Categoria A

REVISTA ARHEOLOGICĂ

serie nouă _ vol. XXI _ nr. 1

Indexată în bazele de date:

SCOPUS, ERIH PLUS, DOAJ, CEEOL, ROAD, ISIFI, CiteFactor

CHIŞINĂU 2025

ISSN 1857-016X
E-ISSN 2537-6144

INSTITUTUL PATRIMONIULUI CULTURAL
SECȚIA PATRIMONIU ARHEOLOGIC

REVISTA ARHEOLOGICĂ

Manuscrisele, cărțile și revistele pentru schimb, precum și orice alte materiale se vor trimite pe adresa: Colegiul de redacție al „Revistei Arheologice", Secția Patrimoniu Arheologic, Institutul Patrimoniului Cultural, bd. Ștefan cel Mare și Sfânt 1, MD-2001, Chișinău, Republica Moldova

Рукописи, книги и журналы для обмена, а также другие материалы необходимо посылать по адресу: редакция «Археологического Журнала», Секция археологического наследия, Институт культурного наследия, бул. Штефан чел Маре ши Сфынт 1, MD-2001 Кишинэу, Республика Молдова

Manuscripts, books and reviews for exchange, as well as other papers are to be sent to the editorship of the "Archaeological Magazine", Section of Archaeological Heritage, Institute of Cultural Heritage, 1 Stefan cel Mare si Sfant bd., MD-2001 Chisinau, Republic of Moldova

Toate lucrările publicate în revistă sunt recenzate de specialiști în domeniu după modelul *double blind peer-review*
Все опубликованные материалы рецензируются специалистами по модели *double blind peer-review*
All the papers to be published will be reviewed by experts according the *double blind peer-review* model

CUPRINS – СОДЕРЖАНИЕ – CONTENTS

STUDII – ИССЛЕДОВАНИЯ – RESEARCHES

Nadezhda Kotova (*Kiev*), **Simon Radchenko** (*Stavanger*)
"M"-like ornamentation in the Southeastern Europe and surroundings
during VII-V Millennia BCE 5

Arsen Harutyunyan, **Vahe Sargsyan**, **Hayk Gyulamiryan** (*Yerevan*)
The Tradition of Epigraphy as a Foundation of State Strategy in the Armenian Highlands 27

Николай Николаев (*Кропивницкий*), **Лилия Цыганенко** (*Измаил*)
Новые памятники малой эпиграфики Северного Причерноморья 41

Kateryna Savelieva (*Kiev*)
Private places of worship in Tyras during Roman times 48

Gheorghe Postică, **Ion Tentiuc** (*Chișinău*)
The money-weight economy in the Carpathian-Dniester area in the 9th-11th centuries
(archaeological contributions) 63

Mariia Videiko (*Kiev*)
Topografia și arheologia orașului Trepol de pe Nipru în secolele XI-XIII 93

MATERIALE ŞI CERCETĂRI DE TEREN – МАТЕРИАЛЫ И ПОЛЕВЫЕ ИССЛЕДОВАНИЯ – PAPERS AND SURVEYS

Najaf Museibli (*Baku*)
Child graves at Galayeri settlement of the Leilatepe culture) 110

Natalia Ovcearov, **Vlad Vornic**, **Sergiu Matveev**, **Sergiu Popovici** (*Chișinău*)
O așezare cu urme de locuire din eneolitic și perioada romană târzie
descoperită la Calarașovca (r-nul Ocnița) 123

Sergiu Popovici (*Chișinău*), **Mariana Popovici** (*Iași*), **Serghei Agulnikov** (*Chișinău*),
Vasilica-Monica Groza, **Ozana-Maria Ciorpac-Petraru** (*Iași*)
Tumulul 23 de la Congaz 138

Vitalii Hutsal (*Kamianets-Podilskii*), **Oleksandr Mohylov**, **Yuliia Ushkova** (*Kiev*)
Bronze Age burial mounds on Husykova Hill in the Zbruch region 160

Игорь Бруяко (*Одесса*)
Жилые сооружения на поселении Картал II (*эпоха раннего гальштата*) 180

Сергей Скорый (*Киев*), **Александр Супруненко** (*Полтава*)
Неординарная находка раннескифского времени на юге
Лесостепного Левобережного Поднепровья 202

Vasile Iarmulschi (*Berlin/Chișinău*), **Vlad Vornic** (*Chișinău*)
O fibulă din bronz de tip Nauheim descoperită la Gura Bâcului
(raionul Anenii Noi, Republica Moldova) 208

DISCUȚII – ДИСКУССИИ – DISCUSSIONS

Эльнур Лятиф оглу Гасанов (*Гянджа*)
Исследование историко-археологических переселений города Гянджи
на основе изучения ремесленных образцов 215

CERCETĂRI INTERDISCIPLINARE – МЕЖДИСЦИПЛИНАРНЫЕ ИССЛЕДОВАНИЯ – INTERDISCIPLINARY SURVEYS

Guram Chkhatarashvili (*Batumi*), **James A. Davenport**, **Michael D. Glascock** (*Missouri*),
Hülya Çalışkan Akgül (*Karadeniz*)
Spread of obsidian and mobility pattern of humans in the South-Eastern Black Sea Coast 226

Дмитрий Кириченко, **Анар Абдуллаев** (*Баку*)
О двух случаях травматических повреждений на черепах из Азербайджана
(эпоха античности) 238

IN HONOREM

To the anniversary of Professor S.A. Skoryi
(Oleksandr Mohylov, *Iași*) 252

LISTA ABREVIERILOR – СПИСОК СОКРАЩЕНИЙ – LIST OF ABBREVIATION 256

INFORMAȚII ȘI CONDIȚIILE DE EDITARE A *REVISTEI ARHEOLOGICE* 257

ИНФОРМАЦИЯ И УСЛОВИЯ ИЗДАНИЯ *АРХЕОЛОГИЧЕСКОГО ЖУРНАЛА* 258

INFORMATION AND CONDITION OF PUBLICATION IN THE *ARCHAEOLOGICAL MAGAZINE* 259

CERCETĂRI INTERDISCIPLINARE – МЕЖДИСЦИПЛИНАРНЫЕ ИССЛЕДОВАНИЯ – INTERDISCIPLINARY SURVEYS

Guram Chkhatarashvili, James A. Davenport, Michael D. Glascock, Hülya Çalışkan Akgül

Spread of obsidian and mobility pattern of humans in the South-Eastern Black Sea Coast

Key words: Ajara, site, artefacts, obsidian, XRF.
Cuvinte cheie: Adjaria, sit, artefacte, obsidian, XRF.

Guram Chkhatarashvili, James A. Davenport, Michael D. Glascock, Hülya Çalışkan Akgül
Spread of obsidian and mobility pattern of humans in the South-Eastern Black Sea Coast

Archaeological excavations conducted at various times along the southeastern Black Sea coast (Ajara) have revealed stone age sites, with a notable collection of flint and obsidian. However, the precise origins of obsidian remain ambiguous. In recent years, Georgian and USA researchers have published noteworthy works connected to origins of obsidian artefacts [Chkhatarashvili, Glascock 2022; Chkhatarashvili *et all.* 2024a; Chkhatarashvili *et all.* 2024b]. This work present the results of geochemical analyses conducted on obsidian artefacts discovered at the sites of Kvirike, Jikhanjuri, and Choloki, located within the Kobuleti municipality. The research was carried out using the XRF method at the Archaeometry Laboratory at the University of Missouri Reactor Research (MURR). The analysis identified four different sources of obsidian supply, which once again indicates that the Caucasus region has been an active zone of human mobility and contact since ancient times.

Guram Chkhatarashvili, James A. Davenport, Michael D. Glascock, Hülya Çalışkan Akgül
Răspândirea obsidianului și modelul de mobilitate a oamenilor în sud-estul coastei Mării Negre

Săpăturile arheologice efectuate în diferite perioade, de-a lungul sud-estului coastei Mării Negre (regiunea Adjaria), au scos la iveală situri din epoca pietrei, cu o colecție remarcabilă de silex și obsidian. Cu toate acestea, originea exactă a obsidianului rămâne neclară. În ultimii ani, cercetători georgieni și americani au publicat lucrări legate de originea artefactelor din obsidian [Chkhatarashvili, Glascock 2022; Chkhatarashvili *et all.* 2024a; Chkhatarashvili *et all.* 2024b]. Această lucrare prezintă rezultatele analizelor geochimice efectuate asupra artefactelor din obsidian descoperite în siturile Kvirike, Jikhanjuri și Choloki, situate în cadrul municipalității Kobuleti. Cercetarea a fost efectuată utilizând metoda XRF la Laboratorul de arheometrie al Universității Missouri Reactor Research (MURR). Analiza a identificat patru surse diferite de aprovizionare cu obsidian, ceea ce indică încă o dată că regiunea Caucazului a fost o zonă activă în mobilitatea și contactele dintre comunități umane încă din cele mai vechi timpuri.

Introduction

The South-Eastern Black Sea Coast (Ajara) is distinguished by its abundance of archaeological sites, which are dispersed both along the Black Sea coast and in the foothills and mountainous zones. The Batumi N. Berdzenishvili Research Institute, an institution dedicated to scientific research, initiated archaeological works in the Ajara region in the second half of the 20th century. The institute's primary objective was to conduct in-depth scientific research on various stages of our history. The archaeological expeditions have unearthed and systematically investigated numerous significant stone age sites along the Black Sea coast of Ajara, particularly in the Kobuleti municipality. However, due to various constraints, there have been limitations in addressing certain crucial issues related to these sites.

Recently, a collaborative effort has been initiated by Georgian and foreign scientists to re-examine previously discovered Stone Age sites within the Ajara region, employing contemporary methods for studies. Through interdisciplinary research, significant advancements have been made in elucidating various aspects of human existence in the Kintrishi Gorge during the early Holocene period [Chkhatarashvili, Manko 2020; Chkhatarashvili *et all.* 2022; Manko, Chkhatarashvili

Revista Arheologică, serie nouă, vol. XXI, nr. 1, 2025, p. 226-237
http://doi.org/10.52603/RA.XXI.1.2025_15

2023a; Manko, Chkhatarashvili 2023b; Manko, Chkhatarashvili 2023c; Chkhatarashvili *et all.* 2024a; Chkhatarashvili *et all.* 2024b].

Unfortunately, Kvirike, Jikhanjuri, and Choloki sites have not been the focus of scholarly attention for several decades. Furthermore, the available information regarding these sites is incomplete and often ambiguous. Primarily, this concerns the procurement of obsidian raw materials and the subsequent chronological framework. The present publication aims to address this knowledge gap and provide a scientific resolution.

Geographical position

Kvirike, Jikhanjuri, and Choloki are open-air sites located in the Kobuleti municipality. Topographically, the sites occupy natural hills near the river, and geographically, they belong to the Colchis Plain, which is located on the eastern side of the Black Sea (fig. 1). The Colchis Plain is characterized by a subtropical climate, where plants typical of the mentioned geographical zone are widespread. The Black Sea coastal strip of the Ajara region is distinguished by frequent precipitation and high humidity, which have had a significant impact on the preservation of faunal and anthropological material in open-air sites. Consequently, stone tools and remains of the produce (cores, flake, chunks, cheeps) provide the primary evidence for understanding the lifestyle of ancient people.

Recent studies have revealed intriguing findings on the paleoclimatic environment of the Early Holocene period in the Kobuleti municipality. Specifically, the Kintrishi Gorge has been identified as a region where a moderate and warm climate was present during this time (Chkhatarashvili *et all.* 2020; Chkhatarashvili *et all.* 2024a].

Archaeological background

a) Kvirike. The discovery of the Kvirike is associated with the archaeological works carried out in the Kintrishi Gorge in the 1960s. Specifically, in 1968, archaeologists discovered interesting materials on the M. Inaishvili farm in the Kinkisha Gorge (a tributary of the Kintrishi River). The artefacts unearthed included flint and obsidian tools, along with production remnants [Gogitidze 1973, 38-56; Manko, Chkhatarashvili 2022]. Unfortunately, subsequent excavations at the site have not been undertaken.

b) Jikhanjuri. The site was unearthed in the Kobuleti Municipality, within the area designated as the so called "Jikhanjuri Soviet agricultural Farm", following the archaeological reconnaissance conducted in 1969 [Gogitidze 1978]. The site was located on a hill, which was bifurcated during the construction of a road, led to the discovery of artefacts in both the lower and upper parts of the hill. The area had previously been cultivated for tea and corn. Unfortunately, the cul-

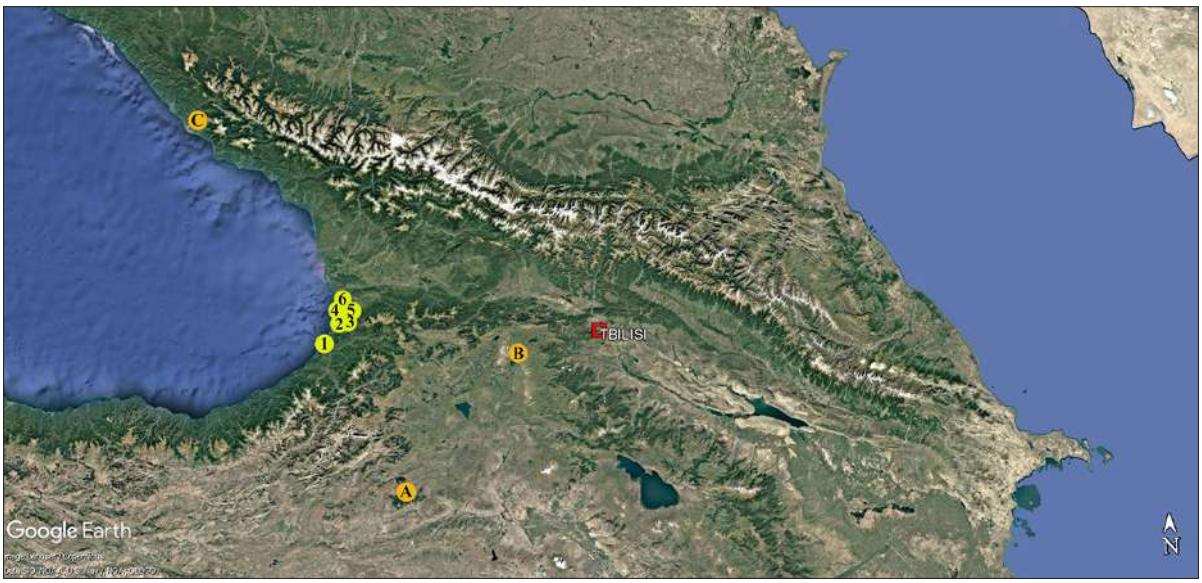


Fig. 1. Map showing the location of the archaeological sites and identified obsidian sources. 1 – Makhvilauri; 2 – Kvirike; 3 – Khutsubani; 4 – Kobuleti; 5 – Jikhanjuri; 6 – Choloki; A – Sarikamiş (Hamamli); B – Chikiani; C - Akhtsu type.

tural layer was severely damaged due to anthropogenic factors. The expedition collected flint and obsidian industry in surface. In 1971, small-scale archaeological work was carried out to determine the distribution boundaries of the Jikhanjuri site and search for an immovable cultural layer. The expedition made several control trenches (2×2 m). The archaeological remains were primarily found in the humus layer, where, in addition to artefacts from the Stone Age, remains from other periods were also observed. Unfortunately, no immovable cultural layer was confirmed in the trenches. According to specialists, this must have been due to the washing of the hill, its intensive cultivation, the construction of the road, etc. [Gogitidze 1978].

Unfortunately, there hasn't been any archaeological work on the site for a long time. From 2021 to 2023, we were able to do some archaeological work (head of excavations: Guram Chkhatarashvili) in the Kobuleti and Khutsubani sites. This work was supported by the Kobuleti Municipality City Hall. During the expedition we visited the Jikhanjuri site, selected places where we thought there might be something important and made trenches (2×1 m). After the Humus, we found yellow clay soil, but we didn't find any artefacts. In humus layer we discovered several pieces of flint and obsidian, but nothing important. We hope that in the future, we will be able to make full-scale excavations in order to find the immovable layer.

c) Choloki. The Choloki site was discovered on the terrace on the right side of the Choloki River as a result of prospecting work in 1969. The site has been completely destroyed due to anthropogenic factors, which are associated with the extensive cultivation of tea plantations and corn fields. Unlike Jikhanjuri, archaeological work has never been carried out on the site. Flint and obsidian artefacts were discovered in surface during the agricultural works [Gogitidze 1974, 4-33; Gogitidze 1978, 28]. Presently, the site is completely lost, and despite extensive efforts, the cultural layers remain undetermined.

Materials and methods

The stone collection was studied using the typological method developed by J. Tixie [1974] and J. Pelegrin [2012]. This method involved categorizing the artefacts based on their typological characteristics.

Obsidian is present in significant quantities in the Kvirike, Jikhanjuri, and Choloki stone collections (fig. 2). Its notable diversity suggests multiple origins, which we sought to ascertain through a geochemical analysis of the material.

This research was conducted at the Archaeometry Laboratory of the University of Missouri

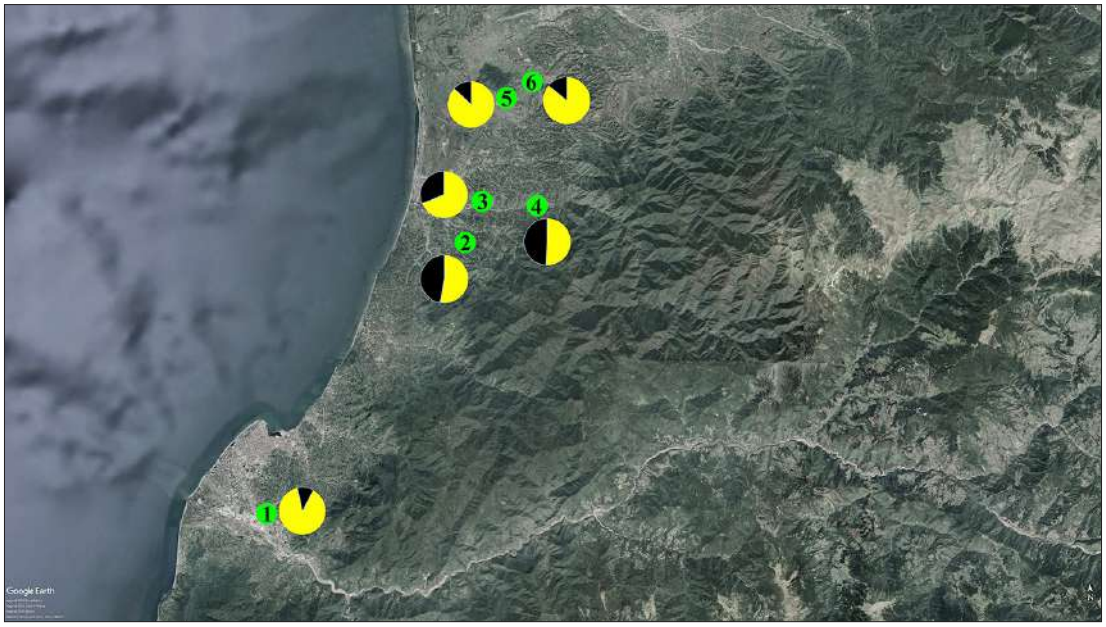


Fig. 2. Relative proportion of obsidians in the stone complexs of the sites of Ajara region. Black represents the percentage of obsidians in assemblages: 1 – Makhvilauri 11 %; 2 – Kvirike 45 %; 3 – Khutsubani 31 %; 4 – Kobuleti 49 %; 5 – Jikhanjuri 13 %; 6 – Choloki 14 %.

Research Reactor Center. The study was conducted by submitting 84 artefacts from the Kvirike, Jikhanjuri and Choloki samples to the Archaeometry Laboratory at the University of Missouri Reactor Research (MURR). Analysis was performed using a Thermo Quantx ARL lab-based XRF spectrometer.

The instrument has a rhodium-based X-ray tube which was operated at 35kV with a current to measure the emitted X-rays with a silicon diode detector. The instrument was specifically calibrated for obsidian by measuring a set of 40 very well-characterized obsidian source samples using data acquired by neutron activation analysis (NAA), inductively coupled plasmamass spectrometry (ICP-MS), and XRF. For more information about this calibration see a publication by Glascock [2020].

The artefacts were non-destructively analysed by XRF. Samples were counted for one minute each. The elements measured include K, Ca, Ti, Mn, Fe, Zn, As, Rb, Sr, Y, Zr, Nb and Th. However, due to the variation in sizes, shapes and thicknesses of the artefacts, the most reliable data is usually only possible for Rb, Sr, Y, Zr, and Nb. Sample size and thickness can be problematic for small artefacts, an issue that was solved by examining element ratios (Sr/Rb, Rb/Zr, etc.) as recommended by Hughes [2010]. Multiple elements were used to determine differences between sources where ratio values would otherwise overlap.

Results

Flint and obsidian were the main raw materials for making the tools at the Kvirike, Jikhanjuri, and Choloki sites. The superior quality of these raw materials indicates that ancient humans possessed the knowledge necessary to select the optimal materials for the production of stone tools.

The flint and obsidian stone collection contains a variety of artefacts of interest (fig. 3, table 1), which have been extensively published by archaeologist Sergo Gogitidze [Gogitidze 1973; Gogitidze 1978]. Therefore, a brief review of the collection will be conducted herein.

Technological analysis of the stone confirms that the hand-pressing technique was used to process stone tools at the sites. This is confirmed by the presence of conic and pencil-like cores and tabletts. It is noteworthy that a large part of the cores are completely utilized.

The diversity of stone tools is characterized by a wide array of tools, including burins, scrapers, retouched blades, among others. The collection under consideration comprises a single set of chisel and perforator. According to techno-typological analysis, blades were primarily utilized for the making of tools, though there are also numerous tools that were produced on a flakes.

The results of the XRF analysis were compared to a database of obsidian source samples which were also analysed at MURR using the same

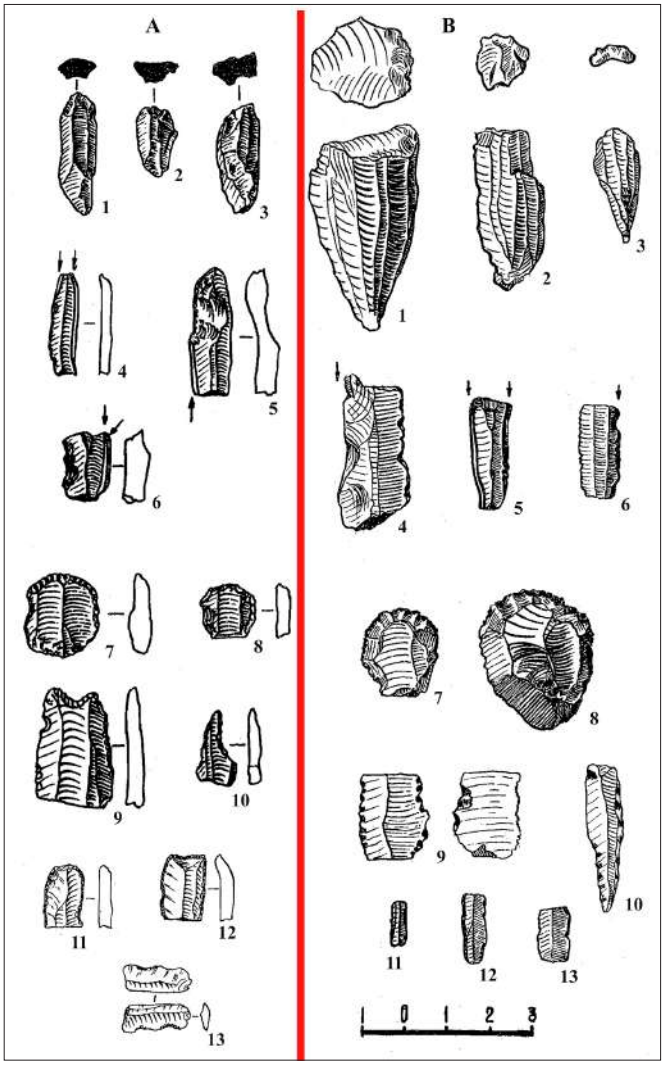


Fig. 3. Lithic artefacts. A (Jikhanjuri) – 1-3 Core; 4-6 burins; 7-8 Scrapers; 9 - Chisel; 10 – Perforator; 11-13 retouched blade and bladelets; B (Kvirike) – 1-3 Cores; 4-6 Burins; 7-8 Scrapers; 9 – Retouched blade; 10 – Perforator; 11-13 Microblade with abrupt retouched.

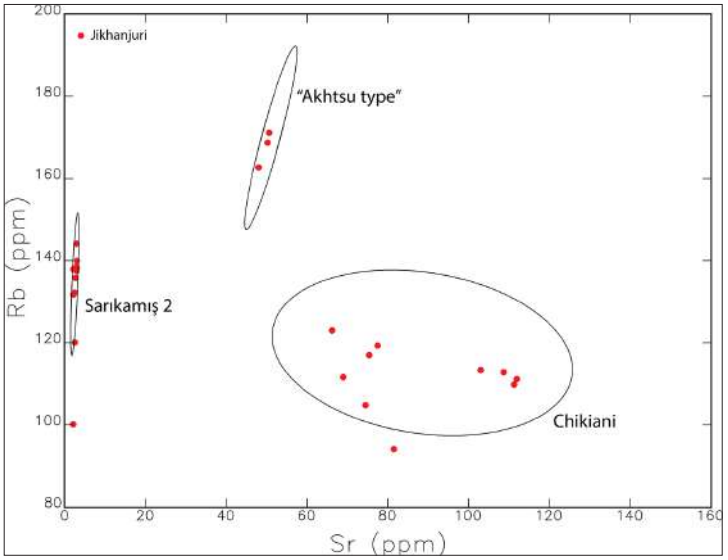
Types of artefacts	Kvirike			Jikhanjuri			Choloki		
Cores and products of knapping	**Flint**	**Obsidian**	**Total**	**Flint**	**Obsidian**	**Total**	**Flint**	**Obsidian**	**Total**
Cores	5	2	2	3	-	3	1	-	1
Tablets	2	-	2	-	-	-	-	-	-
Blades	14	7	21	6	-	6	-	-	-
Bladelets	22	9	31	13	-	13	1	-	1
Microblades	6	10	16	3	-	3	-	-	-
Primary flakes	7	2	9	5	-	5	3	-	3
Secondary flakes	59	46	105	135	-	135	142	-	142
Chunks	18	10	28	19	-	19	-	-	-
Cheeps	5	-	5	13	-	13	72	-	72
Burin spalls	4	2	6	1	-	1	-	-	-
Tools	**36**	**66**	**102**	**21**	**10**	**31**	**6**	**18**	**24**
Burins	18	31	49	11	-	11	2	-	13
Scrapers	4	2	6	8	-	8	-	4	4
Retouched blades	6	5	11	-	10	10	3	3	6
Retouched flakes	-	-	-	1	-	1	-	5	5
Notched blades	1	19	20	-	-	-	1	5	6
Perforators	2	2	4	1	-	1	-	-	-
Chisels	1	0	1	-	-	-	-	1	1
Truncated blades	1	1	2	-	-	-	-	-	-
Backed bladelets and microblades	3	6	9	-	-	-	-	-	-
Total	**173**	**154**	**327**	**219**	**10**	**229**	**225**	**18**	**243**

Table 1. Flint and obsidian complexes.

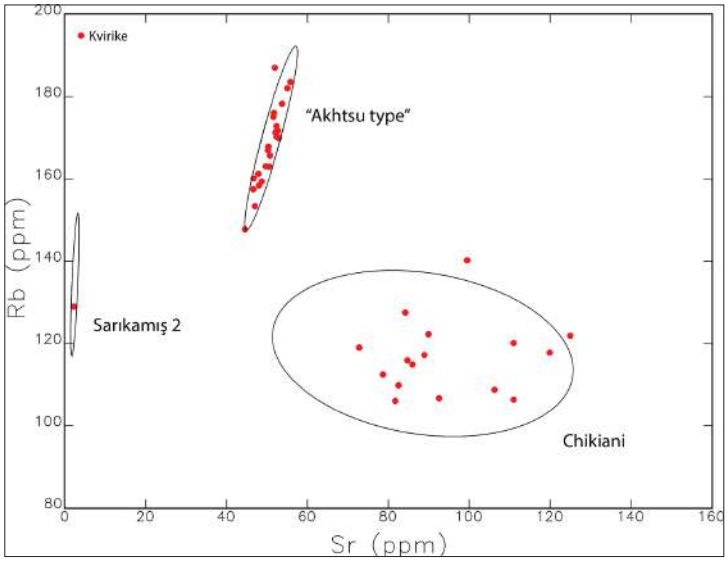
Thermo Quantx ARL lab-based XRF spectrometer. An overview of the data reveals four sources for the obsidian in this study. These are Chikiani in Georgia, Sarıkamış 2 (Hamamli) in Türkiye and "Akhtu type" in North Caucasus (*see* fig. 4,a-d; table 2-3). Regrettably, the fourth source could not be identified.

Discussion

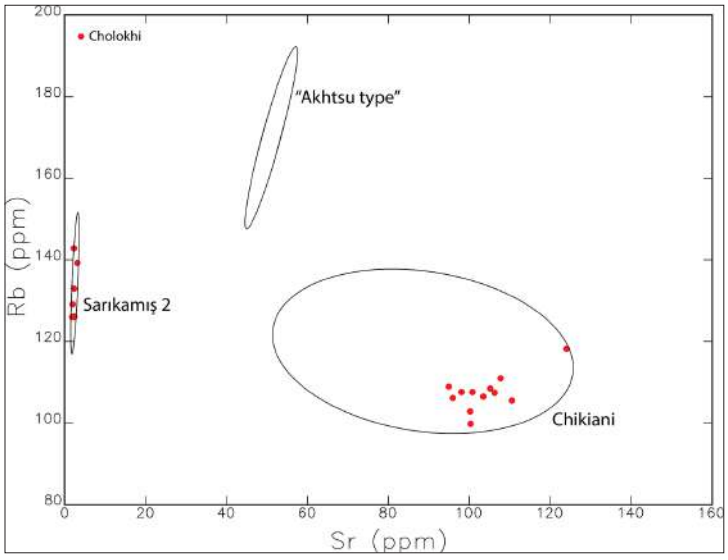
Unfortunately, the absolute dates of the Kvirike, Jikhanjuri, and Choloki remain undetermined. The determination of their age was conducted using the relative dating method [Gogitidze 1978; Gogitidze 2008]. Recently, several significant absolute dates have been obtained, which will facilitate the precise determination of the age of the sites (*see* table 4). The following should be designated as direct analogues of the sites: Kobuleti [Chkhatarashvili *et all.* 2020; Manko, Chkhatarashvili 2022; Chkhatarashvili 2023; Chkhatarashvili, Glascock 2022), Khutsubani [Chkhatarashvili et all. 2024a], Darkveti rock shelter (Layer V) [Chkhatarashvili *et all.* 2025), Bavra-Ablari [Varoutsikos *et all.* 2017], and others. Additionally, a close resemblance has been observed between the stone industry and the sites of the so-called Mle'phaatien culture in the Middle East [Hole 1977; Hole 1987; Howe 1983; Dittermore 1983]. Furthermore, the techno-typological analysis of the stone industry has permitted the formulation of a hypothesis concerning the large migration processes that commenced from the Middle East at the Late Pleistocene-Early Holocene periods [Manko, Chkhatarashvili 2022].


Jikhanjuri
"Akhtsu type"
Sarıkamış 2
Chikiani
Rb (ppm)
Sr (ppm)
200
180
160
140
120
100
80
0
20
40
60
80
100
120
140
160

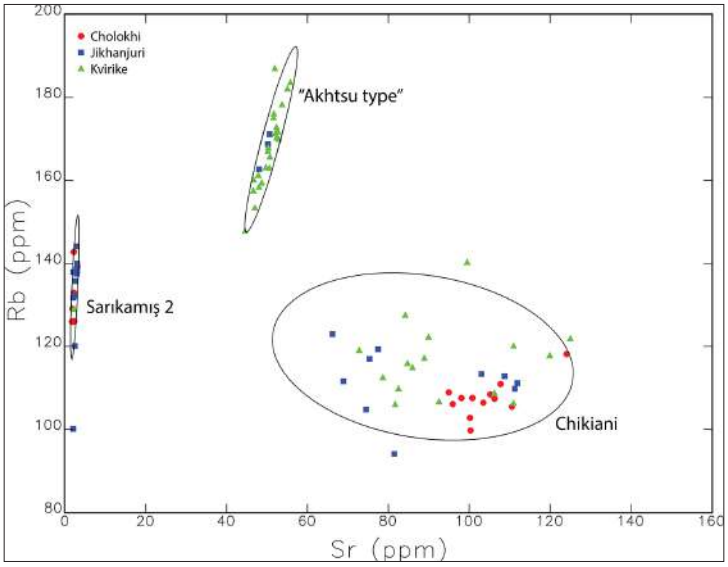
a


Kvirike
"Akhtsu type"
Sarıkamış 2
Chikiani
Rb (ppm)
Sr (ppm)
200
180
160
140
120
100
80
0
20
40
60
80
100
120
140
160

b


Cholokhi
"Akhtsu type"
Sarıkamış 2
Chikiani
Rb (ppm)
Sr (ppm)
200
180
160
140
120
100
80
0
20
40
60
80
100
120
140
160

c



d

Fig. 4. a-d – Scatterplot of strontium (Sr) versus zirconium (Zr) showing obsidian samples from Jikhanjuri, Kvirike and Choloki sites, with ellipses drawn at 90% confidence intervals representing probable sources.

Layer	Sample	Source	K	Ca	Ti	Mn	Fe	Zn	As	Rb	Sr	Y	Zr	Nb	Th
Neolithic	1	Chikiani	28381	4045	726	360	6162	44,5	0,0	107,6	98,1	9,9	102,5	18,6	13,9
Neolithic	2	Sarik 2	25357	1457	405	520	7067	67,4	5,0	125,9	1,8	38,3	199,8	23,5	15,8
Neolithic	3	Chikiani	24881	4163	811	387	6248	52,3	0,0	107,4	106,3	9,5	111,5	15,3	14,5
Neolithic	4	Sarik 2	20984	1696	394	558	7040	80,0	3,4	126,1	2,3	38,0	215,5	24,0	16,9
Neolithic	5	Chikiani	24583	4050	786	325	5651	43,4	0,0	102,8	100,2	9,2	105,2	16,3	15,4
Neolithic	6	Chikiani	28207	4447	862	390	6341	48,4	0,0	107,6	100,7	10,6	104,8	16,3	14,7
Neolithic	7	Chikiani	26990	4177	953	382	6398	43,7	0,0	105,5	110,5	9,4	115,0	16,6	14,2
Neolithic	8	Chikiani	36240	5660	1041	467	8257	56,6	0,1	118,2	124,0	11,6	123,6	16,6	15,8
Neolithic	9	Sarik 2	24130	1770	867	534	8818	68,4	3,3	132,9	2,3	38,5	175,4	25,3	16,6
Neolithic	10	Sarik 2	27374	1926	711	574	8833	106,7	6,0	139,2	3,1	39,8	194,4	26,2	18,2
Neolithic	11	Chikiani	23953	3800	696	382	5769	48,4	0,0	108,9	94,9	9,9	98,6	18,9	14,6
Neolithic	12	Chikiani	27735	4066	786	353	5683	40,8	0,0	106,1	95,9	11,0	101,8	16,9	12,4
Neolithic	13	Sarik 2	22637	1704	432	547	7078	79,8	3,9	129,1	1,9	38,7	196,3	23,8	18,2
Neolithic	14	Chikiani	30930	4380	767	372	6026	43,2	0,0	108,4	105,2	10,6	110,9	16,4	15,7
Neolithic	15	Chikiani	26665	4145	865	374	6071	52,5	0,0	106,4	103,5	10,0	107,4	15,8	13,6
Neolithic	16	Sarik 2	28314	1598	912	567	9858	138,3	4,4	142,8	2,2	39,7	178,2	24,4	19,6
Neolithic	17	Sarik 2	31967	1964	500	629	8618	83,2	4,8	139,2	3,0	41,3	232,9	24,6	18,3
Neolithic	18	Chikiani	27405	3975	768	331	5390	41,6	0,0	99,7	100,3	8,4	106,8	15,4	12,7
Neolithic	19	Chikiani	36657	4311	873	383	6752	59,1	0,0	110,9	107,7	10,7	111,0	16,4	15,5
Neolithic	20	Sarik 2	20015	1631	537	483	7436	77,7	2,8	126,0	2,3	38,5	227,7	23,3	15,3
Neolithic	1	Akhtsu Type	38814	4220	364	331	4151	38,1	7,3	171,1	50,6	12,2	67,8	26,7	15,9
Neolithic	2	Unknown	13948	888	483	355	5869	55,7	0,0	100,1	2,1	29,3	169,4	23,3	14,2
Neolithic	3	Sarik 2	24753	1286	733	523	8659	82,3	3,4	135,8	2,7	38,9	166,4	25,6	17,1
Neolithic	4	Sarik 2	23515	1573	611	475	6839	73,2	6,7	132,2	2,4	39,6	157,1	25,0	16,7
Neolithic	5	Chikiani	27537	3505	505	429	5061	41,4	0,0	117,0	75,3	11,9	79,8	18,2	14,4

Neolithic	6	Sarik 2	36077	2192	892	691	10917	104,9	9,1	144,1	2,9	42,0	216,4	26,3	19,5
Neolithic	7	Chikiani	29297	3536	672	441	5392	47,0	0,0	119,3	77,4	12,7	83,3	17,6	13,4
Neolithic	8	Sarik 2	30752	2041	1097	540	10868	92,9	7,0	140,0	3,0	41,2	202,6	26,6	17,2
Neolithic	9	Chikiani	29823	4378	798	407	6085	45,0	0,0	113,4	103,0	11,8	105,0	17,8	13,4
Neolithic	10	Chikiani	28037	3341	573	419	4919	46,2	0,0	123,0	66,2	13,4	67,0	20,5	12,2
Neolithic	11	Chikiani	29905	4337	826	389	6571	43,9	0,0	111,1	111,9	10,9	117,2	16,9	15,6
Neolithic	12	Chikiani	23892	964	651	475	6811	62,7	4,3	131,8	2,1	37,6	155,1	25,3	17,8
Neolithic	13	Akhtsu Type	26205	3800	426	330	4317	38,4	5,7	168,7	50,2	11,5	69,9	27,2	17,4
Neolithic	14	Chikiani	31887	4858	928	429	6532	47,3	0,0	112,8	108,7	11,6	113,3	17,4	15,0
Neolithic	15	Chikiani	23186	2968	818	349	5797	45,2	0,0	104,8	74,5	10,9	81,7	17,1	13,7
Neolithic	16	Sarik 2	27283	1510	314	580	6601	69,3	4,1	137,9	2,1	38,2	170,9	25,2	18,7
Neolithic	17	Akhtsu Type	26057	4182	386	317	4162	41,0	7,0	162,7	48,0	11,4	64,2	27,1	15,3
Neolithic	18	Sarik 2	29109	1436	599	583	7941	73,9	6,0	138,1	3,0	40,0	197,4	25,0	18,9
Neolithic	19	Sarik 2	31053	2083	471	614	8595	80,3	5,9	137,5	2,9	42,0	231,3	25,5	16,9
Neolithic	20	Chikiani	24120	3694	584	326	5054	38,3	0,0	94,1	81,5	8,3	91,7	15,5	12,2
Neolithic	21	Sarik 2	26221	1671	532	497	7328	77,5	5,7	138,5	2,9	39,8	159,5	25,8	16,6
Neolithic	22	Sarik 2	23728	1062	496	481	7758	66,2	2,2	120,1	2,5	37,9	210,9	24,1	15,7
Neolithic	23	Chikiani	31714	5098	950	379	7283	46,9	0,0	109,8	111,2	10,7	115,1	16,8	16,7
Neolithic	24	Chikiani	24472	3459	582	395	4620	40,3	0,0	111,6	68,9	10,6	75,3	17,6	14,1
Mesolithic	1	Chikiani	33792	3498	725	360	5521	41,1	0,0	109,8	82,5	11,4	96,2	16,3	13,9
Mesolithic	2	Chikiani	27582	3382	643	422	5061	44,7	0,0	119,0	72,7	11,7	74,4	17,4	13,8
Mesolithic	3	Akhtsu Type	25316	3883	410	332	4338	36,8	7,1	160,1	46,7	11,0	63,0	26,8	16,3
Mesolithic	4	Akhtsu Type	29292	4499	406	365	4264	36,5	8,5	186,9	51,9	13,0	69,1	27,8	16,1
Mesolithic	5	Akhtsu Type	26969	4501	509	352	5126	37,2	8,5	167,8	50,3	12,0	68,2	27,2	15,6
Mesolithic	6	Chikiani	39948	7497	1117	908	9203	65,9	1,2	140,2	99,5	14,2	100,7	21,3	17,6
Mesolithic	7	Akhtsu Type	25900	4096	336	342	3914	35,1	7,2	161,2	47,8	11,2	63,6	25,5	15,2
Mesolithic	8	Akhtsu Type	26815	4410	495	356	5273	41,6	8,3	165,6	50,7	12,3	66,8	26,4	16,1

Table 2. Concentrations in parts per million for the artefacts analyzed in this study.

These processes resulted in the dissemination of numerous significant innovations to our region.

Chikiani is a volcanic mountain situated in South Georgia, within the Javakheti region, near Paravani Lake. The obsidian is high quality – very homogeneous and absent of inclusions [Badalyan *et all.* 2004]. As research confirms, Chikiani obsidian was a highly sought-after product in various historical periods [Badalyan *et all.* 2004; Biagi *et all.* 2017; Biagi, Nisbet 2018; Gratuze, Rova 2022].

Sarikamiş. The Sarıkamış obsidians, which formed within a pyroclastic sequence containing rhyolite and perlite along the Sarıkamış-Mescitli road, appear as grains and blocks ranging in size from 1-2 cm to 1-2 meters within pink-yellow tuffs. These obsidians display a variety of colors, ranging from green to black and yellow to red. The oldest estimated obsidian formations in Eastern Anatolia have been identified in the southwestern part of this region [Innocenti *et all.* 1982; Bigazzi *et all.* 1997]. In the early 2000s, another obsidian

Site	Chikiani	Sarıkamış 2	"Akhtsu Type"	Unknown	Total
Cholokhi	12	8	–	–	*20*
Jikhanjuri	11	9	3	1	*24*
Kvirike	16	1	23	–	*40*
Total	*39*	*18*	*26*	*1*	***84***

Table 3. Summary of obsidian sources in this samples listed by archaeological sites.

№	Dates (BP)	Dates 95.4% (BC)*	Lab. Index	Sample	Site	Reference
1	9600±70	9231-8776	SPb-3624	charcoal	Kobuleti	Chkhatarashvili 2023
2	9587±70	9227-8765	SPb-3621	charcoal	Kobuleti	Chkhatarashvili 2023
3	9510±32	9121-8657	FTMC-PE65-3	charcoal	Kobuleti	Chkhatarashvili 2023
4	9465±32	9111-8632	FTMC-PE65-2	charcoal	Kobuleti	Chkhatarashvili 2023
5	8670±100	8171-7534	SPb-3084	charcoal	Kobuleti	Chkhatarashvili *et all.* 2020
6	7949±70	7047-6653	SPb-3623	charcoal	Kobuleti	Manko, Chkhatarashvili 2022b
7	9629±37	9231-8832	FTMC-LD04-1	charcoal	Khutsubani	Chkhatarashvili *et all.* 2024a
8	9527±37	9129-8736	FTMC-ZL16-1	charcoal	Khutsubani	Chkhatarashvili *et all.* 2024a
9	9646±38	9240-8841	FTMC-ZL16-2	charcoal	Khutsubani	Chkhatarashvili *et all.* 2024a
10	8085±47	7308-6826	FTMC-JU83-8	bone	Darkveti rock shelter (V layer)	Chkhatarashvili *et all.* 2025
11	10250 ± 50	10493-9803	Poz-61367	teeth	Bavra-ablari	Varoutsikos *et all.* 2017
12	9530 ± 40	9134-8736	Poz-66742	charcoal	Bavra-ablari	Varoutsikos *et all.* 2017
13	9410 ± 40	8797-8563	Poz-61370	charcoal	Bavra-ablari	Varoutsikos *et all.* 2017
14	9420 ± 40	8806-8566	BETA -363172	charcoal	Bavra-ablari	Varoutsikos *et all.* 2017
15	8670±30	7739-7594	BETA -393559	bone	Bavra-ablari	Varoutsikos *et all.* 2017
16	9720±45	9293-8925	OS-90615	charcoal	Anaseuli I	Meshveliani 2013
17	9540±40	9138-8747	OS-78999	charcoal	Anaseuli I	Meshveliani 2013
18	8260±35	7462-7086	OS-78998	charcoal	Anaseuli I	Meshveliani 2013
19	9960±140	10000-9162	LU-9477	Bone	Sosruko	Golovanova *et all.* 2020
20	9945±35	9659-9296	IGANams-7988	bone	Sosruko	Leonova 2021

* Radiocarbon dates were calibrated using the online calibration program OxCal 4.4.4 [Bronk Ramsey, Lee 2013] using atmospheric data from Paula J. Reimer *et all.* [2020].

Table 4. Absolute dates of analogies of Kvirike, Jikhanjuri and Choloki sites.

deposit was discovered west of Sarıkamış, near the village of Handere [Gallet 2001].

The chemical analyses confirm that the obsidian deposits in the Sarıkamış region can be divided into two distinct groups:

Sarıkamış South Group: This group is represented by obsidian from Mescitli and Şehitemin. It is characterized by notable barium content and relatively low levels of heavy rare earth elements (yttrium, erbium, and ytterbium). The Sarıkamış South group is the older of the two, dating to approximately 4.9-4.4 million years ago [Bigazzi *et all.* 1998].

Sarıkamış North Group: This group includes obsidian from Kızıl Kilisa, Handere, and Hamamlı. It is distinguished by a lower barium

content, along with higher concentrations of yttrium and especially zirconium. The Sarıkamış North group is younger, dating to approximately 3.8-3.5 million years ago [Bigazzi *et all.* 1998], and originates from a more evolved magma, where zircon is present as micro-crystals [Gallet 2001].

Our studies have shown that Hamamlı obsidian, which is part of the "Northern Group" of Sarıkamış, was used.

Akhtsu Type – the source referred to as "Akhtsu Type" is an unknown source of obsidian that was first identified from the site of Akhtsu near Sochi, Russian Federation. Obsidians from this type were first reported by Yaroslav Kuzmin, who suggested the source may be located in the North Caucasus [Kuzmin *et all.* 2023]. This source is compositionally distinct from all other known sources in the Caucasus, including Zayukovo (Baksan), thus far the only other known source in the North Caucasus.

Conclusion

According to conducted analysis, the Kvirike, Jikhanjuri and Choloki sites give us important information about the ancient inhabitants of South-Eastern Black Sea region. This data encompasses not only the methods employed in the production of stone tools but also the strategies employed in the selection of suitable raw materials, mobility patterns, and contacts. The procurement of obsidian necessitated extensive mobility, with the supply needs of the region requiring travel over long distances, estimated to be between 180 and 250 kilometers (180 kilometers to Chikiani, 190 kilometers to Sarikam, and 250 kilometers to Akshtu). This underscores the importance of establishing active contacts with regions abundant in obsidian to ensure the acquisition of high-quality materials. The hypothesis that there was also "trade" in obsidian is not excluded; A techno-typological analysis of the stone industry reveals several nuances. Specifically, the hand-pressed technique is prevalent in the Kvirike, Jikhanjuri, and Choloki sites, as evidenced by conic and pencil-like cores. Also, diversity of burins, round and oval scrapers, and microblades with abrupt retouched are the main features of this sites. A close similarity is observed with the contemporaries sites of Western Transcaucasia. The use of absolute dates from the latter allows for the dating of the sites study.

Bibliography

Badalyan *et all.* 2004: R. Badalyan, C. Chataigner, Ph. Kohl, Trans-Caucasian obsidian: The exploitation of the sources and their distribution. Ancient Near East. Stud. (Supplement 12), 2004, 437-465. Peeters.

Berdzenishvili, Nebieridze 1964: N. Berdzenishvili, L. Nebieridze, Kvis khanis namosakhlari k'int'rishis kheobashi. In: (A. Inaishvili ed.), Samkhret-dasavlet sakartvelos dzeglebi, I. (Tbilisi, 1964), 7-16.

Bigazzi *et all.* 1997: G. Bigazzi, Z. Yegingil, T. Ercan, M. Oddone, M. Özdogan, Age determination of obsidian bearing volcanics in Eastern Anatolia using fission track dating method. Geological Bulletin of Turkey, 40(2), 1997, 57-72 (in Turkish).

Biagi *et all.* 2017: P. Biagi, R. Nisbet, B. Gratuze, Discovery of obsidian mines on mount Chikiani in the lesser Caucasus of Georgia. Antiquity 91 (357), 2017, 1-8.

Biagi, Nisbet 2018: P. Biagi, R. Nisbet, The Georgian Caucasus and its resources: the exploitation of the mount Chikiani uplands during the metal ages. Antiquity 92 (362), 2018, 1-9.

Bronk Ramsey, Lee 2013: C. Bronk Ramsey, S. Lee, Recent and Planned Development of the Program OxCal. Radiocarbon 55/2-3, 2013, 720-730.

Chkhatarashvili 2023: G. Chkhatarashvili, Preistoriuli epokhis arkheologiuri dzeglebi Pichvnaris hemogarensi, Pichvnari VIII, (Batumi 2023), 9-23 (in Georgian).

Chkhatarashvili, Glascock 2022: G. Chkhatarashvili M.D. Glascock, Obsidian at Kobuleti (Western Georgia): Evidence for early human contact in Western Transcaucasia during the early Holocene. Archaeological Research in Asia, vol. 29, 2022, 1-8.

Chkhatarashvili, Manko 2020: G. Chkhatarashvili V. Manko, Kobuleti Site. The Evidence for Early Holocene Occupation in Western Georgia. Documenta Praehistorica, XLVII, 2020, 28-35.

Chkhatarashvili *et all.* 2020: G. Chkhatarashvili, V. Manko, A. Kakhidze, K. Esakiya, M. Chichinadze, M. Kulkova, M. Strelcov, South-East Black Sea coast in early Holocene period (according to interdisciplinary investigations in

Kobuleti site). Sprawozdania Archeologiczne 72 (2), 2020, 213-230.
Chkhatarashvili *et all.* 2023a: G. Chkhatarashvili, V. Manko, M. Khalvashi, Apearing of weaving and Early Human activities of South-West Georgia (according to newest studies). Chronos, № 4, 2023, 211-226.
Chkhatarashvili *et all.* 2023b: G. Chkhatarashvili, V. Manko, M. Khalvashi, The Caucasus andtheMiddle East in theearly Holocene56(According torecent archaeological research). Herald of oriental studies, Vol. VI, 2023, 408-445.
Chkhatarashvili *et all.* 2024a: G. Chkhatarashvili, M. Chichinadze, M.D. Glascock, J.A. Davenport, M. Khalvashi, L. Aslanishvili, Sh. Rodinadze, Interdisciplinary investigation of the Khutsubani site (Western Georgia). Revista Arheologică, serie nouă, vol. XX, nr. 1, 2024, 171-183, https://doi.org/10.52603/RA.XX.1.2024_09
Chkhatarshvili *et all.* 2024b: G. Chkhatarashvili, J.A. Davenport, M.D. Glascock, M. Khalvashi, T. Zoidze, Reconstructing Neolithic obsidian procurement in Western Georgia through an obsidian characterization study. Journal of Archaeological Science: Reports. vol. 57, 2024, https://doi.org/10.1016/j.jasrep.2024.104663
Chkhatarashvili *et all.* 2025: G. Chkhatarashvili, N. Tskvitinidze, N. Tsikaridze, J.A. Davenport, M.D. Glascock, New Insights into the Mesolithic and Neolithic Layers of the Darkveti Rock Shelter in the Imereti Region, Western Georgia. Doceumenta Praehistorica, 52, 2025, https://doi.org/10.4312/dp.52.2
Dittermore 1983: M. Dittermore, The Soundings at M'lefaat. In: (L.S. Braidwood, R.J. Braidwood, B. Howe, C.A. Reed and P.J. Watson eds.), Prehistoric archaeology along the Zagros flanks (Oriental Institute Publication 105). Chicago: Oriental Institute of the University of Chicago, 1983, 671-692.
Gallet 2001: S. Gallet, Les obsidiennes de la région de Kars et de Sarıkamıs¸ -géochimie et application à l'archéologie, Travail d'étude et de recherche. (Université de Clermont-Ferrand 2001).
Glascock 2020: M.D. Glascock, A systematic approach to geochemical sourcing of obsidian artefacts. Scientific Culture 6, 2020, 35-46.
Gratuze, Rova 2022: B. Gratuze, E. Rova, New data on different patterns of obsidian procurement in Georgia (Southern Caucasus) during the Chalcolithic, Bronze and Iron Age Periods. Archaeological Research in Asia, 32, 2022, 1-17.
Gogitidze 1974: S. Gogitidze, Neolituri khanis dzegli md. Cholokis sanapiroze. In: (A. Inaishvili ed.), Samkhret-dasavlet sakartvelos dzeglebi. IV (Tbilisi, 1974), 4-33 (in Georgian).
Gogitidze 1978: S. Gogitidze, Samkhret-aghmosavlet shavizghvisp'iretis neolituri k'ult'ura. (Tbilisi 1978) (in Georgian).
Gogitidze 2008: S. Gogitidze 2008, The archaeological sites of the stone age in the Kintrishi valley. (Batumi 2008).
Golovanova *et all.* 2020: L.V. Golovanova, V.B. Doronichev, E.V. Doronicheva, T.F. Tregub, M.A. Volkov, Y.N. Spasovskiy, A.Yu. Petrov, F.E. Maksimov, A.G. Nedomolkin, Dynamique du climat et du peuplement du Caucase Nord-Central au tournant du Pléistocène et de l'Holocène. L'anthropologie, 124, no. 2, 2020, 1-20.
Hole 1977: F. Hole, Studies in the archeological history of the Deh Luran plain. The Excavation of Chagha Sefid (Memories of the Museum of Anthropology. University of Michigan 9). Ann Arbor: Museum of Anthropology. (University of Michigan 1977).
Hole 1987: F. Hole, Chronologies in the Iranian Neolithic // Chronologies in the Near East: relative chronologies and absolute chronology 16.000-4.000 B.P. C.N.R.S. International symposium, Lyon (France) 24-28 November 1986. – Oxford: BAR, 1987. – P. 353-379. (BAR International Series. Vol. 379).
Howe 1983: B. Howe, Karim Shahir. In (L.S. Braidwood, R.J. Braidwood, B. Howe, C.A. Reed and P.J. Watson eds), Prehistoric Archaeology along The Zagros Flanks (Oriental Institute Publication 105). Chicago: Oriental Institute of the University of Chicago, 1983, 23-154.
Hughes 2010: R.E. Hughes, Determining the geologic provenance of tiny obsidian flakes in archaeology using nondestructive EDXRF. American Laboratory 42(7), 2010, 27-31.
Innocenti *et all.* 1982: F. Innocenti, R. Mazzuoli, G. Pasquaré, F. Radicati di Brozolo, L. Villari, Tertiary and Quaternary volcanism of the Erzurum-Kars area (eastern Turkey): geochronological data and geodynamic evolution. Journal of Volcanology and Geothermal Research, 13, 1982, 223-40.
Kuzmin *et all.* 2023: Y.V. Kuzmin, S.A. Kulakov, M.D. Glascock, S.Y. Budnitsky, A.V. Grebennikov, Where is the source? In search of unknown primary obsidian locale in northern Caucasus. Poster presented at the International Obsidian Conference (IOC), Engaru, Japan, 3-6, July, 2023.
Leonova 2021: E.V. Leonova, Grot Sosruko: reviziia materialov iz raskopok S.N. Zamiatnina i radiouglerodnaia khronologiia verkhnikh sloev kamennogo veka. Camera praehistorica, No 1, 2021, 101-119 // Е.В. Леонова, Грот Сосрук: ревизия материалов из раскопок С.Н. Замятнина и радиоуглеродная хронология верхних слоев каменого века. Camera praehistorica, No 1, 2021, 101-119.
Manko, Chkhatarashvili 2022a: V. Manko, G. Chkhatarashvili, Transcaucasia and Neolithic of South of Eastern

Europe. Arheologia, № 2, 2022, 19-52.
Manko, Chkhatarashvili 2022b: V. Manko, G. Chkhatarashvili, Kvirike: The Early Holocene Site in Western Georgia. Revista Arheologică, serie nouă, vol. XVIII, nr. 2, 2022, 5-16.
Meshveliani 2013: T. Meshveliani, K voprosu o vozniknovenii neolita v Zapadnoi Gruzii. Archeologiia, etnografiia i antropologiia Evrazii, 2 (54), 2013, 61-72 // Т. Мешвелиани, К вопросу о возникновении неолита в Западной Грузии. Археология, этнография и антропология Евразии, 2(54), 2013, 61-72
Pelegrin 2012: J. Pelegrin, New Experimental Observations for the Characterization of Pressure Blade Production Techniques. In: (P.M. Desrosiers ed.), The Emergence of Pressure Blade Making: From Origin to Modern Experimentation, 2012, 465-500.
Reimer *et all.* 2020: P.J. Reimer, W.E.N. Austin, E. Bard, A. Bayliss, P.G. Blackwell, C. Bronk Ramsey, M. Butzin, H. Cheng, R.L. Edwards, M. Friedrich, P.M. Grootes, T.P. Guilderson, I. Hajdas, T. J. Heaton, A. G. Hogg, K. A. Hughen, B. Kromer, S.W. Manning, R. Muscheler, J. G. Palmer, C. Pearson, J. Plicht, R. W. Reimer, D.A. Richards, E.M. Scott, J.R. Southon, C.S.M. Turney, L. Wacker, F. Adolphi, U. Büntgen, M. Capano, S.M. Fahrni, A. Fogtmann-Schulz, R. Friedrich, P. Köhler, S. Kudsk, F. Miyake, J. Olsen, F. Reining, M. Sakamoto, A. Sookdeo, S. Talamo, The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0-55 cal kBP). Radiocarbon 62/4, 2020, 725-757.
Tixie 1974: J. Tixie, Glossary for the description of stone tools, with special reference to the Epipaleolithic of the Maghreb, Newsletter of Lithic Technology. Special Publication, 1974, 3-40.
Varoutsikos *et all.* 2017: 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 eds.), Context and Connection: Essays on the Archaeology of the Ancient Near East in Honour of Antonio Sagona. Leuven: Peeters, 2017, 233-255.

Guram Chkhatarashvili, PhD, Batumi Shota Rustaveli State University, e-mail: guramchkhatarashvili@bsu.edu.ge, ORCID: 0000-0002-0568-9797.

James Davenport, PhD, Research Reactor Center, University of Missouri, e-mail: davenportja@missouri.edu, ORCID: 0000-0003-2666-2996.

Michael D. Glascock, PhD, Research Reactor Center and Department of Anthropology, University of Missouri, e-mail: glascockm@missouri.edu, ORCID: 0000-0003-0686-7556.

Hülya Çalışkan Akgül, PhD, Karadeniz Technical University, e-mail: hulyaakgul@ktu.edu.tr, ORCID: 0000-0002-6619-9898.