## Provenance Study of Obsidian Artifacts from the Neolithic Settlement of Masis Blur (Armenia) Using Portable X-ray Fluorescence Spectrometry

#### Abstract

In the Souther Caucasus (Fig.1) geochemical characterization and archaeological obsidian source studies have gained momentum in the last decade and have significantly advanced our understanding of how human groups interacted with the landscape and utilized obsidian resources through time. The southern Caucasus has abundant sources of obsidian. Some 9 major sources (about 26 flows) have been identified throughout Armenia and southern Georgia. Armenia, is one of the most obsidian-rich regions in the world and its prehistoric cultural landscape is abundant with lithic assemblages predominantly composed of obsidian.

This study reports on research undertaken in Armenia in 2013-2014 and presents preliminary results obtained with a portable X-ray florescence (pXRF) spectrometer on the chemical characterization and provenience of 206 obsidian artifacts from the pre-pottery Neolithic settlement of Masis Blur. This assemblage was used to assess the prevailing belief that the raw material for the majority of the artifacts was primarily coming from one of the two Arteni sources in Northwestern Armenia, this one being nearest to the settlement (60 km NW).

Geological samples were systematically documented and hundreds of samples collected. These samples were analyzed along with the archaeological samples in order to explore regional patterns of Neolithic procurement and distribution in the Ararat plain of Armenia.

## Masis Blur Archaeological Project

The Masis Blur Archaeological Project (MBAP) is a collaborative archaeological research project in the Ararat plain of Armenia (Fig. 2), conducted jointly under the auspices of the Cotsen Institute of Archaeology (UCLA) and the Institute of Archeology and Ethnography in Yerevan (Armenia). Our interests revolve around the emergence of sedentary agricultural communities in the Armenian Highlands and with this aim we began excavations of the Neolithic settlement of Masis Blur.

The Pre-pottery Neolithic settlement of Masis Blur (6200-5700 BC) is located on the ancient west bank of the Hrazdan River in the Ararat plain. The mound stood 2.5 meters above the plain and measured 1 ha in size before it was entirely leveled in the early 1970s. The surface material belonging to the destroyed layers indicates that the upper layers of the mound belonged to the pottery Neolithic and the Eneolithic periods. A deep sounding placed in 2013 revealed that the cultural layers continue for another 2.7 meters below the modern surface.

From three seasons of excavations (2012-2014), the settlement has yielded an abundance of artifacts such as incised grooved stones, axe heads, personal ornaments out of various materials, bone tools, and nacre – all characteristic of Near Eastern Neolithic assemblages.

Agricultural practices at the site are centered on cereal cultivation and a preference for sheep/got can be noted in the faunal assemblage, although wild taxa, such as fish, deer and turtle are still present

### Masis Blur Lithic Assemblage

Several thousand lithic artifacts have been unearthed during our excavations and the study of these shows that obsidian was the raw material of choice of the Neolithic inhabitants of Masis Blur. Cortical artifacts are very few and even though throughout the site there are river-rolled cobbles and pebbles brought downstream from the flows by the Hrazdan, these does not seem to have been utilized at all. While these would offer a year-round

availability and easy access to the inhabitants, their small size made knapping very difficult and unpractical for blade production.

Thus far, we have not been able to identify knapping areas and the general rarity of initial core producing debris suggests that core pre-forms were collected during the summer months in the course of transhumant exploitation of highland pastures and brought to the settlement at the end of fall along with the folks of sheep and goat. Of course, this is not the only scenario, and we do not exclude that obsidian coming from sources located a few hundred kilometers from the settlement could have been a result of trade and familial interactions with other settlements in the region.

Figure 6. The lithic assemblage of Masis Blur.

Figure 3. 2012 team of MBAF







Masis Blur. Trench M9/6







Figure 2 Map of Armenia . Masis Blur Neolithic settlement is marked with a star.





#### **Documenting Obsidian Sources**

The Armenian Highlands contain some 400 volcanoes. Five of the six volcanic regions in Armenia - Ketchut, Aragats, Geghama, Vardenis, Syuniq - produce obsidian (Figure X). These sources are quite variable in terms of the quality and quantity of obsidian, the range of colors they produce, and their accessibility in terms of ease of location access and snow-cover.



Figurer 10. GPS points of individual obsidian sar

Some of the sources, such as Arteni and Gutanasar are only an hour drive from the Masis Blur settlement and even before the construction of modern roads would have been easily accessible; while others, such as those located in northern and southern Armenia require several hours of off-road driving and strenuous hiking. Additionally, some of the flows of the Vardenis and Syuniq volcanic ranges are under snow-cover by mid to late August.

In August of 2013 I visited all but one (Khorapor) of the obsidian sources in Armenia and collected several hundred geo-referenced geological samples (Fig. 12), 73 were choose for pXRF analysis and exported to the US.





Figure 7. Unused blades found in situe in a round storage structure along with two grinding stones.

### pXRF Analysis: Methods and Materials

I analyzed 206 artifactual samples from the Masis Blur Neolithic settlement and 80 geological samples from 11 Armenian and 1 NE Turkish sources.

The samples were analyzed using a hand-held Bruker Tracer III-V+ spectrometer equipped with a rhodium x-ray tube and a Si-PIN detector. The x-ray tube was operated at 40 kV, 14 µA, using a Cu-Ti filter and the acquisition time was set at 200 seconds.



Figure 12. Several samples of obsidian from various Armenian sources.

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Figure 8. Poqr Satanaqar obsidian source, Syunik province, Armenia



an sources. [Karapetyan et al in Von Majkop bis Trialeti 2010]

#### Results

□ Among all the quantifiable elements Nb, Rb, Zr, Y, and Fe oxides proved to be excellent discriminators between all sources analyzed.

□ Based on these elements I was able to assign 83% (n=171) of the archaeological samples to one of the sources analyzed in the study (Fig. 14 and 15).

□ The analysis show that the inhabitants of Masis Blur exploited at least 6 (but possibly as many as 13) different obsidian sources through direct (Hatis range sources) or indirect (Sarikamiş) procurement strategies.

□ Obsidian deposits of Arteni (65km NW of MB) and Gutanasar (45km NE of MB) were the main sources utilized, each contributing nearly 30% of the total assemblage analyzed.

□ Obsidian of Poqr Spitakasar presents the second largest group, 17%, at for Masis Blur, although noticeably fewer than Arteni and Gutanasar (Fig. 15).

□ Absent from Masis Blur's obsidian assemblage is obsidian from Mec Spitakasar (far east) and sources located in the Syunik volcanic range (far south).

□ The analysis of the geological samples revealed that the Akunq source of Hatis volcanic mountain, contains previously unidentified (or unreported) two distinct compositional types, clearly differentiated from one another by iron oxides, Strontium (Sr) and Zirconium (Zr) concentrations (Fig. 16).





Figure 11. Lab-work using a Bruker pXRF for the analysis of obsidian.

#### Discussion

The results show that the inhabitants of Masis Blur had a wide-reaching obsidian source exploitation pattern with a preference for sources located to the north of the settlement, while those in the south are completely absent from the assemblage. The distance to the source or visual characteristics (e.g. color and internal striations or mottling) was not the essential parameter in the choice of deposit exploitation. Other factors such as opportunistic exploitation (e.g. sources located near summer pastures), the importance of contacts and exchange between groups in neighboring regions, and the existence of loci of circulation among such groups as more significant determinants in the choice of deposits.

It is very likely that a large group of the unassigned artifacts from Masis Blur belong to still uncharacterized sub-sources within the Geghama volcanic range. However, we do not exclude the possibility that a number of these can also belong to obsidian sources of Eastern Anatolia.

Considering the presence of Sarikamis obsidian at Masis Blur, as well as the presence of imported painted pottery from all three Late Neolithic settlements of the Ararat plain, most likely coming from the Lake Van region, it is not inconceivable that obsidian form this area was also traveling along the same communication routs to the settlements in the Ararat plain.



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Figure 14. Distribution of Masis Blur obsidian artifacts based on Zr and Nb.



type identified by this study and distinguishable by a significantly higher iron oxides, Sr, and Zr content.

