McDONALD INSTITUTE MONOGRAPHS

Temple landscapes

Fragility, change and resilience of Holocene environments in the Maltese Islands

By Charles French, Chris O. Hunt, Reuben Grima,
Rowan McLaughlin, Simon Stoddart & Caroline Malone

Volume 1 of Fragility and Sustainability – Studies on Early Malta,
the ERC-funded *FRAGSUS Project*

Temple landscapes

McDONALD INSTITUTE MONOGRAPHS

Temple landscapes

Fragility, change and resilience of Holocene environments in the Maltese Islands

By Charles French, Chris O. Hunt, Reuben Grima, Rowan McLaughlin, Simon Stoddart & Caroline Malone

With contributions by
Gianmarco Alberti, Jeremy Bennett, Maarten Blaauw, Petros Chatzimpaloglou, Lisa Coyle McClung, Alan J. Cresswell, Nathaniel Cutajar, Michelle Farrell, Katrin Fenech, Rory P. Flood, Timothy C. Kinnaird, Steve McCarron, Rowan McLaughlin, John Meneely, Anthony Pace, Sean D.F. Pyne-O'Donnell, Paula J. Reimer, Alastair Ruffell, George A. Said-Zammit, David C.W. Sanderson, Patrick J. Schembri, Sean Taylor, David Trump†, Jonathan Turner, Nicholas C. Vella & Nathan Wright

Illustrations by
Gianmarco Alberti, Jeremy Bennett, Sara Boyle, Petros Chatzimpaloglou, Lisa Coyle McClung, Rory P. Flood, Charles French, Chris O. Hunt, Michelle Farrell, Katrin Fenech, Rowan McLaughlin, John Meneely, Anthony Pace, David Redhouse, Alastair Ruffell, George A. Said-Zammit & Simon Stoddart

Volume 1 of Fragility and Sustainability – Studies on Early Malta, the ERC-funded *FRAGSUS Project*

SEVENTH FRAMEWORK PROGRAMME

European Research Council
Established by the European Commission

This project has received funding from the European Research Council (ERC) under the European Union's Seventh Framework Programme (FP7-2007-2013) (Grant agreement No. 323727).

Published by:
McDonald Institute for Archaeological Research
University of Cambridge
Downing Street
Cambridge, UK
CB2 3ER
(0)(1223) 339327
eaj31@cam.ac.uk
www.mcdonald.cam.ac.uk

ISBN: 978-1-902937-99-1

Cover design by Dora Kemp and Ben Plumridge.
Typesetting and layout by Ben Plumridge.

On the cover: *View towards Nadur lighthouse and Għajnsielem church with the Gozo Channel to Malta beyond, from In-Nuffara (Caroline Malone).*

Edited for the Institute by James Barrett (*Series Editor*).

Contents

Contributors

Dr Gianmarco Alberti
Department of Criminology, Faculty for Social Wellbeing, University of Malta, Msida, Malta
Email: gianmarco.alberti@um.edu.mt

Jeremy Bennett
Department of Archaeology, University of Cambridge, Cambridge, UK
Email: jmb241@cam.ac.uk

Dr Maarten Blaauw
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: marten.blaauw@qub.ac.uk

Dr Petros Chatzimpaloglou
Department of Archaeology, University of Cambridge, Cambridge, UK
Email: pc529@cam.ac.uk

Dr Lisa Coyle McClung
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: l.coylemcclung@qub.ac.uk

Dr Alan J. Cresswell
SUERC, University of Glasgow, East Kilbride, University of Glasgow, Glasgow, Scotland
Email: alan.cresswell@glasgow.ac.uk

Nathaniel Cutajar
Deputy Superintendent of Cultural Heritage, Heritage Malta, Valletta, Malta
Email: nathaniel.cutajar@gov.mt

Dr Michelle Farrell
Centre for Agroecology, Water and Resilience, School of Energy, Construction and Environment, Coventry University, Coventry, UK
Email: ac5086@coventry.ac.uk

Dr Katrin Fenech
Department of Classics & Archaeology, University of Malta, Msida, Malta
Email: katrin.fenech@um.edu.mt

Dr Rory P. Flood
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: r.flood@qub.ac.uk

Prof. Charles French
Department of Archaeology, University of Cambridge, Cambridge, UK
Email: caif2@cam.ac.uk

Dr Reuben Grima
Department of Conservation and Built Heritage, University of Malta, Msida, Malta
Email: reuben.grima@um.edu.mt

Dr Evan A. Hill
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: ehill08@qub.ac.uk

Prof. Chris O. Hunt
Faculty of Science, Liverpool John Moores University, Liverpool, UK
Email: c.o.hunt@ljmu.ac.uk

Dr Timothy C. Kinnaird
School of Earth and Environmental Sciences, University of St Andrews, St. Andrews, Scotland
Email: tk17@st-andrews.ac.uk

Prof. Caroline Malone
School of Natural and Built Environment, Queen's University, University Road, Belfast, BT7 1NN, Northern Ireland
Email: c.malone@qub.ac.uk

Dr Steve McCarron
Department of Geography, National University of Ireland, Maynooth, Ireland
Email: stephen.mccarron@mu.ie

Dr Rowan McLaughlin
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: r.mclaughlin@qub.ac.uk

John Meneely
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: j.meneely@qub.ac.uk

Dr Anthony Pace
UNESCO Cultural Heritage, Valletta, Malta
Email: anthonypace@cantab.net

Dr Sean D.F. Pyne-O'Donnell
Earth Observatory of Singapore, Nanyang Technological University, Singapore
Email: sean.1000@hotmail.co.uk

Prof. Paula J. Reimer
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: p.j.reimer@qub.ac.uk

Dr Alastair Ruffell
School of Natural and Built Environment, Queen's University, University Road, Belfast, Northern Ireland
Email: a.ruffell@qub.ac.uk

George A. Said-Zammit
Department of Examinations, Ministry for Education and Employment, Government of Malta, Malta
Email: george.said-zammit@gov.mt

Prof. David C.W. Sanderson
SUERC, University of Glasgow, East Kilbride, University of Glasgow, Glasgow, Scotland
Email: david.sanderson@glasgow.ac.uk

Prof. Patrick J. Schembri
Department of Biology, University of Malta, Msida, Malta
Email: patrick.j.schembri@um.edu.mt

Dr Simon Stoddart
Department of Archaeology, University of Cambridge, Cambridge, UK
Email: ss16@cam.ac.uk

Dr Sean Taylor
Department of Archaeology, University of Cambridge, Cambridge, UK
Email: st435@cam.ac.uk

Dr David Trump†

Dr Jonathan Turner
Department of Geography, National University of Ireland, University College, Dublin, Ireland
Email: jonathan.turner@ucd.ie

Prof. Nicholas C. Vella
Department of Classics and Archaeology, Faculty of Arts, University of Malta, Msida, Malta
Email: nicholas.vella@um.edu.mt

Dr Nathan Wright
School of Social Science, The University of Queensland, Brisbane, Australia
Email: n.wright@uq.edu.au

Figures

Tables

Preface and dedication

Caroline Malone

The *FRAGSUS Project* emerged as the direct result of an invitation to undertake new archaeological fieldwork in Malta in 1985. Anthony Bonanno of the University of Malta organized a conference on 'The Mother Goddess of the Mediterranean' in which Colin Renfrew was a participant. The discussions that resulted prompted an invitation that made its way to David Trump (Tutor in Continuing Education, Cambridge University), Caroline Malone (then Curator of the Avebury Keiller Museum) and Simon Stoddart (then a post-graduate researcher in Cambridge). We eagerly took up the invitation to devise a new collaborative, scientifically based programme of research on prehistoric Malta.

What resulted was the original Cambridge Gozo Project (1987–94) and the excavations of the Xagħra Brochtorff Circle and the Għajnsielem Road Neolithic house. Both those sites had been found by local antiquarian, Joseph Attard-Tabone, a long-established figure in the island for his work on conservation and site identification.

As this and the two other volumes in this series report, the original Cambridge Gozo Project was the germ of a rich and fruitful academic collaboration that has had international impact, and has influenced successive generations of young archaeologists in Malta and beyond.

As the Principal Investigator of the *FRAGSUS Project*, on behalf of the very extensive *FRAGSUS* team I want to dedicate this the first volume of the series to the enlightened scholars who set up this now 35 year-long collaboration of prehistoric inquiry with our heartfelt thanks for their role in our studies.

We dedicate this volume to:

Joseph Attard Tabone
Professor Anthony Bonanno
Professor Lord Colin Renfrew

and offer our profound thanks for their continuing role in promoting the prehistory of Malta.

Acknowledgements

This volume records research undertaken with funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013)/ERC Grant Agreement n. 323727 (*FRAGSUS Project*: *Fragility and sustainability in small island environments: adaptation, cultural change and collapse in prehistory* – http://www.qub.ac.uk/sites/FRAGSUS/). All the authors of this volume are indebted to the ERC for its financial support, and to the Principal Investigator of the *FRAGSUS Project*, Prof. Caroline Malone (Queen's University, Belfast, UK), for her central role in devising the project and seeing this research through to publication.

For Chapter 2, we extend warm thanks to the staff of the ^{14}CHRONO centre at QUB, especially Stephen Hoper, Jim McDonald, Michelle Thompson and Ron Reimer, all of whom took a keen interest in the *FRAGSUS Project*. The success of the *FRAGSUS Project* in general and the radiocarbon dating exercise has depended on their work. We thank the Physical Geography Laboratory staff at the School of Geography, University College Dublin, for the use of their ITRAX XRF core scanner. In particular, we would like to thank Dr Steve McCarron, Department of Geography, National University of Ireland, Maynooth and Dr Jonathan Turner, Department of Geography, National University of Ireland, University College, Dublin. We thank Prof. Patrick Schembri for sourcing and collecting the *Acanthocardia* samples from the Natural Museum of Natural History. Sean Pyne O'Donnell thanks Dr Chris Hayward at the Tephrochronology Analytical Unit (TAU), University of Edinburgh, for help and advice during microprobe work. Dr Maxine Anastasi, Department of Classics and Archaeology, University of Malta, helped identify the pottery from the settlement cores. Dr Frank Carroll helped show us the way forward; but sadly is no longer with us. Chris Hunt, Rory Flood, Michell Farrell, Sean Pyne O'Donnell and Mevrick Spiteri were the coring team. They were helped by Vincent Van Walt, who provided technical assistance. Al Ruffell and John Meneely did geophysical evaluation and GRP location of the cores. During fieldwork, Tim Kinnaird and Charles French were assisted by Sean Taylor, Jeremy Bennett and Simon Stoddart. We are grateful to the Superintendence of Cultural Heritage, Malta and Heritage Malta for permission to undertake the analyses and much practical assistance.

For Chapter 5, we would like to thank all at Heritage Malta, the Ġgantija visitor's centre and the University of Malta for their friendly and useful assistance throughout. In particular, we would like to thank George Azzopardi, Daphne Caruana, Josef Caruana, Nathaniel Cutajar, Chris Gemmell, Reuben Grima, Joanne Mallia, Christian Mifsud, Anthony Pace, Ella Samut-Tagliaferro, Mevrick Spiteri, Katya Stroud, Sharon Sultana and Nick Vella. We also thank Tonko Rajkovača of the McBurney Laboratory, Department of Archaeology, University of Cambridge, for making the thin section slides, the Physical Geography Laboratory, Department of Geography, University of Cambridge, and the ALS Global laboratory in Seville, Spain, for processing the multi-element analyses.

For Chapter 6, Reuben Grima wrote the first draft of this contribution, receiving comments and additions from the other authors.

For Chapter 7, Simon Stoddart wrote the first draft of this contribution, receiving comments and additions from the other authors.

For Chapter 9, we thank Sharlo Camilleri for providing us with a copy of the GIS data produced by the MALSIS (MALtese Soil Information System) project. We are grateful to Prof. Saviour Formosa and Prof. Timmy Gambin, both of the University of Malta, who facilitated the donation of LiDAR data, together with computer facilities, as part of the European project ERDF156 *Developing National Environmental Monitoring Infrastructure and Capacity*, from the former Malta

Environment and Planning Authority. A number of individuals were happy to share their recollections of shepherding practices in Malta and Gozo over the last sixty or seventy years; others facilitated the encounters. We are grateful to all of them: Charles Gauci, Grezzju Meilaq, Joseph Micallef, Louis Muscat, Ċettina and Anġlu Vella, Ernest Vella and Renata Zerafa.

Simon Stoddart would like to thank Prof. Martin Jones and Rachel Ballantyne for their advice in constructing Figure 11.4. The editors would like to thank Emma Hannah for compiling the index.

Firstly, the FRAGSUS Project is the result of a very generous research grant from the European Research Council (Advanced Grant no' 323727), without which this and its two partner volumes and the research undertaken could not have taken place. We heartily thank the ERC for its award and the many administrators in Brussels who monitored our use of the grant. The research team also wants to record our indebtedness to the administrators of the grant within our own institutions, since this work required detailed and dedicated attention. In particular we thank Rory Jordan in the Research Support Office, Stephen Hoper and Jim McDonald – CHRONO lab, and Martin Stroud (Queen's University Belfast), Laura Cousens (Cambridge University), Glen Farrugia and Cora Magri (University of Malta), the Curatorial, Finance and Designs & Exhibitions Departments in Heritage Malta and Stephen Borg at the Superintendence of Cultural Heritage. Finally, we thank Fr. Joe Inguanez (Emeritus Head of Department, Department of Sociology, University of Malta) for offering us the *leitmotif* of this volume while a visiting scholar in Magdalene College, Cambridge: '*Mingħajr art u ħamrija, m'hemmx sinjorija*' translating as 'without land and soil, there is no wealth'.

Foreword

Anthony Pace

Sustainability, as applied in archaeological research and heritage management, provides a useful perspective for understanding the past as well as the modern conditions of archaeological sites themselves. As often happens in archaeological thought, the idea of sustainability was borrowed from other areas of concern, particularly from the modern construct of development and its bearing on the environment and resource exploitation. The term sustainability entered common usage as a result of the unstoppable surge in resource exploitation, economic development, demographic growth and the human impacts on the environment that has gripped the World since 1500. Irrespective of scale and technology, most human activity of an economic nature has not spared resources from impacts, transformations or loss irrespective of historical and geographic contexts. Theories of sustainability may provide new narratives on the archaeology of Malta and Gozo, but they are equally important and of central relevance to contemporary issues of cultural heritage conservation and care. Though the archaeological resources of the Maltese islands can throw light on the past, one has to recognize that such resources are limited, finite and non-renewable. The sense of urgency with which these resources have to be identified, listed, studied, archived and valued is akin to that same urgency with which objects of value and all fragile forms of natural and cultural resources require constant stewardship and protection. The idea of sustainability therefore, follows a common thread across millennia.

It is all the more reason why cultural resource management requires particular attention through research, valorization and protection. The *FRAGSUS Project* (Fragility and sustainability in small island environments: adaptation, cultural change and collapse in prehistory) was intended to further explore and enhance existing knowledge on the prehistory of Malta and Gozo. The objective of the project as designed by the participating institutional partners and scholars, was to explore untapped field resources and archived archaeological material from a number of sites and their landscape to answer questions that could be approached with new techniques and methods. The results of the *FRAGSUS Project* will serve to advance our knowledge of certain areas of Maltese prehistory and to better contextualize the archipelago's importance as a model for understanding island archaeology in the central Mediterranean. The work that has been invested in *FRAGSUS* lays the foundation for future research.

Malta and Gozo are among the Mediterranean islands whose prehistoric archaeology has been intensely studied over a number of decades. This factor is important, yet more needs to be done in the field of Maltese archaeology and its valorization. Research is not the preserve of academic specialists. It serves to enhance not only what we know about the Maltese islands, but more importantly, why the archipelago's cultural landscape and its contents deserve care and protection especially at a time of extensive construction development. Strict rules and guidelines established by the Superintendence of Cultural Heritage have meant that during the last two decades more archaeological sites and deposits have been protected in situ or rescue-excavated through a statutory watching regime. This supervision has been applied successfully in a wide range of sites located in urban areas, rural locations and the landscape, as well as at the World Heritage Sites of Valletta, Ġgantija, Ħaġar Qim and Mnajdra and Tarxien. This activity has been instrumental in understanding ancient and historical land use, and the making of the Maltese historic centres and landscape.

Though the cumulative effect of archaeological research is being felt more strongly, new areas of interest still need to be addressed. Most pressing are those areas of landscape studies which often become peripheral to the attention that is garnered by prominent megalithic monuments. *FRAGSUS* has once again confirmed that there is a great deal of value in studying field systems, terraces and geological settings which, after all, were the material media in which modern Malta and Gozo ultimately developed. There is, therefore, an interplay in the use of the term sustainability, an interplay between what we can learn from the way ancient communities tested and used the very same island landscape which we occupy today, and the manner in which this landscape is treated in contested economic realities. If we are to seek factors of sustainability in the past, we must first protect its relics and study them using the best available methods in our times. On the other hand, the study of the past using the materiality of ancient peoples requires strong research agendas and thoughtful stewardship. The *FRAGSUS Project* has shown us how even small fragile deposits, nursed through protective legislation and guardianship, can yield significant information which the methods of pioneering scholars of Maltese archaeology would not have enabled access to. As already outlined by the Superintendence of Cultural Heritage, a national research agenda for cultural heritage and the humanities is a desideratum. Such a framework, reflected in the institutional partnership of the *FRAGSUS Project*, will bear valuable results that will only advance Malta's interests especially in today's world of instant e-knowledge that was not available on such a global scale a mere two decades ago.

FRAGSUS also underlines the relevance of studying the achievements and predicaments of past societies to understand certain, though not all, aspects of present environmental challenges. The twentieth century saw unprecedented environmental changes as a result of modern political-economic constructs. Admittedly, twentieth century developments cannot be equated with those of antiquity in terms of demography, technology, food production and consumption or the use of natural resources including the uptake of land. However, there are certain aspects, such as climate change, changing sea levels, significant environmental degradation, soil erosion, the exploitation and abandonment of land resources, the building and maintenance of field terraces, the rate and scale of human demographic growth, movement of peoples, access to scarce resources, which to a certain extent reflect impacts that seem to recur in time, irrespectively of scale and historic context.

Anthony Pace
Superintendent of Cultural Heritage (2003–18).

Appendix 1

How ground penetrating radar (GPR) works

Alastair Ruffell

Ground penetrating radar (or GPR) uses the transmission and reflection of radio waves (typically 25 to 2 GHz) in imaging the subsurface. Radar waves, introduced in the ground, may reflect back to surface when they intersect objects or surfaces of varying dielectric permittivity. Thus a GPR system requires a source antenna and receiving antenna (built to measure the same frequency). *Note that the plural of electrical devices is antennas; antennae are exclusively for animals such as insects. The transmitting antenna generates a pulse of radiowaves that the receiver detects at a set time interval: the longer the time interval, (potentially) the deeper the waves will have travelled into the ground (or to a nearby surface object) and back again. When the ground has a slow radarwave velocity, so a buried object may appear deeper than in ground with a fast transmissive velocity. As the antennas pass over discrete objects with different dielectric properties to the surrounding medium (boulders, pipes, coffins, trenches), they may generate hyperbolae, or arc-like reflections, or depressions. Radar waves also travel horizontally from the transmitting antenna, which in open ground simply dissipate with distance. However, in areas with upstanding structures, especially those that have a significant dielectric contrast to their surroundings, interference from such surface objects can create artefacts on the radargram. When such isolated objects (powerlines, telegraph wires, metal poles, trees, windmills/waterpump structures) are passed during a traverse, a series of hyperbolae may be generated that appear like a subsurface object but are simply out-of-plane reflections. Radar antennas are commonly elongate, generating radar waves in a widening arc from their long axis. Thus when moved in parallel to the antenna axis, the radar waves may reflect from a larger subsurface area in front and behind the antenna, (the so-called footprint) than when moved with the antennas at right angles to survey direction. Antennas may be shielded with radio-wave attenuating materials that reduce such out-of-plane interference. Unlike other forms of electromagnetic radiation used in geophysics, radio waves have far higher rates of attenuation, and thus penetration and reflection depths are typically low, but horizontal accuracy is high, coupled with rapid, real-time results, unlike all other geophysical techniques bar metal detectors and magnetometer raw data. The receiving antenna has either electronic or fibre-optic link to a recorder that converts incoming radiowaves to digital format and displays these graphically as wavelets. As the transmitter-receiver array is moved, so these wavelets are stacked horizontally to produce a radargram, a kind of x-ray slice into the Earth, but recorded in the time taken for radar waves to penetrate and reflect, as opposed to real depth. The speed of radiowave propagation is determined by the makeup of the transmitting medium: in this case the speed of light and dielectric permittivity. Magnetic properties can also influence radar wave speed. Changes in dielectric permittivity can cause radar wave reflection, without which GPR profiling would be impossible. Radarwave attenuation, or signal loss is extreme in conductive media such as seawater, clays (especially hydrous) and some leachate. GPR has good depth penetration (tens to hundreds of metres) in ice (with minor fracturing/interstitial water), hard rocks like limestone and granite and clay-poor quartz silts or sands. Vertical resolution *vs.* depth penetration is of major concern when choosing antenna frequency. Low frequencies (15–50 MHz) achieve deep penetration with poor vertical resolution in the received signal, due to the long wavelength. High frequencies (500–1000 MHz) show high resolution with weak penetration (centimetres to metres). Low-frequency antennas are large (a few metres long), high frequency antenna are small (tens of centimetres). Again, this can influence the use of the method, as deeply buried targets in enclosed spaces are virtually impossible to survey.

As with all geophysical methods, some intelligence concerning the likely size and makeup of the target is useful: where unknown or questioned, then a range of antennas should be used, and in very poorly understood locations, with other geophysical and invasive techniques (Blunderbuss Approach). Moisture contents influence radar wave velocity because in homogenous media porosity has a direct relationship to dielectric permittivity. Thus dry sand will allow increased wave propagation: sand with high freshwater content will give improved vertical resolution. A problem with unshielded antenna is the effect of 'out-of-plane' reflections (see above, trees, poles), analysed by surveying the same line with different antenna orientations. It is easy to think of the radar wave as a focused beam (the ray-path at right-angles to the wave) when in fact the radar wave as it travels into the subsurface is more like a bubble, hemispherical at first, expanding and becoming distorted as it travels at different speeds into the ground. Thus lateral to the antenna, on or in the ground surface may be structures that cause reflections at ground level. The effect of these surface features can be diminished by altering the orientation of the antennas, or by shielding the above-ground portion of the antenna, such that the radio wave is only allowed to penetrate the ground. GPR has found it's best uses in imaging glaciers, sand deposits (river, non-saline coastal sands), aquifers (porous nature), archaeological features (moats, buried buildings) and concrete/pavements.

Temple landscapes

The ERC-funded *FRAGSUS Project* (*Fragility and sustainability in small island environments: adaptation, cultural change and collapse in prehistory, 2013–18*), led by Caroline Malone (Queens University Belfast) has explored issues of environmental fragility and Neolithic social resilience and sustainability during the Holocene period in the Maltese Islands. This, the first volume of three, presents the palaeo-environmental story of early Maltese landscapes.

The project employed a programme of high-resolution chronological and stratigraphic investigations of the valley systems on Malta and Gozo. Buried deposits extracted through coring and geoarchaeological study yielded rich and chronologically controlled data that allow an important new understanding of environmental change in the islands. The study combined AMS radiocarbon and OSL chronologies with detailed palynological, molluscan and geoarchaeological analyses. These enable environmental reconstruction of prehistoric landscapes and the changing resources exploited by the islanders between the seventh and second millennia BC. The interdisciplinary studies combined with excavated economic and environmental materials from archaeological sites allows Temple landscapes to examine the dramatic and damaging impacts made by the first farming communities on the islands' soil and resources. The project reveals the remarkable resilience of the soil-vegetational system of the island landscapes, as well as the adaptations made by Neolithic communities to harness their productivity, in the face of climatic change and inexorable soil erosion. Neolithic people evidently understood how to maintain soil fertility and cope with the inherently unstable changing landscapes of Malta. In contrast, second millennium BC Bronze Age societies failed to adapt effectively to the long-term aridifying trend so clearly highlighted in the soil and vegetation record. This failure led to severe and irreversible erosion and very different and short-lived socio-economic systems across the Maltese islands.

Editors:
Charles French is Professor of Geoarchaeology in the Department of Archaeology, University of Cambridge.
Chris O. Hunt is a Professor in the School of Biological and Environmental Sciences, Liverpool John Moores University, Liverpool.
Reuben Grima is a Senior Lecturer in the Department of Conservation and Built Heritage, University of Malta.
Rowan McLaughlin is Senior Researcher in the Department of Scientific Research at the British Museum and honorary research scholar at Queen's University Belfast.
Caroline Malone is a Professor in the School of Natural and Built Environment, Queen's University Belfast.
Simon Stoddart is Reader in Prehistory in the Department of Archaeology, University of Cambridge.

Published by the McDonald Institute for Archaeological Research,
University of Cambridge, Downing Street, Cambridge, CB2 3ER, UK.

Cover design by Dora Kemp and Ben Plumridge.

ISBN: 978-1-902937-99-1

ISBN 978-1-902937-99-1
9 781902 937991

UNIVERSITY OF CAMBRIDGE