

A bioarchaeological approach for personal identification based on human handprint from the village of Ploski, Southwest Bulgaria

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ABSTRACT

The discovery of imprints of human hands and feet in various archaeological sites and on materials is extremely rare. Even rarer are the studies of these traces for personal identification. The current article concerns the analysis of a human handprint on a brick, unearthed in a tile kiln, excavated during 2017. The main goal is not only to establish the age and sex of the person left his mark but to pay particular attention to the possibilities of these type of anthropological investigations in the research of the ancient man. The handprint belongs to the right hand. It is preserved partly from second to fifth fingers. The values of the imprint gives us reason to assume that the hand on the brick from the village of Ploski belongs to a child aged between 6 and 7 (*Infans I/Infans II*), most probably a boy (?).

Key words: Handprint, physical anthropology, bioarchaeology, age determination, sex assessment, bricks, Revival period

Биоархеологически подход за идентификация на личността въз основа на отпечатък на човешка ръка от с. Плоски, Югозападна България

Борислава Гълбова

РЕЗЮМЕ

Откриването на отпечатъци от човешки ръце и ходила върху археологически обекти и предмети е изключително голяма рядкост. Още по-голямо изключение е анализа на тези следи с цел биологична идентификация на човека. В настоящата статия е анализиран отпечатък от човешка ръка открит върху тухла от пещ за керемиди, проучена през 2017 г. Целта е освен да бъде направено възрастово-полово определяне на индивида, но и да се обърне специално внимание върху възможностите на този вид антропологични изследвания в изучаването на древния човек. Откритият отпечатък е от дясна ръка. Той е фрагментиран, като са запазени отпечатъците от втори до пети пръсти. Получените стойности ни дават основание да заключим, че отпечатъкът принадлежи на дете на възраст между 6 – 7 години (*Infans I/Infans II*), най-вероятно момче (?).

INTRODUCTION

The discovery of imprints of human hands and feet in various archaeological sites and on materials is extremely rare. Even rarer are the studies of these traces for personal identification. The methods of physical anthropology used for studying living populations permit similar analysis to be carried out. They enable as well age and sex assessment of the individuals as the reconstruction of their stature and weight (Paulis 2015). In recent years, the attention of scientists has focused on different kind of imprints left by

the ancient people, which led to a significant increase in the number of these type of studies (Gunn 1998, Greer, Greer 1999; Gunn 2006; Wang, Ge, Snow, Mitra, Giles 2010; Tung 2012; Linge 2012; Pettitt, Castillejo, Arias, Peredo, Harrison 2014; Carden, Blanco 2016; Nelson, Hall, Randolph-Quinney, Sinclair 2017; Rabazo-Rodríguez, Modesto-Mataa, Bermejoa, García-Díez 2017; Marado, Ribeiro 2018; Atamtürk, Özbal, Gerritsen, Duyar 2018; Chopra 2018; Panarello, Mazzardo, Mietto 2018).

At this stage anthropological research of human hand and foot imprints on ancient bricks and tiles have not been carried out in Bulgaria. We find scarce information for some handprints in three publications.

In 2009, Maria Inkova refers for a footprint on an ancient tile discovered in the Kalyata fortress, near the town of Yakoruda, Blagoevgrad district. According to her, the footprint belongs to a two-year-old child. However, Inkova does not specify how these results have been obtained (Инкова, Ковачев, Гошев 2008; Инкова 2009; Инкова, Робовянов, Иванов 2010).

Another famous handprint is the one on the pithoi mouth, discovered in a grave from the mound 1, near the village of Dolna Rositsa, Targovishte region (4th-3rd c. BC) (Овчаров 1961). Given its small size (6.5 cm x 3.5 cm), the author has the right to assume that it is a seal (Овчаров 1961, 62), not a child handprint (Radev 2000, 156).

The third note belongs to Georgi Kitov. He mentioned about a hand stencil on the murals in the tomb from Sarafova Mound (4th-3rd c. BC), Kazanlak region. According to him the stencil have been painted in red but did not give more details (Китов 2008, 102).

The current article concerns the analysis of a human handprint on a brick, unearthed in a tile kiln. The main goal is not only to establish the age and sex of the person left his mark but to pay particular attention to the possibilities of this type of anthropological investigations in the research of the ancient man.

The site is located in the northwestern part of the village of Ploski, Sandanski region, Southwest Bulgaria and was explored during the rescue archaeological excavations in 2017 by A. Harizanov (Харизанов, Косева 2018, 564, 1). Two tile kilns placed one over the other were excavated. They have functioned seasonally at the end of the 19th century. (Харизанов, Косева 2018, 568). A brick fragment with human handprint was discovered in the lower chamber of the second kiln. (Харизанов, Косева 2018, 568).

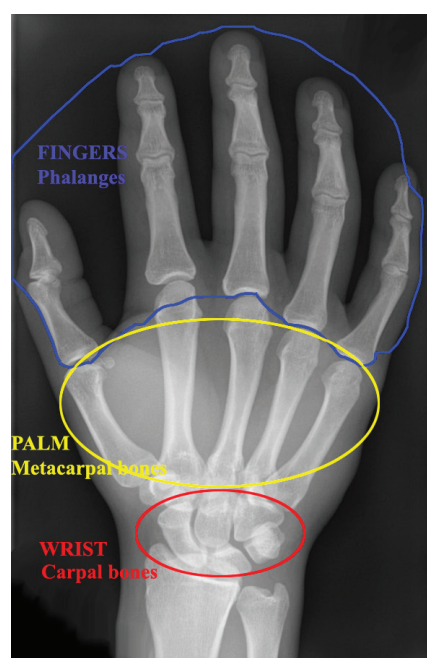


Fig. 1. Composition of the hand
(X-ray of human right hand)

The bones, muscles nerves, blood supply, and veins formed the human upper limb. It consists of the upper arm – from the shoulder to the elbow, the forearm – from the elbow to the hand and the hand. The hand (*manus*) extends beyond the wrist to the fingertips. Most often, the term hand is used for the whole upper limb, which is incorrect.

There are twenty-seven bones in the composition of the hand, forming its three main parts – wrist, palm and fingers. The wrist is composed of eight carpal bones, the distal ends of the radius and ulna and the proximal portions of the fifth metacarpal bones. The palm includes five metacarpal bones located between the bones of the wrist and the base of each of the five fingers of the hand. Fingers, except for the thumb, consist of three bones called phalanges. There are two phalanges in the thumb composition. (Fig. 1)

MATERIAL AND METHODS

The brick fragment is with a rectangular shape, well-formed sides and very well smoothed upper surface. The brick is made of clay, with small amount inclusions of quartzite and limestone of small size (under 2 mm) and a large

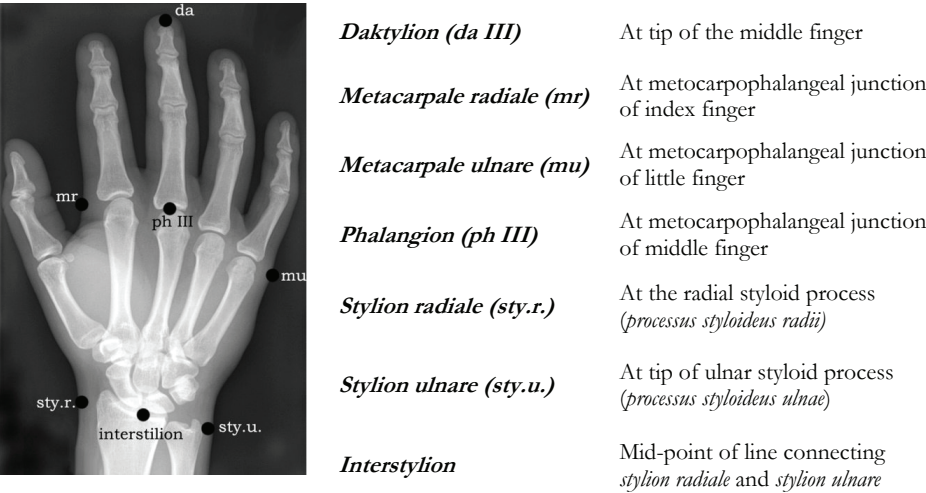


Fig. 2. Somatometric points of the hand according methods of Martin-Saller (1957)

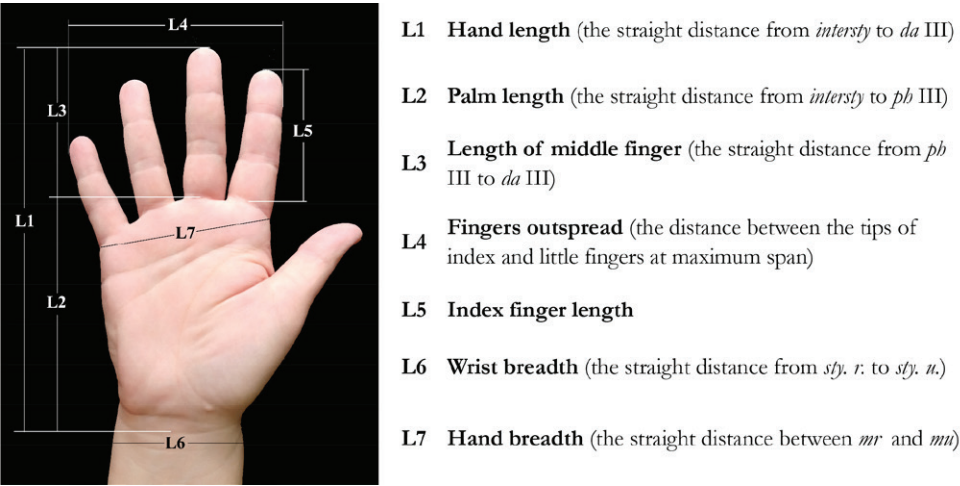


Fig. 3. Directly measured features.

amount of mica. The surfaces are yellowish red (5YR5/8, 5YR6/8) with grey spots (5YR7/1) caused by secondary firing. The brick fractures are grey to the red, result of irregularly baked. Preserved brick sizes: length of 14 cm in its shortest part, 24 cm in the longest part, 22.6 cm depth and height varies from 4.2 cm to 5.4 cm in various sections (Fig. 4).

Method selection to study the handprint was quite difficult. On the one hand, the methods for assessing the biological profile based on the hand size and hand imprints developed from Bulgarian samples are insufficient. On the other hand, all methods known in the literature are related to the identification of adults and are missing for children.

For the purpose of the current investigation, the somatometric points of the hand were applied according to the methods of Martin-Saller (1957) for studying living population (Fig. 2).

Seven are directly measured features (Fig. 3).

The obtained results are assessed in comparison with characteristics for adult living population in Bulgaria aged between 30 and 40 years (Йорданов, Начева, Торньова-Ранделова, Кондова, Димитрова, Паскова-Топалова 2006) and with biostatistical data for physical development in children and youths in Bulgaria (Начева, Жечева, Янкова, Филчева, Митова, Йорданов 2012).

The Munsell soil-color charts (Munsell color Company 2009) are used for colour changes on the brick during secondary firing.

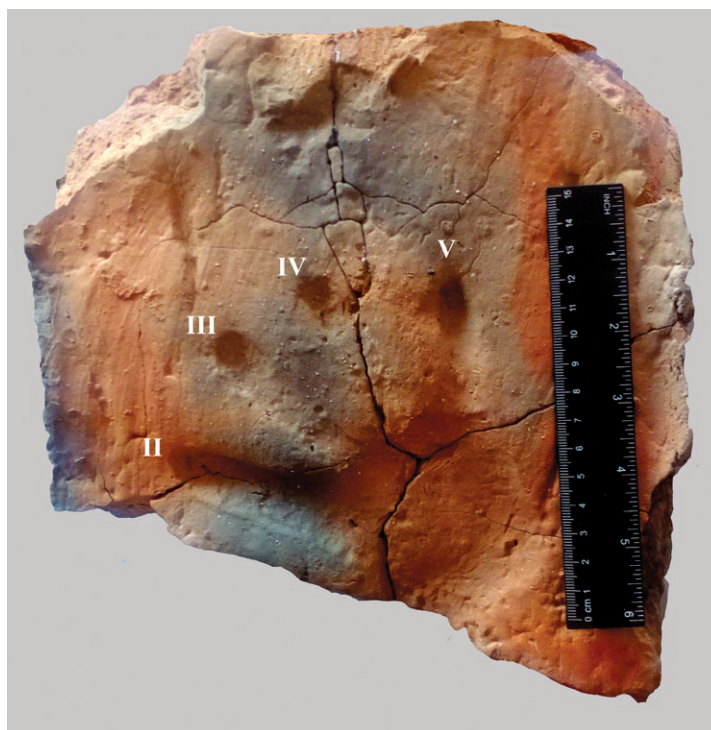


Fig. 4. Handprint on the brick from village of Ploski, Sandanski region.

RESULTS

The handprint is detected almost in the middle of the brick surface. It belongs to the right hand. The imprints of second to fifth fingers are preserved. The brick section with the first finger (the thumb) place is missing (Fig. 4).

The hand was placed unintentionally on the brick, while the clay was still wet. The depth of the fingerprints in their distal (front) part gives us a reason to assume that in contact with the wet clay, the pressure has fallen on the fingertips. No papillary patterns are count in the print, which not allows made a dactyloscopy examination.

The obtained results from the directly measured features in the handprint based on the somatometric points are detailed described in Table 1.

The comparisons between the obtained results with the biostatistical data from the studies of the living adult population aged between 30-40 years (male/female) from Bulgaria indicate significant differences in the size of the hand (Table 2) (Йорданов, Начева, Торньова-Ранделова, Кондова, Димитрова, Паскова-Топалова 2006, 313, табл. 78; 314, табл. 79; 315, табл. 80; 316, табл. 81; 317, табл. 82). These results prove that the handprint on the brick belongs to a child.

Table 1. Results of directly measured features of the handprint from village of Ploski, Sandanski region

Feature		Measurements (mm)
L1	Hand length	141.0
L2	Palm length	76.0
L3	Length of the middle finger	65.0
L4	Fingers outspread	125.0
L5	Index finger length	62.0
L6	Wrist breadth	48.0
L7	Hand breadth	70.0

Table 2. Comparisons between the handprint dimensions and the average hand size of the living adult population of both sexes in Bulgaria

Feature	Village of Ploski	♂		♀	
L1	138.0	min	175.0	min	151.0
		max	238.0	max	225.0
		mean	206.4	mean	188.1
L2	76.0	min	73.0	min	62.0
		max	119.0	max	113.0
		mean	99.5	mean	90.5
L3	65.0	min	89.0	min	80.0
		max	125.0	max	116.0
		mean	106.9	mean	97.6
L6	48.0	min	51.0	min	44.0
		max	70.0	max	66.0
		mean	60.0	mean	53.0
L7	70.0	min	75.0	min	65.0
		max	105.0	max	100.0
		mean	88.9	mean	78.9

Table 3. Comparisons between handprint measurements and mean hand size in children and adolescents of both sexes in Bulgaria by L1 feature

L1 Age	Boys			Girls			Village of Ploski
	min	max	mean	min	max	mean	
0	5.1	7.0	6.29	5.3	7.4	6.21	141.00
3	9.5	13.1	11.31	9.6	12.4	10.98	
4	10.5	13.1	11.97	9.8	13.3	11.58	
5	10.8	14.7	12.65	10.7	13.8	12.41	
6	11.7	15.0	13.29	11.0	15.7	13.18	
7	12.5	20.4	15.84	12.6	23.0	15.78	
8	12.6	19.2	16.17	12.9	18.7	15.78	
9	13.7	19.9	16.63	11.8	20.1	16.60	
10	14.6	20.1	17.39	14.4	21.2	16.89	
11	14.8	20.1	17.81	15.2	21.2	17.79	
12	15.1	21.5	18.26	14.4	21.7	18.21	
13	15.3	24.2	18.69	15.0	29.1	18.46	
14	15.4	23.0	19.92	14.8	21.9	18.75	
15	17.2	24.0	20.43	15.3	22.5	18.47	
16	15.2	24.9	20.72	16.1	21.7	18.58	
17	18.1	27.2	21.03	15.6	22.7	18.70	

To determine the child age left his mark on the brick, we compared some features with the results of the studies of children and adolescents from Bulgaria (Table 3 and Table 4), (Начева, Жечева, Янкова, Филчева, Митова, Йорданов 2012, 284, табл. 5. 5. 1. ; 286, табл. 5. 6. 1.).

Unfortunately, the investigated hand features in children and adolescents from Bulgaria are insufficient, which does not allow us to make a comprehensive comparative analysis for the age determination of the individual left his mark on the brick. For this reason, we conducted an experimental measurement of the right hands of two children – a girl and a boy at the age of six and a half.

Table 4. Comparisons between handprint measurements and mean hand size in children and adolescents of both sexes in Bulgaria by L7 feature

L7 Age	Boys			Girls			Village of Ploski
	min	max	mean	min	max	mean	
0	3.0	4.0	3.44	2.9	3.7	3.35	70.00
3	4.8	6.1	5.44	4.7	5.8	5.27	
4	5.0	6.5	5.74	4.7	6.3	5.55	
5	5.3	7.2	5.99	5.3	6.9	5.83	
6	5.4	7.1	6.23	5.0	6.8	6.05	
7	5.4	7.5	6.25	5.1	7.2	6.06	
8	5.8	7.5	6.52	5.4	7.1	6.26	
9	5.9	8.2	6.79	5.8	7.5	6.65	
10	6.0	8.3	6.99	5.6	7.7	6.81	
11	6.4	8.0	7.26	6.1	8.0	7.14	
12	6.6	9.0	7.59	6.0	8.5	7.40	
13	6.7	9.3	7.87	6.5	8.2	7.46	
14	6.8	9.3	8.25	6.8	8.5	7.56	
15	7.2	9.4	8.40	6.7	8.4	7.52	
16	7.5	9.8	8.51	6.6	8.7	7.59	
17	7.7	9.6	8.58	6.8	8.6	7.58	

Table 5. Comparisons between the dimensions of the handprint with the print of the right hands of two children – girl and boy aged 6.5 years

Feature	Village of Ploski	Boy	Girl
		6 years 5 months	6 years 5 months
L1	141.0	145.0	135.0
L2	76.0	78.0	75.0
L3	65.0	67.0	60.0
L4	123.0	113.0	107.0
L5	60.0	57.0	50.0
L6	50.0	52.0	41.2
L7	70.0	72.0	61.7

Table 6. Value of directly measured features of handprint with standard shrinkage of the clay and comparisons with the values of the hand of both children

Feature	Village of Ploski				Boy 6 y. 5 m.	Girl 6 y. 5 m.
	Directly measured feature (mm)	Min. shrinkage 7%	Max. shrinkage 10%	Avr. shrinkage 8.5%		
L1	141.0	147.66	151.80	149.73	145.00	135.00
L2	76.0	81.32	83.60	82.46	78.00	75.00
L3	65.0	69.55	71.50	70.53	67.00	60.00
L4	123.0	133.75	137.50	135.63	113.00	107.00
L5	60.0	66.34	68.20	67.27	57.00	50.00
L6	50.0	51.36	52.80	52.08	52.00	41.20
L7	70.0	74.90	77.00	75.95	72.00	61.70

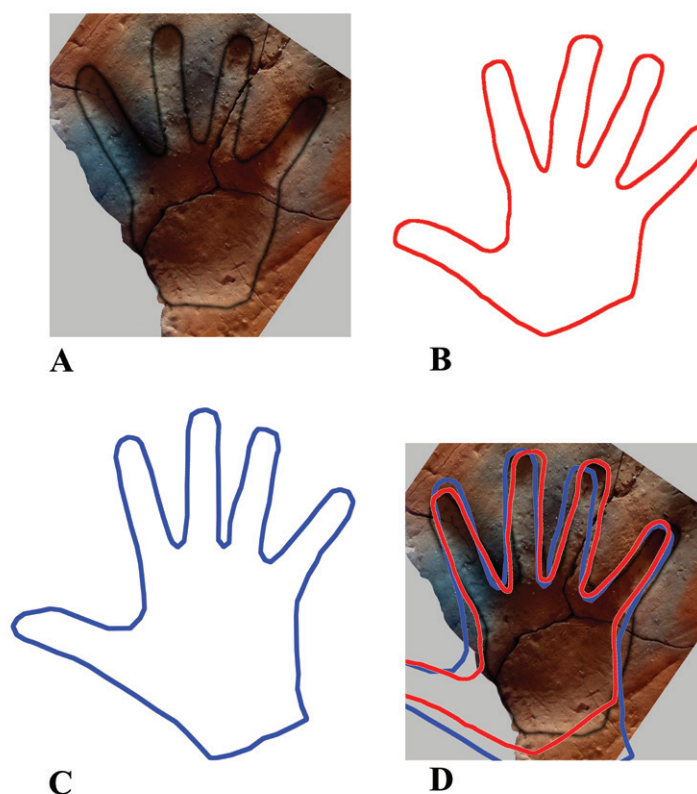


Fig. 5. Comparison of handprint from village of Ploski with the hands of two children: A – imprint of right hand in the brick from Ploski; B – right hand, 6.5 year old girl; C – right hand, 6.5 year old boy; D – The hands of two children – red (girl), blue (boy) over the imprint of the hand from village of Ploski

The results indicate that the dimensions of the handprint from the village of Ploski fall between the hand size of both children, but is more close to the dimensions of the boy. (Table 5).

In the analysis of the results, we have to take into account also the standard shrinkage of the clay dough during firing (7-10%) (Table 6).

Thus, from the obtained results, we can conclude that the imprint of the right hand on the brick from the village of Ploski is to a child aged between 6 and 7 (*Infans I/Infans II*). Because the sex differences in this age are too poorly identifiable, it is difficult to determine the exact sex of the child. The values of the separate features of the hand are closer to the boy's arm, which permits to assume that the child was a boy (?) (Fig. 5).

DISCUSSION

It is hard to say what has been the purpose of leaving all handprints in ancient time. One is sure, they provide a real view for the physic of the ancient man, his faith and beliefs, and remain a record for the future.

With this study, we would like to pay more attention to this kind of archaeological finds that will allow us to expand the demographic picture of the ancient inhabitants in the future.

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