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Neolithic Chipped Stone Industry of Mentesh Tepe (Middle Kura Valley, Azerbaijan)

Technological Markers and Relations to North-Eastern Anatolia

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Abstract

Neolithic phases at Mentesh Tepe (Middle Kura Valley, Azerbaijan) date to the first half of the 6th millennium BCE. This occupation with its peculiar architecture, pottery, lithic industry and other archaeological features is related to the Shomutepe-Shulaveri Culture (hereafter SSC). In this paper, we describe the Neolithic lithic industry of Mentesh, paying attention to the origins of raw materials, technology and typology. Obsidian procurement, least cost path analysis, technology and typology are combined to better understand the process of exploitation of the rocks. Employing these methodologies, we identify technical markers that are compared to other assemblages. Obsidian came from eight distinct sources (in North-Eastern Anatolia, Armenia and Georgia), sometimes very distant from one another. We wish to emphasize the relation between the SSC sites of the Middle Kura Valley and North-Eastern Anatolia. Moreover, whatever the source of the raw material, a great homogeneity in both technology and typology is noticed.

Caucasus, Neolithic, Shomutepe-Shulaveri Culture, technology, obsidian

1. Introduction

In the last fifteen years, our understanding of the process of Neolithic transformation of the South Caucasus has increased. New excavations have provided data and secure radiocarbon dates. However, the pre-Neolithic stages are still documented by a handful of sites. One of the most important is the rock-shelter of Kmlo 2 (Fig. 1), an early Holocene site in Armenia, whose age spans the 11th and the 8th millennia BCE (Arimura *et al.* 2009, 2012). The ancient lithic assemblage is characterized by obsidian microliths,



Fig. 1. Sites mentioned in the text.

such as backed bladelets and scalene triangles, and the 10th-8th millennia cal. BCE phases produced numerous obsidian tools, including microliths and 'Kmlö tools'. At Lernagog, also in Armenia (Arimura *et al.* 2018), Mesolithic occupation was identified and dated to the beginning of the 7th millennium BCE. The lithic industry includes a few microliths and 'Kmlö tools'. Another important step in the research occurred when a Japanese and Azerbaijani team resumed the excavation of Damjili cave in Azerbaijan. They brought to light a Late Mesolithic level dated to the end of the 7th millennium BCE (Nishiaki *et al.* 2019a). The lithic industry is characterized by the presence of pressure-flaked *débitage* and geometrics such as lunates, trapezes and teardrop-shaped pieces. The next level is Neolithic and dates to the middle of the 6th millennium BCE. The industry shows the use of pressure flaking to produce blades with a width mean slightly higher than that of the Mesolithic period; blades are less frequent in the assemblage; a decrease in microliths that are only trapezes is noticed; wedges (*pièces esquillées*), burins and a few pressure-retouched blades ("Damjili tools") were noticed.

Coeval with the advent of a food-production socio-economy -farming and animal husbandry- at the beginning of the 6th millennium BCE, the Shomutepe-Shulaveri

Culture is well-known, with sites located in different regions such as the Middle Kura valley in Georgia and Azerbaijan, and the Middle Araxes valley (Ararat plain) in Armenia. Sites on the Mil plain appear to be part of another cultural entity (Chataigner *et al.* 2014; Lyonnet *et al.* 2012). Mentesh Tepe is part of a cluster of neighboring sites found in the middle Kura Valley, including as well Hacı Elamxanlı Tepe (11.3 km distant), Kіçik Tepe (8.9 km) and Göytepe (11.1 km). The four sites are not strictly contemporaneous (Fig. 2). Hacı Elamxanlı Tepe is the earliest and its recent levels 1-2 correspond to the earlier phase 3 at Kіçik; phase 2 at Kіçik is contemporaneous with Mentesh Period I, phase 1; Mentesh Period I, phase 2 corresponds to Göytepe's oldest layers; the rest of the Göytepe sequence comes next (Kadowaki *et al.* 2016; Lyonnet and Guliyev 2017; Nishiaki *et al.* 2015; Nishiaki and Guliyev 2020; Palumbi *et al.* 2021). On the basis of data from Hacı Elamxanlı Tepe and Göytepe, Y. Nishiaki has noticed a succession of two phases, with preliminary data suggesting "that the known cultural changes from this period represent incremental developments within the same cultural tradition (*i.e.* the SSC tradition; Nishiaki and Guliyev 2019: 471).

In this paper, firstly, we shall present the general components of the Neolithic assemblage at Mentesh Tepe.

Secondly, we shall focus on obsidian exploitation using a combined approach (procurement, least cost path analysis, technology and typology). Thirdly, we wish to highlight that these methodologies allow us to identify cultural markers comparable to other sites of the SSC, and obviate links to other regions, including North-Eastern Anatolia.

Mentesh Tepe

Mentesh Tepe is located in the middle of the Kura Valley, on one of its right bank tributaries, the Zeyemchaj. The site is small, c. 1 ha, though its exact size is unknown, as the part above ground was entirely levelled in the 1970s, and modern roads and houses now cover most of this location. Eight seasons of excavations under Bertille Lyonnet and Farhad Guliyev's direction have shown that, underground, protohistoric levels were preserved.

Three main periods were identified, separated by gaps in occupation (Lyonnet *et al.* 2012; Lyonnet and Guliyev 2017). The earliest dates back to the Neolithic period (Mentesh I, first half of the 6th millennium BCE). Following a hiatus of about 800 years, the site underwent a rebirth during the Chalcolithic period, which can be divided into two separate phases with a short gap in between: Mentesh II, with ephemeral occupation in the first half of the 5th millennium, and Mentesh III, with an important (tripartite?) building and remains of dense craft-production activities (last third of the 5th millennium). A long hiatus of nearly a thousand years followed, before the site was used as a funerary mound (Mentesh IV, Early Bronze Age, from the end of the 4th to the middle of the 3rd millennium BCE).

This long sequence of occupation is rare in the southern Caucasus, where sites usually date to only one period. This gave the opportunity to observe the evolution of architecture and material culture.

The Neolithic occupation at Mentesh Tepe is not very long in duration (Lyonnet *et al.* 2016; Lyonnet and Guliyev 2017). Two main periods of construction were recorded. They were marked by houses rebuilt on the same spot. The first one (c. 5800-5750 in median cal. radiocarbon dates) is the longest. Buildings are constructed with a single row of moulded plano-convex bricks or cob, and are all more or less circular (Baudouin 2017). Some are adjacent one to another ("snowman" shape) and built above ground. Their walls are preserved only a few courses of bricks high, not exceeding half a meter. Other buildings are dug deep into the ground, but still encircled by a wall of mudbricks. In these half-buried and better-preserved houses, several levels of occupation with a succession of red floors (intentionally covered with ochre) and charcoal layers are visible. The artefacts recovered from these different houses are, however, extremely limited. After the collapse of one of the houses, the place was re-used as a funerary pit that contained 31 skeletons, apparently all buried at the

	Mentesh Tepe	Hacı Elamxanlı Tepe	Kiçik Tepe	Göytepe
5450				
5500				
5550				
5600				
5650				
5700	Period I 2			
5750				
5800	Period I 1		Phase 2	
5850			Phase 3	
5900				
5950				
6000				

Fig. 2. Mentesh Tepe, Hacı Elamxanlı Tepe, Kiçik Tepe and Göytepe: radiocarbon dates.

same time (Pecqueur and Jovenet 2017). Other individual infant burials are scattered, some at the base of the wall, others outside (Lyonnet *et al.* 2016; Poulmarc'h *et al.* 2017). The building material for these constructions probably comes from a large and deep oval man-made pit found next to them. The end of this first phase of occupation is marked by a thick level of grey ashes that covers a large part of the excavated area. The second phase (c. 5700-5650 in median cal. radiocarbon dates) is much more poorly known. The buildings are very badly preserved, probably due to their long exposure to the elements after the site was abandoned.

Very few finds were found in the two phases of occupation within these buildings, except for grinding stones (Hamon 2012). Most of what we have, pottery (Lyonnet 2012, 2017a), bone tools (Taha and Le Dosseur 2017), lithic industry (Astruc *et al.* 2012; Guilbeau *et al.* 2017; Astruc *et al.* forthcoming), animal bones (Benecke 2017), plant remains (Decaix *et al.* 2016; Neef *et al.* 2017), comes from this anthropogenic pit of phase 1 used as a place for discarding garbage by the inhabitants. The material associated with phase 2 is extremely scanty and is mostly out of context; its chronological attribution is suggested in consideration of its total absence in the pit of phase 1, and on the basis of its similarities with material known at other sites like Göytepe (Aleksbarov 2018) and Aruchlo (Bastert-Lamprichs 2017).

When looking at its material and architecture, one can conclude that Mentesh Tepe belongs to the Shomutepe-Shulaveri Culture, identified long ago after the excavations made at Shomutepe (Azerbaijan) and Shulaveris Gora (Georgia). This culture extends over a large area on both sides of the modern border separating the two countries. Contemporary sites in Armenia, like Aknashen and Masis Blur are considered as part of this culture or very close to

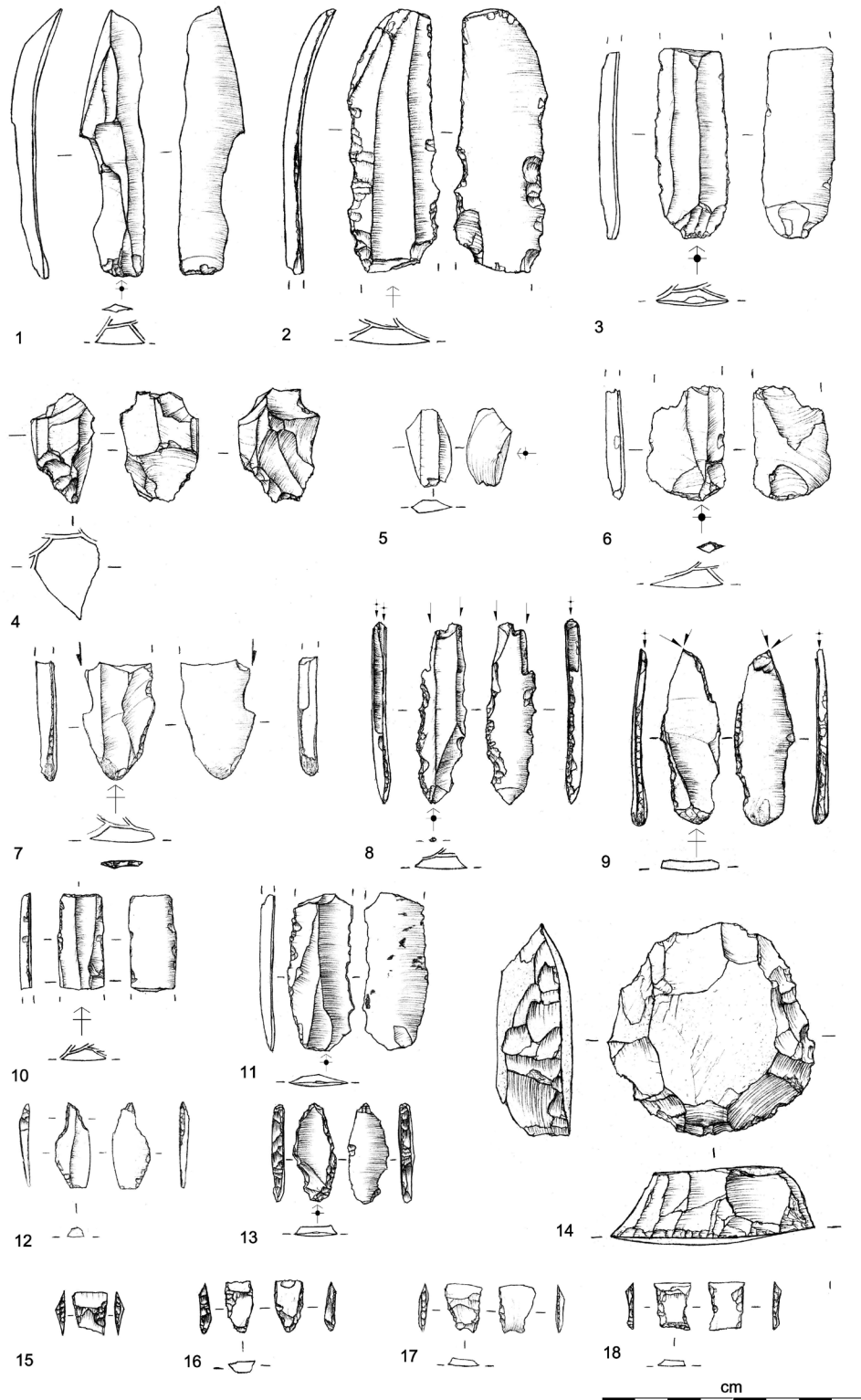


Fig. 3. The Neolithic lithic industry of Mentesh Tepe. 1: Rejuvenation blade; 2: Lever pressure blade; 3: Pressure blade; 4: Blade core; 5: Flake from a blade core; 6: *Pièce esquillée*; 7: Burin; 8: Multiple burin; 9: Dihedral burin; 10: Truncation; 11: Lateral blade with bitumen traces; 12-13: Borers; 14: Scraper; 15-18: Trapezes. N°1, 3-5, 8, 9, 11-13 and 15-17 on obsidian from Sarıkamış; n°6, 7, 10 and 18 on obsidian from Tsaghkunjats; n°2 on obsidian from Yaglıca; n°14 on a metamorphic raw material.

Raw materials	N	%
Obsidian	1457	85
Chalcedony	210	12.5
Flint	25	1.5
Others	20	1.2
Total	1712	100

Table 1. Lithic raw materials.

it (Badalyan *et al.* 2010). Recent excavations on a number of settlements give a better understanding of this culture, which seems to appear quite suddenly and is already full-blown at the dawn of the 6th millennium, developing side-by-side with a still poorly known Mesolithic tradition (Nishiaki *et al.* 2019a). Though these sites present many common features, it seems clear by now that they also show a number of differences, for the moment interpreted as regional specificities (Lyonnet 2017b). Many radiocarbon dates make it possible to establish their succession and overlaps from Hacı Elamxanlı Tepe (Nishiaki *et al.* 2015) and Aknashen (Badalyan and Harutyunyan 2014; Badalyan *et al.* 2004, 2010) to Kіçiktepe (Palumbi *et al.* 2021), Gadachrili (Hamon *et al.* 2016), Mentesh Tepe (Lyonnet *et al.* 2016), Aruchlo (Hansen, Mirtskhulava 2017; Hansen *et al.* 2017), Gۆytepe (Nishiaki *et al.* 2013, 2015) and Masis Blur (Martirosyan-Olshansky *et al.* 2013).

For reasons yet unknown, this culture disappears around 5300 BCE and little is known after that, though continuity in some pottery shapes and decoration (Lyonnet 2017a), and in some technological aspects like the lithic industry (Astruc *et al.* forthcoming), point to an ongoing but discrete and probably mobile occupation linking it with the Chalcolithic period.

The assemblage

The lithic industry of the two Neolithic phases at Mentesh Tepe is homogeneous. It includes 1712 artefacts (Fig. 3). The dominant raw material (as high as 85% of the total) is obsidian (Table 1), chalcedony constitutes 12.5% of the total, and flint 1.5%. Other rocks are marginal.

In the sample, waste is plentiful (54%, Table 2) whereas blocks of raw material and cores are rare (0.8%). The majority of cores are flake cores (6 on obsidian and 2 on chalcedony). They are knapped using direct percussion for the production of small irregular flakes. Some of them are made on a flake and others bear a residual cortical surface. Only a blade core was collected (Fig. 3: 4): we have no more than a mesial fragment damaged by a secondary *débitage* of small irregular flakes; it is of obsidian.

Artefacts	Obsidian	Chalcedony	Flint	Total
Blades	391	1	1	393
Flakes	273	93	7	373
Waste	786	109	17	912
Blade core	1	0	0	1
Flake cores	6	2	0	8
Blocks	0	5	0	5
Total	1457	210	25	1692

Table 2. Technological breakdown.

Blades of obsidian are found. Among the identified blanks (waste is here excluded), blades represent 59% of the total. The exploitation of unipolar prismatic cores, following a semi-turning or turning exploitation, is done by pressure flaking. The modes 2 to 5 (knapping with a shoulder crutch [mode 2], a short crutch in a sitting position [mode 3], using a long crutch in a standing position [mode 4], using a lever [mode 5]) can be identified (Pelegrin 2012) but the more common mode is *débitage* with a crutch in a standing position. Production with the help of a lever was also identified, since large blades are attested (see below). Preparation for detachment is made towards the *débitage* surface, and the butts of the blades are small and mainly plain, linear, punctiform, or, rarely cortical. We observed one faceted butt. In three occurrences, the use of a copper tip is hypothesized because of the presence of a small crack on the butt (see Pelegrin 2012: 483) but the use of a device with an organic tip is common. *Débitage* of flakes is also attested with six cores and several blanks.

Chalcedony and flint are exclusively flake industries. The *débitage* is either unipolar or with multiple orientations. The technique is hard-direct percussion. Cores were less shaped and the production done with a minimum of preparation. The blanks are thus less regular and their shape is less controlled. Five fragments of blocks of chalcedony were collected, two of them are river pebbles. No other piece of unworked raw material is known in these Neolithic phases.

The typology is diversified for obsidian (Table 3): 70% of the blades, 58% of the flakes and 23% of the waste are retouched. Types are diverse: burins (10.8%), wedges (*pièces esquillées*, 48.3%), blanks with lateral retouch (9.8%), pieces with irregular retouches (29%) are the most frequent, followed by trapezes (geometrics), denticulates, notches, truncations, scrapers, borers and beaks. We notice that multiple tools are frequent for obsidian. Four trapezes are made of obsidian, and a fragment of another may be made of flint. For chalcedony (17.8% of retouched pieces), the groups are much more restricted in number. We have wedges, pieces with lateral retouches or

	Blanks	Burin	Burin / Lateral retouch	Burin / Lateral retouch / Truncation	Burin / Pièce esquillée	Burin / Truncation	Pièce esquillée	Pièce esquillée / Lateral retouch	Lateral retouch	Lateral retouch / Truncation	Lateral retouch / Notch	Truncation	Borer	Beak	Notch	Denticulate	Scraper	Trapeze	Irregular retouch	Unretouched	Sickle elements	Sickle elements / Lateral retouch	Backed blades	Total
Obsidian	Blade	34	10	1	1	4	71	8	36	1	2	1	1	1	2	1	3	97	117					391
	Flake	10	3		1		74	1	11			1				4	1	1	50	116				273
	Waste	2					139	2	10										28	605				786
Chalcedony	Blade																			1				1
	Flake						1		5										4	59	20	2	2	93
	Waste						1												1	107				109
Flint	Blade																		1					1
	Flake																		3	1	3			7
	Waste																	1?	16					17
Total	46	13	1	2	4	286	11	62	1	2	2	1	1	2	4	2	5	184	1022	23	2	2	1678	

Table 3. Typological breakdown.

irregular ones, elements of sickles (22 specimens) and backed pieces. On flint, apart from the possible trapeze, there are pieces with irregular retouches and sickles (2 specimens). Sickles are all hafted obliquely. As opposed to chalcedony and flint, sickles made of obsidian are not easy to identify with the naked eye; we put forward the hypothesis that eight obsidian blanks could have been used as sickles as they bear a mat surface on their edges; they are not indicated in the table, since their identification is uncertain.

Obsidian provenience, least cost path analysis and techno-typology

A total of 165 Neolithic artefacts was selected for obsidian sourcing (Tables 4-6, Astruc *et al.* forthcoming). The artefacts were studied using LA-ICP-MS and XRF in the IRAMAT laboratory (Orléans). This large sample allowed us to identify main exploited sources, as well as secondary ones: eight sources in total were identified, two in Eastern Anatolia, one in Georgia and five in Armenia (Fig. 1). Sarıkamış is the most common with 89 specimens, followed by Tsaghkunyats (56 items). Chikiani represents a small number of pieces (13) and the remaining sources are represented by one (Gutansar, Hatis, Yağlica) or two specimens (Arteni, Gegham). The nature of the cortical surfaces found over some of the blanks and the size of the blocks necessary for the production show us that the pieces of obsidian were not acquired in river beds, but at primary sources. We shall see in the discussion that a polysource model is not surprising in the case of the South Caucasus, and that North-Eastern Anatolian sources were identified at several sites in the region.

Least-constraint routes were calculated between Mentesh Tepe and the obsidian sources attested in the Neolithic phases at the site (Fig. 4, Table 4). The movement model (Eastman 1999) is a function of the terrain slope only. Thereby, rather than an image of the material reality of the ancient routes, cartography proposes virtual and hypothetical itineraries that have no aim other than to render readable the possible paths between the large topographic entities.

The distances-times were calculated for a reasonably trained walker (average speed on the flat of 5 km/h and a walking time of 7 to 8 hours per day). As the obsidian sources are all situated in mountain pastures, it could be hypothesized that obsidian was gathered by shepherds at that time, or was exchanged with other shepherds coming from other areas. However, transhumance to the highlands was not practiced with certainty at Mentesh during the Neolithic period (Mashkour and Berthon, forthcoming).

Table 4 shows the lack of correlation between proximity and rate of different obsidian sources in Mentesh's supply, which suggests the concomitance of several modes of acquisition of the material (direct access, exchange, redistribution). Exchange can be assumed for obsidian sources represented by one or two samples (Gutansar, Hatis, Geghasar, Arteni, Yağlica). Redistribution is a hypothesis for Chikiani, as this source was largely exploited by sites of the Shomutepe-Shulaveri Culture located in the Khrami valley, these being halfway along the path between Mentesh and Chikiani.

Direct access is a first hypothesis for the three most exploited sources (Tsaghkunyats, Sarıkamış North, Sarıkamış South), whose paths from Mentesh Tepe are

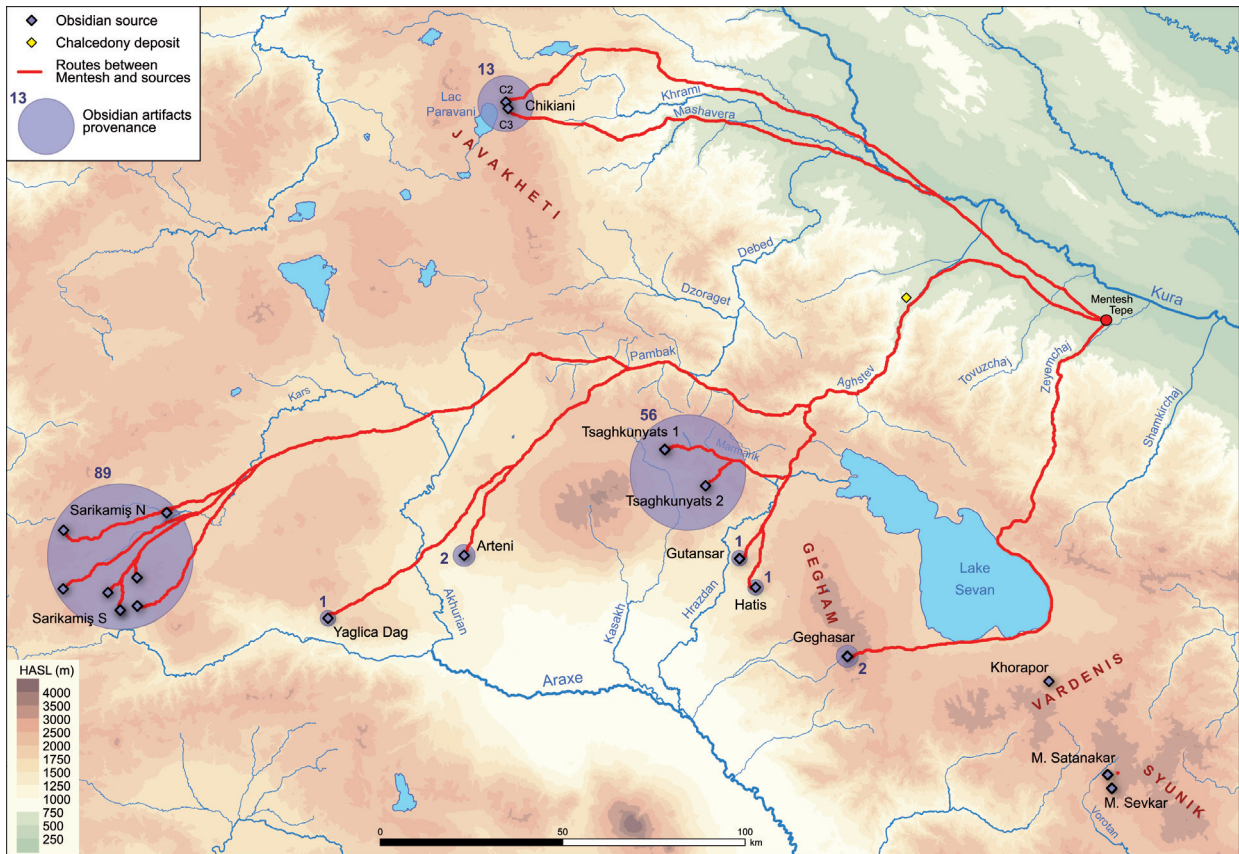


Fig. 4. Obsidian supply from Mentesh Tepe in the Neolithic period.

Table 4. Distances-times between Mentesh and obsidian sources.

NEOLITHIC	Gutansar	Chikiani	Hatis	Tsaghkunyats	Gegham	Arteni	Yaglica	Sarikamiş North	Sarikamiş South
obsidian	1	13	1	56	2	2	1	76	13
Days' walk	5.9-6.7	5.9-6.8	6.2-7.1	6.5-7.5	6.6-7.6	8.1-9.2	9.5-10.8	9.9-11.4	11.1-12.7

Table 5. Technological breakdown of the sourced artefacts.

	Blade core	Flake core	Flake	Blade width < 24mm	Blade width > 24mm	Undetermined	Total
Sarikamiş north	1	2	14	54	3	2	76
Sarikamiş south				12	1		13
Tsaghkunyats		2	5	45	2	2	56
Chikiani				12	1		13
Arteni			1	1			2
Gegham			2				2
Gutansar				1			1
Hatis				1			1
Yağlica					1		1
Total	1	4	22	126	8	4	165

	Br	Br/ LR	Br/ Tr	PE	PE/ LR	LR	LR/ Tr	Tr	Tp	Bo	B	N	Sc	Ir	Un	Total
Sarıkamış north	9	3	3	9	1	5			3	1	1			19	22	76
Sarıkamış south	2	1	1		1	1								2	5	13
Tsaghkunyats	7			5	1	6	1	1	1	1	1	1	1	13	18	56
Chikiani	2	1	1	1		4								2	2	13
Arteni				1										1		2
Gegham														1	1	2
Gutansar															1	1
Hatis	1															1
Yağlıca						1										1
Total	21	5	5	16	3	17	1	1	4	2	1	1	1	38	49	165

Table 6. Typological breakdown of the sourced artefacts. Br, burin; LR, lateral retouch; Tr, truncation; PE, *pièce esquillée*; Tp, trapeze; Bo, borer; B, beak; N, notch; Sc, scraper; Ir, irregular retouch; Un, unretouched. The presence of sickle elements is not considered here.

each other's close neighbours. However, as the Sarıkamış outcrops are far from Mentesh Tepe, and since other closer sources were not exploited, another hypothesis can be proposed: as shown by recent excavations (Hnila *et al.* 2019), several sites on the Aragats mountain, which rises near the Tsaghkunyats range, may have served as points of assembly for communities belonging to the same regional group, notably at Karmir Sar from the end of the 6th millennium. It is possible that such sites were meant as places of encounter and exchange between people from Mentesh Tepe and populations who lived during the summer in the Sarıkamış region.

The blanks found at Mentesh Tepe during the Neolithic came from different sources, which were sometimes very distant from one another. Can different ways of producing blanks and tools be identified? Overall, we see a great homogeneity both in technology and in typology from one source to the other (Tables 5 and 6). Cores are rare in the assemblage: a blade core and two flake ones from Sarıkamış, and two flake cores for Tsaghkunyats. Flakes were produced on obsidian from Sarıkamış, Tsaghkunyats, Arteni and Gegham (Geghasar and Spitaksar). The main production seen in all the raw materials (except Gegham, as the sample includes only two cores) is pressure-flaking on prismatic cores exploited via a turning or semi-turning mode, the main technique being pressure with a crutch in a standing position. Blades with width exceeding 24 mm could also be produced with a lever, and this was noticed in the cases of Sarıkamış, Tsaghkunyats, Chikiani and Yağlıca. Pressure is applied with a tip made of an organic material in our sample, but a few examples of the use of a copper tip were noted in the non-sourced material.

Typology is documented mainly for Sarıkamış and Tsaghkunyats. The typology of pieces is similar, *i.e.* burins, *pièces esquillées* (wedges) and pieces with

lateral retouch are the most frequent tools. Blanks with irregular retouches that could correspond to used pieces were observed as well. Blades with multiple tools such as burins with lateral retouch or truncation, wedges with truncation or lateral retouch with truncation were also documented at Sarıkamış, Tsaghkunyats and Chikiani. Trapezes are from the two main sources (4 specimens) and borers, beaks, notches and scrapers are only represented by one or two specimens. Two blades bear a lateral retouch made by pressure flaking (one on obsidian from Tsaghkunyats and the other on the same material from Yağlıca).

Discussion

Some technical markers of the Neolithic assemblage at Mentesh Tepe appear to be shared with other sites of the Shomutepe-Shulaveri Culture.

Among the exploited raw materials, obsidian plays a constant and major role. Moreover, the technology used in manufacturing this raw material into tools is clearly different from that for chalcedony and flint. The obsidian industry is characterised by skilled productions made mainly on unipolar prismatic cores, which are exploited by a semi-turning or turning mode using the pressure technique (the flake production is in a minority). As for chalcedony or flint industries, they are characterised by *ad hoc* productions managed on cores with unipolar or multiple platforms, knapped by hard direct percussion. Among the sites of the middle Kura Valley (Kıçık Tepe, Hacı Elamxanlı Tepe, Göytepe), Mentesh is the only one where chalcedony appears crucial; the other settlements show assemblages with flint as a second raw material.

Concerning obsidian, our results indicate a polysource model of exploitation with eight identified

sources. This type of model is common in the Southern Caucasus. It notably appears as early as the 10th-8th millennium at Kml0 2 (Arimura *et al.* 2009; Chataigner and Gratuze 2014), at all the Shomutepe-Shulaveri sites: Hacı Elamxanlı Tepe (Y. Nishiaki pers. com.), Kçük Tepe (Palumbi *et al.* 2021), Göytepe (Nishiaki *et al.* 2019b), Aratashen (Badalyan *et al.* 2004, 2007), Aknashen (Badalyan *et al.* 2010), Masis Blur (Martirosyan-Olshansky 2018a, 2018b), as well as at Kamiltepe and other Neolithic sites of the Mil plain (Guilbeau *et al.* forthcoming). It is worth noting that differences were observed from one region to another, with a prevalence of North-Eastern Anatolian sources for the most ancient sites of the middle Kura Valley, of Arteni and Gutansar for the sites in the Ararat plain, and of Syunik and Gegham for those in the Mil plain.

Pressure-flaking on unipolar prismatic cores was noticed on Mentesh Tepe's assemblage. This was mainly done with a crutch in a standing position, but also with the help of a lever. Where the lever technique is suggested at a site, the pressure technique with a crutch is also attested. The lever technique was already identified at various sites: at Göytepe (Nishiaki 2020); at Kçük Tepe, on obsidians from Chikiani 2, Sarıkamış North, Tsaghkunyats 1 and Gegham (Palumbi *et al.* 2021); at Aratashen (Badalyan *et al.* 2007; Chabot *et al.* 2009; Chabot and Pelegrin 2012); at Aknashen (Varoutsikos and Petrosyan 2019; Chabot *et al.* 2022); at Masis Blur (Martirosyan-Olshansky 2018a, 2018b); at Tsaghkunk (Petrosyan *et al.* 2018); at Aruchlo (Gatsov and Nedelcheva 2017; L. Astruc, personal observation); and at various sites of the Mil plain (Guilbeau *et al.* forthcoming): Qarabel Tepe (two blades from Gegham and Syunik), MPS86 (one blade from Gegham), possibly Kamiltepe (one blade from Gegham), MPS04 (one blade from Gegham), MPS103 (one blade from Syunik), MPS05 (one blade from Syunik) (Guilbeau *et al.* forthcoming). Pressure-flaking with a lever is the technique demanding the most skill. Its earliest occurrence documented so far in the Near East was identified at Çayönü Tepesi in Eastern Anatolia at the end of PPNB (around 7500-7300 BCE). An important landmark for this technique was uncovered at Sabi Abyad in upper Mesopotamia around 6200 BCE. A diffusion of the technique from this region to the southern Caucasus is likely (Altınbilek *et al.* 2012).

Focusing now on typology, Mentesh Tepe shares similarities with the sites of the Middle Kura Valley through the presence of trapezes, burins, wedges and pieces with lateral retouch. Moreover, sickle elements were recognized on non-obsidian raw materials and were part of composite instruments, all hafted obliquely.

Although blanks made on chalcedony and flint appear to have been knapped on site (cores are present),

the question remains open in the case of obsidian blanks. Blade cores are attested at the sites of the Ararat plain (Aknashen and Aratashen) and at others like Hacı Elamxanlı Tepe and Göytepe. They are nearly absent from Mentesh Tepe (one example). Technical pieces such as cortical flakes, crested blades or platform rejuvenation flakes are scarce. This could tell us that the obsidian industry was mainly introduced in excavated spaces in the form of preformed nuclei or finished objects. It is worth noting that, in any case, obsidian blanks may have been knapped at every stage in the diffusion of the raw material from sources to settlement.

The skill and know-how necessary to follow such manufacturing process (the *chaîne opératoire*) are essential. Our data demonstrates that the raw materials collected in different geological contexts, sometimes located at considerable distances, were exploited in the same way by small groups of specialists, as if the provenience of the raw material simply did not matter to the producers and the users of the artefacts. At Göytepe (Nishiaki *et al.* 2019b), the excavators – using a methodology different from ours – were able to show that the exploitation of different kinds of obsidian followed the same rules.

To sum up, the peculiar morphology of the cores, the method of knapping, the use of the pressure-flaking and similarities in typology point to a common technical tradition among Shomutepe-Shulaveri knappers, a tradition identified notably at Mentesh Tepe, Hacı Elamxanlı Tepe, Kçük Tepe, Göytepe, Aruchlo, Aratashen and Aknashen. Sites of the Mil plain also share some similarities with these assemblages. Chronological or regional differences were also observed.

At Mentesh Tepe, during the Neolithic, obsidian from the Sarıkamış region is the most common. This location is at a considerable distance from the settlement (270 km as the crow flies), representing 10 to 13 days for a lone walker and 20 to 28 days for a shepherd with his herd. The path goes to the north of the Tsaghkunyats range, where several outcrops are located, the latter also exploited by the inhabitants of Mentesh Tepe. This obsidian may have been at least in part acquired by exchange with other groups. The link between the Middle Kura Valley and North-Eastern Anatolia is also emphasized by the study of the earliest levels at Göytepe (levels 14-8, Nishiaki *et al.* 2019b) and of Hacı Elamxanlı Tepe (Nishiaki pers. com.), where North-Eastern Anatolian obsidians (Sarıkamış, Kars, Akbaba) are also dominant. However, at Kçük Tepe, though Sarıkamış obsidian is present, it comes only second after that from the Chikiani source (but the sample is rather limited at this stage of study).

Conclusion

Clearly, as shown by the diffusion of obsidian from distant regions, relations existed between the different areas of the whole southern Caucasus. If one focuses on ceramics, relations are apparent between diverse geographical entities. Mentesh Tepe presents many similarities with the SCC in ceramics (ceramic shapes of hole-mouth pots, rare open shapes). But many differences are attested as well (hole-mouth pots partly covered on the top, no basalt-temper and almost no grit-temper, the predominance of temper with poacee seeds, almost no applied ornamentation, a few painted sherds, a large predominance of polished wares, no mat-impressed bottoms..., see Lyonnet *et al.* 2016; Lyonnet 2017a). These differences may be due to Mentesh Tepe's chronological attribution, *i.e.* later than Aknashen VII and Hacı Elamxanlı Tepe with their imported painted pottery (Early Halaf, Samarra and Halaf-related pottery), and earlier than Aruchlo and Göytepe where a more "typical" SCC pottery is known. The differences may be due to regional variations as well. In the SCC, only Shomutepe shares shapes with those of Mentesh Tepe, but we lack of radiocarbon dates for this site. On the contrary, nothing similar is mentioned at contemporary Gora Tepe or in the recent excavations at Shulaveris Gora Tepe; regional variation is therefore also possible, Mentesh and Shomutepe being on the eastern edge of the SCC. Similarities in the pottery between Mentesh Tepe and the Mil-Karabagh steppe area are worth noticing, but these sites are dated slightly later. Recent excavations at Kültepe I in Nakhchivan, however, with a level I partly contemporary with Mentesh Tepe, show that this kind of pottery began earlier in this eastern area. At all these sites, pottery is mainly poacee and/or vegetal tempered, light-coloured and polished, and only rarely has applied decoration. Many sites in the Mil-Karabagh area present the same hole-mouth pots partly covered on the top. This region, however, also developed its own specificities compared with those at contemporaneous Aruchlo and Göytepe, especially in the introduction of painted decoration around the middle of the 6th mill. Along the Araxes, relations with the Proto-Halaf and Halaf area are attested by the presence of several potsherds (at Aknashen -early Halaf and Samarra-, Aratashen -Halaf-, Kültepe I -Halaf-, Marro *et al.* 2019). At Hacı Elamxanlı Tepe, a few painted sherds are said to present similarities with Samarran ware. At Mentesh Tepe, no similarities with these north Mesopotamian sites are attested.

Following a hiatus of 800 years, another world appears with the advent of the Chalcolithic period of Mentesh Tepe. Architecture and pottery are clearly different, though some continuity was noticed in the shape and decoration of part of the vessels. Drastic change in obsidian procurement occurred, with the

prevalence at the time of Gegham. Obsidian reduction sequences remained the same, but several important modifications occurred (Astruc *et al.* forthcoming). Flint knapping was no longer *ad hoc* but highly skilled, with the dominant production consisting of blades knapped on prismatic cores by pressure-flaking. Pressure retouch is generalised in the typology. For this period, comparisons can hardly be drawn, as contemporaneous sites are rare and lithic studies mostly allusive.

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