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Population of the Armenian Upland: Paleopathology and Paleoecology

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There is then just one science of men in time.
It requires us to join the study of the dead
and of the living.

M. Bloch

ABSTRACT

Population of the Armenian Upland has a complex gene pool consisting of diverse and different levels of microevolutionary lines. It is a product of not only differentiation, but integration as well. The ethnic and cultural influences fixed by monuments of archeology and history, judging by anthropological material, were not so strong as to change the process of ethnogenesis among the Armenian people. A consecutive comparison of data allowed tracing the continuity line: the so-called "directed in time" changes of skull structure are thus considered, of course, mainly the brachycephaly processes, which are accurately fixed in the sixth period (XX century). Upon analysis of the epoch-making variability of tooth system in representatives of the Armenian Upland, we have concluded that the microevolutionary changes of teeth in the populations inhabiting this region had an identical direction: the tendency to reduction. Various pathological changes in population of the Armenian Upland were revealed. They are present on the general background of disadaptive processes of an organism to extreme social conditions. The overestimated frequency in occurrence of such signs as anemia, enamel hypoplasia, caries, lifetime loss of teeth owing to inflammatory process, cases of odontogenic osteomyelitis, Kashin-Beck disease, etc. indicate that the organism here was exposed to internal and external stressful influences varying in force and duration.

KEYWORDS: Armenian Upland, ethnogenesis, paleopathology, cryogenic stress, nutrition stress, enamel hypoplasia, infections.

Anthropological features of people in no way define the direction of a historical process; nevertheless, the formation of their physical shape, spreading and changes are indirectly connected with history of the concrete people. It is not always that history of the people equally and simultaneously states the history of all ancient components that have formed this people. Paleoanthropological analysis reveals these components defining their contribution to the formation and development of people. Now we have a clear general idea of the physical shape of people, who occupied the Armenian Upland throughout all basic stages of history in this region.

The first period *(IV-III millennium B.C.).* The analysis of craniological signs reveals two basic Caucasian layers.

The Mediterranean variant I: Representatives of this type have rather narrow and low face that is the most typical feature of this variant. The forehead is average; the nose is of average width and prominent. It pertains to the craniological series from Lanjik and Djrarat.

The *Mediterranean variant II*: Among morphological signs it is necessary to allocate high and average width face. A frontal bone is wide enough and of average bent. This group involves series from Shengavit and Meidanner.

The second period (*XV/XIV – XI centuries B.C.*). The basic components comprising combination of the above noted signs distinctly come to light. Subjects from Nerkin Getashen were attributed to *Mediterranean variant I*, and those from Artik were ascribed to *variant II*. As we see, this

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same population occurred in these places in the preceding period.

The third period (*XI – IX/VIII centuries B.C.*). The analysis of anthropological signs allows revealing a similar combination of signs. Skulls from Sarukhan and Artsvaqar belong to *Mediterranean variant I*, and subjects from Noraduz I, Tsamakaberd and Horom belong to *variant II*.

In **the fourth period** (*VIII – VI centuries B.C.*) population of the Armenian Upland is attributed to the *Mediterranean variant III*. Representatives of this type have rather narrow and high face, most typical for this variant. In this group we included series from Noraduz II and Urartu.

The fifth period (*I century B.C. – III century A.D.*). The detailed analysis of craniological materials from the Beniamin necropolis has allowed to discover difficult anthropological structure of the ancient population of the Armenian Upland and reveal the reasons of anthropological and ethnic heterogeneity of the population [*Khudaverdyan A., 2000; 2001*]. The analysis of signs gives the chance to allocate two groups of the population. The first complex of signs is not local. The second complex is the most ancient and should be attributed to the *Mediterranean variant II*. The specified complex is one of the basic components of anthropological structures of the Armenian Upland population in later period [*Khudaverdyan A., 2000*]. Ancient skulls are of the *Mediterranean variant I* from Shirakavan and Karchaghpyur necropolises.

The genesis and destiny of another component established on the paleoanthropological material of Beniamin necropolis during an ancient epoch is of great interest. The search for this burial, conducted by a wide comparison to anthropological complexes of an ancient epoch from surrounding territories, permits the assumption that carriers of this complex could not be numerous and were gradually dissolved in the local Mediterranean population. It is necessary to state that carriers of this complex remind representatives from the territory of Moldova (Nikolaevka) and Turkmenistan (Meshreti-Takhta) [*Khudaverdyan A., 2000*]. Does this complex of signs at the Armenian Upland have ancient roots? The paleoantropologic materials considered above (despite some lacunas), give the chance to ascertain that carriers of this complex of signs have appeared during the considered epoch.

The sixth period (*XX century*). The final stage of ethnogenetic process at the Armenian Upland is also reflected in the anthropological data. Research of Armenians' craniology (Van area) from the point of view of their place among the ancient population has shown an affinity of Mediterranean (Armenoid) type with previous representatives from territory of the Armenian Upland. This complex pertains to the *Mediterranean variant II*.

The ethnic and cultural influences fixed by monuments of archeology and history, judging by anthropological material, were not so strong that to essentially change the process of ethnogenesis in the Armenian people. The consecutive comparison of data allowed tracking the continuity line (the so-called "directed in time" changes in a skull structure are thus considered, of course, mainly brachycephaly processes, which are accurately fixed in the sixth period). The complex introduced by an alien component remains away from this line of development. Most likely, it was completely dissolved in the local population. The main local substratum, the variant of which is presented in the ancient population of the Armenian Upland underlay further formation of the pivotal anthropological complexes of the modern population of Armenia.

Through intergroup comparisons of cranioscopical markers [*Berry A., Berry R., 1967; Movsesyan A. et al., 1975; Kozintsev A., 1988*] a considerable level of the transgression, consideration of which is especially important since it reflects the degree of genetic interactions from a position of an initial genetic kernel, is ascertained [*Khudaverdyan A., 2009*]. In local samples, as elementary units, the variability range, whose scale can be applied in quality as the most adequate base for phenotypic changeability, is presented as much as possible. Interconnected sub-group in relation of the taxonomical division can be the result of various processes. In fact, it is possible to present ethnogeny as a process of systemogenesis, in which historical dynamics is provided with variability and combination theory of the markers realized within borders of a concrete ethnic range. The stable part of system (ethnics) remains due to steady genes, the conservatism of which is defined in many respects by action of a variety of barrier conditions (ecological, ethnocultural, confessional).

Groups occurring at different times in one geographical zone, the Shirak Plateau, belong to one cluster, namely:

- Lanjik (*V-III millennium B.C.*);
- Black Fortress (*II millennium B.C.*);
- Black Fortress I (*I century B.C. – III century A.D.*);
- Artik (*XV / XIV– XI centuries B.C.*);
- Shirakavan, Beniamin, Vardbakh (*I century B.C. – III century A.D.*)

Another cluster of population lived in geographically differing conditions, but in all cases near water reservoirs, and there was much in common in their diet [*Khudaverdyan A., 2009*]:

- Nerkin Getashen (*XV century B.C., XIII–XII centuries B.C., IX–VIII centuries B.C.*);
- Karmir, Sarukhan, Artsvaqar, Qarashamb (*XI–IX / VIII centuries B.C.*);
- Karchaghpyur (*I century B.C. – III century A.D.*);
- *Crania Armenica* (*XX century*).

The analysis of cranyoscopic (discretely varying) signs revealed territorial differentiation of groups, and the influence of ecological factors is not excluded.

The height of representatives from the Armenian Upland is medium. Since the late Bronze Age it remained without changes till the III century A.D.; only in the beginning of the XX century some acceleration has been observed to proceed till nowadays [*Khudaverdyan A., 2001*].

The set of odontologic signs represents a complex of the heterogeneous indicators, allowing the investigation on the ethnogenetic and reduced processes. They also differ in degree of epoch-making conservatism, intergroup correlatedness, genetic determination, transgression or discreteness. Distribution of such signs as shovel-shaped crown of central incisor, (I^1), 6-cuspid forms of the first molar (M_1), 4-cuspid forms of M_1, DTC, DW, TAMI, 1eo (3) on M^1 and crowding without considering non-similarity/heterogeneity of groups might be characterized as partial (insignificant) transgression or its absence that is accepted as a criterion of their differentiating ability. Other signs: Carabelli's tubercle on M_1, 2med (II) on M_1, a reduction of hypocone on M^2, spacing, etc., are not excluded from the list of significant components of the ethnogenetic analysis and epoch-making transformations of the tooth system. Having analyzed the epoch-making variability of tooth system among representatives of the Armenian Upland, we have come to conclusion that the micro-evolutionary changes of teeth in the populations occupying this region had an identical direction: the tendency to reduction [*Khudaverdyan A., 2011*].

Estimation of the general health status according to stress markers

The urgency, scientific and practical value of a profound and comprehensive study of the ecological traditions of separate populations, processes of their formation, historical development and interaction with other sociocultural traditions are first of all caused by a great necessity of identifying all the rational and useful contributions in cultural and historical heritage of each people – large or small - for overcoming the challenges faced by humanity in the modern world. In this connection the analysis of the enormous historical experience of separate peoples that have developed singular methods for regulation of the interrelations of a person and nature, society and nature, human being and society, - is of the utmost value.

The study on skeletons of people of different epochs considering conditions of their life and work provides the anthropologist with the richest material for study of the ancients. This latter is aimed at revealing laws of specific evolution of the human being and its variability conditioned by concrete influence of natural and social conditions of their lives. The estimation of such an approach is based on the interrelation of peculiarities in adaptation of the person to various conditions of existence depending on individual properties of an organism, and its non-specific resistance as well. The process of organism adaptation to its environment is one of the main components of the biological history of humankind and represents a universal phenomenon. Adaptation shifts in an organism occur and concern all levels: from the cellular to the whole organism. The adaptive properties of an organism, whether in the form of physiology or character of behavior, are inseparable from the environment, in which it lives. Adaptive reactions of the person to outward environmental influences can be carried out both at the level of acclimatization that is genetically determined by norm of reaction and at level of evolutionary adaptations conditioned by natural selection. During evolutionary adaptation, as the longest process of adaptation to the environment occurring throughout the life-span of many generations, there occurs a redistribution of already available and accumulation

of the new genetic information. Maintaining balanced functional reactions, the genetic "luggage" to the highest possible extent allows the organism to cope with the constantly changing conditions of the natural and social environment. The physiological and morphological variety of features marked in modern populations is the basic condition for existence of *Homo sapiens* widely settled all over the entire inhabited world and the consequence of both great intra-individual, inter-individual and intergroup variability that is characteristic for this species.

Anemia: The analysis of markers of anemia at the paleoanthropological level shows the influence of natural factors and habitat conditions (changes of food allowance, population density, migration, transition to another type of managing and housekeeping, etc.) [*El-Najjar M. et al., 1976; Lallo J. et al., 1977; Stuart-Macadam P., 1992*] and allows considering the prevalence of anemia during various historical epochs as well. Anemia implies reduction of total blood volume or decrease of erythrocytes count and hemoglobin. It is necessary to note that any congenital or acquired form of anemia in the conditions of high mountains can lead to more serious consequences compared to those at sea level. Specific changes on the upper internal surface of an eye-socket (anemia, *cribra orbitalia*) have the maximum frequency of occurrence among those buried in the IV-III millennium B.C. in the Lanjik necropolis and a low frequency in the ancient population of Beniamin (Figure 1). The sign is non-uniformly distributed among age and sex groups. In women of the early Bronze Age (Lanjik) the sign is met more often than in men (80% and 50%). In children of the series, this sign does not exceed 50%. During the late Bronze Age (Black Fortress) anemia turned to be met here less often (54.6%). The maximum frequency of occurrence is noted in adult men (100%) from the Black Fortress necropolis, and in women the frequency of *cribra orbitalia* does not exceed 55%. In the group of observed children's skulls, the sign is noted in 33.4% [*Khudaverdyan A., 2009*]. In men *cribra orbitalia* is met more often than in women; at antiquity groups in Beniamin and Vardbakh this refers to all age groups. In all cases the sign is expressed poorly. The fact of lower frequency in occurrence of the given stress marker in ancient women can be interpreted as an indirect evidence of slightly better state of health in females, probably owing to social reasons. Overall, stress loads, judging by this indicator, were extremely great at the territory of the Armenian Upland [*Khudaverdyan A., 2010 a; b*].

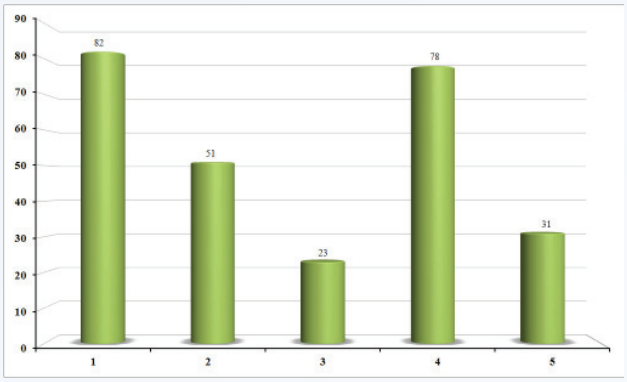

Figure 1. *Anemia at buried from the Armenian Upland: 1. Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.*

Periostitis: Periostitis is reaction of a bone tissue to a wide range of pathogenic reasons [*Orthner D., Putchar W., 1981*]. Anemic syndromes, infections, and inflammations of traumatic origin are the causes of periostitis [*Orthner D., Putchar W., 1981*]. The presence of periostitis and paraperiostitis manifestations is noted in 53.9% of population of the late Bronze Age from the Black Fortress necropolis (no osteological material remains in the Lanjik series). The frequency of the sign is very high, providing the basis to assume the adverse external influences and, most importantly, extreme environmental factors, lack of food, etc. Our observations allow to assume that subjects from the Black Fortress necropolis during life were exposed to considerable physical loads, especially on the shoulder girdle ("rider's complex") [*Khudaverdyan A., 2009*]. It is possibly connected with restrictions on pedestrian mobility in the conditions of high mountains. Inactivity in a cold environment could cause an overcooling of feet and development of stagnation in the peripheral blood and lymphatic systems, promoting the onset of periostitis. Attention should be paid to sign distribution in the series from ancient (antique) burials (Beniamin - 32.3%, Vardbakh - 61.6%, Black Fortress I - 21.1%). It should be noted that periostitis and *cribra orbitalia* are as much as possible fixed in those buried in the Vardbakh necropolis. It is interesting that among those buried in Vardbakh, periostitis is more often fixed in women and is much rarer in men (♀: 38.5% and ♂: 15.4%) and children. Periostitis is possibly caused by stresses connected with

the kinds of activity of the adult population. The population engaged in cattle breeding was probably infected by helminths. All stated data clearly suggest that in this and other pathological processes, it is necessary to consider bones not separately, but as part of a uniform biological whole associated with the general vitality of the human being.

Cryogenic stress: A decrease in the partial oxygen pressure in the air is one of factors among severe climatic conditions of high mountains. The low temperature and air humidity, gale-force winds, increasing intensity of solar radiation, especially in the ultraviolet spectrum create a difficult complex of weather conditions in mountains, thus exerting a stressful (cryogenic) influence on the human organism**.** In paleoanthropological materials vascular reactions of bone tissue are more frequent: the wide, nutritious apertures form a porous surface that reminds an orange-peel [*Buzhilova A., 1995*]. This sign is marked on the frontal (Figure 2), parietal and occipital bones of the skull-cap: the presence of vascular changes of skull-cap bones was noted in 30.0% of Bronze Age representatives of Lanjik and 41.7% of the Black Fortress inhabitants. Men and children experienced a much higher degree of cryogenic stress than women; for the most part of the day women stayed at home and were engaged in domestic tasks. The vascular changes of skull-cap bones

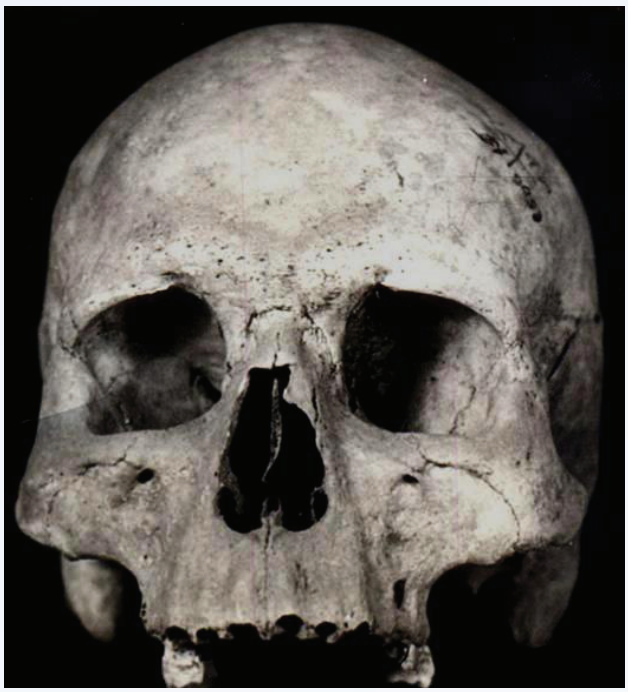

Figure 2. *Cryogenic stress. Materials from excavation of Lchashen necropolis (Bronze Age).*

are rarely (minimally) observed in the ancient population of the Armenian Upland. It is easily noticed that population of the late Bronze Age (Black Fortress) was to the maximum subject to cryogenic stress. Such a wide occurrence of this marker in the Black Fortress group testifies that they spent a long time in the open air and their vascular system was adapted to such conditions (Figure 3).

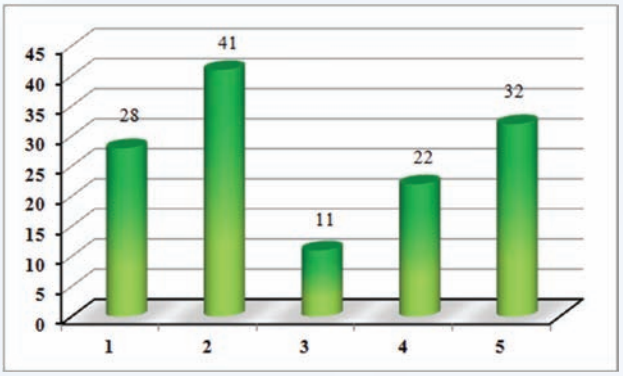

Figure 3. *Vascular reaction of skull bones in the buried from the Armenian Upland:*
1. Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.

In the conditions of elevated cryogenic stress the type of lifestyle with a high-calory diet containing a high percentage of proteins and fats is formed. On the contrary, at decline of extreme cold environments the specific gravity of products with a high content of carbohydrates in a food allowance, which is characteristic of an agricultural type of economy, increases. A number of diseases are to some extent provoked by food stresses. As one of direct markers of food stress, caries (Figure 4) must be considered in paleopopulations.

Figure 4. *Caries. Odontogenous osteomyelitis. Materials from excavation of Black Fortress necropolis.*

In representatives of the Bronze Age the occurrence of caries is maximal (Figure 5). Through the results of the chronological changeability in level of caries, it is possible to conclude that such factors as use of natural preserving agents, the specific mode of thermal processing of food, and the occurrence of new foodstuffs influenced the structure of a diet as a whole, thus affecting the teeth in the population of the Armenian Upland.

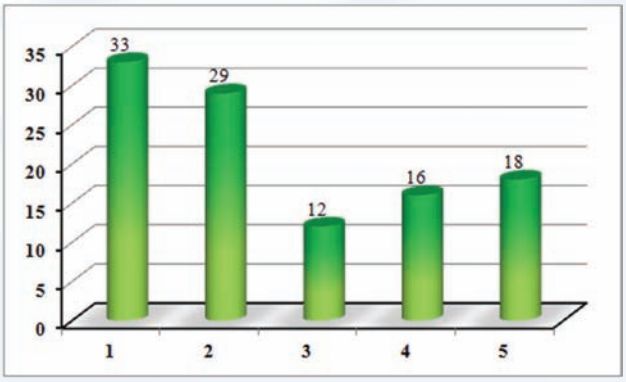

Figure 5. *Caries at buried from Armenian Upland: 1. Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.*

For estimation of functional loads on the dentoalveolar apparatus, signs of deterioration on the chewing surface of teeth, occurrence of peculiar thickenings (*tori*), arthrosis of jaw joints, etc. are be used [*Rokhlin D., 1965; Buzhilova A., 1998; Khudaverdyan A., 1997; 2000*].

Considerable and constant load of rough food promoted the occurrence of torus-like thickenings at the alveolar edge from the interior of the upper and lower jaws. According to our data, these thickenings were torus- and cone-shaped. The extent of these thickenings was various, more often at level of roots of one or two teeth, more rarely at three or four teeth. The minimum frequency of this sign was revealed during the late Bronze Age (Black Fortress), and maximum was observed during the antique age (Vardbakh). These structures are considered as the original buttresses appearing as a result of considerable mechanical loads on the roots of teeth. Such loads arose when the subject gripped an article and clamped his teeth, trying to extend the mentioned making great efforts. Similar pressures are typical for a number of economic operations known from ethnology (tawing leather, tightening of cords (strings) from tendons, etc.). Therefore, subjects with cone-shaped swellings can be considered as indirect proof of intensive economic activity of the ancient population.

It is possible to trace the defect of tooth enamel to food pathologies (enamel hypoplasia). Enamel hypoplasia is the developmental anomaly at infringement of its structure and growing out of insufficient or slowed down function of adamantoblasts. The change of their function occurs as a result of infringement of parathyroid glands activity that occurs in such illnesses as measles, scarlet fever, syphilis, rickets, etc. Among those buried in Beniamin (an antique epoch), the frequency of marker occurrence is minimal at the territory of the Armenian Upland. However, to characterize paleopopulations of the Armenian Upland as a whole, it is necessary to note the high percentage of occurrence of enamel hypoplasia (Figure 6).

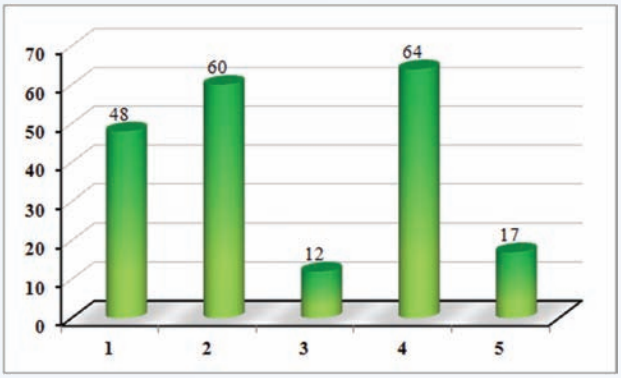

Figure 6. *Enamel hypoplasia on teeth in groups from Armenian Upland: 1. Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.*

Enamel hypoplasia is noted in as much as 66.7% of population from the Vardbakh burial ground and in 61.7% of buried in the Black Fortress. The relatively high frequency of enamel hypoplasia in all age groups, including infants, points to the persistence of a stressful situation in childhood. The absence of an accurate difference between discussed indicators in adults and children also testifies that these stresses, in general, did not result in destruction. Full absence of enamel (aplasia) more often met on hillocks of molars or cutting edge of incisors is sometimes marked. The size, depth, localization of a site of lesion depend on age and duration of action produced by factors breaking calcination. The maximum degree of affection of enamel is noted in population from the Black Fortress.

Being a reaction of an organism to adverse conditions of development, fluctuating asymmetry within a

person reflects the stress level in a population [*Nass G., 1982;* K*hudaverdyan A., 2005; 2009*] (Figure 7).

Special kinds of teeth asymmetry are indicators of the physiological stresses an organism bore in childhood. Asymmetry in size and structure of teeth has an undirected, fluctuating character connected with fluctuations of penetrance and expressivity of genes owing to a complex of reasons: environmental in character, genetic, etc. Fluctuating asymmetry is more distinctly shown in ethnic groups with an

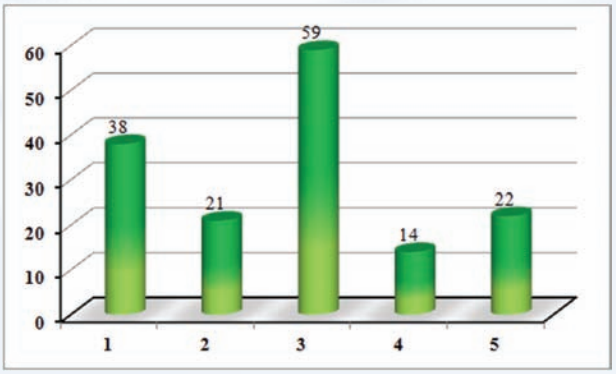

Figure 7. *Asymmetry of teeth in groups from Armenian Upland:*
1. Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.

archaic type of economy, in a way that is coordinated with a conclusion on links of this phenomenon with harsh conditions of life. Among those buried in Beniamin (an antique age), the frequency of this marker occurrence at the territory of the Armenian Upland makes it necessary to note the maximum asymmetry, as the minimum frequency of a sign is revealed in the antique-age population of Vardbakh. Recognizing that the groups lived in an identical environment and, probably, had a similar economy, it is possible to assume that distinctions in stress indicators were defined by different group size and the sociocultural conditions of life of the three ancient settlements (Beniamin, Vardbakh, Black Fortress). The most probable reasons of these stresses are the following: hunger, undernourishment, and pathologies of the gastrointestinal tract.

Evidence of traumatic risk

Involving the group of illnesses of traumatic origin in the analysis does not contradict concepts of geographical pathology and is justified by the purposes of our work; ecologically caused laws of a geographic distribution of illnesses can extend to traumatism. Data on traumatism, characteristic for some paleopopulations, deserve the careful attention of researchers. Some trades of the ancient world have been credibly correlated to an increased risk of traumatism. A number of researchers mark a direct link between an increase in the general level of traumas and the occurrence of specific traumas caused by social changes.

Perforated and blunt fractures are very often observed in paleoanthropological collections [*Khudaverdyan A., 2005*]. In some cases damages of a mixed type were revealed that extend over some anatomic areas of a skeleton (Black Fortress, burial 37).

Hypoxia of the brain plays the primary role in the occurrence of some pathological phenomena in the sharp period of a trauma. It aggravates frustration of brain blood circulation, promotes brain hypostasis, and causes metabolic infringements (infringement of oxidation-reduction processes) shown in the form of suboxide metabolism products accumulation in blood and liquor. On the basis of our research, the sign of anemia in the form of bone tissue hypertrophy in the area of an internal corner of eye-sockets was established among subjects with cranial traumas from the Black Fortress necropolis in the late Bronze Age:

- among women: burial 9 (30-40 years); burial 37 (30-40 years); burial 3 (30-40 years);
- among men: burial 14 (30-40 years); burial 10 (40-50 years).

Furthermore, in two women (burial 3 and burial 9) internal dropsy is apparent.

Accurate correlations between the above-mentioned signs confirm the expressed assumption. The fact might

Figure 8. *Fracture of an ulnar bone at the site of foramen nutricium with an outcome in a false joint. Materials from excavation of Black Fortress necropolis.*

be explained by either aggressive habitat of the Black Fortress dwellers characterized with marital cultural traditions, probably coupled with an increase in density of population in the late Bronze Age or by the spread of initiation ceremonies affecting both the male and female population. Until new data is obtained, it is necessary to discuss both assumptions.

At excavation in the Black Fortress, the skeleton of woman (aged about 40 years, burial 37) was found to have fracture in the top part of diaphysis of an ulnar bone (at the site of *foramen nutricium*) with an outcome in a false joint (Figure 8). Unusual conditions, movements, and loads led to early deformation, deforming arthrosis in an elbow joint. Jointed surfaces in a new joint had powerful regional bone growths. Besides the described changes, the hernia of an intervertebral disk is noted. Dystrophy of bones, passing glazing and fracture of the 2nd cervical vertebra in the area of the *tuberculum post* are among observed results (Figure 9).

Figure 9. *Fracture of the 2nd cervical vertebra at the site of tuberculum post. Materials from excavation of Black Fortress necropolis.*

During actual lifetime the subject was exposed to considerable physical loads. An occipital relief, osteoblastic reaction in the place of the attachment to the cervical muscles are clearly expressed. The postcranial section of the skeleton can be characterized as moderately massive. The bone relief is developed considerably on a shoulder, shovel, elbow and radial bones, and on a femur. Analysis of the skeletal remains of the woman justifies the assumption that she was a horsewoman (*an Amazon?).* Falling from a horse could have been the reason of these infringements and fractures. The discovery of strong osteoclastic reaction around the pelvis and signs of gout is noteworthy. The horsewoman remained an invalid and lived many years after the trauma. In 38.5% of subjects from the Black Fortress, signs of relief development connected with regular riding and additional loads on the shoulder girdle (*archery ?)* were pronounced. It is probably connected not only with the restrictions of pedestrian moving in the conditions of high mountains, but also with participation of the population in marital operations [*Khudaverdyan A., 2009*]. In representatives of the

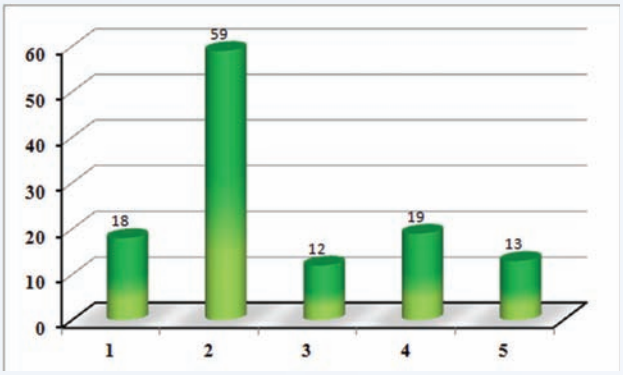

Figure 10. *Traumatic damages at buried from the Armenian Upland:*
Lanjik; 2. Black Fortress; 3. Beniamin; 4. Vardbakh; 5. Black Fortress I.

Black Fortress, the occurrence of trauma is maximal (Figure 10).

König's disease, a disease of the tubular bones affecting both sexes, is revealed in the representative of the Vardbakh necropolis (burial 4). A roundish defect (diameter: 0.4 cm) in epiphysis of femur is observed (Figure 11). Chronic micro-trauma causing infringement of bone marrow ranks as basic reason in the origin of this illness. It is mainly diagnosed in subjects, who are engaged in hard physical work.

Figure 11. *König' s disease. Materials from excavation of Vardbakh necropolis.*

Degenerate-dystrophic injuries of osteoarticular system

As known, the skeleton of a person is subject to age-related changes. Various pathologies of advanced age are connected with deterioration of the skeleton. The occurrence of degenerative changes on the joints in young men testifies to considerable stress (infectious, mechanical, metabolic – depending on the kind of pathological changes). Deforming arthrosis and spondylosis are characteristic for all epochs. The maximum frequency of deforming arthrosis and arthritis is observed in the ancient population of Beniamin. The greatest frequencies of occurrence of spondylosis are revealed in the Beniamin and Black Fortress groups. Perhaps, after tooth pathologies, spondylosis is among the most widespread, and the frequency of its occurrence has no direct dependence on climate, diet, or standard of living. Kashin-Beck disease (Figure 12) is observed among those buried in the Black Fortress necropolis both during the late Bronze Age and in earlier antiq-

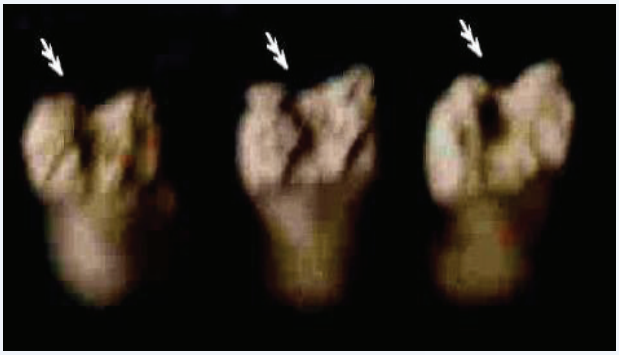

Figure 12. *Kashin-Bek disease (burial 43). Materials from excavation of Black Fortress necropolis.*

uity. According to one researcher, the occurrence of the given disease is caused by a high level of strontium salts in drinking water; other scientists consider fungi to be the etiological factor.

Shmorl's knot is formed as a result of mechanical squeezing of vertebras and can be successfully used for reconstruction of physical activities. The maximum frequency of occurrence of a marker of mechanical stress is observed in those buried in the Vardbakh necropolis.

Benign and malignant tumours of bone tissue

On bone materials from the Armenian Upland benign tumours (osteomatis) were most often revealed on skull-cap. According to our data, osteoma was observed practically in all investigated series. A very rare type of osteoma localization is observed inside of the lower jaw of the man (30-40

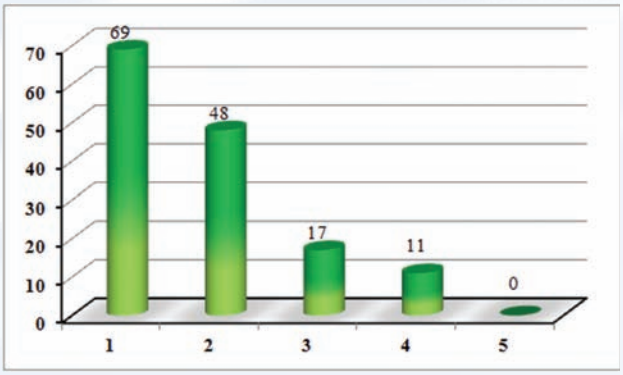

Figure 13. *Benign tumours of bone tissue in buried from Armenian Upland:*
1.Black Fortress; 2. Black Fortress I; 3. Vardbakh; 4. Beniamin.

years, burial 217) from Beniamin burial ground [*Khudaverdyan A., 2000*]. As a result of our research exostosis of different localization is revealed in subjects of antique burial grounds: 50.3% (Black Fortress I): and 18.5 % (Vardbakh). The decrease in occurrence frequency of benign tumours during later epoch (Figure 13) should be mentioned. Besides benign tumours, we revealed malignant changes on bones of a skeleton with metastases in various departments (Figure 14). Extensive cancer osteophytosis is observed at subjects of antique necropolises Black Fortress I (5.3%) and Vardbakh (7.7%) [*Khudaverdyan A., 2005*].

Sclerosing metastases (Mari-Bamberger syndrome) in chest vertebras were observed in woman (25-35 years, burial 7) from the Vardbakh necropolis. The picture of stiffened periosteal stratifications of diaphysis of humeral and radial bones differed by rather correct, but mainly longitudinal rugosity. One third of scull-cap was destroyed mainly in its superficial layers. Some part of destruction foci was observed as desiccants resulting

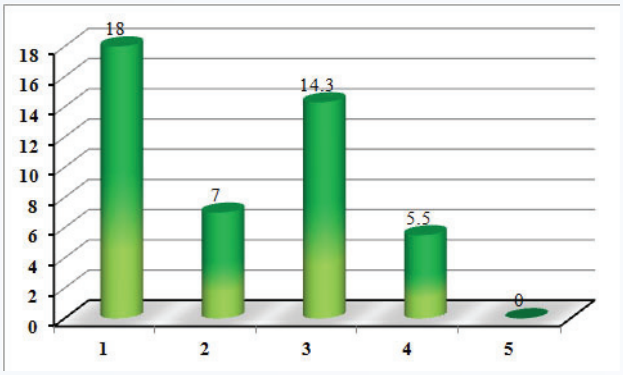

Figure 14. *Malignant tumours of bone tissue in buried from Armenian Upland:*
1.Black Fortress; 2. Black Fortress I; 3. Vardbakh; 4. Beniamin.

from fusion of earlier isolated foci of damage. This pathology, possibly, was a cause of death. We observed similar changes of a skeleton at 23.1% of subjects from the Vardbakh necropolis.

Infections

Irrespective of etiology, osteomyelitis represents an inflammation of bone marrow (Figure 4). It arises due to the influence of various pathogenic microorganisms and extends to bone tissue. The most frequent infecting agents are *Staphylococcus aureus* (more rarely: *Streptococcus haemolyticus*), *Streptococcus albus, Pneumococcus, bacilli of typhus and paratyphus*, etc. [*Aufderheide A., Rodriguez-Martin C., 1998*]. In representatives of the early Bronze Age the occurrence of a marker is maximum. The high frequency of odontogenic osteomyelitis is found during an antique epoch (Beniamin).

Tubercular damage of joints and backbone was revealed at 37.5% of those buried in the Black Fortress necropolis. Similar signs were found at antique-age buried in Beniamin (5.5 %) and the Black Fortress I (8.4 %) necropolises. Some subjects with tubercular spondylitis lived many years.

Syphilis is the chronic infectious disease induced by *Treponema pallidum* (Figure 15). At the territory of the Armenian Upland the most ancient findings of bones with signs of syphilis are in representatives of the early Bronze Age (Lanjik) [*Khudaverdyan A., 2005*]. Syphilitic plaques during the late Bronze Age were revealed in 11% of buried in the Black Fortress necropolis. In antique epoch subjects with syphilitic plaques were found in 1.39% of those buried in the Beniamin necropolis, 15.3% in the Vardbakh necropolis, and 26.4 % in the Black Fortress I necropolis. On each skull there were some (2-7) syphilitic plaques (Figure 16).

Figure 15. *Tertiary syphilis. Materials from excavation of Black Fortress necropolis.*

Thus, population of the Armenian Upland has a complex gene pool consisting of diverse and different levels of microevolutionary lines. It is a product of not only differentiation, but integration as well. The ethnic and cultural influences fixed by monuments of archeology and history, judging by anthropological material, were not so strong to change the process of ethnogenesis among the Armenian people. A consecutive comparison of data allowed tracing the continuity line (of course, the so-called "directed in time" changes in skull structure are thus considered, mainly the brachycephaly processes, which are accurately fixed in the sixth period (*XX century A.D.*)).

Figure 16. *Syphilitic gumma on the left parietal bone. Materials from excavation of Lanjik necropolis.*

Upon analysis of the epoch-related variability of tooth system in representatives of the Armenian Upland, we concluded that microevolutionary changes of teeth in the populations occupying this region had an identical direction: the tendency to reduction. Various pathological changes in population of the Armenian Upland are revealed. They are present on the general background of disadaptive processes of an organism to extreme social conditions.

The elevated frequency of occurrence of such signs as anemia, enamel hypoplasia, caries, lifetime loss of teeth owing to inflammatory process, cases of odontogenic osteomyelitis, Kashin-Beck disease, etc. indicate that the human organism was exposed here to internal and external stressful influences varying in force and duration .

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