Imports and Outcrops: Characterizing the Baantu Obsidian Quarry, Wolaita, Ethiopia, Using Portable X-Ray Fluorescence

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INTRODUCTION

The Ethiopian branch of the East African Rift contains many obsidian sources (Negash *et al.* 2020) exploited as far back as 1.7 mya (Gallotti & Mussi 2015). It is an ideal region for studying long-term variation in technological organization and especially raw material procurement in contexts of evolutionary, demographic, and environmental change. At deeply stratified, well-dated sites like Mochena Borago rockshelter (Brandt et al 2012), archaeologists can examine even subtle shifts in obsidian procurement across broad time periods.

The Baantu obsidian quarry was the primary source of toolstone for Mochena Borago, although artifact types on the surface suggest quarrying and tool manufacture began much earlier than this.

Initial sourcing of the Mochena Borago obsidians identified some shifts in obsidian selection. However, a thorough survey of the quarry itself was needed to identify the geochemical fingerprint of the Baantu obsidian.

The quarry sits within a large area of eroded quaternary alluvium. Obsidian outcrops appear throughout, and obsidian artifacts cover the surface.

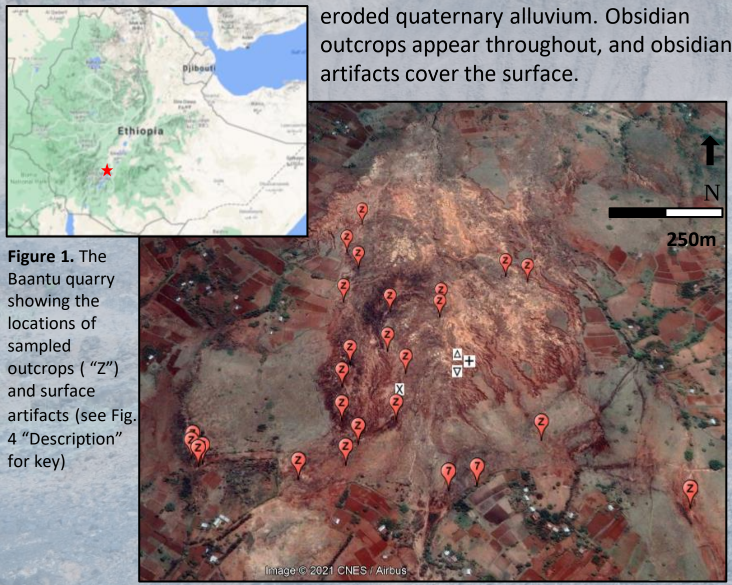


Figure 1. The Baantu quarry showing the locations of sampled outcrops ("Z") and surface artifacts (see Fig. 4 "Description" for key)

Outcrops and surface materials were likely exploited for toolstone. The goal of this project was to identify any variation in the Baantu obsidian outcrops and where possible identify imported obsidians.

MATERIALS & METHODS

Survey was made possible by the Wolaita Zonal Tourism offices, especially Ato Girma Dubusho. Our goal was to identify obsidian outcrops (Figs. 1, 2) relative to the surface material covering much of ~1km² Baantu surface area. Large flakes were struck from each outcrop. In some areas surface materials were collected along transects at regular intervals. This amounted to 32 sampled outcrops and 45 bags of lithic materials. Some volcanic tuffs and pottery were also collected

In the limited time available, I recorded 32 spectra at the Ethiopian Authority for Research and Conservation of Cultural Heritage (ARCCH) in Addis Ababa using a Bruker IIIeV Tracer + portable XRF spectrometer. These included:

- **25 obsidian outcrop flakes** (Fig. 2, see Fig. 1 for location).
- **6 obsidian artifacts** collected from the Baantu surface (Fig. 3).
- **1 obsidian artifact** from Mochena Borago.

Figure 2. Quarried obsidian outcrop at Baantu.

Figure 3. Obsidian artifacts from Baantu surface a) aa large levallois core, b) a bifacial point, and c) grey/green obsidian.

To maintain internal consistency, all XRF spectra were recorded on a single machine (Bruker IIIeV Tracer +, SN: K0437). It is equipped with a rhodium tube. The filter is composed of 1µm Ti, 12µm Al, 6µm Cu. It records MnKa1, FeKa1, ZnKa1, GaKa1, ThLa1, RbKa1, SrKa1, Y Ka1, ZrKa1, and NbKa1.

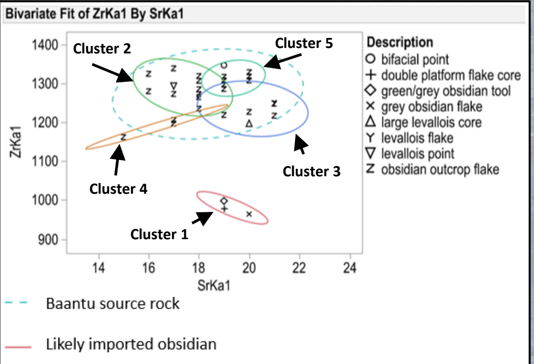
The machine was recalibrated on 11/6/2017 using the Bruker/MURR 40 standards, a Lucas-Tooth regression method.

Each sample was >3mm thick with a fresh break where possible, and large enough to cover the 3x4mm X-ray spot size. Spectra were recorded once for each sample using Bruker's accompanying software S1PXRF at 40kV in 180-second intervals.

RESULTS

K-Means cluster analysis (LMP) revealed five clusters within the 32 samples (Fig. 4). Obsidian outcrop flakes clustered together, and most surface artifacts fell within this range of variation.

Artifacts from cluster 1 likely represent another obsidian source and suggest that obsidian was being imported and quarried at Baantu.



Cluster Means

Cluster	RbKa1	SrKa1	Y Ka1	ZrKa1	NbKa1
1	141	19	117	980	187
2	189	17	146	1290	255
3	180	20	140	1235	246
4	172	16	130	1188	237
5	191	19	150	1314	258

Figure 4. The largest 95% confidence ellipse is the grouping of all "outcrop" samples encompassing clusters 2-5, likely representing minor sub-groups among the outcrops. Cluster 1 likely represents a different source. Figures by L.R.M. Johnson

CONCLUSIONS AND FUTURE RESEARCH

The Baantu obsidian outcrops appear to cluster well together and this preliminary comparison suggests that they are distinguishable from imported obsidians. More data are needed to 1) evaluate cluster integrity, 2) identify possible sub-sources, and 3) assess the variety of imported obsidians represented on the surface.

Other obsidian sources in the region should also be sampled and compared to the Baantu outcrops using consistent calibration standards.

By identifying obsidians and reduction strategies at quarries and in well-dated archaeological sequences, archaeologists can address questions of temporal and spatial variation in obsidian procurement across major periods of evolutionary, environmental, and social change.

REFERENCES:

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