McDONALD INSTITUTE CONVERSATIONS

Inspired geoarchaeologies: past landscapes and social change

Essays in honour of Professor Charles A. I. French

Edited by Federica Sulas, Helen Lewis & Manuel Arroyo-Kalin

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with contributions from
Michael J. Allen, Andrea L. Balbo, Martin Bell, Nicole Boivin, Christopher Evans, David Friesem, Kasia Gdaniec, Lars Erik Gjerpe, Michael Gill, Martin Green, Ann-Maria Hart, Robyn Inglis, Martin Jones, Gabriella Kovács, Helen Lewis, Johan Linderholm, Roy Loveday, Richard I. Macphail, Caroline Malone, Wendy Matthews, Cristiano Nicosia, Bongumenzi Nxumalo, Innocent Pikirayi, Tonko Rajkovaca, Rob Scaife, Simon Stoddart, Fraser Stuart, Federica Sulas & Magdolna Vicze

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On the cover: *Hand drawn illustration by Charly French, aged around 10 years old. Courtesy of Kasia Gdaniec.*

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Mike's (BSc, PhD, MCIfA, FLS, FSA) research and geoarchaeological interest was originally based around the analysis of colluvium and land snails, including in the South Downs, Dorchester, Cranborne Chase, Stonehenge and Avebury in particular; these were the subject of both his undergraduate and PhD research. He has combined a career dominated by commercial archaeology with involvement in university research projects and as a staff lecturer at Sussex, Bournemouth and Oxford Universities. He was Environmental Manager at Wessex Archaeology for twenty years and for fifteen years has run his own geoarchaeological consultancy from a purpose-built bespoke lab, where he is involved in research designs and coordination of environmental archaeology from fieldwork to publication. Projects have been as diverse as intertidal zone research and Maltese prehistoric temples. His interests now lie principally in landscape archaeology and the development and creation of landscapes through prehistoric human intervention. He has worked with – and still is working with – Charly French in Cranborne Chase, the Stonehenge Riverside Project, and both recent Avebury landscape projects. He is vice-president of the Conchological Society, and as founding editor of the Prehistoric Society Research Papers has seen ten peer-reviewed volumes through to publication.

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Martin began a fieldwalking survey as a lad on Cranborne Chase in the latter 1960s. Following experience gained on a number of field projects, he began excavating independently in the region in 1976. He joined Richard Bradley's and John Barrett's Cranborne Chase Project the following year, contributing four site excavations to *Landscape, Monuments and Society* in 1991. He continued independent fieldwork in the early 1990s in collaboration with Mike Allen, in particular on the Fir Tree Field shaft which revealed a remarkable sequence of deposits dating from the late Mesolithic to the Beaker period, and worked with Charly French on the Upper Allen Valley Project 1998–2003, contributing four further site excavations to *Prehistoric Landscape Development and Human Impact in the Upper Allen Valley, Cranborne Chase, Dorset* (2007). Since that time, he has continued independent research, also in collaboration with Josh Pollard and Southampton University, on the Dorset Cursus, on Down Farm and in the Knowlton environs whilst continuing to increase the biodiversity on his small farm. He was made an FSA (Fellow of the Society of Antiquaries) in 2004 and received an honorary Doctor of Science degree from Reading University in 2006.

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Richard trained in geology and geography, specializing in soil science (BSc Swansea University). An MSc in pedology and soil survey (Reading University) prepared him for a soil science PhD on podzol development on heathlands (Kingston Polytechnic). An English Heritage-funded archaeological soil contract at the Institute of Archaeology (University College London) provided further training and international research opportunities were developed, including working with the Soil Survey of England and Wales and Macaulay Institute, UK, the CNRS, France, and the Soprintendenza, Italy. This led to the publication of *Soils and Micromorphology in Archaeology* (with Courty and Goldberg; Cambridge University Press 1989), the founding of the International Archaeological Soil Micromorphology Working Group, and training weeks at UCL. As a result, *Practical and Theoretical Geoarchaeology* (Blackwell 2006; Wiley 2022) and *Applied Soils and Micromorphology in Archaeology* (Cambridge University Press 2018), both with Goldberg, were written. Macphail is a recipient of the Geological Society of America's Rip Rapp Award for Archaeological Geology (2009), and is a fellow of the Geological Society of America. He is also the 2021 co-awardee (with P. Goldberg) of the International Union of Soil Sciences Tenth Kubiëna Medal for Soil Micromorphology. The paper included here also reflects more than two decades of research across Scandinavia.

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Wendy is a specialist in Near Eastern Archaeology and geoarchaeology, focusing on micromorphology of the built environment and long-term perspectives on sustainability (MA Edinburgh 1984; PhD Cambridge 1992, 'Micromorphology of occupational sequences and use of space in a Sumerian city'). She was a research associate and fellow of the McDonald Institute (1993–2000) and is an associate professor in Archaeology at the University of Reading, following a semester as visiting lecturer at UC Berkeley. She was a member of the *Çatalhöyük* team and steering committee, Turkey (1993–2017). She co-directs the *Central Zagros Archaeological Project* investigating the Neolithic of the Eastern Fertile Crescent, Iraq, Iran (2007–), and has conducted research in Syria and Bahrain. She has co-supervised twenty-two PhD students and teaches modules on past, present and future sustainability; micromorphology; and Mesopotamia. She co-designed a new prehistory gallery at the Slemani Museum with Iraqi and Reading colleagues, with sustainability as a central theme.

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Francis has studied the archaeology of the Fens since 1971. His major excavations in the region took place near Peterborough at Fengate, Maxey and Etton. In 1982 his team's survey of fenland drainage dykes revealed the timbers of a waterlogged Bronze Age timber platform and causeway at Flag Fen, which was opened to the public in 1989. He was a member of Channel 4's long-running series *Time Team*. He has written many popular books including *Seahenge* (2001), *Britain BC* (2003), *Britain AD* (2004), *The Making of the British Landscape* (2010), *Home* (2014), *Stonehenge* (2016) and *The Fens* (2019). His most recent book is *Scenes from Prehistoric Life* (Head of Zeus 2021).

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Tonko is chief research laboratory technician in geoarchaeology at the University of Cambridge. Involved in archaeology since his childhood, he held posts of archaeological site director and museum curator in Serbia (pre-1994) before moving to the UK to specialize in the late Upper Palaeolithic archaeology of ex-Yugoslavia via an MPhil (2004) at the University of Cambridge, and a PhD at the University of Ljubljana (2017). After four years at the Cambridge Archaeological Unit, he took up the post of geoarchaeology technician at the Department of Archaeology in 2008, and since then he has been working at the McBurney Laboratory of Geoarchaeology. He has directed and managed several archaeological projects, field and laboratory training in the UK and eastern Europe. He has authored several volumes and articles, including a monograph on preventive archaeology in ex-Yugoslavia published by Belgrade's Institute of Archaeology (2019) and a manual of archaeological excavation (co-authored with J. Appleby, 2015).

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Rob is a visiting professor of palaeoecology and environmental archaeology at the University of Southampton, and an honorary research associate of the McDonald Institute for Archaeological Research at the University of Cambridge. His first degree was in geography with geology, and an interest in the Pleistocene led him into palynology. He investigated the Late and Post-glacial vegetation changes of the Isle of Wight for his PhD (King's College London). Subsequently, he worked at the Institute of Archaeology, London, and the Ancient Monuments Laboratory at English Heritage. As a freelance palaeoecologist, he has continued to work across southern and eastern England, along with international studies in Italy, Turkey, Peru and Chile.

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Simon and Caroline have been engaged in the research of ancient landscapes for nearly forty years, with a

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Figures

Tables

Chapter 4

Geoarchaeology in fluvial landscapes

Andrea L. Balbo

Rivers nurture a great variety of landscapes; we need to look at all these landscapes and consider their transformations through time, climates and ecologies. In this chapter I revisit major events of human population and history through the lens of geoarchaeology: the spread of anatomically modern humans (AMHs) across Europe since the Last Glacial Maximum, the flourishing of fully developed agricultural and trading economies in late antiquity and the Middle Ages, and the vulnerabilities in the light of climate changes affecting river environments. I then propose some closing thoughts on the status and potential of geoarchaeological research, both in fluvial landscapes and more generally. When coupled with our increasing capacity to predict mid- and long-term climatic and environmental changes, lessons learned from geoarchaeological research may indeed highlight the scope of anticipatory learning that is required in order to address contemporary climatic, economic, and ecological challenges.

From spring to delta, through lakes and wetlands, rivers nurture a great variety of landscapes, from arctic steppes to tropical deserts, from mountain glaciers to lush seashores. When the temporal dimension is considered, we need to look at all these landscapes and consider their transformations through time, climates and ecologies. It is through this broad geoarchaeological approach that possible biases can be identified in support of robust archaeological interpretations. Starting from a selection of five case studies across Europe, from Scandinavia to the Mediterranean, in this chapter I revisit major events of human population and history through the lens of geoarchaeology. Evidence for the spread of anatomically modern humans (AMHs) along river axes in Europe is considered in the context of sea-level rise since the Last Glacial Maximum in the Mediterranean and the melting of the Scandinavian Ice Sheet in the Holocene. The flourishing of fully developed agricultural and trading economies is evaluated in the context of river environments in late antiquity and in the Middle Ages. Lastly, vulnerabilities of the same social-economic contexts are examined in light of climate changes affecting river environments through the Medieval Climatic Anomaly and the Little Ice Age. I then propose some closing thoughts on the status and potential of geoarchaeological research, both in fluvial landscapes and more generally. Ideally equipped among archaeological disciplines to study human-environment interactions, fluvial geoarchaeology (and geoarchaeology at large) may contribute to the timely identification of prime archaeological evidence exposed or threatened by rapid climate change. When coupled with our increasing capacity to predict mid- and long-term climatic and environmental changes, lessons learned from geoarchaeological research may indeed highlight the scope of anticipatory learning that is required to address contemporary climatic, economic, and ecological challenges.

Four hundred feet under. The flooded Raša-Boljunšćica River system and the spread of anatomically modern humans to Mediterranean Europe

The last glacial period in Europe saw the progressive spread of anatomically modern humans (AMHs) and the extinction of Neanderthals. Many questions remain open regarding this population expansion, which started around 50,000 years ago and was completed by the beginning of the Holocene (Scarre 2005). Among the major challenges that hamper archaeological research for this period is the effect of sea-level rise during the climatic transition to the current interglacial, which caused the submersion of vast landscapes and, consequently, much Palaeolithic evidence. The geoarchaeological study of the Raša-Boljunšćica River system, running through the Istria Peninsula in Croatia, helps us to understand the scale of such changes, their impact on the archaeological record, and ultimately our limitations for understanding population dynamics around the Mediterranean basin during the Middle and Late Palaeolithic (Balbo 2008).

Sea level reached its present position from a minimum of about -120 m below present-day sea level (bsl) during the Last Glacial Maximum (28,000–15,000 BP; Lambeck & Chappell 2001). The end of the last glacial and the beginning of the Holocene attracted striking variations in the levels of the Adriatic and Mediterranean Seas. South of the Istria peninsula, a large, emerged plain stood at the shallowest portion of the Adriatic Sea. Bathymetric studies and reconstructive maps show that the northern half of the Adriatic shelf was not submerged, such that the Raša-Boljunšćica River system probably constituted the longest Dinarid watercourse cutting through the North Adriatic Plain (Fig. 4.1; Shackleton *et al*. 1984).

Of the few Palaeolithic assemblages of Istria, two were discovered along the Raša-Boljunšćica River system: Šandalja II Cave (Miracle 1995; Karavanić 2003) and the open-air scatter of Ivšišće (Balbo *et al*. 2004). Both are attributed to the Aurignacian period (40,000–25,000 BP) and thus related to the spread of AMHs (Malez 1970; Balbo 2008). In spite of sustained archaeological research, this relatively scant evidence remains some of the best available for the region for the period. Like most of the Raša-Boljunšćica river system and Adriatic plain, the largest portion of the archaeological record seems to have been submerged in the transition from the last glacial to the Holocene. Interpreted through this geoarchaeological lens, Palaeolithic archaeological evidence for the Istria Peninsula

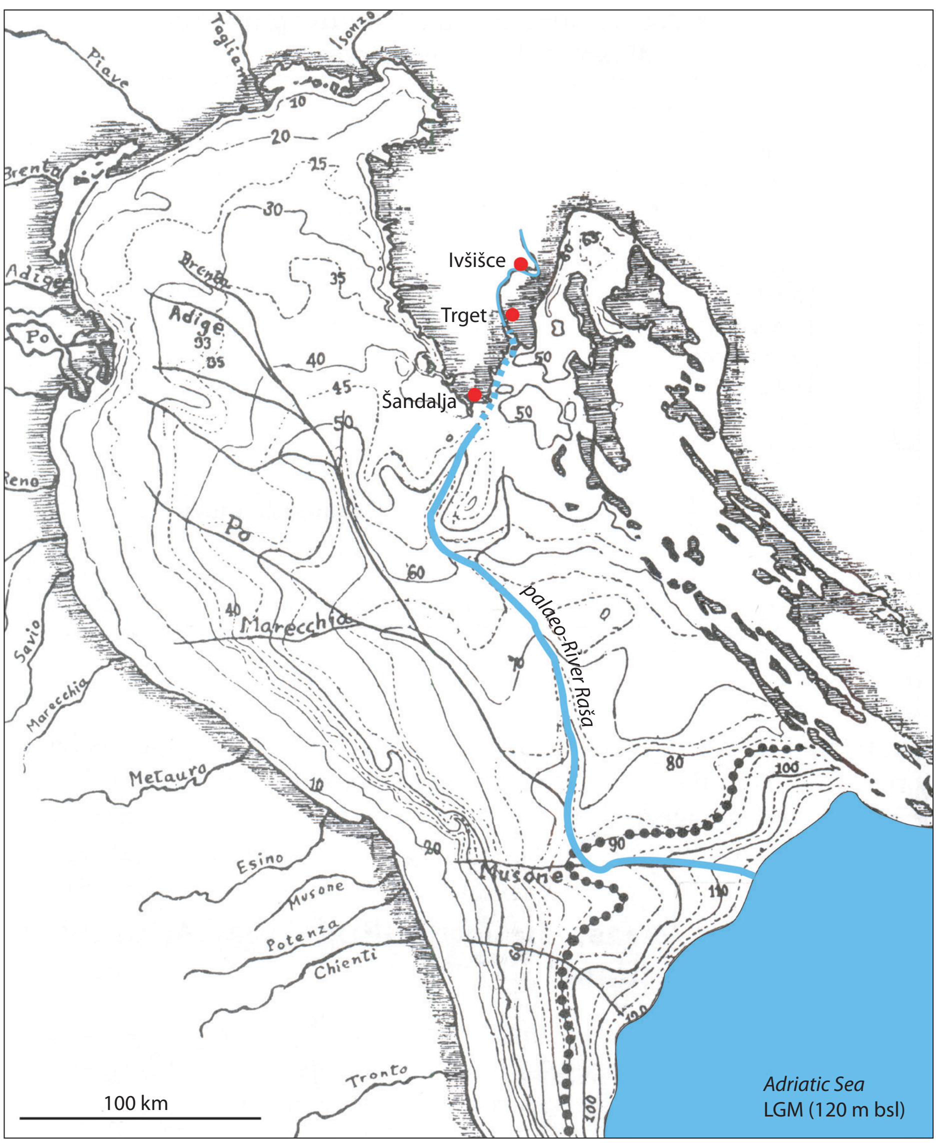

Figure 4.1. *Reconstructive map of the now-submerged Adriatic Plain, exposed during the LGM, cut by the Raša-Boljunšćica River system (modified from Mussi 2001). Palaeolithic evidence includes the open-air site of Ivšišće, Šandalja cave, and the associated lithic outcrop of Trget. Image: Andrea L. Balbo.*

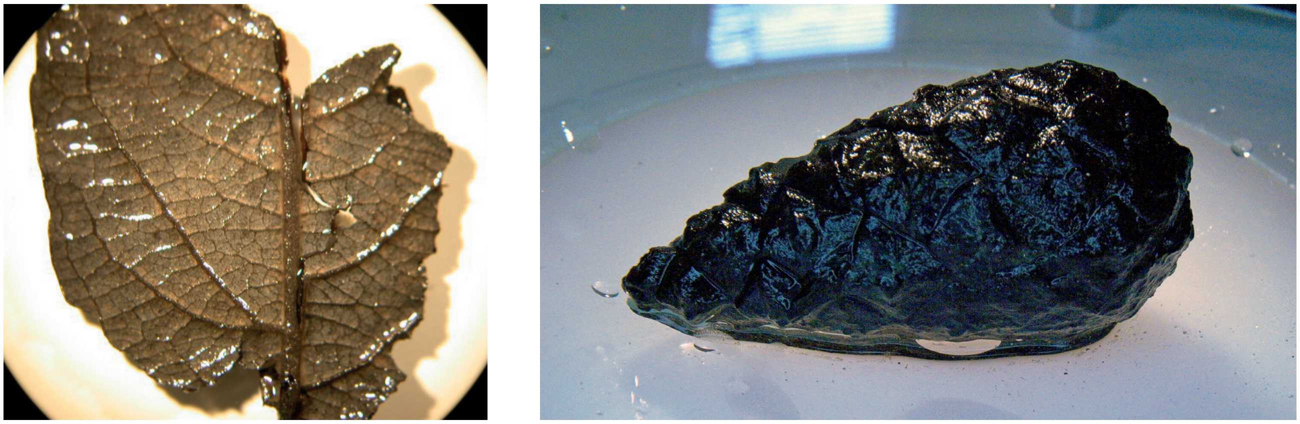

Figure 4.2. *Short-lived plant materials, recovered from riverside sedimentary sequences, support accurate chronologies. Left: Leaf (birch) sample TUa-6987 (3305 ± 40 14C uncal.* BP*). Right: Pinecone sample TUa-7401 (8160 ± 40 14C uncal.* BP*) (Balbo 2010). Images: Andrea L. Balbo.*

seems to represent only the tip of the actual record. The topography of Istria suggests that the Raša-Boljunšćica River system could have provided an access through the now-submerged North Adriatic Plain, and a shelter during the LGM period, when modern human populations spread across Europe along its main rivers and wetlands.

After the ice. Northern incursions along the Rena River at the beginning of the Holocene following the melting of the Scandinavian Ice Sheet

Archaeological evidence has progressively pushed back the date for the first human settlement of Scandinavia. In Norway, major discoveries over the past two decades were made possible by rescue archaeological projects related to major infrastructure developments. In south-east Norway, the geoarchaeological study of riverside settlements in environments that became ice-free during the last deglaciation along the Rena River helps us understand the timing of the first human incursions and later Holocene population of Scandinavia, especially in relation to the retreat of the Scandinavian Ice Sheet (SIS) (Balbo *et al*. 2010).

The sedimentology and chronology of riverside sedimentary sequences along the Rena River shows that the region became ice-free in the early Holocene as the SIS retreated from LGM limits across northern Europe. In the study area, postglacial soil formation began about 10 ka (9,930 ± 320 cal. BP; Balbo 2010; Balbo *et al*. 2010) (Fig. 4.2). Considering estimated delays of 450 years between ice melting, vegetation growth and soil formation for the region (Birks & Birks 2008), we can infer that the study area was first deglaciated around 10.4 ka. This is consistent with evidence for a front of the SIS retreating to the vicinity of Elverum (30 km south of Rena) around 10.4 ka (10,380 ± 105 cal. BP) (Longva 2004). The earliest lithic assemblages embedded in secondary depositional contexts within the Rena riverbank sediments point to sporadic human incursions around 9.2 ka (9,190 ± 200 cal. BP; Stene 2010), one millennium after ice retreat.

The sedimentary record suggests that frequent and intense floods persisted between *c*. 9–8.5 ka (9120 ± 610 and 8460 ± 100 cal. BP; Balbo 2010; Balbo *et al*. 2010). More stable river conditions were established thereafter, leading to the widespread draining of the river terraces around 7.4 ka (7400 ± 160 cal. BP; *ibid*.). Not surprisingly, the first consistent and undisputable human settlement in the area is attested about 8 ka (8050 ± 140 cal. BP; Stene 2010), in a context of reduced water discharge, as glaciers retreated further upstream during a 'warmer' phase of the early Holocene, shortly after the 8.2 ka climatic downturn event (Hammarlund *et al*. 2003; Thomas *et al*. 2007). Human settlement was then maintained, except during a period of abandonment between *c*. 4–3 ka, associated with a sustained period of high river discharge during the last phase of glacier advance in the Rena River region, which has been linked to the climate downturn known as the late-Holocene Thermal Decline (Neoglacial) (Jessen *et al.* 2005).

The combined geoarchaeological study of riverside settlements and peri-glacial fluvial landforms in southeast Norway suggests possible human incursions around 9 ka, i.e. about 1000 years after glacial retreat. However, persistent human settlement of the region is only attested starting around 8 ka, following consistent Holocene climate and environmental stabilization after the 8.2 ka climatic event.

Down the river. Agriculture and trade in the dynamic floodplain of Basses Terres, Rhône River during late antiquity

Two features have been associated with the expansion of the Roman Empire in antiquity: the creation of an extended communication and trade network over water and land, and the introduction of a standardized subdivision of agricultural land, called centuriation (*centuriatio*). In France, the geoarchaeological study of the evolution of the alluvial plain of Basses Terres, along the Rhône River, provides evidence of these characteristic features in a preserved fluvial landscape dating back to late antiquity. The main urban centre in the area was Aoste, located in the Dauphinée Region, east of present-day Lyon. Known as *vicus Augustus* in the Roman period, Aoste was founded in 16–13 BC as part of the province *Narbonnaise* (ex *Gallia Transalpina*) and overseen by the capital *Lugdunum* (Lyon) (Jospin & Laroche 2001).

The importance of the *vicus* as a crossing point along the Rhône-Rhin commercial fluvial route is attested by its representation in the Tabula Peutingeriana, the most ancient and complete map representing the land and fluvial network of the Roman empire (Jospin & Laroche 2001). The importance of Aoste is confirmed by the identification of locally made ceramic mortars (*pelves*), across the Roman empire (e.g. those produced by the *ATISII* family in the first and second centuries AD, described in Rougier 1977, 512). Indeed, archaeological research in the town of Aosta has revealed the presence of several ceramic ovens, plus several glass and metal workshops. Through geoarchaeological investigations, we have contextualized these findings and historical information, reconstructing about fifteen kilometres of this section of the Rhône River in antiquity (Fig. 4.3), and identifying remains of the Roman centuriation in the alluvial plain (Balbo 2002; Salvador *et al*. 2004).

Situated at the foot of the Jura Mountains, the alluvial plain of Basses Terres is a dynamic fluvial environment, where the Rhône River has often changed its course, generating an intricate pattern of intercutting channels and river morphologies (Balbo 2002). In this context, the combination of remote sensing and ground physiographic survey has led to the diachronic mapping of different fluvial phases. The best preserved and most complete coincides with the foundation and occupation of *vicus Augustus* in antiquity. Indeed, the survey of the banks during the identification of this section of the ancient course of the Rhône River has revealed over fifty previously unknown archaeological scatters, including the remains of an oven and traces of several riverside buildings. Archaeological and geomorphic evidence point to the systematic occupation of land in proximity of the river in antiquity, confirmed by evidence of centuriation visible on airborne imagery (Balbo 2002).

Streamlined water networks. Spring capture, irrigation and terracing in the Valley of Ricote, al-Andalus, Spain

Starting from AD 711, the expansion of the Islamic world led to the migration of Arab-Amazigh/Berber tribes and clans across the Strait of Gibraltar into the

Figure 4.3. *Example of aerial photograph used for the reconstructions of the ancient course of the Rhône River across the alluvial plain of Basses Terres. This photo, taken by Michel Revol after the floods of 1977, highlights several palaeomeanders near les Andréas arch-shaped hamlet (centre). Image originally published in Balbo 2002, with permission of M. Revol.*

Figure 4.4. *A snapshot of the central portion of the Ricote irrigated terrace system during a campaign of high-resolution mapping of channels and terraces. Image: Andrea L. Balbo.*

Iberian Peninsula, then known as al-Andalus. In Spain, the origins of irrigated agricultural terraces have historically been associated with these events. Historical texts refer to later extensions of the original Andalusi irrigated terrace fields, but little was written about their foundation period (Puy 2014). The geoarchaeological study of these human-designed fluvial systems has provided insight into their development (timing and technique) in the Valley of Ricote, Murcia, Spain. The micromorphological and physico-chemical characterization of buried soils sheds light on the initial stages of terrace building in al-Andalus. Andalusi peasants settling the area built the first terraces on the saline hypercalcic calcisol that had developed on colluvial materials. Following clearance by fire of a likely sparse bushy vegetation, terrace construction required the shifting of large volumes of sediment, which resulted in the inversion of the original soil stratigraphy (Puy & Balbo 2013).

These interventions were combined with the capture of the nearby spring by constructing an increasingly intricate network of channels (Fig. 4.4). Radiocarbon dating of charred wood fragments embedded in the Ab horizon (of the buried calcisol) suggests that the original irrigated terraces of Ricote could have been built shortly after the arrival of Arab-Amazigh/Berber populations (AD 647–778). Nevertheless, further dates cluster more broadly around AD 989–1210, suggesting a conservative hypothesis, whereby the origins of this human-transformed fluvial agricultural landscape would have occurred two centuries after the arrival of the first Andalusian settlers (Puy *et al.* 2016). The coordinated transformation of the local drainage and geomorphology led to the conversion of an arid fluvial landscape into lush irrigated agricultural land, which would be productive for centuries after the departure of the populations responsible for its creation (Puy 2014). These findings, therefore, confirm the Andalusian origin of these landscapes, emblematic of the Iberian Peninsula, and which face new challenges in terms of water scarcity, energy and innovation dependency, outmigration, and knowledge loss (Balbo *et al*. 2020).

Boom and burst. Terraced agriculture in Minorca through the Medieval Climatic Anomaly and the Little Ice Age

Debates on human environmental impact have often been locked into cause-and-effect reasoning, whereby human impact competes with climatic variability as a driving force. Geoarchaeological research in fluvial landscapes of medieval Minorca, by contrast, provides an example of amplified environmental change, emerging from complex feedbacks between climatic and historical events within the broader Mediterranean region. In particular, unprecedented sediment mobilization starting around AD 1300 led to environmental vulnerability as a result of mutual positive feedbacks between changing climate and land-use.

Settled by Arab-Amazigh/Berber tribes and clans during the Al-Andalus period (AD 902–1287), Minorca (Balearic Islands, Spain) was conquered by feudal powers in the framework of the Crusades (AD 1287; Bartlett 1993; Barceló & Retamero 2005). The feudal conquest led to a shift in the rural economy of the island, from irrigated terrace agriculture towards the cultivation of cereals and vines, combined with extensive animal husbandry. In the same period, the end of the so-called Medieval Climate Anomaly (MCA, *c*. AD 900–1300) was followed by the onset of the Little Ice Age (LIA, *c*. AD 1300–1850; Mann *et al*. 2009). In the Mediterranean, the MCA-LIA transition was characterized by colder temperatures (Cisneros *et al*. 2016), higher-frequency variation in water flux and sediment discharge (Arnaud *et al*. 2005), increased storminess (Sabatier *et al*. 2012) and acute flood events (Benito *et al*. 2008).

The geoarchaeological study of an alluvial sedimentary sequence from the gully of Algendar (Balbo *et al*. 2017) reveals a five- to twenty-three-fold increase in sedimentation rates between the thirteenth and fourteenth centuries AD and a fourteen- to twenty-seven-fold increase from approximately AD 1300 onwards, leading to the rapid aggradation of the valley floor (Fig. 4.5). Associated with a five-fold increase in grain coarseness, this acceleration in sedimentation points to intensified slope erosion starting approximately AD 1300. The sequence was retrieved in a context characterized by the presence of extended Al-Andalus-age irrigated terrace agriculture, partially collapsed following the settlement of Christian peasants during the feudal conquest of the island (completed by AD 1287).

Figure 4.5. *Preparation of the sampling site for the recovery of the main sedimentary sequence from Algendar. Field terraces are visible in the background. Image: Andrea L. Balbo.*

The detailed quantification of human impacts remains difficult, but an increasing number of records around the Mediterranean suggest that during the Crusades even minor land-use changes (such as the introduction of grazing on steep slopes) could have contributed to an exponential increase in soil erosion and sediment accumulation, especially when coupled with the major MCA-LIA climatic transition, revealing complex feedbacks that cannot be explained as a linear sum of factors (Balbo *et al*. 2017).

What's next? Trends and potential for geoarchaeology in fluvial landscapes, and beyond

Fluvial landscapes are undergoing immense pressure globally due to human exploitation and climate change. Rivers are progressively drying due to reduced ice masses, intensive extraction and damming, which could expose archaeological remains precious for the understanding of key moments of the human past. Similarly, delta ecosystems are increasingly exposed to the global challenges of sea-level rise and increasingly frequent intense weather events, threatening accessibility to unique archaeological evidence, most notably in the context of early urban developments, across continents.

In this context of rapid environmental change, geoarchaeology has the means and the responsibility to identify and focus on the study of the most endangered fluvial landscapes worldwide. Geoarchaeologists can significantly contribute to prioritizing research and systematizing recovery of key archaeological evidence in light of current and foreseeable climatic and environmental trends. Such an approach would provide the archaeological community with excellent opportunities to recover unique integrated archaeological and palaeoenvironmental records, typically preserved in fluvial contexts characterized by waterlogging and rapid sedimentation. Aimed at the understanding of past human adaptation and mitigation strategies in highly dynamic fluvial environments, this applied geoarchaeological approach may indeed contribute to defining current responses to social, economic, environmental and climatic challenges.

While the recovery of deep-flooded fluvial contexts from the Last Glacial remains extremely challenging, the upper portions of such buried fluvial systems show potential for filling remaining knowledge gaps. Complementary to that, the close monitoring of fluvio-glacial landscapes that are undergoing rapid environmental change in high latitude and high-mountain contexts will increase our opportunities to study unique evidence that has been ideally preserved for millennia, but becomes extremely vulnerable once exposed to weathering. Fluvial landscapes have driven human settlement, agriculture and trade, providing fertile land, consistent water resources and accessible travel and transportation routes.

By their climate-sensitive and dynamic nature, alluvial plains and deltas are testimony not only to human ingenuity for landscape transformation and for adaptation to changing conditions, but also to the possible undesirable side-effects of such transformations, often reinforced by climate change.

Among all the archaeological disciplines, geoarchaeology is perhaps the best positioned for contributing to the understanding of complex human-environment interactions, in fluvial landscapes and elsewhere. Paired with our increased capacity to predict climate change within reasonable uncertainty boundaries, geoarchaeology can ultimately inform anticipatory learning in the context of current and foreseeable climatic, economical, and ecological transformations.

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Inspired geoarchaeologies

Geoarchaeological research captures dimensions of the past at an unprecedented level of detail and multiple spatial and temporal scales. The record of the past held by soils and sediments is an archive for past environments, climate change, resource use, settlement lifeways, and societal development and resilience over time. When the McDonald Institute was established at Cambridge, geoarchaeology was one of the priority fields for a new research and teaching environment. An opportunity to develop the legacy of Charles McBurney was bestowed upon Charles French, whose 'geoarchaeology in action' approach has had an enormous impact in advancing knowledge, principles and practices across academic, teaching and professional sectors. Many journeys that began at Cambridge have since proliferated into dozens of inspired geoarchaeologies worldwide. This volume presents research and reflection from across the globe by colleagues in tribute to Charly, under whose leadership the Charles McBurney Laboratory became a beacon of geoarchaeology.

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