



**HAL**  
open science

## The Demeter project: eight millennia of agrobiodiversity changes in the northwest Mediterranean basin

Allowen Evin, Laurent Bouby, Jérôme Ros, Sarah Ivorra, María Saña, Marine Jeanjean, Angèle Jeanty, Camille Dham, Margaux Tillier, Julien Azuara, et al.

### ► To cite this version:

Allowen Evin, Laurent Bouby, Jérôme Ros, Sarah Ivorra, María Saña, et al.. The Demeter project: eight millennia of agrobiodiversity changes in the northwest Mediterranean basin. Elisa Nicoud; Marie Balasse; Emmanuel Desclaux; Isabelle Théry-Parisot. Biodiversités, environnements et sociétés depuis la Préhistoire: nouveaux marqueurs et approches intégrées: Actes des 41èmes Rencontres Internationales d'Archéologie et d'Histoire – Nice Côte d'Azur, Éditions APDCA, pp.77-86, 2021, 2-904110-64-X. hal-03451253

**HAL Id: hal-03451253**

**<https://hal.science/hal-03451253>**

Submitted on 21 Jul 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

**Pour citer cet article**

Allowen Evin, Laurent Bouby, Jérôme Ros, Sarah Ivorra, Marine Jeanjean, et al. The Demeter project: eight millennia of agrobiodiversity changes in the northwest Mediterranean basin. Elisa Nicoud; Marie Balasse; Emmanuel Desclaux; Isabelle Théry-Parisot. Biodiversités, environnements et sociétés depuis la Préhistoire : nouveaux marqueurs et approches intégrées : Actes des 41èmes Rencontres Internationales d'Archéologie et d'Histoire – Nice Côte d'Azur, Éditions APDCA, pp.77-86, 2021, 2-904110-64-X. <hal-03451253>

## The Demeter project: eight millennia of agrobiodiversity changes in the northwest Mediterranean basin

Allowen Evin<sup>1</sup>, Laurent Bouby<sup>1</sup>, Jérôme Ros<sup>1</sup>, Sarah Ivorra<sup>1</sup>, Marine Jeanjean<sup>1</sup>, Angèle Jeanty<sup>1</sup>, Camille Dham<sup>1</sup>, Margaux Tillier<sup>1</sup>, Julien Azuara<sup>1</sup>, Vianney Forest<sup>2,3</sup>, Ferran Antolin<sup>4,5</sup>, Odile Peyron<sup>1</sup>, María Saña<sup>6</sup>, Joaquim Ripoll<sup>6</sup>, Vincent Bonhomme<sup>1</sup>, Silvia Valenzuela-Lamas<sup>7</sup>, Isabel Figueiral<sup>2</sup>, Lionel Gourichon<sup>8</sup>, Laure Paradis<sup>1</sup>, Jean-Frédéric Terral<sup>1</sup>

1 UMR ISEM - Institut des Sciences de l'Évolution de Montpellier

2 Inrap - Institut national de recherches archéologiques préventives

3 TRACES - Travaux et recherches archéologiques sur les cultures, les espaces et les sociétés

4 Integrative Prehistory and Archeological Science, Department of Environmental Sciences, University of Basel

5 Department of Natural Sciences, German Archaeological Institute

6 SAPPO - Departament de Prehistòria de la Universitat Autònoma de Barcelona

SAPPO - Seminari d'Arqueologia Prehistòrica del Pròxim Orient

7 Consejo Superior de Investigaciones Científicas (IMF-CSIC)

8 CEPAM - Centre d'Études Préhistoire, Antiquité, Moyen Âge

### **Abstract**

The development of agricultural societies is closely entangled with that of domestic animals and plants. Local and traditional domestic breeds and varieties are the result of millennia of selection by farmers. DEMETER (2020-2025) is an international project which is aiming to characterize the changes in animal and plant agrobiodiversity (pigs, sheep, goats, and barley) in relation with environmental and socioeconomic factors in the northwestern Mediterranean basin since the beginnings of agriculture. The project is based on a combination of approaches including phenomics (through geometric morphometrics), databasing, zooarchaeology, archaeobotany, climate modeling, paleoproteins (ZooMs) and statistical analyses. Several hundreds of archaeological sites from the South of France and Catalonia will be studied, covering the maximum environmental, societal and cultural diversity of context over the course of the last eight millennia.

### **Keywords**

Archaeozoology, Archaeobotany, Diachrony, Domestication, Agriculture

## **INTRODUCTION**

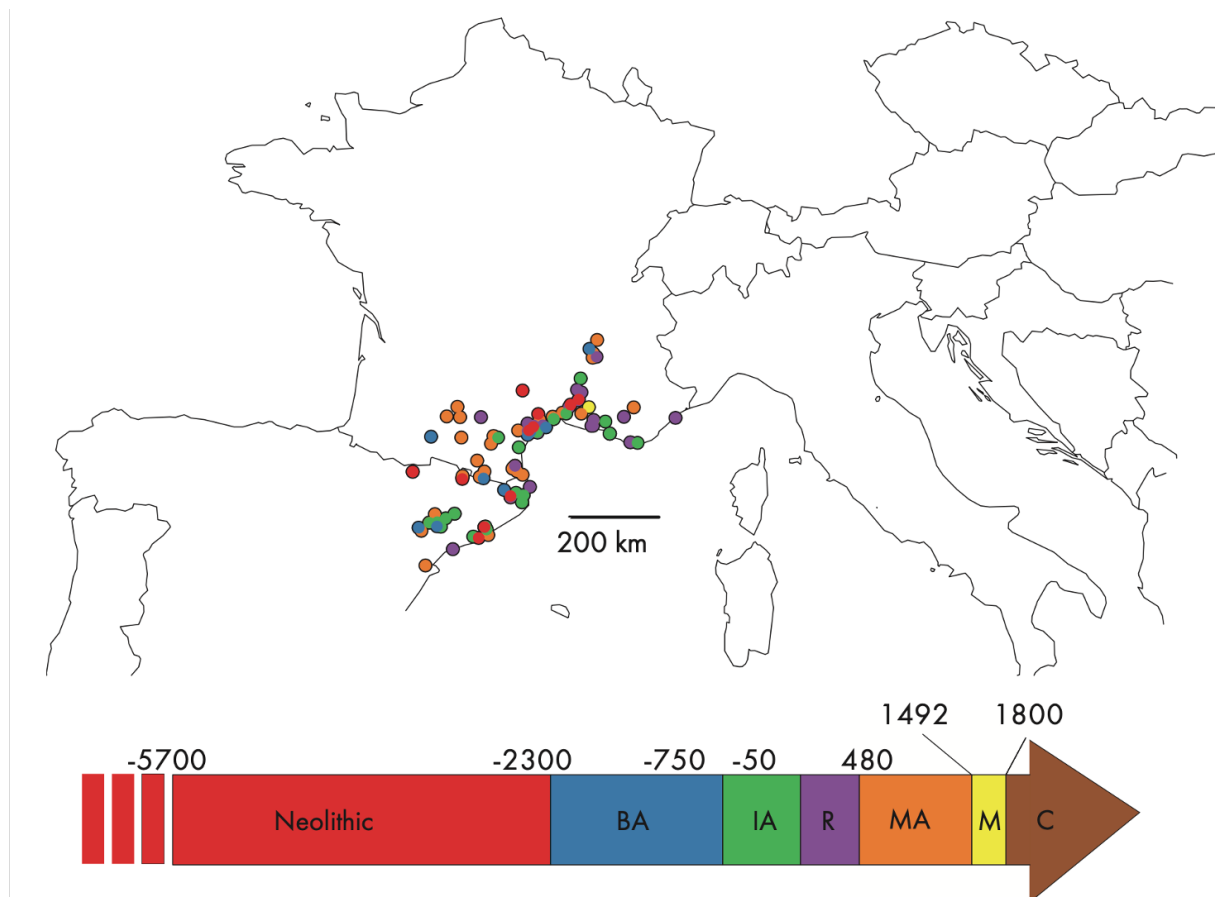
The onset of plant and animal domestication marks a major transition in human history and a key element in the development of modern societies (Dodson, Dong 2016; Vigne et al. 2011; Zeder 2015). Domestication led to important changes in ecology, demography, and the social organization of human populations (Bocquet-Appel, Bar-Yosef 2008). Domesticated plants and animals play a pivotal role in our modern Western societies, being the primary sources of food. However, we are now experiencing a major worldwide crisis, with losses in the diversity of food production systems and the progressive disappearance of traditional due to the imposition of industrial intensive farming models. Local knowledge and the farming culture are under threat, as well as the diversity and sustainability of cultivated species, varieties and breeds. Our current breeds and varieties are the result of never-ending artificial selection of morphological, physiological and behavioral traits resulting from thousands of years of human-plant-animal interactions. To date, bioarchaeological research has focused more on the earliest stages of the domestication process, in order to trace the origins of domestic populations, rather than on their subsequent evolution within and alongside human societies involved in intensive and continuous relationships with them outside the “domestication centers”. In this context, the DEMETER project (2020-2025), funded by the European Research Council, pursues three main questions: How have domestic plants and animals changed through time, far from their centers of origin? Which socioeconomic, cultural and environmental transformations interacted with this agrobiodiversity? In what way was this process achieved?

Among the many possible factors affecting the past diversity of domestic plants and animals, it is necessary to consider the chronocultural and socioeconomic context (e.g., household production, long/short distance trade networks), the geography (e.g., topology, distance to the coast) (Alonso, BoubY 2017), the type of site (e.g., open- air, urban, rural, etc.), its function (i.e., main activities, specialization) (Bréhard et al. 2010) and the prevailing environmental parameters, such as climate (Arbogast et al. 2006). However, a holistic approach to disentangle the respective roles of these factors in shaping ancient agrobiodiversity has not yet been undertaken. Here we will present our overall objective and the three main methodological approaches, i.e., geometric morphometrics, paleoclimatic modeling and databasing that have been implemented during the first year of the project, in addition to progress on current research.

## **THE NORTHWESTERN OCCIDENTAL MEDITERRANEAN BASIN**

DEMETER is focused on the Northwestern Occidental Mediterranean basin (southern France and Catalonia), i.e., outside the core domestication area of the selected species. Several reasons make this an excellent area for investigating the different parameters that may have contributed towards the development of new breeds and varieties : various socioeconomic dynamics (e.g., agricultural strategies, exchanges between populations, selection), long chronology, large number of archaeological settlements with various functions and status (e.g., rural, urban sites) and rich environmental contexts, since the region hosts varied geography including littoral plains, mountains, valleys, lagoons and deltaic areas. Moreover, the climatic evolution of the Mediterranean basin during the Holocene has been well described (Azuara et al. 2015; Frigola et al. 2007; Jalali et al. 2016; Sabatier et al. 2012). This region has a rich and complex history that cannot be easily synthesized. Six major chronocultural periods nevertheless emerge (fig. 1). The first being the Neolithic (5,850-2,300 BC). The Northwestern Occidental Mediterranean basin witnessed the arrival of the

Mediterranean stream of Neolithic expansion through the impressed ware cultural complex, which influenced inland Europe ; received continental influences during the Bronze Age (2,300-750 BC) ; developed considerably in the Iron Age (750-50 BC), entering into contact with Phoenicians, Greek and Etruscan populations before Roman colonization and the foundation of large cities ; it underwent the deconstruction of the Roman Empire (ca 480 AD), the arrival of the Visigoths and the subsequent Islamic conquest, both of whom contributed to its prosperity during the Middle Ages (480-1,492 AD), while important trade routes across the Mediterranean and northern Europe became increasingly integrated (Wickham 2005) with such developments continuing during the Modern period (1,492- 1,800 AD). Thus far, no regional synthesis of the evolution of the targeted species and diachronic changes in cultivation and husbandry practices has yet covered the large time span selected by DEMETER. However, a relatively large amount of grey literature (i.e., site reports, monographs) has been produced and provides essential information about the changes that occurred during specific time periods or a specific focus on a single species (e.g., cattle during historic periods; Forest, Rodet-Belarbi 2002). By the end of the project, DEMETER should include the study of at least 100 archaeological sites spread across the last eight millennia (fig. 1).



**Fig. 1.** Preliminary list and locations of 140 archaeological sites identified for the DEMETER project. Dots on the map and the timeline are colored according to the following timeframe: Neolithic (5700-2300 BC), Bronze Age-BA (2300-750 BC), Iron Age-IA (750-50 BC), Roman-R (50 BC-480 AD), Middle Ages-MA (480-1492 AD), Modern-M (1492-1800 AD) and Contemporaneous-C periods (since 1800).

## **SHEEP, GOATS, PIGS AND BARLEY**

We focus on a series of species domesticated during the Neolithic that spread into Western Europe along with the first farming communities as part of the Neolithic package, together with agricultural practices, ceramic production, increases in storage activities and sedentariness, and marked demographic expansion (Bocquet-Appel, Bar-Yosef 2008). The selected model species are of major economic importance today and have been continuously valued in the region: sheep (*Ovis aries*), goats (*Capra hircus*), pigs (*Sus scrofa*), and barley (*Hordeum vulgare*).

In general, sheep have been the dominant mammalian species found among archaeological remains from the final Neolithic until today (e.g., Antolín et al. 2018; Nieto-Espinet et al. 2021; Saña et al. 2020), with some exceptions, such as those sites showing a particularly large predominance of goats (e.g., medieval sites in a borough of Montpellier; Fabre et al. 2002). Sheep and goats have been among the main domestic mammals (with pigs and cattle) of the Mediterranean since the Neolithic and are the two inseparable emblematic species of the Mediterranean basin landscapes. They have the advantage that their wild ancestors (i.e., the Asian mouflon [*Ovis orientalis*] and the bezoar ibex [*Capra aegagrus*], respectively) are absent from Europe, making taxonomic identifications easier. The earliest known evidence of morphological modifications linked with domestication were identified ~10,500 years ago in the Upper Euphrates basin (Peters et al. 2005). The two species are morphologically close, but several studies have confirmed a clear differentiation based on metrical (Salvagno, Albarella 2017) and macroscopic (e.g., Gillis et al. 2011) analyses of bones and teeth.

Pigs were consumed at all times, but their remains are rare in the Neolithic and become abundant during the Roman Empire (50 BC-480 AD; Forest 2000; Nieto-Espinet et al. 2021), likely linked with the social differentiation of consumers (Forest 2009). Pig is certainly the species whose history of domestication is best known from archaeological remains and has been the subject of many studies. Pigs were domesticated from the wild boar, which naturally occurs in Europe, and makes the identification of wild and domestic archaeological specimens particularly challenging (Albarella et al. 2006). Nonetheless, recent geometric morphometric studies have allowed traditional identifications to be refined (Evin et al. 2013). Additionally, pigs have been the subject of numerous bioarchaeological studies over the last decade (e.g., Duval et al. 2015 ; Evin et al. 2015b ; Krause-Kyora et al. 2013 ; Larson et al. 2007 ; Ottoni 2012).

Domestic barley is divided into two morphological types: two-rowed (subsp. *distichum*) and six-rowed (subsp. *vulgare*) barley, which both include naked and hulled forms (Zohary et al. 2012). Barley has been one of the main cereals in Mediterranean agriculture since the Neolithic, and a major element of both human and animal diets. Carbonized grains are commonly found in archaeological sites (Zohary et al. 2012) from all periods. Barley is found from the Neolithic to Modern times in the study region. Two-row and six-row varieties have been identified, as well as lax-eared and dense-eared forms, and naked and hulled types. Naked 6-row barley was important in the Neolithic, being replaced by hulled 6-row barley from the 3rd/2nd millennium cal. BC onwards. This species becomes of major importance in regional agriculture from the end of the Bronze Age (ca 1,400-750 BC). Two-row barley is present in the early Neolithic but it remains undetected in later periods until Roman times (Alonso, Bouby 2017; Antolín et al. 2015; Antolín, Buxó 2012; Bouby 2001; 2014; Ros 2020). Barley is used for many purposes, and adapts to more environmental conditions than most wheat species.

## **A MULTI-METHODOLOGICAL APPROACH**

The project is based on a combination of approaches, including phenomics (through geometric morphometrics), databasing, zooarchaeology, archaeobotany, climate modeling, paleoproteins (ZooMs) and statistical analyses.

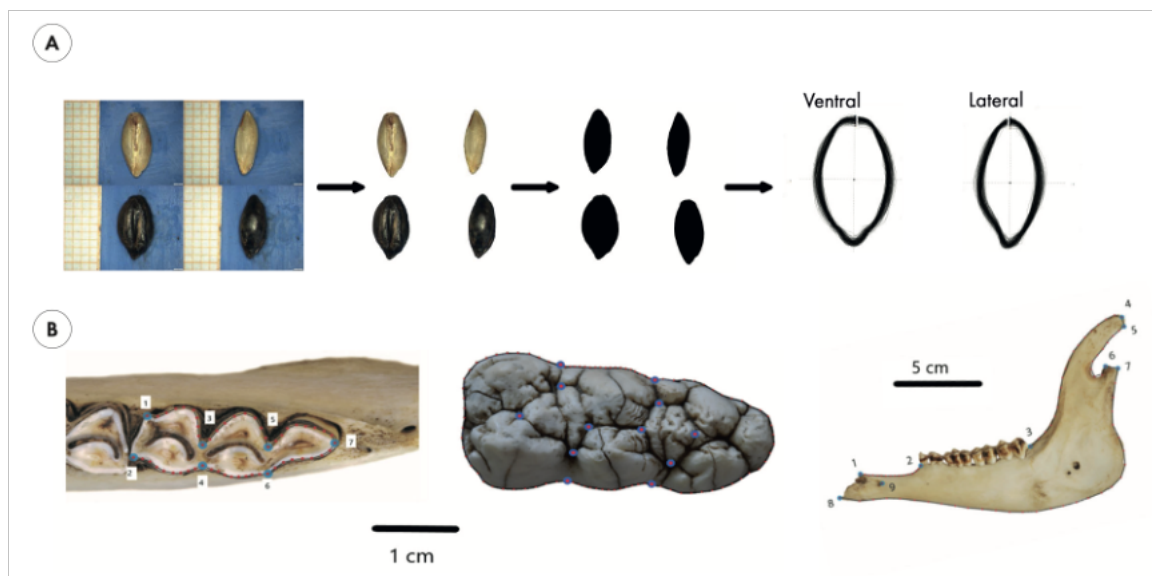
### ***Geometric morphometrics***

Recent methodological advances in geometric morphometrics (i.e., the study of forms in multi-dimensional spaces allowing in-depth investigation of morphological change) (Rohlf, Marcus 1993), allow us to address questions regarding the micro-evolutionary processes that accompanied the long history of domestic species in an unprecedented way. Geometric morphometrics (GMM) is increasingly used for bioarchaeological studies in order to track differences between diachronic populations (Bouby et al. 2020; Cucchi et al. 2014; Ottoni et al. 2013; Pagnoux et al. 2021; Price, Evin 2017; Terral et al. 2004), domestication signatures (Bonhomme et al. 2020; Cucchi et al. 2011; Evin et al. 2013; Evin et al. 2015b), or husbandry practices (Bopp-Ito et al. 2018; Duval et al. 2015; Duval et al. 2018; Price, Evin 2017). Geometric morphometrics provide highly resolute tools to quantify and analyze morphometric variation, which pick up from the previous traditional biometric analyses and are applied to archaeological plant and animal remains to investigate domestication and the morphometric variation of domestic populations (Bouby et al. 2013; Evin et al. 2013; Evin et al. 2015b; Ottoni et al. 2013; Ros et al. 2014; Terral et al. 2010; Terral et al. 2004). Moreover, morphometric analyses are often the only available approach with sufficient fine-scale resolution, suffer less from preservation limitations than other approaches (e.g., aDNA, isotopes) and can be carried out on a large scale in a non-destructive manner. We have a relatively good understanding of the morphological changes that took place at the early stages of the domestication process in the near-eastern center (e.g., Colledge, Conolly 2007; Conolly et al. 2011; Vigne et al. 2005; Zeder 2006; Zeder et al. 2006), but how domesticated populations evolved and diversified after the initial steps and outside the “domestication centers” remains largely unknown, due to the lack of large-scale diachronic studies. During the evolution of domesticates, local environmental and anthropic contexts will have led to subtle differences in the morphology of the populations (Balasse et al. 2016). Thus, DEMETER seeks to precisely quantify this morphological variation using cutting-edge geometric morphometric approaches.

The teeth of mammals and charred cereal grains have the advantage of being well preserved in archaeological assemblages, in comparison to other types of remains. In addition, they are frequently found in large numbers and are known to be taxonomically informative, and protocols and modern specimens of known taxonomy (species, breed/variety, wild/domestic status) are already available (Burger et al. 2011; Cucchi et al. 2011; Larson et al. 2007; Terral et al. 2010). Therefore, pig, sheep and goat teeth and barley grains will be primarily used as phenotypic markers. The link between human selection and mammal tooth morphology is not yet well understood, but previous work on wild and domestic pigs revealed strong tooth shape differences between wild and domestic populations, as well as strong differences between wild populations as well as marked differences between domestic breeds (Evin et al. 2015a). Thus, this work demonstrated the power of geometric morphometrics when applied to tooth morphology to quantify fine-scale differences. This link between human selection and morphology is more straightforward for cereal grains, since they were directly targeted for food production, even if their shape was not likely the target of selection itself. For cereals, an additional constraint comes from the taphonomic preservation of the remains, which are

usually found carbonized. Charring can significantly modify the size and shape of the grain (Boardman, Jones 1990; Bonhomme et al. 2017; Braadbaart 2008; Ros et al. 2014). Nevertheless, it has already been demonstrated that carbonization is not detrimental to the discrimination of two-rowed and six-rowed hulled barley grain shapes (Ros et al. 2014). The size and shape of the cereal grains are quantified using outline analyses (Bonhomme et al. 2014; Kuhl, Giardina 1982; Mayer et al. 1998, fig. 2A), while the teeth and mandibles of mammals are quantified using outline, landmark and sliding semi-landmark based approaches (fig. 2B). Because the use of geometric morphometrics requires specific computational and analytical training, we will ultimately develop an expert system (a computer knowledge-based system), based on geometric morphometric techniques, aiming at fostering morphometric analysis of archaeological remains to study domesticated species. Tooth measurements are based on a landmark and sliding semi-landmark geometric morphometric approach (fig. 2B). Pig teeth are measured following Evin et al. (2013), while new geometric morphometric protocols have been established for measuring sheep and goat teeth and mandibles (fig. 2B), and repeatability tests performed (following Evin et al. 2020). Initial work has focused morphometric differences between modern sheep and goats (Jeanjean et al. in prep.), which can now be used to identify archaeological specimens before exploring the spatiotemporal variation of the two species. In parallel, linear measurements from a maximum number of sites are also analyzed.

The evolution of barley is studied using both archaeological seeds and a reference collection of seeds from 58 modern varieties from France. Because archaeological seeds are mainly preserved charred, fresh barley seeds are being charred to allow a more realistic comparison. Based on the literature (Bonhomme et al. 2017; Charles et al. 2015; Ros et al. 2014; Styring et al. 2013) and numerous preliminary experiments, modern samples are charred for 3 h 30 in an anoxic environment and a temperature of 240 °C. Morphometric analyses are based on automatic extraction of outline point coordinates from a black and white mask of the original photograph of the grain (fig. 2A). The next line of research will involve the study of grains from archaeological sites of different chrono-cultural phases.



**Fig. 2.** Geometric morphometric protocols used for capturing the size and shape of barley grain (A), the lower third molar of sheep (left), pig (middle), and the mandible of sheep (right). A: Acquisition steps of the grain outline coordinates. B: Landmarks and sliding-semi landmark positions on teeth and mandibles.



### ***Climate reconstruction and modeling***

Climate is certainly a determining factor, through natural selection, in the evolution of breeds and landraces, as exemplified by the presence of traditionally small, stocky and heavy-headed horses in the colder north compared to Arabian horses living in hot and arid regions, which possess fine heads, long and slender legs, each being thus adapted to their local environments (Clutton-Brock 2012). Climate changes can be reconstructed quantitatively from fossil pollen data obtained from sediment cores using several methods (review in Chevalier et al. 2020). Here, quantitative climate reconstruction of seasonal and annual temperatures are obtained using three independent mathematical methods: (i) the Modern Analogue Technique (Guiot 1990), (ii) the Weighted Average Partial Least Square regression (Ter Braak, Juggins 1993) and, for the first time for the Mediterranean area, (iii) Boosted Regression Trees (Salonen et al. 2014). This multi-method approach is applied to approximately 20 pollen records from the studied area with satisfactory age controls and aggregated to reconstruct past climate changes over the last 10,000 yrs. This classical approach (Davis et al. 2003) optimizes the signal-to-noise ratio to provide reliable climate values at the regional scale, and is potentially less sensitive to biases such as the impact of human activities on the vegetation and thus the pollen assemblages. Future research will include a new paleoclimatology proxy: the Branched Glycerol Dialkyl Glyceryl Tetraethers (brGDGTs), which offers new perspectives on continental temperature reconstructions (Martin et al. 2020).

### ***Databasing***

Archaeology has a long tradition in databasing, as a way for gathering, updating and managing (Corboud 2002) all the artifacts and information recorded during an excavation in a lasting fashion. The analysis of a large number of sites and specimens requires the establishment of carefully designed and rigorously maintained databases. For each archaeological site and occupation level, the following information is specifically recorded: geography (latitude, longitude, and altitude) and environment (e.g., mountain, low land, etc.); archaeology: chrono-cultural information, relative dating, absolute dating, type (e.g., open-air) and function of the site (e.g., sheepfold-caves, funerary sites, etc.). For each site and occupation level, we review the published and grey literature, including archaeobotanical and archaeozoological data to register the human food spectrum and the relative importance of the species in the local economy. In addition, available osteometric measurements and mortality profiles are recorded. During the first year of the project, carpological, zooarchaeological and archaeological files have been collected and rigorously formatted, and are now ready to be analyzed. In future, all databases will be integrated into an open-source relational database (PostgreSQL) including a geographic information system (GIS).

### **CONCLUSION**

DEMETER aims to test the following hypotheses : 1) the diversity of ancient domesticates has varied non-linearly through time and space, with periods of homogenization and periods of diversification, 2) human selection for desired traits is associated with other forces acting on domesticated species and contributing to shape many aspects of their morphology, 3) the influence of human and environmental factors in the domesticated species has varied in time and space, according to cultural and biological conditions, 4) domestication is a complex biological and cultural process during which each species follows its own path. This paves the way for the exploration of fundamental changes in farmed animals and crops, in connection

to different, past rural communities and their evolution under new farming practices in a given geographic area.

This multi-disciplinary project will provide a better understanding of the resilience of agrobiodiversity in an ever-changing socioeconomic and environmental world. Furthermore, we will be able to increase awareness of the risks associated with current policies, which lead towards highly specialized, homogeneous and centralized production, and a greater disconnection between human populations and domestic plants and animals.

### **ACKNOWLEDGEMENTS**

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement ERC-StG 852573 – Demeter). The research also benefits from close collaboration with the ERC-StG 716298 – and the SNSF Professorship Project AgriChange (170515). We thank all our close and cherished collaborators. We also thank the Direction Regionale de l'Archéologie et de la Culture – Occitanie and the Biological Resources Centre (INRAE, Clermont-Ferrand) and their personnel.

### **BIBLIOGRAPHY**

ALBARELLA U., DOBNEY K. & ROWLEY-CONWY P. 2006. « THE DOMESTICATION OF THE PIG (SUS SCROFA). NEW CHALLENGES AND APPROACHES », IN: EDER M.A., BRADLEY D.G., EMSHWILLER E., SMITH B.D. (EDS.), DOCUMENTING DOMESTICATION: NEW GENETIC AND ARCHAEOLOGICAL PARADIGMS. BERKELEY, UNIVERSITY OF CALIFORNIA PRESS : 209-227.

ALONSO N. & BOUBY L. 2017. « RESSOURCES VEGETALES DE L'AGE DU BRONZE ET DU PREMIER AGE DU FER DANS LE NORD-OUEST DU BASSIN MEDITERRANEEN », COMPTES RENDUS - PALEVOL., 16, 4 : 363-377.

ANTOLÍN F. & BUXÓ R. 2012. « CHASING THE TRACES OF DIFFUSION OF AGRICULTURE DURING THE EARLY NEOLITHIC IN THE WESTERN MEDITERRANEAN COAST », RUBRICATUM, 5: 95-102.

ANTOLÍN F., JACOMET S. & BUXÓ R. 2015. « THE HARD KNOCK LIFE. ARCHAEOBOTANICAL DATA ON FARMING PRACTICES DURING THE NEOLITHIC (5400-2300 CAL. BC) IN THE NE OF THE IBERIAN PENINSULA », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 61: 90-104. DOI : 10.1016/J.JAS.2015.05.007.

ANTOLIN F., NAVARRETE V., SAÑA M., VIÑERTA Á. & GASSIOT E. 2018. « HERDERS IN THE MOUNTAINS AND FARMERS IN THE PLAINS? A COMPARATIVE EVALUATION OF THE ARCHAEOBIOLOGICAL RECORD FROM NEOLITHIC SITES IN THE EASTERN IBERIAN PYRENEES AND THE SOUTHERN LOWER LANDS », QUATERNARY INTERNATIONAL, 484, JUNE: 75-93. DOI: 10.1016/J.QUAINT.2017.05.056.

ARBOGAST R.-M., JACOMET S., MAGNY M. & SCHIBLER J. 2006. « THE SIGNIFICANCE OF CLIMATE FLUCTUATIONS FOR LAKE LEVEL CHANGES AND SHIFTS IN SUBSISTENCE ECONOMY DURING THE LATE NEOLITHIC (4300-2400 B.C.) IN CENTRAL EUROPE », VEGETATION HISTORY AND ARCHAEOBOTANY, 15, 4: 403-418. DOI: 10.1007/S00334-006-0053-Y.

AZUARA J., COMBOURIEU-NEBOUT N., LEBRETON V., MAZIER F., MÜLLER S.D. & DEZILEAU L. 2015. « LATE HOLOCENE VEGETATION CHANGES IN RELATION WITH CLIMATE FLUCTUATIONS AND HUMAN ACTIVITY IN LANGUEDOC (SOUTHERN FRANCE) », CLIMATE OF THE PAST, 11, 12: 1769-1784. DOI: 10.5194/CP-11-1769-2015.

BALASSE M., EVIN A., TORNERO C., RADU V., FIORILLO D., POPOVICI D., ANDREESCU R., DOBNEY K., CUCCHI T. & BĂLĂȘESCU A. 2016. « WILD, DOMESTIC AND FERAL? INVESTIGATING THE STATUS OF SUIDS IN THE ROMANIAN GUMELNIȚA (5TH MIL. CAL. BC) WITH BIOGEOCHEMISTRY AND GEOMETRIC MORPHOMETRICS », JOURNAL OF ANTHROPOLOGICAL ARCHAEOLOGY, 42: 27-36. DOI: 10.1016/J.JAA.2016.02.002.

BOARDMAN S. & JONES G. 1990. « EXPERIMENTS ON THE EFFECTS OF CHARRING ON CEREAL PLANT COMPONENTS », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 17, 1: 1-11. DOI: 10.1016/0305-4403(90)90012-T.

BOCQUET-APPEL J.P. & BAR-YOSEF O. 2008. THE NEOLITHIC DEMOGRAPHIC TRANSITION AND ITS CONSEQUENCES. DORDRECHT, SPRINGER NETHERLANDS.

BONHOMME V., FORSTER E., WALLACE M., STILLMAN E., CHARLES M. & JONES G. 2017. « IDENTIFICATION OF INTER- AND INTRA-SPECIES VARIATION IN CEREAL GRAINS THROUGH GEOMETRIC MORPHOMETRIC ANALYSIS, AND ITS RESILIENCE UNDER EXPERIMENTAL CHARRING », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 86: 60-67. DOI : 10.1016/J.JAS.2017.09.010 ; HTTP :// DX.DOI.ORG/10.1016/J.JAS.2017.09.010.

BONHOMME V., PICQ S., GAUCHEREL C. & CLAUDE J. 2014. « MOMOCS: OUTLINE ANALYSIS USING R », JOURNAL OF STATISTICAL SOFTWARE, 56, 13: 1-24. DOI: 10.18637/JSS.V056.I13; HTTP ://WWW.JSTATSOFT.ORG/V56/I13/.

BONHOMME V., PICQ S., IVORRA S., EVIN A., PASTOR T., BACILIERI R., LACOMBE T., FIGUEIRAL I., TERRAL J.-F. & BOUBY L. 2020. « ECO- EVO-DEVO IMPLICATIONS AND ARCHAEOBIOLOGICAL PERSPECTIVES OF TRAIT COVARIANCE IN FRUITS OF WILD AND DOMESTICATED GRAPEVINES », PLOS ONE, 15, 11: E0239863. DOI: 10.1371/JOURNAL.PONE.0239863.

BOPP-ITO M., CUCCHI T., EVIN A., STOPP B. & SCHIBLER J. 2018. « PHENOTYPIC DIVERSITY IN BRONZE AGE PIGS FROM THE ALPINE AND CENTRAL PLATEAU REGIONS OF SWITZERLAND », JOURNAL OF ARCHAEOLOGICAL SCIENCE: REPORTS, 21, OCTOBER 2017: 38-46. DOI : 10.1016/J. JASREP.2018.07.002.

BOUBY L. 2001. « L'ORGE A DEUX RANGS (HORDEUM DISTICHUM) DANS L'AGRICULTURE GALLO-ROMAINE : DONNEES ARCHEOBOTANIQUES », ARCHEOSCIENCES, REVUE D'ARCHEOMETRIE, 25 : 35-44. DOI : 0.3406/ARSCI.2001.999.

BOUBY L. 2014. L'AGRICULTURE DANS LE BASSIN DU RHONE DU BRONZE FINAL A L'ANTIQUE : AGROBIODIVERSITE, ECONOMIE, CULTURES. TOULOUSE, ARCHIVES D'ECOLOGIE PREHISTORIQUE.

BOUBY L., FIGUEIRAL I., BOUCHETTE A., ROVIRA N., IVORRA S., LACOMBE T., PASTOR T., PICQ S., MARINVAL P. & TERRAL J.-F. 2013. « BIOARCHAEOLOGICAL INSIGHTS INTO THE PROCESS OF DOMESTICATION OF GRAPEVINE (VITIS VINIFERA L.) DURING ROMAN TIMES IN SOUTHERN FRANCE », PLOS ONE, 8, 5: 1-13. DOI: 10.1371/JOURNAL.PONE.0063195.

BOUBY L., WALES N., JALABADZE M., RUSISHVILI N., BONHOMME V., RAMOS-MADRIGAL J., EVIN A., IVORRA S., LACOMBE T., PAGNOUX C., BOARETTO E., GILBERT M.T.P., BACILIERI R., LORDKIPANIDZE D. & MAGHRADZE D. 2020. « TRACKING THE HISTORY OF GRAPEVINE CULTIVATION IN GEORGIA BY COMBINING GEOMETRIC MORPHOMETRICS AND ANCIENT DNA », VEGETATION HISTORY AND ARCHAEOBOTANY. DOI: 10.1007/S00334-020-00803-0.

BRAADBAART F. 2008. « CARBONISATION AND MORPHOLOGICAL CHANGES IN MODERN DEHUSKED AND HUSKED TRITICUM DICOCCUM AND TRITICUM AESTIVUM GRAINS », VEGETATION HISTORY AND ARCHAEOBOTANY, 17, 1: 155-166. DOI: 10.1007/S00334-007-0134-6.

BRAAK C.J.F. TER & JUGGINS S. 1993. « WEIGHTED AVERAGING PARTIAL LEAST SQUARES REGRESSION (WAPLS): AN IMPROVED METHOD FOR RECONSTRUCTING ENVIRONMENTAL VARIABLES FROM SPECIES ASSEMBLAGES », HYDROBIOLOGIA, 269-270, 1: 485-502. DOI: 10.1007/BF00028046.

BRÉHARD S., BEECHING A. & VIGNE J.-D. 2010. « SHEPHERDS, COWHERDS AND SITE FUNCTION ON MIDDLE NEOLITHIC SITES OF THE RHÔNE VALLEY: AN ARCHAEOZOOLOGICAL APPROACH TO THE ORGANIZATION OF TERRITORIES AND SOCIETIES », JOURNAL OF ANTHROPOLOGICAL ARCHAEOLOGY, 29, 2: 179-188. DOI : 10.1016/J.JAA.2010.02.001.

BURGER P., TERRAL J.-F., RUAS M.-P., IVORRA S. & PICQ S. 2011. « ASSESSING PAST AGROBIODIVERSITY OF PRUNUS AVIUM L. (ROSACEAE): A MORPHOMETRIC APPROACH FOCUSED ON THE STONES FROM THE

ARCHAEOLOGICAL SITE HÔTEL-DIEU (16TH CENTURY, TOURS, FRANCE) », VEGETATION HISTORY AND ARCHAEOBOTANY, 20, 5: 447-458. DOI: 10.1007/ S00334-011-0310-6.

CHARLES M., FORSTER E., WALLACE M. & JONES G. 2015. « “NOR EVER LIGHTNING CHAR THY GRAIN”<sup>1</sup>: ESTABLISHING ARCHAEOLOGICALLY RELEVANT CHARRING CONDITIONS AND THEIR EFFECT ON GLUME WHEAT GRAIN MORPHOLOGY », SCIENCE AND TECHNOLOGY OF ARCHAEOLOGICAL RESEARCH, 1, 1: 1-6. DOI: 10.1179/2054892315Y.0000000008.

CHEVALIER M., DAVIS B.A.S., HEIRI O., SEPPÄ H., CHASE B.M., GAJEWSKI K., LACOURSE T., TELFORD R.J., FINSINGER W., GUIOT J., KÜHL N., MAEZUMI S.Y., TIPTON J.R., CARTER V.A., BRUSSEL T., PHELPS L.N., DAWSON A., ZANON M., VALLÉ F., NOLAN C., MAURI A., VERNAL A. DE, IZUMI K., HOLMSTRÖM L., MARSICEK J., GORING S., SOMMER P.S., CHAPUT M. & KUPRIYANOV D. 2020. « POLLEN-BASED CLIMATE RECONSTRUCTION TECHNIQUES FOR LATE QUATERNARY STUDIES », EARTH-SCIENCE REVIEWS, 210, MAY: 103384. DOI: 10.1016/J.EARSCIREV.2020.103384.

CLUTTON-BROCK J. 2012. ANIMALS AS DOMESTICATES: A WORLD VIEW THROUGH HISTORY. MICHIGAN STATE UNIVERSITY PRESS.

COLLEDGE S. & CONOLLY J. 2007. « THE ORIGINS AND SPREAD OF DOMESTIC ANIMALS IN SOUTHWEST ASIA AND EUROPE ».

CONOLLY J., COLLEDGE S., DOBNEY K., VIGNE J.-D., PETERS J., STOPP B., MANNING K. & SHENAN S. 2011. « META-ANALYSIS OF ZOOARCHAEOLOGICAL DATA FROM SW ASIA AND SE EUROPE PROVIDES INSIGHT INTO THE ORIGINS AND SPREAD OF ANIMAL HUSBANDRY », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 38, 3: 538-545. DOI: 10.1016/J. JAS.2010.10.008.

CORBOUD P. 2002. « CREATING OF A DATABASE FOR PREHISTORIC SITES: WHICH ARE THE GOALS, THE STRATEGY AND WHAT MEANS TO PUT IN PLACE? », IN: BURENHULT, G. & ARVIDSSON J. (EDS.), ARCHAEOLOGICAL INFORMATICS: PUSHING THE ENVELOPE. CAA 2001: COMPUTER APPLICATIONS AND QUANTITATIVE METHODS IN ARCHAEOLOGY: PROCEEDINGS OF THE 29TH CONFERENCE, GOTLAND, APRIL 2001. OXFORD: 469-474.

CUCCHI T., BARNETT R., MARTÍNKOVÁ N., RENAUD S., RENVOISÉ E., EVIN A., SHERIDAN A., MAINLAND I., WICKHAM-JONES C., TOUGARD C., QUÉRÉ J.P., PASCAL M., PASCAL M., HECKEL G., O’HIGGINS P., SEARLE J.B. & DOBNEY K.M. 2014. « THE CHANGING PACE OF INSULAR LIFE: 5000 YEARS OF MICROEVOLUTION IN THE ORKNEY VOLE (MICROTUS ARVALIS ORCADENSIS) », EVOLUTION, 68, 10. DOI: 10.1111/EVO.12476.

CUCCHI T., HULME-BEAMAN A., YUAN J. & DOBNEY K. 2011. « EARLY NEOLITHIC PIG DOMESTICATION AT JIAHU, HENAN PROVINCE, CHINA: CLUES FROM MOLAR SHAPE ANALYSES USING GEOMETRIC MORPHOMETRIC APPROACHES », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 38, 1: 11-22. DOI: 10.1016/J. JAS.2010.07.024.

DAVIS B.A.S., BREWER S., STEVENSON A.C., GUIOT J., ALLEN J., ALMQVIST-JACOBSON H., AMMANN B., ANDREEV A.A., ARGANT J., ATANASSOVA J., BALWIERZ Z., BARNOSKY C.D., BARTLEY D.D., BEAULIEU J.L. DE, BECKETT S.C., BEHRE K.E., BENNETT K.D., BERGLUND B.E.B., BEUG H.J., BEZUSKO L., BINKA K., BIRKS H.H., BIRKS H.J.B., BJÖRCK S., BLIAKHARTCHOUK T., BOGDEL I., BONATTI E., BOTTEMA S., BOZILOVA E.D.B., BRADSHAW R., BROWN A.P., BRUGIAPAGLIA E., CARRION J., CHERNAVSKAYA M., CLERC J., CLET M., COÛTEAUX M., CRAIG A.J., CSERNY T., Cwynar L.C., DAMBACH K., VALK E.J. DE, DIGERFELDT G., DIOT M.F., EASTWOOD W., ELINA G., FILIMONOVA L., FILIPOVITCH L., GAILLARD-LEMDHAL M.J., GAUTHIER A., GÖRANSSON H., GUENET P., GUNOVA V., HALL V.A.H., HARMATA K., HICKS S., HUCKERBY E., HUNTLEY B., HUTTUNEN A., HYVÄRINEN H., ILVES E., JACOBSON G.L., JAHNS S., JANKOVSKÁ V., JÓHANSEN J., KABAILIENE M., KELLY M.G., KHOMUTOVA V.I., KÖNIGSSON L.K., KREMENETSKI C., KREMENETSKII K. V., KRISAI I., KRISAI R., KVAVADZE E., LAMB H., LAZAROVA M.A., LITT T., LOTTER A.F., LOWE J.J., MAGYARI E., MAKOHONIENKO M., MAMAKOWA K., MANGERUD J., MARISCAL B., MARKGRAF V., MCKEEVER, MITCHELL F.J.G., MUNUERA M., NICOL-PICHARD S., NORYSKIEWICZ B., ODGAARD B. V., PANOVA N.K., PANTALEON-CANO J., PAUS A.A., PAVEL T., PEGLAR S.M., PENALBA M.C., PENNINGTON W., PEREZ-OBOL R., PUSHENKO M., RALSKA-JASIEWISZOWA M., RAMFJORD H., REGNELL J., RYBNICKOVA E., RYBNICKOVA M., SAARSE L., SANCHEZ GOMEZ M.F., SARMAJA-KORJONEN K., SARV A., SEPPA H., SIVERTSEN S., SMITH A.G., SPIRIDONOVA E.A., STANCIKAITE M., STEFANOVA J., STEWART D.A., SUC J.P., SVOBODOVA H., SZCZEPANEK K., TARASOV P., TOBOLSKI K., TONKOV S.P., TURNER J., KNAAP W.O. VAN DER, LEEUWEN J.F.N. VAN, VASARI A., VASARI Y.,

VERBRUGGEN C., VERGNE V., VESKI S., VISET L., VUORELA I., WACNIK A., WALKER M.J.C., WALLER M.P., WATSON C.S., WATTS W.A., WHITTINGTON G., WILLIS K.J., WILLUTZKI H., YELOVICHEVA Y., YLL E.I., ZELIKSON E.M. & ZERNITSKAYA V.P. 2003. « THE TEMPERATURE OF EUROPE DURING THE HOLOCENE RECONSTRUCTED FROM POLLEN DATA », QUATERNARY SCIENCE REVIEWS, 22, 15-17: 1701-1716. DOI: 10.1016/S0277-3791(03)00173-2.

DODSON J. & DONG G. 2016. « WHAT DO WE KNOW ABOUT DOMESTICATION IN EASTERN ASIA? », QUATERNARY INTERNATIONAL, 426, JUNE: 2-9. DOI: 10.1016/J.QUAINT.2016.04.005.

DUVAL C., CUCCHI T., HORARD-HERBIN M.-P. & LEPETZ S. 2018. « THE DEVELOPMENT OF NEW HUSBANDRY AND ECONOMIC MODELS IN GAUL BETWEEN THE IRON AGE AND THE ROMAN PERIOD: NEW INSIGHTS FROM PIG BONES AND TEETH MORPHOMETRICS », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 99, FEBRUARY: 10-18. DOI: 10.1016/J. JAS.2018.08.016.

DUVAL C., LEPETZ S., HORARD-HERBIN M.-P. & CUCCHI T. 2015. « DID ROMANIZATION IMPACT GALLIC PIG MORPHOLOGY? NEW INSIGHTS FROM MOLAR GEOMETRIC MORPHOMETRICS », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 57: 345-354. DOI: 10.1016/J.JAS.2015.03.004.

EVIN A., BONHOMME V. & CLAUDE J. 2020. « OPTIMIZING DIGITALIZATION EFFORT IN MORPHOMETRICS », BIOLOGY METHODS AND PROTOCOLS, 5, 1: 1-10. DOI: 10.1093/BIOMETHODS/BPAA023.

EVIN A., CUCCHI T., CARDINI A., STRAND VIDARSDOTTIR U., LARSON G. & DOBNEY K. 2013. « THE LONG AND WINDING ROAD: IDENTIFYING PIG DOMESTICATION THROUGH MOLAR SIZE AND SHAPE », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 40, 1: 735-743. DOI: 10.1016/J. JAS.2012.08.005.

EVIN A., DOBNEY K., SCHAFBERG R., OWEN J., STRAND VIDARSDOTTIR U., LARSON G. & CUCCHI T. 2015A. « PHENOTYPE AND ANIMAL DOMESTICATION: A STUDY OF DENTAL VARIATION BETWEEN DOMESTIC, WILD, CAPTIVE, HYBRID AND INSULAR SUS SCROFA », BMC EVOLUTIONARY BIOLOGY, 15, 1: 6. DOI: 10.1186/S12862-014-0269-X.

EVIN A., FLINK L.G., BĂLĂȘESCU A., POPOVICI D., ANDREESCU R., BAILEY D., MIREA P., LAZĂR C., BORONEANȚ A., BONSALL C., VIDARSDOTTIR U.S., BREHARD S., TRESSET A., CUCCHI T., LARSON G. & DOBNEY K. 2015B. « UNRAVELLING THE COMPLEXITY OF DOMESTICATION: A CASE STUDY USING MORPHOMETRICS AND ANCIENT DNA ANALYSES OF ARCHAEOLOGICAL PIGS FROM ROMANIA », PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY: BIOLOGICAL SCIENCES, 370, 1660: 20130616. DOI: 10.1098/RSTB.2013.0616; [HTTPS://ROYALSOCIETYPUBLISHING.ORG/DOI/10.1098/RSTB.2013.0616](https://royalsocietypublishing.org/doi/10.1098/RSTB.2013.0616).

FABRE L., FOREST V. & GIVOUNEZ O. 2002. « BLANCARIA ET MAROQUINERIE A MONTPELLIER (HERAULT) AU BAS MOYEN AGE », IN : AUDOIN- ROUZEAU F., BEYRIES S. (EDS.), « LE TRAVAIL DU CUIR DE LA PREHISTOIRE A NOS JOURS », XXIII RENCONTRES INTERNATIONALES D'ARCHEOLOGIE ET D'HISTOIRE D'ANTIBES, ANTIBES : 437-450.

FOREST V. 2000. « LOTS OSSEUX FAUNIQUES ARCHEOLOGIQUES EN LANGUEDOC-ROUSSILLON : APERÇU DE LEUR COMPOSITION DU NEOLITHIQUE FINAL AU BAS MOYEN-AGE », IN: MARANDET M.-C. (ED.), L'HOMME ET L'ANIMAL DANS LES SOCIETES MEDITERRANEENNES », 4E JOURNEE D'ETUDES DU CENTRE DE RECHERCHES HISTORIQUES SUR LES SOCIETES MEDITERRANEENNES, PRESSES UNIVERSITAIRES DE PERPIGNAN : 15-26.

FOREST V. 2009. « INDICES ARCHEOZOOLOGIQUES DE RURALITE EN GAULE NARBONNAISE : L'EXEMPLE DE LA TRIADE DOMESTIQUE EN BAS- LANGUEDOC », IN : « LES FORMES DE L'HABITAT RURAL GALLO-ROMAIN. TERMINOLOGIES ET TYPOLOGIES A L'EPREUVE DES REALITES ARCHEOLOGIQUES », COLLOQUE AGER VIII, 22-24 MARS 2007, AQUITANIA, SUPPLEMENT 17, BORDEAUX : 25-45.

FOREST V. & RODET-BELARBI I. 2002. « A PROPOS DE LA CORPULENCE DES BOVINS EN FRANCE DURANT LES PERIODES HISTORIQUES », GALLIA, 59, 1 : 273-306. DOI : 10.2307/43608196.

FRIGOLA J., MORENO A., CACHO I., CANALS M., SIERRA F.J., FLORES J.A., GRIMALT J.O., HODELL D.A. & CURTIS J.H. 2007. « HOLOCENE CLIMATE VARIABILITY IN THE WESTERN MEDITERRANEAN REGION FROM A DEEPWATER SEDIMENT RECORD », PALEOCEANOGRAPHY, 22, 2: 1-16. DOI: 10.1029/2006PA001307.

GILLIS R., CHAIX L. & VIGNE J.-D. 2011. « AN ASSESSMENT OF MORPHOLOGICAL CRITERIA FOR DISCRIMINATING SHEEP AND GOAT MANDIBLES ON A LARGE PREHISTORIC ARCHAEOLOGICAL ASSEMBLAGE (KERMA, SUDAN) », *JOURNAL OF ARCHAEOLOGICAL SCIENCE*, 38, 9: 2324-2339. DOI: 10.1016/J.JAS.2011.04.012.

GUIOT J. 1990. « METHODOLOGY OF THE LAST CLIMATIC CYCLE RECONSTRUCTION IN FRANCE FROM POLLEN DATA », *PALAEO GEOGRAPHY, PALAEO CLIMATOLOGY, PALAEO ECOLOGY*, 80, 1: 49-69. DOI : 10.1016/0031-0182(90)90033-4.

JALALI B., SICRE M.A., BASSETTI M.A. & KALLEL N. 2016. « HOLOCENE CLIMATE VARIABILITY IN THE NORTH-WESTERN MEDITERRANEAN SEA (GULF OF LIONS) », *CLIMATE OF THE PAST*, 12, 1: 91-101. DOI: 10.5194/ CP-12-91-2016.

KRAUSE-KYORA B., MAKAREWICZ C., EVIN A., FLINK L.G., DOBNEY K., LARSON G., HARTZ S., SCHREIBER S., CARNAP-BORNHEIM C. VON, WURMB-SCHWARK N. & NEBEL A. 2013. « USE OF DOMESTICATED PIGS BY MESOLITHIC HUNTER-GATHERERS IN NORTHWESTERN EUROPE », *NATURE COMMUNICATIONS*, 4. DOI: 10.1038/NCOMMS3348.

KUHL F.P. & GIARDINA C.R. 1982. « ELLIPTIC FOURIER FEATURES OF A CLOSED CONTOUR », *COMPUTER GRAPHICS AND IMAGE PROCESSING*, 18, 3: 236-258. DOI: 10.1016/0146-664X(82)90034-X.

LARSON G., CUCCHI T., FUJITA M., MATISOO-SMITH E., ROBINS J., ANDERSON A., ROLETT B., SPRIGGS M., DOLMAN G., KIM T.-H., THUY N.T.D., RANDI E., DOHERTY M., DUE R.A., BOLLT R., DJUBIANTONO T., GRIFFIN B., INTOH M., KEANE E., KIRCH P., LI K.-T., MORWOOD M., PEDRINA L.M., PIPER P.J., RABETT R.J., SHOOTER P., BERGH G. VAN DEN, WEST E., WICKLER S., YUAN J., COOPER A., DOBNEY K. 2007. « PHYLOGENY AND ANCIENT DNA OF SUS PROVIDES INSIGHTS INTO NEOLITHIC EXPANSION IN ISLAND SOUTHEAST ASIA AND OCEANIA », *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES*, 104, 12: 4834-4839. DOI: 10.1073/PNAS.0607753104.

MARTIN C., MÉNOT G., THOUVENY N., PEYRON O., ANDRIEU-PONEL V., MONTADE V., DAVTIAN N., REILLE M. & BARD E. 2020. « EARLY HOLOCENE THERMAL MAXIMUM RECORDED BY BRANCHED TETRA- ETHERS AND POLLEN IN WESTERN EUROPE (MASSIF CENTRAL, FRANCE) », *QUATERNARY SCIENCE REVIEWS*, 228: 106-109. DOI: 10.1016/J. QUASCIREV.2019.106109.

MAYER J.J., NOVAK J.M. & BRISBIN I.L. 1998. « EVALUATION OF MOLAR SIZE AS A BASIS FOR DISTINGUISHING WILD BOAR FROM DOMESTIC SWINE: EMPLOYING THE PRESENT TO DECIPHER THE PAST », IN: NELSON S.M. (ED.), *ANCESTORS FOR THE PIGS. PIGS IN PREHISTORY*, MASCA RESEARCH PAPERS IN SCIENCE AND ARCHAEOLOGY 15, UNIVERSITY OF PENNSYLVANIA PRESS: 39-53.

NIETO-ESPINET A., HUET T., TRENTACOSTE A., GUIMARÃES S. & VALENZUELA-LAMAS S. 2021. « RESILIENCE AND LIVESTOCK ADAPTATIONS TO DEMOGRAPHIC GROWTH AND TECHNOLOGICAL CHANGE: A DIACHRONIC PERSPECTIVE FROM THE LATE BRONZEAGE TO LATE ANTIQUITY IN NE IBERIA », *PLOS ONE*, 16, 2: E0246201. DOI: 10.1371/JOURNAL.PONE.0246201.

OTTONI C. 2012. « ARTICLE PIG DOMESTICATION AND HUMAN-MEDIATED DISPERSAL IN WESTERN EURASIA REVEALED THROUGH ANCIENT DNA AND GEOMETRIC MORPHOMETRICS », *MOLECULAR BIOLOGY AND EVOLUTION*, 1719: 136-138. DOI: 10.1093/MOLBEV/MSS261.

OTTONI C., GIRDLAND FLINK L., EVIN A., GEÖRG C., CUPERE B. DE, NEER W. VAN, BARTOSIEWICZ L., LINDERHOLM A., BARNETT R., PETERS J., DECORTE R., WAEKENS M., VANDERHEYDEN N., RICAUT F.X., ÇAKIRLAR C., ÇEVİK Ö., HOELZEL A.R., MASHKOUR M., MOHASEB KARIMLU A.F., SHEIKHI SENO S., DAUJAT J., BROCK F., PINHASI R., HONGO H., PEREZ-ENCISO M., RASMUSSEN M., FRANTZ L., MEGENS H.J., CROOIJMANS R., GROENEN M., ARBUCKLE B., BENECKE N., STRAND VIDARSDOTTIR U., BURGER J., CUCCHI T., DOBNEY K. & LARSON G. 2013. « PIG DOMESTICATION AND HUMAN-MEDIATED DISPERSAL IN WESTERN EURASIA REVEALED THROUGH ANCIENT DNA AND GEOMETRIC MORPHOMETRICS », *MOLECULAR BIOLOGY AND EVOLUTION*, 30, 4: 824-832. DOI: 10.1093/MOLBEV/MSS261.

PAGNOUX C., BOUBY L., VALAMOTI S.M., BONHOMME V., IVORRA S., GKATZOGIA E., KARATHANOU A., KOTSACHRISTOU D., KROLL H. & TERRAL J.-F. 2021. « LOCAL DOMESTICATION OR DIFFUSION? INSIGHTS INTO

VITICULTURE IN GREECE FROM NEOLITHIC TO ARCHAIC TIMES, USING GEOMETRIC MORPHOMETRIC ANALYSES OF ARCHAEOLOGICAL GRAPE SEEDS », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 125: 105-263. DOI: 10.1016/J.JAS.2020.105263.

PETERS J., DRIESCH A. VON DEN & HELMER D. 2005. « THE UPPER EUPHRATES-TIGRIS BASIN: CRADLE OF AGRO-PASTORALISM? », IN: VIGNE J.-D., PETERS J., HELMER D. (EDS.), THE FIRST STEPS OF ANIMAL DOMESTICATION: NEW ARCHAEOLOGICAL APPROACHES. OXFORD, OXBOW BOOKS: 96-124.

PRICE M.D. & EVIN A. 2017. « LONG-TERM MORPHOLOGICAL CHANGES AND EVOLVING HUMAN-PIG RELATIONS IN THE NORTHERN FERTILE CRESCENT FROM 11,000 TO 2000 CAL. BC », ARCHAEOLOGICAL AND ANTHROPOLOGICAL SCIENCES, 11, 1: 237-251. DOI: 10.1007/S12520-017-0536-Z.

ROHLF J.F. & MARCUS L.F. 1993. « A REVOLUTION MORPHO- METRICS », TRENDS IN ECOLOGY AND EVOLUTION, 8, 4: 129-132. DOI : 10.1016/0169-5347(93)90024-J.

ROS J. 2020. 2000 ANS D'AGRICULTURE EN ROUSSILLON, PRODUCTIONS VEGETALES ET TERROIRS PROTOHISTORIQUES, ANTIQUES ET MEDIEVAUX. COLLECTION ARCHEOLOGIE DES PLANTES ET DES ANIMAUX, DREMIL-LAFAGE, EDITIONS MERGOIL.

ROS J., EVIN A., BOUBY L. & RUAS M.-P.M.-P. 2014. « GEOMETRIC MORPHO- METRIC ANALYSIS OF GRAIN SHAPE AND THE IDENTIFICATION OF TWO-ROWED BARLEY (HORDEUM VULGARE SUBSP. DISTICHUM L.) IN SOUTHERN FRANCE », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 41: 568-575. DOI: 10.1016/J.JAS.2013.09.015.

SABATIER P., DEZILEAU L., COLIN C., BRIQUEU L., BOUCHETTE F., MARTINEZ P., SIANI G., RAYNAL O. & GRAFENSTEIN U. VON. 2012. « 7000 YEARS OF PALEOSTORM ACTIVITY IN THE NW MEDITERRANEAN SEA IN RESPONSE TO HOLOCENE CLIMATE EVENTS », QUATERNARY RESEARCH, 77, 1 : 1-11. DOI: 10.1016/J.YQRES.2011.09.002.

SALONEN J.S., LUOTO M., ALENIUS T., HEIKKILÄ M., SEPPÄ H., TELFORD R.J. & BIRKS H.J.B. 2014. « RECONSTRUCTING PALAEOCLI- MATIC VARIABLES FROM FOSSIL POLLEN USING BOOSTED REGRESSION TREES: COMPARISON AND SYNTHESIS WITH OTHER QUANTITATIVE RECONSTRUCTIONMETHODS », QUATERNARY SCIENCE REVIEWS, 88: 69-81. DOI: 10.1016/J.QUASCIREV.2014.01.011.

SALVAGNO L. & ALBARELLA U. 2017. A MORPHOMETRIC SYSTEM TO DISTINGUISH SHEEP AND GOAT POSTCRANIAL BONES, PLOS ONE 12, E0178543.

SAÑA M., ANTOLIN F., ALCANTARA R., SIERRA A. & TORNERO C. 2020. « INTEGRATING DOMESTICATES: EARLIEST FARMING EXPERIENCES IN THE IBERIAN PENINSULA », IN: GRON K.J., SØRENSEN L., ROWLEY- CONWY P. (EDS.), FARMERS AT THE FRONTIER: A PAN EUROPEAN PERSPECTIVE ON NEOLITHISATION, OXFORD, OXBOW BOOKS: 161-176.

STYRING A.K., MANNING H., FRASER R.A., WALLACE M., JONES G., CHARLES M., HEATON T.H.E., BOGAARD A. & EVERSHED R.P. 2013. « THE EFFECT OF CHARRING AND BURIAL ON THE BIOCHEMICAL COMPOSI- TION OF CEREAL GRAINS: INVESTIGATING THE INTEGRITY OF ARCHAEOLOGICAL PLANT MATERIAL », JOURNAL OF ARCHAEOLOGICAL SCIENCE, 40, 12: 4767-4779. DOI: 10.1016/J.JAS.2013.03.024.

TERRAL J.-F., TABARD E., BOUBY L., IVORRA S., PASTOR T., FIGUEIRAL I., PICQ S., CHEVANCE J.-B., JUNG C., FABRE L., TARDY C., COMPAN M., BACILIERI R., LACOMBE T. & THIS P. 2010. « EVOLUTION AND HISTORY OF GRAPEVINE (VITIS VINIFERA) UNDER DOMESTICATION: NEW MORPHOMET- RIC PERSPECTIVES TO UNDERSTAND SEED DOMESTICATION SYNDROME AND REVEAL ORIGINS OF ANCIENT EUROPEAN CULTIVARS. », ANNALS OF BOTANY, 105, 3: 443-455. DOI: 10.1093/AOB/MCP298.

TERRAL J.-F., ALONSO N., BUXÓ I CAPDEVILA R., CHATTI N., FABRE L., FIORENTINO G., MARINVAL P., JORDÁ G.P., PRADAT B., ROVIRA N. & OTHERS. 2004. « HISTORICAL BIOGEOGRAPHY OF OLIVE DOMESTICATION (OLEA EUROPAEA L.) AS REVEALED BY GEOMETRICAL MORPHOMETRY APPLIED TO BIOLOGICAL AND ARCHAEOLOGICAL MATERIAL », JOURNAL OF BIOGEOGRAPHY, 31, 1: 63-77.

VIGNE J.-D., CARRERE I., BRIOIS F. & GUILAINE J. 2011. « THE EARLY PROCESS OF MAMMAL DOMESTICATION IN THE NEAR EAST », *CURRENT ANTHROPOLOGY*, 52, S4: S255-S271. DOI: 10.1086/659306.

VIGNE J.-D., PETERS J. & HELMER D. 2005. *THE FIRST STEPS OF ANIMAL DOMESTICATION: NEW ARCHAEOZOOLOGICAL TECHNIQUES (PROCEEDINGS OF THE 9TH ICAZ CONFERENCE)*. OXFORD, OXBOW BOOKS LIMITED.

WICKHAM C. 2005. *FRAMING THE EARLY MIDDLE AGES: EUROPE AND THE MEDITERRANEAN, 400-800*. OXFORD UNIVERSITY PRESS.

ZEDER M.A. 2006. « CENTRAL QUESTIONS IN THE DOMESTICATION OF PLANTS AND ANIMALS », *EVOLUTIONARY ANTHROPOLOGY*, 15, 3: 105-117. DOI: 10.1002/EVAN.20101.

ZEDER M.A. 2015. « CORE QUESTIONS IN DOMESTICATION RESEARCH », *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES*, 112, 11: 3191-3198. DOI: 10.1073/PNAS.1501711112.

ZEDER M.A., EMSHWILLER E., SMITH B.D. & BRADLEY D.G. 2006. « DOCUMENTING DOMESTICATION: THE INTERSECTION OF GENETICS AND ARCHAEOLOGY », *TRENDS IN GENETICS*, 22, 3: 139-155. DOI: 10.1016/J.TIG.2006.01.007.

ZOHARY D., HOPF M. & WEISS E. 2012. *DOMESTICATION OF PLANTS IN THE OLD WORLD: THE ORIGIN AND SPREAD OF DOMESTICATED PLANTS IN SOUTHWEST ASIA, EUROPE, AND THE MEDITERRANEAN BASIN*. OXFORD, NEW YORK, OXFORD UNIVERSITY PRESS.