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Focus on the target. The importance of a transparent fracture terminology for understanding projectile points and projecting modes

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ABSTRACT

Projectile points have always attracted a lot of attention, but the last few years, efforts have intensified to recognize them in assemblages and to understand the details of their functioning (propulsion mode, hafting method, …). Debates have increased following the recognition of older projectile points and the use of projectiles as indicators of human behavioural complexity. The most frequently used method for identifying projectiles relies on the identification of so-called "diagnostic impact fractures". Although this procedure appears clear, a careful review of the literature reveals numerous inconsistencies in their description and terminology. We discuss some of these inconsistencies that seem to cause confusion and we present some first steps toward an improved methodology for the identification of projectile points based on new experimental data.

1. Introduction

Projectiles, defined here generically as referring to all weapon types independent of their projecting mode, have always been considered important in archaeological assemblages. Their suggestive morphology has attracted the attention of many archaeologists. Thanks to their rapid and distinct morphological variation across time and space, they were quickly used to construct the first typo-chronologies and models of cultural variation (see Knecht, 1997 for an extensive review). Some points are intensely worked, due to which they often served as a basis for technological studies (see Knecht, 1997 for an extensive review). The function of these points has been much debated. Most often they have been considered as weapon tips, sometimes as knives, but it is clear that morphological attributes alone are insufficient to determine their use (Beyries and Plisson, 1998; Brindley and Clarkson, 2015; Chesnaux, 2014; Clarkson, 2016; De Bie and Caspar, 1996; Hauck et al., 2013; Hester and Heizer, 1973; Moss and Newcomer, 1982; Nance, 1971; O'Farrell, 1996; Shea, 1988).

Hunting and preparing for the hunt (manufacturing, using and repairing the equipment, etc.) must have been an important and time consuming activity in the life of Palaeolithic populations (Bleed, 1986; Ellis, 1997; Greaves, 1997; Lee, 1968). Studying hunting equipment in more detail thus has the potential to shed more light on a crucial aspect of Palaeolithic human behaviour. Since early on, researchers have realised the relevance of a closer examination of fractures to identify projectiles in assemblages (Witthoft, 1968) and their examination has nourished many earlier debates on the existence of projectiles in the Middle Palaeolithic/Middle Stone Age and the capacity of different hominids to hunt (Beyries and Plisson, 1998; Shea, 2009, 1988, 2006; Sisk and Shea, 2011; Villa and Roebroeks, 2014). More recently, these debates have shifted towards the importance of different projecting modes for understanding behavioural complexity (Brown et al., 2012; Lombard and Haidle, 2012; Shea and Sisk, 2010). Especially the development of long-range hunting weapons is considered to have significantly impacted human subsistence and it has been suggested that it may have been an important factor in the development of our species (Shea and Sisk, 2010; Shea, 2006). Up until today, projectiles thus form a crucial element in debates on human behaviour (McBrearty and Brooks, 2000; Villa and Roebroeks, 2014). In most cases, the key elements of hunting equipment have disappeared, as they were manufactured out of organic material, and the stone points are the only evidence that is left. Therefore, an improved comprehension of their operational details, for example, the appearance and development of new weapon projecting techniques needs to rely on these stone points.

While several stone point types have been assumed to have served as hunting weapons, efforts have been invested over the last decades to verify these assumptions with empirical data. In the framework of functional studies of wear traces, a combination of criteria has been

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proposed that would allow the recognition of projectiles in archaeological assemblages. The most commonly used procedure to identify projectiles, however, relies on the identification of tip (apex) or base fractures, often referred to as so-called "diagnostic impact fractures". This method is based on several archaeological and experimental studies in which particular fractures were observed on the apex of projectile points and appeared to result from forces upon contact with an animal, more in particular with bone (Barton and Bergman, 1982; Bergman and Newcomer, 1983; Frison, 1974; Moss and Newcomer, 1982; Odell, 1978; Witthoft, 1968). The recurrent observation of apex fractures on experimental projectile points and the realisation that some of these may be diagnostic for projectile use (Fischer et al., 1984), gradually developed into a more formalised procedure, even though it remained based on sparse and very diverse experiments (Beyries and Plisson, 1998; Chesnaux, 2014; Crombé and Caspar, 2001; De Bie and Caspar, 1996; Hutchings, 2011; Lazuén, 2012; Lombard et al., 2004; O'Farrell, 1996; Pargeter, 2007; Pétillon et al., 2011; Rots and Plisson, 2014; Schoville and Brown, 2010; Shea et al., 2001; Sisk and Shea, 2009; Soriano, 1998; Wilkins et al., 2012; Yaroshevich et al., 2010). Together with the shift in the debate toward the potential behavioural implications of different projecting modes, efforts have recently also been invested in trying to find empirical data that would allow a reliable identification of the propulsion mode that was used (Cattelain, 1997; Geneste and Plisson, 1990; Iovita et al., 2014; Sano and Oba, 2015, 2014; Shea, 2006).

Given the importance of projectile points for understanding broader technological evolutions and variability, their identification based on impact fractures gradually gained in popularity. While initial determinations generally remained rather cautious (Fischer et al., 1984), more ambitious determinations have been proposed more recently (e.g., Wilkins et al., 2012). It has been criticised that the latter determinations relied on a poor understanding of impact fractures and that apex fractures cannot be used as sole arguments for projectile identification (Rots and Plisson, 2014).

2. Background

Historically, attitudes have changed in terms of the value that was attributed to diagnostic impact fractures. In order to illustrate these changes, we review 16 projectile studies in which the diagnostic value of specific impact fractures considered by the authors was clearly indicated. These studies are considered to be representative of the chronological development of the discipline (Table 1). In the beginning, the terms flute-like and burin-like fracture and their diagnostic value were shared amongst authors (Barton and Bergman, 1982; Bergman and Newcomer, 1983; Witthoft, 1968). Also the lithic use-wear conference organised by Brian Hayden in Columbia (Canada) resulted in a nice synthesis about fracture mechanics in siliceous material (Hayden, 1979), on the occasion of which the Ho Ho Committee proposed an attribute-based system for fracture description (Committee, 1979). Fischer et al. (1984) are the first to apply the Ho Ho terminology to describe impact fractures. They created three specific categories that they considered diagnostic to recognize projectiles based on attribute aggregation: step-terminating bending fractures, spin-offs and bifacial spin-offs. At the same time, they stressed that these "diagnostic" fracture phenomena can also occur during blank production. Indeed, it was recognized from the start that these fracture types in themselves are only characteristic of a specific load and direction of pressure, forces that may equally occur in circumstances other than projectile use. This is exactly the reason why functional analysts have always sought to corroborate the fractures with other lines of evidence (i.e., wear traces, residues) (see Rots and Plisson, 2014 for a discussion). Odell and Cowan (1986) introduced a first mixture of descriptive systems as they continued to use the old typological system (Barton and Bergman, 1982; Bergman and Newcomer, 1983; Witthoft, 1968), but they combined it with the Fischer et al. categories and they added a hinge-terminating bending fracture as a diagnostic category. De Bie and Caspar (1996) followed the same idea, but they also added the feather-terminating bending fracture. Afterwards, most authors

Table 1
Diagnostic impact fracture categories that are taken into account in different publications and the variation through time.

Diagnostic impact fractures	Flute-like	Burin-like	Spin-offs	Bif spin-offs	Step terminating bending	Hinge terminating bending	Feather terminating bending	Crushing
Witthoft, J., 1968	■	■						
Bergman, Barton, 1982	■	■						
Bergman, Newcomer, 1983	■	■						
Fischer et al., 1984			■	■	■			
Odell, Cowan, 1986	■	■			■	■		
Caspar, De Bie, 1996		■	■	■	■	■	■	
O'Farrell, 2004			■	■	■	■	■	
Lombard, 2005		■	■	■	■			
Lombard, Pargeter, 2008		■	■	■	■			
Villa, Lenoir, 2006		■	■	■	■			
Villa, Lenoir, 2009	■	■	■	■	■		■	
Sano, 2009	■	■	■	■	■	■	■	
Sano, Oba, 2014	■	■	■	■	■	■	■	
Lazuén 2012	■	■			■	■	■	■
Wilkins, et al., 2012		■	■	■	■			
Chesnaux, 2014		■	■	■	■	■	■	