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FROM THESE BARE BONES

Raw materials and the study of worked osseous objects

edited by

Alice Choyke and Sonia O'Connor

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CHAPTER 6

Changed into Tools. Camelid Bones from the Southern Calchaquíes Valleys (Formative Period, North-western Argentina)

Andrés D. Izeta, Roxana Cattáneo, M. Cristina Scattolin and Leticia I. Cortés

This paper presents the results of macro- and microscopic analysis of a sample of ten bone tools dated to the Formative Period in the southern Calchaquíes valleys, north-western Argentina. All these implements were manufactured from South American camelid metapodials following a very standardized technique. In accordance with previous models of handling and use of camelid resources, we propose that these instruments could have been employed in the processing soft materials (e.g. weaving or basketry).

Keywords

Zooarchaeology; South America; north-western Argentina; bone instruments; microscopic analysis.

Introduction

Over the last 30 years, the Formative Period (*c.* 1500 BC–AD 600) in the southern Calchaquíes valleys has been subject of extensive archaeological research, increasing both the number of excavated sites and the lines of evidence that have been explored. Household architectural patterns, archaeobotany, obsidian provenance analysis, pottery manufacture, iconographic studies, zooarchaeological and funerary analysis have been pursued in the complex task of reconstructing pre-Hispanic local history (e.g. Scattolin and Gero 1999; Gero and Scattolin 2002; Scattolin 2006a, 2006b; Izeta 2007; Palamarczuk *et al.* 2007; Bugliani 2008; Calo 200; Lazzari *et al.* 2009; Scattolin *et al.* 2009b; Pereyra Domingorena 2010; Scattolin 2010; Cortés 2011; Oliszewski 2011).

The Formative Period in the archaeology of north-western Argentina has been described as a time of segmented groups with low levels of social hierarchy, a mixed economy subsistence system based on agriculture, hunting and herding

and a settlement pattern of scattered architectural units and agricultural fields (e.g. Tarragó 1992; Olivera 2001; Scattolin 2006a, 2010). Houses were usually made of stone or adobe walls and thatched roofs, arranged both in circular and square plans, isolated or combined in a variety of sizes (e.g. Scattolin 2006a, 2010). Cemetery areas and burial structures have been found in association with dwelling structures as well as beneath house floors. Although mostly self-sufficient, these villages were connected through distribution and exchange of goods on a regional scale. During the Terminal Formative Period (AD 500–600), architectural layouts diversified and residential and ceremonial places are found separated from each other. Contemporary with Tiwanaku expansion, social inequalities increased. At the same time, there was a reduction in population mobility, residential expansion, and increased stability. These changes fostered craftsmanship and popularized the use of various raw materials and manufactured goods such as pottery, basketry, textiles, metalwork, stone and bone tools, among others things. (Fig. 6.1).

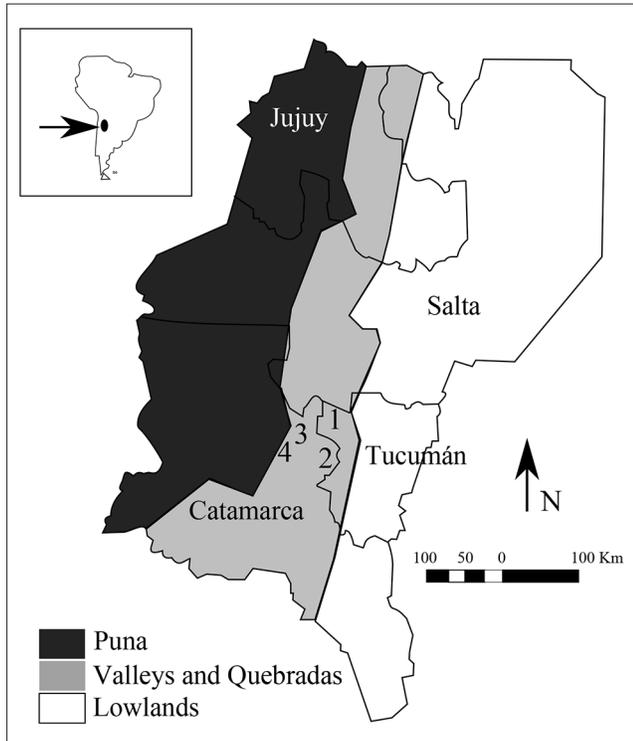


Figure 6.1 Map of the region showing the locations of sites mentioned in this paper.

The archaeological investigations in the southern part of the Calchaquíes valleys began with initial work of Scattolin on the western slopes of the Aconquija mountain range (Scattolin 1990) and the adjacent Santa María Valley (Scattolin *et al.* 2001) later expanding towards the western Cajón Valley (Scattolin and Gero 1999). The combined work of all team members has deepened our understanding of lifeways at the first agrarian villages settled in these three areas, which were otherwise mainly known from evidence of the subsequent Late Period (c. AD 1000–1500).

In particular, the study of faunal assemblages carried out by Izeta began to unravel the local strategies of management and use of wild and domesticated species (Izeta 2007, 2008). The ubiquity of camelid bones in the archaeological record shows that they were used and consumed in a variety of forms. The domestication of some Andean camelids (*Lama glama*, *Vicugna pacos*) was fundamental to the daily life of past peoples: not only were they consumed as food resources (meat, grease, marrow, bone grease and possibly even milk) but also their fibres. It may be leather and tendons were also employed for a variety of purposes. As many well studied archaeological and ethnographic contexts reveal, camelid fibers were widely used in textile manufacture throughout the Central and Meridional Andes. Although the evidence for these practices comes from indirect sources in our study area – such as spindle-whorls,

possible wool textile imprints in baked mud (Calo 2008) – or from adjacent regions – human remains dressed or wrapped in fabrics made of camelid wool from the Puna (López Campeny 2000, 2010; Agüero and Cases 2004), camelid fabrics from Ansilta, San Juan Province (Renard 1997). Thus, it is safe to assume that camelid textile manufacture was also commonly practiced in the Formative Period of the Calchaquíes valleys (Renard 1997).

Furthermore, the use of llamas as beasts of burden has been the main argument behind one of the most popular models in the cultural development of the South Central Andes area (Núñez and Dillehay 1979). Indirect evidences such as ceramic, vegetable and obsidian trade support the widespread hypothesis of camelids being used to carry goods along the caravan routes and networks that connected different areas within north-western Argentina (Núñez and Dillehay 1979; Scattolin and Lazzari 1997; Yacobaccio *et al.* 2004). Alternative models for camelid handling and use have, however, been proposed for the Puna region (Haber 1999).

Earlier considerations of the zooarchaeological record based on the analysis of faunal remains from 15 archaeological contexts dated to the Formative Period resulted in a consistent image of animal handling and use (Izeta 2007, 2008; Scattolin *et al.* 2009a). South American camelid age profiles, bone fracture and discard patterns within household activity areas indicate that mainly adult animals were consumed throughout the whole period (Izeta 2007). In particular, age profiles of domestic camelids (*Lama glama*) have shown that they were primarily exploited as cargo animals or for their secondary products (wool or fleece) rather than primary ones (meat, grease, etc.). Supporting evidence for the use of camelids as beasts of burden has been verified by palaeopathological alterations on camelid phalanges (Izeta and Cortés 2006; Cartajena *et al.* in press). In other words, domestic animals appeared to have been consumed after they reached a ‘non-productive’ age instead of being slaughtered while still young. Nevertheless, a different pattern has been observed in contemporary occupations in nearby areas such as the Ambato valley, Antofagasta de la Sierra in the southern Puna, and at least in one location in the Santa María Valley, where primary products appear to have been the main purpose of camelid husbandry (Belotti 2007; Dantas 2010; Grant Lett-Brown 2008; Olivera 1998).

As a result, the study of animal bones has been central to the understanding of early subsistence strategies among ancient villagers in north-western Argentina (Izeta 2008; Izeta *et al.* 2012). In this sense, zooarchaeological analysis emphasized approaches to animal bones as indicators of culinary or transport activities, rather than bones as implements.

While systematic research on the use of bone as a raw material and the associated technical strategies has been undertaken in the last few years in different regions of Argentina, it is still at its beginning for material from the



Figure 6.2 Artefacts made from South American camelid metapodials. A) C493-1, Cardonal Tomb 1; B) C493-2, Cardonal Tomb 1; C) Yu-1341, Yutopíán Structure 1; D) Yu-165, Yutopíán Structure 4; E) Yu-141, Yutopíán Structure 4; F) Yu-54, Yutopíán Structure 4; G) C58-2, Cardonal E 2; H) 469-1, Bañado Viejo; I) 404-8, Bañado Viejo; J) 105-1, Loma Alta Nucleus E. All scales represent 1 cm.

north-western region (e.g. Casiraghi 1985; Scheinsohn 1997; Núñez Regueiro 1998; Nasif and Gómez Cardozo 1999; Buc and Loponte 2007; Buc 2011). To date, little is known about the techniques used in the manufacture of personal bone adornment, needles, awls, musical instruments, figurines, among other worked osseous objects.

Therefore, although previous investigations have deepened our understanding of the different modes of acquisition, production, consumption and discard of animal remains (leather, meat, fleece, etc.), the use of bones as a raw material or the occurrence of bone tools is yet to be fully considered. The analysis of a sample of ten implements made of camelid metapodials discussed in this paper (Fig. 6.2) thus begins to fill this gap by offering a first approach to the study of bone as a raw material during the Formative Period in north-western Argentina.

Archaeological contexts and bone tools

As far as the records show, bones from different taxa were employed in the manufacturing of implements of various kinds (Table 6.1) although South American camelids appear to have been preferred over other species reflecting the extensive use of all of the South American camelid sub-products. Without exception, they are the most common and frequent animals found on all recorded archaeological sites in the north-west region of Argentina (Izeta 2008; Olivera 1998). Another reason can be related with culturally weighted preferences for particular species and skeletal elements as raw material. Miller (1979) in his ethnoarchaeological research in the Central Andes noted that modern female Aymara weavers' use a particular bone tool called *wichuña* and they prefer llama bones over alpaca, and adult camelid bones rather than bones from younger animals. Such preferences correspond to certain

Table 6.1 Bone artefacts quantification from selected southern Calchaquíes Valley Formative sites.

TAXON	BODY SIZE	BAÑADO VIEJO	LOMA ALTA	YUTOPIÁN	CARDONAL T I	TOTAL
AVES	2	1	–	–	–	1
Rodentia	2	–	1	–	–	1
CARNIVORA	2	–	–	1	–	1
Ungulata	4	1	4	6	–	11
Camelidae	4	2	2	1	2	7
Lama guanicoe	4	–	1	–	–	1
Unknown	1	–	1	–	–	1
	3–4	–	1	–	–	1
Total		4	10	8	2	24
NISP (whole site)		1527	1763	5341	2	8633
NISP % bone instruments		0.26	0.57	0.15	100.00	0.27

archaeological samples as far as choices of raw material for tool-making is concerned.

The assemblage of bone tools considered here comes from four sites located in the southern Calchaquíes valleys: Bañado Viejo, Loma Alta, Yutopián and Cardonal (Fig. 6.1). These sites have been discussed elsewhere (Scattolin 1990; Scattolin and Gero 1999; Scattolin *et al.* 2001; Izeta 2005, 2007; Scattolin *et al.* 2009a). However, a summary description of them is provided below.

Bañado Viejo

Bañado Viejo is a multi-component open-air site with no associated architectural features, located in Santa María Valley bottom, 5 km north of the modern town of El Bañado (Tucumán Province). Pottery shards, bone fragments and lithic materials were found densely dispersed all over the surface. A 4 m² test pit, reaching a depth of 3.60 m revealed five stratigraphic units (or deposits). Three radiocarbon dates are available: 1760±100 BP (LP962) Deposit VI, 1400±40 BP (LP940) Deposit III, and 1170±40 BP (LP923) Deposit II (Izeta 2007; Scattolin *et al.* 2001). Two bone tools were recovered (Table 6.2). Item 404-8 (Fig. 6.2H) from Deposit II is associated with the most recent date while item 469-1 (Fig. 6.2I), from Deposit IV, corresponds to an intermediate date in-between the other two layers.

Loma Alta

Loma Alta is located on the western slopes of the Aconquija mountain range at 3000 masl. The architectural layout shows a sparse concentration of domestic structures surrounded by agricultural fields. One bone instrument, item 105-1 (Fig. 6.2J), comes from the domestic compound called Nucleus E (NE) which associated with radiocarbon dates spanning a time from 1600±120 BP (GX21580) to 1560±130 BP (GX21581) (Izeta 2007; Scattolin 1990). Loma Alta NE had different

kinds of modified bone, although only the above-mentioned specimen (105-1) corresponds to a transformed metapodial.

Yutopián

Yutopián is situated in the Cajón Valley, at 3000 masl, west of the Santa María Valley. Of the several excavated domestic compounds, a total of eight worked bones were recovered from Structure 1 (1777±45 BP, AA 82255), Structure 4 (1630±60 BP, Beta 95611), Structure 5 (1870±60 BP, Beta 95608) and Structure 11 (1940±90 BP, Beta 95610) (Scattolin and Gero 1999; Gero and Scattolin 2002; Izeta 2005, 2007). Of these, three from Structure 4, items YU-54 (Fig. 6.2F), YU-141 (Fig. 6.2E) and YU-165 (Fig. 6.2D), and a fourth from Structure 1, YU-1341 (Fig. 6.2C), correspond to transformed camelid metapodials.

Cardonal

Cardonal is situated in the locality of La Quebrada, only 10 km from Yutopián. The settlement of Cardonal runs along a shallow terrace at 3000 masl and occupies a privileged place along a natural route that connects the territories of Puna (highland plateau) and Yungas (humid eastern slopes of north-western Argentina). Dated to cal. AD 70–220 (Scattolin *et al.* 2009a), Cardonal is a remarkable example of the first sedentary agricultural communities in this region. Both domestic and funerary contexts have been the subject of recent investigations. The excavation of Structure 2 of the household compound Nucleus 1 yielded one bone instrument coded C58-2 (Fig. 6.2G).

Another two instruments with similar characteristics were found in association with human remains in a funerary context located a few minutes walk uphill from the residential area of the household structures. The sepulchre – a rounded structure formed by several concentric rows of stones – contained the body of one adult male whose head had been removed previous

Table 6.2 Qualitative and quantitative description of transformed metapodials.

CAT	SITE	PROVENIENCE	FIELD SEASON	COMPLETENESS	WEATHERING	EPIPHYSIAL FUSION	MT37	MT38	MT39	MT40	MT41	MACRO AND MICROSCOPIC TECHNOLOGICAL FEATURES	
												MICROSCOPIC TECHNOLOGICAL FEATURES	MICROSCOPIC FEATURES
C493-1	Cardonal	TOMB 1	2008	Complete	3	Fused	130,00	46,37	60,86	17,39	10,00	Altered	Altered
C493-2	Cardonal	TOMB 1	2008	Complete	2-3	Fused	101,26	55,80	17,18	10,04	18,77	Altered	Altered Polished
YU-1341	Yutopian	STR 1	1994	Complete	2	Unfused	118,00	60,14	49,12	21,04	6,90	Cutting Graving Flaking	Polished
YU-165	Yutopian	STR 4	1996	Fractured	1	Unfused	112,00	-	-	-	-	Flaking	-
YU-141	Yutopian	STR 4	1998	Fractured	1	-	126,00	-	-	17,25	18,70	Flaking Cutting	Polished
YU-54	Yutopian	STR 4	1998	Complete	1	Fused	155,00	52,38	64,89	15,14	12,67	Graving Cutting Graving Flaking Cutting	Polished
C58-2	Cardonal	STR 2	2006	Complete	1	Fused	104,00	58,47	28,37	17,61	6,11	Graving Flaking Cutting	Microflaking Posdepositional alteration
469-1	Bañado Viejo	S1 L14 Component IV	1998	Complete	3	Fused	101,00	-	-	-	-	Altered	Altered CO3Ca
404-8	Bañado Viejo	S1 L4 Component II	1997	Fractured	2	Unfused	132,00	-	-	-	-	Cutting Graving Flaking	Micro polished area Cut marks Striations
105-1	Loma Alta	R47	1989	Fractured	1	Fused	73,00	54,19	-	-	-	Transversal cut marks	Transversal cut marks

MT37: max length (mm); MT38: Distance between distal fusion line and transversal cut (handle area); MT39: active area (from transversal cut to the tip); MT40: max width between beginning of roundedness and tip; MT41: Length of the rounded area

to inhumation. Both implements C493-1 (Fig. 6.2A) and C493-2 (Fig. 6.2B) were found around the pelvic area (Cortés 2011). Dated to 1326 ± 43 BP (AA87286), this interment is actually several centuries later than the residential compounds.

In sum, the studied sample comprises ten worked camelid metapodial implements (Fig. 6.2) from four archaeological sites ascribed to different moments within the local Formative Period: two from Bañado Viejo; one from Loma Alta; four from Yutopían; and three from Cardonal. A discussion of the macro and micro analyses that were carried out and the results obtained follows.

Raw material, fragmentation patterns and bone tools

A relevant point made by Stahl (2007) triggered our interest in delving further into the analysis of the particular fragmentation pattern of bone observed at these archaeological sites and to consider how these patterns connected to the sub-products of implement production (Izeta 2007, 2013). A consistent trend between discarded and manufactured bones was observed: discarded elements corresponded mainly to the proximal epiphyses of the metapodials, while diaphyses and distal epiphyses are most commonly found in the form of worked implements.

A first consideration of the sample shows that no particular preference was observed with regard to the age of the animals (Table 6.2): in six cases (Cardonal Tomb 1, Cardonal Structure 2, Yutopian Structure 4, Loma Alta NE, and Bañado Viejo Deposit IV) fused epiphyses indicate that these camelids were older than 36 months and therefore came from adult animals. By contrast, bones of immature animals were used to make the other three tools (Yutopian Structure 1 and 4, and Bañado Viejo Deposit II). The remaining implement (Yutopian Structure 4) was fragmented and therefore could not be assigned to any age category. Further considerations of the preference of using mature or immature bone as raw material was hampered by the small sample size.

Measurements of a set of continuous variables were taken on each of the instruments: maximum length (MT37), maximum length between the line of fusion of the distal epiphysis and the line of the transverse cut (MT38), length of the active area from the transverse cut to the apex of the instrument (MT39), maximum length between the rounded area and the tip (MT40) and width of the active portion of the rounded area (MT41) (Fig. 6.3). Results show that the maximum length of the instruments varies between 73 mm and 155 mm, with 110–120 mm being the most common range. The distance between the line of fusion and the transverse cut shows great regularity, the difference between the lower and the higher value being no greater than 13 mm. The length of the active area is also very regular, except in one case (C58-2). Finally, both the maximum width between the rounded area and

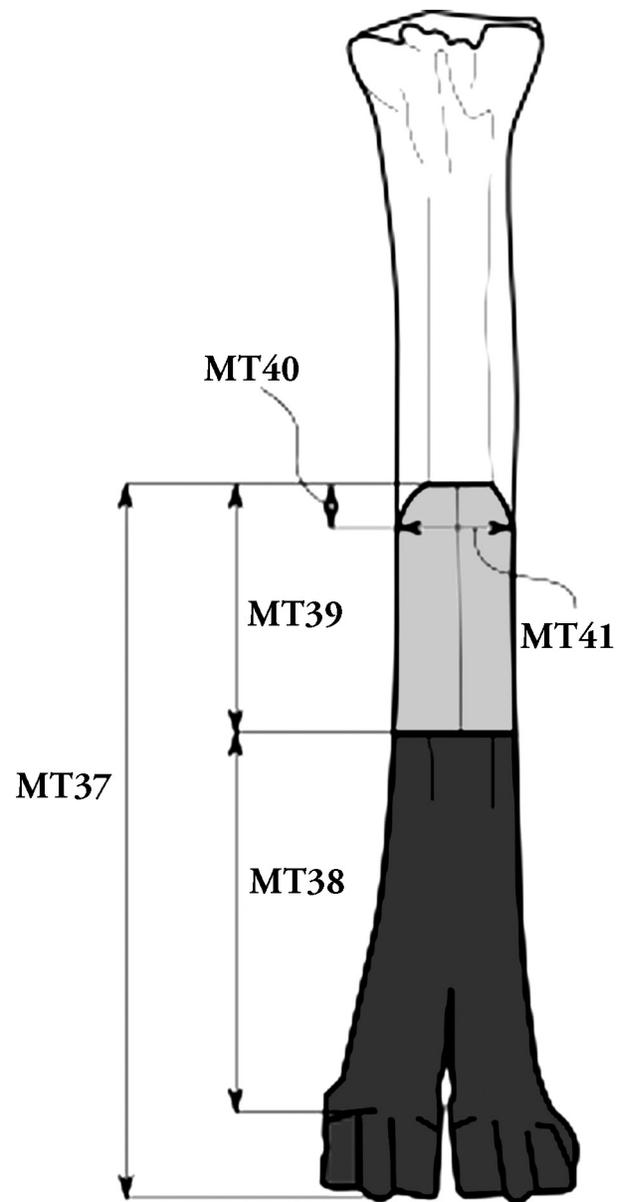


Figure 6.3 Variables used in the osteometric characterization of the bone implements. The template corresponds to a South American camelid metacarpal and is used without distinction for recording both for metacarpals and metatarsals.

the tip, and length of the active portion of the rounded area display consistent values with very little dispersion. Therefore, the overall dimensions of the bones are similar in every case, indicating a great mental regularity in the concept of this kind of implement, in other words, the ways of making and using this type of tool over time were maintained.

Implements were differentially affected by various taphonomic agents and processes. Weathering (Behrensmeyer

1978) was one of the main factors that produced obstacles to performing microscopic analyses on many of these objects.

Macroscopic analysis showed that instruments were discarded at different stages in their use-life (Choyke and Daróczy-Szabó 2010). Six of them were complete and the remaining four were fractured. Given the type of fracture pattern, two appear to have been broken in a dry state, probably as a result of taphonomic processes. The remaining two have marks consistent with fresh-bone fracture (404-8 from Bañado Viejo and 105-1 from Loma Alta (Fig. 6.2I and 2J)).

Manufacturing techniques encompassed actions of flaking and cutting while re-modelling or curation was a direct consequence of use. Macroscopic traces revealed cutting, grooving and flaking marks in the remaining portion of the shaft, most of them related to manufacturing (Table 6.2). Cut marks similar to those described as processing cut marks (Fisher 1995) were distinguished on implement 404-1 (Fig. 6.4, 2b). Four implements exhibited a deep transverse section

(probably made by cutting) leaving the distal end complete and the proximal end severed on the dorsal face (Fig. 6.4, 1b and 1d). As a result, the internal face of the dorsal portion of the metapodial was exposed. In those same implements, grooving was recognized in soft textured zones in different parts of the bone. Flaking was identified on six of the instruments. It was caused by two distinct actions: reduction of the element and use, evidenced by traces of microflaking microscopically observed on one of the instruments (Fig. 6.4, 2a). The same analysis permitted polish and micropolish attributes to be distinguished as well as cut marks. A Motic SMZ168 stereomicroscope was used at 20× and 40× and a Nikon Epiphot 300 inverted metallographic microscope was used at 200× and 500× for all microscopic observations.

As far as this last point is concerned, it is likely that these implements were employed in the processing of soft materials as opposed to their use as flakers or tools for working hard materials (Fig. 6.4, 3a–c). Furthermore, according to the

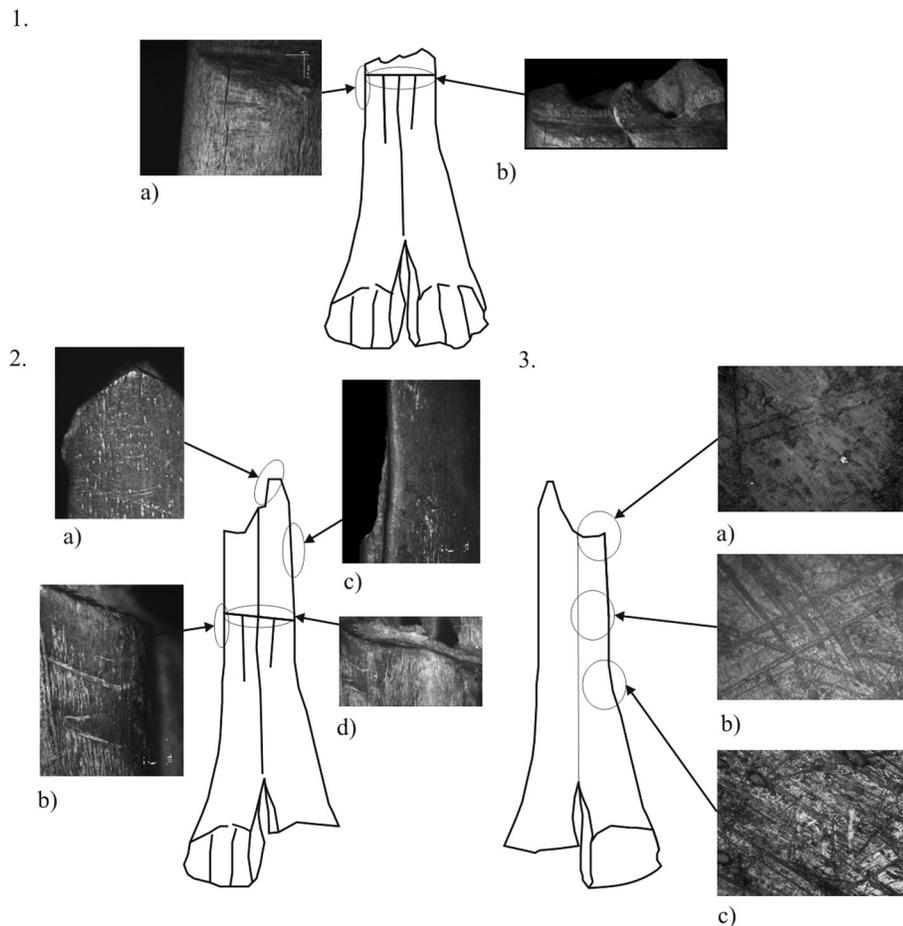


Figure 6.4 Examples of manufacture and use wear patterns. 1) Item 105.1 with a) detail of tool production cut-mark (50×) and b) detail of tool production cut-mark (20×); 2) Item 404-1 norma caudalis with a) polish over the edge and transverse striations made by use, b) polish over the edge and cut-marks probably made during transverse cutting during implement production, c) polished area along the edge and d) transverse cut detail; 3) Item 404-1, norma cranialis with a) surface showing micropolish and the later formation of striations (500×), b) surface showing micropolish and the later formation of striations (200×) and c) surface showing micropolish and the later formation of striations breaking bone fibres (200×).

microscopic features observed (Table 6.2, Fig. 6.4) there is no evidence of reworking of the active area with new flaking of the edges. In the cases described with an unaltered surface these were usually the largest tools, in other cases (Fig. 6.2G and 2H) it is not possible to assess any reworking process or curation because of the post-depositional alteration of the bone surface.

Conclusions

The archaeological record for the southern Calchaquíes valleys offer a unique opportunity to reconstruct lifeways of the pre-Hispanic societies of north-western Argentina. This article was aimed at presenting some of the technological choices related to the manufacturing of bone instruments within the study area, emphasizing several points to complement earlier approaches to animal processing and use during the Formative Period.

Results show that camelid metapodials were employed as the sole raw material for this type of implement and that their shaping was to a great degree standardized. If, as previous analyses have shown (Izeta 2004, 2007, 2008), camelid use was mainly devoted to secondary products such as transport or wool production, these instruments could be interpreted as part of the toolkit for camelid wool producing/weaving. It is likely that these blunt-ended instruments were used for working soft materials such as organic fabrics for basketry and textile manufacturing. Both practices have been inferred by indirect sources of evidences at Cardonal. Interestingly, and for a long period of time, the way these implements were made did not vary significantly.

The great majority of the instruments were found within domestic contexts although two objects were found in association with human remains. The presence of these instruments both within domestic and funerary contexts will foster further consideration of their significance in the past.

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