World Heritage papers 42

HEADS 5

Human Origin Sites and the
World Heritage Convention in the Americas

VOLUME I

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# Human Origin Sites and the World Heritage Convention in the Americas

HEADS 5
VOLUME I

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PUEBLA
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# Foreword

*The Americas were the last continents to be colonized, very recently in the two-million-year long history of humankind and were the culmination of a long progression of expansion by* Homo sapiens *from Africa. However, the process of the peopling of the Americas, while key in the history of humankind, is an area that lacks due recognition. There is comparatively little research on this topic and there is a great need for further investigation to understand the vital role of this process for our human species.*

*The last twenty years have brought about new scientific discoveries and an improved understanding of the peopling of the Americas, how they were first inhabited, how the populations survived and how their evolution led to them colonizing the continents. Much still remains to be researched and learnt.*

*The places related to the origins of humanity in the Americas are underrepresented on the World Heritage List and the importance of ensuring the future recognition, conservation and research of sites related to the process of human evolution, adaptation, dispersal and social development in the continents has never been –more pertinent. The lack of acknowledgment of these sites represents a challenge for the Americas. This publication therefore brings together the best experts in the field, to highlight this crucial process of human history, present its strengths and weaknesses and to establish the need for more scientific research, methodological innovation and improved collaboration on a national, regional and international level.*

*I encourage different institutions and research centres in this field to continue to address this topic for the benefit of future generations.*

**Mechtild Rössler**
*Director of the UNESCO World Heritage Centre*

# Foreword

*This publication presents the most up-to-date research on the peopling of the Americas. The studies and discoveries brought to the reader in these articles review the latest developments in this field of knowledge: how the Americas were first experienced, how and where their colonization took place, and what aided the successful development of cultural diversity at the last continental frontier for the human species.*

*This book stems from the international meeting,* **The First Peopling of the Americas and the World Heritage Convention,** *held in Puebla, Mexico, from 2 to 6 September 2013. It is thanks to this meeting and the discussions arising from it that a cooperation strategy with the State Government of Puebla is being established by the UNESCO Office in Mexico; this cooperation aims to launch actions to better preserve the heritage of the first peopling of the Americas, where our species,* **Homo sapiens,** *put into practice the vast trajectory of human experience they had accumulated thus far. These volumes provide the rationale and arguments for the future recognition, conservation and research of sites linked to the processes of human evolution and diversity in the American continent. This fascinating journey investigates the scientific, cultural, ethological, geographical and historical dimensions of the earliest steps of human development in the Americas, and the earliest American evidence of human ritual, expression and practice.*

*I would like to take this opportunity to thank the invaluable assistance and cooperation of officials from the State Government of Puebla and the Municipality of Puebla for hosting this meeting at the Palafoxiana Library, which was the first public library in the Americas and is recognized as Memory of the World by UNESCO. I also extend my sincerest gratitude to the HEADS Scientific Committee and especially to Professor Robin Dennell for his never-ending dedication and fruitful cooperation in the framework of the HEADS programme..*

**Nuria Sanz**

*Head and Representative of the UNESCO Office in Mexico*

# Introduction

## HEADS in the Americas

***Nuria Sanz***
*Head and Representative of the UNESCO Office in Mexico*

In 1960, *Current Anthropology* devoted a special issue to the archaeology of the Bering Strait, the gateway to the Americas, with the aim of circumscribing it as the principal entry route into the American continent, opposing other theories such as Paul Rivet's who insisted, over several decades, on a southern transoceanic austral route. Almost half a century later, interdisciplinary teams came together at the recent American Archaeological Society meetings.

Beginning 15,000, and perhaps as early as 25,000 years ago, humans began to quickly disperse across the American continent, a continent that brings together all of the world's geographic landscapes and that, furthermore, involves challenges that had not, until that point, been come across. We now need to understand how humans travelled over the American territory during the initial 10,000 years of settlement. By that time, *Homo sapiens sapiens* could draw upon a wealth of knowledge and accumulated experiences they had acquired through trial and error after they began the colonization of Eurasia *c*. 120,000 years ago. The Americas became the last continental frontier for the migrant species *par excellence*. In the last decade, research has verified that the southern borders were one of the first destinations of this advance. While it is true that we can see the rapid occupation of the continent, we still do not understand why the phases prior to humans' arrival at the Bering Strait advanced so slowly.


*Figure 1. The First Settlement of the Americas © UNESCO/Sarah Ranlett, 2013. Based on a map from http://www.latinamericanstudies.org/ancient.htm*

30,000 years ago, *Homo sapiens* reached Beringia, an enormous land bridge between Asia and the Americas, and 15,000 years ago, the melting ice sheets and rise in sea level forced humans to choose between the two continents. From this moment onwards, the land bridge would gradually be submerged. Without a doubt, underwater archaeology, detailed bathymetric studies of the northern Pacific and marine geomorphologic research will provide information on the sequence of territorial advance and the early ways of life in the Americas. Future research could provide American traces linked to evidence found in sites such as Yana in Siberia that documents the life of the mammoth hunters in the Arctic region between 29,000 and 27,000 cal BP. What we do know is that genetically the groups that arrived in the Americas were characterized by a long period of occupation in the extreme north of the continent. It is essential from now onwards to investigate records previous to the Last Glacial Maximum (LGM) in this area.

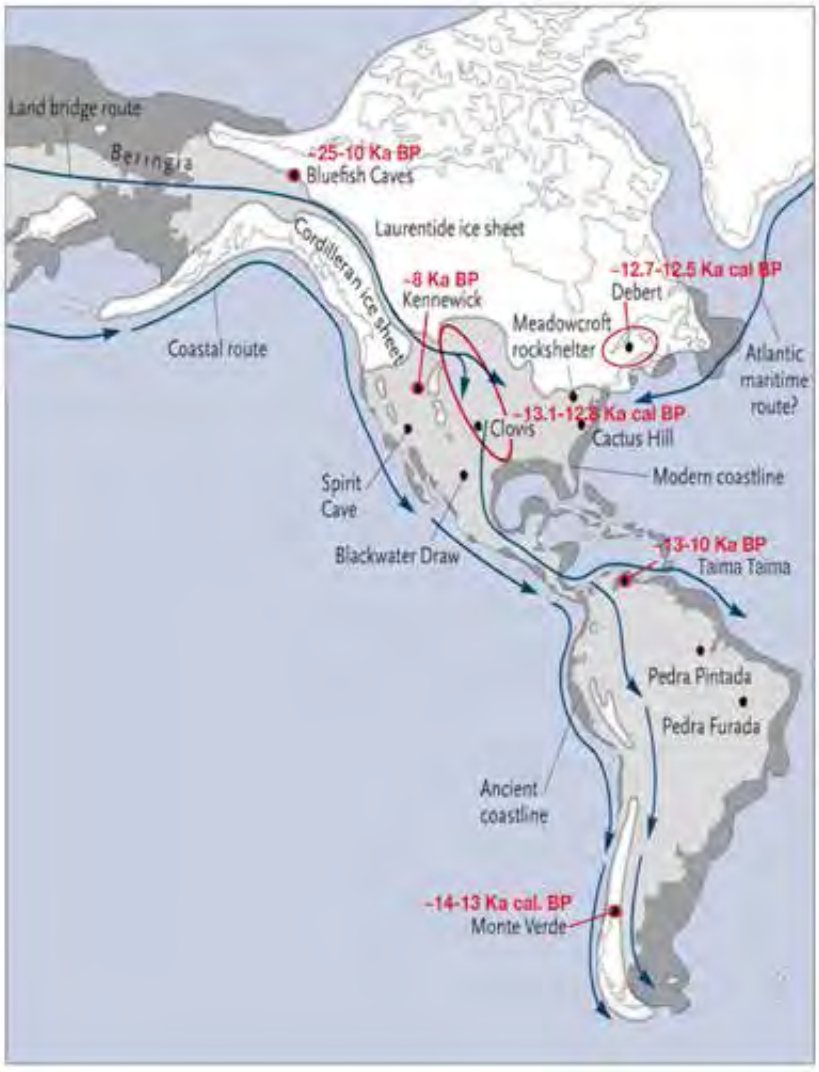


*Figure 2. Radiocarbon Dating and the First Settlement of the Americas*
*© UNESCO/Sarah Ranlett, 2013. Based on a map from*
*http://www.latinamericanstudies.org/ancient.htm*

The dates of the first occupations of North and South America are contemporaneous, according to the archaeological record. Clovis began around 13,000 BP in North America and everything before this date in the Clovis culture must be researched. What we do know is that all the contemporary material culture found in South America time does not have any affinity to Clovis, and neither in North or South America is there evidence of an earlier presence related to the Clovis culture.

The Debra L. Friedkin site, the oldest proof of human settlement in the Western Hemisphere, together with the Gault site and the Meadowcroft rockshelter, and Paisley Caves, shared their dating with Huaca Prieta, Peru, 14,100 cal BP and Monte Verde, Chile, 14,500 cal BP on the southern coast of the Pacific. For the time being, this evidence makes us think of a rapid costal advance, for which the archaeological remains at Serra da Capivara in Brazil or Arroyo Seco in Argentina leave us with significant questions to answer. The subsequent dating of Lake Charlie to

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*c.* 12,350 cal BP could make us think of a type of intermediate continental corridor open 2,000 years after the hypothetical initial costal route. Thanks to the skeletal remains of the Anzick boy (*c.* 12,707–12,556 years BP), the discovery of the complete Palaeo-American genome is a large part of a puzzle that still has big pieces left to be filled.

We could mention as well that the Pre-Clovis occupation *c.* 14,550 cal BP at the Page Ladson site, Florida, indicates how hunter-gatherers along the Gulf Coastal Plain coexisted with megafauna for 2,000 years before this fauna became extinct (Halligan, J.J. et al., 2016).

It is also worth noting that during excavations at the Upper Sun River in the Tanana River Basin archaeological site, two infants' skeletons dated to 11,500 cal BP were found by the University of Alaska Fairbanks. Buried together at the same time and covered by a layer of ochre (Potter, B. et al., 2014), it demonstrated that their ancient DNA showed that they came from two mothers who belonged to genetically distinct population groups.

On the other hand, the discovery and analysis of 'Naia', the 13,000 year-old Late Pleistocene Palaeoamerican human skeleton with Beringian-derived mitochondrial DNA that was found in the cave of Hoyo Negro in the Yucatan Peninsula of Mexico illustrates that the differences between Palaeoamericans and Native Americans probably resulted from *in situ* evolution rather than a separate ancestry (Chatters J.C. et al., 2014). This discovery in Central America, 4000 km south-east of any other pre-10-Ka in the Americas, extends the geographical distribution of Pleistocene-age Beringian mtDNA in the Western Hemisphere.

Moreover, multidisciplinary research in the Amazon, specifically the studies on the Tapayó River show that the transformation of the Amazon ecosystems also started 13,000 years ago, an age that is attributed to the first anthropic soils.

The retreat of Arctic and Patagonian ice and change in climate gave way to other forms of flora, fauna and ecosystems. Initial human adaptation to tropical forests, to large river basins, to the largest coastal mountainous chains and deserts in the world were scenes of early colonization for the first Americans. Cultural diversity coupled with the search for solutions and answers endogenous to the tundra, the cold seas, the boreal forests, tropical rainforests, and the high valleys of the Andes were major challenges that were successfully overcome. This is why America becomes a promising research area into the environmental history of modern humans and their responses to the some of the most extreme geographies of the planet: ice in its continental extremes, the cold currents from the Pacific, the Andes mountain range, the deserts of Chile, and the rainforests of the Amazon, among others. It was from this landmass that humans made the last leap to the High Arctic, to Greenland and Iceland, the last human frontiers on the planet.

Our wealth of shared knowledge is always a long-term resource, and in this long period of time we will be able to understand the cultural processes of decision-making regarding forms of consumption and productive strategies. Our answers to the best and worse conditions of the species' survival and the possibility of continuing to produce knowledge on our oldest-recorded responses is fundamental for the implementation of the United Nations 2030 Agenda for Sustainable Development. These pages give arguments for this endeavour.

The main objective of the previous pages has been to show how to frame debates on national and international policies to improve the preservation of the ancient traces of our cultural diversity in the Americas, through the international cooperation provided by the HEADS programme.

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# HEADS around the World

Human evolution, and its attendant study of the processes of adaptation, dispersal and social development are part of our universal human heritage. These processes can be traced back to the earliest toolmaking members of the human lineage at least 3.3 million years ago in the African continent. As the last continental frontier for the human species, the study of the first peopling of the Americas provides a unique opportunity to view how and where the *Homo sapiens* put into practice the vast trajectory of human experience they had accumulated thus far.

In much the same way, the development of the HEADS Thematic Programme[1] is reaching its final continental frontier with the publication of *Human Origin Sites and the World Heritage Convention in the Americas*. Our journey, both humankind's and the programme's, has taken us across the continents of Africa, Asia and Eurasia on our way to the Americas. These volumes have endeavoured to trace the unique pathways followed in each place, to explore the universal significance of changes that have left their mark on the intellectual development of the human species.

As humankind's accumulated experience played an integral role in the peopling of the Americas, so have the cooperation of experts, governmental bodies, states parties and research and academic institutions over the past eight years contributed to the programme's success and made this moment possible. We are able to arrive to this point as a result of immense collaborative efforts and only by building on the vast body of knowledge that we have constructed so far. The following pages illustrate the journey that the HEADS programme has taken around the world and to the Americas.

As per Decision: *WHC-14/38.COM/16,* the Office of UNESCO in Mexico has coordinated the implementation of the HEADS Thematic Programme's activities since 2013 by organizing international meetings, providing technical advice for nominations, and advancing Rock Art conservation and documentation policies to the benefit of the thematic programme. As requested by the World Heritage Committee, the following report outlines the outcomes of the projects of the follow up of the HEADS Programme that have taken place between 2013 and 2015, while the Americas publication was underway.

## A. Major Results

The 2013 to 2015 period of the HEADS Thematic Programme has achieved major results in terms of the development of the awareness and promotion of research that recognises the importance and relevance of the earliest heritage related to Human Evolution to the origin of our cultural diversity across all continents. A variety of activities have taken place in support of the thematic priorities and objectives of the HEADS Action Plan.

The following figures illustrate the progress in building and reinforcing the community of interest between Science and the World Heritage Convention since the programme's inception in 2008 and the major results specifically achieved in the 2013-2015 period:

1 http://whc.unesco.org/en/heads

**2009 - 2015**
**21** International meetings
Cooperation with **265** researchers from **5** continents
**10** prehistoric sites inscribed on the World Heritage List since 2009
**4** volumes of the World Heritage Paper Series published with **2** in preparation featuring a sum total of **103** contributions
**4** site events to submit detailed results on an annual basis to the World Heritage Committee

## 2013 – 2015

**6** international meetings
Cooperation with **173** experts from **5** continents and more than **30** countries.
**4** prehistoric sites inscribed on the world Heritage list since 2014
**2** volumes of the HEADS World Heritage Paper Series published with **2** in preparation featuring a sum total of **87** contributions

## i. Development of the Prototype of the Rock Art World Archive in Mexico

The project, which will implement the digital platform already developed, is ready to be implemented by 32 States in Mexico and will be led by the UNESCO Office in Mexico in collaboration with national and the academic institutions responsible for the preservation of rock art heritage in Mexico.

In Mexico, there are more than 1,000 instances of rock art manifestations that have until now remained unrecorded in a systemized documentary register.

Over the course of three years, the programme will develop a web platform that is interoperable with State and national archives, as well as archives from research centres and academic institutions. The programme's goal is to compile, by means of a digital archive, the documentary, graphic, archaeological and anthropological memory of rock art manifestations in Mexico.

The work that will be developed by archaeologists, anthropologists, institutional managers, local and indigenous communities and interoperable database management specialists in Mexico, could be replicated in more than 150 countries in the world.

## ii. Regional and/or Thematic International Meetings

**1. International Expert Meeting for the Nomination Process of Tehuacan-Cuicatlán to the UNESCO World Heritage List. The transition from hunter-gatherer societies to agricultural societies. *The Origins of Food Production and the World Heritage Convention*.**
This international meeting was held in Puebla, Mexico on 18 to 22 August 2014 and brought together a group of 39 experts from 13 countries to help identify and define the Outstanding Universal Value of Tehuacán-Cuicatlan in comparison with other World Heritage sites, with the aim beginning the nomination process of the property to the World Heritage List as a mixed site.

This meeting also acted as an important step in strengthening international and regional cooperation, and deepened the comparative analysis of the origins of food production in all continents. By bringing together such a distinguished group of

scholars in the field, the meeting provided key insights into understanding the transition from hunter-gatherer societies to sedentary societies and highlighted the importance of the preservation of related archaeological sites.

Press release: http://www.unesco.org/new/es/mexico/press/news-and-articles/content/news/reunion_internacional_heads_en_puebla/#.VuMd8_krLak

**2. Settlement Dynamics in Human Evolution: Human History from Dispersals and Migrations to Adaptations to Sedentary Societies, Implications for the World Heritage Convention**

This international meeting of experts was held in Ankara, Turkey from 11 to 13 November 2014 in order to reconsider the way in which sites related to the transition from hunter-gatherers to food production are conceptualised by the UNESCO World Heritage Convention and represented on the UNESCO World Heritage List. http://on.unesco.org/1UpMf6P

**3. Interdisciplinary Preservation Practices for Rock Art**

The International Meeting *Interdisciplinary Preservation Practices for Rock Art in Mexico* was held at the UNESCO Office in Mexico, Mexico City, from 5 to 6 June 2015. This meeting brought together 12 international and national experts in rock art preservation from 4 countries and 8 institutions.

During four scientific sessions, each of the invited experts presented a case study from their professional experience on integrated approaches for the preservation of rock art. In addition to the presentation of case studies, four round table discussions were organized, during which the experts discussed the main challenges facing the study, research and preservation of rock art in Mexico, how these challenges could be overcome, and how to design and implement, on a national and international level, a standardised protocol for the preservation of rock art.

Due to the impressive variety in time, space and style of rock art in Mexico, it was agreed that Mexico could serve as a pilot country for the implementation of the Rock Art World Archive (RAWA).

Press release: http://www.unesco.org/new/es/media-services/single-view/news/la_oficina_de_la_unesco_en_mexico_reune_a_expertos_nacionales_e_internacionales_para_discutir_sobre_la_preservacion_del_arte_rupestre/#.VuBWJvkrLak

**4. Exploring Frameworks for Tropical Forest Conservation: Managing Production and Consumption for Sustainability**

The International Meeting *Exploring Frameworks for Tropical Forest Conservation: Managing Production and Consumption for Sustainability* was held at the Institute of Ecology in Xalapa, Veracruz, Mexico, from 6 to 8 December 2015. This meeting brought together 40 experts in archaeology, biology, botany, historical ecology and forest management, as well as traditional and local producers, representing 8 countries and 36 institutions.

In the framework of the United Nations Post-2015 Development Agenda and in collaboration with the Institute of Ecology (INECOL), the National Commission for Knowledge and Use of Biodiversity (CONABIO) and the German Corporation for International Cooperation (GIZ), this meeting was organized to provide an interactive and interdisciplinary forum for the sharing and synthesis of research and progress in tropical forest conservation and sustainable development from social, economic, and environmental perspectives.

The meeting was separated into four primary themes, the most relevant of which was 'Interpreting the Past to Inform the Present and Implication for the Future: lessons from archaeology and historical ecology' which highlighted the very potent impact that early human populations played in the formation of tropical forest environments, especially in South and South-East Asia and South America, and the challenges of preserving sites of this kind for future appreciation and study. The meeting

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was concluded with working group sessions, one of which was dedicated specifically to 'Archaeological research toward the conservation of cultural heritage in the tropical forest'.

Press release: http://www.unesco.org/new/es/mexico/press/news-and-articles/content/news/la_oficina_de_la_unesco_en_mexico_lleva_a_cabo_en_el_inecol_en_xalapa_la_reunion_internacional_explorando_marcos_para_la_conservacion_del_bosque_tropical_gestion_de_la_produccion_y_consumo_para_la_sostenibilidad/#.VuLzTvkrLak

## iii. HEADS Publications

## iii.a Four Issues of the World Heritage Paper Series

**1. World Heritage Papers 39, HEADS 3: *Human Origin Sites and the World Heritage Convention in Asia*; ISBN 978-92-3-100043-0** (http://whc.unesco.org/en/series/39/)
We are all familiar with iconic prehistoric sites in Africa, Latin America and Europe but less so with such sites in Asia. This must change, as Asia holds a wealth of data, which includes some startling challenges to traditional archaeological paradigms of the emergence and dispersal of modern humans. This issue of the World Heritage Paper Series tackles these questions head-on – exploring recent research programmes, ideas and debates that are lifting the profile of Asia in human evolution studies, while addressing the practical issues of site protection and management. The result is a fascinating compendium that reflects the international and interdisciplinary approach that inspires all work under the World Heritage Convention. This issue builds on the vibrant archaeological research presented at the conference, entitled *Human Origins Sites in Asia and World Heritage Convention,* held at the Jeongok Prehistory Museum in the Republic of Korea in September 2012.

**2. World Heritage Papers 41, HEADS 4: *Human Origin Sites and the World Heritage Convention in Eurasia*; Vol. 1 ISBN 978-92-3-100107-9/ Vol. 2 978-92-3-100109-3** (http://whc.unesco.org/en/series/41)
The purpose of this publication in its two volumes is to present the reader with a panorama of Human Origins in Eurasia, by bringing together key papers written by leading scientists in the domain of research into human origins. The first volume focuses on the topic of Human Origins in Eurasia, whilst the second volume focuses entirely on the case of the Swabian Jura Aurignacian, which is particularly important in relation to some of the major research issues surrounding the dispersal of modern humans on the continent. The perspective of this publication is on Eurasia as a whole, transcending modern, political, cultural and regional frontiers, and thus allows for a greater and more profound study of prehistoric archaeological sites.

**3. World Heritage Papers 45, HEADS 5: *Human Origin Sites and the World Heritage Convention in the Americas*; Vol. I ISBN: 978-92-3-100140-6/ Vol. II ISBN: 978-92-3-100141-3**
The purpose of this publication is to present the reader with a panorama of Human Origins in the Americas, by bringing together key papers written by leading scientists in the domain of research into human origins. As a region, the Americas hold many properties with strong links to human origins; some of which are insufficiently represented on the World Heritage List. Thus their value is under-recognized and it is often challenging for State Parties to conserve this heritage and manage its specific vulnerability. This publication addresses many of the aforementioned properties, explaining their links to human evolution, dispersal and social adaptation.

**4. HEADS 6: *The Origins of Food Production and the World Heritage Convention*; to be published in August 2016; II Volumes**

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Sites related to the transition from hunter-gatherer societies to sedentary societies hold important links to the overall scientific narrative of Human Evolution and are often insufficiently represented on the World Heritage List. Thus their value is under-recognized and it is often challenging for State Parties to conserve this heritage and manage its specific vulnerability. This publication will address properties related to the Neolithic transition from a multi-regional platform and explains their links to human evolution. This publication will provide an important step in strengthening international and regional cooperation and capacities to understand the forager-farmer transition in general, and more specifically, the future protection and sustainability of global early sites associated with food production. It will feature the most current research from many multidisciplinary perspectives including biology, genetics and soil micro-morphology in an evaluation of the Outstanding Universal Value (OUV) of agricultural-related heritage sites.

## iii.b Prehistoric sites inscribed on the World Heritage list since 2014

1. Decorated Cave of Pont d'Arc, known as Grotte Chauvet-Pont d'Arc, Ardèche (France)
2. Monumental Earthworks of Poverty Point (United States of America)
3. Pre-Columbian Chiefdom Settlements with Stone Spheres of the Diquís (Costa Rica)
4. Rock Art in the Hail Region of Saudi Arabia (Saudi Arabia)

### iv. Nominations proposed for 2016

Massif de l'Ennedi: paysage naturel et culturel (Chad)
Zuojiang Huashan Rock Art Cultural Landscape (China)
Antequra Dolmens Site (Spain)
Gibraltar Neanderthal Caves and Environments (United Kingdom)

### v. Nominations proposed for 2017

Dilmun Burial Mounds (Bahrain)
Caves with the oldest Ice age art (Germany)
Tehuacán-Cuicatlán Valley: originary habitat of Mesoamerica

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University of Tübingen
Spanish National Research Council (CSIC)
Institute of Ecology (INECOL)
The National Commission for Knowledge and Use of Biodiversity (CONABIO)

National Commission of Protected Natural Areas (CONAMP)
German Federal Enterprise for International Cooperation (GIZ)
National Institute for Anthropology and History (INAH)

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# The Applicability of World Heritage Criteria for the First Populations in the Americas

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The colonization of the Americas was one of the great milestones in the history of humankind. In its global context, the Americas were the last continents to be colonized, and the final part of a lengthy and complex process of expansion by *Homo sapiens* from Africa, where our species is evidenced as early as 160-190,000 years ago (White et al., 2003; McDougall et al., 2005). Although there is ongoing controversy and uncertainty over when *H. sapiens* dispersed across Asia, with some (for example, Dennell and Petraglia, 2012) arguing that this may have begun *c.* 100,000 years during the last interglacial and others (for instance, Mellars, 2006; Mellars et al., 2013) arguing that it began only after 60,000 years ago, almost all authorities believe that the Americas were colonized near the end of the Pleistocene, and long after humans had entered Siberia, Australia, Japan and north China. Debates over the initial colonization of the Americas tend to focus on three issues: when precisely it was first colonized; whether the initial dispersal of humans into the Americas resulted in permanent colonization; and whether the Americas were colonized from more than one direction. Each of these needs to be briefly summarised before considering how the criteria of the World Heritage Convention might be applied to the type of sites resulting from the initial peopling of the Americas.

## When did humans first enter the Americas?

For many years, the prevailing wisdom was that the Clovis Complex, or Culture, represented the first peopling of the Americas. The Clovis Complex is named after a distinctive type of bifacial, pressure-flaked point (Figure 1) that is widespread over the mainland of the United States (excluding Alaska) and south into Venezuela and the northern parts of South America (see Figure 2). Radiocarbon dating has established that it lasted from *c.* 13,600 cal BP (calibrated radio-carbon years before present) to 13,200 cal BP (Goebel et al., 2008), or according to a re-evaluation of these dates, from 13,200-12,800 cal BP (Waters and Stafford, 2007), right at the end of the Pleistocene. The 'Clovis first' model envisaged an initial dispersal of humans into Alaska from north-east Siberia across the enormous land bridge known as Beringia; once in Alaska, they were then able to disperse into the mainland United States through a corridor that opened up between the ice sheets over the Rocky Mountains and Canada when these began to retreat in the early Holocene.

Points like these were made ca. 13,000 years ago and are widely distributed across the United States and southwards into Columbia. Typically, they are *c.* 15 cm long and are arguably the finest examples of craftsmanship from the Palaeolithic world. For many years, they were supposed to represent the earliest inhabitants of the Americas, but it is now clear that human arrived earlier: how much earlier remains unclear. Although Clovis is no longer first, the Clovis point is still the most iconic symbol of the earliest habitation of North America.

*Figure 1. A Clovis point.*
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## The Americas in the Late Pleistocene

At the height of the last glaciation ca. 18,000 – 15,000 years ago, North America was dominated by two conjoined ice sheets – the Laurentide over most of Canada, and the Cordilleran over the Rockies. There was also a smaller but significant ice sheet over the southern Andes in South America. Because sea levels were ca. 100 m lower than at present, there were extensive coastal plains (shown by the dotted line) along the western coasts of North America, the Caribbean and South America, and the crucially important land bridge of Beringia between Alaska and Siberia.

The map shows the principal sites mentioned in the text. Most date (or are claimed to date) from before the Clovis Complex. The most unambiguous ones are Meadowcroft and Monte Verde, and specialists are still divided about the others. Two sites are part of the Clovis Complex – the type site, and Taima Taima in Venezuela. Teohuacan in Mexico is shown as a critically important American site as it was the area where maize was first domesticated.


*Figure 2. Principal early sites in the Americas.*
*Source: the author, but adapted from Meltzer 2009, Figure 1.*

This model has been periodically challenged by various claims for an earlier entry into both North and South America; some of these are shown in Table 1. Some of these could easily be dismissed; for example, claims on the basis of a few crude looking and poorly stratified stone tools (or geofacts) that there was a Lower Palaeolithic in North America (Carter, 1978) are unconvincing, and almost all researchers would suspect that dates of 258-295,000 BP from the Toca di Esperanza, Brazil (see Table 1) are either inaccurate and/or unrelated to any archaeological material. Doubts over the dating, stratigraphic context and identification of stone or bone as humanly modified have been sufficient to refute many claims for a pre-Clovis presence of humans in the Americas. Nevertheless, doubts persisted and two claims in particular have proved especially persistent. The first is the evidence from the rock shelter of Meadowcroft in Pennsylvania. This site has been meticulously excavated and the lowest levels (stratum IIa) have six $^{14}C$ dates in association with archaeological evidence from 12,88 to 16,175 BP, with an average of 14,250 BP (Adovasio et al., 1998; Meltzer, 2009, 111). The evidence seems highly compelling; indeed, it seems fair to suggest that if the same evidence was found in, for instance, France or Germany, it would be accepted without question on its own merits, irrespective of what was known from other excavations. The main weakness of Meadowcroft as definitive evidence that humans were in North America in pre-Clovis times is that even though there are over 75 publications on the site, the excavations have not yet been published in full. Whilst it is probable that if and when published in full, Meadowcroft will demonstrate that humans were in North America before 14,500 years ago, those critics who insist on full publication of any evidence contradicting the Clovis-first model can continue to doubt the veracity of Meadowcroft. There are, however, several sites in the United States that appear to contain pre-Clovis artefacts, such as Cactus Hill and Saltville, Virginia, the Topper Site, South Carolina (see Goodyear, 2005), the Debra L. Friedkin and Gault sites, Texas, the Paisley Caves, Oregon, Page Ladson, Florida (Waters et al., 2011a) and the Manis site, Washington (Waters et al., 2011b), and it is increasingly difficult to maintain a 'Clovis-first' model for the colonization of the Americas.

## Table 1: Pre-Clovis dates (i.e. pre 13,000 BP) from the Americas

When did humans first arrive in the Americas? How many of these early dates are fully secure, and how many can be rejected? Although Monte Verde unequivocally demonstrates that human had reached South America by 12,500 years ago, there is still considerable confusion over when they first arrived in both North and South America.

| Site | Material | Age | Source |
|---|---|---|---|
| Cactus Hill, Virginia | Clovis assemblage and hearth<br>Fluted points, flakes, charcoal (1)<br>Artefacts with hearth (1) | 10,920 ± 250<br><br>15,070 ± 70 BP; 16,670 ± 730 BP; | Goodyear, 2005 |
| Debra L. Friedkin site, Texas | >15,000 artefacts under a Clovis assemblage | ~13,000 – 15,500 BP; | Waters et al., 2011a |
| Manis, Washington State | Projectile point in mastodon rib | 13,800 BP;. | Waters et al., 2011b |
| Meadowcroft IIa, Pennsylvania (2) | Artefacts, bone | 12,880 to 16,175 BP; | Meltzer, 2009, 111 |
| Paisley 5 Mile Point Caves, Oregon | Human coprolites | 14,100 BP; | Gilbert et al., 2008; Goebel et al., 2008 |
| SV-2, Saltville, Virginia | AMS date on bone tool associated with Proboscidean skeleton | 14,510 ± 80 BP; (lowest horizon) | Goodyear, 2005 |
| SV-2, Saltville, Virginia | Stone and bone artefacts, fauna and wood twigs | 13,950 ± 70 BP; (middle horizon) | Goodyear, 2005 |
| Topper site, South Carolina | Clovis horizon<br>Underlying assemblage (3) | 13,500 ± 1000 cal BP;<br>At least 15,200 ± 1500 | Goodyear, 2005 |
| Various States | Petroglyphs, dated by cation ratios and AMS $^{14}C$ | 12-19,000 BP; | Whitley et al., 1996 |
| **South America** | | | |
| Brazil: Alice Boer | | 14,200 ± 1150 | Dillehay, 2000, 313 |
| Brazil: Caldeiro de Rodriguez | | 17,000 ± 400 | Dilley, 2000, 314 |
| Brazil: Morro Furado, | | 16,200 ± 290,<br>18,570 ± 130,<br>21,090 ± 420 | Dillehay 2000, 305 |
| Pedra Furada, Brazil (4) | Numerous dates<br><br>ABOX 14C dating of hearths | 25,200 ± 320 to 44,800 ± 1400<br><br>53,120 + 3965/-2640<br>55,575 + 5685/-3300 | Dillehay, 2000, 316<br><br>Santos et al., 2003 |
| Toca di Esperanza, Brazil | Layer IV, breccia | 258,000 ± 84 to 295,000 ± 780 | Dillehay, 2000, 317 |
| Monte Verde I, Chile | Carbonised wood | 33,370 ± 530 | Dillehay, 2000, 303 |
| Monte Verde II, Chile | Wood, charcoal | 11,900 ± 220 - 13,565 ± 250 (11 dates) | Dillehay, 2000, 303 |
| Pubenza, Colombia | Gastropods, seeds | 13,280 ± 110 – 17,790 ± 120 | Dillehay, 2000, 296 |
| Tequendama, Colombia | charcoal | 22,250 ± 470, 28,890 ± 840 | Dillehay, 2000, 296 |
| Huaro Cave, Peru | Bone collagen | 13,160 ± 700, 13,510 ± 700 | Dillehay, 2000, 298 |
| Pikimachay, Peru | Sloth bones, zone I | 14,150 ± 180,<br>12,750 ± 1400 | Dillehay, 2000, 300 |
| Pikimachay, Peru | Sloth bones, zone J | 17,650 ± 3000,<br>20,200 ± 1050 | Dillehay, 200, 300 |
| Venezuela: Taima Taima, | Masticated twigs | 12,890 ± 85, 13,000 ±200,<br>13,860 ± 120 | Dillehay, 2000, 298; Bryan et al.,1978 |
| Uruguay: Arroyo del Vizcaíno, | Cutmarked bone | 27-30,000 BP; | Fariña et al., 2014 |

*Notes:*
*1) Cactus Hill: these were stratigraphically below the Clovis horizon*
*2) Meadowcroft has been dated by over 50 $^{14}C$ dates in near perfect chronological order*
*3) The assemblage came from below this date in alluvial sands probably 16-20 ka*
*4) See Meltzer et al., 1994*

The evidence from Meadowcroft and other North American sites is especially challenging to the Clovis-first model because it implies that either there was an ice-free corridor through which they could enter North America, or that they entered by a different route – for example, by taking a coastal route by which they landed south of the ice sheets. Both these suggestions are problematic. We know that there was not an ice-free corridor during and immediately after the glacial maximum *c.* 18-15,000 years ago, so if they did enter the United States, their first entry would have been before this time – which few are prepared to concede. A coastal route is perhaps a more attractive possibility, given that the Australian, the Japanese and Philippine islands and island South-East Asia were all colonized by sea after 40-50 Ka. Additionally, the Northwest Pacific is extremely rich in marine life and humans might easily have followed the 'kelp highway', as proposed by Jon Erlandson (2002). However, because the glaciers along the Northwest coast of the Rockies discharged directly into the ocean, any coastal migration along the southern edge of Beringia would have been a serious undertaking during which landfall was not possible over perhaps

hundreds of kilometres until the very end of the Pleistocene (see Dickinson, 2011). Additionally, no evidence has yet been found for colonization along the coast (Dillehay et al., 2008).

The second site that challenges the Clovis-first model is Monte Verde II in Chile, far to the south of Clovis or any site in North America. After a protracted and often acrimonious struggle lasting several years, this site is now accepted by virtually all authorities as conclusive evidence that humans were in the Americas before the Clovis culture (see, for example, Adovasio and Pedler, 1997; Meltzer et al., 1997; Meltzer, 2009). Monte Verde II is an open air site that was remarkably well-preserved in peat and waterlogged sediments. Excavation revealed a settlement with tent-like huts built with wooden frames. Because preservation was so remarkable, even the wooden stakes and parts of knotted fibres used to peg the hides covering one hut were preserved. The density of fur residue inside the structure indicated that the floor was covered with pelts from mastodons; there were even lumps of meat preserved and evidence that sea weed – obtained from several kilometres away – were likely used as medicines (Dillehay et al., 2008). In addition to thousands of stone artefacts, numerous wooden tools were also found. Radiocarbon evidence shows clearly that the site was occupied *c.* 14,500 cal BP – at least a thousand years before Clovis. Unlike Meadowcroft, Monte Verde II has been fully published (see Dillehay, 1989, 1997) and cannot be challenged on the grounds that only a biased selection of the evidence has been presented.

Tom Dillehay, the principal investigator of Monte Verde, is one of the few prehistorians to have successfully caused a paradigm shift in archaeological thinking: Monte Verde II provides an unequivocal demonstration that the Americas were colonized before the Clovis culture appeared. Its location in southern Chile 16,000 km south of the Bering Land Bridge furthermore implies that either there was an extremely rapid dispersal of humans from Alaska to southern South America after 14,500 BP, or that humans did indeed enter the Americas long before this time but thereafter dispersed more slowly towards South America. At present it is difficult to decide between these possibilities, although the latter seems more likely. A short but very rapid dispersal of humans throughout the Americas in the Late Pleistocene is problematic for two reasons. The first is that it is far more rapid than other comparable dispersals outside the Americas. For example, the colonization of Siberia by our species during the later part of the Upper Pleistocene probably took several millennia between 45 and 30 Ka. The environments of Siberia are also far more homogenous than those crossed by the first inhabitants of the Americas from the Arctic to Patagonia. Although there are still many substantial geographic gaps to fill and the current dating is not as precise as we would wish, it is currently thought unlikely that areas as large as Siberia were colonized in only a millennium or two. Likewise with the Australian landmass which comprised New Guinea, Australia and Tasmania when first colonized after 40 Ka (Allen and Holdaway, 1994; O'Connell and Allen, 1998, 2004) or perhaps 55-60 Ka (Roberts et al., 1994); in this instance, the earliest archaeological evidence from highland New Guinea dates to *c.* 49 Ka (Summerhayes et al., 2010), but in Tasmania and South West Australia dates to only *c.* 40 Ka, implying that it took several millennia before this enormous landmass was occupied. A second difficulty is that unlike Siberia, the first inhabitants of North and South America were encountering an enormous range of habitats from the Arctic to the Equator and southwards through South America, and rates of dispersal must surely have been reduced by the need of these early colonists to learn how to adapt to such different environments. As stated by Dillehay (2002, p. 765) 'initial human colonization could not have been a blitzkrieg movement …. but was likely a stutter-step, characterised by hesitancy followed by rapid transience through or around inhospitable environments and slow migration through hospitable ones.' On the other hand, if dispersal through the Americas took several millennia, it is hard to understand why so little firm evidence for it has been obtained; for example, in the far smaller area of western Europe, there are hundreds of caves and open air sites from the late glacial that contain evidence showing the recolonization of this area when the ice sheets retreated at the end of the last ice age.

In summary, Meadowcroft probably and Monte Verde II definitely shows that the Americas were colonized at the latest by 14,500 cal BP. How much earlier remains uncertain. Few would place any confidence in dates of >50,000 BP from Pedra Furada, Brazil (Santos et al., 2003), still less the ones in excess of 250,000 BP from the Toca di Esperanza, also in Brazil. More recent dates of 12-30,000 BP may prove less easy to dismiss out of hand. Some are listed in Table 1; these include the small open air site of Monte Verde I, dated at *c.* 33,000 BP, and some from Brazil, Peru and Venezuela. Additionally, some linguists claim that the present-day and recent linguistic diversity of the Americas may imply that this divergence occurred over a far longer period than 12-15,000 years, as argued by archaeologists and some geneticists. It has even been suggested that the earliest, presumably mono-lingual immigrants arrived in a single dispersal event *c.* 50,000 years ago, or in several dispersals starting *c.* 30,000 years ago (see Meltzer, 2009, p.192). On the assumption that these would have been our own species, *H. sapiens*, this would imply that north-east Siberia could have been reached around the same time as the Japanese islands and north China. Few, if any, archaeologists and geneticists would support that contention. However, geneticists differ amongst themselves as much as archaeologists over when the Americas were first colonized. For example, Bonatto and Salzano (1997) suggested humans has crossed Beringia *c.* 30-40,000 years ago; and in a recent paper that synthesised archaeological and genetic evidence, Goebel et al. (2008) suggested that humans migrated towards the Bering Land Bridge no earlier than 30,000 years ago and possibly after 22,000 years ago, and migrated from Beringia into North America sometime after 16,500 BP This scenario is broadly consistent with one proposed on genetic grounds by Fagundes et al. (2008), who suggest that humans dispersed across Beringia between ~15,000 and ~19,000 years ago, but a shorter time-line of only ~13,000 BP is proposed in

another genetic-based paper by Ray et al. (2010), and ~15,000 BP for North America and ~10,000 years ago for South America (Eriksson et al., 2012). Both these imply that humans dispersed very rapidly from Alaska to Patagonia, which was definitely inhabited by 10,000 BP (Borrero, 1999) and probably reached by 11,000 BP (Dillehay, 2000, p. 214). Whilst the jury is currently deliberating its verdict on these claims for when humans first reached North America, they have implications relevant to the other two issues concerning the initial peopling of the Americas that were mentioned above.

## Failed dispersals versus successful colonization

A point that is often overlooked in discussions over when a taxon such as *Homo sapiens* first colonized a region is that not all dispersals result in successful, permanent colonization. Most in fact do not. As example, many plant and animal dispersals are transient and thus 'unsuccessful' because their presence in a region is dependent upon the prevailing climate. Many of the plants and animals in present-day Germany, for example, would have been absent during the severest parts of the last glaciation because they would not have survived prolonged periods of severe cold. Likewise, the reindeer that thrived in south-west France during the last glaciation could not do so today. In many parts of Eurasia, hominins were routinely present only during relatively short interglacial or shorter (interstadial) periods. In Britain, for example, they have probably been absent for *c.* 80% of the last 500,000 years (Stringer, 2006), so the most recent 'permanent' colonization event occurred at the end of the last ice age. From this perspective, the Pleistocene history of hominins in Britain is one of a series of 'failed dispersals'.

In discussions of our own species, 'colonization' normally implies a dispersal event that persists to the present, rather than its duration. For example, *Homo sapiens* were present in the Levant between the last interglacial (*c.* 125-100 Ka) and 70,000 years ago, when they were displaced by Neanderthals during a climatic downturn and did not return until *c.* 40-45,000 years ago. Their presence in the Levant between 125,000 and 70,000 years has been termed a 'failed dispersal' (Shea, 2008) because it did not persist into the present, even though it lasted longer than *Homo sapiens* has been in Western Europe, Japan, Siberia and probably Australia, and far longer than humans have been in the Americas. The point that is relevant here to the Americas is that humans may have entered several times before 14,500 BP, but without establishing populations that persisted beyond that date. Thus, even if some of the claims of a human presence in the Americas before 14,500 BP are confirmed, it would not necessarily follow that they indicate permanent colonization. They may instead indicate a 'failed dispersal' in which people died out because of, for example, climatic downturns, because they became too dispersed to maintain viable mating networks or because of disease. This might be especially applicable to any humans that might have entered the Americas more than 20,000 years ago, before the last glacial maximum.

At present, there seems little agreement over how often humans migrated into the Americas, with various researchers proposing that the present-day genetic and linguistic diversity resulted from one, two, three or even more dispersal events (see Meltzer, 2009, pp. 183-207). At present, many, perhaps most Americanists tend to favour the notion of a single dispersal event that resulted in the initial colonization of both North and South America, but without excluding the arrival of later populations across Beringia or the post-glacial Bering Straits. This model may change if pre-14,500 BP dates from American sites (such as Meadowcroft) are upheld.

## How did humans first reach the Americas?

The idea that humans first arrived in the Americas from north-east Siberia across the land bridge of Beringia is long-standing and has considerable support from geneticists (for example, Goebel et al., 2008; Eriksson et al., 2012) and physical anthropologists. Christy Turner (for instance, Turner, 1987) in particular has shown that the shovel-shaped incisors of many indigenous North Americas are derived from north-east Asia. Linguistic specialists also derive most native North American languages from north-east Asia.

The archaeological evidence for a 'Beringia highway' from Siberia into Alaska is less convincing, largely because eastern and north-east Siberia is so enormous and inhospitable. The easternmost province of Chukotia, for example, is larger than France and Germany combined, has few roads and no railways and even now has only *c.* 50,000 inhabitants. Unsurprisingly, there is little Palaeolithic data from this part of the world. The nearest sites with evidence relevant to the colonization of the Americas, such as Dyuktai are *c.* 1,500-1,750 miles west of the Bering Straits, or a distance equivalent to that between London and Istanbul (see Stanford and Bradley, 2012). Additionally, those Siberian sites containing artefacts that show some resemblance to early ones in North America tend to be younger than 11,500 BP (and thus irrelevant to the colonization of the Americas); those older tend to have only very general similarities.

## 'Across the Ice' – the Solutrean connection?

One daring hypothesis that has been advanced recently is that humans also reached the Americas from south-west Europe via the southern edge of the Atlantic sea-ice (Bradley and Stanford, 2004; Stanford and Bradley, 2012). These authors draw heavily upon similarities between the bifacial, pressure-flaked points of the Solutrean culture in south-western Europe and the Clovis culture of North America. Rather than explain these as coincidental (or 'technological convergence' ), they suggest that Solutrean people exploited the rich off-shore marine resources of the Bay of Biscay from boats and gradually acclimatised to sealing and fishing along the edge of the pack-ice, and thereby some eventually reached the eastern seaboard of the United States. A point that tends to be overlooked by some of the critics of Stanford and Bradley is that they are not proposing that their model is an alternative to Beringia; only that humans may have arrived in North America from both the Atlantic sea-ice and Beringia.

Nonetheless, their views have received much criticism (see for example, Straus et al., 2005) and their critics seem to outnumber by far their supporters. One problem is that the Solutrean, dated to *c.* 21-18 Ka, is several millennia earlier than the Clovis. A second is the overwhelming genetic, linguistic and dental evidence favouring north-east Asia and Beringia as the main source population for the Americas. (Although Stanford and Bradley cite the genetic haplotype X [found mainly in Western Europe and in some North American populations] as evidence that supports their hypothesis, this haplotype is also found in Siberia (see Fagundes et al., 2008; Goebel et al., 2008) and might even have originated there and spread later to both Western Europe and North America). A third problem with their hypothesis is that there is no evidence that humans in southern Europe were reaching the islands of the Mediterranean until the early Holocene (Broodbank, 2006), yet Stanford and Bradley (2012) suggest that late Palaeolithic groups in south-west Europe had already crossed an ocean only a few millennia earlier.

These points aside, I (Dennell, 2013) have not dismissed their ideas as readily as some of their critics on the grounds that there is compelling evidence that Late Pleistocene humans were competent sailors and navigators, as evidenced by the marine colonization of the islands of South-East Asia, Australia, the Philippines, Japan and off-shore islands such as the Bismarcks (north of New Guinea) and Okinawa, all of which had been reached by *c.* 30 Ka. There is thus no intrinsic reason why Late Palaeolithic groups in Western Europe could not have used boats for offshore and even beyond-the-horizon sailing, even if they do not appear to have done so in the Mediterranean. If future discoveries indicate that the earliest evidence for humans in the Americas comes from South America (where various claims have been made of a human presence as early as 30 Ka), it would be almost inevitable that someone proposes that it was reached by people sailing from the west coast of Africa.

To summarise: Beringia remains the most likely point of entry into the Americas, but there may have been others. There may also have been 'failed dispersals' that left only an ephemeral record both before and after 14,500 BP.

These uncertainties over basic questions concerning the first peopling of the Americas impact on assessment of the evidence indicating its initial settlement. Irrespective of when, how often and from where the Americas were first settled, the archaeological evidence for its first peopling is extremely ephemeral. For a non-Americanist such as myself, whose initial training was in the European Palaeolithic record, the evidence for the early peopling of the Americas is remarkably sparse. Unlike late glacial Siberia and Eastern Europe, there are (with the exception of Monte Verde II) no major settlement sites, little elaborate material culture (such as carved bone and antler objects), few major butchery sites, very little rock or cave art, almost no mobiliary art and very little human skeletal evidence. The earliest American evidence is broadly similar to that of Pleistocene Australia, although the latter has some notable burials (for example, those from Lake Mungo), and some rock art. Closer parallels to the American evidence are the early Mesolithic of Western Europe and the early Aurignacian of Western Europe: in both cases and the Americas, there are very few high-quality settlement sites, many low-quality lithic scatters and cave/rockshelter records and little skeletal evidence.

Several have commented on the lack of human skeletal evidence for the earliest Americans (for example, Dillehay, 2000; Meltzer, 2009) and the early Aurignacian (Davies, 2001). It may indeed be the case that the earliest Americans did not bury their dead but instead either cremated them (if fuel was abundant) without subsequently burying the ashes, or left them for carrion, as with modern Parsees. The near-absence of human burials seems to be real rather than the result of insufficient survey and may indicate ideological factors – for example, if (as seems likely) the earliest colonists were highly mobile, they might have felt less affinity for the land they were temporarily occupying and more with the fauna they depended upon: so, rather than return their dead to the land, they let them rejoin the living birds and mammals around them. Nevertheless, it is hard to understand why so few human remains have been found in river deposits, as these frequently contain human (and other faunal) remains in Europe.

The overall impression of the earliest American evidence for humans is that they were highly mobile, with a rapid rate of dispersal across both North and South America, and were also extremely adaptable to an astonishingly wide range of environments from the Artic to the tropics and south to Patagonia. In the space of what appears to have been only a few

millennia, these early settlers accomplished a feat of colonization that took far longer in a more limited range of environments in Europe, Asia and Australia. A corollary of this model of high mobility and rapid dispersal is that the vast majority of early sites in the Americas are ephemeral and (to non-specialists at least) unspectacular.

At this point we can consider the extent to which the criteria of the World Heritage Convention are applicable to the evidence for the first colonization of the Americas.

## The criteria of the World Heritage Convention

The relevant paragraph is number 77, each part of which can be taken in turn.

'The Committee considers a property as having Outstanding Universal Value (see paragraphs 49-53) if the property meets one or more of the following criteria. Nominated properties shall therefore: :

(i) represent a masterpiece of human creative genius';

It is difficult to see how this criterion could be applied to the ephemeral evidence left by these early colonists. The one item that might be nominated under this criterion is the Clovis point. First, the best are superbly made and are among the finest examples of pressure-flaking from anywhere in the Palaeolithic world. This technique was invented near the end of the Pleistocene: briefly, instead of detaching flakes by striking a stone with a stone or antler hammer, they were detached by applying pressure via a narrow piece of bone, ivory or wood. When used successfully, extremely thin flakes could be detached, almost as though they had been squeezed off. In skilled hands, flaking could be highly symmetrical and when done on both sides of a piece, an exceptionally thin artefact could be produced. A second reason for nominating the Clovis point is their iconic significance to North American researchers. As mentioned above, the 'Clovis people' were long regarded as the first in North America; supposedly highly mobile, successful hunters who rapidly dispersed across North and Central America, leaving Clovis points from the American Midwest to Venezuela. Their descendants gradually became less mobile and more closely associated with particular territories and so the Clovis point was developed into a wide range of broadly similar but regionally distinct styles, of which the Folsom is the best known. Even though we now know that Clovis points do not represent the first inhabitants of the Americas, the Clovis point remains the most distinctive product of the earliest Americans: it has the same iconic significance as the Acheulean handaxe in Europe, as the most widely recognized artefact of the Palaeolithic.

(ii) 'exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design';

This criterion is inapplicable to the type of mobile hunter-gatherers that colonized the Americas.

(iii) 'bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared';

This criterion could be usefully applied to a number of cases. Perhaps the most obvious are the Tehuacán and Oaxaca Valleys of Mexico, where maize was first domesticated along with squash and cucurbits. This area of Central America has one of the longest records of plant domestication in the world and, as the area where the world's most important commercial cereal was first domesticated, deserves World Heritage status for that aspect alone. The fact that maize cultivation underpinned the Maya civilisation before its overthrow by the Spanish in the sixteenth century is a further justification for nominating Tehuacán and Oaxaca as exemplifying cultural traditions that are still living (with the modern local culinary and artistic traditions, and local beliefs about maize) and past civilisations (in the case of the Maya).

A second possible candidate would be the High Arctic of Alaska and northern Canada, where there were remarkable human adaptations to the Arctic. Here, the Dorset and later Thule traditions can be cited as outstanding cultural traditions, much of which persist into modern times.

A third that can be singled out in the Americas is the High Andes, where humans were adapting to high-altitude living by 10,000 years ago (Dillehay, 2000, p.172-185). Depending upon which dates are preferred for the colonization of the Tibetan Plateau above 4,000 metres, the High Andes may represent the earliest example of human adaptation to habitual life at high altitudes. Additionally, this was the area where the potato was first domesticated, which was unquestionably one of the most important domestic plants that was transplanted to Europe and Asia (along with tobacco, cotton and maize). Among many examples of this, we can mention Ireland, where the failure of the potato harvest in 1848-49 was one of the most catastrophic

events in Irish history, and the importance of potato in Indian cuisine after 1600 (Collingham, 2005). A further reason for including the High Andes is that it was in this region that camelids (llama, alpaca and vicuna) were first domesticated (Dillehay, 2011). These animals, used for their wool, meat, milk and as pack animals, were the main animals that were domesticated in the Americas, and given their importance, the area where they were first domesticated deserves recognition.

Other examples might be the American Southwest, with a very long tradition of adaptation to a desert landscape; the Northwest Coast of the Pacific; the Peruvian coast; and Patagonia, where humans equipped with only a rudimentary technology settled 'at the uttermost end of the earth' in one of the least hospitable parts of the planet.

(iv) 'be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history';

The Clovis culture is (as with criterion i) perhaps the obvious candidate for showing 'an outstanding ….. technological ensemble' , although its significance is contentious. As noted already, it is no longer indicative of the earliest settlement of the Americas, nor is it a valid example of 'Pleistocene overkill', as proposed by Paul Martin (1984), who envisaged a 'blitzkrieg' wave of advance by Clovis hunters who dispersed rapidly and hunted many animals to extinction. A less dramatic but still worthy assessment of the significance of the Clovis culture is that it represents a conspicuous phase in the human colonization of North America.

(v) 'be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change';

The outstanding American example of a traditional pattern of human land- and sea-use that is under the impact of irreversible change is the Canadian and Alaskan Arctic, where climate change is already having major and probably irreversible impacts on human settlement, the fauna, flora and coastline. The ongoing shrinkage and thinning of the Arctic summer ice is bringing benefits to commercial shipping by opening up the Northwest Passage between the Pacific and Atlantic, but is causing profoundly negative impacts on indigenous communities by eroding the coast and disrupting their use of the sea. At the current rate of shrinkage, indigenous life ways that have persisted for millennia may well disappear within a generation.

Climate change may also cause irreversible damage in the High Andes, particularly because the Andean glaciers provide much of the water for agriculture and city life in the lowlands and along the Peruvian coast. Ongoing climate change will also negatively impact on the vegetation and dependant fauna, including llama and alpaca.

A third example of an outstanding type of land/sea-use is the Peruvian coast, which has evidence of human adaptations extending back *c.* 13,000 years (Sandweiss, 2003).

(vi) 'be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria)';

The outstanding example here are the Tehuacán and Oaxaca Valleys of Mexico, where maize was first domesticated and which have vibrant traditions centred on maize cultivation that extend back nine millennia. As shown so clearly in the Tehuacán Museum, maize is a recurring theme in the art and iconography of local life in the present, in the years following the Spanish conquest in the sixteenth century, in the preceding Maya and Olmec civilisation and their non-urban predecessors. This criterion could also be applied to examples cited above from the high Andes, the Arctic and the Northwest Pacific coast.

(vii) 'contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance';

The inherent weakness of this criterion is that it is subjective: and subject to change. As noted in an earlier report (Dennell, in press), 'There is no universal agreement over what is 'beautiful' and beauty is inevitably very much in the eye of the beholder. To take one example, until the Romantic Movement of the late eighteenth and early nineteenth centuries, mountainous areas in western Europe were seen by most as barren and inhospitable places that were to be avoided as much as possible, and landscape artists and poets tended to praise and select gentler, humanised landscapes such as farmlands and managed woodlands in their appreciation of nature. Only later did people regard mountains as beautiful rather than fearful, as places to explore, climb and map (as with the British obsession with the Alps and then the Himalayas). Similarly, polar regions were seen as devoid of any beauty until they became associated with heroism and competitive behaviour by Europeans (and North Americans) over who could go furthest north or south, lose the most toes and fingers, and survive the worst blizzards' .

Nevertheless, in the current age, barren landscapes (deserts and polar ones in particular), ones with dramatic changes in altitude (notably mountain and karst landscapes) and/or with marked variation in plant and animal life (for example, the African Rift Valley) tend to be regarded as exceptional examples of natural beauty, in contrast to ones that are flat and monotonous. With the Americas, one is spoilt for choice in specifying examples of 'outstanding natural beauty' . As an outsider whose appreciation of American landscapes is largely through the media, I would specify the High Arctic, the Rockies, the American Southwest, the Grand Canyon, the High Andes, the Atacama Desert and Patagonia as prime examples.

(viii) 'be outstanding examples representing major stages of earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features';

In the broadest use of this criterion, one could single out for the Americas the 3 billion year geological record of the Canadian Shield, the Jurassic Park of Wyoming, the formation of the Panama Isthmus c. 3.0 Ma which conjoined the Americas, the Grand Canyon, the uplift of the Rockies and Andes and many others. If applied to examples of the earth's history within the brief period that humans have been in the Americas, the choice is obviously much more limited. However, one could highlight Holocene examples from the last 10,000 years, such as the formation of the rainforests of the Amazon Basin and Panama, or the formation of the grasslands of the Argentinian pampas and American Midwest; the redwood forests of the Rockies, the wetlands of Florida, the post-Pleistocene formation of the deserts of the American Southwest, all of which have associated human adaptations. Likewise, the present-day topography of the islands and coastlines of the American Arctic are a product of the Holocene, as they were previously buried under ice.

(ix) 'be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals';

All the landforms mentioned above have their associated, ongoing ecological and biological processes. Particularly important ones might be the Holocene formation of the Amazonian rainforest, the Canadian Arctic, the grasslands of the American Midwest and Argentina, and the deserts of the American Southwest and Peru/Chile.

(x) 'contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation'.

The most threatened communities in need of conservation and further scientific investigations are those in the Arctic and the Amazonian rainforest. The dominant threats are climate change in the Arctic, and human pressure through logging and forest clearance for farming in Amazonia. In both cases, indigenous communities are also under threat. Both factors are also threatening the stability of the fauna and flora of the High Andes.

## Discussion

From the perspective of the World Heritage Convention, the evidence for the initial peopling of the Americas is problematic in two respects. First – and with the exception of Monte Verde II, Chile, and Huaca Prieta, Peru - there are very few major 'flag-ship' sites that could serve as the basis for a nomination: there are no equivalents to sites such as Mezherich in the Ukraine, with its structures of mammoth bones, or Dolni Vestonice in Moravia, with a triple burial and the earliest evidence for ceramics; no cave art sites comparable to Chauvet; no cave sites with substantial and crucially important hominin or human remains, such as Atapuerca or Mount Carmel; and so on. (And unfortunately, the main occupation area of Monte Verde no longer exists [Meltzer et al., 1997, p. 660]). This dearth of spectacular evidence is entirely consistent with what one would expect of small groups of humans with a simple kit of stone tools (but probably a much more complex one made from perishable materials such as cordage, leather, fur, basketry and wood) that were highly mobile and covered large distances each year. With such groups, no single site will give a representative indication of the totality of activities that were undertaken each year. Only later, when groups became more sedentary, is the quality and quantity of evidence likely to increase. However, because the earliest American sites are so ephemeral, it is hard to apply criteria i) 'masterpiece of human creative genius' , or ii) developments in architecture or technology, monumental arts, town-planning or landscape design'. A second problem with the Americas is that major sites that could serve as the basis for a World Heritage Convention nomination also require full publication. Again, Monte Verde II is the one obvious flag-ship site that has been fully published. Hopefully, Meadowcroft will follow suit, and if its claims for occupation before 14,500 BP are upheld, there would be a major flag-ship site in North America. Until more sites and surveys are published in full, issues of authenticity (paragraph 80: 'The ability to understand the value attributed to the heritage depends on the degree to which information sources about this value may be understood as credible or truthful') are largely irrelevant, as interim reports and conference presentations are insufficient to demonstrate that a claim is 'credible or truthful' . (Paragraph 81 states that 'cultural heritage must be considered and judged primarily within the cultural contexts

to which it belongs' when establishing authenticity; in the context of discussions on the first peopling of the Americas, the 'cultural context' has surely to be that of a rational, Western scientific tradition is which data can be verified or disproven).

The criteria with perhaps the greatest scope for application to the Americas are numbers (iii) ('exceptional testimony to a cultural tradition'), (iv) 'outstanding example of a ….. technological ensemble or landscape'; (v) ('outstanding example of a traditional human settlement, land-use, or sea-use', (vi) ('events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance'), (vii) ('exceptional natural beauty and aesthetic importance' ); (viii) ('outstanding examples representing major stages of earth's history' ); (ix) ('significant ongoing ecological and biological processes' ) and (x) ('most important and significant natural habitats for in-situ conservation of biological diversity' ). Somewhat paradoxically, all but two of the WHC criteria have potential applicability to the earliest sites in the Americas, even though the archaeological evidence for the initial peopling of the Americas is so meagre. It is clear from this list that a landscape approach is probably the best one to develop if the sparse evidence for the colonization of the Americas is to be appreciated at a World Heritage level. The Americas are not unique in that respect. The same point would apply to other areas of the world, such as mainland and island South-East Asia, where the colonization of rain forest was a major development in global history, but not one that left much in the way of eye-catching archaeological evidence. Likewise, with Palaeolithic evidence from the Lower and Middle Palaeolithic, a landscape approach is the most appropriate way of integrating the archaeological evidence into a coherent picture.

The World Heritage Convention provides additional guidance on the requirements of nominations under criteria (i) -(vi) and (vii) - (x) that are worth further attention.

Paragraph 88 states: 'Integrity is a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes. Examining the conditions of integrity, therefore requires assessing the extent to which the property:

a) includes all elements necessary to express its Outstanding Universal Value;

b) is of adequate size to ensure the complete representation of the features and processes which convey the property's significance;

c) suffers from adverse effects of development and/or neglect'.

Paragraph 89 states: 'For properties nominated under criteria (i) to (vi), the physical fabric of the property and/or its significant features should be in good condition, and the impact of deterioration processes controlled. A significant proportion of the elements necessary to convey the totality of the value conveyed by the property should be included. Relationships and dynamic functions present in cultural landscapes, historic towns or other living properties essential to their distinctive character should also be maintained'.

These are problematic for assessments of the earliest evidence from the Americas. Open air archaeological sites from the Late Pleistocene and early Holocene are inherently fragile, rarely if ever in 'good condition', and when exposed by erosion, 'deterioration processes' are hard to control. (The same is true of course of Early and Middle Pleistocene open air sites). It is easier to demonstrate 'good condition' and control deterioration with cave sites, and long-term, these may offer better potential as candidates for nomination.

Paragraph 90 of the World Heritage Convention concerns properties nominated under criteria (vii) - (x). Here, it states that:

'bio-physical processes and landform features should be relatively intact. However, it is recognized that no area is totally pristine and that all natural areas are in a dynamic state, and to some extent involve contact with people. Human activities, including those of traditional societies and local communities, often occur in natural areas. These activities may be consistent with the Outstanding Universal Value of the area where they are ecologically sustainable'.

These comments are applicable to all of the Americas, since there are no areas 'totally pristine' and all are dynamic: indeed, environmental archaeologists have been at the forefront of demonstrating just how dynamic most landscapes have been in the last 12,000 years. Indigenous 'traditional' societies persist in many parts of South America and the Arctic, even if often substantially transformed after European contact.

Paragraphs 93 to 95 are primarily relevant to nominations under the IUCN as they focus exclusively upon 'natural' habitats in which humans are excluded or irrelevant. These are cited below:

Paragraph 93: **'**Properties proposed under criterion (viii) should contain all or most of the key interrelated and interdependent elements in their natural relationships. For example, an "ice age" area would meet the conditions of integrity if it includes the snow field, the glacier itself and samples of cutting patterns, deposition and colonization (e.g. striations, moraines, pioneer stages of plant succession and so on); in the case of volcanoes, the magmatic series should be complete and all or most of the varieties of effusive rocks and types of eruptions be represented'.

Paragraph 94: 'Properties proposed under criterion (ix) should have sufficient size and contain the necessary elements to demonstrate the key aspects of processes that are essential for the long term conservation of the ecosystems and the biological diversity they contain. For example, an area of tropical rain forest would meet the conditions of integrity if it includes a certain amount of variation in elevation above sea level, changes in topography and soil types, patch systems and naturally regenerating patches; similarly a coral reef should include, for example, seagrass, mangrove or other adjacent ecosystems that regulate nutrient and sediment inputs into the reef'.

Paragraph 95: 'Properties proposed under criterion (x) should be the most important properties for the conservation of biological diversity. Only those properties which are the most biologically diverse and/or representative are likely to meet this criterion. The properties should contain habitats for maintaining the most diverse fauna and flora characteristic of the bio-geographic province and ecosystems under consideration. For example, a tropical savannah would meet the conditions of integrity if it includes a complete assemblage of co-evolved herbivores and plants; an island ecosystem should include habitats for maintaining endemic biota; a property containing wide ranging species should be large enough to include the most critical habitats essential to ensure the survival of viable populations of those species; for an area containing migratory species, seasonal breeding and nesting sites, and migratory routes, wherever they are located, should be adequately protected'.

The distinction in paragraphs 93-95 between the human and the natural worlds may seem self-evident to many, and is clear-cut in some cases: for example, coral reefs and ice fields and glaciers are 'natural' phenomena in which human presence and agency can be excluded. In many cases, however, the distinction between the human and natural is hard to maintain. For example, volcanic landscapes might seem at first sight 'natural' , yet volcanic soils are often highly fertile, and in many regions of the world (for example, Hawaii, Italy, Indonesia), volcanoes occasionally threaten but more usually sustain communities, many of which become extremely prosperous because of their access to fertile, well-drained volcanic soils. Or, to take another example, the tussock-grass páramo is the dominant vegetation in the High Andes above the forest-line, and have been seen as a type of 'natural' vegetation that is controlled principally by rainfall and temperature. However, as humans have lived in the region for 10-11,000 years and frequently deliberately burnt vegetation to increase research productivity (as in many other areas of the world), the páramo is more likely to be a man-made type of vegetation (White, 2013).

## Summary

Although the colonization of the Americas occurred very recently in the two-million-year long story of our genus, it was one of the most important events in that story and deserves to be celebrated as a vital part of our global history as a colonizing species. However, because the evidence for the initial peopling of the Americas is (with the exception of a very small number of sites) very meagre, a different approach is required when considering the World Heritage Convention than in areas where the late Palaeolithic record is much richer, as in Europe, Siberia, the Levant and South Africa. In these areas, the most obvious route to selecting candidates for nomination for World Heritage status is to build a nomination around a site or group of sites that have outstanding features in terms of their human skeletal, artistic and/or artefactual evidence. In the case of the Americas, it is probably more useful to build a nomination around a particular type of landscape that was colonized at an early date and which contains a representative range of unspectacular sites as proof of human presence.

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# The First North Americans: the State of the Art, 2014

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Twenty years ago, in the early 1990s, almost all North American archaeologists were convinced that the question of the continent's peopling had been resolved. The first arrivals possessed the Clovis lithic technology, an assemblage including large, fluted, trianguloid projectile points, bifaces often as large as dinner plates, end and side scrapers, gravers, notches and occasionally burins. This technological package is almost ubiquitous from the southern margins of the terminal Pleistocene glaciers to northern Colombia (Ranere, 2006), seemingly marking it as the trace of the Hemisphere's first colonists. Clovis points were often found in mammoth kills, which consistently dated to nearly 13,000 cal BP. No other technology could be found to reliably predate Clovis. Clovis also approximately coincided with the mass-extinction of most of the continent's megafauna (Martin, 1973). In addition, linguists linked all of the hemisphere's older languages to the Amerind group (Greenberg et al., 1986), further corroborating a single colonization event.


*Figure 1. Locations of major sites mentioned in the text. Glacial ice and coastlines are shown as they would have been circa 20,000 and 12,000 cal BP.*

The story was a simple one, repeated in nearly every textbook. Sometime around 13,500 years ago, the Laurentide and Cordilleran ice sheets had receded far enough to open an ice-free corridor from Beringia to temperate North America. As few as 100 big game hunters migrated down that corridor and found an unoccupied land filled with large game that had no innate fear of them. Free of constraints, they expanded rapidly, reaching the southern tip of South America within only a few hundred years. Through this blitzkrieg, as Paul S. Martin (1973) called it, they annihilated most of the continent's large herbivores and caused the native predators to follow them to extinction. Clovis was listed first in every regional chronology.

This Clovis-first paradigm, as it is now known, became scientific orthodoxy. Its staunchest adherents readily and, in most cases, quite convincingly dispensed with any suggestion of a pre-Clovis discovery. By the mid-1990s, only one strong contender for a pre-Clovis reality had come forward. In large part due to the meticulous stratigraphic work and tenacity of James Adovasio (Adovasio et al., 1990; Adovasio and Page, 2002), Meadowcroft Rockshelter in Pennsylvania (Figure 2) remained a viable contender despite numerous attempts to question its chronology and palaeoecological record (summarized in Adovasio et al., 1998). Believers in American cultures that predated Clovis occupied the fringe of the discipline. Alternatives to the single migration story were not welcome.

Archaeological opinion has since turned almost 180 degrees. More than a dozen unquestionably archaeological North American sites now convincingly predate Clovis times. Improvements in our understanding of glacial histories have opened up the possibility of alternatives to the ice-free corridor as a migration route to account for the early arrivals. We now have better evidence that the earliest human arrivals in the Americas, Clovis foremost among them, did indeed contribute to megafaunal extinctions. It is now clear that a second technological tradition coexisted with Clovis in North America. New horizons of research are being explored and geologists and archaeologists explore below water, both on the continental shelf and the drowned karst systems of the Caribbean rim. Finally, we have recovered and studied enough of the skeletons

of the earliest human occupants to speak effectively about the lives they led. The story of the earliest colonists, although less certain than it once was, is now much more interesting.

*Figure 2. General view of documentation procedures at Meadowcroft Rockshelter facing southeast; colored pencils which represented different combinations of silt, sand, and clay-sized materials were employed to produce microstratigraphic profile maps of all parts of the excavation. © J. M. Adovasio*

## The Pre-Clovis Record

Waters and Stafford (2007) critically evaluated existing radiocarbon dates for Clovis assemblages and re-dated many of them using refined bone pre-treatment methods and accelerator mass spectrometry. They concluded that Clovis occupies only a brief window of time between approximately 13,100 and 12,700 cal BP and used the result to support the argument that cultures existed in the Americas before Clovis. Although their inference is disputed (Haynes et al., 2007), the argument may be moot because three groups of sites and another currently isolated locality clearly demonstrate the presence of humans in North America before Clovis. The site groups, which I refer to here as the ice-margin kills, the Mid-Atlantic Complex, Gault and Friedkin; and the isolated site of Paisley Caves, are distributed throughout North America (Figure 1), indicating widespread human presence before 13,100 cal BP.

### Ice margin kill sites

Claims of pre-Clovis megafauna kills, based solely on purported cut marks on the bones, such as the Ayers Pond bison (Kenady et al., 2011) and Lindsay Mammoth (Davis and Wilson, 1985), are numerous but few pass close inspection. Even rarer are associations between these palaeontological remains and unquestionably human-produced artefacts. To be convincing, cut marks must meet stringent criteria for production by stone tool edges (Johnson et al., 2013), and artefacts must be in direct contact with and preferably beneath the bones, with both in primary context. The Manis Mastodon in Washington, Schafer and Hebior mammoths in Wisconsin and Firelands Megalonyx in Ohio meet these criteria.

The Manis site, Washington, discovered in 1977 (Gustafson et al., 1979) (Figure 1) consists of the cut-marked skeleton of an aged adult mastodon, one side of which remains articulated while the other lies scattered nearby. This pattern of incomplete carcass use is characteristic of Clovis proboscidian kills, reflecting a subsistence strategy that emphasized immediate food return (Haynes and Hutson, 2013). A bone splinter, identified through a high resolution CT scan as a bone projectile point made from the rib of another mastodon (Waters et al., 2011a) was found embedded in the right 14$^{th}$ rib. Four radiocarbon dates on this rib and the mastodon's tusk averaged 11,960±17 rcy BP, or approximately 13,800 cal BP. The site is situated near the Strait of Juan de Fuca and lay fewer than 100 km from the retreating margin of the Juan de Fuca lobe of the Cordilleran ice sheet.

Schaefer and Hebior are similarly situated in newly deglaciated terrain near the shores of Lake Michigan, south-east Wisconsin (Joyce, 2013). Each consists of the disarticulated remains of a single adult mammoth bearing multiple cut marks and associated with lithic tools. The Schafer specimen exhibits 30 cut marks primarily on longbone, which indicate the animal was butchered while fresh. Two chert flakes were found directly beneath the pelvis (Figure 3), confirming the cause of the cut marks. Fifteen radiocarbon dates on purified collagen place the death of this animal between 12, 290±60 and 12,570±45 rcy BP (Joyce, 2006), approximately 14,200 cal BP. The Hebior mammoth exhibits stone tool cut marks on nine elements, primarily those of the feet, but more advanced weathering of much of the skeleton precluded identification of such marks on most elements. Associated tools include two bifaces, an unmodified flake of chert and a weathered dolomite fragment labelled a 'chopper'. One biface lay beneath a thoracic vertebra; the other chert implements were also associated with skeletal elements. Three radiocarbon dates

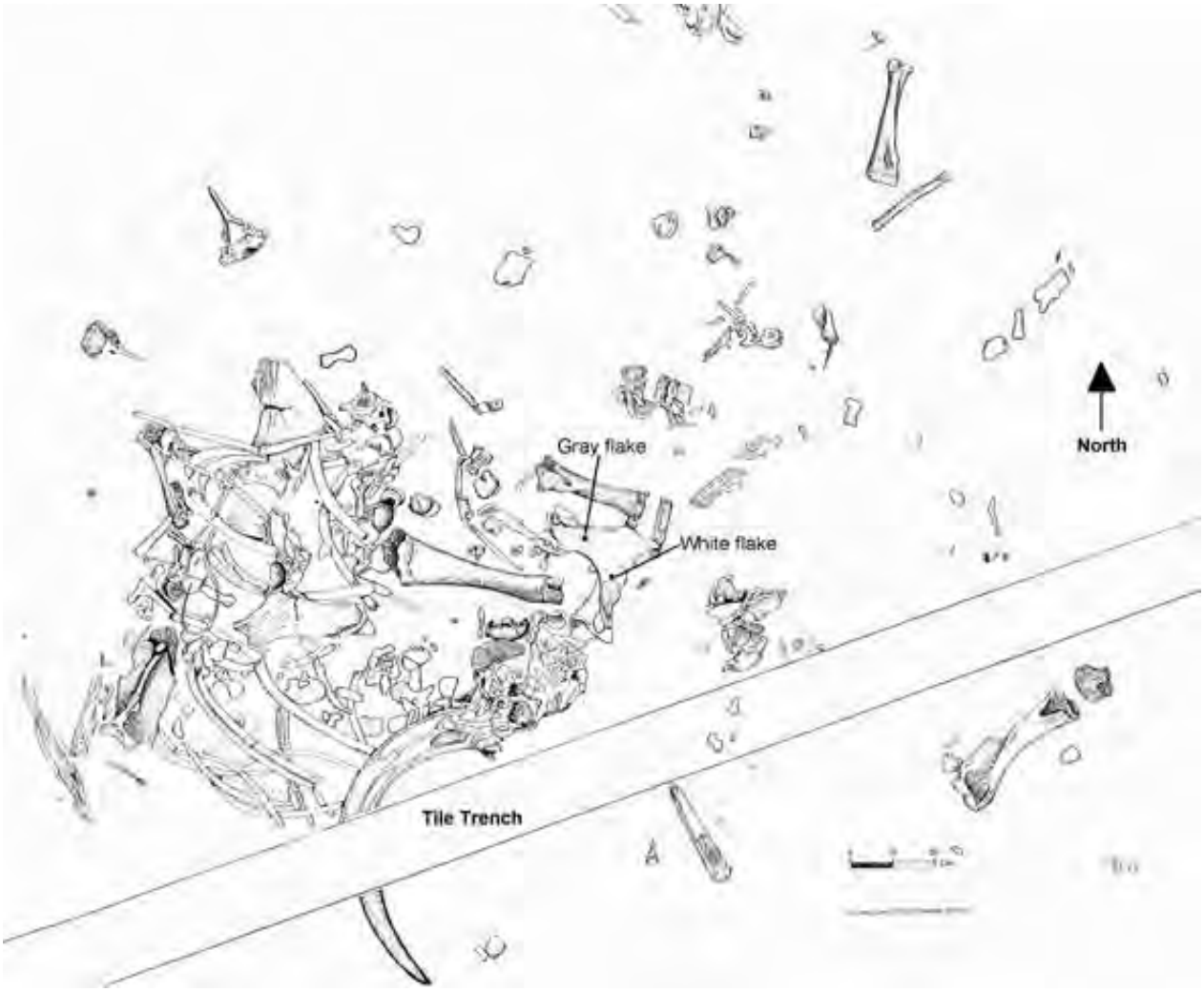


*Figure 3. A plan map of the Schaefer mammoth, showing the location of lithic artefacts found in association with the skeleton. © Daniel Joyce.*

on purified collagen place this kill between 12,480±60 and 12,590±50 rcy BP (Overstreet and Kolb, 2003), or around 14,800 cal BP.

The final convincing pre-Clovis megafaunal kill is the Firelands *Megalonyx*, the partial remains of a giant ground sloth found in northernmost Ohio, in a swamp near the shore of Lake Ontario (Redmond et al., 2012). From a local museum collection and lacking comprehensive records about its recovery, the Firelands *Megalonyx* lacks the detailed provenience of the Manis or Wisconsin specimens, but its validity is nonetheless convincing. Among ten skeletal elements is a complete left femur with multiple cut marks. The anteriodistal aspect of this element exhibits 47 linear and arcuate incisions apparently resulting from the effort to remove the large quadriceps muscles. Casts of a sample of these were studied by scanning electron micrography (SEM) and, based on a stepped or "shouldered" cross-section (Johnson et al., 2013), they represent stone tools cuts. A parallel series of multiple cuts change from one- shouldered to two-shouldered as they progress along the shaft, from which Redmond et al. infer the butcher switched from a unifacial to a bifacial tool. Given the continuous parallel orientation of the cuts, it is more likely that the addition of a shoulder in later cuts is evidence for progressive dulling of a single unmodified flake by removal of small chips, which is the most convincing evidence for butchery. A single radiocarbon date on collagen from this specimen, 11,740±35 rcy BP places it at around 13,600 cal BP. This is the first confirmed evidence for ground sloth hunting in North America. It could, however, benefit from additional radiocarbon dating to confirm the age of the kill event.

These four sites, stretching across the North American continent south of the glacial ice, convincingly demonstrate that humans were living near the ice margin between 14,000 and 15,000 cal BP, well before the invention and spread of Clovis technology. Lacking here, however, are details of the technology and settlement patterns of these early peoples.

## Middle Atlantic complex

Evidence is building for a potentially very early human presence along the eastern seaboard, where at least 5 sites have produced similar artefact assemblages dating as early as 20,000 cal BP. In the early 1970s, the Meadowcroft Rockshelter, in western Pennsylvania, produced a small number of artefacts and human remains well beneath a classic Clovis assemblage, sealed from it by a thick layer of roof fall (Adovasio and Page, 2002). In this unit, called Stratum IIa, were multiple hearths, along with fibre and lithic artefacts. Among hundreds of waste flakes were two small, trianguloid, straight- to slightly concave-based projectile points, retouched flake tools, and retouched and unretouched bladelets. Adovasio named this assemblage the Miller Complex and its projectile point the Miller lanceolate. Radiocarbon dates on the Clovis assemblage placed it within the appropriate 13,000 cal BP time range, but the underlying assemblage dated between 20,500 and 14,100 cal BP (Adovasio et al., 1990). For many years, this small collection stood alone amidst heavy criticism, but since the late 1990s a similar superposition of Clovis projectile points above an assemblage closely similar to the Miller Complex has been found repeatedly in sites around Chesepeake Bay.

The same small, trianguloid projectile points and bladelets of the Miller Complex, as well as polyhedral bladelet and flake cores, burins and a variety of retouched flake tools have been found at Cactus Hill, Virginia and across the Chesapeake Bay on the Delmarva Peninsula at Miles Point, Oyster Cove and Cator's Cove (Lowery and Wagner, 2013; Stanford and Bradley, 2012). At Cactus Hill, this assemblage was found beneath an eolian deposit containing Clovis artefacts, separated from them by a palaeosol. Geochemical tests on sediment within sub-Clovis artefact concentrations showed accumulations of phosphorus, indicating the artefacts had not been relocated from an overlying stratum (McAvoy et al., 2000). On the Delmarva Peninsula, Miller Complex-like artefacts occur as small clusters within a well-developed palaeosol, named the Tilghman (Lowery and Wagner, 2013). The surface of the Tilghman Paleosol has been truncated by wind erosion and is overlain by loess dated to the Younger Dryas. Clovis artefacts are frequently encountered between the two, having been deflated onto the B Horizon of the wind-resistant palaeosol. Some of the Miller Complex-like artefacts were firmly incorporated into peds of this B Horizon, indicating they were present when the soil was forming. Charcoal from one apparent hearth in the Miller component at Cactus Hill radiocarbon dated 15,070±70 or 18,450 cal BP[1] (McAvoy et al., 2000); organic material from the Tilghman Paleosol ranges between 16 and 24,000 years old (Lowery and Wagner, 2012). In a recent presentation, Lowery conservatively gave age of the pre-Clovis components on the Delmarva Peninsula as at least 14,000 years. The Miller Complex of the Mid-Atlantic region is thus a fully replicated pre-Clovis phenomenon.

One additional discovery that highlights the pre-Clovis presence of humans in the mid-Atlantic region is known as the Cinmar biface. In 1970, a scallop dredge working 100 km off the coast of Virginia brought up a mastodon skull and a 19 cm long, laurel-leaf biface (Stanford and Bradley, 2012). The objects came in a single dredge haul from a depth of 75 m below sea level near the outer edge of the continental shelf. Geochemical analysis of the biface and the tooth and tusk saved by the discovering fisherman indicated they had lain in a freshwater bog for some length of time before rising sea level inundated them around 14,500 years ago. The mastodon bone radiocarbon dates to around 27,000 cal BP (Lowery, 2010), so the biface likely dates to sometime after that but before inundation took place. The antiquity of this find is, however, contested (Boulanger and Eren, 2015.

## Gault and Debra L. Friedkin sites

These two sites are located in central Texas at a major source of high quality Edwards chert that has been used throughout prehistory. Both sites contain uninterrupted but properly superimposed sequences of artefacts ranging from Clovis through Palaeoindian and Archaic (Collins et al., 2013). At both, large assemblages of artefacts have been found beneath the Clovis horizon. Of these, the findings at Friedkin have been more completely described (Waters et al., 2011b). The assemblage consists of over 2,300 pieces of macro-debitage and 56 tools distributed within a 20 cm thick zone underlying a 2.5 cm thick Clovis horizon. Tools include blades and bladelets, what appear to be unfinished bifaces, edge-modified flakes and a discoidal core. Blade cores were not found but are inferred from the large number of blades and bladelets. Waters et al. (2011b) have named this small assemblage the Buttermilk Creek Complex, but more excavations are needed to clarify its technological composition and lithic reduction trajectory.

The Friedkin site lacks organic material suitable for radiocarbon dating, so Waters et al. (2011a) established a chronology using optically stimulated luminescence (OSL). The 49 OSL dates form two columns formed a stratigraphically consistent sequence from the Early Archaic to Buttermilk Creek horizons. Two samples from the Clovis horizon (14,350±910 and 14,070±910 cal BP) overlap the radiocarbon-established age range for that technology (Waters and Stafford, 2007) at two

1 A date on a second 'hearth' has too high a standard error to be considered here.

*Figure 4. Excavation in the Paisley Caves, Oregon, from which coprolites dating over 14,000 cal BP produced human DNA and Western Stemmed Tradition artefacts coeval with Clovis were discovered. © Dennis Jenkins.*

standard deviations. A conservative age estimate based on the minimum ages of the 18 measurements from the Buttermilk Creek horizon, which range from 14,000±890 to 16,515±1075 places the age of the complex between 13,200 and 15,500 cal BP. The researchers use detailed soil chemistry and micromorphology to establish that the artefact assemblage did not migrate down from the denser lithic concentrations in overlying levels.

Similar artefacts are found beneath the Clovis horizon at Gault and preliminary OSL results indicate a similar age range (Collins et al., 2013). Analysis of the bifacial reduction trajectory in this assemblage by Bruce Bradley shows it to be distinct from the Clovis pattern (See **Clovis Contemporaries**, below). Bladelets and the unfinished bifaces may indicate similarity to the Miller Complex, but small, split stem projectile points, which differ markedly from any other early assemblages in North America, also have been found, raising the possibility that more than one distinct lithic tradition existed in North America at this early date (Collins et al., 2013).

## Paisley Caves

The earliest human presence in western North American has been established not by artefacts but by faeces. Dry sediments in the Paisley Caves of south-central Oregon (Figure 4) have produced numerous coprolites found by the research team to contain human DNA (Gilbert et al., 2008; Jenkins et al., 2012, 2013). The dry sediments of the cave, which contain copious amounts of well-preserved plant materials sometimes cemented together with packrat urine, have been meticulously documented and dated with 203 radiocarbon analyses. Coprolites dating between 14,000 and 15,000 cal BP were collected from the deepest levels of the cave and are interpreted as evidence for human presence in the Great Basin by this time in prehistory. No unquestionable artefacts have been found in association with them, however, leaving the human identification of the coprolites in question. Cultural layers above the coprolite deposit, however, have provided solid evidence for occupation by people contemporary with Clovis but using a non-Clovis technology (See **Clovis Contemporaries**, below).

### Pre-Clovis occupation of America

Collectively this series of sites documents the presence of humans in North America by at least 15,000 years ago - and possibly much earlier in the case of the Mid-Atlantic findings. Artefacts representing this early occupation, where sufficient material exists for characterizing lithic technology, show a combination of core-and-blade and biface industries that, although lacking the distinctive lithic reduction approach that distinguishes Clovis, is not markedly dissimilar from it. This similarity has led one Clovis-First proponent to recognize a proto-Clovis culture in the Americas (Haynes, 2002; Haynes and Hutson, 2013).

## Alternative routes of colonization

For many years, opponents of the Clovis-First model argued that the first Americans could not have entered via an ice-free Corridor in Western Canada because such a corridor did not exist (for example, Dixon, 1999). Evidence for such a corridor was equivocal. Either the Cordilleran and Laurentide ice masses had not parted by 13,500 years ago, in time for the Clovis progenitors to enter or massive melt-water lakes blocked the path of any prospective migrants. Given this inference and final acceptance of human presence more than 14,200 years ago at Monte Verde in southern Chile (Dillehay, 2000; see also this volume) archaeologists began seeking alternative routes. Two principal routes have been proposed: A circum-Pacific route, often called the Kelp Highway Hypothesis (Erlandson et al., 2007) and the Solutrean Hypothesis, which proposes immigration around the north Atlantic (Stanford and Bradley, 2012).

### The Kelp Highway hypothesis

Long thought to have remained under glacial ice until well after an interior corridor opened up, the mountainous coast of British Columbia and south-eastern Alaska is now known to have been largely free of ice by 16,000 cal BP. Caves along this coast have produced palaeontological collections indicating the presence of terrestrial animals, including bears and caribou, by this early date (References in Dixon, 1999). A growing number of researchers has embraced the long-discredited notion first proposed by Fladmarck (1979; See also Gruhn, 1994) that the first Americans entered not as hunters of terrestrial big game but as coastal and maritime foragers who emphasized food from the sea (for example, Dixon, 1999; Erlandson et al., 2007). The idea has a great deal of merit from a theoretical standpoint and is indirectly supported by archaeological evidence from around the Pacific Rim. As articulated by Erlandson et al. (2007), the Kelp Highway Hypothesis asserts that people occupying the coast of eastern Siberia and the Japanese islands, in possession of simple watercraft and a technology for exploiting shellfish, bird, sea mammal and near-shore fish resources could have expanded onto the southern rim of Beringia in the late glacial. Once the ice melted from the north-west coast of North America enough that coastal patches became available, they could have continued their expansion without any change in their basic adaptive strategy. The same kind of resources can be found and exploited in the same ways along this entire coastal 'megapatch,' regardless of the adjacent terrestrial ecosystem. Coastal-adapted colonists could have followed this megapatch down the Pacific Coast, entering the interior along major rivers like the Columbia, Sacramento and Colorado, or continuing south into Central America. At Panama, some would cross the isthmus while others continued south to Tierra del Fuego. The group that crossed could have split again, some proceeding north along the Gulf and Atlantic Coasts and others proceeding south toward Brazil and the Amazon River delta. In North America, those who entered via the Sacramento or Columbia would give rise to the Western Stemmed Tradition; migrants up the Colorado or up the Mississippi or other south-eastern rivers would be the progenitors of Clovis (Anderson et al., 2013) (see **Clovis Contemporaries**, below).

Much of this remains conjecture because postglacial sea level rise has obliterated or inundated the evidence, but there is some archaeological support for the idea in the Terminal Pleistocene lithic technologies of the Pacific Rim. Stemmed projectile points represent the earliest cultures along the west coast of the Americas and the Amazon lowlands and can also be found in Late Pleistocene assemblages from north-easternmost Asia (Erlandson and Braje, 2011; Gruhn and Bryan, 2011). The 16,000 year old Incipient Jomon on Sakhalin Island, Ushki VII from Kamchatka, Lind Coulee and Cooper's Ferry sites in Washington, and the earliest occupations of the Channel Islands off southern California all include small, thin contracting-stemmed and often barbed projectile points of remarkably similar form. The Channel Islands' Amol and Channel Island barbed (Erlandson et al., 2011), and the Lind Coulee style projectile points from Cooper's Ferry (Davis and Schweger, 2004) are remarkably similar to specimens from Ushki Lake (Dikov, 1996). These are associated on the Channel Islands with a subsistence emphasis on birds, fish and shellfish (Erlandson et al., 2011). The mere presence of people on the Channel Islands nearly 13,000 years ago demonstrates that at least some of the earliest Americans were producing seaworthy watercraft, substantially supporting the coastal migration hypothesis. People following big game across interior

steppes are unlikely to have retained such know-how, nor are their descendants likely to have developed it within a mere 200 to 300 years after their arrival.

### The Solutrean hypothesis

Stanford and Bradley (2012) observe numerous close similarities between Clovis assemblages and the Solutrean assemblages of the Iberian Peninsula. The two are said to share multiple technological and artistic traits, including cylindrical bone projectile points with bevelled, sometimes zig-zag incised bases, eyed needles, incised stone tablets, spurred end scrapers, multi-pointed gravers, a blade technology that emphasizes bladelets, indented-based trianguloid points, sometimes flaked only unifacially (plane-faced points), use of exotic, aesthetically pleasing lithic material - including quartz crystal - often from hundreds of kilometres away, heat treatment to improve flaking of raw materials and *outré passé* thinning of large bifaces. *Outré passé* flaking thins stone by taking broad, thick flakes completely across a preform, removing a portion of the edge opposite the striking platform. The method enables production of very broad, thin finished implements and was used to produce both Clovis projectile points and Solutrean laurel-leaf bifaces. According to Stanford and Bradley, these are the only two cultures to have ever systematically applied this technique. The authors see the Solutrean people, who were partially coastal/maritime adapted, seasonally occupying pack ice, from which they exploited a rich diversity of birds, sea mammals and fish in a rich food web supported by a nitrate infusion from glacial ice. Living on the ice and moving by boat, they ultimately expanded across the North Atlantic to the east coast of North America. Stanford and Bradley see the Mid-Atlantic pre-Clovis manifestation (which I group under the Miller Complex here) as descendants of this Solutrean expansion. They point to the close similarity between the Solutrean and Miller Complex assemblages in bladelet technology, small, trianguloid, often indented-based projectile points and large, leaf-shaped bifaces, including Cinmar, that have been dredged from the submerged continental shelf, as firm evidence for their hypothesis.

The Solutrean Hypothesis was heavily criticized by Solutrean expert, Lawrence Strauss, (2000; Strauss et al., 2005) even before it was fully explicated. In his 2000 critique, Strauss points to the nearly 6000-year disparity between the youngest Solutrean and oldest Clovis discoveries as making a relationship between the two cultures impossible. Strauss et al. (2005) argue that Solutrean-like components of Clovis can be found across Eurasia in the Middle and Upper Palaeolithic, so a Siberian origin for Clovis technology is not ruled out. The age of the Miller Complex (see Pre-Clovis: Record: *Middle Atlantic Complex*) narrows the gap somewhat, but the hypothesis has gained few adherents.

Ancient DNA findings seem to further weaken the Solutrean Hypothesis. Both nuclear and mitochondrial DNA (mtDNA) of an 18 month-old infant from the Anzick Site indicate a primarily Asian, not European ancestry, although European Upper Palaeolithic progenitors are indicated to a minor degree (Rasmussen et al., 2014). The infant's remains were found along with a large cache of Clovis artefacts, leading Rasmussen et al. to conclude that Clovis could not be descendant from the Solutrean. However, the human skeleton consistently dates 400 years younger than two bone foreshafts from the Clovis cache leading Waters and Stafford (2007) to conclude the two are not associated. A second probably Clovis-age female skeleton from the Hoyo Negro site on the Yucatan Peninsula also has an Asian-derived mitochondrial genome (Chatters et al., 2014). Clovis is the earliest documented archaeological manifestation in Central America (Ranere, 2006), suggesting that the Hoyo Negro woman could have been Clovis. The Yucatan, however, has yet to produce a single late Pleistocene-age archaeological site, so the cultural affiliation of this individual remains a mystery. The genetic background of Clovis people cannot yet be definitively identified, nor the Solutrean Hypothesis entirely ruled out.

## Reconsidering the ice-free corridor

The question of whether or not an ice-free corridor predated the appearance of Clovis was long plagued by a lack of geochronological data from the vast and often-inaccessible region the corridor transected. With new information coming from as far north as the upper McKenzie River basin south to the US-Canadian border, however, the chronology of the corridor is finally becoming clear (Ives et al., 2103). The northern Cordilleran ice sheet was in retreat by 13,500 to 14,000 cal BP. The northern clade of Bison that gave rise to modern American *Bison bison*, had moved as far south as north-eastern British Columbia by 13,100 cal BP, indicating habitable steppe existed from the Yukon to north-eastern British Columbia/ north-western Alberta by that time. The north-western Laurentide ice sheet had begun retreating by around 15,300 cal BP and by 13,700 bison grazed in the lower McKenzie Valley. The south-western Laurentide ice sheet had receded far enough by 13,200 cal BP that horse and bison were grazing east of Edmonton, Alberta. Collectively these findings indicate that steppe ecosystems supporting big game did indeed form a continuous band from eastern Beringia to the US border by a few centuries before Clovis.

Archaeological evidence does not, however, support a pre-Clovis southward expansion along that corridor. Survey of fluted projectile points shows such artefacts are common in the southern part of the corridor and extend northward to north-eastern most British Columbia (Ives et al., 2013). Some of these artefacts are classic Clovis, but as one progresses northward, they take on the multiple-fluted and more deeply concave bases of Alaskan fluted projectile points, which are known to postdate Clovis by several centuries (Smith et al., 2013). It appears that Clovis and their descendants migrated north through the corridor, not south.

## Megafaunal extinctions

Paul Martin's idea of a Clovis 'blitzkrieg' expansion causing extinction of most the Western Hemisphere's megafauna came under intense criticism early in the twenty-first century, with the most intense attack coming from Grayson and Meltzer (2002, 2003). These authors question the possibility that human hunting could have led to the extinction of 33 large mammalian genera within only a few thousand years of their arrival for two primary reasons: 1) the timing of extinctions did not (in their view) shortly follow the 13,000 cal BP arrival of Clovis hunters in the Americas, rather, extinctions occurred over several thousand years of the last deglaciation and 2) direct evidence existed for only two genera, *Mammuthus* (mammoth) and *Mammut* (mastodon), although there was indirect, but equivocal evidence for *Equus* (horse) and *Camelops* (giant camel). They assert that climatic change and its impact on the habitats of megafauna is the most likely explanation. Better radiocarbon dating of extinct North American species and new evidence of human-megafauna interactions, along with substantiated evidence for human presence in the Americas by nearly 2000 years before Clovis has proven both of these assertions wrong.

### Timing of immigration and extinction

Radiocarbon chronologies place the extinction of most of the now-missing North American mega-herbivores, and with them their mega-predators, between 15,000 and 12,000 cal BP, after humans had resided on the continent for up to 3,000 years (Waguespack 2013). Most North American megafauna were in decline by around 13,000 cal BP (Feidel, 2009; Guthrie, 2006) with most disappearing by 12,000 cal BP. Although some authors assert that the span of human-megafaunal coexistence is too long for a rapid anthropogenic event, others see it as evidence that sustained pressure on ecologically-weakened animal populations is more likely than Martin's blitzkrieg to have eliminated most large mammals (Waguespack, 2013). In fact, most extinctions appear to have occurred within the Clovis time period, a much more rapid event than the period of overlap would suggest (Barnosky et al., 2004; Haynes, 2009). Ecologists, palaeontologists and wildlife biologists see a human hand in the extinctions (Alroy, 2001; Barnosky et al., 2004; Brook and Browman, 2004), although the Younger Dryas climatic cooling episode, which also coincides with the events, probably played a major role in further reducing already vulnerable populations. Reversing the habitat changes that were already under way due to the rapid warming of the terminal Pleistocene, this event would have delivered a second blow to many species.

### Patterns of predation

The earliest human hunters in North America did not kill only mammoth and mastodon, as Grayson and Meltzer (2002, 2003) assert, but hunted many of the now-extinct megafauna. This is now evident in three discoveries made since the beginning of the twenty-first century: the Firelands *Megalonyx*, Ohio; Fin del Mundo, Sonora, Mexico; and the Wally's Beach Site, Alberta. The Firelands *Megalonyx*, discussed above (**Preclovis Record**: *Ice Margin Kill Sites*), provides proof that this species of ground sloth (*M. jeffersonii*), at least, was hunted by Palaeoamericans. At Fin del Mundo, remains of two butchered subadult lowland gompotheres (*Cuvieronius sp* [probably *C. tropicus*]) have been found in association with Clovis projectile points (Sanchez et al., 2014), adding a third proboscidean genus to mammoth and mastodon in the list of Clovis prey. It is the Wally's Beach site, however, that has provided the greatest blow to those who believe humans did not play a major hand in the extinctions.

Wally's Beach is located in south-western most Alberta, in the drawdown zone of the St. Mary's irrigation reservoir. Since 1999 erosion of denuded eolian sand deposits has exposed megafauna trackways and concentrations of large mammal bone. Among the finds are the partial skeletons of Mexican horse (*Equus conversidens*) and giant camel (*Camelops hesternus*). Each of the horses has been found in association with lithic artefacts and dates a few centuries before the Clovis window. The single giant camel, which dates 11,440±25 rcy BP (13,255-13,313 cal BP), consists of two sets of articulated vertebrae, beside which lie three large flakes of a local quartzite, one of which was found directly between the articular processes of a cervical vertebra (Kooyman et al., 2012; Waters et al., 2015). Cut marks made by stone tools have been

identified on the specimens. The ribs heads show clear evidence of having been chopped free of the bodies, which were removed from the area, demonstrating the animal was methodically butchered, leaving little behind at the kill location. Eight horses are represented in seven bone clusters scattered over an area more than 600 m long. Each is associated with from one to eight flakes or retouched tools, most of them also of local quartzite (Kooyman et al., 2006). At least one horse exhibits cut marks on its hyoid bone. This group dates between 11,410±30 and 11470±35 rcy BP (13,215 to 11,360 cal BP) (Waters et al., 2015). Clovis projectile points have been found in the site, although none is directly associated with any of the megafauna. Thus, Wally's Beach provides evidence of human predation just before the Clovis era of two now-extinct mega-herbivores never before seen in a kill site.

The Wally's Beach horses and trackways are most informative about the process by which humans could have brought about the extinction of so many mega-herbivores. Kooyman et al. (2006) note that the species of horse found at the site, *Equus conversidens*, is taxonomically closest to a subgroup of horses that today maintain small, stable groups of mares defended by a single stallion. When threatened by pack predators, such horses form tightly bunched defensive clusters, which is no defence at all against human predators with long distance projectiles, such as the Clovis hunters possessed. From the broad distribution, and usually isolated occurrence of individual horses, it appears the hunters picked off their prey one-by-one, as needed. Modern camels and musk oxen behave in similar ways; whereas modern North American herbivores that have survived the Pleistocene do not (Gregory Green personal communication). Extinction was thus selective, which we would not expect if habitat deterioration were the primary cause of species losses. Trackways provide a second line of information. Tracks have been found of mammoth, camel, bison and caribou, all of which we know from this and many other sites to have been hunted by early Americans. Mammoth tracks show very few infants walking with older individuals, suggesting that recruitment was low. McNeil et al. (2005) see this as evidence that the mammoth population was under ecological stress, yet they also interpret the density of other tracks at the site as an indicator of a rich mammoth steppe ecosystem, not a shortage of food. Perhaps the young mammoths were being selectively taken by the Clovis hunters and this selective predation led to a rapid decline in mammoth numbers, as well as those of other of the largest herbivores.

An additional line of evidence suggesting humans of the Clovis era played a major role in the extinction process is the Clovis subsistence emphasis on large herbivores. Some authors assert that the earliest Americans were faunal generalists rather than megafauna specialists (for example, Cannon and Meltzer, 2004, 2008; Dixon, 1999). Their argument is threefold: 1) the record is biased toward big bones; 2) the presence of some small game in sites attests to a broader, more generalized subsistence base; and 3) theoretically (in their view) a generalist strategy would transfer more easily from one ecosystem to another than would one specializing in big game. The evidence does not support this point of view. Even accepting that all of the animals Cannon and Meltzer (2004, 2008) assert were eaten by Clovis people, including small rodents such as gophers, packrats and deer mice, were in fact eaten, there is a decided emphasis on large animals both in the frequency of occurrence and the number of identified specimens in each assemblage. Extinct species are found in 90 percent of the archaeological faunal assemblages from the period of human/megafaunal coexistence (Waguespack, 2013). Furthermore, when prey animals are grouped by size and tabulated by occurrence, it is evident that the largest animals – proboscideans - occur most commonly (Waguespeck and Surovell, 2003; see also Haynes and Hutson, 2013). Species in the *Bison* size range - camelids, horses and bison - are second, and deer-size animals (among which they include ground sloths, which belong in the bison category) are third. Smaller animals are rarely found. This is opposite the pattern that would be expected if Clovis hunters simply took prey in the frequency in which they encountered them; animal populations are inversely proportional to animal size (Waguespack and Surovell, 2003).

Clovis hunters were also inefficient in their use of prey, particularly the largest kills (Haynes, 1982). Carcasses of proboscidians, like the Manis mastodon described above (**The Pre-Clovis Record: *Manis Mastodon***) are often only partially disarticulated. Longbones, including those found at Wally's Beach, were rarely broken for the marrow. People took only the meat they could consume immediately, making no effort to extract all available meat and fat (Haynes and Hutson, 2013). This strategy required new kills to be made frequently, adding to the stress on prey populations.


*Figure 5. The cervical and thoracic vertebrae of a human-butchered giant camel (Camelops hesternus) from the Wally's Beach Site, Alberta. The letter A is just below and to the right of a quartzite core, which lays partially under a cut-marked cervical vertebra. Rib heads seen articulated with the thoracic vertebrae, to the right, were severed during butchering. This is the first example of a* Camelops *kill in North America. © B. Kooyman.*

### Extinction was (in part) anthropogenic

People were present in North America when most of the late Pleistocene megafauna became extinct. New kill sites demonstrate that Clovis hunters preyed upon mammoth, mastodon, gomphothere, Mexican horse, giant camel and Jefferson's ground sloth: more than one-quarter of the North American mega-herbivores that became extinct at the end of the Pleistocene. Those hunters took, and may have focused on, animals that make defensive stands when threatened, which are many, if not most, of the species that are now extinct. They emphasized the largest prey for their subsistence and were wasteful in the use of their kills. The evidence is increasingly strong that humans, particularly Clovis hunters, played an important role in the extinction of many large herbivores.

## Clovis contemporaries

Whereas Clovis appears to be the technological underpinning in the prehistory of most of North America, the American West, comprised of the Great Basin, California, Colombia Plateau and Snake River Plain have a different history. In those regions, the Western Stemmed Tradition (WST) held sway from the terminal Pleistocene through the early Holocene. It is becoming increasingly evident that the WST was distinct from the Clovis Tradition in its technology and subsistence emphasis. Evidence has also come to light that the Clovis and WST shared North America during the terminal Pleistocene, both having evolved from the continent's earlier colonists.

### Technologies

Beck and Jones (2010, 2013 and elsewhere) describe the WST and Clovis technologies in detail. Clovis technology included a blade component over parts of its range, but the principal strategy was based on reduction of large bifacial cores by the *outré passé* technique. The ultimate product of biface reduction was the large, fluted lanceolate Clovis point (Figure 6 a), but the large thinning flakes produced by *outré passé* were used as blanks for other retouched tools, including end and side scrapers, gravers, notches and occasional burins. Projectile points and other tools were thus made from the same materials, which often appear to have been selected for their beauty and frequently were transported over great distances. The technology was, overall, conservative of lithic raw material, an indicator of the high mobility lifestyle of Clovis hunters. WST followed separate trajectories and ordinarily used different materials for projectile points and other lithic tools, producing the two from different materials. Projectile points, rather than being reduced from bifacial cores, were made from side-struck flakes, usually of fine-grained volcanic material. Primary bifacial reduction followed a broad-collateral flaking method rather than *outré passé*. The waste flakes from this process were rarely used for tools. Other lithic implements were produced on flakes reduced from bifacial cores of chert or chalcedony. Blade technology is not indicated, despite occasional objects being identified in WST assemblages as 'blades.' The process thus lacked the conservatism of the Clovis system.

Toolkits differed as well. Clovis implements included the large, trianguloid, fluted Clovis projectile point (Figure 6 a), along with end and side scrapers, gravers, notches and burins. Bone implements included cylindrical, bevelled bone projectile point and fine, eyed needles (Stanford and Bradley, 2012). WST assemblages contained similar tools, including the bone points and needles (for example, Daugherty, 1956; Greene et al., 1998), but the projectile points, rather than being thin, fluted specimens are often thick in cross-section and have elongated, tapering stems (Figure 6 b). Evidently, Clovis tool makers hafted their projectile points on split foreshafts whereas WST artisans socketed theirs. In addition to this difference, the WST includes the enigmatic 'crescent,' a bifacially flaked implement of unknown function found almost exclusively in the earliest dated WST contexts (for example, Daugherty, 1956; Erlandson et al., 2011).

### Subsistence emphases

Subsistence emphases of the two groups also differed. The content of faunal assemblages strongly indicates Clovis people systematically sought and killed mega-herbivores as their primary food supply (Haynes and Hutson, 2013; Waguespack and Surovell, 2003) (see **Megafaunal Extinctions**: *Patterns of Predation*, above). This does not appear to have been the case for WST foragers. There is certainly evidence that WST hunters did kill megafauna: proboscidian blood residue has been identified on a Haskett projectile point from Utah like that seen in Figure 5 (b) (Yost cited in Haynes and Hutson, 2013); the Lind Coulee (Daugherty, 1956) and Sentinel Gap (Galm and Gough 2008) sites in Washington contain primarily bones

of butchered *Bison antiquus* (an extinct form)[2]. However, most evidence indicates a more generalized foraging pattern emphasizing marine, riverine and littoral resources. WST sites are typically found concentrated along the now-dry shores of pluvial lakes in the Great Basin (Grayson, 2011) and California (Moratto, 1984), along the Columbia River system on the Columbia Plateau (Chatters et al., 2012) and on islands off the California coast (Erlandson et al., 2011), suggesting the importance of fish and perhaps seaweed and marsh plants. In the earliest sites that contain faunal remains, birds, fish and shellfish play important roles. Birds often rank within the top four animal groups on the Columbia Plateau (Chatters et al., 2012); gulls, cormorants, eagles, condors and salmon dominate the faunal collection from WST levels of the Five-Mile Rapids site (Cressman et al., 1960). Geese, shellfish and nearshore marine fish comprise nearly all of the 12,000 year-old WST faunal assemblages from the Channel Islands, off southern California (Erlandson et al., 2011). Blood residues on some of the earliest stemmed projectile points in Paisley Caves indicate the use of fish and waterfowl (Jenkins et al. 2013), which, along with small mammals, are common in WST sites in the Great Basin (Grayson, 2011).

Further evidence for different subsistence emphases comes from the distribution of finds of Clovis-like fluted projectile points in the Great Basin. Although Clovis is absent from this region, a smaller, more deeply concave-based, fluted form known as Great Basin Fluted (GB Fluted) is not uncommon. GB fluted points often co-occur with WST assemblages along lakeshores. The two styles of projectile point are often determined by obsidian hydration analysis to be approximately the same age, but they are made from different materials, indicating distinct patterns of lithic resource use (Beck and Jones, 2013). At the Dietz site, Oregon, where GB Fluted and WST projectile points are found to be coeval, the fluted points are made from a smaller number of material types, from less far-flung sources than the Western Stemmed. This suggests that although WST and fluted point makers sometimes occupied the same lakeshores, they represented different ethnic groups. It is possible that these groups occupied distinct niches - -the fluted point makers seeking megafauna, the WST people concentrating on smaller game and littoral resources.

## WST/Clovis chronology

Although some researchers continue to assert that Clovis predates the WST in the American West, multiple lines of evidence suggest otherwise. Classic Clovis projectile points are only found in the west across a span from Wyoming through the Snake River Plain and into Washington and Oregon (Miller et al., 2013). The one radiocarbon date purportedly associated with Clovis from that region is 10,880±260 rcy BP from the Heil Pond Site on the eastern Snake River Plain (Reid, 2011). Beck and Jones (2010, 2013) point to this age, at the young end of the Clovis window, and to the distribution and content of Clovis Caches as evidence that Clovis originated in the southern Plains or south-east (see also Stanford and Bradley, 2012), from which they moved onto the central and northern Great Plains and thence to the west across the Rocky Mountains and east along the margin of glacial ice. They also moved to the south, as far as Colombia (Ranere, 2006). Fluted point styles descended from but younger than Clovis are found in the Great Basin (GB Fluted), the newly deglaciated Northeast (Northeastern Fluted) (Miller et al., 2013) and through the ice-free corridor into northern Alaska (Alaskan Fluted) (Smith et al., 2013). As noted above, obsidian hydration dating indicates GB Fluted and WST projectile points tend to be the same age when they co-occur. However, the oldest dated GB Fluted finds are all younger than the oldest WST (Beck and Jones, 2013: Tables 16-1, 16-2).

Radiocarbon dates of greater than 10,800 rcy BP, the end of the Clovis window, have been reported for WST components in the Great Basin and Columbia Plateau since the 1970s (Beck and Jones, 2013: Table 16-2), but have not been taken seriously. In 2012, Jenkins and collaborators reported the *in situ* discovery of a western-stemmed projectile point encrusted by a thin silt stratum, sandwiched between radiocarbon dates of 11,070±25 and 11,205±25 rcy BP, placing the age of the projectile point at around 13,000 cal BP or near the early end of the Clovis window (Jenkins et al., 2013)[3].

By 13,000 cal BP, near the beginning of the Younger Dryas climatic episode, North America was occupied by at least two distinct cultural traditions. Clovis big game hunters occupied Central America and from the Great Plains eastward, making forays into what is now the north-western US. WST occupied the west, following a more generalized, but aquatic-oriented way of life.

2 Despite Lyman's (2013) assertions to the contrary, WST faunal assemblages in the Columbia Plateau show an emphasis on large game, distinguishing that region from others occupied by the WST (Chatters et al., 2012).

3 One other site, Cooper's Ferry in northern Idaho has produced radiocarbon dates even earlier (c. 11,400 rcy BP, Davis and Schweger, 2004), but the presence in the same context of much younger dates leaves this finding open to question.

## The Palaeoamericans themselves

In the early 1990s, little was known about the physical characteristics or personal lives of the earliest Americans. Skeletons, when discovered, were described largely in isolation, with little attempt being made to analyse the early skeletons as a group (but see, for example, Steele and Powell, 1992). That has changed, in part because of the high profile controversy over the skeleton known as Kennewick Man (Chatters, 2001).

Remains of more than 50 individuals who died more than 9,000 years ago have been discovered in North America, most of them in the western United States and the Valley of Mexico. Only 30 of these individuals died more than 10,000 years ago and only six predate 12,000 cal BP (Chatters et al., 2014: Tables 1 and S1). Skeletons are often fragmentary; fewer than 30 have skulls and/or nearly complete skeletons and many were cremated. Most sets of remains have been found as individuals or in pairs, so we cannot generalize the characteristics of individual bands or regional populations. If the available skeletons are looked at as a group and taken as representative of the North Americans of their time, however, much can be said about their morphology and the nature of their lives.

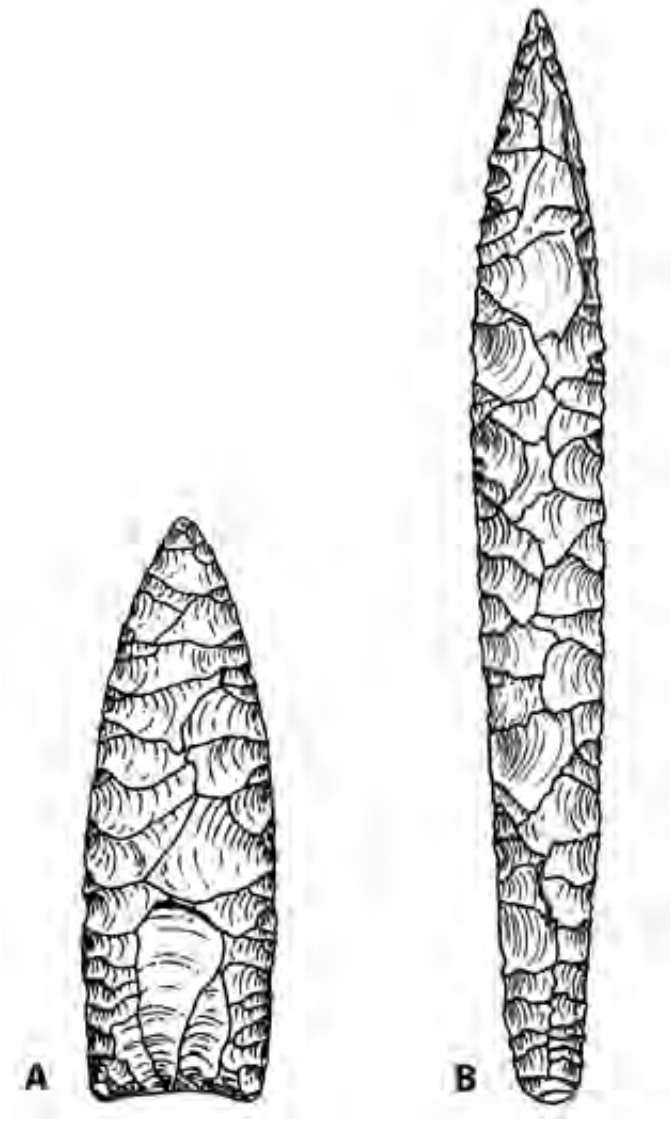


*Figure 6. Drawings of Clovis (A) and Haskett (B) (a Western Stemmed Tradition style) projectile points, showing the distinct differences between these contemporary tool technologies. © Claire Chatters.*

### Distinction from modern Native Americans

Palaeoamericans, as this group is called, tend to show a high degree of variability in details of their morphology (Auerbach, 2012; Jantz and Owsley, 2001) and dentition (Powell, 2004), but no regional morphological or dental patterns have yet been described. Morphometric analyses, however, do demonstrate that these earliest people are distinct from those who succeeded them (Steele and Powell, 1999; Jantz and Owsley, 2001), with the change in morphology often being evident within a few centuries after 9000 cal BP (for example, Chatters 2001, 2010a). In comparison with those later peoples and modern Native Americans, they tend to have larger, longer, lower crania with markedly angled occipital bones, shorter, more projecting faces and lower, broader eye and nose apertures. This observation raised the question of whether the earliest Americans represent a different migration from the later people, perhaps even originating in a different region of the world (for example, Lahr, 1997). Ancient DNA from two of the most ancient individuals, however, appears to show that the earliest arrivals came to America via Beringia, as has long been believed. The Anzick skeleton, an infant dated approximately 12,600 cal BP[4], produced a Native American nuclear genome and a mtDNA subhaplogroup of D4h3a (Rasmussen et al., 2014). A teenage female from Hoyo Negro in the Yucatan Peninsula, radiocarbon dating around 12,800 cal BP and therefore within the Clovis temporal window, exhibits mtDNA haplogroup D1 (Chatters et al., 2014). Both of these haplogroups are considered on the basis of modern genetics to be founding lineages that evolved in Beringia before people migrated southward into the Americas. The change in cranial morphology probably results from genetic drift and natural selection that occurred after the initial colonization south of glacial ice, either in remnant Beringian populations who migrated south in the Holocene, as appears to have occurred in north-western North America (Chatters, 2010a), through genetic drift (Powell, 2004) or through natural selection. Chatters (2014) suggests that the changes may result in part from selection for more docile males after expansion of the plant component of the diet gave females a greater role in the society, selection that resulted incidentally in morphological neoteny.

4 Rasmussen et al. (2014) claim this individual was a member of the Clovis population, but as noted elsewhere in this presentation, the child predates the associated Clovis Cache by about 400 years, so the claim cannot be substantiated.

## Sexual differences

Skeletons exhibit marked differences between the sexes in stature, morphology and life span. Males tended to be muscular, wide-bodied (Auerbach, 2012) and robust, averaging around 168 cm tall. They would be considered stocky in build, although their limb proportions varied. Female body proportions have not been studied due to the lack of the needed skeletal elements, but they typically appear small and gracile, reaching only an average of 153 cm in height. The sexual dimorphism index this stature difference represents is 1.10 (Chatters, 2104), which is at the upper extreme for modern humans. Sexual dimorphism is strongly illustrated in the craniofacial morphology. Males, even some of the smallest, like the men from Spirit Cave, Nevada (Jantz and Owsley, 1997), and Horn Shelter, Texas (Young et al., 1987), tend to have very large, rugged skulls with prominent supraorbital (brow) ridges, nuchal lines and fronto-malar eminences. They appear hyper-masculine. Females are just the opposite-, appearing hyper-feminine. (Figure 6) The difficulty in distinguishing male from female crania, which is often experienced in working with more recent Native American crania, is not a problem with the Palaeoamericans. This pattern is strongly expressed in skeletons from the Valley of Mexico. The >12,000 year-old Chamalhuacan male and other early males from that region are massively muscled; all sexual indicators score at maximum values, whereas the Penon III woman scores at or near the minimum (Jimenez Lopez et al., 2006). The same is true of the Hoyo Negro female, from the nearby Yucatan Peninsula (Chatters et al., 2014).

Male and female skeletons also show marked differences in longevity. Among 32 individuals for whom sex and age can be determined, females died at an average age of between 19 and 23 years, males at between 27 and 34 years (Chatters, 2014). To bring the contrast into clearer focus, 11 of 16 males lived beyond 30 years; only 2 of 16 females survived that long. Conditions of high mobility, indicated for both Clovis and WST populations, were particularly hard on females. If females led particularly short lives, they had little opportunity to reproduce and care for their children. Because of this, it is highly unlikely a population arriving through the ice-free corridor shortly after 13,500 cal BP could have fully occupied the hemisphere within less than 500 years (Chatters, 2010b). Humans must have been on this continent for many generations before first becoming archaeologically visible.

## Violent lives

Palaeoamerican men were prone to violence. In a recent analysis of skeletal trauma among the earliest human remains in North America, Chatters (2014) found that 58 percent of males and 18 percent of females had injuries that are consistent with interpersonal violence. Most of that violence was indicative of nonlethal fights between males, probably in competition for dominance or mating rights. Chatters concluded that the Palaeoamericans were representative of a common ancestral phenotype that was strongly selected for risk-taking and novelty-seeking behaviour because they often faced large, dangerous animals during the hunt and were constantly offered new lands to colonize. Biochemical determinants of those behaviours are also associated with aggression, which is exacerbated by high testosterone levels. In competition for scarce females, indicated by the mortality profile of women, the higher testosterone males would win out, supporting a high level of sexual dimorphism and perpetuating the tendency for violence. He suggests this pattern was selected against after human populations increased and became less mobile, making antisocial behaviour undesirable.

## Palaeoamericans

We have not yet seen a Pre-Clovis American, but it is likely that they closely resembled the people from the latest Pleistocene and earliest Holocene whose remains have been found. They had large, low skulls and short, forward-projecting faces with wide noses and wide-set eyes. The males were all stocky in build, markedly masculine in their features and much larger than their equally feminine females. High mobility took a major toll on the females, who tended to die very young. Males were prone to violence, perhaps because of strong natural selection, imposed by a colonizing and hunting way of life. In these respects, they closely resemble the earliest *Homo sapiens* throughout the northern Hemisphere and may be considered a Western Hemisphere manifestation of this ancestral form.

Discoveries in two new settings, the cenotes of the Yucatan Peninsula (Chatters et al., 2014; González et al., 2013) and the Museo Nacional de Antropología in Mexico City (for example, Jimenez Lopez et al., 2006) have the potential to add greatly to our understanding of physical characteristics, behaviour and health of the earliest people in the Americas. Their utility is, thus far, limited by the need for accurate dating, which should be a top priority for research. In both cases, numerous individuals are in question and preservation is excellent.

*Figure 7. Examples of female (left) and male (right) Palaeoamerican crania, showing the strong sexual dimorphism. The female is from the Wilson-Leonard Site, the male is Burial 1 from Horn Shelter No. 2, both from Texas. Both are approximately 12,000 years in age.*

## New horizons

Work is just getting well under way in two underwater realms that have the potential to add immeasurably to knowledge about how people first reached the Americas and what they were like. Those are the submerged North American continental shelves and the drowned cave systems of the Yucatan and Florida peninsulas.

With the ice-free corridor appearing less likely to have been an initial route of entry to North America, attention is turning to coastal routes. Chance finds of bifaces, like Cinmar, from the Atlantic Shelf (Stanford and Bradley, 2012) and lithic artefacts found by methodical dredging near Haida Qwaii, off the west coast of Canada (Mackie et al., 2013) demonstrate the archaeological potential of these submerged landscapes. Researchers in both the Gulf of Mexico and along the Pacific coast have begun to use sonar and geophysical modelling to predict the probable location of ancient campsites (Hemmings and Adovasio, 2013; Mackie et al., 2013). Hemmings and Adovasio (2013) have identified a floodplain deposit along the now-submerged channel of the Aucilla River off western Florida and have begun underwater excavations, finding megafauna bone and a possible habitation site.

Whereas research on the continental shelves is finding possible occupation areas of known age, but so far little human evidence of human activity, cave divers in the Yucatan Peninsula have been finding, for more than a decade, human skeletons that were apparently deposited at times of lowered sea level, but archaeologists struggle to date them. Nine sets of human remains that lack the cranial deformation of the late prehistoric Maya have been reported (Gonzalez et al., 2013; Chatters et al., 2014), but thus far, it has been only possible to determine the age of one of these finds with confidence. The young female skeleton found at a depth of 42 m below modern sea level in Hoyo Negro (Figure 7) dates to nearly 13,000 cal BP, making her one of the earliest, if not the earliest, in the Western Hemisphere (Chatters et al., 2014). One or more of the other reported finds, such as Najaron or el Templo, might be as old or older. The human skeletons are being found in the same submerged tunnel systems as the bones of extinct megafauna. In Hoyo Negro alone, 11 species of large mammal have been found at or near the same depth as the human. These include gomphothere (*Cuvieronius tropicus*) two species of giant ground sloth and the sabertooth (*Smilodon fatalis*). None of these has yet been determined to be coeval with the human, but Gonzalez suggests a blackened camelid bone from a nearby cave demonstrates human predation of megafauna. Human action has yet to be established in that case, however. Nonetheless, it appears to be only a matter of time and careful scientific research before a relationship between megafauna and humans is demonstrated on the Yucatan Peninsula. Similar potentials exist in Florida's karst systems.

## Summary

Over the past 20 years, scientific understanding of the peopling of North America has undergone significant changes. The Clovis-first model, although still retaining its staunch adherents, has been weakened by the discovery of verified archaeological deposits older than 13,500 years. These have been found from the Paisley Caves in Oregon to the Delmarva Peninsula and outer continental shelf of Maryland. It now appears likely that the first people entered North America by 15,000 cal BP. Because no ice-free corridor existed this early on the northern Great Plains between the Cordilleran and Laurentide Ice sheets, it is likely people first entered along the Pacific Coast, not as big-game specialists but as coastal-maritime foragers. The big game specialization, represented by Clovis and its immediate descendants developed after people arrived, perhaps in the southern Great Plains or south-east. Clovis shared the continent with the Western Stemmed Tradition, which continued an aquatic-oriented subsistence strategy. Evidence is building that these early peoples - perhaps primarily the specialists - did indeed play a major role in bringing many of the continent's megafauna to extinction. Much remains to be learned, however. New research on the continental shelves and in submerged cave systems, as well as improved dating methods and efforts to apply those methods to both new and existing collections, will go a long way toward filling the knowledge gaps. The next twenty years promise to be at least as informative and exciting as the last.

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# Underwater Archaeology and Prehistory: the Case of the Cenotes in Mexico

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## Abstract

Much of the early prehistory of the Americas lies underwater along its coastlines and in the submerged caves and cenotes of Florida and Central America. A cenote (from Yucatan Maya *dzoonot* 'well') is a deep natural pit, or sinkhole, resulting from the collapse of a doline or limestone bedrock that exposes groundwater underneath. Cenotes are a unique resource in a dry land, especially associated with the Yucatan Peninsula and some nearby Caribbean islands, and were sometimes used by the ancient Maya for sacrificial offerings. In times of lowered sea level and drier climate, as prevailed in the terminal Pleistocene, they were rare sources of freshwater for people and animals. Cenotes and the extensive cave systems to which they are linked have become the focus of palaeontological and palaeoanthropological studies by North American and Mexican Prehistorians, with the Vice-Directorate for Underwater Archaeology, National Institute of Anthropology and History (INAH) commanding several of these efforts. The search for early humans in the Yucatan Peninsula started more than a century ago when Henry Mercer arrived in search of early Americans; however, only in the last fifteen years have systematic efforts been undertaken. Efforts by archaeologists and cave-diving explorers have already resulted in the discovery of numerous assemblages of Pleistocene megafauna and pre-Maya humans. Finds near Tulum, Quintana Roo state, include some of the most complete early Americans skeletons, as well as a largely varied faunal complex including numerous examples of extinct megafauna. Some of the human skeletons are thought to be among the oldest in the hemisphere and they are so well preserved that now they are providing enough organic material for ancient DNA analysis and stable isotope studies. Associated concentrations of bat guano, wood, wood charcoal and calcite formations hold promise for advances in palaeoecology and sea-level history. Despite their great scientific value, these deposits are increasingly at risk from water pollution, salinization, tourism and urban development. As such dangers threaten inundated caves and cenotes all over the world, a major concern for UNESCO and other international and national agencies has been to set minimal standards for protecting this important heritage, which includes detailed recording at the sites and maintaining the materials *in situ* whenever possible.

## Introduction

Geographically, Mexico has an important role in regard to current discussion about the First Americans. It has been considered a large biogeographic corridor (Ríos-Muñoz, 2013) for the first human groups coming from north to south. Few data are available, however, regarding the interactions of these early peoples and large Pleistocene mammals in Mexico (for example, Arroyo-Cabrales et al., 2006; Johnson et al., 2006). Data equally are limited on the relationship, if any, between the extinction of those large mammals and early peoples in southern North America (Sanchez, 2001; González and Huddart, 2008).

The Prehistory of the Americas, the time when the earliest human presence is found on the continent and a hunter-gatherer society begins to develop, has been quite elusive, with several controversial sites all over the continent, from Canada to southern Argentina and Chile, showing possible anthropic evidence either as human skeletons, lithics, hearths or modified bone. In the last fifteen years, there has been a steady increase in studies referring to the early peopling of the Americas, mostly those in North America (for example, Bonnichsen and Turnmire, 1999; Jiménez López et al., 2006; Graf et al., 2013). Particularly in Mexico, interest in early peopling has existed for over a century (for instance, Reyes, 1881; Mercer, 1896); however, scientists have not yet been able to define when and where the earliest people came into Mexico (for example, Mirambell, 2012).

**Since 2002, a symposium regarding the early peopling of the Americas has been held biannually, in which colleagues from all over the continent and further afield present their ongoing research on the matter. It was originally started in Mexico by scientists from the National Institute of Anthropology and History, the federal agency that is in charge of the care of archaeological heritage. The symposium has also been held in Argentina (2010) and Colombia (2012) and was held again in Mexico in 2014. Topics that have been dealt with include evolution, genetics, dating methods, migration, palaeoenvironments, megafauna, geology and the like (Jiménez López et al., 2011).**

**One of the ongoing areas of research for world and Mexican Prehistory is Underwater Archaeology. Currently Underwater Cultural Heritage comprises all the tracks left by human presence with some cultural, archaeological, historical or palaeontological characteristics, and which have been underwater, maritime, fluvial and lacustrine, periodically or continuously for at least the last one hundred years. In fact, there has been interest to protect this important cultural heritage for over one hundred years now, with several Caribbean islands creating special commissions to look after this resource (Leshikar-Denton and Luna Erreguerena, 2008). Much of the early prehistory of the Americas lies underwater along its coastlines and in the submerged caves and cenotes of Florida and Central America.**

**The geology of the Yucatan Peninsula has been extensively studied. It consists of a Cenozoic sedimentary marine sequence that decreases in age northward and is deposited on a stable basement of older Mesozoic sedimentary and Palaeozoic crystalline and sedimentary rock bodies. Limestone landforms occur only because of the calcareous nature of the platform. In the northern sector, an area of pitted flats is present that has numerous sink holes (cenotes) and no surface drainage (Ferrusquía-Villafranca, 1993).**

**The HEADS charter specifically mentions the importance of caves as storehouses of evidence for human biological, cultural and artistic evolution. Cave formations are unique in also containing, within small geographic footprints, islands of biological diversity, formations of minerals found in no other geologic contexts and settings of breathtaking natural beauty. The limestone karst systems of the Caribbean rim are no exception to this natural wealth. Long known to speleologists and cave divers for their geologic wonders and increasingly studied by biologists, these systems have recently begun producing a wealth of remarkably well-preserved late Pleistocene palaeontological resources, including some of the earliest human remains yet found in the Americas. Scientific research into these systems has only recently begun to reveal an unexpectedly diverse megafaunal community but also evidence of humans' adaptation to the tropical lowlands within but a few centuries of their first arrival from the Arctic. This presentation concentrates on the cave systems of the Yucatan Peninsula of Mexico and neighbouring Belize, but could equally apply to the limestone platforms of south Florida, Cuba and other Caribbean Islands.**

## Geological context

The Yucatan is a nearly level-lying platform of late Cenozoic and Tertiary limestones formed from successions of coral reef systems. Over hundreds of millennia, limestone strata of variable strength have been subjected to sea level changes. During periods of high sea level, the platform is flooded with salt water overlain by a lens of fresh water. The brackish water at the contact between the two water bodies is slightly acidic and has dissolved tunnels into the less resistant strata (Smart et al., 2006). When the sea level drops, these tunnels form a drainage system so effective that the water table tracks sea level to within 2 m as far as 10 km inland. It is, in effect, a natural sponge, soaking up seawater during interglacial times, when sea levels are low and desiccating the land by its effective drainage during glacial times.

Interglacial dissolution has created massive cave networks throughout the peninsula, the closest of these lying within about 10 m to 15 m of the present land surface. Although many systems are dry, especially in higher-elevation portions of the peninsula, such as eastern Yucatan state, more than 90% are currently inundated and serve as conduits carrying fresh water to the sea in an area with no other form of surface drainage system. To date, more than 1,200 km of inundated caves have been mapped along the eastern coast of Quintana Roo state alone.

Cenotes (from Yucatan Maya *dzoonot* 'well') are deep natural pits, or sink holes, resulting from the collapse of a part of the ceiling of dissolution tunnels in doline or limestone bedrock, which expose groundwater underneath (Hubp, 1999). Cenotes are a unique resource in a dry land, particularly associated with the Yucatán Peninsula and some nearby Caribbean islands. They were a source of water to the ancient Maya, who used them for sacrificial offerings. In times of lowered sea level and drier climate, as prevailed in the terminal Pleistocene, they were rare sources of freshwater for people and animals.

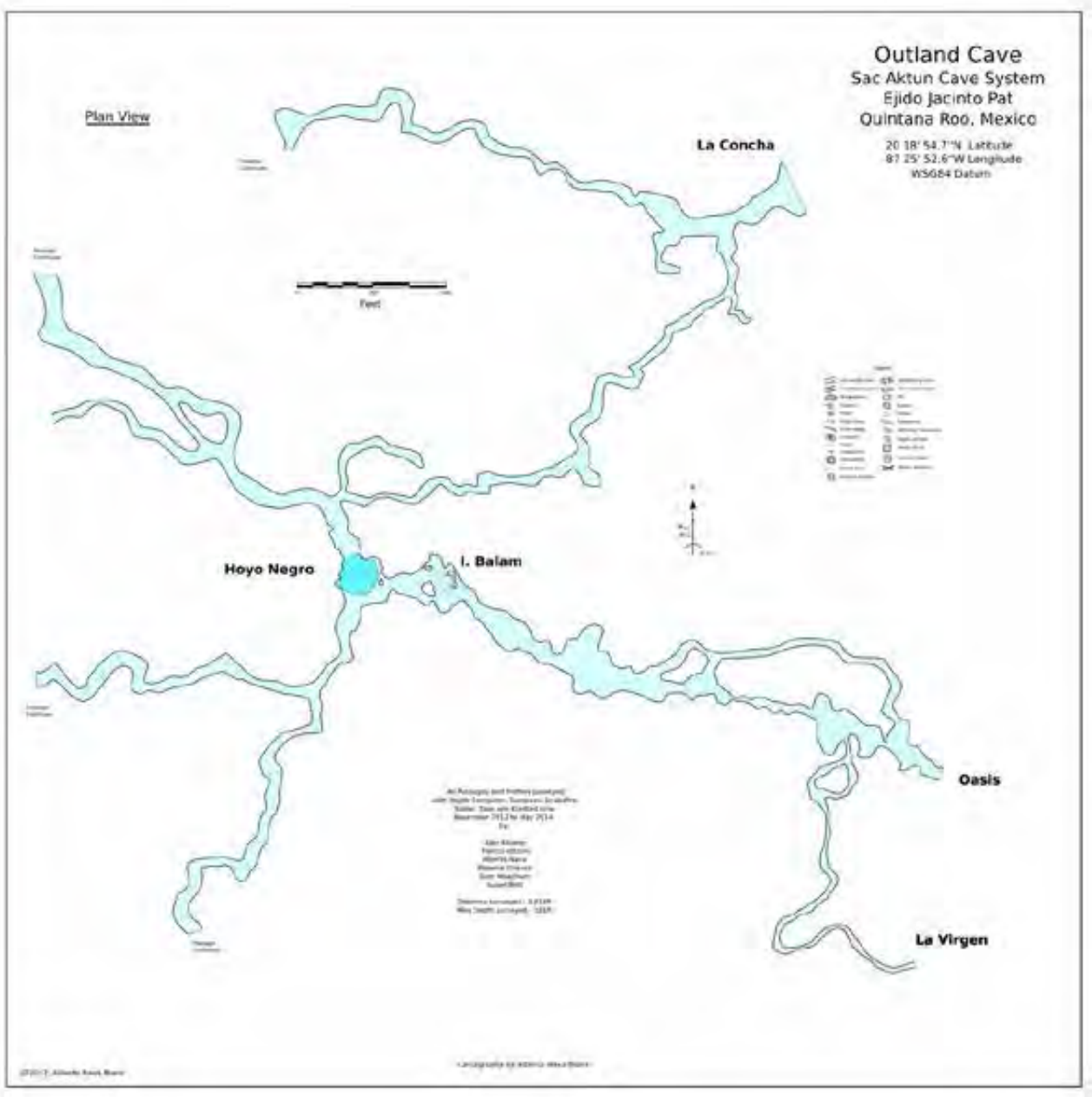


*Figure 1. Map of Sac Outland System, Quintana Roo, Mexico, showing the location of Hoyo Negro. Drawn by Alberto Nava Blank.*

## Investigations of the cenotes

Research on cenotes started in the late nineteenth century with the expeditions of Henry Mercer and colleagues (Mercer, 1896).They reported several extinct animals but not any human remains related to them. Later, Edward Thompson (1904-1909) recovered the first ancient human skeletons from the Sacred Cenote at Chichén-Itzá, which dated to the classic (800-1100 AD) and postclassic (1100-1550 AD) periods of Maya civilization. Much more recently in 1999, INAH initiated systematic research in several cenotes under the title *Atlas Arqueológico Subacuático para el registro, estudio y protección de los cenotes y cuevas inundadas y semi inundadas en la Península de Yucatán* (Underwater Archaeological Atlas for the recording, study and protection of cenotes and inundated and semi inundated caves in the Yucatan Peninsula).

Over the past two decades, cave divers, many associated with the Quintana Roo Speleological Survey (www.caves.org/project/qrss) have reported finding bones of large animals and humans deep within the tunnel systems of the western Yucatan Peninsula. A team affiliated with the *Museo del Desierto*, Saltillo, has been actively recovering these finds (González and Huddart, 2008; González et al., 2013). Thus far, they have found eight human skeletons from cave systems near the city of Tulum. These skeletons, some of which were almost complete (>80%) and anatomically articulated, have been found at distances of between 12 m and 1,240 m from the nearest entrances and at depths between 8 m and 45 m below sea

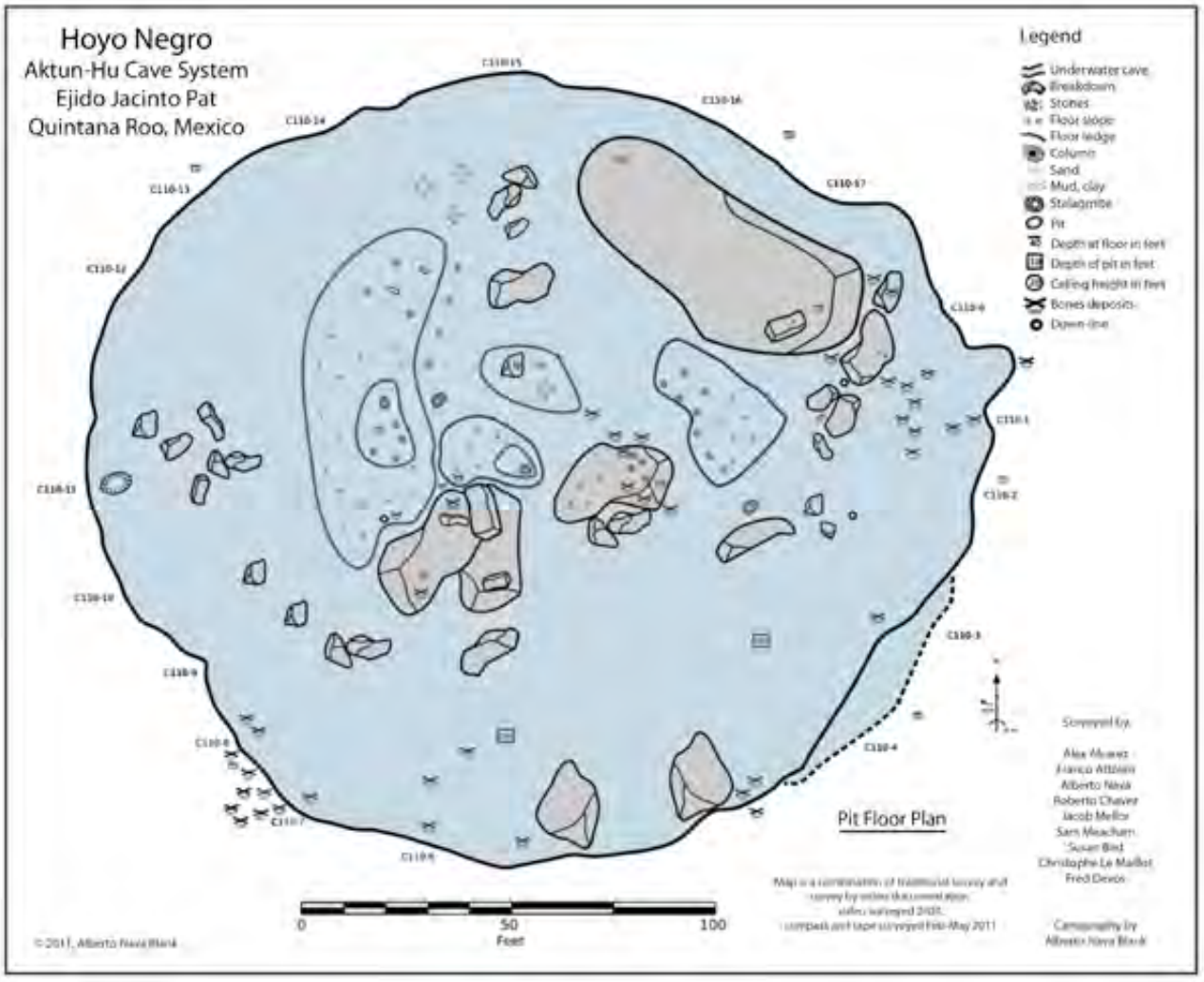


*Figure 2. Map of the Hoyo Negro collapse chamber, Quintana Roo, Mexico, showing locations of paleontological finds. Drawn by Alberto Nava Blank.*

level. Radiocarbon dating of these finds has been difficult. Radiocarbon dates from several laboratories on bone apatite and residual proteins has produced absolute ages between 8,591 and 13,721 cal BP (modified from González and Huddart, 2008). However, Taylor (2009) who conducted the analysis of the oldest individual from Naharon, indicated that the date was problematic and, at best, a preliminary estimate was awaiting further support, like human skeletal samples from this site with much better protein preservation. In general, the cranial morphology of the cenote individuals is considerably different from pre- and post-Hispanic Maya and more similar to that of Palaeoamericans found elsewhere in the Americas.Archaeological sites associated with this early occupation of the region have not yet been found, but Gonzalez and Huddart (2008) report llama bones (*Hemiauchenia macrocephala*) that had been burned and have possible anthrogenic cut marks, but further studies are needed. A concentration of charcoal found in a covered basin deep within a cave connected with Carwash Cenote, also near Tulum, has been reported as an anthropogenic hearth and dated to over 10,000 cal BP. This too warrants further study.

As for the faunal complex, scattered skeletons representing several extinct and extant species have been found. Extinct animals include the gomphotheres (Proboscidea, Gomphotheriidae, *Cuvieronius*), glyptodonts (Cingulata, Glyptodontidae, *Glyptotherium*), giant ground sloths (Megalonychid forms; Pilosa, Megatheriidae, Megalonychidae), llama (Artiodactyla, Camelidae, *Hemiauchenia*), horse (Perissodactyla, Equidae, *Equus*) and Tremarctine bears (Carnivora, Ursidae, Tremarctinae). Modern species, including animals such as the grey fox (Carnivora, Canida, *Urocyon*) and tapirs (Perissodactyla, Tapiridae, *Tapirus*), also occur. Based on the faunal complex, there are elements with Neotropical (large 'Xenarthrans' and gomphotheres) and Nearctic (carnivores, lagomorphs) affinities and probably some endemic animals, like the ground sloths, which require further studies. Most of those animals are included within the North American Rancholabrean land mammal age, ranging in age between 120,000 and 10,500 years BP and more specifically, at the late Pleistocene.

*Figure A. Hoyo Negro sinkhole. View to the north. © Roberto Chavez Arce / Grupo HN 2013.*

## Hoyo Negro

One site stands out among these findings. Working in *La Virgen* Cenote, a part of the Sac Aktun cave system, divers of the Tulum Speleological Project discovered a massive underground collapse chamber more than 600 m from the opening (Figure 1; Attolini, 2010) and (Figure A). The immense, bell-shaped chamber, more than 30 m in depth and 60 m at its bottom, was named *Hoyo Negro* or Black Hole after the astronomic feature that swallows all light. It is worth mentioning that it is not a true cenote because the ceiling has not collapsed in. Bones of tapir and gomphothere occur in the tunnels leading to the *Hoyo Negro*, but skeletons are unusually concentrated on its floor and lower walls. Remains of at least 27 large mammals, including the near-complete skeleton of a human, are found along its deeper, southern half (Figure 2).

The human skeleton is the nearly complete remains of a teenage female, including an intact skull and full complement of teeth. Named as *Naia*, meaning water nymph in Greek mythology, this skeleton has Palaeoamerican craniofacial features and produced mitochondrial DNA of haplogroup D1, a lineage that formed in Beringia. Radiocarbon dating of tooth enamel and uranium-thorium dating of calcite formations developed on the bones after deposition placed Naia's age at between 13,000 and 12,000 calendar years ago. Thus, the differences between Palaeoamericans and Native Americans probably resulted from *in situ* evolution rather than separate ancestry (Chatters et al., 2014).

The animal skeletons found at the site include those of extinct and extant species. Extinct species include the highland gomphothere *Cuvieronius*, the Shasta ground sloth (Pilosa, Megatheriidae, *Nothrotheriops shastensis*) and a new species of Megalonychid ground sloth (Pilosa, Megalonychidae), sabertooth cats (Carnivora, Felidae, *Smilodon fatalis*) and tremarctine bears. Extant species are the puma (*Puma concolor*) (Figure C), bobcat (*Lynx rufus*), coyote (*Canis latrans*), tapir (*Tapirus bairdii*), collared peccary (*Tayassu pecari*) (Figure B), white-nosed coati (*Nasua narica*) and domestic dog (*Canis lupus familiaris*). Numerous skeletons of fish and bats, including the fruit-eating bat (*Artibeus*) are also found. The bobcat and coyote are not found in the region today, indicating significant habitat change between the time of deposition and today. The fauna includes animals with both Nearctic and Neotropical affinities, showing that the Yucatan Peninsula was an important region for the merging of northern (Carnivora) and southern (Pilosa) migrants. Dating has not yet been completed for all nonhuman fauna, but at least one gomphothere (whose pelvis can be seen in Figure 3) died between 19,000 and 40,000 years ago. The elevation of other specimens indicates deposition on the cave floor to more than 10,000 years ago. The close association of so many animals and a human is unique even for the caves of Quintana Roo; concentrations of charcoal and plant seeds, as well as plant microfossils and stable isotope records from cave sediment offer unequalled opportunities for understanding climate and habitat change during the end of the last global glaciation. Detailed research is underway by an INAH-led team and protection is critical for this important site. Efforts focus on using modern technology for documentation in order to leave the majority of the palaeontological finds *in situ*.

*Figure 3. Associated human and gomphothere bones on the bottom of Hoyo Negro, Quintana Roo, Mexico. The human skull is a stand-in placed after unauthorized divers disturbed the actual skull. © Roberto Chávez Arce.*

## Status of the cenote resources

Despite their great scientific value, the palaeoanthropological and palaeontological records in the Cenotes are increasingly at risk. The eastern Yucatan Peninsula, where most known deposits occur, is scheduled for massive urban development by the government of Mexico, as well as by national and foreign investors. Water pollution, salinization of aquifers and incorporation of the caves into resort developments are among the threats, but tourism poses even greater risks. Inadvertent damage by well-meaning but poorly trained divers and outright theft of priceless specimens has already begun to occur (Nowikowski, 2012). Those dangers threaten inundated caves and cenotes all over the world.

International organizations have begun to promote regulations for protecting the underwater cultural heritage. Two examples of this are the ICOMOS Charter on the Protection and Management of Underwater Cultural Heritage (1996) and the UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001). A major concern for UNESCO and other international and national agencies has been to set minimal standards for protecting this important heritage. These minimal standards include detailed recording at the sites and maintaining the materials *in situ* whenever possible. Furthermore, academic organizations and NGOs have realised the importance of the study and conservation of underwater cultural heritage and are producing the required literature to guide these efforts in a concerted manner (for example, Leshikar-Denton and Luna Erreguerena, 2008).

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# Cuevas Prehistóricas de Yagul y Mitla en los Valles Centrales de Oaxaca, los cazadores-recolectores y el origen de la domesticación de una dieta mesoamericana

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El sitio Cuevas Prehistóricas de Yagul y Mitla en los Valles Centrales de Oaxaca es uno de los tres sitios que cuentan con la categoría de Sitio Patrimonio Cultural de la Humanidad, junto con la zona de monumentos arqueológicos de Monte Albán y del Centro Histórico de la Ciudad de Oaxaca. El hecho de que haya alcanzado esta importante categorización no es fortuito, dado que es un espacio de una gran importancia en el que se localizan los restos de plantas domesticadas más antiguas de América.

Durante la mayor parte de la década pasada, se llevaron a cabo las gestiones para otorgarle esta categoría al sitio, trabajo difícil y lleno de obstáculos, pero que finalmente rindió sus frutos el 1 de agosto del año 2010, con la declaratoria por parte de la UNESCO en su conferencia anual en Brasilia.

El trabajo realizado no pudo quedarse en esta etapa, dado a las características particulares del sitio, esto debido a que el manejo del mismo es tanto o más importante que el haber logrado su declaratoria. Para explicar cómo es que las estrategias orientadas a una gestión adecuada de este sitio se han llevado a cabo, comentaremos sus características particulares, así como las estrategias que se han generado para su adecuado control y protección.

La principal categoría en la que se ha clasificado a este importante espacio es el denominado "paisaje cultural", comprendido no en un sentido estético, sino como una herramienta metodológica referente a una diversidad de valores que se traslapan en un espacio geográfico (Robles et al., 2009). Es decir, el espacio protegido es la conjunción de una serie de elementos culturales, naturales, tangibles e intangibles que se distribuyen a lo largo de una extensa área y que de manera conjunta otorgan de sentido al sitio.

Las Cuevas Prehistóricas de Yagul y Mitla incluyen un área de 5.300 ha en donde se incluyeron elementos culturales que exaltan los valores científicos, arqueológicos, naturales, estéticos, económicos, sociales e identitarios del área que comparten los municipios de Tlacolula de Matamoros, Villa de Díaz Ordaz y San Pablo Villa de Mitla, junto con la agencia municipal de Unión Zapata.

En el área con declaración patrimonial se conjugan distintos elementos de actividades humanas que son representativas del paso del hombre en el Valle de Tlacolula, siendo este Valle testigo de una actividad humana ininterrumpida por aproximadamente 10 mil años, además de haber sido el lugar donde se dieron importantes hitos en la historia de la humanidad; como la transición del nomadismo al sedentarismo con el desarrollo de las actividades agrícolas.

Este paisaje cultural está compuesto por:

*Figura 1. Paraje Guilá Naquitz. Unión Zapata. Mitla. © INAH-Tania Escobar 2009.*

*Figura 2. Vista al norte desde el Conjunto Monumental de Yagul. Tlacolula. Oaxaca © INAH-Tania Escobar 2009.*

*Figura 3. Caballito Blanco Vista Sur. Tlacolula. Oaxaca. © INAH-Tania Escobar 2009.*

**Una serie de cuevas y abrigos rocosos** con rastros de ocupación humana cuyo origen se remonta al periodo prehistórico, y en la que se han documentado evidencias del uso de gran cantidad de plantas útiles para la vida humana, así como proceso de domesticación de aquellas especies que constituyeron y aún constituyen el alimento básico de los pueblos mesoamericanos, tales como la calabaza, el frijol, el chile y el cultivo más importante: el maíz.

**El marco natural de selva baja caducifolia**, conservado de manera por demás afortunada, da origen a un paisaje estéticamente incomparable que guarda dentro de sí una larga lista de especies útiles, incluyendo especies endémicas, que hicieron posible la presencia humana en una interacción que refleja claramente el balance ecológico del área con la población humana como eje del aprovechamiento y la sustentabilidad regional desde épocas remotas.

**Los vestigios arqueológicos de ciudades monumentales**, siendo Yagul una de las ciudades posclásicas más importantes de México, sitio clave para comprender las dimensiones del desarrollo de las culturas mesoamericanas en las épocas cercanas a la conquista hispana.

Los estudios arqueológicos relacionados con el estudio de las Cuevas Prehistóricas de Yagul y Mitla tienen su antecedente más importante en el estudio de cuevas secas realizado por Richard MacNeish con respecto a la búsqueda de los orígenes de la agricultura realizados en Tamaulipas, Puebla y Chiapas (MacNeish, 1992). Estos trabajos lograron localizar importantes datos referentes a los primeros cultígenos, principalmente encontrados en la cueva de Coxcatlán en Puebla. Los restos arqueológicos de la cueva de Coxcatán comprendieron una larga secuencia de materiales botánicos muy bien preservada, con depósitos que se fecharon desde el 7000 a.C. hasta el momento del contacto europeo (MacNeish, 1964).

Las tierras altas sureñas de México constituyen un sistema complejo único, formado por varios subsistemas comprendidos en el lapso que va desde el 8000 a.C. al 200 a.C. Los estudios realizados por Flannery, Kirkby y Williams (1967), Mac Neish (1961-62-64), Callen (1965) y Smith (1965) sobre restos de huesos de animales y plantas, fueron realizados en el Valle de Oaxaca, el Valle de Tehuacán, Cueva Guilá Naquitz, Cueva Blanca, Abrigo Martínez, Cuevas de Coxcatlán, Purrón, Abejas, El Riego y San Marcos. Todos ellos indican que hubo plantas y animales de mayor importancia, de acuerdo al ecosistema, y que la tecnología y la destreza de los habitantes es lo que les permitió subsistir (Flannery, 1968).

Con base en los nuevos paradigmas de la evolución cultural que se refieren a la capacidad de adaptación humana, Kent Flannery buscó también cuevas secas en el Valle de Oaxaca. Una de estas fue la llamada Guilá Naquitz, ubicada en el Valle de Tlacolula; la secuencia precerámica que encontró fue más corta que en Coxcatlán, pero mucho más antigua, ya que halló elementos fechados en 10750 AP, hasta 8670 AP (Flannery, 1986). Las conclusiones que fueron encontradas a partir de las excavaciones de este sitio consistieron en obtener un patrón de recolección y domesticación temprana de distintas plantas, entre

las que se encuentran la calabaza, el maíz, el guaje y los chiles, aunque también se encontraron otro tipo de plantas no domesticas como el piñón, la cebolla silvestre, maguey, guaje, frijoles, nanche, nopales y moras; sugiriendo que los habitantes de este lugar estaban involucrados en prácticas protoagrícolas tanto con plantas estacionales como con las que posteriormente serían domesticadas, mostrando un proceso de coevolución que posteriormente fomentaría una interdependencia entre estas especies y el hombre (Pearsall, 1995).

*Figura 4. Cueva de la Paloma. Unión Zapata. Mitla. © INAH-Aciel Sánchez 2001.*

Para Flannery, los recolectores precerámicos se nos presentan como individuos hábiles para obtener de la naturaleza sus mejores recursos. Los observa como grupos competitivos con un ordenamiento social interno y con gran preocupación por el estatus, acumulación de bienes de lujo, control del agua, etcétera. Uno de los modelos propuestos era el de la cultura adaptada a una zona especial: bosque de roble, pradera de mezquita, chaparral de espino, bosque tropical, etcétera. El autor sugiere la difícil adaptabilidad de ambientación a todas las zonas ya que, a su juicio, la adaptación básica no se da en microambientes (Flannery, 1986).

Otro modelo indica que el cambio cultural que se da en el paso de la recolección a la agricultura sedentaria se debe pensar como un experimento que estos pobladores comenzaron a hacer con las plantas, pues durante la recolección esos productos no formaban parte de su dieta alimenticia. Así, el cambio de la recolección a la agricultura sedentaria (5000 a.C.-1500 a.C.), se sugiere entonces como un cambio gradual, determinado por la estacionalidad y la programación. Dicho cambio es resultado de la expansión y contracción de los sistemas ya existentes (Flannery, 1968).

Dentro del análisis de las cuevas prehistóricas, se identifica una serie de atributos que permiten observar diversos comportamientos humanos basados en estaciones, suponiendo que cada piso de ocupación en una cueva dada representa los desechos de un solo campamento, usualmente datando una sola estación. Así, las combinaciones de restos de plantas y animales observados en un nivel dado se han interpretado de la siguiente manera, para el contexto arqueológico obtenido (Flannery, 1986):

**Campamentos de estación seca** (de octubre a marzo). Dependiendo de la elevación sobre el nivel del mar, puede haber grandes depósitos de plantas y animales otoñales e invernales silvestres, pero en general falta la variedad vista en los niveles de la estación lluviosa y quizás más significativamente tienen un alto porcentaje de aquellas plantas que –aunque no particularmente gustosas– están disponibles todo el año: tuna, maguey, raíz de Ceiba y otras más. Estas son las llamadas "plantas del hambre", que se consumen justo en la estación seca, cuando se dispone de pocas cosas más. Estos mismos niveles también tienden a tener altos porcentajes de hueso de ciervo.

**Campamentos de estación lluviosa** (de mayo a septiembre). Hay gran cantidad de plantas disponibles en esa época del año: mezquite, magueyes, amaranto, aguacate salvaje, zapotes y otros más. También son ricos en fauna pequeña como conejo de rabo de algodón, zarigüeya, mapache topo e iguana negra. El ciervo representa sólo un pequeño porcentaje del mínimo de animales en los escombros. Lo que estas generalizaciones sugieren, en su mayoría, es la preferencia a la estacionalidad de las plantas recolectadas, y cuando surgieron situaciones de conflicto, fue cercenada la explotación animal.

En total, fueron registradas en ese momento alrededor de 60 cuevas y abrigos rocosos, caracterizando a su estudio como la descripción cultural de bandas nómadas de cazadores-recolectores, que ocupaban campamentos estacionales y refugios temporales en las cuevas, mismas que constituyen el depósito arqueológico del área.

El análisis de los tres más antiguos fragmentos de la inflorescencia de Zea mays de Guilá Naquitz, Oaxaca, México, demuestra que no se desarticulan de manera natural, lo que indica que la selección agrícola de teocintle domesticado estaba en marcha ya 5.400 años 14C antes del presente (alrededor de 4.200 años a.C dendrocalibrados). La co-ocurrencia de dos ejemplares clasificados con dos filas y cuatro filas de granos y numerosas características morfológicas adicionales de estos ejemplares apoyan la hipótesis basada en el análisis de genética molecular y cuantitativa de que el maíz evolucionó a partir del teocintle. La domesticación del ancestro silvestre del maíz se produjo antes de finalizar el quinto milenio antes de Cristo (Benz, 2001).

La más antigua evidencia macrobotánica de las fases iniciales de la evolución del maíz proviene de dos lugares arqueológicos de Mesoamérica, los valles de Tehuacán y Oaxaca. Estas dos localidades han producido las primeras evidencias del cultivo de maíz por cazadores-recolectores precerámicos. Un amplio debate acerca de estos especímenes gira en torno a su relativa antigüedad y un análisis e interpretación detallada de su morfología. La comparación morfológica de las muestras de Oaxaca y Tehuacán, junto con la fecha exacta de las muestras de Guilá Naquitz, indica que los esfuerzos para domesticar el teocintle tuvieron éxito por lo menos 700 años antes de que las primeras mazorcas de maíz se incorporan a la basura precerámica de la cueva de San Marcos del Valle de Tehuacán (Benz, 2001).

Muestras arqueológicas de las inflorescencias del Zea domesticado (mazorcas) de Guilá Naquitz (C9 y D10) fueron objeto de la espectrometría de acelerador de masas (AMS) de datación por radiocarbono. Dos de los tres ejemplares fueron fechados por AMS en 5420 ± 60 (C9) y 5410 ± 40 (D10) 14C años AP (6235 años calibrados AP). Las pruebas de la contemporaneidad indican que las dos fechas pueden ser promediadas (5412 ± 33 años AP), ya que sus edades no son significativamente diferentes (t = 0,14, no significativo). Las fechas de AMS en las mazorcas Guilá Naquitz indican que son alrededor de 730 años más antiguas que los ejemplares más antiguos de maíz reportados en el Valle de Tehuacán (Benz, 2001).

Los dos ejemplares de C9 se produjeron de la misma procedencia y presunta unidad de sedimentación, y se informó que son fragmentos de una inflorescencia. Los intentos de volver a colocar las dos muestras no tuvieron éxito. La comparación estadística con el conjunto de maíz de Tehuacán se ha realizado como si las dos muestras de C9 fueran de diferentes inflorescencias. Las características morfológicas de las mazorcas de Guilá Naquitz apoyan la evidencia de una acumulación genética que demuestra la hipótesis de la relación ancestro-descendiente para el teocinte y el maíz, y además documenta algunas de las diferencias genéticas que distinguen a las inflorescencias de los Zea silvestres y domésticos (Benz, 2001).

Una comparación de las características morfológicas de tres mazorcas de Guilá Naquitz con los tres primeros ejemplares de la Cueva de San Marcos (4.750 años AP2, 14C3) indica que las dos poblaciones no son distinguibles desde el punto de vista estadístico. Por lo tanto, desde 5.400 años AP (14C) y por los siguientes 700 años, la selección humana parece haberse centrado en la estabilización de las dísticas, no desarticulando a un fenotipo de grano desnudo e incrementando el número de espigas de granos de uno a dos por nodo. La similitud morfológica de los ejemplares de Guilá Naquitz y las primeras muestras de Tehuacán sugieren que la intencionalidad humana trató de mantener o aumentar la productividad de este cultivo de cereales. Esta evidencia no rechaza la posibilidad de que el uso humano de teocintle se haya centrado en algo diferente al grano, pero sí sugiere que en el sexto milenio antes de nuestra era, los humanos enfocaron sus actividades de subsistencia en mantener fácilmente cosechables las inflorescencias productoras de granos. Estos fragmentos de algunas inflorescencias también sugieren que la propagación de teocintle domesticado durante este periodo estuvo basado en la subsistencia humana y el sistema de asentamiento, con un grado de permanencia que le permitió desarrollar dependencia de las prácticas del manejo humano de la tierra a lo largo de la temporada de cultivo y de cosecha (Benz, 2001).

La fecha de ca4 4.700 años AP (14C) para las más antiguas mazorcas de maíz del Valle de Tehuacán, junto con las fechas de Guilá Naquitz del teocintle domesticado, sugieren que las primeras evidencia de la manipulación humana del teocintle espera su descubrimiento en yacimientos arqueológicos de Mesoamérica (Benz, 2001).

En los estudios llevados a cabo por Dolores Piperno (2001), la determinación de la antigüedad por parte del acelerador de espectrometría de masas de mazorcas de maíz (Zea mays L.) de Guilá Naquitz en Oaxaca, México, produjeron fechas de 5.400 años de 14C AP, por lo que esas mazorcas son de las más antiguas de América. Los macrofósiles y fitolitos localizados de frutas silvestres y domesticadas están ausentes en estratos más antiguos del lugar, aunque el polen ha sido previamente identificado a partir de esos niveles, así se sugieren que las prácticas culturales que llevaron a la domesticación se produjo probablemente en otras partes de México, concluyendo que Guila Naquitz ahora ha dado la evidencia más temprana de macrofósiles para la domesticación de dos importantes plantas de cultivo de América, la calabaza (Cucurbita pepo) y el maíz (Piperno y Flannery, 2001).

Entre los arqueólogos, se han producido dos modelos explicativos para la diversificación del maíz. De acuerdo con uno, ya que el más antiguo fechado de maíz fósil proviene de las tierras altas de México, la temprana diversificación del maíz producido en las tierras altas se extiende a las tierras bajas en una fecha posterior. El segundo modelo interpreta fitolitos de maíz de las tierras bajas como el maíz más antiguo, y por lo tanto pone la temprana diversificación del maíz en las tierras bajas. Los datos científicos sugieren que el maíz se diversificó en las tierras altas antes de extenderse a las tierras bajas (Matzuoka et. al, 2002).

Además de la domesticación del maíz, las filogenias revelan la diversificación geográfica de las variedades criollas de maíz. Los tipos de maíz basales en ambos filogenias son los de las tierras altas de México. Este resultado coloca a la temprana diversificación del maíz en las tierras altas, entre los estados de Oaxaca y Jalisco. En este sentido, llama la atención que el maíz arqueológico más antiguo conocido es el de Oaxaca, y notablemente el maíz basal donde se presenta una correspondencia entre la evidencia genética y arqueológica (Matzuoka et. al, 2002).

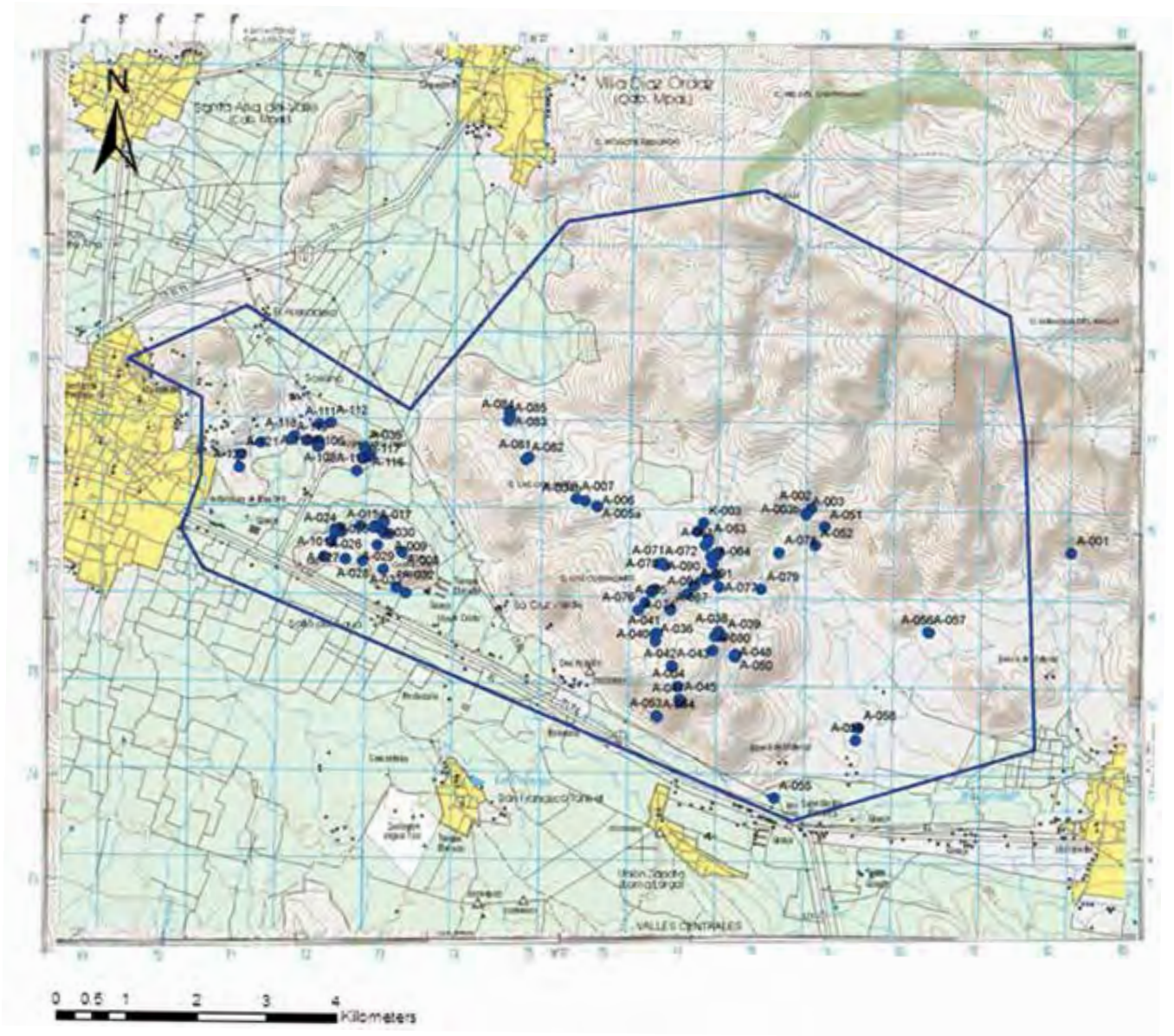


*Figura 5. Mapa de registro de abrigos, artefactos, cuevas y fauna. © INAH- Robles, Ríos et al., 2012*

Las excavaciones en Guilá Naquitz y la Cueva de Silvia, también arrojaron 122 restos de chiles que datan del periodo entre 600 a.C. y 1521 d.C. Los chiles pueden ser asignados a por lo menos 10 tipos, todos ellos pertenecientes a la especie Capsicum annuum o Capsicum frutescens. Las muestras permiten una evaluación de los criterios utilizados para chiles silvestres y para distinguir entre razas cultivadas. Además, ofrecen la oportunidad de evaluar la fiabilidad de los granos de almidón para documentar la presencia de chiles en sitios arqueológicos, donde hay restos macrobotánicos (Perry, 2007).

Algunos pedúnculos de chile que fueron recuperados han añadido una nueva dimensión a nuestra comprensión de la agricultura, de la subsistencia y de la gastronomía en ambos sitios, y muchas interpretaciones previamente establecidas sobre el uso de la cueva han sido confirmadas. Además, los datos permitieron reexaminar los criterios utilizados en el pasado para documentar la domesticación de los pimientos picantes. La mayoría de los chiles se recuperaron de la capa denominada A, una gruesa capa de cenizas, restos orgánicos, y cerámica Monte Albán IIIb-IV, que produjo fechas 14C no calibradas de 620 + - 130 AD (Perry, 2007).

En los años de 1970 a 1980, la Universidad de Michigan efectuó una investigación basada en recorridos de superficie en los Valles Centrales de Oaxaca. Los resultados obtenidos (Kowalewski, 1989) permitieron obtener un conocimiento amplio de la ecología cultural de la región, dando con esto un giro a la investigación y abriendo un rico campo de acción para equipos multidisciplinarios. Hacia mayo de 1996, el Centro INAH-Oaxaca y la Dirección de Registro Público de Monumentos y Zonas Arqueológicas (DRPMZA), efectuaron trabajos de campo para delimitar la poligonal envolvente que protegerá la superficie de Yagul; estas actividades comprendieron los reconocimientos de superficie en el perímetro alrededor de la zona arqueológica y levantamiento topográfico correspondiente.

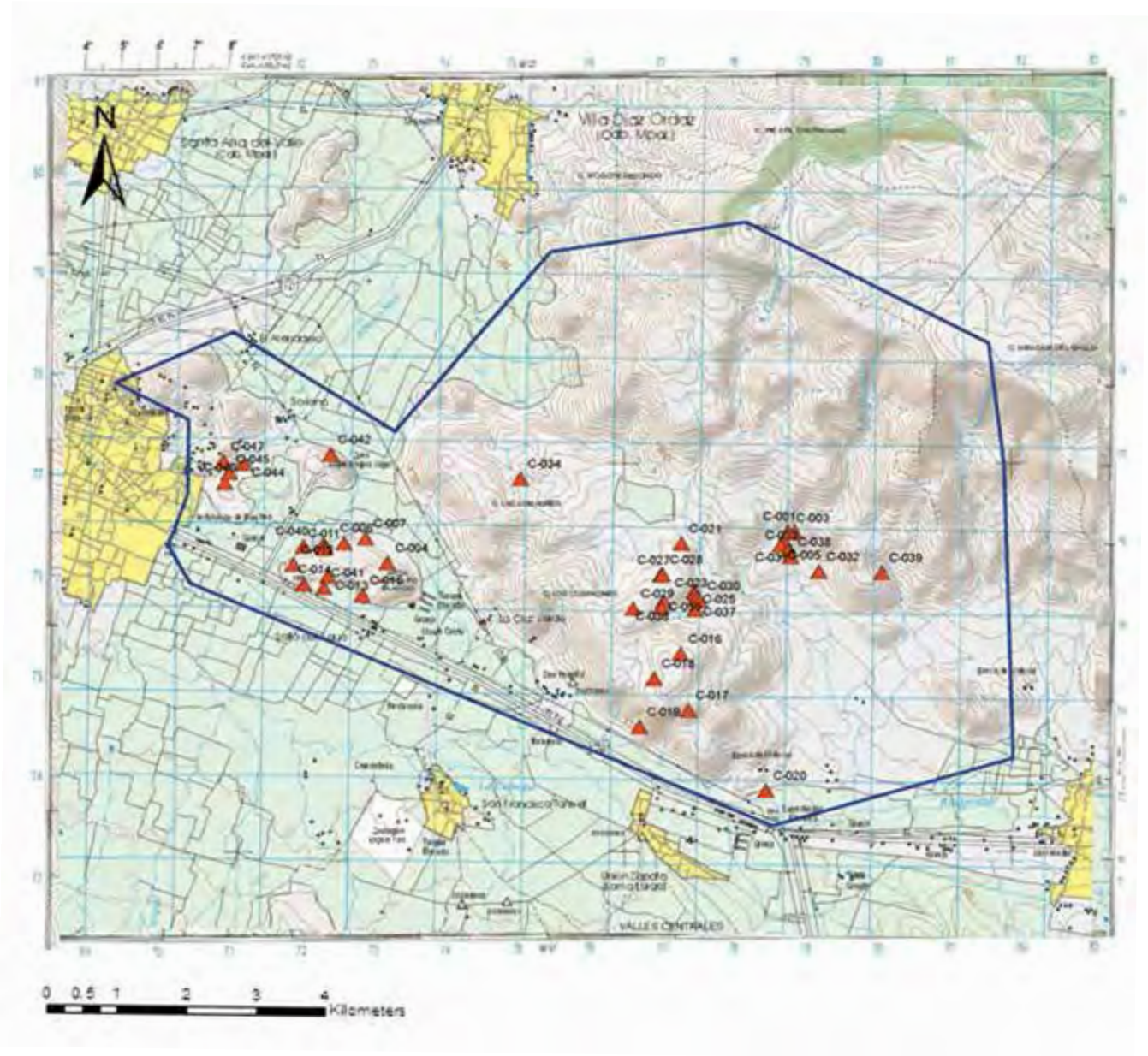


*Figura 6. Mapa de registro de abrigos, artefactos, cuevas y fauna. © INAH- Robles, Ríos et al., 2012*

Con estos datos, se comenzó la catalogación de las cuevas y abrigos rocosos en el área, trabajo que años más tarde serviría para conformar el Proyecto de Investigación y Conservación de las Cuevas Prehistóricas del Valle de Tlacolula. Específicamente, este proyecto surgió a raíz del Salvamento Arqueológico Carretera Oaxaca-Mitla, diseñado por el Arqu. Samuel Mata y el Dr. Marcus Winter, adscritos al Centro INAH Oaxaca en el año 2000, el cual pretendía trazar el tramo Díaz Ordaz-Mitla de la autopista Oaxaca-Istmo por el área de cuevas prehistóricas investigadas en los años 60, en el Proyecto Prehistoria y Ecología Humana en el Valle de Oaxaca, de Flannery. Esto provocó la reacción de algunos investigadores, quienes consideraron que dicho proyecto carretero no era viable dada la importancia arqueológica del área que sería destruida. De tal forma que en el año 2001, se realizaron recorridos de superficie que documentaron la existencia de sitios arqueológicos no documentados durante el proyecto de Flannery, así como la propuesta de una primera delimitación (Robles et al., 2001).

Dadas estas circunstancias, fue presentado ese mismo año el PICCPVT ante al Consejo de Arqueología del INAH, el cual, durante el año 2006, llevó a cabo su primera temporada de campo a cargo del arqueólgo Rosalío Félix Ruiz, adscrito al CAVO, y con el apoyo de los arqueólogos Miguel Ángel Cruz G. y José Ángel Ruiz Cabañas. Así, ampliando el área de estudio y subdividiéndola en distintos parajes, se documentaron 56 nuevos elementos arqueológicos distribuidos en tres parajes principalmente: Caballito Blanco, Cueva Blanca y Los Compadres. En el año 2005 fue presentado el Proyecto Integral para la Conservación de los Recursos Naturales y Culturales en el Ámbito Regional Yagul-Mitla (PICRCNARYM), el cual se enfocó principalmente en dos frentes: por un lado la restauración de las estructuras arquitectónica del área monumental de la zona arqueológica de Yagul, a cargo del arqueólgo Jorge L. Ríos Allier, y, por otro, la continuación del registro de cuevas y abrigos comenzada durante el PICCPVT, esta vez a cargo del arqueólgo Antonio Martínez Tuñón y con el apoyo del Arq. Luis García Lalo, quienes continuaron con el registro de sitios y llevaron a cabo la primera excavación en el sitio CAVO-A54, cuyos restos

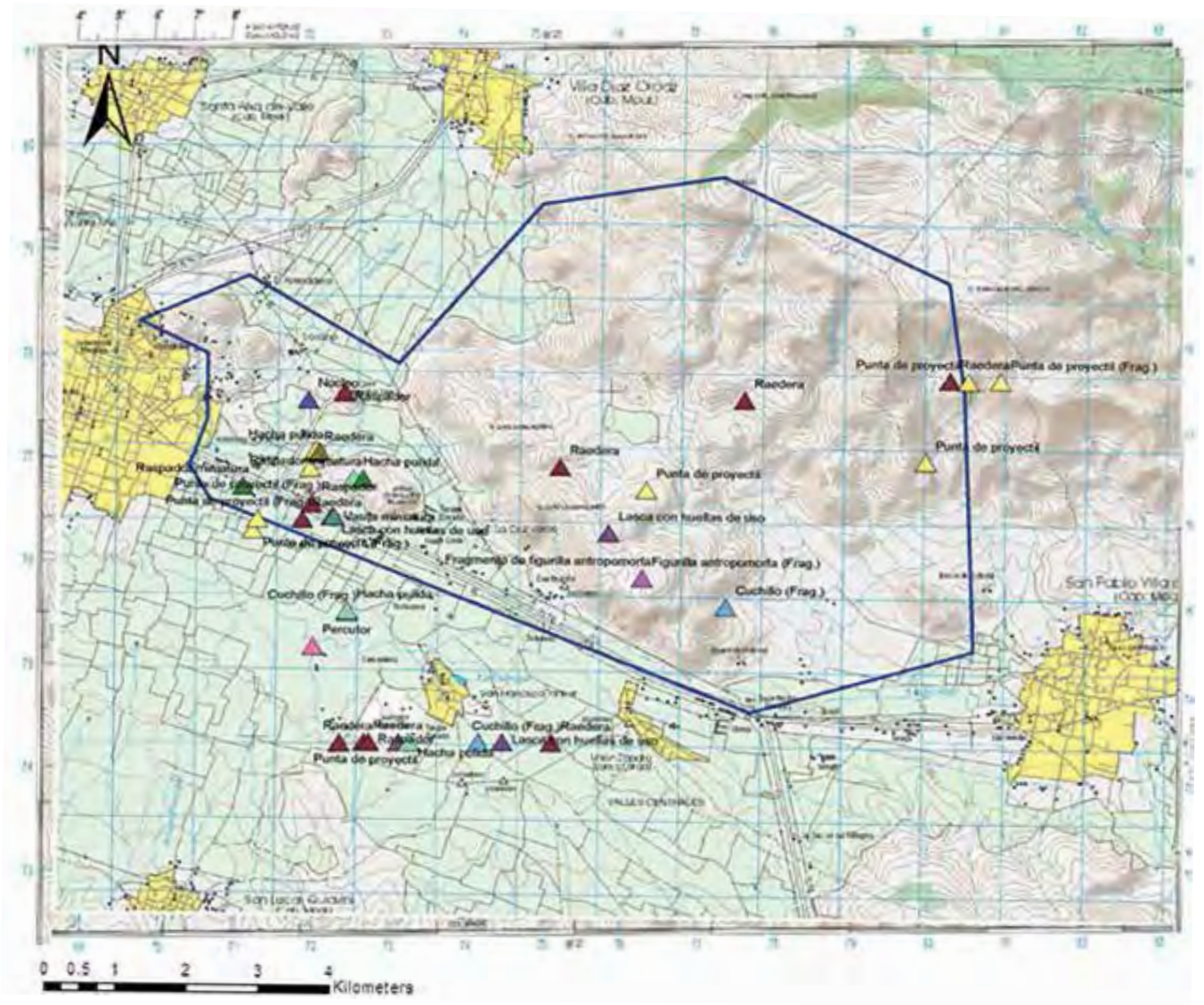


*Figura 7. Mapa de registro de abrigos, artefactos, cuevas y fauna. © INAH- Robles, Ríos* et al.*, 2012*

orgánicos están siendo analizados por la Dra. Noreen Tuross, adscrita al Laboratorio de Bioquímica de la Universidad de Harvard, E.U.A, siendo éste un aspecto fundamental para la defensa legal de los sitios arqueológicos (Robles et al., 2009).

La Declaratoria como Patrimonio Mundial de las Cuevas Prehistóricas de Yagul y Mitla (2010) es el punto de partida para el reconocimiento del tema de la domesticación temprana de plantas y el inicio de la agricultura incipiente hacia lo que después se convirtió en una dieta mesoamericana integral, reflejando con ello la continuidad de este paisaje cultural en lo particular.

Desde su aprobación, el Plan de Manejo de este bien patrimonial ha proporcionado herramientas metodológicas, enfocándose los esfuerzos en el área de investigación, específicamente en el registro de elementos naturales y culturales con el objetivo de complementar a mediano plazo un inventario regional, así como en la gestión con las comunidades y la interacción de las misma en todos los procesos de conservación.

Los elementos que se tienen ahora registrados dentro de este paisaje cultural nos muestran una capacidad adaptativa humana comparable a otras latitudes del mundo donde se ha llevado a cabo la domesticación de otros cereales y que ha derivado en grandes culturas. Los estudios recientes nos permiten mencionar nuevos contextos y adicionar información a los que continúan integrando conocimiento.

En un primer estudio realizado por Enrique Martínez y Ojeda, en 1996-97, sobre el entorno natural actual del bien, se clasifica en la categoría de selva baja caducifolia o bosque tropical caducifolio, lo que implica que la mayor parte de las especies vegetales pierden las hojas en el periodo de sequía y en la época de lluvias presentan gran exuberancia. Este tipo de vegetación presenta una compleja estratificación arbórea vertical con tres o cuatro estratos identificados: herbáceo de 1 m de altura en la parte baja, intercalado con cactáceas bajas esferoidales como: chilillos o cardos y abrojos de tallo cilíndrico; continúa el arbustivo de 6 m de altura, con una cantidad importante de espinos, dentro de éstas se

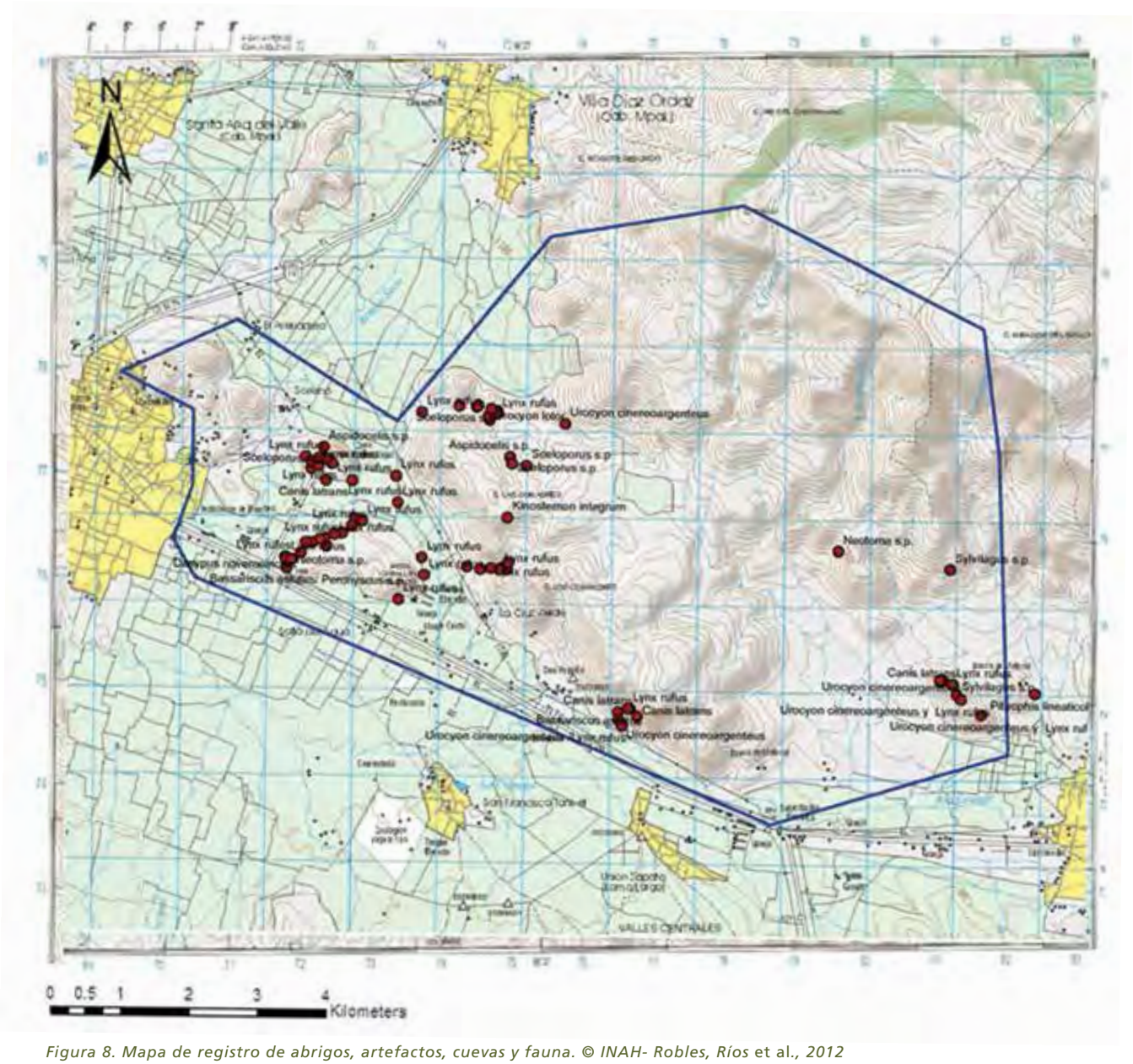


*Figura 8. Mapa de registro de abrigos, artefactos, cuevas y fauna. © INAH- Robles, Ríos* et al.*, 2012*

encuentran las llamadas epifitas (son aquellas plantas que viven sobre plantas) como bromelias y helechos; trepadoras herbáceas y parásitas (plantas que viven sobre otras plantas extrayendo nutrientes). Actualmente, se siguen llevando estudios para la catalogación de especies de plantas endémicas y el estudio de capacidad de carga física (Ríos et al., 2013).

En cuanto a la fauna como elemento natural, se puede decir que "todos los animales localizados en los Valles Centrales de Oaxaca" se ubican dentro de lo que Udvary (1984) reconoce como provincia Madrean Cordilleran, del Reino Neártico. Actualmente estos animales se encuentran refugiados en los manchones de vegetación que aún quedan en los cerros situados dentro (como en el caso de Yagul) y en los alrededores de los valles. En el caso específico del área de Yagul y Mitla, se han realizado importantes avances en el conocimiento del catálogo faunístico, principalmente en los estudios relacionados con las poblaciones de aves (Grosselet, 2011; Robles, 2011). A la fecha, se siguen realizando estudios para la catalogación de especies de mariposas, mamíferos y de herpetofauna (Ríos et al., 2013).

Un segundo componente es el integrado por los sitios arqueológicos prehistóricos que se encuentran esparcidos a lo largo del sitio, y que están distribuidos entre sitios abiertos, abrigos rocosos y manifestaciones gráfico rupestres. Hasta el momento se ha realizado el registro de 215 sitios con estas características (Ríos et al., 2012), donde las investigaciones van encaminadas en este momento al conocimiento de los materiales usados en las pinturas murales (Tuross y Robles, 2010) o a estudios particulares de reconstrucción de la dieta prehistórica (Warinner, Robles y Tuross, 2013), lo que nos permite en este momento dentro del paisaje cultural conceptualizar una serie de contextos arqueológicos diversos, siendo los más importantes los siguientes:

## a) Guilá Naquitz

Es una pequeña cueva ubicada a una altura de 1.926 msnm. En el extremo sur del macizo rocoso que lleva su nombre. Éste fue el principal sitio investigado por Flannery en la década de 1960, en el cual, debido a las condiciones secas que presenta, fue posible recuperar una importante cantidad de plantas antiguas que documentan el proceso de domesticación de las plantas, en particular del maíz que fue la base de la subsistencia de las comunidades prehispánicas. Al parecer, el elemento fue ocupado en distintas ocasiones durante el periodo arcaico, lo que nos muestra algunas de las actividades más importantes de sus ocupantes. Algunas de las primeras acciones que allí realizaron fue la recolección de grandes cantidades de hojas de encino para ser utilizado como colchones, así como la excavación de un pozo de almacenamiento poco profundo y la preparación de un fogón en el centro de la cueva. Desde allí se dedicaron durante todo el otoño a la recolección de vegetales silvestres y a la caza, en la que obtuvieron al menos un venado y diversos conejos. La riqueza del medio era tal que al momento de abandonar la cueva en invierno, probablemente para trasladarse a las partes altas del cerro donde se conservaba mayor humedad, dejaron en el abrigo grandes cantidades de alimentos, entre ellos más de 3 mil bellotas que quedaron sin ser comidas, lo que indica que las poblaciones de este periodo no sufrían de escasez de alimentos y difícilmente se puede considerar que existiera una gran densidad poblacional en el área.

## b) Cueva Blanca

Este sitio contiene la evidencia humana más antigua en nuestro sitio, correspondiente al periodo Paleoindio. En ella se encontraron restos óseos de fauna pleistocénica con muestras de haber sido quemados y fracturados de manera deliberada. Cueva Blanca arrojó también información significativa del periodo arcaico en cuanto a la tecnología lítica, de la forma en que Guilá Naquitz lo hizo sobre las cuestiones biológicas. De ella se obtuvo una importante muestra de herramientas de material lítico, a partir de las cuales se realizó un estudio por parte de Robert Reynold con el que se pudo identificar herramientas asociadas a las actividades femeninas y masculinas, lo cual enriquece nuestra comprensión de la división de trabajo durante el arcaico. En un nivel superior se encontraron herramientas exclusivamente para la caza de venado, lo que pudiera evidenciar un estado posterior en el desarrollo cultural, cuando las microbandas de forrajeros que recorrían grandes extensiones del territorio en búsqueda de recursos comenzaron a establecer campamentos semipermanentes en los cuales se organizaban partidas de búsqueda de recursos específicos por parte de algunos de los miembros del grupo, mientras que el resto permanecían en el campamento base, lo cual puede considerarse como una nueva estrategia económica del arcaico tardío en vías del sedentarismo y la agricultura.

## c) Gheo Shih

Gheo Shih ("río de los calabazos") es un sitio arcaico al aire libre localizado en el aluvión aledaño al Río Mitla, en la parte baja del sitio que ocupa aproximadamente 1,5 ha. Durante el verano, los mezquites del área y otros vegetales daban abundantes frutos, a la vez que los conejos y venados se concentraban en el bosque aluvial, por lo que la gran cantidad de recursos permitía que las diversas microbandas que se encontraban dispersas durante el resto del año se reunieran y aprovecharan la abundancia de recursos para realizar diversas actividades sociales. Destaca de este sitio el hallazgo de dos líneas paralelas de cantos rodados que se prolongaban por 20 m, separadas por un espacio de 7 m entre ambas, el cual carecía de cualquier clase de objetos mientras que en la parte exterior del espacio delimitado los objetos eran abundantes y diversos, es decir, había sido limpiado. Esto se ha interpretado como que dicho sitio funcionó como un espacio para la realización de danzas, de la forma en que los instalaban algunos indios del oeste estadounidense (Marcus y Flannery 1996, 2001). Otra característica significativa de este sitio es el hallazgo de guijarros perforados en el centro a manera de ornamentos, lo que no se ha localizado en ningún otro de los sitios menores del arcaico.

## d) Cueva de la Paloma

Cueva de grandes dimensiones (35 x 14 m aproximadamente) cuya boca se dirige hacia el norte. El acceso presenta algunas dificultades debido a lo escarpado del terreno y la abundante vegetación, compuesta principalmente por matorral espinoso. Para acceder a la cueva hay que subir por un afloramiento rocoso en talud, frente a la línea de goteo no puede hablarse de terraza ya que se encuentra abundante roca de gran tamaño formando una pared entre la boca de la cueva y el talud del cerro, lo que provee a la cueva de protección adicional. En su suelo se puede observar una gran cantidad de sedimento, producto principalmente de la erosión de las paredes, las cuales son de toba volcánica, si bien también se observan restos de excremento

de ganado bovino y otros animales. Dentro de la cueva se encontró la presencia de cuatro rocas formando un cuadro que podrían corresponder a un fogón. En el suelo es posible observar gran cantidad de materiales arqueológicos como cerámica y lítica, y en sus paredes se distinguen dos pinturas rupestres, una representa dos figuras antropomorfas, una con una lanza y la otra con un penacho, que parecen referir a rituales de caza, mientras que la otra representa una paloma atravesada por una flecha.

*Figura 9. Pintura rupestre en Los Machines. Unión Zapata. Mitla. © INAH-Tania Escobar 2009.*

## e) Abrigo Banco de Sílex

Éste es un abrigo rocoso localizado al este de Guilá Naquitz que presenta una gran altura y poca profundidad. La mayor parte de sus paredes son de toba volcánica muy suave y presenta una fuerte erosión natural. Sin embargo, a media altura contiene un banco de roca de pedernal de buena calidad con muestras de explotación arqueológica. El acceso no es difícil, aunque la pendiente para llegar a él es considerable. La terraza frente al abrigo tiene entre 2 y 4 m de extensión, tras la cual el talud tiene una pendiente considerable. Hay que resaltar que las principales herramientas utilizadas durante el periodo arcaico fueron fabricadas de materiales líticos, por lo que contar con un banco de material de buena calidad contribuyó al desarrollo tecnológico de los habitantes del área.

## f) Guigósj o piedra tirada

Al sureste del área de estudio, en el paraje conocido como Don Pedrillo, se encuentra un sitio llamado Guigósj o piedra tirada, en el cual puede observarse desde la carretera a 50 m sobre el piso del valle una enorme piedra recortada a la manera de los dinteles de Mitla. Al llegar al lugar se reconoce que en realidad son dos conjuntos de cantera trabajada: el primero es una en la que se observa la cantera con claros cortes hechos para la extracción de material y siete rocas ya cortadas en asociación; el segundo es el observado desde la carretera, formado por seis piedras monumentales, una de las cuales presenta pintura rupestre que muestra cinco líneas verticales paralelas de color rojo (Robles, 1994, p. 17). Este sitio muestra los grandes avances tecnológicos alcanzados por los grupos prehispánicos del área en cuestiones arquitectónicas y en procesos de extracción de materia prima para la solución de las mismas.

## g) Corral de Piedra

Este sitio se encuentra en el extremo noreste del polígono a más 2.200 msnm. Se trata de una serie de muros de contención que rodean la parte más alta de un mogote y se distribuyen por más de 8 ha. Se encuentran distribuidos de tal forma que restringen los pasos más accesibles a la parte superior. En la parte de arriba no ha sido posible identificar estructuras arquitectónicas, lo que hace pensar que el lugar no estuvo habitado más que por un pequeño campamento, y que serviría como punto de vigía de la ciudad prehispánica de Mitla, ya que desde este punto es posible observar casi la totalidad del Valle de Tlacolula, e incluso los márgenes de la ciudad actual de Oaxaca.

## h) Cueva de los Machines

Esta cueva no presenta mucha profundidad pero sí considerable altura. En ella se pueden observar abundantes pinturas rupestres de color rojo. La cueva muestra evidencias de ocupación contemporánea por los restos de una fogata reciente y otros materiales actuales. También se encontró un metate de tres pies fragmentado por la mitad que no parece ser prehispánico, ni presenta huellas de uso. Tiene una cavidad de menor altura en el lado este, en el cual se puede observar la presencia de enjambres de abejas.

El suelo está cubierto por sedimentos además de detritos de ganado vacuno. El acceso, si bien no es difícil, se complica un poco debido a la abundante vegetación compuesta principalmente por matorral espinoso. Frente a la línea de goteo se puede observar un talud de inclinación moderada, que puede formar parte de las áreas de actividad de los ocupantes de esta cueva. Al interior de la cueva, cerca de la entrada, se pueden observar algunas plantas pequeñas, además de un árbol de más de 4 m de altura. El arte rupestre en este sitio es abundante, se puede encontrar un grabado en la piedra que representa un rostro, la pintura es variada y abundante, los principales diseños pintados son un felino, figuras humanas, representaciones celestes, probablemente referentes al planeta Venus, lo que pudiera ser la representación de un maíz, asociado a un elemento acuático; hay también manos al negativo y diseños abstractos.

## i) Pinturas y petroglifos de Caballito Blanco

Otro elemento relevante en cuanto al arte rupestre es el localizado en la parte suroeste de la mesa de Caballito Blanco, el cual cuenta tanto con pinturas como con petroglifos. Las pinturas de Caballito Blanco adquirieron su nombre por un diseño pintado en la roca que tiene cierta similitud con un caballo del mismo color. La primera pintura ubicada en la pared este se conoce como "el candelabro", por la similitud con el objeto, y presenta una combinación de fondo rojo ocre y el diseño en blanco. Debajo de esta pintura y a 3 m del nivel del suelo, se observan dos diseños, en el primero se localiza al sur de la roca y tiene una forma geométrica; el segundo se ubica al sureste de la misma roca y fue realizado con pintura blanca, representando las facciones de un personaje con tocado en la cabeza. El estado de conservación de las pinturas es regular, tomando en cuenta que se encuentran expuestas a la intemperie y a fenómenos naturales como el agua, el viento y el sol, que propician una rápida erosión.

*Figura 10. Caballito Blanco. Tlacolula. Oaxaca. © INAH-Tania Escobar 2009.*

Debajo de la pintura del candelabro se logró localizar un piso que contenía una impresionante cantidad de grabados en la piedra, así como una representación escultórica que parece corresponder al dios murciélago. Para ingresar a este lugar es necesario atravesar por una serie de grietas en el macizo rocoso hasta llegar a una pequeña terraza bajo la pintura, desde la cual se puede dominar buena parte del Valle, de tal forma que quien acceda a ella puede ser observado desde el piso, lo que nos hace pensar que su uso pudo ser para la celebración de rituales públicos. La gran complejidad que presentan los grabados y su asociación con la zona arqueológica nos indican que pueden proceder de la época de esplendor de Yagul, durante el periodo posclásico. Sin embargo, es necesario un registro y estudio completo de las mismas, lo cual presenta una serie de dificultades dadas las características físicas que caracterizan al elemento. De cualquier forma, se considera de vital importancia para la comprensión del complicado sistema de escritura zapoteca, del cual estos grabados representan un ejemplo sobresaliente.

## j) Caballito Blanco

Este sitio arqueológico fue explorado por John Paddock e Ignacio Bernal (Paddock, 1983). Pertenece al periodo Preclásico terminal o Monte Albán II (200 a.C.-250 d.C.). Está conformado por un conjunto de cuatro edificios congregados alrededor de una plaza. Probablemente, la característica más importante de este pequeño conjunto arqueológico sea la Estructura O, localizada casi en el borde sur de la meseta, que presenta una planta singular en forma de flecha al suroeste que la asemeja al Edifico J de Monte Albán, el cual se ha considerado durante mucho tiempo como un observatorio, si bien la inclinación de ambos edificios no es completamente igual (Schavelzon, 2011).

## k) Yagul

Yagul es uno de los sitios más importantes del Valle de Oaxaca para la comprensión de la transición del periodo Clásico al Posclásico (Bernal y Gamio, 1974). Este sitio complejo está localizado en las laderas y en la parte superior de un macizo rocoso del mismo nombre, el cual ha sido modificado por el hombre, formando una serie de plataformas y terrazas habitacionales en donde se asentó la población. Este sitio tiene presencia de ocupación desde el Preclásico Temprano en su fase Tierras largas (1500 a.C.), empero no es sino hasta el Clásico Tardío (650-850 d.C.) con el apogeo del estado de Monte Albán (época IIIb-IV), que comienza el apogeo del sitio, extendiéndose hasta el Posclásico Tardío, donde fueron construidos la mayor parte de los edificios que actualmente se pueden apreciar.

## Conclusiones

El sitio Cuevas Prehistóricas de Yagul y Mitla en el Valle Central de Oaxaca constituye, así, un paisaje cultural de Valor Universal Excepcional, compuesto por parajes extraordinariamente ricos que guardan evidencias de la domesticación temprana de plantas, en especial del maíz, en un verdadero compendio de plantas útiles para la supervivencia humana y de la conformación posteriormente de una dieta mesoamericana.

El maíz, cuyo posible origen se ha documentado en las Cuevas Prehistóricas de Yagul y Mitla, no sólo fue el sustento material que posibilitó el surgimiento de las civilizaciones mesoamericanas, sino que constituye un elemento central en la ideología de dichas civilizaciones, formando parte fundamental de los mitos y creencias antropogénicas, con base a las cuales estos pueblos se comprendían a sí mismos.

El maíz tiene una significativa relevancia no solo económica sino también ideológica, que se desarrolló en las culturas mesoamericanas a tal grado que éstas pueden ser contempladas como "culturas del maíz", lo cual comprende desde los orígenes de la agricultura mediante la domesticación del maíz, hasta el complejo culto que se formó en torno a éste, así como el cultivo básico que dio origen a la tradición cultural que caracteriza hasta nuestros días a los pueblos mesoamericanos.

De la misma forma que la tradición agrícola que surgió a partir de esta planta se dispersó en un amplísimo espectro geográfico, diversificándose de tal forma como ninguna otra planta lo ha hecho, el maíz se fue conformando como elemento idiosincrático de los pueblos de los que forma parte.

No es raro entonces que, ante la importancia económica e ideológica que presentó esta planta para las culturas prehispánicas de América, se les conozca a éstas como "culturas del maíz", en contraposición a las "culturas del trigo" en el Mediterráneo y a las "culturas del arroz" en Asia, en relación al grano básico en que fundaron sus respectivas civilizaciones. Y no es extraño tampoco que los descendientes contemporáneos de estas culturas sigan manteniendo un fuerte arraigo cultural a esta planta y a los productos gastronómicos que en ella se basan, ya que son parte de lo que los identifica ante el mundo.

Las Cuevas Prehistóricas de Yagul y Mitla albergan los testimonios importantes del inicio de la civilización en América mediante la domesticación de las plantas. Las semillas de calabaza (Curcubita Pepo) encontradas en la cueva de Guilá Naquitz, cuya antigüedad es de 10.000 años, son de las más antiguas plantas cultivadas encontradas hasta el día de hoy en Norteamérica y han revolucionado el conocimiento científico de los orígenes de la agricultura en la región.

Sin lugar a dudas, el desarrollo de la agricultura representa el primero y más importante paso del proceso civilizatorio, al conformarse como la base con la que los grupos humanos pudieron agruparse en establecimientos permanentes y solventar especialistas de tiempo completo, sin los cuales ninguna civilización es posible.

Por último, cabe mencionar que parte fundamental del proyecto es la integración de las comunidades circundantes e involucradas en el sitio como parte esencial de su manejo y como los principales beneficiarios de su implementación dentro del Patrimonio Mundial mediante el fomento y asesoría a proyectos productivos compatibles con los valores del sitio. A la vez que diseñar esquemas en que las infraestructuras de visita se encontrarán al interior de dichas comunidades y no dentro del sitio, lo que redundaría en importantes beneficios tanto para la conservación del sitio como para las comunidades involucradas. Así, con base en los diversos estudios que se desarrollan en el área, se podrán plantear y realizar las gestiones necesarias para el fomento a las actividades agrícolas productivas compatibles con los valores del sitio.

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# An Overview of Late Pleistocene Faunal Research and the Early Peopling of Mexico

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## Abstract

One of the most exciting issues of archaeozoological research is the initial peopling of the Americas in the late Pleistocene. At this critical moment, humans were a migrant species who invaded a new territory and then interacted with nature, in particular with the fauna, which is studied mainly by examining skeletal remains for their uses. Some of these uses include basic dietary needs and raw materials for tools, and the assignment of symbolic and ritual values to different animals.

The Americas were also a complex natural scenario during the late Pleistocene, as it comprises the two largest biogeographical regions in the world: the Nearctic and the Neotropical, each with its particular composition of biota, as well as many biological exchanges on different regional and temporal scales, from the late Pliocene to the early Holocene. The peopling of the Americas was probably one of the last colonization events to have had radical environmental consequences.

This paper is an overview of the research carried out on these issues in Mexico, where the first discoveries of Pleistocene megafauna in the New World took place between the sixteenth to eighteenth centuries and were mainly reported by Spanish scientific explorers. Later in the mid-nineteenth century, the first Mexican scientific societies raised interest in human and associated megafaunal remains, which were both assigned to the late Pleistocene and mainly found in emblematic localities such as Tequixquiac and Peñón de la Baños, among others.

From this point, the study of the peopling of the Americas in Mexico has two components: firstly, human remains and their associated cultural artefacts and secondly, faunal remains, predominantly from mammals and birds as these were the commonest discoveries, and provide the basis for palaeoenvironmental interpretations.

Many questions remain surrounding the interaction with the environment produced by these human migratory waves and by the routes they used, such as the degree of influence of human participation in the process of the extinction of the mega- and meso-fauna, the diversity of subsistence strategies by hunter-gatherers in the late Pleistocene and the environmental scenarios associated with the first settlers. Among other issues, it is also worth considering the similarity of migration routes of both animal and human populations, and humanly-induced changes to the geographical distribution of plants and animals.

Knowledge of the peopling of the Americas and interaction with animals not only provides information on a certain moment in time but also helps us to understand the changes and persistence in the subsistence strategies of humans, a diachronic perspective that could be extended to the present. Furthermore, it contributes to the discussion of defining or delimiting cultural, natural or biocultural heritage and its preservation by present societies.

## Introduction

Research on palaeoenvironments in Mexico covers a period that extends from the late Pleistocene to the Holocene, *c.* 35k years before present (BP), but the main discoveries have been on a time scale ranging from 10k to *c.* 4k BP, where the presence of human populations was mainly in agricultural societies that maintained a close relationship with the local wildlife, using it for their immediate needs, such as for food or raw materials, or for ritual purposes. The possibility of learning about the ways of life of these early populations arises from the application of various interdisciplinary approaches such as palaeobiology and archaeology, especially related to prehistory and archaeozoology. In order to explore the development of research on prehistory and palaeoenvironments, it is relevant to provide a brief historical

**sketch of it. This outline seeks to highlight the importance of further research into this early point in the history of our country, which marks some of the influences in the later development of the Mesoamerican cultures.**

## A brief historical outline on the origins and development of prehistoric studies in Mexico

Prehistory in Mexico is mainly the study of non-sedentary human populations that are also known as pre-ceramic, or by the generic name of hunter-gatherer societies. Beyond the applied terminology, the fact is that prehistory places special emphasis on the recovery and analysis of biological materials, such as animal bones, pollen, seeds and so on, with the intention of providing hypotheses on the reconstruction of the environment and subsistence practices of these social groups (Fiedel, 1996). For these reasons, Mexican prehistory is closely related to archaeozoology and the peopling of the Americas.

Since colonial times, different ideas have been put forward to explain human presence in the Americas, such as that of Joseph de Acosta who proposed, in the sixteenth century, the hypothesis of a passage through northern Europe (Pompa, 2006). The Conquest process also included the recognition and inventory of natural resources for exploitation. The relationships that ancient Mexican cultures maintained with faunal and natural resources were recorded, sometimes in detail, in the main chronicles of that time such as those of, among others, Francisco Hernández, Fray Bernardino de Sahagún, Hernán Cortés, Bernal Díaz del Castillo, Jerónimo de Mendieta, Jose Torrubia, Antonio Pineda and Antonio de Herrera (Corona-M., 2002).

The works of the first two authors in particular refer to food, medicinal and ornamental uses of natural resources as well as the domestic environments that these organisms inhabited. The remains of ancient megafauna, which probably belonged to extinct Proboscidean relatives of mammoths, mastodons and gomphotheres, are scarcely mentioned. These remains were believed to belong to giants, who at the time were considered the ancient inhabitants of the earth and were called *Quinametzin* in Nahuatl (Corona-M., 2002; Corona- M., et al., 2008).

The last decade of the eighteenth century was characterized by several events that indicate the development of intense scientific activity and is a key point in understanding the origins of Mexican palaeontology, archaeology and natural sciences, especially with regards to the relationship between humans and fauna. One of these events was the discovery of a pre-Hispanic offering of animal remains in 1790, the first to be studied in some detail by naturalists such as León y Gama and Antonio Pineda (Corona-M., 2002, 2008; Corona- M., et al., 2008; León y Gama, 1990; Maldonado Polo, 1999). Other scientific events of importance were the excavation of mammoth remains led by Antonio Pineda in the vicinity of the present-day Basilica of Guadalupe (in the north of Mexico City), and the inauguration of the first Royal Cabinet of Natural History in 1799, one of the first museum sites of New Spain whose content was based on the most current and up-to-date scientific theories of the time.

The display of flora, fauna and minerals were based on the Linnaean system, which was one of the most up-to-date methodologies of the time, whilst on the other hand, the fossil remains were interpreted as ancient organisms from the past. The excitement generated around these discoveries is also noted in the cultural publications of the time, in the *Gazeta de Mexico* for instance, where several articles were written about reported scientific activities (Corona-M., 2008).

These activities were accompanied by the first attempts to create local scientific institutions, such as the aforementioned Cabinet of Natural History. However, the effects of the struggle for independence, including the economic crisis and the emigration of some scholars associated with it, limited the development of these institutions and prevented their consolidation. By 1821, with the end of the struggle for independence and the opening of borders, several foreign geographers and naturalists visited the country, giving new life to research and building relationships with the local scientific community. In this context, the most popular was the voyage of Alexander Humboldt (Maldonado Koerdell, 1952).

All this led to the creation of various local scientific institutions in the nineteenth century. The National Museum was founded in 1825, but existed only on paper, whilst the remaining local scientific institutions carried out few activities and many of them stopped operating. As a consequence, much of the scientific research carried out was the result of individual efforts (Gortari, 1980; Trabulse, 1983). The National Museum of Mexico was founded in the 1860s and was one of the leading institutions of natural history. Within this framework, it generated innovative research in order to understand the relationship between humans and nature. Members of the institutions included Mariano Bárcena, Alfonso Herrera and brothers Eugenio and Alfredo Dugès, who contributed to the data obtained from colonial historical sources, particularly in regard to the use of resources by the ancient cultures and indigenous communities of Mexico (Corona-M. et al., 2008).

The nineteenth century is also a very significant time for prehistoric research due to two discoveries in the Basin of Mexico that are still very emblematic to the discipline. The first was the finding of a locality in Tequixquiac, in the state of Mexico, with a well-preserved and diverse Pleistocene fauna, principally composed of proboscideans, camels and horses. The second, also discovered in the same location, was a camel sacrum with many marks considered of cultural origin, including two holes that look like a representation of an animal head. Bárcena described the piece in 1882 and it became irrefutable evidence of the use of fauna by the first settlers of the Basin of Mexico. These findings could be considered as the modern origin of archaeozoological studies and prehistory in Mexico. Subsequent studies have discussed if the cultural marks, in particular the drilling holes, were made using prehistoric methods and were contemporary with the animal's death. However, no studies have proved conclusive in this regard. The locality of El Peñón de los Baños, in the east of Mexico City, which was located very near the current airport but has now disappeared due to urban growth, was another important discovery of human remains considered as late Pleistocene and therefore provided direct evidence of the early peopling of the Americas. This finding led to a heated debate about its correct dating and increased researchers' interest in the subject (Bárcena, 1885; Bárcena and Castillo, 1886; Newberry, 1886). Later in the early twentieth century, Enrique Lozano Díaz was one of the first to explore the interaction between the first inhabitants and extinct fauna. He also conducted pioneering research on the historic locality of Tepexpan, where evidence of human occupation in the late Pleistocene was also found (Corona-M., 2008).

## The current situation of research on fauna in prehistoric localities

In 1958, the foundation of a department dedicated to prehistoric research at the Instituto Nacional de Antropología e Historia (INAH, the National Institute of Anthropology and History) was an impetus for research. It was promoted by Professor José Luis Lorenzo, a well-known archaeologist. The department was made up of laboratories for disciplines such as palaeozoology, palaeobotany, soil chemistry, geology and radiocarbon dating, interacting with archaeologists to provide palaeoenvironmental hypotheses, constituting a novel contribution to archaeological and palaeobiological research (Lorenzo, 1991; Corona-M., et al., 2010).

The Palaeozoology Laboratory, now renamed the Archaeozoology Laboratory, began activities in 1963 by studying a large number of skeletal remains from prehistoric contexts in Mexico (Alvarez, 1965, 1967), where it was assumed there was interaction between early human populations and extinct fauna. At a later stage, the faunal remains of Pre-Hispanic localities were included in the analysis.

These research projects provided a relative chronological framework, comprising two main stages: the first is located in the transition from the late Pleistocene to the mid-Holocene, prior to 4,000 BP and is called the Archaeolithic or the Lithic stage. Extinct faunae and small populations of hunter-gatherers, mainly in the Mexican Plateau and the Basin of Mexico, are predominant in this stage (Garcia Bárcena, 2007). The second stage comprises the first sedentary societies that had an economy based on agriculture and the later complex hierarchical societies with intensive control of their territories. Most of these cultural forms were developed before the Spanish Conquest in the mid-sixteenth century. These contexts are the most prevalent in archaeozoological studies in Mexico.

Whilst the former Department of Prehistory still exists, in the 1980s it was transformed into the Archaeology Laboratories Section, which promoted research in at least 20 locations, 10 of them located in the Basin of Mexico. These investigations uncovered stone tools (for example, arrowheads and axes) and some bones modified by cultural use, mainly with butchering marks and some others characterized as bone tools artefacts (Figure 1).

## Summary of localities and faunal groups studied

Over 700 locations with mammalian records were studied and the most diverse of these were 20 locations that included mammals, birds and herpetofauna, known from the Quaternary Period in Mexico (Corona-M., 2014; Arroyo-Cabrales et al., 2002). The terminal phase of the late Pleistocene, named in mammalian ages as the Rancholabrean, in accordance with the North American Land Mammal Ages (NALMA) system, spans the last 120,000 BP. At some point during this phase, human groups started to colonize the Americas. Due to the quantity and diversity of faunal remains identified, it is necessary to carry out a broad characterization of the known localities in the five regions (Figure 1).

One region is the Mexican Plateau that has over 250 locations. Of these, the San Josecito Cave, in Nuevo Leon, has the greatest faunal diversity of all known Mexican localities. In addition to faunal diversity, El Cedral, in San Luis Potosi, has the oldest

claimed evidence of human inhabitants (c. 33,000 BP), but the debate with regard to its chronology and human presence at this time remains unresolved. Valsequillo, in Puebla, is another largely controversial site in the Americas regarding the chronology of early humans. Several archaeological excavations from the late 1950s to the mid-2000s have provided contradictory evidence about the presence of the earliest peoples in the area. An occupation as early as from the Sangamonian interglacial (between 132 and 119 BP; Van Landingham, 2004) was postulated, but then questioned and rejected (Feinberg et al., 2009; Mark et al., 2010). The most reliable dating on fauna is more conservative, at 20,780 BP (Arroyo-Cabrales et al., 2010).


*Figure 1. Map of México showing the regionalization discussed in the text.*

The Basin of Mexico, which mainly covers the current Federal District (Mexico City) and the state of Mexico, is the most explored area in the country and has nearly 215 localities. Furthermore, it is the region with the highest density of localities as well as more emblematic and well-known localities, such as Tequixquiac, Tlapacoya and El Peñón de los Baños, to name a few. The enormous amount of construction that continues to occur in the region has resulted in the discovery of numerous palaeontological localities and archaeological sites. One of the earliest findings of a woman´s bones at El Peñon de los Baños dates to 10,755 ± 75 RC BP (González et al., 2003; González and Huddart, 2008). This early age indicates that these human remains were among the oldest human skeletal remains in the Americas (Meltzer, 2009). In Tlapacoya, hearths, extinct fauna and human remains were found, not in direct association with each other, but it is assumed that they are contemporary.

Some authors propose fifteen sites that could be linked to the modified bone in this area, which is mainly mammoth (*Mammuthus columbi*). These sites are: Tequixquiac, Chimalhuacán, Los Reyes La Paz, Atenco, San Bartolo Atepehuacan, Santa Isabel Iztapan I y II, Los Reyes Acozac, Tlapacoya, Santa Lucía, Santa Marta Acatitla, Tepexpan, Tepexpan Hospital, Gertrudis Sánchez, Tocuila and Villa de Guadalupe (Aveleyra, 1950; Corona-M., 2014). Other authors were more conservative in their proposals and consider only three sites linked to the mammoth bones, Santa Isabel Iztapan, Villa de Guadalupe and Tocuila (Arroyo-Cabrales et al., 2006).

In fact, this debate should be further investigated and refined as it is a critical issue in prehistoric studies, in meeting the criteria to evaluate the sites and to review the localities and the specimens of bone artefacts on both a regional level and a country level. The late Pleistocene Basin of Mexico was an extremely rich environment that supported a large Columbian mammoth (*Mammuthus columbi*) population. Over 100 mammoth localities are known in the area, yet very few show evidence of human interaction with the carcass (Arroyo-Cabrales et al., 2006).

Other regions with fewer locations, but no less important, are the states covering the western coast, including the states of Jalisco and principally the localities near Chapala Lake and Sonora. In the latter, in recent years more than a dozen Clovis sites have been found, but few have stratigraphically-controlled excavations such as the one named *El Fin del Mundo* (Gaines and Sanchez, 2009; Sanchez-Miranda et al., 2009). At this site, possible interaction between people and gomphotheres indicates either hunting or scavenging activities (Sanchez-Miranda et al., 2009). It is important to keep in mind that Clovis points are conventionally considered as a marker for the presence of early technology among the first people arriving to the Americas. In Mexico, however, there is no evidence for the presence of Clovis people. A few Clovis points have been recovered from Baja California to Costa Rica, including some in the state of Hidalgo in the Mexican Plateau (Sanchez-Miranda, 2001).

The southern region includes two sub-regions, the states Oaxaca and Chiapas, and the states of Morelos and Guerrero. The first sub-region has been actively explored over the last few years and Guila Naquitz, a small shelter in central Oaxaca, is an example of a site that has been investigated. Flannery's (1986) excavation yielded both seeds and peduncles of squash (*Cucurbita pepo)* with indications of domestication as early as 9.0 $^{14}$C k BP (Smith, 1997). This date coincides with views about the earliest Naquitz phase being attributed to the early Archaic period (Flannery, 1986). Nearby in Mitla and Tehuantepec,

two sites have been discovered with a postulated association of gomphoteres and Clovis-like points elaborated in silex (Winters, 2014).

The research seems to indicate the presence of two early cultural traditions in the Americas: North American Clovis from Oaxaca and Chiapas, and fish-tail fluted points from Central and South America (Santamaría and García-Bárcena, 1989). Recent studies from rockshelters near Ocozocuautla in Chiapas have provided strong evidence of human presence in the state around 11.0 to 10.0 $^{14}$C kyr BP. These sites have yielded lithics, reflecting an expedient technology and also milling stones and botanical samples that may indicate incipient horticulture starting at the end of the Pleistocene to the early Holocene. Small and medium-sized animals (such as deer, peccary and rabbit) were the most hunted prey, while megafaunal remains were not found (Acosta Ochoa, 2010).

The subregion Morelos-Guerrero has been studied in recent years and the reports include one of the most complete specimens of mammoth, seven reliable localities, one with herpetofauna, birds and mammals (Cueva Encantada) and others with only extinct fauna, mainly mammoth such as La Nopalera (Corona-M., 2006, 2013). The findings show some presumably distributional modifications, for instance, southern records of clearly known Nearctic mammals, suggesting changes in vegetation (Figure 2). The region of the east coast (Tamaulipas, Veracruz, Tabasco), with the exception of some localities, seems to have neither a great faunal diversity nor clues about the early population of Mexico.

*Figure 2. Palaeontological explorations at Tlayacapan, Morelos.*

There has been important progress in the Baja Californian Peninsula, with at least five sites with $^{14}$C dates from 11, 000 to 9,000 BP: Isla de Cedros, Abrigo Paredón-Laguna Chapala, Abrigo de los Escorpiones, Sierra de San Francisco and Isla Espíritu Santo. Some hypothetical routes are in debate; one, the most accepted, is the peopling from the north, either by terrestrial or maritime routes. Two kinds of subsistence strategies are clearly shown: one is the hunter-gatherer exploiting land resources and the other is the more specialized maritime hunter-gatherer who fished, gathered edible molluscs, crustaceans and urchins, and also hunted sea lion, seals and marine turtles; they also occasionally hunted terrestrial mammals (Fujita and Porcayo-Michelini, 2014).

Finally, there have also been some important discoveries in the Yucatan Peninsula. A few decades ago, there were only a few Pleistocene records known from caves and these were mainly of horses and ground-sloths (*Paramylodon*). The most diverse cave was Loltun Cave that had reptiles, birds and mammals, including gomphotheres, carnivores, meso- and micro-fauna (Alvarez, 1983; González Gonzalez et al., 2006; Corona-M., 2010). This assemblage suggests an arid steppe environment, very different from today's dry tropical forest. Current explorations in this region have increased the records, with glyptodonts and camels; one of these specimens was in a hearth with fire marks and is presently being recorded.

In addition, two new early human specimens were found in Naharon Cave (11,670±60 RCBP) and Las Palmas (8,050±130 RCBP) and in evidence of hearths (8,941±39RCBP) (González Gonzalez et al., 2006). Most recently, saber-tooth cat and spectacled bear-like (*Tremarctos*) remains have been found in several *cenotes* (submerged caves) in the Yucatan Peninsula, as a result of thorough research into early human presence.

**Notes on palaeodiets and biogeographical issues**. Stable isotope analysis provides particular data on the palaeodiets of herbivores in twenty-four Mexican localities. As example, it was generally maintained that mammoths and horses were grazers, specialists of C4 plants, but analyses show that they were also occasional browsers including a mix of C3/C4 plants, for instance, leaves and shrubs. Particularities were also observed in gomphotheres; these animals were traditionally considered specialist browsers, but only the *Stegomastodon* specimen showed a diet of mixed C3/C4 plants, while the *Cuvieronius* specimens were grazers (Pérez -Crespo et al., 2012). These analyses also support the palaeoenvironmental

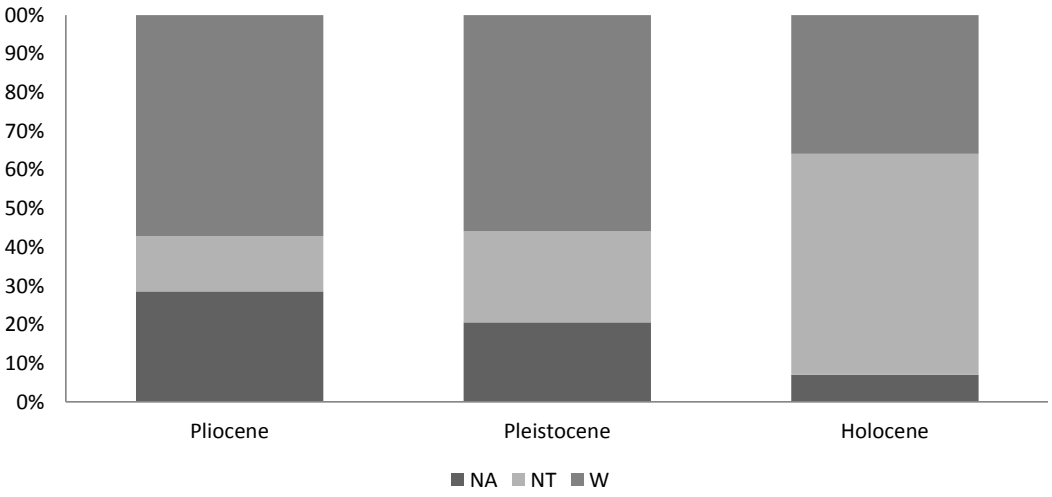


*Figure 3. Changes in bird groups based on biogeographic origin, see the growth of neotropical group from Pleistocene to Holocene. NA=Neartic; NT=Neotropical; W=Wide distribution. Based on data from Corona-M. 2010.*

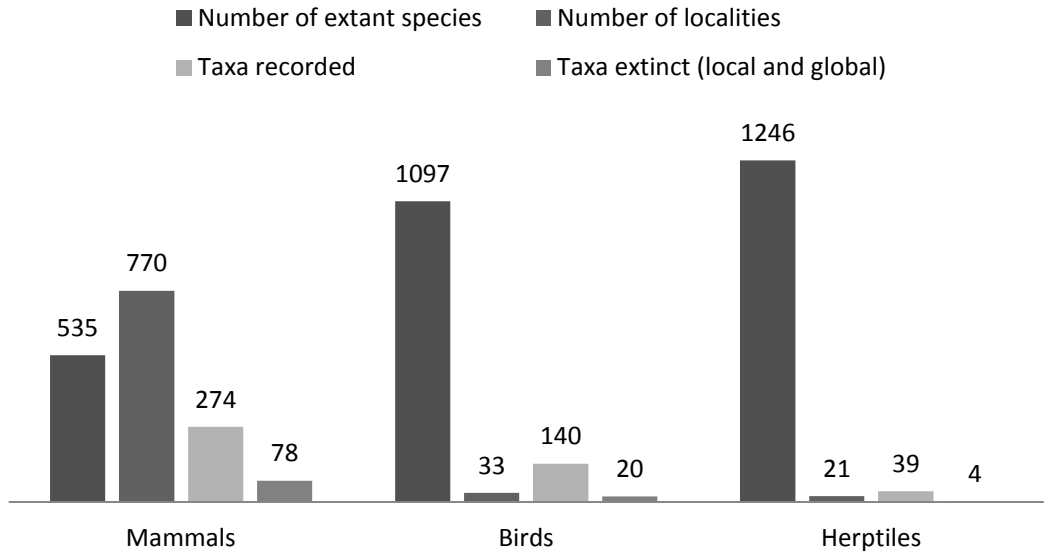


*Figure 4. Comparative between classes of terrestrial vertebrates based on data from late Pleistocene Mexican localities and Holocene records, based on data from Arroyo-Cabrales* ***et al.*** *2008.*

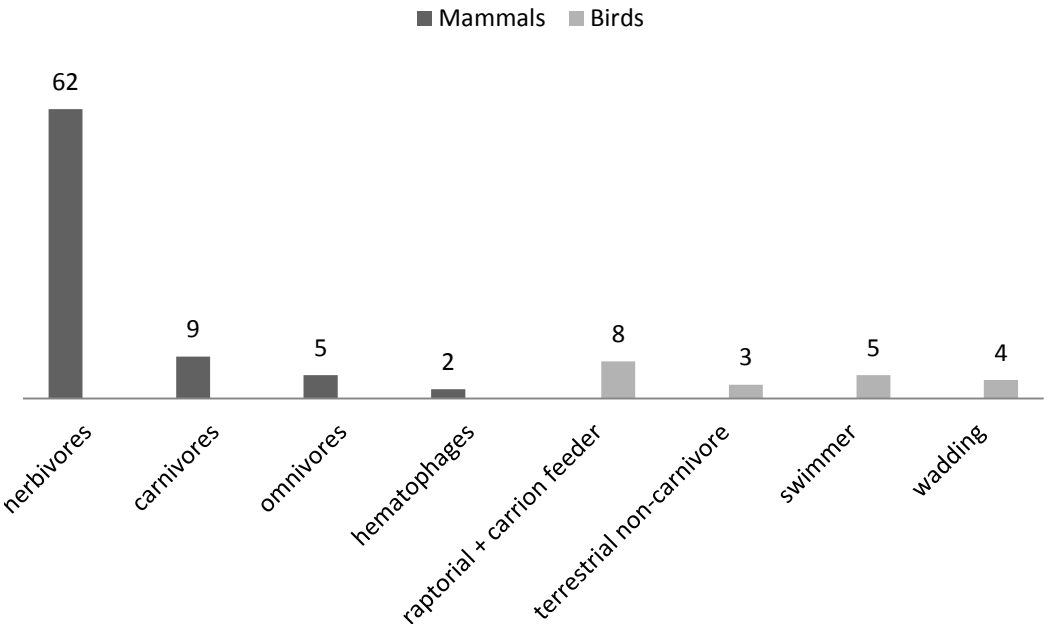


*Figure 5. Comparative of late Pleistocene extinct species based on "taxon-free" groups. based on data from Arroyo-Cabrales et al., 2008 and Corona-M., 2010.*

reconstruction of sites such as El Cedral and Laguna de las Cruces, San Luis Potosi and Valsequillo, Puebla, where it is suggested that these were sites with a mixed composition of grassland and open forest.

The coming together in Mexico of two major biogeographic regions, the Nearctic and Neotropical, led to a series of north-south exchanges in the transition of Pliocene - Pleistocene; in particular, after forming the Panamian Bridge (*c.* 3.7 Mya), which facilitated the transit of terrestrial species and substantially changed the composition of the fauna and environments, especially in the regions of the Mexican Plateau and the Basin of Mexico. An example of this radical change occurs in the bird fauna composition, where an increase of Neotropical birds is observed to the detriment of Nearctic birds (Corona-M., 2010: Figure 3).

This biogeographic influence has also delimited the ancient distribution of mastodons (Polaco et al., 2001), gomphotheres (Alberdi and Corona, 2005; Corona and Alberdi, 2006), mammoth and another mammals (Arroyo-Cabrales et al., 2010). Later, other changes in the distributional ranges of individual species of birds, mammals and herpetofauna were recorded, suggesting changes in palaeoenvironments during the late Pleistocene, but further research on this issue will be necessary.

**Extinctions.** The processes of extinction during the late Pleistocene can be evaluated by comparisons with extant taxa. Here, the extinction of mammals is highest, with losses of almost 50% of recorded mammals, whilst the extinction of birds and herpetofauna represents a loss of less than 2% of each group (Figure 4). These differences could be caused by a sample size effect, as mammals are the most recognized and recorded Pleistocene group, but overall the data indicates the sheer size of extinction in Mexican localities. In order to make a better comparison, taxon-free categories related to habitats and diet were used (Figure 5), showing that herbivorous mammals and their predators, and scavenger birds were the most affected groups in the extinctions that took place.

Currently the four major species of extant mammals (reaching approximately 100 kg) are the pronghorn (*Antilocapra americana*), the mule deer (*Odocoileus hemionus*), the white-tailed deer (*O. virginianus*) and the bighorn sheep (*Ovis canadensis*), but in the late Pleistocene almost 61 species were recorded, most of which were herbivores that were up to 10 times larger than the existing mammals (weighing almost a ton), such as mammoths (*Mammuthus* sp.), the American mastodon (*Mammut americanum*), gomphotheres (*Cuvieronius and Stegomastodon*) and ground sloths (*Glossotherium, Eremotherium*). In this scenario, some unique taxa were completely lost, like the Notoungulata order (*Toxodon*) and six families, Camelidae, Herpestidae, Equidae, Elephantidae, Hydrochoeridae and Megalonychidae. In other taxa, only some representatives survive, such as antilocaprids and bovids, whilst some others are extant in other areas of the world, such as the red dog (*Cuon*), which survives today in Asia; the spectacled bear (*Tremarctos*) and the giant anteater (*Myrmecophaga tridactyla*), both inhabitants of South America, while the yellow-bellied marmot (*Marmota flaviventris*) and metorito (*Synaptomys cooperi*) occur in North America (Arroyo-Cabrales et al., 2008).

In the case of birds, taxa affected by extinction processes include various water birds such as divers (*Plyolimbus baryosteus*, *Podiceps parvus*), ducks (*Oxyura zapatima*), cormorants (*Phalacrocorax goletensis* and *P. chapalensis*) and two storks (*Mycteria wetmorei* and *Ciconia* cf. *maltha*). Terrestrial birds were a kind of turkey (*Meleagris crassipes*) and a small parakeet (*Rhynchopsitta phillipsi*), along with several types of scavenger or predator birds (*Teratornis merriami*, *Breagyps clarki*, *Wetmoregyps daggetti, Neogyps errans, Neophrontops americanus, Buteogallus fragilis, Spizaetus grinnelli, Strix brea*) (Corona-M., 2010).

The overall data are consistent and similar with the processes that have occurred in North America. Nonetheless, the debate on the main causes for this mass extinction still continues. However, the strong dichotomy between environmental changes and the role of humans as extreme events to explain the extinctions has been slowly abandoned. Instead, it has come to be understood as a multi-effect process where environmental changes, the life histories of the species involved, and the human waves peopling the Americas all contributed to the mass extinction of the late Pleistocene in which the net effect is the loss of herbivores, carnivores and scavengers, the simplification of food webs and a loss of ecosystem stability (Barnosky et al., 2004).

## Future challenges of prehistoric studies in Mexico

This overview shows the progress in studies of late Pleistocene fauna that include new localities, the identification of mammals, enhancing the data on birds and herpetofauna; the particularities of palaeodiets of herbivores in Mexican localities, the ancient range of distribution of some vertebrates and their changes in biogeographic distribution (Nearctic / Neotropical); most of these are the product of climatic and vegetational changes.

I should also highlight the presence of human specimens over 10 or 11 ky (Peñon de los Baños, Basin of Mexico and Naharon, Yucatán) or early evidence of lithic points in Sonora and Chiapas, with different techniques suggesting that the peopling of Mexico is earlier than 10ky, and also this peopling covers practically all the current territory and that different terrestrial routes were used. Maritime routes should not be ruled out, but at this time no clear evidence exists on this topic. This evidence is congruent with the genetic and archaeological findings of early populations in North America, with the arrival through the Beringia Land Bridge between 30-22 ky and migration from Beringia to the Americas by 16.5 ky (Goebel et al., 2008). Surely, new discoveries on this issue will contribute to solving the puzzle of the prehistoric colonization of the Americas, and promote new ideas on its configuration.

In Mexico, however, some issues should be resolved or improved, such as a fine radiometric chronology, incorporating palaeobotanical data, a complete biogeographical distributional analysis of vertebrates, refining the categories of modified bone, the delimitation of the correlation between the migratory routes of animals with humans, and, last but not least, the search for the direct association and traces of the use of animal remains with human skeletons.

Another important topic is local and regional analysis to avoid discoveries by chance or as a result of urban growth in the cities, since most of this produces disturbed localities. In any case, this inevitable situation could be improved by means of outreach work with local authorities, residents and students of basic levels in order to produce cooperation and incorporation of the towns and cities in the protection of palaeontological and archaeological evidence. In this way, research could be transformed into heritage that could be natural, cultural or biocultural, and could produce legal procedures or in some cases, the incorporation of that heritage into local economies, by means of local museums, and the supervision and consultation by researchers.

The alliance between researchers, institutions and local populations who are all involved in the production of knowledge and in the care of localities and their content, always offer the best results with a view of building a social heritage, and in this case, a social heritage relating to prehistoric sites. Nowadays, it is possible to expand this effort by the use of mass media and social networks. The opportunity to construct a collective narrative is near, at hand and surrounding us, and involves the coming together of scientific resources, local knowledge and traditional practices, all of which are incorporated into legal frameworks that facilitate the cooperation and the care of this heritage. All that we need to do is take the opportunity to construct it.

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# Los primeros grupos humanos en el Centro de México

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## Introducción

**El ser humano, dentro del mundo animal, es la única especie que ha dedicado parte de su vida a formular una serie de preguntas relacionadas con su origen, evolución, migración, antigüedad, así como con los procesos sociales que ha desarrollado. Para responder a estas interrogantes se han planteado una serie de investigaciones que han permitido adentrarse en el conocimiento de los diferentes momentos históricos de la humanidad.**

**Para hacerlo, ha desarrollado diferentes modelos, por medio de los cuales se explica el origen del Homo sapiens. Uno de ellos es el llamado *multiregional*, que plantea los procesos de trasformación filogenética de nuestra especie a partir de las poblaciones ancestrales del Homo sapiens, que evolucionó gradualmente hasta llegar al Homo sapiens arcaico y, posteriormente, al hombre moderno. Este hecho se inició con la salida de pequeños grupos humanos del continente africano, que se dispersaron por diferentes lugares de la tierra.**

**Durante el trascurso del tiempo se dieron una serie de cambios evolutivos, mismos que provocaron nuevas modificaciones anatómicas importantes en los individuos, con lo que el ser humano adquirió una capacidad cognoscitiva que le permitió explorar nuevos nichos ecológicos, elementos que fueron necesarios para sobrevivir y desarrollarse fuera de África. Uno de estos nichos fue el continente americano, donde tuvo que enfrentarse a una serie de problemas; por ejemplo, conocer los cambios medioambientales (que eran muy severos), problemática que finalmente resolvió con éxito tras la exploración del terreno y la ubicación de las mejores condiciones para trazar las rutas que facilitaran su ingreso en el nuevo continente. Otro de los factores importantes que permitieron llevar acabo la conquista de América fue la obtención de una buena alimentación, elaboración de instrumentos, utilización del fuego, domesticación de plantas y animales, diseño de un vestuario apropiado para las condiciones del lugar, conocimiento de cómo curar y controlar algunas enfermedades, etcétera. Todos estos son factores importantes que contribuyeron para que los grupos humanos sobrevivieran e ingresaran con éxito al continente americano, al punto de habitarlo por completo en tan sólo unos miles de años.**

**Partiendo de la premisa de que América fue el último de los continentes en ser colonizado por los humanos, este suceso se da a conocer después de los primeros contactos entre Europa y América, momento en que surgió la incógnita respecto al origen de los nativos americanos (en aquella época no se tenía noticia de la existencia del continente, mucho menos se sabía que estuviera habitado por humanos). Es a partir de la llegada de los europeos cuando se formula una serie de hipótesis y teorías en relación al origen, migración y antigüedad del poblamiento del continente.**

**Así, en el trascurso del tiempo se fueron generando nuevas investigaciones tanto antropofísicas como arqueológicas, lingüísticas, genéticas y geológicas, por mencionar algunas, cuyo objetivo era obtener mayor información sobre los primeros grupos humanos que llegaron al continente. La interpretación de los resultados ha generado posiciones enfrentadas entre los especialistas debido a que no existe consenso en relación con algunas aseveraciones, tales como las rutas de migración.**

Éstas son las principales vías que se discuten sobre el ingreso de los primeros grupos de seres humanos que conquistaron América. La que tiene mayores adeptos es la ruta Siberia-Alaska, debido a que en este lugar se formó un puente natural que tenía las condiciones necesarias para que los grupos humanos pasaran al continente. Sin embargo, para tener más elementos de análisis, se deben desarrollar investigaciones antropológicas en esta zona que permitan localizar más evidencias que soporten esta teoría. De la misma manera, se debe rastrear todo tipo de testimonio humano en la región de Siberia para verificar que éste haya sido uno de los puntos de partida de los humanos que después dieron origen a los nativos americanos.

Otra de las discusiones sobre la llegada de los primeros humanos al continente gira en torno a la fecha en que esto ocurrió. Actualmente se debate una gran cantidad de fechamientos, que van de los 12.000, los 16.000 y los 18.000, hasta los 20.000 años. Dichos cálculos se han obtenido tras el análisis de diferentes sitios en el continente, lo cual provoca una enorme heterogeneidad y da pie a una serie de cuestionamientos: cómo fueron obtenidos, cuáles fueron las evidencias datadas, con que métodos, etcétera. Aclarando todas estas interrogantes se podrá llegar a una fecha aproximada.

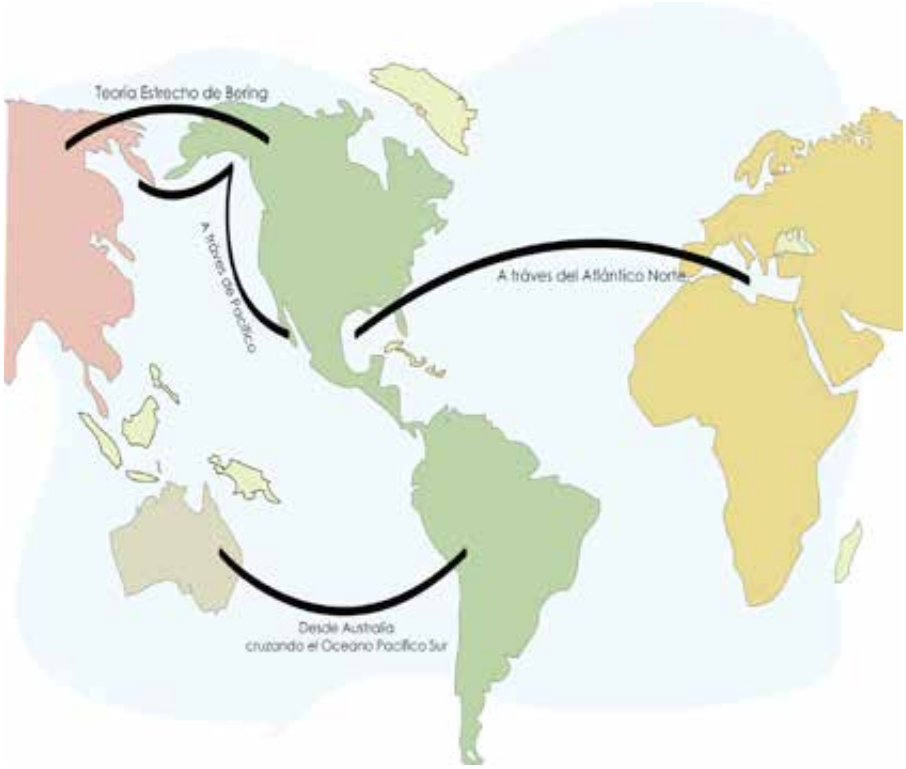


*Figura 1.*
*1. Migración desde Oceanía, a través de la Polinesia, a América del Sur. Modelo sustentado con base en evidencias arqueológicas muy antiguas, con fechas que van de 14.440, 12.560 y 11.500 años, por mencionar algunos. Otro indicador es que los especímenes humanos antiguos de estos lugares comparten ciertas afinidades biológicas con la población de la Polinesia. Tales son algunos de los argumentos que sustentan que éste fue uno de los corredores por donde ingresaron los primeros grupos humanos que colonizaron la parte sur del continente.*

*2. Migración desde Europa, siguiendo la ruta del Atlántico, para llegar al noroeste de América. Esta hipótesis se sustenta en la similitud morfológica de las puntas Clovis (datadas en 11.500-10.900 años) con las puntas solutrenses europeas (18.000-16.000). Esta ruta fue por donde se desplazaron los cazadores y pescadores solutrenses, tomando como referencia las masas de hielo del Atlántico norte en dirección a América.*

*3. Ruta más aceptada por donde se cree que ingresaron los primeros grupos humanos a América fue por el puente terrestre, formado en el estrecho de Bering. Debido a la cercanía geográfica entre la parte oriental de Siberia y Alaska, hay una mayor posibilidad de que los humanos ingresaran por esta vía, partiendo del noreste de Asia para llegar al noroeste de América entre los 25.000-10.000 años.*

Otro de los temas que se han puesto sobre la mesa es si los nativos americanos están conformados por una población homogénea, producto de un solo grupo fundador, como afirmaba Hrdlička (1916), o si, más bien, la variabilidad encontrada es atribuible no sólo a las migraciones sino también a factores evolutivos como la deriva génica, la selección natural y el flujo de genes *in situ,* como lo tipifica Greenberg et al. (1986) y Turner (1985). En relación con esto, Stewart y Newman (1951) mencionaban que la heterogeneidad podría atribuirse a los distintos grupos humanos que ingresaron al continente.

En décadas pasadas se ha aceptado que el origen del hombre americano responde al modelo propuesto por Greenberg, Turner y Zegura (1986), el cual propone que existe cierta variabilidad en las poblaciones nativas americanas producto de tres migraciones que salieron del noreste asiático con un patrón mongoloide. Según este modelo, los grupos que ingresaron al continente son principalmente tres: los primeros en llegar fueron el grupo de los paleoamericanos, alrededor de los 14.000 años (si esto es cierto, éste es el grupo que dio origen a la población amerindia); el segundo grupo en entrar fue el de los Na-Dené, el cual migró tiempo después, alrededor de los 10.000 años, asentándose en la costa noreste de Canadá; los últimos en ingresar fueron los esquimales, los cuales tienen una temporalidad que oscila en los 4.500 años y que habitan en el Círculo Polar Ártico Americano.

En años recientes se sabe que la población amerindia es más variable y diversa de lo que se esperaba. Al respecto, se han propuesto otros modelos migratorios como alternativa al modelo tripartita de Greenberg et al. (1986). Uno de ellos es el propuesto por Neves y Pucciarelli (1991), en el que añaden una migración más a la tripartita, basada principalmente en una morfología no mongoloide que caracteriza a los amerindios. Estos autores sugieren que los primeros humanos que colonizaron el continente americano derivaron de un grupo de Homo sapiens moderno que migró del norte y sur de Asia, dejando descendencia en Australia y América.

Así, basándose en el patrón de diferenciación, los paleoamericanos representan un grupo de inmigrantes no mongoloides del Pleistoceno Tardío provenientes del este de Asia, quienes ingresaron a América durante el Holoceno. Posteriormente llegó el grupo Na-Dené y, finalmente, los esquimales aleutianos.

Siguiendo el modelo propuesto por Neves y Pucciarelli, en los últimos años se han realizado estudios alternos para evaluar la variabilidad fenotípica de los primeros habitantes americanos, a partir de la morfología craneal (Jantz y Douglas, 2001; Powell y Neves, 1999; González et al., 2008; González et al. 2005; Sardi *et al*, 2005). Los resultados de estos estudios han permitido conocer que existe una ruptura en la morfología, sin mostrar rasgos fenotípicos de continuidad en el tiempo, además de cuestionar la homogeneidad que se dice existir entre las primeras poblaciones americanas.

Estos autores han utilizado dos términos para referirse a las poblaciones americanas, los llamados amerindios y los paleoamericanos, estos últimos fueron los primeros en llegar al continente.

La morfología que caracteriza a los paleoamericanos ha sobrevivido en grupos más recientes, sobre todo en lugares como México. Estudios reportan similitudes biológicas entre los cráneos de los pobladores más antiguos del continente, con los de grupos cronológicamente más recientes, tales como los pericúes de Baja California Sur y los laguneros de las cuevas de La Candelaria y La Paila, en el estado de Coahuila. Éstos presentan formas dolicoide, que son características morfológicas de las primeras oleadas que migraron al continente americano (Imbelloni ,1938; Martínez del Río, 1947; Rivet, 1943; Romano, 1955, 2007).

Uno de los problemas que se tienen en el continente es que son muy escasos los esqueletos humanos de los primeros nativos americanos, lo que dificulta tener información integral que permita discernir con mayor claridad los marcadores morfogenéticos de la antigüedad, así como su desarrollo cultural, lo cual es una de las bases primarias para entender los fenómenos poblacionales.

En México, la Dirección de Antropología Física del INAH ha reunido 45 esqueletos humanos de ambos sexos y de edades diferentes del periodo prehistórico.

Así, por ejemplo, en 1884 se dio a conocer el primer hallazgo en la cuenca de México de un esqueleto humano perteneciente a la época prehistórica, el cual fue bautizado como el "hombre del Peñón I". Es a partir de esta fecha que nace el interés por iniciar una búsqueda de las primeras evidencias humanas en territorio mexicano. La mayoría de estos esqueletos se ha localizado en la Cuenca de México.

El objetivo de este trabajo es presentar la información morfológica de cinco cráneos humanos, uno del sexo femenino y cuatro masculinos, con una antigüedad que oscila entre los 12.700 y 10.500 años.

La hipótesis que se tiene de estos esqueletos humanos es que pertenecieron a dos grupos que ingresaron por el estrecho de Bering, pertenecientes a la primera oleada, tomando como referencia la morfología y su antigüedad.


*Figura 2. Cuenca de México, señalando los lugares donde se localizaron los cráneos precerámicos.*


*Figura 3. Oleadas de ingreso al continente Americano.*

*Figura 4. Profesor Maldonado dentro del pozo donde se localizó la "Mujer del Peñón III". Fotografía tomada, González Rul (1959).*

Esta hipótesis se apoya en las evidencias arqueológicas localizadas en Alaska, Canadá, Estados Unidos y México, donde se pueden trazar rutas posibles por donde estos grupos se fueron desplazando hasta llegar a la frontera con México. Tomando como referencia estas evidencias podemos decir que una de las vías con mayor posibilidad es que entraran por los estados de Nuevo León, Tamaulipas, San Luis Potosí, Querétaro y Estado de México, hasta llegar a la Cuenca de México.

## Material y método

Se presenta una muestra de cinco cráneos humanos de ambos sexos y de edades diferentes, todos ellos ubicados cronológicamente en el Pleistoceno Tardío y procedentes de la Cuenca de México y del Estado de Puebla.

La determinación de la edad y sexo se basa en el método propuesto por Lovejoy (1984), Lovejoy, Meindl, Pryzbeck, Mensforth (1985), y Loth y Henneberg (1996).

## Datación

***Directa:*** se tomó una muestra de hueso del esqueleto y fue analizado por el método del Carbono 14 ($^{14}C$).

***Indirecta:*** se tomó una muestra de tierra de la parte endocraneal, la cual fue analizada por el método de geoquímica.

El análisis de la muestras se realizó en el Research Laboratory for Archaeology and History, de la Universidad de Oxford, Inglaterra, en el año 2000.

La información presentada en este trabajo es en relación con los cráneos localizados en el periodo que va de 1959 a 1980. El primero de ellos es el cráneo que pertenece al esqueleto de la "Mujer del Peñón".

## Mujer del Peñón III

En 1959 fue descubierto accidentalmente el esqueleto marcado como la "mujer del Peñón III" cuando el señor Tereso Hernández cavaba un pozo en el patio de su casa, ubicada entre las calles de Emiliano Zapata y Bolívar, Manzana 78, Lote 2, en la colonia Peñón de los Baños, muy cerca del Aeropuerto Internacional Benito Juárez, en la Ciudad de México.

El esqueleto fue entregado al Departamento de Prehistoria del INAH y, por la importancia del mismo, se comisionó al arqueólogo Francisco Gonzales Rul para que realizara una serie de pozos de sondeo con la finalidad de verificar la estratigrafía del área. El arqueólogo encontró que el esqueleto se ubicaba en la parte inferior de un sedimento con características de toba volcánica, intensamente humítica, de posición subacuática y sellada por una capa de roca travertínica de un espesor de 2 m. El depositó en que se hallaba el espécimen humano era totalmente acerámico (Aveleyra, 1950). El esqueleto pertenece a un individuo del sexo femenino, con una edad entre los 24 y los 26 años a la muerte.

### Perfil morfológico

*Figura 5. Mujer del Peñón III*

**Norma frontal.** El frontal es de forma abombada, las eminencias frontales son prominentes, presenta una quilla a lo largo de la sutura metópica, crestas laterales prominentes, marcadas las líneas curvas en la región del parietal. El torus orbitario es poco prominente al igual que la glabela. Los bordes supra-orbitarios son fuertes y cortantes. Las apófisis ascendentes son amplias, los agujeros infraorbitarios son grandes, las órbitas son redondeadas.

**Norma lateral derecha.** El malar es amplio y fuerte, el ángulo inferior es prominente y robusto, la sutura temporoparietal está abierta, la cresta supramastoidea es prominente, el conducto auditivo externo es amplio.

**Norma lateral izquierda.** La sutura fronto-cigomática está abierta, la apófisis marginal del hueso malar es prominente, el orificio anterior es doble, el ángulo inferior es robusto, el arco cigomático es fuerte, las líneas temporales marcadas. La cresta supramastoidea es prominente, la apófisis mastoides es grande y robusta. El conducto auditivo externo es amplio de forma ovalada.

**Norma basal.** La bóveda palatina es profunda, el conducto palatino posterior del lado derecho presenta dos pequeños agujeros accesorios. La apófisis piramidal del hueso palatino es pequeña. Conserva once piezas dentarias y una raíces, las faltantes fueron perdidas post mórtem. Todas las piezas presentan un desgaste muy marcado.

**Mandíbula.** Es grácil, la sínfisis es pequeña y poco prominente. El borde anterior de la rama es cortante, ambos cóndilos se proyectan ligeramente hacia adentro, la apófisis corónides son poco elevadas, los gonios son pequeños. Conserva todas las piezas dentarias, presentan un desgaste muy marcado, en algunas piezas queda al descubierto la pulpa, pero sin provocar ninguna infección. El mayor desgaste lo presentan los incisivos. Tiene tres incisivos, el del lado izquierdo no brotó, así como los terceros molares, posiblemente por falta de espacio o por un problema congénito.

**Métrica.** El cráneo se pudo medir en su totalidad, lo que permitió calcular los índices que permitieron tener una configuración del cráneo: es alargado (70,59), de altura media (96,97), frente de anchura media (67,42), anchura de la cara es media (50,76), orbitas altas (95,94), paladar ancho (91,30). Su estatura es de 1,51 m.

**Datación.** Fue por medio del método del 14C, obteniendo una antigüedad de 12.700 años AP calibrado con un valor de isótopos estableces de carbono de & C13-11,6, & N15=13,6, C.N=3,5, Collagen mg/g=50,3.

## Hombre de la Cueva de Texcal

En el año de 1964 y 1965 se llevaron a cabo una serie de excavaciones en la Cueva de Texcal por el Departamento de Prehistoria del INAH. La cueva se localiza en el municipio de Texcal y pertenece a la región sur del Valle de Puebla-Texcal. Se ubica en el margen del antiguo río Atoyac, que hoy en día está cubierto por las aguas de la presa Manuel Ávila Camacho, muy cerca de las faldas del volcán Toluquilla (García, 1977).

La excavación del abrigo se realizó en cuatro temporadas, la primera fue a partir de 1964, cuando se recuperaron seis enterramientos humanos secundarios, y 1965, cuando se halló uno más de tipo primario en posición de decúbito lateral flexionado, con una orientación de norte-sur (García, 1977). El cráneo pertenece a un individuo de sexo masculino, adulto, de 31 a 35 años a la muerte.

*Figura 6. Por sus características geológicas, la Cueva de Texcal es un abrigo rocoso natural, formado por una oquedad poco profunda con un talud plataforma de ocupación y un techo tipo visera.*

## Perfil morfológico

**Norma frontal.** El torus orbitario es prominente al igual que la glabela. Las órbitas son cuadradas, la sutura fronto-nasal se encuentra abierta, el hueso nasal es grande y prominente.

**Norma lateral derecha.** Los malares son robustos, arcos cigomáticos fuertes, presenta el orificio anterior del conducto malar y un accesorio. La línea temporal superior es marcada y rugosa, los arcos cigomáticos son grandes, el conducto auditivo externo de ambos lados es amplio y de forma ovalada, las apófisis mastoides son grandes y robustas.

**Norma posterior.** Se observa cierta asimetría en las eminencias parietales. La sutura lambdoidea está abierta, presenta pequeños huesos wormianos, y un hueso interparietal cuyas dimensión es 44 x 46 mm. La porción escamosa presenta huellas de fuertes inserciones musculares. Las apófisis mastoides son muy asimétricas, el occipital es ligeramente pronunciado.

*Figura 7. Hombre de la Cueva de Texcal*

**Norma basal.** Los bordes inferiores del hueso malar son amplios, robustos. La bóveda palatina es poco profunda, presenta cuatro rebordes óseos, dos de cada lado. Las láminas horizontales del palatino son prominentes y curvas. Conserva el primer premolar del lado izquierdo, el cual presenta un desgaste que llegó hasta el cuello de la pieza, dejando expuesta la dentina, las piezas faltantes fueron perdidas post mórtem.

**Mandíbula.** Incompleta, la sínfisis es pronunciada, a nivel del canino tiene un absceso que llega casi a la mitad del cuerpo mandibular, la línea oblicua externa es pronunciada. Los ángulos se proyectan hacia fuera, al igual que las apófisis coronoides, se observa un proceso de reabsorción alveolar. Conserva cuatro piezas dentarias, con un desgaste muy marcado dejando expuesta la dentina. De las piezas faltantes, seis fueron perdidas post mórtem y las demás ante mórtem, se observa un proceso infeccioso y reabsorción alveolar.

**Métrica.** El cráneo fue restaurado debido a que estaba muy fragmentado, lo que permitió tomar algunas medidas para valorar su forma. Es de longitud corta (80,66), de altura media (64,64), de frente angosta (65,75), nariz angosta (46,15), orbitas de altura media (82,93).

**Datación.** Fue por el método del 14C, tiene una antigüedad de 7.480 + 55 AP, &13C= -14,4, &15N= 11,0, C: N= 3,5, Collagen mg/g =12,3.

## Hombre de Tlapacoya I

Desde finales de 1965 hasta 1973, se realizan una serie de excavaciones en el cerro de Tlapacoya. Este cerro es un promontorio volcánico que se localiza al sur de la Sierra del Pino, en la región sureste de la Cuenca de México. Estos trabajos arqueológicos fueron motivados por la construcción de la autopista México-Puebla, que pasa bordeando el cerro de Tlapacoya. Durante la excavación aparecieron huesos de diversos animales, artefactos líticos y cantos de piedra que indicaban ser restos de un hogar, que sin duda fue producto de una actividad humana.

En el año de 1968 se recibió la noticia de que habían localizado un cráneo humano, accidentalmente fuera de contexto. El cráneo está incompleto, pertenece a un individuo masculino adulto, con una edad aproximada de 30 a 35 años a la muerte.

### Perfil morfológico

**Norma frontal.** Cerca de la zona bregmática presenta un ligero hundimiento, de forma irregular, con una dimensión de 31 x 18 mm. Es probable que fuera provocado por un traumatismo ocasionado a una edad muy temprana. En la parte media del frontal se aprecia un ligero aquillamiento. Los arcos supraorbitarios están muy desarrollados.

**Norma lateral derecha**. La apófisis mastoides es grande. En el borde posterior, así como en la cara lateral, presenta huellas provocadas por un roedor. Se marca muy bien el triángulo mastoideo. El conducto auditivo es grande y de forma ovalada.

**Norma posterior.** El occipital es prominente, las líneas curvas superior e inferior están muy marcadas, al igual que la cresta externa del occipital. La sutura lambdoidea presenta una gran cantidad de huesos wormianos.

*Figura 8. Hombre de Tlapacoya I*

**Norma basal.** Las órbitas son cóncavas, en la derecha se aprecian dos pequeños agujeros debajo de la escotadura supraorbitaria.

**Métrica.** El cráneo es alargado y angosto (67,17), es de altura media (73,23), frontal ancho (72,93).

**Datación.** Fue por el método del 14C, teniendo un resultado 10.200 + 65 años AP, &13C=-10.6, CN: 3.5 colágeno/ mg/g 10.9.

## Hombre Metro Balderas

En 1968, en la calle de Balderas, entre las avenidas Independencia y Juárez, al realizar excavaciones profundas para construir el túnel para el Sistema de Transporte Colectivo Metro, en la Ciudad de México, se localizó accidentalmente un cráneo con su mandíbula a una profundidad de 3,10 m.

Pertenece a un individuo masculino, con una edad de 35 a 40 años a la muerte.

### Perfil morfológico

**Norma frontal.** El frontal es grande y huidizo; los arcos superciliares son marcados, la glabela es ligeramente pronunciada, las crestas laterales son muy marcadas, las órbitas son de forma cuadrada con bordes redondeados. La sutura que une la apófisis orbitaria externa del frontal con la apófisis orbitaria del malar se encuentra abierta. Las fosas orbitarias son cónicas y profundas, los techos son convexos. El hueso nasal está incompleto, las fosas caninas son muy marcadas.

**Norma lateral derecha.** El parietal es pronunciado, la línea curva temporal superior se aprecia claramente. La cresta supramastoidea es robusta, como la apófisis mastoides. La apófisis marginal del hueso malar es pronunciada, el conducto auditivo es pequeño.

**Norma lateral izquierda**. La línea curva temporal superior es muy marcada, la apófisis mastoides es prominente, el agujero auditivo es pequeño de forma oval.

*Figura 9. Hombre Metro Balderas*

**Norma superior.** La sutura coronal y sagital están abiertas, presenta huesos wormianos.

**Norma posterior.** La sutura sagital y lambdoidea presentan huesos wormianos, el occipital es abombado, la línea curva superior es ligeramente marcada, a diferencia de la inferior que es muy pronunciada.

**Norma basal.** El paladar es largo, ancho, profundo, la arcada alveolar es casi cuadrada. Ambas tuberosidades del maxilar son robustas, el conducto palatino anterior es grande. Conserva nueve piezas dentarías, faltándole siete, tres de ellas las perdió ante mórtem y las demás post mórtem. Todas las piezas presentan un desgaste muy marcado, en algunas en forma de bisel. Queda expuesta la dentina.

**Mandíbula.** Es grande, robusta, en forma de herradura, marcadas inserciones musculares; conserva todas las piezas dentarias, presentan un desgaste muy evidente.

**Métrica.** Se calcularon los índices que permitirán valorar la forma del cráneo, es alargado y angosto (73,97), de frente ancha (80,83) orbitas altas (86,04) y paladar ancho (75,47).

**Datación.** La antigüedad obtenida fue de 10.500 AP, se obtuvo de manera indirecta. Debido a que el proceso de mineralización que presenta el cráneo es muy avanzado, no fue posible obtener colágeno. Se tomó una muestra de sedimento que se encuentra en la parte endocraneal, ésta fue analizada por el método de la geoquímica.

## Hombre de Chimalhuacán

El esqueleto fue localizado accidentalmente en el año de 1980, cuando cavaban una fosa séptica, en la colonia el Embarcadero, Municipio de Chimalhuacán, Estado de México. Pertenece a un individuo de sexo masculino, de una edad de 33-35 años a la muerte.

### Perfil morfológico

**Norma frontal.** Presenta una quilla en la parte superior del frontal, el torus orbitario es pronunciado en forma de pequeños arcos, la glabela prominente, los arcos supraorbitarios son robustos, los bordes son redondeados, en ambas órbitas presenta el agujero supraorbitario, órbitas cuadradas.

**Norma lateral izquierda.** La apófisis marginal del hueso malar es prominente, arco cigomático robusto, son marcadas las dos líneas curvas frontotemporales, la apófisis mastoides es grande, la cresta supramastoidea es prominente, el conducto auditivo externo es amplio, de forma ovalada, proyectado hacia arriba y ligeramente hacia delante, el borde externo del hueso timpánico es pequeño.

**Norma lateral derecha.** El ángulo superior del hueso malar es muy prominente, el arco cigomático robusto, la apófisis mastoides grande, la cresta supramastoidea es pronunciada, el conducto auditivo externo es grande, de forma ovalada.

**Norma posterior.** La sutura sagital, lambdoidea se encuentra abierta, presenta pequeños huesos wormianos, el occipital es de forma prominente.

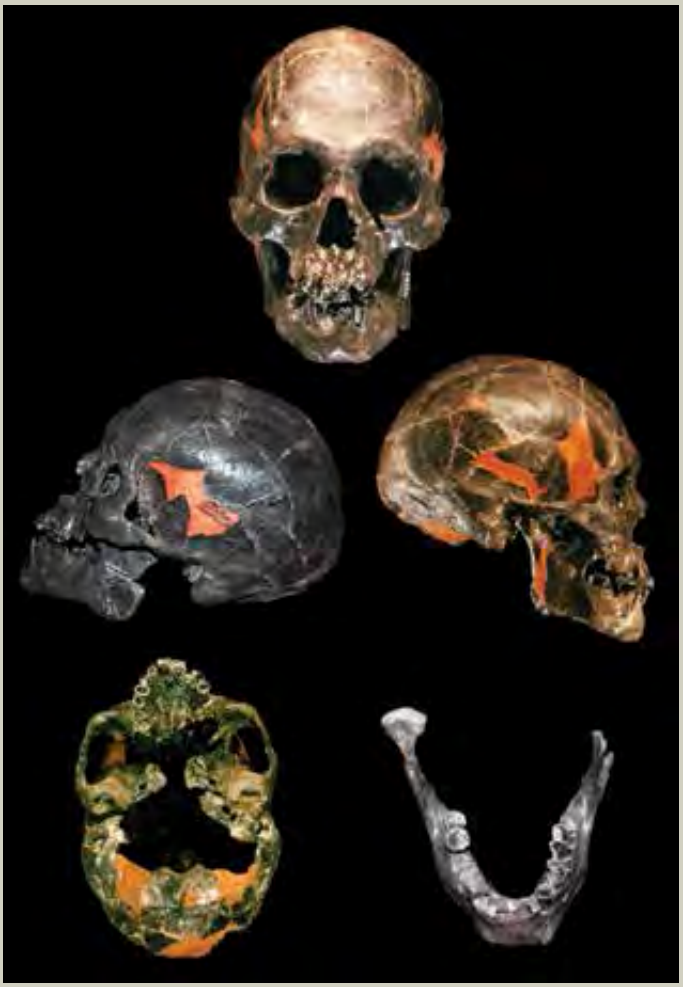

*Figura 10. Hombre de Chimalhuacán I*

**Norma basal.** La bóveda palatina es profunda, presenta ocho piezas dentarias con un marcado desgaste dentario, deja al descubierto la dentina. Las piezas faltantes fueron perdidas post mórtem.

**Mandíbula.** La sínfisis es alta, pronunciada, los tubérculos laterales son marcados y robustos, las apófisis coronoides se dirigen ligeramente hacia fuera, mientras que el cóndilo se proyecta hacia dentro, el tubérculo es robusto, se observa el agujero mentoniano de tamaño medio de forma ovalada, la línea oblicua externa es pronunciada, el borde inferior es robusto con marcadas huellas de inserciones musculares. Conserva ocho piezas dentarias completas dos incompletas, presentan un desgaste muy marcado, quedando al descubierto la dentina.

**Métrica.** Se pudo valorar la forma del cráneo, que es largo (70,70), es de cara media (51), nariz angosta (41), orbitas altas. Estatura de 1,70 m.

**Datación.** La antigüedad es de 10.500 años, fue obtenida indirectamente debido a que no se encontró colágeno en los huesos por el proceso de mineralización tan avanzado. El fechamiento fue a través de sedimento que pertenece a cenizas volcánicas que se correlacionan con la Pómez Toluca. Superior (tripartita), este material se encuentra en la parte endocraneal, fue analizado por el método de la geoquímica.

## Resultados de los Análisis

Los resultados del análisis morfológico de los cráneos indican que cuatro de ellos pertenecen a un grupo, debido a que comparten características morfológicas semejantes. El cráneo es dolicocéfalo con un índice craneal de 67.67, esto apoya la hipótesis de que uno de los primeros grupos que ingresaron al continente, tenía estas particularidades anatómicas. Además estos cráneos están dentro del rango cronológico que se marca cuándo ingresan los primeros grupos, que va de 12.700-10.500 años AP. Estos cráneos fueron localizados en diferentes sitios dentro de la Cuenca de México. El cráneo que no comparte los rasgos morfológicos fue localizado durante las excavaciones realizadas en la Cueva de Texcal Puebla. Se caracteriza por ser corto, ancho, bajo, y tiene una antigüedad de 7.480 años AP. Con esta información de estos especímenes podemos inferir que entre 12.700- 7.480 años, llegaron entre dos o más grupos humanos al Territorio Nacional.

Uno de los esqueletos con mayor relevancia para la investigación prehistórica en México es la "Mujer del Peñón III", cronológicamente es el más antiguo. Además presenta particularidades anatómicas en la mandíbula, no le brotó el incisivo del lado izquierdo, así como los terceros molares. Una de las causas puede ser que la mandíbula sufrió un decrecimiento y no hubo espacio para que brotaran las piezas. Otra posibilidad es que ello sucediera por causas biomecánicas, tipo de alimentación, etcétera, o a un proceso micro-evolutivo o congénito. Este fenómeno se observar hoy en día en algunos grupos mexicanos, donde existe un porcentaje elevado de personas que no tienen espacio suficiente en el maxilar, en la mandíbula para que les brotan los terceros molares. Se puede inferir que en estos dos segmentos anatómicos del esqueleto es donde se refleja un proceso micro-evolutivo en los grupos mexicanos, que posiblemente ha tenido una continuidad ininterrumpida desde la llegada de los primeros grupos al continente hasta la actualidad.

Un aspecto más que llama la atención es en relación con la estatura de la "mujer del Peñón III", que es 1,51 m. La estatura promedio de la mujer mexicana, de la época prehispánica, virreinal y actual, es de 1,51-52 m. Esto se debe a causas relacionadas con la genética, problemas alimentarios, estrés, factores biológicos característicos de la mujer (embarazo, parto, menstruación, número de hijos, amamantamiento, estrés, el medio ambiente, etcétera).

En el caso de los hombres de la Cuenca de México con una antigüedad de 10.500 años, tienen una estatura promedio de 1,72 m. Para la población masculina de la época prehispánica, virreinal y actual, que habitaron el territorio de México, el promedio es de 1,68-69 m. En este caso se observa un decrecimiento durante 10.500 años a la fecha. Una de las aseveraciones que se pueden plantear es que los grupos posteriores y actuales no descienden de este grupo. Otro de los indicadores es que fue por causas mestizaje entre los grupos que ingresaron y uno de ellos fue el que predominó genéticamente. La alimentación fue menos balanceada, pudo haber sido por escasez, debido a un crecimiento demográfico, etcétera.

En términos generales podemos decir que estos individuos no presentan ningún problema de enfermedad debido a que no se observa huella alguna en el esqueletos, posiblemente las enfermedades que padecían eran virales, que no dejan su marca en el esqueleto. Lo que se aprecia son traumatismos, infecciones en el maxilar y la mandíbula, debido al desgaste que sufrieron los dientes provocados por la alimentación y posiblemente por falta de una limpieza constante y adecuada.

Es importante mencionar que las piezas dentarias de estos individuos jugaban un papel muy importante en la elaboración de posibles instrumentos e implementos personales o de uso social, como algunas correas que sirvieran para elaboración de sus vestuario, debido a que los dientes tienen un desgaste que sólo puede ser provocado por una constante actividad como la elaboración de un materia, como pieles, raíces y el tipo de alimentación, etcétera.

Otro de los aspectos que llama la atención es el promedio vida, que es entre los 25 y 30 años, con esto podemos señalar que su edad reproductiva era a muy temprana edad. Además su crecimiento demográfico era muy regulado, por éste y otros factores, como puede ser el fallecimiento de infantes, etcétera. Posiblemente habían desarrollado una inteligencia que les permitió vencer todo tipo de problemas que se opusiera la sobrevivencia del grupo, lo que permitió radiar todo el continente americano.

La datación de estos esqueletos los convierte en las mujeres y hombres más antiguas de México, que soportaron todas las inclemencias naturales como las bajas temperaturas, las lluvias torrenciales, el enfrentamiento con animales y las enfermedades que pudieron padecer, etcétera. A pesar de todo esto y algunas eventualidades más, lograron llegar a la cuenca de México entre los años 12.700 AP. Con los resultados obtenidos de la antigüedad de los cuatro cráneos más 36 evidencias de esqueletos humanos y la mega-fauna que se han localizado, la Cuenca de México se perfila entre los sitios prehistóricos más importantes del territorio nacional.

Este lugar, durante el Pleistoceno final y principios del Holoceno, tenía las condiciones propicias para el desarrollo de los grupos humanos. Debido a que en la cuenca existían lagos de agua dulce y salada, en donde había pescados, acociles, ranas, aves de todo tipo, patos, garzas, amaranto, quintonil, verdolaga, quelite, nopal, tunas, animales, conejos, ardillas, liebres, mamut, etcétera. La suma de la variedad de productos comestibles formó una dieta adecuada que permitió que estos grupos humanos

tuvieran un desarrollo físico y mental armonioso. Además, en la cuenca había una gran cantidad de manantiales de agua dulce para su consumo. Éstos fueron algunos factores que permitieron el desarrollo de los grupos. La Cuenca de México debió ser uno de los puntos de partida de algunos grupos que poblaron parte del Territorio Mexicano actual.

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# La producción de arte rupestre en el contexto del primer poblamiento de México: algunas evidencias tempranas

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## Resumen

Durante gran parte del siglo XX, el arte rupestre prehistórico ocupó un lugar secundario y de poco valor para el estudio de las sociedades que lo crearon. Dicha situación es comprensible si consideramos las pocas expectativas que su investigación generaba para la arqueología de aquel entonces, por lo que durante décadas su estudio quedó rezagado de las principales corrientes de esta disciplina. Algunos factores que contribuyeron a este rezago se relacionan con la dificultad que implicaba el tratar de situarlo cronológicamente e integrarlo en un marco interpretativo general.

En México, fue hasta la década de 1980 cuando empezó a registrarse un interés creciente por abordarlo de manera consistente y sistemática. En aquellos años, se fundó un número importante de centros de investigación del Instituto Nacional de Antropología e Historia (INAH) en el norte y noroeste de México, región que se destaca por la abundancia y buena conservación de numerosos sitios con imaginería rupestre. Poco a poco, el desarrollo de la arqueología norteña acrecentó el inventario de sitios con arte rupestre (Murray y Valencia, 1996; Murray et al., 2003; Viramontes et al., 2008). Paralelamente, el panorama a nivel mundial dio un vuelco cuando su estudio empezó a abordarse a través de novedosas perspectivas teórico-metodológicas. Esto, sumado al desarrollo de sofisticadas herramientas tecnológicas y científicas, nos coloca hoy en día ante la posibilidad de avanzar con presteza en su estudio y, así, reducir la desventaja que todos estos años de indiferencia trajeron consigo. No obstante, pocos son los casos que han abordado la investigación arqueológica de esta manifestación cultural desde una perspectiva contextual y regional, incluyendo la posibilidad de investigar y definir su antigüedad (Gutiérrez, 2013).

A continuación se revisará el estado que guardan las investigaciones en México, que ya sea directa o indirectamente tratan de colocar en el tiempo las abundantes manifestaciones rupestres del país, aspecto crucial para el estudio integral de la imaginería plasmada en piedra. Por la limitación que impone el espacio disponible, se expondrán ejemplos de algunos sitios que destacan por su antigüedad y su posible correlación con las primeras ocupaciones humanas en el país. Posteriormente se abordará el caso de la región central de la península de Baja California, en la cual ha tenido lugar una investigación arqueológica integral de largo plazo, lográndose el establecimiento de un corpus cronológico consistente, que sitúa la ocupación humana en la región en cerca de 11 mil años AP (Gutiérrez y Hyland, 2002) y el inicio de la tradición pictórica de los Grandes Murales, al menos, en 7.500 años AP (Gutiérrez, 2013; Watchmann et al., 2002).

Finalmente, como evidencia adicional para sustentar la antigüedad del arte rupestre de la región y su posible relación con los primeros pobladores de México, se expondrá el caso de los Volcanes Tres Vírgenes, extraordinario *Lugar Natural* (Bradley, 2000) que reúne bajo sus dominios algunos rasgos de naturaleza excepcional que fueron "…culturizados y codificados con significado" (Strang, 2006, p. 68), como por ejemplo: grandes yacimientos de pigmentos minerales y de obsidiana, este último con un aprovechamiento calculado en al menos 10 mil años AP, manantiales de aguas termales y un abrigo rocoso insólito con un arte rupestre enigmático, pero que incluye, al menos, dos motivos muy característicos del subestilo pictórico Gran Mural denominado San Borjitas, hasta el momento uno de los que evidencia mayor antigüedad en la región (Gutiérrez, 2013).

## Introducción

**Desde finales del siglo XIX, los rumbos que tomó la arqueología mexicana fueron decididos, sin lugar a dudas, por la presencia consistente y trascendental de las culturas que se desarrollaron en Mesoamérica, región cultural que ocupa gran parte del territorio nacional. Ésta se extiende aproximadamente desde el paralelo 28° hasta los actuales territorios de Guatemala, El Salvador y Honduras. Ante esta inagotable fuente de estudio, arqueólogos mexicanos y extranjeros encauzaron su interés casi exclusivamente en lo mesoamericano, realizando importantes investigaciones en torno a tan maravilloso e innegable legado. En consecuencia, el avance logrado en el conocimiento de Mesoamérica fue sustancial, sobre todo durante la segunda mitad del siglo XX (Gutiérrez, 2006, pp. 13-20).**

**Mientras esto ocurría, más allá de los límites septentrionales de este reservorio pluricultural, el norte del país, región denominada coloquialmente la "Gran Chichimeca" por los antiguos cronistas, guardaba sus secretos al amparo de su vasto, agreste y remoto territorio. Ya desde épocas prehispánicas, esta distante y desconocida región era considerada un espacio geográfico muy temido, asociado con la muerte y con una serie de carencias de todo tipo. "Ellos llamaban aquella región la Chichimecatlalli —o tierra de los Chichimecas— y también la Teotlapan Tlacochcalco Mictampla —o 'campos espaciosos que están hacia el norte-lugar de la muerte'—" (Braniff, et al., 2001, p. 7).**

**Si bien aquellas distantes y misteriosas regiones no presentaban las ventajas geográficas y ecológicas que prevalecían en Mesoamérica, y que fueron importantes para el desarrollo de notables "civilizaciones", esto no significa que esplendor y complejidad cultural no hayan sido alcanzadas en tan remota región, como se verá más adelante.**

**De este modo, es más que evidente que la arqueología en México ha sido bastante desequilibrada, dada la diversidad de culturas que se desarrollaron en su vasto territorio. Ejemplo de esta inequidad del proceso investigativo es la notable escasez de estudios dirigidos a la prehistoria temprana, etapa en la que arribaron al país sus primeros pobladores (Arcaico Temprano, Etapa lítica, Pueblos Clovis, son algunas de las maneras de referirse a dicha etapa), así como el estudio de otro tipo de sitios arqueológicos y regiones culturales que representan contextos arqueológicos esenciales y cruciales para entender los ajustes y adaptaciones desarrollados por los pueblos que protagonizaron el largo proceso de poblamiento del continente Americano, el cual aún se encuentra rodeado de grandes enigmas y mitos, presentando el conocimiento científico importantes vacíos que no permiten vislumbrar con claridad las características de los primeros grupos humanos que llegaron a estas tierras milenios atrás, así como las rutas que siguieron, la cultura material que produjeron y el pensamiento y la cosmovisión que regían sus actuares cotidianos y excepcionales.**

**Como mencioné en un inicio, otro elemento cultural reiteradamente marginalizado por la arqueología mexicana es el arte rupestre. La imaginería plasmada en piedra, ya sea pintada o grabada, es uno de los recursos simbólicos más utilizados por los grupos humanos en todo el mundo, a través del cual los pueblos materializaron su pensamiento, ordenaron su mundo y crearon y negociaron sus identidades, perpetuando así su memoria, la cual permanece en el paisaje desde tiempos ancestrales. Una circunstancia que llama mucho la atención respecto a este recurso de comunicación visual es que muchos signos y símbolos del repertorio rupestre registrados a nivel mundial se repiten en todos y cada uno de los continentes, adquiriendo una connotación universal. Entonces, el arte rupestre puede ser considerado un metalenguaje que expresa pensamientos, conductas y realidades codificadas, probando que, en ocasiones, durante el proceso cognitivo, la mente humana interpreta la realidad y asocia ciertos signos a las mismas entidades o fenómenos, simbolizándolos. La omnipresencia de algunos elementos iconográficos rupestres en el orbe entero permite reflexionar acerca de la posibilidad de que, desde un pasado muy remoto, el hombre ha respondido de manera similar a los estímulos, fenómenos y circunstancias de su entorno, además de que eran portadores de un acervo de signos y significados heredados genética y culturalmente a lo largo de incontables generaciones. En este orden de ideas, los pueblos originarios percibieron su realidad, hicieron sentido de ella y asignaron un significado a sus diversos componentes; esto otorgó un orden y precisó la representación de este mundo mediante la creación de códigos metonímicos y metafóricos, en este caso, a través de la pintura o el grabado sobre las rocas, realizados mediante una diversidad de técnicas y en una pluralidad de contextos.**

## México y su enigmático e incomprendido arte rupestre

Al ser considerado un elemento ordinario y arqueológicamente improductivo, el arte rupestre fue olvidado por la arqueología mexicana hasta muy avanzado el siglo XX, lo que generó un enorme atraso en la sistematización de su registro y la innovación de postulados teóricos y metodológicos que permitieran una visión profunda y objetiva de su sentido y significado. Esto resulta paradójico dada su abundancia en todo el país, especialmente en su territorio septentrional, espacio geográfico que posibilitó el desarrollo de interesantes pueblos que hicieron uso de este recurso visual a lo largo de amplios territorios y enormes lapsos. En México, la imaginería rupestre fue producida tanto por pueblos de tradición sedentaria y agrícola, como por móviles sociedades cazadoras recolectoras, quienes en un prodigio de adaptación ecológica a un medio ambiente recio y riguroso, lograron desarrollar interesantes complejos culturales.

En la actualidad, la mayoría de sitios rupestres registrados e investigados en el país se localizan en su septentrión, aunque esto no significa que en el resto de su territorio no haya igual o mayor cantidad de sitios; lo que sucede es que tal vez aún no se han encontrado. La riqueza de contextos rupestres en esta enorme región creó la falsa impresión de que su producción estaba relacionada, exclusivamente, a sociedades cazadoras-recolectoras, pensamiento que prevaleció durante un largo periodo:

> durante décadas, el Norte ha sido considerado un lugar habitado por cazadores-recolectores, que fueron más propensos a producir arte rupestre que sus vecinos agricultores sedentarios del sur. Sin embargo, esta imagen es

> falsa, de hecho, el arte rupestre es común a ambas sociedades, sedentarias y nómadas. Además, el fuerte sesgo de la arqueología mexicana para el estudio de las sociedades agrícolas sedentarias de Mesoamérica fue una influencia que margina los estudios del arte rupestre en los estados del sur de México, porque se pensó, erróneamente, que el arte rupestre fue exclusivo de las sociedades nómadas (Viramontes et al., 2008).

En torno a este paradigma, es necesario mencionar algunos otros factores que han contribuido a afianzar esta subjetiva apreciación: el México septentrional se caracteriza por su amplio y en ocasiones abrupto territorio, su clima semidesértico y su inherente aridez o semiaridez son elementos que han contribuido, de manera notable, a la buena conservación de miles de sitios grabados y/o pintados. Esta variable ambiental, sumada a la geología de ciertas regiones, ha sido definitiva para la preservación de la imaginería del norte y noroeste del país, si tomamos en cuenta las condiciones climáticas totalmente opuestas que se manifiestan en el centro, sur y sureste de México, donde la erosión pluvial y eólica y el efecto del desarrollo de la abundante y exuberante cobertura vegetal, entre otros factores, inciden directamente en la pintura, en ocasiones "desescamando" el soporte pétreo y colapsando fragmentos del panel pintado, y en otras cubriéndolo con sustancias que las ocultan, como por ejemplo los oxalatos y carbonatos de calcio. En el caso de los petrograbados, el desarrollo de una capa vegetal densa, e incluso el crecimiento de musgos y líquenes al interior de los surcos que conforman las figuras o motivos, pueden impedir su visibilidad. De este modo, mejores condiciones para la conservación inciden en las cifras de los inventarios y es así que, hasta el momento, el norte es la región que presenta un mayor porcentaje de sitios rupestres registrados y en ciertas áreas constituye uno de los elementos que otorgan identidad y representatividad a las diversas prehistorias regionales.

## Cronología y arte rupestre

Dejando a un lado las políticas de investigación nacional que imperaron en las siete primeras décadas del siglo XX y que dejaron en hibernación los estudios del arte rupestre, también se requiere enfocar la atención en otras razones de carácter científico que coadyuvaron a la marginación de esta manifestación cultural y la marcada indiferencia hacia su estudio; esta variable se relaciona con la complejidad que seguramente representó el abordar un material cultural tan ambiguo e "improductivo" para la arqueología de aquellos tiempos. Whitley y Loendorf (1994) señalan dos importantes factores que favorecieron esta tendencia, no sólo en México sino en todo el continente americano.

El primero se refiere a la posibilidad de fechamiento por radiocarbono que se dio en los años cincuenta y que no fue aplicable al arte rupestre. El segundo tiene que ver con el desarrollo de la Nueva Arqueología, corriente que, salvo excepciones, "falló en cumplir la promesa de integrar plenamente todos los aspectos del registro arqueológico en interpretaciones y explicaciones incluyentes" (Whitley & Loendorf, 1994, p. xii). Al prevalecer estas dificultades, era casi imposible integrar al arte rupestre en un panorama interpretativo general, lo que desalentó a los colegas de aquellos tiempos (Gutiérrez, 2007). Esto es aún más comprensible si consideramos que un elemento que va aparejado a hallazgos notables es cuán antiguos puedan ser; esto es algo que durante años fue el anhelo común de los arqueólogos, descubrir lo "más antiguo". La antigüedad probada de un vestigio arqueológico incrementa el prestigio del investigador, y aún hoy en día, atrapa la atención de la comunidad científica y del público en general. Esta búsqueda de lo arcaico, y lo que trae consigo, tiende a sesgar y fraccionar los objetivos de una investigación arqueológica integral, al priorizar ciertos indicadores y desechar otros. Ahora bien, esto no significa que se subestime la importancia de contar con indicadores cronológicos precisos de antigüedad considerable, pero sí es necesario no enfocar la atención sólo en esta propiedad de lo arqueológico.

Partiendo de esta disyuntiva, ubicar los eventos del pasado en una línea de tiempo que permitiese las comparaciones entre eventos prehistóricos e históricos, se convirtió en un requisito para la investigación, y ésta es, quizás, la única variable donde el arte rupestre no aportaba valores confiables. Hasta hace relativamente poco, a lo más que se podía aspirar para asignar temporalidades a este material cultural, era a la reconstrucción de secuencias relativas, lo cual comúnmente sólo puede realizarse en caso de existir sobreposición de figuras y motivos, así como cambios en las tendencias de representación gráfica. Un apoyo esencial para determinar dichas secuencias con mayor precisión es la observación y registro detallados de la erosión diferencial de las diversas capas pictóricas para su posterior comparación, procedimiento muy útil y productivo en ciertos contextos. En el caso de que figuras y motivos estén aislados, la situación se complica. Una figura que se percibe sumamente deteriorada parecería ser muy antigua, sin embargo, esto es muy impreciso, pues el deterioro de la pintura rupestre no sólo la determina su desgaste por el paso de los procesos erosivos durante largos periodos; existen otros factores que las dañan y esto no se relaciona en nada con su temporalidad real (tipo de soporte pétreo, exposición al sol, erosiones eólica y pluvial y la calidad de la fórmula de la pintura).

Pero, asumiendo que estas secuencias relativas fuesen coherentes, lograr su temporalidad absoluta requiere *vincularlas* a artefactos utilizados durante el *evento de pintar*, o asociados a éstos, que fuesen fechables por $^{14}C$; podría pensarse que estos artefactos se encuentran con relativa frecuencia en los depósitos arqueológicos de los recintos pictóricos, no obstante,

esto, por lo común, no pasa. Es sumamente raro el hallazgo de estos vestigios, tal vez por su naturaleza frágil y deleznable, aunque debo decir que en contextos desérticos o semidesérticos sucede lo contrario: las cuevas "secas" conservan muy bien los materiales arqueobotánicos y zooarqueológicos. Tal vez la ausencia de artefactos utilizados para pintar obedece a que poseían un valor simbólico profundo y por tanto, una cualidad sagrada, lo que hacía que fuesen objetos muy venerados, protegidos, resguardados e incluso heredados por los especialistas rituales, de generación en generación. Bajo los conceptos de Latour (2008), podríamos pensar que se trataba de "cuasi-objetos u objetos actantes"[1] vinculados estrechamente a la parafernalia del especialista ritual pintor y sobre todo a él, como el responsable de realizar esta trascendental actividad y, como en el caso de otros *cuasi-objetos* utilizados por diferentes especialistas rituales, su gran valor simbólico y poder intrínseco los hizo elementos sagrados, escasos, codiciados y por tanto difíciles de encontrar en el contexto arqueológico.

A finales de la década de 1980, las limitadas posibilidades de fechamiento aplicables al arte rupestre dieron un vuelco: se puso al alcance de la investigación arqueológica la posibilidad de obtener fechas radiocarbono de muestras de pintura rupestre a través del Espectrómetro de Masas (AMS por sus siglas en inglés):

> The major advancement that laid the groundwork for the later dating revolution was the development of accelerator mass spectrometry (AMS). That innovation led to a drastic reduction in the amount of carbon necessary for a radiocarbon date - from a few grams to less than 1 mg of carbon. This reduction in sample size opened the way for even the small amounts of organic matter in rock paintings to be dated starting a decade later in 1987. Assigning painted images to a particular time period and, thus, a prehistoric culture, allows archaeologists to gain information on the artistic, cultural, technical and religious aspects of a people. (Rowe, 2015)

No obstante, aun cuando este método en sus inicios pareció ser la solución a los problemas para calcular la antigüedad del arte rupestre, también adolece de ciertas deficiencias y esto tiene que ver, básicamente, con el origen del carbón que se fecha. Por ejemplo, la datación es más confiable en el caso de que las pinturas hayan sido elaboradas con sustancias orgánicas que al mismo tiempo aportaron el color, por ejemplo, el carbón de madera para elaborar pintura negra y quizás la sangre para elaborar pintura roja; el asunto se complica cuando las fórmulas de las pinturas están realizadas a partir de pigmentos minerales, los cuales carecen de carbón; en algunos casos sólo se mezclaban con agua, lo cual hace imposible el fechamiento; en otros casos, al pigmento molido se le añadía un aglutinante, a la par del agua u otros líquidos que, en condiciones afortunadas, es el que provee el carbón que puede ser fechado. Luego entonces, primero es necesario saber si la pintura que queremos fechar contiene material orgánico datable.

En la actualidad, la datación AMS en muestras de pintura rupestre es objeto de una severa controversia, especialmente cuando es puesta en duda la pureza de las muestras y el origen del carbón a partir del cual se obtuvieron las fechas. En los albores del siglo XXI, ignorábamos que al paso de los años, esta revolucionaria técnica de fechamiento sería cuestionada, sin embargo fue aplicada a una amplia cantidad de muestras provenientes de sitios Gran Mural de las cordilleras centrales de la península de Baja California, lo cual arrojó interesantes resultados, como se verá en la segunda parte de este escrito.

## La investigación del arte rupestre

Las diversas maneras que existen de abordar el estudio de la imaginería rupestre son muy heterogéneas y prácticamente obedecen a los intereses de cada investigador y al grado de profundidad interpretativa que se quiera alcanzar. Como he reiterado, en ciertas circunstancias es necesario que su estudio sea regional, pues cada lugar pintado y/o grabado constituye tan sólo una parte de un universo simbólico que comunica discursos, por lo tanto aislar la imaginería de su contexto general sólo permitirá una aproximación parcial a su posible lectura e interpretación.

Por lo común, uno de los primeros asuntos que interesa investigar es la identificación de las diversas maneras de "representación" que desarrollaron los artífices del arte rupestre, su clasificación, la definición de estilos y sus secuencias; esto puede hacerse a partir de varios niveles de aproximación que pueden ir desde el estudio de un solo panel, hasta el de toda una región. En ocasiones, la espectacularidad que presentan ciertos sitios, por su tamaño, superficie pintada, excelente grado de conservación, temáticas y el lugar que ocupan en el paisaje, entre otros factores, puede atrapar al investigador

1 "Para este autor [Bruno Latour], incluso en el mundo actual no debería hablarse de la separación absoluta entre el sujeto y el objeto, sino más bien de cuasi sujetos y cuasi-objetos 'actantes' en las redes de su 'teoría de la red de actores'. Según Latour los seres humanos siempre han estado conectados con las redes 'actantes' de los objetos. Todos los objetos que participan en la mediación entre los seres humanos 'actúan'en cierta manera. Los rasgos del paisaje también. Además de formar una red actante los rasgos del paisaje participan en los procesos de vincular el pasado con el presente, pues constituyen las huellas y los recuerdos del pensamiento cognitivo y simbólico de las generaciones pasadas". [Iwaniszewski, 2012]

haciendo que su interés se enfoque exclusivamente en algunos de estos sitios excepcionales; esto indudablemente representa un sesgo profundo en la investigación y repercute en la interpretación final, pues se pasan por alto otros sitios que conforman este sistema de códigos metonímicos y metafóricos. Por lo tanto, es importante elevar el nivel de la investigación al ámbito regional, pues esto permite dos elementos esenciales para la comprensión de este metalenguaje: la familiarización con sus atributos cualitativos y cuantitativos, así como con sus entornos inmediatos, mediatos y remotos.

Desafortunadamente, en México son pocas las investigaciones que se han desarrollado en los términos descritos y, menos aún, aquellos que han contemplado la posibilidad de establecer un control cronológico relativo o absoluto de la imaginería rupestre, aunque es necesario reconocer que no siempre es por falta de interés; me refiero, por un lado, a la ya mencionada dificultad para la obtención de artefactos fechabes relacionados directamente con el evento de pintar y grabar y, por el otro, a los costos que conlleva el fechamiento por AMS y las dificultades logísticas y financieras de todo el proceso, desde la obtención de las muestras, hasta su preparación y procesamiento en el espectrómetro de masas. A esto hay que añadir que el fechamiento directo de pintura rupestre es relativamente nuevo, como se señaló con anterioridad, lo que ha colocado a esta metodología en el fondo un debate profundo.

## Evidencia temprana de arte rupestre en México

En el ámbito internacional, existen importantes ejemplos de sitios que cuentan con evidencia contundente para ubicar con cierto rango de precisión, el tiempo en el que se inició la práctica de plasmar en la roca el pensamiento humano, a través de signos y símbolos que en ocasiones tienen una connotación universal; tal es el caso de lugares como las grutas de Altamira, El Castillo y Tito Bustillo, en España, las Grutas de Laxcaux y de Cosquer en Francia y abundantes sitios en Australia, por mencionar algunos ejemplos. En México, son pocas las regiones del país donde se han desarrollado esfuerzos para lograr la obtención de cronologías precisas del arte rupestre a través de las nuevas metodologías y tecnologías de las últimas décadas.

En el norte del país, esta práctica discursiva conforma grandes redes de comunicación, metalenguajes consistentes y persistentes aunque, la gran mayoría de las veces, enigmáticos e incomprensibles debido a la ausencia de estudios sistemáticos, regionales y de larga duración. Sin embargo, existe otra razón que nos impide *descubrir* lo que esta *encubierto* (Heidegger, 1953): nuestra incapacidad de percibir la imaginería rupestre a partir de la recreación de una realidad paralela a la que prevaleció en el mundo indígena, y dejar de lado, en la medida de lo posible, el pensamiento occidental que domina nuestro inevitable "pre-entendimiento" del mundo, aprehendido de las múltiples generaciones que nos precedieron, así como la preconcepción de nuestra propia realidad, aprendida de nuestras propias vivencias (David, 2002; Gadamer, 1993; Gutiérrez, 2013).

A continuación se revisarán brevemente los pocos ejemplos que han intentado ubicar cronológicamente la imaginería rupestre en nuestro país. La mayor parte de la información ha sido tomada de la obra quinquenal Rock Art, News of The World I (Murray y Valencia, 1996), II (Murray et al., 2003), III (Viramontes et al., 2008) y IV (Viramontes et al., 2012), a menos que se indique lo contrario (figura 1).

## Noreste y Norte de México

En esta región del país, no se han realizado dataciones directas de pinturas rupestres, sin embargo, se cuenta con valiosa información que permite un cálculo aproximado de la temporalidad que podrían presentar algunos destacados sitios rupestres; si bien estas fechas no se vinculan directamente al evento de la producción de la imaginería, confirman la muy temprana ocupación de estas localidades, algunas de ellas asociadas a restos de paleofauna.

### Nuevo León

Este es uno de los estados de México que destacan por el desarrollo de investigaciones de larga duración, en las cuales el arte rupestre es considerado un elemento arqueológico fundamental para profundizar en su prehistoria. Algunos de los sitios que han reportado una gran antigüedad son el abrigo rocoso ubicado en las inmediaciones de La Morita Villaldama, (12.000 AP), La Calzada (10.600 AP) y Loma El Muerto (5.000 AP), localidad próxima a General Terán (Rivera, com. per.). Si bien estas fechas no pueden ser directamente relacionadas con la producción de la imaginería rupestre, sí demuestran que grupos de personas ya transitaban y moraban estas tierras, al menos hacia los finales de la glaciación Wisconsin y, ¿por qué no?, la producción de ciertos tipos de imaginería rupestre, especialmente la grabada, podría ser contemporánea al establecimiento de estos antiguos asentamientos humanos. Estas fechas arcaicas corroboran la antigüedad que ha sido definida en otros sitios rupestres de Nuevo León, como Cueva Ahumada y Boca de Potrerillos.


*Figura 1. Sitios mencionados en el texto*

### Boca de Potrerillos

Se trata de un sitio destacado del inventario de sitios rupestres de este estado; el enorme yacimiento concentra miles de figuras y motivos[2] grabados. Excavaciones realizadas por Valadez (2005) han descubierto la presencia de entierros humanos; el hallazgo de prácticas mortuorias en este espacio revela uno de los ejes esenciales de la cosmovisión indígena: la veneración de los muertos y los ancestros. La evidencia de este tipo de ritualidades en el contexto general del sitio incrementa, aun más, su enorme carga simbólica. En Boca de Potrerillos se han realizado algunos fechamientos radiocarbónicos de muestras provenientes de las excavaciones, colocando las primeras ocupaciones humanas en alrededor de 8.000 años AP (Turpin et al., 1993, 1994, 1995, 1996; Valadez et al., 1998; Valadez y Carpynteiro, 2011), y no existe razón para negar la posibilidad de que algunos de los petrograbados asociados al área de excavación de este importante complejo petroglífico, pudieron haber sido realizados en esas remotas épocas.

Paralelamente, en Cueva Ahumada, N.L. (Corona, 2001), las excavaciones han llevado al establecimiento de una cronología que va del Arcaico Medio Temprano (ca. 7.000 AP) a una ocupación de entre 5.000 y 3.500 años AP; de trascendental importancia es que estas últimas fechas fueron obtenidas de muestras provenientes de estratos adyacentes a un sector del panel pintado, mismos que contenían algunos nódulos de pigmento.

### La cronología entrelazada entre Cueva Ahumada y Boca de Potrerillos, Nuevo León, y El Pelillal, Coahuila

Un evento afortunado ha permitido ubicar en el tiempo, con cierto rango de certeza, la producción de un tipo de imaginería en algunos sectores del área cultural que nos ocupa; me refiero al hallazgo de arte rupestre mobiliar, es decir, placas pétreas portátiles con incisiones, en tres localidades arqueológicas de la región. Turpin es la primera que reporta este tipo de artefacto "ritual" para el sitio Boca de Potrerillos (Turpin et al., 1996); posteriormente, otras placas similares fueron encontradas en las excavaciones de Cueva Ahumada, Nuevo León y el Pelillal, Coahuila (Turpin & Eling, 2003), estas últimas yaciendo en

2 "el elemento básico de toda descripción de un panel de arte rupestre es un icono equiparable a la representación mental de un referente real o construido […]. Como primer paso, y aunque complica ligeramente la terminología, abogaríamos por hacer una diferencia entre la figura y el motivo. Una figura sería el icono individual, que pasaría a ser un motivo una vez identificado" (Berrocal, 2002, p. 94, citado en Gutiérrez, 2013).

contexto estratigráfico datable, lo cual permitió situar la antigüedad de este arte rupestre mobiliar en el Arcaico, quizás en aproximadamente 5000 años antes del presente (Heling, 2002).

Otro suceso afortunado que consolidó esta temporalidad relativa es que las excavaciones en Cueva Ahumada produjeron también una secuencia de puntas de proyectil en contexto estratigráfico datable. Tipos de puntas semejantes a los de esta secuencia han sido reconocidas en los grabados de Boca de Potrerillos y otros sitios de la región, proporcionando una temporalidad relativa a esta importante área rupestre (Valadez y Carpynteiro, 2011).

### Chihuahua

En el vasto espacio del norte de México, el Estado de Chihuahua destaca por la considerable cantidad de sitios rupestres que concentra a lo largo y ancho de su enorme territorio. El registro sistemático de su imaginería y su investigación arqueológica integral comenzó a practicarse en la década de 1990; en consecuencia, el inventario de sitios rupestres se ha incrementado de manera notable y algunos de ellos han sido investigados detalladamente, lo que ha aportado una gran cantidad de información que ha puesto de relieve el potencial que el estudio de esta manifestación cultural tiene para la investigación arqueológica en el país. Sin embargo es preciso enfatizar que, dada su enorme extensión, los contrastantes paisajes que conforman su geografía y la complejidad de su arqueología, aún falta mucho por hacer. Es pertinente señalar que territorios que se caracterizan por la diversidad de su paisaje como Chihuahua, con sus abruptas cordilleras que incluyen innumerables mesetas, cañones y valles intermontanos, así como las vertientes exteriores y las planicies desérticas que rodean las montañas, representan todo un reto para la investigación arqueológica integral.

Si bien no ha habido proyectos específicos enfocados a la obtención de fechas radiocarbono de la imaginería, existe un ejemplo en el cual se ha logrado establecer una cronología a través de métodos indirectos. Se trata del caso del sitio rupestre que lleva por nombre Boquilla Flores-Códice de Piedra (conocido también como Boquilla de Conchos, de Flores o The Rock Codex). En este sitio se han contabilizado alrededor de 116 grabados individuales, entre los cuales destaca un conjunto de puntas de proyectil que recuerdan a los tipos Shumla[3] y que están asociados a antropomorfos de cuerpo triangular. A partir del análisis de estos tipos de puntas de proyectil grabadas, Michael Bilbo y Kay Sutherland (1986: 11-30) han remontado la antigüedad de la producción de estos grabados hacia el Arcaico Medio, es decir, unos 4.500 años AP.

## Península de Baja California

### Baja California

En años recientes, los proyectos de investigación arqueológica en Baja California (norte) se han incrementado de manera notable y, si bien la investigación del arte rupestre no es el objetivo central de los mismos, sí han producido interesante información arqueológica con respecto a grandes áreas previamente desconocidas (Porcayo, 2009; Porcayo et. al., 2010). De esta manera, la posibilidad de obtener una visión regional del arte rupestre que concentra el estado está aumentando gradualmente.

Pocos han sido los intentos para datar directamente pinturas rupestres de algunos de los sitios emblemáticos de Baja California: El único caso conocido es el realizado en el panel rupestre del sitio El Vallecito. En principio, este proyecto se llevó a cabo para determinar la composición de las pinturas rupestres (Valdez, 2004). Los resultados preliminares demostraron que la fórmula de la pintura no incorporó ningún aglutinante, sólo se agregó agua; el análisis demostró que los pigmentos blanco, rojo y naranja son de origen mineral, mientras que el negro resultó ser carbón vegetal. Esta última circunstancia facilitará su datación, aunque actualmente no se sabe si las muestras de carbón ya fueron sometidas al proceso para definir la antigüedad de las pinturas (Oviedo, 2003, 2005). Estos resultados marcan dos importantes diferencias con relación a la composición de la fórmula con que fue elaborada la pintura rupestre en la península Central, ya que en esta región, los pigmentos utilizados para elaborar la pintura son: óxido de manganeso para el color negro, mientras que para los colores rojo y amarillo se utilizó óxido de hierro, y el blanco se realizó a partir de yeso. Todos estos pigmentos minerales son muy abundantes en la región (Gutiérrez y Hyland, 2002).

### Baja California Sur

La investigación arqueológica realizada en torno al arte rupestre de Baja California Sur ha tenido lugar, especialmente, en el norte del estado, específicamente en las Sierras de San Francisco y Guadalupe, donde se ha desarrollado un proyecto regional

3 Las puntas de proyectil tipo Shumla se sitúan entre el 2000 a.C. y el 200 d.C, de acuerdo con el esquema cronológico propuesto por Shum y Jelks (1962), (Viramontes et al., 2012, p. 274).

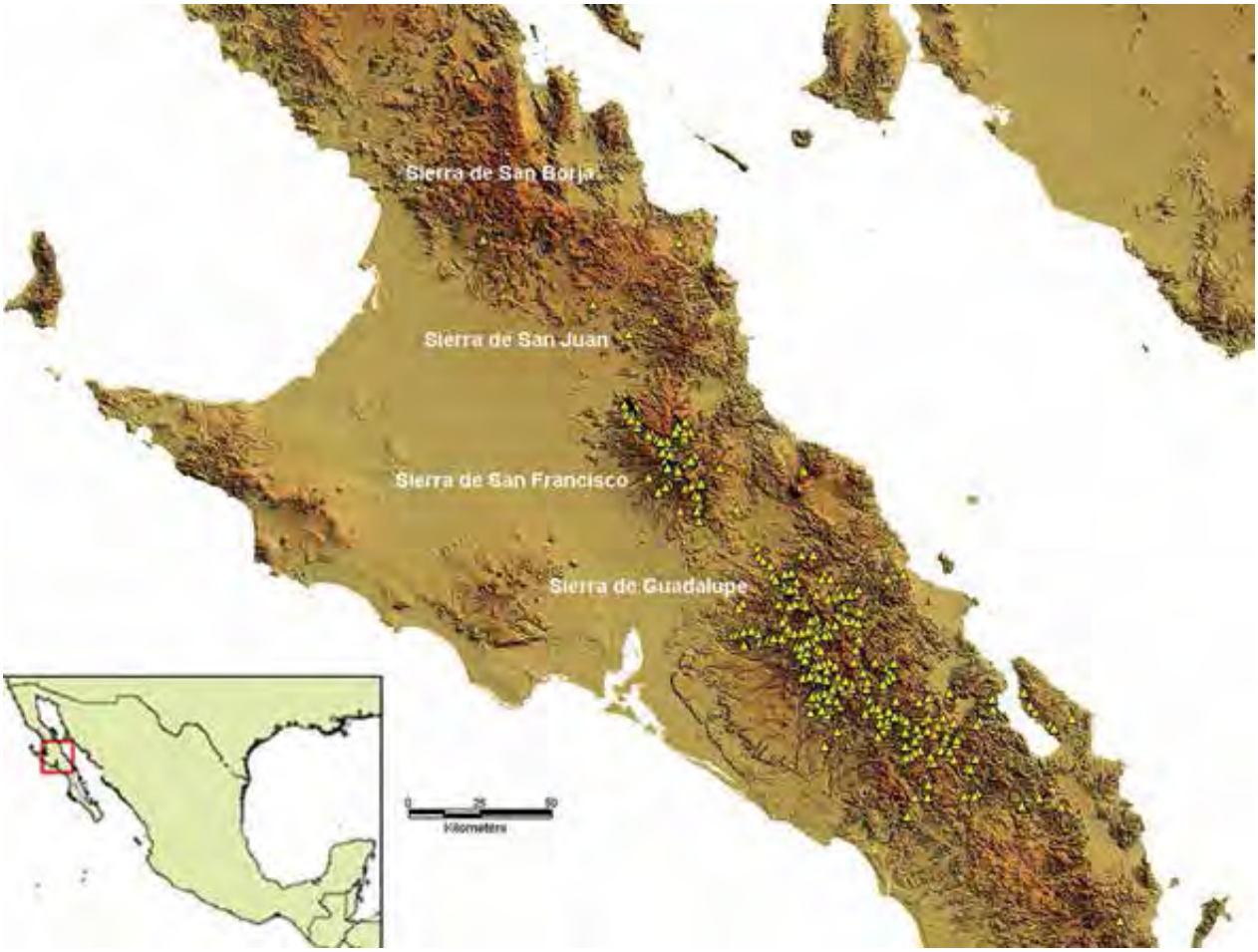


*Figura 2. Sitios rupestres en las sierras de San Francisco y Guadalupe, Baja California Sur.*

de largo plazo que ha incluido todos los elementos de un estudio arqueológico integral e interdisciplinario; este proyecto inició hace tres décadas y aún queda mucho material por analizar y muchas vertientes de estudio que escudriñar (figura 2).

Uno de los principales objetivos del proyecto consistió en establecer una cronología confiable para la imaginería de la tradición pictórica Gran Mural, porque hasta hace relativamente poco se contaba sólo con unas cuantas fechas directas para un fenómeno que se extiende por miles de kilómetros cuadrados (Fullola et al., 1994; Gutiérrez y Hyland, 2002). Por lo tanto, el proyecto general incluyó un subproyecto específico para alcanzar este objetivo. Esto no sólo consideró la posibilidad de obtener fechas directas, sino también la caracterización de los componentes de la pintura, poniendo un especial énfasis en la identificación de los aglutinantes que se utilizaron en la fórmula (Gutiérrez, 2003; Watchman et al., 2002).

Se obtuvieron cerca de 300 muestras de arte rupestre de algunos de los sitios Gran Mural más representativos de las cuatro cordilleras donde se distribuye: las Sierras de San Borja, San Juan, San Francisco y Guadalupe. Hasta este momento, se ha obtenido una gran cantidad de fechas, entre las que destaca la de Cueva San Borjitas, con una antigüedad de 7.500 años AP, ubicando el panel pintado de este sitio como uno de los más antiguos de la zona de los Grandes Murales (figura 3). Estos resultados han superado las expectativas, en virtud de la considerable antigüedad que representan. No obstante, es necesario puntualizar que la obtención e interpretación de todas las fechas aún está en proceso, razón por la cual no contamos con conclusiones consistentes. Lo que por el momento es posible afirmar es que existe una persistente continuidad en la práctica de pintar imaginería rupestre de esta tradición, misma que se extendió por un largo periodo. Tal vez esto explica la gran cantidad de sobreposición que se manifiesta en muchos de los paneles rupestres de estos sitios. Además, la notable antigüedad de algunos de los fechamientos obtenidos de muestras de pintura rupestre es consistente con ciertas fechas radiocarbónicas obtenidas en otro tipo de evidencia arqueológica, como se verá más adelante.

El análisis practicado en la parte orgánica de la pintura, es decir, el aglutinante añadido a la fórmula, parece indicar que su origen es vegetal, probablemente derivado de la savia de una o varias cactáceas y/o mezcal (*agave sp*), plantas muy abundantes en los alrededores de los sitios pintados y disponibles durante todo el año. Este componente de la fórmula es lo que ha permitido la obtención de las fechas a las que me he referido en párrafos anteriores (Gutiérrez, 2013; Gutiérrez y Hyland, 2002;

*Figuras 3. Panel del sitio rupestre Cueva San Borjitas.*

Watchman et al., 2002). A continuación se analizarán otros aspectos esenciales para ubicar la temporalidad de la imaginería rupestre y se ampliará la información sutilmente perfilada en párrafos anteriores, con el objetivo de consolidar la propuesta cronológica regional y establecer los tiempos en los que fue construido este paisaje ancestral, escenario del fenómeno Gran Mural.

**Los Volcanes Tres Vírgenes: Agentes Sociales en el proceso de Culturización y Fechamiento del Paisaje en Baja California Central**

En la primera parte de este texto, se señaló que la península de Baja California representa un parteaguas en cuanto a la investigación del arte rupestre, desde el momento en que su estudio se abordó a partir de una perspectiva regional y una visión de continuidad de largo plazo. Sus peculiaridades geográficas, climáticas, arqueológicas e históricas han hecho de este territorio un terreno muy fértil para desarrollar distintas aproximaciones a su excepcional y muy recurrente imaginería, no obstante, muchos años tuvieron que pasar para lograr este propósito.

Localizada en el noroeste de México, esta alargada franja de tierra permaneció casi inexplorada hasta muy avanzado el siglo xx. Este desinterés es, hasta cierto punto, paradójico, porque durante años se presentó en proporción inversa a la importancia y riqueza de su arqueología y su destacado arte rupestre. A excepción de su extremo septentrional, fue habitada por grupos cazadores-recolectores-pescadores que subsistieron en una amplia gama de circunstancias ecológicas y configuraciones sociales. Como se ha señalado, se sabe que dichos grupos se desplazaban sobre estas tierras por lo menos desde los finales del Pleistoceno (Gutiérrez y Hyland, 2002). La condición casi insular de Baja California mantuvo a estos pueblos relativamente aislados de las influencias continentales, permitiendo el desarrollo de excepcionales complejos culturales. Y, precisamente, uno de los rasgos más sobresalientes de la prehistoria peninsular es que estos pueblos promovieron, en algunas regiones, la producción masiva de arte rupestre desde tiempos muy remotos. Tal es el caso de las cordilleras centrales de la península, espacio en donde se manifiesta una gran cantidad de pinturas rupestres y petrograbados pertenecientes a diferentes estilos y temporalidades; sin embargo, lo que más llama la atención en estas montañas es que fueron un escenario ideal para el desarrollo de una singular tradición pictórica: los Grandes Murales (Crosby, 1997; Gutiérrez, 2013; Gutiérrez y Hyland, 2002).

A lo largo de todos estos años de investigación, las preguntas más recurrentes que suelen hacerse los investigadores y el público en general en torno a estas pinturas de gran escala son ¿quién las hizo? y, sobre todo, ¿cuándo las hicieron? Por supuesto, la primera pregunta es de más fácil resolución pues la investigación arqueológica y la abundante información que emana de las fuentes etnohistóricas y etnográficas permiten "rastrear", en ocasiones, la posible filiación cultural de quienes ahí moraron. Sin embargo, responder a la segunda pregunta es mucho más complicado; ya se ha hecho amplia referencia a las dificultades que conlleva la ubicación cronológica directa de la producción del arte rupestre; es por esto que en muchos casos, sólo nos queda la posibilidad de estimar su antigüedad a partir del fechamiento de materiales culturales asociados a los escenarios en los que tuvo lugar el evento de pintar y/o grabar.

## La cronología del paisaje

Antes de 1992 se carecía de indicios cronológicos confiables que permitiesen la ubicación temporal de los desarrollos culturales que tuvieron lugar en la parte central peninsular. Esta situación es una más de las desafortunadas consecuencias que trajo consigo la escasez y parcialidad de los trabajos arqueológicos que aquí tuvieron lugar hasta dicho año. Si bien el hallazgo de la Punta Clovis de San Joaquín, reportada para el área en la década de 1950 (Ashmann, 1951), permitió inferir que grupos humanos transitaban por esta tierra por lo menos desde el Holoceno,[4] era evidente el enorme vacío cronológico que imperaba en la región. La escasez de fechas radiocarbono, la relativa homogeneidad del conjunto de artefactos regionales y, en especial, la falta de una tipología de las puntas de proyectil nos enfrentaban a contextos arqueológicos sin indicios cronológicos diagnósticos para definir su antigüedad y las etapas de desarrollo de los grupos humanos que aquí moraron. Ante esta situación, la investigación arqueológica desarrollada en la región priorizó la obtención de una muestra representativa de fechas que permitiese establecer una cronología regional confiable. Los objetivos de este programa no solo se encaminaron a la obtención de indicadores cronológicos aislados, sino que también se hicieron cargo del reconocimiento previo de los contextos y los procesos culturales relacionados. Dadas las dificultades para encontrar óptimos contextos estratificados y, en consecuencia, materiales fechables procedentes de niveles primarios, se trató de abarcar la mayoría de técnicas posibles. En estos términos, los indicadores cronológicos obtenidos a través de métodos y materiales diversos nos colocarían ante la posibilidad de definir un cuadro cronológico amplio y sobre todo de parámetros confiables (Gutiérrez y Hyland, 2002).

Los indicadores para definir la temporalidad de la ocupación humana en la región fueron los siguientes: 1) la obtención de cerca de 100 fechas radiocarbono de carbón, madera, cordel y hueso, incluyendo restos óseos humanos provenientes de contextos excavados y de superficie de sitios de diversa naturaleza;[5] 2) el análisis de diversos tipos de artefactos líticos diagnósticos, especialmente de una amplia muestra de puntas de proyectil que cuentan con referentes cronológicos; y 3) el desarrollo de un programa dirigido especialmente al fechamiento radiocarbono AMS de la producción Gran Mural.

## Fechas Radiocarbono de materiales arqueológicos diversos

En la secuencia de fechas radiocarbono obtenidas de materiales arqueológicos de la Sierra de San Francisco, destaca la presencia de dos fechas muy tempranas: 10860 ± 90 AP y 6990 ± 60 AP. La fecha de 10860 ± 90 AP (fecha calibrada 11040-

4 Cabe destacar que a un kilómetro al suroeste de San Joaquín (rancho El Mezquital) fueron reportados restos fósiles de mamut (*Mamuuthus archidiskodon imperator*) (Alvárez y González, 1986). La asociación geográfica relativamente cercana entre la Clovis de San Joaquín y los restos de fauna pleistocénica podría estar representando más que un evento fortuito (Gutiérrez y Hyland, 1994; Hyland y Gutiérrez, 1995).

5 Abrigos rocosos o cuevas con y sin arte rupestre, cuevas funerarias y campamentos al aire libre.


*Figura 4. Sitios funerarios excavados en la región central peninsular.*

10620 a.C.), proviene de un fragmento de carbón recuperado en la Unidad 1 de Cueva Pintada, sitio rupestre emblemático localizado en el Arroyo de San Pablo. Podría discutirse la posibilidad de que este carbón tenga un origen natural (Nelson, 1994), sin embargo, dada su presencia en un depósito arqueológico y la identificación del periodo Clovis o Paleoindio en la región (Gutiérrez y Hyland, 1994; Hyland y Gutiérrez, 1996), es muy probable que se derive de un evento cultural. La fecha 6990 ± 60 AP (fecha calibrada 5960-5700 a.C.) se obtuvo de un cordel torcido de agave, recuperado en la excavación de la Unidad 1 en Cueva de la Soledad o Pájaro Negro,[6] situada en un tributario del arroyo de San Pablo.

En términos de una periodización histórico-cultural regional, la distribución de las fechas cubre la secuencia completa desde el Paleoindio y el Arcaico hasta el prehistórico tardío Comondú y los periodos posteriores al contacto Misional. La cúspide de la distribución desciende hacia los siglos XV y XVI AC durante el periodo prehistórico tardío Comondú (Gutierrez y Hyland, 2002), el cual integró el conjunto de cultura material de los hablantes de Cochimí del periodo histórico en la región (Massey, 1966a).

## Fechas radiocarbono de Restos Óseos Humanos

Uno de los aspectos menos conocidos de la arqueología de la parte central de la península es el que se refiere a los rituales mortuorios practicados por los grupos humanos que la habitaron. Actualmente, en el área de estudio sólo se han investigado seis cuevas funerarias, muy pocas si consideramos la gran extensión de dicha región; éstas son El Pilón de Guadalupe y La Cueva del Cartucho en la Sierra de San Francisco y Las Cuevas de La Cañada, El Guano, La Gallineta y Los Muertos en la Sierra

6 Este abrigo rocoso se sitúa en el Arroyo de La Soledad, tributario muy importante del Arroyo de San Pablo, en el sector noroeste de la Sierra de San Francisco.

de Guadalupe (figura 4). No obstante, la información recabada ha permitido conocer algunos elementos esenciales acerca del pensamiento que estos grupos desarrollaron en torno a la muerte (Gutiérrez, 2013).

Algunas muestras de hueso provenientes de cuatro de estos sitios han sido datadas. En el caso del Pilón de Guadalupe las fechas obtenidas exhiben un rango de 3.090 a 3.380 años AP, lo que indica que la inhumación de los individuos tuvo lugar durante un breve lapso. Para La Cueva de La Gallineta, las fechas presentan un rango de 2.552 a 2.689 años AP, sin embargo aún no es posible concluir nada puesto que esta cueva no ha sido excavada en su totalidad. El caso de la Cueva de los Muertos es muy interesante, ya que presenta un rango de 2.024 a 2.786 años AP, cerca de 760 años de intervalo; lo que llama la atención es que las fechas más antiguas provienen de un cráneo, una pelvis y una clavícula que se encontraron en profundas grietas del piso del pequeño abrigo rocoso, acompañadas de una lasca de basalto y cubiertas con capas de zacate y tierra, lo que parece indicar que estos elementos fueron intencionalmente colocados ahí, tal vez consagrando el lugar como recinto mortuorio (Gutiérrez, 2013, pp. 110-112).



*Figura 5. Desierto Central. Puntas acanaladas: a la izquierda Clovis del Batequi, realizada en obsidiana del Yacimiento Valle del Azufre; a la derecha Clovis de San Francisco de la Sierra.*

## Cronología del equipo tecnológico

El análisis tipológico del total de artefactos recuperados en el área que nos ocupa ha incrementado el conocimiento acerca de su distribución regional en el área geográfica comprendida entre la Bahía Concepción hacia el sur (Ritter, 1979) y el área de Bahía de Los Ángeles hacia el norte (Davis, 1968; Ritter 1944, 1995) donde ya se había realizado trabajo previo. El análisis corroboró la existencia de una fuerte continuidad tipológica entre la extensa área desplegada entre estas dos bahías, particularmente presente en los materiales diagnósticos del conjunto prehistórico tardío Comondú, representados especialmente por las puntas de proyectil *Comondú Triangular* y *Comondú Serrated*.

De la colección analizada en la década de 1990, destacan dos puntas acanaladas tipo Clovis. Una de ellas es a la que me referí en páginas anteriores y se trata de un fragmento basal de obsidiana proveniente de las inmediaciones del Rancho El Batequi, localizado al suroeste de San Ignacio (Gutiérrez y Hyland, 1994; 2002; Hyland y Gutiérrez, 1995). De especial importancia es que la obsidiana que fue usada para producir esta punta proviene del yacimiento Valle del Azufre, en el campo Volcánico Tres Vírgenes. La segunda punta está completa y fue encontrada en superficie cerca de San Francisco de la Sierra, poblado localizado en una de las partes más altas de la Sierra de San Francisco; este segundo espécimen está realizado a partir de un silicio de grano fino, de origen aparentemente no local. Ambas fueron catalogadas como Puntas Clovis Típicas (García-Bárcena, com. per.) (figura 5), las cuales al parecer son las más tempranas de entre los cinco grupos de puntas acanaladas. Su edad mínima se ha calculado en 12.000 años AP. en Texas y áreas vecinas y en 10.700 años AP, en Guatemala (García-Bárcena, 1979, p. 15).

Posterior al hallazgo de estas puntas acanaladas, en la década del 2000 se reportaron dos puntas más para la región central, ambas encontradas en la Isla de Cedros en superficie; estos dos especímenes representan las únicas puntas acanaladas encontradas en contexto *isleño* para la costa de California y la península de Baja California (Des Lauries, 2006, 2008, 2010). Una de ellas es un fragmento basal realizado de material microcristalino de color café oscuro y con un elevado grado de patinación (Sitio Arce-Meza; PAIC-70) (Des Lauries, 2008, p. 271); el otro espécimen fue encontrado durante la prospección arqueológica en el sitio PAIC-44 en enero de 2009 (Des Lauriers, 2010, p. 60). También se trata de un fragmento basal pero en esta ocasión, realizado a partir de sílex rojo tabular derivado de fuentes locales. Des Lauries (2008) señala que ambas puntas fueron recuperadas de sitios de grandes dimensiones y contextos muy erosionados, y es contundente al señalar que es difícil determinar su antigüedad con precisión.

La historia temprana en la región central peninsular es un interesante asunto que ha sido poco abordado por la arqueología mexicana; los hallazgos de artefactos de antigüedad considerable son esporádicos, aunque en algunas áreas muestran cierta "recurrencia"; en estos términos, es indispensable que se desarrollen proyectos arqueológicos interdisciplinarios en dichas áreas para profundizar en las condiciones y escenarios en los cuales los pueblos originarios de la península central arribaron a esta asombrosa región.

## La temporalidad de la imaginería

La impresión que la imaginería Gran Mural causó en los pocos jesuitas que en algún momento la conocieron fue que las pinturas eran *antiguas*. Esta impresión se basó en la valoración de las características físicas de la imaginería y en las respuestas que obtuvieron de sus informantes cuando se les preguntó acerca del origen de los Grandes Murales. Los Cochimís locales negaron conocer el origen de la imaginería, señalando que había sido realizada por una antigua y ya desaparecida raza de gigantes que habían poblado las sierras arribando desde el norte. Dada la política jesuita de erradicar la religión nativa, la veracidad de tales respuestas está abierta a un cuestionamiento serio[7] (Gutiérrez, 2013; Gutiérrez y Hyland, 2002).

Poniendo a un lado las subjetivas estimaciones jesuitas acerca de la condición de las pinturas y el resultado de sus interrogatorios, algunos investigadores han sugerido que los Grandes Murales deben ser considerados relativamente recientes (Crosby, 1984, pp. 180-183; Grant, 1974, p. 115; Meighan, 1966, p. 379, 1978, p. 11; Ritter et al., 1982, p. 53). Esta premisa se fundamenta en el conjunto de artefactos del periodo Prehistórico tardío relacionados a la cultura Comondú, que por lo común se encuentran en los depósitos de los sitios Gran Mural, y en una fecha de radiocarbono confirmada, la primera para uno de estos sitios: 530 ± 80.AP, proveniente de un fragmento de madera encontrado en la superficie de Cueva Pintada (Meighan, 1966, 1969). Los materiales Comondú (Massey, 1966a y b) de los contextos prehistóricos e históricos, están asociados con los Cochimís del periodo del contacto y con sus ancestros prehistóricos inmediatos.

Con respecto a fechamientos por radiocarbono de pintura rupestre, como se mencionó con anterioridad, antes del 2000 sólo se contaba con seis fechas absolutas AMS de tres paneles Gran Mural de la Sierra de San Francisco: Cueva del Ratón, San Gregorio II y La Palma de San Gregorio, un número muy reducido para un fenómeno que se extiende por miles de kilómetros cuadrados (Fullola et al., 1994; Gutiérrez y Hyland, 2002, p. 337). Por ello, en la primera década del siglo XXI, uno de los objetivos principales de la investigación arqueológica desarrollada en la región fue expandir la cronología conocida para los Grandes Murales, específicamente con la intención de rastrear en el tiempo y el espacio, el surgimiento de las diversas tendencias de representación visual de dicha tradición pictórica y proponer una secuencia cronológica relativa de las mismas (Gutiérrez, 2000, 2013).

Como se señaló anteriormente, la investigación no sólo contempló la posibilidad de obtener fechas directas AMS, sino también la caracterización de los componentes de la pintura, poniendo un especial énfasis en la identificación de los aglutinantes que fueron utilizados en la fórmula. De 300 muestras de pintura provenientes de algunos de los lugares más emblemáticos y representativos de las diversas tendencias de representación visual Gran Mural, se han obtenido 60 fechas, las cuales presentan un amplio rango de temporalidad llegando a colocarse en momentos tan distantes como 7.500 años AP en Cueva San Borjitas (Watchman et al., 2002) (figura 3) y tan recientes como la época del contacto, a finales del siglo XVII. Estos resultados son sorprendentes porque superan todas las expectativas al colocar la producción de esta tradición rupestre en una época tan remota.

Sin embargo, actualmente, la datación AMS en muestras de pintura rupestre es objeto de una severa controversia, especialmente cuando es puesta en duda la pureza de las muestras y el origen del carbón a partir del cual se obtuvieron las fechas. A principios del siglo, ignorábamos que al paso de los años sería cuestionada esta revolucionaria técnica de fechamiento en su aplicación a la imaginería rupestre, por lo que concluimos el proyecto obteniendo interesantes, aunque controvertidos resultados. No obstante, estas dataciones no sólo han modificado las interpretaciones y discrepancias que se produjeron en torno a las primeras fechas (Fullola et al., 1994; Gutiérrez et al., 2002; Magar et al., 2004; Murray et al., 2003), sino que también aportaron valiosa información relativa al proceso de producción de las imágenes pintadas, el uso que se les dio a éstas y a los recintos que las contienen, y el sentido que su elaboración tuvo para las antiguas sociedades que las generaron (Gutiérrez, 2013; Watchman et al., en preparación).

A la luz de todas estas consideraciones, lo único que queda muy claro es que tenemos más interrogantes que respuestas en torno a la cronología del Gran Mural. En los años por venir será necesario conseguir financiamiento adicional para obtener más

7 Los reportes de los jesuitas Joseph Mariano Rothea y Francisco Escalante en torno a las narraciones indígenas acerca de estos gigantes se encuentran en Barco (1988, pp. 221-212).

fechas del resto de muestras de pintura, además de hacer un énfasis particular hacia la posibilidad de entender la química del carbono, esto debido a que, como he mencionado, en términos prácticos, este método aún está lejos de poder ser considerado rutinario y confiable en la totalidad de los casos, debido a los complejos problemas asociados con el control del origen del carbono en las muestras (esto es, que el carbono medido esté realmente asociado con el evento pictórico); se espera que la tecnología en torno a la datación por radiocarbono AMS avance cada día más para obtener resultados precisos y confiables.

## El campo volcánico Tres Vírgenes y sus lugares naturales codificados

Un asunto de gran interés para hipotetizar acerca de la antigüedad de las pinturas rupestres de la región es aquel que se relaciona con los importantes yacimientos de materias primas a las que me he referido con anterioridad. Estudios especializados han determinado que la punta Clovis de El Batequi (Gutierrez y Hyland, 1994; Hyland y Gutiérrez, 1995; Shakley et al., 1996) fue realizada con obsidiana proveniente de dicho yacimiento, lo que implica que su descubrimiento puede remontarse a unos cuantos milenios atrás, muy probablemente a principios del Holoceno (11.000 AP). Pero, ¿cómo la antigüedad establecida para el inicio de la explotación del yacimiento puede ser considerada un indicador cronológico para inferir indirectamente la antigüedad de las pinturas rupestres de la región?

Indudablemente, el territorio central peninsular reúne una serie de elementos que lo hicieron sumamente atractivo para los nativos, sin importar su temporalidad: oasis de planicie e intermontanos que les aseguraron la disponibilidad del vital líquido, una diversidad de recursos alimenticios, terrestres y marinos disponibles a lo largo de un ciclo anual, abundantes materias primas para la elaboración de artefactos de diversa naturaleza, de origen orgánico y lítico (entre estos últimos destacan los grandes yacimientos de basaltos y, por supuesto, la obsidiana). Pero a todo este cúmulo de recursos se suma otro elemento especialmente singular: el enorme yacimiento de pigmentos minerales que lleva por nombre el Cañón del Azufre y que se encuentran a sólo 3,5 kilómetros del yacimiento de obsidiana Valle del Azufre. A continuación se describirá brevemente el espacio simbólico que ocupan Los Volcanes, en el cual coexisten excepcionales rasgos naturales del paisaje que, de acuerdo con la evidencia arqueológica encontrada en estos dominios, muy probablemente fueron conocidos desde épocas muy tempranas, cuando los primeros hombres llegaron a estas tierras privilegiadas en su titánica aventura migratoria.

## El sistema volcánico Tres Vírgenes

Este Sistema Volcánico se localiza en el *ombligo* de la península de Baja California, hacia su flanco oriental. Está conformado por tres volcanes: El Viejo, El Azufre y La Virgen, éste último es el más elevado, alcanzando una altitud de 1.940 msnm (figura 6).

*Figura 6. El Sistema Volcánico Tres Vírgenes.*

El volcán más joven, La Virgen, es un estratovolcán andesítico con numerosos domos y flujos de lava en sus flancos. Una gran erupción explosiva en su ladera suroeste ha sido datada por radiocarbono en alrededor de 6.500 años AP, pero la exposición de helio y de uranio dan una serie de fechas que colocan este evento a finales del Pleistoceno. Un sacerdote jesuita español reportó una columna de cenizas que emanaba de este volcán, mientras navegaba por el Golfo de California en 1746, sin embargo no se han encontrado depósitos de una erupción tan reciente; no obstante, en la cumbre de La Virgen, flujos de lava andesítica que no han sido fechados podrían estar relacionados con este suceso. Actualmente, en el extremo norte del complejo cerca del borde de la caldera Pleistocénica de El Aguajito, opera una planta geotérmica de la Comisión Federal de Electricidad.[8]

En las planicies desérticas aledañas a estos volcanes se han localizado numerosos sitios arqueológicos, especialmente hacia el sureste, en el Valle de la Virgen, donde son comunes los campamentos habitacionales y yacimientos de piedra pómez y canteras-taller de basaltos, algunos de considerables dimensiones. Antiguas puntas de proyectil han sido localizadas sobre este valle (Gutiérrez, 2000).

8 Tomado de Global Volcanism Program 2012: http://www.volcano.si.edu/world/volcano.cfm?vnum=1401-01

En abril de 2009, realicé el ascenso a la cumbre de La Virgen. Mi principal objetivo fue detectar la presencia de actividad humana prehistórica en la cima de la montaña y a lo largo del sendero que me condujo hasta allí. La cumbre más alta y el cono principal carecieron de vestigios arqueológicos,[9] no obstante, casi al llegar a la cúspide, encontré dos artefactos de obsidiana: una lasca con retoque y una punta de proyectil. Dichos hallazgos indican que los nativos visitaban esporádicamente estos elevados parajes, tal vez como parte de una acción ritual y/o para la cacería del borrego cimarrón, muy abundante en estas abruptas montañas. El borrego cimarrón representa un elemento que pudo haber sido relacionado con deidades o poderes míticos. En las pinturas rupestres de toda la región es uno de los animales más representados (figura 7); durante la travesía se observaron algunos individuos de esta especie. Desde la cumbre de La Virgen se domina una espectacular panorámica de las sierras de San Francisco y Guadalupe, el Golfo de California y el Océano Pacífico.

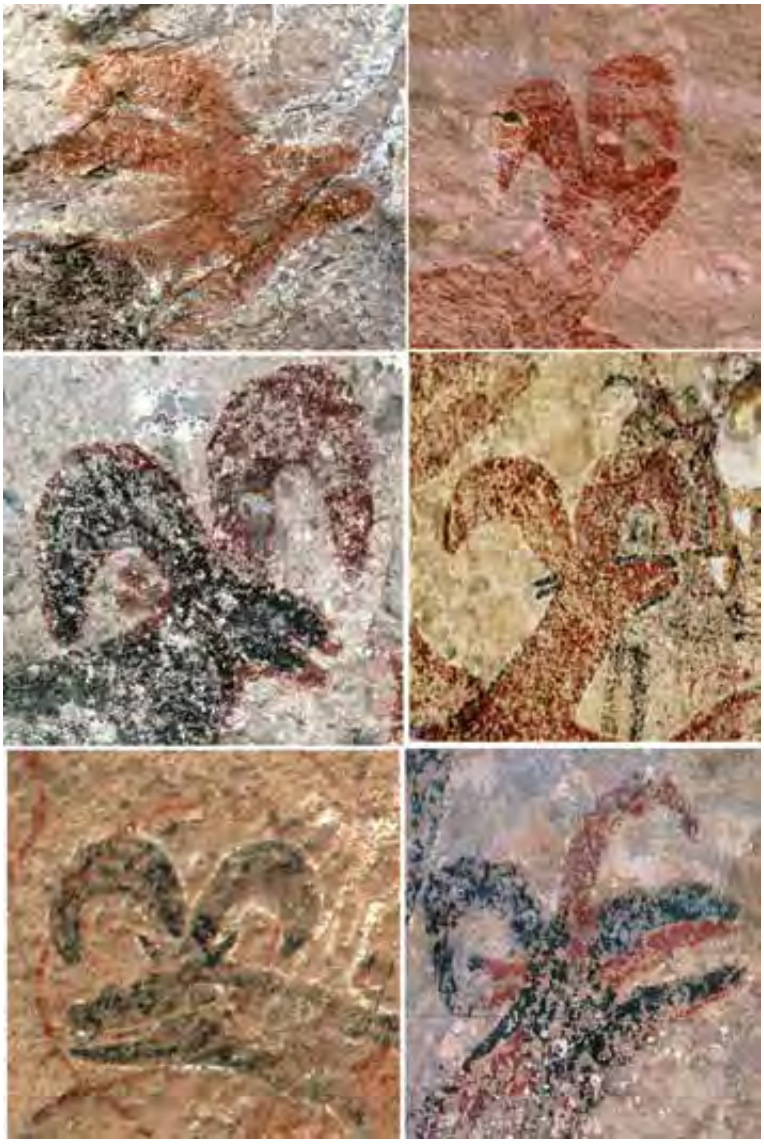

*Figura 7. Algunos ejemplos de representación de borrego cimarrón en la pintura rupestre de las Sierras de San Francisco y Guadalupe.*

Estos volcanes son, por mucho, el rasgo fisiográfico más conspicuo de la región. Su imponente elevación y la manifestación de antiguos eventos eruptivos y tectónicos pudieron haber sido razones suficientes para que por derecho propio, los habitantes de estas tierras les asignaran un significado especial. Estoy convencida de que su sola percepción en lontananza, incidió profundamente en la conciencia y el actuar de las poblaciones indígenas, por lo tanto considero que todo el sistema volcánico es un extraordinario Lugar Natural (Bradley, 2002), pero además, el probable carácter mitológico de su origen pudo haber sido reforzado por la presencia de otros elementos del paisaje que se albergan bajo sus dominios, rasgos naturales que fueron "…culturizados y codificados con significado" (Strang, 2006, p. 68); como mencioné, hacia las estribaciones occidentales del sistema se han localizado importantes yacimientos de materias primas como piedra pómez, obsidiana y pigmentos minerales (óxidos de hierro y yeso), afloramientos de concha fósil, así como un manantial de aguas termales vinculado a un abrigo rocoso que exhibe un arte rupestre insólito, totalmente diferente al que se manifiesta en la región.

Los Lugares Naturales son espacios de importancia simbólica relevante que se vinculan a rasgos destacados o excepcionales del paisaje, presentan escasa o nula evidencia arqueológica, predominando en ellos el elemento natural (Bradley, 2002).[10] Por lo común se trata de sitios alejados de los espacios habitacionales y prácticamente no están afectados por las actividades que en ellos sucedieron, pasando desapercibidos para aquellos que desconocen su existencia o ubicación. Paradójicamente, estos lugares han conservado sus formas a través de largos periodos, sin embargo, el modo en el que han sido percibidos los ha

9 Además de ser un volcán muy popular entre los excursionistas regionales y foráneos, en este lugar se ubican dos antenas (repetidores) de radio, las cuales son visitadas periódicamente para su mantenimiento. Por estas razones es muy posible que, si la cumbre albergaba algún tipo de evidencia arqueológica, ésta fuera removida en tiempos recientes.

10 Pueden ser volcanes, montañas, cerros, colinas, peñascos y malpaisales, bosques, manantiales, ríos, pantanos, lagos y cascadas, cuevas, grietas, ínsulas y penínsulas y afloramientos de materias primas, entre otros.

"alterado" en cierta medida (Bradley, 2002, p. 33). Esta alteración tiene lugar en el momento en que la mente humana toma conciencia de su existencia y les asigna un significado y un poder.

Los lugares naturales no pueden ser considerados monumentos pues no son resultado de la acción humana. Entonces, en muchas ocasiones su origen puede ser explicado en términos mitológicos: "estos lugares pudieron haber sido formados por los ancestros o por fuerzas sobrenaturales" y "tienen una arqueología porque alcanzaron un significado para las personas del pasado" (Bradley, 2002: 35, citado en Gutiérrez, 2013).

¿Cómo *percibieron* los indígenas esta elevada *presencia* y el vasto espacio que la rodea? ¿Qué significado le asignaron? ¿Cómo fueron experimentados, interpretados y vinculados a ellos los lugares en donde se concentran productos de antiguos eventos eruptivos? ¿Constituyeron "centros de actividad corporal, significado humano y accesorio emocional"? (Tilley, 1994: 15). Los Volcanes ocupan un espacio prístino, en términos de su percepción a la distancia, que se ha mantenido casi inalterado a lo largo de milenios, y considero que su importancia simbólica en el mundo-de-la-vida indígena no sólo derivó de su prominente ubicación en este paisaje semidesértico, sino también de los significados particulares que fueron asignados a los lugares naturales que alberga y articula a través de diversos contextos situacionales. En este orden de ideas, propongo que los Volcanes y sus productos eruptivos jugaron un papel fundamental en la cosmovisión de estos pueblos y actuaron como agentes sociales en la formación y reafirmación de sus identidades personales y grupales y en la integración del proceso de su reproducción social (Gutiérrez, 2013). A continuación describiré brevemente estos elementos.

## El yacimiento de obsidiana Valle del Azufre

El origen geológico de este yacimiento de obsidiana es principalmente Cuaternario, por lo que proporcionó grandes nódulos de excelente calidad para la elaboración de artefactos, especialmente de puntas de proyectil en una diversidad de tipos, algunos de ellos muy antiguos. Como mencioné, la explotación de esta fuente se empezó a dar desde el Holoceno temprano, tal y como lo demuestra la punta Clovis realizada con obsidiana proveniente de dicha fuente, a la que ya me he referido. El registro arqueológico de la obsidiana proveniente de este yacimiento está bien documentado y su distribución alcanzó lugares tan lejanos hacia el sur como la región de Loreto (Gutiérrez y Hyland, 2002; Shackley et al., 1996).

Ser el único yacimiento de obsidiana de calidad que existe para esta extensa región pudo haber sido razón suficiente para que los indígenas lo consideraran un lugar de importancia excepcional. Sin embargo, dicha importancia no sólo se relacionaría con la posibilidad de obtener este apreciado vidrio volcánico, sino además, la toma de conciencia de este estado de excepción por parte de los indígenas, pudo haber vinculado su origen con entidades sobrenaturales.

## El yacimiento de Pigmentos del Cañón de Azufre

Este yacimiento de pigmentos es la fuente de óxidos de hierro rojos más grande registrado hasta el momento en la región, presentando una amplia gama de tonalidades. También contiene yeso y, en menores cantidades, óxidos de hierro amarillos (figura 8). Dada la importancia de la producción de pintura rupestre y pintura corporal entre la sociedad indígena Cochimí, esta fuente de pigmentos debió ser muy apreciada por los habitantes de toda la región. Otro elemento que llama la atención cuando se camina por este cañón y que pudo haber incidido en la conciencia de los indígenas como algo significativo, son los afloramientos de concha fósil, infinidad de bivalvos que se encuentran incrustados en un soporte pétreo muy deleznable y de intenso color rojo.

*Figura 8. Yacimiento de Pigmentos del Cañón del Azufre*

Hacia la desembocadura de este cañón, en una parte elevada del terreno se localizó un lugar con evidencia arqueológica relacionada con la extracción del pigmento. Entre los materiales destacan dos lascas de obsidiana y tres tajadores, dos de basalto y uno de obsidiana. Cabe destacar que sobre el lecho del arroyo no se conserva ninguna evidencia arqueológica debido a las fuertes avenidas del arroyo durante la época de lluvias.

## El Manantial de Aguas Termales y Sulfurosas

*Figura 9. El Manantial de aguas termales.*

Cuando visité por primera vez este manantial en 1992, se encontraba rodeado de un pequeño bosquecillo de mezquites y huisaches, así como de piedras de gran tamaño, sin embargo, la incidencia de los huracanes que impactaron la región en los últimos años ha transformado varias veces la topografía del cauce en esta parte del arroyo, debido a las fuertes avenidas. No obstante, el agua sulfurosa sigue fluyendo del manantial, aunque ahora casi no presenta vegetación en su entorno (figura 9).

Además de lo útil que resultó esta fuente de agua para saciar la sed durante el acopio de los pigmentos, es posible que los indígenas hayan percibido en este peculiar manantial un simbolismo inherente a su *excepcionalidad*. Strang (2008, p. 127) señala que "en paisajes áridos la rareza de las fuentes de agua les otorga una particular y poderosa influencia"; esta autora considera también que el agua proporciona "un vasto potencial imaginativo para expresar significados culturales…" (Strang, 2008, p. 124).

Agua caliente brotando de la piedra, olor a azufre y pequeñas columnas de vapor. Fuente inagotable del elemento vital en un constante fluir y, además, abrevadero del borrego cimarrón. Desde el manantial se observa el abrigo rocoso con arte rupestre y viceversa, el vínculo entre estos dos lugares parece innegable y los círculos concéntricos pintados en el abrigo rocoso parecen confirmar esta idea. Este motivo se ha encontrado grabado en asociación con algunas tinajas de las montañas circundantes, representando, tal vez, un signo que puede leerse como "agua"; la codificación de este motivo puede deberse a los ondas concéntricas que se forman cuando un objeto es arrojado a un depósito que contenga este muy apreciado recurso.

## El sitio rupestre "El Viejo" del Cañón del Azufre

Aproximadamente a 700 metros de la Boca del Cañón del Azufre, sobre su ladera sur, se localiza el abrigo rocoso con pintura rupestre al que me he referido y que he denominado "El Viejo" (figura 10). Hasta el momento, es el único sitio rupestre reportado para este cañón y para el área de Los Volcanes. Su panel rupestre es totalmente atípico, si lo comparamos con las otras tendencias de representación visual que predominan en la región. Cabe destacar que el Cañón del Azufre se localiza a una distancia equidistante de las sierras de San Francisco y Guadalupe, donde se manifiesta, principalmente, la tradición pictórica de los Grandes Murales. No obstante, a pesar de su contenido inusual, en el panel destaca un motivo que es recurrente en muchos de los lugares con pintura rupestre de las sierras mencionadas. Se trata de un motivo al que se ha denominado bastón

*Figura 10."El Viejo del Cañón del Azufre", sector central del panel rupestre del enigmático sitio.*

ceremonial-símbolo fálico (Gutiérrez y Hyland, 2002; Gutiérrez, 2007, 2013); en el panel de El Viejo, estos singulares motivos se presentan por lo menos 12 veces (figura 11).

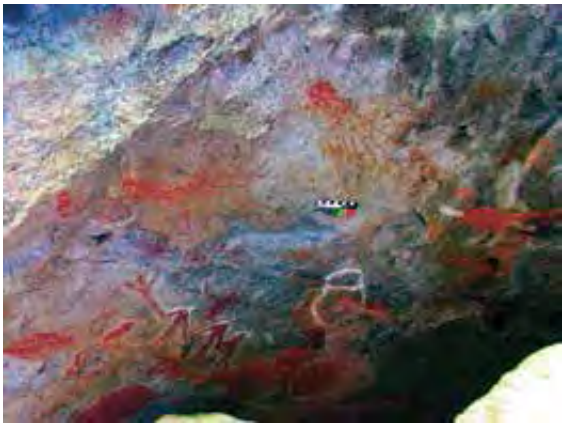

*Figura 11. Motivo denominado bastón ceremonial-símbolo fálico, el cual se representa en el panel de "El Viejo", por lo menos doce veces.*

Sin duda, la profusa representación de este motivo en el pequeño panel, codifica el lugar y le otorga un significado destacado que trasciende el tiempo y el espacio y que, además, permite vincularlo con las montañas aledañas, donde su manifestación es muy recurrente, tanto en pintura rupestre como en petrograbado; en estos espacios los indígenas estructuraron otras actividades habituales y rituales, entre las que destaca la producción de pintura rupestre monumental (Gutiérrez, 2013).

Por el momento es muy difícil tratar de explicar el inusual contenido de este panel, por un lado, porque la deconstrucción de su imaginería aún está en proceso y por el otro, por la enorme ambigüedad de las figuras y motivos que agrupa. En esta intrigante escena, la representación de antropomorfos se limita a la presencia de dos motivos-compuestos, conformados cada uno por tres antropomorfos sumamente esquematizados, tomados de las manos. Los antropomorfos ubicados en el extremo izquierdo de cada terna exhiben un brazo extremadamente largo con enormes manos, una con tres dedos y la otra con cuatro; sobre uno de los tríos, se encuentra un ave en vuelo y ambos conjuntos están rodeados de bastones ceremoniales-símbolos fálicos. En el panel lateral derecho se manifiesta un singular antropomorfo que luce lo que al parecer es una *capa*; figuras similares con *capas* han sido observadas en algunos sitios rupestres de la región.

La importancia de este lugar es innegable, no sólo porque se ubica adyacente a la fuente de pigmentos, sino también por estar justo frente al manantial de aguas termales (y, como dijimos anteriormente, los círculos concéntricos que aquí se expresan, vinculan simbólicamente el sitio rupestre con el manantial).

## Tras las huellas de los primeros pobladores de América

A lo largo de este artículo he tratado de desenmarañar, parcialmente, la compleja y tupida red de evidencia arqueológica que se entrelaza en el tiempo y el espacio, y le otorga una importancia trascendental a una de las regiones más asombrosas de la península de Baja California: su región central. Este angosto territorio se sitúa entre el apacible Golfo de California con sus aguas tranquilas y tibias, y el impetuoso Océano Pacífico; aquí se eleva una impresionante serie de cordilleras, que, junto con los mares que abrazan la tierra, ofrece interesantes contrastes entre el mar, el desierto y la montaña. Esta diversidad de ambientes proporcionó abundantes recursos de todo tipo, creándose las condiciones óptimas para el desarrollo de poblaciones humanas a lo largo de milenios. ¿Cuántos milenios? Para el sector peninsular no tenemos aún una respuesta contundente, sólo aproximaciones (Gutiérrez y Hyland, 2002), sin embargo para la Isla de Cedros se sabe con certeza que ya estaba habitada al menos 12.000 años atrás (Des Lauries, 2006, 2008, 2010).

La imaginería pintada y grabada es quizás el valor cultural más "llamativo" y conocido de la región, que, además, asume una trascendencia externa o paralela a sus sentidos iconográficos, integrando un elemento fundamental en la configuración del paisaje; asimismo, constituye un importante desarrollo cultural que extiende el campo del significado más allá del panel rupestre y del sitio para considerar el extenso contexto de la geografía social. Su producción fue tan masiva y su diversidad tan "abrumadora" que hay motivos para reflexionar acerca de que la práctica de grabar y pintar pudo haberse originado milenios atrás. Cabe destacar la gran cantidad de yacimientos de petrograbados que conforman parte de esta red semiótica relacional y referencial, algunos de los cuales han recuperado completamente la patina en el lugar donde fue desplazada la corteza pétrea para perfilar la imagen grabada. En estos sitios se percibe una existencia añeja.

El objetivo de este escrito ha sido mostrar algunos lugares de México donde se ha encontrado evidencia arqueológica muy antigua, relacionada tal vez con la llegada de los primeros pobladores al continente americano; a la vez se ha argumentado que por sus características y ubicación geográfica, estos sitios originados durante el Pleistoceno Terminal y el Holoceno (Arcaico temprano, medio y tardío) están vinculados, al menos espacialmente, a excepcionales tradiciones de arte rupestre: de ninguna manera se está equiparando la antigüedad probada de yacimientos arqueológicos fechados o artefactos arqueológicos diagnósticos de esta antigua migración humana, con el surgimiento del arte rupestre, pero es necesario intensificar la investigación de la prehistoria antigua para entender los procesos y ajustes culturales que aquí tuvieron lugar, y dedicar

*Figura 12. Panorámica del paisaje desde la cumbre del volcán La Virgen.*

estudios paralelos en el abundante arte rupestre asociado a estos enclaves del hombre temprano en México. En estos términos, la península media nos ofrece una serie de elementos que permiten hipotetizar acerca de la posible antigüedad de ciertas tradiciones rupestres presentes en esa región.

¿Qué condiciones climáticas y medioambientales prevalecían en la región central peninsular cuando los primeros humanos arribaron a ella? ¿Qué impresión les causó el peculiar paisaje de montaña, planicie y mar que se extendía en todas direcciones? Una vez que se haya profundizado en la prehistoria antigua de la región, será posible responder a la primera pregunta; la respuesta a la segunda es todo un reto e implica tomar en cuenta la aproximación fenomenológica (véase Gutiérrez, 2013, pp. 37-58).[11]

En otro lado se ha propuesto que es necesario recrear un modelo del mundo antiguo que estudiamos:

> a través de la deconstrucción de elementos esenciales de la materialidad del pasado que están cargados de sentido y significado y que, además, son potencialmente productivos para entrever la naturaleza de la relación de las personas y la de los lugares que habitaron, y cómo experimentaron su cotidianeidad y entendieron su existencia (Thomas, 1995, p. 28). (Gutiérrez, 2013)

Por supuesto, esto no significa que logremos conectarnos al pensamiento de esos hombres desaparecidos, sin embargo, considero que mientras más capaces seamos de percibir la materialidad del mundo antiguo como producto de la experiencia inmediata, la toma de conciencia y la acción humanas, y entendamos que los vestigios que estudiamos son portadores de intenciones, ideas y reflexiones de quienes los crearon, más nos acercamos a la posibilidad de "ensayar la recreación de pensamientos afines a los de las sociedades pretéritas; esto podría ser un hilo conductor para develar una realidad paralela que al menos, nos aproxime a su conocimiento" (Gutiérrez, 2013, p. 39).

Los grupos humanos que arribaron a la península durante el Holoceno eran portadores de una "estructura" que incluyó sus tradiciones culturales, organización social, conductas, acciones, memoria y pensamientos; sin embargo, la propia evolución de las personas y los paisajes ha desvanecido casi por completo los indicios de los componentes de esa "estructura", y sólo la percibimos de manera fragmentaria, lo que en ocasiones la hace aparecer como algo "inexistente".

Para Giddens (2006, p. 396), la estructura alberga parcialmente la noción de la materialidad, pero también aquella que involucra las relaciones sociales; ambas son generadas por conductas y acciones, que tienen lugar en un tiempo y un espacio, y no en otro. Identificar la estructura de esta sociedad puede ser viable a través de la búsqueda de sus "huellas mnémicas",[12]

11 En palabras de Heidegger (1953, p. 44), fenomenología significa "hacer ver desde sí mismo aquello que se muestra, y hacerlo ver tal como se muestra desde sí mismo".

12 Gidddens (2006, p. 395 y 396, citado en Gutiérrez, 2013: 53) entiende la Estructura como "el elemento y el resultado de la conducta que ella organiza recursivamente" y que sólo es posible rastrear a través de sus huellas mnémicas "es la base orgánica de un entendimiento humano, actualizada en una acción".

cuyos rastros se han desvanecido casi por completo; sin embargo, estos escasos y difusos vestigios constituyen razón suficiente para continuar la investigación arqueológica regional y, ante la levedad de la evidencia, será importante buscar "apoyo fenoménico para fijar la mirada en el Mundo" (Heidegger, 1953, p. 62), en este caso en un mundo muy antiguo:

> Buscar apoyo fenoménico para fijar la mirada en el mundo, resulta una posibilidad muy tentadora y enriquecedora, que induce a tomar conciencia, sentir y pensar en situaciones, sujetos y objetos que antes no importaron, o que incluso pasaron desapercibidos. Esta experiencia conlleva un redescubrimiento de nuestros sentidos y la posibilidad de desarrollar nuestras atrofiadas capacidades sensoriales, lo que puede resultar muy estimulante y aleccionador, y lo más importante, puede llevarnos a experimentar, en la actualidad del mundo bajo análisis, visiones, situaciones e intencionalidades de ese mundo antiguo. La cotidianeidad del vivir-habitar el mismo espacio, permite entrever, intuir sutilmente, parte de esa lejana realidad (Gutiérrez, 2013, p. 40).

## Conclusiones

Como señalé anteriormente, la península media es el reservorio de una serie de elementos y vestigios que, me parece, no están aquí por casualidad: la presencia dominante de los volcanes y su percepción a la distancia, los yacimientos de obsidiana y pigmentos minerales que están "bajo sus dominios", los abundantes afloramientos de basaltos de extraordinaria calidad, la presencia, hasta cierto punto "recurrente", de puntas Clovis en contexto insular y peninsular y la antigüedad probada mediante fechamiento por radiocarbono en depósitos arqueológicos de la Isla de Cedros (12.000 años AP), donde dos de estas arcaicas puntas han sido encontradas (Des Lauries, 2011, p. 168). Si a esto añadimos la abundancia de recursos alimenticios de todo tipo que permitía asegurar la subsistencia a lo largo del año en este aparentemente "riguroso" medio ambiente, entonces estamos ante un escenario ideal para indagar el porqué de las peculiares características de la evidencia arqueológica que aquí se concentra.

Hasta el momento, el recuento total de puntas Clovis encontradas en esta región es el siguiente: dos en la Isla de Cedros (Des Lauries, 2010), cinco en el área de los Ranchos San Joaquín (Aschman, 1952) y El Batequi (Gutiérrez y Hyland, 1994; Hyland y Gutiérrez, 1996; Gutiérrez et al., en prep.), una en la Sierra de San Francisco (Gutiérrez y Hyland, 2002) lo que da un total de ocho.[13] Una de las Clovis recientemente encontradas en las inmediaciones del rancho El Batequi, (Gutiérrez et al., en prep.) es de obsidiana, y a pesar de que aún no se ha realizado su análisis químico, todo parece indicar que el yacimiento del que proviene es el del Valle del Azufre. Se podría argumentar que esta concentración de evidencia arcaica en la media península, puede ser el resultado de que se trata de una de las áreas más investigadas de la región, sin embargo, no podemos descartar que desde el Holoceno temprano aquí se dieron condiciones óptimas, para que las personas moraran estas tierras temporal o permanentemente.

Des Lauries hace una interesante reflexión en torno a los hallazgos extremadamente insólitos de este tipo de puntas en las costas de California y en la parte central de la península de Baja California, especialmente, en la Isla de Cedros:

> The seemingly „out-of-place" context for these points was noted decades ago by Rogers 1966) in reference to a smattering of fluted points recovered from „San Dieguito" 67; Warren and True 1961) sites in the Southern California deserts. These Alta California sites –and Rogers's concept of San Dieguito– were much more closely linked to what would today be referred to as some variant of the many stemmed point traditions, so common in the culture histories of the Far West (Bryan 1980; Faught 2008; Haynes 2007:256; Willig and Aikens 1988). The absence of Pleistocene megafauna, the atypical coastal/insular location, and their apparent association with a maritime-focused economy all combine to place these examples of fluted points in contradiction to common assumptions of strict association with big-game-hunting, high mobility foraging groups (Des Lauries, 2010).

Como señalé anteriormente, prueba irrefutable y destacada de la presencia milenaria del hombre en Isla de Cedros son los fechamientos AMS obtenidos de muestras provenientes de dos depósitos excavados en el sur de la Isla, lo que demuestra la presencia de isleños ocupando este territorio desde épocas muy remotas. Es muy posible que desde entonces los isleños realizaran expediciones hacia la cercana costa occidental de la península y, ¿por qué no?, tierra adentro, hacia las montañas, y allende éstas, hasta el campo volcánico Tres Vírgenes, lugar donde se localizan los yacimientos de obsidiana y pigmentos

13 Existe una novena punta Clovis completa, realizada en cuarzo cristalino y que fue donada por un coleccionista privado al Museo Regional de Antropología e Historia de La Paz, B.C.S. A decir del donante, la punta fue encontrada en alguna parte de los llanos de Hiray, al norte de Cd. Constitución,, mucho más al sur de la región que nos ocupa (Zuñiga de La Toba, com.per.).

referidos con anterioridad. Es muy significativo que la punta Clovis de El Batequi muestre una fuerte similitud tipológica y de dimensiones con las puntas acanaladas isleñas.

Indudablemente, a 62 años del hallazgo y reporte de la primera punta Clovis de la región (Aschmann, 1952), tener el reporte de siete puntas acanaladas más en esta muy localizada región de la península central viene a reafirmar el interesante enigma que rodea a esta antigua industria lítica del continente americano y en particular nos hace reflexionar el porqué de su "relativa frecuencia" en el contexto geográfico, peninsular e insular al que me he referido. Des Lauires señala muy acertadamente lo siguiente:

> If the bearers of the Clovis tradition were, in fact, highly mobile, terrestrially focused foragers, then the archaeological traces of such groups on the Peninsula may represent short-term forays into uncharted territory that did not ultimately lea to extensive colonization by follow-on groups practicing similar strategies. They came, they saw, they left. Conditions may not have been suitable, or sustainable, for groups with narrower technological requirements and subsistence strategies. The actual initial colonization of the Peninsula, whether earlier, contemporary, or later than Clovis, would therefore have been accomplished more effectively by technologically flexible, broadly skilled opportunists (Des Lauries, 2011: 174)

No obstante, es necesario contar con más información. Conforme se profundice en la investigación de la Prehistoria antigua de la península media, a través de proyectos arqueológicos multidisciplinarios de mediana y larga duración y se establezcan las estrategias para que sean encontrados esos elementos que permanecen *encubiertos* por la propia evolución del paisaje, dilucidar todas estas interrogantes será más fácil y productivo. Es necesario estudiar esta región a través de la investigación puntual de sitios que presentan un gran potencial para encontrar contextos sub-superficiales inalterados, que corroboren la antigua presencia de estos migrantes milenarios que arribaron a América e hicieron un alto temporal, o bien se establecieron en la región y que permitan trazar con rigurosa cientificidad, su trayectoria por estas tierras y/o su navegar por estos mares, durante el Pleistoceno terminal y los inicios del Holoceno por lo menos desde 12.000 AP.

Asimismo, es necesario avanzar en la investigación arqueológica sistemática, pero *regional* de espacios peninsulares prácticamente desconocidos, los cuales se ubican aproximadamente al norte del paralelo 28° y al sur del paralelo 26°10'; esto es de importancia trascendental para complementar la información fragmentaria con la que se cuenta, y así lograr una comprensión más acabada de los primeros colonizadores del continente americano y las rutas que tomaron para concretar su aventura migratoria, la cual definitivamente diversificó sus destinos y, con ello, las posibilidades de arraigarse o no a la tierra, de acuerdo con las oportunidades que estos territorios desconocidos les ofrecían. Quienes se quedaron, renovaron su equipo tecnológico a través de desarrollos locales que derivan de la tecnología de puntas acanaladas y otro tipo de artefactos primigenios.

Otro asunto que debe ser abordado es la depuración de la cronología del arte rupestre de esta región, mediante dos procesos: la excavación de sitios pictóricos cuyo arte rupestre ha producido fechas de gran antigüedad, con el objetivo de encontrar evidencia fechable de la actividad pictórica (Watchman et al., 2002); de este modo será posible vincular la antigüedad de la ocupación de los sitios rupestres con el evento pictórico. Asimismo, es esencial que se continúen aplicando nuevas metodologías de datación directa AMS en paneles que ya han sido fechados, y otros que tengan potencial para la obtención de fechas antiguas, esto para corroborar los primeros resultados cronológicos obtenidos o desecharlos por posible contaminación. Por supuesto, el panel rupestre de "El Viejo" del Cañón del Azufre, deberá ser estudiado exhaustivamente; este sitio es clave para indagar las razones que los indígenas tuvieron para significar de esta manera portentosa este pequeño abrigo rocoso.

Ascender el volcán y observar los mares, desiertos y montañas que lo rodean, me permitió experimentar el paisaje desde otra perspectiva. Antes sólo había observado la visión panorámica de este paisaje y sus volcanes desde el sentido opuesto: las cumbres elevadas de las sierras circundantes (figura 12). Pero desde aquí, tuve la sensación de estar en el centro de una organizada aunque enigmática tierra, donde cada lugar "natural", localidad arqueológica y panel rupestre formaron parte de diversas narrativas que, desafortunadamente, aún no se pueden desentrañar del todo, pero que igual es posible distinguir, aunque vagamente. El paisaje entonces se dinamiza y se reconoce como la entidad que estructuró las prácticas sociales y al mismo tiempo fue estructurado por la acción humana de morar el mundo (Gutiérrez, 2013).

Los volcanes eran visitados periódicamente por los indígenas para abastecerse de obsidiana y de pigmentos. Es posible que estas fuentes tuviesen significados mitológicos. El abrigo rocoso con pinturas rupestres puede ser considerado un lugar sagrado, quizás de peregrinaje, donde se realizaban actos de veneración hacia las fuerzas naturales o divinas que encontraron aquí recurrente manifestación: temblores frecuentes, géiseres, aguas termales, el borrego cimarrón, la obsidiana y los apreciados

pigmentos. Especialmente estos últimos ocuparon un importante lugar en el mundo de la vida indígena, pues fueron esenciales para desarrollar la práctica de la pintura corporal y la producción de las abundantes pinturas rupestres de la región.

Por otro lado, existe evidencia adicional que demuestra la importancia que tuvieron los volcanes en la formación de estas identidades, especialmente con respecto a la elaboración de pinturas rupestres: el origen "mítico" de los pigmentos, el cual en muchos pueblos es relacionado con la "sangre de los ancestros". Atribuirle poderes a las montañas y sus lugares sagrados demandó el uso de objetos simbólicos, en este caso las pinturas del pequeño abrigo rocoso, las cuales fueron esenciales en la construcción cultural de este paisaje.

Las dinámicas de este proceso pueden ser comprendidas más claramente a través de un enfoque sobre el papel que jugaron como agentes sociales, estos prominentes rasgos del paisaje y los seres físicos y espirituales que "los moraban": ellos "forzaron" la realización de peregrinaciones hacia sus dominios, "permitieron" el acceso a sus dones y las personas retornaban simbólicamente a sus orígenes. Entonces, los nativos pudieron pintar sus cuevas y sus cuerpos con los pigmentos, "sustancia dadora de vida de sus ancestros" que bien pudo haber sido considerada una reliquia.

En este orden de ideas, si los indígenas peregrinaban hacia el cañón para el acopio ritual del pigmento, y si el yacimiento de obsidiana se encuentra a tan solo 3,5 kilómetros del cañón, y dicho yacimiento tiene una probable explotación de por lo menos 11.000 años, entonces se propone la hipótesis de que el yacimiento de pigmentos fue aprovechado en la misma época. No es posible definir si los pigmentos extraídos eran para hacer pintura rupestre, o para realizar la práctica de la pintura corporal, muy común entre este tipo de sociedades pretéritas y practicada por muchos pueblos originarios que aún subsisten. En síntesis, la posibilidad de que el inicio de explotación de ambos yacimientos fuese contemporáneo no puede ser descartada del todo. Probarlo resulta complicado, pero siempre quedará como un postulado difícil de desechar. Si se pudiese saber con certeza cuándo empezó la explotación de los pigmentos del Cañón del Azufre, entonces, la antigüedad que se ha obtenido del fechamiento de algunos sitios Gran Mural sería congruente pues quedaría en el margen de aprovechamiento del yacimiento de pigmentos del citado cañón.

Y es que cuando uno se acerca a los volcanes desde las planicies desérticas occidentales, desde una gran distancia es posible apreciar el rojo intenso del cañón, que "se muestra" con persistencia. Es lógico pensar que las expediciones de los nativos a los dominios de los Volcanes para el acopio de la obsidiana, eran aprovechadas también para recolectar el pigmento mineral, esencial para pintar sus cuevas y sus cuerpos.

Finalmente, Los Volcanes y los lugares codificados que se encuentran interrelacionados en el vasto espacio de sus dominios, representan un claro ejemplo de cómo estos pueblos se relacionaron con su entorno no-humano a través de signos naturales; las personas no sólo establecían relación y comunicación con sus semejantes y con "los otros", o bien evadían a estos últimos, sino que también era posible relacionarse con seres inanimados de diversa índole y poder o, también, evadirlos (Gutiérrez, 2013)..

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# Conservation of Palaeontological Sites in Mexico: Legal, Research and Communication Measures for Integrated Approaches

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## Resumen

**En México, el patrimonio paleontológico está conformado por los bienes (colecciones y yacimientos) que representan la evidencia del pasado geológico y biológico del país. A partir de la adición del Artículo 28bis a la Ley Federal de Monumentos y Zonas Arqueológicas, Artísticos e Históricos, así como de la modificación de la Ley Orgánica del Instituto Nacional de Antropología e Historia, es competencia de esta institución la investigación, la conservación, la protección y la difusión de este singular patrimonio.**

**Con el objetivo de poder dar cumplimiento a esta nueva tarea, el INAH convocó en 1994 a la formación de un consejo consultivo en materia paleontológica donde se reunió a especialistas que representaban a la institución académica y que a nivel nacional desarrollaban investigación en la materia. Estos especialistas elaboraron una propuesta de procedimientos para el desarrollo de las investigaciones paleontológicas, las actividades educativas y turísticas en los yacimientos paleontológicos, los criterios para el resguardo de los materiales paleontológicos y las colecciones, así como del registro de localidades y la protección de éstas; además de establecer las definiciones que permitieran establecer límites entre los bienes arqueológicos así como los fósiles que tienen una utilidad industrial.**

**En la actualidad, a través del Sistema Único de Registro Público de Monumentos y Zonas Arqueológicas e Históricos, se tiene el formato de inscripción tanto de colecciones como de localidades paleontológicas. Asimismo, se ha comenzado con la delimitación de localidades paleontológicas para con ello establecer criterios de protección y conservación tanto de los fósiles como de su yacimiento.**

**En cuanto a las actividades de turismo ecológico-cultural, se ha comenzado con la regulación de localidades paleontológicas que cuentan con visita pública no regulada. Para ello se está trabajando en el desarrollo de los planes de manejo adecuados al contexto del paisaje y de las características del yacimiento, pero sobre todo en la recuperación de la información académica generada por los investigadores que los estudiaron, así como el seguimiento de dónde se encuentra resguardado el material recuperado.**

**Así, a casi 30 años de asignar a una institución que velara por la regulación de la investigación, la conservación, la protección y la difusión del patrimonio paleontológico en México, no se han podido establecer al cien por ciento los mecanismos para hacerlo a nivel nacional. Por ende, sólo la difusión de los casos, así como los éxitos y fracasos de todo el proceso, permitirán establecer los procedimientos de gestión en todo el país.**

## Introducción

**El territorio que actualmente forma México tiene una historia geológica compleja, aspecto que tiene consecuencias en su geografía, su fisiografía y la gran riqueza biológica que posee (Arroyo-Cabrales et al., 2008) (figura 1). Para analizar esta complejidad histórica, actualmente se está empleando la unidad espacial denominada provincia morfotectónica y con ello comprender el desarrollo de procesos como la evolución, la migración, la especiación y la extinción de muchos taxa en conjunto con el registro fósil (Ferrusquía-Villafranca, 1993, 1998; Ferrusquía-Villafranca et al., 2010) (figura 2).**

**Los fósiles, definidos como cualquier evidencia de vida preservada en las rocas, son una fuente de información muy importante para comprender el desarrollo y la evolución de la vida en la Tierra. Dadas las etapas a las que se ven sometidos los restos originales de los organismos desde su muerte hasta su preservación en las rocas, y al ser recuperados como consecuencia de los procesos de erosión, cada fósil es único y no sustituible (Aguilar Arellano y Polaco Ramos, 2006).**

**En el país, el registro fósil que se encuentra preservado es diverso y de amplia temporalidad, aproximadamente desde hace 1.600 millones de años hasta finalizar el Pleistoceno (10 mil años antes del presente) (Mirambell et al., 1988) (figura 3). Gran parte del trabajo paleontológico ha estado vinculado a la exploración de recursos mineros y energéticos y al conformarse grupos de investigación en instituciones académicas se han desarrollado indagaciones específicas según el grupo biológico de interés.**

*Figura 1. Mapa de México mostrando las características de su relieve. © CONABIO (2003).*

## El aspecto legal, la protección de los fósiles

Si se considera que la tradición paleontológica en México comenzó a finales del siglo XIX (Gío-Argáez, 2004) se esperaría que existieran leyes y reglamentos que regularán las actividades y se contemplara un estado de protección; sin embargo, esto no sucede de manera explícita (Carreño y Montellano-Ballesteros, 2005), salvo en la Ley General de Bienes Nacionales (Artículo VI, apartado XVIII), donde se indica que las colecciones de piezas paleontológicas forman parte del patrimonio nacional (Aguilar Arellano y Polaco Ramos, 2006; Cristín y Perrilliat, 2011).


*Figura 2. Regiones en las que se divide México considerando su historia geológica, paleontológica y ambiental.*

Así, es hasta el 13 de enero de 1986 que se publica en el Diario Oficial de la Federación la adición del Artículo 28bis de la Ley Federal sobre Monumentos y Zonas Arqueológicas, Artísticos e Históricos, que a la letra dice (INAH, 1995):

> Para los efectos de esta Ley y de su Reglamento, las disposiciones sobre monumentos y zonas arqueológicos serán aplicables a los vestigios o restos fósiles de seres orgánicos que habitaron el territorio nacional en épocas pretéritas y cuya investigación, conservación, restauración, recuperación o utilización revistan interés paleontológico, circunstancia que deberá consignarse en la respectiva declaratoria que expedirá el Presidente de la República.

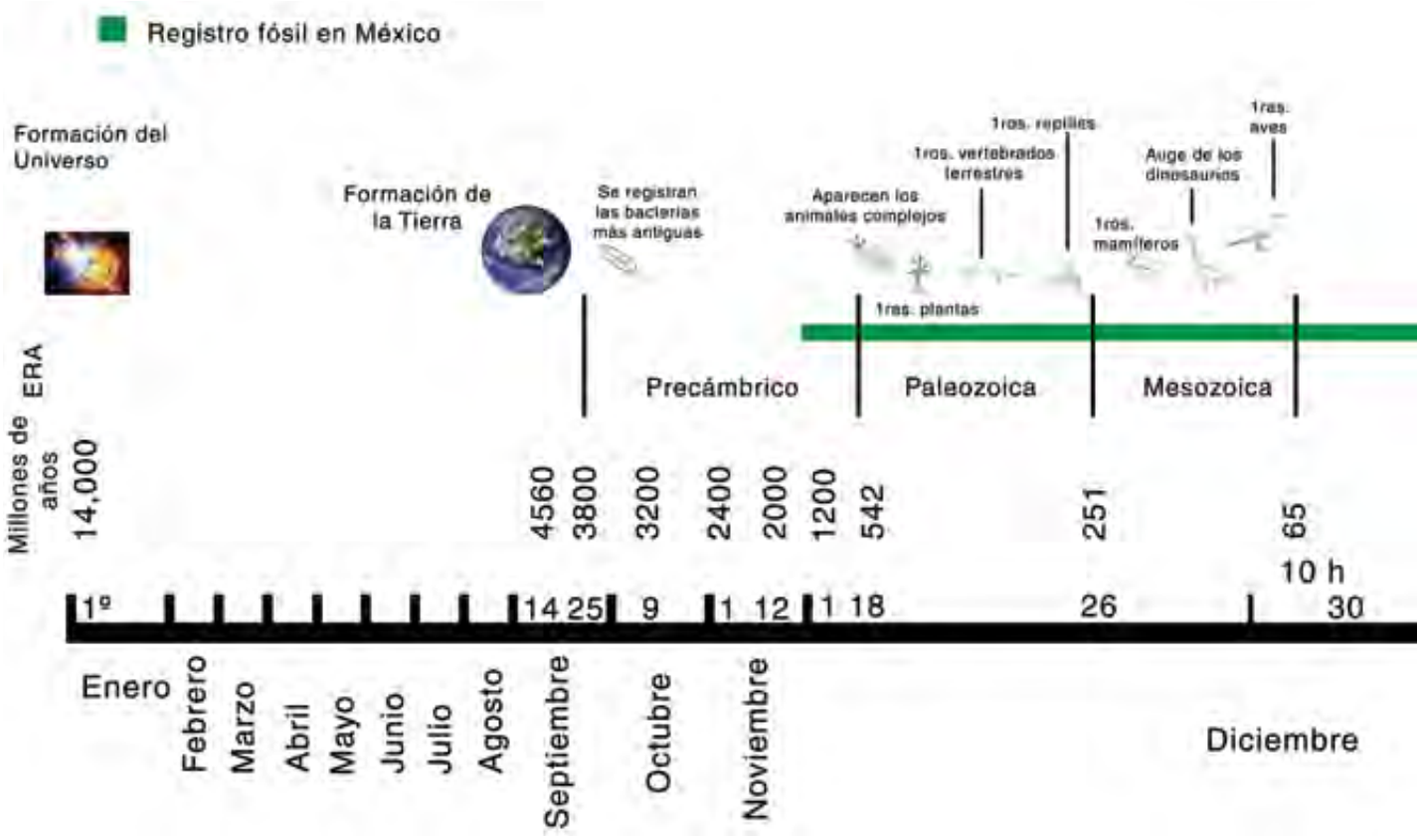



*Figura 3. Escala del Tiempo Geológico, mostrando el registro fósil presente en México y un comparativo con un año. Se resaltan los eventos biológicos principales. Gráfico elaborado por Felisa J. Aguilar Arellano, 2011.*

Es entonces que se le da una protección jurídica al patrimonio paleontológico al equipararlo con el arqueológico (Aguilar Arellano y Polaco Ramos, 2006). Asimismo, a partir de la misma fecha, al modificar la Ley Orgánica del Instituto Nacional de Antropología e Historia (INAH), el patrimonio paleontológico queda bajo la jurisdicción de la Secretaría de Educación Pública (SEP) a través del INAH, con los objetivos de proteger, conservar, restaurar, recuperar, promover y difundir este patrimonio (Aguilar Arellano y Polaco Ramos, 2006; Carreño y Montellano-Ballesteros, 2005).

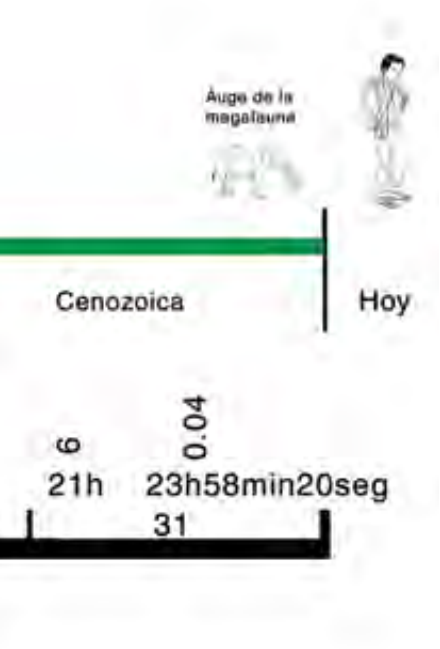
Estas nuevas tareas, tanto en la comunidad académica externa como en el interior del INAH, fueron discutidas con especial énfasis en las diferencias entre el patrimonio paleontológico y el arqueológico, tales como la distribución temporal, la espacial, el estado de propiedad, la unicidad de los monumentos y su integración como parte del patrimonio cultural (García-Bárcena, 1986), lo que complicaba su equiparación en términos jurídicos con el arqueológico (Mirambell et al., 1988). En su momento, el Ingeniero Joaquín García-Bárcena (1986) realizó un documento analizando los pros y contras de la nueva asignación indicando que

> el poder legislativo decidió que el patrimonio paleontológico deberá estar bajo la responsabilidad del INAH, con la distorsión en sus funciones que esto implica; por tanto, mientras la legislación vigente no cambie, el INAH deberá de tomar las medidas para cumplir adecuadamente con esta nueva función que le ha sido asignada.

De esta forma, el INAH creó el Consejo Nacional de Paleontología, un órgano consultivo, que tenía como uno de sus objetivos el crear un reglamento propio para el patrimonio paleontológico (Amador, 2005; Carreño y Montellano-Ballesteros, 2005). La constitución del mismo consistió en reunir a un grupo multidisciplinario e interinstitucional mediante invitación del director del INAH a las instituciones de educación superior e investigación involucradas con dicho patrimonio (cuadro 1), comenzando sus labores en mayo de 1994.

Tras un consenso de sus integrantes, este órgano generó definiciones sobre los diferentes tipos de fósiles, así como sobre la regulación de actividades de investigación y económicas rentables. Finalmente, aprobó un proyecto de disposiciones reglamentarias para la aplicación del Artículo 28bis (García-Bárcena et al., 1995).

El documento generado establece en 48 artículos los criterios de protección durante la investigación y otras actividades en localidades o zonas paleontológicas, sobre el tipo de materiales (al diferenciar los fósiles en esenciales y extraordinarios) y




*Cuadro 1. Instituciones que formaron el Consejo Nacional de Paleontología, órgano consultivo del INAH, en 1994.*

| Institución | Cargo |
|---|---|
| Instituto Nacional de Antropología e Historia | Presidente y dos vocales |
| Universidad Nacional Autónoma de México | Vocal |
| Universidad Autónoma de Baja California | Vocal |
| Instituto Politécnico Nacional | Vocal |
| Universidad Autónoma de Nuevo León | Vocal |
| Instituto Mexicano del Petróleo | Vocal |
| Sociedad Mexicana de Paleontología, A. C. | Vocal |

su resguardo en colecciones (científica, no científica institucional, no científica privada y de enseñanza), así como el registro y la protección de las localidades y zonas paleontológicas. Este documento sirvió de base para una propuesta de ley que protegiera el denominado patrimonio paleontológico conservable, es decir, aquellos vestigios o restos de seres orgánicos que no se utilizan en la industria y no se encuentran asociados a un contexto cultural (Aguilar y Polaco, 2005). Dicha ley fue presentada ante la Comisión de Cultura de la LVII Legislatura del Senado de la República y turnada a la Cámara de Diputados, por lo que aún sigue en proyecto (Amador, 2004a; Carreño y Montellano-Ballesteros, 2005).

De manera paralela, el INAH ha venido trabajando en la salvaguardia del patrimonio paleontológico a través de la aplicación del concepto "protección por convicción", fomentando en la población el valor que tienen los fósiles no sólo como fuente de información sobre el pasado, sino como promotores de identidad al ser parte de la herencia cultural y natural local (Aguilar Arellano y Polaco Ramos, 2006, 2009).

## El registro, las colecciones y las localidades paleontológicas

A partir de 2009, dos aspectos han sido retomados por el INAH: la situación del resguardo de los materiales paleontológicos y sus colecciones (tanto las particulares como las institucionales), así como el registro y la protección de las localidades paleontológicas. Estas actividades han sido encomendadas a la Dirección de Registro Público y Monumentos y Zonas Arqueológicas del INAH, como lo marca la Ley Federal sobre Monumentos y Zonas Arqueológicas, Artísticos e Históricos (INAH, 1995), que las realiza con apoyo de los especialistas en el área de paleontología de la misma institución (e. g. Aguilar y Porras-Múzquiz, 2009) como aquellos adscritos a instituciones de educación superior, tales como la UNAM.

Con el registro de las colecciones paleontológicas, se da fe pública de la existencia física de los bienes paleontológicos, ya que es la primera medida académico-legal destinada a preservar los bienes únicos y no renovables (Martínez-Muriel, 2009), además de asignar la responsabilidad legal de la custodia y protección de los fósiles que la componen al responsable de la misma (Cristín y Perrilliat, 2011).

En el caso de las localidades paleontológicas, uno de los criterios empleados para iniciar su registro son aquellas que son empleadas como atractivos turísticos y que cuentan con visita pública no regulada (Amador, 2004b; Expedición, 2005; Aguilar Arellano y Polaco Ramos, 2006, 2009) (figura 4) o bien que pueden ser afectadas por el crecimiento urbano. Inicialmente se tomó la cédula de registro empleada para los sitios arqueológicos, anexando la descripción de las evidencias paleontológicas presentes in situ, y en la actualidad ya se cuenta con una definida para tal patrimonio. Se está exhortando a los investigadores a que hagan el registro de sus localidades para contar con una base de datos que permita en su momento ayudar en la planeación de proyectos de rescate o salvamento, como ocurre con lo arqueológico.

*Figura 4. Vista de la localidad de dinosauricnitas Las Águilas, Porvenir de Jalpa, General Cepeda, Coahuila, México.*

También se ha iniciado la delimitación de zonas paleontológicas, siguiendo los aspectos técnicos involucrados en la elaboración de las poligonales de las zonas arqueológicas: 1) elección de la localidad, 2) delimitación (definición del área paleontológica con el trazo de la poligonal envolvente), 3) la formación del expediente técnico, y 4) la elaboración de la propuesta de declaratoria (Escartín Adam, 2009). Por lo menos en Coahuila ya se cuenta con dos poligonales de protección para localidades paleontológicas (Aguilar, 2012a) (figura 5), y en el caso de una de las localidades tanto el trazo de la poligonal como el expediente técnico sirvieron de base para la elaboración del Decreto Estatal de Área Natural Protegida con carácter de zona paleontológica (Aguilar, 2012b).

Hoy en día, a través del Sistema Único de Registro Público de Monumentos y Zonas Arqueológicas e Históricos, se tiene el formato de inscripción tanto de colecciones como de localidades paleontológicas, con lo que se espera incrementar el interés de particulares y de instituciones en el registro de colecciones y localidades para salvaguardar la riqueza paleontológica que el país posee.

*Figura 5. Panorámica de la localidad paleontológica Rincón Colorado, General Cepeda, Coahuila, México, primera en contar con un decreto estatal de zona paleontológica. © José Luis Gudiño Maussán, 2012.*

## Perspectivas

En la actualidad, los recursos paleontológicos del mundo están desapareciendo rápidamente como consecuencia del desarrollo económico, la construcción, la industrialización, el vandalismo y la recolecta continua de fósiles por profesionales y aficionados, así como por la ambición de algunos colectores comerciales (Lipps, 2009).

Aunado a estas causas se suma la falta de una cultura de protección de dichos bienes, que debería ser considerada como una "pérdida de biodiversidad". En los países en desarrollo, dos de los factores principales que propician esta situación son la falta de principios éticos que rijan el trabajo tanto profesional como aficionado, y la corrupción, aspecto que ya está siendo ampliamente discutido (Smith et al., 2003).

Si bien existe ya una preservación de los especímenes colectados en colecciones científicas y museos, es necesario dar fe legal de la existencia de las mismas, pero sobre todo un seguimiento para que éstas no desaparezcan.

En el caso de las localidades paleontológicas, a nivel mundial se están desarrollando estrategias para la protección y conservación de los restos paleontológicos, principalmente al asociar la investigación científica con áreas como la educación, la recreación y el turismo, o bien utilizando las figuras de paleoparques (Lipps, 2009), de zonas paleontológicas (Andrés Moreno, 2006), además de interrelacionar la protección de este patrimonio junto con planes que involucren al medio ambiente (Montes Lasheras, 2006) y a la población que vive con dicho patrimonio (Muñoz Collazos, 2006). Estas experiencias, en general exitosas, se han implementado ya en China, España, Estados Unidos, Francia, Nueva Zelanda y Turquía (Aguilar, 2012a).

Así, a casi 30 años de asignar al INAH la regulación de la investigación, la conservación, la protección y la difusión del patrimonio paleontológico en México, no se han podido establecer al cien por ciento los mecanismos necesarios para hacer tal cosa a nivel nacional. En este sentido, sólo la difusión de los casos, así como los éxitos y fracasos de todo el proceso, permitirán establecer los procedimientos de gestión en todo el país y estar a la par del proceso de conservación de este singular patrimonio a nivel mundial.

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# The First Colonization of Brazil: A Review of the Pleistocene-Holocene Transition, Chronologies and Routes

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In the Pleistocene-Holocene transition, the eastern lowlands of South America had already been occupied by hunter-gatherer populations that developed diversified strategies to adapt to the transformation of the landscape. In chronological terms, such diversity involves an initial occupation earlier than those assumed by traditional models. Radiocarbon dating that supports the hypothesis of a Pleistocene initial settlement of South America have been obtained for several archaeological sites in Brazil; but the validity of these data has been questioned, as they pertain to isolated contexts whose discrete characteristics make it difficult to identify any association with human activities (Dias, 2004; Dias and Bueno, 2013; Bueno, 2011; Bueno et al., 2013; to additional critical analysis to Brazilian Pleistocene sites, see also Meltzer et al., 1994; Prous, 1997; Schmitz, 1987, 1990).

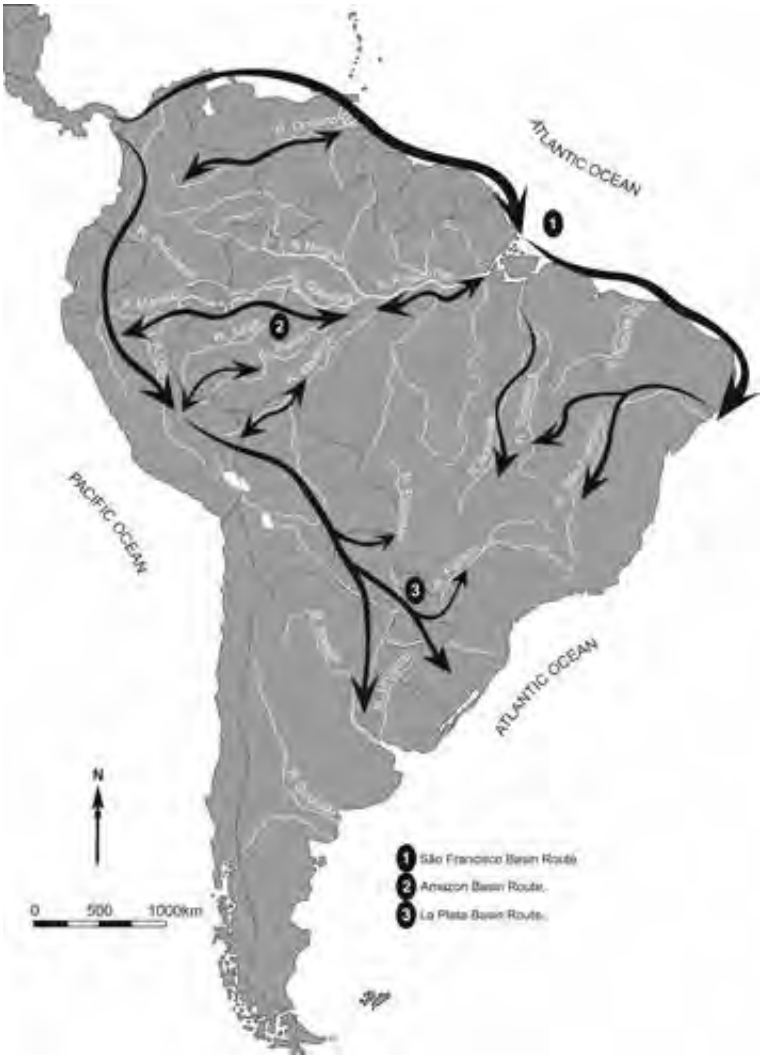


*Figure 1. Hypothetical main routes for the initial colonization of the eastern South American lowlands. Dias and Bueno, 2013, p. 351.*

Likewise, some models suggest that the pioneer colonization route of eastern South America occurred mainly through the Atlantic Coast, and the dispersal movements into the interior happened only in the Early Holocene, when the environment became more productive (Araújo et al., 2012; Dillehay, 2000; Dillehay et al., 1992; Dixon, 2001; Miotti, 2003, 2006; Miotti and Salemme, 2003). These models generally consider the geographical conditions of the Atlantic shore as a facilitating agent for pioneer population movements, and to some extent assume that the presence of tropical forests in the north of South America constituted an ecological barrier that inhibited an ancient human presence. However, recent archaeological, bio-anthropological and palaeoenvironmental research suggests that the process of initial colonization of the South American eastern lowlands entailed multiple strategies that included ancient inland routes related to the exploitation of fluvial settings and forest habitats.

Bueno et al. (2013) document the quantity, quality and distribution of archaeological $^{14}$C dates for Brazilian territory between 13,000 and 8,000 BP. Analysing the resulting database, the authors indicate 277 dating samples for 90 sites distributed all over Brazil. The inclusion criteria for $^{14}$C dates required information be available on: 1) type of material dated, method of analysis and sample lab number; 2) stratigraphic provenience of dated sample; 3) cultural associations (artefacts, features) with the dated sample; and 4) statistical uncertainty of the date (with the additional criterion that the standard error bars should be no greater than 300 years).

The authors analysed the dynamics of population expansion and cultural diversification, and their core hypothesis is that the colonization of the South America eastern lowlands involved two phases: *pioneering* and *establishment*. They may have been

initiated at different times and left distinctive demographic and cultural signatures in the archaeological record. The *pioneering* phase would have involved entering, exploring and gaining familiarity with the landscape, with the selection of specific places as foci of recurrent activity to facilitate exploitation of previously uninhabited lands. This process led to an archaeological record of low average population density, but concentrated in physically distinctive places that could have been frequently re-occupied. Regarding rates of population expansion and regional cultural diversification in inner Brazil, an archaeological threshold seems to have been reached in all occupied regions at *c.* 10,500 $^{14}$C BP. The number of sites increased, as supported by the evidence of settlement of all biomes and, most importantly, there is clear evidence of inter-regional cultural diversity. In this sense, the 11$^{th}$ millennium $^{14}$C yr BP represents the *establishment* phase of the colonization process of Brazil. From the beginning of the Holocene onwards, human populations expanded radially along branching routes and in an increasing range of locations, as part of a process of social and cultural construction of a landscape whose geographical structure was now familiar. There is cultural evidence of regional variation, possibly associated with the definition of smaller territories, with greater local density of occupation and regular cycles of annual mobility. The Early Holocene was the first phase of a more permanent settlement of inner Brazil, with delimitation of territorial boundaries associated with a peopling process, which involved multiple routes and dispersal dynamics (Bueno et al., 2013; Dias and Bueno, 2013).

Based on the results of the radiocarbon database and following the original hypothesis of Sauer (1944), Dias and Bueno (2013) suggest at least three main routes for the *pioneering* phase of human colonization of the eastern South American lowlands (Figure 1).

São Francisco Basin Route would be the oldest inland route with dates from the Pleistocene-Holocene transition. Associated with unifacial lithic industries (Itaparica Tradition), it probably was related to another *pioneering* settlement route linking the Caribbean, the northern Atlantic Coast and eastern portions of the Andean Chain. In this route, the São Francisco River may have linked the Atlantic Coast with north-eastern and central Brazil. This process continued in an *establishment* phase of the colonization process during the Early Holocene, with a radial expansion connecting other important hydrographic basins of central Brazil, such as Araguaia-Tocantins and La Plata.

During the early Holocene, a second *pioneering* route through the Amazon basin could have connected the northern Guyana Plateau, Venezuela and Colombia, entering Brazil by the rivers of the northern part of the country and by the lower Amazon. This hypothesis is based on the chronology and stylistic similarities noted between the Guyana and the lower Amazon basin archaeological record. The Brazilian data for this period support the idea of an early adaptation to tropical forests, also confirmed by the Colombian archaeological record. It can also be proposed that this northern route was related to the ancient sites of the middle Orinoco valley and the inland mountains of Colombia. The connection with northern Brazil could have been facilitated by rivers such as the Branco, the Trombetas and the Paru do Leste.

In the early Holocene, a third inland *pioneering* route to south and south-eastern Brazil is represented by bifacial lithic industries with projectile points (Umbu Tradition), which may have followed the fluvial systems of the Paraguay, the Paraná and the Uruguay rivers. Although there is still scant archaeological evidence for this area, the available information in Brazil seems to support the idea that the Bolivian llanos seem to have been a 'hot-spot' for population dispersals into southern South America. In this scenario, the La Plata Basin would have been a primary pathway connecting the east Andes with the Atlantic Coast, and even with the Amazon basin. Towards the mid-Holocene evidence of an *establishment* phase is represented by the growing number of sites in southern and south-eastern Brazil, stimulated by the spreading of the Atlantic Forest biome. It is also possible that this same scenario was present in similar ecological settings in Paraguay and north-eastern Argentina, where the archaeological record for this period still is poorly known.

## The São Francisco Basin Route: The importance of Serra da Capivara and the Peruaçu Regions to Settlement of America Models

The pioneering phase of São Francisco Basin human colonization is represented by the regions of Serra da Capivara and Peruaçu. The location of several contemporary sites in these two areas, thousands of kilometres apart, support the idea that river valleys were one of the first main dispersion routes into the South American interior (Bueno, 2011, 2013; Bueno et al., 2013; Dias and Bueno, 2013).

The Serra da Capivara region is located in Piauí State, north-eastern Brazil. Archaeological research in this area was initiated in the 1970s by a French-Brazilian scientific mission, coordinated by Niéde Guidon (Guidon, 1978). The Serra da Capivara National Park was created in 1979 and has an area of 129,139.9 hectares, with a perimeter of 214.2 km. In 1991 it was inscribed on the UNESCO World Heritage List and in 1998, a proposal was submitted to the UNESCO Tentative List to incorporate three

*Figure 2A. Boqueirão da Pedra Furada site, Serra da Capivara, Brazil © Sirlei Hoeltz, 2010*

*Figure 2B. Boqueirão da Pedra Furada site, Serra da Capivara, Brazil © Sirlei Hoeltz, 2010*

contiguous Permanent Preservation Areas to the Park, with an additional 35,000 hectares (Guidon, 2007; Pessis and Guidon, 2007).

Serra da Capivara National Park spreads over a geological border where an extensive cliff separates the Piauí-Maranhão sandstone plateau from the São Francisco River plain. On both the slopes of the escarpment and the inner valleys, there are many rockshelters with paintings. Sites with rock engravings are also numerous on rock outcrops located on the banks of ancient and now intermittent rivers. The rock art is characterised by anthropomorphic figures and representations of a narrative nature, by compositions illustrating daily life and ritual scenes of the human groups that lived in the region. They also represent very diverse themes, such as dancing and hunting, but also sex and violence depicted in the form of battle, capture and execution scenes (Pessis, 2003; Pessis and Guidon, 2007) (Figure 2).

In the park area there is a record of more than 900 prehistoric archaeological sites, 657 of them with rock art. One of these sites is Boqueirão da Pedra Furada rockshelter, which presents Pleistocene dates. It is associated with a sandstone cliff, carved by waterfalls that contributed to the deposit formation. Between 1978 and 1987 an area of approximately 400 $m^2$ was excavated in the eastern and central portion of this site, revealing thousands of charcoal fragments in all levels, 156 archaeological features (interpreted as hearths) and around 8,000 lithic artefacts, 600 of them in the Pleistocene layers. The rockshelter's sedimentation is the result of two different phenomena: 1) the desegregation of the sandstone wall in the protected portion of the site; and 2) the quartzite pebbles which originated from the upper conglomerate that in times of major precipitations

*Figure 3. Lapa do Caboclo 2, Peruaçu, Brazil ©: Andrei Isnardis, 2014*

are dragged and projected over the slopes of the scarp. Due to the homogeneity of sedimentation there are no macroscopically different levels, but lenses of burnt remains which have discontinuous planimetric development. As a consequence, part of the excavated remains has a poor correlation with the dated structures (Parenti, 1996).

In the 1990s, Guidon and her research team considered that Boqueirão da Pedra Furada rockshelter had reliable radiocarbon dates ranging from 6,150 to 50,000 $^{14}$C yr BP. Two principal cultural phases were identified. The oldest is the Pedra Furada Phase, with 32 radiocarbon dates from the Upper Pleistocene. It is characterised by debris of artefacts and choppers and chopping tools made of locally occurring quartzite and quartz that constitutes the walls of the upper conglomerate of the rockshelter. The Pedra Furada Phase lacks bones, wood and other organic remains, save for diffuse pieces of charcoal; and was divided into three chronological periods: PF1, with dates from 50,000 to 35,000 BP; PF2, with dates from 32,000 to 25,000 BP; and PF3 with dates from 21,000 to 13,000 BP. Additional AMS dates on charcoal and thermoluminescence on burnt quartz pebbles suggest dates between 30,000 and 100,000 BP for the layers PF1 and PF2, but there is no evidence that the heating was related to human activities. The second phase is the Serra Talhada Phase, with 6 radiocarbon dates between 9,500 and 10,400 BP. It is associated with a unifacial lithic industry (Itaparica Tradition), also present in other 15 sites of Serra da Capivara Park, with additional 25 radiocarbon dates between 12,440 and 9,000 BP. It includes artefacts of local quartzite and exotic chert, abundant rock art, human remains, and fire structures (Guidon, 1986, 1989; Guidon and Delibras, 1986; Guidon and Arnauld, 1991; Guidon et al., 1994; Lourdeau, 2010, 2012; Martin, 1997; Parenti, 1992, 1996; Santos et al., 2003; Valladas et al., 2003).

Two other sites from the Serra da Capivara Park present chronological evidence from the Pleistocene-Holocene transition. Toca do Gordo do Garrincho site has a date of 12,210±40 $^{14}$C BP associated with a human tooth articulated in a maxillary fragment and its stratigraphical location, above a stalagmite, provides a secure chronological reference point. At Toca do Sítio do Meio there is a clear stratigraphic association between a charcoal sample dated to 12,440±240 $^{14}$C BP and an Itaparica Tradition lithic assemblage characterised by flakes, cores, scrapers and *limaces* made of siltite, quartz and quartzite. This site has been recently investigated by Eric Böeda and his team, and test excavations reveal dates of 20,280±450 and 25,170±140

$^{14}$C BP for charcoal fragments, but there is no other kind of cultural association to the dates (Böeda et al., 2013; Guidon et al., 1994; Peyre et al., 1998).

The Pleistocene dates of Boqueirão da Pedra Furada site stimulated a broad debate (Guidon et al., 1994, 1996; Meltzer et al., 1994; Parenti et al., 1996; Prous, 1997; Prous and Fogaça, 1999; Schmitz, 1987, 1990); and it results can be compared with two other Pleistocene sites recently investigated in the same area: Vale da Pedra Furada and Toca da Tira Peia (Boëda et al., 2013, 2014; Lahaye et al., 2013). All these sites have the same problematic, unresolved issues: a) a lack of information about the contextual relationship between dated samples and artefacts; b) a lack of specific palaeoenviromental, geoarchaeological and formation process studies for supporting a better understanding of the cultural and natural differences between the occupational phases of the Serra da Capivara region. The methodology of dating is not the main issue here, but the absence of palaeoecological studies on factors other than human activity that could be responsible for the Pleistocene charcoal lenses (Dias and Bueno, 2014).

Another important aspect in this debate is that dates between 50,000 and 100,000 BP for PF1 not only questioned the Clovis Horizon as indicating the initial settlement of the American Continent, but contradicted the accepted evolutionary chronology for the modern human Africa *diaspora.* Important arguments in this debate are offered by the studies of palaeoparasitology on human coprolites found in Boqueirão da Pedra Furada, although it only demonstrated a tendency for coastal patterns of colonization that also included the Bering route (Araújo et al., 2008).

The same chronological controversies occur in relation to the Boqueirão da Pedra Furada rock art. The site has around 1,000 figures on its walls, whose age was first estimated at around 20,000 years ago by association with radiocarbon dates of some rock blocks with paintings discovered during the excavation. However, all the dates have standard error bars of more than 300 years, suggesting contamination: 17,000±400 BP (GIF 5397); 26,300±800 BP (GIF 6309); and 29,860±650 BP (GIF 6651) (Pessis and Guidon, 2007). More controversial data related to dating techniques for rock art in the Serra da Capivara region was published by Watanabe et al. (2003). Using thermoluminescence and EPR dating for calcite formation found on a painting at Toca da Bastiana rockshelter, an age of 35,000 to 43,000 BP was obtained. This paper was strongly criticised by Rowe and Steelman (2003) whose analysis on the same site and other sites in the Serra da Capiva Park indicate a chronology between 3,700 and 1,200 BP for these paintings.

Located in Minas Gerais State, in the south-eastern region of Brazil, the Caves of the Peruaçu Federal Environmental Protection Area and Veredas do Peruaçu State Park are two continuous areas, of 180,702 hectares, that were nominated to the UNESCO

*Figure 4. Santa Elina site, Serra de Araras, Brazil.*

Tentative List in 1998. Peruaçu River is one of the few permanent tributaries of the São Francisco River on its course from sub-humid tropical Savanas's (*Cerrado*) where it started, towards the semi-arid regions (*Caatinga*) of north-eastern Brazil. The Peruaçu River flows through a deep canyon, boarded by high limestone cliffs with caves, holes and secondary galleries. It is crossed by impressive limestone 'bridges' and in some stretches still flows underground through monumental caves.

Archaeological investigations in the Peruaçu region were initiated in 1978, when the first surveys were conducted by Alan Bryan, Ruth Gruhn and Carlos Magno Guimarães. Between 1981 and 1999, André Prous coordinated a French-Brazilian scientific mission in this area that recorded 84 prehistoric sites; mostly rock shelters, 64 of them with rock art. The superposition of drawing in a same panel, associated with radiocarbon dating of layers with pigments and buried fragments of panels, suggests a chronology of production of rock art for between 9,000 and 2,000 BP (Figure 3). Although it is difficult to relate the paintings from different styles with specific cultural occupational periods, cronostylistic studies in Peruaçu and in the near region of Montalvânia suggest that the tradition of painting large panels with geometrical figures made with two or three colours, some of them with more than 15 m high (São Francisco Tradition), began during the Middle Holocene. Later, cultural diversification in this area is represented by other rock art stylistic variations represented by animals (mostly birds and deer) and human beings superimposed on these geometric panels (Stylistic Units Piolho do Urubu and Desenhos) (Isnardis, 2004; Prous and Ribeiro, 1996/1997; Prous and Rodet, 2009; Ribeiro, 2006).

Situated in the centre of the Peruaçu Canyon, Lapa do Boquete Cave is one of the oldest sites in the region. The excavations here occurred between 1988 and 1996 and extended over an area of 150 $m^2$, revealing the existence of nine stratigraphic units which were subdivided into 27 archaeological occupational levels. Units VII and VIII were dated between 12,070 and 9,870 $^{14}C$ BP. These levels have a rich lithic industry, bone instruments, pit structures, hearths, food remains and red pigments. The lithic assemblage from the lower levels is associated with hearth features and is essentially a unifacial industry, classified as the Itaparica Tradition. It consists of large utilised flakes, small cores, thick scrapers, end and side scrapers and *limaces*. A big engraved block with pecked figures, polished grooves and cupules was discovered under the unit VI dated at 9,350±80 BP. An area of 25 $m^2$ was excavated in the western part of the cave, along a large fallen stalactite that constituted a kind of wall. In this area a big anvil used to break nuts and a ball of red pigments occupied the centre of an empty circular area. An accumulation of flint waste was around this cleaned area; and also a fragment of a bifacial projectile point. A deep cylindrical artificial pit, containing an anvil, several bones, a hammerstone, limestone splinters and several retouched instruments, including nearly all the silicified sandstone artefacts of this level were also found in unit VIII. Three combustion structures with charcoal and ash lenses were located on the boundary of this circle and post holes were found at its limits. Most of the subsistence remains were found near or within the hearths; like concentrations of carbonised palm nuts and other plants seeds and bone refuse, as well thousands of half calcinated bivalvia shells and small freshwater molluscs *(Pomacea* and *Limnea)*. Quantitative studies of archaeofaunistic remains of Lapa do Boquete Cave indicate that broad-spectrum hunting strategies were continuous from the Pleistocene-Holocene transition until the Middle Holocene, and mainly focused on medium and small prey, 3 kg or less, such as mocó (*Kerodon rupestres)* and preá (*Cavia aprea*), armadillos *(Euphractus* and *Dasypus)* and reptiles such as teiu (*Tupinambis* sp.) and calango (*Ameiva* sp.). Large mammals such as deer, peccaries and tapirs are also present in the Boquete Cave diet, and there is no evidence of Pleistocene megafaunal exploitation (Fogaça, 2001; Kipnis, 1998, 2002, 2003; Prous and Fogaça, 1999; Rodet, 2006; see also Prous and Ribeiro, 1996/1997; Prous and Rodet, 2009).

Lapa do Dragão rockshelter is the only other ancient Itaparica site in the middle São Francisco Valley, with radiocarbon dates between 10,000±255 and 11,000±300 $^{14}C$ BP. However, no hearth structures have been found in this site and the dates come from isolated charcoal pieces. Located 150 km north of Lapa do Boquete site, in the Montalvânia region, it presents a chert and sandstone industry that includes unifacially retouched quartzite instruments and chalcedony and chert flakes (Prous and Ribeiro, 1996/1997; Prous and Fogaça, 1999).

The occupational sequence of Lapa do Boquete Cave continues through the Holocene. Between 7,000 and 4,000 BP there is a cultural rupture with Itaparica Tradition occupation in Peruaçu region and Lapa do Boquete Cave started to be used as a cemetery, with a similar pattern that characterised Lagoa Santa and Santa do Riacho regions in an earlier period. The individual graves were made in pits whose bottoms were covered with limestone blocks. The bodies were covered with red pigments and accompanied by several kinds of lithic artefacts and adornments in shell and vegetal fibbers. Between 4,000 and 700 BP Lapa do Boquete Cave began to be used for another ritual proposes, related to agricultural societies. Pottery and an expedient lithic industry is found in association with several small pits (caches), with around 2 kg of volume, containing remains of crops, fruits and artefacts made of feathers (Prous and Ribeiro, 1996/1997; Rodet, 2006).

## Via north and west: first evidence of settlement in the Brazilian Amazon and La Plata Basin routes

The first evidence of a pioneering route in the lower Amazon basin is represented by the lowest cultural level of Pedra Pintada rockshelter, with a radiocarbon date of 11,145±135 $^{14}$C BP. This site also has 15 dates between 10,905 and 10,250 $^{14}$C BP associated with cultural evidence of a consistent adaptation to the tropical forest biome, with a broad variety of plant and faunal remains that point to the preferential exploitation of fish, bivalve molluscs, turtles, birds, rodents and medium-size mammals. This data has a positive relation with palaeoenvironmental studies conducted at the mouth of the Amazon River that point to low deposits of grass pollen in the Last Glacial Maximum, indicating the persistence of tropical forests during the Pleistocene. The Pedra Pintada site presents a lithic assemblage that comprises scrapers, *limaces*, blade-like flakes, gravers and bifacial artefacts, as well as stemmed projectile points with triangular shapes (Colinvaux, 1987; Roosevelt et al., 1996).

Evidence places the establishment phase in the Amazon basin between 10,000 and 8,000 $^{14}$C yr BP, and 11 sites have been recorded with 16 dates between 9,570 and 8,050 $^{14}$C yr BP. Geographical expansion enlarged, reaching the middle Amazon, near the confluence of the Negro and Solimões Rivers, and the transition zone between the Tropical Forest and Savannahs biomes in the south-western lower Amazon (Carajás region). A tendency towards regional diversification on lithic industries can also be observed here. In the middle Amazon, the assemblage contains both unifacial and bifacial tools made of local raw materials. In the Carajás area the assemblages are dominated by informal artefacts made of quartz, with evidence of bipolar flaking technique (Bueno, 2011).

The initial colonization of La Plata Basin also shows a complex picture. La Plata Basin is one of the main South American lowlands internal fluvial corridors that connect western and eastern parts of the subcontinent. It links the Bolivian *chaco* with the Amazon basin through the Paraguay River. Likewise, the connection between central South America and the Atlantic coast is possible by the Paraná River and with the southernmost parts of the continent by the Uruguay River. For these reasons, this fluvial system that crosscuts a variety of ecological settings also represented a key role in human dispersal and cultural diversification in the Early Holocene. La Plata Basin was probably used in the same period as a gateway to the East for different cultural traditions that would be already present in Central South America. This situation can be illustrated by some of the most ancient evidence of human occupation of Paraguay Basin (Dias and Bueno, 2013).

Santa Elina rockshelter is located in the Serra das Araras, Mato Grosso State, in the geodesic centre of South America. This limestone rockshelter is a flat wall about 30 m high, with approximately 900 paintings of animals, human figures and signs associated with a panel 60 m long and 4 m high. Another low wall, in declivity and covered with sedimentation, is visible in part of the shelter. It lies 3 to 5 m distant from the painted wall, parallel to it and with the same inclination. The dwelling area is delimited by this gap. The site was subject of a French-Brazilian scientific mission, coordinated by Águeda Vilhena-Vialou, Denis Vialou and Levy Figuti. The excavation of the site occurred between 1984 and 2001, covered an area of 90 m$^2$ and 46 radiocarbon dates were conducted. An assemblage of 8,000 lithic remains was discovered, made in local raw material, mainly the limestone of the rockshelter's walls, as well silex, sandstone and hematite from sources no less than 5 km away from the site (A. V. Vialou, 2003, 2005, 2007).

The chronostratigraphy of the site is divided in three phases. Unit I (80-120 cm deep) has 22 radiocarbon dates from 275 to 6,000 BP, with evidence of intense human activity related to hunting and gathering local resources. The main plant species identified in this unit were jatobá (*Hymenaea* sp.), araticum and pindaíba (*Annonaceae* family), sapucaia (*Lecythis* sp.), ingá (*Inga* sp.), figo (*Ficus* sp.), veludo (*Guettarda viburnoides*) and pitomba (família *Sapotaceae*) (Scheel-Ybert and Solari, 2005). The faunal remains indicate the consumption of red brockets (*Mazama americana*), peccaris (*Tayasu* sp.), armadillos (*Dasypus novemcinctus* and *Euphractus sexcintus*), spotted paca (*Agouti paca*), agouti (*Dasyprocta* sp.), mocó (*Kerodon rupestres*) and other small rodents (*Echimyidae* and *Cricetidae*). Reptiles such as calango (*Ameiva* sp.), fish, molluscs (*Megalobuliminus* sp. and *Pomacea* sp.) and bivalves (*Diplodon* sp.) are also present (Figuti, 2005). Levels of red pigments are associated with this unit indicating the chronological association with painting activities. Most of the signs are geometrical and the remaining figures represent humans and groups of deer. Fish, birds, monkeys, tapirs, peccaries and felines are also represented. Santa Elina is the only site in the region with rock art and other sites with rock paintings in Serra das Araras are 200 km south-west (D. Vialou, 2005).

Unit II (100-250 cm deep) has 16 radiocarbon dates between 6,000 and 10,000 BP, and presents an assemblage of hearths aligned with the back wall dated to 10,120±60 $^{14}$C BP. Also present in this unit are hundreds of bone remains (osteroderms) of giant sloth (*Glossotherium lettsomi)* with a Uranium-Thorium date of 13,000±1000 BP. The lithic assemblage is composed of 1,055 pieces, mainly limestone flakes and blanks. This unit presents some local evidence of sedimentary disturbance due to an area of fallen blocks (A. Vialou, 2003, 2005, 2007).

Unit III (250-350 cm deep), with Pleistocene dates, has sandy sediments rich in pebbles, but poor in charcoal. In an area of 8 $m^2$, there are 200 bone fragments and 4,000 osteroderms of a single giant sloth (*Glossotherium lettsomi)*. Two of these osteoderms of 2 cm are pierced and one of them has been abraded. The lithic assemblage is composed of 265 pieces, with 22 retouched limestone artefacts made on blanks or flakes and 4 artefacts in silex flakes, including a micro-scraper. This unit has three dates. One osteoderm was dated by Uranium-Thorium at 27,000±2000 BP; sediments associated with the faunal remains were dated by OSL to 27,600±1500 BP; and small fragments of charcoal were dated by AMS at 23,120±260 $^{14}$C BP (Gif 99177). Two fragments of floated wood were dated by AMS at 22,500±500 $^{14}$C BP (Gif 9366) and 23,320±1000 $^{14}$C BP (Gif 9365) but they were considered contaminated by the disturbance in the base of unit II (A. Vialou, 2003, 2005). These chronological results were considered by Agueda Vialou and her team as coherent, indicating ages around 22,000 and 25,000 $^{14}$C BP to the initial occupation of this site (A. Vialou, 2003, 2005, 2007).

It is important to mention that Santa Elina is located at the boundary of tropical forest and savannah environments, in the upstream area of the Amazonian and several river systems of the Brazilian Central Plateau. Besides the taphonomic issues regarding the Pleistocene unit of this site, this is a very important place in the discussions of early routes and displacements because it would be the western site for the *pioneering phase* of settlement in Brazil and a possible connection between the eastern highlands and western lowlands of South America, indicating the possibility of the initial human colonization of the La Plata basin, at least around the Pleistocene-Holocene Transition.

Similarly, this is the same period when the first evidence of human presence in the Middle Uruguay River was identified. In the Touro Passo region, Rio Grande do Sul State, Pleistocene sediments were deposited all along the lower reaches of the Uruguay River under volcanic ash layer dated at 10,400±110 $^{14}$C BP. On the eroded terraces several bones of *Glossotherium robustus* were found, dated at 12,270±220 $^{14}$C BP. At the same stratigraphic levels, crude basalt and quartzite choppers and flakes were found associated with the rolled bones. However, both the artefacts and their association with the bones (which were found around 4.5 km away from the $^{14}$C sample) are doubtful (Prous and Fogaca, 1999; Dias and Jacobus, 2001).

The oldest evidence of human presence in this area is represented by two open air sites, Laranjito and Milton Almeida, with five radiocarbon dates between 10,800 and 10,200 $^{14}$C BP (Dias and Jacobus, 2001). Related to grassland biomes (*Pampa*), these archaeological sites are associated with lithic industries characterised by the predominance of bifacial technology (Umbu Tradition). It is characterised by a variety of bifacial triangular projectile points, pedunculated and non-pedunculated, some of them with serrated edges and others with unifacial retouch, usually associated with bolas. The technological characteristics point to similarities with contemporary archaeological contexts in Uruguay, possibly indicating a common cultural matrix (Suarez and Lopez, 2003; Suarez and Santos, 2010; Lopez-Mazz, 2013). Nonetheless, based on the absence of fishtail projectile points in these assemblages, it is reasonable to propose that the routes that gave origin to the initial colonization of the Brazilian Pampa could be closely related to the occupation of the Paraguay and the Paraná river basin, still poorly known archaeologically (Bueno et al., 2013; Dias, 2012; Dias and Bueno, 2013; Hadler et al., 2013).

## Regional diversification: Itaparica Tradition, Lagoa Santa Complex and Umbu Tradition

The general process of regional diversification in the South American eastern lowlands continued between 10,000 and 8,000 $^{14}$C BP. Between 9,000 and 8,000 $^{14}$C yr BP, the Itaparica Tradition reaches its greatest spatial extent, with 21 sites in the Araguaia-Tocantins and São Francisco basins, and 42 radiocarbon dates. However, after 8,500 $^{14}$C yr BP some regions of central and north-eastern Brazil seem to have been abandoned. This process was accompanied by an abrupt cultural change in distinct regions, with a tendency for regional differentiation in rock art styles and lithic industries; the latter were mostly characterised by an expedient unifacial technology (Bueno et al., 2013).

Archaeological excavations carried out at rockshelters in the states of Goiás and Minas Gerais indicate that these spaces were used as domestic areas, often associated with rock paintings and human burials. General exploitation of the tropical savannah resources were dominant in the early stages of this occupation, especially the consumption of red brocket (*Mazama americana),* pampas deer *(Ozotocerus benzoarticus*), white-lipped peccary (*Tayassu tajacu*), armadillos (*Cabassous tatouay, Euphractus sexcintus* and *Dasypus novencinctus*), monkeys (*Alouatta caraya, Lagothricha lagothrix* and *Cebus apella*), capybaras *(Hydrochoeris hydrochoeris*), lizards (*Tupinambis teguxin* and *Common ameiva*) and turtles (*Chelonia sp.*), as well as several species of fish, birds and gastropods. There is also early evidence of heavy consumption of seasonal fruits like gueroba (*Syagrus oleacea*), jerivá (*Syagrus romanzoffiana*), acumã (*Syagrus flexuosa)*, jatobá (*Hymenea stigonocarpa*), babaçu (*Orbignya sp.*), cashew (*Anacardium sp.*), licuri (*Syagmus coronata*) and pequi (*Caryocar brasiliense*). Studies of settlement systems suggest that the mobility strategies in tropical savannahs were mediated by the rainy season (December to May). The higher productivity of flora in this period would support the concentration of people, these being dispersed in the dry season over areas that could cover up to 2,000 $km^2$. The aggregation sites would be marked by regional styles of rock art and lithic debitage which

displayed strategies of territorial demarcation and maintenance of long-distance social networks (Prous and Fogaça, 1999; Kipnis, 1998, 2003).

There is an increase in the number of occupational events in semi-deciduous forests in the middle of the São Francisco Valley, with 81 dates between 9,900 and 8,040 $^{14}$C BP for 15 sites (Bueno et al., 2013). The most striking aspect of this record is the presence of human burials in several rockshelters at Lagoa Santa and Santana do Riacho regions, making them the largest and best preserved samples of human remains found in Brazil for this period. The burial practices of Lagoa Santa have been the subject of archaeological studies since the late nineteenth century. The first French-Brazilian scientific mission in Lagoa Santa was coordinated by Anette Laming-Emperaire, between 1971 and 1976 (Laming-Emperaire, 1979). In the excavation of Lapa Vermelha IV, the skull of a woman was deposited in the intermediate levels between 10,200±220 BP and 11,680± 500 BP. Recently, an AMS date on these human bones was obtained, with a value of 9,330±60 $^{14}$C BP (Beta 84439). In more recent levels, some bones and coprolites of a giant sloth (*Scelidotherium*) are dated *c.* 9,580±200 $^{14}$C BP (Gif 3208). There were no fireplaces or any typical lithic artefacts of this period. Thus, dating was generally performed on scattered charcoal, probably of natural origin (Prous and Fogaca, 1999). In 2000, Walter Neves begin a long-term archaeological research project in the area. Since 2001, four limestone rockshelters (Lapa das Boleiras, Cerca Grande VI, Lapa do Santo and Lapa Grande de Taquaraçu), one palaeontological site (Cuvieri Cave), and two open air sites (Sumidouro and Coqueirinho sites) were excavated. Until today the Lagoa Santa Region has generated a sample of around 300 human skeletal remains, associated with two burial peaks in the area: the older one, between 10,000 and 8,000 BP, and a more recent one between 2,000 and 1,000 BP. It is noteworthy that this second phase of occupation is related to a horticultural population without a biological relationship to the original hunter-gatherer groups (Araújo et al., 2005, 2012).

The results of the bio-anthropological analysis have offered support for the hypothesis that at least two biological components constituted the populations that originally colonized South America. The earliest occupation was carried out by people with a generalized cranial morphology, similar to that currently found among African and Australian indigenous populations, which also prevailed in East Asia for much of the Late Pleistocene. This biologic standard is modified from the mid-Holocene onwards, when a Mongoloid morphology became dominant among the South American population. These data suggest that a second wave of population with a classic Mongoloid morphology entered the Americas during the Early Holocene. The biological changes of present-day Native Americans indicate an abrupt transition, possibly involving population replacement by competition and, to a lesser extent, hybridisation. These features suggest that the time interval between the two population waves with distinct biological features may have been quite short, around two to three millennia at most (Neves et al., 2013; Neves and Hubbe, 2005).

The occupation of south-eastern and southern Brazil follows a different pattern from that recorded in central Brazil, with a growing number of Umbu Tradition sites towards the mid-Holocene. Ten sites have been identified with 21 dates between 9,855 and 8,020 $^{14}$C BP. Their geographical distribution mainly follows the Paraná and Uruguay Basins; and the new colonized territories mostly correspond to the Atlantic Forest biome. Even though separated by long distances, in some cases more than 1,500 km apart, Umbu Tradition lithic assemblages in the Paraná and Uruguay basins show technological similarities, with predominant bifacial technologies and a variety of stemmed projectile points made on local raw materials. Furthermore, subsistence studies indicate a pattern that persisted throughout the Holocene, characterised by generalist hunting strategies mainly focused on forest resources. The hunt for mammals was characterised by a preference for armadillos (*Dasypus sp.*), red brocket and pampas deer (*Mazama americana* and *Ozotocerus bezoarticus*), collared peccaries (*Pecari tajacu*) and cavies (*Cavia aperea*). Reptiles were also a hunting priority, especially lizards (*Tupinambis sp*), and fragments of rhea eggs (*Rhea americana*) are frequent in the archaeological assemblages. Mollusc gathering also played an important role in subsistence, particularly the gastropod *Megalobulimus* and *Pomacea* and the bivalve *Diplodon* (Dias, 2012; Dias and Bueno, 2013; Bueno et al., 2013; Hadler et al., 2013).

## Concluding remarks

Brazilian data for the Pleistocene-Holocene transition reinforce the idea that a *pioneering* phase of the human colonization of South America eastern lowlands was characterised by recurrent activities at salient landmarks or orientation points in a landscape that was still being explored, 'mapped' and encoded into traditional knowledge systems. Such a recurrence would have facilitated mobility and social aggregation into sparsely inhabited or uninhabited landscapes. Large river valleys in north-eastern and central Brazil, in the Amazon and in the La Plata Basin seem to have played this key role during the Pleistocene-Holocene transition, concentrating and directing an expansion that quickly reached new and distant areas without completely filling the vast territory surrounding these early settlement points. Besides being key navigational axes and reference points in the landscape, easily located and recognized, these river valleys also provided diverse and abundant resources for subsistence and technology, which must have been very valuable in situations of little or low knowledge of this large area (Dias and Bueno, 2013).

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# A Millenary Habit Evidenced by Palaeoparasitology: Perspectives on Methodologies and their Contribution to Understanding Human Dispersals in the Americas

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## Abstract

The first finding of a parasite in prehistoric material was reported in 1910 by Sir Marc Armand Ruffer, when eggs of *Schistosoma haematobium* were found in renal tissue of an Egyptian mummy dated to1250 BC. In 1978, Dr Luiz Fernando Ferreira (FIOCRUZ, Brazil) named the term Palaeoparasitology, defined as the study of parasites found in palaeontological or archaeological material. Palaeoparasitological studies allow the identification of parasite species that affected our ancestors and have been prevalent throughout history. These parasites were disseminated with the conquest of new territories and particularly increased by agriculture and the domestication of animals, which came about from the higher density of human demographics. Prehistoric parasites can be found in mummified tissues, in the sediments deposited on the bones of the abdominal and pelvic cavities, in latrines, septic tanks and in coprolites, which are some of the most abundant biologic material in archaeological sites. The parasitological analysis can be made by classic laboratory methods and by sophisticated molecular biology techniques. An important advance in Brazilian palaeoparasitology took place in 1984, in collaboration with Dr Niéde Guidon, the President of the American Man Museum Foundation (FUMDHAM) and the co-manager of the Serra da Capivara National Park, (Piauí, north-eastern Brazil). There are 1,335 rock art sites registered within the Serra da Capivara National Park in the regions of Serra da Capivara and Serra das Confusões, and investigations of human and animal coprolites from some of these sites continuously produce interesting results. The oldest *Ancilostomatidae* eggs found in the Americas were detected in human coprolites dated from 7,230 ± 80 years, collected in the excavation site of the Boqueirão da Pedra Furada (PI, BR). This finding supports the likelihood of human transmaritime migration to the Americas. As with other geohelminthes, the hookworm eggs and larvae are resistant to environmental conditions, but have narrow tolerance limits, which allow reasoning of their geographical distribution. Northern locations such as Siberia and Alaska do not possess environmental conditions suitable for maintaining this parasite's life cycle. Hence, their introduction in the Americas must have been achieved by alternate ways other than crossing the Bering region. Transmission model studies that demonstrate the speed of infection in a closed human group have shown that one infected subject could infect another 300 individuals in the period of a year. Relating this study with prehistoric populations, one infected person arriving from Asia by boat could infect the South American population. Thus, it is likely that different routes brought prehistoric people (and their worms) to the Americas. Other palaeoparasitological studies with coprolites and archaeological materials include the search for ectoparasites in mummified bodies; the analysis of *Ascaris lumbricoides* DNA sequences (as their eggs are rare in coprolites from South America but common in Europe); studies about the unusual zoonotic parasites also found in human coprolites by the ingestion of new food; the phylogenetic analysis of *Enterobius vermicularis*, a worldwide parasite hosted by humans; the studies of parasites on extinct animals and the host-parasite adaptations through the forest-semiarid transition in the last forty thousand years in the north-eastern region of Brazil.

## Introduction

Palaeoparasitology has generated knowledge about parasites in ancient times and the history of diseases, and has also aided the understanding and reconstruction of the landscapes, migratory routes, habits, behaviours and cultures of their hosts.

The first parasite finding in prehistoric material was reported by Sir Marc Armand Ruffer in 1910, when eggs of *Schistosoma haematobium* were found in renal tissue of an Egyptian mummy dated to 1250-1000 BC (Ruffer, 1910). Subsequently, other parasite findings were made during palaeopathological studies in mummified bodies from Prussia and Europe (Szidat, 1944) and in the analysis of mummified faeces (Taylor, 1955; Fry, 1970).

**In 1978, Dr Luiz Fernando Ferreira devised the term Palaeoparasitology during a discussion with his colleagues at the Oswaldo Cruz Foundation (Brazil) about the origins of parasitic infections. His definition conceptualises Palaeoparasitology as the study of parasites found in palaeontological or archaeological material (Ferreira et al., 2014). Dr Ferreira's field of study was about the origins of parasitic infections present in pre-Columbian America and the new parasites that had been introduced by Europeans or Africans. His main interest was to verify the origins of the *Schistoma mansoni* infection in Brazil, which had been classically attributed to the trading of slaves (Fonseca, 1972).**

**As an interdisciplinary science, the interpretation of results in palaeoparasitology depends on the knowledge of many professionals, and incorporates practical and theoretical knowledge of medicine, biology, archaeology, anthropology, geography, genetics, molecular biology, history and others (Ferreira et al., 2014). Thus, palaeoparasitological studies allow the identification of past parasitic infections; the study of the origins and spreading of parasites and their hosts, and the correlation of parasites with host population dynamics, diet and sociocultural habits. Moreover, it produces clues about the palaeoenvironment, the current environmental, temporal climate changes and the emergence of diseases (Chaves and Reinhard, 2006; Reinhart et al., 2013).**

## Perspectives on methodologies

The associations between parasites and hosts can be made by phylogenetic analysis and by biogeographical record distributions (Araújo and Ferreira, 2000; Gonçalves et al., 2003; Leles et al., 2008). These studies indicate which parasite species are inherited from our ancestors and which were acquired through history, with the conquest of new territories and the approach and use of new species of plants and animals, especially with the domestication and the increase of human density due to agriculture (Loreille and Bouchet, 2003; Pearce-Duvet, 2006).

It is possible to find prehistoric parasites in many materials: in tissues from mummified bodies, in the sediment deposited in the abdominal and pelvic cavities of skeletons and also in latrines and septic tanks (Reinhard, 1992; Bouchet et al., 2003). Nowadays, using molecular biology and immunology techniques, it is possible to rescue fragments of DNA from bone marrow, tissues and from other organic materials and sediments (Iñiguez et al., 2003a, 2003b, 2006, 2012, Le Baily et al., 2008; Lima et al., 2008; Wanke et al., 2013). Nevertheless, the most abundant biological material in archaeological sites is mummified faeces – coprolites.

Coprolites, although abundant and normally well preserved in the sediments, pose the first challenge for any palaeoparasitologist, followed by their identification needed for the posterior correlation of the parasitic results with the archaeological and palaeontological context. In Brazil, the current methodology used for the identification of coprolites establishes parameters for the differentiation between human coprolites from other species by shape, the presence of coal, cooked starch, food remains and species-specific parasites (Chame, 2003; Chame and Sianto, 2014). Another critical point in the study of coprolites, as well as in all archaeological and palaeontological materials, is the necessity to consider the interferences resulting from taphonomic processes such as termite drilling, soil alterations, flooding and other disturbances.

Depending on the importance and complexity of samples, many complementary techniques can be used to obtain data and confirm the parasitological diagnosis found in archaeological sites. Every investigation is initiated by a simple macroscopic identification of materials. The next steps are to use classic methods of parasitological analysis and then the most sophisticated ones, such as electronic microscopy and the techniques of immunology and molecular biology (Reinhard, 1992; Araújo et al., 1998; Frias et al., 2013).

In most cases, because of the nature of the samples it is necessary to rehydrate them prior to preparing them for analysis. The most used method was proposed by Callen and Cameron in 1960 and consists of immersing the samples in a 0.5% solution of sodium triphosphate ($Na_3PO_4$) for 48 to 72 hours. To avoid cross-contamination with fungi and bacteria, the samples must be kept at constant conditions, optimally at 4 ºC or in preservative solution.

Hair, bones, teeth, seeds, pieces of arthropods and other food items can be found in macroscopic analysis, aiding the understanding of the dynamics of parasite transmission. These materials also help in the identification of the availability and preference of food supply, seasonality and cultural habits, such as selection, technique of preparation and cooking for nourishment. In the microscopic analysis it is possible to find eggs and larvae of helminthes, protozoans, pollen, grains of cooked starches, vegetable epidermis, hair, algae, small arthropods and eggs of aquatic animals. All these items help to complement the puzzle of existing diseases in prehistoric men and animals.

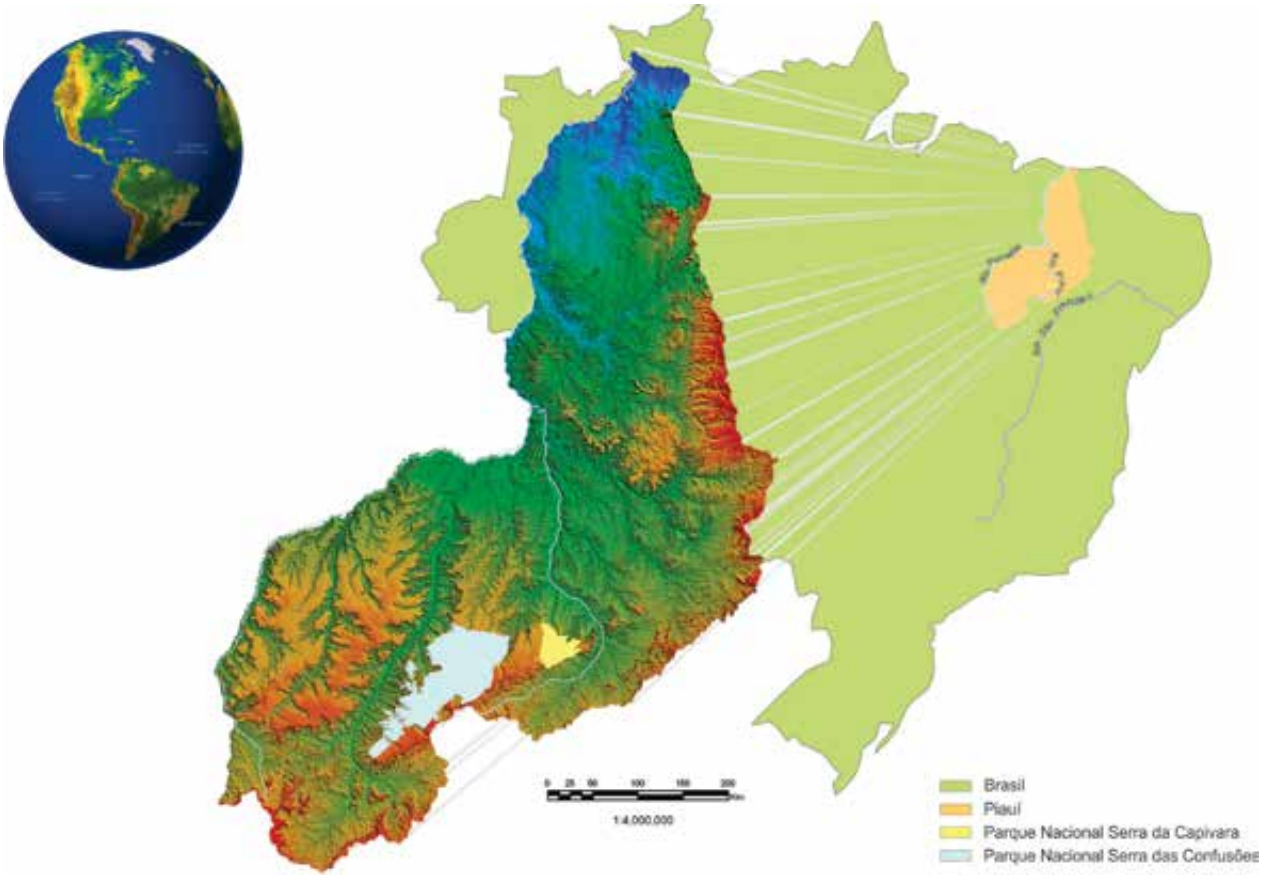



*Figure 1. Location of Serra da Capivara National Park, World Heritage Cultural Site in Brazil.*

Recently, DNA sequencing by genomics has opened large possibilities for undertaking phylogenetic studies, especially on the virulence of pathogens over time (Reinhard et al., 2013) and the spill-over of zoonotic diseases to new hosts.

## The contribution of Palaeoparasitology to the understanding of human dispersals and adaptation in the Americas

The first studies conducted by Dr Luiz Fernando Ferreira with Palaeoparasitology began in 1970 with the parasitological analysis of coprolites from the State of Minas Gerais, in central Brazil. However, the big boost to Brazilian Palaeoparasitology took place in 1984 when Dr Niéde Guidon invited Dr Ferreira and his group to study the archaeological materials of the Serra da Capivara National Park, in Piauí, Brazil.

*Figure 2. Aerial view of Serra da Capivara with the plateau, canyons and plain. © FUMDHAM*

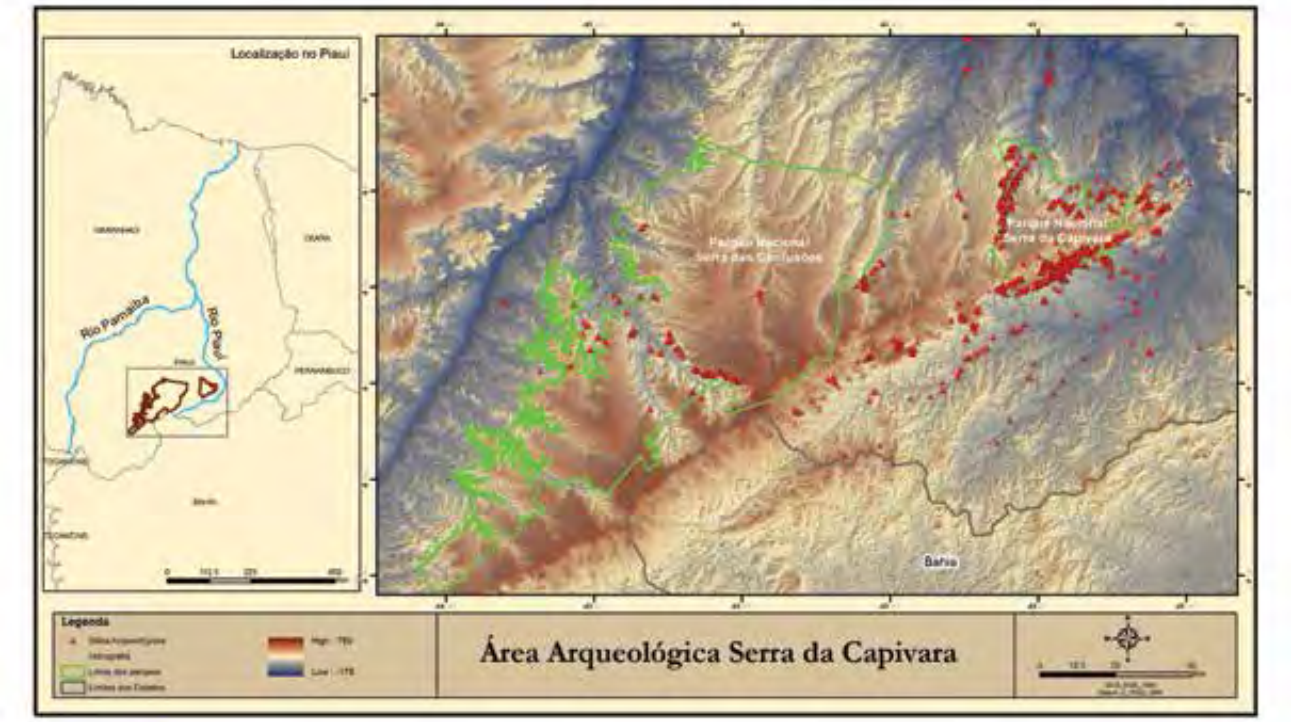



*Figure 3. Distribution of archaeological sites in the Serra da Capivara Region, north-eastern Brazil.*

Since then, palaeoparasitologists of the Oswaldo Cruz Foundation have become part of the multidisciplinary team coordinated by Dr Guidon. The latter created the American Man Museum Foundation (FUMDHAM) that manages the park in conjunction with the Brazilian government (Guidon and Pessis, 1998; Pessis, 2003; Pessis and Guidon, 2007).

The Serra da Capivara National Park was created in 1979 and was inscribed on the UNESCO World Heritage List in 1991. It is situated in north-eastern Brazil, in Piauí state (Figure 1), and covers an area of 129,140 hectares of Caatinga, an exclusively Brazilian biome, characterised by a mosaic of vegetation and landscape types adapted to a semi-arid climate and with a considerable and still unexplored biodiversity (Emperaire, 1983; Leal et al., 2005; Albuquerque et al., 2012) (Figure 2). The park´s protected area is distributed across five municipalities. The climate is hot and dry; favourable to the preservation of archaeological materials. However, the region is poorly developed due to the combination of long periods of drought, inadequate policies on socioeconomic and environmental management and the historical occupation of the region (Pessis, 2003).

*Figure 4. Archaeological sites and rock art of the Serra da Capivara National Park, north-eastern Brazil. © FUMDHAM.*

*Figure 5. Caatinga in dry season, Serra da Capivara National Park, Piauí, Brazil.*

*Figure 6. Registration of coprolites at the Palaeoparasitology Collection at the Oswaldo Cruz Foundation, Rio de Janeiro, Brazil. © Palaeoparasitology Laboratory, Oswaldo Cruz Foundation, Brazil.*

*Figure 7. The site of Boqueirão da Pedra Furada, Serra da Capivara National Park, Piauí, Brazil.*

The combination of these facts makes the preservation of the Park and its archaeological sites a quest of great political and financial effort.

The area of study includes the Serra da Capivara and its surroundings that still cover the National Park of Serra das Confusões. Together they house 800,000 hectares where 1,335 rock art sites are registered, some of which may be more than 30,000 years old (Figure 3).

The high concentration of archaeological sites and their antiquity designates the Serra da Capivara as one of the most significant archaeological sites worldwide (Guidon, 1995, Guidon and Pessis, 1998; Pessis and Guidon, 2007) (Figure 4). Evidence of hunter-gathering human settlements that may be older than 40,000 years brought new elements to the classic theories of American human migration through Beringia (Guidon and Delibrias, 1986; Guidon, 1987, Guidon and Arnaud, 1991; Guidon et al., 1994) and important palaeoparasitological evidence make the origins of man in South America even more intriguing (Ferreira et al., 1987; Araujo et al., 1988, Ferreira and Araujo, 1996, Montenegro et al., 2006, Ferreira et al., 2014).

Although the discussion about the antiquity of the arrival of pre-historical humans in the Americas is a controversial subject (Meltzer et al.,1994, Guidon et al., 1996), new studies point to other entry routes of prehistoric man in the colonization of the Americas. Since 1994, the discussions have evolved based on new findings, data and techniques in the Serra da Capivara region and also in other areas in South America (Meltzer et al., 1997; Dillehay, 2010, Watanabe et al., 2003, Lahaye et al., 2015; Boëda et al., 2013, 2014, Skoglund et al., 2015). Among the new evidence of the ancient presence of the Serra da Capivara pre-historic man, it is important to highlight the works of the team of Dr Lahaye (2015) and Dr Boëda (2013,2014). Dr Boëda is currently undertaking a new excavation next to the original excavation carried out by Dr Niéde Guidon. This new excavation is away from the rock matrix and until now Dr Boëda's team have found human remains dated to 24,000 years. This certainly allows us to expect even older data as found in the original excavation.

The Serra da Capivara region also includes villages, camps, lithic workshops, burial sites and 172 archaeological sites prepared for visitation.

In the past 40,000 years, the region has suffered an important environmental transformation (Ab'Saber, 1977; Chaves and Renault-Miskovsky, 1996; Behling et al., 2000; Chaves, 2002; Pennington et al., 2004). At this time the region was a junction of the Amazon and Atlantic Forest presenting open areas such as grasslands, inhabited by megafauna and humans (Guérin 1991; Guérin et al., 1996; Brooks and Bowman, 2002). Ribeiro and colleagues (2013) made recent compilation of Brazilian Quaternary megafauna data for the northeast region of Brazil and new studies support the meeting of them in period coincide with the presence of prehistoric man in the Serra da Capivara National Park region and in the north-east region of Brazil.

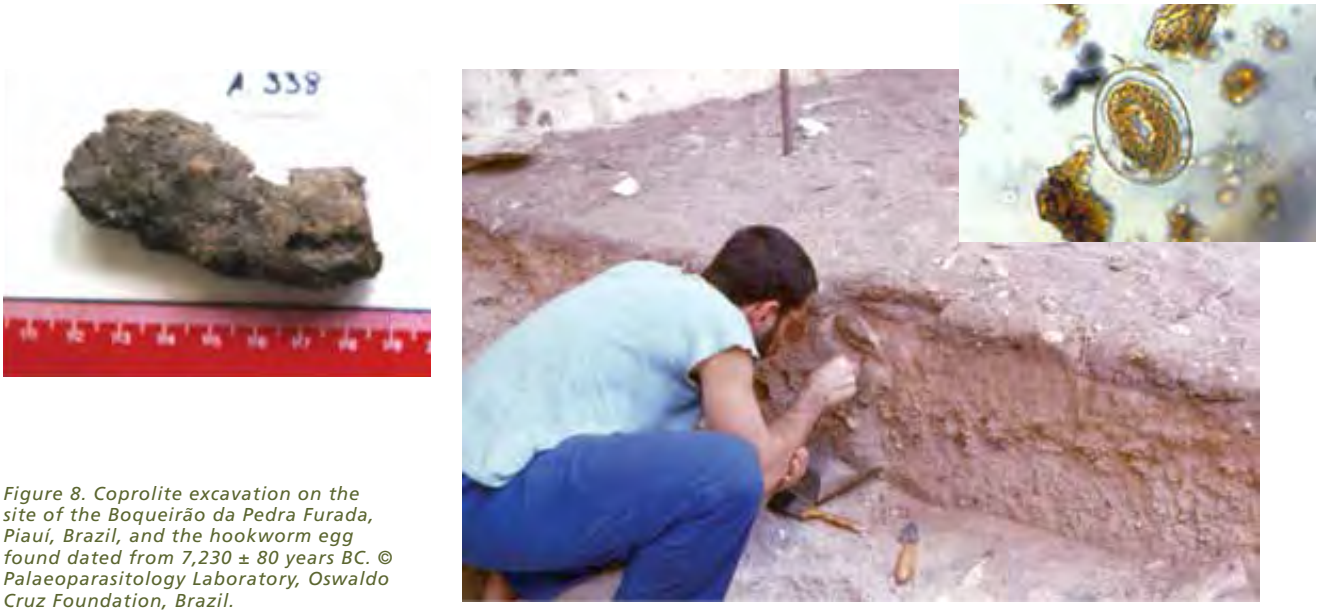



*Figure 8. Coprolite excavation on the site of the Boqueirão da Pedra Furada, Piauí, Brazil, and the hookworm egg found dated from 7,230 ± 80 years BC. © Palaeoparasitology Laboratory, Oswaldo Cruz Foundation, Brazil.*

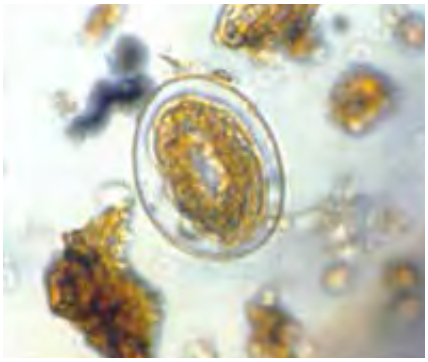
Kionshita and colleagues (2014) dated Toxodontinae and Gomphotheridae from 7 ka up to 71 ka on a temporary lake in the southern region of Serra da Capivara National Park – Lagoa dos Porcos, and Dr Hubbe (2013) discussed the simultaneous presence of megafauna and humans in the Pleistocene / Holocene transition.

In the past ten thousand years, the region has gone through a regional process of desiccation and the forest and prairies gave way to Caatinga, a scrubland biome (Oliveira et al., 2005) (Figure 5). Although a deciduous forest remains inside the large and deep canyons and along of edges of the sierras, the dominance of shrub vegetation on the plateau and plains (Emperaire, 1983) and the loss of the biggest and perennials rivers impact not only the human life, but also the life strategy of many species, including parasites.

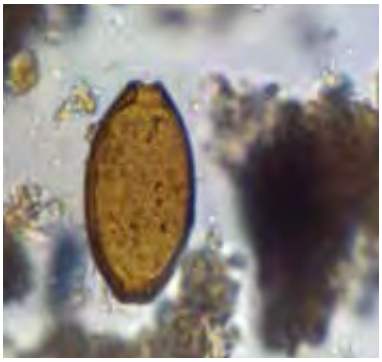
Research materials collected by the FUMDHAM archaeological team over the past 30 years have been stored and preserved at the Oswaldo Cruz Foundation Palaeoparasitology Collection, which contains about 2,800 samples of coprolites, latrine samples, tissues, bones, teeth, hair and sediment (Figure 6). The collection includes materials from other Brazilian archaeological and palaeontological sites, as well as from other South America countries, Europe and the United States, due to scientific collaboration with research groups in these regions. Most of the sample collection is composed of coprolites; about 954 of them are from Serra da Capivara, of which 127 are human.

Throughout the decades, very interesting results have been obtained from analysing human and animal coprolites in the region, especially from samples collected in the excavation site of Boqueirão da Pedra Furada (Ferreira et al., 2014) (Figure 7). The most special sample was from a human coprolite containing the oldest hookworm egg ever found: dated from 7,230 ± 80 years BC. These results have an important historical meaning as they reinforce the likelihood of transmaritime human migration to the Americas (Meggers & Evans, 1966; Ferreira et al., 1987; Sorenson & Johannessen, 2006; Araujo et al., 2008, Montenegro et al., 2006) (Figure 8). Recently two new studies (Raghavan et al., 2015; Skoglund et al., 2015) have reinforced the paleoparasitological results. Skoglund and colleagues show that indigenous communities from the Brazilian Amazon and from the central part of Brazil had their populations founded by people more closely related to indigenous Australians, New Guineans and Andaman Islanders than to any present day Eurasians or Native Americans. The genetic signature found in Brazilian people is not present nowadays to the same extent in Northern and Central Americans (Raghavan et al., 2015) or even in the Clovis associated genome. They show a more diverse set of genes responsible for the foundation of populations of the Americas than previously accepted.

Most intestinal parasites that infect the human population nowadays also infected prehistoric humans. Amongst them are parasites with direct life cycles. These parasites are transmitted directly from person to person without going through the environment or another host or vector. This is the case of the *Enterobius vermicularis* which is still endemic in human populations from different climates, including the Arctic (Araújo et al., 1985; Iñiguez, 2003a). Other parasites such as *Ascaris, Trichuris* and hookworms (Ancilostomatidae) are geohelminthes, because their eggs and larvae develop as free-living forms in the soil, before infecting a new host. Despite their resistance to different environmental conditions, these worms have narrow tolerance limits, which allow inference of their geographical distribution. Other parasite species like *Diphyllobothrium,* a common marine mammal parasite, use several intermediate hosts, such as fish, before infecting their definitive hosts, who become infected by eating these (Ferreira et al., 1984) (Figure 9). Infection in humans is caused by eating raw fish.

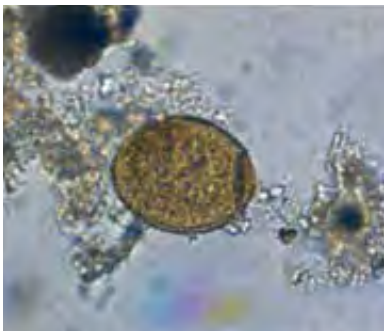


Ancylostomatidae

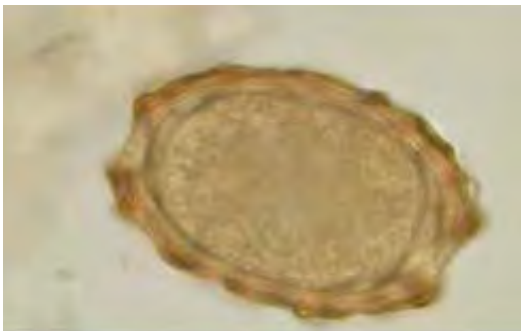


Trichuris trichiura

Enterobius vermiculares



Diphyllobothrium spp.



Ascaris lumbricoides

*Figure 9. Parasite eggs found in prehistoric human coprolites and in present data. © The Palaeoparasitology Laboratory, Oswaldo Cruz Foundation, Brazil.*

When studying different parasite transmission scenarios, much can be learned from the pre-Columbian hookworm, which highlights new routes on human prehistoric migration to the Americas. Hookworm disease or ancylostomiasis can be caused by the infection of two species, the *Ancylostoma duodenale* and *Necator americanus.* These parasites, alone or associated, are widespread in tropical and subtropical regions and can cause different anaemia levels by intestinal spoliation (Rey, 2001). It has been accepted that they have different dispersion centres, with *A. duodenale* originating from Northern Africa and Asia and *N. americanus* from the south-eastern Sahara and southern Asia, in an ancient relationship with humans (Montenegro et al., 2006; Rey, 2001; Ferreira et al., 2014; Mitchell, 2015).

In 1974, Allison and colleagues were the first to find adult worms still attached to the intestinal mucosa of a Peruvian mummy they examined, dated 900 years BP. In Brazil, the first article related to the finding of hookworms and whipworms in coprolites was published in 1980 by Dr Ferreira and colleagues. The material analysed was about 2000 years old and was collected in Gentio II Cave at Minas Gerais. After these, others hookworm eggs were reported from North and South America (Iñiguez et al., 2003a; Montenegro et al., 2006), but the record of the Boqueirão da Pedra Furada remains the oldest so far (Ferreira et al., 1987, 2014).

The palaeoparasitological finding of the Boqueirão da Pedra Furada started discussions about the origin of parasitism in South America and possible ways of the parasites' arrival, since the limits of tolerance in the free-life cycle of the two species could not have allowed their survival amongst humans reaching the Americas through Bering Strait migration (Araújo et al., 1981, 1988; Dillehay, 1991; Hawdon and Johnston, 1996; Fuller, 1997, Reinhard et al., 2001, Mitchell, 2015).

Based on the biological cycle of hookworm and *Trichuris trichiura*, on climate modelling and on epidemiological data and transmission experiments, Dr Ferreira and Dr Araújo have proposed that the introduction of the hookworm in the Americas could not have happened by crossing the Bering region (Marasciulo, 1992; Ferreira and Araújo, 1996; Araujo et al., 2008; Montenegro et al., 2006). A series of assumptions was used for the formulation of their theory regarding the trans-Pacific origin of ancilostomiasis in the Americas. Among them, hookworms and *Trichuris trichiura* have phylogenetic origins and were already present in the ancestors of hominins. It is theorised that these parasites accompanied their human hosts from Africa to other territories through environments distinct from those in which they originated and that these regions allowed the life cycles of these worms to be maintained, perpetuating parasitosis. Where the weather allowed, hookworm and whipworm spread with human migration. Based on the proposed dates for populating the Americas, the cold temperatures of Siberia and Alaska could not have provided suitable conditions for maintaining the cycle of these parasites. Interestingly, in 1925 the French anthropologist, Paul Rivet, proposed the trans-Pacific alternative route to the Americas at the same time that the Portuguese anthropologist, Mendes Corrêa, proposed transatlantic migrations to the Americas, through the use of sea currents and periods of lowering of sea levels.

In the life cycle of a hookworm, the eggs need soil temperatures between 17 °C and 35 °C , 25 °C to 30 °C being an optimum range for the eggs to evolve into infective larvae in moist and oxygen-rich soils. In these conditions, eggs can survive for 30 days and the infective larvae can be ready after 5 to 14 days. Infective larvae can resist for 2 to 10 months when environmental conditions are good, but they are incapable of surviving under 14 °C (Cox, 1982; Schad and Warren, 1990). It is important to point out some biological differences between these two parasite species. *A. duodenale* can get in hypobiosis inside their hosts in regions with severe climatic conditions, such as the semi-arid areas of India, while *N. americanus* prevalence is higher in more humid regions (Ferreira et al., 2014).

Other hypotheses considered by Dr Ferreira, Dr Araújo and colleagues included models of transmission that focused on the speed of infection in a closed human group. Experiments performed with 300 volunteers have shown that one infected individual introduced into the group could infect them all in the period of a year (Marasciulo, 1992). By correlating their model with the prehistoric populations, an infected person arriving by boat from Asia could infect the South America population. Combining the palaeotemperature knowledge with the distances to be covered by migrating populations walking from Asia to North America via Bering and Alaska, and the life span of the parasites, Montenegro and colleagues (2006) have modelled different climate scenarios in search of a reasonable explanation for the presence of hookworm parasites in pre-Columbian Americas. They have concluded that the Bering route would not have allowed the presence of hookworms in any scenario tested.

There are a few ideas that can be discussed to explain the presence of hookworms in the Americas (Ferreira et al., 2014). The first one is that the human migrations in cold climates were rapid and occurred over a period of eight years, the average life span of adult worms in the intestines of hosts (Cheng, 1986). There is no precedent for this hypothesis. As such, prehistoric humans would have gone directly from Siberia to American mild areas, as discussed by Montenegro et al. (2006). Secondly, the migrants became infected in places where temperatures allowed the development of eggs and larvae in the soil. The palaeotemperature data demonstrates that it is unlikely that shelters in Siberia and Alaska had mild conditions allowing worm development. Even today, the temperatures in the caves are much lower than 17 °C. The third hypothesis is that hookworms brought by migrants were able to develop in environments with much lower temperatures. Again, there is no register of species varieties tolerant to such low temperatures and this hypothesis should also be discarded. Hence, the Palaeoparasitology data indicates that different routes were used by prehistoric men to reach the Americas, which included mild environmental conditions of 25 °C in the soil ensuring the concomitant survival of worms requiring these temperatures. Palaeoparasitologists hope that archaeologists discover these new routes allowing new multidisciplinary studies.

Like hookworms, other parasites were found in Serra da Capivara materials and allowed not only to identify their presence in the past, but also to correlate them with other species and human's and animal's way of life. Among these, lice were found in the hair of the mummified body (Araújo et al., 2000) and *Ascaris lumbricoides* DNA sequences were identified in negatives coprolites samples where eggs were not visible by microscope observation.

Recent *Ascaris* DNA studies have shown how the negative data should be treated with caution. Presently, ascaridiasis incidence is the commonest helminthiasis in Brazil, but *A. lumbricoides* are rare in coprolites from South America, using traditional parasitological techniques (Gonçalves et al., 2003; Leles et al., 2010), but common in Europe (Bouchet et al., 2003). DNA tests have revealed that this parasite existed in prehistoric Andean populations and in the Brazilian lowlands, as well in Serra da Capivara coprolites (Leles et al., 2008). The diminished prevalence of this parasitosis is probably a consequence of waterborne transmission in these semiarid regions, associated with the great mobility and small number of individuals in the hunter-gatherers groups where the best preserved archaeological sites are found (Ferreira et al., 2014). Accordingly, a low prevalence of *A. lumbricoides* is still observed in human Serra da Capivara populations presently, corroborating with the environmental limitations imposed in the Caatinga.

The low occurrence of *Enterobius vermicularis* eggs in coprolites can be partially explained by the parasite's life cycle. Female worms lay their eggs in the perianal region of the host, not in the intestinal lumen, explaining why the eggs are not abundant in the faeces. The transmission and dispersion of eggs between hosts occurs through hand contamination after intense anal itching. The direct oral transmission protects the parasite from harsh environmental conditions facilitating its spreading, including populations of very cold environments (Iñiguez et al., 2003a). Although *E. vermiculares* was present in Chile for at least 6,000 years, all other encounters of this parasite were recorded only on the Pacific Coast and northern Argentina (Zimmerman and Morilla, 1983; Ferreira et al., 1989). However, it is probable that infection was dispersed among other human groups in South America, but to find traces of this new techniques must be tested.

Consequentially, the Oswaldo Cruz Foundation Palaeoparasitology Laboratory recently initiated a new DNA study about the phylogenetic analysis of *Enterobius vermicularis* in coprolites that may provide an understanding about the relationship between the biogeographic distributions of this oxyurid in human populations.

Other remarkable parasites were found in human coprolites from the Serra da Capivara sites. Alimentary habits have been revealed by the presence of unusual parasites in human coprolites, demonstrating the consumption of undercooked bush meat (Sianto et al., 2009, 2012; Reinhard et al., 2013). An example is the finding of the Nematoda Pharyngodonidae, a worm found in the intestine of a lizard, unable to infect humans, whose eggs and flakes were found in human coprolites dated from 10,640 and 400 years from the Toca dos Coqueiros and Toca da Baixa dos Caboclos sites (Sianto et al., 2009, 2012). Another possibility that must be considered in Serra da Capivara, and certainly in other prehistoric sites, is that parasites may have been acquired by the interaction of prehistoric humans with animals approaching their shelters in search of food. The habit of concentrating food consequently attracts small animals, their predators and inevitably insects. *Hymenolepis nana* is a little tapeworm found in rodents and beetles as hosts and accidental ingestion of these small beetles or even contaminated food with rodent faeces is not uncommon. The finding of these eggs in coprolites 3,800 years old from the Baixão do Perna I allows the inference that this site was a permanent dwelling (Martin, 1999), with a reasonable density population since the eggs remain viable on the soil for only 10 days.

The synthesis of the palaeoparasitological studies in Serra da Capivara show richness of parasites species from ancient times until the present, especially with the colonization and introduction of domestic animals species. In these analyses, it is important to consider the relativity of the data, with its limitations of analysis of the material that has been found in the sites. Additionally, there are methodological difficulties in identifying unknown parasite species, especially when it comes to wildlife. Despite this, and with the available data, it is possible to observe the increase of parasites over time, even when the environment changes from forest to Caatinga.

In order to better understand the effects of environmental changes on the permanence of the parasites in the Caatinga, new studies are linking landscape parameters with the occurrence of hosts and parasites. The model of occurrence of parasites over time and environmental changes uses the *Kerodon rupestris* (Caviidae: Rodentia) and the parasite *Trichuris* sp. as a study case, since this rodent's coprolites were found uninterruptedly from 30,000 years to the present in Serra da Capivara. Preliminary approaches used the mathematical technique of genetic programming that is an inspired symbolic optimisation in the evolutionary process of natural selection, to infer relationships between environmental standards and the occurrence of *Trichuris* sp. Initial results indicate a significant association between 100 environmental parameters, including vegetation type, geomorphology, presence of water, human impacts, based on 900 samples of recent faeces and 200 coprolites for the presence of parasites in samples collected at altitudes of 438 m to 800 m (Chame et al., 2013). The explanation for this distribution is consistent with the fact that *K. rupestris* is now restricted to rocky areas, in metapopulations, especially in the mountains and canyons offering food, water and mild climate. The environmental changes from forest to Caatinga, rather than extinguishing the parasites, expanded the population density of *K. rupestris* in these areas and increased the rate of transmission of parasites. Interestingly, occurrence modelling using BIOCLIM data indicates that the parasite-favourable areas are the same as the occurrence of archaeological sites, and this deserves new and more tests.

Over the last 30 years of study, palaeoparasitology has not only brought new data on the origin of the diseases, but together with archaeology, has enabled further discussions and contributions to new theories. The results of the palaeoparasitological studies are still applied to wildlife management of the Serra da Capivara National Park and are available to the government to guide health policy. The region's biodiversity is unique and the Park is the most representative of the original conditions of the Caatinga preserved by the biosphere reserve. Archaeological studies in the region extrapolate research goals and contribute to regional economic development, education and public health. It is crucial a major and regular support for archaeological sites and biodiversity conservation to face the great challenges.

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# Adaptaciones humanas tempranas y dispersión de la población durante la colonización del Río de la Plata y Río Uruguay

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## Resumen

El presente capítulo presenta los principales avances sobre el poblamiento temprano en la cuenca del Río de la Plata, focalizándonos en el Río Uruguay medio, donde en las últimas décadas, se ha producido nueva información. Existe una importante base de datos con más de 30 sitios tempranos de los cuales 14 tienen 60 edades radiocarbónicas. Se comparan desde una perspectiva amplia los resultados de investigaciones realizadas en Uruguay y el sur de Brasil. Los cazadores-recolectores durante el poblamiento utilizaron dos estrategias de movilidad, por un lado movimientos frecuentes entre los sitios residenciales del Río Uruguay medio y, por otro lado, estrategias logísticas donde debieron utilizar circuitos planificados de movilidad para aprovisionarse de rocas específicas como el ágata. La información disponible indica que humanos colonizaron las planicies del sureste de América del Sur hace 14.000 años cal AP. Posteriormente hacia el año 13.000 cal AP surge una tradición cultural bifacial orientada hacia la producción de artefactos bifaciales que incluyen núcleos, puntas, preformas y cuchillos. La evidencia estratigráfica, cronológica y arqueológica de diferentes sitios tempranos (Pay Paso 1, K87, Laguna Canosa, RS-I-69, RS-I-70 entre otros) sugiere que por el Río Uruguay medio-alto circularon diferentes diseños de puntas tempranas. Se ha reconocido en la región desde la década de 1960 el clásico diseño de puntas cola de pescado (fishtail) que a nivel regional ha sido datado en 12.800-12.200 años cal AP. Recientemente, a partir de las investigaciones actuales hemos reconocido dos nuevos diseños de puntas tempranas que se denominan Tigre, datadas entre 12.200 y 11.200 años cal AP, y Pay Paso, datadas entre 11.000 y 10.065 años cal AP. Las planicies vinculadas al Río Uruguay medio fue una región del Sureste de América del Sur donde se sucedieron importantes transformaciones e innovaciones tecnológicas y culturales durante el poblamiento inicial. La aparición de las puntas Tigre es posiblemente una respuesta tecnológica asociada a la reorganización del armamento de los cazadores recolectores a los cambios en los parámetros climáticos, ambientales y faunísticos que se suceden al iniciarse el Holoceno, vinculado a una fase climática más cálida y húmeda iniciada hace 12.400 años cal AP.

## Introducción

La cuenca del Río de la Plata incluye diferentes regiones ecológicas caracterizadas por planicies bajas (Pampa, Campos y Pantanal), una extensa y ramificada red hidrográfica, bosques subtropicales y monte en galería que se localiza en las márgenes de ríos y arroyos; ésta es la segunda cuenca de América con una superficie aproximada de 3.200.000 km2. El Río de la Plata se forma donde desembocan los ríos Paraná y Uruguay, actualmente es un estuario, sin embargo hacia finales del Pleistoceno, debido al menor caudal, el paleocauce discurría entre bañados y zonas bajas desembocando en el Océano Atlántico, frente a la costa uruguaya.

El poblamiento temprano de esta región se realizó a partir de la costa Atlántica, utilizando los grandes ríos (del Plata, Uruguay y Paraná) como vías naturales de ingreso de pequeños flujos humanos hacia el interior del continente (Miotti, 2006; Suárez, 2011a). Existe un patrón de asentamiento, donde los sitios tempranos se ubican asociados al Río Uruguay medio y al Río Negro medio en la desembocadura de sus afluentes, ya sean ríos, arroyos o cañadas. La línea de costa sobre el Océano Atlántico al final del Pleistoceno se ubicaba entre 100-150 km mar adentro. Los grandes cursos de agua como los ríos de la Plata y Río Uruguay tenían menor caudal que el que presentan hoy. Sin embargo, estos importantes ríos concentraron variados recursos como fauna (mamíferos, peces y aves), rocas silicificadas para producir artefactos, así como agua dulce y leña que minimizaron los riesgos durante el proceso inicial del poblamiento.

El Río Uruguay medio y sus afluentes son un excelente laboratorio para investigar las adaptaciones humanas tempranas asociadas al poblamiento del sureste de América del Sur. Actualmente afloran en diferentes lugares de la cuenca depósitos sedimentarios que se extienden desde antes del Último Máximo Glacial hasta el final del Holoceno. Existen más de 30 sitios arqueológicos con evidencia de ocupaciones tempranas de los cuales 14 (figura 1) presentan más de 60 dataciones radiocarbónicas (véase tabla 1).

Este capítulo se enfoca en el Río Uruguay medio y sus afluentes. Las investigaciones en esta región han sido discontinuas y se iniciaron en la margen brasileña a finales de la década de 1960 con los trabajos de E. Miller (1987 p. 41), quien generó la primera base de datos cronológica de 18 edades radiocarbónicas. Luego, la UNESCO dirigió la Misión de Rescate Arqueológico de Salto Grande (MRASG) (MEC, 1989), un programa tendiente a evitar el impacto arqueológico que sufrirían los bienes patrimoniales-arqueológicos con la construcción de la represa de Salto Grande. Estos trabajos se desarrollaron entre 1976 y 1979, y participaron equipos de investigación de diferentes países (Francia, Estados Unidos, Brasil, Canadá, Alemania) liderados originalmente por Annette Laming-Emperaire y, luego de su trágica muerte, por Niedé Guidón (Laming-Emperaire y Guidón, 1980). Uno de los principales aportes de la MRASG fue haber obtenido las primeras dataciones radiocarbónicas en sitios tempranos en Uruguay (MEC, 1989).

En el año 1999 se inició en la margen uruguaya del Río Uruguay medio un programa de investigación multidisciplinario que continúa hasta el presente, cuyo objetivo es avanzar en diferentes aspectos relacionados con las ocupaciones tempranas, la evolución paleoambiental y climática desde el final del Pleistoceno vinculado al poblamiento inicial de la región (Suárez, 1999, 2002, 2003, 2006, 2010, 2011a, 2011b, 2014, 2015a, 2015b, Suárez y Piñeiro 2002, Suárez y Santos 2010).

Las investigaciones sobre el poblamiento temprano no son homogéneas en la cuenca del Plata, hay importantes áreas que aguardan el inicio de investigaciones sistemáticas. Debido a las características geológicas y geomorfológicas, existen extensas zonas donde los sitios tempranos posiblemente no se hayan conservado. Sí existen, se ubican estratigráficamente a decenas de metros de profundidad bajo planicies de inundación sedimentarias que se sucedieron durante el Holoceno (ej. Río Paraná bajo). Hay otras regiones con escasa visibilidad arqueológica en relación a la arqueología del final del Pleistoceno. Existen, además, amplias regiones de las cuencas del Río Paraná, Paraguay, Pilcomayo y Bermejo (Bueno y Dias 2015) donde actualmente no existe información disponible sobre las ocupaciones tempranas, por lo cual considerarlas dentro de modelos de poblamiento tiene ciertos problemas empíricos y metodológicos.

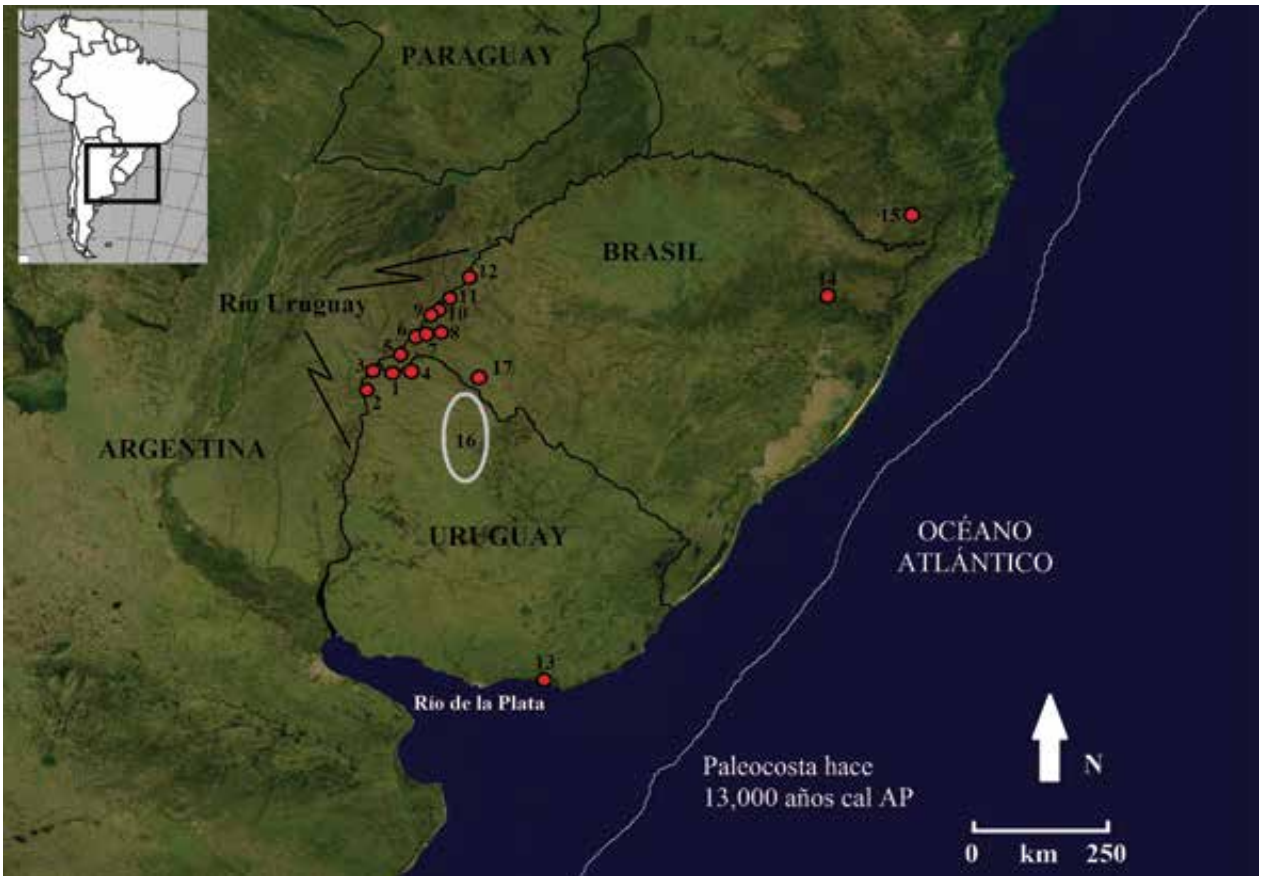


*Figura 1. Ubicación de los principales sitios referidos en el texto. Del 1 al 13, sitios tempranos con dataciones radiocarbónicas. Del 14 al 15, sitios del sur de Brasil con puntas Tigre y Pay Paso. (1) Localidad Pay Paso, (2) Sitio K87, (3) Laguna Canosa, (4) Boca del Río Cuaró, (5) RS-I-98, (6) RS-I-67, (7) RS-I-66, (8) RS-I-68 y RS-I-97, (9) RS-I-70 y RS-I-69, (10) RS-I-72, (11) RS-I-99, (12) RS-I-IJ67, (13) Urupez. Sitios del Sur de Brasil (14) Sitio das Flechas, (15) Sitio Avencal Baixo (Urubici), (16) Región Arqueológica Catalanes Nacientes Arapey, (17) Areal.*

*Tabla 1. Edades $^{14}C$ obtenidas en sitios arqueológicos de la cuenca del Río Uruguay medio y Río de la Plata, en Uruguay y Brasil.*

| Sitio/País | Edad radiocarbónica (C14yr BP) | Edad Calibrada | Número laboratorio | Referencia |
|---|---|---|---|---|
| Urupez 2/Uruguay | 12,000 ± 40 | 13,998-13,703 | Beta 394639 a | Meneghin, 2015 |
| Urupez/Uruguay | 11,690 ± 80 | 13,708-13,292 | Beta 211938 | Meneghin 2004 |
| RS-IJ-68/Brasil | 11,555 ± 230 | 13,791-12,835 | SI-3750 [b] | Miller 1987 |
| K87/Uruguay | 11,320 ± 40 | 13,236-13,057 | UCIAMS 145429 [a] | Suárez, 2016 |
| RS-I-69/Brasil | 10,985 ± 100 | 13,035-12,698 | SI-3106 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 10,930 ± 20 | 12,802-12,705 | UCIAMS 21631[a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,910 ± 30 | 12,797-12,698 | UCIAMS 27738 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,895 ± 30 | 12,786-12,693 | UCIAMS 27744 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,880 ± 25 | 12,759-12,692 | UCIAMS 27745 [a] | Suárez 2011a |
| RS-I-66/Brasil | 10,810 ± 275 | 13,205-11,823 | SI-2622 [b] | Miller 1987 |
| RS-I-69/Brasil | 10,800 ± 150 | 13,034-12,387 | N-2523 [b] | Miller 1987 |
| Urupez/Uruguay | 10,690 ± 60 | 12,713-12,436 | Beta 165076 | Meneghin 2006 |
| Pay Paso 1/Uruguay | 10,680 ± 20 | 12,674-12,558 | UCIAMS 21637 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,630 ± 25 | 12,655-12,440 | UCIAMS 21636 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,595 ± 30 | 12,642-12,430 | UCIAMS 27746 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,580 ± 20 | 12,618-12,429 | UCIAMS 21644 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,555 ± 20 | 12,552-12,426 | UCIAMS 21645 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,540 ± 35 | 12,629-12,174 | UCIAMS 27747 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,520 ± 20 | 12,551-12,177 | UCIAMS 21643 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,500 ± 25 | 12,548-12,114 | UCIAMS 27740 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,465 ± 30 | 12,429-12,058 | UCIAMS 28692 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,450 ± 25 | 12,422-12,064 | UCIAMS 28682 [a] | Suárez 2011a |
| K87/Uruguay | 10,420 ± 90 | 12,552-11,840 | KN 2531 | MEC, 1989b |
| RS-I-69/Brasil | 10,400 ± 110 | 12,554-11,773 | N-2521 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 10,390 ± 30 | 12,400-12,001 | UCIAMS 27741 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,320 ± 70 | 12,401-11,767 | RT 5257 b | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,285 ± 25 | 12,051-11,821 | UCIAMS 21639 [a] | Suárez 2011a |
| RS-I-69/Brasil | 10,240 ± 80 | 12,367-11,404 | SI-3106 | Miller 1987 |
| Pay Paso 1/Uruguay | 10,225 ± 70 | 12,251-11,406 | RT 5256 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 10,205 ± 35 | 12,008-11,629 | UCIAMS 21632 [a] | Suárez 2011a |
| RS-I-69/Brasil | 10,200 ± 125 | 12,384-11,273 | N-2522 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 10,180 ± 20 | 11,974-11,623 | UCIAMS 21634 [a] | Suárez 2011a |
| RS-I-98/Brasil | 10,180 ± 110 | 12,362-11,268 | SI-3752 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 10,115 ± 25 | 11,795-11,399 | UCIAMS 21633 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9890 ± 90 | 11,700-10,887 | | Austral 1995 |
| RS-IJ-67/Brasil | 9855 ± 130 | 11,708-10,763 | SI-2637 [b] | Miller 1987 |
| RS-I-67/Brasil | 9840 ± 105 | 11,608-10,782 | N-2519 [b] | Miller 1987 |
| L. Canosa/Uruguay | 9730 ± 30 | 11,213-10,826 | UCIAMS 27739 [a] | Suarez 2011a |
| RS-I-69/Brasil | 9620 ± 110 | 11,202-10,590 | SI-2631 [b] | Miller 1987 |
| RS-I-97/Brasil | 9605 ± 120 | 11,205-10,572 | SI-3754 [b] | Miller 1987 |
| RS-IJ-67/Brasil | 9595 ± 175 | 11,265-10,299 | SI-2637 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 9585 ± 25 | 11,081-10,711 | UCIAMS 21641 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9555 ± 25 | 11,070-10,685 | UCIAMS 21642 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9550 ± 20 | 11,069-10,679 | UCIAMS 21647 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9545 ± 20 | 11,068-10,666 | UCIAMS 21635 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9545 ± 20 | 11,068-10,666 | UCIAMS 21646 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9525 ± 20 | 11,064-10,595 | UCIAMS 21640 [a] | Suárez 2011a |
| Pay Paso 1/Uruguay | 9525 ± 20 | 11,064-10,595 | UCIAMS 21638 [a] | Suárez 2011a |
| RS-I-72/Brasil | 9450 ± 115 | 11,089-10,293 | SI-2634 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 9280 ± 200 | 11,124-9,901 | Uru-248[b] | Suárez 2011a |
| RS-I-67/Brasil | 9230 ± 145 | 10,752-9,915 | SI-2625 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 9120 ± 40 | 10,353-10,176 | Beta-156973 [a] | Suárez 2011a |
| RS-I-70/Brasil | 9120 ± 340 | 11,185-9,471 | SI-2632 [b] | Miller 1987 |
| RS-I-99/Brasil | 9035 ± 100 | 10,389-9,739 | SI-3755 [b] | Miller 1987 |
| ZT-1/Uruguay | 8770 ± 30 | 9,877-9,554 | UGAMS 7459 [a] | Suárez et al. 2011 |
| ZT-1/Uruguay | 8750 ± 30 | 9,882-9,546 | UGAMS 7460 [a] | Suárez et al. 2011 |
| RS-IJ-67/Brasil | 8585 ± 115 | 9,898-9,274 | SI-2636 [b] | Miller 1987 |
| Pay Paso 1/Uruguay | 8570 ± 150 | 10,119-9,093 | Uru-246 [b] | Suárez 2011a |
| Boca río Cuaró/Uruguay | 8405 ± 20 | 9,466-9,303 | UCIAMS 27743[a] | inédita |

*Notas: a AMS; b Método estandard. Calibración realizada con Calib 7.0. SHcal13.14. Hogg et al. 2013.*

**Este trabajo tiene como objetivo presentar los avances de las últimas décadas relacionados con las adaptaciones durante el poblamiento temprano, la movilidad y dispersión de la población durante el final del Pleistoceno y Holoceno temprano. Además, se plantean diferentes aspectos de la tecnología lítica como la presencia de una tradición tecnológica bifacial durante la exploración y colonización de la región que incluye diferentes diseños de puntas de proyectil, núcleos y cuchillos bifaciales, la accesibilidad y preferencias de determinadas materias primas para manufacturar conjuntos de artefactos durante el proceso inicial de ocupación de la cuenca del Río Uruguay.**

## Condiciones paleoambientales y paleoclimáticas

Una característica de la cuenca del Río de la Plata es el paisaje de praderas y planicies bajas que ocupan parte del este de Argentina (provincias Buenos Aires, Entre Ríos y Corrientes), el sur de Brasil (estado de Rio Grande do Sul) y parte del actual territorio de Uruguay. Esta región contiene pendientes levemente onduladas y planicies, así como algunas sierras modeladas por la acción fluvial durante el Terciario. El paisaje presenta colinas con formas alargadas, cerros y una amplia red fluvial muy ramificada con gran cantidad de ríos, arroyos, cañadas, lagunas y bañados. Los sitios más antiguos conocidos son sitios al aire libre o cuevas y abrigos rocosos, siempre relacionados o situados junto a cursos de agua como ríos, arroyos, lagos, lagunas, etcétera.

*Figura 2. Núcleo bifacial en arenisca silicificada de grandes dimensiones (227 mm de largo por 170 mm de ancho) proveniente de las canteras y talleres del Arroyo Catalán Chico, Región Arqueológica Catalanes Nacientes Arapey.*

Al terminar el Último Máximo Glacial (ca. 18.000 años AP), el paleocauce del Río de la Plata iniciaba su recorrido inmediatamente después de la desembocadura de los ríos Paraná y Uruguay, próximo a la costa Argentina; luego se extendía y recorría la costa de Uruguay frente a la actual ciudad de Montevideo (Violante y Parker, 2004), para desaguar en el Océano Atlántico.

Durante las glaciaciones del Pleistoceno, la cuenca del Plata permaneció libre de mantos de hielo como una zona periglacial. El principal efecto de las glaciaciones se registra en los depósitos de loess y dunas de arena generadas por la acción eólica (Iriondo, 1999; Rabassa et al., 2005). A partir del final del Último Máximo Glacial, el nivel del mar comienza a subir. Así, durante el final del Pleistoceno las condiciones climáticas generales comienzan a mejorar, haciéndose menos rigurosas, pasando de frías y secas a ligeramente áridas y frías, sub-húmedas/húmedas en Uruguay, Pampa (Argentina) y el sur de Brasil (Dias, 2012; Behling et al., 2005; Iriondo, 1999; Prieto, 2000).

Para el sur de Brasil, Pampa y Uruguay, extensas praderas de gramíneas dominan el paisaje antes y durante el final del Último Máximo Glacial, el final del Pleistoceno y durante el Holoceno (Behling et al., 2005, Behling and Pillar 2008, Iriondo, 1999, Prieto, 2000, Suárez 2011a). Al final del Último Máximo Glacial, las heladas se debieron repetir y las temperaturas durante el invierno alcanzarían los -10 °C.

En el norte de Uruguay, el registro palinológico de tres sitios Pay Paso 1, Pay Paso 0 (turba) y Pay Paso 2 indica que hace 13.000 años cal AP el clima seco y frío de finales del Pleistoceno fue gradualmente remplazado por condiciones más húmedas y templadas hace 12.400 años cal AP, marcando el inicio del Holoceno (Suárez, 2011a). Hace 12.800 años cal AP la hierba *Chenopodiaceae-Amarathus* comienza a establecerse y colonizar las márgenes del río Cuareim, próximo a su desembocadura en el Río Uruguay. Hacia 12.400 años cal AP, *Amarathus* desciende en el registro polínico, cuando comienza la expansión de una variada comunidad arbustiva subtropical-seca. Árboles de gran porte que superan los 20 metros de altura como *Jacarandá, Jacaratia, Astronium* "Urunday", *Protium*, arbustos *Ambrosia, Rhus*, plantas adaptadas a suelos húmedos *Cyperaceae* y *Typha* (paja totora) y a condiciones de alta humedad como helechos *Selaginella*, permiten sugerir que el bosque o "monte" comenzó

a establecerse en las márgenes del Río Cuareim afluente del Río Uruguay hace 12.400 años cal AP, lo que, asociado con el aumento en la temperatura y precipitaciones, indicarían el inicio del Holoceno.

## Diversidad cultural e innovaciones tecnológicas durante el poblamiento

Los datos y la evidencia recuperada en dos sitios arqueológicos en el sur y el norte de Uruguay sugieren que las praderas del sureste de América del Sur estaban pobladas por lo menos 1.000 años antes de la aparición de los grupos portadores de las puntas cola de pescado. En los sitios Urupez 2 y K87 (arroyo del Tigre) recientemente se han obtenido interesantes datos cronológicos y culturales que indican presencia humana entre aproximadamente 14.000 y 13.300 años cal AP (Meneghin, 2015; Suárez, 2016). Estas son evidencias de migraciones humanas que ingresaron al interior del continente durante una etapa de dispersión inicial. Los datos recuperados en Uruguay deben ser confirmados con nuevas investigaciones y con nuevas dataciones radiométricas de esos y otros contextos arqueológicos para garantizar la confiablidad de los resultados. A nivel regional, es importante señalar que en el sitio Arroyo Seco 2 en Pampa (Argentina) se han recuperado evidencias cronológicas y culturales que indican ocupaciones humanas de entre 14.000-13.100 años cal AP (Politis et al., 2014), similares a las recientemente obtenidas para Uruguay. Estos datos amplían la evidencia que indica ocupaciones humanas que rondan 14.000-15.000 años cal AP al este como al oeste de los Andes en el Cono Sur (Dillehay, 2008; Politis et al., 2014; Suárez, 2014).

Posteriormente, a este evento de dispersión inicial la investigación que se viene realizando en la cuenca del Río Uruguay permite sugerir la presencia de una tradición cultural orientada hacia la producción de artefactos bifaciales entre 12.800 y 10.065 años cal AP. Se reconocen tres grupos culturales con diferentes diseños o tipos de puntas de proyectil (Suárez, 2015b). Esta tecnología bifacial se caracteriza por su alto grado de conservación y mantenimiento, versatilidad y utilización de las mejores rocas disponibles, así como el reciclaje de los artefactos bifaciales como puntas a otras formas funcionales (Suárez, 2006). Los grupos humanos debieron adaptarse a las cambiantes condiciones climáticas, faunísticas, paisajísticas y botánicas que se sucedían durante la transición del Pleistoceno al Holoceno. La producción de artefactos bifaciales se orientó hacia la manufactura de núcleos bifaciales (figura 2), puntas de proyectil (figuras 3, 4 y 5) y cuchillos bifaciales (figura 6).

Dentro de esta tradición cultural se han identificado hasta el presente tres grupos culturales que se caracterizan por tener diferentes diseños en su armamento de caza (puntas de proyectil). A medida que las investigaciones en los sitios tempranos del Río Uruguay medio comienzan a ser sistemáticas, emerge una interesante diversidad en el diseño y estilo de las puntas de proyectil (Suárez, 2015a). Las puntas tempranas definidas provienen de excavaciones arqueológicas y contextos estratigráficos que tiene muy buena resolución arqueológica y cronológica, como por ejemplo el sitio Pay Paso 1 (figura 7) y el sitio K87 Arroyo del Tigre (figura 12).

La investigación en sitios estratigráficos en la margen uruguaya del Río Uruguay (sitios Pay Paso 1, K87, Laguna Canosa) (Suárez, 2011a), contrastada con la información regional obtenida principalmente en el sur de Brasil en los sitios (sitios RS-I-66, RS-I-69 y RS-I-70, Areal y Das Flechas) (Corteletti, 2008, Mentz Ribeiro et al., 1995, Miller, 1987) indica que durante el poblamiento de esta región existieron redes sociales de intercambio de información y conocimiento (Borrero, 2015) que se extendieron por amplios territorios del sureste de América del Sur, concebidos como paisajes sociales (Gamble, 2002). Aspectos tecnológicos, económicos, simbólicos y uso del espacio posiblemente fueron compartidos por los grupos tempranos que circulaban por el Río Uruguay medio, nacientes del Río Uruguay, río Negro medio y la costa atlántica durante el final del Pleistoceno y el Holoceno temprano.

El nombre de cada uno de los tipos de puntas de proyectil (Tigre y Pay Paso) se relaciona directamente con el sitio donde estas puntas fueron datadas por primera vez. La distribución de estas puntas incluye el actual territorio de Uruguay y sur de Brasil. La margen argentina del Río Uruguay medio no se está investigando sistemáticamente.

## Puntas cola de pescado o "fishtail"

Las puntas cola de pescado (figura 3) son un artefacto diagnóstico de los cazadores-recolectores tempranos que ocuparon extensas regiones del Cono Sur (Uruguay, Pampa, Patagonia y Tierra del Fuego). Fueron recuperadas por primera vez en estratigrafía asociadas a fauna extinguida del Pleistoceno en Cueva Fell (Bird, 1938). Un pionero de la arqueología uruguaya publica a finales del siglo XIX —sin saber obviamente que estas puntas eran tempranas— una clasificación morfológica de puntas de proyectil, distinguiendo en su muestra dos clásicos ejemplares de puntas cola de pescado provenientes de contextos superficiales de la costa Atlántica (Figueira, 1892, p. 210).


*Figura 3. Puntas cola de pescado (fishtail points) ca. 12.800-12.200 años cal AP. Obsérvese en el ejemplar B acanaladura basal y el ejemplar D punta reciclada probablemente a un artefacto de corte (nótese filo redondeado).*

Este diseño o tipo de punta se ha recuperado con mayor frecuencia en sitios de superficie y en menor medida en sitios estratigráficos en Pampa y Patagonia (Argentina y Chile) (Flegenheimer et al., 2013), el sur de Brasil (Miller, 1987, Dias, 2012) y Uruguay (Suárez, 2003, 2011a). Estas puntas presentan variaciones tecnológicas, morfológicas y estilísticas ligadas al mantenimiento, reciclaje, y/o a diferentes calidades técnicas que se pueden observar en la confección de las mismas, distinguiendo en el conjunto si fueron manufacturadas por aprendices o expertos talladores (Suárez, 2003, 2006). Aunque, en otros casos, las variaciones pueden representar estilos o diferencias culturales locales o regionales (Suárez, 2003).

Entre los aspectos tecnológicos, el tratamiento de la base de la muestra de Uruguay indica que 38.6% (n = 34) de las puntas tienen acanaladura, en tanto que 61.4% (n = 54) no tiene acanaladura; en este último caso la base fue adelgazada por medio de retoque.

Estas puntas sufrieron un intenso proceso de manteniendo, rejuvenecimiento y reciclaje. Las causas del mantenimiento de estos artefactos no están vinculados a la falta de materias primas como se sugiere tradicionalmente (Bamforth, 1986; Binford, 1979; Shott, 1996; Shott y Ballenger, 2007), pues puntas altamente mantenidas y ejemplares reciclados se han registrado en zonas donde existe excelente disponibilidad de rocas de alta calidad, como es el caso del Río Negro medio (véase figura 3D). La figura 3 presenta ejemplares en caliza silicificada (chert) donde se puede observar las diferentes etapas de vida útil por las que pasan estos artefactos para prolongar su vida útil como armas de caza (figura 3, ejemplos B y C), hasta que son reciclados a artefactos cortantes (cuchillos) (figura 3, D) (Suárez, 2006). Además, las puntas cola de pescado de Uruguay, al igual que las de Ecuador y Pampa incluyen puntas unifaciales (Suárez, 2009).

## Puntas Tigre

Este diseño de puntas se distribuye geográficamente en el norte y centro de Uruguay, así como el sur de Brasil. Las puntas Tigre fueron recuperadas en estratigrafía y reconocidas primeramente en el sitio K87, Arroyo del Tigre, durante los trabajos de la MRASG-UNESCO (MEC 1989), pero fueron mejor definidas a partir de evidencia cronológica, arqueológica y estratigráfica en los sitios Pay Paso 1 y Laguna de Canosa (Suárez, 2011a, pp. 185-188). Las puntas Tigre fueron datadas con seis edades radiocarbónicas en tres sitios y los datos cronológicos indican que tienen entre 12.200 y 11.213 años cal AP (10.200 a 9.730 años $^{14}$C AP) (tabla 1). En el sur de Brasil, estas puntas han sido registradas en el estado de Rio Grande do Sul, en los sitios RS-I-69 y RS-I-70 (véase Miller 1987, p. 54, figura 13, puntas b, c y d), y en el sitio "das Flechas" (Corteletti, 2008), este último sitio fuera pero muy próximo a la cuenca del Río Uruguay (figura 1, 14-15).

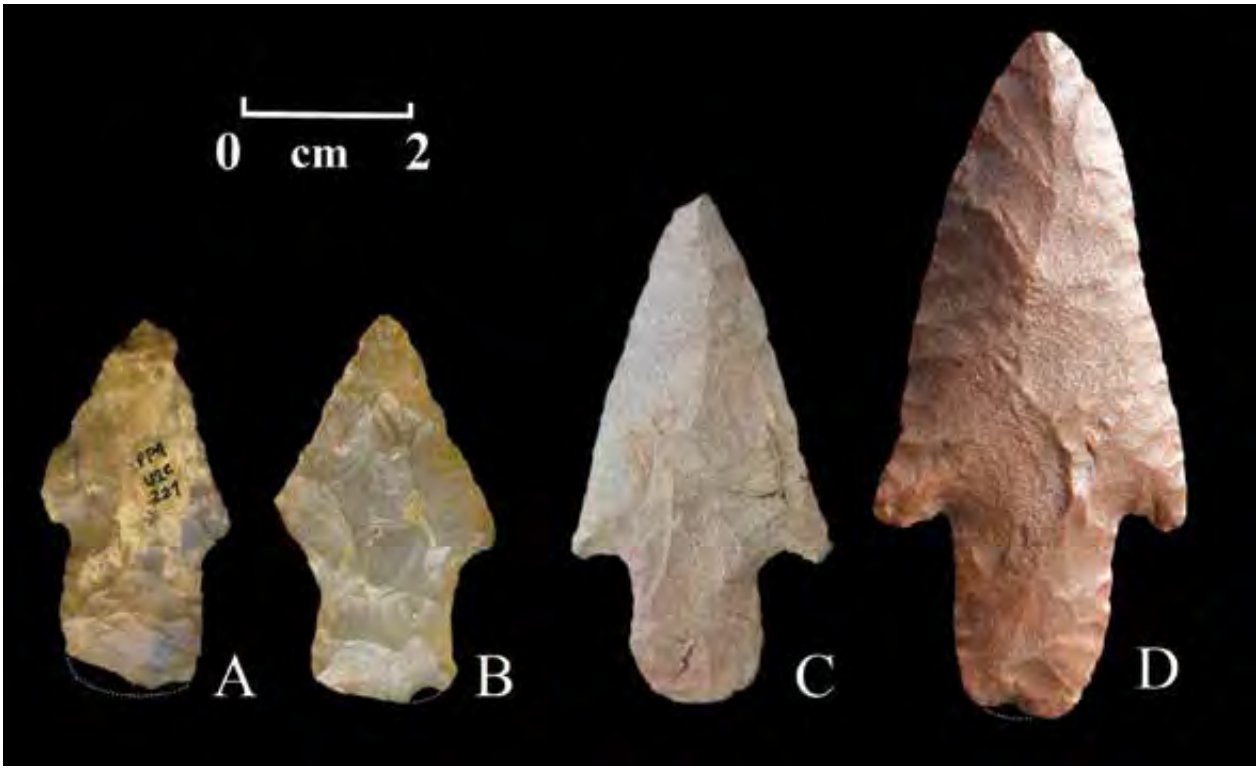


*Figura 4. Puntas Tigre del Río Uruguay medio. (A) Proveniente de la excavación del sitio Pay Paso 1, componente 2 datado en 12.000 años cal. AP, manufacturada en madera silicificada; (B) proveniente de excavación en la Laguna Canosa, datada en 11.213 años cal AP, manufacturada en ágata traslúcida; (C) superficie sitio Pay Paso 1; (D) Río Uruguay, arenisca silicificada.*

Las características morfológicas y tecnológicas principales de las puntas Tigre (figura 4) son pedúnculo ancho con lados rectos o levemente convexos, base convexa o convexa atenuada generalmente adelgazada por retoques, aletas u hombros muy pronunciados con ángulos de entre 70°-90° para ejemplares escasamente rejuvenecidos, limbo triangular corto para las puntas que han sido muy reavivadas y limbo triangular largo en las puntas que están al inicio de su vida útil. Estas puntas tienen adelgazamiento bifacial completo, fueron manufacturadas a partir de preformas bifaciales (véase figura 10 C). A medida que estas puntas son utilizadas como armas en actividades de caza y/o guerra, tienden a perder las aletas que se modifican hacia hombros muy o poco pronunciados, debido al rejuvenecimiento.

Las puntas Tigre que se han recuperado en contextos estratigráficos datados por $^{14}$C han sido altamente mantenidas y rejuvenecidas, indicando que han tenido una larga vida útil (figura 4, A y B). Estas puntas representan un diseño secundario-rejuvenecido, resultante de una tecnología conservada orientada a extender su vida útil, que debió ser diferente del diseño original-primario o prototipo con escaso mantenimiento (figura 4, C y D).

Recientemente, López Mazz (2013, pp. 99) denomina a las puntas Tigre puntas "pedunculadas triangulares con aletas" "*stemmed triangular with wings*" (STW), omitiendo el nombre que originalmente le dimos a este diseño. Este tipo de punta temprana fue definido como tal en la tesis de doctorado de R. Suárez realizada en 2010 que se publicó un año después (véase Suárez 2011a, pp. 185-188). Previamente a que definiéramos este diseño (año 2010), López Mazz et al.,= (2009a, 2009b), en trabajos referidos al poblamiento temprano de Uruguay, no hace mención a la existencia de este diseño o tipo de punta de proyectil. De cualquier manera, lo importante aquí es señalar que nombrar un tipo de puntas tempranas "*pedunculadas triangulares con aletas*" es impreciso. Primero, porque se basa en atributos generales como las aletas y forma triangular del limbo. Las aletas y la forma del limbo son atributos modificados durante la vida útil de estos artefactos, debido al constante proceso de rejuvenecimiento que sufren estas armas para ser funcionales en actividades de caza. Segundo, porque puntas "*pedúnculadas triangulares con aletas*" se han recuperado en diferentes periodos cronológicos de la prehistoria de Uruguay: desde la transición Pleistoceno Holoceno (Suárez, 2011a), en contextos arqueológicos del Holoceno medio datados entre 4.190 a 3.460 años $^{14}$C AP (Iriarte, 2003, figura 4.17) y en sitios del Holoceno reciente (Hilbert, 1991). Tercero, y relacionado con el punto anterior, es un término ambiguo. La gran mayoría de puntas de proyectil provenientes de contextos superficiales y estratigráficos en Uruguay son puntas "pedunculadas triangulares con aletas", y tienen una significativa variabilidad en la morfología del pedúnculo, forma de las aletas, y forma del limbo. Por lo tanto, el nombre "*puntas pedunculadas triangulares con aletas*" es general, impreciso y ambiguo. El principal problema es de orden cronológico pues se puede incluir en esta denominación puntas de diferentes periodos, o sea puntas tempranas (final del Pleistoceno) como puntas más recientes (Holoceno medio y Holoceno final). Si un criterio similar se hubiera utilizado para denominar los diferentes tipos de puntas

tempranas en América del Norte, se las hubieran denominado "*apedunculadas lanceoladas sin aletas*", de esta forma se incluirían en un mismo tipo a las puntas Clovis, Folsom, Agate Basin, Mesa y Goshen (Stanford et al., 1999).

En los sitios Pay Paso 1, Laguna Canosa, y K87, las excavaciones realizadas permitieron recuperar bifaces, láminas, raspadores y otros artefactos que formaban parte del conjunto de artefactos utilizados por los grupos humanos que portaban las puntas Tigre (figura 8, C y D).

## Puntas Pay Paso

Las puntas Pay Paso fueron definidas por Suárez (2003) y datadas a partir de una base cronológica de 10 edades radiocarbónicas entre 11.081 y 9.930 años cal AP (9585-8570 años $^{14}$C AP). Hasta el presente, se han registrado un total de 40 puntas Pay Paso en Uruguay y 5 en el Sur de Brasil.

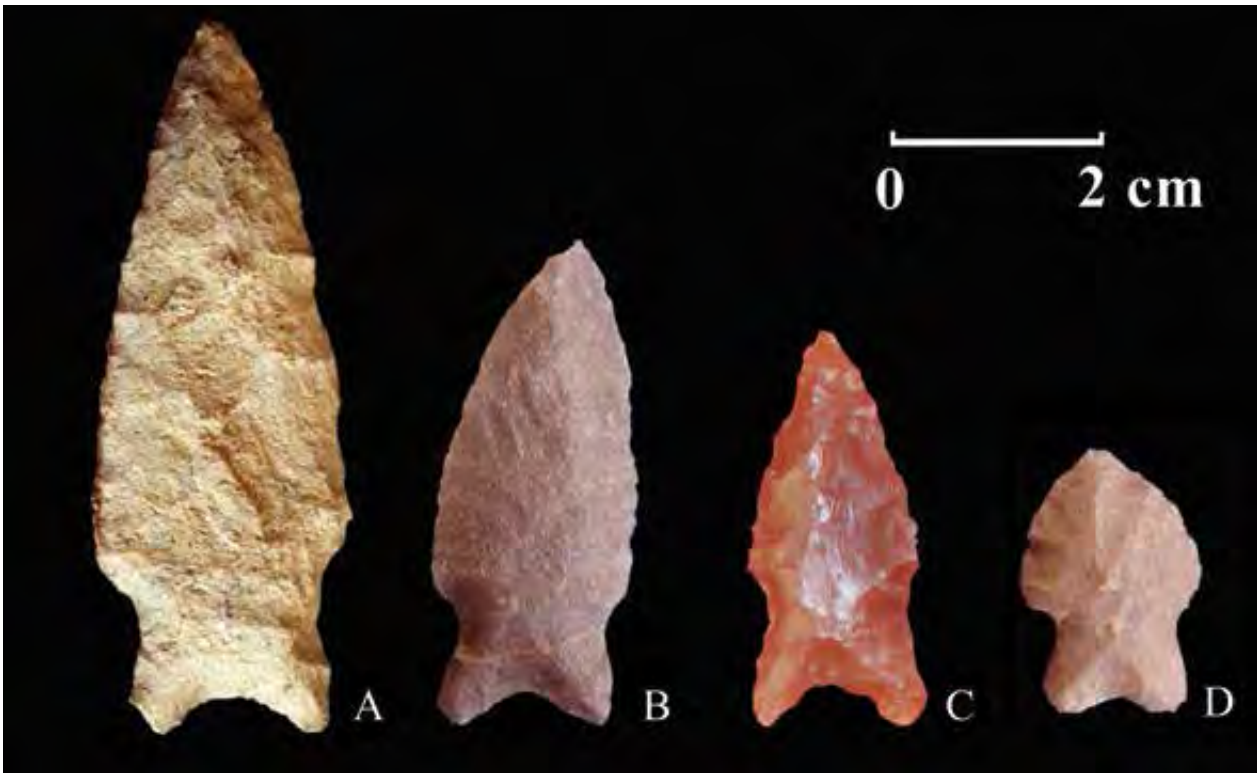


*Figura 5. Puntas Pay Paso de tres regiones de Uruguay. (A) Proveniente de los arenales del Río Tacuarembó Grande; (B) recuperada en excavación arqueológica del sitio Pay Paso 1, componente 3 datado en 11.081-10.800 años cal AP, arenisca silicificada; (C) Río Negro medio, caliza silicificada; (D) sitio Pay Paso 1 (superficie) arenisca silicificada. Obsérvese en los ejemplares B, C y D el negativo de lascado triangular en la base, característica de este tipo de puntas de proyectil.*


*Figura 6. Cuchillos bifaciales asimétricos tempranos del Río Uruguay medio. (A) Río Uruguay, Salto Grande manufacturado en caliza silicificada; (B) sitio Pay Paso 4 desembocadura río Cuareim, en ágata traslúcida; (C) Río Uruguay medio (tiene una fuerte pátina negra que no permite la identificación de la materia prima).*

*Figura 7. Vista panorámica del sitio Pay Paso 1. © Natalia Azziz.*

El diseño y principales características tecno-morfológicas de las puntas Pay Paso (figura 5) incluyen pedúnculo corto, base cóncava profunda, lados del pedúnculo cóncavos divergentes expandidos hacia la base, lados del limbo convexo o recto, retoque laminar regular en el limbo y tratamiento de la base muy cuidadoso realizado con un negativo triangular (Suárez, 2003).

Hemos registrado 40 puntas Pay Paso en varios sitios tempranos del Río Uruguay medio, río Cuareim, río Negro y río Tacuarembó. Este mismo tipo fue identificado en el sur de Brasil en los sitios Areal (Mentz Ribeiro et al., 1995) y "das Flechas" en estado de Rio Grande do Sul y en la región de Urubucí en el sitio Avencal Baixo 1 en el estado de Santa Catarina (Corteletti 2008, p. 41, Corteletti 2013). Los sitios del sur de Brasil están localizados aproximadamente a 802 y 610 km respectivamente del sitio tipo Pay Paso. Esto nos muestra el vasto territorio ocupado por los cazadores-recolectores que manufacturaron las puntas Pay Paso. Al igual que las puntas cola de pescado y las Tigre, las puntas Pay Paso sufrieron un intenso proceso de rejuvenecimiento y mantenimiento.

Una de las características distintivas de las puntas Pay Paso es la presencia de un lascado triangular profundo de la base (véase la figura 5, B, C y D). Además, generalmente el ancho del pedúnculo en la base es mayor al largo del pedúnculo, esto causa que el diseño de esta punta se vea como una punta de pedúnculo corto.

## Movilidad y dispersión de la población durante la colonización inicial

La distribución y frecuencia de las puntas cola de pescado, Tigre y Pay Paso permiten comprender diferentes aspectos ligados a la movilidad y ambientes ocupados por los grupos humanos que colonizaron la región durante el poblamiento inicial de la cuenca del Plata.

Bamforth (2009, p. 146) indica que las puntas de proyectil fueron una clase de artefacto importante para los grupos humanos que las produjeron. Tienen características morfológicas propias en su diseño y se distribuyen por amplias regiones geográficas. Presentan un alto grado de mantenimiento y en muchos casos fueron recicladas. Todas estas características se pueden observar en las puntas tempranas que circularon por la cuenca del Plata y Río Uruguay. Podemos conjeturar entonces que las puntas cola de pescado, Tigre y Pay Paso fueron transportadas y descartadas en diferentes sitios y ambientes de una amplia región geográfica (Bamforth, 2009; Binford, 1979; Shott, 1986, 1996; Shott y Ballenger, 2007), como lo es el sureste de América del Sur. De esta forma es importante poder observar la frecuencia y distribución de las puntas tempranas en esta región del continente porque permite definir un vasto territorio donde hay evidencias de ocupaciones tempranas.

La distribución de las puntas cola de pescado se registran en Pampa-Patagonia en Argentina y Chile, todo Uruguay, sur de Brasil, en ambientes de praderas con pasturas; así como en otras regiones y ambientes de América del Sur (Ecuador, centro de Chile, Perú). En el Cono Sur se distribuyen desde la costa del océano Atlántico hasta el océano Pacífico.

Las puntas Tigre y Pay Paso tienen una distribución más restringida, son frecuentes en el norte, centro y sur de Uruguay, en las cuencas de los ríos Uruguay medio, Negro medio y Tacuarembó grande; en el sur de Brasil se registran en el Río Uruguay medio-alto, en los estados de Río Grande del Sur y Santa Catarina (Corteletti, 2008, 2013; Miller, 1987). El límite sur del territorio utilizado por estos cazadores-recolectores fue la desembocadura del Río Uruguay (34°10'S - 58°09'O), no hay evidencia arqueológica

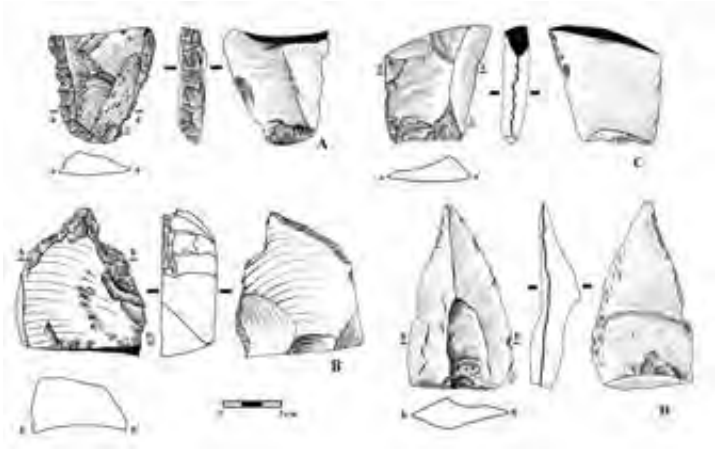

*Figura 8. Artefactos formatizados recuperados en la excavación del sitio Pay Paso 1, componente 2 datado entre 12.008 y 11.400 años cal AP, asociados con puntas Tigre. (A) Raspador denticulado de filo largo (arenisca silicificada); (B) raspador de filo extendido (caliza silicificada); (C) artefacto de filo retocado (basalto); (D) lasca de arista con filo natural utilizado (arenisca silicificada).*


*Figura 9. Artefactos unifaciales y desechos de talla en ágata traslúcida recuperados en los componentes tempranos del sitio Pay Paso 1.*

de puntas Tigre y/o Pay Paso más al sur en Pampa (Argentina). Además, no se han registrado estos diseños en contextos superficiales o estratigráficos en esta región geográfica.

Por otro lado, los recursos líticos y fuentes de materias primas han atraído interés pues permiten conocer diferentes aspectos de la movilidad y organización de la tecnología de los cazadores-recolectores (Amick, 1996; Binford, 1980; Kelly 1983; Odell 1996).

En el norte de Uruguay, recientemente se definió un corredor de 100 km de largo por 40 km de ancho donde hay talleres, canteras de aprovisionamiento de recursos líticos silicificados y afloramientos de ágata traslúcida, arenisca silicificada, jaspe, ópalo y otras materias primas para hacer artefactos de piedra (Suárez, 2010). Esta área fue denominada *Región Arqueológica Catalanes Nacientes Arapey* (RACNA) (figura 1, 16). Los nuevos datos obtenidos permiten plantear pautas sobre la accesibilidad y transporte de rocas y artefactos durante la prehistoria de la región, ligados a la movilidad de los cazadores-recolectores tempranos.

Existen tres sitios residenciales sobre el Río Uruguay medio con muy buena información sobre el uso de ágata traslucida durante la transición Pleistoceno Holoceno. El sitio K87 (30° 37'38, 20" S - 57° 50'17, 00" W), se localiza sobre el Río Uruguay próximo a la desembocadura del arroyo del Tigre, fue datado por la misión de la UNESCO en 10.420 ± 90 años $^{14}$C AP (MEC, 1989, p. 60). En los niveles antiguos del sitio fueron recuperados artefactos en ágata traslúcida (MEC 1989, p. 50-54; Suárez, 2011b). El sitio Pay Paso 1 (30° 16'06, 60" S - 57° 27'38, 30" W), se ubica en la margen izquierda del río Cuareim a 53 km del sitio K87, tiene una muy buena resolución arqueológica, estratigráfica y cronológica (Suárez, 2011a). El sitio tiene más de 30 edades radiocarbónicas que datan los tres componentes entre 12.800-9.600 años cal AP (figura 7) (Suárez, 2011a, tabla 5.2, p. 93) donde el segundo recursos lítico más utilizado fue ágata traslúcida tanto en artefactos formatizados (14,41%) como en desechos de talla (*debitabe*) (10,71%) (figura 9). El sitio Pay Paso 1 es el único del Río Uruguay donde se recuperó fauna del Pleistoceno (caballo americano extinguido *Equus* sp. y Gliptodonte) asociada con artefactos líticos. El tercer sitio que ofrece información sobre la utilización de ágata traslucida durante el poblamiento de la región es el sitio Laguna de Canosa, localizado 47 km al norte del sitio K87 y a 20 km al oeste del sitio Pay Paso 1. En el nivel antiguo del sitio datado en 11.200 años cal AP se recuperaron artefactos en ágata traslúcida, así como una punta Tigre muy rejuvenecida (véanse las figuras 4, B, y 10, A).

Los componentes tempranos de los sitios estratigráficos K87, Pay Paso 1 y Laguna Canosa comparten la presencia de artefactos formalizados manufacturados en ágata traslúcida.

La presencia de grandes cuchillos bifaciales en ágata traslúcida que superan los 110 mm de largo en los sitios residenciales del Río Uruguay medio y desembocadura del Río Cuareim (figura 6, B) sugieren el uso de preformas y formas bases que debieron superar los 180-150 mm de largo. Las canteras o afloramientos de rocas para manufacturar estos artefactos se ubican a 170 km al este de los sitios residenciales del Río Uruguay medio (figura 1, 16). En la Región Arqueológica Catalanes Nacientes Arapey la disponibilidad y accesibilidad de ágata traslúcida en forma de geodas es apropiada para iniciar la reducción y/o adelgazamientos de series completas de artefactos bifaciales que culminan en la producción de bifaces que superan los 110 mm de largo (figura

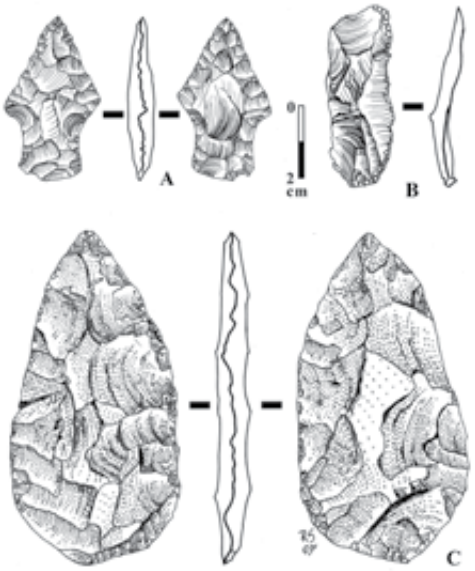


*Figura 10. Artefactos del sitio Laguna Canosa (Río Uruguay) datados en 11.200 años cal. AP. (A) Punta Tigre en ágata traslúcida; (B) lámina con filo natural utilizado en madera silicificada; (C) preforma bifacial en arenisca silicificada.*


*Figura 11. Variante de punta cola de pescado recuperada en superficie en el sitio Laguna Canosa (Río Uruguay medio), obsérvese aleta y hombro muy pronunciado y limbo triangular largo, manufacturada en caliza silicificada.*

6, B) como los que se han recuperado en los sitios residenciales del Río Uruguay medio. En esta región es interesante señalar la presencia de importantes canteras prehistóricas de abastecimiento de ágata traslúcida, entre los sitios arqueológicos más importantes de esta región se ubican los sitios sobre el arroyo Catalán Seco y arroyo Catalán Chico. Estos sitios se encuentran en serio peligro de destrucción debido al avance de la explotación minera de ágatas y amatistas que se desarrolla en la zona. Aún hay posibilidad de generar acciones tendientes a preservar-conservar in situ estos sitios arqueológicos donde durante la prehistoria diferentes grupos humanos se aprovisionaron de ágata traslúcida. Además, estos sitios arqueológicos tienen un valor agregado, pues son el único lugar reconocido donde la actividad humana que desarrolla nuestra sociedad actualmente (canteras de ágatas) es exactamente la misma actividad que realizaron los grupos de cazadores recolectores prehistóricos que recorrieron la zona hace 12.800-10.000 años cal AP que utilizaron los afloramientos de ágata como canteras y talleres para manufacturar artefactos de piedra.

## Discusión y conclusiones

Los datos generados en los diferentes países (Uruguay-Brasil por ejemplo) deben necesariamente integrarse en una base de datos que vaya más allá de los límites naturales o arbitrarios de los países, pues durante el poblamiento no existían las fronteras políticas actuales. Este trabajo va en ese sentido, integra la información generada en Uruguay y sur de Brasil, falta integrar los datos de la margen Argentina del Río Uruguay, donde aún no comenzaron las investigaciones sistemáticas en relación al poblamiento temprano.

El ingreso los primeros flujos humanos hacia el interior del continente se produce desde la costa Atlántica, el acceso por la red fluvial donde las cuencas del Plata y del Río Uruguay son una de las principales vías de ingreso y dispersión de la población, habría minimizado los riesgos de explorar y colonizar espacios previamente inhabitados (Miotti, 2006; Miotti y Magrin 2012; Suárez 2011a, 2015a).

El reciente reconocimiento de las puntas Pay Paso y Tigre tienen una fuerte implicancia para comprender las adaptaciones tempranas ocurridas durante la transición Pleistoceno Holoceno. Los datos sugieren diversidad tecnológica durante el poblamiento del sureste de América del Sur, que comienza a reconocerse en diferentes diseños de puntas de proyectil y grupos humanos que circularon en la cuenca del Plata y en particular en la cuenca del Río Uruguay.

El río Uruguay medio en una extensión aproximada de 450 km entre los ríos Queguay (Uruguay) e Ijuí (Brasil) es una región donde hay una importante base cronológica que evidencia redundantes ocupaciones tempranas ligadas al poblamiento inicial del sureste del continente. Los grupos humanos luego de ingresar por la vertiente atlántica se dispersaron hacia el norte, alcanzando probablemente el estado de Santa Catarina (sur de Brasil), hacia el sur hay evidencia de ocupaciones tempranas en el río Negro medio y la costa Atlántica en el actual territorio de Uruguay. Hay que remarcar que el límite sur del territorio utilizado por los grupos Tigre y Pay Paso es la desembocadura del río Uruguay. En sitios tempranos de Pampa Argentina estos diseños de puntas de proyectil no se han recuperado o registrado hasta el presente. Sin embargo, el uso del espacio que realizaron estos grupos humanos hacia el norte indica la utilización y reconocimiento de amplios territorios ligados con ambientes fluviales que incluyen los actuales estados de Río Grande del Sur, Santa Catarina y Paraná en el sur de Brasil, donde se han recuperado puntas de proyectil Tigre y Pay Paso.

*Figura 12. Vista general de componente temprano durante la campaña de excavación del sitio K87 Arroyo del Tigre en el año 2012.*

*Figura 13. Excavación arqueológica realizada en el sitio K87 Arroyo del Tigre en septiembre de 2012.*

Los sitios arqueológicos del Río Uruguay medio presentan redundancia de ocupaciones tempranas durante el poblamiento en diferentes periodos cronológicos, o sea durante el final del Pleistoceno, transición Pleistoceno al Holoceno y Holoceno temprano.

El inicio de la ocupación de esta región comienza con flujos humanos que reconocen las planicies del sur de Uruguay hace 14.000 años cal AP, los sitios de este periodo son muy escasos pero recientemente se viene presentando evidencia cronológica y arqueológica de estas efímeras ocupaciones (Suárez, 2014, 2016; Meneghin, 2015). Posteriormente, entre 12.800-10.065 años cal AP se reconoce una tradición bifacial con grupos humanos que manufacturan diferentes diseños de puntas de proyectil pedunculadas, aunque se registran también núcleos bifaciales, preformas y cuchillos. Hacia 12.800 años cal AP (ca. 10.800 años $^{14}$C AP) la tecnología asociada a las puntas cola de pescado está presente en las planicies de Uruguay y sur de Brasil, en este mismo periodo en las excavaciones arqueológicas del sitio Pay Paso se reconoce una tecnología orientada hacia la producción de hojas. Estos grupos humanos se adaptaron en vastos territorios de praderas con gramíneas y pasturas en el Cono Sur.

En el Río Uruguay medio hace ca. 12.200-12.000 años cal AP, ocurre una reorganización tecnológica con innovaciones culturales como la aparición de las puntas Tigre y la tecnología asociada a las mismas. La restructuración tecnológica incluye cambios tecnológicos y morfológicos en las puntas de proyectil, destacándose la aparición de aletas, la disminución de la acanaladura como técnica para adelgazar la base, la forma de los lados del limbo, así como la forma de la base y lados del

pedúnculo. Entre los aspectos tecnológicos existe una reducción significativa en la acanaladura de la base, disminuyendo de 38.6% en las puntas cola de pescado a 4.7% en las puntas Tigre. Esto podría indicar una transición entre las dos tecnologías, donde se tiende a dejar de acanalar la base de las puntas. Si bien se observan cambios en la morfología del pedúnculo y la base, el tamaño del pedúnculo —largo y ancho— se mantiene constante sin mayores cambios en las puntas cola de pescado y Tigre. La punta ilustrada en la Figura 11 podría ser un ejemplo de esta transición tecnológica, donde los productores de puntas cola de pescado comienzan a experimentar realizando cambios y mutaciones en las aletas a las puntas, pero manteniendo la clásica forma del pedúnculo y lados del limbo. Esta punta tienen 94,2 mm de largo por 40 mm de ancho, y 7,5 mm de espesor; es importante remarcar que una de las aletas tiene un ángulo de 75° y sobresale 10 mm del pedúnculo donde se inicia el limbo, lo que es infrecuente en las puntas cola de pescado. Además, se observa que esta punta esboza un limbo triangular largo, pero manteniendo los lados convexos.

Las innovaciones morfológicas que se suceden en las puntas del Río Uruguay medio están asociadas al cambio en la forma de los lados del limbo, que pasan de ser convexos en las puntas cola de pescado a rectas en las puntas Tigre. Estos cambios e innovaciones pueden ser respuestas tecnológicas vinculadas a la reorganización del armamento de los cazadores al iniciarse el Holoceno. Esta innovación tecnológica no necesariamente implica un reemplazo cultural, representa el reacondicionamiento de las armas como respuesta a cambios en los parámetros climáticos, paleoambientales y faunísticos asociados con la expansión del bosque en galería por el Río Uruguay medio y a una fase climática más cálida y húmeda que comienza hace ca. 12.400-12.200 cal años AP, justo cuando aparecen las puntas Tigre.

El aprovisionamiento de recursos líticos para hacer artefactos indica que durante el poblamiento de esta región del continente los grupos humanos tenían una movilidad logística que incluía circuitos de cientos de kilómetros en busca de rocas específicas para confeccionar sus artefactos.

Existen dos casos de estudio bien documentados. El caso del ágata traslucida en el norte de Uruguay, donde los grupos humanos se trasladaron desde los sitios residenciales del Río Uruguay medio hasta la *Región Arqueológica Catalanes Nacientes Arapey,* alcanzado rangos de movilidad de hasta 170 km. Las largas distancias que debieron viajar los cazadores-recolectores para obtener ágata traslúcida sugieren una movilidad logística (Binford, 1980; Shott 1986) relacionada con circuitos de movilidad planificados para acceder a recursos líticos específicos. Quizás la cualidad de ser traslúcida le dio al ágata un significado social o un valor simbólico que la hizo particularmente atractiva para manufacturar artefactos.

Por otro lado, Flegenheimer et al. (2003) señalan el transporte de caliza silicificada rojiza desde el centro-sur de Uruguay hasta Pampa Argentina por medio de intercambio entre grupos humanos que alcanzarían distancias de entre 400-500 km durante la Transición Pleistoceno Holoceno. Aunque también el acceso a este recurso por grupos humanos de Pampa, pudo haber ocurrido de forma directa. O sea, grupos humanos de Pampa pudieron haber accedido al recurso caliza silicificada rojiza de Uruguay durante procesos de agregación social, cuando diferentes bandas se pudieron reunir en el río Negro medio, donde existe la mayor densidad de puntas cola de pescado en Uruguay y pudieron acceder a los afloramientos regionales de caliza silicificada rojiza.

Existieron, por lo tanto, dos estrategias diferentes relacionadas con incursiones o viajes a largas distancias para el acceso a lugares específicos de aprovisionamiento de caliza silicificada rojiza y ágata traslúcida que estarían unidas a estrategias logísticas de movilidad e intercambio que ocurrieron durante el poblamiento del sureste de América del Sur.

El poblamiento de la cuenca del Plata y el Río Uruguay medio se inició con pequeños flujos humanos que lentamente exploraron y colonizaron esta región. Los grandes cursos fluviales, como el Río Uruguay, donde se puede obtener concentraciones significantes de recursos (líticos, fauna, madera, agua, etcétera), fueron las principales rutas de entrada, comunicación y dispersión de los primeros exploradores (en el sentido de Borrero, 1999) y poblaciones que se aventuraron hacia el interior del continente desde la costa Atlántica (Miotti, 2006; Miotti y Magnin 2012; Suárez 2011a). El ingreso por el denso sistema de ríos debió haber minimizado los riesgos de explorar una región del continente previamente desconocida e inhabitada. Las poblaciones debieron ser muy pequeñas y estar esparcidas a través de vastos territorios, generando bajos niveles de visibilidad en el registro arqueológico (Borrero, 1999). La tecnología cola de pescado representa uno de los procesos iniciales y más exitosos de exploración humana en el Cono Sur. Sin embargo, los datos recientemente obtenidos indican que las planicies de Uruguay estaban pobladas antes de la aparición del horizonte cola de pescado. Existieron poblaciones dispersas por vastos territorios hace 14.000 años cal BP, adaptadas a diferentes regiones geográficas del Cono Sur durante el final del Pleistoceno, como el centro-sur de Chile (Dillehay, 2008), Pampa en Argentina (Politis et al., 2014) y Uruguay (Suárez, 2014).

Por otro lado, las adaptaciones y tecnologías Tigre y Pay Paso tienen una más restringida distribución geográfica. Estos grupos humanos circularon por vastas regiones del norte y centro de Uruguay, así como por el sur de Brasil. Puntas Pay Paso por ejemplo se han reconocido a 800 km del sitio homónimo. Estos grupos explotaron y utilizaron amplios territorios que

alcanzan aproximadamente 600.000 km$^2$, incluyendo el actual territorio de Uruguay y los estados de Río Grande del Sur y Santa Catarina del Sur de Brasil.

La explotación de ambientes con un amplio rango y variedad de recursos como se encuentra usualmente en los grandes ríos favoreció la exploración y colonización de esta región. Los cazadores-recolectores entre aproximadamente 12.800-9.500 años cal AP tenían una alta movilidad residencial caracterizada por traslados y movimientos frecuentes por las márgenes del Río Uruguay y sus tributarios, que eran utilizados como vía de comunicación y tránsito. Además, se observa una movilidad logística para acceder a recursos específicos, como se ha indicado en los viajes necesarios para acceder a recursos líticos.

Las diferentes adaptaciones tempranas observadas en diferentes tecnologías asociadas a la variación morfológica en las puntas responden a reorganizaciones sociales internas de los grupos humanos que debieron enfrentan los bruscos cambios climáticos, ecológicos y faunísticos ocurridos durante la transición Pleistoceno-Holoceno. Las innovaciones tecnológicas observadas en el cambio del diseño de las puntas de proyectil no significan un reemplazo cultural, pero sí transiciones tecnológicas causadas por cambios paleoambientales asociados con el avance de la floresta en galería por las márgenes de los ríos durante el inicio del Holoceno. El estilo de vida de los grupos humanos portadores de los diseños cola de pescado, Tigre y Pay Paso probablemente siguió siendo similar en cuanto a sus estrategias sociales, políticas y de movilidad.

La investigación sobre el poblamiento en la cuenca del Plata es un excelente laboratorio para investigar la inicial dispersión y colonización humana del sureste de América del Sur, sin embargo es necesario integrar nuevas regiones a la discusión, esto sin duda aportará información inédita que permitirá ampliar y discutir el esquema propuesto en este trabajo.

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# Climate, Catastrophe and Culture in the Ancient Americas: the Case of the Pacific Coast

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## Abstract

**The Peruvian coast is an extreme environment of radical contrasts. Though tropical, the desert landscapes that dominate much of this coast are usually one of the driest deserts on earth. Dense human populations and complex social organizations are possible thanks to two factors: rivers that run down from the adjacent Andes mountains to fill irrigation canals, and one of the world's richest marine fisheries. Large magnitude earthquakes and sometimes tsunamis occasionally shatter this apparent tranquillity. At least as devastating are El Niño events that occur at irregular intervals and intensities. By warming the normally cool water of the Antarctic Humboldt Current, El Niño not only reduces marine biomass but also causes convective storms leading to torrential rainfall on the coastal plain. Rain in the desert is rarely a good thing. On the Peruvian coast, waters coalesce into raging, destructive floods that alter the landscape and destroy human infrastructure, while pooling on the countryside to rot crops and attract disease-bearing insects.**

**Since the arrival of humans over 14,000 years ago, El Niño frequency has varied along with population density and social complexity. Before 9,000 BP, El Niño was present but of unknown frequency. People lived in small groups that hunted, fished and gathered. Social complexity was low. From 9,000 to about 6,000 years ago, El Niño was absent or extremely rare. Through this period, human populations grew slightly and aggregated into villages, even building small-scale monumental architecture and developing or acquiring farming. From 6,000 to 3,000 BP, El Niño returned but with less frequency than in modern times. Populations grew more rapidly and people established major monumental centres that suggest a higher degree of social complexity. From 3,000 years ago until AD 1532, El Niño became much more frequent, populations grew rapidly along with site size and volume of monumental construction, and states and empires arose. The Spanish conquistadors arrived in AD 1532 and within a century, coastal population had plummeted to as little as 1% of the final Pre-Columbian numbers. Through time, then, growth in population and complexity paralleled increasing risk as defined by El Niño frequency. Only a fully anthropogenic event, the Spanish Conquest, was able to trigger a long-term demographic disaster. These broad-brush patterns require that we examine the nature of catastrophe more closely, both in the past and for the future.**

**The Peruvian coast has over 14,000 years of sites that demonstrate the above patterns. Some of these sites are feasible for inclusion on the UNESCO Tentative List because they fit some or all of the following criteria for Outstanding Universal Value (World Heritage Centre 2013, paragraph 77): 'bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared (criterion iii); be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history (criterion iv); and be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change' (criterion v). They also concur with the narratives considered for the definition of Human Evolution Sites for consideration of the HEADS Programme: 'Sites important for the history of science, Sites related to human mobility, Colonization of new environments and dispersion, and Deposits useful for the reconstruction of palaeo-environments'. I close this chapter with a brief review of sites that fit these criteria and narratives.**

## Introduction

**The Pacific coast of Peru is subject to significant natural disasters that tend to recur frequently but without a predictable periodicity. Both climate and geology drive events that alter resources, change landscapes and affect human societies in this dynamic region. Here, I briefly review the natural forces that have impinged on culture and society since people first arrived in Peru over 14,000 years ago (Sandweiss et al., 2001, 2007; Sandweiss, 2014; Sandweiss and Quilter, 2012). As El Niño is the most patterned of these natural processes and therefore most likely to correlate with patterned**

*Figure 1. Peruvian coastal desert looking south from the Los Morteros site, Salinas de Chao, north Coast of Peru.*

*Figure 2. Artisanal fishing fleet at Bayovar, north Coast of Peru.*

*Figure 3. Irrigated fields in the Supe Valley, north Central Coast of Peru, looking toward Caral.*

**change in human behaviour, I go into some detail on our reconstruction of El Niño frequency over the span of human occupation in this region. I point to several correlations between El Niño and prehistoric cultural change. Finally, I review several Peruvian sites that might be considered for inclusion in the UNESCO Tentative List; one is directly related to the reconstruction of ancient El Niño behaviour.**

## Natural forces

The Peruvian coast lies between the cold Humboldt or Peru Current flowing up from Antarctica and the Andes Mountains. As a result of these two barriers to rainfall, in a normal year the region is one of the driest deserts on earth (Figure 1). However, the same cold current that prevents rain is also a highly productive upwelling zone that is one of the world's richest fisheries (Figure 2).

At the same time, the Andes capture precipitation in the form of rain and snow, some of which flows into rivers that run down to the coast and fill irrigation canals (Figure 3). These two factors have provided the necessary resources for large coastal populations and the development of large, complex societies.

The Andes are located on a subducting plate margin (the oceanic Nazca Plate is sliding under the continental South American Plate), so the region experiences frequent seismic activity and volcanism. Earthquakes, volcanic eruptions and the tsunamis sometimes associated with seismic activity have a devastating impact not only on the people but also on the towns, cities and economic infrastructure, such as irrigation systems (for example, Giesecke and Silgado, 1981). However, because of the unusual shallow-angle subduction under northern and central Peru, active volcanism does not occur here as it does in Ecuador and in southern Peru, Bolivia, northern Chile and Argentina (Barazangi and Isacks, 1976). Consequently, this sector of the central Andes lacks catastrophic volcanic eruptions.

El Niño Southern Oscillation (ENSO) dominates present-day climatic variability on inter-annual timescales in the tropics and involves both the atmosphere and the ocean in the tropical Pacific (for example, Maasch, 2008). On the central Andean coast, El Niño warms near-shore waters, bringing torrential rainfall to the land and depressed biotic productivity to the adjacent

ocean. Frequency, intensity and duration of El Niño events generally follow a latitudinal gradient, decreasing toward the south. However, each event is different and rainfall can skip valleys or occur in different sectors of valleys, with variable consequences. In this largely unvegetated region, the rains often lead to destructive flooding as well as plagues of insects and diseases (see, for instance, Alcocer, 2001 [1580] for eyewitness accounts of the first large magnitude El Niño of the Colonial epoch, in AD 1578).

Seismic activity and El Niño flooding work synergistically to alter landscapes, affecting human settlements. Earthquakes produce abundant debris on the landscape; El Niño flooding mobilises this unconsolidated sediment, often resulting in coastal progradation (seaward expansion of the shoreline) and inland dune incursions that can cover fields and depress agricultural productivity (see Sandweiss et al., 2009; Sandweiss and Quilter, 2012).

## Prehistory of El Niño

In the wake of several large-scale El Niño events over the last 30 years, archaeologists, geologists and palaeoclimatologists have worked hard to reconstruct the prehistory of this climatic anomaly. Molluscs found in archaeological sites on the north and central coasts of Peru provided the first clues that El Niño frequency had varied significantly throughout the Holocene. In the aggregate, available archaeological and palaeoclimatic data support a major change in tropical Pacific climate at about 5800 cal yr BP (Rollins et al., 1986; Sandweiss et al., 1996, 2001, 2007), though it is unclear whether El Niño was absent or just extremely rare for several millennia prior to that date. Molluscan remains from Peru also suggest that between *c.* 5800 and 3000 cal yr BP, El Niño was present but less frequent than today. Modern, rapid recurrence intervals were apparently achieved only after that time (Sandweiss et al., 2001).

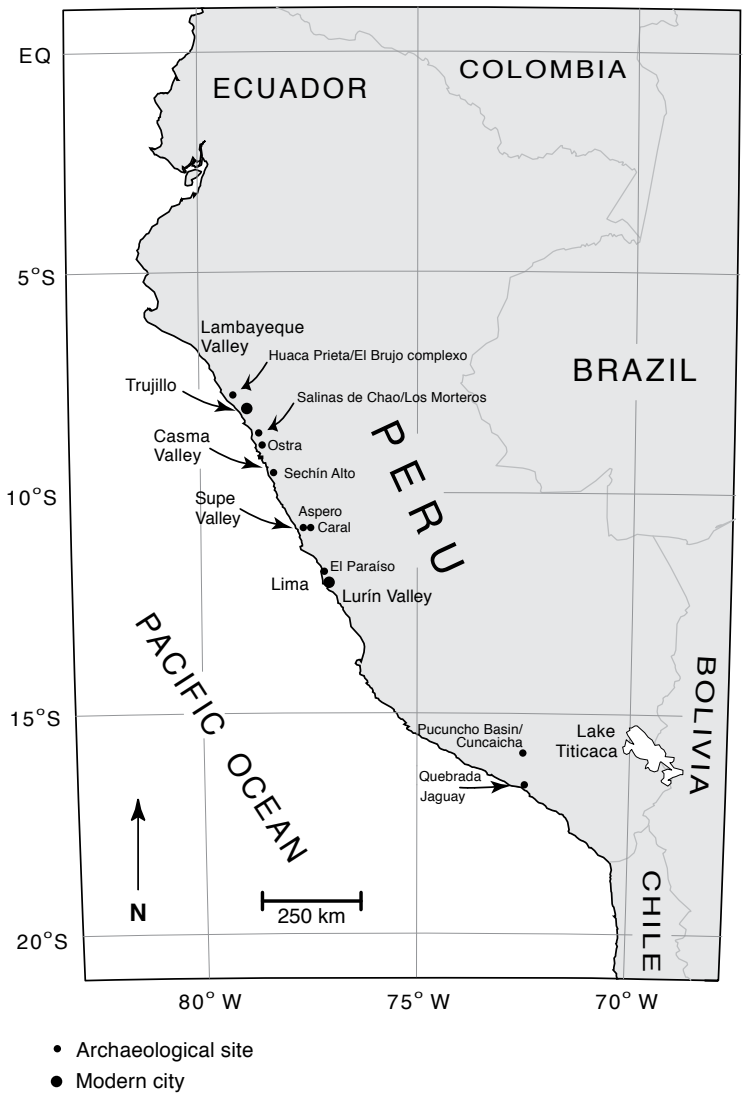


*Figure 4. Map showing locations mentioned in the text.*

Archaeological and palaeontological deposits on the fossil beach and associated archaeological sites of the Ostra Complex, just north of the Santa River on the north-central Peruvian coast (9°S), date to about 5800 to 7150 cal yr BP (Rollins et al., 1986; Perrier et al., 1994; Sandweiss et al., 1996; Andrus et al., 2003) (see Figure 4 for the location of the Ostra sites and other places mentioned in the text). Research at Ostra beginning in 1980 led to the hypothesis that the Ostra sites reflect a time when El Niño did not function as it does today (Rollins et al., 1986; Sandweiss, 1986, 1996, 2003; Sandweiss et al., 1983, 1996, 1997, 1998a, 2001).

Situated on the shores of a now-dry embayment, the principal sites of the Ostra Complex are the Ostra Base Camp (OBC), located on the southern end of the fossil bay and the Ostra Collecting Station (OCS), located on a rocky knoll about halfway along the shore of the fossil bay (Figure 5). Both the sites and the fossil beach contain mollusc species no longer present in the area - in fact, they are now found more than 4 degrees of latitude to the north, near the Equator (Sandweiss et al., 1983). At Ostra, we found the same molluscs in living position in the former bay, indicating that the site's inhabitants were collecting the

shells from the adjacent beach rather than from distant shores. We refer to assemblages like those from the Ostra Complex as warm water molluscan assemblages; we use the term 'cool water assemblages' for the Peru Current-adapted species found at later sites (see Reitz and Sandweiss, 2001).

Just 20 km north of the Ostra Complex is the Salinas de Chao, a palaeoembayment and fossil shoreline with many associated sites. One of these sites, Los Morteros (8˚40'S), dates between 5500 and 3600 cal BP and is an early example of monumental architecture (Cárdenas, 1979, 1995; Sandweiss et al., 1983, 2010; Perrier et al., 1994) (Figure 1). All of the molluscs in this site and those around it are from the cool water assemblage. Molluscan assemblages had clearly changed sometime in the centuries immediately following 5800 cal yr BP. Further north, near Talara in Peru, Richardson (1973, 1978) had observed a similar change from warm water mangrove molluscs to cool water species, also around 5800 cal yr BP. We expanded our research to include fish as well as molluscs and carried out additional work at one of the Talara sites, Siches (4˚30'S). Ostra and Siches fish and mollusc assemblages were are predominately warm water prior to 5800 cal BP (Sandweiss et al., 1996; Reitz and Sandweiss, 2001).

We considered several hypotheses to explain these data. After compiling all available data for the Mid-Holocene in the Pacific Basin, we concluded that for some time prior to 5800 years ago, the coast of Peru north of *c.* 10˚ S latitude was characterised by permanent warm water and that El Niño did not operate for some period before 5800 cal yr BP; after that time, we saw conditions as essentially the same as today (Rollins et al., 1986; Sandweiss et al., 1996, 2007).

Additional insight into the climatic conditions reflected by the pre-5800 cal yr BP, Mid-Holocene marine fauna in coastal sites north of 10˚S came from Andrus's geochemical analyses of growth increments in fish otoliths (fish ear bones) from OBC and Siches (Andrus et al., 2002, 2003) and in a mollusc from OBC (Andrus et al., 2005). Delta $^{18}O$ of the otoliths showed that in the millennium preceding 5800 cal yr BP, average sea surface temperature (SST) was about 3-4 ˚C warmer than today, consistent with our interpretation of the marine fauna. However, the seasonal structure of SST showed a more complex picture. At Siches (4˚30'S), the annual SST cycle in the Mid-Holocene paralleled that of today but was offset by 3-4 ˚C. In contrast, at OBC winters were about as cool as today but summers were significantly warmer (Andrus et al., 2002); the amplitude of seasonal temperature at OBC was apparently the same as the amplitude of normal to El Niño SST today, but occurred annually rather than inter-annually. This pattern explains the difference between molluscan and fish fauna assemblages at OBC. Molluscs are sessile and therefore controlled by maximum annual temperature; OBC contained only species that can survive in warm water. Fish are mobile, so during the cool summers, cool water fish could move north to the Ostra area while the warm water fish would be present during the warm summers. The OBC fish fauna was dominated by warm water species but included some cool water fish as well.

In the late 1990s, further consideration of the molluscan record in Mid-Holocene Peruvian coastal sites led to additional insight (Sandweiss et al., 2001). We noticed that sites immediately post-dating the postulated onset of El Niño at 5800 cal yr BP had molluscan assemblages dominated by two species that are extremely sensitive to warm water. The large purple mussel *Choromytilus chorus* has an LT-50 (the temperature at which 50% of the population dies in 24 hours) of 28˚C, based on studies in Chile (Urban, 1994). Although we don't have LT-50 data for *Mesodesma donacium*, this wedge clam was fished commercially as far north as Lima (12˚S) before the 1982-83 El Niño, after which its northern limit shifted south to Lomas (15˚30'S). Following the 1997-98 El Niño, the Peruvian government was forced to ban fishing of *Mesodesma* anywhere in Peru. The abundant presence of these two species in coastal sites between Lima and Trujillo (8˚S) during the Late Preceramic and Initial Periods (*c.* 5800-3000 cal yr BP) would not have been possible with an El Niño recurrence interval as short as it is today. The disappearance of the two mollusc species from north-central and northern Peruvian sites after 3000 cal yr BP strongly suggests an increase in El Niño frequency at that time (Sandweiss et al., 2001), as the shorter recurrence interval for warm water events would not have permitted these species to recolonize the region.

Sandweiss (2003: Table 1) summarises the archaeological record of Terminal Pleistocene to Mid-Holocene climate change along the Peruvian coast. This broad review of excavation results from multiple projects supports the outlines of Holocene change detailed from our own work (Sandweiss et al., 1996, 2001, 2007), with clearly marked transitions in the behaviour of El Niño at *c.* 5800 and 3000 cal yr BP. Sandweiss et al. (2007) also summarises information from natural archives (flood deposits, soils, lake cores and marine cores) that support our reconstruction of the last 14,000 years of El Niño behaviour.

## Cultural records of the early to mid-Holocene associated with El Niño

As reviewed above, Peruvian coastal archaeological sites contain or are associated with a variety of records pertinent to reconstructing El Niño behaviour over the last 14,000 years. These include biogeography (for example, Reitz and Sandweiss, 2001; Sandweiss et al., 1996), growth increment analysis (for instance, Rollins et al., 1986, 1987) and biogeochemistry (for example, Andrus et al., 2002, 2005) of molluscs and fish, differential preservation of soft organic materials, stylistic connections

*Figure 5. Looking across the Ostra Paleoembayment from the OCS site to the OBC site.*

between distant regions sharing similar environments (Sandweiss, 1996), flood deposits ( for instance, Keefer et al., 2003) and beach ridge morphology (for example, Sandweiss, 1986; Shafer et al., 2004).

Peruvian sites also demonstrate change through time in cultural attributes that correlate temporally with the changes we have identified in El Niño frequency in the Mid-Holocene (Sandweiss et al., 2001; Sandweiss, 2003; Richardson and Sandweiss, 2008). Major indicators of cultural change include settlement pattern (the distribution and function of sites across the landscape), construction style (size, form and function of monuments as well as dwellings), subsistence practices, long-distance exchange or contact, symbolic content of artefacts and structures, and burial patterns. In this section, I focus on large-scale changes in settlement pattern, construction style and subsistence. In terms of cultural chronology, the relevant periods are the Early Preceramic Period (*c.* 14,000-9000 cal yr BP), the Middle Preceramic Period (*c.* 9000-5800 cal yr BP), the Late Preceramic Period (*c.* 5800-4100 cal yr BP) and the Initial Period (*c.* 4100-2800 cal yr BP).

Prior to 5800 cal yr BP, there was no large-scale monumental architecture in coastal Peru and only a few small structures elsewhere, as at Nanchoc on the western slopes of the northern Peruvian Andes (Dillehay, 1992; Netherly and Dillehay, 1986) and the initial monumental phases of Huaca Prieta on the north coast of Peru (Dillehay et al., 2012a). With the exception of Huaca Prieta, coastal sites in the millennia preceding 5800 cal yr BP range from small fishing camps such as Early to Middle Preceramic Quebrada Jaguay (16˚30'S, Sandweiss et al., 1998b) and Siches (4˚30'S, for example, Richardson, 1973, 1978; Sandweiss et al., 1996) and Middle Preceramic Ostra Base Camp (8˚55'S, for instance, Sandweiss, 1996; Sandweiss et al., 1996) to villages such as Paloma (12˚30'S, for example, Benfer, 1990). Early and Middle Preceramic coastal sites had subsistence systems based on marine resources, wild plants and occasionally early domesticated plants (Sandweiss, 2014). Marine organisms recovered from sites north of 10˚S are predominately warm water species, while to the south of 10˚S, and especially south of 12˚S, marine organisms are almost entirely cool water species (for example, Sandweiss et al., 1996; Reitz and Sandweiss, 2001; see above).

Human populations in Peru grew through time (for example, Rick, 1987; Wilson, 1988; Sandweiss and Quilter, 2012) and consequently created more and larger archaeological sites. Combined with the stabilisation of sea level during the Mid-Holocene, this demographic trend resulted in an increasing number of sites preserved for analysis. In the following paragraphs, I review data for the best known Late Preceramic and Initial Period coastal sites (see Sandweiss, 2003:Table 1; Moseley, 2001; Burger, 1992; Quilter, 2014 *inter alia* for other sites of this time). This is the critical period when sea level had stabilised, El Niño had returned, large scale monumental architecture first appeared and social complexity increased dramatically.

## Late Preceramic period

Coastal monuments first appear during the Late Preceramic Period, after the climatic transition at 5800 cal yr BP. Although Late Preceramic mounds are distributed between Lima (12˚S) and the Lambayeque Valley (6˚48'S), it is now clear that the first florescence of monument building in coastal Peru took place on the North Central Coast (aka Norte Chico) between about 10˚S and 11˚S. At Aspero (10˚45'S) on the shore of the Supe Valley, Feldman (1980, 1985) excavated several small, early temple mounds, but only recovered materials from the last several construction phases. These phases date to *c.* 5000-4300 cal yr BP. However, Feldman also obtained one anomalously early date of *c.* 5650 cal yr BP on charcoal that may have been recycled from an earlier construction phase and may therefore indicate an onset of monument building as early as that date.

Subsistence at Aspero was based on fishing, farming and gathering. All of the marine species are typical, cool water Peru Current taxa. Among the molluscs, *Choromytilus chorus* and *Mesodesma donacium* were particularly important. The most important domesticated plants were cotton (*Gossypium barbadense*) for nets and textiles and gourd (*Lagenaria siceraria*) for floats and containers (Feldman, 1980), utilitarian species which Moseley (1975) calls industrial plants. Though present in Peru by the Late Preceramic Period (for example, Grobman et al., 2012; Perry et al., 2006), maize was not a dietary staple on the coast.

Though known for decades as Chupacigarro Grande (for instance, Kosok, 1965), the site now called Caral (10˚45'S) (Figure 3) was not proven to be Late Preceramic in age until recently (Shady et al., 2001). A suite of radiocarbon dates, many on short-lived plants used in construction, place the site between about 4600-3900 cal yr BP (ibid.). Called the New World's first city, Caral is a complex settlement with six large mounds and residential areas with different kinds of architecture suggesting different social classes (ibid.; Shady, 2005; Shady and Leyva, 2003;). In contrast to Aspero, Los Morteros and other Late Preceramic monumental sites known before 2001, Caral is located about 25 km inland, up the same valley as Aspero. Work by Shady elsewhere in the Supe Valley, and more recently by Haas et al. (2004) in neighbouring valleys, has uncovered additional inland Late Preceramic centres with mounds.

Caral has been extensively excavated for almost two decades and R. Shady's multidisciplinary team has analysed many classes of subsistence remains (for example, Shady and Leyva, 2003; Shady, 2005). Despite the distance from the shore, the animal diet came almost entirely from the ocean. As elsewhere on the North Central Coast and Central Coast, *Choromytilus* and *Mesodesma* were dominant molluscan species, the most abundant fish were sardines (*Sardinops sagax sagax*) and anchoveta (*Engraulis ringens*), and the most common plants were cotton and gourd.

Caral and the surrounding, contemporary Supe Valley sites (Figure 3) also provide a clear example of the potential synergy between natural forces and cultural systems. Working with Peruvian archaeologist, Ruth Shady, (for example, Shady Solis, 2005; Shady et al., 2001), Michael Moseley and other colleagues, I was able to track a coastal disaster sequence beginning about 3,800 years ago (Sandweiss et al., 2009; Sandweiss and Quilter, 2012). Several sites had clear evidence of earthquake damage followed by reconstruction. In this largely unvegetated environment, earthquakes produce abundant debris on the landscape, just waiting for the torrential rains of El Niño to wash them down the valley slopes, into the river, and out to the shore. That this process happened about 3,800 cal BP is clear. A massive beach ridge formed along the shore and eventually blanketed about 100 km of coastline. Bays filled with sediment and sand began blowing inland. Because the Caral settlement system relied heavily on agriculture for cotton, gourds and increasingly for food, when sand covered the fields it created an economic crisis. In several sites, sand deposits were covered by a final construction level, less well made than earlier structures, and then the sites were abandoned.

In the Supe case, the temporal correlation between natural and cultural events is clear, frozen in time by human construction. Given the tight chronology, there is almost certainly correlation between the natural disasters and the human activities culminating in abandonment. Whether the disasters caused the abandonment is harder to know, though it is tempting to believe that they played a role in the regional cultural changes at the end of the Late Preceramic Period. What were those changes? First, as far as we know, only the monumental sites were abandoned; we do not know what happened to the population of the Supe and adjacent valleys after the large sites fell out of use. Second, monumental, preceramic or aceramic sites continued for several hundred years on the peripheries of the Supe Culture area, to the north at Salinas de Chao (Alva, 1986) and to the south at El Paraíso (Quilter, 1985), beyond the reach of the massive beach ridge that fed the invading sand sheets. Were these sites homes to different societies with different cultural dynamics? Were they successful for longer simply because they were safe from the sand and other disasters? Did they receive migrants fleeing the Supe area who enhanced their labour pools and contributed to their longer survival as monumental sites? These are all important topics for future research.

Los Morteros is a large mound on the fossil bay at Salinas de Chao (8˚40'S). Radiocarbon dates on materials from shallow excavations date the final occupation of the structure to *c.* 5500-5100 cal yr BP (Cardenas, 1979, 1995); the structure itself is earlier, though how much earlier is unknown at this time (Sandweiss et al., 2010). Later ephemeral use of the mound surface

produced food remains that date as recently as 3600 cal BP. Molluscan remains from this site are typical cool water Peru Current species. Los Morteros is the northernmost Late Preceramic monumental structure on the Peruvian coast.

Near Lima, El Paraíso is a large aceramic site with dates falling at the end of the Late Preceramic Period and overlapping the Initial Period (*c.* 4100-3200 cal yr BP; Quilter, 1985; Quilter et al., 1991). The site covers about 58 ha and consists of six large mounds and at least five smaller structures. Though test excavations failed to find evidence for a large resident population, primary midden deposits did provide insight into diet (Quilter et al., 1991) and climate (Sandweiss et al., 1996). Like other Late Preceramic sites, molluscs and fish provided most of the animal food, while plant food was a combination of wild and domesticated taxa. Once again, the most important crops were cotton and gourd.

Although modest-sized permanent settlements such as Asia Unit 1 (12˚30'S, Engel, 1963) have been found south of Lima, El Paraíso is the southernmost Late Preceramic monumental site known to date.

Debate continues about the temporal priority of shoreline vs. inland centres in the Late Preceramic Period (Haas and Creamer, 2006; cf. Sandweiss, 2006, 2009), but the weight of evidence currently available supports a sequence beginning on the coast with fishing/farming sites, with later population growth driving expansion inland to increase production of cotton and gourds to intensify the fishing industry (Sandweiss and Rademaker, 2006; Sandweiss, 2009). How complex Late Preceramic societies really were continues to be debated, but the recent work at Caral and the other North Central Coast monumental sites supports earlier arguments for social stratification, at least in the core region between about 12˚ and 8˚S. The North Central Coast was the centre of Late Preceramic development, with the greatest number, size and complexity of monumental sites. In this pristine setting, supernatural sanctions (religion) must have played an important role in the consolidation of power in the hands of a nascent elite (Roscoe, 2008).

## Initial period

During the Initial Period, the size of monumental structures increased and the geographical ranges expanded south to the Lurín Valley just south of Lima (12˚15'S) and north to the Lambayeque Valley (6˚30'S). Like the majority of Late Preceramic monumental sites in the North Central Coast valleys, Initial Period monuments throughout the entire range tend to be located inland from the shore. Seafood was still important, but agriculture played an increasingly significant role in subsistence (see Burger, 1992; Moseley, 2001 for a review of Initial Period coastal sites). The suite of marine species exploited during the Initial Period is substantially similar

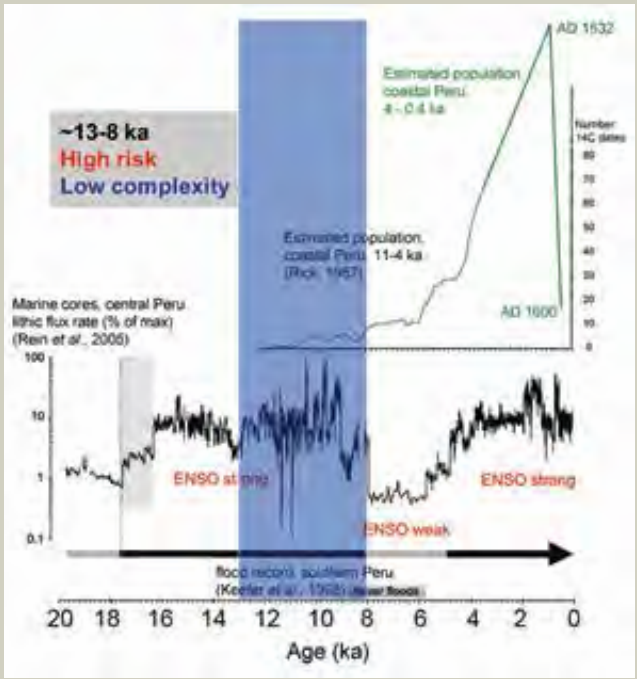


*Figure 6. Population, risk, and complexity on the Peruvian coast, 13,000–8000 BP (years before present/AD 1950). Population curve drawn from Cook (1981), Moseley (2001), Rick (1987), and Wilson (1988) (see text). Risk is based on frequency/ intensity of El Niño, from Rein et al. (2005) and Sandweiss et al. (2007). Complexity is based on the authors' experience and the general literature (e.g., Moseley 2001; Richardson 1994). Figure drafted by Kurt Rademaker. Adapted from Sandweiss and Quilter (2012).*

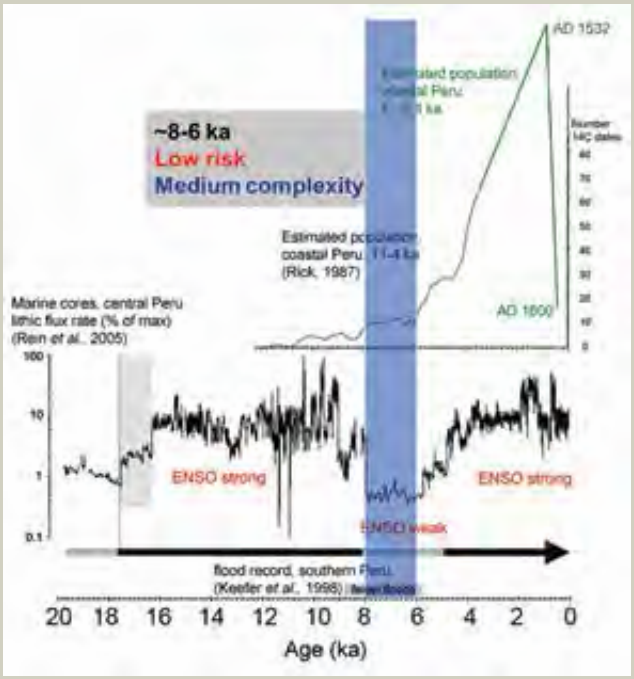


*Figure 7. Population, risk, and complexity on the Peruvian coast, 8000–6000 BP. See figure 5.5 caption for sources. Figure drafted by Kurt Rademaker. Adapted from Sandweiss and Quilter (2012).*

to that of the Late Preceramic Period, with *Choromytilus* and *Mesodesma* among the most important molluscs, and sardines and anchoveta dominating the fish (Sandweiss et al., 2001).

Monumental construction ceased or decreased greatly in the North Central Coast valleys after the Late Preceramic Period and the Casma Valley (9˚30'S) became the focal point for Initial Period development. Among the many Casma sites of this time, Sechín Alto was the largest mound in the Americas for its epoch; like Pampa de las Llamas/Moxeke, Sechín Alto and associated sites demonstrate large-scale site planning (Pozorski and Pozorski, 1987). At Pampa de las Llamas/Moxeke, this plan extends across 2 km, uniting a temple mound (Moxeke) with a monumental storeroom (Pampa de las Llamas) along a central axis of symmetry (Pozorski and Pozorski, 1986, 1987).

A secondary focus of development occurred in the valleys around Lima (12˚S), with sites such as Huaca la Florida (Patterson, 1985) and Garagay (Ravines et al., 1982) in the Rimac Valley and a series of mound sites in the Lurín Valley (Burger, 1992). Burger's work at three of the Lurín centres, Cardal (Burger and Salazar-Burger, 1991), Mina Perdida (Burger, 1992) and Manchay Bajo (Burger, 2003), showed that these mounds were built incrementally. Burger and Salazar-Burger (1991) argue that the Lurín mounds would not have required sufficient labour and central direction to justify attributing the sites to a complex society. This view contrasts with the Pozorskis' (1986, 1987) interpretation of the Casma Initial Period sites as evidence for an early state. Given differences in the size and complexity of sites in the two valleys, social complexity may well have been unevenly distributed along the coast at this time.

Regardless of the level of social complexity in the different valleys of the Peruvian coast, people living in many of the valleys between about 6˚S and 12˚S built mounds during the Initial Period, continuing the tradition begun in the Late Preceramic Period. At the end of the Initial Period, the 3,000 year sequence of coastal monument building came to a halt for at least several centuries at the same time that El Niño events increased in frequency (Sandweiss et al., 2001, 2007).

## Larger patterns in climate, catastrophe and culture on the Peruvian Coast

Over the time span of human occupation of coastal Peru, from about 14,000 years ago through the Spanish Conquest in AD 1532 and its immediate consequences, we see an intriguing pattern in the relation among demography, complexity

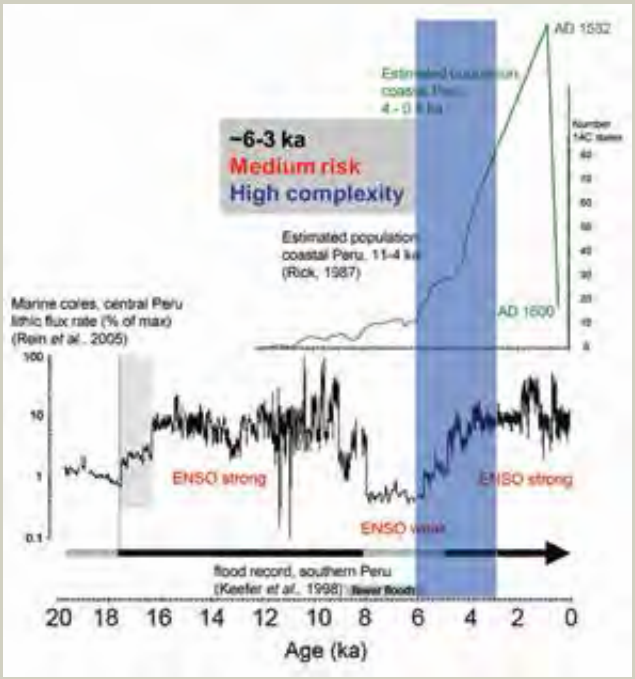


*Figure 8. Population, risk, and complexity on the Peruvian coast, 6000–3000 BP. See figure 5.5 caption for sources. Figure drafted by Kurt Rademaker. Adapted from Sandweiss and Quilter (2012).*

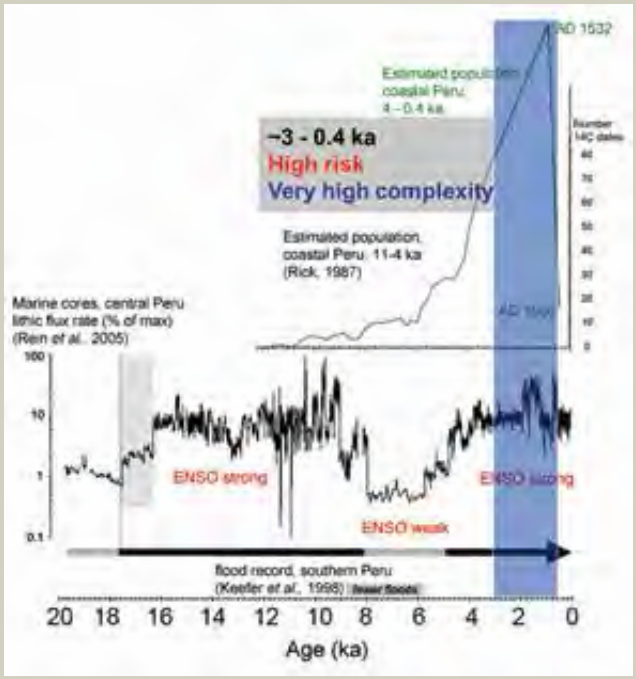


*Figure 9. Population, risk, and complexity on the Peruvian coast, 3000 BP–present. See figure 5.5 caption for sources. Figure drafted by Kurt Rademaker. Adapted from Sandweiss and Quilter (2012).*

and risk from disasters on the Peruvian coast. Through time, populations grew, though it is difficult to quantify prehistoric population levels. To substantiate our assertion of the direction and approximate rates of growth, Quilter and I (Sandweiss and Quilter, 2012) spliced and smoothed John Rick's (1987) radiocarbon date–based curve for the Preceramic Period (*c.* 13,000–3600 calendar years before present) with David Wilson's (1988) site survey–based curve for the coastal Santa Valley (~9° S) for the Initial Period through the Middle Horizon (*c.* 3,600 to 1,000 years ago, or 1600 BC to AD 1000).

*Figure 10. Huaca Prieta, occupied from about 14,500 cal BP to about 2400 cal BP.*

For the final two prehistoric periods, the Late Intermediate Period time of the north coast Chimu Empire and the Late Horizon or Inca Empire (*c.* AD 1000–1532), Wilson's curve shows a population decline in the Santa Valley; however, he recognizes that continuity in the local ceramic tradition may mask the continued occupation of sites under Chimu and Inca domination. Considering ethnohistoric records relating to population at the time of the Spanish Conquest in AD 1532 (for example, Cook, 1981) and broader archaeological patterns (for instance, Moseley, 2001), Figures 6-9 show continued population growth through these final two prehistoric periods. The early historical record is very clear on the demographic disaster that followed the Spanish Conquest, with depopulation ratios of as much as 100:1 in less than a century for some coastal valleys (Cook, 1981).

The archaeological record shows a general increase in social complexity through time along the coast (for example, Moseley, 2001; Richardson, 1994). The earliest settlers were mobile or semi-sedentary hunter-fisher-gatherers (Sandweiss, 2014) who became sedentary shortly before 6,000 years ago, when they began to build large monuments. Despite fluctuation in monument building, such as the Supe case outlined earlier, the volume of construction and the nature of social and economic organization evidenced in the archaeological record and (for the latest period) in the ethnohistoric record show a general trend toward larger volumes and more complex arrangements.

The frequency of volcanism and tectonically driven earthquake and tsunami activity should not have fluctuated through the time of human occupation; these events do not have a regular recurrence interval but do recur at average rates through time that are independent of climate on a human timescale. In contrast, El Niño frequency did change throughout the period of human occupation of Peru (Keefer et al., 1998; Rein et al., 2005; Sandweiss et al., 2007) and we therefore use El Niño as our proxy for risk (Figures 6-9).

The following paragraphs summarise my colleagues' and my current understanding of the interplay between climate risk, population and social complexity for the Peruvian coast from first arrivals to the Spanish Conquest (Sandweiss et al., 2007; Sandweiss and Quilter, 2012):

From *c.* 13,000 to 8,000 years ago, El Niño occurred at an unknown frequency; we assess risk as high, but complexity and population were low (Figure 6). From *c.* 8000 to 6000 cal BP, few or no El Niño events took place, coastal waters were seasonally warmer than present in northern Peru and there was probably seasonal rainfall north of 10° S. At this time, population began to grow but remained low overall. Complexity increased as the first sedentary villages were founded. Risk was minimal (Figure 7).

From *c.* 6,000 to 3,000 years ago, El Niño events were strong but infrequent; coastal waters were cool along all of Peru. Complexity increased with the onset of large-scale monument building, evidence of different social classes at monumental centres and a diversifying economy. The rate of population growth increased notably (Figure 8).

From *c.* 3000 cal BP to present, El Niño variability fluctuated within the range of modern variability. Population grew rapidly until the Spanish Conquest in the early 1530s and then plunged precipitously. Complexity also increased, from state-level societies to large (ultimately pan-Andean) empires (Figure 9).

Though very broadly painted, this record shows that through the prehistoric era on the coast of Peru, increasing population and growing complexity were accompanied by ever greater risk from natural hazards. In stark contrast, the demographic collapse after the 1530s was not caused by natural disasters but instead resulted from human-induced disasters - warfare, economic and social disruption and disease (Cook, 1981; cf. Kiracofe and Marr, 2009). This pattern seems counterintuitive at first glance but may hold important lessons.

*Figure 11. Fish and mollusc remains at the Ostra Base Camp representing dramatically different climatic conditions between about 6250 and 7150 cal BP.*

## Sites for Consideration for the Tentative List

The Peruvian coast has over 14,000 years of sites that offer unique and critically important information about ancient climate, catastrophe, culture and the correlations between them. Some of these sites are feasible for inclusion on the UNESCO Tentative List because they fit the following criteria for Outstanding Universal Value (World Heritage Centre n.d., paragraph 77, criterion iii): 'bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared; be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history (criterion iv); and be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change (criterion v)'. They also concur with the narratives considered for the definition of Human Evolution Sites for consideration of the HEADS Programme: 'Sites important for the history of science, Sites related to human mobility, Colonization of new environments and dispersion, and Deposits useful for the reconstruction of palaeo-environments'. Below, I briefly review three sites or site complexes that fit one or more of these criteria.

Located on the modern shoreline of the Chicama Valley on the northern coast of Peru, Huaca Prieta (Figure 10), meets multiple criteria and narratives for Outstanding Universal Value. Junius Bird's (1963; Bird et al., 1985) excavations at the site in the 1940s constitute the first large-scale archaeological investigation of a preceramic site in Peru, so Huaca Prieta is a 'Site important for the history of science'. Bird's work also demonstrated links 600 km north to the coast of Ecuador before about 4000 BP, fulfilling the HEADS narrative of 'Sites related to human mobility'. Tom Dillehay's work at Huaca Prieta over the last decade has significantly added to the importance of the site and its feasibility for inscription on the Tentative List (Dillehay et al., 2012a, 2012b; Grobman et al., 2012 *inter alia*). First, Dillehay has demonstrated that the first occupation of the site dates to 14,500 BP, making it the earliest reliably dated site in Peru and one of the earliest in South America (Dillehay et al., 2012b). Therefore, Huaca Prieta fits the OUV criterion (iii) of being 'a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared'. Furthermore, faunal remains discovered in this early occupation

*Figure 12. Quebrada Jaguay, an early fishing site dating from about 13,000 to about 8000 cal BP*

demonstrate use of both marine and terrestrial resources. Therefore, Huaca Prieta fits the HEADS narrative of 'Colonization of new environments and dispersion'. Plant micro- and macro-fossils and faunal remains offer information on past climate and environments as well as on past lifeways, so Huaca Prieta also fits the HEADS narrative of 'Deposits useful for the reconstruction of palaeo-environments' (see also Dennell, this volume).

Unlike most sites related to the peopling of the Americas, Huaca Prieta appears monumental. The site currently presents as a large, highly visible mound and the presence of this structure on top of the earliest deposits probably accounts for their preservation. Dillehay's work has shown that monumental architecture, though initially small-scale, is as early as any found in South America (Dillehay et al., 2012a). Dillehay and his colleagues have also found evidence of the early adoption of domesticated plants, including maize (*Zea mays*) (Grobman et al., 2012). Finally, Huaca Prieta is in close proximity to monumental sites of later ages: 1) Huaca Cao Viejo (also know as El Brujo) belongs to the first millennium AD Moche culture and has been extensively excavated, revealing polychrome murals and the tomb of the Señora de Cao (for example, Mujica, 2007); 2) Huaca Cortada, also Moche, has a large looters' trench but has not been scientifically excavated; and 3) Magdalena Vieja dates to the early Colonial Period (late 16$^{th}$ to early 17$^{th}$ centuries) and has been excavated scientifically (for example, Quilter, 2011). These sites together form a triangle with sides from 1 to 1.5 km, about 0.75 km$^2$. For both of these reasons, Huaca Prieta fits the OUV criterion (iv) of 'an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history'.

Located just north of the Santa River along a palaeoshoreline (c. 8°50′ to 8°55′ S) (Figure 5), the sites of the Ostra Complex are critical in understanding the prehistory of El Niño. I reviewed these sites and their role in climate studies above. Our work at the Ostra Collecting Station and the Ostra Base Camp (Figure 11) led directly to the now well-accepted hypothesis that El Niño frequency has varied significantly through time (Sandweiss et al., 1996, 2001, 2007). Furthermore, at the time we first proposed a major change in Eastern Pacific climate dynamics in the Mid-Holocene (Rollins et al., 1986), the prevailing view of a climatically stable Holocene was just beginning to break down. The Ostra work thus contributed to the modern perspective that Holocene climate has been highly variable though not on the scale of Pleistocene fluctuations. Finally, the Ostra Base Camp produced proto-figurines related to Ecuadorian figurines from 700 km to the north but unlike anything known from Peru. At the time when the site was occupied, the coasts of northern Peru and southern Ecuador shared a similar warm water environment and the similarity of the figurines suggests a cultural connection (Sandweiss, 1996). For these reasons, the Ostra Complex fits the following OUV criterion (v) for inclusion on the Tentative List: 'an outstanding example of a traditional human settlement, land-use or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change'. The Ostra complex also accords with the HEADS narratives of 'Sites important for the history of science, Sites related to human mobility, and Deposits useful for the reconstruction of palaeo-environments'. Protection for the Ostra Complex is particularly urgent, as the major site (OBC) has been damaged by looting, irrigation and gravel mining, and it may not survive at all for much longer.

Located at 16°30′ S on the south coast of Peru, Quebrada Jaguay is one of the oldest fishing sites known in the New World (Sandweiss et al., 1998b; Sandweiss, 2003, 2014). Dating as old as 13,000 years ago during the Terminal Pleistocene, remains at the site show that the inhabitants were sophisticated maritime fishers and gatherers who targeted particular marine species, built rectangular houses, situated their camp for the efficient use of a wide variety of natural resources and either travelled to the adjacent highlands or maintained trade relations with people in the sierra. Quebrada Jaguay thus accords with the OUV

*Figure 13. Pucuncho Basin, a high altitude wetland in the Andes of Arequipa Department in southern Peru, associated with Terminal Pleistocene occupations up to 12,500 years old. © Kurt Rademaker.*

criterion (iii) of 'a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared'.

Rademaker et al. (2013) traced obsidian found at Quebrada Jaguay (Figure 12) to a specific source (Alca-1) near the Cotahuasi Valley of the highlands. In doing so, Rademaker identified six geochemically distinct sub-sources of Alca obsidian, the first time multiple sub-sources have been identified at an Andean obsidian deposit. He also found a series of early high-altitude sites in the Pucuncho Basin (Figure 13), about 150 km inland and uphill from coastal Quebrada Jaguay at elevations above 4000 MASL. Rademaker's excavations in one site, Cunchaicha Rock Shelter at 4488 MASL, have revealed the oldest high-altitude human occupation in the world. Basal dates are as old as 12,400 cal BP, during the Terminal Pleistocene (Rademaker, 2012; Rademaker et al., 2014; Sandweiss and Rademaker, 2013). Furthermore, Cunchaicha lies on the least-cost path from Quebrada Jaguay to the Alca-1 subsource and has obsidian from Alca-1. These data suggest that Quebrada Jaguay and Cuncaicha were part of a multi-elevational, long-distance interaction sphere at the end of the Ice Age. For these reasons, Quebrada Jaguay and the Pucuncho Basin together fit the following OUV criterion (v) for inclusion on the Tentative List: 'an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change'. These linked sites and landscapes also fall under the HEADS narratives of 'Colonization of new environments and dispersion, Sites related to human mobility and Deposits useful for the reconstruction of palaeo-environments'. In this case, the sites/areas would be discontinuous but culturally linked.

## Conclusions

The Peruvian coast is a study in contrasts. Fertile valleys watered by streams from the adjacent Andes alternate with some of the starkest deserts on earth and contact with one of the world's richest fisheries. The region witnesses extreme environmental events - earthquakes, tsunamis and El Niño climate catastrophes - on a recurring if unpredictable schedule. Yet people settled this land over 14,000 years ago. Through time, populations grew and social complexity increased even as environmental risk also increased. This counter-intuitive pattern lends particular urgency to the study of coastal Peruvian prehistory, for surely it holds lessons for us in a time of burgeoning population and evermore variable climatic risk. If we are to harvest the lessons of antiquity in this core region, then we must preserve key sites such as those listed above.

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# The Outstanding Universal Value of the Monte Verde Site and a Comparative Analysis of the Authenticity and Integrity of the Site in a Regional Perspective

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## Introduction

**Between 1976 and 1987, the author directed a large interdisciplinary research team to study the archaeological site of Monte Verde in south-central Chile (Figure 1). The site is an open air campsite on the banks of a small stream, surrounded by sandy knolls, small bogs and damp forests that have been there since at least 20,000 BP. The bog later developed in the stream basin, covering the abandoned site under a layer of peat. Because the lack of oxygen in the bog inhibited bacterial decay and because the constant saturation prevented drying for thousands of years, various types of organic materials that normally disappear from archaeological sites have been preserved. An interdisciplinary research team of more than sixty scientists studied the remains excavated from two areas at the site, called Monte Verde I and Monte Verde II. The results of this study were published in two large volumes by the Smithsonian Institution Press (Dillehay, 1989 and 1997) and more recently, in a single volume in the Spanish language (Dillehay, 2004).**

A number of remarkable and unexpected finds were recovered at Monte Verde: not only stone tools and spear points (Figure 2), typical of several early South American sites, and animal bones of an extinct fauna, but also, a wide variety of plant remains and numerous wooden objects, hearths, the fallen remains of two tent-like structures (Figures 3 and 4), and human footprints (Figure 5). The organic remains indicate the importance of plants as well as animals in the inhabitants' diet. The existence of wood and wooden tools (Figure 6), more common at Monte Verde II than stone artefacts, provides an intriguing look at food items, technology and equipment rarely seen in late Ice Age archaeological records. All these remains indicate a variety of tasks, primarily food preparation and consumption, tool production and maintenance, and the construction and occupation of shelters.

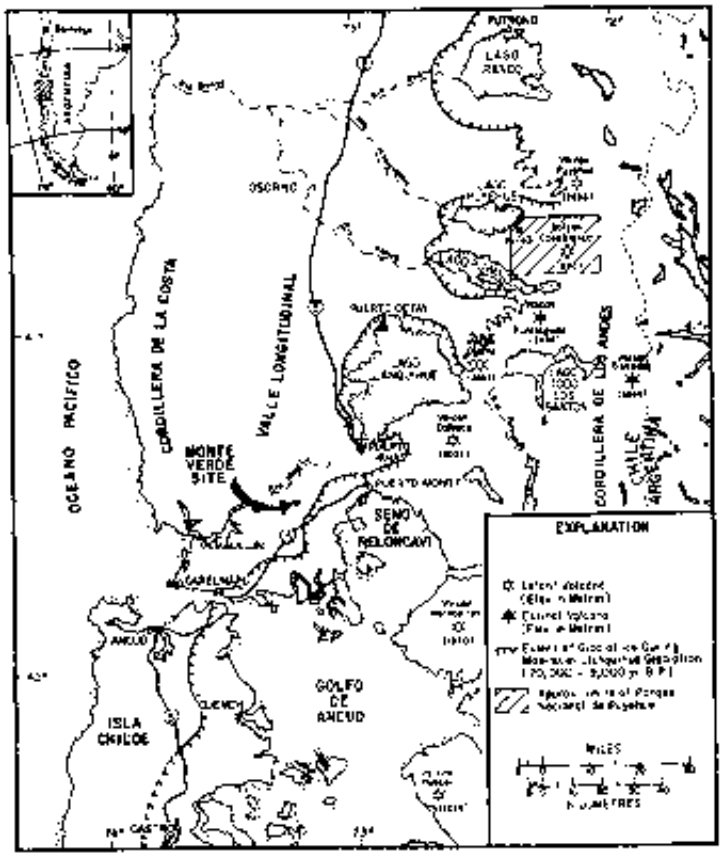


*Figure 1. Location map of Monte Verde.*

Monte Verde was the centre of considerable controversy for nearly 25 years, because in the 1970s it was in the wrong time and place to comfortably fit with the established understandings of when the continents were first settled, by Clovis hunters, about 11,200 years ago. Because of the hemisphere-wide significance of Monte Verde in reconstructing the Late Pleistocene human occupation of the New World, there was careful scrutiny of the Monte Verde data and interpretations. In 1997, the National Geographic Society sponsored a blue-ribbon panel of 12 archaeologists to visit the site and to study the excavated materials in order to confirm the validity of the Monte Verde II levels. The site was confirmed as being a legitimate pre-Clovis settlement and the results of this visit were published in 1997 in the Society's popular magazine, as well as in *Science* (Meltzer, 1997) and *American Antiquity* (Meltzer et al., 1997). The interdisciplinary research at Monte Verde and other early sites broke the foundations of what archaeologists had understood about how the Americas were populated, leading to the idea and eventual acceptance of a pre-Clovis occupation in the Americas (Meltzer, 2009). The implications have been massive: by helping to break down the Clovis barrier, the conservative

*Figure 2. Projectile points of the Monte Verde II site.*

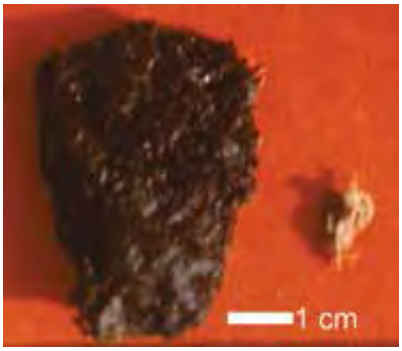


*Figure 3. Preserved plant remains from Monte Verde II (various species of marine algae are on the left; a wild potato skin is on the right).*

*Figure 4. Wishbone-shaped structure in Monte Verde II.*

Clovis school has had to reconsider its theory about the arrival of people in America (Pitblado, 2011). Although some minor controversy continues today, many more pre-Clovis sites have now been identified and are being much more seriously considered than they were before Monte Verde was discovered.

There are five reasons why Monte Verde is unique and valuable as an archaeological site.

Monte Verde is currently one of the earliest Late Pleistocene sites in all of the Americas, and it has been the most extensively worked from an interdisciplinary perspective.

It is the archaeological site that was pioneering in breaking the Clovis-first paradigm of the earliest peopling of the Americas, a paradigm that had dominated American archaeology for more than sixty years.

What makes the site important is not only related to the above two points, but Monte Verde is the only Late Pleistocene wet site that has been excavated to date in the New World. Not only are organic food and non-food remains well-preserved in the site, but two hut-like structures are present as well. These remains reveal a broad-spectrum diet of hunters and gatherers who were well- adapted to the cool temperate rainforest of the region.

Monte Verde also is significant because it has high archaeological integrity, meaning the site is geologically intact and has been subjected to very little disturbance that might have compromised its scientific validity.

In summary, it is the chronology, wide array of artefactual and ecofactual materials present, conservation and integrity, and historical paradigm-breaking role of Monte Verde that makes it unique and valuable to world cultural heritage.

Presented below are more facts about the cultural materials found at Monte Verde and the site's wider role in interpretative models of the first peopling of the Americas and in programmes of public education and outreach about early Americans.

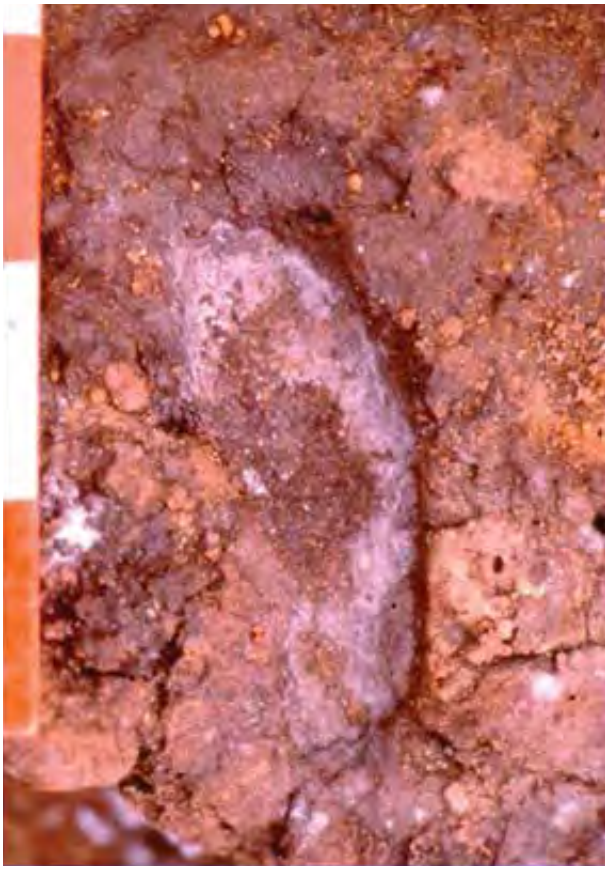

*Figure 5. Human footprint from Monte Verde I.*

## Life at Monte Verde as perceived through the material record

As mentioned earlier, Monte Verde II, dated about 12,500 BP radiocarbon years, exhibits the remains of a long tent-like structure made of wooden poles and animal hides. Several pieces of cordage and string made of reed wrapped around the poles and stakes holding them in place were recovered among the architectural remains. These data suggest that the people planned a lengthy stay. The tent's dirt floor was embedded with hundreds of microscopic flecks of hide tissue, suggesting that it was covered with animal skins. On the floor of the tent were brazier pits lined with clay and surrounded by stone tools and the remains of edible seeds, nuts and berries. Outside the tent were two large communal hearths, a store of firewood, wooden mortars and grinding stones and three human footprints near one of the large hearths. All of these remains indicate tasks, primarily food preparation and consumption, tool production and maintenance, and the construction of shelters.

*Figure 6. Wooden artefacts from Monte Verde II.*

The remains of a wide variety of local and non-local edible plants and a few bones of palaeo-llama (*Paleollama llama* sp.) also were recovered from the hearths, living floors and small pits. The presence of exotic foods, including ten varieties of seaweed and other items at the site shows that distant coastal and Andean mountain habitats provided important resources to the Monte Verde economy. Three different stone tool technologies existed at the site, including bifacial tools, unifacial implements and waste debris, and grinding stones. Also present were tools made of animal bones and wood, especially hardwoods that grow locally.

The second structure was wishbone-shaped in ground plan and made of wooden uprights set into a foundation of sand and gravel. Parts of gomphotheres (*Cuvieronicus* sp.) carcasses were butchered, hides were prepared, and stone and wood tools were manufactured in and around the structure. Eighteen probable medicinal plants were found inside the structure. These activities suggest a public non-living area. This also seems to have been a place used for healing the sick. Eighteen probable medicinal plants were found in this structure - the same species the Huilliche people, who live in the area today, use to treat various diseases. Most of these medicinal plants were from the coast or across the Andean mountains from the Patagonian plains of western Argentina.

In addition to medicinal herbs, the remains of a wide variety of edible plants were recovered from the hearths, living floors and small pits inside the structures, along with the remains of mastodon, palaeo-llama, small animals (for example, rodents, birds, amphibians) and freshwater molluscs. Aquatic plants from the freshwater marshes and lagoons of the flood plain and from brackish marshes of the river delta provided the greatest variety and, along with meat and wild potatoes, the bulk of the Monte Verdeans' diet. Most of these ecological zones are located far away in the basin of the Maullin River to the north and along the Pacific shoreline or in the Andean mountains.

The distinct living structures, features and concentrations of specific materials at the site suggest that the occupation was continuous and that portions of the site were used more intensively than others, particularly the long tent-like structure. Different kinds of artefacts give evidence of a wide variety of activities. A long sequence of radiocarbon dates on different organic materials from the site, place the Monte Verde II occupation at about 12,500 BP – more than a thousand years before Clovis.

Exploiting this wide range of resources from various environmental zones undoubtedly called for sophisticated knowledge and perhaps a division of labour. This also is suggested by the separation of the living from non-living areas at the site and by the association of distinct activity areas and living spaces with different tool types and food remains. The many different artefacts give evidence of a wide variety of living activities. There is also evidence for specific family or social unit tasks, special purpose activities, and spatial separation between domestic and non-domestic tasks. The internal division and size of the long tent suggest that a moderately large group of people had a mixed hunting and gathering economy focused on many different ecological zones in the area. All this evidence reveals a more complex social and economic organization than previously expected of early New World cultures.

In the deepest levels of Monte Verde, separated from the later 12,500 year settlement and buried in a different area of the site, we found a possible earlier occupation, Monte Verde I, with twenty-six stone tools and three burned clay features. Six of these are valid stone tools. Radiocarbon dates placed this possible occupation around 33,000 years ago. We hesitate to accept this older level without more evidence and without sites of comparable age elsewhere in the New World. Not enough archaeological and geological data were recovered from this area of the site to warrant a more detailed understanding. Until this site has been restudied and re-dated by radiocarbon assays and other dating techniques, this area of the site remains nothing but a possible human locale.

In addition to the Monte Verde site, two radiocarbon dates were obtained from the Chinchihuapi site, located 500 m upstream from Monte Verde. Excavations at the site in 1983 and 1985 yielded two unifacial flakes, one heavily modified spheroid and three pieces of burned and modified wood. A single piece of burned and cut wood was dated at 12,500 years ago, as well as an unburned sliver of wood, which dated at 11,800 BP. More archaeological work also needs to be done at this site.

In summary, there is no question that the younger Monte Verde II occupation represents a human settlement practising a generalized economy throughout most of the year. The archaeological evidence suggests that the settlement was formed by a group of exploratory or incipient colonizers who lived along the banks of the small stream. Although few contemporary sites have been found in the Americas, it is probable that the Monte Verdeans were part of a low-density colonizing population adapted to a cool, temperate wetland-and-forest environment in times of advanced deglaciation. In the end, Monte Verde II has made us question the accepted theory that all Ice Age people were nomadic big-game hunters, since the settlement was probably occupied throughout the year by at least a portion of its inhabitants, and they gathered a wide variety of plant and animal foods.

## Placing Monte Verde within a hemispherical setting

Much rethinking about the peopling of the Americas has taken place in recent years as a result of the acceptance of Monte Verde and other early sites, new discoveries across the Americas and in palaeoanthropology. Besides Monte Verde, several archaeological sites in both North America and South America have recently documented very early traces of human occupation (Adovasio, 2002; Adovasio and Pedler, 2010; Bryan, 1973; Dillehay, 2000; Dillehay et al., 2012; Dixon, 1999; Leon Canales, 2007; Meltzer, 2004). A few localities in the United States also have yielded convincing evidence of sites ancestral to the widely documented 11,200 year old Clovis culture, which is best known for its fluted bifacial projectile point and big-game hunting tradition. Meadowcroft Shelter in Pennsylvania, Cactus Hill in Virginia, Paisley Cave in Oregon, the Gault and Buttermilk Creek sites in Texas and a few others suggest that groups of generalized hunters and gatherers may have lived in these areas possibly as far back as 16,000 to 13,000 years ago (for example, Collins, 2002). These possibilities are supportive of the 12,500 year occupation at Monte Verde II in South America, because if people first came into the Americas across the Bering land bridge, we would expect earlier dates in North America. It also is likely that multiple early migrations took place and people moved along the edge of the ice sheets from Siberia to Chile (Dixon, 1999; Dillehay, 2000) and from northern Europe into eastern North America (Stanford and Bradley, 2013). Although remote possibilities, there also is discussion of possible influences from Africa and even Australia. For instance, some palaeoanthropologists believe that the oldest skeletal material from Brazil more strongly affiliates with ancient Africans and Australians than with modern Asians and Native Americans. This may suggest the presence of non-Mongoloid as well as Mongoloid populations in the Americas (for example, Neves et al., 2005; Steele and Powell, 2002; c.f. Perez, 2011). There also are new databases provided by genetic studies over the past several years (for instance, Schurr, 2004) that have added to our insights into the peopling process.

## Climates, environments and human adaptations

Taken together, these early finds from across the Americas reflect early human adaptations to a wide variety of changing environments and climates of the late Ice Age. What we know about these adaptations largely depends on the quality and preservation of the archaeological and palaeocological records at sites (for example, Ackert et al., 2008; Borrero, 2003, 2007; García, 2003; Heusser, 2003). The preservation of organic remains is a key factor that allows a reconstruction of the local climate and environment of each site. This reconstruction especially depends on the specific species of floral and faunal remains preserved in sites, which make the Monte Verde site particularly important because all types of organisms are present, including animal bones and soft tissue, plants remains, diatoms, insects, pollen and so forth. The presence of this wide diversity of organisms at Monte Verde has allowed a more precise interpretation of the type of climate and environment that the Monte Verde people adapted to. Based on the data recovered from the site, we know that the climate at the time of its occupation was slightly warmer and wetter within a cool temperature rainforest, similar to that of south-central Chile today.

From a wider perspective, major changes in vegetation communities have taken place over the past 18,000 to 10,000 years. During the period from 13,000 to 10,000 years ago, for instance, when most American environments were likely inhabited by humans, temperatures were generally warmer in the summer and cooler in the winter, and rainfall was increasing. Patchy heterogeneous biotic zones were shifting to broadly homogenous mosaics with new and different mixtures of plant and animal species. In contrast to many interior regions, the coastal areas displayed a combination of higher and more reliable and greater ecological diversity. These features may have been particularly desirable as cold and arid conditions reduced ecological productivity over much of the extreme northern and southern latitudes of the Americas, but even in some of these areas human occupation may have intermittently concentrated in short-lived warming episodes. In the high Andean mountains, for example, this is indicated by the pulsing of occupation at several caves and rockshelters and the abandonment of some areas (Dillehay, 2000). This also may have been the case at Monte Verde. The cool temperate rainforest of south-central Chile was subject to intermittent periods of cold and cool climates, accompanied by vegetation changes that facilitated or possibly even inhibited human adaptation to the area, particularly in the Andean mountains east of Monte Verde where glaciers existed until about 16,000 years ago.

Regional geological evidence shows that although glacial moraines came within 5-6 km of the Monte Verde site, they never covered the site or inhibited human movement to and from it. As determined by palaeoecological studies at Monte Verde and other sites across the Americas, a major factor determining expansive ice sheets in some regions, changing sea levels, mammal extinction, regional biotic restructuring and the movement of Late Pleistocene fauna, flora and people was climatic change. Although glacial ice sheets greatly affected the routes available to early migrants in the higher latitudes of North America and the southern Andes, they had little to no effect on the middle and lower sections of North America, all of Central America and most of South America. During the terminal Pleistocene, sea levels were 70 or more metres lower than at present, and the Pacific and Atlantic shorelines were considerably farther out than their present position. As the continental ice sheets melted and retreated, the oceans rose and inundated most of the continental shelves. Most early archaeological sites along old shorelines have thus been destroyed or inundated by water. Widespread extinctions also accompanied these changes, particularly the loss of more than 30 genera of large mammals. It is not known whether climatic change, human overkill or both led to the extinction of some species (c.f. Martin and Klein, 1984; Grayson and Meltzer, 2003). (Two megafaunal species were present at Monte Verde in the form of bone, hide and soft tissue remains. Presently not known is why they became extinct in the area, although it is likely due to both factors, that is, human overkill and changing climates).

Taken together, the palaeoecological and archaeological evidence is still a long way from accurately transforming palaeoclimatic data into statements about economic resource productivity, availability and reliability during the Late Pleistocene period, which would be of value to archaeologists in reconstructing past human lifeways (Flegenheimer et al., 2006; Lavallée, 2000; Lavallée et. al., 1999; Gnecco and Aceituno, 2006; Massone, 2005; Miotti and Salemne, 2004; Vialou, 2005). On both a regional and local level, climatic shifts must have greatly influenced human land and resource use patterns, resulting in differential patterns of archaeological site location, abandonment and occupation, and artefact content and structure (Kelley, 1995). Yet climatic factors, such as ice sheets, rainfall and aridity, are only one among several (for example, technology, social alliances, perceived alternatives by people) influencing decisions to occupy or abandon parts of a landscape and how the archaeological record of each landscape is studied and preserved.

To conclude this section, it is my belief that the first migrants into the Americas adapted to many different environments quickly, creating a mosaic of contemporary different types of hunters and gatherers (such as big-game hunters, general foragers, coastal foragers) immediately after they entered new environments. A key issue is not just the rate of migration and adaptations but rapid social change and a steep "learning curve" across newly encountered environments, that is, adaptation of technological, socioeconomic and cognitive processes over several generations (c.f., Dillehay, 1997, 2000, 2004; Meltzer, 2004). As the early archaeological records of South America and parts of the eastern United States suggest, this was not a single unitary process, but many. While hunter and gatherer groups were settling into one new environment, others were

probably just moving into neighbouring areas for the first time. Others probably stayed for longer periods in more productive environments. All of these processes must have begun sometime before 13,000 years ago in order to produce the types of technological and economic diversity reflected in the archaeological record (Bryan, 1973). The record left behind by these processes is characterized by variable site sizes, locations, functions, occupations, artefact assemblages and internal structures that collectively reflect different human adaptations to different environments, of which Monte Verde represents only one case of these processes.

## The peopling process

From a hemispherical perspective, there is archaeological evidence that by 13,000 to 11,000 years ago people had colonized most broad environments in the Americas, such as deciduous forests, coasts, tropical rain forests, cold steppe and shrub grasslands, and deserts. With the exception of eastern Beringia (Alaska and Yukon Territory) in the far north-west, firm evidence for early colonization of the northern boreal forests and tundra of Canada is still lacking, although promising evidence comes from Bluefish Caves where modified bones suggest early human habitation around 20,000 to 15,000 years ago. Another series of early sites is found in the Nenana Valley of Alaska that date between 11,500 and 11,000 years ago. Thus, it appears that by at least 11,500 years ago, people with similar tool technologies moved from western to eastern Beringia and thus became some of the first people to have entered the New World. It is not known whether these people migrated farther south through ice-free corridors or followed the Pacific coastline. Further, the lithic industries from these areas appear to have little resemblance to Clovis stone tools. By 11,200 years ago, there is widespread evidence of the Clovis culture throughout the middle sections of North America and in parts of northern Mexico. Clovis and other fluted-point traditions are widely distributed in the eastern United States and Canada at the Vail, Bull Brook, Shoop, Shawnee-Minisink, Debert and other sites. In west-central North America, along the eastern slopes of the Rockies and on the southern plains, Clovis and Folsom sites are common. Studies in the Plains and Southwest deserts reveal parallel or sequential point traditions associated with hunting economies, especially big-game in open terrain. These also include Clovis followed by several regional point styles such as Folsom, Midland, Goshen and Plainview. Clovis is much less frequent in the far western United States where stemmed points are associated with varying hunting and gathering economies (Dixon, 1999; Meltzer, 2009).

Although generally perceived as a big-game hunting tradition, not all Clovis and other fluted point sites support this notion. Better preserved than plants, faunal remains suggest that any idea of a single Late Pleistocene economy is unrealistic. For instance, at Meadowcroft Shelter and other early woodland sites in eastern North America, both Holocene and Late Pleistocene faunae are dominated by small and medium-sized animals, perhaps reflecting greater environmental stability in the eastern woodlands and earlier extinction of mega-fauna. If so, then human populations may also have been better able to maintain themselves in these mixed woodland habitats than elsewhere. In fact, Meltzer has proposed that rather than being specialized big-game hunters, Clovis and later fluted point makers were generalized foragers, particularly in the eastern woodlands and southern areas where the environment was more diversified than northern latitudes. The rather uniform forest cover in the eastern United States would have been conducive to generalized foraging populations. These groups probably foraged over the landscape, repeatedly moving their campsites as resources in their immediate area were depleted. Generally, these sites are small in size, represent short-term occupations and contain expedient lithic assemblages designed for generalized economies that exploited a wide range of plant and animal food types. In the eastern United States, formal, curated tools tend to be infrequent at such sites, as is the use of high-quality stone material, unless it outcrops locally.

In contrast to North America, the fluted point tradition played a minor and late role in the peopling of South America. Instead, a wide variety of unstemmed and stemmed point and unifacial industries associated with broad spectrum economies are found in many regions from at least 12,500 to 11,000 years ago. In the Andes and in the eastern tropical lowlands, many caves and rockshelters were occupied intermittently from at least 11,800 to 11,000 years ago, especially in eastern and central Brazil and in extreme southern Patagonia. It is not known whether this pulsing of rockshelter occupations is simply an artefact of climatic change or simply human patterns of social and economic change. Strong similarities in the dates of occupation pulses as far apart as 1,000 km, however, implicate climatic processes operating on subcontinental scales. The surviving evidence of recently discovered human occupation of the Amazon basin and other forested areas may be no more than a small sample of the populations that once concentrated there and elsewhere.

The current evidence from South America is clear: early technological and economic developments show cultural diversity at the outset of human entry and the establishment of ever increasingly distinct regional economic combinations on the coast and in highland Andean valleys. Although the current evidence is still too scanty to discern the specifics of these developments in all environments, two general transitions can be inferred. The first was a change in adaptive strategies and organizational abilities during and at the end of the Pleistocene period. This transition signifies the rapidly increasing ability of people to recognize the environmental potentials that existed in coastal wetlands, desert oases, intermontane valleys, lowland river valleys and

high altitude puna grasslands, to communicate these potentials to others and to take advantage of them and to develop the social organization required to exploit resources in a wider variety of compressed environments. Second, early people probably learned many hunting and gathering techniques, and on occasion employed them to domesticate some plants (for instance, squash, chili peppers, *Chenopodium*) and to begin a semi-sedentary or sub-territorial lifestyle in some areas by at least 10,000 to 9,000 years ago. With the exception of only two sites in South America - Taima-Taima in Venezuela and Tagua-Tagua in Chile - there is no hard evidence to show that hunting was the mainstay of the earliest known South Americans (Lavallée, 2000). Instead, most early South Americans employed a generalized, or proto-Archaic, economy (Dillehay, 2000) that was associated with expedient tool technologies and territorialism.

Another dimension of Late Pleistocene subsistence throughout the Americas remains difficult to investigate though the evidence of older sites suggests that marine foods also were exploited. Changes in sea level and occupation hiatuses at several coastal sites in Chile (Huentelafquen, Quebrada de Las Conchas) and Peru (Quebrada Tacahuay, Quebrada Jaguay, Quebrada de los Burros) during the 11,000 to 10,000 year period mean that earlier marine-oriented sites may exist on submerged continental shelves (for example, DeFrance and Alvarez, 2004; Dillehay et al., 2008; Jackson et al., 2007; Keefer et al., 1998; Sandweiss et al., 1998). Freshwater and brackish fish also were taken in northern Peruvian Paijan sites dated around 10,500 years ago and in several early sites along rivers in eastern Brazil (Chauchat et al., 2003; Dillehay et al., 2003; Dillehay, 2000). Similar evidence is being retrieved from several sites along the submerged shelves of Florida and the state of Washington in the United States.

In my opinion, these patterns may help to explain the rise of later complex societies in some areas of South America where we know that large nomadic hunter-gatherer bands eventually settled down to establish productive food economies and dynamic social systems by 10,000 to 9,000 years ago (Dillehay, 2000). Not known are the conditioning factors that brought about these changes in regional settings. The archaeological evidence for a broad-spectrum economy is weak in some areas. Only in the past twenty years we have come to realise how widespread this type of economy was in the Late Pleistocene of the eastern woodlands of the United States and especially along the Pacific coast, lowland tropical forests and northern Andean regions of South America (Stothert et al., 2003; Balter, 2007). This is probably a result of better recovery techniques (for instance, flotation studies) to find new foods, which have opened archaeologists' minds to the idea that not all early people were big-game hunters. Examples of 'new' foods are the thousands of snails recovered from Paijan sites on the north coast of Peru; the variety of seeds, nuts, soft leafy plants, tubers and seaweeds recovered from residential floors at Monte Verde; and the abundant remains of palm nuts and other plant types found at several caves and rockshelters in Brazil dating between 11,600 and 10,000 BP. Despite these new foods, other groups developed economic practices that relied on a specific species, for instance, hunting high quantities of camelids (guanaco) or a few other species on the high puna or tundra of the Andes. This evidence from South America jointly confirms a Late Pleistocene human past somewhat distinct from that of North America.

## Monte Verde and public outreach

Today, Monte Verde is preserved and protected by Chilean law, which in 2008 declared the site as a national historical monument. I am currently working with the same interdisciplinary research team that excavated the site in the late 1970s and 1980s to build a site museum where the artefacts will be permanently housed and where the site will be duplicated in life-size form to reconstruct the activities carried out by the Monte Verdeans nearly 12,500 years ago.

We also have established dialogues with indigenous groups in southern Chile (Mapuche, Huilliche, Chilota) to listen to their ideas about Monte Verde and about the meaning of the site to them. The idea is not to treat the site as a dead or past history, but also as a past lived everyday in the present. Indigenous people in the forested region where Monte Verde is located still exploit the same kinds of economic resources (except for the extinct animals) that were hunted and gathered 12,500 years ago. To these people, sites like Monte Verde are not dead or inert, but live in their cultural memory and in their everyday practices. To them, their ancestors still live and walk about in sites. As a result of the indigenous interest in Monte Verde and other archaeological sites, we have shared the scientific information that we have collected from the site with them. We also have sought their interpretations of the site and their opinions of our interpretations of it.

Although we have always shared our experiences at Monte Verde with the public and with indigenous communities, the increased dialogue and communication that we have had with them has significantly enhanced our understanding of Native American concerns, of the archaeological record in general and of our relations with indigenous communities. I will explain briefly:

Only a few years ago, there was a broad notion within the discipline of archaeology and bio-anthropology that to acknowledge the interests of indigenous people would compromise the integrity of science. The scientific position was that close relations

with indigenous groups and their concerns might limit archaeological fieldwork and require the return of excavated materials to local communities. Many archaeologists believed that science was objective, neutral and for the benefit of all, while the religious and political claims of indigenous people were sectarian, subjective and for the benefit of few.

However, as the years have passed more and more archaeologists have changed their ideas and have begun to work much closer with indigenous groups. Increasingly, indigenous voices are being heard, in dialogue with archaeologists.

As part of the sweeping changes in the discipline, we have obtained scholarships for Huilliche and Mapuche students to study anthropology at the Universidad Austral de Chile in order to establish an indigenous-regulated archaeology that makes more use of their concepts of time, space and the material world in the excavation of sites and in the interpretation of archaeological remains. From the perspective of these students, 'the scientific objective measuring and recording of sites is combined with their living past.' As a result of these changes, our practice of doing archaeology has changed considerably in the past few years, especially where we are excavating on or near indigenous lands. We have formed partnerships with indigenous communities to study the past from the perspective of the 'past still living.' This new perspective has opened up the possibility of other kinds of archaeological practices, 'archaeologies' done by and for the Huilliche and Mapuche. Our research at Monte Verde and the dialogues we have established with indigenous peoples has given a more meaningful historical context to the site.

In recent years, the research team also has begun to play an important role in developing cultural heritage and ecological tourism at Monte Verde, which involves looking at the site from a local, regional, national and international perspective. The new focus on heritage tourism already is realizing positive impacts that include building community pride among local indigenous groups, enhancing the community's sense of identity, contributing to community stability, providing employment opportunities and ensuring that not only Monte Verde but other cultural and historic sites are preserved and maintained. An outgrowth of this is the development of long-term public support for protection of resources by engendering appreciation and understanding of the value of other cultural resources, providing the exchange of information necessary for the successful adaptation of visitors to the site environment and developing support for policies and programmes that incorporate the protection/preservation of resources as a fundamental part of their management and use.

To conclude, the contribution that Monte Verde has made to Chilean culture and history was recognized by Chile's use of the site as the official emblem, or Sello Bicentenario, to symbolise the country's bicentennial, which the nation celebrated in 2010. This is an honour that we are proud of.

## Epilogue

The old models for understanding worldwide changes taking place in human societies from the Late Pleistocene and to the middle Holocene periods have been altered significantly in the light of new archaeological evidence and new ways of thinking about these changes. For instance, recent studies have shown that not all Pleistocene peoples were highly mobile, big-game hunters but also territorial foragers subsisting on a wide variety of local foods. It also is becoming clear that plant and animal domestication, sedentism, crop production, social complexity, population growth, environmental stress and new technologies such as pottery do not constitute a coherent package of changes which drove each other progressively forward in the manner once envisioned by Lewis Henry Morgan and Gordon Chile. The new global picture is becoming a highly regional one of fluid, multi-velocity, even reversible changes. We now see similar kinds of innovations that took place independently at different places and times across the globe. Processes we once thought of as 'switches' and 'triggers' often unfolded at a gradual pace stretching over centuries or millennia. People tried new food producing strategies and then rejected some or all of them and returned to a foraging strategy, or they aggregated in or disaggregated from sedentary communities. We like to think that the evidence from and the research at Monte Verde has helped to change this thinking and to set a new course toward interpreting the human past.

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# *Primeras evidencias arqueológicas y la ecología de paleopaisajes en Patagonia*

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## Resumen

**A diferencia de las ciencias que llevan mucho más años de desarrollo o abordan problemas relativamente simples y constantes, la arqueología, como disciplina histórica y centrada en un agente tan flexible e impredecible como el ser humano, genera un conocimiento muy dinámico, en cambio permanente. Ningún sitio, por famoso que sea, resiste el paso del tiempo. Las técnicas con que se estudió ya están superadas y la importancia de las ideas que generó reside, muchas veces precisamente, en su posterior revisión.**

**La siguiente discusión, por ende, pretende ir más allá de los sitios clásicos para considerarlos meros hitos simbólicos y puertas de entrada para discutir procesos tan interesantes y sujetos a frecuentes cambios en el conocimiento, como son los referidos al poblamiento y dispersión de los seres humanos por el continente americano.**

**Por su mismo carácter de llamativos, estos sitios suelen ser los primeros en estudiarse (con técnicas en gran parte obsoletas) y estar muy alterados por lo que hoy se privilegia: la investigación de muchos sitios menores en los alrededores, procurando documentar una amplia gama de actividades en grupos muy móviles, las que están reflejadas en diversos contextos. La mera cantidad de sitios que se excava actualmente, la complejidad de sus análisis, la velocidad con que cambian sus interpretaciones y valoración, y la multiplicidad y dispersión de medios informativos, obstaculizan su conocimiento y aceptación masiva.**

**Dado que la arqueología patagónica ha florecido en los últimos años a la par del desarrollo de este nuevo paradigma, es claro que todos los sitios (e incluso los hallazgos aislados) son igual de importantes.**

**Ya que la UNESCO quiere precisamente destacar las narrativas que hacen un sitio interesante más allá de su atractivo evidente, y dado que estas narrativas exceden cualquier sitio en particular, esta revisión toca además contextos menores, desconocidos para el gran público y que han sido estudiados con enfoques interdisciplinarios modernos.**

**Ya que casi todos los contextos arqueológicos tempranos en Patagonia corresponden a ambientes esteparios al este de los Andes, también discutimos sitios que son evidencia del poblamiento inicial en el litoral Pacífico o en ciertos espacios marginales, pese a ser posteriores a la transición Pleistoceno/Holoceno, ya que el proceso de dispersión humana por la Tierra —foco del programa HEADS— no termina entonces.**

## Patagonia y el problema de los primeros americanos

Aunque corresponde al extremo meridional del continente americano y en consecuencia al territorio más distante de la supuesta via de entrada inicial[1] –o tal vez por eso mismo…– Patagonia (fig. 1) ha jugado un rol central en las discusiones sobre el poblamiento inicial del "Nuevo Mundo".

Recién se había zanjado la polémica de Clovis o la coexistencia del hombre con megafauna pleistocena extinta en Norteamérica, cuando, en 1936, Junius Bird excavó la que pasó a llamarse "Cueva Fell", cerca del Estrecho de Magallanes. Con los limitados conocimientos entonces disponibles, bastó la presencia de huesos de animales extintos con puntas bifaciales semejantes a las del paleoindio norteamericano para relacionar ambos fenómenos y suponer que eran más o menos contemporáneos, cosa que vino a ratificar el ulterior desarrollo de la datación radiocarbónica. Ese temprano descubrimiento despertó una serie de preguntas que siguen resonando hasta el día de hoy: si las primeras evidencias humanas al sur de los

1 Sea terrestre o costero, el arribo por Beringia cuenta con un respaldo empírico muy superior al de otras hipotéticas rutas, aunque hay una minoría que las defiende.

hielos revelan la llegada del ser humano a América un poco antes, ¿cómo avanzaron tan rápido? ¿O no es más bien una invitación a considerar que pudieron llegar mucho antes?

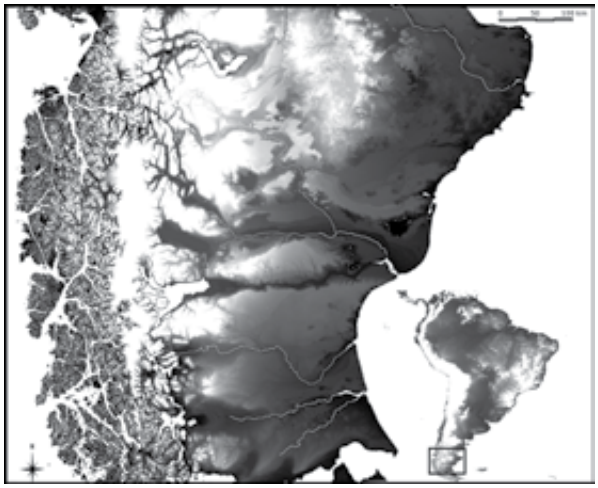

*Figura 1. Mapa de Patagonia.*

Cuarenta años más tarde, otro descubrimiento austral vino a revolucionar el pensamiento y las discusiones sobre el poblamiento inicial de América. Otro arqueólogo norteamericano descubrió e investigó el sitio abierto de Monte Verde, defendiendo con muy buenos argumentos no sólo una antigüedad mayor de lo aceptado por la mayoría, sino que abriendo los ojos hacia el estudio de sistemas basados en gran medida en una dieta vegetal y una tecnología de la madera y –sobre todo– a una gran diversidad, más allá de los cazadores de grandes presas en espacios abiertos semidesérticos estudiados (¿o susceptibles de estudiar con las técnicas entonces disponibles?) tradicionalmente. Aunque convencionalmente esta área no se considera parte de Patagonia, no hay dudas al menos que se encuentra en sus límites, muy próxima a ella.

Que documentar otros contextos alrededor de un sitio "clásico" es considerado hoy un criterio fundamental para su evaluación explica los recientes esfuerzos por descubrir y excavar sitios aledaños a Monte Verde, que es lo que se está haciendo en los mismos momentos en que se escribe esto (Pino et al., 2013, reexcavaciones en MV con especial énfasis en sitios aledaños como Chinchihuapi). Lejos de ser "marginal", esta información no sólo ayuda a entender el sitio tradicional sino que aporta información adicional, contribuyendo a entender el sistema de vida de un grupo humano, que siempre abarca mucho más que un sitio (sobre todo si se trata de poblaciones cazadoras-recolectoras, por lo general más móviles que los agricultores).

## Los sitios "clásicos" y famosos como faro para guiar la búsqueda de sitios alrededor

*Figura 2. Vista Cueva Fell.*

Los estudios en Cueva Fell (figura 2) fueron excepcionales ya que, de hecho, desde un principio la investigación se centró en varios sitios y Bird (1988, p. 212) incluso creyó encontrar en Cerro Sota los cuerpos de los mismos individuos que habían vivido en Cueva Fell. En su intento por excavar y relacionar varios sitios vecinos, se vislumbra un interés por entender la vida de los seres humanos, más allá de un sitio en particular.

Este esfuerzo —típico de la arqueología moderna— se ha expandido a todo el campo volcánico, donde hoy se reconocen una veintena de contextos excavados (figura 3; Borrero y Charlín, 2010). Aunque la mayoría de ellos siguen siendo cuevas u otros reparos rocosos, y testimonian ocupaciones mucho más recientes, varios yacimientos finipleistocénicos han entregado valiosa información acerca del contexto medioambiental y en especial de otros mamíferos que convivían (y competían) con el ser humano, en una compleja interrelación que ha sido detectada también en sitios donde hay claras evidencias antrópicas, como Cueva Fell o Pali Aike (Martin y Borrero, 2010).

Los niveles inferiores de Cueva Fell han sido datados en 11.000 ± 170 AP (I-3988) y revelan un énfasis inusual en el uso de puntas "cola de pescado", orientadas a la caza del guanaco (*Lama guanicoe*). Pese a que lo más llamativo[2] son los restos de fauna extinta, y aunque parece lo más probable que se haya consumido al menos (aunque no cazado) milodón (*Mylodon darwinii*), las evidencias de ello son muy discutibles, al igual que en el sitio de Pali Aike, localizado a unos 20 km.

2 Y antes del desarrollo de la datación radiocarbónica lo único disponible para definir una ocupación fini-pleistocena.

Las evidencias más tempranas halladas al oeste, en la región de Última Esperanza (figura 4) capitaneada por la famosa Cueva del Milodón (figura 5) hablan de un sistema de vida algo distinto.

Si bien las puntas cola de pescado son semejantes y suelen agruparse en un mismo sistema (Massone y Prieto, 2004), el énfasis estuvo puesto en esta área en la caza del caballo americano (*Hippidion saldiasi*), que también se encuentra como presa en los sitios de la región volcánica discutida antes, pero en proporción mucho menor. Al igual que allí, la relación con el tan famoso milodón es, por decir lo menos, poco clara (Borrero et al., 1991). Aunque es indiscutible que los seres humanos llegaron a la zona cuando este gran endentado todavía era relativamente común, no hay evidencias claras de su consumo. En Alero Dos Herraduras, los restos de milodón se encuentran embebidos en cenizas volcánicas producto de la erupción del Volcán Reclus, hacia el 10300 AP, fenómeno que pudo ser decisivo en la declinación y eventual extinción de este animal. El registro fini-pleistoceno de esta zona se asemeja también al de la zona de Fell y Pali Aike en que la gran mayoría de los refugios rocosos (ej., Cueva Lago Sofía 4; Alero Chico) entregan evidencias de animales como grandes felinos (*Panthera onca, Smilodon* sp.) u osos (*Arctotherium* sp.), que competían por alimento y espacio vital con los humanos, quienes rara vez podían ocupar las cuevas que aquellos usaban como madriguera.

Otro ejemplo de un sitio "clásico" que en la perspectiva que da el tiempo se valora sobre todo por su rol en llamar la atención sobre el registro circundante, es la cueva 2 de Los Toldos en la altiplanicie central de Santa Cruz. En un radio de unos 250 km de este sitio, se conocen hoy una gran cantidad de yacimientos fini-pleistocénicos u holoceno tempranos, incluyendo localidades tan importantes como Piedra Museo (Miotti, 2004) o La María (Paunero, 2009).[3]

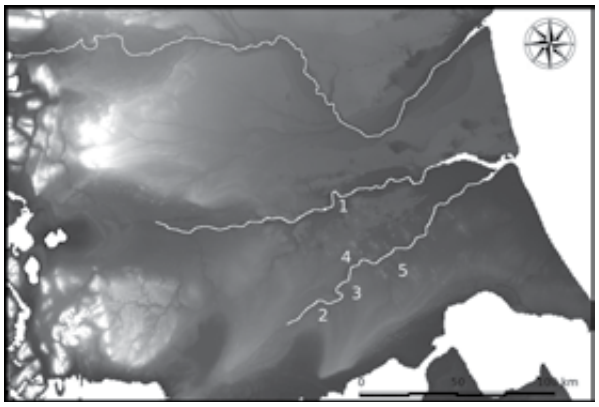


*Figura 3 Mapa Campo Volcánico Pali Aike (Cueva Fell y alrededores)*
*1. Río Gallegos (Las Buitreras, Abrigo de los Pescadores) 2. Río Chico (Fell, Laguna Sota y varios otros) 3. Don Ariel 4. Markatch Aike 5. Pali Aike, Cueva de los Chingus (Barberena, 2008, p. 267).*

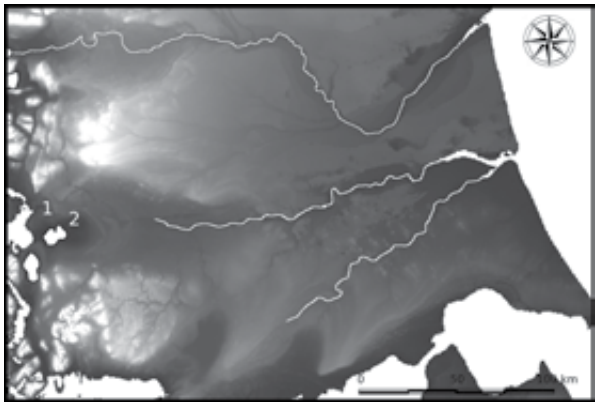


*Figura 4. Mapa Ultima Esperanza (Cueva del Milodón y alrededores) **1**. Lago Sofía (varios) **2**. Cerro Benítez (Cueva del Milodón, Cueva del Medio, Dos Herraduras, Cueva Chica, Cueva de la Ventana y varios otros).*

*Figura 5. Vista Cueva del Milodón.*

3 Muchos de estos sitios son de hecho tanto o más llamativos que las cuevas del Cañadón de Los Toldos, pero son menos conocidas que las que se excavaron primero, cuando la arqueología era relativamente rara y todos se informaban por unos pocos medios (véase Mena, 2002).

Excavada inicialmente por Menghin (1952), Los Toldos pasó a representar para la Patagonia argentina una proyección del paleoindio norteamericano, parecido a lo que había sido Fell más al sur y en territorio chileno. Los trabajos posteriores de Cardich —aunque realizados en otro sitio del mismo cañadón (Los Toldos 3)— agregaron además el dato sensacional de la fecha más antigua de Patagonia. A pesar de que su calidad ha sido muy discutida, hoy hay varias fechas procedentes de algunos de estos sitios menos conocidos que permiten afirmar que este sector fue poblado por primera vez por el hombre hace unos 13.000 años o quizás 14.000 años (ca. 15.500 cal BP; Prates et al., 2013). En otras palabras, la fecha puede no estar tan errada, pero fue dada a conocer en razón de su sensacionalismo, pese a su falta de rigor. Nuevamente hicieron falta trabajos serios en sitios menos publicitados para aceptarla.

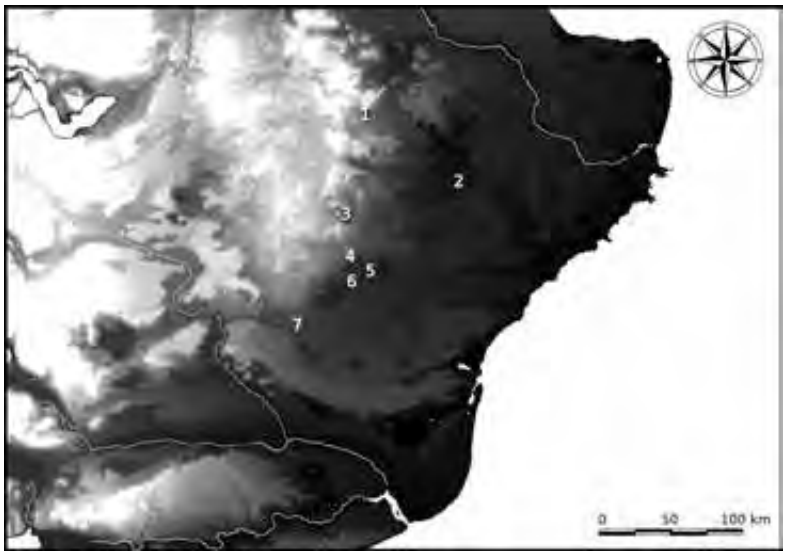


*Figura 6. Mapa Meseta Central de Santa Cruz (Cuevas de Los Toldos y alrededores): **1** Los Toldos (varios); **2** Piedra Museo (varios); **3** Cerro Tres Tetas; **4** Tunel; **5** El Ceibo; **6** La María (Casa del Minero y varios otros); **7** La Gruta.*

Uno de estos sitios es Alero El Puesto 1 (AEP1; conocido muchas veces como "Piedra Museo", aunque hoy que se han excavado tantos sitios en esa localidad es conveniente llamarlo por su nombre particular), donde se han reconocido dos bloques cronológicos, ofreciendo una de las evidencias más convincentes de que efectivamente hubo una primera oleada poblacional (que quizás no llegó al pie de las estribaciones andinas al oeste) con una estrategia de caza oportunista y grandes artefactos unimarginales previos al desarrollo y difusión de las puntas "cola de pescado".

## Ecología de paleopaisajes en la transición Pleistoceno/Holoceno

Hoy existe bastante evidencia de que ya había seres humanos en Patagonia hace unos 12 mil años y —aunque hemos aprendido que nunca detectamos "lo primero" y no podemos descartar futuros hallazgos más antiguos— es poco probable que los primeros ocupantes hayan llegado hace 20 mil o más años. Estos primeros exploradores (¿correspondientes tal vez al bloque temprano reconocido en AEP1?) debieron ser grupos relativamente pequeños por lo que —para ser genéticamente viables— no deben haber avanzado rápidamente ni separarse mucho de sus grupos de origen. Es muy probable que sus efímeras huellas se encuentren profundamente enterradas (y difíciles de detectar en un territorio poco alterado por obras que implican excavación), sobre todo si –como los grupos paleoindios norteamericanos– rara vez ocuparon cuevas. Es también posible que las evidencias más antiguas se hallen bajo el mar, puesto que cuando gran parte del agua líquida que hoy llega al océano estaba apresada en los casquetes glaciares continentales, la costa Atlántica se extendía varias decenas de kilómetros hacia el este. Particularmente intrigante es el que no se hayan encontrado sus restos esqueletarios, problema común a todo el continente americano, donde excepcionalmente se han encontrado a partir del 9000 AP.[4]

Es entonces también cuando se observa una tendencia más o menos sostenida[5] hacia un clima más templado y húmedo, que alcanza su culmine hace unos 5 mil años. Aunque no se pude generalizar a este enorme territorio y los estudios en marcha revelan que cada zona tuvo sus particularidades, ésto puede relacionarse con una fase de colonización efectiva o estabilización. Antes, en lo que podemos llamar una fase exploratoria o de colonización inicial, el paisaje experimentó cambios importantes.

4 Los restos de Baño Nuevo (Reyes et al., 2012), siendo los más antiguos documentados a la fecha en Patagonia (Borrero, 2008), no reflejan un evento poblacional exploratorio y deben representar individuos separados por varias generaciones de los primeros pobladores del continente. No sabemos si esta ausencia se debe a prácticas funerarias destructivas o a que simplemente no se ha buscado en los lugares adecuados.

5 Sin duda hay variaciones menores aunque significativas a la escala de un actor humano.

Si bien es cierto que en lo general el relieve fundamental se mantuvo inalterado (ej. la cordillera de los Andes ya estaba plenamente emergida y constituía —como ahora— un verdadero "biombo climático") y los glaciares ya se habían retirado hacia el oeste, hubo lagos donde hoy no existen, los existentes estaban mucho más altos y muchos de los que hoy drenan al Pacífico, lo hacían hacia el Atlántico. Así como debió haber caudalosos ríos actuando como "barreras relativas" u obstáculos a la movilidad, no existían otros tan importantes como el Estrecho de Magallanes, que era otro gran lago separado de los mares por lenguas de hielo y morrenas transitables (Sugden et al., 2005 y artículos varios en el mismo volumen). Cuando los seres humanos ingresaron por primera vez a Patagonia, éste era un territorio muy inestable y muy diferente del actual. Aparte de que existían —como hemos visto— algunos animales que se extinguieron durante este largo periodo de inestabilidad y cambio post máximo glacial (ej. milodón, paleolamas, oso chico, tigre dientes de sable, una subespecie del jaguar, caballo americano[6]) había especies que hoy se encuentran en otras latitudes (el *Rhea americana*, vicuña) y de que el paisaje era diferente del actual, con un clima dominantemente frío y una vegetación dominada por estepas incluso donde hoy existe bosque deciduo, hay factores más locales que es necesario considerar. Así, por ejemplo, la erupción explosiva del volcán Reclus en Última Esperanza (Moreno et al., 2012) o la sequía registrada en el Campo Volcánico Pali Aike hace 9.300 años (Zolitschka et al., 2013) definen un contexto especial para entender el proceso de extinción de la megafauna y en general el "escenario" activo en que vivieron (y ayudaron a construir…) los primeros humanos en la zona.

## Procesos de colonización post-Pleistocénicos

Si bien el poblamiento de Patagonia se inició en las estepas orientales y quizás en la costa atlántica, en este momento de grandes transformaciones hace unos 12 o 13 mil años hubo algunas zonas que se poblaron mucho más tarde.[7] Es el caso, por ejemplo, de los archipiélagos y canales de la Patagonia occidental.[8]

Aunque los recursos costeros en el Atlántico o el Estrecho fueron explotados oportunistamente desde temprano[9] (si bien aumenta en intensidad en los últimos milenios; Castro y Moreno, 1998, Barberena, 2008) la evidencia disponible revela que ya había poblaciones canoeras hace unos 6.500 años en el canal Beagle (Orquera y Piana, 1984), la zona del mar de Otway (Legoupil, 1997) y el Estrecho de Magallanes (Morello et al., 2012) que aparentemente se desarrollaron poco antes. A pesar de que los descubrimientos en el extremo norte de los canales patagónicos son un poco más recientes (Ocampo y Rivas, 2004; Gaete et al., 2003), es inevitable sospechar de la simple hipótesis de una rápida migración de sur a norte, que es lo que suele postularse con base en la información disponible (Legoupil y Fontugne, 1997). Sea donde sea que surgió la adaptación canoera, es claramente posterior a la colonización pedestre de Patagonia oriental y no puede relacionarse de ningún modo con una presunta "ruta costera" de poblamiento, que tiene un respaldo creciente (ej. Dixon, 1999). Algunos extremos de este mundo insular fueron ocupados por primera vez por el ser humano aun más tarde. La isla de los Estados, las Wollaston y el archipiélago de Cabo de Hornos, por ejemplo, debieron ser pobladas recién hacia el 2000 AP (Legoupil, 1993).

## Reflexiones finales

El hecho de que en Patagonia —a diferencia de en la mayoría del continente— hayan sobrevivido cazadores-recolectores hasta hace relativamente poco tiempo, constituye una bendición y una maldición a la vez. Aunque sin duda es un privilegio poder tener acceso a crónicas, fotos y hasta películas de grupos con una tecnología y economía que ofrecen información útil para entender los sistemas prehistóricos, existe también el riesgo de las comparaciones directas y la proyección acrítica, como si los pueblos históricos documentados por los ojos "occidentales" fueran fósiles vivientes, congelados en el tiempo.

En ausencia de diseños cerámicos o textilería, a los arqueólogos no nos queda más que rescatar y analizar piedras, huesos, conchas o excepcionalmente un pedacito de cuero o cestería que nos hablan de la esfera más estrecha de la economía o la ecología: la subsistencia. Cuando nos enfocamos en los primeros pobladores, muchas veces no tenemos ni el arte rupestre. Es tentador, por ende, rellenar los vacíos con analogías etnográfica simplistas y esencialistas.

6 Aunque sea un desvío un poco fuera de lugar, creemos importante aclarar que en estas latitudes nunca hubo mastodonte, ni menos mamut.
7 Y algunas que no se poblaron (ej. las Islas Malvinas) ni talvez se pueblen jamás (ej. los Campos de Hielo). De igual modo, es engañoso generalizar acerca de cuándo se pobló América, porque es muy diferente Beringia al norte de los hielos, las actuales praderas de Estados Unidos, el altiplano o las islas del Caribe…
8 Así como de los bosques montanos, que representan un desafío tal a la investigación arqueológica, que ni siquiera es prudente aventurar nada.
9 No podemos descartar que la intensidad de este uso costero haya variado también de norte a sur, aunque su detección y estudio está muy afectada por la ingresión marina del Holoceno medio.

El desafío es ir más allá de comparaciones anecdóticas de elementos y buscar principios generales a un nivel estructural. Desgraciadamente, esos mismos principios generales son lo que quisiéramos detectar a través de las observaciones. En un sistema tan complejo e impredecible como aquel que es blanco de nuestro interés (seres humanos flexibles y no optimizadores en un ambiente cambiante y espacialmente diverso del que forman parte…) debemos necesariamente navegar lo mejor que podamos en un laberinto donde deducciones e inducciones se retroalimentan.

Una recomendación que siempre será útil, sin embargo, es procurar huir del fenómeno aislado, prestar atención a la mayor cantidad y variedad posible de datos y procurar una mirada integradora. Muchas veces el elemento más modesto resulta clave cuando se ve en esta perspectiva, como ejemplifica en la misma arqueología patagónica los excrementos de milodón que guardó Bird y que luego sirvieron para datar el sitio del mismo nombre y estudiar la dieta de este animal y la vegetación circundante. Lo mismo pasa con los sitios menores y menos llamativos.

La ciencia consiste en buscar patrones y hasta "leyes" detrás de la descripción. Aunque ambas se complementan, la biología ha pasado de la historia natural a la ecología evolutiva. Nos ha costado mucho mirar más allá del sitio. El desafío es saber volver a verlo como símbolo de un proceso y una historia que lo rebasa y le da sentido.

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# Spatial Demarcation of Archaeological Population Cores in Southern Patagonia

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## Abstract

**The archaeological record of southern Patagonia between the Atlantic and the Pacific coasts can be characterized as spatially discontinuous. This discontinuity cannot be explained as a result of differential sampling efforts or differences in archaeological visibility. The distribution of rock art, stable isotopic values on human bones and maritime items is used to demarcate two different core populational areas used during the last 4,000 radiocarbon years. The distribution of tools made on known lithic sources offers independent evidence supporting that demarcation. The core zones are separated by one ample zone, where archaeological evidence is minimal or even non-existent for long stretches. The eastern population is concentrated on the Pali Aike Volcanic Field, while the western population is located along a relatively narrow longitudinal band that goes from the south of the Argentino Lake to Última Esperanza. This recorded Late Holocene distinction probably is a result of the divergent populational history of southern Patagonia.**

## Introduction

**The southern tip of South America is configured like a relatively narrow peninsula (Morello, 1984). It originally included the island of Tierra del Fuego, which at the beginning of the Holocene was cut off by the post-glacial rising sea level (McCulloch et al., 2005).**

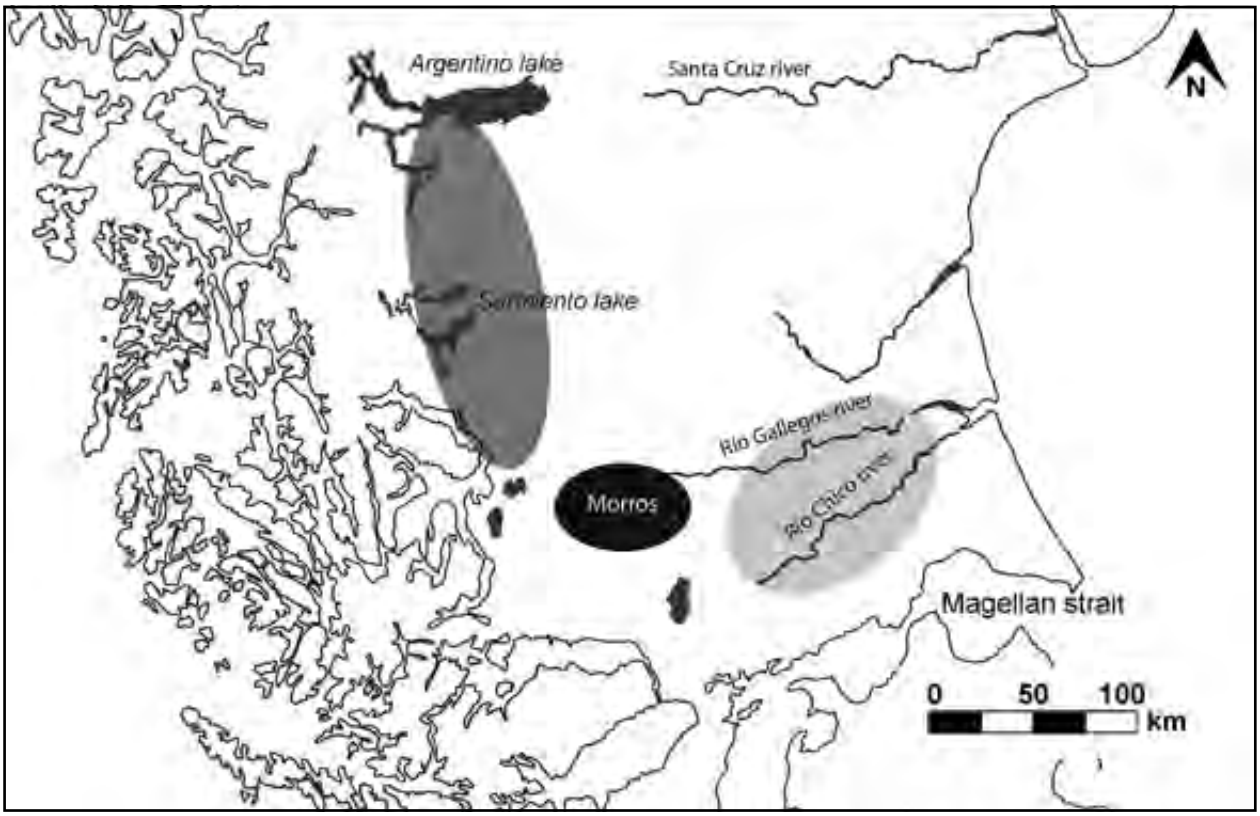


*Figure 1. Map. Light grey marks the Pali Aike Volcanic Field, black marks the region of the 'morros' and dark grey the longitudinal band near the Cordillera that goes from the south coast of Argentino Lake to Ultima Esperanza.*

**The earliest archaeological record in the southern extreme of the continent is not abundant. Two groups of sites are located in the Pali Aike Volcanic Field and in an area near the Cordillera in Última Esperanza, in the west. Between these two clusters of sites is an extended plain of more than 150 km dotted by a few buttes, locally known as '*morros*'. This plain is largely devoid of archaeological manifestations. The archaeology from those two areas attests to the clear presence of humans approximately during the period 11,000-10,000 BP. These early inhabitants were characterised by their use of projectile points known as fishtail or Fell Cave and other lithic tools. They were found in close association with hearths and the bones of extinct horse (*Hippidion saldiasi*), *Mylodon* sp. and camelids, particularly guanaco (*Lama guanicoe*) (Nami, 1987; Bird, 1988; Prieto, 1991; Martin, 2013). Cut marks on some of the bones are proof of their exploitation, but it is not always clear how they were acquired by humans (Martin, 2013).**

Moving forward in time several thousand years, the archaeological record of the late Holocene of the same regions again displays two widely separated groups of sites. One difference with the previous period is that now the frequency of sites is higher in both regions. Accordingly, their distribution covers much wider areas. While the Pali-Aike sites were still restricted to the volcanic field (Charlin, 2005), the findings at Última Esperanza were extended to the North to include the Cordón Baguales, the south coast of Argentino lake and parts of the eastern steppes. Importantly, the separation between both regions still exists and it is at least 100 km wide, marking the existence of a significant piece of land where archaeological manifestations are scarce and even absent for long stretches.

Thus, the archaeological record of southern Patagonia between the Atlantic and the Pacific coasts can be characterised as spatially discontinuous on a regional scale. The importance of this discontinuity was such that the idea that the distribution of the historical Aonikenk was restricted to the eastern region was entertained (Gómez Otero, 1991).

The environmental and geographic characteristics of the areas where the two clusters of sites are located are quite distinctive. Pali Aike is a volcanic region where more than 400 volcanic apparatus are identified (D'Orazio et al., 2000). Precipitation is around 200-250 mm/year and the vegetation is mostly steppe with patches of shrubs. The archaeological record is relatively abundant in caves, lava tubes and craters, both in stratigraphy and on the surface (Martin et al., 2011). The western region, closer to the Cordillera, is more varied, including plateaus, pampas, the mountains of the Cordón Baguales and smaller hill systems. The archaeological record is less abundant than in Pali Aike. Precipitation is higher than in the eastern steppes, reaching 350-500 mm/year. The vegetation is characterised by the extensive presence of forest. Farther west the maze of the archipelagos is characterised by much higher precipitation, in the order of >5000 mmm/year (Endlichter and Santana, 1988). The archaeological record in this maritime zone is sparse (Legoupil and Sellier, 2004; Maire et al., 2009).


*Figure 2. South America with the region of the buttes indicated by a rectangle. Transformed from Borrero et al. 2011.*

It may be the case that the richness of the archaeological record of Pali Aike is a result of its higher archaeological visibility. Effectively, at Última Esperanza most of the findings are in caves and the forests of the hill systems make it difficult to find sites. In spite of this, moderate field efforts produced some evidence of the presence of prehistoric humans at Cancha Carrera (Pallo and Borrero, 2015), the eastern end of Baguales (Borrazzo, 2008).

## The region of the buttes

The northern hinterland up to the middle basin of the Gallegos River, an area near the ecotone between the western forests and the eastern steppes, is characterised by the presence of four buttes that interrupt a basically flat landscape.

On the basis of the decline in the abundance of archaeological remains, it can be sustained that the zone of the '*morros*' presented extremely low population densities in prehistoric times. It can be seen as a relatively unused area, perhaps not used residentially. It may well be that we are just dealing with an area away from one or more core areas of intensive human use. It is an area of mesic steppe that even when exposed to seasonal changes in the availability of resources, possess a relatively high carrying capacity (Mazzoni and Vázquez, 2010). The resources are the same that are present both east and east of the buttes region.

The originally known archaeological record of the intermediate zone includes:

**1.** A concentration of lithic tools near Laguna Condor (Gómez Otero, 1991).

**2.** Funerary assemblages located above each of the four buttes (Ortiz Troncoso, 1973; Bate, 1982; Prieto, 1984). The number and frequency of rare offerings in these burials is higher than usual in the region. Red ochre-embedded silex bifaces were found associated with a multiple burial at Morro Philippi (H. Roehr, pers. comm.; Ortiz Troncoso, 1973). The silex is not local, is very rare in the region and has only been found at Bahía Santiago 2 on the coast (Prieto, 1993–1994) and Mala Cueva on Pali Aike (Martin and San Roman, 2010). A decorated/carved lignite pendant was found with the human skeletal remains at Morro Chico (Prieto, 1984).

**3.** Concentrations of surface findings at places with soil erosion at Estancia Rincón de los Morros (Molinari, 2000) and at Little Hill (Carballo Marina et al., 2008).

In sum, only four funerary and three surface loci were known in the region of the '*morros*'.

*Figure 2. Pali Aike Volcanic Field.*

## New results

Intense field efforts were made searching for archaeological manifestations in the area separating both clusters of sites. Using a regional taphonomical approach, searches took advantage of exposures like natural cuts produced by wind, streams or recent anthropic activities and places with high visibility in general. Locations with severe erosion were specifically selected (Mazzoni and Vázquez, 2010, p. 362). Systematic random transects were implemented at those places, which were complemented with intensive searches at selected places. In spite of all these efforts, the archaeological record of the intermediate zone continues to be small. Thus, it appears that these discontinuities cannot be explained as a result of differential sampling efforts or differences in archaeological visibility.

Our search at estancias Stag River, Santa Ana, Glencross, Morro Chico and Rincón de los Morros, clearly showed a highly discontinuous distribution of archaeological materials, with many empty quarters and few focal clusters of artefacts. In fact, most of the area displays no archaeological evidence at all. This results not only from our own work, but also from the results of other archaeologists (Gómez Otero, 1991) and amateurs, especially the latter, who failed to find tools after decades of search. Again, even when our work produced a few new discoveries (Charlin et al., 2011), none were substantial. Only limited concentrations at Puesto Aserradero and isolated findings were added west of the most eastern previously known findings - those of Laguna Cóndor and morro Philippi -. The absence of an archaeological record at Stag River and extensive sectors of Estancias Santa Ana and Glencross, as well as in the area near Río Turbio implies the existence of ample areas where no archaeological evidence was ever recovered.

Our work at places which are still characterised by the presence of patches of *Nothofagus* forests produced archaeological assemblages and isolated findings at Puesto Aserradero (Estancia Santa Ana). These assemblages located N and NW of the intermediate zone are characterised by a completely different technology from that observed both at Laguna Cóndor and Pali Aike. In contrast, the occupations at Laguna Cóndor are better explained as a result of logistical exploitation from Pali Aike in the east. The distribution of rock sources selected for tools confirms this (Charlin, 2009a; Charlin, et al., 2011). Additionally, from these places access to forest resources like huemul (*Hippocamelus bisulcus*) or wood was possible. It is clear that both localities were part of different annual foraging ranges.

As already mentioned, the concentration of archaeological remains at Laguna Cóndor, morro Philippi and areas nearby at Estancia Glencross suggest a redundantly visited place, perhaps under a logistic mode of exploitation. Effectively, relatively abundant artefacts were recovered at eroded places on the NW coast of Laguna Cóndor and at the north slope of morro Philippi. The available radiocarbon dates indicate that they reflect late historic occupations, probably during Aonikenk times (Martinic, 1995). At that time, the settlement of cacique Mulato was located at the Zurdo basin, some 30 km from Laguna Condor before moving to the middle Coyle River (Childs, 1936; Martinic et al., 1995). An alternative to logistic exploitation is circulation, but the distribution of lithics and technological studies do not support this interpretation.

*Figure 3. The Guillermo River, near Cancha Carrera.*

## Regional lines of evidence

The point now is to evaluate to what extent both core areas can be considered independent. In order to discuss this we have developed a number of independent lines of evidence.

The importance of maritime protein in the diet varies with the distance to the coast. There is an abundance of coastal items including molluscs and sea mammals in sites near the eastern mouth of the straits of Magellan (Borrero and Barberena, 2006). The distribution of molluscs, seal and whale bones is ubiquitous in Pali Aike (Borrero and Barberena, 2006), while it is only restricted to the western part of the Última Esperanza region (Laming-Emperaire, 1972). It is clear that there was a degree of interaction between Pali Aike and the coastal zone (Barberena, 2008). In the case of Última Esperanza, the Pacific Ocean is clearly the origin of these items, whose presence was only detected within a narrow coastal band. This situation led to the so-called Dual Hypothesis (Borrero et al., 2006), in which human circulation in Última Esperanza is marginal both in relation with the lands east of the mountains and with the western archipelagos (Legoupil, 2000). In contrast, there is a gradual decrease in the abundance of marine remains as one moves from the coasts of the Strait of Magellan toward the hinterland (Borrero and Barberena, 2006).

Stable isotopes on human bones also present a clear-cut spatial pattern. They indicate mixed diets in both the coast and the hinterland (Barberena, 2002). This pattern changes approximately 30 km from the strait, where stable isotopes on human bones uniformly display a fully terrestrial diet (Barberena, 2002; Borrero et al., 2001, 2009). Again, the evidence for the Atlantic coast indicates a more widespread utilisation of marine resources. The consumption of maritime resources is recorded to some extent in Pali Aike, where practically every site displays some evidence of interaction with the ocean. In many cases the marine items appear as burial goods, but there is at least one important exception. The archaeological site of Orejas de Burro 1 can be considered as a place where the transport of marine mollusc, some 20 km inland, for consumption occurred (L'Heureux, 2008).

Rock art is one of the many markers that can be used to map the distribution of archaeological human populations (Charlin and Borrero, 2012). There is a general similarity of the rock art recorded at both the western and the eastern extremes of the study region, but there are specific trends in the ratio of certain types of motifs. Figurative motifs - anthropomorphs and zoomorphs - are more abundant in Lago Argentino, near the Cordillera. Dots and dotted geometric figures predominate in Última Esperanza, also near the Cordillera. In contrast, lines and lineal geometric figures are the most important motifs in Pali Aike (Charlin and Borrero, 2012).

Information about the provenance of rocks used for artefacts is also available (Charlin, 2009a). Green obsidian is abundant at Morro Domeyko (Prieto, 1993–1994) and Morro Chico (Stern and Prieto, 1991). This obsidian is completely foreign to the steppe regions and can only be obtained in the channels area, at least 120 km to the west (Morello et al., 2004). Other

obsidians also show distinct patterns (Franco, 2008; Charlin, 2009b). The distribution of other lithic raw materials used for the manufacture of different tools, their exploitation intensity and the technological strategies in general are also different mainly between Lago Argentino and the Pali Aike region (Franco, 2008; Charlin, 2007). In Lago Argentino the dacite is both the most abundant and the most exploited rock for the manufacture of artefacts, while several types of fine grained dark rocks are usually selected at Pali Aike despite being relatively scarce (Charlin, 2007, 2009a, 2009b).

*Figure 4.* 'Morros' *Philippi and Domeyko.*

Lithic technology also presents some differences (Pallo and Charlin, 2010). The same types of small and medium triangular stemmed projectile points - which functioned within different weapon systems (Ratto, 1994) - were used in both regions (Franco et al., 2005; Cirigliano, 2011), although differences in the selection of rocks are known (de Azevedo et al., 2014, p. 204). There are also important differences in the lithic assemblages from these regions (Franco, 2002; Franco et al., 2004; Charlin, 2009a; Charlin et al., 2011). A trend of reduction in artefact diversity is observed from the coasts of the straits of Magellan toward the hinterland (Charlin and Cardillo, 2010: 94).

There are also important differences in settlement patterns. Both the size and intensity of occupations are larger at sites in Pali Aike (Barberena, 2008). It is possible that the pattern of occupation near the Cordillera was affected by seasonality (Borrero et al., 2006; Borrazzo, 2008; Pallo and Borrero, 2015).

## Conclusions

Summing up, there are a number of markers indicating relatively independent archaeological concentrations that we interpret as evidence of the existence of two populations: one occupying Pali Aike, with regular connections with the maritime zone and the other near the Cordillera, more focused on terrestrial resources (Borrero and Charlin, 2010; Charlin et al., 2011). It is clear that both regions display quite distinct archaeological signatures and constitute non-overlapping spatial units. The main difference between both populations is derived from their location. One is near the Cordillera ecotone, offering access to resources like grey obsidian, huemul or wood, while the other is on the eastern steppe, with better access to ocean resources. The concept of relative isolation, in which no strict barrier exists, makes sense in this discussion (Broodbank, 2008). Different patterns of stable isotopes from human bones, lithic artefacts and settlement patterns suggest that there are also different non-overlapping extended annual ranges. The area near the Cordillera appears to be less connected with the coast than the area of Pali Aike, where the presence of different kinds of maritime items and the degree of reduction of some lithic raw materials from the coast point to a more typical relationship with the coastal area (Borrero and Barberena, 2006; Charlin, 2007, 2009a).

Finally, the existence of extensive intermediate zones where archaeological remains are not abundant is significant. The '*morros*' probably were significant natural landmarkers for humans. We know that they were selected for burials and that these burials were often accompanied by offerings, which included art productions. However, the region where these '*morros*' are located presents limited evidence of subsistence oriented occupations. These occupations can be better explained as a result of logistical exploitation. The archaeological evidences indicate that this intervening space appears to have interacted more with Pali Aike and correspondingly with the sea. Moreover, all the available chronological evidence indicates that the process of utilisation of the region of the '*morros*' took place very late during the Holocene, more probably during historic times (Borrero et al., 2011; Charlin et al., 2011). The evidence is not strong, but it can be the case that these populational cores are the result of divergent evolution that started within a relatively homogeneous colonizing population at the end of the Pleistocene.

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