PLAYING WITH THE TIME. EXPERIMENTAL ARCHAEOLOGY AND THE STUDY OF THE PAST

Editors: Rodrigo Alonso, Javier Baena & David Canales

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THE SOLUTREAN SHOULDERED POINT WITH ABRUPT RETOUCH: HAFTING AND PROPULSION SYSTEMS

Puntas de muesca solutrenses de retoque abrupto: sistemas de enmangue y propulsión

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Abstract

The Solutrean shouldered point with abrupt retouch is one of the most characteristic hunting tools at the end of Solutrean period in the outer-Cantabric area. Its morphological and volumetric variability permitted a large variety of hafts with the intention of creating composed projectiles. For that reason, our main aim is to carry out an experimental programme to find out which hafting systems are most effective for the hunting of medium sized ungulates. In order to achieve this, some replicas of shouldered points with abrupt retouch have been attached with birch tar and, in some cases, strengthened by means of gut in hafts of different lengths and diameters in order to create arrows with one, two or three shouldered points. These arrows were shot by three different types of bows at two deer previously taken down in order to test their effectiveness. The results have enabled us to establish four basic models of hafting shouldered points, and to test their hunting efficiency and perfect ballistic behaviour to be mounted on arrow shafts.

Keywords: solutrean shouldered point with abrupt retouch, Upper Evolved Solutrean, hafting, bow and arrow, hunting, ballistic.

Resumen

La punta de muesca de retoque abrupto es uno de los elementos más característicos del instrumental cinegético del final del Solutrense en la región extracantábrica. Su variabilidad morfológica y volumétrica permite una importante diversidad de posibilidades de enmangue para crear proyectiles compuestos, por lo que llevamos a cabo un programa experimental para establecer qué sistemas de engaste son los más efectivos para la caza de ungulados de talla media. Para ello, se han realizado réplicas de puntas de

muesca de retoque abrupto que se han fijado con brea de abedul y en algunos casos con refuerzo de tripa en astiles de diferentes longitudes y diámetros para crear flechas con una, dos y tres puntas. Para testar su eficacia estas flechas fueron disparadas con tres tipos de arcos sobre dos gamos previamente abatidos Los resultados obtenidos han permitido establecer cuatro modelos básicos de enmangue de las puntas de muesca, corroborar su eficacia cinegética y su perfecto comportamiento balístico para ser montadas en astiles de flecha.

Palabras clave: punta de muesca de retoque abrupto, Solutrense superior evolucionado, enmangue, arco y flecha, caza, balística.

INTRODUCTION

The shouldered point with abrupt retouch (SP) is one of the most characteristic components of the hunting tool kit used in the final Solutrean of the outer-Cantabric area. It was first cited in 1912 when H. Breuil presented the systematization of the Upper Paleolithic at the Congress of Geneva (Breuil, 1913), which he modelled on the basis of an item from the collection of Federico de Motos from the Cueva de Ambrosio site (Vélez Blanco, Almería, Spain). These points were manufactured from blades. They presented an abrupt, direct and marginal retouch on the edge opposite the notch, which usually did not cover the whole cutting edge. Some notch edges had semi-abrupt or simple retouch, others direct and partial. The notch was formed by abrupt retouch with several series of impacts, (Muñoz, 2000), (Figure 1).

This projectile first appeared during the Upper Solutrean and at the same time, more tools were elaborated from small blades. The SP became the most important projectile in the Valencia area. In the meantime, in the rest of the outer-Cantabric area, barbed and tanged points were the most abundant elements. This was the most characteristic element of the Evolved Solutrean in all regions, and it has been found more frequently than any other projectile from the Solutrean Group. This transformation of hunting tools could be due to the increased efficiency of this type of points, related to the use of composite elements and the consolidation and improvement of new methods of propulsion (the bow).

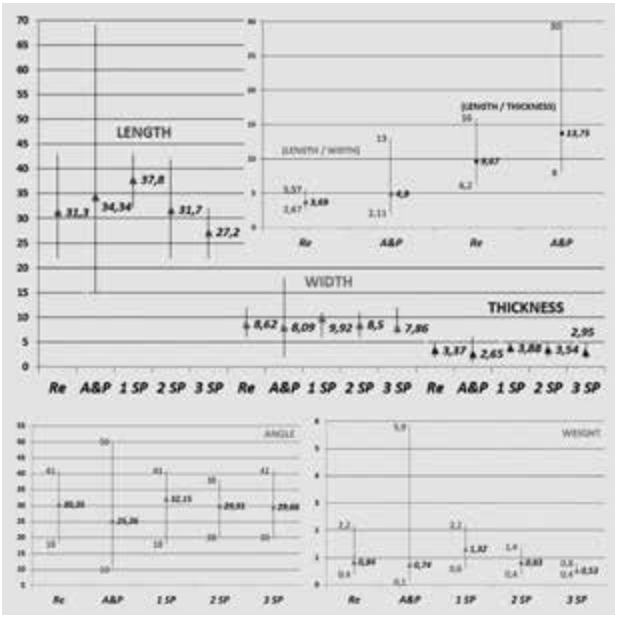
Figure 1. Solutrean shouldered points with abrupt retouch knapped for the experimental programmme. 1-5: Points for arrows with 3 blades. 6-9: Points for arrows with 2 blades. 10-15: Points for arrows with 1 blade.

EXPERIMENTAL PROGRAMME

The morphological and volumetric variability of the SP allowed *a priori* for a considerable range of handle possibilities for the creation of composite projectiles. Therefore we proposed an experimental programme in order to define which assembly methods were the most effective for the purpose of hunting medium-sized ungulates.

We knapped a total of 45 flint SP, all replicas of archaeological artefacts found in the Upper Solutrean and Evolved Upper Solutrean levels of the Cueva de Ambrosio, (Figure 1). The experimental points were slightly shorter, broader, thicker and therefore also heavier than the arithmetic mean of those from Cova del Parpalló (Valencia) and Cueva de Ambrosio (Almería), the only sites with significant lithic collections that could be used for a diagnostic statistical comparison. Moreover, the angle of the point was slightly greater than the one found in the archaeological artefacts, (Figure 2). We decided to create points which were less morphologically suitable in order to correctly probe their use in hunting.

Figure 2.
Measurements of the Solutrean shouldered points with abrupt retouch. Re: Replicas. A&P: Ambrosio and Parpalló points. 1 SP: Points for arrows with 1 blade. 2 SP: Points for arrows with 2 blades. 3 SP: Points for arrows with 3 blades.



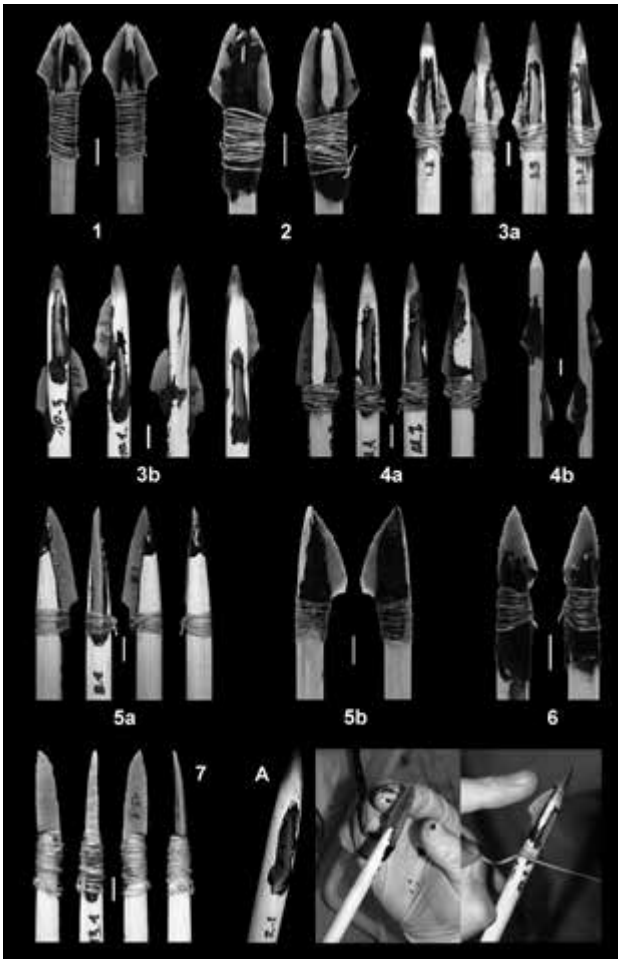


Figure 3. Technical data of the arrow used in the experiment.

These points were attached to 25 cedar, oak and beech arrow hafts. Their diameter measured between 9 and 10 mm and their length between 66 and 90.6 mm. Vulture feathers were attached to the arrow hafts using lamb gut. Each arrow type had 2 or 3 stabilizers, placed at regular distances from one another. We decided to use rather large feathers (13.12 cm) and a high fletching angle (42.36º). This reduced the arrow speed but assured straight flight with great directional stability (Figure 3).

In order to attach the points to the shafts we defined 7 basic models, some with small variations, based on the morphology of arrowheads which are nowadays used in archery hunting, and experimental studies with prehistoric bows, ballistics and projectiles, (Figure 4):

TYPE 1: Arrows with three blades on one end, symmetrically x-shaped (current hunting archery and Muñoz, 2000).
TYPE 2: Arrows with two blades on one end, symmetrically x-shaped (current hunting archery and Muñoz, 2000).
TYPE 3a: Arrows with three blades in the shaft near the end, symmetrically x-shaped (current hunting archery).
TYPE 3b: Arrows with three blades in the shaft near the end, asymmetrically x-shaped (current hunting archery).
TYPE 4a: Arrows with two blades in the shaft near the end, symmetrically x-shaped in the style of backed blades (current hunting archery; Pétillon *et al.*, 2011 and Taylor, 2012).
TYPE 4b: Arrows with two blades in the shaft near the end, asymmetrically x-shaped in the style of backed blades (current hunting archery; Pétillon *et al.*, 2011 and Taylor, 2012).

TYPE 5a: Arrows with a single tip at the distal end, with the notch facing outwards and the opposite edge partially incorporated into the shaft (Soriano, 1998).
TYPE 5b: Arrows with a single tip at the distal end, with the notch facing outwards and the opposite edge completely incorporated into the shaft (Soriano, 1998).
TYPE 6: Arrows with a single tip at the distal end, with the notch facing outwards (Yaroshevich, 2012).
TYPE 7: Arrows with a single tip at the distal end, with the notch facing inwards (Geneste and Plisson, 1989).

To insert the points, a groove was made in the shaft's lateral side in order to insert the edge opposite to the notch (TYPES 1-5), or at the distal end in order to insert the notch (TYPES 6-7). The points were fastened with birch tar and, for at least one arrow of each type, lamb gut in order to make it more resistant. In the same manner, at least one arrow of type 3 and 4 which ended in a point was hardened using fire, (Figure 4).

The arrows were shot using three types of bows: two simple laminated bows of 40 and 50 lb and another simple bow made of a single piece of elm wood weighing 40 lb, which was a replica of the Holmegaard bow (Rausing, 1967). Shooting was always at a distance of 8 m. In order to recreate the real hunting conditions as accurately as possible, two recently killed deer were hung from a frame. One of them was an infant specimen of 22 kg with an irreversible pathology, shot with a pulley bow and an arrow with a metal arrowhead. The other one was an adult male specimen of 45 kg, shot with a firearm during selective population control. In total 62 launches were made (Figure 5).

CONCLUSIONS

In spite of the great variety of hafting types used for these points, in order to create simple and composite projectiles, the experiment has enabled us to restrict the possible mounting models of SP in arrow shafts.

Figure 4. Proposed hafting systems (1-7) and their implementation (A).

TYPE	HAFT		Nº FEATHERS	FLETCHING LENGTH	FLETCHING ANGLE	ARROW WEIGHT	ARROW LENGTH	HAFTING
	WOOD	Ø						
1	oak	10	3	12	44	59.5	90.7	Gut reinforcement
1	beech	10	2	13.5	43	48.5	90.2	
1	oak	10	2	11	44	56.9	89.9	Gut reinforcement
2	cedar	9	3	12	39	34.9	82	Gut reinforcement
3a	oak	10	3	12	44	46.3	80.1	Gut reinforcement
3a	oak	10	2	11	44	42.6	80.7	Gut reinforcement
3b	cedar	9	2	14	28	27.5	81	Gut reinforcement
4a	cedar	9	2	14	28	32.1	81.5	
4a	beech	10	2	13.5	43	36.9	78.9	
4a	cedar	9	2	14.5	47	26.2	80.2	Gut reinforcement
4a	cedar	9	2	13	30	25.7	80.1	Gut reinforcement
4b	cedar	9	2	14	44	23.2	80.4	
4b	cedar	9	2	13	30	30.9	81.2	
5a	cedar	9	2	12	43	24.3	81.1	Gut reinforcement
5a	cedar	9	2	12	40	26.1	81.6	Gut reinforcement
5b	cedar	9	2	14.5	47	31.3	81.1	Gut reinforcement
6	cedar	9	3	12	53	30.4	84.5	Gut reinforcement
6	cedar	9	2	12	43	30.3	83.9	
6	cedar	9	2	12	40	30.4	82.7	Gut reinforcement
6	cedar	9	2	13	50	32.2	82.8	Gut reinforcement
7	cedar	9	2	14	44	26.6	83.6	Gut reinforcement
7	cedar	9	2	17	44	30.1	84	
7	cedar	9	3	12	53	24.7	82.1	Gut reinforcement
7	cedar	9	2	13	50	28.1	82.4	Gut reinforcement
7	cedar	9	2	17	44	25.3	83	Gut reinforcement

Type 1 and 2 are not functionally viable options, as the projectiles placed on the distal end do not form a well-defined conical point. Therefore the arrows bounced off the target upon impact, (Figure 5). The theoretical hafting system proposed by Muñoz (2000) would not be plausible. Types 3a and 3b were only effective when relatively strong bows were used, from 50 lb and up, (Figure 5). Although arrow with a strength similar to 50 lb may have existed at the end of the Solutrean, similar examples are more common only from the Mesolithic onwards (Muñoz and Ripoll, 2006). For this reason we decided to discard this model.

Types 4a and 4b (without additional gut reinforcement), 5a and 5b showed good ballistic performance

and good penetrating capacity (Figure 5). However, upon impact, the points were lost relatively easily, staying behind inside the animal. For type 4 this was due to the lack of gut reinforcement. As for type 5, the point experienced a slight inclination towards the exterior side of the cutting edge of the notch on impact, the weakest point of the hafting. In spite of being reinforced, the collision force caused the point to become separated from the shaft. These hafting systems do not match the data in the archaeological record: from the 707 analysed PM from Cova del Parpalló and Cueva de Ambrosio, 597 were fractured, of which more than 1/3 were impact fractures (Muñoz, 2000).

TYPE	Holmegaard 40 lb		Laminated 40 lb		Laminated 50 lb	
	SHOTS	PENETRATION	SHOTS	PENETRATION	SHOTS	PENETRATION
1	2	0	1	0	1	0
2	1	0	1	0	0	-
3a	4	0	2	0	5	5-21 cm
3b	4	0	1	0	2	5 cm
4a	6	21-6 cm	1	0	2	8 cm
4b	1	13 cm	2	6 cm	0	-
5a 5b	3	12 cm	1	16 cm	1	10 cm
6	2	10-20 cm	1	40 cm	0	-
7	4	8-50 cm	0	-	0	-

Figure 5. Efficiency of the shots carried out with different types of arrows.

Therefore, types 4a (with gut reinforcement on the hafting), 6 and 7 would be ideal for correct hunting use of the SP. They best reproduced the use marks found on archaeological material and also represented the best penetration (Figure 5). Type 4 needed to use small points with a straight or slightly curved edge opposite the notch. Types 6 and 7 could make use of bigger examples, using points with a rectilineal border opposite the notch for type 6 and a curved border opposite the notch for type 7. A gradual reduction in the size of the points can be observed moving through the Solutrean sequence towards the end of this technocomplex. Also, there are more examples with two rectilineal edges and a lengthened triangular morphology (Muñoz, 2000). Therefore, types 6 and 7 would be the first to appear in the Upper Solutrean, being gradually replaced by type 4a. This morphology would be similar to the composite projectiles formed by backed blades which emerged in the Magdalenian.

This experimental programme, which is still running, will be completed by a use-wear analysis of the replicas and their correlation with the archaeological material.

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