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Von Majkop bis Trialeti
Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.–2. Jt. v. Chr.

Beiträge des Internationalen Symposiums in Berlin
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herausgegeben von
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Obsidian in the Southern Caucasus: The use of raw materials in the Neolithic to Early Iron Ages

In Memory of Zaal Kikodze

During the last 20 years a range of large-scale international projects has systematically investigated the obsidian sources in the Caucasus and northeastern part of the Armenian Highland and has examined the distribution of raw materials from the Neolithic through the Early Iron Age, utilizing various analytical techniques (approximately 1,300 analyses).

Based upon the analyses of 574 artefacts from 36 Sites dating to the 6th–2nd/1st millennium B.C., this report discusses the use of obsidian within more or less compact geographic groups of synchronous (mono-culture) sites from various regions of the Southern Caucasus *(Fig. 1)*.

All the sites represented in the report belong to the young volcanic zone, and their lithic industries are characterized by the strong domination of obsidian (over 90%). Only at Alikemektepesi and the majority of sites from the Black Sea and Caspian Sea littorals did flint predominate.

The materials were investigated by NAA (J. Blackman, National Institute of Standards and Technology, Gaithersburg, Maryland; K. Kasper, Institut für Archäometrie, Bergakademie Freiberg), ICP-MS (B. Gratuze, CNRS, Orleans), XRF (J. Keller, Institut für Mineralogie, Petrologie und Geochemie, Universitat Freiburg), and fission-track dating (G. Bigazzi, Istituto di Geochronologia e Geochimica Isotopica, Pisa).

The available data do not encompass the whole territorial-chronological continuum of the Southern

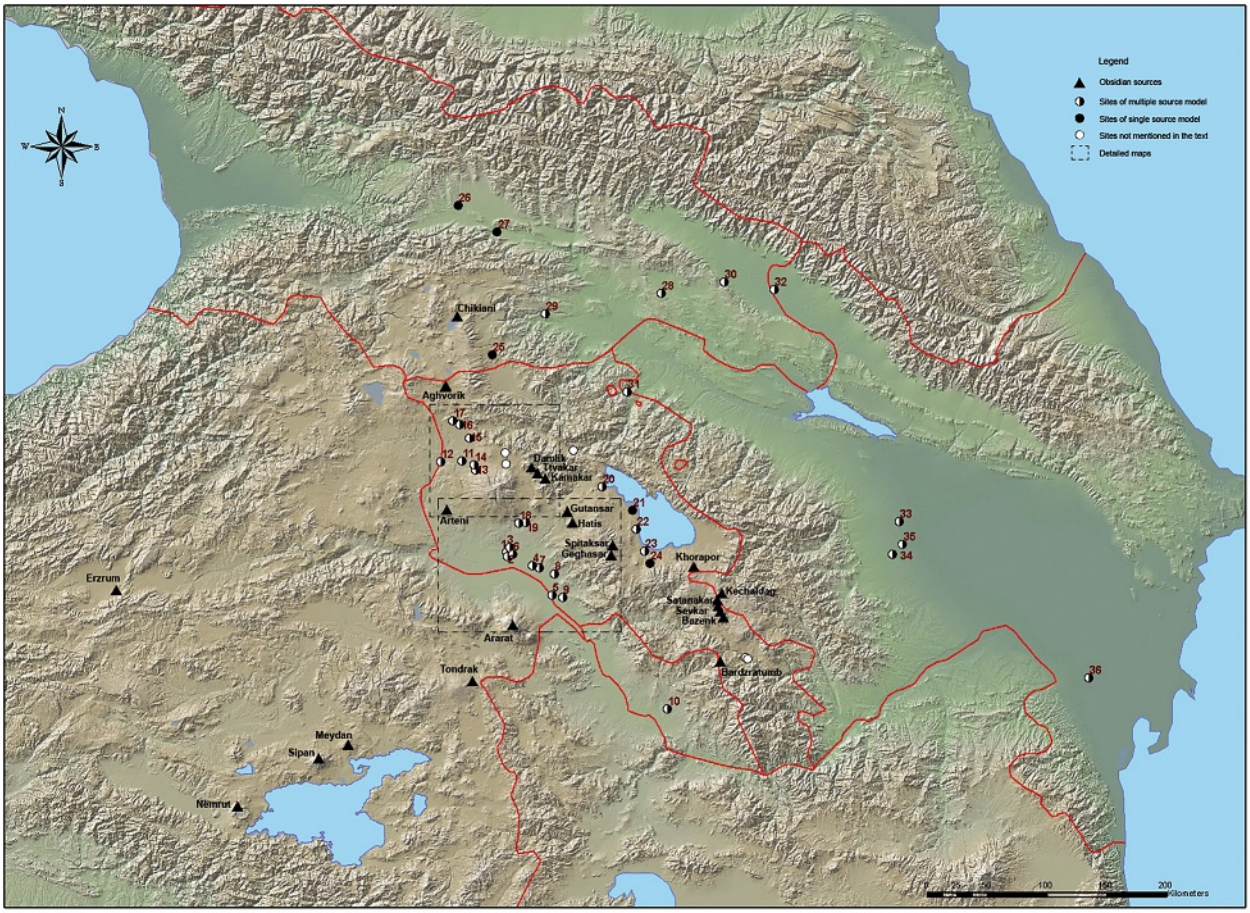


Fig. 1. Map of the obsidian sources of the South Caucasus, North-Eastern part of the Armenian Highland and the sites concerned in the article.

Caucasus. Furthermore, the investigated series do not have equal statistical reliability (ranging from 6–8 up to 67 analyses per site). Nevertheless, they reflect certain regularities in the consumption of obsidian raw materials which are of interest.

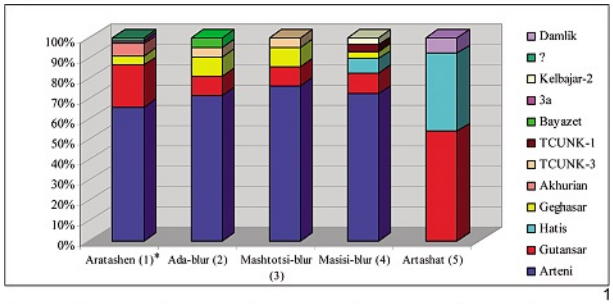
Obsidian sources in the Southern Caucasus

The obsidian sources of the Caucasus and the northeastern part of the Armenian Highland have been the recent subject of various special investigations,[1] which allow us to provide here only a brief listing of the sources necessary for the illustration of the subsequent text.

South Caucasian sources of obsidian coincide with local volcanic-structural sub-zones, which extend in a 300 km-long chain from the northwest to southeast. Javakheti (Kechut), the Aragats highlands, the Tsaghkuniats ridge, the Gegham, Vardenis and Syunik (Karabakh) massifs and the Zangezur ridge are all elements of this chain. On the Javakheti highland, in the foothills of its western slope on the northeastern shore of Lake Paravani, is the extrusive dome of Chikiani (Koyundag). In the southwestern foothills of the highland, close to villages Aghvorik and Sizavet, is another small deposit of obsidian. The largest rhyolite complex in Armenia, the Arteni volcano, is located at the southwestern periphery of the Aragats highland. The sources of obsidian in the Tsaghkuniats ridge coincide with the rhyolite volcanoes of Damlik, Tumb, Ttvakar, Kamakar, Arkayasar, and Pstlik, located along the main axes of the ridge that extends from the northwest to southeast. Obsidian sources in the Gegham massif form two geographical groups: Hrazdan-Abovian (in the western foothills, coincident with the volcanoes of Gutansar, Fontan, Alapars, and Hatis) and Martuni (on the watershed in the southern part of the highland, which includes the volcanoes of Spitakasar and Geghasar). On the Vardenis massif obsidian is one product of the Khorapor volcano. The obsidian exposures of the Syunik massif coincide with the Mets Satanakar, Michnek Satanakar, Pokr Satanakar, Mets Sevkar, Pokr Sevkar and Bazenk volcanoes, which form the Vorotan (Sisian) group in the basin of the headwaters of the Vorotan River. Northeast of this group, in the upper course of the Tartar River, is the extrusive cupola of Merkasar (Kechaldag) which is related to the obsidian sources of the Kelbajar I and II groups. Obsidian exposures of the Zangezur ridge exposures are known from the Bardzratumb volcano.

Neolithic settlements in the Ararat valley

Five settlements, the materials of which are discussed in the present report (151 samples) *(Tab. 1)*, are located



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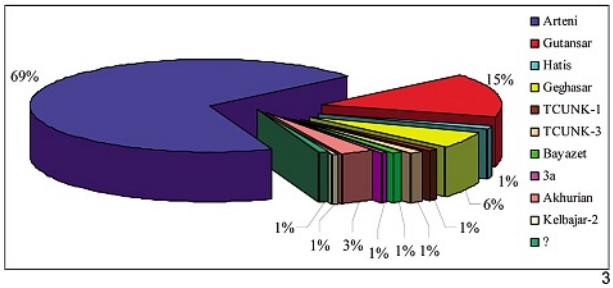
	Aratashen	Ada-blur	Mashtotsi-blur	Masisi-blur	Artashat	Total
Arteni	44	15	16	21		96
Gutansar	14	2	2	3	7	28
Hatis				2	5	7
Geghasar	3	2	2	1		8
Akhurian	4					4
TCUNK-3		1	1			2
TCUNK-1				1		1
Bayazet		1				1
3a	1					1
Kelbajar-2				1		1
?	1					1
Damlik					1	1
Total	**67**	**21**	**21**	**29**	**13**	**151**

2



3

Tab. 1. Neolithic settlements of the Ararat Valley (* - Numbering of the sites is in accordance with the map).

in various parts of the Ararat valley. Aratashen, Ada-blur and Mashtotsi-blur form a compact group in the lower reaches of the Kasakh River, while Masisi-blur is located a little farther to the east, and Artashat is found farther to the southeast *(Fig. 2)*.

The general principle for the exploitation of obsidian in all of the settlements mentioned above is the same: Each settlement simultaneously utilized raw materials from 3–6 sources. Basing in general upon the materials from this group of settlements, obsidians from 12 sources have been documented.[2]

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[1] Карапетян / Сагателян 1966, 458–482; Мкртчян 1971; Карапетян 1972; Keller / Seifried 1990, 57–87; Keller et al. 1996, 69–86; Blackman et al. 1998, 205–231; Oddone et al. 2000, 673-682; Badalian et al. 2001, 373–378; Karapetian et al. 2001, 189–220; Badalian et al. 2002, 15–18; Badalyan et al. 2004, 437–465.

[2] In the present study the obsidian sources are described according to the names given to them by the authors of the analyses. However, it is possible that future investigations of obsidian samples may show that the sources identified as 3a and Meidan Dag, 3a and Bayazet, and/or Akhurian and Kars may not represent distinct sources. As a result it is possible that the number of sources noted at present may decrease.

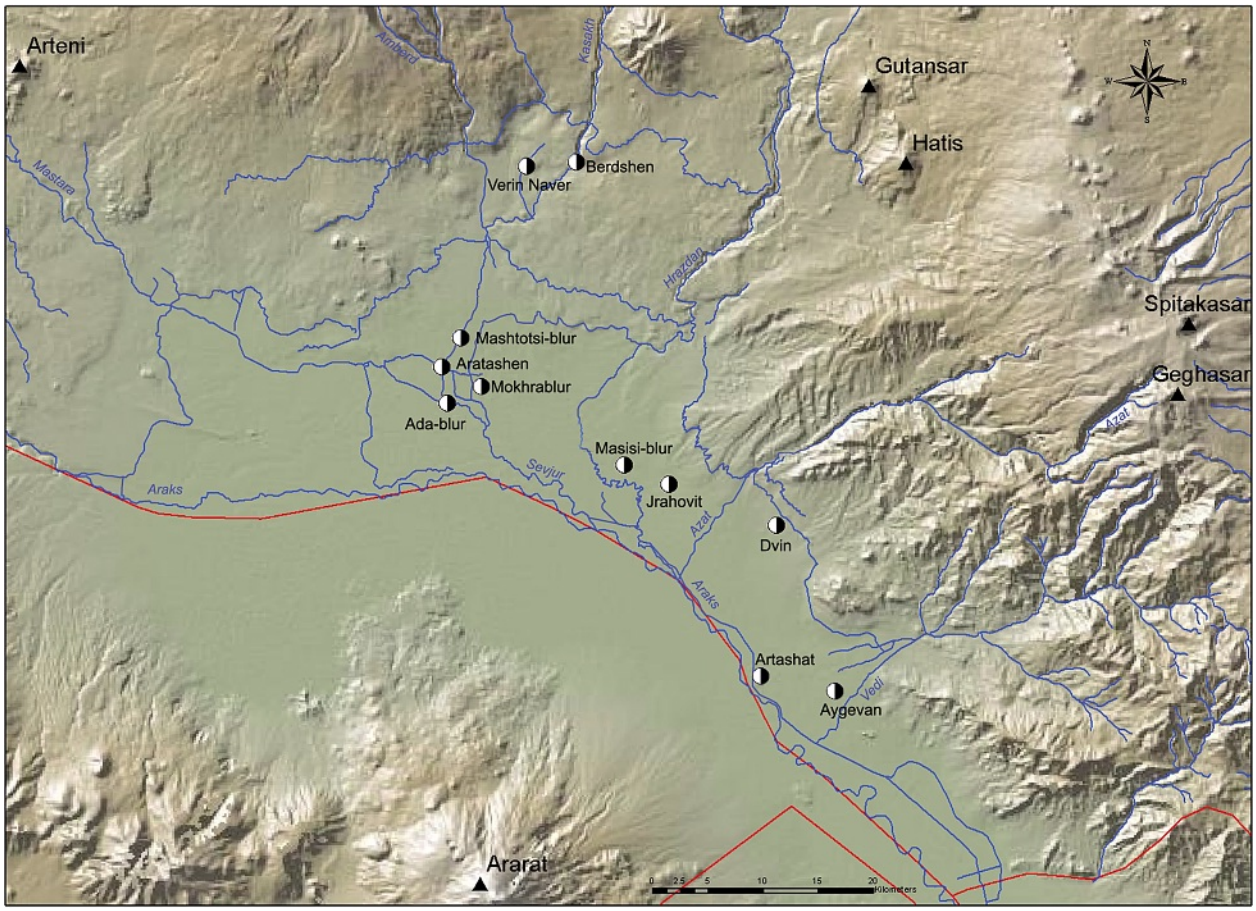


Fig. 2. Map of the Neolithic and Early Bronze Age settlements of the Ararat Valley and the Middle Bronze Age sites of Ashtarak.

However, the specific sources utilized vary in different parts of the valley.

For all of the settlements in the northern part of the valley (Aratashen, Ada-blur, Mashtotsi-blur, Masisi-blur), the main source was the Arteni deposit, 45–50 km to the northwest (Masisi-blur – 65 km). Obsidian from this source constitutes 65.7% to 76.2% (average – 69%) of the total assemblage. Sources at Gutansar, 40–50 km to the southeast (from 9.5 to 21%), and Geghasar, 50–65 km to the east (from 3.4 to 9.5%), were of secondary significance, representing 15% and 6% respectively of the total assemblage. In general, 91% of obsidian raw materials was obtained from a distance of 35–65 km (Arteni, Gutansar – Hatis, Geghasar). Obviously, the obsidian of the Hatis, Akhurian, Bayazet, 3a, Kelbadjar 2, TCUNK 1 and TCUNK 3 sources were incidental for the discussed sites *(Tab. 1,3)*.[3]

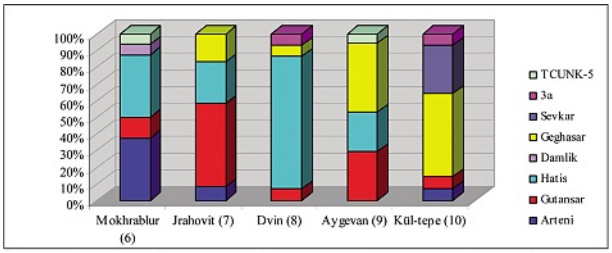
A different pattern of source exploitation is visible in the materials from Artashat. No raw materials from Arteni were found there; the predominant sources were the deposits of Gutansar and Hatis (a distance of 55 and 45 km from the site), which yielded respectively around 54% and 38.4% of obsidian.

Thus far, during the Neolithic period in the Ararat valley, two zones are clearly distinguishable: Sites in the northern part of the valley lie within the Arteni zone, while sites in the southeastern part belong to the zone of the Gutansar and Hatis sources.

Early Bronze Age settlements in the Ararat valley

A total of 86 obsidian samples from five Early Bronze Age settlements in the Ararat valley *(Fig. 2)* has been examined *(Tab. 2)*. Eight different sources were identified within this group of samples. Each settlement utilized obsidian from four to fife sources. For

[3] To the above mentioned deposits, the obsidian of which was brought to the settlements of the Ararat valley during the Neolithic period, should be added also the source of Nemrut "Southern", which was documented by the XRF analyses (J. Keller) of a single sample from the Neolithic (?) settlement close to Sardarapat (Бадалян 2002, 19).



	Mokhrablur	Jrahovit	Dvin	Aygevan	Kül-tepe	Total
Arteni	6	2			1	9
Gutansar	2	12	1	5	1	21
Hatis	6	6	12	4		28
Damlik	1					1
Geghasar		4	1	7	7	19
Sevkar					4	4
3a			1		1	2
TCUNK-5	1			1		2
Total	**16**	**24**	**15**	**17**	**14**	**86**

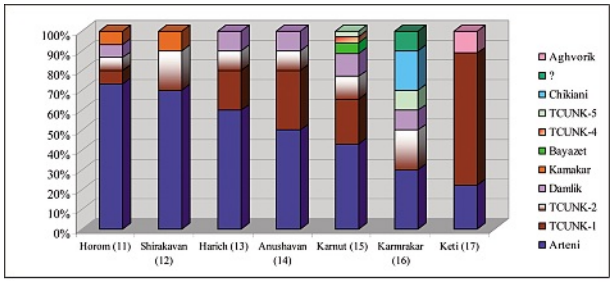
Tab. 2. Early Bronze Age settlements of the Ararat Valley.

Mokhrablur, Jrahovit, Dvin and Aygevan, the main sources were the deposits of Hatis and Gutansar (a distance of 32–40 km from the first three of these settlements). Interestingly, the percentage of obsidian from these sources increases in the sites from north to south (from 50% to 75%), reaching a maximum at Dvin (86.67%) and a minimum at Aygevan (almost 53%; 45–55 km from the sources), where the representation of Geghasar obsidian increases significantly (more than 40%; 40 km from the settlement). The Arteni source was of secondary importance for the population of Mokhrablur (37.5%); the raw materials from Damlik, 3a and TCUNK 5 were incidental to the settlements of the Ararat valley. Farther to the southeast, the raw materials of Geghasar (50%; in 110 km) predominate at Nakhijevan Kultepe, while the obsidian of the Satanakar–Sevkar source holds a secondary place (around 30%). Satanakar–Sevkar obsidians predominate within a zone significantly farther to the east, in Mughan steppe (Alikemektepesi is approximately 250 km from these sources). The obsidians of Arteni, Gutansar and source 3a are represented by single samples and, in the given context, seem to be incidental. Thus far, the settlements of Mokhrablur, Jrahovit, Dvin and Aygevan belong to the Gutansar and Hatis source zone; farther to the south the Geghasar source zone is evident from the remains of Nakhijevan Kultepe.

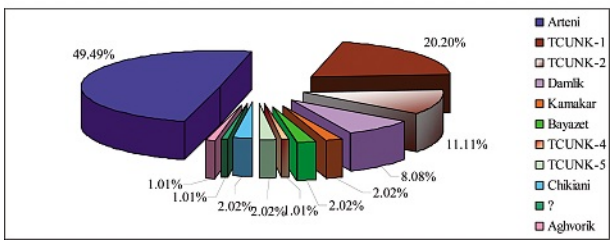
It is important to note that no Hatis obsidian was found in assemblages from the Neolithic settlements of the Kasakh River basin; yet, during the Early Bronze Age the obsidian of Hatis constituted more than one-third of the raw materials (Mokhrablur). Comparison of the data from the settlements of the Hrazdan River Basin – Neolithic Masisi-blur and Early Bronze Age Jrahovit – shows an almost identical list of exploited sources (Arteni, Gutansar, Hatis, Geghasar), with Arteni supplying the largest share of raw materials for Masisi-blur, and Gutansar and Hatis providing the majority of material for Jrahovit. In other words, the outlines of source zones during the Early Bronze Age were altered from the patterns established during the Neolithic period. Specifically, the Arteni zone was reduced, while the Hatis zone expanded to the southwest and to the south. At the same time a comparison of neighbouring Artashat and Aygevan shows considerable variation in the southern limit of the Gutansar–Hatis zone during the Early Bronze Age due to the intrusion of Geghasar raw materials. In addition, no obsidian from Tsaghkuniats ridge was documented in Neolithic sites of the Kasakh basin; during the Early Bronze Age one sample from Damlik was recorded in Mokhrablur.

Early Bronze Age settlements on the Shirak Plain

From seven settlements in the Shirak depression *(Fig. 3)*, 99 obsidian samples were examined *(Tab. 3)*. From the Early Bronze Age settlements of the region, a total of eleven obsidian sources were recorded. Each settlement utilized raw material from 3–7 sources. In general, the main obsidian source during the period was the Arteni volcano (around 50% of raw materials). Nevertheless, the representation of Arteni obsidian in the assemblages seems to decrease from south to north; in any case, Arteni was dominant (50–73.3%) only in the group of southern



	Horom	Shirakavan	Harich	Anushavan	Karnut	Karmrakar	Keti	Total
Arteni	11	7	6	5	15	3	2	**49**
TCUNK-1	1		2	3	8		6	**20**
TCUNK-2	1	2	1	1	4	2		**11**
Damlik	1		1	1	4	1		**8**
Kamakar	1	1						**2**
Bayazet					2			**2**
TCUNK-4					1			**1**
TCUNK-5					1	1		**2**
Chikiani						2		**2**
?						1		**1**
Aghvorik							1	**1**
Total	**15**	**10**	**10**	**10**	**35**	**10**	**9**	**99**



Tab. 3. Early Bronze Age settlements of the Shirak Plain.

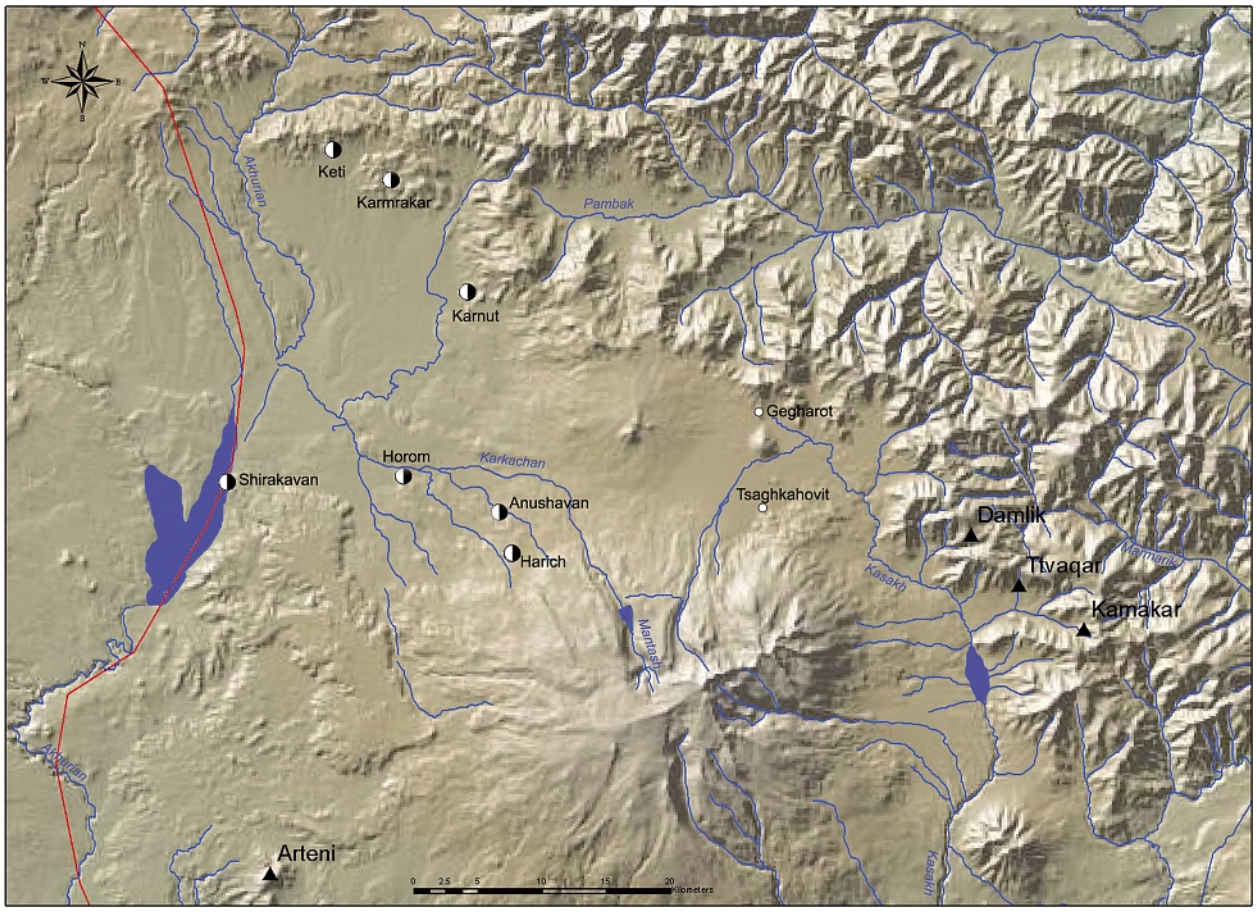


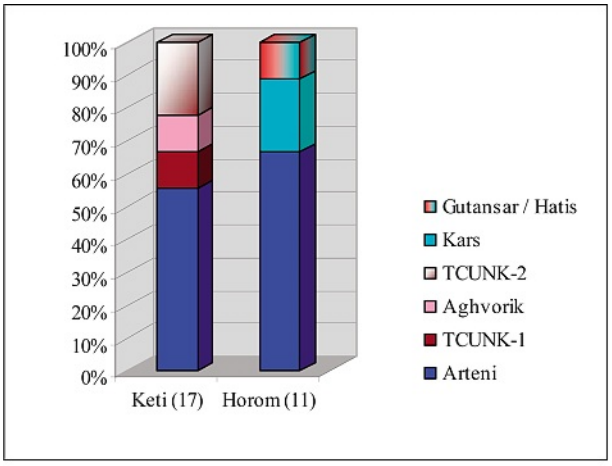
Fig. 3. Map of the Early Bronze Age settlements of the Shirak Plane and the sites of the Tsaghkahovit Plane.

sites, 32–35 km from the source (Horom, Harich, Anushavan, and Shirakavan), while farther north (a distance of some 50–60 km) obsidian from the Arteni source declines to 22–30% of the assemblages (Karnut, Karmrakar, Keti). The primary source for Keti was the unidentified deposit TCUNK 1 (66.7%). The obsidian of this deposit is secondary for the region in general (20%); the TCUNK 2[4] (11%) and Damlik (8%) sources belong to the same category. The deposits of Kamakar, Chikiani, Aghvorik, Bayazet, TCUNK 4 and TCUNK 5 are each represented by only 1–2 samples; they comprise in total 11% of the raw materials used by Shirak population.

Early Iron Age settlements on the Shirak Plain

Nine samples from the Early Iron Age layers of the settlements of Horom and Keti were analysed *(Tab. 4)*. The dominant source for the Horom population in this period remained the Arteni volcano (66.7%). Horom also provided the only sample from the Gutansar–Hatis source documented in a Shirak Plain site. Comparison of the Early Bronze and Early Iron Age samples from Keti demonstrated that

[4] The possible localization of the sources TCUNK 1 and TCUNK 2 is perhaps indicated by the role of the latter in obsidian supply of Southern Caucasus settlements. First, it must be mentioned that 91.3% of the obsidian from the TCUNK 1 group (21 samples out of 23) and 72.2% (13 samples out of 18) from the source TCUNK 2 were recorded in Shirak settlements. In general, the distribution of obsidian from both sources is characterized by a very high level of similarity, which consists first of all of paramount orientation to Shirak. The exploitation of these sources took place synchronously, which can be demonstrated by the simultaneous discoveries of obsidian from both groups in identical layers from the settlements of Horom, Harich, Anushavan and Karnut. The evident conclusion, firstly, is that both sources are located close to one another. Secondly, it is very likely that they can be found close to the Shirak border. These conditions point most strongly to the obsidian deposits of the Kars plateau (Бадалян et al. 1996, 262). It seems necessary to compare obsidian samples from TCUNK 1 and 2 (NAA by J. Blackman) with those from the Akhurian group (ICP-MS B. Gratuze) and to correlate them with the obsidian of Digor, which has Fission-Track parameters (G. Bigazzi) that are very close to those of obsidians from the Kars group.



	Keti	Horom	**Total**
Arteni	5	6	**11**
TCUNK-1	1		**1**
Aghvorik	1		**1**
TCUNK-2	2		**2**
Kars		2	**2**
Gutansar / Hatis		1	**1**
Total	**9**	**9**	**18**

Tab. 4. Early Iron Age settlements of the Shirak Plain.

the use of multiple sources remained constant, even while primary sources changed. By the Early Iron Age the significance of TCUNK 1 had decreased considerably (to 11.1%) and was replaced by raw materials of the Arteni deposit (55.5%).

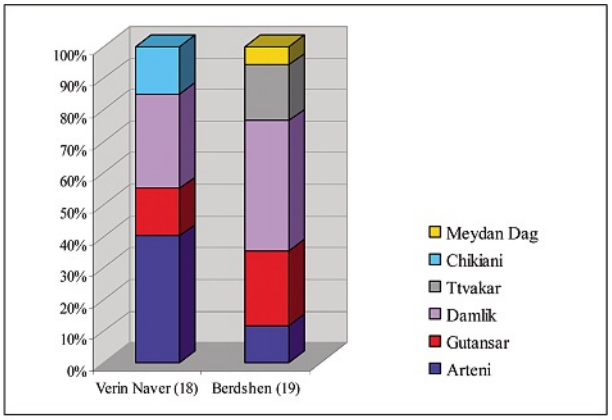
To date, an Arteni zone (Horom, Harich, Anushavan, Shirakavan) and a TCUNK 1 zone (Keti) are clearly evidenced in Early Bronze Age sites on the Shirak plain. During the Early Iron Age, by contrast, the vector of the predominant obsidian supply shifted from the TCUNK 1 source in the west to the Arteni source in the south; accordingly, during the Early Iron Age the Arteni zone expanded up to the northern border of Shirak plateau.

Middle Bronze Age sites of Ashtarak

The neighbouring sites of the Berdshen settlement and the cemetery of Verin Naver,[5] (at a distance of 3–4 km from each other) in the southeastern foothills of Mt. Aragats *(Fig. 2)*, represent a crossroads of the main communication routes, a fact clearly evident in the assortment of the analyzed obsidian. Thirty-seven analysed samples derive from six sources. The assemblage from Berdshen revealed raw materials from five sources, while the Verin Naver materials came from four sources *(Tab. 5)*. The primary sources of obsidian raw materials are different at each site: At Varin Naver, Arteni obsidian (around 50 km from the site) is dominant (40%), while at Berdshen, farther to the east at the edge of the canyon of the Kasakh River, raw material from the Tsaghkuniats ridge sources Damlik and Ttvakar (58.83%) (37–33 km) predominates. Secondary sources for Verin Naver appear to have been Damlik (30%) and Gutansar (15%); the obsidian of Chikiani, which quantitatively is equal to Gutansar obsidian, was recovered in only one burial (No. 34) and is most probably incidental (140 km). In total, 85% of the raw materials was brought to Verin Naver from a distance of 30–50 km. For Berdshen the primary and secondary sources, which yielded 94.12% of the raw material, are also located at a distance of 30–50 km. The deposit of Meidan Dag, which yielded the only, and certainly an incidental sample, is located in 170 km from the site.

Sites of the 2nd millennium B.C. in the Sevan Lake basin

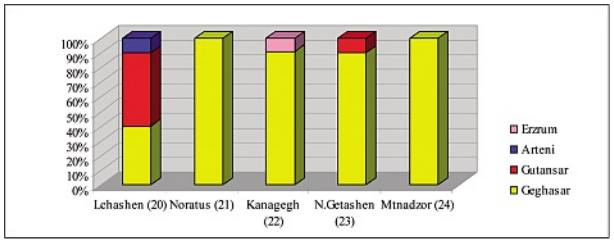
A total of 48 samples of obsidian from five settlements on the western and southwestern shores of the Lake Sevan basin were examined *(Tab. 6)*. The analyzed series reflect various strategies for obtain-



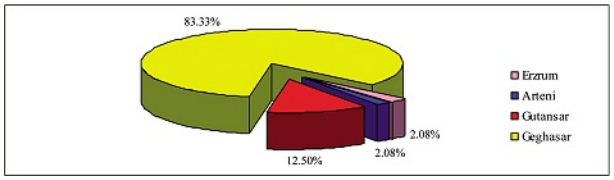
	Verin Naver	Berdshen	**Total**
Arteni	8	2	**10**
Gutansar	3	4	**7**
Damlik	6	7	**13**
Ttvakar		3	**3**
Chikiani	3		**3**
Meydan Dag		1	**1**
Total	**20**	**17**	**37**

Tab. 5. Middle Bronze Age sites of Ashtarak.

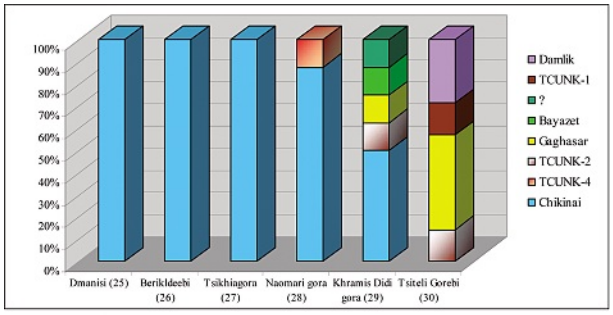
[5] Summary data for the burials 12, 34, 40, 41 and 52 are given in *Table 5*. The most complete pattern is demonstrated by the burial 34 (12 samples), which contained samples of all four sources determined on the site.



	Lchashen	Noratus	Kanagegh	N.Getashen	Mtnadzor	Total
Geghasar	4	10	10	9	7	40
Gutansar	5			1		6
Arteni	1					1
Erzrum			1			1
Total	**10**	**10**	**11**	**10**	**7**	**48**



Tab. 6. Sites of the 2nd millennium B.C. of the Sevan Lake Basin.



	Dmanisi	Berikldeebi	Tsikhia-gora	Naomari gora	Khramis Didi gora	Tsiteli Gorebi	Total
Chikiani	8	14	8	14	4		48
TCUNK-4				2			2
TCUNK-2					1	1	2
Geghasar					1	3	4
Bayazet					1		1
?					1		1
TCUNK-1						1	1
Damlik						2	2
Total	**8**	**14**	**8**	**16**	**8**	**7**	**61**

Tab. 7. Sites of Eastern Georgia.

ing obsidian, which were conditioned first of all by the geographical locations of the sites. At Lchashen, which connects the Hrazdan river valley with the western shore of the lake, raw materials from three sources were recorded, the most dominant of which, at almost equal levels (50–40%) were the deposits of the Gegham ridge: Gutansar and Geghasar (27 and 45 km from the site, respectively). Represented by a single sample, Arteni should be attributed to the category of incidental finds. From the remaining sites, enclosed in the narrow defile between the Gegham ridge and the lake, the obsidian of Geghasar (34 km from Noratus, 23–25 km from the rest of the sites) is either the only raw material, or it is found in association with individual samples from other sources. Among the latter we should mention a sample found in the burial No. 5/2 of the Early Iron Age cemetery of Kanagegh, which came from Erzerum, 320 km to the west.

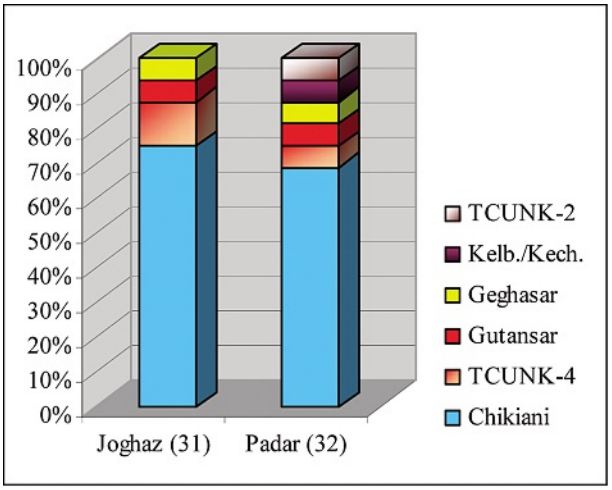
Sites in Eastern Georgia

Materials from fifteen sites in western and eastern Georgia demonstrate two principal ways of exploiting obsidian raw materials;[6] the most characteristic examples (six settlements with a comparatively representative sample size – 61 samples) are provided in *Table 7*. On the one hand, a series of diachronic settlements, including Late Neolithic Dmanisi, Early Bronze Age Berikldeebi and Early Bronze Age Tsikhiagora (as well as Anaseuli I, Kobuleti, Samele Klde, Akhali Zhinvali, Abanoskhevi, Arukhlo, Dzhavakhi, a series which is statistically less reliable with only 4–7 samples) utilized obsidian from a single source: the Chikiani volcano (at a distance of 35, 65 and 70 km, respectively). On the other hand, the Neolithic settlement of Khramis Didi Gora, the Chalcolithic site of Tsiteli Gorebi and the Early Iron Age site Naomari Gora (Udabno I as well as Anaseuli II and Zhinvali) utilized raw materials from 2–5 sources. While the obsidian of Chikiani constituted a significant majority at Naomari Gora and Khramis Didi Gora (at a distance of 125 and 95 km respectively; accordingly 87.5 and 50%), this source has not been recorded at Tsiteli Gorebi yet.

There are interesting similarities in the obsidian consumption at Khramis Didi Gora and that of both the Early Bronze Age settlement of Joghaz in northeastern Armenia (basin of the Aghstev River) and the Late Chalcolithic–Early Bronze Age settlement of Padar in northwestern Azerbaijan (Alazani River basin) *(Tab. 8)*. At Joghaz four obsidian sources were noted, while at Padar six sources were documented; in both cases the raw material of Chikiani predominates (accordingly 75and 68.75%, 130 and 230 km). It should also be noted that a list of sources recorded at each site is partially similar (Gutansar, Geghasar, TCUNK 4).

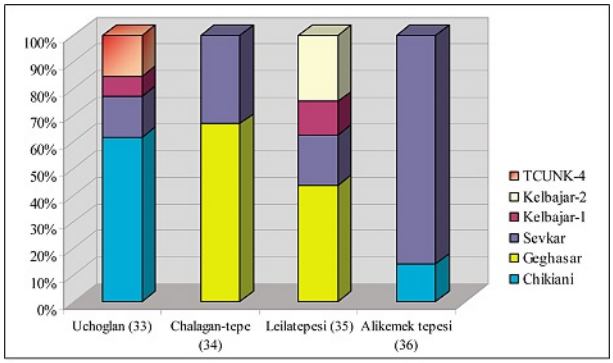
However, comparison of sites in the Alazani River basin – Tsiteli Gorebi and Padar – reveals significant differences in their connections: Whereas Padar belongs to the Chikiani zone, Tsiteli Gorebi is oriented more toward the sources of the Gegham and Tsaghkuniats ridges and probably the Kars plateau.

[6] Badaljan et al. 2003, 162;170.



	Joghaz	Padar	Total
Chikiani	12	11	**23**
TCUNK-4	2	1	**3**
Gutansar	1	1	**2**
Geghasar	1	1	**2**
Kelb./Kech.		1	**1**
TCUNK-2		1	**1**
Total	**16**	**16**	**32**

Tab. 8. Joghaz and Padar settlements.



	Uchoglan	Chalagan-tepe	Leila-tepesi	Alikemek tepesi	Total
Chikiani	8			1	**9**
Geghasar		4	7		**11**
Sevkar	2	2	3	6	**13**
Kelbajar-1	1		2		**3**
Kelbajar-2			4		**4**
TCUNK-4	2				**2**
Total	**13**	**6**	**16**	**7**	**42**

Tab. 9. Neolithic-Chalcolithic sites of Mil-Karabakh and Mughan Steppes.

Neolithic-Chalcolithic sites in the Mil-Karabakh and Mughan Steppes

For the settlements of Uchoghlan, Chalaghan-tepe and Leilatepesi in the Mil-Karabakh steppe, the obsidian industry dominates the lithic assemblage, while at Alikemektepesi (Mughan steppe) the flint industry is more characteristic (78.3%; obsidian makes 21.7%).[7] According to the results of analyses of 35 obsidian samples from these three sites *(Tab. 9)* it is evident that each used raw materials from 2–4 sources; nevertheless, although located relatively close to one another, these sites used different deposits as their dominant source.

At the settlement of Uchoghlan, Chikiani obsidian (found 320 km from the site) predominates (61.5%), while the closer sources of the Syunik massif (approximately 130 km away) provided only 23% of the raw materials. It is evident that Uchoghlan's obsidian consumption is more similar to that of Padar and Joghaz; these settlements also include obsidian from the TCUNK 4 group, which is not yet recorded at other sites in the Mil-Karabakh and Mughan steppes.

The settlements of Leilatepesi and Chalaghan-tepe, located somewhat to the south of Uchoghlan, used the obsidian of Geghasar and the sources of the Syunik massif (in a summary account, an equal number of samples). Based upon the available data, Chalaghan-tepe should be attributed to the Geghasar zone, while Leilatepesi belongs to the Syunik massif zone (in Chalaghan-tepe the raw materials of Geghasar comprise 66.7%, while the sources of Syunik amount to 33.3%; in Leilatepesi Geghasar obsidians comprise 43.75% of the assemblage, those from Syunik massif equal 56.25%). Further analyses will determine their ascription more precisely.

The series of results from the settlement of Alikemektepesi consists almost entirely of obsidian of the Satanakar/Sevkar source (85.7%); the only sample from Chikiani evidently is an incidental, which was brought here most probably from Uchoghlan.

Summarizing these ideas, we will try to describe the use of obsidian by the inhabitants of various regions of the Southern Caucasus during the 6th–2nd/1st millennium B.C. first as a system of "zones of domination" – geographical regions, within which obsidian of a given source constitutes the majority of obsidian raw materials *(Fig. 4)*. It should be mentioned, that the zones described below are for the time being simply geographical terms and include sites of various ages. As we gather more analyses it should be possible to specify the borders of each zone for a given cultural-chronological period.

The Arteni Zone extends to the southeast and the north from the source; the sites to the north of Ararat plain (lower Kasakh River basin) and in the Shirak depression, a radius of around 60 km from the source, belong to this zone.

The sites in the eastern part of Ararat plain and the northwestern shore of the Lake Sevan belong to the zone of the Hrazdan–Abovian group (Gutansar

[7] Аразова 1974, 21.

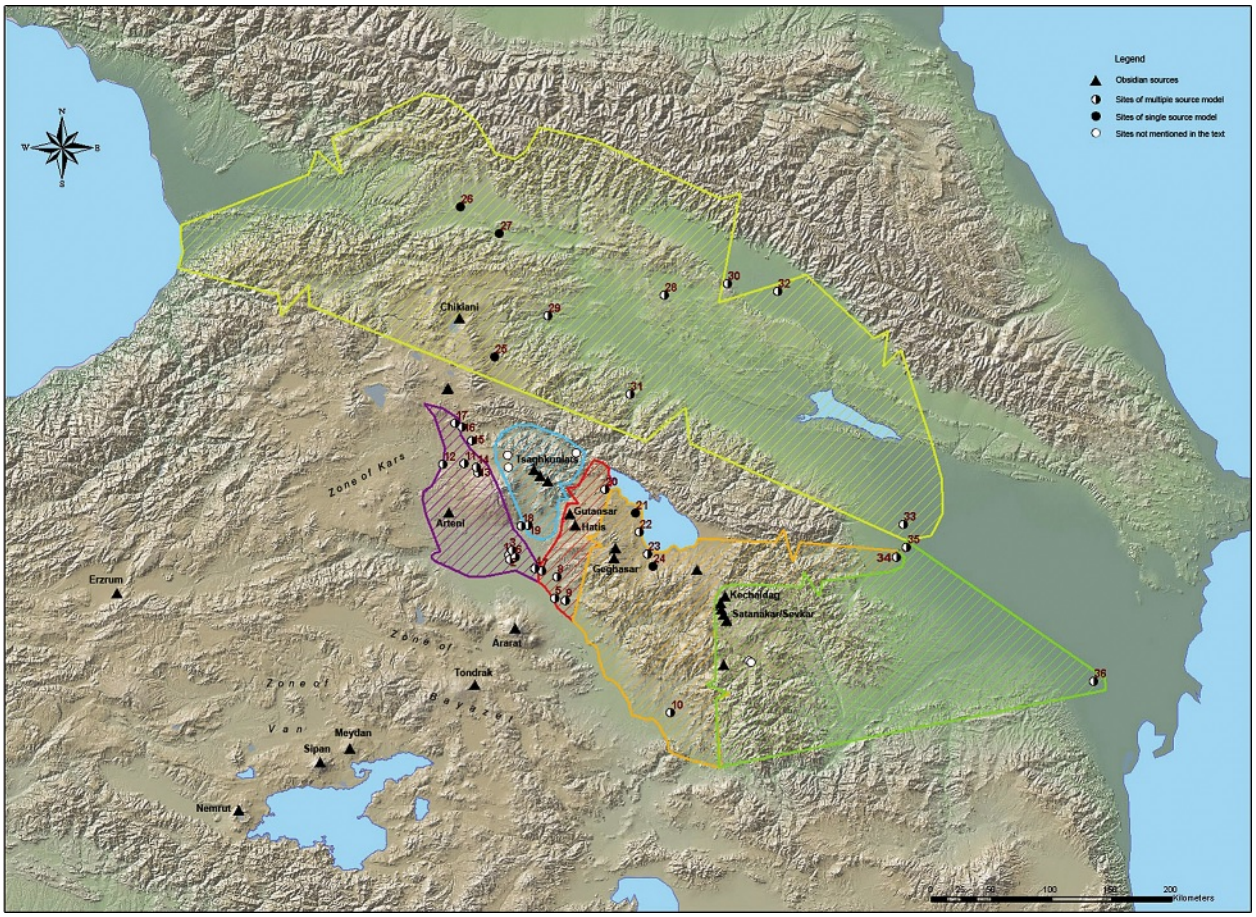


Fig. 4. Map of the "zones of domination" of the South Caucasian/North-Eastern part of the Armenian Highland, obsidian sources.

and Hatis) of sources, which extends for 50–60 km from the sources. It should be taken into account that the division of this zone into two sub-zones of Gutansar and Hatis will be possible in future; the latter source seems to be already associated with the settlement of Dvin. Between the zones of Arteni and the Hrazdan–Abovian group is the zone of the Tsaghkuniats ridge sources, which includes the sites of the Pambak ridge (upper Aghstev River), Tsaghkahovit and Aparan valleys (upper and middle Kasakh River basin) at a distance of 15–40 km from the sources. East of the Hrazdan–Abovian group's zone, the Geghasar zone extends to the north, including sites on the western and southwestern shores of the Lake Sevan to Nakhijevan Kultepe (110 km from the source) in the south, to the settlement of Chalaghan-tepe to the east in the Karabakh plain (around 185 km from the source).

At present the zone of the Vorotan/Sisian group of sources represents a region that extends to the east and south from the sources. The eastern extent of the zone is marked by the settlement of Alikemektepesi in the Mughan steppe, 250 km from the sources. It is likely that later it will be possible to divide this group into two sub-zones: a northern Merkasar (Kechaldag) zone and a southern Satanakar/Sevkar zone.

This mosaic pattern changes farther to the north, where we find the vast homogenous Chikiani zone, which occupies the main part of the Kura River basin and spreads, according to the available data, from southern Colchis (Kobuleti, Anaseuli) to the northern reaches of the Mil-Karabakh steppe (Uchoghlan). In the northwest it extends at least as far as the Rioni River basin, while on the northeast it includes the Alazani River basin.

The borders of the zones appear to have changed over time (as discussed above, during the Early Bronze Age the Hatis zone expanded to the southwest and south in place of the zone of Arteni, while during the Early Iron Age the Arteni zone expanded northwards into what had been the zone of TCUNK 1). Nevertheless, it is evident that the sizes and configurations of the various zones were conditioned first of all by the coordination of sources. The internal zones – Arteni, Tsaghkuniats, Gutansar–Hatis are not large, encompassing 20 to 60 km (it appears that to the west and south the Arteni, Gutansar–Hatis and Geghasar zones are limited by the postulated zones around the sources on the Kars plateau

and in Bayazet–Ararat/Tondrak). By contrast, the external zones – Chikiani (which seems in turn to be limited to the north by the zone of the Baksan–Chegem sources), Satanakar/Sevkar extend across areas of 200–250 km expanse or more. The flanks of these zones both to the west (Anaseuli, Kobuleti) and to the east (Alikemektepesi) already interdigitate with flint industry zones. The geographic asymmetries visible for various zones are evidently conditioned by the locations of sources. Asymmetries tend to be minimal in the direction of a neighbouring source and maximal in directions, where there are no other sources. In fact, the internal zones in general correspond to the volcanic massifs.

Secondly, as is obvious from the above, settlements of the Southern Caucasus from the 6th–2nd/1st millennium B.C. practiced two main principles of obsidian exploitation. The first consisted of the simultaneous use of 3–6 sources with the domination of a single source (50–80%). This poly-source model[8] is recorded, in particular in the Neolithic and Early Bronze Age settlements of the Ararat valley, the Early Bronze Age and Early Iron Age settlements of Shirak, the Early Bronze Age settlement of Joghaz in northeastern Armenia, the Middle Bronze Age site of Ashtarak, the Late Bronze Age complex of Lchashen, the Neolithic–Chalcolithic settlements of the Mil-Karabakh steppe, the Late Chalcolithic Early Bronze Age settlement of Padar, Neolithic Khramis Didi Gora in Kvemo Kartli and Chalcolithic Tsiteli Gorebi in Kakheti.

The second single-source principle of obtaining of obsidian consists of an extreme orientation to one source of raw material.[9] This situation was recorded at sites in the Chikiani–Dmanisi (Kvemo Kartli) zone, including Berikldeebi and Tsikhiagora (Shida Kartli) and Noratus and Mtnadzor[10] of the Gehgasar zone in the Sevan basin. In other words, the sites in which the population practiced a single-source model of consumption are localized on the periphery of sources, within a radius of 25–35 km, lengthened maximally to 65–70 km.

To date, each of these models has been observed during the entire period in question: the 6th–2nd/1st millennium B.C. In other words, during any epoch synchronous (single-cultured) societies of various regions of the Southern Caucasus practiced various principles of obtaining of obsidian. As a rule, the primary source was the closest deposit, although Uchoghlan and Tsiteli Gorebi show the possibility of exceptions. In general, this pattern demonstrates that the primary principles for obtaining of raw materials arose first and foremost in response to geological-geographical realities.

Changes in the dominant sources recorded in a series of multi-layered sites (Keti) and alterations in the geographic outlines of zones were most likely the result of a number of factors, many of which may have been only marginally connected to economical activity. It is possible that the reasons for changes in dominant sources lay in cultural, political and economical changes that must be explained in the context of a given historical situation.

Apparently to be considered in the same context are the samples found at various sites (Sardarapat, Aratashen, Ada-blur, Nakhichevan Kultepe, Khramis Didi gora, Karnut, Dvin, Berdshen, Kanagegh), which come from sources in the western regions of the Armenian Highland (Erzrum, Nemrut, Meydan-Dag, 3a, Bayazet). The unique nature of these finds at the sites, a total of only 1.6% of the given material, allows us to consider them as not the product of strict economic motivations, but rather representative of an intrusion that occurred as a result of contacts not directly related to the obsidian trade. Part of these samples was found in the Neolithic–Chalcolithic settlements in association with Halaf and Ubaid pottery. Evidently in this case the infiltration of obsidian to the northeast took place alongside the importation of ceramics to settlements in the Southern Caucasus. The sporadic character of this diffusion of samples from local sources outside their main area may depend upon various aspects of relations between the regions of the Armenian Highland and the Southern Caucasus.

Acknowledgments

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[8] Бадалян 2001, 37.

[9] Бадалян 2001, 36.

[10] A similar situation is observed also in Siunik: All of the sixteen samples from three diachronic sites investigated by the Fission-Track method by G. Bigazzi, are located in a comparatively compact area around the Sisian city (Karkarer, epi-Palaeolithic? – 6 samples; Sisian I and II, Middle Bronze Age – 6 samples [duplicated by J. Keller NAA]; Zorakarer, undated, 2nd–1st mill. B.C. – 4 samples) and come from the source of Satanakar/evkar.

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Summary

During the last 20 years in the framework of several international projects a systematical investigation of the obsidian sources of the Caucasus and the distribution of the raw materials in the Neolithic – Early Iron Ages was realized. The investigations were conducted by the NAA, XRF, ICP-MS, and FT methods.

In the present report data of 34 archaeological sites of the 6^{th} – 2^{nd}/1^{st} mill. B.C. from various regions of the Southern Caucasus are summarized. The results of analyses of 536 artifacts allowed determining the main principles of the obsidian quar-

rying. Two models are evident – poly-source (multiple-source) and mono-source (single-source). In the first case the matter concerns the consumption of the raw materials from 3–6 deposits with domination (50–80%) of one of them; the second principle concerns the extreme orientation to a single obsidian source.

The poly-source model is characteristic of the Neolithic – Chalcolithic, Early and the Middle Bronze Ages settlements of the Ararat valley, the Early Bronze Age of the Shirak plain, as well as the Neolithic – Chalcolithic settlements of the Mil – Karabakh steppe.

The mono-source model is typical, in particular, for the majority of the Neolithic – Early Bronze Age settlements of the Eastern Georgia, a significant part of the Middle-Bronze – Early Iron Ages sites of the Lake Sevan basin, as well as the sites of Syunik. The sources of the obsidian were the volcanoes Chikiani (Djavakheti range), Geghasar (Gegham range) and Pokr Sevkar (Syunik range).

Резюме

За последние 20 лет в рамках ряда международных проектов было проведено систематическое масштабное исследование источников обсидиана Кавказа и северо-восточной части Армянского нагорья и распространения сырья в неолите – раннем железном веке с применением различных аналитических техник (около 1300 анализов). В настоящем сообщении по данным анализов 574 артефактов с 36 памятников 6.–2./1. тыс. до н.э. рассматривается потребление обсидиана населением различных областей Южного Кавказа.

Потребление обсидиана описано, во-первых, в виде системы "зон доминирования" – географических областей, на памятниках которых обсидиан того или иного источника составляет большинство (50% и более) обсидианового сырья. Границы зон, видимо, несколько менялись во времени. Однако в целом очевидно, что размеры и конфигурация зон обусловлены в первую очередь взаимным расположением источников. Внутренние зоны – Артени, Цахкуняц, Гутансар – Атис – невелики – 20–60 км, в то время как внешние зоны – Чикиани, Сатанакар – Севкар – протягиваются на 200–300 и более км. Фланги этих зон, как на западе (Анасеули, Кобулети), так и на востоке (Аликемектепеси), уже перекрывают зоны кремневой индустрии. По существу, внутренние зоны в основном соответствуют вулканическим нагорьям.

Во-вторых, при описании потребления обсидиана следует учитывать, что население Южного Кавказа в 6.–2./1. тыс. до н.э. практиковало два основных принципа получения сырья, причем оба прослеживаются на протяжении всего рассматриваемого периода. Первый из них – полиисточниковая модель – заключался в одновременном использовании 3–6 источников при доминировании (50–80%) одного. Второй – моноисточниковый – принцип получения обсидиана состоит в исключительной ориентации на один источник сырья. В целом, вышеописанная картина свидетельствует о детерминированности основных принципов получения сырья в первую очередь геолого-географическими реалиями.

Зафиксированные факты смены доминирующих источников и обусловленное этим изменение контуров зон, скорее всего, были порождены целым набором факторов, часть которых, быть может, лишь косвенно связана с данным аспектом экономической деятельности. Вероятно, причины смены доминирующего источника заключаются в изменении культурной, политической, экономической коньюктуры и должны быть обьяснены в контексте конкретной исторической ситуации.

В этом же контексте, очевидно, следует рассматривать встречающиеся на ряде памятников образцы, происходящие из источников западных областей Армянского нагорья. Единичность этих находок на памятниках, составляющих в целом лишь около 1,6% приведенного материала, позволяет считать их экономически не мотивированными; скорее всего, проникновение последних происходило в рамках контактов, не связанных непосредственно с обсидиановой торговлей. Часть этих образцов обнаружена на неолит – энеолитических поселениях в ассоциации с халафской и убейдской керамикой; очевидно, в данном случае инфильтрация обсидиана на северо-восток имела место в русле поступления импортной керамики на поселения Южного Кавказа.