EVIDENCE OF HAFTING TRACES ON LITHICS END-SCRAPERS AT MARIPE CAVE SITE (SANTA CRUZ, ARGENTINA)

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This paper presents a review related to using microwear analysis to identify hafting process in archaeological contexts and also presents actualistic and archaeological information of hafting traces. In this way, the case of mid-Holocene (7500–3000 BP ca. years) end-scrapers from Maripe Cave site (Santa Cruz Province, Argentina) provides abundant evidence to identify this kind of traces that are often difficult to recognize. In this research, we also study the relationship between use mode and tool shapes that can be used to interpret how hafted tools were used in the past.

KEYWORDS: *Patagonia, Microwear analysis, End-scrapers, Hafting traces, Hunter-gatherers*

INTRODUCTION

Dialectics between tool shapes and their use has been a topic of interest since the beginning of our discipline, as it is determined by different paradigms that exist in archaeology (Cahen et al. 1979; Keeley 1980; Odell 2001; Semenov 1964; Vaughan 1985).

Earlier typological studies of tool use have relegated functional issues to morphological research (Binford 1973; Bordes 1961, 1972; Dibble 1987; Ferguson 1980; Wilmsen 1968).

The idea that there is a direct relation between the shapes of tools and their use has created a lack of solid scientific data that makes it impossible to generate reliable evidence when it comes to giving meaning to material culture, and ignores the complexity of the relationship between form and function (Dibble 1984, 1987; Keeley 1980; Symens 1986).

In this way, the concept of functionality and use begins to come into play often presented as synonymous. The use of an artifact involves specific manipulation of a tool that is not necessarily identified with the real function of such object. On the other hand, the function of a tool is an abstract concept full of cultural and social connotations, of which the use is just one more constituent (Caspar and Cahen 1987 in Calvo Trias 1999). Following this definition, the study of tool use should cover the analysis and identification of active and worked edges, kinematics, working angle, worked material, use mode, among other variables (Juel Jensen 1988; Keeley 1980; Vaughan 1985; Yerkes and Kardulias 1993).

The use of a tool means its manipulation in different ways, either by manual prehension and use or by hafting the tool in some sort of handle that provides a better grip for the tool when the desired activities, are carried out (Keeley 1982; Odell 1980; Rots 2003, 2010).

However, studies of hafted tools have been limited to identification of prehension and hafting traces on archaeological specimens. The organic composition of most of the materials used for the handles of hafted tools makes it difficult to identify these materials when they are not preserved at archaeological sites. Even so, studies of residue identification allowed to infer the presence of archaeological haft or the material used (Dinnis et al. 2009; Pawlik 2011; Robertson and Attenbrow 2008; Rots and Williamson 2004).

Following Lemonnier (1992), our study on material culture focuses on a technological perspective, in which similarities and differences in manufacturing procedures allow us to establish technological concepts that are an interesting and relevant topic.

In this way, we propose to study the mode of use of end-scrapers from Maripe Cave site (Santa Cruz province, Argentina) in the mid-Holocene period (7500–3000 BP ca. years). This work will be

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carried out based on two levels of analysis (microscopic–macroscopic) in order to identify and document use traces associated with different types of hafted tools.

The results of previous experiments (Lynch and Hermo 2012) allow us to investigate this issue.

HAFTING TRACES AND MICROWEAR ANALYSIS

Haft traces on stone tools reflect not only manufacture but also their subsequent use. This may reveal the mental conceptions that ancient people had regarding stone tool production and use (Calvo Trias 2002). Elements, which by their nature are not preserved in the archaeological record (the handles, shafts, or "hafts"), are lost, and make conjectures about past activities difficult.

With the development of use-wear analysis (Anderson 1981; Keeley 1980; Mansur-Franchomme 1983, 1987a; Semenov 1964; Vaughan 1981; Yerkes and Kardulias 1993; among others), it has become possible to indirectly infer the presence of handles and hafts from visible microscopic traces and residues produced from friction between the haft and the inserted tool during use (Anderson-Gerfaud and Helmer 1987; Mansur and Lasa 2005; Miller 2013; Moss and Newcomer 1982; Odell 1980; Odell and Odell-Vereecken 1981; Rots 2002, 2003, 2010; Rots et al. 2006; Stemp and Graham 2006; Stordeur 1987; Yerkes 2002; Yerkes and Kardulias 1993). The academic interest on this issue was reflected in an international symposium carried out in Lyon (France, 1984). At this symposium, researchers discussed the limitations of functional analysis related to the study of hafting processes and the importance such processes had on the cultural affiliation of stone tools. From this symposium, numerous archaeological works began to appear (Anderson and Helmer 1987; Keeley 1982; Mansur-Franchomme 1987a, 1987b; Plisson 1987), as well as experimental and ethnographic works (Rots 2002; Rots et al. 2006). Nevertheless, scholars observed that hafting traces were difficult to detect, although it has been possible to recognize them (Castro and Moreno 1994; Moss and Newcomer 1982; Odell 1980; Rots 2002, 2003; Rots et al. 2006).

Lithic analysis at the central Plateau of Santa Cruz in Argentina has been related to technomorphological studies (Cattáneo 2002; Hermo and Miotti 2003; Miotti 1996; Paunero 2003; among others). While traceology was applied to various contexts (Álvarez 2003; Briz 2004; Castro de Aguilar 1994; Clemente 1997; Leipus 2006; Mansur-Franchomme 1983, 1987a, 1987b), specific studies have developed very recently, which consider the possible detection of haft presence (Castro and Moreno 1994; Forlano and Dolce 2006–2007; Mansur and Lasa 2005).

For this reason, we proposed to study traces that may be associated with hafting processes. This will allow a more complete interpretation of the use and function of archaeological scrapers.

Maripe Cave Archaeological Site

The Maripe Cave site is located in the middle course of La Primavera canyon (Province of Santa Cruz, Argentina) (Figure 1), at 560 masl on an outcrop of tuff and ignimbrites of the Chön Aike Formation (Panza 2001).

The cave is 24-m wide and 26-m deep with a natural slope of 12.5%, and it is composed of two main chambers separated by a rock wall. The main chamber is located in the northern sector of the cave, while the southern chamber is smaller.

Different occupations have been identified during the excavations corresponding to early, middle, and late Holocene, with radiocarbon dates from 9500 to 1000 BP ca. years (Hermo 2008; Miotti et al. 2007, 2014).

Maripe Cave is situated within an important archaeological region for the study of the initial peopling of the continent and across the Holocene. It is located in the same hydrographic basin as the Piedra Museo rock shelter, in which were recorded some of the earliest occupations of South America (ca. 13 000 BP) associated with extinct fauna i.e., *Hippidion saldiassi*, *Lama gracilis*, and *Mylodon* sp., with clear human processing marks (Marchionni 2013; Marchionni and Vázquez 2012; Miotti 2003; Miotti et al. 1999). In this sense, its study makes possible the approach to important issues of Patagonian archaeology and nearby regions.

Since the beginning of Maripe Cave research, archaeological excavations were conducted on both sides of the cave, which allowed analysis and discussion whether the differences between the chambers could have played a significant role in the decisions taken by hunter-gatherer societies. The occupation of the North chamber has a wider distribution in comparison with the archaeological

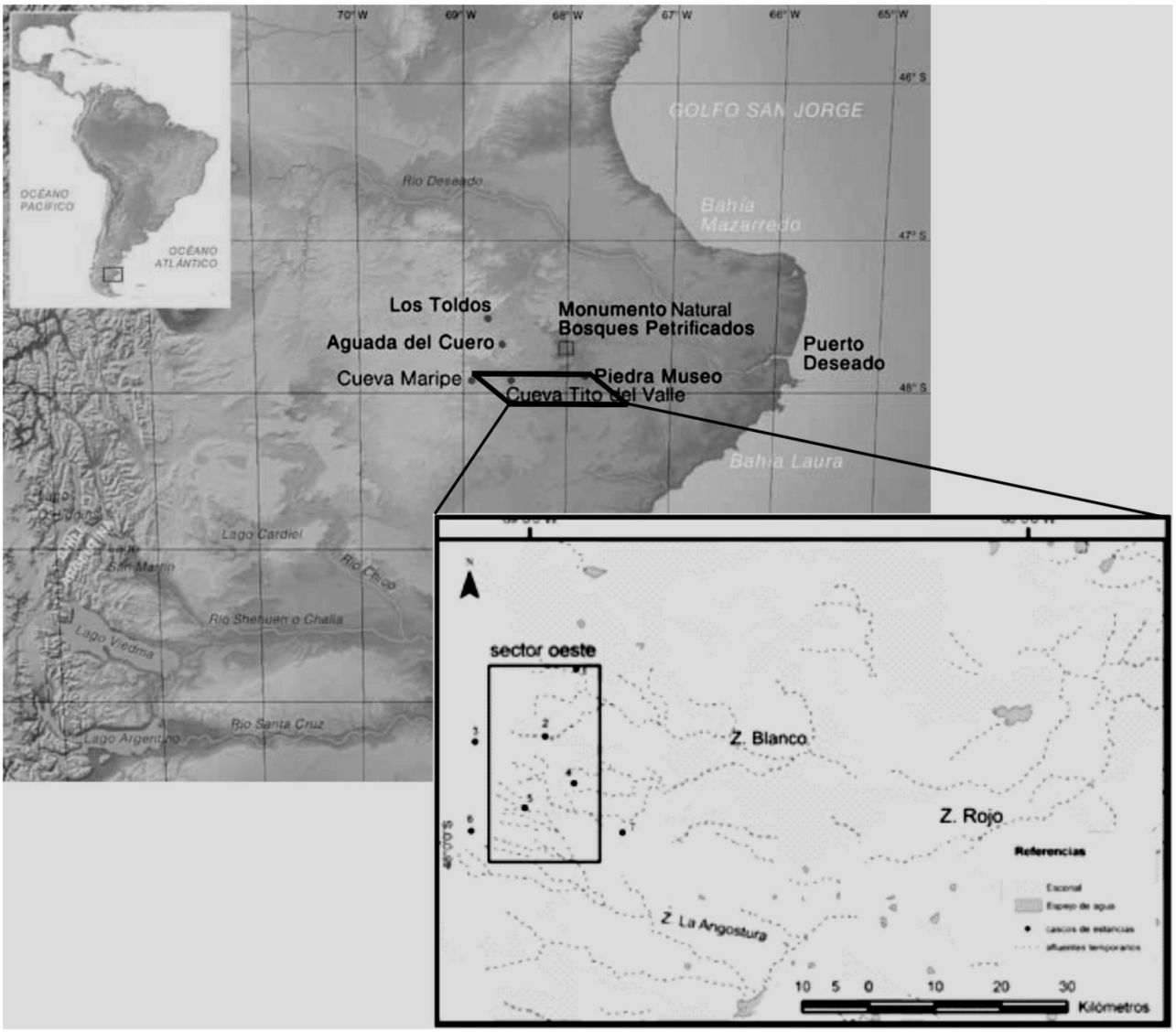

FIGURE 1. Location of Maripe Cave site (Santa Cruz Province, Argentina).

sequence of the South chamber, which is more compressed. Despite the higher volume of sediments excavated at the North chamber, the artifact density is higher in the South chamber (Hermo 2008; Miotti et al. 2007).

EXPERIMENTAL SERIES

The functional analysis of end-scrapers from Maripe Cave began with replication experiments.

The functions of the artifacts were determined by matching their microwear traces with the use-wear patterns found on experimental chipped stone tools in a reference collection of over 183 experimental tools made of several different chert types and worked on different materials (hide, wood, bone, etc.). This collection includes 10 retouched stone end-scrapers inserted in wood hafts (using resin). A single type of haft was regarded and this type is called "cepillo de carpintero" used by the northern Tehuelches (Casamiquela 1978; Mansur-Franchomme 1983, 1986, 1987b, 1987a). It consists of a piece made of molle wood (*Schinus* sp.) whose distal sectors have notches. In that area are inserted end-scrapers. These tools were used for hide working for 45′ and 60′. Macroscopic and microscopic examination of these replicas revealed distinct microtraces that were associated with this particular type of haft (see Lynch and Hermo 2012) (Figure 2).

In the hafted experimental pieces, the distal portion of the tools showed well-developed hide micropolish with a slightly glossy or matte sheen and homogeneous polish. The micropolish was

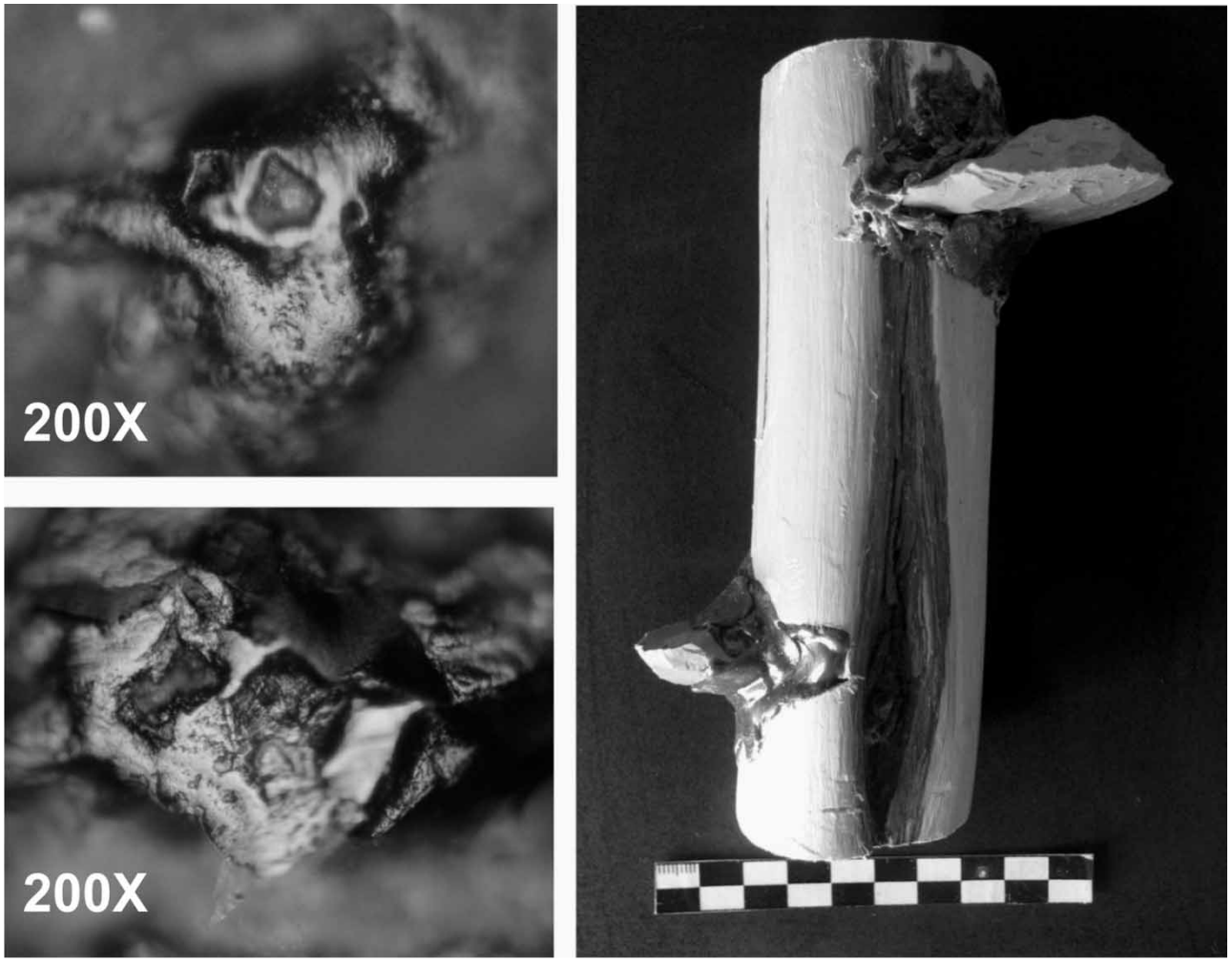

FIGURE 2. Hafting traces on experimental end-scraper: wood micropolish in proximal area.

marginal, since the working angle was greater than 90°, and the ventral and dorsal faces were both in contact with the worked material. All experimental pieces had parallel deep furrows on the worked edge that have been related to hide working in other experimental programs (Álvarez 2003; Keeley 1980; Mansur-Franchomme 1983).

In the hafting portion of the experimental tools, resin residues from fixing the tool into the haft were visible on all but one piece and in some cases bright spots on the microsurface were also observed. This could be a consequence of the contact with hard material (wood) at the hafting area of the worked piece, as a result of the detachment of the adherent substance (resine). In this way, the tool would be in direct contact with the haft made from this kind of material, developing these traces. Furthermore, in the proximal portion, most of the artifacts showed lateral slanted microscars, probably a consequence of use and extraction from the handles. In one case, there was also a fracture on the lateral edge. Moreover, at the hafted region on the dorsal surface, micropolishes of vegetal hard materials on crystals were observed. These microtraces were registered in 50% of the sample (Figure 2). However, the development of micropolishes on the platform of the end-scrapers was not observed in any of the experiments.

ARCHAEOLOGICAL SERIES

The study was based on the analysis of mid-Holocene end-scrapers from Maripe Cave site (3500–7500 BP ca. years, see Hermo et al. 2014, Lynch 2014, Miotti et al. 2014). The materials came from six squares of excavation of 2 × 2 m; three squares correspond to the North chamber (C5, D5, and D6 = 12 m²), and three to the South chamber (A12, B12, and E11 = 12 m²)

(Hermo 2008; Lynch 2013, 2014; Miotti et al. 2007, 2014). This paper considered only completed pieces that were examined by microwear analysis ($n = 63$, 177 edges).

The total number of end-scrapers identified at the cave was 145, 117 pieces belonged to the southern chamber with 284 edges (complete tools ($n = 45$) and distal fragments ($n = 72$)). A total of 28 end-scrapers with 62 edges (complete tools ($n = 18$) and distal fragments ($n = 10$)) were identified in the north section of the cave.

The use-wear analysis was conducted using a reflective light Nikon Epiphoto 200 microscope to observe micropolishes with bright field illumination (from 50× to 500×). The edge damage was observed under a stereomicroscope Nikon SMZ800 (10× to 63×), using the criteria established by Mansur-Franchomme (1983, 1999). The analysis and study of hafting traces were carried out from two levels. First, a macroscopic level was considered: (a) the presence or absence of retouched side or edge; (b) the lack of systematic retouches or use traces on lateral (side) edges (interpreted as a possibility for haft identification because part of the tool had been hidden—González Urquijo and Ibañez 1994, 1999); (c) lower limit of tool length (indicated by the efficacy of manual prehension or hafting; in the second case, this could generate standardized tools of short length—Caspar and Cahen 1987; Mansur-Franchomme 1987a; Vila i Mitjà 1981); (d) fragmentation (at the haft contact area, tools are exposed to higher risk of breakage between the passive part, inside the handle and the active part out of it, either during use or edge retouching (González Urquijo and Ibañez 1999), and (e) the presence of residues (it allowed us to

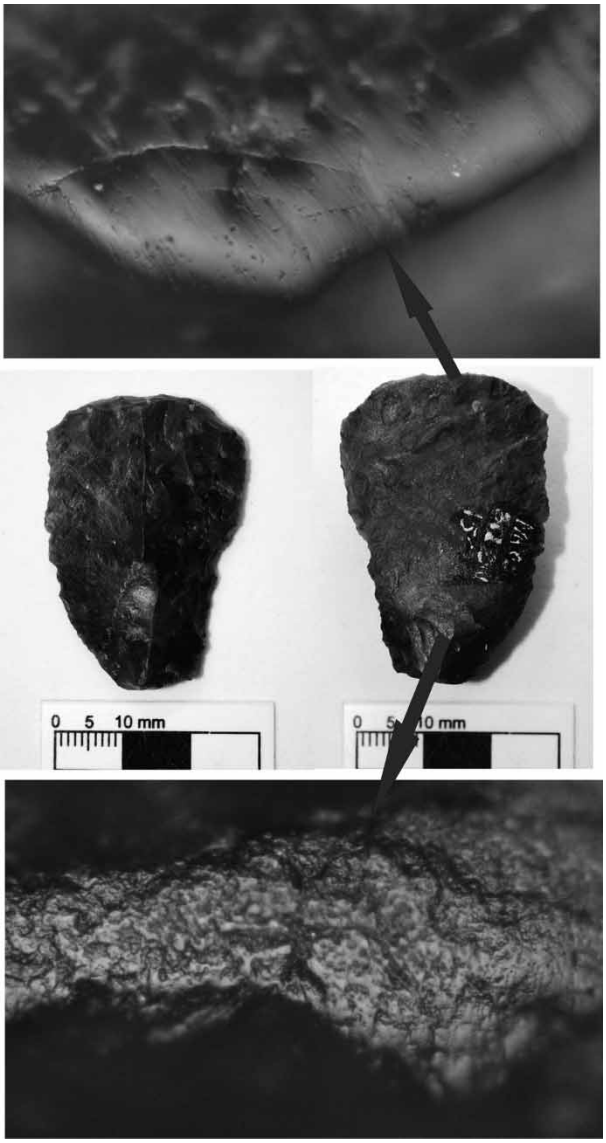

FIGURE 4. Wood micropolish on distal area and micropolishes of hard material on proximal area probably from haft contact (bright field illumination—200×. Piece no.: MA05-B12–156).

FIGURE 3. End-scrapers made of different raw materials and very small sizes.

determine if resins were used to secure the tool in its haft).

Secondly, microscopic features were recorded as follows: (a) micropolishes that developed on proximal areas, opposed to worked edges (this would indicate friction between the haft and the tool); (b) striations (to determine the mode of use); (c) rounding in proximal areas opposite to the active edges; and (d) slanted microscars on side edges that were not retouched and together with other diagnostic features, have been recognized as indicators of hafting.

Morphological and Microwear Analysis of Archaeological Material

The presence of a large sample of end-scrapers made on siliceous raw materials at the cave is more than 60% (at the northern sector $n = 28$ from 41 tools and at the southern $n = 117$ from 203 tools).

Of this group of end-scrapers, 40% were complete tools ($n = 63$) and the remaining were distal fragments. We examined only the complete tools in our microwear study. These implements were

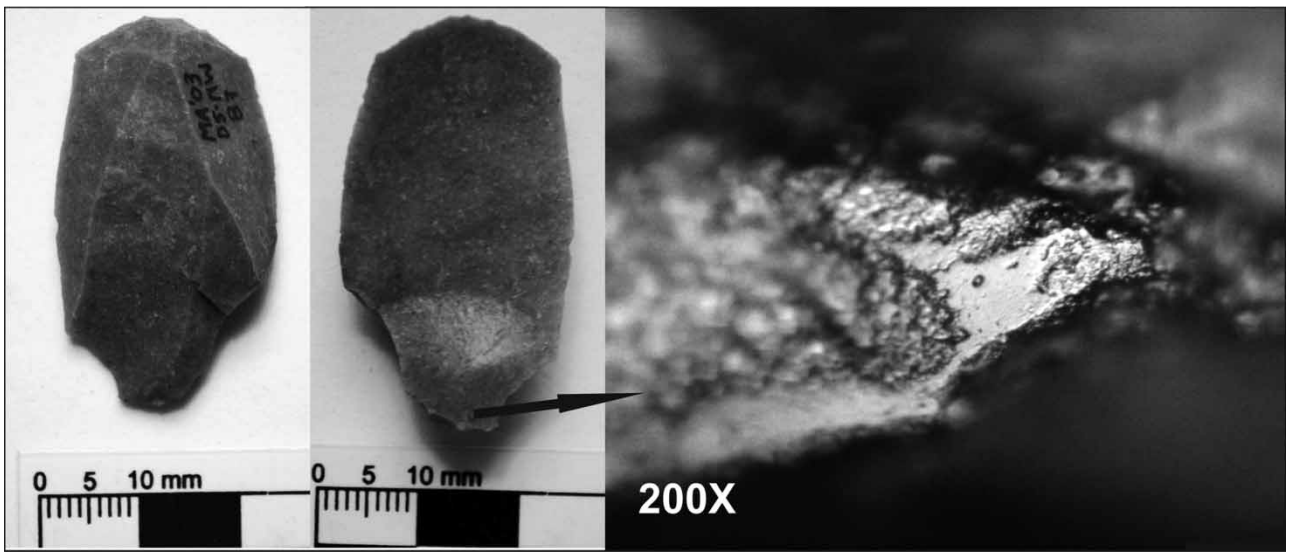

Figure 5. Bright spot from a contact with hard material on proximal area related to haft presence (bright field illumination—200×. Piece no.: MA03-D5-87).

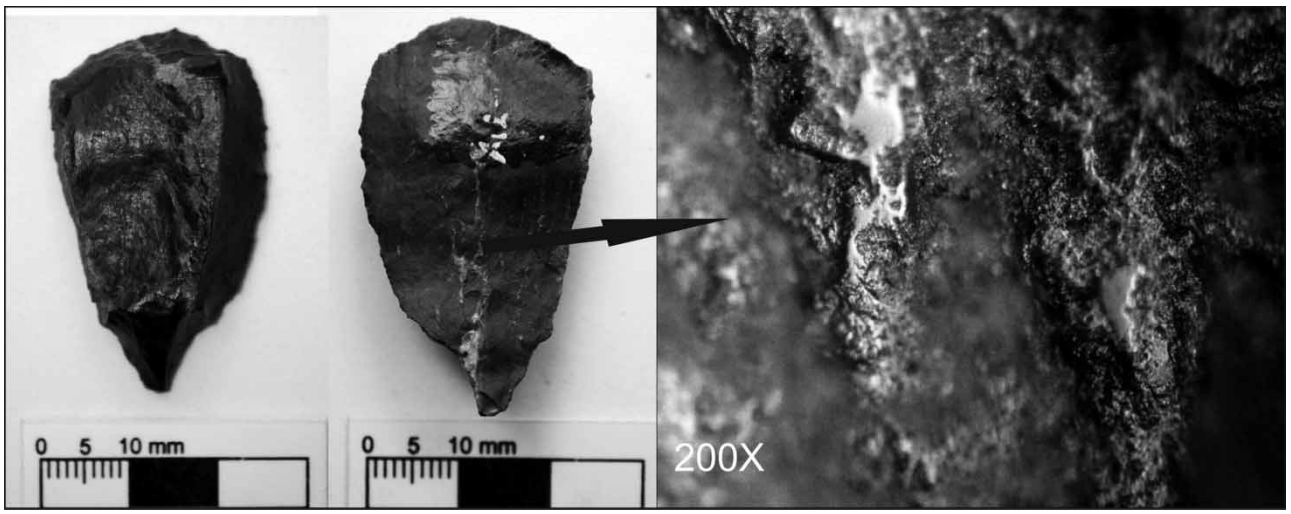

Figure 6. Micropolish from a contact with hard material on proximal area (bright field illumination—200×. Piece no.: MA04-A12-117).

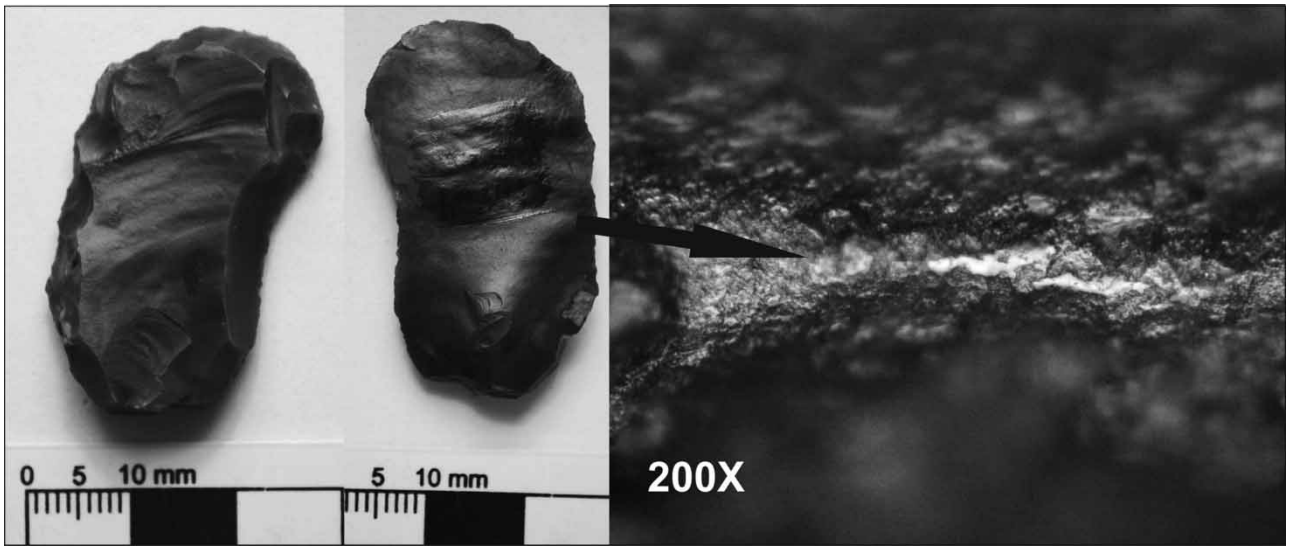

FIGURE 7. Polish from contact with hard material on proximal area (Bright field illumination 200×. Piece no.: MA04-AA12-186).

characterized by large- and small-sized end-scrapers (46%) and normal medium-sized (42%)—*sensu* Aschero (1975, 1983) (Figure 3). As regards edge angle, a large percentage corresponds to angles greater than 60° (50%), while those between 45°–60° (28%) and less than 45° (22%) are represented in smaller proportions. Most of these edges were dulled due to excessive reviving or microfracture thereof. This could indicate a significant amount of edge retouching to extend tool life that produced the more right edge angles.

From 63 tools (177 edges), 19 (24%) had some kind of use trace associated with hafting and these pieces also showed no evidence of being affected by post-depositional processes (soil sheen or different degrees of patination; (Levi-Sala 1993, 1996)). The use traces identified were mainly recorded along the lateral edges of the proximal areas and on the ventral surface of the striking platforms of the blanks.

In specific areas on the medial portion of the tools, bright thick polishes with 'microholes' (bright spots) were identified in 25% of the samples (Figures 4–8), the 28% remaining did not record this kind of traces. The micropolishes recorded could be ascribed to the contact with hard material indeterminate (Figures 5 and 6). These traces would be a consequence of haft presence made of hard or semihard material (e.g., wood or bone). The features mentioned show a discrete distribution associated with passive sections of the pieces.

On the other hand, on the proximal area of those artifacts where hafting traces were recorded, 82% ($n = 14$ end-scrapers) showed micropolishes related to hard material. On the medial area, the rest of end-scrapers recorded nondifferentiated polishes and rounding (12%) and nondifferentiated polishes and fractures (6%) (Table 1).

The absence of systematic retouches and the presence of slanted microscars on side edges that were recorded in most cases (Table 1) was not associated with possible hafting traces ($\chi^2 = 0.41$, d.f. = 1, $P = 0.83$; $\chi^2 = 0.81$, d.f. = 1, $P = 0.36$), so it could be a consequence of other processes. However, the presence of residues (of dark

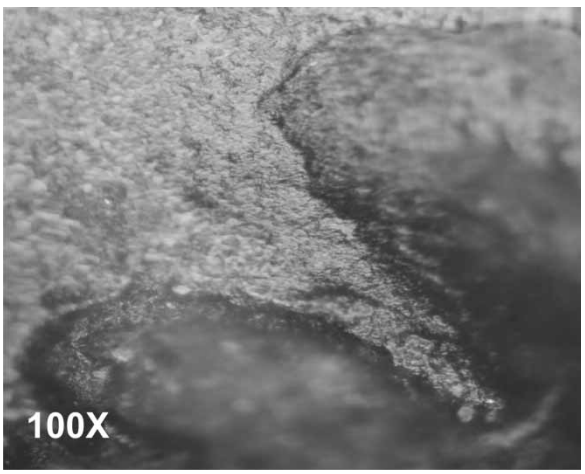

FIGURE 8. Microscars on side edges (bright field illumination—100×).

TABLE 1. DETAILS OF PIECES WITH HAFTING TRACES DETECTED AT MARIPE CAVE

No. Artefact	Edge Features			Distal Portion			Hafting traces		Slanted micro-scars	Residues
	Length (mm)	Edge angle	Used	Worked material	Motion	Position	Type	Identified material		
A12-NW-1	21,5	74°	+	ND	TR	B4-5	MP	HM	1	1
A12-SE-10	25,4	000	+	ND	TR	B2	MP	SM	1	1
A12-NE-13	26	76°	X	W	ND	B8U	MP	HM	1	0
A12-SE-44	18,2	000	X	ND	ND	B6	MP	HM	1	0
A12-NW-47	26,7	76°	X	ND	TR	B26	MP-RD	ND	1	0
A12-NW-84	20,7	57°	+	HM	ND	B6	MP	HM		0
A12-NW-117	21,5	67°	X	ND	TR	B3-B8	MP	HM	1	0
A12-SW-285	22,2	73°	+	W	TR	B35	MP	HM	1	0
A12-NW-84	20,7	57°	+	HM	ND	B8UW	MP	HM	1	0
B12-NW-54	24,5	77°	X	ND	ND	B8UW	MP-RD	HM	1	0
B12-SW-135	20,4	80°	X	ND	TR	B68	MP-RD-FC	HM	1	1
B12-SW-156	29,2	000	+	W	LN	B6	MP	HM	1	0
Ell-SW-313	24,2	68°	+	ND	ND	B6	MP	HM	1	1
Ell-NE-224	21,3	75°	X	ND	TR	B15	MP	B	1	1
Ell-NW-424	18,1	65°	+	SM	TR	B8	MP-Residues	-	1	1
D5-NE-177A	59	44°	+	W	TR	B8	RD	-	1	1
D5-NW-86	26	56°	X	ND	ND	B3	MP	W	1	1
D5-NE-318	22	62°	+	W	TR	B 6	MP	HM	1	0
D5-NW-87	18,2	70°	+	HM	TR	B8	MP	HM	1	0

ND: not determinate, W: wood, B: bone, HM: hard material, SM: soft material, TR: transverse motion, LN: longitudinal motion (following Mansur-Franchomme 1983), Position: *sensu* Brezillion (1968), MP: micropolish, RD: rounding, FC: fracture, 1: presence, and 0: absence.

coloration) was significantly correlated with hafting traces ($\chi^2 = 8.96$, d.f. = 1, $P = 0.003$).

DISCUSSION

In archaeological contexts where it is possible to recover hafted tools, it is difficult to identify them and it often requires indirect evidence; therefore, it is very important to develop an appropriate experimental series for comparison (Álvarez 2003; Keeley 1980; Mansur-Franchomme 1983, 1999).

Although the experimental series for identifying hafting traces included only one type of haft ("cepillo de carpintero" used by southern Tehuelches), experimentation made from 183 pieces mostly made on several different chert types and worked on different materials (bone, wood, leather, and mineral substances) with different kinematics and used time, allow identifying these materials in any part of the tool and specially in the artifacts analyzed. In this sense, the identification of use traces associated with any hafting process can be carried out on archaeological material. However, it has certain limitations when it comes to interpret the haft type used in the archaeological record. Thus, conducting new experiments will allow in the future to deepen and clarify these issues. Therefore, the analysis carried out is a first approach to this subject and in this sense may be mentioned some points about it.

On a macroscopic level, it was possible to make a first approach based on the extent of edge retouches and on artifact size. In the sample, edge angles are above 60° on medium-sized scrapers that seem to have been resharpened. We also found that the highest proportions of the sample were related to distal fragments. This could be due to an intentionally or accidental fracture during the edge-retouching, resharpening process and use. It was also observed that residues were correlated with the presence of possible hafting traces.

On a microscopic level, the first analysis consisted in a careful study of use traces that had not been affected by post-depositional processes. It is easier and possible to identify hafting traces of these tools. However, it is much more difficult to establish the type and technique of hafting (Álvarez 2003; Castro de Aguilar 1994; Keeley 1982; Mansur-Franchomme 1983; Rots 2003; Rots and Williamson 2004; Rots et al. 2001, 2006; Stordeur 1987).

Many times, the micropolishes on tool surfaces, as well as rounding and striations are not sufficiently developed to identify hafts made of wood, bone, or other material, due to that their presence is a consequence of the movement of the pieces inside the handle (Rots 2003; Rots et al. 2001, 2006).

On the other hand, it is common to observe that use traces start developing on the higher surfaces of the microtopography of the tool. These areas are often attacked by post-depositional processes that make interpretation difficult (Levi-Sala 1993, 1996; Shea and Klenck 1993). Even so, at Maripe Cave, the end-scrapers with hafting traces were not affected by these processes and its location on the instruments (nonactive edge) would give more support to them. We also observed that the presence/absence of lateral retouches and slanted microscars are variables that in the sample were not associated with detected hafting traces. They may have been produced by other processes. Even so, we agree on the observations noted by Rots et al. (2006), who suggested that polishes and scarring are the dominant wear traces for hafted tools, including bright spots, while striations and rounding are infrequent.

In turn, it is necessary to note that not all hafting processes generate significant traces, so the number of hafted tools may have been greater than those detected.

Following these criteria, the recorded percentage of hafting traces (25%) is likely to be the minimum number of end-scrapers that were hafted (Collin and Jardon-Giner 1993; Lewenstein 1993; Odell 1994; Rots et al. 2006).

Conclusions

According to the previous results, and taking into account that hafting is a technological process that can distinguish different cultural traditions (Mansur-Franchomme 1983, 1986), it is of fundamental importance to develop specific analysis of tools and associated waste in order to make a more thorough analysis of the issues raised here.

The study presented has provided some indicators of haft presence, from the development of experiments, to the identification of these traces in a substantial part at the archaeological sample analyzed. In this way, a more thorough consideration of these studies, in laboratory conditions (experiments with different haft types) as well as in the archaeological collection, should clarify these issues. However, it is possible to suggest that during the mid-Holocene occupations at Maripe Cave site, end-scrapers were made, hafted, and used. The micropolishes of hard materials identified at the sample, similar to those detected by Rots in his experimental series (Rots et al. 2006, plates 13 and 15), allow us to infer that hafts would be made at least of wood, bone, or other hard materials (Figures 4–7).

On the other hand, hafting indicators should be evaluated under different parameters, providing new information about technological choices for manufacturing and using such tools. This research offered a deeper understanding on the use of scrapers in societies that have occupied the Central Plateau of Santa Cruz from early times.

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References

Álvarez, M. R. 2003 Organización tecnológica en el Canal Beagle. El caso de Túnel I (Tierra del Fuego, Argentina). Tesis doctoral. Facultad de Filosofía y Letras, Universidad de Buenos Aires, Buenos Aires, MS.

Anderson, G. 1981 Contribution méthodologique a l'analyse des micro-traces d'utilization sur les outils préhistoriques. Tesis de Doctorado, Universite de Bordeaux 1, Bordeaux.

Anderson-Gerfaud, P., and D. Helmer 1987 L'emmanchement au Moustérien. In *La main et l'outil: manches et emmanchement préhistoriques*, edited by D. Stordeur pp. 37–54. Travaux de la Maison de l'Orient 15, Paris.

Aschero, C. A. 1975 *Ensayo para una clasificación morfológica de artefactos líticos aplicada a estudios tipológicos comparativos*. Informe al CONICET, Buenos Aires, MS.

Aschero, C. A. 1983 *Ms. Ensayo para una clasificación morfológica de artefactos líticos aplicada a estudios tipológicos comparativos*. Informe al CONICET. Revisión 1983, Inédito.

Binford, L. 1973 Interassemblage Variability: the Mousterian and the "Functional" Argument. In *The Explanation of*

Culture Change, edited by C. Renfrew, pp. 227–254. Duckworth, London.

Brezillion, M. 1968 La denomination des objets de Pierre Taillèe matèriaux pour un vocabulaire des prèhistoriens de langue française. In *Gallia prèhistoire Supplement 4*. Centre National de la Recherche Scientifique, Paris.

Briz, I. 2004 Dinàmiques econòmiques de producció-consum en el registre lític caçador-recolector de l'extrem Sudamericà. La societat Yámana. Tesis de doctorado, Departament de Prehistòria, Universitat Autònoma de Barcelona, Barcelona. http://www.tdx.cesca.es.

Bordes, F. 1961 *Typologie du Paleolithique Ancien et Moyen*. Publications del l'Institute de Prehistoire de l'Universite de Bordeaux, Memoire 1, Bordeaux.

Bordes, F. 1972 Du Paléolithique moyen au Paléolithique supérieur: Continuité ou discontinuité. In *The Origin of Homo Sapiens*, edited by F. Bordes, pp. 211–218. UNESCO, Paris.

Cahen, D., L. Keeley, and F. Van Noten 1979 Stone Tools, Toolkits and Human Behavior in Prehistory. *Current Anthropology* 20: 661–683.

Calvo Trias, M. 1999 Reflexiones en torno al concepto de útil, forma función y su relación con los análisis funcionales. *Pyrenae* 30, 17–38.

Calvo Trias, M. 2002 *Útiles líticos prehistóricos. Forma, función y uso*, Ed. Ariel Prehistoria, Barcelona.

Casamiquela, R. 1978 Temas patagónicos de interés arqueológico. III. La técnica de la talla del vidrio.ñe/ac/ones de la. *Sociedad Argentina de Antropología*, XII: 213–233.

Caspar, J. P., and D. Cahen 1987 Enmachements des outils danubiens de Belgique: donnés techniques et tracéologiques. In La main et l'outil. Manches et enmanchements préhistoriques, edited by D. Stordeur, pp. 185–195. Travaux de la Maison de l'Orient, 15, Paris.

Castro, A., and E. Moreno 1994 Determinación de enmangues en instrumentos líticos por medio del análisis de huellas de utilización. *Paleoetnológica* 7: 7–20.

Castro de Aguilar, A. 1994 El análisis funcional del material lítico por medio de la observación de huellas de uso como alternativa al modelo de clasificación tipológica. Tesis doctoral, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, La Plata, MS.

Cattáneo, R. G. 2002 Una aproximación a la organización tecnología lítica entre los cazadores recolectores del Holoceno medio/Pleistoceno final en la Patagonia Austral. Tesis Doctoral de la Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, La Plata, MS.

Clemente, I. 1997 Los instrumentos líticos de Tunel VII: una aproximación etnoarqueológica. In *Treballs d‘ Etnoarqueologia,* 2, UAB-CSIC, Madrid.

Collin, F., and P. Jardon-Giner 1993 Travail de la peau avec des grattoirs emmanchés. Réflexions sur des bases expérimentales et ethnographiques. In *Traces et fonction: Les gestes retrouv'es*, edited by P. Anderson, S. Beyries, M. Otte, and H. Plisson, pp. 105–117. ERAUL, No. 50, Li'ege.

Dinnis, R., A. Pawlick, and C. Gaillard 2009 Bladelet Cores as Weapon Tips? Hafting Residue Identification and Microwear of Three Carinated Burins from the Late Aurignacian of Les Vachons, France. *Journal of Archaeological Science* 39: 1922–1934.

Dibble, H. L. 1984 Interpreting Typological Variation of Middle Paleolithic Scrapers: Function, Style, or Sequence of Reduction? *Journal of Field Archaeology* 11: 43l–436.

Dibble, H. L. 1987 The Interpretation of Middle Paleolithic Scraper Morphology. *American Antiquity* 52: 109–117.

Ferguson, W. C. 1980 Edge-Angle Classification of the Quininup Brook Implements: Testing the Ethnographic Analogy. *Archaeology & Physical Anthropology in Oceania* 56–72.

Forlano, A., and M. V. Dolce 2006–2007 Experimentación con raspadores enmangados de la Patagonia Argentina. *Boletín de arqueología experimental* 7: 100–113. http://www.uam.es/otros/baex.

Forlano, A., and M. V. Dolce 2007 El raspador por el mango. Actas del CNNA Jujuy. *Pacarina* 1: 643–646, Jujuy.

González Urquijo, J., and J. Ibañez 1994 *Metodología para el análisis funcional de instrumentos tallados en sílex*. Universidad de Deusto, Bilbao.

González Urquijo, J., and J. Ibañez, 1999 Fabrication et utilisation de l'outillage à dos à la fin du Paléolithique Supérieur au Pays Basque, en A. Thevenin (ed.) y P. Bintz (dir.), L'Europe des derniers chasseurs. Épipaléolithique et Mésolithique. *50 Colloque International UISPP*. Ëditions du CTHS, Paris, pp. 109–114.

Hermo, D. 2008 Los cambios en la circulación de las materias primas líticas en ambientes mesetarios de Patagonia. Una aproximación para la construcción de los paisajes arqueológicos de las sociedades cazadoras-recolectoras. Tesis doctoral de la Facultad de Ciencias Naturales—UNLP, La Plata, MS.

Hermo, D., V. Lynch, and A. Ceraso 2014 Tendencias temporales en la tecnología lítica del sitio Cueva Maripe (Santa Cruz, Argentina). *Latin American Antiquity*, in press.

Hermo, D., and L. Miotti 2003 El efecto zoom para relacionar los desechos líticos de un sitio y los paisajes arqueológicos de cazadores recolectores del Holoceno en la meseta central de Santa Cruz. *Intersecciones antropol.* [Online]. n. 4, 111–121. ISSN 1850-373X.

Juel Jensen, H. 1988 Functional Analysis of Prehistoric Flint Tools by High-Power Microscopy: A Review of West European Research. *Journal of World Prehistory* 2: 53–88.

Keeley, L. H. 1980 *Experimental Determination of Stone Tools Uses: A Microwear Analysis*. University of Chicago Press, Chicago.

Keeley, L. H. 1982 Hafting and Retooling: Effects on the Archaeological Record. *American Antiquity* 47(4): 798–809.

Leipus, M. 2006 Análisis de los modos de uso prehispánicos de las materias primas líticas en el Sudeste de la Región Pampeana. Una aproximación funcional. Tesis doctoral de la Facultad de Ciencias Naturales y Museo, UNLP, La Plata, MS.

Lemonnier, P. 1992 *Elements for an Anthropology of Technology*. University of Michigan, Ann Arbor.

Levi-Sala, I. 1993 Use-Wear Traces: Processes of Development and Post-Depositional Alterations. In *Traces et fonction: les gestes retrouvés. Actes du colloque*

international de Liège, 8-9-10 décembre 1990, edited by P. C. Anderson, S. Beyries, M. Otte, and H. Plisson, Vol. 2. pp. 401–415. ERAUL, 50, Liège.

Levi-Sala, I. 1996 *A Study of Microscopic Polish on Flint Implements*. BAR International Series 629, Oxford.

Lewenstein, S. M. 1993 Experimentation in the Formation and Variability of Lithic Use-Wear Traces on Obsidian and Chert Implements. In *Traces et function: Les gestes retrouv'es*, edited by P. Anderson, S. Beyries, M. Otte, and H. Plisson, pp. 287–294. ERAUL, No. 50, Li'ege.

Lynch, V. 2013 Análisis morfológico-funcional de raspadores líticos del sitio cueva Maripe (Santa Cruz, Argentina). In *Tendencias teórico-metodológicas y casos de estudio en la arqueología de la Patagonia*, edited by A. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, S. Paulides, L. Salgán, and A. Tivoli, pp. 417–424. SAA. Bs. As, Buenos Aires, Argentina.

Lynch, V. 2014 Estudio comparativo de la producción y uso de artefactos líticos en el Macizo del Deseado (Santa Cruz, Argentina). PhD thesis, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina.

Lynch, V., and D. Hermo 2012 ¿Es posible la detección de huellas de enmangue? Evidencias macro y microscópicas en instrumentos líticos experimentales. *Magallania*, 39 (1): 241–252, Chile.

Mansur, M. E., and A. Lasa 2005 Diversidad Artefactual vs Especialización funcional. Análisis del IV componente de Tunel I (Tierra del Fuego, Argentina). Magallania (Chile) 33(2): 69–91.

Mansur-Franchomme, M. E. 1983 Traces d´utilisation et technologie lithique: exemples de la Patagonie. N° 1860. Tesis doctoral inédita de la Universidad de Bordeaux I, Francia.

Mansur-Franchomme, M. E. 1986 Microscopie du matériel lithique préhistorique: Traces d'utilisation, altérations naturelles, accidentelles et technolo giques. In *Cahiers du Quaternaire 9*, C.N.R.S. edn, 286pp. Bordeaux.

Mansur-Franchomme, M. E. 1987a. Outils etnographiques de Patagonie enmanchement et traces d'utilisation. In *La main et l'outil: manches et enmanchements préhistoriques*, pp. 297–306. Travaux de la maison de l'Orient, Lyon, 15.

Mansur-Franchomme, M. E. 1987b. Enmanchement et traces d'utilisation. In *Le main et l'outil: manches et enmanchements préstoriques*, pp. 329–330. Travaux de la Maison de L'Orient, Lyon, 15.

Mansur-Franchomme, M. E. 1999 Análisis funcional de instrumental lítico: problemas de formación y deformación de rastros de uso. In *Actas del XII Congreso Nacional de Arqueología Argentina*, t. 1. Editado por C. Diez Marin. pp. 355–366. La Plata.

Marchionni, L. 2013 Comparación de las distintas historias tafonómicas en conjuntos zooarqueológicos provenientes de la Meseta Central de la provincia de Santa Cruz. PhD Thesis, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina.

Marchionni, L., and M. Vázquez 2012 New Data on Exploited Pleistocene Fauna at Piedra Museo (Central Plateau of Santa Cruz Province, Argentina). En Miotti et al. (Eds.). Southbound. Late Pleistocene Peopling of Latin America. Texas A&M University Press, Texas, Estados Unidos.

Miller, G. L. 2013 Illuminating Activities at Paleo Crossing (33ME274) Through Microwear Analysis. *Lithic Technology* 38(2): 108–97.

Miotti, L. 1996 Piedra Museo (Santa Cruz): nuevos datos para el debate de la ocupación Pleistocénica en Patagonia. En: *Arqueología, sólo Patagonia.* Editado por J. Gómez Otero, pp 27–38. CENPAT-CONICET, Puerto Madryn.

Miotti, L. 2003 Patagonia: A Paradox for Building Images of the First Americans During the Pleistocene/Holocene Transition. *Quaternary International* 109–110: 147–173.

Miotti, L., D. Hermo, L. Magnin, N. Carden, L. Marchionni, A. Alcaráz, B. Mosquera, E. Terranova, and M. Salemme 2007 Resolución e Integridad Arqueológica en la Cueva Maripe (Santa Cruz, Argentina). In *Arqueología de Fuego-Patagonia: levantando piedras, desenterrando huesos… y develando arcanos*, edited by F. Morello, M. Martinic, A. Prieto, and G. Bahamondem, pp. 555–569. Ediciones CEQUA, Punta Arenas, Chile.

Miotti, L., L. Marchionni, B. Mosquera, D. Hermo, and A. Ceraso 2014 Fechados radiocarbónicos y delimitación temporal de los conjuntos arqueológicos de Cueva Maripe, Santa Cruz (Argentina). *Relaciones de la Sociedad Argentina de Antropología* XXXIX(2), julio-diciembre 2014: 509–537.

Miotti, L., M. Vázquez, and D. Hermo 1999 *Piedra Museo: un yamnagoo pleistocénico de los colonizadores de la meseta de Santa Cruz. El estudio de la arqueofauna*. Soplando en el viento, Actas III Jornadas de Arqueología de la Patagonia, Neuquén–Buenos Aires.

Moss, E., and M. Newcomer 1982 Reconstruction of Tool Use at Pincevent. Microwear and Experiments. In *Tailler! Pour quoi faire: Prehistoire et technologie lithique II: Recent Progress in Microwear Studies*, edited by D. Cahen, pp. 289–312. Studia Praehistorica Belgica 2, Leuven-Liège.

Odell, G. H. 1980 Butchering with Stone Tools: Some Experimental Results. *Lithic Technology* 9: 39–48.

Odell, G. H. 1994 Prehistoric Hafting and Mobility in the North American Midcontinent: Examples from Illinois. *Journal of Anthropological Archaeology* 13: 51–73.

Odell, G. H., and F. Odell-Vereecken 1981 Verifying the Reliability of Lithic Use Wear Assessment by "Blind Tests": The Low Power Approach. *Journal of Field Archaeology* 7: 87e120.

Odell, G. H. 2001 Stone Tool Research at the end of the Millennium: classification, function and behavior. *Journal of Archaeological Research* 9(1): 45–100.

Panza, J. 2001 *Hoja Geológica Monumento Natural Bosques Petrificados 4769–IV, Provincia de Santa Cruz, Instituto de Geología y Recursos Minerales*, Boletín no. 258, SEGEMAR, Buenos Aires.

Paunero, R. S. 2003 The Presence of a Pleistocene Colonizing Culture in La Maria Archaeological Locality, Casa del Minero 1. In *Where the South Winds Blow: Ancient Evidence of Paleo South Americans*, edited by L. Miotti, M. Salemme, and N. Flegenheimer, Editor-in-chief Robson Bonnichsen, Center for the Study of the First Americans (CSFA) and Texas A&M University Press. College Station, Thomson-Shore, INC, Dexter. pp. 127–132. ISBN: 1-55889-455-1.

Pawlik, A. 2011 Have We Overlooked Something? Hafting Traces and Indications of Modern Traits in the Philippine Palaeolithic. *Journal of Indo-Pacific Archaeology* 30: 35–53.

Plisson, H. 1985 Etude fonctionelle des outillages lithiques préhistoriques par l'analyse des micro-usures: recherche méthodologique et archéologique. Thèse de Doctorat présentée à l'Université Paris I, Pantheon-Sorbone, Paris.

Plisson, H. 1987 L'emmanchemment dans l'habitation n 1 Pincenvent. In *La main et l'outil Manches et emmanchements préhistoriques*, edited by D. Stordeur, pp. 75–88. Maison de l'Orient, Lyon.

Robertson, G., and V. Attenbrow 2008 Skin-Working at Emu tracks 2, New South Wales, Australia: An Integrated Residue and Use-Wear Analysis of Backed Artefacts. *Lithic Technology* 33(1), 31–49.

Rots, V. 2002 *Hafting Traces on Flint Tools: Possibilities and Limitations of Macro- and Microscopic Approaches*. Unpublished PhD thesis, Katholieke Universiteit Leuven, MS.

Rots, V. 2003 Towards an Understanding of Hafting: The Macro- and Microscopic Evidence. *Antiquity* 77: 805–815.

Rots, V. 2010 *Prehension and Hafting Traces on Flint Tools: A Methodology*. Universitaire Pers, Leuven.

Rots, V., and B. S. Williamson 2004 Microwear and residue analyses in perspective: the contribution of ethnographical evidence. *Journal of Archaeological Science* 31, 1287–1299.

Rots, V., L. Pirnay, P. Pirson, and O. Baudoux, 2006 Blind Tests Shed Light on Possibilities and Limitations for Identifying Stone Tool Prehension and Hafting. *Journal of Archaeological Science* 33(7): 935–952.

Rots, V., L. Pirnay, P. Pirson, O. Baudoux, and P. M. Vermeersch 2001 Experimental Hafting Traces, Identification and Characteristics. *Notae Praehistoricae* 21: 129–137.

Semenov, S. A. 1964 *Prehistoric Technology*. Cory–Adams Mackay, Londres.

Shea, J. J., and J. D. Klenck 1993 An Experimental Investigation of the Effects of Trampling on the Results of Lithic Microwear Analysis. *Journal of Archaeological Science* 20: 175–194.

Stemp, W. J., and E. Graham 2006 Ancient Maya Procurement and Use of Chipped Chert and Chalcedony Tools at Marco Gonzalez, Ambergris Caye, Belize. *Lithic Technology* 33(1), 27–55.

Stordeur, D. 1987 *La main et l'Outil. Manches et Emmanchements préhistoriques*. Edited by D. Stordeur, pp. 11–34. Maison de l'Orient, Lyon.

Symens, N. 1986 A Functional Analysis of Selected Stone Artefacts from the Magdalenian Site at Verberie, France. *Journal of Field Archaeology*, 13: 213–222.

Vaughan, P. 1981 Lithic Microwear Experimentation and the Functional Analysis of the Lower Magdalenian Stone Tool Assemblage. Ph.D. dissertation, University of Pennsylvania. Pensilvania, USA.

Vaughan, P. 1985. Use-Wear Analysis on Flaked Stone Tools. University of Arizona Press, Tucson. University of Pennsylvania, Philadelphia.

Vila Mitjà, A. 1981 Les activitats productives en el Paleolític i el seu desenvolupament (un exemple catala: El Castell sa Sala i El Cingle Vermell). Tesis Doctoral. Universitat de Barcelona, Barcelona.

Wilmsen, E. N. 1968 Functional Analysis of Flaked Stone Artifacts. *American Antiquity*, 33, 156–161.

Yerkes, R. W. 2002 Microwear Analysis of a Sample of Chipped Stone Artifacts from the Late Archaic Davisson Farms Site (33Le619), Lawrence County, Ohio. In Phase III Archaeological Investigations of the Davisson Farm Site (33Le619) in Support of the Proposed Hanging Rock Energy Facility, edited by M. P. Purtill, Hamilton Township, Lawrence County, Ohio. Volume II, Appendix D. Report prepared by Gray & Pape, Inc. On file with the Ohio Historic Preservation Office.

Yerkes, R., and P. N. Kardulias 1993 Recent Developments in the Analysis of Lithic Artifacts. *Journal of Archaeological Research* 1: 89–119.

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