Human Adaptations to the Last Glacial Maximum

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The Solutrean and its Neighbors

Edited by
Isabell Schmidt,
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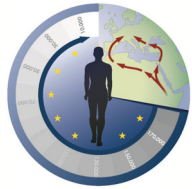

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INTRODUCTION

Research on the Last Glacial Maximum (LGM) in Europe reflects our ubiquitous interest in understanding humans cultural and economic responses to changing environmental conditions, the effects of spatio-temporal patterns of demographic dynamics, and the resilience of social networks… The list could become endless. The outstanding western European archaeological and paleoclimatic record of the Solutrean technocomplex provides insights into these processes. The present volume follows the 3rd International Conference on the Solutrean, held in October 2017 at the University of Algarve, Faro, Portugal. The conference brought together scientists from different countries and covering a rich range of archaeology-related expertise and their application to the LGM record. An eclectic range of topics was presented and discussed across several thematic symposia, including reports on recent site/context discoveries, paleoenvironmental studies, technological analysis, and investigations on art and ornaments.

We noticed, however, that the role of the LGM as one of the main focus of Western European prehistoric research has been, over recent years, somehow obfuscated by an exponential investment in other equally fascinating topics, such as the Neanderthals-Anatomically Modern Humans transition. In reality, however, it is rather clear that the rich cultural heritage and distinctive paleoenvironmental settings to which the Solutrean is associated has repetitively allowed the application, testing, and improvement of new theories and analytical methods, often serving as steppingstones for the construction of models applied in broader anthropological inquiries (e.g., the role of refugia in past human adaptations). In addition, the LGM is also in the focus of numerous climate modelling projects, so that a high-resolution data record is available, making this time slice very attractive for broader archaeological studies. So, the starting point for hosting the 3rd conference on the Solutrean was a shared belief amongst the organizers and editors of the present volume, that the focus on the Solutrean technocomplex and LGM-related cultures merits revitalization and a broad forum for interdisciplinary exchange and discussion.

Accordingly, the volume addresses readers with a background in archaeology as well as related disciplines, providing an overview as well as detailed insights into a broad array of current research topics and methods

applied in LGM contexts. The book constitutes a rich source for new data and interpretive models on human behavior.

One of the highpoints of the conference was the thematic session organized in honor of Prof. Lawrence Guy Straus, whose seminal and extensive work on the Solutrean adaptations in Northern Iberia has strongly influenced all developments in LGM studies across Iberia and beyond. Prof. Straus is now retired, but we hope that he can keep contributing for many years with his invaluable insights on the Late Pleistocene adaptations in Western Europe. He authored the first chapter of this book, and we gratefully dedicate the whole volume to him and his remarkable career.

The book is subdivided into five thematic sections, PART I to V, broadly following the structure of the conference. While PART II-V are centered on topics related to the Solutrean, PART I focused on what we called the Solutrean Neighbors. During the conference, general reviews but also new data reports on the LGM human ecodynamics across different regions of Europe and North Africa were presented. This broadening of the conference scope was a priority for us from the beginning, intending to discuss human adaptations to the LGM from a wider paleoanthropological perspective. Two of the original contributions to this symposium appear published in this book (Part I: THE SOLUTREAN AND ITS NEIGHBOURS), focusing on the LGM occupations in Northern Italy (Chapter 2) and its environmental and landscape settings, and Northern Morocco (Chapter 3), where researchers discovered a very different occupation history to what is known from Iberia.

Contributions of PART II "INSIGHTS FROM SITE CASE-STUDIES" focus on current excavations and the reinvestigation of old excavations across Western Europe. The report from Les Bossats provides an exceptional insight into the intra-site spatial organization of an extensively excavated Solutrean open-air-site at the northernmost fringe of known human LGM settlement (Chapter 4). Turning to the record from Iberia, contributions are sorted geographically, clockwise, starting with archaeological sites in the North of the Peninsula. An overview on multi- and interdisciplinary results on site formation processes and archaeological and archaeozoological finds from El Buxu, including art, is given in Chapter 5, much of which is published in English for the first time. The rediscovery of archaeological material from an old excavation at Cova Rosa – including finds and sediment samples – allowed deriving substantial new archaeological as well as palaeoenvironmental information on the occupation during the LGM (Chapter 6). The subsequent two contributions reach out into higher elevations and position new discoveries within a larger spatial framework. New dates and finds from Montlléo trigger a discussion of mobility and

contacts of populations across and around the Pyrenees during the LGM, taking typological similarities and differences between adjacent regions into account (Chapter 7). The report on ongoing excavations of an archaeological stratigraphy in the central Meseta Plateau challenges the longstanding model of humans avoiding the unfavorable interior of the Iberian Peninsula during long periods of the Upper Paleolithic (Chapter 8). New stratigraphic data and multidisciplinary results from current excavations at Ardales provide contextual information on a typologically indifferent assemblage, now dated to the LGM, supported by diagnostic surface finds in the cave (Chapter 9). The Gravettian-Solutrean sequence from Lapa do Picareiro in central Portugal is presented in Chapter 10, discussing implications for the (supra-)regional chrono-cultural sequence of this transition.

Turning to Part III: LITHIC TECHNOLOGY IN CONTEXT, contributions (again geographically sorted) reflect the broad spectrum of available methods in lithic analysis. It starts with an innovative approach combining results of spatial analysis and technological description, conducted for Solutrean layers of Las Caldas (Chapter 11). The subsequent chapters provide comprehensive techno-economic studies of assemblage from sites in southern Iberian, which synthesize results from studies of raw-material, techno-typology, reduction processes, tool-manufacture, and use; focusing on the discussions on the regional chrono-cultural context (Chapter 12), site function and mobility networks (Chapter 13), and the value of open-air sites for investigating human presence on the landscape (Chapter 14). Experimental data on Solutrean shouldered points from southern Iberia is presented in Chapter 15, reconstructing a use of these implements in a bow-and-arrow hunting technology – a claim repeatedly raised for these Solutrean point types. Finally, Chapter 16 provides an original study on lithic raw material of sources and archaeological contexts from Portugal, observing a tool-specific raw-material-usage behavior during the LGM. It is a general tendency that raw-material provenience has by now become an integral part of many studies in Iberia, this book providing numerous references to such data.

Contributions of Part IV: HUMAN-ENVIRONMENT INTERACTION DURING THE LGM operate at different spatial scales and use a variety of proxies (animal, plant, and cultural remains) to understand the interaction of humans with their biotic environment and climatic conditions. A spatially-explicit statistical study (Chapter 17) on up-dated information about faunal assemblage composition from northern Iberia innovatively tests observations already made by L.G. Straus during an early stage of his career. The following two chapters are dedicated to a still underrepresented source of information from the archaeological record of the Late

Pleistocene: charred plant remains. Using evidence from two well excavated and comprehensively sampled sites, La Boja Rock-Shelter and Cova de les Cendres, anthracological and carpological data are used to understand humans' interaction with the specific vegetation of the LGM. Chapter 18 exemplifies the rich information derived by anthracology from combustion features; and Chapter 19 provides an exceptional case study and demonstrates how charred remains can be used to open up insights into past climate, landscape structure, intra-site organization and the daily life of hunter-gatherers.

A large-scale overview on fish-remains along the Mediterranean coast of Iberia (Chapter 20) shows that they are more than just another species on the LGM menu - set into context of changing paleoshorelines and the archaeological record, a complex picture emerges which demands further explanation. Chapter 21 takes an innovative approach by firstly testing the relationship between environment and archaeological faunal remains through a species distribution model, and secondly exploring potential relationship by adding data from artistic expressions at the respective sites. The last chapter of Part IV takes a closer look on paleo-environmental proxies (Chapter 22). The final Part V of the book is on RESEARCH ON ARTISTIC AND SYMBOLIC EXPRESSIONS. Three contributions present evidence for rock art, including new data and interdisciplinary approaches to its analysis and documentation: A comprehensive overview is provided on the dense panels at Cueva de Ambrosio, a site also known for its rich Solutrean stratigraphy (Chapter 23). At Malamuerzo Cave, also known for numerous paintings, reported excavations demonstrate the sealing of newly discovered motifs by Magdalenian deposits, providing an *ante-quem* date for this artistic expression (Chapter 24). Potential evidence of Solutrean art from Gibraltar is presented and discussed in the light of local, site-specific conditions, e.g., accessibility of the cave, and within its regional context of archaeological evidence (Chapter 25). Finally, Chapters 26 and 27 presents, respectively, results from an analysis of a newly discovered set of perforated shells from a Proto-Solutrean context and two Solutrean engraved slabs at the site of Vale Boi, southern Portugal.

We would like to express our gratitude to all people who assisted during the physical realization of the book: Nina Avci, Tom Noack, and Lutz Hermsdorf-Knauth for their input to the formal editing process; Dr. Jayson Orton and Geneviev de Waal for their outstandingly thorough and vigilant work on the English language; and Dr. Werner Schuck for providing full support on any matter of the accounting.

We thank all colleagues who contributed to the conference, making it an inspiring and successful event through presentations, posters, and discussions. Last but not least we would like to acknowledge the scientific committee and the essential work of the reviewers, who have provided their long-standing expertise on the archaeological and environmental record of the Last Glacial Maximum.

CHAPTER ONE

JUST HOW DENSE ON THE CANTABRIAN LANDSCAPE WERE SOLUTREAN PEOPLE? CURRENT SPECULATIONS

LAWRENCE GUY STRAUS[1]

Abstract

Although the number of known Solutrean sites in the Cantabrian region of Spain is far greater than those of the preceding Gravettian and Aurginacian periods, but similar to the number of Early Magdalenian sites, the densities of cultural materials therein are generally relatively small compared to those of many Magdalenian sites. This might suggest that although the region was an important Last Glacial Maximum refugium, the numbers of people may not have been very large at any one time – perhaps not many more that what would be required for a regional band to maintain its biological viability (perhaps at least c. 475) through time by means of a basically linear social network of mate exchange along the Cantabrian coastal strip and into the extreme SW corner of France. Population seems to have increased during the Late Glacial, a period of general climatic amelioration and demographic rebound throughout Europe.

Keywords: Solutrean, Cantabrian Spain, population density, Last Glacial Maximum, Magdalenian

Caveats

This contribution is at its core a speculative mental exercise in trying to imagine within reasonable (albeit debatable) parameters the comparative densities of human population in a geographically circumscribed region

between the Last Glacial Maximum (LGM) and Oldest Dryas. Both the representativeness of the archeological record and the use of artifact-based proxies for human abundance are fraught with problems – factual and theoretical. Furthermore, the reliance on "magic" numbers for average local band size and for the range of regional band sizes generalized from many ethnographic studies of (sub-)contemporary forager societies leaves the tentative conclusions open to characterizations of equifinality or even circularity in reasoning. This is true. But after nearly a half-century of researching and thinking about the Solutrean phenomenon in SW Europe, I am here engaging in what I freely admit is a "mental exercise" – a thought game – in which I try to imagine how abundant were Solutrean-age people might have been on the landscapes of Cantabrian Span and how population densities may have changed between the Solutrean and the following Early and Late Magdalenian periods, that developed throughout the course of the climatically dynamic Late Glacial. This essay begins with the premise that human populations were dramatically affected by the severe climatic conditions in both formerly (i.e., Aurignacian- and Gravettian-age) occupied northerly regions of Western Europe (extreme cold and aridity) and even in the mid-latitude, oceanic, regions of Southwestern Europe, notably Cantabrian Spain. The effects of the LGM could have led not only to the demise of local human groups in the North, but also to a thinning of remaining human population in general, even in relatively favored regions such as coastal Atlantic Spain, with its ecologically diverse, resource-rich, high-relief landscapes.

Introduction

For some three decades, beginning with a 1987 paper in a Society for American Archaeology symposium on the Last Glacial Maximum organized by Olga Soffer and Clive Gamble (Straus, 1990) and inspired by Michael Jochim's (1987) essay on Late Pleistocene refugia, I have been arguing for a Solutrean population boom in Cantabrian Spain (and more generally in SW Europe) as NW Europe was substantially depopulated due to extreme aridity and cold (see e.g., Straus, 1991a,b, 2000, 2001, 2012, 2013, 2015, 2018; Straus *et al.,* 2000a,b). During these years, as more sites and Solutrean cultural levels were discovered in the three autonomous regions that constitute this narrow, physically bounded geographical region along the northern Atlantic coast of the Iberian Peninsula (from East to West: the Spanish autonomous regions of Euskadi, Cantabria and Asturias), I could count the number of places

which had yielded characteristic foliate or shouldered stone points (or at least credible C14 dates falling between 20.5-17 uncalibrated ka BP) as they increased from some 40 to about 64 at the present time. Even as the number of Gravettian sites has grown, particularly with new discoveries of not only cave sites, but also open-air ones in the Basque Country, the Solutrean still stands out for the density of sites throughout this region (as it does in Levantine Spain, Andalusia and Portuguese Estremadura). High density also characterizes the distribution of early and late Magdalenian sites in Vasco-Cantabria, but the inflection point in the trend of site numbers seems to have come during the LGM, after which they seem to continue to increase, albeit at first less dramatically (Straus *et al.,* 2000a,b).

Nonetheless, I always had the lurking sense that something was largely missing among the Solutrean sites of the Cantabrian region, namely genuine "super-sites". While simple site *numbers* did not "explode" during the Early Magdalenian vis à vis the Solutrean as they had between the Gravettian and Solutrean, what about the relative "importance" of sites? Where in the Solutrean record are major settlements like the Magdalenian settlements at Urtiaga, El Valle, El Castillo, El Pendo, Altamira, El Juyo, Tito Bustillo, La Paloma or El Mirón, with their masses of lithic and osseous artifacts, portable art objects and personal ornaments, abundant hearths and fire-cracked rocks, very abundant faunal remains, etc.? One could point to Cueto de la Mina together with the adjacent La Riera in eastern Asturias, or Las Caldas in the central sector of that province (about which we now know much more because of M.S. Corchón's just-published monographs [2017a, 2017b]), together with the nearby Lluera caves, or maybe Aitzbitarte IV in Guipúzcoa as major settlements. But even some of the more "important" Solutrean sites such as Bolinkoba, Altamira, El Pendo or La Pasiega seem relatively insignificant compared with many Magdalenian loci (or even with the Magdalenian components in the same caves). Indeed there are many sites with major Magdalenian deposits atop really minor Solutrean ones. El Castillo is a classic example of such a glaring contrast: a very thin (13 cm), artifact-poor Solutrean layer (with only 14 points) overlain by the massive (1.45-2 m[!]) Early Magdalenian "Beta" horizon, extraordinarily rich in all manner of lithic and osseous artifacts, portable art objects, hearths and faunal remains (Cabrera, 1984). El Mirón is another example of a site with massive Early Magdalenian deposits atop very poor Solutrean levels (in this case dominated by foliate and shouldered point fragments suggestive of ephemeral hunting camps; Straus *et al.,* 2012). And of course it was during the Magdalenian

that the human range re-expanded into areas of NW and Central Europe (and into mountain chains such as the Pyrenees, Massif Central and Alps, as well as onto the high *mesetas* of Castile) from the southwestern refugia, suggesting the existence of a major wellspring of human population in Iberia and southern France.

It had always been the case that counting Solutrean sites was easier than counting many sites of other Upper Paleolithic cultural periods because of the distinctiveness of the foliate and shouldered points (despite possible confusions with certain small Middle Paleolithic bifaces or Chalcolithic arrowheads – not as much an issue in Cantabrian Spain as in some other regions of Iberia). So there was a risk of "over-counting" Solutrean sites relative to banal lithic assemblages of other periods, especially as when some of their temporally most diagnostic artifacts are made of less-universally preserved antler material. Another significant problem that may inflate Solutrean site numbers is that there may be many small, short-term ("logistical") camps assignable to this period because they have yielded one or a few Solutrean points. Such sites end up being counted in the same way as larger, richer ("residential") sites. Small sites of other periods without temporal diagnostics can end up being either ignored as unclassifiable or incorrectly attributed. Some sites can be labelled "Solutrean" simply on the basis of the find of a single (presumably) diagnostic projectile point. For example, it is very difficult accurately to estimate the numbers of Early Magdalenian sites, since there are no distinctive *and* common diagnostic artifacts for the Initial, Lower and Middle phases in contrast to the Late (i.e., Upper and Final) Magdalenian with its "true" antler harpoons.

This contribution owes its genesis to a conversation I had in 2017 with Mikel Aguirre at his extraordinary Solutrean site of Antoliñako Koba on a steep hilltop north of the great Magdalenian site (but insignificant Solutrean locus) of Santimamiñe overlooking the Urdabai valley near Guernica (Vizcaya). While discussing the Solutrean phenomenon, Aguirre remarked that, at least in the Basque Country, people might not have been very dense on the landscape. As a consequence, I thought I should try to dig deeper into the question of Solutrean population density. Of course, in any event prehistoric archeologists are dependent on (grossly imperfect) proxies for estimating even relative population levels, lacking cemeteries (and hence the possibility of developing life tables to estimate population size) and indeed anything more than few, isolated human remains attributable to the regional Solutrean. Site counts is one such proxy; radiocarbon counts

is another, but Solutrean C14 dates from Vasco-Cantabria are still relatively few and come mainly from just a few sites (notably La Riera, Las Caldas, and, to lesser extents, Altamira and El Mirón [see a nearly complete list in Schmidt, 2015, Table 5.3]).

As a first step and to explore the impression that most known Solutrean sites were minor occupations – and probably not long-term, intensively or repeatedly occupied residential camps – I set out to gauge the range of inter-site variability in the record. To try to quantify my impression that there were major differences among Solutrean sites in terms of the intensity and/or frequency of human occupation, I tabulated the numbers of Solutrean points per site and the numbers of retouched tools per cubic meter excavated. Solutrean points are the objects most likely to be collected and reported from sites and retouched tools are much more likely to be saved more or less completely and uniformly accounted for in site reports – far more than unretouched debitage or even cores. By "retouched tools", I mean lithic artifacts that are classified into the Upper Paleolithic typology of D. de Sonneville-Bordes and J. Perrot – the standard for most prehistorians working in this period in Europe, despite its manifold imperfections. Naturally there are major problems in comparing assemblages from sites that were dug and curated with very different methods and at very different times in the development of the science of prehistoric archeology – in this case from the 1924-1925 excavation of Altamira by H. Obermaier to the 1996-2013 excavation of El Mirón, Indeed the values from some of the older excavations (like Altamira) are highly suspect (in this case, too low, probably in great part due to losses from collections made before the Spanish Civil War). The quality and quantity of reporting on the collections is also highly variable – from short notes in journals to major monographs such as those of La Riera (Straus and Clark, 1986) and Las Caldas (Corchón, 2017b). Many of the relevant data had already been compiled in published versions of doctoral dissertations by Straus (1983) and Schmidt (2015). Particularly difficult in many cases was the calculation of the volumes excavated – essential for standardizing the densities of tools among the sites. Few site reports (e.g., La Riera) actually specify this information, so I had to use site plans (or descriptions of the areas excavated) and descriptions of level thickness (or extrapolation from published stratigraphic sections, usually involving the calculation of average thicknesses from graphically or textually published ranges). In the case of old excavations, these estimations may be especially problematic. The most reliable values are those from modern, relatively well-reported excavations, including Las Caldas, La

Viña, La Lluera, Güelga, El Buxú, La Riera, Chufín, El Linar, Las Aguas, El Ruso, Morín, La Garma, El Mirón, Arlanpe, Antoliña, Aitzbitarte III. The basic idea is that the more a site was used and the larger its average residential group size, the more tools were likely to be abandoned (usually) after use (hence, density of retouched tools per m^3). Despite many great inaccuracies in my volume estimates, the values do give useful approximations with which to compare sites. Naturally, the simple count of Solutrean points can be heavily influenced by site function (i.e., hunting camp or not) or the part of the site excavated quite by accident in terms of sampling internal activity area variations, but it does also give a crude sense of site importance as living place on the landscape, since Solutrean points are fairly ubiquitous markers of this cultural period. A final note is that, because the sites were dug in such diverse and disparate ways (from single, often thick Solutrean horizons that today would no doubt be subdivided among several levels – as in the case of Altamira –to multiple, thin levels such as those of La Riera, Las Caldas or El Mirón), I decided to lump all Solutrean levels at each site to give point counts and tool densities per site. To use only sites with multiple, but thin levels defined during modern-quality excavations would severely limit sample size, but lumping all of the Solutrean deposits from each site (as was often done during older excavations such as at Altamira) does make for very coarse units of site occupation. This means that in some cases not only hundreds, but possibly a thousand or more years may be represented by these values. In any event, we know that Paleolithic levels in caves are almost always fairly massive palimpsests accumulated from the debris of multiple human occupations (often with differing specific functions and sampled blind and "by accident" by archeologists' test pits or area excavations, none of which ever uncover entire site areas.

Quantities of Solutrean Points per Site

The results of these tabulations are given in Tables 1 and 2 and in Figures 1 and 2.

Table 1: Cantabrian Solutrean assemblages (all levels per site combined; m³ volumes often very approximate).

Site	m³ Excavated	No. Retouched Tools	No. Solutrean Points	Tools per m³
Caldas (Jordá)		177	31	
Caldas Sala I (Corchón)	5.5	2055	493	373.6
(Caldas total)		(2232)	(524)	
Viña[1]	3.8	~1400	163	368.4
Lluera I	3.0	1099	64	366.3
Lluera II			?	
Candamo		34	4	
Oscura		167	11	
Aviao			≥1	
Güelga[2]			1	
Buxú[2]	1.4	132	8	94.3
Corao			≥1	
Collubil[2]			2	
Cova Rosa	1.5	217	38	144.7
Cierro (Lev.5)	2.2	337	3	153.2
Coberizas		8	1	
Cueto de la Mina	12.5	840	130	67.2
(Vega del Sella + Jordá)				
Riera (Vega del Sella)		143	11	
Riera (Straus & Clark)	7.8	1561	94	200.1
(Riera total)		(1704)	(105)	
Tres Calabres		64	2	
Balmori		25	8	

Site	m³ Excavated	No. Retouched Tools	No. Solutrean Points	Tools per m³
Sulamula			≥1	
LlonÍn[1]	5.7	~500	207	87.7
Canes			?	
Sel			≥1	
ChufÍn	1.6	272	51	170.0
Locos			1	
Meaza			1	
Altamira (Alcalde)		50	31	
Altamira (Obermaier)	31.2	522	69	16.7
(Altamira total)		(572)	(100)	
Linar	0.1		1	
Aguas*			0	
Ruso	3.5	168	8	48.0
Pendo		38	12	
Covalejos			2	
Camargo		5	3	
Morín (Vega + Carballo)		47	28	
Morín (Echegaray)	2.1	138	15	65.7
(Morín total)		(185)	(43)	
Castillo (Carballo)		8	3	
Castillo (Obermaier)		191	11	
(Castillo total)		(199)	(14)	
Monedas			1	

Site	m^3 Excavated	No. Retouched Tools	No. Solutrean Points	Tools per m^3
Pasiega	1.5	331	33	220.7
Hornos de la Peña	0.9	125	15	138.9
Cabarceno			1	
San Juan de la Canal		80	5	
Santa Ana	1.4	82	1	58.6
Lacavada			1	
Fuente del Francés			2	
Garma A			?	
Salitre			≥1	
Rascaño/Bona			1	
Luz			2	
Mirón	2.3	213	28	92.6
Haza			1	
Ramales		12	2	
Cobrante*			0	
Bolinkoba (D)	7.0	527	7	75.3
Arlanpe	0.6	22	1	36.7
Atxeta		14	1	
Santimamiñe			1	
Antoliña[3]	5.4	1,299	133(+~50 from mixed)	240.6
Atxuri			3	
Lezetxiki			1	
Ermittia	3.8	131	2	35.3
Amalda	3.8	518	8	136.3
Urtiaga	15.0		1	

Site	m³ Excavated	No. Retouched Tools	No. Solutrean Points	Tools per m³
Ekain*	3.9	27	0	6.9
Portugain			1	
Aitzbitarte IV	3.3	335	32	101.5
Aitzbitarte III (Lev.II)*	0.7	94	0	134.3
TOTAL SITES: 64				
PAYS BASQUE FRANÇAIS				
Isturitz		562	>42	
(Passemard + St.Périer)				
Haregi			>2	
Azkonzilo	0.6	202	36 (+66 from mixed)	366.7
Lezia			1	
Kurutzaldea			1	
Bidartia			1	
Chabiague			?	
Phare			?	

*: provisional attribution to the Solutrean based solely on radiocarbon dates.
[1]: Information provided by M. de la Rasilla (personal communication, August 2017).
[2]: Information provided by J.M. Quesada (personal communication, July 2017).
[3]: Information provided by M. Aguirre (personal communication, July 2017).

Table 2: Sizes of Cantabrian Solutrean sites lithic assemblages.

No. Retouched Tools	No. Sites	No. Solutrean Points	No. Sites
5-50	9	1-10	40
51-100	3	11-50	9
101-500	14	51-100	3
501-1000	4	101-207	5
1001-1704	4	493	1
2055	1	0	4
Unknown*	29	Unknown*	2
Total:	64	Total:	64

*: in most/all cases, probably very few.

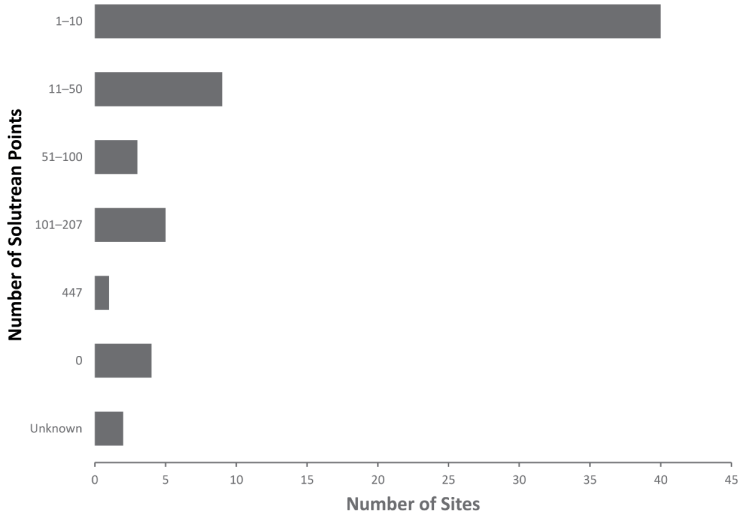

Figure 1: Numbers of Solutrean points per site in Cantabrian Spain (L.G. Straus & J. Dombrosky).

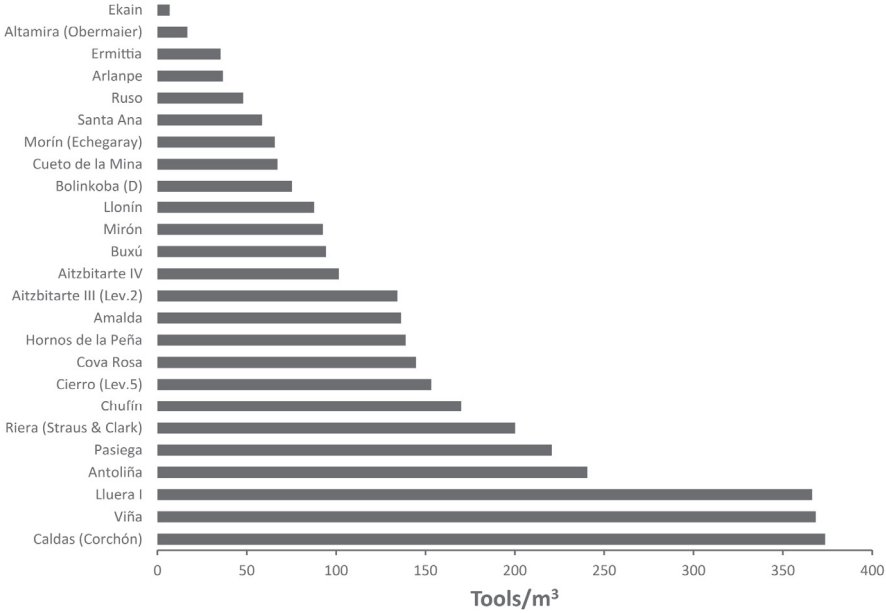

Figure 2: Retouched tools per m³ excavated in Cantabrian Solutrean sites (L.G. Straus & J. Dombrosky).

First I consider the numbers of Solutrean points. The raw data are summarized as follows: known total point numbers range from Las Caldas' 524 (if one includes both those from the early test pits of F. Jordá and from M.S. Corchón's major excavations in Sala I) and c. 183 from Antoliña (both the intact and disturbed areas dug by M. Aguirre) to many sites with only one reported point (or in some cases, dated to the Solutrean period by 14C, but with no points [i.e., Ekain, Aitzbitarte III, Cobrante, Las Aguas]). Indeed of 64 total sites, fully 40 have only only 1-10 reported Solutrean points, and half of those have only one point – not very impressive. Only six sites have yielded more than 100 points. The limited information from the Pays Basque is similar: only two sites – Isturitz and Azkonzilo – have many points. From the point of view of a/the major life-supporting activity conducted by Solutrean-age people – hunting – most sites seem rather insignificant at least in terms of used projectile discard (most points in the record being fragments). Modern excavations, with systematic collection even of small point fragments and good collection curation (and less time or possibilities for losses to occur) dominate the class of point-rich sites. In addition to Las Caldas (Corchón) – clearly a Solutrean point manufacturing locus (Corchón, 2017b) – and Antoliña, these include La Viña, Llonín, and La Riera. But some old excavations have large (n≥100) point collections: Cueto de la Mina, Altamira – truly major Solutrean sites, although even these seem to pale in comparison to several Magdalenian "super-sites" in the region (including the Magdalenian deposits in the same sites), as I will note later.

A measure of richness of some Magdalenian occupation residues (and hence the intensity of human activity) could include numbers of antler points/*sagaies* (mostly fragments, as they were clearly used in hunting). Such projectiles (often "edged" or "barbed" with backed bladelets) were probably the functional equivalents of lithic Solutrean points. As examples of this richness, El Mirón Lower Magdalenian Level 17 (c. 35 cm. thick and excavated over 9.25 m²) yielded 113 of these projectiles (Straus, 2018). Initial Magdalenian levels 119.3-117, c. 30 cm. thick and excavated in only 3 m², yielded 33 (Straus *et al.,* 2014). La Riera Lower Magdalenian Levels 18-23, totaling about 30 cm. thick and dug over an average of c. 10 m², yielded about 50 fragmentary *sagaies* (González Morales, 1986). In El Juyo, excavated in at most c.15 m², thin (c. 5-20 cm.), but extensive Lower Magdalenian Levels 4 and 6 yielded respectively 86 and 20 *sagaies* (almost all fragmentary) from the 1978-79 excavations (Barandiarán 1985). Review of the classic corpora on osseous artifacts from the Upper Paleolithic of Vasco-Cantabria (Barandiarán, 1967; Corchón, 1986) shows the overall abundance of antler points in many Magdalenian sites throughout the region

– generally far more numerous than Solutrean points, despite their greater vulnerability to complete destruction.

Densities of Retouched Tools per Site

Perhaps a more general indicator of the relative importance of human population levels is the overall density of retouched tools per cubic meter in sites. As with Solutrean point counts, Las Caldas (Corchón) leads with 373 tools/m³, followed closely by the modern excavations at nearby La Viña (J. Fortea excavations 368 tools/m³) and La Lluera I (A. Rodríguez Asensio excavations 366 tools/m³) in the middle Nalón Valley of central Asturias. These are followed by two other modern excavations: La Riera (200 tools/m³) and Antoliña (241 tools/m³), but other modern excavations have far lower densities of tools (e.g., Cueva Morín , Llonín, El Ruso, El Mirón, Arlanpe), and some have only modest ones (Chufín, Amalda, Aitzbitarte III – all of which are modern excavations with fine-screening and good collection curation). And some old excavations have surprisingly high densities (e.g., El Cierro, Cova Rosa – both Jordá excavations – La Pasiega, Hornos de la Peña, Aitzbitarte IV. It is true that there are some old excavations with many points, but low tool densities (e.g., Altamira, Cueto de la Mina), suggestive of poor collection and/or curation histories. Nevertheless, these statistics suggest to me that not all the variability is due to the quality of excavation and curation. There are a few Solutrean sites with high tool densities, most (but not all, e.g., La Lluera, El Cierro, Amalda) also with large numbers of points. The exceptions might be indicative of sites where hunting activities were of lesser importance (or where discard of points just did not take place in areas sampled by the excavations). In short, as with Solutrean point numbers, the densities of retouched tools/m³ do indicate the existence of only a few "major" sites. Most Solutrean sites are modest or poor in terms of lithic artifact abundance. (Osseous artifacts are in general far scarcer in Solutrean sites than in Magdalenian ones, in which *sagaies*+bladelet inserts replaced the large stone foliate and shouldered points).

Comparison with the Magdalenian Situation

Table 3 gives the densities of retouched tools among early (i.e., Initial and Lower) Magdalenian levels from six recently excavated sites: Las Caldas (Sala I – Corchón excavation), La Riera (Straus and Clark), El Juyo (Freeman and González Echegaray), Rascaño (González Echegaray and Freeman), El Mirón (Straus and González Morales) and Santimamiñe (López Quintana).

Table 3: Densities of retouched tools from modern Cantabrian Early Magdalenian excavations*.

Site	Level(s)	m³ Excavated+	No.Retouched Tools	Tools/m³
Las Caldas (Sala II)	XIII-XI	5.95	899	151.1
La Riera	18	0.84	225	267.9
“	19	0.54	219	405.6
“	20	0.80	203	253.8
“	21-23	3.25	61	18.8
El Juyo	6	2,80	474	314.5
“	4	2,42	877	362.4
El Rascaño	5*	0.98	207	212.3
“	4b	0.46	130	282.6
“	4	0.62	195	314.5
“	3	0.96	324	337.2
El Mirón	17	3.73	5353	1434.4
“	15	0.95	204	214.7
“	312	0.35	579	1654.3
“	119-117*	1.05	1123	1069.5
“	115	0.85	359	422.4
“	505	0.48	365	760.4
“	504	0.60	969	1615.0
Santimamiñe	Csn-Camr	0.54	83	153.7

* All levels are attributed to the Cantabrian Lower Magdalenian except Rascaño 5 and Mirón 119-117, Initial Magdalenian.
+ Volumes excavated are approximate.

The highest densities are all from El Mirón – four levels with over 1000 tools/m³, two over 400 and one over 200 tools/m³, while the Solutrean density from the same site is barely over 90 tools/m³. Nine of the other sites/levels have densities over 200 and two have densities of just over 150 tools/m³. In contrast, recall that all but three of the Solutrean sites have densities ≤200 m³ and most of these have densities lower than almost all the Magdalenian sites/levels (except the very poor level 21-23 in La Riera). Admittedly there are biases in this comparison (all the Magdalenian sites are modern excavations, which is not the case among the Solutrean ones), but I think the contrast is still quite valid and clear. Although average number per millennium of Early (i.e., Initial, Lower and Middle) Magdalenian sites (c. 11) is similar to the number of Solutrean ones (c. 13), there are far more "major" Early Magdalenian sites (including "super-sites"). The Solutrean spanned about 5 millennia from 25-20 ka cal BP, while the Early Magdalenian spanned about 4 millennia from 20-16 ka cal BP. Many Early Magdalenian sites contain extraordinarily thick, dense living surface palimpsests. Examples of this phenomenon include the classic Lower (or Middle) Magdalenian sites of Altamira, El Castillo (level Beta), El Juyo, El Mirón (levels 17, 312, 110-116, 503-505), Urtiaga (level E), Las Caldas (levels XIII-IX), La Garma. In the Upper Magdalenian there are also extremely rich sites such as Tito Bustillo, La Paloma, Cueto de la Mina, El Valle, etc. – a phenomenon virtually unknown among Solutrean sites (with the possible exception of the adjacent sites of Cueto de la Mina and La Riera). Many of these Magdalenian deposits are packed with faunal remains (including mollusks and fish, as well as extraordinarily abundant bones/teeth of red deer, ibex and other ungulates) representing amounts of food also suggestive of large numbers of people and/or long, repeated stays at numerous sites. In the Late (Upper and Final) Magdalenian, in addition to very rich "super-sites", there seems to have been a further increase in numbers of sites: on average about 26 sites per millennium for this short (2,500 years) period., during which time there is increased evidence of people moving up into the interior highlands of Spain. The impression given by the Magdalenian record is one of denser human populations, including many individual sites that were frequently, repeatedly occupied by fairly large numbers of people, perhaps sometime for significant periods of time during each stay. These "hub" residential sites were at the core of well-established, significantly populated territories that during Solutrean times may have been inhabited by smaller and/or fewer bands than in post-LGM Magdalenian times. What has been elusive are credible estimates of how many people actually lived in the geographically circumscribed Cantabrian region during Solutrean (or any Upper Paleolithic) times.