Glass arrow to hunt guanaco from Gusinde's collection, WMW, inv. no. 121.599

Judith Charlin, is an archaeologist and professor at the University of Buenos Aires and researcher for the National Research Council (CONICET) of Argentina. Her research focuses on lithic technology from southern Patagonia and statistical methods.
E-mail: judith.charlin@gmail.com

On the Importance of Museum Ethnographic Collections for Archaeological Research: the Case of Native Weapons from Tierra del Fuego at the Weltmuseum Wien

Judith Charlin

Key research issues

The use of ethnographic analogies to aid the interpretation of archaeological remains is an important theoretical and methodological tool in archaeological research. Historic records, folklore, ethnographic reports and the most archaeological-driven actualistic research like ethnoarchaeology are the main sources to develop a wide range of analogies, from the function or production techniques of particular objects to activity areas and discard patterns, as well as broader models of socio-political and economical organization (Binford 1994, 2001; Sillar and Joffré 2016). Native material culture stored in museums provides core material for analogies since only a fraction of the artefacts used in the past are preserved in the archaeological record. Many organic materials, such as baskets, textiles, leathers, woods, do not leave any trace, excepting unusual situations of very good preservation. Prehistoric weapons offer a clear example of these conservation problems. In general the overall technical system, which is mostly composed of perishable materials - such as wooden bows and arrow shafts - is rarely preserved in the archaeological record. The weapon points, mainly the lithic ones, are typically the only remains recovered by archaeologists and according to their morphometric attributes form the basis for overall weapon system reconstruction (Ames et al. 2010; Hildebrandt and King 2012; Hughes 1998; Shott 1993; Walde 2014). For this reason, ethnographic weapons from museum collections are a very valuable source of information for the study of technical and functional traits of prehistoric weapons since they often preserve the overall technical system.

In archaeology, the study of prehistoric weapons, especially their performance, has mainly been examined through four indirect methods: 1. experimental and replication studies in simulated use situations (Clarkson 2016; Hunzicker 2008; Hutchings 2011; Iovita et al. 2014), 2. ethnoarchaeological and ethnographic observations (Bartram 1997; Hitchcock and Bleed 1997; Politis 2007), 3. Studying mechanical physics of weapon systems in the frame of optimal engineering

(Cotterell and Kamminga 1990; Hughes 1998; Ratto 1994, 2003), and 4. analyzing museum ethnographic weapon collections of known function to derive parameters to classify prehistoric ones (Ratto 2003; Shott 1997; Thomas 1978). This last line of research was the frame of reference in my study of Weltmuseum Wien (WMW) weapon collections from South America, North America and Oceania and Australia with a fellowship of the National Research Council of Argentina (CONICET). My interests are focused in size and shape variation among weapon systems, especially in their points, according to function and raw material. Following this goal, I have surveyed several collections at the WMW, such as the bow and arrow and harpoon collections from Tierra del Fuego (Gusinde and Hagenbeck's collections), the arrows from Brazil (Natterer and Kanoe's collections), the spearthrowers and harpoons from the Arctic (Cook's collection), the spears from New Guinea (Haas collection) and Papua New Guinea (Hassner, Boban, Kukic, Finsch, Webster, Reischek, Parkinson, Sobotka, Brunner, Wolff-Knize, and Benesch's collections), and the spear, daggers and hafted knives from Australia (Kolig, Clement, Liebler, Finsch, and Franz Ferdinand's collection). This survey was part of a long-term project pursuing the aim of assessing size and shape variability among different kinds of weapons. The goal of the general project is to build functional models to assign a function to archaeological points of unknown use through the analysis of morphometric attributes of ethnographic weapons and by means of experimentation with replicated arrows and spears. Here I will present the main results obtained from the morphometric analysis of Tierra del Fuego arrow collections surveyed at the WMW, including also some other Fuegian collections with comparative purposes.

Archaeologists are usually interested in addressing questions such as when and why bow and arrow technology was adopted, whether it was enough efficient to replace spear systems, or whether both kinds of technologies were maintained in use, since bow and arrow technology is a comparatively recent innovation among weapon systems, despite of its popular use in historical times, especially in the Americas (Ames et al. 2010; Hughes 1998; Shott 1997). For this reason, the identification of arrowheads in the archaeological record is a fundamental issue, as well as a problematic one when the whole weapon system is unpreserved. In this way, ethnographic models are useful to estimate some parameters aimed to serve as proxies to assign a function to archaeological points (Ratto 2003; Shott 1997; Thomas 1978).

The case of Tierra del Fuego: a brief ethnographic and archaeological background

Tierra del Fuego (TDF) ethnographic weapon collections offer an interesting scenario for achieving our goals since native groups who settled the archipelago at historical times developed different subsistence and technological strategies. While on the north of the Isla Grande de Tierra del Fuego the inhabitants, known as Ona or Selk'nam, were hunter-gatherers with a diet centered in guanaco (*Lama guanicoe*), on the south, on the Beagle Channel and southernmost islands (whose inhabitants are known as Yámana or Yahgan) and also in the Western part (people called Alacaluf or Kaweskar), they were maritime hunter-gatherers living mainly from products of the sea (mollusks, fish, pinnipeds, and whales) (Bird 1946; Borrero 1985, 2001; Chapman 1986; Fitz Roy 2009; Lothrop 1928; Orquera and Piana 1999, 2009. Fig. 1). In the classical literature they were distinguished as "foot Indians" and "canoe Indians". The nature of a fourth group, which occupied the southeast portion of the island, called Haush, is an issue of debate (Borrero 2001; Chapman 1986; Gusinde 1982; Zangrando et al. 2011).

Since the 16th century, there is abundant ethnographic information about TDF produced by explorers, scientists and religious missioners (Beauvoir 2005; Bove 2005; Bridges 2003; Chapman 1986; De Agostini 2005; Fitz Roy 2009; Gusinde

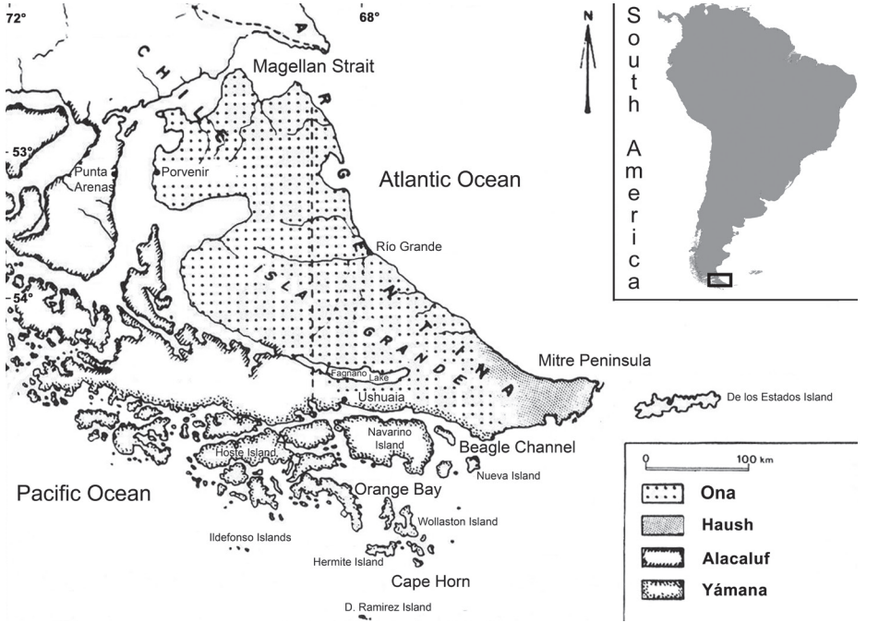

Fig. 1 Ethnic territories delimitation in Tierra del Fuego at historical times (after Chapman 1986 with modifications)

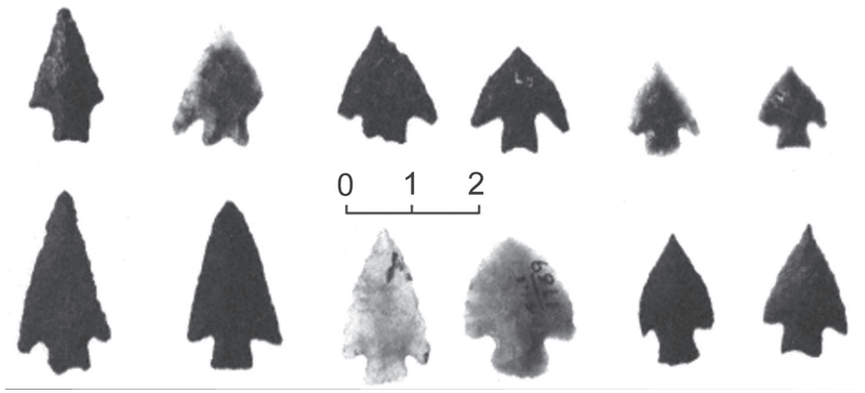

Fig. 2 Archaeological "Ona points" from southern continental Patagonia according to Bird (Pali Aike cave, after Bird 1988)

1982; Hyades and Deniker 1891; Lista 1998), who collected most of native artefacts nowadays stored in many European and North American museums. The particular importance of TDF ethnographic samples regarding our aims is twofold: by the diversity of weapons that these groups developed to hunting and fishing different resources, and because the "ethnographic model" has played an important role in the pioneering archaeology of TDF and southern continental Patagonia, especially in relation to the classification of archaeological projectile points.

The North American archaeologist Junius Bird (1938, 1946, 1988), who was the first in developing systematic archaeological works in Patagonia, pointed out the similarity between historical Ona arrows from northern TDF and those recovered in Late Holocene archaeological sites located on the mainland[1] (Magallanes, Chile). For this reason, he called "Ona points" the archaeological projectile points of Period V (ca. 700 BP, Fig. 2) in the cultural sequence he proposed for southern continental Patagonia. Moreover, he assumed "Ona points" were arrow points based on a direct ethnographic analogy and the smaller size of these points in comparison with older ones, the type IV (see Charlin and Gónzalez-José 2012 for a comprehensive review). Thus, based on artefact similarities at the northern and southern coast of Magellan Strait, Bird held that the Onas inhabited the mainland in prehistoric times[2].

[1] J. Bird excavated the caves of Fell and Pali Aike, which are ones of the earliest cultural evidence in southernmost South America, including remains of extinct mammals from the final Pleistocene and early Holocene

[2] In this regard, it is worth to mention that until ca. 8000 BP the island of TDF was connected to the continent by a land bridge across what today is an inter-oceanic passage, the strait of Magellan (McCulloch et al. 1997).

Within this frame, our main objectives at studying WMW Fuegian collections were, firstly, assess the existence of morphometric variability in ethnographic arrow technology across TDF since adaptations focused in different resources (land and sea resources) were developed (Charlin et al. 2016); secondly, test the classical analogy between historical Ona arrows and archaeological projectile points assigned to type V according to Bird's periodization for the mainland (Charlin and González-José 2017), and, thirdly, complete the extant ethnographic weapons database to generate a model to distinguish weapon types. I'm going to synthesize here the obtained result pursuing the first two objectives. The third one will be achieved in the long-term through the survey of ethnographic collections available at several museums around the world.

The Weltmuseum Wien weapon collections from Tierra del Fuego: Gusinde and Hagenbeck's samples

The WMW houses a large ethnographic collection from Tierra del Fuego recovered by the missionary and ethnologist Martin Gusinde, a priest of the congregation Society of the Divine Word (SVD), who was trained by Wilhelm Schmidt. These artefacts were collected between 1918 and 1921 during his visits to Tierra del Fuego. The assemblage arrived at the museum in 1927 and includes bows, arrows, harpoons, masks, toys and headdresses, among other artefacts, from the Ona, Yámana and Alacaluf.

Gusinde (1982) published three volumes about the customs of the indigenous groups from Tierra del Fuego with very useful illustrations and maps and a fourth one with anthropometric measurements of the three groups, a typical objective of the ethnography at that time.

Gusinde's collection at the WMW includes different kinds of arrows. There are three whole Ona arrows, each one manufactured on a different raw material: wood, leather and glass. The different materials used to make the points are in relation with distinct weapon functions and targets. The wooden arrow (Fig. 3) was used to hunt birds according to the references and

Fig. 3 Wooden arrow to hunt birds from Gusinde's collection, WMW, inv. no. 97.901

Fig. 4 Leather arrow for training novices from Gusinde's collection, WMW, inv. no. 121.602

illustrations provided by Gusinde (1982: Fig. 36). Its total length is 731 mm and weights 31 g. The tip is a thin stick 76.33 mm long, with both extremes pointed, and transversely attached to the shaft. In this way, the impact surface is wider, producing a stronger hit (Gusinde 1982: 220-221).

The arrow with a leather ball as a point (7.45 mm in diameter) was used for training novices (Fig. 4). Its total length is 706 mm and its weight 29 g. It was used for practicing while preserving lithic or glass points, which were highly valuable. According to Gusinde (1982: 221), the targets were leather pieces or a trunk. Bridges (2003: 412) points out this kind of arrows was also common for competences and sport activities to avoid producing mortal wounds.

On the other hand, the arrow with a glass point 28.35 mm long was the typical for guanaco hunting (Fig. 5). The total length is 783 mm and 40 mm correspond to the fletching. The main part of the shaft is decorated with zig-zag incised and parallel lines. The shaft proximal end shows the remains of a white substance and a black string of resin (i.e. mastic). According to Gusinde (1982: 217–218), the first is gypsum dust mixed with saliva, used to fix the tendon to attach the fletching. Through recycling of bottles or bottle fragments from shipwrecks, the glass started to be used to make arrowheads by native populations, and it was the first cultural change resulting from colonialism, even before direct contact with Europeans (Borrero 2001).

Two shafts without reference to either place or ethnic origin were also available in Gusinde's collection. They may have been novice training arrows since the distal ends does not report any groove to insert the lithic or glass point; it cannot be related to an unfinished state since the proximal ends shows evidence of different patinas generated by fletching. Therefore, they were used for a long time. Both shafts have also the white dust and the resin already described in the proximal end.

The last example of Gusinde's sample is an isolated lithic point labeled as Yámana, in a grayish metamorphic rock, which is very similar to Fuegian archaeological projectile points from the last two thousand years according to its raw material, size and shape. The comparison against metrical attributes of archaeological and ethnographic points corroborated this hypothesis (see detailed analysis in Charlin et al. 2016).

Fig. 5 Glass arrow to hunt guanaco from Gusinde's collection, WMW, inv. no. 121.599

The WMW also stores a sample of Fuegian artefacts collected by Carl Hagenbeck (1844–1913) for his entertainment company devoted to the trade of exotic wild animals and anthropological-zoological exhibitions or Völkerschau (Ames 2008: 18). He was a world-famous animal dealer and ethnographic showman who developed an extensive corporate network of travelers, hunters, agents and dealers in the animal business and recruited indigenous performers for park shows. He was also a prolific ethnographic artefact collector well-known by anthropologists and zoo directors (Revol 1995).

Between 1880 and 1884 the WMW acquired from Hagenbeck several harpoons, bows, arrows, daggers and other artifacts from Tierra del Fuego. The arrow collection comprises 10 whole arrows, three arrowheads and two shafts, all of

Fig. 6 Hagenbeck's arrow collection at Weltmuseum Wien (from left to right and upper to bottom) WMW, inv. nos. 19.824, 19.831, 19.833, 19.832, 19.830 and 19.834b

them identified as "Fuegians" and with glass points (Fig. 6). The shafts are of polished wood with a circular cross-section. A total of 10 shafts preserve the fletching and three of them have a white substance which covers the proximal end of the shaft. One shaft, on the other hand, does not present any evidence of fletching (such as fresh or non-patinated surface) which suggests it was not finished.

According to museum archives, some of these artefacts (all of them classified as "Fuegian") belonged to the indigenous people exhibited in the *Jardin d'Acclimatation* at Paris and in Berlin zoo in 1881. Despite the many documents about these people, their ethnical identity was much discussed due to a wrong reference stated by Deniker (1882: 16) (see Báez and Mason 2006 and Revol 1995 for a discussion of this issue). He correctly pointed out that these people were "Alikhoolips" (Alacaluf), but he added that they came from Hermite Island, a location in Yámana territory (Fig. 1). As a consequence, a debate about their ethnic origin emerged (Revol 1995). Taking this problem into account and to avoid any kind of bias in the metrical comparison of arrows according to ethnic assignment, we decided to grouping the arrows according to main economic strategy that characterized the subsistence of native groups, i.e. land or sea resources-focused diet. In this way, Ona arrows (land resource hunter-gatherers) were compared against Alacaluf and Yamana ones (sea resources hunter-gatherers). For a broader comparison, we enlarge the arrow ethnographic sample including the Fuegian collections surveyed in the Quai Branly Museum (Paris, France)[3] and in the Ethnologisches Museum (Berlin, Germany). In the last, there is one arrow also bought from Hagenbeck recorded as "Yámana" from Hermite Island. Following this reference it could be possible to compare morphometric characteristics of Hagenbeck's arrow collections from both Berlin and Vienna museums to assess similarities and corroborate its affiliation (Charlin et al. 2016).

3 Materials collected in 1882–1883 by the Cape Horn French scientific expedition (Hyades and Deniker 1891; Martial 2005) and by H. Rousson and P. Willems (1893) between 1890 and 1891 in the expedition organized by the French Ministry of Public Instruction and Fine Arts. Both collections derive from the former Musée de l'Homme (Charlin et al. 2016).

Results

1. Is there variability in arrow technology across Tierra del Fuego at historical times?

By means of multivariate statistics (principal component analysis and discriminant analysis), the metrical comparison of the whole arrows (point + shaft), as well as the individual points and shafts, from land- and sea-resources specialized hunter-gatherers revealed size differences. In this comparison only the arrows and arrowheads made in glass were included. The results showed that Ona arrows present longer and wider shafts, with smaller fletching and points, while Alacaluf and Yámana arrows show the opposite trend.

The interest in evaluating the possibility of such differences among the arrows manufactured by the several ethnographic groups rested on the results from previous archaeological analyses. Such studies yielded a long-term pattern of spatially constrained morphometric variation in projectile points following a north-south distribution which seems to approximately reproduce the location of indigenous populations at historical times (Charlin et al. 2014). The results obtained from the metrical comparison of time-specific ethnographic arrows (late 19th–early 20th century) showed that morphometric variations previously detected on archaeological projectile points for the last 3000 years are also present in historical times (at least regarding size, Charlin et al. 2016).

Studies of stable isotopes in human bones dated to 1500 years before European contact indicated a clear continuity in subsistence patterns as well (Yesner et al. 1991: 2003). Therefore, both lines of archaeological evidence support the ethnohistorically identified patterns, at least for the Late Holocene.

This study also contributed to identify the similarity between the arrows from the Hagenbeck's collection at the WMW classified as "Fuegians" (some of them supposed to belong to the Alacaluf) and the Yámana arrow at the Ethnologisches Museum. Multivariate comparisons proved that both sets of arrows from sea resources hunter-gatherers always grouped together, presenting more similarities among them than with Ona arrows.

A third conclusion derived from this work was an statistical support to the hypothesis of an archaeological origin and functional difference of the isolated metamorphic "Yámana" point from the WMW, which clustered together with five similar points from the Quai Branly museum. The statistical comparisons showed

these pieces are much larger than ethnographic arrow points regardless the raw material used. This size dissimilarity could be related with their use in a different technical weapon system (i.e. throwing spear) as previous archaeological studies suggested (Álvarez 2009a, 2009b, 2011; Ratto 1991a, 1991b, 1992). Indeed, this subsample also showed some size difference when compared to the archaeological points classified as arrows according to Ratto's functional model (Charlin et al. 2016).

2. Are Late Holocene archaeological projectile points from southern continental Patagonia similar to ethnographic Ona arrows from northern Tierra del Fuego?

Although ethnographic observations and historical documents are very useful to build hypothesis and models or to generate material expectations to be tested in the archaeological record (Binford 2001), many times "direct ethnographic analogies" based on historical continuity and same environment conditions are proposed, without very much evidential support (Sillar and Jofré 2016: 657). This last is the case of Bird's analogy between Ona arrowheads and type V archaeological projectile points from the mainland (Bird 1938, 1946, 1988). Despite of the differences found in assemblage composition (diversity and abundance of tool types) and morphometric attributes of Late Holocene archaeological projectile points between both sides of the strait of Magellan (Cardillo et al. 2015, Charlin et al. 2013), the direct comparison between the archaeological type V points and the ethnographic Ona arrows needed still to be formally performed.
To test this classical analogy we compared size and shape of type V projectile points from several archaeological sites of the mainland against Ona arrowheads from ethnographic collections surveyed at the WMW (Vienna, Austria), Musée du quai Branly (Paris, France), Ethnologisches Museum (Berlin, Germany), Museo Etnográfico "J. B. Ambrosetti" (Facultad de Filosofía y Letras, Universidad de Buenos Aires, Argentina), Museo de la Patagonia "Francisco P. Moreno" (Administración de Parques Nacionales, San Carlos de Bariloche, Argentina) and Instituto de la Patagonia Austral (Universidad de Magallanes, Punta Arenas, Chile) (Charlin and González-José 2017).
The statistical analyses showed size and shape differences between Ona historical arrowheads from Tierra del Fuego Island and type V archaeological projectile points from the southern continent before and after controlling for reduction. By reduction archaeologists are referring to point size and shape-related changes between the first and last use of the weapon, including all point modifications due to damage and resharpening along its use-life (Shott 2005). These results note design differences between both kinds of points as well as in their use-life. Indeed, the comparison of reduction variables measured on archaeological and ethnographic points showed that archaeological type V points present the highest levels of reduction showing a longer history of use, damage, repairing and resharpening, while the ethnographic arrows are less reduced, depicting scarce use, a pattern possibly related with their manufacturing as "souvenirs" for exchange with colonialists, as many studies with materials of the Contact period have shown (Borrero and Borella 2010; Harrison 2006; Scheinsohn 1990–1992; Torrence 1993, 2002). In general, those "artifacts for exchange" show a standardized design with scarce variation. Therefore, reduction is an important source of variation on size and shape differentiation between archaeological and ethnographic points that must be considered. Other two factors should be taken into account to understand morphometric differences between Ona and type V points as raw material (glass vs. stone) and chronological variations. These factors are closely related since the principal component analysis done by Charlin and González-José (2017) showed that only the 18th century archaeological point manufactured on obsidian (the lithic raw material closest to glass) cluster together with ethnographic arrowheads from late 19th-early 20th century. The differences in time span covered by both ethnographic and archaeological points (which go back ca. 3600 years ago) should be controlled in future comparisons, although the available chronological information about projectile points from stratigraphic contexts is still scarce.

Regarding of the usefulness of ethnographic weapons as functional models, a broader comparison of projectile point shapes including spear-like archaeological points showed that despite of the pairwise differences between Ona arrowheads and type V archaeological points, both point assemblages cluster together in a context of functional diversity, and distinguish clearly from spear-like points. These points correspond to the type IV defined by Bird (1938, 1946, 1988) in the cultural sequence he proposed for southern continental Patagonia, dated in ca. 3500 years BP (Fig. 7). This point type was considered by Bird as a spear point by its bigger size in comparison to type V and Ona ethnographic arrows. Several other studies using morphometric variables and performance expectations have estimated the use of type IV points like hand-throwing and thrusting spears (Banegas et al. 2014, Charlin and González-José 2012; Ratto 1994). In consequence, we might reject the "morphometric analogy" proposed by Bird in terms of size and morphological variables, but we are not able to refuse the functional analogy regarding the use of type V point as arrowheads. On the contrary, the analysis of a wider sample including type IV points shed light on Ona and type V overall design similarity against spear-like points, although reduction differences.

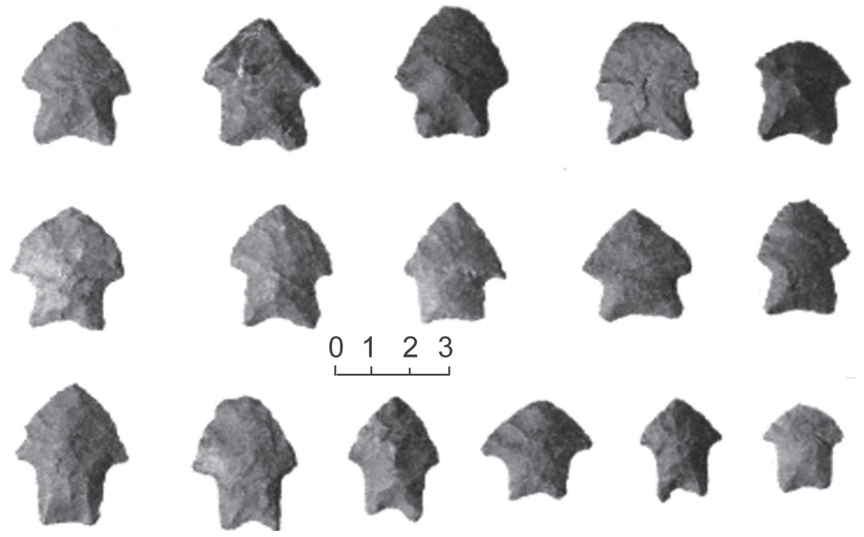

Fig. 7 Type IV projectile points according to Bird (from Pali Aike cave, Bird 1988)

Some general conclusions

The evolution of lithic technology in general, and weapon systems in particular show a different trajectory between the Isla Grande of Tierra del Fuego and southern continental Patagonia after the formation of the Magellan strait ca. 8000 years ago (Cardillo et al. 2015; Charlin et al. 2013). At that time, hunter-gatherer populations previously inhabiting the region were divided and isolated from each other by this marine channel (see Fig. 1), and a long-term process of cultural divergence started (Borrero 1989–1990). Beyond the studies on stone-tools reported here, several lines of evidence, such as rock art (Fiore 2006) and bioanthropological data (Cocilovo and Guichón 1985–1986; Béguelin and Barrientos 2006; González-José et al. 2004) have also found important cultural and biological differences between human populations at both sides of the Magellan strait, i.e. between Tierra del Fuego and southern mainland.

It is worth to pointing out here that the differences in shape and size between historical Ona arrows and type V archaeological projectile points do not invalidate the use of ethnographic samples to build functional models, as the comparison with spear-like points has clearly shown, but highlight the necessity to control reduction variations. Our approach indicates that reduction is an important factor responsible for most of this variation.

Our general research is aimed to recognizing the diagnostic morphometric attributes that characterize the points of different kind of weapons with the final goal to allow archaeologists to be able to distinguishing among them.

On the long-term we expect to generate a functional predictive model from both the study of ethnographic collections and the experimentation with replicated arrows and spears. A research project pursuing this goal is in progress with a National Agency of Scientific and Technological Promotion's funding of Argentina (PICT 2015 # 0411). It is the first step required to deepen our discussions on hunting strategies in different spaces and times throughout prehistory. This proposal involves the interplay among several disciplines (archaeology, ethnography, history, cultural studies, among others) to integrate the outcomes of distinct kinds of analyses into wider cultural discussions.

Acknowledgements

The survey of museum collections in Europe was founded by a CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina) fellowship. I want to thank Claudia Augustat and Clara Urban for their kind collaboration for the study of Fuegian collections at the Weltmuseum Wien and their friendly reception when I was staying in Vienna during my the fellowship (2013) and during my last visit in 2016. I would also like to thank to Gabriele Weiss and Gerard van Bussel for the access to the weapon collections from Australia, Melanesia and the Arctic.

Literature

Álvarez, M.

2009a "Diversidad tecnológica en el extremo sur de Patagonia: tendencias y continuidades en el diseño y uso de materiales líticos", in: Barberen, R., K. Borrazzo, and L.A. Borrero (eds.), *Perspectivas actuales en Arqueología Argentina*, Buenos Aires: Conicet-Imhicihu: 241–267.

2009b "Tendencias y cambios en las prácticas tecnológicas de los grupos cazadores recolectores del extremo sur sudamericano", in: Salemme, M., F. Santiago, M. Álvarez, E. Piana, M. Vázquez, and M. Mansu (eds.), *Arqueología de Patagonia: Una mirada desde el último confí*n, Ushuaia: Utopías: 19–33.

2011 "Puntas de arma del extremo sur de Patagonia: algunas consideraciones sobre diseño y contexto de uso", in: Martínez, J., and D. Bozzuto (eds.), *Armas prehispánicas: múltiples enfoques para su estudio en Sudamérica* , Buenos Aires: Fundación de Historia Natural Félix de Azara: 15–36.

Ames, E.

2008 *Carl Hagenbeck's. Empire of Entertainments*. Seattle and London: University of Washington Press.

Ames, K., K. Fuld and S. Davis

2010 Dart and arrow points on the Columbia Plateau of western North America. *American Antiquity*, 75(2): 287–325.

Báez, C. and P. Mason
2006 *Zoológicos humanos. Fotografías de fueguinos y mapuche en el Jardin d'Acclimatation de París, siglo XIX*. Santiago de Chile: Pehuén.

Banegas, A., J. Gómez Otero, S. Goye and N. Ratto
2014 *Cabezales líticos del Holoceno tardío en Patagonia meridional: Diseños y asignación funcional*. Magallania, 42(2): 155–174.

Bartram Jr., L. E.
1997 "A comparison of Kua (Botswana) and Hadza (Tanzania) bow and arrow hunting", in: Knetch H. (ed.), *Projectile Technology*, New York: Plenum Press: 321–344.

Beauvoir, J. M.
2005 [1915] *Aborígenes de la Patagonia. Los Onas: tradiciones, costumbres y lengua*. Buenos Aires: Ediciones Continente.

Béguelin, M. and G. Barrientos
2006 Variación morfométrica postcraneal en muestras tardías de restos humanos de Patagonia: una aproximación biogeográfica. *Intersecciones en Antropología*, 7: 49–62.

Binford, L.
1994 *En busca del pasado*. Barcelona: Crítica.

Binford, L.
2001 *Constructing frames of reference: analytical method and theory building using ethnographic and environmental data sets*. Berkeley: University of California Press.

Bird, J.
1938 Antiquity and migrations of the early inhabitants of Patagonia. *Geographical Review*, 28: 250–275.
1946 "The Archaeology of Patagonia", in: Steward, J. H. (ed.), *Handbook of South American Indians. The Marginal Tribes*, Washington: Smithsonian Institution, Bureau of American Ethnology: 17–24.
1988 *Travels and archaeology in South Chile*. Iowa City: University of Iowa Press.

Borrero, L. A.
1985 *La economía prehistórica de los habitantes del norte de la Isla Grande de Tierra del Fuego.* PhD dissertation, Universidad de Buenos Aires.
1989-1990 "Evolución cultural divergente en la Patagonia Austral", in: *Anales del Instituto de la Patagonia*, 19: 133–140.
2001 *Los Selk'nam (Onas). Evolución cultural en Tierra del Fuego*. Buenos Aires: Ed. Galerna-Búsqueda de Ayllu.

Borrero, L and F. Borella
2010 "Harpoons and travellers: Fuegian ethnographic collections and the recent archaeological record", in: *Before Farming*, 2010/1.

Bove, G.
2005 [1883] *Expedición a la Patagonia. Un viaje a las tierras y mares australes (1881–1882)*. Buenos Aires: Ediciones Continente.

Bridges, E. L.
2003 [1952] *El último confín de la tierra*. Buenos Aires: Emecé Editores.

Cocilovo, J. and R. Guichón
1985-1986 "Propuesta para el estudio de las poblaciones aborígenes del extremo austral de Patagonia", in: *Anales del Instituto de la Patagonia*, 16: 111–123.

Chapman, A.
1986 [1982] *Los Selk'nam. La vida de los Onas*. Buenos Aires: Emecé Editores.

Charlin, J. and R. González-José
2012 "Size and shape variation in Late Holocene projectile points of southern Patagonia. A geometric morphometric study", in: *American Antiquity*, 77(2): 221–242.
2017 "Testing an ethnographic analogy through geometric morphometrics: a comparison between ethnographic arrows and archaeological projectile points from Late Holocene Fuego-Patagonia", in: *Journal of Anthropological Archaeology*, under review.

Charlin, J., K. Borrazzo and M. Cardillo
2013 "Exploring size and shape variations in late Holocene projectile points from Northern and Southern coasts of Magellan Strait (South America)", in: *Djinjian, F.* and S. Robert (eds.), *Understanding Landscapes, from Land Discovery to their Spatial Organization*, Oxford: Archaeopress: 39–50.
2014 "Spatial Patterns in Late Holocene Lithic Projectile Point Technology of Tierra del Fuego (Southern South America): Assessing Size and Shape Changes", in: *World Archaeology*, 46(1): 78–100.

Charlin, J., C. Augustat and C. Urban
2016 "Metrical variability in ethnographic arrows from southernmost Patagonia: Comparing collections from Tierra del Fuego at European museums", in: *Journal of Anthropological Archaeology*, 41: 313–326.

Clarkson, C.
2016 "Testing archaeological approaches to determining past projectile delivery systems using ethnographic and experimental data", in: Iovită, R. and K. Sano (eds.), *Multidisciplinary approaches to the study of Stone Age weaponry*, Dordrecht: Springer: 189–201.

Cotterell, B. and J. Kamminga (eds.)
1990 "Projectiles", in: *Mechanics of pre-industrial technology*, Cambridge: Cambridge University Press: 160–188.

De Agostini, A.
2005 [1956] *Treinta años en Tierra del Fuego*. Buenos Aires: El Elefante Blanco.

Fitz Roy, R.
2009 [1839] *Viajes del Adventure y el Beagle*. Buenos Aires: Zagier & Urruty Publications.

González-José, R., N. Martínez-Abadías, S. van der Molen, C. García-Moro, S. Dahinten, and M. Hernández
2004 *Hipótesis acerca del poblamiento de Tierra del Fuego-Patagonia a partir del análisis genético-poblacional de la variación craneofacial*. Magallania, 32: 79–98.

Gusinde, M.
1982 [1931] *Los indios de Tierra del Fuego. Buenos Aires: Centro Argentino de Etnología Americana, Consejo Nacional de Investigaciones Científicas y Técnicas*.

Hildebrandt, W. and J. King
2012 "Distinguishing between darts and arrows in the archaeological record: Implications for technological change in the American west", in: *American Antiquity*, 77(4): 789–799.

Hitchcock, R. and P. Bleed
1997 "Each according to need and fashion: spear and arrow use among San hunters of the Kalahari", in: Knetch, H. (ed.), *Projectile Technology*, New York: Plenum Press: 345–370.

Hughes, S.
1998 "Getting to the Point: Evolutionary Change in Prehistoric Weaponry", in: *Journal of Archaeological Method and Theory*, 5: 345–408.

Hunzicker, D.
2008 "Folsom projectile technology: an experiment in design, effectiveness and efficiency", in: *Plains Anthropologist*, 53(207): 291–311.

Hutchings, W. K.
2011 "Measuring use-related fracture velocity in lithic armatures to identify spears, javelins, darts, and arrows", in: *Journal of Archaeological Science*, 38: 1737–1746.

Hyades, P. and J. Deniker
1891 "Anthropologie et ethnographie", in: Hyades, P. and J. Deniker (eds.), *Mission scientifique du Cap Horn, 1882–1883*, vol. VII., Paris: Gauthier-Villars et fils.

Iovita, R., H. Schönekes, S. Gaudzinski-Windheuser, and F. Jäger
2014 "Projectile impact fractures and launching mechanisms: results of a controlled ballistic experiment using replica Levallois points", in: *Journal of Archaeological Science*, 48(1): 73–83.

Lista, R.
1998 [1887] *Viaje al país de los Onas*. Buenos Aires: Editorial Confluencia.

Lothrop, S.
1928 *The Indians of Tierra del Fuego. Museum of the American Indians*. New York: Heye Foundation.

Martial, L.
2005 [1888] *Misión al Cabo de Hornos*. Buenos Aires: Zagier & Urruty Publications.

McCulloch, R., C. Clapperton, J. Rabassa and A. Currant
1997 "The natural Setting. The glacial and Post-Glacial environmental history of Fuego-Patagonia", in: *McEwan, C,* L.A. Borrero and A. Prieto (eds.), *Patagonia,* London: British Museum Press: 12–31

Orquera, L. A., and E. L Piana
1999 *Arqueología de la región del canal Beagle (Tierra del Fuego, Argentina)*. Buenos Aires: Sociedad Argentina de Antropología.
2009 "Sea Nomads of the Beagle Channel in Southernmost South America: Over Six Thousand Years of Coastal Adaptation and Stability", in: *The Journal of Island and Coastal Archaeology*, 4(1): 61–81.

Politis, G.
2007 *Nukak: Ethnoarchaeology of an Amazonian People*. Walnut Creek: Left Coast Press.

Ratto, N.
1991a "Análisis funcional de las puntas de proyectil líticas de sitios del sudeste de la isla grande de Tierra del Fuego", in: *Arqueología*, 1: 151–178.
1991b "Análisis funcional de las puntas de proyectil líticas del sitio Punta Maria 2 (Tierra del Fuego)", in: *Shincal*, 3(1): 171–177.
1992 "Técnicas de caza prehistóricas en ambientes de Patagonia (Tierra del Fuego, Argentina)", in: *Palimpsesto*, 1: 37–49.
1994 "Funcionalidad vs. adscripción cultural: cabezales líticos de la margen norte del estrecho de Magallanes", in: *Lanata, J. L.* and L. A. Borrero (eds.), *Arqueología de cazadores-recolectores. Límites, casos y aperturas*, Buenos Aires: Arqueología contemporánea 5, Special edition: 105–120.

Ratto, N.
2003 *Estrategias de Caza y Propiedades de Registro Arqueológico en la Puna de Chaschuil (Dpto. de Tinogasta, Catamarca, Argentina)*. PhD dissertation, Universidad de Buenos Aires. http://cambiocultural.homestead.com/ratto.html.

Revol, P.
1995 [1881] *Des Fuégiens en Europe. In: Cape Horn 1882–1883. Rencontre avec les indiens Yahgan. Collection de la photothèque du Musée de l'Homme.* Paris: Éditions de la Martinière, Muséum National d'Histoire Naturelle, Photothèque du Musée de l'Homme.

Rousson, H. and P. Willems
1893 *La Terre de Feu et ses habitants. In: Association française pour l'avancement des sciences. Compte rendu de la 21e session*. Seconde partie. Notes et extraits, Paris: 961–965.

Scheinsohn, V.
1990–1992 "El sistema de producción de los instrumentos óseos y el momento del contacto: Un puente sobre aguas turbulentas", in: *Relaciones*, XVIII: 121–138.

Sillar, B. and G. Joffré
2016 "Using the present to interpret the past: the role of ethnographic studies in Andean archaeology", in: *World Archaeology*, 48(5): 656–673.

Shott, M.
1993 "Spears, darts, and arrows: late Woodland hunting techniques in the upper Ohio valley", in: *American Antiquity*, 58(3): 425–443.
1997 "Stones and shafts redux: the metric discrimination of chipped-stone dart and arrow points", in: *American Antiquity*, 62: 86–101.
2005 "The Reduction Thesis and Its Discontents: Review of Australian Approaches", in: Clarkson, C. and L. Lamb (eds.), *Lithics 'Down Under': Australian Perspectives on Lithic Reduction, Use and Classification*, Oxford: Archaeopress: 109–125.

Thomas, D.
1978 "Arrowheads and atlatl darts: how the stones got the shaft", in: *American Antiquity*, 43(3): 461–472.

Torrence, R.
1993 "Ethnoarchaeology, museum collection and prehistoric exchange: obsidian-pointed artifacts from the Admiralty Islands", in: *World Archaeology*, 24(3): 467–481.
2002 "Obsidian-pointed spears and daggers: what can we learn from 130 years of museum collecting", in: Kauffman C., C. Kocher Schmid and S. Ohnemus (eds.), *Admiralty Islands art from the south seas*, Zurich: Museum Rietberg.

Walde, D.
2014 "Concerning the atlatl and the bow: further observations regarding arrow and dart points in the archaeological record", in: *American Antiquity*, 79 (1): 156–161.

Yesner, D., M. J. Figuerero Torres, R. Guichón and L. Borrero
1991 "Análisis de isótopos estables en esqueletos humanos: confirmación de patrones de subsistencia etnográficos para Tierra del Fuego", in: *Shincal*, 3(2): 182–191.

Yesner, D., M. J. Figuerero Torres, R. Guichón and L. Borrero
2003 "Stable isotope analysis of human bone and ethnohistoric subsistence patterns in Tierra del Fuego", in: *Journal of Anthropological Archaeology*, 22: 279–291.

Zangrando, A. F. J., M. Vázquez and A. Tessone
2011 *Los cazadores-recolectores del extremo oriental fueguino. Arqueología de Península Mitre e Isla de los Estados*. Buenos Aires: Sociedad Argentina de Antropología.