# ՀՆԱԳԻՏՈՒԹՅՈՒՆ
# ARCHAEOLOGY

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## "SOIL MEMORY" AND "CULTURAL MEMORY" OF HISTORICAL LANDSCAPES OF ARMENIA: LAUNCHING OF A MULTIDISCIPLINARY STUDY OF BRONZE AND EARLY IRON AGE SITES

*Key words:* archaeology, soil science, Bronze Age, Iron Age, economic models, funeral rites, soil microflora.

### *Introduction*

Soil is a unique natural substance, which preserves information, concerning various environmental changes in its physical, chemical and biological properties[1].

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This feature is known as "memory of soil"[2]. Contrary to archaeological finds, microbes are an indivisible part of the soil. In a certain sense, the soil of archaeological cultural sediments can be considered as an ecotope, and the microbial communities in it – ecofacts, which carry information about past events like the archaeological artifacts[3]. Therefore, various archaeological units, such as settlements, burials, inventory and particular items can be considered as peculiar ecological niches inhabited by different microbial communities that have their specific biodiversity and enzymatic activity. The composition of the soil microbial community is retained for a long time due to the ability of microbes to shift to resting state and return to the active state in favorable conditions[4]. Regarding the enzymes, even in the case of partial death of microbial communities, a certain amount of produced enzymes attaches to the organic-mineral soil matrix and remains active in soils for a long time[5]. Upon the decomposition of different organic materials in soil, the number of microorganisms involved in their transformation increases, i.e. the microbes that decompose and use that specific organic matter grow best and dominate in the microbial community. After the utilization of these materials, a part of the microbial community dies off, and another part passes into a resting state. However, the fact of the former input of organic material, is retained in the residual amount and diversity of soil microbial communities ("soil microbiological memory"). Alongside with the structure of microbial communities, the composition of enzymes that microbes use to destroy organic substrates also changes (these enzymes are involved in the mineralization process, and this phenomenon is known as "enzymatic memory of soil")[6]. The cultural layers and soils of archaeological monuments are objects, in which the organic matter received in the past could leave some imprint on the properties of microbial communities and enzymatic patterns. The phenomenon of "soil memory" is used in archaeology to study the boundaries of the settlements and their infrastructures, to determine the places of the livestock grazing and animal pens,

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[2] **Таргульян, Горячкин** 2008.

[3] Margesin et al. 2017.

[4] **Бухарин и др.** 2005; Khomutova et al. 2019.

[5] Caldwell 2005.

[6] Caldwell 2005; Margesin et al. 2017; Khomutova, Borisov 2019.

and the borders of ancient cultivated fields as well as the fact of fertilization of the ancient fields[7]. The effectiveness of the use of the soil "microbiological and enzymatic memory" for the reconstruction of the funeral rites, as well as the initial contents of the ritual vessels, has already been confirmed[8]. The possibility to detect the traces of proteins, lipids and carbohydrates in the soil by microbiological methods was also confirmed through long-term model experiments[9].

Archaeological sites from the territory of Armenia have never been tested for their "soil memory". Our Armenian-Russian research team plans to carry out multidisciplinary investigations involving archaeological, pedological, microbiological and biochemical studies in selected archaeological sites in Armenia. The specific objectives of the project are to determine the character of economic activity of various societies of the Bronze and Iron Ages in the region, to study the infrastructure of the settlements, determine the areas used for animal-breeding and agriculture, the assemblage of domestic animals and cultivated plants, to find out the ways of fertilization and irrigation applied for the cultivated lands, as well as to reconstruct some episodes of the funeral rites, and particularly the composition of food in vessels, the presence of leather and fur items, etc. Within the framework of this interdisciplinary project, methods of soil science and soil microbiology at several Bronze and Iron Age period settlements and tombs in Armenia are tested for the first time. The territory of Armenia is located in the contact zone of the ancient civilizations of the Near East and pastoral communities of the southern steppes of Russia, which is reflected in economic models and funeral rites of the Bronze and Iron Age societies of the region[10]. From this point of view, the aim of this project is to expand the existing views, regarding the features of historical and cultural developments of the population of ancient Armenia by discussing the mechanisms of possible contacts between the civilizations of the Near East and the steppe cultures of southern Russia[11].

*The Scope of the Study*

Often, due to a variety of cultural and natural factors, organic (archaeobotanical and archaezoological) materials are poorly preserved or not at

[7] Peters et al. 2014; **Черныше**ва и др. 2019.

[8] **Каширская и др.** 2018; **Демкин и др.** 2014.

[9] **Хомутова и др.** 2019.

[10] **Ավետիսյան** 2014.

[11] Bobokhyan 2008.

all in archaeological deposits. As a result, there is a lack of materials and findings that could provide data on the agriculture and animal-breeding of prehistoric societies, as well as on food preferences. In such cases, archaeologists can only be satisfied with the assumptions based on indirect data or parallels from other sites. In this regard, the study of cultural heritage in combination with natural sciences becomes urgent. The link between all this is the soil, which has a certain "memory", that is, the ability to change and retain these changes as a result of past human influences. Within the framework of this project, the information potential of "land memory" is planned to be used for archaeological purposes. In particular, it is planned to use for the first time the methods of soil microbiology and enzymology to detect traces of agricultural and livestock farms, the peculiarities of the burial rites and other components of the region's historical and cultural development, which cannot be detected by other methods. The choice of soil microbiology and enzymology methods used in the project depends on the specifics of the research objects and problems. This project aims to conduct research in the following sites, which have been selected based on the characteristics of different levels of ecosystems (Fig. 1-6): Artanish, Sotk, Metsamor and Karmir Sar.

The Artanish site-cluster consists of a cemeteries and settlements of the Bronze and Iron Age periods in the northeastern shore of Lake Sevan, on elevation about 2000 m above sea level. This micro-district is being studied for archaeology for the first time. Excavations were carried out in 2019 and 2020; several Iron Age period burials and a little part of the Early Bronze Age settlement were excavated. The excavated cultural sediments, including vessel soil contents, were sampled for archaeobiological investigations. In general, food remains in vessels from burials may give information about the local diet, burial rituals, agriculture and even environment, but archaeobotanical studies of the vessels' soil from the burials of Armenia often do not reveal any macroscopic (eye-visible) plant remains. Similar situation was also in the case of Artanish; only few grains were preserved in the examined vessels. The ritual food buried with the deceased individuals is an important part of the burial rites. The implementation of the microbiological-enzymological approach in the study of the soil filling of ceramic vessels from burials can provide information about their initial contents. The planned microbiological-enzymological studies are supposed to reveal also the limits of the

infrastructure of the settlement, the arrangement of the burials and the presence of wool and leather items.

The Sotk site-cluster includes cemeteries and settlements on the southeastern shore of Lake Sevan, about 2100 m above sea level[12]. Archaeological investigations conducted here by the Armenian-German expedition since 2011 discovered several settlements and cemeteries of the Early, Middle and Late Bronze as well as the Early Iron Ages. Archaeobotanical research has been fulfilled in the Sotk-2 settlement for several years. Hundreds of charred grains of cultivated cereals were found, while the seeds of pulses (leguminous cultivated plants) are missing in the archaeobotanical material. It can be assumed that only cereals were cultivated at this settlement[13]. Perhaps the others, for example, pulses' seeds (rich with proteins) or the seeds of oil-plants (rich with vegetable fat) were not preserved due to the specific characteristics of the soil which covered/formed on the cultural layers of the site. Pulses are endosymbiotic plants and nitrogen-fixing bacteria live in their roots. The cultivation of pulses in a certain area for a long period of time leaves its traces in the biochemical characteristics, microflora, and in the composition of soil enzymes. The continued growth of hydrophile plants, which is recorded by the presence of a significant amount of the seeds found in the archaeological layers of the Sotk-2 site (now the area is covered with steppe vegetation), also possibly left its trace on the aforementioned characteristics of the soil and hopefully may be fixed by the microbial-enzymatic methodology proposed in this project. As for the previous case, we plan to study the limits and infrastructures of the settlement, using the methods of microbiology and enzymology. We plan to make a series of soil sections at different distances from the archaeological sites, within the proposed economic zone of the settlement. In each section, archaeological material, primarily ceramics, will be fixed and soil samples will be taken for chemical and microbiological studies. Under laboratory conditions the samples will be determined within the content of organic carbon, phosphates, composition of soil texture; microbial biomass and the activity of urease, phosphatase, as well as the number of specific groups of soil microorganisms will be evaluated. Within the framework of the study of burial rites, the research of soil in pots will be carried out, using the method developed

[12] Kunze et al. 2013; Bobokhyan et al. 2015; Hovsepyan 2017; **Մկրտչյան**, **Սիմոնյան** 2018; Karapetian et al. 2019; Movsesian et al. 2020.

[13] Hovsepyan 2013, 2017b.

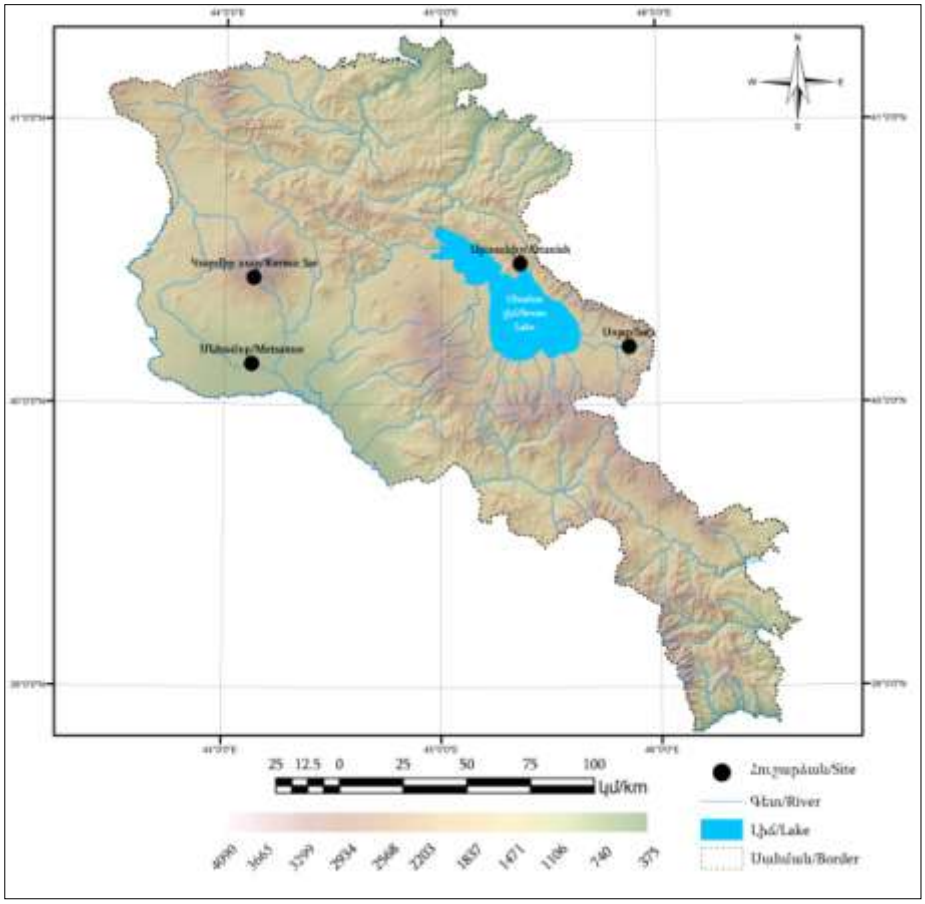


Fig. 1. Location of archaeological sites mentioned in the text (Sotk expedition, 2020, H. Danielyan)

Fig. 2. Artanish peninsula: view on Sevan Lake and the Geghama Mountains from the fortress Artanish-9 (Artanish expedition, 2019, L. Mkrtchyan)

Fig. 3. Village Sotk and the archaeological site Sotk-1 (Sotk expedition, 2021, A. Mkrtchyan)

Fig. 4. Village Sotk and the archaeological site Sotk-2 (Sotk expedition, 2021, A. Mkrtchyan)

Fig. 5. The highland environment of the Karmir Sar sanctuary, Aragats ("Vishap" project, 2015, A. Bobokhyan)

Fig. 6. The 12 canals that feed the lowland zone, which originate from the sources of the Amberd River, Karmir Sar, Aragats ("Vishap" project, 2017, A. Bobokhyan)

by the Russian team on multi-substrate testing of the respiratory activity of soil microorganisms and the activity of specific groups of enzymes (phosphatase, lipase, amylase, etc.) involved in the decomposition of substrates of a protein, polysaccharide and lipid nature.

The Metsamor site-cluster consists of a cemetery and settlement of the Bronze and Iron Age periods in the Ararat Valley, about 1000 m above sea level. It is one of the famous sites of Armenia, which is being studied since the 1960's up to date[14]. This ancient settlement is surrounded by modern fields of cultivated plants and swamps, and there is a need to determine the boundaries of ancient cultivated fields, as well as to investigate the issue of the ancient irrigation system of the territory. Here too, we plan to study the limits and infrastructure of the settlement, the arrangement of the burials, the possible presence of wool and leather items, and the initial contents of the ritual vessels using the methods of microbiology and enzymology.

The Karmir Sar site-cluster is a sacred space and ancient pasture of the Bronze and Iron Age periods situated on the southern slopes of Mount Aragats, with 12 megalithic stelae locally called "vishaps" ("dragon-stones" in Armenian), cromlechs and a temporary settlement at an altitude of 2860 m above sea level. It is a site of worldwide significance, which represents a rich cultural landscape in such an elevation (the parallels can be traced only in the Andes and the Himalayas)[15]. The site was discovered by archaeologists in 2012, excavations and archaeobotanical studies have been conducted since 2013 to date. Presumably, this concave area was partially flooded with waters of a small mountain lake, which run dry from time to time. This assumption is confirmed by geomorphological studies. The area probably turned into a highland steppe after the process of lake's desiccation, where the cattle were supposedly grazed. The usage of this area in the past as pasture has not yet been proven: animal bones have not been found here. The situation is more confound by the archaeobotanical data, since the charred seeds of cultivated cereals as well as some seeds and nut-stones of other cultivated plants (pea, grape, plum, etc.) were found in different archaeological layers[16]. The remains of charred wood of various trees and bushes

[14] **Խանզադյան և ուր**. 1973; Khanzadian 1995; Jakubiak et al. 2016; 2019; Simonyan et al. 2019; **Мкртчян и др**. 2017; 2019; Simonyan 2017.

[15] Gilibert et al. 2012; Bobokhyan 2018; Hovsepyan 2021.

[16] Hovsepyan 2021

are also unexpected, since the upper border of forests in Armenia usually does not exceed 2400 m above sea level, which is 400 meters below the research area. The aforementioned height is also the upper limit for farming in the region. It can be assumed that in the past people brought with them grains and other food, and also wood. But we cannot reject the fact that the climate was different in the past and the forests reached this height, and that the cultivation of plants at this level was possible[17].

It is planned to study the history of soil development in the region, to identify the presence of the lake using microbiomorphic soil analysis methods (sponge spicules and phytoliths of aquatic vegetation) to answer the above-mentioned questions. Traces of possible pasture usage of the territory will be revealed by analyzing urease activity and traces of the presence of specific helminths in the soil which are typical of different types of livestock. It is supposed to study the limits and infrastructure of the pastoral settlement and livestock housing areas using the methods of soil microbiology and enzymology. A study will be conducted on the urease activity of soils concerning the number of thermophilic microorganisms that develop at temperatures above 60° C during composting and self-heating of manure.

Within the framework of our project, in the context of the study of archaeological sites in Armenia, for the first time, a wide range of methods of soil science and soil bacteriology will be applied. Archaeological, archaeobiological, palaeopedological, microbiological, enzymatic and bio-archaeological studies will significantly expand our understanding of the features of the region's productive economy, the organization of settlements, and the burial rites. At the end of the project, the methodology of soil research, stratigraphic, microbiological and enzymatic marker system will be improved in order to apply them in the archaeological investigations of other geographical areas.

*Methods of Implementation*

During the excavations to be carried out at the first stage of the research, the appropriate archaeological, anthropological and archaeobotanical as well as microbiological studies will be conducted.

The archaeobotanical methods are based on the discovery of plant remains, their study, identification and interpretation of the research data. Macroscopic

[17] Hovsepyan et al. in preparation.

remains of the carpological material (seeds, fruits and other organs related to the generative reproduction of plants) will be recovered from the soil samples by flotation and wet-sieving methods and will be studied based on their preserved morphological and anatomical features. Archaeobotanical materials provide information on various archaeological contexts, including the original contents of the vessels, vegetal origin of food and diet in general, cultivated plants and agriculture, as well as about the flora and vegetation surrounding the site[18]. Palaeozoological and palaeoanthropological methods are based on the study of bone remains and their morphological-anatomical identification.

The microbiological studies will be aimed at reconstructing the infrastructure of the settlements, the livestock housing areas and the pastures. In particular, methods presenting the phosphatase and urease activity of the sampled soil will be used, and methods determining the number of thermophilic bacteria will be applied to confirm the fertilization of cultivated lands.

For the reconstruction of the components of the burial rite such as the garments of the deceased and the funerary litter will be carried out by the methods of determining the cellulolytic and keratolytic activity of microorganisms. The high activity of cellulolytic enzymes may indicate the presence of tissues of plant origin, mainly carpets, and the keratolytic activity of the soil detects the high content of wool, feathers, horns and other materials. The presence of proteins, fats and starch in the soil of the vessels will be assessed by the respiration activity of microorganisms in a response to addition of respective low-molecular compounds as inducers and used to restore the content of ritual vessels.

The data obtained during the implementation of these methods will be combined for historical and cultural conclusions.

The use of pedological-archaeological methods in multi-layered ancient sites of Armenia will significantly expand the existing scientific perceptions and practical applications in this field. The proposed interdisciplinary approaches will widely contribute to its realization as our team involves archaeologists, archaeobotanists, palaeoanthropologists, a specialist of palaeosoil, microbiologists and biochemists. Our cooperation and the joint research results will increase the efficiency and respectability of the conducted investigations, which will be a beneficial achievement for all of the sides of the cooperation.

[18] Hovsepyan 2017a.

The above-mentioned methodology proposed by the Russian side has not been tested in various landscape ecosystems, while it is possible to do in the corresponding sites of Armenia proposed for the current study. Research data will allow us to evaluate the informative potential of these methods, especially from two perspectives. First of all, they will help to recover the leather or fur made objects unearthed in the burials, traces of garments, and the contents of the vessels. Afterward, the above-mentioned pedological-microbiological methods can demonstrate their effectiveness for the first time in alpine zones. Traces of human activity are difficult to detect in the highlands due to the preservation state of organic materials and a number of other problems. From this point of view, the successful implementation of the project will substantially expand the scientific tools of archaeological research in mountainous countries.

*Expected Results*

In the proposed collaborative investigations, the pedological-microbiological methodology is innovative and will be tested for the first time in Armenia. We expect that this methodology will be effective when used in future investigation of other archaeological sites of Armenia, contributing to deciphering situations of the past related to human household and activity that cannot be documented with the help of traditional archaeological methods.

BIBLIOGRAPHY

**Ավետիսյան Պ.** 2014, Հայկական լեռնաշխարհը մ.թ.ա. XXIV-IX դարերում (սոցիալ-մշակութային ձևափոխումների դինամիկան ըստ հնագիտական տվյալների), Դոկտորական ատենախոսության սեղմագիր, Երևան, ՀՀ ԳԱԱ, 92 էջ:

**Խանզադյան Է., Մկրտչյան Կ., Պարսամյան Է.** 1973, Մեծամոր, ՀՍՍՀ ԳԱ հրատ., 214 էջ:

**Մկրտչյան Ռ., Սիմոնյան Հ.** 2018, Շիրակի և Գեղարքունիքի բրոնզեդարյան բնակչության կենսահնագիտական ցուցիչների համեմատական, Ավետիսյան Հ. (խմբ.), Արագածի թիկունքում. հնագիտական հետազոտություններ նվիրված Տելեմակ Խաչատրյանի հիշատակին, ՀՀ ԳԱԱ «Գիտություն» հրատարակչություն, Երևան, էջ 143–149:

**Бухарин О.В., Гинцбург А.Л., Романова Ю.М., Эль-Регистан Г.И.** 2005, Механизмы выживания бактерий, Москва, «Медицина», 367 с.

**Демкин В.А., Демкина Т.С., Удальцов С.Н.** 2014, Реконструкция погребальной пищи в глиняных сосудах из курганных захоронений с использованием фосфатного и микробиологического методов, Вестник археологии, антропологии и этнографии, N 2(25), с. 148–159.

**Каширская Н.Н., Потапова А.В., Клещенко А.А., Борисов А.В.** 2018, Микробиологическое выявление субстратов животного происхождения в погребальных подстилках эпохи бронзы, Краткие сообщения Института археологии, N 253, с. 403–416.

**Мкртчян Р.А., Воронцова Е.Л., Симонян А.Г.** 2017, Население страны Этиуни (по краниологическим данным), Вестник Московского университета. Антропология, Серия XXIII, N 4, с. 91–106.

**Мкртчян Р.А., Воронцова Е.Л., Симонян А.Г.** 2019, Страна Этиуни, Кавказ и Степной мир (Сравнительное краниологическое исследование), Международная конференция «VIII Алексеевские чтения», сборник тезисов, Москва, 19-21 августа, с. 44–45.

**Таргульян В.О., Горячкин С.В. (ред.)** 2008, Память почв: почва как память биосферно-геосферно-антропосферных взаимодействий, Москва, изд-во ЛКИ, 680 с.

**Хомутова Т.Э., Дущанова К.С., Смирнов В.Э., Борисов А.В.** 2019, Сукцессия микробного сообщества серой лесной почвы при разложении различных органических соединений, Почвоведение, N 8, с. 966–973.

**Чернышева Е.В., Каширская Н.Н., Демкина Е.В., Коробов Д.С., Борисов А.В.** 2019, Термофильные микроорганизмы в почвах как результат хозяйственной деятельности человека в древности, Микробиология, N 88(5), с. 624–626.

Bobokhyan A. 2008, Kommunikation und Austausch im Hochland zwischen Kaukasus und Taurus, ca. 2500–1500 v. Chr., Bd. 1–2. British Archaeological Reports 1853, Oxford, “Hedges”, 674 S.

Bobokhyan A., Gilibert A., Hnila P. 2018, Karmir Sar: New Evidence on Dragon Stones and Ritual Landscapes on Mount Aragats, Armenia. in: Batmaz A., Bedianashvili G., Michalewicz A., Robinson A. (eds), Context and Connection: Essays on the Archaeology of the Ancient Near East in Honour of Antonio Sagona, Orientalia Lovaniensia Analecta 268, Leuven - Paris - Bristol, p. 255–270.

Bobokhyan A., Kunze R., Meliksetian K., Pernicka E., Meller H. 2015, Archaeological Investigations around the Gold Mines of Sotk, Armenia, Işikli M., Can B. (ed.), International Symposium on East Anatolia - South Caucasus Cultures, 10-13 October 2012, Erzurum University, Cambridge, Scholars Publishing, p. 342–354.

Caldwell B. 2005, Enzyme Activities as a Component of Soil Biodiversity: A Review, Pedobiologia, N 49, p. 637–644.

Hovsepyan R. 2013, First Archaeobotanical Data from the Basin of Lake Sevan, Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt, Bd. 67, Archäologie in Armenien II, Halle (Saale), S. 93–105.

Hovsepyan R. 2015, On the Agriculture and Vegetal Food Economy of Kura-Araxes Culture in the South Caucasus, Paléorient, N 41(1), p. 69–82.

Hovsepyan R. 2017a, Archaeobotanical Sampling: Instructions for Fieldwork, Proceedings of the Institute of Archaeology and Ethnography, vol. 2: Habitus: Studies in Anthropology and Archaeology - 2, Yerevan, «Gitutyun», p. 212–216.

Hovsepyan R. 2017b, New Data on Archaeobotany of Lake Sevan Basin, Iran and the Caucasus, N 21(3), p. 251–276.

Hovsepyan R. 2021. Seeds from Vishaps' Environment: Archaeobotanical Findings from the High Mountainous Site of Karmir Sar (Tirinkatar, Mt. Aragats, Armenia), Quaternary International 579: 19–28.

Jakubiak K., Mkrtchyan R., Simonyan H. 2019, Metsamor (Armenia): Fieldwork in the 2018 Season, Polish Archaeology in the Mediterranean, N 28/2, p. 311–332.

Jakubiak K., Piliposyan A., Iskra M., Zaqyan A., Simonyan H. 2016, Metsamor (Armenia): Preliminary Report on the Excavations in 2013, 2014 and 2015, Polish Archaeology in the Mediterranean, N 25, p. 553–574.

Karapetian M., Mkrtchyan R., Simonyan H. 2019, Ankylosing Spondylitis: Antiquity and Differential Diagnosis – a Case Study of a Bronze Age Skeleton from Norabak, Southeastern Armenia, HOMO, N 70(3), p. 171–183.

Khanzadian E. 1995, Metsamor 2: La Necropole 1, CPO, Hors serie 1, Neuchatel, Paris.

Khomutova T., Borisov A. 2019, Estimation of Microbial Diversity in the Desert Steppe Surface Soil and Buried Palaeosol (IV mil. BC) Using the TRFLP Method, Journal of Arid Environments, N 171, p. 104004.

Kunze R., Bobokhyan A., Pernicka E., Meliksetian K. 2013, Projekt Ushkiani. Untersuchungen der Kulturlandschaft um das prähistorische Goldrevier von Sotk, Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen Anhalt – Landesmuseum für Vorgeschichte 67, Halle, S. 49–88.

Margesin R., Siles J.A., Cajthaml T., Ohlinger B., Kistler E. 2017, Microbiology Meets Archaeology: Soil Microbial Communities Reveal Different Human Activities at Archaic Monte Iato (Sixth Century BC), Microbial Ecology, N 73, p. 925–938.

Peters S., Borisov A., Reinhold S., Korobov D., Thiemeyer H. 2014, Microbial Characteristics of Soils Depending on the Human Impact on Archaeological Sites in the Northern Caucasus, Quaternary International, N 324, p. 162–171.

# ՀԱՅԱՍՏԱՆԻ ՊԱՏՄԱԿԱՆ ԼԱՆԴՇԱՖՏՆԵՐԻ «ՀՈՂԻ ՀԻՇՈՂՈՒԹՅՈՒՆԸ» ԵՎ «ՄՇԱԿՈՒԹԱՅԻՆ ՀԻՇՈՂՈՒԹՅՈՒՆԸ». ԲՐՈՆԶ-ԵՐԿԱԹԵԴԱՐՅԱՆ ՀՈՒՇԱՐՁԱՆՆԵՐԻ ՄԻՋՄԱՍՆԱԳԻՏԱԿԱՆ ՀԵՏԱԶՈՏՈՒԹՅԱՆ ՄԵԿՆԱՐԿԸ

ԲՈԲՈՒՅԱՆ Ա., ԽՈՄՈՒՏՈՎԱ Տ., ՀՈՎՍԵՓՅԱՆ Ռ.

## Ամփոփում

***Բանալի բառեր***՝ ինագիտություն, հողագիտություն, բրոնզի դար, երկաթի դար, տնտեսական մոդելներ, թաղման ծես, հողային միկրոֆլորա:

Մեկնարկած հետազոտության նպատակն է միջմասնագիտական հողագիտական մեթոդների օգնությամբ համալրել Հայաստանի տարածքի բրոնզերկաթեդարյան հասարակությունների տնտեսության և թաղման ծեսի մասին առկա գիտելիքը: Հնագիտական մեթոդներին զուգահեռ, կիրառելով հողային մանրէաբանության և ֆերմենտագիտության մեթոդները, փորձ է կատարվելու պարզել բնակատեղիների, նրանց ենթակառուցվածքի և մասնավորապես գյուղատնտեսական նպատակներով օգտագործված հողատարածքների սահմաններն ու օգտագործման նպատակները, ինչպես նաև՝ վերակազմել թաղման ծեսի առանձնահատկությունները: Առաջարկվող մեթոդաբանությունը հիմնված է հողի կենսաբանական «հիշողության» վերծանմանն ուղղված գործոնների վրա: Այդ «հիշողության» կրողներն են հողային մանրէների համակեցությունները և կենսազանգվածը, որոնց բազմազանությունը և ֆերմենտային ակտիվությունը հանդիսանում է անցյալի բնական միջավայրի և մարդու տնտեսական գործունեության ցուցիչ: Հետազոտվող հնավայրերի ընտրությունը կատարվել է՝ նպատակ ունենալով տվյալներ ստանալ Հայաստանի տարածքի տարբեր էկոխորշերից՝ ցածր (Մեծամորի բնակավայրն ու դամբարանադաշտը), նախալեռնային (Սոթքի ու Արտանիշի բնակավայրերն ու դամբարանադաշտերը) և բարձրալեռնային (Կարմիր Սար սրբավայրը) գոտիներից:

# «ПАМЯТЬ ПОЧВ» И «КУЛЬТУРНАЯ ПАМЯТЬ» ИСТОРИЧЕСКИХ ЛАНДШАФТОВ АРМЕНИИ: НАЧАЛО МУЛЬТИДИСЦИПЛИНАРНОГО ИЗУЧЕНИЯ ПАМЯТНИКОВ ЭПОХИ БРОНЗЫ И РАННЕГО ЖЕЛЕЗА

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## Резюме

***Ключевые слова:*** археология, почвоведение, бронзовый век, железный век, экономические модели, погребальный обряд, почвенная микрофлора.

Целью исследования является восполнение существующих знаний об экономике и погребальном обряде обществ бронзового и железного века на территории Армении с помощью междисциплинарных методов почвоведения. Наряду с археологическими методами, на основе применения ме-

тодов почвенной микробиологии и энзимологии будет предпринята попытка определения границ поселений, их инфраструктуры и, в частности, используемых в сельскохозяйственных целях угодий. Реконструкция особенностей погребального обряда также является важным вопросом исследования. Предлагаемая методология основана на факторах, направленных на расшифровку биологической «памяти» почвы. Носителями этой «памяти» являются сообщества почвенных бактерий и биомассы, разнообразие и ферментативная активность которых являются показателем природной среды прошлого и хозяйственной деятельности человека. Археологические памятники выбраны с целью получения данных из различных экосистем Армении: низменности (поселение и некрополь Мецамор), предгорья (поселения и некрополи Сотка и Артаниша) и высокогорья (святилище Кармир Сар).