

Armenia: Animal remains from Neolithic and Bronze Age settlements and burials (Review of osteological material from the collection funds of the Institute of Zoology)

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"... to our sorrow the Mesolithic and Neolithic periods in Transcaucasia are not studied sufficiently to restore the process of the agriculture and cattlebreeding formation to some extent. In this aspect the most interesting monuments are obviously situated in Armenia, while they are less known, and information about the ones excavated are rather poorly published and not available to the researchers." (V. Schnirelmann 1980, p. 68).

Abstract: *The paper presents the results of the study of osteological material from the excavation of archaeological sites in Armenia, stored in the collection funds of the Institute of Zoology. Characteristics of the species composition of animal bone remains from the excavations of ancient settlements and burials on the territory of modern Armenia (from the V millennium BC to the Late Bronze Age) showed the presence of wild and domestic animals (mammals). The following wild species have been identified: *Bos primigenius*, *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Martes foina*, *Sus scrofa*, *Cervus elaphus*, *Ovis orientalis*, *Capra aegagrus*, *Cazella subgutturosa*, *Equus hemionus*, *Capreolus capreolus*, *Meles meles*, *Lepus europaeus*, and *Vormela peregusna*. Domestic animals are represented by all main species, such as cattle, horse, sheep, goat, pig and dog.*

Rezumat: *Articolul prezintă rezultatele studiului faunei ce provine din săpăturile arheologice din Armenia, materiale ce se găsesc stocate în depozitele Institutului de Zoologie din Erevan. Studiul spectrelor faunistice ce provin din săpăturile unor așezări și morminte de pe teritoriul Armeniei moderne (între mileniiul V î.Hr. până la epoca târzie a bronzului), au arătat prezența atât a animalelor sălbatice, cât și domestice (mamifere). Au fost identificate următoarele specii sălbatice: *Bos primigenius*, *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Martes foina*, *Sus scrofa*, *Cervus elaphus*, *Ovis orientalis*, *Capra aegagrus*, *Cazella subgutturosa*, *Equus hemionus*, *Capreolus capreolus*, *Meles Meles*, *Lepus europaeus* și *Vormela peregusna*. Animalele domestice sunt reprezentate de toate speciile principale, cum ar fi vita, calul, oaia, capra, porcul și câinele.*

Keywords: *Armenia, archaeozoological collection, fauna, wild and domestic animal, mammals.*

Cuvinte cheie: *Armenia, colecție arheozoologică, faună, animale sălbatice și domestice, mamifere.*

◆ Introduction

The mentioned gap in restoration of the leading forms of the economy, hunting and cattle breeding of the ancient inhabitants of the Armenian area can be filled in to some extent by osteological material from archaeozoological collection (fig. 1).

Archaeozoological collection, skulls and postcranial skeleton elements, subfossil vertebrates, was established in the laboratory of Vertebrate Zoology at the Institute of Zoology of the National Academy of Sciences of the Republic of Armenia as a result of gathering faunal materials discovered at archaeological excavation throughout the Armenian territory. For the present, a safe-kept material characteristic with its species diversity and time range have accumulated, based on which a collection of subfossil animals of Armenia has been created.

Animal bone remains were examined by the staff of the Institute of Zoology N. Manaseryan and L. Mirzoyan. They have done a tremendous work on pretreatment and sorting of bone samples delivered from archaeological excavations. For the first time, a list of species has been developed and faunal assemblages have been analyzed (N. Manaseryan, L. Mirzoyan 2005, p. 200-205).

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In recent years, scientific collections have been replenished with contributions from archaeologists who supplied new material, primarily from actively excavated ancient sites. This fact necessitated the need to carry out a comprehensive revision of entire scientific collections, to define the species composition of mammalian fauna from Holocene settlements and burials.

Studied material out of excavations of Neolithic - Chalcolithic settlements, burials and settlements of the Early, Middle and Late Bronze Age, stored in the collections of the Institute of Zoology. Altogether approximately 20,000 identified animal remains have so far been studied (tab. 1).

Animal remains, altogether approximately 688 bones, from six Neolithic-Chalcolithic settlements were identified (tab. 2). In the layers of the 4th millennium, we find the concrete remains of domestic animals, but it is clear that the origin of their domestication took place in an earlier period. This problem can be resolved after studying the faunal material derived from much earlier archaeological sites going back to the 6th or 7th millennium BC.

In this respect, the animal bone remains from the Yenghigea (6th-5th millennium BC) and Khatunarkh (5th millennium BC) settlements are of some interest. It is a unfortunate that the number of bones from those sites is limited. Settlements of Teghut, Adablur and Tsakhkunk are dated to the 5th or 4th millennium BC. The number of bone remains from those sites is also extremely small.

More numerous is the material from the settlements of later periods dated to the first half of the 4th and middle of the 3^d millennium BC, which is divided to three unequal periods: as by the quantity of studied sites, as well as by identified bone remains. Chronologically they belong to Early Bronze Age (4 settlement - 8147 bone remains), Middle Bronze Age (13 settlement, 10 burial - 9361 bone remains) and Late Bronze Age (5 burial - 1046 bone remains) periods.¹

Some rodent and birds remains which have not yet been identified are not included in list. The fauna comprises six species of domestic mammals, twenty species of wild mammals, one tortoise species, two fish species and two bird species.

◆ Remains of wild animals

The rich wild mammalian fauna is represented by hare, beaver, and eight carnivore species including lion, wild pig, two deer species, gazelle, bezoar goat, moufflon and aurochs.

If one compares the wild mammalian fauna from the Neolithic layers with the one of the Bronze Age settlements, it can easily be observed that most species occur in both periods. An interesting exception is the lion. Up to now the lion remains have been identified only among the bone remains from the Middle Bronze Age period Verin Naver and Karashamb. Two fragments of the mandible of different species were identified in materials of Lori Berd burials (Late Bronze – Early Iron Age). Of a special interest is the lion image on Geghama Mountains rock carvings (N. Manaseryan 2003, p. 193-201).

Lepus europaeus Pallas, 1778 – Brown hare

Units of hare remains found in the excavations out of Verin Naver, Karashamb. The fragments of mandibles indicate them to belong to brown hare, which is well known in Minor Asia, North Iran and South Caucasus. In Armenia the contemporary brown hare is registered almost in all landscapes except central areas of the forest.

Castor fiber Linnaeus, 1758 – Ordinary (river) beaver

Fragments of mandible with ascending broken part found from Shengavit (mid-3d Millennium BC). Information on existence of beavers in Armenia is rather questionable.

Meanwhile, the beaver bone remains in osteological issues indicate both the inhabitation of that beast in Armenia and expand the area of its inhabitation in bygone days. It is fully annihilated in Middle Holocene.

Canis lupus L. - Wolf

The skull and bones units of extremities from Yeghegis settlement.

Vulpes vulpes L. - Fox

The foxes' skulls, mandible fragments, and bones of extremities are out of Teghut, Mokhrablur, Shengavit, Lchashen, Talin sites. A common and rather numerous representative of fauna in Armenia inhabited in various landscape zones.

¹ There were estimated bone remains (not large by volume) from Eneolithic and Bronz Ages settlements (Kelanlu, Zhdanovo, Kosi Jotter, etc.), where each species is represented by one or two bones at least, that is why they are not included in the tables.

***Ursus arctos L.* - Bear**

The bear skull is from Tsamakaberd site. Bear refers to the list of the largest species of post glacial theriofauna maintained in Armenia up to present.

***Martes foina Erxl.* - Marten**

The skull and bones of extremities are out of Shirakavan, Talin, and Lchashen sites. It is a valuable fur animal.

***Mustela nivalis L.* - Weasel**

The skull and mandible fragments out of Verin Naver, Shengavit. The weasel is common in Armenia everywhere except for dry subtropics.

***Vormela peregusna G.* - Polecat**

The skull and mandible fragments out of Shengavit, Keti, Mastara, and Sevan sites. Very rare. It is inhabited in the zones of mountainous steppes, in the Southern part it comes across in the semi-desert areas, and in the East it does in the zone of skeletal mountains.

***Meles meles L.* - Badger**

The skull and mandible fragments out of Artik, Tsamakaberd, Lchashen, and Shamiram sites. At present the North-Iranian badger is noticed in dry subtropics, semi-deserts, mountainous steppe, meadow steppe, and forest zones of the South Caucasus and North Iran. Alike old times it is hunted, perhaps, for the fur, fat (used by folk medicine), and partially for the meat.

***Lutra lutra L.* - Otter**

The skull fragment from bone lens from Akhkala, and Sevan villages. The otter bones are met rare and are not numerous in the sites of Armenia. At present they are met in the rivers and lakes from the dry subtropics and semi-deserts up to forest and mountainous steppe zones.

***Sus scrofa L.* – Boar**

It should be noted that in Neolithic settlements, particularly in Khatunarkh, mandible fragments and particular teeth of wild boar were discovered in great quantity.

***Camelus sp.* - Camel**

The skull fragments from the sites of Tsamakaberd.

***Cervus elaphus maral O.* - Red deer** (S. Mejlumian, R. Ghucassian 1986, p. 99-127).

In numerous cultural layers of post-glacial scurf, from the Paleolithic to Medieval ages, there are cranial fragments (fig. 2), bones from extremities, and mainly horn debris of the Caucasian red deer with signs of modification.

Despite the small quantity of material, a skull of the adult female from the Mokhrablur settlement is of particular interest. A massive skull with accrete suture has the following indices in mm (tab. 3).

As indicated above, there are a large number of antler fragments, which were probably collected by the inhabitants for household use: from Teghut, there is a stub with a part of frontal bone, the edges for rosella are in some places effaced; from Mokhrablur there are debris of an axis, a rosella and a supraorbital processes, and fragments with signs of modification; from Shengavit, there is a antler of a young deer with a well defined crown.

In addition, it should be mentioned that during the whole post-Paleolithic era, the red deer was a beloved subject for artists and sculptors to decorate weapons and dresses, as well as for pottery-masters to decorate ceramics for various purposes.

***Capreolus capreolus L.* - Roe Deer**

The horncore and bones of extremities from Khatunarkh, Adablur, Shengavit.

***Bos primigenius Boj.* - Aurochs**

The skull and mandible fragments from Shamiram burial (fig. 3). It is not excluded the possibility of defining aurochs bone fragments (especially of the females) as ones of domestic bull. Hence, aurochs in the materials may be more than registered till now. By the end of Iron era the auroch was annihilated everywhere.

***Bison bonasus caucasicus Sat.* – Bison** (S. Mejlumian 1988, p. 36-65).

The skull fragment and horncore are from the sites around Sevan-lake basin: Ayrivan (tab. 4, tab. 5).

The remains are not numerous, and in some sites they are represented by a small number of samples. It is fully annihilated.

***Gazella subgutturosa Gul.* – Gazelle**

The horncore and their fragments out of Metsamor, Shirakavan, Talin, and Norabats. The remains are represented in single samples. It is fully annihilated in the Middle Holocene.

Capra aegagrus Erxl. - Bezoar goat (fig. 4) (Red data book... 1987, p. 28-29).

The horncore fragments from Joudjevan, Garni, Ayrivan and Karashamb. The remains are not numerous, and in some sites they are represented with small number of samples. It is not numerous, and has a tendency to decrease in number and area. It is included in the Red Book.

Ovis orientalis Gmelin - Armenian mouflon (Red data book... 1987, p. 29-31).

The fragments of horncore (fig. 5), and bones of extremities from Mokhrablur, Shengavit, Garni, Joudjevan, Metsamor, Talin, Lori Berd, Karashamb sites. It is not excluded the possibility that in the materials large bones stems of domestic sheep exist.

They are on the edge of annihilation. It is included in the Red Book

Ovis aries et Capra hircus – Sheep and Goats

All the elements of the skeleton, such as: atlants, epistrophe, scapulae, bones of lower extremities and upper extremities. In a number of publications on archaeozoology the domestic sheep and goat is referred under common title "The Small cattle". It is often explained by the fact that not all the bones of sheep and goat are distinguishable from each other. In our material the bone remains of sheep and goat have not been fully defined up to the species, hence, their majority is considered in a total.

◆ **Remains of domestic animals**

Domestic animals represented at collections include the usual artiodactyls cattle (*Bos*), sheep (*Ovis*), goat (*Capra*) and pig (*Sus*), as well as the perissodactyls horse (*Caballus*), and finally the dog (*Canis*) as a carnivore (tab. 6).

Sheep and goat are the most frequent species, followed by the cattle in the Neolithic settlements. Pig are a rare species, especially applies to the Early Bronze Age.

The frequency of dog is more or less the same in the different of the Early and Middle Bronze Age. In the settlement of the Middle Bronze Age, the cattle are once again the most numerous species, followed by sheep and goat with nearly equal percentages. Previous investigations have provided a large number of osteometric data which permit some conclusions concerning the size of the domestic animals (N. Manaseryan 2004, p. 282-290).

Domestic cattle (*Bos*) (fig. 6), (N. Manaseryan, L. Mirzoyan 2003, p. 87-107).

The majority bones of bulls and cows (adult animals) are subjected to decay, as always results from meat consumption. It refers especially to the skulls and proximal parts of the skeleton extremities.

One unique and valuable finding is a bull skull fragment out of kitchen remains found in Shengavit settlement. By the delicately curled space of the face, thickened forehead, under-developed eye-sockets and direction of the horns, the skull, probably, belongs to the cattle originating from *Bos primigenius* Boj (the latter was widely known on the territory of Armenia).

Seven well-preserved horncore (from Mokhrablur – 118-165 mm, from Shengavit – 146- 155 mm) belong, probably, to cows. Horncore basal circumference for bull skull from Shengavit is 190 mm; another one, which differs by its larger horncore basal circumferences (199 mm) may belong to either bull, or ox (tab. 7).

It is worth to pay attention to the mandible measurement data of animals from different sites (tab. 8).

As it was mentioned when dealing with the aurochs remains, there is no obvious discontinuity between the size-ranges of the bone remains of domestic and wild cattle. It should be kept in mind, however, that the size ranges –particularly for Middle Bronze Age Cattle – might reach somewhat higher if some of the unspecified cattle remains actually are from domestic animals.

Now let us observe the bones of the post-cranial skeleton, which are abundant also provide much relevant information.

Analyzing the variation row of changeability for astragals, we have discovered that only 10.5% of the measured samples of the sites (Aratashen, Gegakar, Etchmiadzin, Shengavit and Sevan) have the length over 74 mm, which is peculiar to wild bulls, and the rest of these and all the other sites (relatively smaller samples), obviously, belong to the domestic animals (tab. 9).

Too little information is obtained from the analysis of variations in the general length of the calcaneus and first phalanges in extremities (tab. 10, 11). There is a lack of detailed data on their length in Aurochs, which, naturally, does not permit precise identifications of samples from faunal remains of excavations.

Several well preserved metacarpals and metatarsals were studied out of the sample of the metapodia.

Summarizing the literary data on measurements of auroch metacarpals, in the animal bone remains from excavations (out of archaeological sites of Early Bronze Age period), there are no identified auroch metacarpals of even minimal size (219 mm) (tab. 12).

In the studied remains, intact metatarsals, which show the bone general length and basic proportions are seldom preserved similar to undestroyed metacarpals (tab. 13). All metatarsals, except from Agavnatun and Lori Berd are much shorter in length than that of Aurochs (260 mm, minimal length), and they certainly belong to domestic animals.

Metapodia let define the height at withers for domesticated cattle (V. Tsalkin 1960, p. 109-126) (tab. 14).

As can be seen from table 14, the Early Bronze Age cattle were of similar size as cattle populations from the Middle Bronze Age (except from Aruch, Agavnatun and Lori Berd). Their withers heights varied approximately between 114-125 cm.

Sheep and Goat (*Ovis and Capra*) (Manaseryan 1984, p. 966-975).

Bones of both species are numerous of the studied materials. Bone preservation is poor as a result of the decay of animal bones (animals used as food). A significant percentage of bones belong to the young species, and their bones are preserved poorly compared with the ones of adults. Naturally it makes it difficult to study the material, especially if we take into consideration the fact that there are mixed remains of two different species of animals. Their differentiation is not always possible, even if the bones were well preserved. In addition, while the properties for differentiation are well expressed in wild goats and sheep, they more uniform in domestic species, especially in young ones.

Moreover, the small structural peculiarities, which can sometimes be of great importance for bone identification, are hardly distinguished at subfossil samples. That is why a number of samples remain undetermined. Hence, let us apply to the observation of those goat and sheep skeleton bones the differences which can be easily noticed, particularly the fragments of skull, horncore and metapodia.

The horncore of sheep from Neolithic monuments belong to males and females (in the materials there are fragments of skull and hornless females). A sample of horncore of a subfossil sheep from Mokhrablur is well preserved (4th millennium BC). It has a barely visible outer edge; the temporal and frontal surfaces are merged without any marks of separation. The length of the axis along the frontal edge is 205 mm, horncore basal circumference is 150 mm. Cranial fragments of the females from Adablur, Khatunarkh and Teghut settlements (4-5 millennium BC) have horncore with curved endings and in certain cases well expressed fissures along the whole length of the axis. Horncore basal circumference is in the limits of 60-97 mm, which is less compared with the horncore basal circumference of female moufflons. The length of a horn axis measured along frontal edge of a species with straight horncore (like the moufflon's one) is 54 mm (tab. 15). It should be noted that the horncore of the Armenian female moufflons are short and straight, while the subfossils have slightly curved arced horns with a shape of irregular circle in section. In the settlements at the end of the 4th and middle of the 3^d millennium, the sheep horncore had the following sizes:

The cranial fragments of the females from Garni should be observed in more detail (tab. 16).

The obtained parameters were compared with the ones of moufflons and domesticated sheep. After calculation of indices of the cranium, occipital bone and parietal surface, there is no disparity in the indicated measurements. Thus, it can be resumed that the sheep cranial part is not useful for estimation of the differences between wild and domesticated ones.

An interesting exception is skulls belong to hornless (n=17) and horned females (n=11) from Lchashen (tab. 17). Most of skulls were from mature animals, and were in satisfactory condition. In order to discover diagnostic criteria for domesticated forms, the parameters of skulls' length were taken which were obtained in comparison to wild sheep (*Ovis orientalis* n=14) with domesticated *Ovis aries* ones (Armenian native breed "Masech" n=28). The subfossil of 'Masech' breed (one strict distinction from 25 measurements). As mentioned above, the distinction of wild and domestic *Ovis* is possible only when having the whole skull intact. The investigations allow us speak about the stability of craniological signs during the period of 3-4 thousand years.

Among several greatly decayed metapodia, only two metatarsals are well preserved: from Khatunarkh (149 mm) and Mokhrablur (140 mm) settlements (tab. 18). As known, one of the general and typical changes in reference to domestication is the decrease of general body size, which results

in the decrease of sizes of skeletal bones. Taking into consideration the fact that the length of metatarsals for Armenian moufflons is in the limits of 169-190 mm for males and 152-179 mm for females, it can be assumed that the metatarsus from Khatunarkh settlement belongs to moufflon, while the one from Mokhrablur settlement belongs to the domesticated variant. The length of metacarpals from Mokhrablur varies in the limits of 137-143 mm, and from Shengavit measures 148 mm. The metatarsals are 140- 149 mm and 142-149 mm respectively. The height in withers of the sheep (V. Tsalkin 1961, p. 115-132) could be 66-70 cm (tab. 19).

Keeping in mind that the height in withers of domesticated sheep of native Armenian species (named MazeKh) is in the limits of 61-74 cm, it can be assumed that the sheep from the old settlements have similar shape if compared with modern ones. As seen in the comparison of measurements, between sheep of the Chalcolithic period with those of the Bronze and Iron Ages sites, it appeared the sheep had remained almost the same size.

It is supposed that this stability of the species depends on similar conditions of existence and on the absence of introduction of those animals from other places.

There is no data verification for wild goat remains in the studied samples. The fragments of horncore belonging to goats with sharpened frontal edge and positive curling (peculiar to domestic forms) (fig. 7) are discovered from Mokhrablur settlement (length along the frontal edge is 145-186 mm; the horncore basal circumference is 110-137 mm).

The females from Khatunarkh settlement had a length of axis in the limits 120-125 mm, with a circumference of 70-75 mm. There is no doubt that the horncore belong to large species of domesticated goats, as their horncore basal circumference does not differ from the one of modern wild goats. The horncore basal circumference of *Bezoar goats* varies in the limits of 101-179 mm at males, and 65-96 mm at females. The horncore basal circumference of the subfossils is 110-137 mm for males in Mokhrablur, while nine well-preserved horncore females in Shengavit and in Shirakavan measure 71-79 mm (length on the greatest curve 138-148 mm); and 72-80 mm (length on the greatest curve 138-158 mm) respectively (tab. 20).

The length of the goat metatarsus from Shengavit and Mokhrablur varies in short limits: 104-107 mm (tab. 21). The length of metatarsus for *Bezoar goats* varies in males from 130 to 140 mm, and in females it is from 118 to 142 mm. As noted, they are much shorter in length than those of Bezoar goats, hence there are grounds for considering them as domesticated species.

Metapodia from Shengavit and Mokhrablur allow the height in withers for domesticated goats, which is 52-50cm. It correspond to the height in withers of modern *Bezoar goats*. It can be assumed that the domesticated goats of the settlements originate from the population of *Bezoar goats* in Armenian mountains, and positive curling of the horns is only a domestication change of the horn form for the wild *Capra aegagrus* taken place as a result of mutation.

Dog - *Canis familiaris*

In the archaeological collections, bone remains of dogs occur regularly, although in small numbers. Material recovered from 6 sites, 8 dog skulls were well preserved. Analysis results showed that the skulls represent two different types: a medium-sized dog and a larger one. By cranium structure the following kinds of dogs can be indicated: species with wide forehead and narrow forehead; with narrow and wide cheekbones; with broad- and narrow-nosed (N. Manaseryan, L. Antonyan 2000, p. 227-235).

Pig - *Sus scrofa domestica*

In the Neolithic cultural layers from most settlements, we find pig bones, but they are not numerous. The discovered remains are extremely decayed and are represented by cranial fragments, mandible and upper maxilla. Upper and lower jaw fragments, some cutting teeth and molars, strongly different from the ones of pig remains by their sizes are out of Khatunarkh, Kelanlu, Adablur. Bone preservation is poor and there is little possibility for osteometric characteristic. Available measurements are represented in the (tab. 22, 23).

On 7 skulls with various injuries of forehead and brain areas and 17 fragments of skulls (tab. 24) have been found in Lchashen burials (N. Manaseryan 1997, p. 145-14). These skulls, on its whole outline, inclined to wild boar of the "western" form, have similarity with domestic pigs.

Horse - *Equus caballus*

When making the description and interpretation of horse bone remains, it is necessary to indicate first that they go back to the end of the 5th and middle of the 4th millennium BC. The first evidence of domestic Horse remains quite possible comes from Aratashen. Because the wild horse is completely missing in the large bone material from the neighboring Chalcolithic and Early Bronze Age,

we consider these bones as coming from domestic horses. Whether they really belong to the domestic horse, still needs to be checked by C14 dating. Of nearly the same age are the oldest horse bones from Shengavit, Sepasar and Aparan found there in the Early Bronze Age sites.

Horse bone remains were found in large quantities in the Early and Middle Bronze Age settlement and burials (N. Manaseryan, L. Mirzoyan 2000, p. 87 -107). It is of special interest, that the astragals, phalanges, and calcareous from Neolithic- Chalcolithic sites have the same size and proportions in the bones of horses from the sites of later periods in Armenia (fig. 8), such as Lori Berd (Late Bronze and Early Iron era), and are usual for domestic horses (tab. 25).

Resuming data on horse osteometry it is necessary to indicate its wide diversity. But undoubtedly the majority consists of medium and full-grown species with height in wither (V. Vitt, 1952, p. 163-205) 136-144 cm (45.2%) and 144-152cm (34%) (N. Manaseryan 2006, p. 271-274) (tab. 26).

And one more interesting note: in Bronze Age burials from Chestnut Sabino and Bay, there were found horses! (Shirakavan 895-795 BC – Chestnut, Lchashen 1410-1210 BC – Chestnut Sabino, and Lori Berd 1950-1750 BC-Bay) A. Ludwig *et alli* 2009, p. 1- 29.

In presenting the species list, the occurrence of various wild mammal species in the faunal assemblage of monument, has already been mentioned. We will now have a closer look at the ratio between domestic and wild mammals in the various chronological sites (tab. 27).

In the Neolithic – Chalcolithic site, which corresponds to the 6th - 4th Millennium BC, the percentage of wild mammals exceeds 12% on average. From this, appears that hunting was importance in the economy of this settlement. In the Early and Middle Bronze Age the various settlements do not contain many bones from wild mammals. Their percentages vary between 4% and 4.6% (tab. 28).

As one can easily see, *Cervids* played a major role as hunted animals. In transition to the Middle Bronze Age there is a further decrease in this group, whereas the frequency of wild sheep, moufflon, distinctly increases. In addition it has to be mentioned that during the whole post-Paleolithic history, the red deer was a beloved subject for the artists and sculptors to decorate the weapon and dresses, as well as for pottery-masters at decoration of the pottery for various purposes.

Moufflons and *Bezoar goats* are included in the number of the most important animals for hunting activity by the ancient population. At the same time, the goat and sheep are the oldest agricultural animals. According to the bone remains, both animals have been bred by inhabitants of the settlements since 6th - 5th millennium BC. Since that time they have become widespread and are of great importance for the local economy. From the materials out of excavations, the sheep in quantity prevails over goats, and almost all of Rock carving art (reflecting the ancient way of life in general and spiritual life of humans) is full of goat images. Perhaps this phenomenon can be explained by the fact that the main quantity of rock carvings are in mountainous regions, and represent a hunting style similar to that in the high mountainous region (typical places for *Bezoar goat*).

◆ Concluding remarks

The study of such a diverse collection of mammalian remains obtained during the excavations on the territory of Armenia has produced new information about life ancient population. Characteristics of the species composition of animal bone remains from the excavations of ancient settlements and burials on the territory of modern Armenia (from the V millennium BC to the Late Bronze Age) showed the presence both wild and domestic animals. Species structure of animals is highly diverse: twenty six species of mammals (20 wild and 6 domestic) have been identified.

The percentage of wild animals in the faunistic materials of the Early Bronze Age is 2 times higher than in those of the Late Bronze. This fact may be regarded as evidence of the diminished importance of hunting.

Judging from the bone remains discovered in the archaeological sites of the Bronze Age remains of domestic animals predominate, compose of 94% the total number of examined bones, most of them being cattle (50%).

Sheep and goats belong to the number of most ancient domestic animals. They were bred by the inhabitants of Neolithic settlements as early as in V millennia BC. Bones of sheep and goats were found in great quantities (making on average 45% of all bone remains). Sheep in general were large-sized, probably no less than 64 - 70 cm at the withers. Goat bones are less numerous than sheep bones.

The discovered pig remains are extremely decayed and are represented by cranial fragments, mandible and upper maxilla. The skulls of pig from Lchashen burials on its whole outline, inclined to wild boar of the "western" form, have similarity with domestic pigs.

More than 2 thousand horse bones were examined. The bones most often belonged to adult horses and accounted for a substantial percentage of all bone remains. Both in size and proportions of bones the horses of territorially distant areas showed no considerable differences. The highest in number were horses of middle height at the withers (136-144 cm); constituting (128-136 cm) and very large (144-152 cm) were rare (16% and 35% respectively).

Accordingly we resume: existence of such a big complex of domesticated animals suggests that animal husbandry was not in initial stage, which allows us to consider that animal husbandry in this territory of Armenia was in its high level of development.

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◆ References

- A. Ludwig *et alii* 2009 A. Ludwig, M. Pruvost, M. Reissmann, N. Benecke, G.A. Brockmann, P. Castaños, M. Cieslak, S. Lippold, L. Llorente, A.S. Malaspinas, M. Slatkin, M. Hofreiter, Coat color variation at the beginning of horse domestication, *Science*, vol. 324, p. 485.
- N. Manaseryan 1997 Remains of Pigs from Bronze Age Graves in the Territory of Armenia, *Anthropozoologica*, 25-26, p. 145-147.
- N. Manaseryan 1984. Small cattle from Bronze Age monuments in Armenia, *Biological journal of Armenia*, 11, p 966-975 (in Russian).
- N. Manaseryan, L. Antonian 2000 Dogs of Armenia in *Dogs through Time: An Archaeological Perspective*, Oxford, England, p. 227-235.
- N. Manaseryan, L. Mirzoyan 2000 Loshadi iz pogrebeniy epoxi bronzi i rannego geleza, *Westnik MANEB*, 7/31, p. 34-35. (in Russian).
- N. Manaseryan 2003 Hunting tackle, animals and objects in rock engravings from Armenia, *Archaeofauna*, 12, p. 193-201.
- N. Manaseryan, L. Mirzoyan 2003 Domestic animal remains from the interments of Lori Berd, *Ecological journal of Armenia*, 2, p. 87-107 (in Russian).
- N. Manaseryan 2004 Ancient Domestic Animals of Armenia and Adjoining Regions, *Historical-Phylogical Journal*, 2:166, p. 282-290 (in Russian).
- N. Manaseryan L. Mirzoyan 2005 Collections of subfossil mammals, *Culture of ancient Armenia*, 13, p. 200-205.
- N. Manaseryan 2006 The Stature of Horses in Armenian Bronze and Early Iron Age Burials. Horses and Humans: The Evolution of Human-Equine Relationships, *BAR IS*, 1560, p. 271-274.
- S. Mejlumian, R. Ghukassian 1986 Changes in the spreading of the Caucasian Red Deer and their ecologo-morphological peculiarities, *Zoological Papers*, XX, p. 99-127 (in Russian).
- S. Mejlumian 1988 *Holocene mammal fauna of Armenia*, Academy of Sciences of Armenia, Yerevan, p. 3-183 (in Russian).

- Red data book of Armenian SSR 1987 *Rare and Endangered Species of Animals*. Aiastan Rare and endangered species of animals, K.A. Airomoian and S.O. Movesesian (eds.), Hayastan, p. 11-28 (in Russian).
- V. Schnirelmann 1980 *Origins of animal husbandry*. Moskow (in Russian).
- V. Tsalkin 1960 Metapodial variation and its significance for the study of ancient Horned Cattle, *Bulletin of Moscow society of Naturalists, Biological series, V, LXV (1)*, p. 109-126 (in Russian).
- V. Tsalkin 1961 The variability of metapodia in Sheep. *Bulletin of Moscow society of Naturalists, Biological series, V, LXVI (5)*, p. 115-132 (in Russian).
- V. Vitt 1952 Horses of the Pazyryk Burial Mounds, *Soviet archaeology, V, XVI*, p. 163-205 (in Russian).



Fig. 1. Map of Armenia.
Harta Armeniei.

Age/ Site	Specimen	%	Age/ Site	Specimen	%
Neolithic – Chalcolithic Settlement			Early Bronze Age Settlement		
	688			8147	
Yenghija	63	9.1	Mokhrablur	518	6.3
Aratashen	308	44.7	Shengavit	6457	79.2
Tsakhkunk	36	5.2	Sepasar	792	9.7
Teghut	43	6.2	Aparan	380	4.6
Khatunarkh	96	13.9			
Adablur	142	20.6			
Middle Bronze Age Settlement			Middle Bronze Age Burial		
	3014			6347	
Garni	18	0.5	Horom	208	3.2
Kelanlu	15	0.4	Shirakavan	407	6.4
Arevik	11	0.3	Mastara	4	0.06
Takavoranist	17	0.5	Lchashen	1533	24.1
Kosi Choter	16	0.5	Loriberd	2053	32.3
Mokhrablur	343	11.3	Aghavnatun	1194	18.8
Metsamor	248	8.2	Norabats	366	5.7
Aigevan	174	5.7	Verin Naver	327	5.1
Karnut	101	3.3	Aruch	158	2.4
Kouchak	24	0.7	Djogaz	97	1.5
Joudjevan	59	1.9			
Sevan	1617	53.6			
Shamshadin	371	12.3			
Late Bronze Age Burial					
	1046				
Karashamb	186	17.7	Talin	60	5.7
Artik	240	22.9	Sisian	540	51.6
Shamiram	20	1.9			

Tab. 1. Age and sites with a number of identified remains.
Numărul de resturi identificate în siturile citate.

Group/Species	Neolithic- Chalcolithic	Early Bronze Age	Middle Bronze Age	Late Bronze Age
	Settlement	Settlement	Burial	Burial
1. Domestic Mammals				
Cattle <i>Bos taurus</i>	170	1723	1617	350
Sheep <i>Ovis aries</i>	89	261	143	38
Goat <i>Capra hircus</i>	16	107	32	6
Pig <i>Sus domesticus</i>	25	153	47	19
Horse <i>Equus caballus</i>	9	170	1052	45
Dog <i>Canis familiaris</i>	6	157	58	67
Aurochs/Bull	39	3552	995	7
Sheep/Coat	245	1644	2146	350
2. Wild				
Hare <i>Lepus europaeus</i>	7	2	16	14
Beaver <i>Castor fiber</i>	-	1	-	-
Fox <i>Vulpes vulpes</i>	9	68	98	7
Brown bear <i>Ursus arctos</i>	1	1	1	4
Wolf <i>Canis lupus</i>	-	72	1	4
Badger <i>Meles meles</i>	-	17	13	2
Weasel <i>Mustela nivalis</i>	-	-	-	-
Marten <i>Martes foina</i>	1	2	44	5
Polecat <i>Vormela peregusna</i>	-	-	4	3
Lion <i>Pantera leo</i>	-	-	3	-
Ass <i>Equus hemionus</i>	1	5	3	4
Wild pig <i>Sus scrofa</i>	20	12	-	-
Mouflon <i>Ovis orientalis</i>	19	55	2	50
Bezoar goat <i>Capra aegagrus</i>	-	1	1	1
Red deer <i>Cervus elaphus</i>	13	88	54	62
Roe deer <i>Capreolus capreolus</i>	10	54	5	1
Cazelle <i>Gazella subgutturosa</i>	7	2	5	1
Aurochs <i>Bos primigenius</i>	1	-	-	6
Bison <i>Bison bonasus</i>	-	-	-	-
Otter <i>Lutra lutra</i>	-	-	7	-

Tab. 2. List of the identified species from the different chronological sites.
Lista speciilor identificate în diferite situri.



Fig. 2. *Cervus elaphus* skull fragments from Ayrivan.
Fragmente de neurocraniu de *Cervus elaphus* de la Ayrivan.

Measurements	Tsamakaberd (Middle Bronze Age)	Mokhrablur (Middle Bronze Age)
	♀ #1	♀ #4
Greatest inner length of the orbit	58	-
Greatest inner height of the orbit	56	-
Least breadth between the bases of the antlers	51.5	68.5
Greatest breadth of the foramen magnum	40	40
Height of the foramen magnum	19.5	26.5
Greatest length of the nasals	116	-
Facial breadth	121	-
Length of the cheektooth row	125	-
Premolare - Prosthion	80	-

Tab. 3. Measurements (mm) of the cranium of *Cervus elaphus maral* Ogilby.
Măsurători (mm) ale craniului de *Cervus elaphus maral* Ogilby.



Fig. 3. The *Bos* sp. skull fragment from Shamiram burial.
Fragmentul de craniu de *Bos* sp. din mormântul de la Shamiram.

Site	1	2	3	4	5	6	7	8	9	10	11
Sevan	263	274	332	43	46	118	166	77	640	235	135

Tab. 4. Measurements (mm) of the cranium of *Bison bonasus caucasicus* Sat.

1. Least breadth between the bases of the horncores. 2. Least frontal breadth. 3. Greatest breadth across the orbits. 4. Height of the foramen magnum. 5. Greatest breadth of the foramen magnum. 6. Greatest breadth of the occipital condyles. 7. Least occipital breadth. 8. Least diameter of the horncore base. 9. Greatest tangential distance between the outer curves of the horncores. 10. Proximal circumference of the horncore. 11. Distal circumference of the horncore.

Măsurători (mm) ale craniului de *Bison bonasus caucasicus* Sat.

1. Lățimea minimă dintre bazele proceselor cornulare. 2. Lățimea minimă a frontalului. 3. Lățimea maximă de-a lungul orbitelor. 4. Înălțimea lui foramen magnum. 5. Lățimea maximă a lui foramen magnum. 6. Lățimea maximă a condiliilor occipitali. 7. Lățimea minimă a occipitalului. 8. Diametrul minim al bazei procesului cornular. 9. Distanța maximă tangențială dintre curbele exterioare ale proceselor cornulare. 10. Circumferința proximală a procesului cornular. 11. Circumferința distală a procesului cornular.

Site	1	2	3	4
Sevan # 12	270	275	425	780
Sevan # 18	232	245	232	-
Sevan # 22	267	264	303	-

Tab. 5. Measurements (mm) of horncore of *Bison bonasus caucasicus* Sat. (Middle Bronze Age).
Measurements: 1. proximal circumference of the horncore. 2. distal circumference of the horncore. 3. length of the outer curvature of the horncore. 4. greatest tangential distance between the outer curves of the horncores.

Măsurători (mm) ale proceselor cornulare de *Bison bonasus caucasicus* Sat. (epoca bronzului mijlociu).
1. Circumferința proximală a procesului cornular. 2. Circumferința distală a procesului cornular. 3. lungimea curburii exterioare a procesului cornular. 4. Distanța maximă tangențială dintre curbele exterioare ale proceselor cornulare.

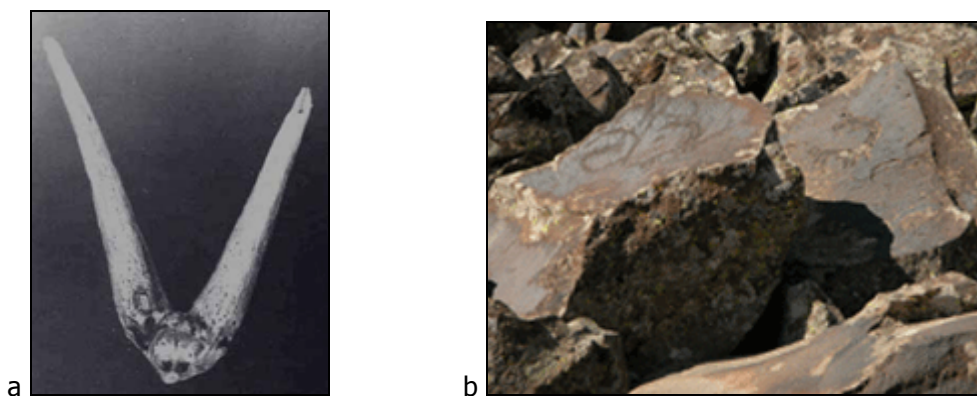


Fig. 4. a) Horncore of *Bezoar goat*. b) Rock carving of *Bezoar goat*.
a) Procese cornulare de capră *Bezoar*. b) Gravură în piatră ce reprezintă o capră *Bezoar*.



Fig. 5. Horncore of mouflon from Mokhrablur (a) and Arich (b).
Procese cornulare de mufon descoperite la Mokhrablur (a) și Arich (b).

Species	Neolithic Chalcolithic	Early Bronze Age	Middle Bronze Age		Late Bronze Age
	Settlement	Settlement	Burial	Settlement	Burial
Equus	1.3	2.0	6.4	16.5	4.3
Dog	0.8	1.9	1.2	0.9	6.4
Cattle	24.7	21.1	55.3	25.4	33.4
Sheep	12.9	3.2	4.1	2.2	3.6
Goat	2.3	1.3	2.5	0.5	0.5
Pig	3.6	1.8	2.4	0.7	1.8
Sheep/Goat	35.6	20.1	20.7	33.8	33.4
Aurochs/Bull	5.6	43.5	2.5	15.6	0.6

Tab. 6. Relative frequencies of domestic mammals in different chronological sites (% based on NISP).
Frecvența relativă a speciilor de mamifere domestice descoperite în diferite perioade preistorice (% bazate pe NISP).

Site/Age	♀ Horncore length				♀ Horncore circumference			
	n	min, max	M	σ	n	min-max	M	σ
Early Bronze Age								
Mokhrablur					7	118, 165	-	-
Shengavit					3	146, 155	150.3	4.5
Middle Bronze Age								
Metsamor					3	135, 145	140.0	5.0
Lchashen	1		160		7	132, 165	147.7	12.4
Shirakavan	1		220		15	140, 165	155.6	6.4
Sevan	8	175, 280	237.2	36.6	68	120, 168	150.5	12.5
Ayrivan	11	160, 250	202.7	27.6	68	120, 168	154.3	8.8
Tsamakaberd					71	120, 168	154.7	8.7
Site/Age	♂ Horncore length				♂ Horncore circumference			
	n	min, max	M	σ	n	min, max	M	σ
Neolithic-Chalcolithic								
Adablur					1		205	
Early Bronze Age								
Mokhrablur					2	187, 190	-	-
Middle Bronze Age								
Metsamor					3	175, 200	195.0	18.0
Keti					3	170, 220	198.3	25.6
Lchashen	1		330		14	170, 262	213.4	34.2
Shirakavan					7	170, 225	190.5	21.4
Sevan	6	256, 313	281.0	23.9	65	170, 273	199.1	27.3
Ayrivan	10	180, 370	258.0	68.4	76	170, 240	195.4	20.7
Tsamakaberd					4	170, 213	184.5	19.4

Tab. 7. Measurements (mm) of horncore of cattle (legend : n - number of specimens; min, max - the extreme values; M - the average values; σ - standard deviation).

Măsurători (mm) ale proceselor cornulare de vită domestică (legendă : n - număr de specimene ; min, max - valorile extreme ; M - media valorilor ; σ - deviația standard).

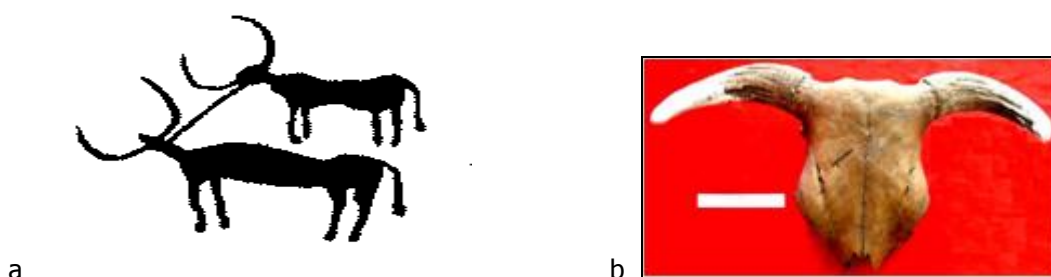


Fig. 6. Rock carving of cattle (a). Skull fragment of Bull (Shengavit; b).
Gravură în piatră ce reprezintă vite domestice (a). Fragment de craniu de vită domestică (Shengavit; b).

Measurements	Early Bronze Age Mokhrablur (settlement)			Middle Bronze Age Lchashen (burial)			Middle Bronze Age Sevan (bone lens)		
	min, max	M	σ	min max	M	σ	min, max	M	σ
Length of the diastema	92, 108	101.6	8.5	86, 129	107.5	12.8	-	-	-
Length of premolar row	52, 53	52.5	0.7	46, 54	49.8	2.5	46, 59	49.6	4.0
Length of molar row	84, 89	86.5	3.5	79, 92	85.4	4.3	78, 94	84.1	5.1
Length of the cheektooth row	-	132.0	-	130, 143	135.6	4.2	132, 143	137.0	3.7
Height of the mandible in front of P ₁	-	-	-	33, 48	40.1	3.7	33, 48	38.6	4.2
Height of the mandible behind M ₃	71, 76	73.5	3.5	63, 80	71.6	4.4	63, 75	70.4	3.9

Tab. 8. Measurements of the mandible of cattle (mm); legend - see the Tab. 7.
Măsurători (mm) ale mandibulei de vită domestică; legendă - vezi Tab. 7.

Site/Age	n	min, max	M	σ
Neolithic-Chalcolithic				
Khatunarkh	4	62, 72	64.5	5.0
Etchmiadsin	3	70, 75	72.6	2.5
Adablur	1	72	-	-
Aratashen	4	60, 75	68.2	6.4
Early Bronze Age				
Mokhrablur	11	57, 73	63.8	1.5
Shengavit	50	56, 82	68.2	5.6
Middle Bronze Age				
Zhdanovo	2	58, 63	-	-
Lori Berd	8	60, 68	65.8	2.9
Kelanlu	2	72, 76	74.0	2.0
Aruch	6	58, 71	63.8	4.4
Karnut	3	67, 70	69.0	1.7
Shirakavan 3	4	66, 69	67.7	1.5
Gegakar	6	64, 75	67.6	3.9
Tsamakaberd	6	63, 70	65.8	2.4
Sevan	26	57, 84	66.0	5.4
Shirakavan 1	9	58, 72	67.4	4.3
Ayrivan	76	54, 72	63.6	3.6

Tab. 9. Greatest length of astragalus of cattle (mm); legend - see the Tab. 7.
Lungimea maximă a astragalului de vită domestică; legendă - vezi Tab. 7.

Site/Age	n	min, max	M	σ
Early Bronze Age				
Shengavit	3	136, 149	140.00	7.9
Middle Bronze Age				
Aruch	2	146, 148	147.00	1.4
Metsamor	4	119, 129	124.25	4.9
Lori Berd	4	132, 139	135.50	3.1
Sevan	21	118, 148	131.43	8.9
Tsamakaberd	6	113, 150	124.33	15.4
Shirakavan	7	123, 146	129.43	8.0

Tab. 10. Greatest length of calcaneus of cattle (mm); legend - see the Tab. 7.
Lungimea maximă a calcaneului de vită domestică; legendă - vezi Tab. 7.

Site/Age	n	min, max	M	σ
Neolithic-Chalcolithic				
Yengija	3	57, 64	62.33	3.7
Aratashen	3	57, 66	62.33	4.7
Early Bronze Age				
Shengavit	77	54, 75	66.39	5.0
Middle Bronze Age				
Aruch	10	54, 75	66.80	5.8
Metsamor	8	50, 65	58.38	5.6
Karnut	5	62, 68	65.20	2.2
Lori Berd	33	59, 72	67.58	3.0
Sevan	62	49, 73	60.15	4.9
Shirakavan	63	50, 74	57.89	3.8

Tab. 11. Greatest length (mm) of first phalanges (ant. or post.) of cattle; legend - see the Tab. 7.
Lungimea maximă a falangei I de vită domestică (anterioară sau posterioară); legendă - vezi Tab. 7.

Site/Age	n	min, max	M	σ
Early Bronze Age				
Shengavit	1	-	182.0	-
Mokhrablur	3	179, 188	182.3	4.9
Middle Bronze Age				
Aghavnatun	2	222, 231	-	-
Aruch	1	-	218	-
Lori Berd	16	208, 235	225.8	7.2
Lchashen	10	198, 223	207.0	7.0
Sevan	7	190, 206	196.2	5.7
Shirakavan	1	-	205	-

Tab. 12. Variations in metacarpal bone lengths of cattle from different archaeological sites (mm) ; legend - see the Tab. 7.
Variația lungimii osului metacarp de vită domestică descoperit în diferite situri arheologice; legendă - vezi Tab. 7.

Site/Age	n	min, max	M	σ
Early Bronze Age				
Shengavit	1	-	238	-
Mokhrablur	4	213, 222	217.3	4.5
Middle Bronze Age				
Aghavnatun	3	253, 261	258.3	4.6
Aruch	3	243, 257	248.3	7.5
Lori Berd	15	235, 267	256.2	9.3
Lchashen	12	210, 254	227.2	14.0
Sevan	7	227, 231	229.2	1.7
Shirakavan	4	210, 229	219.5	10.4

Tab. 13. Variations in metatarsal bone lengths of cattle from different archaeological sites (mm); legend - see the Tab. 7.
Variația lungimii osului metatars de vită domestică descoperit în diferite situri arheologice (mm); legendă - vezi Tab. 7.

Site	n	min, max	M	σ
Early Bronze Age				
Mokhrablur	7	109.5, 121.4	114.6	5.5
Middle Bronze Age				
Aghavnatun	5	135.8, 142.7	140.1	3.0
Aruch	4	132.9, 140.5	135.2	3.3
Lori Berd	34	127.2, 146.1	139.4	4.6
Lchashen	24	105.2, 138.9	125.5	8.4
Ayrivan	7	117.5, 125.3	123.7	3.4
Sevan	7	116.2, 125.8	121.6	3.8
Shirakavan	6	112.6, 125.4	119.6	6.0

Tab. 14. Comparison of withers height size of the Bronze Age cattle in the different chronological sites (cm); legend - see the Tab. 7.

Comparații ale înălțimii la greabăn a vitelor din Epoca Bronzului (cm); legendă - vezi Tab. 7.

Age/Site	1			2			Site	1		
	Male			Male				Female		
	M	min, max	σ	M				M	min, max	σ
Early Bronze Age										
Shengavit, n=9	153.8	140, 172	9.7	225			Shengavit, n=7	77.0	53, 95	17.1
Mokhrablur, n=7	158.4	137, 181	13.5	222; 225						
Middle Bronze Age										
Garni, n=2	151; 162						Garni n=7	80.7	65, 94	10.3
Metsamor, n=14	149.9	132, 171	12.5				Kirovakan, n=2	79; 89		
Shirakavan, n=1	143						Metsamor, n=3	74.0	67, 85	9.6
Norabats, n=1	150						Shirakavan, n=1	82		
Joudjevan, n=1	130						Sevan, n=2	85; 93		
Tsamakaberd, n=1	139			154			Lchashen, n=4	81.7	70, 98	13.2
Ayrivan, n=4	150.7	133, 160	12.5	178; 224			Ayrivan, n=2	48; 94		
Lchashen, n=5	156.6	140, 192	21.1							

Tab. 15. Measurements of horncore of sheep (mm): 1. circumference of the basis; 2. length measured on the greatest curve; legend - see the Tab. 7.

Măsurători ale proceselor cornulare de oaie (mm): 1. circumferința bazei; 2. lungimea măsurată pe curbura mare; legendă - vezi Tab. 7.

Measurements of the cranium	Garny n= 6		Muflon n=14		Mazech n=28	
	min, max	M	min, max	M	min, max	M
Greatest breadth at the bases of the paraoccipital processes	61, 69	63.8	61, 70	66.5	-	58
Length-basion-bregma	39, 46	42.2	35, 45	41.9	30, 47	40
Greatest neurocranium breadth	61, 67	64.8	60, 72	66.5		62
Greatest breadth of the foramen magnum	19, 21	20.0	18, 23	20.0	15, 23	19
Indexes						
Braincase	111.2, 125.7		95.8, 108.5		92-27	
Occipital bone	115.3, 126.3		113.9, 123.0		118-137	
Parietal surface	70.5, 86.9		61.6, 84.7		72-78	
Lambdoid site	242, 306		177, 250		236-288	

Tab. 16. Measurements (mm) of the cranial fragments of sheep from Garni; legend - see the Tab. 7.
Măsurători (mm) ale fragmentelor craniene de oaie de la Garni; legendă - vezi Tab. 7.

Measurements of the cranium	Hornless n=17			With horns rudimentary n=11		
	min, max	M	σ	min, max	M	σ
Profile length	22.1, 23.6	22.9	0.1	21.5, 23.5	22.9	0.4
Condylbasal length	21.9, 23.3	22.4	0.1	20.9, 23.0	22.2	0.4
Basal length	20.3, 21.9	20.8	0.1	19.2, 21.1	20.5	0.4
Lateral length of the premaxilla	6.5, 8.6	7.5	0.1	7.3, 7.6	7.4	0.0
Viscerocranium length	12.6, 13.9	13.2	0.1	12.6, 13.9	13.3	0.3
Neurocranium length	12.2, 13.0	12.0	0.1	11.1, 13.0	12.0	0.2
Short lateral facial length	13.6, 15.1	14.3	0.1	13.7, 15.5	14.7	0.3
Greatest breadth of the foramen magnum	1.7, 2.3	2.0	0.0	1.8, 2.2	2.0	0.0
Greatest breadth at the bases of the paraoccipital processes	5.7, 6.6	6.2	0.0	5.6, 6.7	6.1	0.0
Greatest breadth across the orbits	10.5, 12.1	11.5	0.1	11.2, 12.2	11.7	0.1
Greatest breadth across the premaxillae	7.0, 8.2	7.5	0.0	6.8, 8.2	7.4	0.1
Greatest breadth across the nasals	2.8, 3.6	3.2	0.0	3.2, 3.6	3.3	0.0
Frontal length	10.9, 13.1	12.2	0.1	11.5, 13.8	12.5	0.2
Greatest length of the nasals	8.5, 9.2	8.8	0.1	8.2, 9.3	8.6	0.2
Length of the molar row	6.4, 7.9	7.1	0.0	6.4, 7.6	7.1	0.1

Tab. 17. Measurements (mm) of sheep cranium from Lchashen; legend - see the Tab. 7.
Măsurători (mm) ale craniilor de oaie de la Lchashen; legendă - vezi Tab. 7.

Age / Site	Metacarpal bones		Metatarsal bones	
	1	2	1	2
Neolithic- Chalcolithic				
Khatunarkh	-	-	149	70
Mokhrablur (IV millennium BC)	-	-	140	66
Early Bronze Age				
Mokhrablur	137	67	140	66
	139	68	146	69
	143	70	149	70
	-	-	142	67
Shengavit	-	-	142	67
	-	-	149	70
Middle Bronze Age				
Ayrivan	-	-	142	69
Keti	-	-	118	58
Lchashen	-	-	123	60
	134	66	140	66
	137	65	144	67
	140	66	154	72
	127	62	136	64
	129	63	135	64
	127	62	136	64
	138	68	133	62
	128	63	139	65
	132	64	132	62
Sevan	-	-	135	64
	129	63	135	64
	130	64	141	67
	130	64	137	64

Tab. 18. Measurements of metacarpal and metatarsal bones of sheep: 1. greatest length (mm), 2. height of the withers (cm).

Măsurători ale metacarpienelor și metatarsienelor de oaie: 1. lungime maximă (mm), 2. înălțime la greabăn (cm).

Age/Site	n	min, max	M	σ
Neolithic-Chalcolithic				
Khatunarkh	1	-	70	-
Mokhrablur (IV millennium)	1	-	66	-
Early Bronze Age				
Mokhrablur (III millennium)	7	66, 70	68.1	1.5
Shengavit,	4	67, 70	68.2	1.5
Sepasar	8	62, 70	65.7	2.8
Aparan	6	62, 70	66.1	3.2
Middle Bronze Age				
Lchashen	18	60, 72	64.1	2.7
Lori Berd	8	56, 68	63.1	4.2
Sevan	8	63, 67	64.2	1.1
Shamshadin	5	55, 69	61.8	5.8

Tab. 19. Withers height of sheep in different periods based on the length of metapodia (cm); legend - see the Tab. 7.

Inălțimea la greabăn a oii din diferite perioade pe baza lungimii metapodiilor (cm); legendă - vezi Tab. 7.

Age/Site	1			2			Site	1		
	Male			Male				Female		
	M	min, max	σ	M	min, max	σ		M	min, max	σ
Neolithic-Chalcolithic							Khatunarkh, n=2	70; 75		
Early Bronze Age										
Mokhrablur, n=4	165.2	145, 186	16.7	122.7	110, 137		Shengavit, n=8	77.2	71, 85	5.5
Middle Bronze Age										
Garni, n=2	201			111; 145			Kirovakan, n=3	80.5	73, 84	6.3
Shirakavan, n=2	295			134; 165			Shirakavan, n=11	73.4	56, 88	8.9
Arevik, n=5	138.8	111, 164	26	145.8	136, 159	7.6	Metsamor, n=1	74		
Tsamakaberd, n=1	147			115			Tsamakaberd, n=1	84		
Ayrivan, n=2	154; 167			103; 12			Sevan, n=4	78.5	66, 91	10.6
Lchashen, n=1	206			134			Aigevan, n=4	84.5	75, 92	8.3

Tab. 20. Measurements (mm) of horncore of goat: 1. length measured on the greatest curve; 2. circumference of the basis; legend - see the Tab. 7.

Măsurători (mm) ale proceselor cornulare de capră: 1. lungimea măsurată pe curbura mare; 2. circumferința bazei; legendă - vezi Tab. 7.

Age /Site	Metacarpus	Age/Site	Metatarsus	Height of the withers
Early Bronze Age				
Shengavit	104	Shengavit Mokhrablur	107 104	52 50
Middle Bronze Age				
Arevik	102	-	-	50
Shirakavan	103	-	-	50

Tab. 21. Greatest length of metacarpal and metatarsal bones of goat. Measurements: 1. greatest length (mm). 2. height of the withers (cm).

Lungimea maximă a metacarpalienelor și metatarsienelor de capră. Măsurători: 1. lungime maximă (mm), 2. înălțime la greabăn (cm).



Fig. 7. Horncore of domestic goat.
Procese cornulare de capră.

Site/Age	Length of the cheek tooth row	Length of the premolar row	Length of the molar row	Length of M ³	Breadth of M ³	Height of M ³
Early Bronze Age						
Shengavit #13	-	72	47	-	-	-
Shengavit #8	119	71	47	36	19	-
Shengavit #23	120	-	-	33	17	-
Shengavit #20	117	70	39	33	18	12
Middle Bronze Age						
Lchashen	106	69	38	31	20	14
Tsamakaberd #3	-	56	-	26	15	11
Tsamakaberd #5	-	56	-	26	13	10

Tab. 22. Measurements of the maxilla of pig (mm).
Măsurători ale maxilarului de porc (mm).

Sites/Age	Length of the cheek tooth row	Length (P ₂ -I ₃)	Length of molar row	Length and breadth M ₃	Height of the mandible behind M ₃	Height of the mandible in front of M ₁	Height of the mandible in front of P ₂	Height of M ₃
Neolithic-Chalcolithic								
Khatunarkh	-	-	-	44/-	-	-	-	-
Early Bronze Age								
Mokhrablur	100	58	64	34/13	-	-	-	-
Mokhrablur	124	-	85	44/17	50	40	41	-
Mokhrablur	99	-	64	34/14	48	41	41	12
Mokhrablur	-	-	-	42/18	48	-	-	13
Mokhrablur	-	-	-	42/18	48	-	-	13
Middle Bronze Age								
Kelanlu	-	-	-	52/19	57	-	-	-
Tsamakaberd	-	-	65	31/14	-	-	-	12

Tab. 23. Measurements of mandible of pig (mm).
Măsurători ale mandibulei de porc (mm).

Lchashen	Number of specimens	The extreme values (mm)	The average values (mm)	σ
Profile length	3	315-326	321.6	5.8
Basal length	3	285-300	291.3	7.7
Upper length of the lacrimal	9	29-52	38.44	8
Length of nasal bones	2	166-167	-	-
Breadth of M ³	8	16-19	17.5	0.9
Greatest inner length of the orbit	5	32-38	35.7	2.6
Length of M ³ upper	8	29-33	31.6	1.4
Length of the cheektooth row	5	107-115	111.2	3.2
Length of the molar row	8	60-70	64.6	3.0
Length of the premolar row	5	43-48	46	2.1

Tab. 24. Range of individual variability of absolute sizes pig skulls (*Middle Bronze Age*).
Variabilitatea individuală a craniilor de porc (Epoca bronzului mijlociu).

Age /Sites	GH				GB			LmT		
	n	min, max	M	σ	min, max	M	σ	min, max	M	σ
Neolithic-Chalcolithic										
Aratashen	1	60			67			66		
Early Bronze Age										
Shengavit	1	52			53			63		
Mokhrablur	1	63			66			61		
Sepasar	1	73			62			55		
Middle Bronze Age										
Metsamor	2	52, 55			51, 62			53, 73		
Lori Berd	9	52, 67	59.8	4.2	58, 67	64.7	3.0	54, 66	60.3	3.6
Sevan	3	60, 61	60.0	1.0	63, 66	64.6	1.5	57, 58	57.6	0.5
Tsamakaberd	4	56, 75	62.0	8.8	58, 75	66.2	7.6	54, 66	60.7	5.7

Tab. 25. Astragalus size comparison between Neolithic-Chalcolithic and Bronze Age horses (mm). Legend - see the Tab. 7. Measurements: GH – greatest height (=length); GB – greatest breadth; LmT – length of the medial part of the Trochlea tali.

Comparații între dimensiunile de astragal de cal din neo-eneolitic și epoca bronzului (mm). Legendă - vezi Tab. 7. Măsurători: GH - înălțime maximă (= lungime), GB - lățime maximă; LmT - lungimea părții mediale a trohlei talusului.

Age	Undersized 128-136 (cm)	Medium by height 136-144 (cm)	Stalwart 144-152 (cm)
Neolithic-Chalcolithic	1	-	1
Early Bronze Age	3	9	6
Middle Bronze Age	11	15	8
Late Bronze` Age	2	28	22

Tab. 26. Variability in the size of height at the shoulder for the horses according to time periods. Variabilitatea înălțimii la greabăn la cai de-a lungul diferitelor perioade istorice.



Fig. 8. *Equus* astragalus from Aratashen (a) and Verin Naver (b). Astragale de *Equus* descoperite la Aratashen (a) și Verin Naver (b).

Age	Total	Wild	Domestic
Neolithic – Chalcolithic	688	12.9%	87.0%
Early Bronze Age	8147	4.6%	95.3%
Middle Bronze Age (settlement)	3014	4.4%	95.5%
Middle Bronze Age (burial)	6347	4.0%	95.9%
Late Bronze` Age	1046	15.6%	84.3%

Tab. 27. Ratio between wild and domestic mammals in different chronological sites. Raportul dintre mamiferele sălbatice și cele domestice în diferite perioade cronologice.

Age	Red deer	Roe deer	Fox	Hare	Marten	Mouflon
Neolithic – Chalcolithic	14.6	11.2	10	7.8	1.1	21.3
Early Bronze Age	23.1	14.2	17.8	0.5	0.5	14.4
Middle Bronze Age (settlement)	62.2	9.6	3.7	0.7	0.7	2.2
Middle Bronze Age (burial)	21.0	1.9	38.1	6.2	17.1	0.7
Late Bronze Age	37.8	0.6	4.2	8.5	3.0	30.4

Tab. 28. Ratio (%) of most important wild mammals in different chronological sites (based on NISP).
 Procentele celor mai importante mamifere sălbatice în diferite perioade cronologice (bazat pe NISP).