

# PROCEEDINGS

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# **A NEOLITHIC OBSIDIAN INDUSTRY IN THE SOUTHERN CAUCASUS REGION: ORIGINS, TECHNOLOGY AND TRACEOLOGY**

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## **1. CONTEXT: SOUTHERN CAUCASUS IN THE 6<sup>TH</sup> MILLENIUM (5900-5600 BC)**

The settlement of Aratashen, situated about 25 km west of Yerevan and 5 km south-west of Vagharshapat (Echmiadzine), is positioned in a loop of the river Kasakh, which flows into the Arax a few kilometres to the south (Fig. 1). This habitation site, of which the stratigraphy is now well understood, covers the Chalcolithic and Neolithic phases of the regional culture of the Ararat plain. The site has been regularly excavated from 1999 to 2004, under the direction of R. Badalyan and P. Lombard, as part of the Franco-Armenian “Caucasus” mission, directed by C. Chataigner.

The lithic artefacts discovered in the course of the excavation of this site enabled the recovery of a large obsidian industry, which consists of 15,000 whole objects and 3000 fragments. Only 26 pieces of the whole lithic industry (about 0.1 %) are in flint, quartz, secondary quartzite, silicified limestone, mudstone or serpentine. Numerous analyses have been done on this material in order to understand the role these tools played. Here we present an overview of the results of three of these analyses: sourcing, technological and functional analyses (high magnification traceology). These have shown that, like in Northern Mesopotamia, agricultural tools made on long regular blades are a major phenomenon in this region. Hundreds of such blades made with obsidian have been found at every level of occupation of this ancient village.





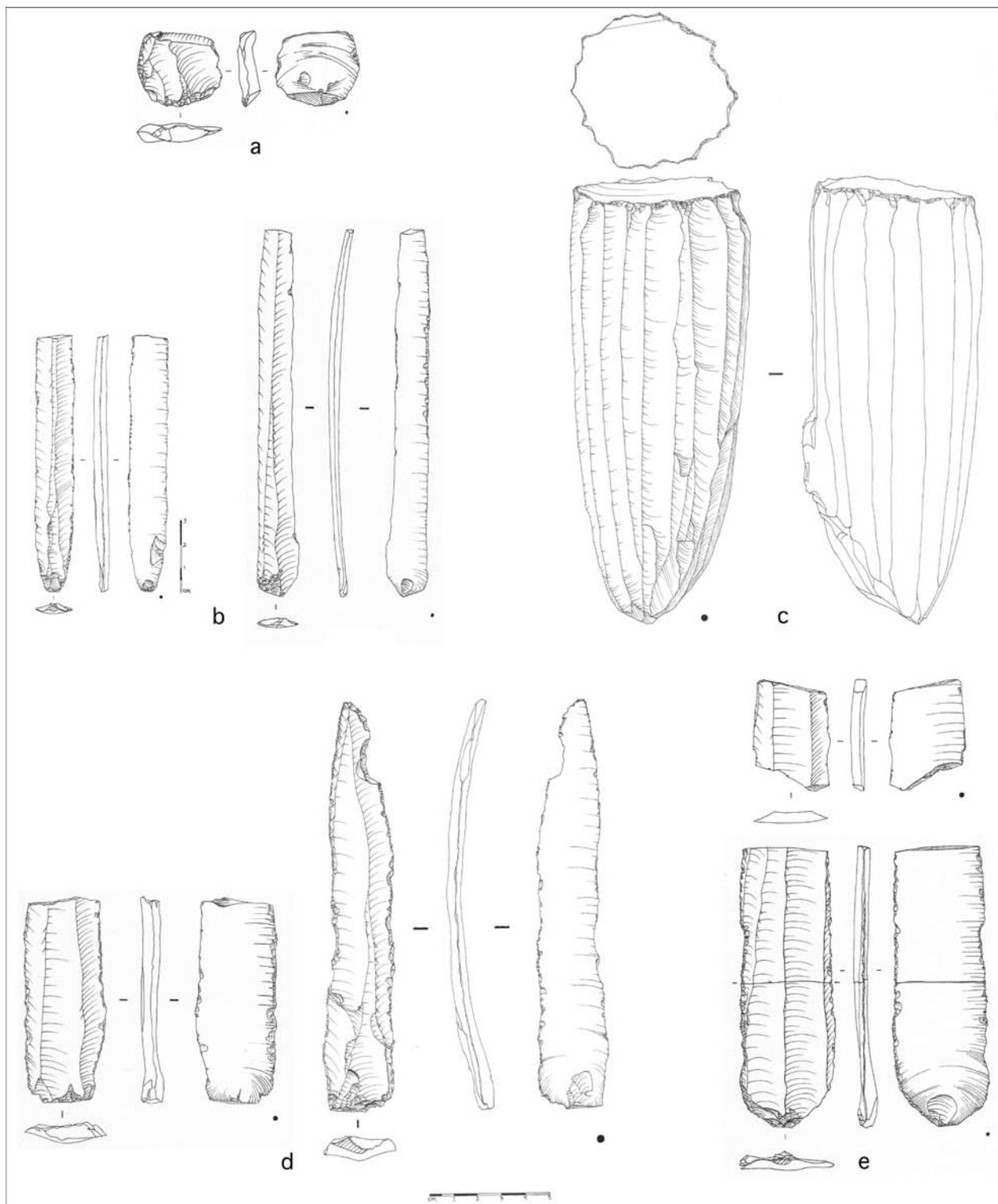
**Figure1.** Map of Aratashen in the context of Armenia.

## 2. SOURCES OF THE OBSIDIAN OF ARATASHEN

The obsidian artefacts discovered at Aratashen are of several different colours: opaque black, slightly transparent black, grey, transparent colourless with sometimes black veins, red-brown, streaked or mottled red and black... Observation of the colours of these obsidian objects is only useful for database classification. It is by physico-chemical analyses that the sources of the obsidian objects could be determined.

Many sources of obsidian are in the mountains, which surround the plain of Ararat: in the Lesser Caucasus in the North, in the province of Kars in the West, in the region of Lake Van in the South. In order to determine the origins of the obsidian used by the inhabitants of Aratashen, chemical analyses were carried out on 69 samples from the surface and from different levels of the *blur*. In total, chemical analyses allowed us to identify eight local volcanic sources where the obsidian was taken.





**Figure 2.** Debitage : (a) retouched flake (b) blades made by pressure debitage with crutch (c) pressure with crutch nucleus (d) blades made by indirect percussion (e) blades made by pressure with lever.



The most exploited source (62 %) is that of Arteni, a volcano situated in the western part of the plain of Ararat, some fifty kilometres from Aratashen, that is, some ten hours by foot as the terrain is not rough (Fig. 1). The obsidian flows are limited in size, but the material is of excellent quality and can be obtained in all seasons.

The second source (19 %) is situated in the foothills of the Lesser Caucasus, on the right bank of the river Razdan, at about 9 hours walk from the *blur*. The flows of the Gutansar complex cover a vast territory, easy of access and nearer to Aratashen than the Arteni volcano; however, they played only a secondary role in supplying the settlement.

The four other sources are much less represented at Aratashen; all are located more than 20 hours walk from the site: to the east, Geghasar (4 %) located at more than 3000 m, in the mountain chain which dominates Lake Sevan; to the west, the province of Kars (7 %) in Turkey; to the south, the region of Lake Van (3 %) with the volcanoes of Tendürek and Meydan Dag. Added to these are 5 % of the samples for which the origin could not be determined and which probably came from Eastern Turkey, the only region for which geochemical characterisation is still incomplete.

Therefore, Aratashen, like most of the Chalcolithic and Early Bronze Age settlements in the Ararat plain, had a “polysource” strategy with a single source (here Arteni) predominating.

### 3. TECHNOLOGY

#### 3.1. Debitage on flakes

The lithic assemblage of Aratashen is essentially an industry on long blades,debitage on flakes being in the minority. Tools on flakes account for only 2.3 % of the total tool assemblage of Aratashen, as opposed to 97.7 % for the tools on blades. Except for retouched flakes, the other types of tools on flakes (end-scrapers, fine-toothed, notches and side-scrapers) account for only a minor proportion of the assemblage (Fig 2a).

The tools on flakes were obtained opportunistically: by means of direct percussion with a hard stone hammer, flakes were simply detached from a nucleus which had received no real preparation. These flakes were then retouched (very little elaborated partial retouch), while others were probably used as they were. This is the simplest known method ofdebitage and is universal. This method produces blanks of non-standardised forms which, retouched or not, were intended for use in various short-term tasks. This *ad hoc*debitage is partly improvised because it depends upon the result of a given removal; thus each time the nucleus changes, the next blow is decided upon, until the small block of stone is exhausted.



## 3.2. Debitage on blades

The tools on blades, however, were made on blade blanks obtained by more elaborate debitage methods.

### *Blades obtained by pressure debitage with a crutch*

Fine blades, thin, light and slender (Figs. 2b and 2c). Although the majority of specimens identified at Aratashen were fragmented for functional reasons, we have nevertheless recovered several of these objects in a whole state. The maximum length observed is 16.2 cm, with a width between 1.3 and 2.5 cm and a thickness between 0.3 and 0.6 cm.

The following morpho-technological characteristics have led to a diagnosis of pressure (stand up pressure with a crutch): a punctiform butt, and thus the proximal part is less wide than the body of the blade (the blade is often widest immediately after its proximal part), the presence of a small protruding bulb which is high and short, the absence of a lip, sometimes abrasion of the overhang (but this criterion is not obligatory), rectilinear profile, distal curvature, edges and arrises very regular and parallel, general slenderness (especially the mesial part), no marked ripples on the inferior face. There is no limit on length, but as stated above, obsidian blades knapped by pressure debitage with a crutch cannot attain more than 2.6-2.8 cm in width.

### *Blades obtained by indirect percussion*

These blades are in general long and robust, but at Aratashen more modest examples do exist (Fig. 2d).

The blades of Aratashen knapped by indirect percussion present the following morpho-technological characteristics: plain and thick butts (to enable application of the “punch”) and as wide as the blade, a protruding bulb, wide and spread-out, the debitage angle about 90 degrees (between 80 and 95 degrees), frequent bulb scars, frequent abrasion of the overhang, edges and arrises which are less regular than on blades knapped by pressure techniques, inferior face presenting slight bulges (caused by the instability of the system), beginning of a curve at the mesial part (the long blades usually have an arched profile, with a section which is often wide and thick). The blades, which have not been deliberately fragmented can be as long as 20 cm, as wide as 4 cm (although more often around 3.2 cm) and as thick as 0.5 to 0.8 cm.



### ***Blades obtained by pressure with lever***

As for many blade assemblages made by pressure with lever in Northern Mesopotamia (Canaanite blades) (Anderson, Chabot & van Gijn 2004), the blade segments of Aratashen knapped according to this technique are in the form of mesial, proximal or proximal-mesial segments (Fig. 2e). In fact, it seems that here too, for a functional reason, these blades were deliberately broken in such a way as to obtain and use the most rectilinear parts, which explains why few blades with a distal part have been discovered. Thus, even if it is possible to obtain blades as long as thirty centimetres with this technique, the segments found at Aratashen have a maximum length of 13 cm, but usually between 5 and 9 cm. In general they are between 2.2 and 4 cm wide, most often about 3.2 cm. In section they are slender, between 0.4 and 0.6 cm. The operating code for the majority of the blades is 2-1-2.

J. Pelegrin's experimental work (Pelegrin in Chabot 2002) has shown that the presence of three morpho-technological characteristics on the same piece is convincing indications of pressure using a lever: great regularity of the edges and the arrises, straightness of the profile (except in the distal end), slenderness of the section. Naturally, other morphological characteristics also enable the recognition of this technique: faceted, dihedral or small plain butts smaller than the body of the piece, well-marked point of contact, bulb high and short, great regularity of the edges and the arrises, straightness of the profile (blades flat in their mesial part). The systematic study of fissures in the butts, which will be made on all of the segments (ongoing research), should provide proof that the point used for this type of debitage was in copper.

The method for obtaining such long regular blades by pressure using a lever implies the successive use of three knapping techniques. First of all a heavy nucleus is prepared by cutting down a large block with a stone hammer. Then, still with direct percussion, long flakes are detached to regularise the nucleus of triangular section. A ridge is formed by the removal of flakes; then this first ridged blade, consisting of two series of counter-bulbs, is removed by indirect percussion. A whole series of blades are then obtained at this ridge by indirect percussion. Once this stage is completed and the nucleus regularised, full debitage by pressure with a lever can begin. Thus the nucleus is immobilised in a hollowed out tree trunk and the blades are obtained by pressure (up to 300 kg of pressure) exercised by a long lever, equipped with a deer antler or a copper point (Pelegrin in Chabot 2002).



### 3.3. Use-wear analysis<sup>1</sup>

As it is often the case for *ad hoc* tools (expedient tools), which are intended to serve only for the immediate occasion, hardly any significant traces could be observed on the flake tools of Aratashen and it is difficult to determine their function.

On the other hand, our use-wear analyses on blades have shown that a large proportion of the segments of retouched blades as well as those used in the raw form have a function related to agricultural work: they were used either for harvesting or for treating the harvests.

#### *Sickle elements*

When an obsidian blade is hafted to be used as a sickle for harvesting, the micro-traces on the functional area present a smooth, slightly glossy aspect (“smooth polish”) with rounding on the cutting edge (Fig. 3a). At a microscopic level, an important characteristic is the formation of parallel striations on the edge, which look like a series of small dots. At a more advanced stage, these dots take on the form of lines or deep grooves. On certain objects many striations can be seen, while on others they are rarer, depending upon the intensity of the work carried out. Unaligned scratches are sometimes present, but never omnipresent; at the most a few isolated scratches can be seen in places. Little circles of raw material not affected by the cutting of plants are also visible in some places; these indicate micro-sectors where the surface of the object is deeper.

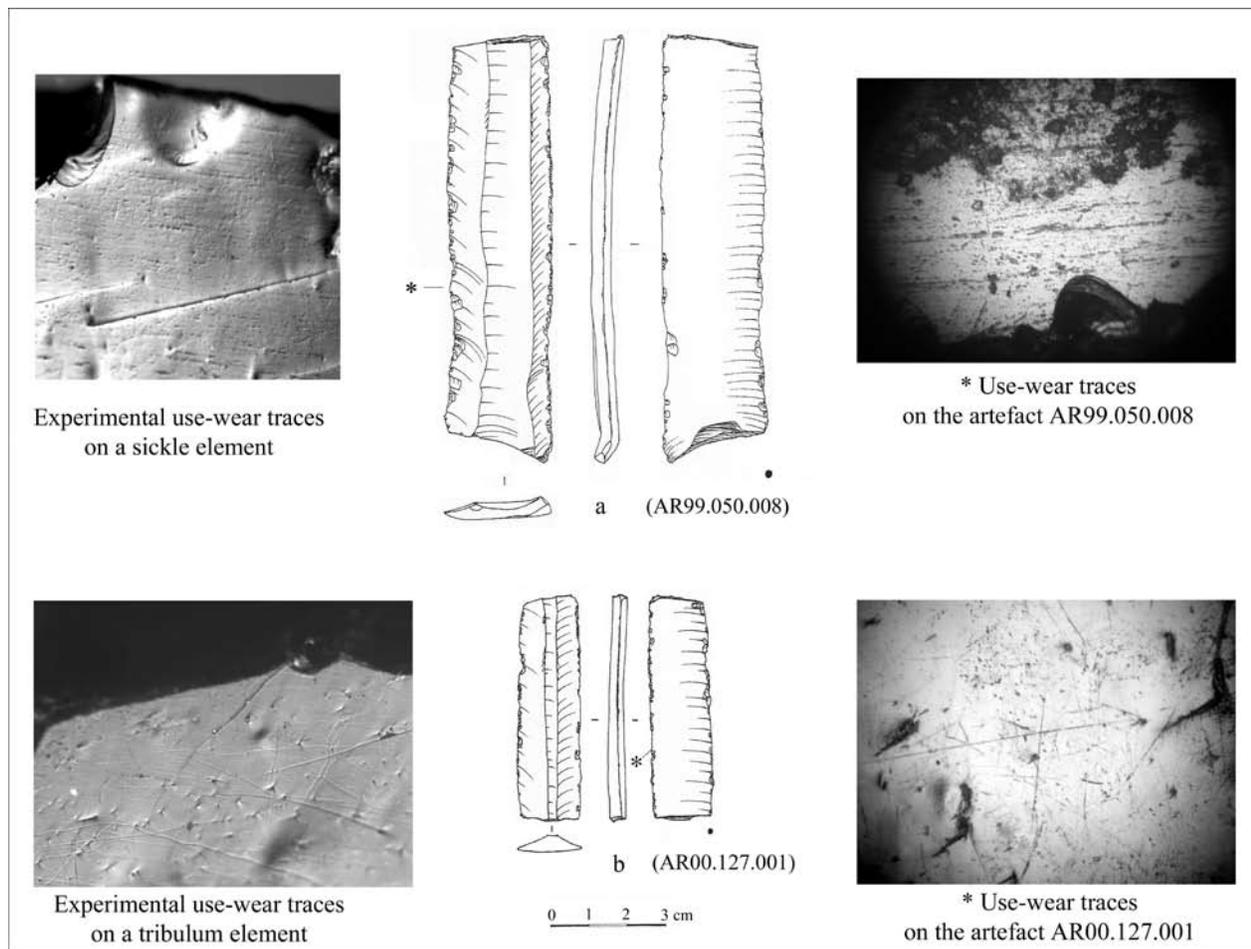
#### *Tribulum elements*

When an obsidian blade is fitted into a threshing sledge, also called a “tribulum”, the polish is much less brilliant than that of sickle elements and it is very discreet on a large number of objects (Fig. 3b). The “glossy” aspect observed on the sickle elements is not present. In general, the micro-traces present a more “agitated” aspect, as the active zones have scattered scratches in all directions, which indicate a more violent action (abrasion) carried out by the tool. However, the edges of the Aratashen objects which were inserted into a threshing sledge are clearly less rounded and thus appear to have better preserved their cutting edge. These artefacts do not present parallel striations on their cutting edges. Sometimes comet shapes are visible, scrapes which indicate the direction in which the tool worked.

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1. It is only at high magnification (100-200X) that one can detect attributes (polish, morphology of abrasion, striae, pits, etc.) indicating the tool’s mode of use, that is, the motion, direction and the particular contact material held stationary or in motion. This requires use of a reflected-light (metallographic) microscope (up-right and inverted microscope were used in this study), the analyses are also supplemented by a stereoscope (5-50X magnification). On a macroscopic level, the position of the gloss and other traces such as edge rounding and edge chipping, as well as adhesive traces, help to deduce the mode of insertion of the object in an instrument.





**Figure 3.** Obsidian artefacts: Experimental and archaeological use wear traces (a) sickle elements (b) threshing sledge (*tribulum*) elements.

The two examples at Aratashen of which the use traces are illustrated are non-retouched segments, hence confirming our hypothesis according to which many blank segments of blades discovered on the site are tools intended to be used non-retouched for agricultural work. It is thus very interesting to observe that perhaps only a minority of the tools of Aratashen were retouched.



### 3. GENERAL DISCUSSION

This research deals with one of the most remarkable stone-tool types in the Old World Prehistory, the long and regular blades made by pressure with a lever and used in agricultural activities in the Neolithic and Chalcolithic periods. The advanced and highly specialised technology required to produce these standardised blades defies the general idea that stone technology became less important in the Late Prehistory and later almost insignificant with the advent of metal tools. In fact, this technique is known on flint in several Old World cultures: the Chalcolithic of Portugal, Sardinia, France (Toulouse region), Northern Mesopotamia, Bulgaria (Varna culture) and the early Neolithic in Greece. So in the state of our present knowledge of the pressure technique using a lever, the super-blades made on local obsidian by the inhabitants of Aratashen would seem to be one of the oldest specimens to have been identified (that is nearly 2000 years before lever pressure is known from their neighbours of Northern Mesopotamia/ Canaanite blades) and one of the only example of this technique applied on obsidian.



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