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BIOARCHAEOLOGICAL EVIDENCE FOR THE HEALTH STATUS OF A LATE BRONZE AND EARLY IRON AGES BOVER POPULATION (ARMENIA)

ABSTRACT: Osteological data from Late Bronze and Early Iron Ages skeletal series provide insight into health, disease, and stress levels in Bover site (Armenia, Lori Region). The sample was recovered during excavations in 2009 and 2015. Sixty two skeletons from burial ground Bover were analyzed macroscopically and X-ray for pathological conditions such as traumatic injuries, trepanation, infectious disease and dental pathology. This study has shown that average age at death was relatively high. Life expectancy at birth for the Bover population is 32.1 years. Trauma to the skull was common, which suggests a high level of inter-personal violence. Cases of benign neoplasm's observed in group should be viewed as non-life-threatening disorders. Bover site showed a high frequency of auditory exostosis. The dental pathology conditions of this population were numerous. Agriculture introduced people to carbohydrates, or sugars, which affect the teeth and cause dental caries. The staple diet of ancient population from Lori Region (Shnogh river) consisted of wine, bread, vegetables, and fruits.

KEY WORDS: Armenia – Late Bronze and Early Iron Ages – Bover – Metabolic disease – Trauma – Trepanation – Tumors – Infectious disease – Dental pathologies

INTRODUCTION

The Armenian Highland was in early history a crossroads, linking the East and West. Overland trade routes existed between the Near East through the Armenian Highlands and the Caucasus and on to the Balkans, and through Caucasus and the Balkans to the north Black Sea coast and back. Since the Early Bronze Age, the ethnic history of the region developed under the interaction of various groups, among which the Indo-European tribes played an important role (Khudaverdyan 2011a).

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In the Late Bronze and Early Iron Ages, Armenian Highland was home to a number of established sedentary farming communities. The people dwelt in open settlements consisting of round or rectangular huts with clay walls. Sedentary group lived in this village, whose subsistence system was based on agriculture and the exploitation terrestrial resources, adequate for the relatively small populations. The primary food resource for communities was a variety of grain crops, which would have been grown in agricultural fields watered by man-made irrigation canals. They raised domestic animals-cattle, sheep, goats, and pigs; they harnessed oxen, horses to carts. Mining and metallurgy quickly developed along with animal husbandry and agriculture. The beginning in the second half of the 3nd millennium BC, the copper mine deposits of Lori District began to be exploited.

The present paper discusses human remains uncovered at Bover necropolis (village Teghut). In this paper we focus on the description, frequency and preliminary interpretation of the pathologies found in the Bover sample of 15th–14th centuries BC from the Shnogh River basin (Lori Region, Armenia) (*Figure 1*). The village Teghut is situated 16 km east of the town Alaverdi, Lori province, on the right bank of the river Shnogh, tributary of Debed, in a landscape rich in forests. The village is known with its turquoise ores. In recent times Teghut region turned to be an important mining region with rich copper resources which are currently being exploited with merciless deforestation of the landscape. Earlier the region was scarcely known archaeologically first of all because of its landscape rich in forests. Only since 2009 rescue archaeological surveys and excavations have been conducted in and around the village Teghut (as well as partly in the nearby village Shnogh), where the mining activities are currently concentrated. These investigations are guided by S. Hobosyan, Institute of Archaeology and Ethnography, Armenian Academy of sciences. The archaeology of Lori is only partly investigated. Chalcolithic sites are not known. Early Bronze Age is very good represented in Lori through settlements (Tagavoranist, Dimats, Kosi Choter, Lorut) and less tombs (Pidjut). Middle Bronze Age is known only through tomb excavations (Vanadsor, Lori Berd, Kamakatar, cf., however, the settlement of Lori Berd). The Late Bronze Age and Early Iron Age (Cheshmanis, Dimats, Lori Berd, Kobayr, Vomak, Sanahin, Bover, Bardzryal, Bakheri chala) are also represented through cemetery excavations (Gevorgyan, Bobokhyan 2014, Khudaverdyan, Hobosyan 2017b). The Archaeological Expedition of the Institute of Archaeology and Ethnography, National Academy of Science, Republic of Armenia has uncovered many human skeletal remains of Bover site (Armenia) in recent years. A craniological, odontological and palaeopathological project to study the human remains from this site was initiated in 2015 (Khudaverdyan 2016, 2017a). To date there have been only a few studies that have examined skeletal samples (Bover, Bakheri chala, Tekhut, Bardzryal).

Metabolic disease

Cribra orbitalia and porotic hyperostosis are porous lesions found on the external table of the orbital roofs and the skull vault. Sign is often used as an indicator of general stress (Lewis 2000, Roberts, Manchester 2005) and is frequently found associated with agricultural economies (Roberts, Cox 2003). Environmental stressors, such as parasites and disease, rather than specific dietary deficiencies, are more likely to be responsible for the observed pathology.

Trauma

Trauma (or wound to bodily tissue) is one of the most frequently occurring recorded pathologies within archaeological collections (Bennike 2008, Larsen 1997, Roberts, Manchester 2007, Walker 2001).Information on forms of trauma evident within (or between) populations allows to our understanding of both how people are cooperating with one another and their environment. Fractures are identified as a break, either partial or complete in the skeletal tissue (Bennike 2008, Roberts, Manchester 2007). Antemortem fractures are injuries that took place to death and are identified as such because they show proof of healing in the shape of new bone growth (Larsen 1997, Roberts, Manchester 2007, Walker 2001, Khudaverdyan 2014). Fractures that show no sign of healing are deemed perimortem, or occurring around time of death (Larsen 1997, Roberts, Manchester 2007, Walker 2001, Khudaverdyan 2010). Postmortem fractures are those that resulted from taphonomic processes and reduction methods and are normally diagnosed by the lighter coloring of the bone at the interruption site (Larsen 1997, Roberts, Manchester 2007, Walker 2001, Khudaverdyan 2014). By focusing on the location, patterning and type of fractures, paleopathologists are able to make conclusions about human conduct (Larsen 1997, Roberts, Manchester 2007, Walker 2001).

The designation "violent" is applied to trauma that displays evidence, by location and patterning, of

FIGURE 1: Location map of the Bover cemetery.

malevolent intent (Walker 2001).Violent trauma seen archaeologically can be categorized into blunt, projectile, sharp trauma (Larsen 1997, Roberts, Manchester 2007). Accidental trauma is supposed to be generally indicative of living conditions and daily hazards faced by an individual (Larsen 1997, Walker 2001).Anthropologists have identified repeated patterns of unintentional trauma, including fracture, muscle tear, and dislocation, as most commonly occurring to the clavicle, upper arm, wrist, hip, and lower leg (Larsen 1997, Walker 2001).

Trepanation

Medicine is an integral part of the ancient culture of Armenia and its roots go back thousands of years. Doctors were able to treat not only internal diseases, but also resorted to surgical interventions, and often quite difficult. Considerable progress has been made in human anatomy and physiology, which has allowed for a variety of operations, ranging from simple autopsies to skull trepanation. There are three types of trepanations: actual (surgical) – any hole in the skull made in life; ritual – postmortem autopsy of the skull; symbolic – a life-long operation that does not spread further than the diploë, and the internal bone plate was not exposed (Aufderheide, Rodríguez-Martín 1998, Nemeskéri *et al.* 1960). For therapeutic purpose trepanations are performed for removal of bone fragments penetrating into the cranial box as a result of blows, in case of severe headaches, epilepsy, in case of elimination of other intracranial pathologies, which caused physical suffering to the person or cause certain deviations in his behavior (Açikkol *et al.* 2009, Brothwell 1981).

There are four main trepanation techniques: scraping (hole opened with an abrasive instrument), drilling (hole opened with a trephine/drill), cutting (a hole opened with an incisive instrument to produce different types of orifice), and boring-and-cutting (a hole opened with both a drill and an incisive instrument) (Lisowski 1967).

Neoplastic Conditions

Tumors are traditionally classified as being either benign or malignant. Benign tumors are typically asymptomatic and generally not harmful, being on average small. Malignant tumors pose a dual danger to the body in their ability both to ruin tissue in a localized area and to propagate to others (Aufderheide, Rodríguez-Martín 1998, Waldron 2009). Arrangement to tumors of any kind is influenced by heredity, environment, and lifestyle, also as age and sex depending on the type of tumor (Ortner 2003, Waldron 2009). Benign tumors are regularly identified in archaeological sites and among them osteomas are fairly common (Ortner 2003, White *et al.* 2011). Typically occurring on the outer cranial vault, they appear as dense, well determined bone growths and termed button osteomas for this reason (Ortner 2003). Ear exostoses is another spread benign tumor found in anthropological material and results from growth in the lateral end of the external auditory meatus (Aufderheide, Rodríguez-Martín 1998).

Infectious Disease

Bone can respond to infection through depositing new bone at the site of an inflammation. Initially this bone is disorganized and porous, and is termed 'woven bone'; the presence of this type of bone indicates an infection that was active at the time of death. Bone can respond to infection through depositing new bone at the site of an inflammation. The presence of lamellar bone suggests the infection had healed.

Infections are the result of viruses, bacteria, fungi, and/or parasites with an individual's chance of contraction being variable by age, sex, genetic inheritance, current health status, and nutrition (Roberts, Manchester 2007).Middle ear and mastoid infections are localized responses to infection that begins in the middle ear (Roberts, Manchester 2007). If an abscess forms in the course of a severe middle ear infection and penetrates the surrounding bone it is able of producing a mastoid infection.

Tuberculosis is caused by the bacilli Mycobacterium tuberculosis and *M. bovis*. Transmission is typically airborne with an infected host expunging tubercle bacilli into the air onto a surface. As *M. tuberculosis* is often an airborne illness, most cases begin although the respiratory tract with the primary infection occurring in the lungs (Larsen 1997).

Periostitis is the inflammation of the outer layer, or periosteum, of the bone caused by infection or trauma. The most commonly affected bone by far is the tibia, with suggested reasons ranging from a cooler surface area, courtesy of its proximity to the skin surface; inactivity at the area, leading to bacterial colonization; and from the ability of blood to stagnate in the lower leg, also allowing for the accumulation of bacteria (Roberts, Manchester 2007). While infection from periostitis is rarely fatal, osteomyelitis, while still being nonspecific in nature, is often systemic and can cause death if the infection spreads to the organs (Larsen 1997).

Dental Pathologies

Linear enamel hypoplasia is a defect in the structure of the enamel of the tooth that is represented as defined, linear, horizontal grooves of reduced enamel thickness (Aufderheide, Rodríguez-Martín 1998). The factors causing dental enamel hypoplasia include malnutrition, hemolytic disease of the newborn, premature birth, dietary deficiencies of vitamins A, C, and D, childhood fevers, tuberculosis, congenital syphilis, and newborn hypoxia (Aufderheide, Rodríguez-Martín 1998).The change from breast milk to other food seems like a realistic stress factor in the early life of a child. Dental problems observed in archeological assemblages tend to reflect subsistence strategy and/or food preparation/ processing (Roberts, Manchester 2007). The most common dental disease is dental caries (Larsen 1997, Roberts, Manchester 2007). Caries can occur as opacities on the tooth surface or as cavities, ranging from slight to extreme; sometimes resulting in the complete destruction of the tooth crown (Larsen 1997, Roberts, Manchester 2007).Caries is directly related to diets high in sugar and/or carbohydrates (Larsen 1997, Roberts, Manchester 2007). Dental wear can lead to the formation of carious lesions if severe enough (Larsen 1997, Roberts, Manchester 2007). Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. Dental calculus (mineralised dental plaque) is commonly observed in archaeological populations whose dental hygiene was not as rigorous as it is today. If plaque is not removed from the teeth effectively (or on a regular basis) then these plaque deposits mineralise and form concretions of calculus on the tooth crowns or roots, along the line of the gums (Hillson 1996).

Periodontal disease, or periodontitis, is an inflammation of the periodontium (gingival, periodontal ligament, alveolar bone, and cementum) that often results in minor to severe resorption of the alveolar process. Periodontal disease is caused by several irritants such as bacterial plaque that becomes calculus due to calcification of plaque, and living or dead microorganisms (Aufderheide, Rodríguez-Martín 1998, Ortner 2003). Another cause of periodontal disease can be gingivitis, an inflammation of the teeth surrounding soft tissues, if it remains untreated (Ortner 2003). In a progressive phase of periodontal disease, the roots of the teeth may be exposed and tooth loss may occur. Abscesses are pockets of puss and bacteria that collect and eventually lead to a drainage hole in the surrounding bone (Roberts, Manchester 2007). They typically result from a cavity that has gotten near the tooth root which opens up the pulp cavity and exposes the individual to infectious bacteria from the outside (Larsen 1997, Roberts, Manchester 2007). Ante-mortem tooth loss (AMTL), or the loss of teeth during life, can occur as a result of a variety of factors, including dental caries, pulp-exposure from heavy tooth wear, or periodontal disease (occurring when inflammation of the gums, gingivitis, spreads to the underlying bone).

MATERIALS AND METHODS

Excavations at Lori region began in 2009 by S. Hobosyan and lasted until 2018 in progress. Archaeological excavations were done near the villages of Shnogh and Teghut, Lori District of the Republic of Armenia. The large area of between villages Shnogh and Tekhut was divided into 8 archaeological zones. Due to good climatic and geographic conditions, the basin of the Shnogh river, where the Dukanadzor mining district is situated, had been inhabited since the Stone Age. On the area of nearly 1500 ha there are tens of settlements and cemeteries dealing especially with the period from the Bronze Age to medieval times (Hobosyan 2011). The present paper discusses human remains uncovered at Bover burial ground (*Figure 1*). Only burials dated to the Late Bronze Age and Early Iron Age are included in this analysis. The excavations of Bover cemetery produced minimum number (MNI) of 62 skeletons: 26 males and 11 females, 20 individuals is not defined sexual identity. Four children (2–9 years) and one adolescent were the only subadults present in the sample (*Table 1*). All analyzed individuals were buried in a flexed position, in graves in the shape of a stone coffin. All of the burials appear to have been primary interments, typical of the Late Bronze and Early Iron Ages (c. 15^{th}–14^{th}BC), and oriented in an east east-west direction. The necropolis exhibit a range of mortuary practices as displayed through the form of burial (flexed and semi-flexed burials, cremation). Most of the skeletons were accompanied by large numbers of pottery vessels, bangles, and beads, semi-precious stones. Excavations of Bover cemetery uncovered a small number of cremation burials (4 of 62 individuals) (Khudaverdyan, Hobosyan 2017a).Only one individual was present in each ceramic urn. Made of ceramic, the urn had clearly

been made during the Late Bronze Age between – a period in which some people were being cremated and their ashes either scattered, or collected and buried in vessels like. Archaeologists are still unsure whether these funerary urns were specially made for burials, or whether they might have been used during life for cooking or storing food (*Figure 2*). Analysis of the cremated bones suggests that the remains in graves represent the burial of adults (1 – female, 2 -- male, 1 – of indeterminate sex) (Khudaverdyan, Hobosyan 2017a). In bone samples the retort temperatures range from 500 to 550 °C (Walker, Miller 2005). The bones exhibited longitudinal splitting and superficial checking of the external surfaces and less evidence of warping (Khudaverdyan, Hobossyan 2017a). The bones color having changed to ash-like gray. The degree of bone coloration also varies with burning time, and a long period of burning results in more severe color alteration (Walker *et al.* 2008).The organic matrix disappears at a comparatively early phase (Thurman, Willmore 1981).

The age-at-death and sex of adults were assessed through the use of multiple indicators: morphological features of the pelvis and cranium were used for the determination of sex (Phenice 1969, Buikstra, Ubelaker 1994) a combination of pubic symphysis (Gilbert, McKern 1973, Katz, Suchey 1986, Meindl *et al.* 1985), auricular surface changes (Lovejoy *et al.* 1985), degree of epiphyseal union (Buikstra, Ubelaker 1994), and cranial suture closure (Meindl *et al.* 1985) were used for adult age estimation. For subadults, dental development and eruption, long bone length, and the appearance of ossification centers and epiphyseal fusion were used (Moorrees *et al.* 1963a, 1963b, Ubelaker 1989, Buikstra, Ubelaker 1994, AlQahtani *et al.* 2010).

FIGURE 2: The clay dishes from burials 28 (a) and 46 (b) in which the cremated bones were found.

The purpose of this paper was to provide an overview of some of the common and unusual pathologies that have been recorded on the Bover skeletal collection. All bones were examined macroscopically and X-Ray for evidence of pathological changes. The method by Acsádi, Nemeskéri (1970) is one of the predominant tools used in early paleodemographic research.

Traumatic lesions were observed both in cranial and postcranial skeletal remains. Antemortem trauma was distinguished from perimortem trauma by the appearance of new bone deposits, resulting in callus formation or beveled edges (Aufderheide, Rodríguez-Martín 1998). We were following the recommendations of Galloway *et al.* (1999) for the diagnostics and determination of the prescription of the trauma. Some bones were submitted to radiological study at Armenia Republican Medical Center. In the cases of healing after a surgical intervention, the perforation has relatively flat outlines of oval or round shape, with smooth and rounded (sometimes thinned) margins.

Benign neoplasms were described in terms of their type, location, size, and amount of involvement.

Each orbital roof is recorded as a single unit with cribra orbitalia noted as present, absent or unobservable. Lesions are recorded following the grading system defined by Stuart-Macadam (1991) (types 1–5).

Periosteal lesions were recorded using the method outlined by Buikstra, Ubelaker (1994). Each was recorded in terms of the bony element affected and location upon that element. Lesions were assessed as either slight, moderate, or severe, based on the amount of the element affected and severity within the population. A distinction was drawn between active and healed cases (Mann, Murphy 1990). If a pattern of involvement was apparent, then a diagnosis was attempted. Otherwise, each instance was recorded as a non-specific infection.

Enamel defects were described in terms of their location and characteristics (see Buikstra, Ubelaker 1994, Hillson 1996). Enamel hypoplasia is recorded on individual tooth level.

Dental caries was recorded for each tooth and surface affected. Location is divided into seven categories, based on a recording system by outlined by Buikstra and Ubelaker (1994). Care was exerted in order to avoid confusing legitimate caries with pulp exposure due to severe wear. Calculus was recorded on an individual tooth level stating the location and severity of the formation. The location was recorded as supra- or sub-gingival based on the location of the deposit (on the crown or the root) and on the characteristics of the calculus (Hillson 1996). The severity was recorded as slight, medium or considerable deposition following Brothwell (1981).

AMTL was assessed based on evidence of resumption of alveolar bone around a tooth socket. If remodeling was evident, and the socket was partially (>2 mm) or fully filled in, then a tooth was considered to have been lost antemortem. Sockets that were open and smooth, with no evidence of remodeling, were recorded as having lost teeth postmortem (Turner *et al.* 1991).

Abscesses were recorded based on their presence and location. Buccal or labial lesions were differentiated from lingual perforations (Buikstra, Ubelaker 1994). If the abscess severely affected the associated tooth, then comments were made concerning the amount of involvement.

Periodontal disease was assessed by measuring the amount of alveolar bone loss. Measurements were taken from the cemento-enamel junction to the surface of the alveolar bone. Only those measurements that exceeded 2 mm were recorded as evidence of periodontal disease (Turner *et al.* 1991).

Due to small sample size, no statistical testing of inter-sex or inter-site differences was applied.

RESULTS

Demography

The results of the analysis indicate that a minimum of 62 individuals were interred in the Bover burial including 57 adults and 5 subadults. Given the incomplete archaeological data and fragmentary nature of most of the skeletons, age-and sex-specific mortality profiles cannot be accurately determined. The results of the age and sex analysis for this sample are presented in Table 1 and show the presence of children, adolescent, and adults of all five age categories (young adult, early middle adult, later middle adult, mature adult, and old adult).

The unbalanced sex ratios at site may be the result of factors that have nothing to do with differential treatment of the sexes after death. Poor skeletal preservation, especially at Bover, may have skewed paleodemographic assessments. One vexing paleodemographic problem that is found in the entire Bover sample is the paucity of subadults (birth to 20 years of age). Four children (2–9 years) and one adolescent were the only subadults present in the sample (*Table 1*). It is hypothesized that the under-

TABLE 1: Number of individuals from Bover.

Sex	Age categories						
	0–10	**11–19**	**20–29**	**30–39**	**40–49**	**50+**	**Total**
male			8	7	6	5	26
female			5	2	4		11
undet.	4	1	12	4	3	1	25
total	4	1	25	13	13	6	62

representation of infants and children is due to a variety of factors including preservation issues and differential placement of infant burials elsewhere. The deliberate separation of infants and young children from the group seems somewhat common in other provinces Armenia (Khudaverdyan 2009). This dearth of young individuals is mirrored at other sites in the region (see Khudaverdyan 2012, Khudaverdyan, Hobosyan 2017b). Only 9.7% of the individuals in group were assessed as old adults. Life expectancy at birth (eox) for the Bover population is 32.1 years. Estimated life expectancies are high for both males (37.3 years), and females (33 years). These mortality rates should be viewed cautiously.

Trauma

In the sample from Bover, signs of trauma were detected in 7 skeletons:

1. Burial 10 (male, 50–59 years), ante-mortem blunt force trauma of oval shape was observed on the occipital bone (supposedly 12.0 × 5.5 mm). The injury was successfully healed;
2. Burial 13 (*Figure* 3a, male, 30–39 years), signs of two traumatic lesions were detected on the skeleton. A round blunt force injury healed long before death could have been seen in the right parietal (size 42.0×35.5 mm, depth 1.5 mm) (*Figure* 3b). No signs of necrosis. In the sacrum, there was a transverse fracture observed, which occurred as a result of a fall on the buttocks. Manifestations of healing of the bone were detected (*Figure* 3c);
3. Burial 27 (female, 20–29 years), signs of two non-penetrating successfully healed wounds were observed on the right parietal (28.0×20.0×5.5 and 8×8 mm);
4. Burial 35 (male, 40–49 years), blunt force ante-mortem trauma was detected on the left parietal (16×15 mm);
5. Burial 41 (male, 40–49 years), an injury caused by chopping weapon in the tangential direction (24 mm) was detected on the left parietal. There were signs of an acute inflammatory response, which probably led to death of the individual;
6. Burial 44 (*Figure 4a*, male, 40–49 years), signs of three traumatic lesions were detected. An oval depressed fracture (26×16mm), which only affected the outer table of the vault, could have been seen on the right parietal (*Figure 4c*). The two other lesions were on the frontal bone: an elongated lesion on the left from metopion (16×4mm) (*Figure 4b*), and a non-penetrating depressed fracture (8×3 mm) some 37mm from the first lesion. There were no signs of inflammation in both cases. Apparently, both injuries were caused during the same encounter;
7. Burial 51 (female, 30–39 years), blunt force trauma of the nasal bones was found.

Trephination

The skeleton of the 35-year-old male (burial 7: *Figure 5a*) shows a rounded depression. The right frontal bone presents an osseous, rounded, infundibular defect, with a striated surface ending in a deep vortex adjacent to an exostotic formation (*Figure 5b*). The size of the lesion is transverse diameter 33.5 mm and anterior-posterior diameter 27 mm, the surface is 3–3.5mm deep. The centre of the depression is rough. The smoothed, albeit slightly uneven, edges with beveling indicate the regrowth of bone, as apparent from examination of both the peripheral part of the depression and that close to the centre, characterized by reactive new bone formation and substantial bone remodeling. Considerable osseous regeneration is also testified by fusion of the outer and inner bone layers at the defect margins and disappearing of the diploic structure. The radiography reveals a zone of progressive attenuation and the hyperostotic ring (*Figure 5c*), which would indicate the individual's prolonged postoperative survival, since skull bone regenerates slower than long bones (Nerlich *et al.* 2003, White, Folkens 2005). The lesion is a healed incomplete trephination, made several years before the death of the individual.

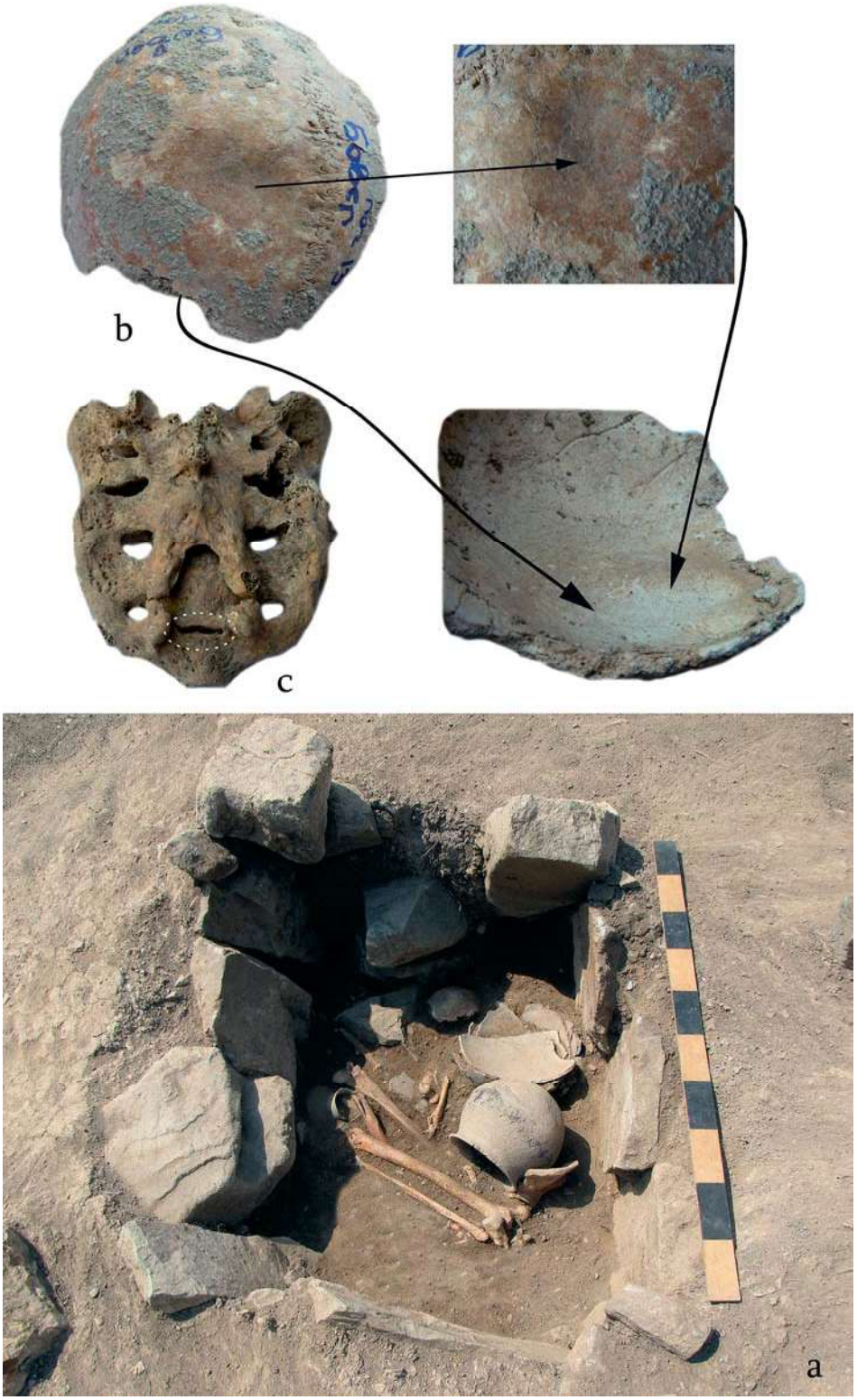

FIGURE 3: Burial (No. 13). Plan of Burial No 13 (a), round blunt force injury in the right parietal (b), transverse fracture sacrum (c).

FIGURE 4: Burial (No. 44). Plan of Burial No 44 (a), round blunt force injury in the frontal bone (b), depressed fracture of the parietal bone (c).

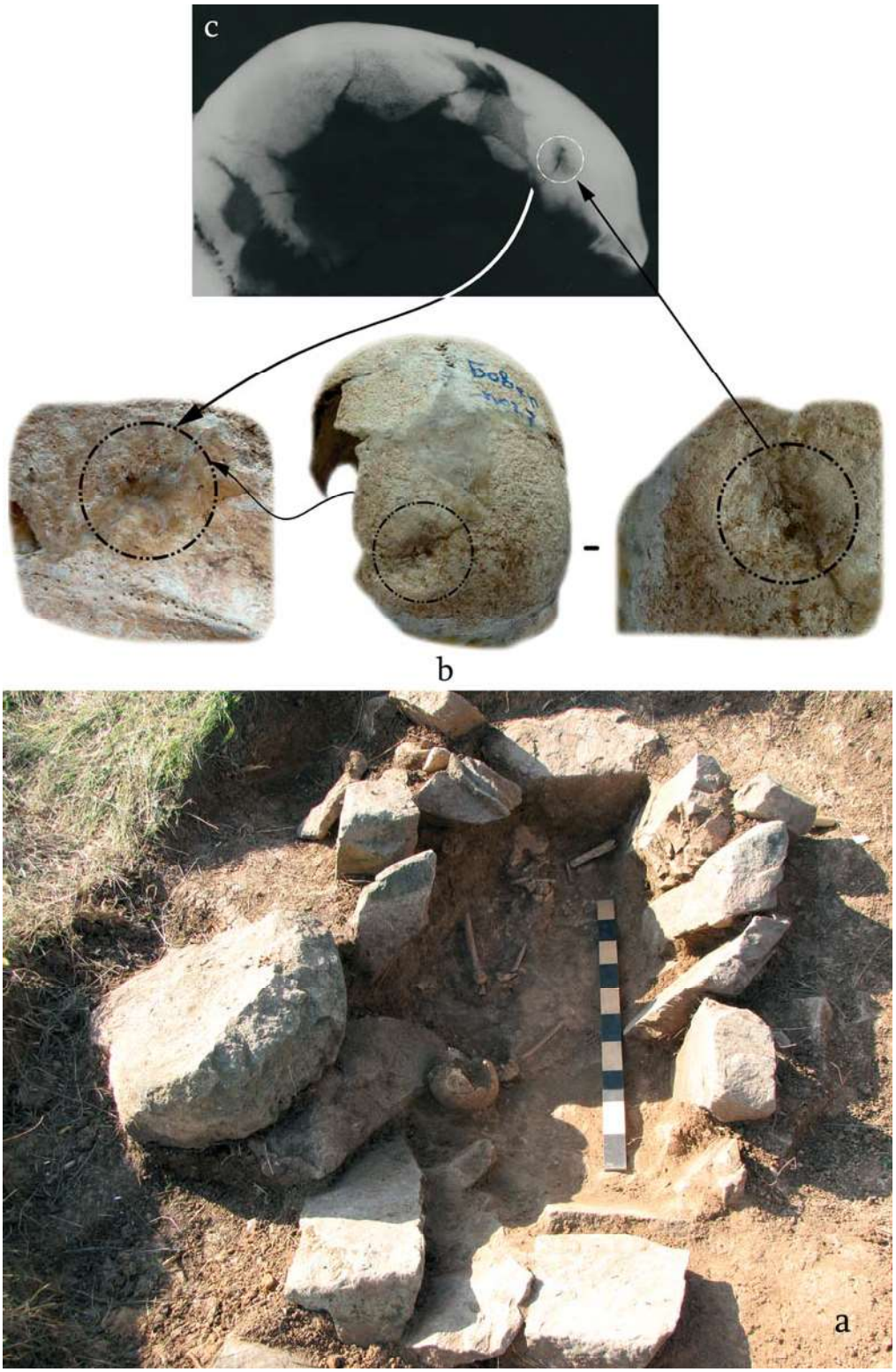

FIGURE 5: Burial (No. 7). Plan of Burial No 7 (a), surface lesions (trephination), gross morphology (b), X-ray (c).

Benign neoplasm

The skeleton of an adult male was discovered in burial 35 (*Figure 6a*).His age at death was determined to be higher than 40 years. The right frontal bone displays a button osteoma (*Figure 6b*). Three individuals from Bover (9.68%, n=31) have osteomas present.

Nine individuals (burials: 40, 16-1, 28, 7, 44, 41, 32, 24, 51) showed external ear manifestations of bony growths. Morphological and paleopathological assessment implicating differential diagnosis of these bony growths identified them as external ear exostoses. Hence, an 81.82% observation ratio of exostoses was revealed from this sample.

Porotic Hyperostosis and Cribra Orbitalia

Almost 39% individual in the Bover sample displays porotic hyperostosis in the form of both active (on the sub-adults) and healed porosity along the sagittal and lambdoidal sutures. This porosity ranges from slight to severe, with the most severe expressions on the parietal bones. Females are more affected (50%) than males (40.91%) although the difference is not significant.

Many individuals (72.73%) also display cribra orbitalia in the form of porosity on the superior wall of the orbit. These pores range from slight to severe. Interestingly, most of the cases of cribra orbitalia are displayed on the sub-adults. Males are more affected (85.72%) than females (50%).

Infectious Conditions

Five out of eight individuals (part of the bones of postcranial skeletons was not preserved) in Bover group were observed to have periosteal lesions. One is female, three are males, and one is of undetermined sex. The most commonly affected bone is the tibia. *Figure 7b* demonstrates a slight healed periosteal bony apposition on the tibia. Other bones displaying signs of periosteal reactions were the femur, radius, metatarsals, and fibula. In most cases the lesions appear to be healed and not active at the time of death, as they are characterized by thickened areas with slight porosity, longitudinal striations, and smooth edges.

The skeletal material from Bover presents only 2 cases of tuberculosis (25%). The predilection sites of osseous tuberculosis are the thoracic and lumbar spine with typical ventral destruction. The spinal affection seems to result from a spread from the thorax (pulmonary, pleuritis tuberculosa) to the adjacent vertebral bodies (via lymphatics, the paravertebral venous plexus) or the systemic spread by the blood stream. Not high frequencies of mastoiditis have been found among individuals from Bover site (20.28%, 3/11). Mastoiditis was found only in three men. The destruction of the mastoid wall and mastoid cells suggests that most cases of mastoiditis were probably acute.

Dental Pathologies

In Bover site, forty-eight dentitions had at least one observable tooth. These dentitions held a total of 335 teeth that were complete and observable. Incidences of enamel hypoplasias were frequent (77.09% of individuals, *Figure 8a*). Thirty-five individuals (72.92% of individuals: 19 males, 4 females, 12 individuals of undetermined sex), all adults, were observed to have a hypoplasia.

The Bover site doesn't show high frequency of chipping (14.59%; 6 males, 1 individual of undetermined sex). One possible explanation for the chipping in sample is the result of biting down on a hard substance.

The Bover site show a high frequency of dental calculus (47.92%; 14 males, 2 females, 7 individuals of undetermined sex) (*Figure 8b*). The most severely affected teeth were the incisors, molars. Three out of 14 observable dentitions (21.43%) possessed some form of alveolar bone loss. The most severely affected teeth in this group were the molars. AMTL was a frequent pathology in the dentitions. Out of 28 observable tooth sockets, 14 teeth were lost antemortem (50%). However, there was a greater occurrence of AMTL (*Figure 8d*) among males than females. The most commonly affected teeth were the molars. Caries affected 18.75% of individuals (6 males, 2 females, 1 undetermined sex) (*Figure 8c*). In terms of the numbers of caries, the molars were most commonly affected. Example of dental caries are shown in *Figure 8c* (burial 51).

The average dental wear was moderate to severe. This trend was observed on both the maxilla and the mandible. The most heavily worn teeth were the first molars and the incisors. The most heavily worn teeth were in seven individuals (males: burial 40, burial 7, burial 44, burial 41 (*Figure 9b*), burial 33, burial 4; female: burial 6).

Dental abscesses were found on 7 individuals, which is 50% of those observable. The teeth most commonly affected by abscesses were the molars, followed by the premolars, canines. Burial 41, adult male, suffered from a large abscess of the right maxillary first molar and heavy dental wear (*Figure 9b*). Periapical lesions are related to pulpitis when an infection penetrates the pulp cavity.

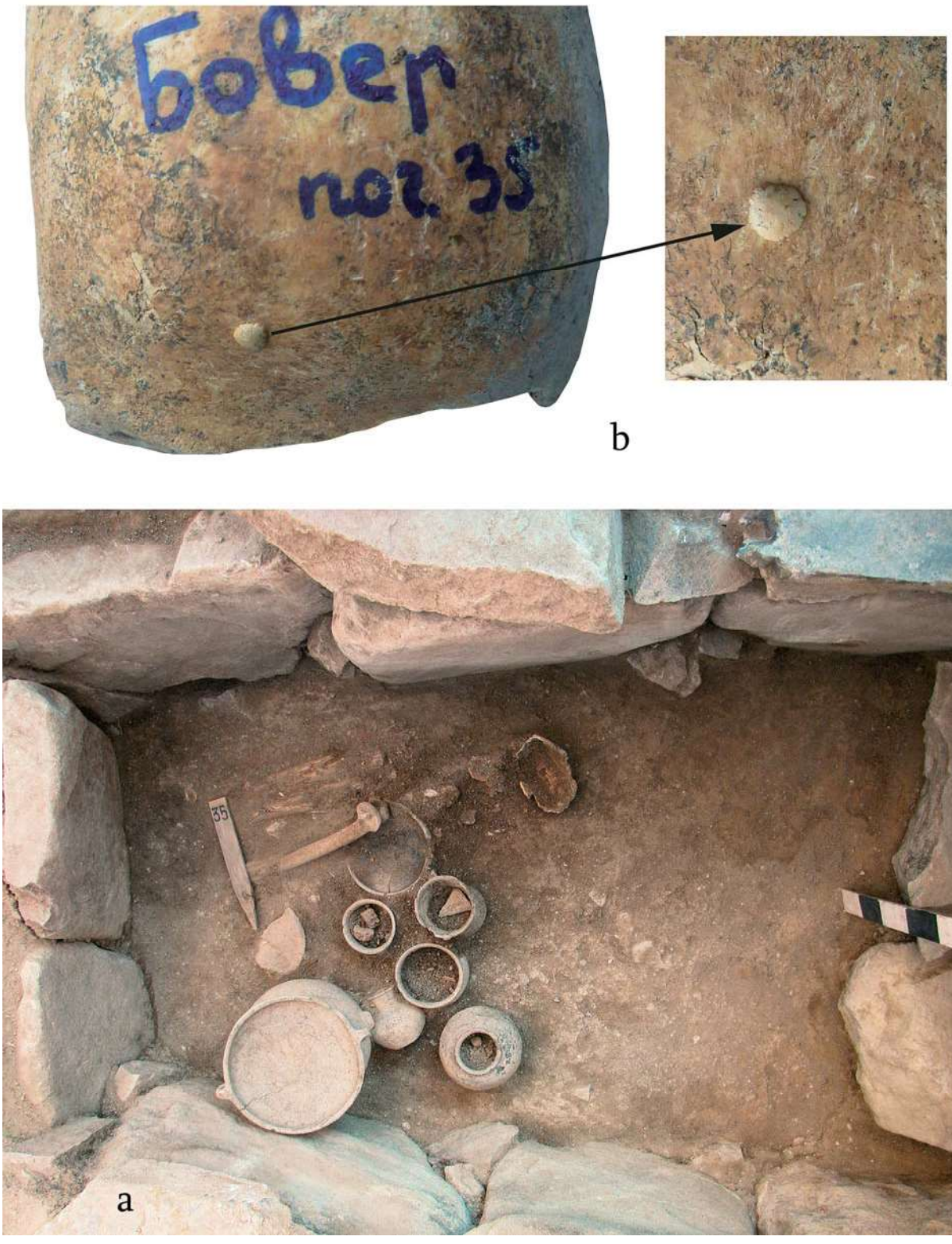

FIGURE 6: Burial (No. 35). Plan of Burial No 35 (a), button osteoma on the right frontal bone (b).

FIGURE 7: Burial (No. 56). Plan of Burial No 56 (a), active and healed periostitis on the anterior-medial aspect of the left tibia. Reactive woven lamellar reaction indicating active infection at the time of death (b).

DISCUSSIONAND CONCLUSION

The purpose of this paper was to provide a brief overview of the pathologies that have been recorded on the Bover skeletal collection to date. This large skeletal collection is unique in that it provides a large sample from a Late Bronze and Early Iron population. Uneven sex ratios, in terms of more males to females, have been reported at Bover site. Yet, the unbalanced sex ratios at this site may be the result of other factors that have nothing to do with differential treatment of the sexes after death. Poor skeletal preservation may have skewed paleodemographic assessments. Another one vexing paleodemographic problem that is found in the

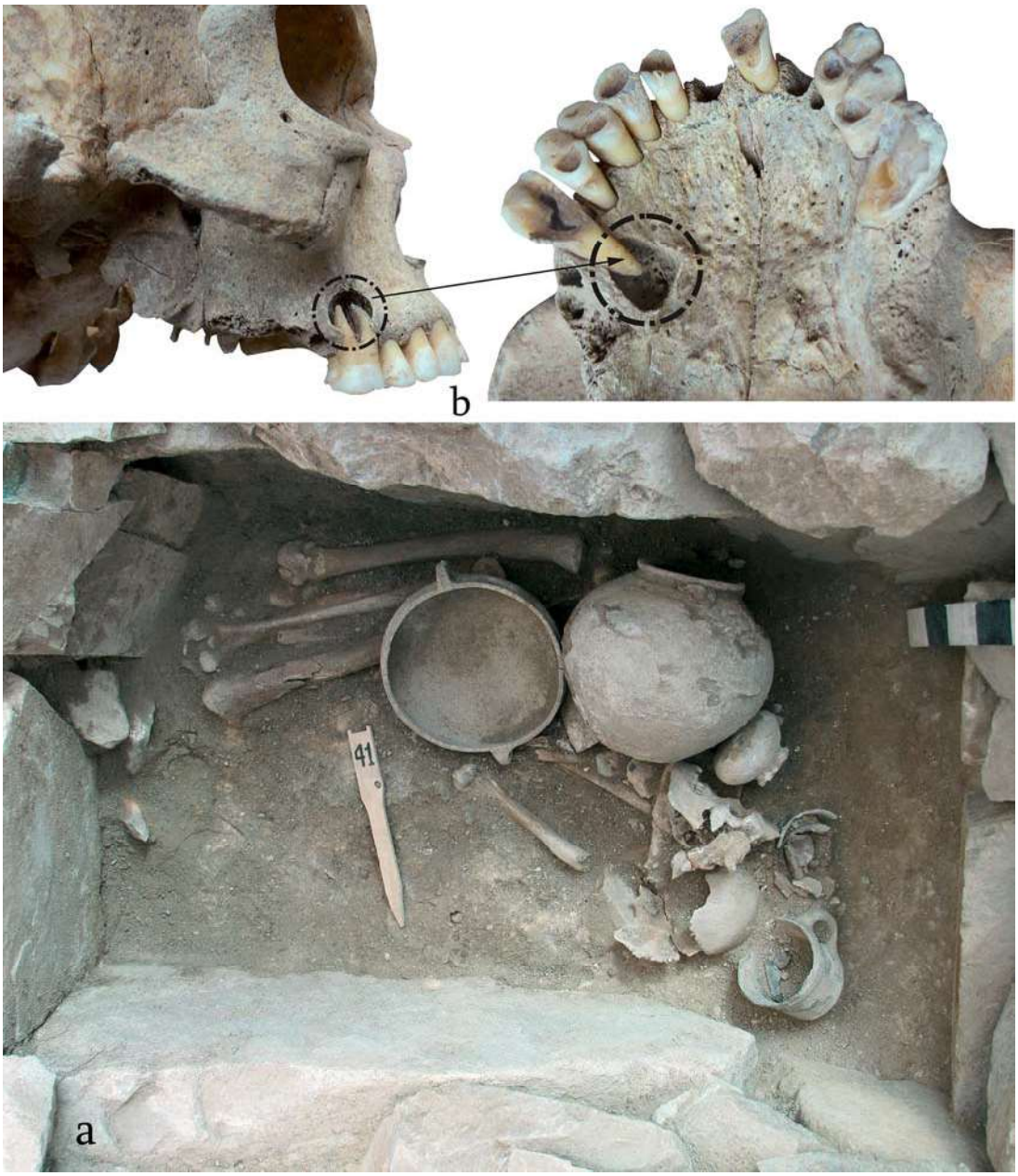

FIGURE 8: Enamel hypoplasias (a), dental calculus (b),dental caries (c), antemortem tooth loss (d).

Bover sample is the paucity of subadults (birth to 20 years of age). Subadults make up only 10% of the sample. This dearth of young individuals is mirrored at other sites in the region (see Khudaverdyan 2012, Khudaverdyan, Hobosyan 2017b). There are several lines of speculation that can be explored in order to explain this situation.

One possibility is that most of the young individuals in the population were surviving to adulthood. Nutrition was good, diseases were few (although know – most diseases don't leave traces on skeleton), and the amount of physiological stress facing the youngsters was slight. This should translate into an excellent state of health not only for the children, but for the

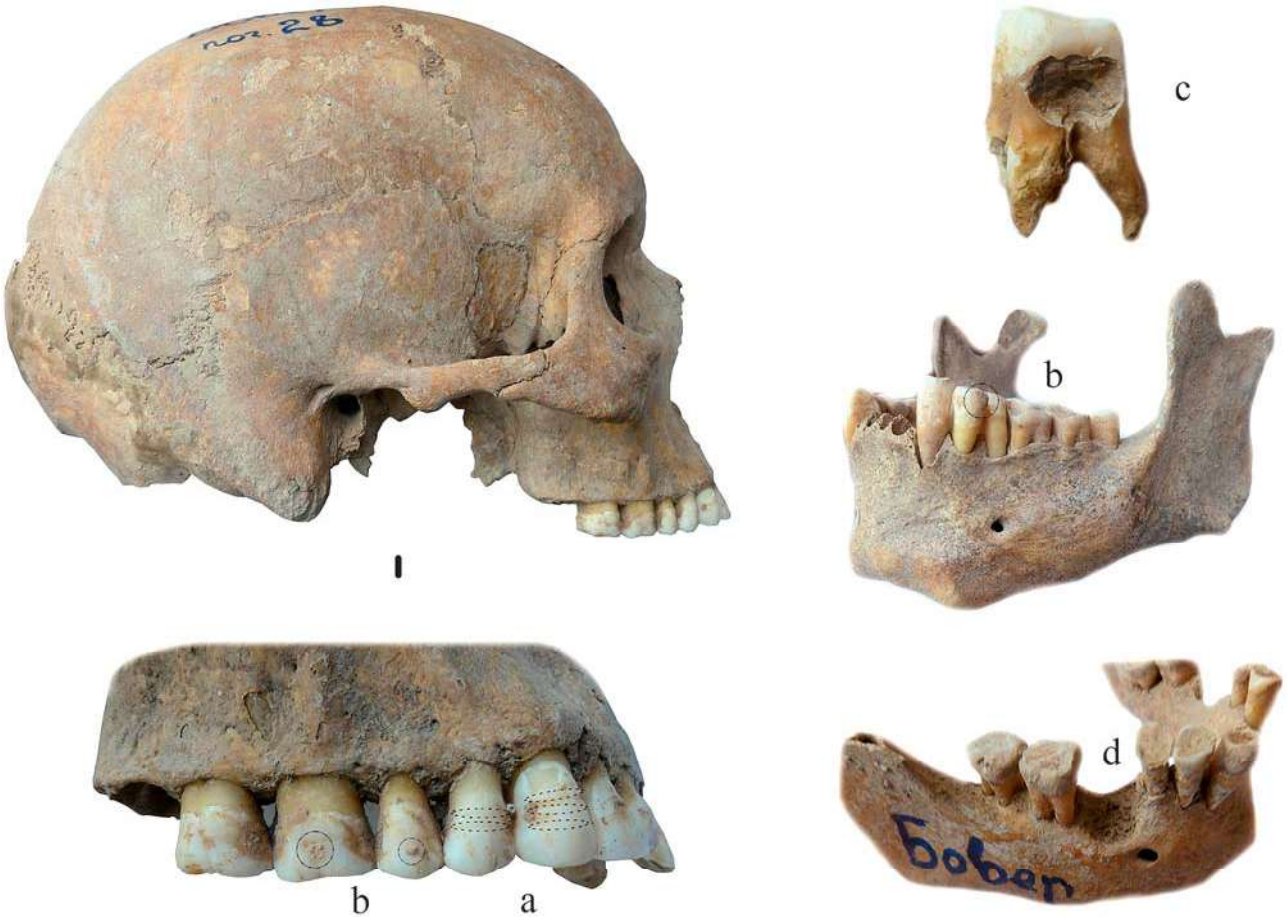

FIGURE 9: Burial (No. 41). Plan of Burial No 41 (a), apical abscess on right maxillary M1, heavy dental wear on the maxillary dentition (M1) (b).

population at large. However, this scenario is not likely. Another possibility for the lack of subadult skeletons is the taphonomic process. The soil type of the Bover site is not conducive to good skeletal preservation. It would be reasonable to deduce that the lighter, less dense skeletal elements of subadults simply did not preserve at the same rate as older individuals. Only 12% of the individuals in the group were assessed as old adults. This dichotomy has implications concerning the health and adaptation of the Late Bronze Age and Early Iron Age.

Through the analysis of skeletal trauma, pathology, and biomechanical markers, bioarchaeologists reconstruct human behavior and life ways of the past (Pearson, Buikstra 2006). Pathological conditions can manifest themselves on the skeleton, especially when these are chronic conditions or the result of trauma to the bone. The interpretation of antemortem fractures was relied on consideration of the skeletal element involved, location on the bone, observed deformation, and factors intrinsic to the individual. Such indicators provide information on the possible type of injury and potential causal factors. The prevalence of skull traumas at Bover is 12.59 %. They are found mostly on the male skulls, and usually these are blunt force traumas of the vault. The injuries were observed on frontal bone (burial 7, 44; both males), on parietal bone (burial 13, 35, 44, males; burial 27, female), and on occipital bone (burial 10, female). There are reasons to suppose that in all cases a similar weapon was used. This could have been the butt of an axe, mace, or staff. One individual (burial 41) displayed signs of a chopping blow to the parietal area. Some injuries were caused during frontal encounters (traumas of

frontal bone and face), while others were caused from behind (parietals and occipital area).

There also are facial traumas: a healed fracture of nasal bones (burial 51, female, 30–39 years). The nasal bones trauma was caused by a blow from the left, thus the woman probably stepped back and right trying to avoid the blow. Another type of trauma is the depressed blunt force injury of the frontal bone (burial 44, male, 40–49 years) (*Figure 4b*). In all cases, signs of healing process and the absence of the inflammatory reaction suggest that the injuries were suffered long before death. In 2 males (burial 13: *Figure 3b*; burial 44: *Figure 4b*) and 1 female (burial 27), skulls depressions of the outer table of the right parietal were detected. In one male (burial 35) the lesion was found on the left side of the skull: the blow was caused from the right. In one case, an elongated incision (24 mm) caused by a weapon with sharp cutting edge was observed on the left parietal (burial 41, male, 40–49 years). The attacker was standing behind the victim, the latter was able to react to the attack and tried to avoid it. Depressed lesions on the occipital bone were found in one male skull (burial 10).

Severe traumas are characterized by the lesions of mixed type that involve several parts of the skeleton (*Figure 3b, c*). A male (burial 13) exhibits signs of a healed fracture in the form of a rounded depression on the right parietal. The injury shows no manifestations of the complicated process of healing, like inflammation or osteomyelitis. After receiving a strong blow to the skull, the man, probably, fell unto his buttocks.

The frequency of cranial trauma is quite variable in all of the samples from Bronze and Iron Ages from Armenia and ranges from 14.3% to 56.3% (Khudaverdyan 2014, Khudaverdyan *et al.* 2014, Khudaverdyan, Hobosyan 2017b). The highest frequencies of cranial lesions are observed at Lori Berd (57.2%), Black Fortress (50%) and Sarukhan (41.7%) groups, and they mainly involved males (Khudaverdyan *et al.* 2014). Approximately 32.5% of the combined sample from Shirak plateau (12 of 37) showed injuries to the cranium. Evidence of trauma was present in the combined sample from the Sevan Region (19.2%, 18 of 94); however, the frequency of injuries in the Sevan Region was lower than that of Shirak plateau (Khudaverdyan 2014). The cranial trauma rate among population from the Bakheri chala (Lori Region, Late Bronze and Early Iron Ages) also was lower 15.63% (Khudaverdyan, Hobosyan 2017b).

The lesion at the right frontal bone is a healed trepanation, made several years before the death of the 35-year-old male from Bover (burial 7). Performance of this type of superficial and ectocranial trepanation was done using a scraping technique. Scraping is defined as removing the required area of bones by gradually scraping away bone tissue (Lisowski 1967). The skin would be cut and folded away from the skull, the shape of either a circle or almond was carved in, and the external bone was removed. The process could be completed by using a simple, sharp, and strong knife. No publication concerns the particular tools used with this technique in Armenian Highland, it is accepted that tools were made of metals, stone, glass and bones (Lisowski 1967). After completion, the skin would be sewed back on. Once healing began, the rough open bone would get covered with a new layer of compact bone but would never completely refill the area that had been removed - leaving a depression.The individual from Bardzryal (burial 97) also provided direct evidence of a trepanation (Khudaverdyan *et al.* 2018). The skull belonged to a female about 20–25 years old (Bardzryal, burial 97). The depression measuring approx. 21.5(±2) mm × 31(±2) mm (the dimensions cannot be determined exactly due to the poor bone preservation) is observed on the left temporal bone. In both incomplete trepanations (Bover and Bardzryal), the regrowth is documented by the dense beveled but uneven edges, resulting in a raised volcano like area of bone surrounding the lesion.Some of the ellipic trepanations were only engraved along the desired shape, and their centre would not be stroken out (Bartucz 1950, Boev 1968, Fóthi *et al.* 2001). When starting the preparation of this special engraved trepanation case, the process was disrupted, and the "surgeon" could only carve the shape into the bone.The shape resembles symbolic trephinations from Hungary, which are only engraved in the bone, and their central portion is not stroken out (Hódmezövāsārhely-Nagysziget, grave 20; Hódmezövāsārhely Nagysziget, grave 65; Bereczki, Marcsik 2005). Ferembach (1970) has suggested that partial trepanation (or symbolic trepanation?) may have been carried out at the proto Neolithic settlement of Zawi Chemii Shanidar in Iraq where three out of eight skulls showed circumscribed circular depressions of the cranial bones, although none penetrated the skull completely. She suggested that in these cases, only the outer table of the bone was operated on.Depressions from blunt force trauma or bone loss due to tumors' could have a similar appearance. However, both of these would likely cause a periosteal reaction of new bone growth above the cranium and have other symptoms. So the

epidermoid tumors' leave a trace, normally conical, with a nodule at the bottom (Campillo 1998). The angiomas, normally originate a very characteristic radiographic image, known as "daisy" (Dietemann 1985). Many other tumours may leave a trace as well, generally, a cupola shape depression, as it usually happens with fibroma (Campillo 1998). Hematoma or trauma to the external soft tissue could result in bony change, but usually these are irregular in shape. Osteoblastomas occur on the endocranial or exocranial surfaces, and the area of involvement is usually small (Cervoni *et al.* 1997, Lin *et al.* 2005). Finally, lesions such as the one on the frontal and temporal bones (Bover, Bardzryal) could result from a localized blunt force trauma. Blunt trauma tends to produce large comminuted or linear fractures and/or compression of the cranial base (Galloway *et al.* 1999, Harvey, Jones 1980, Lovell 1997). None of these tumors' and trauma produces the kinds of depressed lesion seen on the frontal and temporal bones. We believe that the lesions at the individuals from Bover and Bardzryal sites are the cases of therapeutic purpose trepanations. The 30–39 year old male from Bover (burial No 7), in addition to a trepanation on the right frontal bone, had inflammation (mastoiditis). This is the only clue as to why the trepanation was performing. The severity of the mastoiditis in case was obvious. It is likely that trepanation was performed in an attempt to relieve the ear pain. Mastoiditis is an infection of the mastoid process of the skull. It is usually caused by a middle ear infection (acute otitis media). The infection may spread from the ear to the mastoid process of the temporal bone and this could be the reason for the trepanation. Somewhat similar cases of cranial trepanation were found. The oldest cranium with a man made hole found in Anatolia is on display in the Ancient Civilisations Museum. A rather large trepanation had been performed in the left posterior frontal region of the skull dating to the Neolithic Age (Erbengi 1993). The next skull (male, 40–49 years) was found at the site of Hřiby near Kolín (Early Bronze Age). The trepanation hole is located on the left side of the frontal bone (Jelínek 2012). Trepanations also were found on the frontal (24 cases) bones in the Cuzco Region of Peru (Andrushko, Verano 2008, Verano 2016).

Cranium from Bardzryal site (burial 97) showed an abnormal thickening of the left frontal bone where the inner cranial plate bulged into the cranial vault, expanding the diploë space, whereas the outer plate remained unaffected. We believe that trepanation was used specifically to treat the Dyke-Davidoff-Masson syndrome (Khudaverdyan *et al.* 2018). Dyke-Davidoff-Masson syndrome refers to atrophy or hypoplasia of one cerebral hemisphere (hemiatrophy), which is usually due to an insult to the developing brain in fetal or early childhood period (Sharma *et al.* 2006). The clinical features present with recurrent seizures, facial asymmetry, contralateral hemiplegia, mental retardation, and speech and language disorders. The purpose of trepanation was to free the individual from generalized or focal uncontrolled seizures. Little is known regarding anesthesia, which probably was based on herbal preparations. Small wine pithoi and goblets were found in burials Bagheri chala, Bardzryal and Bover (Lori province, Late Bronze and Early Iron Ages), next to the deceased. Parts of different wine glasses were found in the pithoi, probably immersed in wine (Hobosyan 2011, Hovhannisyan *et al.* 2017). Maybe, alcoholic beverages such as wine were given to patients in large amounts, before a trepanation, causing a soporific effect. Pairing wine and hemp (*cannabis* sp.) have been exploited as medicine practices since prehistoric times (Chu 2004). According to the Chronicle of the Three Kingdoms (ca. 270 AD) and the Annals of the Later Han Dynasty (ca. 430 AD; Chu 2004), Hwa Tuo performed operations under general anesthesia. Before the surgery, he gave an anesthetic to the patient to drink to become drunk, numb and insensible. It should be noted that Hua Tuo (c. 140–208) was a Chinese physician who lived during the late Eastern Han dynasty. The historical texts Records of the Three Kingdoms and Book of the Later Han record Hua Tuo as the first person in China to use anaesthesia during surgery. The anesthetic was called "foamy narcotic powder" (or hemp-bubble-powder) and probably dissolved in wine (Chu 2004). It proves the importance of intoxicating preparations containing hemp in the conducting trepanation. Yet, for the time in Armenia not being at least, direct evidence is lacking wine and hemp as an anesthetic during trepanation. In fact, pairing cannabis and wine is fixed in the mortuary rites of the Areni-1 cave. Clay structures were excavated in close neighborhood of an industrial wine production complex proving the incontestable connection of wine production to unique burial rituals held there (Gasparyan 2014, Hovhannisyan *et al.* 2017). One exceptional example is the traces of cannabis and wine in the pithoi.

All neoplasms observed in Bover site were of the benign variety. Cases of benign neoplasms observed in group should be viewed as non life-threatening

disorders. An osteoma (or also known as button osteoma), is a benign, slow-growing tumor which occurs almost exclusively in the skull (Aufderheide, Rodríguez-Martín 1998, Ortner 2003). It is most frequently located on the outer table and is presented as a smooth bump that is usually not bigger than 2 cm in diameter, sharply demarcated, and usually solitary (Aufderheide, Rodríguez-Martín 1998, Ortner 2003).Within the skeletal samples from the Lori Region, external auditory exostoses are almost unique to site. Presence and features of auditory exostoses were investigated in nine individuals in Late Bronze and Early Iron Age in Bov er site. The results showed a high frequency in the male sample (63.64%). Bakheri chala site (Lori region) showed a high also frequency of auditory exostosis (51.73%) (Khudaverdyan, Hobosyan 2017b). Auditory exostoses are commonly recognized as localized hyperplastic growths of predominantly acquired origin. Causes of auditory exostoses include exposure to cold water (Kennedy 1986, Manzi *et al.* 1991), chronic infection or inflammation, genetics, and mastication stress (Aufderheide, Rodríguez-Martín 1998). The exact etiology of the disorder is unknown (Kennedy 1986, Manzi *et al.* 1991). These people from Bover could have been in direct contact with water. It is more likely, that they were included in making canals. Ecological conditions of the Bover and Bakheri chala populations, close to the river, were suitable for exploiting. It is probable that one of the work activities was diving or included in making canals. The frequency of auditory exostosis supports this hypothesis.

The surviving skeletal elements suggest that there was a genuinely low rate of infectious disease during the Late Bronze and Early Iron Ages. The skeletal material from Bover presents only 2 case of tuberculosis. Also two individuals from Bakheri chala (burials 19 and 18) have tuberculosis present, located on the sternum and vertebrae (Khudaverdyan, Hobosyan 2017b). Tuberculosis is sometimes referred to as "disease of poverty" and it is a chronic infectious disease caused by one of the microorganisms of the group Mycobacterium. Aufderheide, Rodríguez-Martín (1998) describe the two phases of the disease: 1) the primary infection phase and 2) the re-infection or reactivation phase. Typical for tuberculosis is both bone formation and bone destruction (Roberts, Buikstra 2003). Tuberculosis of the spine, especially of the lower spine, is highly frequent in all age groups; this can be explained by the red marrow content of vertebrae, ribs, and sternum (Ortner 2003).

Mastoiditis is a severe middle ear infection that is the result of otitis media. Otitis media may be caused by a variety of bacteria, but infections caused by *Streptococcus pneumoniae*, and *Haemophilus influenza* are the most common (Aufderheide 2003, Lewis 2007). The process of pneumatization forms air cells or cavities in tissues, especially in the temporal bone, the ethmoid, and the mastoid (Flohr, Schultz 2009). Berman (1995) lists the complications of mastoiditis that can result in death, including sepsis, meningitis, brain abscess, subdural emphysema, lateral sinus vein thrombosis, and disabilities of the central nervous system, such as spasticity, paralysis, mental retardation, cortical blindness, seizures, labyrinthitis, and facial nerve paralysis. The skeletal material from Bover presents only 3 cases of mastoiditis.

Five individuals in Bover group were observed to have periosteal lesions. Periostitis is a nonspecific inflammatory reaction of the periosteum due to bacterial infection or injury (Larsen 1997, Ortner 2003). The reaction is usually localized and results in lesions of woven bone that appear on the surface as if separate from the cortex (Ortner 2003). Healed periosteal lesions appear denser and smoothed over as they are incorporated into the cortex, but can still be recognized by a thickened appearance with longitudinal striations and/or porosity. Periosteal lesions are commonly observed in archaeological samples, although their etiology in such samples is difficult to determine (Ortner 2003).

Cranial pitting is often viewed as a non-specific response to anemia caused by a number of factors. These factors include genes, diet, parasites, and several other non-specific environmental conditions (Aufderheide, Rodríguez-Martín 1998, Goodman *et al.* 1984, Larsen 1997, Ortner, Putcshar 1981, Stuart-Macadam 1992). In general, the presence of porotic hyperostosis and cribra orbitalia lesions, regardless of their origin, is associated with a poor quality of life (Larsen 1997). Through this research, the expected findings are that adults will have higher prevalence of cribra orbitalia. Total frequency of cribra orbitalia in Bover (72.73%) is somewhat lower than the frequency recorded of the Bakheri chala sample (83.34%) from the territory of the Lori Region (Armenia) (Khudaverdyan, Hobosyan 2017b). Total frequency of cribra orbitalia in Bover and Bakheri chalar is somewhat higher than the frequencies recorded in most of the skeletal samples from the territory of the Armenia (Khudaverdyan 2010, 2011b, 2012). Porotic hyperostosis in Bover group was seen in 12 cases and

in Bakheri chalar was only seen in 7 cases. The presence of porotic hyperostosis and especially cribra orbitalia is a great indicator to determine the health and nutritional status of past populations (Facchini *et al.* 2004).

Cribra orbitalia may be also associated with dental enamel hypoplasia which also indicates stress periods in life. Dental enamel hypoplasia is a disturbance/ disruption in the formation of enamel during a tooth's development (Hillson 1979, Lukacs 1989). It is usually observed as a transverse line or band of depressed enamel on the sides of the tooth crown and is believed to possibly indicate dietary/ nutritional deficiencies or physiological stress (such as illness) in childhood (Hillson 1979, Lukacs 1989). It is generally accepted that the stress that could cause enamel hypoplasia can occur between the ages of 0 and 7 years; 13 if on the third molar (Mays 1998). Lovell, Whyte (1999) point out that the presence of hypoplasia in the deciduous dentition often reflects maternal and neonatal hypocalcemia, while hypoplasia in the permanent dentition reflects nutritional and infectious stress that is commonly associated with the process of weaning. Enamel hypoplasias occurred in a high frequency in dental samples in Bover site. Out of all the individuals excavated, 77.09% had one or more teeth affected by dental enamel hypoplasia. Dental enamel hypoplasia have higher frequencies in males in Bover site (86.37%). Total frequency of enamel hypoplasias in Bover is somewhat higher than the frequencies recorded of the skeletal samples from Bakheri chala (60%) of the Armenia (Khudaverdyan, Hobosyan 2017b). This suggests that the Late Bronze Age and Early Iron Age was a time of great nutritional stress. The archeological record indicates that population increased in the Late Bronze, which would have meant greater competition for resources.

Dental caries are the most common form of dental pathology and are age progressive (Larsen *et al.* 1991). The prevalence of caries depends on diet, oral hygiene, fluoride levels in the water and the general immune status of the individual. Carious lesions can ultimately contribute to pulpitis, periodontal disease and antemortem tooth loss. The skeletal material from Bakheri chala shows higher frequency of dental caries (24%) (Khudaverdyan, Hobosyan 2017b), than in Bover site (18.75%). The majority of carious lesions were on occlusal surfaces, indicating the consumption of refined carbohydrates as they are sticky and are easily trapped in grooves of the enamel surface. Caries occurs in higher frequencies in agricultural societies (Larsen 1997). Agriculture introduced people to carbohydrates, or sugars, which affect the teeth and cause dental caries. The staple diet of ancient population from Lori region (Shnogh river) consisted of wine, bread, vegetables, and fruits (Hobosyan 2011).

Dental calculus was recorded on the teeth of 23 individuals (47.92%) in Bover sample. Calculus is mineralized plaque that has accumulated on the enamel surfaces of teeth as the result of poor hygiene and diet (Hillson 1996). Plaque buildup can occur in diets with heavy carbohydrate consumption (Hillson 1996), although protein may increase oral alkalinity, thereby promoting calculus mineralization. Studies suggest that the presence of calculus can result in protection against caries as the tooth surface is covered with hard concretions making it less susceptible to infection (Hillson 1979). The calculus build-up on these individuals is quite severe and starts at a young age. In addition, research has reported that diets high in coarser foods, such as grains, produce fewer instances of caries due to the natural cleansing process resulting from chewing these foods (Buikstra, Ubelaker 1994). However, the above-mentioned foods consumed by the Bover contain coarser grains, which can cause heavy occlusal wear and periodontal disease. This heavy mastication can become an irritant to the alveolar bone, which results in the resorption of the bone. Calculus formation is also a common cause of periodontal disease (Ortner 2003). Dental calculus is quite heavy in Bakheri chala population (40% individuals) (Khudaverdyan, Hobosyan 2017b).

The enhanced frequencies of abscesses have been found in Bover group (50%). Dental abscesses were found on 30% individuals from Bakheri chala (Khudaverdyan, Hobosyan 2017b). Abscesses of a tooth lead frequently to its exfoliation and cause a remodeling process that usually destroys the alveolus and reduces the size of the alveolar process at the site of the tooth loss (Ortner 2003). Some researchers state that abscesses are caused by *Fusobacterium nucleatum, Streptococcus milleri, or Streptococcus mitis* (Oguntebi *et al.* 1982, Lewis *et al.* 1986). Herrera *et al.* (2000) report that abscesses can be caused by various sources, such as pulp necrosis, periodontal infection, trauma (may be caused by uncommon things, such as a piece of a toothpick, a popcorn kernel, or a piece of dental floss), or surgery. Abscesses originate at the apex of the root canal, commonly of a non-vital tooth, and are associated with the destruction of the alveolar bone (Herrera *et al.* 2000).

Dental chipping is an ante-mortem irregular crack in the enamel or enamel and dentine of a tooth, usually on the buccal, lingual, or interproximal edge/crest of

the tooth (Milner, Larsen 1991). It is generally associated with masticatory and non-masticatory activities and can result from chewing and crushing hard and abrasive foods or extraneous substances (e.g. shell, fruit stones, bone), gripping an object between the teeth, or accidental trauma (Molnar 2008). Chipping of the teeth has numerous causes, but is generally the result of a large compression and tensile force whilst biting down on something. One possible explanation for the chipping in sample is the result of biting down on a hard substance. A higher incidence of chipping on the posterior dentition, rather than the anterior, suggests an etiology related to the diet, mastication techniques, hardness of foodstuffs and the inclusion of foreign particles in the oral cavity, whereas chipping of the anterior dentition often suggests an etiology of trauma (e.g. a fall or fight) or use of the teeth as the 3rd hand (Khudaverdyan *et al.* 2014).

Antemortem tooth loss is characterized by remodeling of the alveolar bone that leads to the obliteration of the tooth sockets. Determining the etiology of AMTL is difficult as evidence may have been lost, especially in instances of carious teeth (Hartnady, Rose 1991). However, the close association between periodontal disease, dental caries, and AMTL is well established, especially in archaeological populations (Larsen 1997, Khudaverdyan 2012). The overall frequency of AMTL in the dentitions in Bover group is 50%. There was a greater occurrence of AMTL over group among males from Bover than females. The skeletal material from Bover shows higher frequencies of AMTL, than in Bakheri chala site (32%) (Khudaverdyan, Hobosyan 2017b).

Through adopting a biocultural approach it is hoped that this research will provide a greater understanding of lifestyles, diet, health and economy in a Late Bronze and Early Iron population in Lori Region (Armenia). This analysis of the individuals from the Lori region is by no means complete, but it provides a data set to be used for future studies.

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