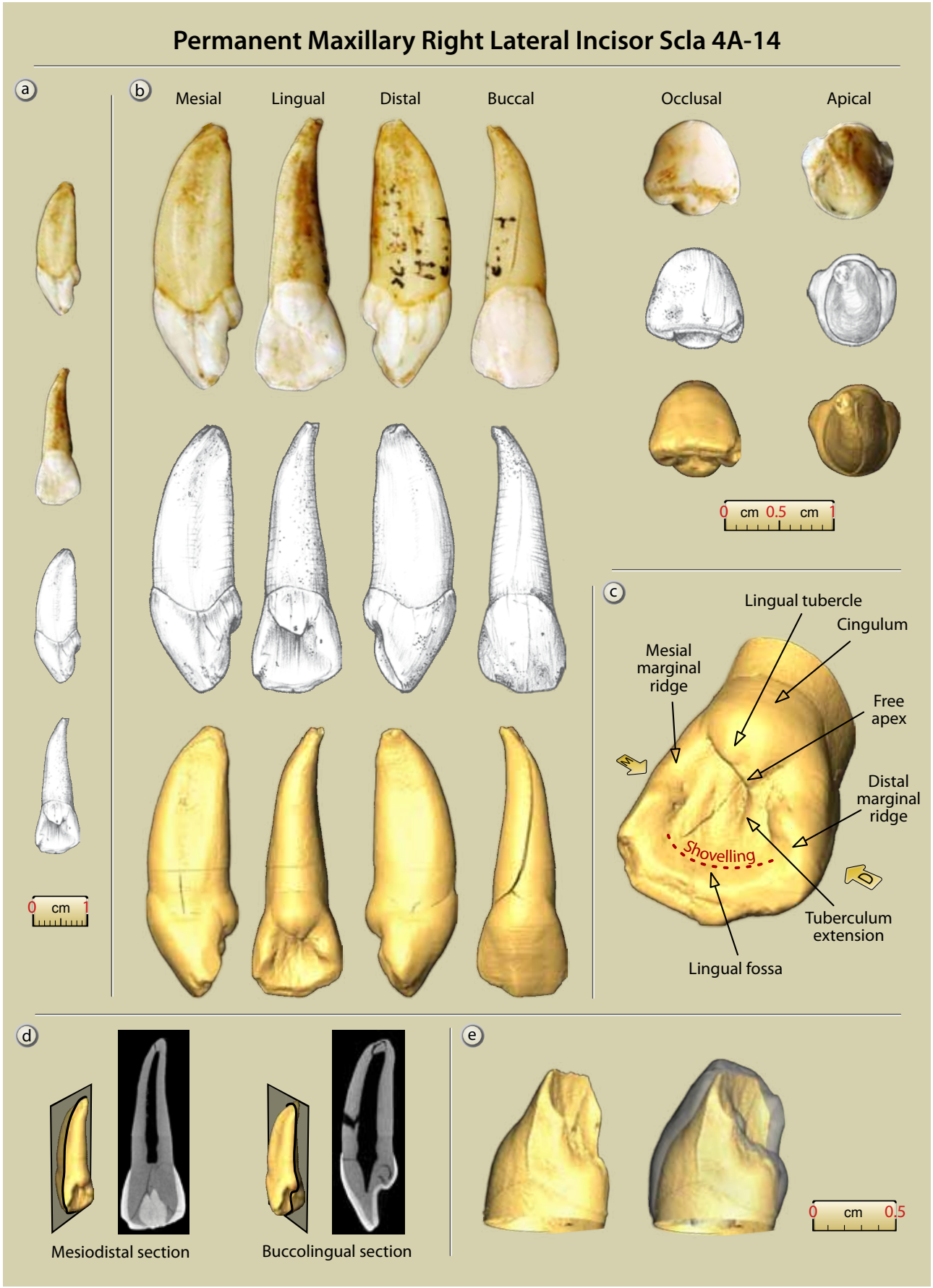


**Figure 4:** Scla 4A-14 permanent maxillary right lateral incisor: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the incisor (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

the mesial marginal ridge, and the *tuberculum* extension.

The mamelons of the incisal edge have been worn away.

The maximum height of the tubercle from the cervix is around 4.75 mm, while the total height of the crown is 10.05 mm.

The rounded V-shape of the enamel-cement junction convexity is better marked on the mesial face than on the distal one.

The interproximal wear facet for the central maxillary incisor is flat, vertically elongated, and with subvertical grooves. Its height is 3.6 mm and its width 1.8 mm. The tooth does not have a distal interproximal wear facet.

The length of the root is about 14.8 mm on its lingual border and 14.9 mm on the labial one. The section of the root is irregularly elliptical with flattened sides and an anterior-posterior long axis; two shallow longitudinal grooves run on the mesial and distal sides of the root, the mesial one being a bit more pronounced.

When viewed from the side, the root is anteriorly convex and this convexity is in the continuity of that of the crown. So, the complete profile of the tooth, crown and root included, is generally convex. In labial or lingual views, the tip of the root is tilted distally.

### 3.2.2. Taxonomy

The Neandertal permanent maxillary lateral incisors exhibit a morphology which is very close to that of the permanent maxillary central incisors and allow them to be distinguished from anatomically modern humans (Crummett, 1995; Bailey, 2006[a]): marked expression of lingual marginal ridges with associated shovel shape, labial convexity, developed lingual tubercle (*tuberculum dentale*), and superior-inferior convexity of the crown and root when viewed from the side (Table 5). Compaired with the central incisors, the main differences are slightly smaller dimensions.

Both Scla 4A-14 and Scla 4A-17 present the typical features of Neandertal permanent maxillary lateral incisors.

### 3.2.3. Morphometric analysis

Measurements of the permanent maxillary lateral incisors are as follows:

**Scla 4A-14, RI[2]**

**MD diameter**: 8.21 mm
**BL diameter**: 8.27 mm
**MD at the cervix**: 5.70 mm
**BL at the cervix**: 7.38 mm
**Length of the tooth**: 24.55 mm

**Scla 4A-17, LI[2]**

**MD**: 8.38 mm
**BL**: 8.40 mm
**MD at the cervix**: 5.96 mm
**BL at the cervix**: 7.65 mm
**Length of the tooth**: 24.45 mm

The MD and BL diameters of Scla 4A-14 and 4A-17 depart significantly from the average of the different comparison samples only in the case of modern humans, both in the case of the DP probabilistic distance and ECRA. In addition, the BL diameter also departs from UPMH (Table 6). The MD and BL diameters of the crown are also, in the bivariate graph of Figure 5, compared to the ellipses (95%) of Early and Late Neandertals as well as of MPMH, UPMH and MHSS. Scla 4A-14 and 4A-17 are situated in the area where EN, LN and MPMH ellipses overlap, just slightly outside the ellipse of UPMH and clearly outside that of modern humans (MHSS). These observations indicate that the size of the upper lateral incisors distinguish Neandertals and recent MHSS (Semal, 1988: 49); however, these dimensions do not provide clear taxonomic indications within fossil taxa (especially between EN, LN, MPMH)..

| Permanent Maxillary Lateral Incisors | Modality | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-17 | Scla 4A-14 |
|---|---|---|---|---|---|---|---|
| Lingual marginal ridges/shovelling | presence (grade 2 or above) | 100% | 100% | 83.3% | 43% | yes | yes |
| | strong expression (grade 4 or above) | | 81% | | | grade 4 | grade 4 |
| Lingual tubercles | presence | 100% | 96% | 66.70% | 0% | yes | yes |
| | strong expression | | cusp-like: 62% | 0% | 0% | cusp-like grade >5 | cusp-like grade 6 |
| Double shovelling | presence | 100% | 3.7% | 0% | 12.50% | no | no |
| | expression | | weak | | | | |

**Table 5:** Distinctive anatomical features on permanent maxillary lateral incisors of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-14 & 17.

| Scladina | N | Diameter | Value |
|---|---|---|---|
| $I^2$ | Scla 4A-14 | MD | 8.21 |
| | | BL | 8.27 |
| | Scla 4A-17 | MD | 8.38 |
| | | BL | 8.4 |

**Table 6:** Scla 4A-14 & 17 (permanent maxillary right and left second incisors): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

| | | | | | vs Scla 4A-14 | | vs Scla 4A-17 | |
|---|---|---|---|---|---|---|---|---|
| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA | DP | ECRA |
| LN left & right | 22 | MD | 7.713 | 0.7448 | 0.512 | 0.321 | 0.381 | 0.431 |
| | 29 | BL | 8.145 | 0.5669 | 0.827 | 0.108 | 0.656 | 0.220 |
| EN left & right | 21 | MD | 8.242 | 0.5566 | 0.955 | −0.028 | 0.807 | 0.119 |
| | 21 | BL | 8.752 | 0.8600 | 0.581 | −0.269 | 0.687 | −0.196 |
| MPMH left & right | 12 | MD | 7.841 | 0.6515 | 0.583 | 0.257 | 0.426 | 0.376 |
| | 12 | BL | 7.516 | 0.5874 | 0.226 | 0.583 | 0.161 | 0.684 |
| UPMH left & right | 28 | MD | 6.896 | 0.9547 | 0.180 | 0.671 | 0.132 | 0.758 |
| | 31 | BL | 6.851 | 0.5265 | 0.011 | 1.320 | **0.006** | 1.441 |
| MHSS | 88 | MD | 6.302 | 0.652 | **0.004** | **1.472** | **0.002** | **1.603** |
| | 88 | BL | 6.027 | 0.477 | **0.000** | **2.366** | **0.000** | **2.503** |

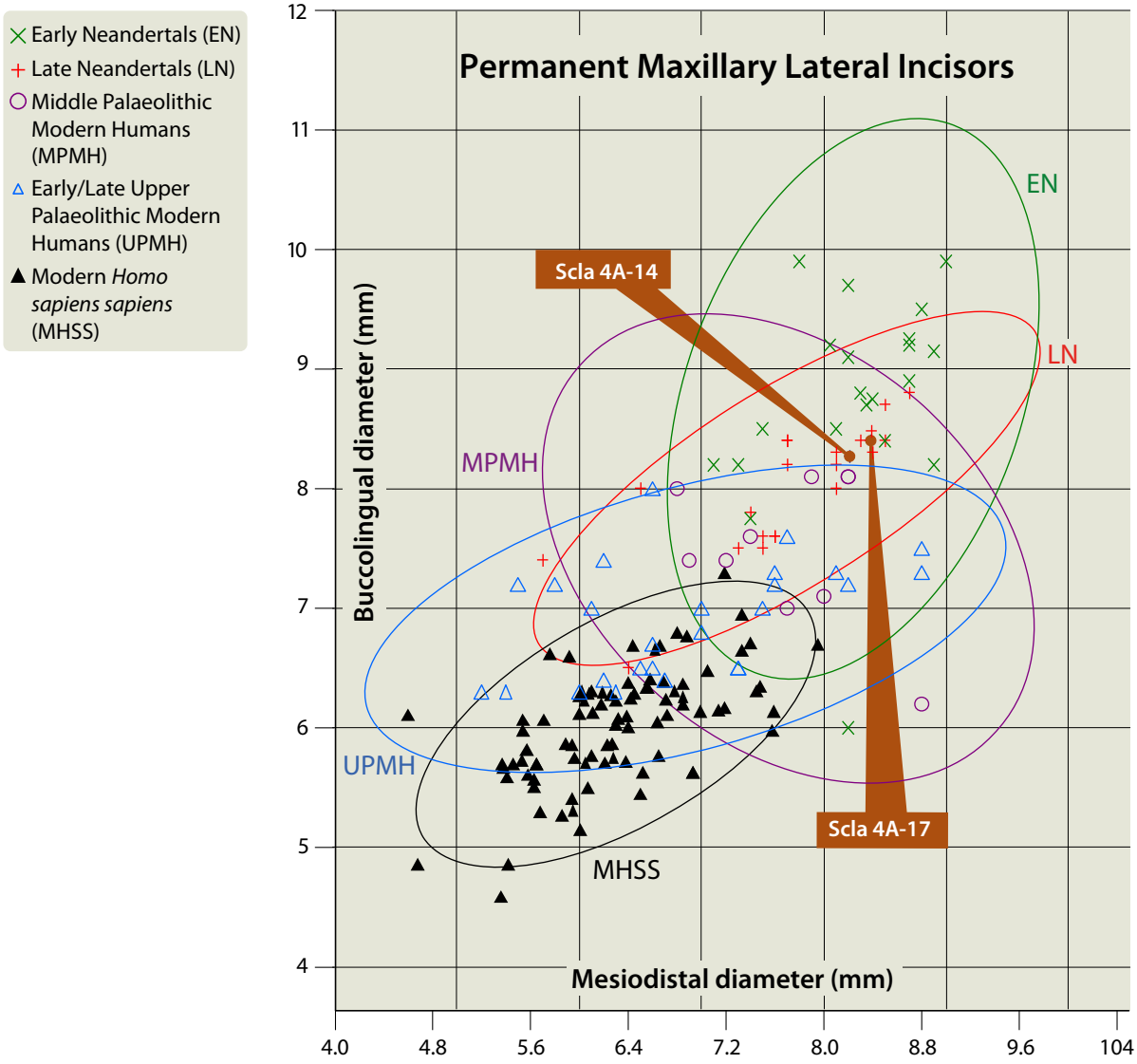


**Figure 5:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary lateral incisors with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-14 & 17.

## 3.3. Permanent mandibular right central incisor, $RI_1$

**Field identification**: Sc 1990-37-25
**Palaeoanthropological identification**: Scla 4A-15
**Date of discovery**: 22 February 1990
**Date of identification**: 14 December 2004
**Square**: H27
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: units 4A POC or 3-INF (units 4A-IP, 4A-CHE, 3-SUP)

### 3.3.1. Description (Figure 6)

This permanent mandibular right central incisor was first identified as a lateral incisor. However, the discovery in 2006 of another right mandibular incisor, Scla 4A-20, larger than Scla 4A-15, led us to realize that Scla 4A-15 was in fact a central incisor (see Table 2).

This tooth fits well in the corresponding tooth socket of the Scla 4A-1 mandibular fragment, found in Square D29, former Layer 4A, at a distance of nearly 5 m.

The crown and root of this incisor are completely formed. The crown exhibits numerous vertical cracks, but also some oblique ones. The root has some vertical cracks too. No pathological conditions have been noted.

The incisal rim of the crown exhibits minor occlusal wear which has produced a transversal occlusal narrow strip, but without dentine exposure (grade 2 of Molnar, 1971, tending towards grade 3). The incisal plane of wear slightly slants mesiodistally, as well as slightly lingually. No mamelons are still present. The tooth was clearly in functional occlusion.

Both mesial and distal marginal ridges are very weakly expressed, mainly on the upper half of the lingual surface. The lingual surface of the crown is not strongly shovel-shaped (ASUDA, grade 2). The cingulum is moderately expressed and lacking a free apex. It blends into a median ridge which is weakly developed. A weak interruption groove separates the cingulum from the distal edge of the crown.

The height of the crown is 9.2 mm on the lingual face while the total length of the tooth is 22.15 mm.

One third of the way down from the occlusal surface the labial face exhibits a moderate degree of transversal convexity, as in ASUDAS, grade 3. In mesial view, this labial face is convex in its third portion that is close the cervix, then becomes nearly flat in the direction of the incisal edge. In anterior view, the labial surface is smooth, without double-shovelling. Both lateral sides diverge from the cervix. The angle between incisal edge and mesial edge is sharp, while the angle between incisal edge and distal edge is nearly right.

The two interproximal wear facets of Scla 4A-15 are well marked. Both are vertically orientated and nearly flat.

On the mesial and distal faces, the enamel line dips inferiorly, forming a V-shape with its tip pointing towards the incisal rim. As usual, this V convexity is better marked on the mesial face than on the distal one.

The root is mesiodistally compressed, with its labial component slightly broader than the lingual one, forming an elliptical cross-section. There are wide and shallow longitudinal developmental grooves on both the mesial and distal faces. When viewed from the side, the labial root outline is slightly convex from cervix to apex. The upper two thirds of the lingual outline are vertical and the lower third is strongly convex. The apex is fully closed. In lingual and labial views, the root is gently inclined distally, except for the tip of the apex which is inclined mesially. The length of the root is 13.5 mm.

### 3.3.2. Taxonomy

Neandertal mandibular central incisors tend to be unremarkable and are therefore not very useful to establish taxonomical relationships (Bailey, 2006[a]). Indeed, they exhibit a combination of features also present in other Non-Neandertal Archaics (Bailey, 2006[a]; Bailey & Hublin, 2006): trace to moderate shovelling, median ridge moderately or strongly developed, and occasionally a cingulum shelf. In addition, the Neandertal mandibular incisor crowns, relative to the crowns of their posterior teeth, seem to be significantly larger than those of Early Modern Humans (Stefan & Trinkaus, 1998). It has also been suggested that Neandertals have significantly longer mandibular incisor roots relatively to Early Modern Europeans (Bailey, 2006[b], but see Chapter 16 for a critical discussion of this aspect).

The Scladina Scla 4A-15 first right mandibular incisor possesses the features of a Neandertal mandibular incisor.

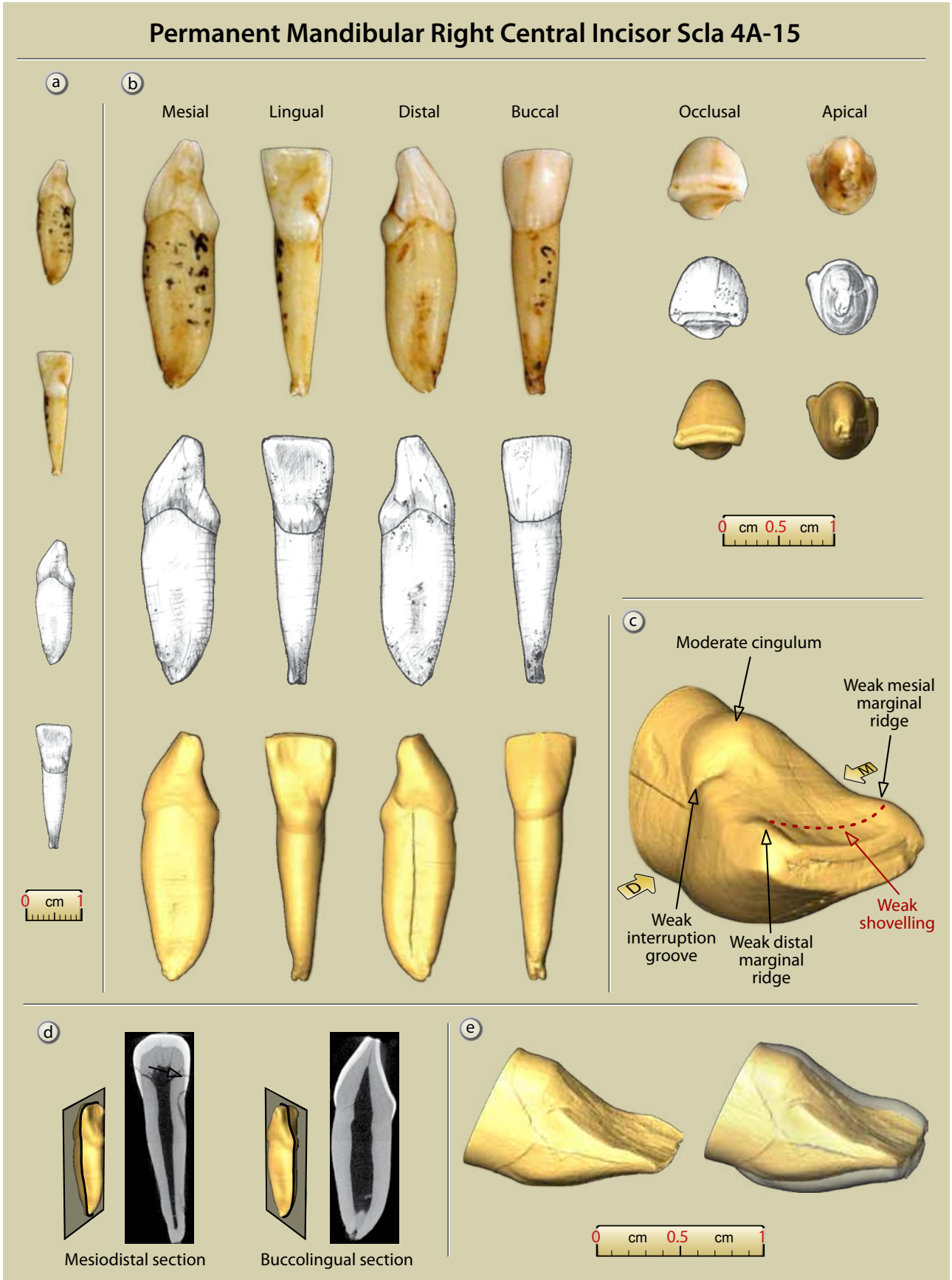


**Figure 6:** Scla 4A-15 permanent mandibular right central incisor: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the incisor (2:1 scale) c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

### 3.3.3. Morphometric analysis

Measurements of Scla 4A-15 are as follows:

**MD**: 6.27 mm
**BL**: 6.79 mm
**MD at the cervix**: 4.30 mm
**BL at the cervix**: 6.21
**Length of the tooth**: 22.08 mm

The MD diameter of Scla 4A-15 departs significantly from the average of the different comparison samples only in the case of modern humans (MHSS), both in the case of the DP probabilistic distance and ECRA. The same applies for the BL diameter (Table 7). In addition, MD and BL diameters of the crown are, in the bivariate graph of Figure 7, compared to the ellipses (95%) of Early and Late Neandertals as well as of UPMH

| Scladina | Diameter | Value |
|---|---|---|
| $RI_1$ (Scla 4A-15) | MD | 6.27 |
| | BL | 6.79 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 16 | MD | 5.759 | 0.446 | 0.270 | 0.537 |
| | 16 | BL | 7.619 | 0.405 | 0.059 | −0.960 |
| LN right & left | 23 | MD | 5.500 | 0.462 | 0.110 | 0.804 |
| | 25 | BL | 7.112 | 0.406 | 0.436 | −0.384 |
| MPMH right & left | 6 | MD | 5.717 | 0.941 | 0.582 | 0.229 |
| | 9 | BL | 6.878 | 0.429 | 0.843 | −0.089 |
| UPMH right & left | 27 | MD | 4.997 | 0.916 | 0.176 | 0.676 |
| | 28 | BL | 6.216 | 0.482 | 0.244 | 0.581 |
| MHSS right & left | 94 | MD | 5.058 | 0.392 | **0.003** | **1.556** |
| | 94 | BL | 5.712 | 0.372 | **0.005** | **1.460** |

**Table 7:** Scla 4A-15 (permanent mandibular right central incisor): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

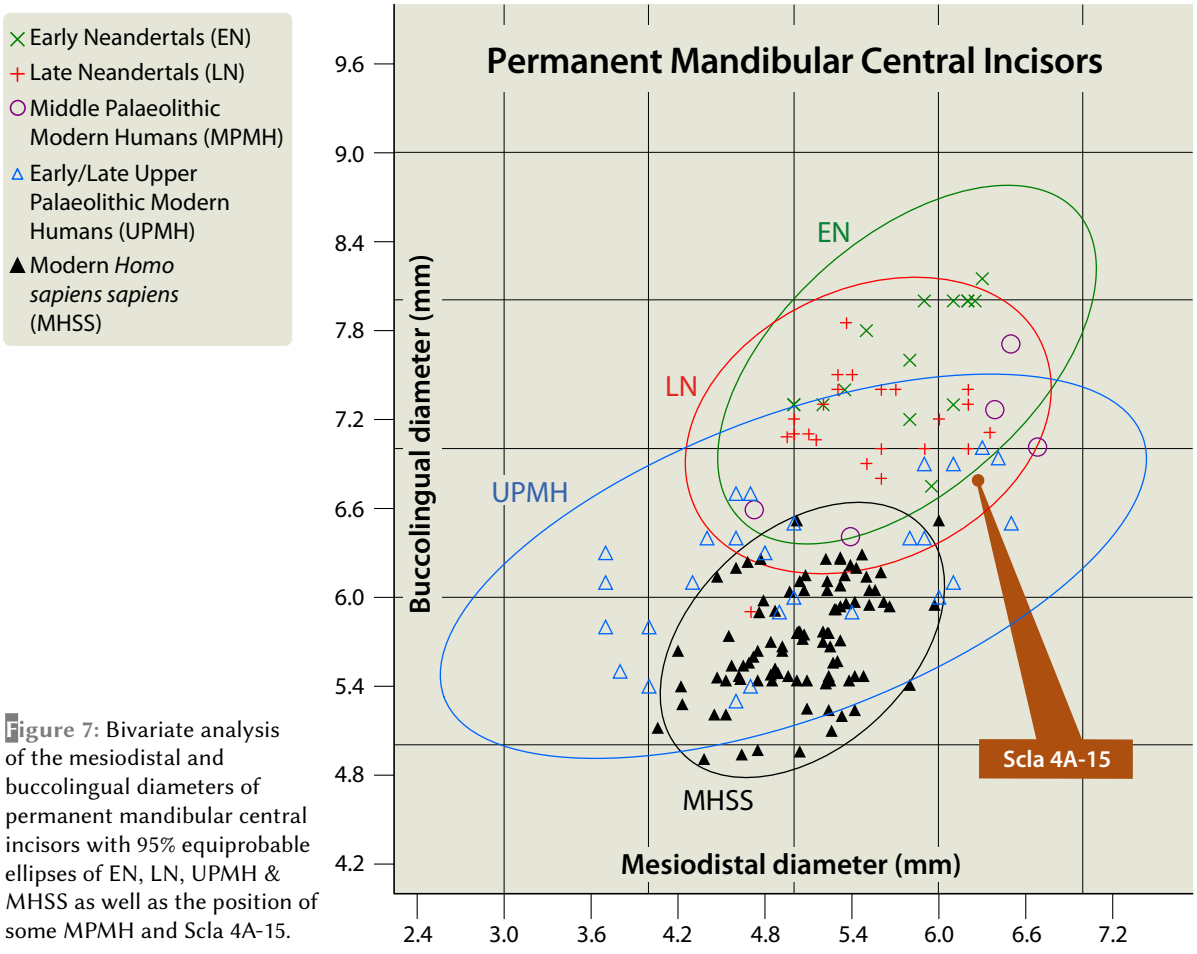


**Figure 7:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular central incisors with 95% equiprobable ellipses of EN, LN, UPMH & MHSS as well as the position of some MPMH and Scla 4A-15.

and MHSS. Scla 4A-15 is situated in the area where EN, LN and UPMH ellipses (95%) overlap, however close the upper limit of the MD diameter. Scla 4A-15 is clearly outside the 95% ellipse of modern humans. As for the permanent maxillary incisors, this indicates that the dimensions of the crown of the mandibular central incisor do not always provide many clear taxonomic indications as far as fossil taxa are concerned.

## 3.4. Permanent mandibular lateral incisors, $I_2$

### 3.4.1. Description

*Permanent mandibular right lateral incisor, $RI_2$ (Figure 8)*

**Palaeoanthropological identification**: Scla 4A-20
**Field identification**: Sc 2006-81-1
**Date of discovery**: 12 July 2006
**Date of identification**: 12 July 2006
**Square**: F35-F37
**Stratigraphic position**:
— **Former stratigraphy**: unknown (collapse of a sedimentary profile)
— **New stratigraphy**: units 4A-POC or 3-INF (Unit 3-SUP)

This permanent tooth was found isolated in collapsed sediments after a section fell down during the night of 26–27 April 2006 in squares F35 to F37. Only later, on July 12, during the sieving of these sediments, the tooth was recognized as human and identified. According to the morphology of the area of collapse, where badger dens cross-cut portions of the cave's sediment, it seems that it comes from the Sedimentary Complex 4A, possibly Unit 4A-POC (or maybe 3-INF; see Chapter 5 for more details).

This mandibular lateral incisor fits relatively well in the corresponding tooth socket of the Scla 4A-1 mandibular fragment, found in Square D29, former Layer 4A, at a distance between 6 and 9 m.

The crown is completely formed and fully occluded. The root apex was broken postmortem. The crown exhibits numerous vertical cracks, but also some oblique ones. No pathological conditions have been noted.

The incisal rim of the crown exhibits minor occlusal wear which has produced a transversal, occlusal, narrow strip, without dentine exposure (grade 2, according to Molnar, 1971). No mamelons are present. The tooth was in functional occlusion.

Both mesial and distal marginal ridges are moderately expressed, mainly on the upper half of the lingual face. There are traces of shovelling, as in ASUDAS UI1, grade 2. The cingulum is more developed than that of the I1 Scla 4A-15. It lacks a free apex, but blends into the central ridge which is weakly developed.

The height of the tubercle is 3.95 mm from the cervix, while the height of the crown is 9.20 mm on the lingual face.

At one third of the way down from the occlusal surface, the labial face is moderately and mesiodistally convex, as in ASUDAS, grade 3. In mesial view, this face also exhibits an irregular superior-inferior convexity, from the incisal edge to the cervical line. In anterior view, the labial surface is smooth, without double shovelling. Both lateral sides asymmetrically diverge from the cervix. The angle between incisal edge and mesial edge is sharp, while the angle between incisal edge and distal edge is much more rounded.

Interproximal wear facets for the adjacent teeth are present. Both are vertically elongated and nearly flat.

On the mesial and distal faces, the crown-root junction line is V-shaped with its tip pointing towards the incisal rim. This V-convexity is better marked on the mesial face.

The lingual length of the root is about 13.9 mm in its actual state of preservation, but as it is broken, a few millimetres has to be added to obtain the original length which was obviously over 15.0 mm (15.23 in Table 2a of Chapter 16). The root is mesiodistally compressed, with its labial component slightly broader than the lingual one. There are wide and shallow longitudinal developmental grooves on both mesial and distal faces. When viewed from the side, the anterior root outline is slightly convex from cervix to apex.

*Permanent mandibular left lateral incisor, $LI_2$ (Figure 9)*

**Palaeoanthropological identification**: Scla 4A-19 (= Scla 3-4)
**Field identification**: Sc 1995-108-197-1
**Date of discovery**: 08 March 1995
**Date of identification**: 10 April 1995
**Square**: D34
**Stratigraphic position**:
— **Former stratigraphy**: 3, then 4A
— **New stratigraphy**: units 4A-POC or 3-INF (Unit 3-SUP)

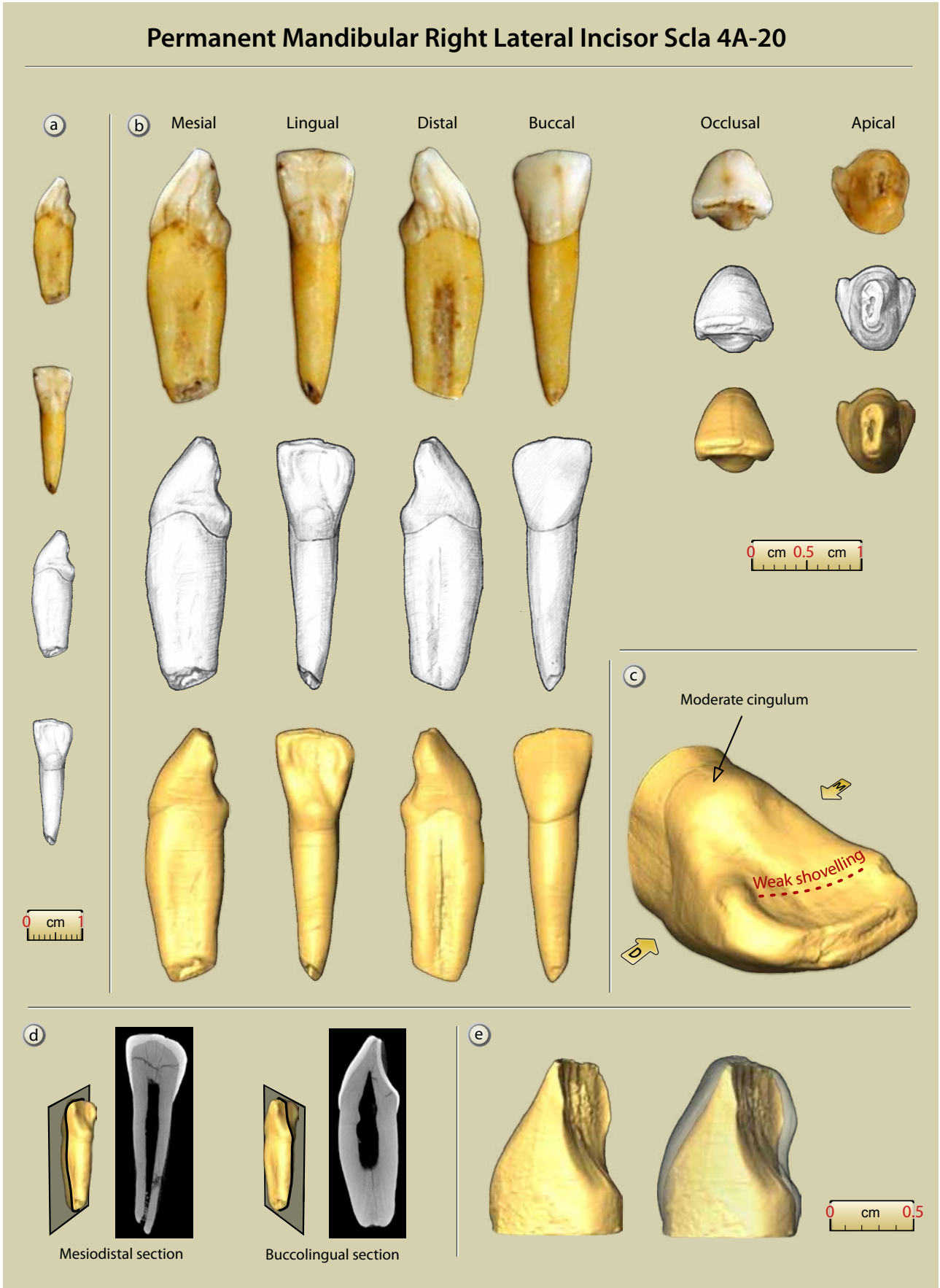


**Figure 8:** Scla 4A-20 permanent mandibular right lateral incisor: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the incisor (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

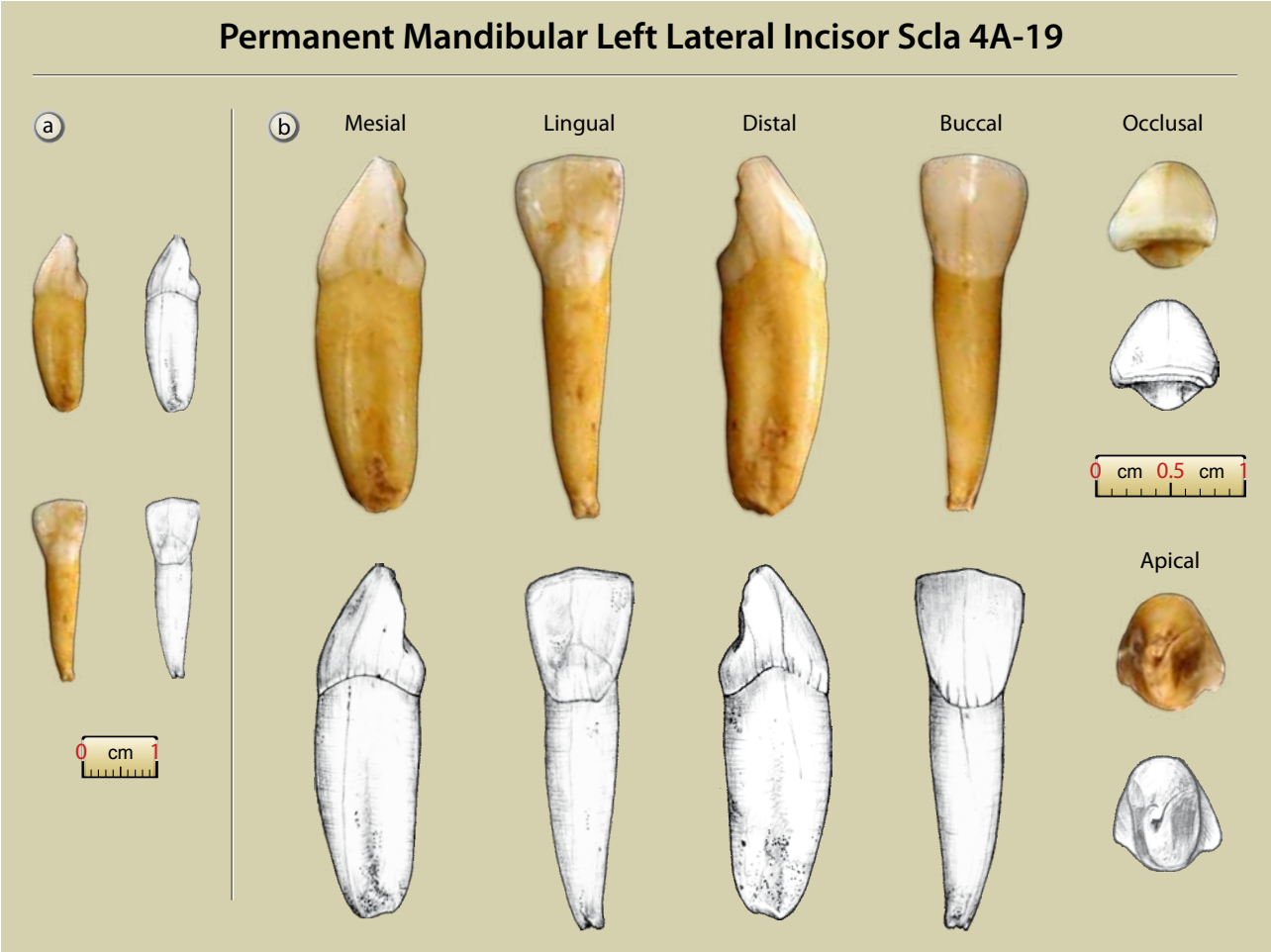


**Figure 9:** Scla 4A-19 permanent mandibular left lateral incisor: a. mesial and lingual views (1:1 scale); b. photographs and drawings of the six faces of the tooth (2:1 scale) (pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

This incisor fits relatively well in the corresponding tooth socket of the Scla 4A-9 mandibular fragment, found in Square C28, at a distance of over 6 m.

The crown is completely formed and fully occluded. The root apex is slightly damaged. The crown and root exhibit some cracks, mainly vertical. No pathological conditions have been noted.

The incisal rim of the crown exhibits minor occlusal wear which produced a transversal narrow strip, with very little dentine exposure (grade 2, according to Molnar, 1971). No mamelons are present. The tooth was in functional occlusion.

Both mesial and distal marginal ridges are moderately expressed and mainly on the upper half of the lingual face. There are small traces of shovelling, slightly less than in Scla 4A-20 (ASUDAS UI1, grade 1). The cingulum lacks a free apex, but blends into the central ridge which is weakly developed.

The height of the tubercle is 4.1 mm from the cervix, while the height of the crown is 9.03 mm on the lingual face.

One third of the way down from the occlusal surface the labial face is moderately and mesio-distally convex, as in ASUDAS, grade 3. In mesial view, this face also exhibits an irregular superior-inferior convexity, from the incisal edge to the cervical line. In anterior view, the labial surface is smooth, without double shovelling. Both lateral sides asymmetrically diverge from the cervix. The angle between the incisal and mesial edges is sharp, while the angle between the incisal and distal edges is nearly right but rounded.

An interproximal wear facet for the adjacent left central incisor is present. It is vertically elongated and nearly flat.

On the mesial and distal faces the crown-root junction line is V-shaped with its tip pointing towards the incisal rim. This V-convexity is better marked on the mesial face.

The lingual length of the root is about 15.0 mm. The root is mesiodistally compressed with its labial component slightly broader than the lingual one. There are wide and shallow longitudinal developmental grooves on both the mesial and distal faces. When viewed from the side, the anterior root outline is slightly convex from the cervix to the apex.

### 3.4.2.Taxonomy

Neandertal mandibular lateral incisors, like the central ones, are not very useful to establish taxonomical relationships (Bailey, 2006[a]). They exhibit a combination of features also present in other Non-Neandertal Archaics (Bailey, 2006[a] ; Bailey & Hublin, 2006): trace to moderate shovelling, median ridge moderately or strongly developed, and occasionally a cingulum shelf. They also appear to be distinctive in their relative size, being significantly larger relatively to the posterior teeth than those of Early Modern Humans.

The two Scladina second mandibular incisors exhibit these features.

### 3.4.3. Morphometric analysis

Measurements of the permanent mandibular lateral incisors are as follows:

**Scla 4A-20, $RI_2$**

**MD**: 7.03 mm
**BL**: 7.28 mm
**MD at the cervix**: 4.50 mm
**BL at the cervix**: 6.79 mm
**Length of the tooth in its actual state of preservation**: 22.63 mm

**Scla 4A-19, $LI_2$**

**MD**: 7.20 mm
**BL**: 7.35 mm
**MD at the cervix**: 4.67 mm
**BL at the cervix**: 6.89 mm
**Length of the tooth**: 23.72 mm

The MD and BL diameters of Scla 4A-19 and 4A-20 only depart significantly from the average of the different comparison samples in the case of modern humans, both in the case of the DP probabilistic distance and ECRA (Table 8). In addition, the MD and BL diameters of the two crowns are, in Figure 10, compared to the ellipses (95%) of Early and Late Neandertals as well as of MPMH, UPMH and MHSS. Both Scla 4A-19 & 20 are situated in the area where EN, LN, MPMH and UPMH ellipses (95%) overlap. They are outside the 95% ellipse of modern humans. As for the other permanent maxillary and mandibular incisors, this indicates that the dimensions of the crown of the permanent mandibular lateral incisor provide only limited taxonomic indications.

## 3.5. Permanent maxillary canines, C'

### 3.5.1. Description

*Permanent maxillary right canine, RC' (Figure 11)*

**Palaeoanthropological identification**: Scla 4A-16
**Field identification**: Sc 1990-49-1
**Date of discovery**: 23 February 1990
**Date of identification**: 16 December 2004
**Square**: H27
**Stratigraphic position**:
— **Former stratigraphy**: 4A

| Scladina | N | Diameter | Value |
|---|---|---|---|
| $I_2$ | Scla 4A-19 | MD | 7.2 |
| | | BL | 7.35 |
| | Scla 4A-20 | MD | 7.03 |
| | | BL | 7.28 |

| | | | | | vs Scla 4A-19 | | vs Scla 4A-20 | |
|---|---|---|---|---|---|---|---|---|
| **Comparison Samples** | **N** | **Diameter** | **Mean** | **Stand. Dev.** | **DP** | **ECRA** | **DP** | **ECRA** |
| **EN right & left** | 21 | MD | 6.702 | 0.572 | 0.394 | 0.417 | 0.573 | 0.275 |
| | 21 | BL | 7.986 | 0.472 | 0.193 | –0.646 | 0.150 | –0.717 |
| **LN right & left** | 28 | MD | 6.454 | 0.485 | 0.136 | 0.749 | 0.246 | 0.578 |
| | 34 | BL | 7.705 | 0.527 | 0.505 | –0.331 | 0.426 | –0.396 |
| **MPMH right & left** | 12 | MD | 6.617 | 0.598 | 0.350 | 0.443 | 0.504 | 0.314 |
| | 10 | BL | 7.400 | 0.693 | 0.944 | –0.032 | 0.866 | –0.077 |
| **UPMH right & left** | 29 | MD | 5.956 | 0.813 | 0.137 | 0.747 | 0.197 | 0.645 |
| | 31 | BL | 6.799 | 0.491 | 0.271 | 0.549 | 0.335 | 0.480 |
| **MHSS right & left** | 102 | MD | 5.692 | 0.425 | **0.001** | **1.790** | **0.002** | **1.588** |
| | 102 | BL | 6.113 | 0.385 | **0.002** | **1.618** | **0.003** | **1.526** |

**Table 8**: Scla 4A-19 & 20 (permanent mandibular left and right lateral incisors): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

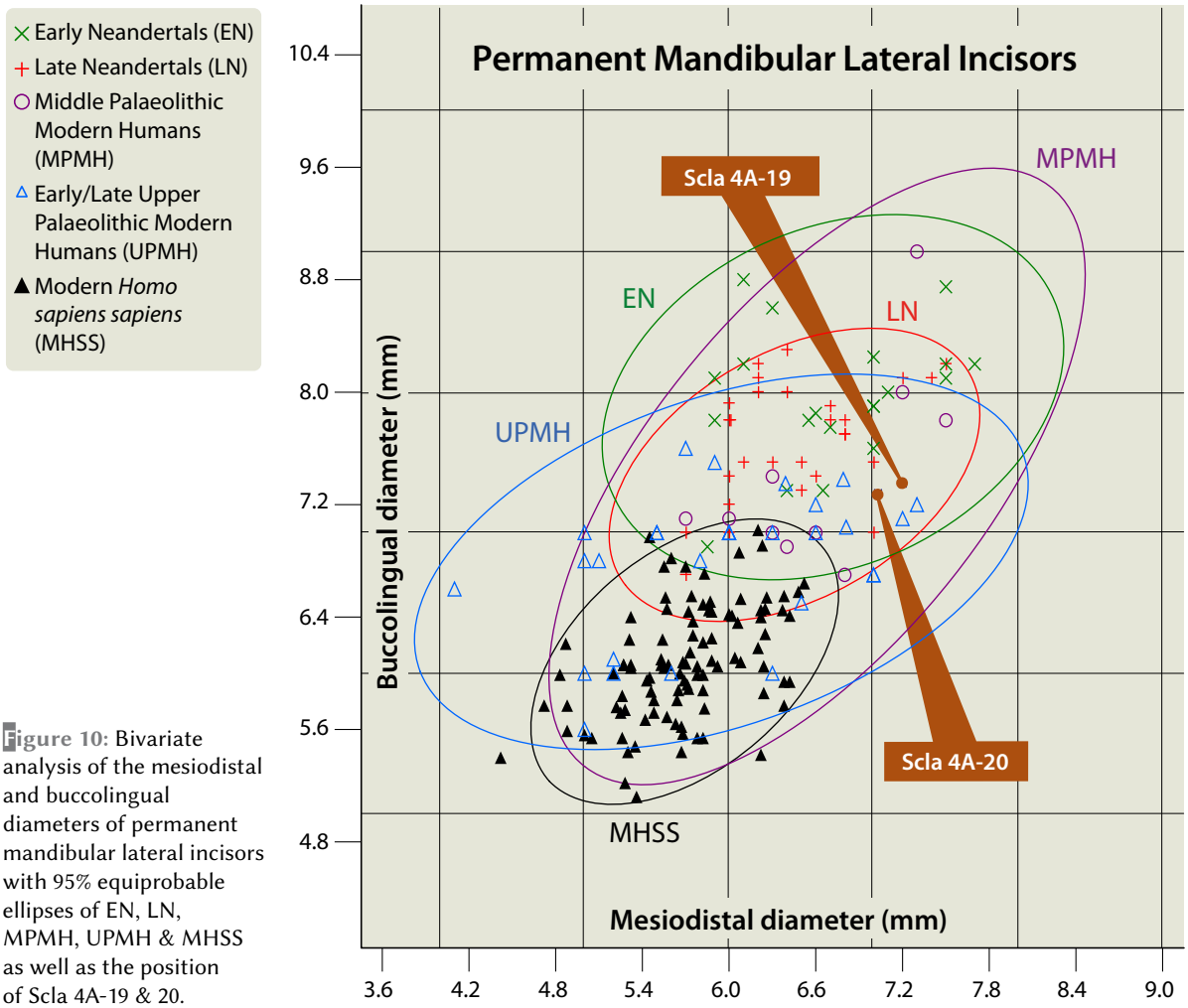


**Figure 10:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular lateral incisors with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-19 & 20.

— **New stratigraphy**: Unit 4A-POC (units 4A-IP, 4A-CHE, 3-INF)

The tooth is in good condition. The tip of the apex is slightly open (1.9 × 1.2 mm), so the root is not fully formed. As usual with Scladina teeth, this fossil exhibits cracks on the crown, mainly vertical ones. It fits well in the corresponding socket of the Scla 4A-2 right maxilla, found in Square D30, former Layer 4A, at a distance over 4 m. No pathological conditions have been noted.

The incisal edge and its main cusp are mostly unworn, with a very superficial and small wear facet on its tip (Molnar, 1971, stage 2, but very close to 1).

On the buccal surface, some very weak double shovelling can be seen in contrasting light, especially on the distal side of the crown (grade 1 of ASUDAS). Occlusally viewed, the labial face is, mesiodistally, strongly convex, more than in ASUDAS UI1, grade 4. When viewed from the mesial and distal sides this face also exhibits an irregular superoinferior convexity, from the cervical line to the incisal edge, though the convexity is much stronger near the cervix, as is also the case for the permanent maxillary incisors.

In buccal and lingual views, the crown is asymmetrical; it is divergent in its cervical half; in its lower half, the mesial part of the incisal edge is rounded while the distal edge is mesially oblique but nearly straight.

The mesial and distal marginal ridges are well expressed. Therefore, traces of shovelling are clear (grade 2 of ASUDAS). The canine mesial ridge does not form a Bushmen canine.

There is a quite prominent lingual tubercle (*tuberculum dentale*). In its lower half, it is divided into two parts by a vertical groove. The mesial part forms a separate cusplet with a small but distinct free apex (smaller but close to DAR UC grade 5). The distal part goes down to the lingual surface, forming a *tuberculum* extension (medial ridge).

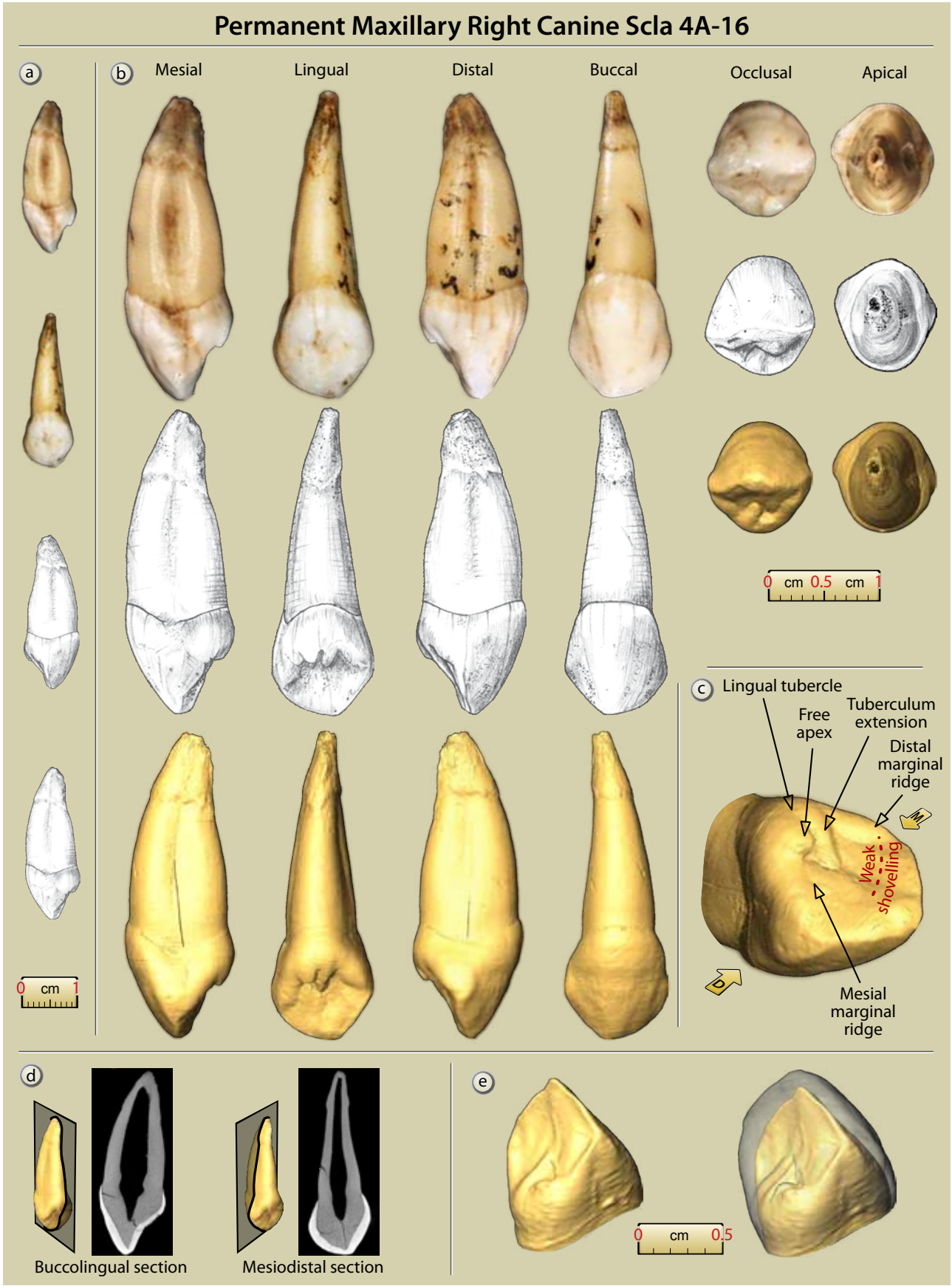


Figure 11: Scla 4A-16 permanent maxillary right canine: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

On both sides, the lingual tubercle is distinct from the marginal ridges but without marked grooves.

No distal accessory ridge is present.

On the mesial and distal faces, the enamel line dips inferiorly, forming a rounded V-shape with its tip in the direction of the incisal rim; the incisal curve of the cervical margin is deeper on the mesial face than on the distal one.

There is a rounded interproximal wear facet for the adjacent permanent maxillary lateral incisor that is extremely faint and small, but no distal interproximal wear facet.

The root is mesiodistally compressed and ovoid in its transverse section, and broader labially. It has well marked mesial and distal longitudinal grooves. There is a rough thickening of the apical part of the root surface. In mesial or distal view, the anterior border of the root is convex, as is also the crown; so, the profile of the tooth, crown and root included, is generally convex. The length of the root, measured from the lingual aspect, is 17.1 mm. As the tip of the apex is not completely formed, at least 0.5 mm should be added in order to obtain the fully developed root length.

*Permanent maxillary left canine, LC' (Figure 12)*

**Palaeoanthropological identification**: Scla 4A-18 (Scla 3.3)
**Field identification**: Sc 1991-590-1
**Date of discovery**: 19 November 1991
**Date of identification**: October 1993
**Square**: F26
**Stratigraphic position**:
- **Former stratigraphy**: 3, then 4A
- **New stratigraphy**: Unit 4A-POC (units 4A-IP, 4A-CHE, 3-INF)

The tooth is in good condition. The tip of the apex is still slightly open (2 × 1.4 mm), so the root is not fully formed. The fossil exhibits cracks on the crown and root, in particular, a strong vertical one on the buccal side, but also oblique and subhorizontal ones. No pathological conditions have been noted.

The morphology of this permanent maxillary left canine is quite similar to that of its antimere, Scla 4A-16.

The incisal edge and its central cusp are mostly unworn. In contrasting light, some very weak double shovelling can be seen on the distal side of the crown (grade 1 of ASUDAS).

The labial face is mesiodistally (over ASUDAS UI1, grade 4) and superoinferiorly (mainly near the cervix) strongly convex.

In buccal and lingual views, the outline of the crown is slightly narrower than that of its antimere and even looks slightly more asymmetrical; it is divergent in its upper half while in its lower half, the mesial part of the incisal edge is more rounded. The mesial and distal marginal ridges are well expressed, with clear traces of shovelling (grade 2 of ASUDAS). The lingual tubercle, divided in two in its lower part, exhibits a separate cusplet in its mesial part (Dar UC grade 4–5) while its distal part goes down to the lingual surface, forming a *tuberculum* extension (medial ridge).

No distal accessory ridge is present. There are no interproximal wear facets for the adjacent teeth.

As its antimere, the root is mesiodistally compressed and ovoid in its transverse section, and broader labially. It has well marked mesial and distal longitudinal grooves. There is also a rough thickening of the apical part of the root surface. In mesial or distal view, the anterior border of the root is convex, as is also the crown; so, the profile of the tooth, crown and root included, is generally convex. The length of the root, measured from the lingual aspect, is 17.5 mm. As the tip of the apex is not completely formed, at least 0.5 mm should be added in order to estimate the fully developed root length.

### 3.5.2. Taxonomy

Neandertal permanent maxillary canines are usually quite robust. They tend to reflect the lingual morphology of the permanent maxillary incisors, especially in the lingual surface of the crown (Bailey, 2006[a]). Their main features are (Table 9):

- moderate to strong convexity in both mesiodistal and inferosuperior directions;
- trace of shovelling (at least grade 2 of ASUDAS) or semi shovelling (grade 3) are extremely frequent (96%);
- high frequency (84%) of lingual tubercle, sometimes strongly developed;
- moderately high frequency (two thirds) of distal accessory ridge;
- presence of Bushmen canine (43%);
- a third of the permanent maxillary canines exhibit double shovelling, but only weakly (grade 1).

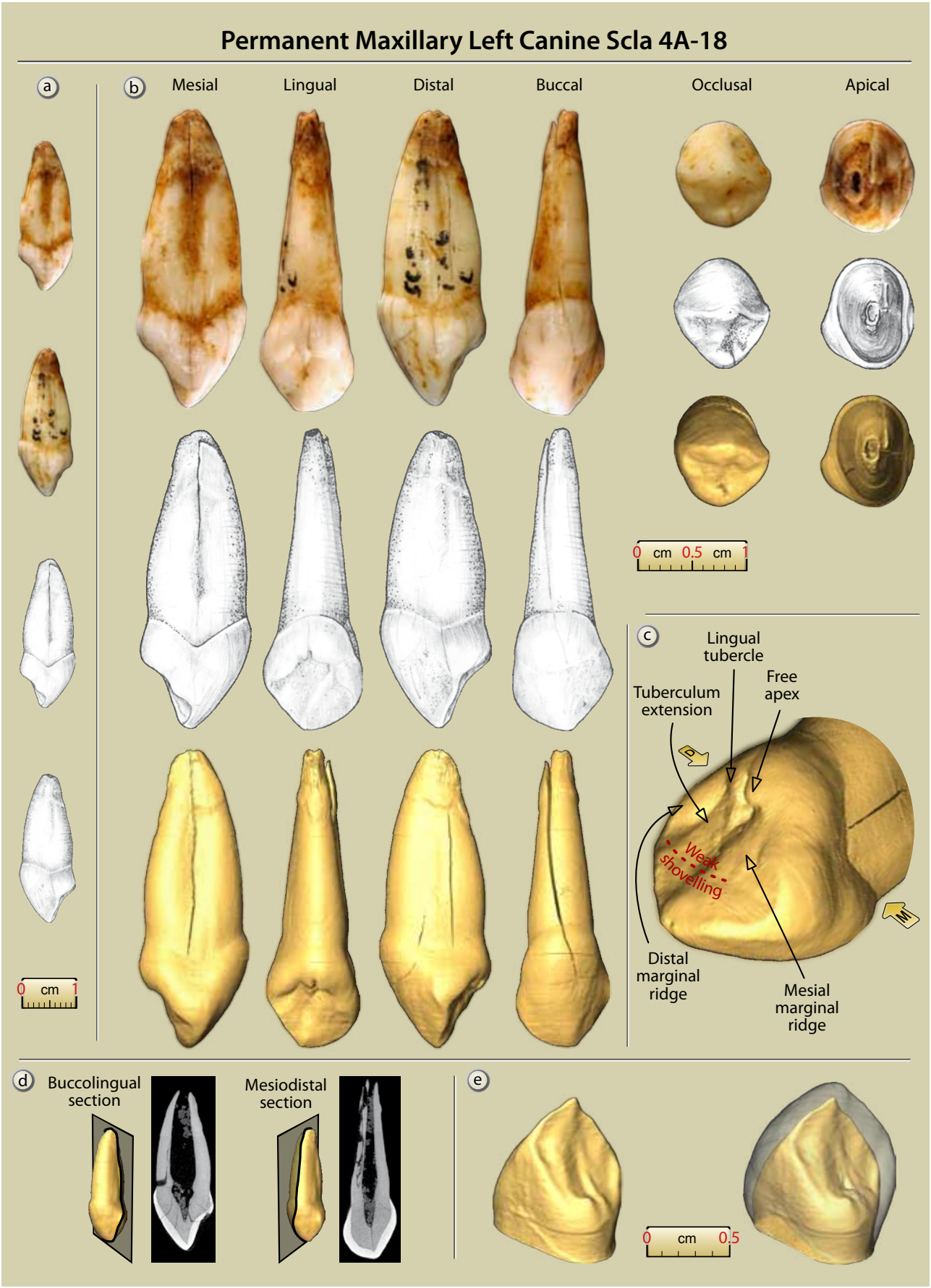


**Figure 12:** Scla 4A-18 permanent maxillary left canine: a. mesial and distal views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Permanent Maxillary Canines | Modality | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-16 | Scla 4A-18 |
|---|---|---|---|---|---|---|---|
| Lingual marginal ridges/shovelling | presence (grade 2 or above) | 100% | 95.8% | 100% | 50% | yes | yes |
| | expression | | 42% (grade 3 or above) | max grade 2 | max grade 2 | grade 2 | grade 2 |
| Double shovelling | presence | 0% | 0–33.0% | 12.5% | 12.5% | yes | yes |
| | expression | | grade 1 | grade 1 | (grade 1) | grade 1 | grade 1 |
| Lingual tubercles(s) | presence | 100% | 84% | 20% | 50% | yes | yes |
| | strong expression (tubercle form > grade 4) | | 32% | relatively weak | relatively weak | grade 5 | grade 4–5 |
| Canine mesial ridge (Bushman canine) | presence | — | 42.9% | 0% | 14.3% | no | no |
| Distal accessory ridge | presence | — | 66.7% | 100% | 100% | no | no |
| | large expression (> grade 3) | | 20% | 50% | 50% | | |

**Table 9:** Distinctive anatomical features on permanent maxillary canines of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-16 & 18.

Both maxillary canines from Scladina exhibit most of these features: convexity in both inferosuperior and mesiodistal directions, trace of shovelling, weak double shovelling and developed lingual tubercle. Conversely, neither distal accessory ridge nor Bushmen canine are present.

### 3.5.3. Morphometric analysis

Measurements of the permanent maxillary canines are as follows:

**Scla 4A-16, RC'**

**MD**: 9.05 mm
**BL**: 9.65 mm
**MD at the cervix**: 6.16 mm
**BL at the cervix**: 8.67 mm
**Length of the tooth**: 27.31 mm

**Scla 4A-18, LC'**

**MD**: 8.60 mm
**BL**: 9.95 mm
**MD at the cervix**: 6.10 mm
**BL at the cervix**: 9.02 mm
**Length of the tooth**: 27.30 mm

The MD and BL diameters of Scla 4A-16 and 18 depart significantly from the average of the recent humans (MHSS), both in regard to the DP probabilistic distance and ECRA. Also, the MD diameter of Scla 4A-16 departs significantly from the average of the UPMH comparative sample (Table 10). The MD and BL diameters of the Scla 4A-16 and 18 permanent maxillary canine crowns are, in Figure 13, compared to the ellipses (95%) of Early and Late Neandertals as well as of MPMH, UPMH, and MHSS. Both Scla 4A-16 and 18 are situated in

| Scladina | N | Diameter | Value |
|---|---|---|---|
| C' | Scla 4A-16 | MD | 9.05 |
| | | BL | 9.65 |
| | Scla 4A-18 | MD | 8.6 |
| | | BL | 9.95 |

| | | | | | vs Scla 4A-16 | | vs Scla 4A-18 | |
|---|---|---|---|---|---|---|---|---|
| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA | DP | ECRA |
| EN right & left | 22 | MD | 8.716 | 0.870 | 0.705 | 0.185 | 0.895 | –0.064 |
| | 24 | BL | 10.035 | 0.743 | 0.609 | –0.251 | 0.909 | –0.056 |
| LN right & left | 24 | MD | 8.169 | 0.713 | 0.229 | 0.597 | 0.552 | 0.292 |
| | 29 | BL | 9.551 | 0.729 | 0.893 | 0.066 | 0.588 | 0.267 |
| MPMH right & left | 14 | MD | 8.643 | 0.573 | 0.490 | 0.329 | 0.942 | –0.035 |
| | 13 | BL | 9.315 | 0.749 | 0.663 | 0.205 | 0.414 | 0.389 |
| UPMH right & left | 36 | MD | 7.886 | 0.457 | **0.016** | **1.253** | 0.128 | 0.769 |
| | 33 | BL | 8.827 | 0.822 | 0.324 | 0.492 | 0.181 | 0.671 |
| MHSS right & left | 91 | MD | 7.299 | 0.468 | **0.000** | **1.882** | **0.007** | **1.399** |
| | 92 | BL | 7.898 | 0.637 | **0.007** | **1.385** | **0.002** | **1.622** |

**Table 10:** Scla 4A-16 & 18 (permanent maxillary canines): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

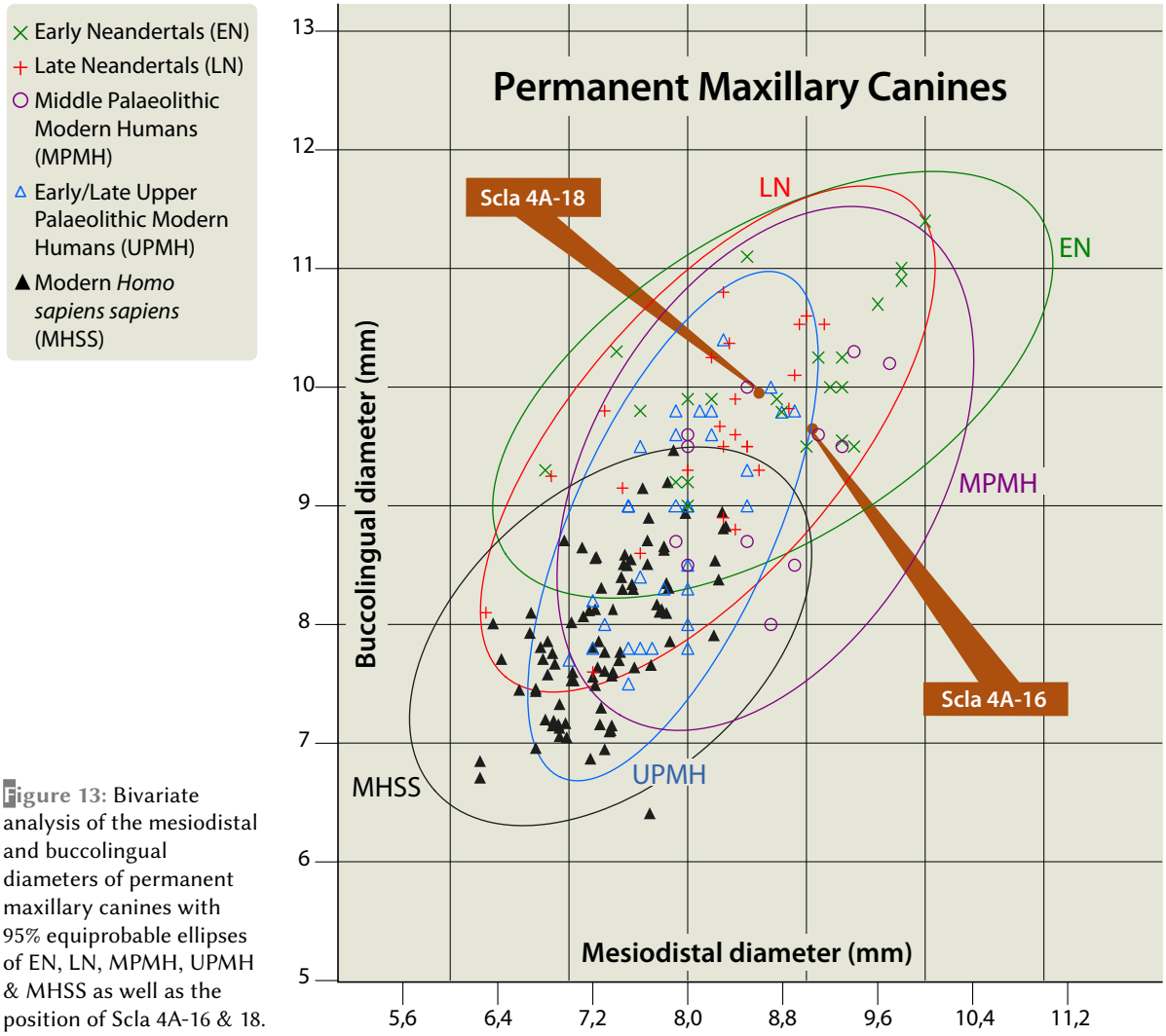


**Figure 13:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary canines with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-16 & 18.

the area where EN, LN, MPMH and UPMH ellipses overlap. They are outside the ellipse of modern humans. Like for most other permanent anterior teeth, this indicates that the dimensions of the permanent maxillary canine crowns often allow to separate fossils from MHSS but do not provide clear taxonomic indications within fossil taxa.

## 3.6. Permanent mandibular right canine, RC,

**Palaeoanthropological identification**: Scla 4A-12
**Field identification**: Sc 1990-90-1
**Date of discovery**: 28 March 1990
**Date of identification**: July 2001
**Square**: F27
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: units 4A-POC or 3-INF (units 4A-IP, 4A-CHE, 3-SUP)

### 3.6.1. Description (Figure 14)

The specimen is very well preserved. The root is complete with the tip of the apex still very slightly open (1.1 mm). It exhibits some cracks on the crown and root, mainly vertical ones. No pathological conditions have been noted. It fits well in the corresponding socket divided between Scla 4A-1 (right part of the mandible) and Scla 4A-9 (left part). Scla 4A-1 was found in Square D29 at a distance of over 2 m from the tooth, and Scla 4A-9 was found in Square C28, at a distance over 2 m.

The central cusp and the incisal edge are slightly worn. There is a very small wear facet present on the tip and a transversely elongated but narrow wear facet on the mesial part of the incisal edge (Molnar, 1971, stage 2).

When viewed from the occlusal aspect, the buccal face is mesiodistally strongly convex (over ASUDAS, grade 4). When viewed from the mesial and distal sides, that face also exhibits a

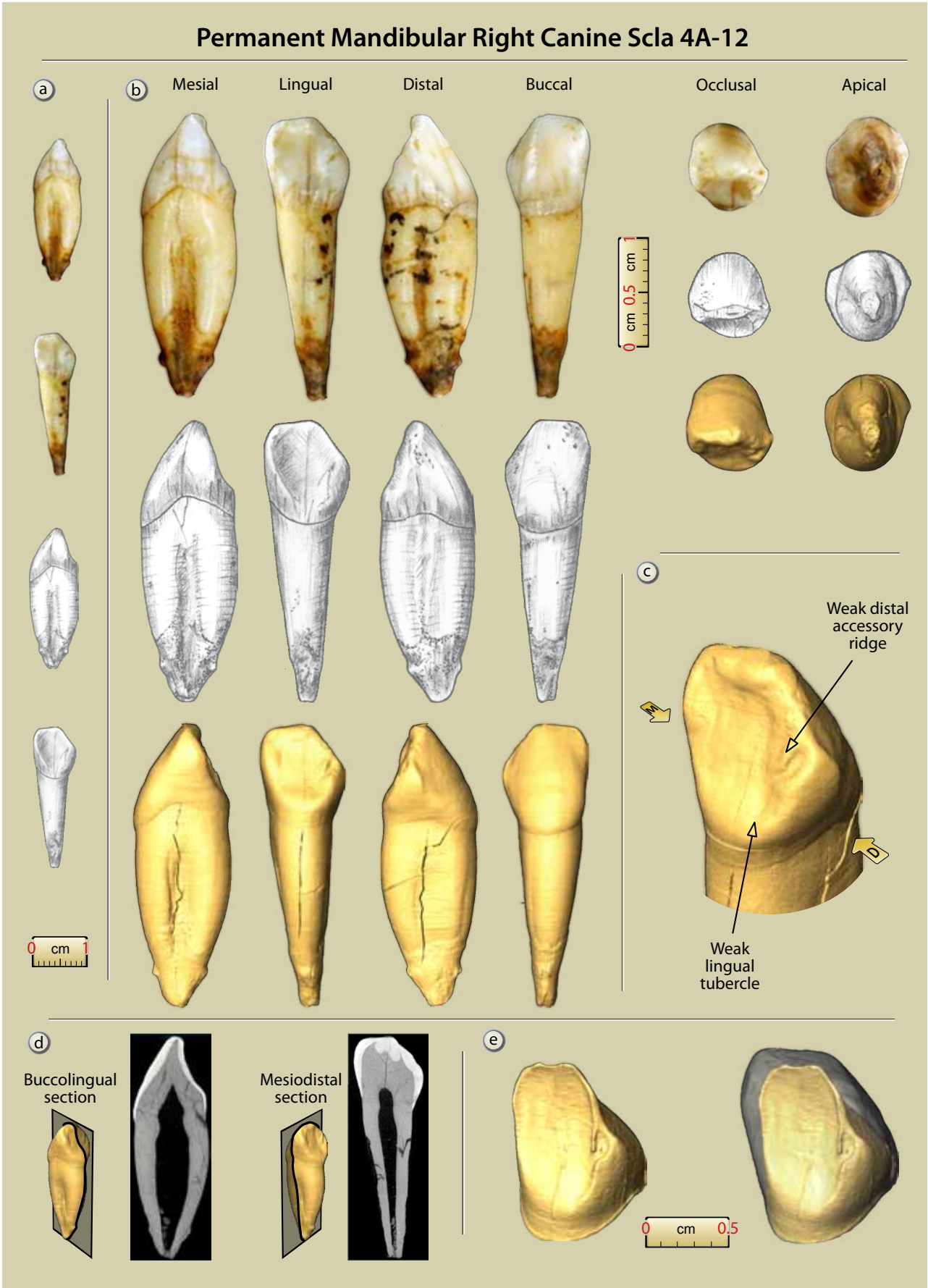


Figure 14: Scla 4A-12 permanent mandibular right canine: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

slight irregular superoinferior convexity, from the cervical line to the incisal edge, with a stronger convexity near the cervix.

In lingual view, the crown is asymmetrical: the mesial half of the incisal edge is nearly horizontal, like in incisors, while its lateral part is running down distally.

The distal marginal ridge is slightly expressed, and the mesial one even less. There is no clear shovelling (grade 1 of ASUDAS). A faint distal accessory ridge is present (DAR LC grade 1–2).

The lingual tubercle is very weak, much less marked than in the permanent maxillary canine. It has no separate cusplet.

The rounded V-shape of the incisal rim is deeper on the mesial face than on the distal one.

A flat interproximal wear facet for the second right mandibular incisor is present. It is roughly rounded.

The root is mesiodistally compressed and has well marked mesial, and to a lesser extent, distal, longitudinal grooves. Its section is elliptical. In proximal view, the anterior border of the root is convex, but less so than on the permanent maxillary canines. There is a slight thickening on the apical part of the root.

The length of the root, measured from the lingual aspect, is 16.5 mm.

### 3.6.2. Taxonomy

Like the permanent mandibular incisors, the permanent mandibular canines are not really useful indicators of taxonomic and biological distance. Neandertal permanent mandibular canines tend to reflect the permanent maxillary canines morphology (Bailey, 2006[a]). They are, however, less robust. The frequency of the distal accessory ridge is 50% in Non-Neandertal Archaics, nearly 85% in Neandertals, 100% in Early Modern Afro-Asians and 28.6% in Early Modern Europeans. The Scla 4A-12 permanent mandibular canine exhibits a very faint distal accessory ridge.

### 3.6.3. Morphometric analysis

Measurements of the permanent mandibular right canine are as follows:

**MD**: 7.80 mm
**BL**: 8.75 mm
**MD at cervix**: 5.60 mm
**BL at cervix**: 8.46
**Length of the tooth**: 25.89 mm

The MD and BL diameters of Scla 4A-12 depart significantly only from the average of the recent humans (MHSS) comparison sample, in regard to both the DP probabilistic distance and ECRA. (Table 11). The MD and BL diameters of the Scla 4A-12 crown are, in Figure 15, compared to the ellipses (95%) of Early and Late Neandertals as well as of UPMH and MHSS. Scla 4A-12 is situated in the area where EN, LN and UPMH ellipses overlap. The fossil is outside the 95% ellipse of modern humans. Like for most other permanent anterior teeth, this indicates that the dimensions of the permanent mandibular canines often allow to separate fossils from MHSS but do not provide clear taxonomic indications within fossil taxa.

## 3.7. Maxillary right second premolar, RP$^4$

**Palaeoanthropological identification**: Scla 4A-2/P$^4$
**Field identification**: Sc 1992-1283-96-1

| Scladina | Diameter | Value |
|---|---|---|
| RC, (Scla 4A-12) | MD | 7.8 |
| | BL | 8.75 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 25 | MD | 7.830 | 0.586 | 0.960 | −0.025 |
| | 24 | BL | 9.119 | 0.714 | 0.611 | −0.250 |
| LN right & left | 40 | MD | 7.662 | 0.386 | 0.722 | 0.177 |
| | 43 | BL | 8.899 | 0.878 | 0.866 | −0.084 |
| MPMH right & left | 10 | MD | 7.890 | 0.886 | 0.921 | −0.045 |
| | 11 | BL | 8.400 | 0.844 | 0.687 | 0.186 |
| UPMH right & left | 33 | MD | 7.065 | 0.636 | 0.256 | 0.567 |
| | 34 | BL | 8.440 | 0.695 | 0.658 | 0.220 |
| MHSS right & left | 99 | MD | 6.427 | 0.467 | **0.004** | **1.482** |
| | 99 | BL | 7.291 | 0.542 | **0.008** | **1.357** |

Table 11: Scla 4A-12 (permanent mandibular right canine): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

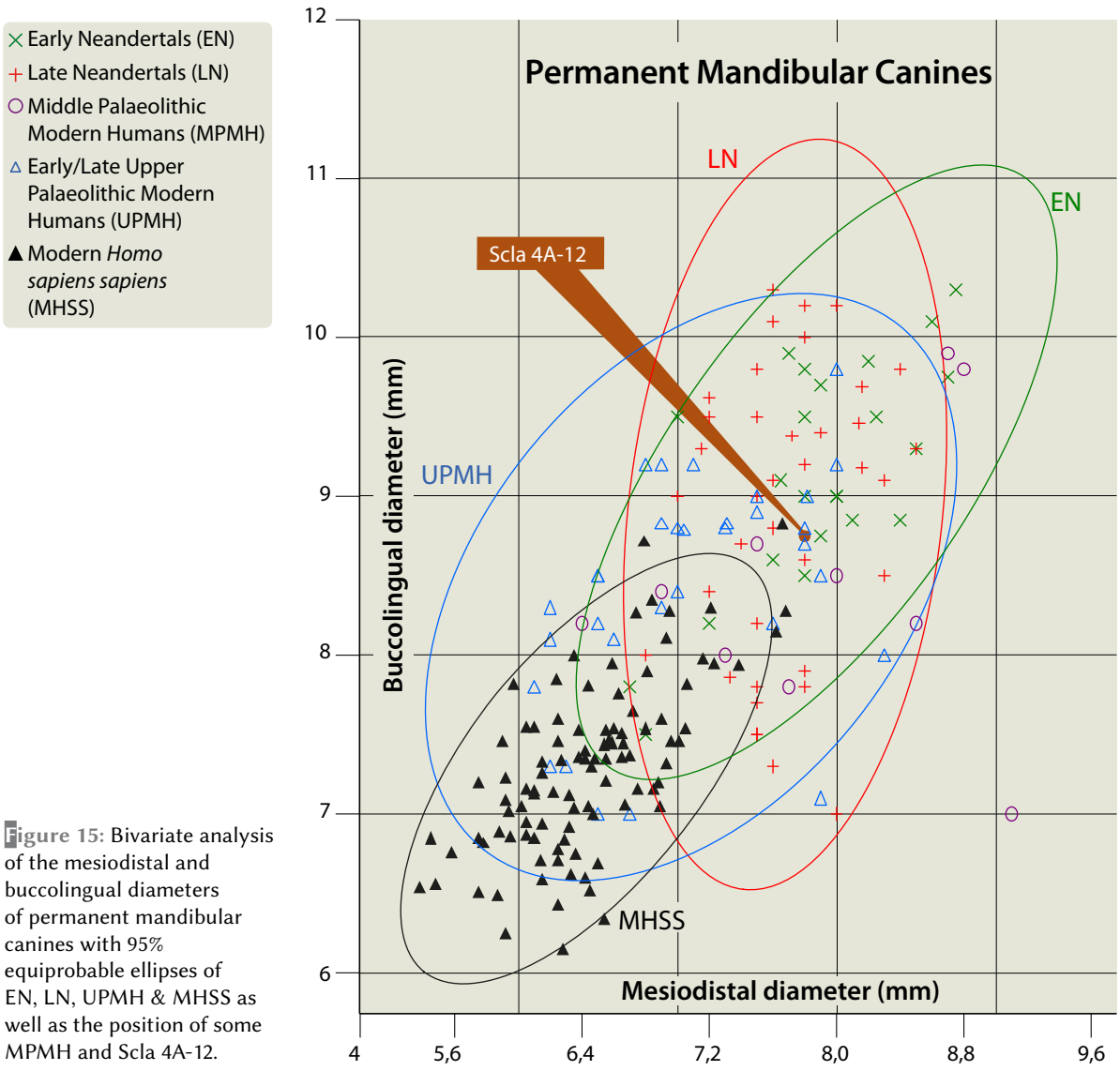


**Figure 15:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular canines with 95% equiprobable ellipses of EN, LN, UPMH & MHSS as well as the position of some MPMH and Scla 4A-12.

**Date of discovery**: 18 February 1992
**Date of identification**: October 1993
**Square**: D30
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: Unit 4A-POC (Unit 4A-CHE)

### 3.7.1. Description (Figure 16)

This tooth is unerupted in the Scla 4A-2 right part of the maxilla. Its crown is completely formed and unworn; a small part of the crown can be seen from the bottom of the crypt of the second deciduous molar. About half of the root is formed.

The crown has two primary cusps, the protocone (lingual cusp or cusp 1) and the paracone (cusp 2). The paracone is nearly as high as the protocone, as usual in $UP^4$s. The occlusal morphology of the fossil tends to be complex. The essential crests of both cusps are well developed and present slight bifurcations. Mesial and distal accessory ridges, visible on the outer enamel surface (OES) and even more clearly on the enamel–dentine junction (EDJ), are present on the slopes of the protocone and paracone. The mesiodistal groove exhibits two pits: a small mesial fossa and a bigger distal fossa. An accessory cusplet with its own crenulation is present on the distal border of the occlusal surface. In mesial and distal views, the buccal face of the tooth is more convex than the lingual face.

The uncompleted root has a distal groove which produces a strong C-shaped cross-section.

### 3.7.2. Taxonomy

The morphology of the occlusal surface of Neandertal upper $P^4$s is somewhat complex (Bailey, 2002[b], 2006[a]). They frequently present accessory cusplets, more frequently distal than

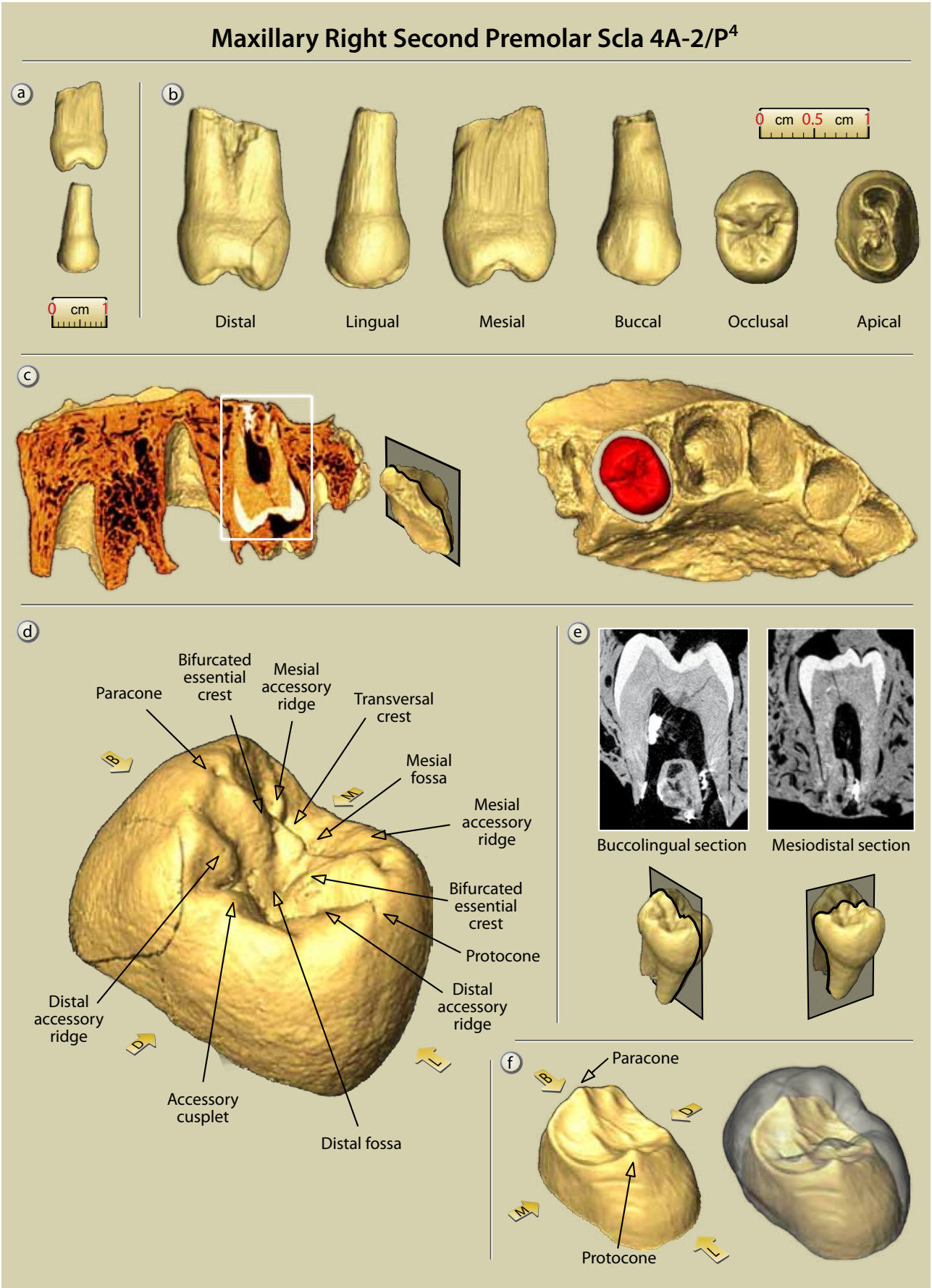


**Figure 16:** Scla 4A-2/P⁴ unerupted maxillary right second premolar: a. mesial and lingual views (1:1 scale); b. 3D reconstructions of the six faces of the tooth (2:1 scale); c. section showing the unerupted premolar in situ; d. 3D reconstruction with main anatomical features; e. internal sections; f. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Maxillary Second Premolars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-2/P⁴ |
|---|---|---|---|---|---|
| Mesial/distal accessory ridges | 50% | 77.8% | 40% | 33.3% | mesial and distal |
| Accessory cusps | 50% | 47.6% | 12.5% | 33.3% | yes |
| Bifurcated buccal essential crest | 50% | 70% | 0% | 0% | yes |

Table 12: Distinctive anatomical features on maxillary second premolars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-2/P⁴.

mesial. Both primary cusps have a developed essential crest which is often bifurcated. Mesial and distal accessory ridges are frequent but more often buccally than lingually (Table 12). Scla 4A-2/P⁴ associates all the typical Neandertal features.

### 3.7.3. Morphometric analysis

Measurements of the maxillary right second premolar are as follows:

**MD**: 7.65 mm
**BL**: 10.38 mm

The MD and BL diameters of Scla 4A-2/P⁴ depart significantly from the average of the recent humans (MHSS) comparative sample, both in the case of the DP probabilistic distance and ECRA (Table 13). The MD and BL diameters of the Scla 4A-12 crown are, in Figure 17, compared to the means of Early and Late Neandertals as well as of UPMH and MHSS. Scla 4A-12 is situated in the area where EN, LN and UPMH ellipses (95%) overlap. The fossil is outside the 95% ellipse of modern humans. Like for the incisors and canines, this indicates that the dimensions of the P⁴ crowns do not provide clear taxonomic indications within fossil taxa but sometimes allow to distinguish between the latter and MHSS.

## 3.8. Mandibular right first premolar, $RP_3$

**Palaeoanthropological identification**: Scla 4A-6
**Field identification**: Sc 1990-132-41
**Date of discovery**: 04 July 1990
**Date of identification**: October 1993
**Square**: G27
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: units 4A-CHE or 4A-POC (units 4A-IP, 3-INF)

### 3.8.1. Description (Figure 18)

Found isolated, this mandibular right first premolar fits well in the corresponding tooth socket of the Scla 4A-1 right mandible, found in Square D29, former Layer 4A, at a distance over 3 m.

The tooth is not fully erupted. Approximately two thirds of the root are formed. The tooth is well preserved, though the crown and the root exhibit numerous microfissures, mainly along their length. The lower two fifths of the root are dark brown. No pathological conditions have been noted.

The crown of the Scla 4A-6 premolar shows a sub-triangular outline in occlusal view. It tends to be asymmetrically shaped, with an inclination of

| Scladina | | Diameter | Value | | | |
|---|---|---|---|---|---|---|
| RP⁴ (Scla 4A-2/P⁴) | | MD | 7.65 | | | |
| | | BL | 10.38 | | | |
| **Comparison Samples** | **N** | **Diameter** | **Mean** | **Stand. Dev.** | **DP** | **ECRA** |
| EN left & right | 21 | MD | 7.624 | 0.795 | 0.974 | 0.016 |
| | 20 | BL | 10.513 | 0.626 | 0.835 | –0.101 |
| LN left & right | 31 | MD | 6.958 | 0.510 | 0.185 | 0.665 |
| | 31 | BL | 10.104 | 0.622 | 0.661 | 0.217 |
| MPMH right & left | 11 | MD | 7.073 | 0.476 | 0.253 | 0.545 |
| | 10 | BL | 10.150 | 0.826 | 0.787 | 0.123 |
| UPMH right & left | 36 | MD | 6.811 | 0.683 | 0.227 | 0.605 |
| | 40 | BL | 9.660 | 0.630 | 0.260 | 0.565 |
| MHSS right & left | 200 | MD | 6.464 | 0.452 | **0.009** | **1.330** |
| | 200 | BL | 8.907 | 0.563 | **0.010** | **1.326** |

Table 13: Scla 4A-2/P⁴ (maxillary right second premolar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

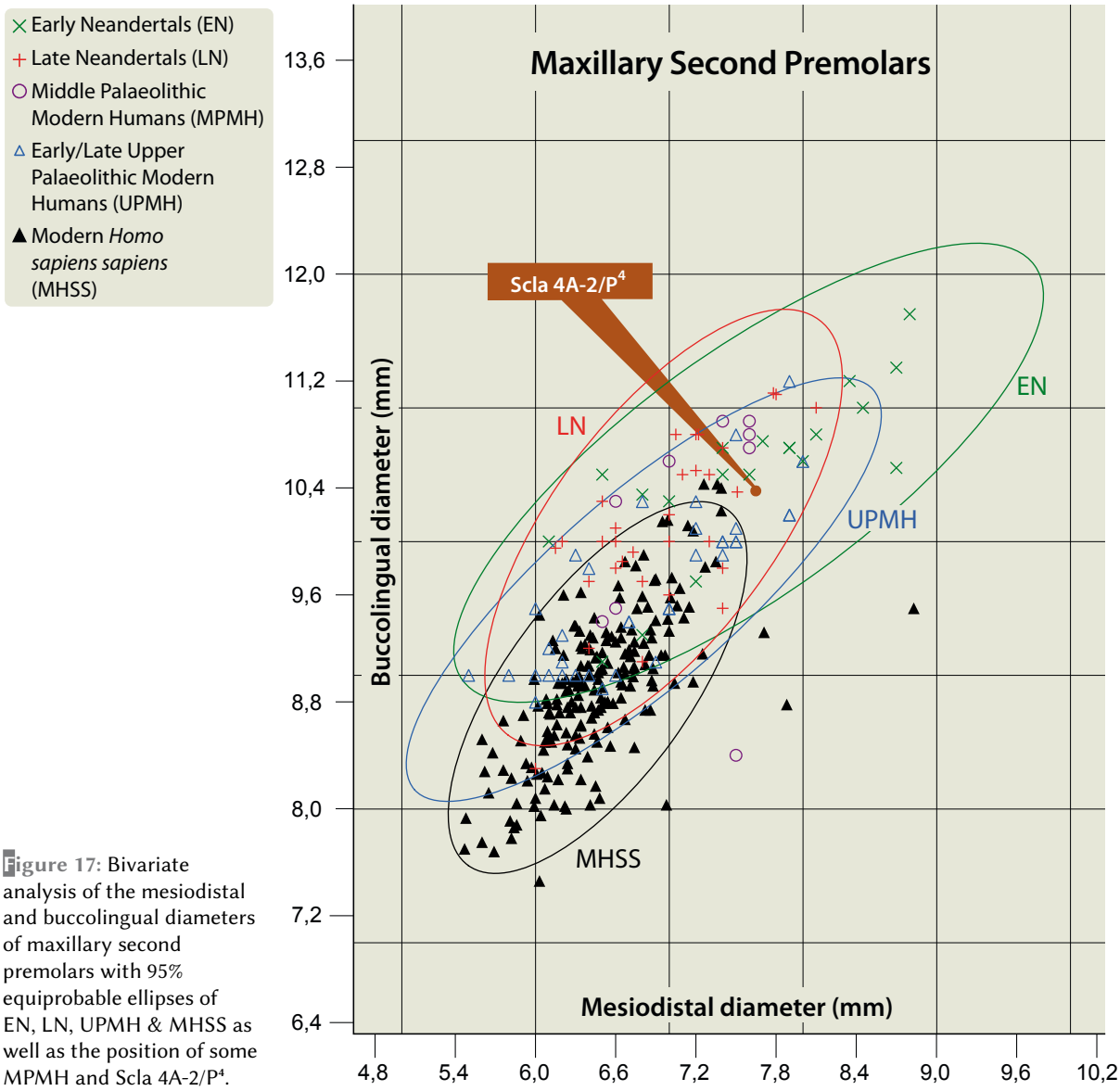


**Figure 17:** Bivariate analysis of the mesiodistal and buccolingual diameters of maxillary second premolars with 95% equiprobable ellipses of EN, LN, UPMH & MHSS as well as the position of some MPMH and Scla 4A-2/P⁴.

its mesiolingual border. Its occlusal morphology is quite complex.

As usual in mandibular first premolars, the buccal cusp, or protoconid, is significantly higher than the lingual part of the crown, while the buccal cusp of the second premolar is usually just slightly higher that the lingual cusp. The mandibular right first premolar exhibits a double lingual cusp composed of two not very well separated parts. One of these, the metaconid, is slightly mesially placed. A small accessory cusplet (distolingual accessory cusp) is on the crest lingually limiting the distal fossa; it is much smaller and more distally placed than the metaconid (ASUDAS LP1 cusp, grade 3; Turner et al., 1991: 21).

A mesiodistal groove, or central groove, separates the buccal and lingual cusps. An essential crest runs down the buccal cusp into this groove and fuses with the essential crest running down the metaconid, forming a continuous buccolingual ridge, the transverse crest. So, the central groove is divided into two depressions, the mesial and distal fossae, limited by distal and mesial marginal ridges. From the distal part of the protoconid, a distal accessory ridge descends to the center of the distal fossa. No mesial accessory ridge is present. All these features, visible on the outer enamel surface (OES), are even better marked on the enamel dentine junction surface (EDJ). The mesiolingual groove is short and only very weakly marked.

In proximal and distal views, the buccal face is convex near the cervix and nearly flat but oblique anterosuperiorly, in its upper two thirds.

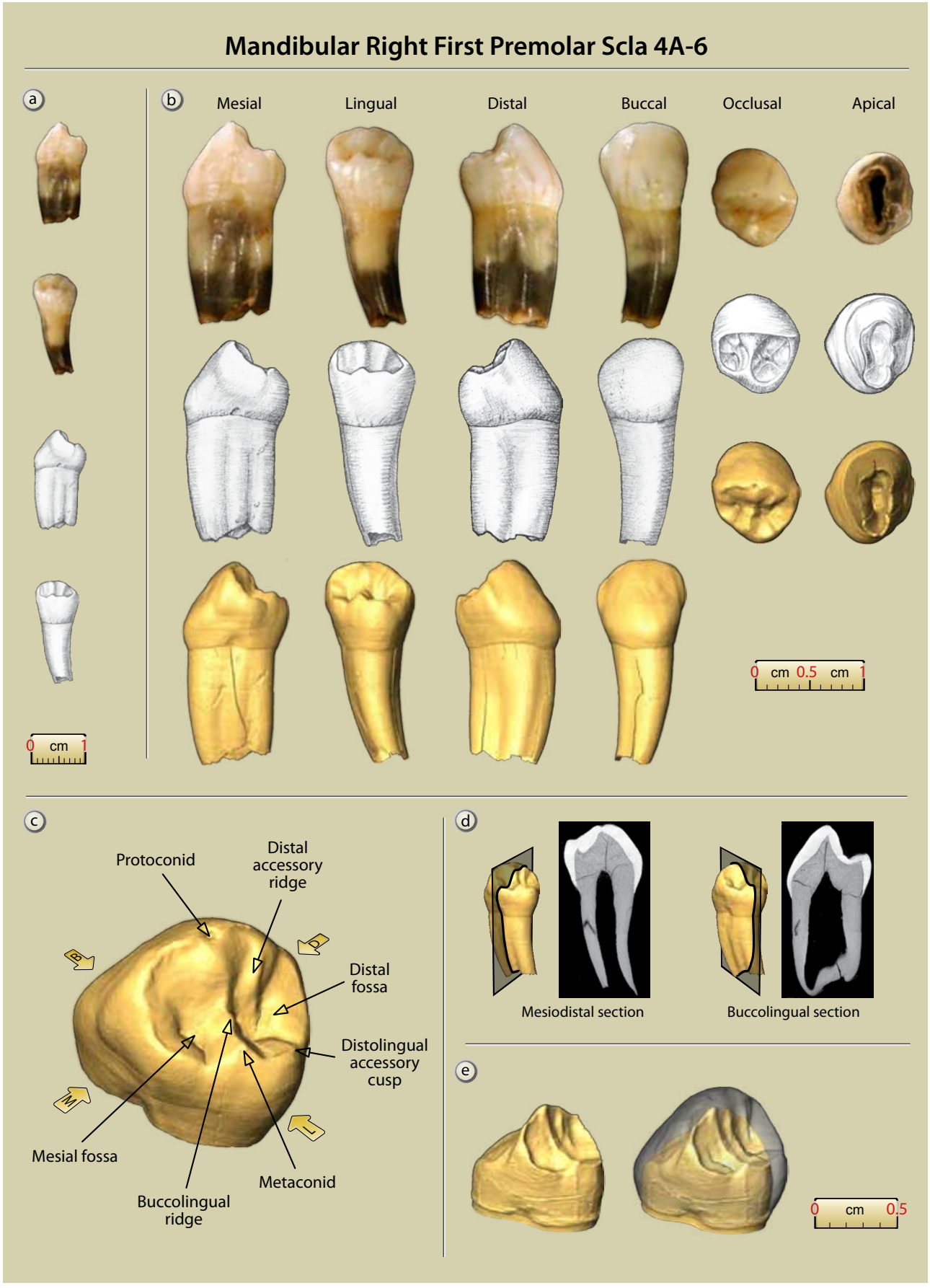


**Figure 18:** Scla 4A-6 mandibular right first premolar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

The crown is unworn, or nearly so (Molnar, 1971, stage 2). There are no interproximal wear facets.

The tooth is single-rooted, at least in its already formed part. The root deflects distally. Its length below the cervix is 10.6 mm on its buccal side and 9.6 mm on its lingual side. This premolar exhibits one distal and two mesial developmental grooves, showing the limits of the radicals. The section of the cervix is elliptical.

### 3.8.2. Taxonomy

The occlusal morphology of Neandertal first mandibular premolars tend to be complex (Bailey, 2006[a]). It exhibits some traits that, while sometimes present in modern human, make it distinctive because of their higher frequency and their combination (Table 14; Bailey, 2002[a], 2002[b], 2006[a]):

— complex occlusal morphology with a triangular outline and a tendency to be asymmetrically shaped;
— well developed and continuous essential/transverse crest;
— higher frequency of the distal accessory ridge (90%) than in modern human;
— higher frequency of the mesial lingual groove than in modern human;
— frequent presence of a distal accessory cusplet co-occurring with the metaconid.

The Scla 4A-6 premolar presents a combination of most of these traits.

### 3.8.3. Morphometric analysis

Measurements of the Scla 4A-6 mandibular right first premolar are as follows:

**MD diameter**: 8.12 mm
**BL diameter**: 9.38 mm
**MD diameter at the cervix**: 5.50 mm
**BL diameter at the cervix**: 7.76 mm
**Length of the tooth**: 18.30 mm

The MD and BL diameters of Scla 4A-6 departs significantly only from the average of the recent humans (MHSS) comparative sample, both in regard to the DP probabilistic distance and ECRA. The BL diameter of Scla 4A-6 also departs significantly from the average of the UPMH sample (Table 15). The MD and BL diameters of the crown of Scla 4A-6 are, in Figure 19, compared to the ellipses (95%) of Early and Late Neandertals as well as of MPMH, UPMH and MHSS. Scla 4A-6 is situated in the area where EN, LN and UPMH ellipses (95%) overlap, and at the limit of the UPMH ellipse. In addition, the fossil is outside the 95% ellipse of modern humans. As with all incisors, canines and the maxillary second premolar, this indicates that the dimensions of the crown of the mandibular first premolar do not provide clear taxonomic indications except that they allow to distinguish fossils taxa from MHSS.

## 3.9. Mandibular second premolars, $P_4$

### 3.9.1. Description

Both right and left portions of the Scladina Child mandible, namely Scla 4A-1 and Scla 4A-9, have an unerupted second premolar.

These two teeth have been extracted from a 3D computerized model reconstructed from micro-CT scans of the fossils recorded at the University of Antwerp and the Max Planck Institute in Leipzig, with the Amira® software package. These 3D reconstructions were then reproduced as physical objects via stereolithography.

| Mandibular First Premolars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-6 |
|---|---|---|---|---|---|
| Asymmetry/triangular outline | 66.7% | 94.4% (well marked in 39%) | 75% | 56.3% | yes |
| Distal accessory ridge | 75% | 90% | 50% | 100% | yes |
| Mesial accessory ridge | 0% | 23.5% | 0% | 12.5% | no |
| Accessory lingual cusp | 25% | 20.6% | 16.7% | 7.1% | distolingual accessory cusp. grade 3 |
| Transverse crest | 50% | 96.7% | 75% | 81.3% | yes |
| Mesial lingual groove | 66.7% | 64% | 25% | 50% | very weak |

Table 14: Distinctive anatomical features on mandibular first premolars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-6.

| Scladina | Diameter | Value |
|---|---|---|
| $RP_3$ (Scla 4A-6) | MD | 8.12 |
| | BL | 9.38 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 23 | MD | 7.878 | 0.753 | 0.751 | 0.155 |
| | 21 | BL | 9.057 | 0.724 | 0.661 | 0.214 |
| LN right & left | 42 | MD | 7.536 | 0.488 | 0.238 | 0.592 |
| | 41 | BL | 8.994 | 0.698 | 0.583 | 0.274 |
| MPMH right & left | 8 | MD | 7.888 | 0.426 | 0.602 | 0.231 |
| | 8 | BL | 8.888 | 0.599 | 0.438 | 0.348 |
| UPMH right & left | 39 | MD | 7.058 | 0.536 | 0.055 | 0.979 |
| | 39 | BL | 8.322 | 0.416 | 0.015 | 1.254 |
| MHSS right & left | 82 | MD | 6.578 | 0.423 | 0.000 | 1.830 |
| | 82 | BL | 7.330 | 0.483 | 0.000 | 2.132 |

**Table 15:** Scla 4A-6 (mandibular right first premolar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

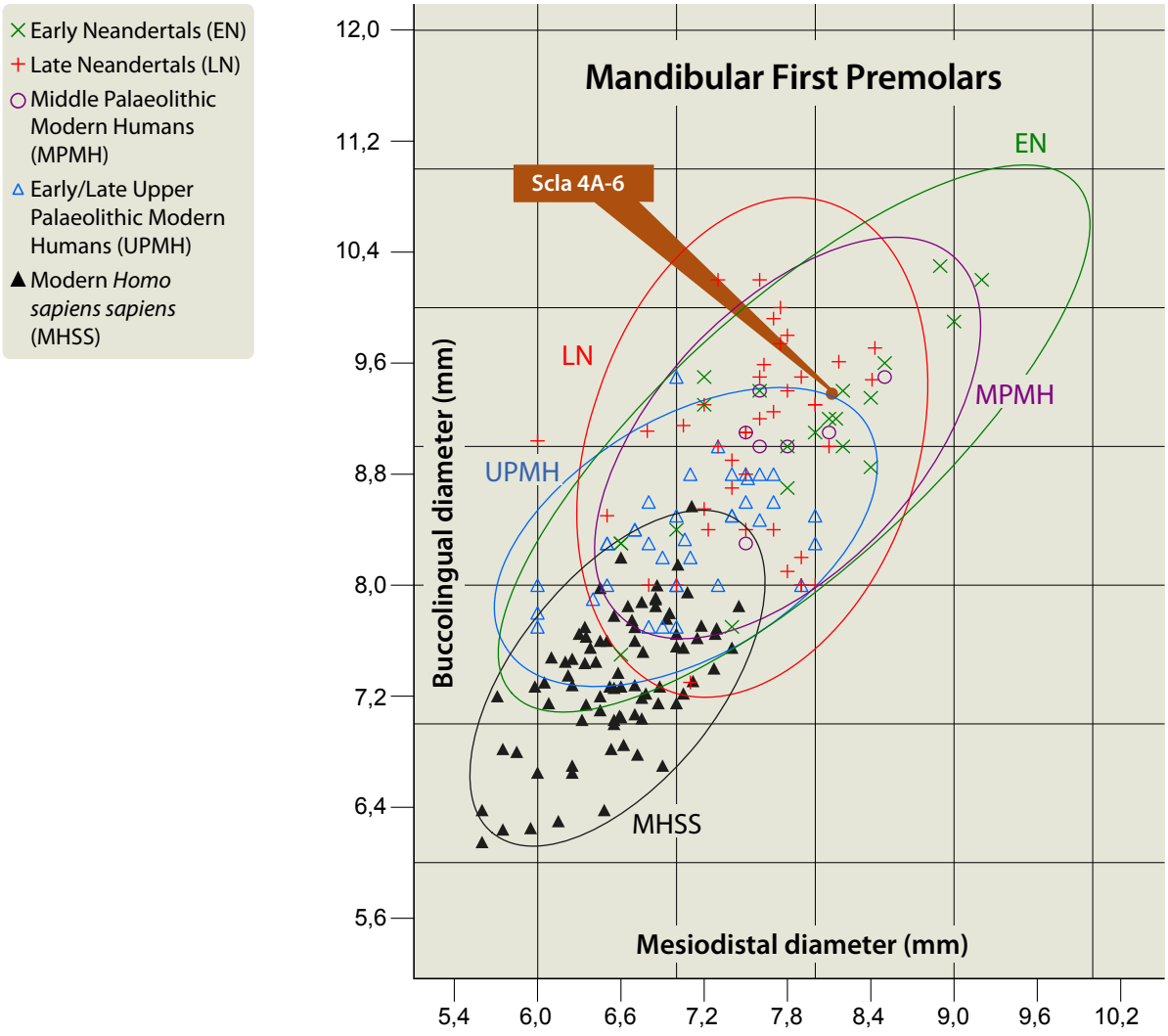


**Figure 19:** Bivariate analysis of the mesiodistal and buccolingual diameters of mandibular first premolars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-6.

### *Mandibular left second premolar, $LP_4$ (Figure 20)*

**Palaeoanthropological identification**: Scla 4A-9/$P_4$
**Field identification**: Sc 1996-203-1
**Date of discovery**: 12 July 1996
**Date of identification**: 12 July 1996
**Square**: C28
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: Unit 4A-CHE (Unit 4A-POC), Layer 4A-JA (?)

This tooth is included in the Scla 4A-9 left part of the mandible. Its crown is completely formed and unworn. Its root is not complete; about two thirds are formed (Figure 20).

The crown is asymmetrical in occlusal view, with an inclination of the mesiolingual border and a truncated mesiolingual lobe. So its outline is somewhat triangular. Its occlusal topography is complex.

The metaconid is well developed, just a little lower than the protoconid. It is mesially placed and more strongly developed than the metaconid of the mandibular right first premolar Scla 4A-6.

A continuous and strong transversal crest, visible on the OES and even more clearly on the EDJ, connects the protoconid and metaconid. Because of the mesial position of the metaconid, this crest is also mesially disposed and the mesial fovea is much smaller than the distal one.

The protoconid does not have any mesial accessory ridge. However, it exhibits a central ridge which descends from the apex of the cusp and, after a few millimetres, divides itself into two branches, one forming the continuous transverse ridge already mentioned and another, very faint, descending to the distal fovea. Slightly more distal is the DAR (distal accessory ridge).

In mesial and distal views, the buccal face of the tooth is very convex.

The P4 has two accessory lingual cusps. The first one is on the distolingual angle of the occlusal surface and the second one on the distal marginal ridge. They are well separated by shallow grooves going down to the center of the distal fovea.

The uncompleted root has a mesiolingual groove which produces a C-shaped root morphology or Tomes' root morphology (Hillson, 1996: 41, 44). This vertical groove is shallow in its cervical third, but becomes increasingly deeper as it reaches the end of the root. The lingual part of the root is the largest.

### *Mandibular right second premolar, $RP_4$ (Figure 21)*

**Palaeoanthropological identification**: Scla 4A-1/$P_4$
**Field identification**: Sc 1993-148-185
**Date of discovery**: 16 July 1993
**Date of identification**: 20 July 1993
**Square**: D29
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: Unit 4A-CHE, Layer 4A-GX

This tooth is totally unerupted. It is embedded within the Scla 4A-1 right part of the mandible. However it is possible to see a very small part of its crown by looking carefully through the bottom of the alveolus of the right second deciduous molar.

Its crown is completely formed but unworn and its root is not complete, like that of its antimere.

The morphology of this tooth is quite similar to the corresponding mandibular left first premolar unerupted in the Scla 4A-9 left part of the mandible.

The crown exhtibits a somewhat triangular outline. It is asymmetrical in occlusal view, with an inclination of the mesiolingual border.

The metaconid is well developed, just a little lower than the protoconid, and is mesially disposed. A continuous and strong transversal crest connects the protoconid and metaconid. This crest is also mesially disposed and the mesial fovea is much smaller than the distal fovea.

The protoconid does not have any mesial accessory ridge. As in the left $P_4$, it exhibits a central ridge descending from the apex of the protoconid which divides itself into two branches, one forming the transverse ridge already mentioned. A distal accessory ridge is also present.

In lateral view, the buccal face of the tooth is irregularly convex.

This right $P_4$, like the left one, has two accessory distolingual cusps and they are at the same position. The first lies at the distolingual angle of the occlusal surface and the second on the distal marginal ridge. They are well separated by shallow grooves going down to the center of the distal fovea.

As for the left $P_4$, the incomplete root of the right $P_4$ has a mesiolingual vertical groove which produces a C-shaped root morphology or Tomes' root morphology. The lingual component of the root is also the largest.

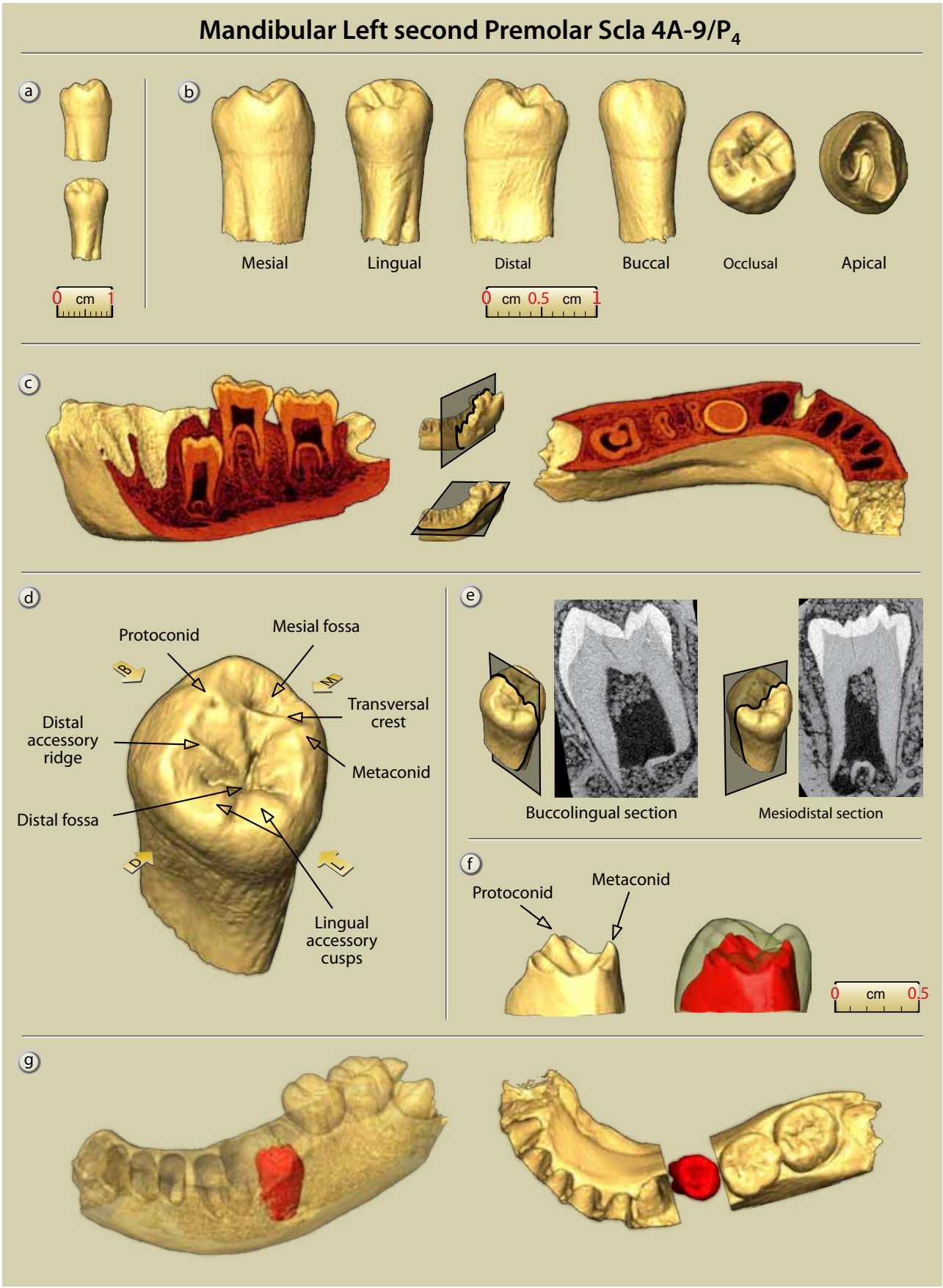


**Figure 20:** Scla 4A-9/$P_4$ unerupted mandibular left second premolar: a. mesial and lingual views (1:1 scale); b. 3D reconstructions of the six faces of the tooth (2:1 scale); c. section showing the unerupted premolar in situ; d. 3D reconstruction with main anatomical features; e. internal sections; f. 3D lingual views at the EDJ without and with enamel; g. other views of the location of the unerupted premolar (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

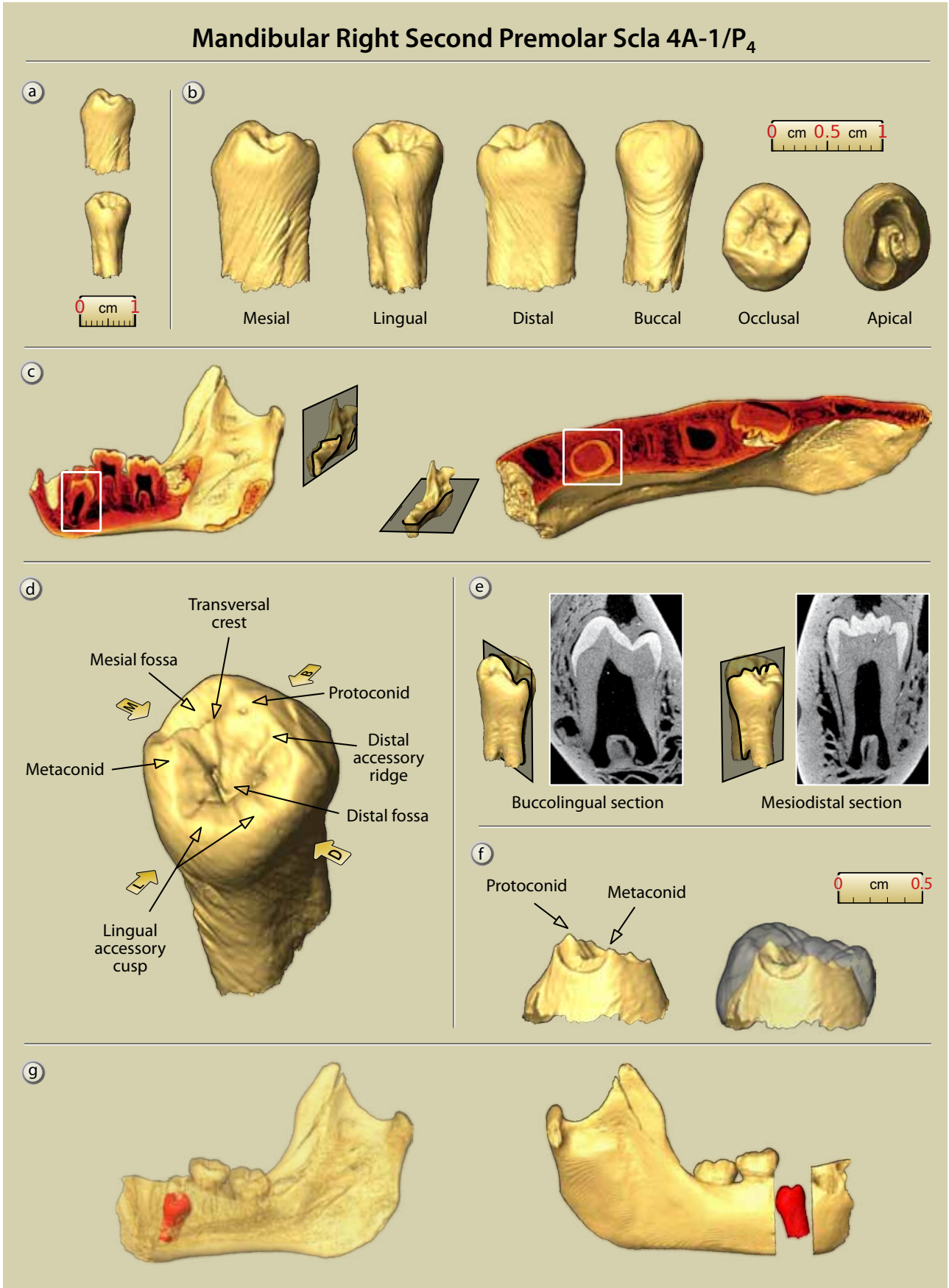


**Figure 21:** Scla 4A-1/$P_4$ unerupted mandibular right second premolar: a. mesial and lingual views (1:1 scale); b. 3D reconstructions of the six faces of the tooth (2:1 scale); c. section showing the unerupted premolar in situ; d. 3D reconstruction with main anatomical features; e. internal sections; f. 3D lingual views at the EDJ without and with enamel; g. other views of the location of the unerupted premolar (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Mandibular Second Premolars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-1/$P_4$ | Scla 4A-9/$P_4$ |
|---|---|---|---|---|---|---|
| Asymmetry/triangular outline | 16.7% | 93.5% | 33.3% | 33.3% | yes | yes |
| Mesial position of the metaconid | 100% | 96.9% | 50% | 73.3% | yes | yes |
| Transverse crest (continue) | 33.3% | 93.5% | 16.7% | 23.5% | yes | yes |
| Distal accessory ridge | 100% | 87.5% | 66.7% | 25% | yes | yes |
| Mesial accessory ridge | 20% | 12.5% | 66.7% | 0% | - | - |
| Accessory lingual cusps | 80% | 90.6% | 66.7% | 50% | yes | yes |
| Mesial lingual groove | 0% | 8% | 0% | 0% | - | - |

Table 16: Distinctive anatomical features on mandibular second premolars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-1/$P_4$ & Scla 4A-9/$P_4$.

### 3.9.2. Taxonomy

Some $P_4$ crown traits are particularly useful to distinguish Neandertal $P_4$s from those of modern humans and *Homo erectus* (Table 16; Bailey, 2002[a], 2002[b], 2005, 2006[a]):

- distinctive complex crown outline in occlusal view, with marked asymmetry of the lingual contour, caused by the truncation of its mesiolingual lobe (± 90% of Neandertal $P_4$s, against a third or less in Archaic *Homo erectus*, *Homo sapiens* and modern humans);
- mesially placed metaconid which is also large and well developed;
- strong and continuous transverse crest (over 90% of Neandertal $P_4$s).
- extra lingual cusps (present on ± 90% of Neandertal $P_4$s);
- distal accessory ridges, whose frequency in Neandertals and *Homo erectus* (≥ 90%) is higher than in modern humans (two thirds or less).

In fact, each of these traits may be present in anatomically modern populations but it is the frequency with which they occur together within a single tooth which is taxonomically diagnostic and distinguishes Neandertals from contemporary humans and *Homo erectus*. In detail (Bailey, 2002[a]: 154), 59% of Neandertals exhibit the first three traits together and 35% two of these traits, whereas 94% of Neandertals present at least two of these three features in combination; only 2.4% of the modern humans do.

The two Scladina $P_4$s both present the asymmetry of the lingual contour when viewed occlusally, a mesially positioned metaconid, multiple lingual cusps as well as a marked transverse crest.

### 3.9.3. Morphometric analysis

Measurements of the mandibular second premolars are as follows:

**Scla 4A-1/$P_4$**

MD = 8.0 mm
BL = 9.68 mm

**Scla 4A-9/$P_4$**

MD = 8.1 mm
BL = 9.3 mm

The MD and BL diameters of both mandibular second premolars depart significantly from the average of the recent humans (MHSS) comparative sample, in regards to the DP probabilistic distance and ECRA. The BL diameter of both teeth also departs significantly from the average of the UPMH sample (Table 17). The MD and BL diameters of the crown of both mandibular second premolars are, in Figure 22, compared to the means of Early and Late Neandertals as well as of MPMH, UPMH and MHSS. They are situated in the area where EN, LN, MPMH and UPMH ellipses (95%) overlap. In addition, the fossil is outside the 95% ellipse of Modern Humans. As with all incisors, canines and other premolars, this indicates that the dimensions of the crown of the mandibular second premolar do not always provide clear taxonomic indications within fossil taxa but often allow to separate the latter from MHSS.

## 3.10. Permanent maxillary right first molar, $RM^1$

**Palaeoanthropological identification**: Scla 4A-4
**Field identification**: Sc 1993-330-127
**Date of discovery**: 14 December 1993
**Date of identification**: 14 December 1993
**Square**: C30

| Scladina | N | Diameter | Value |
|---|---|---|---|
| $P_4$ | Scla 4A-1/$P_4$ | MD | 8.0 |
| | | BL | 9.68 |
| | Scla 4A-9/$P_4$ | MD | 8.1 |
| | | BL | 9.3 |

| | | | | | vs Scla 4A-1/$P_4$ | | vs Scla 4A-9/$P_4$ | |
|---|---|---|---|---|---|---|---|---|
| **Comparison Samples** | **N** | **Diameter** | **Mean** | **Stand. Dev.** | **DP** | **ECRA** | **DP** | **ECRA** |
| **EN right & left** | 24 | MD | 7.729 | 0.692 | 0.699 | 0.189 | 0.597 | 0.259 |
| | 23 | BL | 9.348 | 0.501 | 0.515 | 0.319 | 0.925 | -0.046 |
| **LN right & left** | 47 | MD | 7.371 | 0.637 | 0.329 | 0.491 | 0.258 | 0.569 |
| | 47 | BL | 9.019 | 0.748 | 0.381 | 0.439 | 0.709 | 0.187 |
| **MPMH right & left** | 9 | MD | 7.611 | 0.535 | 0.488 | 0.315 | 0.387 | 0.396 |
| | 9 | BL | 8.989 | 0.655 | 0.322 | 0.458 | 0.647 | 0.206 |
| **UPMH right & left** | 39 | MD | 7.312 | 0.577 | 0.240 | 0.589 | 0.18 | 0.675 |
| | 40 | BL | 8.649 | 0.486 | 0.040 | 1.050 | 0.188 | 0.663 |
| **HSS right & left** | 90 | MD | 6.896 | 0.426 | 0.011 | 1.305 | 0.006 | 1.423 |
| | 90 | BL | 7.973 | 0.484 | 0.001 | 1.774 | 0.007 | 1.379 |

**Table 17:** Scla 4A-1/$P_4$ & Scla 4A-9/$P_4$ (mandibular second premolars): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

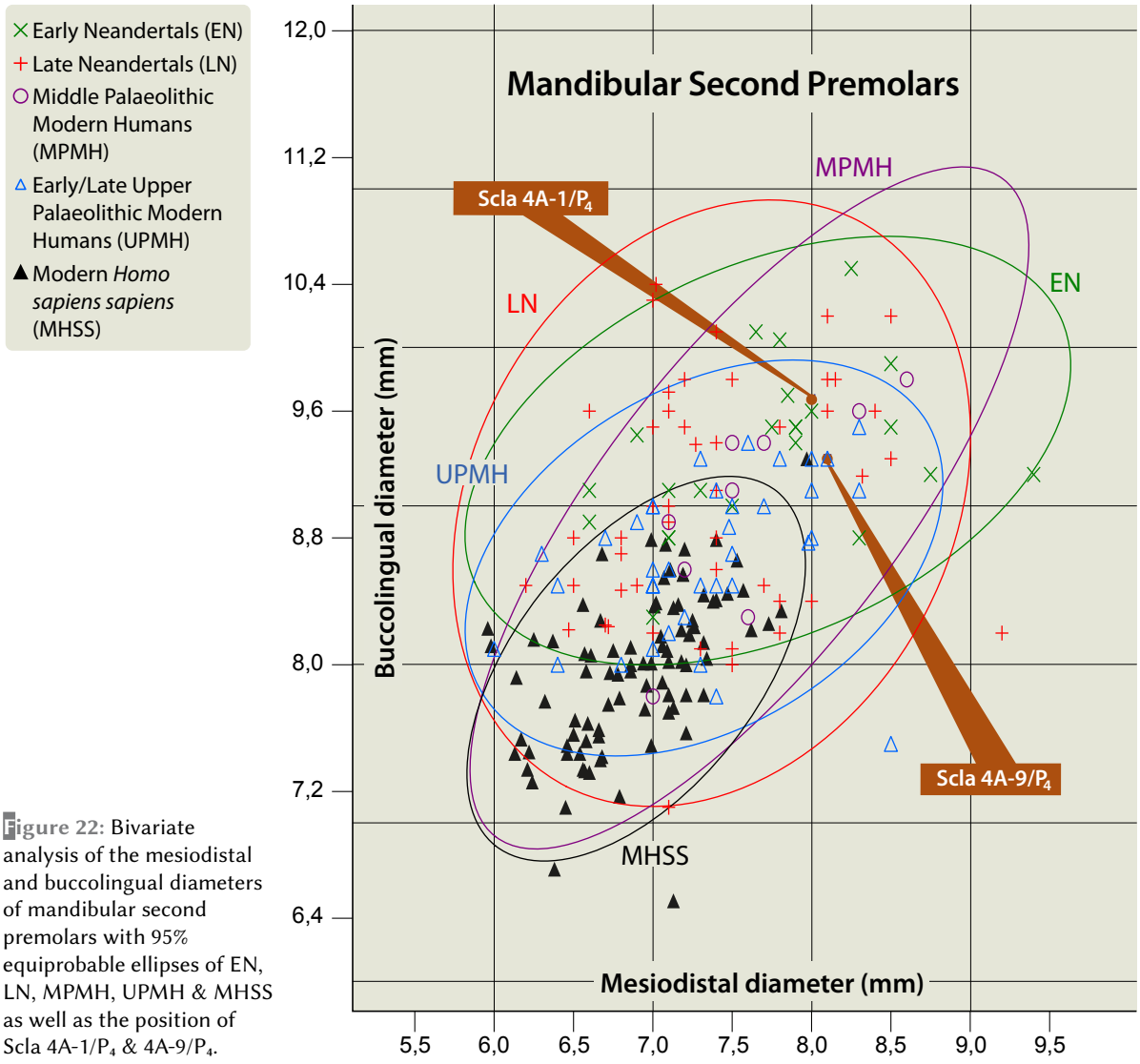


**Figure 22:** Bivariate analysis of the mesiodistal and buccolingual diameters of mandibular second premolars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-1/$P_4$ & 4A-9/$P_4$.

**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: Unit 4A-POC, Layer 4A-BO

### 3.10.1. Description (Figure 23)

Immediately recognized as human in the field, this permanent maxillary first right molar fits perfectly into the corresponding socket of the Scla 4A-2 right maxilla fragment found in adjacent Square D30, at a distance of about 1 m.

The tooth is completely formed and was functional, as attested by the slight wear of the cuspids (grade 2 of Molnar, 1971). The crown and roots, with closed apices, were well preserved at the time of discovery of the fossil. The buccal roots were later sampled for C/N and DNA analysis. On the Scla 4A-2 maxilla, the alveoli of the buccomesial root is well preserved and that of the buccodistal root is partially preserved, from which the shapes of the roots can also be studied. Later, in 2007, a histological section was obtained from the molar, in order to study the age at death of the specimen (Smith et al., 2007 & Chapter 7). The two resulting portions of the tooth were subsequently glued together to the approximate original dimensions and coloured with a dental restorative (temporary resin acrylic) and dental sticky wax.

No pathological conditions have been noted. The right $M^1$ has four main cusps: protocone> paracone> hypocone>metacone.

In occlusal view, the Scla 4A-4 crown exhibits a skewed rhomboidal surface. The cusps also appear to be internally compressed. The tooth is crenulated with essential crests running down from the cusps into the depressed occlusal surface. The paracone (cusp 2) draws a sharp, but truncated, angle. The hypocone (cusp 4) is large, projecting lingually and rounded. The metacone (cusp 3) is quite small, rounded and shifted internally. A tiny distal accessory cusp lies between the hypocone and the metacone on the distal marginal ridge (ASUDAS UM cusp 5, grade 2/3). The two buccal cusps (paracone and metacone) are more mesially placed than the lingual cusps (protocone and hypocone).

In side view, the protocone (cusp 1) has tiny subvertical smooth grooves at the limit of its mesial and lingual surfaces; these represent an extremely subtle manifestation of the tubercle of Carabelli (ASUDAS, grade 1). A small cusp is present on the buccal surface of the paracone: a very weak parastyle (grade 2 in the ASUDAS scoring system). On the lingual face of the crown a well marked groove separates the protocone and the hypocone. Another groove separates the paracone and the metacone on the occlusal half of the buccal surface of the crown. Between the hypocone and metacone, on the distal surface of the tooth, the cervical enamel line forms a faint enamel extension directed apically which deviates by nearly 1 mm from the horizontal axis of the cervical enamel line.

On the mesial face of the crown is a large (5 mm) horizontal interproximal wear facet; its height is 2.3 mm. This facet slightly affects the outline of the crown. On the distal face of the crown, no interproximal wear facet is present for the second molar, which is normal as the second molar was not completely erupted.

The lingual root forms a cone flattened in the buccolingual direction. It diverges at first from the vertical axis of the crown then bends slightly to become again almost vertical. Its apex is fully closed. Both the buccal and lingual faces of that lingual root have a shallow vertical groove. The length of the root is 13.6 mm, measured on the lingual face from the middle of the cervix. The two buccal roots (now broken) join near the cervical line, only separated by a shallow vertical groove. The mesiobuccal root is wider than the distobuccal one. They diverge at around 5 mm of the cervix. The distobuccal root has a length of 12.4 mm and is slightly curved distally. The mesiobuccal root is 10.5 mm and is nearly straight.

### 3.10.2. Taxonomy

In occlusal view, Neandertal maxillary first molars exhibit a few interesting features (Table 18) which, however, fall within the range of anatomically modern *Homo sapiens* (amHS; Bailey, 2002[b], 2004[a], 2006[a, b]).

The crowns are usually strongly skewed, compared with the maxillary molars of contemporary modern humans, with a large hypocone projecting lingually. Their shape is therefore rhomboidal. The Neandertal $M^1$ is somewhat crenulated and has usually four main cusps as well as accessory cusps and crests. The buccal cusps (paracone and metacone) are more mesially placed than the lingual cusps (protocone and hypocone). The Neandertal metacone is also shifted lingually. Cusp 5 is present in two thirds of the $M^1$. Carabelli's cusp is frequently present and often well developed. The cusps are more internally compressed than in modern humans, their

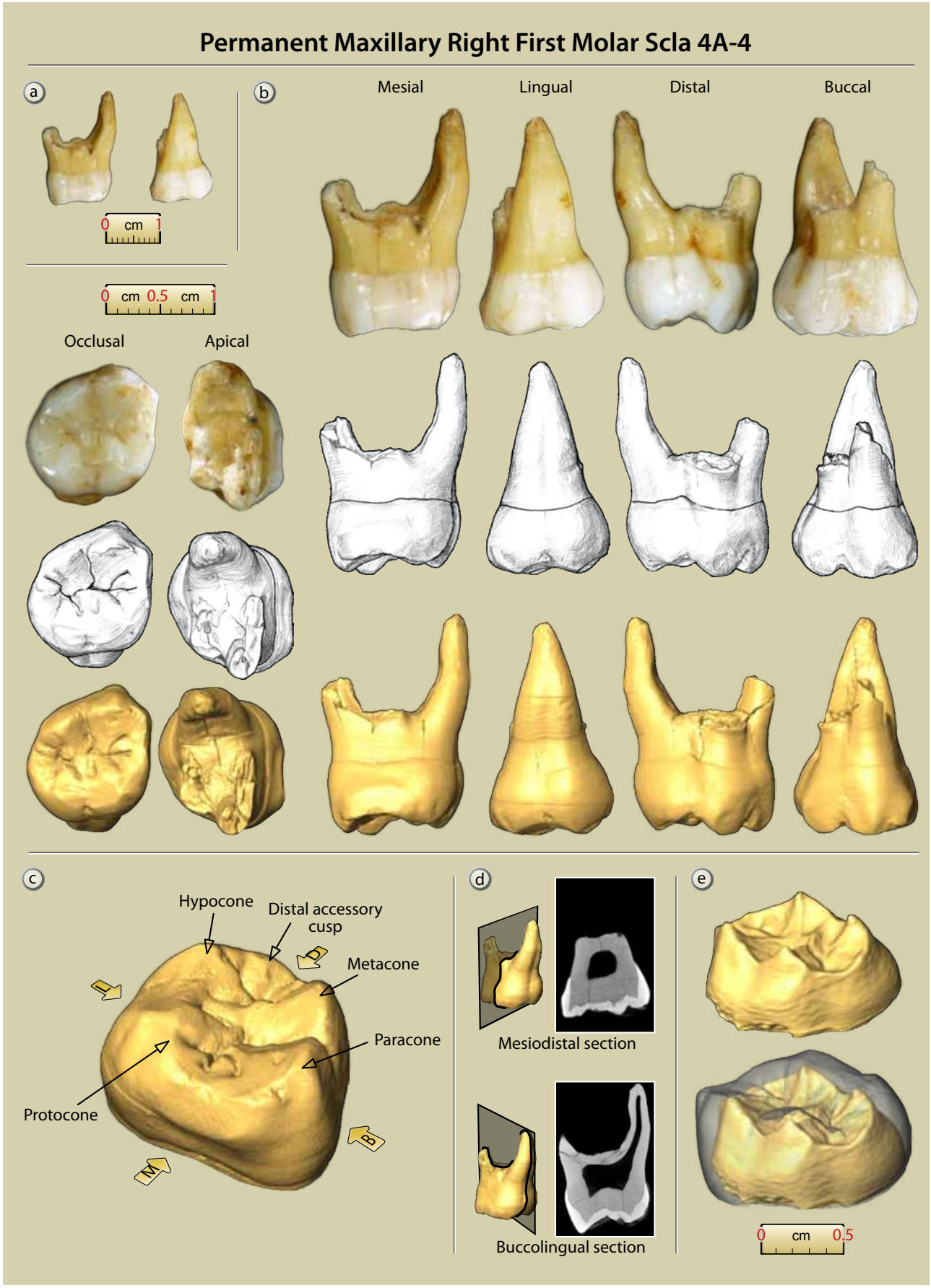


**Figure 23:** Scla 4A-4 permanent maxillary right first molar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Permanent Maxillary First Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-4 |
|---|---|---|---|---|---|
| Distal accessory cusplet | 25% | 63.6% | 40% | 52.9% | yes( tiny) |
| Carabelli's trait | 75% | 68% | 33.3% | 40.0% | yes (tiny) |
| Mesial accessory cusps | 0% | 40% | 0% | 22.2% | yes |
| Hypocone reduction | 0% | 0% | 0% | 0% | no |

**Table 18:** Distinctive anatomical features on permanent maxillary first molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-4.

apices being orientated more towards the occlusal basin as well as closer; therefore, the occlusal polygon, drawn by joining the apices of the four main cusps, is smaller than in other human groups (Bailey, 2004[a]: 194). The metacone is relatively reduced and internally oriented.

The Scla 4A-4 first maxillary molar presents all these Neandertal traits. It is skewed, the buccal cusps are mesially placed, the cusps are internally compressed, there is a large hypocone.

### 3.10.3. Morphometric analysis

Measurements of the Scla 4A-4 permanent maxillary first molar are as follows:

**MD**: 10.57 mm
**BL**: 11.92 mm
**Length of the tooth**: (21.0 mm)
**MD at the cervix**: 7.80 mm
**BL at the cervix**: 11.0 mm

The MD and BL diameters of Scla 4A-4 do not depart significantly from the average of any of the five comparison samples (EN, LN, MPMH, UPMH & MHSS), both in regard to the DP probabilistic distance and ECRA (Table 19). When both diameters are situated on equiprobable ellipses (95%) they are in an area where of all these taxa overlap (Figure 24). Like for all incisors, canines and premolars, this indicates that the dimensions of the crown of the permanent maxillary first molar do not provide taxonomic indications in the case of Scladina.

## 3.11. Permanent maxillary right second molar, RM²

**Palaeoanthropological identification**: Scla 4A-3
**Field identification**: Sc 1992-411-107-1
**Date of discovery**: 15 October 1992
**Date of identification**: October 1993
**Square**: C30
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: units 4A-CHE or 4A-POC

### 3.11.1. Description (Figure 25)

Like the permanent maxillary right first molar, the permanent maxillary right second molar of the Scladina Juvenile was lost postmortem.

The fossil is well preserved, despite the presence of numerous vertical cracks. The crown is

| Scladina | Diameter | Value |
|---|---|---|
| RM¹ (Scla 4A-4) | MD | 10.57 |
| | BL | 11.92 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 21 | MD | 11.817 | 0.949 | 0.204 | –0.630 |
| | 21 | BVL | 12.133 | 0.671 | 0.754 | –0.152 |
| LN right & left | 36 | MD | 11.008 | 0.884 | 0.623 | –0.244 |
| | 37 | BL | 12.052 | 0.667 | 0.845 | –0.097 |
| MPMH right & left | 19 | MD | 11.268 | 0.594 | 0.255 | –0.559 |
| | 18 | BL | 12.344 | 0.655 | 0.526 | –0.307 |
| UPMH right & left | 59 | MD | 10.644 | 0.731 | 0.920 | –0.051 |
| | 60 | BL | 12.038 | 0.668 | 0.860 | –0.089 |
| MHSS right & left | 102 | MD | 10.020 | 0.651 | 0.401 | 0.425 |
| | 103 | BL | 10.988 | 0.593 | 0.119 | 0.793 |

**Table 19:** Scla 4A-4 (permanent maxillary right first molar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

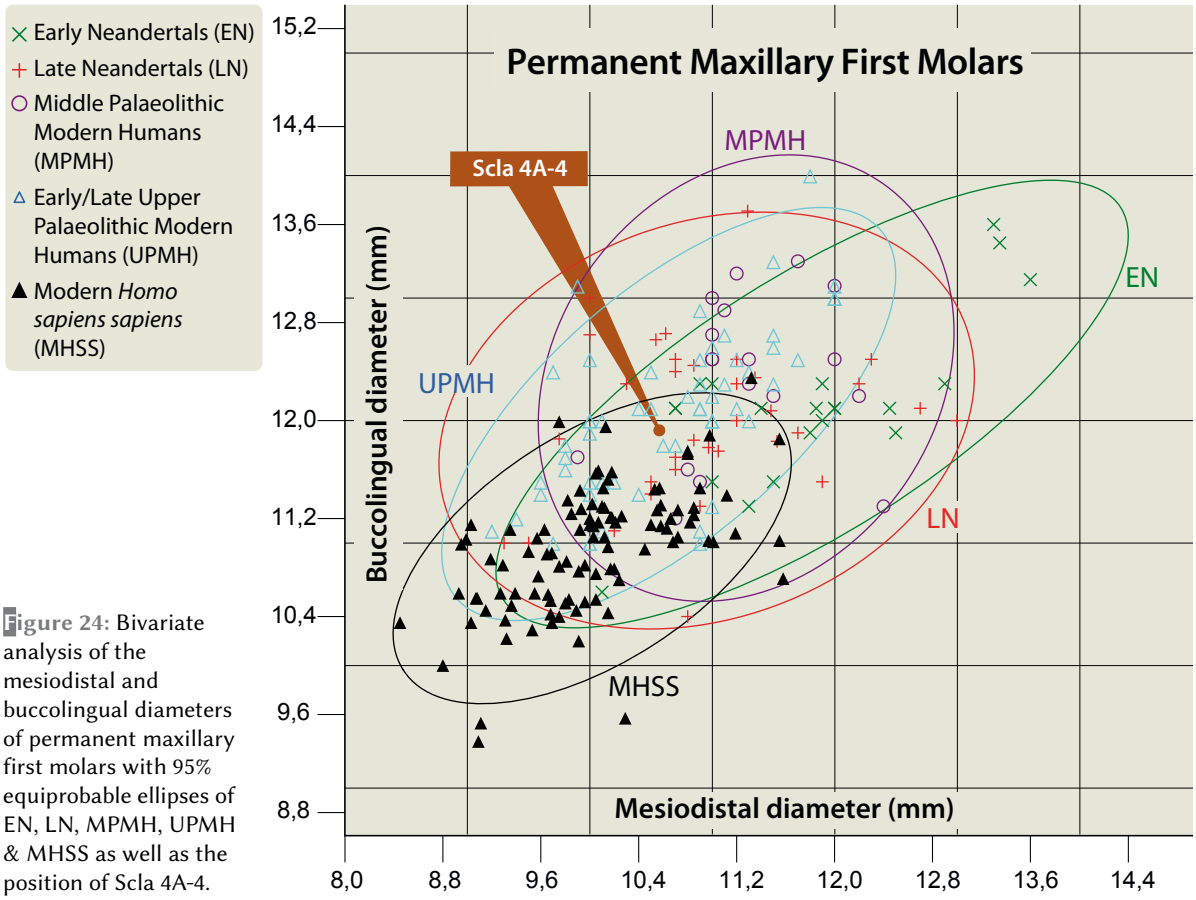


**Figure 24:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary first molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-4.

not completely erupted and is nearly unworn (grade 1 of Molnar, 1971). About half of each root is formed (max length: 7 mm). No pathological condition has been observed.

In occlusal view, this $M^2$ exhibits a skewed rhomboidal shape. Its occusal surface is very complex. It is a crenulated tooth characterized by four main cusps and some accessory cusps, fissures, and crests. Its shape is slightly different from that of the Scla 4A-4 $M^1$ as its distal outline is not as rounded but is more transversal due to a slightly more important metacone (cusp 3). In occlusal view, the protocone (cusp 1) exhibits an essential crest descending from its tip (Figure 25c: no. 1). Three other essential crests (no. 2-4) are present on the mesial marginal ridge: the most lingual one (no. 2) originates from the slope of the protocone and the most buccal one (no. 4) emanates from the mesial accessory tubercle. The paracone (cusp 2) has two essential crests (no. 5-6). The metacone has three crests, an essential one on its tip and an accessory one on each side descending from very small accessory cusps (no. 7-9). It is separated from the hypocone (cusp 4) by a quite deep groove which runs mesio-lingually. The metacone (cusp 3) is slightly more developed than on the $M^1$ (ASUDAS, grade 5). The distolingual corner of the tooth exhibits two cusplets: the hypocone itself and a more distal cusp 5 (metaconule). Two other small accessory cusps are between the protocone and the hypocone: one on the middle of the lingual border of the occlusal surface and another one more internal (no. 10).

In mesiolingual view, the protocone (cusp 1) has tiny subvertical smooth grooves on the limit of its mesial and lingual surfaces; it is a slightly individualized expression of the tubercle of Carabelli (ASUDAS, grade 1). The paracone (cusp 2) does not have a parastyle.

Scla 4A-3 has three roots. The lingual root is oval in shape; its length is 5.6 mm; its opening, whose main axis is mesiolingual to distobuccal, is 5.5 × 3.7 mm. The mesiobuccal and distobuccal roots are fused near the cervix but can be distinguished as they are separated by a buccal groove. Their irregular opening is 7.5 mm buccolingually and 6.4 mm mesiodistally.

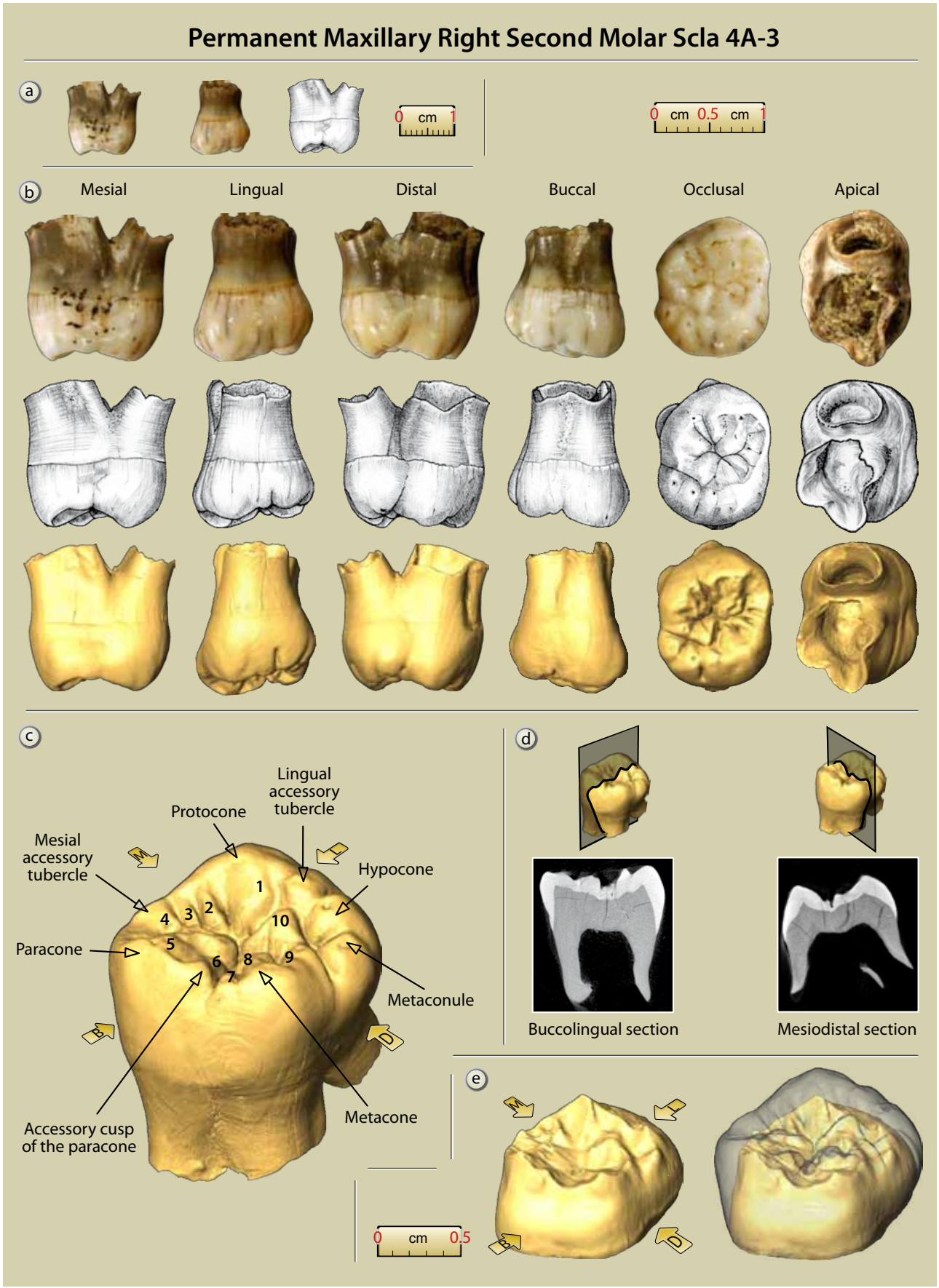


**Figure 25:** Scla 4A-3 permanent maxillary right second molar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

### 3.11.2. Taxonomy

The morphology of the Neandertal $M^2$ is complex (Table 20; Bailey, 2002[a], 2002[b], 2004, 2006[a]). The Neandertal $M^2$ possesses four developed main cusps; indeed, the hypocone is usually well developed. Cusp 5 is frequent (two thirds), as is Carabelli's trait (50%). There are accessory cusps deriving from the mesial marginal ridge (100%). The Scla 4A-3 second maxillary molar presents all these Neandertal traits.

### 3.11.3. Morphometric analysis

Measurements of the Scla 4A-3 permanent maxillary second molar are as follows:

**MD**: 10.21 mm
**BL**: 12.60 mm
**MD at the cervix**: 8.9 mm
**BL at the cervix**: 12.4 mm
**Length of the tooth**: 13.1 mm

The MD diameter of Scla 4A-3 does not depart significantly from the average of any of the five comparative samples (EN, LN, MPMH, UPMH & MHSS), both in regard to the DP probabilistic distance and ECRA. On the contrary, Scla 4A-3 departs from the MHSS sample as far as the BL diameter is concerned (Table 21). When both diameters of Scla 4A-3 are situated on equiprobable ellipses (95%) they are in an area where all these taxa overlap, even if close to the upper limit of the BL diameter of MHSS (Figure 26). Like for all incisors, canines, premolars and $M^1$, this indicates that the dimensions of the crown of the permanent maxillary second molar provide only limited taxonomic indications.

## 3.12. Permanent maxillary right third molar, $RM^3$

**Palaeoanthropological identification**: Scla 4A-8
**Field identification**: Sc 1995-286-7-1
**Date of discovery**: 14 July 1995
**Date of identification**: 14 July 1995
**Square**: C32
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: Unit 4A-POC (Unit 4A-CHE), Layer 4A-LEG (Layer 4A-JA)

### 3.12.1. Description (Figure 27)

The germ of this permanent maxillary right third molar was immediately recognized as human on the day of the discovery. When the child was alive

| Permanent Maxillary Second Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-3 |
|---|---|---|---|---|---|
| Distal accessory cusplet (5) | 100% | 68.2% | 50% | 38.9% | yes |
| Carabelli's trait | 66.7% | 50% | 14.3% | 15.8% | yes |
| Mesial accessory cusps | 100% | 100% | 50% | 12.5% | yes |
| Hypocone reduction | 0% | 6% | 0% | 15% | no |

Table 20: Distinctive anatomical features on permanent maxillary second molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-3.

| Scladina | Diameter | Value |
|---|---|---|
| $RM^2$ (Scla 4A-3) | MD | 10.21 |
| | BL | 12.6 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 26 | MD | 10.979 | 1.096 | 0.490 | −0.341 |
| | 26 | BL | 12.444 | 0.830 | 0.853 | 0.091 |
| LN right & left | 30 | MD | 10.521 | 0.830 | 0.711 | −0.183 |
| | 30 | BL | 12.474 | 0.981 | 0.898 | 0.063 |
| MPMH right & left | 13 | MD | 10.454 | 1.074 | 0.824 | −0.104 |
| | 12 | BL | 12.242 | 0.502 | 0.490 | 0.324 |
| UPMH right & left | 56 | MD | 10.154 | 0.838 | 0.947 | 0.034 |
| | 56 | BL | 12.175 | 0.866 | 0.626 | 0.245 |
| MHSS right & left | 100 | MD | 9.202 | 0.678 | 0.141 | 0.749 |
| | 100 | BL | 11.148 | 0.671 | **0.033** | **1.091** |

Table 21: Scla 4A-3 (permanent maxillary right second molar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

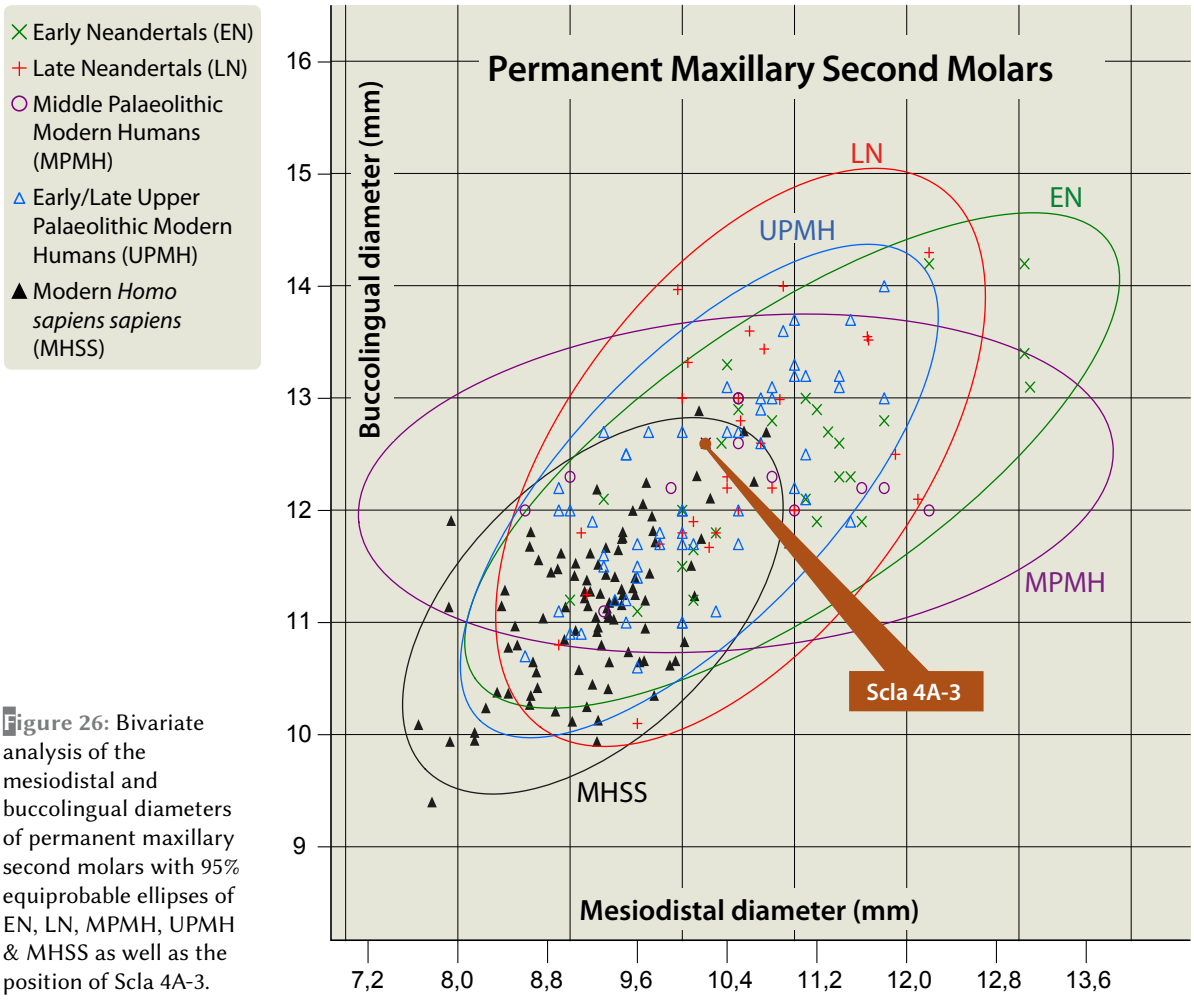


**Figure 26:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary second molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-3.

the tooth was still in its crypt; it was lost post-mortem. The crown is nearly completely formed and is unworn. It is well preserved, despite numerous vertical cracks. No root is yet formed. No pathological conditions are noted.

In occlusal view, this $M^3$ exhibits a complex morphology around a central fovea. The crown is crenulated and characterized by numerous cusps, fissure, and crests. It is skewed and has a rhomboidal shape. The protocone and the paracone are the highest cusps.

The paracone (cusp 2) exhibits three crests: mesial (Figure 27c: no. 1), essential (no. 2) and distal (no. 3). A faint groove on its buccal surface corresponds to stage 1 of the parastyle ASU UM plaque of ASUDAS.

The protocone (cusp 1) has 2 crests, essential (no. 6), and distal (no. 7). Lingually to the distal crest of the protocone and distally to the protocone itself is a small rounded independent cusplet. Two ridges originate from the mesial marginal ridge: a small buccal one (no. 4) which joins the essential ridge of the paracone and a central one (no. 5) descending from a very faint mesial accessory tubercle (Scott & Turner, 1997: 46).

The distal marginal ridge exhibits three small, low cusplets. The one at the limit of the lingual and distal faces seems to correspond to a reduced hypocone. The more distal one could be cusp 5 (metaconule; ASUDAS, grade 3) and the more buccal one a reduced metacone.

### 3.12.2. Taxonomy

The Neandertal $M^3$ presents a complex occlusal morphology with a hypocone that is often reduced (two thirds) or nearly absent (Table 22; Bailey, 2006[a]). Frequently, the mesial marginal ridge has accessory cusps (two thirds). Cusp 5 may also be present (one third). Carabelli's trait is less frequent (14%) than on $M^1$ and $M^2$. Scla 4A-8 has a complex morphology, notably a reduced hypocone, a cusp 5 and an accessory cusp on its mesial marginal ridge.

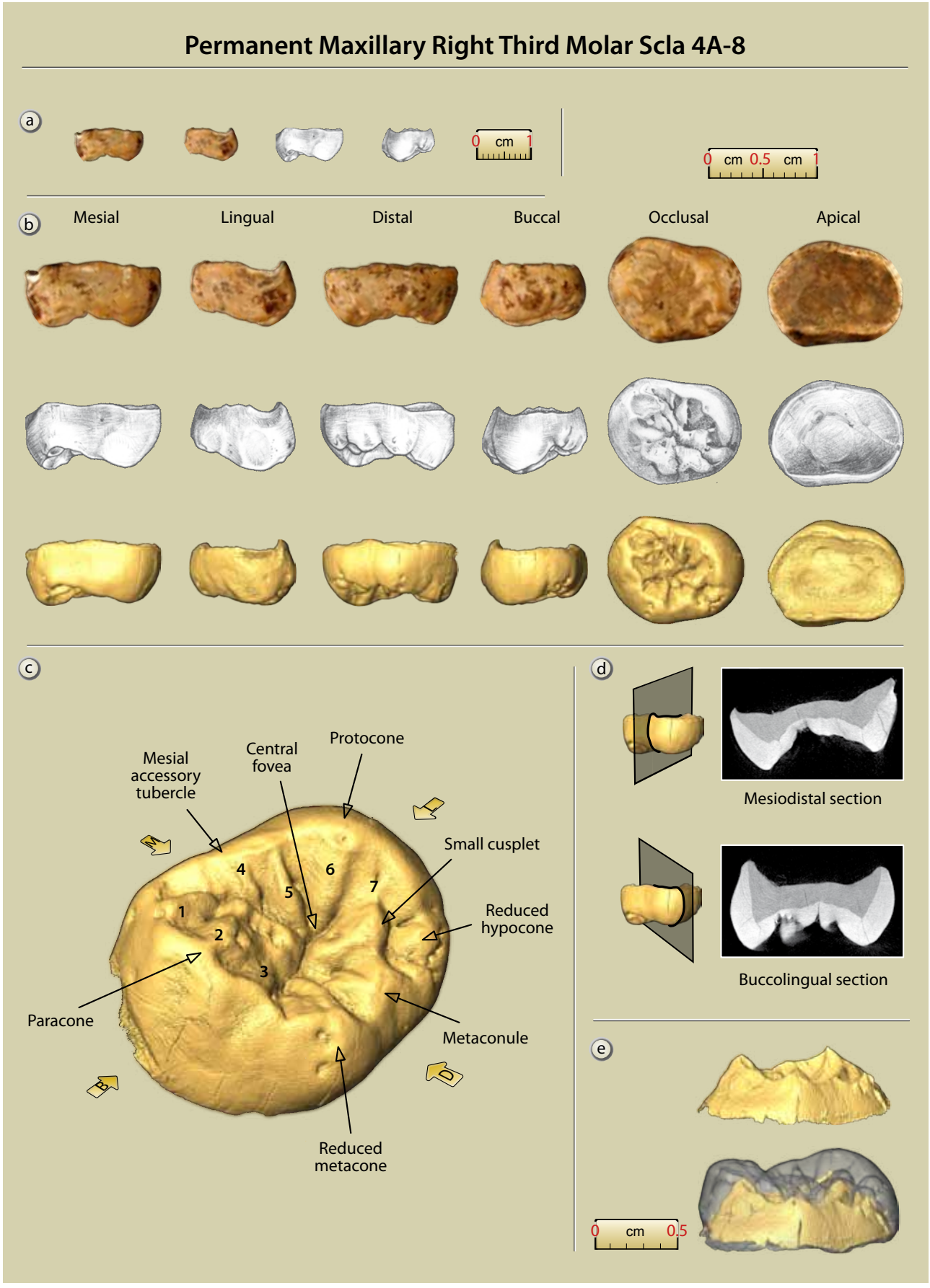


**Figure 27:** Scla 4A-8 permanent maxillary right third molar: a. mesial and lingual views (1:1 scale) ; b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Permanent Maxillary Third Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-8 |
|---|---|---|---|---|---|
| Distal accessory cusplet | 100% | 35.3% | 33.3% | 28.6% | yes |
| Carabelli's trait | 0% | 14.3% | 0% | 25.0% | yes |
| Mesial accessory cusps | - | 70% | 100% | 27.5% | yes |
| Hypocone reduction | 0% | 68.4% | 25.0% | 57.1% | yes |

Table 22: Distinctive anatomical features on permanent maxillary third molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-8.

### 3.12.3. Morphometric analysis

Measurements of the Scla 4A-8 permanent maxillary right second molar are as follows:

**MD**: 9.55 mm
**BL**: 12.20 mm

The MD and BL diameters of Scla 4A-8 do not depart significantly from the average of any of the five comparison samples (EN, LN, MPMH, UPMH & MHSS), both in regard to the DP probabilistic distance and ECRA (Table 23). When both diameters are situated on equiprobable ellipses (95%) they are in an area where all these five taxa overlap (Figure 28). Like for all incisors, canines, premolars and $UM^1$ and $UM^2$, this indicates that the dimensions of the crown of the permanent maxillary third molar do not frequently provide clear taxonomic indications.

## 3.13. Deciduous maxillary right first molar, $Rdm^1$

**Palaeoanthropological identification**: Scla 4A-7
**Field identification**: Sc 1991-574-11
**Date of discovery**: 12 November 1991
**Date of identification**: October 1993
**Square**: F27

**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: Units 4A-CHE or 4A-POC (units 4A-IP, 3-INF)

### 3.13.1 Description (Figure 29)

This deciduous upper molar consists of a complete crown with roots affected by partial resorption, but preserved for slightly more than the cervical third. The crown is quite heavily worn (Molnar, 1971, stage 4); its wear is very close to that of the right $dm^1$ of La Quina 18 (Figure 30) and, to a lesser extent, of the left $dm^1$ of La Quina 18. The enamel is vertically cracked over all its surfaces. No pathological conditions are noted.

The wear of the occlusal surface makes an accurate description difficult. Four cusps (paracone, protocone, hypocone and metacone) are present. The surface is crossed by some bridges of enamel, one joining the protocone and the metacone and another the protocone and hypocone. Between these bridges are six dentine areas of varying dimension. The cusp tips are internally compressed. The paracone is the biggest and the highest cusp.

The tooth exhibits a strong cingulum bulge near the crown base and, on its buccal face,

| Scladina | Diameter | Value |
|---|---|---|
| $RM^3$ (Scla 4A-8) | MD | 9.55 |
| | BL | 12.2 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 21 | MD | 10.069 | 0.773 | 0.510 | –0.322 |
| | 19 | BL | 12.121 | 0.868 | 0.929 | 0.043 |
| LN right & left | 22 | MD | 9.437 | 0.594 | 0.851 | 0.092 |
| | 21 | BL | 12.026 | 1.224 | 0.888 | 0.068 |
| MPMH right & left | 10 | MD | 9.440 | 0.631 | 0.865 | 0.077 |
| | 9 | BL | 12.089 | 0.891 | 0.904 | 0.054 |
| UPMH right & left | 36 | MD | 9.312 | 0.936 | 0.801 | 0.125 |
| | 37 | BL | 11.581 | 1.141 | 0.591 | 0.268 |
| MHSS right & left | 91 | MD | 8.616 | 0.659 | 0.160 | 0.714 |
| | 91 | BL | 10.693 | 0.818 | 0.069 | 0.928 |

Table 23: Scla 4A-8 (permanent maxillary right third molar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

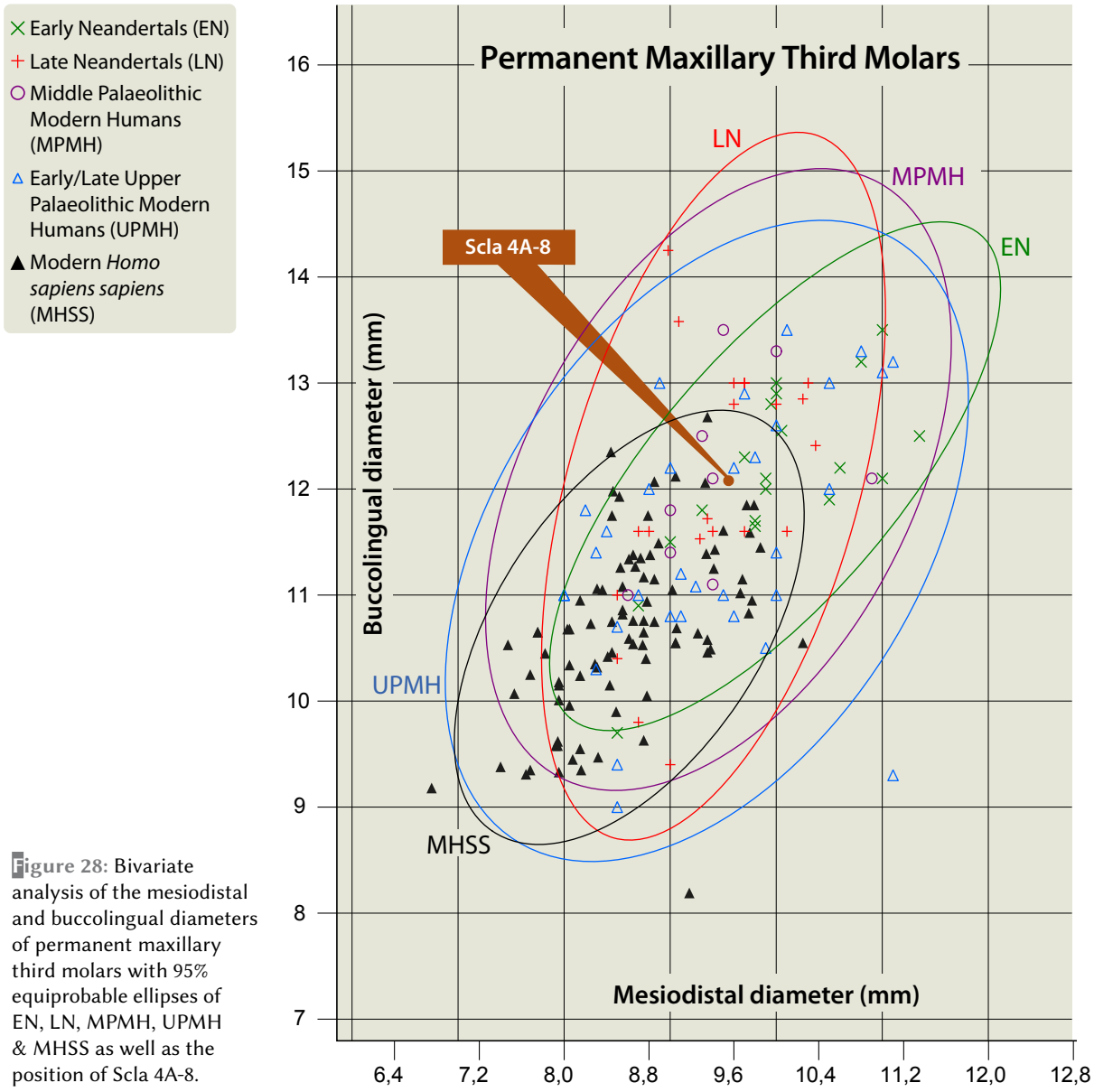


**Figure 28:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent maxillary third molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-8.

a pronounced mesiobuccal cingulum projection at the base of the paracone: the paramolar tubercle (*tuberculum molare* or parastyle). The protocone does not exhibit a Carabelli trait.

Interproximal wear facets are present on both the mesial and distal surfaces. In occlusal view, they affect the outline of the crown. The mesial side has a slight ripple parallel to its lower edge, highlighted by a breaking of the edge of the buccal side. There seems to have been two successive facets, one for the deciduous canine and the other for the permanent canine that is superimposed over the first.

### 3.13.2. Taxonomy

Most Neandertal dm[1]s have four cusps (Châteauneuf, Subalyuk, Shanidar 7, Grotte du Renne 34, Gibraltar II). Early Modern Middle Palaeolithic Humans are variable: four at Skhûl I but three at Qafzeh 4 (Bailey & Hublin, 2006; Tillier, 1979). Upper Palaeolithic and MHSS dm[1]s have usually two or three cusps; these teeth are more premolar-like than those of Neandertals. It has been reported (Bailey & Hublin, 2006) that the presence of Carabelli's structure would be diagnostic as such a trait would be absent in MHSS dm[1]s. Scla 4A-7 has four cusps but no Carabelli trait.

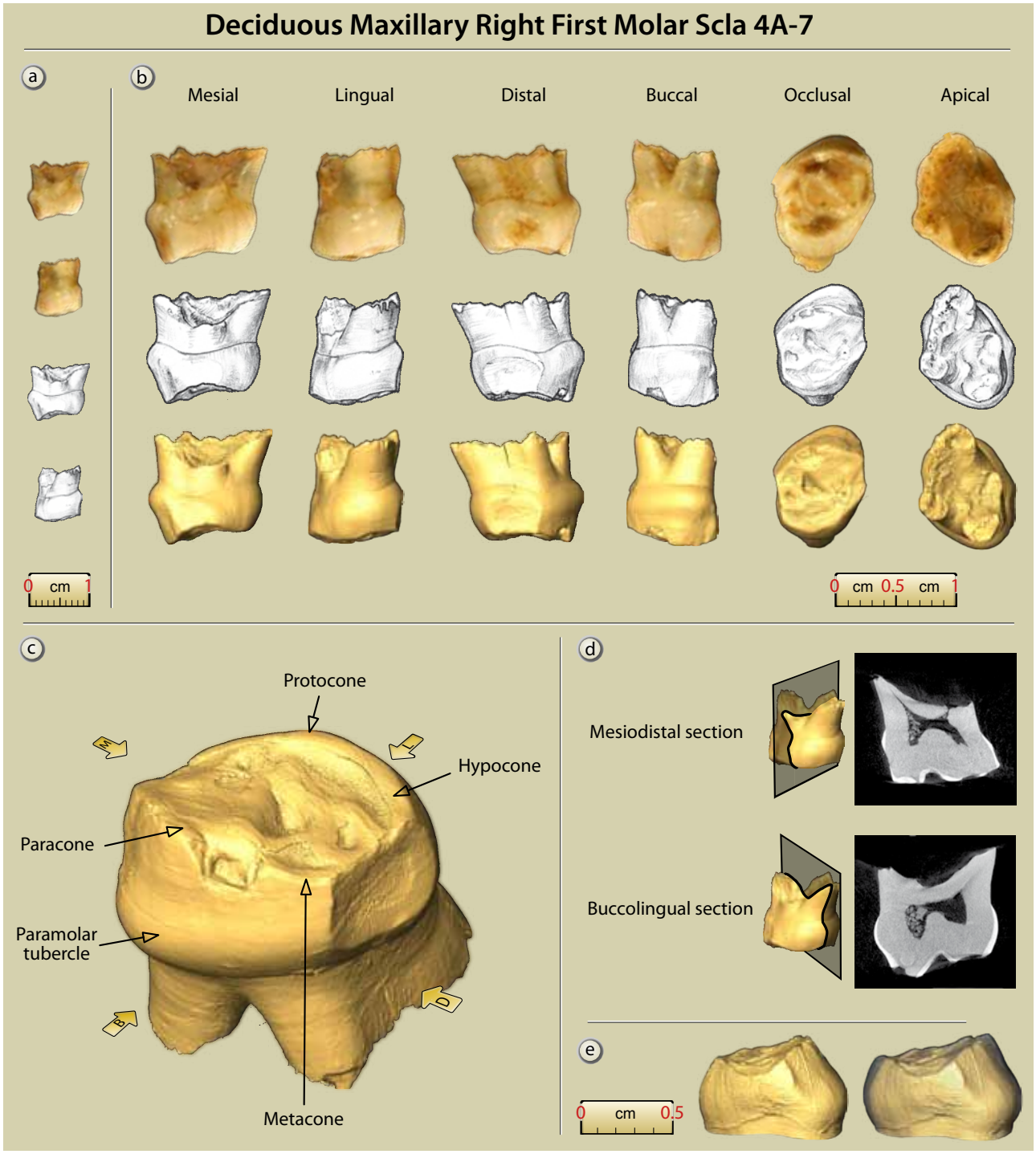


**Figure 29:** Scla 4A-7 deciduous maxillary right first molar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

**Figure 30.** Comparison of the wear of maxillary right dm¹, dm² and M¹ of Scladina I-4A (below) and La Quina 18 (above): original specimens.

### 3.13.3. Morphometric analysis

Measurements of the Scla 4A-7 deciduous maxillary right first molar are as follows:

**MD**: 7.52 mm
**BL**: 9.29 mm
**MD at the cervix**: 6.33 mm
**BL at the cervix**: 8.65 mm

The MD diameter of Scla 4A-7 departs significantly from the average of the MPMH comparative sample, only in regard to the DP probabilistic distance, but the samples are very small. The BL diameter does not depart from any of the comparative samples (Table 24). When both diameters of Scla 4A-7 are situated on equiprobable ellipses (95%) they are in an area where Neandertals, Upper Palaeolithic Modern Humans (UPMH) and MHSS overlap

| Scladina | Diameter | Value |
|---|---|---|
| Rdm[1] (Scla 4A-7) | MD | 7.52 |
| | BL | 9.29 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| Neandertals | 17 | MD | 7.84 | 0.43 | 0.468 | −0.351 |
| | 17 | BL | 9.14 | 0.4 | 0.713 | 0.177 |
| MPMH | 4 | MD | 8.6 | 0.23 | 0.018 | −1.475 |
| | 4 | BL | 9.16 | 0.51 | 0.815 | 0.004 |
| UPMH | 17 | MD | 7.37 | 0.6 | 0.806 | 0.118 |
| | 16 | BL | 9.15 | 0.77 | 0.858 | 0.085 |
| MHSS | 99 | MD | 7.1 | 0.61 | 0.493 | 0.347 |
| | 100 | BL | 8.55 | 0.56 | 0.189 | 0.666 |

**Table 24:** Scla 4A-7 (deciduous maxillary right first molar): MD and BL dimensions compared to those of Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

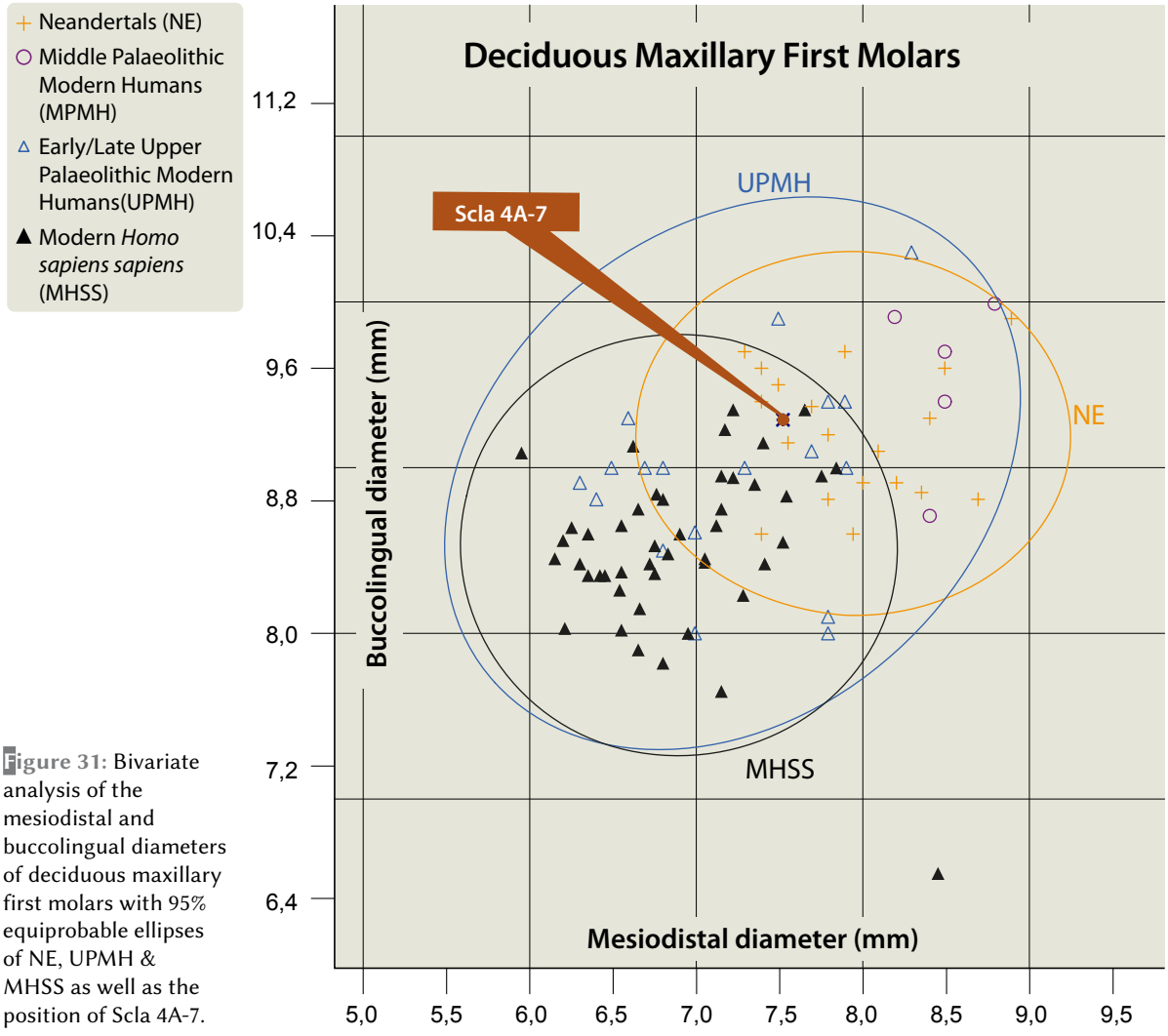


**Figure 31:** Bivariate analysis of the mesiodistal and buccolingual diameters of deciduous maxillary first molars with 95% equiprobable ellipses of NE, UPMH & MHSS as well as the position of Scla 4A-7.

(Figure 31). This indicates that the dimensions of the crown of the deciduous maxillary first molar do not provide clear taxonomic indications.

## 3.14. Deciduous maxillary right second molar, Rdm²

**Palaeoanthropological identification**: Scla 4A-5
**Field identification**: Sc 1990-81-46
**Date of discovery**: 13 March 1990
**Date of identification**: October 1993
**Square**: G27
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: units 4A-POC or 3-INF (units 4A-IP, 4A-CHE, 3-SUP)

### 3.14.1. Description (Figure 32)

This tooth consists of a complete crown. The mesiobuccal root is complete, but the lingual and distobuccal roots are incomplete, due to the beginning of resorption. The enamel is vertically cracked over all its surfaces. No pathological conditions are noted.

The occlusal outline of the tooth, which has four large main cusps, is rhomboidal; the distal cusps (especially the metacone) are placed lingually relatively to the mesial cusps (paracone and protocone). The crown is slightly worn (Molnar, 1971, stage 2-3), which prevents a detailed description of the details of the occlusal basin.

The protocone is the largest cusp. It does not have Carabelli's cusp. A well-developed *crista obliqua* connects the protocone and metacone. Another crest connects the metacone and the mesial part of the hypocone. The hypocone is larger than the metacone.

The lingual surfaces exhibit a vertical groove between the protocone and the hypocone. On the buccal surface is a similar, but incomplete, groove separating the paracone and the metacone.

There is a large distal interproximal wear facet in the middle of the distal face of the crown: 3.9 mm in width × 2.25 mm in height. A small mesial interproximal wear facet occurs on the lingual part of the mesial face of the crown.

The tooth has three divergent roots, the buccodistal and the lingual ones being incomplete, due to the erupting $P^4$. The section of the lingual root is slightly C-shaped while the sections of both the buccal roots are 8-shaped.

### 3.14.2. Taxonomy

The dental morphology of the Neandertal second deciduous maxillary molar is similar to that of the permanent $M^1$ (Tillier, 1979; Bailey & Hublin, 2006), i.e. four main cusps, metacone mesially and lingually orientated, hypocone larger than metacone and sometimes a large Carabelli's cusp. The Scla 4A-5 deciduous molar is similar to this Neandertal pattern, except for the absence of Carabelli's structure.

### 3.14.3. Metrics

Measurements of the Scla 4A-5 deciduous maxillary right second molar are as follows:

**MD**: 8.83 mm
**BL**: 10.29 mm
**MD at the cervix**: 7.3 mm
**BL at the cervix**: 9.4 mm
**Length of the tooth**: 13.6 mm

The MD and BL diameters of Scla 4A-5 do not depart significantly from the average of any of the five comparative samples (Neandertals, MPMH, UPMH & MHSS), in regard to both the DP probabilistic distance and ECRA (Table 25). When both MD and BL crown diameters of Scla 4A-5 are situated on equiprobable ellipses (95%) they are in an area where Neandertals, Upper Palaeolithic Modern Humans and MHSS overlap (Figure 33). This indicates that the dimensions of the crown of the deciduous maxillary second molar do not often provide clear taxonomic indications, especially in the case of Scla 4A-5.

## 3.15. Permanent mandibular first molars, $M_1$

### 3.15.1. Description

*Permanent mandibular right first molar, $RM_1$ (Figure 34)*

**Palaeoanthropological identification**:
Scla 4A-1/$M_1$ (as part of the right hemimandible)
**Field identification**: Sc 1993-148-185
**Date of discovery**: 16 July 1993
**Date of identification**: 20 July 1993
**Square**: D29
**Stratigraphic position**:
- **Former stratigraphy**: 4A
- **New stratigraphy**: Unit 4A-CHE, Layer 4A-GX

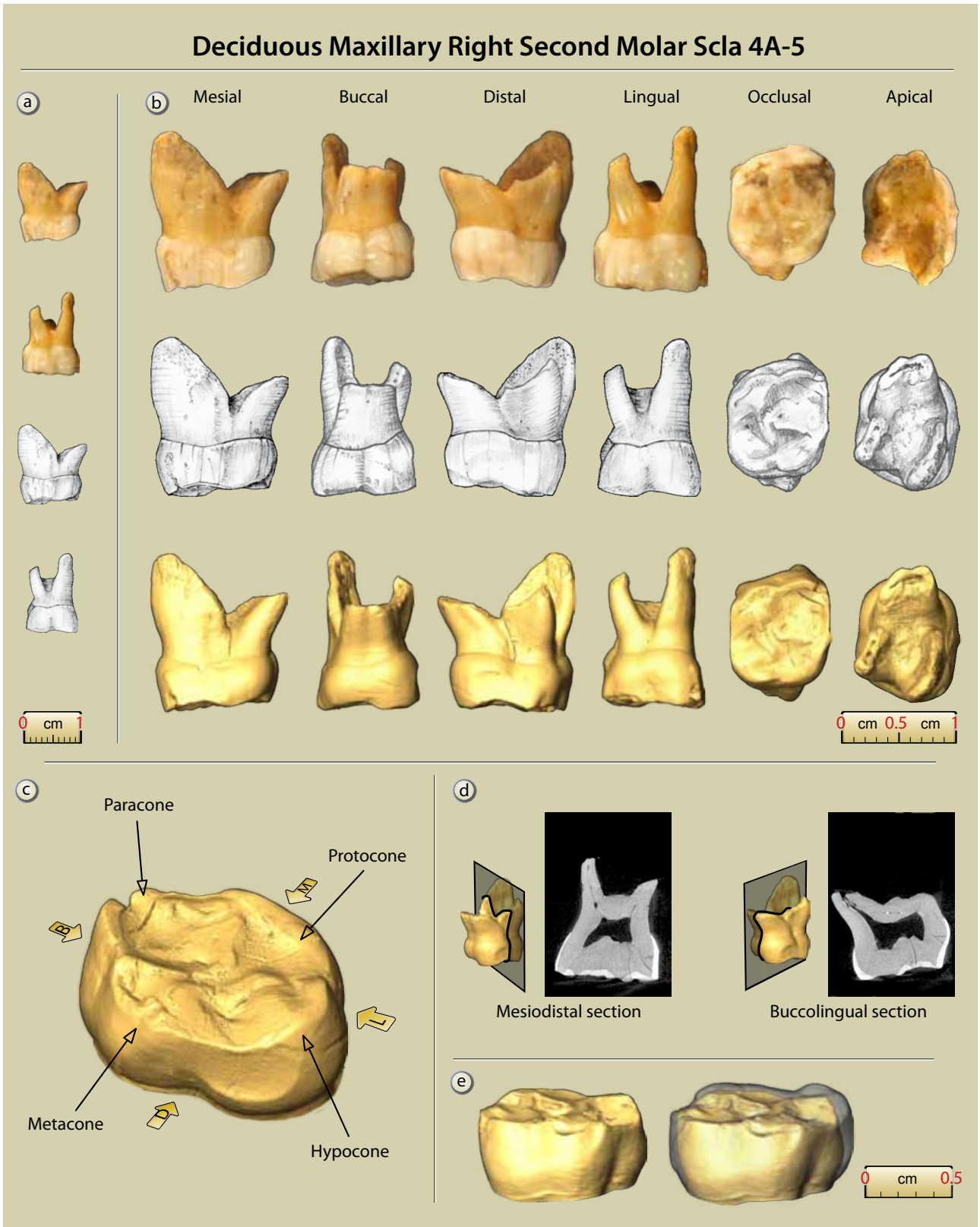


**Figure 32:** Scla 4A-5 deciduous maxillary right second molar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Scladina | Diameter | Value |
|---|---|---|
| Rdm² (Scla 4A-5) | MD | 8.83 |
| | BL | 10.29 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| Neandertals | 17 | MD | 9.43 | 0.67 | 0.383 | –0.422 |
| | 17 | BL | 10.26 | 0.58 | 0.959 | 0.024 |
| MPMH | 5 | MD | 9.58 | 0.36 | 0.105 | –0.750 |
| | 5 | BL | 10.81 | 0.65 | 0.468 | –0.288 |
| UPMH | 17 | MD | 9.14 | 0.73 | 0.676 | –0.200 |
| | 16 | BL | 10.21 | 0.55 | 0.886 | 0.068 |
| MHSS | 47 | MD | 8.64 | 0.422 | 0.654 | 0.224 |
| | 47 | BL | 9.54 | 0.497 | 0.138 | 0.750 |

**Table 25:** Scla 4A-5 (deciduous maxillary right second molar): MD and BL dimensions compared to those of Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

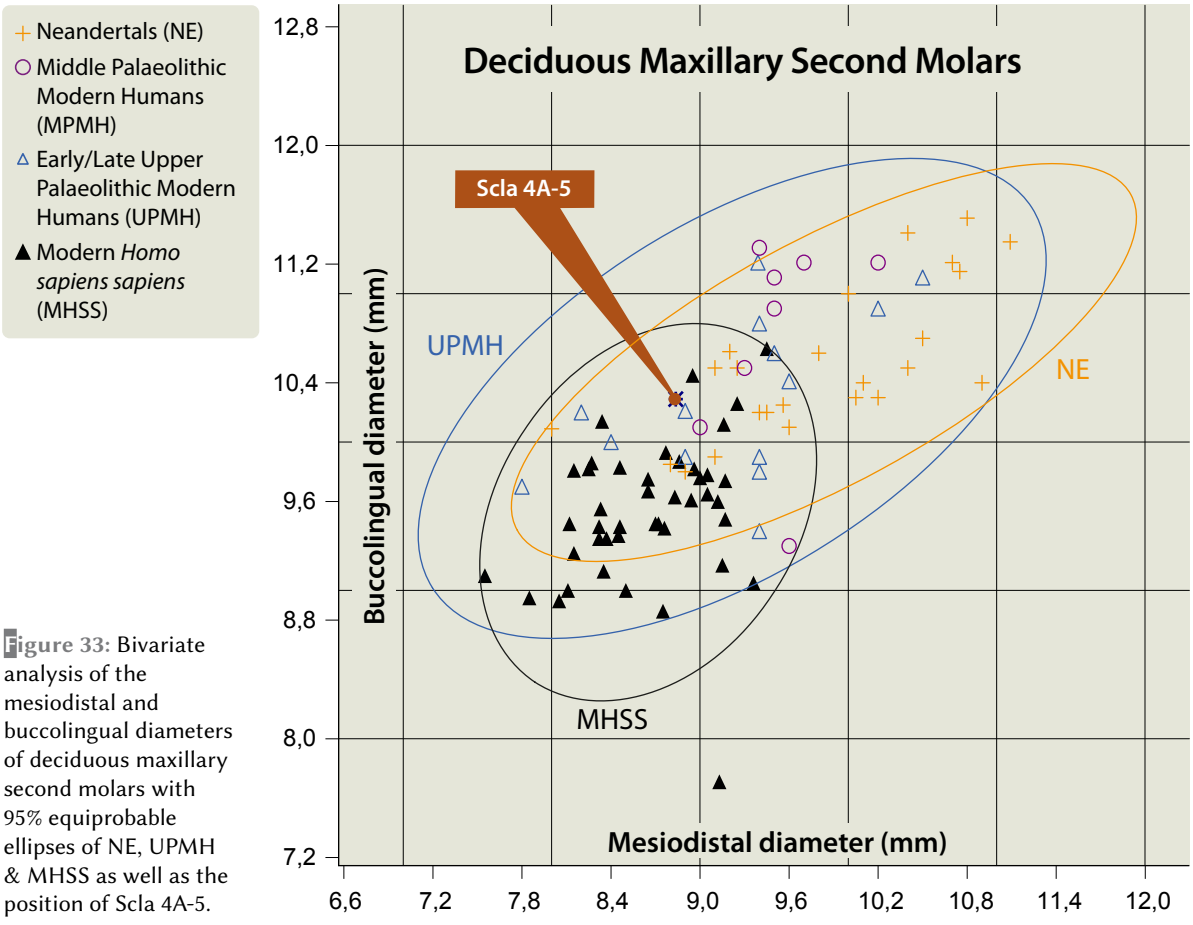


**Figure 33:** Bivariate analysis of the mesiodistal and buccolingual diameters of deciduous maxillary second molars with 95% equiprobable ellipses of NE, UPMH & MHSS as well as the position of Scla 4A-5.

This tooth, in situ in the Scla 4A-1 right half of the mandible, is completely erupted. Its crown was functional. Its roots are also completely formed with closed apices. No pathological conditions are noted. It is well preserved, except for vertically, and some horizontally, orientated microfractures on the crown.

The occlusal surface presents five cusps, arranged in a Y5 pattern. The protoconid (cusp 1, mesiobuccal) is the largest, followed by the metaconid (cusp 2, mesiolingual) and entoconid (cusp 4, distolingual), then the hypoconid (cusp 3, centrobuccal), and the hypoconulid (cusp 5, distobuccal), which is the smallest (ASUDAS, grade 4). There is neither cusp 6 (*tuberculum sextum*/entoconulid) nor cusp 7 (*tuberculum intermedium*/metaconulid). Wear degree is nearly at stage 3 of Molnar (1971) with only extremely small dentine patches.

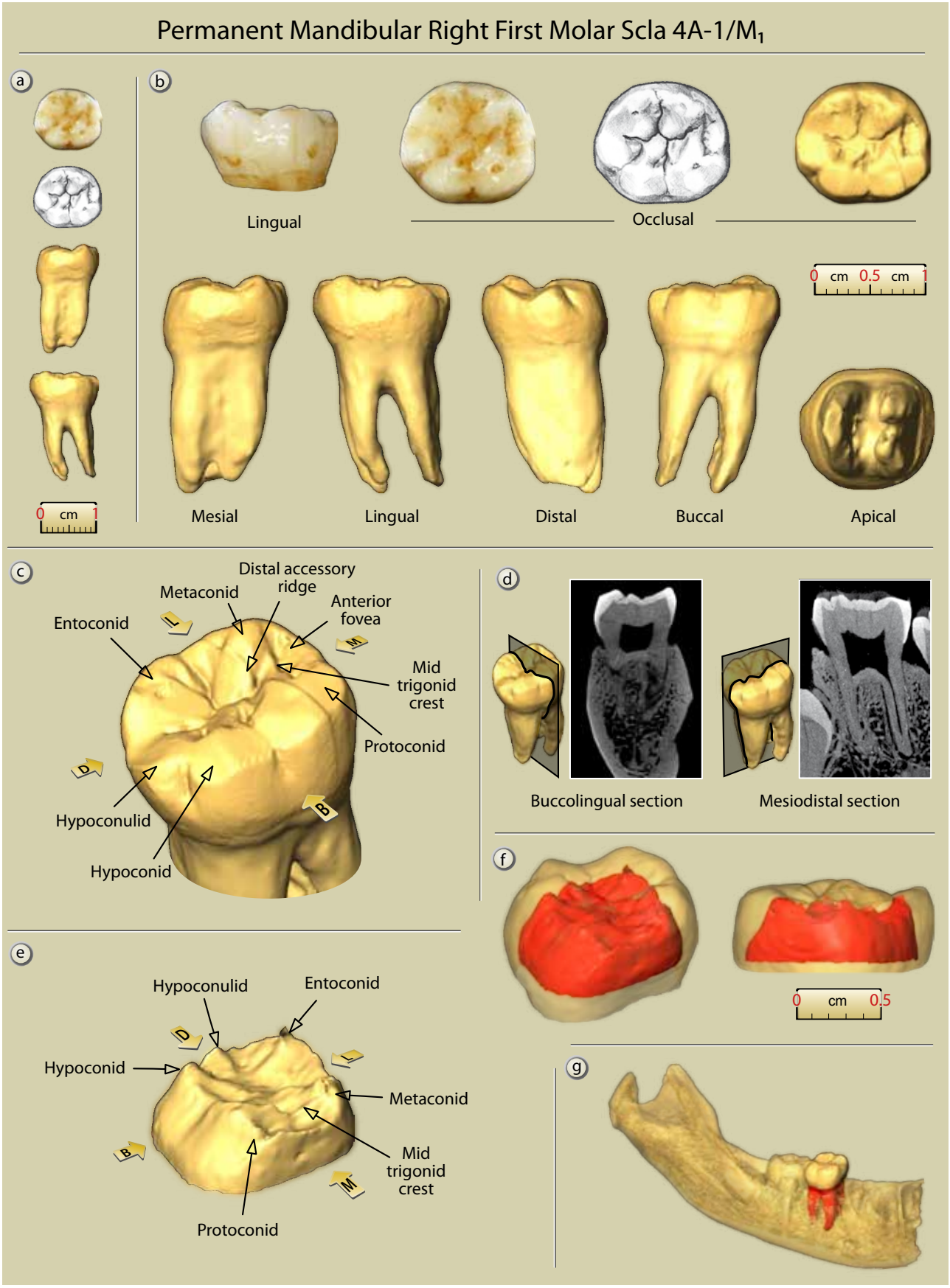


Figure 34: Scla 4A-1/M$_1$ permanent mandibular right first molar: a. occlusal, mesial and lingual views (1:1 scale); b. lingual and occlusal faces, photograps; occlusal face, drawing; 3D reconstruction of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D reconstruction with main anatomical features at the EDJ; f. 3D views at the EDJ with enamel; g. position of the tooth (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

The mesial marginal ridge, delineating the mesial edge of the occlusal surface, exhibits a concave profile in anterior view. It does not have any clear mesial marginal accessory tubercle, just a tiny undulation in its center. Behind the mesial marginal ridge, the anterior fovea is transversal, wide and quite deep (ASUDAS, Anterior fovea $LM_1$, grade 4).

On the outer enamel surface (OES), the mid-trigonid crest (MTC; Bailey, 2002[a, b]) is continuous but is reduced at the level of the sagittal sulcus (Bailey et al., 2011). Its distal slope is marked by an oblique groove toward the lingual side, corresponding to the front part of the sagittal sulcus. The MTC is formed by the junction of the essential/middle ridge of the protoconid and the mesial accessory ridge of the metaconid (see Skinner et al., 2008). On the EDJ (enamel-dentine junction) surface, the MTC is also continuous but reduced at the sagittal sulcus; it has the same origin as the OES, i.e. on the middle lobe segment of the protoconid and the mesial lobe segment of the metaconid.

The protoconid exhibits a short and low distal accessory ridge on the OES and more clearly on the EDJ. It joins the mesial part of the essential crest of the metaconid, forming a faint and interrupted bridge.

The essential crest of the metaconid does not exhibit any clear angulation, or deflection, in its course towards the central occlusal fossa; so there is no real deflecting wrinkle (Turner et al., 1991). The distal part of this essential crest of the metaconid joins, on the OES, that of the hypoconid, creating a Y pattern.

The protoconid lacks a true protostylid (as defined by the ASUDAS; Turner et al.,1991: 24).

The hypoconid is well defined and separated from the adjacent protoconid and hypoconulid by marked grooves, both on the OES and the EDJ. The hypoconulid, which has one essential crest or wrinkle, is well separated from the entoconid on the OES and more strongly on the EDJ.

A mesial interproximal wear facet, measuring 2.6 mm in height × 3.2 mm in width, is present on the buccal half of the mesial face of the crown. Its inferior border is slightly concave; the angles between inferior and lateral borders are rounded. It does not have any subvertical grooves. In occlusal view, this facet slightly alters the outline of the crown. As the adjacent right $M_2$ was not at its final level at death, and as far as the 3D reconstruction visually allowed, there is no real distal interproximal facet. The cervix of Scla 4A-1/$M_1$ slightly dips in the middle of both the buccal and lingual sides.

This $M_1$ does not exhibit any degree of taurodontism. The mesial root is flattened, 8-shaped in cross-section, slopes distally, and curves behind its apex, where it is divided in two (bifurcated apically). Its mesial face exhibits a vertical groove. The distal root is also flattened, but C-shaped, and slopes distally but with a weaker groove and without apical division. The three apices are all closed.

### *Permanent mandibular left first molar, $LM_1$ (Figure 35)*

**Palaeoanthropological identification**: Scla 4A-9/$M_1$ (as part of the left hemimandible)
**Field identification**: Sc 1996-203-1
**Date of discovery**: 12 July 1996
**Date of identification**: 12 July 1996
**Square**: C28

- **Stratigraphic position**: Former stratigraphy: 4A
- **New stratigraphy**: Unit 4A-CHE (Unit 4A-POC), Layer 4A-JA (?)

The morphology of this permanent mandibular left first molar is very close to that of the corresponding right molar.

The tooth is in situ in the Scla 4A-9 left half of the mandible. It is completely erupted and has a functional crown. Its roots are also completely formed with closed apices. No pathological conditions are noted. It is well preserved, except for vertically, and some horizontally, orientated microfractures on the crown. Black spots of manganese are present, mainly on the occlusal surface.

Like its antimere, the occlusal surface has five cusps, arranged in an Y5 pattern. The protoconid (cusp 1) is the largest, followed by the metaconid (cusp 2) and entoconid (cusp 4), then the hypoconid (cusp 3), and the hypoconulid (cusp 5), which is the smallest (ASUDAS, grade 5). There is no cusp 6 (*tuberculum sextum*/entoconulid) or cusp 7 (*tuberculum intermedium*/metaconulid). Wear degree is at stage 3 of Molnar (1971) with only small dentine patches.

As in the right $M_1$, the mesial accessory crest of the metaconid and the essential crest of the protoconid form the MTC which is, on the OES, continuous but reduced at the sagittal sulcus (Bailey, 2002[b], grade 2). On the EDJ surface, the MTC is nearly continuous. The essential crest of the metaconid does not present deflection. It joins the essential crest of the hypoconid, so that the

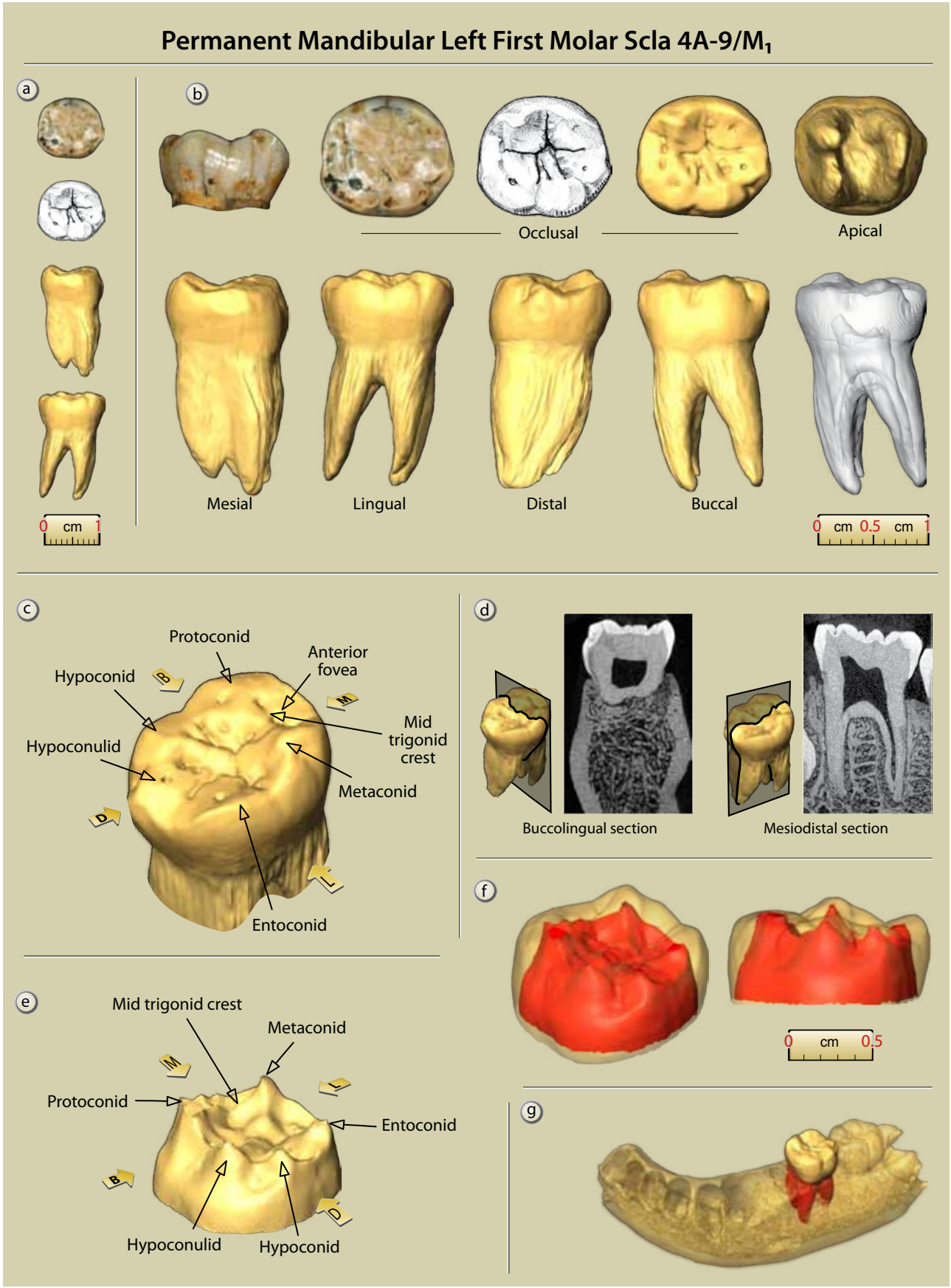


Figure 35: Scla 4A-9/M1 permanent mandibular left first molar: a. occlusal, mesial and lingual views (1:1 scale); b. lingual and occlusal faces, photograps; occlusal face, drawing; 3D reconstruction of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D reconstruction with main anatomical features at the EDJ; f. 3D views at the EDJ with enamel; g. position of the tooth (micro-CT data processing and graphics J.-F. Lemaire, SPW ; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Permanent Mandibular First Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-9/$M_1$ | Scla 4A-1/$M_1$ |
|---|---|---|---|---|---|---|
| Four cusps | 0% | 2% | 0% | 2.9% | no (5 cusps) | no (5 cusps) |
| Fissure pattern: Y | 100% | 97.3% | 100% | 92.9% | yes | yes |
| Anterior fovea | 83.3% | 88.6% | 83.3% | 52.6% | yes | yes |
| Mid-trigonid crest | 71.4% | 93.5% | 20% | 0% | yes | yes |
| Distal trigonid-crest | 0% | 3% | 0% | 4% | weak | weak |
| Deflecting wrinkle | 0% | 3.8% | 75% | 15.8% | no | no |
| Cusp 6 | 0% | 36.4% | 0% | 18.2% | no | no |
| Cusp 7 | 0% | 36.1% | 50% | 6.9% | no | no |

**Table 26:** Distinctive anatomical features on permanent mandibular first molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-9/$M_1$ & Scla 4A-1/$M_1$.

tooth has a Y pattern. No well defined distal trigonid crest is present.

A mesial interproximal wear facet can be observed, on the buccal half of the mesial face of the crown, like on the right $M_1$. Its general shape is similar but it can be divided into two parts, with a small superior subfacet on the buccal side. It does not have subvertical grooves. In occlusal view, the outline of the crown is only slightly affected. There is no clear distal interproximal facet.

In buccal view, there is a strong but short groove separating the protoconid and the hypoconid and a furrow between the hypoconid and hypoconulid. Like its antimere, the cervix of Scla 4A-9/$M_1$ slightly dips in the middle of both the buccal and lingual sides.

The left $M_1$ does not exhibit any degree of taurodontism. Its roots are very close to those of the right $M_1$. They are flattened and slope distally; the mesial one is 8-shaped and curves behind its apex, where it is divided in two. It exhibits a vertical groove. The distal root is C-shaped. The three apices are closed.

### 3.15.2 Taxonomy

Overall, the morphology of the Neandertal $M_1$s tend to be complex (Bailey, 2002[b] and Table 26, from Bailey, 2006[a]):

- Neandertal $M_1$s nearly always (98%) possess more than four cusps, like *Homo erectus* and Archaic *Homo sapiens*. A few Upper Palaeolithic amHS and contemporary humans may have, however in very low frequency, four cusps;
- Neandertal $M_1$s exhibit high frequencies of the Y-pattern but this feature is not specific to this taxon insofar as other human fossils and modern humans have almost similar percentages;
- some Neandertal $M_1$s exhibit an entoconulid (cusp 6) and a metaconulid (cusp 7), but in relatively low frequencies (Bailey, 2002[b]: 91, 93), which is within the ranges of contemporary amHS;
- Neandertal $M_1$s tend to possess a deep and wide anterior fovea (Bailey, 2002[b]), much outside the range of Early Modern Europeans, while *Homo erectus* and Archaic *Homo sapiens* are closer to Neandertals;
- The $M_1$s exhibit a well-developed bridge of enamel, the mid-trigonid crest (MTC), which joins the protoconid and metaconid, bordering distally the anterior fovea (Bailey, 2002[b]: 91–94; Bailey & Hublin, 2006: 19). The Neandertal MTC is continuous. It is the most notable feature differentiating Neandertals from contemporary humans.

The first two mandibular molars of Scladina exhibit a deep and wide anterior fovea and a MTC, two typical characters of the Neandertal $M_1$ pattern. They also possess five cusps and an Y5 pattern, like numerous other Neandertal molars.

### 3.15.3. Metrics

Measurements of the Scla 4A-1/$M_1$ and Scl 4A-9/$M_1$ molars are as follows:

**Scla 4A-1**

**MD**: 11.70 mm
**BL**: 10.48 mm

**Scla 4A-9**

**MD**: 11.64 mm
**BL**: 10.68 mm

The MD and BL diameters of Scla 4A-1/$M_1$ and 4A-9/$M_1$ do not depart significantly from the average of any of the five comparison samples (EN,

LN, MPMH, UPMH & MHSS), in regard to both the DP probabilistic distance and ECRA (Table 27). When both MD and BL crown diameters of the permanent mandibular first molars are situated on equiprobable ellipses (95%) they are in an area where Early and Late Neandertals, Middle Palaeolithic and Upper Palaeolithic Modern Humans as well as MHSS overlap (Figure 36).

| Scladina | N | Diameter | Value |
|---|---|---|---|
| $M_1$ | Scla 4A-1/$M_1$ | MD | 11.7 |
| | | BL | 10.48 |
| | Scla 4A-9/$M_1$ | MD | 11.64 |
| | | BL | 10.68 |

**Table 27:** Scla 4A-1/$M_1$ & 4A-9/$M_1$ (permanent mandibular first molars): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

| | | | | | vs Scla 4A-1/$M_1$ | | vs Scla 4A-9/$M_1$ | |
|---|---|---|---|---|---|---|---|---|
| **Comparison Samples** | **N** | **Diameter** | **Mean** | **Stand. Dev.** | **DP** | **ECRA** | **DP** | **ECRA** |
| **EN right and left** | 28 | MD | 11.902 | 0.864 | 0.817 | −0.114 | 0.764 | −0.148 |
| | 27 | BL | 11.165 | 0.731 | 0.358 | −0.456 | 0.513 | −0.323 |
| **LN right and left** | 58 | MD | 11.291 | 0.632 | 0.520 | 0.323 | 0.583 | 0.276 |
| | 58 | BL | 10.783 | 0.567 | 0.595 | −0.267 | 0.857 | −0.091 |
| **MPMH right and left** | 14 | MD | 11.707 | 0.812 | 0.993 | −0.004 | 0.935 | −0.038 |
| | 13 | BL | 11.385 | 0.954 | 0.362 | −0.435 | 0.474 | −0.339 |
| **UPMH right and left** | 60 | MD | 11.512 | 0.826 | 0.821 | 0.114 | 0.877 | 0.077 |
| | 62 | BL | 10.995 | 0.522 | 0.328 | −0.493 | 0.549 | −0.302 |
| **MHSS** | 102 | MD | 10.813 | 0.679 | 0.194 | 0.659 | 0.226 | 0.614 |
| | 103 | BL | 10.125 | 0.458 | 0.440 | 0.390 | 0.229 | 0.610 |

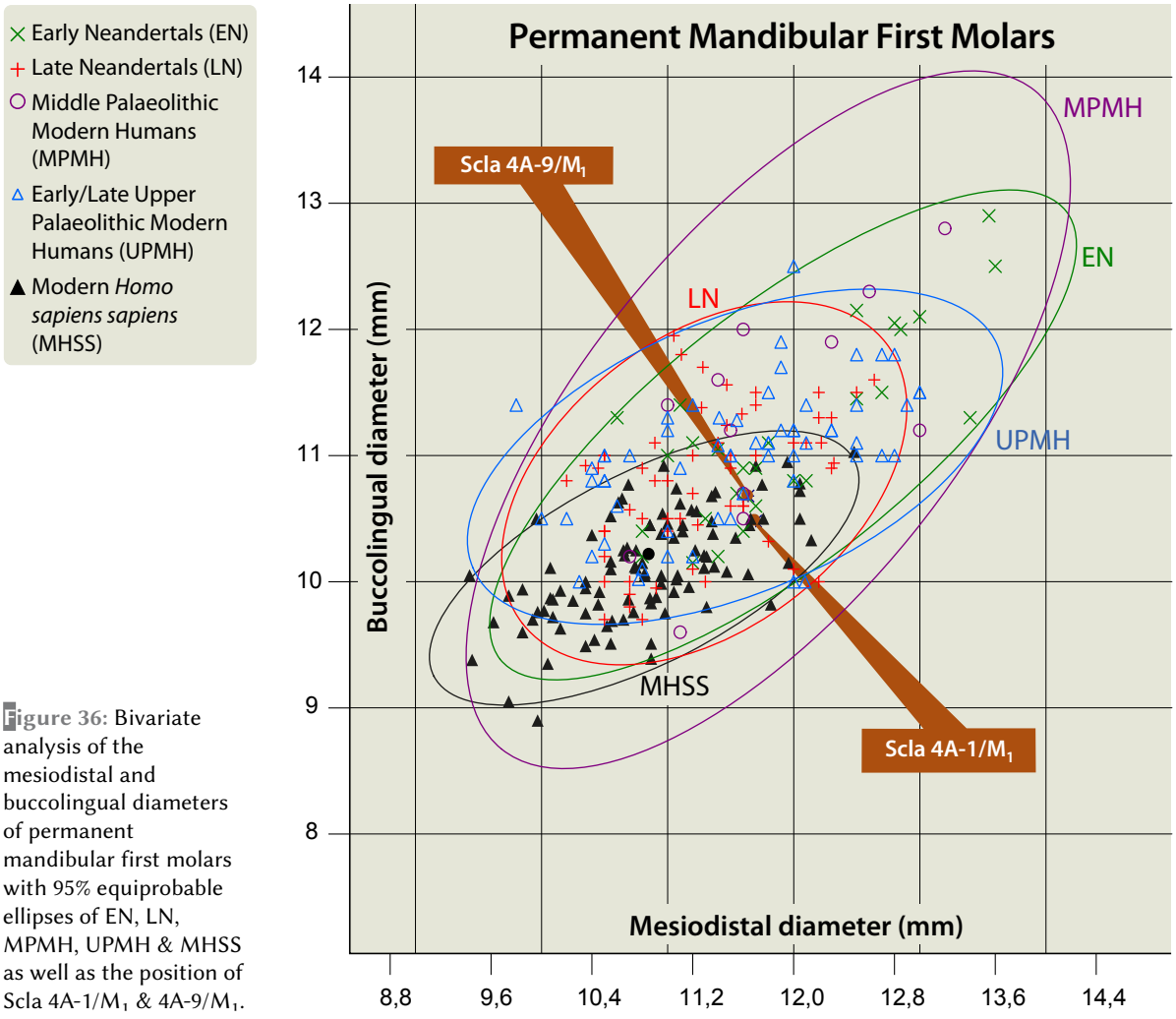


**Figure 36:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular first molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-1/$M_1$ & 4A-9/$M_1$.

## 3.16. Permanent mandibular second molars, $M_2$

### 3.16.1. Description

*Permanent mandibular right second molar, $RM_2$ (Figure 37)*

**Palaeoanthropological identification**:
Scla 4A-1/$M_2$ (as part of the right hemimandible)
**Field identification**: Sc 1993-148-185
**Date of discovery**: 16 July 1993
**Date of identification**: 20 July 1993
**Square**: D29
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: Unit 4A-CHE, Layer 4A-GX

This tooth, embedded within the Scla 4A-1 right half of the mandible, is almost completely erupted. Its crown was not yet really functional. The $M_2$ shows only very superficial wear of the cusp tips' enamel (Molnar, 1971, stade 2). Only two thirds of its roots are formed. No pathological conditions are noted. It is well preserved, except for rare, vertically orientated microfractures on the crown.

The occlusal surface presents five cusps. The protoconid is the largest, then the metaconid, followed by the hypoconid and entoconid, and finally the hypoconulid, the smallest (ASUDAS, grade 4). There is no cusp 6 (*tuberculum sextum*) or cusp 7 (*tuberculum intermedium*/metaconulid).

The mesial marginal ridge does not present any clear marginal accessory tubercle. The anterior fovea is transversal, deep and wide (ASUDAS LM1, grade 4).

The MTC is formed by the junction of the essential/middle ridge of the protoconid and the mesial accessory ridge of the metaconid (see Skinner et al., 2008). This bridge is interrupted in its upper half by two grooves. The most lingual (Figure 37c: no. 1) of these grooves corresponds to the central groove (sagittal sulcus) which also runs across the anterior fovea. The most buccal groove (no. 2) of the mid-trigonid crest slopes inward to the central fovea, so that the centre of the MTC nearly forms a distinct cuspule (no. 3). On the EDJ, however, the MTC is more continuous but concave at the level of the sagittal sulcus. In mesial view, the MTC is higher than the mesial marginal ridge.

As on the first molar, the protoconid exhibits a distal, but better marked, accessory ridge (no. 4) on the OES and the EDJ. It joins the central part of the essential ridge (no. 5) of the metaconid, forming a bridge, interrupted at the level of the sagittal sulcus, that can be regarded as a distal trigonid crest. The distal part of the essential crest of the metaconid joins, on the OES, the essential crest of the hypoconid, creating a Y5 pattern. There is no deflecting wrinkle of the essential crest of the metaconid. A weak protostylid is visible on the buccal surface of the protoconid (ASUDAS, grade 1).

The entoconid presents an essential crest that bifurcates mid-way to the occlusal basin, with a distal branch (no. 7) joining the sagittal fissure and a mesial one (no. 6) joining the transverse sulcus between the metaconid and entoconid. The hypoconid has a small mesial accessory ridge and a long essential crest joining the distal part of the essential crest of the metaconid. The hypoconulid is grade 3 of ASUDAS; it has an essential crest and, mainly on the EDJ, a faint accessory crest on its buccal part. In buccal view, there is a strong but short furrow between the protoconid and the hypoconid. A furrow also appears between the hypoconid and hypoconulid.

Neither mesial nor distal interproximal facets are present.

Both roots are flattened, and slope slightly distally. In cross-section, the mesial root is 8-shaped while the distal root is C-shaped.

*Permanent mandibular left second molar, $LM_2$ (Figure 38)*

**Palaeoanthropological identification**:
Scla 4A-9/$M_2$, (as part of the left hemimandible)
**Field identification**: Sc 1996-203-1
**Date of discovery**: 12 July 1996
**Date of identification**: 12 July 1996
**Square**: C28
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: Unit 4A-CHE (Unit 4A-POC), Layer 4A-JA (?)

In situ in the Scla 4A-9 left hemimandible, this tooth has a general morphology which is quite similar to its Scla 4A-1/$M_2$ antimere.

It is not completely erupted, but somewhat more so than Scla 4A-1/$M_1$. The crown is at least partly functional with superficial wear of the enamel of the tips of the cusps (Molnar, 1971, stade 2). The roots are incompletely formed : only two thirds are formed. No pathological conditions are noted. Numerous microfractures, mainly vertically orientated, can be observed on the crown.

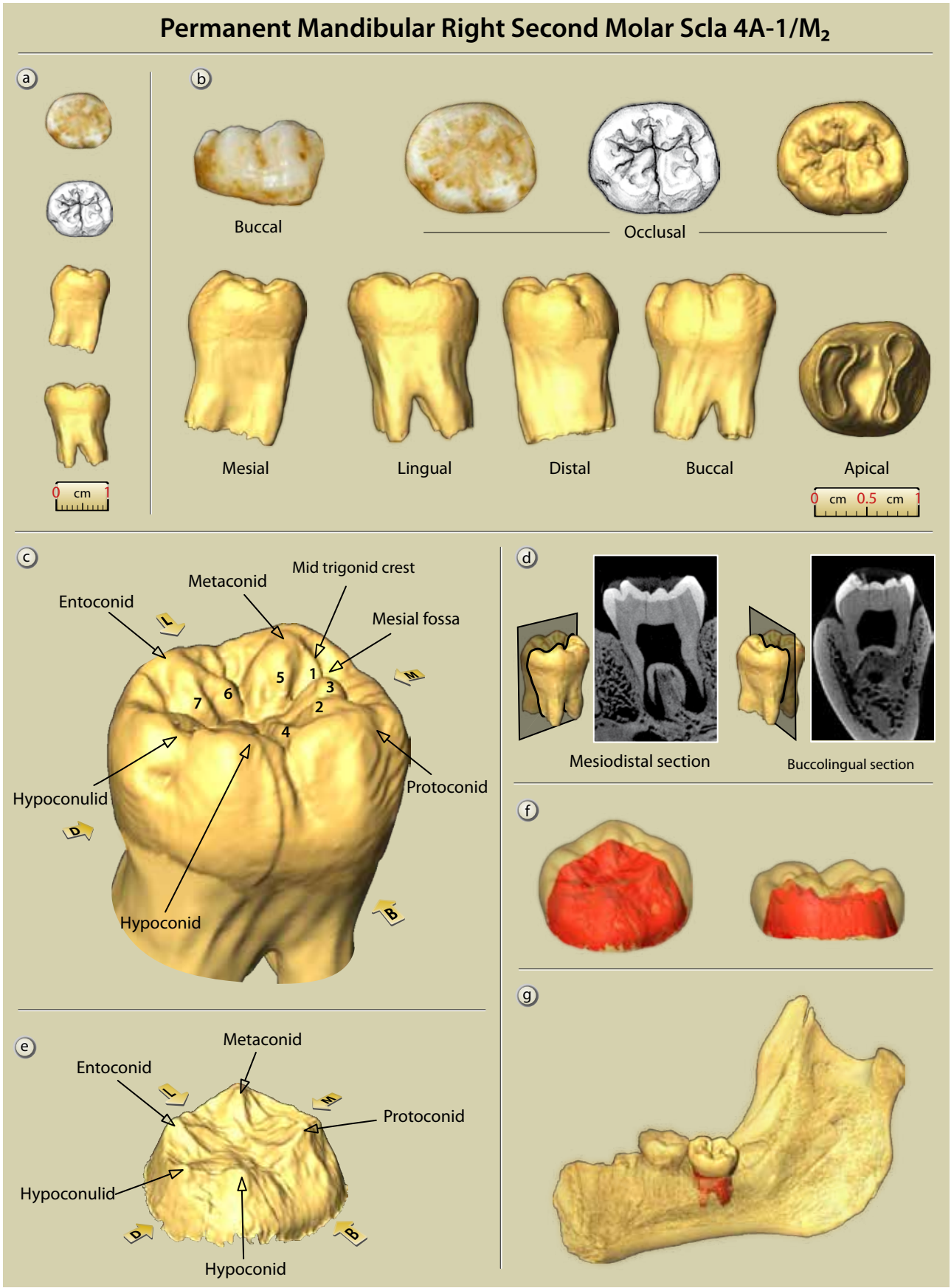


**Figure 37:** Scla 4A-1/$M_2$ permanent mandibular right second molar: a. occlusal, mesial and lingual views (1:1 scale); b. buccal and occlusal faces, photograps; occlusal face, drawing; 3D reconstruction of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D reconstruction with main anatomical features at the EDJ; f. 3D views at the EDJ with enamel; g. position of the tooth (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

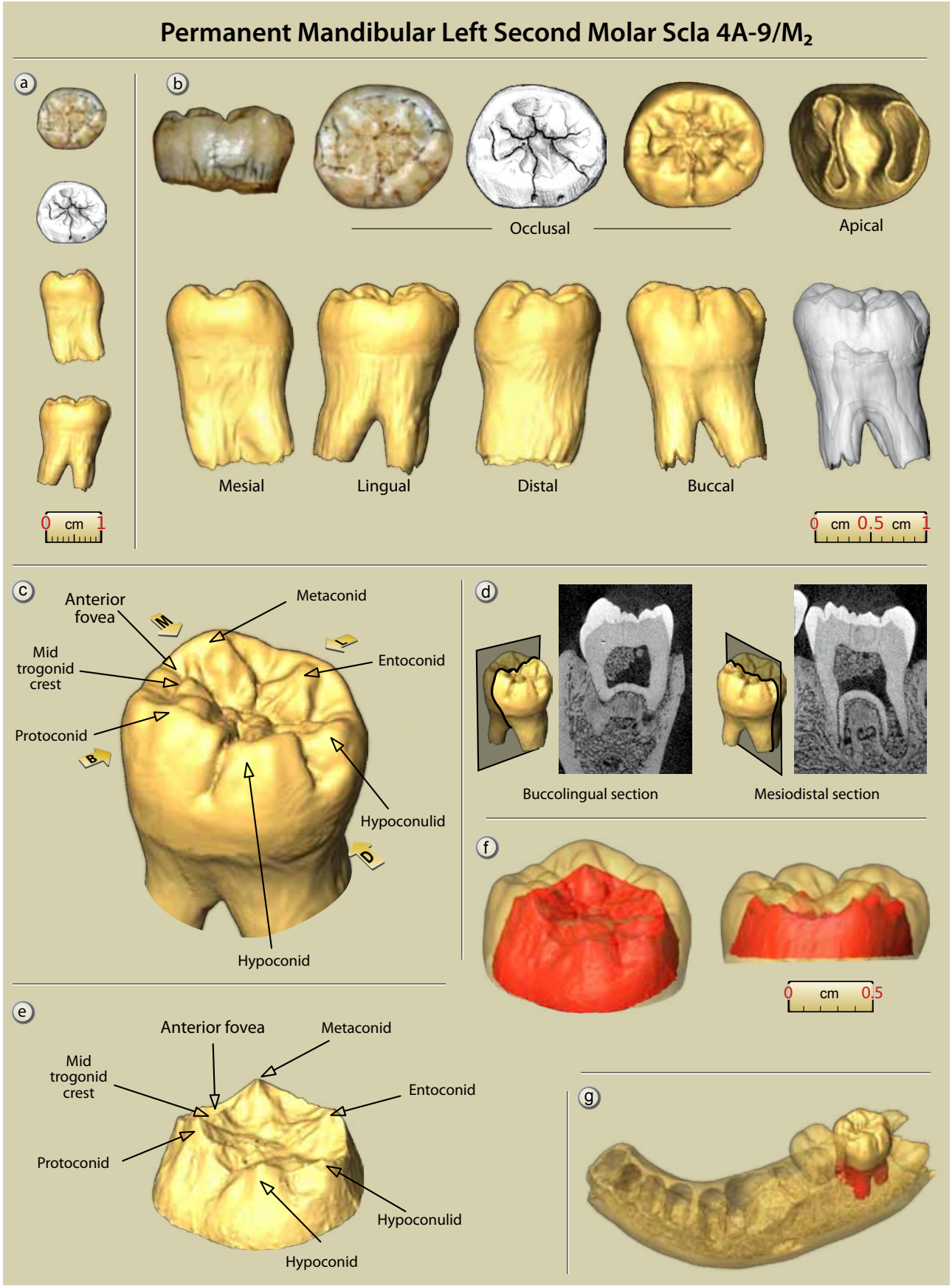


**Figure 38:** Scla 4A-9/$M_2$ permanent mandibular left second molar: a. occlusal, mesial and lingual views (1:1 scale); b. lingual and occlusal faces, photograps; occlusal face, drawing; 3D reconstruction of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D reconstruction with main anatomical features at the EDJ; f. 3D views at the EDJ with enamel; g. position of the tooth (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

The occlusal surface presents five cusps, arranged in a Y5 fissure pattern in the central fossa but with only narrow contact between metaconid and hypoconid. The protoconid (cusp 1) is the largest, then the metaconid, following by the hypoconid and entoconid, then the hypoconulid (cusp 5), the smallest (ASUDAS, grade 3). There is no cusp 6 or cusp 7.

The anterior fovea is transversal, deep and wide. The mesial accessory crest (ridge) of the metaconid runs buccally to form a bridge of enamel, the mid-trigonid crest, or MTC, with the mesial crest of the protoconid. This bridge is continuous but interrupted, in its upper half, by two grooves, notably the sagittal sulcus (Bailey, 2002[b], grade 2), like its antimere, so that the centre of the MTC nearly forms a distinct cusplet. In mesial view, the MTC is higher than the mesial marginal ridge. There is no deflecting wrinkle, or angulation of the essential crest of the metaconid.

Just behind the essential crest of the protoconid, the distal accessory ridge of this cusp runs buccolingually, forming a low distal trigonid crest with the anterior part of the essential crest of the metaconid. The distal part of the essential crest of the metaconid joins, on the OES, the essential crest of the hypoconid, creating a Y5 pattern.

A weak protostylid is present on the buccal surface of the protoconid; it is a bit more marked than on its antimere.

The essential crest of the entoconid, mid-way to the occlusal basin, is divided in four crenulations, therefore being more complex than its antimere. The hypoconid has a bifurcated essential crest as well as small mesial and distal accessory ridges. The hypoconulid is grade 5 of ASUDAS; it has an essential crest and a long buccal accessory crest. In buccal view, there is a distinct but short furrow between the protoconid and hypoconid. A large furrow also appears between the hypoconid and hypoconulid. Between entoconid and hypoconulid is a weak posterior fovea but better marked than on its antimere.

Neither mesial nor distal interproximal wear facets are present. Both roots are flattened, and slope slightly distally. In cross-section, the mesial root is 8-shaped while the distal root is C-shaped.

### 3.16.2. Taxonomy

The Neandertal permanent mandibular second molar is generally similar to the $M_1$ in its morphology (Table 28; Bailey, 2002[a], 2006[a]; Bailey & Hublin, 2006):

- rarely four cusps (2.7% in Bailey, 2002[a]; 0% in Bailey, 2006[a] and Table 28), but often at least five cusps;
- large anterior fovea;
- mid-trigonid crest (± 95%), rare on the $M_2$ of anatomically modern Humans;
- Y pattern much more frequent than in European amHS;
- No deflecting wrinkle.

Although each of these individual features may be present in anatomically modern humans, their frequent association is characteristic of Neandertals. Both $M_2$s exhibit a typical Neandertal combination of traits: five cusps, large anterior fovea, MTC, Y pattern, and absence of deflecting wrinkle.

### 3.16.3. Metrics

Measurements of the permanent mandibular second molars are as follows:

**Scla 4A-1/$M_2$**

**MD**: 11.97 mm
**BL**: 10.68 mm

**Scla 4A-9/$M_2$**

**MD**: 12.2 mm
**BL**: 10.80 mm

Only the MD diameter of Scla 4A-9/$M_2$ departs significantly from the average of one of the five comparative samples (MHSS), both in regard to the DP probabilistic distance and ECRA (Table 29). When both MD and BL crown diameters of the permanent mandibular second molars are situated on equiprobable ellipses, (95%), they are in an area where Early and Late Neandertals, Middle Palaeolithic and Upper Palaeolithic Modern Humans as well as MHSS overlap (Figure 39).

## 3.17. Permanent mandibular right third molar, $RM_3$

**Palaeoanthropological identification**:
Scla 4A-1/$M_3$, as part of the right hemimandible
**Field identification**: Sc 1993-148-185
**Date of discovery**: 16 July 1993
**Date of identification**: 20 July 1993
**Square**: D29
**Stratigraphic position**:
— **Former stratigraphy**: 4A

| Permanent Mandibular Second Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-9/$M_2$ | Scla 4A-1/$M_2$ |
|---|---|---|---|---|---|---|
| Four cusps | 0% | 0% | 10% | 35% | no (5 main cusps) | no (5 main cusps) |
| Fissure pattern: Y | 70% | 75% | 100% | 44.4% | yes | yes |
| Anterior fovea | 75% | 88.5% | 20% | 50% | yes | yes |
| Mid-trigonid crest | 71.4% | 96.2% | 0% | 4.2% | yes | yes |
| Distal trigonid-crest | 0% | 13.8% | 0% | 0% | very weak | very weak |
| Deflecting wrinkle | 0% | 0% | 0% | 0% | no | no |
| Cusp 6 | 0% | 50% | 0% | 23.5% | no | no |
| Cusp 7 | 12.5% | 20% | 10% | 8.3% | no | no |

**Table 28:** Distinctive anatomical features on permanent mandibular second molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-9/$M_2$ & Scla 4A-1/$M_2$.

| Scladina | N | Diameter | Value |
|---|---|---|---|
| $M_2$ | Scla 4A-1/$M_2$ | MD | 11.97 |
| | | BL | 10.68 |
| | Scla 4A-9/$M_2$ | MD | 12.2 |
| | | BL | 10.8 |

**Table 29:** Scla 4A-1/$M_2$ & 4A-9/$M_2$ (permanent mandibular second molars): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

| | | | | | vs Scla 4A-1/$M_2$ | | vs Scla 4A-9/$M_2$ | |
|---|---|---|---|---|---|---|---|---|
| Comparison Samples | N | Diameter | Mean | Stand. dev. | DP | ECRA | DP | ECRA |
| EN right & left | 24 | MD | 12.242 | 0.826 | 0.745 | −0.159 | 0.960 | −0.024 |
| | 23 | BL | 11.320 | 0.571 | 0.275 | −0.540 | 0.373 | −0.439 |
| LN right & left | 57 | MD | 11.612 | 0.732 | 0.627 | 0.244 | 0.425 | 0.401 |
| | 59 | BL | 10.963 | 0.732 | 0.700 | −0.193 | 0.824 | −0.112 |
| MPMH right & left | 12 | MD | 11.083 | 0.816 | 0.300 | 0.494 | 0.198 | 0.622 |
| | 13 | BL | 11.169 | 0.670 | 0.479 | −0.335 | 0.592 | −0.253 |
| UPMH right & left | 53 | MD | 11.201 | 0.848 | 0.369 | 0.452 | 0.244 | 0.587 |
| | 67 | BL | 11.009 | 0.734 | 0.656 | −0.224 | 0.777 | −0.142 |
| MHSS right & left | 92 | MD | 10.637 | 0.765 | 0.085 | 0.878 | 0.044 | 1.029 |
| | 92 | BL | 9.835 | 0.633 | 0.186 | 0.671 | 0.131 | 0.767 |

— **New stratigraphy**: Unit 4A-CHE, Layer 4A-GX

## 3.17.1. Description (Figure 40)

This crown, unerupted in the Scla 4A-1 right hemimandible, is well preserved and, of course, not functional. The following description of this tooth is therefore based on micro-CT data and stereolithographic models. Its roots are not formed. No pathological conditions are noted.

The occlusal surface is complex. It presents seven cusps, both on the OES and on the EDJ: protoconid > metaconid > hypoconid > entoconid > hypoconulid as well as two very small cusps between the hypoconulid and the entoconid (one of them is the *tuberculum sextum*/entoconulid or cusp 6).

The mesial marginal ridge does not present any marginal accessory tubercle but exhibits some anteroposterior crenulations. The anterior fovea is transversal, deep and wide.

The mesial accessory ridge (Figure 40d: no. 1) of the metaconid and the mesial accessory ridge (no. 2) of the protoconid join to form a bridge of enamel, the mid-trigonid crest (MTC), interrupted in its upper part at the level of the sagittal sulcus.

The distal ridge (no. 3) of the metaconid joins the essential ridge (no. 4) of the protoconid to form the distal trigonid crest which is much lower than the MTC and is interrupted by the sagittal sulcus. Between the mesial and distal ridge of the metaconid is a short central ridge (no. 5). Other salient features are: a distal ridge (no. 6) on the protoconid; the bifurcation (no. 7-8) of the essential/central ridge of the entoconid; an essential ridge on both the hypoconid (no. 9) and the hypoconulid (no. 10); a small essential ridge on the two small cusps (no. 11-12) between the entoconid and hypoconulid.

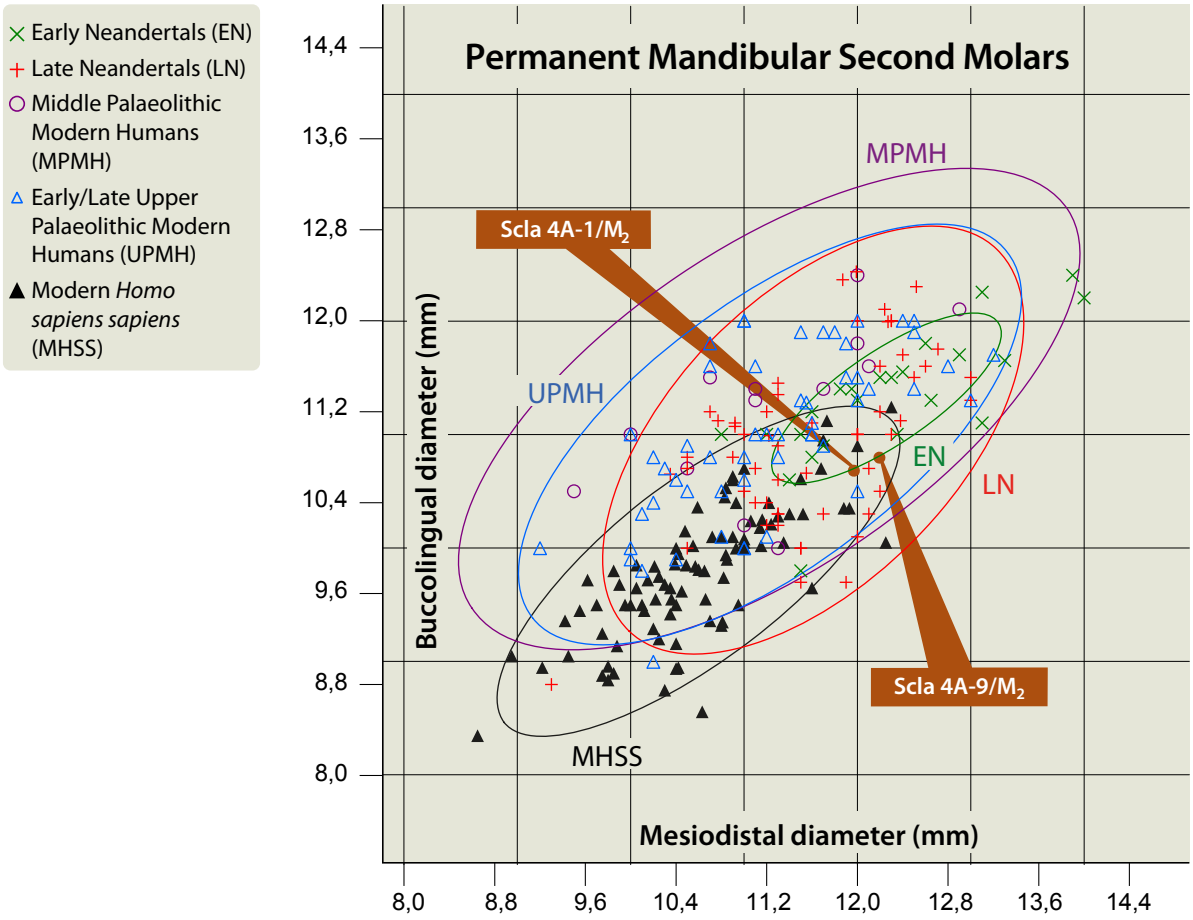


Figure 39: Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular second molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-1/$M_2$ & 4A-9/$M_2$.

A vertical depression on the anterior part of the buccal surface of the protoconid corresponds to a weak protostylid. In buccal view, two vertical grooves separate the hypoconid of the adjacent cusps 1 and 5.

### 3.17.2. Taxonomy (Table 30)

The Neandertal $M_3$ usually has five or more cusps, with a *tuberculum sextum* (cusp 6) in half of the cases. That tooth has very frequently (over 90%) a mid-trigonid crest (MTC) and a large anterior fovea. The distal trigonid crest is occasionally present (10.5%). Some deflecting wrinkles occur (± 7%).

Hence the $M_3$ is probably the most informative permanent mandibular molar in distinguishing Neandertals from recent and Early Modern Humans (Bailey, 2006[a]). For instance, Early Modern Human $M_3$s often have four cusps and no MTC.

The Scladina right $M_3$ presents most of the Neandertal traits: seven cusps, large anterior fovea, MTC, weak distal trigonid crest and *tuberculum sextum*.

### 3.17.3. Metrics

Measurements of the permanent mandibular third molar are as follows:

**MD**: 11.5 mm

**BL**: 11.4 mm

The BL diameter of this tooth departs significantly from the five comparative samples only in the case of MHSS, both in regard to the DP probabilistic distance and ECRA (Table 31). When both MD and BL crown diameters of Scla 4A-1/$M_3$ are situated on equiprobable ellipses (95%) they are in an area where Early and Late Neandertals, Middle Palaeolithic and Upper Palaeolithic Modern Humans as well as MHSS overlap, but very close to the upper limit of BL diameter of MHSS (Figure 41).

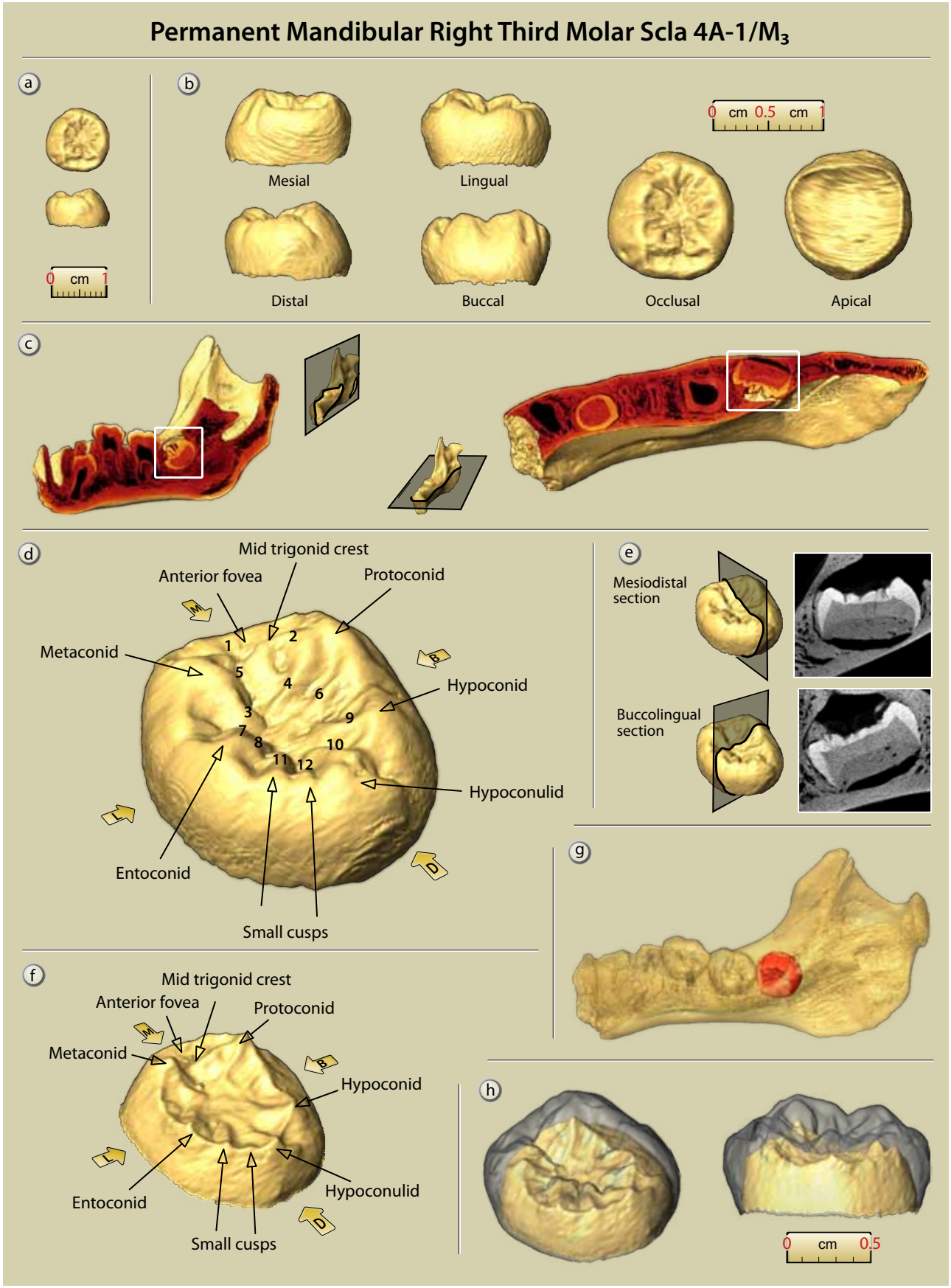


**Figure 40:** Scla 4A-1/$M_3$ permanent mandibular right third molar: a. occlusal and distal views (1:1 scale); b. 3D reconstruction of the six faces of the tooth (2:1 scale); c. views of the position of the unerupted molar; d. 3D reconstruction with main anatomical features; e. internal sections; f. 3D reconstruction with main anatomical features at the EDJ; g. position of the tooth; h. 3D views at the EDJ with enamel; (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

| Permanent Mandibular Third Molars | Non-Neandertal Archaics | Neandertals | Early Modern Afro-Asians | Early Modern Europeans | Scla 4A-1/$M_3$ |
|---|---|---|---|---|---|
| Four cusps | 0% | 0% | 28.6% | 31.6% | no (7 cusps) |
| Fissure pattern: Y | 0% | 41.2% | 50% | 55.6% | no |
| Anterior fovea | 75% | 92.9% | 0% | 46.7% | yes |
| Mid-trigonid crest | 50% | 93.3% | 0% | 0% | yes |
| Distal trigonid-crest | 0% | 10.5% | 0% | 0% | yes (weak) |
| Deflecting wrinkle | 0% | 6.7% | 0% | 0% | no |
| Cusp 6 | 66.7% | 50% | 40% | 41.2% | yes |
| Cusp 7 | 0% | 40% | 0% | 16.7% | no |

**Table 30:** Distinctive anatomical features on permanent mandibular third molars of Non-Neandertal Archaics, Neandertals, Early Modern Humans (after Bailey, 2006[a]) and Scla 4A-1/$M_3$.

| Scladina | Diameter | Mean |
|---|---|---|
| $RM_3$ (Scla 4A-1/$M_3$) | MD | 11.5 |
| | BL | 11.4 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN right & left | 23 | MD | 12.033 | 0.745 | 0.482 | −0.345 |
| | 22 | BL | 10.673 | 0.675 | 0.294 | 0.518 |
| LN right & left | 47 | MD | 11.596 | 0.649 | 0.884 | −0.073 |
| | 49 | BL | 11.117 | 0.918 | 0.759 | 0.154 |
| MPMH right & left | 11 | MD | 11.627 | 1.013 | 0.903 | −0.056 |
| | 11 | BL | 10.691 | 0.804 | 0.399 | 0.396 |
| UPMH right & left | 25 | MD | 11.016 | 1.166 | 0.682 | 0.201 |
| | 26 | BL | 10.746 | 1.105 | 0.559 | 0.287 |
| MHSS right & left | 104 | MD | 10.436 | 0.924 | 0.252 | 0.581 |
| | 104 | BL | 9.796 | 0.761 | 0.037 | 1.063 |

**Table 31:** Scla 4A-1/$M_3$ (permanent mandibular right third molar): MD and BL dimensions compared to those of Early and Late Neandertals as well as MPMH, UPMH and MHSS, with DP and ECRA.

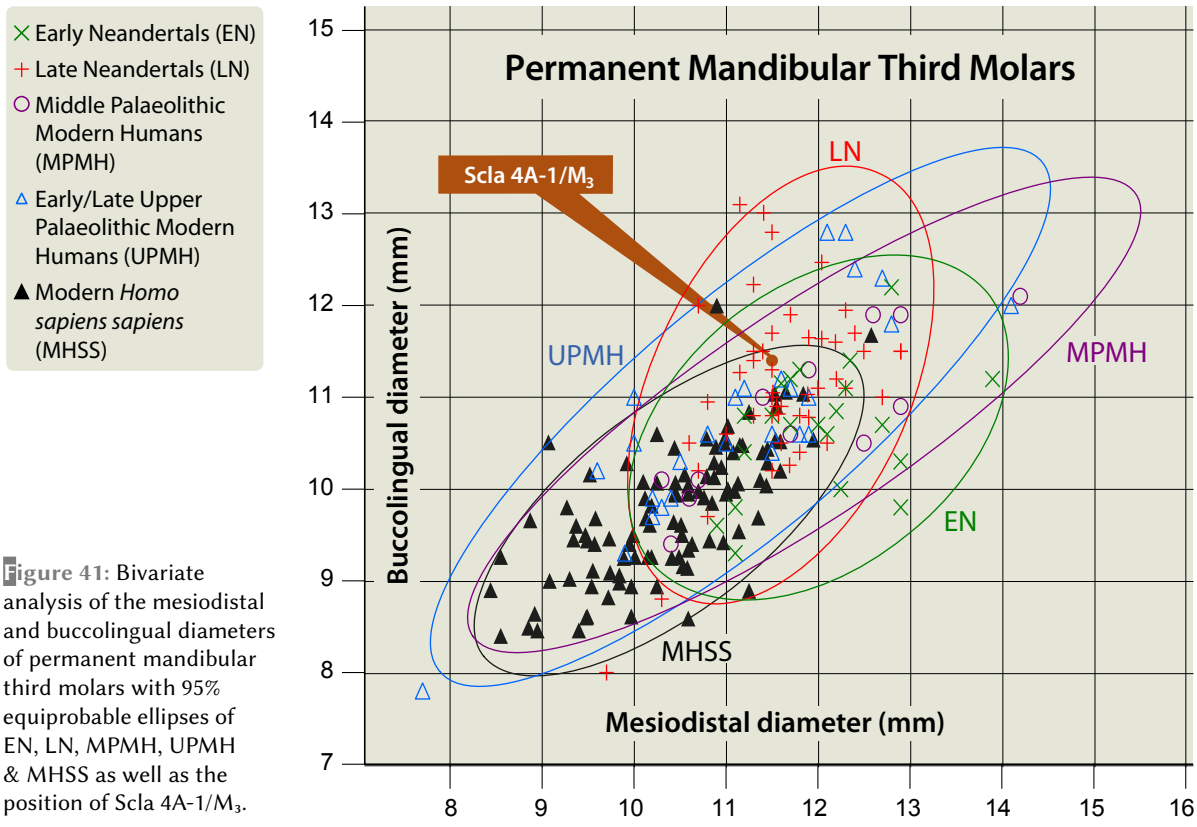


**Figure 41:** Bivariate analysis of the mesiodistal and buccolingual diameters of permanent mandibular third molars with 95% equiprobable ellipses of EN, LN, MPMH, UPMH & MHSS as well as the position of Scla 4A-1/$M_3$.

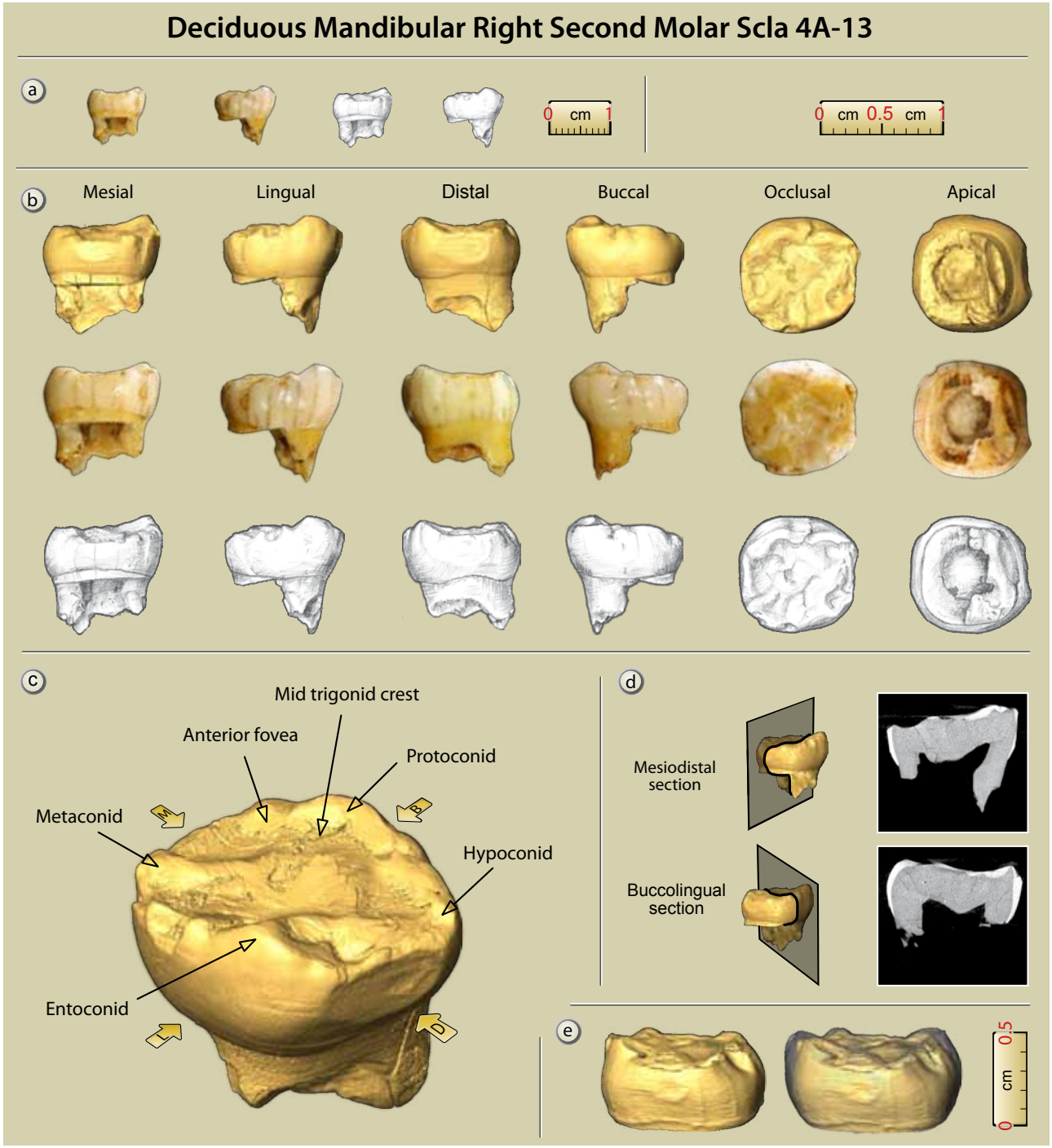


**Figure 42:** Scla 4A-13 deciduous mandibular right second molar: a. mesial and lingual views (1:1 scale); b. photographs, drawings and 3D reconstructions of the six faces of the tooth (2:1 scale); c. 3D reconstruction with main anatomical features; d. internal sections; e. 3D lingual views at the EDJ without and with enamel (micro-CT data processing and graphics J.-F. Lemaire, SPW; pencil drawings S. Lambermont, AWEM; photographs J. Eloy, AWEM).

## 3.18. Deciduous mandibular right second molar, $Rdm_2$

**Palaeoanthropological identification**: Scla 4A-13
**Field identification**: Sc 2001-262-44
**Date of discovery**: 13 November 2001
**Date of identification**: 13 November 2001
**Square**: E38
**Stratigraphic position**:
— **Former stratigraphy**: 4A
— **New stratigraphy**: Unit 4A-POC; Layer 4A-LEG

### 3.18.1. Description (Figure 42)

The deciduous mandibular right second molar has a fully formed crown. Only a small part (3.8 mm) of its roots is preserved, the rest being reduced by

the emergence of the right second premolar which is still unerupted in the mandible. The tooth was still in situ in the Scla 4A-1 right hemimandible when the child was alive, but was lost post-mortem. It was found in Square E38, at a distance of 9.5 m from the mandible.

The mesial half of the root was removed in 2001 for DNA analysis, which provided interesting results (Orlando et al., 2006 & Chapter 17).

The crown is worn. In fact, all the cusps are blunt and large areas of dentine are exposed. The wear is close to stage 4-5 of Molnar (1971). The four lateral faces of the crown are affected by some vertical cracks. No pathological conditions are noted.

Due to the strong level of wear, the morphology of the crown cannot be described in detail. Nevertheless, the four major cusps are present as well as some additional small cusps. So it seems that the crown did present a complex occlusal morphology before being worn.

The occlusal plane is nearly horizontal, with just the entoconid slightly higher. Only the bottom of the anterior fovea is preserved. The mid-trigonid crest (MTC) is present but blunt. Between the blunt metaconid and the entoconid there is a small cuspid; in lingual view, it is separated from the metaconid by a distinct fissure, so it could be a trace of cusp 7 (*tuberculum intermedium*). Behind the hypoconid, the hypoconulid (cusp 5) can be detected.

In buccal view, a small groove limited to the upper part of the crown separates the protoconid and the hypoconid.

The mesial surface exhibits a transversally elongated interproximal wear facet which modifies only slightly the outline of the tooth as seen in occlusal view. This facet has a maximal height of 1.8 mm, a buccolingual diameter of 3.3 mm, and a slightly curved inferior border. The distal surface has an interproximal wear facet (height: 2.5 mm; buccolingual diameter: 4.1 mm) related to the presence of the permanent first molar; its inferior border is slightly curved. In occlusal view, this facet does affect the outline of the crown.

### 3.18.2. Taxonomy

According to Bailey & Hublin (2006: 505), the primary feature differentiating Neandertal deciduous mandibular molars from those of anatomically modern humans is the prominent crest that connects the mesial cusps (i.e. the mid-trigonid crest or MTC). Machiarelli et al. (2006) add that such a morphology seems to be associated with a generally more complex enamel-dentine junction. Other Neandertal features are an ovoid occlusal outline, internally compressed cusps, and a wide anterior fovea bordered by a well-defined mesial marginal ridge (Bailey & Hublin, 2006). In contrast, Upper Palaeolithic $dm_2$s have a rectangular occlusal outline, with more widely spaced cusps and no continuous mid-trigonid crest. It should be added that at least some immature Neandertal $dm_2$s, such as those of Engis 2 and La Chaise, have a MTC which does not form a complete bridge (score 1 of Bailey, 2002[b]), like some Upper Palaeolithic $dm_2$s, Isturitz for instance (Bailey & Hublin, 2006). As far as morphology is concerned, the Scla 4A-13 $dm_2$ closely resembles those of Neandertals. It exhibits a complex occlusal morphology and possesses an ovoid outline, internally compressed cusps, and well defined marginal ridges. An MTC is present, although only preserved in its lower part.

It is well known that permanent Neandertal molars have a thinner enamel than *Homo sapiens* (Macchiarelli et al., 2006; Olejniczak et al., 2008; Bayle et al., 2009; Smith et al., 2012). In addition, the analysis of the Couvin dm2 has recently proved that deciduous Neandertal molars present thinner lateral enamel (Toussaint et al., 2010; Figure 43). Scla 4A-13 exhibits the same Neandertal pattern, despite the shortcomings of the previously used methods, including at Couvin, might have amplified the real range of enamel thickness variation of this taxon, which is still poorly known (see Chapter 14).

### 3.18.3. Metrics

The $dm_2$ has a MD diameter of 9.47 mm and a BL diameter of 9.38 mm. It has been compared to five series of teeth: 1) Preneandertals/Early Neandertals; 2) Classic Neandertals; 3) Palaeolithic Modern Humans (combination of Mousterian from the Middle East and Upper Palaeolithic from Europe); 4) Belgian Neolithics; 5) Middle Ages and subactual modern humans.

The MD diameter of Scla 4A-13 departs significantly from the EN and Palaeolithic Modern Humans comparative samples only, both in regard to the DP probabilistic distance and ECRA (Table 32). The BL diameter is statistically close to all comparison samples. Due to its low MD diameter, the tooth is outside the ellipse (95%, Figure 44) of the Early Neandertals, at the limit of MHSS, and in an area where Late Neandertals and Palaeolithic *Homo sapiens* overlap.

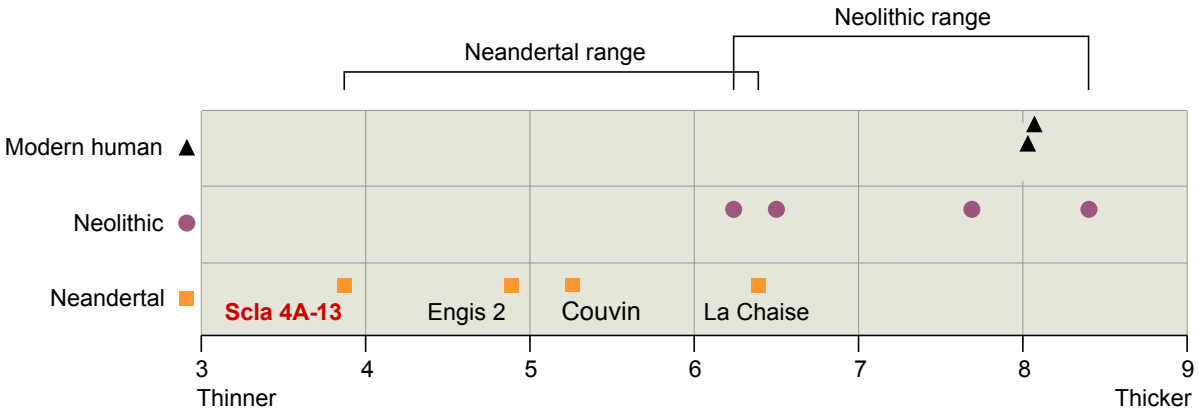


**Figure 43:** Plot depicting the range of lateral relative enamel thickness index values in the Neandertal, Neolithic *Homo sapiens* and Recent Modern *Homo sapiens* samples. The Scla 4A-13 deciduous molar falls cleary within the range of Neandertals (modified after Toussaint et al., 2010).

**Table 32:** Scla 4A-13 (decidous mandibular right second molar): MD and BL dimensions compared to those of Early and Late Neandertals as well as Palaeolithic Modern Humans (MPMH & UPMH) and two samples of Belgian MHSS, with DP and ECRA.

| Scladina | Diameter | Value |
|---|---|---|
| $Rdm_2$ (Scla 4A-13) | MD | 9.47 |
| | BL | 9.38 |

| Comparison Samples | N | Diameter | Mean | Stand. Dev. | DP | ECRA |
|---|---|---|---|---|---|---|
| EN | 11 | MD | 10.764 | 0.486 | 0.024 | −1.195 |
| | 11 | BL | 9.573 | 0.438 | 0.669 | −0.198 |
| LN | 32 | MD | 10.266 | 0.579 | 0.179 | −0.674 |
| | 32 | BL | 9.278 | 0.451 | 0.823 | 0.111 |
| Palaeolithics modern humans (MPMH & UPMH) | 19 | MD | 10.737 | 0.601 | 0.049 | −1.003 |
| | 20 | BL | 9.465 | 0.620 | 0.892 | −0.066 |
| Belgian Neolithics | 29 | MD | 10.128 | 0.458 | 0.162 | −0.701 |
| | 29 | BL | 9.017 | 0.390 | 0.360 | 0.454 |
| Belgian Modern Humans | 57 | MD | 10.000 | 0.492 | 0.286 | −0.537 |
| | 57 | BL | 8.660 | 0.478 | 0.138 | 0.752 |

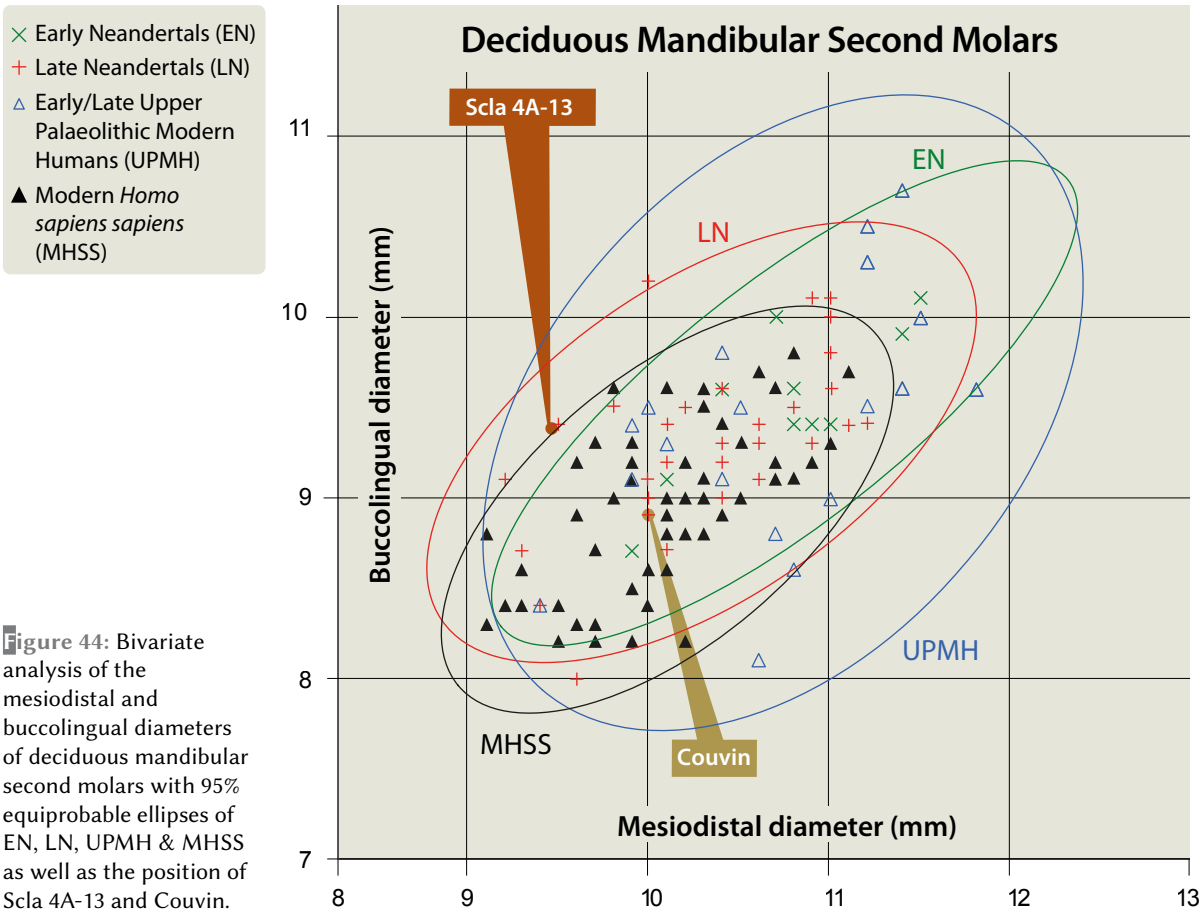


**Figure 44:** Bivariate analysis of the mesiodistal and buccolingual diameters of deciduous mandibular second molars with 95% equiprobable ellipses of EN, LN, UPMH & MHSS as well as the position of Scla 4A-13 and Couvin.

## 4. Discussion

The crowns of the 24 teeth available for the mandible and maxilla of Scladina (Figure 45) have been examined one by one in a statistical and anatomical perspective in the previous paragraphs. It would be useful, and this is one of the purposes of this discussion, to analyse them as a series.

The ECRA of both the MD and BL diameters of all Scladina teeth are shown, in Figures 46 & 47, compared to a series of samples, i.e. Early Neandertals (EN), Late Neandertals (LN), Middle

**Figure 45:** Scladina mandible (Scla 4A-1 & 9) and maxilla (Scla 4A-2) with the isolated teeth refitted (photographs J. Eloy, AWEM).

Palaeolithic Modern Humans (MPMH), Early/Late Upper Palaeolithic Modern Humans (UPMH) and modern *Homo sapiens sapiens* (MHSS). It thus appears that the diameters of the Scladina tooth crowns are never different from those of Late Neandertals; only in one case ($dm_2$), the MD diameter departs from Early Neandertals. Scladina differs slightly from MPMH only for the MD diameter of the decidous maxillary first molar. Compared to UPMH, significant differences were observed with the BL diameter of the permanent maxillary lateral incisors and the MD diameter of the permanent maxillary canine and with the BL diameters of the mandibular premolars. Further significant differences occur between Scladina and MHSS; this is the case for both the MD and BL diameters of all the incisors, canines and premolars and very rarely for molars.

All these observations confirm those that were made individually for each tooth. The Scladina teeth are therefore systematically within the variability of Neandertals and present some differences with other taxa, especially with MHSS. However, on the strict basis of MD and BL diameters, it is generally not possible to classify these teeth as either Early or Late Neandertals. However, the Scladina mandible is outside the ellipse of Early Neandertals and inside that of Late Neandertals for the deciduous mandibular second molar (Figure 44; see also Figure 47).

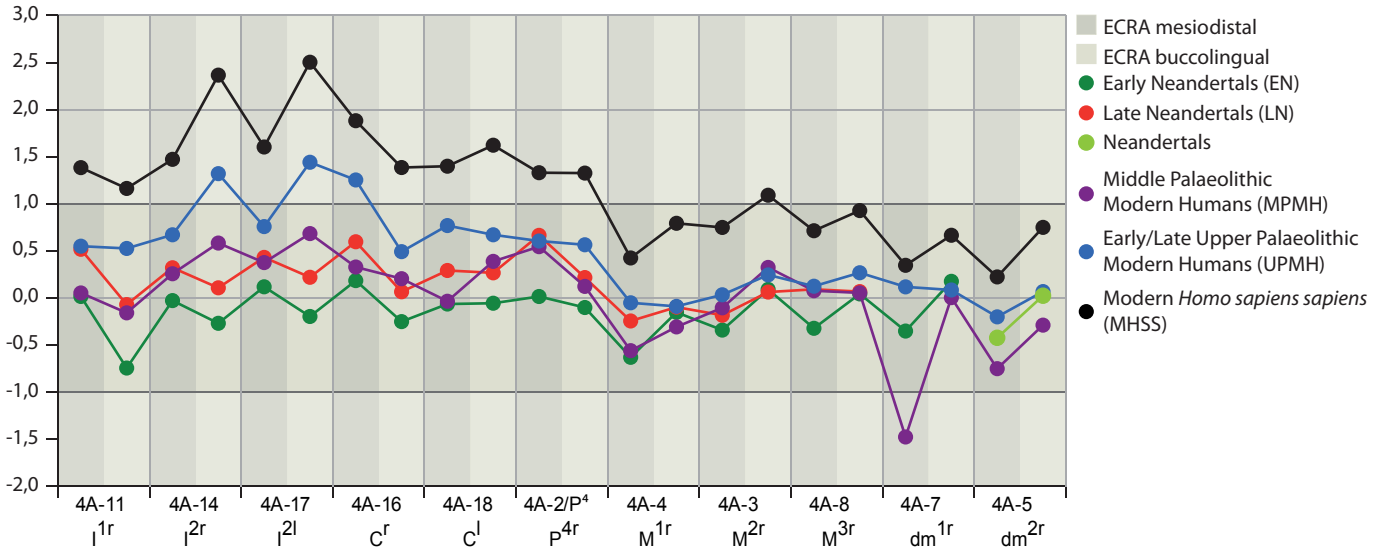


**Figure 46:** ECRA of both the MD and BL diameters of the maxillary Scladina teeth.

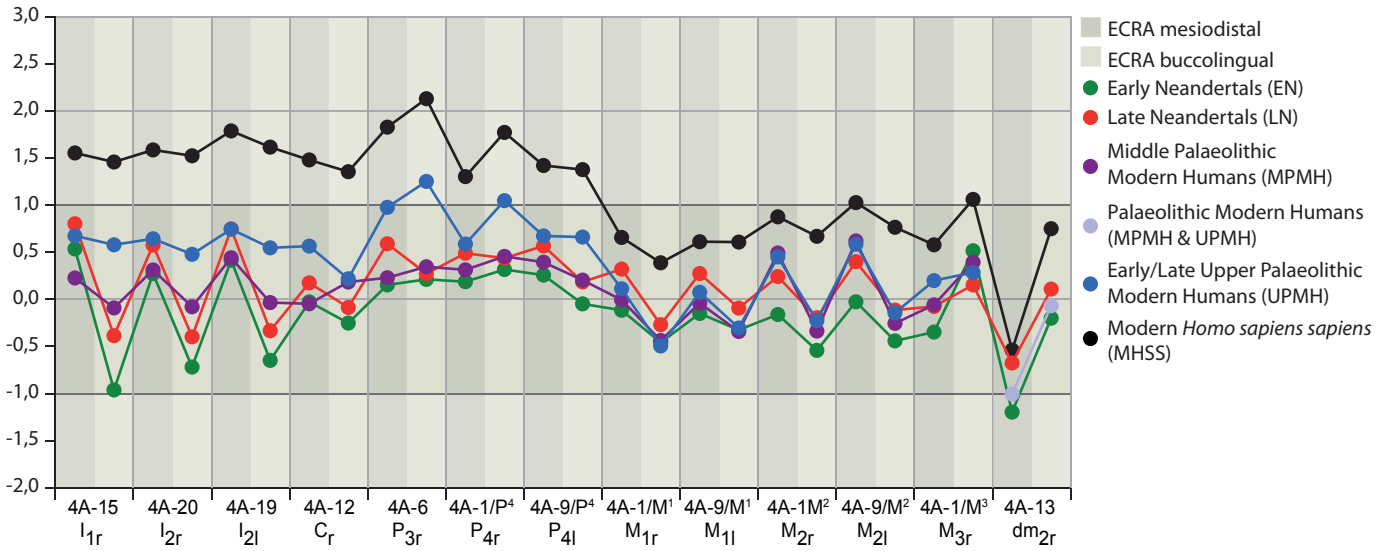


**Figure 47:** ECRA of both the MD and BL diameters of the mandibular Scladina teeth.

Morphologically, the Scladina teeth, like those of similar sites, do not exhibit any character which would be exclusively Neandertal. But, as mentioned previously by many scholars, for example Bailey (2002[a, b]; 2004[a, b]; 2006[a, b]), most Neandertal teeth often possess an original pattern which distinguishes them from anatomically modern humans because of the higher frequency of their features and their combination. The Scladina teeth fit very well in the general Neandertal pattern.

Regarding the taxonomic allocation of the juvenile teeth from Scladina, there is no doubt, based on descriptions and analyzes presented in this chapter, that they possess the characteristic Neandertal pattern. The question of their attribution to either an Early or a Late Neandertal is less obvious. However, some clues tend to substantiate a hypothetical allocation to an early classic form of this taxon (see Chapters 20 & 21), which is also true of some analyzes of specific aspects presented in other chapters, including the study of the enamel dentine junction (see Chapters 14 & 15).

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