Some methodological issues of endostructural analysis of the deciduous lower second molars from the upper Paleolithic sites of the East European plain and Siberia.

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Aims

In the last decennaries microCT methods is widespread in the study of dental findings of the Paleolithic Age. Initially, it was used for investigation of enamel-dentine junction morphology. This junction copies structure of outside surface of enamel. So, important evolutional and taxonomic information stores at abrasion of the masticatory surface. Later, endostructure analysis develops as independent research method. New measurement criteria of the dental findings taxonomic status appears. One of these criteria is lateral dentine and pulp volume (LDPV). LDPV is the volume of the tooth crown between best-fit cervix plane and the parallel plane which is passing through most low-lying point of mid-occlusal basin. Previous studies showed statistical difference of LDPV values between the teeth of Neanderthals and the teeth from the medieval-modern. The Neanderthals LDPV various in the ranges 132,8 - 227,2 with the average value 183,7. For modern people range is 103,7- 168,5, with the average value 138,2. Though the transgression zone is wide, the accuracy of species definitions based on this criterion is 88.5%. So, 3 from 28 Neanderthal teeth and one from two Upper Paleolithic teeth had wrong identification (Benazzi et al., 2011). The aim of this research is the investigation of LDPV limits of variation for Upper Paleolithic teeth.

Method

It was investigated 3 second lower molar (Lm2). The most ancient was the sample from Kostenki 14(Voronezh region, RF). It was found at the layer, dated by radiocarbon technique between 37-36 thousand years ago and 44 thousand years ago dating by stratigraphic and palenological techniques. Sample from Malta Upper Paleolithics site (Irkutsk region, RF) has an age of 24 thousand years. The youngest (15-12 thousand years ago) sample is deciduous tooth from Judinovo site (Bryansk region, RF).

Sample was scanned at Skyscan-1172 with U=100 kV, I = 100 μA, rotation step = 0,25°, averaging by 3 frames, resolution was 3,45 μm/pixel. Scanned images was reconstructed by NRecon software. 3D models of teeth were built at CTAn. Virtual separating of dentin and enamel was made by CTAn, also. Visualization of digital model was made by CTVox.

Digital models of enamel-dentin junction was described by standard scoring procedures for key morphological traits ASUDAS (Turner, Nichol, Scott, 1991). For each tooth were measured next parameters: the maximum lateral enamel thickness of metaconid, the maximum bucco-lingual (BL) diameter of enamel dentine crown, LDPV (table 1). The thickness of metaconid enamel measured at bucco-lingual slice (slice passed through the tops of metaconid and protoconid) perpendicularly to vertical axe of lingual wall of crown. At same slice was measured inside and

outside bucco-lingual diameters. It was taken the maximal diameter for dentine (inside diameter) and enamel (outside diameter) at line, paralleled to tooth cervix plane.
LDPV was measured using CTAn software according to method from previuos papers (Benazzi et al., 2011, Toussaint et al., 2010).

Results

Non-metric traits
Sample 1 (Kostenki-14) (Figure 1)
The crown consists of five cusps with “Y”-pattern of intercusp furrows. Additional horns, distal trigonid crests and deflecting wrinkle of metaconid are absence, massive mesial crests of metaconid and protoconid forms transversal bridge between these cusps. Transversal bridge decrease at groove I area. Anterior fovea was found at mesial part of the crown. It was not found Neanderthal features, but increasing of transversal bridge look like at some Neanderthals teeth. Odontoglyphic pattern is complicate.

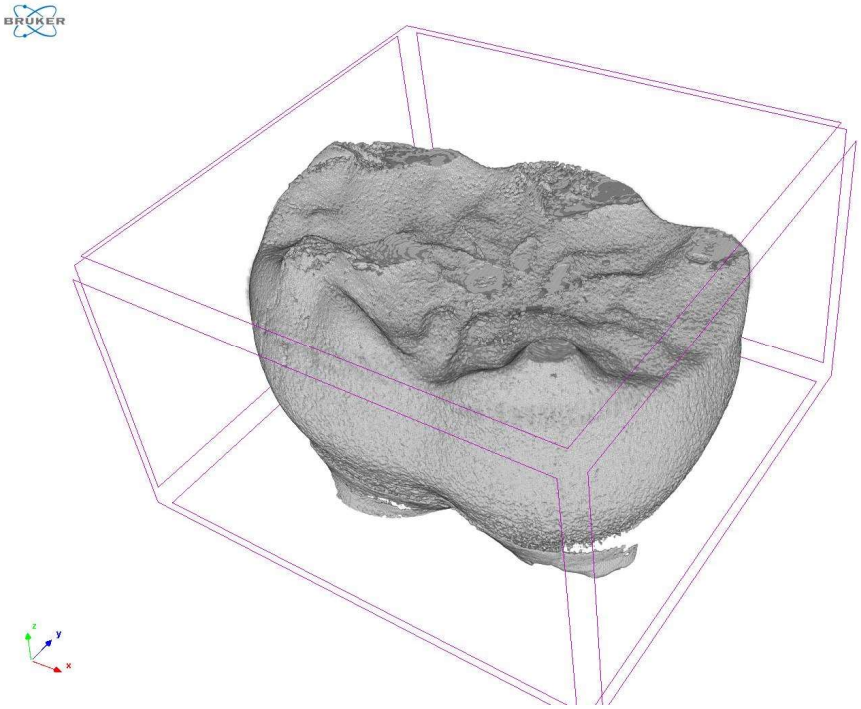

Figure 1. Dental topography of tooth from Kostenki-14

Sample 2 (Judinovo) (Figure 2).
The crown consist of six cusps with “Y”-pattern type contact between them. Initial form of tami was marked at entoconid structure. Distal and mesial trigonid crests and deflecting wrinkle of metaconid are absence. Mesial part of the crown has anterior fovea. Markers of Neanderthal are absence, also.

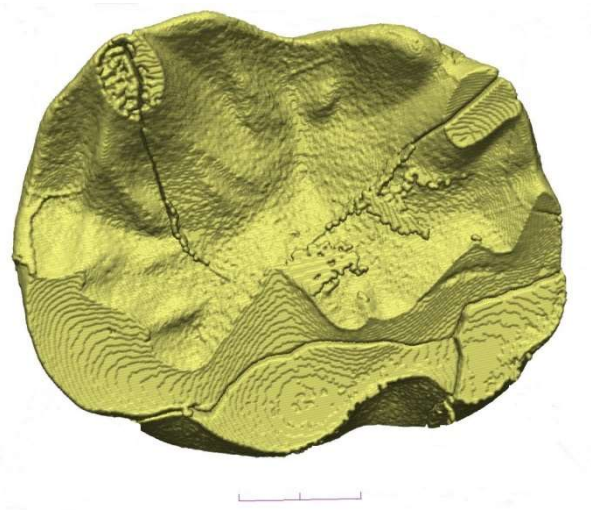

Figure 2. Dental topography of tooth from Judinovo

Sample 3 (Malta) (Figure 3).
The crown consists of five cusps with “Y”-pattern of intercusp furrows. The surface topography is extremely simplified. Additional cusps are absence. Main part of odontoglyphics elements is reduced. Mesial part of the crown has anterior fovea.

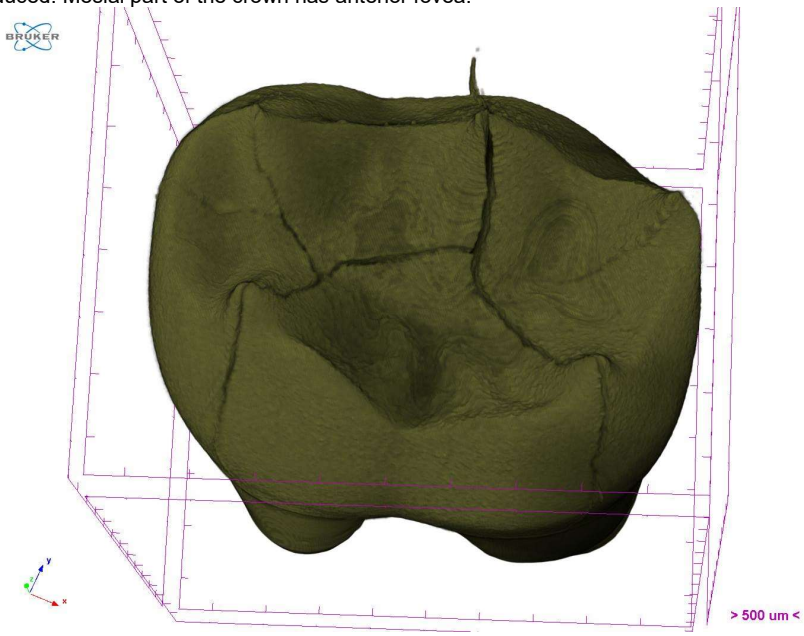

Figure 3. Dental topography of tooth from Malta

Metric traits.
The absolute values of the studied parameters are presented in table 1. It can be noted, that difference between inside and outside bucco-lingual diameters increase in time due to the increasing of enamel thickness for European samples (Samples 2 and 3). But sample 1 (Malta) is out of this tendency. LDPV of Kostenki-14 and Judinovo samples increase in time, but the most ancient tooth from Malta (older more, than 10000 years) demonstrates the lowest value of LDPV.
Table 1

	BL (enamel)	BL (dentine)	BL dentine / BL enamel	LDPV	metaconid enamel thickness
Kostenki 14	8,7	7,9	90,8	192	0,9
Malta	8,2	7	85,35	140,4	1,2
Judinovo	9,3	8,2	88,17	171,05	1,037

Conclusion

A small number of samples not allow making far-reaching conclusions, but we can suggest hypothetically that the reason is in geographical position of sites. Much more significant is that the value of LDPV of the tooth from Kostenki-14 and Judinovo has “Neanderthal” range of characteristic value. Together with the results of previous research (Benazzi et al., 2011), this calls into question the diagnostic capabilities of a LDPV criteria for finds from the Upper Palaeolithic sites.
We hope to welcome you at the Micro-CT User Meeting with an oral or poster presentation and look forward to receiving your submissions for our annual picture and movie contest, an opportunity to win great prices.

References:

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