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POLYSOURCE PROCUREMENT AT NAKHCHIVAN TEPE (AZERBAIJAN, CHALCOLITHIC): FIRST INSIGHTS INTO THE OBSIDIAN CONSUMPTION PATTERNS OF A DALMA SITE RECENTLY DISCOVERED IN THE SOUTHERN CAUCASUS

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Abstract: Obsidian sourcing studies in the Caucasus have long focused on the modern Armenian territory, at the expense of other areas. Although excavation campaigns are multiplying in Western Azerbaijan, thus completing our knowledge of the prehistoric populations of the region, few data are available on the obsidian consumption patterns of Nakhchivan, an autonomous republic part of Azerbaijan that is landlocked between Armenia, Turkey, and Iran. This small region of 5,500 km² is however of prime interest for the reconstitution of past trade networks, given its strategic location at the crossroads of north-south and east-west circulation axes and its well-known copper deposits, rich summer pastures, and numerous water sources. Understanding the raw material consumption patterns in this region seems essential if we are to grasp the broader economic processes that existed in the Caucasus between the Neolithic and the Bronze Age. This is one of the aims of two recent research projects conducted in the region: PAST-OBS (LaScArBx LabEx, dir. F.-X. Le Bourdonnec) and SCOPE (University of New England, dir. M. Orange). In this paper, we focus on one particular site, Nakhchivan Tepe, which is located in a strategic position not far from the confluence of the Naxçıvançay and the Araxes rivers: the evidence suggests that this site may have had a specific function in the trade networks of the Chalcolithic period.

Keywords: *Caucasus, Chalcolithic, Dalma, obsidian consumption, provenance studies*

***Nakhchivan Tepe: a Chalcolithic site on
the Araxes River***

Nakhchivan River (39.1816°N 45.4317°W, **Fig. 1., Fig. 2.**), and culminating at 853m above sea level.

Nakhchivan Tepe is a small settlement (ca. 2 ha) located in the south-eastern outskirts of Nakhchivan city, on the right bank of the



Fig. 1.: Main sites and obsidian sources cited in the text.



Fig. 2.: Satellite view of the area locating the site of Nakhchivan Tepe and composite plan of the excavated area. G. Gadebois (INRAP).

Table 1: Radiocarbon dates obtained from the Nakhchivan Tepe site (occupation layer 2). Calibration based on OxCAL v4.3.2 Bronk Ramsey (2017) and r:5 intCal13 atmospheric curve (Reimer et al., 2013).

Occupation layer	Cultural chronology	Field ID	Lab ID no.	Average C-14 Age $\pm 1\sigma$ year BP	$\delta^{13}\text{C}$ (‰)	Calibrated Range $\pm 2\sigma$
2	Chalcolithic	NA-2018-1165	LTL18624A	5724 \pm 45	-20.3 \pm 0.1	4686-4464 BC
2	Chalcolithic	NA-2018-1179	LTL18625A	5777 \pm 40	-23.1 \pm 0.5	4720-4529 BC

The excavations directed by V. Bakhshaliyev led to the discovery of four occupation layers, ranging from the Neolithic to the Chalcolithic period¹. The material analysed in the present study comes from the two uppermost layers, labelled downwards 1 and 2. Occupation layer 1 is characterized by rectangular buildings made of mud bricks; it is dated, by comparison with other settlements, to approximately 4600-4400 cal. BC².

The pottery recovered from this layer exhibits marked similarities with contemporary sites located in North-western Iran, such as Dalma Tepe³. Occupation layer 2 provided charcoal samples radiocarbon dated to the 4720-4464 cal. BC range (2σ ; LTL18624A: 5724 \pm 45 BP, LTL18625A: 5777 \pm 40 BP; **Table 1.**). This level is characterised by hearths and semi-subterranean dwellings; the pottery corresponds to an early stage of the Dalma Tepe culture and represents so far the northernmost example of Dalma pottery known in the South Caucasus, and thus its northernmost border of distribution. Concerning the subsistence strategies, both layers are characterised by a clear pastoral activity based on the herding of cattle, sheep, and goats. However, with its high proportion of cattle (around 45% of the total number of identified remains) compared with sheep and goats, Nakhchivan Tepe stands apart from the other Chalcolithic settlements located in the vicinity⁴. The evidence for hunting is minimal.

Materials and Methods

The analyses on the obsidian artefacts were conducted by portable XRF [pXRF] in the field

house of the Kültepe I excavations, which is located in the village of Kültepe (province of Babek, Nakhchivan), in August 2017. The instrument is a Bruker Tracer III-SD from Southern Cross University. We quantified a set of ten elements using the MURR obsidian calibration⁵: Mn, Fe, Zn, Ga, Th, Rb, Sr, Y, Zr, and Nb. Each sample was measured once for 180 seconds (40 Kv, 39 μA), using the green filter (0.006" Cu, 0.001" Ti, 0.012 Al). Several standards were analysed at the beginning and end of each run to ensure the repeatability, accuracy, and precision of our measurements. Before analysis, the samples were cleaned in an ultrasonic bath and rinsed thoroughly with water to remove any attached soil. In total, 38 samples were characterised, and their geochemical fingerprints compared with those of geological samples originating from a selection of sources that could be expected in this region, following previous provenance studies⁶.

Results

The results obtained by pXRF analysis on these samples show the presence of six different compositional groups. A visual discrimination of these groups is presented in **Fig. 3.**, comparing the (Nb/Y), (Sr/Y), (Zr/Y), and (Rb/Y) log ratios⁷ of the artefacts with those of geological samples from the Caucasus and Eastern Anatolia. The comparison of zirconium and thorium contents measured on the artefacts and twenty-five geological samples from the Gegham source (Geghasar and Spitaksar outcrops) is illustrated in **Fig. 4.**

¹KULIYEVA & BAHŞELIYEV 2018, BAXŞƏLIYEV et al. 2018, BAXŞƏLIYEV et al. 2019.

²BAXŞƏLIYEV et al. 2019:88.

³HAMLIN 1975.

⁴BERTHON 2014, BERTHON et al. *in press*.

⁵GLASCOCK & FERGUSON 2012.

⁶e.g. BADALYAN 2010, CHATAIGNER & GRATUZE 2014.

⁷AITCHISON 1986.

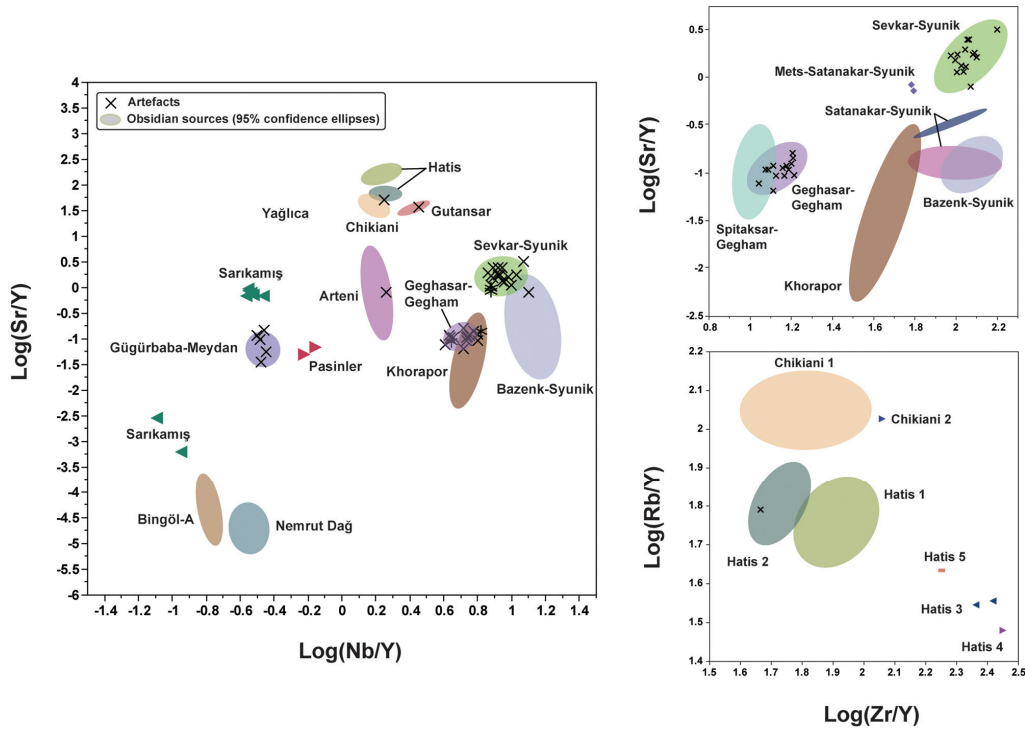


Fig. 3.: Comparison of the (Nb/Y), (Sr/Y), (Zr/Y) and (Rb/Y) log-ratios obtained by portable XRF on the samples from Nakhchivan Tepe and geological samples from the Caucasus and Eastern Anatolia. 95% density ellipses.

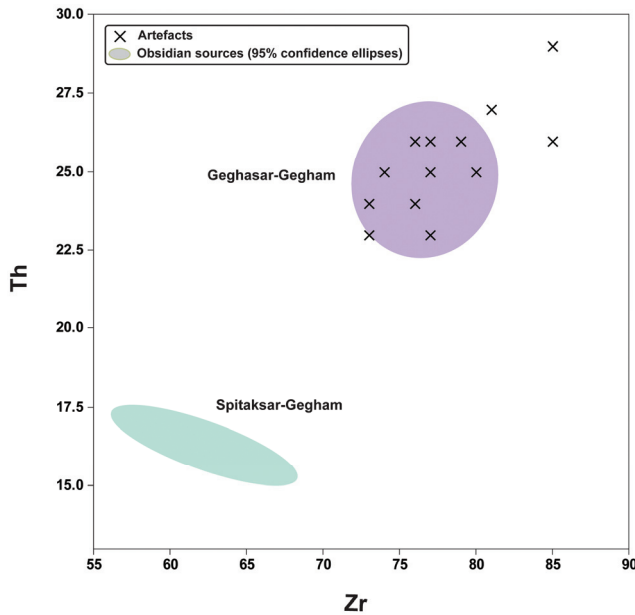


Fig. 4.: Comparison of the zirconium and thorium contents obtained on 13 artefacts from Nakhchivan Tepe and the 25 geological samples of the Gegham source (Geghasar and Spitaksar outcrops).

Table 2.: Final provenance summary, by occupation layer, for the obsidian artefacts of Nakhchivan Tepe.

Occupation layer	Sevkar-Syunik	Gegham	Gügürbaba-Meydan	Gutansar	Hatis	Arteni	Total
1	6	3	0	1	0	1	11
2	10	11	5	0	1	0	27
Total	16	14	5	1	1	1	38

Table 3.: Final provenance attribution by artefact, based on the results obtained by portable XRF.

Occupation layer	Excavation	Context	Artefact reference	Provenance
Occupation layer 1	NA'17	1044	PAST-OBS-2017_00709	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00711	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00712	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00713	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00714	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00715	Geghasar-Gegham
	NA'17	1044	PAST-OBS-2017_00716	Sevkar-Syunik
	NA'17	1044	PAST-OBS-2017_00718	Geghasar-Gegham
	NA'17	1044	PAST-OBS-2017_00719	Geghasar-Gegham
	NA'17	1044	PAST-OBS-2017_00717	Gutansar
	NA'17	1044	PAST-OBS-2017_00710	Arteni
Occupation layer 2	NA'17	1073	PAST-OBS-2017_00722	Sevkar-Syunik
	NA'17	1073	PAST-OBS-2017_00726	Sevkar-Syunik
	NA'17	1073	PAST-OBS-2017_00728	Sevkar-Syunik
	NA'17	1073	PAST-OBS-2017_00729	Sevkar-Syunik
	NA'17	1073	PAST-OBS-2017_00721	Geghasar-Gegham
	NA'17	1073	PAST-OBS-2017_00723	Geghasar-Gegham
	NA'17	1073	PAST-OBS-2017_00724	Geghasar-Gegham
	NA'17	1073	PAST-OBS-2017_00727	Geghasar-Gegham
	NA'17	1073	PAST-OBS-2017_00720	Gügürbaba-Meydan
	NA'17	1073	PAST-OBS-2017_00730	Gügürbaba-Meydan
	NA'17	1073	PAST-OBS-2017_00731	Gügürbaba-Meydan
	NA'17	1073	PAST-OBS-2017_00725	Hatis 2
	NB'17	2066	PAST-OBS-2017_00700	Sevkar-Syunik
	NB'17	2066	PAST-OBS-2017_00702	Sevkar-Syunik
	NB'17	2066	PAST-OBS-2017_00703	Sevkar-Syunik
	NB'17	2066	PAST-OBS-2017_00696	Gügürbaba-Meydan
	NB'17	2066	PAST-OBS-2017_00698	Gügürbaba-Meydan
	NB'17	2066	PAST-OBS-2017_00695	Geghasar-Gegham
	NB'17	2066	PAST-OBS-2017_00697	Geghasar-Gegham
	NB'17	2066	PAST-OBS-2017_00699	Geghasar-Gegham
	NB'17	2066	PAST-OBS-2017_00701	Geghasar-Gegham
	NB'17	2066	PAST-OBS-2017_00695	Geghasar-Gegham
	NB'17	2093	PAST-OBS-2017_00705	Sevkar-Syunik
	NB'17	2093	PAST-OBS-2017_00706	Sevkar-Syunik
	NB'17	2093	PAST-OBS-2017_00708	Sevkar-Syunik
	NB'17	2093	PAST-OBS-2017_00704	Geghasar-Gegham
	NB'17	2093	PAST-OBS-2017_00707	Geghasar-Gegham

Table 4.: Geochemical fingerprints obtained by portable XRF on the 38 artefacts from Nakhchivan Tepe (results in ppm).

Artefact reference	Excavation	Occupation layer	Context	Mn	Fe	Zn	Ga	Th	Rb	Sr	Y	Zr	Nb	Provenance attribution
PAST-OBS-2017_00694	NB'17	2	2066	642	4292	35	21	25	198	11	24	80	49	Geghasar-Gegham
PAST-OBS-2017_00695	NB'17	2	2066	602	3949	34	17	24	190	9	22	73	49	Geghasar-Gegham
PAST-OBS-2017_00696	NB'17	2	2066	504	9160	77	21	23	192	24	54	264	34	Gügürbaba-Meydan
PAST-OBS-2017_00697	NB'17	2	2066	667	4008	31	20	23	191	10	26	77	50	Geghasar-Gegham
PAST-OBS-2017_00698	NB'17	2	2066	592	9642	71	22	23	203	16	55	271	35	Gügürbaba-Meydan
PAST-OBS-2017_00699	NB'17	2	2066	687	4080	34	19	25	205	9	25	80	52	Geghasar-Gegham
PAST-OBS-2017_00700	NB'17	2	2066	525	5693	37	26	33	194	15	14	107	38	Sevkar-Syunik
PAST-OBS-2017_00701	NB'17	2	2066	657	4163	33	21	27	208	10	25	81	53	Geghasar-Gegham
PAST-OBS-2017_00702	NB'17	2	2066	462	5321	37	22	30	177	19	14	108	33	Sevkar-Syunik
PAST-OBS-2017_00703	NB'17	2	2066	506	5297	40	20	28	177	16	14	106	36	Sevkar-Syunik
PAST-OBS-2017_00704	NB'17	2	2093	757	4520	41	26	26	220	10	30	85	55	Geghasar-Gegham
PAST-OBS-2017_00705	NB'17	2	2093	494	4784	42	21	30	186	11	12	95	36	Sevkar-Syunik
PAST-OBS-2017_00706	NB'17	2	2093	511	5882	43	26	31	191	18	14	112	39	Sevkar-Syunik
PAST-OBS-2017_00707	NB'17	2	2093	702	4217	35	21	26	200	10	23	77	50	Geghasar-Gegham
PAST-OBS-2017_00708	NB'17	2	2093	440	5634	36	22	26	178	21	14	109	36	Sevkar-Syunik
PAST-OBS-2017_00709	NA'17	1	1044	425	4948	31	17	27	166	17	14	103	34	Sevkar-Syunik
PAST-OBS-2017_00710	NA'17	1	1044	584	4304	39	19	11	126	22	24	83	31	Arteni
PAST-OBS-2017_00711	NA'17	1	1044	424	5082	37	20	30	166	18	14	104	35	Sevkar-Syunik
PAST-OBS-2017_00712	NA'17	1	1044	523	6000	43	27	33	202	17	15	116	39	Sevkar-Syunik
PAST-OBS-2017_00713	NA'17	1	1044	483	5473	35	24	29	186	16	15	111	36	Sevkar-Syunik
PAST-OBS-2017_00714	NA'17	1	1044	402	5396	40	23	28	173	20	12	108	35	Sevkar-Syunik
PAST-OBS-2017_00715	NA'17	1	1044	653	4029	35	20	26	197	10	26	76	49	Geghasar-Gegham
PAST-OBS-2017_00716	NA'17	1	1044	430	5357	40	22	30	167	21	14	109	34	Sevkar-Syunik
PAST-OBS-2017_00717	NA'17	1	1044	582	7964	40	20	14	132	111	23	157	36	Gutansar / Kaputan Est
PAST-OBS-2017_00718	NA'17	1	1044	662	4076	33	23	25	201	9	25	77	52	Geghasar-Gegham
PAST-OBS-2017_00719	NA'17	1	1044	646	3895	36	19	24	191	10	25	76	47	Geghasar-Gegham
PAST-OBS-2017_00720	NA'17	2	1073	554	9612	73	22	24	200	13	55	264	34	Gügürbaba-Meydan
PAST-OBS-2017_00721	NA'17	2	1073	673	4178	37	22	26	204	8	26	79	53	Geghasar-Gegham
PAST-OBS-2017_00722	NA'17	2	1073	491	5257	36	20	29	172	19	15	108	36	Sevkar-Syunik
PAST-OBS-2017_00723	NA'17	2	1073	607	4010	38	19	25	195	8	22	74	49	Geghasar-Gegham
PAST-OBS-2017_00724	NA'17	2	1073	601	3837	35	16	23	186	9	23	73	48	Geghasar-Gegham
PAST-OBS-2017_00725	NA'17	2	1073	467	6282	35	18	16	108	100	18	95	23	Hatis 2
PAST-OBS-2017_00726	NA'17	2	1073	474	5144	37	20	30	175	17	13	105	33	Sevkar-Syunik
PAST-OBS-2017_00727	NA'17	2	1073	753	4696	37	28	29	222	10	26	85	54	Geghasar-Gegham
PAST-OBS-2017_00728	NA'17	2	1073	448	4858	33	15	27	164	15	12	98	32	Sevkar-Syunik
PAST-OBS-2017_00729	NA'17	2	1073	464	5423	41	21	30	169	21	14	110	35	Sevkar-Syunik
PAST-OBS-2017_00730	NA'17	2	1073	520	9194	72	21	23	190	19	52	261	32	Gügürbaba-Meydan
PAST-OBS-2017_00731	NA'17	2	1073	520	9653	72	23	24	191	21	53	258	32	Gügürbaba-Meydan

Each of the compositional groups that emerged from this analysis is described below, and a summary of the sources identified from the samples collected at Nakhchivan Tepe is presented in *Table 2.* and *Table 3.* Complete geochemical data obtained by pXRF is reported in *Table 4.*

Group 1

The first group includes 16 artefacts, characterised by high Zr values (between 95 and 116 ppm), and relatively low Y contents (<16 ppm). The overall geochemical composition of these artefacts matches the geochemical fingerprint of the Syunik outcrops, located in the Zangezor range, the closest source to Nakhchivan Tepe (see *Fig. 1.*).

This obsidian source, which displays excellent quality material in abundance, was exploited extensively during Prehistory and has been used throughout the Southern Caucasus from the Neolithic onwards⁸. More particularly, the Sr, Zr, and Y contents of this set of artefacts correspond specifically to the Sevkar outcrop (see *Fig. 3.*).

Group 2

A second group, involving 14 artefacts in total, is characterised by Mn values higher than those observed for the other groups, while exhibiting high Rb (186-220 ppm) and Nb contents (47-54 ppm). These artefacts have a geochemical composition matching the Geghasar-Gegham outcrop, located north of Nakhchivan near the Sevan Lake and presenting a high-quality obsidian material for knapping. While the Spitaksar-Gegham outcrop is geochemically close to Geghasar-Gegham, they can be differentiated by a simple Zr vs. Th binary diagram (*Fig. 4.*). Furthermore, the Spitaksar outcrop is of a considerably lower quality because of its many inclusions; a visual examination of the samples confirms that they correspond to the Geghasar outcrop.

Group 3

The third group identified (five artefacts) is characterised by relatively high Fe (>9000 ppm), Zn (>70 ppm), Y (>50 ppm), and Zr (>260 ppm) contents. This specific geochemical signature is characteristic of the Gögürbaba-

Meydan obsidian source, located near Lake Van in South-eastern Anatolia.

Group 4-5-6

Three artefacts did not match the compositions of groups 1, 2, or 3. However, they individually matched the geochemical fingerprint of three specific obsidian sources located in contemporary Armenia: Hatis, Arteni and Gutansar (*Fig. 3.*).

Discussion

In spite of its relatively small size (38 artefacts), the obsidian assemblage from Nakhchivan Tepe reveals a high diversity in procurement strategies. In this preliminary sampling, six different sources have been identified: they correspond to the Sevkar-Syunik, Geghasar-Gegham, Gögürbaba-Meydan, Hatis, Arteni, and Gutansar outcrops⁹. This variety confirms the patterns observed on the other valley settlements excavated in Nakhchivan¹⁰: a preference for the close-by sources of Syunik and Gegham, where high quality and abundant obsidian resources are available, together with the more occasional use of obsidian sources located further north (Hatis, Gutansar, Arteni) or further west (Gögürbaba-Meydan).

However, it should be noted that the proportion of obsidian coming from Syunik/Gegham that has been identified at Nakhchivan Tepe is not identical to what has been found on the settlements of Kültepe I or Ovçular Tepesi, also located in the Araxes valley: on the former, Syunik was the main outcrop used during both the Neolithic (66%) and the Kura-Araxes (61%) periods, while on the latter, and for the period for which a considerable number of artefacts have been analysed (i.e. the Chalcolithic, 445 artefacts in total), the source of Gegham greatly prevails (76%). In the case of Nakhchivan Tepe, we are faced with a mixture of these two sourcing strategies, since Syunik and Gegham are represented in almost equal proportions (42% and 37% respectively). The polysource consumption model, where the overall assemblage comprises obsidian coming from several beds, with only one favourite outcrop, is

⁸BADALYAN et al. 2004.

⁹See e.g. BADALYAN et al. 2004.

¹⁰ORANGE et al. *in press*

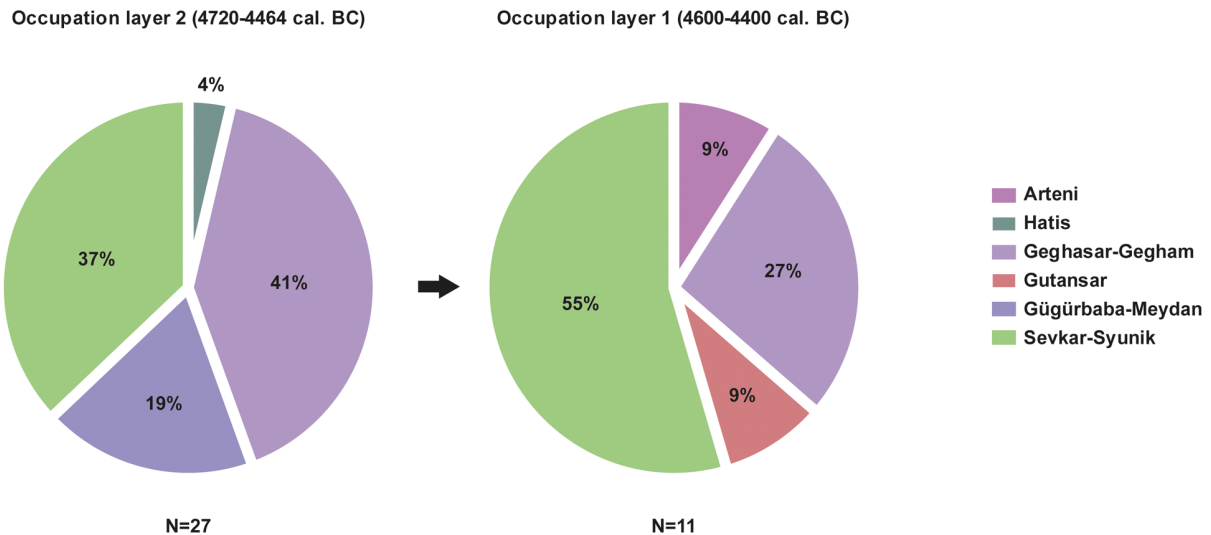


Fig. 5.: Comparison of the obsidian source proportions (in %) between occupation layer 2 and occupation layer 1 of Nakhchivan Tepe. N = total number of artefacts analysed.

frequently observed on numerous Neolithic and Chalcolithic sites of the Southern Caucasus¹¹. But the predominance of two sources exploited at once in equal proportion seems to be less common (given that a significant number of artefacts are analysed): rare examples include the Neolithic assemblage of Masis Blur¹² in Armenia (equal proportions of Gutansar and Arteni products) or Dem-i-Suliman¹³ in the Urmiah region (Syunik and Gögürbaba-Meydan).

While the preference for the obsidian of Syunik or Gegham encountered respectively at Kültepe I and Ovçular Tepesi might be explained by the proximity of each source to that one site (Gegham is closer to Ovçular, while Syunik is closer to Kültepe I), the location of Nakhchivan Tepe (only 10 km south from Kültepe I) does not justify the predominance of both sources at once. If we now look at the sourcing strategies by occupation layer (**Fig. 5.**), the Gegham/Syunik parity continues from the earlier occupation period (layer 2, 4720-4464 cal. BC) to the next (layer 1, 4600-4400 cal. BC); a Fisher's exact test shows that there is no significant difference in the consumption of the obsidian from Syunik/Gegham between layer 1 and layer 2

($p= 0.4397$, Fisher's two-tailed exact test). The main disparity between the two layers observed in the consumption patterns is that the raw material from Hatis and Gögürbaba-Meydan is replaced in the later level by the obsidian from Gutansar and Arteni.

The disappearance of artefacts made from the Gögürbaba-Meydan obsidian in layer 1, which were present in significant amounts (19%) in occupation layer 2, might be representative of a general decrease in the use of this specific raw material in Nakhchivan over time¹⁴: while the analyses we conducted on Chalcolithic assemblages from several sites of the region have shown that up to 3% of the 756 analysed artefacts could be attributed to this outcrop, not one artefact from the Kura-Araxes period¹⁵ (164 artefacts analysed) matched the Gögürbaba-Meydan fingerprint. Further analyses are now needed to confirm whether the populations settled north of the Araxes River, in Nakhchivan for instance, entirely ceased to use or to obtain their obsidian from Gögürbaba-Meydan in later periods, and thus may have ceased to have direct or indirect contacts with groups living in the vicinity of Lake Van (if they had any in the first place). In Nakhchivan Tepe alone, hundreds of obsidian artefacts from

¹¹BADALYAN et al. 2004.

¹²MARTIROSYAN-OLSHANSKY 2015.

¹³GHORABI et al. 2010.

¹⁴Data obtained in the framework of the PAST-OBS and SCOPE projects.

¹⁵Assemblages from Ovçular Tepesi, Kültepe I, and Uçan Ağıl. Publications in preparation.

occupation layer 1 remain to be analysed: we may find more artefacts that match this specific source. Our current analyses are based on a restricted sampling; as our work goes on, the number of identified artefacts will gradually increase, in keeping with our research group's exhaustive characterisation strategy¹⁶. However, a similar pattern should be noted for Dava Göz¹⁷, where artefacts from the Transitional Chalcolithic/Dalma (5000-4500 BCE, 93 artefacts), Pisdeli-LC1 (4500-4200 BCE, 17 artefacts), and Chaff-Faced Ware-LC2 (4200-3700 BCE, 16 artefacts) periods have been analysed by portable XRF: a sharp decrease in the number of artefacts from Gögürbaba-Meydan is also conspicuous, even if the low sampling for the LC1 and LC2 horizons might also explain the apparent decrease in the proportion of obsidian from Gögürbaba-Meydan, which drops from 22% during the TC/Dalma period to 12% and 6% in the later occupation layers.

Finally, among the Syunik sources, the preference noted for the Sevkar outcrop confirms the hypothesis put forward by Cherry and colleagues¹⁸, according to which the Sevkar outcrops had several assets over Satanakar and Bazenk:

“The Metz and Pokr Sevkar complex [...] appears to represent the best source for several reasons: the quality of the obsidian is everywhere excellent, the flows are spread over a very substantial area, lower elevation (2700 m) results in a snow pack of lesser duration, there are few topographic barriers to movement, and the area as a whole is readily approached on foot by following the various streams that flow down from the mountains as the headwaters of the Vorotan River.”

Following this hypothesis, Cherry et al. analysed 70 artefacts originating from three different settlements (Shaghat 1, Aghidu, Godedzor; 5th to 1st millennium B.C.), and confirmed the overwhelming predominance of the obsidian from Sevkar among the sites of the Vorotan project (90% of the assemblages).

Conclusions

This preliminary study shows the diversity of obsidian raw materials in use at Nakhchivan Tepe during the Chalcolithic (4720-4440 cal. B.C.), with up to six sources identified. Small but significant differences mark the evolution of this polysource procurement pattern, which favours two specific outcrops (Sevkar-Syunik and Geghasar-Gegham) over time: while the earlier occupation level (layer 2) has shown the use of a relatively high amount of the Gögürbaba-Meydan obsidian (19%), this outcrop seemingly fell out of use during the following phase (layer 1). Likewise, changes appear in the more sporadic exploitation of other regional sources: Hatis is present in the earlier occupation phase, but it is later replaced by Arteni and Gutansar. Given the small sample we have analysed so far, our interpretation may change to some extent. Nevertheless, the presence in relatively equal proportions of obsidian from both Syunik and Gegham already constitutes a notable difference with what has been observed on other settlements of the Araxes valley, where a single source usually predominates¹⁹. Ultimately, these patterns will have to be confirmed by further analyses, as hundreds of artefacts remain to be characterised.

The great number, and the type of obsidian artefacts retrieved from Nakhchivan Tepe, suggests the existence of an obsidian workshop on the site itself. This repertoire in fact recalls the obsidian assemblage from Uçan Ağıl, a pastoral campsite located in the foothills of the Lesser Caucasus, less than 20 km away from Nakhchivan Tepe as the crow flies²⁰. Interestingly enough, Uçan Ağıl, which is contemporaneous with Nakhchivan Tepe, has only yielded a very small quantity of Dalma ware. Both are interpreted as pastoral sites, but their location differs greatly: Nakhchivan Tepe is a valley settlement, while Uçan is set in the foothills of the Lesser Caucasus. The latter is interpreted as a *yarim yayla*, an intermediary pastoral campsite between the valley settlements and the summer pastures of the

¹⁶ORANGE et al. 2017.

¹⁷ABEDI et al. 2018.

¹⁸CHERRY et al. 2010:150.

¹⁹ORANGE et al. *in press*.

²⁰The excavation of Uçan Ağıl is in progress under the supervision of V. Bakhshaliyev and C. Marro (*Mission Archéologique du Bassin de l'Araxe*).

highlands (*yaylas*) (see **Fig. 1.**). While the resemblances so far noted in the obsidian treatment could originate from similar activities practised on the sites (i.e. herding), the differences in obsidian procurement strategies could be explained by their respective location: as suggested by Chataigner and colleagues²¹, the area englobing Nakhchivan Tepe is situated at the crossroads of the east-west axis following the Araxes valley and the potential north-south path linking North-western Iran to the Kura valley (Western Azerbaijan), following centuries-old transhumance patterns²². This 'central' position could explain the variety of obsidian products found on the site: they could have been brought over by populations coming from different places (e.g. Eastern Anatolia) through exchange, or obtained by direct acquisition during seasonal migrations to the pasturelands located near these outcrops. The groups transiting through Uçan Ağıl during the Chalcolithic, on the contrary, mostly used the obsidian from Syunik (86% of the total assemblage analysed, n=299)²³, potentially confirming its role as an intermediary campsite on the road to the summer pastures, which are themselves located near the close-by obsidian outcrops of Syunik.

In conclusion, the obsidian consumption patterns brought to light during our preliminary sourcing campaign seem to confirm the strategic position of this site at the crossroads of north-south and east-west axes of circulation. Given its large obsidian assemblage, further geochemical analyses are now required to confirm the patterns so far detected. In addition, a complete typo-technological study needs to be conducted on the assemblage from Nakhchivan Tepe, in order to reconstruct the full picture of obsidian consumption on this site. A comparison with the contemporary site of Uçan Ağıl should also provide interesting information by examining the use of this material on sites that may have had different functions in the overall obsidian exchange networks.

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²¹ CHATAIGNER et al. 2010.

²²MARRO et al. 2019.

²³ORANGE et al. *in prep.*

References

ABEDI, A.; VAROUTSIKOS, B. & CHATAIGNER, C.

2018. Provenance of obsidian artefacts from the Chalcolithic site of DavaGöz in NW IRAN using portable XRF. *Journal of Archaeological Science: Reports*, 20, 756–767.

AITCHISON, J.

1986. *The statistical analysis of compositional data*. Monographs on statistics and applied Probability: Chapman and Hall, London.

BADALYAN, R.

2010. Obsidian of the Southern Caucasus: The use of raw materials in the Neolithic to Early Iron Ages. In: HANSEN, S.; HAUPTMANN, A.; MÖTZENBÄCKER, I. & PERNICKA, E. (eds.) *Von Majkop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien* 4. – 2. Jt. v. Chr. Bonn, Rudolf Habelt GmbH. S.

BADALYAN, R., CHATAIGNER, C. & KOHL, P. L.

2004. Trans-Caucasian obsidian: the exploitation of the sources and their distribution. In: SAGONA, A. (ed.) *A view from the highlands: archaeological studies in honour of C.A. Burney*. Leuven, Peeters Press.

BAXŞƏLİYEV, V.; QULİYEV, Z.; BAXŞƏLİYEV, E.; HƏŞİMOVA, T. & MEHBALİYEV, K.

2019. *Naxçıvan tərəda 2018-ci ilin arxeoloji tədqiqatları*. Naxçıvan: Əcəmi.

BAXŞƏLİYEV, V.; QULİYEV, Z.; HƏŞİMOVA, T.; MEHBALİYEV, K. & BAXŞƏLİYEV, E.

2018. *Naxçıvan Təpəyaşayış yerində arxeoloji tədqiqatlar*. Naxçıvan, Əcəmi.

BERTHON, R.

2014. Past, Current and Future Contribution of Zooarchaeology to the Knowledge of the Neolithic and Chalcolithic Cultures in South Caucasus. *Studies in Caucasian Archaeology*, 2, 4–30.

BERTHON, R.; GIBLIN, J.; BALASSE, M.; FIORILLO, D. & BELLEFROID, E.

- In press. The role of herding strategies in the exploitation of natural resources by early mining communities in the Caucasus. In: MARRO, C. & STÖLLNER, T. (eds.) *On Salt, Copper, and Gold: The Origins of Early Mining and Metallurgy in the Caucasus*, Maison de l'Orient et de la Méditerranée, Lyon.

BRONK RAMSEY, C.

2017. OxCal4.3.2. <https://c14.arch.ox.ac.uk/oxcal.html>.

CHATAIGNER, C., AVETISYAN, P., PALUMBI, G. & UERPMANN, H.-P.

2010. Godedzor, a late Ubaid-related settlement in the Southern Caucasus. In: CARTER, R. A. & PHILIP, G. (eds.) *Studies in Ancient Oriental Civilizations*, 63. Chicago, Oriental Institute of the University of Chicago.

CHATAIGNER, C. & GRATUZE, B.

2014. New Data on the Exploitation of Obsidian in the Southern Caucasus (Armenia, Georgia) and Eastern Turkey, Part 1: Source Characterization. *Archaeometry*, 56, 25–47.

CHERRY, J. F.; FARO, E. Z. & MINC, L.

2010. Field Survey and Geochemical Characterization of the Southern Armenian Obsidian Sources. *Journal of Field Archaeology*, 35, 147–163.

- GHORABI, S.; KHADEMI NADOOSHAN, F.; GLASCOCK, M. D.; NOUBARI-HEJABARI, A. & GHORBANI, M.
 2010. Provenance of Obsidian Tools from Northwestern Iran Using X-Ray Fluorescence Analysis and Neutron Activation Analysis. *International Association for Obsidian Studies Bulletin*, 43, 14–26..
- GLASCOCK, M. D. & FERGUSON, J. R.
 2012. Report on the analysis of obsidian source samples by multiple analytical methods. *University of Missouri Research Reactor, Columbia*.
- HAMLIN, C.
 1975. Dalma Tepe. *Iran*, 13, 111–127.
- KULIYEVA, Z. & BAŞELIYEV, V.
 2018. Nahçıvan’ın Kalkolitik çağı kültürü (Azerbaycan). *Türkiye Bilimler Akademisi Arkeoloji Dergisi*, 23, 29–52.
- MARRO, C., BAKHSHALIYEV, V., BERTHON, R. & THOMALSKY, J.
 2019. New light on the Late Prehistory of the South Caucasus: data from the recent excavation campaigns at Kültepe I in Nakhchivan, Azerbaijan (2012–2018). *Paléorient*, 45, 81–113.
- MARTIROSYAN-OLSHANSKY, K.
 2018. Sourcing obsidian artifacts from Masis Blur, Armenia. *Aramazd, Armenian Journal of Near Eastern Studies*, XII/1, 19–34.
- ORANGE, M.; LE BOURDONNEC, F.-X.; BELLOT-GURLET, L.; LUGLIÈ, C.; DUBERNET, S.; BRESSY-LEANDRI, C.; SCHEFFERS, A. & JOANNES-BOYAU, R.
 2017. On sourcing obsidian assemblages from the Mediterranean area: analytical strategies for their exhaustive geochemical characterisation. *Journal of Archaeological Science: Reports*, 12, 834–844.
- ORANGE, M.; LE BOURDONNEC, F.-X.; BERTHON, R.; MOURALIS, D.; GRATUZE, B.; THOMALSKY, J. & MARRO, C.
In press Extending the scale of obsidian studies: towards a high-resolution investigation of obsidian prehistoric circulation patterns in the Southern Caucasus and North-western Iran. In press for *Archaeometry*.
- REIMER, P.J.; BARD, E.; BAYLISS, A.; BECK, J.W.; BLACKWELL, P.G.; RAMSEY, C.B.; BUCK, C.E.; CHENG, H.; EDWARDS, R.L.; FRIEDRICH, M.; GROOTES, P.M.; GUILDERTON, T.P.; HAFIDASON, H.; HAJIDAS, I.; HATTE, C.; HEATON, T.J.; HOFFMANN, D.L.; HOGG, A.G.; HUGHEN, K.A.; KAISER, K.F.; KROMER, B.; MANNING, S.W.; NIU, M.; REIMER, R.W.; RICHARD, D.A.; SCOTT, E.M.; SOUTHON, J.R.; STAFF, R.A.; TURNER, C.S.M. & VAN DER PLICHT, J.
 2013. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. *Radiocarbon* 55/4, 1869–1887.