

COMUNE DI CIMITILE
FONDAZIONE PREMIO CIMITILE
SECONDA UNIVERSITÀ DI NAPOLI
DIPARTIMENTO DI LETTERE E BENI CULTURALI
UNIVERSITÀ DEGLI STUDI DEL MOLISE
DIPARTIMENTO DI SCIENZE UMANISTICHE, SOCIALI E DELLA FORMAZIONE
CENTRO STUDI LONGOBARDI

TERRITORIO, INSEDIAMENTI E NECROPOLI FRA TARDA ANTICHITÀ E ALTO MEDIOEVO

Atti del Convegno internazionale di studi
Territorio e insediamenti fra tarda antichità e alto medioevo
Cimitile-Santa Maria Capua Vetere, 13-14 giugno 2013

Atti del Convegno internazionale di studi
*Luoghi di culto, necropoli e prassi funeraria
fra tarda antichità e medioevo*
Cimitile-Santa Maria Capua Vetere, 19-20 giugno 2014

a cura di
CARLO EBANISTA e MARCELLO ROTILI

ROGIOSI EDITORE
2016

Enti promotori

Comune di Cimitile

Fondazione Premio Cimitile

Seconda Università di Napoli
Dipartimento di Lettere e Beni culturali

Università degli Studi del Molise
Dipartimento di Scienze umanistiche, sociali e della formazione

Centro Studi Longobardi

Impaginazione: Domenico Alfano

In copertina: Lucerna di produzione locale (V-VI secolo) dalla catacomba di S. Severo a Napoli.
A pagina 1: Bottiglia di vetro (fine VI secolo) dalla necropoli di via Egiziaca a Napoli.

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Via Tino da Camaino, 13 - 80128 Napoli
tel/fax 0815564086 - info@rogiosi.it

ISBN 978-88-6950-164-7

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THE ASYMPTOTE OF LIFE AND DEATH OF THE LATE ROMAN PERIOD IN SPLIT (CROATIA)

1. *Introduction*

During the provincial Roman period the necropolis extend outside the town walls and develop from the moment of the town founding. Very rarely, at that period, graves spread inside the walls due to a town degradation or destruction. Good examples are presented in Dalmatia and Pannonia, where inside the walls exist cleared parcels or *insuli* as a nucleus of family graveyards in development. Together with Roman, Christian grave areas develop very early in towns, but also inside the houses, as a sign of uncertain times, when it is dangerous to step out of the town walls. Such burying practice is more common in small towns. A good example is Vranje near Sevnica, a famous site situated under the fortress Ajdovski gradec in Slovenia, which has been conserved as an archaeological park. During the 5th and 6th century this site belonged to the German *foederati*, and its necropolis was found both inside and outside the town walls. Due to such situation, it is possible to separate two groups, according to the archaeological material¹. Normally, burials positioned inside a town are situated near the churches, while later, more often, beside basilicas or in basilicas' narthex.

During the Late Roman Period big towns like Salona and Split extend their necropolis outside the town walls. Necropolis or the 'city of dead' continues on the 'city of living'. Essentially, it means that necropolis should start from the main town gates and expand to the road side. But this access to a town is also an area where people live and die. Newcomers will first be situated outside the walls, where a more modest but very lively copy of the town activities is present. Here people live and die, from old age, hunger or disease. It is not rare that soldiers also live here, in this tampon zone around a town. In times of danger, this area becomes the first battlefield line.

Diocletian's Palace was a palace, a production drive, and a center of an estate. Who were its inhabitants? A military garrison, craftsmen, merchants and in the final phase, also refugees. It was a fortress, a Late Roman period palace, typologically defined as a fortified *villa rustica*. Firstly, it was imagined as a palace, villa rustica with residential, economic, ceremonial and defense functions. As mentioned before, it was a palace with a manufacture drive. There are many theories about the exact production

¹ KNIFIC 1994.

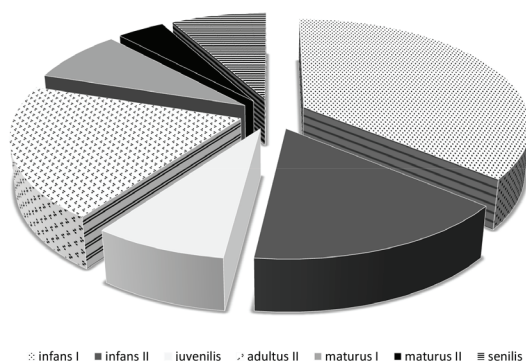


Fig. 1. Distribution of the deads by age categories - Dominican monastery of St. Catherine of Alexandria in Split.

Ga₃, Ga₄, Ga₅, Ga₆, Ga₇, Ga₈), burials under *tegulae* type *a capana* (graves: Gt, Gt₁, Gt₂, Gt₃, Gt₄), and burials in wooden coffins marked and covered with gravestones (G, G₁). All burials are primary and dug in sterile soil with predominant grave position Southwest-Northeast (graves: Ga, Ga₁, Ga₃, Ga₄, Ga₆, Ga₇, Ga₈). Other grave positions are: West-East (G₁, Gt, Gt₁, Gt₃), Southeast-Northwest (G, Gt₄), and just in one case Northwest-Southeast (Ga₂) and in one South-West (Ga₂).

The skeletal remains of 27 persons from 16 graves and probe S1 were analyzed. The remains were stabilized and cleaned in the field laboratory of Split City Museum at the archaeological site. The anthropological analysis was performed at the Chair of Archeometry and Methodology, Department of Archaeology, Faculty of Humanities and Social Sciences, University of Zagreb. The preparation of samples and the histological analysis were conducted at the Chair of Archeometry and Methodology, Faculty of Humanities and Social Sciences. The analyzed skeletal remains are kept in the storage of Split City Museum.

The skeletal growth and development in early infant years, together with basic osteometrics were performed using the data by Fazekas and Kósa (1978) and Scheuer and Black (2000). The analysis of age for juvenile skeletons was determined by stages of dental development³, by maximum long bone diaphyseal length⁴ and finally, by fusion of epiphyseal lines on the bones⁵.

For adult persons, age at death, together with sex, in most cases was determined from less than 50% of preserved anatomical elements of the skeleton. The basic

of the estate, the most accepted being cloth manufacturing².

2. Material and methods

Archaeological excavations on the site of Dominican monastery of St. Catherine of Alexandria in Split were conducted by the Split City Museum during 2007 and 2008. The excavated area starts from the main city gates and encircles the South-West part of the Late Roman period necropolis. Sixteen graves can be detached in three main types: *amphorae* burials (graves: Ga, Ga₁, Ga₂,

² BELAMANIĆ 2009.

³ BUIKSTRA-UBELAKER 1994.

⁴ SCHAEFER-BLACK-SCHUEER 2009.

⁵ SCHAEFER-BLACK-SCHUEER 2009.

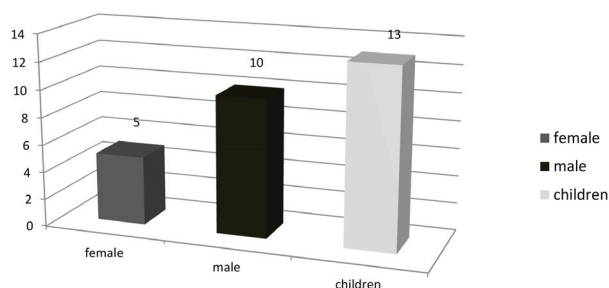


Fig. 2. Distribution of the deads: female, male and children category - Dominican monastery of St. Catherine of Alexandria in Split.

of age at death, sex and stature⁷, an analysis of pathological conditions⁸, and development degree of the musculo-skeletal attachments obtained from anatomical elements of the skeleton with modified scoring system⁹. The age of a person was determined under standard macromorphological parameters¹⁰. The crania with lower jaw methods comprised an analysis of the dental attrition degree on occlusal surfaces of the teeth, root transparency progression¹¹. A secondary method of age determination was the cranial suture and hard palate obliteration degree¹². The postcranial morphological analysis encompassed several methods: an analysis of sternal end rib phases¹³, an analysis of the auricular surface degradation degree¹⁴, and changes in the face of pubic symphysis on the coxal bone of a hip¹⁵.

The estimation of age at death for adult persons was completed with the modified histological method by Kerley (1965), using the regression formula. It was important to confirm age at death in addition to the histology method. The histological analysis samples of the femoral diaphysis were taken according to the protocol¹⁶. The light microscopic analysis was performed under standard magnifications: 10x10, 20x10, 40x10 (Olympus CX41RF). Photomicrographs were made with a digital camera (Olympus C Zoom-5050).

The analysis of the musculo-skeletal attachments was partially conducted, due

dental analysis was limited to dental status, possible pathology and detected macromorphological characteristics. All osteological measurements were taken with a set of the anthropological instruments GPM-Sieber Hegner. The morphometric analysis comprised standard measurements for humeral, radial, ulnar and tibial bones⁶. The anthropological methods used in this work encompassed determination

⁶ MARTIN 1988; BUIKSTRA-UBELAKER 1994.

⁷ BUIKSTRA-UBELAKER 1994.

⁸ AUFDERHEUDE-RODRIGUEZ-MARTIN 2011; DAMJANOV-JUKIĆ-NOLA 2008; ORTNER 2003; ŠUTALO-PETOLAS 1994.

⁹ VILLOTE *et alii* 2010.

¹⁰ BUIKSTRA-UBELAKER 1994.

¹¹ LAMENDIN *et alii* 1992; PRINCE-UBELAKER 2002.

¹² NAWROCKI 1998.

¹³ IŞÇAN-LOTH-WRIGHT 1984.

¹⁴ LOVEJOY *et alii* 1985.

¹⁵ SUCHHEY-KATZ 1986; SUCHHEY-BROOKS-KATZ 1988.

¹⁶ HINČAK-MIHELIĆ-BUGAR 2007.

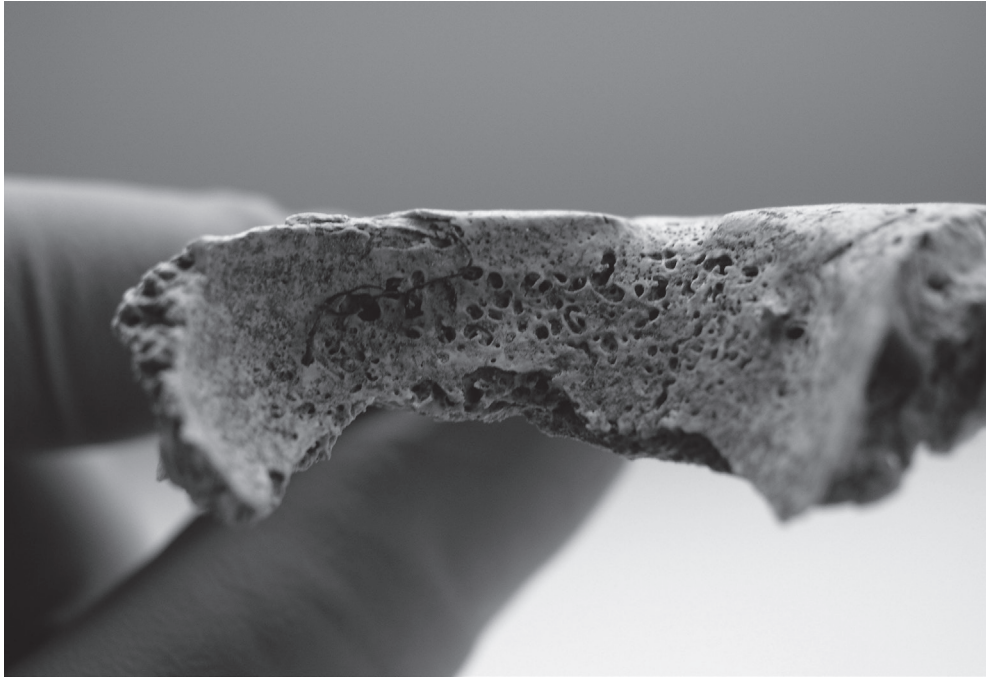


Fig. 3. Orbitae of a nine years old child from the grave G₁.

to the incomplete skeletal elements, together with the analysis of the markers of occupational stress.

Due to the very small number of graves and individuals, the results will not be discussed on the paleodemographical level.

3. Results

The remains of eighteen persons were found in sixteen graves. Outside the graves, but still in the same cultural horizon (probe S1) with analysis of isolated, sometimes very fragmented anatomical elements, at least nine more individuals were detected.

The children skeletons in all three phases show a very high share with 60%, presenting the highest rate of mortality on the site (fig. 1). This percentage is especially high for the youngest and most vulnerable children in *infans I* phase (36%), which embraces the period from birth to the age of seven. More precisely, from nine children skeletons in this phase, six of them belong to children under the age of one, while the other three are in the upper part of the phase. Obviously, if a child survives the early age, mortality in later phases will be lower, with 16% in *infans II* (7-14 years) and 8% in teenager, or *juvenis* phase (fig. 1).

The skeletons of adult persons comprise only 40% of skeletons on the site (fig. 1). The most numerous phase is *adultus II* (30-39 yrs) with 26%; it includes skeletons of

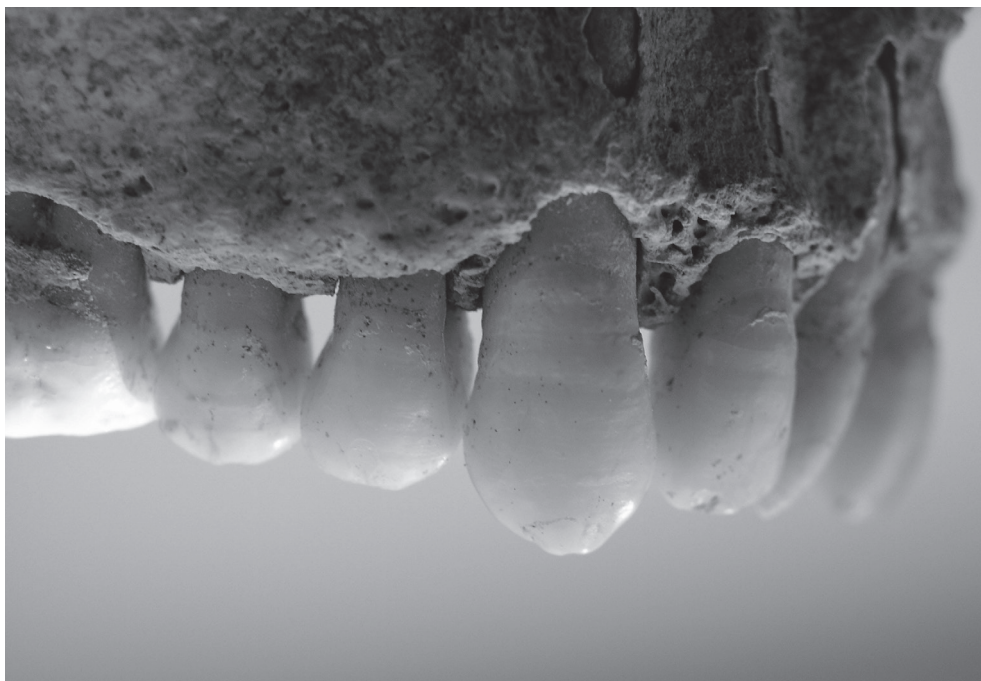


Fig. 4. *Maxilla* of the male person buried in grave Gt₄.

five males and two female persons. Later phases show a remarkable decrease with just 7,41% in both *maturus I* (40-49 yrs) and *senilis* (+60 yrs) phase and 3,70% in *maturus II* phase (50-59 yrs). The preservation degree of skeletal remains is poor, although there are several good preserved skeletons (probe S₁, graves: G, Gt, Gt1, Gt4).

Beside the distribution of the deaths by age categories figure, a separate graph presentation was made to show proportion of male and female skeletons (fig. 2). Thirteen children skeletons include two phases, *infans I* and *infans II*. The sex determination of the skeletons of nine male and five female persons was performed for skeletons of *juvenis* phase and all phases of adult persons. For males, the calculated sexualisation degree is predominantly robust type *hypermasculinum*, and for females less gracile type *femininum*.

The determination of stature was carried out according to the Pearson's regression formulas for the maximum length of the humeral, radial and tibial bones. The stature of the female persons is in both categories from low to medium high with the range 141-151 cm. The stature of the male persons was in a category of medium high with the range 165-169 cm.

Pathological changes visible on the bone and dental remains are not numerous. The most frequent are *cribra orbitalia*, linear enamel hypoplasia and periosteal changes. Various degrees of osteoarthritic changes were registered on the skeletal remains of the adult and mature persons.

Cribra orbitalia, porosities in the outer table of supraorbital roof was detected on the cranial bones of an adult person from the grave Gt3. It is a healed *cribra orbitalia*

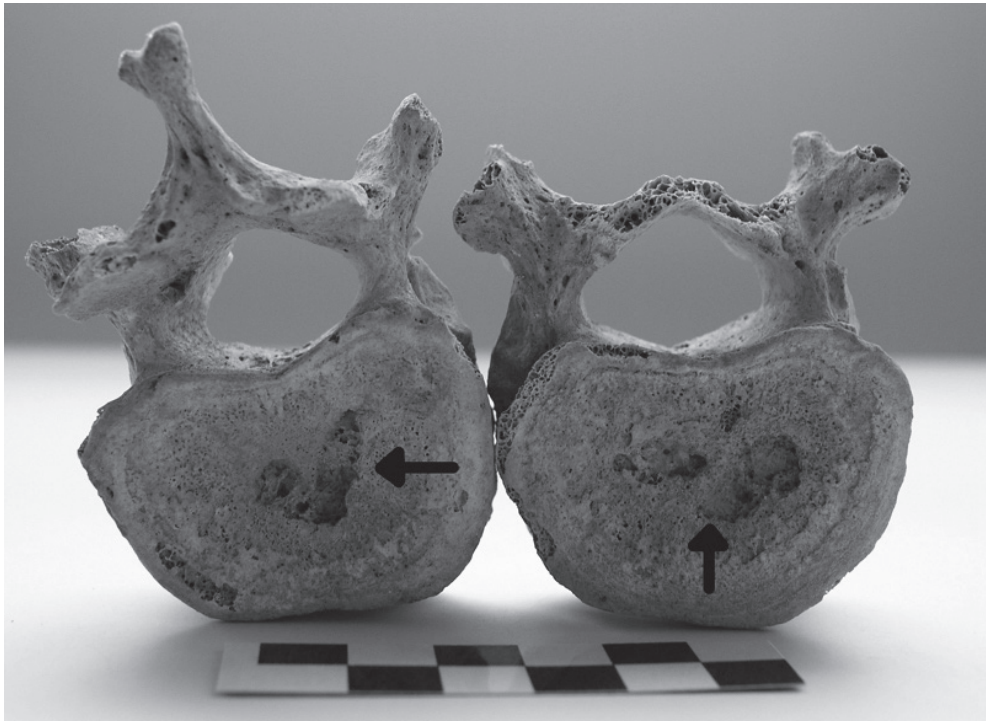


Fig. 5. Part of the vertebral column of the male person from the grave Gt₄.

of second degree of the Brothwell scale. The age at death of the person is in age range 30-39 years and the only preserved remains of the skeleton are fragmented frontal and both parietal bones. The second case of this pathological change with the same intensity was found bilaterally, on the orbitae of a nine years old child (± 24 months) from the grave G1 (fig. 3). Other three encompass the gentle traces of a healed *cribra orbitalia* of first degree, identified bilaterally on the frontal bones of two female and one male person aged 30-39 years (probe S1).

Linear enamel hypoplasia was confirmed in three cases, in a male person aged 30-35 years (grave Gt₄), in a female teenager aged about 15 years (grave Ga1) and in a female person aged 35-39 years (S1). The *maxilla* of the male person (grave Gt₄) preserves the complete dental row. Two deep transverse lines are visible on the teeth crown of incisors, canines and premolars (fig. 4). The timing calculation when the stress occurred has shown two such episodes during infancy, the first at 2-3 years and the second when he was about five years old. A low degree of cranial bones preservation for the skeleton of the teenage girl from grave Ga1 imply a lower preservation of *maxilla* and high fragmentation of *mandibula*. Nevertheless, the left maxillary dental row is almost complete (incisors, canine, premolars, first molar) while it is more fragmented in the right *maxilla* (canine, premolars). The lower jaw is very fragmented and four completely preserved incisors are out of tooth sockets. Two transversal lines are visible on all the incisors, canines and premolars. At the time



Fig. 6. Vertebral column fragments of the male person from the probe S₁.

of lines emergence, as a sign of stress and disturbance of the enamel deposition the person was one and two years old. The skeleton of the female person (S1) has a more damaged lower and upper jaw. However, it is possible to detect upper left first and second incisors and canine of *maxilla*, while *mandibula's* dental row is almost complete. One transverse line was identified along all preserved incisors, canines and first premolars. The timing calculation of the stress occurring was at the age of five.

A mild forms of healed periostitis was detected only on the tibial diaphysis of two male adult persons' skeletons from graves G_t and G_{t4} (both in age range 30-34 years). In both cases the traces of periosteal activities have less distinct margins and are less pitted; they fit so well into surrounding bone area that are hardly detectable. The traces are on the distal third of tibial *facies medialis* and have oval shape. Only in the case of the male person from the grave G_{t4}, healed periosteal activity is detected on the distal third of tibial *facies lateralis*.

On the vertebral bodies of the skeletons from the graves G and G_{t1} Schmorl's disc herniation was detected. In a case of the female person from the grave G (50-54 years), the herniation of *nucleus pulposus* is visible on vertebral plates of the last thoracal (T₁₂), second and third lumbar (L₂, L₃) and there is a very expressed herniation on the



Fig. 7. Female person from the grave G: *m. triceps brachii* of ulnar bone.

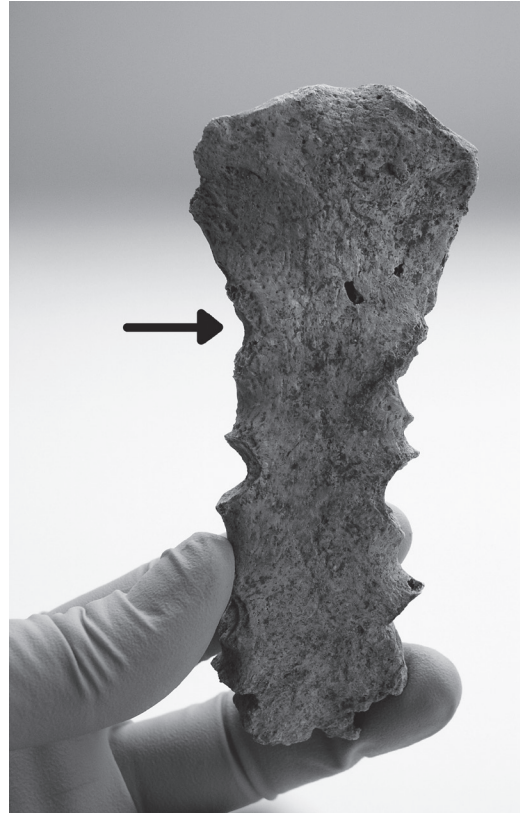


Fig. 8. Ossification of manubrium and sternum.

fourth lumbar vertebral body (L_4). Much more serious disc herniation is present on a part of the vertebral column of the male person from the grave Gt₄ (30-34 years), it expands from the tenth thoracal to the fifth lumbar vertebrae (T_{10} - L_5) (fig. 5). On the plate of the ninth thoracal vertebrae (T_9) an intra-canal herniation of the *nucleus pulposus* with posterior crossing of the *annulus fibrosus* was detected.

On the edges of some vertebral bodies on the skeletons of the persons older than 35 years it is possible to determine a growth of new bone. *Osteophythisis vertebrae* is obvious on the lower thoracal and lumbar vertebrae of the skeletons from the grave G (female person, 50-54 years) and probe S1 (male person, 60+, female person 60+). The vertebral column fragments of the male person from the probe S₁ demonstrate additional, osteoarthritic changes on the vertebral and thoracal segments. The facet joints of the cervical vertebrae show porosity and grooving, with a small area of dense, shiny surface of *eburnation* (fig. 6).

It is hard to indicate caries prevalence, due to predominantly poor preservation of the osteological remains. Lesions of all four types were detected on the teeth remains, but it seems that the prevalence is not high. On the occlusal surfaces of all adult persons it is possible to detect a different degrees of abrasion. Secondary dentin



Fig. 9. Anterior distal end of the right tibia.

is also clearly visible on the teeth of the adult persons.

A statistical presentation of the musculo-skeletal attachments and enthesopathy development was not elaborated due to the incomplete and poorly preserved human remains. From few well preserved skeletons, a case study of the female person from the grave G who died at the age of 50-54 years is described. The muscle attachments involved in shoulder movements are stronger developed than the ones on the bones of the lower extremities. The analyzed and scored development of the tendon, ligament and muscle attachments of the upper limb include: *m. triceps brachii* (L2:R2), *lig. costoclaviculare* (L2:R2), *m. trapezius* (L2,5:R2,5), *lig. conoideum (impressio lig. costoclavicularis)* (L2,5:R2,5), *m. pectoralis major* (L2:R2), *m. deltoideus* (L2:R2,5), *m. latissimus dorsi/teres major* (L1,5:R1,5), *m. biceps brachii* (L1:R1,5), *m. pronator teres* (L1:R1), *membrana interossea* (L1,5:R1,5), *m. triceps brachii* (L2:R2), *m. supinator* (L2:R2) and *m. brachialis* (L1,5:R2). A small exostosis is present in the attachments of *m. triceps brachii* of both ulnar bone (fig. 7). From the scoring results for the left and right attachments involved in shoulder movements, it is clear that the attachments of the right arm are slightly stronger developed than the ones of the left arm. The person was, presumably, righthanded.

Ossification of manubrium and sternum is complete (fig. 8). The sternal fusion is of normal width, without concavity. Schmorl's disc herniation is visible on the vertebral plates of the last thoracic (T12), second and third lumbar (L2, L3), and the fourth lumbar vertebral body (L4). A moderately developed *osteophytosis vertebrae* is seen on a thoracic segment of the vertebral column from the fourth to the eight *vertebrae*. On the lower extremity femoroacetabular impingement in the form of reaction area on anterior part of the proximal and medial femoral neck - fossa of Allen is visible. Vastus impression or Messeri's patella was detected on the left patella. Ankle facet was found on the anterior distal end of the right tibia (fig. 9). Unilaterally, on the left *calcaneus* vertically oriented exostosis at the *insertio* of the Achilles tendon is present (fig. 10).

4. Discussion and conclusion

The archaeological excavation of the necropolis on the site Dominican monastery of St. Catherine of Alexandria in Split revealed sixteen graves with skeletons of eighteen persons, and nine more individuals from the same cultural horizon from the probe S1. Children skeletons dominate with high frequency of 60%. The mortality of children was high, with frequency of 36% in the first age group, which occupy the range from birth to the seven years of age. The number of children burials on site is usually smaller, for children graves are less deep and are sooner destroyed. Skeletons of adult persons comprise only 40% of the skeletons of the site, with the highest mortality of 26% in the range 30-39 years. Children skeletons are poorly preserved while the ones of adult persons are better preserved. The female stature was in the range 141-151 cm, and the male stature in the range 165-169 cm.

Pathological changes are not frequent, the reason could be poor preservation of the osteological material. *Cribra orbitalia*, linear enamel hypoplasia, periosteal changes and Schmorl's disc herniation on the lower extremities are the most frequent pathological changes detected on the human remains of the site. Generally, these changes are also the most frequent pathological changes detected in the skeletal remains of all archaeological periods and are considered one of the indicators of health and/or nutritional status of past human populations. *Cribra orbitalia*, porotic lesions, have frequently been referred to as a nutritional stress indicator, a manifestation of iron-deficiency anaemia, and a condition caused by chronic infections¹⁷.

Dental deformation, such as linear enamel hypoplasia is a permanent marker of childhood physiological stress¹⁸ and in analyzed cases the age when stress occurred was between one and five years. The paucity of tibial periostitis can be interpreted in a number of ways, but it is generally an indicator of adult health¹⁹. The analyzed cases on the tibial bones of two male persons aged 30-35 years show a mild, healed type of periosteal activity.

A generalized physical stress can cause Schmorl's disc herniation²⁰. In the

¹⁷ MANN-HUNT 2012; AUFDERHEIDE 2011; DAMJANOV-JUKIĆ-NOLA 2008.

¹⁸ ORTNER 2003; ŠUTALO-PETOLAS 1994.

¹⁹ HARTLEY *et alii* 2012; LARSEN 2002; DANIELS-NASHEL 1983.

²⁰ CAPASSO-DI TOTTA 1991.



Fig. 10. Left *calcaneus* with vertically oriented exostosis at the *insertio* of the Achilles tendon.

archaeological populations and in young persons' skeletons, this type of herniation is connected with heavy and continuous working activity²¹. But nowadays researches connect the development of Schmorl's disc herniation on the vertebral bodies of older persons with sedentary lifestyle. The herniation was detected on vertebral segments of a female person from the grave G (50-54 years), and of a male person from the grave Gt₄ (30-34 years). Osteoarthritic changes, as identified in the skeleton of a male person aged 60+ (probe S1), is the most common joint disease in ancient, but also in modern populations²².

The chosen case study, the skeleton of a female person aged 50-54 years from the grave G, should demonstrate habitual activities of the analyzed person, scoring the degree of the muscular, ligament and tendon attachments' development. Patterns are easy to read, the pull-push muscle pattern with marks on the attachments of *m. triceps brachii* and *m. biceps brachii* of the skeleton. Also, when shoulders move the arms across the chest during pushing and *m. trapezius* is in bilateral activities, when the head is tilted backwards. Some other muscles are also involved, like *m. pectoralis major*. Pushing and flexion will activate mostly *m. brachialis*, which participates in complete flexion and *m. biceps brachii*, *m. pronator teres* in movements of supination and pronation. Lifting a hand above the head and lowering a hand from above activate muscles such as *m. triceps brachii* and *m. latissimus dorsi*, and to a certain extent even *lig. costoclavicularis* is activated while *m. pectoralis major* lifts the thorax. The muscle developments activated during the flexion of the forearms, movements that correspond to activities such as carrying a load in the hands, all their attachments have a high score. Ossification of the manubrium and the sternum could be a sign of aging, but also of carrying a heavy load on the back²³. The female person has strong attachments on the upper extremities, but had very moderately developed those of the lower extremities. It is a sign of hard work at and around home. Schmorl's disc herniation on the vertebral plates of the thoracic and lumbar vertebral bodies can occur due to repetitive flexion and lateral bending of the vertebral column, especially from lifting heavy objects²⁴. On a lower extremity femoroacetabular impingement - fossa of Allen - could be connected with activity related motions such as hyperflexion, abduction and hyperextension of a hip joint²⁵. Several bone changes are related with squatting position and chronic knee flexion, vastus impression or Messeri's patella and ankle facet of the tibia²⁶. Achilles tendon entheses, present on the left *calcaneus*, could be developed after repetitive plantar hyperflexion, like balancing over rough terrain²⁷.

Due to the small number and poor preservation of the skeletons' anatomical elements it is not possible to present a paleodemographical study of the finds, only the basic anthropological analysis. Yet, further chemical and biological analysis of the human remains from the site will give us a deeper understanding of the personal story of each individual.

²¹ MANN-HUNT 2012.

²² ROGERS *et alii* 1994.

²³ CAPASSO-DI TOTTA 1991.

²⁴ CAPASSO-DI TOTTA 1991.

²⁵ WILCZAK 1998.

²⁶ MESSERI 1961.

²⁷ MOLLESSION-HODGSON 1993.

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Figg. 1-10 (Zdravka Hincak-Helga Zglav Martinac)