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landscapes: a comparative perspective

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HUNTER-GATHERER LAND USE STRATEGIES AND HAND STENCILS IN SOUTHERN PATAGONIA: A COMPARATIVE ANALYSIS OF THE STROBEL PLATEAU AND CARDIEL LAKE (ARGENTINA)

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Abstract

Southern Patagonia rock art is characterized by the presence of a large number of hand stencils with a wide distribution. The general aim of this paper is to contribute to the study of spatial trends in hand stencil production in this region and its relationship with different land use strategies carried out by hunter-gatherer groups. Here we explore the contribution that the study of this particular rock art motif may have to understanding the demography of the human groups that occupied the area. In particular, rock art from the Cardiel Lake low basin and the Strobel high plateau located in the province of Santa Cruz, Argentina, is analysed. Current research suggests that these two areas were occupied intensively and in a complementary way in the last 2,500 years (Late Holocene). While the Cardiel Lake basin would have been mainly used for residential purposes year-round, the Strobel Plateau occupations would have been logistic and seasonal. The results obtained make it possible to identify the greatest importance of hand stencils in the rock art of Cardiel basin. On the other hand, the participation of all age groups is evident in the production of this type of motif, both in the low basin and the Strobel Plateau. The latter fact complicates the previously proposed panorama and raises a new series of questions for archaeological research.

Keywords

Hunter-gatherers – rock art – hand stencils – age groups – Patagonia

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Introduction

The rock art of Southern Patagonia (between 44° and 51° South) is characterized by a large quantity of hand stencils, among other designs. This motif type has a wide distribution and has been documented in most research areas¹. It was produced from the initial occupations of Patagonia (ca. 10,000 years BP) until contact with populations of European descent (ca. 300 years BP)². This chronology has been established by different

¹ A. Acevedo, D. Fiore, N. Franco y M. Ocampo, "Arte y espacio. Estructuración de los repertorios de arte rupestre en los cañadones Yaten Guajen y El Lechuza (margen norte del río Santa Cruz, Patagonia, Argentina)", *Mundo de Antes* num 8 (2012–2014): 9-33, A. Acevedo, "Arte, composición visual y paisaje. Un estudio de la producción rupestre de los grupos cazadores-recolectores de la región Extremo Sur del Macizo del Deseado. Provincia de Santa Cruz, Argentina". Tesis de Doctorado en Universidad de Buenos Aires, Facultad de Filosofía y Letras, MS, 2017, C. A. Aschero, "El arte rupestre del lago Posadas", MS. (1995), C. A. Aschero, C. T., Bellelli, M. T., Civalero, S. L., Espinosa, R. A., Goñi, G., Guraieb, y R., Molinari, "Holocene Park: arqueología del Parque Nacional Perito Moreno", *Anales de Parques Nacionales: naturaleza y cultura* num XVII (2005): 71-119, G. A. Brook, N. V. Franco, A. Cherkinsky, A. Acevedo, D. Fiore, T. R. Pope y T. T. Salguero, "Pigments, binders, and ages of rock art at Viuda Quenzana, Santa Cruz, Patagonia (Argentina)", *Journal of Archaeological Science: Reports* num 21 (2018): 47-63, N. M. Carden, *Imágenes a través del tiempo. Arte rupestre y construcción social del paisaje en la Meseta Central de Santa Cruz*, (Buenos Aires: Sociedad Argentina de Antropología, 2008), N. M. Carden, L. L. Miotti, y R. Blanco, "Nuevos datos sobre las pinturas rupestres de Los Toldos (Santa Cruz, Argentina): bases para un enfoque comparativo en Patagonia Meridional", *Latin American Antiquity*, num 29, 2 (2018): 293-310, C. A. Gradín, "El arte rupestre de la cuenca del río Pinturas, Provincia de Santa Cruz, República Argentina", *Ars Praehistorica* num II (1983): 87-149, C. A. Gradín, "Caracterización de las tendencias estilísticas del arte rupestre de la Patagonia (Provincias de Río Negro, Chubut y Santa Cruz, República Argentina)", *Contribuciones al Estudio del Arte Rupestre Sudamericano 2* (La Paz, SIARB) (1988): 54-66, C. A. Gradín y A. Aguerre, "Arte rupestre del 'Área La Martita' Sección A del Departamento Magallanes, Provincia de Santa Cruz", *Relaciones de la Sociedad Argentina de Antropología* num XV (1983): 195-223, F. Guichón, "Redes de información durante el Holoceno medio y tardío en Patagonia meridional. Estudio de las representaciones rupestres en la Cuenca del Lago Cardiel y sur de la Meseta del Strobel" (Tesis de Doctorado, en Universidad de Buenos Aires, MS, 2018), O. Menghin, "Estilos de arte rupestre de Patagonia", *Actas Praehistoricas* num 1 (1957): 57-87, R. Paunero, *El arte rupestre milenario de Estancia La María (Meseta central de Santa Cruz)* (La Plata: Imprenta Grafitos, 2009), A. Re, "Representaciones rupestres en mesetas altas de la provincia de Santa Cruz. Circulación de información en espacios de uso estacional" (Tesis de doctorado, en Facultad de Filosofía y Letras, Universidad de Buenos Aires, MS, 2010), A. Re y J. B. Belardi, "Pinturas rupestres y comunicación en la cuenca de los lagos Tar y San Martín (provincia de Santa Cruz)", *Revista del Museo de Antropología* 12 (1) (2019): 73-84, A. Re, R. A. Goñi, J. Flores Coni, F. Guichón, J. M. Dellepiane y M. Umaño, "Arqueología de la meseta del Strobel (Patagonia meridional): 15 años después", *Relaciones de la Sociedad Argentina de Antropología XLII*: 1 (2017): 33-158, J. Schobinger y C. Gradín, *Arte rupestre de la Argentina. Cazadores de la Patagonia y agricultores andinos* (Madrid: Encuentro Ediciones, 1985), among others.

² A. Acevedo, *Arte, composición visual y paisaje...* 514, C. Aschero, "El arte rupestre del lago Posadas..."; N. M. Carden, *Imágenes a través del tiempo...*; C. J. Gradín, "Las pinturas de la Cueva Grande (Arroyo Feo), área Río Pinturas, Provincia de Santa Cruz", *Relaciones de la Sociedad Argentina de Antropología* num XIV 2 (1981-82): 241-265; C. A. Gradín, *El arte rupestre de la cuenca...* 87-149, C. A. Gradín, *Caracterización de las tendencias estilísticas...*, 54-66; F. Guichón, *Redes de información...*; O. Menghin, "Las pinturas rupestres de la Patagonia", *RUNA* num V (1952): 5-22, O. Menghin, *Estilos de arte rupestre de Patagonia...* 57-87; R. Paunero, *El arte rupestre milenario de Estancia La María...*; A. Re, *Representaciones rupestres en mesetas altas...*; A. Re et al., *Arqueología de la meseta...* 33-158; J. Schobinger y C. Gradín, *Arte rupestre de la Argentina*.

researchers largely by relative means and by association with dated archaeological deposits. Hand stencils have been mainly located in regions between 200 and 900 masl. Although this motif type has been found in different contexts, its higher frequencies are associated to archaeological sites with evidence of domestic activities³.

Hand stencils are one of the archaeological research lines which allow us to generate knowledge about the composition of human groups in the past.

Given the use of the stencil technique, the analysis of hands sizes and shapes involve the potential to make inferences about the sex and age of its producers. Research in different areas of Southern Patagonia has been carried out regarding this issue. Positive results have been summarized, as well as some difficulties⁴.

In this paper we analyse hand stencil production in the Cardiel Lake low basin and on the Strobel high plateau (Central-Western Santa Cruz province, Argentina) (Figure 1).

The information is used to discuss different land use strategies carried out by hunter-gatherer groups in the last 6,000 years and –mainly- the last 2,500 years (Middle and Late Holocene).

³ A. Agnolin y F. Guichón, "Tecnología y representaciones rupestres en la cuenca del lago Cardiel: El caso de la meseta Cascajosa (centro oeste de Santa Cruz)". En J. Gómez Otero, A. Svoboda y A. Banegas (eds.), *Arqueología de Patagonia: El Pasado en las arenas* (Puerto Madryn: CENPAT, 2019), 647-660, C. Aschero "El arte rupestre del lago..."; N. M. Carden, *Imágenes a través del tiempo* 2008; C. A. Gradín, *El arte rupestre de la cuenca...*, 1983, 87-149; C. A. Gradín y A. Aguerre, *Arte rupestre del "Área La Martita"...* 195-223; F. Guichón, *Redes de información...*; J. Schobinger y C. Gradín, *Arte rupestre de la Argentina...*

⁴ C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; N. Carden y R. Blanco, "Measurements and Replications of hand Stencils: a Methodological Approach for the Estimation of the individual's' age and sex". En R. G. Bednarik, D. Fiore, M. Basile, T. Huisheng y G. Kumar (eds.), *Paleoart and Materiality. The science study of rock art* (Oxford: Archaeopress Archaeology, 2016), 126-145.

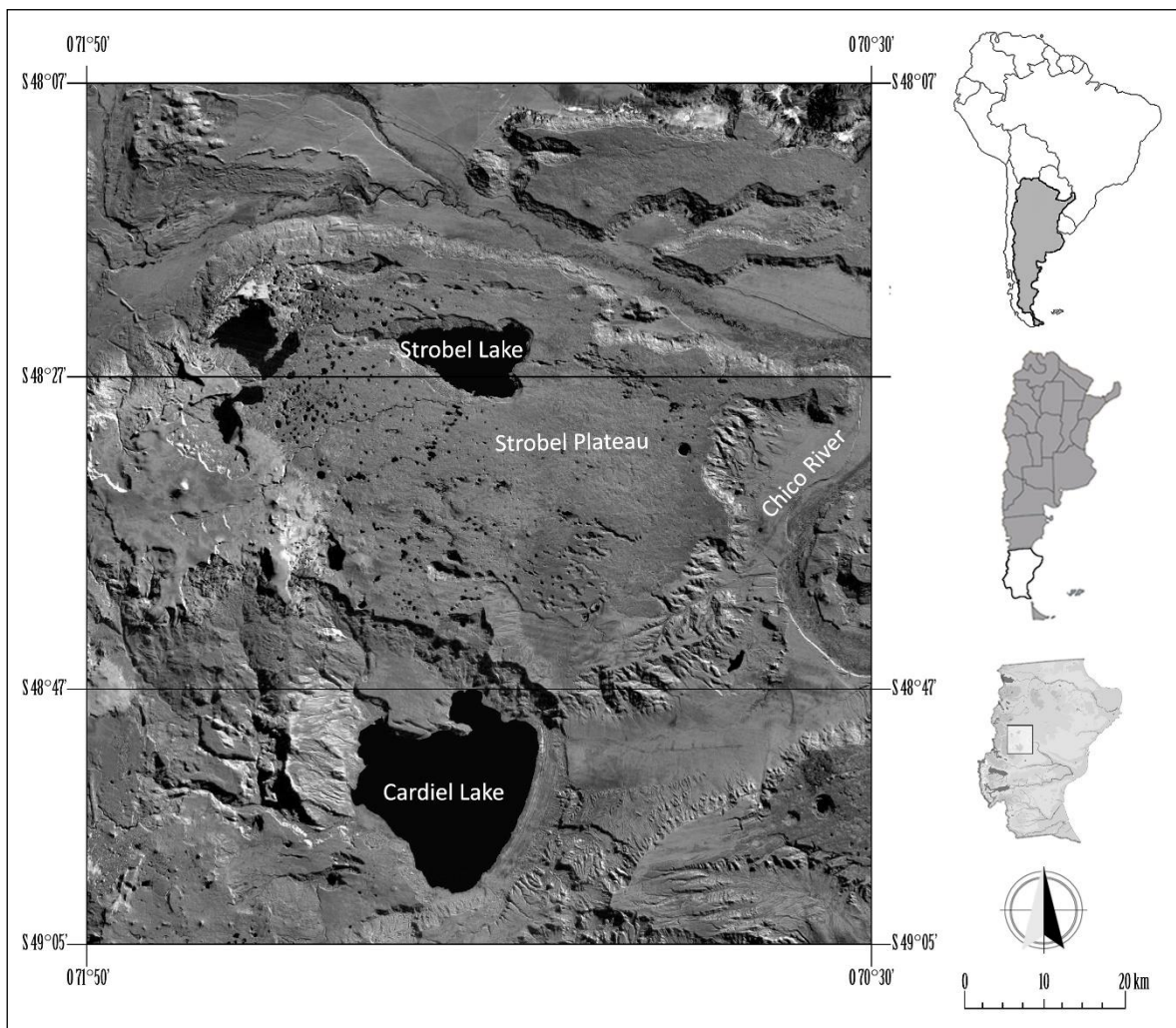


Figure 1
Cardiel Lake and Strobel Plateau location
(Southern Patagonia, Argentina)

An archaeological model was outlined for the region under study which proposes a residential use of low areas in contrast with a logistic use of high spaces in the Late Holocene⁵. In accordance with this model, as well as ethnohistoric and archaeological data already available, in this paper we propose two hypotheses related to the production of hand stencils in the study area. Different variables are examined in a two-step analysis. Firstly, the frequency and distribution of all hand stencils are presented comparing the low lake basin and the high plateau. The available sample of this motif type includes more than 700 paintings located in 31 sites. The second step is to consider the representation of

⁵ R. A. Goñi, "Cambio Climático y poblamiento humano durante el Holoceno tardío en Patagonia meridional. Una perspectiva arqueológica" (Tesis doctoral, Universidad de Buenos Aires, MS, 2010); R. A. Goñi, G. Barrientos y G. Cassiodoro, "Condiciones previas a la extinción de las poblaciones humanas del sur de Patagonia: una discusión a partir del análisis del registro arqueológico de la cuenca del lago Salitroso", Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano num 19 (2000-2002): 249-266; R. A. Goñi et al., "Climate changes, human peopling and regional differentiation during Late Holocene in Patagonia", Quaternary International num 30 (2018): 1-17, among others.

different age groups inferred from three complementary hand measures. The data partially supports previous research but also shows a more complex scenario. Thus, the importance of rock art studies to understanding land use strategies and population dynamics is highlighted.

1. The region and its environment

The region under study includes two areas located in Central-Western Santa Cruz province, Southern Patagonia (Argentina): the Cardiel Lake basin and the Strobel Plateau (Figure 1). The region stretches from the Chico River in the North to the Siberia Plateau in the South, thus having a North-South extension of 90 km, and measuring 60 km in East-West direction. It has important altitudinal differences which vary between 300 masl and 1,200 masl and define two environments: lowlands between 300 and 500 masl (Cardiel Lake basin) and highlands between 700 and 1,200 masl (Strobel Plateau).

The region is characterized by a semi-desertic climate⁶ with prevalence of a steppe environment (shrub and grass steppe). The guanaco (*Lama guanicoe*), an ungulate of up to 150 kg, is the only large mammal in this environment and consequently was the most important animal resource for hunting populations in the past. Other species like grey foxes (*Pseudalopex griseus*), red foxes (*Pseudalopex culpaeus*) and pumas (*Felis concolor*) can be found in the steppe, along with dwarf armadillos (*Zaedyus pichiy*) and numerous rodents. There is also a wide variety of birds, among which the choique (*Pterocnemia pennata*), a flightless bird, stands out given its size (15-25 kg).

One of the main characteristics of the region is the heterogeneous distribution of water resources. Given its dry climate, spaces with permanent fresh water available all year-round are restricted to river valleys, lake basins and wetlands. Also noteworthy, due to its high latitude, is the strong seasonality exhibited by the region that affects highlands and lowlands differentially. While lowlands present more benign conditions all year round, highlands are covered with snow during winter. Conversely, during spring and summer the high plateau has a wider distribution of water (600 to 1200 lagoons depending on the year⁷). This impacts on the vegetation and the behaviour of animals, in particular, the guanaco that migrates according to the season.

According to paleoclimatic studies, the present landscape of the region is related to several processes established during the Late Holocene (last 2,500 years). Changes in winds direction and intensity, the so-called Southern Westerlies, were recorded from 6,000 years BP and particularly after 1,800 years BP⁸. Consequently, fluctuations in the distribution of hydric resources in space, as well as decreasing humidity, have taken place in the last 2,500 years BP⁹ on a regional scale (*sensu* Dincauze¹⁰). In this context, epic

⁶ J. M. Paruelo, M. R. Aguilar, R. A. Golliscio y R. J. León, "La Patagonia extrandina: análisis de la estructura y el funcionamiento de la vegetación a distintas escalas" (Tesis Doctoral Dissertation, Asociación Argentina de Ecología, 1992).

⁷ J. L. Lancelotti, "Caracterización limnológica de lagunas de la Provincia de Santa Cruz y efectos de la introducción de Trucha Arco iris (*Oncorhynchus mykiss*) sobre las comunidades receptoras" (Tesis Doctoral, Universidad Nacional del Comahue, MS, 2009).

⁸ A. Gilli, F. S. Anselmetti, D. Ariztegui, J. Bradbury, K. Kelts, V. Markgraf y J. MacKenzie, "Tracking abrupt climate change in the Southern Hemisphere: a seismic stratigraphic study of Lago Cardiel, Argentina (49°S)", *Terra Nova* num 13 Vol: 6 (2001): 443-448.

⁹ D. Ariztegui et al., "Lake-level changes in central Patagonia (Argentina): crossing environmental thresholds for Lateglacial and Holocene human occupation", *Journal of Quaternary Science* num

droughts *circa* 900 years BP were recorded and related to the global-scale episode known as Mediaeval Climatic Anomaly (MCA)¹¹.

The decrease in humidity caused descents in lake levels such as the Cardiel Lake¹². Therefore, this process made new spaces available in this area, which was gradually colonized by shrub steppe species, such as the molle (*Schinus molle*) and the calafate (*Berberis microphylla*). These environmental changes provided the scenario for hunter-gatherer settlement during the Late Holocene.

2. Archaeological model and previous research

Based on the described environmental and paleoclimatic conditions, in previous papers a peopling model for Central-Western Santa Cruz province was proposed¹³. This model suggests important changes in peopling dynamics related to climatic changes recorded for the Late Holocene which affected the environment and the space availability in the research area.

25, 7 (2010): 1092-1099; D. Ariztegui, A. Gilli, F. S. Anselmetti y V. Markgraf. "Limnogeología del Lago Cardiel y la reconstrucción de cambios ambientales desde el Pleistoceno tardío". En R. A. Goñi, J. B. Belardi, G. Cassiodoro y A. Re (eds.), *Arqueología de las cuencas de los lagos Cardiel y Strobel* (Buenos Aires: Aspha ediciones, 2014), 31-40; A. Gilli et al., Tracking abrupt climate change, 443-448; A. Gilli et al., "Seismic stratigraphy, buried beach ridges and contourite drifts: the Late Quaternary history of the Closed Lago Cardiel basin, Argentina (49°S)", *Sedimentology* num 52 (2005): 1-23; M. A. González, "Paleoambientes del Pleistoceno Tardío/Holoceno Temprano en la cuenca de los lagos Belgrano y Burmeister (47°40/48' Sur, 72° 30' Oeste, Santa Cruz)", *Fundación Carl C. Zon Caldenius Informe Técnico: N°9* (1992): 1-7; L. Horta y C. A. Aschero, "Evidencias de un paleolago Pleistoceno tardío-Holoceno temprano en el área del lago Pueyrredón, noroeste de la provincia de Santa Cruz". En R. Bárcena y H. Chiavazza (eds.), *Arqueología Argentina en el Bicentenario de la Revolución de Mayo, XVII Congreso Nacional de Arqueología Argentina* (Mendoza: UNCuyo-CONICET, 2010) 1929-1934; L. Horta et al., "Paleogeographic and paleoenvironmental variations in the Pueyrredón, Posadas and Salitrosos lakes, Santa Cruz Province, Argentina, during the Holocene and its relationship with occupation dynamics", *Paleogeography, Paleoclimatology, Paleoecology* num 436 Vol:8 (2016): 541-562; L. Horta et al., "Paleolacustrine records from Late Pleistocene – Holocene in the Perito Moreno National Park, Argentinian Patagonian Andes", *Quaternary International* num 436 (2017): 8-15; V. Markgraf et al., "Holocene paleoclimates of Southern Patagonia: limnological and environmental history of Lago Cardiel, Argentina", *The Holocene* num 13 Vol: 4 (2003): 581-591; J. Quade y M. R. Kaplan, "Lake-level stratigraphy and geochronology revisited at Lago (Lake) Cardiel, Argentina, and changes in the Southern Hemispheric Westerlies over the last 25 ka", *Quaternary Science Reviews* num 177 (2017): 173-188; S. Stine y M. Stine, "A record from Lake Cardiel of climate change in southern South America", *Nature* num 345 (1990): 705-708, among others.

¹⁰ D. Dincauze, *Environmental Archaeology, Principles and Practice* (Cambridge: Cambridge University Press, 2000).

¹¹ S. Stine y M. Stine, *A record from...* 705-708.

¹² D. Ariztegui et al., *Limnogeología del Lago Cardiel...* 31-40; A. Gilli et al., *Seismic stratigraphy...* 1-23; S. Stine y M. Stine, *A record from...* 705-708; S. Stine, "Extreme and persistent drought in California and Patagonia during mediaeval time", *Nature* num 369 (1994): 546-549; V. Markgraf et al., *Holocene paleoclimates of Southern Patagonia...* 581-591.

¹³ R. A. Goñi, "Fechados radiocarbónicos y registro arqueológico en la cuenca de los lagos Salitroso/Posadas (Santa Cruz)", *Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano* num 19 (2000-2002): 666-668; R. A. Goñi, *Cambio Climático y poblamiento humano...*, 2010; R. A. Goñi et al., *Climate changes, human peopling...* 1-17, among others.

Firstly, a strong reduction in residential mobility reaching its critical point during and after the MCA was proposed¹⁴. Low basins make possible more stable camps due to their resource availability year-round (water, firewood, plants and animals) becoming optimal places for residential purposes. These characteristics, together with spatial constraints originated by the new arid conditions, derived in higher concentrations of populations in areas like Cardiel Lake⁶.

The model also suggests the extension of the action ranges of the human populations. In this context logistic and seasonal mobility increased as a way of dealing with resources differentially distributed in time and space. Thus, an extensification strategy (*sensu* Binford¹⁵) was established to allow the complementary use of different environments. In this process, the high plateaus, such as the Strobel Plateau, were fully incorporated into the mobility range of hunter-gatherers.

Throughout more than 30 years of research in Central-Western Santa Cruz province, a large number of radiocarbon dates show occupations between 6,000 years BP and modern times and mostly in the last 2,500 years¹⁶. The observed patterns in the archaeological record of lowlands differ from those seen in the highlands and support the outlined model of complementary used spaces during the Late Holocene¹⁷.

Fifty-eight archaeological sites have been recorded in the Cardiel Lake basin, 22 of which have rock art¹⁸. These sites are generally sandstone rockshelters of different sizes, along with a few examples of basalt rockwalls. A total of 1,264 motifs was recorded. Most of them are paintings (95%) with a low frequency of engravings (5%). While the sandstone rockshelters present only paintings, rockwalls have motifs produced by both techniques. The variability of motifs is low with a predominance of hand stencils (Figure 2). It has been suggested that Cardiel Lake rock art and specifically hand stencils have been produced since at least 6,000 years BP, with a strong increase over the last 2,500 years¹⁹. This chronology has been proposed through the analysis of superimpositions and differential fading in conjunction with available radiocarbon dates in several archaeological sites.

¹⁴ R. A. Goñi et al., Climate changes, human peopling... 1-17.

¹⁵ L. R. Binford, *Constructing Frames of Reference. An Analytical Method for Archaeological Theory Building Using Ethnographic and Environmental Data Sets* (Berkeley: University of California Press 2001).

¹⁶ R. A. Goñi et al., "Registro arqueológico y cronología de las ocupaciones cazadoras recolectoras en la cuenca del Lago Cardiel". En R. A. Goñi, J. B. Belardi, G. Cassiodoro, A. Re (eds), *Arqueología de las cuencas de los Lagos Cardiel y Strobel. Poblamiento humano y paleoambientes en Patagonia* (Buenos Aires: Editorial Aspha, 2014a), 135-154; A. Re et al., *Arqueología de la meseta...* 33-158.

¹⁷ R. A. Goñi et al., Climate changes, human peopling... 1-17; G. Cassiodoro et al., "Arqueología del Holoceno medio y tardío en Patagonia meridional: Poblamiento Humano y fluctuaciones climáticas", *Diálogo andino* num 41(2013): 5-23.

¹⁸ A. Agnolin y F. Guichón, *Tecnología y representaciones rupestres...* 647-660; F. Guichón, "Representaciones rupestres en los cañadones de la cuenca del lago Cardiel: Alero del León y sitios aledaños (Santa Cruz)". En F. Mena (ed.), *Arqueología de la Patagonia: de mar a mar* (Santiago de Chile 2016: Ediciones CIEP/Ñire Negro, 2017), 450-459; F. Guichón, *Redes de información...*; A. Re et al., "Las representaciones rupestres de la cuenca del lago Cardiel". En R. A. Goñi, J. B. Belardi, G. Cassiodoro, A. Re (eds.), *Arqueología de las cuencas de los lagos Cardiel y Strobel. Poblamiento humano y paleoambientes en Patagonia* (Buenos Aires: Aspha ediciones, 2014), 136-154.

¹⁹ F. Guichón, *Redes de información...*; Re et al., *Las representaciones rupestres...* 136-154.

Thus, the temporal trend was established by relative means and could be improved in the future.

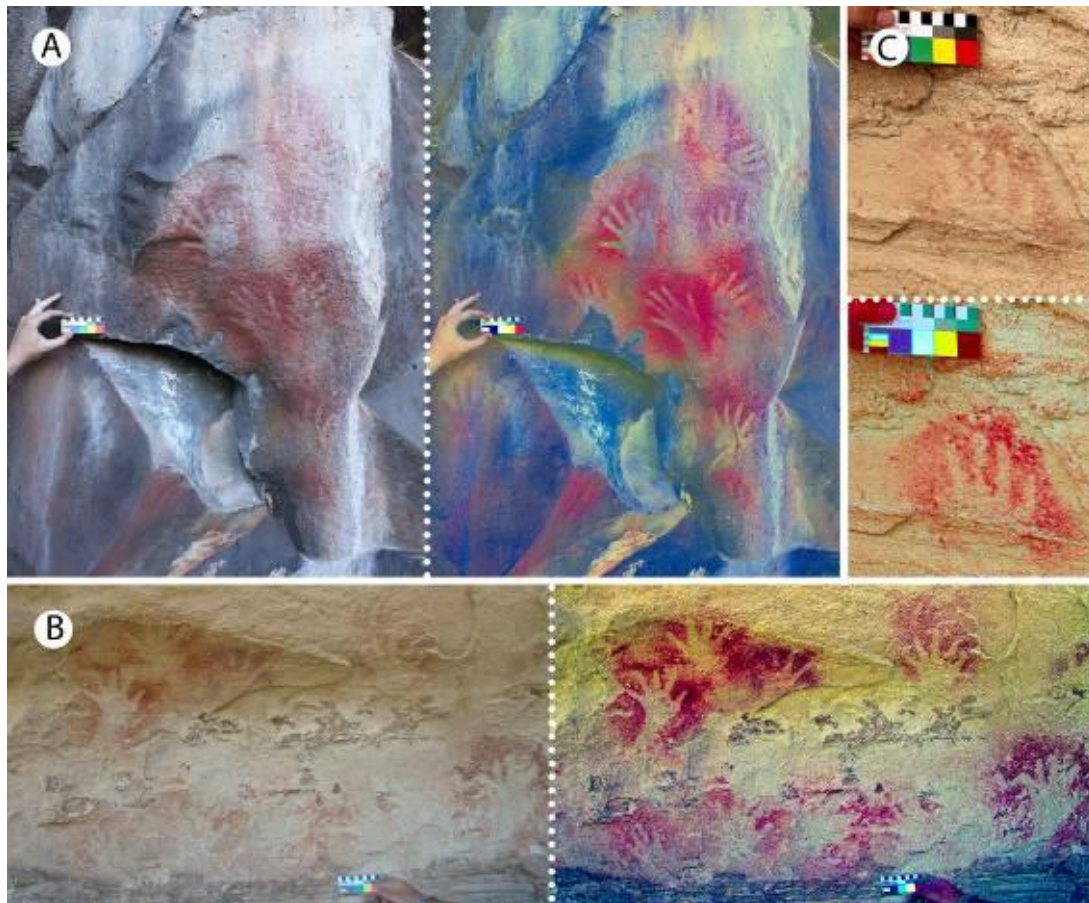


Figure 2

Hand stencils from different sites in the Cardiel Lake basin. A. Hand stencils from Gerasin 1 (basalt rock wall); B. Hand stencils from C1 - Alero 1 (sandstone rock shelter); C. Small hand stencil from C3 – Alero del Frente (sandstone rock shelter)

On the other hand, research on the Strobel Lake Plateau made possible to record 264 archaeological sites, 105 of which present rock art²⁰. In these sites, there are approximately 12,000 motifs mostly made by engraving and, in a very low proportion, painting (*circa* 1%). They are located mainly on basalt rockwalls associated with lagoons and present a great variety of motif types with a predominance of abstract and zoomorphic motifs. Hand stencils were also recorded in the repertoire of the Strobel Plateau in the same sites as engravings (Figure 3) and will be later analysed in this paper. The production of this highland's rock art was related to different periods, from the initial occupation of this higher altitude space around 5,000 years BP to contact with populations of European descent in the 18th century²¹. An increase in the production of rock art motifs

²⁰ Re et al., *Arqueología de la meseta...* 33-158; Re et al., "Los puntos clave para la comunicación por medios materiales: Estudios de sitios con alta densidad de representaciones rupestres en la meseta del Strobel (Santa Cruz)". En *Libro de Resúmenes del XX Congreso Nacional de Arqueología Argentina* (Córdoba: Universidad Nacional de Córdoba, 2019), 252-254.

²¹ J. B. Belardi y R. A. Goñi, "Representaciones rupestres y convergencia poblacional durante momentos tardíos en Santa Cruz (Patagonia Argentina). El caso de la meseta del Strobel". En D.

during the last 2,500 years BP has been suggested. In particular paintings would have started to be executed during this period. In this area the rock art chronology was also determined through relative indicators, such as superimpositions, engravings' patina, paintings' fading, diagnostic morphologies and association with radiocarbon dates in nearby deposits.

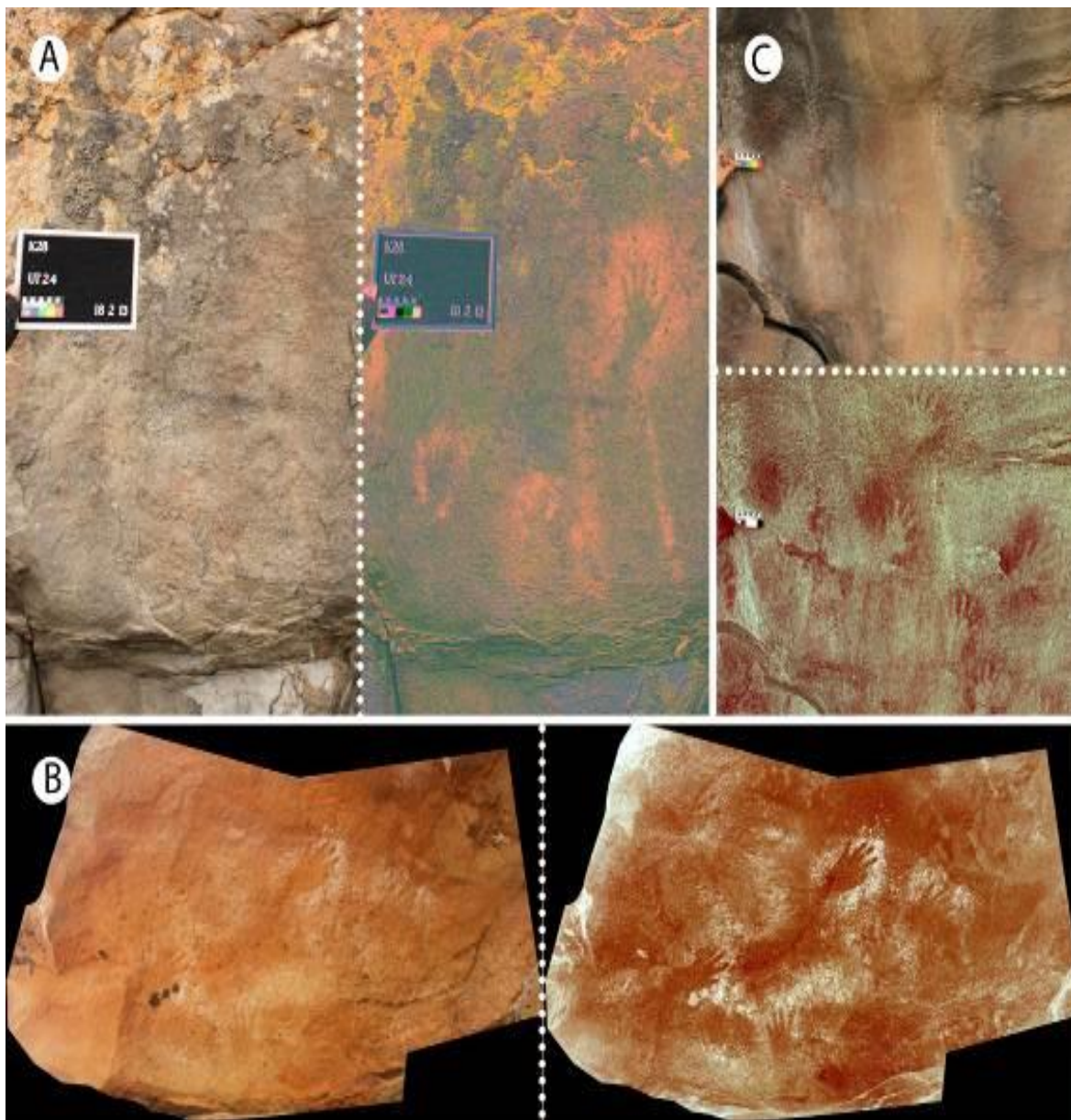


Figure 3

Hand stencils from different sites on the Strobel Plateau. A. Hand stencils from K28-Don Edmundo; B. Hand stencils from K24 – Laguna Los Negros; C. Hand stencils from K47 – La Nativa

Fiore y M. M. Podestá (eds.), *Tramas en la Piedra* (Buenos Aires: WAC, SAA y AINA, 2006), 85-94; F. Guichón, *Redes de información...*; F. Guichón, *Representaciones rupestres...*, 2017, 450-459; A. Re, *Representaciones rupestres en mesetas altas...*; A. Re et al., *Arqueología de la meseta...* 33-158.

The rock art of the Cardiel Lake basin and the Strobel Lake Plateau has been compared in previous works²². The chronology of this line of evidence, established by relative means, is coherent in both spaces, supporting the complementary use already suggested by other lines of evidence. On the other hand, the different frequency and variety of motifs has been interpreted as the circulation of diverse types of information in each of them and the greater hierarchy of the plateau in terms of communication by material means. This data has been used to suggest a population convergence on the Strobel Plateau during the Late Holocene²³. This convergence would have entailed the seasonal use of this highland by human groups from different areas, though not necessarily simultaneously. Therefore, the information from rock art has already been integrated with the population model proposed for the region. This paper attempts to deepen this integration and contribute to the discussion of demographic aspects based on the study of a particular motif type: hand stencils.

3. Premises and hypotheses

This paper seeks to link the study of hand stencils with the dynamics of space use implemented by human groups, within the framework of the previously summarized population model. In the following, we present information from different sources that will allow us to propose two hypotheses, which will be contrasted through the analysis of hand stencils.

Thanks to previous archaeological research in Southern Patagonia, the presence of hand stencils has been identified in a great variety of regions with altitudes ranging mostly between 200 and 900 masl. The highest frequencies have been recorded in lower regions such as river valleys or lake basins, spaces that were generally associated with domestic activities, although they present very diverse characteristics²⁴.

For the purposes of this paper, it is relevant to delve into the age composition of the human groups that inhabited the two areas under study. In hunter-gatherer ethnographic studies – available worldwide– it is common to identify the existence of task group division²⁵. These show that adult and adolescent males were generally in charge of

²² L. Ferraro y R. Molinari, “¡Último momento! El arte de los cazadores-recolectores recorre el lago Cardiel y se dirige al Strobel”. En F. Oliva, N. de Grandis, J. Rodríguez (eds.), *Arqueología Argentina en los Inicios de un Nuevo Siglo*. Publicación del XIV Congreso Nacional de Arqueología Argentina (Rosario: Centro Estudios Arqueológicos - Facultad de Humanidades y Artes-Universidad Nacional de Rosario, 2010), 523-534, F. Guichón, *Redes de información...*; A. Re et al., *Las representaciones rupestres...* 136-154.

²³ J. B. Belardi y R. A. Goñi, *Representaciones rupestres y convergencia poblacional...* 85-94: A. Re, *Representaciones rupestres en mesetas altas...*

²⁴ A. Acevedo et al., “Arte y espacio...” 9-33; C. Aschero, “El arte rupestre del lago...”, 1995; C. Aschero et al., *Holocene Park...* 71-119; N. M. Carden, L. L. Miotti, y R. Blanco, *Nuevos datos sobre...* 293-310; C. A. Gradín, *El arte rupestre de la cuenca...* 87-149; F. Guichón, *Redes de información...*; A. Re y J. B. Belardi, *Pinturas rupestres y comunicación...* 73-84; among others.

²⁵ R. Bliege Bird y D. F. Codding, “The sexual Division of Labor”. En R. Scott y S. Kosslyn (eds.), *Emerging trends in Social and Behavioral Sciences* (New Jersey: John Wiley y Sons Inc, 2015), 1-16; M. Guvern y K. Hill, “Why do men hunt? A reevaluation of “man the hunter” and sexual division of labor”, *Current Anthropology* num 50 Vol: 1 (2009): 51-74; C. Stiner y S. L. Khun, “Paleolithic Diet and the Division of Labor in Mediterranean Eurasia”. En J. Hublin y M. P. Richards (eds.), *The Evolution of Hominin Diets: Integrating Approaches to the Study of Palaeolithic Subsistence*. (Dordrecht: Springer Science + Business Media BV, 2009), 157–169; N. M. Waguespack, “The

activities related to obtaining major prey. Although this issue is subject to great debate in recent research about sexual division of labour, different authors have constructed theoretical models which involve the almost exclusive participation of adult men in logistic task groups related to hunting activities²⁶.

Also, the chronicles of 18th and 19th century European travellers who visited Southern Patagonia indicate the existence of this division in the daily activities of the local hunter-gatherer groups that inhabited the region²⁷. Thus, these travellers pointed out the existence of male hunting parties in charge of obtaining large prey (guanaco and choique), comprised by adult men and teenagers.

Therefore, the population model, along with the ethnographic and ethno-historical information, enables us to suggest that human groups which moved across spaces of logistic use, such as the Strobel Plateau, would have been composed mostly of adolescent and adult men, while the lower basins, on the other hand, would have been inhabited by the entire family group. It should be noted that bioarchaeological information is available for a low basin, located 80 km north of the study area (the Salitroso Lake basin), that partially supports these ideas. A formal burial area with over 90 individuals in 37 burial structures²⁸, was detected in this area. Available radiocarbon dates placed this record in the last 2,500 years, with an emphasis after 900 years BP²⁹. The constructed mortality profile for the Salitroso Lake sample allowed the identification of female and male

organization of male and female labor in foraging societies: Implications for early Paleoindian archaeology”, *American Anthropologist* num 107 Vol: 4 (2005): 666-676.

²⁶ L. R. Binford, L. R., “Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation”, *American antiquity* num 45 (1980): 4-20; L. R. Binford, “The archaeology of place”, *Journal of Anthropological Archaeology* num 1 (1982): 5-31; L. R. Binford, *Constructing Frames of Reference*, P. Halstead y J. O’Shea, *Bad year economics: cultural responses to risk and invertainty* (Cambridge: Cambridge University Press, 2004); R. L. Kelly, *The Foraging Spectrum. Diversity in Hunter-Gatherer Lifeways* (Washington: Smithsonian Institution Press, 1995); R. L. Kelly, “Elements of Behavioral Ecological Paradigm for the Study of Prehistoric Hunter – Gatherers”. En M. Schiffer (ed.), *Social Theory in Archaeology*. (Salt Lake City: Foundations of Archaeological Inquiry, The University of Utah Press, 2000), 64-82; R R. B. Lee y I. De Vore, *Man the Hunter* (Chicago: Publishing Company, 1968); J. F. O’Connell, K. Hawkes y N. Blurton Jones, “Patterns in the Distribution, Site Structure and Assemblage Composition of Hadza Kill-Butchering Sites”, *Journal of Archaeological Science* num 19 (1992): 319-345.

²⁷ B. F. Bourne, *Cautivo en la Patagonia* (Buenos Aires: Emecé, 1998 [1948-1949]); F. P. Moreno, *Exploración de la Patagonia sur II. El Lago Argentino y los Andes meridionales (1877)* (Buenos Aires: Ediciones Continente, 2007); C. Moyano, *Capitán de Navío Retirado. Viajes de exploración a la Patagonia (1877-1890)* (Buenos Aires: Imprenta Mercatali, 1931); G. C. Musters, *Vida entre los patagones. Un año de excursiones por tierras no frecuentadas, desde el Estrecho de Magallanes hasta el Río Negro* (Buenos Aires: Ediciones El Elefante Blanco, 1997 [1869-1870]); C. Onelli, *Trepando los Andes. Un naturalista en la Patagonia Argentina (1903)*. (Buenos Aires: Editorial Continente, 2007); A. Pigafetta, *Primer viaje alrededor del Globo* (Barcelona: Ediciones Orbis S.A., 1986).

²⁸ S. García Guraieb, R. A. Goni y A. Tessone, “Paleodemography of Late Holocene hunter-gatherers from Patagonia (Santa Cruz, Argentina): An approach using multiple archaeological and bioarchaeological indicators”, *Quaternary international* num 356 (2015): 147-158; S. García Guraieb, “Bioarqueología de cazadores-recolectores del Holoceno tardío de la cuenca del lago Salitroso (Santa Cruz): aspectos paleopatológicos y paleodemográficos” (Tesis de doctorado, Universidad de Buenos Aires, MS, 2010).

²⁹ S. García Guraieb, R. A. Goni y A. Tessone, *Paleodemography of Late Holocene...* 147-158; S. García Guraieb, R. Goñi y R. Guichón Fernández, “Aporte a la cronología de chenques tardíos del lago Salitroso (Santa Cruz, Argentina)”, *Revista Arqueología* num 24 (2018): 271-280.

individuals. Their age estimations range from subadults to people over 50 years old³⁰. The distribution of the sex-age structure of the skeletal sample from the Salitroso basin is consistent with the idea of residential use of the lower basins, in which the entire family group was present.

Regarding rock art images, the summarized information enables us to suggest that the importance of the production of hand stencils and the age groups which participated will vary according to the different land use strategies carried out by hunter-gatherer groups. Therefore, we evaluate two hypotheses in this article, one for each area under study. In the Cardiel Lake basin, where a residential use has been proposed, we expect that the production of hand stencils would have had a greater importance and all age groups would have participated. On the Strobel plateau, an area related to logistic and/or seasonal use, the execution of hand stencils would have a lesser importance and only adults and adolescents participated in its production.

4. Methodology

Several variables are considered to evaluate the proposed hypotheses in a two-step analysis. The first stage involves the discussion of data about the frequency and spatial distribution of hand stencils in the region under study. The number of sites with this motif type and the amount of hand stencils are compared between the Cardiel Lake basin and the Strobel Plateau. Also, the relative percentage of this motif against all others is presented.

The second stage involves the identification of different age groups by measuring hand sizes. The measurement of rock art motifs has been considered by several authors as a useful variable to characterize this record. As a descriptive tool, the size of a motif enables the recognition of significant differences for the classification of designs, the identification of the instruments used in its creation, the evaluation of the intensity of use of a given panel, the detection of motifs with uncommon characteristics, among other uses³¹. In this regard, hand stencil and hand print measurements have been utilized by a number of rock art researchers around the world to investigate the age and sex of its producers³².

³⁰ S. García Guraieb, R. A. Goni y A. Tessone, Paleodemography of Late Holocene... 147-158; S. García Guraieb, Bioarqueología de cazadores-recolectores...

³¹ M. Alvarez y D. Fiore, "Recreando imágenes: diseño de experimentación acerca de las técnicas y los artefactos área para realizar grabados con arte rupestre", Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano num 16 (1995): 215-239; D. Fiore, "The economic side of rock art: concept on the production of visual images", Rock Art Research num 24 Vol: 2 (2007): 238-259; F. Guichón, "Representaciones rupestres del sector norte de la meseta del Strobel: escalas espaciales y tendencias temporales" (Tesis de licenciatura, Universidad Nacional del Centro de la Prov. Bs. As., 2012); M. M. Podestá et al., "Arte rupestre de los pasos cordilleranos del bosque andino patagónico (El Manso, Región de los Lagos y Provincia de Río Negro, Chile-Argentina)", Magallania num 36 Vol: 2 (2008): 143-153; A. Re, "Grabados de guanacos en la Patagonia austral", Intersecciones en Antropología num 18 Vol: 2 (2017): 135-147; A. Re y F. Guichón, "Desenredando líneas. Variabilidad en grabados abstractos de Patagonia meridional". En F. Oliva, A. Rocchietti y F. Solomita Banfi (eds.), Imágenes rupestres: lugares y regiones. (Rosario: Universidad Nacional de Rosario, 2016), 537-546.

³² R. G. Bednarik, "Children as Pleistocene artists", Rock art Research num 25 Vol: 2 (2008): 173-182; R. Blanco, "El arte rupestre en los macizos del Deseado y Somuncurá: la producción de grabados y pinturas entre cazadores-recolectores desde el Holoceno medio" (Tesis de Doctorado, en Universidad Nacional de La Plata, Facultad de Ciencias Naturales y Museo, MS, 2015), 2015; N. Carden y R. Blanco, Measurements and Replications of hand Stencils, 126-145; J. Flood, "Rock art

Particularly, in Southern Patagonia, efforts have been made to characterize the individuals who produced, directly or indirectly, hand stencil images³³. In this paper we will focus in the distinction of age groups. The estimation of the sex of the producers will be considered in a future stage of the research.

A variety of measurements have been used to assess the age of the producers. Among them, Flood³⁴ uses the middle finger length (mf-l) of stencils. He defines five age classes and suggests that certain archaeological sites were "family sites" as they contained the full range of sizes including babies' hands and feet. On the other hand, the works of Gunn³⁵ propose the use of hand width (h-w) to derive a tentative age division between children, adolescents or adults and adult males. This hand measure enables, like mf-l, the identification of possible age but with an indeterminate adolescent to adult age group caused by measurement overlap³⁶. In addition, Henneberg and Mathers³⁷ found that hand length (h-l) was the most reliable indicator of age. However, like the other measures, it does not distinguish between adult and adolescent individuals.

Diverse researchers agree on some issues which make it difficult to obtain a reliable sex and age estimation of the individuals whose hands were used to make the stencils³⁸. One of the major challenges is the process of growth and development as well as the sexual dimorphism in different populations.

of the Koolburra plateau", *Rock art Research* num 4 Vol: 2 (1987): 91-126; C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; F. Guichón, *Redes de información...*; R. G. Gunn, "Hand sizes in Rock art: interpreting the measurements of hand stencils and print", *Rock Art Research* num 23 Vol: 1 (2006): 97-112; A. Manhire, "The role of hand prints in the rock art of the South-Western Cape", *South Africa Archaeological Bulletin* num 53 Vol: 168 (1998): 98-108; J. McDonald, "Looking for the woman's touch: indications of gender in shelter sites in the Sydney Basin". En J. Balme y W. Beck (eds.), *Gendered archaeology: the second Australian Women in Archaeology Conference* (Canberra: ANH Publications, Australian National University, 1995), 92-96; P. Pettitt et al., "New views on old hands: the context of stencils in El Castillo and La Garma caves (Cantabria, Spain)", *Antiquity* num 88 Vol: 339 (2014): 47-63; D. R. Snow, "Sexual dimorphism in Upper Paleolithic cave art", *Antiquity* num 80 (2006): 390-404; among others.

³³ D. Artigas, R. Cordero y C. Muñoz, "Reinterpretando paredes: Memoria colectiva, interacción e intercambio de información en el Ibáñez medio, Patagonia central, Chile". En A. L. Aquino, M. S. Caro y G. E. Ruiz de Bigliardo (eds.), *Actas del XIX Congreso Nacional de Arqueología Argentina*. (Tucumán: Facultad de Ciencias Naturales e Instituto Miguel Lillo de la Universidad Nacional de Tucumán, 2016), 2289-2295; R. Blanco, *El arte rupestre en...*; N. N. Carden, *Imágenes a través del tiempo...*; N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; R. Casamiquela, *El Arte Rupestre de la Patagonia* (Buenos Aires: Editorial Siringa, 1981); C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; C. J. Gradín, *Contribución a la arqueología del Río Pinturas, provincia de Santa Cruz* (Buenos Aires: Búsqueda de AYLLU, 1994); O. Menghin, *Las pinturas rupestres...* 5-22; O. Menghin, *Estilos de arte rupestre de Patagonia...* 57-87.

³⁴ J. Flood, *Rock art of the Koolburra plateau...* 91-126.

³⁵ R. G. Gunn, *Hand sizes in Rock art...* 97-112.

³⁶ R. G. Gunn, *Hand sizes in Rock art...* 97-112; J. McDonald, *Looking for the woman's touch...* 92-96.

³⁷ M. Henneberg y K. Mathers, "Reconstruction of body height, age and sex from handprint", *South Africa Journal Science* num 90 (1994): 493-496.

³⁸ N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; P. Galeta, J. Bruzek y M. Laznickova-Galetova, "Is sex estimation from handprints in prehistoric cave art reliable? A view from biological and forensic anthropology", *Journal of Archaeology Science* num 45 (2014): 141-149; R. G. Gunn, *Hand sizes in Rock art...* 97-112; R. D. Guthrie, *The Nature of Paleolithic Art* (Chicago: University of Chicago Press, 2005); M. M. Henneberg y K. Mathers, *Reconstruction of body height...* 493-496; E. M. Mackie, "Estimating age and sex:

Very little information can be found in anthropological and ethnographic literature concerning the demography of the societies that inhabited Southern Patagonia. There is only scarce information about hands sizes of Tehuelches and Selk'nam groups related mainly to adult individuals³⁹. For the Tehuelche groups, there is information only from males hands with average values of 200 mm for h-l and 87 for h-w⁴⁰. Among the Selk'nam, who occupied Tierra del Fuego province, data are available for male and female adults⁴¹. The average male adult hands were 194 mm in h-l, 87 mm in h-w and 110 mm in mf-l. Female adults hands measured an average of 176 mm in h-l, 78 mm in h-w and 99 mm in mf-l.

Interpretations about the age and sex of hand stencils' producers have been a subject of interest since the beginning of archaeological research in Patagonia. Already Menghin's first works in the 1950⁴² included some comments on this topic. Beyond these first reflections, it was the work of Carlos Gradin in Cueva Grande de Arroyo Feo (located 180 km north of the Strobel plateau) which first proposed a methodology to evaluate age groups from different hand sizes in Patagonia⁴³. Using four reference points, together with ethnographic data and current population information from Buenos Aires city, Gradin suggested two measures to address hand sizes which match with h-l and h-w. He divided hands into small (3 to 5 years), medium (6 to 12 years) and large (more than 13 years). Small hands have 10 to 13 cm in h-l and 6,5 to 8 cm in h-w, medium hands 14 to 16 cm in h-l and 8 to 9,5 cm in h-w and large hands 17 to 20 cm in h-l and 9 to 11 cm in h-w. He recognized the difficulty in establishing the sex of individuals. More recently, the works of Carden and Blanco⁴⁴ considered an experimental approach to this discussion in Patagonia. They performed stencil technique replication with a sample of individuals of different ages and sexes from La Plata city. This novel approach, together with the evaluation of bioanthropological information available for Patagonia and the analysis of negative hands from an area in the Deseado Massif (located 250 km northeast of the Strobel plateau), enabled them to define new parameters for male and female hand sizes and the introduction of a correction value error caused by paint application techniques (see below). They considered h-l as the more reliable measurement and defined four age groups: under 3 years old (less than 100 mm in h-l), 3 to 5 years old (100 to 139 mm in h-l), 6 to 12 years old (140 to 169 mm in h-l) and more than 13 years old (more than 170 mm in h-l). Very large hands (more than 195 mm in h-l) were interpreted as belonging to adult males.

Paleodemographic identification using rock art hand sprays, an application in Johnson County, Wyoming", *Journal of Archaeological Science: Reports* num 3 (2015): 333-341; P. Pettitt et al., *New views on old hands...*, 2014, 47-63; D. R. Snow, *Sexual dimorphism...*, 2013, 390-404; D. R. Snow, "Sexual dimorphism in European Upper Paleolithic cave art", *American Antiquity* num 78, 4 (2013): 746-761; among others.

³⁹ M. Gusinde, *Los Indios de Tierra del Fuego. IV (1 y 2)* [1939]. *Antropología Física*. Traducido por H. Jung y C. Hedwig Romero (Buenos Aires: Centro Argentino de Etnología Americana, 1989); J. Imbelloni, "Los Patagones. Características corporales y psicológicas de una población que agoniza", *Runa* num 2 (1949): 5-58; R. Lehman-Nitsche, "Etudes anthropologiques sur les Indiens Onas (Gropu Tshin) de la terre du Feu", *Revista del Museo de La Plata* num 23, 2 (1916): 174-184.

⁴⁰ J. Imbelloni, *Los Patagones...* 5-58; R. Lehman-Nitsche, *Etudes anthropologiques...* 174-184.

⁴¹ M. Gusinde, *Los Indios de Tierra del Fuego...*; R. Lehman-Nitsche, *Etudes anthropologiques...* 174-184.

⁴² O. Menghin, *Las pinturas rupestres...*, 1952, 5-22; O. Menghin, *Estilos de arte rupestre...* 57-87.

⁴³ C. J. Gradin, "Las pinturas de..." 241-265.

⁴⁴ R. Blanco, *El arte rupestre en...* N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145.

Current population hands were also measured in Buenos Aires city during our own previous research in this topic⁴⁵. A sample of 40 individuals hands was measured. It included a range of males and females between 2 and 75 years. Age and sex information was collected for each of them and then the contour of the hand was drawn on a sheet of paper. Subsequently, values of h-l, mf-l and h-w were obtained from the hand tracing and a data base was built.

Taking into account all available information and previous research, for the analysis of the hand stencil sample from the Strobel Plateau and the Cardiel Lake basin, three measures were considered (Figure 4): hand length (h-l), middle finger length (mf-l) and hand width (h-w). In some cases, all three could not be recorded due to the presence of incomplete hand negatives, either because of how they were originally executed or because of paint deterioration. In order to address this limitation, the hand length (h-l) was considered to provide the most precise value for the estimation of age followed by hand width (h-w)⁴⁶. It should be noted that estimates based on two or more measurements are considered more reliable.

In this analysis hands stencils from Cardiel Lake and the Strobel plateau were assigned to three inclusive age groups in order to minimize errors in their classification:

- 1) Infant (individuals less than 5 years old);
- 2) Child (individuals between the ages of 6 and 12);
- 3) Adolescent/adult (individuals above the age of 13).

To achieve an adequate estimate of the age groups of hand stencils, value ranges for each hand size measure were defined taking into account the available ethnographic information as well as the formerly described current population data –from other researchers⁴⁷ as well as from our own previous research⁴⁸. Figure 4 and Table 1 summarize the different values attributed to the infant, child and adolescent/adult age groups in each of the three measures considered⁴⁹.

Age groups	Hand stencil measurements		
	h-l	h-w	mf-l
Infant (< 5 years)	< 14 cm	< 6 cm	< 5 cm

⁴⁵ F. Guichón, *Redes de información...*

⁴⁶ N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; J. Flood, *Rock art of the Koolburra plateau...* 91-126; C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; R. G. Gunn, *Hand sizes in Rock art...* 97-112; among others.

⁴⁷ R. Blanco, *El arte rupestre en...*; T. D. Campbell, J. H. Gray y C. J. Hackett, "Physical anthropology of the Aborigines of central Australia", *Oceania* num 7 (1936): 106-139; N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; J. Flood, *Rock art of the Koolburra plateau...* 91-126; C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; R. G. Gunn, *Hand sizes in Rock art...* 97-112; M. Henneberg y K. Mathers, *Reconstruction of body height...* 493-496.

⁴⁸ F. Guichón, *Redes de información...*

⁴⁹ T. D. Campbell, J. H. Gray y C. J. Hackett, *Physical anthropology of...* 106-139; N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265; J. Flood, *Rock art of the Koolburra plateau...* 91-126; M. Henneberg y K. Mathers, *Reconstruction of body height...* 493-496; D. R. Snow, *Sexual dimorphism...* 390-404; D. R. Snow, *Sexual dimorphism in European...* 746-761.

Child (6 to 12 years)	14 to 17cm	6 to 7 cm	5 to 7 cm
Adolescent/Adult (> 13 years)	> 17 cm	> 7 cm	> 7 cm

Table 1

Value ranges for the three hand size measures that allow age group estimation.
References: h-l: hand length; mf-l: middle finger length; h-w: hand width

Another factor that makes it difficult to measure hands in rock art is the distortion associated with production techniques. Experimental research carried out by different authors have suggested variations in the h-l, h-w and mf-l measurements due to the stencil technique⁵⁰ and particularly the angle where the paint source was located²⁴. In this paper, the correction value of 7 mm suggested by Carden and Blanco is adopted⁵¹. Thus, the age group estimates may overlap (Figure 4) and could present ambiguity in some cases.

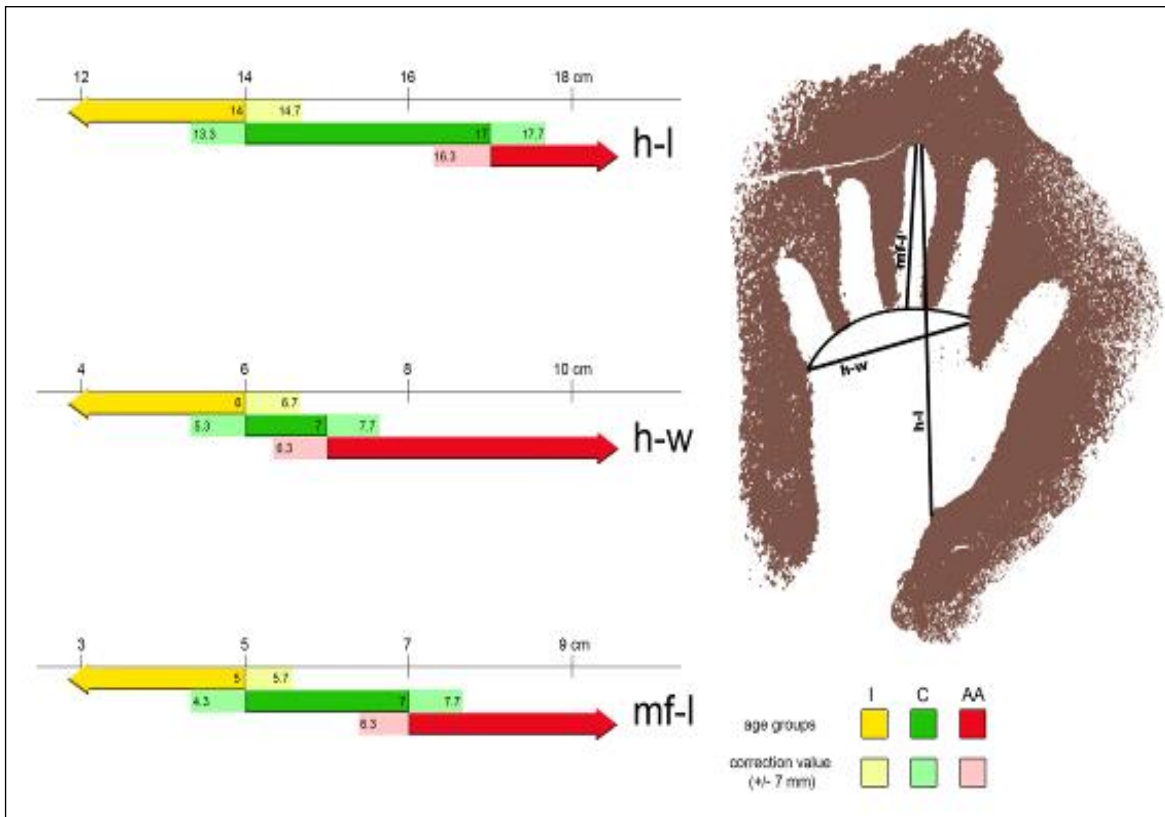


Figure 4

Graphic representation of the value ranges for the three hand size measures that allow age group estimation. References: h-l: hand length; mf-l: middle finger length; h-w: hand width; I: Infant; C: Child; AA: Adolescent/Adult

Finally, it should be pointed out that, due to fieldwork conditions related to rough terrain and low time availability, hand measurements were made in the laboratory from detailed, high-resolution and scaled photographs. This methodology adds error to the measurements, mainly in convex or concave rock supports. For the time being it is assumed that correction value is adequate to deal with this difficulty. In future fieldworks we plan to carry out a hand measurements control.

⁵⁰ R. Blanco, El arte rupestre en...; N. Carden y R. Blanco, Measurements and Replications of hand Stencils... 126-145; R. G. Gunn, Hand sizes in Rock art... 97-112.

⁵¹ N. Carden y R. Blanco, Measurements and Replications of hand Stencils... 126-145.

5. Results

In order to evaluate the importance of hand stencils production in the region under study, we first consider its frequency and distribution in the two areas. Including all motif types and techniques, more than 8,000 motifs in 101 sites in the region have been analysed⁵². Around 85% of these images are located in the Strobel Plateau. In this area more sites have been identified in recent field works but are yet to be studied. Nonetheless, they appear to share similar characteristics with the other sites.

In particular, hand stencils amount to a total of 757 cases distributed in 31 sites (Table 2). Most of them (n: 658) were found in 21 sites located in the Cardiel Lake basin. It is also interesting to note the percentage of hand stencils against all other motifs. While in the Cardiel Lake basin this motif represents more than half of the total sample (52.1%) and is located in most rock art sites, in the Strobel Plateau it represents only 1.3% of all recorded images and was identified in few sites. In this area the dominant technique is engraving. This information highlights the importance of hand stencil production in the lowlands despite the lower rock art sample.

The differential distribution of hand stencils could be partly due to preservation biases. In the Strobel Plateau rock art is generally located on vertical rockwalls with greater exposure to climatic factors than the sandstone rockshelters and caves in the Cardiel Lake basin⁵³. Specifically, the few paintings recorded in the plateau are usually documented in small sectors of the rockwalls that provide a small amount of shelter. However, although the differential exposure could partly impact over the frequency of hand stencils, it is estimated that the trend would not be substantially modified, given that we have also observed many sheltered supports devoid of motifs on the plateau. Likewise, in the Cardiel Lake basin a great number of paintings on vertical basalt walls have also been recorded (Figure 2A).

	Rock art sites*	n motifs	Sites with hand stencils		n hand stencils	
			n	%	n	%
Cardiel	22	1264	21	95.5	658	52.1
Strobel	79	7429	10	12.6	99	1.3
Total	101	8693	31	30.6	757	8.7

Table 2

Frequency of sites with hand stencils and of hand stencils motifs in the region under study. References: *Rock art sites with quantitative information on motifs

In the next step of the analysis the information about hand size is presented. It was possible to adequately measure more than half of the hand stencils (n: 472) to estimate the age group of the person whose hand was employed to paint it (Table 3). In these cases we determined one or more of the three previously described measures: hand length (h-l), hand width (h-w) and/or middle finger length (ml-l). The rest of them (n: 285)

⁵² F. Guichón, Redes de información...; A. Re et al., Las representaciones rupestres... 136-154; A. Re et al., Arqueología de la meseta... 33-158.

⁵³ J. B. Belardi y R. A. Goñi, "Distribución espacial de motivos rupestres en la cuenca del lago Cardiel (Patagonia Argentina)", Boletín de la SIARB num 16 (2002): 29-38, F. Guichón, Redes de información...

could not be considered due to the state of preservation or to the lack of adequate photographs.

	n measured hands				Indeterminate	Total
	h-l	h-w	ml-l	Total		
Cardiel	164	349	316	403	255	658
Strobel	38	61	59	69	30	99
Total	202	410	375	472	285	757

Table 3

Sample of measured hand stencils. References: h-l: hand length, h-w: hand width, ml-l: middle finger length

In Table 4 age group estimates are summarized for the sample of measured hand stencils. It was possible to assign most of them (n: 353) to one of the categories defined in the methodology section, while in a few cases there was ambiguity due to the correction margin.

The presence of the three age groups is recognized in the region under study (Table 4). Fifty-eight cases of infants under 5 years of age were identified, while 91 examples correspond to children between the ages of 6 and 12 years. In turn, 43 hands could be examples of either one of the two categories mentioned above. Finally, 204 hands are assigned to adolescents/adults, making it the most abundant age group in the sample.

When comparing hand sizes in the Cardiel Lake basin and the Strobel Plateau (Table 4 and Figure 5), a similar relative frequency of the identified age groups is evident, despite differences in the available samples. Thus, leaving aside the cases of ambiguous assignments, we observe the predominance in both areas of adolescents/adults (between 50 and 60%), followed by children (between 24 and 32%) and then infants (between 16 and 18%). This information suggests the participation of all age groups and probably the entire family group in the production of hand stencils in both areas. Although it is not the scope of this paper, it should be noted that, from the available measurements, the presence of adolescent/adult men in the two areas has also been recognized in similar percentages⁵⁴.

Age groups	Cardiel		Strobel		Total	
	n	%	n	%	n	%
I	49	12.2	9	13.0	58	12.3
I or C	35	8.7	8	11.6	43	9.1
C	75	18.6	16	23.2	91	19.3
C or AA	66	16.4	10	14.5	76	16.1
AA	178	44.2	26	37.7	204	43.2
Total	403	100.0	69	100.0	472	100.0

Table 4

Age groups identified in hand stencils in the Cardiel Lake basin and the Strobel Plateau. References: I: Infant; C: Child; AA: Adolescent/Adult

⁵⁴ F. Guichón, Redes de información...

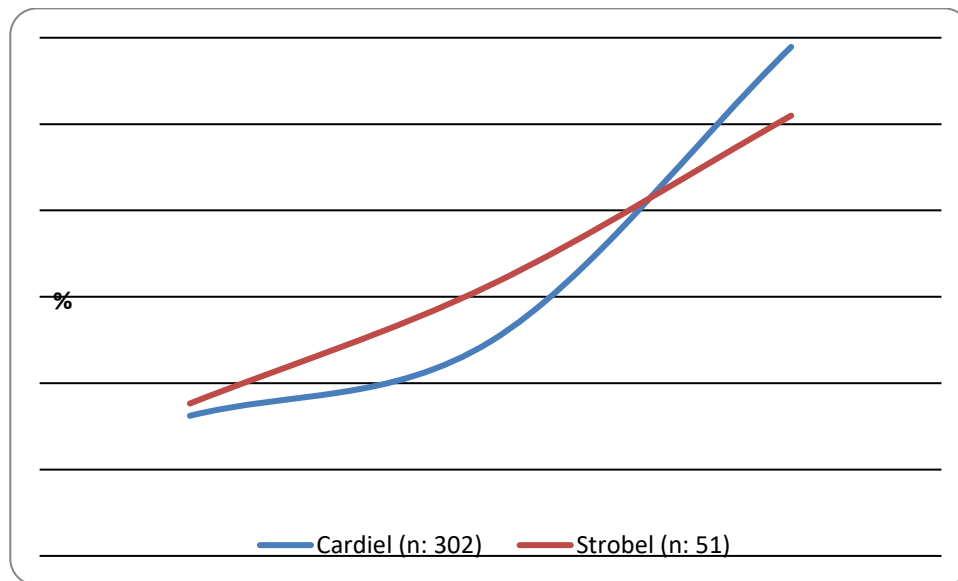


Figure 5

Age groups identified in hand stencils in the Cardiel Lake basin and Strobel Plateau (ambiguous cases are not considered)

References: I: Infant; C: Child; AA: Adolescent/Adult

The pattern observed in the plateau –initially– does not support one of the hypotheses. In order to delve more deeply into this issue, the possibility of internal divergences related to differences in altitude and proximity to lower spaces is considered. It is useful to evaluate if the production of hand stencils in lower parts of the Strobel plateau that are nearer to residential areas like the Cardiel Lake basin differ from the higher and more seasonal parts. Thus, for the particular case of the Strobel Plateau, the age groups identified in sites located near the edge of the plateau (up to 5 km) are compared with those located at higher altitudes in its centre (more than 5 km from the border) (Table 5 and Figure 6).

As can be seen in Figure 6, sites with hand stencils are widely distributed on the Strobel Plateau. Thus, four of them are located near the edge and six in the centre. Sites near the southern and eastern border are located between 700 and 850 masl while those located inside the plateau have altitudes ranging from 850 to 1000 masl. Although the number of sites with hand stencils is similar, the frequency of this motif is higher at the border (Table 5). In both sectors there are sites with hands that belong to infants, children and adolescents/adults, with a predominance of the latter category. In the border hand stencils belonging to infants and children were found, for example, at K28-Don Edmundo. This site is characterized by its proximity to the low lake basin⁵⁵. In the centre it is also

⁵⁵ A. Agnolin, J. Flores Coni y R. A. Goñi, “Las bolas y el viento: análisis de la distribución de bolas en las cuencas de los lagos Cardiel y Strobel”. En J. Gómez Otero, A. Svoboda y A. Banegas (eds.), *Arqueología de Patagonia: El Pasado en las arenas* (Puerto Madryn: CENPAT, 2019), 81-92; J. B. Belardi y R. A. Goñi, *Representaciones rupestres y convergencia poblacional...* 85-94; L. Ferraro y R. Molinari, “Usos y valoración de las alas mesetas santacruceñas a partir del estudio del arte rupestre. Lago Strobel (Argentina)”. En D. Fiore y M. M. Podestá (eds.), *Tramas en la Piedra* (Buenos Aires: WAC, SAA, AINA, 2006), 95-102; A. Re, *Representaciones rupestres en mesetas altas...*; A. Re et al., *Arqueología de la meseta...* 33-158.

important to point out the presence of the two age groups at different sites, even at a distance of more than 20 km from the edge (K24 - Laguna Los Negros).

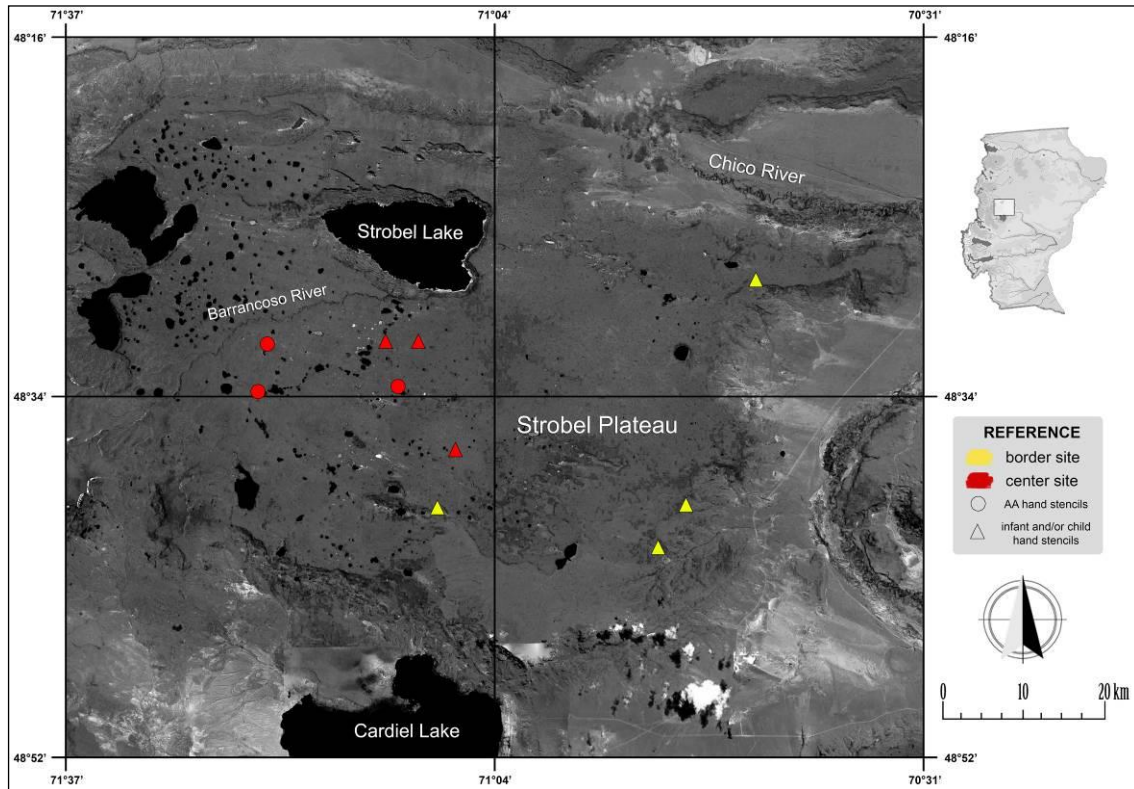


Figure 6
Location of sites with hand stencils in the Strobel Plateau.
References: AA: Adolescent/Adult

	Border		Center		Total	
	n	%	n	%	n	%
I	4	11.4	5	31.3	9	17.6
C	11	31.4	5	31.3	16	31.4
AA	20	57.1	6	37.5	26	51.0
Total	35	100	16	100	51	100

Table 5

Hand stencils on the Strobel Plateau classified by age group and proximity to its border.
References: I: Infant; C: Child; AA: Adolescent/Adult

In summary, a greater frequency of hand stencils is recorded in the lowlands. However, there is a significant number of examples for all age groups in the two defined areas. The use of adolescents/adults hands as stencils is prevalent both on the plateau and in the lake basin. On the other hand, the similar frequency of children and, particularly, of infants under 5 years of age in different sites of both areas stands out. Although it is a complex issue and further research is needed, this data could indicate the participation of the entire family group, either directly or indirectly, in the making of these paintings both in the lowland and the highland.

6. Discussion and final remarks

The results obtained in this paper allow us to discuss the land use and communication strategies developed by hunter-gatherer groups in the Cardiel Lake basin and the Strobel Plateau (Southern Patagonia, Argentina). Important information has been summarized regarding the distribution of hand stencils and the characteristics of the producers of these paintings.

The chronology proposed for the production of rock art in both areas (from 6,000/5,000 years ago and especially the last 2,500 years) is similar and allowed us to compare them, as both spaces were used contemporaneously. In particular, hand stencils would first appear in low numbers in the Cardiel Lake basin around 6,000 years ago. In the last 2,500 years they would have been more frequently produced in this area while they would start to be executed in the Strobel Plateau, together with most engravings documented in this high altitude space.

The analysis firstly emphasized the wide distribution of hand stencils in the study region. This is consistent with the information available from other areas of the extreme south of the American continent⁵⁶. On the other hand, the finding of hand stencils above 900 masl in the plateau is significant, because in Southern Patagonia they are mostly found in lower altitude regions.

When comparing the Cardiel Lake basin and the Strobel Plateau, it became evident that the number of sites with painted hands and the frequency of this motif are different in the two areas. In the lower basin there are more sites and motifs of this type and hand stencils dominate the rock art repertoire. In the future, we plan to delve deeper into the possible preservation biases in the Strobel Plateau, related to the available rock surface. However, we believe that the trend we observed would not be greatly altered, although some paintings have surely faded.

Another interesting issue in relation to the distribution of the motifs involves the presence of hands on the Strobel plateau. Although they are scarce when compared with lowlands, they are found in several sites. It is important to note that hand stencils have not been recorded in other plateaus of Southern Patagonia with similar characteristics and thus with the same preservation biases⁵⁷. Therefore, it is possible to assume that the execution of hand stencils in this space is linked to the population convergence suggested for the last 2,500 years⁵⁸.

⁵⁶ D. Artigas, R. Cordero y C. Muñoz, Reinterpretando paredes... 2289-2295; C. A. Aschero et al., Holocene Park... 71-119; N. Carden y R. Blanco, Measurements and Replications of hand Stencils... 126-145; R. Paunero, El arte rupestre milenario de Estancia La María...; among others.

⁵⁷ A. Re y F. Guichón, "Las representaciones rupestres de la meseta del lago Guitarra (provincia de Santa Cruz)". En F. Zangrando, R. Barberena, A. Gil, G. Neme, M. Giardina, L. Luna, C. Otaola, L. Paulides, L. Salgán, y A. Tivoli (eds.), Tendencias Teórico-Methodológicas y Casos de Estudio en la Arqueología de Patagonia. (Mendoza: Museo de Historia Natural de San Rafael, 2013), 495-504; A. Re, F. Guichón y J. B. Belardi, "Las mesetas de San Adolfo y del Cardiel Chico (provincia de Santa Cruz): su uso y jerarquización regional a partir de los motivos rupestres", Cuadernos del INAPL num 23 Vol: (2013-2014): 91-106.

⁵⁸ J. B. Belardi y R. A. Goñi, Distribución espacial de motivos... 29-38; A. Re, Representaciones rupestres en mesetas altas...

The second stage of the analysis enabled us to evaluate the individuals who produced the hand stencils. We recognized a total of 472 cases with reliable information to estimate the age of the persons whose hands were used as templates. The results show in both areas similar frequencies in the three age groups that participated in the production of hand stencils. In both cases, the hand motifs generally show a higher frequency of adolescent/adults (individuals over 13 years of age), followed by children (6 to 12 years) and infants (less than 5 years). Even when the centre and border of the Strobel Plateau were compared, no differences were found.

The presence of individuals under 12 years of age and particularly under 5 years old on the Strobel Plateau, characterized by its logistic and seasonal use, is unexpected. Thus, all age ranges seem to have participated –directly or indirectly– in the production of hand stencils. This is valid for areas mostly considered residential (Cardiel Lake basin), as well as for the areas where logistic and seasonal use has been proposed (Strobel Plateau).

As previously summarized, research in nearby areas also recorded hand stencils assigned to infants and children. The presence of these age groups has been mentioned in the Rio Pinturas area⁵⁹. Also, research carried out in the Rio Ibañez valley, in the Chilean mountain range, showed an important frequency of small hands which were considered evidence of the movement of entire family groups to this region⁶⁰. Lastly, in the Northern Deseado Massif, the frequency of these small hands is high, representing more than 50% of the sample⁶¹. The researchers of this area argue that subadult individuals were an important agent in the production of this motif⁴⁷.

At this point it is useful to reconsider the hypotheses we formulated, given that the information we presented in this paper both supports and contradicts them. On one hand, the analysis of hand stencils in the Cardiel Lake supports our suggestion that the production of this type of motif would have had a greater importance and all age groups would have participated in this area where a residential use has been proposed. On the other hand, results from the Strobel plateau, an area related to logistic and/or seasonal use, indicated that while the execution of hand stencils had a lesser importance, all age groups participated in its production, showing a similar trend as the one observed in the lower basin.

Hence, the results of this research make us reconsider the premises and the population model that were the starting point of the proposed hypotheses. The first question is, given that all age groups are represented in the hand stencils of the Strobel Plateau, do we need to re-evaluate the logistic use of this highland during the Late Holocene? All other lines of evidence (lithic technology, stone structures and faunal remains) are in agreement and mostly point to hunting activities on this plateau⁶². Therefore, we believe the proposal for the logistic use still stands.

⁵⁹ C. J. Gradín, *Las pinturas de la Cueva Grande...* 241-265.

⁶⁰ D. Artigas, R. Cordero y C. Muñoz, *Reinterpretando paredes...* 2289-2295.

⁶¹ N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145.

⁶² G. Cassiodoro, R. A. Goñi y S. Pasqualini, "Variabilidad del registro arqueológico en sectores altos de Santa Cruz: tendencias generales en el uso del espacio". En *Arqueología de Patagonia: de mar a mar*, ed. F. Mena. (Coyhaique: Ediciones CIEP/Ñire Negro, 2016), 224-234; J. Flores Coni, "Poblamiento humano y uso del espacio en la meseta del Strobel (provincia de Santa Cruz). Un análisis sobre la variabilidad tecnológica durante el Holoceno" (Tesis de Doctorado, Universidad de Buenos Aires, MS, 2018); S. Pasqualini, G. Cassiodoro y J. Dellepiane, "Logistic mobility on

So, do we reconsider the age groups involved in the logistic use of the Strobel plateau? The evidence from rock art suggests that this is true, at least partly. Clearly individuals of different ages participated in the paintings production at this plateau and we can consider the possibility that the entire family group could have been involved in the execution of this type of motif. However, paintings are just a small proportion of the rock art produced in this area. Then, who made the majority of the motifs, that is, the engravings? Hence, we propose a more complex scenario that needs to be tested in the future against new data from rock art and other lines of evidence. Some results from the analysis of lithic technology and faunal remains already indicate differences among archaeological sites in this area⁶³. Some sites indicate the exclusive presence of hunting activities while others suggest a wider range of activities and a more intensive use. In this context we suggest as a possibility that in the Strobel Plateau mainly adult and adolescent male hunting parties could be responsible for most engravings, while also families with infants and children could have inhabited this area in some instances and produced the paintings. Thus the available evidence supports a more varied use of the Strobel Plateau by hunter-gatherer groups than what was initially thought. This could be related to the population convergence suggested for the Late Holocene.

In the future, we hope to continue this discussion by evaluating the representation of men and women in hand stencils. The available measurements have been used to suggest the presence of adolescent/adult men in the two areas in similar proportions⁶⁴. However, several researchers have indicated the existing difficulties and the need to explore other hand measures to make this estimate⁶⁵.

To conclude, the analysis of hand stencils accounts for little-known demographic aspects in relation to the nature of logistic and/or seasonal use of the Strobel Plateau. Hence the information analysed here represents a learning opportunity and gives insight into the use of rock art by hunting-gatherer groups that inhabited Southern Patagonia throughout the Middle and particularly the Late Holocene. This research has opened new questions which can be addressed through new lines of evidence and the deepening and expansion of rock art studies in the region.

plateaus in centerwest Santa Cruz, Argentina. An anthracological, technology and archaeofaunal approach”, *Quaternary International* num 455 Vol: 16 (2016): 132-151.

⁶³ J. M. Dellepiane y J. Flores Coni, “Aspectos tecnológicos y faunísticos en sitios a cielo abierto: variabilidad del registro en los parapetos de la meseta del Strobel, provincia de Santa Cruz”. En F. Mena (ed.), *Arqueología de la Patagonia: de mar a mar* (Coyhaique: Ediciones CIEP / Ñire Negro, 2016), 245-255; S. Espinosa, R. A. Goñi y J. Flores Coni, “Aproximación tecnológica al uso de pampas y bajos en la meseta del lago Strobel”. En M. Salemme, F. Santiago, M. Álvarez, E. Piana, M. Vásquez, M. E. Mansur (eds.), *Arqueología de Patagonia: una mirada desde el último confín.*, tomo 2 (Ushuaia: Editorial Utopías, 2009), 977-984; J. Flores Coni, *Poblamiento humano y uso del espacio...*, 2018; R. A. Goñi et al., “Un lugar muy particular. Caza, convergencia de poblaciones y circulación de información en la meseta del Strobel”. En R. A. Goñi, J. B. Belardi, G. Cassiodoro, A. Re (eds.), *Arqueología de las cuencas de los lagos Cardiel y Strobel. Poblamiento humano y paleoambientes en Patagonia* (Buenos Aires: Aspha ediciones, 2014b), 155-186; A. Re et al, *Arqueología de la meseta...* 33-158.

⁶⁴ F. Guichón, *Redes de información...*

⁶⁵ N. Carden y R. Blanco, *Measurements and Replications of hand Stencils...* 126-145; A. Manhire, *The role of hand prints...* 98-108; J. McDonald, *Looking for the woman’s touch...* 92-96; D. R. Snow, *Sexual dimorphism...* 390-404.

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