ISSN 1829-1376

ARAZD

ARMENIAN JOURNAL OF NEAR EASTERN STUDIES

VOLUME XIII ISSUE 1 · 2019

VOLUME XIII ISSUE 1 2019

ISSN 1829–1376

Archaeopress Journals

ARAMAZD

ARMENIAN JOURNAL OF NEAR EASTERN STUDIES

VOLUME XIII ISSUE 1 2019

ASSOCIATION FOR NEAR EASTERN AND CAUCASIAN STUDIES, YEREVAN
OXFORD 2019

ԱՐԱՄԱԶԴ

ՄԵՐՁԱՎՈՐԱՐԵՎԵԼՅԱՆ ՈՒՍՈՒՄՆԱՍԻՐՈՒԹՅՈՒՆՆԵՐԻ ՀԱՅԿԱԿԱՆ ՀԱՆԴԵՍ

ՀԱՏՈՐ XIII, ՀԱՏՈՐ 1 2019

ԱՌԱՋԱՎՈՐԱՍԻԱԿԱՆ ԵՎ ԿՈՎԿԱՍՅԱՆ ՀԵՏԱԶՈՏՈՒԹՅՈՒՆՆԵՐԻ ԱՍՈՑԻԱՑԻԱ, ԵՐԵՎԱՆ
ՕՔՍՖՈՐԴ 2019

Association for Near Eastern and Caucasian Studies in collaboration with the Institute of Archaeology and Ethnography (National Academy of Sciences of Armenia)

ARAMAZD

ARMENIAN JOURNAL OF NEAR EASTERN STUDIES (AJNES)

Communications for the editors, manuscripts, and books for review should be addressed to the Editor–in–Chief or Vice-Editors.

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http://www.ancs.am

ISSN 1829–1376
ISBN 978-1-78969-292-1

Typeset and published by Archaeopress Publishing Ltd, Oxford, UK

Subscriptions to **Aramazd** should be sent to
Archaeopress Publishing Ltd, Summertown Pavilion, 18-24 Middle Way, Oxford OX2 7LG, UK
Tel +44-(0)1865-311914 Fax +44(0)1865-512231
e-mail info@archaeopress.com
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Tick remains from Areni-1 (Birds' Cave, Armenia)

Noushig Zarikian, Kim Dilbaryan and Boris Gasparyan

Abstract: Ticks have never been included in archaeological analytic studies. Here, we present the discovery of a tick from the archaeological excavations at Areni-1 Cave in the Republic of Armenia. The well preserved tick *Rhipicephalus bursa* provides important information about the prevailing ecology during the periods of habitation and usage of the cave by Medieval inhabitants and supports previous hypotheses, that ticks were a potential source of disease for human and other mammals especially cattle, sheep, horse and dog. This discovery has health, behavioral and ecological implications for the people that occupied the cave.

Keywords: Archaeozoology, Areni-1 Cave, Armenia, paleopathogeny, tick remains

Introduction

The analysis of tick remains from archaeological contexts is a rare-attached part of archaeology and archaeozoology, but the main of archaeoparasitology. Studies of arthropods preserved in archaeological deposits can provide information about past human economy and resource exploitation, diet, activity and living conditions, as well as about the fauna.[1] Besides the supply of additional material for systematic studies, the resulting comparative data on the *Acari* fauna after an extended interval could be of value to the anthropologists, climatologists, and acarologists. Possible human and animal health hazards can be foreseen through these investigations since some species of Acari are able to carry and transmit bioagents.

Ticks belonging to the *Rhipicephalus bursa* Canestrini and Fanzago, 1878 group are among the most important vectors of pathogenic microorganisms, some of which can cause severe diseases in vertebrate hosts, including humans, cattle, sheep, horse and dog.[2]

The purpose of this paper is to discuss the tick from Areni-1 cave materials, supposing that further studies in this field will allow a better understanding of ticks and their relationship with the paleo-environment and their paleo-hosts.

Areni-1 (also known as Birds' Cave) is a three-chambered karstic cave located on the left-hand side of the Arpa River basin, a tributary of the River Araxes, within the eastern portion of the modern village of Areni in the Vayots Dzor Province of southern Armenia (Figure 1). Excavations at the site began in 2007 and were directed by Boris

[1] Radovsky 1970.
[2] Jongejan, Uilenberg 2004; Domingos *et al.* 2013; Sonenshine, Michael Roe 2014.

Gasparyan (Institute of Archaeology and Ethnography, National Academy of Sciences, Armenia) and co-directed by Ron Pinhasi (School of Archaeology, University College Dublin, Ireland) and Gregory Areshian (Cotsen Institute of Archaeology at UCLA, USA).

Since 2007 six trenches have been excavated at Areni-1 (Figure 2), but the major significance of the site was abundantly clear during the initial excavations when very well preserved Late Chalcolithic (4300–3400 cal BC) and Medieval (4th–18th centuries AD) occupations were exposed.[3] It appears that from the end of the 5th millennium BC onwards, people used the cave for different purposes – as a habitation, for keeping animals and storing plant foods, for the production of wine, as well as for ritual purposes. The Chalcolithic data from the cave demonstrate clear evidence for incipient social complexity. The workshops, wine producing complex, and the funerary features or 'burials' represent a common ritual and production oriented complex.[4]

Medieval finds in the cave span the entire medieval period from the 4th to the 18th centuries AD. Remains of a well preserved circular dwelling span the 7th to 9th centuries AD. Later finds dating to the 11th to 14th centuries AD include structures, a fragment of an Armenian manuscript, two well preserved ovens, a wine-storage jar, associated pottery, fragments of glass, and other small finds.[5] A group of limited small finds dated via 14C dating document Early Medieval usage of the cave between the 4th and the 7th centuries AD, as well as later during the 15th to 18th centuries AD.[6]

Minimal temperature oscillations and constant levels of low humidity within the cave have provided an ideal environment for preservation of organic remains. Because of this constant microclimate, Areni-1 has yielded large quantities of exceptionally well-preserved organic remains including the world's oldest leather shoe[7] along with basketry and clothing, textile fragments and wool.[8]

The material presented in this paper is originating from Trench 1, which is located in the main or first gallery inside the cave and contains artifacts and features that are clearly related to funerary ritual including human remains and wine making paraphernalia dating to 4000 – 3800 Cal BC.[9] Chalcolithic Horizons here are covered with 0.4-0.5 m thick layer of zoogenic humus or dung, which contains artefacts from 13th to 14th centuries AD. In some parts of the trench later periods (Bronze Age and Medieval Period) intrusions into the Chalcolithic contexts are recorded.

Rhipicephalus bursa biology

Rh. Bursa is considered a major parasite of sheep in the Mediterranean basin and southern part of the Palearctic mainly due to the transmission of ovine babesias.[10]

[3] Pinhasi *et al.* 2010; Areshyan *et al.* 2012; Wilkinson *et al.* 2012.
[4] Smith *et al.* 2014.
[5] Areshyan *et al.* 2012; Smith *et al.* 2014.
[6] Smith *et al.* 2014.
[7] Pinhasi *et al.* 2010.
[8] Stapleton *et al.* 2014.
[9] Stapleton *et al.* 2014.
[10] Motas 1903.

Despite its economic importance, *Rh. bursa* has been incompletely studied. It has been considered adapted to a habitat characterised by a low average precipitation and a long dry summer.[11] *Rhipicephalus bursa* is generally found in areas ranging in latitude from low to medium. They can also range in environment from mountainous slopes to semi- desert, but are generally found in grassy areas and rendzinas types of soil.[12]

Pathogenesis

Cattle: *Babesia bigemina, Babesia bovis, Anaplasmam arginale.*
Horse: *Babesia caballi, Babesia equi.*
Sheep: *Babesiamotasi, Babesiaovis, Theileriaseparata, Anaplasmaovis, Ehrlichiaovina.*
Other pathogens and diseases that have been associated with *R. bursa* include:
Tick paralysis and Crimean-Congo haemorrhagic fever virus.

Materials and methods

Materials

Tick remain was picked from a preserved piece of a triangular felt fragment discovered from Trench 1 (2010 excavations), found in Square O16, Unit 3, between Spits 16-17 (Z=80-85 cm), in the area near loci 22 and 77, which is practically a medieval intrusion into the Chalcolithic context. The sample was directly dated to 1610±15 BP (UCIAMS-96018), which is in the range of 400 – 540 Cal AD (2 sigma range) and corresponds to the Early Medieval Period (Figures 3 and 4).[13]

Methods

Since the organic remains are desiccated, and contact with water results in their disintegration, dry sieving was used to recover them. All sediment samples were sieved using a 1 mm sieve and material <1mm was discarded. Of these sieved material was find wool, leather, hair, and other organic materials.[14]

The sample has been through the second processing stage in the laboratory (the 'separating' stage). The tick was placed individually on Petri dishes and examined under a stereomicroscope.

[11] Hoogstraal 1978.
[12] Yeruham *et al.* 1985.
[13] Excavations in Trench 1 were directed by K. Martirosyan-Olshansky (UCLA). The dating of the sample was obtained by L. Stapleton (UCLA). Authors would like to express their deepest thanks to both colleagues.
[14] Smith *et al.* 2014.

Identifications of the sample were achieved through anatomical comparisons with modern specimen collections of NAS RA Scientific Centre of Zoology and Hydrogeology and according to Krantz,[15] Woolley[16] and Harutyunyan and friends.[17]

Results and discusion

This female tick was identified as belonging to the genus *Rhipicephalus* and more *Rh. bursa* based on the following general characters: anal groove posterior to anus and coxae I deeply cleft, spiracular plates comma-shaped. Furthermore, on the basis of the scutalpunctation pattern, spiracular plates, width of dorsal tail of spiracular plates relative to the adjacent festoon.

From the perspective of the function of a tick as a disease vector, specific identification matters. Tick-borne diseases have been suggested as potential health threats for Ancestral Areni-1 Cave people. The discovery of *Rh. Bursa* in the Cave materials is the first empirical evidence that ticks and humans were in contact.

The presence of this tick may suggest that the cause of some vertebrates, even human being death could be related to this massive ectoparasite infestation and/or to the infection by tick-borne pathogens. In spite of their long co-evolution with their hosts, tick-borne pathogens may cause severe disease and, eventually, the death of infected animals.

However, this discovery raises interesting questions on the origin of this tick. During that period, this area was a theatre for relevant historical events and a transit path of different cultures as well as the final destination for the native population. The waves of migration occurring before, during and after this period have contributed to the dissemination of ticks, by which the diseases related. On the other hand, because *Rhipicephalus bursa* is typically a Mediterranean tick the most probable hypothesis is that these ticks were introduced into this land at a certain point of time, most probably with people from Mediterranean (probably North East and East of it) regions passerby merchants.

The observation of this tick also refers to the paleoenvironment based on the biology and ecology of this group (mentioned above). Results presented here support the hypothesis that *Rh. bursa* would be the species with the highest rate of newly suitable habitat under scenarios of increased temperature and reduced rainfall (Hulme *et al.* 1999) the results of the current study support a trend toward changes in tick fauna (and transmitted pathogens) over wide areas.

Conclusion

The genus and species recovered in the Areni-1 Cave still exist in the territory of Armenia. We suppose that human action has favored the colonisation of domiciliary

[15] Krantz 1978.
[16] Woolley 1988.
[17] Harutyunyan *et al.* 2006.

environments by ticks previously associated with animals bringing, as a result, undesired consequences to human beings. The way of life made possible for the population of the cave to interact with the region's animals and plants, and consequently with their ticks.

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Figure 1. Areni-1 Cave location in the landscape.

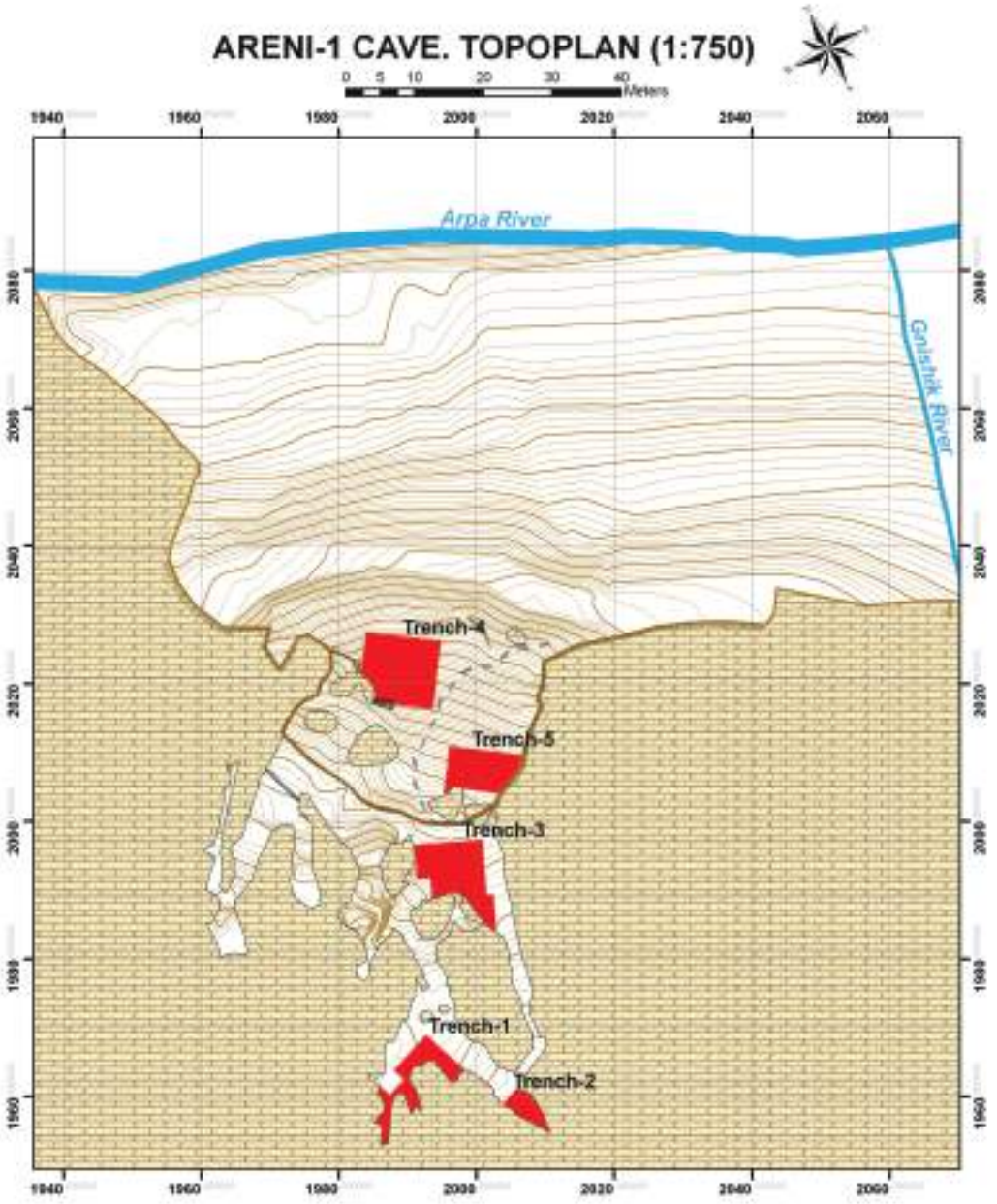

Figure 2. Areni-1 cave topoplan.

Figure 3. Triangular felt fragment from Trench 1 (the scale is 1 cm).

Figure 4. The tick in the felt fragment.

Figure 5. *Rhipicephalus bursa*; a. dorsal view; b. ventral view.

ՏԶԻ ՄՆԱՑՈՐԴԱՑՆԵՐ ԱՐԵՆԻ-1 ՔԱՐԱՆՁԱՎԻՑ (ԹՌՉՈՒՆՆԵՐԻ ՔԱՐԱՆՁԱՎ, ՀԱՅԱՍՏԱՆ)

ՆՈՒՇԻԿ ՋԱՐԻԿՅԱՆ, ԿԻՄ ԴԻԼԲԱՐՅԱՆ, ԲՈՐԻՍ ԳԱՍՊԱՐՅԱՆ

Հայաստանում հնագիտական վերլուծական ուսումնասիրություններում տարբեր պատճառներով տզերը երբևէ չեն ընդգրկվել որպես հնակենդանաբանական նյութ: Այս ուսումնասիրությունը վերաբերում է Հայաստանի Հանրապետության տարածքից՝ Արենի-1 քարանձավի հնագիտական պեղումներից հայտնաբերված նյութերի մեջ լավ պահպանված մի տզի՝ *Rhipicephalus bursa*-ին: Այն կարևոր տեղեկություններ է փոխանցում միջնադարյան բնակիչների կողմից քարայրի օգտագործման և բնակեցման ժամանակահատվածում գերիշխող էկոլոգիայի մասին և սատարում է այն տեսակետը, ըստ որի՝ տզերը հանդիսացել են բազում հիվանդությունների պոտենցիալ աղբյուր մարդու և այլ տնտեսական նշանակություն ունեցող կաթնասունների, հատկապես՝ կովերի, ոչխարների, ձիերի և շների համար: Հոդվածում քննվում են Արենի-1 քարայրը զբաղեցնող մարդկանց առողջական և վարքային իրավիճակի, ինչպես նաև էկոլոգիայի խնդիրներ:

ՀՆԱԳԻՏԱԿԱՆ ԺԱՌԱՆԳՈՒԹՅԱՆ ԱՐԴԻԱԿԱՆԱՑՄԱՆ ՀԵՌԱՆԿԱՐՆԵՐԸ ՀԱՅԱՍՏԱՆՈՒՄ (ՊԱՏՄԱԿԱՆ ԱՐՏԱՇԱՏԻ ԹԱՆԳԱՐԱՆԱՑՄԱՆ ՀԻՄՆԱԿԱՆ ՍԿԶԲՈՒՆՔՆԵՐԸ)

ԱՐԵՎ ՍԱՄՈՒԵԼՅԱՆ

Հոդվածում ներկայացված է Արտաշատի հիմնադրումը և պատմական զարգացումը, մասնավորապես՝ քաղաքի տարածքային բաժանումն ըստ ֆունկցիոնալ նշանակության, այն է՝ պալատական-վարչական, պաշտամունքային, արհեստավորական-առևտրական, ռազմապաշտպանական և այլն:

Հատուկ անդրադարձ է կատարված հնագիտական պեղումների արդյունքներին, որոնք մեկնարկել են նախորդ դարի 70-ական թթ-ից և շարունակվում են մինչև մեր օրերը: Նմանատիպ ուսումնասիրությունները հնարավորություն են տալիս գիտության ժամանակակից պահանջներին համապատասխան՝ վերականգնել և ուսումնասիրել հնագույն և հին Հայաստանի բնակեցման համակարգի, բնաշխարհի յուրացման և տարածքի քաղաքաշինական կազմակերպման առանձնահատկությունները: Այդ առումով շատ կարևոր է դառնում Հայաստանի հին մայրաքաղաք Արտաշատի թանգարանացումը և քաղաքատեղիի զբաղեցրած տարածքում արգելոցի կարգավիճակով հնագիտական արգելոցի ստեղծումը:

Abbreviations

ABSA	The Annual of the British School at Athens, Athens – London
ACSS	Ancient Civilizations from Scythia to Siberia, Leiden
ADOG	Abhandlungen der Deutschen Orient-Gesellschaft, Leipzig – Berlin – Saarbrücken – Wiesbaden
AI	Acta Iranica, Leiden
AJA	American Journal of Archaeology, Baltimore – Princeton
AJNES	Aramazd: Armenian Journal of Near Eastern Studies, Yerevan
AMI	Archäologische Mitteilungen aus Iran, Neue Folge, Berlin
AMI (Erg.)	Archäologische Mitteilungen aus Iran (Ergänzungsband), Berlin
AMIT	Archäologische Mitteilungen aus Iran und Turan, Berlin
AnAr	Anadolu Araştırmaları (JKlF – Jahrbuch für Kleinasiatische Forschungen), İstanbul
ANES	Ancient Near Eastern Studies, Louvain
ANJ	Armenian Numismatic Journal, Rico Rivera, CA
AnSt	Anatolian Studies. Journal of the British Institute at Ankara, London
AOAT	Alter Orient und Altes Testament, Kevelaer / Neukirchen-Vluyn
AoF	Altorientalische Forschungen, Berlin
AST	Araştırma Sonuçları Toplantısı, Ankara
BASOR	Bulletin of the American Schools of Oriental Research, New Haven
BAVA	Beiträge zur Allgemeinen und Vergleichenden Archäologie, München
BEH	Banber Erevani hamalsarani, Yerevan
BF	Baghdader Forschungen, Mainz
BSOAS	Bulletin of the School of Oriental and African Research, Oxford/Cambridge
BzN	Beiträge zur Namenforschung, Neue Folge, Heidelberg
CHANE	Culture and History of the Ancient Near East, Leiden
DHAA	Hayastani Hanrapetut'yunum daštayin hnagitakan ašxatank'neri ardyunk'nerin nvirvac gitakan nstašrǰan. Zekuc'umneri t'ezisner (Conference Devoted to Archaeological Fieldwork Results in the Republic of Armenia, Abstracts of Reports), Yerevan
DocAs	Documenta Asiana, Roma
EJ	Ethnographical Journal, Tbilisi
HA	Handēs Amsoreay (Zeitschrift für armenische Philologie), Wien
HdO	Handbuch der Orientalistik, Leiden – Köln – Boston – New York – København
HHM	Hin Hayastani mšakuyt'ə (The Culture of Ancient Armenia), Yerevan
IA	Iranica Antiqua, Leiden
IBS	Innsbrucker Beiträge zur Sprachwissenschaft, Innsbruck
IF	Indogermanische Forschungen. Zeitschrift für Indogermansitik und allgemeine Sprachwissenschaft, Straßburg – Leipzig – Berlin
IJDL	International Journal on Digital Libraries, Berlin – Heidelberg
IstM(itt.)	Istanbuler Mitteilungen, İstanbul – Tübingen
JAR	Journal of Archaeological Research, Dordrecht – Berlin
JAS	Journal of Archaeological Science, Amsterdam
JBAA	Journal of the British Astronomical Association, London
JFA	Journal of Field Archaeology, Boston
JHA	Journal for the History of Astronomy, Cambridge
JIES	Journal of Indo-European Studies, Hattiesburg

JLR	Journal of Language Relationship, Moscow
JMA	Journal of Mediterranean Archaeology, London
JNES	Journal of Near Eastern Studies, Chicago
JRASC	Journal of the Royal Astronomical Society of Canada, Toronto
KSIIMK	Kratkie soobščenija Instituta istorii material'noj kul'tury. Moscow
KST	Kazı Sonuçları Toplantısı, Ankara
LHG	Lraber hasarakakan gitut'yunneri (= VON – Vestnik obščestvennyx nauk), Yerevan
MDOG	Mitteilungen der Deutschen Orient- Gesellschaft, Berlin
MSS	Münchener Studien zur Sprachwissenschaft, München
OA	Oriens Antiquus, Roma
ÖNf	Österreichische Namenforschung, Wien
OrNS	Orientalia, Nova Series, Roma
PBH	Patma-banasirakan handes (= IFŽ – Istoriko-filologičeskij žurnal), Yerevan
QJRAS	Quarterly Journal of the Royal Astronomical Society, London
RlA	Reallexikon der Assyriologie und Vorderasiatischen Archäologie, Berlin – Leipzig – New York
SA	Sovetskaja arxeologija, Moscow
SAOC	Studies on Ancient Oriental Civilizations, Chicago, Ill.
SMEA	Studi Micenei ed Egeo-Anatolici, Roma
StBoT	Studien zu den Boğazköy-Texten, Wiesbaden
THG	'Tełekagir' GA HSSH (hasarakakan gitut'yunner), Yerevan
VT	Vetus Testamentum, Leiden
WO	Die Welt des Orients, Wuppertal – Göttingen
ZfE	Zeitschrift für Ethnologie, Braunschweig

ARAMAZD

VOLUME XIII/1

ISBN 978-1-78969-041-5