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Unusual Burial of an Adult Individual from the Cathedral of the Armenian Apostolic Orthodox Church in Armenia (preliminary announcement)

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Abstract

The Mother See of Holy Etchmiadzin has been the administrative headquarters of the Armenian Church. During restoration work in June 2019, human remains from an ancient burial were discovered in the Cathedral within an archaeological context of 4th century AD. The gross anatomy of the bones was investigated through macroscopic and microscopic analyses. The reason for the extensive burning on much of the individual's body is unknown. The color of the burns ranged from black to white (calcined). We see white, furry or "bloom" growths, as crystals on the bone surface. Ground water can carry these salts into the pores of the bones during burial leaving them behind when the water evaporates.

Keywords: Armenia, White powder, Salt crystals, Fire exposure, Cathedral, Etchmiadzin, Taphonomy

1 Introduction

1.1 Early Medieval burial in the Holy Etchmiadzin Monastery

Etchmiadzin Cathedral is the mother church of the Armenian Apostolic Church, located in the city of Vagharshapat (Etchmiadzin). The original church was built in the early fourth century — between 301 and 303 according to tradition — by Armenia's patron saint Gregory the Illuminator, following the adoption of Christianity as a state religion by King Tiridates III. It was built over a pagan temple, symbolizing the conversion from paganism to Christianity. The core of the current building was built in 483/4 by Vahan Mamikonian. For much of its history, the complex around the cathedral, which includes the residence of the Catholicos (patriarch), was known as the Monastery of Etchmiadzin. It was formerly surrounded by 30 ft (9.1 m) high walls, made of brick or cob, and had eight circular towers (turrets). The walled monastery, a vast quadrangular enclosure, could be accessed through four gates. The cathedral stood — and continues to stand — at the center of a quadrangular courtyard 349 feet 6 inches (106.53 m) by 335 feet 2 inches (102.16 m).

As the center of Armenian Christianity, Vagharshapat has been an important location in Armenia not only religiously, but also politically and culturally. Along with several important early Medieval churches located nearby, the cathedral was listed as a World Heritage Site by UNESCO in 2000.

2019 on 26 May, an Early Medieval burial (4th century AD) site was discovered during excavations near the southern wall of the Holy Etchmiadzin Monastery (Figure 1). The burial was oriented in a north-westerly direction. A white residue presumed to be lime was detected during excavations. The sarcophagus was covered with rough tufa stones. The base of the sarcophagus was covered with earth. The bones demonstrate signs of burning and salt deposits.

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This article examines this unusual burial dating to the Early Medieval period, discovered the Holy Etchmiadzin Monastery. This also requires an assessment whether there were liturgical, practical or other motivations and justifications for burial in Holy Etchmiadzin Monastery. Each example of such a burial necessitates analysis to determine if the burial in this location was incidental, accidental, or intentional. The objectives of this article are as follows:

1. To assess the role and significance of post-depositional practices within the Medieval funerary context.
2. To identify and define different forms of post-depositional disturbance and to document any recognisable attributes of such practices.
3. To elucidate Medieval attitudes towards the dead, physical interaction with deceased individuals and human skeletal material.
4. To assess the significance of white substances in interpreting taphonomic burial processes and their funerary context.

1.2 *Taphonomic factors*

Taphonomy (from *taphos*, 'burial' and *nomos*, 'law') is integrated into many scientific disciplines, relating to the body itself (anthropology, forensic medicine, etc.), the body in interaction with the soil, otherwise known as the "decomposition island" (toxicology, genetics, forensic macro- and microbiology, etc.), in relation to the detection of the body (archaeology, botany, forensic geology, etc.). After death the human body is subject to the processes of autolysis and putrefaction. It is the combination of intrinsic and extrinsic factors which make every burial unique. Intrinsic factors depend on the nature of the body itself and the complexity of its structure such as age, sex and physical state at the time of death (Garland & Janaway, 1989; Henderson, 1987; Mant, 1987). Extrinsic factors can be divided into two main categories: the environment of the burial site, and human activities. The environmental factors which affect decomposition are water, soil, temperature, oxygen, and local fauna and flora (Gill King, 1996; Henderson, 1987; Janaway, 1996; Tibbett & Carter, 2008).

Salt is a generic term covering all the soluble salts in soil, mainly comprising Na, K, Ca, Mg, chlorides, sulphate, and sodium bicarbonates and carbonates. The salts deposited in and on an artefact (or bones) during burial can be divided into two groups: insoluble salts, and soluble salts. Soluble salts will dissolve in moisture in the air. This property is known as deliquescence. The salts can move through porous artifacts or bones as moisture is drawn out through evaporation. As the salts reach the surface of the artifact, they may crystallize as white, often furry growths on the surface. If the surface is less porous than the underlying structure they can crystallize just below the surface. These crystals exert immense pressure and may cause the surface layer to spall off. "Insoluble" salts are not truly insoluble but will take days or weeks to dissolve in water. They are not deliquescent and so will not cause further damage after excavation. Insoluble salts can, however, be quite disfiguring, and may require removal for identification or reconstruction of a bone or artifact.

Soluble salts can also be deposited into artifacts through past conservation treatments, including "acid cleaning". In this process, objects are dipped in a dilute acid solution to remove insoluble salt deposits from the surface of ceramics. The acid changes them into a water-soluble form. The soluble salts can then penetrate into the porous body of the artifact and later recrystallize on or under the surface as described above. Acid residues may also react with the artifact causing crystal growth.

Porous archaeological materials such as ceramics, stone, bone, and ivory often contain soluble salts. After excavation, these salts can crystallize at or just below the surface of the artifact causing damage. A variety of descriptive terms are used for this damage including spalling, flaking, powdering, and sugaring. The force of growing crystals can break apart the surface of bone, stone, ceramics and other porous materials so that detail is lost. In bad cases it can remove the entire surface of an artifact. In the worst cases, it can destroy an artifact.

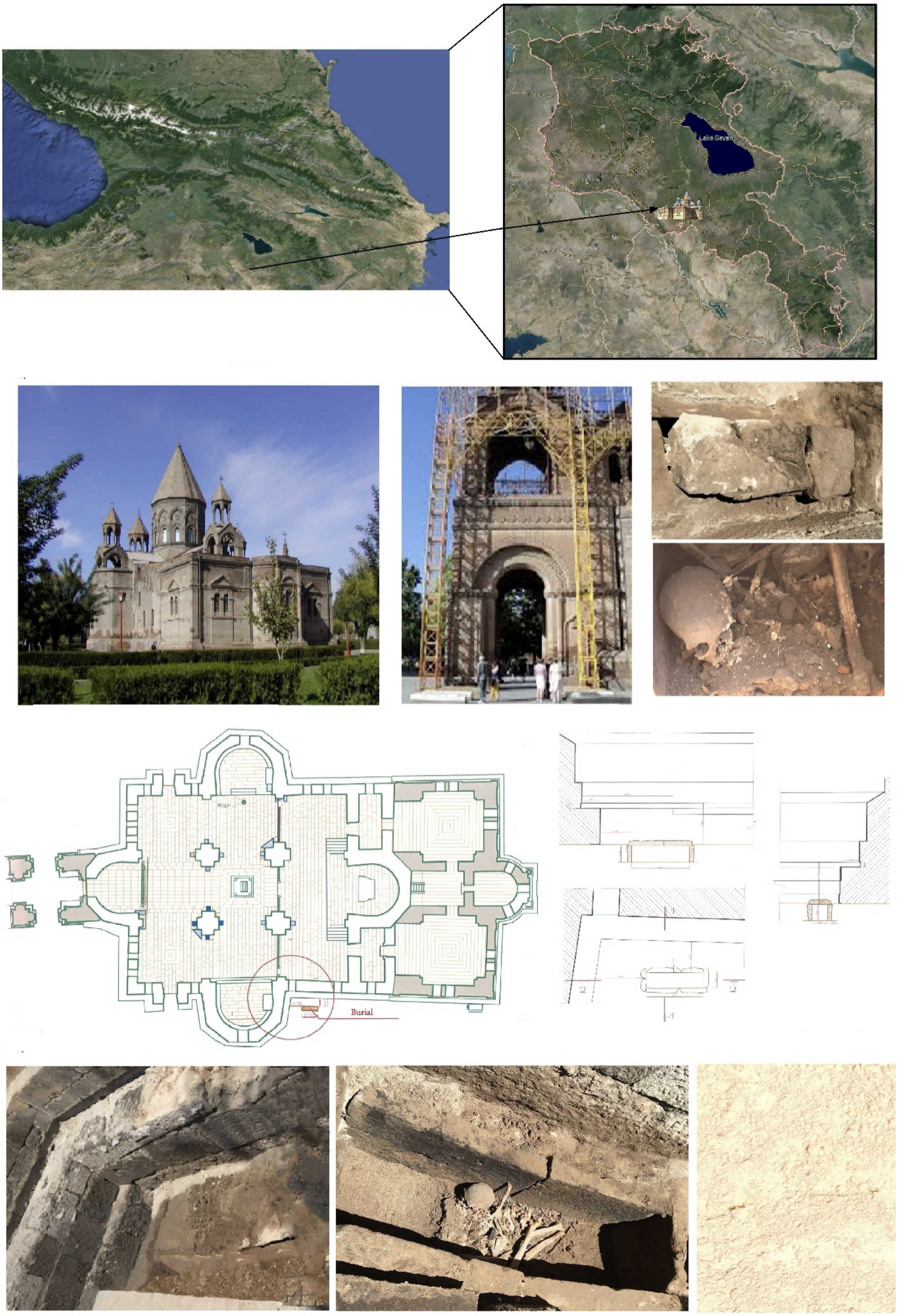

Figure 1: Cathedral of the Armenian Apostolic Orthodox Church.

1.3 Impact of combustion on bones

Fire is a very destructive force, capable of causing great damage. Burned human remains can be found in a variety of situations, from archaeological funerary urns to volcanic eruptions. Let us list the diversity of possible origins for bone combustion: intentional discard of bone waste in hearths (Cain, 2005; Spennemann & Colley, 1989), alimentary cooking (Costamagno & Fano Martínez, 2005; Gifford-Gonzalez, 1989; Pearce & Luff, 1994; Wandsnider, 1997), ritual combustion (Tchesnokov, 1995; Vaté & Beyries, 2007), accidental combustion after burying (Bennett, 1999; Cain, 2005; David, 1990; Stiner et al., 1995), and natural fires (Bellomo, 1993; Bellomo & Harris, 1990). In spite of this range of contexts, the actual effects on the body and the bones (which we refer to as "heat-induced changes") are the same. In fact, the changes we see from fire are in many ways the same as normal diagenesis over time, just much faster. It is important to note that the skeleton does not 'turn to ash' when burned. Even in modern crematoria, which burn efficiently and at high temperatures, the skeleton will survive.

The human body is made up of soft and hard tissues, and fire has a dramatic effect on both. The heat causes significant changes to the bones. Bone goes through four stages of transformation when burned: 1. dehydration (removal of water from the bone due to moisture evaporating in response to the heat; this occurs at a temperature range of 100-500°C), 2. decomposition (the organic component of the bone (the collagen) is lost.), 3. inversion (changes to the inorganic, mineral part of the bone, the phosphates and carbonates; this occurs at a temperature range of 500-1100°C), 4. fusion (the crystals that form the bone mineral start to melt and coalesce together; this occurs at a temperature range of 700-1200°C). These four stages are not discrete phases — a given bone could be experiencing all four stages in different parts at the same time (Thompson et al., 2017). Some bones will burn more intensely than others, depending on factors such as body fat distribution, proximity to the heat source, etc. (Schmidt & Symes, 2015; Thompson, 2015).

The fire will cause the soft tissues to contract, which causes the skin to tear and the fat and muscles to shrink. The internal organs will also shrink. The muscles contract due to burning and this causes the joints to flex. As a result, burned bodies are often contorted into what is known as a pugilistic, or boxer pose (Thompson, 2015). Distinguishing between ante and post mortem alterations can be challenging even for the skilled paleopathologist and, as this case indicates, paleopathological diagnoses must be supported by detailed examinations.

1.4 White residues in burials

When white substances are found in burial contexts, it is often assumed that the white material is lime (CaO or $Ca(OH)_2$) or another derivative of limestone (Schotsmans et al., 2012). For centuries (ca. 11th millennium BP to present), white plaster (variously gypsum, lime or chalk) has been added to burials for many different reasons, although such finds have rarely been analysed (Schotsmans et al., 2015). For example, the earliest intentional use of gypsum in a funerary context, as confirmed by analysis, comes from *Körtik Tepe* in Turkey and dates to the Pre-Pottery Neolithic A (Erdal, 2015).

What are the intentions for the application of white powder? The interpretations of this custom are diverse and sometimes contradictory. Are some of the historical examples a Christian custom related to resurrection with the white colour as a sign of purity? Does it represent the transition from the world of the living to the world of the dead? Or was it applied for practical reasons? Several suggestions are made regarding the intentions. Lime could have been applied to burials to desiccate and preserve a body, with the intention to dissolve the body and accelerate decay, to facilitate a quick turnover for next interments, against body snatchers to make the remains useless for dissection, to absorb the putrefaction fluids, as a disinfectant, to protect the body, to conceal the body, to suppress the odour, to make the burial look neat etc. Who made these interpretations? Are they based on historical documents, on scientific evidence or on personal assumptions of the authors? As an illustration, Naphy & Spicer (2000, p. 88) state "that the decay of plague bodies might produce infected gasses. For this reason the extensive use of lime to 'dissolve' the bodies was a medical necessity." Similarly, Weiner (2010) mentions that "the addition of lime removes foul odours and kills pathogens" (Weiner, 2010, p. 194). Fiedler et al. (2009) state that the Roman custom of adding calcium hydroxide was used to dissolve the flesh from the bones and get rid of the odour, referring to a source of 1973 (Cüppers, 1973).

2 Material and Methods

In 2019, excavations led by Nyura Hakobyan (Institute of Archaeology and Ethnography, National Academy of Sciences, Republic of Armenia) uncovered an early Medieval tomb near the southern wall of Etchmiadzin Cathedral, in the ground in a typical stone sarcophagus facing north-west (Figure 1). The sarcophagus is made of stone and lined with polished tuff slabs. The sarcophagus is covered with unworked massive tuffs. The base of the sarcophagus is sprinkled with earth. The non-anatomical arrangement of human remains within the sarcophagus — characterized by disarticulated bones and disruption of the skeletal structure — suggests the likelihood of a secondary burial. The bones are compact within a spatially limited area, significantly smaller than the dimensions of a fully extended human body. This compact placement strongly indicates that the remains were exhumed and subsequently reinterred in a deliberate and non-primary context. Such a configuration serves as a critical diagnostic criterion in both archaeological and anthropological analyses, pointing to post-depositional human activity. Any skeletal material that is disinterred or disarticulated by means of this process is regarded as a secondary act. "Translation" is the term used to describe the disinterment and relocation of the whole skeleton or preserved remains of an individual, from their initial burial place to a secondary site of interment. The remains were redeposited in a new location within a church. Translations and elevations were reserved for those individuals who had exhibited signs of saintliness during their life or after death. "This was the ancient equivalent of canonization: only those honoured by a burial above ground in the church were considered worthy of liturgical cult" (Farmer, 2004, p. 21).

There is no written documentation indicating when or under what circumstances the remains were reburied. However, it is likely that the individual held particular importance within the church community. Burials within the church or on consecrated church grounds were not conducted arbitrarily; such spaces were traditionally reserved for individuals of notable religious standing, most commonly members of the clergy (Armenian Book of Canons, 1964)[1].

A white layer was found at the bottom of the grave (inside and outside). The bones also were covered with a white powder. The white plaster substance had been identified by archaeologist N. Akopyan as gypsum, lime

System: or a chalk-gypsum mix. Due to time and budgetary constraints, the white powder sample was not subjected to laboratory analysis. White powder was found in lumps 2-10 cm in diameter. The sarcophagus has been dated to the early 4th century on the basis of its construction, orientation, stratigraphic data and comparable parallels, i.e. before the foundation of Etchmiadzin Cathedral.

The study of burned human remains poses special challenges compared to the anthropological study of non-thermally altered bones as exposure to heat produces macroscopic color changes, warping, fragmentation, and shrinkage. Charge in bone color is caused by thermal degradation or pyrolysis of their organic components, producing a sequence of heat-related color changes (Walker et al., 2008). During a fire, temperatures do not remain constant but instead fluctuate and change throughout the fire's incipient growth, development, full involvement or flashover, decay, and/or extinction (DeHaan, 2006, 2008; DeHaan & Icove 2012; Icove & DeHaan, 2004; Pope, 2023). Depending on the type and duration of the fire, the maximum temperatures of the fire may only last for several minutes or longer but are not always constant, unlike the artificial fire environment of a furnace or crematorium. Oxygen levels also vary in and between fires from oxygen rich (wind-driven/ventilated) to oxygen poor (smoky smoldering). Bone color can therefore be influenced not only by the maximum temperatures which fluctuate, but also by the duration of the bone's exposure during the fire event and post-flashover conditions, varying cortical thicknesses, the availability of oxygen, the progressive stages of pyrolysis of the bone's organic matrix, byproducts of combustion and

[1] This compilation is one of the most important sources of Armenian ecclesiastical law and canonical tradition. It includes canons from the medieval and late medieval periods of the Armenian Apostolic Church, based on both Byzantine and Armenian traditions. Regarding the topic mentioned above — that random individuals could not be buried inside or within the grounds of a church — this principle is indeed reflected in various canons within the collection. According to several rulings in the *Kanonagirq*, burial inside a church was reserved exclusively for clergy, individuals who had exhibited signs of saintliness, or individuals of high status. The rest of the population was to be buried within the churchyard or cemetery, but not within the church structure itself.

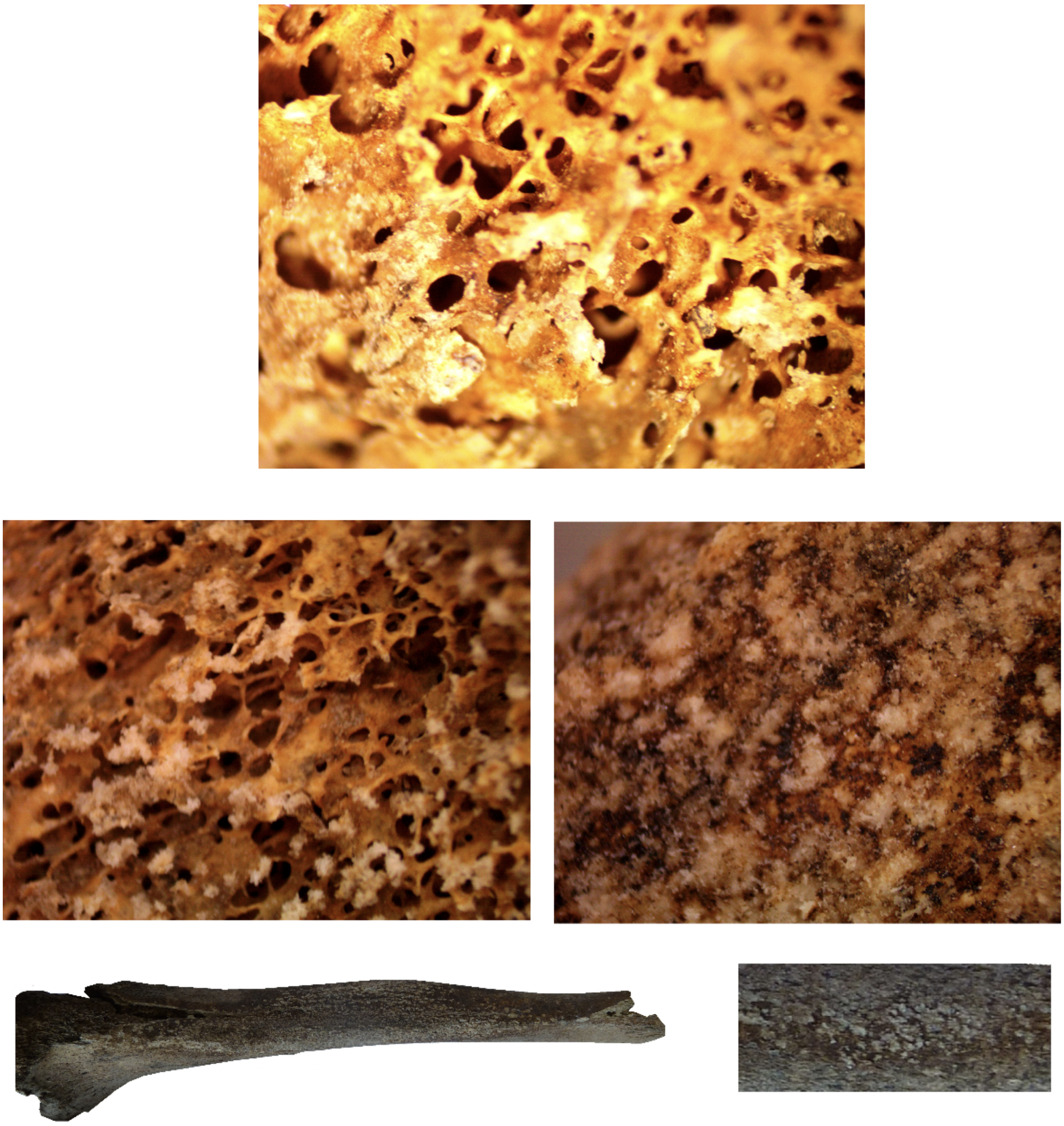

Figure 2: Crystalline structures observed on bones.

other contaminants, and post-fire exposure of the burned body to a smoky scene (Devlin & Herrmann, 2013; Symes et al., 2015). Fracturing, shrinkage, and warping accompany calcination (Schwark et al., 2011; Thompson, 2005). In temperatures under 700°C, there is little fragmentation except in the long bone epiphyses (Bohnert et al., 1998; Pope & Smith, 2004). Even though fire duration is important, greater bone fragmentation does not necessarily imply a longer duration of fire exposure. DeHaan (2012) experimented with a seven-hour fire and found that the head and upper limbs were left largely intact. Gonçalves et al. (2011) argued that warping would depend on bone collagen preservation, thus it would not be related to the presence of soft tissues.

Sex and age at death were estimated using standard anthropological methods. Sex was determined based on cranial and pelvic morphology (Buikstra & Ubelaker, 1994; Phenice, 1969). Age at death was determined based on the degree of obliteration of the cranial sutures (Buikstra & Ubelaker, 1994; Meindl & Lovejoy, 1985) and dental wear (AlQahtani et al., 2010; Cox & Mays, 2000). The stature was reconstructed on the basis of the long bones after K. Pearson & A. Lee (1903: Alekseev, 1966). To assess the development of the relief of the long bones, a three-point scale was used which included intermediate values of 1.5 and

2.5. The following indicators were calculated: 1. average scores for individual traits, 2. average score for the development of bone relief, 3. total average score (for the right and left bones) (Fedosova, 1986).

The temperature to which the bones had been exposed was estimated using a color scale developed experimentally by burning samples on experimental soil surfaces (Walker et al., 2008).

A scanning electron microscope was used for bone analysis at the Yerevan State University (N.A. Hovhanisyan). The scanning electron microscope has a higher resolution and a greater depth of focus than a conventional light microscope. In bioarchaeology, it is often used to understand the external morphology (texture) or surface topography of a specimen and to assess degradative change (Bell, 1990; Wilson et al., 2010).

3 Results

The state of preservation of the bones was mixed. Where the gypsum had remained relatively dry during burial, the bones of the skeleton were usually reasonably well preserved.

The discovered skeleton was incomplete (Figure 3). The skeletal preservation can probably be related to moisture ingress into the burial. Based on physical characteristics, the bones belong to a man aged 50-59 years. The skull is generally gracile, the brow ridges are moderately pronounced. The skull is oval in shape. It is characterized by a mesocranial type, with average transverse and longitudinal diameters (Figure 3-2, Appendix Table A1) (Alekseev & Debets, 1964). The skull has an average height, being hypsicranic according to the height-to-transverse ratio and orthocranic according to the height-to-longitudinal ratio. The diameter of the skull base is average, while the width is large. The occipital bone is of medium width, with a small occipital condyle and average circumference. The size of the parietal arc is large, and the chord diameter is within the average and large range. The mastoid process is moderately developed. The frontal bone is of medium width. The size of the frontal arc is average. The upper facial height and the length of the facial base are small.

First of all, we will point out the anomalies (non-metric traits variation of the skull) whose origin is not (or is weakly) related to diseases and physiological status of the individual, but is genetically determined. The following markers are included: *foramina infraorbitalia*, *processus temporalis ossis frontalis*, *foramina parietalia*, *os apicis lambda*, *os wormii suturae lambdoidea*, *torus occipitalis* (1.5), *foramina mastoidea*, *sutura palatina transversa* (Π*-shaped*), *canalis craniopharyngeus*, *processus paramastoideus* (Figure 3-3).

The upper right canine, first premolar, and molar were examined. The remaining teeth were lost. The odontometric measurements overall indicate that the crowns of the teeth are small. The mesiodistal dimensions of the first molar fall into the category of small to medium values (Zubov, 1968).

The strength indicator of the right humerus corresponds to the category of large values. An intercondylar foramen is observed on the right humerus. The right femur is classified as medium-long based on two length measurements, and the circumference of the mid-shaft is very large. A bony protuberance or plaque is noted on the neck of the femur at the site of *Poirier's facet*. Calculated based on the length of the femur and using the formula by K. Pearson & A. Lee, the individual's stature was 163.96 cm. Thus, the reconstructed height of the individual falls into the average category (Alekseev, 1966).

This individual was of robust build and physically trained. The radial tuberosities of the left radius are strongly developed, reflecting the corresponding development of the muscles that flex the shoulder and forearm. The right ulna shows good development of the distal lateral crest, to which the *pronator quadratus* muscle attaches. There is also good development of the lateral edge of the distal end of the radius, which is where this muscle also attaches.

Traces of significant functional loads on the ligaments of the pubic symphysis were found on the pelvic bones. Signs of enthesopathy have formed at the attachment sites of the superior and arcuate ligaments of the pubis. On the symphyseal surface of the pubic bone, there are pronounced areas of bone tissue lysis in the form of round holes with a diameter of 1–2 mm (Figure 3-11). Bone growths of irregular shape are also observed in the area of the upper edge of the acetabulum.

The greater sciatic tuberosity and the rough line of the femurs are very well developed, indicating significant loading on the muscles that flex, extend, adduct and abduct the thigh, as well as those that flex

Figure 3: Bones from the Cathedral of the Armenian Apostolic Orthodox Church: the preservation of the bones (1), nonmetric cranial signs (5), musculoskeletal stress (7-11), paleopathology (3, 4, 6, 12).

and extend the leg. The *linea aspera* on the femurs is also well developed (Figure 3-8), a structure formed under the influence of many years of horseback riding (Capasso et al., 1999). In addition, the individual exhibits inward-oriented, irregularly rounded osseous proliferations on fragments of the superior portion of the iliac wings. Enthesopathies of similar etiology are present within the pelvic cavity, at the superior margin of the sacroiliac joint surface. The pronounced development of muscular relief on the femurs, along with enthesopathies on the pelvic bones, indicates that the individual was likely a horse rider (Capasso et al., 1999; Khudaverdyan et al., 2016; *Pálfi*, 1992).

On the fragments of the tibiae, there is an enhancement of the *soleus* muscle line (Figure 3-9). The *m. soleus* is part of the *triceps surae*, primarily responsible for foot flexion and heel elevation. It does not significantly protrude above the level of the body but is quite long. The upper part of the individual's left tibia shows a well-developed tuberosity (*tuberositas tibiae*) at the site of attachment of the *quadriceps femoris* muscle (*m. quadriceps femoris*).

On the articular surfaces of the calcaneus, signs of enthesopathy are observed. Multiple exostoses are noted on the calcaneal tuberosity (apophysis). The powerful *Achilles tendon* of the *triceps surae* muscle attaches to this tuberosity. The presence of exostoses indicates strong mechanical loads. The muscular reaction on the phalanges is average.

Intensive loads on the musculoskeletal system are evidenced by degenerative changes observed in the vertebrae of the individual examined. Degenerative-dystrophic changes were found, including cartilaginous nodes (*Schmorl's nodes*) and osteophytes in the thoracic and lumbar vertebrae, as well as deforming spondylosis. Central positioning of the intervertebral hernias is noted. Cartilaginous hernias form under significant compressive loads on the spine, primarily during periods of growth (Angel, 1966; Bridges, 1991). The pattern of spinal lesions, which are mostly localized in the thoracic and lumbar regions, along with the characteristics of muscle relief development, indicates the impact of mechanical stress, most likely associated with horseback riding (Tsirikos et al., 2001). The rider's posture causes the muscles in the back to contract to balance the spine and to prevent injury, which leads to large compressive forces being produced resulting in greater pressure placed on the intravertebral discs and facet joints (Nicol et al., 2014).

Porotic hyperostosis of the inner area of the orbit (*cribra orbitalia*) is expressed weakly (score 1). This characteristic forms in childhood and is most often associated with iron deficiency anemia, which develops in the chronic course of infectious and parasitic diseases (Stuart-Macadam, 1992). Weakly expressed signs of *cribra orbitalia* are not always manifestations of an adaptive response to anaemia, but can occur in the presence of localized inflammatory processes (Wapler et al., 2004).

Among dental pathologies, mineralized deposits of a light gray color are observed on the upper canine and premolar. Mineralized deposits can be observed on both the buccal (cheek) and lingual (tongue) sides. In addition to the content of trace elements in food and individual differences in tooth structure, the occurrence of this pathology is influenced by high-protein (meat) diets, which promote the mineralization of plaque by raising the pH of saliva (Forshaw, 2014). The individual had lost most of his teeth ante-mortem, and there was horizontal bone loss relative to the cementoenamel junction and vertical bone loss around an individual tooth (periodontal disease).

Salt crystals have been observed on bones (Figure 2). Salt crystals with a lumpy, uneven appearance are visible as a white growth on the surface of a lower limb bone. They are different from the white crystals on the surface bones. So, the white crystals on the surface bones are the consequence of a taphonomic event and are not due to a pathological condition.

The bones exhibit minor straight transverse cracking, deformation, and charring. The color observed in the burned bone ranges from bluish hue (which occurs when calcined bone gets wet) to black. At 500–800°C, organic components decompose and this results in color change, weight loss, reduction in mechanical strength, and changes in porosity. Since naturally occurring carbon is black in color, carbonized bone is also black (Symes et al., 2015). Black color results from the combustion of the organic components of collagen and carbon, while gray and white colors are the outcome of continued combustion that alters the crystalline structure (Devlin & Herrmann, 2013). The maximum combustion temperature reached up to 700 degrees. It is assumed that the individual may have perished in a fire or was deliberately subjected to burning. Our conjecture is that this was a holy martyr who was burned alive.

4 Discussion and Conclusions

The analysis of white residues from archaeological contexts demonstrates that such materials have been identified in many cultures across different time periods. The crystalline structures may be a form of calcium oxalate (CaC_2O_4). Calcium oxalates are common in nature. *Whewellite* and *weddellite*, the sedimentary mono- and dihydrates of calcium oxalate respectively, are minerals reported to be present in soils and sediments (Del Monte et al., 1987). Calcium oxalates occur widely in nature and can result from microbial activity. Watchman et al. (2005) report that oxalic acid is produced by bacteria and fungi in moist, shaded micro-environments. According to Del Monte et al. (1987), *weddellite* and *whewellite* are readily formed in natural systems. According to the researchers, the secretion of oxalic acid from any microorganism interacts with the calcium carbonate present virtually everywhere, forming calcium oxalate monohydrate and dihydrate.

The remains from Etchmiadzin Cathedral were covered in white powder and were in a warm, humid environment. These conditions favour the formation of calcium oxalate. In Neolithic burials in the North area of *Çatal-höyük* (central Turkey), a white crystalline substance has frequently been observed on and in the bones. These deposits, generally referred to as 'salts' by the excavation team, have also been interpreted as possible adipocere (Knüsel et al., 2012). Instances of lime burials have been identified in the Jiroft culture in southeastern Iran dated to around the late 3rd millennium BC, where people of high status were buried under a hard layer of lime (Circle of Ancient Iranian Studies, 2007).

In the 5th century BC Herodotus describes a custom of the Ethiopians. "When the dead body has been dried, either in the Egyptian, or in some other manner, they cover the whole with gypsum, and adorn it with painting until it is as like the living man as possible. Then they place the body in a crystal pillar which has been hollowed out. ... It neither gives out any unpleasant odour, nor is it in any respect unseemly" (Herodotus, 2009, p. 117). This quote by Herodotus is significant through times. It shows that in the 5th century BC people already believed that lime or gypsum had an effect on the smell.

The Romans used lime for many purposes. In the 1st century AD Pliny the Elder describes lime in detail in his "Chapters on Chemical Subjects". In chapter XVII, Pliny describes the corrosive properties of lime and the effect of lime on dead bodies and grave goods: "It is known that bodies of the dead which are buried in coffins of this material consume away within forty days, with the sole exception of the teeth. We know further that mirrors, body-scrapers, clothes and shoes, buried with the dead become petrified. ... If fastened to the bodies, even of living men, it consumes the flesh." (Bailey, 1932, p. 117, 252)

In North Africa, plaster burials emerged between the 3rd and the 1st centuries BC and became recurrent features in Christian cemeteries of the 3rd and 4th centuries AD. There are examples of Christian cemeteries in Algeria and central Tunisia (*Tipasa*, *Timgad*) where stone coffins contained bodies, wrapped in a shroud, covered in plaster and enclosed in a wooden or lead inner coffin (Aufderheide, 2003; Sparey-Green, 1977).

In the early 4th century BC the rite became fashionable and plaster burials became a widespread practice in Italy, France, Germany and Britain (Sparey-Green, 1977). In Rome several lime burials were discovered in the catacombs of Saint *Pierre-et Marcellin* dated between the end of the 1st and the beginning of the 3rd century AD (Blanchard et al., 2007; Devièse et al., 2010). Other plaster burials were discovered in the Catacombs of *Priscilla*, founded in the 2nd century AD (Sparey-Green, 1977).

In France, at *Les Bolards*, 120 Roman chalk burials were discovered which appeared to be from young people (Planson, 1982, p. 170-173). Lime and plaster burials were revealed at cemeteries in the cities of Trier and Bonn in the Rhineland with most plaster bodies wrapped in a shroud, covered with plaster and buried in sarcophagus coffins (Reifarth, 2011a,b; Sparey-Green, 1977; Teegen & Reifarth, 2008). Remarkable is that the examination of the skeletal remains of St. *Maximin*'s plaster burials in Trier revealed an unusually high percentage of deceased racially not native to western Europe (Ramm, 1971; Sparey-Green, 1977).

In Britain, Late Roman and Early Christian plaster burials were recorded at more than 55 sites (Philpott, 1991, p. 90-96). Gypsum burials represent a high status rite in late Roman Britain, based on the association of gypsum burials with stone, lead or lead-lined wooden coffins, the richer grave goods within the coffins and, in some cases, the application of resins and balms to the gypsum-wrapped bodies (Philpott, 1991; Barber & Bowsher, 2000; Davies et al., 2002; Devièse et al., 2010; Reifarth, 2011b). At the eastern cemetery of Roman London, 81 (12.4 %) of the inhumation burials contained a white substance around the body. A representative sample of the white material from five burials in five plots was examined by the Ancient Monuments Laboratory with XRD and SEM and characterised as chalk. These burials had a slightly higher frequency of burial goods (Barber & Bowsher, 2000). Twelve plaster-packed lead or stone coffins were found in a cemetery in *Old Ford* on Colchester Road, east of the city (Sparey-Green, 1977). Another plaster burial was found in a Roman sarcophagus in *Westminster Abbey* (Stanley, 1870; Sparey-Green, 1977). Several Roman "white powder burials", were encountered during excavations at *Poundbury* and at

Alington Avenue to the West and the East of the city of *Dorchester* (Davies et al., 2002; Molleson et al., 1986). An overview of plaster burials in Roman Britain is summarised by Philpott (1991).

In Portugal, 19th-century burials covered with plaster were discovered in *Igreja das Freiras* (Church of the Nuns) in *Lagos* during archaeological excavations. The white material was not analysed and the intentions of deposition were not clear (Mendes et al., 2009). White substances of Medieval and post-Medieval burials were recovered in *Mechelen* (Belgium) during excavations of the former cemetery of the Cathedral of St. *Rombouts* (van de Vijver, 2012).

Herodotus (2009) describes the preservative properties of plaster in the 5th century BC, and a few centuries later, in the 1st century AD, Pliny the Elder describes its corrosive properties and how it consumes the body (Bailey, 1932). Several authors (Barber & Bowsher, 2000; Devièse et al., 2010; Philpott, 1991; Sparey-Green, 1977; Yorke, 1995) interpret the use of plaster in burials as an attempt to preserve the body and slow down decay. Because the physical resurrection of the body was expected and hoped for, it has been suggested that there may have been a connection with Christianity. This belief was recognised as Christian by the middle of the 2nd century AD (Schotsmans et al., 2012).

It is known (Hempel, 2006; Morris, 1976) that cholera victims were buried in lime. E. Chadwick (1842, pp. 28, 95, 128, 138, 164, 156) described regulations regarding the depth of graves and the addition of lime to prevent miasma from escaping. He also explained how coffins could be made "impervious to the escape of all morbific matter by coating the interior with a cement composed of lime, sand and oil which soon sets and becomes almost as hard and resisting as stone" and that "newly slaked lime can be employed to absorb carbonic acid".

In Armenia, early Medieval burials were found in sarcophagi covered with white powder (Jamkochyan, 1976). The plaster burial in Cathedral of the Armenian Apostolic Orthodox Church may be due to local sources of chalk and lime (unfortunately, the white material was not analysed). The skeletal material from the 'plaster' burial was in a degraded condition. We link bone degradation to gypsum in combination with seepage of ground water into the coffin. Ground water can carry the salts into the pores of the bones during burial leaving them behind when the water evaporates. The force of growing crystals can break apart the surface of bones. These crystals exert immense pressure and may cause the surface layer to spall off.

The use of white powder may have had symbolic value. It could have been of use to the dead person on the journey, or its white colour could have been a symbol of purity for the Christians (Philpott, 1991; Devièse et al., 2010). An alternative interpretation of the purpose of using lime or plaster in burials is to hasten the decay of the soft tissues. Jewish authorities permitted calcium to be sprinkled over the body in order to stimulate decomposition (Philpott, 1991). This suggests that lime may have been used in the disposal and disinfection of bodies due to either natural decay or disease (Devièse et al., 2010; Philpott, 1991). To date, it is not clear whether this was a religious rite, a visual element, or a practical custom related to disinfection. Similarly, lime burials are documented in the post-Medieval period and linked to pauper graves and plague burials. Lime is also observed in clandestine burials (Bass & Jefferson, 2003; D'Errico et al., 2011; Hochrein, 2002; Jackson, 2002; Jackson & Jackson, 2008; Jones, 1987; Laudermilk, 1932). A number of those sarcophagi were packed with white residues (Reifarth, 2011b).

The persecution of Christians can be historically traced from the first century of the Christian era. Christian missionaries and converts to Christianity have both been targeted for persecution, sometimes to the point of being martyred for their faith, ever since the emergence of Christianity. The Church schisms of the Middle Ages often provoked serious conflicts between Christian denominations, including the persecution of one another for their beliefs. Death by burning is mentioned multiple times, but unlike the Middle Ages, which primarily preferred traditional burning at the stake (as also seen in Antiquity with figures like Saint *Trofim* of *Nicomedia* and Saint *Anastasia* the Deliverer), the early Christian hagiographies provide a wider variety of descriptions of execution methods. Martyrs could be roasted alive on an iron grate (with coals), their bodies pressed against it with pitchforks (as with Saint *Lawrence*). They could be thrown into a cauldron of boiling pitch, sulfur, and wax (as with Saints *Januarius* and *Faustinus*), or into a cauldron of boiling oil (as with Saint *Vitus*), or subjected to molten lead (as with Saints *Crispin* and *Crispinian*), among other methods (Saramago, 1999).

In Armenia also, there have been persecutions of Christians. The traditional date for Armenia's adoption of Christianity is considered to be 301 AD, during the first half of the reign of King Tiridates III the Great (287–330). A key role in the adoption of Christianity was played by Gregory the Illuminator, who became the first Catholicos of the Armenian Church (302-326). However, there were already Christian communities in Armenia before Christianity was adopted as the state religion, as evidenced by the mention in Eusebius's book of a letter from the Alexandrian bishop *Dionysius* (190–265) "regarding the repentance of the brethren in Armenia, where *Meruzan* was the bishop" (Eusebius HE, IX, 6.45.2).

The Patriarch of the Armenian Church in Constantinople, *Magakian* (*Ormanian*), points to persecutions during the reigns of the kings *Artashes* (early 2nd century), *Khosrov* (first half of the 3rd century), and Tiridates III (*Ormanyan*, 2006). There is also a tradition about the martyrdom of the Apostle *Thaddeus* during the reign of *Sanatruk* in the 1st century. Most of the martyrs who suffered in Armenia before 301 AD are recognized as universal Christian saints. As is known, during this time many who were unwaveringly devoted to the Christian faith were subjected to burning as the greatest punishment, including figures like *Athanagines*, *Theodorus* the General, and others (Avgerian, 1874, 1913; Gatrtchyan, 1852; Vardyan, 2005).

This burial in the Cathedral of the Armenian Apostolic Orthodox Church is the first burial with charred remains so far encountered in Armenia. Christianity emphasized abhorrence for cremation. Consequently, the remains could not have been exposed to fire (cremation) post-mortem. Only bodies of sinners and criminals were denied burial, deliberately cremated and scattered so that they would have no hope of resurrection (Sparey-Green, 1977). The remains in the Cathedral of the Armenian Apostolic Orthodox Church were interred with great honor.

The earliest evidence for the creation of relics from an individual is documented in 4th-century Passions, which are descriptions of a martyr's death. These describe how the remains of the martyred person were collected for reburial elsewhere in a shrine or tomb so that they may serve as a focal point for those wishing to celebrate their life and sacrifice, but also to serve as inspiration for Christians to commit to their beliefs in the face of adversity and persecution (Rollason, 1989, p. 5). This desire to create or sustain a reverence for a saintly individual appears to be the origin for the justification of moving physical or bodily remains from one location, to another more prominent position.

Bones intended to be translated and removed from the grave were believed to be of saintly people and therefore were regarded as holy artefacts. Consequently, coming into physical contact with the bones was a deeply meaningful and solemn act. Preparation of the soul in order to partake in the translations would have been essential. The first documented case of translation occurred in Italy between 351 and 354, with the translation of the bones of the martyr *Babylas* by the emperor *Gallus* (Rollason, 1989, p. 10). The veneration of a revered individual's grave has origins in Biblical passages where the graves of exceptionally holy people are recorded as being distinguished (Anonymous 1971: Book of Tobit 4, 18, Matthew 23, 29-31).

This is documented by Abbot *Wulfstan* of *Winchester*, in relation to the translation of the bones of St. *Swithun* in 971 (Keynes, 2007). *Wulfstan* describes in great detail the spiritual preparation required prior to the translation, not only for the individuals charged with the task of undertaking the physical movement of the saint's bones, but also for all members of the associated ecclesiastical community. The monks who were chosen to translate the remains of *Thomas Becket* at *Canterbury* in 1173 were selected due to their holy and untainted lives (Nilson, 1998, p. 14, 27). These monks then handed each bone removed from *Thomas*' grave to the archbishop, who himself placed them in a wooden box (Nilson, 1998, p. 29). The bones of King *Oswald* of *Northumbria* were translated from *Shropshire* to *Bardney* after his death in 642, where the bones were "placed in the church with fitting honours" (Colgrave & Mynors, 1969, p. 247). Bishop *Fursey*, who died in *Latiniacum*, France in 633, was also translated to a chapel within his church at *Péronne*, France "with all due honour" (Colgrave & Mynors, 1969, p. 277). St. *Alchmund* of *Hexham*, who died in 781, supposedly appeared in a vision to Bishop *Eadmond* between 1020 and 1041, requesting that his bones and those of Bishop *Acca* be translated "to a more honourable position within the Church" at *Hexham*, Northumberland (Battiscombe, 1959, p. 40). *Wilfrid* died in *Oundle* in 709 (Farmer, 2004, p. 180). When his body was translated to *Ripon* by a number of abbots, they chanted on the journey, and "The community came out with the holy relics to honour the cortège" (Farmer, 2004, p. 181). *Wilfrid* was subsequently "buried with all honour", or "with the honour befitting so great a bishop" (Farmer, 2004,

p. 181; Colgrave & Mynors, 1969, p. 517). When *Æthelthryth*'s body was translated in 660, the whole community of *Ely* was present. They are described as having stood around the grave as it was disinterred, chanting, "the brothers on one side and the sisters on the other" (Colgrave & Mynors, 1969, p. 395). This may be one form of "honours" or reverence which was bestowed on the deceased saints. Their resting place was dependent on their status as martyr, confessor or saint.

There is no actual evidence about how the remains ended up in the territory of the Cathedral of the Armenian Apostolic Orthodox Church. It is not impossible that the reburial of the remains in the tomb took place during the time of Gregory the Illuminator, under strict secrecy. Sacred relics have received special reverence in the regulations of the Armenian Church. Churches were later built on relic-bearing sites (Buzand, 1914).

The role of relics of saints in Medieval religion is essentially the only post-depositional practice that has been extensively investigated to date. The ideological importance of relics to Medieval lay and ecclesiastical society and their religious significance has been established (Cosgrave & Mynors, 1969; Crook, 2011; Neale & Webb, 1843; Nilson, 1998; Rollason, 1989).

Translations and elevations were the deliberate and intentional removal of a person's remains from their grave, in order to relocate those bones or preserved body to a church's interior, where they could be revered more appropriately in a sanctified location, as relics. This act represented the canonisation of the individual, which was the official recognition of that person being of saintly status. This act of disinterring a grave signifies the first incidence of structured post-depositional disturbance in relation to Christian practices. The act was an exclusive one; to be disinterred was a privilege reserved for only the most esteemed and worthy members of society. The miracles attributed to their skeletal material or preserved bodies were proof of a holy presence within the remains. The worship of these people, centuries after their death, combined with the continuous miraculous occurrences attributed to them, effectively made these people immortal.

This paper presents an analytical approach for the holistic investigation of white materials, salt crystals and fire exposure on human remains encountered in a burial context. Further genetic analyses will determine whose remains are located at the wall of the Cathedral of the Armenian Apostolic Orthodox Church.

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References

Alekseev, V. P. (1966). *Osteometriya: Metodika antropologicheskikh issledovaniy [Osteometry: Anthropological research methodology]*. Moscow: Nauka. (in Russian)

Alekseev, V. P., & Debets, G. F. (1964). *Kraniometriya: Metodika antropologicheskikh issledovaniy [Craniometry: Methods of Anthropological Researches]*. Moscow: Nauka. (in Russian)

AlQahtani, S. J., Hector, M. P., & Liversidge, H. M. (2010). Brief communication: The London Atlas of Human Tooth Development and Eruption. *American Journal of Physical Anthropology*, *142*(3), 481–490.

Angel, J. L. (1966). Early skeletons from Tranquility, California. *Smithsonian Contributions to Anthropology*, *2*, 1–19.

Aufderheide, A. C. (2003). *The Scientific Study of Mummies*. Cambridge: Cambridge University Press.

Avgerian, M. (1874, 1913). *Vark ev vkayabanutiun Srboc [Conduct and Testimony of the Saints]*. Venice: Holy Venice, Book D. (in Armenian)

Bailey, K. C. (1932). *The Elder Pliny's Chapters on Chemical Subjects, part II*. London: Arnold & Co.

Barber, B., & Bowsher, D. (2000). *The Eastern Cemetery of Roman London: Excavation 1983–1990* (No. 4). London: Museum of London Archaeology Service.

Bass, W. M., & Jefferson, J. (2003). *Death's Acre*. New York: Putnam.

Battiscombe, C. F. (1959). *The Relics of Saint Cuthbert*. Oxford: Oxford University Press.

Bell, L. S. (1990). Paleopathology and diagenesis: An SEM evaluation of structural changes using backscattered electron imaging. *Journal of Archaeological Science*, *17*, 85–102.

Bellomo, R. V. (1993). A methodological approach for identifying archaeological evidence of fire resulting from human activities. *Journal of Archaeological Science*, *20*, 525–553.

Bellomo, R. V., & Harris, J. W. K. (1990). Preliminary reports of actualistic studies of fire within Virunga National Park, Zaïre: Toward an understanding of archaeological occurrence. In N. T. Boaz (Ed.), *Evolution of Environments and Hominidae in the African Western Rift Valley* (pp. 317–338). Martinsville, VA: Virginia Museum of Natural History.

Bennett, J. L. (1999). Thermal alteration of buried bone. *Journal of Archaeological Science*, *26*, 1–8.

Blanchard, P., Castex, D., Coquerelle, M., Giuliani, R., & Ricciardi, M. (2007). A mass grave from the catacomb of Saint Peter and Marcellinus in Rome, second-third century AD. *Antiquity*, *81*, 989–998.

Bohnert, M., Rost, T., & Pollak, S. (1998). The degree of destruction of human bodies in relation to the duration of the fire. *Forensic Science International*, *95*, 11–21.

Bridges, P. S. (1991). Degenerative joint disease in hunter-gatherers and agriculturists from the Southeastern United States. *American Journal of Physical Anthropology*, *85*, 379–392.

Buikstra, J. E., & Ubelaker, D. H. (1994). *Standards for data collection from human skeletal remains: Proceedings of a seminar at the field museum of natural history*. Fayetteville, AR.

Buzand, P. (1914). *Hayots' patmut'yun [History of Armenia]*. Venice. (in Armenian)

Cain, C. R. (2005). Using burned animal bone to look at Middle Stone Age occupation and behavior. *Journal of Archaeological Science*, *32*, 873–884.

Capasso, L., Kennedy, K., & Wilczak, C. (1999). *Atlas of Occupational Markers on Human Remains*. Teramo.

Chadwick, E. (1842). *Report on the Sanitary Condition of the Labouring Population of Great Britain*. Edinburgh: Edinburgh University Press.

Circle of Ancient Iranian Studies. (2007). *Evidence of lime burial discovered in Jiroft.* http://www.cais-soas.com/News/2007/March2007/08-03-evidence.htm. London.

Colgrave, B., & Mynors, R. A. B. (Eds.). (1969). *Bede's Ecclesiastical History of the English People*. Oxford: Clarendon Press.

Costamagno, S., & Fano Martínez, M. A. (2005). Pratiques cynégétiques et exploitation des ressources animales dans les niveaux du Magdalénien supérieur-final de El Horno (Ramales, Cantabrie, Espagne). *Paleo*, *17*, 31–56.

Cox, M., & Mays, S. (Eds.). (2000). *Human Osteology in Archaeology and Forensic Science*. Cambridge: Cambridge University Press.

Crook, J. (2011). *English Medieval Shrines*. Woodbridge: Boydell Press.

Cüppers, H. (1973). Kindergräber aus St. Matthias. *Kurtriersches Jahrbuch*, *13*, 178–182.

David, B. (1990). How was this bone burnt? In S. Solomon, I. Davidson, & B. Watson (Eds.), *Problem Solving in Taphonomy* (pp. 65–79). Tempus.

Davies, S. M., Bellamy, P. S., Heaton, M. J., & Woodward, P. J. (2002). *Excavations at Alington Avenue, Fordington, Dorchester, Dorset 1984–1987* (No. 15). Dorset: Dorset Natural History and Archaeological Society.

DeHaan, J. D. (2006). Fire-Related Deaths and Injuries. In Kirk (Ed.), *Fire Investigation* (6th ed.). Prentice Hall.

DeHaan, J. D. (2008). Fire and bodies. In C. W. Schmidt & S. A. Symes (Eds.), *The Analysis of Burned Human Remains* (pp. 1–13). Academic Press.

DeHaan, J. D. (2012). Sustained combustion of bodies: Some observations. *Journal of Forensic Sciences*, *57*, 1578–1584.

DeHaan, J. D., & Icove, D. J. (2012). *Kirk's Fire Investigation* (7th ed.). Brady Publishing.

Del Monte, M., Sabbioni, C., & Zappia, G. (1987). The origin of calcium oxalates on monuments, historical buildings and natural outcrops. *Science of the Total Environment*, *67*, 17–39.

D'Errico, S., Turillazzi, E., Pomara, C., Fiore, C., Monciotti, F., & Fineschi, V. (2011). A novel macabre ritual of the Italian mafia ('Ndrangheta): Covering hands with gloves and burying the corpse with burnt lime after execution. *American Journal of Forensic Medicine and Pathology*, *32*(1), 44–46.

Devièse, T., Vanhove, C., Chapoulie, R., Blanchard, P., Colombini, M. P., Regert, M., & Castex, D. (2010). Détermination et fonction des substances organiques et des matières minérales exploitées dans les rites funéraires de la catacombe des Saints Pierre-et-Marcellin à Rome (I-III siècle). In I. Cartron, D. Castex, P. Georges, M. Vivas, & M. Charageat (Eds.), *De corps en corps. Traitement et devenir du cadavre* (pp. 115–139). Maison des Sciences de L'Homme d'Aquitaine.

Devlin, J. B., & Herrmann, N. P. (2013). Taphonomy of fire. In M. T. A. Tersigni-Tarrant & N. R. Shirley (Eds.), *Forensic Anthropology: An Introduction* (pp. 307–323). Boca Raton: CRC Press.

Erdal, Y. S. (2015). Bone or flesh: Defleshing and post-depositional treatments at Körtik Tepe (southeastern Anatolia, PPNA period). *European Journal of Archaeology*, *18*(1), 4–32.

Farmer, D. H. (Ed.). (2004). *The Age of Bede*. London: Penguin.

Fedosova, V. N. (1986). General assessment of the development of the mesomorphic component based on osteological data: (osteological methodology). *Voprosi antropologii [Questions of anthropology]*, *76*, 105–116. (in Russian)

Fiedler, S., Buegger, F., Klaubert, B., Zipp, K., Dohrmann, R., Witteyer, M., ... Graw, M. (2009). Adipocere withstands 1600 years of fluctuating groundwater levels in soil. *Journal of Archaeological Science*, *36*, 1328–1333.

Forshaw, R. J. (2014). Dental indicators of ancient dietary patterns: Dental analysis in archaeology. *British Dental Journal*, *216*(9), 529–535.

Garland, A. N., & Janaway, R. C. (1989). The taphonomy of inhumation burials. In C. Roberts, F. Lee, & J. Bintliff (Eds.), *Burial Archaeology: Current Research, Methods and Developments* (pp. 15–38). Oxford: BAR.

Gatrtchyan, H. V. H. (1852). *Cosmic History from the Beginning of the World to Our Time [Tiyezerakan Patmut'iwn i iskzbane ashkharhi minch'ev ts'mer zhamanaks]* (Vol. 2). Vienna. (in Armenian)

Gifford-Gonzalez, D. (1989). Ethnographic analogues for interpreting modified bones: Some cases from East Africa. In R. Bonnichsen & M. Sorg (Eds.), *Bone Modification* (pp. 179–246). Orono, ME: Center for the Study of First Americans.

Gill-King, H. (1996). Chemical and ultrastructural aspects of decomposition. In W. D. Haglund & M. H. Sorg (Eds.), *Forensic Taphonomy: The Post-Mortem Fate of Human Remains* (pp. 93–108). Boca Raton: CRC Press.

Gonçalves, D., Thompson, T. J. U., & Cunha, E. (2011). Implications of heat-induced changes in bone on the interpretation of funerary behaviour and practice. *Journal of Archaeological Science*, *38*, 1308–1313.

Hakobyan, V. (Ed.). (1964). *Kanonagirq Hayots [Armenian Book of Canons]* (Vol. 1). Yerevan. (in Armenian)

Hempel, S. (2006). *The Medical Detective. John Snow, Cholera and the Mystery of the Broad Street Pump*. London: Granta Books.

Henderson, J. (1987). Factors determining the state of preservation of human remains. In A. Boddington, A. N. Garland, & R. C. Janaway (Eds.), *Death, Decay and Reconstruction* (pp. 43–54). Manchester: Manchester University Press.

Herodotus. (2009). *The Histories*. London: J.M. Dent.

Hochrein, M. J. (2002). An autopsy of the grave: Recognizing, collecting, and preserving forensic geotaphonomic evidence. In W. D. Haglund & M. H. Sorg (Eds.), *Advances in Forensic Taphonomy* (pp. 45–70). Boca Raton: CRC Press.

Icove, D., & DeHaan, J. (2004). Basic fire dynamics. In D. Icove & J. DeHaan (Eds.), *Forensic Fire Scene Reconstruction. An Engineering Approach* (pp. 36–68). Prentice Hall.

Jackson, A. R. W., & Jackson, J. M. (2008). *Forensic Science*. Essex: Pearson.

Jackson, S. (2002). *No Stone Unturned. The Story of Necrosearch International*. New York: Kensington.

Jamkochyan, A. (1976). Excavations of the early medieval burial ground of Jrvezh [Jrvedzi vakh miđnadaryan dambaranadashti pekhumner]. *Historical & Philosophical Journal*, *1*, 220–225. (in Armenian)

Janaway, R. C. (1996). The decay of buried human remains and their associated materials. In J. Hunter, C. Roberts, & A. Martin (Eds.), *Studies in Crime. An Introduction to Forensic Archaeology* (pp. 58–85). London: Routledge.

Jones, A. M. (1987). An unusual atypical gunshot wound. A coin as an intermediate target. *American Journal of Forensic Medicine and Pathology*, *8*(4), 338–341.

Keynes, S. (2007). An abbot, an archbishop, and the Viking raids of 1006–7 and 1009–12. *Anglo-Saxon England*, *36*, 151–220.

Khudaverdyan, A. Y., Khachatryan, H. H., & Eganyan, L. G. (2016). Multiple trauma in a horse rider from the Late Iron Age cemetery at Shirakavan, Armenia. *Bioarchaeology of the Near East*, *10*, 47–67.

Knüsel, C., Haddow, S. D., Sadvari, J. W., & Byrnes, J. (2012). Çatalhöyük human remains 2012. In B. Tung (Ed.), *Çatalhöyük 2012, Archive Report* (pp. 132–154). Turkey.

Laudermilk, J. D. (1932). Concerning quicklime burial. *American Journal of Police Science*, *3*(1), 59–63.

Mant, A. K. (1987). Knowledge acquired from post-war excavations. In A. Boddington, A. N. Garland, & R. C. Janaway (Eds.), *Death, Decay and Reconstruction* (pp. 65–80). Manchester: Manchester University Press.

Meindl, R. S., & Lovejoy, C. O. (1985). Ectocranial suture closure: A revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology*, *68*(1), 57–66.

Mendes, C., Neves, M. J., & Dias, G. (2009). Igreja das Freiras (Lagos): contributo da arqueologia acima e abaixo da cota zero para a historia da evolucao arquitectonica do edificio. In *Actas do 7° Encontro de Arqueologia do Algarve, XELB 10* (pp. 531–546).

Molleson, T. I., Eldridge, D., & Gale, N. (1986). Identification of lead sources by stable isotope ratios in bones and lead from Poundbury Camp, Dorset. *Oxford Journal of Archaeology*, *5*, 249–253.

Morris, R. J. (1976). *Cholera 1832*. London: Croom Helm.

Naphy, W., & Spicer, A. (2000). *Plague. Black Death and Pestilence in Europe*. Stroud: Tempus.

Neale, J. M., & Webb, B. (Eds.). (1843). *The Symbolism of Churches and Church Ornaments: A Translation of the First Book of the Rationale Dibinorum Officiorum Written by William Durandus, Sometime Bishop of Mende*. Leeds: T. W. Green.

Nicol, G., Arnold, G. P., Wang, W., & Abboud, R. J. (2014). Dynamic pressure effect on horse and horse rider during riding. *Sports Engineering*, *17*(3), 143–150.

Nilson, B. (1998). *Cathedral Shrines of Medieval England*. Woodbridge: Boydell Press.

Ormanyan, M. (2006). *Armyanskaya Tserkov. Istoria. Uchenie. Uklad. Vnutrenniy stroi. Nastoyaschee. Literatura. Liturgia [The Armenian Church: History, Teaching, Way, Internal Structure, Present, Literature, Liturgy]*. Moscow: Mediacrat. (in Russian)

Pálfi, G. (1992). Maladies, environnement et activités: traces sur l'os humain ancien. exemple de la série anthropologique de Solliès-Toucas (IIIe à IVe siècle A.D., Var, France). *Préhistoire Anthropologie Méditerranéenne*, *1*, 61–72.

Pearce, J., & Luff, R. (1994). The taphonomy of cooked bones. In R. Luff & P. Rowley-Conwy (Eds.), *Whither Environmental Archaeology?* (pp. 51–56). Oxford: Oxbow Monograph.

Phenice, T. W. (1969). A newly developed visual method of sexing the os pubis. *American Journal of Physical Anthropology*, *30*, 297–302.

Philpott, R. (1991). *Burial Practices in Roman Britain. A Survey of Grave Treatment and Furnishing AD 43–410* (No. 219). Oxford: Tempus Reparatum.

Planson, E. (1982). *La Nécropole Gallo-Romaine des Bolards*. Paris: Editions du Centre Nationale de la Recherche Scientifique.

Pope, E. J. (2023). Fire environments and characteristic burn patterns of human remains from four common types of fatal fire scenes. In S. Ellingham, J. Adserias-Garriga, S. C. Zapico, & D. H. Ubelaker (Eds.), *Burnt Human Remains: Recovery, Analysis and Interpretation* (pp. 13–36). John Wiley & Sons.

Pope, E. J., & Smith, C. (2004). Identification of traumatic injury in burned cranial bone: An experimental approach. *Journal of Forensic Sciences*, *49*, 431–440.

Ramm, H. (1971). The end of Roman York. In R. M. Butler (Ed.), *Soldier and Civilian in Roman Yorkshire* (pp. 179–199). Leicester University Press.

Reifarth, N. (2011a). *Spätantike Sarkophagbestattungen aus St. Maximin in Trier. Ergebnisse einer methodenkritischen Analyse archäologischer Befunde* (PhD thesis). Otto-Friedrich-Universität Bamberg.

Reifarth, N. (2011b). Textiles in their scientific context. Interdisciplinary cooperation during the evaluation of burial textiles. In C. Alfaro, J.-P. Brun, P. Borgard, & R. Pierobon Benoit (Eds.), *Purpureae Vestes III. Textiles y tintes en la ciudad antigua* (pp. 101–107). Valencia: Universitat de Valencia.

Rollason, D. (1989). *Saints and Relics in Anglo-Saxon England*. Oxford: Basil Blackwell.

Saramago, J. (1999a). *The Gospel According to Jesus*. Moscow: Vagrius. (Translated from Portuguese by A. Bogdanowski)

Saramago, J. (1999b). *The Gospel According to Jesus Christ*. London: Harvill Press.

Schmidt, C. W., & Symes, S. A. (2015). *The Analysis of Burned Human Remains* (2nd ed.). Amsterdam: Elsevier.

Schotsmans, E. M. J., Denton, J., Dekeirsschieter, J., Ivaneanu, T., Leentjes, S., Janaway, R., & Wilson, A. S. (2012). Effects of hydrated lime and quicklime on the decay of buried human remains using pig cadavers as human body analogues. *Forensic Science International*, *217*(1–3), 50–59.

Schotsmans, E. M. J., van de Vijver, K., Wilson, A. S., & Castex, D. (2015). Interpreting lime burials: A discussion in light of lime burials at St. Rombout's cemetery in Mechelen, Belgium (10th – 18th centuries). *Journal of Archaeological Science: Reports*, *3*, 464–479.

Schwark, T., Heinrich, A., Preuße-Prange, A., & von Wurmb-Schwark, N. (2011). Reliable genetic identification of burnt human remains. *Forensic Science International Genetics*, *5*, 393–399.

Sparey-Green, C. (1977). The significance of plaster burials for the recognition of Christian cemeteries. In *Council for British Archaeology Research Reports* (pp. 46–53). London.

Spennemann, D. H. R., & Colley, S. M. (1989). Fire in a pit: The effects of burning of faunal remains. *Archaeozoologia*, *3*, 51–64.

Stanley, A. R. (1870). Observations on the Roman sarcophagus lately discovered at Westminster. *Archaeological Journal*, *27*, 103–109.

Stiner, M. C., Kuhn, S. L., Weiner, S., & Bar-Yosef, O. (1995). Differential burning, recrystallization, and fragmentation of archaeological bones. *Journal of Archaeological Science*, *22*, 223–237.

Stuart-Macadam, P. (1992). Anemia in past human populations. In P. Stuart-Macadam & S. Kent (Eds.), *Diet, Demography and Disease. Changing Perspectives of Anemia* (pp. 151–170). New York.

Symes, S. A., Rainwater, C. W., Chapman, E. N., Gipson, D. R., & Piper, A. L. (2015). Patterned thermal destruction in a forensic setting. In C. W. Schmidt & S. A. Symes (Eds.), *The Analysis of Burned Human Remains* (2nd ed., pp. 17–59). Amsterdam: Elsevier.

Tchesnokov, Y. (1995). La culture traditionnelle des éleveurs de rennes du Nord-Est de la Sibérie: problèmes et perspectives de développement. In A.-V. Charrin, J.-M. Lacroix, & M. Therrien (Eds.), *Peuples des Grands Nords. Traditions et transitions* (pp. 305–314). Paris: Presses de la Sorbonne Nouvelle, Institut National des Langues et Civilisations Orientales.

Teegen, W.-R., & Reifarth, N. (2008). New ways in the documentation of human burials using 3D-laser scanning and digital microscopy: Two Late Roman sarcophagus burials from Trier – St. Maximin. *American Journal of Physical Anthropology*, *46*, 205.

Thompson, T. (2015). Fire and the body: Fire and the people. In T. Thompson (Ed.), *The Archaeology of Cremation: Burned Human Remains in Funerary Studies* (pp. 1–18). Oxford: Oxbow Books.

Thompson, T. J. U. (2005). Heat-induced dimensional changes in bone and their consequences for forensic anthropology. *Journal of Forensic Sciences*, *50*, 1008–1015.

Thompson, T. J. U., Gonçalves, D., Squires, K., & Ulguim, P. (2017). Thermal alteration to the body. In E. M. J. Schotsmans, N. Márquez-Grant, & S. L. Forbes (Eds.), *Taphonomy of Human Remains: Forensic Analysis of the Dead and the Depositional Environment* (pp. 318–334). Chichester: Wiley.

Tibbett, M., & Carter, D. O. (2008). *Soil Analysis in Forensic Taphonomy*. Boca Raton: CRC Press.

Tsirikos, A., Papagelopoulos, P. J., Giannakopoulos, P. N., Boscainos, P. J., Zoubos, A. B., Kasseta, M., ... Korres, D. S. (2001). Degenerative spondyloarthropathy of the cervical and lumbar spine in jockeys. *Orthopedics*, *24*(6), 24561–24564.

Van de Vijver, K. (2012). The uses of field anthropology on the excavation of the St-Rumbold cemetery, Mechelen, Belgium. In P. D. Mitchell & J. L. Buckberry (Eds.), *Proceedings of the Twelfth Annual Conference of the British Association for Biological Anthropology and Osteoarchaeology* (pp. 175–181). University of Cambridge.

Vardyan, V. M. (2005). *Hayots' yekeghets'in vagh mijnadaryan k'aghak'akan khach'ughinerum [The Armenian Church in the Early Medieval Political Crossroads]*. Vagharshapat: Mother See of Holy Etchmiadzin. (in Russian)

Vaté, V., & Beyries, S. (2007). Une ethnographie du feu chez les éleveurs de rennes du Nord-Est sibérien. In S. Beyries & V. Vaté (Eds.), *Les civilisations du renne d'hier et d'aujourd'hui. Approches ethnohistoriques, archéologiques et anthropologiques. XXVIIe rencontres internationales d'archéologie et d'histoire d'Antibes* (pp. 393–420). Antibes: APDCA-CNRS.

Walker, P. L., Miller, K. M. D., & Richman, R. (2008). Time, temperature and oxygen availability: An experimental study of the effects of environmental conditions on the color and organic content of cremated bone. In C. W. Schmidt & S. A. Symes (Eds.), *The Analysis of Burned Human Remains* (pp. 129–136). San Diego.

Wandsnider, L. (1997). The roasted and the boiled: Food composition and heat treatment with special emphasis on pit-hearth cooking. *Journal of Anthropological Archaeology*, *16*, 1–48.

Wapler, U., Crubézy, E., & Schultz, M. (2004). Is cribra orbitalia synonymous with anemia? Analysis and interpretation of cranial pathology in Sudan. *American Journal of Physical Anthropology*, *123*, 333–339.

Watchman, A., O'Connor, S., & Jones, R. (2005). Dating oxalate minerals 20–45 ka. *Journal of Archaeological Science*, *32*, 369–374.

Weiner, S. (2010). *Microarchaeology. Beyond the Visible Archaeological Record*. Cambridge: Cambridge University Press.

Wilson, A. S., Dodson, H. I., Janaway, R. C., Pollard, A. M., & Tobin, D. J. (2010). Evaluating histological methods for assessing hair fibre degradation. *Archaeometry*, *52*(3), 467–481.

Yorke, B. (1995). *Wessex in the Early Middle Ages*. Leicester: Continuum.

Zubov, A. A. (1968). *Nekotoryye dannyye odontologii k probleme evolyutsii cheloveka i yego ras [Some data of odontology to the problem of the evolution of man and his races]*. Moscow: Nauka. (in Russian)

Appendix

Table A1: Individual measurements and indices of skull.

No by Martin and others		
1	Longitudinal diameter	181
8	Transversal diameter	140?
8:1	Skull indicator	77.35
17	Height diameter from base	135
17:1	Height-longitudinal indicator	74.59
17:8	Height-transversal indicator	96.43
20	Height diameter from po	124
20:1	Height-longitudinal indicator	68.51
20:8	Height-transversal indicator	88.58
5	Height of the skull base	102
9	The least width of the forehead	-
10	Maximum width of the forehead	118
11	Width of the skull base	129
12	Width of the nape	107.5
7	Length of the foramen magnum	39.7
16	Width of the foramen magnum	30.2
40	Length of the base of the face	95
40:5	Indicator of the relief of the face	93.14
45	Skull diameter	-
48	Upper height of the face	67
60	Length of the alveolar arc	55
61	Width of the alveolar arc	62.9
60:61	Alveolar arc indicator	87.45
62	Length of the palate	-
63	Width of the palate	37.5
63:62	Palatial indicator	-
55	Height of the nose	56
54	Width of the nose	-
54:55	Nasal indicator	-
51	Width of the orbit from mf	-
51a	Width of the orbit from d	-
52	Height of the orbit	36
71a	Smallest width of the lower jaw branch	34.5
69	Height of symphysis	29?
69 (1)	Height of the body	26.3
69 (2)	Thickness of the body	12.8

Table A2: Nonmetric cranial signs.

<table>
<tr><th></th><th></th><th>Right</th><th>Left</th></tr>
<tr><td>1</td><td>Sutura frontalis</td><td colspan="2">–</td></tr>
<tr><td>2</td><td>Foramina supraorbitalia</td><td>–</td><td>–</td></tr>
<tr><td>3</td><td>Foramina frontalia</td><td>–</td><td>–</td></tr>
<tr><td>4</td><td>Spina trochlearis</td><td>–</td><td>–</td></tr>
<tr><td>5</td><td>Foramina infraorbitalia</td><td>+</td><td>X</td></tr>
<tr><td>6</td><td>Foramina zygomaticofacialia</td><td>–</td><td>X</td></tr>
<tr><td>7</td><td>Os zygomaticum bipartitum tripartitum</td><td>X</td><td>X</td></tr>
<tr><td>8</td><td>Spina processus frontalis ossis zugomatici</td><td>X</td><td>X</td></tr>
<tr><td>9</td><td>Stenocrotaphia</td><td>X</td><td>X</td></tr>
<tr><td>10</td><td>Processus frontalis squamae temporalis</td><td>X</td><td>X</td></tr>
<tr><td>11</td><td>Processus temporalis ossis frontalis</td><td>X</td><td>+</td></tr>
<tr><td>12</td><td>Os epiptericum</td><td>X</td><td>X</td></tr>
<tr><td>13</td><td>Os Wormii suturae squamosum</td><td>X</td><td>X</td></tr>
<tr><td>14</td><td>Os post squamosum</td><td>X</td><td>+</td></tr>
<tr><td>15</td><td>Os parietale bipartitum</td><td>–</td><td>–</td></tr>
<tr><td>16</td><td>Os Wormii suturae coronalis</td><td>–</td><td>–</td></tr>
<tr><td>17</td><td>Os bregmaticum</td><td colspan="2">–</td></tr>
<tr><td>18</td><td>Os Wormii suturae sagittalis</td><td colspan="2">–</td></tr>
<tr><td>19</td><td>Foramina parietalia</td><td>+</td><td>+</td></tr>
<tr><td>20</td><td>Os Incae completus</td><td colspan="2">–</td></tr>
<tr><td>21</td><td>Os triquetrum</td><td colspan="2">–</td></tr>
<tr><td>22</td><td>Os quadratum</td><td colspan="2">–</td></tr>
<tr><td>23</td><td>Os apices lambdae</td><td colspan="2">+</td></tr>
<tr><td>24</td><td>Os interparietales. sagittalis</td><td colspan="2">–</td></tr>
<tr><td>25</td><td>Processus interparietalis</td><td colspan="2">–</td></tr>
<tr><td>26</td><td>Os Wormii suturae lambdoidea</td><td>+</td><td>+</td></tr>
<tr><td>27</td><td>Sutura mendoza</td><td>–</td><td>–</td></tr>
<tr><td>28</td><td>Os asterion</td><td>–</td><td>–</td></tr>
<tr><td>29</td><td>Torus occipitalis (0-3)</td><td colspan="2">2</td></tr>
<tr><td>30</td><td>Os Wormiisut. occipitomastoideum</td><td>–</td><td>–</td></tr>
<tr><td rowspan="2">31</td><td>Foramina mastoidea on the seam</td><td>+</td><td>+</td></tr>
<tr><td>offseam</td><td>+</td><td>+</td></tr>
<tr><td>32</td><td>Torus palatinus (0-3)</td><td colspan="2">0</td></tr>
<tr><td>33</td><td>Sutura palatine transversa (seam shape) U-shaped</td><td colspan="2">+</td></tr>
<tr><td>34</td><td>Sutura incisiva</td><td colspan="2">–</td></tr>
<tr><td>35</td><td>Foramen pterygospinosum</td><td>–</td><td>–</td></tr>
<tr><td>36</td><td>Canalis craniopharyngeus</td><td colspan="2">+</td></tr>
<tr><td>37</td><td>Foramina spinosum</td><td>–</td><td>–</td></tr>
<tr><td>38</td><td>Condylus occipitalis bipartitum</td><td>X</td><td>–</td></tr>
<tr><td>39</td><td>Processus paramastoideus</td><td>–</td><td>+</td></tr>
<tr><td>40</td><td>Manifestatio vertebrae occipitalis</td><td>–</td><td>–</td></tr>
<tr><td>41</td><td>Tuberculum praecondylare</td><td colspan="2">X</td></tr>
<tr><td>42</td><td>Canalis condyloideus</td><td>–</td><td>–</td></tr>
</table>

Table A3: Dental features of individual from Cathedral of the Armenian Apostolic Orthodox Church.

	Upper jaw **Vestibular-lingual diameter** **VLcor**
	Right
C	8.5?
P1	8.8?
M1	9.9
	Mesio-distal diameter **MDcor**
C	5.8
P1	6.7
M1	9
	Height of the crown **H cor**
M1	5.8
	Mesio-distal diameter of the cervix **MDcol**
M1	7.2
	Area of the cervix **MD × VL**
M1	57.42
	Index of the cervix **Icor (VL / MD) × 100**
M1	170.69
	Module of the cervix **mcor MD + VL /2**
M1	15.7

Table A4: Postcranial measurements of skeleton.

	Right	Left
Humerus		
4. Maximal midshaft breadth	66	X
5. Largest diameter Ø of the middle diaphysis	23	X
6. Smallest Ø of the middle diaphysis	20	X
7. Minimal midshaft breadth	65	X
7a. Midshaft circumference	67	X
7:1 Robusticity index	X	X
6:5 Cross-section index	86.96	X
Ulna		
11. Sagittal diameter	14	14.1
12. Transverse diameter	17	16
13. Upper transverse diameter	19	19.2
14. Upper sagittal diameter	25.5	26
3. Minimal shaft circumference	X	X
3:2 Robusticity index	X	X
11:12 Cross-section index	82.4	88.2
13:14 Platyleny index	74.6	73.3
Femur		
1. Maximal length	440	X
2. Natural length	429	X
6. Sagittal diameter of midshaft	33	31.3
7. Transverse midshaft diameter	31.2	31
9. Upper transverse shaft diameter	34	X
10. Upper sagittal shaft diameter	25.8	X
8. Midshaft circumference	101.2	100
8:2 Robusticity index	23.6	X
6:7 Pilastry index	105.77	100.91
10:9 Platymery index	75.9	X
Tibia		
8. Sagittal diameter at midshaft level	36.5	X
8a. Sagittal diameter at the nutrient foramen level	37	X
9. Transverse diameter at midshaft level	26.8	X
9a. Transverse diameter at the nutrient foramen level	27.8	X
10. Midshaft circumference	107	X
10b. Minimal shaft circumference	86	X
9:8 Cross-section index	73.5	X
10b:1 Robusticity index	X	X
9a:8a Cross-section index	73.2	X
10:1 Robusticity index	X	X

Table A5: The recording system for musculoskeletal stress.

	Right	Left	Average
Humerus			
Crista tuberculi minoris, crista tuberculi majoris	X	X	X
Tuberositas deltoidea	X	1.5	X
Tuberculum majus, tuberculum minus	X	X	X
Margi lateralis, medialis et anterior Epicondili lateralis et medialis	1.5	1.5	1.5
Total	1.5	1.5	1.5
Radius			
Tuberositas radii	3	2.5	2.75
Margo unterossea	2	X	X
Sulcus musculi flexoris halluces	X	X	X
Processus styloideus	X	X	X
Total	2.5	2.5	2.5
Ulna			
Margo interossea, margo posterior	2	2	2
Crista musculi supinatoris	1.5	1.5	1.5
Tuberositas ulnae	2	2	2
Total	1.84	1.84	1.84
Femur			
Trochanter major	2.5	X	X
Trochanter minor	2	X	X
Tuberositas glutea	2.5	3	2.75
Linea aspera	3	3	3
Epicondili	2	X	X
Total	2.4	3	2.7
Tibia			
Tuberositas tibiae	2.5	X	X
Margo anterior, margo interossea	2.5	2	2.25
Linea m. solei, m. soleus	2	2	2
Sulcus musculi flexoris halluces	X	2	X
Total	2.34	2	2.17
Fibula			
Tuberositas tibiae	2	2	2