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- KORNELIJA MINICHREITER
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Digital Radiovisiography in Bone Density Analysis: Neanderthal and Early Modern *Homo sapiens* Versus Modern *Homo sapiens* Supraorbital Region

*Digitalna radioviziografija u analizi gustoće kosti:
nadočna regija neandertalaca i najstarijeg suvremenog Homo sapiensa u usporedbi s
nadočnom regijom suvremenog Homo sapiensa*

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Cilj uratka bio je prikaz evolucijskih trendova, odnosno razlika između neandertalaca (Vindija), najstarijeg suvremenog čovjeka (Velika pećina) i suvremenog čovjeka (uzorak lubanja iz zbirke "Drago Perović" Medicinskog fakulteta u Zagrebu) na tlu Hrvatske, pomoću distribucije vrijednosti najveće gustoće kosti unutar medijalne trećine svake promatrane nadočne regije. Po prvi je put u snimanju fosilnog i recentnog koštanog materijala korištena metoda digitalne radioviziografije (RVG). To je neinvazivna metoda pri kojoj su uzorci kostiju izloženi minimalnom zračenju pri kojem ne postoji mogućnost oštećenja unutarnje strukture kosti, pa tako ni mogućih oštećenja DNK. Dobivene su jednake vrijednosti najveće gustoće kostiju za sve taksone (maksimum vrijednosti je 256 što odgovara gustoći metala koji se koristi u dentalnoj implantaciji), ali s razlikom u načinu distribucije i količini kompaktne kosti.

The aim of this study was to demonstrate evolutionary trends i.e. differences among Neanderthals, early modern *Homo sapiens* and modern *Homo sapiens* by showing the distribution of the highest bone density values within the medial third of each supraorbital region observed.¹

A new perspective on the inner structure of fossil and recent supraorbital regions was obtained by digital radiovisio-

graphy (RVG). Attention was paid to the supraciliary arch, i.e. the morphological subregion occupying the medial third of supraorbital portion. Further attention was paid to the so-

¹ Presented at IV Congress International Association For the Study of Human Palaeontology, International Association of Human Biologists, Dual Congress 1998, Sun City, South Africa, 28 June - 4 July, 1998 (BOLJUNČIĆ et al. 1998).

called supraciliary triangle (the area which approximates that of para-sagittal cross-section of the supraciliary ridge, RUSSELL, 1983).

Seven fossil supraorbital tori were utilised in the study. Six most complete late Neanderthal (LN) fragments from Vindija cave² (3 left*, 3 right, both sexes included) along with a single early modern *Homo sapiens* specimen (EMH, right frontal half, female) discovered in Velika pećina cave³ were subjected to digital radiovisiography. In addition, 20 recent⁴ supraorbital parts (left, right, male, female) were utilised for comparison. Only cross-sectioned crania with approachable inner table were used in the procedure.

Radiovisiography (RVG) was carried out by digital x-rays on the Trophy 96 equipment (70 kV). The advantage of the protected sensor is that it receives x-rays and converts them into light before stopping them. Due to non-aggressive procedure with low doses of x-rays, the inner bone structure (including DNA) remains undamaged. Eventually, pseudo-coloured bone structure survey both plane and 3D along with diagrams of the highest bone density values, was obtained for all included specimens (see Plate I, i.e. diagrams of some fossil specimens showing different patterns of the highest bone density distribution).

The same level of the highest bone density was recorded in all x-rayed taxons (maximum as high as 256 - the level of the metal density used in dental implantation, Plate I, Figs 1-6, Plate II, Figs. 1-6), the difference being in the way of distribution and the quantity of compact bone tissue. As for *Homo neanderthalensis* taxon, the distribution of the highest bone density values varied due to sex, age at death, as well as the level of the occupation layer G3 from which they were excavated. One could possibly explain the lack of more or less continuous compact tissue spread over the Vindija supraorbitals by the process of fossilisation. The latter could result in a lesser bone density in case if water with lower concentration of Ca/Mg carbonate (lower than in bone), flowed throughout the sediment in which the bones were inserted, dissolving Ca/Mg carbonate in the bones respectively (Plate I, Figs. 1-4). For early modern *Homo sapiens* the highest bone density value was recorded in the region of the so-called supraciliary triangle (Plate I, Figs. 5-6). As for modern *Homo sapiens*, it seems that the tendency of the highest bone density was prevalent in the lateral part of the supraciliary arch, but the asymmetry within the supraorbital region (left and right part) of the same individuals was also noticed (Plate, II, Figs. 1-6).

² **Vindija - Hrvatsko zagorje region**

GPS (Global Position System) 46° 18' 9" N, 16° 4' 44" E

LN (G3 occupation level: 42.400 ± 430 B.P.)

(* Vi-137 /224/, 1976 /G3/h/ excluded). The first finds of fossil human remains at the site were found in 1974 (MALEZ, 1975). Material storage: Institute of Palaeontology and Quaternary Geology, Croatian Academy of Sciences and Arts, Zagreb.

³ **Velika pećina - Hrvatsko zagorje region**

GPS (Global Position System) 46° 17' 10" N, 16° 2' 22" E

EMH ("j" layer; stratum "i" immediately above the specimen: 33.850 ± 520 B.P.). Hominid frontal was excavated in association with artefacts which represented an early stage of the Aurignacien (SMITH, 1976, MALEZ, 1979). Material storage: Institute of Palaeontology and Quaternary Geology, Croatian Academy of Sciences and Arts, Zagreb.

⁴ **"Drago Perović" collection.** Storage: Institute of Anatomy, School of Medicine, University of Zagreb.

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BOLJUNČIĆ, J., GUŽVICA, G., RADINOV, D., BABIĆ, K., 1998., Radiovisiography in Bone Density Analysis: the Supraorbital Region in Neanderthals and Early Modern Humans Versus That From Croatia.⁵ IV Congress International Association For the Study of Human Palaeontology, International Association of Human Biologists, Dual Congress 1998, Sun City, South Africa, 28 June - 4 July, 1998: 136, Sun City (Abstract)

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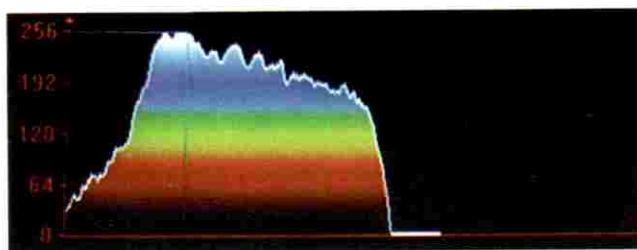
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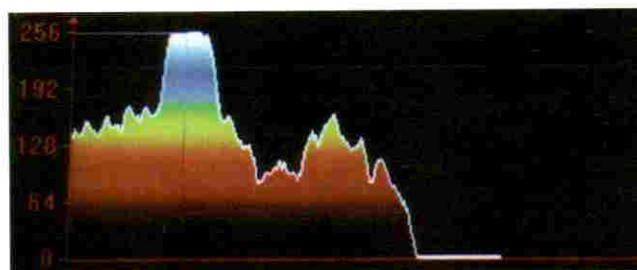
⁵ A print error has crept into the title which should be: Radiovisiography in Bone Density Analysis: the Supraorbital Region in Neanderthals and Early Modern Humans Versus that of Modern Humans From Croatia.

Figure 1.
Vi-11 (261/275), 1977, G3 level
Diagram of the left supraorbital
segment, adult male



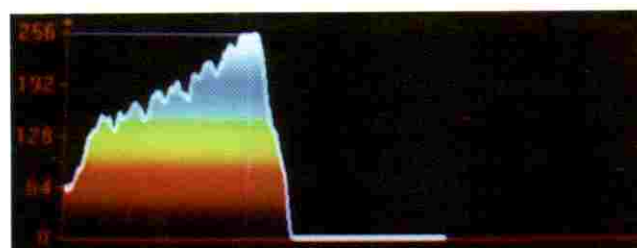
Slika 1.
Vi-11 (261/275), 1977., sloj G3
Dijagram lijevog nadočnog
segmenta, adultni muškarac

Figure 2.
Vi-138 (202), 1975, G3/i level
Diagram of the right supraorbital
segment, adult male



Slika 2.
Vi-138 (202), 1975., sloj G3/i
Dijagram desnog nadočnog
segmenta, adultni muškarac

Figure 3.
Vi-139 (279), 1978, G3 level
Diagram of the right supraorbital
segment, juv.-ad. female



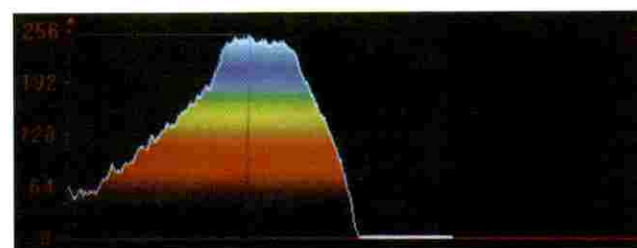
Slika 3.
Vi-139 (279), 1978., sloj G3
Dijagram desnog nadočnog
segmenta, juvenilna-adulna žena

Figure 4.
Vi-144 (262), 1977, G3 level
Diagram of the right supraorbital
segment, adult female



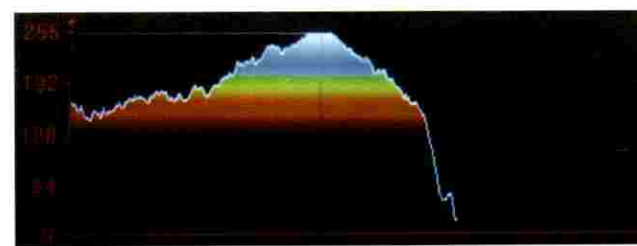
Slika 4.
Vi-144 (262), 1977., sloj G3
Dijagram desnog nadočnog
segmenta, adultna žena

Figure 5.
V. P.-J, "j" layer
Diagram of the right supraorbital
segment, adult female



Slika 5.
V. P.-J, sloj "j"
Dijagram desnog nadočnog
segmenta, adultna žena

Figure 6.
V. P.-J, "j" layer
Dijagram of the glabellar seg-
ment, adult female

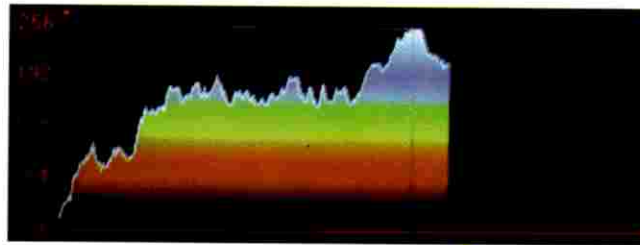


Slika 6.
V. P.-J, sloj "j"
Dijagram glabularnog segmenta,
adultna žena

PLATE I Diagrams of some fossil specimens/1-6/, showing patterns of distribution of the highest bone density within supraorbital region

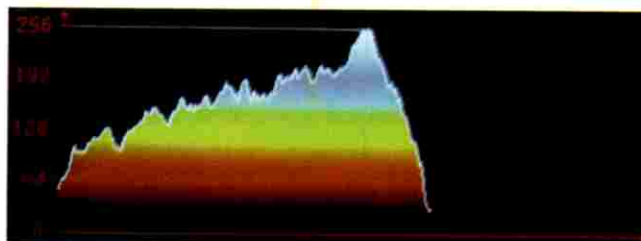
TABLA I. Dijagrami nekih fosilnih primjeraka /1-6/, pokazuju distribuciju vrijednosti najveće gustoće u području nadočne regije

Figure 1.
Cat. No 510
Diagram of the left supraorbital
segment, mature male



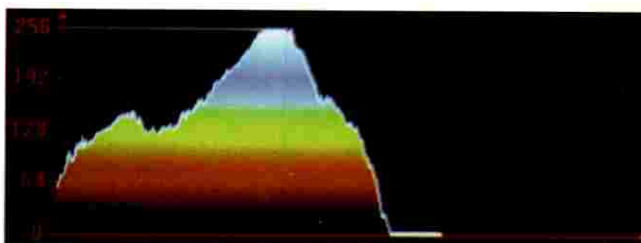
Slika 1.
Kat. br. 510
Dijagram lijevog nadočnog
segmenta, muškarac-maturus

Figure 2.
Cat. No 102
Diagram of the left supraorbital
segment, adult male



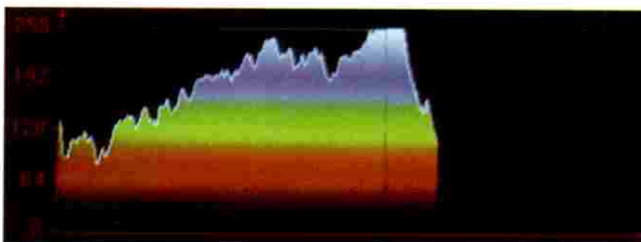
Slika 2.
Kat. br. 102
Dijagram lijevog nadočnog
segmenta, adultni muškarac

Figure 3.
Cat. No 76
Diagram of the left supraorbital
segment, mature female



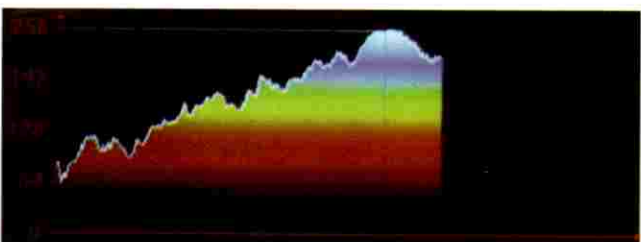
Slika 3.
Kat. br. 76
Dijagram lijevog nadočnog
segmenta, muškarac - maturus

Figure 4.
Cat. No 510
Diagram of the right supraorbital
segment, mature male



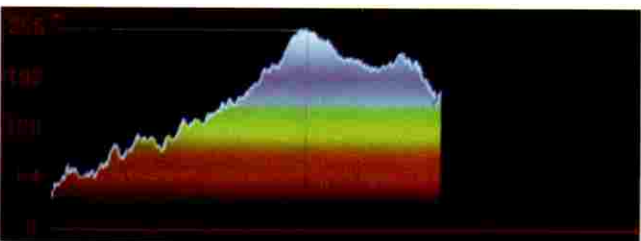
Slika 4.
Kat. br. 510
Dijagram desnog nadočnog
segmenta, muškarac - maturus

Figure 5.
Cat. No 102
Diagram of the right supraorbital
segment, adult male



Slika 5.
Kat. br. 102
Dijagram desnog nadočnog
segmenta, adultni muškarac

Figure 6.
Cat. No 76
Diagram of the right supraorbital
segment, mature female



Slika 6.
Kat. br. 76
Dijagram desnog nadočnog
segmenta, žena - maturus

PLATE II Diagrams of some recent specimens/1-6/, showing patterns of distribution of the highest bone density within supraorbital region

TABLA II. Dijagrami nekih recentnih primjeraka /1-6/, pokazuju distribuciju vrijednosti najveće gustoće u području nadočne regije