

Environmental conditions and cultivation practices when agriculture first emerged in Western Europe

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Credit: Raul Soteras, Institut Arquelògic Alemany/Universitat de Basilea

About 7,000 years ago, the first farmers in the western Mediterranean selected the most fertile land available, cultivated cereal varieties very similar to today's, and made sparing use of domestic animal feces, as they do today. These are some of the elements that characterize the

expansion of agriculture during the Neolithic period in Western Europe, according to an article [published](#) in the *Proceedings of the National Academy of Sciences*.

The first author is Professor Josep Lluís Araus, from the Faculty of Biology at the University of Barcelona and member of Agrotechnio, the CERCA Center for Research in Agrotechnology.

The study reconstructs the environmental conditions, crop management practices and the characteristics of the plants that existed when [agriculture](#) appeared in Western Europe, and takes as a reference the site of La Draga (Banyoles, Girona), one of the most significant and complex sites on the Iberian Peninsula, as well as including data on sixteen other sites from the beginnings of agriculture in the region.

According to the conclusions, at the time of its appearance on the Iberian Peninsula, agriculture had already achieved a consolidated level in agricultural techniques for growing cereals, suggesting an evolution throughout its migration across Europe of the methods and [genetic material](#) originating from the fertile crescent, the cradle of the Neolithic revolution in the Middle East.

Experts from the University of Lleida (UdL) and the joint research unit CTFC-Agrotecnio, the Universitat Autònoma de Barcelona (UAB), the Spanish National Research Council (CSIC), the Universitat de València, the University of Basel (Switzerland), the Agri-Food Research and Technology Center of Aragon (CITA) and the German Archaeological Institute (DAI) also participate in the article.

The excavations in La Draga are coordinated by the Archaeological Museum of Banyoles, within the framework of the four-yearly archaeological excavation projects of the Department of Culture of the Government of Catalonia.

What were the main crops grown on La Draga?

Since its appearance nearly 12,000 years ago in the territories of the so-called fertile crescent, agriculture has transformed the relationship with the natural environment and the socio-economic structure of human populations. Now, the team has applied paleoenvironmental and archaeobotanical reconstruction techniques to identify the conditions in the village of La Draga when agriculture emerged.

Located on the eastern shore of Lake Banyoles, it is one of the oldest settlements of farmers and stockbreeders in the north-east of the Iberian Peninsula (5200–4800 BC), and an extraordinary testimony to the first farming and stockbreeding societies in the Iberian Peninsula. To give a regional dimension to the study, cereal data from other Neolithic sites in the Iberian Peninsula and southern France have also been examined.

Although it was pioneering agriculture—it began in previously uncultivated areas. "The [growing conditions](#) seem to have been favorable, possibly due to a deliberate choice by the farmers of the most suitable land. The crops do not seem too different from the traditional varieties that have been cultivated in the following millennia," says Professor Araus, from the Plant Biology Section of the UB's Department of Evolutionary Biology, Ecology and Environmental Sciences.

Araus has led the reconstruction of the agronomic conditions and characteristics of the crops based on the analysis of the samples collected and identified by the archaeobotanists of the UAB, the DAI and the University of Basel.

The main source of information for studying agricultural practices in [prehistoric times](#) "are the archaeobotanical remains (seeds and fruits) that we find in the archaeological deposits we excavate. The most frequently found remains are carbonized cereal grains. Thus, isotopic

studies on these remains allow us to open an alternative interpretative line to characterize past agricultural practices," notes Ferran Antolín, from the DAI.

Durum wheat and poppy are the species that were mainly cultivated in La Draga. "In addition, barley also appears—always in small amounts—and, occasionally, some traces of small spelt, spelt wheat and *Triticum timopheevii* corn. Moreover, the proportions of cereals during the different phases of occupation remained practically unchanged," says Antolin.

Juan Pedro Ferrio, CSIC research scientist at the Aula Dei Experimental Station says, "Although the domestication of animals is not the focus of the article, several pieces of evidence indicate that animals grazed in the same crop fields. This fact could explain the moderate contribution of organic marinade of animal origin, suggested by the nitrogen isotopic composition of the cereal seeds."

A favorable climate for agricultural practices

At La Draga, the good environmental conditions favored the practice of agriculture when this Neolithic population settled on the shores of Lake Banyoles.

"The isotopic study of carbonized wood and cereal seeds confirms that the availability of water in the area was better than it is today. Previous archaeobotanical studies had shown that vegetation grew in the area around the site that was quite different from what we find today.

"The oak and riparian forests with an abundance of laurel trees would have dominated the environment, and this type of vegetation requires more humid climatic conditions than today," explains Professor Raquel Piqué, from the UAB's Department of Prehistory.

"This evidence of conditions that are wetter than today—and therefore more suitable for agriculture—could be extrapolated to other sites from the beginnings of agriculture in the western Mediterranean," says Professor Araus.

"It is quite likely that agriculture would not have been adopted in response to negative environmental conditions—for example, climate change—and the need to ensure food for the population, but rather as a way of increasing resources and making them more stable compared to a hunting and gathering economy."

How did agriculture expand in the Iberian Peninsula?

Understanding the details of the exploitation of the new agricultural subsistence system is fundamental to understanding the broader process of Neolithic economic, cultural and social change.

"In the case of the Iberian Peninsula, archaeobotanical evidence collected in recent decades has suggested a rapid expansion of agriculture, with the almost simultaneous appearance of the first domesticated plants in different regions," says Jordi Voltas, professor at the UdL and the joint CTFC-Agrotecnio research unit.

"The new study supports existing archaeological models of the spread of [agricultural practices](#) based mainly on migratory phenomena (demic diffusion). In particular, they denote a consolidated agriculture in terms of good agronomic conditions and evolved crop characteristics at the time when agriculture reached the western shores of Europe."

There is still limited knowledge of the nature of crop practices in the early Neolithic populations. "We are talking about prehistoric societies, which, except for exceptional sites such as La Draga, have left relatively scarce material remains that can only be adequately studied with detailed

work through successive excavation campaigns.

"In these contexts, the ecophysiology of crops and all the relational methodologies—[stable isotopes](#), etc.—have been decisive in contributing new knowledge over the past decades to the scientific debate on the origins and spread of agriculture. As this study shows, they will also be so in the future," concludes Professor Araus.

More information: José L. Araus et al, Isotope and morphometrical evidence reveals the technological package associated with agriculture adoption in western Europe, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2401065121](https://doi.org/10.1073/pnas.2401065121)

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