



HAL
open science

Early pastoralism and natural resource management: recent research at Godedzor

Giulio Palumbi, Irena Kalantaryan, Adrian Balasescu, Olivier Barge, Jwana Chahoud, Roman Hovsepyan, Khachatur Meliksetian, Pavel Avetisyan, Christine Chataigner

► **To cite this version:**

Giulio Palumbi, Irena Kalantaryan, Adrian Balasescu, Olivier Barge, Jwana Chahoud, et al.. Early pastoralism and natural resource management: recent research at Godedzor. ON SALT, COPPER AND GOLD THE ORIGINS OF EARLY MINING AND METALLURGY IN THE CAUCASUS, Jun 2016, Tbilisi, Georgia. hal-03433860

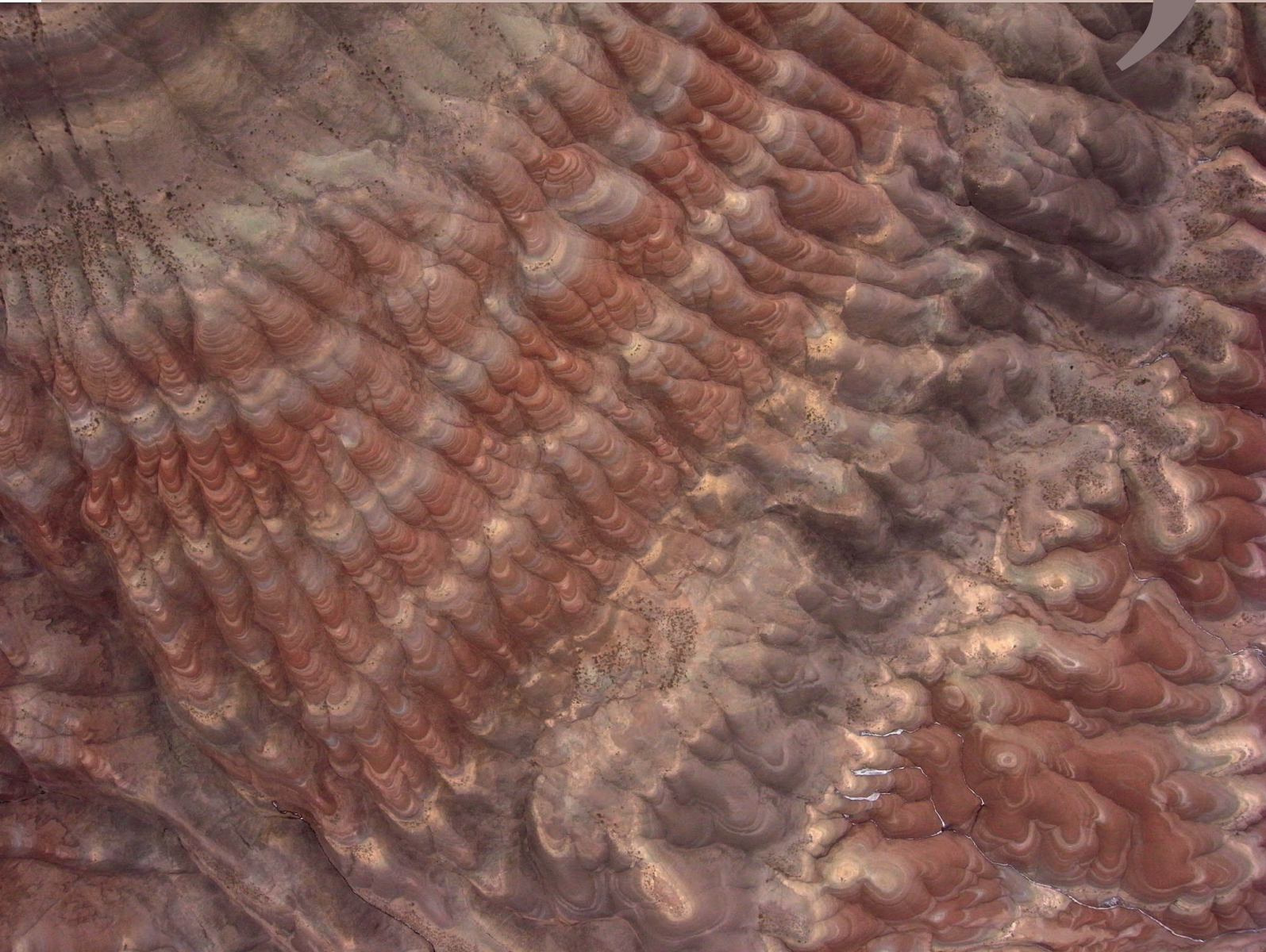
HAL Id: hal-03433860

<https://hal.science/hal-03433860>

Submitted on 15 Dec 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



ON SALT, COPPER AND GOLD
THE ORIGINS OF EARLY MINING
AND METALLURGY IN THE CAUCASUS

edited by Catherine Marro and Thomas Stöllner

ON SALT, COPPER AND GOLD: THE ORIGINS OF EARLY MINING AND METALLURGY IN THE CAUCASUS

ARCHÉOLOGIE(S) // 5



An international conference focused on the beginnings of mining and metallurgy in the Caucasus was organised in Tbilisi in June 16th-19th 2016 under the auspices of the National Museum of Georgia. This conference, which was funded by the Agence nationale de la recherche (France) and the Deutsche Forschungsgemeinschaft (Germany), aimed at discussing the intricate relationships between the emergence of mining and metallurgy, and the shaping of late prehistoric societies in south-western Asia.

The Caucasus is renowned in Near Eastern archaeology for its wealth in natural resources, in particular in metal ores: for decades, scholars have surmised a specific causal relationships between the rise of complex, hierarchical societies in the Near-East and the development of extractive metallurgy. Metallurgy, however, is only the most visible part of the story that accounts for the dramatic changes perceptible in south-western Asia in the course of the 5th millennium BCE. Early mining, which is

not restricted to metal-ore mining, certainly also had an impact in terms of economic networks, social dynamics, settlement patterns and regional integration, not only across the Caucasus, but also in the ancient Near and Middle East.

Drawing on these fundamental questions, this book explores the socio-economic, technological and environmental background that favoured the rise of systematic mining and extractive metallurgy in the Caucasus at the end of the Chalcolithic. How far was early mining linked to the spread of specific subsistence strategies such as pastoral herding? Were mined resources mainly intended for local consumption or distributed throughout the Near East, towards Anatolia, Iran or Mesopotamia? Here are some of the issues that are discussed in the present volume, which contains 21 articles written by some of the most eminent specialists in Caucasian archaeology.

Un colloque international axé sur les origines de l'extraction minière et de la métallurgie dans le Caucase s'est déroulé à Tbilisi du 16 au 19 juin 2016, sous les auspices du Musée national de Géorgie. Ce colloque, financé par l'Agence nationale de la recherche (France) et la Deutsche Forschungsgemeinschaft (Allemagne), avait pour objectif d'aborder les relations entre la naissance des mines et de la métallurgie, et l'évolution des sociétés protohistoriques en Asie du Sud-Ouest.

Le Caucase est connu en archéologie orientale pour sa richesse en matières premières, en particulier pour ses ressources métallifères ; pendant des décennies, les chercheurs ont présupposé l'existence d'un lien de causalité particulier entre l'émergence de sociétés complexes hiérarchisées au Proche et Moyen-Orient et le développement de la métallurgie extractive. Pourtant, la métallurgie n'est que la partie émergée d'une histoire marquée par des changements spectaculaires tout au long du V^e millénaire avant notre ère. L'extraction minière, par exemple, qui ne se réduit d'ailleurs pas à l'exploitation des minerais métallifères, a certainement eu aussi un impact sur les dynamiques sociales, les structures de peuplement, l'organisation des réseaux économiques et les processus d'intégration régionale, en Orient comme dans le Caucase.

Partant de ces questions fondamentales, cet ouvrage explore le contexte socioéconomique, technologique et environnemental dans lequel se sont développées la métallurgie et l'extraction minière à la fin du Chalcolithique dans le Caucase. Ainsi, dans quelle mesure les premières exploitations minières sont-elles liées à des stratégies de subsistance spécifiques, tel le pastoralisme ? Les ressources exploitées étaient-elles destinées à la seule consommation locale ? Ou bien étaient-elles aussi distribuées à travers le Proche-Orient, l'Anatolie, l'Iran ou la Mésopotamie ? Tels sont les thèmes abordés dans ce volume, qui contient 21 articles rédigés par quelques-uns des plus éminents spécialistes de l'archéologie du Caucase.



anr [©]
agence nationale
de la recherche

DFG Deutsche
Forschungsgemeinschaft

© 2021 – Maison de l'Orient et de la Méditerranée – Jean Pouilloux

7 rue Raulin, F-69365 Lyon Cedex 07



ISBN 978-2-35668-074-7
ISSN 2724-8933

9 782356 680747 65 €

MAISON DE L'ORIENT ET DE LA MÉDITERRANÉE – JEAN POUILLOUX

Fédération de recherche sur les sociétés anciennes

Responsable scientifique des publications : Isabelle Boehm

Coordination éditoriale : Ingrid Berthelier

Secrétariat d'édition de l'ouvrage : Christel Visée ; composition : Clarisse Lachat

Conception graphique : Catherine Cuvilly

On salt, copper and gold: the origins of early mining and metallurgy in the Caucasus.

Proceedings of the conference held in Tbilisi (Georgia), June 16th-19th 2016

edited by Catherine Marro and Thomas Stöllner

Lyon, Maison de l'Orient et de la Méditerranée – Jean Pouilloux, 2021

476 p., 258 ill., 30 cm

(Archéologie(s) ; 5)

Keywords :

mining, metallurgy, pastoralism, mobility, ritual , salt, copper, gold, Caucasus, Iran, Chalcolithic, Early Bronze Age

Mots-clés :

mines, métallurgie, pastoralisme, mobilité, rituel, sel, cuivre, or, Caucase, Iran, Chalcolithique, Bronze ancien

ISSN 2724-8933

ISBN 978-2-35668-074-7

© 2021 Maison de l'Orient et de la Méditerranée – Jean Pouilloux

7 rue Raulin, F-69365 Lyon Cedex 07

Diffusion/distribution

FMSH-Diffusion, Paris : fms-diffusion@msh-paris.fr

Commande/facturation : cid@msh-paris.fr

Librairie en ligne : www.lcdpu.fr

ON SALT, COPPER AND GOLD

THE ORIGINS OF EARLY MINING AND METALLURGY IN THE CAUCASUS

Proceedings of the conference held in Tbilisi (Georgia), June 16th-19th 2016

edited by Catherine Marro and Thomas Stöllner

*This volume is dedicated to the memory of our dear colleague
Antonio Sagona † (1956-2017).*



Tony Sagona in the field, region of Sveli, Georgia (courtesy of C. Sagona).

Contents

INTRODUCTION

Catherine Marro, Thomas Stöllner

On salt, copper and gold. The story behind shepherds, metallurgists and miners in the first mining enterprises of the Caucasus	13
---	----

EARLY MINING IN THE CAUCASUS AND BEYOND

Anthony Harding

Prehistoric rock-salt production	29
---	----

Thierry Gonon, Nicolas Gailhard, Baki Varol, Veli Bakhshaliyev, Catherine Marro

Early salt-mining systems and strategies at Duzdağı, Nakhchivan	37
--	----

Caroline Hamon, Nicolas Gailhard, Gilles Fronteau

Salt-exploitation techniques during the Early Bronze Age in the Caucasus. Technology and use-wear of the macro-lithic tools from Duzdağı and Kültepe I (Nakhchivan)	59
--	----

Catherine Marro

The functions of Kura-Araxes ceramic containers in Caucasian early mining	79
--	----

Thomas Stöllner, Irina Gambashidze, Nicole Boenke, Werner H. Schoch,
with contributions from Antoine Courcier and Tobias Skowronek

The Paravani calculation. The early gold-mining complex in Sakdrisi and its societal impact	101
--	-----

Ketevan Tamazashvili

The prehistoric mining implements from Georgia	127
---	-----

Nino Otchvani, Felix Klein, Sebastian Senczek, Irina Gambashidze, Thomas Stöllner

Kura-Araxes ceramics and the prehistoric gold mine of Sakdrisi	139
---	-----

EARLY METALLURGY IN THE CAUCASUS AND BEYOND

Nicolas Gailhard, Michael Bode, Veli Bakhshaliyev, Catherine Marro

The invisible movements of metallurgy: the interactions between nomads and metal. Some evidence from Nakhchivan (Azerbaijan) during the Chalcolithic and the Early Bronze Age	155
--	-----

Moritz Jansen, Andreas Hauptmann, Sabine Klein, Irina Gambashidze, Bakhtiyar Jalilov

Geochemistry of gold from the prehistoric mine of Sakdrisi and Transcaucasian gold artefacts between the 4th and 2nd millennia BC	181
--	-----

Barbara Helwing Patterns of early metallurgy on the Iranian Plateau, from the beginnings to the end of the Bronze Age	201
---	-----

Nima Nezafati, Ernst Pernicka, Barbara Helwing, Dirk Kirchner Reassessment of the prehistoric metallurgy at Arisman, Central Iran	231
--	-----

EARLY MINING AND METALLURGY WITHIN THEIR BROADER ECONOMIC CONTEXT

Rémi Berthon, Julia Giblin, Marie Balasse, Denis Fiorillo, Éric Bellefroid The role of herding strategies in the exploitation of natural resources by early mining communities in the Caucasus	263
--	-----

Giulio Palumbi, Irena Kalantaryan, Adrian Bălăşescu, Olivier Barge, Jwana Chahoud, Roman Hovsepyan, Khachatur Meliksetian, Pavel Avetisyan, Christine Chataigner Early pastoralism and natural resource management: recent research at Godedzor	285
---	-----

Estelle Herrscher, Modwene Poulmarc'h, Liana Bitadze, Nikoloz Vanishvili, Guy André Is there homogeneity in Georgian Kura-Araxes human dietary practices?	325
--	-----

Catherine Longford, Antonio Sagona The Kura-Araxes economy: mobile pastoralism or sedentary agriculture? Perspectives from Sos Höyük	347
--	-----

Veli Bakhshaliyev Archaeological investigations at Nakhchivan Tepe	375
---	-----

Judith Thomalsky Obsidian tool production in the South Caucasus of the 5th and 4th millennium BCE. Technology, typology and sociocultural implications	387
--	-----

THE EXPLOITATION OF NATURAL RESOURCES IN THE CAUCASUS IN LATE PREHISTORY

Laurence Astruc, Antoine Courcier, Bernard Gratuze, Denis Guilbeau, Moritz Jansen, Sonia Ostaptchouk, Bertille Lyonnet, Farhad Guliyev The use of natural resources at Mentesh Tepe during the Late Chalcolithic period and the Early Bronze Age	409
---	-----

Ruben Badalyan The exploitation of mineral resources in Armenia in the Early Bronze Age. Obsidian, metal, bitumen, and salt	425
---	-----

Thomas Stöllner From generalists to specialists? Transcaucasian communities and their approach to resources during the 5th and the 3rd millennium BCE	445
---	-----

Early pastoralism and natural resource management: recent research at Godedzor

Giulio Palumbi

Université Côte d'Azur, CNRS, CEPAM (UMR 7264), Nice (France)

Irena Kalantaryan

National Academy of Sciences, Institute of Archaeology and Ethnography, Armenia

Adrian Bălăşescu

Romanian Academy, "Vasile Pârvan" Institute of Archaeology, Bucharest (Romania)

Olivier Barge

Université de Lyon, CNRS, Archéorient (UMR 5133), Lyon (France)

Jwana Chahoud

Lebanese University, Beirut; Université de Lyon, CNRS, Archéorient (UMR 5133), Lyon (France)

Roman Hovsepian

National Academy of Sciences, Institute of Archaeology and Ethnography, Armenia

Khachatur Meliksetian

National Academy of Sciences, Institute of Geological Sciences, Armenia

Pavel Avetisyan

National Academy of Sciences, Institute of Archaeology and Ethnography, Armenia

Christine Chataigner

Université de Lyon, CNRS, Archéorient (UMR 5133), Lyon (France)

The settlement of Godedzor is located at 1,800 m asl in the region of Syunik (south-eastern Armenia). Previous studies have highlighted the strategic position of the site in connection to both east to west and north to south routes of communication and in relation to the proximity to the main obsidian outcrops of the region. Excavations at Godedzor started in 2005 and revealed three main levels of occupation consisting of wooden and stone architecture. A substantial set of radiocarbon datings proves that the occupation at Godedzor can be dated to the mid 4th millennium and highlights that the site is one of the latest Chalcolithic occupations discovered so far in the southern Caucasus. In this paper, the most recent research on the architectural, ceramic, archeozoological and archeobotanical evidence from Godedzor is analysed and combined so as to build a comprehensive picture on the strategies of the pastoral groups that occupied Godedzor, on their origins and finally on the role that these groups played in the circulation of the obsidian in north-western Iran and in the introduction of farming practices in the highlands of southern Armenia.

L'établissement de Godedzor est situé à 1 800 m d'altitude dans la région du Syunik (sud-est de l'Arménie). Les études précédentes avaient souligné l'implantation stratégique de ce site au cœur d'un réseau de voies de communication est-ouest et nord-sud, à proximité des principaux gisements d'obsidienne de la région. Les fouilles de Godedzor, entreprises en 2005, ont révélé trois niveaux d'occupation avec une architecture de bois et de pierre. Un important corpus de datations au radiocarbone montre que l'occupation de Godedzor remonte au milieu du IV^e millénaire et met en évidence que, parmi les occupations chalcolithiques

découvertes à ce jour dans le sud du Caucase, il s'agit d'une des plus tardives. Dans cet article, les recherches récentes sur les vestiges architecturaux, la production céramique, les données archéozoologiques et archéobotaniques de Godedzor sont analysées et synthétisées dans le but d'obtenir une vue d'ensemble des stratégies des groupes pastoraux qui ont occupé ce site, de leur provenance, ainsi que de leur rôle dans la circulation de l'obsidienne vers le nord-ouest de l'Iran et dans l'introduction des pratiques agricoles sur les hautes terres du sud de l'Arménie.

Introduction

The archaeological evidence from the southern Caucasus points to new developments in the interactions between human and natural resources during the second half of the 5th and up to the first half of the 4th millennium, corresponding to the middle and late stages of the Chalcolithic period.

There is increasing diversification of resources exploitation, both in the plains and river valleys: at the sites of Tekhut, in the Ararat plain (Torosyan 1976); Mentesh Tepe in the Kura basin (Lyonnet, Guliyev 2012); and Tsiteli Gorebi in the Alazani valley (Varazashvili 1992). Such diversification also occurs in the foothills – at Sioni in Kvemo Kartli (Kiguradze, Sagona 2003); and the Areni cave in Vayots Dzor (Areshian et al. 2012) – and the mountains – at the sites of Darkveti and Bavra-Ablari respectively in Imereti and Javakheti (Nebieridze 1978; Varoutsikos et al. 2018).

It is worth noting that this diversification in the occupation of the South Caucasian landscape is also accompanied by a differentiation in the nature and function of the settlements. There were permanent settlements, temporary occupation of shelters (Darkveti, Bavra-Ablari) and caves (Areni) as well as seasonal occupation on the mountains such as Tsaghkahovit, a hunting camp on the north-eastern flank of the Aragats massif (Arimura, Gasparyan, Chataigner 2012). Clearly, this enlarged spectrum of occupation types points to the exploitation of a wider range of resources from specific ecological niches by communities able to develop forms of specialised subsistence and production.

The prevalence of caprines, as is, for example, recorded at Mentesh Tepe in Azerbaijan (Lyonnet et al. 2012), Ovçular Tepesi in Nakhchivan (Marro, Bakhshaliyev, Ashurov 2011) and also at the Areni cave in Armenia (Areshian et al. 2012), may indicate that there was a new economic role played by such species in the regional animal economy (Areshian et al. 2012).

Meanwhile, the mining of salt at Duzdağı in Nakhchivan (Marro, Bakhshaliyev, Sanz 2010) signals that important steps had developed in raw material extraction techniques. Concomitantly with advances in mining techniques, there was a significant evolution in metallurgy; the slags, prills and crucibles retrieved at Mentesh Tepe, Leila Tepe and at Areni clearly suggest that extractive metallurgy techniques focused on copper were developing (Courcier 2014; Bobokhyan et al. 2014; Gailhard et al. 2017; Gailhard et al., this volume).

The case study of Godedzor needs to be contextualised in light of the above-mentioned developments and could itself also provide insightful data on the still poorly understood dynamics and strategies of occupation, frequentation and exploitation of the regions of mountains in the last phases of the Chalcolithic period. As will be discussed in this paper, the final stages of the Chalcolithic, around the mid 4th millennium BC, may have represented a crucial moment of interaction between social, cultural and environmental factors leading to the development of a set of fundamental prerequisites with significant repercussions in the patterns of occupation of the mountain regions. In this sense, the process of sedentarization in the mountainous regions of the South Caucasus, which materialises with the appearance of stable “highland” permanent Kura-Araxes occupation as early as the last quarter of the 4th millennium BC, may have its roots in the developments of the Late Chalcolithic communities.

The settlement of Godedzor lies in the valley of the Vorotan river at about 1,800 m asl on the high volcanic plateau of Syunik in south-eastern Armenia (*fig. 1*). Previous studies have already highlighted that the site of Godedzor is located in a very strategic geographical position: nearby the

obsidian outcrops of the region of Syunik (Chataigner, Gratuze 2014b) and in proximity to important natural axes of communication connecting the steppes of Azerbaijan to the Nakhchivan region and the valley of the Araxes river to north-western Iran and the lake Urmiah (Chataigner et al. 2010; Chataigner, Barge 2010).

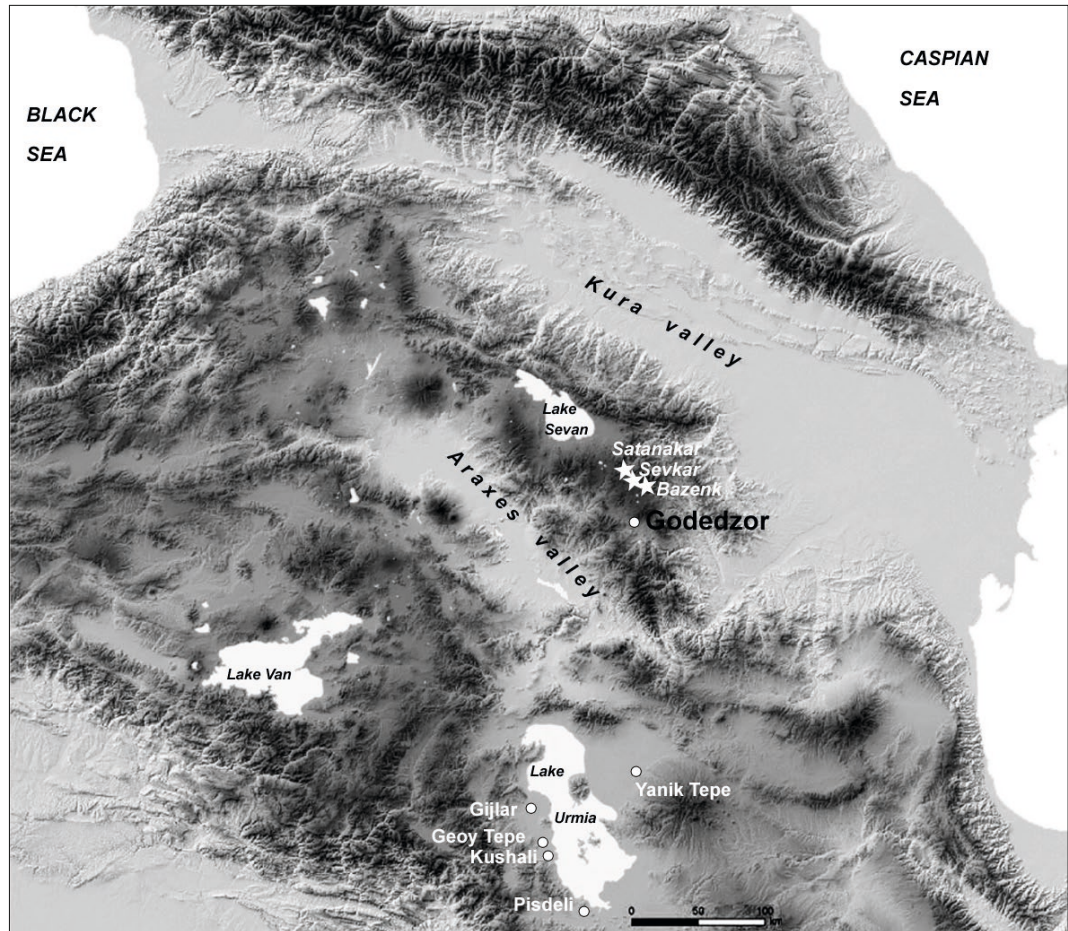


Fig. 1 – Location of Godedzor (Archives Mission Caucase).

The stratigraphic sequence and the architectural evidence (I. Kalantaryan, P. Avetisyan, G. Palumbi, C. Chataigner)

Very little is known of the prehistory of southern Armenia, which remains one of the least investigated regions of the South Caucasus. Four Chalcolithic settlements have been identified so far in the region (Kroll 2006), one of which is Godedzor, first discovered during a pioneering survey in the region carried out by the Institute of Archaeology and Ethnography of Yerevan. The archaeological materials recovered on the surface extended for approximately 10 hectares. Of note, in this area there is also an engraved rock with petroglyphs. These may well relate to a tradition that finds its maximum expression to date on the nearby mountain of Ughtasar.¹

1. For recent researches at Ughtasar, see <http://ughtasarrockartproject.org/index.html>.

Excavations at Godedzor were carried out between 2005 and 2014 as part of a joint project of the Mission Caucasus and the Institute of Archaeology and Ethnography of Yerevan. An area of approximately 90 m² has been exposed, revealing two main periods of occupation: Iron Age and Chalcolithic (*fig. 2*).

While most of the Chalcolithic occupation at Godedzor dates to the very end of this period, at the very bottom of one of the trenches, just above the natural sub-strata, excavations exposed a floor connected to the scanty remains of a fireplace that was radiocarbon dated to the last quarter of the 5th millennium BC. Unfortunately, this is so far the only proof of a 5th millennium BC occupation at Godedzor that sheds any meaningful sense of continuity on the occupation and frequentation of the site during the Chalcolithic period.

As concerns the Late Chalcolithic occupation – the focus of the present article –, excavations have revealed a substantial occupation layer, over 1.5 m thick, consisting of an intense sequence of occupational levels hinting that there had been a consistent use of the same area during a relatively short time span. Three main levels have been identified, each of which was characterized by architectural structures, features and building materials of different nature and functions.

The earliest level II C consists of a series of pits and sporadic postholes (*fig. 3*). In the infill of these pits, abundant charred seeds were found and in one of them some fragments of fired clay sealings bearing the imprint of textiles and of a rope that most probably sealed a ceramic container (*fig. 4*).

The evidence from the following level II B (*fig. 3*) is definitely more substantial and includes two circular stone structures (structures 7 and 8) in the southern sector of the excavated area. These two stone buildings were connected to the east to a posthole floor excavated in square J 15/13. In this latter square, at least three overlapping posthole floors were identified that may have also been connected to different phases of use of structures 7 and 8. West of structures 7 and 8 in square I 15/15, an occupation floor bearing traces of a small posthole may have been connected to two half-interred jars. The practice of half-interring ceramic containers that were functionally related to floors and activity areas was a widespread, possibly practical, tradition at Godedzor that has been also recorded in the later level II A.

Level II A at Godedzor mainly features stone architecture (*fig. 5*). Structure 1 (*fig. 6*) was semi-oval in plan and contained the remains of a fireplace and a small tandir built out of a ceramic jar (*fig. 7*). In the north-eastern sector of the excavated area another large sub-circular stone wall (structure 10) was brought to light (*fig. 5*). This structure, that featured a white-plastered floor, contained a half-dug clay basin and at least seven half-interred ceramic jars (*fig. 8a-b*). To the

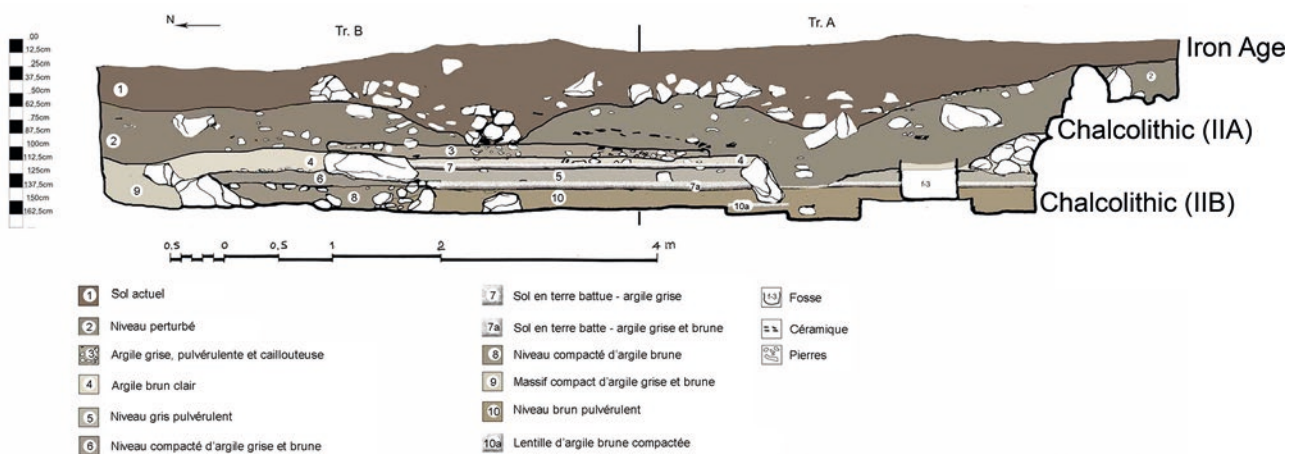


Fig. 2 – Godedzor, E main section showing the Iron Age and Late Chalcolithic occupation (Archives Mission Caucasus).

east, structure 10 appears to be connected to two curved walls that could not be fully exposed as they lay beyond the limits of the excavation. West of structure 10, in square I 15/8, at least five half-interred ceramic jars were associated with the same activity floor (*fig. 9*). Several fragments of bones and bone tools were found on this floor, which may point to its use as a manufacturing area. Finally, in the north-western sector of the excavated area, in square I 15/7, a significant concentration of animal bones was found on another floor, suggesting this may have been a butchering activity area (*fig. 10*).

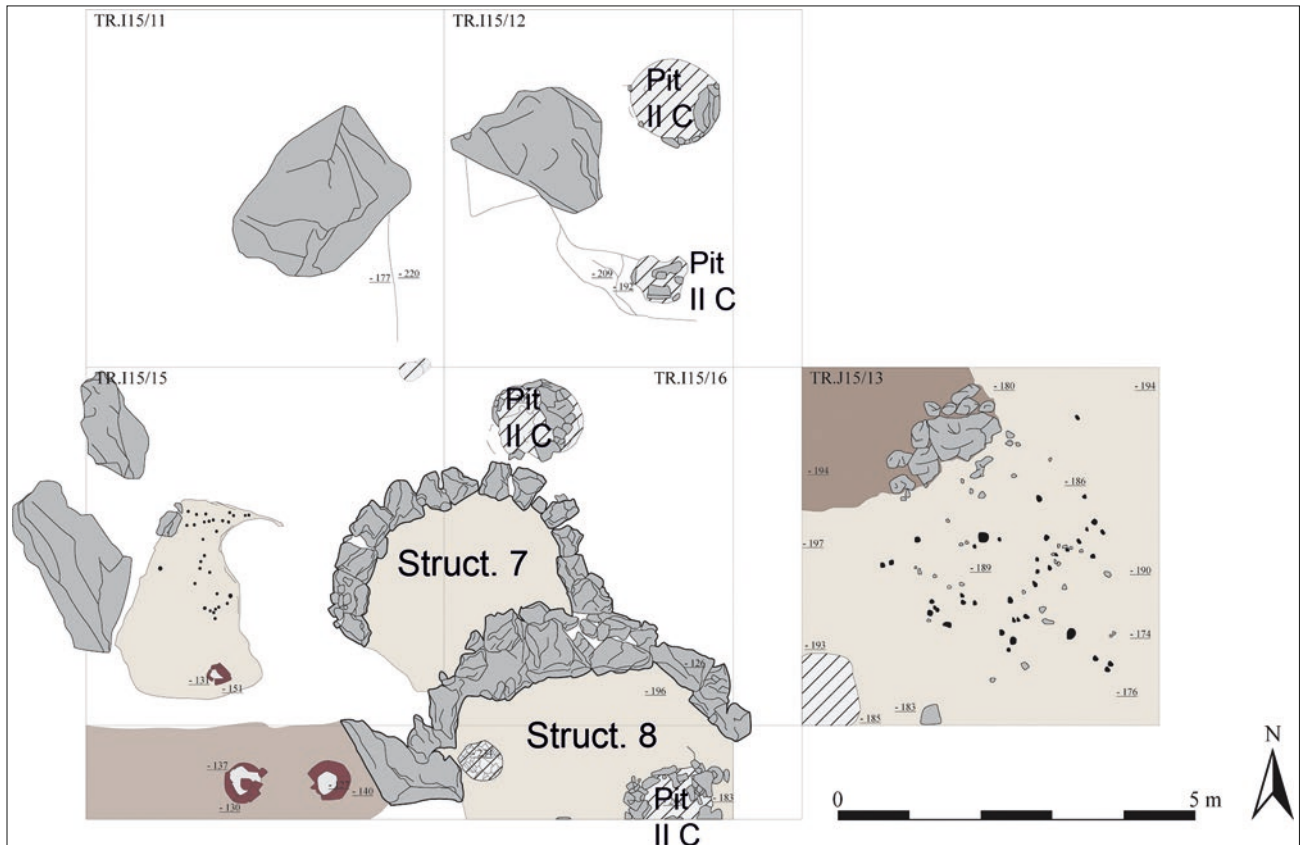


Fig. 3 – Plan of level II C (pits) and level II B (Archives Mission Caucasie).

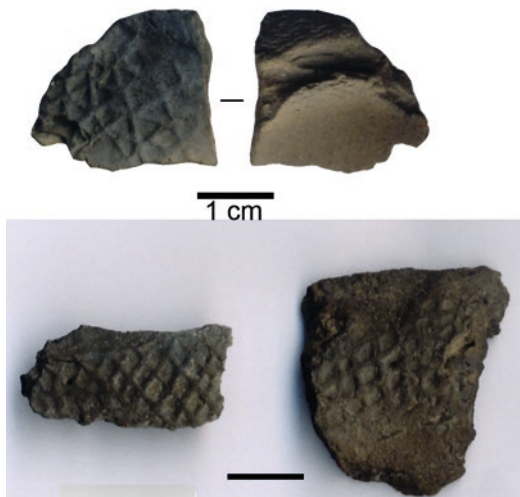


Fig. 4 – Clay sealings from one of the pits of level II C (Archives Mission Caucasie).

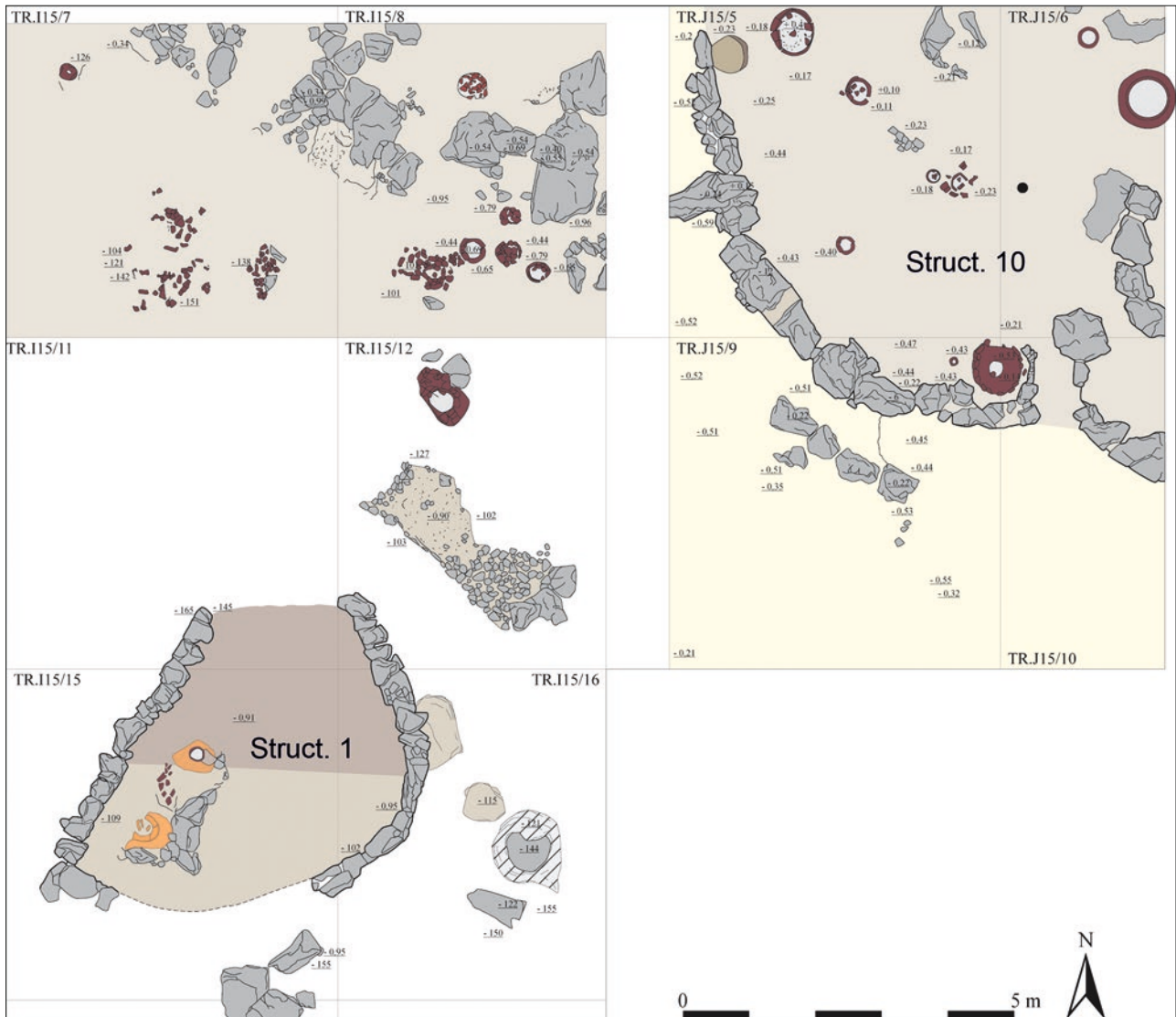


Fig. 5 – Plan of level II A (Archives Mission Caucase).



Fig. 6 – Structure 1, level II A (Archives Mission Caucase).



Fig. 7 – Structure 1, jar used as a fireplace or as a tandoor (Archives Mission Caucase).



a



b

Fig. 8 – Level II A; a: structure 10 as seen from south; b: half-interred jar in structure 10 (Archives Mission Caucase).



Fig. 9 – Level II A, half-interred jars in square I 15/8 (Archives Mission Caucase).



Fig. 10 – Level II A, butchering activity area in square I 15/7 (Archives Mission Caucase).

Two burials were also retrieved in the northernmost squares of the excavated area: tomb 1 contained the remains of an infant, while tomb 2 those of an adult. Both tombs have already been analysed in previous publications (Poulmarc'h, Le Mort 2016). According to the absolute datings, these burials belong to the latest phases of the 4th millennium BC occupation (between 3351 and 2908 cal. BC (95.4%) (*tab. 1*). In 2012, the remains of a third individual were also found in the fill of structure 10 and dated to 4710±30 BP or 3631-3373 cal. BC (95.4%) (Ly-10436/SacA-34239).

We are aware that the excavated area at Godedzor is only a small part of the entire settlement and thus this data can only be considered partial. Nonetheless, although the picture is limited, the information could suggest an increasing investment in building materials (from light-wooden to heavier stone architecture) representing the construction of more substantial and permanent buildings over time.

Code	Square/Sond	UF/Str/Tomb	Material	BP	Cal. BC 1 sigma	Cal. BC 2 sigmas	Level
UGAMS-02284	tr. A	UF 7 str. 1	charcoal	4630±40	3499-3361	3620-3342	II A
Ly-10436 (SacA-34239)	J15/5	UF 512	bone (human)	4710±30	3624-3379	3631-3373	II A
UGAMS-02285	tr. A/B	UF 11	charcoal	4690±40	3520-3375	3630-3368	II B
UGAMS-02286	tr. B	UF 12	charcoal	4660±40	3512-3370	3624-3360	II B
Lyon-8484 (SacA26100)	tr. A	UF 12	charcoal	4545±30	3362-3124	3366-3104	II B
Lyon-8481 (SacA26097)	tr. B	UF 34	charcoal	4620±30	3496-3359	3512-3348	II B?
UGAMS-02287	tr. A/B	UF 33	charcoal	4610±40	3498-3350	3519-3126	II B?
Lyon-8479 (SacA26095)	tr. D	UF 7b	charcoal	4685±30	3517-3376	3626-3370	II B
LTL-5733A	tr. D	UF 13	charcoal	4740±45	3632-3384	3638-3376	II B
Lyon-8478 (SacA26094)	tr. D	UF 16b	charcoal	4625±30	3497-3361	3512-3350	II B
Beta-285585	tr. D	UF 19a	charcoal	4560±40	3370-3340	3491-3102	II B
LTL13033A	tr. D	UF 25a	charcoal	4567±45	3488-3119	3498-3099	II B
UGAMS-03413	tr. A/B	UF 60	charcoal	4700±25	3619-3378	3627-3374	II B/II C
UGAMS-5801	tr. A	UF 75	charcoal	4750±25	3632-3521	3636-3383	II C
LTL-5731A	tr. B	UF 96	bone (bird)	4767±45	3636-3522	3645-3378	II C
LTL-5732A	tr. B	UF 109 (pit)	charcoal	4753±45	3634-3388	3640-3377	II C
Lyon-8480 (SacA26096)	tr. B	UF 109 (pit)	charcoal	4685±35	3517-3376	3627-3368	II C
LTL13034A	tr. D	UF 104	charcoal	4745±35	3633-3386	3636-3380	II C
LTL13035A	tr. B	UF 150	charcoal	4655±45	3513-3367	3626-3354	II C
Beta-285584	tr. B	UF 118	charcoal	5480±40	4361-4266	4446-4251	III
LTL-5729A	tr. A/B-E	UF 97 (tomb 2)	right tibia	4475±45	3333-3090	3351-3020	tomb
LTL-5730A	tr. A/B-E	UF 97 (tomb 2)	humerus	4441±45	3326-3016	3336-2926	tomb
UGAMS-02291	tr. B	UF 14 (tomb 1)	charcoal	4560±40	3370-3119	3491-3102	tomb
LTL-5728A	tr. B	UF 14 (tomb 1)	femur	4403±45	3090-2929	3326-2908	tomb

Tab. 1 – List of ¹⁴C dates (per level) of the Chalcolithic occupation at Godedzor.

The chronology of the Late Chalcolithic occupation (C. Chataigner)

A total of 24 radiocarbon datings (*tab. 1*), that were carried out from charcoal and bone samples retrieved from the three levels of occupation, basically overlap in the time frame stretching between 3650 and 3350 cal. BC without significant shifts from the earliest to the latest level. In order to shrink this time frame, a Bayesian chronological model was constructed by using the program OxCal and the IntCal13 calibration curve. The dates were selected according to the indisputable stratigraphic relations of the units of provenance and were further subdivided into the three main areas of the excavation, that is trenches A, B and D, respectively corresponding to squares I 15/11 and I 15/12 for trench A, squares I 15/15 and I 15/16 for trench B and finally square J 15/13 for trench D.

The modelled boundaries are as follows:

- trench A:
 - start: 3695-3382 cal. BC (3600-3513 cal. BC at 68.2%; median 3544 cal. BC);
 - end: 3507-3288 cal. BC (3491-3352 cal. BC at 68.2%; median 3423 cal. BC);
- trench B:
 - start: 3599-3377 cal. BC (3556-3382 cal. BC at 68.2%; median 3520 cal. BC);
 - end: 3503-3331 cal. BC (3495-3358 cal. BC at 68.2%; median 3447 cal. BC);
- trench D:
 - start: 3885-3380 cal. BC (3674-3504 cal. BC at 68.2%; median 3579 cal. BC);
 - end: 3515-3065 cal. BC (3441-3312 cal. BC at 68.2%; median 3372 cal. BC).

On the basis of the selected dates, the median values of the start and end events of the occupation in trenches A and B are almost identical and show a very tight chronological spectrum covering just over a century: from 3544 to 3423 cal. BC in trench A with a high overall index at 102.4 (*fig. 11*).

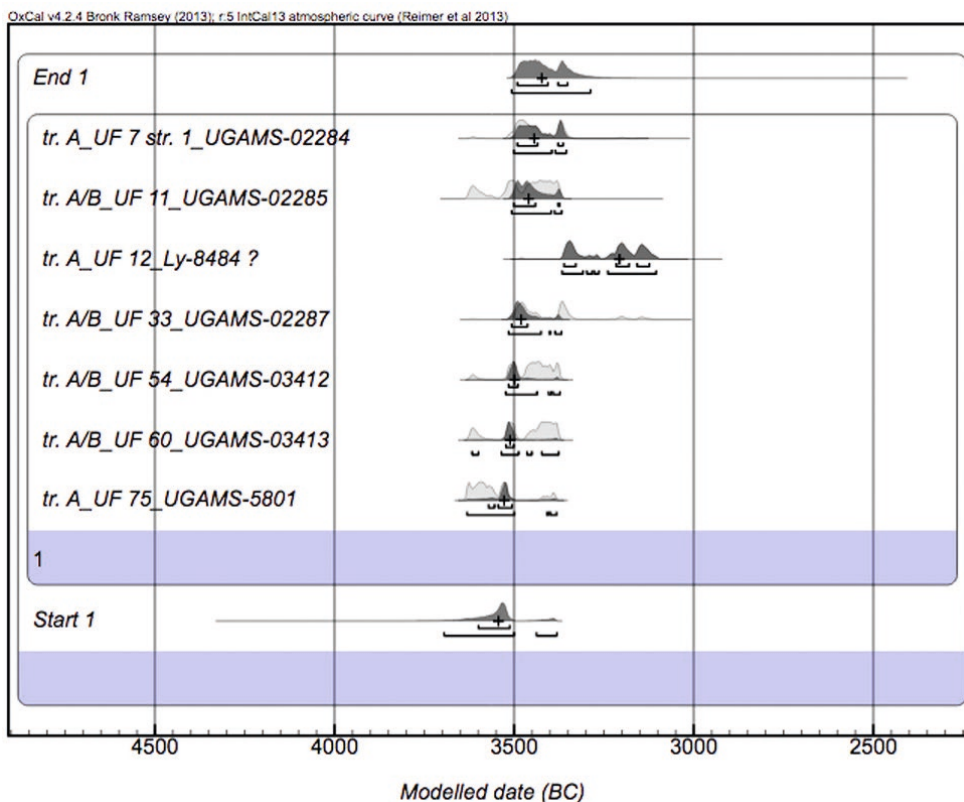


Fig. 11 – Bayesian model for the absolute dating of the main excavated trench, trench A.

As concerns the occupation of trench D, it occurs during a slightly longer span of time stretching between 3579 and 3372 cal. BC, with an overall 77.8 index which is still acceptable but clearly lower than the previous index.

Looking at this data, it is clear that Godedzor was among the latest Chalcolithic settlements known so far in the region, and its occupation can be dated to the period just before the appearance of the Kura-Araxes culture throughout the South Caucasus which, according to the most recent datings, occurred around 3400-3350 cal. BC (Badalyan 2014).²

The Late Chalcolithic ceramics (G. Palumbi)

Ware groups

All the ceramics from Godedzor were handmade and built (in the case of the medium and large containers) by means of superimposing slabs of clay. The analysis of the Late Chalcolithic ceramics has identified four main ware groups.

Chaff-tempered ware

This is the most common ceramic group at Godedzor (making up between 96-99% in the contexts analysed). The main feature of this ware group is the heavy vegetal tempering clearly visible on the external and internal surfaces of the vessels (*fig. 12*). Mineral inclusions are also present in minor quantities, but it is not clear if they were intentionally added to the ceramic paste. Surfaces are usually plain, there is no special attention to finishing or surface treatments which, when they are present, are limited to wet-smoothing and hasty stroke-burnishing. Only a few sherds are characterised by a rather thick whitish slip applied to the external surface.

Surface colours greatly vary from pink, to red, reddish brown, brown, orange to buff; they often feature irregular reddish, grey or blackish fire-clouds pointing either to non-controlled firing atmospheres or to secondary firing (it is possible that some of these vessels were used as cooking pots). Cross-sections are constantly (especially when it comes to thick body-sherds) non-oxidised (generally grey or blackish in colour) thus suggesting that firing must have been hasty and in some cases at low temperatures.

The morphological repertoire is composed of both closed and open shapes. The latter mainly comprise hemispherical bowls with simple rims, while the former are medium and large jars (*fig. 13*) with short everted rims or flaring necks above ovoid or globular bodies. A feature that often occurs on the closed shapes is the presence of single or double handles, and worth mentioning is a narrow-necked “bottle” equipped with three symmetrical handles.



Fig. 12 – Chaff-tempered jar from level II A (Archives Mission Caucase).

2. For a discussion on the evidence concerning the beginning of the Kura-Araxes culture see also Marro, Bakhshaliyev, Berthon 2014; Palumbi, Chataigner 2014; Marro, Bakhshaliyev, Berthon 2015; Palumbi, Chataigner 2015.

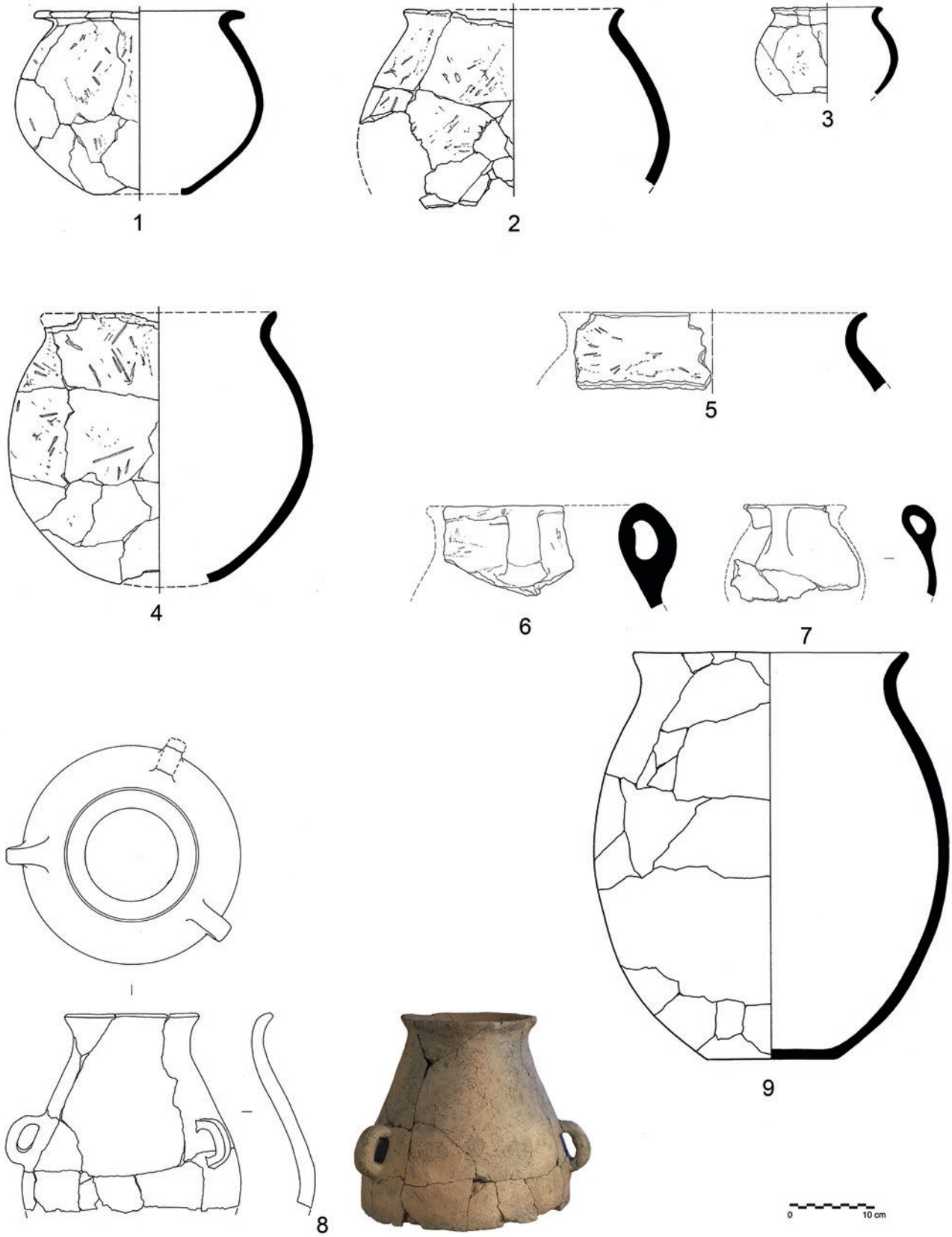


Fig. 13 – Chalcolithic chaff-tempered ceramics (Archives Mission Caucase).

Decorations are completely absent, although, sporadically, some jars of large dimensions, feature appliqués consisting of small (2 cm maximum) circular or oval lumps of clay stuck under the base of the jars (*fig. 14*). The fact that these lumps were only applied on the base may suggest they served a functional purpose.



Fig. 14 – Clay pellets applied on the base of a chaff-tempered jar (Archives Mission Caucase).

Chaff and grit-tempered ware

This ware group (accounting for about 2% of the assemblage) is characterised by a mixed presence of fine to medium vegetal inclusions (coarse vegetal temper is sometimes also present) and mineral temper that occurs in significant quantities (from 40 to 50%). Apart from the considerable presence of gritty inclusions, the chaff and grit-tempered ware does not show any particular differences from the above described chaff-tempered ware in terms of surface colours, finishing and treatments and finally shapes.

Urmiah painted ware

The ceramic paste of this ware group is tempered with both fine vegetal and fine mineral inclusions and mica is also often present. A whitish or yellowish slip is consistently applied to the external surfaces, while the internal surfaces are usually not treated and are yellowish or pinkish in colour. Cross-sections tend to be pink or light-yellow and are fully oxidized. Matt-black or dark-brown paint is applied only to the slipped external surfaces. The painted motifs tend to be rather repetitive and standardised and consist of couples of straight and wavy lines as well as of loops running horizontally at the neck and on the lower body of the vessel. These lines define horizontal spaces on the upper body of the vessels, painted with triangular, lozenge-shaped and rectangular motifs filled with densely cross-hatched lines (*fig. 15*). The morphological repertoire of this ware group consists exclusively of closed shapes and namely small and medium sized necked jars and it is different from that of the chaff-tempered ceramics. The Urmiah painted ware occurs constantly throughout the occupational sequence; it accounts for approximately 1% of the bulk in the counted assemblages, and about three hundred sherds have been identified so far.

Fine painted ware

This second group of painted pottery consists of only a handful of sherds with thin cross-sections and featuring fine ceramic pastes tempered with tiny grit or mica inclusions. The external surfaces are white or cream-slipped, internal surfaces are unslipped and cross-sections' colours range from pink, light buff, grey to greenish suggesting high-firing temperatures. The colour of the paint is dark-brown or black and the motifs exclusively consist of triangular chessboard patterns (*fig. 16*). All of the fragments retrieved so far belong to small-sized jars.

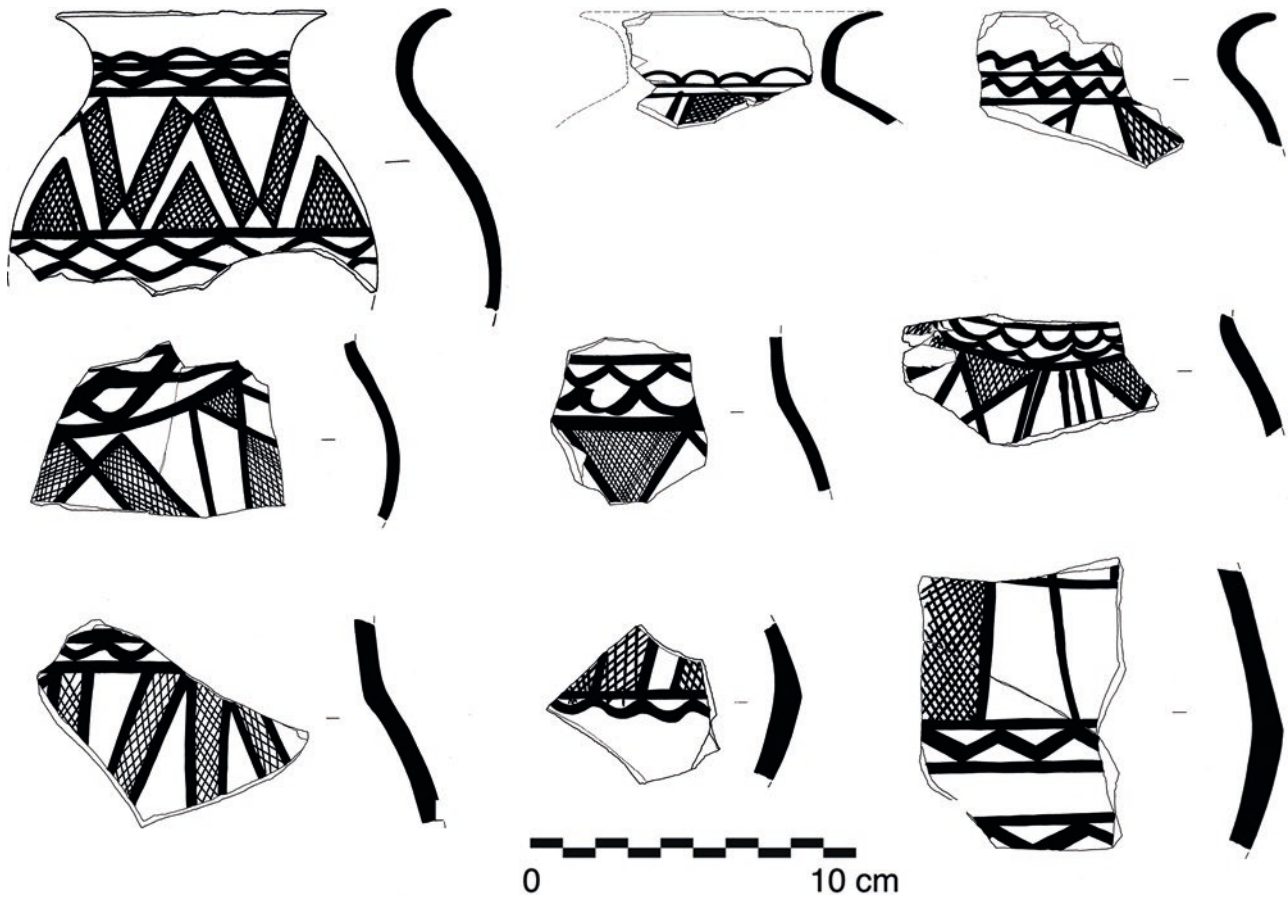


Fig. 15 – Urmiah painted ware retrieved from the Chalcolithic occupation at Godedzor (Archives Mission Caucase).

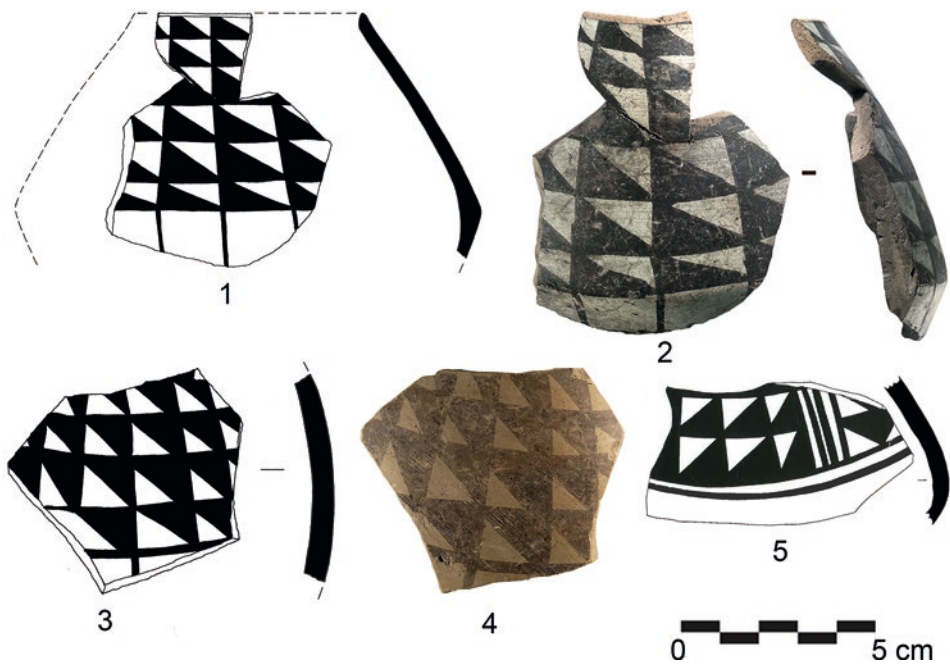


Fig. 16 – 1-4, fine painted ware retrieved from the Chalcolithic occupation at Godedzor (Archives Mission Caucase), 5 from Tepe Sialk (Chiyonobu 1993, pl. 14).

Regional ceramic comparisons

Analogies between the ceramics from Godedzor and those from the Chalcolithic sites of the southern Caucasus are few and very general and mainly concern technical and manufacturing traditions. As for the latter issue, there is no doubt that the predominance of the chaff-tempered ceramics closely links Godedzor to the chaff-tempered ware horizon that developed in the southern Caucasus and eastern Anatolia in the Chalcolithic period (Marro 2010). However, apart from the technical similarities (chaff-tempering, hasty finishing and quick firing processes), the chaff-tempered ceramics from Godedzor share very little with the most typical features of the Chalcolithic chaff-tempered traditions from these regions: combing of the external surfaces, potter's marks, pierced rims and finally painted or relief decorations (Helwing 2012; Marro 2010; Lyonnet et al. 2012). What is more, the morphological repertoire of the ceramics from Godedzor – comprising flaring-neck or everted-rim ovoid jars and simple bowls – is so “ordinary” that only very general comparisons are possible. Possibly one of the most distinguishing features of the chaff-tempered ceramics from Godedzor is the frequent occurrence of handles (*fig. 17*).



Fig. 17 – Handles of Chalcolithic chaff-tempered jars (Archives Mission Caucase).

As for painted ceramics, these are certainly the most characteristic feature of the ceramic repertoire at Godedzor. The most common group, here preliminary referred to as Urmiah painted ware, can be connected with the painted pottery traditions of the Chalcolithic period in north-western Iran. The so-called Pisdeli Tepe tradition, as it was first labelled by Dyson and Cuyler Young from the eponymous site investigated in 1957 and located in the Ushnu-Solduz valley (Dyson, Cuyler Young 1960), could in fact refer to a broad category of painted ceramics dating to the Chalcolithic period. However, in the publication of Pisdeli Tepe a large variability of styles and motifs of painted ceramics was illustrated without any precise reference to the stratigraphic sequence of the site. Recently, the Pisdeli painted ware has been considered as a part of a large “family” of Ubaid-related black-on-buff painted wares

from Iran (Weeks, Petrie, Potts 2010), but unfortunately this cultural definition still lacks a precise correspondence in absolute chronological terms. If on the one hand the beginnings of the Pisdeli Period are considered to date from the mid 5th millennium (Henrickson 1983; Voigt, Dyson 1992; Hole 1987), the end of this tradition still remains uncertain and oscillates between the beginning (Hole 1987), the first quarter (Voigt 1989) and the middle of the 4th millennium BC (Henrickson 1983). Certainly the thick deposits of the main settlements located in the Urmiah basin (Pisdeli, Hansalu, Tepe Gijlar) point to a long Chalcolithic sequence that most probably saw internal developments in the painted ceramics tradition. As has rightly been pointed out by Dyson and Cuyler Young (1960, p. 26), there might be several stages of development in the tradition of the painted ceramics of the Urmiah region, according to which the Pisdeli painted pottery could correspond to an early phase, while the painted ceramics of Geoy Tepe period M (Burton-Brown 1951) belong to a later phase. The latter ceramics have painted motifs consisting of small continuous loops hanging under the rims combined with cross-hatched triangles (fig. 18b, 18c) and wavy lines showing similarities with the motifs of the Urmiah painted ware from

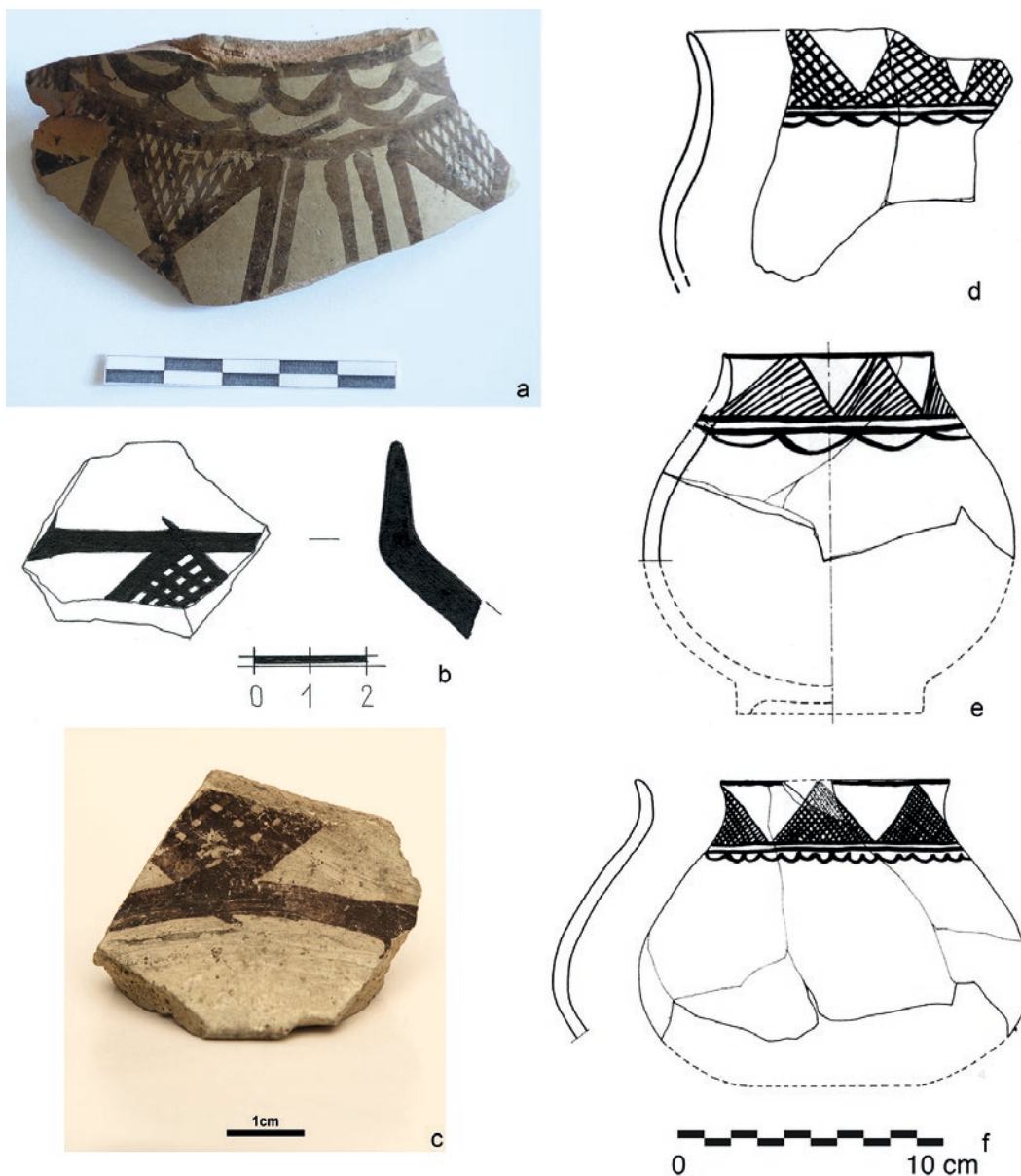


Fig. 18 – Urmiah painted ware; a: Godedzor (Archives Mission Caucase); b-c: Geoy Tepe (History Museum of Armenia); d-f: Tepe Gijlar (Belgionro, Biscione, Pecorella 1984b).

Godedzor (Burton-Brown 1951, fig. 4, pl. I). Analogous decorative motifs also occur at Tepe Gijlar, 30 km north of Geoy Tepe. Period C at Tepe Gijlar corresponds to a 10m-thick occupation deposit which was subdivided into several phases: from phase XVI (the earliest) to X (the latest) (Belgiorno, Biscione, Pecorella 1984a, pp. 241-246). Cross-hatched triangles occur throughout the sequence of phase C but the motifs are most common during the later phases (X-XI) (*fig. 18d, 18e, 18f*). The parallels between these painted motifs and those from Godedzor are very close and confirm a north-western Iranian connection for the most common painted ceramic group found at Godedzor. According to the surveys carried out on the western shores of the Urmiah basin, painted ceramics analogous to those of period C at Tepe Gijlar were also found in a large number of Chalcolithic sites located on the western shores of lake Urmiah (Biscione 1984, pp. 307-308).

As to the definitely less common, fine painted ware, which is characterized by very distinctive triangular checkerboard patterns, we have stated previously that these share some similarities with the Ubaid decorative repertoires (Chataigner et al. 2010). However, by considering that the Late Chalcolithic levels at Godedzor date to the mid 4th millennium BC, an “Ubaid” dating of these ceramics would be unrealistic. While the triangular checkerboard pattern is completely absent from the Urmiah region, checkerboard patterns occur in the Iranian Plateau and more precisely in period III at Tepe Sialk (*fig. 16*), where painted sherds characterised by black-on-buff triangular checkerboard decorations were retrieved throughout the sequence of period III (from III,1 to III,6-7) (Ghirshman 1938, pl. LXXXVI, LXXXII, LXXXIII). What is more, the fact that the colour of the ceramic paste of the painted ceramics of period III,6-7 at Tepe Sialk is “*rose, chamois, grise et gris verdâtre*” (Ghirshman 1938, p. 141) could be another similarity in technique for both the Tepe Sialk III,6-7 ceramics and those from Godedzor. Finally, according to a recent chronological revision of the cultural sequence of the Iranian Plateau, period III,6-7 at Tepe Sialk should be dated to around the mid 4th millennium BC (Petrie 2013, fig. 1.3; Fazeli, Valipour, Kharanaghi 2013) providing a further chronological link with the Late Chalcolithic occupation at Godedzor and strengthening the relationship between the fine painted ceramics from Godedzor and those of Tepe Sialk and the Iranian Plateau.

Metals (K. Meliksetian)

The connections with the Iranian Plateau suggested by the rare sherds of fine painted ware are strengthened by metal artefacts found. Four awls, one earring and one metal blade dating to the Late Chalcolithic occupation were retrieved at Godedzor (*fig. 19*). The chemical analysis carried out on some of these objects at the Curt-Engelhorn-Zentrum Archäometrie, (Mannheim, Germany) revealed that they were made of a copper-arsenic alloy with about 5% of arsenic (for more details on the composition of these objects see Bobokhyan et al. 2014). The enrichment of copper in arsenic is a typical feature of the Chalcolithic and Early Bronze Age metalwork production in the region (Gevorkyan 1980; Meliksetian, Pernicka 2010). The territory of Armenia in general, and the southern part of Armenia in particular, is rich in copper ores (Meliksetian, Pernicka 2010) and some of these ores were exploited in the Early Bronze Age. However, no clear data on the exploitation of the Armenian ores in the Chalcolithic period exist so far.



Fig. 19 – Chalcolithic metals from Godedzor (Archives Mission Caucase).

At Godedzor the absence of ore minerals, moulds, smelting slags and other traces of metalwork production leaves the question open as to whether these objects were produced *in situ* or in other sites or regions. The geochemical analyses of the metal objects from Godedzor have shown an extremely

low lead content, consisting of around 10 ppb (0.01 ppm) and, simultaneously, high silver and nickel contents in one of the awls, that are not a typical signature of the Armenian ores (Meliksetian, Pernicka 2010). Altogether this data suggests that the metal objects found in Godedzor were most probably not produced *in situ* by exploiting the southern Armenian ores and that the origins of these objects lie beyond the South Caucasus. Unfortunately, as the concentration of lead in these objects was very low, it was not possible to carry out lead isotope analyses, the latter being a fundamental geochemical tool for provenance studies on metal artefacts (Gale, Stos-Gale 1982). Yet the very low content of lead is an important and rare geochemical feature of copper-bearing ore deposits. Since lead is a minor component in most copper ores, mainly concentrating in metal artefacts rather than in slags during metallurgical processes, an extremely low lead content should be considered a special feature of the exploited ore deposit rather than a result of the smelting processes. According to N. Nezafati (pers. comm.), ores with very low lead content are known in the Tarom-Hashtjin region (western Alborz, north-western Iran) which is not too far away from the important Chalcolithic metallurgical site of Tepe Sialk (Nezafati, Pernicka, Malek Shahmirzadi 2008). This may be another hint that there were factors other than ceramics that linked Godedzor to the Iranian plateau and to Tepe Sialk. However, to draw more convincing conclusions, further work and comparisons with the chemical composition of the north-western Iran ores is necessary.

The lithic industry (C. Chataigner)

As to the rich evidence of chipped stone recovered at the site, nearly all of it is obsidian artefacts (99%), with flint or quartzite tools only sporadically found. Obsidian is abundant in the vicinity of Godedzor because the main obsidian sources of the Syunik region are located at about one and a half day's walk, on the high plateaus that dominate the site: these are the outcrops of Satanakar, Sevkar and Bazenk (fig. 20a). The streams flowing through these outcrops carry numerous blocks towards the Vorotan river, which passes in a canyon below the settlement of Godedzor (fig. 20b). Chemical analyses of 43 Godedzor artefacts showed that all come from the Syunik sources, Sevkar (77%), more rarely Satanakar (21%) and infrequently Bazenk (2%) (Cherry, Faro, Minc 2008, 2010; Chataigner, Gratuze 2014a, 2014b).

The flint found at Godedzor is red, yellow or grey, and its origin is unknown. There are no outcrops in Syunik; the nearest deposits are found in the Kura basin (lower Aghstev valley) or in the northern part

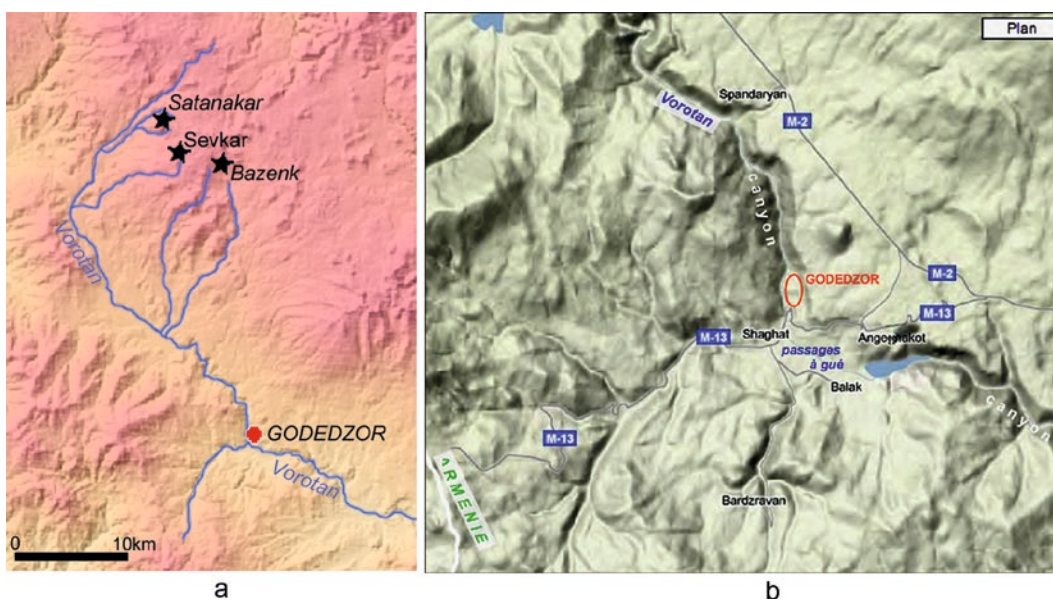


Fig. 20 – The Vorotan river, a link between the obsidian deposits and the Godedzor settlement (20a elaborated by O. Barge).

of the Zagros, in the regions of Khoy (Pessagno et al. 2005) and Kermanshah (Ali et al. 2014). The few flint artefacts are small bladelet cores (fig. 21a) or tools (fig. 21b, 21c) reused until exhaustion; with sickle blades reused as end-scrapers (fig. 21b). As for quartzite, whose origin is unknown, it was knapped in small-sized artefacts.

According to the study carried out by B. Gasparyan, the obsidian industry of Godedzor shows little technical or typological evolution over time, and no knapping activity area was identified at the site. Cores are generally small in size (2 to 5 cm in length) and are prepared on obsidian pebbles (fig. 22a), many of these artefacts still have the “cortex” of the pebbles worn by the river, with a matte, rounded surface marked by repeated impacts. Relatively thick flakes were also utilized for core blanks (fig. 22b).

Most cores are, therefore, atypical in shape and make for the production of flakes and bladelets. However, some cores are larger in dimension, as seen in several blades 6 cm to 10 cm long. Many of the cores have been used up; some of them, even the very small-sized cores, still bear the traces of regular negatives.

As a notable exception, three large conical blade cores of about 17 cm in length (fig. 23) were found together on the surface of the site. Their attribution to the Chalcolithic period is possible, but cannot be conclusive; so far, no tool has been identified that corresponds to removals from such large blade cores, which may suggest that these cores, that were probably prepared on the outcrops on the Syunik plateau, were not exploited *in situ*, but rather stocked and eventually exported to the nearby regions.

Flakes, that are the largest group in the local assemblage, have various shapes (oval, subtriangular or elongated) (fig. 24.2). Many of them have been used as tools: there is a very high percentage of



Fig. 21 – Flint artefacts; a: bladelet core; b: sickle blade reused as an end-scraper; c: bladelets (Archives Mission Caucase).



Fig. 22 – Cores; a: on obsidian pebbles; b: on obsidian flakes (Archives Mission Caucase).

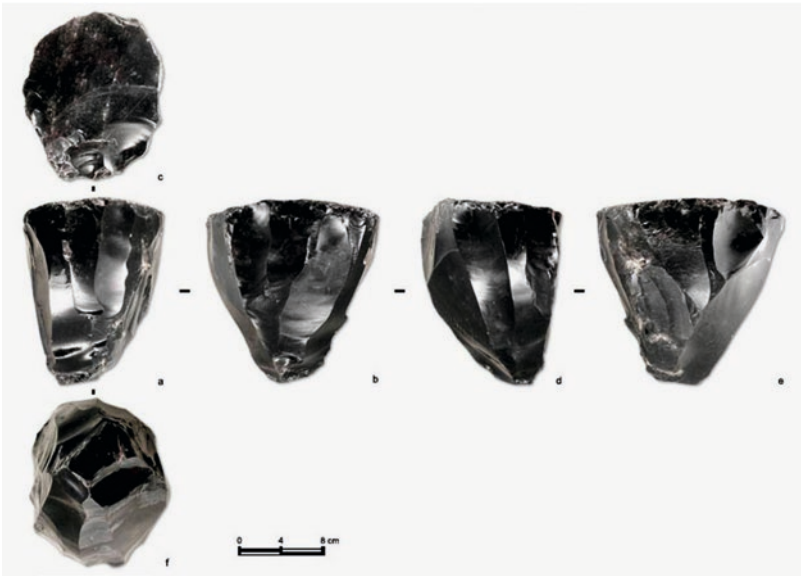


Fig. 23 – Large prismatic core in obsidian (Archives Mission Caucas).

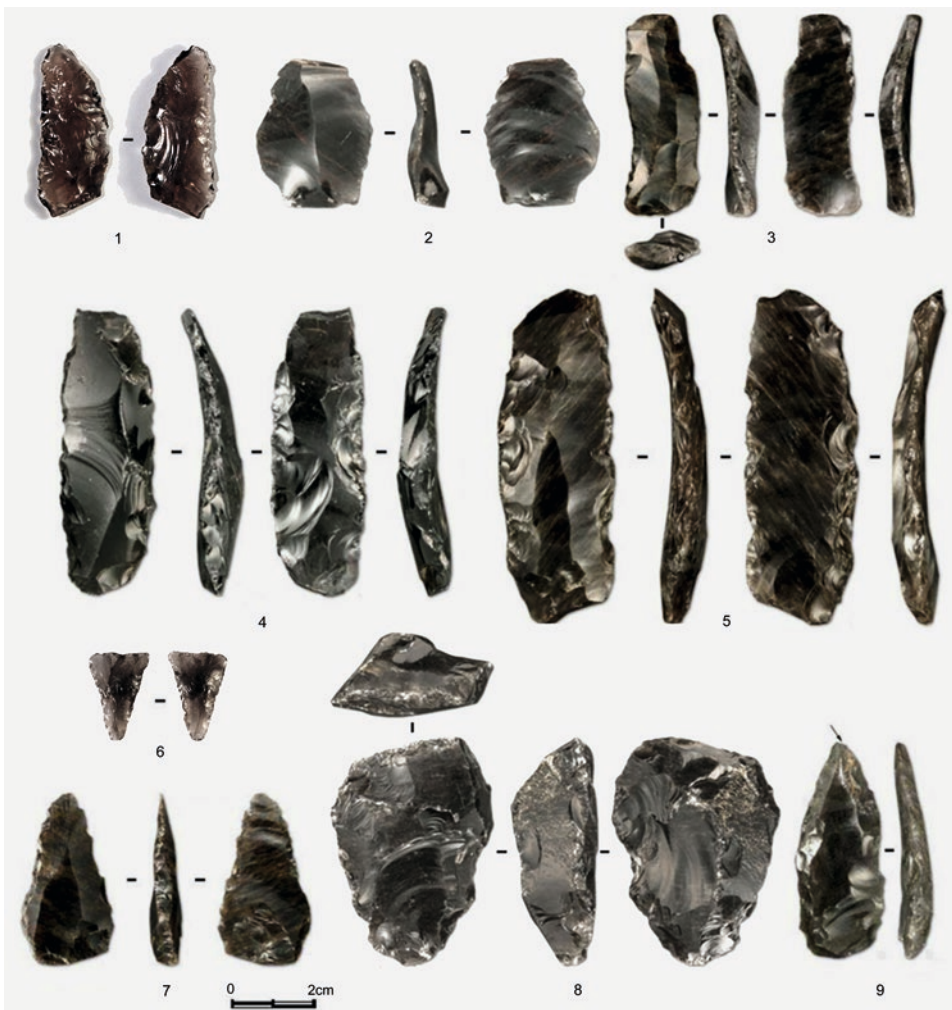


Fig. 24 – Obsidian assemblage; 1: sickle element; 2: flake; 3: bladelet; 4-5: blades; 6: transverse arrowhead; 7: point; 8: scraper; 9: burin (Archives Mission Caucas).

secondary retouches, use-wear traces are often visible on shapeless fragments, even very small ones. Blades that were detached by percussion debitage are small (*fig. 24.3*) and have often been used without any retouch. When retouches are attested (*fig. 24.4-5*), they can be irregular, fine and denticulated, or abrupt and parallel. The Godedzor assemblage includes sickle elements (*fig. 24.1*), scrapers, splintered pieces, notched pieces, burins (atypical, multifaceted) (*fig. 24.9*) as well as some bifacial retouched scrapers (*fig. 24.8*). Some transverse arrowheads, triangular with finely retouched edges (*fig. 24.6*), were also found, but their rarity suggests that hunting was not a significant activity at Godedzor.

The main features of the obsidian industry at Godedzor include:

- the bulk of the raw material coming from obsidian pebbles, hence the reduced dimensions of most of the artefacts;
- a predominance of occasional flakes with retouch as well as a large percentage of artefacts with no evidence of retouch;
- cores used up to exhaustion and use wear often visible on some shapeless and very small fragments.

Such intensive exploitation of the raw material could be explained in a situation of shortage, as is the case with flint, but Godedzor is located close to large obsidian deposits (Sevkar, Satanakar, Bazenk). According to the data, it seems that the population of Godedzor did not regularly visit the primary sources of obsidian and mainly exploited the abundant raw material carried downstream by the Vorotan river.

Circulation of the Syunik obsidian (C. Chataigner)

The Syunik obsidian complex consists of three close chemical groups, which correspond, respectively, to the outcrops of Bazenk, Mets Satanakar and Mets Sevkar/Pokr Sevkar. These groups, which have similar compositions characterized by low contents of barium, zirconium, and yttrium (Keller et al. 1996), can be distinguished according to their concentrations of the lighter rare earth elements (especially La and Th) (Cherry, Faro, Minc 2008). This obsidian, abundant and of high quality, is dark grey to jet black and translucent when thinly flaked; at the Sevkar sources, there are significant occurrences of red-brown mottling (Cherry, Faro, Minc 2008).

The Syunik geochemical signature, which is clearly distinguishable from those of other sources in Transcaucasia, was identified in artefacts from south-eastern Armenia and the steppes of Azerbaijan (Badalyan, Chataigner, Kohl 2004) and also in a small group of artefacts from the Near East – group “3c” – identified by the laboratory at Oxford during pioneering analyses carried out in the 1960s (Renfrew, Dixon, Cann 1966). The work carried out in the 1990s by M.J. Blackman and J. Keller has shown that the deposits of Syunik (and especially Sevkar) are the most probable sources for the obsidian of group 3c (Keller, Seifried 1990, p. 84; Badalyan et al. 1994; Blackman et al. 1998).

The artefacts in this group come mainly from north-western Iran and were found in 6th millennium BC contexts (Hajji Firuz, Yanik Tepe) or the 5th-4th millennia BC (Dava Göz, Kushali Tepe, Kul Tepe (Hadishahr), Ghosha, Yanik Tepe, Kohne Tepesi). The materials from the Lake Van region (Meydan Dag, Nemrut Dag) have also been recorded at these different north-western Iranian sites, together with other Armenian sources (Geghasar, Gutansar, Arteni, Tsaghkunyats) (Ghorabi et al. 2010; Khademi Nadooshan et al. 2013) although rarely.

During the Chalcolithic and Early Bronze Age periods at Kul Tepe (Hadishahr), almost all the lithic industry is in obsidian, with rare flint and chert pieces. Obsidian was brought to Kul Tepe in the form of nodules, blocks and blanks, and processed locally, as suggested by numerous waste and core fragments (Abedi et al. 2014; Khademi Nadooshan et al. 2013). Many of the cores and tools still bear the cortex of pebbles rolled by a river. Their provenance has been determined by a chemical analysis: they come from the Syunik sources (Khademi Nadooshan et al. 2013, p. 1960, fig. 4) (*fig. 25*).

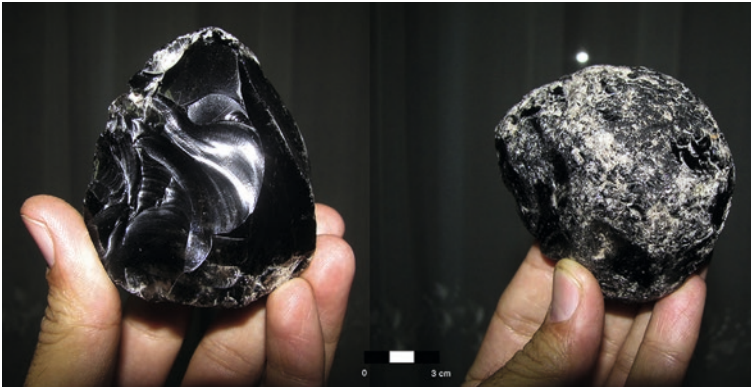


Fig. 25 – Core and pebble with cortex found in Kul Tepe related to Syunik and Vorotan valley sources (Khademi Nadooshan et al. 2013, fig. 4).

Therefore, it seems very likely that much of the obsidian that was transported to Kul Tepe (Hadishahr) was in the form of pebbles collected in the bed of the Vorotan river. The dimensions of these pebbles closely resemble the size of those found at Godedzor, thus suggesting that they may have been retrieved in secondary deposits that may not have been different from, or eventually located at the same distance from, the primary outcrops – as the secondary deposits that were exploited by the inhabitants at Godedzor.

Studies support this hypothesis: during the Chalcolithic period (ca 5000-3500 cal. BC) at Kul Tepe (Hadishahr), 80% of the 20 artefacts analysed come from the Syunik outcrops (Khademi Nadooshan et al. 2013, p. 1961). Scholars have interpreted the predominance of the Syunik obsidian, brought in abundance onto the site mainly as pebbles, as evidence of transhumance. The inhabitants of Kul Tepe (Hadishahr), who lived at a lower altitude (950 m asl), travelled in summer to the upper valley of the Vorotan river (Khademi Nadooshan et al. 2013, p. 1964). Another argument in favour of a direct link between north-western Iran and the Syunik highlands is that the obsidian of this region is not found beyond the lake Urmiah basin: it was apparently used only for local needs and certainly not for extensive trade (Khademi Nadooshan et al. 2013, p. 1964).

Going back to Godedzor, the picture offered by the lithic evidence seems to indicate that the site's inhabitants were neither specialized knappers nor obsidian traders; the direct and intensive exploitation of the nearby primary outcrops of obsidian does not seem to have represented the main economic reason leading to the site's establishment.

Analysis of the animal remains from Godedzor (A. Bălășescu, J. Chahoud)

General analysis

This section presents the analysis of animal remains recovered from Godedzor between 2008 and 2013. The data is presented according to the three main levels of the Late Chalcolithic occupation (II A, II B, II C). Around 5,883 animal remains were recorded and 70% of the bones were identified to the species level, corresponding to 3,370 fragments. In terms of weight, the identified remains account for 44.729 kg (81.7%) and the unidentified for 9.994 kg (18.3%). The faunal remains were hand collected, a sieving test of 40 litres of sediments was conducted during the season of 2013 in order to collect the microfauna, although no smaller bone fragments were retrieved from the sieved samples. The spectrum refers mainly to mammal remains with only four remains of unidentified birds. Levels II C and II B have yielded most of the animal remains respectively accounting for about 1,090 identified out of 2,008 fragments, and 2,158 identified out of 3,656 fragments (*tab. 2*). In contrast, the fauna from level II A is scarce. Due to the difference in the quantity of remains, the comparison between the three levels should be considered with caution.

As for the *faunal spectrum*, mammals are predominant in this assemblage (tab. 2). They are represented by five domestic animals: cattle (*Bos taurus*), sheep (*Ovis aries*), goat (*Capra hircus*), pig (*Sus domesticus*) and dog (*Canis familiaris*), along with 15 wild animal species including wild caprine, small-sized equid, aurochs (*Bos primigenius*), bison (*Bison* sp.), pig (*Sus scrofa*), red deer (*Cervus elaphus*), gazelle (*Gazella* sp.), wolf (*Canis lupus*), fox (*Vulpes vulpes*), mustelids, badger (*Meles meles*), large felid, castor (*Castor fiber*) and hare (*Lepus* sp.). Bone fragmentation is high. The presence of several species (domestic and wild) of large mammals reduced the frequency of identification to the species level. Therefore, fragmented unidentified bones are clustered in ruminant size groups (e.g. *Bos/Bison* – 3.18% and *Bos taurus/Bos primigenius* – 0.51%) (tab. 2).

Species	NISP	NISP	NISP	NISP	NISP
	II C	II B	II A	Total	%
<i>Bos taurus</i>	287	605	24	916	27.18
<i>Ovis aries</i>	32	84	12	128	3.80
<i>Capra hircus</i>	17	42	2	61	1.81
<i>Ovis aries/Capra hircus</i>	552	1,133	78	1,763	52.31
<i>Sus domesticus</i>	2	11		13	0.39
<i>Canis familiaris</i>	20	21		41	1.22
<i>Bos taurus/Bos primigenius</i>	8	9		17	0.50
<i>Sus</i> sp.	12	12		24	0.71
<i>Bos/Bison</i>	79	27	1	107	3.18
<i>Bos/Cervus</i>		4	1	5	0.15
<i>Ovis</i> sp. wild	1	1		2	0.06
<i>Capra</i> sp. wild	2	1		3	0.09
<i>Ovis/Capra</i> wild	16	32	1	49	1.45
<i>Sus scrofa</i>	9	2		11	0.33
<i>Equus</i> sp.		1		1	0.03
<i>Bos primigenius</i>	7	18		25	0.74
<i>Bison bison</i>	5	16		21	0.62
<i>Cervus elaphus</i>	28	86	1	115	3.41
<i>Gazella</i> sp.		5		5	0.15
<i>Canis lupus</i>	3	2	1	6	0.18
<i>Vulpes vulpes</i>	5	1		6	0.18
<i>Meles meles</i>	1	26		27	0.80
<i>Mustelidae</i>	3	11		14	0.42
<i>Felis</i> sp.		1		1	0.03
<i>Castor fiber</i>	1	2		3	0.09
<i>Lepus europaeus</i>		5	1	6	0.18
Total identified mammals	1,090	2,158	122	3,370	100
Total unidentified mammals	917	1,491	97	2,505	
Antler (cervids)	1	3		4	
Birds		4		4	
Total	2,008	3,656	219	5,883	

Species	Weight	Weight	Weight	Weight	Weight
	II C	II B	II A	Total	%
<i>Bos taurus</i>	8,505	13,246	1,772	23,523	52.59
<i>Ovis aries</i>	289	634	110	1,033	2.31
<i>Capra hircus</i>	168	351	19	538	1.20
<i>Ovis aries/Capra hircus</i>	2,255	3,991	373	6,619	14.80
<i>Sus domesticus</i>	50	263		313	0.70
<i>Canis familiaris</i>	159	81		240	0.54
<i>Bos taurus/Bos primigenius</i>	635	401		1,036	2.32
<i>Sus sp.</i>	111	36		147	0.33
<i>Bos/Bison</i>	2,827	988	50	3,865	8.64
<i>Bos/Cervus</i>		37	15	52	0.12
<i>Ovis sp. wild</i>	8	32		40	0.09
<i>Capra sp. wild</i>	46	5		51	0.11
<i>Ovis/Capra wild</i>	145	204	20	369	0.82
<i>Sus scrofa</i>	113	12		125	0.28
<i>Equus sp.</i>		10		10	0.02
<i>Bos primigenius</i>	400	2,534		2,934	6.56
<i>Bison bison</i>	535	1,004		1,539	3.44
<i>Cervus elaphus</i>	548	1,339	40	1,927	4.31
<i>Gazella sp.</i>		114		114	0.25
<i>Canis lupus</i>	30	5	3	38	0.08
<i>Vulpes vulpes</i>	25	6		31	0.07
<i>Meles meles</i>	4	114		118	0.26
<i>Mustelidae</i>	5	21		26	0.06
<i>Felis sp.</i>		10		10	0.02
<i>Castor fiber</i>	8	11		19	0.04
<i>Lepus europaeus</i>		9	3	12	0.03
Total identified mammals	16,866	25,458	2,405	44,729	100
Total unidentified mammals	4,023	5,631	340	9,994	
Antler (cervids)	25	21		46	
<i>Birds</i>		4		4	
Total	20,914	31,114	2,745	54,773	

Tab. 2 – NISP (Number of identified specimen) and weight (g) of animal remains by levels, Godedzor.

The faunal assemblage of the Chalcolithic occupation at Godedzor points to animal husbandry strategies focused on caprines (up to 57.9% of NISP) and on particular sheep. Cattle are the second species exploited at Godedzor with up to 27.18% of NISP. Pigs are represented by 13 specimens remains (0.39%) and their frequency can be more important considering the difficulty of distinguishing between *Sus domesticus* and *Sus scrofa* on additional 24 remains (0.71%). Domestic dogs are represented by 41 specimens (1.22%) and indirectly by the presence of bite marks on ruminant bones. The presence of dogs in Godedzor is important as three fragments from phase II C present butchery marks that signify meat consumption. Cut marks were recorded on pelvis (4) and upper jaw (fig. 26b).

Moreover, burnt traces were noted on a mandible fragment that could indicate preliminary skinning processes (fig. 26a). This identification of dog consumption on site might be a unique practice or a diet preference that needs to be investigated further. The unidentified remains belonging to categories of large and middle-size mammals, wild or domestic are not considered in this chart (*Bos/Bison*, *Bos taurus/Bos primigenius*, *Sus domesticus/Sus scrofa*, *Bos/Cervus*).



Fig. 26 – a: Left mandible of a dog (*Canis familiaris*) with burn marks on teeth (lateral side); b: Left pelvis of a dog (*Canis familiaris*) with cut marks (Archives Mission Caucase).

Some significant changes in the pastoral strategies can be noted during the three phases of occupation. While frequency of cattle exploitation decreases (29% to 21%), caprine exploitation becomes more important (60.6% to 76.7%) from the earliest (II C, II B) to the latest level (II A) (fig. 27). The sheep/goat ratio also changes over time, with a clear preference for sheep (2:1 in levels II C and II B) that becomes higher in level IIA (6:1). Pig and dog consumption is less prominent.

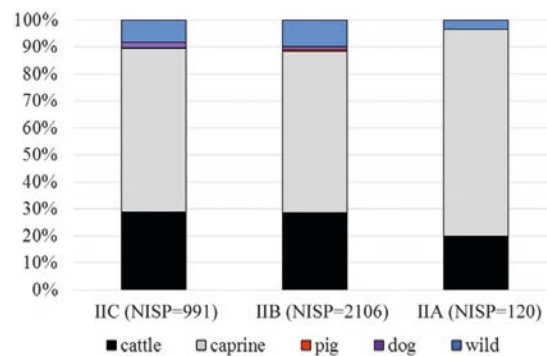


Fig. 27 – Relative frequency of domestic and wild species, by levels (NISP). The unidentified remains belonging to categories of large and middle size mammals, wild or domestic are not considered in this chart (*Bos/Bison*, *Bos taurus/Bos primigenius*, *Sus domesticus/Sus scrofa*, *Bos/Cervus*) (A. Bălăşescu, J. Chahoud).

Along with animal husbandry, hunting was also practised in Godedzor as is demonstrated by the wide diversity of game animals, revealing an exploitation of the surrounding environment. It is well recorded in level II B; remains of wildlife are the most frequent with 15 species represented. Wild species are less abundant in other levels, 11 taxa in II C and 5 taxa in II A. In term of food value, the role of wild game in the diet is minor but remains complementary to domestic animals. The main game hunted at Godedzor is red deer (3.41% NISP), aurochs and bison (1.36% NISP). These taxa provide a good amount of meat and products (skin, horn and antler). The contribution of wild caprine is variable with a frequency of 1.6% NISP. Other wild animals, such as carnivores, are recorded in Godedzor's faunal assemblages, including wolf, fox, badger, mustelid and felid. As a whole, hunting increases slightly from level II C (8.2%) to II B (10%) and decreases in level II A (4%). At Godedzor, the wide range of hunted wildlife (around 15 taxa) indicates an exploitation of the surrounding environment which was mainly mountains and forests.

As regards the weight of domestic animal remains, the frequency of cattle is higher than caprines (more than 52%). Due to their large size and weight, cattle can provide a fair amount of meat for consumption. However, the weathering effects (humidity, cold weather) that are recorded on the bones could have affected the smaller caprines bones, which may have become more fragmented and less well preserved than the larger mammals. Therefore, the larger and more robust cattle bones may have been better preserved and thus overrepresented. The frequency of cattle, according to their

weight remains, decreases from level II C (64%) to level II B (55,2%) and increases in level II A (75,7%). In contrast, caprine frequency, according to weight remains, does not reveal any significant changes across the Chalcolithic levels (around 20 to 21%) (fig. 28). If we consider the weight of wild game, there is a slight increase in their frequency between levels II C (14%) and II B (22.6%) and a decrease in level II A (2.8%) (fig. 28).

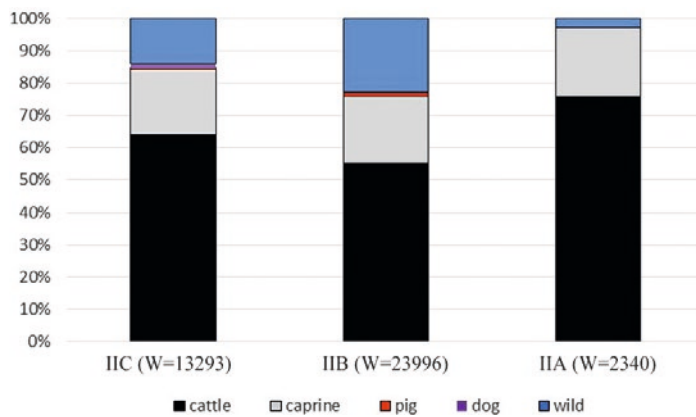


Fig. 28 – Relative frequency of domestic and wild mammals by level according to weight; the unidentified remains belonging to categories of large and middle size mammals, wild or domestic are not considered in this chart (*Bos/Bison*, *Bos taurus/Bos primigenius*, *Sus domesticus/Sus scrofa*, *Bos/Cervus*) (A. Bălășescu, J. Chahoud).

Culling profile of domestic mammals

The study of teeth wear and eruption has been conducted following Schmid (1972), Ducos (1968) and Grant (1982) for cattle, and Payne (1973) and Helmer (2000) for caprines in order to analyse the culling profiles and slaughtering strategies of domestic mammals. Culling profiles are based on the number of teeth (Nt) following Vigne (1988), Helmer (1992) and Helmer, Vigne (2004). To distinguish between sheep and goat teeth, the analysis conducted by Payne (1985), Helmer (2000), Halstead, Collins, Isaakidou (2003) and Balasse, Ambrose (2005) have been used. The mortality data is presented as a histogram following Brochier (2013), without using the a priori correction initially proposed by Vigne, Helmer (2007).

Teeth remains are not abundant for cattle (Nt=44), therefore, a general culling profile has been produced for the level II as a whole (fig. 29). This data reveals a mixed exploitation of milk and meat. Post-lactation slaughter of young individuals (age group 0-6 months – Nt=8, relative frequency density 0.36; age group 6-12 months – Nt=4.5, relative frequency density 0.20) and early culling of dairy cows (age group 4-6.5 years – Nt=6.5, relative frequency density 0.06; age group 6.5-9 years – Nt=6.5, relative frequency density 0.06) reveal the existence of milk exploitation (Gillis et al. 2016). On the other hand, meat production is recorded by the slaughter of sub-adult individuals between one and two years (Nt=4.5, relative frequency density 0.102) for soft meat and between two and four years (Nt=3.5, relative frequency density 0.040) suggesting a culling of individuals at their optimum weight value. Along with these products, cattle were used for transport and traction as it is recorded by the pathology traces noted on adult feet extremities (phalanges; Bartosiewicz, Van Neer, Lentacker 1997) and confirmed by the slaughter of individuals older than nine years (Nt=10.5, relative frequency density 0.077).

The analyses of caprine teeth reveal the importance of this assemblage (Nt=262). Data from goat and sheep separately is scarce and does not allow us to create a representative culling profile. Therefore, we regrouped caprine all together. A culling profile could have been generated for each level of Godezpor: II C 96 teeth; II B 136 teeth; II A 30 teeth (fig. 30). We should bear in mind that conclusions on caprine exploitation of level II A are less representative due to the small number of teeth in comparison with II C and II B.

In general, we observe a major culling of young individuals of age group C (6-12 months) and mainly D (1-2 years) over all levels, which decreases over time, with a total of 0.85 relative frequency density (Nt=58.6) at II C, 0.49 (Nt=52.3) at level II B and 0.27 (Nt=8) at level II A.

These frequencies reveal an important exploitation of caprine meat on one hand. On the other hand, it is complemented by the production of milk as it is attested by the presence of age group B (2-6 months) noted mainly in levels II C (0.05 relative frequency density – $Nt=1.7$) and II B (0.06 – $Nt=2.6$) and by the presence of age group EF (2-4 years) in levels II C (0.11 – $Nt=20.2$), II B (0.13 – $Nt=34.7$) and II A (0.05 – $Nt=3$). All levels record an exploitation of mature individuals mainly for wool and fleece: in group G (4-6 years), the relative frequency density increases from level II C (0.06) to II B (0.11) and especially II A (0.30); group HI (6-10 years) is attested in all levels (*fig. 30*). We should note in level II B an important culling of juvenile individuals that could indicate a natural mortality or culling for milk production (0-2 months, group A: 0.15 relative frequency density – $Nt=3.4$) (*fig. 30*).

Overall, the diachronic exploitation of caprines reveals significant changes. The earliest occupation (II C) records a primary exploitation of meat that evolves in level II B and II A into secondary products exploitation (milk and wool in II B, only wool in II A). Furthermore, meat exploitation gradually changes with a preference for high quality tender meat in level II C (group C, 6-12 months, 0.471 relative frequency density; group D, 1-2 years, 0.38) *versus* an optimum production of meat supply by culling young individuals at their maximum weight in level II A (group C, 0; group D, 0.267 relative frequency density) (*tab. 3*).

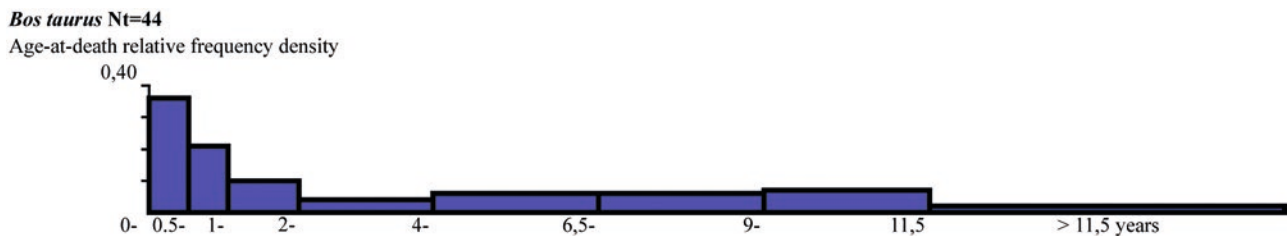


Fig. 29 – Cattle mortality profiles based on dental eruption, development and wear stages, Godedzor, level II (A. Bălăşescu, J. Chahoud).

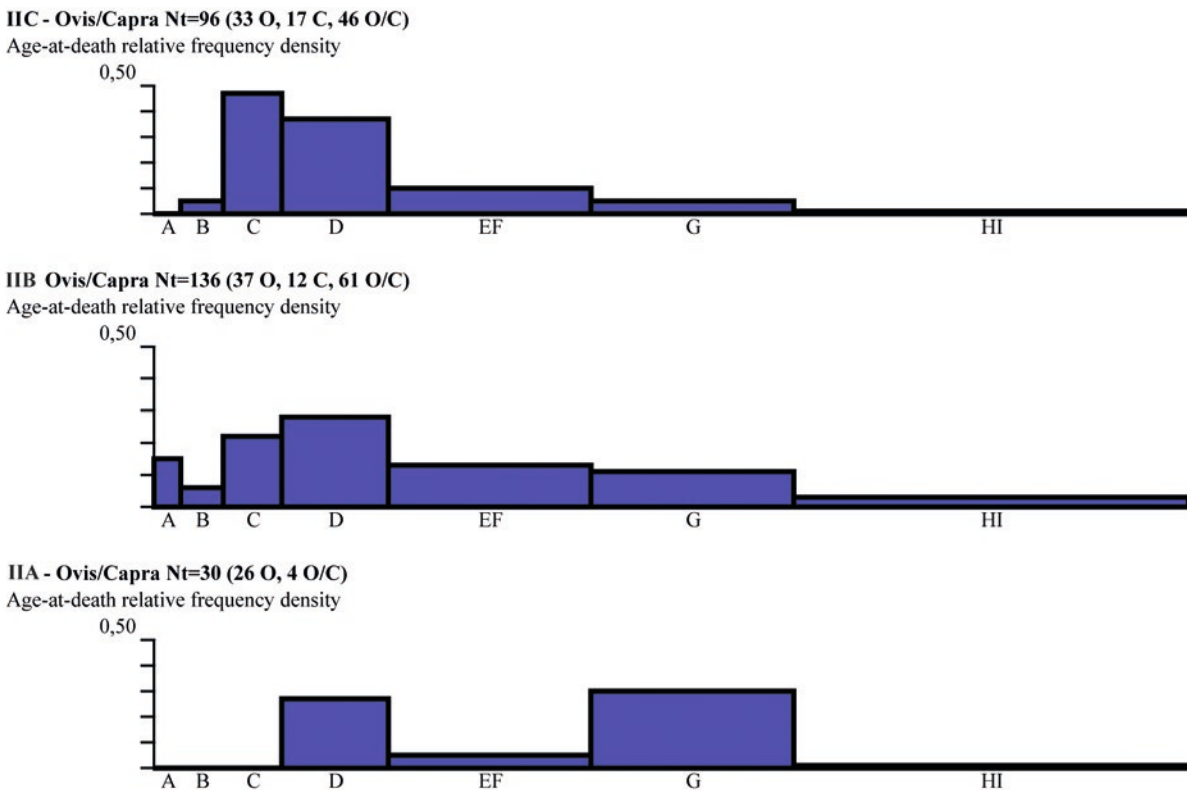


Fig. 30 – Caprine mortality profiles based on dental eruption, development and wear stages, Godedzor, by levels; Nd, age group follow Payne 1973; O: *Ovis aries*, C: *Capra hircus*, O/C: *Ovis aries/Capra hircus* (A. Bălăşescu, J. Chahoud).

		II C	II C	II B	II B	II A	II A
Category	Age	N teeth	RFD	N teeth	RFD	N teeth	RFD
A	0-2 months		0	3.4	0.15	0	0
B	2-6 months	1.7	0.05	2.6	0.06	0	0
C	6-12 months	22.6	0.47	14.6	0.21	0	0
D	1-2 years	36.0	0.38	37.7	0.28	8	0.27
EF	2-4 years	20.2	0.11	34.7	0.13	3	0.05
G	4-6 years	11.1	0.06	29.0	0.11	18	0.30
HI	6-10 years	4.4	0.01	14.0	0.03	1	0.01
Total		96.0		136.0		30	

Tab. 3 – Culling profiles of caprines (per level) taking into account relative frequency density values.

Godedzor is situated at 1,800 m asl and the region is covered by thick snow from November to March which is a condition that, unless sufficient fodder is stored, may cause problems with providing enough feed for domestic animals. Ethnographic sources (Mkrtumyan 1974) indicate the great difficulty that the population of the Syunik region still suffered at the beginning of the 20th century in ensuring the survival of their herds during winter. It is also documented that in the Middle Ages the local inhabitants took their flocks to winter pastures located in the lower and milder valleys of the Kura and Araxes rivers (Mkrtumyan 1974).

At Godedzor, we have evidence of the different age groups of caprine and cattle, from birth to old age. The presence of all the animal's body parts indicates that they were slaughtered and consumed on site. The presence of very young animals is not surprising in the hypothesis of transhumance, since the herd moves into highland pastures soon after lambing and calving occurs (Greenfield 1999; Arnold, Greenfield 2006). Even today, where the herd management is sophisticated and the timing of reproduction planned, several calves are born each year in the mountain pastures (Heitzmann 2003).

The slaughtering profiles of cattle draw our attention to two interesting phenomena:

- the high proportion of animals older than 9 years (0.08 relative frequency density; 23.9% relative frequency), which cannot be exploited for meat or milk; these animals could have been exploited for their traction power, as it is confirmed by the recovery of several phalanx and coxal cattle bones showing pathologies and deformations compatible with transport;
- the proportion of calves slaughtered between 0 and 6 months (0.364 relative frequency density; 18.2% relative frequency) is significantly higher than that of calves between 6 and 12 months (0.205 relative frequency density; 10.2% relative frequency), whereas the mortality of this latter age group includes post-lactation slaughter (Balasse et al. 2000) and preference for tender meat; of the 8 teeth of the group 0-6 months, 7 belong to animals less than 4 months old, the last one is undetermined; this high mortality rate between 0 and 4 months could result from a variety of causes:
 - natural mortality: high levels of neonatal mortality could be a reflection of climatic conditions, especially of wet and cold weather (Halstead 1998); at Godedzor, the arrival of the herd would take place at the end of May or in June; these are the two rainiest months with 70-90 mm of precipitation and the temperature can be quite low at night, at 1,800 m asl;
 - a removal of unwanted animals, particularly males, prior to the onset of winter (Balasse, Tresset 2002); calves born in the highlands on June or July would be less than 6 months old when the herd would have to return to the lowlands in October; therefore, young males could have been slaughtered in early autumn.

While our understanding of cattle exploitation at the site still awaits further data, there is little doubt that our insight into caprines is definitely clearer; caprines played a growing part over time, with a

shift from primary to secondary products. All of this suggests that sheep and goat played an important role in the pastoral economy of Godedzor. In particular, animal fibres, and most probably wool, seem to have had a significant role.

This hypothesis seems to be corroborated by the large and diffused presence, throughout the Late Chalcolithic occupation at Godedzor, of a wide range of bone tools such as combs (*fig. 31.1*), pins (*fig. 31.2-4*), awls (*fig. 31.5*), beaters or swords (*fig. 31.6-9*) and by the abundance of spindle whorls in bone (*fig. 31.12*), fired clay (*fig. 31.11*) and especially those obtained from ceramic sherds (*fig. 31.10, 31.13*). Together this evidence points to an intensive and possibly large scale *in situ* exploitation of secondary products, linked to wool processing and weaving of animal fibres.



Fig. 31 – Textile tools from the Chalcolithic occupation (Archives Mission Caucase).

Reconstruction of the pastoral movements (O. Barge)

We surmise that these pastoral communities would have reached the Syunik region in very early summer, and on this basis, an isochrone map of the least-cost paths based on a slope-dependent cost-function model was created (Eastman 1999). We are aware of the fact that this type of modelling is often criticised (Herzog 2014), as pedestrian paths need to be combined with multiple constraints that are definitely more numerous than inclination slopes alone. For these reasons, isochrones and the paths modelled in this map need to be considered with caution in the absence of a “calibration” model. Albeit approximate, this information helps us to create hypotheses on the accessibility of Godedzor taking into account the geographical position of the region’s main topographic entities.

Two different types of least-cost path models were generated (*fig. 32*): the first one takes into account just the topography of the region (dotted lines), while the second one (continuous line) also takes into account the difficulties and constraints represented by river fording (rivers have been equated with a constraint value 1,000 times higher than other topographical entities). In particular, the Araxes river is characterised by a rapid stream especially difficult to cross (even more difficult with a flock) in

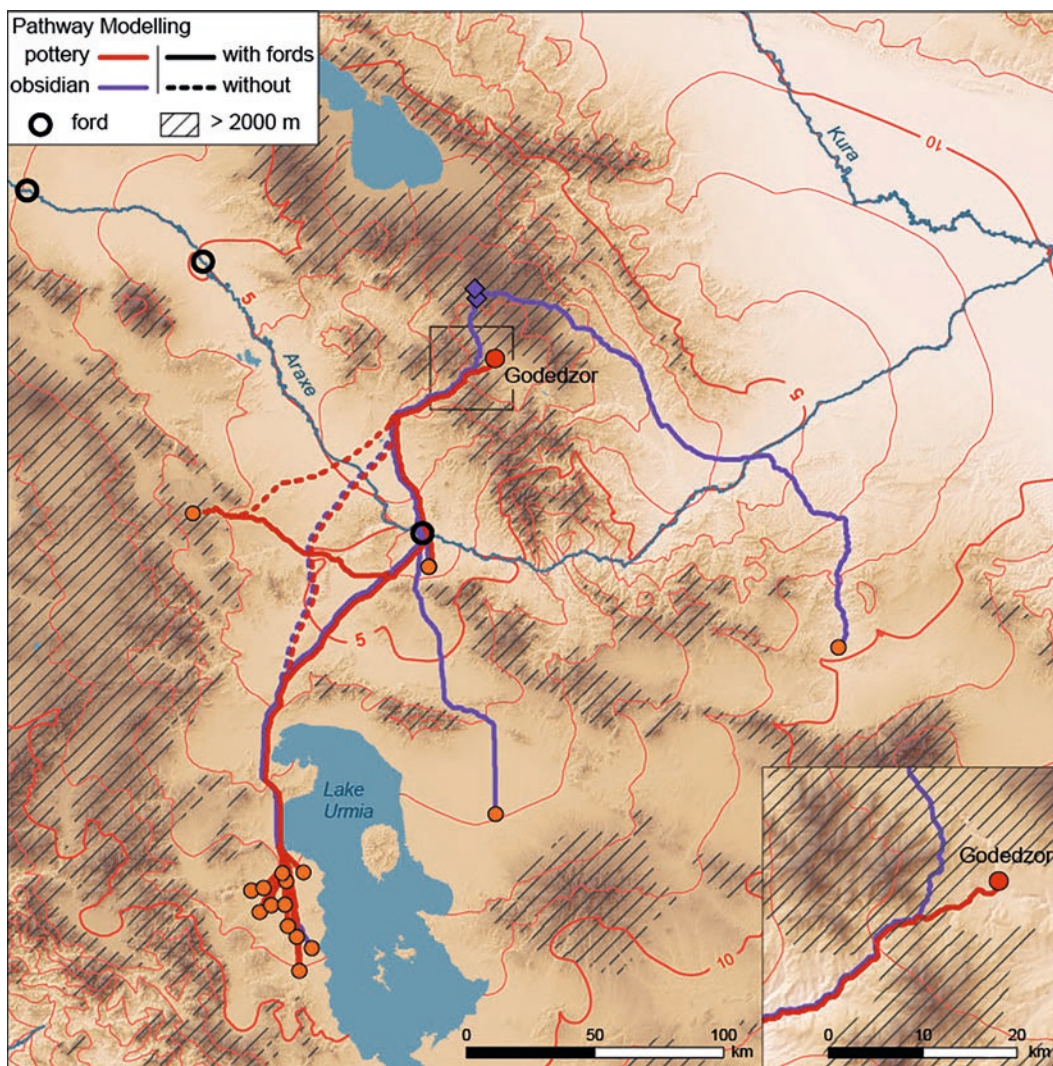


Fig. 32 – Isochrone map of the least-cost paths calculated in day-march from and to Godedzor; dotted lines take into consideration only the topography of the region, simple line also takes into account the river fording; red lines link Godedzor to the sites where Urmiah painted ware was found; blue lines link Godedzor to the Chalcolithic sites in Iran where the obsidian from the region of Syunik was found (O. Barge).

the absence of a ford. We suppose that, especially in this period, it was necessary to cross the river by the fords. In the second model, the constraints represented by the river were suppressed at the point where fords are documented according to the historical accounts of the past centuries' travellers (Pitton de Tournefort 1717; Dubois de Montpéroux 1839).

Godedzor is located at the margins of a small intermountain basin of the Vorotan river in the hearth of the highlands of the region of Syunik that are often higher than 2,000 m asl (*fig. 32*, box) which in itself is an altitude that maintains snow cover for a significant part of the year. In these geographical and environmental conditions and if we consider the hypothesis that Godedzor was a seasonal settlement occupied during the summer transhumance, we asked the following question: through which spaces and paths was it possible to access the site by means of least-cost effort movements?

Isochrones offer, in the absence of further information, some insightful clues to these matters by showing that Godedzor sits on three main axes of communication affording rapid movements across the surrounding countryside:

- in spite of the altitude, the relief conformation that mainly consists of highlands facilitates movements in direction of the lake Sevan basin and from here to the Ararat plain;
- there is a relatively easy access to the Araxes and Kura river valleys *via* an old route documented in ancient maps and travellers' accounts (Colton 1855), linking Nakhchivan to Gandja through Godedzor and Agdam; Godedzor is also connected with the lower Araxes basin through the Vorotan valley;
- several passes at relatively low altitude, among which the Sisian (Bichenek) pass (2,346 m asl), give access to Nakhchivan and the Araxes valley through the western slopes of the massif of the Zangezur; from here, heading north-west you can reach the Ararat plain, while heading south you can reach the lake Urmiah.

This shows that Godedzor is relatively easily accessible from the Kura basin, from the Ararat plain and finally from Urmiah lake in approximately one week's march. The painted ceramics from Godedzor, by showing strong similarities with those of the Urmiah region, suggest that the inhabitants may have been members of the communities settled in the Urmiah region. The modelling of the least-cost paths between the sites of the Urmiah basin and Godedzor suggest the existence of routes across the Sisian (Bichenek) pass to a region nestling in the heart of these highlands. In this framework, the data are coherent with those on the provenance of the obsidian. Finally, the ford modelling also shows that the ford near Djulfa could have strictly controlled or influenced the direction of the regional routes of communication; this ford could have afforded a relatively swift access to the region of Godedzor from the Urmiah basin.

Archeobotany (R. Hovsepyan)

The remains of threshing waste of different cereal species were found in several Late Chalcolithic occupational contexts (pits and fireplaces). These remains, comprising spikelet forks, internodes and glumes, were more common in phase II B, but they were present, although in lesser quantities, in phase II C also. The fact that there were considerable quantities of this waste, especially during phase II B, means that it is highly likely that harvesting and threshing activities took place in or around the settlement. This data certainly opens a new perspective on the nature of the resources that were exploited by the inhabitants of Godedzor during the Late Chalcolithic period, as well as on their subsistence strategies (*tab. 4*).

If on the one hand, faunal data points to a significant pastoral orientation in the economy of the inhabitants of Godedzor, on the other hand, the botanical evidence suggests that farming played also a role in the local subsistence strategies. The fairly abundant botanical evidence highlights a predominance of cereal crops with around 6:4 ratio between wheat and barley. This ratio varies slightly in each level of the Late Chalcolithic occupation but the slight prevalence of wheat over barley remains stable over time.

Horizon		II A	II B	II C	
Volume (litres)		25	445	294	
Concentration of carpological material (seeds/litre)		36.2	26.1	16.4	
Plant taxa	Findings	904	11,631	4,817	
Crops – Weeds		66%	81%	82%	
Triticeae gen. spp.		grains and grains fragments	2	8,599	2,015
Wheat – Barley		50%	60%	58%	
<i>Triticum sp.</i>	grains	0	83	445	
	glumes	0	0	1	
	internodes	0	3	2	
<i>T. aestivum/durum</i>	grains	292	309	611	
<i>T. aestivum</i>	internodes	0	45	2	
<i>T. cf. aestivum ssp. vulgare</i>	grains	0	0	15	
<i>T. cf. aestivum ssp. compactum</i>	grains	0	2	3	
<i>T. cf. durum</i>	grains	0	0	5	
	internodes	0	1	0	
<i>T. dicoccum</i>	grains	0	0	7	
	spikelet fork	0	2	0	
Barley – Wheat		50%	40%	42%	
<i>Hordeum vulgare</i>		grains	288	276	744
<i>H. vulgare</i> (hulled)		grains	0	11	16
<i>H. vulgare</i> (naked)		grains	0	6	17
<i>H. vulgare ssp. vulgare</i>		triplet lateral grains	0	0	3
<i>H. vulgare ssp. vulgare</i> convar. <i>vulgare</i>		triplet lateral hulled grains	0	1	12
<i>H. vulgare ssp. vulgare</i> convar. <i>coeleste</i>		triplet lateral naked grains	0	0	3
Pulses – Cereals		3.2%	0.4%	1.0%	
Viceae gen. spp. (large seeded cultivated pulses)		seeds	0	2	29
<i>Pisum sativum</i>		seeds	2	17	8
<i>Lens culinaris</i>		seeds	17	18	4
<i>Vicia ervilia</i>		seeds	0	0	3
<i>Lathyrus sp. (?)</i>		seeds	0	0	2
Oil plants					
<i>Linum cf. usitatissimum</i>		seed	0	0	1
Weeds – Cultigens		33.5%	19.4%	18.0%	
Trees & Shrubs					
<i>Prunus sp.</i>		nutstones	0	1	1
<i>Rosa sp.</i>		nutlets	0	0	5

Tab. 4 – Cultigens (per level) recorded in the Chalcolithic occupation at Godedzor.

As concerns the cultivated cereal species, free threshing wheat (*Triticum aestivum/durum*) predominates over the rest, and barley is present both in the naked and hulled varieties with an almost equal ratio in phase II C. Regarding the barley, the presence of the six-row variety at Godedzor is recorded since level II C (Hovsepian 2010).

A more general observation can also be made: wheat and barley were always found mixed at Godedzor. Mixed crops remains could mirror a situation in which farming practices mixed the cultivation of wheat and barley; the diversity of the species may have been a risk-buffering strategy against crop failure. This strategy is especially typical of the highlands and mountains that represented – and still do – high-risk regions in terms of agricultural productivity because of the harsh environmental constraints (Stoletova 1930; Gandilyan 1997; Riehl 2006; Hovsepian 2015). It is worth remarking that this strategy was to be widely adopted by the Kura-Araxes communities that settled in the mountains during the second half of the 4th millennium BC (Hovsepian 2015, p. 77).

As concerns the other domestic species, pulses are scarce and only account for about 1% of all the cultivated species. Once again, the farming choices documented at Godedzor seem to anticipate those adopted some decades later by Kura-Araxes communities (Hovsepian 2015).

So far, Godedzor provides among the earliest and the highest evidence, in terms of altitude, of farming activities carried out in the mountains of the southern Caucasus and this evidence makes it possible to put forward some essential questions concerning the nature (permanent, temporary, seasonal) of the occupation.

However, as it was observed by Hole (2009, p. 263), farming may not be antithetical to transhumant pastoralism and this compatibility is still demonstrated today by the fact that crop cultivation is still carried on (or was until recently) in Iran by pastoral communities in the fields adjacent to the summer pastures. Alizadeh highlights the fact that in Iran:

Pastoralist tribes invariably rely on dry farming and take advantage of arable lands in both summer and winter pastures. In the high altitude of summer pastures, just before leaving the area, some members of the tribe sow crops which are covered by the winter snow, sprout in spring, and are ready to be harvested by the time the tribe return (Alizadeh 2006, p. 35).

Similar farming strategies have also been recorded in the mountain valleys of Pakistan (Young 2003, p. 66) and in the highlands of Balochistan (Jasra, Atiq-Ur-Rehman, Afzal 2001, pp. 256-259):

Planting is carried out before leaving the high valley, so the ground is prepared during September, and sown during October. The crop is then left over the winter... and in many cases the ground is covered by snow for at least part of the period of absence. With the spring which occurs slightly later in the high valleys, the crops of wheat ripen, and are ready for harvesting after the return of the groups, generally in May (Young 2003, p. 66).

These ethnographic accounts seem to fit the case of Godedzor and support the hypothesis that the mid 4th millennium BC communities that frequented the mountains of the Syunik region during the seasonal transhumance could have also combined their subsistence strategies with arable farming in the proximity of summer camps.

In this context, it is worth noting that almost 20% of the recovered taxa in the sediments analysed consisted of common weeds. Such a high percentage could point to the fact that weeds highly infested ancient cereal fields and that their growth was not, or could not, be held back by Godedzor's inhabitants (Hovsepian 2008). This data would suggest a low "field control" (Riehl 2006, pp. 114-115) consistent with the idea that the fields were left unattended until the transhumant communities were back in late spring to early summer.

In contrast, it is worth noting that there was a much lower incidence of weeds and an almost total crop-purity from samples retrieved at the Kura-Araxes settlements of Gegharot (floors and pits; Hovsepian 2008), Aparan III (vessels in a pit; Hovsepian 2010) and finally Chobareti (floor; Kakhiani et al. 2013). This data seems to suggest periodical agro-technical procedures and a higher field control than those carried out in

the fields around Godedzor. This could be explained by the fact that unlike Godedzor, which was most probably a seasonal occupation, the above-mentioned Kura-Araxes settlements – all located at the same or even higher altitude than Godedzor – were in fact all permanent settlements.

Conclusions

Godedzor is, in terms of altitude, the highest evidence of a Chalcolithic pastoral-farming community discovered to date in the southern Caucasus. In previous works, by considering the geographical position of the site, the presence of wooden architecture, caprine-focused herding strategies, intensive textile production and the exploitation of animals for transport, we suggested that the settlement could have hosted periodical or seasonal occupations of transhumant herders. We also suggested that the presence of painted ceramics, comparable with those of the Chalcolithic settlements of the Urmiah region, points to strong interrelationship between these groups with north-western Iran, and possibly even to an origin in the Urmiah region.

The new data presented in this article confirms this picture but also adds further elements that lead to a fuller evaluation of the subsistence and economic strategies of these transhumant groups to be carried out, increasing our understanding of how they managed and exploited the different types of natural resources available in the surroundings of Godedzor.

In the southern Caucasus, it is a reasonable hypothesis that pastoralism developed in the mountainous regions during the very beginning of the Chalcolithic period, but new data from the rock-shelter of Bavra Alavari, in the highlands of Javakheti in southern Georgia, takes back the seasonal frequentation of the regions of mountains, presumably by groups of pastoralists, to the Neolithic period (Varoutsikos et al. 2018).

Data from Godedzor confirms this picture; the large availability of summer pastures in the region of Syunik was a fundamental resource not only as sustenance for their animals and as a way of securing the subsistence of both flocks and herders, but also as a step in developing the pastoral economy of these groups towards an economy increasingly focused on secondary animal products.

At the same time, the inhabitants of Godedzor were also aware of other additional and supplementary resources available near to their settlement. While the present evidence does not support the hypothesis that Godedzor was a settlement specialized in the extraction and trade of obsidian, the diffused circulation of the Syunik obsidian in north-western Iran and in the Urmiah region suggests that the pastoral milieu, such as that represented by the community (or communities) that lived at Godedzor, played an important role as a vector of diffusion of this raw material towards north-western Iran, which relied on the seasonal movements of transhumance to acquire the obsidian available in the mountains.

Finally, archaeobotanical data, by providing evidence that cereal agriculture was practised in the proximity of Godedzor, highlights the fact that the spectrum of resources exploited in this period by transhumant groups was definitely larger than we had so far hypothesised and seems to correspond to a “multi-resource” model that has also been ethnographically recorded in the Iranian Plateau (Alizadeh 2010). Alongside the “opportunistic” exploitation of the secondary deposits of obsidian, evidence from Godedzor also hints that its inhabitants approached the highlands differently; not only as grazing lands but as a place that had the potential for the development of crop-based agriculture. Arable farming played a role in the subsistence strategies of the transhumant communities at Godedzor and this data supports Hole’s model which suggests that pastoralism and seasonal transhumance played a crucial role in the spread of crop-cultivation in the Iranian highlands which aimed at providing both fodder for the herd and food for the mobile herders (Hole 1998).

Godedzor provides the evidence that crop cultivation in the mountains of southern Armenia was first introduced by Late Chalcolithic transhumant communities that in this way played a key role

in the enlargement of the spectrum of the resources exploited in the mountains. The significant role that cereals seem to play in the agricultural strategies at Godedzor seems to anticipate the same specialised cereal farming strategies that were the pillar of the subsistence economy of the Kura-Araxes communities that, as early as ca 3300 BC (that is only some decades after the occupation at Godedzor), started to settle permanently in the highlands and mountain regions. In favour of the importance of cereal-based subsistence strategies among the Kura-Araxes communities, we also observe the large number of grinding stones that were found in the mountain settlements and that were not at Godedzor, this latter being an element that may point to a seasonal nature of the settlement.

There is no doubt that radical cultural breaks took place in the entire southern Caucasus at the turn of the mid 4th millennium BC; a crucial moment that saw the systematic replacement of the Chalcolithic by the Kura-Araxes traditions. However, Godedzor underlines the existence of some fundamental traits of structural and economic continuity between the Late Chalcolithic and the Kura-Araxes communities. Among these was the cereal-focused agriculture first introduced in the mountains by the Chalcolithic transhumant groups around the mid 4th millennium BC. These practices may have been the roots, the technical know-how and the structural prerequisites that allowed some decades later the farming Kura-Araxes communities to become fully sedentary in the highlands and to mark, in the southern Caucasus, a completely new “era” in the human-mountain interactions.

Bibliography

- Abedi et al. 2014: A. Abedi, H.K. Shahidi, C. Chataigner, N. Eskandari, M. Kazempour, A. Piromohammadi, J. Hosseinzadeh, “Excavation at Kul Tepe (Hadishahr), north-western Iran, 2010. First preliminary report”, *Ancient Near Eastern Studies* 51, 2014, pp. 33-165.
- Ali et al. 2014: S. Ali, M. Mohajjel, K. Aswad, S. Ismail, S. Buckman, “Tectono-stratigraphy and structure of the northwestern Zagros collision zone across the Iraq-Iran border”, *Journal of Environment and Earth Science* 4/4, 2014, pp. 92-110.
- Alizadeh 2006: A. Alizadeh, *The origins of state organizations in prehistoric highland Fars, southern Iran: excavations at Tall-e Bakun*, OIP 128, Chicago, The Chicago University Press, 2006.
- Alizadeh 2010: A. Alizadeh, “The rise of the Highland Elamite State in southwestern Iran ‘enclosed’ or enclosing nomadism”, *Current Anthropology* 51/3, 2010, pp. 353-383.
- Areshian et al. 2012: G.E. Areshian, B. Gasparian, P.S. Avetisyan, R. Pinhasi, K. Wilkinson, A. Smith, R. Hovsepian, D. Zardaryan, “The Chalcolithic of the Near East and southeastern Europe: discoveries and new perspectives from the cave complex Areni-1, Armenia”, *Antiquity* 86, 2012, pp. 115-130.
- Arimura, Gasparian, Chataigner 2012: M. Arimura, B. Gasparian, C. Chataigner, “Prehistoric sites in Northwest Armenia: Kmlo-2 and Tsaghkahovit”, in J.E. Curtis, R.J. Matthews, R. Chapman, A. Fletcher, A.L. Gascoigne, C. Glatz, S.J. Simpson, M.J. Seymour, H. Taylor, H.J.N. Tubb (dir.), *Proceedings of the 7th International Congress of the Archaeology of the Ancient Near East*, vol. 3, *Fieldwork and recent research – posters*, Wiesbaden, Harrassowitz, 2012, pp. 135-150.
- Arnold, Greenfield 2006: E. Arnold, H. Greenfield, *The origins of transhumant pastoralism in temperate southeastern Europe: a zooarchaeological perspective from the Central Balkans*, BAR International Series 1538, Oxford, BAR Publishing, 2006.
- Badalyan 2014: R. Badalyan, “New data on the periodization and chronology of the Kura-Araxes culture in Armenia”, *Paléorient* 40/2, 2014, pp. 71-92.
- Badalyan, Chataigner, Kohl 2004: R. Badalyan, C. Chataigner, P. Kohl, “Trans-Caucasian obsidian: the exploitation of the sources and their distribution”, in A. Sagona (dir.), *A view from the highlands. Archaeological studies in honour of Charles Burney*, Leuven, Peeters, 2004, pp. 399-420.
- Badalyan et al. 1994: R. Badalyan, P. Kohl, D. Stronach, A. Tonikjan, “Preliminary report on the 1993 excavations at Horom, Armenia”, *Iran* 32, 1994, pp. 1-29.

- Balasse, Ambrose 2005: M. Balasse, S.H. Ambrose, “Distinguishing sheep and goats using dental morphology and stable carbon isotopes in C₄ grassland environments”, *Journal of Archaeological Science* 32, 2005, pp. 691-702.
- Balasse et al. 2000: M. Balasse, A. Tresset, H. Bocherens, A. Mariotti, J.-D. Vigne, “Un abattage ‘post-lactation’ sur des bovins domestiques néolithiques. Étude isotopique des restes osseux du site de Bercy (Paris, France)”, in B. Bassano, G. Giacobini, V. Peracino (dir.), *La gestion démographique des animaux à travers le temps. Animal management and demography through the ages (VI^e colloque international de l’association “L’Homme et l’animal, Société de recherche interdisciplinaire”, Turin, Italy, 16-18 September 1998)*, published in *Journal of Mountain Ecology 5. Anthropolozologica* 31, 2000, pp. 39-48.
- Balasse, Tresset 2002: M. Balasse, A. Trasset, “Early weaning of Neolithic domestic cattle (Bercy, France) revealed by intra-tooth variation in nitrogen isotope ratios”, *Journal of Archaeological Science* 29, 2002, pp. 853-859.
- Bartosiewicz, Van Neer, Lentacker 1997: L. Bartosiewicz, W. Van Neer, A. Lentacker, *Draught cattle: their osteological identification and history*, Annales – Sciences zoologiques 281, Tervuren, Musée royal de l’Afrique centrale, 1997.
- Biscione 1984: R. Biscione, “Il IV Millennio”, in P.E. Pecorella, M. Salvini (dir.), *Tra lo Zagros e l’Urmiah. Ricerche Storiche ed Archeologiche nell’Azerbaijan Iraniano*, Rome, Edizioni dell’Ateneo, 1984, pp. 305-308.
- Belgiorno, Biscione, Pecorella 1984a: M.R. Belgiorno, R. Biscione, P.E. Pecorella, “Catalogo degli insediamenti”, in P.E. Pecorella, M. Salvini (dir.), *Tra lo Zagros e l’Urmiah. Ricerche Storiche ed Archeologiche nell’Azerbaijan Iraniano*, Rome, Edizioni dell’Ateneo, 1984, pp. 141-178.
- Belgiorno, Biscione, Pecorella 1984b: M.R. Belgiorno, R. Biscione, P.E. Pecorella, “Il saggio ed I materiel di Tappeh Gijlar”, in P.E. Pecorella, M. Salvini (dir.), *Tra lo Zagros e l’Urmiah. Ricerche Storiche ed Archeologiche nell’Azerbaijan Iraniano*, Rome, Edizioni dell’Ateneo, 1984, pp. 241-299.
- Blackman et al. 1998: J. Blackman, R. Badaljan, Z. Kikodze, P. Kohl, “Chemical characterization of Caucasian obsidian geological sources”, in M.-C. Cauvin, A. Gourgaud, B. Gratuze, N. Arnaud, G. Poupeau, J.-L. Poidevin, C. Chataigner (dir.), *L’obsidienne au Proche et Moyen-Orient: du volcan à l’outil*, BAR International Series 738, Oxford, BAR Publishing, 1998, pp. 205-231.
- Bobokhyan et al. 2014: A. Bobokhyan, K. Meliksetian, B. Gasparyan, P. Avetisyan, C. Chataigner, E. Pernicka, “Transition to extractive metallurgy and social transformation in Armenia at the end of the Stone Age”, in B. Gasparyan, M. Arimura (dir.), *Stone Age of Armenia*, Kanazawa, Kanazawa University, 2014, pp. 283-313.
- Brochier 2013: J.-E. Brochier, “The use and abuse of culling profiles in recent archaeozoological studies: some methodological comments on ‘frequency correction’ and its consequences”, *Journal of Archaeological Science* 40, 2013, pp. 1416-1420.
- Burton-Brown 1951: T. Burton-Brown, *Excavations in Azarbaijan 1948*, London, John Murray, 1951.
- Chataigner, Barge 2010: C. Chataigner, O. Barge, “GIS (Geographic Information System) for obsidian procurement analysis: pathway modelisation in space and time”, in S. Hansen, A. Hauptmann, I. Motzenbäcker, E. Pernicka (dir.), *Von Majkop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr.*, Bonn, Rudolf Habelt, 2010, pp. 1-14.
- Chataigner et al. 2010: C. Chataigner, P. Avetisyan, G. Palumbi, H.-P. Uerpman, “Godedzor, a Late Ubaid-related site in the southern Caucasus”, in R. Carter, G. Philip (dir.), *Beyond the Ubaid. Transformation and integration in the Late Prehistoric societies of the Middle East*, SAOC 63, Chicago, The Chicago University Press, 2010, pp. 377-394.
- Chataigner, Gratuze 2014a: C. Chataigner, B. Gratuze, “New data on the exploitation of obsidian in the southern Caucasus (Armenia, Georgia) and eastern Turkey. Part 1: source characterization”, *Archaeometry* 56/1, 2014, pp. 25-47.
- Chataigner, Gratuze 2014b: C. Chataigner, B. Gratuze, “New data on the exploitation of obsidian in the southern Caucasus (Armenia, Georgia) and eastern Turkey. Part 2: obsidian procurement from the Upper Palaeolithic to the Late Bronze Age”, *Archaeometry* 56/1, 2014, pp. 48-69.

- Cherry, Faro, Minc 2008: J. Cherry, E. Faro, L. Minc, "Field exploration and instrumental neutron activation analysis of the obsidian sources in southern Armenia", *International Association for Obsidian Studies* 39, 2008, pp. 3-6.
- Cherry, Faro, Minc 2010: J. Cherry, E. Faro, L. Minc, "Field survey and geochemical characterization of the southern Armenian obsidian sources", *Journal of Field Archaeology* 35/2, 2010, pp. 147-163.
- Chiyonobu 1993: Y. Chiyonobu, *Catalogue of archaeological materials in the Department of archaeology of Western Asia. Part 3, Iran (potsherds from Tepe Sialk)*, published in *Tokyo Daigaku Sōgō Kenkyū Shiryōkan Hyōhon Shiryō Hōkoku* 28, 1993.
- Choyke 2011: A. Choyke, "Étude des artefacts en os de Godedzor", *Rapport 2011 de la mission "Caucase" du ministère des Affaires étrangères*, 2011, pp. 86-98.
- Colton 1855: G.W. Colton, *Colton's atlas of the world illustrating physical and political geography*, vol. 2, New York, J.H. Colton and Company, 1855.
- Courcier 2014: A. Courcier, "Ancient metallurgy in the Caucasus from the sixth to the third millennium BC", in B.W. Roberts, C.P. Thornton (dir.), *Archaeometallurgy in global perspective*, New York/London, Springer, 2014, pp. 579-664.
- Dubois de Montpéreux 1839: F. Dubois de Montpéreux, *Voyage autour du Caucase, chez les Tcherkesses et les Abkhases, en Colchide, en Géorgie, en Arménie et en Crimée*, Paris, Librairie de Gide, 1839.
- Ducos 1968: P. Ducos, *L'origine des animaux domestique en Palestine*, Bordeaux, Publications de l'Institut de préhistoire de l'université de Bordeaux, 1968.
- Dyson, Cuyler Young 1960: R.H. Dyson, Jr T. Cuyler Young, "The Solduz Valley, Iran: Pisdeli Tepe", *Antiquity* 34, 1968, pp. 19-28.
- Eastman 1999: J.R. Eastman, *Guide to GIS and image processing*, Worcester, Clark Labs, 1999.
- Fazeli, Valipour, Kharanaghi 2013: N.H. Fazeli, H.R. Valipour, M.H. Kharanaghi, "The Late Chalcolithic and Early Bronze Age in the Qazvin and Teheran plains: a chronological perspective", in C.A. Petrie (dir.), *Ancient Iran and its neighbours. Local developments and long-range interactions in the fourth millennium BC*, Oxford/Oakville, Oxbow Books, 2013.
- Fazeli, Wong, Potts 2005: N.H. Fazeli, E. Wong, D. Potts, "The Qazvin plain revisited: a reappraisal of the chronology of north-western Central Plateau, Iran, in the 6th to the 4th millennium BC", *Ancient Near Eastern Studies* 42, 2005, pp. 3-82.
- Gailhard et al. 2017: N. Gailhard, M. Bode, A. Hauptmann, V. Bakhshaliyev, C. Marro, "Archaeometallurgical investigations in Nakhchivan (Azerbaijan). What does the evidence from Late Chalcolithic Ovçular Tepesi tell us about the beginning of extractive metallurgy?", *Journal of Field Archaeology* 42/6, 2017, pp. 530-550.
- Gale, Stos-Gale 1982: N.H. Gale, Z.A. Stos-Gale, "Bronze Age copper sources in the Mediterranean: a new approach", *Science* 216, 1982, pp. 11-19.
- Gandilyan 1997: P.A. Gandilyan, "Archaeobotanical evidence for evolution of cultivated wheat and barley in Armenia", in A. Damania, J. Valkoun, G. Willcox, C. Qualset (dir.), *The origins of agriculture and crop domestication. Proceedings of the Harlan Symposium (10-14 May 1997, Aleppo, Syria)*, Aleppo, International Center for Agricultural Research in the Dry Areas (ICARDA), 1997, pp. 280-285.
- Gevorkyan 1980: A. Gevorkyan, *Iz istorii drevnejshej metallurgii Armjanskogo nagor' ja*, Yerevan, Akademija Nauk Armjanskoj SSR, 1980.
- Ghirshman 1938: R. Ghirshman, *Fouilles de Sialk (près de Kashan)*, Paris, Geuthner, 1938.
- Ghorabi et al. 2010: S. Ghorabi, F. Khademi Nadooshan, M. Glascock, A. Hejabari Noubari, M. Ghorbani, "Provenance of obsidian tools from northwestern Iran using X-ray fluorescence analysis and neutron activation analysis", *International Association for Obsidian Studies* 43, 2010, pp. 14-26.
- Gillis et al. 2016: R. Gillis, I. Carrère, M. Sana Seguí, G. Radi, J.-D. Vigne, "Neonatal mortality, young calf slaughter and milk production during the Early Neolithic of north western Mediterranean", *International Journal of Osteoarchaeology* 26/2, 2016, pp. 303-313.

- Grant 1982: A. Grant, "The use of tooth wear as a guide to the age of domestic ungulates", in B. Wilson, C. Grigson, S. Payne (dir.), *Aging and sexing animal bones from archaeological sites*, BAR International Series 109, Oxford, BAR Publishing, 1982, pp. 91-108.
- Greenfield 1999: H.J. Greenfield, "The origins of transhumant pastoralism in temperate southeastern Europe", in L. Bartosiewicz, H. Greenfield (dir.), *Transhumant pastoralism in southern Europe. Recent perspectives from archaeology, history, and ethnography*, Budapest, Archaeolingua, 1999, pp. 15-36.
- Halstead 1998: P. Halstead, "Mortality models and milking: problems of uniformitarianism, optimality and equifinality reconsidered", *Anthropozoologica* 27, 1982, pp. 3-20.
- Halstead, Collins, Isaakidou 2003: P. Halstead, P. Collins, V. Isaakidou, "Sorting the sheep from the goats: morphological distinctions between the mandibles and mandibular teeth of adult Ovis and Capra", *Journal of Archaeological Science* 29/5, 2003, pp. 545-554.
- Heitzmann 2003: H. Heitzmann, *La transhumance bovine en Béarn: aspects socio-économiques et sanitaires*, PhD dissertation, École nationale vétérinaire d'Alfort, 2003 (unpublished).
- Helmer 1992: D. Helmer, *La domestication des animaux par les hommes préhistoriques*, Paris, Masson, 1992.
- Helmer 2000: D. Helmer, "Discrimination des genres Ovis et Capra à l'aide des prémolaires inférieures 3 et 4. L'exemple de Dikili Tash (Macédoine, Grèce)", *Journal of Mountain Ecology* 5, 2000, pp. 29-38.
- Helmer, Vigne 2004: D. Helmer, J.-D. Vigne, "La gestion des cheptels de caprinés au Néolithique dans le Midi de la France", in P. Bodu, C. Constantin (dir.), *Approches fonctionnelles en Préhistoire*, Paris, Société préhistorique française, 2004, pp. 397-407.
- Helwing 2012: B. Helwing, "Late Chalcolithic craft traditions at the northeastern 'periphery' of Mesopotamia: potters vs. smiths in the southern Caucasus", *Origini* 34, 2012, pp. 201-220.
- Henrickson 1983: E.F. Henrickson, *Ceramic styles and cultural interaction in the Early and Middle Chalcolithic of the Central Zagros, Iran*, PhD dissertation, University of Toronto, 1983 (unpublished).
- Herzog 2014: I. Herzog, "A review of case studies in archaeological least-cost analysis", *Archeologia e Calcolatori* 25, 2014, pp. 223-239.
- Hole 1987: F. Hole, "Archaeology of the Village Period", in F. Hole (dir.), *The archaeology of western Iran. Settlement and society from Prehistory to the Islamic Conquest*, Washington, Smithsonian Books, 1987, pp. 29-78.
- Hole 1998: F. Hole, "The spread of agriculture to the eastern arc of the Fertile Crescent: food for the herders", in A.B. Damania (dir.), *The origins of agriculture and crop domestication. Proceedings of the Harlan Symposium (10-14 May 1997, Aleppo, Syria)*, Aleppo, International Center for Agricultural Research in the Dry Areas (ICARDA), 1998, pp. 83-89.
- Hole 2009: F. Hole, "Pastoral mobility as an adaptation in nomads", in J. Szuchman (dir.), *Nomads, tribes and the state in the ancient Near East*, Chicago, Smithsonian Institution Press, 2009, pp. 261-283.
- Hovsepyan 2008: R. Hovsepyan, "Nouvelles données archéobotaniques sur le site de Godedzor", *Rapport 2008 de la mission "Caucase" du ministère des Affaires étrangères*, 2008, pp. 74-76.
- Hovsepyan 2010: R. Hovsepyan, "New data on agriculture of Aparan-III Early Bronze Age settlement (Armenia)", *Biological Journal of Armenia* 4/62, 2010, pp. 31-37.
- Hovsepyan 2015: R. Hovsepyan, "On the agriculture and vegetal food economy of Kura-Araxes culture in the South Caucasus", *Paléorient* 41/1, 2015, pp. 69-82.
- Jasra, Atiq-Ur-Rehman, Afzal 2001: A.W. Jasra, A.U. Rehman, M. Afzal, "Socio-economics of pastoralist communities of highland Balochistan, Pakistan", *International Journal of Agriculture & Biology* 3/2, 2001, pp. 256-259.
- Kakhiani et al. 2013: K. Kakhiani, A. Sagona, C. Sagona, E. Kvavadze, G. Bedianashvili, E. Messenger, L. Martin, E. Herrscher, I. Martkoplshvili, J. Birkett-Rees, C. Longford, "Archaeological investigations at Chobareti in southern Georgia, the Caucasus", *Ancient Near Eastern Studies* 50, 2013, pp. 1-135.
- Keller et al. 1996: J. Keller, R. Djerbashian, S. Karapetian, E. Pernicka, V. Nasedkin, "Armenian and Caucasian occurrences as sources for the Neolithic trade: volcanological setting and chemical characteristics", in S. Demirci, A.M. Özer, G.D. Summers (dir.), *Archaeometry* 94. *The proceedings of the 29th International Symposium on Archaeometry (Ankara, 9-14 May 1994)*, Ankara, TUBITAK, 1996, pp. 543-551.

- Keller, Seifried 1990: J. Keller, C. Seifried, "The present status of obsidian source identification in Anatolia and the Near East", *Archéologie et Vulcanologie Pact* 25, 1990, pp. 58-87.
- Khademi Nadooshan et al. 2013: F. Khademi Nadooshan, A. Abedi, M.D. Glascock, N. Eskanderi, M. Khazaei, "Provenance of prehistoric obsidian artefacts from Kül Tepe, northwestern Iran using X-ray fluorescence (XRF) analysis", *Journal of Archaeological Science* 40, 2013, pp. 1956-1965.
- Kiguradze, Sagona 2003: T. Kiguradze, A. Sagona, "On the origins of the Kura-Araxes cultural complex", in A. Smith, K. Rubinson (dir.), *Archaeology in the borderlands: investigations in Caucasia and beyond*, Los Angeles, Cotsen Institute of Archaeology at UCLA, 2003, pp. 38-94.
- Kroll 2006: S. Kroll, "Southern Armenia Survey (Syunik) 2000-2003", *Aramazd* 1, 2006, pp. 19-49.
- Lyonnet et al. 2012: B. Lyonnet, F. Guliyev, B. Helwing, T. Aliyev, S. Hansen, G. Mirtschulava, "Ancient Kura 2010-2011. The first two seasons of joint field work in the southern Caucasus", *Archäologische Mitteilungen aus Iran und Turan* 44, 2012, pp. 1-190.
- Lyonnet, Guliyev 2012: B. Lyonnet, F. Guliyev, "Recent research on the Chalcolithic Period in western Azerbaijan", in J.E. Curtis, R.J. Matthews, R. Chapman, A. Fletcher, A.L. Gascoigne, C. Glatz, S.J. Simpson, M.J. Seymour, H. Taylor, J.N. Tubb (dir.), *Proceedings of the 7th International Congress of the Archaeology of the Ancient Near East*, vol. 3, *Fieldwork and recent research – posters*, Wiesbaden, Harrasowitz, 2012, pp. 85-98.
- Marro 2010: C. Marro, "Where did late Chalcolithic Chaff-Faced Ware originate? Cultural dynamics in Anatolia and Transcaucasia at the dawn of urban civilization (ca 4500-3500 BC)", *Paléorient* 36/2, 2010, pp. 35-55.
- Marro, Bakhshaliyev, Ashurov 2011: C. Marro, V. Bakhshaliyev, S. Ashurov, "Excavations at Ovçular Tepesi (Nakhchivan, Azerbaijan). Second preliminary report: the 2009-2010 seasons", *Anatolia Antiqua* 19, 2011, pp. 53-100.
- Marro, Bakhshaliyev, Berthon 2014: C. Marro, V. Bakhshaliyev, R. Berthon, "On the genesis of the Kura-Araxes phenomenon: new evidence from Nakhchivan (Azerbaijan)", *Paléorient* 40/2, 2014, pp. 131-154.
- Marro, Bakhshaliyev, Berthon 2015: C. Marro, V. Bakhshaliyev, R. Berthon, "A reply to G. Palumbi and C. Chataigner", *Paléorient* 41/2, 2015, pp. 157-162.
- Marro, Bakhshaliyev, Sanz 2010: C. Marro, V. Bakhshaliyev, S. Sanz, "Archaeological investigations on the salt mine of Duzdagi (Nakhchivan, Azerbaidjan)", *TÜBA-AR* 13, 2010, pp. 229-244.
- Meliksetian, Pernicka 2010: K. Meliksetian, E. Pernicka, "Geochemical characterisation of Armenian Early Bronze Age metal artefacts and their relation to copper ores", in S. Hansen, A. Hauptmann, I. Motzenbäcker, E. Pernicka (dir.), *Von Majkop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr.*, Bonn, Rudolf Habelt, 2010, pp. 41-58.
- Mkrtumyan 1974: Y.I. Mkrtumyan, "Types of herding in eastern Armenia", *Ethnography and Folklore of Armenia* 6, 1974, pp. 7-92 (in Russian).
- Nebieridze 1978: L. Nebieridze, *Darkvetis mravalpeniani ekhi (The Darkveti multilayer rockshelter)*, Tbilisi, Metsniereba, 1978.
- Nezafati, Pernicka, Malek Shahmirzadi 2008: N. Nezafati, E. Pernicka, S. Malek Shahmirzadi, "Evidence on the ancient mining and metallurgy at Tappeh Sialk (Central Iran)", in H. Yalcin, H. Özbal, A.G. Paşamehmetoğlu (dir.), *Ancient mining in Turkey and the eastern Mediterranean*, Ankara, Atılım Üniversitesi, 2008, pp. 329-350.
- Palumbi, Chataigner 2014: G. Palumbi, C. Chataigner, "The Kura-Araxes culture from the Caucasus to Iran, Anatolia and the Levant: between unity and diversity. A synthesis", *Paléorient* 40/2, 2014, pp. 247-260.
- Palumbi, Chataigner 2015: G. Palumbi, C. Chataigner, "Answer to C. Marro, V. Bakhshaliyev and R. Berthon", *Paléorient* 41/2, 2015, pp. 163-166.
- Payne 1973: S. Payne, "Kill-off patterns in sheep and goat: the mandibles from Asvan Kale", *Anatolian Studies* 23, 1973, pp. 281-303.
- Payne 1985: S. Payne, "Morphological distinction between the mandibular teeth of young sheep, *Ovis*, and goats, *Capra*", *Journal of Archaeological Science* 12/2, 1985, pp. 139-147.

- Pessagno et al. 2005: E. Pessagno, M. Ghazi, M. Karimnia, R.A. Duncan, A.A. Hassanipak, "Tectonostratigraphy of the Khoy Complex, north-western Iran", *Stratigraphy* 2/1, 2005, pp. 49-63.
- Petrie 2013: C.A. Petrie, "Ancient Iran and its neighbours: the state of play", in C.A. Petrie (dir.), *Ancient Iran and its neighbours. Local developments and long-range interactions in the fourth millennium BC*, Oxford/Oakville, Oxbow Books, 2013.
- Pitton de Tournefort 1717: J. Pitton de Tournefort, *Relation d'un voyage du Levant, fait par ordre du roy: contenant l'histoire ancienne & moderne de plusieurs isles de l'archipel, de Constantinople, des côtes de la Mer Noire, de l'Arménie, de la Géorgie, des frontières de Perse et de l'Asie Mineure*, Paris, Imprimerie Royale, 1717.
- Poulmarc'h, Le Mort 2016: M. Poulmarc'h, F. Le Mort, "Diversification of the funerary practices in the southern Caucasus from the Neolithic to the Chalcolithic", *Quaternary International* 395, 2016, pp. 184-193.
- Renfrew, Dixon, Cann 1966: C. Renfrew, J.E. Dixon, J.R. Cann, "Obsidian and early cultural contact in the Near East", *Proceedings of the Prehistoric Society* XXXII, 1966, pp. 30-72.
- Riehl 2006: S. Riehl, "Nomadism, pastoralism and transhumance in the archaeobotanical record. Examples and methodological problems", in S.R. Hauser (dir.), *Die Sichtbarkeit von Nomaden und saisonaler Besiedlung in der Archäologie. Multidisziplinäre Annäherungen an ein methodisches Problem*, published in *Orientwissenschaftliche Hefte* 21, 2006, pp. 105-125.
- Schmid 1972: E. Schmid, *Atlas of animal bones*, Amsterdam/London/New York, Elsevier, 1972.
- Stein 2012: G. Stein, "Food preparation, social context, and ethnicity in a prehistoric Mesopotamian colony", in S.R. Graff, E. Rodriguez-Alegria (dir.), *The menial art of cooking. Archaeological studies of cooking and food preparation*, Boulder, University Press of Colorado, 2012, pp. 47-64.
- Stoletova 1930: E.A. Stoletova, "Field and garden cultigens of Armenia", *Bulletin of Applied Botany, Genetics and Plant-breeding* 4/23, 1930, pp. 1-378 (in Russian).
- Torosyan 1976: R.M. Torosyan, *Rannezemledel'cheskoe poselenie Tekhuta*, Yerevan, Akademija Nauk Armjanskoj SSR, 1976.
- Varazashvili 1992: V.L. Varazashvili, *Rannezemledel'cheskaja kul'tura jugo-alazanskogo bassejna*, Tbilisi, Metsniereba, 1992.
- Varoutsikos et al. 2018: B. Varoutsikos, A. Mgeladze, J. Chahoud, M. Gabunia, T. Agapishvili, L. Martin, C. Chataigner, "From the Mesolithic to the Chalcolithic in the South Caucasus: new data from the Bavra Ablari rock shelter", in A. Batmaz, G. Bedianashvili, A. Michalewicz, A. Robinson (dir.), *Context and connection. Essays on the archaeology of the Ancient Near East in honour of Antonio Sagona*, Leuven, Orientalia Lovaniensia Analecta, 2018, pp. 233-254.
- Vigne 1988: J.-D. Vigne, *Les mammifères post-glaciaires de Corse. Étude archéozoologique*, Gallia préhistoire. Suppl. XXVI, Paris, Éditions du CNRS, 1988.
- Vigne, Helmer 2007: J.-D. Vigne, D. Helmer, "Was milk a 'secondary product' in the old world neolithisation process? Its role in the domestication of cattle, sheep and goats", *Anthropozoologica* 42/2, 2007, pp. 9-40.
- Voigt 1989: M. Voigt, "Northwest Iran in the fourth millennium BC", *Paléorient* 15/1, 1989, pp. 286-288.
- Voigt, Dyson 1992: M. Voigt, R.H. Dyson, "The chronology of Iran, ca 8000-2000 BC", in R. Ehrich (dir.), *Chronologies in Old World Archaeology*, vol. 1, Chicago, University of Chicago Press, 1992, pp. 122-178.
- Weeks, Petrie, Potts 2010: L. Weeks, C.A. Petrie, D.T. Potts, "Ubaid-related-related? The 'black-on-buff' ceramic traditions of highland southwest Iran", in R. Carter, G. Philip (dir.), *Beyond the Ubaid. Transformation and integration in the Late Prehistoric societies of the Middle East*, SAOC 63, Chicago, The Chicago University Press, 2010, pp. 245-276.
- Young 2003: R. Young, *Agriculture and pastoralism in the Late Bronze and Early Iron Age, North West Frontier Province, Pakistan*, BAR International Series 1124, Oxford, BAR Publishing, 2003.