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Bioarcheology of bone remains from medieval burials from Armenia*

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Abstract

The aim of this article was to document the paleopathology of the individuals from the archeological sites of the Early Middle Age from burials from the Armenia (Lori and Syunik provinces). The examined groups consisted of osteological remains of 28 individuals (10 men, 5 women, 8 children and 5 adults of unknown). Standard bioarchaeological methods were used for sex and age-at-death determinations. The standard assessment program of skeletal pathological conditions, macroscopic and x-ray and histopathology methods were applied. Three cradle-deformed deformed skulls and artificial fronto-occipital deformation were identified. The analysed samples is characterised by the presence of pathological changes which are often associated with stressful episodes such as anaemia, inadequate nutrition, infectious diseases and the occurrence of parasites. Nine of the individuals in the samples presented with well-healed, healing or perimortem fractures. One case in particular showed signs of a traumatic death. The spread of signs of inflammatory processes in the adult and child population indicates the presence of a wide range of factors influencing the appearance of various infectious diseases of a non-specific nature, such as poor hygiene and population density (periostitis: № 1: 4-6 years, № 3: ♂ 40-49 years, № 4: ♂ 50-54 years, № 6: 5-6 years; leprosy: № 4: ♂ 50-54 years, dental abscess: № 5, ♂ 50-59). Probably meat was the basis of the diet of the medieval population of Armenia. Although the sample size was small in the case of 4 sites, bioarchaeological data from the studied historical population of Lori and Syunik provinces are useful in understanding the lifeways of the ancient Armenian population.

Keywords: Armenia; Early Middle Ages; paleopathology; occipital superstructure; artificial cranial modification

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Introduction

Human skeletal remains offer an important source of information for the study of past peoples. Specifically, paleopathological research contributes directly to our understanding of cultural lifeways, biological history, and the interaction between culture and biology in ancient populations (1-6). In the past, human remains were not treated as the precious repositories of information we now know them to be. Human bone from archaeological sites were often ignored, poorly collected. Paleopathology, or the study of how diseases affected past populations (7), is dedicated to understanding the ancient evolutionary relationship between Homo sapiens and disease (4). Physiological disruption resulting from poor environmental circumstances is paramount to the study of health and the adaptive success of past human populations. In paleopathology, adaptation is thought of as a process of adjustment to environmental constraints (2). The most prominent obstacle to human adaptation is stress. Stress can be defined as a biobehavioural response to environmental conditions (2). An ultimate goal of paleopathology is to understand how past human cultures may have caused or responded to stress (2). Stress is the result of three sets of factors: 1. environmental constraints, which are expressed in terms of limited resources or stressors; 2. culture and cultural systems, which may buffer or amplify the effects of stress; 3. host resistance which will affect stress (this host resistance varies by age, sex, and genetic factors) (8). The specific life events that leave trace in bones and teeth of an individual, whether ancient or modem. These events, including trauma and disease, can provide valuable information about the health of past peoples and populations (2; 3). The aim of this work is the descriptions of specific lesions that were observed in skeletal samples from Armenia.

The present paper discusses human remains uncovered from 4 archaeological sites (Lori and Syunik provinces) in Armenia (Figure 1, Table 1). The study was conducted on 28 human skeletons excavated between 2006-2018 with two main intents: first, to provide detailed descriptions of the lesions, and second, to stimulate new thought and perspectives on the epidemiology, history, and geographic distribution of infectious, tumorous and diseases on the Armenian Highlands. In addition, this contribution improved our understanding of disease in populations.

Materials and methods

At this point, several burials of the Early Middle Ages, memorial complexes have been discovered. Material for radiocarbon analysis was collected, which will make it possible to obtain the most accurate dating system in the future. The present paper discusses human remains uncovered at Angeghakot, Bagheri chala I, Pidjut I and Dzori gekh burial grounds. A total of 28 burials were recovered from Lori and Syunik provinces Armenia (Figure 1, Table 1).

In August of 2018 a collective burial was discovered at an altitude of 1 800 m in the district of Angeghakot in the valley of the Vorotan. Angeghakot is a village and rural community (municipality) in the Syunik Province of Armenia. On the territory of Angehakot there are dolmens dating from the Neolithic and Bronze Ages, burial grounds of the Achaemenid period. In the northern part of the village is the "Khachkar Garden" (khachkar: "cross-stone"), which is a monument built to perpetuate the glorious victories of Armenian weapons from khachkar. About Angehakot there is information from Strabo, Pavstos Busand, Movses Khorenatsi and later historians (G. Alishan, S. Orbelyan, M. Chamchyants, E. Lalayan, etc.). In this village there is a half-destroyed Surb Vardan church cut down in a rock, on the territory of which, according to legend, the body of Vardan Mamikonyan brought here by Vasak Suni (Prince Syunik) was buried and an 8-meter monument to the great Armenian commander was erected (Figure 2). Excavation at the Angeghakot site was conducted archaeologist by Tigran Aleksanyan. The burial was dated from the Early Middle Age (400-600 CE) and contained secondary burials.

Archaeological excavations were done near the villages of Shnogh and Teghut, Lori province. The large area of between villages Shnogh and Tekhut wasdivided into 8 archaeological zones. Due to goodclimatic and geographic conditions, the basin of the Shnogh river, where the Dukanadzor mining district issituated, had been inhabited since the Stone Age. Onthe area of nearly 1500 ha there are tens of settlementsand cemeteries dealing especially with the period fromthe Bronze Age to medieval times. The present paper discusses human remains uncovered at Bagheri chala I, Pidjut I and Dzori gekh. Only burials dated to the Early Middle Age are included in thisanalysis. All analysed individuals were laid down on his back.

A sample of 8 from human skeletons from the site at Bagheri chala I housed at the Institute of

Archaeology and Ethnography of NAN RA, was analysed (excavated by the archaeological expedition of the Institute of Archaeology and Ethnography of NAN RA under the leadership of S. Hobosyan in 2006). The excavations of Dzori gekh cemetery brought to the discovery of 9 individuals (excavated by the archaeological expedition of the Institute of Archeology and Ethnography of NAN RA under the leadership of S. Hobosyan in 2014). The excavations of Pidjut cemetery brought to the discovery of 2 females skeletons (excavated by the archaeological expedition of the Institute of Archaeology and Ethnography of NANRA under the leadership of S. Hobosyan in 2010).

The skeletons were analysed in detail, assessing for preservation and completeness, aswell as estimating age-at-death and sex of the individual. Morphological featuresof the pelvis and cranium were used for the sex assessment (9, 10). A combination of pubic symphysis (11-13), auricular surface changes (14), degree of epiphyseal union (10, 15, 16), and cranialsuture closure (13) were used for adult age-at-death estimation. Non adult age at death was estimates through assessment of long bone length (17-19), dental formation and eruption (20-23), epiphyseal fusion (24), and the state of centers of ossification (24).

Documentation of pathological and other abnormal bony features was conducted utilizing a descriptive approach, guided by criteria outlined by Buikstra and Ubelaker (10), Goodman et al. (2, 8) and Ortner (5). Each bone was carefully examined for any evidence of abnormal bone destruction or formation. A hand lens (10-x power) was used when additional magnification was needed. Attributes such as the type of lesion, appearance and location of the affected area, evidence of remodeling/healing, presence and extent of porosity, etc., were noted, and drawings and measurements were taken as appropriate. Photographs were taken of all abnormal bony lesions.

Cranial abnormalities created in infancy as the result of cultural practices were documented following attachment 28 of Buikstra and Ubelaker (10, pp. 160–63). The custom of deliberate ring deformation of a head was known in the population of the Syunik province. Artificial cranial modification is performed during infancy or early childhood while the cranial bones remain malleable. Deformation of the occiput is directly dependent on the characteristics of the device cradle.

The location of fractures of the skeleton is recorded using description combined with measurements from anatomical landmarks. Are determined type following (25, pp. 141–144) eg transverse, oblique, spiral, comminuted, greenstick, compression, avulsion, and depression. Specified state of healing (healed, healing, unhealed), the size and type of bone forming the callus (woven, lamellar or mixed). Where the broken ends have not unified, whether the fracture was in the process of unification (healing) or had permanently failed to unite (healed) is noted. Non-union is divided into hypertrophic (some healing potential) or atrophic (diminished healing potential). The presence of evidence of infection on the fractured bone (or any closely associated bones) together with the proximity to the fracture site.

Dental analysis was guided by criteria outlined in Dental Anthropology (26) and Standards for Data Collection from Human Skeletal Remains (10). Teeth and associated alveolar bone were closely inspected for the presence of caries, enamel defects, calculus, chipping, periodontal disease, and periapical lesions. Calculus was recorded on an individual tooth level stating the location andseverity of the formation. The location was recorded as supra- or sub-gingival based on thelocation of the deposit (on the crown or the root) and on the characteristics of the calculus (26). Carious lesions were recorded on all observable permanent teeth. Care was exercised to avoidconfusing carious lesions with pulp exposure due to severe wear. Incisor, canine, and premolar dental wear was recorded using Smith's (27).

Periostitis is diagnosed where the bony changes overlie the original surface of the bone cortex, though in later stages this may appear as a generalised expansion of the shaft. Periostitis is used as a descriptive term for bony change diagnostic of inflammation of the periosteum, when this change forms part of the diagnostic criteria of a specific infectious or traumatic condition.

The early-medieval material had been analyzed for the presence of osseous changes caused by mastoiditis (28-29).

Diagnostic changes of leprosy are considered to be: bilateral and symmetrical resorption of the alveolar process of the maxillae; resorption of the anterior nasal spine (30, pp. 123–124); haematogenous osteomyelitis, with multiple osteolytic lesions (leprous osteomyelitis) (31, p. 2548); concentric remodelling of the bones of the extremities due to the absorption of cancellous bone resulting in a tapered appearance (31, p. 2550); volar grooves as the result of claw hand deformity (32). Also considered are: tarsal disintegration involving the fragmentation of the articular surfaces of the tibia, talus and calcaneus (31, 2550–2551); secondary infectious changes particularly in the extremities.

Enthesophytes are defined as small bony projections at the site of muscle attachment resulting from chronic or acute trauma or a variety of other pathological conditions. The location and distribution is recorded together with relation to any other pathological change identified on the skeleton.

Degenerative joint changes are recorded for each joint surface using a presence/absence system and catalogued by the severity of marginal osteophyte formation and pitting each on a three-point scale (slight, moderate or severe). Eburnation is considered a diagnostic requirement for osteoarthritis (33, pp. 13, 43, 99). Details of eburnation are also recorded: which part of the articular surface is affected; any grooving visible; and the degree of severity of such grooving. Sub-chondral cysting resulting from the breakdown of cartilage is indicated by the presence of micro and macro porosity. Osteophytes affecting the margins of vertebral bodies are recorded at the joint interface level following Brothwell (34) and scoring formation as intermittent, continuous or extensive. The recording of a Schmorl's node was based on the maximum dimension of depressed circular or linear lesions in the articular surfaces of the centra.

The bones were examined macroscopically, radiologically and through histological procedures.

Results

Of the 20 adults, 5 were females, 10 males and 5 of unknown. In these samples, 8 were under the age of 15 years (Table 1).

Paleopathology of the population from Angeghakot

As Table 1 shows, the total number of individuals found in the graves from Angekhakot is nine. The skeletons belong to 4 non-adult and 5 adults, the latter includes four males and one of unknown sex (Figure 1a).

Four individuals (No 2, No 4, No 5, No 6-1) displays porotic hyperostosis and two individuals (No1-2, No 2) display cribra orbitalia in the form of porosity on the superior wallof the orbit (Table 2). These pores range from slight to severe. Sign is often used as an indicatorof general stress (35, 36) and is frequently found associated withagricultural economies. Environmental stressors, such as parasites and disease, rather than specific dietary deficiencies, are more likelyto be responsible for the observed pathology.

Cranial deformation occurs when the human skull is intentionally deformed with different deforming devices applied to the head while it is developing. The Angekhakot population practiced fronto-occipital deformation (No 3, male 40-44 years, Figure 2a) and cradle deformation (No 4 и No 5: male 50-54 years, Figure 2b). Fronto-occipital deformation skull is characterized by an antero-posterior vault compression, resulting in the flattening of the frontal and occipital bones, alongside a lateral expansion of the head (37, 38). The cradle deformation is most cases characterized by the flattening of the squamous portion of the occipital and the area of the adjoining parietal in the region of the lambdoid suture. In 2 (No 4 и No 5: male 50-54 years) of the 4 crania possessing deformation being exerted solely on the posterior of the cranium. This cradle deformation was probably the unintentional flattening of the back of the skull as a result of cradle boarding of infants (38).

Several injuries were observed in the Angeghakot remains and resulted from both direct and indirect trauma (as defined by Lovell (25)). Three adult exhibit fractures (No 3, No 4, No 5). Adult male No 3 (male 40-44 years) has healed blunt force trauma, below the nasal bones, with maximum width of 2mm and 3mm in length. Also, this individual revealed two well-healed rib (right 8 and left 12 ribs) fractures. The individual No 4 (male, 50-54 years) exhibits a well healed traumatic injury of the nasal bone. Cranial trauma is thought to be more likely due to interpersonal violence than to accident. In addition, a adult male (No 4, 50-54 years) a shallow depression (14×9.8mm) on the right parietal bone, an anatomical position that more commonly results from violence rather than a fall. Skeletons 4 and 5 exhibited multiple bony projections, characterized by dense and rounded outgrowths on the external bone surface (Figure 3a,b). The tibiae lesions were moderate to severein in their size. These features are characteristic and compatible with the ones observed in enthesial lesions. This lesion is a result of probable disruption of the articular cartilage, consequent upon trauma. Proximal tibiofibular synostosis was present on the right side (No 5, male 50-54 years). These fractures were on the lower limbs and probably reflect male role behavior (e.g., agricultural activity, hunting, or violent sports contests).

On the right side of the ilium there is a high-density mass with clear boundaries, density shadows could be seen inside. According to these imaging findings, the individual No 5 was diagnosed with osteochondral exostosis (Figure 3e). On the seventh cervical vertebra, a trauma on the spinous process of the seventh cervical vertebra (individual No 5, Figure 3d) was noted. Most often, it occurs when a heavy object is struck directly on the neck (39). This individual also displayed a synostosis of manubrio-costal (sternocostal) joint (individual No 5, Figure 3e).

The examination of skeleton No 4 (male, 50-54 years) revealed bone alterations of both cranial and infra-cranial bones (40, 41). Rhinomaxillary changes are conspicuous and can be summarized as follows: 1) atrophy of the anterior nasal spine (Figure 4a); 2) evidence for destructive remodelling of the alveolar process of the anterior maxilla (Figure 4a, b); 3) irregular shape in the lingual edge of the alveoli of the anterior teeth (Figure 4a). The alveoli are slightly damaged, making it difficult to observe the extent of the lesions (Figure 4a). 4) Destructive and proliferative bony lesions were observed on the oral and nasal surfaces of the palatine process (Figure 4b). The edges of the hard palate have been resorbed and the area of reaction extends to the alveolar bone of the premaxilla and anterior maxilla. Porosity and a hole were observed around the palatine suture (Figure 4b). Atrophy of the nasal spine, and atrophy of the alveolar bone around the prosthion and inflammatory changes in the surface of the cortical bone on the anterior teeth were confirmed.

This individual also exhibited diffuse lesions on the skull, scapulae, humerii, ulnae, radii, pelvis, femora, tibia, foot. These observed lesions consist of a mix of lytic and blastic activities that were observed throughout the skeleton (Figures 4c,d,f). On the skull, periosteal lesions were seen on the frontal bone and mandible. On the former, a large lesion was located along the midline, and a smaller lesion, on the left portion of the squama close to the coronal suture and on the right side of the lower jaw. On the postcranial skeleton, visible lesions are concentrated in the upper and lower limbs. Skeleton also presented bone changes on the foot (Figure 4e). Exostosis at the medial and dorsal aspects of the head of the first metatarsal were discovered. Ankylosis between a middle and distal left phalanx was noticed. An additional incomplete left phalange presented diaphyseal concentric remodelling. On the tibiae are evidence of periostitis was noted.

Histopathological analysis reveals diffuse granulomatous inflammation (Figure 4g).

The maxillary right medial and lateral incisor, canine, second premolar, first, second and third molars, left lateral incisor, canine, first premolar, third molar, as well as the mandibular left medial and lateral incisor, second and third molars, and the second and third molars were examined. The individual No 4 had lost two teeth antemortem (M1 /mandibular, M3 /maxillary/). Different alterations that are present but believed to be unlinked to leprosy (such as dental hypoplasia, etc). A strong form of the linear enamel hypoplasia is localized on all the incisors, canines, premolars at approximately the same distance from the enamel-cementum junction. Periostitis was severe in the areas with first molar /right/, and there was mild periostitis in all other areas, which was almost the entire maxilla and mandible. Pathology also includes multiple abscesses and infection on the maxillae (the maxillary right P1, M1 (right), as well as the mandibular left medial and lateral incisor) (Table 2). He had caries on the upper left lateral incisor (maxillary) and second molars (right and left: mandibular).

Other inflammatory lesions are generalized and affect the shafts of long bones: these non-specific lesions indicate a chronic inflammation of the periosteum that affected one or more long bones in four individuals (No 3, No 4, No 5, No 6-2), predominantly on the tibiae and fibulae.

Joint disease is common in the remains from Angeghakot, a finding that no doubt is influenced by the small sample size of individuals and the number of middle and old-aged adults. Joint disease appears most often in the spine, where it affects both the synovial posterior facet joints and the non-synovial joints between vertebral bodies. Marginal lipping around vertebral bodies appears at consistent levels among the three vertebral segments: thoracic vertebral bodies, cervical vertebral bodies, and lumbar vertebral bodies were affected (4 individuals: No 3, No 4, No 5, No 6-1). The formation of marginal osteophytes in the Angeghakot vertebrae is usually accompanied by erosive lesions (pitting) on the superior and/or inferior surfaces of the vertebral bodies.

Schmorl's nodes can be seen as impressions in the superior and inferior surfaces of the vertebral bodies. They are common, particularly in the lower thoracic and lumbar region. There are many possible causes, including stress to the

lower spine (28). In the Angeghakot material 4 individuals (No 3, No 4, No 5, No 6-1) have Schmorl's nodes (Table 2).
In the teeth, dental calculus was mainly confined to the tooth crown and cemento-enamel junction. Dental calculus observed at two individuals (No 3, No 4). Two distinct types of bone loss from the alveolar process are recorded. The first type, referred to in this study as alveolar resorption (2 individuals: No 3, No 5), is related to the removal of alveolar bone due to inflammation of the supporting tissues of the teeth associated with periodontal disease (30). The second type of alveolar bone loss is concentrated around the apex of the tooth roots, originating from infections of pulp, so called periapical inflammation or dental abscess (3 individuals: No 3, No 4, No 5). Systemic stress indicators in the form of linear enamel hypoplasia in two individuals (No 1, No 4) they likely represent acute episodes of physiological stress caused by an acute illness and/or a protein-energy insufficiency.

Paleopathology of the population from Bagheri chala I burial ground

A total of 8 skeletons have been found at the burial site: two men (40-44 years), one female (20-24 years), three children (4-9 years), and two individual of unknown sex. The post-cranial skeletons in Bagheri chala I site not were collected (Figure 1b, Tables 1).
Porotic hyperostosis (individuals No 13-1, No 13-2, No 13-3, No 13-4, No 13-5, No 13-6) and cribra orbitalia (individuals No 13-1, No 13-2, No 13-3, No 13-4, No 13-6) (Figure 5a), which are commonly accepted as signs of anaemia, constitute the most commonly observed lesions encountered in the group. Slightly developed porotic hyperostosis and cribra orbitalia were observed in six (individuals No 13-1, No 13-2, No 13-3, No 13-4, No 13-5, No 13-6) and five out of nine individuals (No 13-1, No 13-2, No 13-3) who were examined for anaemia. We also found impressiones digitatae which represent the impression of thecerebral gyri on the inner surface of the cranial vault (Figure 5d). Five individual's (No 13-1, No 13-2, No 13-3, No 13-4, No 13-6) had thin-ning of the tabula interna (impressiones digitatae) of the frontal, parietal and temporal bones. These findings themselves arephysiological, but may also be a pathological sign indicating increased intracranialpressure when present in strong occurrence.
Three individuals displayed external auditory exostoses (individuals No 13-2, No 13-3, No 13-5).
Skeletons No 13-2 (female 20-24 years) and No 13-4 (male 40-44 years) present circular, superficial depressed fractures involving the right frontal boss (No 13-2: 22 × 18.5mm) and (No 13-2: 17 × 16mm). Neither of the lesions involves the inner table.
Three cases (children: No 13-1, No 13-3, No 13-6) of mastoiditis was found in the pathological material (Figure 5c). The infective process causes inflammation of the mastoid and surrounding tissues and led to the destruction of the mastoid processes. It is usually associated with chronic suppurative otitis media. Pitting was also observed on the external lamina surrounding the external auditory meatus, alongside blood vessel canals, suggesting intense vascularity.
Enamel hypoplasia was observed in 4 individuals (No 13-1, No 13-2, No 13-4, No 13-5). It is present on all the canines, incisors and premolars, less frequently on molars (1-3 lines in each tooth) (Table 2). Dental calculus affected 4 of the individuals (No 13-1, No 13-2, No 13-4, No 13-5) (Figure 5b). The molars were the most commonly affected teeth. All cases were slight in occurrence, and affected the mandibular teeth more often than the maxilla. Young adult female (No 13-2) suffered from a large abscess and caries.
Male individual (No 13-5, 40-44 years) display antemortem loos of 5 teeth (I1, P1, M1, M2, M3), among the 15 recovered teeth.

Paleopathology of the population from Pidjut I burial ground

Two female skeletons have been analysed from this site (20-24 years and 40-44 years) (Figure 1c).
One case of porotic hyperostosis (No 2, female 20-24 years) thought to represent an anemic condition. Incidences of enamel hypoplasias were present on one individual (No 1, female 40-44 years) (Table 2). Hypoplasia was found on the premolars (P1, P2) (1-2 lines in each tooth). The premolars and molars were the teeth most commonly affected by dental calculus (No 2, female 20-24 years).

Paleopathology of the population from Dzori geh burial ground

This intervention allowed the recovery of 8 individuals, 6 adults, 1 adolescent and 1 young adult (Table 1). Among the later, 4 men, 2 women, 2 of unknown sex are included. The only non- adult died during infant I stage. The age group between 17 and 44 years are the more representative among adults.

Cribra orbitalia was observed in the orbits of 3 male skeletons (burials 1, 2, 12). Porotic hyperostosis was observed on 5 individuals (burials 1, 2, 9, 10, 13). Lesions were confined to the parietals, the frontal, temporal bones and near the lambda region on the occipital. In the non-adult, the circumscribed thinning of the tabula interna (impressiones digitatae) of the frontal and parietal bones was detected (burial 9: 0.5-1.1 years).

The Dzori geh population practiced cradle deformation (No 1: male 50-54 years). The articular facets of 3 individuals (burials 1, 2, 9-2) revealed extensive changes to the joints with new bone formation and marginal lipping. Femora show arthritic changes at their distal ends, viz. marginal hypertrophy along the articular surfaces, especially the patellar, with changes to the femur being more pronounced. In 2 cases (burial 9-2, burial 12) the retromastoid processes is present (Figure 6b), in one (burial 10) - supramastoid tubercles (Figure 6a). These individuals with strongly expressed changes for at least one side are those associated with insertions of the infraspinatus, pectoralis major, and deltoideus, and origins of the hand extensors & supinators, lateral head of the triceps, and anconeus.

These individuals with strongly enthesopathic changes for at least one side are those associated with insertions of the infraspinatus, pectoralis major, and deltoideus, and origins of the hand extensors & supinators, lateral head of the triceps, and anconeus.

Traumatic lesions of the bony skeleton can be the result of many different factors, as the result of an accident (e.g., a fall), and/or a result of interpersonal violence. Injuries was observed of three male skeletons: two frontal bones had fractures (burial 2: ♂ 35-39 years), the left and right parietals (burial 1: ♂ 50-55 years, burial 12: ♂ 20-24 years) had two apiece. Male individual No 12 (20-24 years) had a healed fracture on the region of the temporal and parietal bones (dimensions 58 × 63 mm) that originated in a massive depression fracture (Figure 7b). This individual, in fact, had two separate injuries, one on each parietal (dimensions 22.5 × 19mm) and parietal-temporal bones (Figure 7a). The linear incisions (12.5mm, 10mm length) on the left femur found in two of the individuals (burial 1: 50-55 years, burial 3-2: 30-34 years), and one example (burial 1: 50-55 years) of depression fracture to the was observed on the left femur (defect length 29mm).

Multiple traumas in individual from burial 11 (female 40-44 years: Figure 8) were noted. The observed narrow, linear 'V'-shaped incision (on the right parietal bone, 7.5 mm) with even walls most closely resembles traumatic lesions (Figure 8a) created by a sharp knife or a hand axe: sword marks are wider, deeper, and associated with damage to the walls of the lesion, while the cross-sections of knife marks generally have smooth walls in a characteristic 'V' shape. There were no signs of healing, suggesting that the wound it occurred perimortem. This female also revealed a healed fracture of the 3th cervical vertebra (in the region of the superior articular surface) (Figure 8c). Injuries seen in this woman involved the 2 ribs (left 3 and 6, Figure 8d), and this could be due to a fall or severe coughing during a long period et al. (33).

At the female also a non-union fracture on the distal end of the right ulna were noted (Figure 8e). The degree of healing suggested that the fracture occurred long before death, and difficulty may have been encountered in treating the fracture. The inner radius area was flattening (Figure 8f). Probably flattening is a result of fracture ulna. The sternum was displaced on the left side (Figure 8b). This individuals' cervical vertebrae are slightly curved and its spinous processes are not in alignment. The lower thoracic vertebrae displayed spicules or exostoses on the posterior vertebral arch which may represent early osteoarthritic formations due to mechanical stressors. Both femora have an oval island of bone on the lateral condyle.

Degenerative joint diseases were identified in three individuals whose joints and vertebras were subjected to investigation (burials 1, 2, 9-2). The articular facets of 3 individuals revealed extensive changes to the joints with new bone formation and marginal lipping. Two individuals (burials 1, 2) exhibit benign neoplastic growths, in the form of small "button" osteomas, on the cranial vault. The sizes of the osteomas varied from 2mm to 7mm. Six individuals displayed extremal auditory exostoses. Two cases (burials 9, 13) of mastoiditis (bilateral) were found in the pathological material. The infective process causes inflammation of the mastoid and surrounding tissues and led to the destruction of the mastoid processes. It is usually associated with chronic suppurative otitis media.

Two individuals were observed to have dental enamel hypoplasia (burials 2, 3-2) (Table 2). The enamel hypoplasia line was found of the I1, I2, C, P1, P2 (1-2 lines in each tooth). Severe dental wear was at two individuals (burials 1, 11). Two individuals displayed a pathological of wear on second incisor canine. Other dentitions within the group displayed a generally flat, even rate of wear. The most heavily worn teeth were the first molars and the incisors. Calculus deposits were noted on 2 individuals (burials 3/2, 11). Dental caries was only observed in the mature adult individuals (1 ♂: burial 1, unknown sex: 9-2, 1♀: burial 11).

Table 1. Anthropological material from the territory of the Republic of Armenia

	Region, locality, series	Males	Females	Sex?	children	Total
1	Syunik Province: Angeghakot	4	-	1	4	9
2	Lori Province: Bagheri chala I	2	1	2	3	8
3	Lori Province: Dzori gekh	4	2	2	1	9
4	Lori Province: Pijut	-	2	-	-	2
Total		10	5	5	8	28

Table 2. Pathology from Angeghakot (affected/observed teeth)

	Cribra orbitalia	Porotic hyperostosis	Enamel hypoplasia	Caries	Dental calculus	Dental abscess	Deformation	Trauma	Osteophytes Schmorl's nodes	Periostitis	Mastoiditis
	Angeghakot										
No 1			+							+	
No 1-2	+										
No 2	+	+									
No 3				+	+	+	fronto-occipital	+	+	+	
No 4		+	+	+	+	+	cradle	+	+	+	
No 5		+		+		+	cradle	+	+	+	
No 6-1		+							+		
No 6-2											
No 6-3											
	Bagheri chala I										
No 13-1	+	+	+		+						+
No 13-2	+	+	+	+	+	+		+			
No 13-3	+	+									+
No 13-4	+	+	+		+			+			
No 13-5		+	+		+						
No 13-6	+	+									+
	Pidjut I										
No 1			+								
No 2		+			+						
	Dzori geh										
No 1	+	+		+			cradle	+	+	+	
No 2	+	+	+					+	+		
No 3-2			+		+			+			
No 9		+									+
No 9-2				+		+			+		
No 10		+									
No 11				+	+			+			
No 12	+							+			
No13		+									+

Discussion and conclusions

The examined groups from Lori and Syunik provinces Armenia consisted of osteological remains of 28 individuals, 20 adults (10 males, 5 females and 5 unknown sex) and 8 non-adults.

Artificial cranial modification is 'the product of the dynamic distortion of the normal vectors of infantile neurocranial growth through the agency of externally applied forces' (42). The restriction of cranial growth in certain directions results in compensatory growth in other less restricted or unrestricted directions (7) and thus alteration of cranial shape. To produce permanent effects, artificial cranial modification must be performed during infancy when the cranial bones are malleable and when the trajectory of growth can be controlled (43, 44). In anatomical terms, the cranial deformation types include those described by O'Loughlin (45), such as occipital deformation, lambdoid deformation, fronto-vertico-occipital, parallel fronto-occipital, and annular deformation. In medieval populations of Armenia two types of artificial deformation are represented: annular frontal-occipital (one individual) which comes near to the cone by form and cradle modification (three individuals). In the case of the first type, the frontal bone is inclined from the backside and stretched upwards, occipital bone is flattened and stretched upwards, and parietal bones are convex in the area of the sagittal suture. The individuals from Hovhannavank (No 1, No 2, No 3, No 4, No 5) also had artificially deformed heads (46). The means (bandages, gauzes, kerchiefs, and ets.)

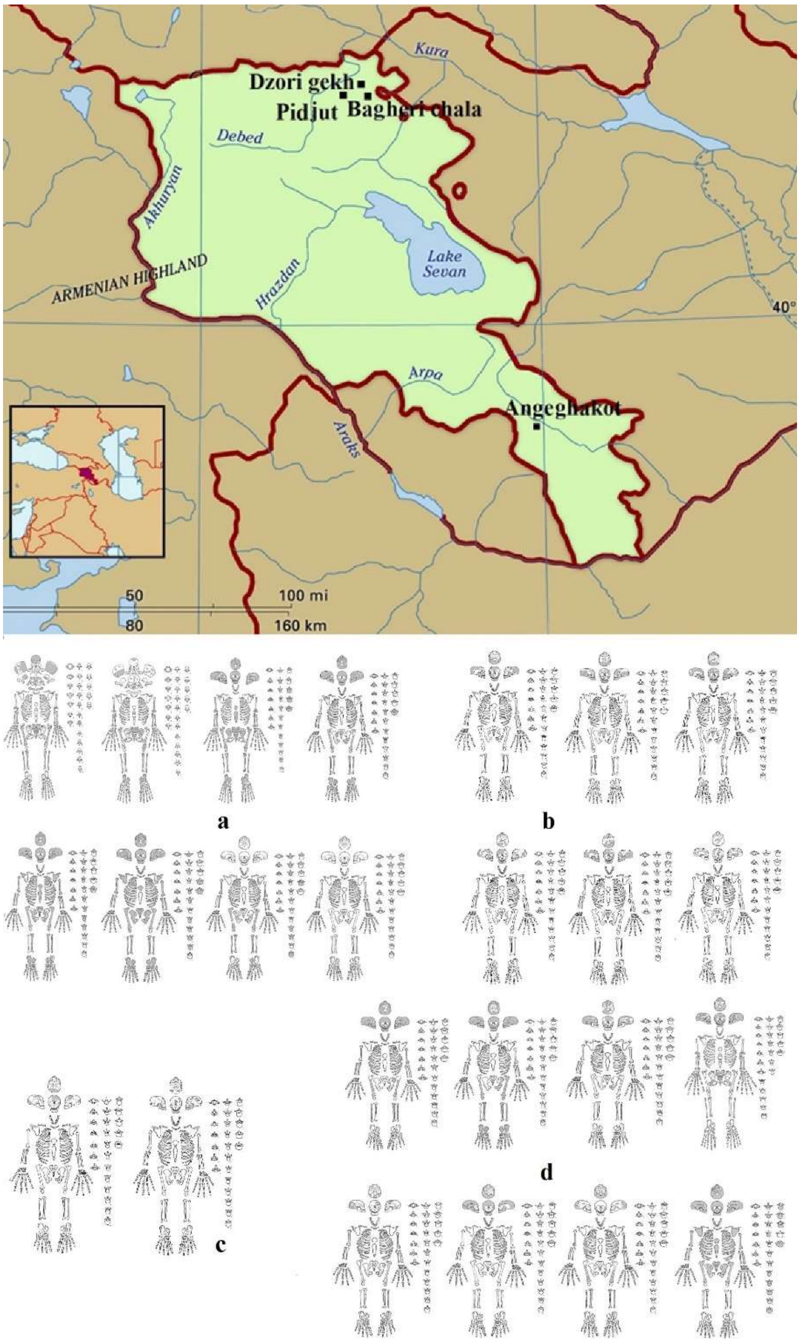

Figure 1. Location of the burial grounds on the map of Armenia, preservation of anthropological materials; a. preservation of anthropological material I from Angeghakot (4 men, 4 children); b. Bagheri chala I burial ground (2 men, 1 women and 3 children); c. Pidjut I burial ground (2 women); d. Dzori gekh burial ground (5 men, 2 women). Lori (40°55′N 44°30′E) is a province of Armenia. Situated at the north of modern-day Armenia, it is bordered by Tavush Province from the east, Kotayk Province from the southeast, Aragatsotn Province from the southwest and Shirak Province from the west. The province is bordered by the Kvemo Kartli region of Georgia. Syunik (39°15′N 46°15′E) is the southernmost province of Armenia. It is bordered by the Vayots Dzor Province to the north, Azerbaijan's Nakhchivan Autonomous Republic exclave to the west, Azerbaijan to the east, and Iran to the south.

Figure 2. Artificial deformation of the head: a. frontal-occipital (No 3, male 40-44 years), b. occipital (cradle deformation, No 4, male 50-54 years).

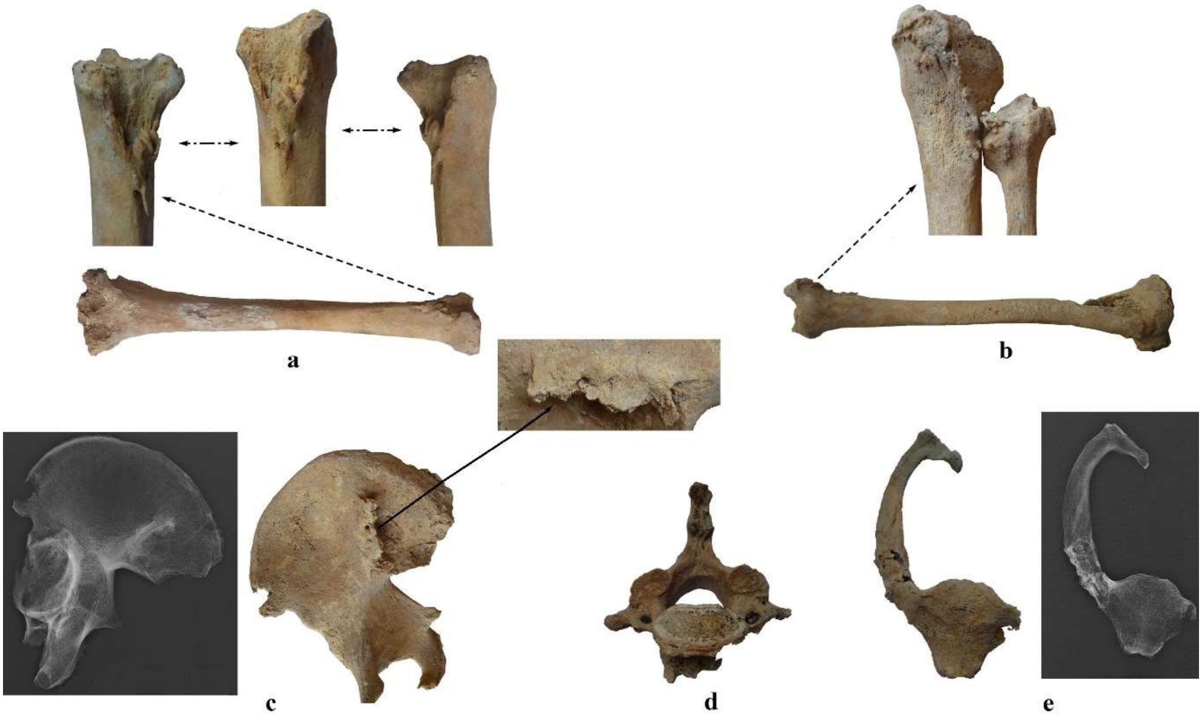

Figure 3. Lesions on the bones of the postcranial skeleton: a, b multiple the interosseous ligament of both distal tibiae also exhibit osteophytic proliferation (No 4 and No 5), c. well develop exostosis of the ilium (No 5), d. trauma to the spinous process (No 5), e. degenerative changes of first manubriocostal (ernocostal) joint (No 5).

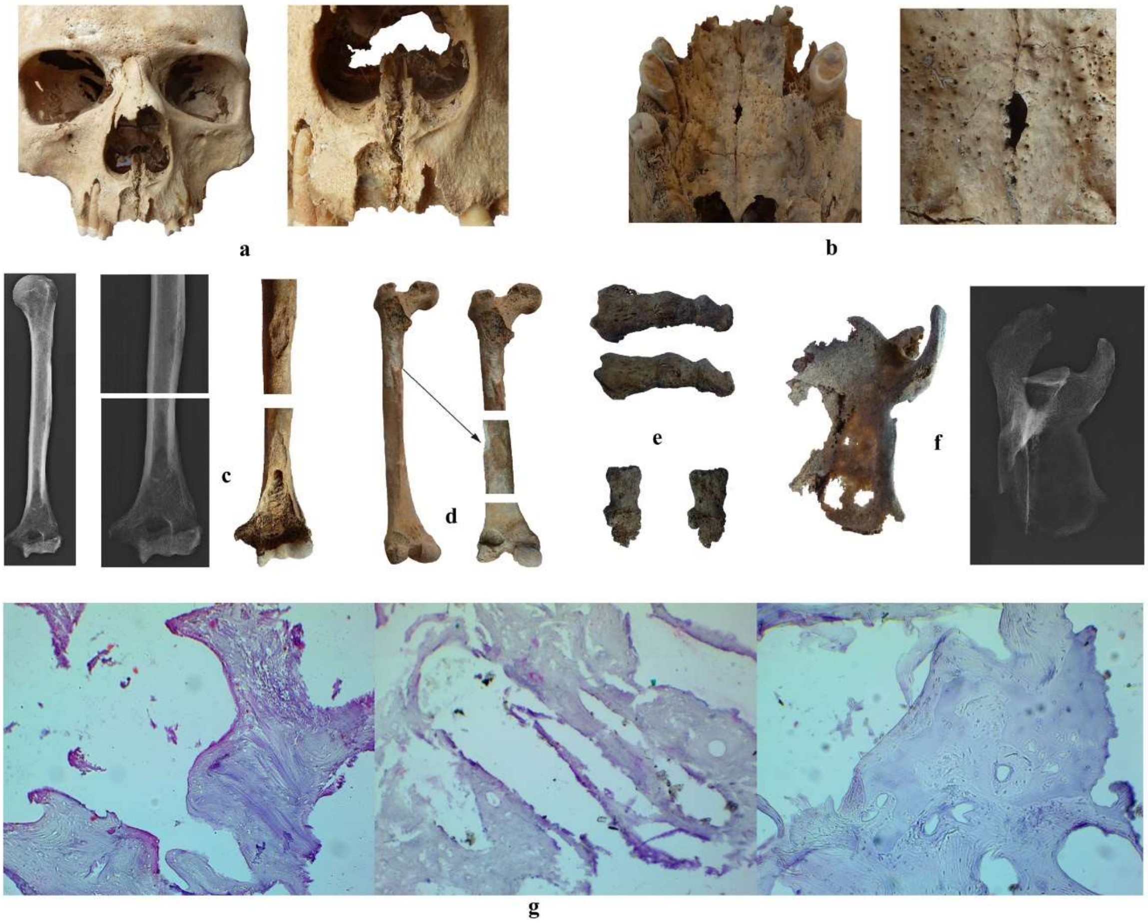

Figure 4. Leprosy in individual No 4 (atrophy of the anterior nasal spine /a/, evidence for destructive remodelling of the alveolar process of the anterior maxilla /b/, diffuse lesions /c, d, f/, ankylosis between a middle and distal left phalanx /e/), histopathologic features showing diffuse lepromatous leprosy /g/ (the samples taken from affected areas) (40).

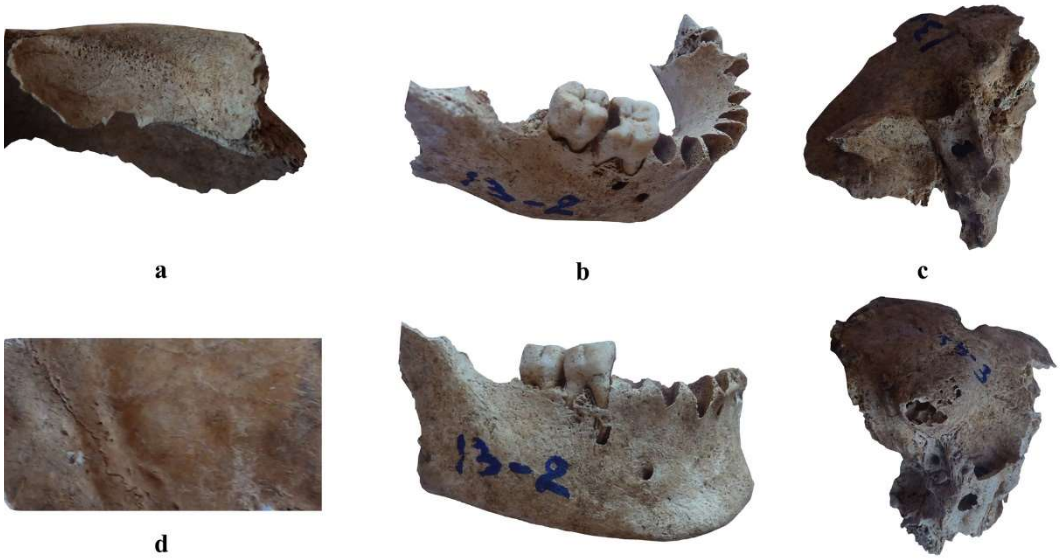

Figure 5. Cribra orbitalia, periapical lesions, caries, mastoiditis, the endocranial surface of the cranial vault with finger-like impressions in the central part (No 13-1, 13-2, 13-3).

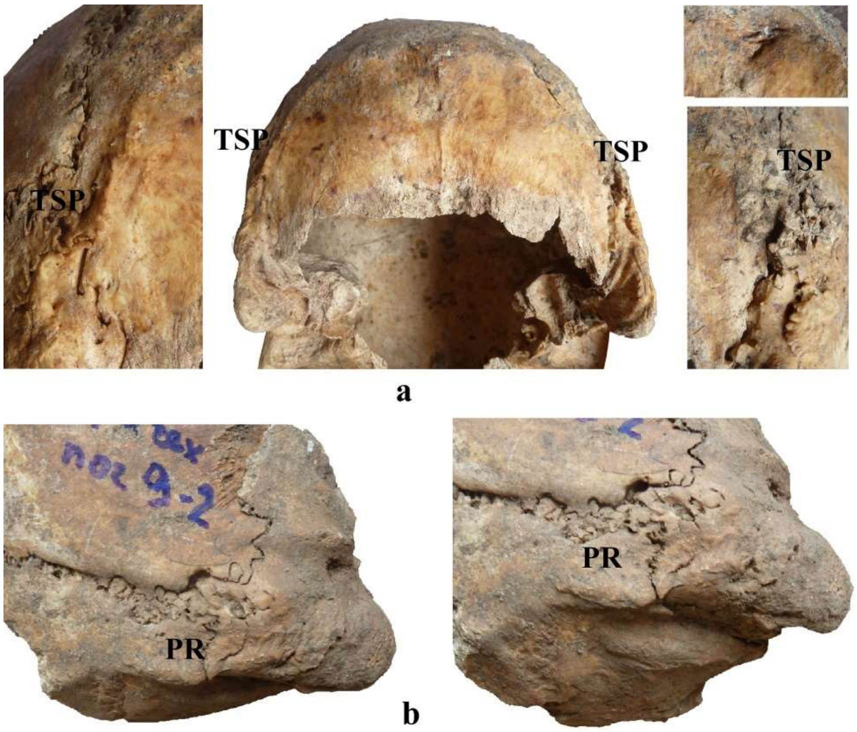

Figure 6. Occipital structures: a) posterior mastoid tubercle /TSP, individual 10, ♂ 35-39 years/, b) posterior mastoid process /PR, individual 9-2, ♂ 50-54 years/.

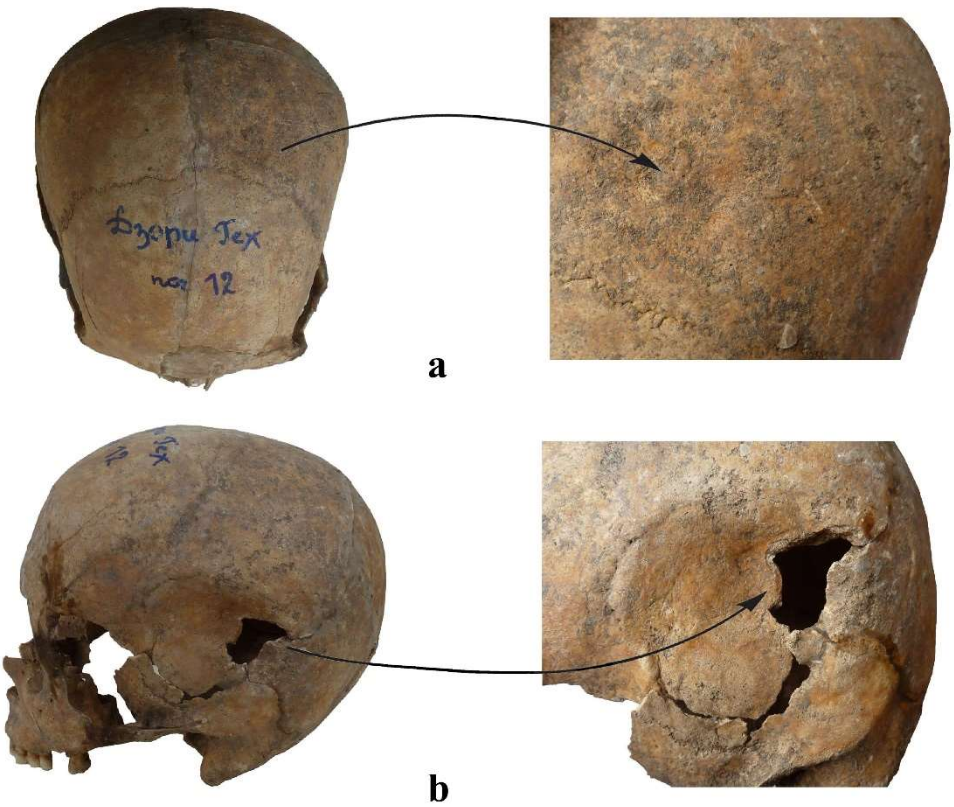

Figure 7. Injuries to the skull (burial 12, ♂ 20-24 years).

Figure 8. Pathological disorders on the skeleton from burial 11: injuries - a, c, d, e, post-traumatic disorders - f, deformity of the sternum - b, osteoarthritis - g.

and methods used for the desired form, degree of the expression of the skull deformation were diversified. Among some ethnic groups from the very beginning of life took place the "forming" of the head manually. Hippocrates describes this custom among peoples residing along the shores of the Black and Azov seas. In the second type, the cradle deformation. Occipital deformation is flattening of the skull perpendicular to the ear-eye plane. This type of modification is often asymmetrical and generally does not involve the frontal bones. It can happen intentionally and, in some cases, unintentionally. Cradle deformation leads to flattening of the nuchal portion of the parietal bones. It was determined that unintentional modification was most likely to result when a child's head and body were bound tightly to a cradleboard or flat, hard structure to prevent the infant from moving during the parent's daily activities (47, 48, 49, 50).

Cranial superstructures associated with attachments for muscles of the neck and shoulder girdle are distinctive in their relatively high frequencies and remarkable in their average degrees of development in archaeologically-recovered Armenian skeletal remains (51). Cranial superstructure is a generalized term which refers to crests, tubercles, processes and tuberosities of the cranium. Along with the more spatially specific term of occipital superstructures (OSS), it was first used to describe morphological features used in the phylogenetic analysis of early hominids (52, 53, 51). These structures are associated with specific muscle insertions rather than with the general morphological features of the cranium. Structures located at the origin of the upper trapezius muscles are referred to as tubercles on the occipital torus (TOT), the pair associated with the insertions of sternocleidomastoid muscles are known as posterior supramastoid tubercles (TSP), and those located where the superior oblique muscles insert (below the inferior nuchal line and lateral to the rectus capitis muscles) are known as retromastoid processes (PR). Morphogenesis and development of OSS are the interactive outcome of a genetically underpinned, chronic activity induced multifactorial process, as follows: (a) inclination for damage at enthesis sites in people with subclinical collagen abnormalities interacts with (b) chronic micro-trauma from arduous muscular overuse beginning at an early age, leading to (c) exuberant reparative processes, resulting in strong OSS development (52, 51). In medieval populations of Armenia two types of cranial superstructures are represented: retromastoid processes (two individual) and supramastoid tubercles (one individual).

Heathcote et al. (52, 55), for example, scored posterior cranial muscle markers of male Mariana Islanders with a sample size of about 100 that dated between 1000 CE and 1521 CE with regard to muscles used for carrying and constructing megalithic structures. Heathcote et al. (52, 55) also noted that a small minority of Chamorro Mariana Islanders had extremely well-developed posterior cranial muscle markers that could be tied to coral limestone quarrying and monument building. Weiss (54), observing 65 prehistoric Californian Native Americans, reported that aggregate upper limb muscle markers have significant correlations with the aggregate cross-sectional robusticity of the humerus (Spearman's rho=0.536; $p<0.01$), cranial length (rho=0.377; $p<0.01$), cranial breadth (rho=0.293; $p<0.05$), and body mass calculated from femoral head breadths (rho=0.385; $p<0.01$). Ibáñez-Gimeno et al. (56), using 62 upper limb specimens from Catalonia and the Balearic Islands, also maintain that individuals with strongly marked entheseal changes have increased diaphyseal rigidities, and that large muscular scars are related to diaphyseal shape. We hypothesize that developed OSSs from Dzori gekh site are related, in (extragenetic) part, to work involved in quarrying, masonry, transport and emplacement of the stone blocks, i.e. related to work activities.

The identification of traumatic lesions in human is of interest for assessing the relative risk of injury to different human groups, the anatomical distribution of trauma and its behavioral implications, the potential to identify interpersonal aggression, and the abilities of humans to survive serious injury and posttraumatic disabilities. The correct interpretation of types of fracture provides information on many aspects of the lifestyle of human groups, principally associated with interpersonal violence, intergroup conflict or warfare, and daily activities (57). Moreover, the frequencies and types of trauma can offer important information about the quantity and quality of therapeutic care available to them (58). Lovell (25) suggested two interrelated levels in the causation of trauma: proximate and ultimate. Proximate mechanisms of injury involve determining whether a fracture is the result of direct or indirect trauma or if the injury is secondary to pathology (e.g., bone weakened by a tumour). The ultimate mechanism of injury considers the influence of both intrinsic constitutional factors like age and sex and the extrinsic environmental and/or sociocultural factors. As the causes of trauma are population specific, it is important to recognize that the aetiology can vary according to environmental or extrinsic factors (i.e., ultimate factors). The inhabitants at Lori and Syunik provinces were involved in agricultural activities. According to McCurdy, Carroll (59), Roberts, Manchester (60) agriculture has been identified as one of the most dangerous occupations in past and present. The main difference between past and present populations is, of course, the fact modern populations are mechanized, but the latter authors note that tending and utilizing (e.g., riding, plowing etc.) livestock and harvesting crops (e.g., grains, fruit, vegetables) results in trauma risks, particularly falls. It is worthwhile to note that falls are the predominant sources of farm related injuries (61). A total of 9 (n=28) of the individuals in the samples (6 individuals from Lori province, 3 from Syunik province) presented with well-healed, healing or perimortem fractures. One case in particular showed signs of a traumatic death (Dzori gekh, burial 11, female 40-44 years). For the Armenian samples was also probably a product of interpersonal conflicts. While there was instance of unhealed sharp force trauma (Dzori gekh, burial 11), most of the trauma involved the maxilo-facial region of the skull, with several depression fractures on various cranial vaults being observed. The facial trauma involved several healed fractures of the nasal region, interpreted as due to fisticuffs. Cranial trauma is often thought to reflect interpersonal violence (62).

In an individual from Lori province, the sternum is tilted to the left. The chest wall has a number of functions that when altered can result in a variety of pathologic processes. Because the chest wall provides a structural framework that is the basis for physiologic motion of the pulmonary system, deformity of the chest wall can result in both restrictive and obstructive lung diseases. The numerous tissues (nerve, bone, muscle) and vasculature of the chest wall can be involved by focal processes, such as tumour or infection, or can show manifestations of systemic illnesses, such as metabolic diseases.

Synostosis between manubrium and gladiolus occur in 10% of individuals replacing the cartilaginous union. All the three parts of the sternum were fused as well. In old age, the costal cartilages tend to ossify superficially and lose their pliability and become brittle. Usually hyperostosis is followed by synostosis. It presents along with clavicular hyperostosis and is considered a part of SAPHO syndrome (Synovitis, Acne, Pustulosis, Hyperostosis, and Osteitis) (63). Individuals may present with spontaneous fracture, chronic recurrent painful swelling of the sternoclavicular region, aseptic inflammation, and hyperostosis of the clavicle, sternum, upper ribs and its adjacent soft tissues. It can also lead to bilateral compression of subclavian vein causing upper limb venous congestion. Ratnapriyanka et al. (64) reported a very rare specimen of synostosis of 1st costo-manubrial joint and reported various causes and age related changes. Synostosis leads to compression of neurovascular bundle causing thoracic outlet syndrome Many literatures have reports of bifid ribs and fused ribs (65, 66). Duru et al. (67) reported segmental costovertebral malformations associated with neural tube defects.

Both bones involved in the knee articulation at 3 individuals exhibited extensive marginal lipping and eburnation in the patellofemoral compartment, clinically indicating the presence of osteoarthritis. Although osteoarthritis is multifactorial in cause older individuals usually exhibit some form of arthritis, often in conjunction with malalignment of regions of the lower limb (68). In modern populations patellofemoral arthritis prevalence is highly variable, ranging from 18% to 79% of people older than 55 years (reviewed in 56) reflecting the diverse cultural, environmental and behaviour factors contributing to osteoarthritis development. Indeed, modern data indicate that East Asian people have more osteoarthritis than their Euro-American counterparts (69). Aspects of culture such as repetitive kneeling and squatting for as little as one hour per day are suggested as possible risk factors contributing to these differences (70). A similar pattern is observed in the past (71).

Arthritic changes at joints (3 individuals), and bone overgrowth and remodelling changes at various tendon and ligament attachment sites appear (2 individuals) to be part of a muscle overuse and heavy weight-bearing syndrome. These changes, taken together with the pronounced development of two of his occipital superstructures and the extraordinary robusticity of especially his upper limb, bespeak a life history that involved bearing, pushing, pulling, and lifting heavy weights (72). At this point, we can only say with confidence that documented skeletal changes are consistent with chronic engagement in reconstructed motor activities involved in such mining, masonry and building work.

Porotic hyperostosis and cribra orbitalia are often viewed as a specific stress indicator, and a response to anemia caused by a number of factors. These factors presence of include diet, parasites, and several other non-specific environmental conditions (7, 8, 3, 73, 74). The presence of porotic hyperostosis and cribra orbitalia lesions, regardless of their origin is associated with a poor quality of life (3). Total frequency of cribra orbitalia in Angekhakot (Syunik province: 40%, n=2) is somewhat lower than the frequencies recorded of the Bakheri chala (100%, n=5) and Dzori geh samples (66.7%, n=3) from the territory of the Lori Region (Armenia). Total frequency of cribra orbitalia in Angekhakot, Dzori gekh and Bakheri chala I is somewhat higher than the frequencies recorded in of the synchronous skeletal sample from the Hovannavanq (20%: No 1, ♀ 45–55 years) (46). Porotic hyperostosis in Dzori geh group was seen in two cases, Angekhakot and Bakheri chala I in five cases each. The enhanced frequencies of porotic hyperostosis have been found in Hovannavanq group (66.7%: No 2, ♂ 45–49 years; No 3, ♂ 18–22 years; No 4, ♂ 50–54 years; No 5, ♀ 30–34 years; No 6, ♂ 35–39 years; No 8, child 2–3 years) (46).

Enamel hypoplasia are defects in enamel thickness across the crown, which change the appearance of the crown surface. The most common type of hypoplasia is linear enamel hypoplasia. Linear enamel hypoplasia are disruptions in the formation of the perikymata (growth lines that appear on the surface of enamel as a series tiny of grooves), which causes them to become 'exaggerated'. As the development sequence of the perikymata on the tooth crowns is well known, and can be linked to age, the location of the linear enamel hypoplasia on the tooth crown can indicate the period in life when the disruption took place (75, 26). Polet (76) argued that the social status affects the development of enamel hypoplasia with thus a high presence in low status individuals. However, the dental analysis from the post-medieval Carmelite friary of Aalst contradicts Polet's assumption since this community of high status individuals was observed with a high prevalence of enamel hypoplasia (77). Total frequency of enamel hypoplasia in Angekhakot (Syunik province: 25%) is somewhat lower than the frequencies recorded of the Bakheri chala I (80%) and Hovannavanq samples (60%: No 2, ♂ 45–49 years, No 3, ♂ 18–22 years, No 4, ♂ 50–54 years). Enamel hypoplasia in Dzori gekh group was seen in one case, Pidjut I also one case. The food resources that were being exploited had a cariogenic component, but were not excessively so. A total of 5 of the individuals in the samples (akheri chala I: 20%: one individual; Dzori gekh: two individuals, Angekhakot: two individuals) presented dental caries. Dental calculus was less of a problem for Angekhakot and Dzori gekh groups (one case each) than for groups Bakheri chala I (80%) and Hovannavanq (60%: No 1, ♀ 45–55 years, No 2, ♂ 40–44 years, No 4, ♂ 50–54 years) (46).

Leprosy (Hansen's Disease), is a chronic infectious disease caused by Mycobacterium leprae which attacks the skin, mucous membranes and peripheral nerves, resulting in destructive skeletal manifestations (78). Leprosy occurs in a variety of forms, causing diverse responses depending on an individual's immunity, with lepromatous leprosy being the most severe and tuberculoid leprosy being the least (60). Although leprosy largely affects humans, the disease is zoonotic, having been noted to occur in Armadillos (79) and several primate species (80). Despite being one of the most widely studied communicable diseases, the exact mode of transmission of leprosy is unknown due to the difficulties of studying the disease in vitro, although droplet inhalation (81) or close repeated contact with infected skin (82) are widely considered as primary causes of transmission. A distinctive trait of leprosy is the diseases long and varied incubation period, lasting up to 6 years in humans (7), although incubation periods of up to 30 years have been observed in wild chimpanzees (83).

Lepromatous leprosy was present in Armenia. The earliest case of Mycobacterium leprae is found in the Middle Bronze Age. Resorption of the alveolar bone in the anterior maxilla was in individual with lepromatous leprosy in Aragatsavan (84). The Lchashen series (Late Bronze and Early Iron Ages) of Sevan pool represents a remarkable material for the study of past mycobacterial infections and very rich in leprous cases (four men and two women) (85). The morphological aspects of the rhinomaxillary changes are characteristic of a facies leprosa. One individual from Karmir (Early Iron Age) has nasopharyngeal lesions, including significant remodelling of the nasal aperture margins (86). Paleopathological analysis indicates that lepromatous leprosy was present and in Ancient Age (Vardbakh, 1st century BC - 3rd century) (87). At woman (20-25 years) from Dvin (Early Middle Age) had bony signs that were e possibly related to facies leprosa (the skull unearthed by archaeologist Nyura Akopyan in 1978) (88). Destructive lesions were observed of the nasal cavity, and atrophy of the margin of the nasal bone (certain degree of pitting). The nasal condition in particular points to this disease rather than any other known to have occurred in medieval Armenia.

Macroscopic, histological and X-ray observation of the bones and scrutiny of lesions according to the paleopathological literature allowed the identification of a probable case of leprosy in an adult male from Angeghakot (skeleton 4). The skeleton of a male (50–54 years) revealed several bony changes indicative of leprosy with clearrhino-maxillary syndrome. Differential diagnosis includes granulomatous diseases such as sarcoidosis and treponemal diseases and fungal infections such asaspergillosis and mucormycosis (phycomycossis), actinomycosis (a bacterial rather than a true fungal disease), and lupus vulgaris (tuberculosis of the facial skin and soft tissue). Sarcoidosis is a systemic disease of unknown etiology characterized by the presence o noncaseating granulomas in any organ, most commonly the lungs and intrathoracic lymph nodes. Like leprosy, it tends to affect the phalanges of the fingers and toes, causing lytic lesions and no reactive bone formation (89). However, in the skull, it causes mainly the destruction of the nasal bones while only rarely of the anterior nasal spine and never of the crest (90). Thus, we can exclude this disease as an explanation for the bony lesions in Angeghakot. Clinicians categorize human treponemal diseases as syphilis (venereal and endemic), yaws, pinta, which are granulomatous infections caused by spirochetes of the genus Treponema. Excluding pinta, which does not affect bones, in the tertiary stage these diseases can involves the skeleton, and they tend to be associated with inflammatory bony changes accompanied by extensive bone regeneration, often resulting in alteration of the bone morphology and in some cases destruction of the nasal-palatal area may occur (89). Yaws is characteristically an infection acquired during childhood through skin contact. In yaws disorder, the last stage can be characterized by widespread bone, joint, and soft tissue destruction, which may include extensive destruction of the bone and cartilage of the nose (rhinopharyngitis mutilans or “gangosa”). Joints may stiffen, and chronic osteitis and periostitis can lead to deformed leg bones (sabre tibiae). A close relative of the syphilis and yaws treponemes is T. pallidum subsp. endemicum, which causes bejel (also known as endemic syphilis). The involvement of the skull is very rare, with gummas of the soft palate and nose developing in the last stage (90). The “gangosa” condition may occur rarely. In venereal syphilis, the most commonly affected bones are (in order of importance) tibia, frontal and parietal (with caries sicca on the outer tables), nasal-palatal region, clavicle, sternum, vertebrae, fibula, femur, humerus and radius, and ulna. The teeth may also be involved, showing a screw drivershape (Hutchinson teeth). No specific involvement of the feet is observed in this pathology (89, 90). The most common bones afflicted during the tertiary stage of the disease are the tibia (with sabre-shaped deformity) and the skull. According to Ortner (89), the calvarial lesions are the most specific diagnostic features. Although the nasal cavity is often enlarged, producing the characteristic “saddle nose,” the nasal spine is usually spared (91). Furthermore, the anterior alveolar change process is uncommon in yaws and syphilis (92). Therefore, the pathogenetic picture of our skeleton does not correspond to that of treponemal diseases. Aspergillosis continue to be an important cause of life-threatening infection in immuno compromised individuals. Aspergillosis is marked by inflammatory granulomatous lesions in the skin, ear, orbit, nasal sinuses, lungs, and sometimes bones and meninges. It affects the paranasal sinuses and orbit or the anterior cranial fossa (90). Most infections are caused by Aspergillus fumigatus. The organism is capable of invading across all-natural barriers, including cartilage and bone. Mucormycosis is an infection caused by fungi belonging to the order Mucorales, which tends to affect people who have poorly controlled diabetes (93). The skin barrier represents a host defense against cutaneous mucormycosis, as evidenced by the increased risk for developing mucormycosis in individuals with disruption of this barrier. However, burns, traumatic disruption of the skin, and persistent maceration of skin enables the organism to penetrate into deeper tissues. Mucormycosis attacks the nasal cavity with involvement of the paranasal sinuses and their walls (89). A diagnosis of aspergillosis and mucormycosis can be ruled out. Actinomycosis is a chronic, and slowly progressive granulomatous disease. Multiple different clinical features of actinomycosis have been described, as various anatomical sites (face, bone, joint, respiratory tract, skin, soft tissue structures) can be affected. When affected of skull, the mandible rather than the maxilla is more involved (89, 94). Lupus vulgaris is a chronic tubercular infection of the skin involving soft yellow swellings, ulcers, and abscesses. Lupus vulgaris and tuberculous dactylitis (which occurs predominantly in young children) are rare clinical entities (95). Long-standing tuberculosis of the facial skin and soft tissues can lead to the destruction of the nasal bones (90). The anterior alveolar process, however, is rarely affected (92), which discounts lupus vulgaris as a diagnosis. Thus, a tuberculous origin for the skeletal lesions observed in skeleton 4 seems highly improbable. Frostbite, also known as freezing cold injury, may also be ruled out (96). Skeleton 4 from Angeghakot displays a pattern of skeletal involvement highly compatible with a diagnosis of leprosy.

Otitis media is a disease of the middle ear that commonly occurs secondary to an infectious process in the upper respiratory tract (97). Some researchers have attributed the prevalence of middle ear disease in Indian and Eskimo groups to poor socio-economic conditions (98, 99). However, subsequent researchers, including Reed and colleagues, have failed to demonstrate a relationship between the prevalence of otitis media and climate, family size, sanitary conditions, or crowding (100, 101, 102). The pathogenesis of otitis media usually follows an event, such as allergy or infection that causes congestion of the respiratory mucosa, obstruction of the isthmus, and accumulation of mucosal secretions of the middle ear (103). In individuals with low resistance or in whom the infection has reached a state of high virulence, the disease quickly spreads throughout the temporal bone, resulting in a local inflammatory response and generalized systemic changes (104). Proliferation of bacteria in the middle ear leads to suppurative (producing pus) and symptomatic otitis media. Mastoid disease, a possible sequela to otitis media, has been associated with pneumonia, influenza, tuberculosis, and exanthemata (105). The spread of bacteria (e.g., Staphylococcus au reus) may result in hearing loss, osseous lesions, and rapid destruction of the mastoid antrum and air cells (mastoiditis), tegmen tympani, and surrounding bone within a few days. Perforation of the tegmen or pyramid may lead to epidural abscess and death (106). Inflammations caused by microorganisms during infancy and early childhood can lead to primary mastoid hypocellularity (107). The children and adolescent described in this article serve as examples of the "natural" course of untreated mastoiditis. The study of skulls shows that mastoiditis was a known illness in ancient Armenia. The destruction of the mastoid wall and mastoid cells suggests that most cases of mastoiditis were probably acute. The temporal bone also shows resorption of the petrous process, with complete destruction (by otitis media) of the tympanic plate. In 5 ossicles, local alterations were visible as pitting and erosive changes. The observation under the binocular operating microscope enables the differentiation of such alterations from artifacts and postmortem modifications. Although the differential diagnosis of disease in archaeological skeletons must be tempered with caution, the morphology and distribution of bone lesions in these children and adolescent provide evidence for distinguishing infectious from tumorous disease. Benign and malignant tumors may cause swelling around the ear. Benign processes such as congenital cysts, lymphatic malformations, etc. can occur around the ear and cause swelling. Cholesteatoma is a destructive and expanding growth consisting of keratinizing squamous epithelium in the middle ear and/or mastoid process (108, 109). Cholesteatomas are not cancerous, but can cause significant problems because of their erosive and expansile properties. This can result in the destruction of the bones of the middle ear (ossicles), as well as growth through the base of the skull into the brain (110). Malignant tumors such as rhabdomyosarcoma can also occur in this area. Middle ear inflammation is usually absent and clinical behavior distinguishes such masses from acute mastoiditis. Symptoms of mastoiditis are similar to symptoms furunculosis of the external ear (111, 112). Furunculosis that appears in the ear canal, on face, especially in perinasal or genial region. He can occur in anyone at any age. However, they are uncommon in children. Unusual inflammatory processes may mimic acute mastoiditis. One such inflammatory process, Langerhan cell histiocytosis, can present with inflammation of the ear and mastoid. The skull is most frequently affected, followed by the long bones of the upper extremities and flat bones. Infiltration in hands and feet is unusual. Osteolytic lesions can lead to pathological fractures (113). Langerhan cell histiocytosis for the skeletal lesions observed in skeletons from Angekhakot seems highly improbable.

Periostitis is a skeletal lesion associated with an infl ammation of the periosteum and this inflammation can be the result of site-specific trauma, infection, varicose veins, or dietary deficiencies (114, 73). Niacin deficiency (vitamin B3) has also been shown to be linked with the formation of periostitis on long bones (115). Periostitis present on many bones from Armenia could represent another infection, although such an infection cannot be determined unambiguously from dry specimens.

The purpose of this paper was to provide a brief overview of pathologies that have been recorded on the skeletal collections from Armenia to date. The diseases outlined here deal predominantly with individual cases, as population-based inferences on the prevalence of diseases in Syunik and Lori provinces. This initial analysis is only the starting-point for reconstructing information about the groups who were buried in Early Middle Age Age in this geographic region.

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