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The integration of historical, archaeological and paleoenvironmental data at the regional scale : the Etang de Berre, Southern France

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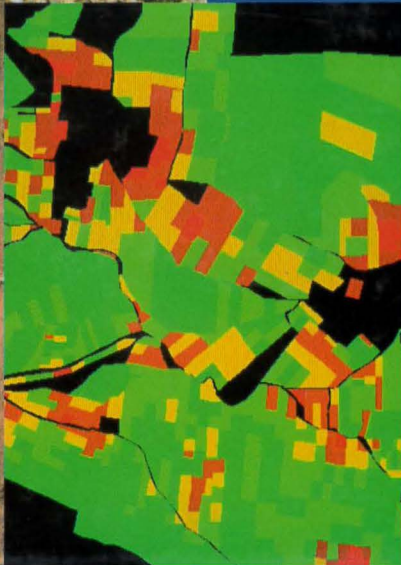
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THE ARCHAEOLOGY OF
MEDITERRANEAN LANDSCAPES 2

Environmental
Reconstruction
in Mediterranean
Landscape
Archaeology

Edited by Phillipe Leveau,
Frédéric Trément,
Kevin Walsh
and Graeme Barker



The Archaeology of Mediterranean Landscapes

Series Editors

Graeme Barker and David Mattingly

1. Reconstructing Past Population Trends in Mediterranean Europe
(3000 BC – AD 1800)

Edited by John Bintliff and Kostas Sbonias

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5. Extracting Meaning from Ploughsoil Assemblages
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General Editors' Introduction: The POPULUS Project

Graeme Barker and David Mattingly

This is one of five volumes being published by the POPULUS project, a European research network funded by the EU Human Capital and Mobility programme (Contract ERB CHRXCT930305) to address a series of methodological issues in Mediterranean landscape archaeology.

THE RESEARCH CONTEXT

Without a long historical perspective, research on changing demographic patterns in modern day Europe can only assess the impact of recurrent or perennial environmental and socio-economic aspects by constructing hypothetical models. The more empirically-based such models are, the greater their relevance to contemporary situations. This is particularly true of the less industrialized regions of Mediterranean Europe, where farming remains the principal economic focus and where the last decades have witnessed considerable migration of population to the cities or other more favoured economic regions. The problems facing these areas of the EU have an historic as well as a contemporary dimension and there is obvious importance in seeking to gain a clearer understanding of their long-term demographic trends.

Long-term demographic changes can be studied from many different perspectives and using many techniques, including history and the natural and social sciences. Numerous factors can be advanced to explain population growth and contraction (economic, environmental, social), but all research is hampered by the absence of detailed census records for much of the pre-modern period. However, landscape archaeology – a constellation of approaches and methodologies bridging the natural and social sciences, applied to both rural and urban contexts – has the potential to provide a major source of new information on the *longue durée* of human settlement in Mediterranean Europe. In recent years advances in field survey and excavation techniques, air photography, remote sensing, GIS (Geographical Information Systems), ceramic

provenancing and dating have led to the accumulation of a wealth of new evidence on past settlement patterns. Potentially, therefore, the techniques of landscape archaeology offer the best opportunity significantly to advance our knowledge of European human demography in pre-industrial times, *c.* 3000 BC–AD 1800.

Despite this potential contribution of landscape archaeology, however, development has been uneven across Europe. In Mediterranean countries in particular, the traditional dominance of art historical approaches in archaeology, compounded by the strength of academic boundaries in other disciplines, has mitigated against the development of an approach to landscape analysis and demographic modelling that by definition demands an inter-disciplinary framework linking the natural and social sciences. Fieldwork in landscape archaeology has been the exception, not the rule. Moreover, where pioneering research has taken place, each team has tended to develop and use its own special methods (often reflecting a particular national tradition of archaeological research), with too little attention being paid to the necessity of achieving greater standardization of data sets. There are also specific problems relating to the interpretation of the status, size and length of occupation of the many sites that have been discovered. Scientific techniques can assist in refining the data so that more reliable demographic assessments can be made, but many interesting and important projects have not been able to make use of the full range of scientific techniques because the appropriate expertise is not available at the regional level. If landscape archaeology is to realize its potential to contribute significantly to debates on long-term demographic trends in Mediterranean Europe, it has to overcome the present lack of agreement on approaches and methods that makes meaningful comparisons between regional data difficult or impossible.

THE POPULUS OBJECTIVES

The aim of the POPULUS project, therefore, was to

investigate the feasibility of establishing a common series of research goals and standards in Mediterranean landscape archaeology so as to advance the study of the ancient demography of the region on a broad comparative front. A research network was established at five EU universities, each hosting a Working Party and training a trans-national Research Fellow in a specific sub-discipline within Landscape Archaeology, as follows:

- Prof Graeme Barker (School of Archaeological Studies, University of Leicester, UK) coordinated the overall project, and his colleague Dr David Mattingly coordinated the work of Working Party 1, and the training of the Research Fellow, in **Geographical Information Systems**;
- Dr John Bintliff (Department of Archaeology, University of Durham, UK) coordinated the work of Working Party 2, and the training of the Research Fellow, in **Demographic Modelling**;
- Prof Philippe Leveau (Centre Camille Julian, Université de Provence, France) coordinated the work of Working Party 3, and the training of the Research Fellow, in **Geoarchaeology**;
- Prof Riccardo Francovich (Dipartimento di Archeologia e Storia delle Arti, Università degli Studi di Siena, Italy) coordinated the work of Working Party 4, and the training of the Research Fellow, in **Field-survey Methodologies**, with particular emphasis on ceramic recording, provenancing and dating;
- Prof Marinella Pasquinucci (Dipartimento di Scienze Storiche del Mondo Antico, Università degli Studi di Pisa, Italy) coordinated the work of Working Party 5, and the training of the Research Fellow, in **Remote Sensing**, with particular emphasis on non-invasive techniques of archaeological survey.

The Working Parties were to bring together relevant expertise to define key issues in the methodologies of their research area, with a particular emphasis on the comparison of different research traditions and methods in different European countries. Each Working Party was to organise a Colloquium that would review methodologies and demonstrate best practice. The Research Fellows were to assist in the organisation of the Colloquia, and also to undertake research within their area of expertise and present their results to the relevant Colloquium. In addition, the Research Fellows and other members of the network were to collaborate in a programme of joint fieldwork to demonstrate the practical integration of improved and standardised methodologies in landscape archaeology. The principal outcome of POPULUS was to be the publication of the five colloquia, including the results of the joint fieldwork, together with a technical manual identifying best practice.

THE WORK PROGRAMME

The project started in January 1994 with the first meeting of the Steering Committee, composed of the coordinators in each of the partner universities. The Research Fellows were appointed through 1994: Leicester in January, Durham in April, Aix-en-Provence in April, Siena from February, and Pisa from June. The Working Parties met through 1994 and 1995, and the Research Fellows' training and field research were also undertaken during 1994 and 1995. In 1995 the project was expanded and strengthened with the addition of a team from the Department of Archaeology at the University of Ljubljana in Slovenia coordinated by Dr Predrag Novaković, under a supplementary EU grant (Contract ERBCIPD940624). The Colloquia took place in the autumn of 1995 and spring of 1996, the papers being revised by their authors through 1996, and then being edited at the five universities by the local coordinators and finally at Leicester (including several that were also translated into English after the main editing) by the General Editors during 1997.

THE WORKING PARTIES

The Working Parties were deliberately set up in terms of personnel from the network and from other universities and institutions to reflect the diversity of Community traditions and methodologies in each of the five main areas addressed. Working Party 1 had members from Britain, France, Greece, Holland, Italy, and Slovenia. Working Party 2 had members from Britain, France, Germany, Greece, Holland, Italy, and Slovenia. Working Party 3 had members from Britain, France, Italy, Spain and Slovenia. Working Party 4 had members from Britain, France, Holland, Italy, Spain and Slovenia. Working Party 5 had members from Britain, France, Greece, Italy and Slovenia.

THE RESEARCH FELLOWS

Under the terms of the Human Capital and Mobility programme, the Research Fellows were to be appointed from EU countries other than the designated place of work. This requirement of the Human Capital and Mobility programme was also seen as an extremely positive contribution to the goals of POPULUS, because the mobility of young archaeologists from one Community country to another was an important part of the process of integrating the different European intellectual and methodological traditions in landscape archaeology. The partner institutions proposed individuals where suitable qualified personnel were available, and the posts were also advertised widely through EU universities, museums and state archaeological services. The Leicester Research Fellow in GIS was Dr Jan van Dalen, a Dutch national with a first and second degree at Leiden University, who was

working for the Dutch Archaeological Service on a programme developing GIS for predictive modelling of site distributions to aid their strategies of heritage management. The Durham Research Fellow in Demographic Modelling was Dr Kostas Sbonias, a Greek national with a first degree at Athens University in archaeology, a PhD from Heidelberg University, and extensive postgraduate experience in Greek landscape archaeology projects. The Aix-en-Provence Research Fellow in Geoarchaeology was Dr Kevin Walsh, a British national with a first degree in archaeology and geography at Lampeter University and an MA and a PhD in environmental archaeology at Leicester University. The Siena Research Fellow in Field Survey Methodologies was a British national, Dr Helen Patterson, who had a first degree in archaeology at Reading University and a PhD in ceramic analysis at Sheffield University, the latter with a primary focus on the analysis of medieval ceramics from a field survey and excavation project in Italy. The Pisa Research Fellow in Remote Sensing was a French national, Dr Frédéric Trément, who had a first degree in archaeology at the University of Lille and a PhD at the University of Aix-en-Provence in landscape archaeology. The Ljubljana Research Fellow was a Greek national, Mrs Helene Simoni, with a first degree in classical archaeology at the University of Athens and an MA in Landscape Studies at the University of Leicester. Her MA had included training in GIS, and she was appointed to Ljubljana to receive further training, and then to undertake research, in GIS.

The Research Fellows prepared discussion documents for each meeting of their respective Working Party. For the first meetings they gathered information about current archaeological research in the Mediterranean relevant to the activities of their Working Party, to help define the key issues for the subsequent Working Party meetings and the themes of the Colloquia, and to suggest names of appropriate speakers. In subsequent meetings they reported further developments in this data-gathering exercise, and also reported on their own field research. Supported by their supervisor (the regional coordinator), they were charged with the primary responsibility for the organization of their respective Colloquia including the soliciting of papers, the circulation of pre-prints to discussants, the running of the Colloquia, and liaison with speakers afterwards to secure finalized versions of papers. They also undertook as much of the preliminary editing of the proceedings as possible before the cessation of their contracts. Dr Trément in particular undertook much of the editing of the Aix as well as the Pisa Colloquia after the Aix Research Fellow left the project before the end of his contract for another post, Dr Trément transferring from Pisa to Leicester from February to June 1995 for this purpose. Each Research Fellow contributed an introductory paper to their Colloquium identifying the major strengths and weakness of current methodologies in their area of specialism, and has provided the supplementary information for the Manual of Best Practice. They also undertook field

research that is published as separate Colloquia contributions and/or in publications on specific projects.

THE POPULUS COLLOQUIA

The five Colloquia took place on 13–16 October (Aix), 6–8 November (Leicester), 25–26 November (Durham), 1–3 December (Siena) and 4–6 December (Pisa) in 1995. Each Working Party coordinator was successful in obtaining limited additional funds locally (university, local administration etc) or nationally to augment the POPULUS budget for the travel and accommodation costs of speakers, and the Project Coordinator also secured a grant of £500 from the British Academy towards the travel costs of a speaker from the US attending the Leicester and Durham Colloquia. The Colloquia were structured to enhance debate amongst the different EU traditions of landscape archaeology. All papers were pre-circulated, and the main focus for each paper at most of the Colloquia was a presentation not by the authors of the paper but by a discussant from another country, followed by a brief response by the author(s) and then an open debate amongst the Colloquium participants. All five colloquia were characterized by vigorous but positive and friendly debate, and the papers were re-written by their authors in the light of the discussions and the general themes and issues that emerged.

THE POPULUS VOLUMES

The five Colloquia are being published as a series by Oxbow Books under the title *Mediterranean Landscapes*, with Graeme Barker and David Mattingly as Series Editors. The five volumes are: 1. *Reconstructing Past Population Trends in Mediterranean Europe (3000 BC – AD 1800)* edited by John Bintliff and Kostas Sbonias; 2. *Environmental Reconstruction in Mediterranean Landscape Archaeology* edited by Philippe Leveau, Frédéric Trément, Kevin Walsh and Graeme Barker; 3. *Geographical Information Systems and Landscape Archaeology* edited by Mark Gillings, David Mattingly and Jan van Dalen; 4. *Non-Destructive Techniques Applied to Landscape Archaeology* edited by Marinella Pasquinucci and Frédéric Trément; and 5. *Extracting Meaning from Ploughsoil Assemblages* edited by Riccardo Francovich and Helen Patterson. The POPULUS volumes bring together a remarkable array of EU expertise in current approaches to Mediterranean landscape archaeology: the papers present the researches of 30 British, 4 German, 6 Dutch, 27 French, 4 Greek, 35 Italian, 8 Slovenian, and 6 Spanish scholars, as well as those of 11 Canadian/US scholars working in the region. They bridge the disciplinary and national boundaries that have mitigated against the development of a coherent methodology in Mediterranean landscape archaeology. The contents are as follows:

1. Reconstructing Past Population Trends in Mediterranean Europe (3000 BC – AD 1800)

edited by John Bintliff and Kostas Sbonias

ARCHAEOLOGICAL SURVEY AND DEMOGRAPHY:

1. *Introduction to issues in demography and survey.* Kostas Sbonias.
2. *Regional field surveys and population cycles.* John Bintliff.
3. *Counting people in an artefact-poor landscape: the Langadas case, Macedonia, Greece.* Stelios Andreou and Kostas Kotsakis.
4. *Demographic trends from archaeological survey: case studies from the Levant and Near East.* Tony Wilkinson.
5. *Archaeological proxy-data for demographic reconstructions: facts, factoids or fiction?* John Chapman.
6. *An attempt at the demographic interpretation of long-term settlement processes in the prehistory of Slovenia: the case of the 'archaeological map of Slovenia'.* Predrag Novaković.
7. *Prospection archéologique et démographie en Provence: approche paléodémographique de la Rive Occidentale de l'Etang de Berre sur la longue durée.* Frédéric Trément.
8. *Demography and Romanization in central Italy.* Franco Cambi.
9. *Beyond historical demography: the contribution of archaeological survey.* Simon Stoddart.

INTERDISCIPLINARY APPROACHES:

10. *Chance and the human population: population growth in the Mediterranean.* Ezra Zubrow and Jennifer Robinson.
11. *The potential of historical demography for regional studies.* Malcolm Smith.
12. *Clearing away the cobwebs: a critical perspective on historical sources for Roman population history.* Tim Parkin.
13. *The population of Roman Italy in town and country.* Elio Lo Cascio.
14. *Documentary sources for the history of medieval settlements in Tuscany.* Maria Ginatempo and Andrea Giorgi.
15. *The Ottoman Imperial Registers: central Greece and northern Bulgaria in the 15th–19th centuries – the demographic development of two areas compared.* Machiel Kiel.
16. *Investigating the interface between regional survey, historical demography and palaeodemography.* Kostas Sbonias.
17. *The contribution of palaeoanthropology to regional demographic history.* C. A. Marlow.
18. *Problems and prospects in palaeodemography.* Claude Masset.
19. *Relating cemetery studies to regional survey: Rocca San Silvestro, a case study.* Riccardo Francovich and Kathy Gruspier.
20. *Counting heads: an overview.* Jeremy Paterson.

2. Environmental Reconstruction in Mediterranean Landscape Archaeology

edited by Philippe Leveau, Frédéric Trément, Kevin Walsh and Graeme Barker

1. *Mediterranean landscape archaeology and environmental reconstruction.* K. Walsh
2. *Landscape archaeology and reconstruction of the Mediterranean environment based on palynology.* S. Bottema
3. *A computerized database for the palynological recording of human activity in the Mediterranean basin.* V. Andrieu, E. Brugiapaglia, R. Cheddadi, M. Reille and J.-L. de Beaulieu
4. *Reconstructing vegetation and landscapes in the Mediterranean: the contribution of anthracology.* J.-L. Vernet
5. *Some examples of climatic reconstruction in the Mediterranean using dendroclimatology.* F. Guibal
6. *Geomorphological techniques in Mediterranean landscape archaeology.* A. G. Brown
7. *L'apport de la micromorphologie des sols à la reconstitution des paléopaysages (Application au bassin méditerranéen pour la période 3000 av. J. C. – 1800 ap. J. C.).* N. Fédoroff
8. *Reconstructing past soil environments in the Mediterranean region.* R. S. Shiel
9. *Energy dispersive X-ray micro-analysis and the geochemistry of soil sediments.* D. D. Gilbertson and J. P. Grattan
10. *Searching for the ports of Troy.* E. Zangger, M. Timpson, S. Yazvenko and H. Leiermann
11. *Case studies from the Pontine region in central Italy on settlement and environmental change in the first millennium BC.* P. Attema, J. Delvigne and B. J. Haagsma
12. *Karst dolinas: evidence of population pressure and exploitation of agricultural resources in karstic landscapes.* P. Novaković, H. Simoni and B. Mušić
13. *Archeologia ambientale padana: un caso di studio – la pianura padana centrale tra il Bronzo medio ed il Bronzo finale (xvi–xiii sec. a. C.).* M. Cremaschi.
14. *Human impacts and natural characteristics of the ancient ports of Marseille and Fos, Provence, southern France.* C. Vella, C. Morhange and M. Provansal
15. *Developing a methodological approach to the evolution of field systems in the middle Rhône valley.* J.-F. Berger and C. Jung

16. *Progradación fluvial y cambios en la línea de costa en época histórica en el Golfo de Valencia (España)*. P. Carmona
17. *The integration of historical, archaeological and palaeoenvironmental data at the regional scale: the Vallée des Baux, southern France*. P. Leveau
18. *The integration of historical, archaeological and palaeoenvironmental data at the regional scale: the Étang de Berre, southern France*. F. Trément
19. *Geoarchaeology in Mediterranean landscape archaeology: Concluding comments*. G. Barker and J. Bintliff.

3. Geographical Information Systems and Landscape Archaeology

edited by Mark Gillings, David Mattingly and Jan van Dalen

1. *Introduction* Mark Gillings and David Mattingly.

GIS AND ARCHAEOLOGY

2. *Geographical Information Systems: today and tomorrow?* Peter F. Fisher.

GIS AND ARCHAEOLOGICAL THEORY

3. *GIS and landscapes of perception* Robert Witcher
4. *Cartography and landscape perception: a case study from central Italy* Peter Attema.

THEORY AND METHOD

5. *Regional survey and GIS: the Boeotia Project* Mark Gillings and Kostas Sbonias
6. *Towards a methodology for modelling surface survey data: the Sangro Valley Project* Gary Lock, Tyler Bell and John Lloyd
7. *Between spaces: interpolation in archaeology* Jennifer M. Robinson and Ezra Zubrow.

GIS AND FIELD SURVEY DATA

8. *GIS-based analysis of the population trends on the island of Brač in central Dalmatia* Zoran Stančić and Vincent Gaffney
9. *Analyzing Rome's hinterland* Martin Belcher, Andrew Harrison and Simon Stoddart
10. *Reconstructing the population history of the Albegna Valley and Ager Cosanus, Tuscany, Italy, in the Etruscan period* Philip Perkins.

DEVELOPING TECHNIQUES AND APPROACHES:

11. *Probability modelling: a Bayesian and a geometric example* Jan van Dalen
12. *Multispectral classification of satellite images* Krištof Oštir, Zoran Stančić and Majda Trušnovc
13. *Geographic Information Systems and archaeology: methodological aspects of the presentation and display of results* Javier Baena Preysler, Concepcion Blasco, Javier Espiago, Alberto Rio

4. Non-Destructive Techniques Applied to Landscape Archaeology

edited by Marinella Pasquinucci and Frédéric Trément

1. *L'apport des méthodes non destructives à l'analyse des sites archéologiques: le point de vue de l'archéologue*. F. Trément.

REMOTE SENSING

2. *Télé-détection et archéologie. Concepts fondamentaux, état de l'art et exemples*. B. Marcolongo and E. Barisano.
3. *Environmental studies through active and passive airborne remote sensing systems*. R. M. Cavalli, C. M. Marino and S. Pignatti.
4. *Metodi di telerilevamento in archeometria e nella diagnostica non invasiva*. A. Tonelli.
5. *Aerial archaeology around the Mediterranean*. B. Jones.
6. *Détection aérienne des camps néolithiques en Languedoc occidental*. J. Vaquer.
7. *La restitution des parcellaires anciens et des limitations antiques à partir des techniques de la télé-détection et du traitement d'images*. D. Charraut and F. Favory.
8. *Digital classification and visualization systems of archaeological landscapes*. M. Forte.

GEOPHYSICS

9. *The IGAPS Project: integrated geophysical acquisition and processing system for cultural heritage*. D. Patella, S. Piro, L. Versino, F. Cammarano, R. Di Maio and P. Mauriello.
10. *La mesure de la résistivité (ou de la conductivité) électrique du sol en prospection archéologique*. A. Hesse.
11. *Magnetic techniques applied to archaeological survey*. D. Jordan.

12. *Radar (G. P. R.) methods for historical and archaeological surveys.* E. Finzi and S. Piro.
13. *Seismic methods.* L. Sambuelli and G. P. Deidda.
14. *The role of gravity surveys in archaeology.* M. Di Filippo, T. Ruspandini and B. Toro.
15. *Acoustic methods in archaeology: prospecting on a site of Parco Marturanum.* G. B. Cannelli, E. D'Ottavi and A. Alippi.
16. *Integration of high resolution georadar and geoelectrical methods: detection of subsurface shallow bodies.* S. Piro.
17. *Filtrage numérique des données géophysiques.* J. Tabbagh.

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19. *Soil geochemistry and artefact scatters in Boeotia, Greece.* J. N. Rimmington.

SURFACE COLLECTION OF ARTEFACTS

20. *The concepts of 'site' and 'off-site' archaeology in surface artefact survey.* J. Bintliff
21. *The comparison of surface and stratified artefact assemblages.* M. Millett
22. *Définition ou hiérarchisation des sites? Approche intégrée en Gaule méditerranéenne.* F. Favory and C. Raynaud.

INTEGRATED STUDIES

23. *The Pisa territory project.* E. Marchisio, M. Pasquinucci, E. Pranzini and G. Vigna Guidi.
24. *Two examples of using combined prospecting techniques.* D. Grosman.
25. *Expérience de croisement de méthodes de prospection sur le site des Girardes à Lapalud (Vaucluse, France).* F. Trément (avec la collaboration de P. Clogg, P. Druelle, G. Ducomet, J.-P. Mariat and J. Taylor).

GENERAL ISSUES

26. *Du site au réseau: archéologie, géographie spatiale ou géographie historique.* Ph. Leveau.

5. Extracting Meaning from Ploughsoil Assemblages

edited by Riccardo Francovich and Helen Patterson

INTRODUCTION

1. *Extracting meaning from ploughsoil assemblages: assessments of the past, strategies for the future.* S. Alcock.

METHODOLOGY

2. *Methods of collection, recording and quantification.* D. Mattingly
3. *Cultural depositional processes and post-depositional problems.* J. Taylor, with comments by Peter van Dommelen.
4. *Ceramics and the site: is survey enough?* Vincent Gaffney.
5. *What are we counting for?* Elizabeth Fentress.
6. *Dating, quantifying and utilizing pottery assemblages from surface survey.* Martin Millett.
7. *The visibility of sites and the interpretation of field survey results: towards an analysis of incomplete distributions.* Nicola Terrenato.
8. *Quando i campi hanno pochi significati da estrarre: visibilità archeologica, storia istituzionale, multi-stage work.* Franco Cambi.
9. *Prospection et chronologie: de la quantification du temps au modèle de peuplement. Methodes appliquées au secteur des étangs de Saint-Blaise (Bouches-du-Rhone) France.* Frédéric Trément.
10. *Discussion.* Martin Millett.

CERAMIC STUDIES IN MEDITERRANEAN SURVEY

11. *The current state of prehistoric ceramic studies in Mediterranean survey,* Caroline Malone and Simon Stoddart
12. *The current state of Roman ceramic studies in Mediterranean survey, or, handling pottery from surveys.* John W. Hayes.
13. *The current state of early medieval and medieval ceramic studies in Mediterranean survey.* Helen Patterson.

CASE STUDIES:

14. *Surface survey analysis of the copper ages site of La Pijotilla (Spain).* Victor Hurtado.
15. *On-site surface distributions and geophysics: the site of Rodik-Adjovscina.* Božidar Slapšak, Branko Mušič, and Verena Perko
16. *La ceramica preromana come indicatore di processi socio-economici: il caso dell'Italia medio-tirrenica.* Andrea Zifferaro, with comments by Alessandro Guidi.
17. *Ceramic chronology and Roman rural settlement in the lower Guadalquivir Valley during the Augustan period.* Simon Keay.

18. *Terracotta and its territory: a tormented relationship*. Franco Cambi.
19. *The Adriatic Islands Project: contact, commerce and commercialization*. Vincent Gaffney, Branco Kirigin, John W. Hayes, and Peter Leach.
20. *De la fouille à la prospection, et retour: céramologie et histoire du peuplement dans la cité de Nîmes*. Claude Raynaud.
21. *Il rapporto fra superficie e sottosuolo; dal survey allo scavo: insediamento e circolazione ceramica fra V e X secolo nella Toscana centro-meridionale*. Riccardo Francovich and Marco Valenti.
22. *Reconstructing the classical landscape with figures: some interpretive explorations in North-West Keos*. Todd Whitelaw.
23. *Demographic trends: the contribution of regional survey data*. John Bintliff and Kostas Sbonias.
24. *Conclusion*. Susan E. Alcock, Franco Cambi, Simon Keay, and Claude Raynaud.

SCIENTIFIC OUTCOMES

All five working groups in the POPULUS network were able to agree on areas of best practice, whilst eschewing the idea of a 'cookbook' approach to methodologies in landscape archaeology, the results of which have been incorporated into the Manual of Best Practice that is currently in the final stages of completion. Its future use by Community archaeologists working in Mediterranean landscape archaeology will be the ultimate test of the effectiveness of the POPULUS project in integrating the best of the diversity of current methodologies in the discipline.

During the discussions of the Working Parties, several alternative views were expressed about the way regional archaeological research and landscape archaeology should be conducted. At one end of the spectrum were some archaeologists who advocated that they (the archaeologists) should enlist a battery of natural scientists and tap into their results for the purpose of understanding the environmental context of an excavation or survey record. At the other end of the spectrum were some geographers who proposed that they (the scientists) should run the regional archaeological projects, the head scientist being partnered by an archaeologist. As Graeme Barker and John Bintliff comment at the end of the Aix-en-Provence volume *Mediterranean Landscape Archaeology 2*, the conclusion from the Colloquia is that both these positions lack one fundamental component: where do we find the interpretative approaches for the human-landscape interaction that constitutes the prime reason that these many specialists are working alongside each other? The work of the POPULUS network has emphasized the enormous potential of effective partnerships between broad-based teams of geoarchaeologists and modern intensive survey teams. Reconstructing the history of Mediterranean landscape change and demography certainly needs natural scientists to analyze the changing forms of the landscape, and archaeologists to analyze changing settlement morphologies and systems. To *understand* that history, however, in terms

of the interactions between landscape and people, and the perceptions, choices and adaptations that have underpinned human actions, will need effective partnerships between broad-based teams of archaeologists, geoarchaeologists, historians, and anthropologists. The greatest challenge of inter-disciplinary landscape archaeology in the Mediterranean in the coming years will be how to bridge the divide between the ecological approaches of the natural sciences to past landscapes, on the one hand, and the concerns of social archaeologists on the other with the interface between human actions and landscape.

In terms of modelling major trends in Mediterranean landscape history, one consistent theme for teams working in the eastern and western Mediterranean emerging from the POPULUS network is evidence for settlement shifts, population increase and agricultural intensification in the third millennium BC, and the extent to which these changes coincide with and are related to marked increases in the scale of human impact on sediments and vegetation and/or with climatic change. Regional inter-disciplinary landscape projects are also contributing as profoundly to our understanding of the impact of Roman imperial expansion and subsequent Romanization on the human and natural landscapes of the Mediterranean. Another central concern is the relative impact of climatic fluctuations and human impact in terms of dramatic environmental change: here, one significant weakness of current work is the lack of emphasis on investigating the prehistory and history of Mediterranean uplands. Some of the major landscape changes we can now detect in the Mediterranean region were the result of gradual long-term processes, others may have been caused by catastrophic events of short duration and very long recurrence intervals. The widespread application of dating techniques such as luminescence and palaeomagnetism in the coming years is likely to have an enormous impact in this respect: more refined chronologies seem likely to emphasize different rates of landscape change rather than uniformity, with profound implications for our understanding of human interactions with their landscape.

ENVIRONMENTAL RECONSTRUCTION
IN MEDITERRANEAN LANDSCAPE
ARCHAEOLOGY

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18. The Integration of Historical, Archaeological and Paleoenvironmental Data at the Regional Scale: the Étang de Berre, Southern France

Frédéric Trément

INTRODUCTION

An investigation carried out between 1987 and 1993 of settlement patterns and landscape development on the western side of the Étang de Berre, the lagoon system on the eastern side of the Rhone delta in southern France, forms the basis for a consideration of the integration of different methods of landscape archaeology on a micro-regional scale (Trément, 1994 and in press, a). It provides an example of a systematic, diachronic, and interdisciplinary study applied to a restricted area (100 km²), in order to analyze as closely as possible the complex interrelations between social systems, geosystems, and ecosystems.

THE CHOICE OF THE MICRO-REGIONAL APPROACH

The archaeological map of the area in question has not been updated since the *Forma*. Nevertheless, a study carried out in 1973 under the direction of P.-A. Février (Vigoureux, 1973), the research of local scholars, and the surveys of Bouloumié and Soyer (1990), have shown the great potential of the area. It would be difficult to imagine otherwise, given the importance of the known sites, most of which have been excavated. These include the well-known protohistoric sites of Saint-Blaise and Ile de Martigues, the early prehistoric sites of Abri Cornille, Abri Capeau and Mourre Poussiou, the neolithic village of Miouvin, the iron age *oppidum* of Castellan, and the Roman port of Fos (mentioned in the Peutinger Tables) discussed in Chapter 16. These major sites, cited and used by archaeologists in their arguments about regional population, trade, the process of urbanization, and the relationship between Greeks and locals, appear to be completely isolated and incomprehensible on a micro-regional level. Thus it was necessary, at this level, to insert them into their contemporaneous rural context. By context I mean both archaeological context and also landscape context.

The archaeological context was gained by means of survey and the landscape context through a series of interdisciplinary collaborations ('Actions Thématiques Programmées') in the area around the Étang de Berre, coordinated by Philippe Leveau.

The *oppidum* of Saint-Blaise was at the centre of the problem (Fig. 18.1). A detailed study of the bibliography of the site enabled me to rephrase a number of the questions formulated over the last few decades, including about salt production and the port of Saint-Blaise, first raised by Benoit (1965) then by Bouloumié (1984). A study of the local historiography has shown that the hypotheses advanced were influenced by a fanciful historical geography invented in the nineteenth century by the authors of the *Statistique des Bouches-du-Rhône*. In fact, the legend of a communication between the lakes and the sea during classical antiquity, based on an ancient tradition that Saint-Blaise was formerly a port on the Étang de Lavalduc, originated with N. Toulouzan (Villeneuve, 1824: pl. X, 9). Onto this imaginary historical geography was projected the medieval and modern image of the exploitation of salt in the lakes, reference to which can be traced back as far as 739.

The failure of archaeological excavations to prove these hypotheses has led to search elsewhere for answers, in this case at the bottom of the lakes, where the real questions have become: were the lakes always saline? were they salty during the period of occupation of Saint-Blaise? was the Étang de Lavalduc open to the sea at any other time? is the altitude of Saint-Blaise compatible with the hypothesis that it was a port?

Some time ago, P. Arcelin undertook a reconsideration of the site of Saint-Blaise, placing it securely within the framework of local indigenous population patterns (Arcelin, 1986). I propose to reduce the perspective even more and focus on a limited area but over a longer time period, changing the scale of the study in order to place the site in its territory (or at least its food-producing territory).

The choice of an intensive interdisciplinary and diachronic study of a geographically-reduced area implied

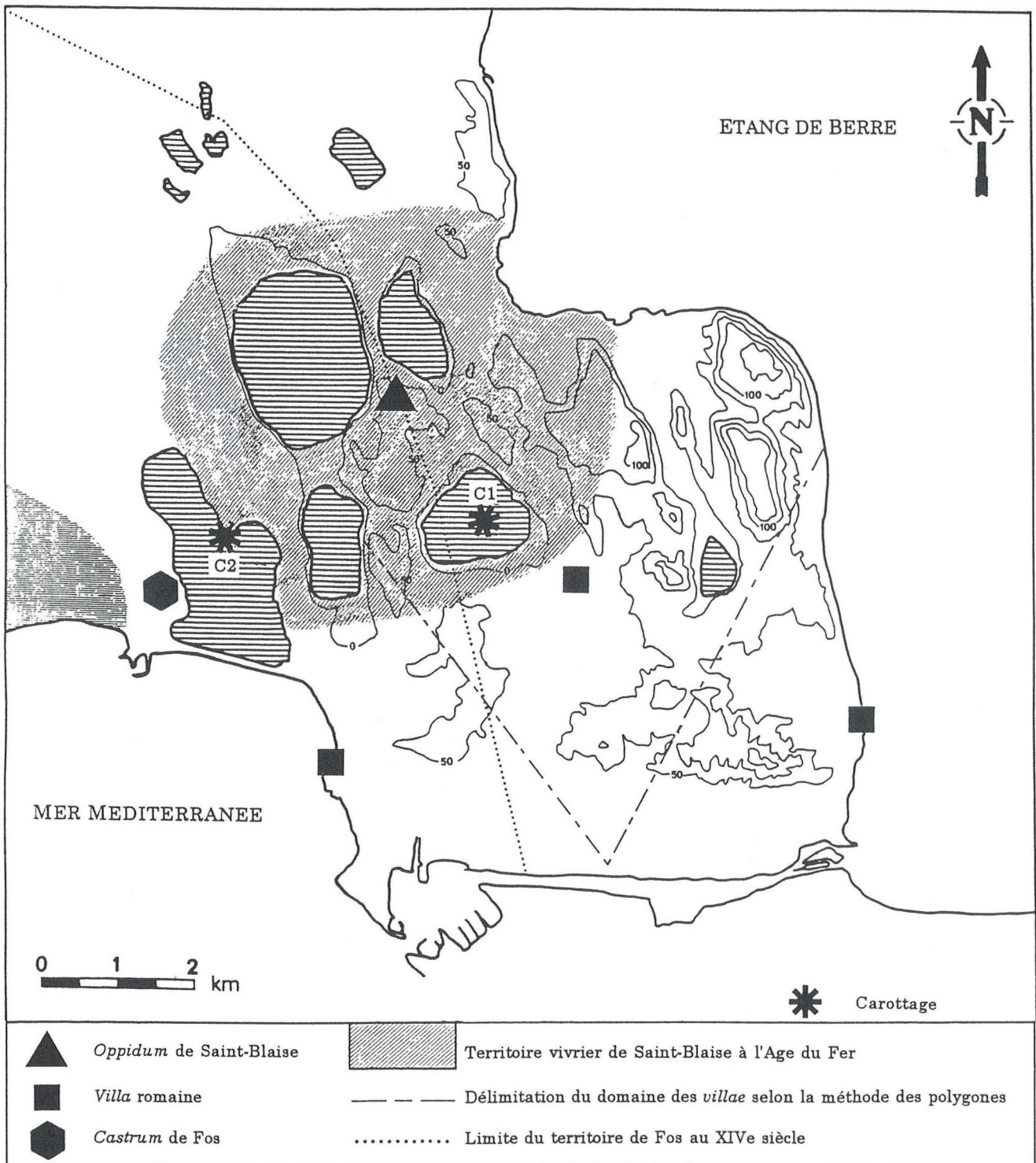


Fig. 18.1. The Etangs west of the Etang de Berre, showing the location of the main archaeological sites mentioned in the text, and of the pollen cores from the Étang de Pourra (C1) and the Étang de l'Estomac (C2), with the estimated territory of the Saint-Blaise iron age oppidum shown in grey, the boundaries of villa estates (according to Thiessen polygon calculations) shown as dashed lines, and the boundary of Fos' territory in the fourteenth century shown as a dotted line.

a collaboration between different specialists through reciprocal exchanges of information, while maintaining their independence. This process that could have resulted either in the integration of ideas or chaos, so it was necessary for each to define the major lines of inquiry. From the point of view of an historian or an archaeologist, the different aspects of the relationship between human beings and the environment can be approached from a triple perspective:

- the definition of a 'natural environment' in which the people exist and which conditions their activities – habitat and food production or other productive activities;
- the human exploitation of the environment – agriculture, stock rearing, hunting, fishing, craft production, industry (at this level the demographic factor is essential);
- the impact of these activities on the environment – deforestation, clearance, erosion, drainage, terracing and so on.

These three points of view are interlinked and interdependent: the humanized environment in turn conditions the human activities, which then result in new types of impact on the environment.

BACKGROUND AND METHODOLOGIES

The excavations at the prehistoric sites of Abri Cornille, Mourre Poussiou and Miouvin, together with the proto-historic and medieval sites of Saint-Blaise and the Ile de Martigues, have already allowed us to pose some questions about the relationship between people and environment. The animal bones, plant remains, molluscs and charcoal ecofacts, particularly from Ile de Martigues, have given us some answers for the Iron Age and the end of classical antiquity (Chausserie-Laprée and Nin, 1988). Surveys carried out some time ago have also given us some evidence, in an intuitive manner, of a clear correspondance between geology and ancient settlement types (Vigoureux, 1973). Finally, the work of historians has concentrated on medieval settlement (Lagrue 1988), medieval and modern salt exploitation (Balzano, 1987; Rolland 1940), and olive cultivation (Fabre, 1988).

The setting up of a series of interdisciplinary research programmes round the Étang de Berre gave me the opportunity to draw attention to the archaeological and palaeoenvironmental potential of the Saint-Blaise area. Three successive programmes were carried out: A.T.P. du PIREN: 'Histoire de l'Environnement et des Phénomènes Naturels': *Mobilité des Paysages et Histoire de l'Occupation du Sol des Rives de l'Etang de Berre, 1986–1988*; *Systèmes Agricoles et Evolution du Paysage depuis le Néolithique au Nord-Est de l'Etang de Berre, 1988–1990*; and Appel d'offre: 'Grands Projets d'Archéologie Métropolitaine': *Archéologie et Histoire*

de l'Occupation du Sol sur les Rives Occidentales et Méridionale de l'Etang de Berre, 1991–1992.

From an archaeological point of view, the density and continuity of occupation allowed for the quantification of human impact on the environment, over a long, finely-calibrated, time period. From a palaeoenvironmental point of view, the characteristics of the closed basins which are typical of this sector (size, negative altitude, watertightness, variability of the lakes, and salinity), make them, *a priori*, excellent recorders of climatic change, landscape change, and human impact on landscape through the Holocene. For these reasons, a team of students under the direction of Mireille Provansal carried out a study of several sectors which were both representative of the local landscape and also related to archaeological problems (Bertucchi and Pelissier, 1991; Bonnefoux, 1992; Iardino-Lamazou and Meyer 1987; Provansal *et al.* 1993).

It became necessary to increase the range of methods and intensify their application. A series of systematic surveys was therefore undertaken in order to study in detail the development of settlement patterns. These were followed by a research excavation of a Roman agricultural site dating to the early Empire, representative of the small dispersed settlements which complemented the villas of that period (Trément, 1997). Several sondages confirmed the validity of the interpretation of the surface finds, which could thus be 'calibrated'. The analysis of the faunal assemblage from the Soires excavation (Columeau, 1997), together with the study of the shellfish from the midden at Clapières (Trément and Brien-Poitevin, 1989), complemented the study of assemblages from the Iron Age and the High Middle Ages by Columeau (1993) and Brien-Poitevin (1993). A core sample was taken in the Étang de Pourra in 1989, in order to try to reconstruct the environment over a long time period. This core was studied by a geomorphologist from the Institute of Geography, together with two palynologists from the Historical Botany and Quaternary Palynology Laboratory and a sedimentologist from the Geosciences and Environment Laboratory (Laval *et al.* 1992; Fig. 18.2).

THE INTEGRATION OF THE DATA: STRATEGY, PROBLEMS AND LIMITS

Strategy of integration

The procedures adopted in the study area had to reconcile two different approaches to the environment corresponding with two different spatio-temporal scales: on the scale of an excavated site, the paleoecological and archaeological information is precisely calibrated in time but is only representative of a restricted area (the surrounding land, the territory) and is also biased by human selection processes; on a micro-regional scale, its evolution can only be seen as a whole, over a long period of time. This last type of approach has a double advantage. First, it

allows us to understand the evolution of the landscape and the consequences of human action in a realistic fashion, rather than through specific analyses of archaeological contexts which represent an environment inevitably altered by human action. Secondly, the division of the study area into a series of independent basins created the possibility that different functions might be recognized in each, which could be related to differing local modes of occupation.

Two cases were investigated. The first shows that spatially-different human activities can be reconstructed on a micro-regional scale through comparative analyses of sedimentation in different basins (Fig. 18.1): the Étang de Pourra went through a phase of prolonged emersion, which seems to represent the combined effect of the climate in classical antiquity and the attempts by the owners of the nearby villa of Péricard (SM-34) to drain the lake and bring the land into cultivation. This event is not recorded in the adjacent lakes situated outside the villa's estate. On the other hand, the increased erosion in the twelfth century observed in the Étang de l'Estomac is perhaps related to clearances, initiated in this period, by the population of the *castrum* of Fos, whose territory surrounds the lake. These results show the potential of an interdisciplinary study of political and social space.

Conversely, the second case proves that, despite human intervention, the major variations in lake levels were primarily conditioned by climatic fluctuations: in effect, there was parallel evolution of the different lakes over the long term. If the ancient low water levels of the Étang de Pourra in antiquity can be explained by attempts at drainage, the same cannot be said for the low levels in the Étang de Lavalduc and the Étang d'Engrenier, the bottoms of which are at a height of 14.50 and 11.80 m above sea level respectively, which made drainage impossible with the techniques available at the time. In contrast, the high post-medieval levels of these latter two lakes can be explained by overspill from the Canal de Craponne; however, the Étang de Pourra, which received no artificial addition of water, also had a high water level at that period. Therefore, it seems likely that changes in water levels were largely the result of the dry climatic fluctuation in classical antiquity and the humid fluctuation of the Little Ice Age.

Dates, resolution and time scales

The integration of data from different disciplines is largely reliant on the ability to correlate the bioclimatic and anthropic chronological sequences. This correlation is extremely delicate on three counts, which are discussed below in turn.

The heterogeneity of the dating methods

The different dating methods used by the various disciplines are both qualitative and quantitative. Texts can provide absolute calendar dates. Excavation and survey give variable date ranges, but generally about 50 years, or indeed, as in the case of the treatments used here, about a

generation. Geoarchaeological and archaeozoological data obtained from archaeological contexts are obviously dependent on archaeological dating methods. The geomorphological sections can also use artefacts as *termini*, but the chronological precision is very variable: for example, a deposit is referred to as being 'post-antique'. In the long core sequences, such as the one from Pourra, the absence of artefacts means that it is necessary to resort to other methods, such as radiocarbon dating or pollen chronozones. Two radiocarbon dates from organic material were obtained from the base of the Pourra core: 14800 BP \pm 290 (Ly5254) at level 480 and 13180 BP \pm 260 (Ly5263) at level 350. Taking into account the organic nature of the sediment dated, the dates probably need to be shifted forward one or two millennia (J. Evin, *pers. comm.*). This correction allows the base of the sequence to be situated in a late interglacial. The dating of the upper half of the core is dependent on the chronology of the pollen zones defined for Provence by H. Laval (Triat-Laval, 1978). In particular, it is based on the appearance and development of *Abies* pollen around 6500/6000 BP and *Fagus* pollen around 4700/4500 BP.

The discontinuity of cultural and bioclimatic sequences

Time is not recorded in a continuous and homogeneous fashion in archaeological and sedimentary deposits. The information conserved is partial and it is therefore necessary to take into account the inevitable gaps that occur: pauses in sedimentation for the geomorphologist, abandonment of occupation for the archaeologist. According to the palynologists, the end of the Pleistocene and the beginning of the Holocene are missing in the Pourra core (Laval *et al.*, 1992). A hiatus can also be envisaged for part of the upper sequence, where the appearance of *Fagus*, generally placed at the beginning of the Subboreal c.4500 BP, coincides with the expansion of *Quercus ilex* from level 130, whereas their development is usually separated in time. The sedimentary pause observed during part of the Iron Age and classical antiquity is also the reason for a relative lack of information about human activity and landscape change in this period. Erosion can also affect archaeological levels, but this increases the readability of the sites on the surface. In fact, survey is an excellent way to analyze the periods of settlement pattern change, when the conditions are favourable. This is true for the Saint-Blaise area, where the composition of the total finds assemblage (finewares, coarsewares and amphorae) has allowed a better understanding of the strong continuity of habitation from the Lower Empire to the beginning of the Early Middle Ages. Finally, the sampling of a stratigraphic profile introduces another level of discontinuity: it can help to mask certain details and thus lead to incorrect interpretations of continuity or change.

The differential chronologies of bioclimatic and anthropic processes

The developments studied by the different disciplines act

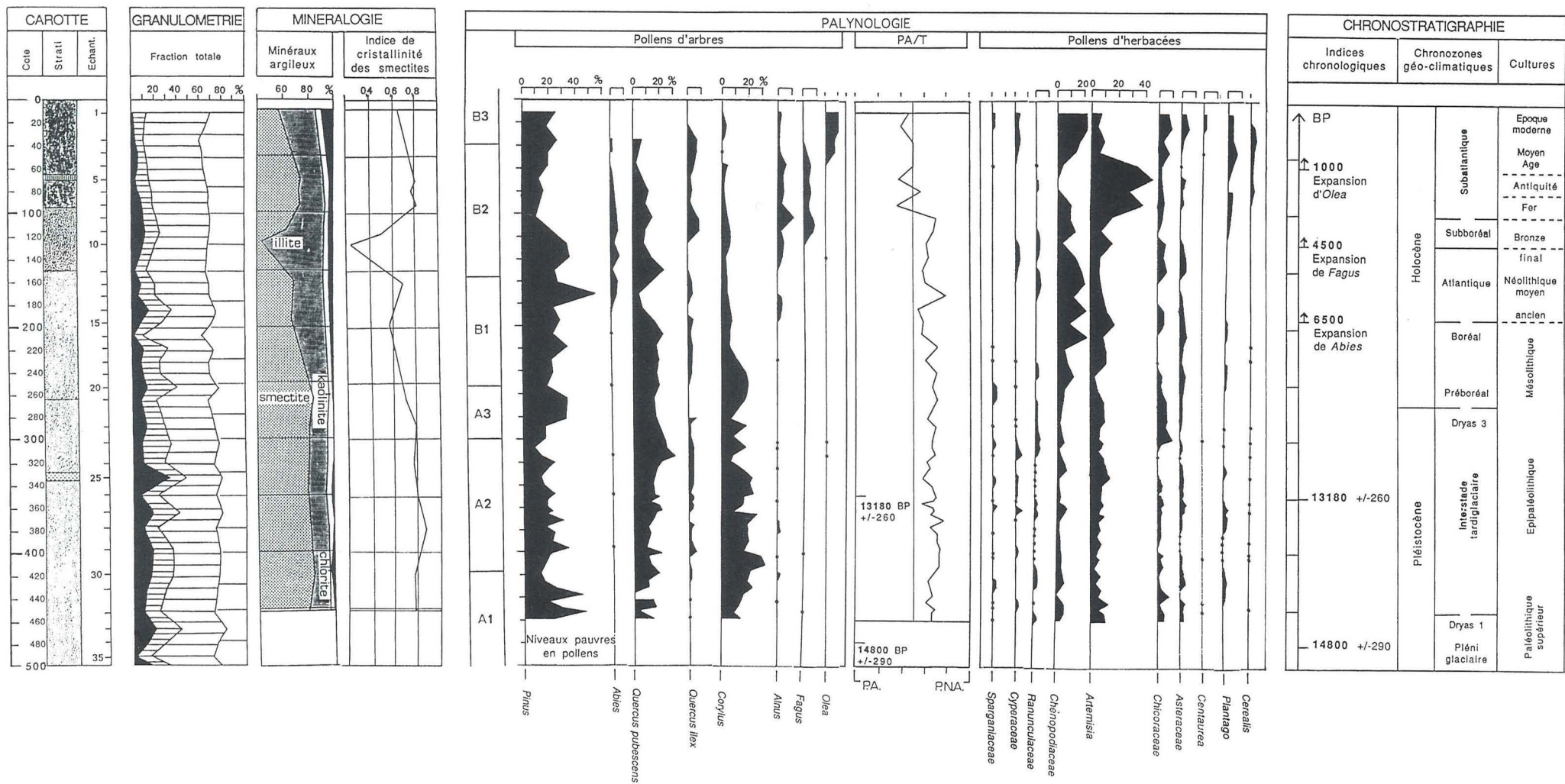


Fig. 18.2. Palyno-sedimentological diagram of the core from the Étang de Pourra

on very variable time scales. The distinction between 'geological time' and 'human time' is not one of chronological succession but of a difference in scale. Within the historical period, Braudel (1958) and Le Roy-Ladurie (1967) have distinguished different 'temporalities'. These temporalities combine their effects in a complex manner: for example, there is no strict parallelism between climatic and vegetation cycles — from the moment that humans interfered with the vegetation cover through clearance, agriculture and pastoralism, a new rhythm was imposed on it, thus increasing the complexity of the chain of causalities. For reasons explained in the earlier two points, the non-coincidence of bioclimatic and cultural temporalities with the scale of chronological resolution can lead to erroneous interpretations.

This is the case when one tries to relate the development of rural habitation in classical antiquity to historical references to invasions. Although the arguments can be accepted on a very general level — that of the Empire (though with many reservations) — it is inappropriate on a micro-regional scale. The perfection of a system of dating sites in bands of twenty years has allowed the recognition of developments in the study area outside of the conventional chronological framework, founded on a political and factual history with little relevance to the reality of the countryside (Trément, in press, c). The study of the Pourra core shows that there is no simple direct relationship between phases of agricultural expansion and the onset of periods of increased erosion. The consideration of 'cycles' and 'phases' has been enriched by integration with the concept of 'thresholds' (Provansal and Morhange, 1994).

Differential spaces and spatial scales

The above remarks could also be applied to the spatial dimension. The space 'perceived' through the techniques used does not obviously correspond with the space 'lived' by the inhabitants of that period. Also, it is necessary to split that which concerns the analytical techniques and that which deals with bioclimatic and anthropic processes. Several problems arise.

For example, the space perceived by the researcher is discontinuous and partial. For example, on the archaeological map, the urban and industrial zones and the transport infrastructure represent 'blank' areas, where information is either inaccessible or has been destroyed. Natural phenomena can also result in the disappearance (real or apparent) of sites: the Holocene rise in sea levels, the rise in lake levels, or erosive activity, affect to a greater or lesser degree the visibility of sites on the surface, leading to an over-representation of the most eroded sites and the masking of buried sites. Finally, sampling splits up the perceived space and makes it appear more mixed. In the study area only about 6600 ha out of a total of 10500 ha were available for survey; 34 per cent of this available area was surveyed, ten per cent in a systematic fashion. The site

density varied from two to twenty per km² between the systematically surveyed and the less intensively surveyed areas. If the results of the surveys carried out in the different landscape units are compared, these differences are no more than about one to three, and are thus more likely to correspond to a real discontinuity of 'lived' space.

The second problem concerns the different spaces of bioclimatic and human processes. Archaeological evidence, ecofacts and palaeoenvironmental markers inform us about more or less extensive spaces. For example, to take two extreme examples in the domain of palynology, the *Pinus* pollen curve in the Pourra core reflects the evolution of pine forests not just in the study area, but in the whole region, as pine produces large quantities of pollen which can be transported a very long way, whereas at the other extreme, cereals produce a small amount of pollen which does not travel far, so is the most representative on a micro-regional scale (Janssen, 1966). There is a similar problem with ecofacts, since their presence in archaeological contexts is the result of selection through animal husbandry, mollusc collection or wood collection. In all these cases, it is only possible to learn about the qualitative evolution of the species consumed (animals, shellfish, wood) and not their overall quantity. For example, it is impossible to know what quantities of beef or mussels were consumed at Ile de Martigues in the second century, while the food consumption between the fifth and second centuries BC is relatively clearly understood (Chausserie-Laprée and Nin, 1988). Consequently, it is impossible to know the size of the herds and therefore the size of the pastures. Only through a comparison of data from different sites is it possible to illustrate the general or particular character of a phenomenon recognized on a site.

Returning to the example of Ile de Martigues in the second century, the palaeoecological and archaeozoological evidence clearly indicates the imbalance between population and resources, with the increasing importance of hunting, the diversification and intensification of shellfish collection, the growth of barley cultivation, and probably the extension of clearance. It is tempting to associate the increased food collection with the complete restructuring of the village at the beginning of the second century. The appearance of new needs can be explained by an increase in the local population due to the regrouping of hitherto-dispersed communities, or by real demographic pressure. However, a comparison with Saint-Blaise means that the second hypothesis has to be refined: the stability of the consumption structure at this site, confirmed by the lack of evidence for erosion in the adjacent drainage basin of the Étang de Pourra, shows a better balance in the exploitation of food resources (Columeau, 1993).

On a larger intra- and inter-regional scale, the question is to determine whether certain events are particular to the study area or illustrate processes happening on a larger scale. This question was applied to the forms of Roman habitation. The adoption of the descriptors used in the

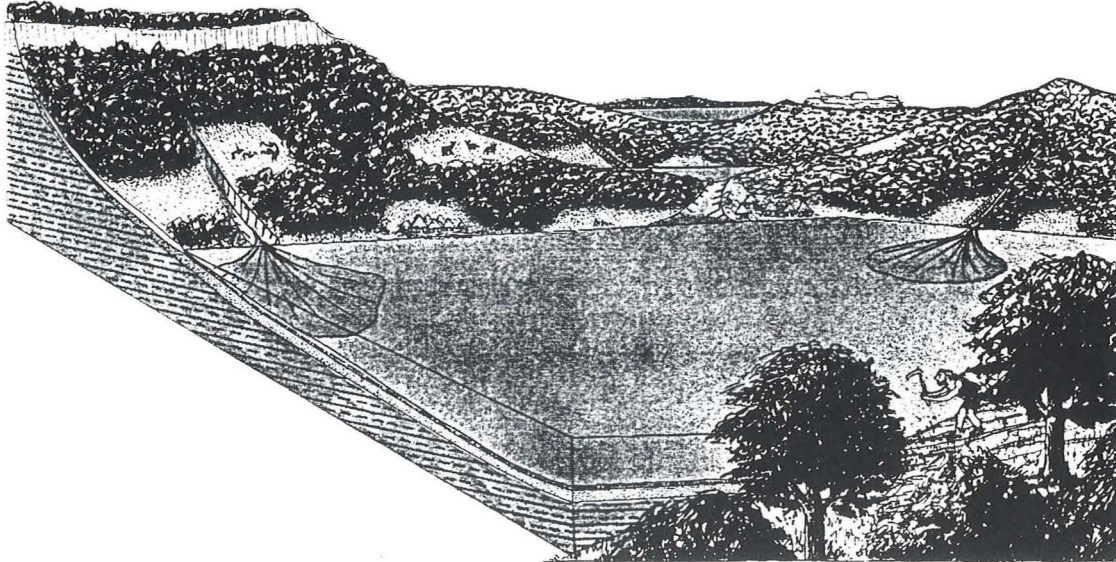


Fig. 18.3. Landscape reconstruction of a closed depression (étang) in the Late Neolithic. (After Trément, 1991).

EU-funded ARCHAEOMEDES programme has allowed systematic comparison with the Beaucaire, Lunel, Tricastin and Vaison-la-Romaine areas (Trément, 1993b). This shows that there was a very similar form of occupation in the whole of the lower Rhône valley. The enlargement of the database to include the whole of Narbonnaise will allow new comparisons to be made (Favory and Fiches, 1988, 1994).

THREE EXAMPLES OF THE INTEGRATION OF DATA

It is not a question of presenting here a synthesis of the results acquired by the systematic integration of data from different disciplines, in the sector of Saint-Blaise (Trément, 1993a, 1994, and in press, a). Rather, the intention is to show, through three examples from different time periods, how the information can be integrated and the limits of interpretation.

The Late Neolithic (Fig. 18.3)

The final neolithic/chalcolithic period provides an excellent example of the interaction of people and nature: there is plentiful archaeological data and the palaeoenvironmental data are relatively securely dated by the appearance of *Fagus* at level 130 and by a radiocarbon date.

One cannot speak of a 'natural environment' at this date,

since the vegetation and soils had already been altered by the first farmers. On the plateaus and the slopes, clearance was undertaken at the expense of deciduous oak forests and pine forests, as the pollen curves of these plummet, while that of *Ulmus* is interrupted. This favoured, on the other hand, the expansion of evergreen oak, which is more resistant to edaphic conditions and tends to regrow from the stumps after forest fires. From level 120, the opposed development of the pollen curves of *Quercus pubescens* and *Quercus ilex* is a sign of increasing human intervention on the vegetation: henceforth cultivation formed an integral part of the landscape.

At this time, the lakes were at a relatively high level. On the south bank of the Étang d'Engrenier, a layer of black lacustrine silts, 1.50 m above the present lake level, has been dated to 4480 ± 280 BP (Provansal *et al.*, 1993: 255–7). In the Pourra core, the *Alnus* peak, the revival of *Chenopodiaceae*, and the variations in *Ulmus* and *Betula* pollen, also indicate a higher lake level, probably the result of the Subboreal climate deterioration. The Engrenier section shows that this humid phase caused marsh development in the whole depression (Provansal 1993: 258–60). This does not seem to have prevented frequent use of the edge of the lake: it seems that these zones, though difficult to occupy and exploit on a long term basis, were not considered unattractive, contrary to a widely-used but simplistic model (Triat-Laval, 1978: 266).

This period corresponds to an expansion of the settlement of Miouvin and a clear increase in the occupation

of the lake zone. Several important sites have been identified on the low plateaus. The density of isolated finds around the edge of the marshy depressions suggests a complementary system of cultivation on the plateaus, together with an intensive exploitation of the food resources of the lakes. The appearance of a continuous curve of *Plantago*, together with a rapid rise in *Artemisia*, reflects an intensification of clearance, confirmed by the stone tool assemblage at Miouvin. In the geomorphological sections and the Pourra core, the increased occurrence of charcoal may be a direct sign of new clearances, and may also reflect the use of fire in the maintenance of pastures. The increase in *Alnus* and *Betula* can be explained by their ability to germinate well in ash. In parallel, the analysis of the faunal assemblage of Miouvin shows a growth in pastoral activities (ovicaprids, small cattle, pigs), fishing (fish bones), and the harvesting of shellfish (mussels, clams, oysters).

The balance in the number of sites through time suggests that we should neither overestimate the effect of humans on the environment nor underestimate the role of climatic factors in this period (Trément, 1998). For all that, one cannot help ascribing – at least in part – the increased erosion in the Subboreal to the speeding up of clearance at the end of the third millennium BC. The deposits accumulated on the slopes and at the bottom of the lakes abruptly change facies: they become finer, changing from silty sands to dark sandy silts rich in charcoal. The reoccurrence of sandy deposits became less frequent and less marked. In the Pourra core all the mineralogical parameters decrease sharply. The partially-decalcified orange-brown soil which developed on the slopes in response to the amelioration of the late glacial and postglacial climate was scoured off during this period. The Subboreal humid fluctuation certainly contributed its effects to those caused by human activity, but it is revealing that the fine fraction of the deposits, resulting from the action of diffuse streams on the soil cover, is systematically associated with cultivated plant taxa. The increase in charcoal in the deposits is a sign of the increased use of the practice of cultivation after scrub-burning, which is particularly damaging at the local scale to the stability of the slopes. The preferential location of habitations – and, it is reasonable to suggest, cultivation – in the zones most affected by erosion, especially the edges of the plateaus, explains why the attacks on the vegetation cover were occasionally devastating. Nevertheless, the whole forest cover was not threatened prior to the Iron Age: the impact of chalcolithic agricultural communities was selective and localized, characteristic of an agrosystem still very mobile and wasteful in its management of the soil.

The Iron Age (Fig. 18.4)

The Iron Age was an important stage in the evolution of the relationship between societies and the environment:

the appearance of agglomerated settlements accompanied by demographic pressure led to an extension and a stabilization of the agrosystem.

During this period, the reversal of the arboreal/non-arboreal pollen ratio clearly indicates that human action on the forest was not just damaging but truly destructive, leading to a general diminution of the tree cover. This important change in the vegetation is characterized by a definitive decline in oak forest, a long-term diminution of pine woods, and an extension of the garrigue and arable and fallow land. At Ile de Martigues, the charcoal and molluscs confirm this image of an open environment, similar to the present-day landscape, where grasses and low shrubs predominate (Magnin, 1988; Thinon, 1988). The evolution of the lakes is more difficult to understand and date. The continuing occurrence of *Chenopodiaceae* suggests a relatively high water level in the Étang de Pourra. The thin shells of the cockles consumed at Saint-Blaise indicate their collection in a very saline environment, perhaps the sea but perhaps also the Étang de Lavalduc and the Étang d'Engrenier. The progressive lowering of the water level during the Iron Age perhaps caused an increase in salinity, therefore allowing the exploitation of salt (Stevenson *et al.*, 1993).

The Early Iron Age coincides with a relatively dense distribution of dispersed settlements around the agglomerated settlement of Saint-Blaise. The map of sixth-century BC occupation shows a concentric structuring of settlement within a radius of about three to five km. Consequently one can envisage that from this period there was a definitive stabilization of the agrosystem around the *oppidum*, through increasing population pressure. This situation seems to have lasted not much beyond the middle of the fifth century BC. The fourth and third centuries BC correspond with a marked contraction of settlement, despite the continuing occupation of Ile de Martigues. Throughout this period, a very strong correlation between the evolution of nucleated and dispersed settlements can be seen. On the other hand, the restructuring of the agglomerated settlements of Saint-Blaise and Ile de Martigues in the second century does not give rise to a resurgence of dispersed settlements similar to those of the Early Iron Age. Nevertheless, there is much more evidence for an increase in productive activities in the agglomerated settlements. This includes a diversification of the resources exploited, increasing storage capacity, an increase in indicators of craft activities, evidence for specialized functional spaces and signs of prosperity such as an intensification in commercial exchanges and the construction of the Hellenistic rampart.

The scarceness of dispersed settlements in the second century could be the result of integration within the agglomerated settlements of activities such as processing and storage which were previously spread throughout the land. The increase in data allows the agricultural system to be reconstructed. Palynological evidence reveals the start of a continuous curve of cereals, and an impressive

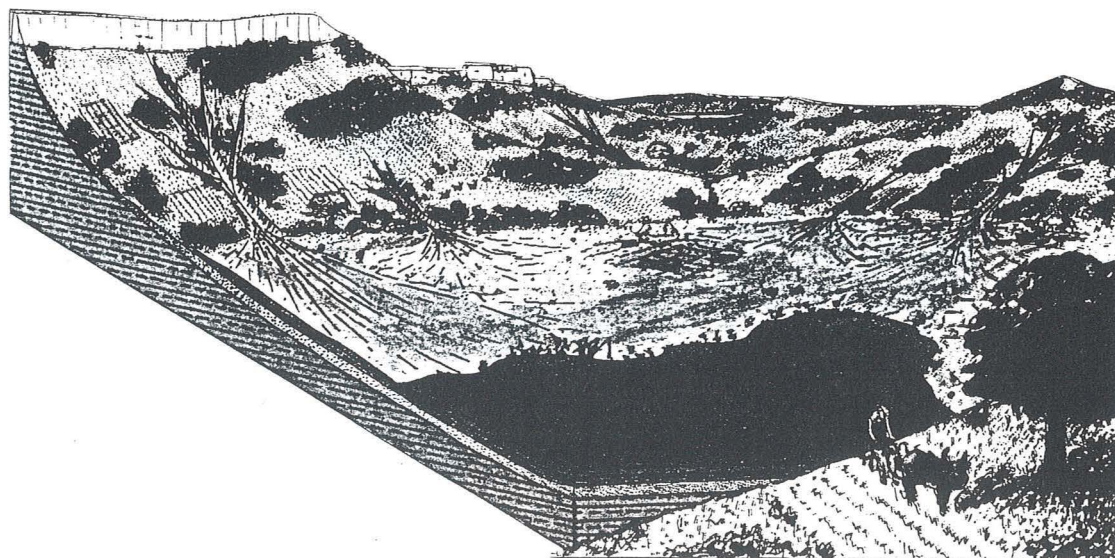


Fig. 18.4. Landscape reconstruction of a closed depression (étang) in the Iron Age. (After Trément, 1991)

expansion in *Artemisia*, indicating intense clearance and sowing. Archaeological finds (mills, presses) and in particular the archaeobotanical studies of the Ile de Martigues excavations confirm the increase in the growing of wheat, barley and millet, plus the appearance of not only olive and vine cultivation, but also linseed, and vetch (Marinval, 1988). Stock raising was a well-developed activity at Saint-Blaise, practised right through the Iron Age (Columeau, 1993). On the other hand, the lack of stability suggested by the stocking of beef within the village of Ile de Martigues forced a strong emphasis on hunting and shellfish collection (Brien-Poitevin, 1993). The divergent evolution of these two sites and the grouping together of settlements suggest population movement rather than demographic expansion such as that witnessed in the Early Iron Age.

Paradoxically, the artificial transformation of the vegetation cover did not precipitate a severe erosion crisis such as that seen in the Late Neolithic. On the contrary, there is a positive inversion of all the mineralogical parameters in the Pourra core, with the increase in the smectite/illite ratio and the index of cristallinity of smectite, as well as a return to normal levels of organic material. This could be interpreted as the result of a direct abrasion of the living rock following the complete stripping away of the soil cover. However, this hypothesis is invalidated both by the preservation of evolved decarbonated soils on the limestone bedrock, which is

borne out by anthracology, and by the slight accumulation of deposits comprising more than 80 per cent of fine silts and clays. It is more likely that there was a resumption of incision through the concentration of water run-off on slopes devoid of cultivation or else sheltered, either naturally through more favourable climatic conditions, or artificially by terracing.

The Early Empire (Fig. 18.5)

The Roman conquest did not cause a particular rupture in the evolution of the countryside, which was directly inherited from the previous period. In the Pourra core, the arboreal/non-arboreal pollen ratio was below 50 per cent, whilst there was a progressive decline in deciduous oak, hazel, and then beech. The evergreen oak was also subject to a slight decline, perhaps momentarily the victim of the extension of the agrosystem into areas which were previously garrigue (the slopes?). On the other hand, pine gradually continued to increase. As regards the herbaceous plants, the most remarkable event is the impressive double peak of *Artemisia*, which peaked at more than 40 per cent and thus alone is responsible for overturning the arboreal/non-arboreal pollen ratio. This episode coincides with a return to the mineralogical parameters present prior to human interference with the environment. The absence of Roman-period deposits on the slopes confirms the hypothesis of a stable and shel-

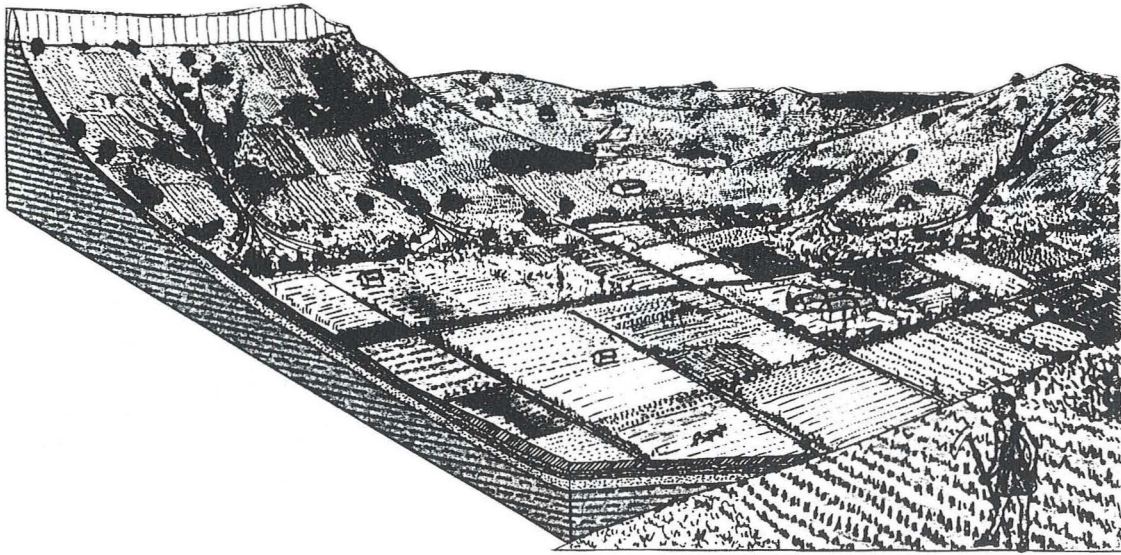


Fig. 18.5. Landscape reconstruction of a closed depression (étang) in the Early Empire. (After Trément, 1991)

tered environment. Yet, paradoxically, the lake sector had never been so deforested before.

The density of protohistoric occupation probably considerably mitigated the effects of Romanization on the countryside. Also, the positive influence of the dry climatic fluctuation in classical antiquity needs to be taken into account, together with the probability that the slopes were terraced. If the development of the villa economy implies the preferential cultivation of the lower land, which was less prone to erosion and well-drained thanks to lower lake levels, the remarkable density of small dispersed rural settlements suggests that the plateaus and the slopes were cultivated as well. The development of the agglomerated settlements of Fos and *Maritima Avaticorum* during the Augustan period suggests an increase in needs and greater human demands on the environment. Consequently, the measures taken by the Gallo-Roman farmers to conserve the slopes – the construction of small walls and terraces – were probably designed to stabilize or indeed favour the development of soil. Finally, the removal of stock to the Crau might have contributed decisively to the slowing down of the rate of erosion (Badan *et al.*, 1995).

The climatic factor probably favoured the drainage of the lower zones, the lowering of the lake levels in the Étang de Lavalduc and the Étang d'Engrenier, and the prolonged drying-out of the Étang de Pourra. The oxidation level observed in the latter at level 65 coincided with a momentary disappearance of *Chenopodiaceae* and

Cyperaceae. It is tempting to link this phenomenon with a drainage channel found in this lake in the eighteenth century (Achard, 1787). This parallel seems more significant given the proximity of the Péricard villa (SM-34) and the 'archaeologically empty' Plan Fossan depression, suggesting that the basin was brought under cultivation by a villa estate. Such an enterprise would have allowed the villa owners to gain several hundred hectares of pasture or arable land. There are parallels for this type of activity in the area, for example, in the depression of Taillades (Fontvieille) (Leveau, 1993).

The Augustan period and the first decades of the first century AD saw a considerable increase in settlement density. As well as the spread of small establishments on the molassic plateaus of the central sector, previously occupied by the inhabitants of the *oppidum* of Saint-Blaise, there was the establishment of a network of villas in the southern hills, which had, until that point, remained unoccupied. This development was part of a general move to colonize the wetland zones as part of the expansion of estate economies. The newly-exploited lands were the heavy wet Bégudien marls, whose improvement required an appropriate technology. Locally, the problem of Romanization arises in the unequal distribution of the two types of habitation. The fact that villas are rare and restricted to the southern sector can be explained in different ways.

The first explanation relates to the natural and techno-

logical conditions. This period benefited from a combination of bioclimatic factors (the dry climatic fluctuation of classical antiquity) and technologies (new techniques of drainage and perhaps a renewal of plants and tools), which facilitated the extension of cultivation into the lowlands.

Secondly, there is a series of historical factors. The settlement patterns at the time of the conquest may have played a decisive role: the area of the extension of the small dispersed settlements corresponds exactly with that of the pre-Roman settlement associated with the Saint-Blaise *oppidum*, so consequently the villas were established in the unoccupied areas where land was available. Another factor may also be involved: that of the southward shift of the political and administrative centres – *Maritima Avaticorum* and the port of *Fossae Mariana* – after the conquest. The creation of a Latin colony at Martigues could have effectively given rise to a local aristocracy who invested in the neighbouring lands.

Furthermore, the original settlements – ‘polynuclear’ or ‘dispersed hamlets’ – spread out into the intermediary zones along the edge of the lakes and in the wet valleys. This can be interpreted as an attempt by the indigenous communities to improve new land by the collective employment of the techniques regularly seen in the working of the estates. The remarkable longevity of these forms of habitation, which lasted until the end of classical antiquity, is a sign of their undoubted success.

A reconstruction of the agricultural system has been attempted for this period, which has produced the greatest quantity of archaeological evidence. This reconstruction has taken into account:

- the palaeoenvironmental data, which can inform us about the extent, the location and the potential nature of the crops;
- the ecofacts recovered from the various excavations, which allow us to trace the outlines of meat and shellfish consumption and indirectly to reconstruct the history of stock rearing and the exploitation of the lakes;
- the installations associated with the processing of agricultural products, mainly olive and grape presses, but also an amphora-manufacturing site (Sivier);
- the containers recovered from survey and excavation (*dolia*, *amphorae*, and other types of receptacle), which, to a certain extent, are able to give an idea of storage capacity and thus indirectly of production;
- the map of pottery scatters linked to cultural activity;
- and finally, obviously, the classification and distribution of settlement types.

A model for the villa estates in the southern sector can be proposed by incorporating the information from the map of settlement types, the geo-pedological data, the palynological and sedimentary data of the Pourra core, the map of pottery scatters associated with agricultural practices, and the distribution map of burial sites. The general

impression is one of a heterogeneous countryside in which productive activities were closely dependent on natural conditions. The basic structures – those that are revealed through settlement analysis – fit very precisely into the principal landscape units determined by the topographic, pedological and hydrological conditions. The central sector, the molassic plateaus of Saint-Mitre, Fos and Istres, had small dispersed or ‘polynuclear’ settlements which appear to have been fairly specialized, either in olive cultivation (Fos) or in viticulture (Saint-Mitre). The southern sector, the Bégudien hills of Martigues, was dedicated to commercial cereal production, within an estate economy, but small dependent settlements may equally well have been involved in arboriculture on additional land.

CONCLUSION

Partial answers have been found to many of the questions asked, through more meaningful reformulation of them as the research advanced. The problem of salt at Saint-Blaise remains unanswered, but the understanding of this major site has nevertheless been advanced and from a new perspective. By combining the archaeological, historical and palaeoenvironmental data it is possible to write a landscape history that permits the reconstruction of the evolution of a micro-region, concentrating on its specifics, while allowing the comparison with data obtained from a wider scale. The method implies the need to ask, right from the beginning, how representative is the information contained in the different archival sources: the soil, the subsoil, the texts. The integration of the experience of each discipline implies an initial independent analysis of the data, in order to avoid circular arguments. In this sense, it is not so much a matter of integrating the methods but of integrating the results. This is why I believe that landscape archaeology should remain simply one method within archaeology – it would be dangerous to try to establish it as a separate discipline.

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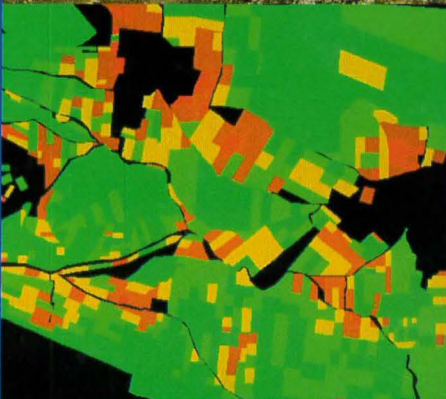
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