

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

Editors: Rodrigo Alonso, Javier Baena & David Canales





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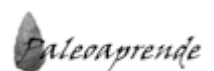
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Index

Introduction

- 01. EXPERIMENTA. A tool for the consolidation of experimental archaeology.**
Rodrigo Alonso, Javier Baena y David Canales..... 11

Technical and technological experimentation, Paleolithic

- 02. Replicating the handaxe shaping strategies from Boxgrove (Sussex, UK).**
Paula García-Medrano..... 19
- 03. Experiments with valve shells - Retouching *Callista chione* to understand neanderthal technical behaviour.**
Francesca Romagnoli, Javier Baena Preysler, Lucia Sarti..... 25
- 04. Dimensional analysis of assemblages generated by experimental discoid, levallois and laminar flaking with flint and quartz.**
Par Michel Brenet, Mila Folgado, Laurence Bourguignon 31
- 05. Specialist and learners: solutrean pedunculated points at El Higueral-Guardia Cave (Málaga, Spain).**
Concepción Torres Navas, Estefanía Pérez Martín, Javier Baena Preysler..... 39
- 06. The solutrean shouldered point with abrupt retouch: hafting and propulsion systems.**
Francisco Javier Muñoz Ibáñez, Juan Antonio Marín de Espinosa Sánchez, Belén Márquez Mora, Ignacio Martín Lerma, Javier Síntes Peláez 47

Technical and technological experimentation, Postpaleolithic

- 07. Making sickles: blade industry and her productivity in different types of sickles.**
Víctor Lamas, Daniel Martínez 55
- 08. Experimental program: Neolithic awls and spatulas.**
Millán Mozota, Antoni Palomo, Ignacio Clemente, Juan F. Gibaja..... 61
- 09. The experiment in the service of archaeology. Pieces of osseous materials processed in the experimental workshop developed on the archaeological site from Bordușani-Popină (Romania).**
Monica Mărgărit, Dragomir Nicolae Popovici, Valentin Radu, Cătălina Cernea..... 67

10. **Experimental programme on resistance/durability of prehistoric adhesives.**
Juan Luis Fernández-Marchena, José Ramón Rabuñal, Gala García-Argudo 73
11. **Scan the archaeo-experiment! Computer science as analytical and interpretive way about 3d lithic refitting.**
Alfredo Maximiano Castillejo 81

Archaeological experimentation by means of use wear analysis

12. **Artefacts or geofacts? The role of experimentation and functional analysis in the determination of tools at Pleistocene sites in Serra da Capivara (Piauí, Brazil).**
Ignacio Clemente-Conte, María Farias, Eric Boëda 89
13. **Approach to the variability of macro-wear on two isotropic materials: flint and limestone.**
Viallet Cyril 95
14. **Experimental and functional analysis of rock crystal projectiles.**
Juan Luis Fernández-Marchena, José Ramón Rabuñal, Gala García-Argudo 101
15. **Experimentation and traces analysis of macro-lithic tools: the case of Grotta della Monaca Cave (Sant'Agata di Esaro-Cosenza, Italy).**
Isabella Caricola, Cristina Lemorini 107
16. **Experimenting with prehistoric sickles: a traceological approximation.**
M^a Cristina López-Rodríguez 113
17. **Manufacturing techniques of greenstone mosaics from Teotihuacan and Palenque.**
Emiliano Ricardo Melgar Tísoc 119
18. **Technological analysis of greenstone objects from the structures surrounding the Great Temple of Tenochtitlan.**
Reyna Beatriz Solís Ciriaco, Emiliano Ricardo Melgar Tísoc 125
19. **Working pottery with flaked stone tools: a preliminary experimental approach.**
Niccolò Mazzucco, Ignacio Clemente-Conte, Juan Francisco Gibaja 131
20. **Traces of textile technology in the Early Neolithic lakeside settlement of La Draga (Banyoles, Catalonia) from an experimental perspective.**
Miriam de Diego, Raquel Piqué, Antoni Palomo, Xavier Terradas, Ignacio Clemente, Millán Mozota 139
21. **Experimenting with wrist-guards. Preliminary results.**
Alejandro Muñoz Martínez, Iván Curto Encabo, Pedro Muñoz Moro, Carmen Gutiérrez Sáez 145
22. **New Aterian stone tool research perspectives using experimentation and use-wear analysis.**
Serena Falzetti, Elena Garcea 151

Experimentation of cut marks, diet and bioenergy

23. **Walking with carnivores: experimental approach to hominin-carnivore interaction.**
Edgard Camarós, Marián Cueto, Luis C. Teira, Andreu Ollé, Florent Rivals 159
24. **Human breakage of bird bones during consumption.**
Antonio J. Romero, J. Carlos Díez, Diego Arceredillo 165
25. **Experimental cut marks characterization using a Confocal Laser Profilometer.**
Daniel Fuentes-Sánchez, María Ángeles Galindo-Pellicena, Rebeca García-González, José Miguel Carretero, Juan Luis Arsuaga 171
26. **Absorption and degradation of fatty acids in prehistoric ceramics: a preliminary study.**
Olga Ordoñez Santaolalla, Cristina Vega Maeso, Isabel Jaime Moreno, Susana Palmero Díaz, Eduardo Carmona Ballester 177

- 27. Performing Paleolithic daily activities: an experimental project on bioenergy.**
Olalla Prado-Nóvoa, Marco Vidal-Cordasco, Ana Mateos, Marcos Terradillos-Bernal, Jesús Rodríguez.... 183

Experimental models of fire, music and rock art

- 28. Combined archaeomagnetic and Raman spectroscopy study of experimentally burnt limestones from the Middle-Palaeolithic site of Pinilla del Valle (Madrid).**
Ángel Carrancho, Susana E. Jorge Villar, Laura Sánchez-Romero, Theodoros Karampaglidis, Alfredo Pérez-González, Enrique Baquedano, Juan Luis Arsuaga 191
- 29. “Getting out the best in you”: observations of heat treatment on flint from the Iberian Central System.**
Sara Díaz Pérez, Paloma de la Sota Blanchart, Foivos Michos Rammos..... 197
- 30. Experiments on digital lighting simulation applied to rock art production and visualization.**
Alfredo Maximiano Castillejo, Camilo Barcia García 203
- 31. Analysis of the perforated batons functional hypothesis.**
Redondo Sanz, Francisco José 209
- 32. Experimental reproduction of the aerophone of Isturitz.**
Carlos García Benito, Marta Alcolea Gracia, Carlos Mazo Pérez..... 215
- 33. Recovering the ring-ring of the bells from various archaeological sites in the lower Ebro area (3rd – 1st century B.C.). The results of an experimental procedure.**
Margarida Genera i Monells, Fernando Guarch Bordes, José Ramon Balagué Ortiz..... 223

Technical and technological experimentation, kilns and pottery

- 34. Experiments with clay: approaching technological choice in pottery production.**
Daniel Alberó Santacreu 231
- 35. Iberian cooking pots from els Estinclells (Verdú, Catalonia): new approach and experimental possibilities.**
Rafel Jornet Niella, Eva Miguel Gascón 237
- 36. Some results of the technical analysis of the Late Bronze Age ceramic material of the Southern Urals tribes.**
Nikolai Shcherbakov, Liudmila Kraeva, Patrick Sean Quinn, Iia Shuteleva, Tatiana Leonova, Alexandra Golyeva 243
- 37. Experiments with surface decoration on Castelluccio pottery (Sicilian Early Bronze Age).**
Giovanni Virruso, Valentina Amonti, Serena Tonietto..... 249
- 38. Firing pits and pottery production at Lugo di Grezzana (VR): using experimental archaeology for the interpretation of archaeological processes.**
Annalisa Costa, Fabio Cavulli, Annaluisa Pedrotti..... 255
- 39. Which way? Handedness in ceramic decoration.**
Aixa Vidal..... 261

Technical and technological experimentation, metallurgy

- 40. Experimental reconstruction of copper metallurgy based on archaeometallurgical remains from the Peñalosa Bronze Age site.**
Auxilio Moreno Onorato, Charles Bashore Acero, Alberto Dorado Alejos, Juan Jesús Padilla Fernández.. 269
- 41. Iron production in the Iberian culture from an experiential perspective.**
José Miguel Gallego, Manel Gómez, Josep Pou 275

- 42. Silver ore smelting process in reverberatory furnace (Santa-Isabel mine, 17th c., Potosi, Bolivia): experimental approach to a South American invention.**
Florian Téreygeol, Pablo Cruz, Ivan Guillot, Jean-Charles Méaudre281

Technical and technological experimentation, agriculture and architecture

- 43. Reproducing Cato: experimental preparation of a sulphur mixture for viticulture.**
Claudia Speciale, Luca Zambito289
- 44. Architectural and agricultural experimentation (2012-2013) at the Experimental Camp of Protohistory (CEP) (Verdú, Urgell, Catalonia).**
Ramon Cardona Colell, Borja Gil Limón, Jordi Morer de Llorens, David Asensio Vilaró, Josep Pou Vallès295
- 45. L'Esquerda, archaeological experiments in medieval and ancient building techniques.**
Imma Ollich-Castanyer, Montserrat de Rocafiuera, Joan-Albert Adell, David Serrat, Maria Ocaña, Oriol Amblàs, Carme Cubero.....301
- 46. Looking for a scientific protocol in prehistoric daub experimental project.**
Alessandro Peinetti, Giorgia Aprile, Kati Caruso, Claudia Speciale.....307
- 47. Roman tegulae and imbrices manufacturing workshop.**
Joaquim Tremoleda, Josefia Simon, Pere Castanyer, Andrea Ferrer, Adriana Clé, Josep Matés.....313
- 48. The archaeology of wine in Italy: a sicilian experiment.**
Mario Indelicato, Daniele Malfiana, Giuseppe Cacciaguerra321

Experience and experiment in learning, teaching and heritage interpretation

- 49. Clays, fire and wait! Prehistoric ceramic production explained to children 5 to 14 years old.**
Alberto Dorado Alejos329
- 50. Sharing archaeological practice among schoolchildren: three groups, one experience.**
Aixa Vidal, Paola Silvia Ramundo, Sol Mallía-Guest.....335
- 51. The EduCEP programme: a didactic interdisciplinary approach to the scientific method drawing on experimental archaeology.**
Natàlia Alonso, Ramon Cardona, Victòria Castells, Borja Gil, Rafel Jornet, Daniel López, Jordi Morer, Ariadna Nieto341
- 52. Experimental and experiential archaeology in Spain: Atapuerca (Burgos) and Arqueopinto (Madrid).**
Raúl Maqueda García-Morales, Manuel Luque Cortina.....349
- 53. The role of the experimental archaeology in the scientific spreading as developer of prehistorical empathy.**
M. Pilar López-Castilla, Marcos Terradillos-Bernal, Rodrigo Alonso Alcalde355

06

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

Puntas de muesca solutrenses de retoque
abrupto: sistemas de empuje 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 empuje 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 breya 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 cinética 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).

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

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).



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.

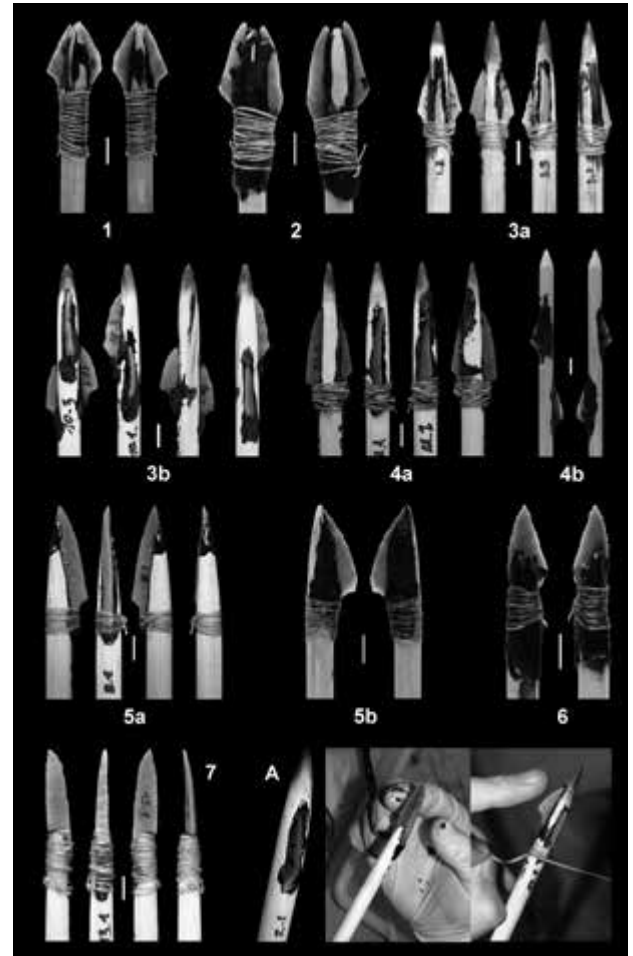
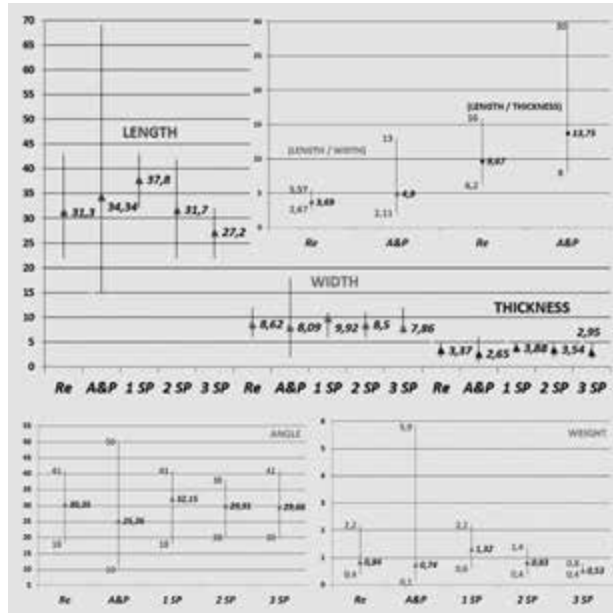


Figure 3. Technical data of the arrow used in the experiment.

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 (42.36°). 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; Pétilion *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; Pétilion *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		N° 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).

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 rectilinear 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 rectilinear 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.

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.

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