Antler Versus Stone:
The Ballistic Differences between Antler and Stone Arrowheads.

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Introduction

The bow and arrow were widely utilized around the world. Archaeologists commonly encounter stone arrowheads in their excavations. This abundance of stone projectile points speaks to the importance of the bow in ancient life. In addition to stone, antler arrowheads have also been recovered – albeit far less often. A review of literature reveals that many different groups of people used antler to make arrowheads - often at the same times and places as other arrowheads made from stone. The usage of multiple materials has led some archaeologists to suggest a difference in function. This study evaluates the performance of stone versus antler arrowheads using experimental replicas shot into ballistics gel to gauge the damage caused and sustained by both arrow types. From these differences, we can infer possible advantages and disadvantages antler tips have compared to stone tips. These findings also provide insight into why antler-tipped arrows are less common in the archaeological record and allow us to infer whether they had a use not found in stone tips.

Antler and stone-tipped arrowheads have observable differences. Stone-tipped arrows are overrepresented within the archaeological record while antler tips are generally rarer and found in less numbers despite appearing in the same places and within the same timeframe. Antler is harder to come by and takes more time to shape compared to stone but is more durable (Engelbrecht 2016).

Hypothesis

For several reasons, I would expect the stone-tipped arrow to perform better than the antler-tipped arrow. First, the antler tip appears more substantial in size drawing into question its ability to fully penetrating the target. Second, the stone point is flatter/thinner in cross-section which will likely allow for greater penetration. Third, the stone point is sharper with a serrated edge while the antler arrow simply has a sharp point and a more conical shape.

Figure 1. Antler-tipped arrow based on 15th and 16th century findings in Northeastern United States.

Figure 2. Obsidian Stone-tipped arrow.

Figure 3. Ballistics Gel

Figure 4. Result of first round of testing.

Figure 5. First round of testing, showing the exit wounds on the gel.

Methods

For this study, arrows tipped with stone and antler were needed to evaluate their performance in ballistics gel. To accomplish this, I first had to make antler points. The points were made from whitetail deer antler. This process involved sanding the tips into a shape modelled after Indigenous arrowheads from the Northeastern United States and Southeastern Canada dating to around the fifteenth or early sixteenth centuries A.D.

The stone arrowhead was purchased from Hunt Primitive as part of another Kilmer supported project conducted in 2021. This arrowhead was made from obsidian.

Both points were hafted to traditional arrows made from cedar. The arrowheads were attached using whitetail deer sinew soaked in hide-glue. I used pine pitch to seal any visible gaps before sinew wrapping the points in place. These arrows can be seen in Figures 1 and 2.

In order to sufficiently test the effectiveness of both of these arrowheads, I carried out an experiment similar to the one found in "Stones, Bones, and Antler Tines: A Comparison of Midwest Arrow Points" by Jamison Jordan. A block of ballistics gel was placed approximately 8.5 yards away from the archer. Both types of arrows were then shot into the ballistics gel multiple times. The depth of penetration in cm was measured along with the arrowhead's mass, length, and width. Ideally, this experiment would be conducted using multiple projectiles of both types and shot at various types of targets, but due to time constraints, this simple experiment is sufficient.

Findings

Projectile Point	Length (mm)	Thickness x Width (mm)	Mass (including shaft) (g)
Stone	47.4 mm	3.8 mm	29.0 g
Antler	66.5 mm	6.4 mm	35.8 g

Figure 6. Length Width and Mass of each Arrowhead.

Stone Attempt #1	Stone Attempt #2	Stone Attempt #3	Antler Attempt #1	Antler Attempt #2	Antler Attempt #3
19.5 cm	20.5 cm	21.0 cm	24.0 cm	25.5 cm	23.7 cm

Figure 7. Depth of penetration of each arrow per shot in cm.

As seen in Figures 4 and 7, the antler-tipped arrow had a deeper penetration than the obsidian stone-tipped arrow. This is surprising since I initially expected the stone tip to outperform the antler. On all three rounds of testing, the antler-tipped arrow made its way deeper into the target, however as seen in Figure 5, the stone arrow left a more damaging impression. This consistently was the case in all three rounds of testing, while the antler tip penetrated deeper, the stone tip cut a large amount of the inside of the target, leaving visible lacerations.

Observation #1 - The antler tipped arrow repeatedly penetrated deeper into the gel than the stone tipped arrow.
Interpretation - The weight difference between the two arrows may help to explain the greater penetration of the antler tipped projectile. The antler arrow is approximately 6.8g heavier, giving it greater mass and kinetic energy when compared to the lighter obsidian tipped arrow. At the same time, the stone point's triangular shape likely caused drag slowing the arrow as it travelled through the target. In other words, the stone point's shape lends itself to cutting rather than the antler tip's forceful piercing of the gel.

Observation #2 - The obsidian tip caused more damage to the interior of the ballistics gel when compared to the antler tip.
Interpretation - Obsidian's superior sharpness certainly played a role in lacerating the gel. Additionally, the stone point was wider and triangular in shape causing greater damage as the arrow travelled through the gel.

Discussion

Both types of arrows performed well in this experiment. Why then did people choose one arrowhead material over another? A possible explanation is that antler may be less common than stone in certain environments. To acquire antler, people would need to hunt/kill a deer or rely upon collecting antler sheds. Both sources are more circumstantial than simply travelling to a known stone quarry to procure raw materials. Furthermore, their construction processes differ greatly from one another. The tips of antler tines need to be sawn or snapped off then ground into a point; while stone tips are flaked and chipped into shape.

In addition, this research shows dramatic differences in ballistic performance between the two arrowhead types. These differences would affect hunting outcomes. For instance, the stone tip, with its wider laceration, might have been more effective when hunting bigger game like deer, bear, turkey, or moose. The sharp stone edge would cause heavy internal bleeding, forcing the animal to expire quicker while providing the hunter with a blood trail to follow. The antler tip on the other hand might be better for smaller game like rabbits, grouse, squirrels, etc. which do not tend to run away once shot with an arrow.

Conclusion

My initial expectations for this experiment were proven wrong as the antler-tipped arrow performed better than expected and penetrated deeper than the obsidian stone-tip. This exemplifies the importance of experiments and interpreting data.

To better understand the differences between stone and antler arrowheads, more experimentation is needed. This pilot study provides tantalizing insight into this ancient technology, yet to reach a better understanding, further experimentation is required. In going forward, I would improve upon this experiment by adding more factors, and eliminating others. For example, I would expand the types of bows used, involve different archers, and set the targets at different distances. Also, it would be beneficial to test more arrowheads of varying sizes and construction based on archaeological findings.

Sources & Acknowledgements

Jordan, J. (2013) *STONES, BONES, AND ANTLER TINES: A COMPARISON OF MIDWEST ARROW POINTS* [Thesis Paper]. University of Wisconsin-La Crosse, La-Crosse, WI, United States.

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