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► **To cite this version:**

Thomas Perrin. The Time of the Last Hunters: Chronocultural Aspects of Early Holocene Societies in the Western Mediterranean. *Open Archaeology*, 2023, 9 (1), 10.1515/opar-2022-0275 . hal-03932926

**HAL Id: hal-03932926**

**<https://hal.science/hal-03932926v1>**

Submitted on 11 Nov 2023

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## Research Article

Thomas Perrin\*

# The Time of the Last Hunters: Chronocultural Aspects of Early Holocene Societies in the Western Mediterranean

<https://doi.org/10.1515/opar-2022-0275>

received April 12, 2022; accepted November 10, 2022

**Abstract:** In the Western Mediterranean Basin, the last hunter-gatherer societies fall within a chronological range between the 9th and 5th millennia cal. BCE, that is, between the cold oscillation of the Younger Dryas and the Holocene climatic optimum, before disappearing under the expansion of the first Neolithic societies. The variability in cultural expressions is very high, as shown by the variability in the lithic industries, a technical field which, from a historiographical point of view, is the preferred approach of archaeologists to address these issues. However, convergences in technical choices or typological features show the existence of major currents of diffusion and exchange between many of these Mesolithic groups. But the discussion of these cultural dynamics requires knowing precisely the absolute chronology of these groups and the detailed characteristics of their material productions. The aim of this article is so to re-examine the chronocultural organization of the Mesolithic of the Western Mediterranean, especially the first part of it, roughly from the middle of the 10th millennium cal. BCE to the middle of the 6th, on the basis of a critical revision of the absolute dates.

**Keywords:** Mesolithic, chronology, radiocarbon, cultural groups, interactions

## 1 Introduction

In the Western Mediterranean Basin, the last hunter-gatherer (HG) societies fall within a chronological range between the 10th and 5th millennia cal. BCE, that is, between the cold oscillation of the Younger Dryas and the Holocene climatic optimum, before disappearing under the expansion of the first Neolithic societies. The variability in cultural expressions is very high, as shown by the variability in the chipped stone industries, a technical field which, from a historiographical point of view, is the preferred approach of archaeologists to address these issues. However, convergences in technical choices or typological features show the existence of major currents of diffusion and exchange between many of these Mesolithic groups, which are still too often imagined as small family units shut away in their clearings. The appearance of pressure flaking, for example, is a symptomatic feature. This technical innovation appeared somewhere in the eastern part of the western Mediterranean basin in the middle of the 7th millennium cal. BCE and then spread very rapidly (Binder, Collina, Guilbert, Perrin, & García Puchol, 2012; Perrin et al., 2009). Combined

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Special Issue published in cooperation with Meso'2020 – Tenth International Conference on the Mesolithic in Europe, edited by Thomas Perrin, Benjamin Marquebielle, Sylvie Philibert, and Nicolas Valdeyron.

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with other elements of the technical system, this diffusion suggests a possible displacement of populations from North Africa to Europe, independently of the climate changes at work during this period (Marchand & Perrin, 2017). This model implies mastery of navigation, rapid long-distance travel, numerous interactions between distant human groups, knowledge of common languages, etc. The discussion of such hypotheses implies to know precisely which human groups are present at the time of this diffusion and what are the detailed characteristics of their material productions.

The precise chronological positioning of the sites and cultural groups involved in all the evolutionary dynamics and cultural exchanges of the Early Holocene in the western Mediterranean and the very definition of these cultural groups are then indispensable preambles to any discourse or modelling. However, these two questions, chronological and cultural, are too often treated in a not very rigorous way or are the subject of too many neglect and accommodations with the reality of the data, especially chronological ones, all the more for this period of the Early Holocene when the absolute dating methods used are not very precise. As already pointed, the chronological organization of this period is too often based on palynological chronozones (Perrin, 2021). The Early Mesolithic is thus confused with the Preboreal, the Middle Mesolithic with the Boreal, the Final Mesolithic with the Atlantic, etc. However, while it cannot be denied *a priori* that the evolution of the climate and the environment may have had a role in the cultural evolution, establishing such a mechanistic correlation is no longer acceptable, as it is far too simplistic and deterministic. The aim of this article is to re-examine the chronocultural organization of the Mesolithic of the Western Mediterranean, especially the first part of it, roughly from the middle of the 10th millennium cal. BCE to the middle of the 6th, on the basis of a critical revision of the absolute dates.

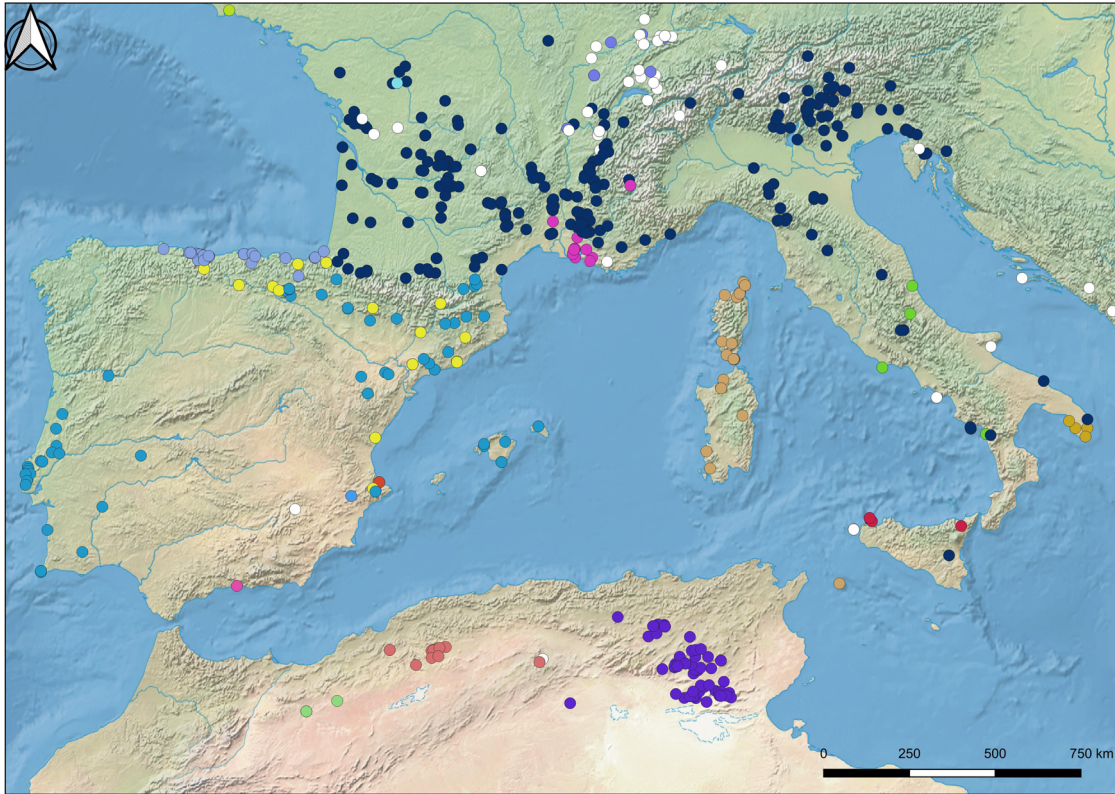
## 2 State-of-the-Art: The Chronocultural Variability of Early Holocene Societies in the Western Mediterranean

In Western Europe, the whole of this period between the 9th and the 6th millennia cal. BCE corresponds to the Mesolithic whilst in North Africa, this term is not used in favour of Epipalaeolithic (Camps, 1974; Tixier, 1963). This distinction is of little importance in itself, since in both cases they are the last groups of HG of the Early Holocene period, which will disappear with the Neolithic expansion. These two names do not correspond to different anthropological realities, only to the history of the research.

But the term Epipalaeolithic underlines the question of the roots of Mesolithic HG societies in the Upper Palaeolithic traditions. It is, of course, rather delicate to give an unequivocal answer to this question for the whole of the geographical area considered here, from North Africa to the Rhone Valley, from the shores of the Adriatic to the Spanish Meseta. In general, however, the hypothesis of an *in situ* evolution from the cultural and human substratum of the Upper Palaeolithic seems to constitute a relatively strong consensus, or at least a preferred hypothesis (Langlais, Naudinot, & Peresani, 2014; Naudinot, 2013, e.g., for France). As it was underlined by Brochier (2005, p. 27), it is quite paradoxical to split an evolutionary continuum into discrete stages, by isolating the Mesolithic from the Upper Palaeolithic. Indeed, the Mesolithic results of the rapid transformations, during the first half of the 10th millennium cal. BCE, of the previous Upper Palaeolithic societies. The tools made remain similar, as do the animal species hunted or the kind of dwellings, at least during the first centuries. Profound changes will then take place with the evolution of the vegetation cover.

The term Mesolithic will therefore be here used in a general meaning, including all the HG societies of very late Pleistocene and early Holocene age, till the Neolithic.

In the Western Mediterranean Basin, the geographical framework of this study, several major cultural groups have been defined, based almost exclusively on their chipped stone productions, which represent distinct technical traditions (Figure 1). A large southern half of France pertains to the Sauveterrian complex, as well as the whole of northern Italy. The Provençal coasts, however, stand out with a few sites attached to the Montadian, while the upper Rhône valley and the Northern Alps show Beuronian impacts. Apart from



#### Cultural groups or facies

- |   |                                     |                                   |
|---|-------------------------------------|-----------------------------------|
| ● Asturian  | ● Geometric Epipalaeolithic         | ● Ligerian Early Mesolithic       |
| ● Bertheaume  | ● Epiromanellian                    | ● Insular Mesolithic              |
| ● Beuronian   | ● Facies of epigravettian tradition | ● Montadian                       |
| ● Typical Capsian                                     | ● Geometric phase A                 | ● Muescas y Denticulados (MMD)    |
| ● Columnatian   | ● Keremian                          | ● Sauveterrian                    |
| ● Epimagdalenian or Sauveterroïde microlaminar (SML)? | ● Lepenski Vir - Schela Cladovei    | ● Sauveterrian microlaminar (SML) |
| ● Undifferentiated Epipalaeolithic                    | ● Lybico-capsian                    | ○ Undetermined                    |

**Figure 1:** Map of the main facies and cultural groups of the First Mesolithic of the Western Mediterranean. Data: BDA database <https://bda.huma-num.fr/>.

the northern part, the situation seems more confused in Italy, particularly in the south, where several more or less well-defined complexes mix between them. In Corsica, Sardinia, and the Tyrrhenian Islands, the occurrences of the First Mesolithic remain relatively rare and poorly characterized. In Spain, the MMD (*Mesolítico de muesclas y denticulados*) is mainly attested around the Ebro valley, and a geometric Epipalaeolithic further south. Finally, North Africa splits also into two main groups, the Typical Capsian in Algeria and Tunisia and the Mediterranean Epipalaeolithic further west. Some of these different cultural groups are themselves divided into several regional and/or chronological facies.

For instance, the French Sauveterrian is divided into three phases (early, middle, and late), or even four if we consider the very late (and dubious) “trapezoidal Sauveterrian” (Rozoy, 1971, 1978). However, the chronology of all these cultural groups, as well as that of their facies and regional variants, remains very vague, more largely based on pollen chronozones than on absolute dating. The early and middle phases are thus attributed to the Preboreal while the recent phase, including the Montclusian, is brought closer to the Boreal. This situation is induced by the relative imprecision of the calibration curve for the 10th and 9th millennia cal. BCE, but also by the great scarcity of radiocarbon dates from reliable and controlled stratigraphic contexts (Perrin, 2021). Merging cultural sequences and pollen chronozones is therefore a sort of second-best solution, with a precision of the order of a millennium. But this implicitly forces us to consider the vegetal environment as one of the primary drivers of cultural evolution. This may of course be correct,

but it is not possible to strictly correlate two such dependent chronologies without falling into circular reasoning. Consequently, only the chronological data (absolute and relative) of the occupations will be taken into account here, to place them objectively in time and to compare the regional sequences with each other and thus to try to identify more general trends at the scale of the Western Mediterranean basin.

In Southwestern Europe, the Mesolithic is nowadays separated into two main periods: the First and the Second Mesolithic (Marchand, 2008). The transition from one to the other is generally situated in the second half of the 7th millennium BCE. In this work, we will focus on the First Mesolithic.

### 3 Methods

To highlight the chronocultural dynamics of the First Mesolithic, it is necessary to avoid partial or doubtful data to retain only the most reliable and well-dated. The method implemented is therefore based on three specific fields: geographical, chronological, and cultural data.

#### 3.1 Geographical Data

The geographical aspects are the easiest to deal with: all published Mesolithic sites have been integrated into the BDA database for years (BDA: “Base de données archéologiques,” created in 1994). All the data used in this article are available in this database. It is a collaborative database, freely accessible (<https://bda.huma-num.fr/>), and today compiles data on more than 5,000 prehistoric sites in Europe, Near East, and North Africa. All these sites are georeferenced, making it easy to obtain precise maps in any GIS.

The location of the sites is based on their geographical coordinates (WGS84 datum), which can be more or less precise depending on the information available in the publications. The location precision is specified in a dedicated field and varies from very precise coordinates taken with GPS on the site itself to the centroid of the municipality for the least accurate. In this work on the scale of the western Mediterranean basin, the imprecision of some locations is not of consequence.

#### 3.2 Chronological Data

The BDA database also contains nearly 7,000 radiocarbon dates (all calibrated according to the last curve; Reimer et al., 2020). All these dates are linked to a specific occupation and are assigned of a reliability index. This one evaluates both the physico-chemical quality of the measurement itself and the value of its link with the anthropic event it is supposed to date (Van Strydonck et al., 1999). Contrary to many current works that consider them as reliable proxies, I think that the dates have meaning only by the link they have with the event they are supposed to date and in no case by themselves out of any archaeological consideration. This approach has already been presented in detail in previous publications, to which we refer the reader for more details (Perrin & Manen, 2021).

Some of these Early Mesolithic occupations belong to stratified sites, between other dated occupations. In this case, the use of Bayesian modelling allows for considerable refinement of chronological precision inside each stratified site. This can also be the case when several measurements are available for a same occupation. These intra-site Bayesian models were mainly carried out with the ChronoModel software (v.2, <https://chronomodel.com/>). They are presented in detail in the study of Perrin (2019).

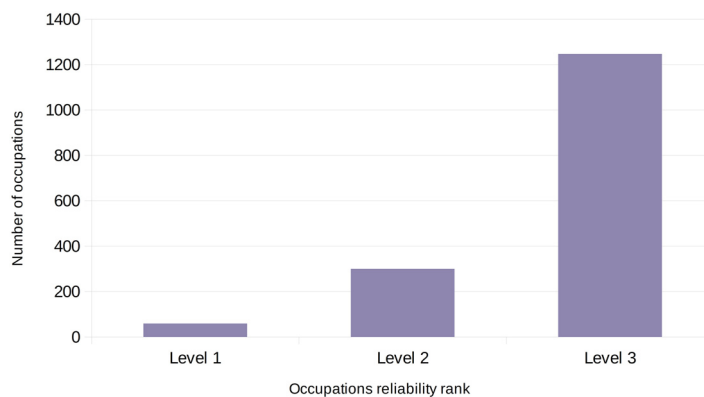
### 3.3 Cultural Data

For the Western Mediterranean Mesolithic, the cultural groups are defined almost solely by the prism of their chipped stone industries. This is indeed the most frequent category of remains, as it is the most resistant to the effects of time. It also makes it possible to address technical and functional aspects, as well as social (learning, networks, etc.) and cultural (exchanges, identity, etc.) aspects of prehistoric groups. Lithic industries are thus considered to be significant of the structure of the prehistoric societies, representative of coherent anthropological entities (cf., e.g., Geneste, 1991; Otte, 1985; Pelegrin, 1995).

But the published data are of very unequal quality and precision, in this area and period. The research traditions also draw quite marked geographical areas that sometimes make comparisons difficult. From a typological point of view, for example, France has long been marked by the work of G.E.E.M. (1969), while Italy was by that of Georges Laplace (Laplace-Jauretche, 1966) and North Africa by that of Tixier (1963). To try to overcome this handicap, we have developed in the last few years, in the line of Didier Binder's work (Binder, 1987), a typological list based on criteria that are not only formal but above all technological and that are hierarchical between them (Perrin, Angelin, & Defranould, 2018; Perrin, 2001). By its conception, this list makes it possible to get rid of the often not very explicit regional names like "Montclus triangle," "Cocina point," "Chacal point," and so on. It is thus particularly useful for developing statistical approaches, especially multivariate ones, both at the site and regional levels.

The review of existing data according to this threefold approach allows us to rank them qualitatively. Some occupations are thus attributed to a given cultural facies only on the basis of partial data, others are dated only indirectly, and still others are too little published to be objectively retained. All the occupations of the Early Mesolithic of the western Mediterranean have thus been evaluated on the basis of published data (presented in detail in Perrin, 2019). The vision proposed here is based only on the most reliable ones, those for which the "reliability rank" estimation ("fiabilité" in French) is of level 1. Indeed, in the BDA database, the reliability of each occupation is classified according to a 4 value scale:

- Level 0 reliability: unknown, the information available on the site and this occupation is too partial to even estimate its value.
- Level 1 reliability: the available data for this occupation are well published, the stratigraphic contexts are well understood as well as the post-depositional taphonomic processes, several good quality absolute dates are available and are consistent with the proposed chronocultural attribution.
- Level 2 reliability: the available data are partial and/or only one absolute dating is available and/or there may be a small doubt about the consistency between the dating and the archaeological material.
- Level 3 reliability: undated or poorly published occupation or existence of doubts about sedimentary or sedimentary coherence, etc.



**Figure 2:** Classification of 1,606 occupations dated between 9500 and 5500 cal. BCE in the western Mediterranean according to their reliability: level 1 good, level 2 medium, and level 3 weak.

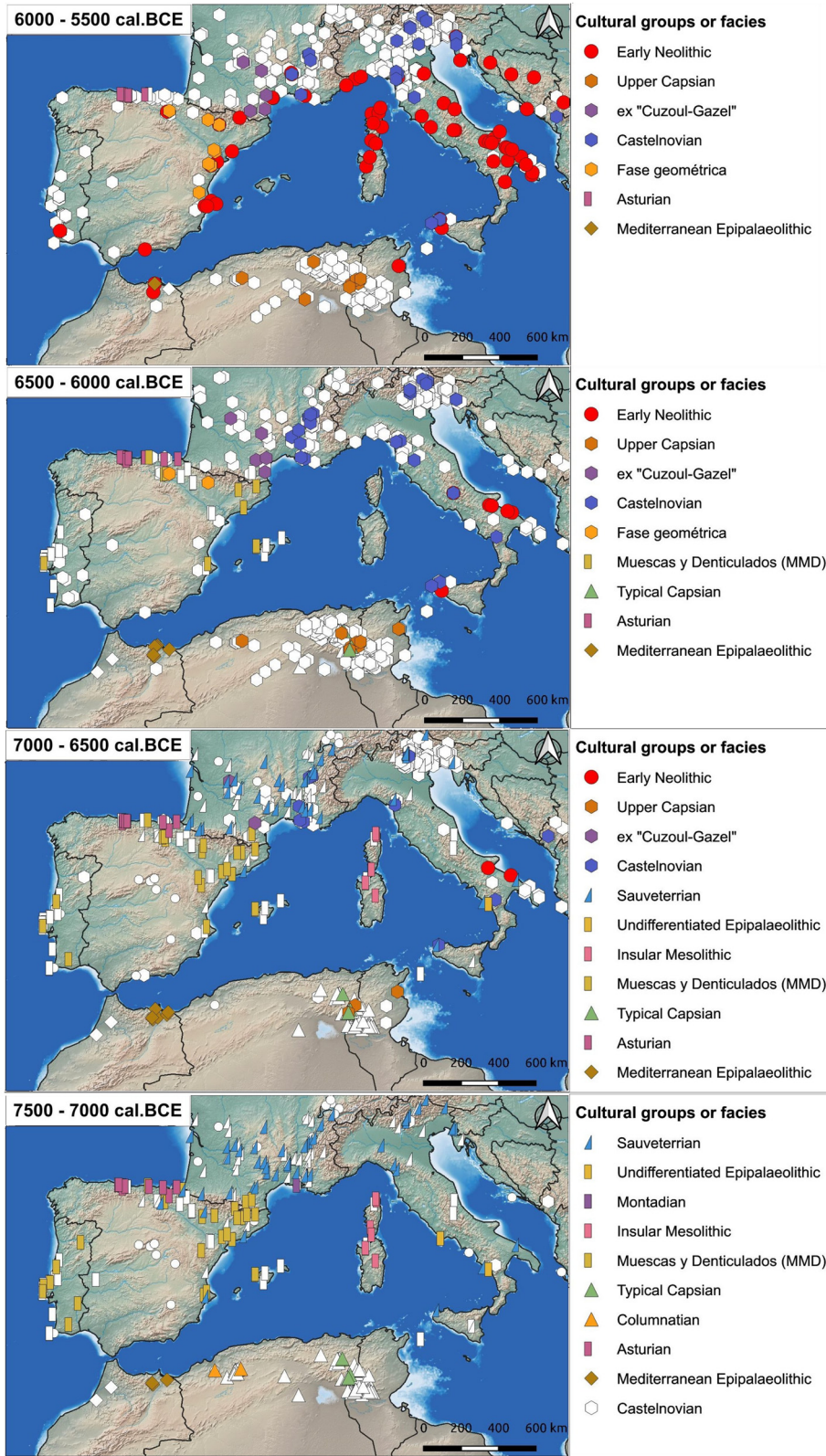
In the BDA database, about 1,600 occupations are dated between 9500 and 5500 cal. BCE for the geographical space considered here, that of Western Mediterranean basin. Of these, only 59 (3.7%) are level 1 and 300 (18.7%) are level 2. All the others (1,247 that is 77.6%) are level 3, i.e., unusable from a chronological point of view (Figure 2).

## 4 The First Mesolithic Cultural Landscape

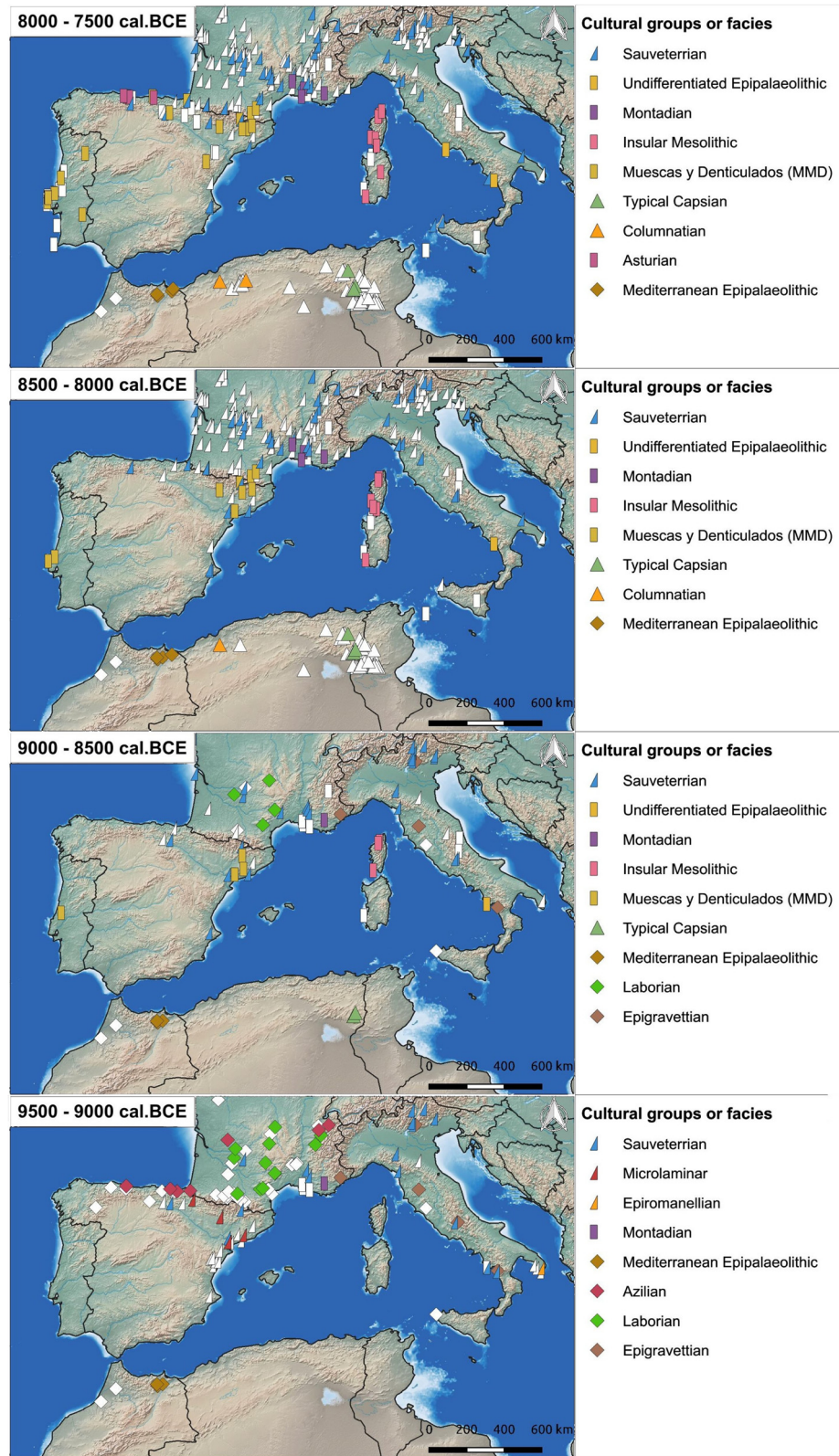
Based on the revised chronological data, it is then possible to draw up chronological maps of prehistoric sites at the scale of the western Mediterranean basin (Figure 3). The chronological resolution step for these maps is 500 years, which may seem large, but in fact corresponds to our current analytical capacity for this period. The use of a finer time step (100 or 250 years) would obviously be desirable, but the very small number of correctly dated occupations does not really allow it yet in the current state of the data. The absolute chronology data are indeed very uneven according to the regions and do not always allow us to be more precise (Perrin, 2021). This is particularly the case in North Africa where acceptable dates are still rare (Perrin et al., 2020). Moreover, some dates or attributions are still open to discussion, and it will be possible, in the future, to be more precise and accurate: the presence of occupations attributed to the Azilian in the second half of the 9th millennium is, for example, only a probable artefact linked to the absence of precise dates or to stratigraphic constraints which, in the Bayesian models, generate very broad highest posterior density. The improvement and refinement of this chronological framework require a collective effort to critique all these radiometric data as well as the realization of new measurements.

According to these revised data (Figure 2), between 9500 and 9000 cal. BCE, the western basin of the Mediterranean seems to be rather little intensively occupied, as shown by the number of occupations. These appear to be attested only in northern Spain, southern France, and northern Italy. Most of the Iberian Peninsula and all the islands (Corsica, Sardinia, and Balearic Islands) except perhaps Sicily seem to be free of any human presence. In North Africa, the Iberomaurusian was long thought to be directly prior to the Typical Capsian (Camps, 1974), but critical analysis of the dates shows that there is an important hiatus between the two, from about 10500 to 9000 cal. BCE (Perrin et al., 2020). There is no obvious reason why there would be a total absence of occupations throughout North Africa at this time, so it is more likely a simple lack of data. Few Late Iberomaurusian sites have been studied recently and even fewer have been well dated, within the exception to the Tatoralt cave, in Morocco (Barton et al., 2013). As a result, the precise chronology of this assemblage eludes us largely. It is theoretically possible that Iberomaurusian occupations exist at the extreme end of the Pleistocene, but we cannot prove it now. Only a few Moroccan sites have yielded, in recent years, occupations of this period, such as Hassi Ouenzga, Ifri el-Baroud “Gunpowder cave,” or Ifri Oudadane (Linstädter, 2008, 2010, 2016). However, the industries remain scarce and therefore poorly characterized. At Ifri Oudadane, “the lithic material is sparse and consists mainly of unspecific flakes. However, besides some notched flakes and blades, scrapers and typical Epipaleolithic backed points are present” (Linstädter, 2016, p. 66). It is difficult, given the state of the literature, to be more precise in the Maghreb for these few centuries.

It is therefore essentially the northern part of the western basin and Italy that contain occupations of this early phase. Most of these occupations belong to the Epipaleolithic traditions with Azilian and Microlaminar Epipaleolithic in Spain, Laborian in France, and Epigravettian in Italy. A few isolated occupations scattered over the entire geographical area attributed to an early phase of the Sauveterrian would already be present, even if we have seen that the reality of this very early phase (between 9500 and 8500 cal. BCE) requires confirmation (Perrin, 2021). In Provence, some sites have yielded industries poor in microliths and attributed to the “Montadian” facies (Escalon de Fonton, 1954), the reality of whose existence cannot be affirmed at present, due to the existence of an important excavation bias, the absence of fine sieving, which artificially led to the under-representation of microliths, which were also very small at this period (Brochier, 2005). The precise typological and technological criteria for distinguishing between the Sauveterrian, Microlaminar Sauveterrian, and Microlaminar Epipaleolithic phases are still rather







**Figure 3:** Chronological maps of First Mesolithic sites in the western Mediterranean in 500-year increments, between 9500 and 5500 cal. BCE according to the last calibration curve (Reimer et al., 2020). The coloured dots represent the dated occupations while the white symbols are not directly dated ones (these occupations are only relatively dated, mainly on a chronotypological basis). All the data used in this map are freely readable in the BDA database (<https://bda.huma-num.fr/>).

unclear in the current literature, and it would certainly be very relevant and instructive to compare these three entities point by point to confirm or not the validity of their individualization (Soto, Valdeyron, Perrin, & Fullola, 2018). In Italy, most of the known occupations for this phase are located in the north of the country (Biagi, Castelletti, Cremaschi, Sala, & Tozzi, 1980; Broglio, 2016; Dalmeri & Pedrotti, 1992; Fontana, 2011), but some are also attested in the south. All are associated with the Sauveterriano, except for four sites located in the “heel of the boot” and attributed to the Epiromanellian (Lo Vetro & Martini, 2016). Here again, we can question the appropriateness of this distinction, which is based solely on typological arguments that deserve to be reviewed more objectively (Collina, 2009). In fact, if we disregard the poorly defined Montadian, the entire northern half of the Mediterranean basin provides groups of HG with flake-based lithic industries and geometric arrowheads, most often triangular, shaped on thin bladelets. In spite of the relative weakness of the documentation, this early phase seems to show a progressive appearance of the Sauveterrian and its related facies in several places of the northern Mediterranean Basin, into several Epipaleolithic traditions. The patterns underlying the chipped stone productions of all these sites are quite similar over the entire geographical area, while admitting local and functional variations or adaptations. It is these similarities that led me to propose to group all these occupations into a same Sauveterrian technocomplex (Perrin, 2019; Perrin, Dachy, López-Montalvo, Manen, & Marchand, 2022).

The next phase (9000–8500 cal. BCE) shows a gradual increase in the number of Sauveterrian occupations. Corsica and Sardinia also begin to be populated, thus indirectly attesting to the mastery of maritime navigation (Perrin, Vigne, & Picavet, 2022). These island HG groups produce lithic industries that are totally different from the Sauveterrian and Epipaleolithic traditions because of the absence of any microlith and bladelets. This character also seems to appear at the same time in southern Italy with the Undifferentiated Epipaleolithic (Lo Vetro & Martini, 2016), as well as in the lower valley of the Ebro and in Catalonia, where appear the first occupations of the *Mesolítico de muescas y denticulados* or MMD (Alday Ruiz, 2006). In Portugal, the Casal Papagaio site could also be dated to this phase (Araújo, 2015) but remains a strange unicum that requires confirmation. Here again, how can we understand the appearance of industries that are close to each other in concept, but very far apart geographically? Should we imagine vast and repeated displacements of populations over such vast distances, or should we consider technical convergences linked, for example, to environmental constraints? The question remains open ... The similarity of these industries seems to be sufficient to suggest that they are also part of a large-scale technocomplex (the “MMD technocomplex”), emerging during this phase, but which would be fully expressed a few centuries later.

During this phase, some new occupations appear in the Maghreb, with a few sites belonging to the Typical Capsian in the Tebessa region, at the eastern end of northern Algeria. In view of the absence of reliable data for the older phases, it is not yet possible to discuss the possible routes of appearance of this Typical Capsian.

Between 8500 and 8000 cal. BCE, the number of occupations increases significantly. The Sauveterrian technocomplex occupies massively the whole area between the Pyrenees and the Center of France as well as the whole northern half of Italy. Some sites of this technocomplex are present further south, in the Valencian Country or in southern Italy, but remain more isolated. The MMD technocomplex still occupies the whole central band of the Western Basin with more occupations in Corsica and Sardinia, as well as in Portugal. In Northern Africa, the number of sites also increases markedly, and the Typical Capsian now occupies a much larger geographic area, corresponding to all of northeastern Algeria and Tunisia. A few sites in western Algeria attributed to the Columnatian also exist, and their possible relationship to the relatively close Mediterranean Epipaleolithic occupations in Morocco should be further investigated (Dachy et al., 2018).

This tripartition of the Mediterranean space, with the Sauveterrian technocomplex in the north, the MMD technocomplex in the centre, and the Epipaleolithic Mediterranean, Columnatian, and Typical Capsian together in the south, is fully present in the next stage, between 8000 and 7500 cal. BCE. The number of occupations continues to grow, especially in Portugal and in the Ebro valley. This stage also sees the appearance of the Asturian on the North Atlantic coast of Spain (Fano Martínez, 2018), a facies devoid of microliths which, in my opinion, is fully integrated into the MMD technocomplex, being a regional and/or functional expression of it. The dynamics of the latter could also be illustrated by the putative colonization

of the Balearics (Fullola et al., 2005). The situation in North Africa seems to remain stable and close to that of the previous stage.

The next stage, between 7500 and 7000 cal. BCE, is almost identical to the previous one. The only difference could be the appearance in the extreme south of Italy of the very first Castelnavian occupations at Latronico cave, in Basilicata (Dini, Grifoni Cremonesi, Kozłowski, Molaro, & Tozzi, 2008). This cave has yielded four Castelnavian levels (A, B, C, and D) located in time by nine radiocarbon measurements. But those attributed to the oldest of these levels are inconsistent, due to Neolithic reworking (Dini et al., 2008, p. 52). It is so much more probable that this first Castelnavian level date in the first centuries of the 7th millennium BCE, as shown by the two R-453 and R-449 dates. If this is confirmed, the situation in the 7500–7000 cal. BCE stage would remain exactly similar to the previous stage.

It is only between 7000 and 6500 cal. BCE that the Second Mesolithic appears, in a very rapid manner, notably with what we called the “Mediterranean flash” between 6600 and 6400 cal. BCE (Perrin et al., 2009). These industries with wide blades and trapezes (Clark, 1958) quickly occupied the whole space, especially on the coasts. The Castelnavian is the main expression that is found from southern Italy to the Gulf of Lion. Further inland, and particularly in southwestern France, the qualification of this Second Mesolithic remains to be reviewed. These occupations were previously attributed to the “Cuzoul-Gazel group” (Barbaza, 1993), an appellation that had no coherence and should therefore be abandoned (Perrin, 2013; Valdeyron, 2000). Pending a taxonomic revival for these sites, I will adopt the inelegant denomination of “ex Cuzoul-Gazel” to designate these occupations. In North Africa, the expression of this Second Mesolithic is the Upper Capsian, which seems to rapidly take precedence over the Typical Capsian, without, however, understanding the processes of this dynamic.

Between 6500 and 6000 cal. BCE, the Second Mesolithic with blades and trapezes took precedence everywhere over the groups of the First Mesolithic: Sauveterrian and Typical Capsian thus totally disappeared. Only the MMD remains, mainly in the upper Ebro valley, as well as its Asturian facies of the North Atlantic coast of Spain. The Upper Capsian is massively present on the whole eastern half of the Maghreb, while the islands of the Corso-Sardinian block will be totally abandoned for around a millennium.

Finally, the last stage, between 6000 and 5500 cal. BCE, shows the rapid and almost generalized development of the Early Neolithic. Only North Africa escaped this wave of Neolithization and will continue to do so for a long time. Does the rather extraordinary density of Upper Capsian occupations testify to the development of very strong and socially structured societies that were able to resist the Neolithic influx for several centuries? This permanence, which does not necessarily mean an absence of contacts and exchanges with Italian and Spanish Neolithic groups, could explain the fact that the first North African Neolithic arrived via Spain and that the direct route from southern Italy via North Africa was not taken.

This detailed approach by cultural entities (defined mainly on the basis of chipped stone industries) shows that, despite the fact that the entire period considered here is globally unfavourable for fine chronological analyses, it is possible to draw up an evolutionary landscape, in steps of a few centuries. We can also simplify this picture by proposing to identify major trends.

## 5 Synthesis: The Cultural Dynamics of the Western Mediterranean First Mesolithic

### 5.1 The Emergence

The question of the emergence of the First Mesolithic merges here first with that of the Sauveterrian. We saw that its appearance seems to correspond to a multipolar process (cf. *supra*), with some occupations of the end of the 10th millennium and the beginning of the 9th that appear simultaneously in several places (Figure 3). Obviously, this synchronicity is directly linked to our chronological resolution, which cannot be fine-grained for this period, and it could so be partly artificial.

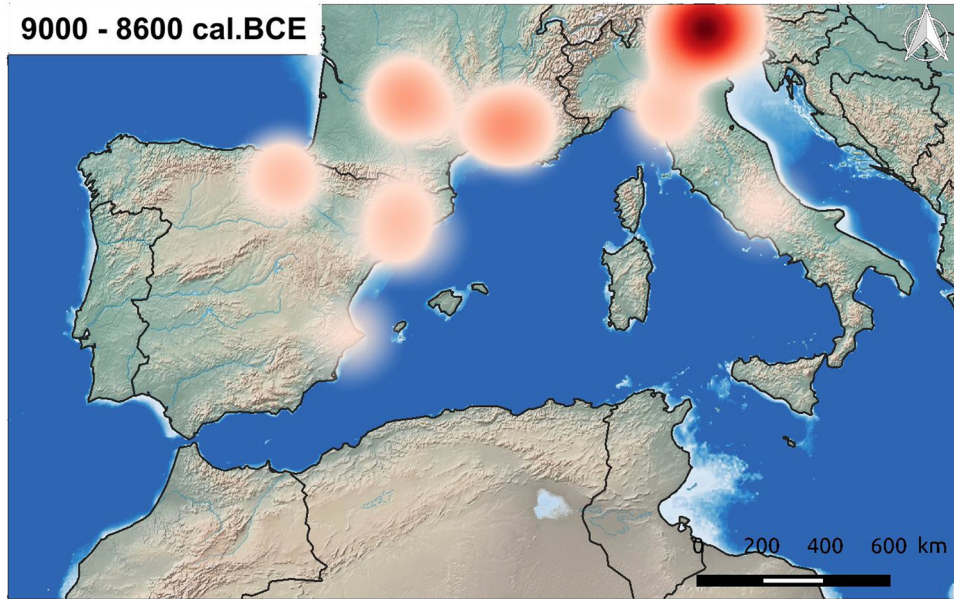


Figure 4: Heat map of the main earliest occupations of the Sauveterrian technocomplex, between 9500 and 8600 cal. BCE.

Nevertheless, between 9000 and 8600 cal. BCE, i.e., before its full expansion, the Sauveterrian technocomplex seems to arise around a few main nuclei (Figure 4). The oldest are in Northern Italy, the lower Rhône Valley, the Lot, and the Pyrenees. In a second time (after 9000 cal. BCE), it also appears in Lazio and the upper Ebro valley. The highest number of sites is in the Northern Italian Alps. Is it a sign of a potential origin area of this technocomplex on Epigravettian substrates, from where it would then have spread

### The origin of the Sauveterrian

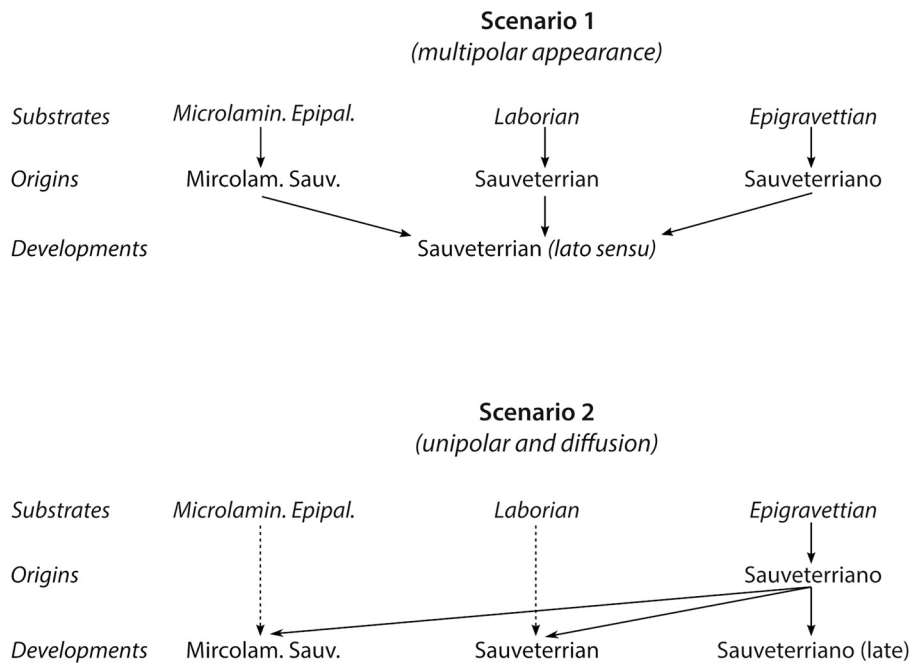


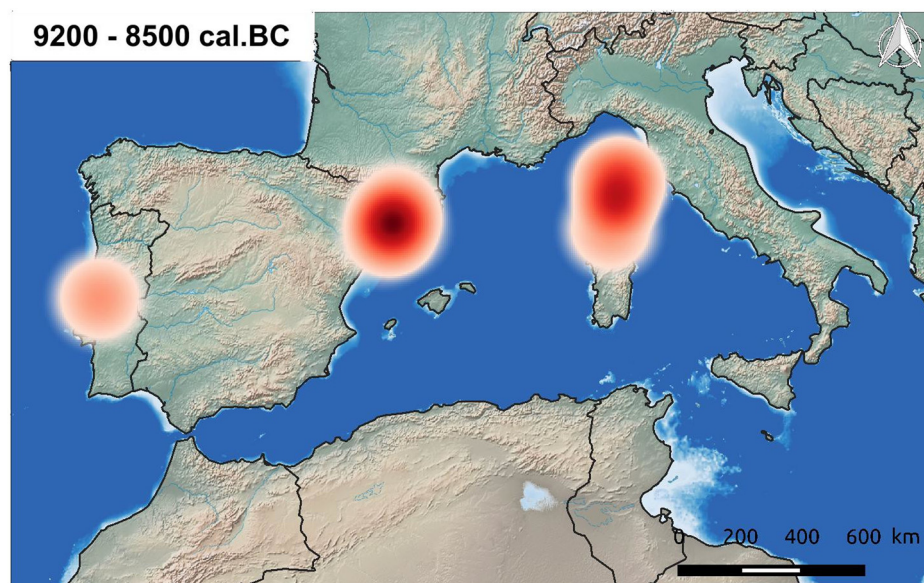
Figure 5: Possible scenarios of the appearance process of the Sauveterrian technocomplex.

southward and westward? Or is this concentration only the result of a higher research dynamism? We cannot actually provide convincing arguments for either of these two hypotheses. However, we can theorize two scenarios. The first is of an appearance and diffusion from a single centre, and the second is of a multipolar appearance resulting from transcultural evolutionary trends (Figure 5). In both cases, a return to earlier cultural groups and their technical productions is a preamble to any discussion of these models. Are there more links between the Northern Italian Epigravettian and the Sauveterriano than between the Laborian and the Sauveterrian of southern France, or between the Spanish Azilian and the microlaminar Sauveterrian? What is the reality of the Montadian (facies with micro-segments) and its possible phyletic link with the Epigravettian?

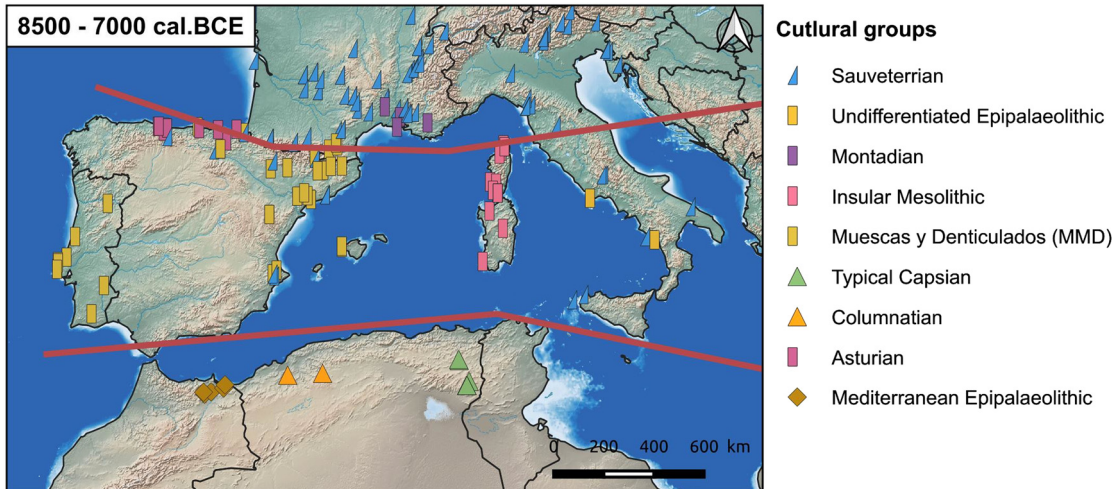
The emergence of the MMD technocomplex, which includes the *Mesolítico de muescas y denticulados* itself, the Insular Mesolithic, the Asturian, and the Southern Italian Undifferentiated Epipaleolithic, raises similar questions. Its beginning is later than that of the Sauveterrian technocomplex, the core of its development being between about 8200 and 6500 cal. BCE. The earliest stage, with its very first possible occurrences, is between 9200 and 8500 cal. BCE, in two or even three nuclear zones (Figure 6). The two main areas are the Corso-Sardinian block (and more specifically Corsica, in the current state of knowledge) and Catalonia. A single site in Portugal could be related to this first step too but remains too isolated for the moment to be demonstrative. Perhaps Provence could be another core too, with the Montadian, but the latter is too badly characterized to be taken into account today. The core of the ancient phase of this MMD technocomplex is thus at least bipartite, between Corsica and Catalonia.

## 5.2 Development and Full Expansion

At the end of this formative phase of the First Mesolithic, the western Mediterranean basin was in fact divided into three distinct areas, following a south–north gradient (Figure 7). From 8600 to 8500 cal. BCE onwards, northern Spain, France, and Italy belong to the Sauveterrian technocomplex. The other parts of the Iberian Peninsula, the islands, and central-southern Italy respond to the MMD technocomplex. North Africa shows the coexistence of the Typical Capsian and the Columnatian/Epipaleolithic Mediterranean. The boundaries between these three spaces are obviously rather vague: the one between the Sauveterrian



**Figure 6:** Heat map of the main earliest occupations of the MMD technocomplex, between 9200 and 8500 cal. BCE.



**Figure 7:** Lines showing the tripartition of the Western Mediterranean basin between 8500 and 7000 cal. BCE according to the lithic industries.

and MMD technocomplexes is placed around 42°N latitude, while that between the MMD and the North African groups is around 37.5°N latitude.

The most surprising and intriguing element in this situation is the MMD technocomplex. Indeed, the coherence of the Sauveterrian technocomplex covers a geographical coherence, or at least a proximity of all the sites, such as one finds “classically” in most archaeological cultures. Similarly, groups identified in North Africa each occupy limited geographical areas. But the MMD technocomplex extends from the Atlantic shores of Portugal to the Tyrrhenian Sea, and perhaps even beyond, since Phase VII of Franchthi, in Thessaly (Greece), presents industries that are not unlike these assemblages, with very few microliths and a significant increase in the number of large tools on flakes, of the denticulated type, for a chronological period situated in the second half of the ninth millennium (Perlès, 1987, 1995). We can of course discuss in detail the coherence of this MMD technocomplex, as differences exist between all these industries. But the trend of a lithic production devoid of microliths and of a tooling mainly based on flakes remains real. And it is not possible to mobilize methodological biases in the excavation methods as an explication at this geographical scale.

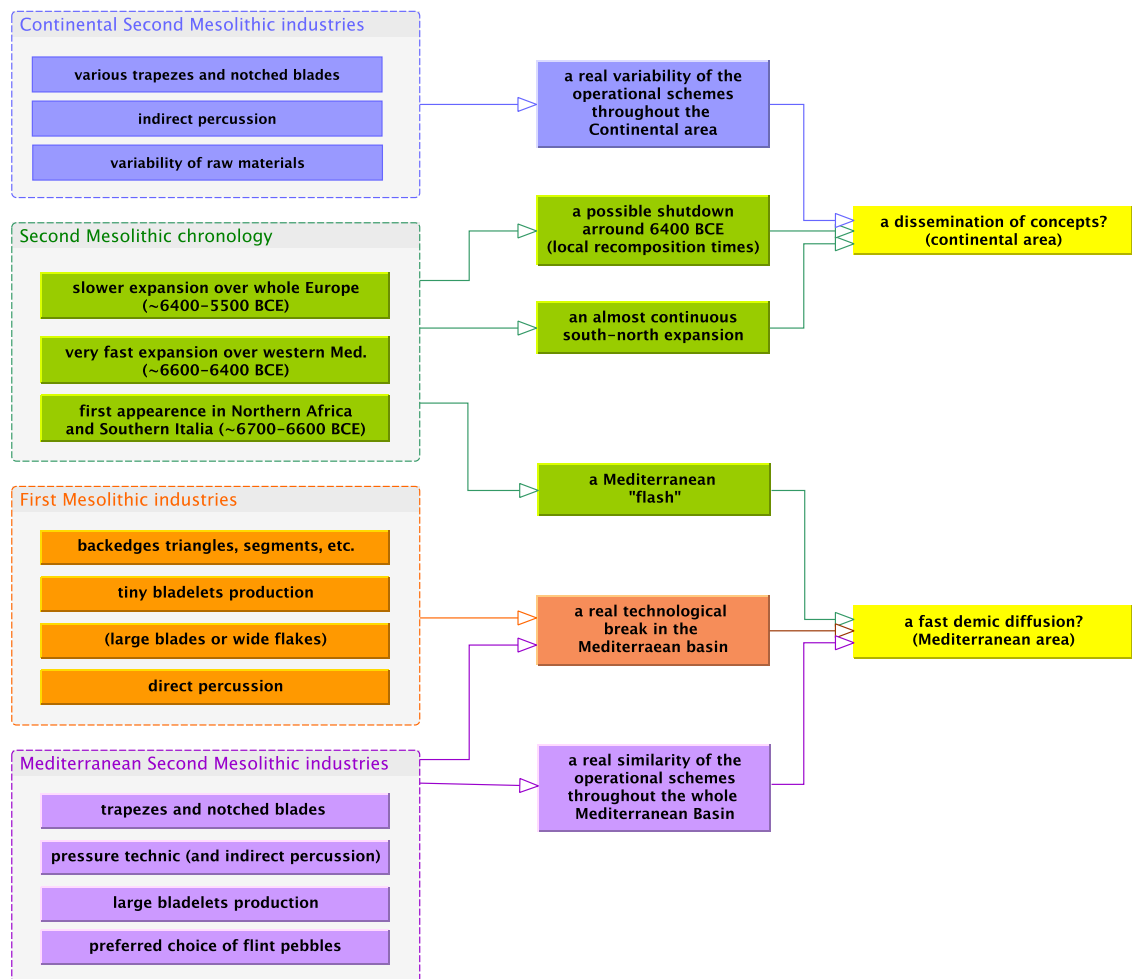
For several of these sites, we could link this particularity of their industries to a functional specificity due to their often coastal location, as has been proposed for the Asturian. But the current coastal location must be modulated by the effects of sea level variation. Sometimes, like in southern-east Corsica, the shoreline could have moved by more than 1.5 km from the 9th millennium. And all the sites in the Ebro valley or in central Portugal are certainly not coastal. Moreover, isotopic analyses of some human bones show that marine resources are not always a major source of food, even in the most coastal occupations (Goude et al., 2016). A maritime determinism is thus not a sufficient explanation for the MMD technocomplex specificity.

Another hypothesis could be that of an adaptation not to a specific geographical context, but rather to a global environment, to a specific climate? The latitude partition may evoke particular rainfall, sunshine, or wind regimes. The climate at the beginning of the Holocene was of course not the one of our days, and we know in particular that it was globally wetter and that it gradually evolved towards the present (i.e., Abrantes et al., 2012). Nevertheless, our study area seems to have presented, as early as that time, a geographical tripartition: the Mediterranean space “marks a transitional zone between the Maghreb-Arabian arid zone, dominated by subtropical high pressure, and central-northern Europe, affected by westerly circulation” (Finné, Woodbridge, Labuhn, & Roberts, 2019, p. 3). Paleoenvironmental reconstructions show that the progressive establishment of the Mediterranean climate between 36 and 41° north latitude from 10 up to 5 kyBP (Jalut et al., 1997), while beyond 41°, the climate presents more humid summers (Jalut et al.,

2000). The aridity of the Maghrebian zone must also be relativized since the beginning of this period corresponds to the “great wet,” an episode during which the Sahara was a green space (i.e., Cheddadi et al., 2021). Although these paleo-environmental restitutions remain general trends, they show a possible correlation between the geographical distribution of these techno-complexes and the major climatic zones. There is obviously no question of seeing here a univocal climatic determinism, but this correlation remains a point to be explored.

### 5.3 Replacement and Disappearance

In North Africa as well as in Southern Europe, the cultural dynamics leading from the First to the Second Mesolithic seem somewhat simpler. From the lithic industries point of view, blades and trapezes industries suddenly replace the technical traditions of the Sauveterrian and MMD technocomplexes and those of the various North African groups. The chronological dynamics of this process is now well known (Binder et al., 2012; Marchand & Perrin, 2015; Perrin et al., 2009). The heart of this phenomenon takes place between 6600 and 6400 cal. BCE, during the stage that we have called the “Mediterranean flash” (Perrin et al., 2009). The Upper Capsian in North Africa, the Castelnovian in Italy, Croatia, and southern France, and the Geometric Mesolithic in the Spanish Levante and the Ebro Valley arise from there.



**Figure 8:** Logistic scheme of the interpretation of the appearance of the Second Mesolithic in the Western Mediterranean.

Two different kinds of processes could be hypothesized to understand this expansion of the Second Mesolithic (Figure 8). At the beginning, during the so-called “Mediterranean flash,” everything changes: the raw materials mobilized, the supports sought, the reduction techniques employed, the tools produced, and even the uses of these tools (Perrin et al., 2009). There is a deep conceptual break between the First and Second Mesolithic from the point of view of lithic industries. On the other hand, there is a real similarity in the operating patterns for the whole of these first Second Mesolithic occupations. The conjunction of these three inferences, namely the very strong dichotomy between these patterns and earlier productions, the extreme rapidity of its diffusion, its similarity on all the Mediterranean shores, and the absence of any correlation with climatic and environmental changes, suggests that this first step could reflect population movements. The coherence of the operating schemes on such a large geographical scale and the extreme rapidity of its diffusion seem particularly incompatible with a simple diffusion of concepts. This hypothesis implies the existence of rapid population movements on the scale of the entire Western Basin, probably by boat. In this model, the modalities of interaction between the indigenous HG groups of the First Mesolithic and the possible new arrivals remain to be documented.

The second step seems different. In Continental Europe, the Second Mesolithic lithic industries show a much greater techno-functional variability (Allard, 2007, 2017; Guéret & Jacquier, 2019; Perrin et al., 2009). The Mediterranean systematic use of pressure is no longer the rule; it is even more often absent. The raw materials used are also more diverse, as are the types of tools. Their uses also change: the trapezoids arrowheads, for example, switch from an exclusive cutting positioning in the first phase to a variety of other possibilities (piercing, barbed, etc.). The regional variability in the operating patterns grows, too. The speed of diffusion also slows down and even seems to pause sometimes (around 6400 cal. BCE, for instance). Perhaps this latent period can be understood as a time of interaction between the indigenous HG and the new arrivals who brought new technical processes. This latency period could correspond to an appropriation, an assimilation by the natives of these novelties, which they then reinterpret and recombine by integrating them into their cultural baggage. The diversity of Second Mesolithic continental production could thus be an indirect reflection of the variability of lithic production of First Mesolithic groups. All of these points argue for the diffusion of concepts during this second step. It implies, once again, the existence of dynamic social networks between Mesolithic HG groups.

## 6 Perspectives

Based strictly on a critical analysis of absolute chronology data, this work aims to renew our vision of the Early Mediterranean Mesolithic cultural entities and their interactions.

At first, this work shows, I hope, the need to reason not by classificatory episode (the Early Mesolithic, the Second Mesolithic, or other), but by time slice. We have seen, for example, that in the seventh millennium, the Western Basin saw the coexistence of groups from the First Mesolithic and the Second Mesolithic, while the Early Neolithic arrived in the extreme south-east. Reflections on the emergence of the First Mesolithic are of the same order, with groups classified sometimes as Mesolithic, sometimes as Epipalaeolithic, and sometimes even as Palaeolithic, these taxonomic distinctions being moreover strongly impacted by research traditions. Putting all these groups into perspective implies going beyond these classifications to apprehend the phenomena in their entirety and especially in all their complexity.

However, these 9th and 8th millennia cal. BCE are strongly impacted by the oscillations of the radiocarbon calibration curve, which limits chronological precision (Perrin, 2021; Reimer et al., 2020). Bayesian modelling can be used to refine the chronology, but this can only be of limited use in periods where plateaus follow one another over the long term. And by definition, the radiocarbon itself can never go beyond these plateaus. We must then collectively invest massively in other dating methods to overcome this handicap. Archaeomagnetism is probably the most interesting possibility, but it involves several years of measurements to construct and refine its own curve, but it is worth it!



The widespread use of techno-economic analyses of chipped stone industries is also a crucial point. This makes it possible to go far beyond simple typological distribution maps which, in the end, provide little information. On the other hand, when backed up by a global reflection on the modes of production and use as well as a reliable chronology, it becomes much more striking. The scenarios that can be inferred from them remain interpretations but built on more solid foundations, which makes the difference.

The scenarios proposed here highlight the great dynamism of all these HG societies, which interacted strongly with each other. It is also evident that Mesolithic groups must have mastered navigation and moved without difficulty throughout the western basin. Similarly, the interactions and convergences in lithic industries, which draw technocomplexes on a small scale, also induce numerous land movements and sometimes long-distance links between all these groups. Some, however, seem to remain much more closed in on themselves, as the Upper Capsian, and draw areas with very strong cultural identities that contrast all the more with the others. The development of anthropological models will undoubtedly be an avenue to explore in the near future to give a little body and insert a little human element behind these technical evolutions!

**Funding information:** Author states no funding involved.

**Conflict of interest:** Author states no conflict of interest.

**Supplementary material:** This is an animated video of the main First Mesolithic occupations in the Western Mediterranean by 500-year time interval between 9500 and 5500 cal. BCE according to their cultural attribution.

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