Journal of Anthropological Archaeology 45 (2017) 142–156

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Fishtail points from the Pampas of South America: Their variability and life histories

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ARTICLE INFO

Article history:
Received 6 July 2016
Revision received 12 December 2016
Accepted 15 December 2016
Available online xxxx

Keywords:
Fishtail points
Life histories
South America
Early peopling

ABSTRACT

Fishtail points (FTP) related to the terminal Pleistocene peopling of the South American continent present morphological, technological and functional variability. We discuss a collection of FTP recovered from central east Tandilia Range in the Pampas of Argentina. We do this by exploring the life histories of a set of 97 FTP, assessing aspects of production, use and discard through morphological, macro-fracture, and fatty acids and sterols analysis. We identify four categories: miniatures, "atypical FTP", medium-sized and large points. Although possibly all were related to the realm of hunting, only medium and large points have clear indications of use as parts of weapons. Transformation due to maintenance, impact or recycling indicates their longevity and the complexity of their life histories. Miniatures are considered representations of full sized points and large points also possibly held a special status, requiring great flintknapping skill. As artifacts covering different roles and used in different social practices repeat the FTP outline, we sustain this shape must have held some significance for the people who produced and used them. Other aspects related to FTP use lives which probably were laden with meaning are the choice of colored and translucent toolstone and their intentional place of discard.

1. Introduction

Fishtail points (FTP) have become iconic artifacts considered diagnostic of an early occupation throughout South and Central America. Their initial finding (Bird, 1938) was the first widely accepted evidence of the coexistence of man and megafauna in the southern continent. Among the features traditionally related to the terminal Pleistocene occupation of South America, they are the ones exhibiting the most widespread distribution, and as such have historically received attention in the literature on early peopling (Bird, 1946; Borrero, 1983; Gnecco, 1994; Mayer Oakes, 1986; Morrow and Morrow, 1999; Politis, 1991; Schobinger, 1973). Recently, several regional syntheses review their presence in the Southern Cone (Flegenheimer et al., 2013a; Miotti and Terranova, 2015; Loponte et al., 2015; Nami, 2014; Rivero and Berberián, 2008; Suárez, 2015; Waters et al., 2015). Uruguay and Argentina exhibit a great number of these points, with the greatest concentrations at a site in the Argentinean Pampas and another in North Patagonia (Flegenheimer et al., 2013a; Miotti and Terranova, 2015). Other known sites in South America yielding large collections are Fell's Cave and El Inga (Bell, 1965; Bird, 1988; Mayer Oakes, 1986). In the Pampas they were recovered at hunting sites (Cerro La China 2), processing sites (Paso Otero 5), rockshelters with domestic activities (Abrigo Los Pinos) and special activity sites both in rockshelters (Amalia 2 and Cerro El Sombrero Abrigo1) and in an extensive open air site (Cerro el Sombrero Cima) (Flegenheimer et al., 2015a; Martínez, 2006; Mazzanti, 2003; Mazzanti et al., 2012).

Bird's initial definition of these points (Bird, 1969) considers a certain variation within the same morphological type. Yet, nowadays a greater variation mainly related to point size and manufacturing techniques is identified. This variability has been assigned to different moments of their use life, raw material, function and geographical provenience (Bayón and Flegenheimer, 2003; Castiñeira et al., 2011; Flegenheimer et al., 2015b; Hermo and Terranova, 2012; Nami, 2015; Politis, 1991; Suárez, 2006). Even when exhibiting remarkably different sizes, these objects show the same characteristic outline and generally the same specific stem attributes. FTP can be described as stemmed points, with a lanceolate blade and a characteristic stem with concave sides and a transverse cross-section that tends to be hexagonal and flattened at the center, with or without fluting. The morphological variability and

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http://dx.doi.org/10.1016/j.jaa.2016.12.001
0278-4165/

specifically the existence of very small specimens and very large ones, have also led to questioning the function of some of these artifacts as projectile points (Bayón and Flegenheimer, 2003; Flegenheimer et al., 2015a; Politis, 1998; Nami, 2013). Analyses leading to establish formal standardization and variability undertaken for other point types (Knecht, 1997) are still in their infancy in our case. In sum, the artifacts known as fishtail points present morphological, technological and functional variability within a general design. In this context, the term "fishtail point" as it is here applied, has a broad meaning and designates objects with a common outline but with different uses and life histories; the use of the term FTP does not imply that all these artifacts were used as projectile points.

In this paper we discuss a collection of FTP recovered from Cerro El Sombrero (CS) and Cerro La China (LCH) archaeological localities in the province of Buenos Aires, Argentina, introducing in detail one of the very few large collections recovered at a single site: Cerro El Sombrero Cima (CSC). We emphasize this provenience context because it eliminates geographical distribution or raw material availability as explanations for the recorded variability. The existence of neighboring and co-relatable sites with FTP allows controlling chronology and adds the occurrence of points at sites with different functions and different activities. This issue is relevant, as there is great functional intersite variability (Flegenheimer et al., 2015a); as can be seen in the materials section, our sample includes points from domestic, special activities and hunting sites as well as the large collection from a weapon refurbishing place (Table 1). These sites exhibit differences in their size, geomorphological situations and lithic assemblage's composition.

Here we explore the life histories of a set of FTP assessing aspects of production, use and discard. We consider that artifact life histories provide an insight into human activities, including social and economic situations and choices related to each activity (Andrefsky, 2010; Fogelin and Schiffer, 2015; Walker, 1995). We consider that these objects have a longer life history including post-depositional processes and current recovery, analysis, interpretation and resignification (Hurcombe, 2007) but these will not be treated in detail here. Even though every object has its individual life history, our intention is to identify groups of objects that share somewhat similar trajectories that are relevant when explaining assemblage variability.

We conceive objects and people interwoven in social networks of relations which find expression in diverse realms of human life (Chilton, 1999; Meskell, 2005). Our research is based on the premise that artifacts, as material expressions of relationships, play an important role in the communication of practical knowledge as well as aesthetic and symbolic values. Here we relate the dynamic aspects of material culture to their context of production, use and discard or loss. Production is considered in relation to raw material availability and selection, manufacturing choices and labor investment. Use is assessed considering macro-fracture and fatty acids analysis. Finally, discard is discussed in relation to the characteristics of the assemblages and places where artifacts were recovered. We do not attempt to describe technology in detail; this issue has been thoroughly studied through experimental work related to other FTP collections (Nami, 2010, 2014). Based on the results of these analyses we discuss social interactions involving people and these objects. Finally, we will briefly consider the role of fishtail points in the context of the peopling of the Southern Cone.

2. Materials: fishtail point collection

FTPs analyzed in this paper were recovered at four sites from two archaeological localities of the central east Tandilia Ranges (center of Buenos Aires Province, Argentina) (Fig. 1). Three early sites were identified at LCH locality, two of them yielded FTPs. LCH1 is a domestic site with five radiocarbon dates ranging from 10,804 ± 75 years BP (AA-8953) to 10,525 ± 75 years BP (AA-8954). A single broken FTP preform and a blank were recovered at this site along with a great variety of bifacial and unifacial tools, flakes, cores, ochers and a scute of *Eutatus seguini*. LCH2, located 85 m away from LCH1 is interpreted as a kill site due to the presence of points as a main tool type throughout the occupation sequence: the initial occupation level yielded two FTPs and two dates of 11,150 ± 135 years BP (AA-8955) and 10,560 ± 75 years BP (AA-8956) (Flegenheimer et al., 2015a). The other two sites are at CS locality, located at the highest hill in the area (Cerro El Sombrero). Abrigo 1 site is a small rock shelter near the hilltop, with a set of radiocarbon dates between 8060 ± 140 (AA-5221) considered anomalous, and 10,725 ± 90 years BP (AA-4765). It is a specific activity site with an emphasis on fresh hide processing based on microscopic use wear analysis (Flegenheimer and Leipus, 2007). Two FTPs, bifacial and unifacial tools, a few cores, flakes and abundant ocher fragments were recovered here (Flegenheimer, 2003). Finally, at the hilltop, which extends over 25,000 m^2, CSC site yielded the largest collection of FTPs recovered at the Pampean region and one of the largest of the southern cone; the total number of FTPs known up to the moment amounts to 130 and is housed at three different museums (Flegenheimer et al., 2015a). Lithic materials consist of a variety of unifacial and bifacial flaked tools, ground artifacts including a discoidal stone with a central engraving and thousands of flakes and were collected from

Table 1
Radiocarbon dates and function of the sites with FTP discussed.

Site	$_{14}$C years BP	Cal years BP	Lab. number (Charcoal)	Site function
Cerro La China 1	10,804 ± 75	12,780–12,600	AA-8953	Domestic rockshelter
	10,790 ± 120	12,810–12,550	AA-1327	
	10,745 ± 75	12,730–12,540	AA-8952	
	10,730 ± 150	12,510–12,280	I-12741	
	10,525 ± 75	12,780–12,450	AA-8954	
Cerro La China 2	11,150 ± 135	13,160–12,880	AA-8955	Hunting open air site
	10,560 ± 75	12,550–12,330	AA-8956	
Cerro El Sombrero Abrigo 1	10,725 ± 90	12,720–12,500	AA-4765	Specific activities rockshelter
	10,675 ± 110	12,690–12,430	AA-4767	
	10,480 ± 70	12,460–12,220	AA-5220	
	10,270 ± 85	12,210–11,765	AA-4766	
	8060 ± 140	9140–8580	AA-5221	
Cerro El Sombrero Cima	–	–	–	Weapon refurbishing, discard of broken artifacts, lookout, open air site

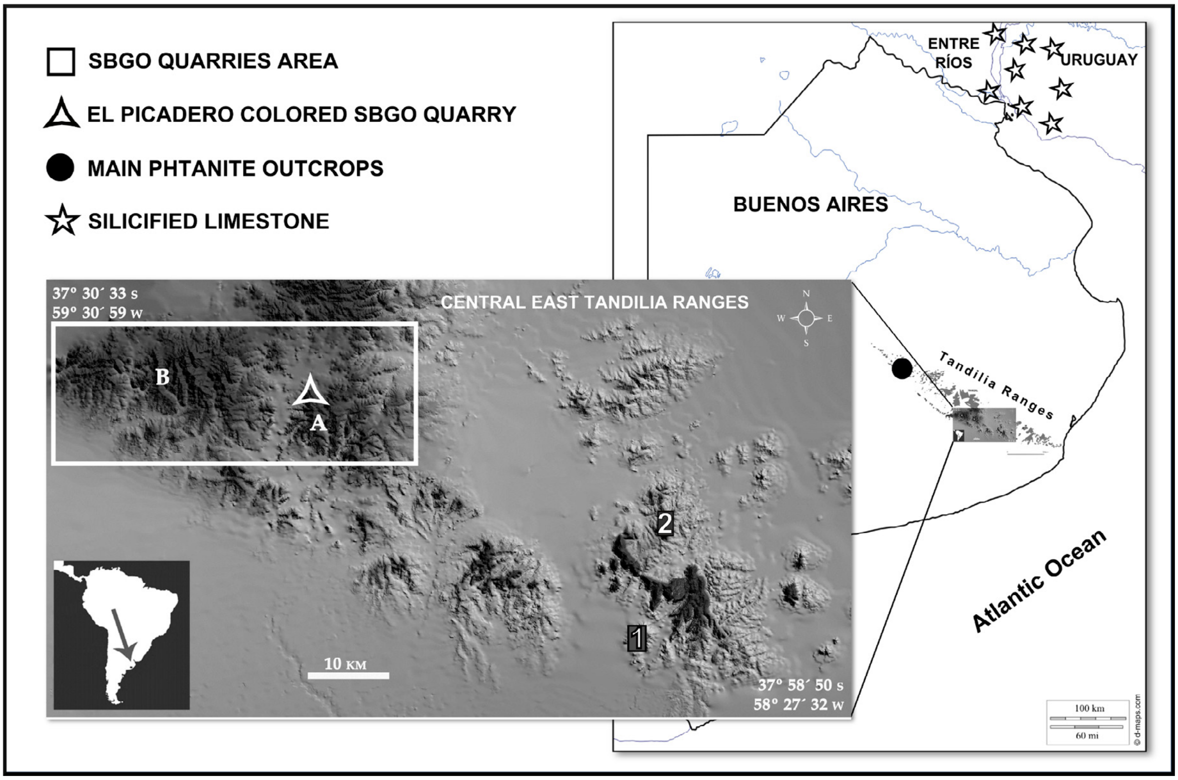

Fig. 1. Study micro-region and sites considered. 1: Cerro La China sites 1, 2 and 3; 2: Cerro El Sombrero Cima and Abrigo 1. A: Barker; B: La Numancia.

the entire summit (Flegenheimer, 2003; Flegenheimer et al., 2013a, 2013b). Although no organic remains are available for radiocarbon dating, the site is assigned to the terminal Pleistocene considering morphological and technological similarities of lithic artifacts and raw materials with nearby dated sites. Besides, no characteristic artifacts of later occupation periods were recovered at the hilltop. This site is interpreted as a place where specific activities were carried out, including weapon re-equipment and refurbishing. Evidences of the final moments of FTP manufacture, maintenance and repair have been mentioned before but up to the moment were not presented in detail. This place is also interpreted as a look out and as a significant node in the terminal Pleistocene social landscape and probably, as a place where broken tools were intentionally discarded (Flegenheimer and Mazzia, 2013; Flegenheimer et al., 2013a; Flegenheimer and Cattáneo, 2013; Weitzel, 2010). The FTPs at this site were recovered from excavations of a small sector of the site and from surface collections. Here we analyze those recovered by one of us (NF), deposited at the Área Arqueología y Antropología, Museo de Ciencias Naturales, Municipalidad de Necochea.

The analyzed sample includes FTP from CSC and all the points found at the other three sites, and consists of 97 specimens with important size variability. Ten are preforms and 87 are finished points; 64 items are broken (65.9%), 7 (7.2%) exhibit damage at the tip only, and 11 (11.3%) are whole but most were repaired; the remaining 15 (15.4%) points were recycled into other tools. Considering that the recycled points were previously broken, breakage ratio of FTP is 93.8%. Table 2 shows the composition and statistics of the analyzed sample according to size categories; these categories are described in the results section. The collection also exhibits 32 other artifacts that cannot be assigned to the FTP type with complete certainty, but which probably correspond to point blades and/or blanks. These last are conservative numbers and detailed study of recycled artifacts could increase them.

3. Results

3.1. Raw material acquisition

We will begin life history analysis at raw material acquisition. This activity involved not only the actual procurement but also a deep knowledge of the environment, location, availability, quality and visual properties of the lithic resources intended to manufacture a FTP (Flegenheimer and Bayón, 1999; Flegenheimer et al., 2015a).

In the Pampean Region lithic resources are highly localized in the landscape in three main areas (Fig. 1), each of which provides different rock types (Bayón et al., 2006 and references cited there). One of these areas, the Tandilia Ranges, includes outcrops of orthoquartzites of different flaking qualities forming characteristic mesa and butte hills. Intensive surveys in the range section where the best toolstone is available, between Barker and La Numancia, has revealed the existence of 56 quarries of Sierras Bayas Group orthoquatzites (SBGO) (Fig. 1A and B), five of these contain mostly colored toolstone, the remaining 51 are mostly white (Colombo, 2013; Colombo and Flegenheimer, 2013). SBGO quarries are located 40–60 km away from the localities CS and LCH (Colombo, 2011, 2013). Quartz crystals are recorded within the same SBGO area at more localized potential sources, these are hydrothermal in origin and exhibit variable sizes up to approximately 15 cm in length (Colombo, 2013); other varieties of poor quality quartz have a wider distribution. Towards the east of the quarries, poor quality orthoquartzite of the Balcarce formation (BFO) crops out and is the

Table 2
Fishtail Point sample composition, measures and statistics (see size categories in the Results section).

	Small	Atypical FTP	Medium	Large	Undeter-mined	Preform	N
Whole	4	2	3	1	–	–	10
Broken	–	1	40	9	3	10	65
Minor damage	1	3	2	–	–	–	6
Maintained	–	–	2	–	–	–	2
Recycled	–	–	7	4	5	–	15
N	5	6	54	14	8	10	97
Minimum stem width[a]	5.73 mm	11.4 mm	14.9 mm	20.4 mm	–	18.8 mm	
Max. stem thickness[a]	2.6 mm	4.1 mm	5.3 mm	6.3 mm	–	5 mm	
Max. stem length[a]	5 mm	9.52 mm	14.3 mm	20.3 mm	–	17.8 mm	
Total length[a]	17.85 mm	21.9 mm	34.5 mm	94.32 mm[b]	–	–	
Max. thickness[a]	2.9 mm	4.8 mm	5.4 mm	8 mm	–	–	
Max. blade width[a]	10.2 mm	15.8 mm	21.9 mm	38.25 mm	–	–	
Minimum stem width range	4.3–7.52 mm	9.97–15.02 mm	9.7–17.68 mm	18.58–20.95 mm	–	11.7–26.38 mm	
Total length range	11.67–24.68 mm	19.11–25.44 mm	26.39–42.23 mm	–	–	–	
Minimum stem width Median	5.2	10.5	14.94	19.7	–	19.12	
Total length Median	16.66	20.9	37.49	–	–	–	
MSW Standard deviation	1.3	2	1.98	0.87	–	4.94	
Total Length Standard deviation	5.4	2.5	7.46	–	–	–	

[a] Average measures.
[b] Value from the only whole large point.

Table 3
Fishtail Points raw material at each site.

	Colored OGSB	White OGSB	F. Balcarce orthoquartzite	Phtanite	Quartz	Quartz crystal	Silicified limestone	Total
Cerro La China S1	–	–	1	–	–	–		1
Cerro La China S2	1	–	–	1	–	–		2
Cerro El Sombrero A1	1	1	–	–	–	–		2
Cerro El Sombrero Cima	49	23	–	4	12	3	1	92
Total/%	51 (52.6%)	24 (24.7%)	1 (1.03%)	5 (5.2%)	12 (12.4%)	3 (3.1%)	1 (1.03%)	97 (100%)

ground rock of the archaeological sites here described. Finally, quarries of *phtanite* (chert) are located to the northwest of the SBGO quarry area, 180 km away from the sites (Barros and Messineo, 2004) and in smaller outcrops in the main SBGO quarry area. These four toolstones were used in fishtail point manufacture (Table 3).

A scarcely represented toolstone in the assemblage is a reddish silicified limestone. This rock comes from 400 to 500 km towards the northeast in Uruguay and northeastern Argentina (Flegenheimer et al., 2003; Martínez et al., 2015) (Fig. 1). According to the formal characteristics of the silicified limestone artifacts and their regional distribution they are interpreted as goods traveling within wide social interaction networks (Flegenheimer et al., 2003).

An interesting issue relates to toolstone selection, supported by systematic studies of regional raw material availability that allow assessing some aspects of the FTP flintknappers' choices. Most of the points are manufactured on colored OGSB (Table 3). Early Pampean societies were highly selective of their raw materials and favored good quality and colored toolstone for point manufacture and for tool manufacture in general. Colored stone is less abundant as a natural resource in the area than white OGSB, so this preference is interpreted as resulting from aesthetic and symbolic values (Flegenheimer and Bayón, 1999; Bayón et al., 2006; Colombo and Flegenheimer, 2013). In addition, quartz is being preferred for point manufacture, even in a higher percentage than for domestic tools. Different varieties of quartz were employed in tool production and one of these varieties, quartz crystal, which was used for FTP manufacture, was not flaked into any other tool type. Poor quality FBO is represented only by one preform, although this rock was used to manufacture informal tools and is abundantly available at the sites. In sum, there is a clear selection for good flaking quality rocks and among these, colored and translucent varieties were favored for FTP manufacture.

3.2. Manufacture

In this section, we will use the notion of technical class as defined by Aschero and Hocsman (2004) and Hocsman (2006), that distinguishes labor investment in the production of chipped stone artifacts: *"The investment of labor is measured, in the final products, through the overlap of flake scars that either completely or partially cover the surface of the artifact, intersecting or not at the center axis of the tool*" (Hocsman, 2014: 204). From lower to higher labor investment technical classes are: non-invasive unifacial retouch, non-invasive bifacial retouch, unifacial reduction, bifacial reduction, unifacial thinning, and bifacial thinning (see Aschero and Hocsman, 2004 and Hocsman, 2006). In addition, several categories (Aschero, 1983) involving technical differences are used to describe stem basal treatment; in order of greater technical difficulty, these categories are: no treatment, dulling, single flake extraction, marginal retouch and fluting.

3.2.1. Preforms

Preforms are identified according to the general outline of the specimen and the absence of traits related to the last moments of manufacture. Stems usually exhibit straight expanding edges, instead of the characteristic biconcave edges and shoulders are not well defined. Stem bases are unfinished and most characteristically stem edges and bases lack abrasion. Yet, most artifacts identified as preforms exhibit a series of marginal retouches along the stem edges producing FTPs characteristic transversal cross section.

All of the preforms are broken (Fig. 2.1–10), and were discarded due to knapping errors (Weitzel et al., 2014a). Two preforms show perverse fractures across the blade (Fig. 2.1, 2). A very small artifact probably corresponds to a base broken during the second fluting and another is a broken base that probably fractured during flute extraction; it shows remnants of nipple preparation for a second, slightly offset, fluting (Fig. 2.7, 2.8). Another preform presents

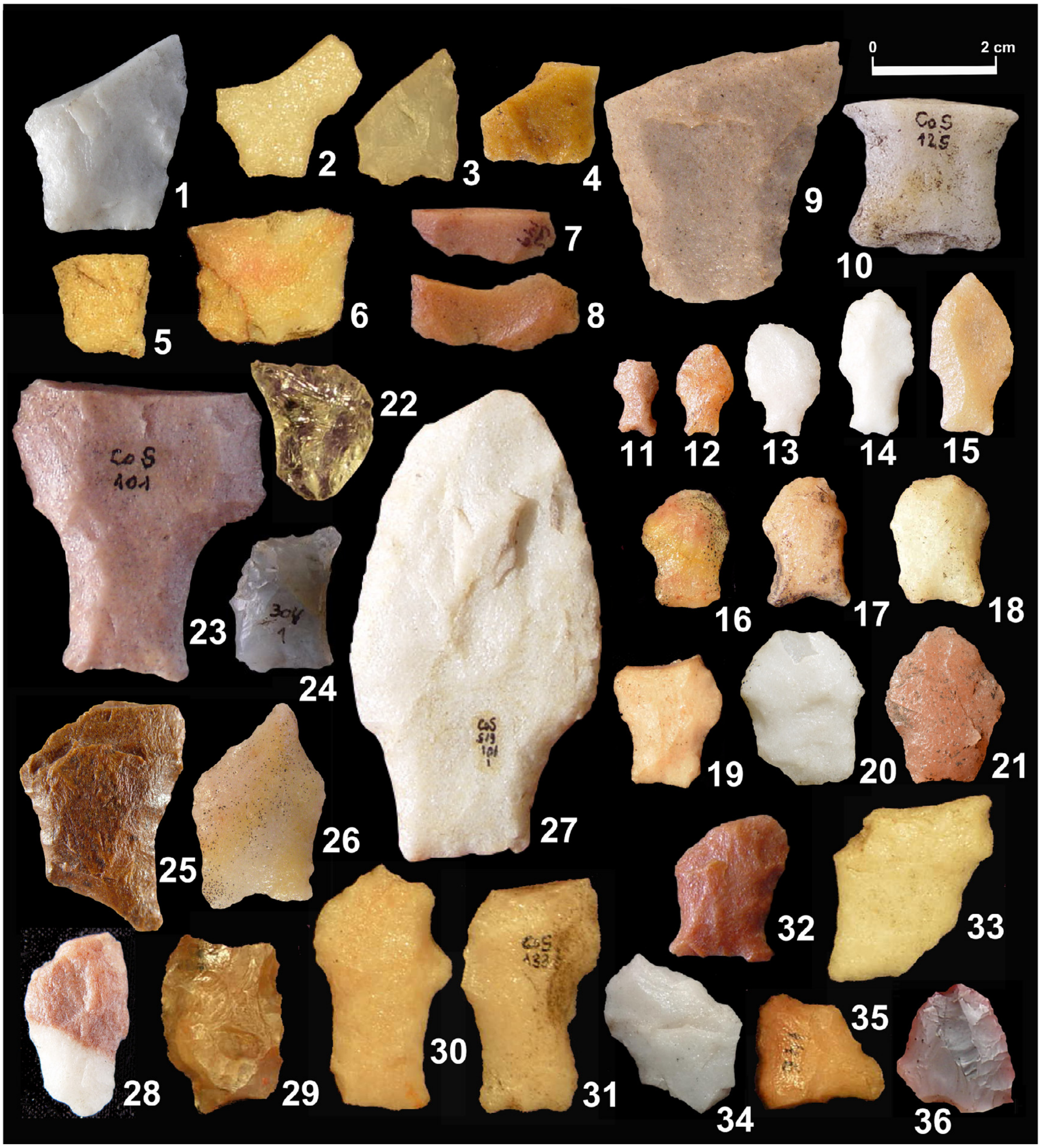

Fig. 2. Preforms (1–10), small (11–15), "atypical" (16–21) and recycled (22–36) Fishtail points.

fluting on one face with extraction preparation by simply beveling the base, a peculiar specimen as it is the only specimen in the sample on BFO (Fig. 2.9). A broken stem (Fig. 2.10) exhibits a failed attempt of basal thinning with a hinge termination and a possible nipple remnant, this is the only specimen where the stem sides are already shaped into their final concavity and the distinction between blade and stem is already insinuated. A stem fragment with multiple fractures (Fig. 2.4) also exhibits fluting on one face and preparation for fluting has been limited to the base beveling. Instead, a quartz stem exhibits nipple preparation (Fig. 2.3). No fluting is registered on the remaining 2 preforms. Only one of these preforms is large enough to preserve the original flake surface and is useful to register the original flake blank thickness (6, 2 mm). Thus, fluting seems to be the riskiest moment in the manufacturing sequence and it has the higher incidence rate in breakage during manufacture.

In addition, according to these observations, fluting was mostly made before the shaping of the stem, except in one case (Fig. 2.10). Both beveling and basal nipples were used as preparation for fluting, as observed in other South American collections (Nami, 2014). These stems were then retouched and exhibit the characteristic transversal section.

3.2.2. Finished FTP

FTPs exhibit a great variation in total length. In our current sample there is a range between 12 mm and 94 mm in total length and for the purpose of this paper we separated three size categories based on the correlation between minimum stem width and total length. A positive correlation between the minimum stem width (MSW) and total length (corr = 0.82; t = 5.88; $p < 0.000$) has been established in this collection (Fig. 3), reinforcing a previous proposal (Bayón and Flegenheimer, 2003); although this correlation may not be valid for oversized points as those registered in Uruguay (Meneghin and Sánchez, 2009; Nami, 2013: Fig. 4L; Suárez, 2016). Fig. 3 plots total length and MSW of those artifacts that are either whole or with minor damage but still allow length to be estimated (N = 26); preforms are not included, as they exhibit wider stems. Seven recycled points with unmodified stems are

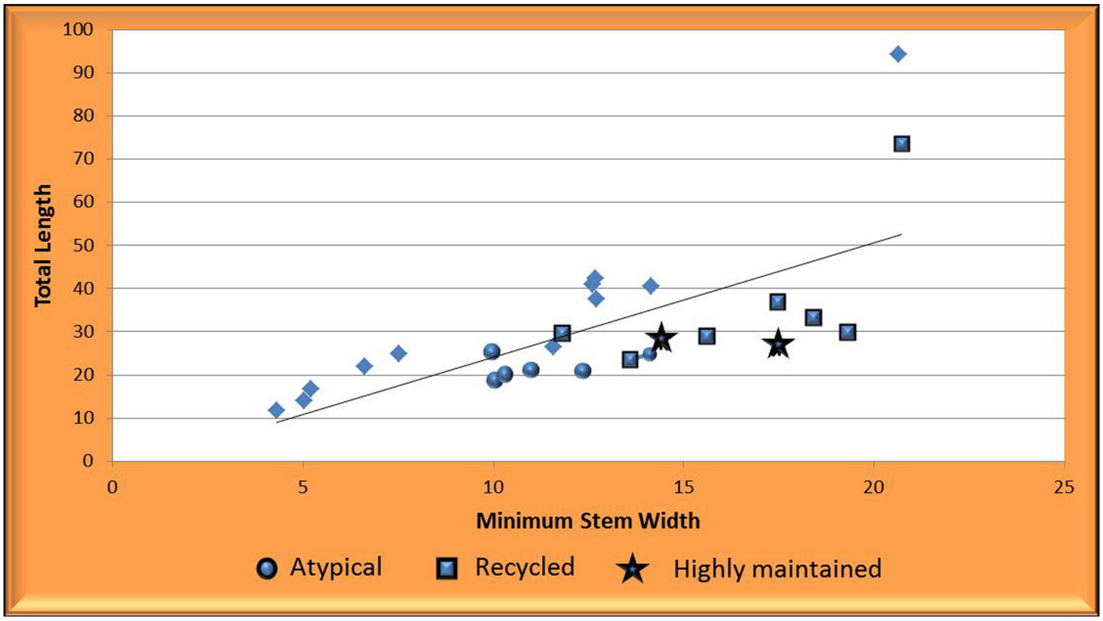

Fig. 3. Size categories according to correlation between minimum stem width and total length.

included but their blade length is modified due to transformations into a new artifact type.

The size categories we use here are small (0–8 mm MSW), medium (8.01–18 mm MSW), and large (more than 18.01 mm MSW). We find important this distinction between different sizes because points of different sizes tend to have different technical traits and life histories.

Minimum stem width (MSW) is a trait that can be measured in most specimens, even when they are broken. So considering the positive correlation between total length and MSW, we found that the most frequent size category is medium, which is mostly composed of stems. In contrast, nearly all the small points are whole except one (Fig. 2.11). Large specimens are few, with a single complete and unmodified point and a nearly complete recycled specimen. Almost all points have some maintenance, yet two highly maintained specimens stand out in Fig. 3 (stars) due to the proportion between MSW and length measures: two medium-sized points with unmodified stems but with much shorter blades resulting from maintenance. Another group of six medium points exhibit odd proportions (Fig. 3, circles) and have particular technical traits; we will refer to them as "atypical FTP" and describe them separately.

Finished specimens of the three size categories exhibit concave stem edges and stem abrasion, most probably related to hafting (Bird, 1969; Flegenheimer et al., 2010). When the blade is preserved shoulders are either rounded or in angle and most points of all sizes present lateral asymmetry.

3.2.2.1. Small points. Small points were only found at CSC and are represented by five specimens (Fig. 2.11–15). They are manufactured on flakes with few retouches. Flake blank selection is not very careful and they could have been picked among the debitage scattered on the hilltop, a large proportion of which corresponds to bifacial thinning flakes (Flegenheimer et al., 2015a). One point still preserves flake curvature (Fig. 2.13) while others are flat with the dorsal ridges of the original flake still visible (Fig. 2.11, 14, 15). Only in one point some attempt to shape the blank into a biconvex cross section has been made, the others are only slightly modified flakes.

Regarding technical classes, retouch is marginal, mostly restricted to the stems. According to technical class classification, most of these points have non-invasive bifacial retouch and the smallest was shaped by non-invasive unifacial retouch. Although all of these specimens have a low labor investment, some show minimum retouch on the blades while others were shaped only along the edges. They do not show retouch by percussion flaking and some of the blades were probably simply shaped by shearing. Base treatment is virtually absent, with two exceptions that exhibit short retouch and stem edges are abraded.

The outline of these miniatures, including: rounded and straight angled shoulders, symmetrical and asymmetrical shapes, pointed and rounded tips, replicates the morphological variation of full sized FTPs; instead, no attention was paid to replicating volume or three-dimensional aspects.

3.2.2.2. Medium-sized points. This group includes the first FTP found in stratigraphy in Argentina (Flegenheimer, 1980). Medium-sized points are the only category found at sites other than CSC. They are the most frequent and include 56 specimens, considering only those in measurable conditions for minimum stem width and/or length. Among medium sized artifacts, a small group which we call "atypical FTP" stands out as poorly manufactured and exhibiting unusual proportions and will be discussed separately.

A great proportion of medium-sized FTP are broken (92%), and most correspond to stems with transverse fractures. There are no evidences in the sites corresponding to the initial moments of production, which probably occurred at the quarries as part of a sequential production (Flegenheimer and Cattáneo, 2013). Cores registered at LCH1, 3 and CS Abrigo 1 sites are exhausted, and too small to provide blanks for FTP¸ they produced blanks for other smaller tool types (Bayón et al., 2006). Most medium points were probably manufactured from a carefully produced flake blank of approximately the same thickness as the finished point, as in other assemblages (Bird, 1969; Nami, 2014; Flegenheimer, 1980). When part of the original flake blank is still recognized, flake thickness varies between 5 and 7 mm. Blades of finished FTP exhibit biconvex or, in some cases, plano-convex transversal cross-sections.

All show some extent of bifacial retouch. In those points preserving part of the blade or in whole points (N = 16), analysis of technical classes shows that five were shaped by bifacial marginal retouch (non-invasive bifacial retouch) leaving the original flake blank still visible (Fig. 4.1, 5, 19–20), usually flake scar extent is dif-

Fig. 4. Medium-sized (1–10, 12, 14–21, 23, 25, 26, 29–39, 41–45, 49, 50, 55–60), large Fishtail points (27, 28, 40, 46–48, 51–54) and undetermined size (11, 13, 22, 24) due to fractures at minimum stem width.

ferent for both faces of the point. An extreme and unique example is the complete point from CS Abrigo 1 (Fig. 4.1) where the blade has been barely shaped and preserves the curvature of the original flake blank. Other five points show bifacial reduction, exhibiting greater labor investment (Fig. 2.25; Fig. 4.2–4, 26). Finally, six points are bifacial but we cannot identify the technical class, as the preserved portion of the blade is small due to extreme maintenance or breakage. In the remaining 40 medium-sized FTP labor investment was not assessed as the stem is the only fragment recovered. Most stem edges have marginal bifacial retouch resulting in the characteristic cross-section mentioned above.

Base treatment also exhibits variations. Nine points (18%) exhibit fluting; only one is fluted on both faces (Fig. 4.33). The eight points with one flute (Fig. 2.25; Fig. 4.3, 28, 41, 45, 57, 59, 60) show varied basal treatments on the opposite face: retouch is the most frequent (37.5%), but also single flake extraction, dulling, or no treatment at all. In nineteen points base treatment consists of marginal retouch on both faces (38%); other fourteen (28%) show retouch on a single face combined with single flake, dulling or no treatment on the other face. In three (6%) base treatment consists of a single retouch, and in five points (10%) it is undetermined due to fractures or post-depositional surface modifications.

3.2.2.3. "Atypical FTP". Here we include six artifacts that exhibit odd proportions (Fig. 2.16–21; Fig. 3 circles) and particular manufacturing techniques which led us to describe them as a separate group. Although the fishtail outline is recognizable, their proportions are different from those described for the type (Bird, 1969) with shorter blades and stems that are more robust. Most of them are nearly complete and with tip damage, with one exception that exhibits a bending fracture transversely across the blade. MSW is wider than that of miniatures, even one is well within the range of the medium-sized points, but length of atypical points is shorter than other medium points. These unusual proportions, similar to those exhibited by highly maintained FTP, go hand in hand with other particularities.

Labor investment in their manufacture is low; it stands between miniatures and medium-sized points: most exhibit non-invasive bifacial retouch, but with regular marginal retouch on one face and few discontinuous flake extractions on the other and one has only non-invasive unifacial retouch (Fig. 2.17). Most have a plano-convex transversal cross-section as opposed to the biconvex cross-section of most medium-sized points. Base treatment was accomplished by retouch with one point showing a short flake removal that resembles fluting (Fig. 2.20). Blanks for their manufacture are also available among the debris at the hilltop of CS.

3.2.2.4. Large points. Fourteen specimens fall within this size category; only one is whole and shows no modifications (Fig. 4.51). Another shows evidence of fracture and recycling, still most of the point is preserved and yields substantial manufacture information (Fig. 2.27). Another one is broken and recycled but preserves part of the blade (Fig. 2.23); and also nine stems correspond to large points. The only whole specimen is 94.32 mm long; 20.64 mm minimum stem width and 7.4 mm for maximum blade thickness and 8.2 mm maximum stem thickness (Table 2). Yet, the nearly complete maintained and recycled point probably was the largest of the assemblage before breakage as it now is 73.56 mm long, but its minimum stem width is 20.73 mm, its maximum blade and stem thickness are 7.9 mm and 6.3 mm respectively.

As in the case of medium-sized points, there are no evidences in the sites of the initial moments of production of large FTP

(Flegenheimer and Cattáneo, 2013). The technical class can only be observed in four points; they are all bifacial but exhibiting different technical classes. One has bifacial reduction with scars not reaching the center of the blade (Fig. 2.23), one has unifacial thinning with scars reaching the center of the point on one face and two have bifacial thinning with scars thinning the blade and reaching and passing the center on both faces (Fig. 2.27 and Fig. 4.51). Only one large point still preserves a small part of the flake blank. Final shaping must have been made with marginal retouch as shown by the only whole point without evidence of repair and maintenance (Fig. 4.51).

Regarding base treatment, seven (53.8%) are fluted: five have fluting on one face (Fig. 2.23; Fig. 4.27, 28, 40, 53) and two on both faces (Fig. 2.27, Fig. 4.51). Those with a single fluting exhibit marginal retouch (N = 2), single flake retouch (N = 2) and undetermined (N = 1) base treatment on the other face. Five bases were modified with marginal retouch on both faces (30.74%) and other two (15.38%) with a single flake removal.

3.2.3. Other related evidence

An exhaustive revision of the collection for products related to FTP manufacture is still pending. Yet according to current records, there are several bifacial fragments at CSC and LCH1 that probably correspond to fishtail points in different moments of the production process (N = 31). All the artifacts considered as blanks are broken; the only complete artifact has a post-depositional transverse bending fracture and was found assembled. Raw materials used for their manufacture are similar to FTP: colored SBGO (61.76%); white SBGO (29.4%); BFO (2.94%); phtanite (2.94%) and quartz (2.94%). Technical classes show a prevalence of bifacial reduction (27.3%) and bifacial thinning (21.2%) followed by bifacial marginal retouch (18.2%), unifacial thinning (12.12%) and unifacial reduction (6%). Many of these broken artifacts exhibit diagnostic knapping errors (35.4%). Other small bifacial tools could also correspond to recycled portions of fractured blanks or preforms.

As mentioned above, some tool blanks could be large bifacial thinning flakes. Also, 19% of the complete flakes recovered at CSC are diagnostic of bifacial thinning (Flegenheimer, 1991). They are small, frequently exhibiting expanding edges and strongly prepared narrow platforms (with facets and abrasion), diffuse bulbs and lips. Most probably, these flakes correspond to the last moments of FTP manufacture and repair carried out at CSC. Analysis of a sample of complete flakes at the site placed them at advanced events in the manufacturing sequence (Flegenheimer and Cattáneo, 2013). A very small proportion of these small thinning flakes exhibit characteristics that could relate them to channel flakes, they are flat, have parallel edges and isolated and strongly prepared platforms.

3.3. Use

We consider two types of evidences for the use of FTP: use related fractures and fatty acids residues; we have dealt with both in previous papers (Flegenheimer et al., 2015b; Mazzia and Flegenheimer, 2015; Weitzel et al., 2014a). Here we consider 80 finished points; recycled points are described in a further section.

3.3.1. Small points

Most of the small points were discarded whole with one exception that has a bending fracture at the tip, probably a post-depositional fracture, not use related. All the small points exhibit stem edge abrasion suggesting they were hafted or bound, nevertheless fatty acid and sterol analyses showed that these points were not in direct and regular contact with organic residues, as the chromatograms obtained had no peaks (Flegenheimer et al., 2015b). That is, they do not exhibit evidences of use as projectiles or hafting.

3.3.2. Medium-size points

Most of the medium-size points exhibit some type of damage (92%); nearly half have one or two broken prongs. The most frequent cause of breakage is impact (32%) and other accidental bending fractures (28%). Diagnostic impact fractures include: large impact flutings (N = 5) initiating from the tip (for example Fig. 2.34; Fig. 4.4, 5, 7), step terminating bending fractures across the stem (for example: Fig. 2.22, 25; Fig. 4.25, 46, 56, 60) (n = 9) and a spin-off fracture (Fig. 4.29). One of the points with tip impact also has an impact fracture at the proximal end that eliminated the basal portion and modified the stem (Fig. 4.4). Two points with step terminating bending fractures also have prongs removed by impact. One shows several impact evidences (Fig. 4.44): a step terminating bending fracture, a prong removed with a step terminating bending fracture, and impact flake removals from both the proximal end and from a stem edge. Regarding accidental bending fracture, their causes are difficult to identify as they can have several origins (Cotterell and Kamminga, 1987; Fischer et al., 1984). In the case of FTP, a frequent relationship between impact breakage and the occurrence of bending fractures located transversely across the stem was identified experimentally (Flegenheimer et al., 2010; Weitzel et al., 2014a); results also showed that fracture location is not strictly related to the haft ending (Flegenheimer et al., 2010). Nine (18%) of the 14 bending fractures of the medium-size points, are located transversely across the stem and most probably are the result of impact. If we add these to the other diagnostic impact fractures, most of the medium-size points (around 50%) have evidences of breakage during their use as projectile points, but this should be considered a minimum impact breakage ratio.

Five medium-size points analyzed for fatty acid and sterols yielded positive results (Mazzia and Flegenheimer, 2015). Two broken points with impact fractures had undetermined organic resources, they were used but particular organic resources cannot be inferred. Other three points showed evidences of possible hafting: a quartz point with a spin-off fracture (Fig. 4.29) yielded results for vegetal or possible hafting (mastic + wood); as this point has no macroscopic evidence of recycling, these results could indicate hafting. A stem with a diagnostic impact fracture also has evidence of hafting and of other undetermined organic resources. Finally, a highly maintained whole point (Fig. 4.6) had fatty acids and sterols of terrestrial animals and mastic or wood, consistent with what is expected of a hunting weapon (Mazzia and Flegenheimer, 2015).

3.3.3. "Atypical" FTP

Only two of these artifacts are whole, yet in most cases they exhibit only slight damage. This difference with the other points is most probably the result of a different use. Three "atypical" FTP have impact fluting at the tip (Fig. 2.17, 20, 21) and one also shows a fractured prong. Another specimen has a bending fracture near the middle portion of the blade. These signs of damage suggest that at least some of these artifacts could have been thrown, yet their design, edge shape and angles, is consistent with their use as scrapers and cutting tools. No fatty acids analyses are currently available for this group of points. Therefore, the use of these points still is unclear and will be further analyzed in the future.

3.3.4. Large points

Most of the large FTPs are broken (64.2%). Two have diagnostic impact fractures and one of them was recycled later (Fig. 4.46 and Fig. 2.33). Bending fractures are the most frequent (N = 7) and four of them run transversely across the stem, a location that can be related to impact as mentioned above. Finally, there are two undeterminated fractures; one is also located transversely across the stem. We consider that nearly 50% of the fractures of large points occurred due to impact when used as projectile points. Only two large points exhibit broken prongs, one of these points also has a diagnostic impact fracture.

There is only one complete point, which was used to represent the type (Morrow and Morrow, 1999) and has been cast (Flegenheimer, 2009) (Fig. 4.51). It has no evidence of use, maintenance, repair or resharpening. This group of points was not analyzed for fatty acids and sterols yet, with the exception of a large recycled point (see below).

3.4. Maintenance and repair

None of the miniatures and "atypical" FTP show evidences of repair or maintenance. In contrast, most of the complete medium-size points are actually maintained by re-sharpening the blade, which could be accomplished while the points were still hafted. This maintenance is identified by changes in the lanceolate blade outline, shortening of the blade length, and changes in the blade edges angles and retouch morphology. Two of these points are highly maintained and are shown with stars in Fig. 3 (Fig. 4.6, 7); they exhibit only a very small portion of the blade remaining; one has a pointed tip and the other is convex. This last artifact presents impact fluting, suggesting it was used after this extreme repair.

There are two points with other evidences of repair: stem fragments corresponding to the medium and large size categories that exhibit perverse fractures diagnostic of knapping errors (Fig. 4.49, 54), located near the mid-section of the stem. So, if these knapping errors occurred during maintenance, it was practiced with the points out of the shafts. Also a medium-sized point has a lateral snap across the blade (Fig. 4.18). As the stem edges are abraded, we consider that they were finished points that were being repaired. A nearly complete large point also has evidences of repair once removed from the haft as the base of the stem has been reworked, altering stem morphology, this point is also discussed below as it was recycled (Fig. 2.27).

Therefore, repair of points in their shafts is probably the more common practice and in some occasions was carried out until a small portion of the blade remained. Yet, in some instances stems were repaired, that is, points were unhafted and then repaired. These different maintenance activities affected point outline proportions in different ways.

3.5. Recycling

Recycled FTP are those modified by retouch to produce a different tool (Hocsman, 2009; Schiffer, 2010). In most cases this was made once points broke due to impact. Fifteen FTP (15.4%) show evidence of recycling, they were all recovered at CSC and correspond only to medium and large points (Fig. 2.22–36). As in the case of maintenance and repair, none of the miniatures and "atypical" FTP recovered were recycled.

Most recycled tools were produced by marginal retouch on the remaining portion of the blade and on stem fragments. Recycling produced a strong morphological change in some FTP; in some cases, this blurred characteristic traits (for example, Fig. 2.28, 30, 31, 35); and other points only have a modification of the blade edge angles to fulfill other functions (Fig. 2.23, 27) or a few flake extractions using a fractured edge (Fig. 2.22, 24, 25).

At least seven recycled points have clear evidence of impact breakage before recycling including two with evidence of a previous impact flute and three with step terminating bending fractures (Fig. 2.22, 24, 25, 32, 33, 34, and 36). FTPs were mainly recycled into burins (for example, Fig. 2.22, 24) and tools with short cutting edges (Fig. 2.30, 32), but other tool types like, side scrapers (Fig. 2.23), drills (Fig. 2.26), chisels (Fig. 2. 25) and notches (Fig. 2.29, 30) are present. Some of the recycled artifacts are multiple tools with two or three different edges. One of the largest points (Fig. 2.27) has a blade edge recycled into a knife.

Four recycled points yielded a variety of resources through fatty acids analysis (Fig. 2.24, 26, 28, 34) (Mazzia, 2010/2011; Mazzia and Flegenheimer, 2015). A burin on a stem presented fatty acids associated to a vegetal haft. Results from a drill also suggest hafting but also include other vegetal oils that may represent the use of this tool after recycling. Another drill has evidence of its use with undetermined organic resources; and in the remaining recycled point fatty acids could be degraded (Fig. 2.25) (Mazzia, 2010/2011; Mazzia and Flegenheimer, 2015).

3.6. Discard

Eleven points (11.7%) were discarded whole. These include four of the five small points (Fig. 2.11–15); the one with a small bending fracture at the tip most probably broke after deposition; so miniatures were discarded without use fractures and without any evidence of use with organic resources. The same happens with the only whole large FTP without recycling, it shows no sign of maintenance, resharpening or use damage; as we don't have fatty acid or use wear traces for this specimen we cannot confirm whether it was used or not. It presents lateral stem abrasion indicating probable hafting. In addition, two "atypical" specimens were recovered complete and without macroscopic evidences of maintenance or repair (Fig. 2.16, 18), one has a bending fracture across the blade (Fig. 2.19) and three have impact fluting at the tip (Fig. 2.17, 20, 21). Finally, only five medium-size points are whole, and four of them exhibit clear evidences of being maintained or highly maintained and even one of them has an impact flute after maintenance. A few medium-size FTPs with some, but not extreme, maintenance are still useful as projectile points (Fig. 4.2–4). Yet, most of the medium and large points were discarded broken (87.8%) and are represented mainly by stem fragments (86.7%) and a small proportion was discarded with damage at the tip (5.8%). Preforms were discarded due to breakage during fluting or during the final shaping of the blade.

Another relevant consideration is: where were these different artifacts discarded? Atypical FTP, miniatures, large and recycled points were discarded only at CSC. Yet, most of the collection from this site comprises medium-sized broken points. At Abrigo 1, a small special activity site, two medium-sized points were recovered, one is nearly complete and has the peculiarity of being expediently manufactured (Fig. 4.1), the other one exhibits bending fracture across the blade (Fig. 4.21). At LCH1 domestic site, only a broken preform (Fig. 2.9) and a blank were identified. Finally at LCH2, a hunting site, two nearly complete medium sized points with impact damage were found (Fig. 2.3, 4). At another nearby multi-activity location, LCH3, no FTPs were registered.

3.7. Post-depositional

Trampling experiments show that artifacts of 7 mm thickness or less are susceptible to breakage (Weitzel et al., 2014b), that is, most of the FTP collection could break due to trampling. But most of the medium and large FTP exhibit diagnostic use related fractures (around 52%). In addition, some fractures (7%) are related to manufacture. That is, few non-diagnostic fractures in the collection could be the result of trampling damage. Some possible examples are the fractured tip of a miniature (Fig. 2.11), the in situ breakage of the blank at LCH1 or some broken prongs. In addition, the absence of refitting along with the experimental trampling breakage ratio on SBGO, has led us to propose that at least at

CSC, trampling has not been an important factor in breakage (Flegenheimer and Weitzel, 2007).

Post-depositional processes have differently affected the excavated and the surface collections. While in excavated FTP only some flake scars evidence slight abrasion, many of the surface specimens have strong post-depositional modifications. These last exhibit both cases of weathering, and rock coatings; lichen growth, patina and thermal alteration have been observed. Some of these surface modifications are strong enough to mask original flaking scars hindering identification of these artifacts as FTP.

4. Discussion

FTP from South America show great variability. The assemblages analyzed here from the central east Tandilia Range display most of the variability known for manufacturing techniques as well as for sizes, with the exception of large oversized points from Uruguay.

Raw material selection shows a preference for the best quality local toolstone (OGSB); this choice of local resources is similar to other FTP assemblages (Hermo et al., 2015; Nami, 2013; Suárez, 2016). Among the good quality rocks a second selection favored colored and translucent shiny rocks; we have previously proposed that the assignation of aesthetic or symbolic values to certain stones was a common practice in the region among terminal Pleistocene societies (Flegenheimer and Bayón, 1999; Colombo and Flegenheimer, 2013). Interestingly the choice for raw materials changed during later times in the Pampas where some lithic assemblages became known as the white industry (Hrdlicka, 1912). Quartz was also used in a greater proportion than in other artifacts; this choice for translucent materials is also recorded for other FTP collections (Briceño, 1999; Hermo et al., 2015; Maggard and Dillehay, 2011; Nami, 2009; Nuñez et al., 1994). Finally, very low frequencies of FTPs on long distance toolstone were registered; they probably were transported as complete FTPs or blanks within wide social networks linking distant areas (Flegenheimer et al., 2003).

FTP manufacture was sequential, with blank production probably occurring at the quarries (Flegenheimer and Cattáneo, 2013) and with the last moments of production at a specific site, in our case study, CSC. This hilltop exhibits a high proportion of point manufacturing debris including blanks and preforms with diagnostic knapping errors. An exception to this proposal is the production of miniatures and atypical points that could have occurred completely at this one site.

Manufacturing sequences are loosely related to FTP size. Miniatures and "atypical" FTP have very low labor investment and their manufacturing sequence could start with blank selection among flakes scattered throughout CSC hilltop. In miniatures retouch is mainly applied to shape the stem, but the blade is simply shaped by shearing; bases either have no basal treatment, or careless retouch. All miniatures stem edges are abraded. Atypical FTP exhibit poorly produced unifacial and/or bifacial marginal retouch over some sections of the edges, base treatment was mostly made by marginal retouch and some points have the stem edges abraded.

Manufacturing of medium points involves greater labor investment. It would start with the production of flakes with thicknesses similar to that of the finished artifact, these were worked by careful bifacial marginal retouch or bifacial reduction. Basal treatment in this group was mostly accomplished through marginal retouch and in some cases by fluting; bifacial fluting is present only in one medium-sized FTP. The final shaping of the stem was produced by marginal bifacial retouch and finally stem edges were abraded.

A third, longer, sequence identified must correspond only to the larger points of these collections. Nodules or more probably, large flakes were worked by bifacial reduction and bifacial thinning which requires skilled flintknappers. Fluting is more frequent in this group than in the others, it also implies skilled flintknapping and has a high failure ratio. As in medium points, final shaping is made with bifacial marginal retouch along the blade and stem edges, finishing with stem edge abrasion. Nami (2010) also identified these two last sequences and replicated them experimentally, finding similarities in FTP manufacture from Patagonia, Ecuador and Uruguay.

So, as in other collections, FTPs were mostly made from selected flakes by bifacial marginal retouch, and less frequently with unifacial retouch, bifacial reduction or bifacial thinning. Labor investment (Fig. 5A) increases with point size: miniatures have the lower investment and larger points fall in the higher labor investment end. "Atypical" FTP overlap with miniatures and medium-size points. Variation is also observed in basal treatment, the most frequent being marginal retouch (53.3%) followed by fluting (18%). The use of a combination of different basal treatments on each face of the point is also common; the FTP collection from El Amigo Oeste in Patagonia also exhibits this combination (Hermo et al., 2015). As mentioned for technical classes, complexity in basal treatment increases with point size and fluting is more frequent in larger points (Fig. 5B). In sum, both technical classes and basal treatment require more labor investment and skill as point size increases (Fig. 5A and B), yet, anomalies to this tendency are registered in some individual specimens.

Regarding point use, macro-fracture analysis shows a high incidence of diagnostic impact fractures (26.7%). Additionally transverse fractures across the stem are considered as resulting from impact according to experimental studies (Weitzel et al., 2014a), including these, about 40% of the sample has some evidence of impact in medium-sized points (around 50%), "atypical" FTP (66%) and large points (near 50%); while miniature points are mostly whole and show no evidence of impact. We are aware that not all small impact flute scars may be considered a solid evidence of the use of artifacts as tips (Hutchings, 2016; Pargeter, 2013; Rots, 2016) and in our particular case further evidences should be sought for atypical FTP to assess their use and function.

Fatty acids analysis has revealed further use evidences, yielding organic resources in medium and large points; no fatty acids or sterols were present in miniatures (Flegenheimer et al., 2015b; Mazzia and Flegenheimer, 2015). So, all the categories analyzed here exhibit use evidences except for miniatures. We have not yet analyzed preforms or "atypical" FTP for fatty acids. Other issues regarding use remain open to study, among them the hunting techniques, prey, and the characteristics of the weaponry. With our current data, this last issue is subject to the problem of equifinality, as is the case with many identifications of launching technology (Iovita and Sano, 2016 and bibliography cited there).

Medium-size and large points show evidence of maintenance, which in most cases was made with the points hafted, and correspond mainly to tip re-sharpening affecting blade morphology. Yet, there are some instances of base rework due to stem repair.

A variety of new artifact types was produced by recycling medium and mostly, large sized points, which were modified after impact breakage. Recycling of FTP must have been a frequent practice and was also identified in collections from Patagonia and Uruguay (Hermo et al., 2015; Nami, 2015; Suárez, 2015). CSC lithic assemblage includes thousands of broken tools (Mazzia and Flegenheimer, 2012), many of which have fractures that are suitable for quickly producing burins or burin-like tools (Weitzel, 2010); however the production of burins on broken tools is exclusive of FTP fragments. We cannot ascertain where this recycling occurred, yet these artifacts are only found at CSC and we therefore suggest that the possibility that they are related to weapon repair merits consideration. In some cases hafting might have been of

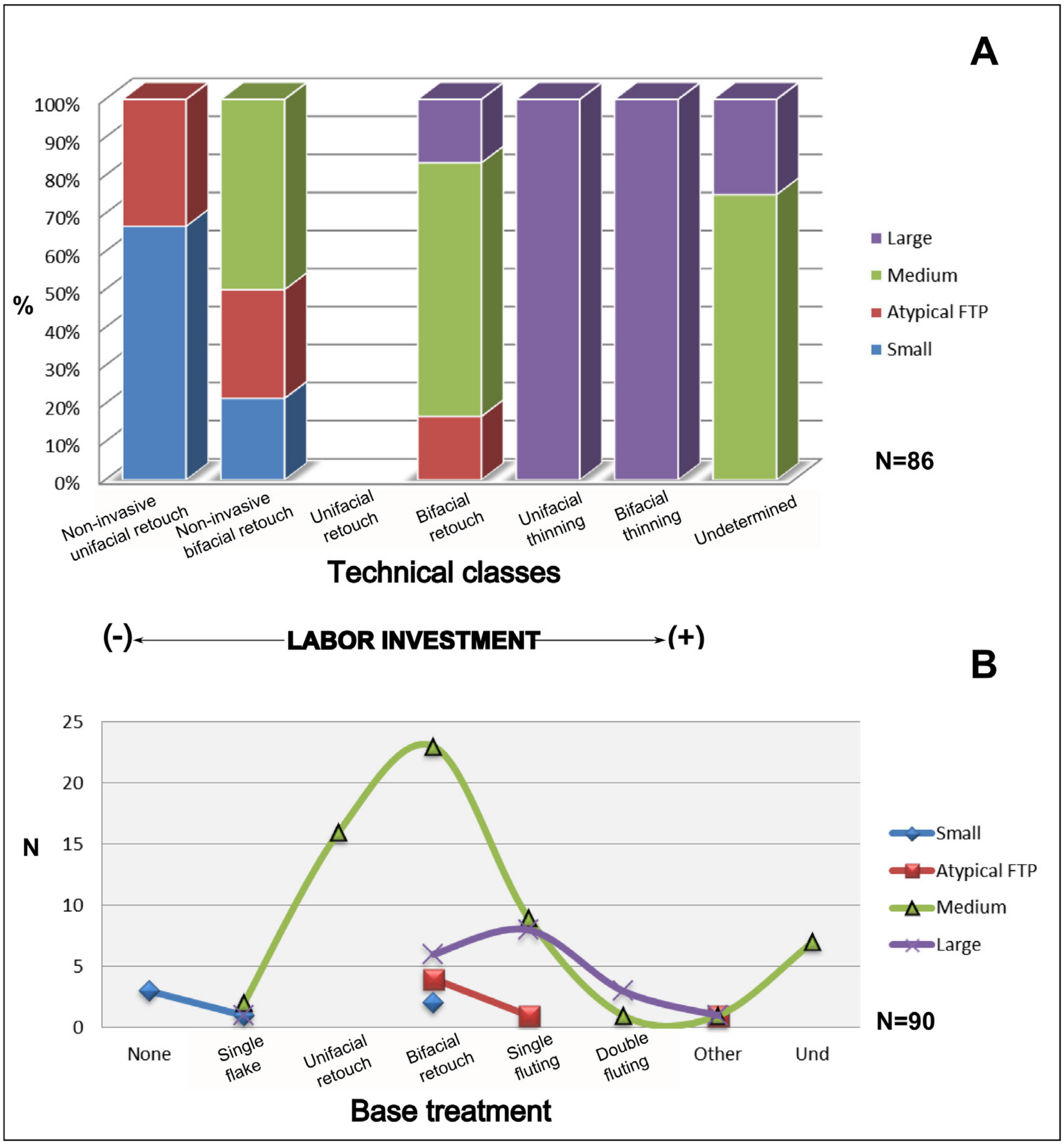

Fig. 5. Labor investment in Fishtail points manufacture. A: Technical classes. B: Base treatment.

special interest, that is a hafted tool was being recycled, but other cases where the stems are reworked are examples of the value of the stone points themselves as recyclable artifacts. Finally, whether FTPs were recycled elsewhere and carried to the hilltop or were selected to be recycled at the hilltop before their final deposition there; it all points to the special significance of these objects.

Another interesting issue is point discard practices. Not only the way some objects are discarded may be symbolic but also the selection of specific places of disposal is meaningful, extending the social use of those objects beyond their discard (Chapman, 2001; Douny, 2007; Miotti and Terranova, 2015; Politis and Jaimes, 2005). In our microregion FTP were disposed mainly in the flat summit of a mesa hill, a place of specific activities including re-furbishing of hunting equipment and discard of other fractured tools: CSC. This is the largest and densest site in the micro-region and is also interpreted as a place of special significance where specific social practices took place (Flegenheimer et al., 2013a; Flegenheimer and Mazzia, 2013). It is the only site in the area that has all FTP size categories: miniatures, "atypical" FTP and very large points were only recovered at CSC together with other unusual tools such as discoidal stones and small spheres, manufactured by grinding, abrasion and engraving (Flegenheimer, 2003; Flegenheimer et al., 2015a). That is, we consider CSC should be assessed as a situation of meaningful disposal of broken artifacts.

Some points were lost or discarded in other situations: during hunting at LCH2 and at a special purpose shelter, CS Abrigo 1. In addition, a few specimens related to manufacture were found at a domestic site, LCH1. Another site of the same network, LCH3, has no evidence of FTP. So, FTPs are scarce in domestic or multi-activity sites and instead they are concentrated at a special purpose site, the hilltop of CSC. These FTP were discarded in several conditions at the four mentioned sites: most were discarded with diagnostic impact fractures, some broke during manufacture and repair and were discarded after breakage; others were recycled after breakage, mainly after impact breakage, and then discarded. Very few points were discarded whole including miniatures, two highly maintained points with signs of impact before and after maintenance with no remnant use life and a very large point without macroscopic evidence of use, resharpening or recycling. This last point could represent a basic morpho-type of these FTP. Finally, there is another very large point almost whole but recycled into a knife. The possibility that FTPs are versatile artifacts that could be turned into bifacial knives or into projectile points when needed, was suggested by Suárez (2015) based on the larger points from Uruguay. This proposal is consistent with the situation of the two larger points from CSC, yet more functional studies are needed to assess the proposal. Although asymmetry has been used as a criterion to propose use of points as knives it should be noted that in FTP specimens found at a hunting site or even small points which could not have functioned as knives, tend to exhibit lateral asymmetry. Yet, multifunctionality and versatility have been recognized as common characteristics for points in many cases (for example, Nelson, 1997; Babot et al., 2013) and either one could be the explanation in our case.

4.1. Life histories

We are now in a position to propose a synthesis of the life history of the groups of FTPs identified (Fig. 6). Small points were manufactured at Cerro El Sombrero Cima, probably using as blanks bifacial thinning flakes scattered throughout the hilltop. They were produced with very little work and they maintain the same, scaled down, proportions and outline of larger points. They show no evidence of use as projectiles and were discarded complete. Stem edges are abraded but none of them has fatty acids evidences, so we suggested they were tied or sown (Flegenheimer et al., 2015b). These points were also used and discarded at the hilltop of CSC and they were not found in other sites of the Pampean Region. We consider these small points are miniatures in the sense of Bailey (2005); as such they might have been representations and abstractions of ordinary sized objects. Their function is still imprecise and we previously suggested that they were linked to point production and social practices related to hunting (Flegenheimer et al., 2015b). Even though their production trajectory is much shorter and localized than that of other FTP, the actual length of their life history is difficult to assess.

"Atypical" FTP were also probably produced at Cerro El Sombrero Cima, they also show low, but slightly higher, labor investment. Yet, their proportions are odd when compared to the rest of the collection, their stem outline is similar to FTP but their blades are different, resembling end-scrapers or short cutting tools, and they are mostly unifacial. Nevertheless, most exhibit impact fluting at the tips, yet these are short negative scars and as mentioned, they should be further studied. Their function is still open to study and their use for practice in hunting or as tools for other activities is under consideration. As with miniatures we do not know the length of their life history.

The continuum medium-large FTP had longer production trajectories that started at sites not included in this study, possibly at the quarries and most of them were probably finished at the hilltop of CS. They were used as projectile points at other locations close to

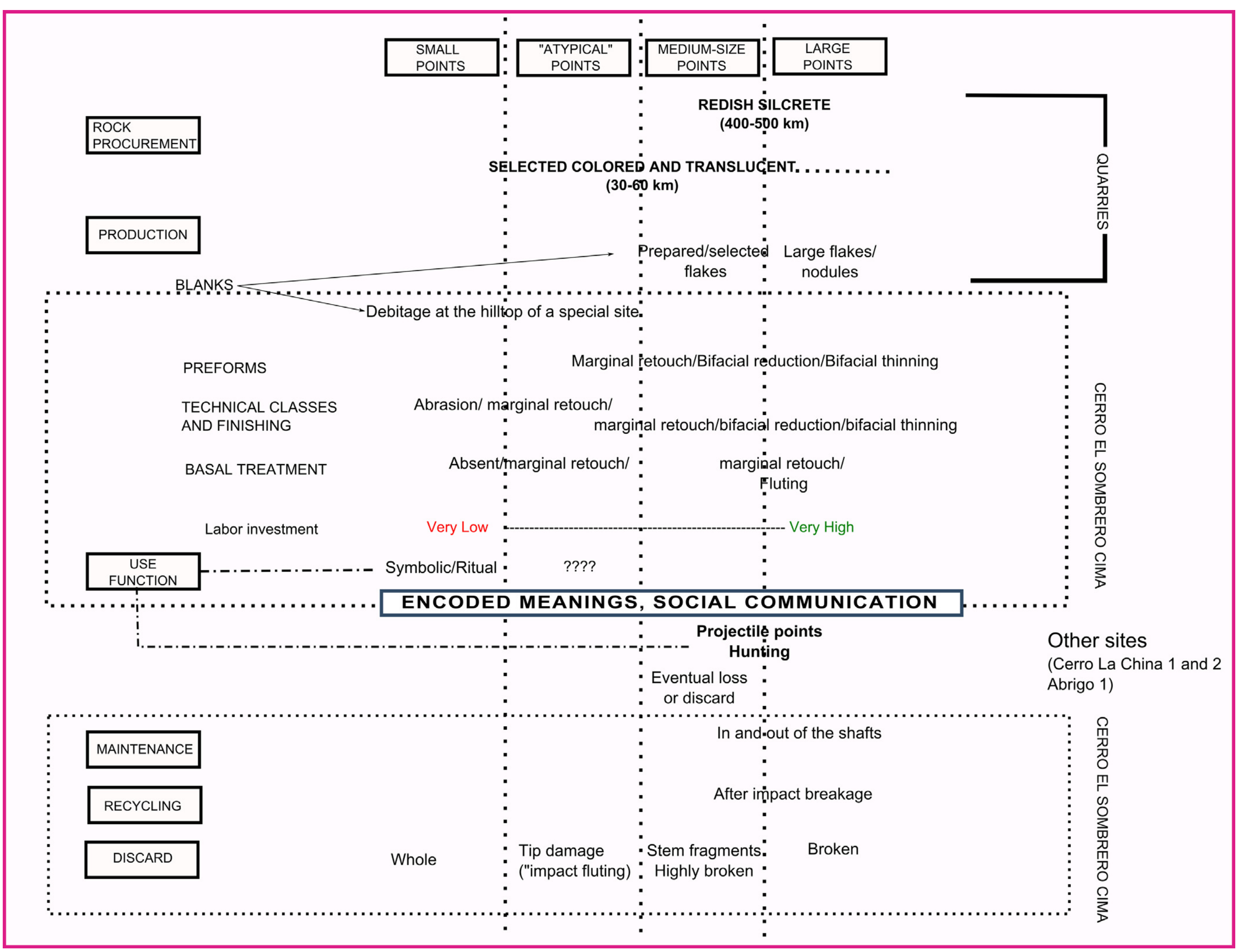

Fig. 6. Summary of central east Tandilia Fishtail points life history.

the plains. These points were maintained when possible; once they broke beyond repair they were either recycled into other tools or were discarded at a re-equipment place. Recycling was more frequent in larger specimens and affected the remaining portion of the blade and sometimes also broken stems. Very few FTP exhibit remnant use life, and probably some of these were lost during hunting. The manufacture of carefully made, very large FTP (Fig. 4.51 and Fig. 2.27) must have been in hands of the most skilled flintknappers. Larger points at CSC exhibit another singularity, two points were discarded with a great use potential, one without macroscopic evidence of use and the other one, which probably was the largest point in the assemblage, was discarded with repair in the base, minor tip damage and a blade edge recycled into a knife. This discard contrasts with that of medium-sized points, which although more abundant, exhibit only one nearly complete and non-recycled specimen at the hilltop (Fig. 4.2). Medium and large FTP therefore exhibit greater longevity than smaller points, their production, use and, sometimes, discard occurring at different places.

5. Conclusion

The term "Fishtail points" includes objects with a similar outline but with different uses and life histories. Miniatures, "atypical FTP" and other medium-sized and large points were conceived from the start to be used in different situations. Although possibly all were in some way related to the realm of hunting, only medium and large points have clear indications of use as parts of weapons. The design of full sized FTP includes a certain range of morphological and technical variability, for example in basal treatment or general approach to manufacture. Size categories established in the medium-large continuum are arbitrary as their cause has not yet been identified. Clearly larger specimens require more skilled manufacture; differences could be related to the use of different weapons or targeting of different prey; but in Taguatagua, the fishtail points associated to a mastodon kill site correspond to medium-size FTPs (Nuñez et al., 1994), suggesting that larger points were not reserved for big game hunting.

A further variation is related to the life history of these objects. The specimens here described were recovered at different contexts, yet almost all show some sign of transformation due to maintenance, impact or recycling. This information is indicative of the longevity of these artifacts and the complexity of their life histories; it is also relevant when using metric or morphological data to compare points, as these transformations have caused strong variations.

Although the role of miniatures is still elusive we have proposed that they are representations of full sized points and possibly related to the realm of ritual (Flegenheimer et al., 2015b). The role of atypical FTP is still more obscure, they may have been poorly manufactured practice points or other tool types, and, as miniatures, they seem to be specially linked to CSC hilltop. Large points also possibly held a special status, they required more skill for manufacture and their larger size renders them more visible. Therefore, as artifacts covering different roles and used in different social practices repeat the FTP outline, we sustain this shape must have held some significance for the people who produced and used them. Other aspects related to FTP use lives which probably were laden with meaning are the choice of colored and shiny toolstone and the place of discard. This significance must be further considered in the temporal and spatial production and use context of FTPs.

FTP were in use during the terminal Pleistocene, a time of climatic change, in a scarcely populated continent, that is, a time when social communication among the colonizing groups must have been important. There is a call for more studies about shared social values and goals, and principles of belief for the early settlers of South America (Dillehay, 2013). We see the analysis of life histories as a way of assessing objects within social dynamics; a way of setting the basis to think of objects in their several dimensions. As other authors, we think that points can be items of economic value but also of social, symbolic or even personal significance (for example, González Ruibal et al., 2011; Miotti and Terranova, 2015; Speth et al., 2013). According to this view, FTPs should have embedded information about various aspects of early societies and people. The repetition of this shape throughout the continent has been interpreted as the result of their importance in communication, they have been considered objects with encoded meanings shared in a wide area (Bayón and Flegenheimer, 2003; Flegenheimer et al., 2013a; Miotti, 1995). The manufacture and discard of FTP in a place isolated from domestic areas including unusual objects, is also indication of their significance. In addition, the existence of another hilltop in northern Patagonia with repeated characteristics, yielding a similar assemblage (Miotti and Terranova, 2015) shows that besides artifact morphology and manufacturing techniques, social practices related to FTP manufacture and discard were shared in a large area. A pattern interweaving both, landscape and social practices related to point manufacture, repair and discard, is observed during the terminal Pleistocene. We consider that these objects held a vital place in early societies and this view is reinforced by the different roles identified for FTP in the assemblages here described and the meaningful discard practices related to their disposal.

Acknowledgments

This paper would not have been possible without the help of numerous colleagues, students, friends and family who helped during fieldwork throughout the years. We are grateful to SENIPEX S.A., Families Corral and Barbería for permitting access to the sites. We also thank Natalia Mazzia and Salomón Hocsman for thoughtful consideration about the collection, and two anonymous reviewers whose comments truly enriched this work. A special thanks to Antonio Ceraso for helping with statistics. The authors acknowledge support from CONICET [grant PIP 112-201101-00177, PIP 112-200801-02979] during the production of this paper.

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